ROBOTICS

Product manual

IRB 7710

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Product manual

IRB 7710

OmniCore

Document ID: 3HAC089600-001

Revision: D

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Additional copies of this manual may be obtained from ABB.

Original instructions.

Table of contents

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Overview of this manual

About this manual

This manual contains instructions for:

- mechanical and electrical installation of the IRB 7710
- maintenance of the IRB 7710
- mechanical and electrical repair of the IRB 7710

The robot described in this manual has the following protection types:

- *Standard*
- *Foundry Plus*

Product manual scope

The manual covers all variants and designs of the IRB 7710. Some variants and designs may have been removed from the business offer and are no longer available for purchase.

Usage

This manual shall be used during:

- installation and commissioning, from lifting the product to its work site and securing it to the foundation, to making it ready for operation
- maintenance work
- repair work
- decommissioning work

Note

It is the responsibility of the integrator to conduct a risk assessment of the final application.

It is the responsibility of the integrator to provide safety and user guides for the robot system.

Who should read this manual?

This manual is intended for:

- installation personnel
- maintenance personnel
- repair personnel.

Prerequisites

A maintenance/repair/installation craftsman working with an ABB robot shall:

- be trained by ABB and have the required knowledge of mechanical and electrical installation/repair/maintenance work.
- be trained to respond to emergencies or abnormal situations.

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References

Documentation referred to in the manual, is listed in the table below.

Document name	Document ID
Product manual, spare parts - IRB 7710	*3HAC089601-001*
Product specification - IRB 7710	*3HAC089603-001*
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*
Product manual - DressPack IRB 7710	*3HAC089604-001*
Product manual - OmniCore V400XT	*3HAC081697-001*
Circuit diagram - IRB 7710/IRB 7720	*3HAC089629-001*
Technical reference manual - System parameters	*3HAC065041-001*
Operating manual - Integrator's guide OmniCore	*3HAC065037-001*
Application manual - Functional safety and SafeMove	*3HAC066559-001*

Tip

All documents can be found via myABB Business Portal, *www.abb.com/myABB*.

Revisions

Revision	Description
A	First edition.
B	Published in release 24C. The following updates are made in this revision: • Added information about KM sleeve for balancing device lock nut. • Added illustration for reduced working range on axis 1 with movable mechanical stops and corrected the limitation angles. And added note about the orientation of the spring washers for the movable mechanical stops. • Added a third lifting point to lift the counter balancing weight. • Added lubrication of the piston rod to the maintenance schedule and the lubrication section. • Added inspection of the balancing device guide ring to the inspection section, and also added a replacement procedure to the repair chapter for replacing the guide ring. • Updated procedure for replacement of the parallel rod with an additional protection ring at both upper and lower end.
C	Published in release 24D. The following updates are made in this revision: • Minor updates and corrections made in repair procedures. • Corrected the indication of degrees for axes 2 and 3 positions when removing the axis-3 gearbox. • Updated the figures and the refitting procedures of arm house cable guide due to changed design. • Added information about removing transportation grease and checking the lubrication of the balancing device piston rod after first installation. • Changed article number for movable mechanical stop set for axis 1.

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Revision	Description
D	Published in release 25A. The following updates are made in this revision: • Corrected axis 2 and axis 3 position for arm house cover replacement. • Added section *Troubleshooting too hot gearboxes on page 647*. • Added flange sealant to refitting of axis-1 cable harness protection ring. Also added spare part number for protection ring o-ring. • Updated spare part number for lubrication label.

Product documentation

Categories for user documentation from ABB Robotics

The user documentation from ABB Robotics is divided into a number of categories. This listing is based on the type of information in the documents, regardless of whether the products are standard or optional.

Tip

All documents can be found via myABB Business Portal, *www.abb.com/myABB*.

Product manuals

Manipulators, controllers, DressPack, and most other hardware is delivered with a **Product manual** that generally contains:

- Safety information.
- Installation and commissioning (descriptions of mechanical installation or electrical connections).
- Maintenance (descriptions of all required preventive maintenance procedures including intervals and expected life time of parts).
- Repair (descriptions of all recommended repair procedures including spare parts).
- Calibration.
- Troubleshooting.
- Decommissioning.
- Reference information (safety standards, unit conversions, screw joints, lists of tools).
- Spare parts list with corresponding figures (or references to separate spare parts lists).
- References to circuit diagrams.

Technical reference manuals

The technical reference manuals describe reference information for robotics products, for example lubrication, the RAPID language, and system parameters.

Application manuals

Specific applications (for example software or hardware options) are described in **Application manuals**. An application manual can describe one or several applications.

An application manual generally contains information about:

- The purpose of the application (what it does and when it is useful).
- What is included (for example cables, I/O boards, RAPID instructions, system parameters, software).
- How to install included or required hardware.
- How to use the application.

Continues on next page

- Examples of how to use the application.

Operating manuals

The operating manuals describe hands-on handling of the products. The manuals are aimed at those having first-hand operational contact with the product, that is production cell operators, programmers, and troubleshooters.

How to read the product manual

Reading the procedures

The procedures contain all information required for the installation or service activity and can be printed out separately when needed for a certain service procedure.

Safety information

The manual includes a separate safety chapter that must be read through before proceeding with any service or installation procedures. All procedures also include specific safety information when dangerous steps are to be performed.

Read more in the chapter *Safety on page 15*.

Illustrations

The product is illustrated with general figures that does not take painting or protection type in consideration.

Likewise, certain work methods or general information that is valid for several product models, can be illustrated with illustrations that show a different product model than the one that is described in the current manual.

1 Safety

1.1 Safety information

1.1.1 Limitation of liability

Limitation of liability

Any information given in this manual regarding safety must not be construed as a warranty by ABB that the industrial robot will not cause injury or damage even if all safety instructions are complied with.

The information does not cover how to design, install and operate a robot system, nor does it cover all peripheral equipment that can influence the safety of the robot system.

In particular, liability cannot be accepted if injury or damage has been caused for any of the following reasons:

- Use of the robot in other ways than intended.
- Incorrect operation or maintenance.
- Operation of the robot when the safety devices are defective, not in their intended location or in any other way not working.
- When instructions for operation and maintenance are not followed as intended.
- Non-authorized design modifications of the robot.
- Repairs on the robot and its spare parts carried out by in-experienced or non-qualified personnel.
- Foreign objects.
- Force majeure.

Spare parts and equipment

ABB supplies original spare parts and equipment which have been tested and approved for their intended use. The installation and/or use of non-original spare parts and equipment can negatively affect the safety, function, performance, and structural properties of the robot. ABB is not liable for damages caused by the use of non-original spare parts and equipment.

1.1.2 Requirements on personnel

General

Only personnel with appropriate training are allowed to install, maintain, service, repair, and use the robot. This includes electrical, mechanical, hydraulics, pneumatics, and other hazards identified in the risk assessment.

Persons who are under the influence of alcohol, drugs or any other intoxicating substances are not allowed to install, maintain, service, repair, or use the robot.

The plant liable must make sure that the personnel is trained on the robot, and on responding to emergency or abnormal situations.

Personal protective equipment

Use personal protective equipment, as stated in the instructions.

1.2 Safety signals and symbols

1.2.1 Safety signals in the manual

Introduction to safety signals

This section specifies all safety signals used in the user manuals. Each signal consists of:

- A caption specifying the hazard level (DANGER, WARNING, or CAUTION) and the type of hazard.
- Instruction about how to reduce the hazard to an acceptable level.
- A brief description of remaining hazards, if not adequately reduced.

Hazard levels

The table below defines the captions specifying the hazard levels used throughout this manual.

Symbol	Designation	Significance
	DANGER	Signal word used to indicate an imminently hazardous situation which, if not avoided, will result in serious injury.
	WARNING	Signal word used to indicate a potentially hazardous situation which, if not avoided, could result in serious injury.
	ELECTRICAL SHOCK	Signal word used to indicate a potentially hazardous situation related to electrical hazards which, if not avoided, could result in serious injury.
	CAUTION	Signal word used to indicate a potentially hazardous situation which, if not avoided, could result in slight injury.
	ELECTROSTATIC DISCHARGE (ESD)	Signal word used to indicate a potentially hazardous situation which, if not avoided, could result in severe damage to the product.
	NOTE	Signal word used to indicate important facts and conditions.

Continues on next page

1.2.1 Safety signals in the manual
Continued

Symbol	Designation	Significance
	TIP	Signal word used to indicate where to find additional information or how to do an operation in an easier way.

1.2.2 Safety symbols on manipulator labels

Introduction to symbols

This section describes safety symbols used on labels (stickers) on the manipulator.

Symbols are used in combinations on the labels, describing each specific warning. The descriptions in this section are generic, the labels can contain additional information such as values.

> **Note**
>
> The symbols on the labels on the product must be observed. Additional symbols added by the integrator must also be observed.

Types of symbols

Both the manipulator and the controller are marked with symbols, containing important information about the product. This is important for all personnel handling the robot, for example during installation, service, or operation.

The safety labels are language independent, they only use graphics. See *Symbols on safety labels on page 19*.

The information labels can contain information in text.

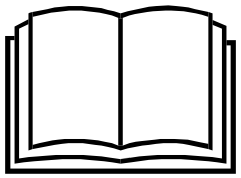
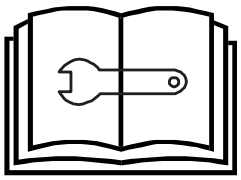
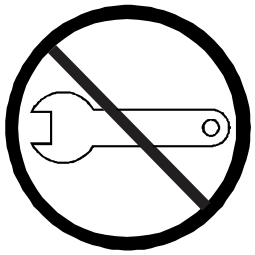
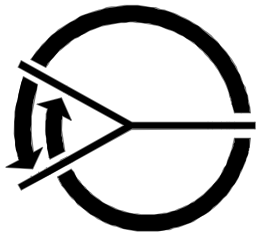
Symbols on safety labels

Symbol	Description
 xx0900000812	**Warning!** Warns that an accident *may* occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, etc.
 xx0900000811	**Caution!** Warns that an accident may occur if the instructions are not followed that can result in injury and/or damage to the product. It also applies to warnings of risks that include burns, eye injury, skin injury, hearing damage, crushing or slipping, tripping, impact, fall from height, etc. Furthermore, it applies to warnings that include function requirements when fitting and removing equipment where there is a risk of damaging the product or causing a breakdown.
 xx0900000839	**Prohibition** Used in combinations with other symbols.

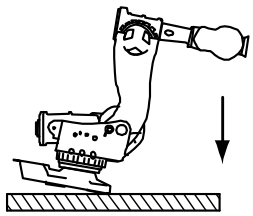
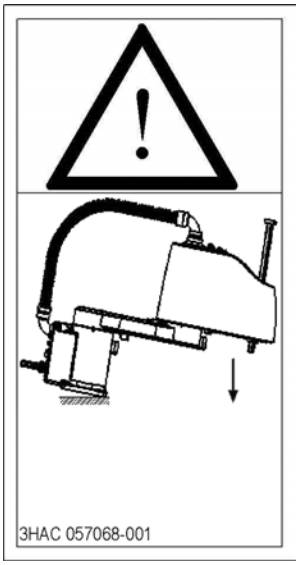
Continues on next page

1.2.2 Safety symbols on manipulator labels

Continued

Symbol	Description
 xx0900000813	**See user documentation** Read user documentation for details. Which manual to read is defined by the symbol: • No text: *Product manual*.
 xx0900000816	**Before disassembly, see product manual**
 xx0900000815	**Do not disassemble** Disassembling this part can cause injury.
 xx0900000814	**Extended rotation** This axis has extended rotation (working area) compared to standard.
 xx0900000808	**Brake release** Pressing this button will release the brakes. This means that the robot arm can fall down.

Continues on next page

Symbol	Description
 xx0900000810  xx1500002402	**Tip risk when loosening bolts** The robot can tip over if the bolts are not securely fastened.
  xx0900000817	**Crush** Risk of crush injuries.

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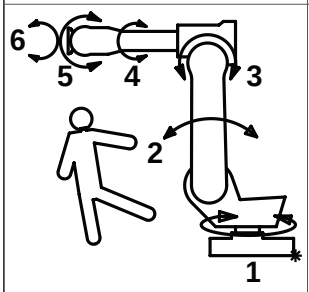
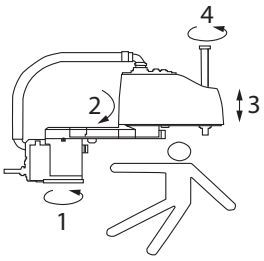
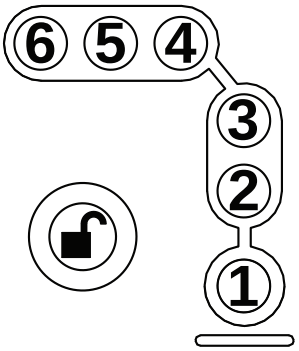
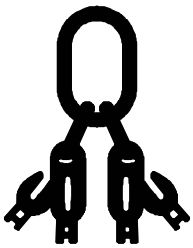
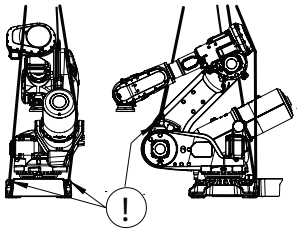
1.2.2 Safety symbols on manipulator labels

Continued

Symbol	Description
 xx0900000818  xx1300001087	**Heat** Risk of heat that can cause burns. (Both signs are used)
 xx2400000736  xx1500002616	**Moving robot** The robot can move unexpectedly.
 xx2100002463	**Brake release buttons**

Continues on next page

Symbol	Description
 xx0900000821	**Lifting bolt**
 xx1000001242	**Adjustable chain sling with shortener**
 xx0900000822	**Lifting of robot**
 xx2400002153	**Swivel eye bolt** The exclamation mark indicates required usage of swivel eye bolts at the lifting points.
 xx0900000823	**Oil** Can be used in combination with prohibition if oil is not allowed.
 xx0900000824	**Mechanical stop**

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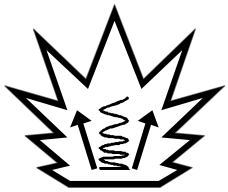
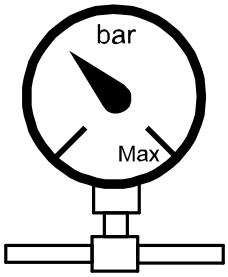
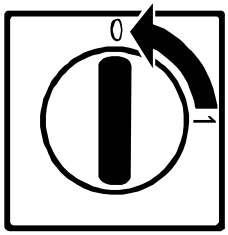
1.2.2 Safety symbols on manipulator labels
Continued

Symbol	Description
 xx1000001144	**No mechanical stop**
 xx0900000825	**Stored energy** Warns that this part contains stored energy. Used in combination with *Do not disassemble* symbol.
 xx0900000826	**Pressure** Warns that this part is pressurized. Usually contains additional text with the pressure level.
 xx0900000827	**Shut off with handle** Use the power switch on the controller.
 xx1400002648	**Do not step** Warns that stepping on these parts can cause damage to the parts.

1.3 Robot stopping functions

Protective stop and emergency stop

The protective stops and emergency stops are described in the product manual for the controller.

For more information see:

- *Product manual - OmniCore V400XT*

1.4 Safety during installation and commissioning

National or regional regulations

The integrator of the robot system is responsible for the safety of the robot system.

The integrator is responsible that the robot system is designed and installed in accordance with the safety requirements set forth in the applicable national and regional standards and regulations.

The integrator of the robot system is required to perform a risk assessment.

Layout

The robot integrated to a robot system shall be designed to allow safe access to all spaces during installation, operation, maintenance, and repair.

If robot movement can be initiated from an external control panel then an emergency stop must also be available.

If the manipulator is delivered with mechanical stops, these can be used for reducing the working space.

A perimeter safeguarding, for example a fence, shall be dimensioned to withstand the following:

- The force of the manipulator.
- The force of the load handled by the robot if dropped or released at maximum speed.
- The maximum possible impact caused by a breaking or malfunctioning rotating tool or other device fitted to the robot.

The maximum TCP speed and the maximum velocity of the robot axes are detailed in the section *Robot motion* in the product specification for the respective manipulator.

Consider exposure to hazards, such as slipping, tripping, and falling.

Hazards due to the working position and posture for a person working with or near the robot shall be considered.

Hazards due to noise emission from the robot needs to be considered.

Consider hazards from other equipment in the robot system, for example, that guards remain active until identified hazards are reduced to an acceptable level.

Allergenic material

See *Environmental information on page 650* for specification of allergenic materials in the product, if any.

Securing the robot to the foundation

The robot must be properly fixed to its foundation/support, as described in the respective product manual.

When the robot is installed at a height, hanging, or other than mounted directly on the floor, there will be additional hazards.

Continues on next page

Using lifting accessories and other external equipment

Ensure that all equipment used during installation, service and all handling of the robot are in correct condition for the intended use.

Electrical safety

Incoming mains must be installed to fulfill national regulations.

The power supply wiring to the robot must be sufficiently fused and if necessary, it must be possible to disconnect it manually from the mains power.

The power to the robot must be turned off with the main switch and the mains power disconnected when performing work inside the controller cabinet. Lock and tag shall be considered.

Harnesses between controller and manipulator shall be fixed and protected to avoid tripping and wear.

Wherever possible, power on/off or rebooting the robot controller shall be performed with all persons outside the safeguarded space.

Note

Use a CARBON DIOXIDE (CO_2) extinguisher in the event of a fire in the robot.

Safety devices

The integrator is responsible for that the safety devices necessary to protect people working with the robot system are designed and installed correctly.

When integrating the robot with external devices to a robot system:

- The integrator of the robot system must ensure that emergency stop functions are interlocked in accordance with applicable standards.
- The integrator of the robot system must ensure that safety functions are interlocked in accordance with applicable standards.

Other hazards

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

The risk assessment should also consider other hazards arising from the application, such as, but not limited to:

- Water
- Compressed air
- Hydraulics

End-effector hazards require particular attention for applications which involve close human collaboration with the robot.

Continues on next page

Verify the safety functions

Before the robot system is put into operation, verify that the safety functions are working as intended and that any remaining hazards identified in the risk assessment are mitigated to an acceptable level.

1.5 Safety during operation

Automatic operation

Verify the application in the operating mode manual reduced speed, before changing mode to automatic and initiating automatic operation.

Unexpected movement of robot arm

WARNING

Hazards due to the use of brake release devices and/or gravity beneath the manipulator shall be considered.

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

1.6 Safety during maintenance and repair

1.6.1 Safety during maintenance and repair

General

Corrective maintenance must only be carried out by personnel trained on the robot.

Maintenance or repair must be done with all electrical, pneumatic, and hydraulic power switched off, that is, no remaining hazards.

Hazards due to stored mechanical energy in the manipulator for the purpose of counterbalancing axes must be considered before maintenance or repair.

Never use the robot as a ladder, which means, do not climb on the controller, manipulator, including motors, or other parts. There are hazards of slipping and falling. The robot might be damaged.

Make sure that there are no tools, loose screws, turnings, or other unexpected parts remaining after maintenance or repair work.

When the work is completed, verify that the safety functions are working as intended.

Hot surfaces

Surfaces can be hot after running the robot, and touching these may result in burns. Allow the surfaces to cool down before maintenance or repair.

Allergic reaction

Warning	Description	Elimination/Action
 **Allergic reaction**	When working with lubricants there is a risk of an allergic reaction.	Make sure that protective gear like goggles and gloves are always worn.

Gearbox lubricants (oil or grease)

When handling oil, grease, or other chemical substances the safety information of the respective manufacturer must be observed.

Note

Take special care when handling hot lubricants.

Warning	Description	Elimination/Action
 **Hot oil or grease**	Changing and draining gearbox oil or grease may require handling hot lubricant heated up to 90 °C.	Make sure that protective gear like goggles and gloves are always worn during this activity.

Continues on next page

Warning	Description	Elimination/Action
 **Allergic reaction**	When working with lubricants there is a risk of an allergic reaction.	Make sure that protective gear like goggles and gloves are always worn.
 **Possible pressure build-up in gearbox**	When opening the oil or grease plug, there may be pressure present in the gearbox, causing hot lubricant to spray from the opening.	Open the plug carefully and keep away from the opening. Do not overfill the gearbox when filling. Put oil absorbent cloth, bags or paper at appropriate locations to catch any oil residues. Use appropriate protective gear such as heat-resistant gloves, goggles/protective visor, or a body suit if necessary.
 **Do not overfill**	Overfilling of gearbox lubricant can lead to internal over-pressure inside the gearbox which in turn may: • damage seals and gaskets • completely press out seals and gaskets • prevent the robot from moving freely.	Make sure not to overfill the gearbox when filling it with oil or grease. After filling, verify that the level is correct.
 **Do not mix types of oil**	Mixing types of oil may cause severe damage to the gearbox.	When filling gearbox oil, do not mix different types of oil unless specified in the instructions. Always use the type of oil specified for the product.
 **Oil residues**	Oil residues might be present in a drained gearbox and spilled when separating a motor and gearbox during repair.	Make sure that protective gear like goggles/protective visor, gloves and arm protection are always worn during this activity. Put oil absorbent cloth, bags or paper at appropriate locations to catch any oil residues.
 **Heat up the oil**	Warm oil drains quicker than cold oil.	Run the robot before changing the gearbox oil, if possible.
 **Specified amount depends on drained volume**	The specified amount of oil or grease is based on the total volume of the gearbox. When changing the lubricant, the amount refilled may differ from the specified amount, depending on how much has previously been drained from the gearbox.	After filling, verify that the level is correct.

Continues on next page

1.6.1 Safety during maintenance and repair
Continued

Warning	Description	Elimination/Action
 **Contaminated oil in gearboxes**	For lifetime reasons always drain as much oil as possible from the gearbox. The magnetic oil plugs will gather residual metal chips.	

Hazards related to batteries

Under rated conditions, the electrode materials and liquid electrolyte in the batteries are sealed and not exposed to the outside.

There is a hazard in case of abuse (mechanical, thermal, electrical) which leads to the activation of safety valves and/or the rupture of the battery container. As a result under certain circumstances, electrolyte leakage, electrode materials reaction with moisture/water or battery vent/explosion/fire may follow.

Do not short circuit, recharge, puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of the product. Risk of fire or explosion.

Operating temperatures are listed in *Operating conditions, robot on page 39*.

See safety instructions for the batteries in *Material/product safety data sheet - Battery pack* (*3HAC043118-001*).

Unexpected movement of robot arm

WARNING

Hazards due to the use of brake release devices and/or gravity beneath the manipulator shall be considered.

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

Related information

See also the safety information related to installation and operation.

1.6.2 Emergency release of the robot axes

Description

In an emergency situation, the brakes on a robot axis can be released manually by pushing a brake release button.

How to release the brakes is described in the section:

- *Manually releasing the brakes on page 75*.

The robot may be moved manually on smaller robot models, but larger models may require using an overhead crane or similar equipment.

Increased injury

Before releasing the brakes, make sure that the weight of the manipulator does not result in additional hazards, for example, even more severe injuries on a trapped person.

DANGER

When releasing the holding brakes, the robot axes may move very quickly and sometimes in unexpected ways.

Make sure no personnel is near or beneath the robot.

Prerequsites for access to brake release buttons

Make sure that the brake release buttons on the manipulator are within reach and quickly accessible in case of emergency situations, even when the manipulator is installed on a height, on a wall, or suspended.

1.6.3 Brake testing

When to test

During operation, the holding brake of each axis normally wears down. A test can be performed to determine whether the brake can still perform its function.

How to test

The function of the holding brake of each axis motor may be verified as described below:

1. Run each axis to a position where the combined weight of the manipulator and any load is maximized (maximum static load).
2. Switch the motor to the MOTORS OFF.
3. Inspect and verify that the axis maintains its position.

   If the manipulator does not change position as the motors are switched off, then the brake function is adequate.

Note

It is recommended to run the service routine *BrakeCheck* as part of the regular maintenance, see the operating manual for the robot controller.

For robots with the option SafeMove, the *Cyclic Brake Check* routine is recommended. See the manual for SafeMove in *References on page 10*.

1.7 Safety during troubleshooting

General

When troubleshooting requires work with power switched on, special considerations must be taken:

- Safety circuits might be muted or disconnected.
- Electrical parts must be considered as *live*.
- The manipulator can move unexpectedly at any time.

DANGER

Troubleshooting on the controller while powered on must be performed by personnel trained by ABB or by ABB field engineers.

A risk assessment must be done to address both robot and robot system specific hazards.

WARNING

Hazards due to the use of brake release devices and/or gravity beneath the manipulator shall be considered.

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

Related information

See also the safety information related to installation, operation, maintenance, and repair.

1.8 Safety during decommissioning

General

See section *Decommissioning on page 649*.

If the robot is decommissioned for storage, take extra precaution to reset safety devices to delivery status.

Unexpected movement of robot arm

WARNING

Hazards due to the use of brake release devices and/or gravity beneath the manipulator shall be considered.

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

2 Manipulator description

2.1 Technical data

Weight, robot

The table shows the weight of the robot.

Robot model	Nominal weight
IRB 7710-500/2.85	2,130 kg
IRB 7710-430/3.1	2,160 kg
IRB 7710-360/3.3	2,170 kg
IRB 7710-310/3.5	2,180 kg
IRB 7710-400/2.85 LID	2,210 kg
IRB 7710-390/3.1 LID	2,230 kg
IRB 7710-325/3.3 LID	2,240 kg
IRB 7710-280/3.5 LID	2,250 kg

Note

The weight does not include additional options, tools and other equipment fitted on the robot.

The weight includes the weight of the DressPack for LID variants.

Mounting positions

The table shows valid mounting positions and the installation (mounting) angle for the manipulator.

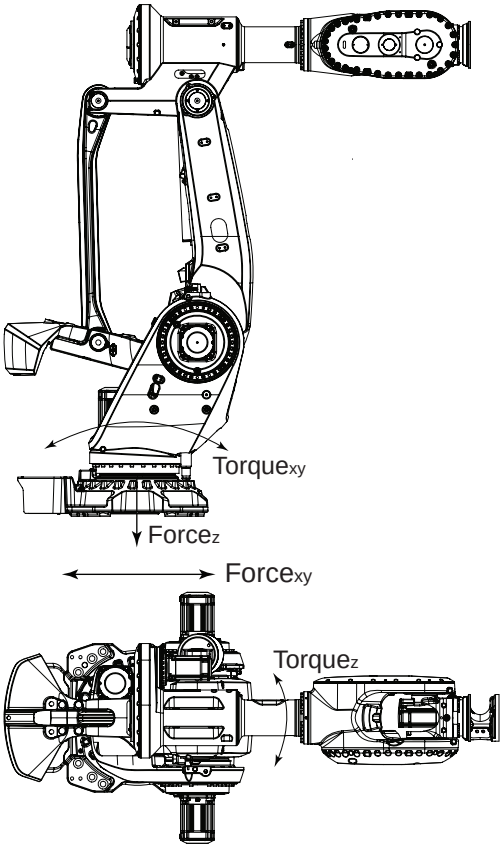
Mounting position	Installation angle
Floor mounted	0°

Note

The actual mounting angle must always be configured in the system parameters, otherwise the performance and lifetime is affected.

Continues on next page

Loads on foundation, robot



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The table shows the various forces and torques working on the robot during different kinds of operation.

Note

These forces and torques are extreme values that are rarely encountered during operation. The values also never reach their maximum at the same time!

WARNING

The robot installation is restricted to the mounting options given in following load table(s).

Floor mounted

Force	Endurance load (in operation)	Maximum load (emergency stop)
Force xy	±9.4 kN	±24.8 kN
Force z	26.7 ±5 kN	26.7 ±16.8 kN
Torque xy	±37.5 kNm	±76.9 kNm
Torque z	±6.4 kNm	±19.4 kNm

Continues on next page

Requirements, foundation

The table shows the requirements for the foundation where the weight of the installed robot is included:

Requirement	Value	Note
Flatness of foundation surface	0.3 mm	Flat foundations give better repeatability of the resolver calibration compared to original settings on delivery from ABB. The value for levelness aims at the circumstance of the anchoring points in the robot base. In order to compensate for an uneven surface, the robot can be recalibrated during installation. If resolver/encoder calibration is changed this will influence the absolute accuracy
Minimum resonance frequency	22 Hz **Note** It may affect the manipulator lifetime to have a lower resonance frequency than recommended.	The value is recommended for optimal performance. Due to foundation stiffness, consider robot mass including equipment. [i] For information about compensating for foundation flexibility, see the description of *Motion Process Mode* in the manual that describes the controller software option, see *References on page 10*.

[i] The minimum resonance frequency given should be interpreted as the frequency of the robot mass/inertia, robot assumed stiff, when a foundation translational/torsional elasticity is added, i.e., the stiffness of the pedestal where the robot is mounted. The minimum resonance frequency should not be interpreted as the resonance frequency of the building, floor etc. For example, if the equivalent mass of the floor is very high, it will not affect robot movement, even if the frequency is well below the stated frequency. The robot should be mounted as rigid as possibly to the floor.

Disturbances from other machinery will affect the robot and the tool accuracy. The robot has resonance frequencies in the region 10 – 20 Hz and disturbances in this region will be amplified, although somewhat damped by the servo control. This might be a problem, depending on the requirements from the applications. If this is a problem, the robot needs to be isolated from the environment.

Storage conditions, robot

The table shows the allowed storage conditions for the robot:

Parameter	Value
Minimum ambient temperature	-25 °C
Maximum ambient temperature	55 °C
Maximum ambient temperature (less than 24 hrs)	70 °C
Maximum ambient humidity	95%

Operating conditions, robot

The table shows the allowed operating conditions for the robot:

Parameter	Value
Minimum ambient temperature	5 °C [i]
Maximum ambient temperature	50 °C
Maximum ambient humidity	95% at constant temperature

[i] At low environmental temperature < 10ºC is, as with any other machine, a warm-up phase recommended to be run with the robot. Otherwise there is a risk that the robot stops or run with lower performance due to temperature dependent oil and grease viscosity.

Continues on next page

Protection classes, robot

The table shows the available protection types of the robot, with the corresponding protection class.

Protection type	Protection class [i]
Manipulator, protection type Standard	IP67
Manipulator, protection type Foundry Plus 2	IP67

[i] According to IEC 60529.

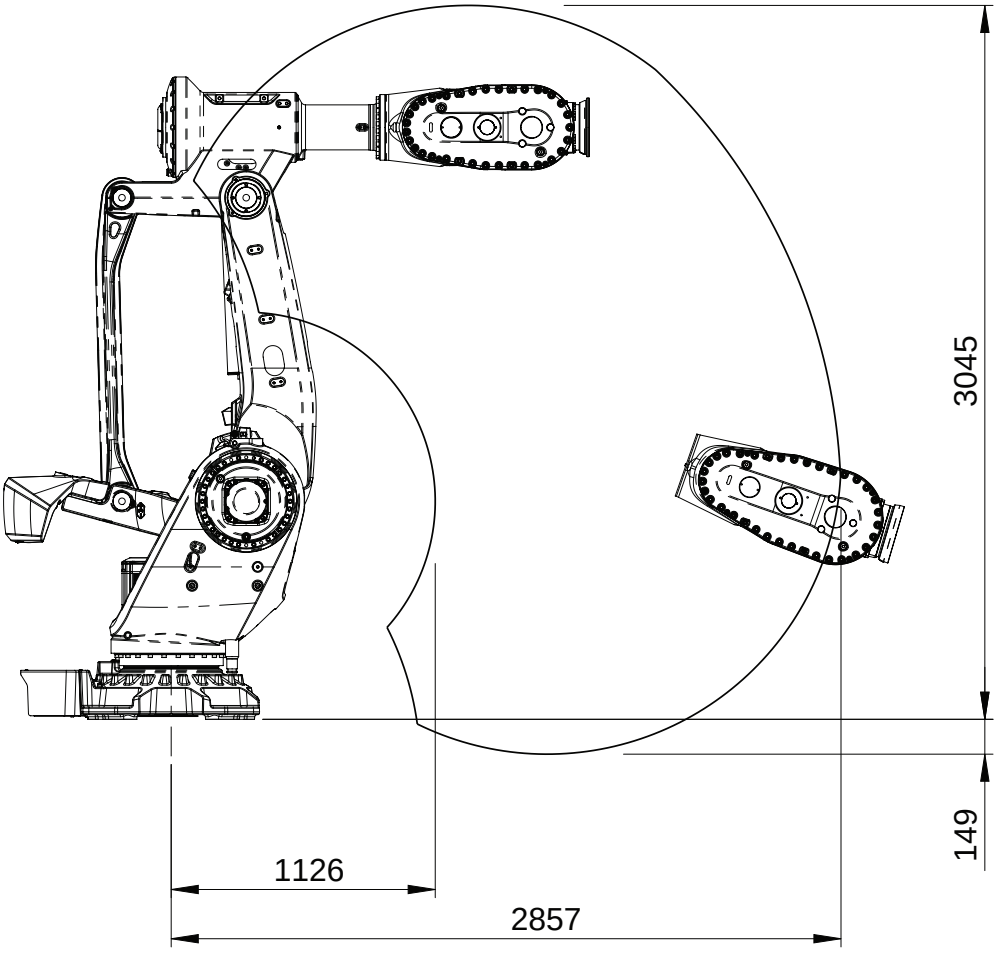
Environmental information

The product complies with IEC 63000. *Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances*.

2.2 Working range

Illustration, working range IRB 7710-500/2.85

This illustration shows the unrestricted working range of the robot.



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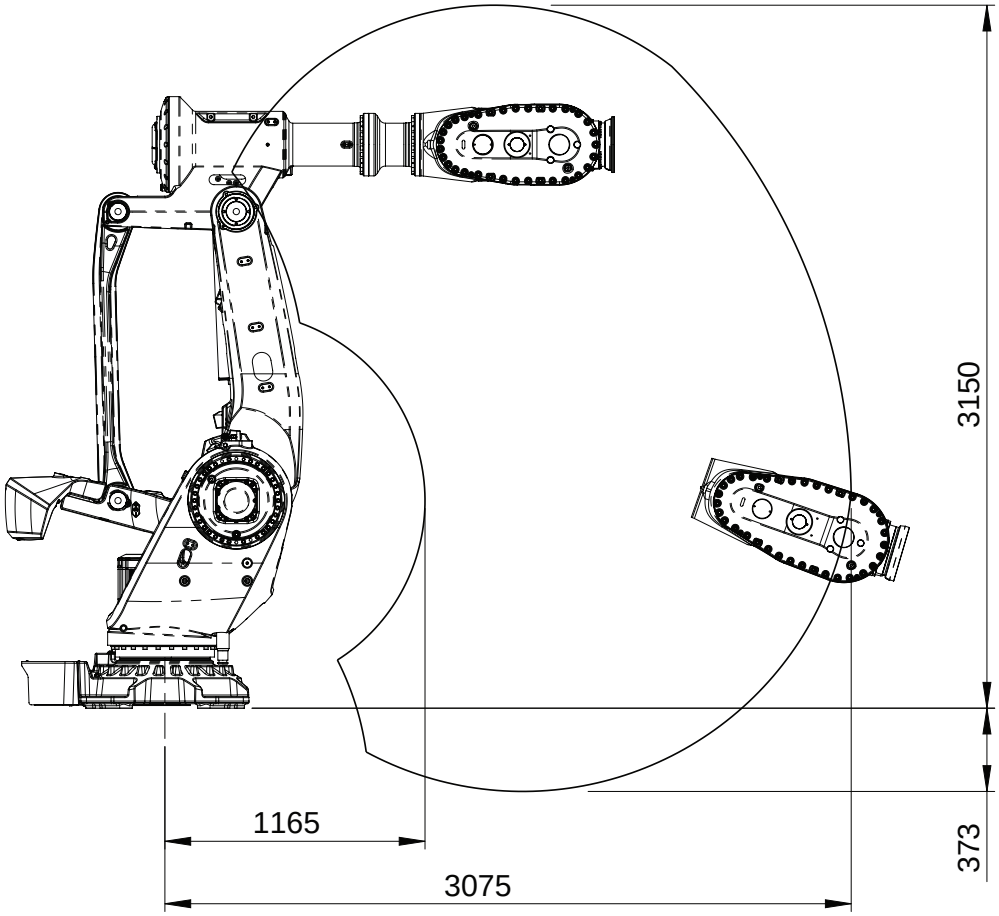
2.2 Working range
Continued

Illustration, working range IRB 7710-430/3.1

This illustration shows the unrestricted working range of the robot.



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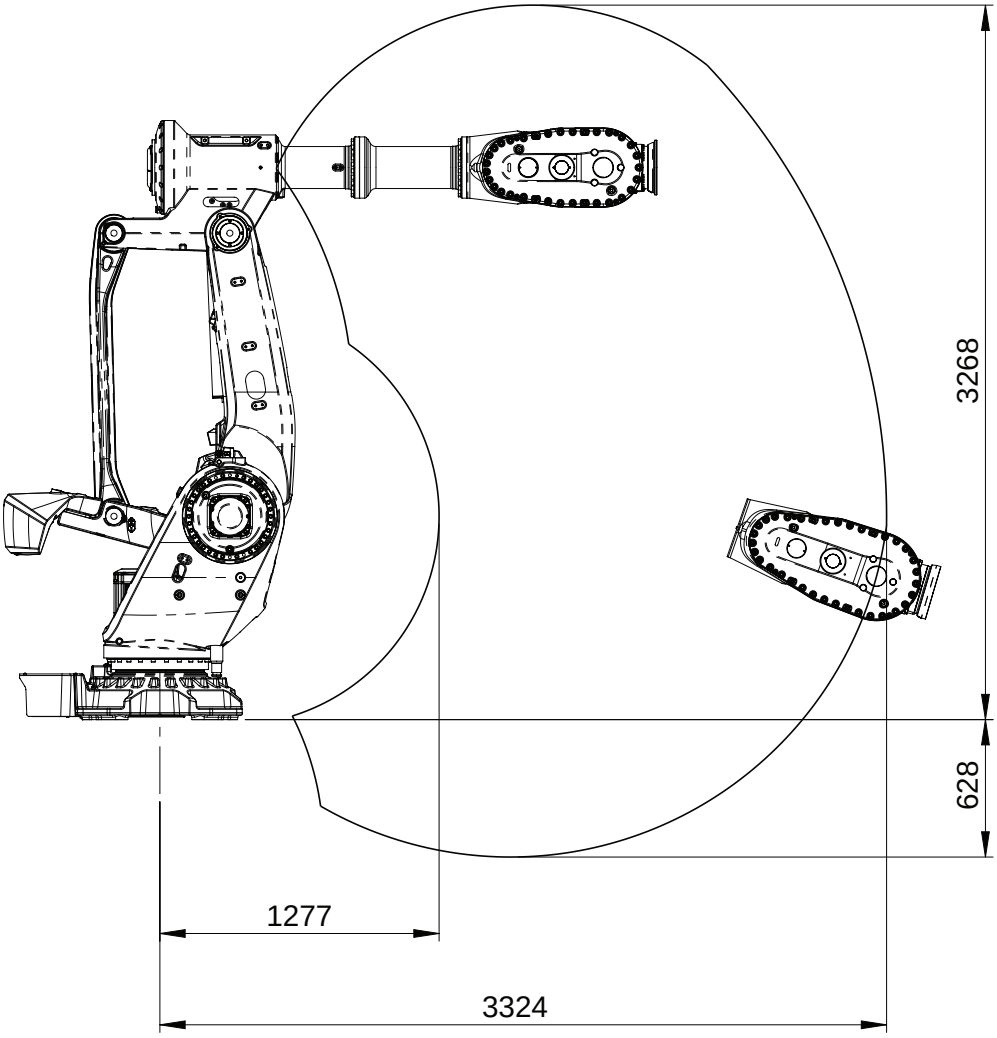
Illustration, working range IRB 7710-360/3.3

This illustration shows the unrestricted working range of the robot.



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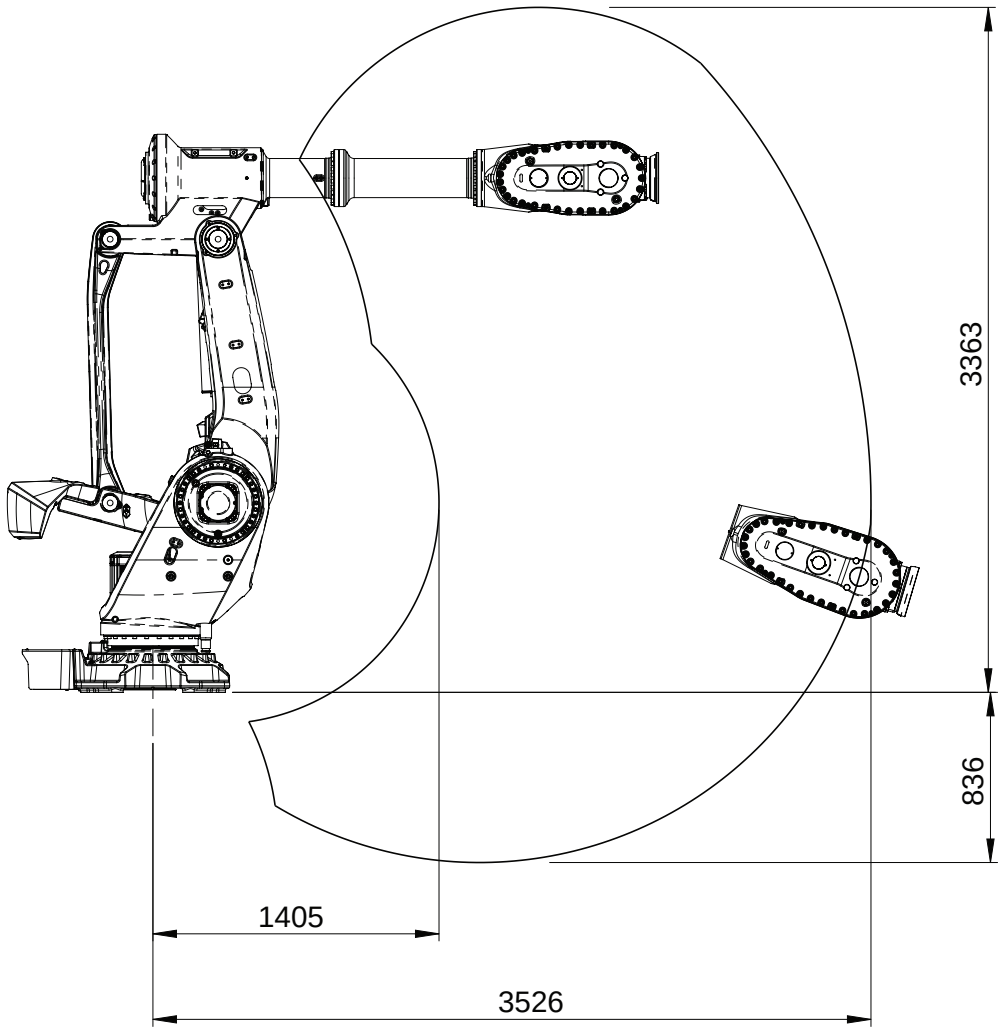
2.2 Working range
Continued

Illustration, working range IRB 7710-310/3.5

This illustration shows the unrestricted working range of the robot.



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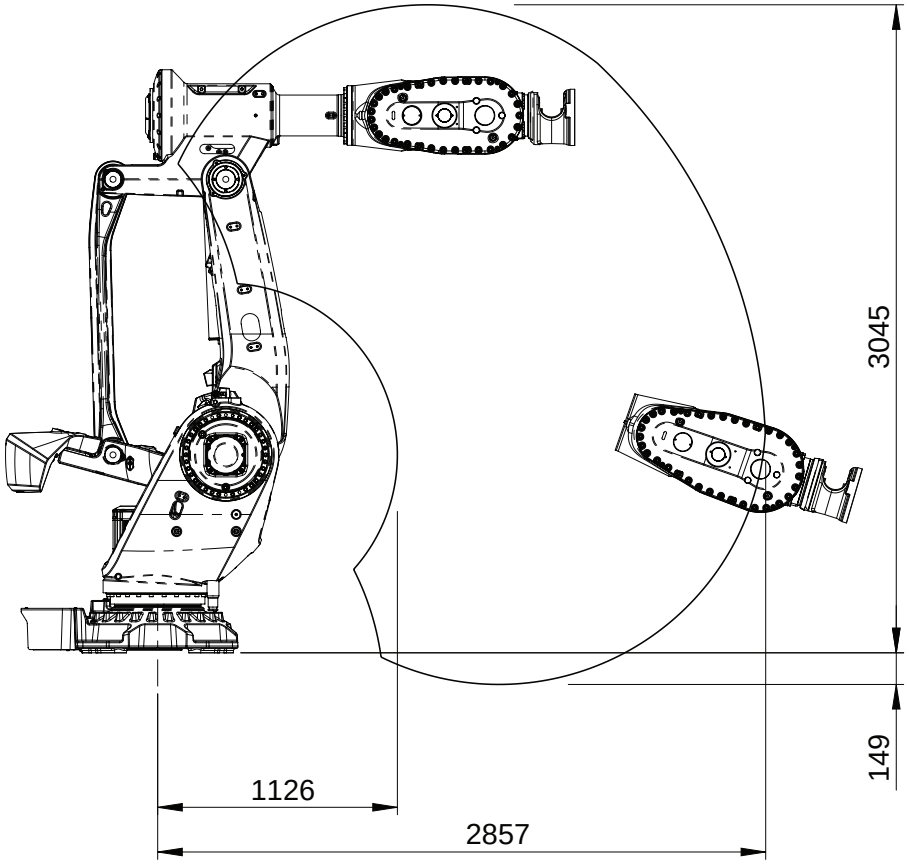
Illustration, working range IRB 7710-400/2.85 LID

This illustration shows the unrestricted working range of the robot.



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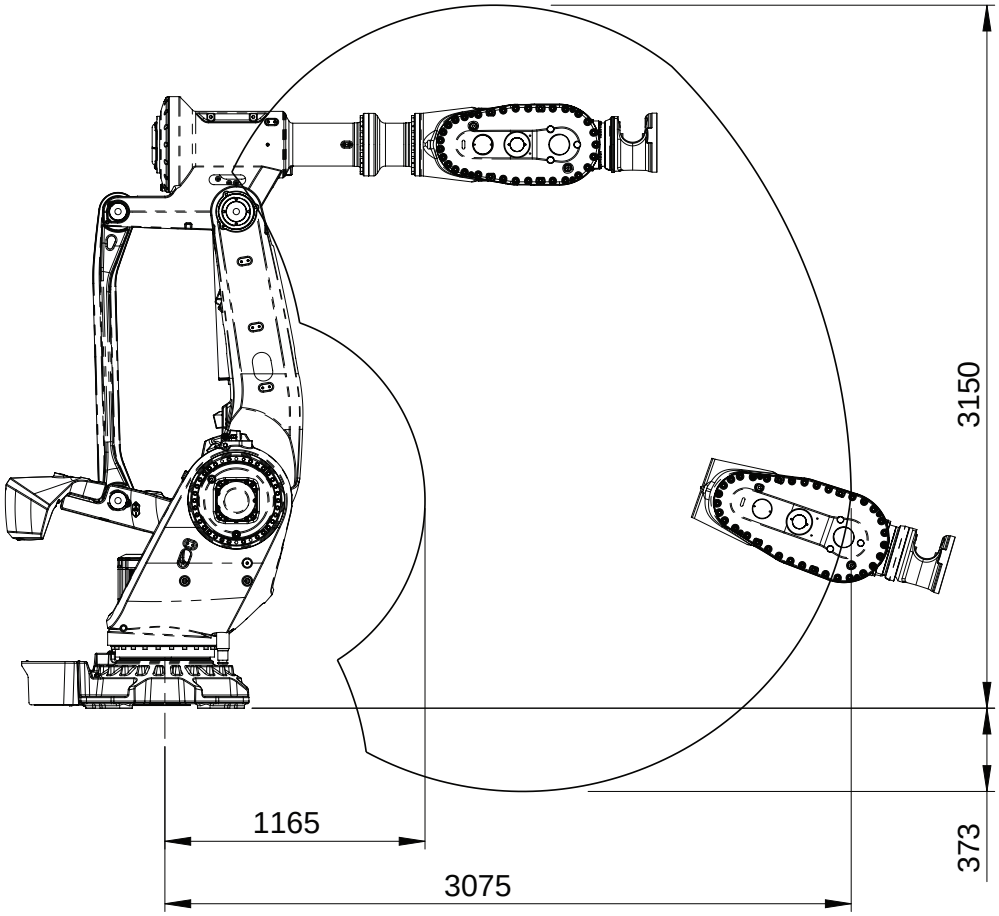
Illustration, working range IRB 7710-390/3.1 LID

This illustration shows the unrestricted working range of the robot.



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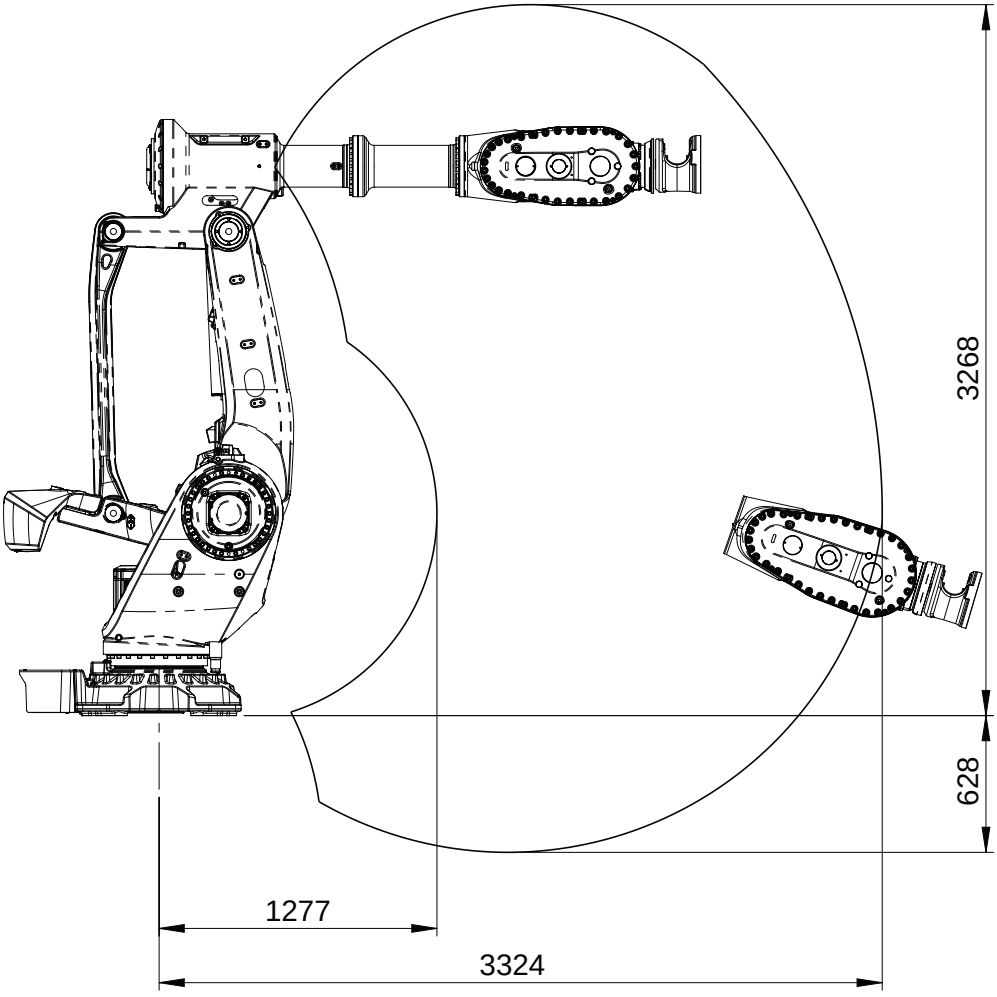
Illustration, working range IRB 7710-325/3.3 LID

This illustration shows the unrestricted working range of the robot.



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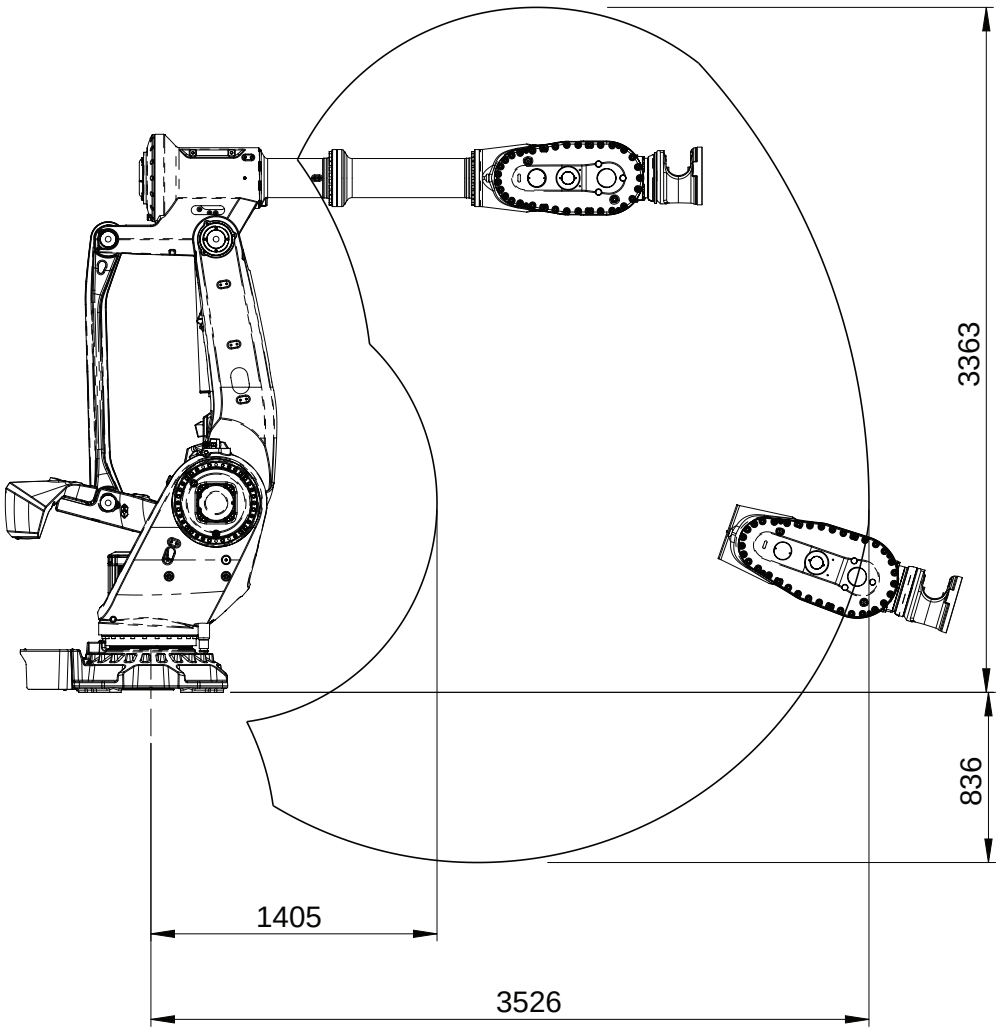
2.2 Working range
Continued

Illustration, working range IRB 7710-280/3.5 LID

This illustration shows the unrestricted working range of the robot.



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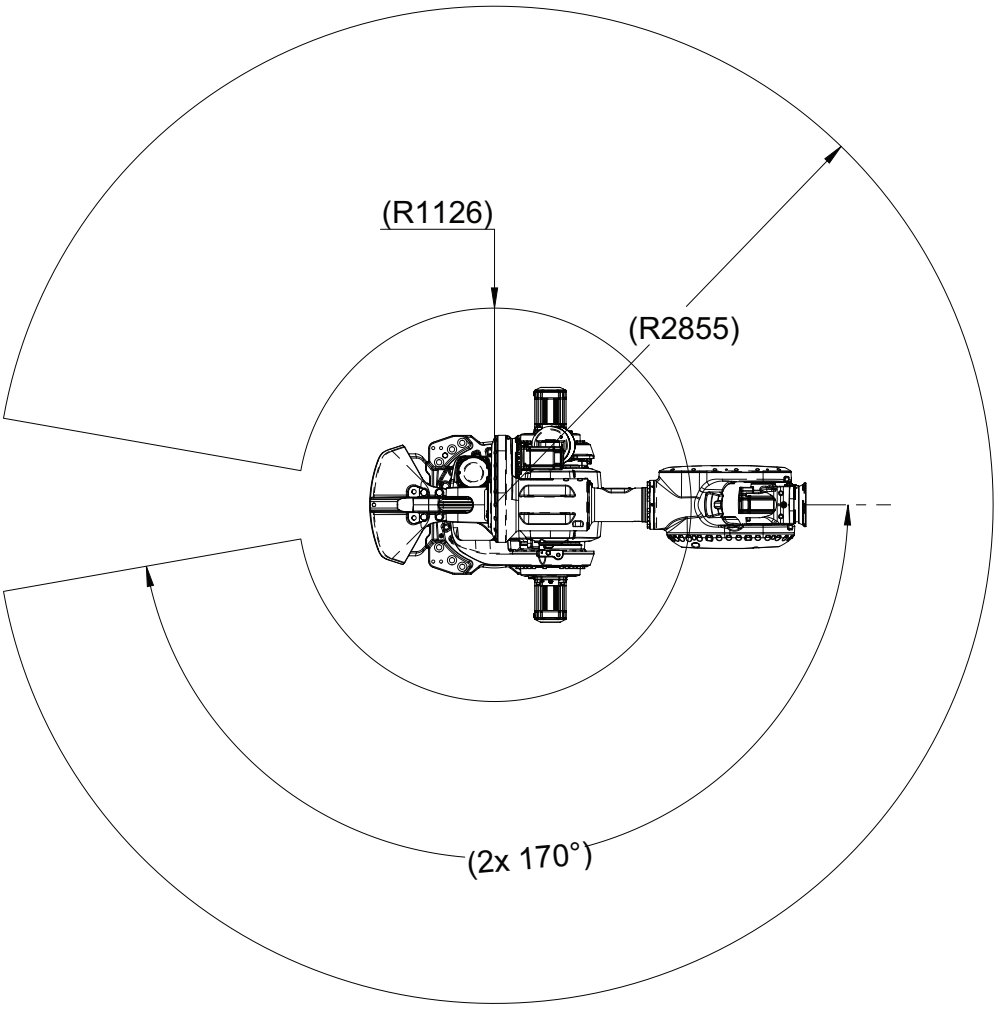
Top view of working range

IRB 7710-500/2.85, IRB 7710-400/2.85 LID



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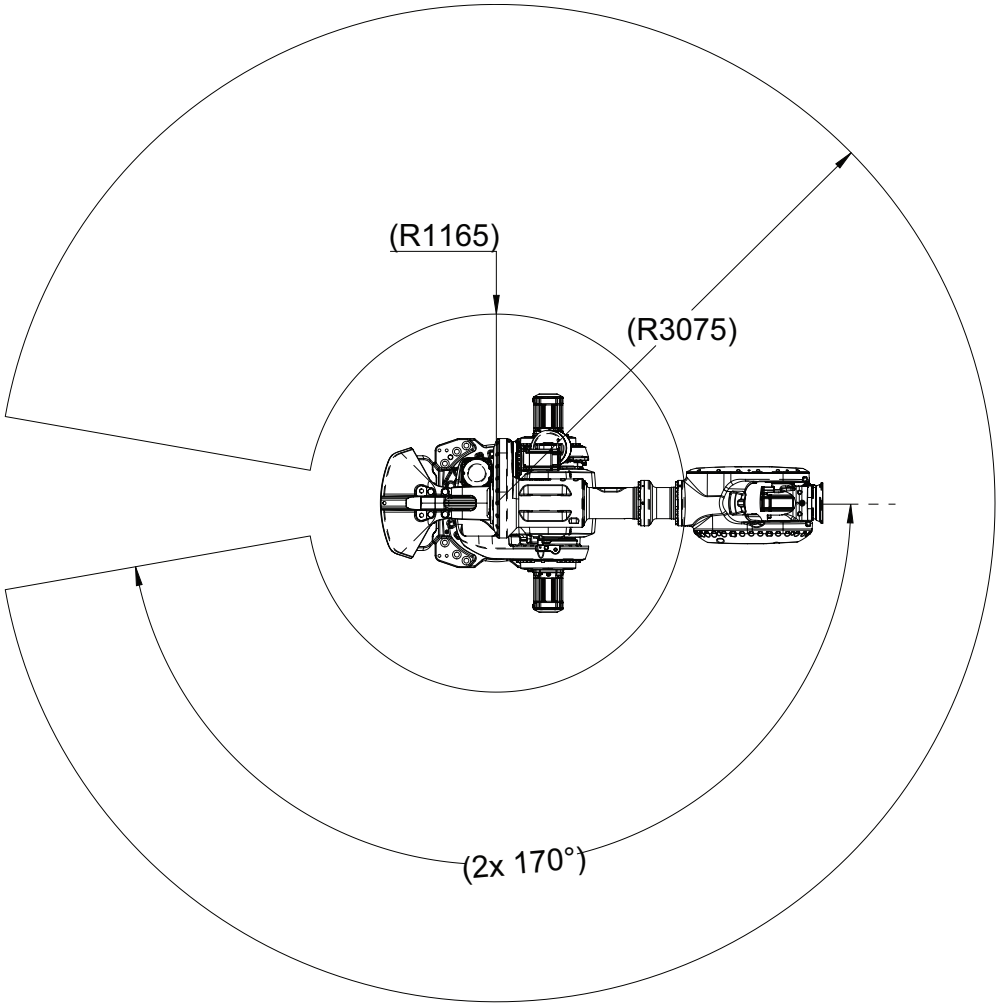
2.2 Working range
Continued

IRB 7710-430/3.1, IRB 7710-390/3.1 LID



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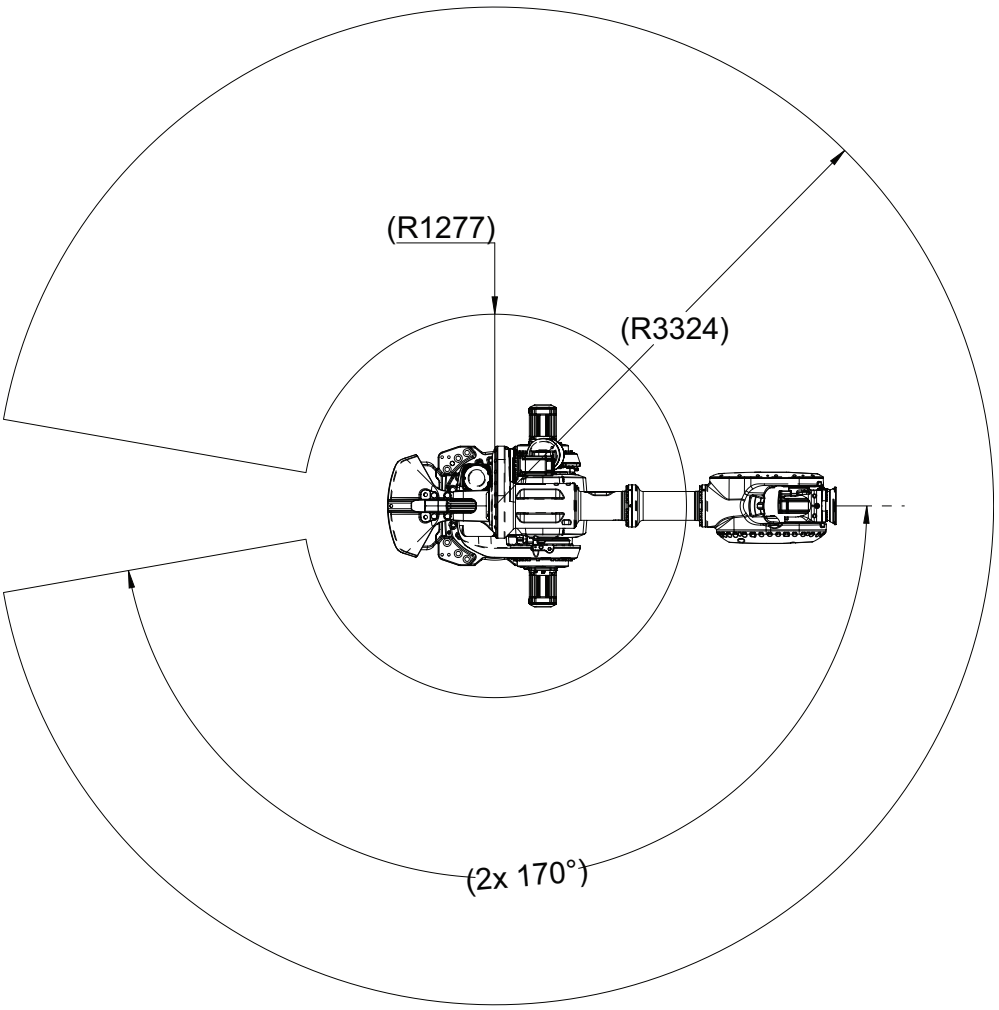
IRB 7710-360/3.3, IRB 7710-325/3.3 LID



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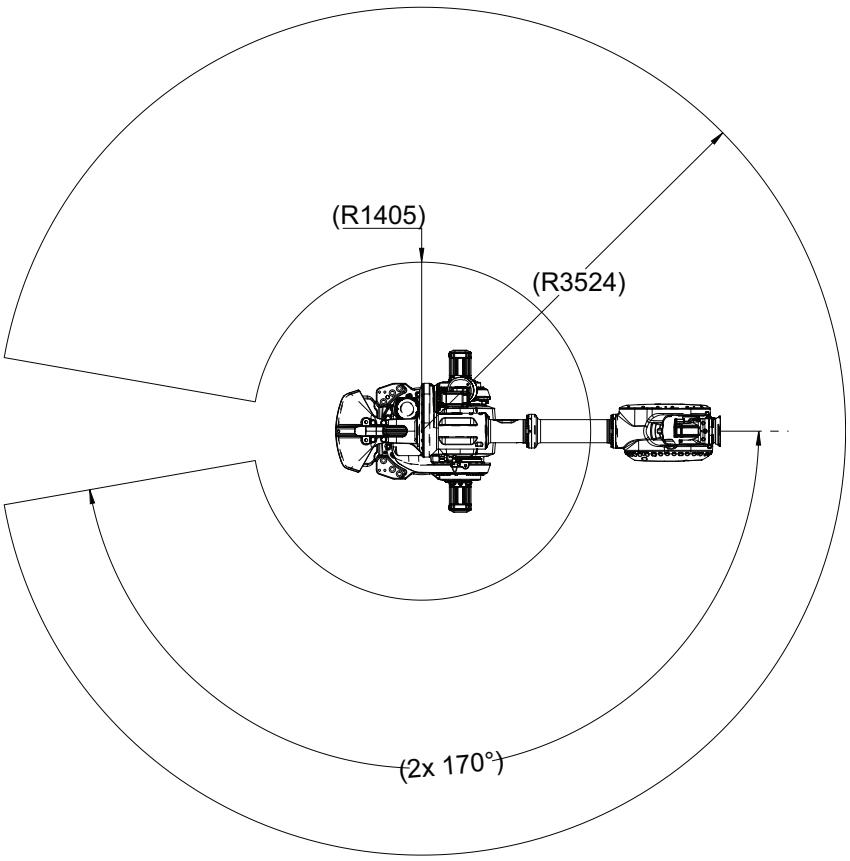
2.2 Working range
Continued

IRB 7710-310/3.5, IRB 7710-280/3.5 LID



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Working range

Axis	Working range	Note
Axis 1	±170°	
	±220° i, ii	The default working range for axis 1 can be extended as an option. See *Extended working range, axis 1 (option) on page 98*.
Axis 2	-65°/+82.2° iii	
Axis 3	-27°/+130° *iii*	
Axis 4	±300°	
Axis 5	±130°	IRB 7710-500/2.85, IRB 7710-430/3.1, IRB 7710-360/3.3, IRB 7710-310/3.5
	±120° iv	IRB 7710-400/2.85 LID, IRB 7710-390/3.1 LID, IRB 7710-325/3.3 LID, IRB 7710-280/3.5 LID
Axis 6	±360°	IRB 7710-500/2.85, IRB 7710-430/3.1, IRB 7710-360/3.3, IRB 7710-310/3.5
	±220° *iv*	IRB 7710-400/2.85 LID, IRB 7710-390/3.1 LID, IRB 7710-325/3.3 LID, IRB 7710-280/3.5 LID

i *Option Extended Working Range Axis 1 (3324-1)*
ii Not valid for DressPack SW.

Continues on next page

iii Maximum combined movements reduced for IRB 7710-400/2.85 LID.
iv Maximum combined movements reduced.

Working range limitation

The working range of axis 1 can be reduced by altering the parameter values. Installation of additional mechanical stops is recommended. See *Working range alterations on page 93*.

2.3 The unit is sensitive to ESD

Description

ESD (electrostatic discharge) is the transfer of electrical static charge between two bodies at different potentials, either through direct contact or through an induced electrical field. When handling parts or their containers, personnel not grounded may potentially transfer high static charges. This discharge may destroy sensitive electronics.

Safe handling

Use one of the following alternatives:

- Use a wrist strap.

  Wrist straps must be tested frequently to ensure that they are not damaged and are operating correctly.
- Use an ESD protective floor mat.

  The mat must be grounded through a current-limiting resistor.
- Use a dissipative table mat.

  The mat should provide a controlled discharge of static voltages and must be grounded.

3 Installation and commissioning

3.1 Introduction to installation and commissioning

General

This chapter contains assembly instructions and information for installing the IRB 7710 at the working site.

See also the product manual for the robot controller.

The installation must be done by qualified installation personnel in accordance with the safety requirements set forth in the applicable national and regional standards and regulations.

The technical data is detailed in section *Technical data on page 37*.

Safety information

Before any installation work is commenced, all safety information must be observed.

There are general safety aspects that must be read through, as well as more specific safety information that describes the danger and safety risks when performing the procedures. Read the chapter *Safety on page 15* before performing any installation work.

3.2 Unpacking

3.2.1 Pre-installation procedure

Introduction

This section is intended for use when unpacking and installing the robot for the first time. It also contains information useful during later re-installation of the robot.

Prerequisites for installation personnel

Installation personnel working with an ABB product must:

- Be trained by ABB and have the required knowledge of mechanical and electrical installation/maintenance/repair work.
- Conform to all national and local codes.

Checking the pre-requisites for installation

	Action
1	Make a visual inspection of the packaging and make sure that nothing is damaged.
2	Remove the packaging.
3	Check for any visible transport damage. **Note** Stop unpacking and contact ABB if transport damages are found.
4	Clean the unit with a lint-free cloth, if necessary. Wipe away the protective transportation grease applied to the tool flange. Do not wipe away any grease from the balancing device piston rod.
5	Make sure that the lifting accessory used (if required) is suitable to handle the weight of the robot as specified in: *Weight, robot on page 37*
6	If the robot is not installed directly, it must be stored as described in: *Storage conditions, robot on page 39*
7	Make sure that the expected operating environment of the robot conforms to the specifications as described in: *Operating conditions, robot on page 39*
8	Before taking the robot to its installation site, make sure that the site conforms to: • *Loads on foundation, robot on page 38* • *Protection classes, robot on page 40* • *Requirements, foundation on page 39*
9	Before moving the robot, please observe the stability of the robot: *Risk of tipping/stability on page 57*
10	When these prerequisites are met, the robot can be taken to its installation site as described in section: *On-site installation on page 59*
11	Install required equipment, if any.

3.2.2 Risk of tipping/stability

Risk of tipping

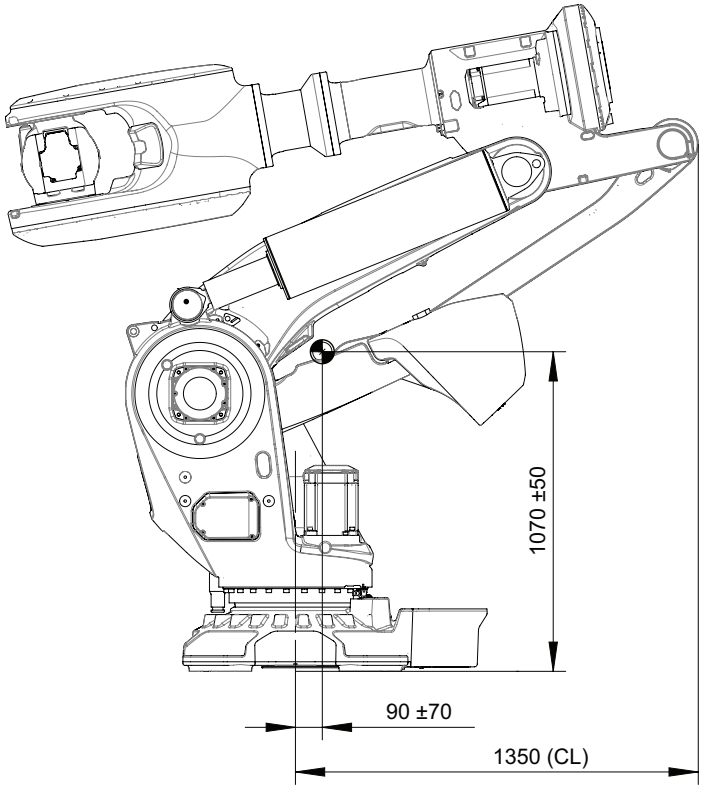
If the robot is not fastened to the foundation while moving the arm, the robot is not stable in the whole working area. Moving the arm will displace the center of gravity, which may cause the robot to tip over.

The transportation position is the most stable position.

Do not change the robot position before securing it to the foundation!

Transportation position

This figure shows the robot in its transportation position.



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Note

The robot might be positioned in a different position at delivery, due to actual configurations and options (for example DressPack).

Axis number	Angle of axis
Axis 1	0° (or 90°)
Axis 2	-55°
Axis 3	+10°
Axis 4	+90°
Axis 5	-90°

Continues on next page

3.2.2 Risk of tipping/stability
Continued

Axis number	Angle of axis
Axis 6	0°

WARNING

The robot is likely to be mechanically unstable if not secured to the foundation.

3.3 On-site installation

3.3.1 Brief installation procedure

Introduction

This procedure is a brief guide when installing the robot for the first time. Also see *Pre-installation procedure on page 56*.

First installation

Use these procedures to install the IRB 7710.

	Action	Note
1	Transport the manipulator to its intended location.	
2	Install the valid platform or prepare the foundation for the manipulator.	See *Installing a base plate on page 60*.
3	Lift and secure the manipulator to the platform/foundation.	See *Lifting the robot on page 69*. See *Orienting and securing the robot on page 77*.
4	Connect the manipulator to the controller.	See • *Product manual - OmniCore V400XT*
5	Configure the safety settings.	See • *Product manual - OmniCore V400XT*
6	How to start and run the robot is described in the product manual for the controller.	See • *Product manual - OmniCore V400XT*
7	Install required equipment, if any.	
8	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	
9	After performing the first test run, lubricate the balancing device piston rod.	See *Lubricating the piston rod on page 188*.

3.3.2 Installing a base plate

Advantages of using a base plate

Instead of installing the robot directly on the floor, a base plate can be manufactured and used as an adapter between the floor and the robot base. This list specifies some of the advantages of using a base plate:

- to ensure a plain surface with a high precision of the robot base hole configuration
- to simplify adjustment of levelness by machined surfaces or by using shims
- to distribute the press force from the robot to a larger foot print
- to compensate poor floor quality that might not be suitable for fastening the robot base directly onto. The base plate has a greater number of fastening points to the foundation and makes a larger footprint, which reduces the load on each fastening point.
- to reduce surface pressure on the foundation contact points, which minimizes the risk of wearing down an uneven surface and thereby causing changes in the robot fastening tightening torque
- to be able to prepare the installation site before robot delivery
- to increase the precision between the positions of an installed robot and other equipment

Note

Do **not** use a base plate for installation of an inverted robot.

Base plate drawing

The following figure shows the dimensions for a base plate (dimensions in mm).

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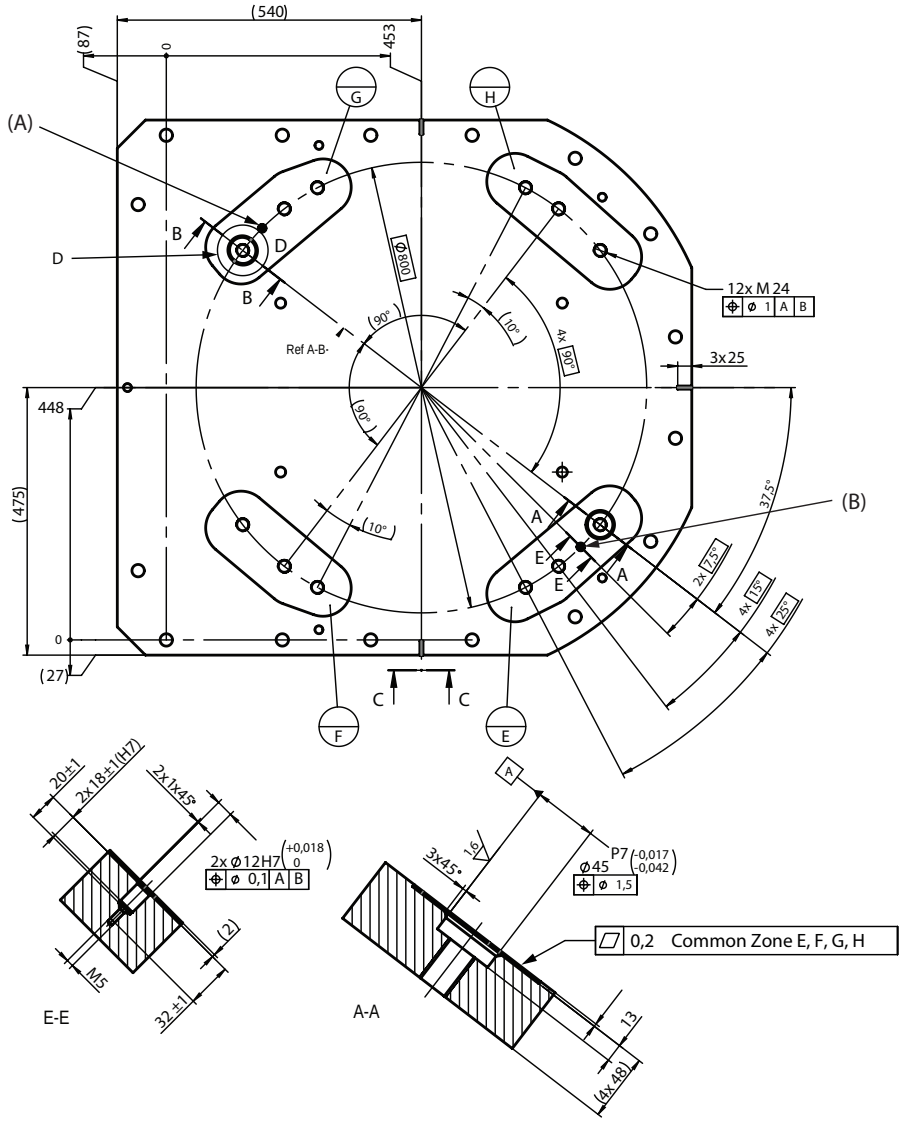

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Pos	Description
A, B	Hole for locating pins, see *Base plate, locating pins on page 64*
E, F, G, H	Common tolerance zone (accuracy all over the base plate from one contact surface to the other)

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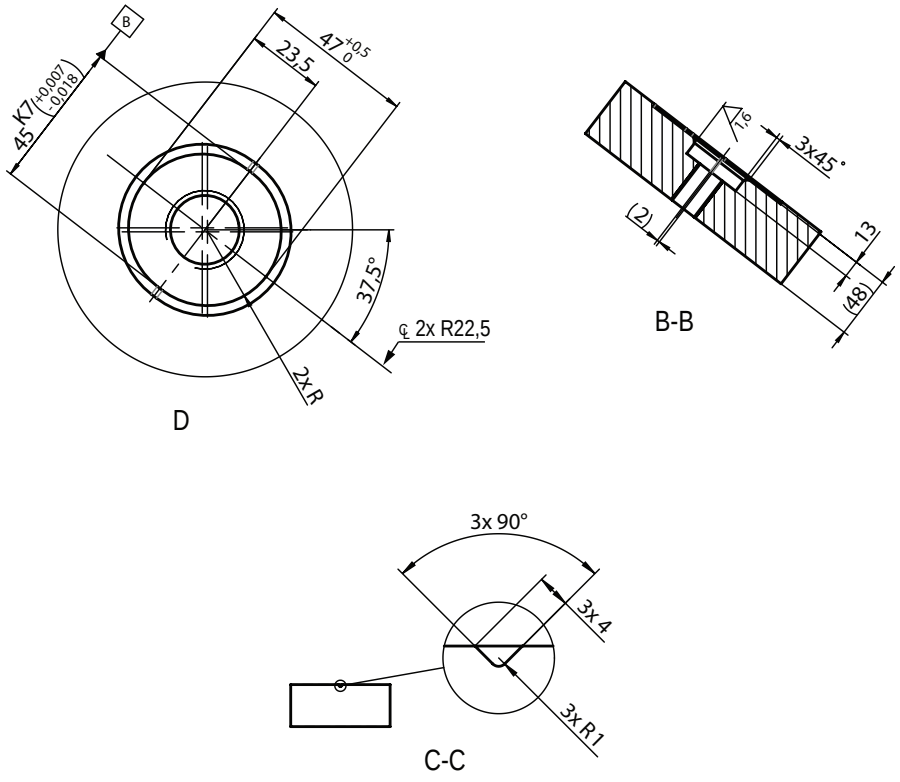
3.3.2 Installing a base plate

Continued



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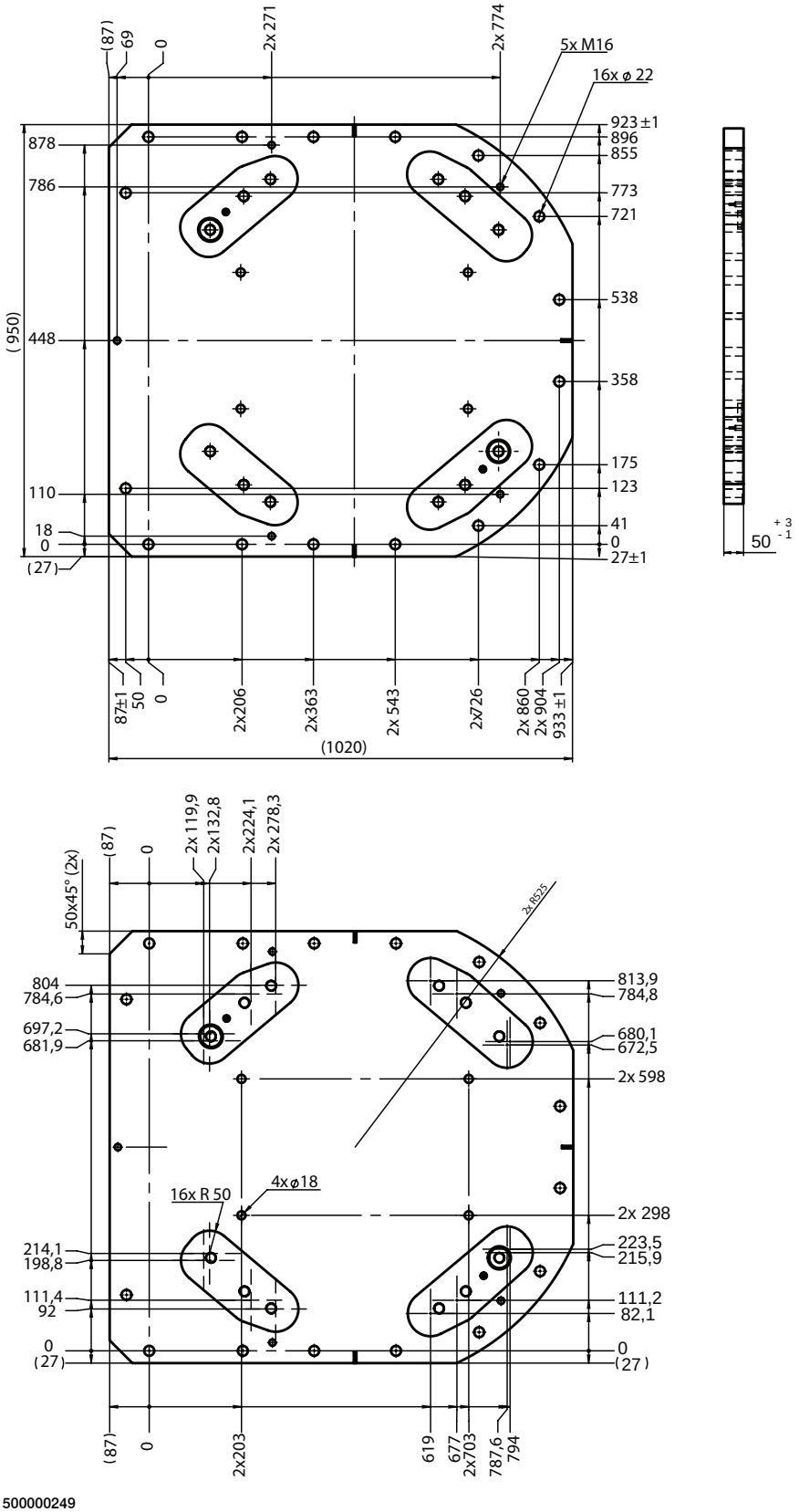

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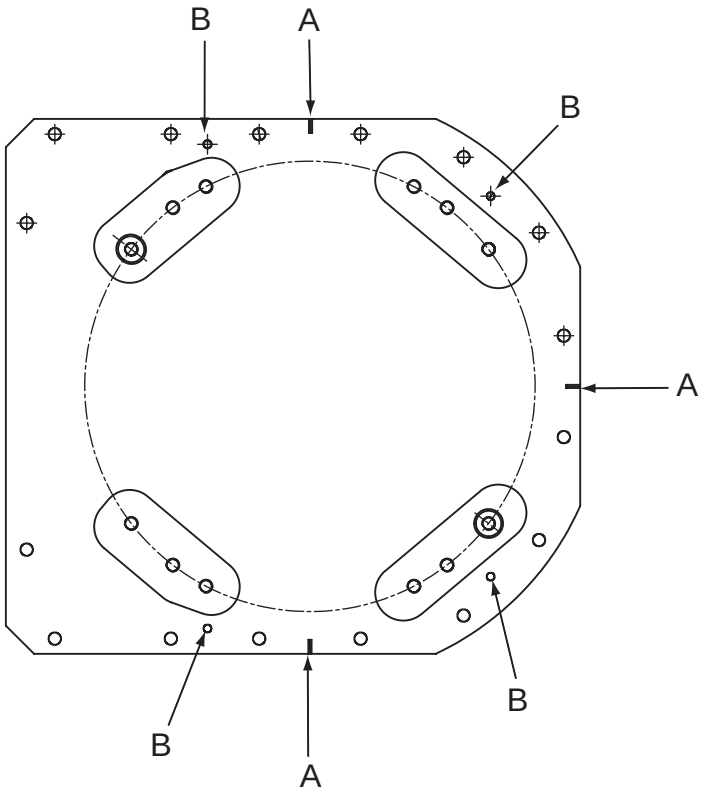
3.3.2 Installing a base plate
Continued

Base plate, orienting grooves and leveling bolts

The illustration below shows the orienting grooves and attachment holes for leveling bolts in the base plate.



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A	Orienting grooves (3 pcs)
B	Levelling bolts, attachment holes (4 pcs)

Base plate, locating pins

Locating pins are the recommended positioning components and especially required for robots with option Absolute Accuracy.

Assembly of locating pins

The figure below shows the locating pins installed in the base plate.

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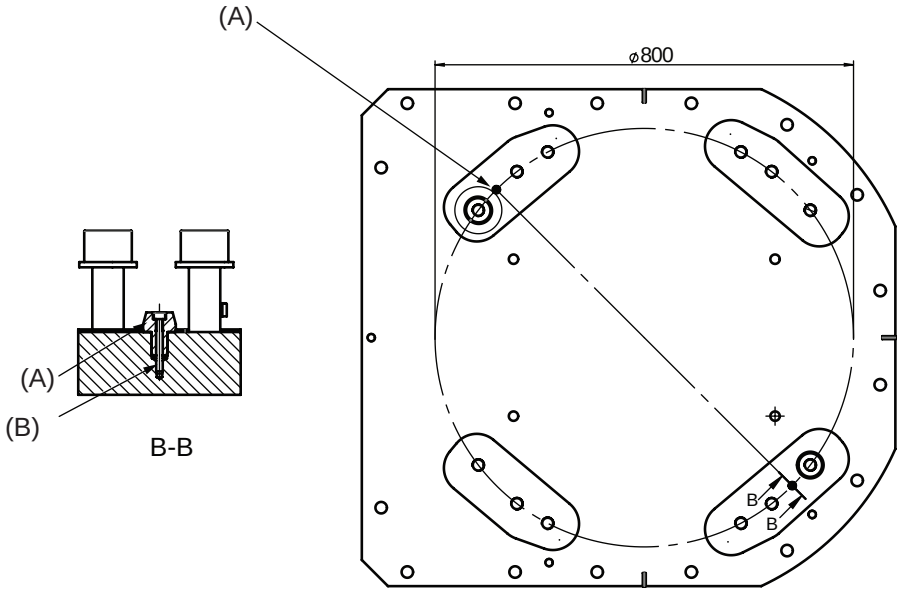

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Pos	Description
A	Locating pin: 3HAC051645-001 (2 pcs)
B	M5 x 40. Tightening torque 6 Nm. (x2)

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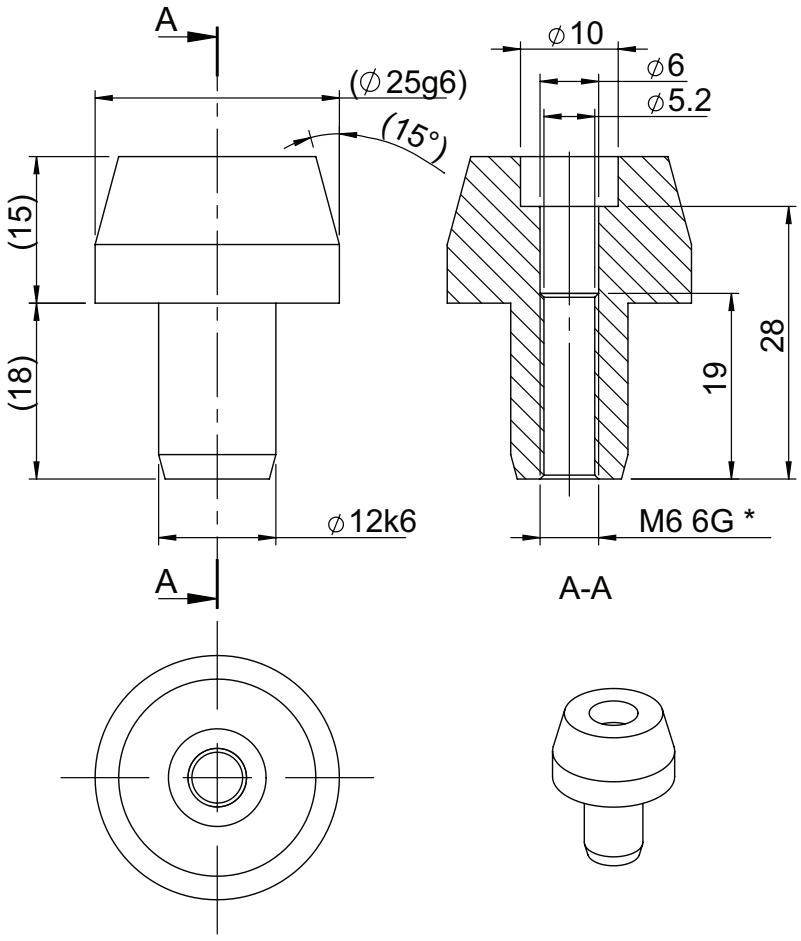
3.3.2 Installing a base plate
Continued

Dimension of locating pins (guide pins)



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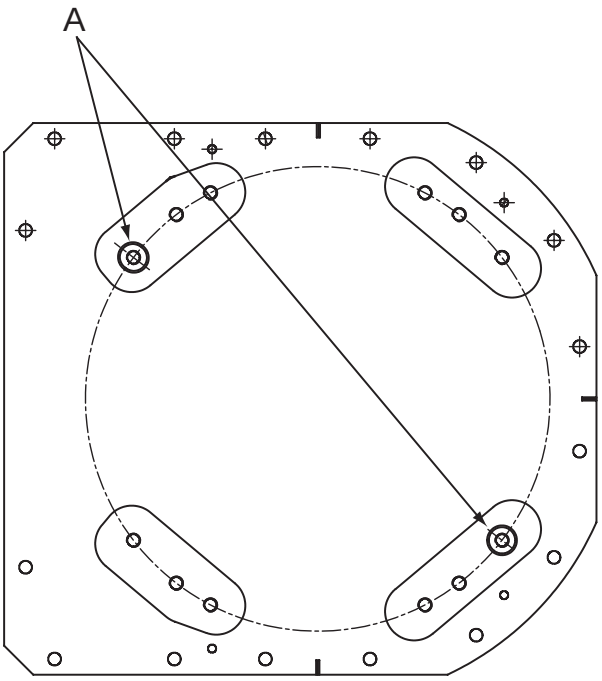
Pos	Description
-	Cylindrical guide pin (Requires attachment screws, see *Assembly of locating pins on page 64*.)
*	Threaded M6 hole that can be used for removal of the locating pin, for example with a slide hammer.

Base plate, guide sleeve holes

Guide sleeves are not recommended for robots with option Absolute Accuracy.

The illustration below shows the guide sleeve holes in the base plate.

Continues on next page



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A	Guide sleeve holes (2 pcs)

Base plate

This section details how to secure the base plate to the foundation.

	Action	Note
1	Make sure the foundation is levelled.	
2	**CAUTION** All lifting equipment used must be sized accordingly!	
3	Position base plate in relation to the robot work location using the grooves in the base plate.	Shown in figure *Base plate, orienting grooves and leveling bolts on page 64*.
4	Lift the base plate to its mounting position.	
5	Use the base plate as a template and drill attachment holes as required by the selected bolt dimension.	Attachment holes: 16 pcs.
6	Fit the base plate and use the levelling bolts to level the base plate.	Shown in figure *Base plate, orienting grooves and leveling bolts on page 64*.
7	If required, fit strips of sheet metal underneath the base plate to fill any gaps.	
8	Secure the base plate to the foundation with screws and sleeves.	

Continues on next page

3.3.2 Installing a base plate
Continued

	Action	Note
9	Recheck the four contact surfaces on the base plate to make sure the base plate is levelled and flat. If it is not, use pieces of sheet metal or similar to bring the base plate to a levelled position.	Maximum allowed deviation all over the base plate, from one contact surface to the other: 0.3 mm.

3.3.3 Lifting the robot

3.3.3.1 Lifting the robot with fork lift

Lifting methods

The robot may be lifted and transported using a fork lift, provided that available special aids are used.

This section specifies available special aids and references to valid user documentation for the lifting accessories.

Required tools and equipment

Equipment	Article number	Note
Fork lift accessory set	3HAC047054-003	Contains fork lift pockets and all required hardware for installation on robot base. User instructions are enclosed with the tool.

Required documents

Document	Document number
Directions for use - Fork lift accessory set 3HAC047054-001	3HAC048484-002

Lifting the robot

	Action	Note
1	Lift the robot with a fork lift according to the user instructions enclosed with the fork lift accessory.	

3.3.3.2 Lifting the robot with roundslings

Recommended lifting method

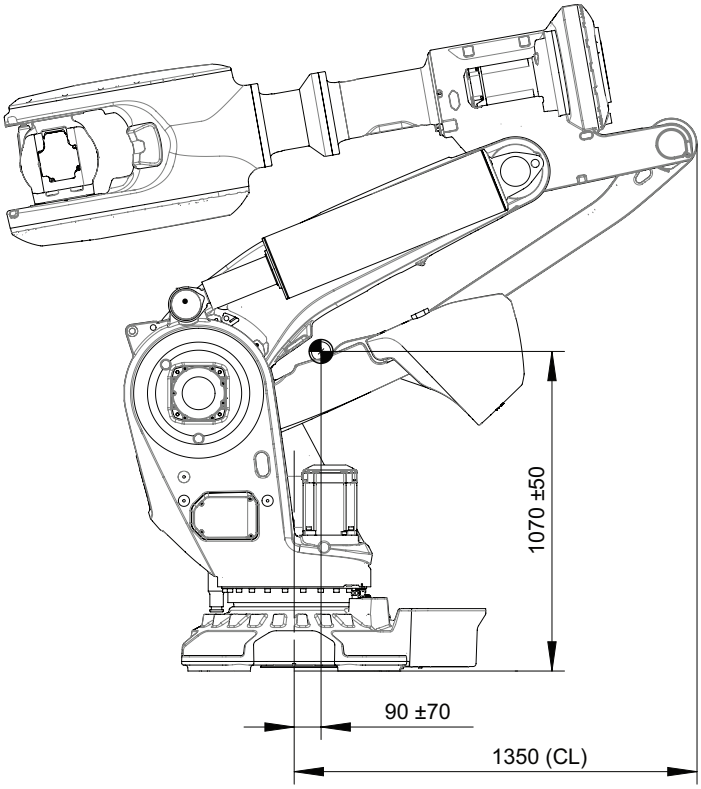
Recommended lifting method for the robot includes one of following lifting accessories:

- Fork lift accessory set: 3HAC047054-003. See *Lifting the robot with fork lift on page 69*.

The robot can also be lifted with roundslings as detailed in this section.

Illustration - lifting position

This figure shows the robot in its lifting and transportation position.



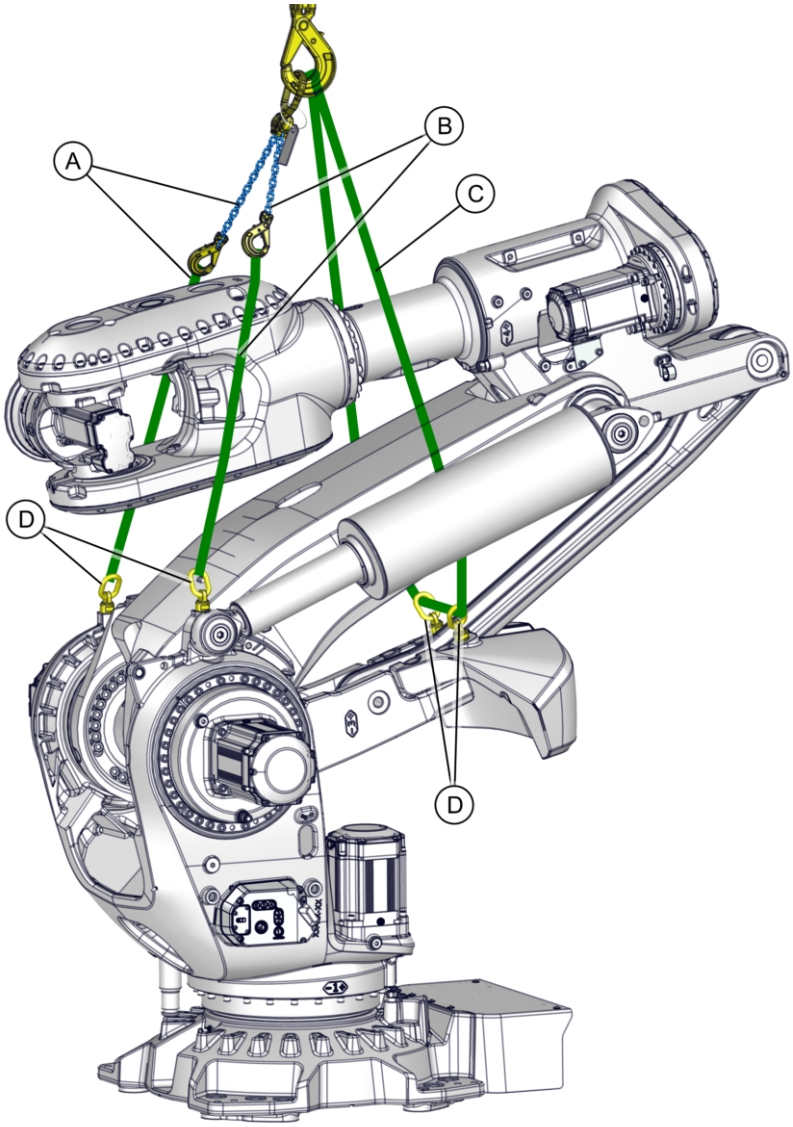
xx2300001519

DANGER

Attempting to lift a robot in any other position than the recommended lifting position may result in the robot tipping over, causing severe damage or injury.

Continues on next page

Illustration - attaching the roundslings



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Pos	Description	Note	Quantity
A	Roundsling and adjustable lifting chain	Complete length 1.86 m [i]	1 pcs
B	Roundsling and adjustable lifting chain	Complete length 1.78 m [ii]	1 pcs
C	Roundsling	4 m	1 pcs
D	Swivel eye bolt M20	M20	4 pcs

i Use a roundsling (for example 1 m) to avoid scratches on the manipulator combined with lifting chains, to get the exact length of the lifting accessory for a balanced lift of the manipulator.

ii Use a roundsling (for example 1 m) to avoid scratches on the manipulator combined with lifting chains, to get the exact length of the lifting accessory for a balanced lift of the manipulator.

Continues on next page

3.3.3.2 Lifting the robot with roundslings
Continued

CAUTION

The weight of the IRB 7710 robot is 2,130 - 2,250 kg (depending on robot variant)

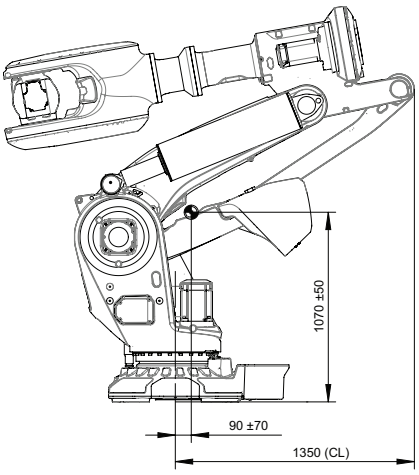
All lifting accessories used must be sized accordingly.

Required tools and equipment

Equipment	Article number	Note
Overhead crane	-	
Roundsling and adjustable lifting chain	-	See *Illustration - attaching the roundslings on page 71*.
Swivel eye bolt M20	-	M20

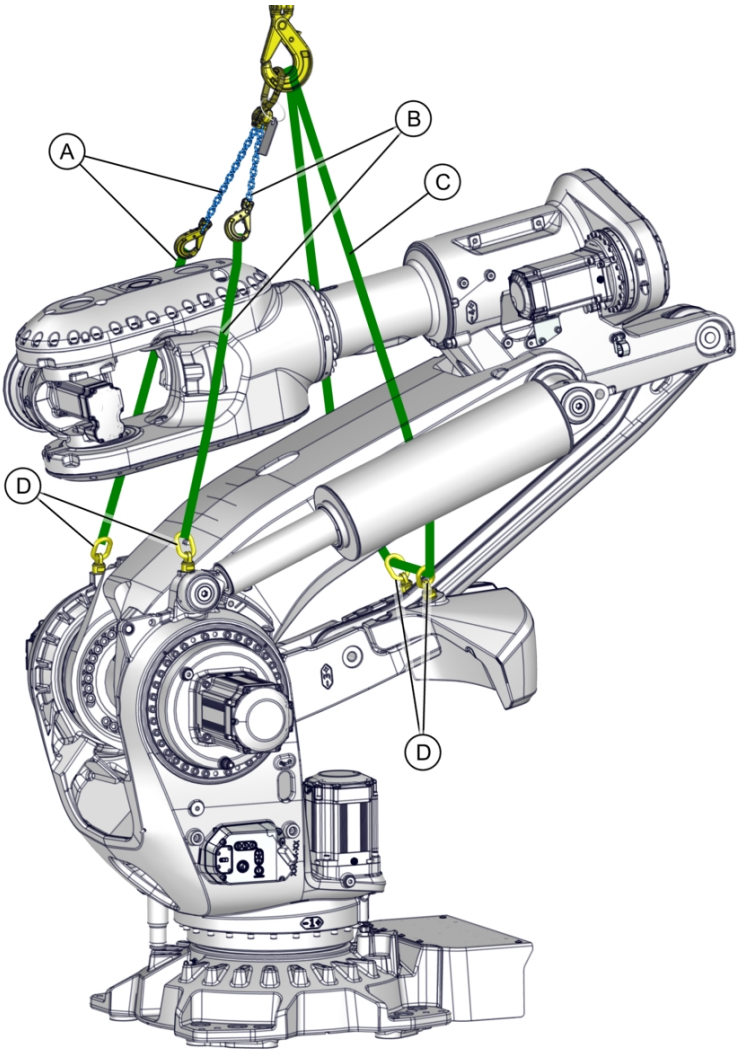
Lifting the robot with roundslings

Use this procedure to lift the robot with roundslings.

	Action	Note
1	Make sure the robot is positioned in the recommended position for transportation and lifting. • Axis 1: 0° (or 90°) • Axis 2: -55° • Axis 3: +10° • Axis 4: +90° • Axis 5: -90° • Axis 6: 0° **WARNING** The robot is mechanically unstable if not secured to the foundation.	 xx2300001519
2	**CAUTION** The weight of the IRB 7710 robot is 2,130 - 2,250 kg (depending on robot variant) All lifting accessories used must be sized accordingly.	
3	Fit lifting eyes / eye bolts to the lifting points of the robot.	Swivel eye bolt M20 (4 pcs)

Continues on next page

	Action	Note
4	Attach the roundslings to the robot according to the figure. Make sure the roundslings do not rub against any sharp edges.	



xx2300001539

Pos	Description	Note	Quantity
A	Roundsling and adjustable lifting chain	Complete length 1.86 m [i]	1 pcs
B	Roundsling and adjustable lifting chain	Complete length 1.78 m [ii]	1 pcs
C	Roundsling	4 m	1 pcs
D	Swivel eye bolt M20	M20	4 pcs

i Use a roundsling (for example 1 m) to avoid scratches on the manipulator combined with lifting chains, to get the exact length of the lifting accessory for a balanced lift of the manipulator.

ii Use a roundsling (for example 1 m) to avoid scratches on the manipulator combined with lifting chains, to get the exact length of the lifting accessory for a balanced lift of the manipulator.

Continues on next page

3.3.3.2 Lifting the robot with roundslings

Continued

	Action	Note
5	 **WARNING** Personnel must not, under any circumstances, be present under the suspended load.	
6	Raise the overhead crane to lift the robot.	

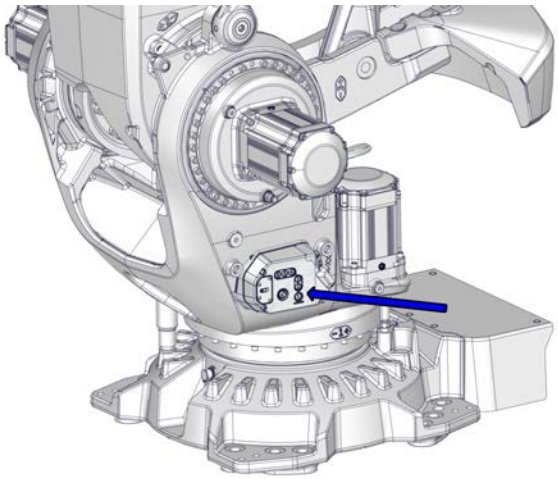
3.3.4 Manually releasing the brakes

Introduction to manually releasing the brakes

This section describes how to release the holding brakes for the axes motors.

Location of the brake release unit

The brake release unit is located as shown in the figure.



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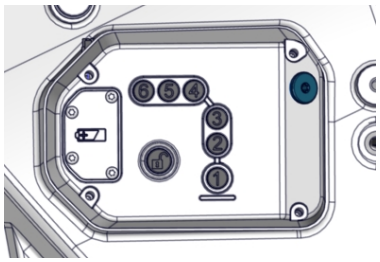
Releasing the brakes

This procedure describes how to release the holding brakes when the robot is equipped with a brake release unit.

	Action	Note
1	The internal brake release unit is equipped with buttons for controlling the axes brakes. The buttons are numbered according to the numbers of the axes. **Note** If the robot is not connected to the controller, power must be supplied to the connector R1.MP according to the section *Supplying power to connector R1.MP on page 76*.	
2	**DANGER** When releasing the holding brakes, the robot axes may move very quickly and sometimes in unexpected ways. Make sure no personnel is near or beneath the robot.	

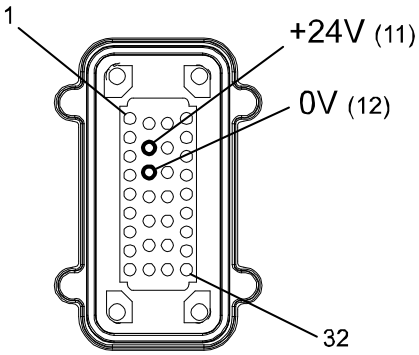
Continues on next page

3.3.4 Manually releasing the brakes
Continued

	Action	Note
3	Release the holding brake on a particular robot axis by pressing the corresponding button and the padlock button simultaneously, on the internal brake release unit. The brake will be enable as soon as the button is released.	 xx2200001751

Supplying power to connector R1.MP

If the robot is not connected to the controller, power must be supplied to connector R1.MP on the robot, in order to enable the brake release buttons.

	Action	Note
1	**DANGER** Incorrect connections, such as supplying power to the wrong pin, may cause all brakes to be released simultaneously and instantly!	
2	Supply • 0V on pin 12. • 24V on pin 11. **Note** Do not interchange the 24V and 0V pins. If they are mixed up, damage can be caused to internal electrical components.	 xx0600002937
3	Use the brake releasing button as described in *Releasing the brakes on page 75*.	

3.3.5 Orienting and securing the robot

General

This section describes how to orient and secure the robot to the base plate or to the steel structure foundation in order to run the robot safely.

Attachment screws

The table below specifies the type of securing screws and washers to be used for securing the robot to the base plate/steel structure foundation.

Suitable screws	M24 x 100
Quantity	12 pcs
Quality	8.8
Suitable washer	4 mm flat washer
Guide pins	Locating pin: 3HAC051645-001 (2 pcs) Locating pins are required if mounting the manipulator to a track motion or to a base plate. Locating pins are also required for robots with option Absolute Accuracy. For more information, see *Base plate, locating pins on page 64*.
Tightening torque	550 Nm (screws lubricated with Molykote 1000) 600-725 Nm, typical 650 Nm (screws none or lightly lubricated)
Screw tightening yield point utilization factor (v) (according to VDI2230)	90% (v=0.9)
Level surface requirements	0.3 mm [i]

[i] See *Requirements, foundation on page 39*.

Securing a floor mounted robot

Use this procedure to orient and secure the robot floor mounted.

	Action	Note
1	Make sure the installation site for the robot conforms to the specifications in section *Technical data on page 37*.	
2	Prepare the installation site with attachment holes or install a base plate. The foundation surface must be clean and unpainted.	The hole configuration of the base is shown in the figure in *Hole configuration, base on page 79*. For information about a base plate, see *Installing a base plate on page 60*.
3	If using a base plate: fit two locating pins in the base plate.	Locating pins are required if mounting the manipulator to a track motion or to a base plate. Locating pins are also required for robots with option Absolute Accuracy. For more information, see *Base plate, locating pins on page 64*.

Continues on next page

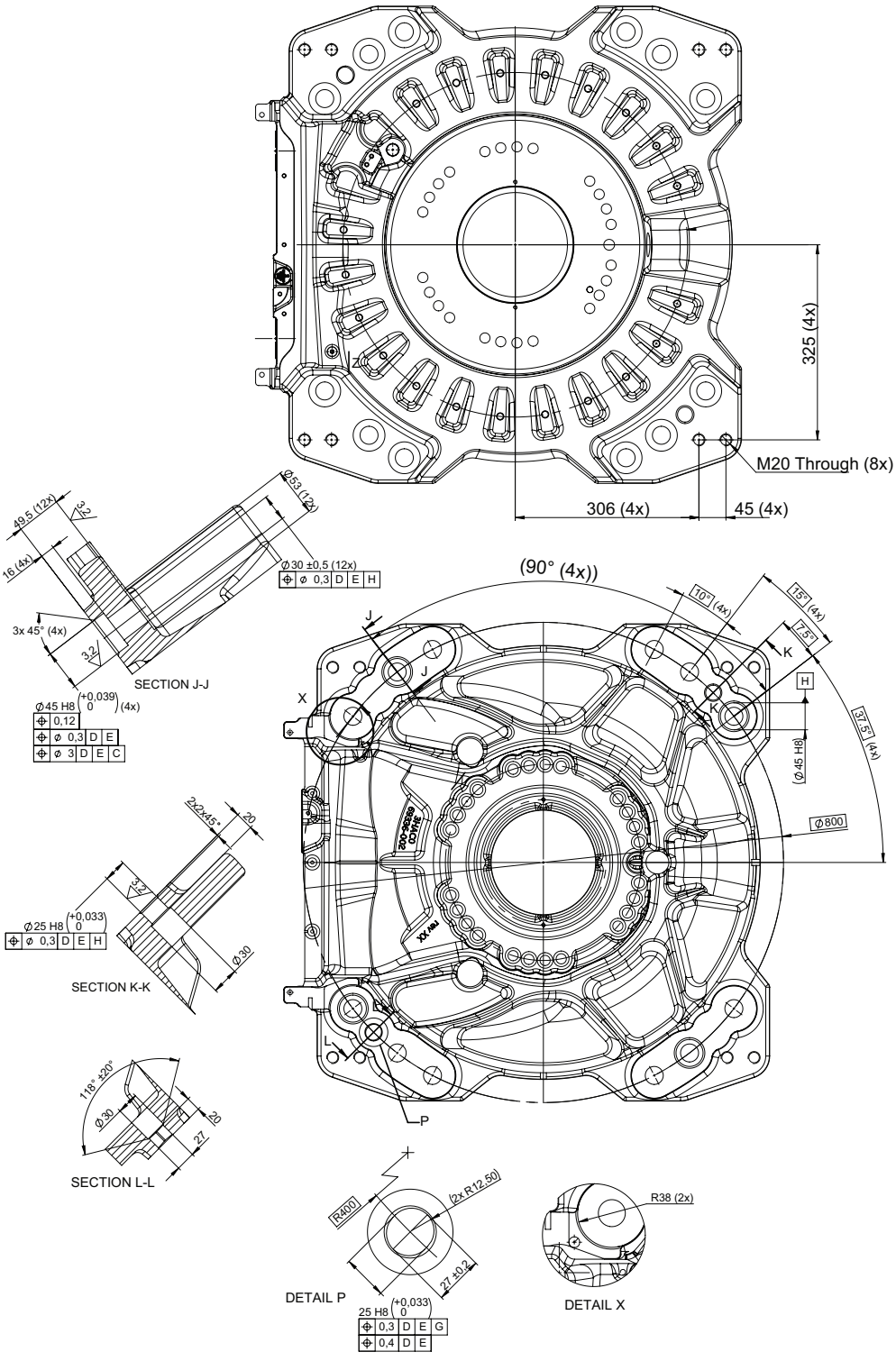
3.3.5 Orienting and securing the robot
Continued

	Action	Note
4	**CAUTION** The weight of the IRB 7710 robot is 2,130 - 2,250 kg (depending on robot variant) All lifting accessories used must be sized accordingly.	
5	**CAUTION** When the robot is put down after being lifted or transported, there is a risk of it tipping, if not properly secured.	
6	Lift the robot.	See *Lifting the robot on page 69*.
7	Guide the robot gently, using the attachment screws while lowering it into its mounting position.	Make sure the robot base is correctly fitted onto the pins.
8	Fit the securing screws and washers in the attachment holes of the base.	Screws: M24 x 100, 12 pcs, quality 8.8 Washers: 4 mm flat washer
9	Tighten the bolts in a crosswise pattern to ensure that the base is not distorted.	Tightening torque: 550 Nm (screws lubricated with Molykote 1000) 600-725 Nm, typical 650 Nm (screws none or lightly lubricated)

Continues on next page

Hole configuration, base

This illustration shows the hole configuration used when securing the robot.



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3.3.6 Loads fitted to the robot, stopping time and braking distances

Define loads carefully

Any loads mounted on the robot must be defined correctly and carefully (with regard to the position of center of gravity and mass moments of inertia) in order to avoid jolting movements and overloading motors, gears and structure.

> **CAUTION**
>
> Incorrectly defined loads may result in operational stops or major damage to the robot.

Load diagrams, permitted extra loads (equipment) and their positions are specified in the product specification. The loads must be defined in the software.

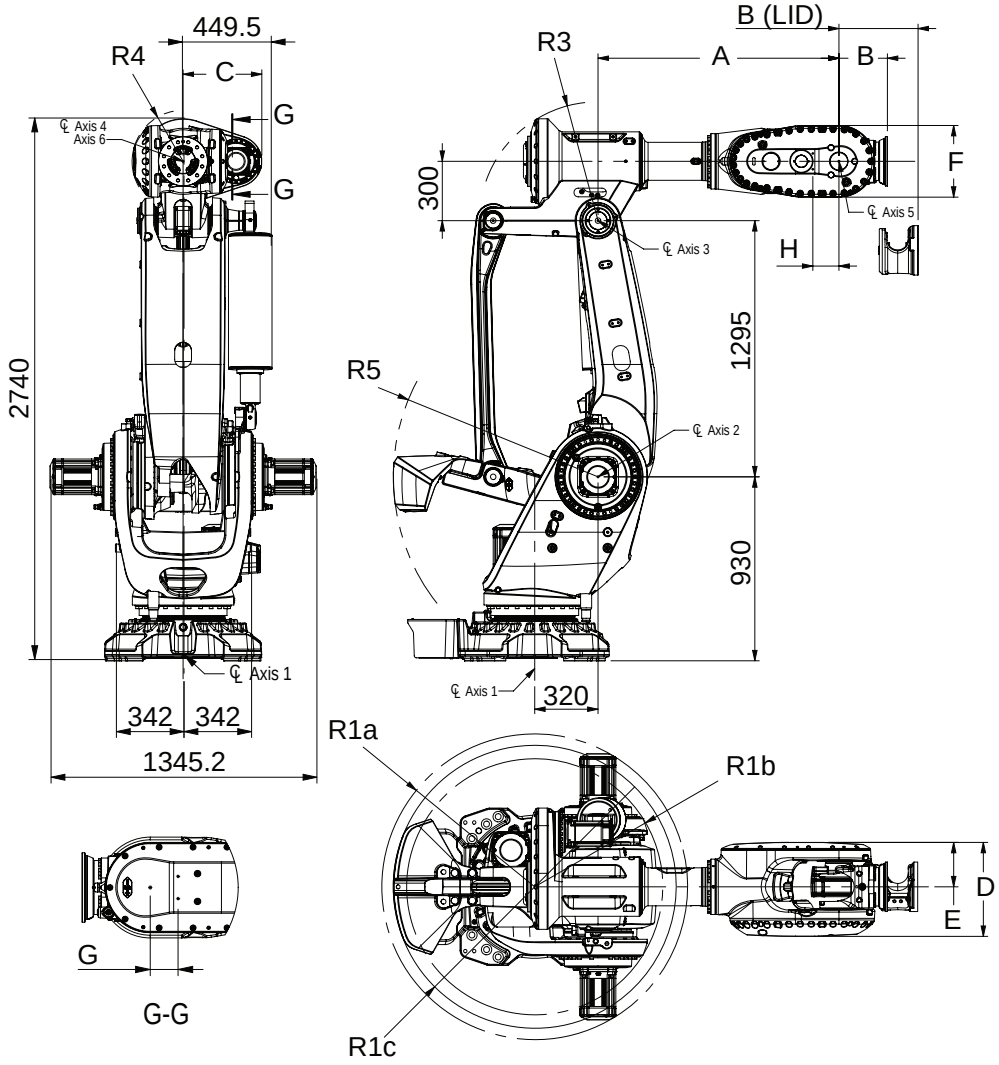
Stopping time and braking distances

The performance of the motor brake depends on if there are any loads attached to the robot.

See the product specification for the robot, listed in *References on page 10*.

3.3.7 Fitting equipment on the robot (robot dimensions)

Robot dimensions



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R1a	Smallest circumscribed radius around axis 1 (side)
R1b	Smallest circumscribed radius around axis 1 (front side)
R1c	Smallest circumscribed radius around axis 1 (side)
R3	Smallest circumscribed radius around axis 3
R4	Smallest circumscribed radius around axis 4
R5	Smallest circumscribed radius around counter weight

Measurements

The measurements are given in mm.

Variant	A	B	C	D	E	F	G	H	R1a	R1b	R1c	R3	R4	R5
IRB 7710-500/2.85	1,218	245	398	475	225	362	100	132	774	647	720	601	258	518

Continues on next page

3.3.7 Fitting equipment on the robot (robot dimensions)
Continued

Variant	A	B	C	D	E	F	G	H	R1a	R1b	R1c	R3	R4	R5
IRB 7710-430/3.1	1,448	245	398	475	225	362	100	132	774	647	720	601	258	518
IRB 7710-360/3.3	1,708	245	398	475	225	362	100	132	774	647	720	601	258	518
IRB 7710-310/3.5	1,918	245	398	475	225	362	100	132	774	647	720	601	258	518
IRB 7710-400/2.85 LID	1,218	400	398	475	225	362	100	132	774	647	720	601	258	518
IRB 7710-390/3.1 LID	1,448	400	398	475	225	362	100	132	774	647	720	601	258	518
IRB 7710-325/3.3 LID	1,708	400	398	475	225	362	100	132	774	647	720	601	258	518
IRB 7710-280/3.5 LID	1,918	400	398	475	225	362	100	132	774	647	720	601	258	518

Extra load on the robot

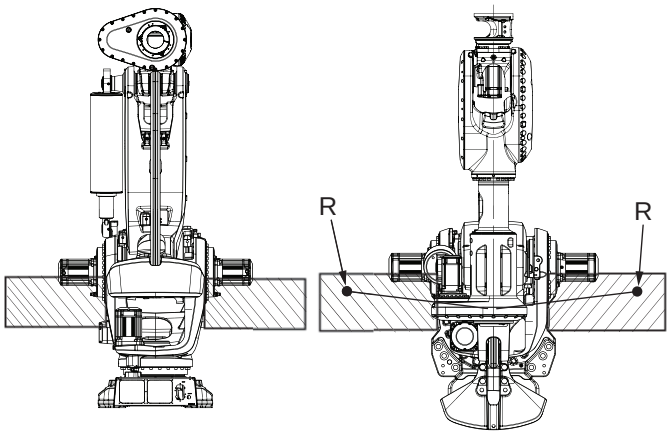
Extra loads can be mounted on robot. Definitions of dimensions and masses are shown in the following figures. The robot is supplied with holes for fitting extra equipment.

Maximum allowed arm load depends on center of gravity of arm load and robot payload.

Frame

The table and figure shows allowed extra load on the frame.

	Description
Permitted extra load on frame	$J_H = 100\ kgm^2$
Recommended position (see the following figure)	$J_H = J_{H0} + M4 \times R^2$ where: • J_{H0} is the moment of inertia of the equipment • R is the radius (m) from the center of axis 1 • M4 is the total mass (kg) of the equipment including bracket and harness (≤ 250 kg)



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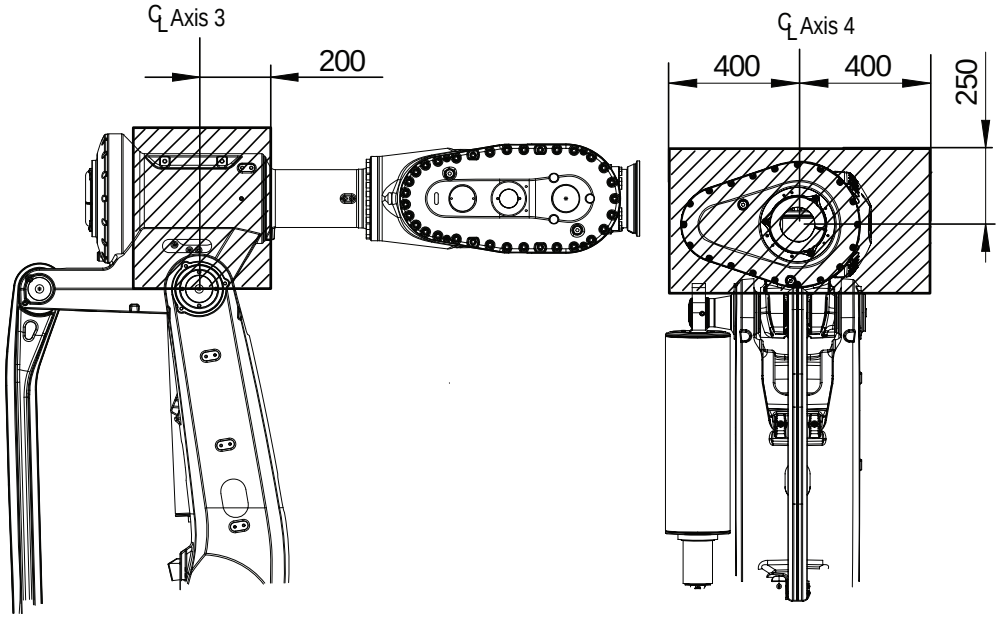
Upper arm

The figure shows the position for a nominal extra load of 50 kg on the upper arm housing on a standard robot. For more precise calculations of allowed extra load up to maximum 200 kg in combination with the reduced payload, use RobotStudio add-in RobotLoad or contact ABB.



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Attachment holes for fitting extra equipment

The robot is supplied with holes for fitting extra equipment.

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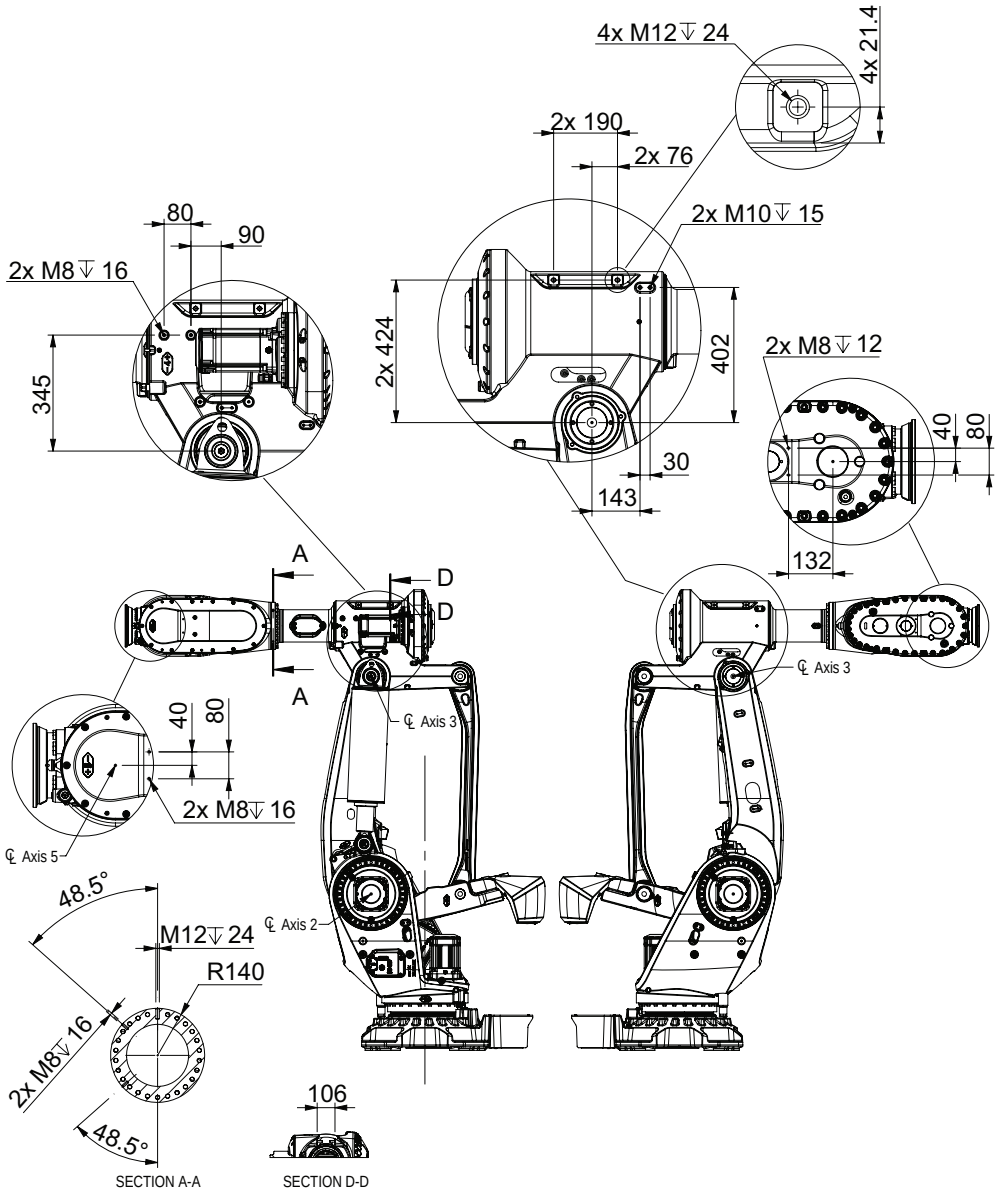
3.3.7 Fitting equipment on the robot (robot dimensions)
Continued

Upper arm



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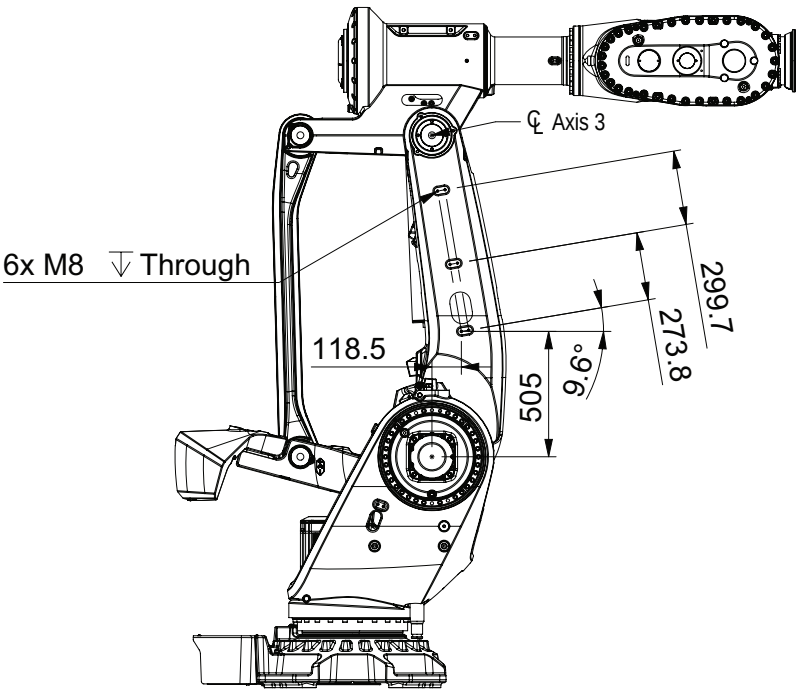
Lower arm



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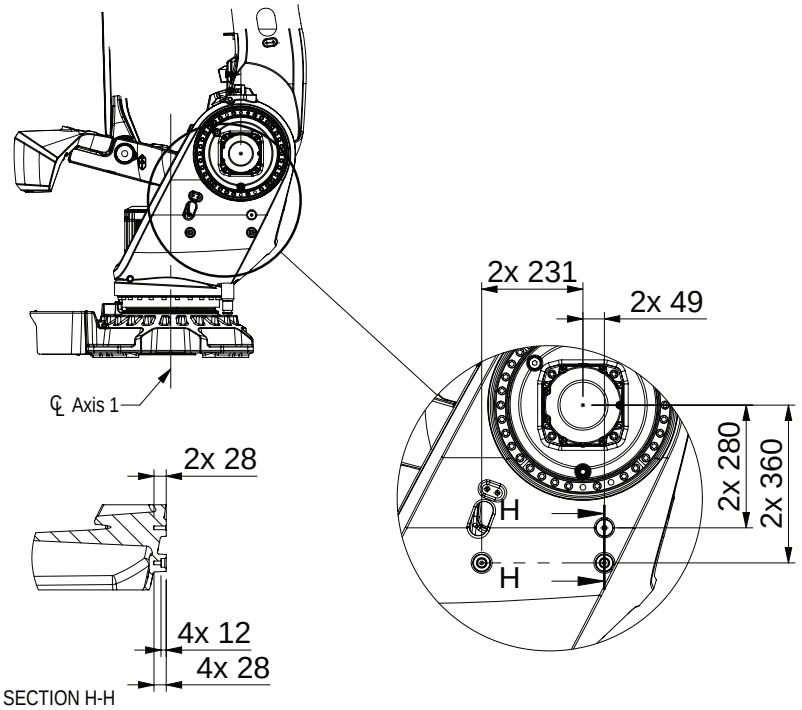
Frame



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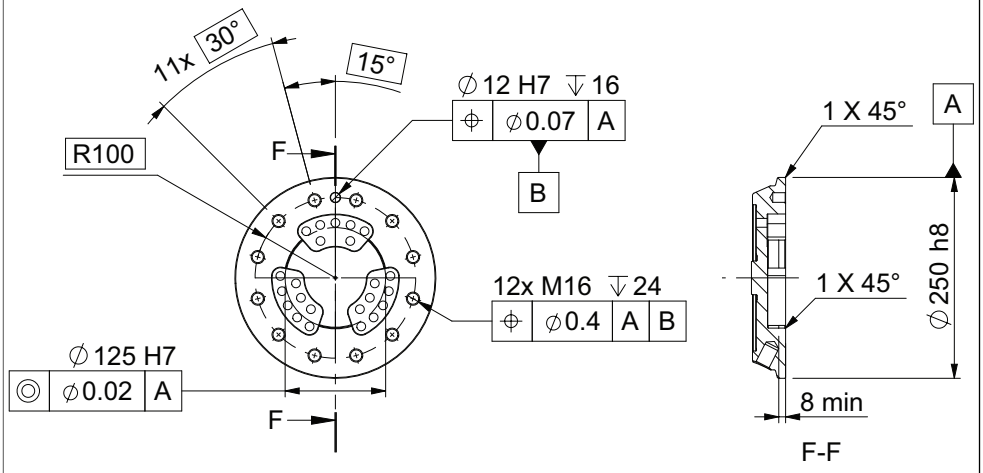
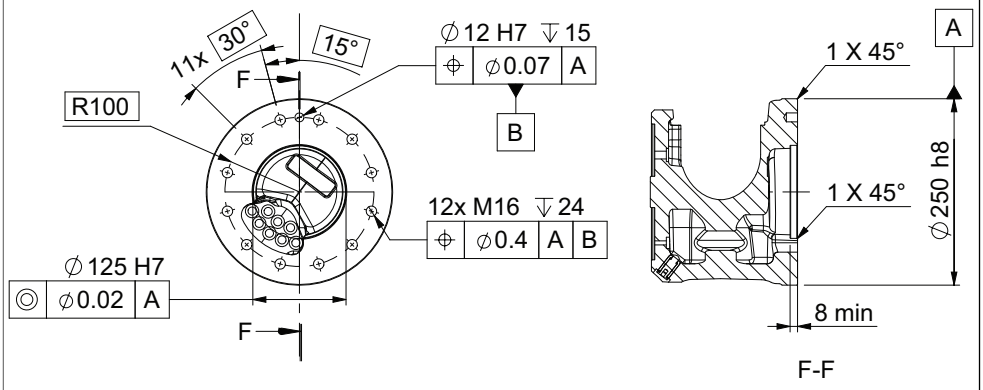
3.3.7 Fitting equipment on the robot (robot dimensions)
Continued

Tool flange dimensions

Robot variant	Tool flange dimension
IRB 7710-500/2.85 IRB 7710-430/3.1 IRB 7710-360/3.3 IRB 7710-310/3.5	
IRB 7710-400/2.85 LID IRB 7710-390/3.1 LID IRB 7710-325/3.3 LID IRB 7710-280/3.5 LID	

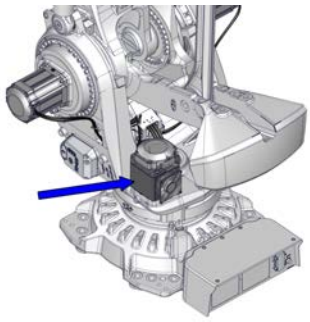
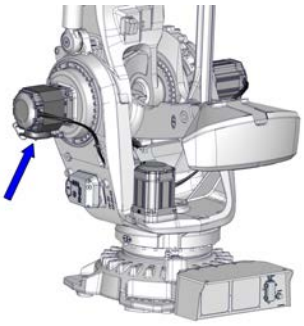
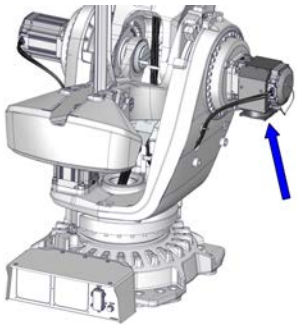
Fastener quality

When fitting tools on the tool flange, only use screws with quality 12.9. For other equipment use suitable screws and tightening torque for your application.

3.3.8 Installing the motor cooling fan (option 3320-1, 3321-1, 3346-1)

Location of the motor cooling fan

A cooling fan can be installed on the motors shown in the figure, as an option. The fan is not possible to install on a robot with protection type Foundry Plus.

Axis- 1	Axis-2	Axis-3
 xx2400000557	 xx2400000558	 xx2400000559

Note

The robot can only have two cooling fans installed at the same time.

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note
Fan unit	3HAC092582-001 (Graphite White) 3HAC092583-001 (ABB Orange)	Available for the axis-1, axis-2 and axis-3 motor. Can not be used together with protection type Foundry Plus. Includes fan unit, customer connection plate and required fasteners.

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required consumables

Consumable	Article number	Note
Cable straps	-	

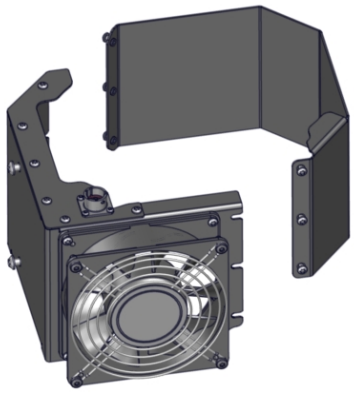
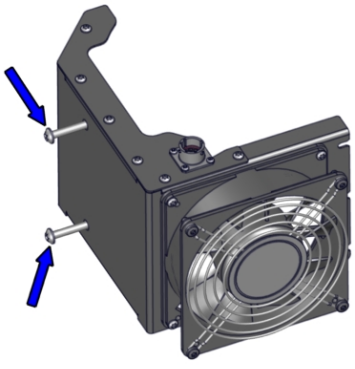
Continues on next page

3.3.8 Installing the motor cooling fan (option 3320-1, 3321-1, 3346-1)
Continued

Installing the cooling fan

Use these procedures to install the cooling fan.

Installing the fan

	Action	Note
1	Move the robot to its synchronization position.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Remove the metal sheet frame from the fan unit assembly by loosening the six screws.	 xx2400000551
4	Loosen the two tightening screws so they do not damage the motor surface during installation.	 xx2400000552

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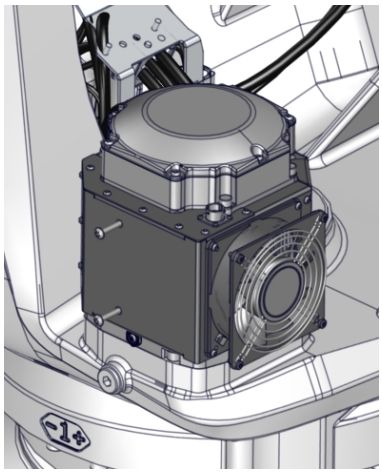
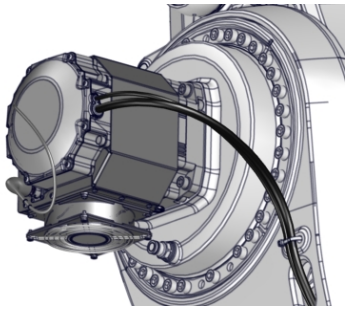
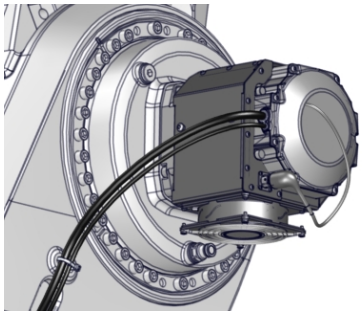
	Action	Note
5	Fit the fan unit sheets around the motor and fasten them to each other by tightening the six screws.	Axis-1 motor:  xx2400000553 Axis-2 motor:  xx2400000554 Axis-3 motor:  xx2400000555

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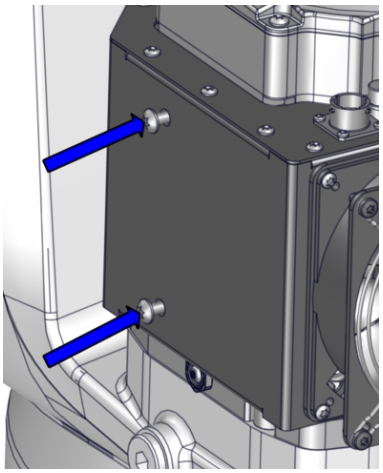
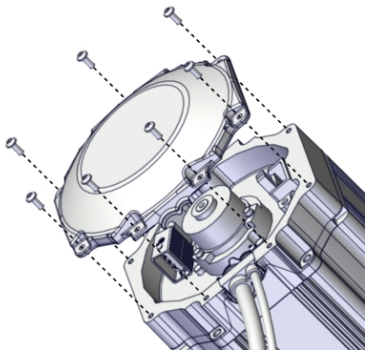
3.3.8 Installing the motor cooling fan (option 3320-1, 3321-1, 3346-1)
Continued

	Action	Note
6	Lift the box so that it does not rest directly on the robot and secure the box against the motor with the two tightening screws. Tighten them so that the box is firmly attached to the motor.	 xx2400000556

Connecting the fan cabling

	Action	Note
1	Open the motor cover. Replace it with a motor cover with threaded connection, if required.	Connection box cover FS180 with gasket: 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection)  xx2100000596
2	Run the fan cabling through the threaded connection in the cover and connect the connectors.	

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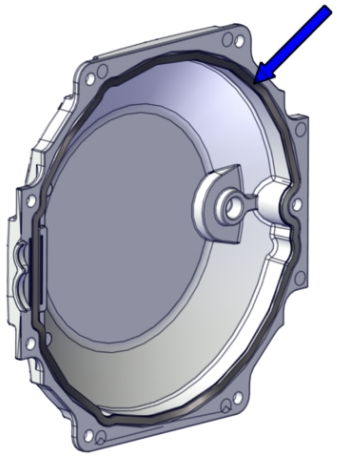
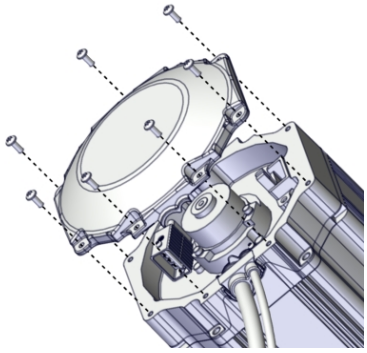
	Action	Note
3	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Connection box cover FS180 with gasket: 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection)  xx2100000600
4	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
5	Refit the motor cover with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.  xx2100000596

Adjustments in RobotWare

	Action	Note
1	Modify the settings in RobotWare to include the cooling fans.	See the operating manual for the controller.

3.3.9 Test run after installation, maintenance, or repair

Safe handling

Use the following procedure after installation, maintenance, or repair, before initiating motion.

DANGER

Initiating motion without fulfilling the following aspects, may increase the risk for injury or cause damage to the robot.

	Action
1	Remove all tools and foreign objects from the robot and its working area.
2	Verify that the robot is properly secured to its position by all screws, before it is powered up.
3	Verify that any safety equipment installed to secure the position or restrict the robot motion during service activity is removed.
4	Verify that the fixture and work piece are well secured, if applicable.
5	Verify that all safety equipment is installed, as designed for the application.
6	Verify that no personnel are inside the safeguarded space.
7	If maintenance or repair has been done, verify the function of the part that was maintained.
8	Verify the application in the operating mode manual reduced speed.

Collision risks

CAUTION

When programming the movements of the robot, always identify potential collision risks before initiating motion.

3.4 Working range alterations

3.4.1 Adjusting the working range

Reasons for adjusting the manipulator working range

The working range of each manipulator axis is configured in the software. If there is a risk that the manipulator may collide with other objects at installation site, its working space should be limited. The manipulator must always be able to move freely within its entire working space.

Working range configurations

The parameter values for the axes working range can be altered within the allowed working range and according to available options for the robot, either to limit or to extend a default working range. Allowed working ranges and available options for each manipulator axis are specified in *Working range on page 52*.

Mechanical stops on the manipulator

Mechanical stops are and can be installed on the manipulator as limiting devices to ensure that the manipulator axis does not exceed the working range values set in the software parameters.

Note

The mechanical stops are only installed as safety precaution to physically stop the robot from exceeding the working range set. A collision with a mechanical stop always requires actions for repair and troubleshooting.

Axis	Fixed mechanical stop[i]	Movable mechanical stop[ii]
Axis 1	yes	yes The working range can be reduced by altering the parameter values. Installation of additional mechanical stops is recommended. See *Installing movable mechanical stops on axis 1 (option 3323-1) on page 94*. The working range can be extended (option 3324-1) by altering the parameter values and removing the movable mechanical stop pin.
Axis 2	yes	no
Axis 3	yes	no
Axis 4	no	no
Axis 5	yes	no
Axis 6	no	no

i Part of the casting or fixed on the casting and can not /should not be removed.

ii Can be installed in one or more than one position, to ensure a reduced working range, or be removed to allow extended working range.

3.4.2 Installing movable mechanical stops on axis 1 (option 3323-1)

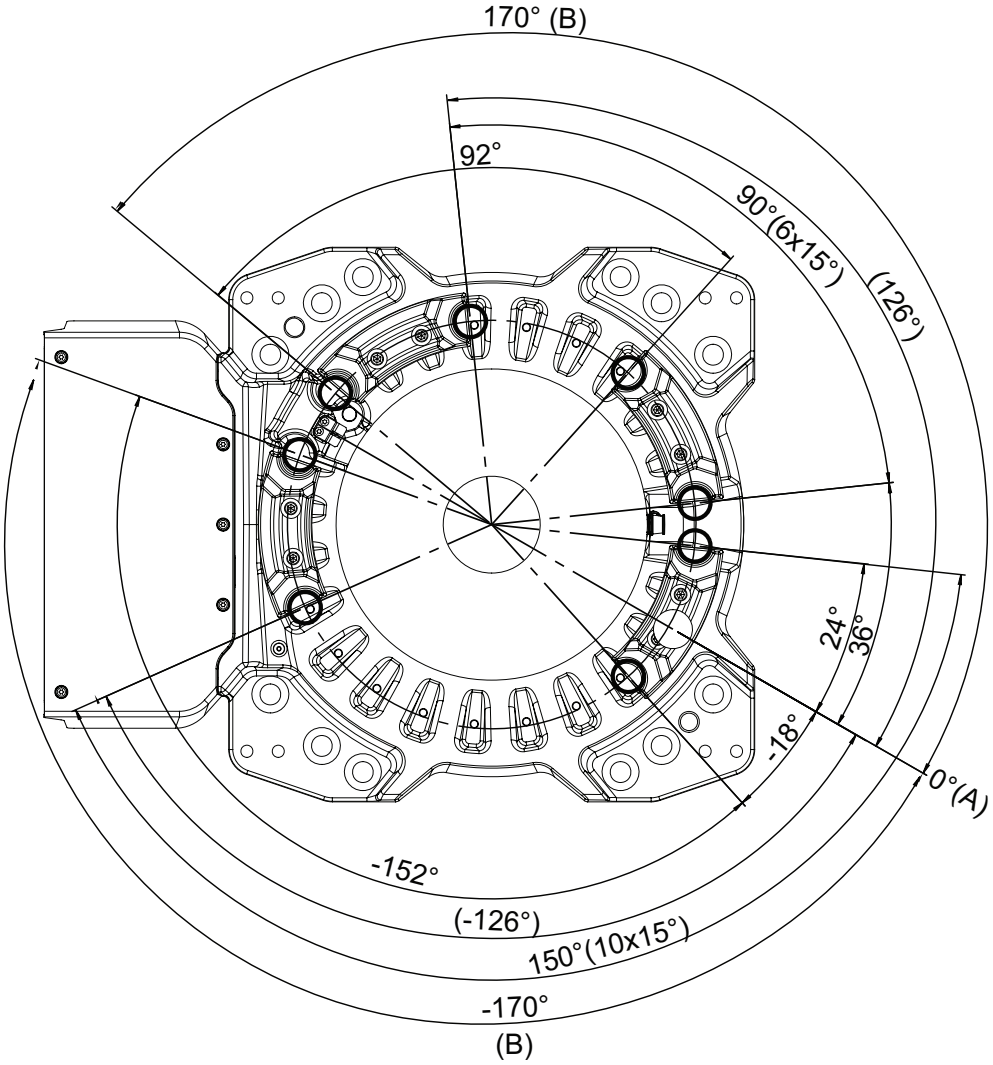
Reduction of the axis-1 working range

The working range of axis 1 is limited by system parameter configuration. To reduce the working range from default range, first adjust the parameter values and then install additional mechanical stops as a safety measure.

The movable mechanical stops reduce the working range according to the table.

Graduation of limited working range	Reduction of working range
15°	between +24° to +126° in one direction, and -18° to -126° in the other direction

Illustration, reduced working range



xx2400001307

A	Axis 1 position
B	Standard working range without limitations

Continues on next page

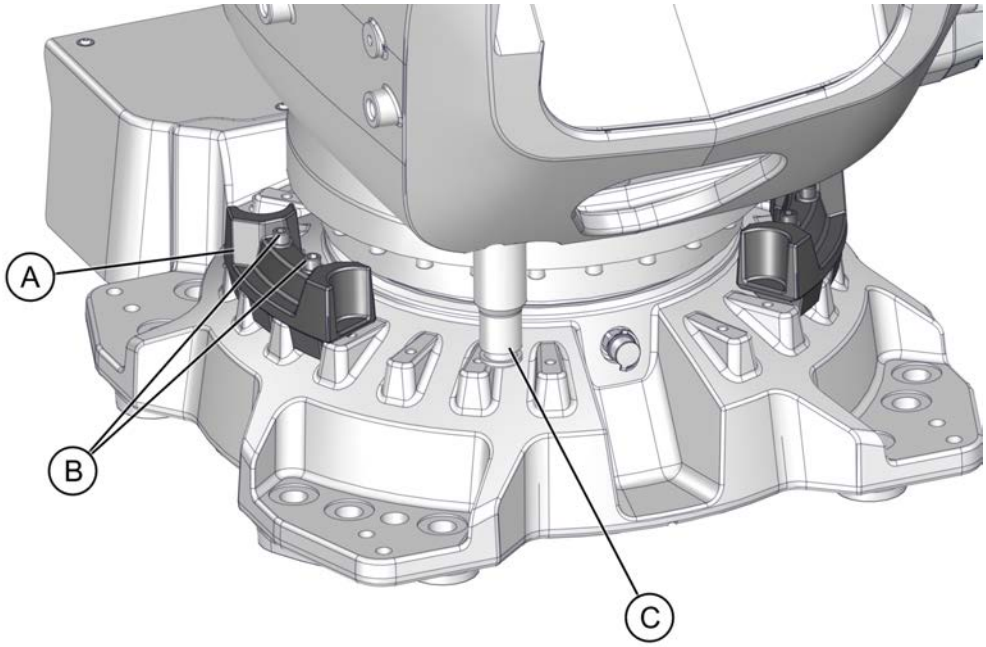
WARNING

If the mechanical stop pin is deformed after a hard collision, it must be replaced!

Deformed movable stops and/or additional stops as well as deformed attachment screws must also be replaced after a hard collision.

Location of the mechanical stops

The mechanical stops are located as shown in the figure.



xx2400000996

A	Attachment screws M12x70 quality 12.9 and washers DIN 125 (2 pcs per additional mechanical stop); Tightening torque 60 Nm
B	Movable mechanical stop
C	Mechanical stop pin axis-1

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note
Movable mechanical stop set, axis 1	3HAC091079-001	Screws and washers are enclosed

Continues on next page

3.4.2 Installing movable mechanical stops on axis 1 (option 3323-1)
Continued

Required tools and equipment

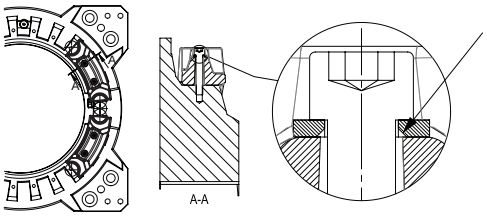
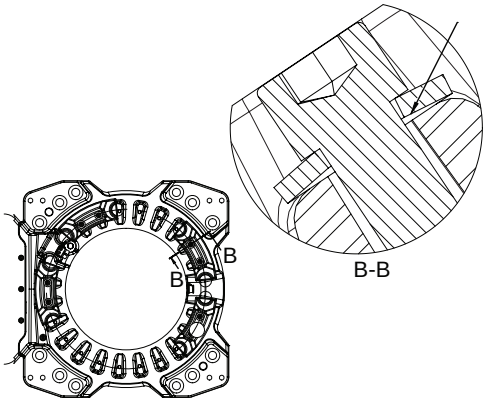
Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Installing the movable mechanical stops

Use this procedure to fit the additional mechanical stops. An assembly drawing is also enclosed with the product.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	Use the additional mechanical stop as a template and drill fastening holes with dimension M12 at the base.	See *Location of the mechanical stops on page 95*.

Continues on next page

	Action	Note
3	Fit the additional mechanical stops according to the figure *Location of the mechanical stops on page 95*. **Note** **Washer with chamfer:** Install the washer with the chamfer turned downwards.  xx2100000974 **Note** **Spring washer:** Install the spring washer with orientation as shown in figure.  xx2400001308	Tightening torque: 60 Nm.
4	Adjust the software working range limitations (system parameter configuration) to correspond to the mechanical limitations.	The system parameters that must be changed (*Upper joint bound* and *Lower joint bound*) are described in *Technical reference manual - System parameters*.
5	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

3.4.3 Extended working range, axis 1 (option)

Overview

The working range of axis 1 can be extended on a floor-mounted robot, from the default range limited by mechanical stops. The working range can be extended to ±220°.

CAUTION

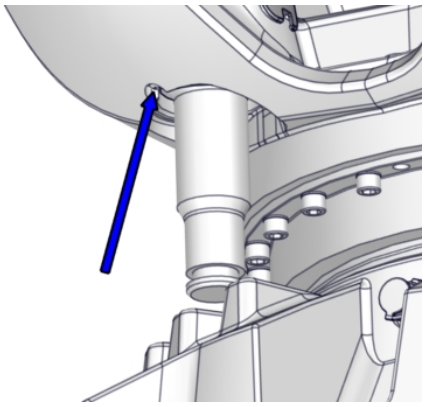
The option *Extended work range* enables an extension of the working range for axis 1, through a software configuration. With this option installed, the working range can exceed the range limited by the mechanical stop on axis 1. The working range shall be limited through the option SafeMove.

A risk analysis must be done to ensure that no risks remain when using option *Extended work range*, to limit the working range, and before removing the mechanical stops.

For information about the option SafeMove, see *Application manual - Functional safety and SafeMove*.

If the mechanical stop is removed, then the manipulator should have a marking for this, for example, a label. If the robot is delivered with the option *Extended work range*, then such a label is included on delivery.

Extending the working range

	Action	Note/Illustration
1	Configure the safety setup and verify it by test.	
2	Hold the mechanical stop pin in a firm grip, and remove it by unscrewing the attachment screw.	 xx2400000142
3	In RobotWare, redefine the working range limitations in the system parameters, topic *Motion*. The *Arm* parameters *Upper Joint Bound* and *Lower Joint Bound* can be changed to the values corresponding to the actual installation.	With the option *Extended working range*, the maximum value for the system parameters *Upper Joint Bound* and *Lower Joint Bound* is 3.84 respectively -3.84. The values are in radians, that is 3.84 radians = 220 degrees.

Continues on next page

Related information

The system parameters are described in detail in *Technical reference manual - System parameters*.

For more information about SafeMove, see *Application manual - Functional safety and SafeMove*.

See *References on page 10* for document numbers.

3.5 Electrical connections

3.5.1 Robot cabling and connection points

Introduction

Connect the robot and controller to each other after securing them to the foundation. The lists below specify which cables to use for each respective application.

> **DANGER**
>
> Turn off the main power before connecting any cables.

> **CAUTION**
>
> Verify that the serial number is according to the number(s) in the *Declaration of Incorporation* (DoI).

Main cable categories

The following table specifies cabling categories between the robot and the controller. Some of the cabling belong to optional applications.

Cable category	Description
Robot cables	Handles power supply to and control of the robot's motors as well as feedback from the serial measurement board. Specified in the table *Robot cables on page 100*.
Fan cables	Handles supply to and feedback from any cooling fan on the robot.
Customer cables	Handles communication with equipment fitted on the robot by the customer, low voltage signals and high voltage power supply + protective ground. The customer cables also handle databus communication. See the product manual for the controller, see document number in *References on page 10*.

Robot cables

These cables are included in the standard delivery. They are completely pre-manufactured and ready to plug in.

Cable sub-category	Description	Connection point, cabinet	Connection point, robot
Robot cables, power	Transfers drive power from the drive units in the control cabinet to the robot motors.	X1	R1.MP
Robot cable, signals	Transfers resolver data from and power supply to the serial measurement board.	X2	R1.SMB

Continues on next page

Robot cable, power

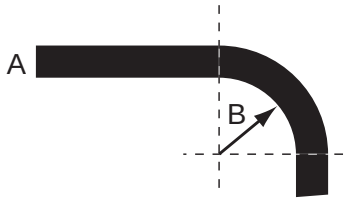
Power cable length	Article number
Power cable 7 m	3HAC026787-001
Power cable 15 m	3HAC026787-002
Power cable 22 m	3HAC026787-003
Power cable 30 m	3HAC026787-004

Robot cable, signals

Signal cable length	Article number
Signal cable, shielded: 7 m	3HAC2493-1
Signal cable, shielded: 15 m	3HAC2530-1
Signal cable, shielded: 22 m	3HAC2540-1
Signal cable, shielded: 30 m	3HAC2566-1

Bending radius for static floor cables

The minimum bending radius is 10 times the cable diameter for static floor cables.



xx1600002016

A	Diameter
B	Diameter x10

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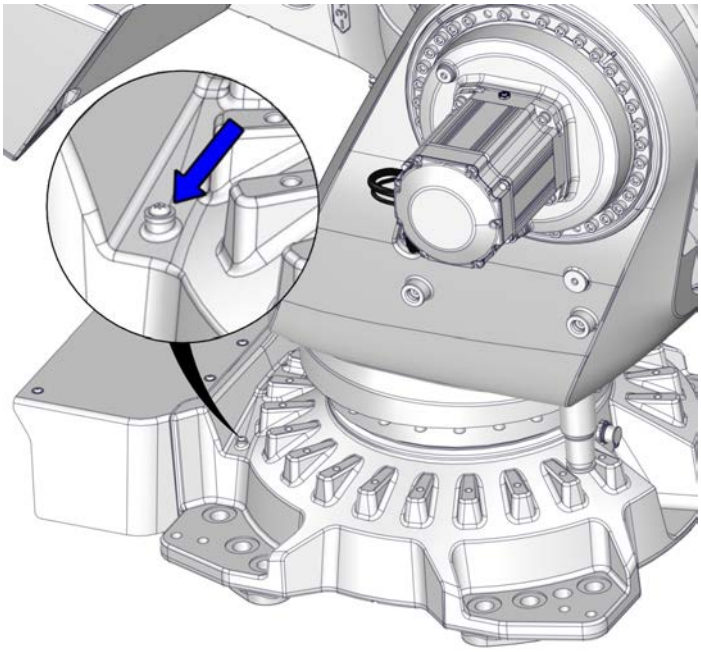
3.5.1 Robot cabling and connection points
Continued

Grounding and bonding point on manipulator

There is a grounding/bonding point on the manipulator base. The grounding/bonding point is used for potential equalizing between control cabinet, manipulator and any peripheral devices.



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Customer cables - CP/CS cable

CP/CS cable length	Article number
Harness CP/CS: 7 m	3HAC022957-001
Harness CP/CS: 15 m	3HAC022957-002
Harness CP/CS: 22 m	3HAC022957-003
Harness CP/CS: 30 m	3HAC022957-004

Customer cables - Ethernet floor cable

Ethernet floor cable length	Article number
Ethernet cable: 7 m	3HAC079476-001
Ethernet cable: 15 m	3HAC079476-002
Ethernet cable: 30 m	3HAC079476-004

4 Maintenance

4.1 Introduction

Structure of this chapter

This chapter describes all the maintenance activities recommended for the IRB 7710.

It is based on the maintenance schedule found at the beginning of the chapter. The schedule contains information about required maintenance activities including intervals, and refers to procedures for the activities.

Each procedure contains all the information required to perform the activity, including required tools and materials.

The procedures are gathered in different sections and divided according to the maintenance activity.

Safety information

Observe all safety information before conducting any maintenance work.

There are general safety aspects that must be read through, as well as more specific safety information that describes the danger and safety risks when performing the procedures. Read the chapter *Safety on page 15* before performing any maintenance work.

The maintenance must be done by qualified personnel in accordance with the safety requirements set forth in the applicable national and regional standards and regulations.

4.2 Maintenance schedule and expected component life

4.2.1 Specification of maintenance intervals

Introduction

The intervals are specified in different ways depending on the type of maintenance activity to be carried out and the working conditions of the IRB 7710:

- Calendar time: specified in months regardless of whether the system is running or not.
- Operating time: specified in operating hours. More frequent running means more frequent maintenance activities.

Robots with the functionality *Service Information System* activated can show active counters in the device browser in RobotStudio, or on the FlexPendant.

4.2.2 Maintenance schedule

Scheduled and non-predictable maintenance

The robot must be maintained regularly to ensure proper function. The maintenance activities and intervals are specified in the table below.

Non-predictable situations also give rise to inspections of the robot. Any damage must be attended to immediately.

Life of each component

The inspection intervals *do not* specify the life of each component. Values for these are specified in the section *Expected component life on page 107*

Maintenance schedule

Maintenance activities	Regularly	Every 6 months	Every 12 months	Every 36 months	Every 8,000 hours [i]	Every 12,000 hours [i]	Every 20,000 hours	Every 40,000 hours [i]	Reference
Cleaning the seals									Minor seepage of grease from the seals can occur, especially during the first running hours. Wipe down affected areas with a dry cloth.
Cleaning the robot	x								*Cleaning the IRB 7710 on page 190*
Inspecting the balancing device			x						*Inspecting the balancing device on page 110*
Inspecting the dampers			x						*Inspecting the dampers on page 119*
Inspecting the information labels			x						*Inspecting the information labels on page 121*
Inspecting the mechanical stop			x						*Inspecting the axis-1 mechanical stop on page 124*
Inspecting the motor seal			x						*Inspecting the motor seal on page 108*
Inspecting the oil level in gearboxes									Inspect the oil level in the actual gearbox if there is a suspected leakage, after an oil change or a maintenance or repair activity where draining and filling oil is required.
Inspecting the robot harness			x [ii]						*Inspecting the cable harness on page 116*

Continues on next page

4.2.2 Maintenance schedule
Continued

Maintenance activities	Regularly	Every 6 months	Every 12 months	Every 36 months	Every 8,000 hours [i]	Every 12,000 hours [i]	Every 20,000 hours	Every 40,000 hours [i]	Reference
Changing the oil in axis-1 gearbox							x		*Changing the oil in axis-1 gearbox on page 149*
Changing the oil in axis-2 gearbox							x		*Changing the oil in axis-2 gearbox on page 154*
Changing the oil in axis-3 gearbox							x		*Changing the oil in axis-3 gearbox on page 159*
Changing the oil in axis-4 primary gearbox							x		*Changing the oil in axis-4 primary gear on page 164*
Changing the oil in axis-4 secondary gearbox							x		*Changing the oil in axis-4 gearbox on page 168*
Changing the oil in axis-5 gearbox							x		*Changing the oil in axis-5 gearbox on page 173*
Changing the oil in axis-6 gearbox							x		*Changing the oil in axis-6 gearbox on page 178*
Replacing the SMB battery pack				x [iii]					*Replacing the SMB battery on page 183*
Lubricating the balancing device bearings and piston rod						x [iv]			*Lubricating the balancing device spherical roller bearing and piston rod on page 186*

i Operating hours counted by the DTC = Duty Time Counter
ii Replace when damage or cracks is detected or life limit is approaching that specified in section *Expected component life on page 107*.
iii The battery is to be replaced at given maintenance interval or at battery low alert.
iv Always lubricate the bearings after refitting the balancing device.

4.2.3 Expected component life

Expected life depends on usage

The expected life of a specific component of the robot can vary greatly depending on how hard it is run.

Expected component life

Component	Expected life	Note
Cable harness, normal usage [i]	40,000 hours [ii]	Not including DressPack or optional upper arm harnesses.
Cable harness, extreme usage [iii]	20,000 hours [ii]	Not including DressPack or optional upper arm harnesses.
Gearboxes	40,000 hours	The SIS system is decribed in *Operating manual - Integrator's guide OmniCore*.
Balancing device	40,000 hours [iv]	

i Examples of "normal usage" in regard to movement: most material handling applications.

ii Severe chemical or thermal environments, or similar environments, can result in shortened life expectancy.

iii Examples of "extreme usage" in regard to movement: press tending, very severe palletizing applications, major use of axis 1 movement.

iv The given life for the balancing device is based on a test cycle of 4,000,000 cycles that starts from the initial position and goes to maximum extension, and back. Deviations from this cycle will result in differences in expected life!

4.3 Inspection activities

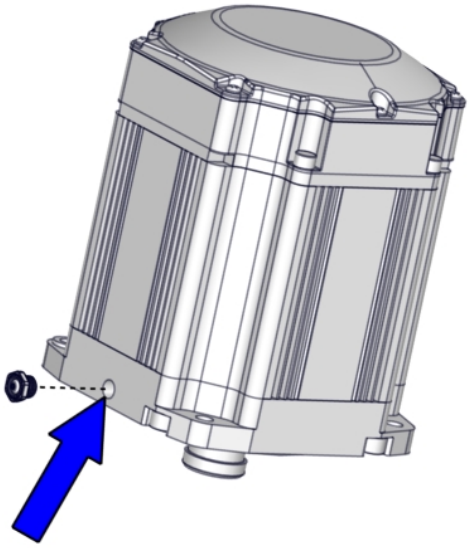
4.3.1 Inspecting the motor seal

Purpose of evacuation holes

The motors include evacuation on the motor flange to indicate failure of primary sealing between the gearbox and the motor.

Location of evacuation hole on motor

The evacuation hole is located on each motor flange. The figure shows axis-1 motor as an example.



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Plug in the evacuation hole

New motors have a transparent plug/sight glass installed in the evacuation hole. Remove the plug or drill a drainage hole with diameter 3 mm, if an open evacuation hole is required instead.

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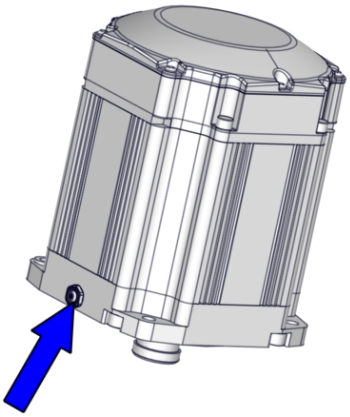
Continues on next page

Inspecting the evacuation hole

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
3	Do a leakage check of the sight glass/evacuation hole of each motor. If any oil is available on the sight glass or if any oil has been spilled out from the evacuation hole, replacement of the motor is recommended. **Note** If oil is present in the evacuation it is an indication that the primary seal of the motor is leaking. A secondary seal after the evacuation is keeping the oil out from the motor, but it is still recommended to replace the motor at a suitable timing if oil is present in the evacuation.	 xx2300001603 Replacing of motors is described in the repair chapter *Motors on page 398*.

4.3.2 Inspecting the balancing device

General

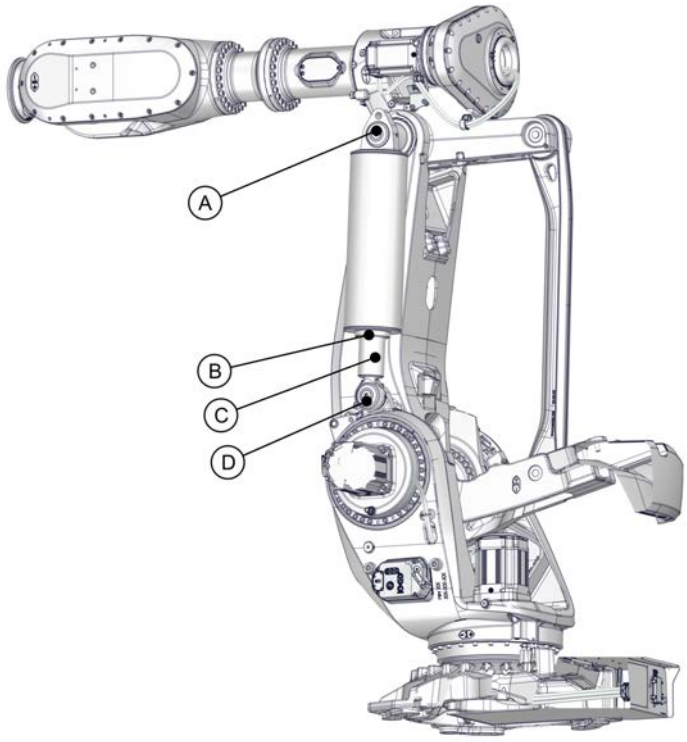
Several points are to be checked on the balancing device during the inspection. This section describes how to perform the inspection regarding:

- dissonance
- damage
- leakage
- guide ring wear / piston rod lubrication / clearance.

Inspection points, balancing device

The balancing device is located as shown in the figure.

The figure shows the inspection points, further described in the instructions.



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A	Upper ear
B	Guide ring
C	Piston rod
D	Lower ear

Required tools

Visual inspection, no tools are required.

Continues on next page

Required consumables and wear parts

Wear part	Article number	Note
Maintenance set, upper link ear	3HAC091950-001	The maintenance kit contains: • End cover • O-ring • Nut • Radial sealing with dust lip • Spherical roller bearing • Support ring
Maintenance set, lower link ear	3HAC091953-001	The maintenance kit contains: • End cover • O-ring • Spacer ring • Radial sealing with dust lip • Spherical roller bearing • Support ring • Washer • Torx pan head screw

Check for dissonance

The check points are shown in the figure *Inspection points, balancing device on page 110*.

	Check points	Action
1	Check for dissonance from the upper and lower bearing.	If dissonance is detected, perform maintenance according to maintenance kits and instructions in section *Replacing the balancing device bearings on page 243*.
2	Check for dissonance from the balancing device (a tapping sound, caused by the springs inside the cylinder).	If dissonance is detected, replace the balancing device or consult ABB Service. How to replace the device is detailed in section *Replacing the balancing device and balancing device bearings on page 236*. This section also specifies the spare part number.
3	Check for dissonance from the piston rod (squeaking may indicate worn plain bearings, internal contamination or insufficient lubrication).	If dissonance is detected, wipe clean the piston rod. If dissonance continues after the piston rod is cleaned, perform maintenance according to given instructions in the maintenance set and instructions in section *Lubricating the balancing device spherical roller bearing and piston rod on page 186*.

Check for damage

Check for damage, such as scratches, general wear, uneven surfaces or incorrect positions.

The check points are shown in the figure *Inspection points, balancing device on page 110*.

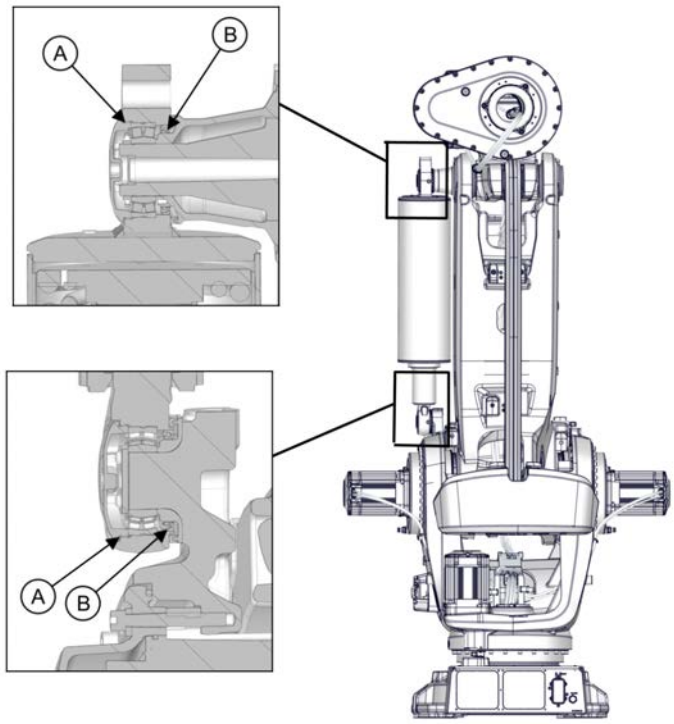
	Check points	Action
1	Check for damage on the part of the piston rod that is visible.	If damage is detected, perform maintenance according to given instructions in Maintenance kit, complete.

Continues on next page

4.3.2 Inspecting the balancing device
Continued

Check for leakage

Leaks at o-rings and radial sealings pointed out in the figure are not acceptable and must be attended to immediately to avoid damage to the bearing.



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A	O-ring
B	Radial sealing with dust lip

	Action	Note
1	Clean the area at the upper and lower ear from contamination.	
2	Run the robot for some minutes, in order to move the balancing device piston.	
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

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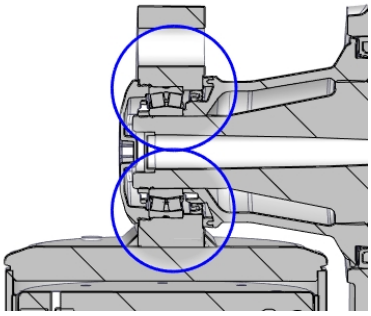
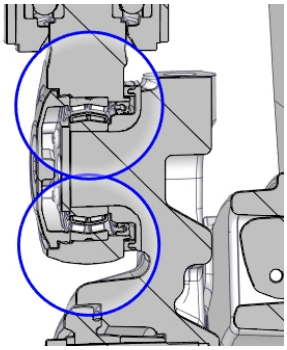
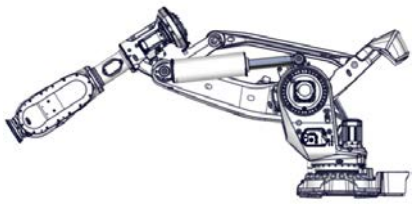
	Action	Note
4	Check the area around the o-ring and radial sealings at the ear, for leakage.	 xx2400000246  xx2400000247
5	Replace o-ring and radial sealings if leaks are detected.	Maintenance set, lower link ear / Maintenance set, upper link ear: 3HAC091953-001 / 3HAC091950-001 Replacement of the complete bearing is described in section *Replacing the balancing device bearings on page 243*.

Check for guide ring wear / piston rod lubrication / clearance

	Action	Note
1	Position axis 2 so that the balancing device is horizontal and the piston rod is extended to the greatest extent possible.	 xx2400001562
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

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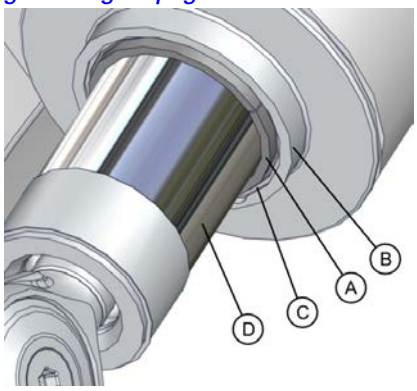
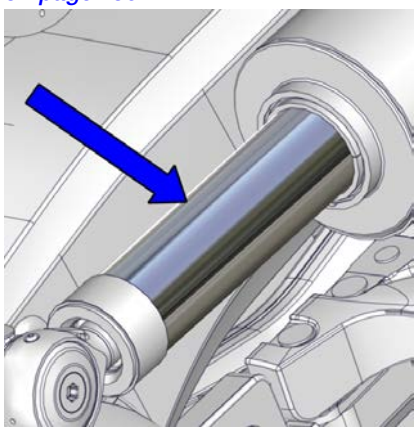
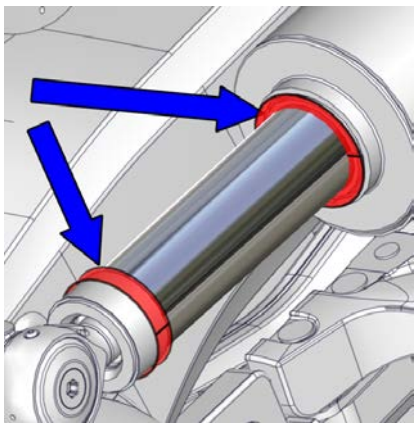
4.3.2 Inspecting the balancing device

Continued

	Action	Note
3	Check the guide ring for wear. Replace if necessary. **Note** If there is risk of metallic contact between the piston rod and end cover, the guide ring must be replaced.	See *Replacing the balancing device guide ring on page 256*.  xx2400001563 A Guide ring B End cover C Circlip D Piston rod
4	Inspect the piston rod and verify it is properly lubricated with a thin layer of grease across the entire unpainted surface. Lubricate piston rod if necessary. **Note** Too little grease may result in premature wear of the guide ring. Too much grease may result in an undesirable appearance or a risk of contaminating the surrounding environment.	See *Lubricating the balancing device spherical roller bearing and piston rod on page 186*.  xx2400001564
5	**Note** Seepage of grease from the balancing device seals can occur, especially during the first running hours. Inspect the indicated areas for excess grease. Wipe away affected areas with a dry cloth.	 xx2400000245

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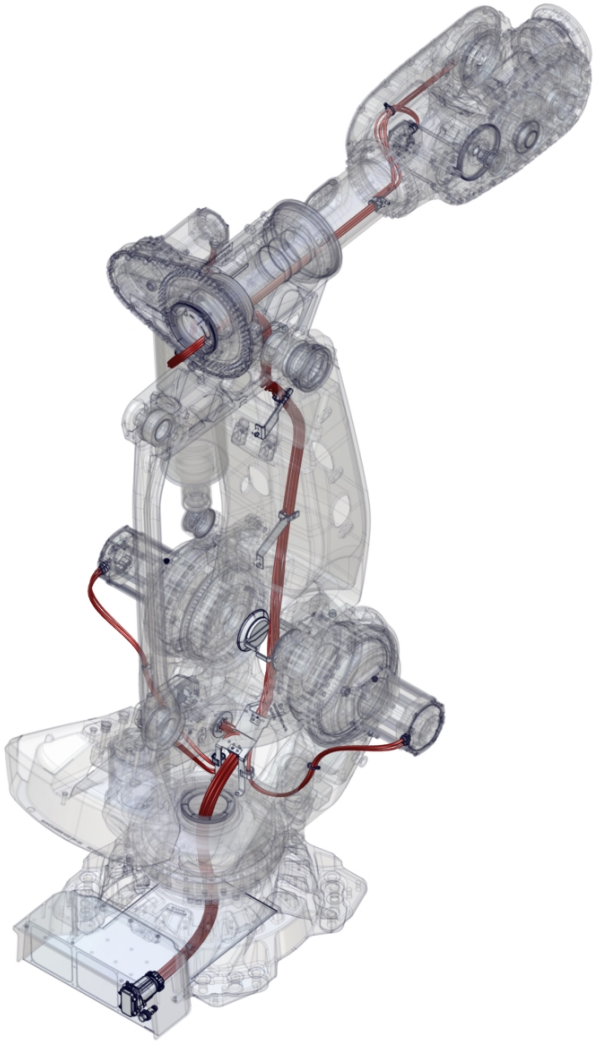
	Action	Note
6	Keep the areas around the balancing device clean and free from objects that could prevent the balancing device from moving freely.	

4.3.3 Inspecting the cable harness

Location of cable harness

The cable harness is located as shown in the figure.



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Required tools

Visual inspection, no tools are needed.

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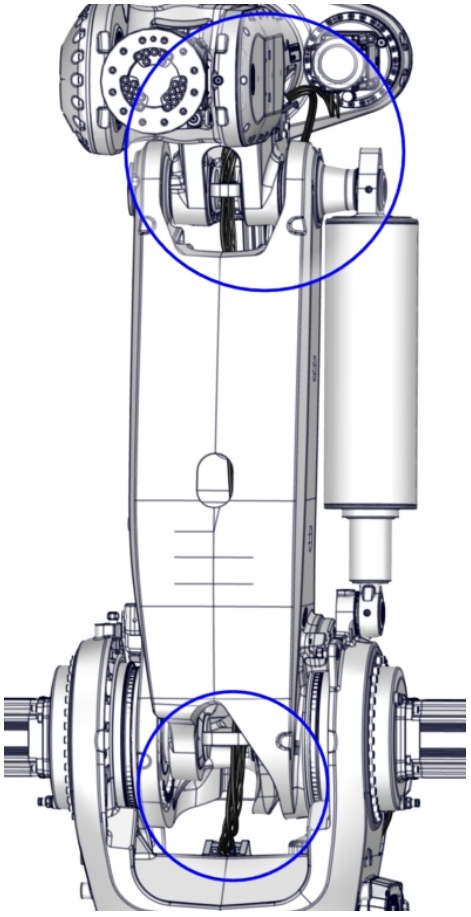
Inspecting the cable harness

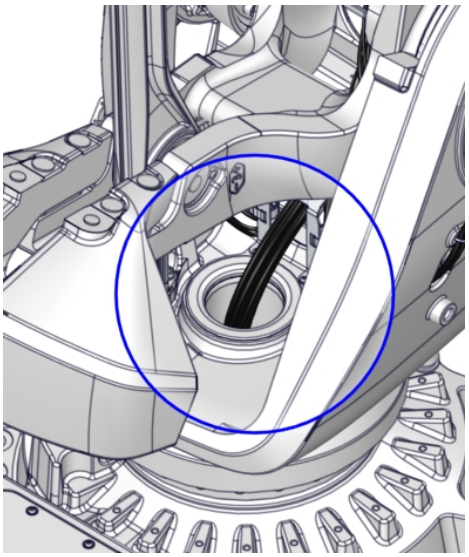
Use this procedure to inspect cable harness of axes 1-6.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	Make an overall inspection of the cable harness in order to detect wear and damage. Pay special attention to the areas of axis-2 and axis-3 movement, shown in the figure. Make sure the cabling is not damaged between the cable brackets in these areas.	 xx2400000137
3	Check that all visible cable brackets, velcro straps and attachments are properly secured, by following the cable harness from the base to the wrist.	
4	Check the motor cables visually for any damage.	
5	Check the connectors and cables at the base visually for any damage.	

Continues on next page

4.3.3 Inspecting the cable harness

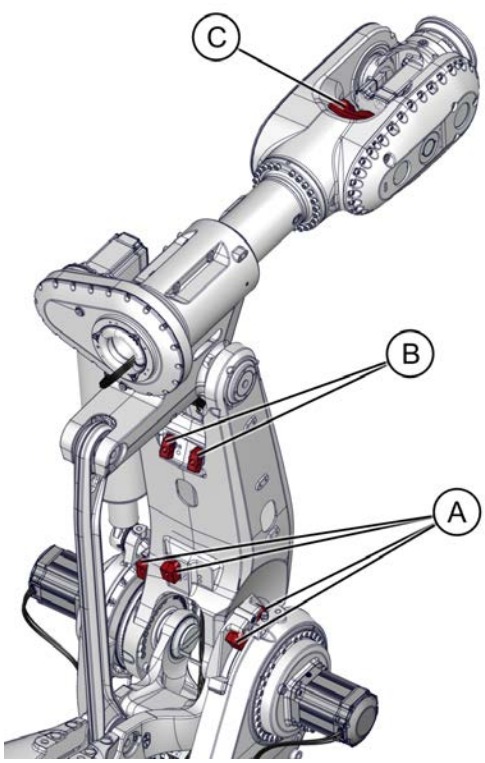
Continued

	Action	Note
6	Check the cabling going through the protection tube, to detect possible cable chafing, by using your hands inside the tube to feel the cables. Ensure that the cables are undamaged. Remove any objects that may cause possible cable chafing. Replace damaged cabling, if any. **CAUTION** Sharp debris might occur. Always wear protective gloves.	 xx2400000138
7	Replace the cable harness if wear, cracks or damage is detected.	See *Removing the cable harness on page 334*.

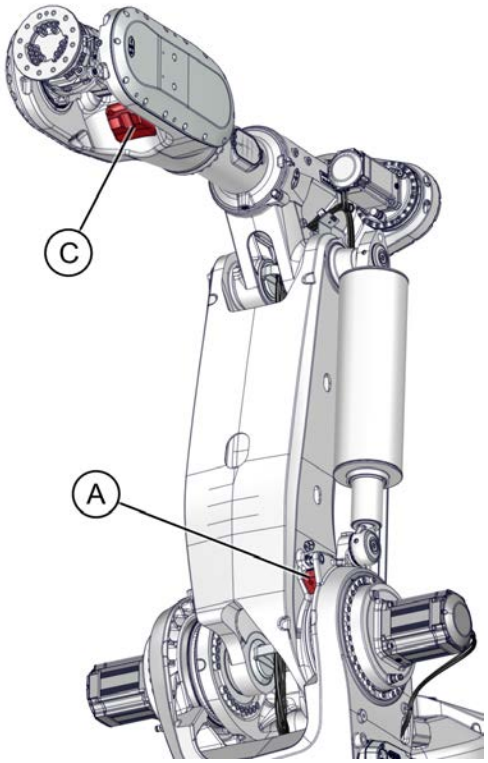
4.3.4 Inspecting the dampers

Location of the dampers

The figure below shows the location of all the dampers to be inspected.



xx2400000139



xx2400000140

A	Damper: 3HAC12991-1
B	Damper: 3HAC022338-001
C	Damper / mechanical stop axis 5: 3HAC085025-001

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note
Damper	See *Location of the dampers on page 119*	

Required equipment

Visual inspection, no tools are required.

Continues on next page

4.3.4 Inspecting the dampers
Continued

Inspecting, dampers

The procedure below details how to inspect the dampers.

Note

A damaged damper must be replaced.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	Check all dampers for damage, cracks or existing impressions larger than 1 mm.	
3	Check attachment screws for deformation.	
4	If any damage is detected, the damper must be replaced with a new one.	Attachment screws: Axis 2 and axis 3: M6x60 8.8-A2F (9ADA624-65) Lower arm: M6x20 A4-80 (9ADA620-57) Wrist: M6x16 A4-80 (9ADA620-56) Locking liquid: Loctite 2400 (or equivalent Loctite 243).
5	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

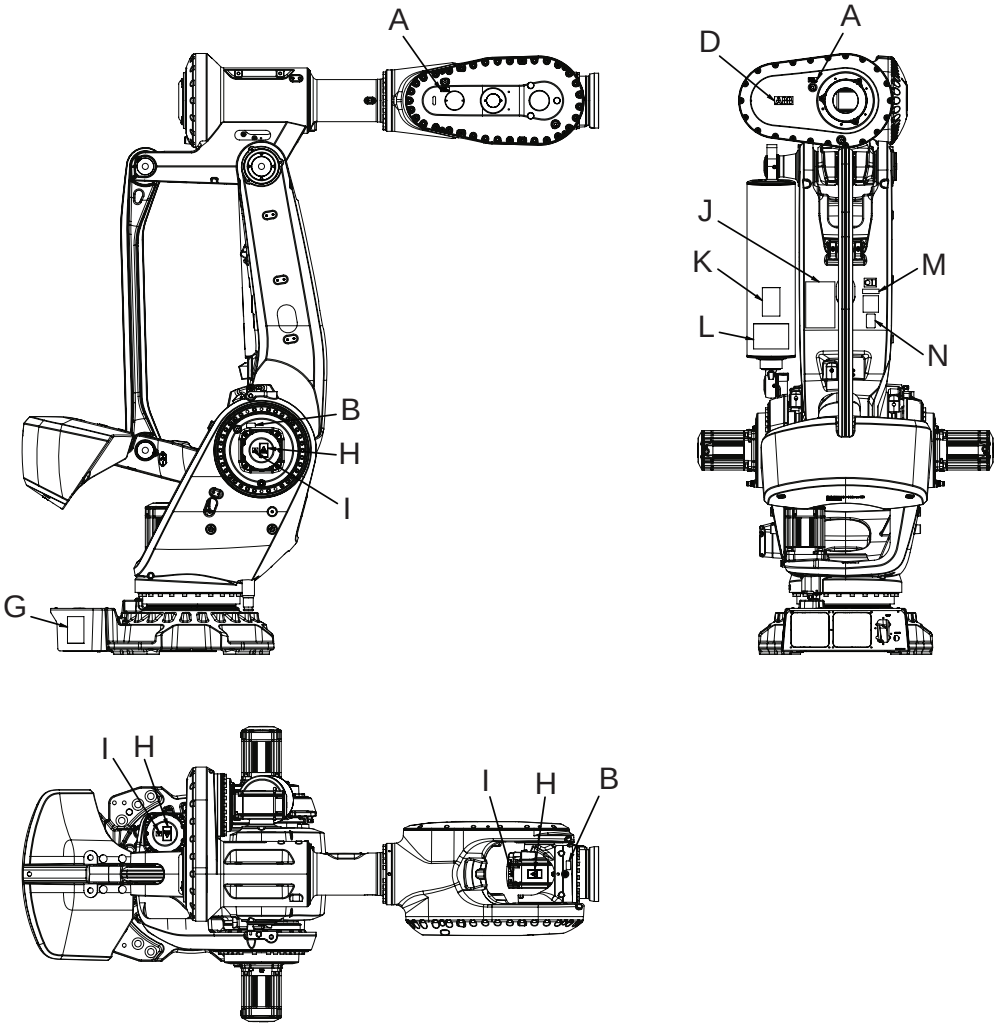
4.3.5 Inspecting the information labels

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

The figures show the location of the information labels to be inspected. The symbols are described in section *Safety symbols on manipulator labels on page 19*.

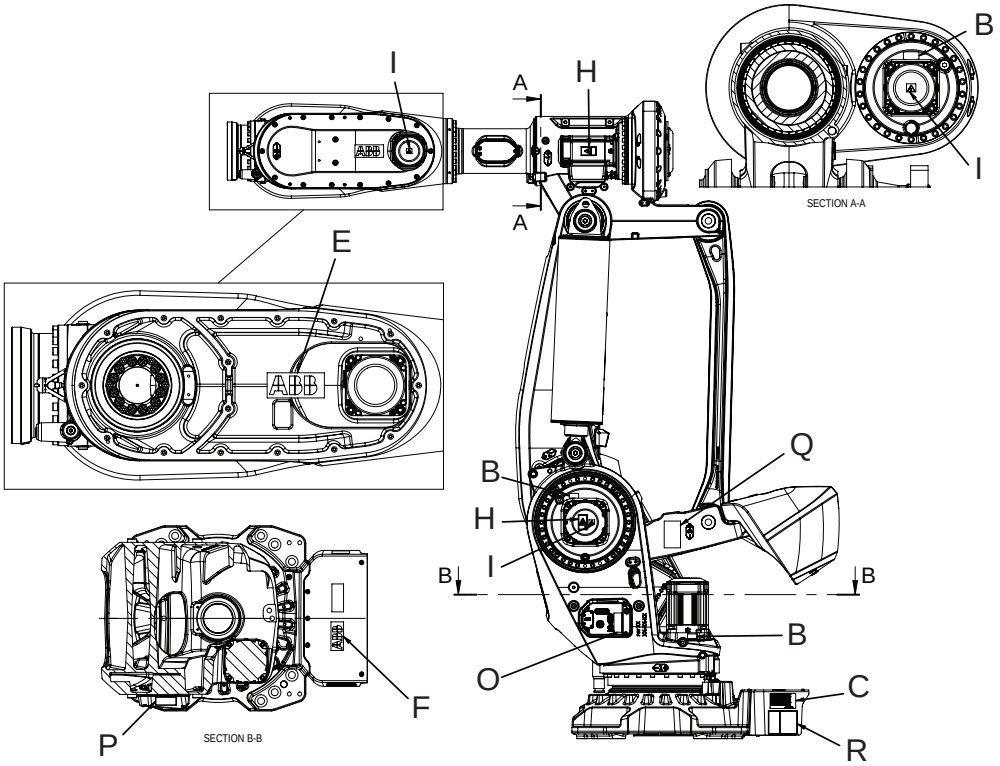


xx2400000261

Continues on next page

4.3.5 Inspecting the information labels

Continued



xx2400000262

	Spare part number	Description
A	3HAC021485-001	Lubrication label Mobilgear 600 XP 320
B	3HAC032726-001	Lubrication label Kyodo Yushi TMO 150
C	3HAC094708-001	Lubrication label
D	3HAC0453-4 / 3HAC17765-1	ABB logotype label
E	3HAC0453-1 / 3HAC5089-1	ABB logotype label
F	3HAC0453-5 / 3HAC077301-002	ABB logotype label
G	3HAC9191-1	Warning label Tipping robot
H	29454489-16	Warning label Hot surface
I	3HAC1589-1	Warning label Electrical (flash)
J	3HAC086908-001	Instruction label Lifting of robot
K	3HAC065665-001 (3HAC3981-1)	Warning label Stored energy
L	3HAC4591-1	Instruction label Before disassembly, see product manual
M	3HAC14257-1	ABB information sign

Continues on next page

	Spare part number	Description
N	3HAC13488-1	Calibration label
O	3HAC076755-001	Instruction label Brake release
P	3HAC076756-001	Warning label / Instruction label Moving robot / MOTORS OFF
Q	3HAC4517-1	Warning label Crush
R	3HAC021761-001	Warning label Extended working range

Required tools and equipment

Visual inspection, no tools are required.

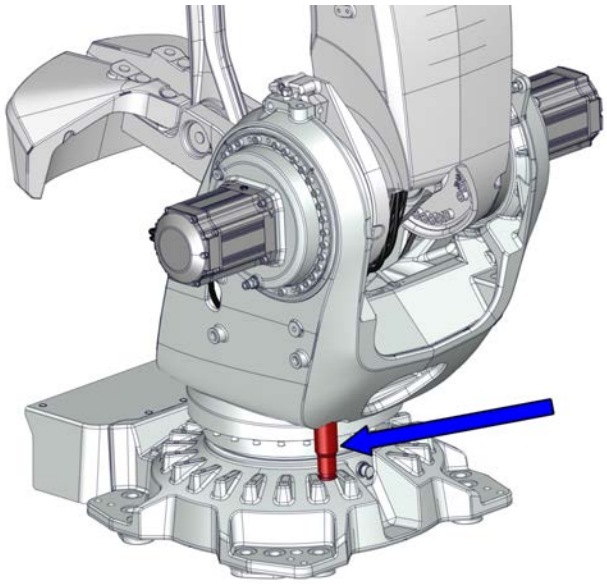
Inspecting, labels

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	Inspect the labels, located as shown in the figures.	
3	Replace any missing or damaged labels.	Article numbers for the labels and plate set is specified in *Required spare parts on page 121*.

4.3.6 Inspecting the axis-1 mechanical stop

Location of mechanical stop pin

The mechanical stop is located as shown in the figure.



xx2400000141

Required equipment

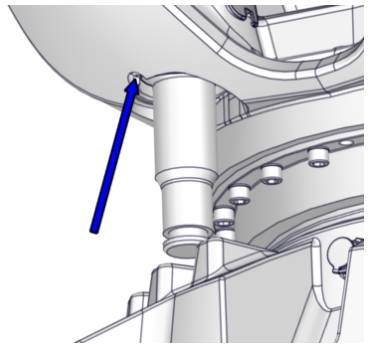
Visual inspection, no tools are required.

Inspecting the mechanical stop pin

Use this procedure to inspect the axis-1 mechanical stop pin.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	Inspect the axis-1 mechanical stop pin. If the mechanical stop pin is bent or damaged, it must be replaced. **Note** The expected life of gearboxes can be reduced after collision with the mechanical stop.	Mechanical stop pin: 3HAC084500-001

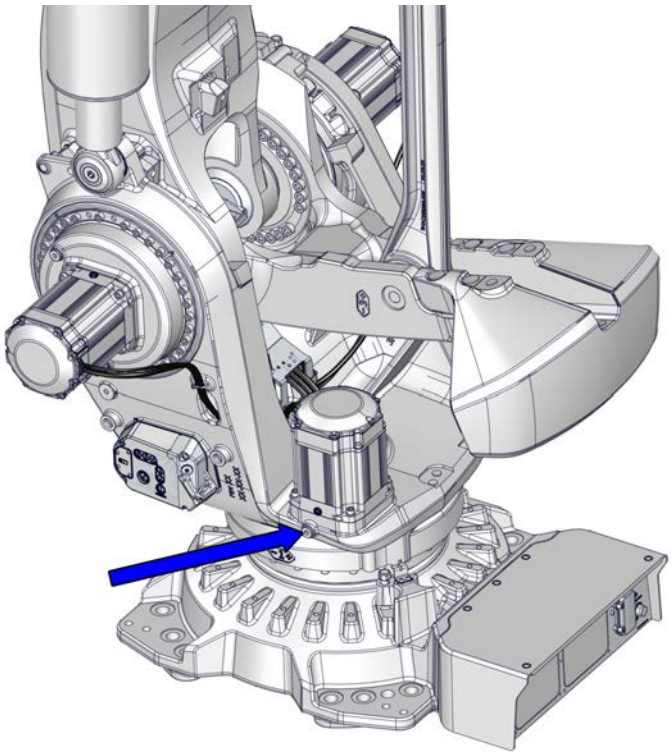
Continues on next page

	Action	Note
3	Check that the mechanical stop pin attachment screw is tightened correctly. **Note** Do not overtighten the attachment screw, use specified tightening torque.	Tightening torque: 10 Nm Locking liquid: Loctite 2400 (or equivalent Loctite 243)  xx2400000142
4	Make sure the mechanical stop pin can move in both directions.	

4.3.7 Inspecting the oil level in axis-1 gearbox

Location of the oil plug

The oil plug for inspection is located as shown in the figure.



xx2300001672

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

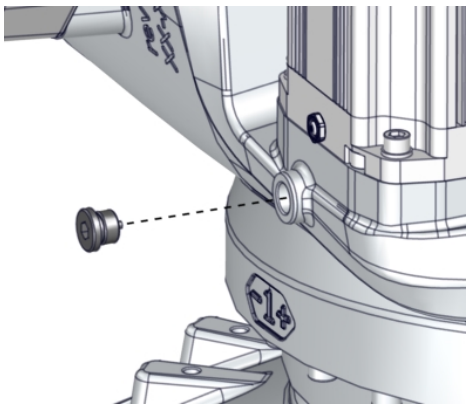
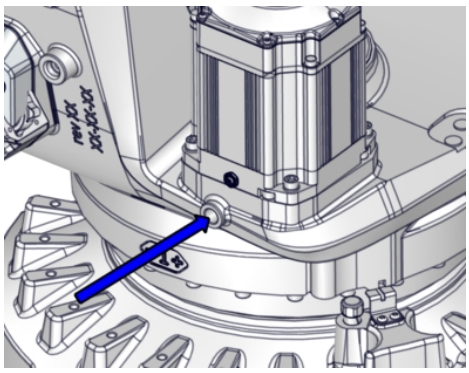
Required documents

Document name	Document number
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*

Continues on next page

Floor-mounted robot: Inspecting the oil level in axis-1 gearbox

Use this procedure to inspect the oil level in the gearbox, when the robot is floor-standing.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
3	Make sure that the oil temperature is +25 °C ± 10 °C.	
4	Open the oil plug.	 xx2300001686
5	Check the oil level. Required oil level is: 0-10 mm below the oil plug hole.	 xx2300001687

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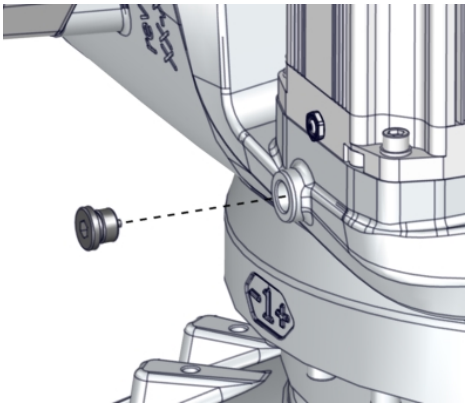
4.3.7 Inspecting the oil level in axis-1 gearbox

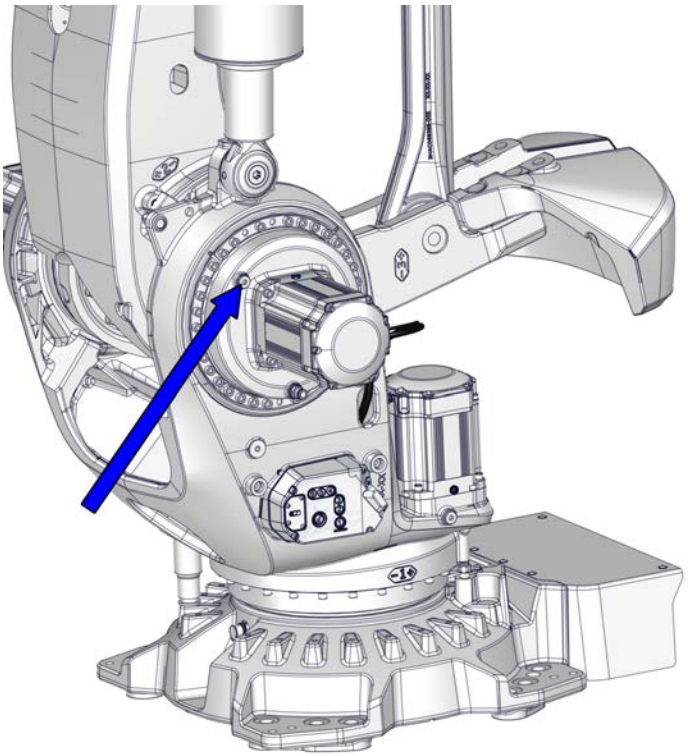
Continued

	Action	Note
6	Add or drain oil, if required.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*. Further information about how to drain or fill with oil is found in section *Changing the oil in axis-1 gearbox on page 149*.
7	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2300001686
8	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

4.3.8 Inspecting the oil level in axis-2 gearbox

Location of the oil plug

The oil plug for inspection is located as shown in the figure.



xx2300001674

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

Required documents

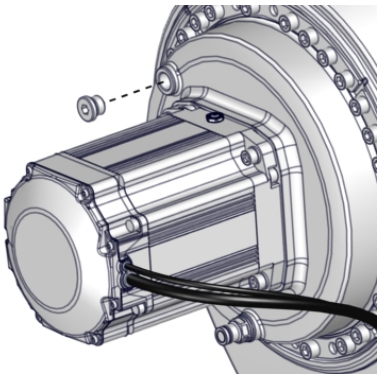
Document name	Document number
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*

Continues on next page

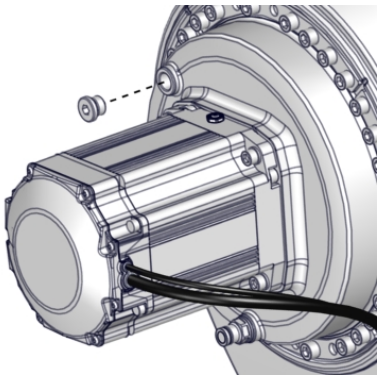
4.3.8 Inspecting the oil level in axis-2 gearbox
Continued

Inspecting the oil level in axis-2 gearbox

Use this procedure to inspect the oil level in the gearbox.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
3	Make sure that the oil temperature is +25 °C ± 10 °C.	
4	Open the oil plug.	 xx2300001688
5	Check the oil level. Required oil level is: 0-10 mm below oil plug hole.	
6	Add or drain oil, if required.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*. Further information about how to drain or fill with oil is found in section *Changing the oil in axis-2 gearbox on page 154*.

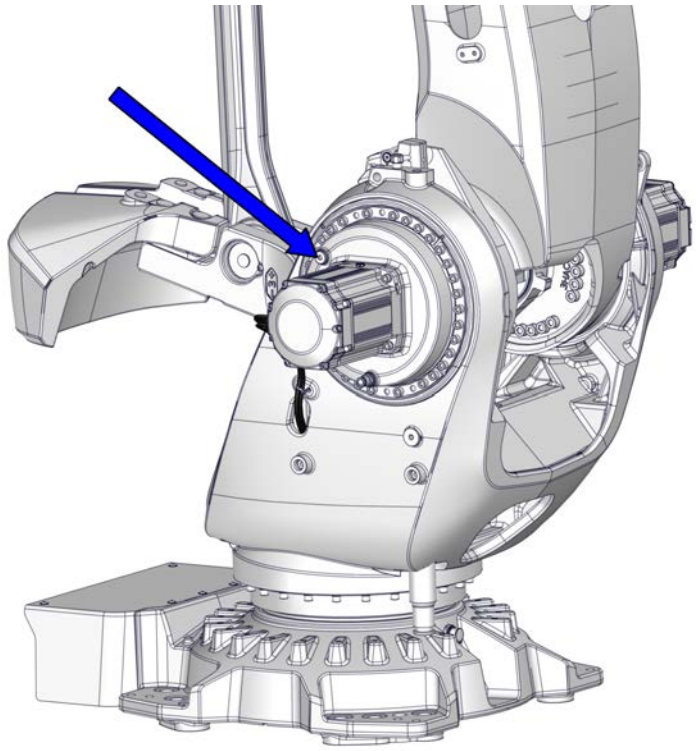
Continues on next page

	Action	Note
7	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2300001688
8	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

4.3.9 Inspecting the oil level in axis-3 gearbox

Location of the oil plug

The oil plug for inspection is located as shown in the figure.



xx2300001678

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

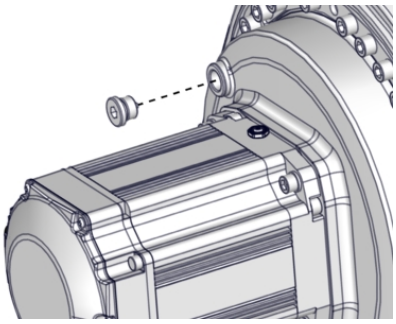
Required documents

Document name	Document number
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*

Continues on next page

Inspecting the oil level in axis-3 gearbox

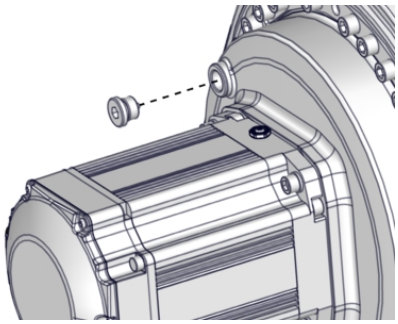
Use this procedure to inspect the oil level in the gearbox.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
3	Make sure that the oil temperature is +25 °C ± 10 °C.	
4	Open the oil plug.	 xx2300001690
5	Check the oil level. Required oil level is: 0-10 mm below oil plug hole.	
6	Add or drain oil, if required.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*. Further information about how to drain or fill with oil is found in section *Changing the oil in axis-2 gearbox on page 154*.

Continues on next page

4.3.9 Inspecting the oil level in axis-3 gearbox

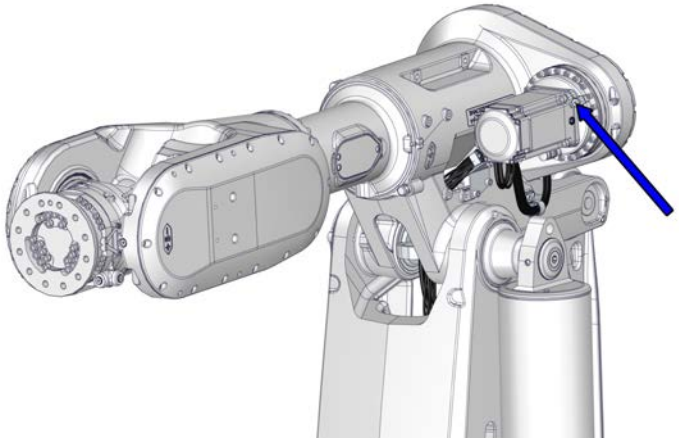
Continued

	Action	Note
7	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2300001690
8	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

4.3.10 Inspecting the oil level in axis-4 primary gearbox

Location of the oil plug

The oil plug for inspection is located as shown in the figure.



xx2300001695

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.
O-ring, G 1/4"	3HAC061327-060	Used on oil plug. Always replace when refitting oil plug.

Required documents

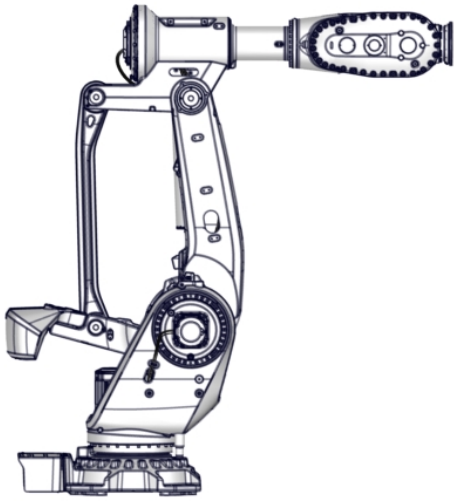
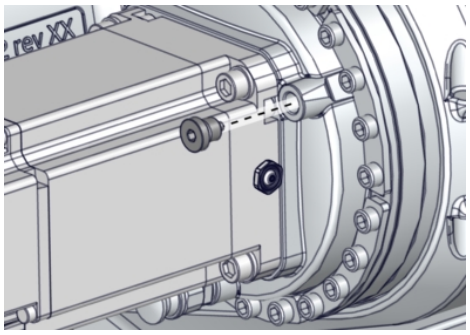
Document name	Document number
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*

Continues on next page

4.3.10 Inspecting the oil level in axis-4 primary gearbox
Continued

Inspecting the oil level in axis-4 gearbox

Use this procedure to inspect the oil level in the gearbox.

	Action	Note
1	Run the robot to a position where the upper arm is horizontal.	 xx2300001691
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Make sure that the oil temperature is +25 °C ± 10 °C.	
4	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
5	Open the oil plug.	 xx2300001697
6	Check the oil level. Required oil level is: 0-10 mm below oil plug hole	

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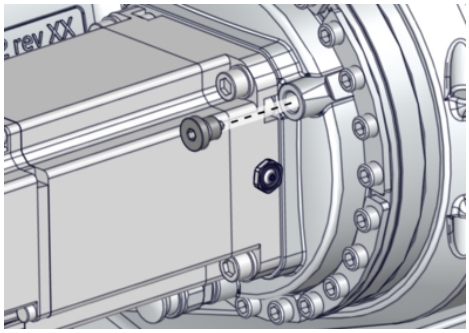
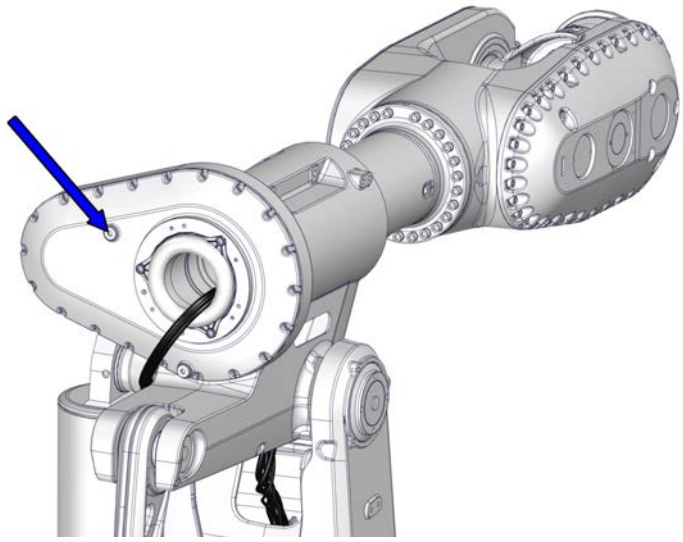
	Action	Note
7	Add or drain oil, if required.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*. Further information about how to drain or fill with oil is found in section *Changing the oil in axis-4 gearbox on page 168*.
8	Refit the oil plug with a new o-ring.	O-ring, G 1/4": 3HAC061327-060 Tightening torque: 20 Nm.  xx2300001697
9	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

4.3.11 Inspecting the oil level in axis-4 gearbox

Location of the oil plug

The oil plug for inspection is located as shown in the figure.



xx2300001680

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

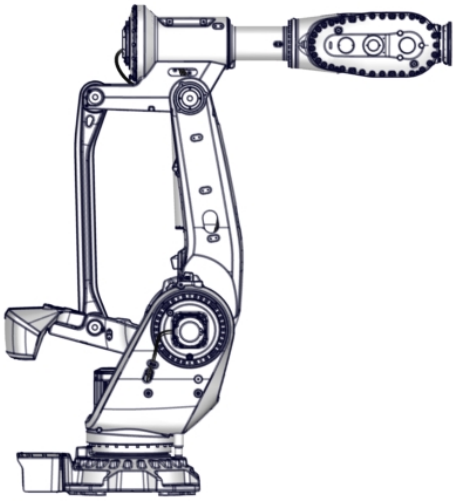
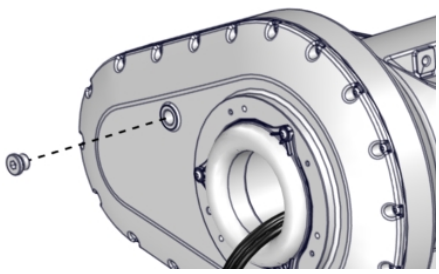
Required documents

Document name	Document number
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*

Continues on next page

Inspecting the oil level in axis-4 gearbox

Use this procedure to inspect the oil level in the gearbox.

	Action	Note
1	Run the robot to a position where the upper arm is horizontal.	 xx2300001691
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Make sure that the oil temperature is +25 °C ± 10 °C.	
4	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
5	Open the oil plug.	 xx2300001692
6	Check the oil level. Required oil level is: 0-10 mm below oil plug hole	

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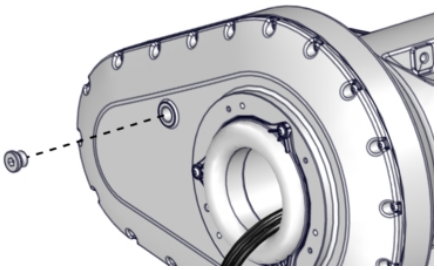
4.3.11 Inspecting the oil level in axis-4 gearbox

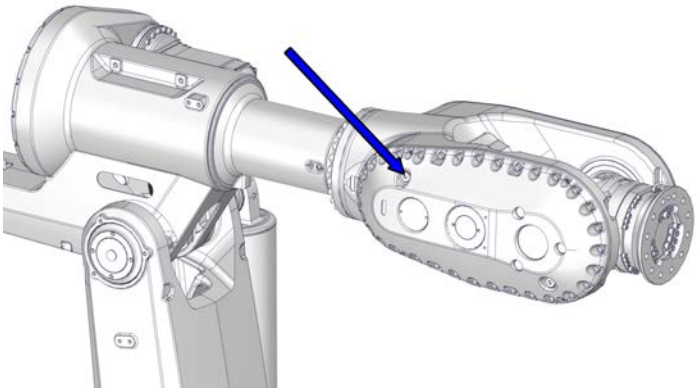
Continued

	Action	Note
7	Add or drain oil, if required.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*. Further information about how to drain or fill with oil is found in section *Changing the oil in axis-4 gearbox on page 168*.
8	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2300001692
9	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

4.3.12 Inspecting the oil level in axis-5 gearbox

Location of the oil plug

The oil plug for inspection is located as shown in the figure.



xx2300001682

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

Required documents

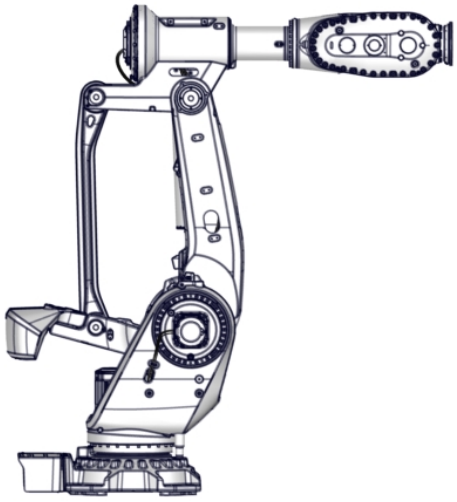
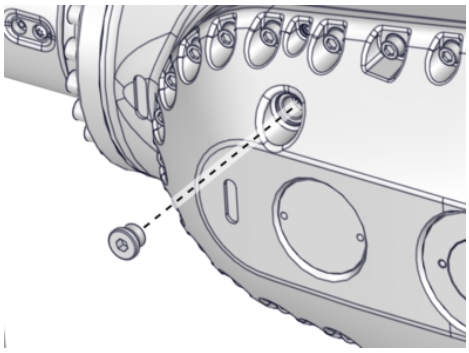
Document name	Document number
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*

Continues on next page

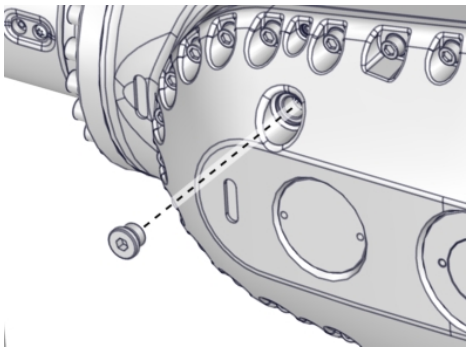
4.3.12 Inspecting the oil level in axis-5 gearbox
Continued

Inspecting the oil level in axis-5 gearbox

Use this procedure to inspect the oil level in the gearbox.

	Action	Note
1	Run the robot to a position where the upper arm is horizontal.	 xx2300001691
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Make sure that the oil temperature is +25 °C ± 10 °C.	
4	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
5	Open the oil plug.	 xx2300001693

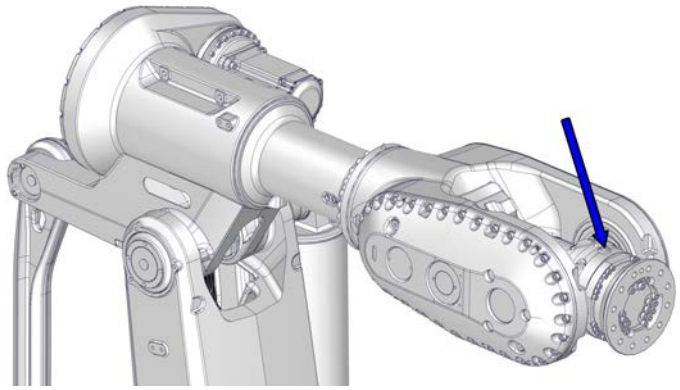
Continues on next page

	Action	Note
6	Check the oil level. Required oil level is: 0-10 mm below oil plug hole.	
7	Add or drain oil, if required.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*. Further information about how to drain or fill with oil is found in section *Changing the oil in axis-5 gearbox on page 173*.
8	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2300001693
9	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

4.3.13 Inspecting the oil level in axis-6 gearbox

Location of the oil plug

The oil plug for inspection is located as shown in the figure.



xx2300001684

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.
O-ring, G 1/4"	3HAC061327-060	Used on oil plug. Always replace when refitting oil plug.

Required documents

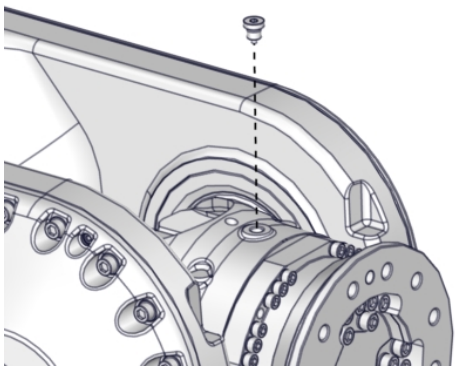
Document name	Document number
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*

Inspecting the oil level in axis-6 gearbox

Use this procedure to inspect the oil level in the gearbox.

	Action	Note
1	Run the robot to a position where the upper arm is horizontal.	

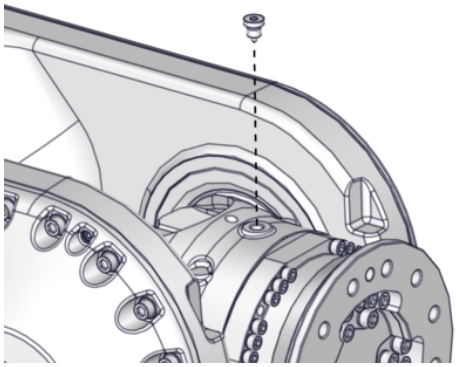
Continues on next page

	Action	Note
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Make sure that the oil temperature is +25 °C ± 10 °C.	
4	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
5	Open the oil plug.	 xx2300001694
6	Check the oil level. Required oil level is: 61-66 mm below oil plug hole	
7	Add or drain oil, if required.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*. Further information about how to drain or fill with oil is found in section *Changing the oil in axis-6 gearbox on page 178*.

Continues on next page

4.3.13 Inspecting the oil level in axis-6 gearbox

Continued

	Action	Note
8	Refit the oil plug with a new o-ring.	O-ring, G 1/4": 3HAC061327-060 Tightening torque: 20 Nm.  xx2300001694
9	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

4.4 Replacement/changing activities

4.4.1 Type of lubrication in gearboxes

Introduction

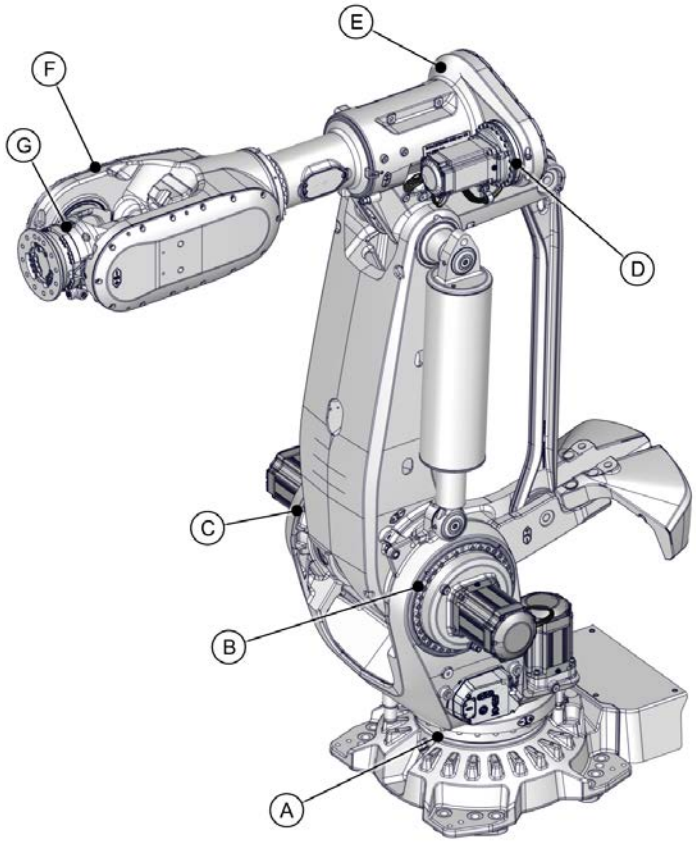
This section describes where to find information about the type of lubrication, article number and the amount of lubrication in the specific gearbox. It also describes the equipment needed when working with lubrication.

Type and amount of oil in gearboxes

Information about the type of lubrication, article number as well as the amount in the specific gearbox can be found in *Technical reference manual - Lubrication in gearboxes* available for registered users on myABB Business Portal, *www.abb.com/myABB*.

Location of gearboxes

The figure shows the location of the gearboxes.



xx2400000259

A	Axis-1 gearbox
B	Axis-2 gearbox
C	Axis-3 gearbox
D	Axis-4 primary gear

Continues on next page

4.4.1 Type of lubrication in gearboxes

Continued

E	Axis-4 gearbox
F	Axis-5 gearbox
G	Axis-6 gearbox

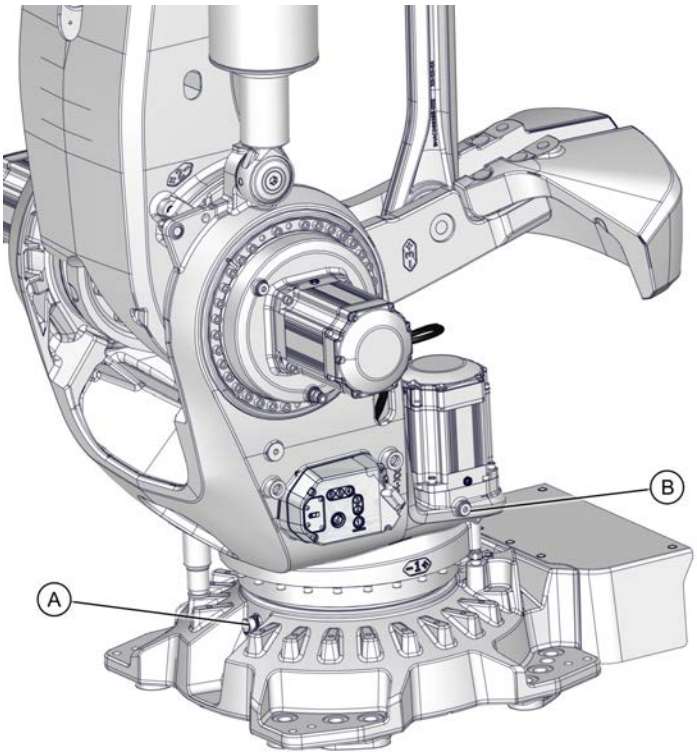
Equipment

Equipment	Note
Oil dispenser	Includes pump with outlet pipe. Use the suggested dispenser or a similar one: • Orion OriCan article number 22590 (pneumatic)
Nipple for quick connect fitting, with o-ring	Dimensions: • Axis-1, axis-2 and axis-3 gearboxes: Series 365, DN10 • Axis-4 gearbox: Series 265, DN6.3

4.4.2 Changing the oil in axis-1 gearbox

Location of the gearbox and oil nipples / plugs

The gearbox and its oil plugs / nipples are located as shown in the figure.



xx2300001673

A	Oil nipple for draining and filling with an oil dispenser
B	Oil plug hole for venting and inspection

Required tools and equipment

Equipment	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section *Type of lubrication in gearboxes on page 147*.
Nipple for quick connect fitting, with o-ring	-	Dimension: Series 365, DN10
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.

Continues on next page

4.4.2 Changing the oil in axis-1 gearbox
Continued

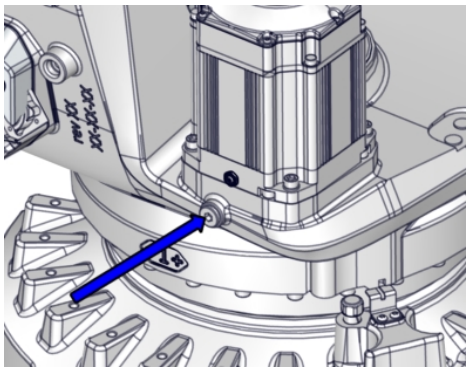
Wear part	Article number	Note
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

Required documents

Document name	Document number	Note
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*	

Floor-mounted robot: Draining the axis-1 gearbox

Use this procedure to drain the gearbox.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
3	Make sure that the oil temperature is +25 °C ± 10 °C.	
4	**CAUTION** The gearbox can contain an excess of pressure that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.	
5	Remove the plug from the venting hole. **WARNING** Let the venting hole stay open during draining and filling using the dispenser, to avoid damaging vital parts in the gearbox.	 xx2300001600

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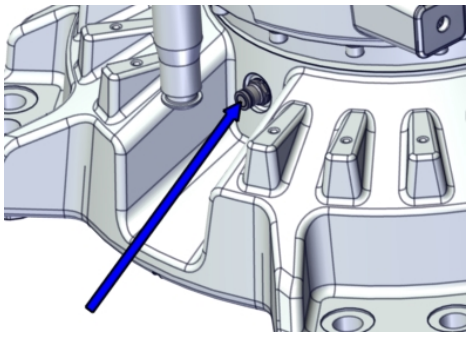
	Action	Note
6	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx2100001476
7	Suck out the oil with the oil dispenser. **Note** There will be some oil left in the gear after draining.	
8	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 649* for more information.	

Floor-mounted robot: Filling oil into the axis-1 gearbox

Use this procedure to refill the gearbox with oil.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	

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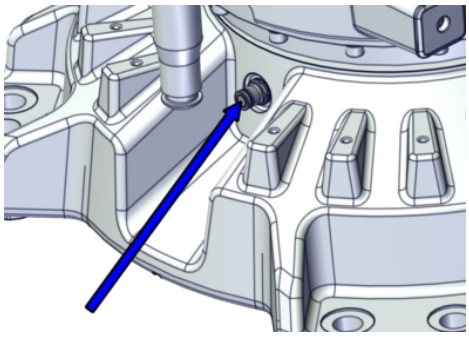
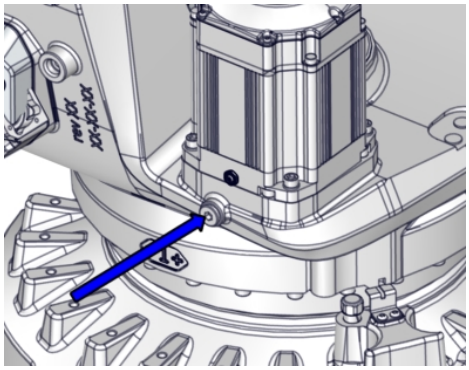
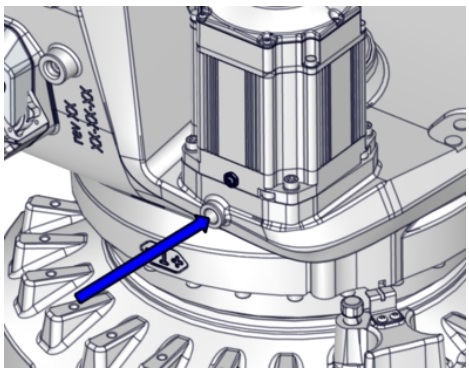
4.4.2 Changing the oil in axis-1 gearbox

Continued

	Action	Note
3	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx2100001476
4	Remove the plug from the venting hole. **Note** The venting hole is opened to let out air during the filling process.	 xx2300001600
5	Refill the gearbox with oil with the oil dispenser. **Note** The amount of oil to be filled depends on the amount previously being drained.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*.
6	Inspect the oil level through the inspection hole. **CAUTION** The oil level sinks when the oil fills all cavities in the gearbox. Wait until the oil stops sinking, before measuring the oil level.	Required oil level: 0-10 mm below the oil plug hole  xx2300001687
7	Remove the oil dispenser and refit the protective cap to the nipple.	

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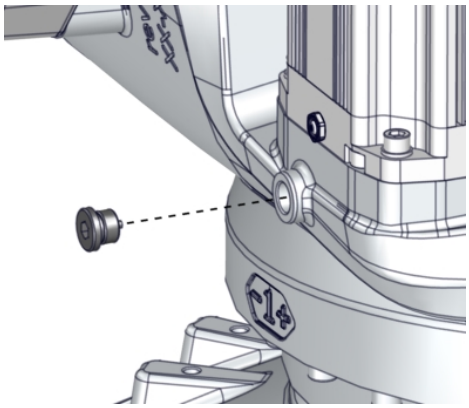
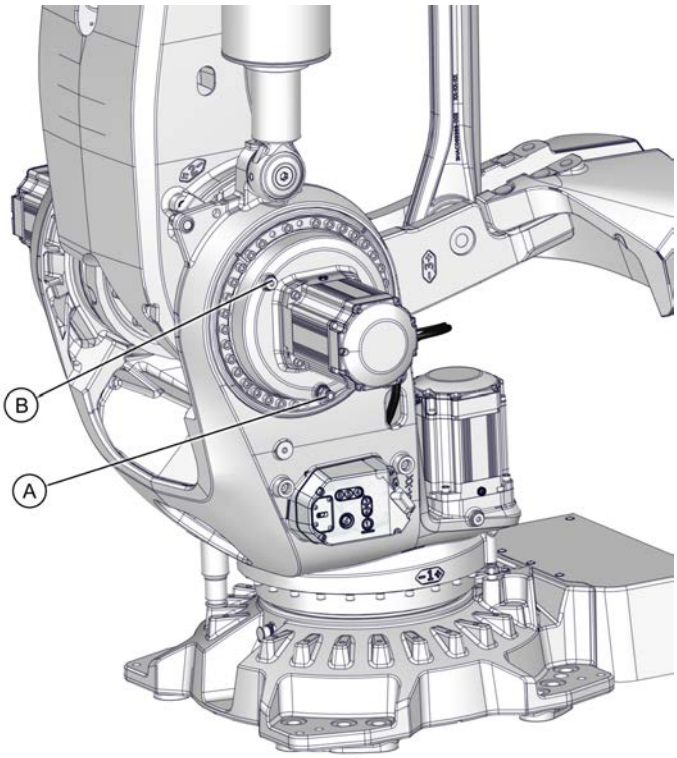
	Action	Note
8	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2300001686
9	**Note** After all repair and maintenance work involving oil, always wipe the robot clean from all surplus oil. The robot color can otherwise be discolored.	
10	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

4.4.3 Changing the oil in axis-2 gearbox

Location of the gearbox and oil plugs

The gearbox and its oil plugs are located as shown in the figure.



xx2300001675

A	Oil plug with nipple for draining and filling with an oil dispenser
B	Oil plug hole for venting and inspection

Required tools and equipment

Equipment	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section *Type of lubrication in gearboxes on page 147*.
Nipple for quick connect fitting, with o-ring	-	Dimension: Series 365, DN10
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.

Continues on next page

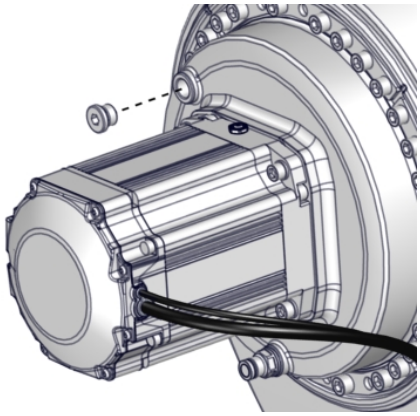
Wear part	Article number	Note
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

Required documents

Document name	Document number	Note
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*	

Draining the axis-2 gearbox

Use this procedure to drain the gearbox.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
3	**CAUTION** The gearbox can contain an excess of pressure that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.	
4	Remove the plug from the venting hole. **WARNING** Let the venting hole stay open during draining and filling using the dispenser, to avoid damaging vital parts in the gearbox.	 xx2300001688

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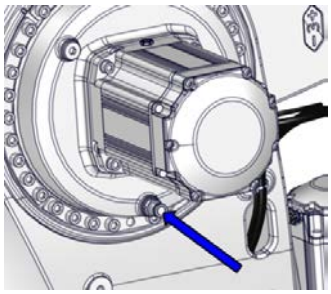
4.4.3 Changing the oil in axis-2 gearbox
Continued

	Action	Note
5	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx2300001676
6	Suck out the oil with the oil dispenser. **Note** There will be some oil left in the gear after draining.	
7	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 649* for more information.	

Filling oil into the axis-2 gearbox

Use this procedure to refill the gearbox with oil.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	

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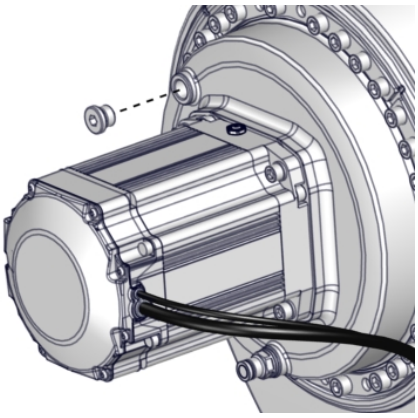
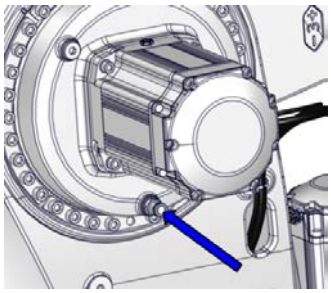
	Action	Note
3	Remove the plug from the ventilation hole. **WARNING** Let the venting hole stay open during draining and filling using the dispenser, to avoid damaging vital parts in the gearbox.	 xx2300001688
4	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx2300001676
5	Refill the gearbox with oil. **Note** The amount of oil to be filled depends on the amount previously being drained.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*.
6	Inspect the oil level at the ventilation hole (level plug). **CAUTION** The oil level sinks when the oil fills all cavities in the gearbox. Wait until the oil stops sinking, before measuring the oil level.	Required oil level is: 0-10 mm below oil plug hole More information is found in *Inspecting the oil level in axis-2 gearbox on page 130*.
7	Remove the oil dispenser. Refit the protective cap on the nipple.	

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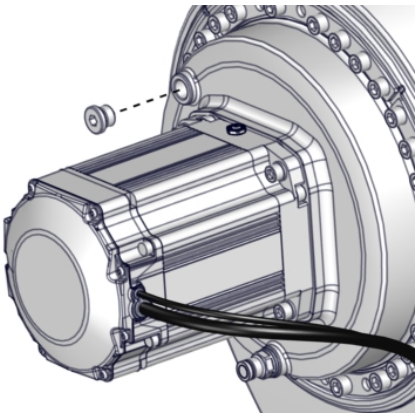
4.4.3 Changing the oil in axis-2 gearbox

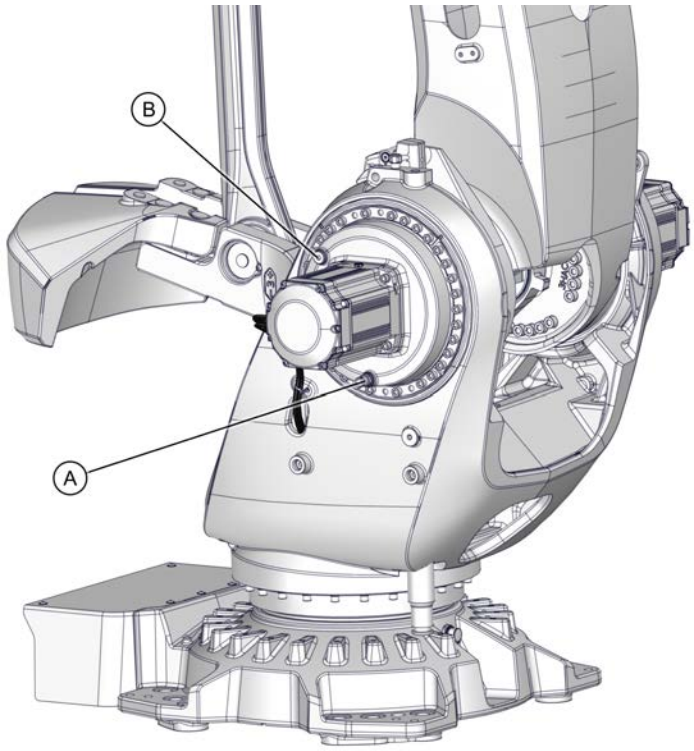
Continued

	Action	Note
8	Refit all removed oil plugs with new o-rings.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2300001688
9	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

4.4.4 Changing the oil in axis-3 gearbox

Location of the gearbox and oil plugs

The gearbox and its oil plugs are located as shown in the figure.



xx2300001679

A	Oil plug with nipple for draining and filling with an oil dispenser
B	Oil plug hole for venting and inspection

Required tools and equipment

Equipment	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section *Type of lubrication in gearboxes on page 147*.
Nipple for quick connect fitting, with o-ring	-	Dimension: Series 365, DN10
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.

Continues on next page

4.4.4 Changing the oil in axis-3 gearbox
Continued

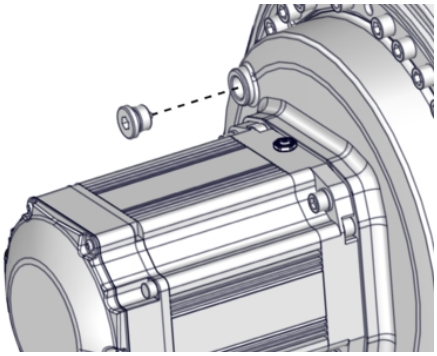
Wear part	Article number	Note
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

Required documents

Document name	Document number	Note
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*	

Draining the axis-3 gearbox

Use this procedure to drain the gearbox.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
3	**CAUTION** The gearbox can contain an excess of pressure that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.	
4	Remove the plug from the venting hole. **WARNING** Let the venting hole stay open during draining and filling using the dispenser, to avoid damaging vital parts in the gearbox.	 xx2300001690

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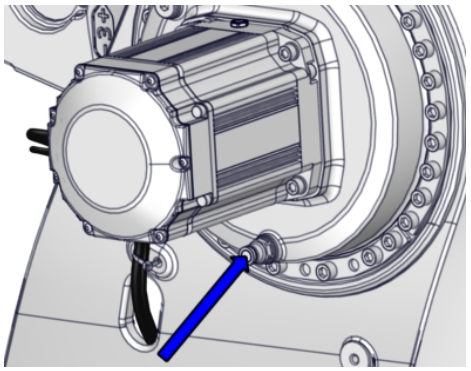
	Action	Note
5	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx2300001677
6	Suck out the oil with the oil dispenser. **Note** There will be some oil left in the gear after draining.	
7	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 649* for more information.	

Filling oil into the axis-3 gearbox

Use this procedure to refill the gearbox with oil.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	

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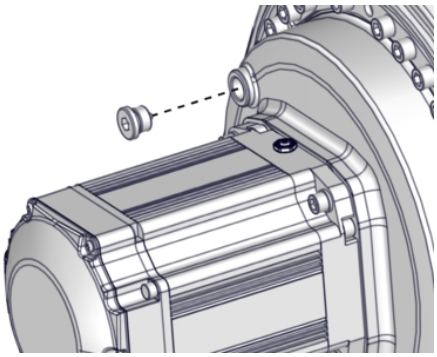
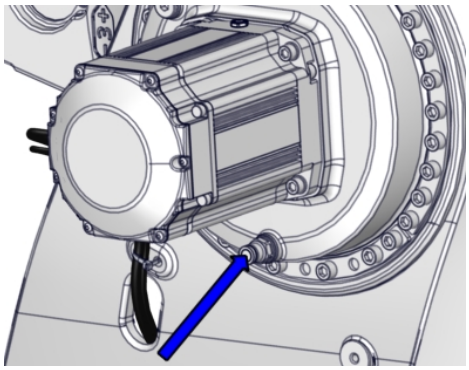
4.4.4 Changing the oil in axis-3 gearbox

Continued

	Action	Note
3	Remove the plug from the ventilation hole. **WARNING** Let the venting hole stay open during draining and filling using the dispenser, to avoid damaging vital parts in the gearbox.	 xx2300001690
4	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx2300001677
5	Refill the gearbox with oil. **Note** The amount of oil to be filled depends on the amount previously being drained.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*.
6	Inspect the oil level at the ventilation hole (level plug). **CAUTION** The oil level sinks when the oil fills all cavities in the gearbox. Wait until the oil stops sinking, before measuring the oil level.	Required oil level is: 0-10 mm below oil plug hole. More information is found in *Inspecting the oil level in axis-3 gearbox on page 132*.
7	Remove the oil dispenser. Refit the protective cap on the nipple.	

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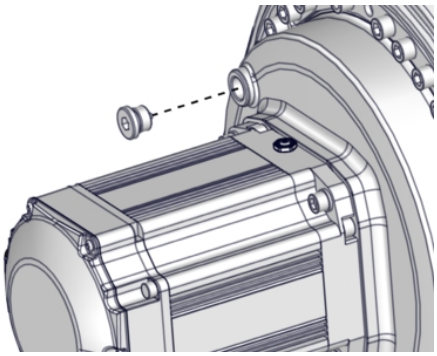
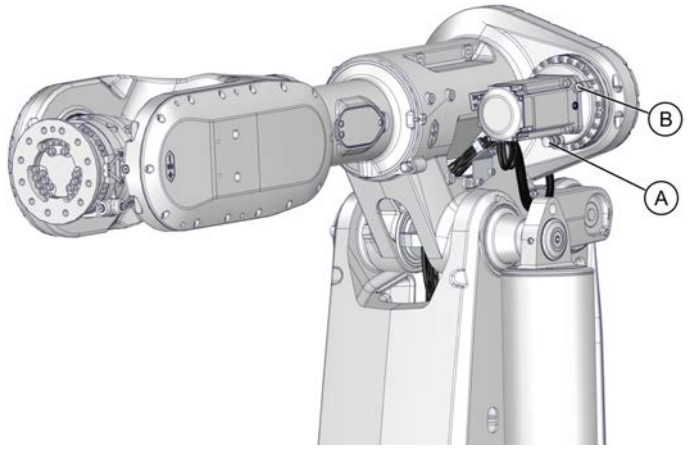
	Action	Note
8	Refit all removed oil plugs with new o-rings.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2300001690
9	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

4.4.5 Changing the oil in axis-4 primary gear

Location of the gearbox and oil plugs

The gearbox and its oil plugs are located as shown in the figure.



xx2300001696

A	Oil plug with nipple for draining and filling with an oil dispenser
B	Oil plug hole for venting and inspection

Required tools and equipment

Equipment	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section *Type of lubrication in gearboxes on page 147*.
Nipple for quick connect fitting, with o-ring	-	Dimension: Series 265, DN6.3
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.
O-ring, G 1/4"	3HAC061327-060	Used on oil plug. Always replace when refitting oil plug.

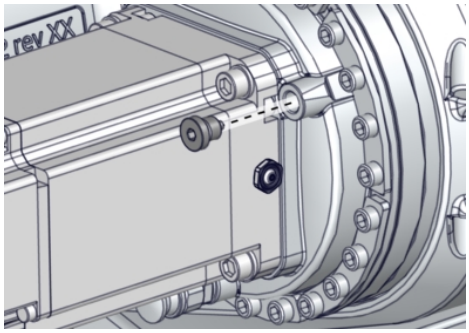
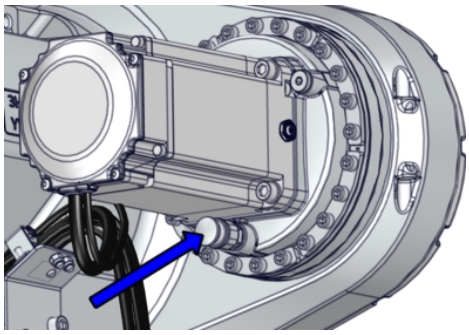
Required documents

Document name	Document number	Note
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*	

Continues on next page

Draining the axis-4 gearbox

Use this procedure to drain the gearbox.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
3	**CAUTION** The gearbox can contain an excess of pressure that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.	
4	Remove the plug from the venting hole. **WARNING** Let the venting hole stay open during draining and filling using the dispenser, to avoid damaging vital parts in the gearbox.	 xx2300001697
5	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx2300001698

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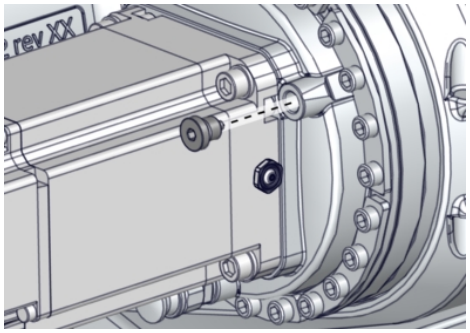
4.4.5 Changing the oil in axis-4 primary gear
Continued

	Action	Note
6	Suck out the oil with the oil dispenser. **Note** There will be some oil left in the gear after draining.	
7	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 649* for more information.	

Filling oil into the axis-4 gearbox

Use this procedure to refill the gearbox with oil.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
3	Remove the plug from the ventilation hole. **WARNING** Let the venting hole stay open during draining and filling using the dispenser, to avoid damaging vital parts in the gearbox.	 xx2300001697

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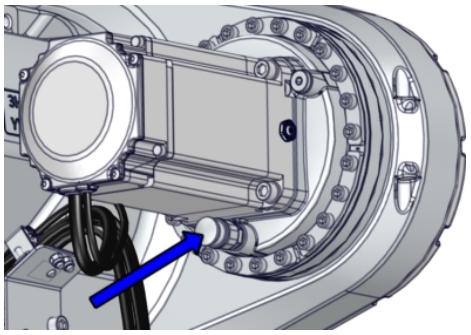
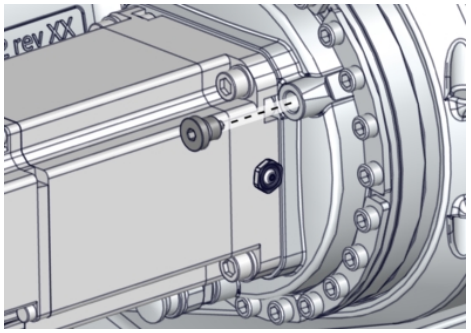
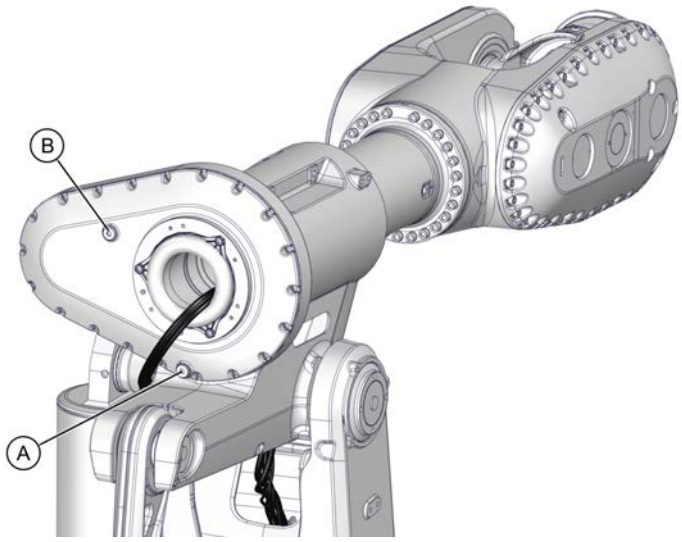
	Action	Note
4	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx2300001698
5	Refill the gearbox with oil. **Note** The amount of oil to be filled depends on the amount previously being drained.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*.
6	Inspect the oil level at the ventilation hole (level plug). **CAUTION** The oil level sinks when the oil fills all cavities in the gearbox. Wait until the oil stops sinking, before measuring the oil level.	Required oil level is: 0-10 mm below oil plug hole. More information is found in *Inspecting the oil level in axis-4 primary gearbox on page 135*.
7	Remove the oil dispenser. Refit the protective cap on the nipple.	
8	Refit all removed oil plugs with new o-rings.	O-ring, G 1/4": 3HAC061327-060 Tightening torque: 20 Nm.  xx2300001697
9	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

4.4.6 Changing the oil in axis-4 gearbox

Location of the gearbox and oil plugs

The gearbox and its oil plugs are located as shown in the figure.



xx2300001681

A	Oil plug for draining
B	Oil plug for filling and venting

Required tools and equipment

Equipment	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Hose	-	Used as an aid to drain the oil into an oil collecting vessel.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

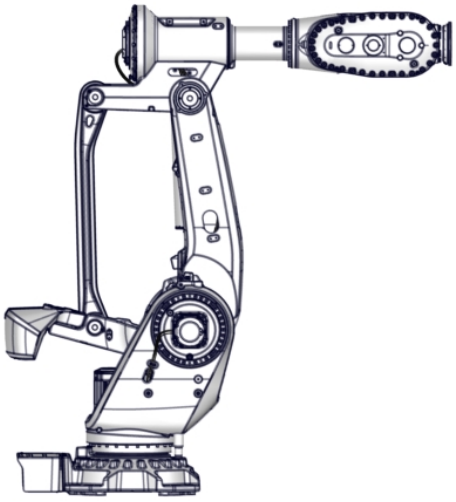
Required documents

Document name	Document number	Note
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*	

Continues on next page

Draining the axis-4 gearbox

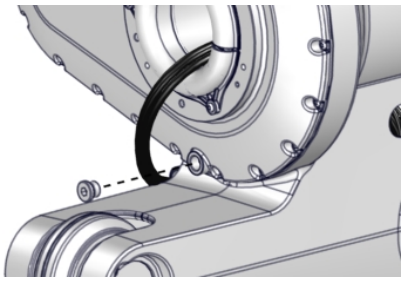
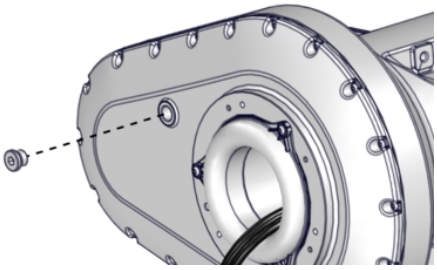
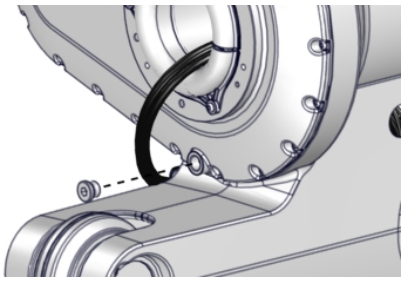
Use this procedure to drain the gearbox.

	Action	Note
1	Run the robot to a position where the upper arm is horizontal.	 xx2300001691
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
4	**CAUTION** The gearbox can contain an excess of pressure that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.	
5	Prepare the hose and the oil collecting vessel at the oil drain plug.	

Continues on next page

4.4.6 Changing the oil in axis-4 gearbox

Continued

	Action	Note
6	Remove the oil plug from the drain hole and let the oil run through the hose into the vessel.	 xx2400000143
7	Remove the oil plug from the fill/level hole. **Note** The oil plug hole is opened to speed up the drainage.	 xx2300001692
8	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 649* for more information.	
9	Refit the oil plug for the drainage hole, with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2400000143

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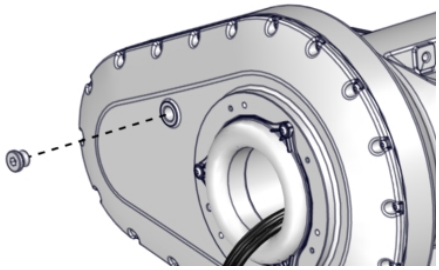
Filling oil into the axis-4 gearbox

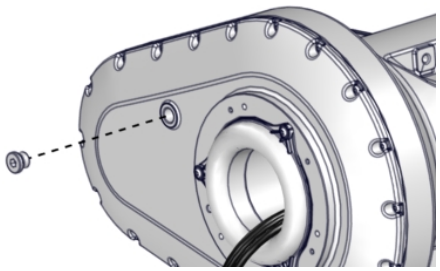
Use this procedure to refill the gearbox with oil.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
3	Open the fill/level plug.	 xx2300001692
4	Refill the gearbox with oil. **Note** The amount of oil to be filled depends on the amount previously being drained.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*.
5	Inspect the oil level. **CAUTION** The oil level sinks when the oil fills all cavities in the gearbox. Wait until the oil stops sinking, before measuring the oil level.	Required oil level is: 0-10 mm below oil plug hole See *Inspecting the oil level in axis-4 gearbox on page 136*.

Continues on next page

4.4.6 Changing the oil in axis-4 gearbox

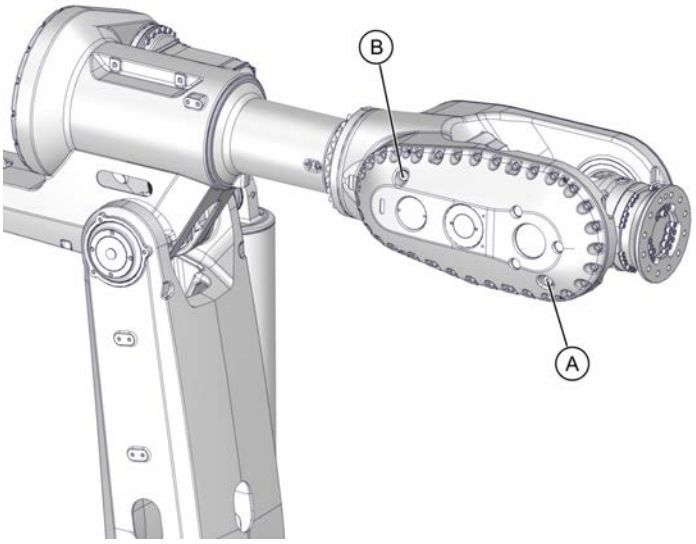
Continued

	Action	Note
6	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2300001692
7	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

4.4.7 Changing the oil in axis-5 gearbox

Location of the gearbox and oil plugs

The gearbox and its oil plugs are located as shown in the figure.



xx2300001683

A	Oil plug for draining
B	Oil plug for filling and venting

Required tools and equipment

Equipment	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section *Type of lubrication in gearboxes on page 147*.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

Required documents

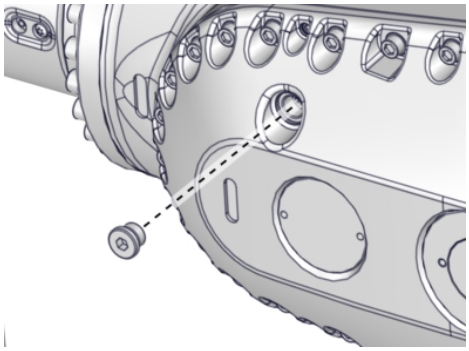
Document name	Document number	Note
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*	

Continues on next page

4.4.7 Changing the oil in axis-5 gearbox
Continued

Draining the axis-5 gearbox

Use this procedure to drain the gearbox.

	Action	Note
1	Jog the robot to calibration position.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
4	**CAUTION** The gearbox can contain an excess of pressure that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.	
5	Remove the oil plug from the fill hole. **Note** The oil plug hole is opened to speed up the drainage.	 xx2300001693
6	Place the oil collecting vessel underneath the oil drain plug.	

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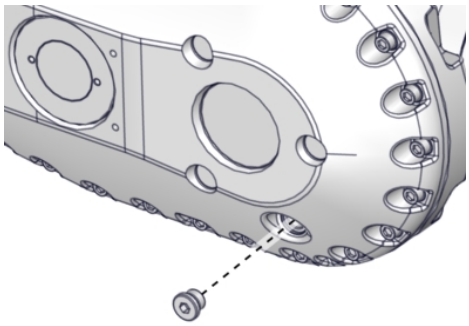
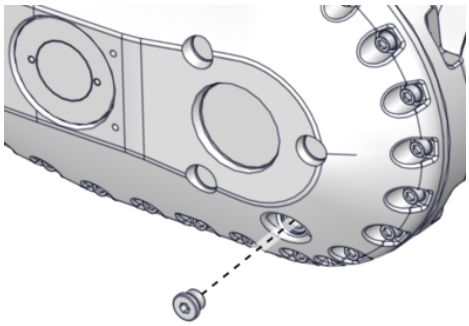
	Action	Note
7	Remove the oil plug from the drain hole and let the oil run into the vessel.	 xx2300001701
8	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 649* for more information.	
9	Refit the oil plug for the drainage hole, with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2300001701

Filling oil into the axis-5 gearbox

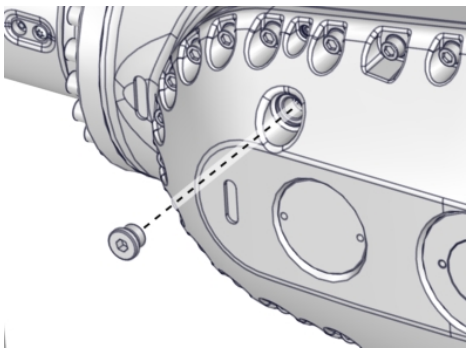
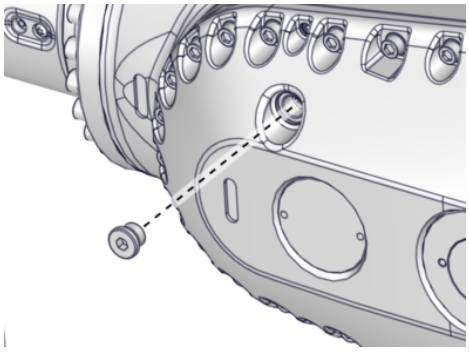
Use this procedure to refill the gearbox with oil.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Continues on next page

4.4.7 Changing the oil in axis-5 gearbox

Continued

	Action	Note
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
3	Open the fill/level plug.	 xx2300001693
4	Refill the gearbox with oil. **Note** The amount of oil to be filled depends on the amount previously being drained.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*.
5	Inspect the oil level at the oil fill/level hole (level plug). **CAUTION** The oil level sinks when the oil fills all cavities in the gearbox. Wait until the oil stops sinking, before measuring the oil level.	Required oil level is: 0-10 mm below oil plug hole. More information is found in *Inspecting the oil level in axis-5 gearbox on page 142*.
6	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2300001693

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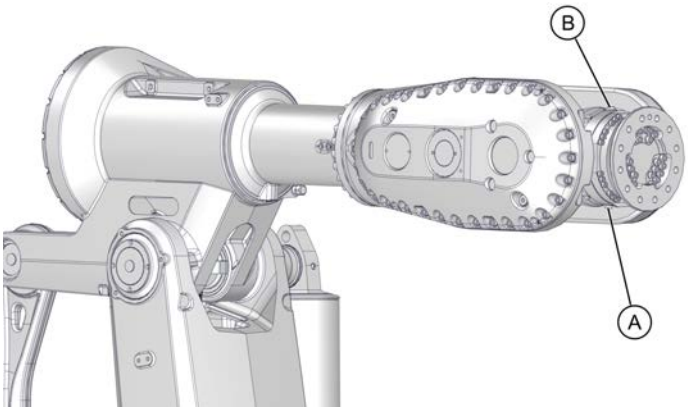
	Action	Note
7	 **DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

4.4.8 Changing the oil in axis-6 gearbox

Location of the gearbox and oil plugs

The gearbox and its oil plugs are located as shown in the figure.



xx2300001685

A	Oil plug for draining
B	Oil plug for filling and venting

Required tools and equipment

Equipment	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section *Type of lubrication in gearboxes on page 147*.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.
O-ring, G 1/4"	3HAC061327-060	Used on oil plug. Always replace when refitting oil plug.

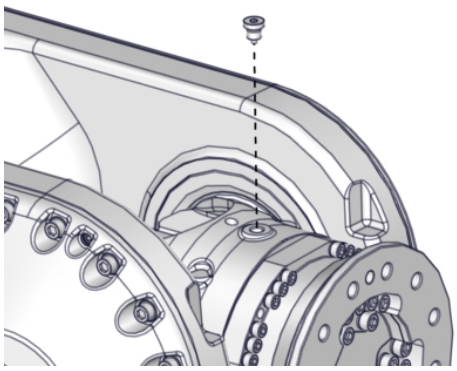
Required documents

Document name	Document number	Note
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*	

Continues on next page

Draining the axis-6 gearbox

Use this procedure to drain the gearbox.

	Action	Note
1	Jog the robot to calibration position.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
4	**CAUTION** The gearbox can contain an excess of pressure that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.	
5	Remove the oil plug from the fill hole. **Note** The oil plug hole is opened to speed up the drainage.	 xx2300001694
6	Place the oil collecting vessel underneath the oil drain plug.	

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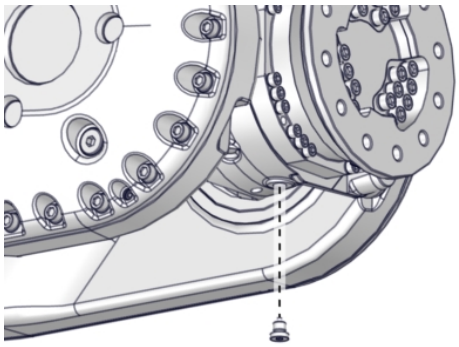
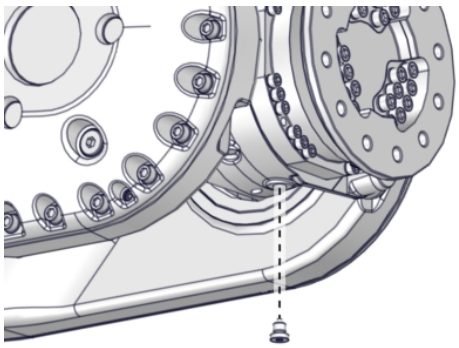
4.4.8 Changing the oil in axis-6 gearbox
Continued

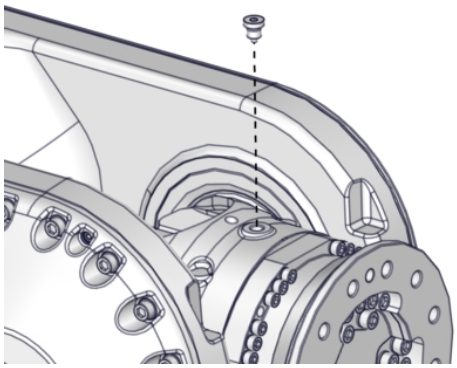
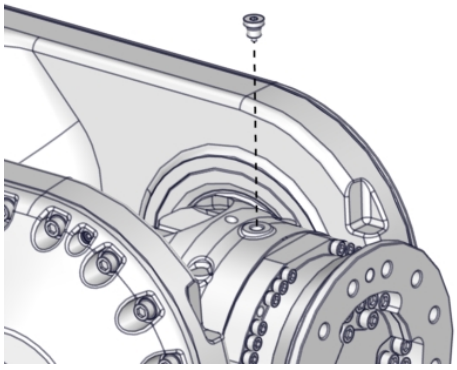
	Action	Note
7	Remove the oil plug from the drain hole and let the oil run into the vessel.	 xx2300001702
8	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 649* for more information.	
9	Refit the oil plug for the drainage hole, with a new o-ring.	O-ring, G 1/4": 3HAC061327-060 Tightening torque: 20 Nm.  xx2300001702

Filling oil into the axis-6 gearbox

Use this procedure to refill the gearbox with oil.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Continues on next page

	Action	Note
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*.	
3	Open the fill plug.	 xx2300001694
4	Refill the gearbox with oil. **Note** The amount of oil to be filled depends on the amount previously being drained.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*.
5	Check the oil level. **CAUTION** The oil level sinks when the oil fills all cavities in the gearbox. Wait until the oil stops sinking, before measuring the oil level.	Required oil level is: 61-66 mm below oil plug hole
6	Refit the oil plug with a new o-ring.	O-ring, G 1/4": 3HAC061327-060 Tightening torque: 20 Nm.  xx2300001694

Continues on next page

4.4.8 Changing the oil in axis-6 gearbox

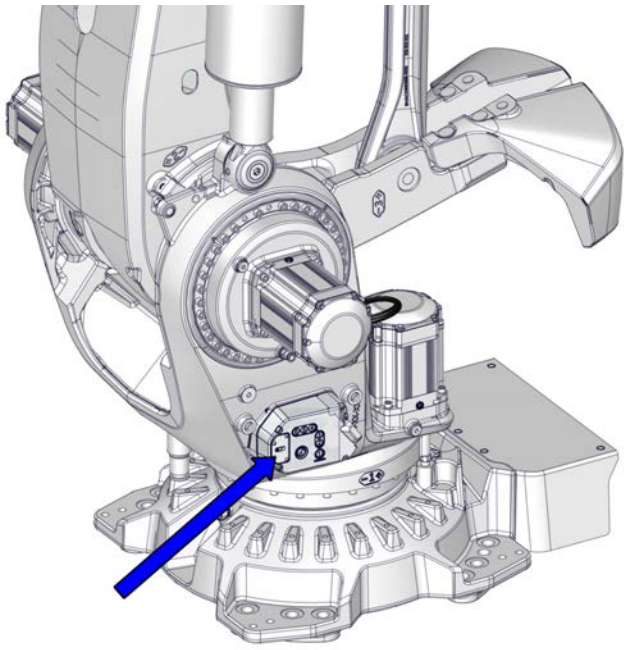
Continued

	Action	Note
7	 **DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

4.4.9 Replacing the SMB battery

Location of the SMB battery

The SMB battery is located as shown in the figure.



xx2400000144

Required consumables and wear parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Wear part	Article number	Note
Battery pack	3HAC044075-001	Battery includes protection circuits. Only replace with the specified spare part or an ABB-approved equivalent.

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

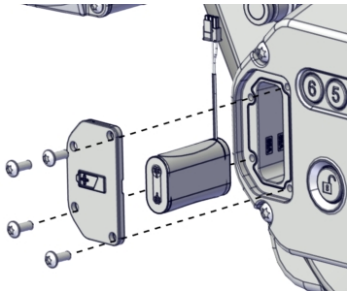
Removing the battery

Use this procedure to remove the SMB battery.

	Action	Note
1	Jog the robot to its calibration position.	This is done in order to facilitate updating of the revolution counter.

Continues on next page

4.4.9 Replacing the SMB battery
Continued

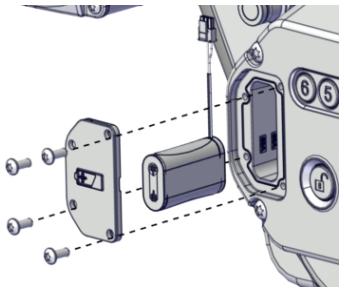
	Action	Note
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
4	Remove the SMB battery cover by unscrewing the attachment screws. **CAUTION** Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.	 xx2100002131
5	Pull out the battery and disconnect the battery cable.	
6	Remove the SMB battery. **Note** Battery includes protection circuits. Only replace with a specified spare part or with an ABB-approved equivalent.	

Refitting the battery

Use this procedure to refit the SMB battery.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Continues on next page

	Action	Note
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
3	Connect the battery cable and install the battery pack into the SMB/battery recess. **Note** Make sure that the connector is assembled in the correct direction according to its keying.	Torx pan head screw: M5x12 Stainless steel A2-70 (4 pcs) Tightening torque: 6 Nm.  xx2100002131
4	Secure the SMB battery cover with its attachment screws.	
5	Update the revolution counters.	See *Updating revolution counters on page 626*.
6	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

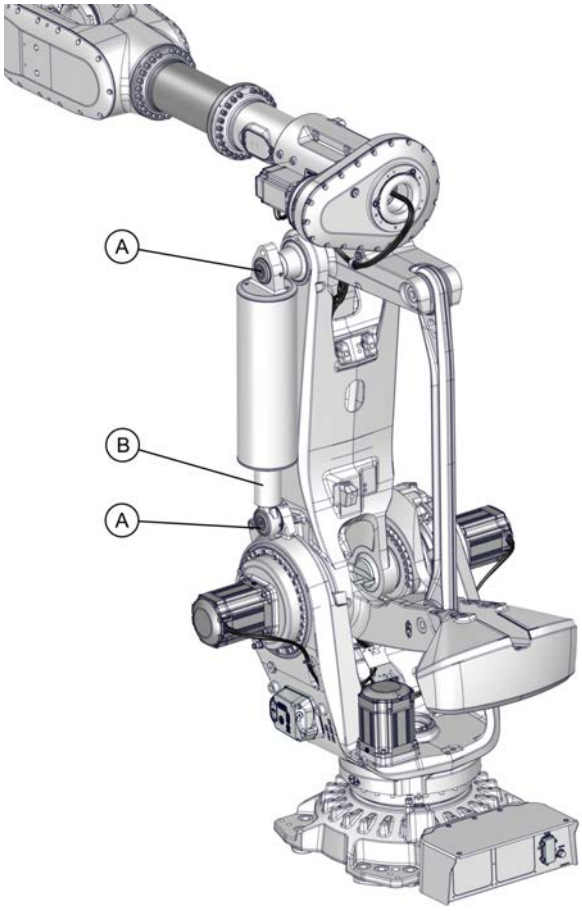
4.5 Lubrication activities

4.5.1 Lubricating the balancing device spherical roller bearing and piston rod

Location of spherical roller bearing and piston rod

The spherical roller bearing is located as shown in the figure.

The spherical roller bearings and the piston rod are located as shown in the figure.



xx2400000147

A	Spherical roller bearing (2 pcs)
B	Piston rod

Lubrication of piston rod after first installation and test run

The balancing device piston rod is pre-lubricated from the factory, and also protected with transportation grease at delivery. To properly prepare the balancing device piston rod for operation after the first test run during installation, perform step *4* to step *6* in *Lubricating the piston rod on page 188*.

Required consumables and wear parts

Wear part	Article number	Note
Cleaning agent	-	Isopropanol

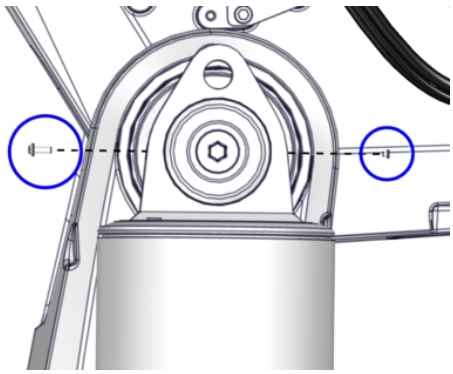
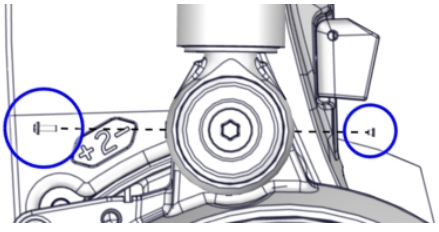
Continues on next page

Wear part	Article number	Note
Bearing grease	3HAC9408-1	Tribol GR 100-2 PD, 85 ml / bearing
Grease	3HAC042536-001	Shell Gadus S2 or equivalent

Lubricating the spherical roller bearing

Use this procedure to lubricate the spherical roller bearing.

Lubricating the spherical roller bearing

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	Unscrew the screw and remove the plastic plug of the bearing and fill grease through the screw hole until grease appears in the other hole. Use a grease nipple.	Bearing grease: 3HAC9408-1 Amount: Tribol GR 100-2 PD, 85 ml / bearing.  xx2400000134  xx2400000135
3	Refit the screw and the plastic plug. Wipe clean from residual grease.	
4	**Note** Inspect the bearings after a few days running. Some of the refilled grease may have emerged from the bearing. Wipe clean from residual grease.	

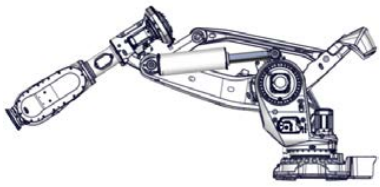
Continues on next page

4.5.1 Lubricating the balancing device spherical roller bearing and piston rod
Continued

Lubricating the piston rod

Use this procedure to lubricate the balancing device piston rod.

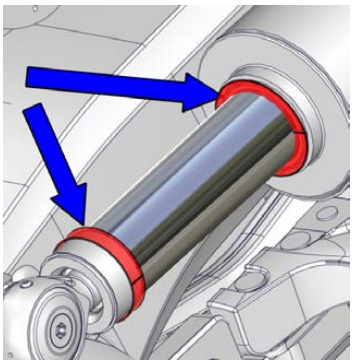
Preparations before lubrication

	Action	Note
1	Piston rods are pre-lubricated from the factory. If lubricating the piston rod during the first installation procedure, skip to step *4* in *Lubricating the piston rod on page 188*.	
2	Position axis 2 so that the balancing device is horizontal and the piston rod is extended to the greatest extent possible.	 xx2400001562
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Lubricating the piston rod

	Action	Note
1	Clean the piston rod.	Cleaning agent: Isopropanol
2	Apply a thin layer of grease across the entire unpainted surface of the piston rod. **Note** Too little grease may result in premature wear of the guide ring. Too much grease may result in an undesirable appearance or a risk of contaminating the surrounding environment.	Grease: 3HAC042536-001
3	Turn on power to the robot again.	
4	Jog the robot through the balancing device's full range of motion. Repeat one time.	
5	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Continues on next page

	Action	Note
6	Wipe away any excessive grease accumulating in the indicated areas.	 xx2400000245

4.6 Cleaning activities

4.6.1 Cleaning the IRB 7710

General

To secure high uptime it is important that the IRB 7710 is cleaned regularly. The frequency of cleaning depends on the environment in which the manipulator works.

Different cleaning methods are allowed depending on the type of protection of the IRB 7710.

Note

Always verify the protection type of the robot before cleaning.

Oil spills

Oil spills from gearboxes

Use the following procedure if any oil spills are detected that can be suspected to originate from a gearbox.

	Action	Note
1	Inspect that the oil level in the suspected gearbox is according to the recommendations.	See *Inspection activities on page 108*
2	Write down the oil level.	
3	Inspect the oil level again after, for example, 6 months.	
4	If the oil level is decreased, replace the gearbox.	

Oil spills discolors painted surfaces

Oil spills on painted surfaces of the robot can result in discoloration.

Note

After all repair and maintenance work involving oil, always wipe the robot clean from all surplus oil.

WARNING

Turn off all electrical power supplies to the robot before starting the cleaning.

Special cleaning considerations

This section specifies some special considerations when cleaning the robot.

- Always use cleaning equipment as specified. Any other cleaning equipment may shorten the life of the robot.
- Always check that all protective covers are fitted to the robot before cleaning.
- Do not use compressed air to clean the robot.

Continues on next page

- Do not remove any covers or other protective devices before cleaning the robot.

Cleaning methods

This following table defines what cleaning methods are allowed for ABB manipulators depending on the protection type.

Protection type	Cleaning method			
	Vacuum cleaner	Wipe with cloth	Rinse with water	High pressure water, steam or spray
Standard	Yes	Yes. With mild cleaning detergent[i] or white spirit.	Yes. The water must contain a corrosion inhibitor and the manipulator must also be wiped with a drying cloth afterwards.	No
Foundry Plus	Yes	Yes. With mild cleaning detergent [i] or white spirit.	Yes. The water must contain a corrosion inhibitor.	No

i Cleaning agent to be tested on a small surface prior usage on complete manipulator.

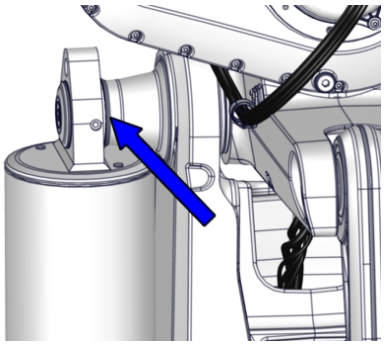
Cleaning with water

Instructions for rinsing with water

ABB robots with protection types *Standard* or *Foundry Plus* can be cleaned by rinsing with water (water cleaner).[1]

The following list defines the prerequisites:

- Spray nozzle should be used with minimum 45° spread.
- Minimum distance from nozzle to encapsulation: 0.4 m.
- Maximum water pressure at the nozzle: 700 kN/m^2 (7 bar) [i]
- Maximum flow: 20 liters/min[i]
- Never point the nozzle at the following positions (example images):

Position	Example of position
Joints	 xx2400000145

1 Exceptions that can not be rinsed with water: motor cooling fans (option number 3320-1, 3321-1, 3346-1).

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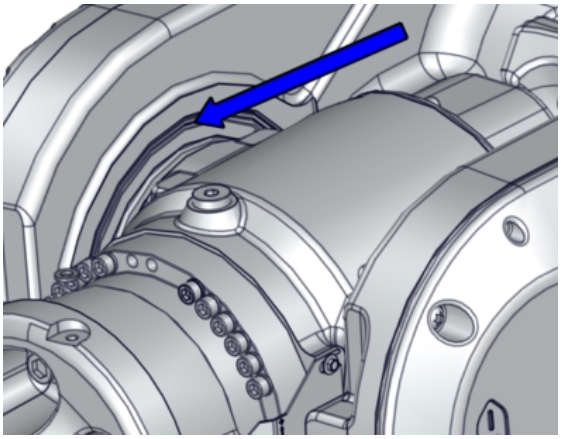
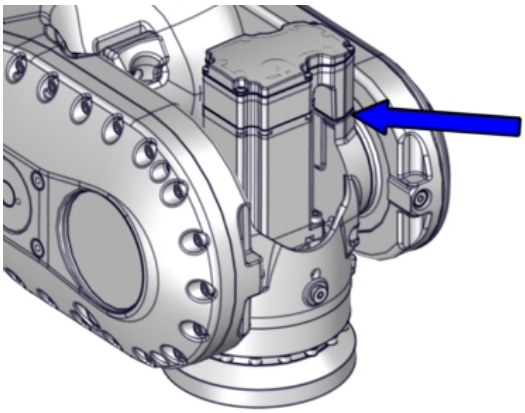
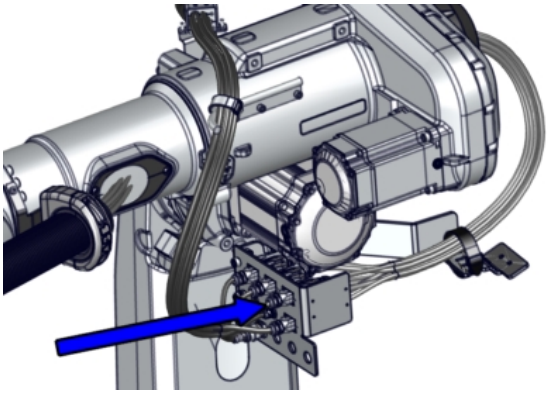
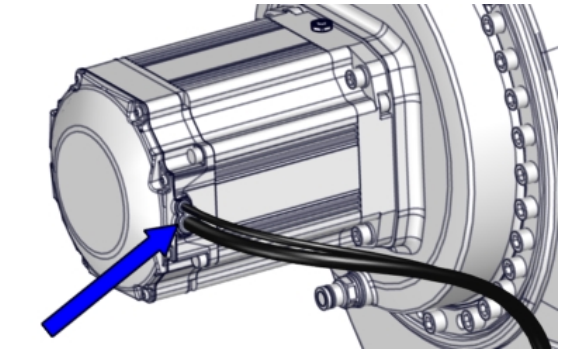
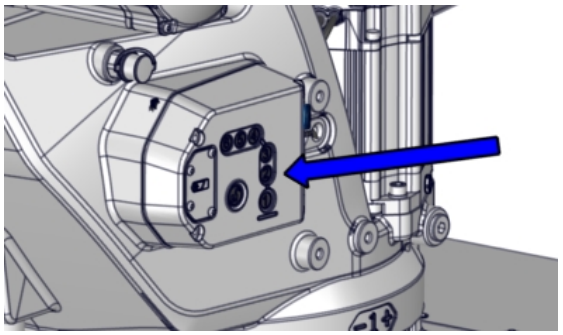
4.6.1 Cleaning the IRB 7710
Continued

Position	Example of position
Rotational sealings	 xx2300001055
Gaskets	 xx2300001056
Connectors	 xx2300001057

Continues on next page

Position	Example of position
Cable inlets	 xx2400000146
Brake release buttons	 xx2300001059

I Typical tap water pressure and flow

Cables

Movable cables need to be able to move freely:

- Remove waste material, such as sand, dust and chips, if it prevents cable movement.
- Clean the cables if they have a crusty surface, for example from dry release agents.

Cassette sealings

Minor seepage of grease from the seals can occur. Wipe down affected areas with a dry cloth.

Cooling fans

Inspect the air supply inlet of the the motor cooling fans. Clean to remove any contamination that could hinder the air supply.

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5 Repair

5.1 Introduction

Structure of this chapter

This chapter describes repair activities for the IRB 7710. Each procedure contains the information required to perform the activity, for example spare parts numbers, required special tools, and materials.

WARNING

Repair activities not described in this chapter must only be carried out by ABB.

Report replaced units

Note

When replacing a part on the IRB 7710, report to your local ABB the serial number, the article number, and the revision of both the replaced unit and the replacement unit.

This is particularly important for safety equipment to maintain the safety integrity of the installation.

Safety information

Make sure to read through the chapter *Safety on page 15* before commencing any service work.

5.2 Definition of spare part levels

Spare part level

ABB spare parts are categorized into three levels, L1, L2 and L3. Always check the part level before conducting a service work on a spare part.

- L1 spare parts

  The L1 parts can be replaced in the field. The maintenance and replacement instructions given in the related product manuals must be strictly followed. If there are any problems, contact your local ABB for support.

- L2 spare parts

  To replace the L2 parts require specialized training and might need special tools. Only ABB field service personnel or qualified personnel trained by ABB can replace L2 parts.

- L3 spare parts

  L3 spare parts shall only be replaced or repaired by qualified ABB service technician with knowledge of the application due to reduce risk of injury or damage to equipment. Improper installation may void warranty.

5.3 General procedures

5.3.1 Performing a leak-down test

When to perform a leak-down test

After refitting any motor and gearbox, the integrity of all seals enclosing the gearbox oil must be tested. This is done in a leak-down test.

The gearbox must be drained of oil before performing the leak-down test.

Required equipment

Equipment, etc.	Article number	Note
Leak-down tester	-	
Leak detection spray	-	

Performing a leak-down test

	Action	Note
1	Finish the refitting procedure of the motor or gear in question, but **do not** refill the gearbox with oil before performing the leak-down test.	
2	Remove the upper oil plug on the gear and replace it with the leak-down tester. Regulators, which are included in the leak-down test, may be required.	
3	Use caution, apply compressed air and raise the pressure with the knob until the correct value is shown on the manometer. **CAUTION** The pressure must under no circumstance be higher than 0.25 bar (20-25 kPa). Also during the time when the pressure is raised.	Correct value: 0.2-0.25 bar (20-25 kPa)
4	Disconnect the compressed air supply.	
5	Wait for approximately 8-10 minutes and make sure that no pressure loss occurs.	If the compressed air is significantly colder or warmer than the gearbox to be tested, a slight pressure increase or decrease may occur. This is quite normal.
6	If any pressure drop occurred, then localize the leak as described in step *7*. If no pressure drop occurred, then remove the leak-down tester and refit the oil plug. The test is complete.	
7	Spray any suspected leak areas with the leak detection spray. Bubbles indicate a leak.	
8	When the leak has been localized, take the necessary measures to correct the leak.	

5.3.2 Mounting instructions for bearings

General

This section describes how to mount and grease different types of bearings on the robot.

Equipment

Equipment, etc.	Article number	Note
Grease	3HAC042536-001	Shell Gadus S2 Used to grease the bearings, if not specified otherwise.

Assembly of all bearings

Attend to the following instructions while mounting a bearing on the robot.

	Action	Note
1	To avoid contamination, let a new bearing remain in its wrapping until it is time for fitting.	
2	Ensure that the parts included in the bearing fitting are free from burrs, grinding waste, and other contamination. Cast components must be free of foundry sand.	
3	Bearing rings, inner rings, and roller elements must not be subjected to direct impact. The roller elements must not be exposed to any stresses during the assembly work.	

Assembly of tapered bearings

Follow the preceding instructions for the assembly of the bearings when mounting a tapered bearing on the robot.

In addition to those instructions, the following procedure must be carried out to enable the roller elements to adjust to the correct position against the race flange.

	Action	Note
1	Tension the bearing gradually until the recommended pre-tension is achieved. **Note** The roller elements must be rotated a specified number of turns before pre-tensioning is carried out and also rotated during the pre-tensioning sequence.	
2	Make sure the bearing is properly aligned as this will directly affect the durability of the bearing.	

Greasing of bearings

Note

This instruction is not valid for solid oil bearings.

Continues on next page

The bearings must be greased after assembly according to the following instructions:

- The bearings must not be completely filled with grease. However, if space is available beside the bearing fitting, the bearing may be totally filled with grease when mounted, as excessive grease will be pressed out from the bearing when the robot is started.
- During operation, the bearing should be filled to 70-80% of the available volume.
- Ensure that grease is handled and stored properly to avoid contamination.

Grease the different types of bearings as following description:

- *Grooved ball bearings* must be filled with grease from both sides.
- *Tapered roller bearings* and axial needle bearings must be greased in the split condition.

5.3.3 Mounting instructions for sealings

General

This section describes how to mount different types of sealings.

Equipment

Consumable	Article number	Note
Grease	3HAC042536-001	Shell Gadus S2

Rotating sealings

The following procedures describe how to fit rotating sealings.

CAUTION

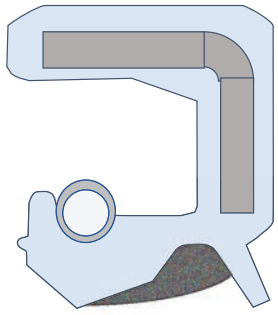
Please observe the following before commencing any assembly of sealings:

- Protect the sealing during transport and mounting, especially the main lip on radial sealings.
- Keep the sealing in its original wrappings or protect it well before actual mounting.
- The fitting of sealings and gears must be carried out on clean workbenches.
- Use a protective sleeve for the main lip during mounting, when sliding over threads, keyways or other sharp edges.
- Do not lubricate a static side of a sealing with grease, since this may result in movement of the sealing during operation.

  The only exception for lubrication of static sides of a sealing, is to use P-80 rubber lubrication gel against certain aluminium surfaces. If usage of P-80 is relevant, it is stated in the repair procedures.

Radial sealings

A radial sealing consists of a flexible rubber lip bonded to a rigid metal case. Only one side of the sealing is static with a metal insert.



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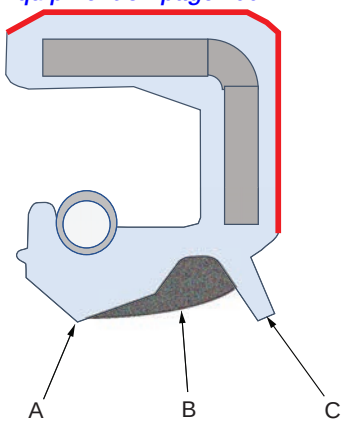
	Action	Note
1	Check the sealing to ensure that: • The sealing is of the correct type. • There is no damage on the main lip.	
2	Inspect the shaft surface before mounting. If scratches or damage are found, the shaft must be replaced since it may result in future leakage. Do not try to grind or polish the shaft surface to get rid of the defect.	
3	Lubricate the sealing with grease just before fitting. (Not too early - there is a risk of dirt and foreign particles adhering to the sealing.) Fill 2/3 of the space between the dust lip and the main lip with grease. If the sealing is without dust lip, just lubricate the main lip with a thin layer of grease.	Article number is specified in *Equipment on page 200*.  xx2000000071 A Main lip B Grease C Dust lip **Note** Ensure that no grease is applied to the red marked surface.

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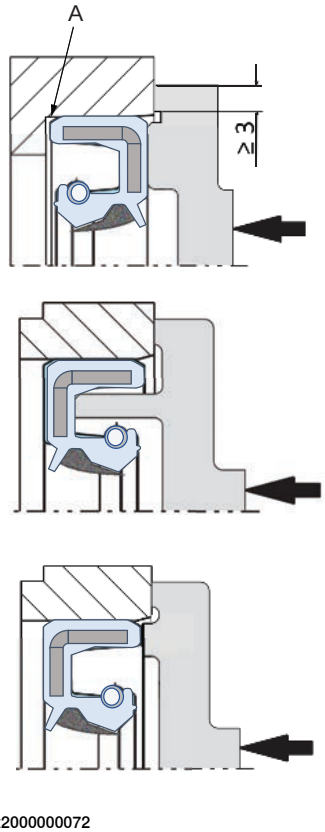
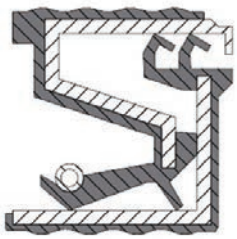
5.3.3 Mounting instructions for sealings
Continued

	Action	Note
4	Mount the sealing correctly with a mounting tool. Never hammer directly on the sealing as this may result in leakage.	 xx2000000072 A Gap

Cassette sealings

A cassette sealing is a fully enclosed seal with an integrated sealing system. Both sides of the cassette sealing are static with metal inserts.



xx2300000432

	Action	Note
1	Check the sealing to ensure that: • The sealing is of the correct type. • There is no damage on the sealing.	
2	Inspect the mating surfaces on the manipulator before mounting. If scratches or damage are found, the part must be replaced since it may result in future leakage. Do not try to grind or polish the surfaces to get rid of the defect.	

Continues on next page

	Action	Note
3	Always install the sealing with a mounting tool specified by ABB. Never hammer directly on the sealing as this may result in leakage.	See the replacement procedure for the cassette sealing, in the repair chapter.

Note

A new sealing has an initial wear that can cause lubricant to seep out and in some cases produce minor residues of rubber particles.

This is normal behavior of the sealing and does not indicate a seal problem. Wipe the surrounding surfaces after initial run time.

Flange sealings and static sealings

The following procedure describes how to fit flange sealings and static sealings.

	Action
1	Check the flange surfaces. They must be even and free from pores. It is easy to check flatness using a gauge on the fastened joint (without sealing compound). If the flange surfaces are defective, the parts may not be used because leakage could occur.
2	Clean the surfaces properly in accordance with the recommendations of ABB.
3	Distribute the sealing compound evenly over the surface.
4	Tighten the screws evenly when fastening the flange joint.

O-rings

The following procedure describes how to fit o-rings.

	Action	Note
1	Ensure that the correct o-ring size is used.	
2	Check the o-ring for surface defects, burrs, shape accuracy, or deformation.	Defective o-rings, including damaged or deformed o-rings, may not be used.
3	Check the o-ring grooves and mating surfaces. They should be free of pores, contamination and obvious scratches/damage.	
4	Lubricate the o-ring with grease.	
5	Tighten the screws evenly while assembling.	
6	Check that the o-ring is not squashed outside the o-ring groove.	

5.3.4 Cut the paint or surface on the robot before replacing parts

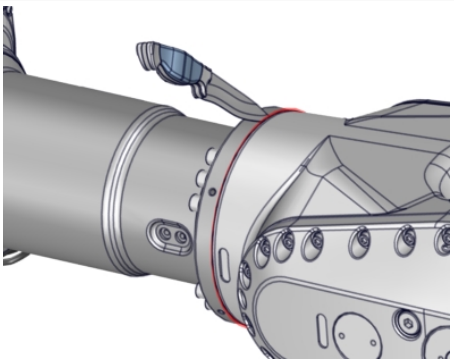
General

Follow the procedures in this section whenever breaking the paint of the robot during replacement of parts.

Required equipment

Equipment	Spare parts	Note
Cleaning agent		Ethanol
Knife		
Lint free cloth		
Touch up paint Standard/Foundry Plus	3HAC067974-001	Graphite White
Touch up paint Standard/Foundry Plus	3HAC037052-001	ABB Orange

Removing

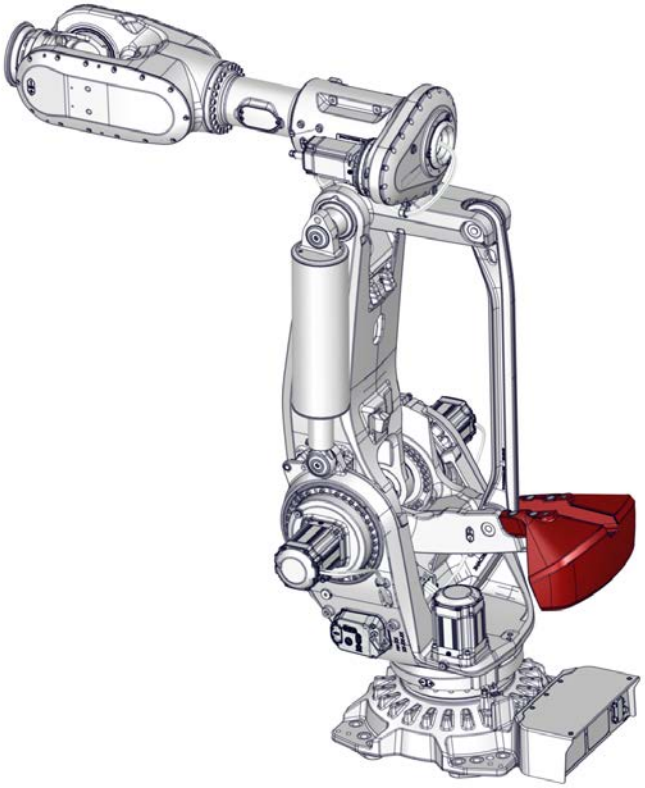
	Action	Description
1	Cut the paint with a knife in the joint between the part that will be removed and the structure, to avoid that the paint cracks.	 xx2300000950
2	Carefully grind the paint edge that is left on the structure to a smooth surface.	

5.4 Counter balancing weight

5.4.1 Replacing the counter balancing weight

Location of the counter balancing weight

The counter balancing weight is located as shown in the figure.



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Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Counter balancing weight	3HAC076326-004 (Graphite White) 3HAC076326-005 (ABB Orange)		L2

Continues on next page

5.4.1 Replacing the counter balancing weight
Continued

Required service parts

Consumable	Article number	Note
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)
Protection plug	3HAC4836-6	For screw holes.
Protection plug	3HAC4836-21	For lifting holes.

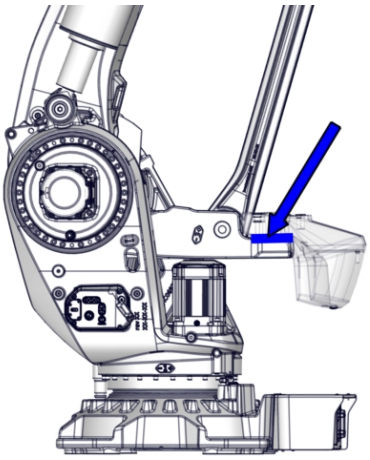
Required tools and equipment

Equipment	Article number	Note
Lifting eye M20	-	
Lifting eye M16	3HAC14457-4	
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Roundsling, 2 m	-	Length: 2 m.

Removing the counter balancing weight

Use these procedures to remove the counter balancing weight.

Preparations before removing the counter balancing weight

	Action	Note
1	Jog the robot to a position where the counter balancing weight attachment area is horizontal to the foundation.	 xx2300001542
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

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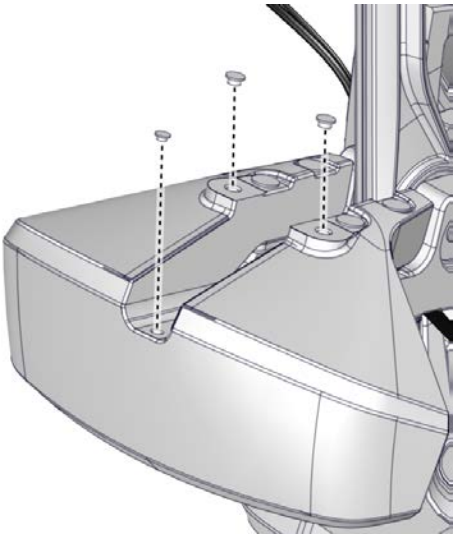
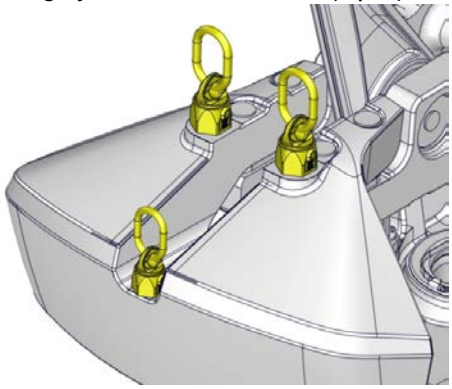
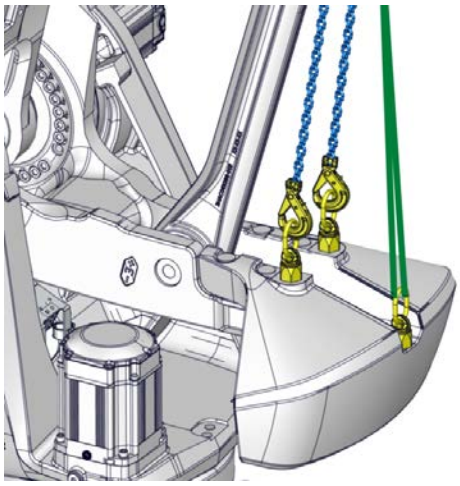
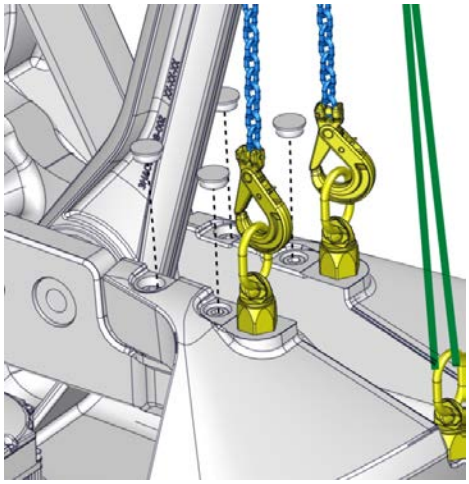
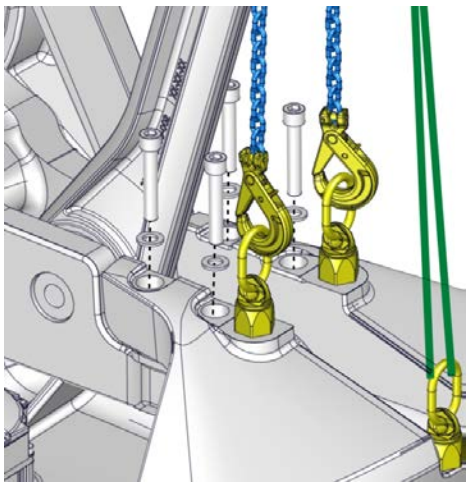
Removing the counter balancing weight

	Action	Note
1	**CAUTION** The weight of the counter balancing weight is 163 kg All lifting accessories used must be sized accordingly.	
2	Remove the plastic plugs that cover the lifting eye holes. **Note** Keep the plastic plugs for refitting.	 xx2300001543
3	Attach lifting eyes.	Lifting eye M20: - (2 pcs) Lifting eye M16: 3HAC14457-4 (1 pcs)  xx2300001544
4	Attach the lifting chains and a roundsling to the lifting eyes.	Lifting accessory (chain): 3HAC15556-1 Lifting instruction 3HAC15880-2 enclosed. Roundsling, 2 m: -

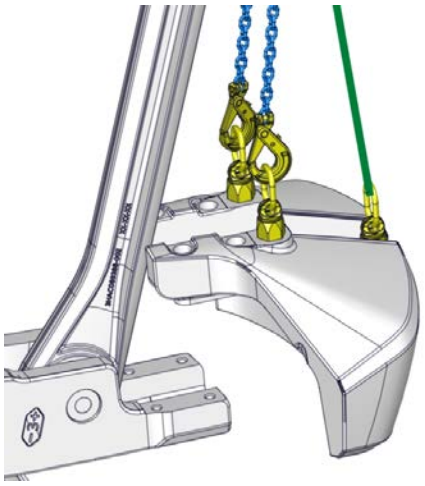
Continues on next page

5.4.1 Replacing the counter balancing weight

Continued

	Action	Note
5	Stretch the lifting accessory to take the weight of the counterweight.	 xx2300001545
6	Remove the plastic plugs that cover the screw holes. **Note** Keep the plastic plugs for refitting.	 xx2300001546
7	Remove the counterweight attachment screws and washers.	 xx2300001547

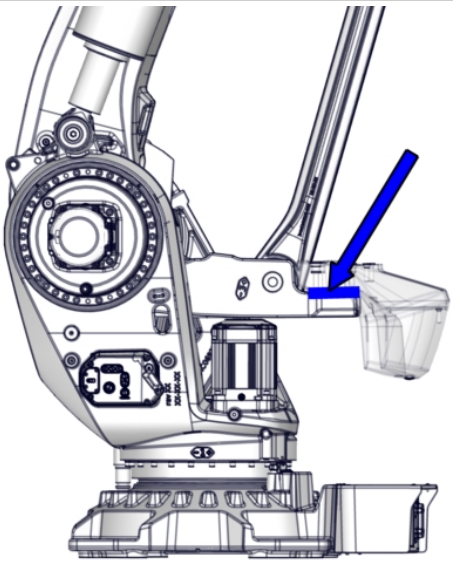
Continues on next page

	Action	Note
8	Lift away the counter balancing weight.	 xx2300001548

Refitting the counter balancing weight

Use these procedures to refit the counter balancing weight.

Robot position when refitting the counter balancing weight

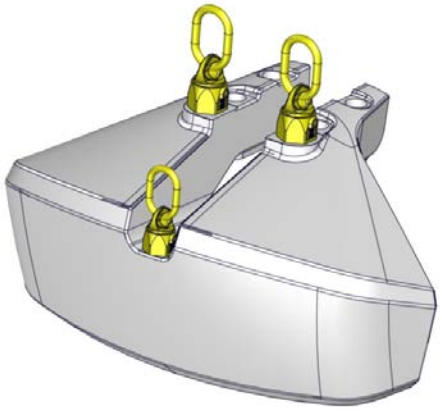
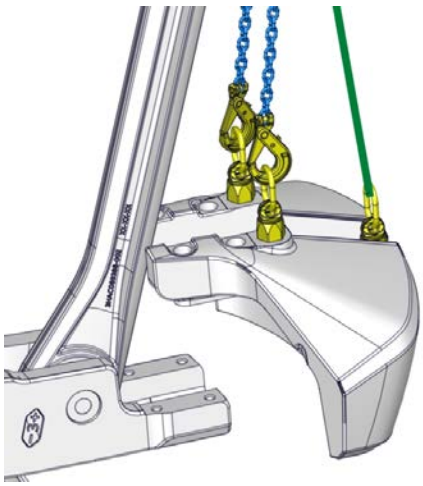
	Action	Note
1	If not already in this position: Jog the robot to a position where the counter balancing weight attachment area is horizontal to the foundation.	 xx2300001542
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Continues on next page

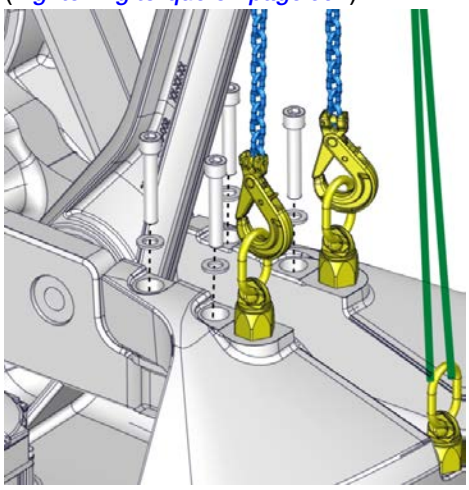
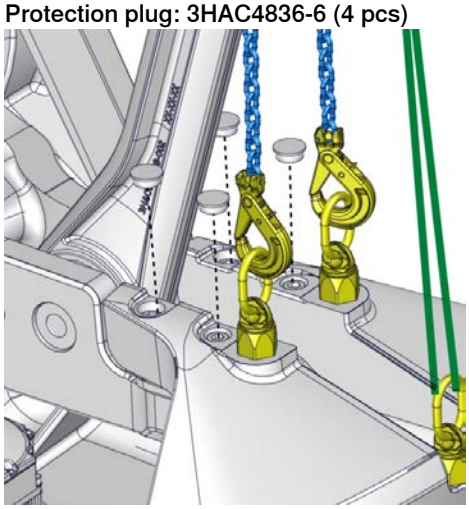
5.4.1 Replacing the counter balancing weight

Continued

Refitting the counter balancing weight

	Action	Note
1	**CAUTION** The weight of the counter balancing weight is 163 kg All lifting accessories used must be sized accordingly.	
2	Attach lifting eyes, if not already done.	Lifting eye M20: - (2 pcs) Lifting eye M16: 3HAC14457-4 (1 pcs)  xx2300001549
3	Attach the lifting chains to the lifting eyes.	Lifting accessory (chain): 3HAC15556-1 Lifting instruction 3HAC15880-2 enclosed. Roundsling, 2 m: -
4	Lift the counter balancing weight into installation position.	 xx2300001548

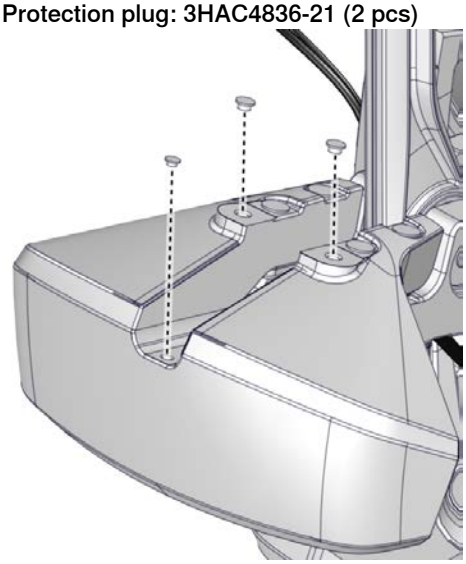
Continues on next page

	Action	Note
5	Secure the counterweight to the parallel arm with attachment screws and washers. Use locking liquid on the attachment screws.	Hex socket head cap screw: M16x90 12.9 Gleitmo 603+Geomet 500 (4 pcs) Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: standard torque 300 Nm (*Tightening torque on page 661*)  xx2300001547
6	Refit the plastic plugs in the screw holes.	Protection plug: 3HAC4836-6 (4 pcs)  xx2300001546
7	Remove the lifting accessories.	

Continues on next page

5.4.1 Replacing the counter balancing weight

Continued

	Action	Note
8	Refit the plastic plugs in the lifting eye holes.	Protection plug: 3HAC4836-21 (2 pcs)  xx2300001543

Concluding procedure

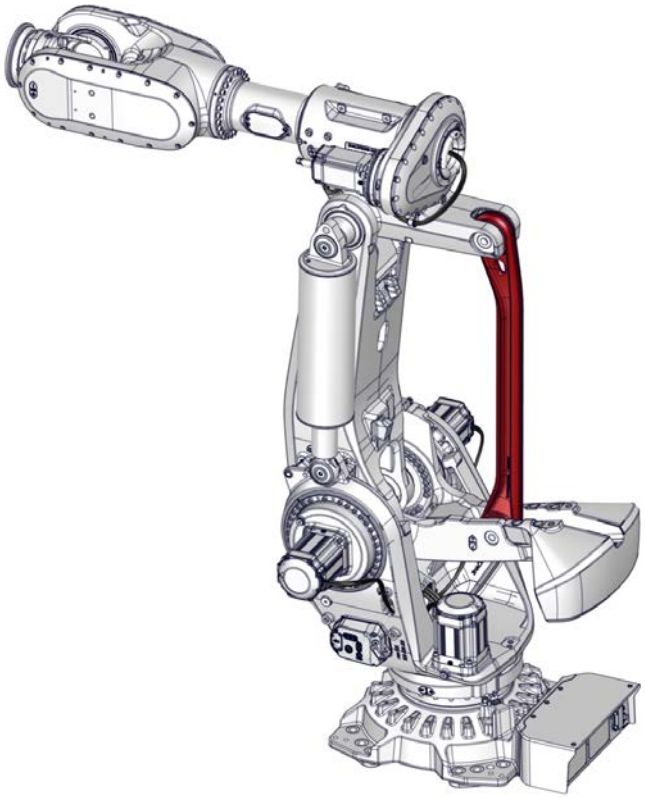
	Action	Note
1	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.5 Lower arm

5.5.1 Replacing the parallel rod and parallel rod bearings

Location of the parallel rod

The parallel rod is located as shown in the figure.



xx2300001894

Summary of the replacement procedure

This is a brief summary of the replacement procedure, containing the major actions to be performed.

1. Secure the weight of the upper arm.
2. Remove the upper and lower parallel rod shafts with press tools.
3. Replace the parallel rod bearings, if needed.
4. Replace the parallel rod.

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Continues on next page

5.5.1 Replacing the parallel rod and parallel rod bearings
Continued

Spare part	Article number	Note
Parallel rod	3HAC085618-003 (Graphite White) 3HAC085618-004 (ABB Orange)	Includes spherical roller bearing and washers.

Required tools and equipment

Equipment	Article number	Note
Lifting eye	3HAC16131-1	M12
Fender washer	-	Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.
Roundsling, 1 m	-	Length: 1 m.
Roundsling, 2 m	-	Length: 2 m.
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
Screw, M10 x minimum 80 mm	-	Used to fix the parallel rod in position
Hydraulic cylinder	3HAC071377-001	Maximum capacity: 6 Ton To be used with the press and puller tools. See technical specifications in the user instructions for the press equipment.
Hydraulic pump	-	To be used with the press and puller tools. See technical specifications in the user instructions for the press equipment.
Press tools, parallel rod shaft and bearing	3HAC093483-001	Used to press out the parallel rod shaft and bearing. User instructions are enclosed with the tool.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required service parts

Consumable	Article number	Note
Rust preventive	3HAC034903-001	Mercasol 3110 Waxcoat. Recommended drying time is 24h.
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

Required documents

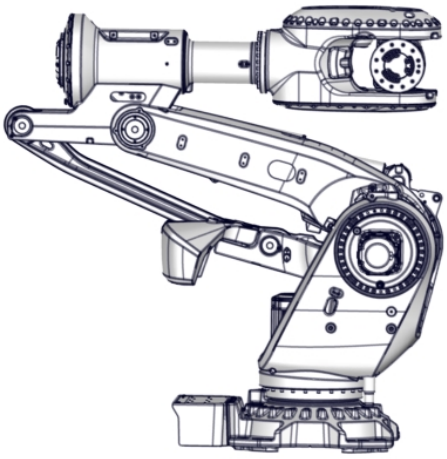
Document	Document number	Note
User instructions, press tool for parallel rod shaft and bearing	3HAC093483-003	Enclosed with the tool.

Continues on next page

Removing the parallel rod

Use these procedures to remove the parallel rod.

Robot position when removing the parallel rod

	Action	Note
1	Jog the robot to the specified position: • Axis 1: No significance, as long as the robot is secured to the foundation. • Axis 2: Comfortable working position. Figure shows -65°. • Axis 3: Comfortable working position. Figure shows approximately +2°. • Axis 4: +90° • Axis 5: -90° • Axis 6: No significance.	**Note** Jog the upper arm to a **horizontal position** against the foundation. The figure shows a suggestion of robot position that gives a comfortable working position.  xx2300001895
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

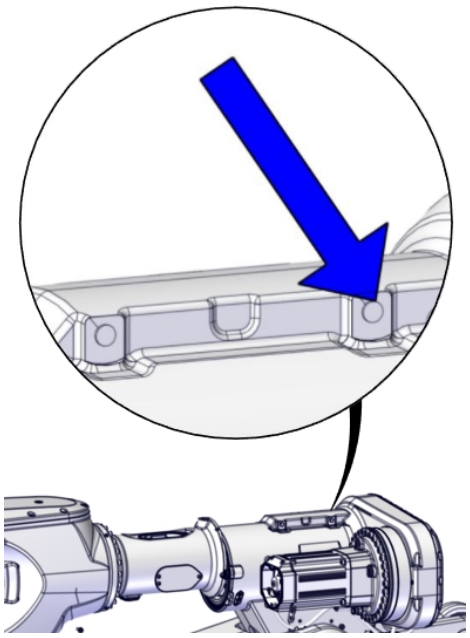
Attaching the lifting accessories to the upper arm

	Action	Note
1	**CAUTION** The weight of the complete upper arm (including the wrist) is 424-485 kg, depending on robot variant All lifting accessories used must be sized accordingly.	

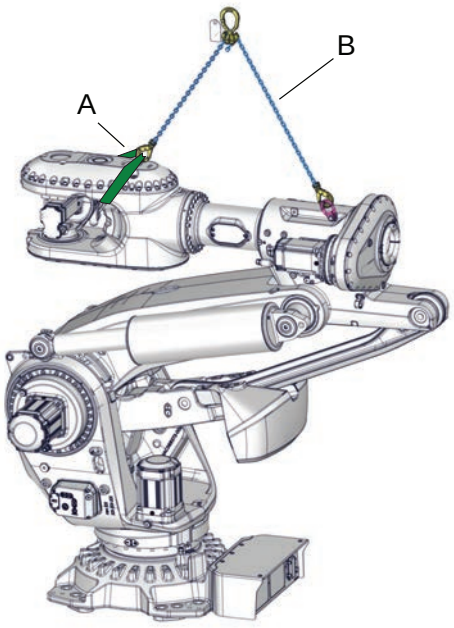
Continues on next page

5.5.1 Replacing the parallel rod and parallel rod bearings

Continued

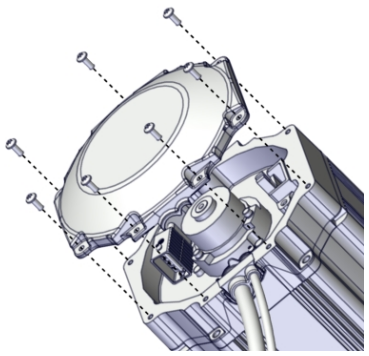
	Action	Note
2	If needed, use a ladder to attach the lifting accessories. **DANGER** Never use the robot as ladder.	Mobile platform ladder
3	Remove the plastic plug from the back hole of the arm housing.	 xx1500002712 Lifting eye: 3HAC16131-1 (M12) Fender washer: Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.
4	Attach a lifting eye to the hole in the arm housing with a fender washer underneath.  xx1400002196	

Continues on next page

	Action	Note
5	Attach lifting chains to the lifting eye in the arm housing and to an overhead crane (or similar).	 xx2300001914 A Roundsling, 1 m B Lifting accessory (chain): 3HAC15556-1
6	Loop a roundsling to the wrist and attach it to the lifting chains.	
7	Stretch the lifting accessories to take the weight of the upper arm.	
8	Adjust the lifting accessories, if needed.	

Releasing the brakes on the axis-2 motor

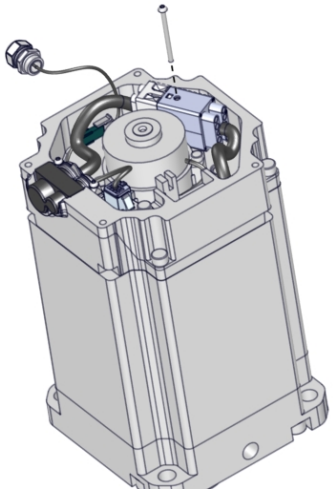
Releasing the brakes on the axis-2 motor is done to unload the weight of the upper arm into the lifting accessories, before starting to remove the parallel rod shaft.

	Action	Note
1	Remove the motor cover of the axis-2 motor by removing the screws.	 xx2100000596

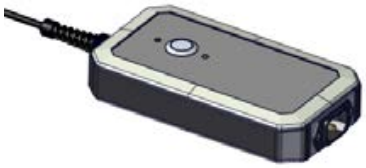
Continues on next page

5.5.1 Replacing the parallel rod and parallel rod bearings

Continued

	Action	Note
2	Disconnect the power cable connector by first removing the attachment screw and then parting the connector.	 xx2200001736
3	Before continuing, make sure that the upper arm is secured in the lifting accessories and overhead crane. Stretch the lifting accessories to unload the upper arm weight. **CAUTION** The upper arm including the wrist weighs approximately 424-485 kg, depending on robot variant. All lifting accessories must be sized accordingly.	

Continues on next page

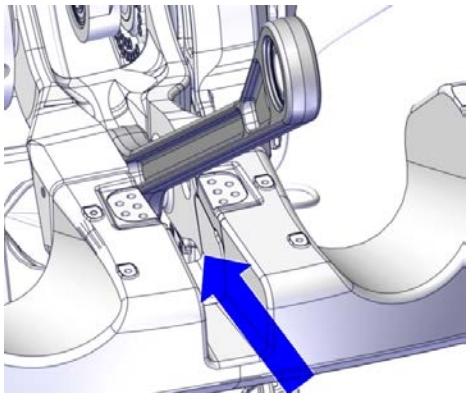
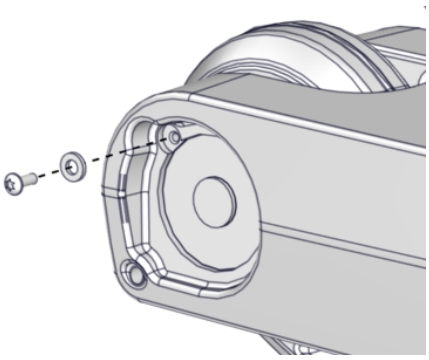
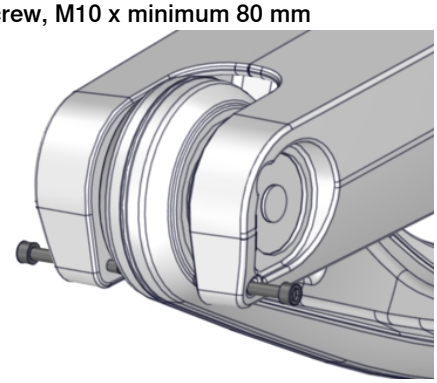
	Action	Note
4	**CAUTION** Releasing the brakes on the axis-2 motor results in weight transfer of upper and lower arm weight to the inserted lock screw in the lower arm or to the attached lifting accessories (whichever is used). If lifting accessories are used, verify that the lifting chains and roundslings are stretched by raising the overhead crane, before releasing the brakes. Release the brakes of the axis-2 motor with the brake release tool, to allow the lower arm to position according to the lifting force applied from the overhead crane. This eliminates any strain in the upper arm shafts: 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
5	Remove the brake release tool from the axis-2 motor.	

Continues on next page

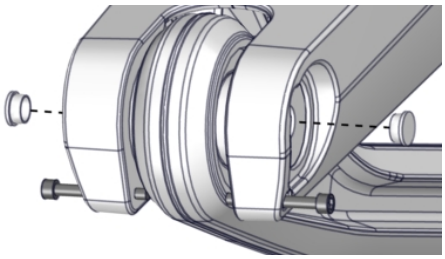
5.5.1 Replacing the parallel rod and parallel rod bearings

Continued

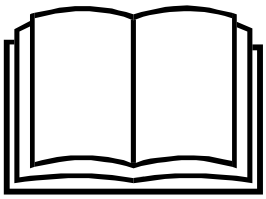
Preparations before removing the upper parallel rod shaft

	Action	Note
1	Put a piece of wood (or similar) between parallel arm and parallel rod, used as protection to prevent the rod from moving unexpectedly during the continued procedure.	 xx1500001963
1	Remove the attachment screw with washer that secure the rod shaft.	 xx2300001896
2	Remove the two protection plugs and fit fixing screws in the holes. Adjust the screws against the parallel rod from both sides. **Note** Keep the plastic plugs. They must be refitted after the work is done.	This is done to prevent the upper arm wings from pinching when pressing the shaft and thereby making it more difficult to press the shaft in or out. Screw, M10 x minimum 80 mm  xx2300001897

Continues on next page

	Action	Note
3	Remove the protection plugs. **Note** Keep the plastic plugs. They must be refitted after the work is done.	 xx2300001898

Removing the upper parallel rod shaft


xx0900000813

Go to the user instructions enclosed with the press tool to remove the parallel rod shaft.

Press tools, parallel rod shaft and bearing: 3HAC093483-001

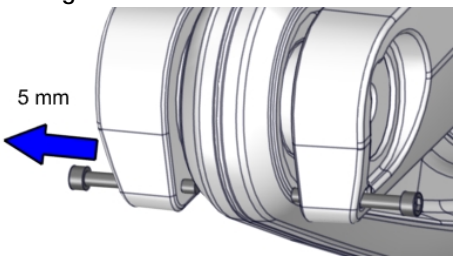
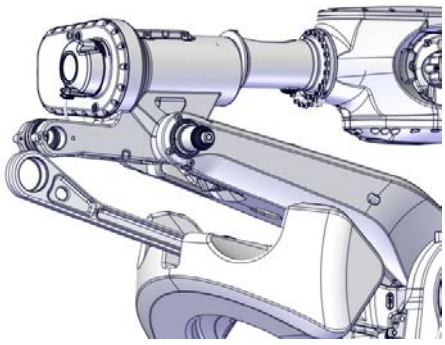
User instructions, press tool for parallel rod shaft and bearing: 3HAC093483-003

WARNING

Handling the tool incorrectly may cause serious injury.

Read and follow enclosed user instructions for the tool.

Removing the upper end of the parallel rod

	Action	Note
4	Unscrew one of the fixing screws, approximately 5 mm, on one side of the parallel rod. Leave the screw on the other side.	This is to be able to remove the parallel rod without problems and to be able to find the correct position of the parallel rod, when refitting it.  xx2300001915
5	Move the parallel rod down and let it rest on the piece of wood, which was put there earlier.	 xx1500001965

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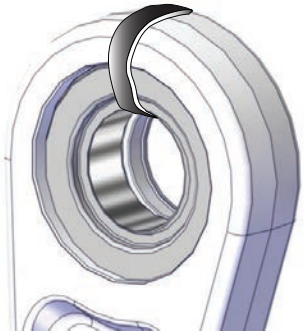
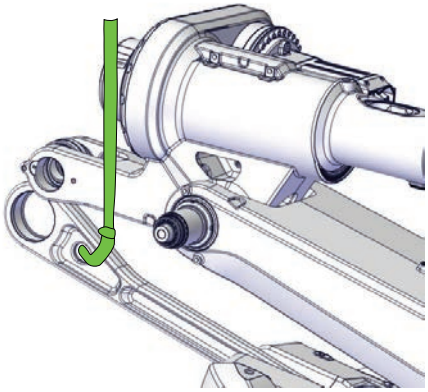
5.5.1 Replacing the parallel rod and parallel rod bearings

Continued

	Action	Note
6	Secure the bearing, thrust washer, protection ring and cover washer with a strap (or similar) to prevent them from dropping out of its position.	Strap  xx1500002716

Preparations before removing the lower parallel rod shaft

	Action	Note
7	**CAUTION** The weight of the parallel rod is 48 kg All lifting accessories used must be sized accordingly.	
8	Attach a roundsling, looped through the parallel rod and to an overhead crane (or similar).	Roundsling, 1 m: Length: 1 m.  xx1500002698
9	Stretch the roundsling to start taking the weight of the parallel rod.	

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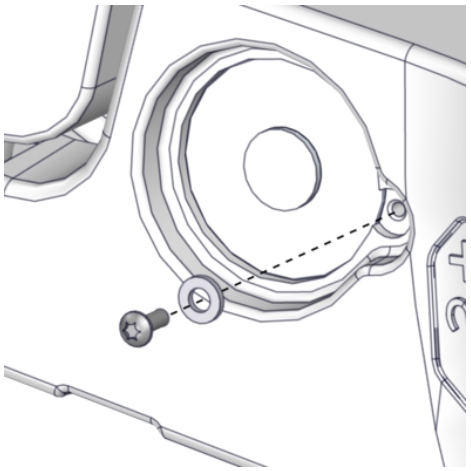
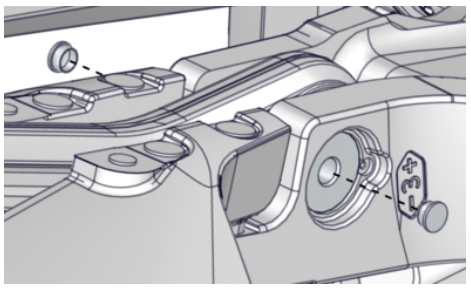
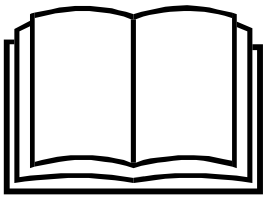
	Action	Note
10	Remove the attachment screw with washer that secure the rod shaft.	 xx2300001916
11	Remove the protection plugs. **Note** Keep the plastic plugs. They must be refitted after the work is done.	 xx2300001917

Removing the lower parallel rod shaft


xx0900000813

Go to the user instructions enclosed with the press tool to remove the parallel rod shaft.

Press tools, parallel rod shaft and bearing: 3HAC093483-001

User instructions, press tool for parallel rod shaft and bearing: 3HAC093483-003

WARNING

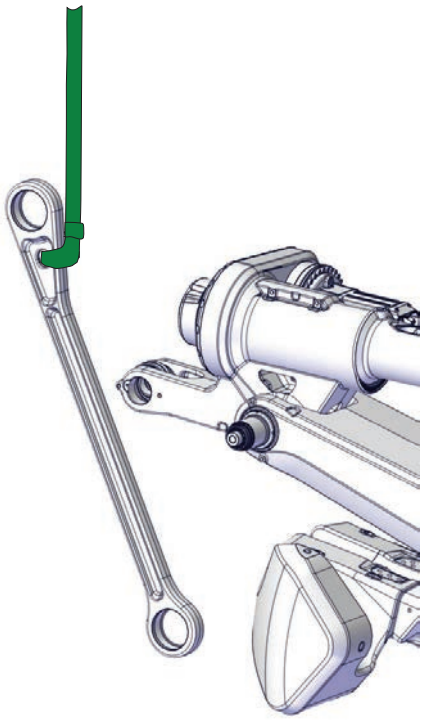
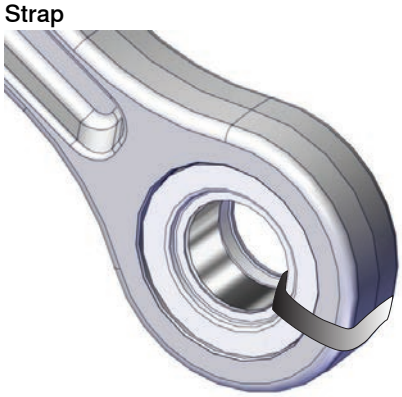
Handling the tool incorrectly may cause serious injury.

Read and follow enclosed user instructions for the tool.

Continues on next page

5.5.1 Replacing the parallel rod and parallel rod bearings
Continued

Removing the parallel rod completely

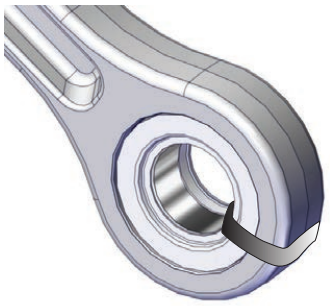
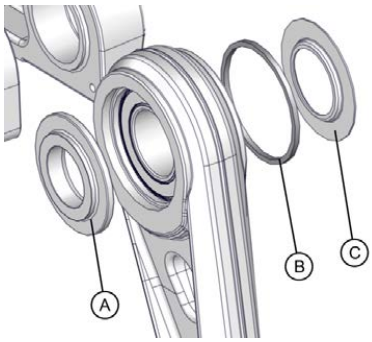
	Action	Note
12	Use caution and lift the parallel rod off.	 xx1500002745
13	Secure the bearing, thrust washer, protection ring and cover washer with a strap (or similar) to prevent them from dropping out of its position.	Strap  xx1500002744

Replacing the parallel rod bearing

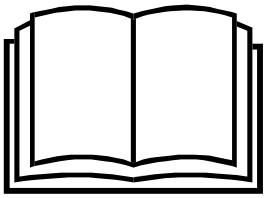
These sections describe how to replace the parallel rod bearings, if needed. The bearings are included in the parallel rod spare part, but can also be replaced separately.

Continues on next page

Preparations before replacing the parallel rod bearing

	Action	Note
1	Remove the strap which was used to keep the bearing, thrust washer, protection ring and cover washer in position.	 xx1500002744
2	Remove the thrust washer, protection ring and cover washer, and wipe them clean.	 xx2400001575 A Thrust washer B Protection ring C Cover washer

Replacing the parallel rod bearing


xx0900000813

Go to the user instructions enclosed with the press tool to replace the parallel rod bearing.

Press tools, parallel rod shaft and bearing: 3HAC093483-001

User instructions, press tool for parallel rod shaft and bearing: 3HAC093483-003

WARNING

Handling the tool incorrectly may cause serious injury.

Read and follow enclosed user instructions for the tool.

Refitting the parallel rod

Use these procedures to refit the parallel rod.

Note

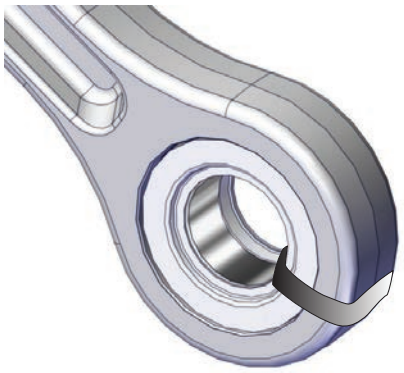
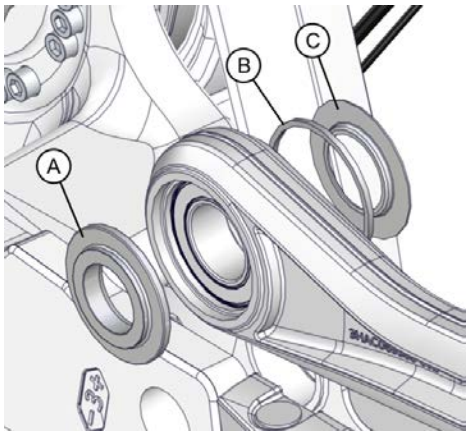
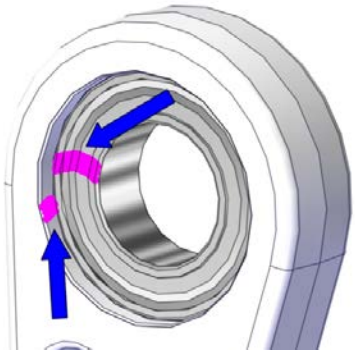
Start refitting the parallel rod in the lower end.

Continues on next page

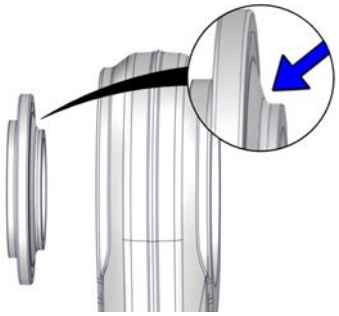
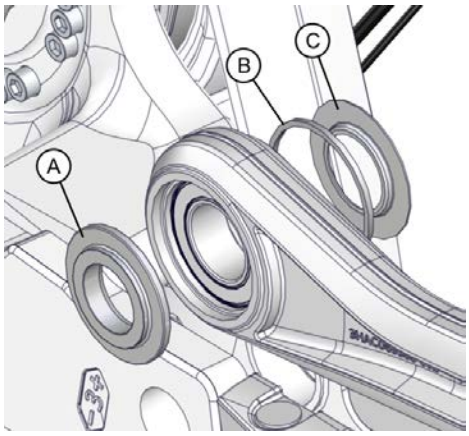
5.5.1 Replacing the parallel rod and parallel rod bearings

Continued

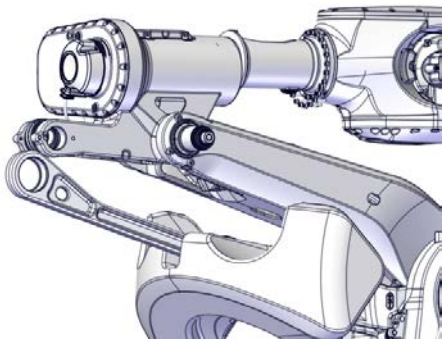
Preparations before refitting the lower end of the parallel rod

	Action	Note
1	Remove the strap which was used to keep the bearing, thrust washer, protection ring and cover washer in position.	 xx1500002744
2	Remove the thrust washer, protection ring and cover washer, and wipe them clean. Check if the corrosion protection of the bearings and all machined surfaces is adequate. If not, proceed with step *3* and step *4*. **Note** Make a note on which side the parts are placed.	 xx2400001574 A Thrust washer B Protection ring C Cover washer
3	Wipe the shafts and the holes for the shafts clean.	
4	Apply corrosion protection on both sides of the bearings, and on all machined surfaces on the parallel rod.	Mercasol  xx1500002100

Continues on next page

	Action	Note
5	Put back the thrust washer (left side) and the protection ring and cover washer (right side). **Note** Turn the conical side of the thrust washer faced inwards.  xx2400001584	 xx2400001574 A Thrust washer B Protection ring C Cover washer

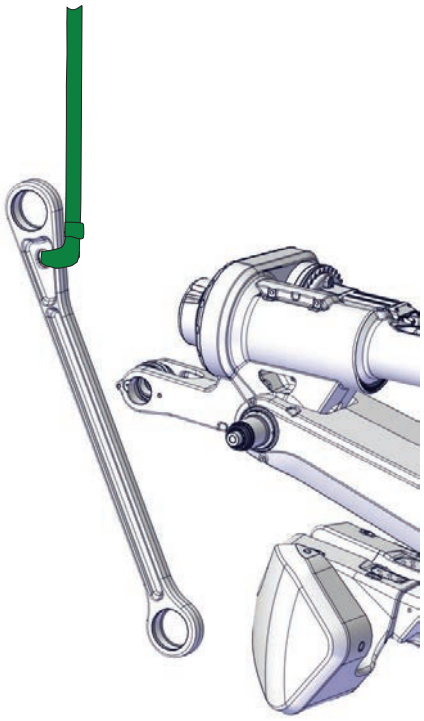
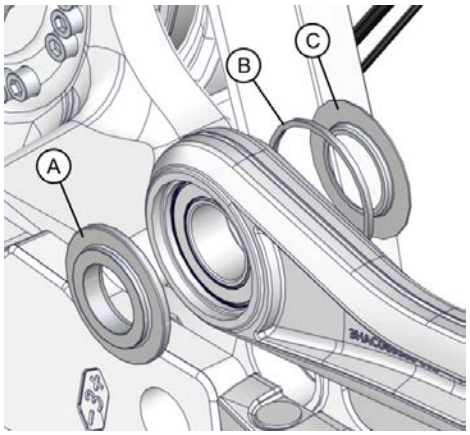
Refitting the lower end of the parallel rod

	Action	Note
14	**Note** Always start refitting at the lower end.	 xx1500001965
15	**CAUTION** The weight of the parallel rod is 48 kg All lifting accessories used must be sized accordingly.	
16	Attach a roundsling to the parallel rod and to an overhead crane (or similar).	Roundsling, 1 m: Length: 1 m.

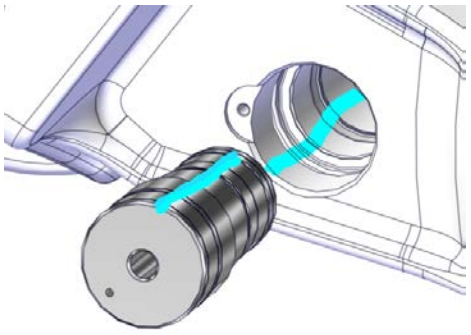
Continues on next page

5.5.1 Replacing the parallel rod and parallel rod bearings

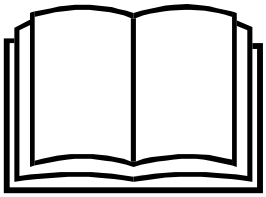
Continued

	Action	Note
17	Use caution, stretch the roundsling and lift the parallel rod into mounting position.	 xx1500002745
18	Place the lower end at mounting position and apply the press tool parts (Assembly tool, Press plate and Round plate).	
19	Make sure that the thrust washer and the protection ring and cover washer on either side of the bearing, are in position. **Note** Make sure that the washers are on the correct sides of the bearing.	 xx2400001574 A Thrust washer B Protection ring C Cover washer

Continues on next page

	Action	Note
20	Apply some grease on the shafts and in the holes on both sides of parallel arm, and as well as in the bearing hole.	 xx1500002301

Refitting the lower parallel rod shaft


xx0900000813

Go to the user instructions enclosed with the press tool to refit the parallel rod shaft.

Press tools, parallel rod shaft and bearing: 3HAC093483-001

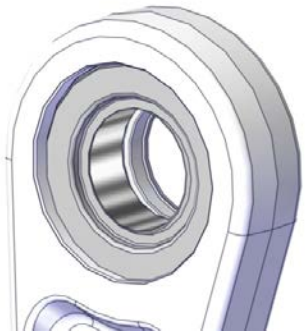
User instructions, press tool for parallel rod shaft and bearing: 3HAC093483-003

WARNING

Handling the tool incorrectly may cause serious injury.

Read and follow enclosed user instructions for the tool.

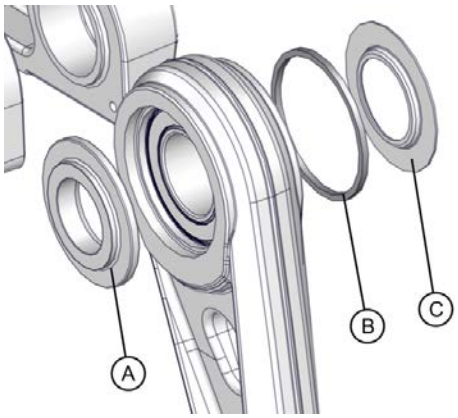
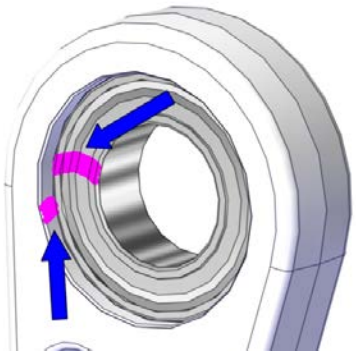
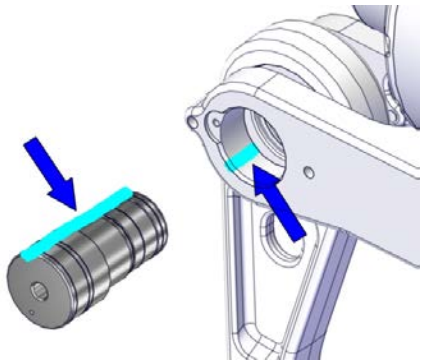
Preparations before refitting the upper end of the parallel rod

	Action	Note
1	Remove the strap, which was used to keep bearing, thrust washer and cover washer in position.	 xx1500002097

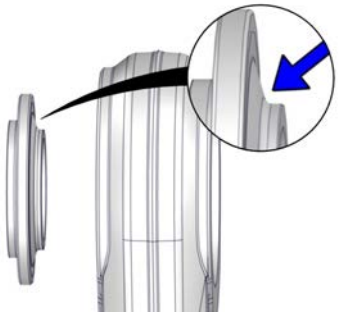
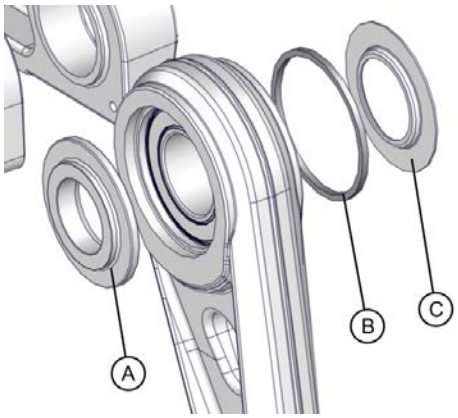
Continues on next page

5.5.1 Replacing the parallel rod and parallel rod bearings

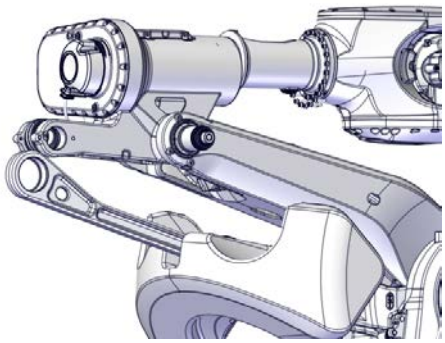
Continued

	Action	Note
2	Remove the thrust washer, protection ring and cover washer, and wipe them clean.	 xx2400001575 A Thrust washer B Protection ring C Cover washer
3	Wipe clean the shafts and the holes for the shafts.	
4	Apply corrosion protection (Mercasol) on both sides of the bearings, and on all machined surfaces on the parallel rod.	Mercasol  xx1500002100
5	Apply some grease on the shafts and in both upper arm mounting holes.	 xx1500002293

Continues on next page

	Action	Note
6	Put back the thrust washer (left side) and the protection ring and cover washer (right side). **Note** Turn the conical side of the thrust washer faced inwards.  xx2400001584	 xx2400001575 A Thrust washer B Protection ring C Cover washer

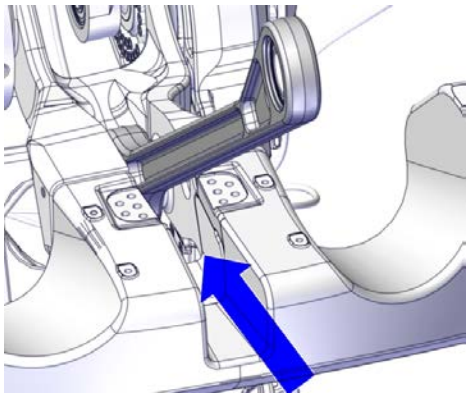
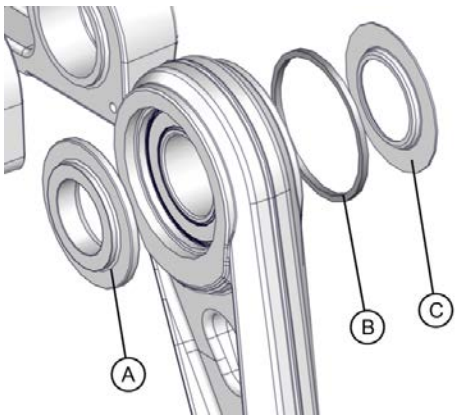
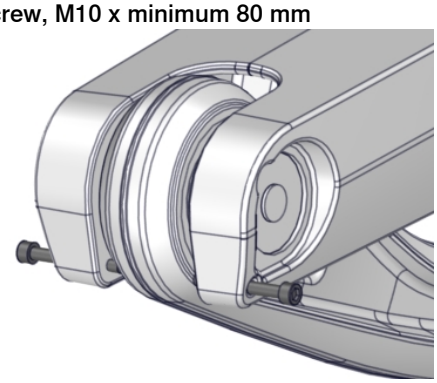
Refitting the upper end of the parallel rod

	Action	Note
21	**Note** If the parallel rod has been removed from the robot, always start refitting at the lower end!	
22	Take a firm grip of the parallel rod and lift it up into mounting position.	 xx1500001965

Continues on next page

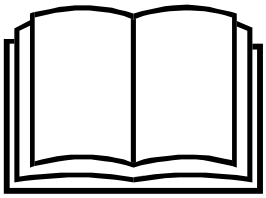
5.5.1 Replacing the parallel rod and parallel rod bearings

Continued

	Action	Note
23	Put a piece of wood (or similar) between parallel arm and parallel rod, used as protection to prevent the rod from moving unexpectedly during the procedure.	 xx1500001963
24	Make sure that the thrust washer and the protection ring and cover washer on either side of the bearing, are in position. **Note** Make sure that the washers are on the correct sides of the bearing.	 xx2400001575 A Thrust washer B Protection ring C Cover washer
25	Place the parallel rod into position and reattach the two fixing screws against the parallel rod. **Note** This is done to prevent the arm housing from being deformed when pressing the shaft and thereby making it more difficult to press the shaft in or out.	Screw, M10 x minimum 80 mm  xx2300001897

Continues on next page

Refitting the upper parallel rod shaft



xx0900000813

Go to the user instructions enclosed with the press tool to refit the parallel rod shaft.

Press tools, parallel rod shaft and bearing: 3HAC093483-001

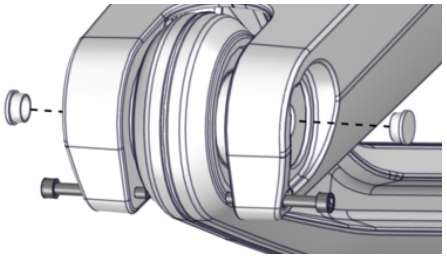
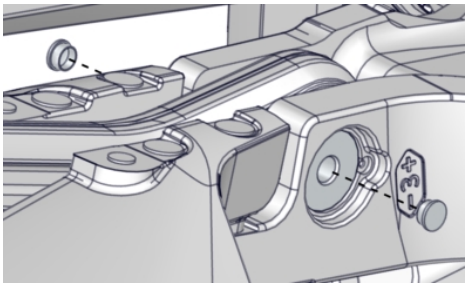
User instructions, press tool for parallel rod shaft and bearing: 3HAC093483-003

WARNING

Handling the tool incorrectly may cause serious injury.

Read and follow enclosed user instructions for the tool.

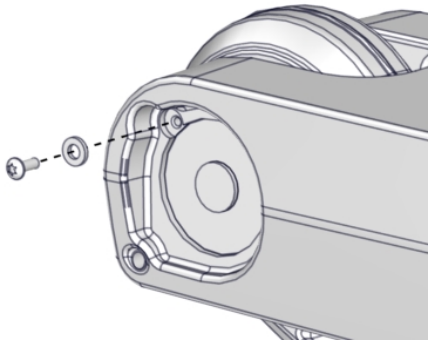
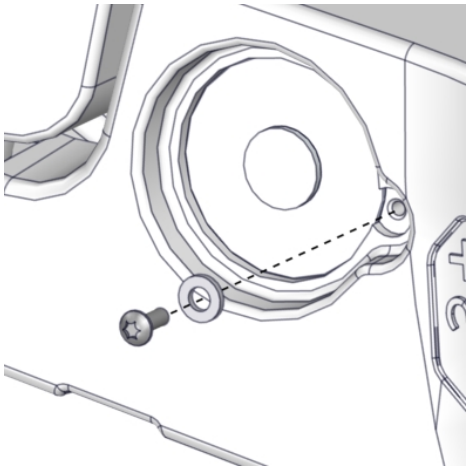
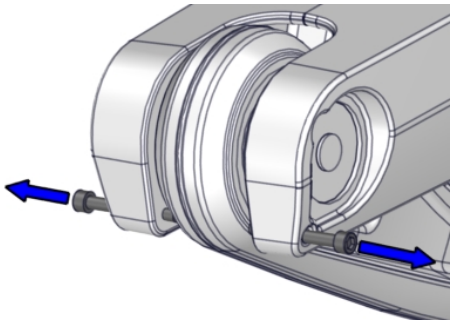
Concluding procedure

	Action	Note
26	Refit the protection plugs.	 xx2300001898  xx2300001917

Continues on next page

5.5.1 Replacing the parallel rod and parallel rod bearings

Continued

	Action	Note
27	Apply locking liquid on the attachment screw and secure shaft.	Torx pan head screw: M6x16 A4-80 Locking liquid: Loctite 2400 (or equivalent Loctite 243)  xx2300001896  xx2300001916
28	Remove the fixing screws and refit the protection plugs.	 xx2300001918
1	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.5.2 Replacing the lower arm / parallel arm

L3 spare part

The lower and parallel arm and are classified as L3 spare parts. The repair procedure is not described in the product manual. Contact ABB Service for replacement.

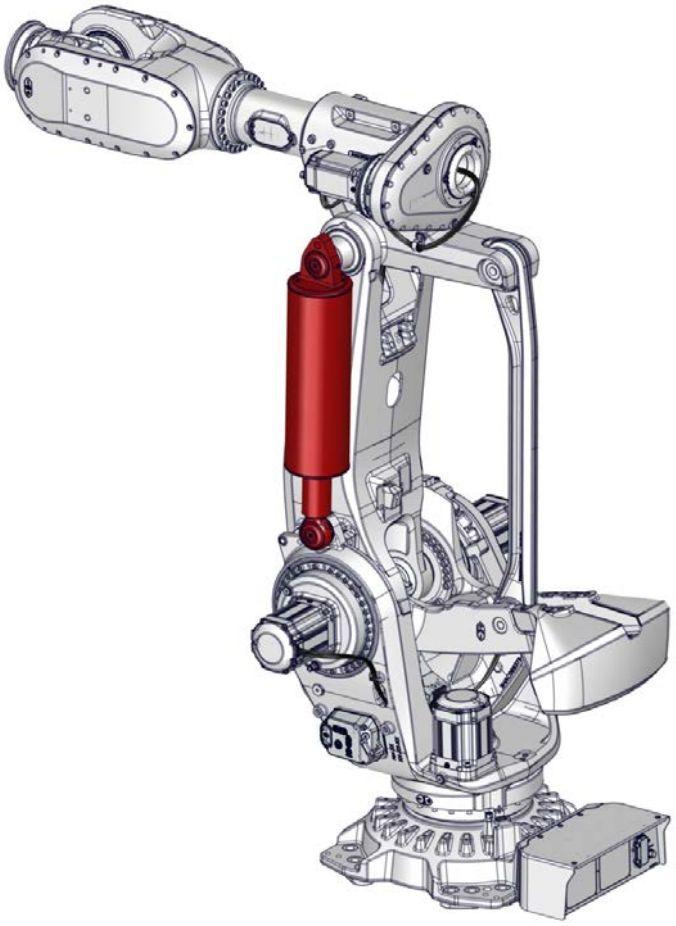
See *Spare part level on page 196*.

5.6 Balancing device

5.6.1 Replacing the balancing device and balancing device bearings

Location of the balancing device

The balancing device is located as shown in the figure.



xx2300001639

Summary of the replacement procedure

This is a brief summary of the replacement procedure, containing the major actions to be performed.

1 Unload the balancing device.
2 Remove the balancing device.
3 If needed, replace the balancing device bearings.
4 Refit the balancing device.

Continues on next page

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note
Balancing device	3HAC084742-003 (Graphite White) 3HAC084742-004 (ABB Orange)	

Required service parts

Consumable	Article number	Note
Cover	3HAC075038-001	On the balancing device ear.
Maintenance set, upper link ear	3HAC091950-001	The maintenance kit contains: • End cover • O-ring • Nut • Radial sealing with dust lip • Spherical roller bearing • Support ring
Maintenance set, lower link ear	3HAC091953-001	The maintenance kit contains: • End cover • O-ring • Spacer ring • Radial sealing with dust lip • Spherical roller bearing • Support ring • Washer • Torx pan head screw

Required tools and equipment

Equipment	Article number	Note
Screw, M12 x minimum 50 mm	-	2 pcs. Used to netraulize the spring force of the balancing device.
Lock nut socket	3HAC092177-001	Used to remove and refit the balancing device lock nut. Enclosed with the press tool kit for the balancing device bearing (3HAC092518-001).
Lifting accessory for balancing device	3HAC054236-001	User instructions enclosed.
Press tools, balancing device bearing	3HAC092518-001	User instructions (3HAC092518-003) are enclosed with the tool.

Continues on next page

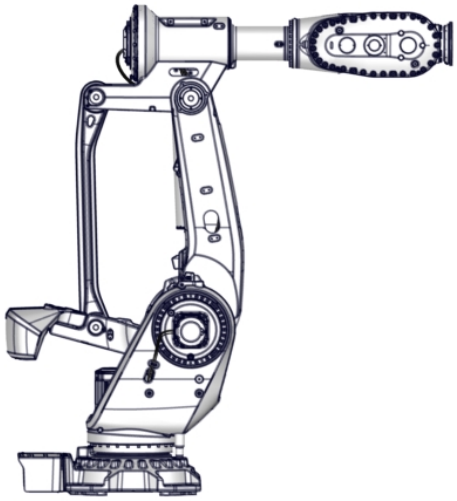
5.6.1 Replacing the balancing device and balancing device bearings
Continued

Equipment	Article number	Note
Hydraulic cylinder	3HAC071377-001	Maximum capacity: 6 Ton To be used with the press and puller tools. See technical specifications in the user instructions for the press equipment.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Removing the balancing device

Use these procedures to remove the balancing device.

Preparations before removing the balancing device

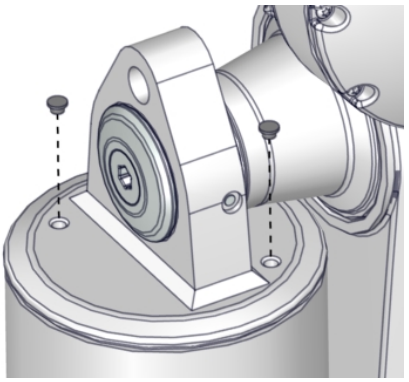
	Action	Note
1	Jog the robot to calibration position.	 xx2300001691
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Unloading the balancing device springs and locking the position

Use this procedure to unload and lock the balancing device in unloaded position.

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

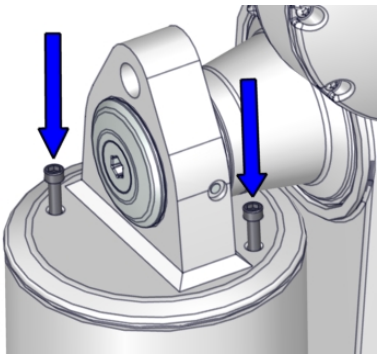
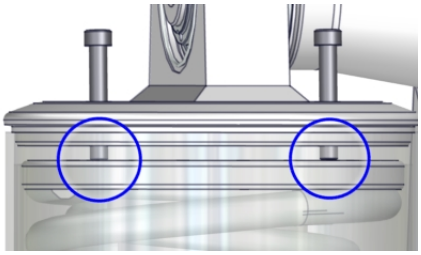
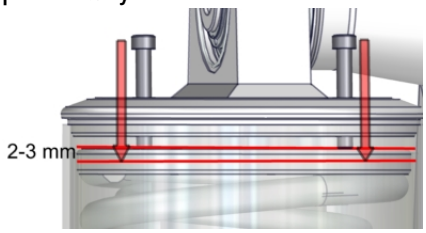
Continues on next page

	Action	Note
2	Remove the plastic plugs in the upper end of the balancing device. **Note** Save the protection screws, to refit after the work is done.	 xx2300001643

Continues on next page

5.6.1 Replacing the balancing device and balancing device bearings

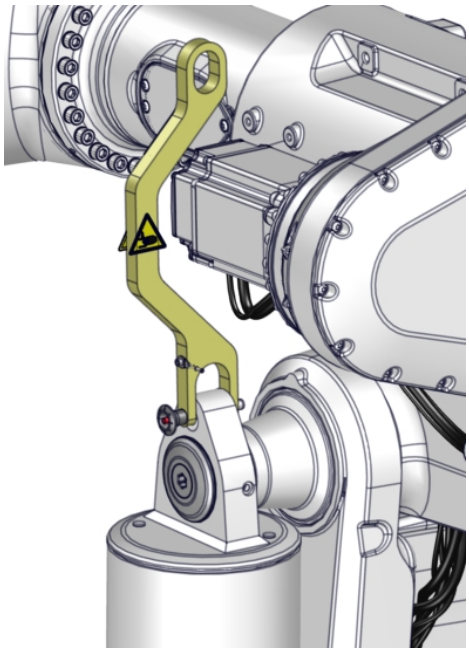
Continued

	Action	Note
3	Neutralize the spring force with two screws: Screw, M12 x minimum 50 mm (2 pcs) 1 Insert two screws.  xx2300001644 2 Screw in the screws until they have contact with the cylinder inside.  xx2400000506 3 Then, alternately little by little, tighten the screws by hand according to the image. Screw in the screws by 1-2 turns, approximately 2-3 mm.  xx2400000507 The length of the cylinder is now locked and the balancing device is unloaded. Check that the device is unloaded by trying to rotate it. It should rotate with ease.	

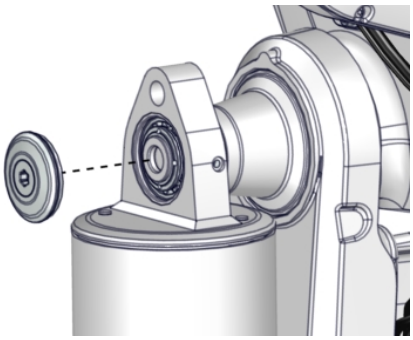
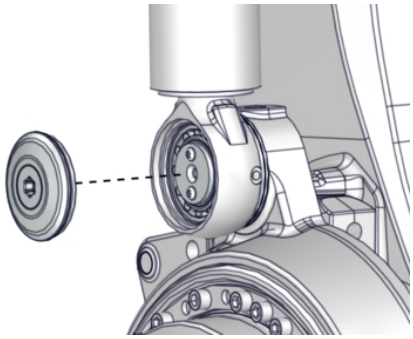
Attaching lifting accessory to the balancing device

	Action	Note
1	**CAUTION** The weight of the balancing device is 77 kg All lifting accessories used must be sized accordingly.	

Continues on next page

	Action	Note
2	Fit the lifting accessory to the balancing device lifting ear.	Lifting accessory for balancing device: 3HAC054236-001
3	Fit the an overhead crane to the lifting accessory and raise to unload the weight.	 xx2400000241

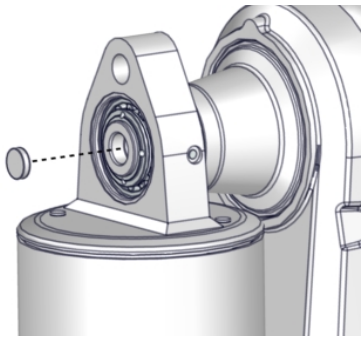
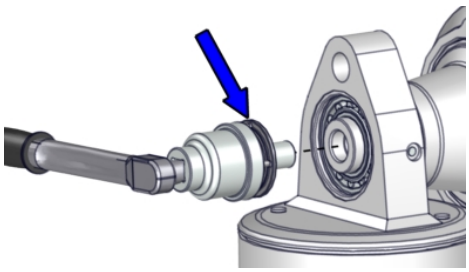
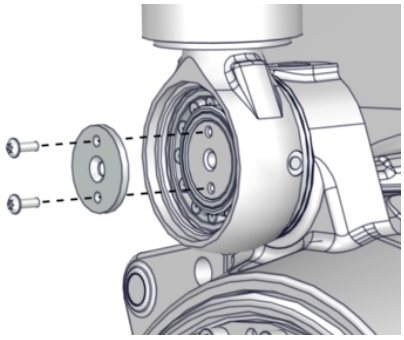
Removing the balancing device

	Action	Note
1	Remove the upper and lower covers.	 xx2300001647  xx2300001648

Continues on next page

5.6.1 Replacing the balancing device and balancing device bearings

Continued

	Action	Note
2	Remove the small VK-cover.	 xx2400000462
3	Remove the lock nut from the upper ear with the sleeve.	Sleeve for KM nut / lock nut: 3HACxxx  xx2300001649
4	Remove the washer from the lower ear by removing the two screws.	 xx2300001650
5	**CAUTION** The weight of the balancing device is 77 kg All lifting accessories used must be sized accordingly.	

Continues on next page

	Action	Note
6	Lift the balancing device away. **Tip** If needed, use a bearing puller to carefully help pressing the balancing device out.	 xx2300001667
7	Remove residual grease and sealing compound.	

Replacing the balancing device bearings

When the balancing device is removed from the robot, the bearings either remain seated inside the balancing device ear or on the shafts.

If the bearings are to be replaced, use this procedure to remove and refit them.

	Action	Note
1	Remove the radial sealing with a crow bar.	

Continues on next page

5.6.1 Replacing the balancing device and balancing device bearings
Continued

	Action	Note
2	Remove the old bearing.	If the bearing is seated inside the balancing device ear, use the press tool kit and a hydraulic cylinder. Press tools, balancing device bearing: 3HAC092518-001 User instructions (3HAC092518-003) are enclosed with the tool. Hydraulic cylinder: 3HAC071377-001 Hydraulic pump
		If the bearing remains fitted to the shaft, use a bearing puller. Bearing puller
3	Wipe the inside of the balancing device ear clean from old grease.	
4	Fit new bearings to the balancing device ears, using the press tool kit and a hydraulic cylinder. Align one of the lubrication holes in the bearing with the lubrication hole inside the balancing device ear.	Maintenance set, lower link ear / Maintenance set, upper link ear: 3HAC091953-001 / 3HAC091950-001 Press tools, balancing device bearing: 3HAC092518-001 User instructions (3HAC092518-003) are enclosed with the tool. Hydraulic cylinder: 3HAC071377-001 Hydraulic pump

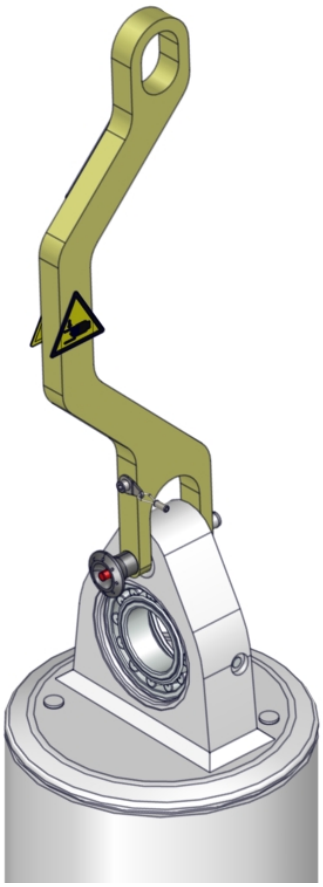
Refitting the balancing device

Use this procedure to refit the balancing device.

Attaching lifting accessory to the new balancing device

	Action	Note
1	**CAUTION** The weight of the balancing device is 77 kg All lifting accessories used must be sized accordingly.	

Continues on next page

	Action	Note
2	Fit the lifting accessory to the balancing device lifting ear.	Lifting accessory for balancing device: 3HAC054236-001  xx2400000242

Unloading a new spare part, balancing device

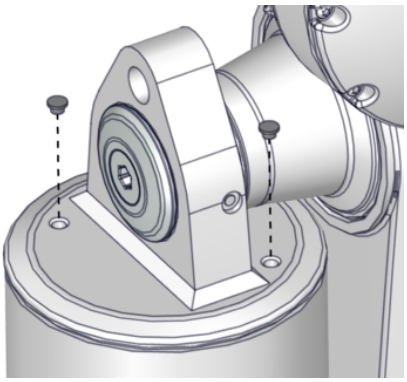
Use this procedure to unload and lock the balancing device in unloaded position.

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

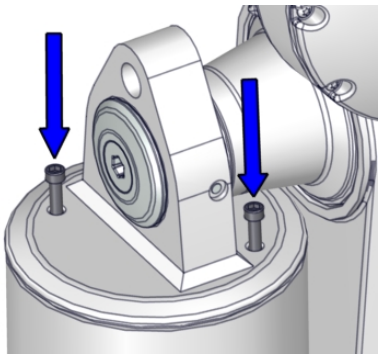
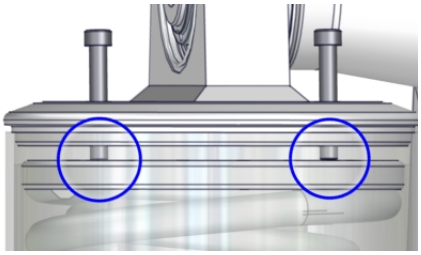
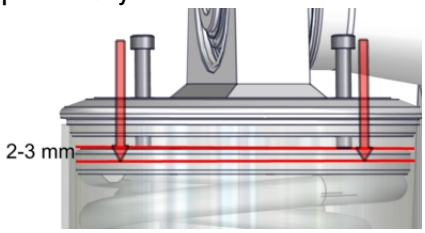
Continues on next page

5.6.1 Replacing the balancing device and balancing device bearings

Continued

	Action	Note
2	Remove the plastic plugs in the upper end of the balancing device. **Note** Save the protection screws, to refit after the work is done.	 xx2300001643

Continues on next page

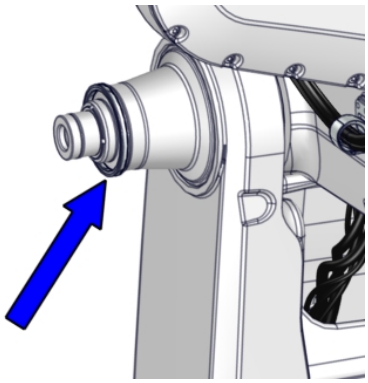
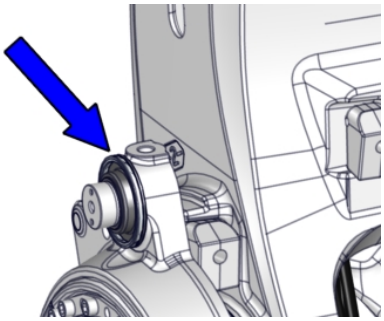
	Action	Note
3	Neutralize the spring force with two screws: Screw, M12 x minimum 50 mm (2 pcs) 1 Insert two screws.  xx2300001644 2 Screw in the screws until they have contact with the cylinder inside.  xx2400000506 3 Then, alternately little by little, tighten the screws by hand according to the image. Screw in the screws by 1-2 turns, approximately 2-3 mm.  xx2400000507 The length of the cylinder is now locked and the balancing device is unloaded. Check that the device is unloaded by trying to rotate it. It should rotate with ease.	

Continues on next page

5.6.1 Replacing the balancing device and balancing device bearings

Continued

Refitting the balancing device

	Action	Note
1	Check that the support ring is in place on the upper shaft.	 xx2400000237
2	Check that the support ring and spacer ring are in place on the lower shaft.	 xx2400000238

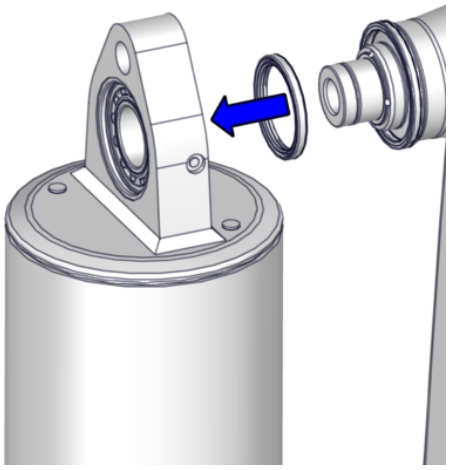
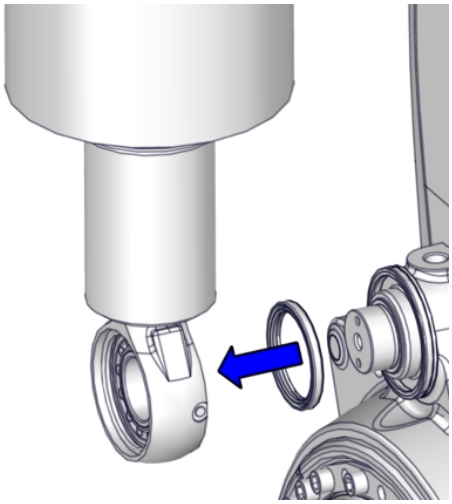
Continues on next page

	Action	Note
3	Check the bearings in the balancing device ears. Replace if damaged. **Note** Make sure the bearings are axially centered in the balancing device ears, before putting them on the shafts.	Maintenance set, lower link ear / Maintenance set, upper link ear: 3HAC091953-001 / 3HAC091950-001  xx2400000239

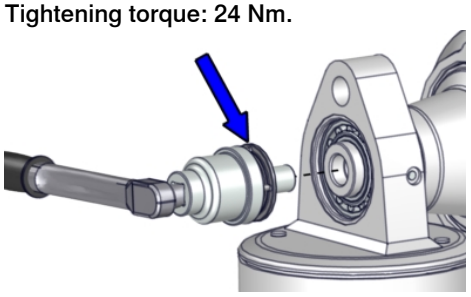
Continues on next page

5.6.1 Replacing the balancing device and balancing device bearings

Continued

	Action	Note
4	Fit new sealing rings at the upper and lower ear, on the side that faces the robot.	Maintenance set, lower link ear / Maintenance set, upper link ear: 3HAC091953-001 / 3HAC091950-001  xx2300001887  xx2300001888
5	**CAUTION** The weight of the balancing device is 77 kg All lifting accessories used must be sized accordingly.	

Continues on next page

	Action	Note
6	Lift the balancing device in place and push it onto the shafts.	 xx2300001667
7	Refit the lock nut to the upper ear.	Lock nut socket: 3HAC092177-001 Tightening torque: 24 Nm.  xx2300001649

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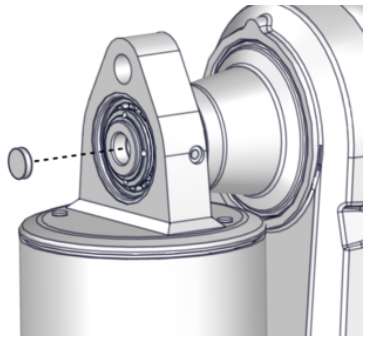
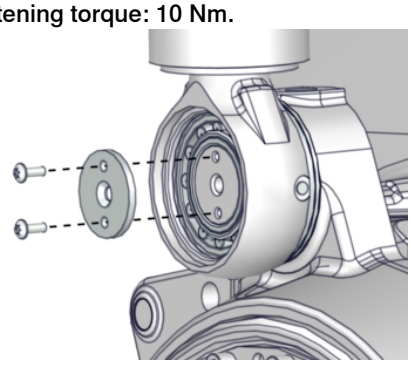
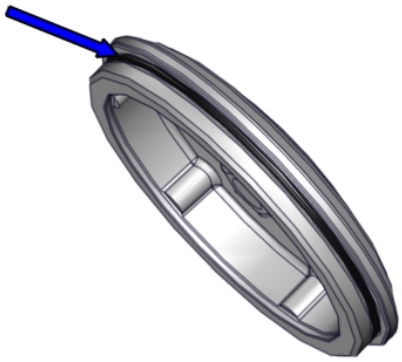
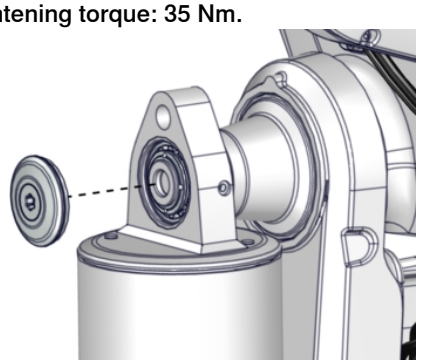
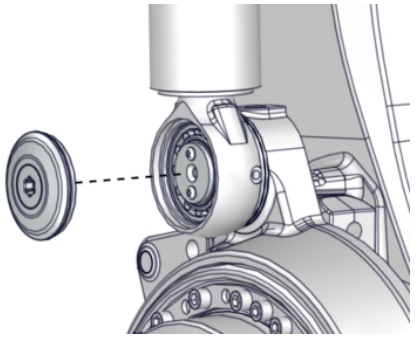
5.6.1 Replacing the balancing device and balancing device bearings

Continued

	Action	Note
8	Fit a new VK-cover.	VK-cover: 3HAA2166-12  xx2400000462
9	Refit the washer to the lower ear with the two screws.	Tightening torque: 10 Nm.  xx2300001650
10	Check the o-rings in the covers. Replace if damaged.	O-ring: 3HAB3772-15  xx2400000240

Continues on next page

	Action	Note
11	Refit the upper and lower covers.	Tightening torque: 35 Nm.  xx2300001647  xx2300001648
12	Remove the lifting accessories.	

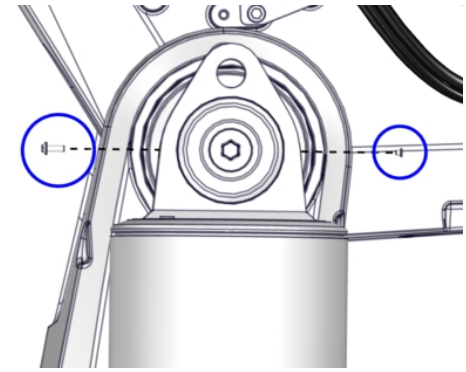
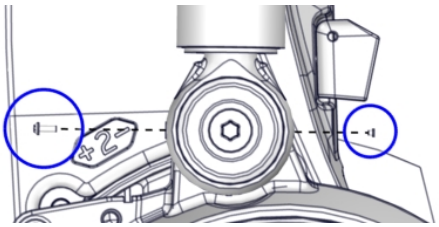
Lubricating the spherical roller bearing

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

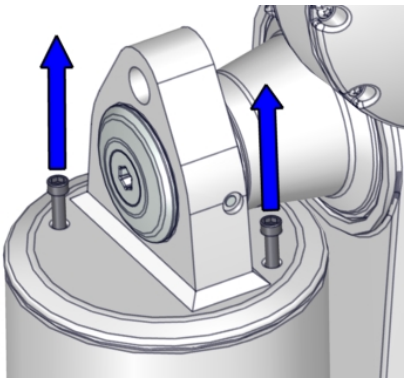
Continues on next page

5.6.1 Replacing the balancing device and balancing device bearings

Continued

	Action	Note
2	Unscrew the screw and remove the plastic plug of the bearing and fill grease through the screw hole until grease appears in the other hole. Use a grease nipple.	Bearing grease: 3HAC9408-1 Amount: Tribol GR 100-2 PD, 85 ml / bearing.  xx2400000134  xx2400000135
3	Refit the screw and the plastic plug. Wipe clean from residual grease.	
4	**Note** Inspect the bearings after a few days running. Some of the refilled grease may have emerged from the bearing. Wipe clean from residual grease.	

Restoring the pressure of the balancing device

	Action	Note
1	Restore the pressure of the balancing device by unscrewing the two screws alternately little by little.	 xx2300001855
2	Remove the screws.	

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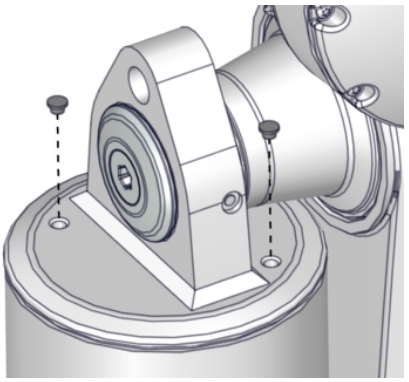
	Action	Note
3	Refit the plastic plugs in the holes on top of the balancing device.	 xx2300001643

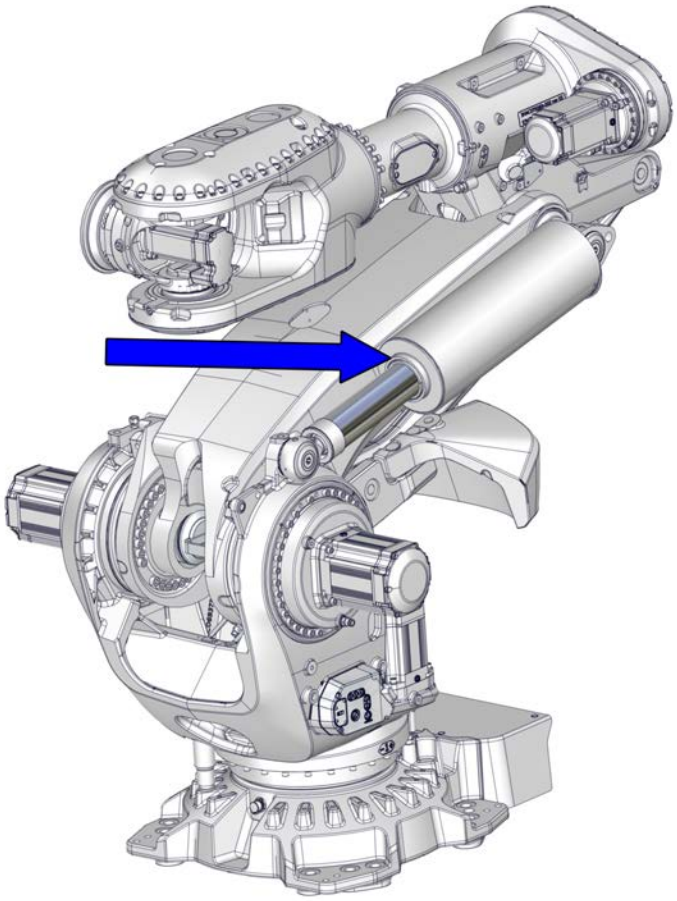
Concluding procedure

	Action	Note
1	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.6.2 Replacing the balancing device guide ring

Location of the guide ring

The guide ring is located as shown in the figure.



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Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note
Guide ring	3HAC034897-001	
Circlip SB 120	3HAC036620-001	

Continues on next page

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

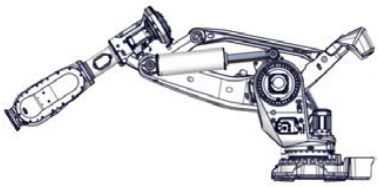
Required service parts

Consumable	Article number	Note
Cleaning agent	-	Isopropanol
Grease	3HAC042536-001	Shell Gadus S2 or equivalent

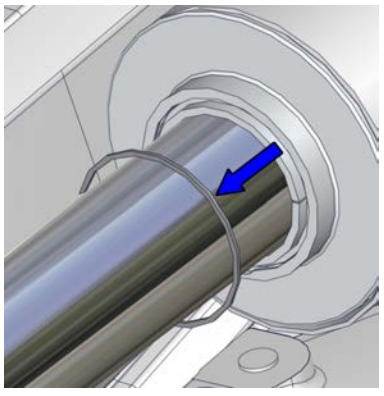
Removing the guide ring

Use these procedures to remove the guide ring.

Preparations before removing the guide ring

	Action	Note
1	Position axis 2 so that the balancing device is horizontal and the piston rod is extended to the greatest extent possible.	 xx2400001562
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Removing the guide ring

	Action	Note
1	Remove the circlip from the end cover.	 xx2400001570

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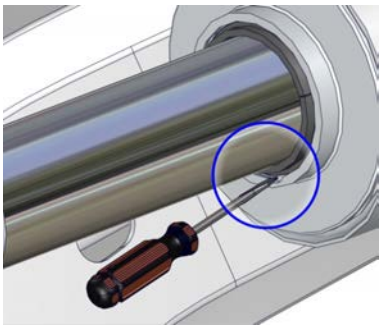
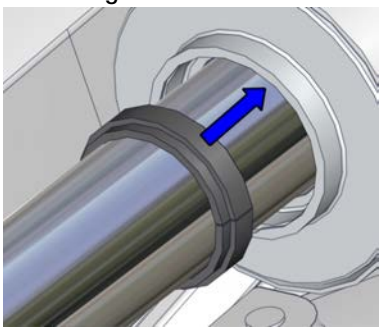
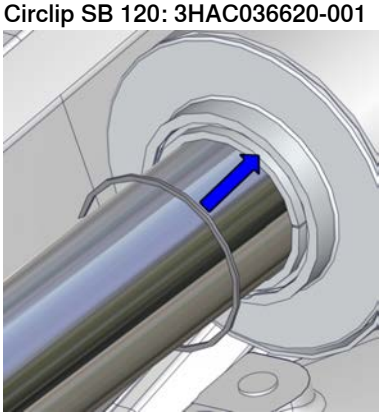
5.6.2 Replacing the balancing device guide ring
Continued

	Action	Note
2	Insert a standard screwdriver into the small slot at the end cover, and bend out the guide ring.	 xx2400001571

Refitting the guide ring

Use these procedures to refit the guide ring.

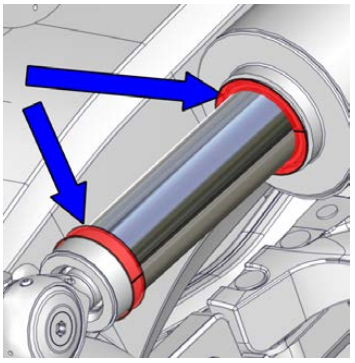
Refitting the guide ring

	Action	Note
1	Place the two halves of the guide ring around the piston rod, with the smallest outer diameter facing outwards, and insert the ring in the end cover.	Guide ring: 3HAC034897-001  xx2400001572
2	Install the circlip.	Circlip SB 120: 3HAC036620-001  xx2400001573

Lubricating the piston rod

	Action	Note
1	Clean the piston rod.	Cleaning agent: Isopropanol

Continues on next page

	Action	Note
2	Apply a thin layer of grease across the entire unpainted surface of the piston rod. **Note** Too little grease may result in premature wear of the guide ring. Too much grease may result in an undesirable appearance or a risk of contaminating the surrounding environment.	Grease: 3HAC042536-001
3	Turn on power to the robot again.	
4	Jog the robot through the balancing device's full range of motion. Repeat one time.	
5	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
6	Wipe away any excessive grease accumulating in the indicated areas.	 xx2400000245

5.7 Upper arm excluding wrist

5.7.1 Replacing the upper arm / upper arm shafts and bearings

L3 spare part

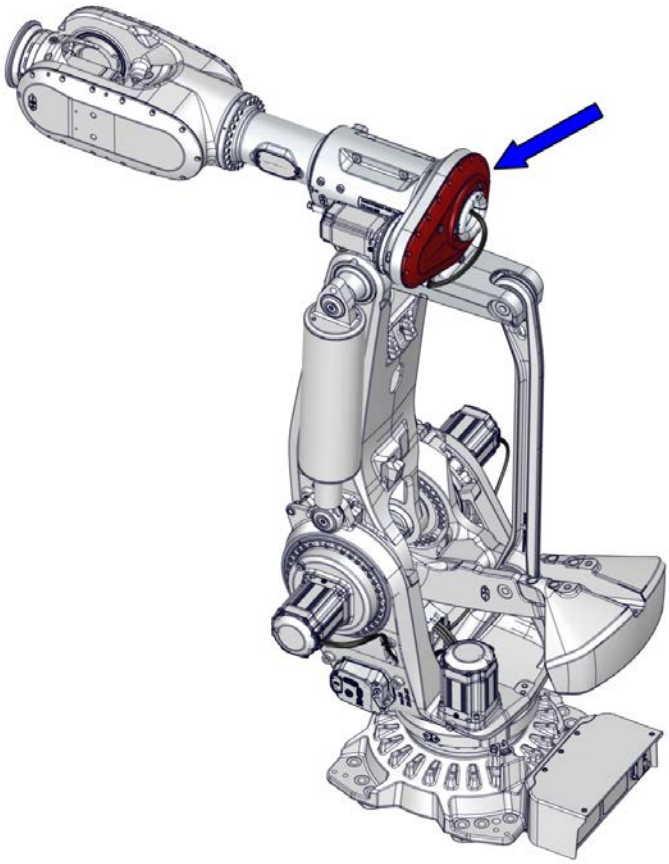
The upper arm and the upper arm shafts and bearings are classified as L3 spare parts. The repair procedure is not described in the product manual. Contact ABB Service for replacement.

See *Spare part level on page 196*.

5.7.2 Replacing the arm house cover including the axis-4 cassette sealing

Location of the arm house cover and cassette sealing

The arm house cover including the cassette sealing is located as shown in the figure.



xx2400000152

Summary of the replacement procedure

This is a brief summary of the replacement procedure, containing the major actions to be performed.

1. *Protection type Foundry Plus*: Remove the cover.
2. Remove the cable harness from the upper arm.
3. Remove the cable guide.
4. Replace the arm house cover including the cassette sealing.

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

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5.7.2 Replacing the arm house cover including the axis-4 cassette sealing
Continued

Spare part	Article number	Note	Level
Arm house cover including cassette sealing	3HAC084032-003 (Graphite White) 3HAC084032-004 (ABB Orange)	Gasket and cassette sealing included	L2

Required service parts

Consumable	Article number	Note
Connection box cover with gasket	3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)	Replace if damaged. On axis-5 motor
Connection box cover with gasket	3HAC079381-003 (Graphite White) 3HAC079381-004 (ABB Orange)	Replace if damaged. On axis-6 motor
Wrist cover	3HAC085026-002 (Graphite White) 3HAC085026-003 (ABB Orange)	Replace if damaged.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.
Grease	3HAC042536-001	Shell Gadus S2
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)
Rust preventive	3HAC034903-001	Mercasol 3110 Waxcoat. Recommended drying time is 24h.
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.

Required tools and equipment

Equipment	Article number	Note
Replacement tool for arm house cover	3HAC079878-001	For removing and fitting the arm house cover, including the axis-4 cassette sealing.
Screw, M6 x minimum 70 mm	-	Used to support the arm house cover
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

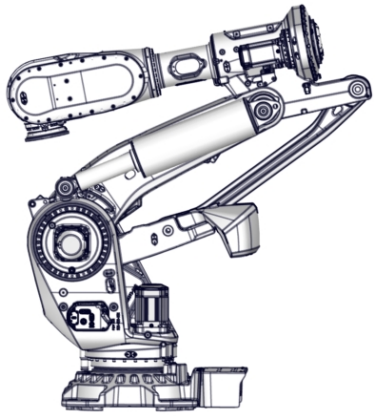
Removing the arm house cover including the cassette sealing

Use these procedures to remove the arm house cover including the cassette sealing.

Preparations before removing the arm house cover

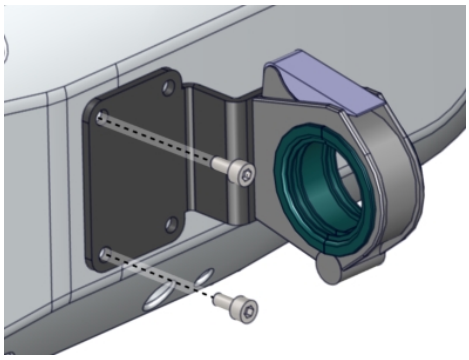
	Action	Note
1	Drain the axis-4 gearbox.	See *Draining the axis-4 gearbox on page 169*.

Continues on next page

	Action	Note
2	Jog the robot to the specified position: • Axis 1: 0° • Axis 2: -55° • Axis 3: +10° • Axis 4: 0° • Axis 5: +90° • Axis 6: no significance. **Note** The specified position is a recommended position for service. Axis-5 must be oriented as close as possible to +90° to be able to open the axis-6 motor cover and to remove the axis-6 motor cables, and in order to avoid the spiral of the cable harness in the carrier, being unwound or placed in the wrong position. Depending on what tool is used, the other axes may need to be jogged to another position.	 xx2300001952
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Retrieving access to the wrist cabling

Use this procedure to remove the wrist cover.

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	If DressPack MH3 is installed: Remove the wrist bracket with the complete ball joint housing still fitted, if the bracket is installed over the two wrist cover screws. **Note** No need to remove the bracket if the two wrist cover screws are accessible.	 xx2300001366

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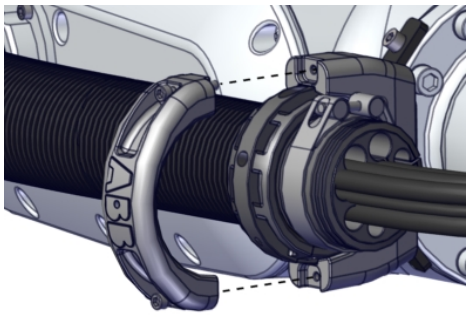
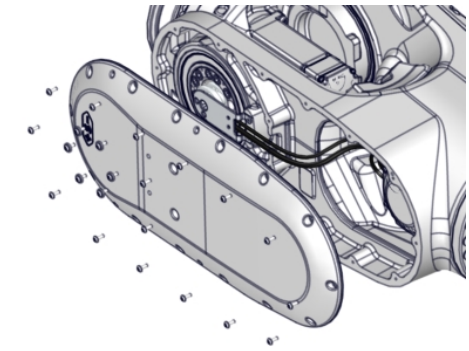
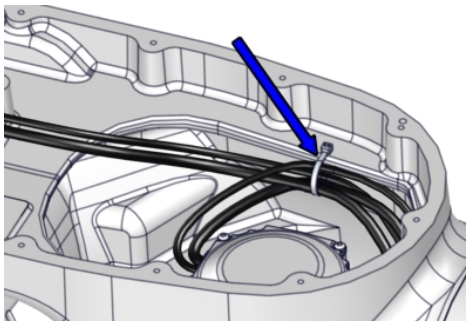
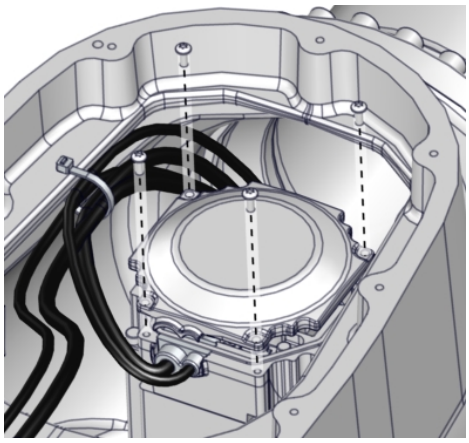
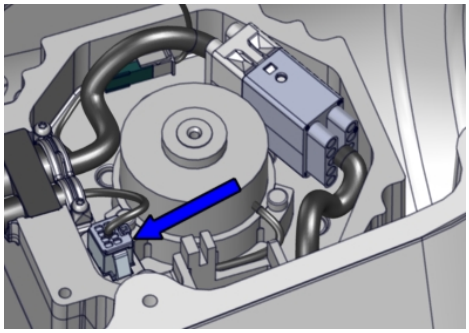
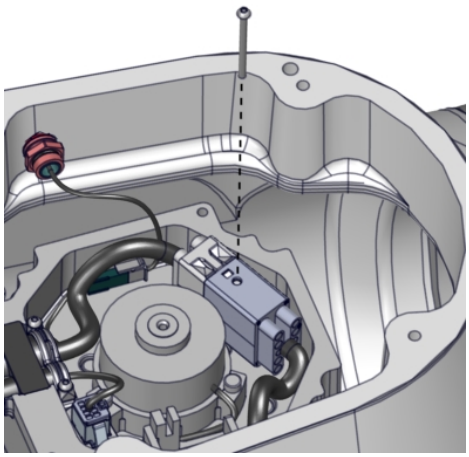
5.7.2 Replacing the arm house cover including the axis-4 cassette sealing
Continued

	Action	Note
3	If DressPack is installed: Open the ball joint housing on the arm tube and remove the DressPack cable package.	 xx2100002709
4	Remove the wrist cover.	 xx2300001883

Disconnecting the axis-5 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Cut the cable tie.	 xx2300001923

Continues on next page

	Action	Note
3	Remove the motor cover by removing the screws.	 xx2300001924
4	Disconnect the signal cable connector.	 xx2200001734
5	Disconnect the power cable connector by removing the attachment screw.	 xx2200001733

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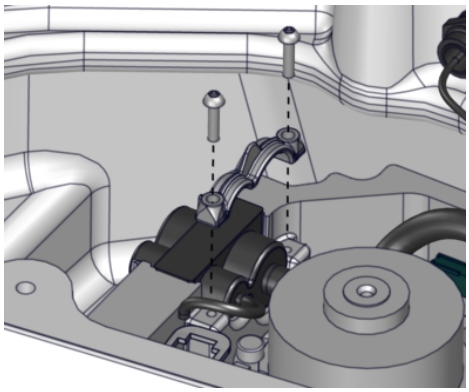
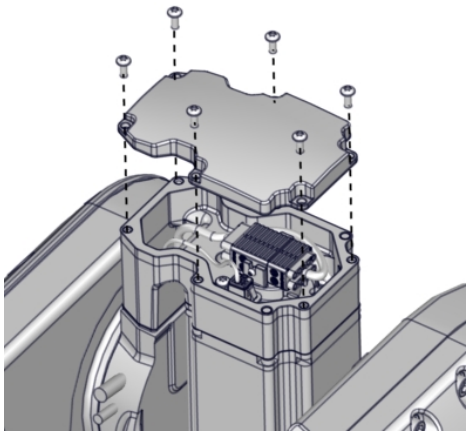
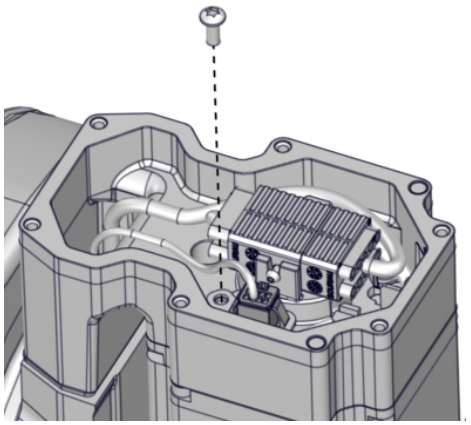
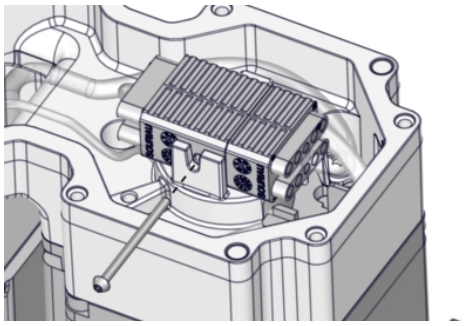
5.7.2 Replacing the arm house cover including the axis-4 cassette sealing
Continued

	Action	Note
6	Remove the cable bracket by removing the screws.	 xx2200001735
7	Remove the motor cables.	

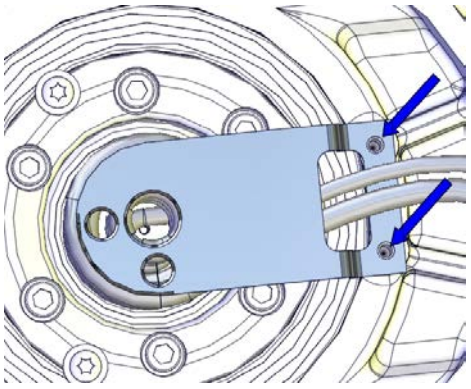
Disconnecting the axis-6 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws and remove the motor cover.	 xx2200001434

Continues on next page

	Action	Note
3	Remove the connector bracket.	 xx2200001730
4	Remove the connector screw.	 xx2200001731
5	Disconnect the motor cables.	

Pushing out the axis-6 motor cables

	Action	Note
1	Unscrew the attachment screws that hold the cable bracket.	 xx1300000484

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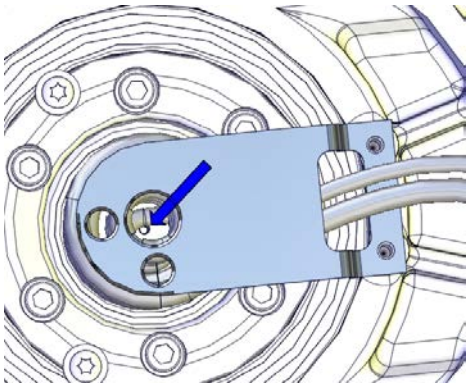
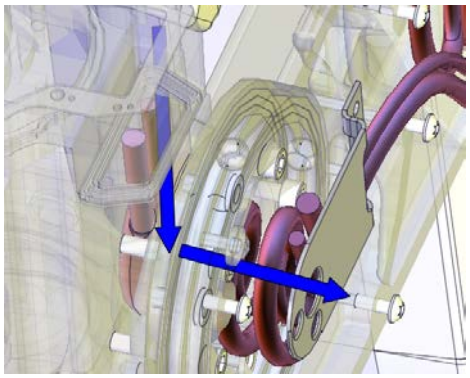
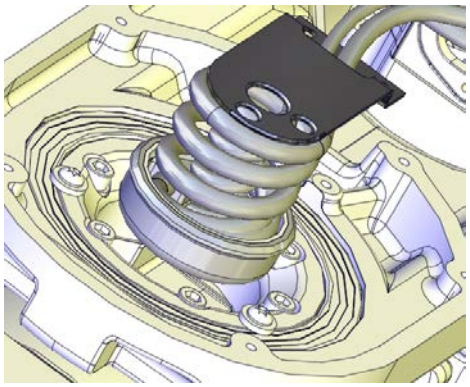
5.7.2 Replacing the arm house cover including the axis-4 cassette sealing

Continued

	Action	Note
2	Unscrew the M4 screw that holds the carrier. **Note** The screw is located at the bottom of the carrier.	 xx1300000485
3	Lift out the axis-6 motor cables by holding the cables with one hand at the motor and the other at the carrier.	 xx1300000666
4	Lift out the carrier from its position.	 xx1300001113

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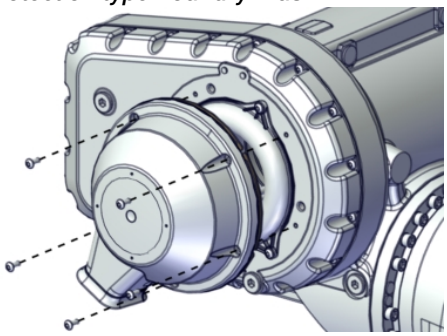
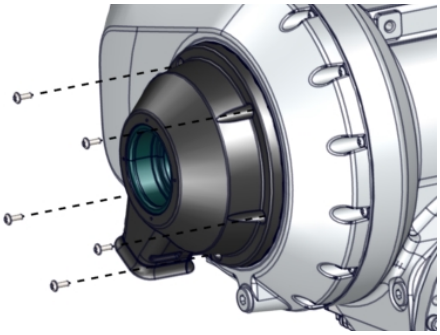
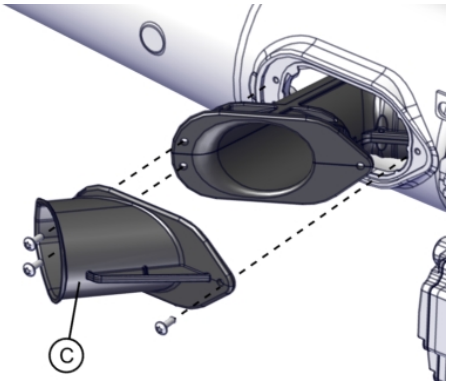
Removing the cable harness from the wrist and upper arm

	Action	Note
1	*Foundry Plus*, *DressPack:* Remove the back cover. **Note** Use caution not to damage the gasket.	*Protection type Foundry Plus:*  xx2000000422 *DressPack*  xx2300001040
2	*DressPack* Loosen the insert. (Cable guard (C) is available for protection type Foundry Plus.)	 xx2100002677

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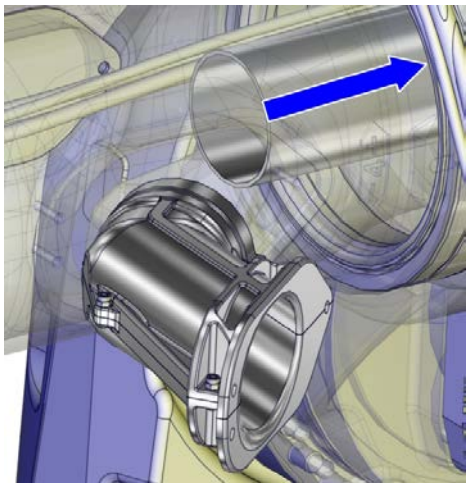
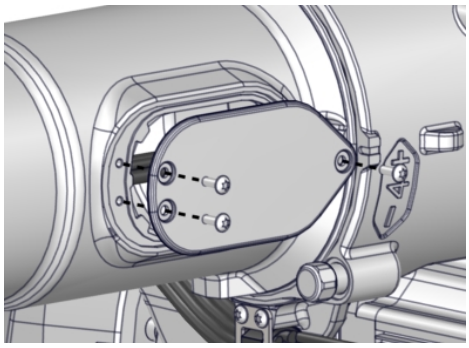
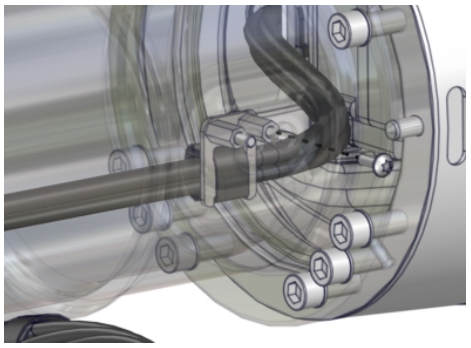
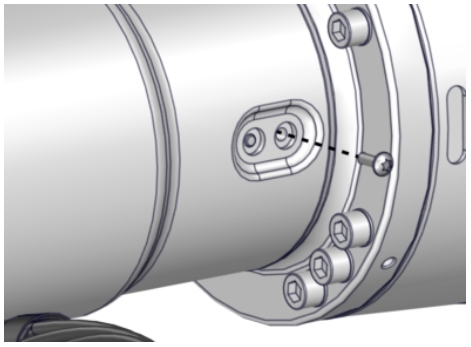
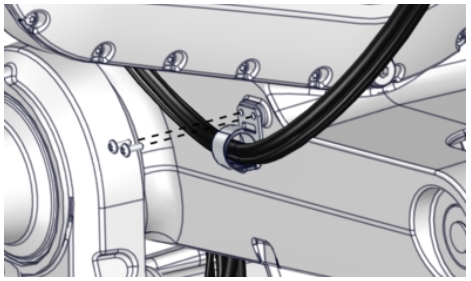
5.7.2 Replacing the arm house cover including the axis-4 cassette sealing

Continued

	Action	Note
3	*DressPack* Push the DressPack tube a little backwards.	 xx1400000720
4	**Tip** Use tape and tie the axis-5 and axis-6 connectors and carrier into a bundle (if not already done). This is done to facilitate the removal and to avoid damaging the parts. This will also make it easier to run the cable harness through the inside of the upper arm.	 xx1300000668
5	Remove the side cover on the arm tube.	 xx2300000031

Continues on next page

	Action	Note
6	Unscrew the attachment screw that secures the axis-4 metal clamp inside the arm tube. **Note** The screw is reached from outside the upper arm.	 xx2300000033  xx2300000032
7	Remove the arm house metal clamp.	 xx2300002013

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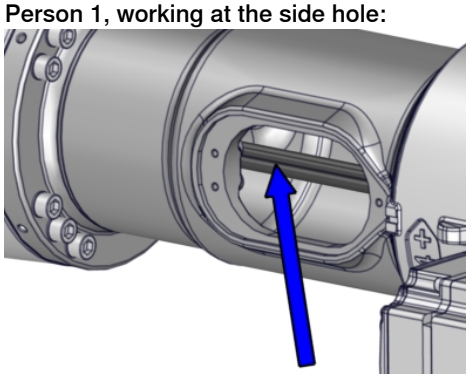
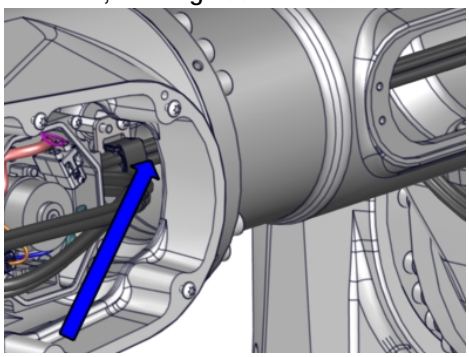
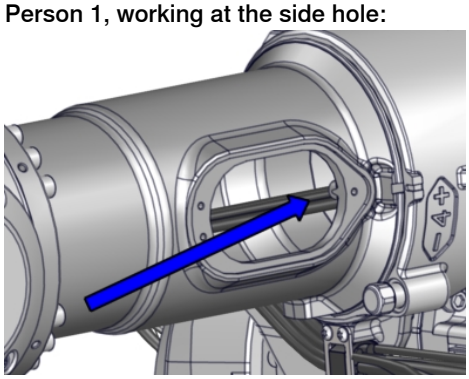
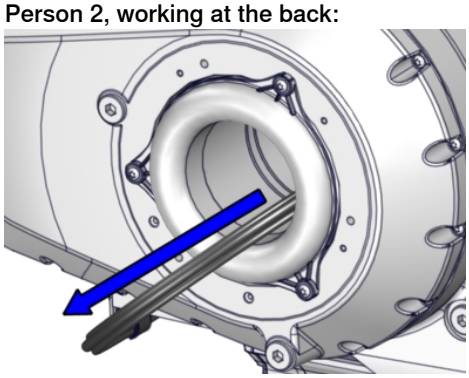
5.7.2 Replacing the arm house cover including the axis-4 cassette sealing

Continued

	Action	Note
8	Remove the cable harness out from the wrist. **Tip** This step is best performed by two persons working together: • Person 1: Put one hand inside the side hole and take a hold of the cable harness. • Person 2: Take a hold on the cable harness inside the wrist. • Together: Move the cable harness past the axis-5 motor and into the arm tube.	Person 1, working at the side hole:  xx2300000035 Person 2, working at the wrist:  xx2300000036
9	Remove the cable harness out of the arm tube, at the back of the upper arm. **Tip** This step is best performed by two persons working together: • Person 1: Put one hand inside the side hole and take a hold of the cable harness. • Person 2: Take a hold on the cable harness at the back of the robot. • Together: Move the cable harness out of the arm tube. **Note** To be able to remove the cable harness with the DressPack tube fitted, the tube needs to be pulled out a little, then be placed on the lower left side in the arm tube and the bracket of the cable harness then needs to be placed on the upper right hand side.	Person 1, working at the side hole:  xx2300000037 Person 2, working at the back:  xx2300000038

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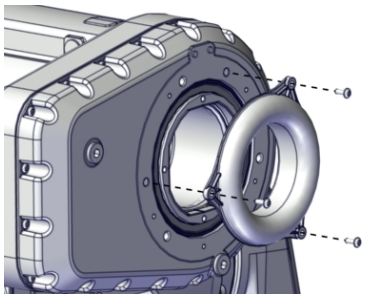
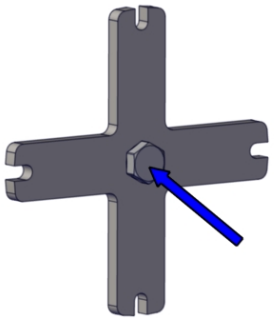
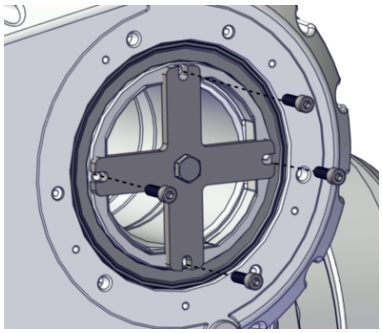
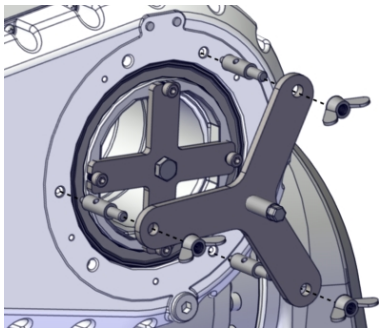
Removing the arm house cover including the cassette sealing

	Action	Note
1	Remove the cable guide by removing the attachment screws.	 xx2100001242
2	Prepare the removal tool by fitting the middle screw to the part of the tool designed as a cross, all the way until it bottoms.	Replacement tool for arm house cover: 3HAC079878-001  xx2100001253
3	Fit the cross to the tube shaft with four M8 screws.	 xx2100001243
4	Fit the three armed tool part with three screws and wing nuts.	 xx2100001254

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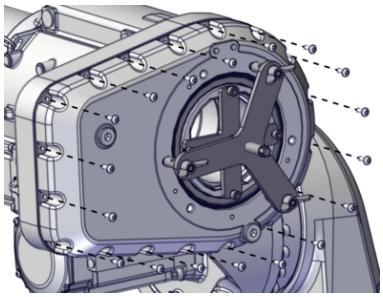
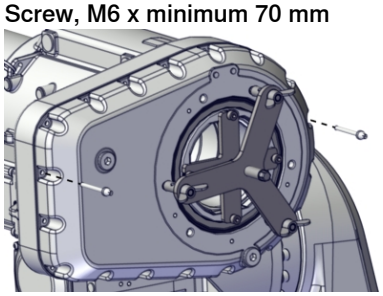
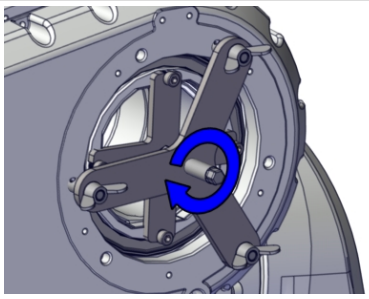
5.7.2 Replacing the arm house cover including the axis-4 cassette sealing

Continued

	Action	Note
5	Remove the arm house cover screws.	 xx2400000151
6	Insert two screws M6 x minimum 70 mm on each short side, as support so that the cover doesn't fall down when pressed out.	Screw, M6 x minimum 70 mm  xx2200001144
7	Prepare the area beneath the cover with oil absorbing material. **WARNING** Oil residues will drip out during removal. Make sure that protective gear like goggles and gloves are always worn. **WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 30*. **WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 649* for more information.	
8	Fit the M12 bolt and rotate it to press out the complete cover.	 xx2100001256

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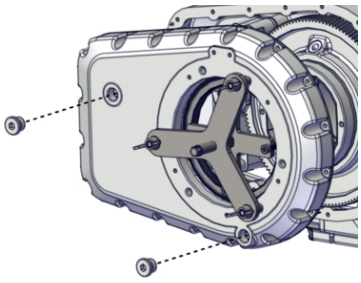
	Action	Note
9	Remove the complete cover. Remove and save the oil plugs for refitting on the new cover. **WARNING** Oil residues will drip out during removal. Make sure that protective gear like goggles and gloves are always worn.	 xx2100001286
10	Remove the tool from the arm house cover. The tool on the tube shaft can stay fitted.	

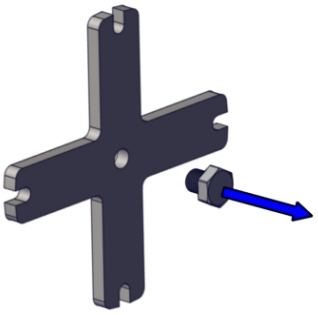
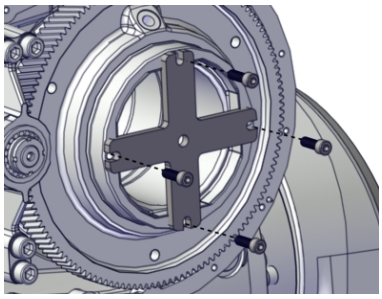
Refitting the arm house cover including the cassette sealing

Use these procedures to refit the arm house cover including the cassette sealing.

Preparations before refitting the arm house cover

	Action	Note
1	Wipe clean all contact surfaces.	

Refitting the arm house cover including the cassette sealing

	Action	Note
1	Prepare the refitting tool by removing the middle screw from the part of the tool designed as a cross.	 xx2100001265
2	Fit the cross to the tube shaft with four M8 screws. **CAUTION** Center the cross on the tube shaft, to not damage the sealing. **CAUTION** Tighten the screws so that the cross bottoms firmly against the tube shaft, but make sure not to damage the cassette sealing.	 xx2100001264

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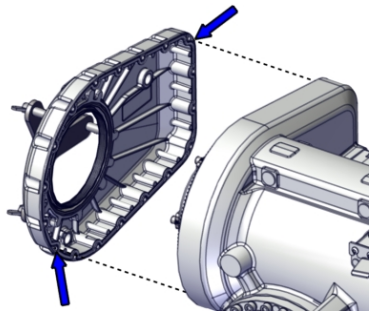
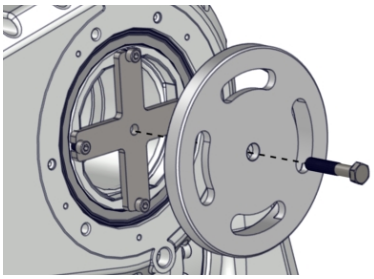
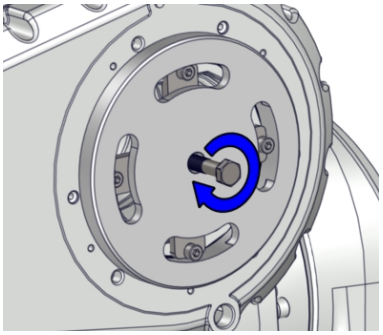
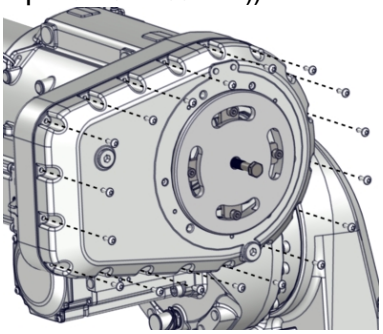
5.7.2 Replacing the arm house cover including the axis-4 cassette sealing

Continued

	Action	Note
3	Fit the arm house cover to the arm house with guidance from the two guide pins in the cover. **Tip** Secure the cover temporarily with two screws M6 on each short side, as support to hold the cover.	 xx2100001269
4	Fit the press plate to the arm house cover, together with the M12 screw. Align the press plate holes over the four M8 screws.	Use the correct press plate: 3HAC079878-009  xx2300001365
5	Press the cover and cassette sealing into place by rotating the M12 screw. If used, remove the temporary support screws before pressing the cover completely into place. Check that the guide pins are inserted in the arm house.	 xx2100001270
6	Fit all attachment screws and tighten them crosswise by hand first. Use locking liquid.	Torx pan head screw: M6x16 A4-80 Locking liquid: - (Loctite 2400 (or equivalent Loctite 243))  xx2100001255
7	Torque tighten the attachment screws crosswise. Ensure gap closure between cover and arm house.	Tightening torque: 10 Nm

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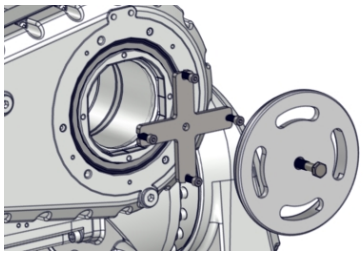
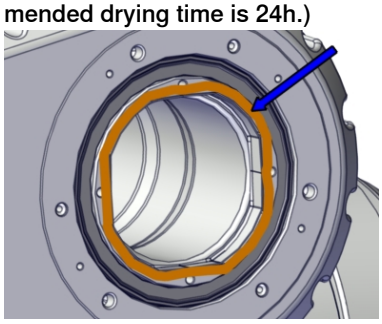
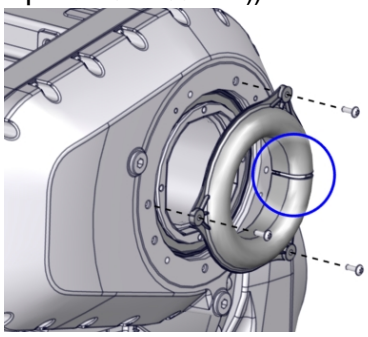
	Action	Note
8	Remove the tool.	 xx2300001367
9	Perform a leak-down test.	See *Performing a leak-down test on page 197*.

Refitting the arm house cable guide

	Action	Note
1	Apply rust preventive on the arm tube machined surface.	Rust preventive: 3HAC034903-001 (Mercasol 3110 Waxcoat. Recommended drying time is 24h.)  xx2100001271
2	Fit the cable guide with attachment screws. Align the cable guide so that the slot is positioned at 90 degrees clockwise, as shown in the figure. Use locking liquid.	Torx pan head screw: M6x16 A4-80 Locking liquid: - (Loctite 2400 (or equivalent Loctite 243))  xx2400001803

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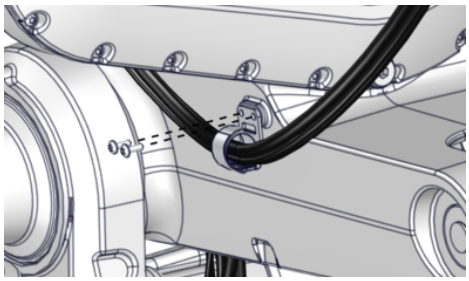
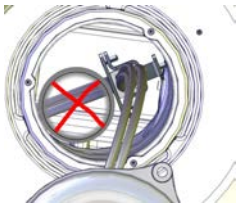
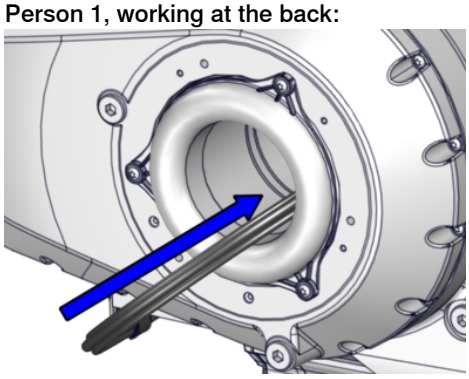
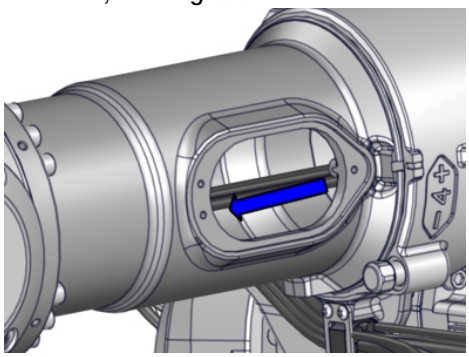
5.7.2 Replacing the arm house cover including the axis-4 cassette sealing
Continued

Refitting the cable harness to the upper arm

	Action	Note
1	Refit the metal clamp beneath the arm house.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2300002013
2	**Tip** Use tape and tie the axis-5 and axis-6 connectors and carrier into a bundle (if not already done). This is done to facilitate the procedure and to avoid damaging the parts during the procedure. This will also make it easier to run the cable harness through the inside of the robot.	 xx1300000668

Continues on next page

	Action	Note
3	Run the cable harness through the cable guide and then into and through the upper arm tube. **Tip** This step is best performed by two persons working together: • Person 1: Put one hand inside the side hole of the arm tube and take a hold of the cable harness. • Person 2: Take a hold on the cable harness at the back of the robot. • Together: Use caution and move the cable harness into the arm tube. **Note** The cable harness is best placed at the upper right hand side of the DressPack tube, if used, through the arm tube. Do not run the cable harness into the DressPack tube! **Note** Do not run the cable harness into the DressPack tube, if one is fitted!  xx1300000820	Person 1, working at the back:  xx2300000039 Person 2, working at the side hole:  xx2300000040

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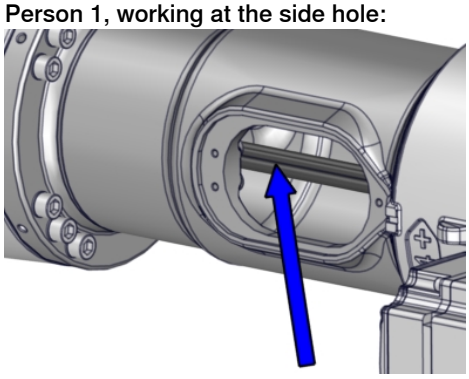
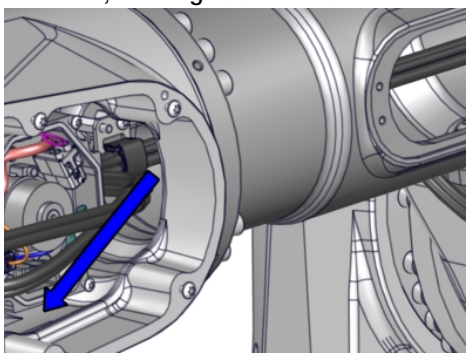
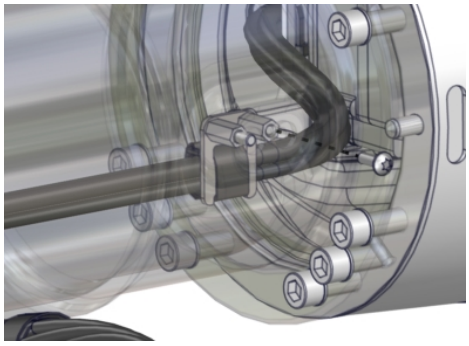
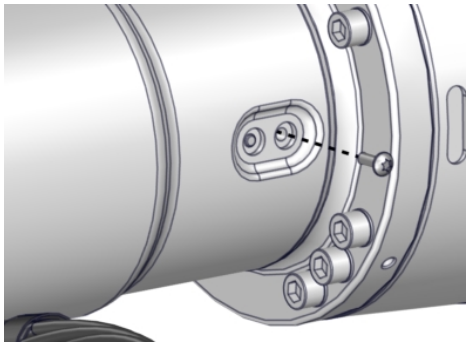
5.7.2 Replacing the arm house cover including the axis-4 cassette sealing

Continued

	Action	Note
4	Use caution and push the cable harness into the wrist. **Tip** This step is best performed by two persons working together: • Person 1: Put one hand inside the side cover hole and take a hold of the cable harness. • Person 2: Take a hold of the cable harness from inside the wrist. • Together: Move the cable harness past the axis-5 motor and into the wrist.	Person 1, working at the side hole:  xx2300000035 Person 2, working at the wrist:  xx2300000041
5	Refit the metal clamp axis-4, inside the arm tube. **Note** The screw is reached from outside the upper arm.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2300000033  xx2300000032

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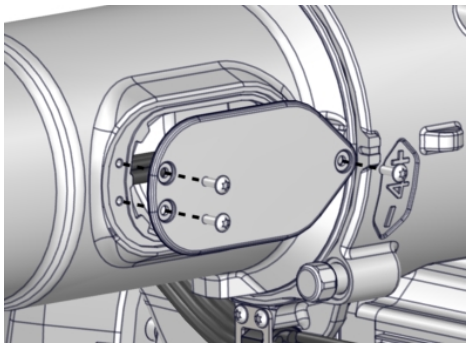
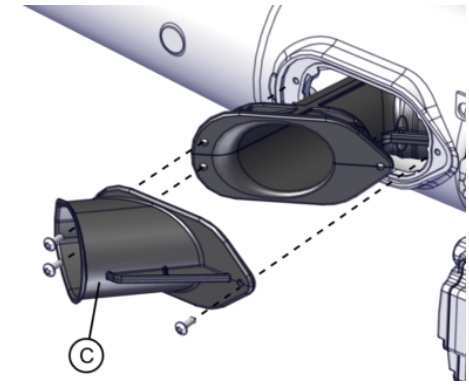
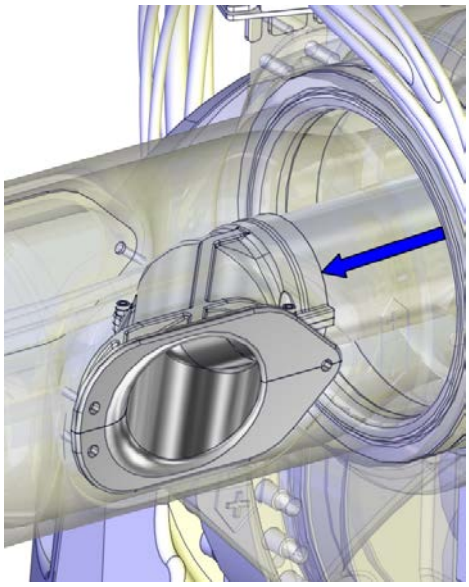
	Action	Note
6	Refit the side cover (if no DressPack is used). **Note** *Foundry Plus*: • Make sure the gasket is fitted correctly on the side cover • Use attachment screws made of stainless steel to fit the side cover.	 xx2300000031
7	With DressPack: Refit the insert that guides the DressPack cable package through the hole in the upper arm. (Cable guard (C) is available for Foundry cable guard.)	 xx2100002677
8	With DressPack: Refit the DressPack tube into the insert.	 xx1400000092

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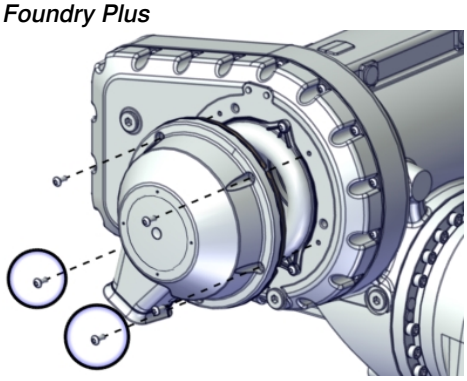
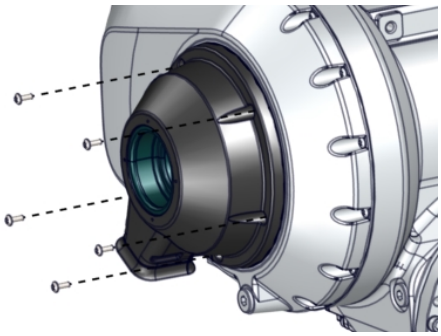
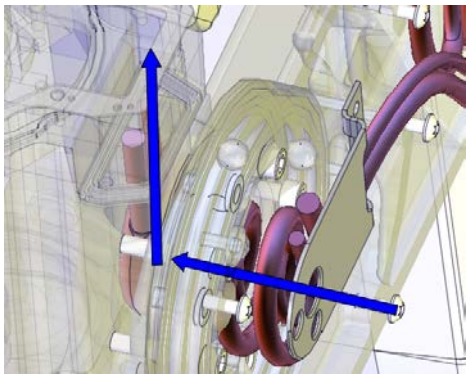
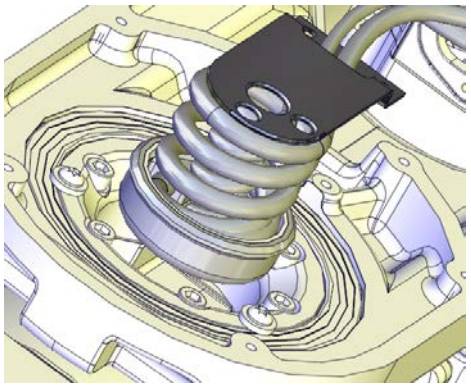
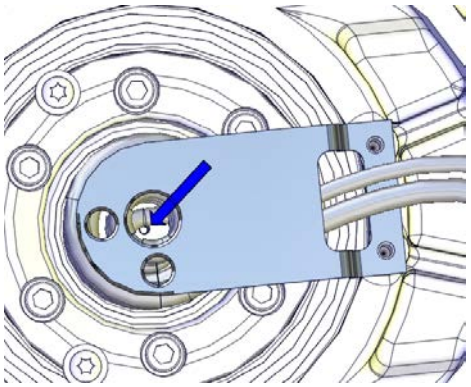
5.7.2 Replacing the arm house cover including the axis-4 cassette sealing
Continued

	Action	Note
9	*DressPack* or *Foundry Plus*: Refit the back cover with the attachment screws. Tighten the two screws closest to the outlet first (shown in figure), to avoid deformation. **Note** With DressPack: Make sure that the tube is fitted correctly in both ends, when fitting the cover.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm. *Foundry Plus*  xx2100002636 *DressPack* Locking liquid: Loctite 2400 (or equivalent Loctite 243)  xx2300001040

Inserting the axis-6 motor cables

	Action	Note
1	**Note** Axis 5 must be in position +90° (or as close as possible) for a correct installation of the cable harness in the wrist. If not, connect the brake release tool to the axis-5 motor connector, release the brakes and move axis 5 manually to +90°.	

Continues on next page

	Action	Note
2	Push the cable harness into the wrist recess and up into the axis-6 motor. **Tip** Moisten the rubber carrier slightly with water or grease around the contact surface, to make it easier to fit into place.	 xx1300000667
3	Push the carrier carefully into position.	 xx1300001113
4	Secure the carrier with the M4x10 screw. **Note** The screw is located at the bottom of the carrier. **Tip** The attachment screw securing the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.	 xx1300000485

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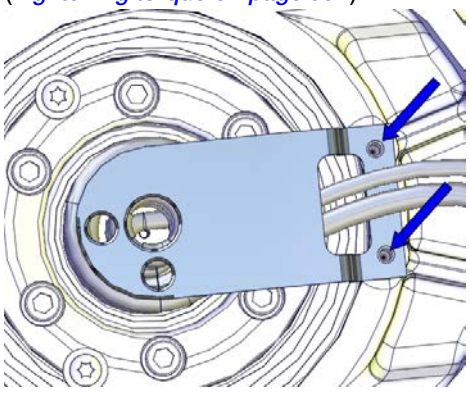
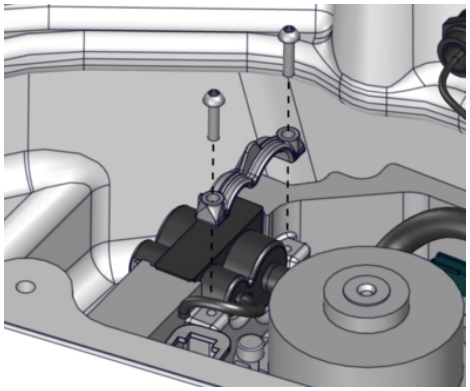
5.7.2 Replacing the arm house cover including the axis-4 cassette sealing
Continued

	Action	Note
5	Secure the cable bracket with its attachment screws.	Torx pan head screw: M6x16 A4-80 Tightening torque: standard torque 10 Nm (*Tightening torque on page 661*).  xx1300000484

Connecting the axis-5 motor cables

	Action	Note
1	Put the motor cables in place in the opening.	
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001735

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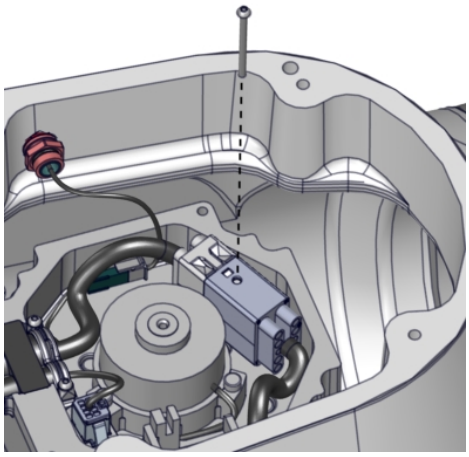
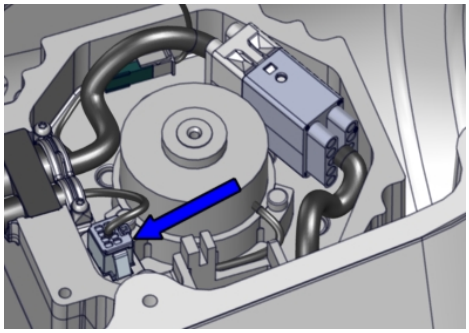
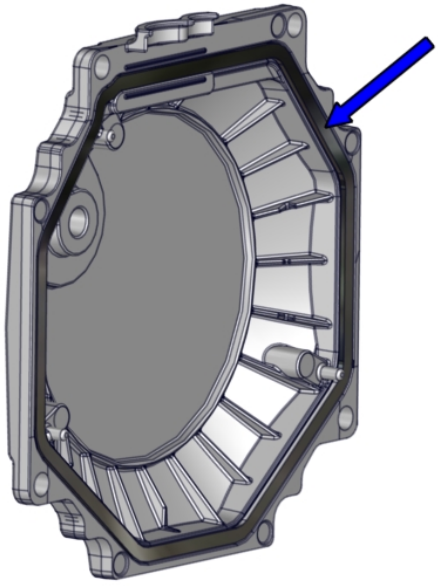
	Action	Note
3	Connect the power cable connector and secure with a screw. Connect in accordance with the markings on the connectors. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001733
4	Connect the signal cable connector. Connect in accordance with the markings on the connectors.	 xx2200001734
5	Inspect the gasket. Replace if damaged.	Connection box cover with gasket: 3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)  xx2200002141

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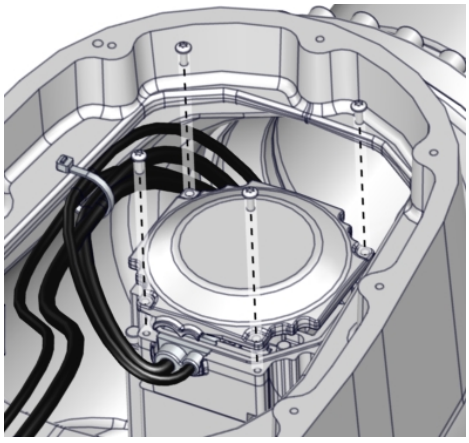
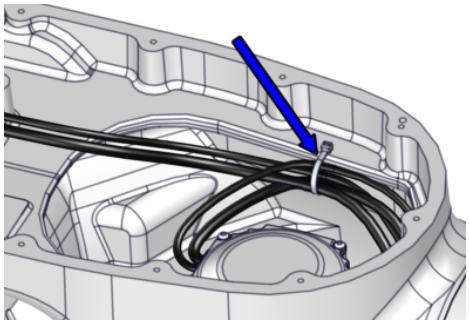
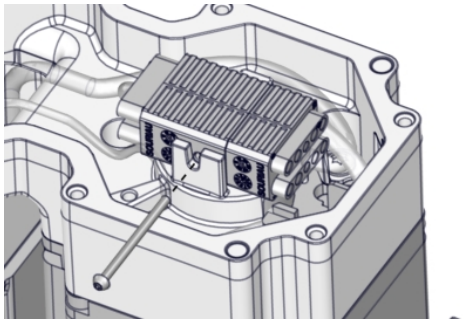
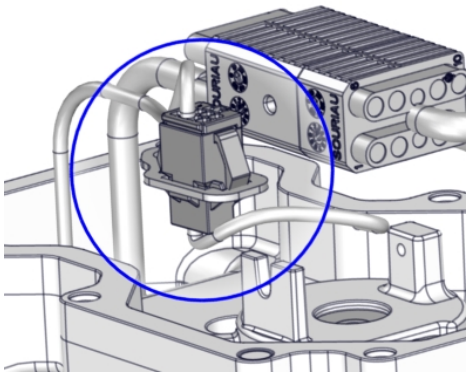
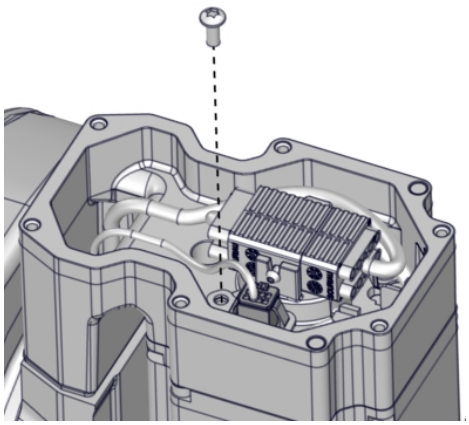
5.7.2 Replacing the arm house cover including the axis-4 cassette sealing
Continued

	Action	Note
6	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
7	Refit the motor cover and the cable protection with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.  xx2300001924
8	Secure the cabling with a cable strap.	Cable strap, outdoor: -  xx2300001923

Connecting the axis-6 motor cables

	Action	Note
1	Connect the motor cables. Connect in accordance with the markings on the connectors.	

Continues on next page

	Action	Note
2	Position the power connector to the bracket with a screw. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001731
3	Snap the signal connectors to each other in the bracket.	 xx2200001921
4	Refit the connector bracket assembly to the motor. **CAUTION** The cabling is sensitive to mechanical damage. Handle it with care to avoid damage to the cabling or the connector, avoid any kind of tilt or skew.	Torx pan head screw: M5x12 Stainless steel A2-70  xx2200001730

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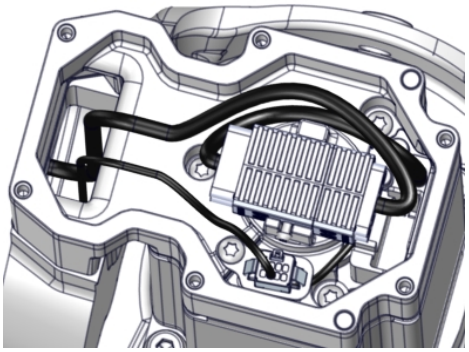
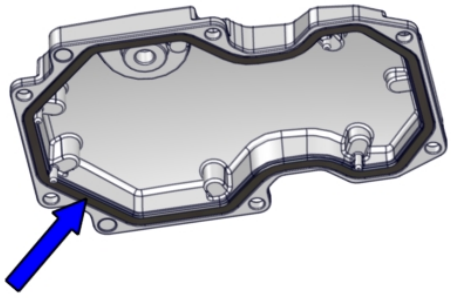
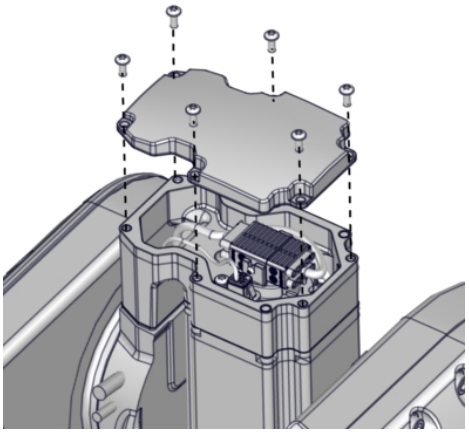
5.7.2 Replacing the arm house cover including the axis-4 cassette sealing
Continued

	Action	Note
5	Verify correct cable layout as shown in the figure. **CAUTION** Route the signal cabling correctly to avoid cable damage.	 xx2300000920
6	Inspect the gasket. Replace if damaged.	Connection box cover with gasket: 3HAC079381-003 (Graphite White) 3HAC079381-004 (ABB Orange)  xx2200001922
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8	Refit the motor cover.	Torx pan head screw, M5x12 Stainless steel A2-70, 6 pcs Tightening torque: 6 Nm.  xx2200001434

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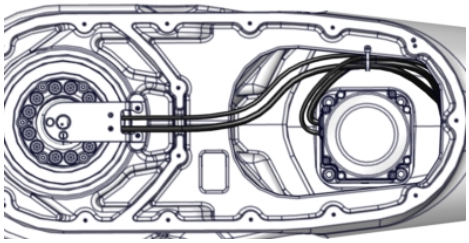
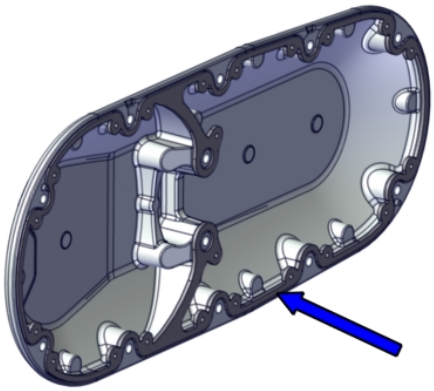
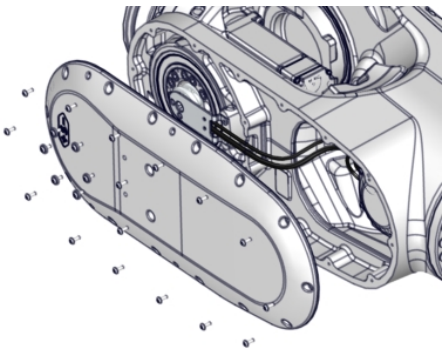
Refitting the wrist cover

	Action	Note
1	Make sure that the cable harness is routed and secured as shown in the figure.	 xx2300001927
2	*Foundry Plus:* Inspect the gasket. Replace if damaged.	Gasket: 3HAC085052-001  xx2100001407
3	Refit the wrist cover and secure with screws. *Foundry Plus:* Fit all the screws first, then torque tighten them twice to achieve correct torque (due to compression from the gasket).	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2300001883

Concluded refitting of the cable harness

	Action	Note
1	If the robot is equipped with DressPack cable package: Refit all parts that belong to the DressPack.	See the product manual for the DressPack.

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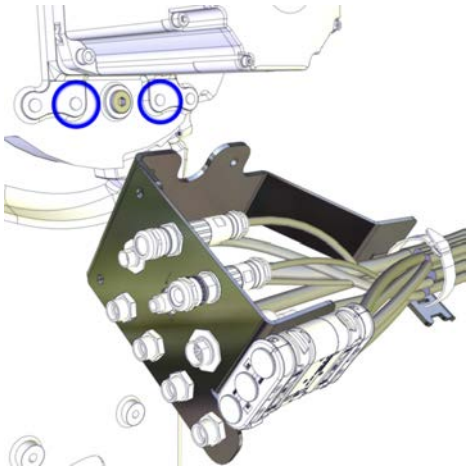
5.7.2 Replacing the arm house cover including the axis-4 cassette sealing

Continued

	Action	Note
2	If the robot is equipped with DressPack cable package: Refit the connection plate.	 xx1200001332

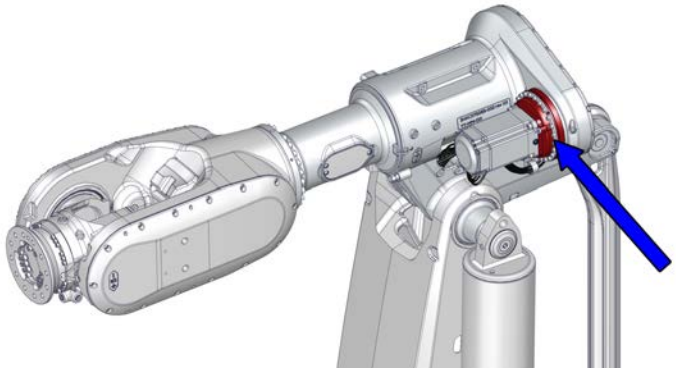
Concluding procedure

	Action	Note
1	Refill oil to the axis-4 gearbox.	See *Filling oil into the axis-4 gearbox on page 171*.
2	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.7.3 Replacing the axis-4 motor flange

Location of the axis-4 motor flange

The axis-4 motor flange is located as shown in the figure.



xx2400000670

Summary of the replacement procedure

This is a brief summary of the replacement procedure, containing the major actions to be performed.

1. Drain the axis-4 primary gearbox.
2. Remove the axis-4 motor.
3. Replace the motor flange.

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note
Motor flange	3HAC069745-004 (Graphite White) 3HAC069745-005 (ABB Orange)	

Required tools and equipment

Equipment	Article number	Note
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Bits extender	3HAC12342-1	300 mm, bits 1/2"

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5.7.3 Replacing the axis-4 motor flange
Continued

Equipment	Article number	Note
Removal tool motor M12	3HAC14631-1	Used to push out the motor, if necessary. Always use removal tools in pairs.
Rotation tool M4	3HAB7887-1	Used to rotate the motor pinion. Add screw M4.
Calibration toolbox, Axis Calibration	3HAC074564-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required service parts

Consumable	Article number	Note
Connection box cover FS130 with gasket	3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)	Replace if damaged. On axis-4 motor
Cleaning agent	-	Loctite 7200
Cleaning agent	-	Loctite 7063
Flange sealant	-	Loctite 5800

Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

	Action	Note
1	Decide which calibration routine to use for calibrating the robot. • Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot. • Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.	
	If the robot is to be calibrated with reference calibration: Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in *Reference calibration routine on page 628*.

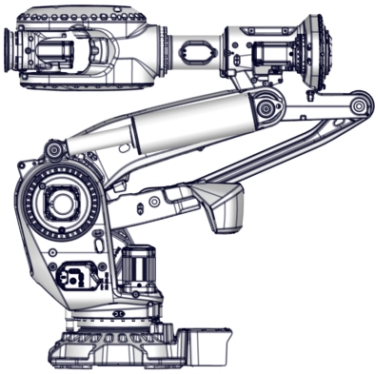
Continues on next page

	Action	Note
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Removing the motor flange

Use these procedures to remove the motor flange.

Preparations before removing the motor flange

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Jog the robot into position: • Axis 1: no significance • Axis 2: jog axis 2 and 3 to a position where the upper arm is horizontal • Axis 3: jog axis 2 and 3 to a position where the upper arm is horizontal • Axis 4: no significance • Axis 5: no significance • Axis 6: no significance	 xx2400000297
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
4	Drain the axis-4 primary gearbox.	See *Draining the axis-4 gearbox on page 165*.

Disconnecting the motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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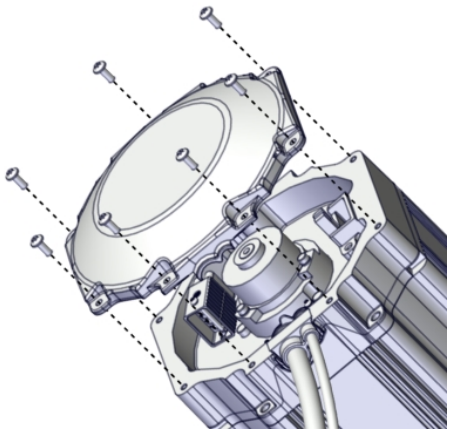
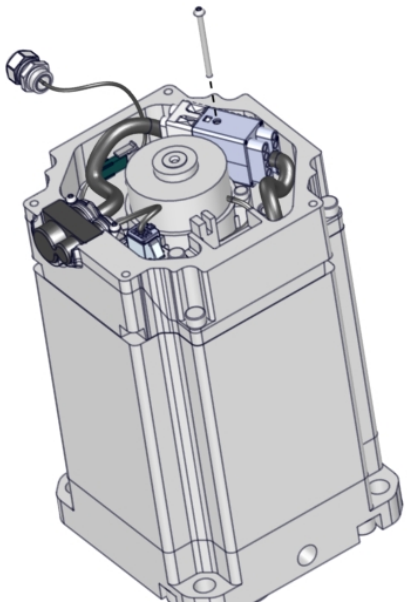
5.7.3 Replacing the axis-4 motor flange

Continued

	Action	Note
2	Remove the motor cover by removing the screws.	 xx2100000596
3	Disconnect the power cable connector by first removing the attachment screw and then parting the connector.	 xx2200001736

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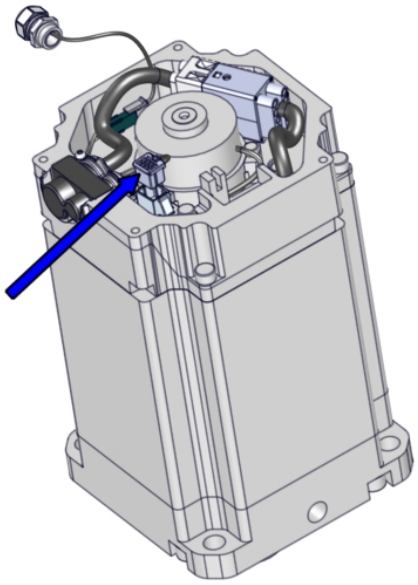
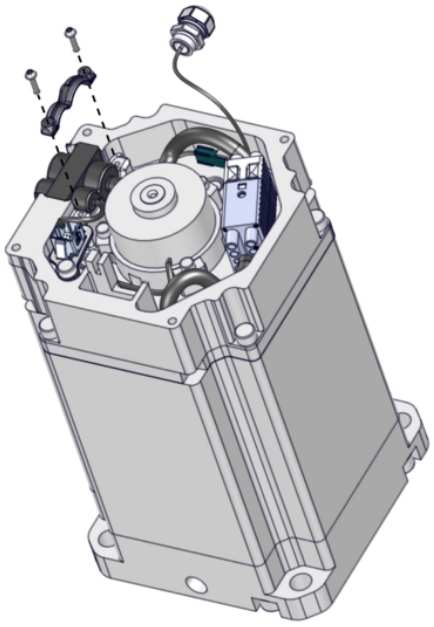
	Action	Note
4	Disconnect the signal cable connector by pulling it out.	 xx2200001737
5	Remove the cable bracket by removing the screws.	 xx2200001738
6	Remove the motor cables from the motor.	

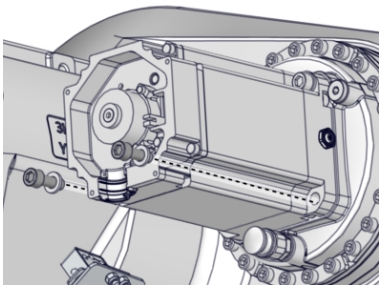
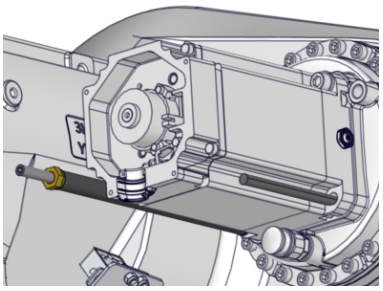
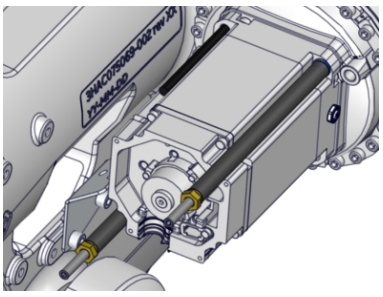
Removing the axis-4 motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

5.7.3 Replacing the axis-4 motor flange

Continued

	Action	Note
2	Before removing the motor, make sure that the gearbox is completely drained.	
3	Remove two of the motor attachment screws.	 xx2400000298
4	Fit a guide pin in the non-threaded hole. Fit a removal tool in the threaded hole.	Guide pin, M10x150: 3HAC15521-2 Removal tool motor M12: 3HAC14631-1  xx2400000299
5	Remove the remaining screws.	
6	Fit a guide pin in the non-threaded hole. Fit a removal tool in the threaded hole.	Removal tool motor M12: 3HAC14631-1 Guide pin, M10x150: 3HAC15521-2  xx2400000300

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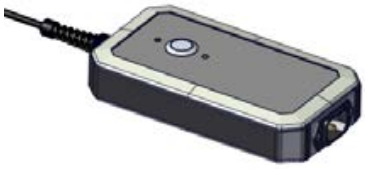
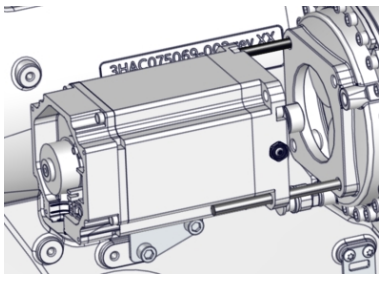
	Action	Note
7	Release the brakes on the motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **CAUTION** Releasing the brakes on the axis-4 motor may cause axis-4 to move unexpectedly. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
8	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
9	Press the motor out of its position by using the removal tools.	
10	**CAUTION** The weight of the motor is 13 kg All lifting accessories used must be sized accordingly.	
11	Remove the motor by lifting it straight out. Make sure the pinion is not damaged.	 xx2400000301

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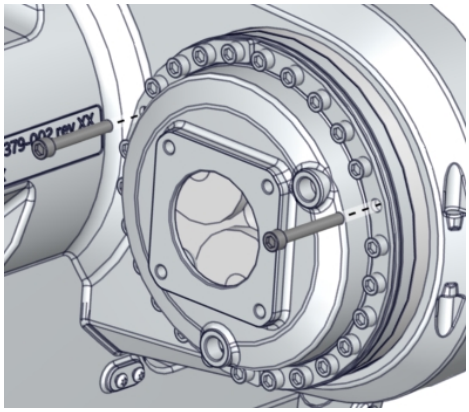
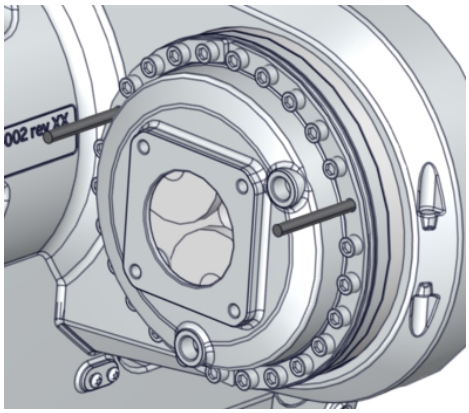
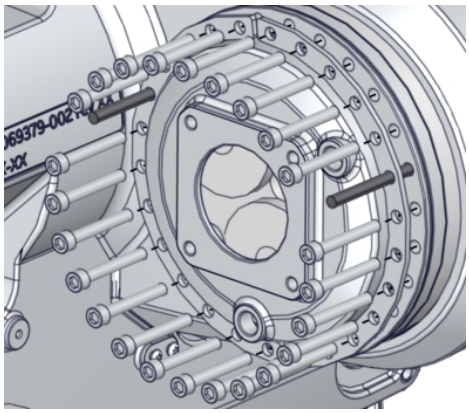
5.7.3 Replacing the axis-4 motor flange

Continued

Removing the motor flange

	Action	Note
1	Remove two attachment screws in opposite holes.	 xx2400000672
2	Fit guide pins in the holes.	Guide pin, M8x150, 3HAC15520-2  xx2400000673
3	Remove the remaining attachment screws and the washers.	 xx2400000674
4	**Note** There will be some oil spill when the motor flange is removed. Put some paper (or similar) to absorb the surplus oil.	

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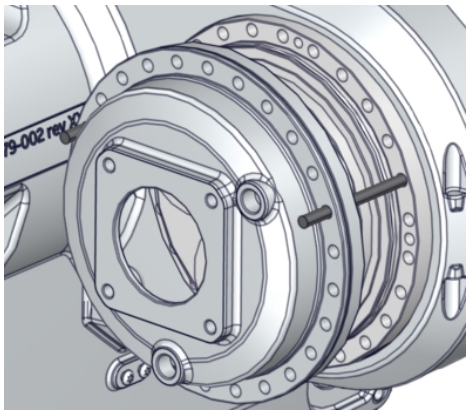
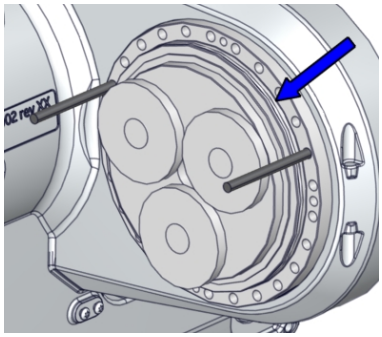
	Action	Note
5	Remove the motor flange.	 xx2400000675
6	Make sure the o-ring is present.	 xx2300001867

Refitting the motor flange

Use these procedures to refit the motor flange.

Refitting the motor flange

	Action	Note
1	Clean the contact surfaces on gearbox and motor flange.	
2	Clean the o-ring and the o-ring groove on gearbox.	 xx2400000676

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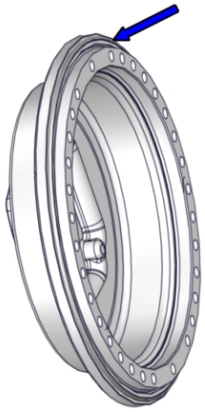
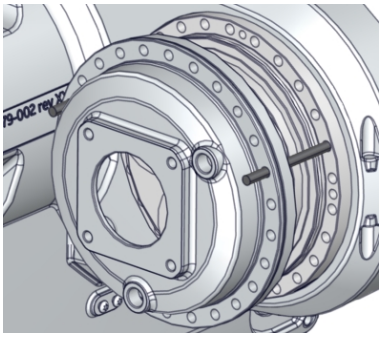
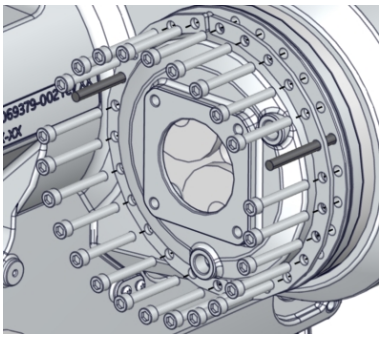
5.7.3 Replacing the axis-4 motor flange

Continued

	Action	Note
3	Lubricate the o-ring and fit to the gearbox. Replace if damaged.	Grease, Shell Gadus S2: 3HAC042536-001. O-ring: 3HAC061327-078
4	Check the motor flange o-ring. Replace if damaged.	O-ring: 3HAB3772-160  xx2300001867
5	Lift the motor flange onto the guide pins.	 xx2400000675
6	Make sure the o-rings are in position and slide the motor flange into position.	
7	Fit the attachment screws with the two washers.	Hex socket head cap screw: M12x80 12.9 Gleitmo 603+Geomet 500  xx2400000674

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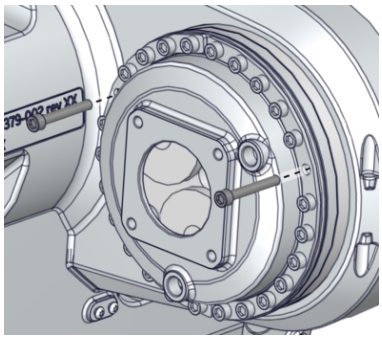
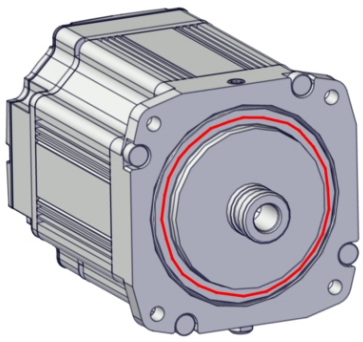
	Action	Note
8	Remove the guide pins and attach the remaining screws.	 xx2400000672
9	Tighten all motor flange screws.	Tightening torque: standard torque 35 Nm (*Tightening torque on page 661*).
10	Perform a leak-down test.	See *Performing a leak-down test on page 197*.

Preparations prior to refitting motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove any old paint or flange sealant residues or other contamination from the contact surfaces on both the motor and the mating parts. **Tip** Remove flange sealant residues with Loctite 7200. Then use Loctite 7063 for cleaning the mating surface.	Cleaning agent: Loctite 7200, Loctite 7063
3	Apply a continuous bead of flange sealant, 1-2 mm wide, inside of the groove on the motor contact surface. **Note** The purpose of the groove is to catch excess sealant. No o-ring is used.	Flange sealant: Loctite 5800  xx2100000520

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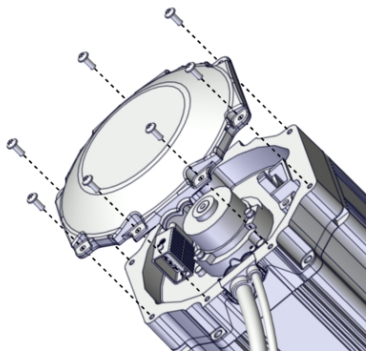
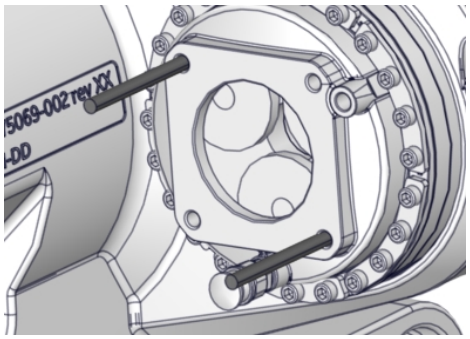
5.7.3 Replacing the axis-4 motor flange

Continued

	Action	Note
4	Remove the cover, if fitted to the new spare part motor.	 xx2100000596

Refitting the axis-4 motor

	Action	Note
1	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.  xx2400000302
2	**CAUTION** The weight of the motor is 13 kg All lifting accessories used must be sized accordingly.	
3	Apply the rotation tool.	Rotation tool M4: 3HAB7887-1

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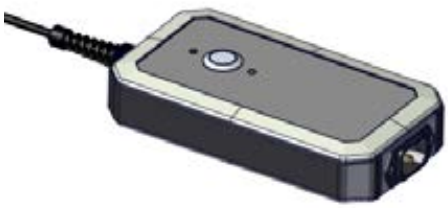
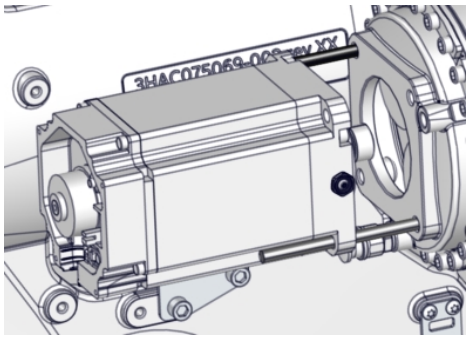
	Action	Note
4	Release the brakes of the axis-4 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
5	Lift the motor and put it on the guide pins as close as possible to its final position without pushing the motor pinion into the gear. Use caution and fit the motor in its final position while at the same time rotating the motor pinion slightly using the rotation tool. • Make sure that the motor pinion is properly mated to the gear of the gearbox. • Make sure that the motor pinion does not get damaged. • Make sure that the direction of the cable exit is facing the correct way. **Note** Make sure the cable gland opening is turned the correct way.	 xx2400000301
6	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

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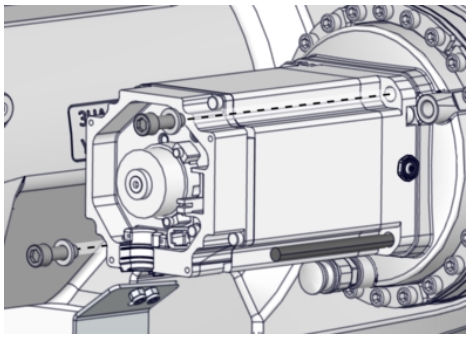
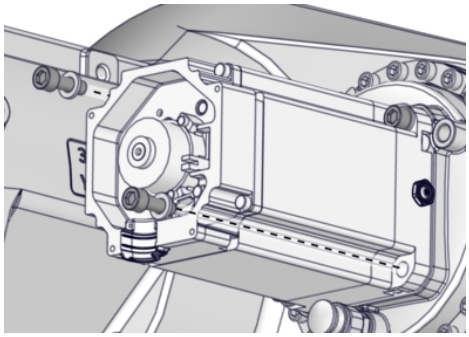
5.7.3 Replacing the axis-4 motor flange

Continued

	Action	Note
7	Fit two of the attachment screws and washers. Use a bits extender in order to reach the screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (2 pcs) Bits extender: 3HAC12342-1  xx2400000303
8	Remove the guide pins and replace with the remaining attachment screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (2 pcs)  xx2400000304
9	Tighten the screws.	Tightening torque: 50 Nm.
10	Disconnect the brake release tool.	
11	Perform a leak-down test.	See *Performing a leak-down test on page 197*.

Connecting the motor cables

	Action	Note
1	Put the motor cables in place in the opening.	

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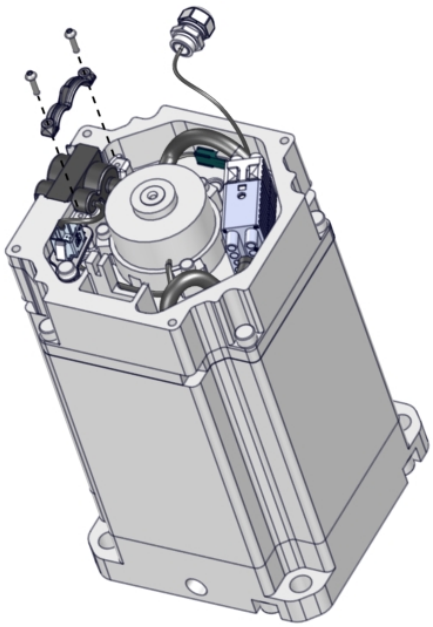
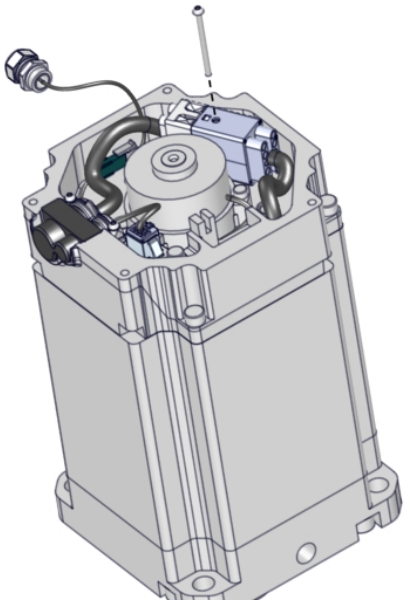
	Action	Note
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001738
3	Connect the motor cables. **Note** Connect in accordance with the markings on the connectors.	
4	Fit a screw to the power connector. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001736

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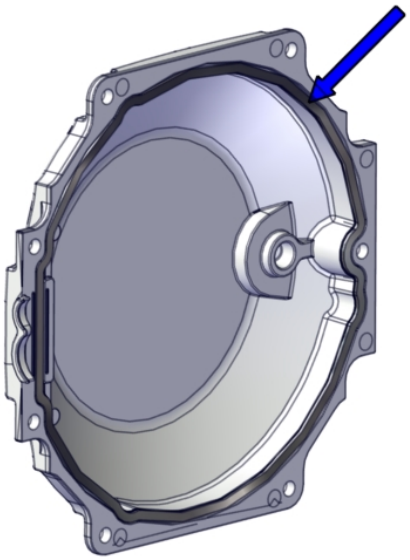
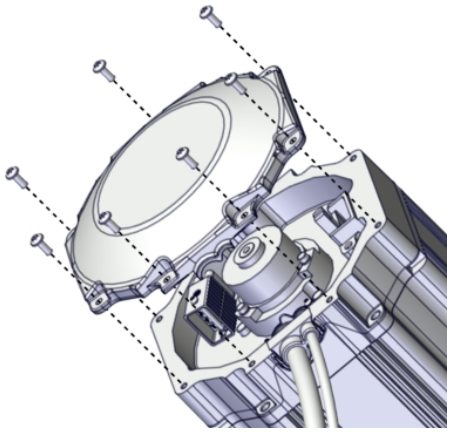
5.7.3 Replacing the axis-4 motor flange

Continued

	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1, axis-2 and axis-3: Connection box cover FS180 with gasket: 3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection) Axis-4: Connection box cover FS130 with gasket: 3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)  xx2100000600
6	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	

Continues on next page

	Action	Note
7	Refit the motor cover with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.  xx2100000596

Concluding procedure

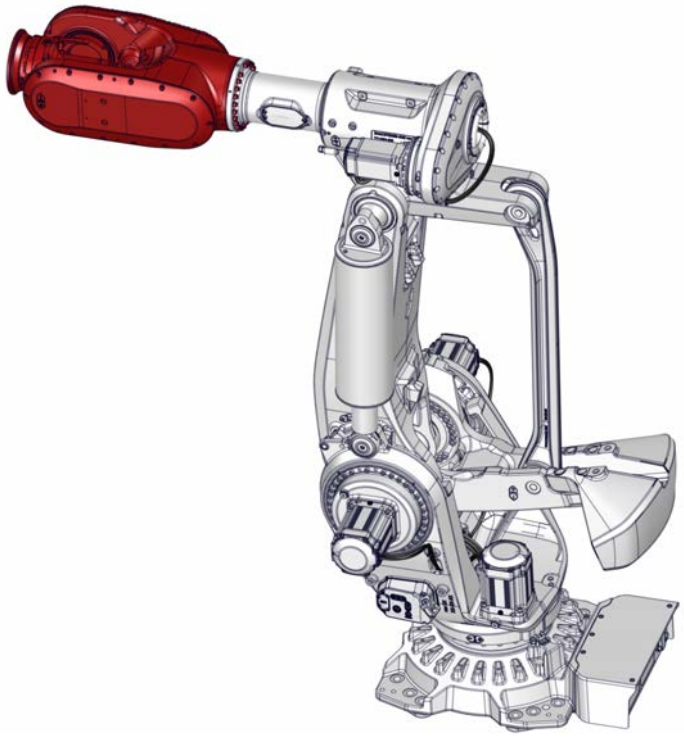
	Action	Note
1	Refill the gearbox with oil.	See *Filling oil into the axis-4 gearbox on page 166*.
2	Re-calibrate the robot.	See *Calibration on page 619*.
3	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.8 Wrist

5.8.1 Replacing the wrist

Location of the wrist

The wrist is located as shown in the figure.



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Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Wrist	3HAC085018-002 (Graphite White) 3HAC085018-003 (ABB Orange)	Complete unit with motors and gears.	L2

Required tools and equipment

Equipment	Article number	Note
Guide pin, M12x150	3HAC13056-2	Always use guide pins in pairs.

Continues on next page

Equipment	Article number	Note
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
Bit holder and hexagon bit SW10		Bit holder dimension: 5/16" (14x18 mm) Used for screw access in narrow locations.
Roundsling, 1 m	-	Length: 1 m.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required service parts

Consumable	Article number	Note
Connection box cover with gasket	3HAC079381-003 (Graphite White) 3HAC079381-004 (ABB Orange)	Replace if damaged. On axis-6 motor
Connection box cover with gasket	3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)	Replace if damaged. On axis-5 motor
Wrist cover	3HAC085026-002 (Graphite White) 3HAC085026-003 (ABB Orange)	Replace if damaged.
Gasket	3HAC085052-001	For wrist cover. Replace if damaged.
Cable strap, outdoor	-	

Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

	Action	Note
1	Decide which calibration routine to use for calibrating the robot. • Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot. • Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.	
	If the robot is to be calibrated with reference calibration: Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in *Reference calibration routine on page 628*.

Continues on next page

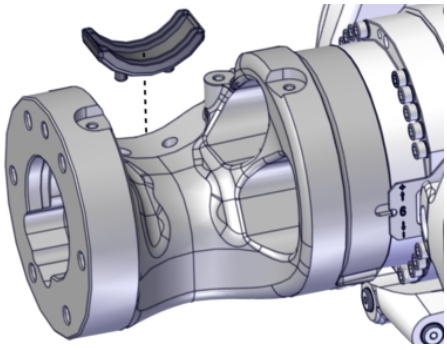
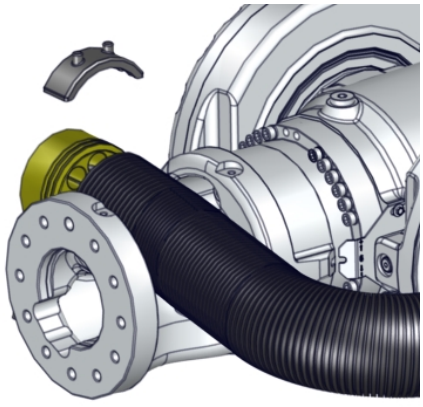
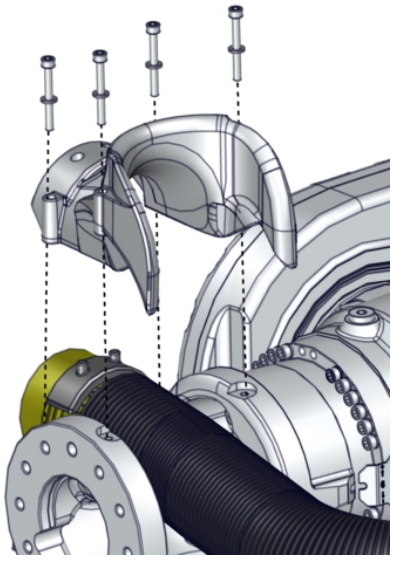
5.8.1 Replacing the wrist
Continued

	Action	Note
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Removing the wrist

Use these procedures to remove the wrist.

Preparations before removing the wrist

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Remove tools and other equipment fitted to the wrist.	
3	If used, open the DressPack axis-6 cable support and remove the DressPack cable package from the process turning disk. **Note** Use caution not to lose the two clamp jaws on either side of the DressPack cable package.  xx2100002712	 xx2300001210  xx2300001211

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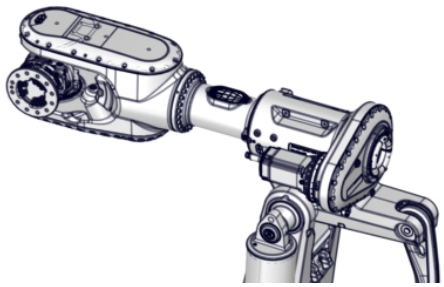
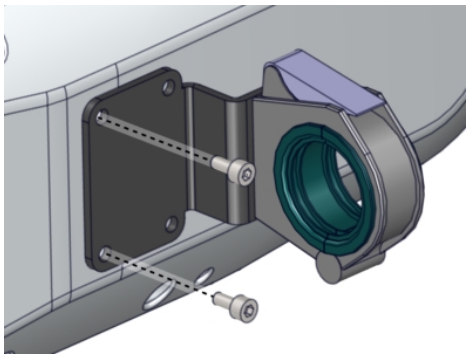
	Action	Note
4	Jog the robot into position: • Axis 1: no significance • Axis 2: jog axis 2 and 3 to a position where the upper arm is horizontal • Axis 3: jog axis 2 and 3 to a position where the upper arm is horizontal • Axis 4: +90° • Axis 5: +90° • Axis 6: no significance	 xx2300001931
5	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Retrieving access to the wrist cabling

Use this procedure to remove the wrist cover.

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	If DressPack MH3 is installed: Remove the wrist bracket with the complete ball joint housing still fitted, if the bracket is installed over the two wrist cover screws. **Note** No need to remove the bracket if the two wrist cover screws are accessible.	 xx2300001366

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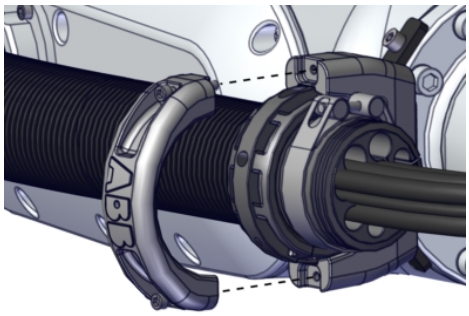
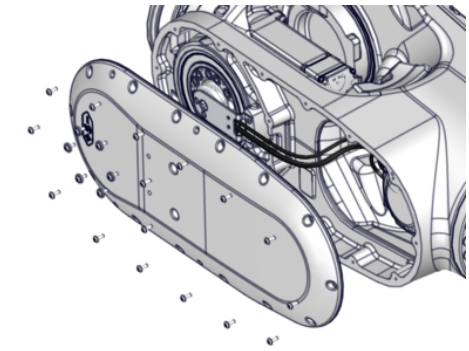
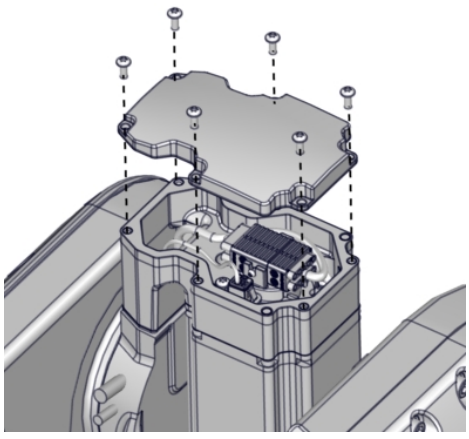
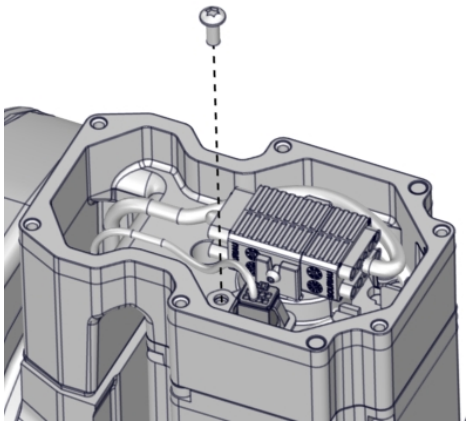
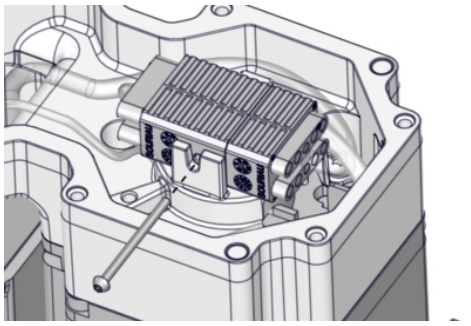
5.8.1 Replacing the wrist
Continued

	Action	Note
3	If DressPack is installed: Open the ball joint housing on the arm tube and remove the DressPack cable package.	 xx2100002709
4	Remove the wrist cover.	 xx2300001883

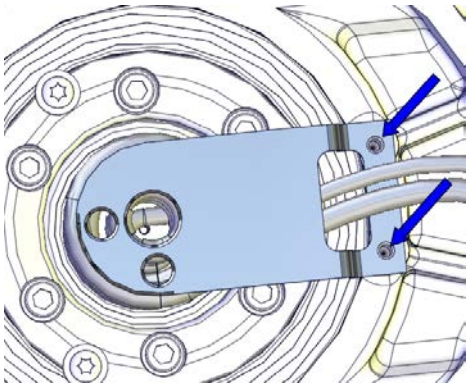
Disconnecting the axis-6 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws and remove the motor cover.	 xx2200001434

Continues on next page

	Action	Note
3	Remove the connector bracket.	 xx2200001730
4	Remove the connector screw.	 xx2200001731
5	Disconnect the motor cables.	

Pushing out the axis-6 motor cables

	Action	Note
1	Unscrew the attachment screws that hold the cable bracket.	 xx1300000484

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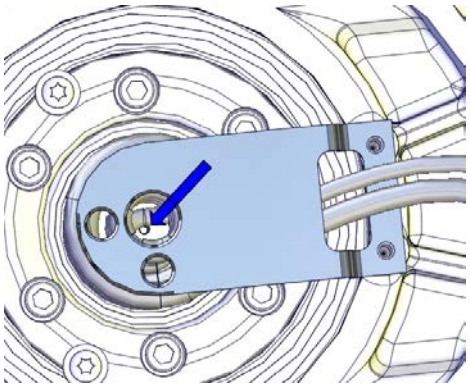
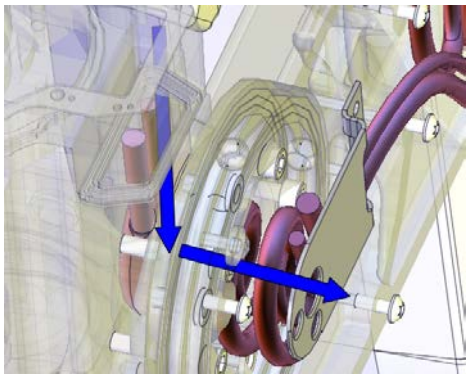
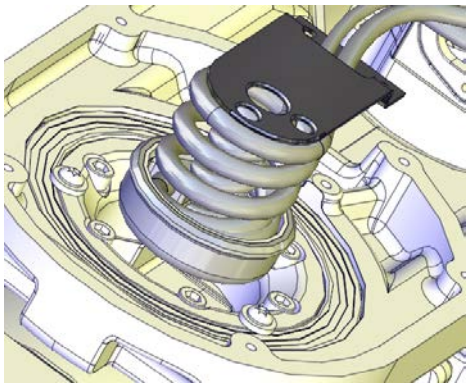
5.8.1 Replacing the wrist

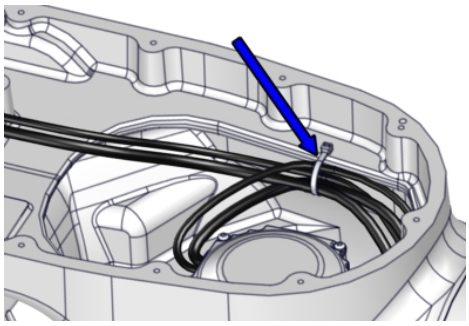
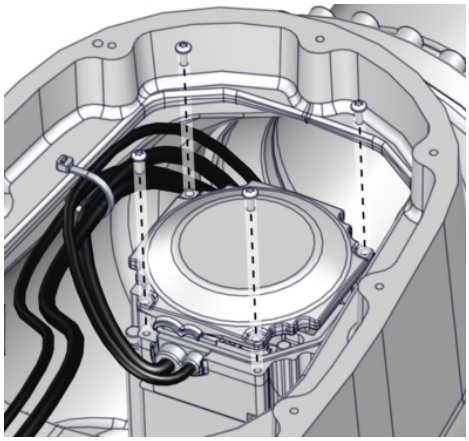
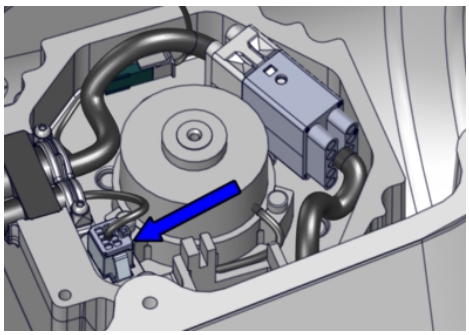
Continued

	Action	Note
2	Unscrew the M4 screw that holds the carrier. **Note** The screw is located at the bottom of the carrier.	 xx1300000485
3	Lift out the axis-6 motor cables by holding the cables with one hand at the motor and the other at the carrier.	 xx1300000666
4	Lift out the carrier from its position.	 xx1300001113

Disconnecting the axis-5 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

	Action	Note
2	Cut the cable tie.	 xx2300001923
3	Remove the motor cover by removing the screws.	 xx2300001924
4	Disconnect the signal cable connector.	 xx2200001734

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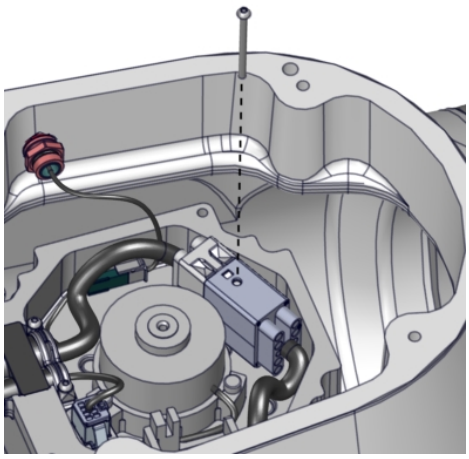
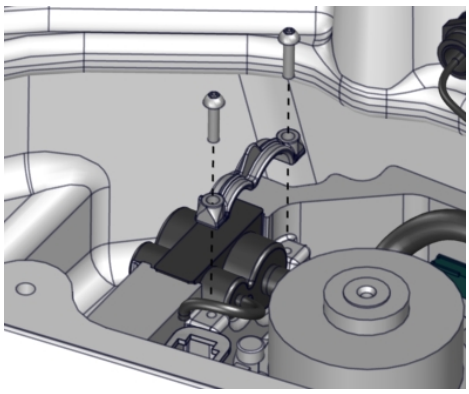
5.8.1 Replacing the wrist

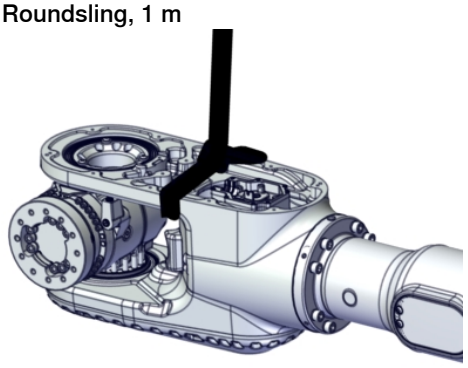
Continued

	Action	Note
5	Disconnect the power cable connector by removing the attachment screw.	 xx2200001733
6	Remove the cable bracket by removing the screws.	 xx2200001735
7	Remove the motor cables.	

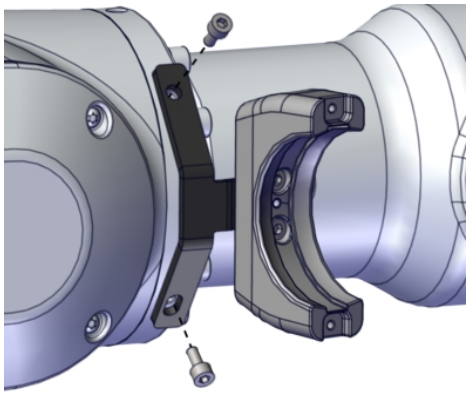
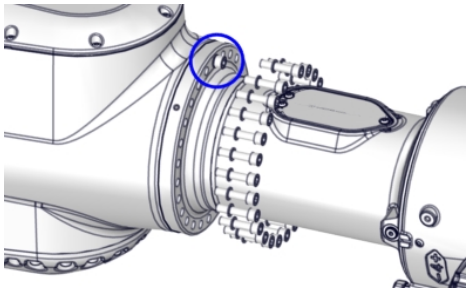
Attaching the lifting accessories to the wrist

	Action	Note
1	**CAUTION** The weight of the wrist is 162 kg / 180 kg (LID) All lifting accessories used must be sized accordingly.	

Continues on next page

	Action	Note
2	Attach a roundsling to the wrist as shown in the figure. **CAUTION** The roundsling placement shown in the figure keeps the wrist balanced when lifted, which reduces risk of damage or injury. Do not attach the roundsling around the axis-5 gearbox!	Roundsling, 1 m  xx2100001290
3	Secure the roundsling to an overhead crane and stretch the roundsling to carry the weight of the wrist.	

Removing the wrist

	Action	Note
1	If used, remove the bracket with the part of the ball joint housing still fitted.	 xx2100002805
2	Remove all attachment screws but leave one.	 xx2300001932

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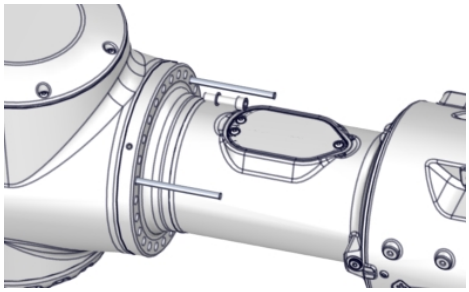
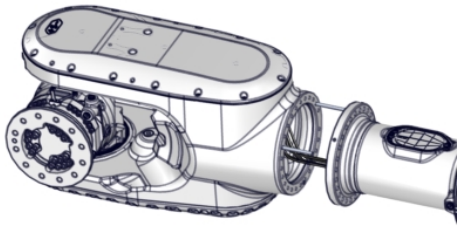
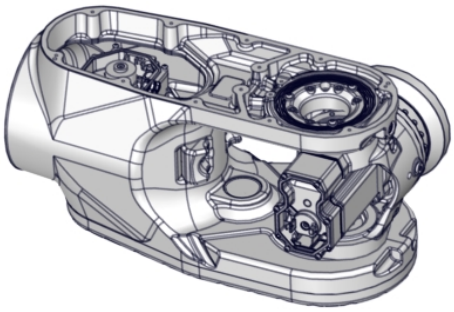
5.8.1 Replacing the wrist
Continued

	Action	Note
3	F it guide pins to the wrist unit	Guide pin, M12x150: 3HAC13056-2
4	Remove the remaining screw.	 xx2300001933
5	Pull out the wrist a bit and bring out the cabling from the wrist unit. **CAUTION** Make sure that the cabling does not get damaged.	Bit holder and hexagon bit SW10 Bit holder dimension: 5/16" (14x18 mm)  xx2300001934
6	Lift away the wrist.	

Refitting the wrist

These procedures describes how to refit the wrist.

Preparations before refitting the wrist

	Action	Note
1	Wipe clean all contact surfaces.	
2	Prepare the new wrist spare part by removing the wrist cover and the motor covers.	 xx2200002149

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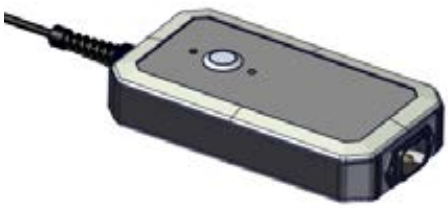
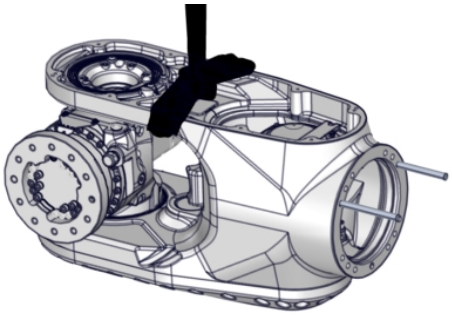
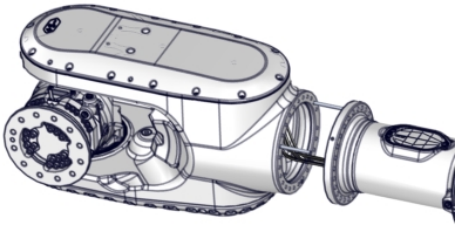
	Action	Note
3	If axis 5 is not already in position +90°, connect the brake release tool, release the brakes and move the axis manually into that position. Release the brakes of the axis-5 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
4	Attach a roundsling and guide pins to the wrist as shown in the figure. **CAUTION** The roundsling placement shown in the figure keeps the wrist balanced when lifted, which reduces risk of damage or injury. Do not attach the roundsling around the axis-5 gearbox!	Roundsling, 1 m: Length: 1 m. Guide pin, M12x150: 3HAC13056-2  xx2300000019

Refitting the wrist

	Action	Note
1	Lift the wrist into mounting position and run the cabling into the wrist housing. Be careful not to damage any part of the cable harness.	
2	Slide the wrist into fitting position.	 xx2300001934

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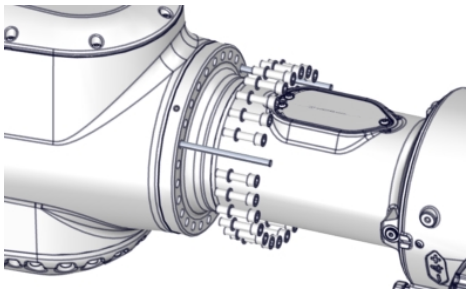
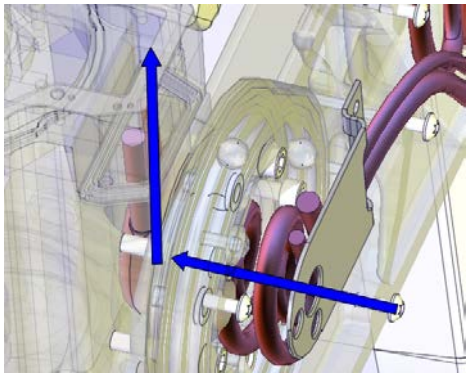
5.8.1 Replacing the wrist

Continued

	Action	Note
3	Fit the attachment screws and washers. Then remove the guide pins and fit the remaining two screws.	Hex socket head cap screw: M12x50 12.9 Gleitmo 603+Geomet 500 Bit holder and hexagon bit SW10 Bit holder dimension: 5/16" (14x18 mm)  xx2400000153
4	Tighten the attachment screws.	Tightening torque: standard torque 120 Nm (*Tightening torque on page 661*).

Inserting the axis-6 motor cables

	Action	Note
1	**Note** Axis 5 must be in position +90° (or as close as possible) for a correct installation of the cable harness in the wrist. If not, connect the brake release tool to the axis-5 motor connector, release the brakes and move axis 5 manually to +90°.	
2	Push the cable harness into the wrist recess and up into the axis-6 motor. **Tip** Moisten the rubber carrier slightly with water or grease around the contact surface, to make it easier to fit into place.	 xx1300000667

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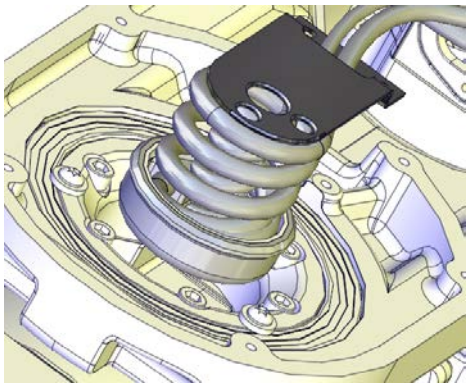
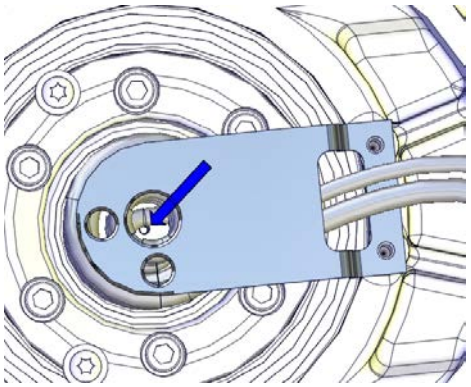
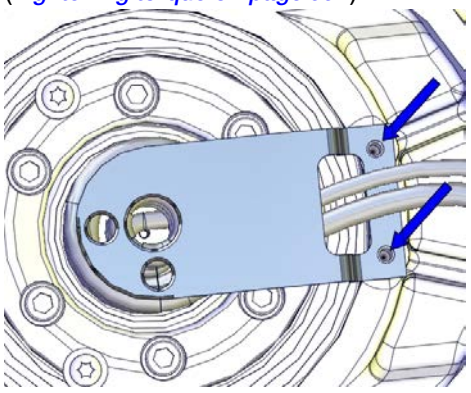
	Action	Note
3	Push the carrier carefully into position.	 xx1300001113
4	Secure the carrier with the M4x10 screw. **Note** The screw is located at the bottom of the carrier. **Tip** The attachment screw securing the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.	 xx1300000485
5	Secure the cable bracket with its attachment screws.	Torx pan head screw: M6x16 A4-80 Tightening torque: standard torque 10 Nm (*Tightening torque on page 661*).  xx1300000484

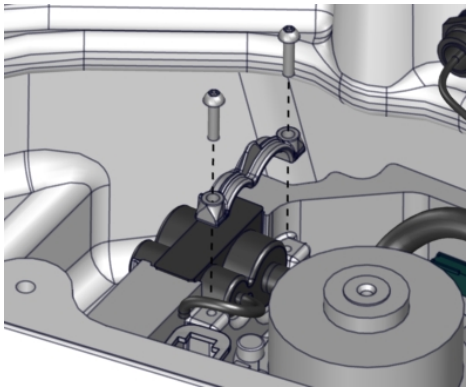
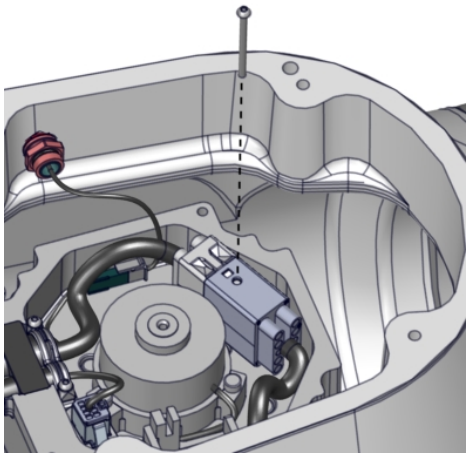
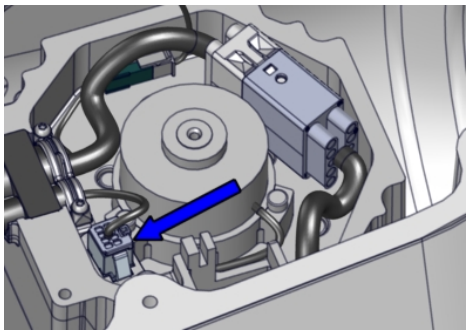
Connecting the axis-5 motor cables

	Action	Note
1	Put the motor cables in place in the opening.	

Continues on next page

5.8.1 Replacing the wrist

Continued

	Action	Note
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001735
3	Connect the power cable connector and secure with a screw. Connect in accordance with the markings on the connectors. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001733
4	Connect the signal cable connector. Connect in accordance with the markings on the connectors.	 xx2200001734

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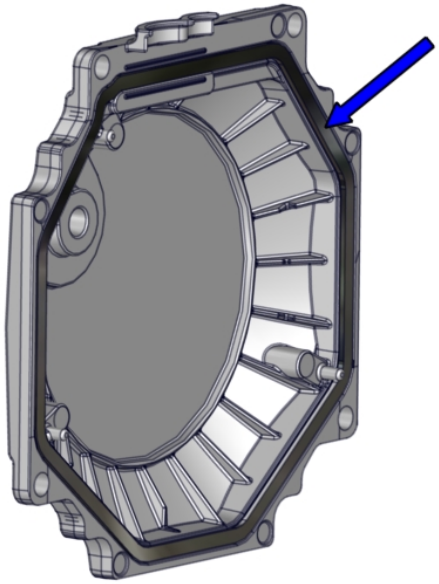
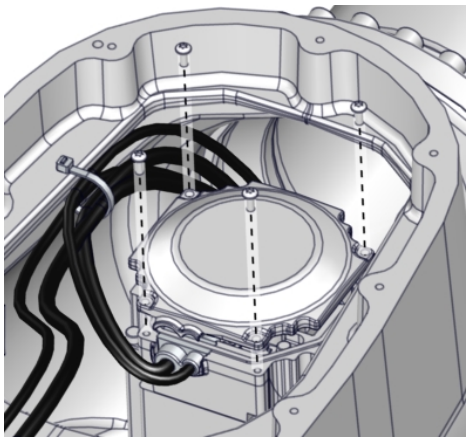
	Action	Note
5	Inspect the gasket. Replace if damaged.	Connection box cover with gasket: 3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)  xx2200002141
6	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
7	Refit the motor cover and the cable protection with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.  xx2300001924

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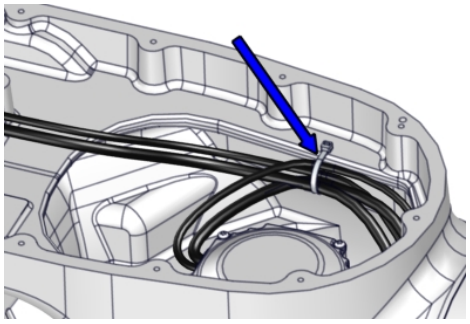
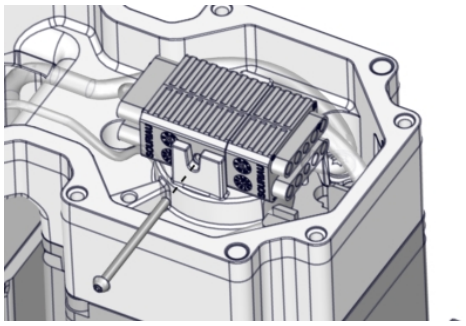
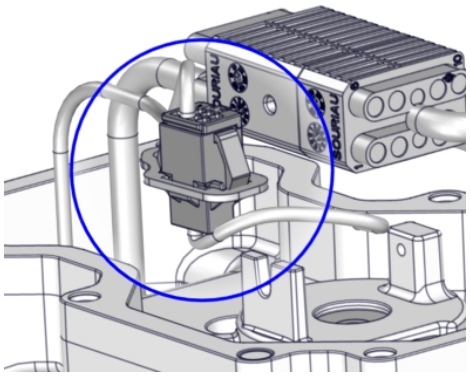
5.8.1 Replacing the wrist

Continued

	Action	Note
8	Secure the cabling with a cable strap.	Cable strap, outdoor: -  xx2300001923

Connecting the axis-6 motor cables

	Action	Note
1	Connect the motor cables. Connect in accordance with the markings on the connectors.	
2	Position the power connector to the bracket with a screw. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001731
3	Snap the signal connectors to each other in the bracket.	 xx2200001921

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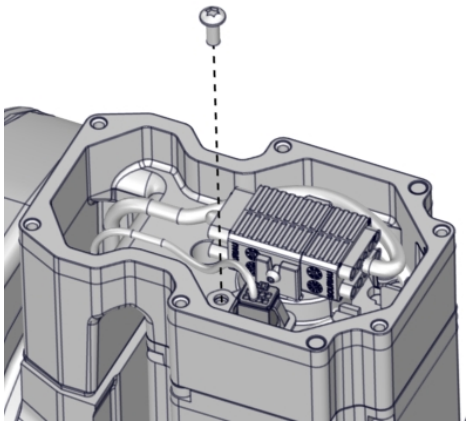
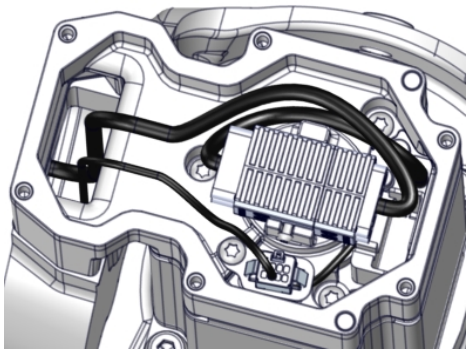
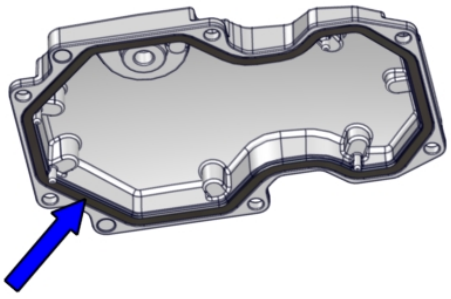
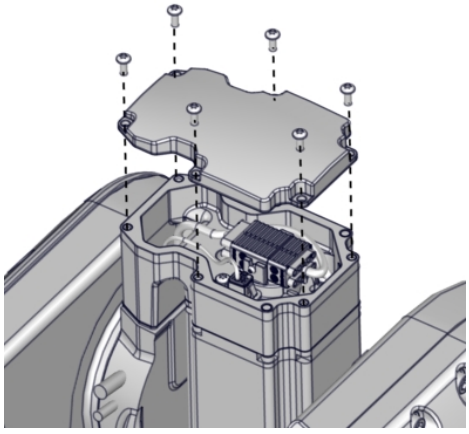
	Action	Note
4	Refit the connector bracket assembly to the motor. **CAUTION** The cabling is sensitive to mechanical damage. Handle it with care to avoid damage to the cabling or the connector, avoid any kind of tilt or skew.	Torx pan head screw: M5x12 Stainless steel A2-70  xx2200001730
5	Verify correct cable layout as shown in the figure. **CAUTION** Route the signal cabling correctly to avoid cable damage.	 xx2300000920
6	Inspect the gasket. Replace if damaged.	Connection box cover with gasket: 3HAC079381-003 (Graphite White) 3HAC079381-004 (ABB Orange)  xx2200001922
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	

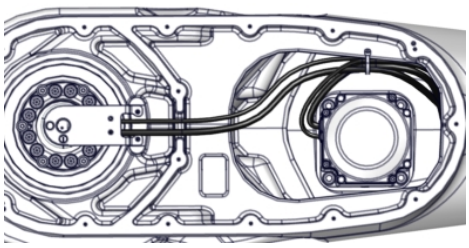
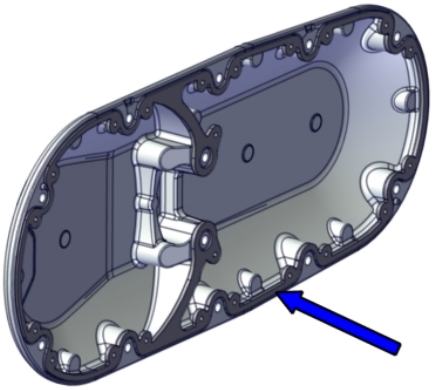
Continues on next page

5.8.1 Replacing the wrist

Continued

	Action	Note
8	Refit the motor cover.	Torx pan head screw, M5x12 Stainless steel A2-70, 6 pcs Tightening torque: 6 Nm.  xx2200001434

Refitting the wrist cover

	Action	Note
1	Make sure that the cable harness is routed and secured as shown in the figure.	 xx2300001927
2	*Foundry Plus:* Inspect the gasket. Replace if damaged.	Gasket: 3HAC085052-001  xx2100001407

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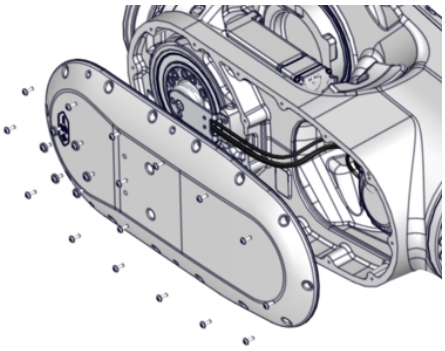
	Action	Note
3	Refit the wrist cover and secure with screws. *Foundry Plus:* Fit all the screws first, then torque tighten them twice to achieve correct torque (due to compression from the gasket).	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2300001883

Concluding procedure

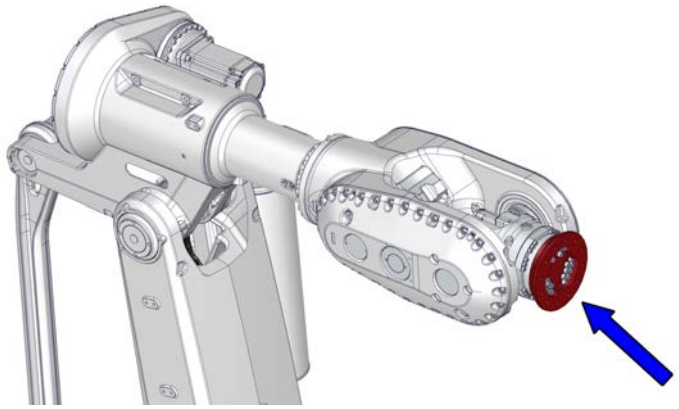
	Action	Note
1	*Foundry Plus:* Refit protection plugs.	
2	If used, refit the DressPack cable package on the wrist.	See product manual for the DressPack.
3	Calibrate the robot.	See *Calibration on page 619*.
4	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.8.2 Replacing the turning disc

Location of the turning disc

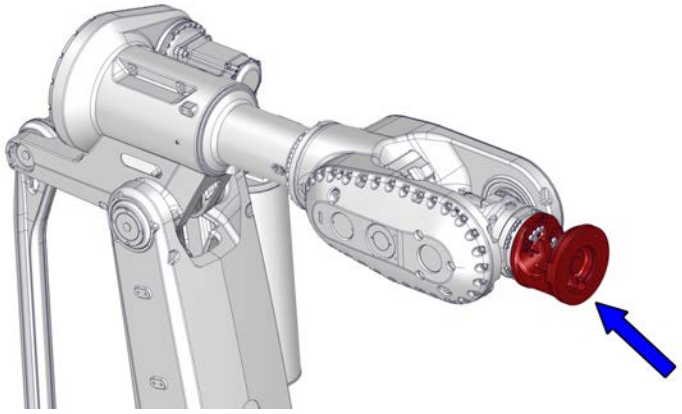
The turning disc is located as shown in the figure.

IRB 7710-500/2.85, IRB 7710-430/3.1, IRB 7710-360/3.3, IRB 7710-310/3.5:



xx2400000165

IRB 7710-400/2.85 LID, IRB 7710-390/3.1 LID, IRB 7710-325/3.3 LID, IRB 7710-280/3.5 LID:



xx2400000166

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Turning disc	3HAC085063-002	**IRB 7710-500/2.85** **IRB 7710-430/3.1** **IRB 7710-360/3.3** **IRB 7710-310/3.5**	L2

Continues on next page

Spare part	Article number	Note	Level
Process turning disc	3HAC084761-004	**IRB 7710-400/2.85 LID** **IRB 7710-390/3.1 LID** **IRB 7710-325/3.3 LID** **IRB 7710-280/3.5 LID**	L2

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

	Action	Note
1	Decide which calibration routine to use for calibrating the robot. • Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot. • Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.	
	If the robot is to be calibrated with reference calibration: Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in *Reference calibration routine on page 628*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Removing the turning disc

Use these procedures to remove the turning disc.

Preparations before removing the turning disc

	Action	Note
1	Run the robot to a position most comfortable for the removal of the turning disc. Jog axis 6 to synchronization position.	

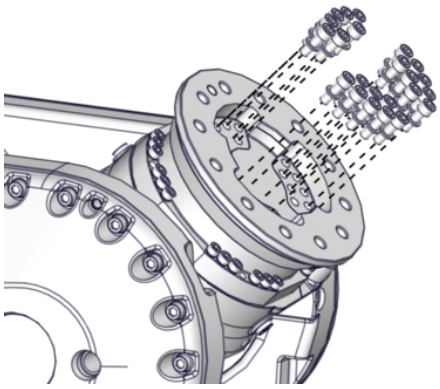
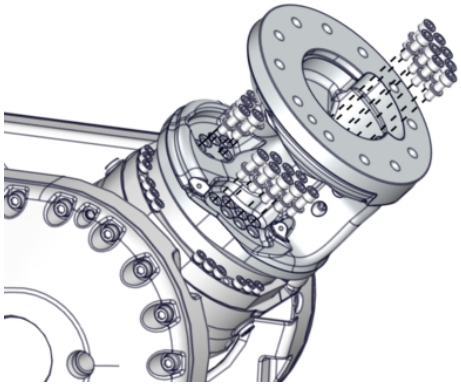
Continues on next page

5.8.2 Replacing the turning disc

Continued

	Action	Note
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Remove any equipment fitted to the turning disc.	

Removing the turning disc

	Action	Note
1	Remove the screws and washers, that secure the turning disc.	IRB 7710-500/2.85 IRB 7710-430/3.1 IRB 7710-360/3.3 IRB 7710-310/3.5:  xx2400000167 IRB 7710-400/2.85 LID IRB 7710-390/3.1 LID IRB 7710-325/3.3 LID IRB 7710-280/3.5 LID:  xx2400000172

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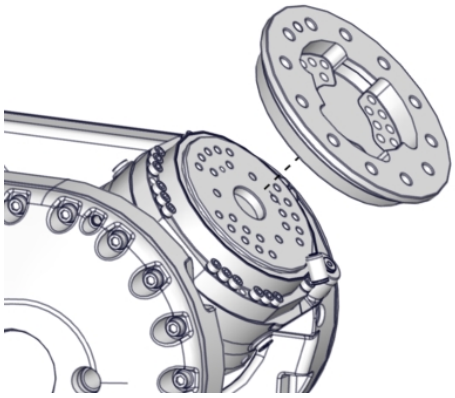
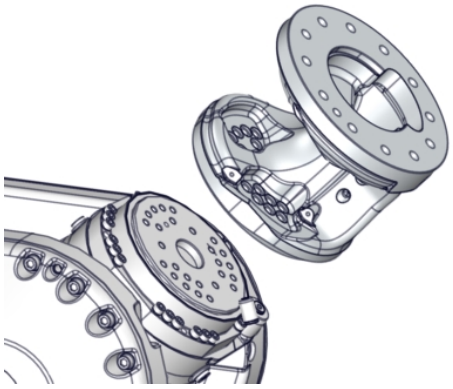
	Action	Note
2	Remove the turning disc.	IRB 7710-500/2.85 IRB 7710-430/3.1 IRB 7710-360/3.3 IRB 7710-310/3.5:  xx2400000174 IRB 7710-400/2.85 LID IRB 7710-390/3.1 LID IRB 7710-325/3.3 LID IRB 7710-280/3.5 LID:  xx2400000176

Refitting the turning disc

Use these procedures to refit the turning disc.

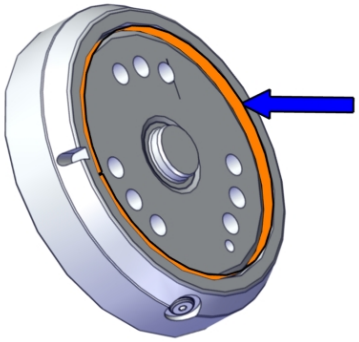
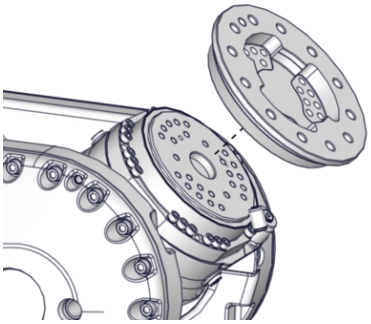
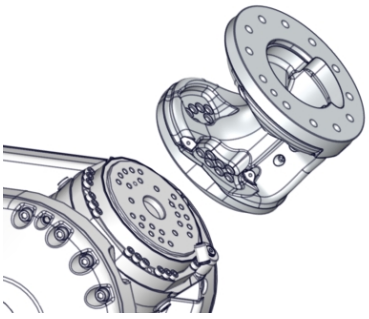
Refitting the turning disc

	Action	Note
1	Wipe clean the contact surfaces.	

Continues on next page

5.8.2 Replacing the turning disc

Continued

	Action	Note
2	*Protection type Foundry Plus*: Apply rust preventive to the surface shown in the figure.	Rust preventive: 3HAC034903-001 (Mercasol 3110 Waxcoat. Recommended drying time is 24h.)  xx2100002232
3	Fit the turning disc to the wrist. Orient the disc according to the synchronization marks.	IRB 7710-500/2.85 IRB 7710-430/3.1 IRB 7710-360/3.3 IRB 7710-310/3.5:  xx2400000174 IRB 7710-400/2.85 LID IRB 7710-390/3.1 LID IRB 7710-325/3.3 LID IRB 7710-280/3.5 LID:  xx2400000176

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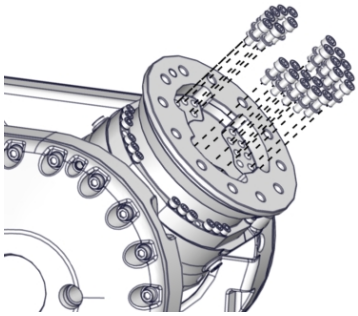
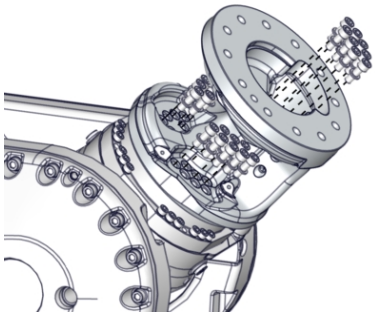
	Action	Note
4	Secure the turning disc with its attachment screws and washers.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 Washers: 3HAB4233-1 Tightening torque: standard torque 70 Nm (*Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws on page 662*).. IRB 7710-500/2.85 IRB 7710-430/3.1 IRB 7710-360/3.3 IRB 7710-310/3.5:  xx2400000167 IRB 7710-400/2.85 LID IRB 7710-390/3.1 LID IRB 7710-325/3.3 LID IRB 7710-280/3.5 LID:  xx2400000172

Concluding procedure

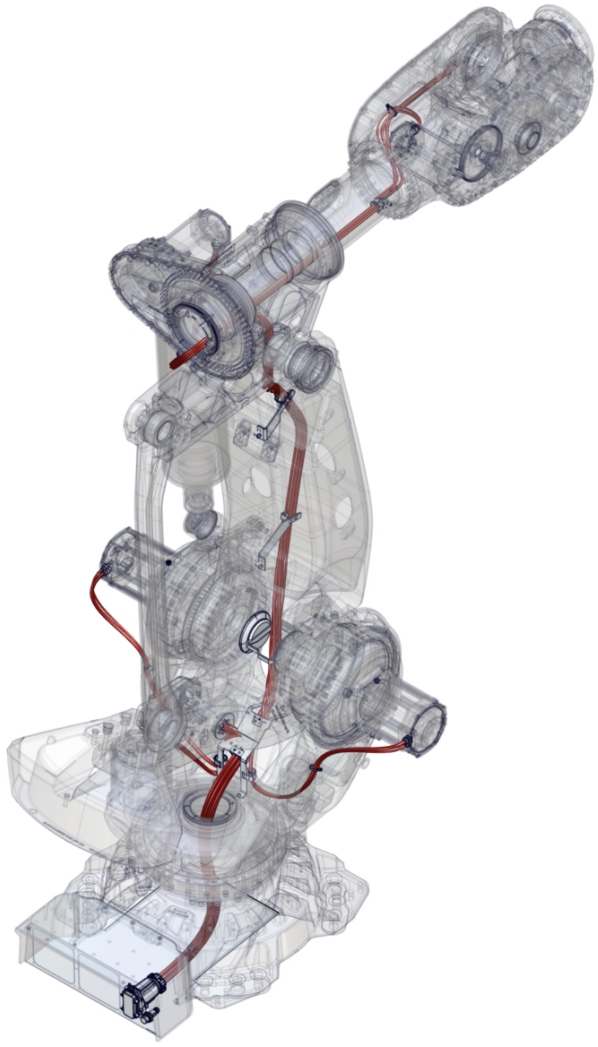
	Action	Note
1	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.9 Electronic parts

5.9.1 Removing the cable harness

Location of the cable harness

The cable harness is located as shown in the figure.



xx2300001882

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

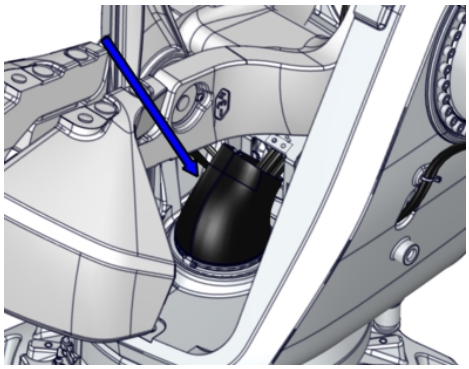
Spare part	Article number	Note	Level
Cable harness	3HAC084561-001		L2

Continues on next page

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Preparations before removing the cable harness

	Action	Note
1	Jog the robot to the calibration position.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	*Protection type Foundry Plus* Remove the axis-1 cable protection.	 xx2300001954

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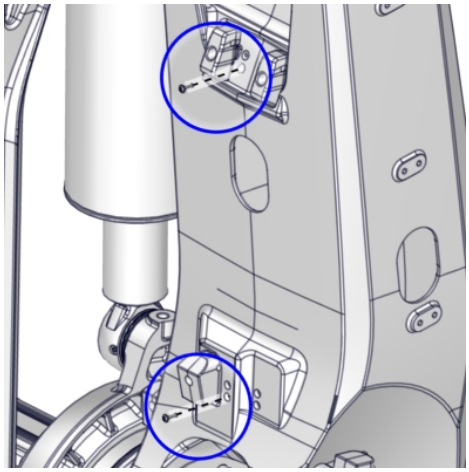
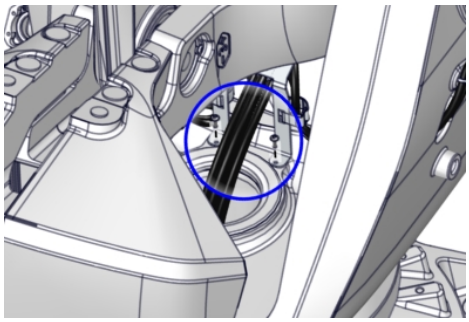
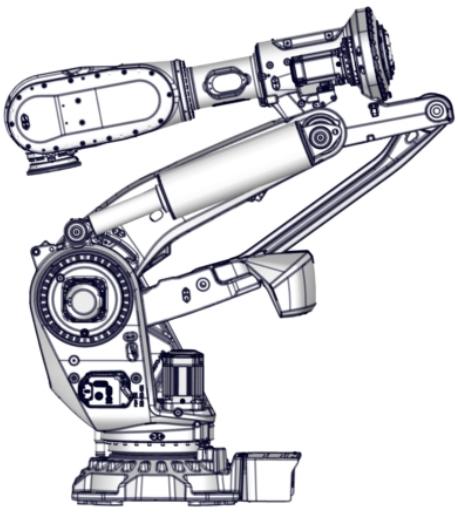
5.9.1 Removing the cable harness

Continued

	Action	Note
4	Loosen the cable brackets on the back of the lower arm and inside the frame, by removing the screws. The space is cramped after the robot is jogged into working position. Use a bit extender on the lower arm cable bracket screws.	Bit extender  xx2300001951  xx2300001950
5	Turn on the power to the robot again.	
6	Jog the robot into position: • Axis 1: 0° • Axis 2: comfortable working position • Axis 3: comfortable working position • Axis 4: 0° • Axis 5: +90° • Axis 6: no significance. **Note** The specified position is a recommended position. Orient axis-5 as close as possible to +90° to be able to open the axis-6 motor cover and to remove the axis-6 motor cables. The axis-5 position is also important to avoid the spiral of the cable harness in the carrier being unwound or placed in wrong position. Depending on what tool is used, the other axes may need to be jogged to another position.	 xx2300001952

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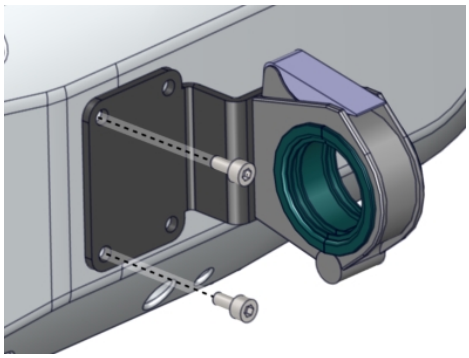
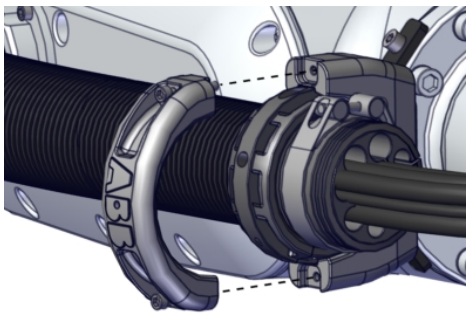
	Action	Note
7	**Note** If only the manipulator harness shall be removed, the DressPack cable package can stay fitted on the process turning disk.	

Removing the cable harness - upper arm and wrist

These procedures describe how to remove the cable harness in the upper arm and wrist.

Retrieving access to the wrist cabling

Use this procedure to remove the wrist cover.

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	If DressPack MH3 is installed: Remove the wrist bracket with the complete ball joint housing still fitted, if the bracket is installed over the two wrist cover screws. **Note** No need to remove the bracket if the two wrist cover screws are accessible.	 xx2300001366
3	If DressPack is installed: Open the ball joint housing on the arm tube and remove the DressPack cable package.	 xx2100002709

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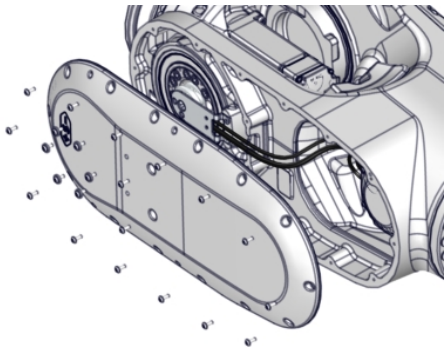
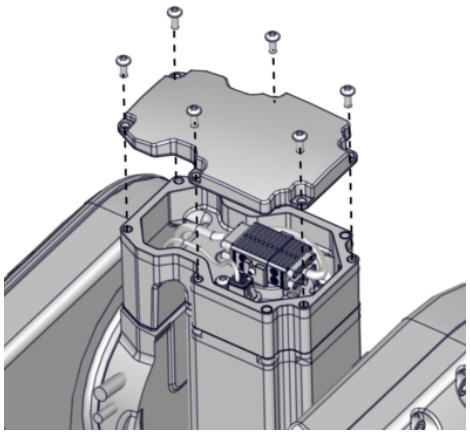
5.9.1 Removing the cable harness

Continued

	Action	Note
4	Remove the wrist cover.	 xx2300001883

Disconnecting the axis-6 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws and remove the motor cover.	 xx2200001434

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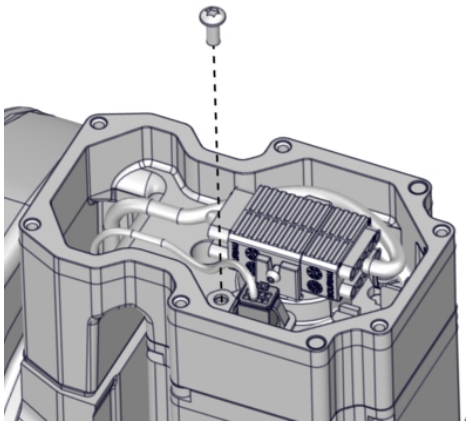
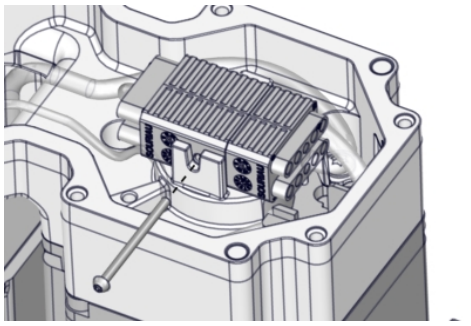
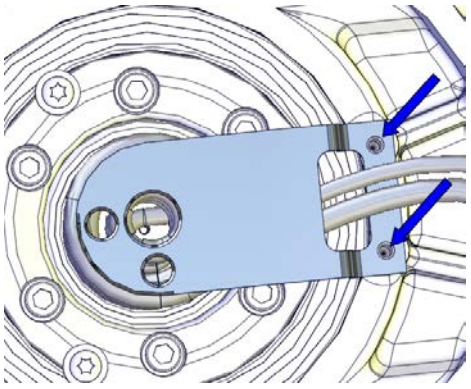
	Action	Note
3	Remove the connector bracket.	 xx2200001730
4	Remove the connector screw.	 xx2200001731
5	Disconnect the motor cables.	

Pushing out the axis-6 motor cables

	Action	Note
1	Unscrew the attachment screws that hold the cable bracket.	 xx1300000484

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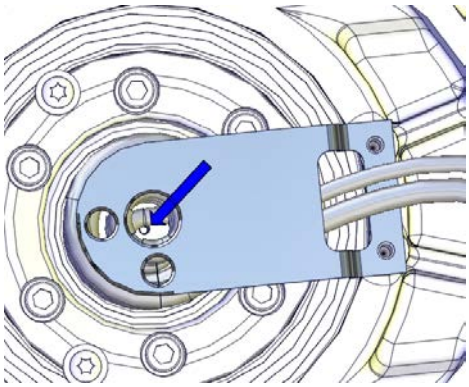
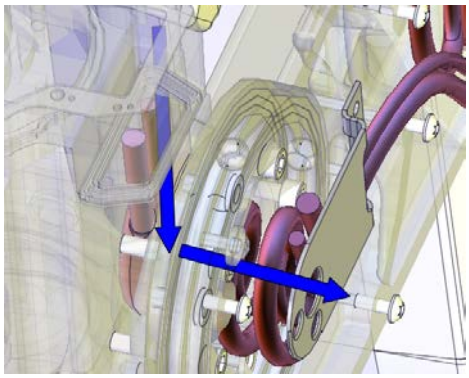
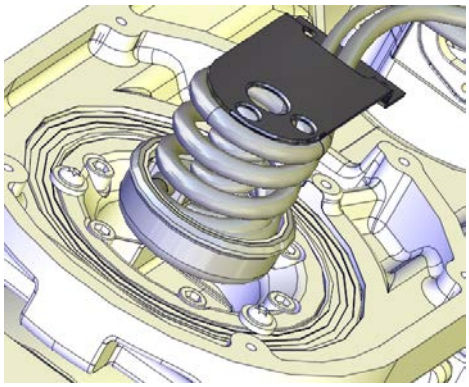
5.9.1 Removing the cable harness
Continued

	Action	Note
2	Unscrew the M4 screw that holds the carrier. **Note** The screw is located at the bottom of the carrier.	 xx1300000485
3	Lift out the axis-6 motor cables by holding the cables with one hand at the motor and the other at the carrier.	 xx1300000666
4	Lift out the carrier from its position.	 xx1300001113

Disconnecting the axis-5 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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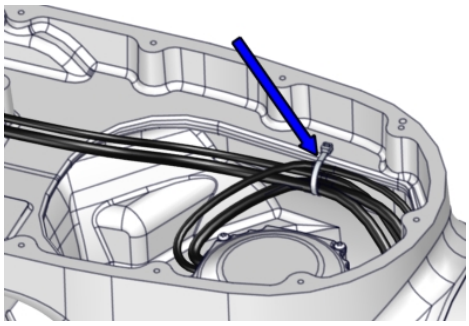
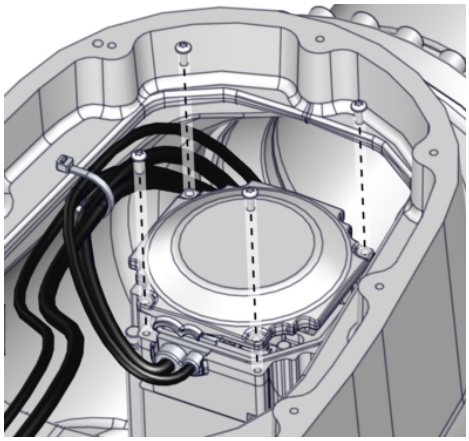
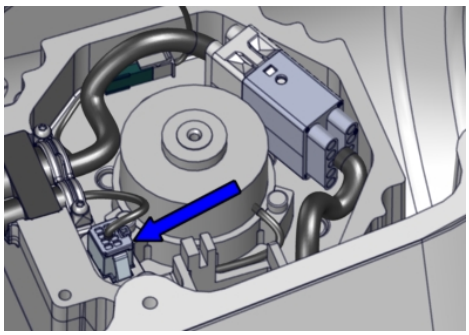
	Action	Note
2	Cut the cable tie.	 xx2300001923
3	Remove the motor cover by removing the screws.	 xx2300001924
4	Disconnect the signal cable connector.	 xx2200001734

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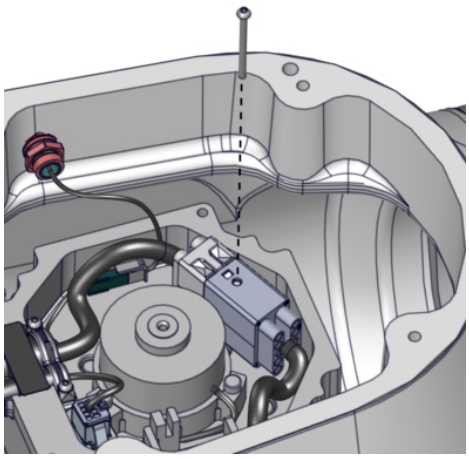
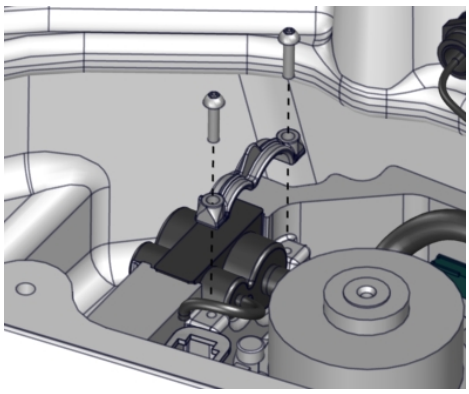
5.9.1 Removing the cable harness

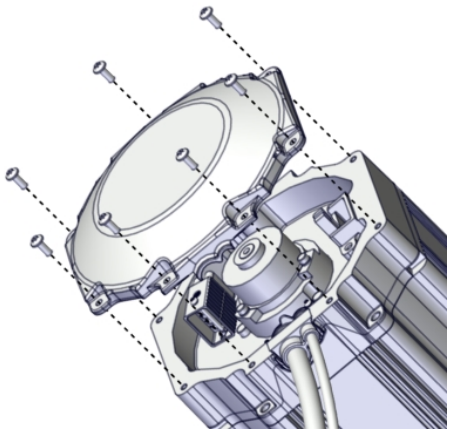
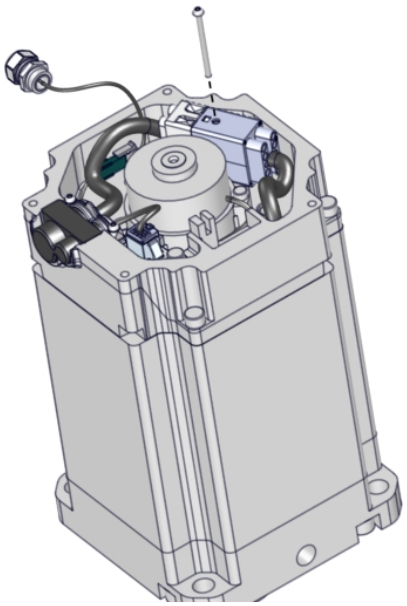
Continued

	Action	Note
5	Disconnect the power cable connector by removing the attachment screw.	 xx2200001733
6	Remove the cable bracket by removing the screws.	 xx2200001735
7	Remove the motor cables.	

Disconnecting the axis-4 motor cable

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

	Action	Note
2	Remove the motor cover by removing the screws.	 xx2100000596
3	Disconnect the power cable connector by first removing the attachment screw and then parting the connector.	 xx2200001736

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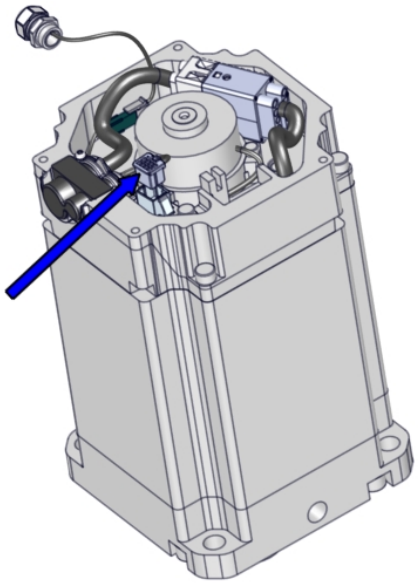
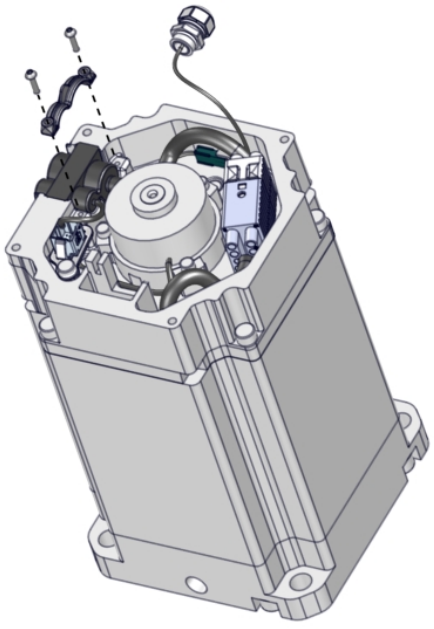
5.9.1 Removing the cable harness

Continued

	Action	Note
4	Disconnect the signal cable connector by pulling it out.	 xx2200001737
5	Remove the cable bracket by removing the screws.	 xx2200001738
6	Remove the motor cables from the motor.	

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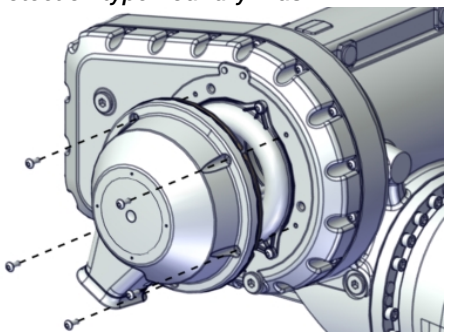
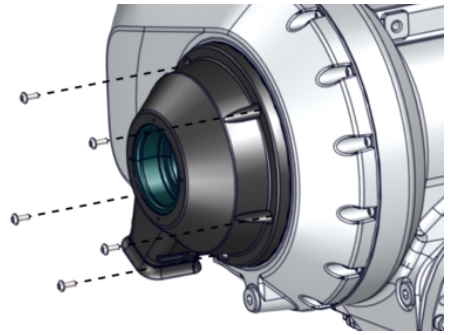
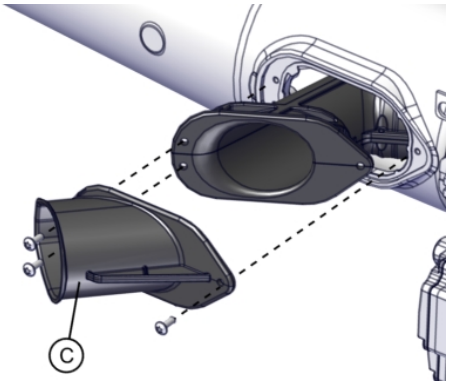
Removing the cable harness from the wrist and upper arm

	Action	Note
1	*Foundry Plus*, *DressPack:* Remove the back cover. **Note** Use caution not to damage the gasket.	*Protection type Foundry Plus:*  xx2000000422 *DressPack*  xx2300001040
2	*DressPack* Loosen the insert. (Cable guard (C) is available for protection type Foundry Plus.)	 xx2100002677

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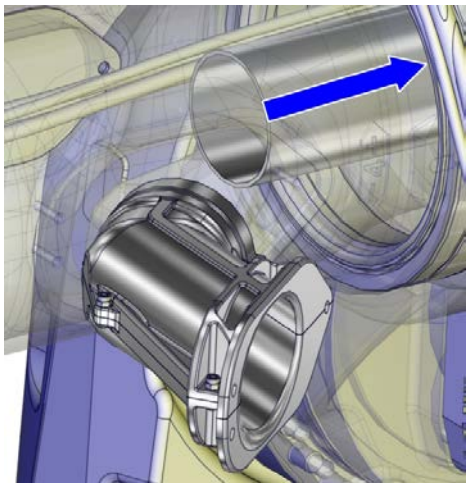
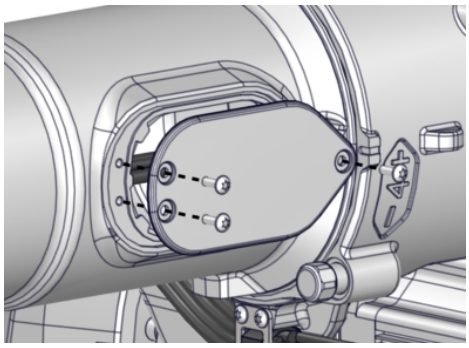
5.9.1 Removing the cable harness

Continued

	Action	Note
3	*DressPack* Push the DressPack tube a little backwards.	 xx1400000720
4	**Tip** Use tape and tie the axis-5 and axis-6 connectors and carrier into a bundle (if not already done). This is done to facilitate the removal and to avoid damaging the parts. This will also make it easier to run the cable harness through the inside of the upper arm.	 xx1300000668
5	Remove the side cover on the arm tube.	 xx2300000031

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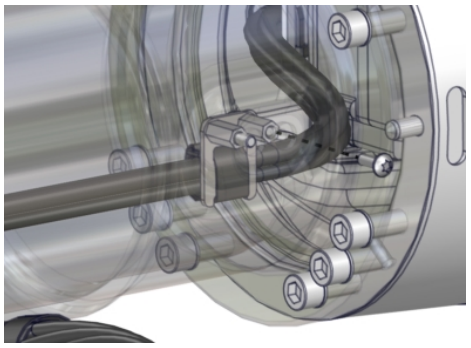
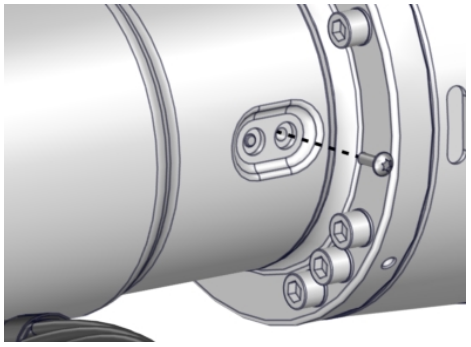
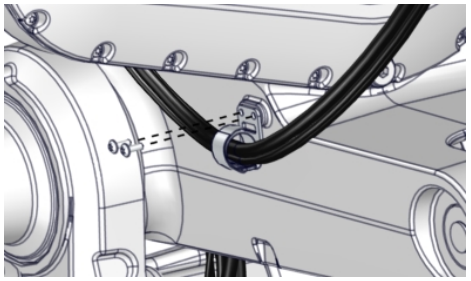
	Action	Note
6	Unscrew the attachment screw that secures the axis-4 metal clamp inside the arm tube. **Note** The screw is reached from outside the upper arm.	 xx2300000033  xx2300000032
7	Remove the arm house metal clamp.	 xx2300002013

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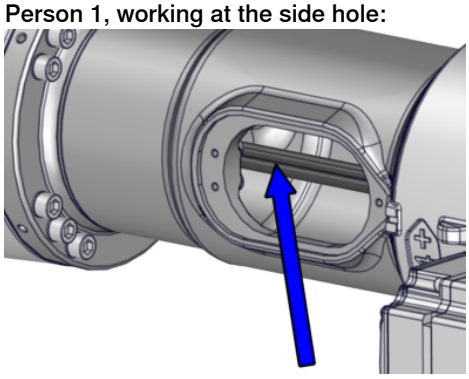
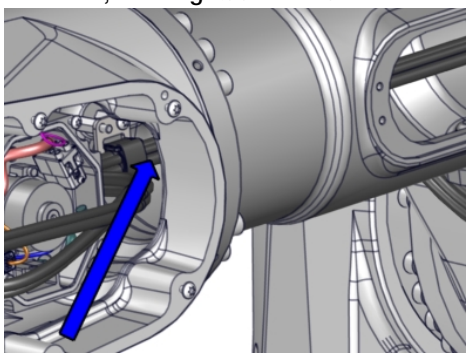
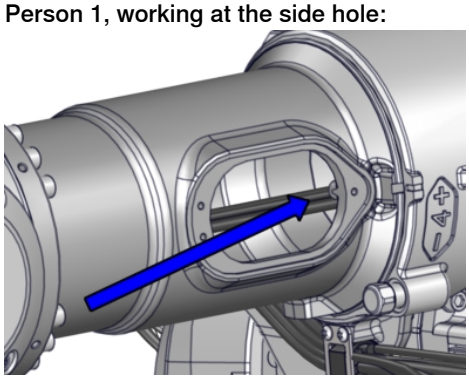
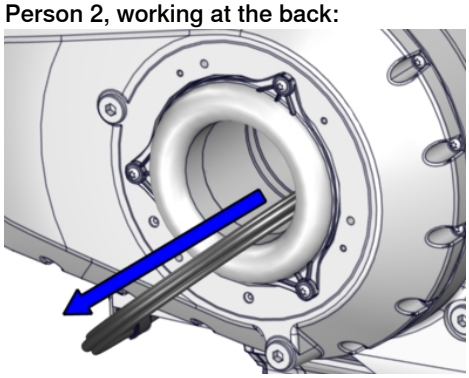
5.9.1 Removing the cable harness

Continued

	Action	Note
8	Remove the cable harness out from the wrist. **Tip** This step is best performed by two persons working together: • Person 1: Put one hand inside the side hole and take a hold of the cable harness. • Person 2: Take a hold on the cable harness inside the wrist. • Together: Move the cable harness past the axis-5 motor and into the arm tube.	Person 1, working at the side hole:  xx2300000035 Person 2, working at the wrist:  xx2300000036
9	Remove the cable harness out of the arm tube, at the back of the upper arm. **Tip** This step is best performed by two persons working together: • Person 1: Put one hand inside the side hole and take a hold of the cable harness. • Person 2: Take a hold on the cable harness at the back of the robot. • Together: Move the cable harness out of the arm tube. **Note** To be able to remove the cable harness with the DressPack tube fitted, the tube needs to be pulled out a little, then be placed on the lower left side in the arm tube and the bracket of the cable harness then needs to be placed on the upper right hand side.	Person 1, working at the side hole:  xx2300000037 Person 2, working at the back:  xx2300000038

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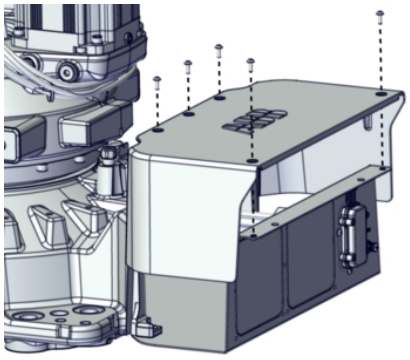
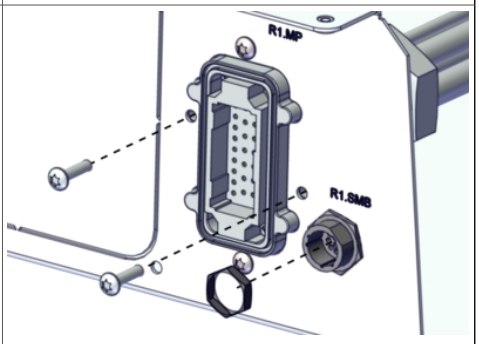
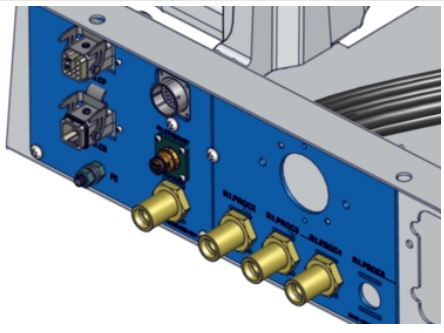
Removing the cable harness - base, frame and lower arm

These procedures describes how to remove the cable harness from base, frame and lower arm.

Preparations before removing the cable harness in the base

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the base cover.	 xx2100000981
3	Loosen the connectors: • R1.MP • R1.SMB	 xx2100001109
4	If used, disconnect the DressPack hoses in the base.	 xx2300001093

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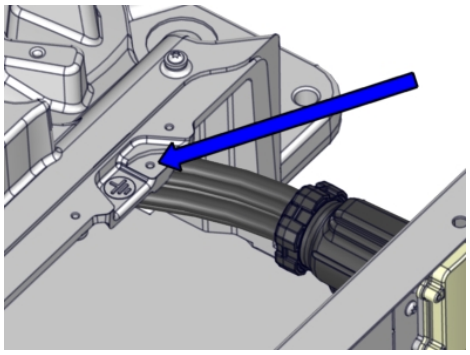
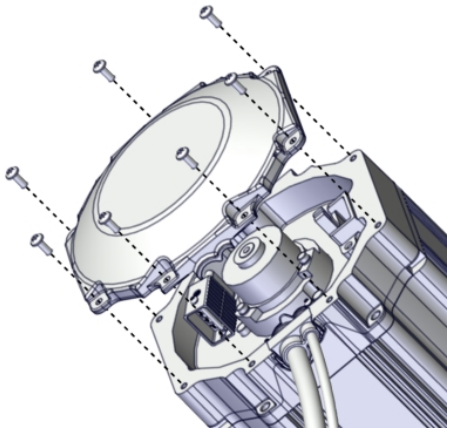
5.9.1 Removing the cable harness
Continued

	Action	Note
5	Disconnect the earth cable.	 xx2200001790

Disconnecting the axis-1, axis-2 and axis-3 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the motor cover by removing the screws.	 xx2100000596

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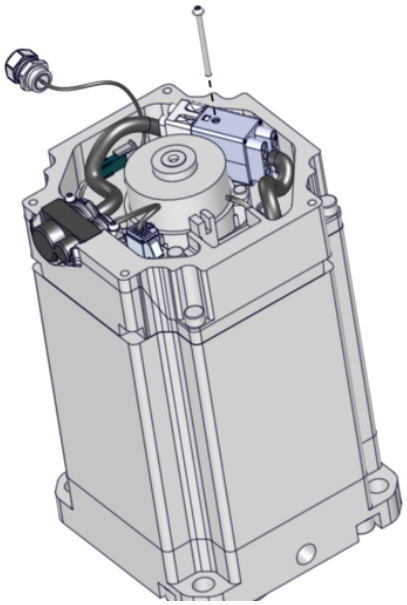
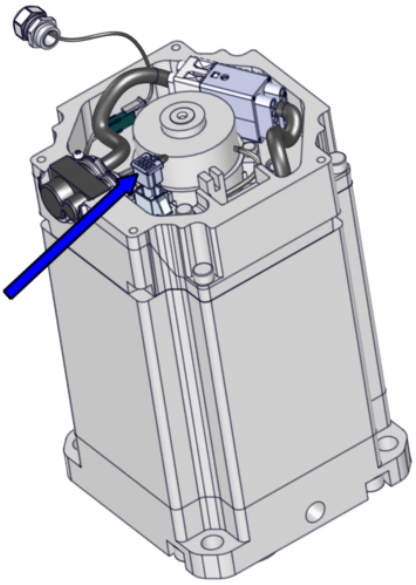
	Action	Note
3	Disconnect the power cable connector by first removing the attachment screw and then parting the connector.	 xx2200001736
4	Disconnect the signal cable connector by pulling it out.	 xx2200001737

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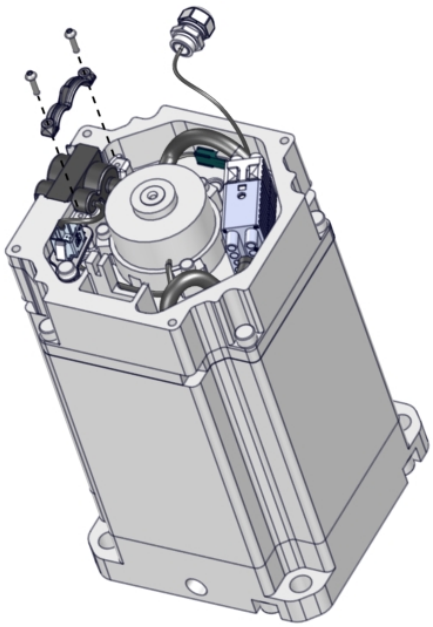
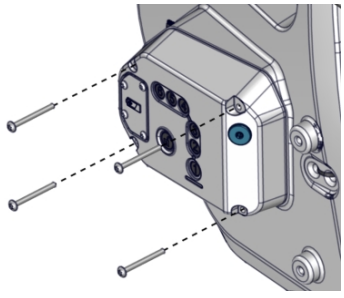
5.9.1 Removing the cable harness
Continued

	Action	Note
5	Remove the cable bracket by removing the screws.	 xx2200001738
6	Remove the motor cables from the motor.	

Removing the electronic box

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
3	Remove the electronic box screws.	 xx2200001721

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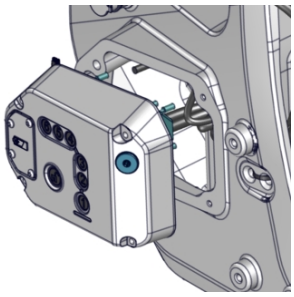
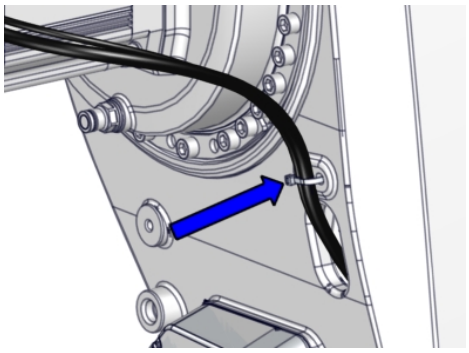
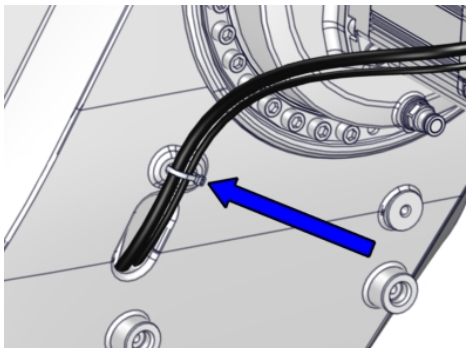
	Action	Note
4	Remove the electronic box, including all internal equipment. **CAUTION** Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.	 xx2200001720

Disconnecting the SMB and brake release units

	Action	Note
1	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
2	Disconnect all connectors from the SMB board.	
3	Disconnect the connectors R2.BU1 and R2.BU2 from the brake release board.	

Removing the cable harness from the frame

	Action	Note
1	Cut the cable ties at the frame.	 xx2300002016  xx2400000191

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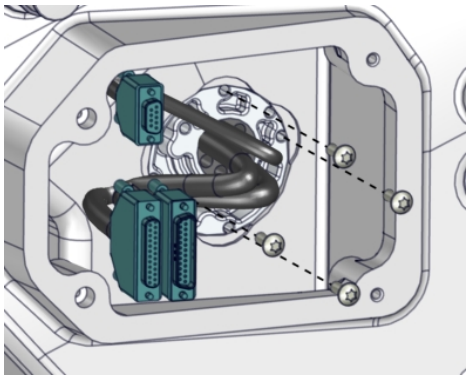
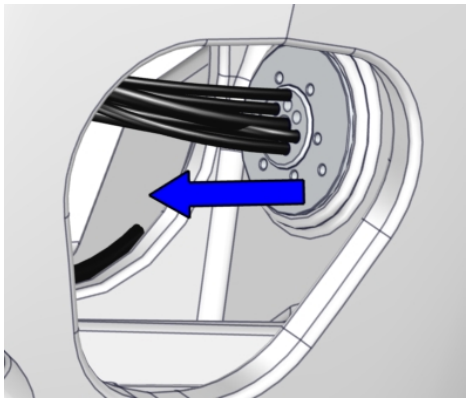
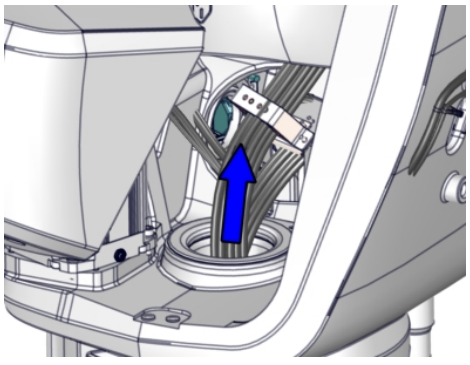
5.9.1 Removing the cable harness
Continued

	Action	Note
2	Remove the cable inlet screws inside the SMB recess	 xx2200001725
3	Loosen the cable inlet by cutting any sealing compound and carefully knocking the inlet loose.	 xx2300002015

Removing the cable harness from the base

	Action	Note
1	If equipped with DressPack, pull out the DressPack cables through the protection tube.	 xx2400000192

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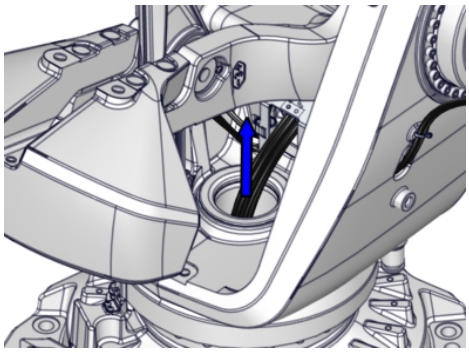
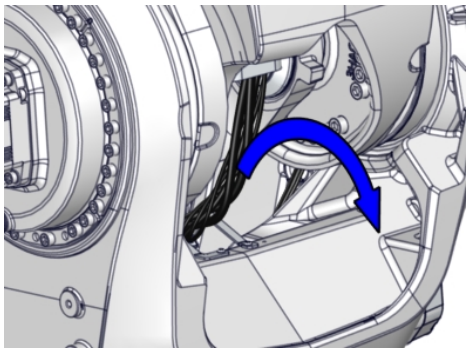
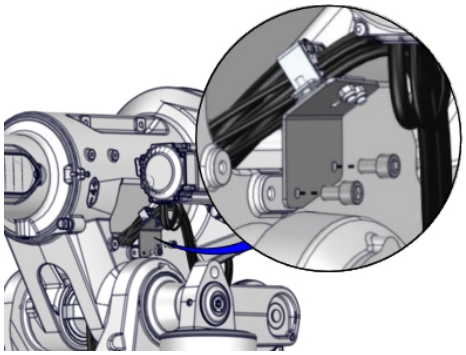
	Action	Note
2	Pull up the robot cable harness through the protection tube and out through the frame recess. Guide the SMB cables out from the SMB recess at the same time.	 xx2300001944  xx2300002017
3	Place the cable harness safely on the floor.	

Removing the cable harness from the lower arm

	Action	Note
1	Remove the cable bracket from the arm house.	 xx2300001953

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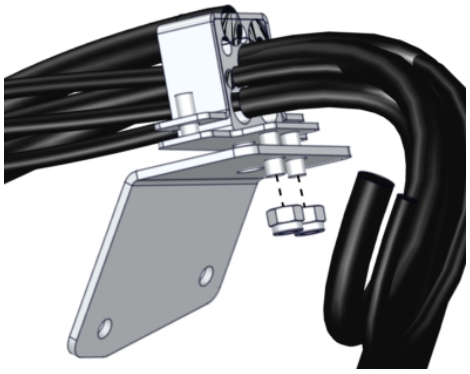
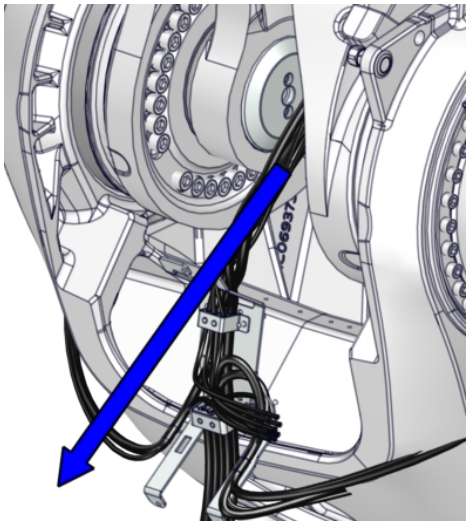
5.9.1 Removing the cable harness

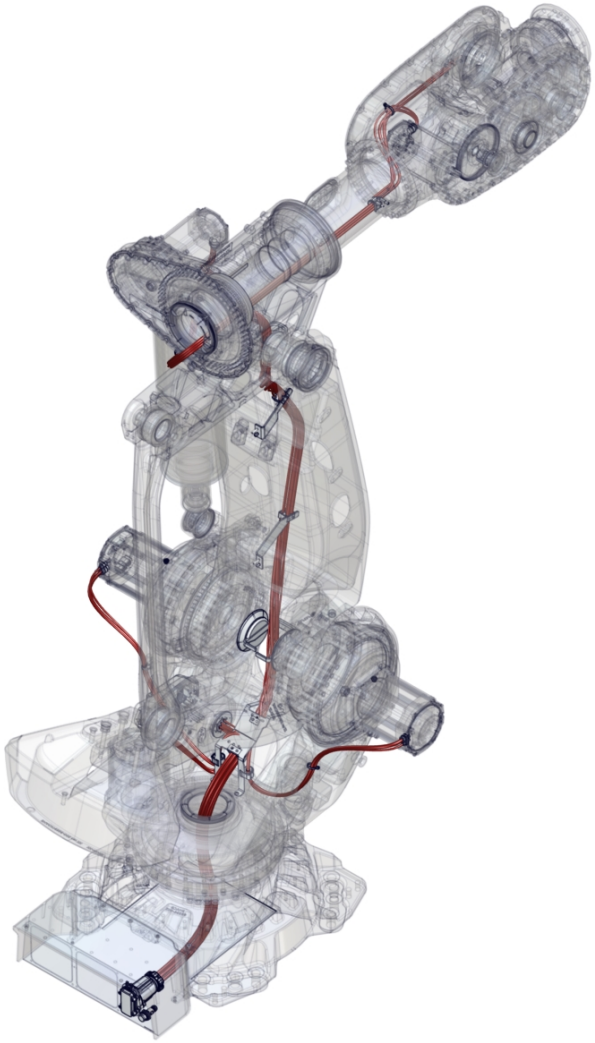
Continued

	Action	Note
2	Remove the cable bracket from the harness cable clamp.	 xx2300002039
3	Use caution and pull the cable harness out from the lower arm. **Tip** This step is best performed by two persons working together: • Person 1: From the front of the robot, pull the cable harness out from the lower arm. • Person 2: From the back of the robot, push the cable harness down through the lower arm. • Together: Move the cable harness out of the lower arm.	 xx2300002040

5.9.2 Refitting the cable harness

Location of the cable harness

The cable harness is located as shown in the figure.



xx2300001882

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Cable harness	3HAC084561-001		L2

Continues on next page

5.9.2 Refitting the cable harness
Continued

Required service parts

Consumable	Article number	Note
Connection box cover FS180 with gasket	3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection)	Replace if damaged. On axis-1 motor A threaded connection is required for cooling fan option.
Connection box cover FS180 with gasket	3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection)	Replace if damaged. On axis-2 motor A threaded connection is required for cooling fan option.
Connection box cover FS180 with gasket	3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection)	Replace if damaged. On axis-3 motor A threaded connection is required for cooling fan option.
Connection box cover FS130 with gasket	3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)	Replace if damaged. On axis-4 motor
Connection box cover with gasket	3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)	Replace if damaged. On axis-5 motor
Connection box cover with gasket	3HAC079381-003 (Graphite White) 3HAC079381-004 (ABB Orange)	Replace if damaged. On axis-6 motor
Wrist cover	3HAC085026-002 (Graphite White) 3HAC085026-003 (ABB Orange)	Replace if damaged.
Cover, electronics	3HAC081189-003 (Graphite White) 3HAC081189-004 (ABB Orange)	Includes gasket. Replace if damaged.
Cable strap, outdoor	-	
Metal strap	3HAC033886-001	

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Consumable	Article number	Note
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)
Sealing compound	3HAC026759-002	Sikaflex 521 FC

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Refitting the cable harness - base, frame and lower arm

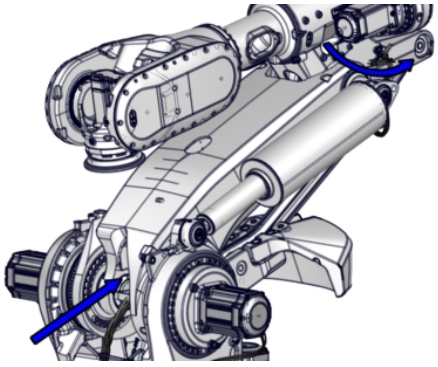
These procedures describes how to refit the cable harness in base, frame and lower arm.

Preparations before refitting the cable harness

Use this procedure to understand the layout of the new cable harness spare part.

	Action	Note
1	Lay the new cable harness on the floor, and place the lower part around the manipulator to understand the layout.	

Refitting the cable harness in the lower arm

	Action	Note
1	**Tip** Use tape and tie the axis-5 and axis-6 connectors and carrier into a bundle (if not already done). This is done to facilitate the procedure and to avoid damaging the parts during the procedure. This will also make it easier to run the cable harness through the inside of the robot.	 xx1300000668
2	Run the upper part of the cable harness through the lower arm. **Tip** This step is best performed by two persons working together: • Person 1: From the front of the robot, push the cable harness up into the lower arm. • Person 2: From the back of the robot, pull the cable harness up through the lower arm and out through the arm house.	 xx2400000193

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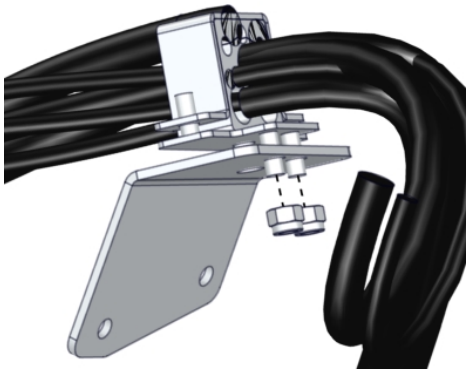
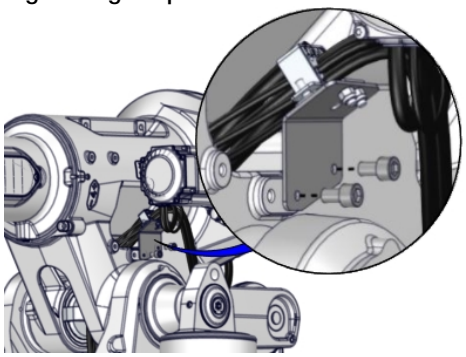
5.9.2 Refitting the cable harness
Continued

	Action	Note
3	Refit the cable bracket to the harness cable clamp.	 xx2300002039
4	Refit the cable bracket assembly to the arm house.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2300001953

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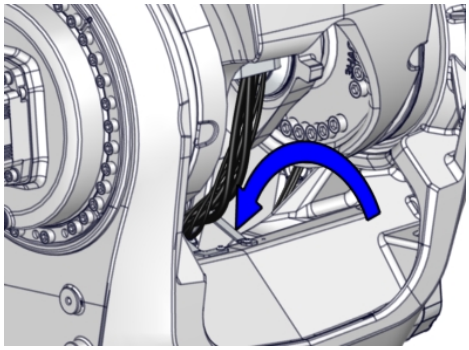
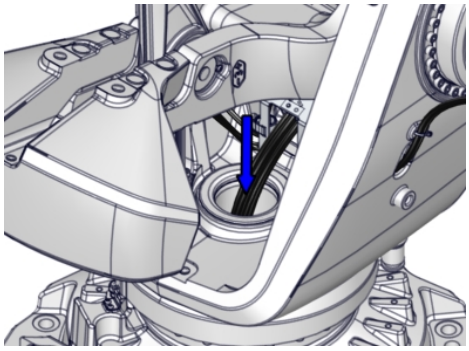
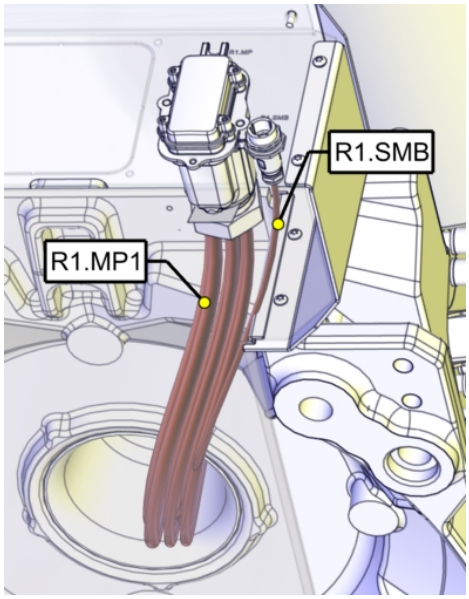
Refitting the cable harness in the base

	Action	Note
1	Run the robot cable harness through the frame recess and down through the protection tube. Guide the SMB cables into the SMB recess at the same time.	 xx2400000194  xx2400000195
2	Run the cabling through the base. • Make sure that the cables are not twisted. Each cable must be in line with its position on the base plate. • Make sure that the R1.SMB cable will run on the correct side of the R1.MP1, see the figure.	 xx1300000736
3	Make sure that the markings on the cables are facing the base cover, when connected.	

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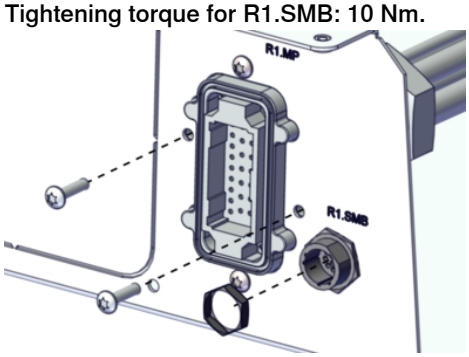
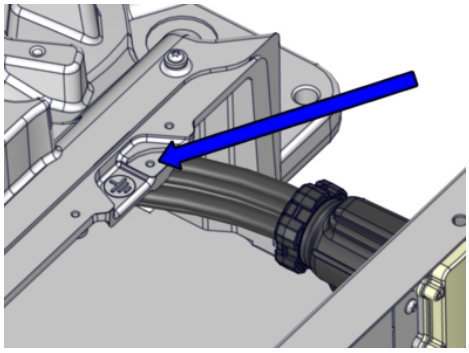
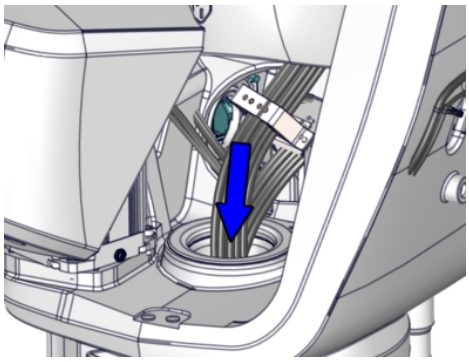
5.9.2 Refitting the cable harness

Continued

	Action	Note
4	Connect connectors R1.MP and R1.SMB.	Screw dimension for R1.MP: M6x25 A4-80 Tightening torque for R1.MP: 10 Nm. Tightening torque for R1.SMB: 10 Nm.  xx2100001109
5	Connect the earth cable.	Screw dimension: M6x16. Washer dimension: 6.4x17x3. Tightening torque: 10 Nm.  xx2200001790
6	If used, run the DressPack hoses through the protection tube in the base. Make sure that the hoses are running correctly and are not twisted!	 xx2400000196

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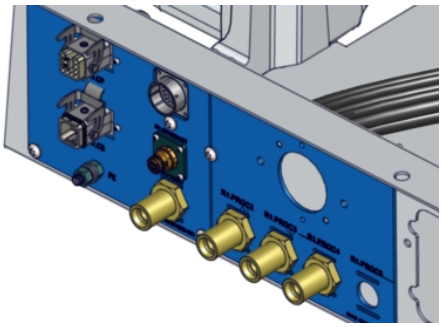
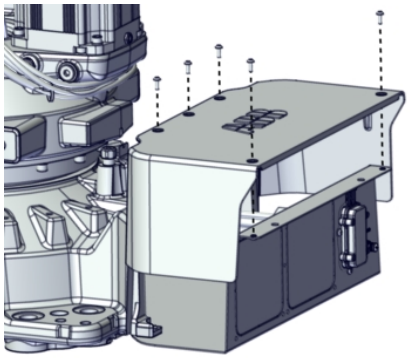
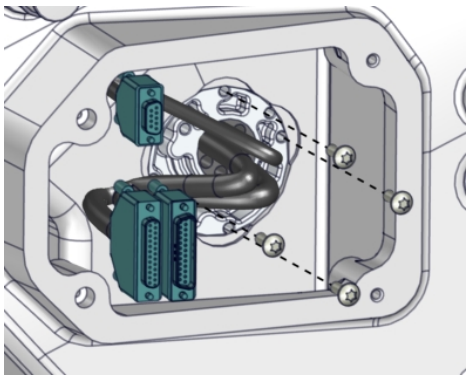
	Action	Note
7	If used, connect the DressPack cable package on the base plate.	 xx2300001093
8	Refit the base cover.	Torx pan head screw: M6x16 Stainless steel A2-70 (5 pcs) Tightening torque: 10 Nm.  xx2100000981

Refitting the SMB cabling

	Action	Note
1	Refit and secure the cable inlet with the screws inside the SMB recess	 xx2200001725
2	Seal the cable inlet with sealing compound.	Sealing compound: 3HAC026759-002 () Sikaflex 521 FC

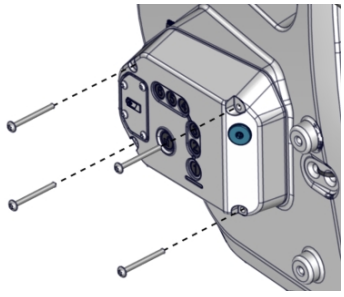
Continues on next page

5.9.2 Refitting the cable harness
Continued

Reconnecting the SMB and BU units

	Action	Note
1	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
2	Check the electronic box gasket. Replace if damaged.	Cover, electronics: 3HAC081189-003 (Graphite White) 3HAC081189-004 (ABB Orange)
3	Connect all connectors to the SMB board: • R1.SMB1-3, R1.SMB4-6 and R2.SMB • If cabling is used for 7th axis (option), refit the connector R1.SMB7	 xx2200001726
4	Connect the connectors R2.BU1 and R2.BU2 to the brake release board.	

Refitting the electronic box

	Action	Note
1	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
2	Refit the electronic box with the attachment screws.	Torx pan head screw: M6x60 (4 pcs) Tightening torque: 10 Nm.  xx2200001721

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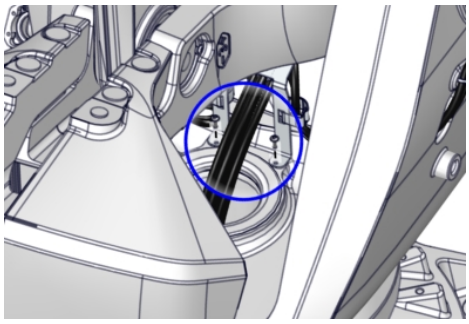
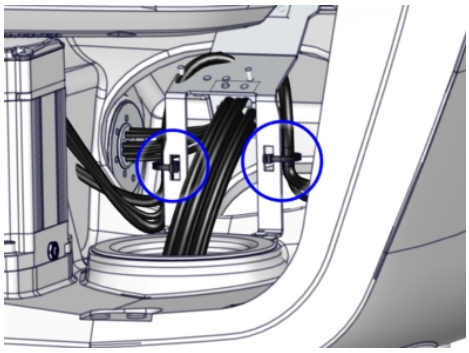
Refitting the cable harness to the frame

	Action	Note
1	Refit the cable brackets to the frame. Collect and secure the cabling to the cable brackets with cable straps.	Cable strap, outdoor Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2300001950  xx2400000197

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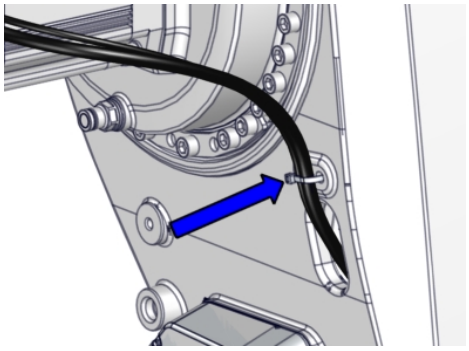
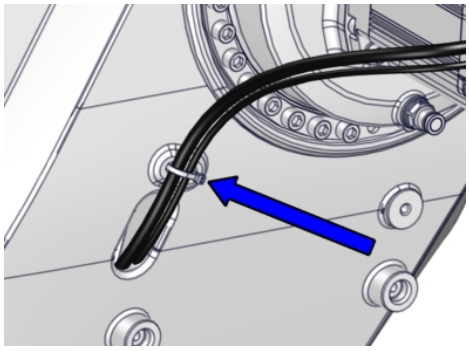
5.9.2 Refitting the cable harness
Continued

	Action	Note
2	Secure the cabling to the frame with cable ties.	Cable strap, outdoor: - (1 pcs)  xx2300002016  xx2400000191

Reconnecting the axis-1, axis-2 and axis-3 motor cables

	Action	Note
1	Put the motor cables in place in the opening.	

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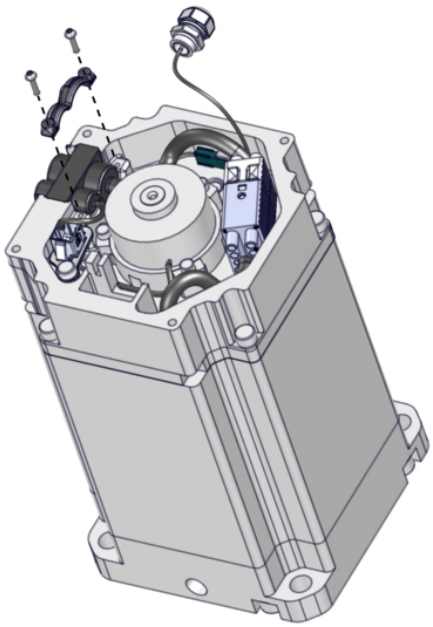
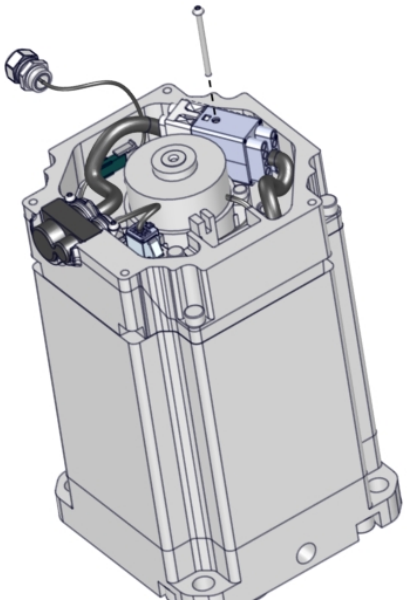
	Action	Note
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001738
3	Connect the motor cables. **Note** Connect in accordance with the markings on the connectors.	
4	Fit a screw to the power connector. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001736

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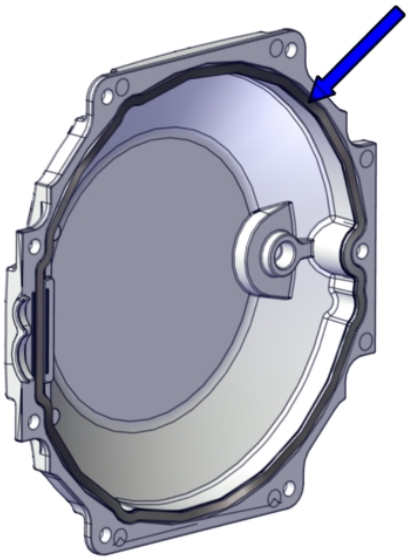
5.9.2 Refitting the cable harness
Continued

	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1, axis-2 and axis-3: Connection box cover FS180 with gasket: 3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection) Axis-4: Connection box cover FS130 with gasket: 3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)  xx2100000600
6	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	

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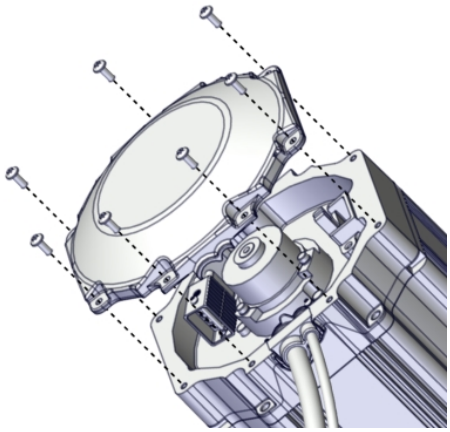
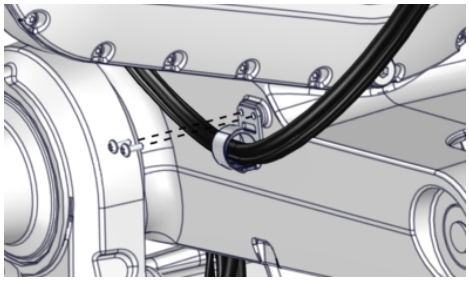
	Action	Note
7	Refit the motor cover with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.  xx2100000596

Refitting the cable harness - upper arm and wrist

These procedures describes how to refit the cable harness in upper arm and wrist.

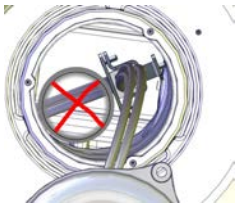
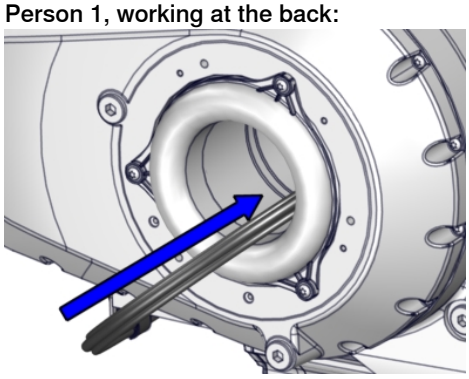
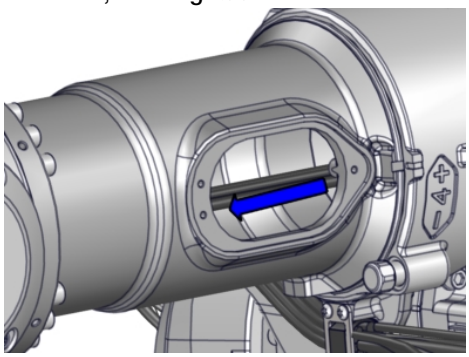
Refitting the cable harness to the upper arm

	Action	Note
1	Refit the metal clamp beneath the arm house.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2300002013
2	**Tip** Use tape and tie the axis-5 and axis-6 connectors and carrier into a bundle (if not already done). This is done to facilitate the procedure and to avoid damaging the parts during the procedure. This will also make it easier to run the cable harness through the inside of the robot.	 xx1300000668

Continues on next page

5.9.2 Refitting the cable harness

Continued

	Action	Note
3	Run the cable harness through the cable guide and then into and through the upper arm tube. **Tip** This step is best performed by two persons working together: • Person 1: Put one hand inside the side hole of the arm tube and take a hold of the cable harness. • Person 2: Take a hold on the cable harness at the back of the robot. • Together: Use caution and move the cable harness into the arm tube. **Note** The cable harness is best placed at the upper right hand side of the DressPack tube, if used, through the arm tube. Do not run the cable harness into the DressPack tube! **Note** Do not run the cable harness into the DressPack tube, if one is fitted!  xx1300000820	Person 1, working at the back:  xx2300000039 Person 2, working at the side hole:  xx2300000040

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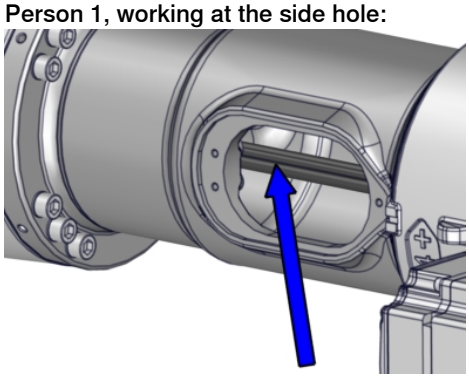
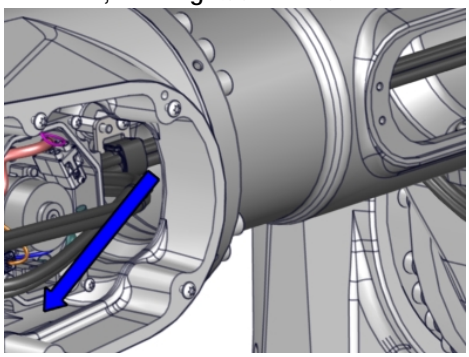
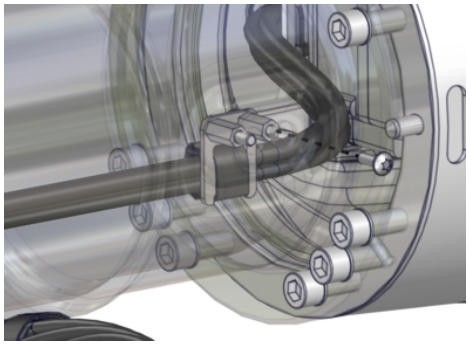
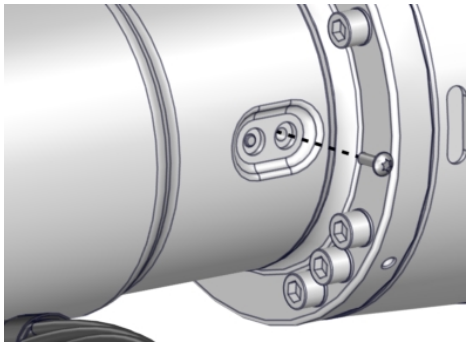
	Action	Note
4	Use caution and push the cable harness into the wrist. **Tip** This step is best performed by two persons working together: • Person 1: Put one hand inside the side cover hole and take a hold of the cable harness. • Person 2: Take a hold of the cable harness from inside the wrist. • Together: Move the cable harness past the axis-5 motor and into the wrist.	Person 1, working at the side hole:  xx2300000035 Person 2, working at the wrist:  xx2300000041
5	Refit the metal clamp axis-4, inside the arm tube. **Note** The screw is reached from outside the upper arm.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2300000033  xx2300000032

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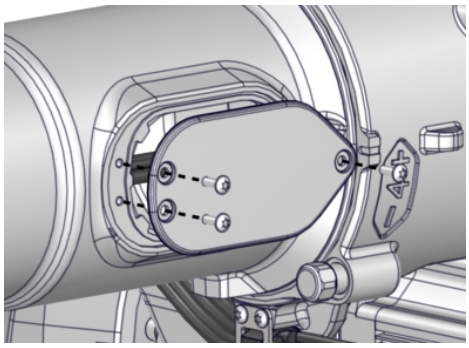
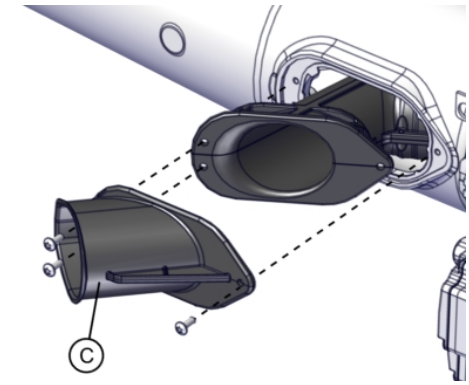
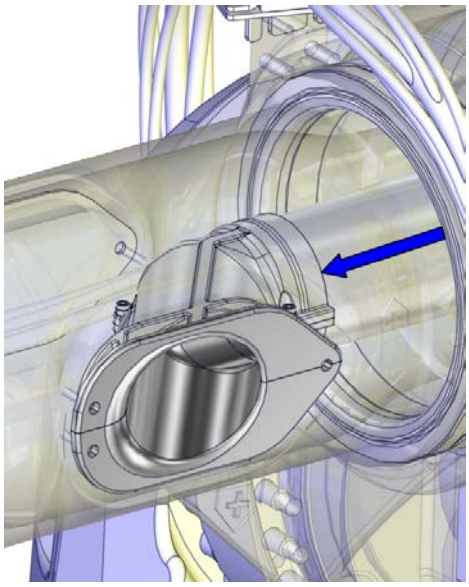
5.9.2 Refitting the cable harness

Continued

	Action	Note
6	Refit the side cover (if no DressPack is used). **Note** *Foundry Plus*: • Make sure the gasket is fitted correctly on the side cover • Use attachment screws made of stainless steel to fit the side cover.	 xx2300000031
7	With DressPack: Refit the insert that guides the DressPack cable package through the hole in the upper arm. (Cable guard (C) is available for Foundry cable guard.)	 xx2100002677
8	With DressPack: Refit the DressPack tube into the insert.	 xx1400000092

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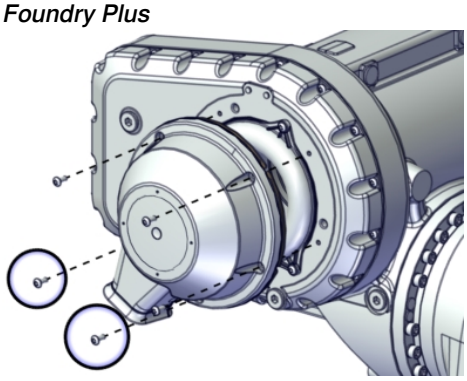
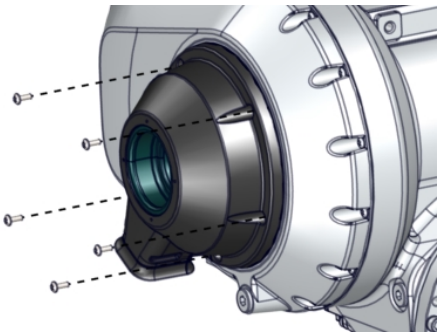
	Action	Note
9	*DressPack* or *Foundry Plus*: Refit the back cover with the attachment screws. Tighten the two screws closest to the outlet first (shown in figure), to avoid deformation. **Note** With DressPack: Make sure that the tube is fitted correctly in both ends, when fitting the cover.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm. *Foundry Plus*  xx2100002636 *DressPack* Locking liquid: Loctite 2400 (or equivalent Loctite 243)  xx2300001040

Reconnecting the axis-4 motor cables

	Action	Note
1	Put the motor cables in place in the opening.	

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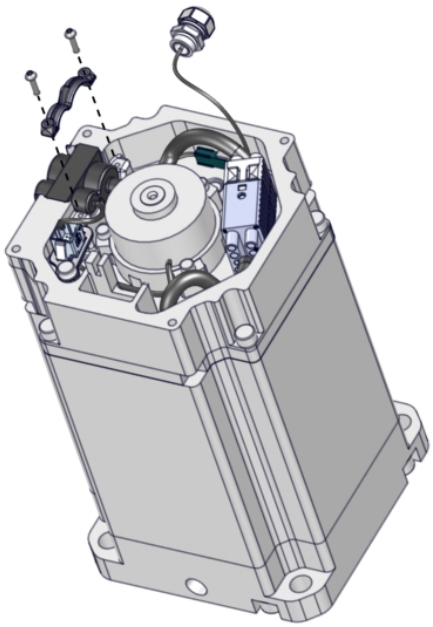
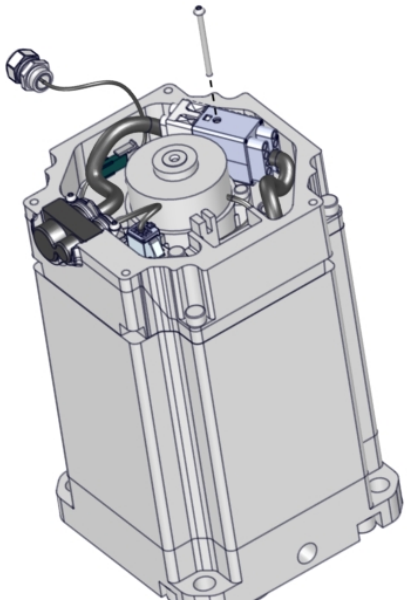
5.9.2 Refitting the cable harness

Continued

	Action	Note
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001738
3	Connect the motor cables. **Note** Connect in accordance with the markings on the connectors.	
4	Fit a screw to the power connector. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001736

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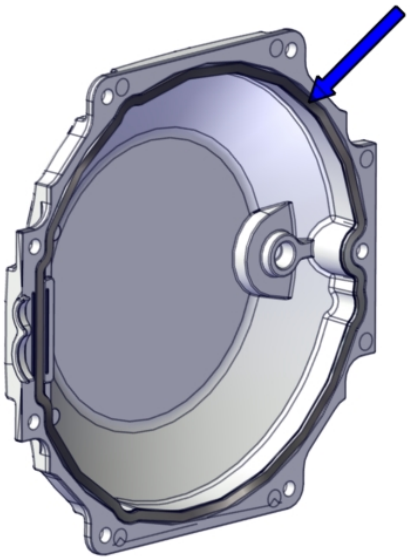
	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1, axis-2 and axis-3: Connection box cover FS180 with gasket: 3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection) Axis-4: Connection box cover FS130 with gasket: 3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)  xx2100000600
6	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	

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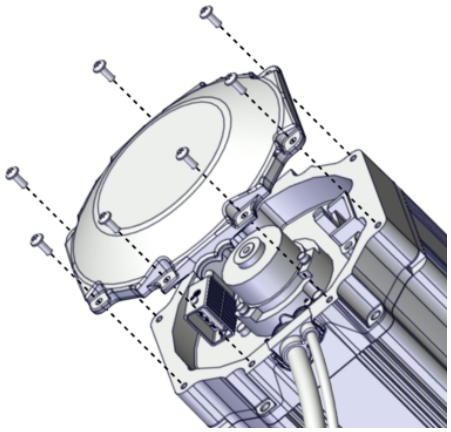
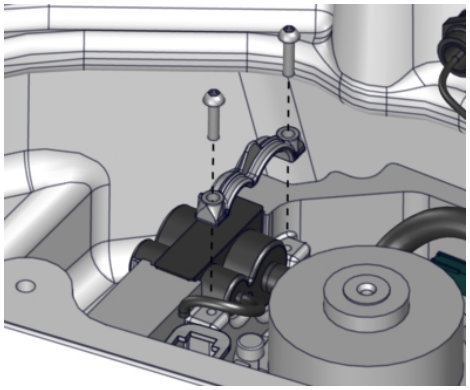
5.9.2 Refitting the cable harness
Continued

	Action	Note
7	Refit the motor cover with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.  xx2100000596

Connecting the axis-5 motor cables

	Action	Note
1	Put the motor cables in place in the opening.	
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001735

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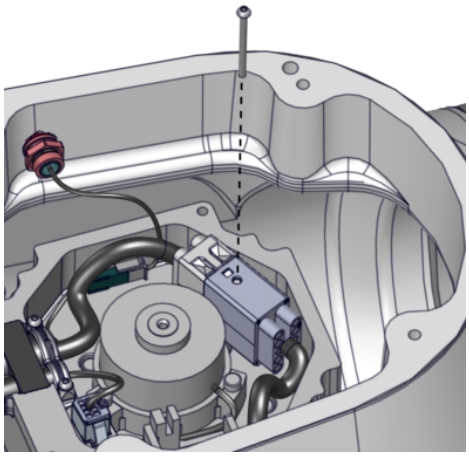
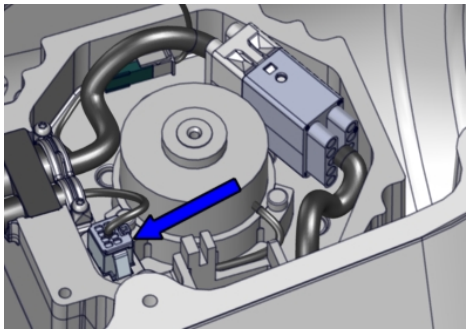
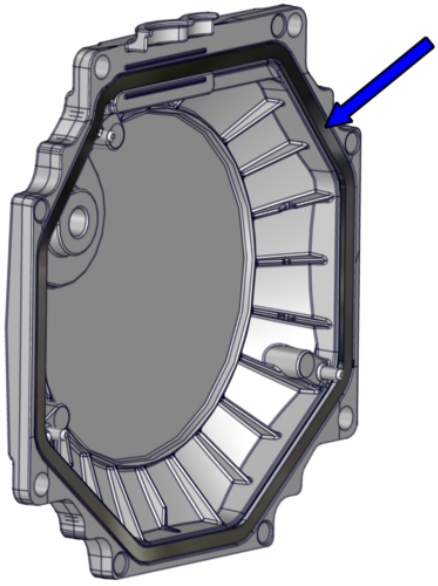
	Action	Note
3	Connect the power cable connector and secure with a screw. Connect in accordance with the markings on the connectors. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001733
4	Connect the signal cable connector. Connect in accordance with the markings on the connectors.	 xx2200001734
5	Inspect the gasket. Replace if damaged.	Connection box cover with gasket: 3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)  xx2200002141

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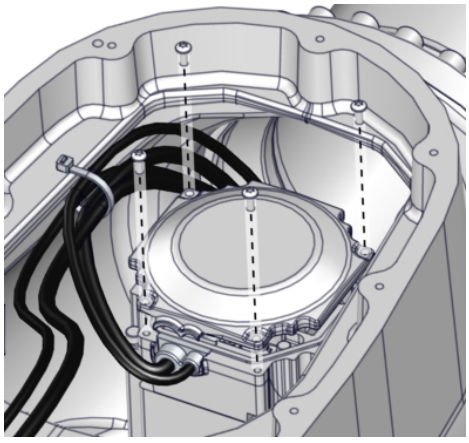
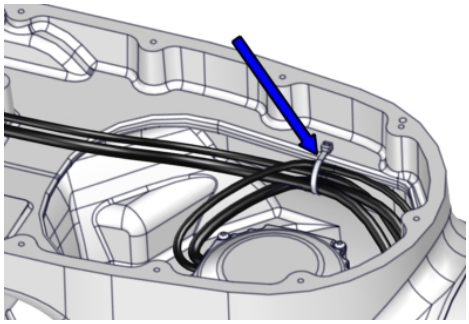
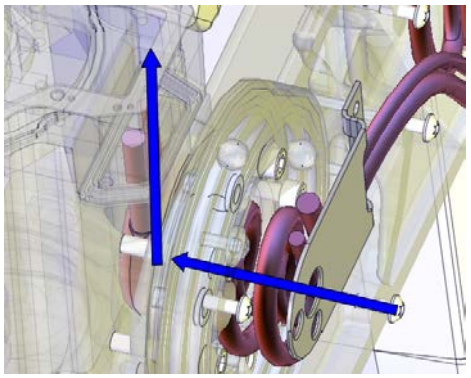
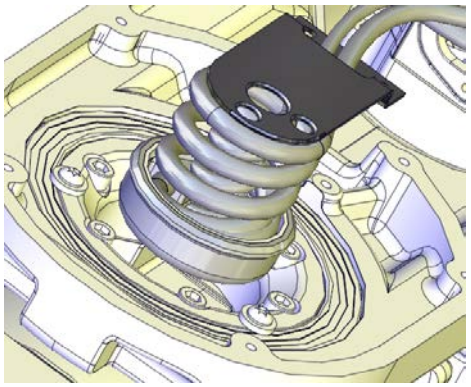
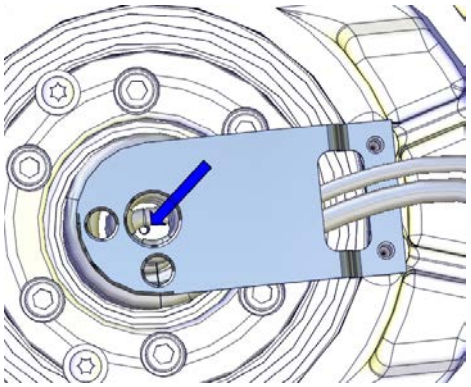
5.9.2 Refitting the cable harness
Continued

	Action	Note
6	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
7	Refit the motor cover and the cable protection with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.  xx2300001924
8	Secure the cabling with a cable strap.	Cable strap, outdoor: -  xx2300001923

Inserting the axis-6 motor cables

	Action	Note
1	**Note** Axis 5 must be in position +90° (or as close as possible) for a correct installation of the cable harness in the wrist. If not, connect the brake release tool to the axis-5 motor connector, release the brakes and move axis 5 manually to +90°.	

Continues on next page

	Action	Note
2	Push the cable harness into the wrist recess and up into the axis-6 motor. **Tip** Moisten the rubber carrier slightly with water or grease around the contact surface, to make it easier to fit into place.	 xx1300000667
3	Push the carrier carefully into position.	 xx1300001113
4	Secure the carrier with the M4x10 screw. **Note** The screw is located at the bottom of the carrier. **Tip** The attachment screw securing the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.	 xx1300000485

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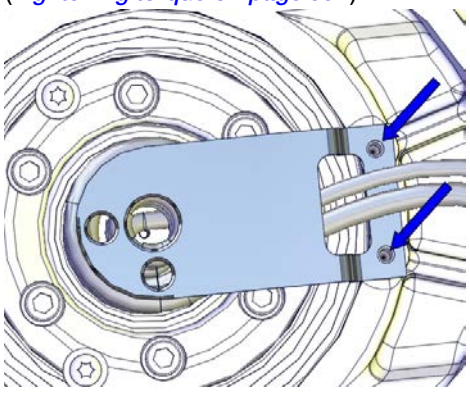
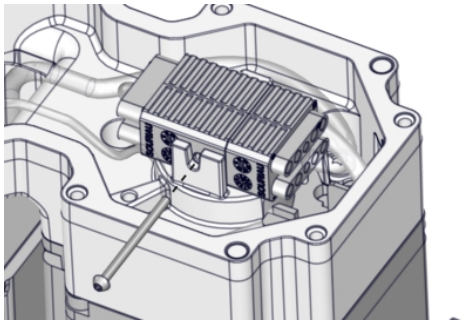
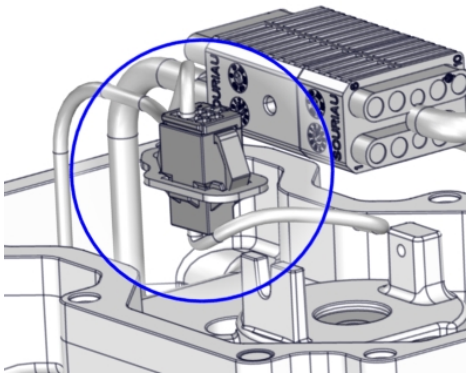
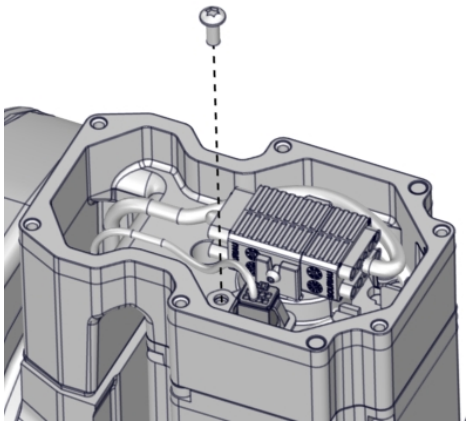
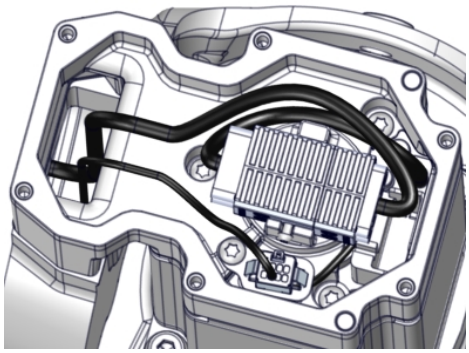
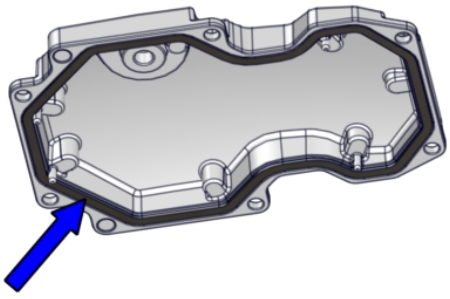
5.9.2 Refitting the cable harness
Continued

	Action	Note
5	Secure the cable bracket with its attachment screws.	Torx pan head screw: M6x16 A4-80 Tightening torque: standard torque 10 Nm (*Tightening torque on page 661*).  xx1300000484

Connecting the axis-6 motor cables

	Action	Note
1	Connect the motor cables. Connect in accordance with the markings on the connectors.	
2	Position the power connector to the bracket with a screw. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001731
3	Snap the signal connectors to each other in the bracket.	 xx2200001921

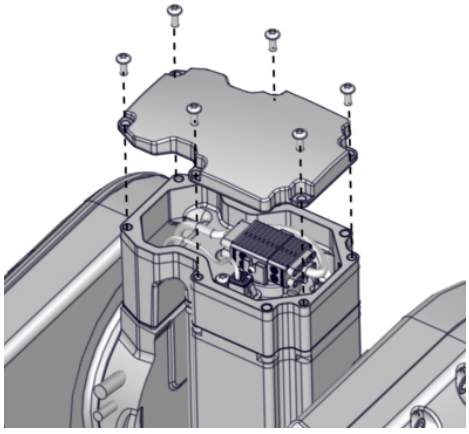
Continues on next page

	Action	Note
4	Refit the connector bracket assembly to the motor. **CAUTION** The cabling is sensitive to mechanical damage. Handle it with care to avoid damage to the cabling or the connector, avoid any kind of tilt or skew.	Torx pan head screw: M5x12 Stainless steel A2-70  xx2200001730
5	Verify correct cable layout as shown in the figure. **CAUTION** Route the signal cabling correctly to avoid cable damage.	 xx2300000920
6	Inspect the gasket. Replace if damaged.	Connection box cover with gasket: 3HAC079381-003 (Graphite White) 3HAC079381-004 (ABB Orange)  xx2200001922
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	

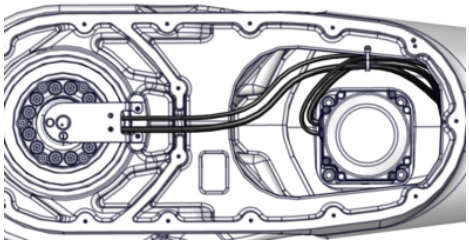
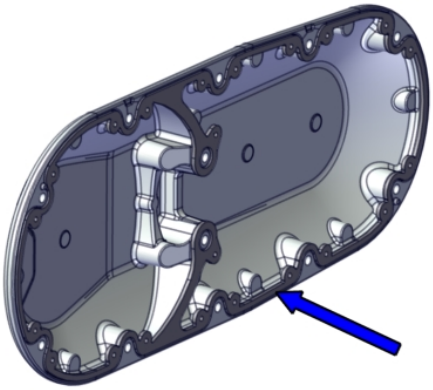
Continues on next page

5.9.2 Refitting the cable harness

Continued

	Action	Note
8	Refit the motor cover.	Torx pan head screw, M5x12 Stainless steel A2-70, 6 pcs Tightening torque: 6 Nm.  xx2200001434

Refitting the wrist cover

	Action	Note
1	Make sure that the cable harness is routed and secured as shown in the figure.	 xx2300001927
2	*Foundry Plus:* Inspect the gasket. Replace if damaged.	Gasket: 3HAC085052-001  xx2100001407

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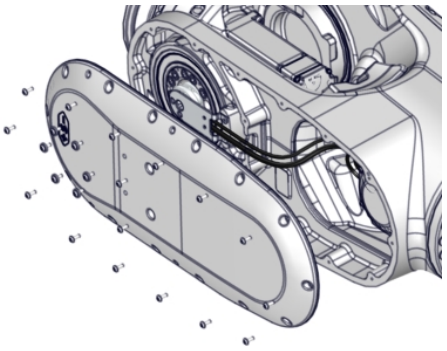
	Action	Note
3	Refit the wrist cover and secure with screws. *Foundry Plus:* Fit all the screws first, then torque tighten them twice to achieve correct torque (due to compression from the gasket).	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2300001883

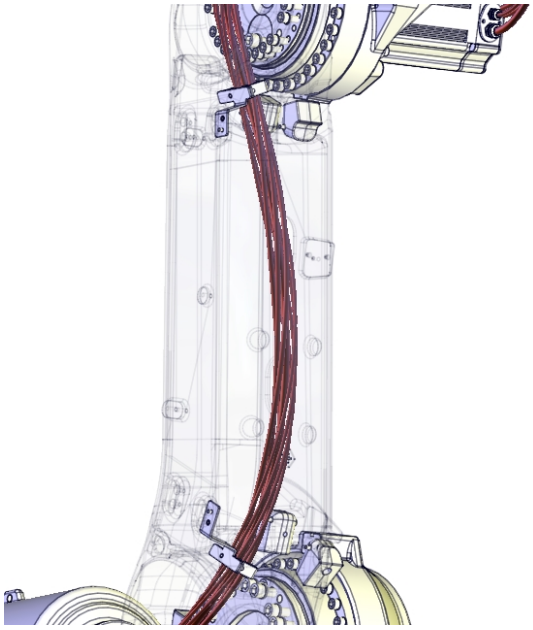
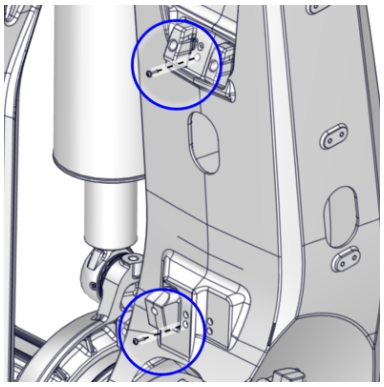
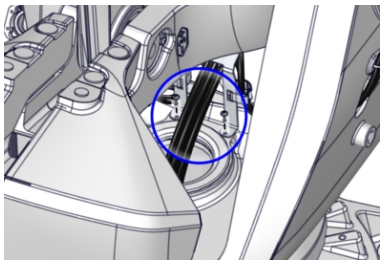
Concluding procedure

	Action	Note
1	If used, refit the DressPack cable package on the wrist.	See product manual for the DressPack.
2	Turn on the power to the robot.	

Continues on next page

5.9.2 Refitting the cable harness

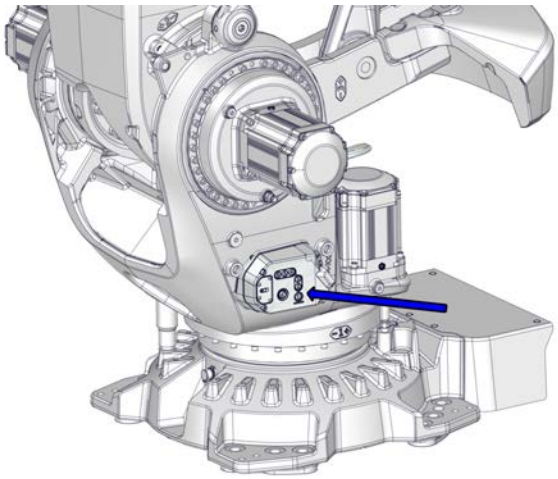
Continued

	Action	Note
3	Jog axis 2 so that the cable brackets on the back of the lower arm and inside the frame are accessible. Secure the cable brackets. Use a bit extender on the lower arm cable bracket screws. **Note** The screws are reached from the outside of the lower arm. **Note** Check that the cabling will stay a little bit twisted between the cable clamps. Do not change the position of the brackets!  xx1300000595	Bit extender Torx pan head screw: M6x20 A4-80 Tightening torque: 10 Nm.  xx2300001951  xx2300001950
4	Make an overall inspection of the installed cable harness.	See *Inspecting the cable harness on page 116*.
5	Update the revolution counters.	See *Updating revolution counters on page 626*.
6	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.9.3 Replacing the brake release unit

Location of the brake release unit

The brake release unit is located as shown in the figure.



xx2300001541

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Brake release unit	3HAC073540-001		L2

Required service parts

Consumable	Article number	Note
Cover, electronics	3HAC081189-003 (Graphite White) 3HAC081189-004 (ABB Orange)	Includes gasket. Replace if damaged.

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Removing the brake release unit

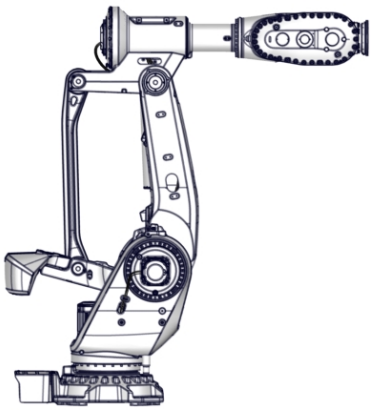
Use this procedure to remove the brake release unit.

Continues on next page

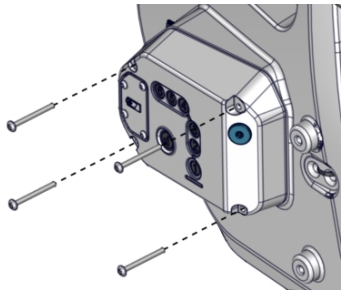
5.9.3 Replacing the brake release unit

Continued

Preparations before removing the brake release unit

	Action	Note
1	Jog the robot to calibration position, if possible. This position facilitates updating of the revolution counters afterwards.	 xx2300001691
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Removing the electronic box

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
3	Remove the electronic box screws.	 xx2200001721

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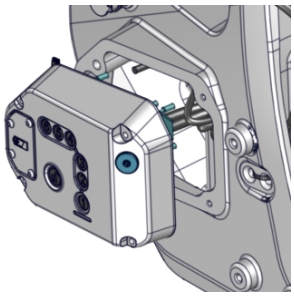
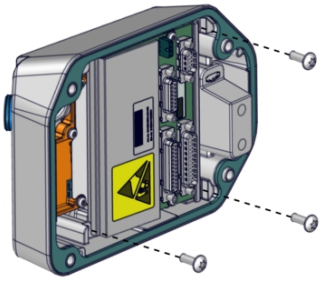
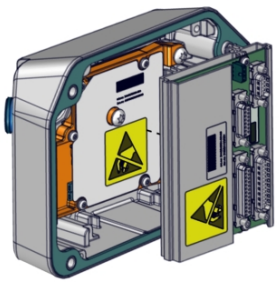
	Action	Note
4	Remove the electronic box, including all internal equipment. **CAUTION** Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.	 xx2200001720

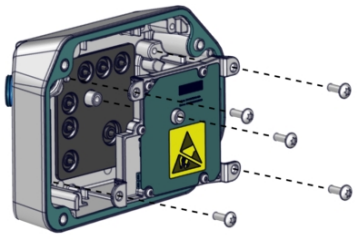
Disconnecting and removing the SMB unit

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
3	Disconnect all connectors from the SMB board.	
4	Remove the screws that secure the SMB unit.	 xx2200001723
5	Snap loose and remove the SMB unit. Put the unit in an ESD bag.	 xx2200001724

Continues on next page

5.9.3 Replacing the brake release unit
Continued

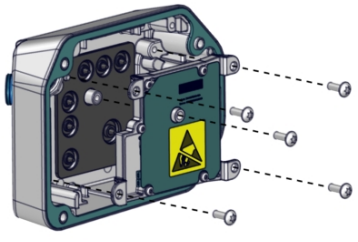
Disconnecting and removing the brake release unit

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
3	Disconnect the connectors R2.BU1 and R2.BU2 from the brake release board.	
4	Remove the brake release unit by removing the screws. Put the unit in an ESD bag.	 xx2200001728

Refitting the brake release unit

Use this procedure to refit the brake release unit.

Refitting the brake release unit

	Action	Note
1	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
2	Fit brake release unit into the electronic box and secure with the screws.	Torx pan head tapping screw: Steel-Fe/Zn 8c M6x16 Tightening torque: 10 Nm.  xx2200001728

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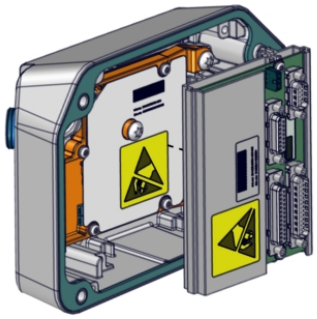
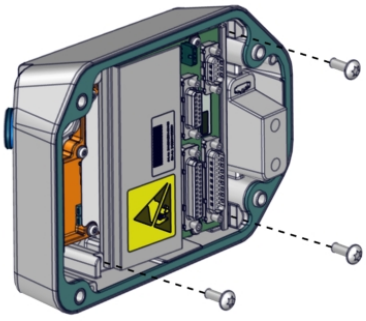
Refitting and connecting the SMB unit

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
3	Check the electronic box gasket. Replace if damaged.	Cover, electronics: 3HAC081189-003 (Graphite White) 3HAC081189-004 (ABB Orange)
4	Fit the SMB unit into the electronic box.	 xx2200001724
5	Secure the SMB unit with the attachment screws.	Torx pan head tapping screw: Steel-Fe/Zn 8c M6x16 Tightening torque: 10 Nm.  xx2200001723

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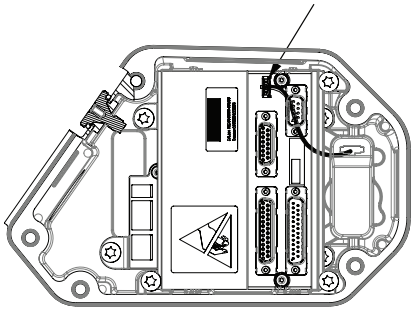
5.9.3 Replacing the brake release unit
Continued

	Action	Note
6	Connect the battery cable to the SMB unit. Make sure the lock snaps into place during refitting. **Note** Make sure that the connector is assembled in the correct direction according to its keying.	 xx2100002161
7	Connect all connectors to the SMB board: • R1.SMB1-3, R1.SMB4-6 and R2.SMB • If cabling is used for 7th axis (option), refit the connector R1.SMB7	 xx2200001726

Reconnecting the brake release unit

	Action	Note
1	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
2	Check the electronic box gasket. Replace if damaged.	Cover, electronics: 3HAC081189-003 (Graphite White) 3HAC081189-004 (ABB Orange)
3	Reconnect the connectors R2.BU1 and R2.BU2 to the brake release board.	

Refitting the electronic box

	Action	Note
1	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	

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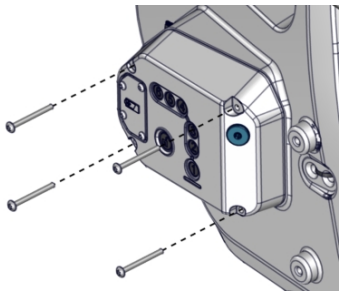
	Action	Note
2	Refit the electronic box with the attachment screws.	Torx pan head screw: M6x60 (4 pcs) Tightening torque: 10 Nm.  xx2200001721

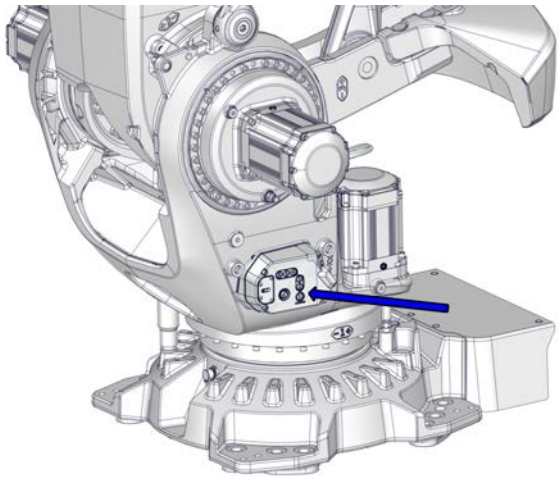
Concluding procedures

	Action	Note
1	Update the revolution counters if the battery has been disconnected.	See *Updating revolution counters on page 626*.
2	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.9.4 Replacing the SMB unit

Location of the SMB unit

The SMB unit is located as shown in the figure.



xx2300001541

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Serial measurement unit	3HAC043904-001		L2

Required service parts

Consumable	Article number	Note
Cover, electronics	3HAC081189-003 (Graphite White) 3HAC081189-004 (ABB Orange)	Includes gasket. Replace if damaged.

Required tools and equipment

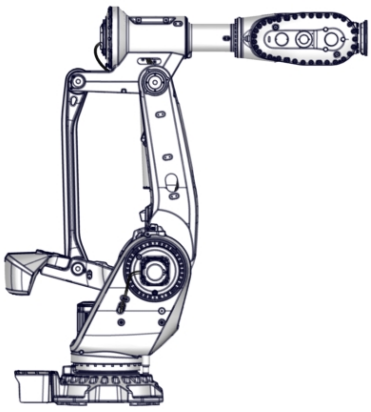
Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Removing the SMB unit

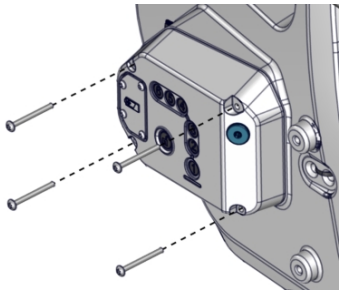
Use these procedures to disconnect and remove the SMB unit.

Continues on next page

Preparations before removing the SMB unit

	Action	Note
1	Jog the robot to calibration position, if possible. This position facilitates updating of the revolution counters afterwards.	 xx2300001691
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Removing the electronic box

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
3	Remove the electronic box screws.	 xx2200001721

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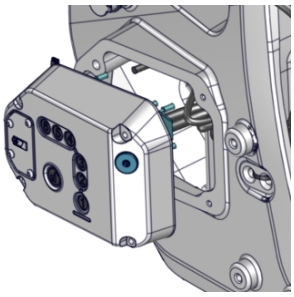
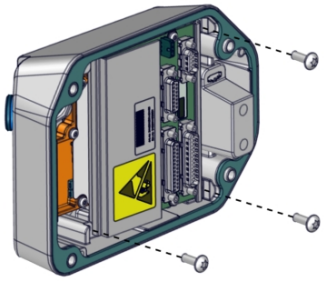
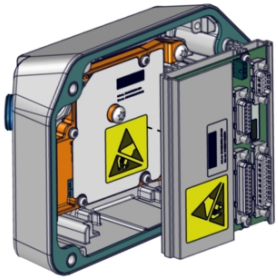
5.9.4 Replacing the SMB unit

Continued

	Action	Note
4	Remove the electronic box, including all internal equipment. **CAUTION** Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.	 xx2200001720

Disconnecting and removing the SMB unit

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
3	Disconnect all connectors from the SMB board.	
4	Remove the screws that secure the SMB unit.	 xx2200001723
5	Snap loose and remove the SMB unit. Put the unit in an ESD bag.	 xx2200001724

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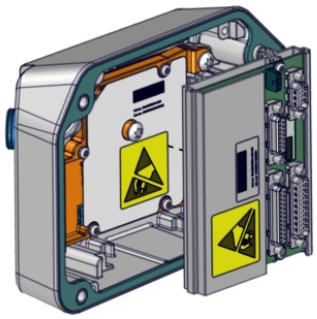
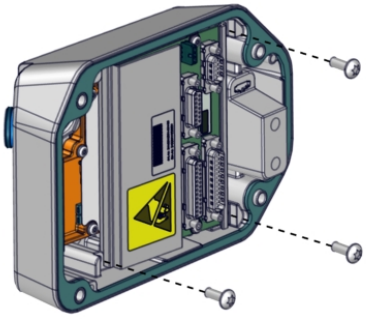
Refitting the SMB unit

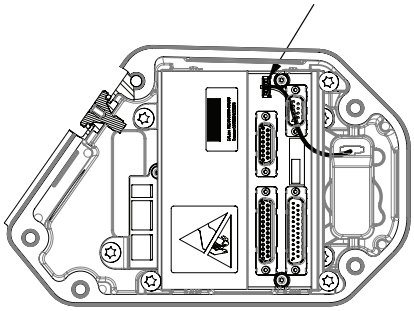
Refitting and connecting the SMB unit

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
3	Check the electronic box gasket. Replace if damaged.	Cover, electronics: 3HAC081189-003 (Graphite White) 3HAC081189-004 (ABB Orange)
4	Fit the SMB unit into the electronic box.	 xx2200001724
5	Secure the SMB unit with the attachment screws.	Torx pan head tapping screw: Steel-Fe/Zn 8c M6x16 Tightening torque: 10 Nm.  xx2200001723

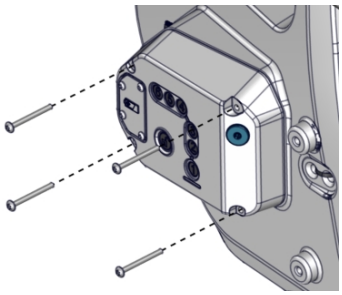
Continues on next page

5.9.4 Replacing the SMB unit

Continued

	Action	Note
6	Connect the battery cable to the SMB unit. Make sure the lock snaps into place during refitting. **Note** Make sure that the connector is assembled in the correct direction according to its keying.	 xx2100002161
7	Connect all connectors to the SMB board: • R1.SMB1-3, R1.SMB4-6 and R2.SMB • If cabling is used for 7th axis (option), refit the connector R1.SMB7	 xx2200001726

Refitting the electronic box

	Action	Note
1	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 54*.	
2	Refit the electronic box with the attachment screws.	Torx pan head screw: M6x60 (4 pcs) Tightening torque: 10 Nm.  xx2200001721

Continues on next page

Concluding procedures

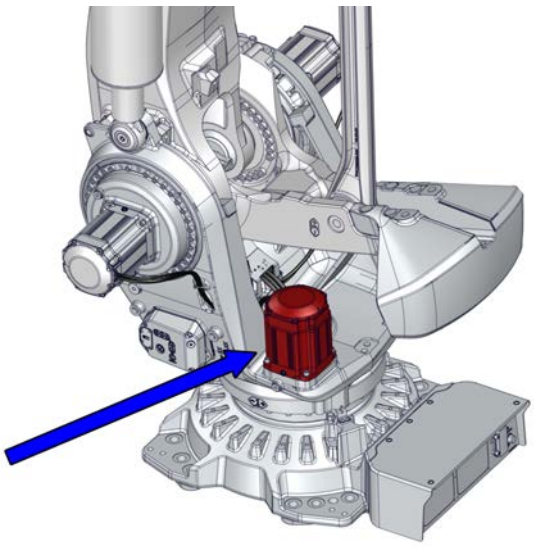
	Action	Note
1	Update the revolution counters.	See *Updating revolution counters on page 626*.
2	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.10 Motors

5.10.1 Replacing the axis-1 motor

Location of the motor

The motor is located as shown in the figure.



xx2300001591

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Motor unit (including connection box and pinion)	3HAC085097-003 (Graphite White) 3HAC085097-004 (ABB Orange)		L2

Continues on next page

Required service parts

Consumable	Article number	Note
Connection box cover FS180 with gasket	3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection)	Replace if damaged. On axis-1 motor A threaded connection is required for cooling fan option.
Cleaning agent	-	Loctite 7200
Cleaning agent	-	Loctite 7063
Flange sealant	-	Loctite 5800
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

Required tools and equipment

Equipment	Article number	Note
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Removal tool motor M12	3HAC14631-1	Used to push out the motor, if necessary. Always use removal tools in pairs.
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
Lifting accessory, motor	3HAC076550-001	
Rotation tool M4	3HAB7887-1	Used to rotate the motor pinion. Add screw M4.
Calibration toolbox, Axis Calibration	3HAC074564-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Continues on next page

5.10.1 Replacing the axis-1 motor
Continued

Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

	Action	Note
1	Decide which calibration routine to use for calibrating the robot. • Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot. • Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.	
	If the robot is to be calibrated with reference calibration: Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in *Reference calibration routine on page 628*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Removing the motor

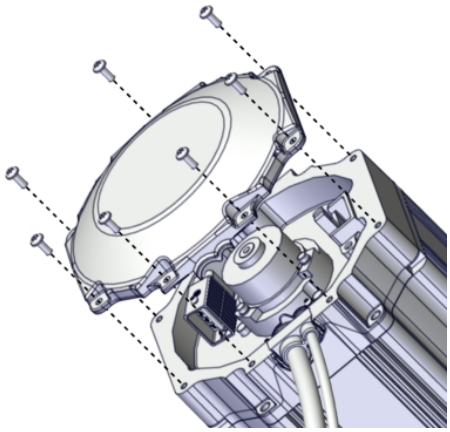
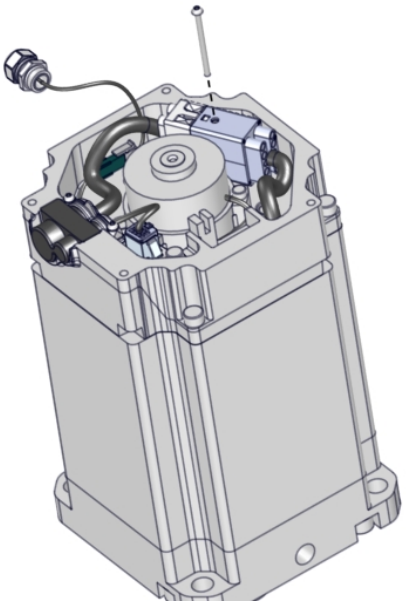
Use these procedures to remove the motor.

Preparations before removing the motor

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	If needed, jog the robot to an appropriate working position that allows space for motor replacement.	
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Continues on next page

Floor-mounted robot: Disconnecting the axis-1 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the motor cover by removing the screws.	 xx2100000596
3	Disconnect the power cable connector by first removing the attachment screw and then parting the connector.	 xx2200001736

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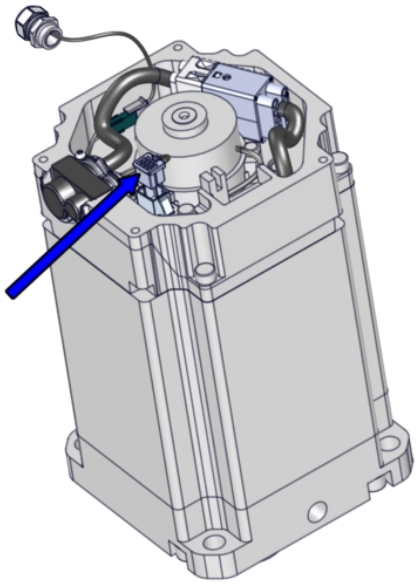
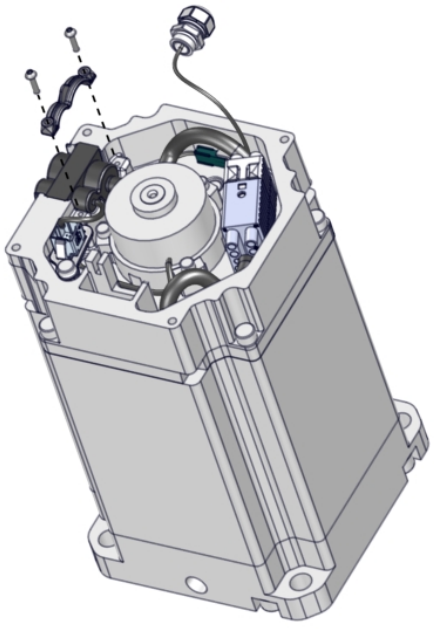
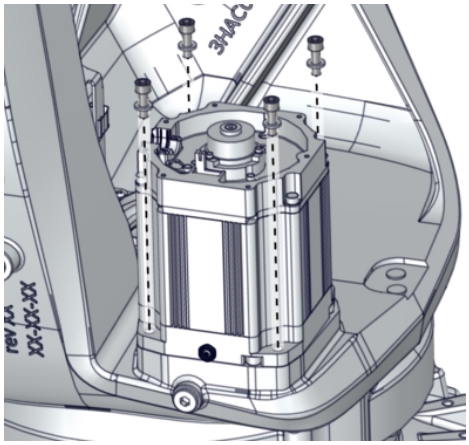
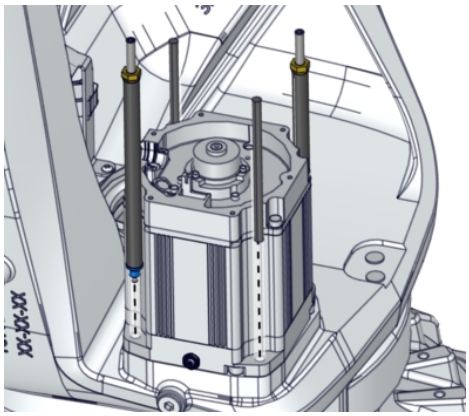
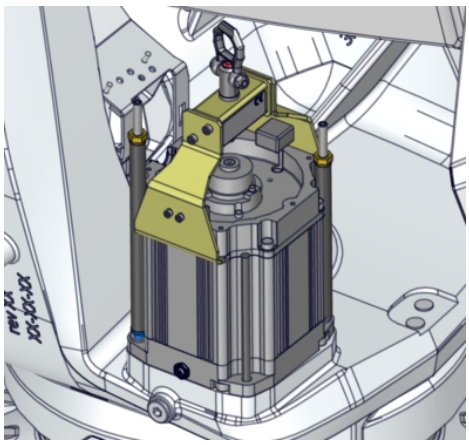
5.10.1 Replacing the axis-1 motor
Continued

	Action	Note
4	Disconnect the signal cable connector by pulling it out.	 xx2200001737
5	Remove the cable bracket by removing the screws.	 xx2200001738
6	Remove the motor cables from the motor.	

Floor-mounted robot: Removing the axis-1 motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

	Action	Note
2	Unscrew the attachment screws and washers. Use a bits extender to reach the screws.	Bits extender: 3HAC12342-1  xx2300001721
3	Fit guide pins in the non-threaded holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
4	Fit removal tools in the threaded holes.	Removal tool motor M12: 3HAC14631-1 Always use removal tools in pairs.  xx2300001723
5	Apply the lifting accessory.	Lifting accessory, motor: 3HAC076550-001  xx2400000491

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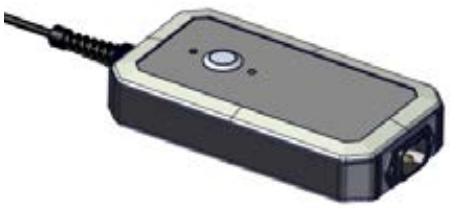
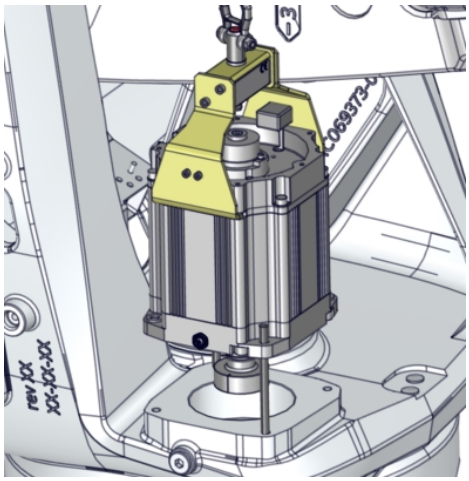
5.10.1 Replacing the axis-1 motor
Continued

	Action	Note
6	Release the brakes of the axis-1 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
7	**CAUTION** The weight of the motor is 23 kg All lifting accessories used must be sized accordingly.	
8	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

Continues on next page

	Action	Note
9	Press the motor out of its position by using the removal tools.	 xx2400000492
10	Use caution and lift the motor straight up to get the pinion parted from the gear.	
11	Disconnect the brake release tool.	

Refitting the motor

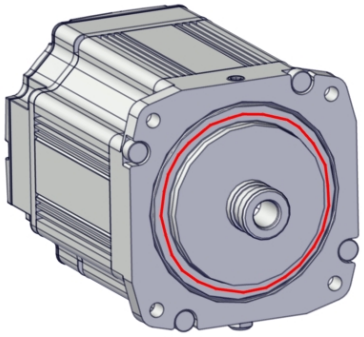
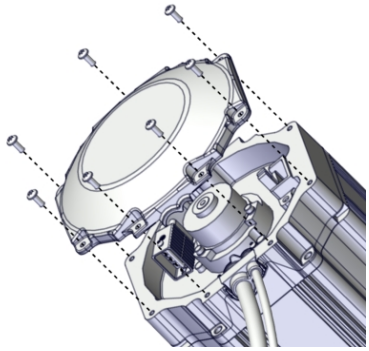
Use these procedures to refit the motor.

Preparations prior to refitting motor

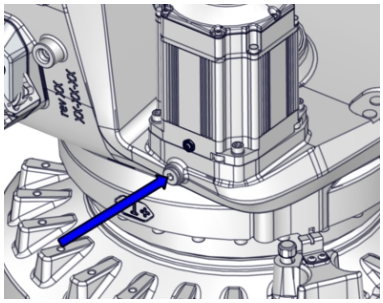
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove any old paint or flange sealant residues or other contamination from the contact surfaces on both the motor and the mating parts. **Tip** Remove flange sealant residues with Loctite 7200. Then use Loctite 7063 for cleaning the mating surface.	Cleaning agent: Loctite 7200, Loctite 7063

Continues on next page

5.10.1 Replacing the axis-1 motor
Continued

	Action	Note
3	Apply a continuous bead of flange sealant, 1-2 mm wide, inside of the groove on the motor contact surface. **Note** The purpose of the groove is to catch excess sealant. No o-ring is used.	Flange sealant: Loctite 5800  xx2100000520
4	Remove the cover, if fitted to the new spare part motor.	 xx2100000596

Floor-mounted robot: Refitting the axis-1 motor

	Action	Note
1	Remove the plug from the venting hole. This is done to evacuate air during refitting of the motor.	 xx2300001600

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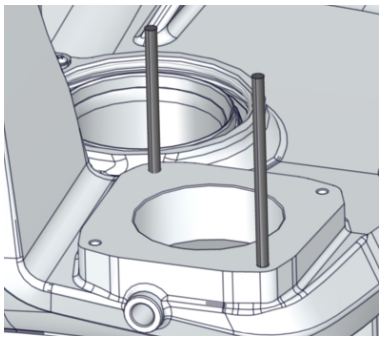
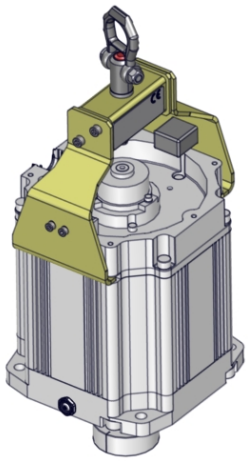
	Action	Note
2	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.  xx2300001801
3	**CAUTION** The weight of the motor is 23 kg All lifting accessories used must be sized accordingly.	
4	Apply the lifting accessory.	Lifting accessory, motor: 3HAC076550-001  xx2400000493
5	Fit the rotation tool.	Rotation tool M4: 3HAB7887-1

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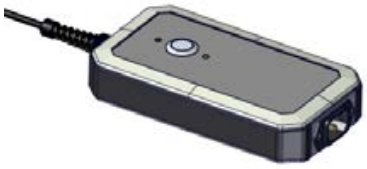
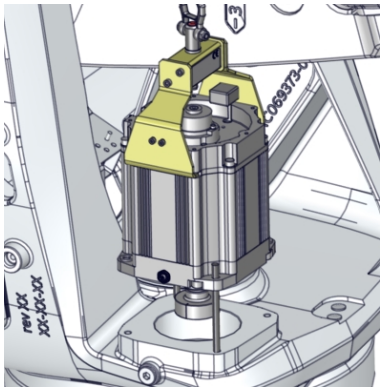
5.10.1 Replacing the axis-1 motor

Continued

	Action	Note
6	Release the brakes on the motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
7	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
8	Lower the motor into position. • Make sure that the motor pinion is properly mated to the gear in the gearbox. • Make sure that the motor pinion does not get damaged. • Make sure that the direction of the cable gland exit is facing the correct way.	 xx2400000492

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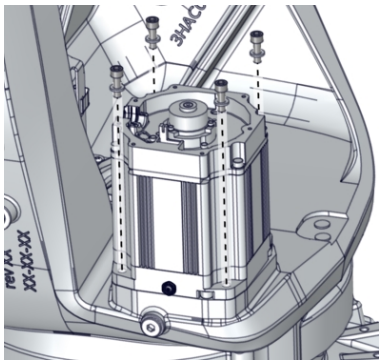
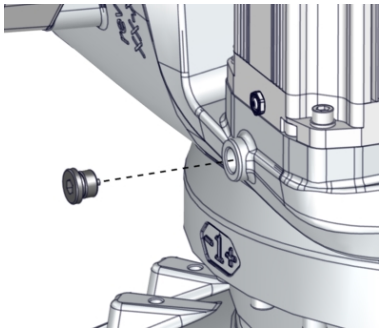
	Action	Note
9	Secure the motor with its attachment screws and washers. Use a bits extender to reach the screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Bits extender: 3HAC12342-1 Tightening torque: 50 Nm.  xx2300001721
10	Disconnect the brake release tool.	
11	Perform a leak-down test.	See *Performing a leak-down test on page 197*.

Refitting the oil plug

	Action	Note
1	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2300001686

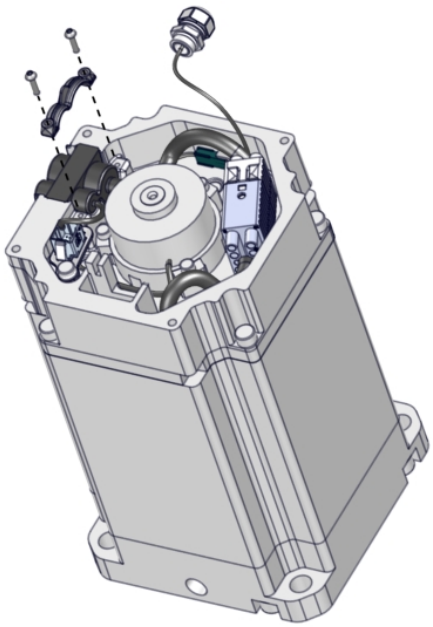
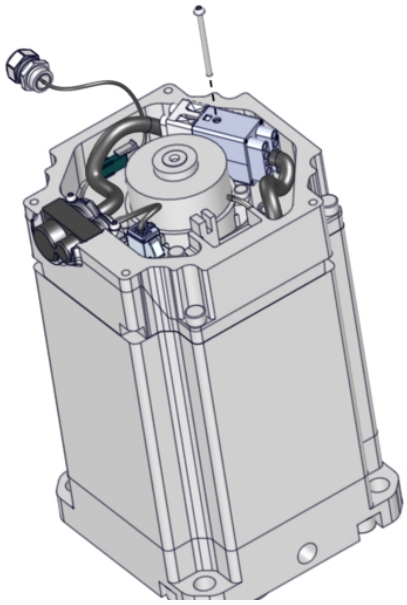
Connecting the motor cables

	Action	Note
1	Put the motor cables in place in the opening.	

Continues on next page

5.10.1 Replacing the axis-1 motor

Continued

	Action	Note
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001738
3	Connect the motor cables. **Note** Connect in accordance with the markings on the connectors.	
4	Fit a screw to the power connector. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001736

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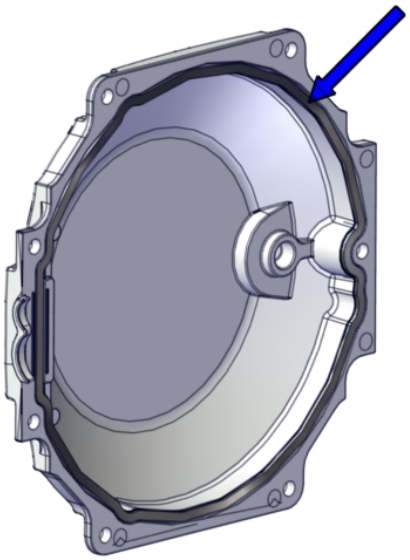
	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1, axis-2 and axis-3: Connection box cover FS180 with gasket: 3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection) Axis-4: Connection box cover FS130 with gasket: 3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)  xx2100000600
6	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	

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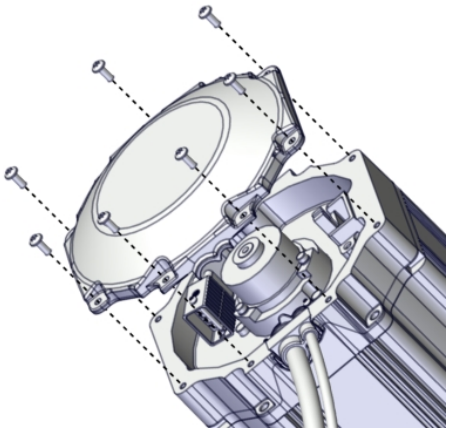
5.10.1 Replacing the axis-1 motor
Continued

	Action	Note
7	Refit the motor cover with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.  xx2100000596

Concluding procedure

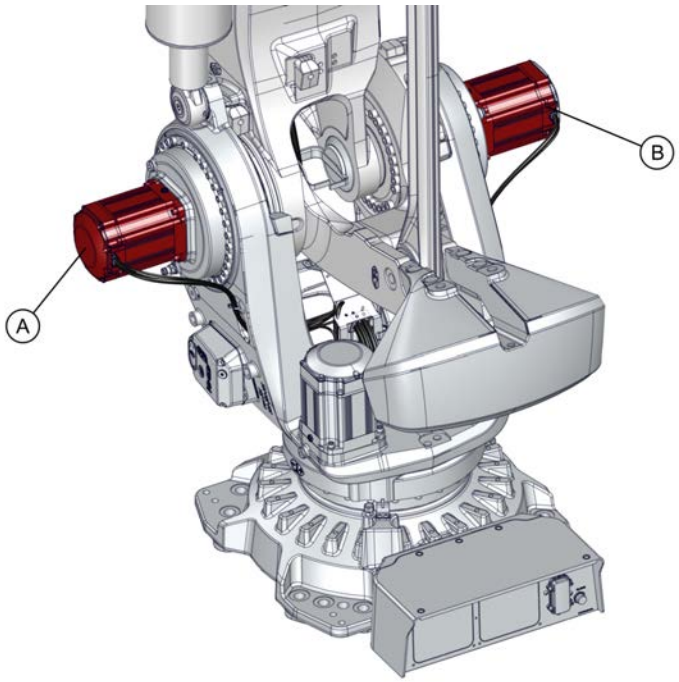
Use this procedure for the concluding refitting.

	Action	Note
1	Re-calibrate the robot.	See *Calibration on page 619*.
2	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.10.2 Replacing the axis-2 or axis-3 motor

Location of the motor

The motors are located as shown in the figure.



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A	Axis-2 motor
B	Axis-3 motor

Summary of the replacement procedure

This list is a brief summary of the replacement procedure, containing the major actions to be performed.

1. Drain the relevant gearbox.
2. Secure the movable arm structure with a lock screw.
3. Replace the motor.

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Motor unit (including connection box and pinion)	3HAC085098-002 (Graphite White) 3HAC085098-003 (ABB Orange)		L2

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5.10.2 Replacing the axis-2 or axis-3 motor
Continued

Required service part

Consumable	Article number	Note
Connection box cover FS180 with gasket	3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection)	Replace if damaged. On axis-2 and axis-3 motor
Cleaning agent	-	Loctite 7200
Cleaning agent	-	Loctite 7063
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.
Flange sealant	-	Loctite 5800

Required tools and equipment

Equipment	Article number	Note
Lock screw, M16x80	-	Used to secure lower arm / movable arm structure.
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Removal tool motor M12	3HAC14631-1	Used to push out the motor, if necessary. Always use removal tools in pairs.
Lifting accessory, motor	3HAC15534-1	Lifting instruction 3HAC15640-2 enclosed.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Rotation tool M4	3HAB7887-1	Used to rotate the motor pinion. Add screw M4.
Calibration toolbox, Axis Calibration	3HAC074564-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Continues on next page

Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

	Action	Note
1	Decide which calibration routine to use for calibrating the robot. • Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot. • Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.	
	If the robot is to be calibrated with reference calibration: Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in *Reference calibration routine on page 628*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Removing the motor

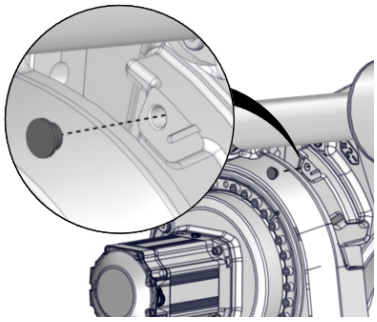
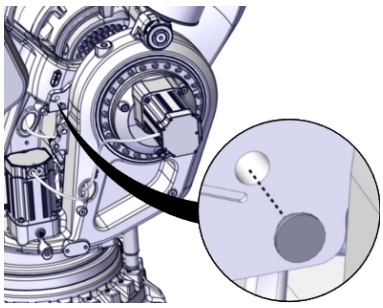
Use these procedures to remove the motor.

Preparations before removing the motor

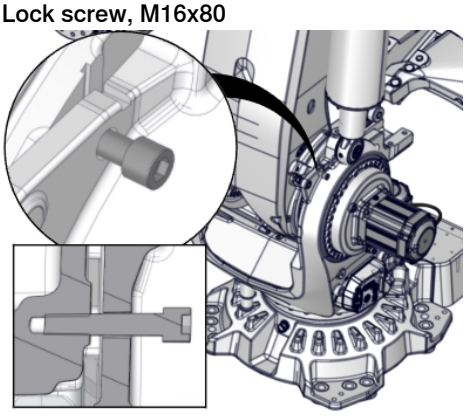
	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	

Continues on next page

5.10.2 Replacing the axis-2 or axis-3 motor
Continued

	Action	Note
2	Jog axis-2 to a position where the plastic plug for the relevant axis lock screw hole is accessible.	Axis-2 lock screw hole:  xx2400001682 Axis-3 lock screw hole:  xx1500002366
3	Remove the plastic plug that covers the lock screw hole. **Note** Keep the plastic plugs. They must be refitted after the work is done.	
4	Jog the robot to the synchronization position.	
5	Drain the oil from the relevant gearbox.	See *Changing the oil in axis-2 gearbox on page 154*. See *Changing the oil in axis-3 gearbox on page 159*.

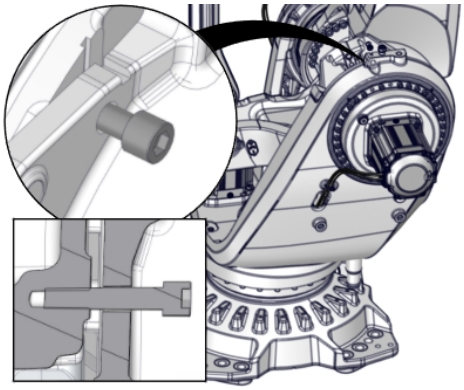
When removing axis-2 motor: locking the axis-2 position

	Action	Note
1	Insert the lock screw into the axis-2 lock screw hole. Do not tighten. If needed, adjust the position of the robot to make it possible to insert the lock screw. The lock screw is used to secure the weight of the movable arm structure, in order to avoid accidents or damage. **CAUTION** Do not insert the screw fully, leave space underneath the screw head. Inserting the screw all the way will result in tension in the arm system which may cause damage to the axis-2 and axis-3 gearboxes.	Lock screw, M16x80  xx2300001881
2	Release the brakes on axis-2 using the brake release button, and let the axis rest on the lock screw.	

Continues on next page

	Action	Note
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

When removing axis-3 motor: locking the axis-3 position

	Action	Note
1	Insert the lock screw into the axis-3 lock screw hole. Do not tighten. If needed, adjust the position of the robot to make it possible to insert the lock screw. The lock screw is used to secure the weight of the movable arm structure, in order to avoid accidents or damage. **CAUTION** Do not insert the screw fully, leave space underneath the screw head. Inserting the screw all the way will result in tension in the arm system which may cause damage to the axis-2 and axis-3 gearboxes.	Lock screw, M16x80  xx2400000236
2	Release the brakes on axis-3 using the brake release button, and let the axis rest on the lock screw.	
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

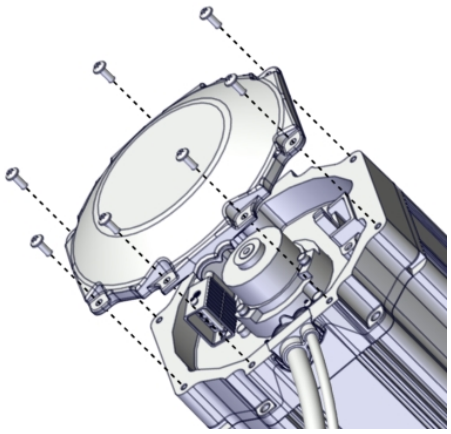
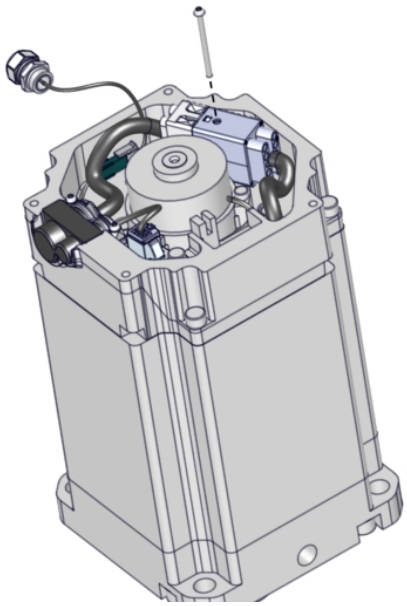
Disconnecting the motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

5.10.2 Replacing the axis-2 or axis-3 motor

Continued

	Action	Note
2	Remove the motor cover by removing the screws.	 xx2100000596
3	Disconnect the power cable connector by first removing the attachment screw and then parting the connector.	 xx2200001736

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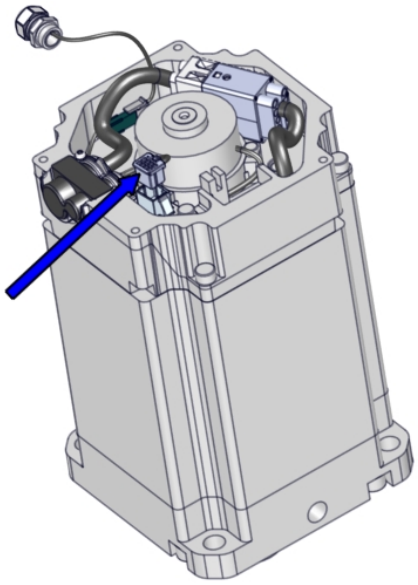
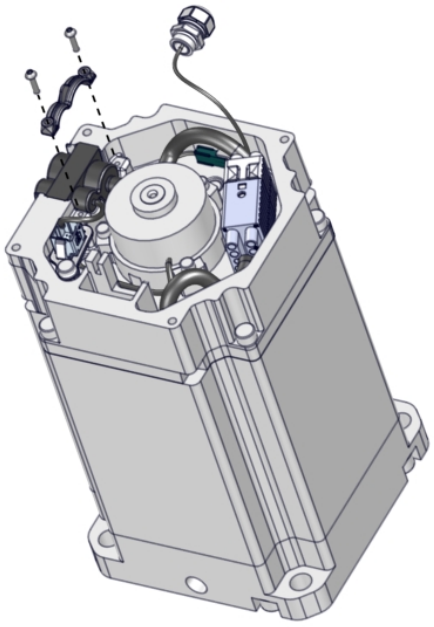
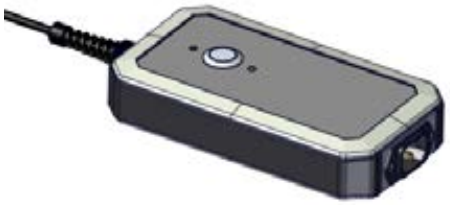
	Action	Note
4	Disconnect the signal cable connector by pulling it out.	 xx2200001737
5	Remove the cable bracket by removing the screws.	 xx2200001738
6	Remove the motor cables from the motor.	

Removing the axis-2 or axis-3 motor

	Action	Note
1	Before removing the motor, make sure that the gearbox is completely drained.	

Continues on next page

5.10.2 Replacing the axis-2 or axis-3 motor
Continued

	Action	Note
2	**DANGER** When releasing the holding brakes of the motor, the lower arm will be movable and may fall down if not secured. Verify that the lower arm is secured as previously described, before continuing.	
3	**CAUTION** Releasing the brakes on the axis-2 or axis-3 motor results in weight transfer of upper and lower arm weight to the inserted lock screw in the lower arm or to the attached lifting accessories (whichever is used). If lifting accessories are used, verify that the lifting chains and roundslings are stretched by raising the overhead crane, before releasing the brakes. Release the brakes on the motor with the brake release tool, to unload the weight: 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666

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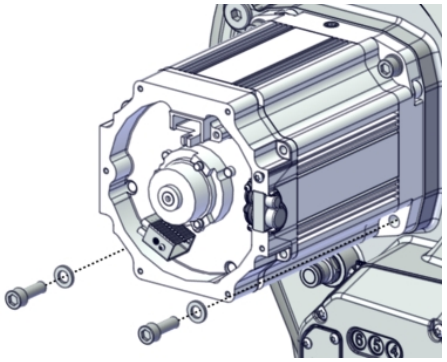
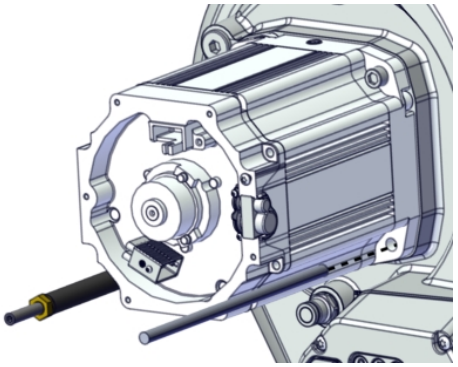
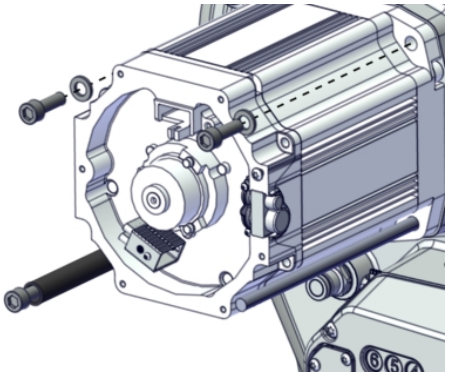
	Action	Note
4	Remove the two lower screws. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx2000000468
5	Fit a guide pin in the non-threaded hole. Fit a removal tool in the threaded hole. **Tip** Lubricate the guide pins with some grease to make the motor slide better.	Guide pin, M10x150: 3HAC15521-2 Removal tool motor M12: 3HAC14631-1  xx2000000456
6	Remove the remaining two screws.	Bits extender: 3HAC12342-1  xx2200001150

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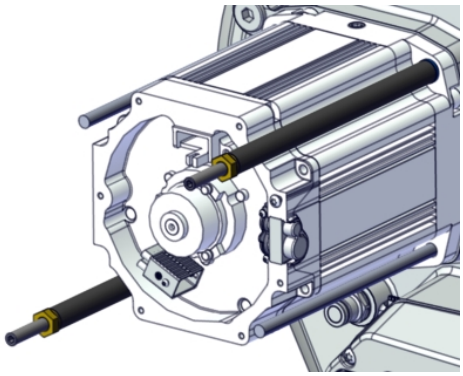
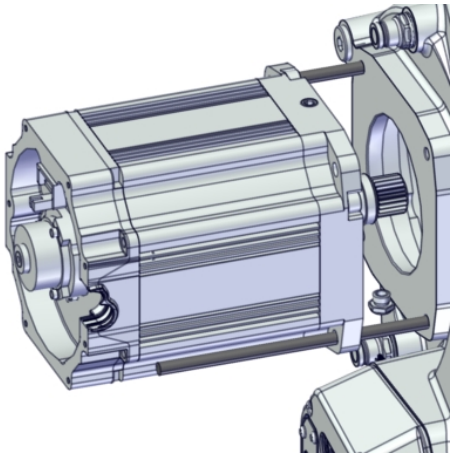
5.10.2 Replacing the axis-2 or axis-3 motor
Continued

	Action	Note
7	Fit a guide pin in the non-threaded hole. Fit a removal tool in the threaded hole. **Tip** Lubricate the guide pins with some grease to make the motor slide better.	Guide pin, M10x150: 3HAC15521-2 Removal tool motor M12: 3HAC14631-1  xx2300000043
8	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
9	Activate the brake release tool again (release the brakes).	The power is only applied for 180 seconds after activation.
10	Press the motor out of its position by using the removal tools. Remove the removal tools.	Used to push out the motor, if necessary. Always use removal tools in pairs.
11	**CAUTION** The weight of the motor is 24 kg All lifting accessories used must be sized accordingly.	
12	Carefully lift the motor out on the guide pins, in order to get the pinion away from the gear and let it rest on the guide pins.	 xx2000000457
13	Disconnect the brake release tool.	

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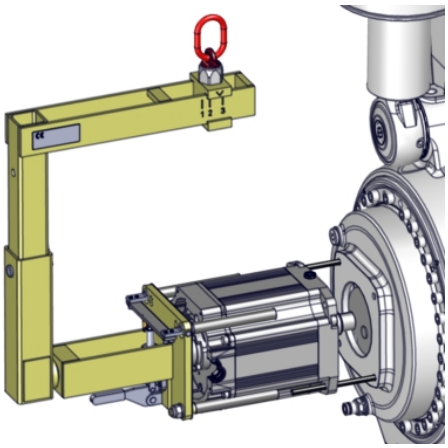
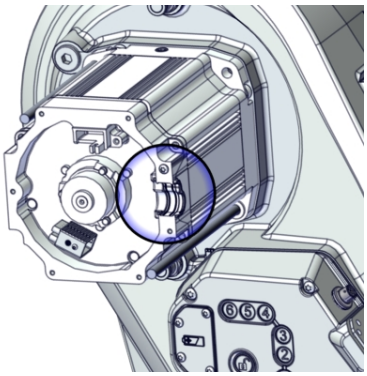
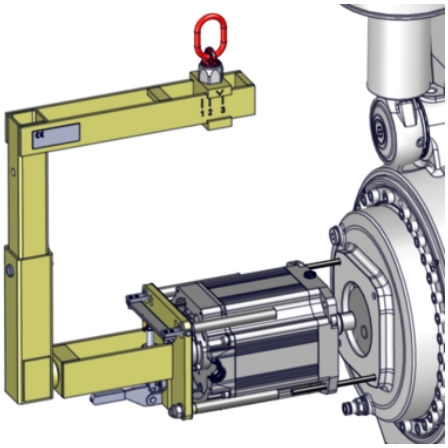
	Action	Note
14	Fasten the lifting accessory. Attach the lifting chain to the accessory and an overhead crane.	Lifting accessory, motor: 3HAC15534-1 Lifting accessory (chain): 3HAC15556-1  xx2400000263
15	Remove the motor by sliding it out on the guide pins and lift it off. **Tip** Make a note in which direction the cable gland hole is facing. The motor shall be refitted in the same position.  xx2100000595	 xx2400000263 Make sure the pinion is not damaged.

Refitting the motor

Use these procedures to refit the axis-2 or axis-3 motor.

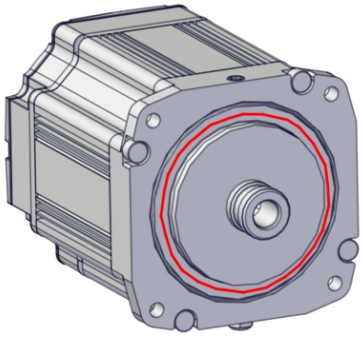
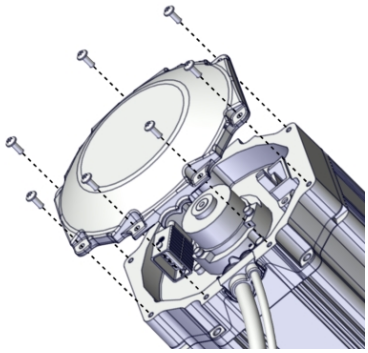
Preparations prior to refitting motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

5.10.2 Replacing the axis-2 or axis-3 motor

Continued

	Action	Note
2	Remove any old paint or flange sealant residues or other contamination from the contact surfaces on both the motor and the mating parts. **Tip** Remove flange sealant residues with Loctite 7200. Then use Loctite 7063 for cleaning the mating surface.	Cleaning agent: Loctite 7200, Loctite 7063
3	Apply a continuous bead of flange sealant, 1-2 mm wide, inside of the groove on the motor contact surface. **Note** The purpose of the groove is to catch excess sealant. No o-ring is used.	Flange sealant: Loctite 5800  xx2100000520
4	Remove the cover, if fitted to the new spare part motor.	 xx2100000596

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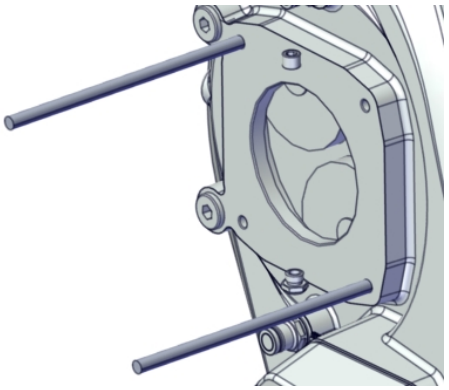
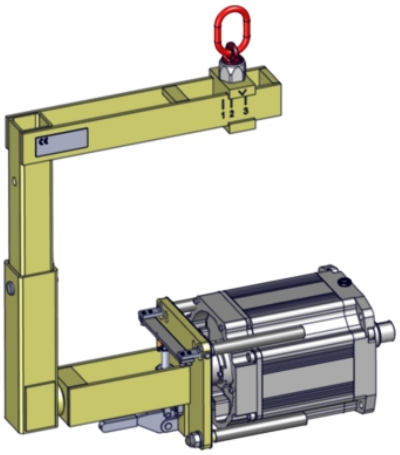
Refitting the axis-2 or axis-3 motor

	Action	Note
1	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.  xx2100000593
2	**CAUTION** The weight of the motor is 24 kg All lifting accessories used must be sized accordingly.	
3	Apply the lifting accessory.	Lifting accessory, motor: 3HAC15534-1 Lifting accessory (chain): 3HAC15556-1  xx2400000264

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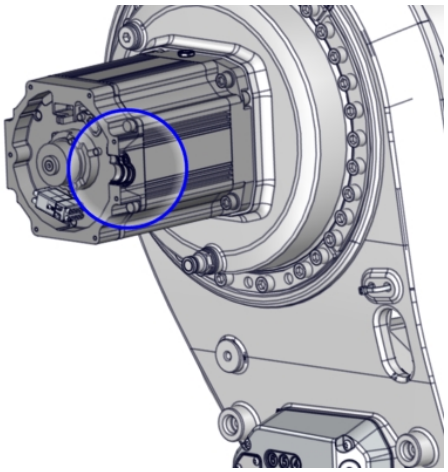
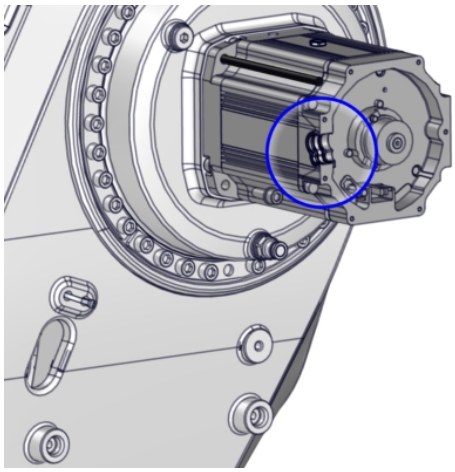
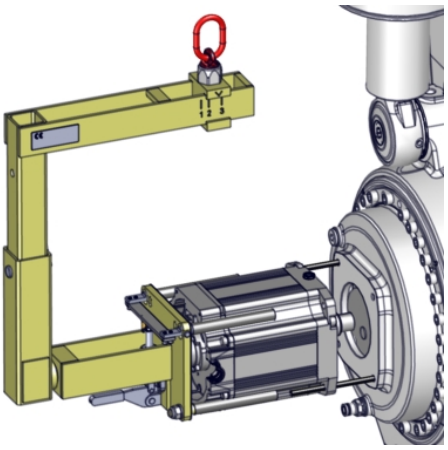
5.10.2 Replacing the axis-2 or axis-3 motor

Continued

	Action	Note
4	**Note** Make sure the cable gland opening is turned the correct way.	Axis-2 motor:  xx2400000265 Axis-3 motor:  xx2400000266
5	Lift the motor and put it on the guide pins as close as possible to its final position without pushing the motor pinion into the gear.	 xx2400000263

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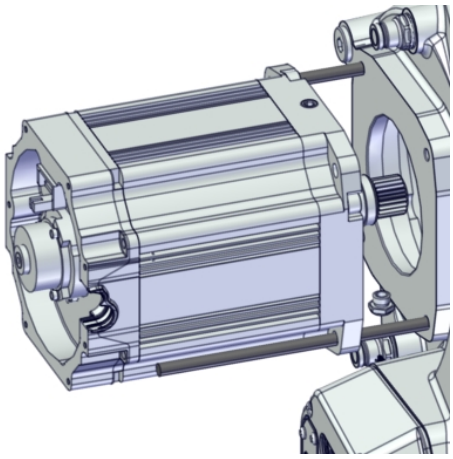
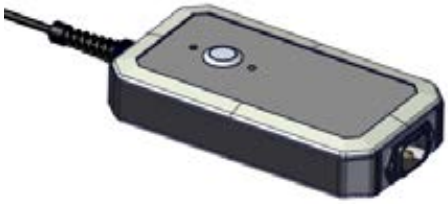
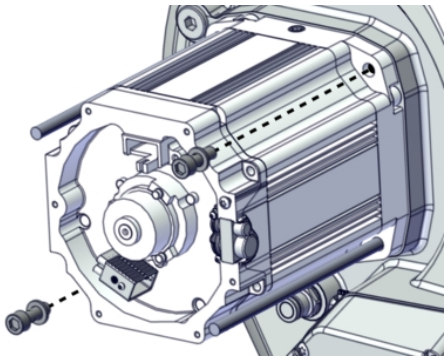
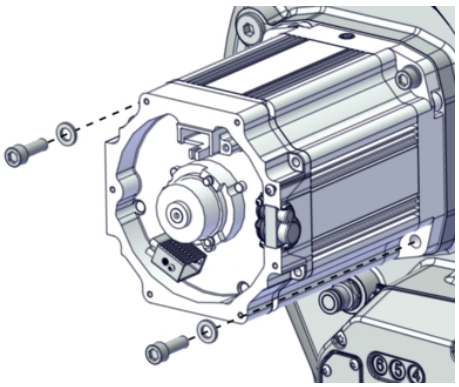
	Action	Note
6	Remove the lifting accessory and allow the motor to rest on the guide pins.	 xx2000000457
7	Release the brakes of the motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
8	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

Continues on next page

5.10.2 Replacing the axis-2 or axis-3 motor

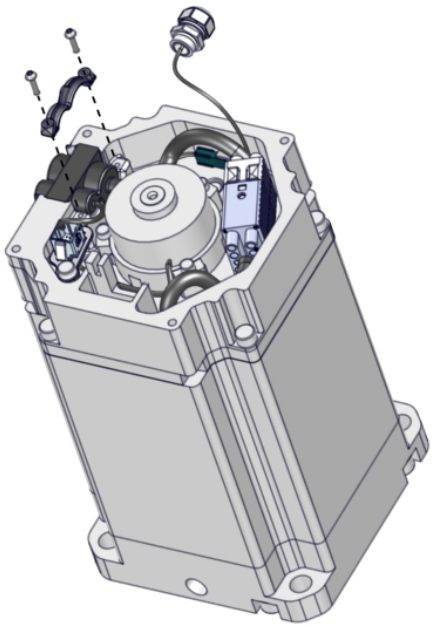
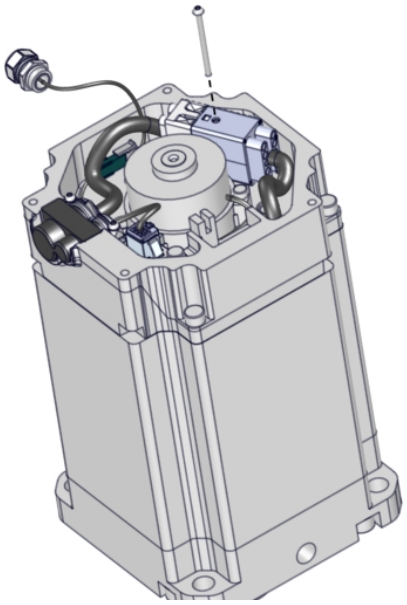
Continued

	Action	Note
9	Apply the rotation tool. Use caution and fit the motor in its final position while at the same time rotating the motor pinion slightly using the rotation tool. • Make sure that the motor pinion is properly mated to the gear of the gearbox. • Make sure that the motor pinion does not get damaged. • Make sure that the direction of the cable exit is facing the correct way.	Rotation tool M4: 3HAB7887-1
10	Fit two of the attachment screws and washers. Use a bits extender in order to reach the screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (2 pcs) Bits extender: 3HAC12342-1  xx2000000467
11	Remove the guide pins and refit the remaining attachment screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (2 pcs)  xx2300000044
12	Tighten the screws.	Tightening torque: 50 Nm.
13	Disconnect the brake release tool.	
14	Perform a leak-down test.	See *Performing a leak-down test on page 197*.

Connecting the motor cables

	Action	Note
1	Put the motor cables in place in the opening.	

Continues on next page

	Action	Note
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001738
3	Connect the motor cables. **Note** Connect in accordance with the markings on the connectors.	
4	Fit a screw to the power connector. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001736

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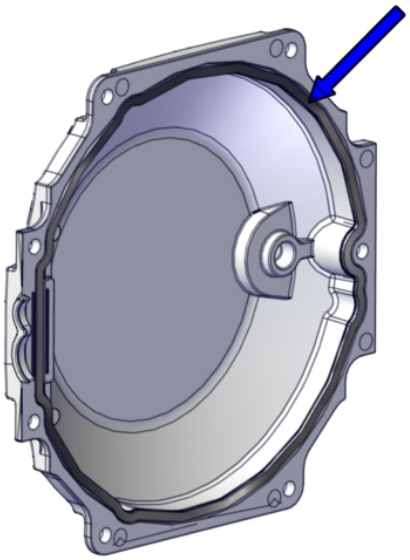
5.10.2 Replacing the axis-2 or axis-3 motor
Continued

	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1, axis-2 and axis-3: Connection box cover FS180 with gasket: 3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection) Axis-4: Connection box cover FS130 with gasket: 3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)  xx2100000600
6	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	

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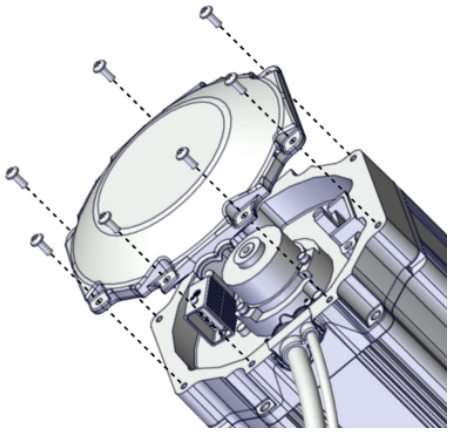
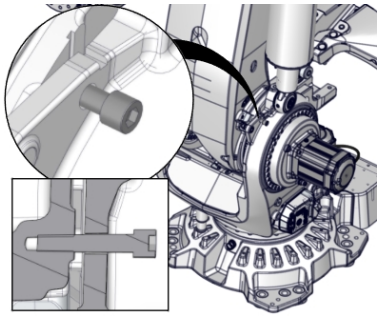
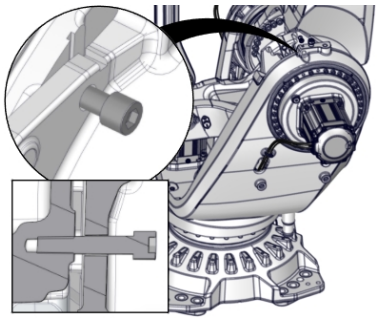
	Action	Note
7	Refit the motor cover with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.  xx2100000596

Concluding procedure

	Action	Note
1	Turn on the power to the robot.	
2	Use caution and jog axis-2 or axis-3 a little to facilitate the removal of the lock screw that secures the lower arm / movable arm structure.	
3	Remove the lock screw.	 xx2300001881  xx2400000236

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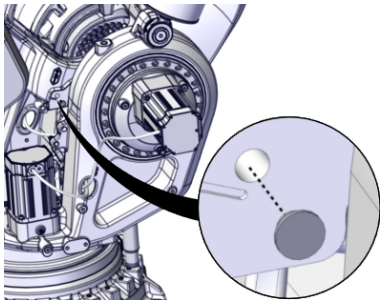
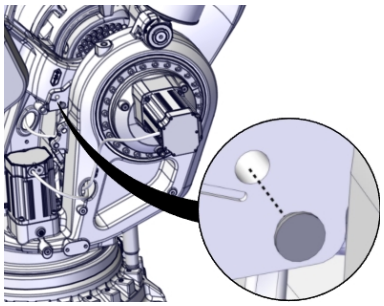
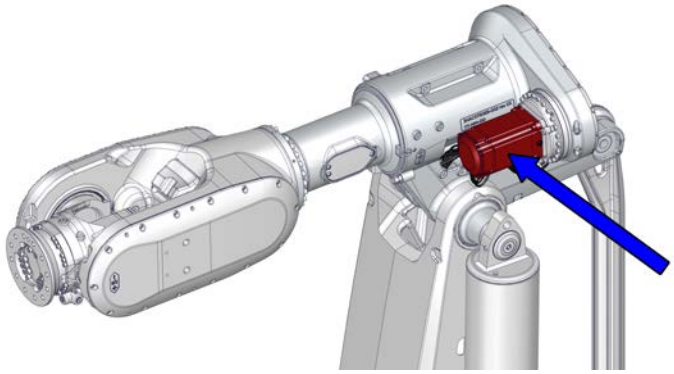
5.10.2 Replacing the axis-2 or axis-3 motor
Continued

	Action	Note
4	Jog axis 2 or axis 3 to be able to attach the plastic plugs. Refit the plastic plugs.	Axis-2 lock screw hole:  xx1500002366 Axis-3 lock screw hole:  xx1500002366
5	Refill the gearbox with oil.	See *Filling oil into the axis-2 gearbox on page 156*.
6	Re-calibrate the robot.	See *Calibration on page 619*.
7	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.10.3 Replacing the axis-4 motor

Location of the motor

The motor is located as shown in the figure.



xx2300001593

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Motor unit (including connection box and pinion)	3HAC084261-003 (Graphite White) 3HAC084261-004 (ABB Orange)		L2

Required service parts

Consumable	Article number	Note
Connection box cover FS130 with gasket	3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)	Replace if damaged. On axis-4 motor
Cleaning agent	-	Loctite 7200
Cleaning agent	-	Loctite 7063
Flange sealant	-	Loctite 5800

Required tools and equipment

Equipment	Article number	Note
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.

Continues on next page

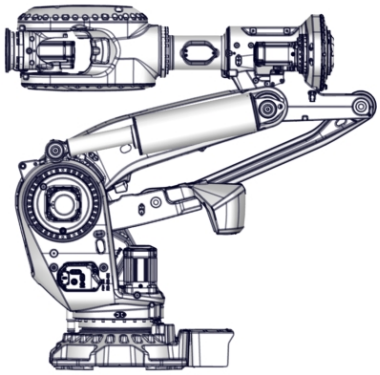
5.10.3 Replacing the axis-4 motor
Continued

Equipment	Article number	Note
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Removal tool motor M12	3HAC14631-1	Used to push out the motor, if necessary. Always use removal tools in pairs.
Rotation tool M4	3HAB7887-1	Used to rotate the motor pinion. Add screw M4.
Calibration toolbox, Axis Calibration	3HAC074564-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Removing the motor

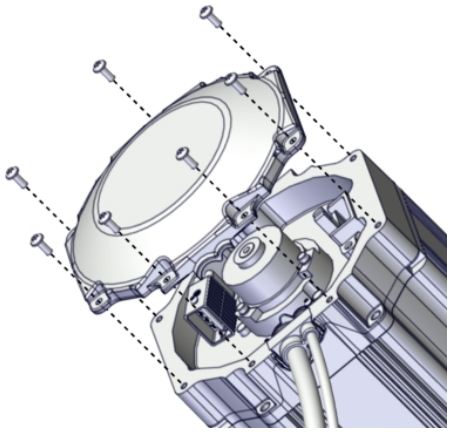
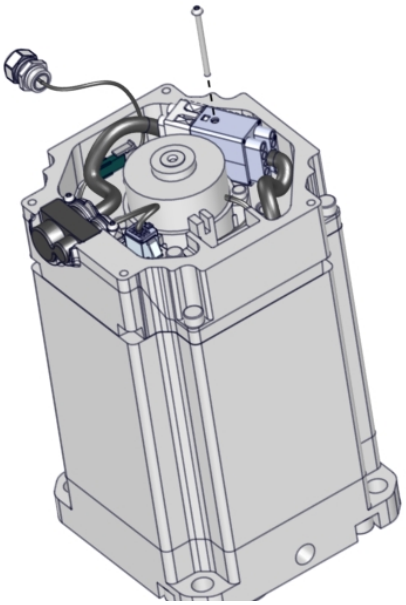
Use these procedures to remove the motor.

Preparations before removing the motor

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Jog the robot into position: • Axis 1: no significance • Axis 2: jog axis 2 and 3 to a position where the upper arm is horizontal • Axis 3: jog axis 2 and 3 to a position where the upper arm is horizontal • Axis 4: no significance • Axis 5: no significance • Axis 6: no significance	 xx2400000297
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
4	Drain the axis-4 primary gearbox.	See *Draining the axis-4 gearbox on page 165*.

Continues on next page

Disconnecting the motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the motor cover by removing the screws.	 xx2100000596
3	Disconnect the power cable connector by first removing the attachment screw and then parting the connector.	 xx2200001736

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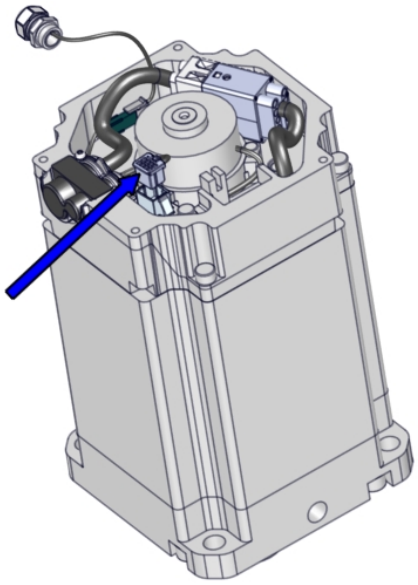
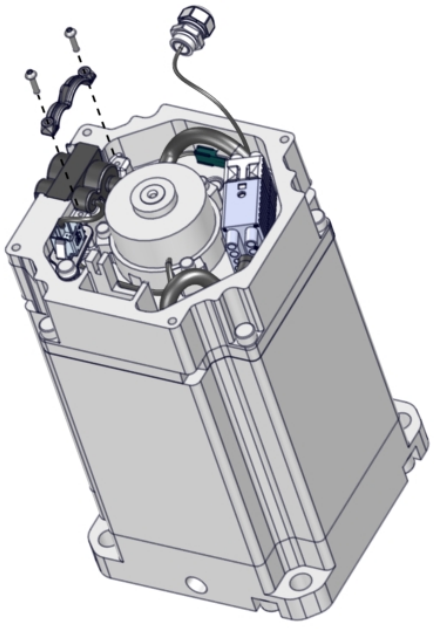
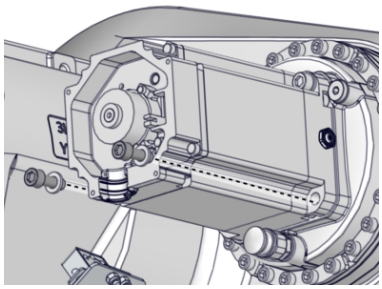
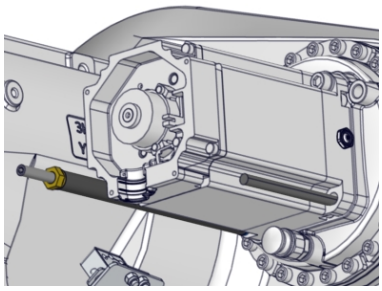
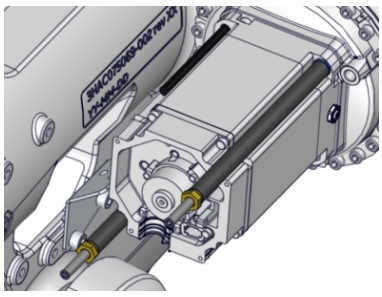
5.10.3 Replacing the axis-4 motor
Continued

	Action	Note
4	Disconnect the signal cable connector by pulling it out.	 xx2200001737
5	Remove the cable bracket by removing the screws.	 xx2200001738
6	Remove the motor cables from the motor.	

Removing the axis-4 motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

	Action	Note
2	Before removing the motor, make sure that the gearbox is completely drained.	
3	Remove two of the motor attachment screws.	 xx2400000298
4	Fit a guide pin in the non-threaded hole. Fit a removal tool in the threaded hole.	Guide pin, M10x150: 3HAC15521-2 Removal tool motor M12: 3HAC14631-1  xx2400000299
5	Remove the remaining screws.	
6	Fit a guide pin in the non-threaded hole. Fit a removal tool in the threaded hole.	Removal tool motor M12: 3HAC14631-1 Guide pin, M10x150: 3HAC15521-2  xx2400000300

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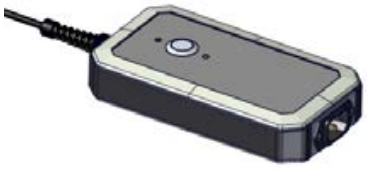
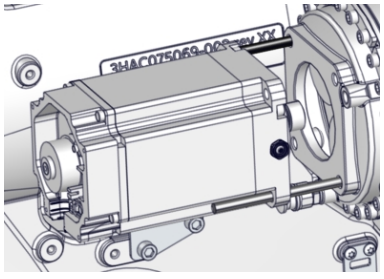
5.10.3 Replacing the axis-4 motor

Continued

	Action	Note
7	Release the brakes on the motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **CAUTION** Releasing the brakes on the axis-4 motor may cause axis-4 to move unexpectedly. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
8	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
9	Press the motor out of its position by using the removal tools.	
10	**CAUTION** The weight of the motor is 13 kg All lifting accessories used must be sized accordingly.	
11	Remove the motor by lifting it straight out. Make sure the pinion is not damaged.	 xx2400000301

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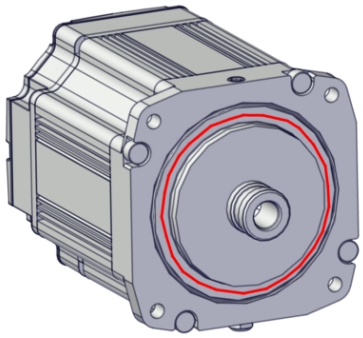
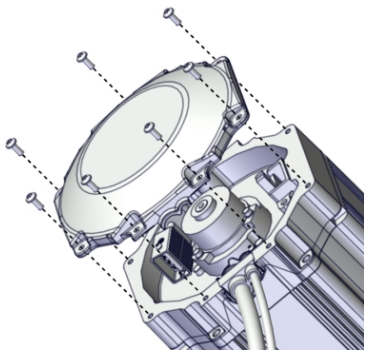
Refitting the motor

Use these procedures to refit the motor.

Preparations prior to refitting motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove any old paint or flange sealant residues or other contamination from the contact surfaces on both the motor and the mating parts. **Tip** Remove flange sealant residues with Loctite 7200. Then use Loctite 7063 for cleaning the mating surface.	Cleaning agent: Loctite 7200, Loctite 7063
3	Apply a continuous bead of flange sealant, 1-2 mm wide, inside of the groove on the motor contact surface. **Note** The purpose of the groove is to catch excess sealant. No o-ring is used.	Flange sealant: Loctite 5800  xx2100000520
4	Remove the cover, if fitted to the new spare part motor.	 xx2100000596

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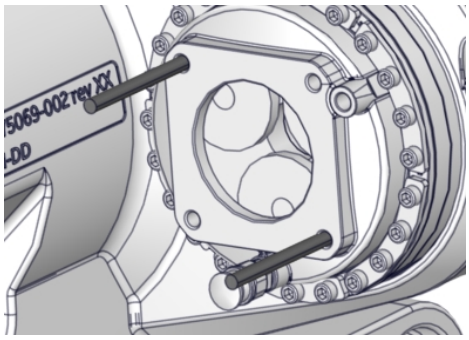
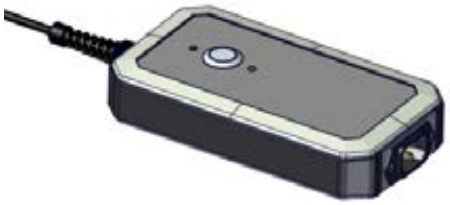
5.10.3 Replacing the axis-4 motor

Continued

Refitting the axis-4 motor

	Action	Note
1	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.  xx2400000302
2	**CAUTION** The weight of the motor is 13 kg All lifting accessories used must be sized accordingly.	
3	Apply the rotation tool.	Rotation tool M4: 3HAB7887-1
4	Release the brakes of the axis-4 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666

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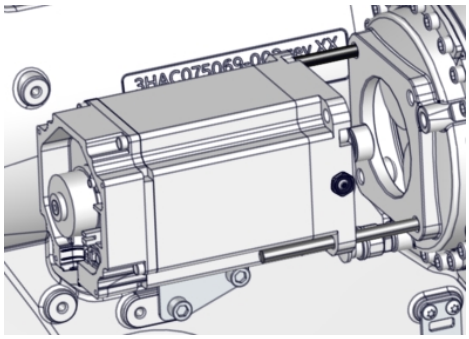
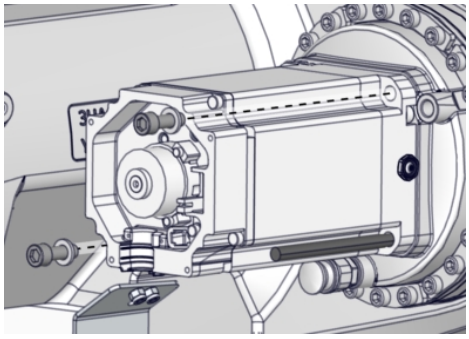
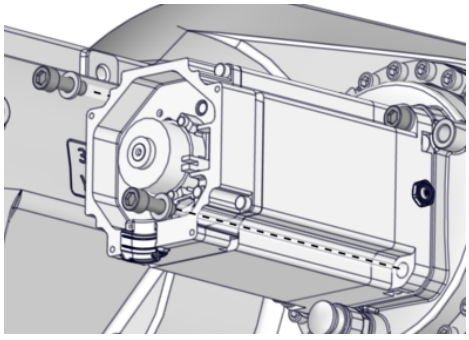
	Action	Note
5	Lift the motor and put it on the guide pins as close as possible to its final position without pushing the motor pinion into the gear. Use caution and fit the motor in its final position while at the same time rotating the motor pinion slightly using the rotation tool. • Make sure that the motor pinion is properly mated to the gear of the gearbox. • Make sure that the motor pinion does not get damaged. • Make sure that the direction of the cable exit is facing the correct way. **Note** Make sure the cable gland opening is turned the correct way.	 xx2400000301
6	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
7	Fit two of the attachment screws and washers. Use a bits extender in order to reach the screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (2 pcs) Bits extender: 3HAC12342-1  xx2400000303
8	Remove the guide pins and replace with the remaining attachment screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (2 pcs)  xx2400000304

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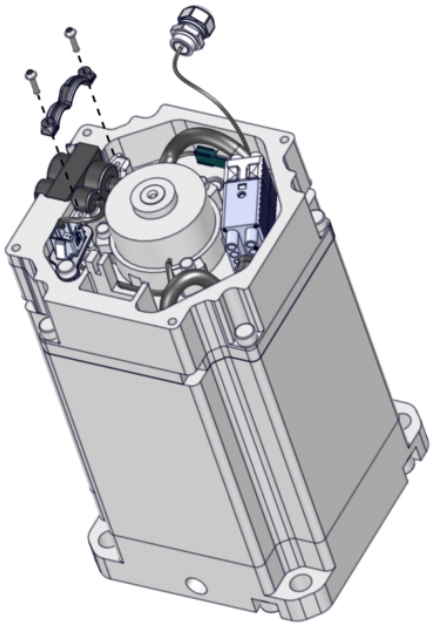
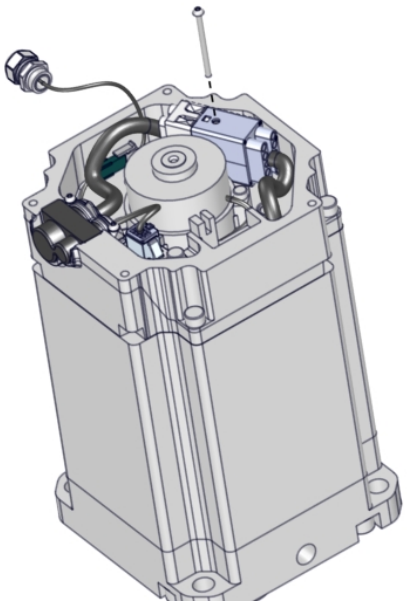
5.10.3 Replacing the axis-4 motor
Continued

	Action	Note
9	Tighten the screws.	Tightening torque: 50 Nm.
10	Disconnect the brake release tool.	
11	Perform a leak-down test.	See *Performing a leak-down test on page 197*.

Connecting the motor cables

	Action	Note
1	Put the motor cables in place in the opening.	
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001738
3	Connect the motor cables. **Note** Connect in accordance with the markings on the connectors.	

Continues on next page

	Action	Note
4	Fit a screw to the power connector. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001736

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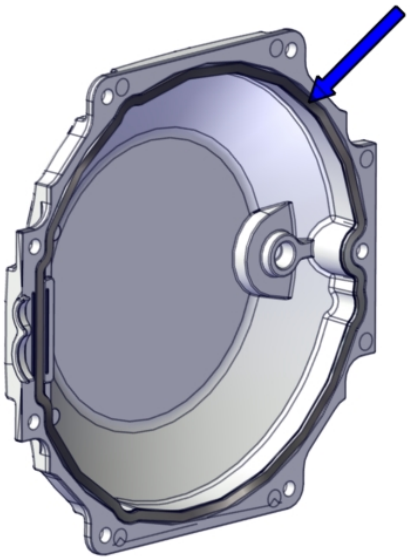
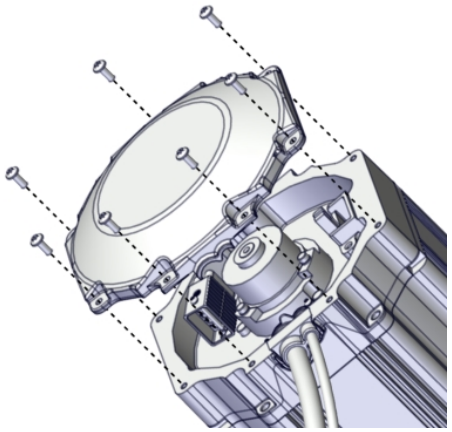
5.10.3 Replacing the axis-4 motor
Continued

	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1, axis-2 and axis-3: Connection box cover FS180 with gasket: 3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection) Axis-4: Connection box cover FS130 with gasket: 3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)  xx2100000600
6	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	

Continues on next page

	Action	Note
7	Refit the motor cover with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.  xx2100000596

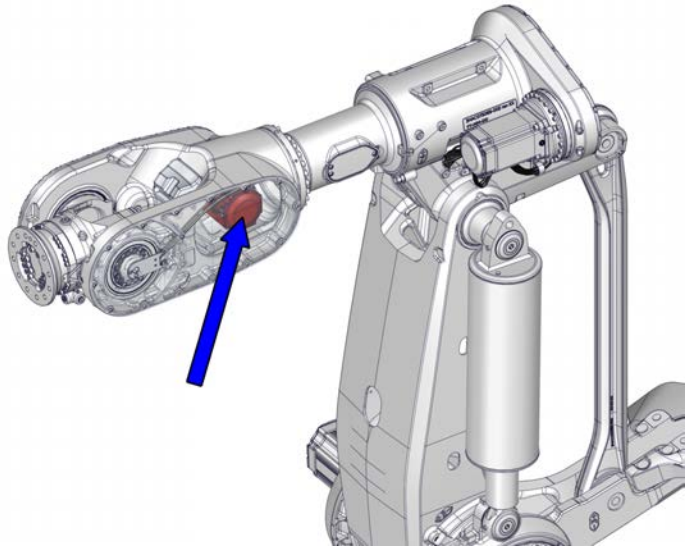
Concluding procedure

	Action	Note
1	Refill the gearbox with oil.	See *Filling oil into the axis-4 gearbox on page 166*.
2	Re-calibrate the robot.	See *Calibration on page 619*.
3	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.10.4 Replacing the axis-5 motor

Location of the motor

The motor is located as shown in the figure.



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Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Motor unit (including connection box and pinion)	3HAC076984-003		L2

Required service parts

Consumable	Article number	Note
Flange sealant	-	Loctite 5800
Cleaning agent	-	Loctite 7200
Cleaning agent	-	Loctite 7063
Connection box cover with gasket	3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)	Replace if damaged. On axis-5 motor
Cable strap, outdoor	-	

Continues on next page

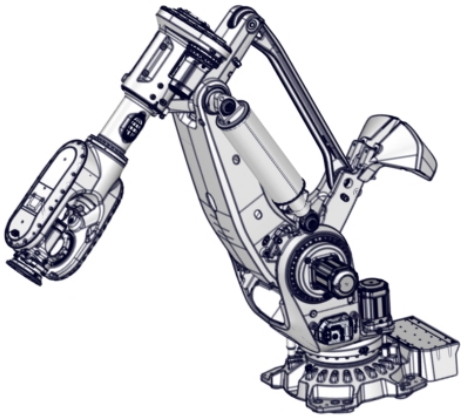
Required tools and equipment

Equipment	Article number	Note
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Removal tool motor M12	3HAC14631-1	Used to push out the motor, if necessary. Always use removal tools in pairs.
Rotation tool M4	3HAB7887-1	Used to rotate the motor pinion. Add screw M4.
Calibration toolbox, Axis Calibration	3HAC074564-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Removing the motor

Use these procedures to remove the motor.

Preparations before removing the axis-5 motor

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Jog the robot into position: • Axis 1: no significance • Axis 2: suitable working position to replace axis-5 motor (for example: +25°) • Axis 3: suitable working position to replace axis-5 motor (for example: +45°) • Axis 4: +90° • Axis 5: no significance • Axis 6: no significance With the robot in this position, there is no need to drain oil from the axis-5 gearbox when the motor is replaced.	 xx2300001922

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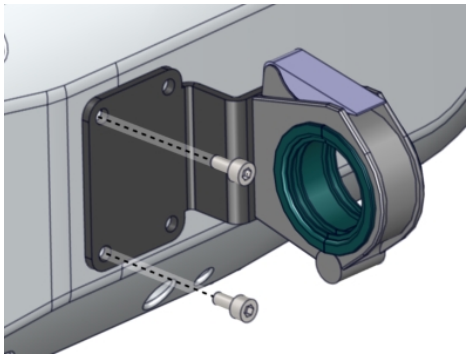
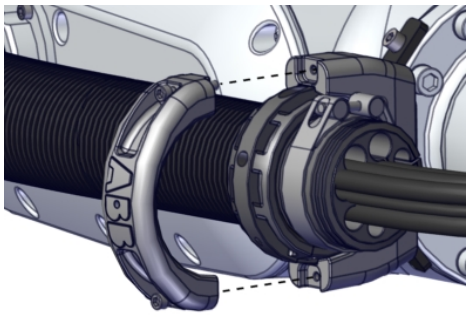
5.10.4 Replacing the axis-5 motor
Continued

	Action	Note
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Retrieving access to the wrist cabling

Use this procedure to remove the wrist cover.

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	If DressPack MH3 is installed: Remove the wrist bracket with the complete ball joint housing still fitted, if the bracket is installed over the two wrist cover screws. **Note** No need to remove the bracket if the two wrist cover screws are accessible.	 xx2300001366
3	If DressPack is installed: Open the ball joint housing on the arm tube and remove the DressPack cable package.	 xx2100002709

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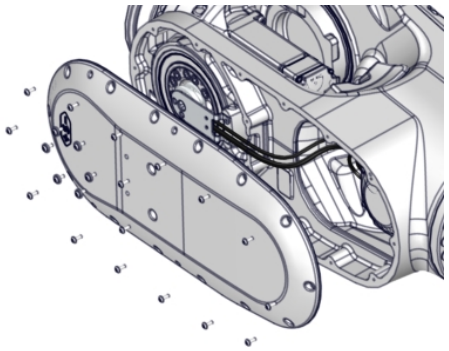
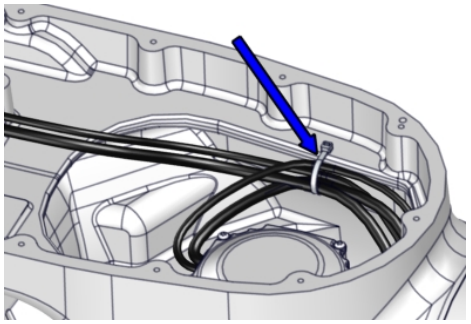
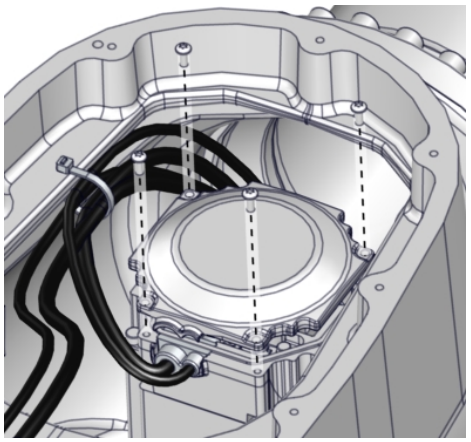
	Action	Note
4	Remove the wrist cover.	 xx2300001883

Disconnecting the axis-5 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Cut the cable tie.	 xx2300001923
3	Remove the motor cover by removing the screws.	 xx2300001924

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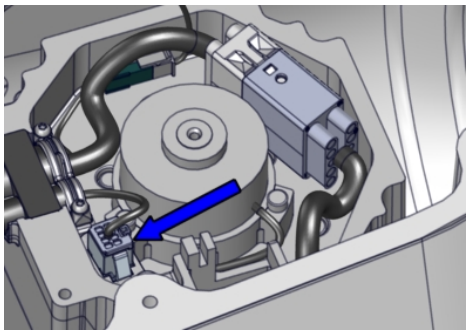
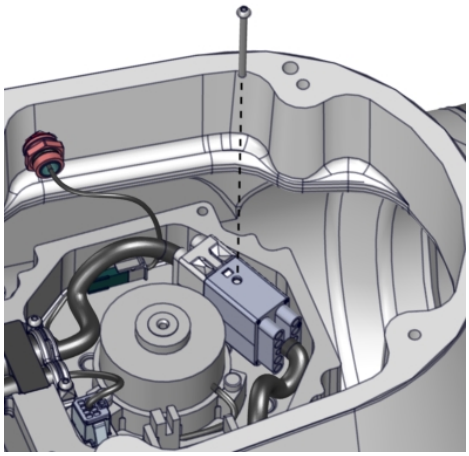
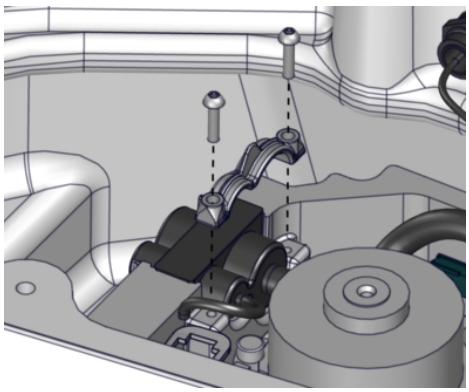
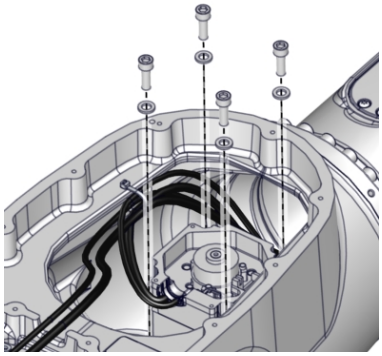
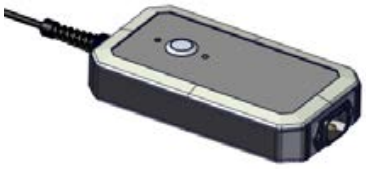
5.10.4 Replacing the axis-5 motor
Continued

	Action	Note
4	Disconnect the signal cable connector.	 xx2200001734
5	Disconnect the power cable connector by removing the attachment screw.	 xx2200001733
6	Remove the cable bracket by removing the screws.	 xx2200001735
7	Remove the motor cables.	

Removing the axis-5 motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

	Action	Note
2	Unscrew the attachment screws that secure the motor, using a bits extender.	Bits extender: 3HAC12342-1  xx2300001926
3	Fit guide pins in the non-threaded holes.	Guide pin, M10x150: 3HAC15521-2
4	Fit removal tools in the threaded holes.	Removal tool motor M12 3HAC14631-1
5	Release the brakes on the motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
6	**CAUTION** The weight of the motor is 13 kg	
7	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

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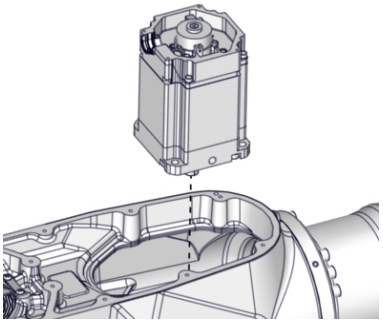
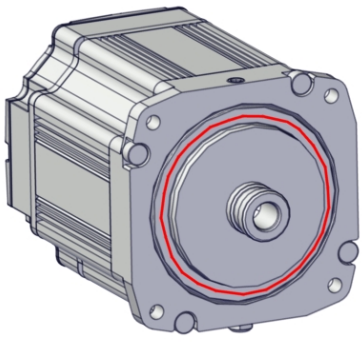
5.10.4 Replacing the axis-5 motor
Continued

	Action	Note
8	Press the motor out of its position by using the removal tools.	Used to push out the motor, if necessary. Always use removal tools in pairs.
9	Remove the motor by carefully lifting it straight out/straight up. Make sure the pinion is not damaged.	 xx2300000204

Refitting the motor

Use these procedures to refit the motor.

Preparations prior to refitting motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove any old paint or flange sealant residues or other contamination from the contact surfaces on both the motor and the mating parts. **Tip** Remove flange sealant residues with Loctite 7200. Then use Loctite 7063 for cleaning the mating surface.	Cleaning agent: Loctite 7200, Loctite 7063
3	Apply a continuous bead of flange sealant, 1-2 mm wide, inside of the groove on the motor contact surface. **Note** The purpose of the groove is to catch excess sealant. No o-ring is used.	Flange sealant: Loctite 5800  xx2100000520

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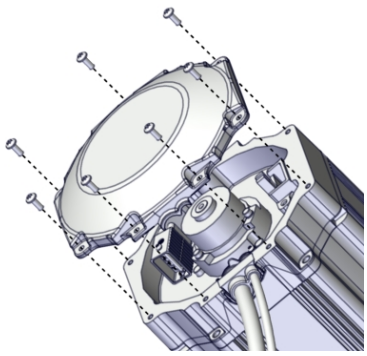
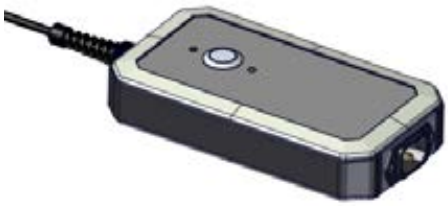
	Action	Note
4	Remove the cover, if fitted to the new spare part motor.	 xx2100000596

Refitting the axis-5 motor

	Action	Note
1	Apply two guide pins in opposite holes.	Guide pin, M10x150 3HAC15521-2
2	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
3	Apply the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool M4: 3HAB7887-1
4	Release the brakes on the motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666

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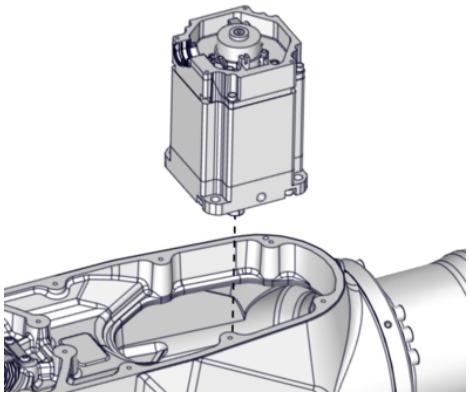
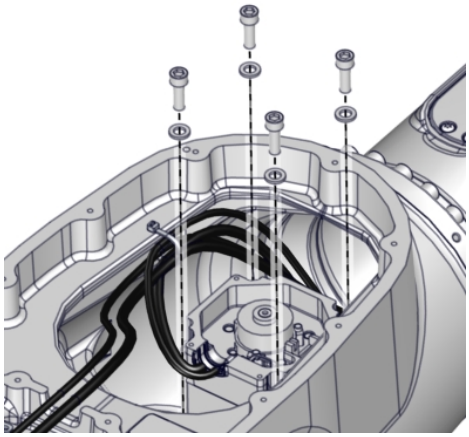
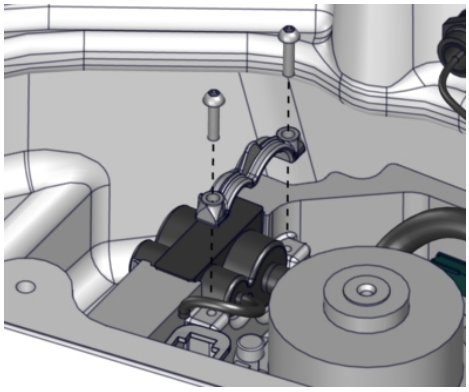
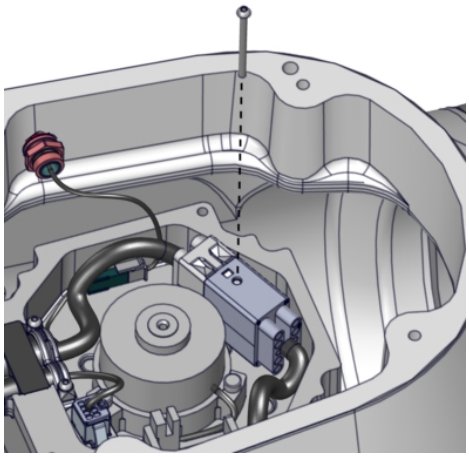
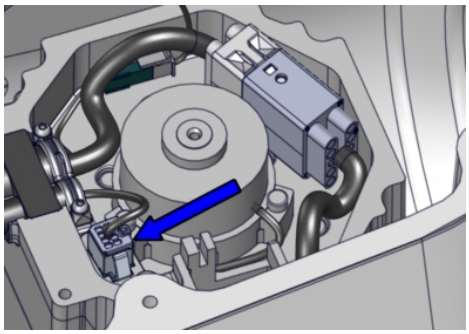
5.10.4 Replacing the axis-5 motor
Continued

	Action	Note
5	**CAUTION** The weight of the motor is 13 kg	
6	Use caution and lower the motor into position on the guide pins, while at the same time rotating the motor pinion slightly. Make sure that: • the motor pinion is properly mated to the gear of the gearbox. • the motor pinion does not get damaged. • the direction of the cable exit is facing the same way as before removal.	Rotation tool M4, 3HAB7887-1  xx2300000204
7	Remove the guide pins.	
8	Secure the motor with its attachment screws and washers.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 50 Nm.  xx2300001926
9	Perform a leak-down test.	See *Performing a leak-down test on page 197*.
10	Disconnect the brake release tool.	

Connecting the axis-5 motor cables

	Action	Note
1	Put the motor cables in place in the opening.	

Continues on next page

	Action	Note
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001735
3	Connect the power cable connector and secure with a screw. Connect in accordance with the markings on the connectors. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001733
4	Connect the signal cable connector. Connect in accordance with the markings on the connectors.	 xx2200001734

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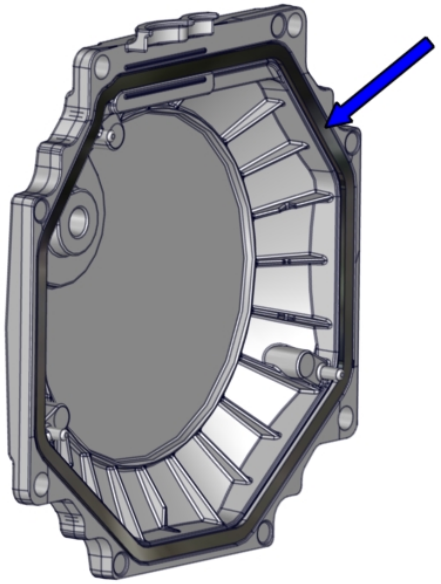
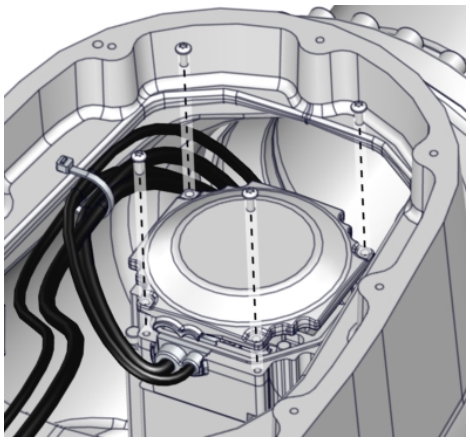
5.10.4 Replacing the axis-5 motor
Continued

	Action	Note
5	Inspect the gasket. Replace if damaged.	Connection box cover with gasket: 3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)  xx2200002141
6	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
7	Refit the motor cover and the cable protection with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.  xx2300001924

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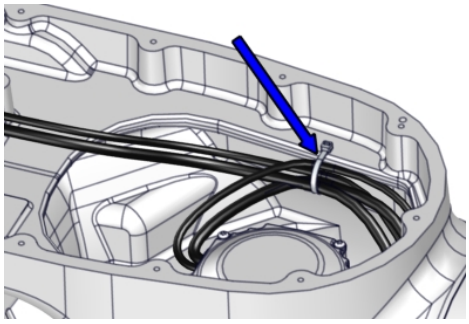
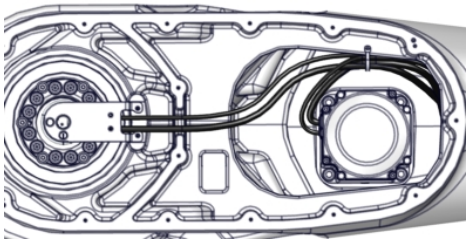
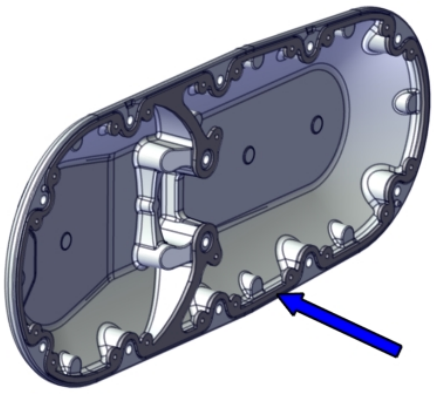
	Action	Note
8	Secure the cabling with a cable strap.	Cable strap, outdoor: -  xx2300001923

Refitting the wrist cover

	Action	Note
1	Make sure that the cable harness is routed and secured as shown in the figure.	 xx2300001927
2	*Foundry Plus:* Inspect the gasket. Replace if damaged.	Gasket: 3HAC085052-001  xx2100001407

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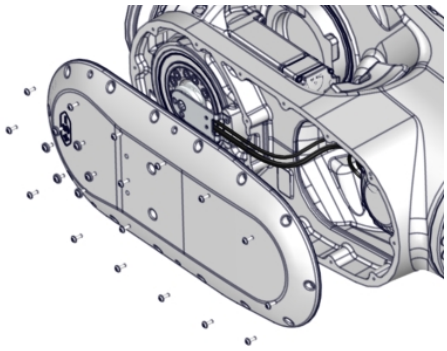
5.10.4 Replacing the axis-5 motor

Continued

	Action	Note
3	Refit the wrist cover and secure with screws. *Foundry Plus:* Fit all the screws first, then torque tighten them twice to achieve correct torque (due to compression from the gasket).	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2300001883

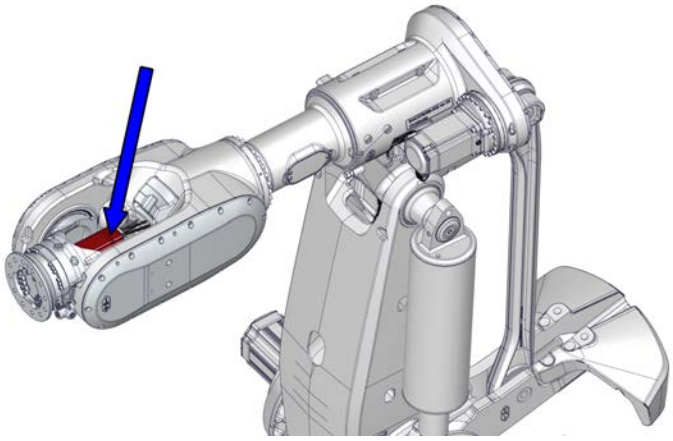
Concluding procedure

	Action	Note
1	If used, refit the DressPack cable package on the wrist.	See product manual for the DressPack.
2	Refill the gearbox with oil, if drained.	See *Filling oil into the axis-5 gearbox on page 175*.
3	Re-calibrate the robot.	See *Calibration on page 619*.
4	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.10.5 Replacing the axis-6 motor

Location of the motor

The motor is located as shown in the figure.



xx2300001595

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Motor unit (including connection box and pinion)	3HAC076985-003 (Graphite White) 3HAC076985-004 (ABB Orange)		L2

Required service parts

Consumable	Article number	Note
Connection box cover with gasket	3HAC079381-003 (Graphite White) 3HAC079381-004 (ABB Orange)	Replace if damaged. On axis-6 motor
Cleaning agent	-	Loctite 7200
Cleaning agent	-	Loctite 7063
Flange sealant	-	Loctite 5800

Required tools and equipment

Equipment	Article number	Note
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.

Continues on next page

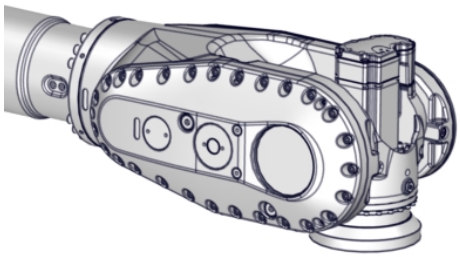
5.10.5 Replacing the axis-6 motor
Continued

Equipment	Article number	Note
Removal tool motor M10	3HAC14972-1	Used to push out the motor, if necessary.
Guide pin, M8x150	3HAC15520-2	Always use guide pins in pairs.
Rotation tool M3	3HAB7887-1	Used to rotate the motor pinion. Add screw M3.
Calibration toolbox, Axis Calibration	3HAC074564-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Removing the motor

Use these procedures to remove the motor.

Preparations before removing the axis-6 motor

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Jog the robot to a position where axis 5 can be positioned with the axis-6 motor pointing straight up at an acceptable working position. With axis 5 in this position it is possible to replace the axis-6 motor without draining the oil from the axis-6 gearbox.	 xx2200001818
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Disconnecting the axis-6 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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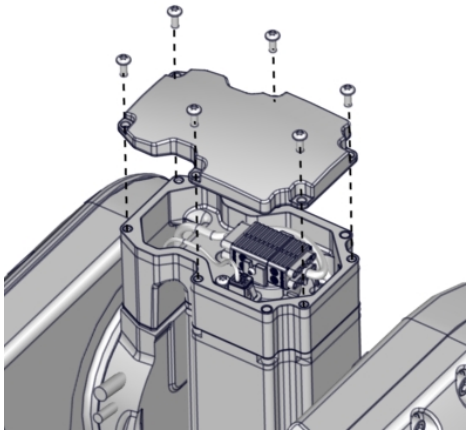
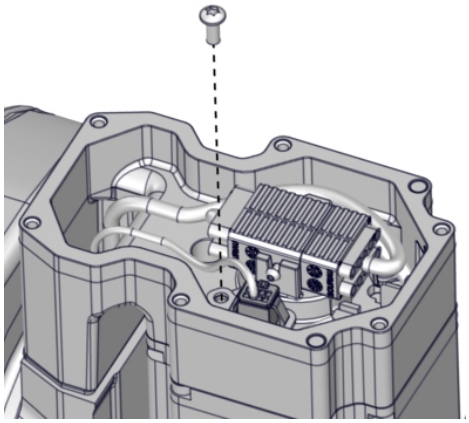
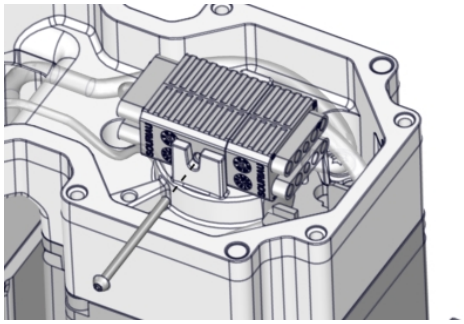
	Action	Note
2	Unscrew the attachment screws and remove the motor cover.	 xx2200001434
3	Remove the connector bracket.	 xx2200001730
4	Remove the connector screw.	 xx2200001731
5	Disconnect the motor cables.	

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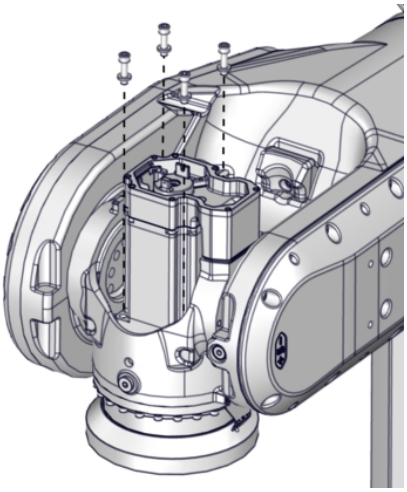
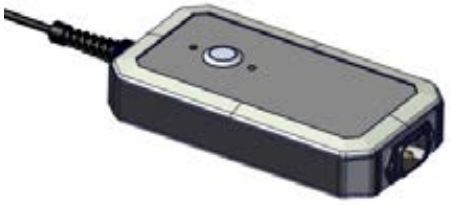
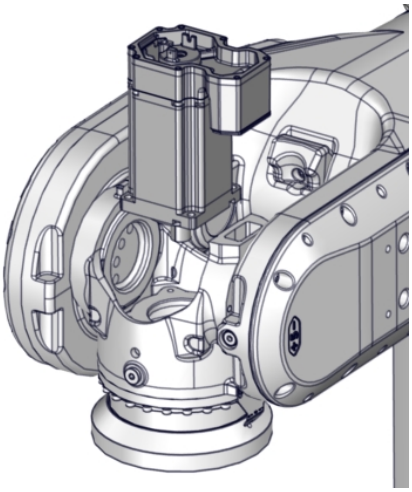
5.10.5 Replacing the axis-6 motor

Continued

Removing the axis-6 motor

	Action	Note
1	Unscrew the motor attachment screws.	 xx2200001806
2	Fit guide pins in the non-threaded holes.	Guide pin, M8x150
3	Fit removal tools in the threaded holes.	Removal tool motor M10: 3HAC14972-1
4	Release the brakes on the axis-6 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
5	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

Continues on next page

	Action	Note
6	Press the motor out of its position by using the removal tools.	Used to push out the motor, if necessary.
7	**CAUTION** The weight of the motor is 7.5 kg	
8	Remove the motor by lifting it straight up from the gear. Make sure the motor pinion is not damaged!	 xx2200001805
9	Disconnect the brake release tool.	

Refitting the motor

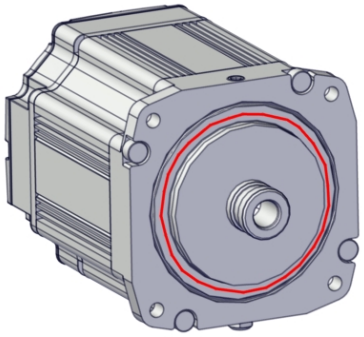
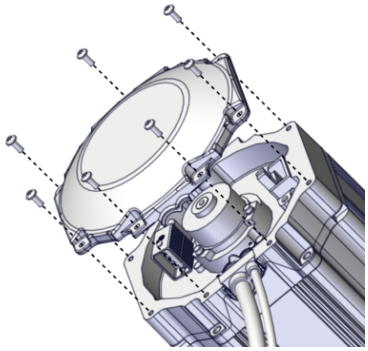
Use these procedures to refit the motor.

Preparations prior to refitting motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove any old paint or flange sealant residues or other contamination from the contact surfaces on both the motor and the mating parts. **Tip** Remove flange sealant residues with Loctite 7200. Then use Loctite 7063 for cleaning the mating surface.	Cleaning agent: Loctite 7200, Loctite 7063

Continues on next page

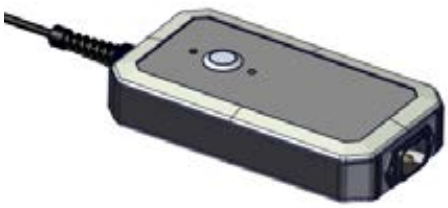
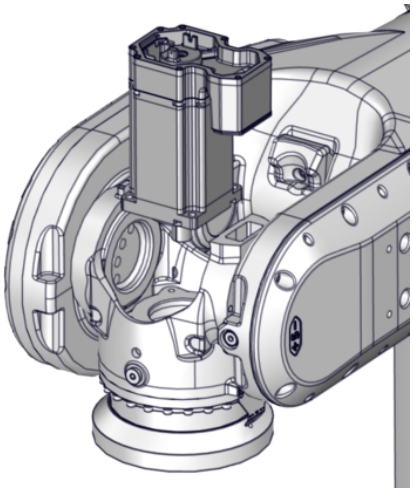
5.10.5 Replacing the axis-6 motor
Continued

	Action	Note
3	Apply a continuous bead of flange sealant, 1-2 mm wide, inside of the groove on the motor contact surface. **Note** The purpose of the groove is to catch excess sealant. No o-ring is used.	Flange sealant: Loctite 5800  xx2100000520
4	Remove the cover, if fitted to the new spare part motor.	 xx2100000596

Refitting the axis-6 motor

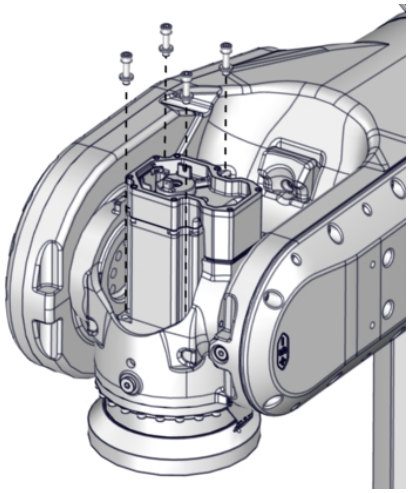
	Action	Note
1	Apply two guide pins in opposite holes.	Guide pin, M8x150
2	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

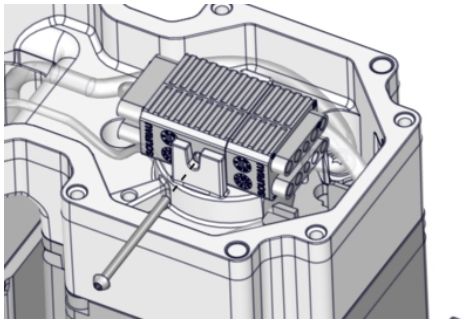
	Action	Note
3	Release the brakes on the axis-6 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
4	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
5	Use caution and lower the motor into position on the guide pins, while at the same time rotating the motor pinion slightly. Make sure that: • the motor pinion is properly mated to the gear of the gearbox. • the motor pinion does not get damaged.	Rotation tool M3, 3HAB7887-1  xx2200001805
6	Remove the guide pins.	

Continues on next page

5.10.5 Replacing the axis-6 motor
Continued

	Action	Note
7	Secure the motor with its attachment screws.	Hex socket head cap screw: M8x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 24 Nm  xx2200001806
8	Perform a leak-down test.	See *Performing a leak-down test on page 197*.

Connecting the axis-6 motor cables

	Action	Note
1	Connect the motor cables. Connect in accordance with the markings on the connectors.	
2	Position the power connector to the bracket with a screw. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001731

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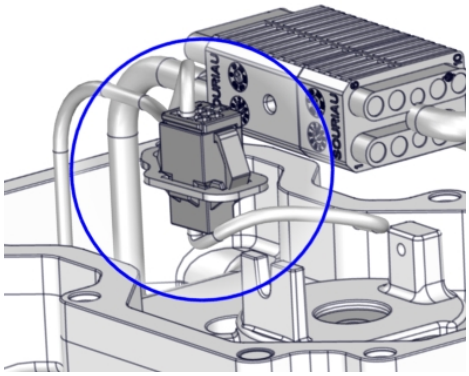
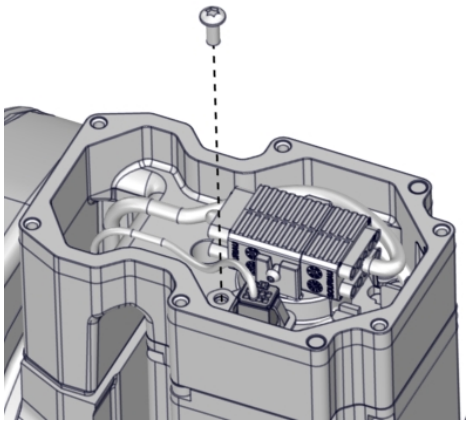
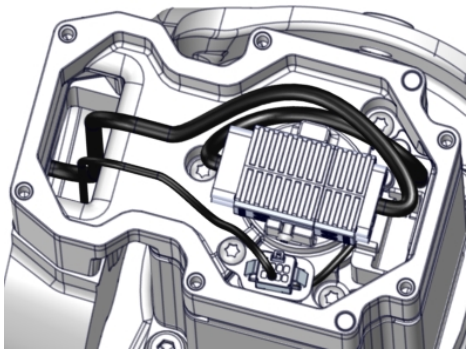
	Action	Note
3	Snap the signal connectors to each other in the bracket.	 xx2200001921
4	Refit the connector bracket assembly to the motor. **CAUTION** The cabling is sensitive to mechanical damage. Handle it with care to avoid damage to the cabling or the connector, avoid any kind of tilt or skew.	Torx pan head screw: M5x12 Stainless steel A2-70  xx2200001730
5	Verify correct cable layout as shown in the figure. **CAUTION** Route the signal cabling correctly to avoid cable damage.	 xx2300000920

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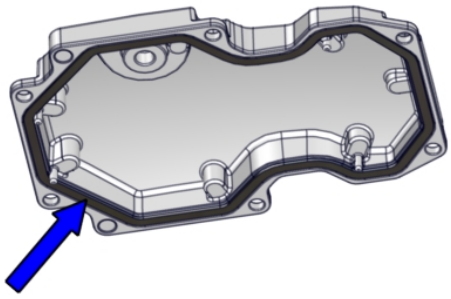
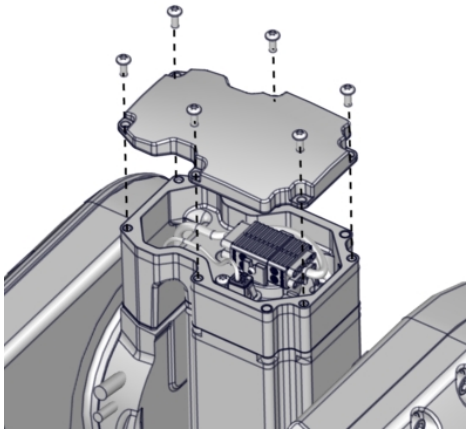
5.10.5 Replacing the axis-6 motor
Continued

	Action	Note
6	Inspect the gasket. Replace if damaged.	Connection box cover with gasket: 3HAC079381-003 (Graphite White) 3HAC079381-004 (ABB Orange)  xx2200001922
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8	Refit the motor cover.	Torx pan head screw, M5x12 Stainless steel A2-70, 6 pcs Tightening torque: 6 Nm.  xx2200001434

Concluding procedure

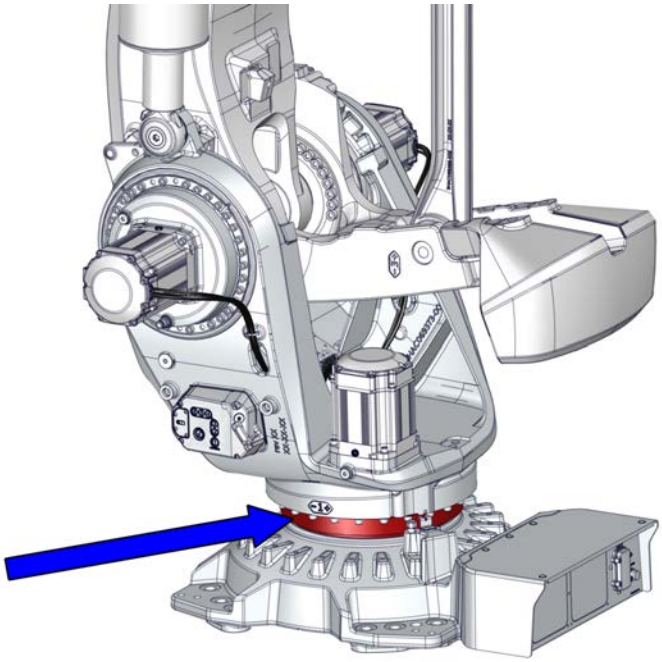
	Action	Note
1	If used, refit the DressPack cable package on the wrist.	See product manual for the DressPack.
2	Re-calibrate the robot.	See *Calibration on page 619*.
3	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.11 Gearboxes

5.11.1 Replacing the axis-1 gearbox

Location of the gearbox

The gearbox is located as shown in the figure.



xx2300001596

Summary of the replacement procedure

This is a brief summary of the replacement procedure, containing the major actions to be performed.

1. Secure the manipulator on top of four support legs.
2. Drain the axis-1 gearbox.
3. Remove the cabling from the base.
4. Remove the axis-1 motor.
5. Remove the upper arm, lower arm and frame (complete manipulator excluding the base and axis-1 gearbox) as an assembly.
6. Replace the axis-1 gearbox.

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

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5.11.1 Replacing the axis-1 gearbox
Continued

Spare part	Article number	Note	Level
Gearbox	3HAC085094-002 (Graphite White) 3HAC085094-003 (ABB Orange)	Includes o-ring 3HAC061327-105	L2

Required service parts

Consumable	Article number	Note
O-ring	3HAC061327-105	On gearbox. Included in gearbox spare part, but replace if damaged.
O-ring	3HAC061327-033	1 pcs. At the oil inlet hole on the gearbox.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.
Connection box cover FS180 with gasket	3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection)	Replace if damaged. On axis-1 motor A threaded connection is required for cooling fan option.
O-ring	3HAB3772-57	On axis-1 protection ring.
Cleaning agent	-	Isopropanol
Rust preventive	3HAC034903-001	Mercasol 3110 Waxcoat. Recommended drying time is 24h.
Grease	3HAC042536-001	Shell Gadus S2
Cleaning agent	-	Loctite 7200
Cleaning agent	-	Loctite 7063
Flange sealant	-	Loctite 5800
Sealant (grey)	3HAC026759-001	Sikaflex 521FC. *Protection type Foundry Plus*.
Protection plug	3HAC4836-21	For lifting holes.
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.

Required tools and equipment

Equipment	Article number	Note
Swivel eye bolt M20	-	M20
Roundsling and adjustable lifting chain	-	Complete length 1.86 m [i]
Roundsling and adjustable lifting chain	-	Complete length 1.78 m [ii]

Continues on next page

Equipment	Article number	Note
Roundsling	-	4 m
Supporting pillars	3HAC061213-001	Used for elevation of the robot to remove and refit axis-1 gearbox. Includes: • Supporting pillars (4 pcs) • User instructions (3HAC062411-002) • Screws 3HAC061400-001 (4 pcs)
Bit holder and hexagon bit SW10		Bit holder dimension: 5/16" (14x18 mm) Used for screw access in narrow locations.
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Removal tool motor M12	3HAC14631-1	Used to push out the motor, if necessary. Always use removal tools in pairs.
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
Lifting accessory, motor	3HAC076550-001	
Guide pin, M12x150 / Guide pin, M12x200	3HAC13056-2 / 3HAC13056-3	Always use guide pins in pairs.
Lifting eye	3HAC16131-1	M12, 2 pcs Use M12 washers beneath the lifting eyes, if the lifting eyes need to be elevated somewhat not to damage the o-ring on the gear-box.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Guide for reduction gear	3HAC043870-009	Used to guide axis-1 gear and frame during refitting.
Rotation tool M4	3HAB7887-1	Used to rotate the motor pinion. Add screw M4.
Calibration toolbox, Axis Calibration	3HAC074564-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

i Use a roundsling (for example 1 m) to avoid scratches on the manipulator combined with lifting chains, to get the exact length of the lifting accessory for a balanced lift of the manipulator.

ii Use a roundsling (for example 1 m) to avoid scratches on the manipulator combined with lifting chains, to get the exact length of the lifting accessory for a balanced lift of the manipulator.

Continues on next page

5.11.1 Replacing the axis-1 gearbox
Continued

Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

	Action	Note
1	Decide which calibration routine to use for calibrating the robot. • Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot. • Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.	
	If the robot is to be calibrated with reference calibration: Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in *Reference calibration routine on page 628*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

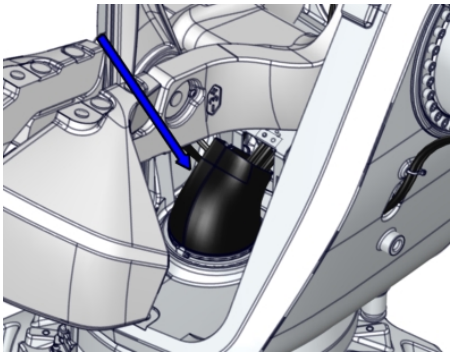
Removing the gearbox

These procedures describe how to remove the gearbox.

Removing tools and equipment from the turning disc

	Action	Note
1	Remove any payload, tools or other equipment fitted on the turning disc. DressPack can stay fitted for the time being.	This is done to achieve the best stability of the arm assembly, when removing and lifting it, and when it is resting by itself after removal.

Removing the covers for Foundry Plus and floor mounted robots

	Action	Note
1	*Protection type Foundry Plus* Remove the axis-1 cable protection.	 xx2300001954

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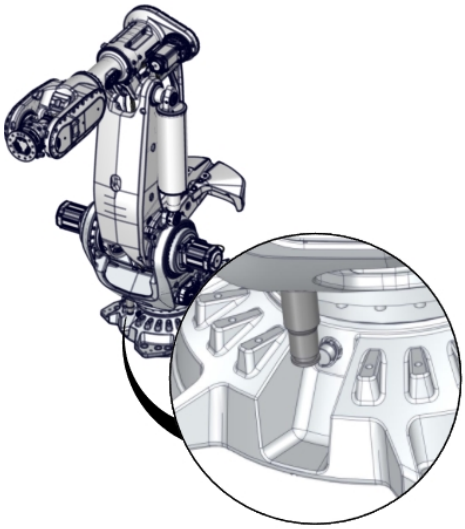
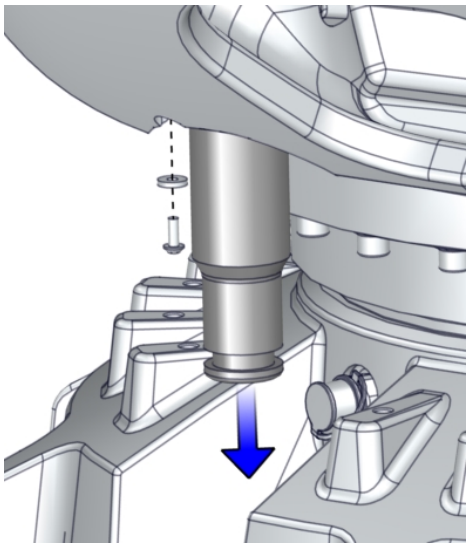
Removing the mechanical stop pin

	Action	Note
1	Jog axis-1 to the position where it is possible to replace the mechanical stop pin.	 xx2300001710
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Take a firm grip on the stop pin with one hand and unscrew the set screw with the other hand. **Note** Always use a flat head Allen key, to not damage the screw head.	Torx bit: T30  xx2300001711

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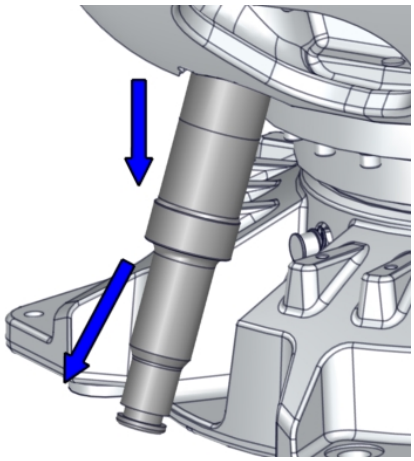
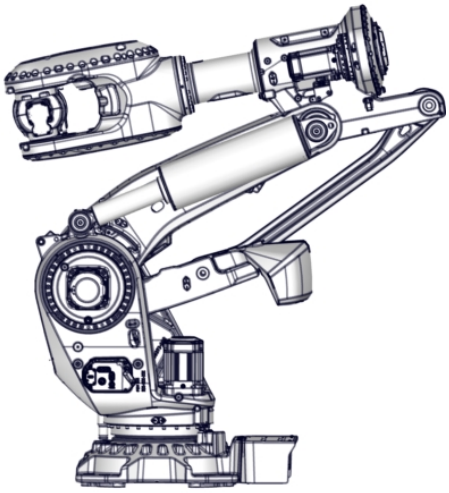
5.11.1 Replacing the axis-1 gearbox
Continued

	Action	Note
4	Remove the stop pin by sliding it down, out off its hole and moving it slightly forwards.	 xx2300001713

Position for the floor mounted robot

	Action	Note
1	Turn on the power to the robot temporarily.	
2	Jog the robot into position: • Axis 1: 0° • Axis 2: -55° • Axis 3: +10° • Axis 4: +90° • Axis 5: -90° • Axis 6: no significance.	 xx2300001531
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

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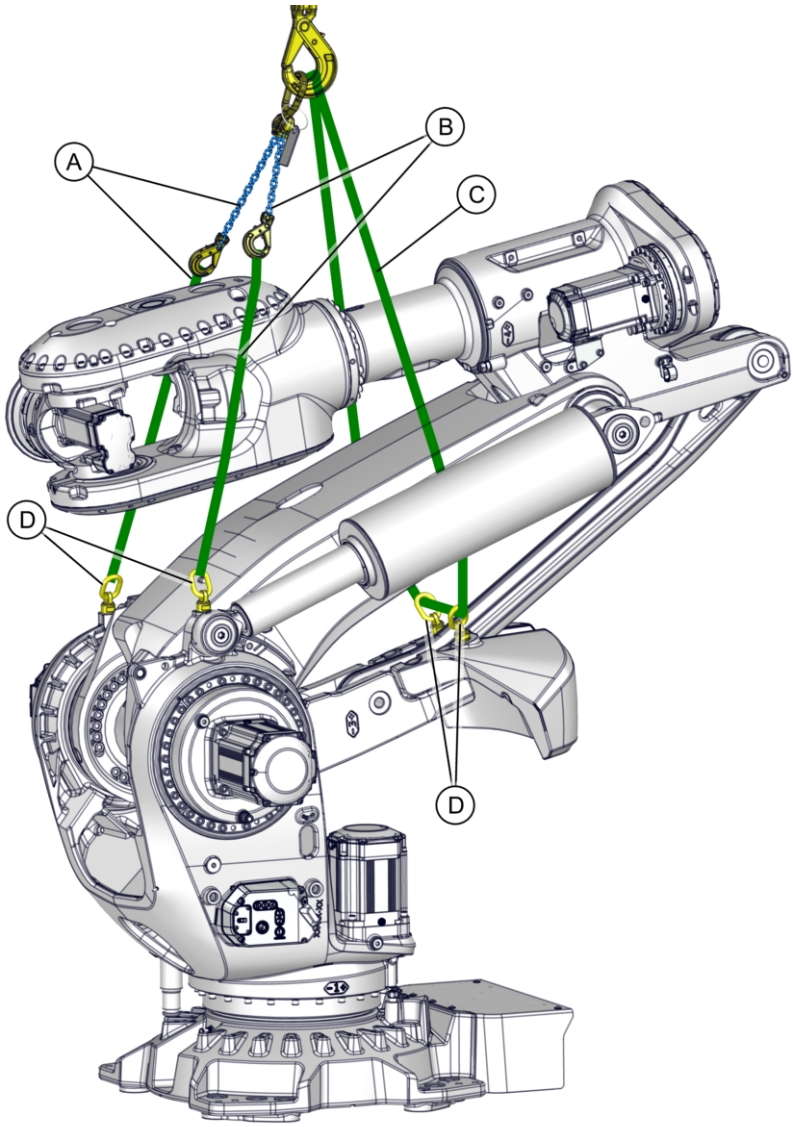
Attaching the lifting accessories to the arm system

Illustration for installing lifting accessories



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Pos	Description	Note	Quantity
A	Roundsling and adjustable lifting chain	Complete length 1.86 m [i]	1 pcs
B	Roundsling and adjustable lifting chain	Complete length 1.78 m [ii]	1 pcs
C	Roundsling	4 m	1 pcs
D	Swivel eye bolt M20	M20	4 pcs

i Use a roundsling (for example 1 m) to avoid scratches on the manipulator combined with lifting chains, to get the exact length of the lifting accessory for a balanced lift of the manipulator.

ii Use a roundsling (for example 1 m) to avoid scratches on the manipulator combined with lifting chains, to get the exact length of the lifting accessory for a balanced lift of the manipulator.

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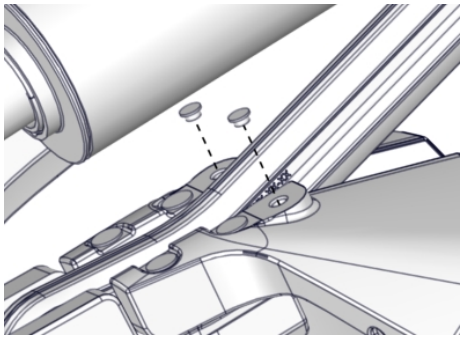
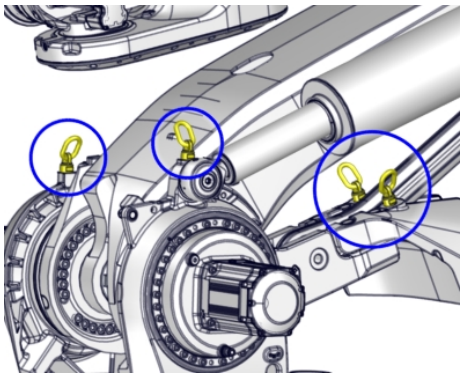
5.11.1 Replacing the axis-1 gearbox

Continued

	Action	Note
1	**CAUTION** The weight of the IRB 7710 robot is 2,130 - 2,250 kg (depending on robot variant) All lifting accessories used must be sized accordingly.	
2	Remove the plastic plugs that cover the lifting eye holes on the counter balancing weight. **Note** Keep the plastic plugs for refitting.	 xx2300001714
3	Fit two lifting eyes to the holes in the frame and two lifting eyes to the holes in the counter weight.	Swivel eye bolt M20 (4 pcs)  xx2300001540
4	Attach the roundslings to the robot according to the figure. Make sure the roundslings do not rub against any sharp edges.	See *Illustration for installing lifting accessories on page 475*.
5	Stretch the lifting accessories to take the weight of the robot.	

Fitting support legs under the floor mounted robot

	Action	Note
1	**CAUTION** The weight of the IRB 7710 robot is 2,130 - 2,250 kg (depending on robot variant) All lifting accessories used must be sized accordingly.	

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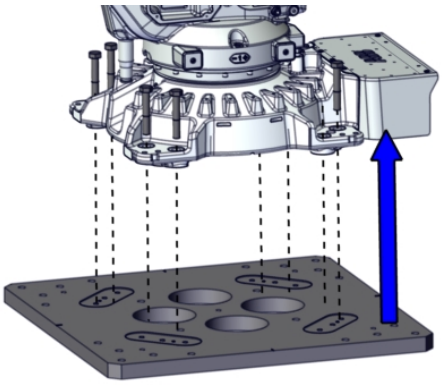
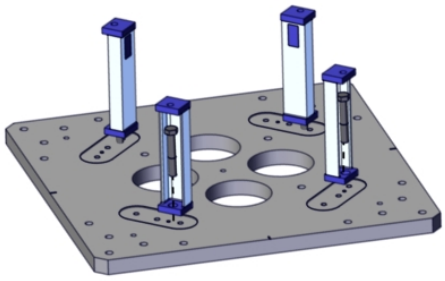
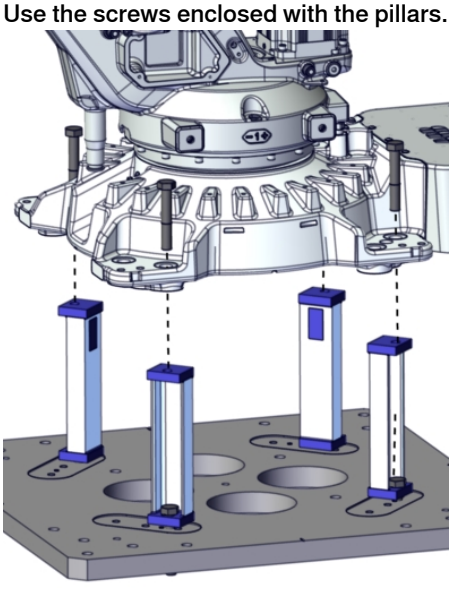
	Action	Note
2	Unscrew the attachment screws from the foundation and lift away the robot to be able to fit the four support legs to the foundation.	 xx2100001115
3	Secure the support legs to the foundation using the same holes as to secure the base.	Supporting pillars: 3HAC061213-001 Tightening torque: 325 Nm Follow user instructions enclosed with the pillars.  xx2100001114
4	Lower the robot to the support legs and secure.	Use the screws enclosed with the pillars.  xx2100001113

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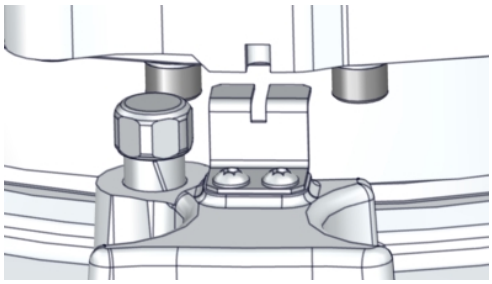
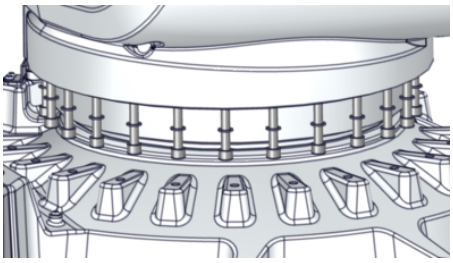
5.11.1 Replacing the axis-1 gearbox
Continued

Preparations before removing the axis-1 gearbox

Use this procedure to do the necessary preparations, before removing the gearbox.

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
3	Begin draining the axis-1 gearbox. **Note** There will be some oil left in the gear after draining.	See *Floor-mounted robot: Draining the axis-1 gearbox on page 150*.
4	Remove the attachment screws. **Note** Leave the screws behind the synchronization plate and calibration pin for now.  xx2300001877	Bit holder and hexagon bit SW10 Bit holder dimension: 5/16" (14x18 mm)  xx2300001876

Disconnecting the axis-1 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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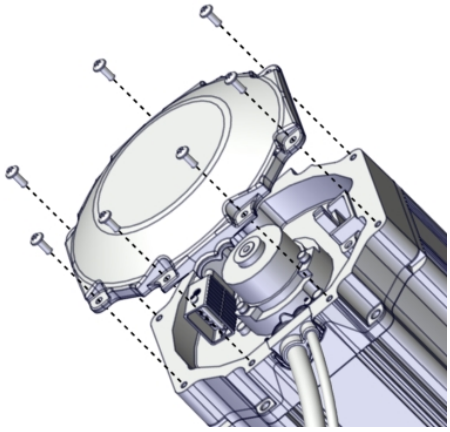
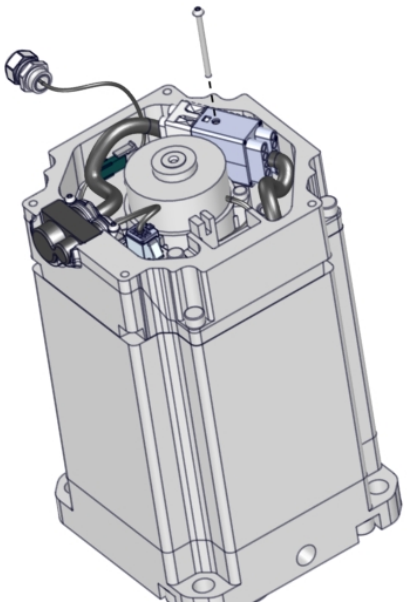
	Action	Note
2	Remove the motor cover by removing the screws.	 xx2100000596
3	Disconnect the power cable connector by first removing the attachment screw and then parting the connector.	 xx2200001736

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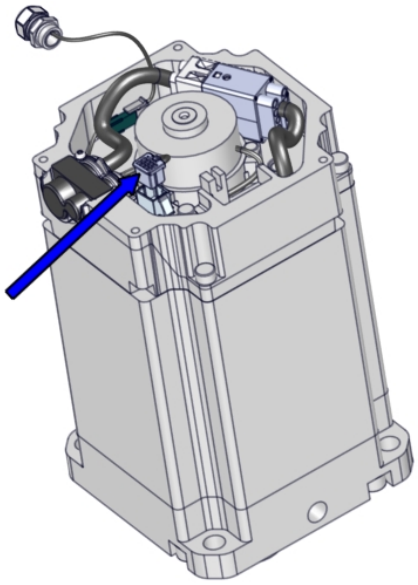
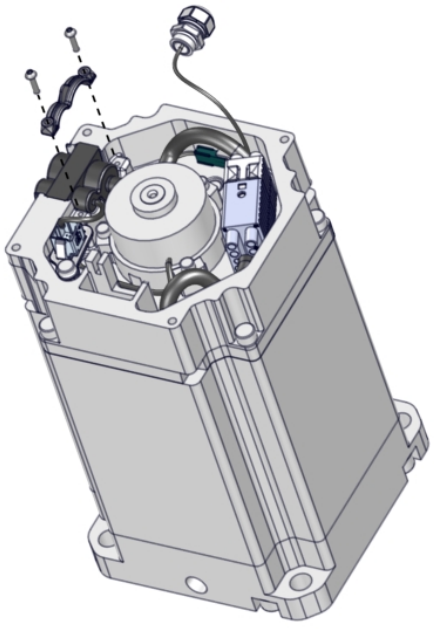
5.11.1 Replacing the axis-1 gearbox
Continued

	Action	Note
4	Disconnect the signal cable connector by pulling it out.	 xx2200001737
5	Remove the cable bracket by removing the screws.	 xx2200001738
6	Remove the motor cables from the motor.	

Removing the axis-1 motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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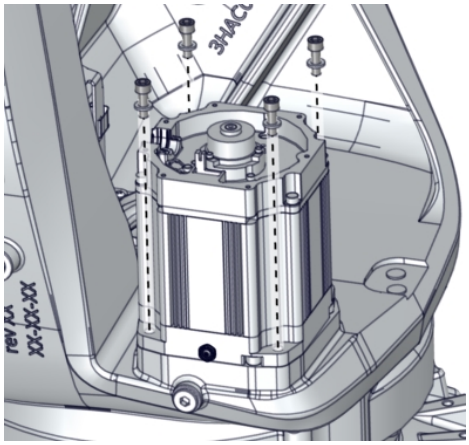
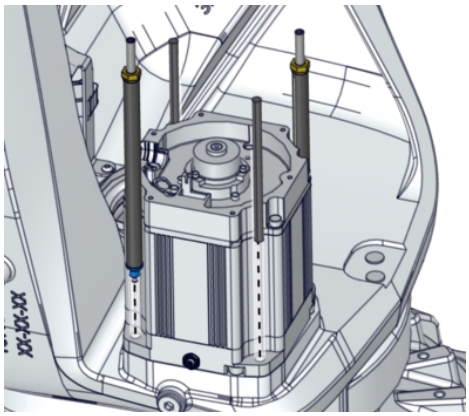
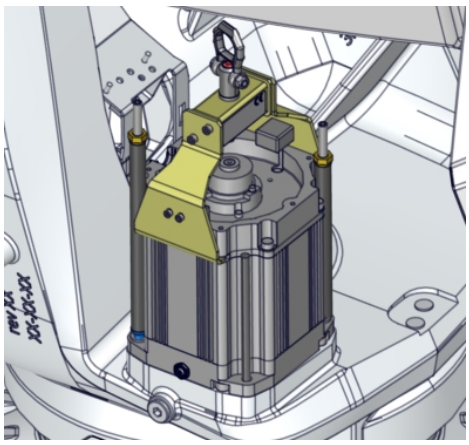
	Action	Note
2	Unscrew the attachment screws and washers. Use a bits extender to reach the screws.	Bits extender: 3HAC12342-1  xx2300001721
3	Fit guide pins in the non-threaded holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
4	Fit removal tools in the threaded holes.	Removal tool motor M12: 3HAC14631-1 Always use removal tools in pairs.  xx2300001723
5	Apply the lifting accessory.	Lifting accessory, motor: 3HAC076550-001  xx2400000491

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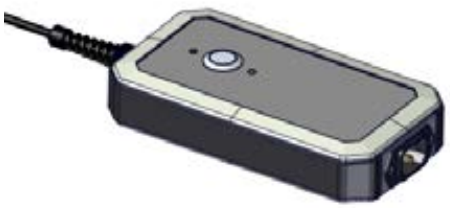
5.11.1 Replacing the axis-1 gearbox
Continued

	Action	Note
6	Release the brakes of the axis-1 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
7	**CAUTION** The weight of the motor is 23 kg All lifting accessories used must be sized accordingly.	
8	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

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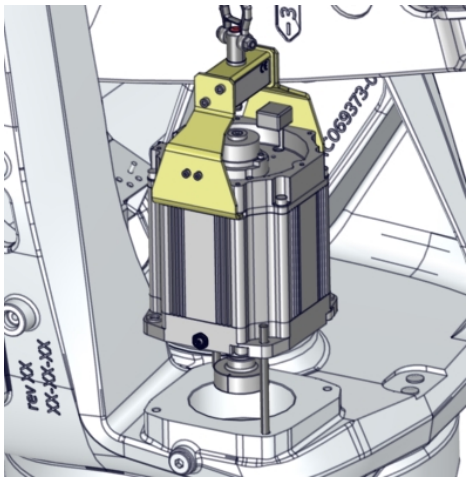
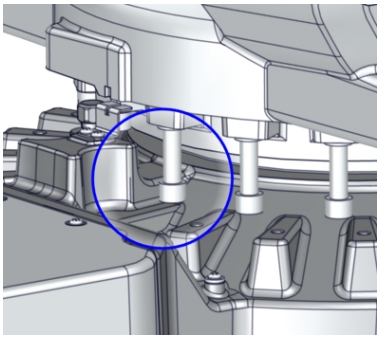
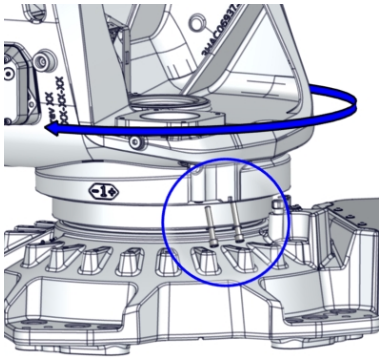
	Action	Note
9	Press the motor out of its position by using the removal tools.	 xx2400000492
10	Use caution and lift the motor straight up to get the pinion parted from the gear.	
11	Disconnect the brake release tool.	

Removing the remaining frame screws

	Action	Note
1	Rotate the robot by hand to access the screws behind the synchronization plate and loosen the screws. **Note** The already loosened screws must be lifted over the casting tab during rotation.  xx2400002138	 xx2400000305

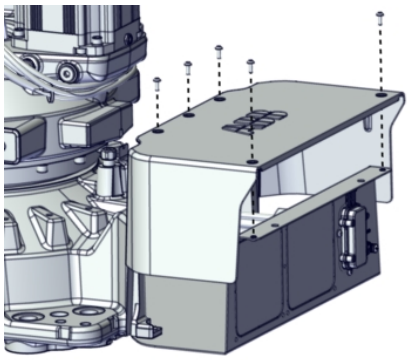
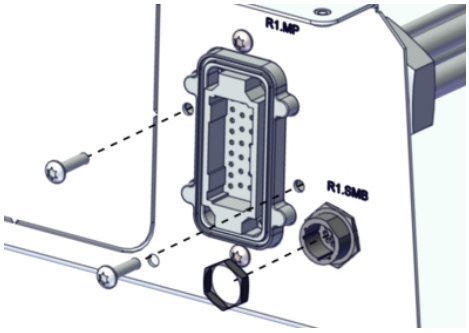
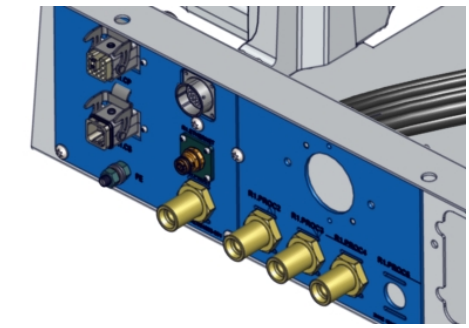
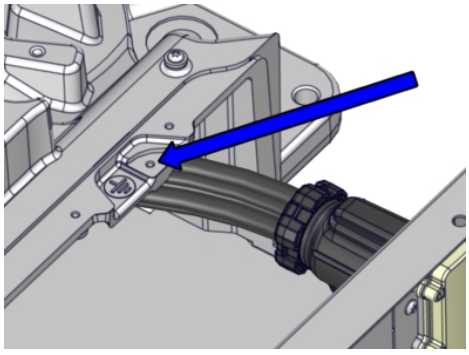
Preparations before removing the cable harness in the base

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

5.11.1 Replacing the axis-1 gearbox

Continued

	Action	Note
2	Remove the base cover.	 xx2100000981
3	Loosen the connectors: • R1.MP • R1.SMB	 xx2100001109
4	If used, disconnect the DressPack hoses in the base.	 xx2300001093
5	Disconnect the earth cable.	 xx2200001790

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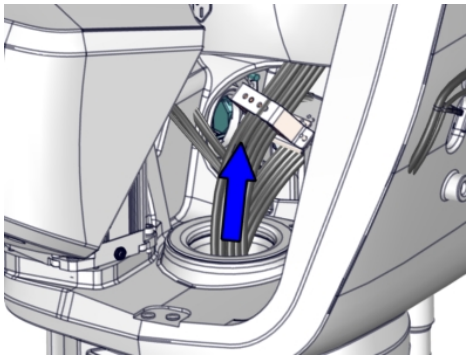
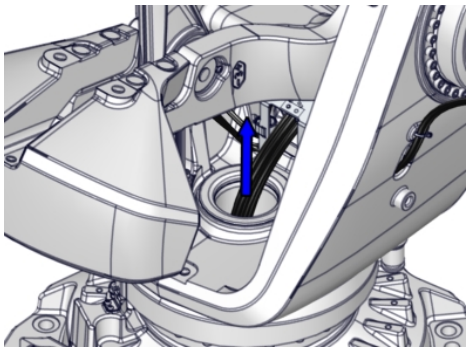
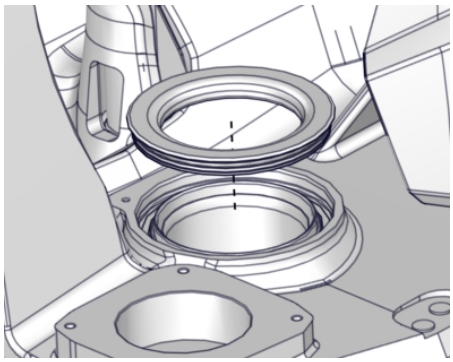
Removing the cable harness from the base

	Action	Note
1	If equipped with DressPack, pull out the DressPack cables through the protection tube.	 xx2400000192
2	Pull out the robot cable harness through the protection tube.	 xx2300001944
3	Place the cable harness safely on the frame or on the axis-2 motor.	

Lifting away the complete arm system

	Action	Note
1	Check that the axis-1 gearbox is drained and then remove the draining equipment.	
2	Remove the protection ring from the frame.	 xx2300001764

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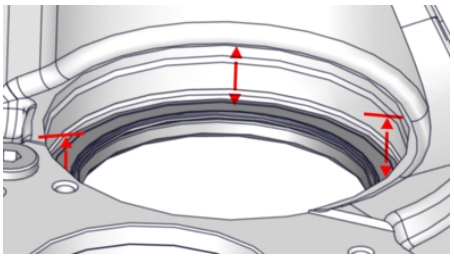
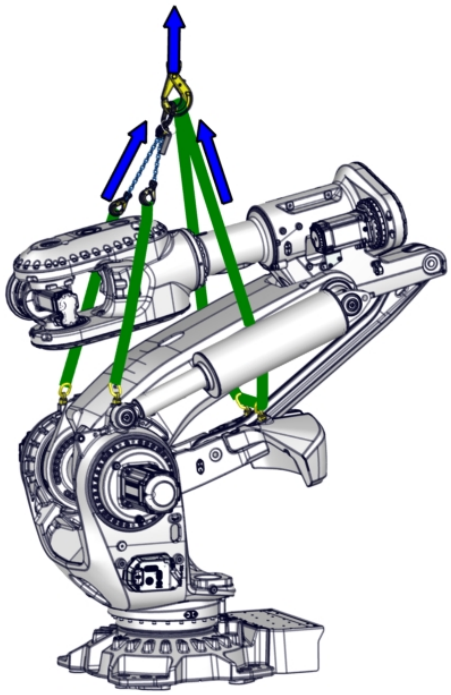
5.11.1 Replacing the axis-1 gearbox

Continued

	Action	Note
3	Measure the distance from the edge of the frame to the radial sealing at three different locations and make notes. The measurement is used as a verification after the arm system has been refitted.	 xx2200001611
4	Raise the overhead crane to stretch all lifting accessories.	 xx2300001769

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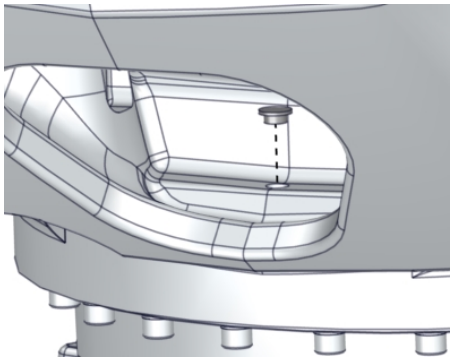
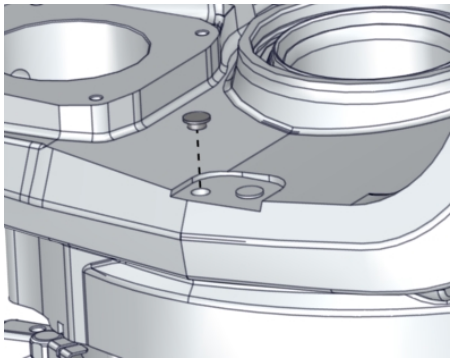
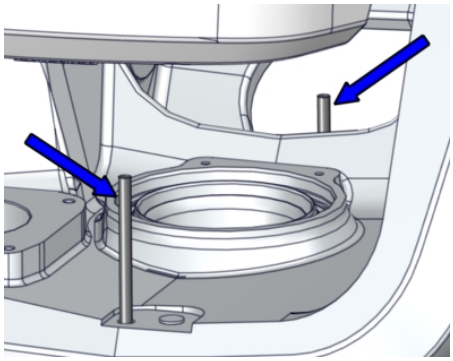
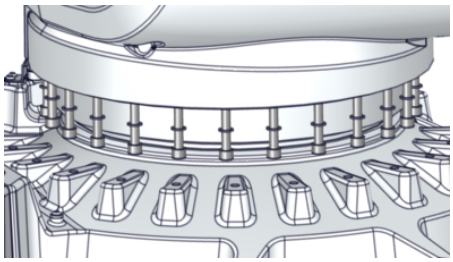
	Action	Note
5	Remove the two protection plugs or screws located on opposite sides of each other in the frame.	 xx2300001770  xx2300001771
6	Install guide pins to the frame. **Tip** Lubricate the guide pins with some grease to make the frame slide better.	Guide pin, M12x150 / Guide pin, M12x200: 3HAC13056-2 / 3HAC13056-3 Always use guide pins in pairs.  xx2300001795
7	Verify that all attachment screws are loosened from the frame.	 xx2300001876

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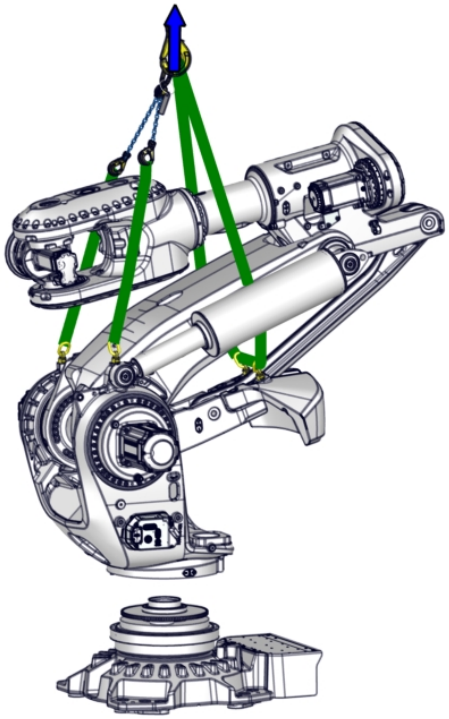
5.11.1 Replacing the axis-1 gearbox

Continued

	Action	Note
8	**CAUTION** The weight of the complete arm system is 1,912 kg All lifting accessories must be sized accordingly.	
9	Lift away the complete arm system. **CAUTION** When the arm system has left the guide pins it can move. Use caution in order to avoid injury or damage! **Note** There will be some oil spill!	 xx2300001772
10	Put down the arm system on the floor.	
11	**DANGER** When the complete arm system is removed and resting by itself on the floor, make sure it is resting completely stable before removing the lifting accessories. Do not change the position of the axes from the position described earlier.	

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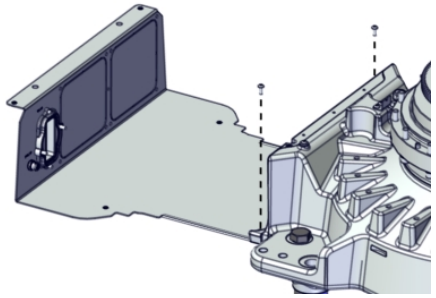
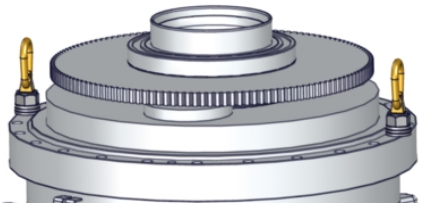
Removing the axis-1 gearbox

	Action	Note
1	Remove the bottom plate by removing the two small screws and pulling the plate out.	 xx2000000411
2	Fit the lifting accessories in opposite holes in the gearbox.	Lifting eye: 3HAC16131-1 M12, 2 pcs Use M12 washers beneath the lifting eyes, if the lifting eyes need to be elevated somewhat not to damage the o-ring on the gearbox.  xx2300001773
3	**CAUTION** The weight of the gearbox is 142 kg All lifting accessories used must be sized accordingly.	

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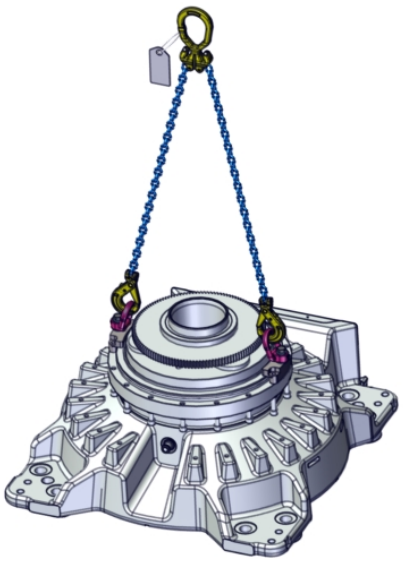
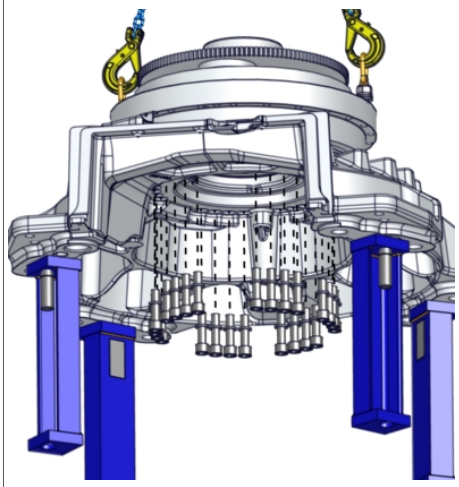
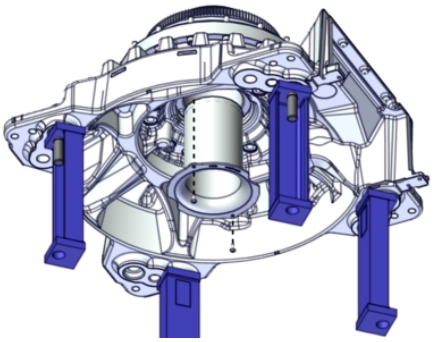
5.11.1 Replacing the axis-1 gearbox

Continued

	Action	Note
4	Attach the lifting accessory.	Lifting accessory (chain): 3HAC15556-1  xx2100002818
5	Remove the gearbox attachment screws, from underneath the base. **Tip** This procedure is best performed by two persons working together: • one underneath the robot base making sure that the bit is being fitted into the screw head holes, all the way until they reach the bottom • one using the torque wrench, loosening the screws from beside the base.	 xx2400000338
6	Remove the protection tube from the base by removing the two attachment screws and pulling the tube downwards.	 xx2100001112

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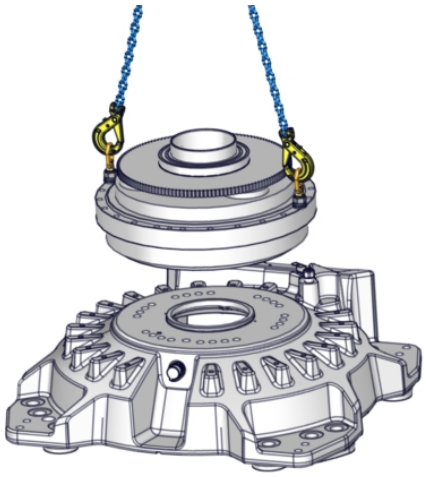
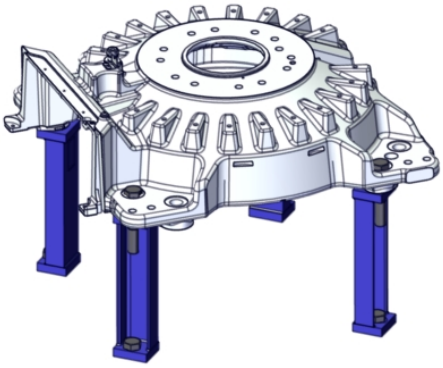
	Action	Note
7	**CAUTION** The weight of the gearbox is 142 kg All lifting accessories used must be sized accordingly.	
8	Lift away the gearbox. **WARNING** Approximately 0.5 l of oil residues will drip out during lifting of the gearbox. Make sure that protective gear like goggles and gloves are always worn. **WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 649* for more information.	 xx2400000335

Refitting the gearbox

These procedures describe how to refit the axis-1 gearbox.

Preparations before refitting the axis-1 gearbox

	Action	Note
1	**CAUTION** The weight of the base is 196 kg All lifting accessories used must be sized accordingly.	
2	If not already done, fit and secure the four support legs to the foundation. Then lift up and secure the base on top of the legs.	Supporting pillars: 3HAC061213-001. Tightening torque: 325 Nm  xx2100001135

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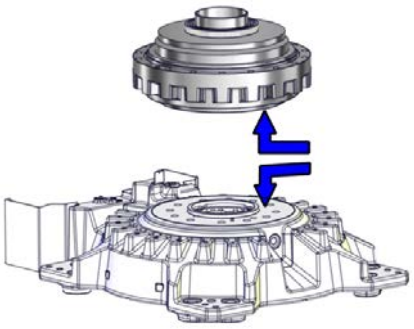
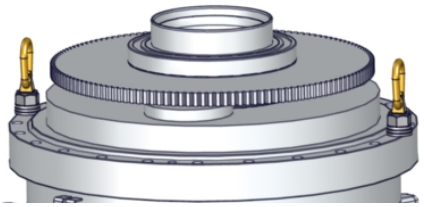
5.11.1 Replacing the axis-1 gearbox
Continued

	Action	Note
3	Wipe the contact surfaces between gearbox and base clean from any contamination.	Cleaning agent: Isopropanol  xx1700000567
4	Fit the lifting accessories in opposite holes in the gearbox.	Lifting eye: 3HAC16131-1 M12, 2 pcs Use M12 washers beneath the lifting eyes, if the lifting eyes need to be elevated somewhat not to damage the o-ring on the gearbox.  xx2300001773
5	**CAUTION** The weight of the gearbox is 142 kg All lifting accessories used must be sized accordingly.	

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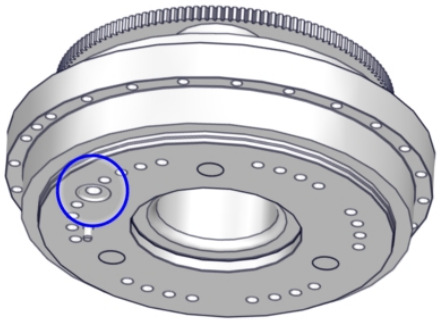
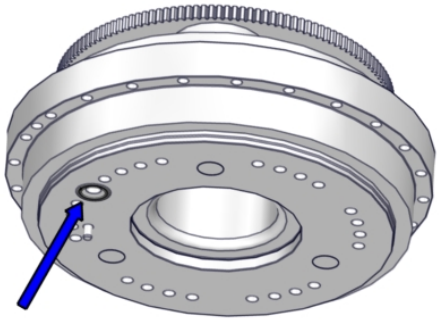
	Action	Note
6	Attach the lifting accessory and lift the gearbox.	Lifting accessory (chain): 3HAC15556-1  xx2400000333
7	Wipe clean the o-ring groove for the small o-ring beneath the gearbox.	 xx2300001796
8	Clean the new o-ring, lubricate it with some grease and fit it in the groove in the gearbox.	O-ring: 3HAC061327-033 (32x4). Grease, Shell Gadus S2: 3HAC042536-001.  xx2300001774

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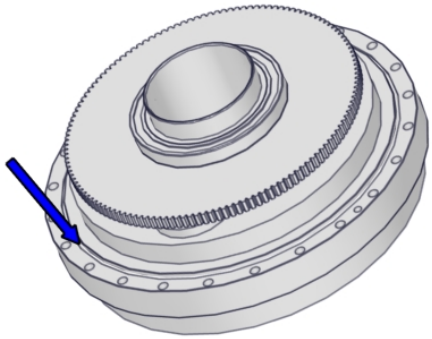
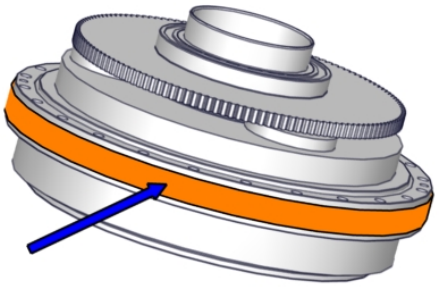
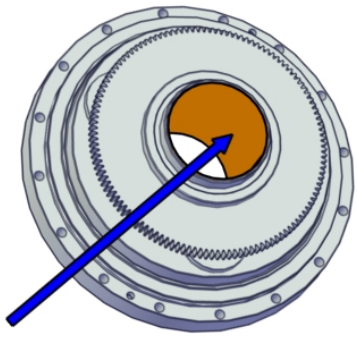
5.11.1 Replacing the axis-1 gearbox

Continued

	Action	Note
9	Check the o-ring and lubricate. Replace if damaged.	O-ring: 3HAC061327-105 Grease, Shell Gadus S2: 3HAC042536-001.  xx2300001755
10	Apply rust preventive to the gearbox surface shown in the figures.	Rust preventive: 3HAC034903-001 (Mercasol 3110 Waxcoat. Recommended drying time is 24h.)  xx2300001756
11	Wipe clean the inner surfaces of the hole in axis-1 gearbox. *Protection type Foundry Plus*: Apply rust preventive to the inner surface of the hole, as shown in the figure.	Rust preventive: 3HAC034903-001 (Mercasol 3110 Waxcoat. Recommended drying time is 24h.)  xx2100001169

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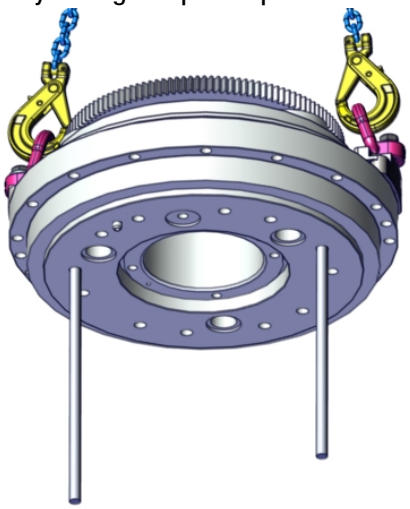
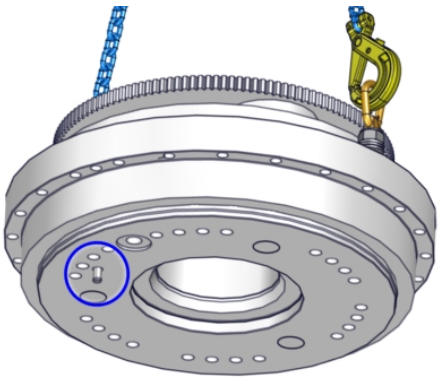
	Action	Note
12	Fit guide pins in opposite holes in the gearbox. **Tip** Lubricate the guide pins with some grease to make the gearbox/gear slide better.	Guide pin, M16x200: 3HAC13120-3 Always use guide pins in pairs.  xx2100002821

Refitting the axis-1 gearbox to the base

	Action	Note
1	Verify that the locating pin in the gearbox will match the hole in the base.	 xx2400000336

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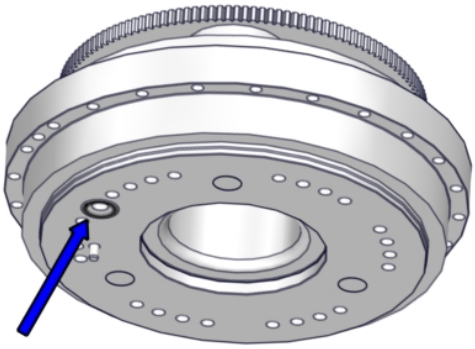
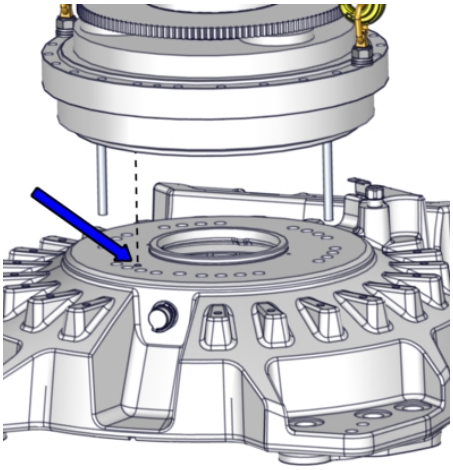
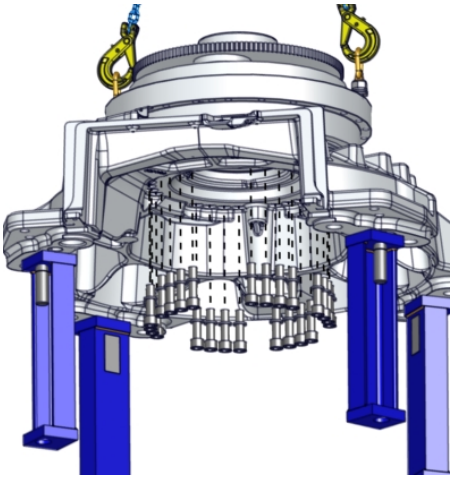
5.11.1 Replacing the axis-1 gearbox

Continued

	Action	Note
2	Lower the gearbox against the base with guidance from the guide pins and locating pin. **Note** Verify that the small o-ring underneath the gearbox, stays fitted correctly when the gearbox is being fitted.  xx2300001774	 xx2400000337
3	Lower the lifting accessory so that the chain is no longer stretched.	
4	Fit the attachment screws that secure the gearbox to the base, from underneath.	Attachment screws: M16x60 12.9 Gleitmo 603+Geomet 500 (24 pcs).  xx2400000338
5	Remove the guide pins and fit the two remaining screws.	

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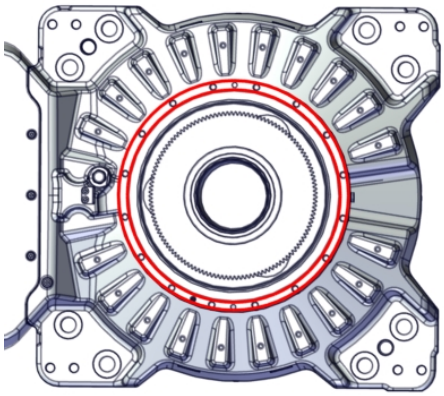
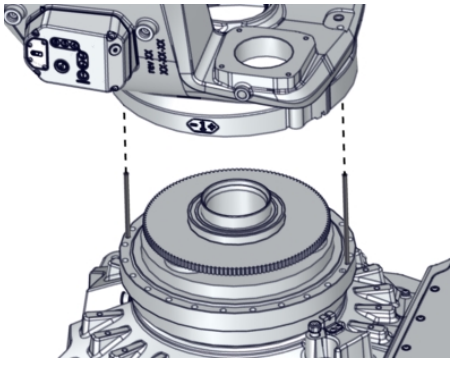
	Action	Note
6	Secure the attachment screws cross-wise. **Tip** This procedure is best performed by two persons working together: • one underneath the robot base making sure that the bit is being fitted into the screw head holes, all the way until they reach the bottom • one using the torque wrench, tightening the screws from beside the base.	Tightening torque: standard torque 300 Nm (*Tightening torque on page 661*).

Preparations before refitting the arm system

	Action	Note
1	Wipe clean the contact surfaces from any contamination.	
2	*Protection type Foundry Plus*: Apply flange sealant to the mounting interface on the gearbox, both inside and outside of the screw holes.	Flange sealant: Loctite 5800  xx2100002225
3	Apply some grease on: • the edge around the gearbox.	
4	Apply guide pins in the guide pin holes in the gearbox. **Tip** Lubricate the guide pins with some grease to make the frame slide better.	Guide pin, M12x150 / Guide pin, M12x200: 3HAC13056-2 / 3HAC13056-3 Always use guide pins in pairs.  xx2300001775

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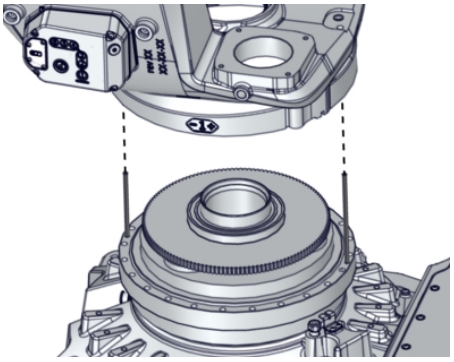
5.11.1 Replacing the axis-1 gearbox
Continued

Refitting the arm system

	Action	Note
1	**CAUTION** The weight of the complete arm system is 1,912 kg All lifting accessories must be sized accordingly.	
2	Make sure that all lifting accessories still is fitted correctly on the arm system.	
3	Lift the arm system up, to be able to reach the contact surfaces underneath the frame.	
4	Wipe clean the contact surfaces from any remaining contamination.	
5	Lubricate the radial sealing.	Grease, Shell Gadus S2: 3HAC042536-001.
6	Lift the arm system to mounting position, verify that the hole pattern match and that the guide pins are installed in the correct holes.	 xx2300001775

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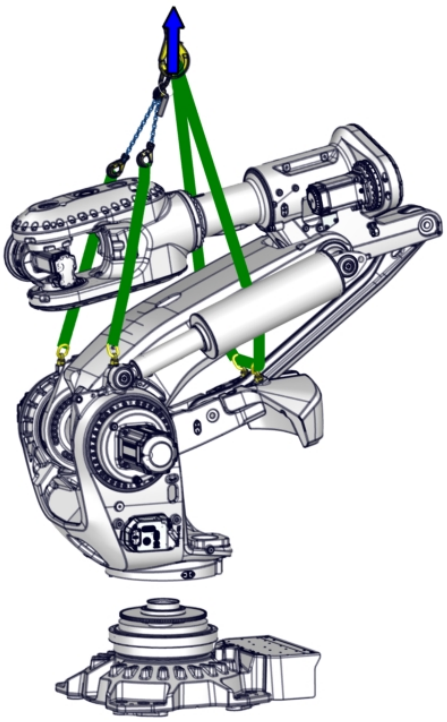
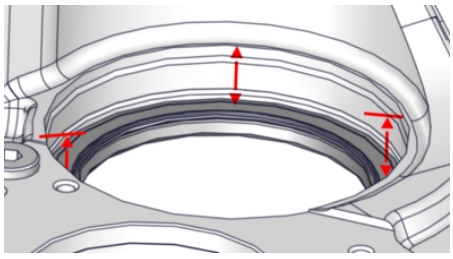
	Action	Note
7	Lift the complete arm system and lower it slowly down over the guide pins, until it is possible to insert the attachment screws manually. **CAUTION** Do not lower the arm system completely at this stage! The attachment screws must be fitted in two steps. If not, the complete arm system will risk resting on the attachment screws in the wrong position!	 xx2300001772
8	Fit the attachment screws manually as far as possible. Lower the complete arm system slowly in steps, all the way down.	Hex socket head cap screw: M12x70 12.9 Gleitmo 603+Geomet 500 (24 pcs)
9	Make sure that the complete arm system is lowered all the way down.	
10	Measure the distance from the edge of the frame to the radial sealing at three different locations (same locations as before removing the arm system). Compare to the measurements made prior the arm system was refitted to the base. Adjust alignment of the sealing if needed.	 xx2200001611
11	Secure all screws now possible to reach. **Note** A bits holder is needed to be able to reach the attachment screws.	Bit holder and hexagon bit SW10 Bit holder dimension: 5/16" (14x18 mm) Tightening torque: standard torque 120 Nm (*Tightening torque on page 661*)
12	If required, manually rotate axis-1 to a position where the remaining attachment screw at the axis-1 synchronization plate can be secured.	

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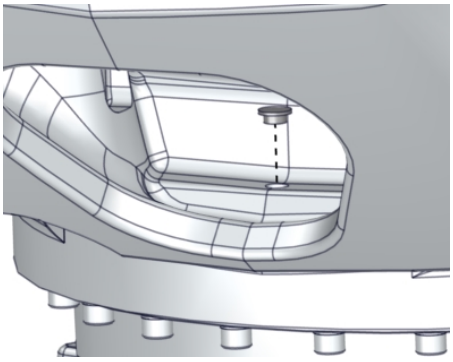
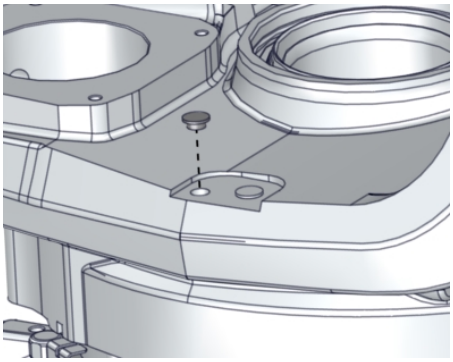
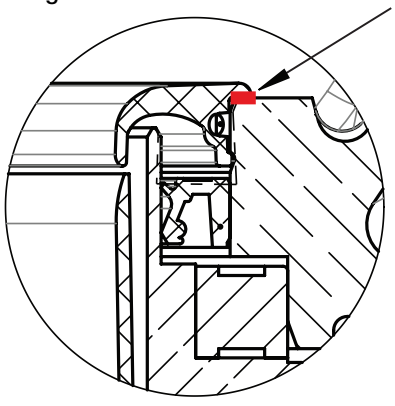
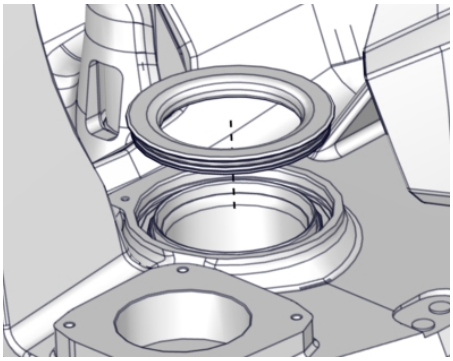
5.11.1 Replacing the axis-1 gearbox

Continued

	Action	Note
13	Remove the guide pins and refit the two plastic protection plugs.	 xx2300001770  xx2300001771
14	Refit the protection ring. Verify that the o-ring is undamaged and placed in its groove on the protection ring. Replace if damaged. *Protection type Foundry Plus:* Apply flange sealant under the protection ring flange.  xx2500000073	Sealant (grey), Sikaflex 521FC: 3HAC026759-001. O-ring: 3HAB3772-57  xx2300001764

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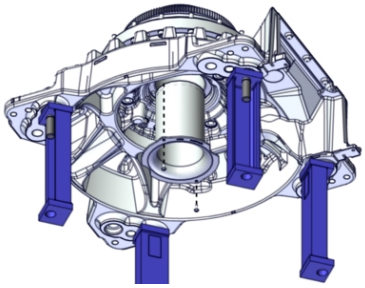
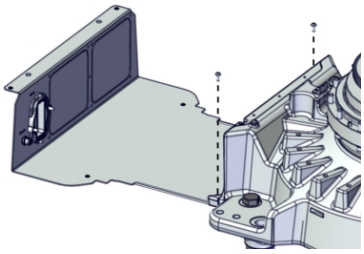
Refitting the protection tube

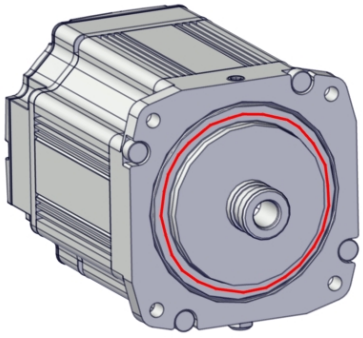
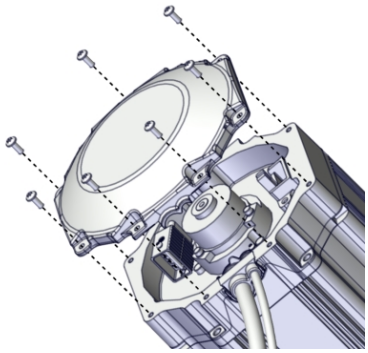
	Action	Note
1	Check the protection tube for damages. Replace if damaged.	 xx1700001374
2	Wipe the surfaces of the protection tube clean from any contamination.	
3	Refit the protection tube to the base. Secure with the attachment screws.	Torx pan head screw: M6x16 Stainless steel A2-70 (2 pcs). Tightening torque: 10 Nm.  xx2100001112 Locking liquid: Loctite 2400 (or equivalent Loctite 243)
4	Refit the back plate and secure with two screws.	Tightening torque: 10 Nm Torx pan head screw: M6x16 Stainless steel A2-70 (2 pcs)  xx2000000411

Preparations prior to refitting motor

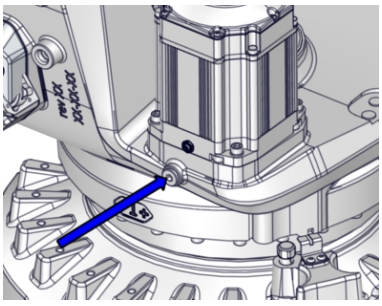
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

5.11.1 Replacing the axis-1 gearbox
Continued

	Action	Note
2	Remove any old paint or flange sealant residues or other contamination from the contact surfaces on both the motor and the mating parts. **Tip** Remove flange sealant residues with Loctite 7200. Then use Loctite 7063 for cleaning the mating surface.	Cleaning agent: Loctite 7200, Loctite 7063
3	Apply a continuous bead of flange sealant, 1-2 mm wide, inside of the groove on the motor contact surface. **Note** The purpose of the groove is to catch excess sealant. No o-ring is used.	Flange sealant: Loctite 5800  xx2100000520
4	Remove the cover, if fitted to the new spare part motor.	 xx2100000596

Floor-mounted robot: Refitting the axis-1 motor

	Action	Note
1	Remove the plug from the venting hole. This is done to evacuate air during refitting of the motor.	 xx2300001600

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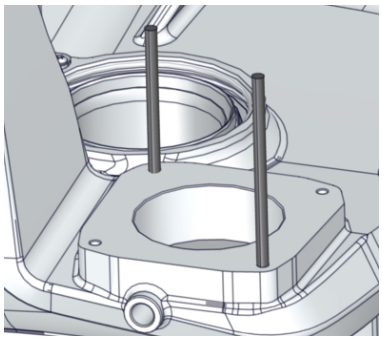
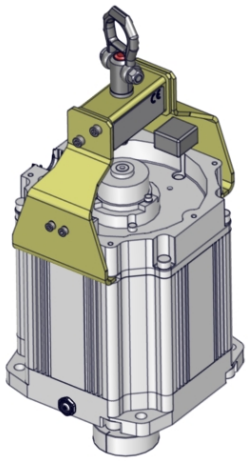
	Action	Note
2	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.  xx2300001801
3	**CAUTION** The weight of the motor is 23 kg All lifting accessories used must be sized accordingly.	
4	Apply the lifting accessory.	Lifting accessory, motor: 3HAC076550-001  xx2400000493
5	Fit the rotation tool.	Rotation tool M4: 3HAB7887-1

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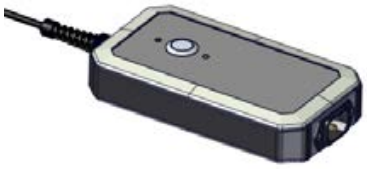
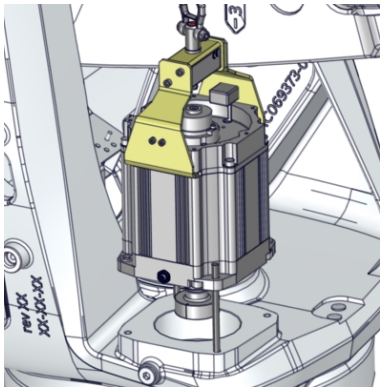
5.11.1 Replacing the axis-1 gearbox
Continued

	Action	Note
6	Release the brakes on the motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
7	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
8	Lower the motor into position. • Make sure that the motor pinion is properly mated to the gear in the gearbox. • Make sure that the motor pinion does not get damaged. • Make sure that the direction of the cable gland exit is facing the correct way.	 xx2400000492

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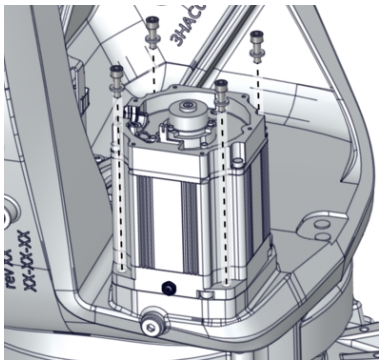
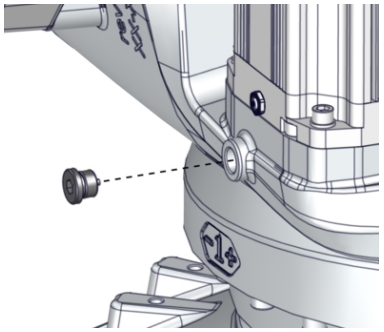
	Action	Note
9	Secure the motor with its attachment screws and washers. Use a bits extender to reach the screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Bits extender: 3HAC12342-1 Tightening torque: 50 Nm.  xx2300001721
10	Disconnect the brake release tool.	
11	Perform a leak-down test.	See *Performing a leak-down test on page 197*.

Refilling oil in the gearbox

	Action	Note
1	Refill oil in the gearbox.	See *Changing the oil in axis-1 gearbox on page 149*.
2	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2300001686

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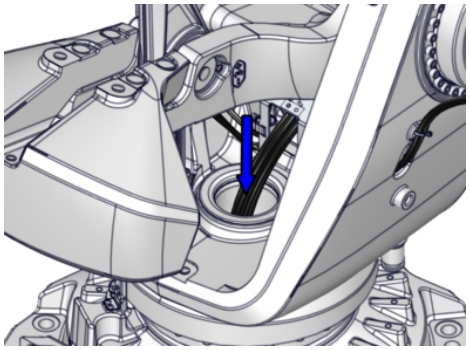
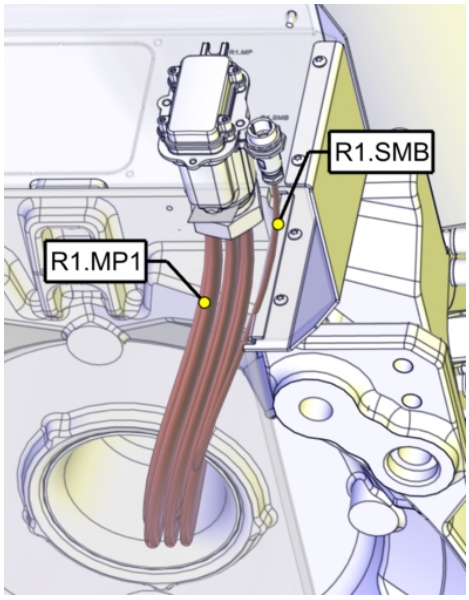
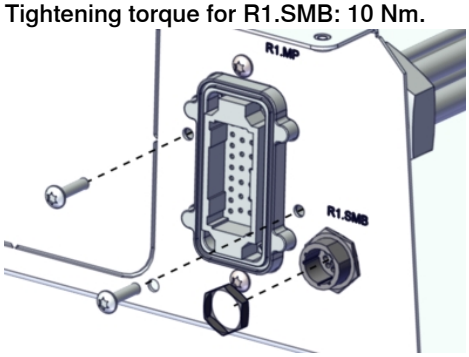
5.11.1 Replacing the axis-1 gearbox
Continued

Refitting the cable harness in the base

	Action	Note
1	Run the robot cable harness through the frame recess and down through the protection tube.	 xx2400000195
2	Run the cabling through the base. • Make sure that the cables are not twisted. Each cable must be in line with its position on the base plate. • Make sure that the R1.SMB cable will run on the correct side of the R1.MP1, see the figure.	 xx1300000736
3	Make sure that the markings on the cables are facing the base cover, when connected.	
4	Connect connectors R1.MP and R1.SMB.	Screw dimension for R1.MP: M6x25 A2-70 Tightening torque for R1.MP: 10 Nm. Tightening torque for R1.SMB: 10 Nm.  xx2100001109

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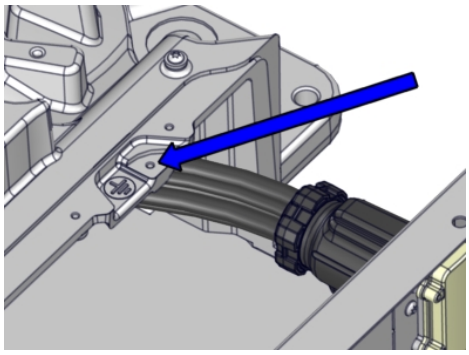
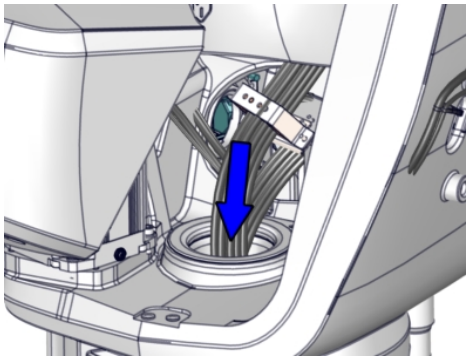
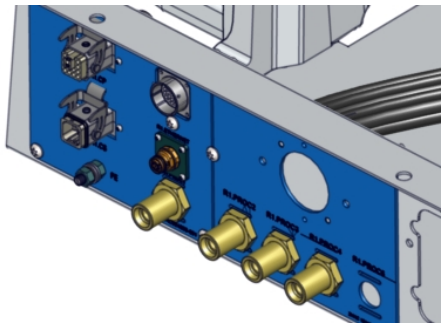
	Action	Note
5	Connect the earth cable.	Screw dimension: M6x16. Washer dimension: 6.4x17x3. Tightening torque: 10 Nm.  xx2200001790
6	If used, run the DressPack cables through the protection tube in the base. If necessary, lubricate the cables with grease to make them run more smoothly.	 xx2400000196
7	If used, run the DressPack hoses through the protection tube in the base. Make sure that the hoses are running correctly and are not twisted!	
8	If used, connect the DressPack cable package on the base plate.	 xx2300001093

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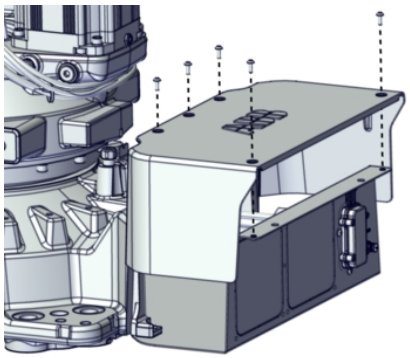
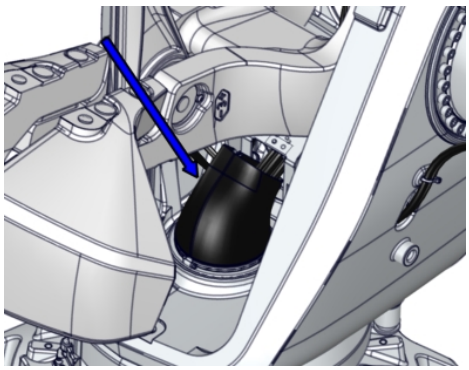
5.11.1 Replacing the axis-1 gearbox
Continued

	Action	Note
9	Refit the base cover.	Torx pan head screw: M6x16 Stainless steel A2-70 (5 pcs) Tightening torque: 10 Nm.  xx2100000981
10	*Protection type Foundry Plus* Refit the axis-1 cable protection.	 xx2300001954

Connecting the axis-1 motor cables

	Action	Note
1	Put the motor cables in place in the opening.	

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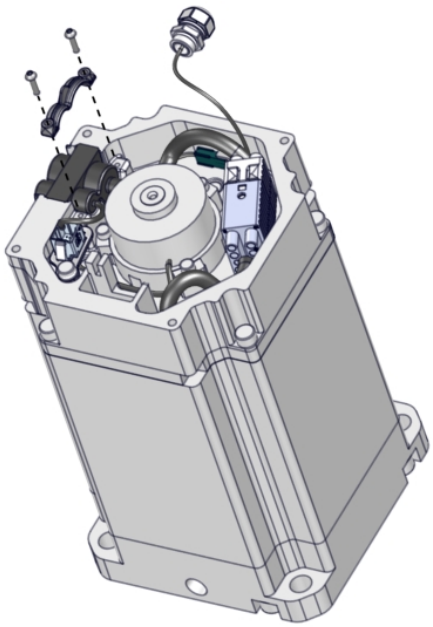
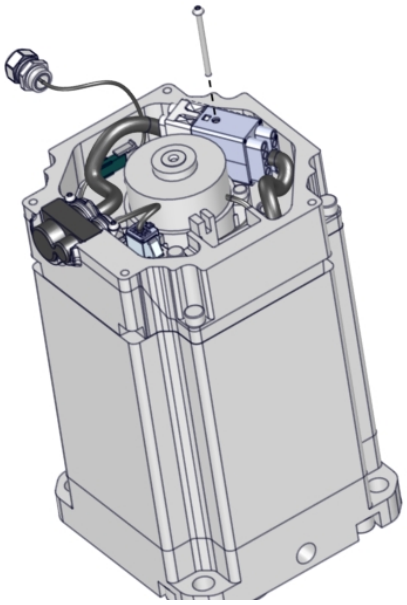
	Action	Note
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001738
3	Connect the motor cables. **Note** Connect in accordance with the markings on the connectors.	
4	Fit a screw to the power connector. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001736

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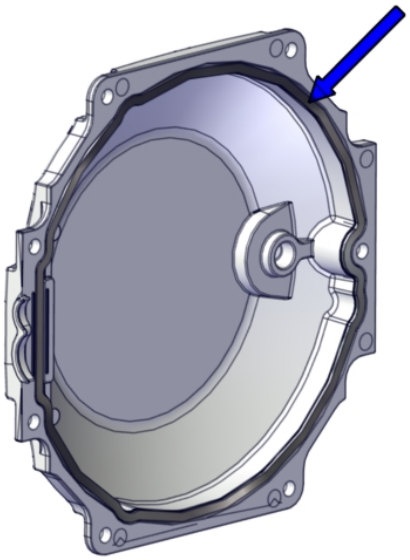
5.11.1 Replacing the axis-1 gearbox

Continued

	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1, axis-2 and axis-3: Connection box cover FS180 with gasket: 3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection) Axis-4: Connection box cover FS130 with gasket: 3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)  xx2100000600
6	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	

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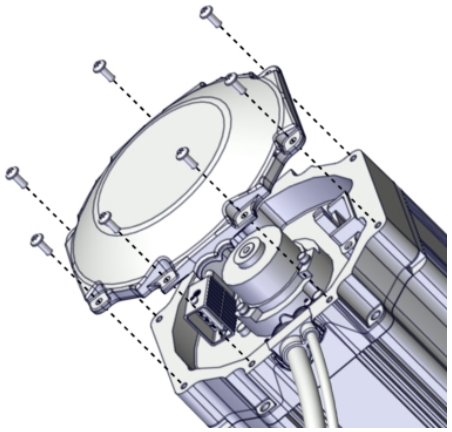
	Action	Note
7	Refit the motor cover with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.  xx2100000596

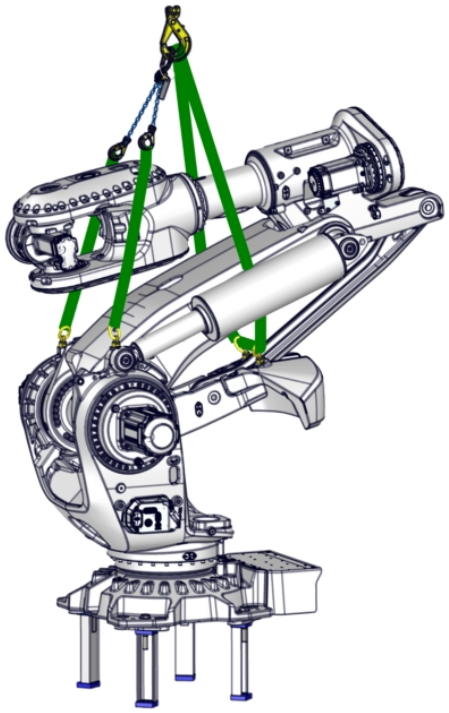
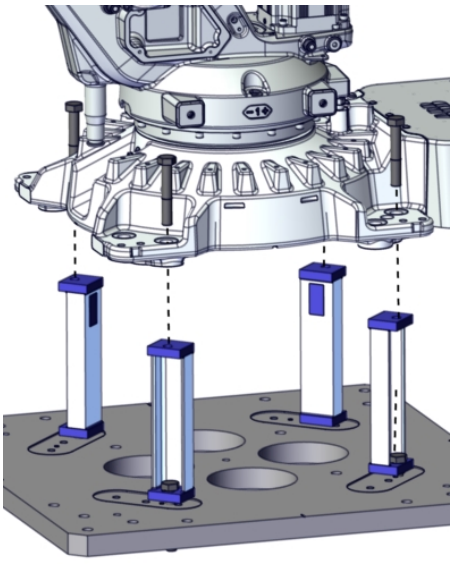
Securing the floor mounted robot to the foundation

	Action	Note
1	**CAUTION** The weight of the IRB 7710 robot is 2,130 - 2,250 kg (depending on robot variant) All lifting accessories used must be sized accordingly.	

Continues on next page

5.11.1 Replacing the axis-1 gearbox

Continued

	Action	Note
2	Attach the lifting accessories to the robot, if removed.	See *Attaching the lifting accessories to the arm system on page 475*.  xx2300001803
3	Stretch the lifting accessories enough to secure the robot, but without taking the full weight of the robot.	
4	Unscrew the screws that secure the base to the support legs and lift up the robot.	 xx2100001113
5	Remove the support legs.	
6	Lower the robot to the foundation.	

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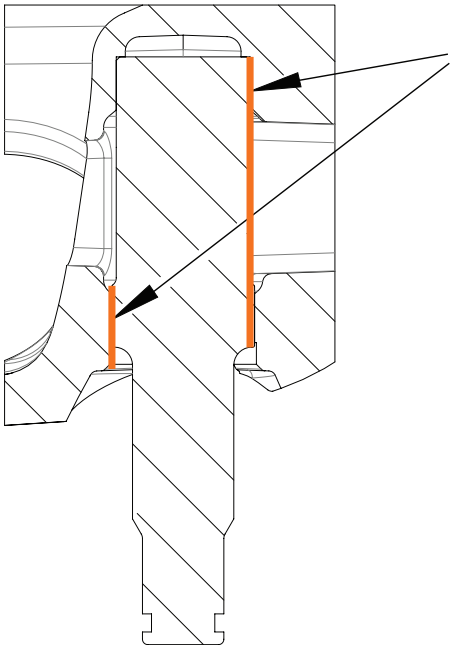
	Action	Note
7	Secure the robot to the foundation.	M24 x 100 (12 pcs) 550 Nm (screws lubricated with Molykote 1000) 600-725 Nm, typical 650 Nm (screws none or lightly lubricated)

Refitting the mechanical stop

	Action	Note
1	Check if the axis-1 is in a position where it will be possible to refit the mechanical stop pin. If not, turn on the power, and jog axis-1 to that position.	
2	*Protection type Foundry Plus* Clean and apply rust preventive on the surfaces shown in the figure, on stop pin and in the hole as shown in the figure.	Rust preventive: 3HAC034903-001 (Mercasol 3110 Waxcoat. Recommended drying time is 24h.)  xx2300001757

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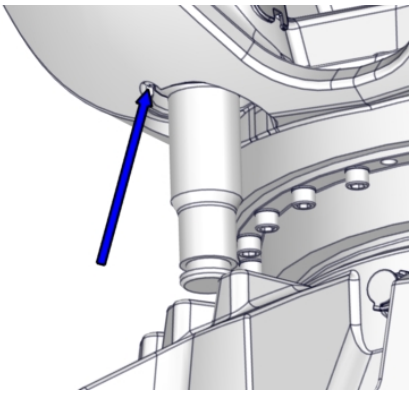
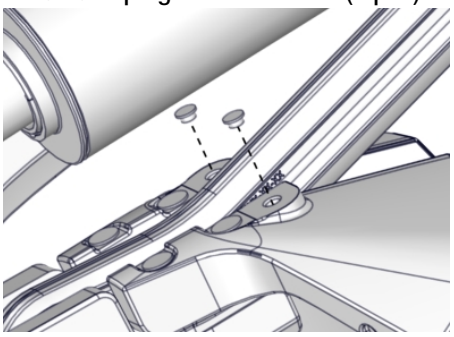
5.11.1 Replacing the axis-1 gearbox

Continued

	Action	Note
3	Refit the mechanical stop pin and secure it with the attachment screw and washer. Apply locking liquid on the screw. **Note** Do not overtighten the attachment screw, use specified tightening torque.	Torx pan head screw: M6x16 A4-80 Plain washer, large: 6.4x17x3, Steel-mZn12c Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 10 Nm  xx2400000142

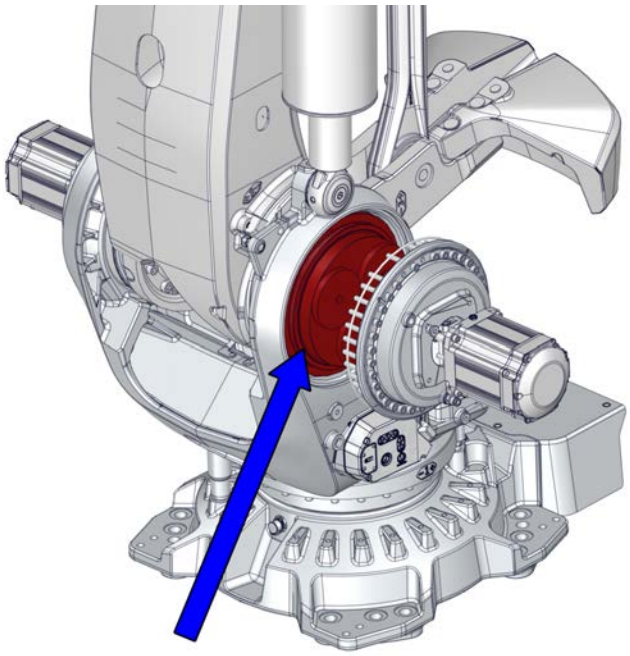
Concluding procedure

	Action	Note
1	Remove the lifting accessories.	
2	Refit the plastic plugs in the lifting eye holes.	Protection plug: 3HAC4836-21 (2 pcs)  xx2300001714
3	Calibrate the robot.	See *Calibration on page 619*.
4	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.11.2 Replacing the axis-2 gearbox

Location of the gearbox

The gearbox is located as shown in the figure.



xx2300001597

Summary of the replacement procedure

This is a brief summary of the replacement procedure, containing the major actions to be performed.

1. Drain the axis-2 gearbox.
2. Lock the arm system with a lock screw.
3. Unload the balancing device pressure.
4. Remove the axis-2 motor.
5. Replace the axis-2 gearbox.

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Gearbox	3HAC074200-006	Includes o-ring 3HAC061327-067	L2

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5.11.2 Replacing the axis-2 gearbox
Continued

Required tools and equipment

Equipment	Article number	Note
Lock screw, M16x80	-	Used to secure lower arm / movable arm structure.
Screw, M12 x minimum 50 mm	-	2 pcs. Used to netraulize the spring force of the balancing device.
Guide pin, M12x150	3HAC13056-2	Always use guide pins in pairs.
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Removal tool motor M12	3HAC14631-1	Used to push out the motor, if necessary. Always use removal tools in pairs.
Lifting accessory, motor	3HAC15534-1	Lifting instruction 3HAC15640-2 enclosed.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Guide pin, M12x200 / Guide pin, M12x250	3HAC13056-3	Always use guide pins in pairs.
Screws M12x100, fully threaded	-	Used to push out and push in the gearbox, if necessary.
Lifting accessory for gear	3HAC081585-001	For lifting the gearbox
Adjustment tool for gear	3HAC080331-001	Used to rotate the gear for matching hole pattern with frame.
Rotation tool M4	3HAB7887-1	Used to rotate the motor pinion. Add screw M4.
Calibration toolbox, Axis Calibration	3HAC074564-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required service parts

Consumable	Article number	Note
O-ring	3HAC061327-067	On gearbox. Included in gearbox spare part, but replace if damaged.

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Consumable	Article number	Note
Connection box cover FS180 with gasket	3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection)	Replace if damaged. On axis-2 motor A threaded connection is required for cooling fan option.
O-ring	3HAB3772-160	On motor flange. Replace if damaged.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.
Cleaning agent	-	Isopropanol
Rust preventive	3HAC034903-001	Mercasol 3110 Waxcoat. Recommended drying time is 24h.
Grease	3HAC042536-001	Shell Gadus S2
Cleaning agent	-	Loctite 7200
Cleaning agent	-	Loctite 7063
Flange sealant	-	Loctite 5800
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.

Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

	Action	Note
1	Decide which calibration routine to use for calibrating the robot. • Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot. • Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.	
	If the robot is to be calibrated with reference calibration: Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in *Reference calibration routine on page 628*.

Continues on next page

5.11.2 Replacing the axis-2 gearbox
Continued

	Action	Note
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Removing the gearbox

Use these procedures to remove the axis-2 gearbox.

DANGER

Never remove both the axis-2 and axis-3 gearboxes at the same time.

One side must always be attached when the gearbox on the other side is removed. If not, there is a potential risk that a severe accident will happen.

Note

The gearbox attachment screws are arranged in three areas. It will not be possible to reach all screws with the robot in only one position.

Removal and refitting must be performed with the robot in several positions, which are described in the procedures.

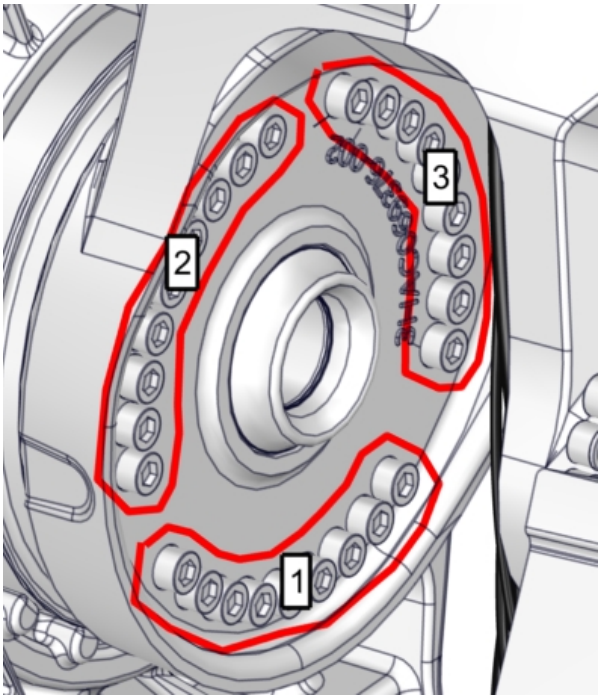
Preparations

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Remove any tool or other equipment fitted on the turning disc.	
3	Drain the axis-2 gearbox.	See *Draining the axis-2 gearbox on page 155*.

Continues on next page

The three areas of screws that secure axis-2 gearbox to lower arm

The axis-2 gearbox is attached to the lower arm with attachment screws arranged in three areas. Use this figure to understand the position of the three areas, when performing this procedure. The figure shows the location of the areas when the robot stands in calibration position.



xx2300001851

The order when removing the attachment screws: area 1, then area 2, and last area 3.

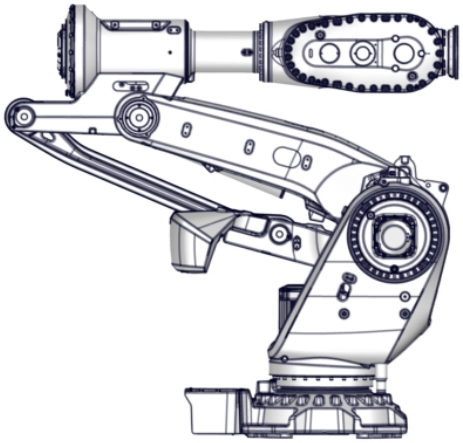
The order when attaching the axis-2 gearbox to the lower arm is reversed: area 3, then area 2, and last area 1.

Continues on next page

5.11.2 Replacing the axis-2 gearbox
Continued

Robot position when removing screws in area 1

With the robot in this position it is possible to reach the screws in area 1 of screws that secure the axis-2 gearbox to the lower arm.

	Action	Note
1	Jog the robot into position: • Axis 1: no significance • Axis 2: -65° • Axis 3: 0° • Axis 4: 0° • Axis 5: no significance • Axis 6: no significance.	 xx2400000339
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Removing the axis-2 gearbox screws in area 1

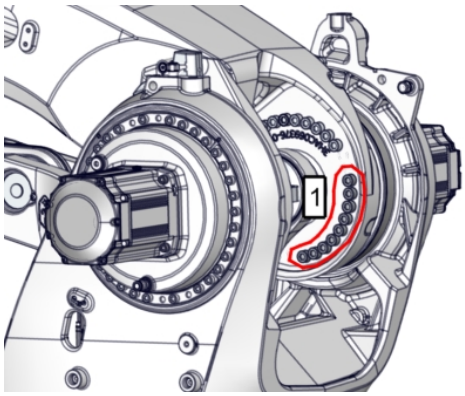
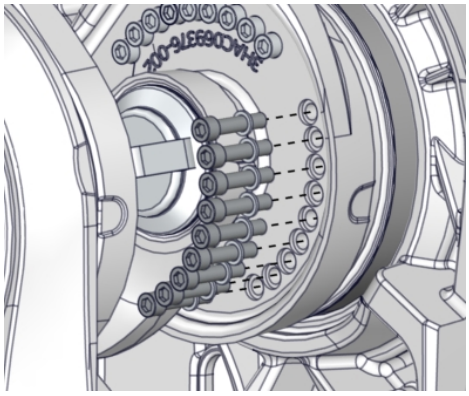
Note

The gearbox attachment screws are arranged in three areas. It will not be possible to reach all screws with the robot in only one position.

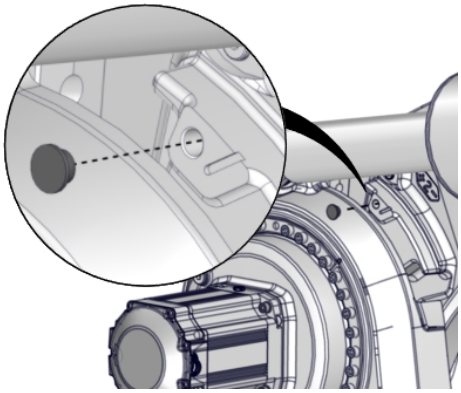
This procedure describes how to reach the screws in area 1.

	Action	Note
1	**DANGER** Never remove the screws on both axis-2 and axis-3 at the same time. One side must always be attached when the gearbox on the other side is removed. If not, there is a potential risk that a severe accident will happen.	

Continues on next page

	Action	Note
2	Find area 1. **Note** Do not remove screws in area 2 or area 3 at this point.	 xx2300001852
3	Remove the screws in area 1.	 xx2300001853

Removing the plastic plug of axis-2 lock screw hole

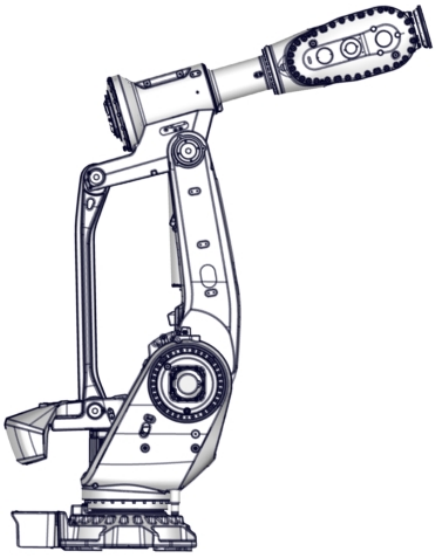
	Action	Note
1	Remove the plastic plug that covers the axis-2 lock screw hole. **Note** Keep the plastic plugs. They must be refitted after the work is done.	 xx2400001682

Continues on next page

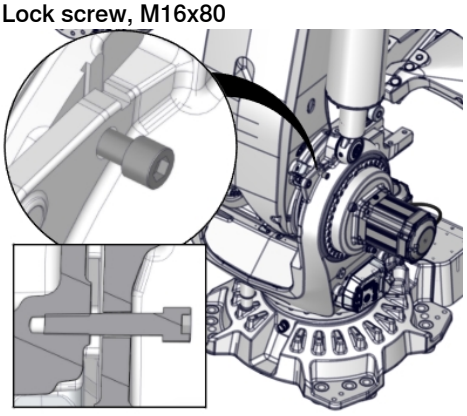
5.11.2 Replacing the axis-2 gearbox
Continued

Robot position for continued procedure

Put the robot in this position for the continued procedures.

	Action	Note
1	Jog the robot into position: • Axis 1: no significance • Axis 2: 0° • Axis 3: -17° • Axis 4: 0° • Axis 5: no significance • Axis 6: no significance.	 xx2400000340

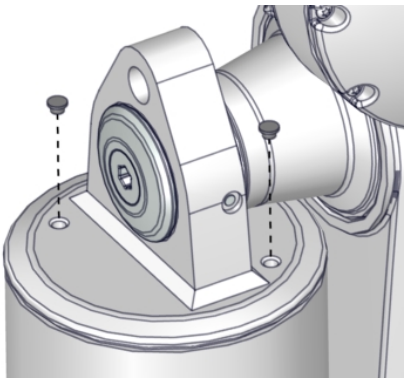
Locking the axis-2 position

	Action	Note
1	Insert the lock screw into the axis-2 lock screw hole. Do not tighten. If needed, adjust the position of the robot to make it possible to insert the lock screw. The lock screw is used to secure the weight of the movable arm structure, in order to avoid accidents or damage. **CAUTION** Do not insert the screw fully, leave space underneath the screw head. Inserting the screw all the way will result in tension in the arm system which may cause damage to the axis-2 and axis-3 gearboxes.	Lock screw, M16x80  xx2300001881
2	Release the brakes on axis-2 using the brake release button, and let the axis rest on the lock screw.	
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Continues on next page

Unloading the balancing device springs and locking the position

Use this procedure to unload and lock the balancing device in unloaded position.

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the plastic plugs in the upper end of the balancing device. **Note** Save the protection screws, to refit after the work is done.	 xx2300001643

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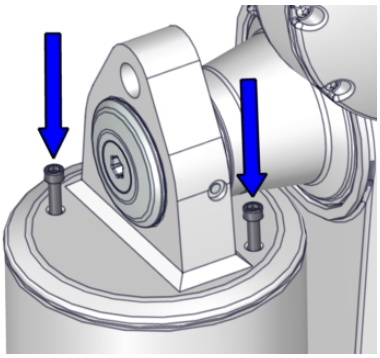
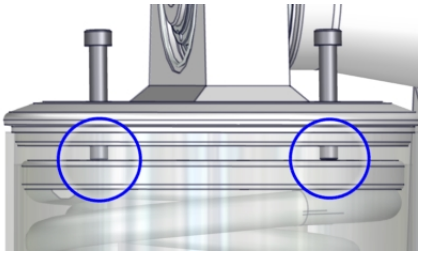
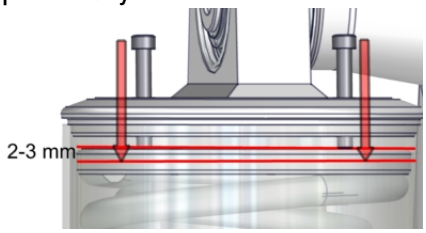
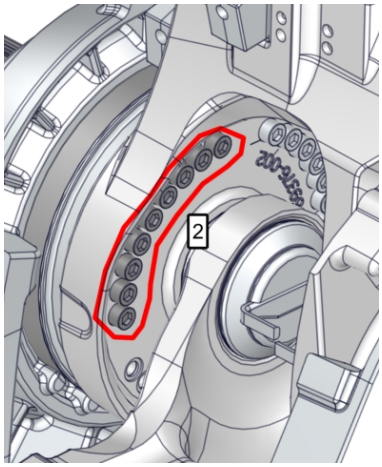
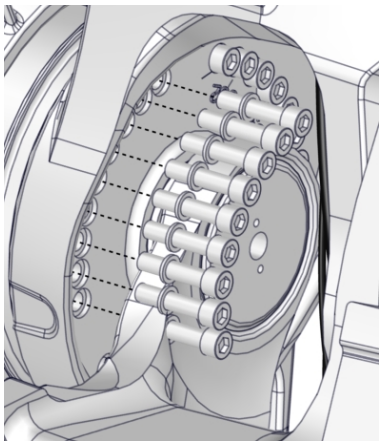
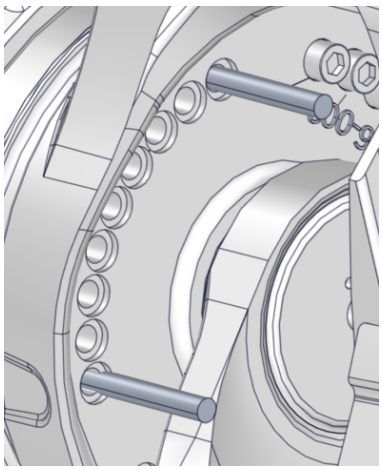
5.11.2 Replacing the axis-2 gearbox
Continued

	Action	Note
3	Neutralize the spring force with two screws: Screw, M12 x minimum 50 mm (2 pcs) 1 Insert two screws.  xx2300001644 2 Screw in the screws until they have contact with the cylinder inside.  xx2400000506 3 Then, alternately little by little, tighten the screws by hand according to the image. Screw in the screws by 1-2 turns, approximately 2-3 mm.  xx2400000507 The length of the cylinder is now locked and the balancing device is unloaded. Check that the device is unloaded by trying to rotate it. It should rotate with ease.	

Continues on next page

Removing the axis-2 gearbox screws in area 2

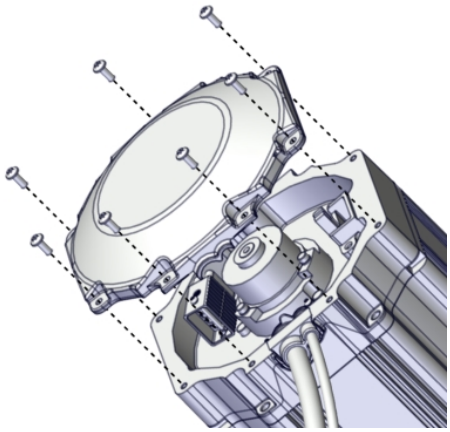
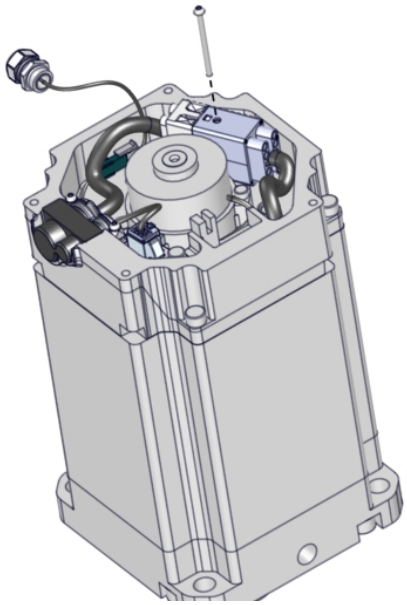
	Action	Note
1	Find area 2.	 xx2300001860
2	Remove the attachment screws in area 2.	 xx2300001861
3	Attach two guide pins in the holes of the area 2 screws.	Guide pin, M12x150: 3HAC13056-2 Always use guide pins in pairs.  xx2300001862

Continues on next page

5.11.2 Replacing the axis-2 gearbox

Continued

Disconnecting the axis-2 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the motor cover by removing the screws.	 xx2100000596
3	Disconnect the power cable connector by first removing the attachment screw and then parting the connector.	 xx2200001736

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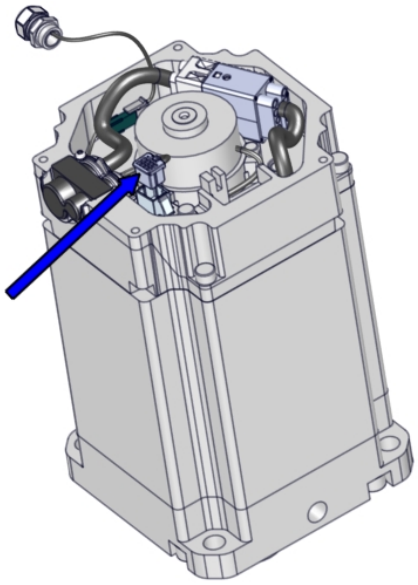
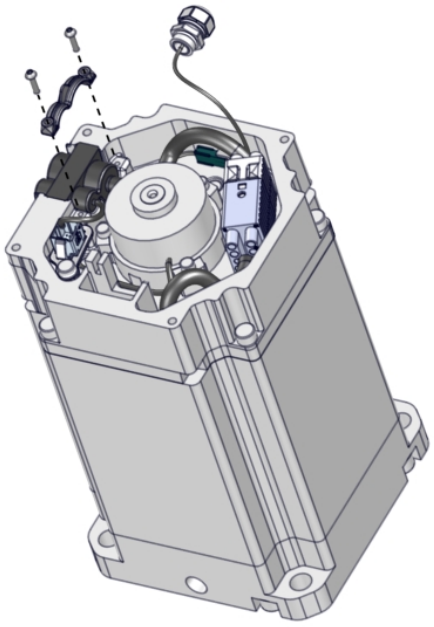
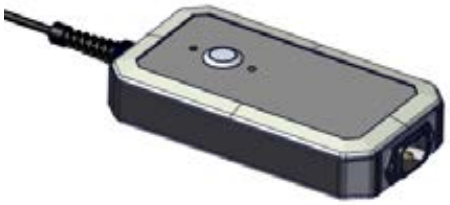
	Action	Note
4	Disconnect the signal cable connector by pulling it out.	 xx2200001737
5	Remove the cable bracket by removing the screws.	 xx2200001738
6	Remove the motor cables from the motor.	

Removing the axis-2 motor

	Action	Note
1	Before removing the motor, make sure that the gearbox is completely drained.	

Continues on next page

5.11.2 Replacing the axis-2 gearbox
Continued

	Action	Note
2	**DANGER** When releasing the holding brakes of the motor, the lower arm will be movable and may fall down if not secured. Verify that the lower arm is secured as previously described, before continuing.	
3	**CAUTION** Releasing the brakes on the axis-2 or axis-3 motor results in weight transfer of upper and lower arm weight to the inserted lock screw in the lower arm or to the attached lifting accessories (whichever is used). If lifting accessories are used, verify that the lifting chains and roundslings are stretched by raising the overhead crane, before releasing the brakes. Release the brakes on the motor with the brake release tool, to unload the weight: 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666

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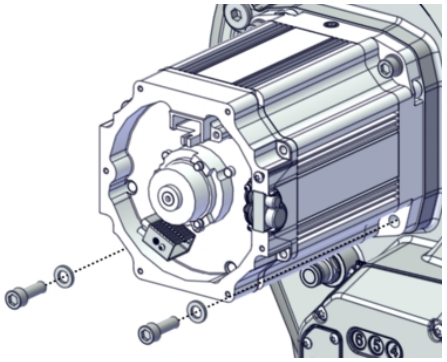
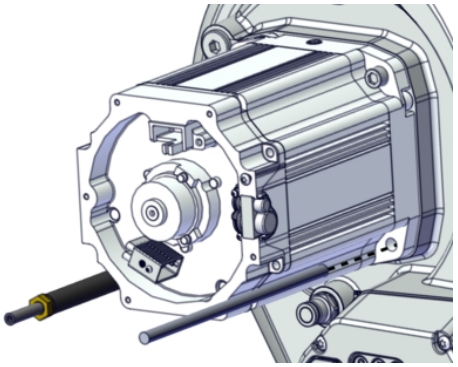
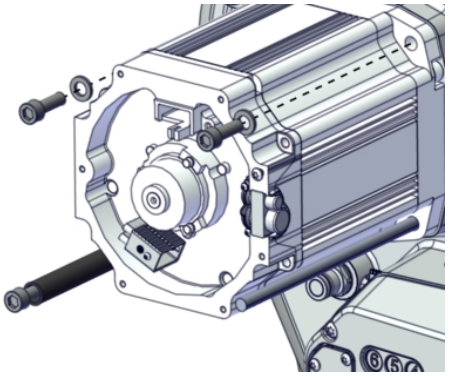
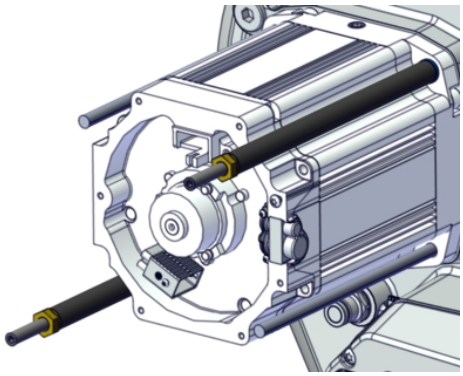
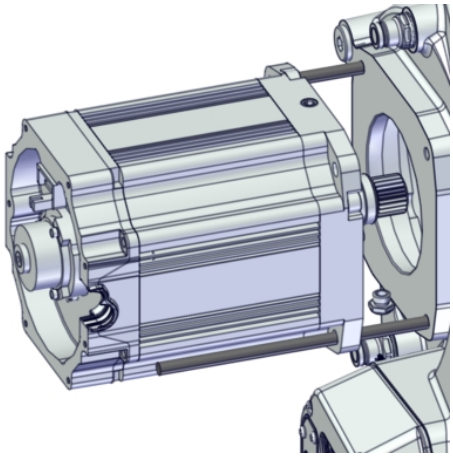
	Action	Note
4	Remove the two lower screws. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx2000000468
5	Fit a guide pin in the non-threaded hole. Fit a removal tool in the threaded hole. **Tip** Lubricate the guide pins with some grease to make the motor slide better.	Guide pin, M10x150: 3HAC15521-2 Removal tool motor M12: 3HAC14631-1  xx2000000456
6	Remove the remaining two screws.	Bits extender: 3HAC12342-1  xx2200001150

Continues on next page

5.11.2 Replacing the axis-2 gearbox

Continued

	Action	Note
7	Fit a guide pin in the non-threaded hole. Fit a removal tool in the threaded hole. **Tip** Lubricate the guide pins with some grease to make the motor slide better.	Guide pin, M10x150: 3HAC15521-2 Removal tool motor M12: 3HAC14631-1  xx2300000043
8	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
9	Activate the brake release tool again (release the brakes).	The power is only applied for 180 seconds after activation.
10	Press the motor out of its position by using the removal tools. Remove the removal tools.	Used to push out the motor, if necessary. Always use removal tools in pairs.
11	**CAUTION** The weight of the motor is 24 kg All lifting accessories used must be sized accordingly.	
12	Carefully lift the motor out on the guide pins, in order to get the pinion away from the gear and let it rest on the guide pins.	 xx2000000457
13	Disconnect the brake release tool.	

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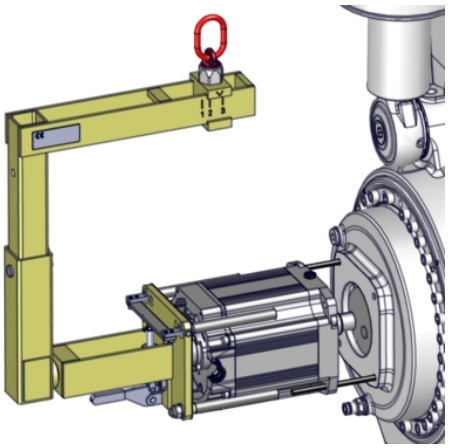
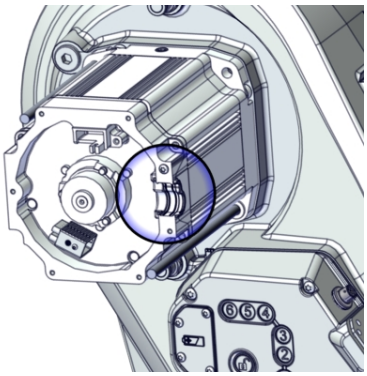
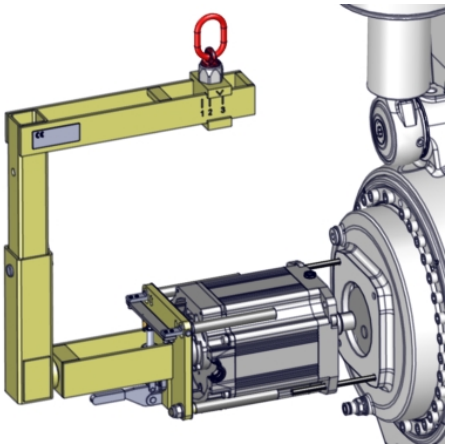
	Action	Note
14	Fasten the lifting accessory. Attach the lifting chain to the accessory and an overhead crane.	Lifting accessory, motor: 3HAC15534-1 Lifting accessory (chain): 3HAC15556-1  xx2400000263
15	Remove the motor by sliding it out on the guide pins and lift it off. **Tip** Make a note in which direction the cable gland hole is facing. The motor shall be refitted in the same position.  xx2100000595	 xx2400000263 Make sure the pinion is not damaged.

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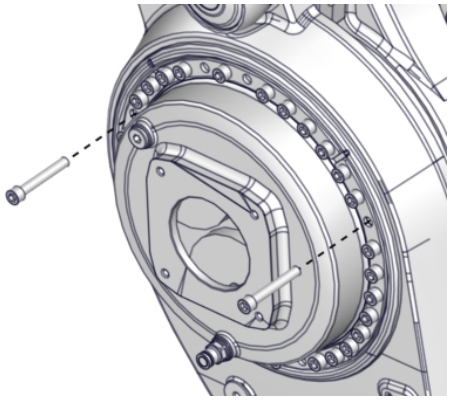
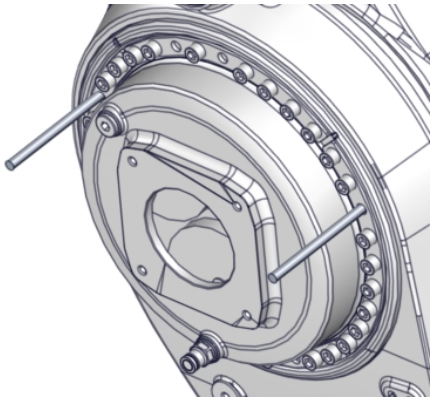
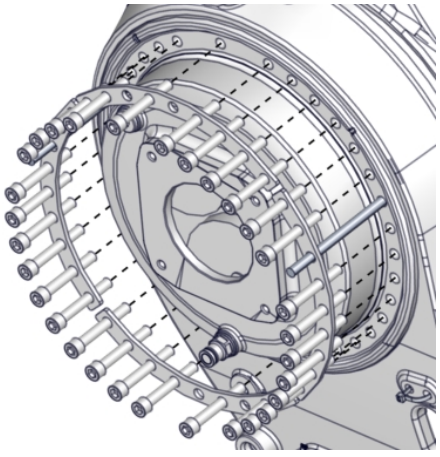
5.11.2 Replacing the axis-2 gearbox

Continued

Removing the motor flange

	Action	Note
1	Remove two attachment screws in opposite holes.	 xx2300001863
2	Fit guide pins in the holes.	Guide pin, M12x200 / Guide pin, M12x250, 3HAC13056-3  xx2300001864
3	Remove the remaining attachment screws and the washers.	 xx2300001865
4	**Note** There will be some oil spill when the motor flange is removed. Put some paper (or similar) to absorb the surplus oil.	

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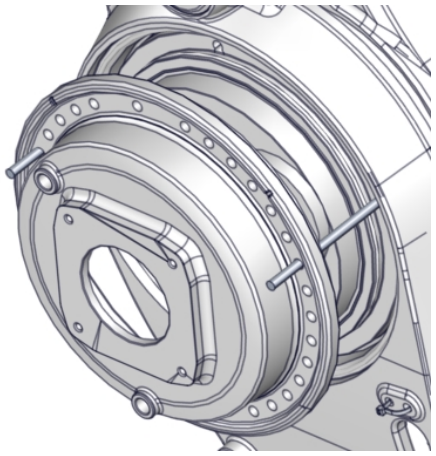
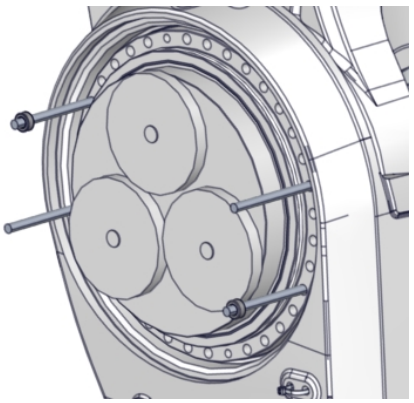
	Action	Note
5	Remove the motor flange.	 xx2300001866
6	Make sure the o-ring is present.	 xx2300001867

Installing guide pins

	Action	Note
1	Attach two additional guide pins in opposite holes, below the present ones. Fasten set collars on two of the guide pins.	Guide pin, M12x200 / Guide pin, M12x250, 3HAC13056-3  xx2400000343

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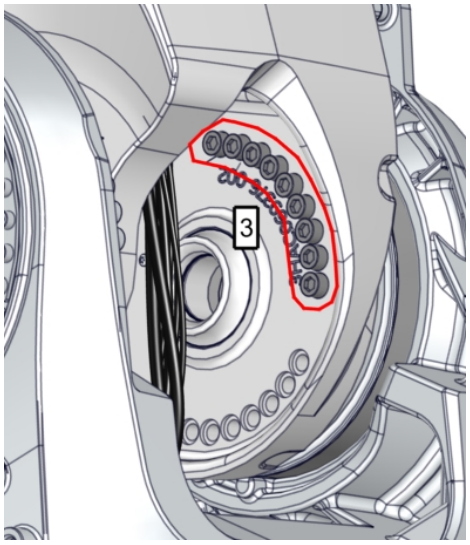
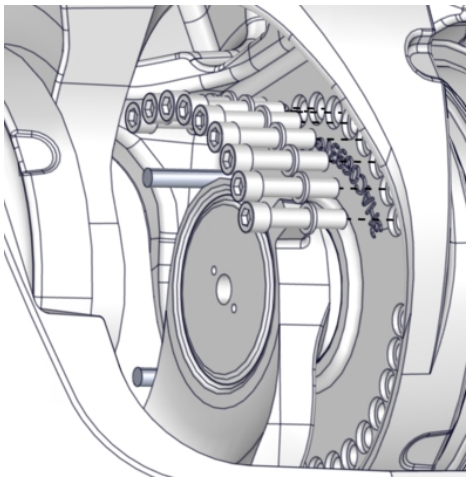
5.11.2 Replacing the axis-2 gearbox

Continued

Removing the axis-2 gearbox screws in area 3

	Action	Note
1	Find area 3.	 xx2300001868
2	Remove the attachment screws that secure the gearbox to the lower arm in area 3.	 xx2300001869

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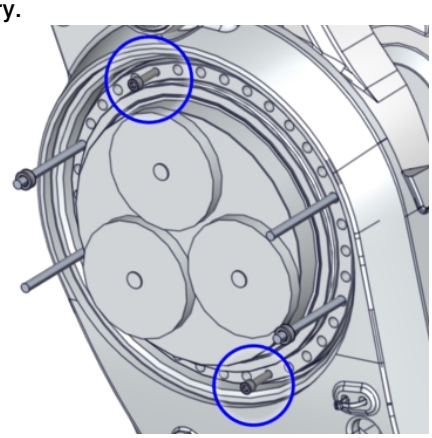
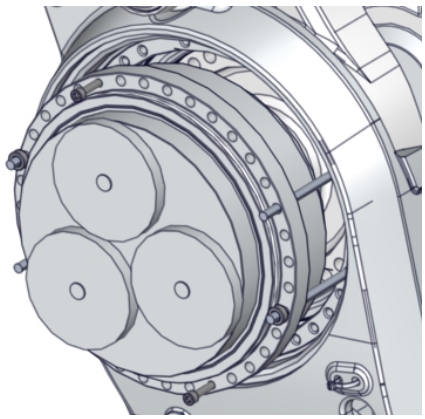
Removing the axis-2 gearbox

	Action	Note
1	Attach two screws and screw them in to push out the gearbox.	Screws M12x100, fully threaded: Used to push out and push in the gearbox, if necessary.  xx2400000344
2	After the gearbox has been pushed out, screw out the screws enough to use them to pull the gearbox further out.	
3	Pull and slide the gearbox out on the four guide pins, just enough to be able to attach the lifting accessories.	 xx2400000345
4	**CAUTION** The weight of the gearbox is 98 kg All lifting accessories used must be sized accordingly.	

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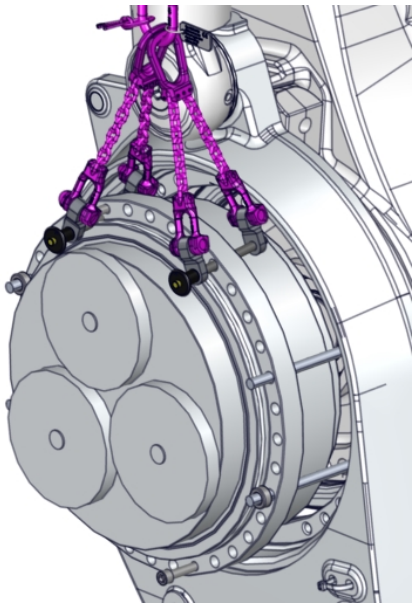
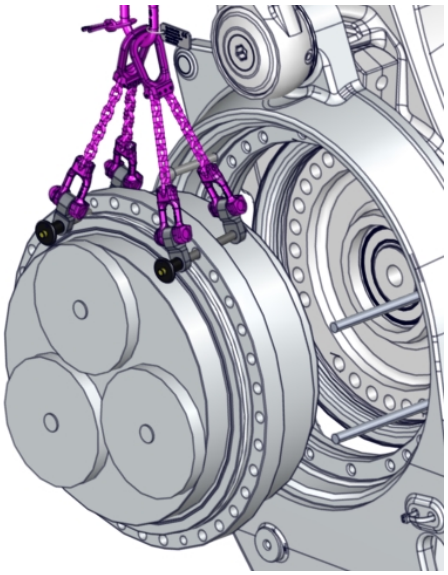
5.11.2 Replacing the axis-2 gearbox
Continued

	Action	Note
5	Attach the lifting accessories to the gearbox.	Lifting accessory for gear: 3HAC081585-001  xx2400000346
6	Remove the stoppers from the guide pins and remove the gearbox.	 xx2400000388

Refitting the gearbox

Use these procedures to refit the axis-2 gearbox.

DANGER

Never remove both the axis-2 and axis-3 gearboxes at the same time.

One side must always be attached when the gearbox on the other side is removed. If not, there is a potential risk that a severe accident will happen.

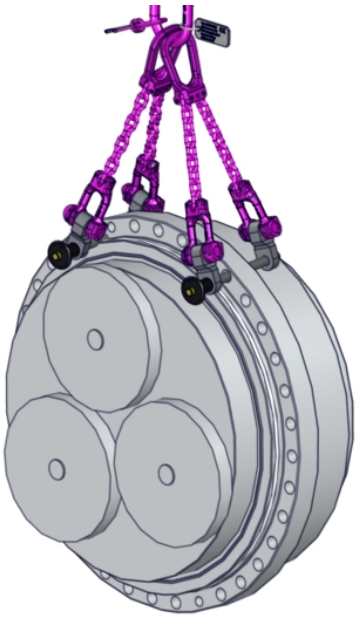
Continues on next page

Note

The gearbox attachment screws are arranged in three areas. It will not be possible to reach all screws with the robot in only one position.

Removal and refitting must be performed with the robot in several positions, which are described in the procedures.

Preparations before refitting the gearbox

	Action	Note
1	**CAUTION** The weight of the gearbox is 98 kg All lifting accessories used must be sized accordingly.	
2	Attach the lifting accessory and lift the gearbox.	Lifting accessory for gear: 3HAC081585-001  xx2400000347
3	Wipe the contact surfaces between gearbox and frame clean from any contamination.	

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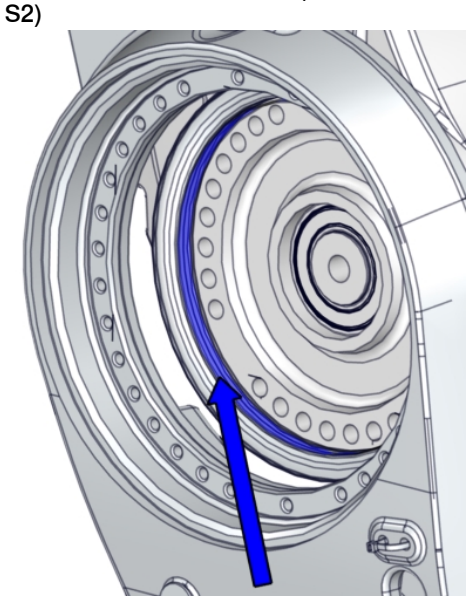
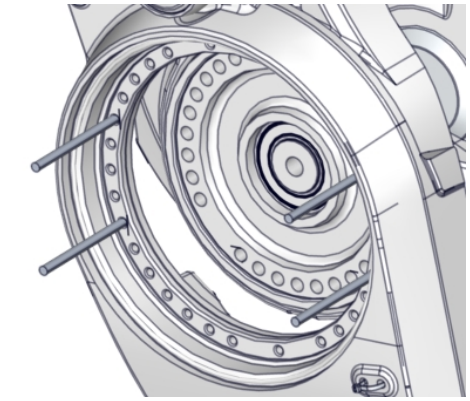
5.11.2 Replacing the axis-2 gearbox

Continued

	Action	Note
4	Apply some grease on the thin chamfer on the lower arm.	Grease: 3HAC042536-001 (Shell Gadus S2)  xx2400000389
5	Fit guide pins in the frame. **Tip** Lubricate the guide pins with some grease to make the gearbox/gear slide better.	Guide pin, M12x200 / Guide pin, M12x250, 3HAC13056-3 (4 pcs) Always use guide pins in pairs.  xx2300001870

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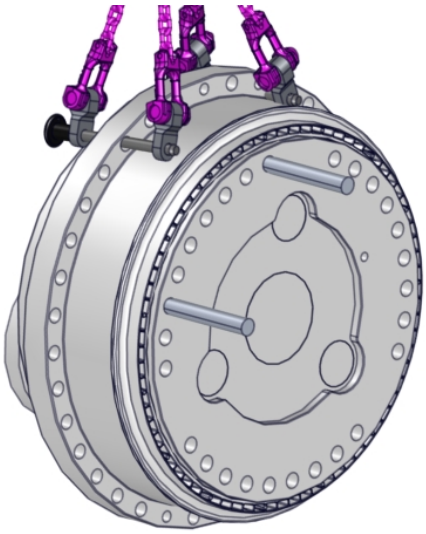
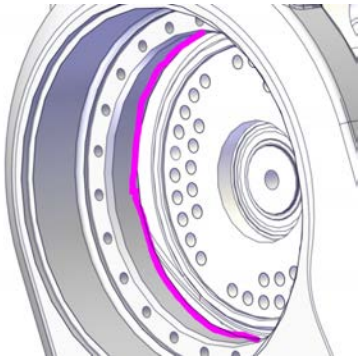
	Action	Note
6	Fit guide pins to the back of the gearbox. **Tip** Lubricate the guide pins with some grease to make the gearbox/gear slide better.	Guide pin, M12x150: 3HAC13056-2 (2 pcs) Always use guide pins in pairs.  xx2300001871

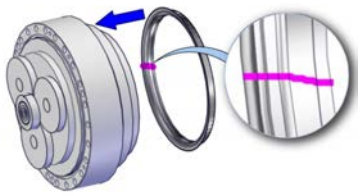
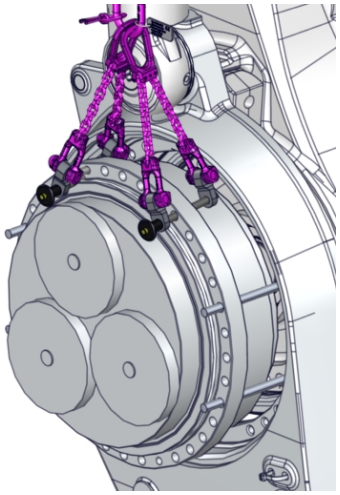
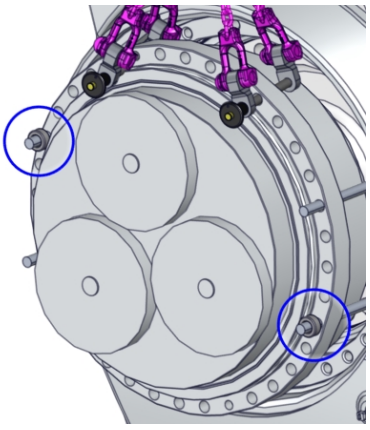
Refitting the axis-2 gearbox to frame

	Action	Note
1	Apply Mercasol (40 mm from the lower arm side) on the contact surface.	Mercasol  xx1500002349 **Note** Area where to apply Mercasol, 40 mm wide, from the lower arm side.

Continues on next page

5.11.2 Replacing the axis-2 gearbox

Continued

	Action	Note
2	Apply Mercasol on the surface of the sealing ring and attach it on the gearbox. **Note** Make sure that the sealing ring is attached correctly on the gearbox.	Mercasol  xx1500002350
3	Lift the gearbox onto the guide pins.	 xx2400000349
4	Fasten set collars on two of the guide pins.	 xx2400000350
5	If the hole pattern does not match, use the adjustment tool to turn the gear to find the hole pattern.	Adjustment tool for gear: 3HAC080331-001

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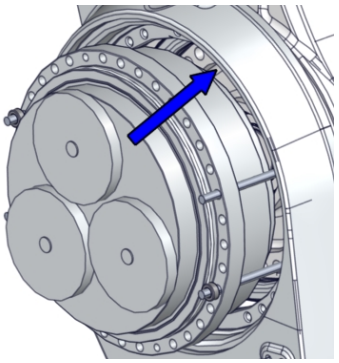
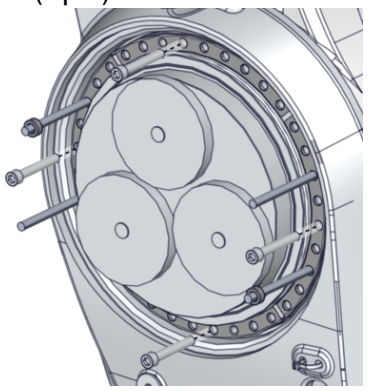
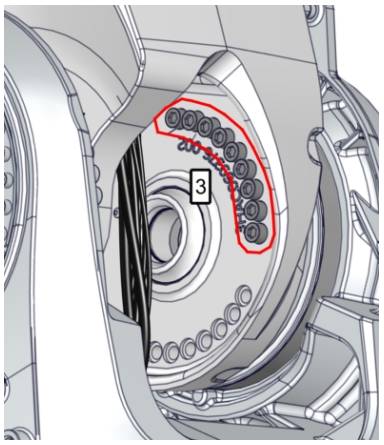
	Action	Note
6	Remove the lifting accessories and push in the gearbox into the frame.	 xx2400000351
7	Attach four attachment screws with nine-hole washers underneath, in a square and use them alternately to press the gearbox into position. **Note** The six-hole washers are needed for protection of the gearbox surface, when the screws are attached.	Tightening torque: 100 Nm Hex socket head cap screw: M12x80 12.9 Gleitmo 603+Geomet 500 (4 pcs)  xx2400000352

Refitting the axis-2 gearbox screws in area 3

	Action	Note
1	Find area 3.	 xx2300001868

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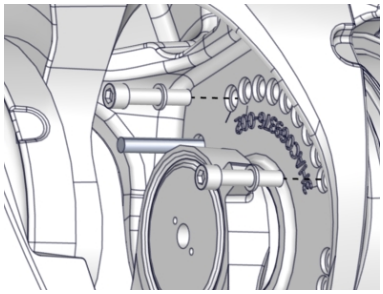
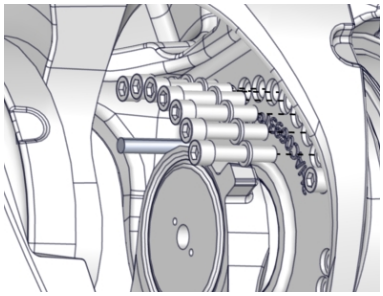
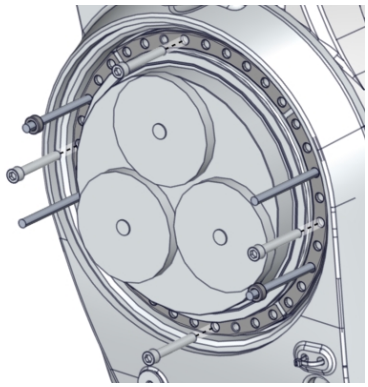
5.11.2 Replacing the axis-2 gearbox
Continued

	Action	Note
2	Begin by fitting the screws and washers in the outermost holes. **Tip** Make sure that the hole pattern match. If needed, use the adjustment tool in the gearbox to find the hole pattern.	Hex socket head cap screw: M12x80 12.9 Gleitmo 603+Geomet 500 (2 pcs)  xx2300001872
3	Then attach the remaining screws with washers, in area 3. **Note** Do not torque the screws at this point.	Hex socket head cap screw: M12x80 12.9 Gleitmo 603+Geomet 500 (7 pcs)  xx2300001873

Refitting the motor flange

	Action	Note
1	Remove the four attachment screws and nine-hole washers, previously attached in a square.	 xx2400000352
2	Clean the contact surfaces on gearbox and motor flange.	

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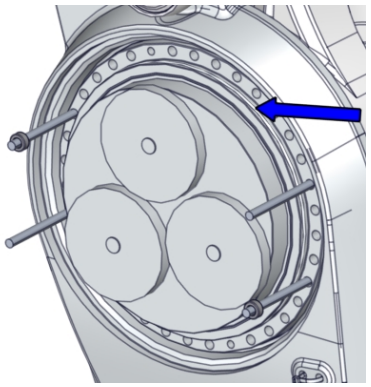
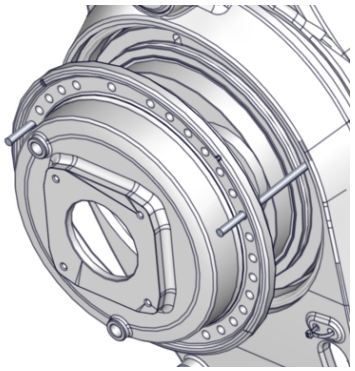
	Action	Note
3	Clean the o-ring and the o-ring groove on gearbox.	 xx2400000353
4	Lubricate the o-ring and fit to the gearbox. Replace if damaged.	Grease, Shell Gadus S2: 3HAC042536-001. O-ring: 3HAC061327-067
5	Check the motor flange o-ring. Replace if damaged.	O-ring: 3HAB3772-160  xx2300001867
6	Lift the motor flange onto the guide pins.	 xx2300001866
7	Make sure the o-rings are in position and slide the motor flange into position.	

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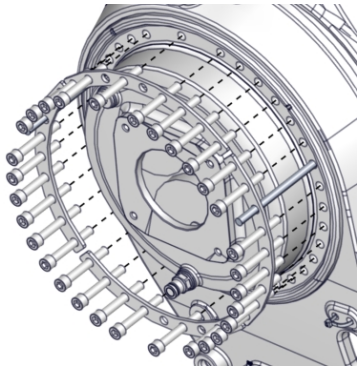
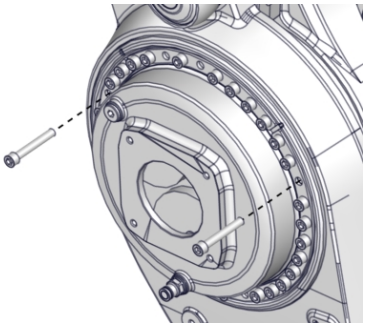
5.11.2 Replacing the axis-2 gearbox

Continued

	Action	Note
8	Fit the attachment screws with the four six-hole washers.	Hex socket head cap screw: M12x80 12.9 Gleitmo 603+Geomet 500  xx2300001865
9	Remove the guide pins and attach the remaining screws.	 xx2300001863
10	Tighten all motor flange screws.	Tightening torque: standard torque 120 Nm (*Tightening torque on page 661*).
11	Perform a leak-down test.	See *Performing a leak-down test on page 197*.

Preparations prior to refitting motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove any old paint or flange sealant residues or other contamination from the contact surfaces on both the motor and the mating parts. **Tip** Remove flange sealant residues with Loctite 7200. Then use Loctite 7063 for cleaning the mating surface.	Cleaning agent: Loctite 7200, Loctite 7063

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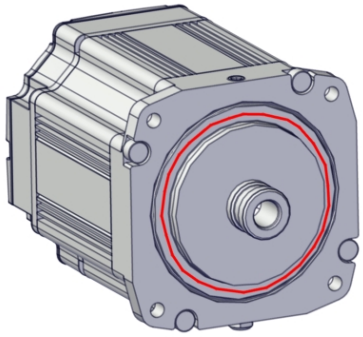
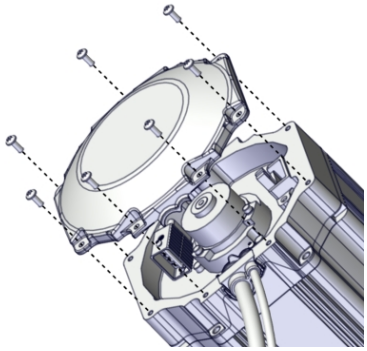
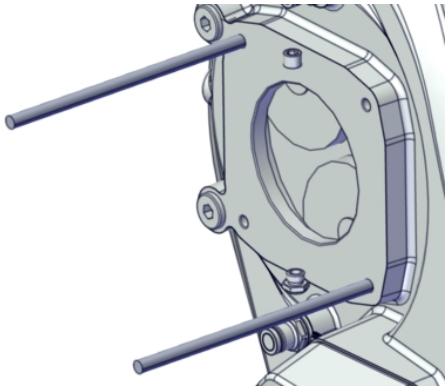
	Action	Note
3	Apply a continuous bead of flange sealant, 1-2 mm wide, inside of the groove on the motor contact surface. **Note** The purpose of the groove is to catch excess sealant. No o-ring is used.	Flange sealant: Loctite 5800  xx2100000520
4	Remove the cover, if fitted to the new spare part motor.	 xx2100000596

Refitting the axis-2 motor

	Action	Note
1	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.  xx2100000593
2	**CAUTION** The weight of the motor is 24 kg All lifting accessories used must be sized accordingly.	

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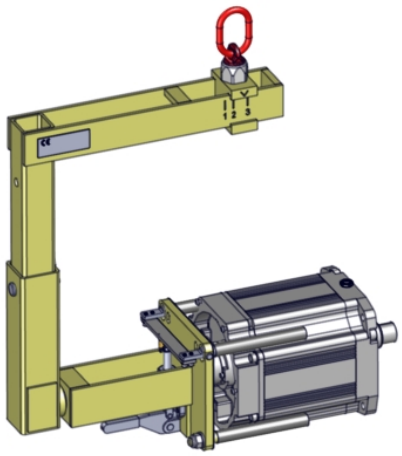
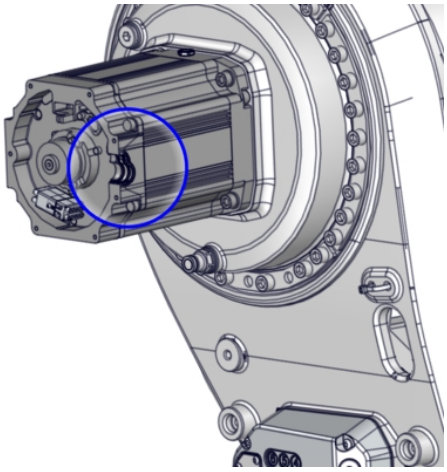
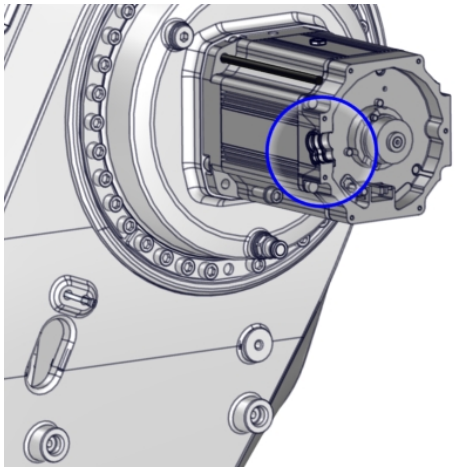
5.11.2 Replacing the axis-2 gearbox

Continued

	Action	Note
3	Apply the lifting accessory.	Lifting accessory, motor: 3HAC15534-1 Lifting accessory (chain): 3HAC15556-1  xx2400000264
4	**Note** Make sure the cable gland opening is turned the correct way.	Axis-2 motor:  xx2400000265 Axis-3 motor:  xx2400000266

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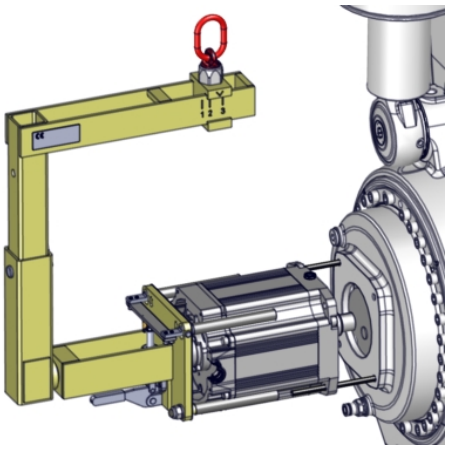
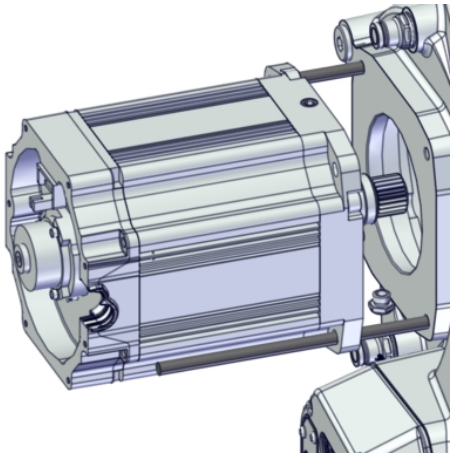
	Action	Note
5	Lift the motor and put it on the guide pins as close as possible to its final position without pushing the motor pinion into the gear.	 xx2400000263
6	Remove the lifting accessory and allow the motor to rest on the guide pins.	 xx2000000457

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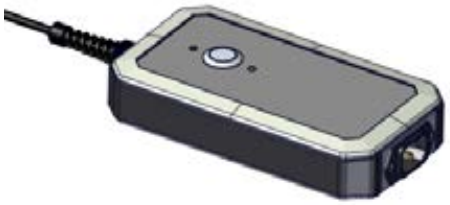
5.11.2 Replacing the axis-2 gearbox
Continued

	Action	Note
7	Release the brakes of the motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
8	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
9	Apply the rotation tool. Use caution and fit the motor in its final position while at the same time rotating the motor pinion slightly using the rotation tool. • Make sure that the motor pinion is properly mated to the gear of the gearbox. • Make sure that the motor pinion does not get damaged. • Make sure that the direction of the cable exit is facing the correct way.	Rotation tool M4: 3HAB7887-1

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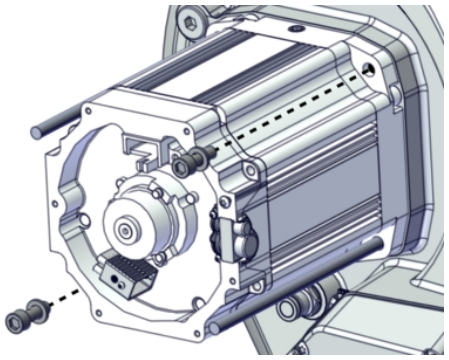
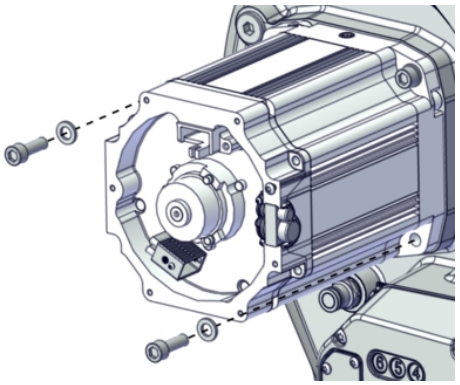
	Action	Note
10	Fit two of the attachment screws and washers. Use a bits extender in order to reach the screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (2 pcs) Bits extender: 3HAC12342-1  xx2000000467
11	Remove the guide pins and refit the remaining attachment screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (2 pcs)  xx2300000044
12	Tighten the screws.	Tightening torque: 50 Nm.
13	Disconnect the brake release tool.	
14	Perform a leak-down test.	See *Performing a leak-down test on page 197*.

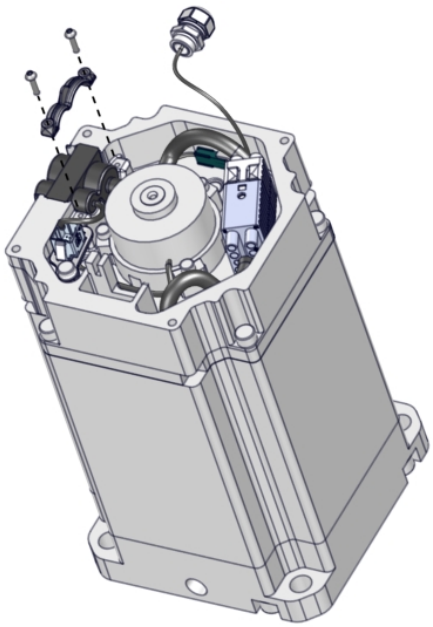
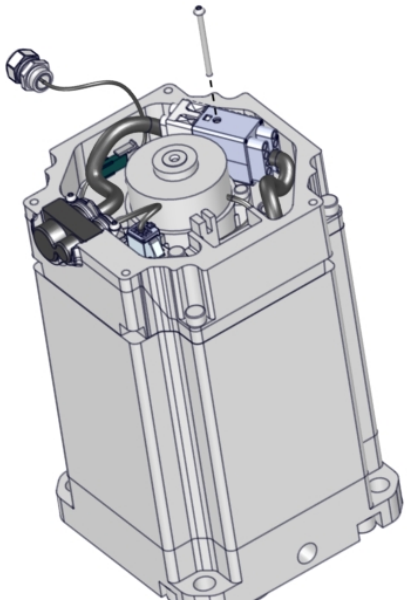
Connecting the motor cables

	Action	Note
1	Put the motor cables in place in the opening.	

Continues on next page

5.11.2 Replacing the axis-2 gearbox

Continued

	Action	Note
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001738
3	Connect the motor cables. **Note** Connect in accordance with the markings on the connectors.	
4	Fit a screw to the power connector. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001736

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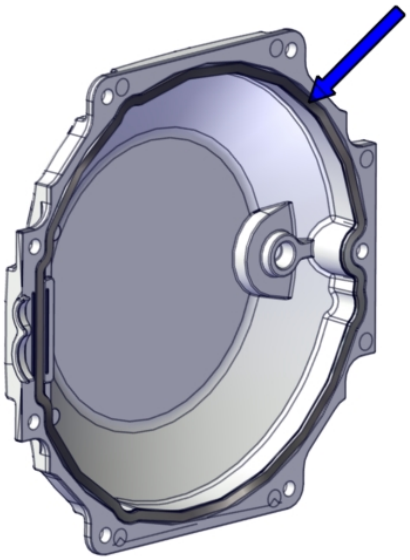
	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1, axis-2 and axis-3: Connection box cover FS180 with gasket: 3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection) Axis-4: Connection box cover FS130 with gasket: 3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)  xx2100000600
6	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	

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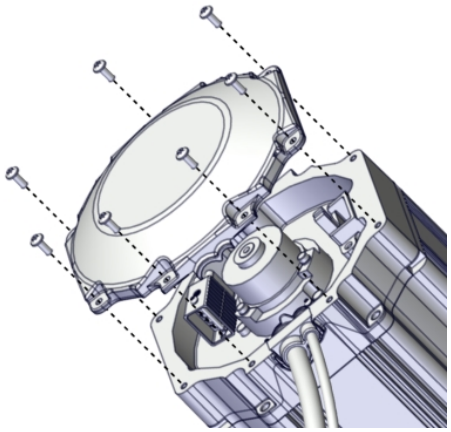
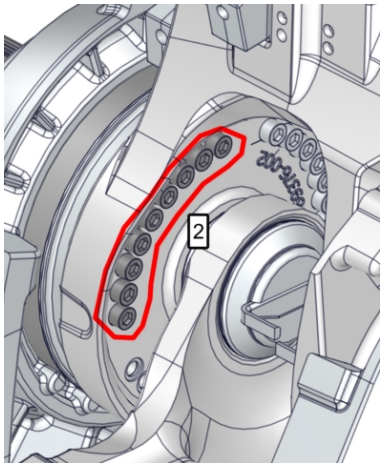
5.11.2 Replacing the axis-2 gearbox

Continued

	Action	Note
7	Refit the motor cover with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.  xx2100000596

Refitting the axis-2 gearbox screws in area 2

	Action	Note
1	Find area 2.	 xx2300001860

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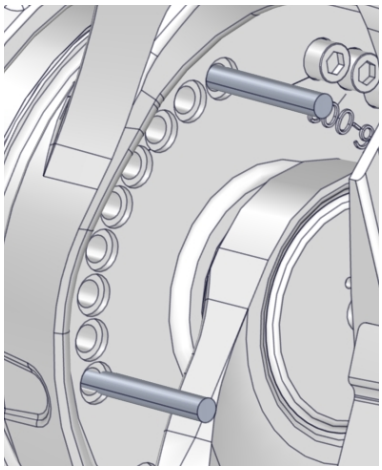
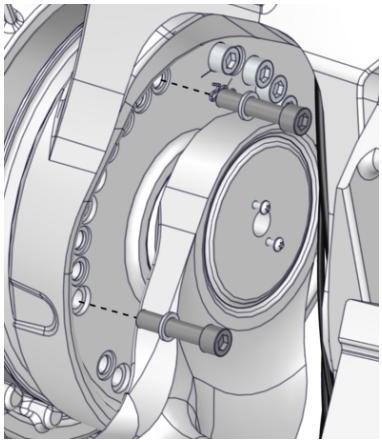
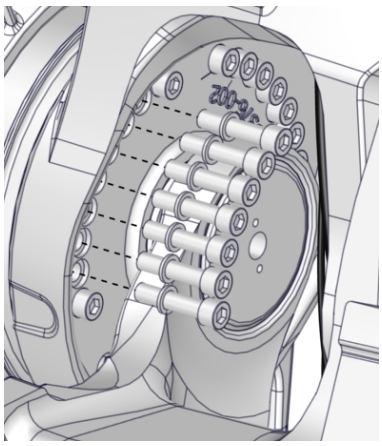
	Action	Note
2	Remove the guide pins.	 xx2300001862
3	Begin by fitting the screws and washers in the outermost holes.	Hex socket head cap screw: M12x80 12.9 Gleitmo 603+Geomet 500 (2 pcs)  xx2300001874
4	Then attach the remaining screws with washers, in area 2. **Note** Do not torque the screws at this point.	Hex socket head cap screw: M12x80 12.9 Gleitmo 603+Geomet 500 (7 pcs)  xx2300001875

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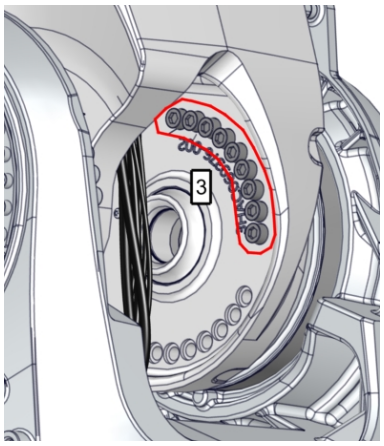
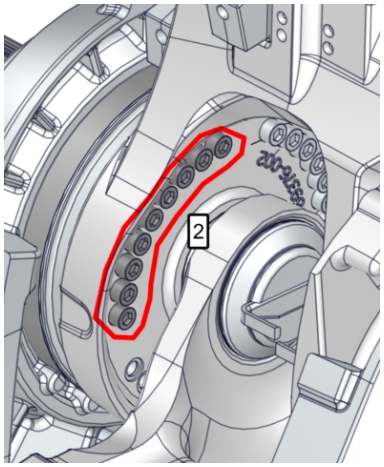
5.11.2 Replacing the axis-2 gearbox

Continued

Securing the axis-2 gearbox screws in areas 2 and 3

	Action	Note
1	Tighten the attachment screws in area 3.	Tightening torque: standard torque 300 Nm (*Tightening torque on page 661*).  xx2300001868
2	Tighten the attachment screws in area 2.	Tightening torque: standard torque 300 Nm (*Tightening torque on page 661*).  xx2300001860

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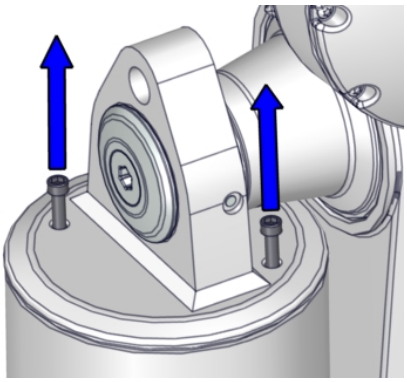
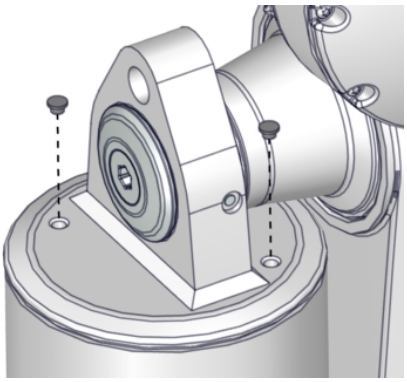
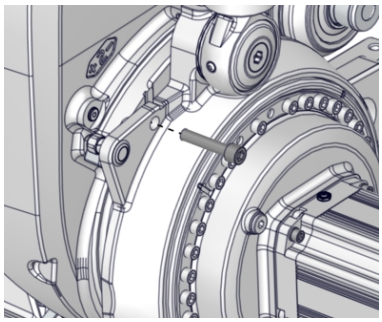
Restoring the pressure of the balancing device

	Action	Note
1	Restore the pressure of the balancing device by unscrewing the two screws alternately little by little.	 xx2300001855
2	Remove the screws.	
3	Refit the plastic plugs in the holes on top of the balancing device.	 xx2300001643

Removing the lock screw

	Action	Note
1	Remove the axis-2 lock screw. **Note** If the screw is jammed, turn on the power to the robot temporarily and carefully jog axis 2, until it is possible to unscrew the lock screw completely.	 xx2400000355

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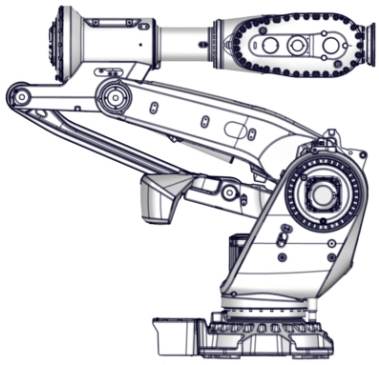
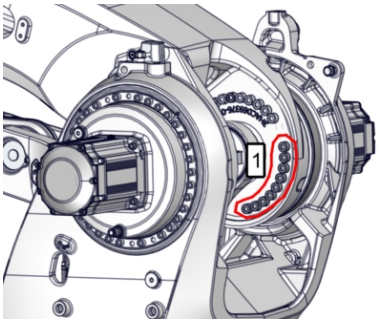
5.11.2 Replacing the axis-2 gearbox

Continued

Refitting the axis-2 gearbox screws in area 1

	Action	Note
1	Jog the robot into position: • Axis 1: no significance • Axis 2: -65° • Axis 3: 0° • Axis 4: 0° • Axis 5: no significance • Axis 6: no significance.	 xx2400000339
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Find area 1.	 xx2300001852

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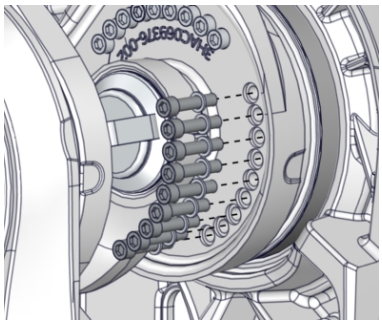
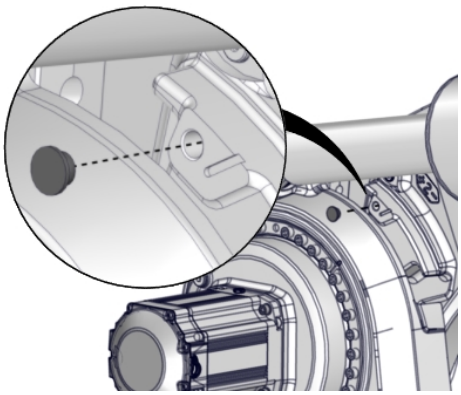
	Action	Note
4	Refit and tighten the screws in area 1.	Hex socket head cap screw: M12x80 12.9 Gleitmo 603+Geomet 500 (9 pcs) Tightening torque: standard torque 300 Nm (*Tightening torque on page 661*).  xx2300001853
5	Examine that all screws have been torqued.	

Refitting the plastic plug to the axis-2 lock screw hole

	Action	Note
1	Refit the plastic plug to the axis-2 lock screw hole.	 xx2400001682

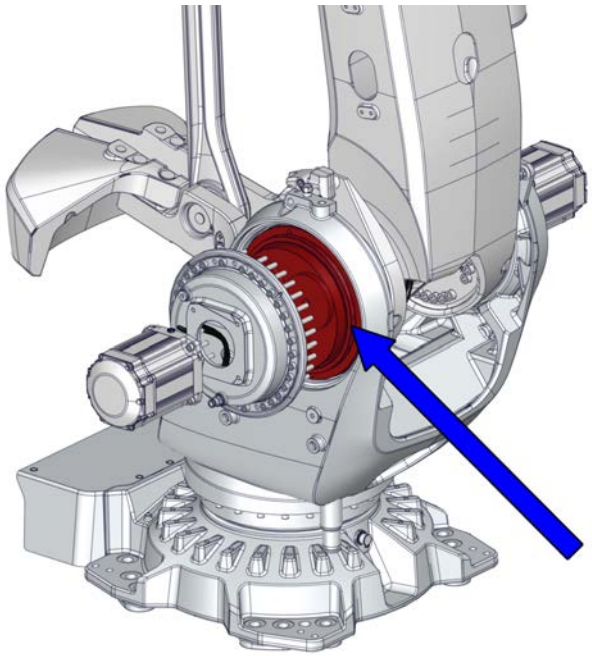
Concluding procedure

	Action	Note
1	Refill the gearbox with oil.	See *Changing the oil in axis-2 gearbox on page 154*.
2	Calibrate the robot.	See *Calibration on page 619*.
3	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.11.3 Replacing the axis-3 gearbox

Location of the gearbox

The gearbox is located as shown in the figure.



xx2300001598

Summary of the replacement procedure

This is a brief summary of the replacement procedure, containing the major actions to be performed.

1 Drain the axis-3 gearbox.
2 Lock the arm system with a lock screw.
3 Remove the axis-3 motor.
4 Replace the axis-3 gearbox.

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Gearbox	3HAC074200-006	Includes o-ring 3HAC061327-067	L2

Continues on next page

Required tools and equipment

Equipment	Article number	Note
Lock screw, M16x80	-	Used to secure lower arm / movable arm structure.
Guide pin, M12x150	3HAC13056-2	Always use guide pins in pairs.
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Removal tool motor M12	3HAC14631-1	Used to push out the motor, if necessary. Always use removal tools in pairs.
Lifting accessory, motor	3HAC15534-1	Lifting instruction 3HAC15640-2 enclosed.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Guide pin, M12x200 / Guide pin, M12x250	3HAC13056-3	Always use guide pins in pairs.
Screws M12x100, fully threaded	-	Used to push out and push in the gearbox, if necessary.
Lifting accessory for gear	3HAC081585-001	For lifting the gearbox
Adjustment tool for gear	3HAC080331-001	Used to rotate the gear for matching hole pattern with frame.
Rotation tool M4	3HAB7887-1	Used to rotate the motor pinion. Add screw M4.
Calibration toolbox, Axis Calibration	3HAC074564-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Required service parts

Consumable	Article number	Note
O-ring	3HAC061327-067	On gearbox. Included in gearbox spare part, but replace if damaged.
Connection box cover FS180 with gasket	3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection)	Replace if damaged. On axis-3 motor A threaded connection is required for cooling fan option.

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5.11.3 Replacing the axis-3 gearbox
Continued

Consumable	Article number	Note
O-ring	3HAB3772-160	On motor flange. Replace if damaged.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.
Cleaning agent	-	Isopropanol
Rust preventive	3HAC034903-001	Mercasol 3110 Waxcoat. Recommended drying time is 24h.
Grease	3HAC042536-001	Shell Gadus S2
Cleaning agent	-	Loctite 7200
Cleaning agent	-	Loctite 7063
Flange sealant	-	Loctite 5800
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.

Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

	Action	Note
1	Decide which calibration routine to use for calibrating the robot. • Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot. • Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.	
	If the robot is to be calibrated with reference calibration: Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in *Reference calibration routine on page 628*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Removing the gearbox

Use these procedures to remove the axis-3 gearbox.

Continues on next page

DANGER

Never remove both the axis-2 and axis-3 gearboxes at the same time.

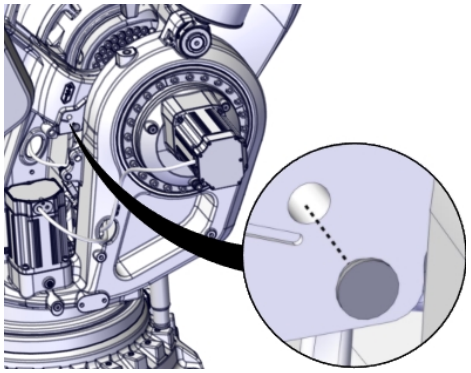
One side must always be attached when the gearbox on the other side is removed. If not, there is a potential risk that a severe accident will happen.

Note

The gearbox attachment screws are arranged in three areas. It will not be possible to reach all screws with the robot in only one position.

Removal and refitting must be performed with the robot in several positions, which are described in the procedures.

Preparations

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Remove any tool or other equipment fitted on the turning disc.	
3	Drain the axis-3 gearbox.	See *Draining the axis-3 gearbox on page 160*.
4	Jog axis-3 to a position where the plastic plug for the axis-3 lock screw hole is accessible.	 xx1500002366
5	Remove the plastic plug that covers the axis-3 lock screw hole. **Note** Keep the plastic plugs. They must be refitted after the work is done.	

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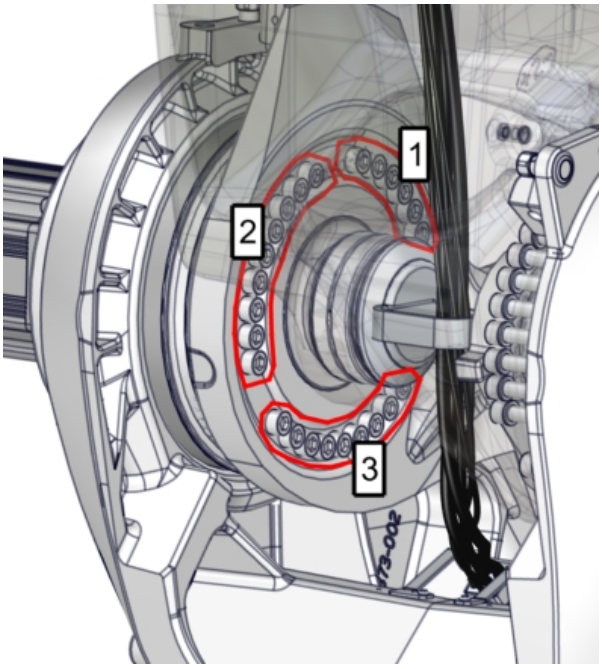
5.11.3 Replacing the axis-3 gearbox
Continued

The three areas of screws that secure axis-3 gearbox to parallel arm

The axis-3 gearbox is attached to the parallel arm with attachment screws arranged in three areas. Use this figure to understand the position of the three areas, when performing this procedure. The figure shows the location of the areas when the robot stands in calibration position.



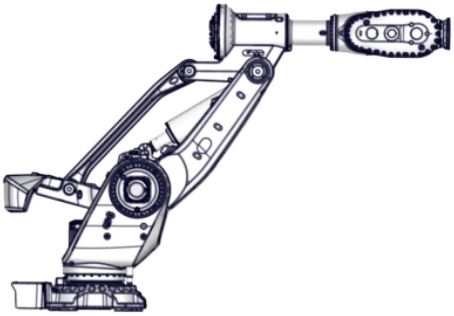
xx2400000356

The order when removing the attachment screws: area 1, then area 2, and last area 3.

The order when attaching the axis-2 gearbox to the lower arm is reversed: area 3, then area 2, and last area 1.

Robot position for access to screws in area 1

With the robot in this position it is possible to reach the screws in area 1 of screws that secure the axis-3 gearbox to the parallel arm.

	Action	Note
1	Jog the robot into position: • Axis 1: no significance • Axis 2: +45° • Axis 3: 0° • Axis 4: 0° • Axis 5: 0° • Axis 6: no significance.	 xx2400000357

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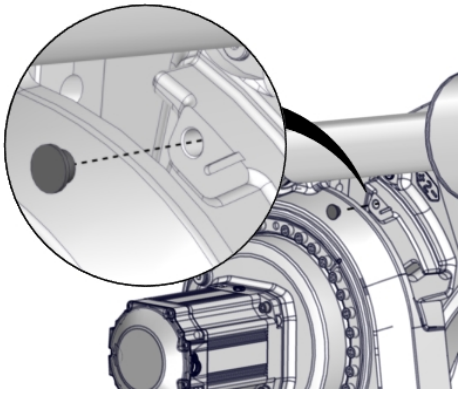
	Action	Note
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Removing the plastic plug of axis-2 lock screw hole

	Action	Note
1	Remove the plastic plug that covers the axis-2 lock screw hole. **Note** Keep the plastic plugs. They must be refitted after the work is done.	 xx2400001682

Removing the axis-3 gearbox screws in area 1

Note

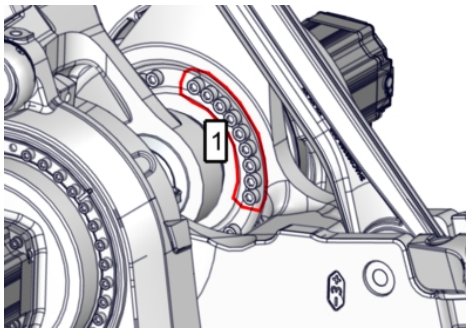
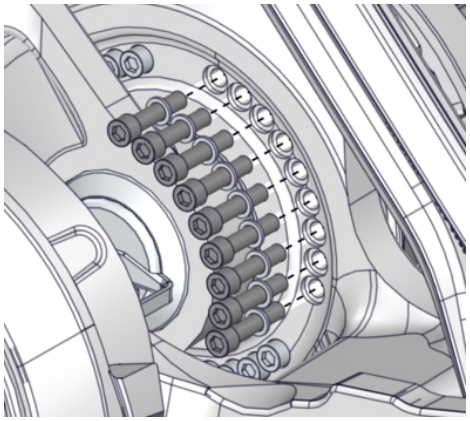
The gearbox attachment screws are arranged in three areas. It will not be possible to reach all screws with the robot in only one position.

This procedure describes how to reach the screws in area 1.

	Action	Note
1	**DANGER** Never remove the screws on both axis-2 and axis-3 at the same time. One side must always be attached when the gearbox on the other side is removed. If not, there is a potential risk that a severe accident will happen.	

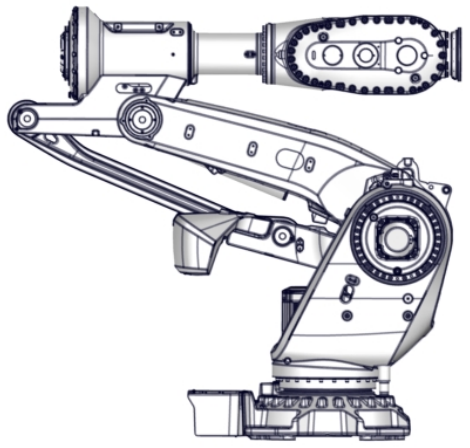
Continues on next page

5.11.3 Replacing the axis-3 gearbox
Continued

	Action	Note
2	Find area 1. **Note** Do not remove screws in area 2 or area 3 at this point.	 xx2400000358
3	Remove the screws in area 1.	 xx2400000359

Robot position for access to screws in area 2

With the robot in this position it is possible to reach the screws in area 2 of screws that secure the axis-3 gearbox to the parallel arm.

	Action	Note
1	Jog the robot into position: • Axis 1: no significance • Axis 2: -65° • Axis 3: 0° • Axis 4: 0° • Axis 5: no significance • Axis 6: no significance.	 xx2400000339

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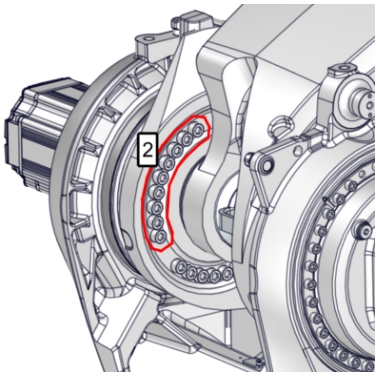
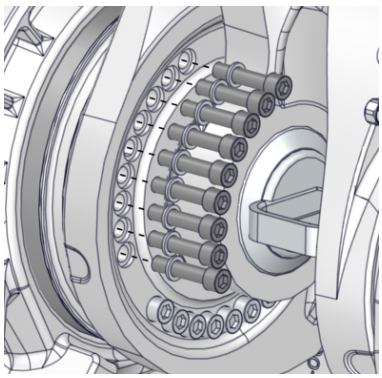
	Action	Note
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Removing the axis-3 gearbox screws in area 2

	Action	Note
1	Find area 2.	 xx2400000360
2	Remove the attachment screws in area 2.	 xx2400000361

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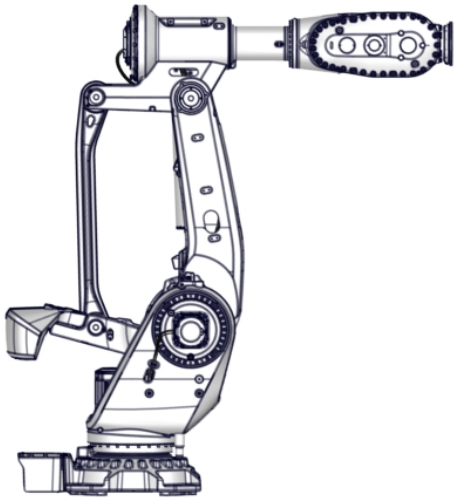
5.11.3 Replacing the axis-3 gearbox

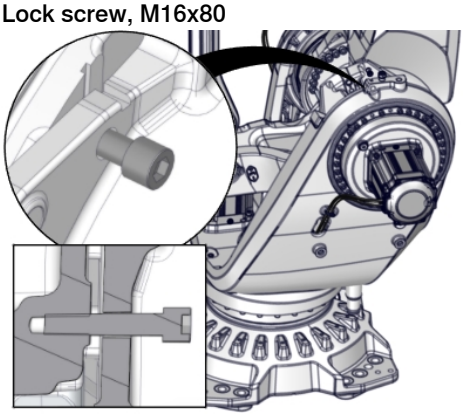
Continued

Robot position for continued procedure

Put the robot in this position for the continued procedures.

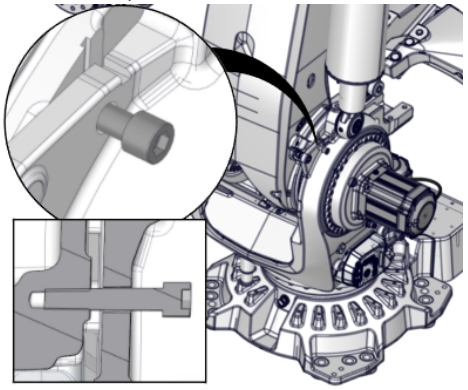
	Action	Note
1	Jog the robot to calibration position.	 xx2300001691

Locking the axis-3 position

	Action	Note
1	Insert the lock screw into the axis-3 lock screw hole. Do not tighten. If needed, adjust the position of the robot to make it possible to insert the lock screw. The lock screw is used to secure the weight of the movable arm structure, in order to avoid accidents or damage. **CAUTION** Do not insert the screw fully, leave space underneath the screw head. Inserting the screw all the way will result in tension in the arm system which may cause damage to the axis-2 and axis-3 gearboxes.	Lock screw, M16x80  xx2400000236
2	Release the brakes on axis-3 using the brake release button, and let the axis rest on the lock screw.	
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Continues on next page

Locking the axis-2 position

	Action	Note
1	Insert the lock screw into the axis-2 lock screw hole. Do not tighten. If needed, adjust the position of the robot to make it possible to insert the lock screw. The lock screw is used to secure the weight of the movable arm structure, in order to avoid accidents or damage. **CAUTION** Do not insert the screw fully, leave space underneath the screw head. Inserting the screw all the way will result in tension in the arm system which may cause damage to the axis-2 and axis-3 gearboxes.	Lock screw, M16x80  xx2300001881
2	Release the brakes on axis-2 using the brake release button, and let the axis rest on the lock screw.	
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Disconnecting the axis-3 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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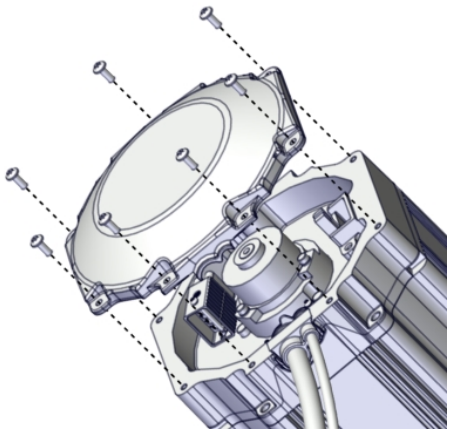
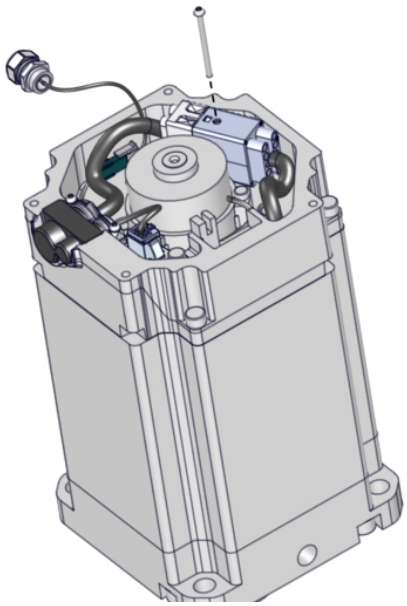
5.11.3 Replacing the axis-3 gearbox

Continued

	Action	Note
2	Remove the motor cover by removing the screws.	 xx2100000596
3	Disconnect the power cable connector by first removing the attachment screw and then parting the connector.	 xx2200001736

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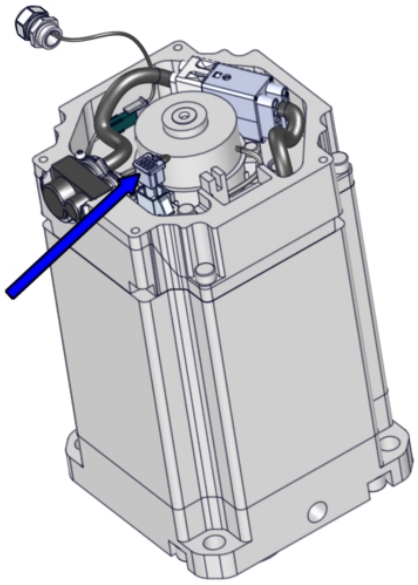
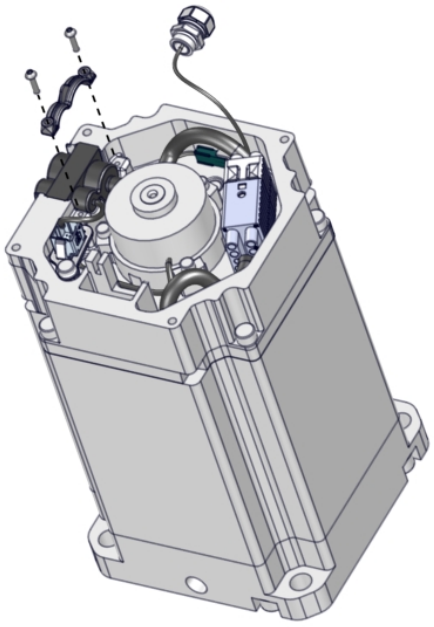
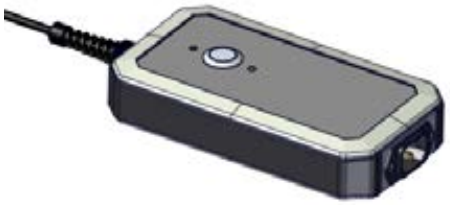
	Action	Note
4	Disconnect the signal cable connector by pulling it out.	 xx2200001737
5	Remove the cable bracket by removing the screws.	 xx2200001738
6	Remove the motor cables from the motor.	

Removing the axis-3 motor

	Action	Note
1	Before removing the motor, make sure that the gearbox is completely drained.	

Continues on next page

5.11.3 Replacing the axis-3 gearbox
Continued

	Action	Note
2	**DANGER** When releasing the holding brakes of the motor, the lower arm will be movable and may fall down if not secured. Verify that the lower arm is secured as previously described, before continuing.	
3	**CAUTION** Releasing the brakes on the axis-2 or axis-3 motor results in weight transfer of upper and lower arm weight to the inserted lock screw in the lower arm or to the attached lifting accessories (whichever is used). If lifting accessories are used, verify that the lifting chains and roundslings are stretched by raising the overhead crane, before releasing the brakes. Release the brakes on the motor with the brake release tool, to unload the weight: 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666

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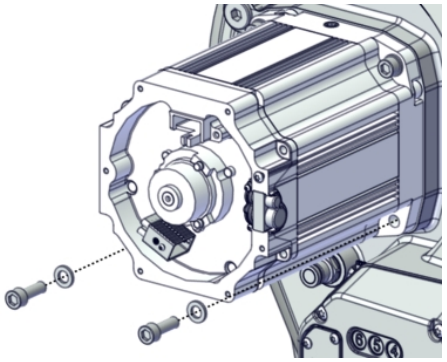
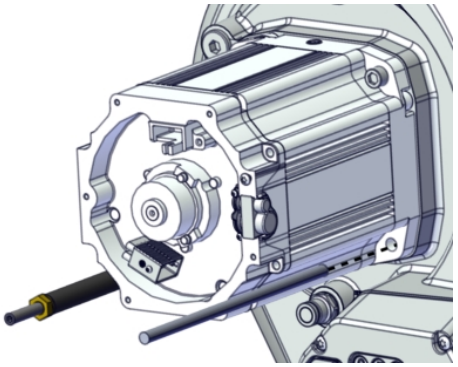
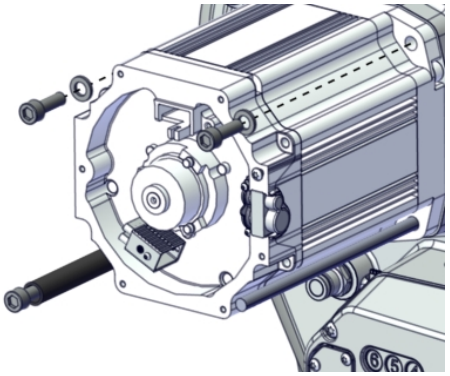
	Action	Note
4	Remove the two lower screws. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx2000000468
5	Fit a guide pin in the non-threaded hole. Fit a removal tool in the threaded hole. **Tip** Lubricate the guide pins with some grease to make the motor slide better.	Guide pin, M10x150: 3HAC15521-2 Removal tool motor M12: 3HAC14631-1  xx2000000456
6	Remove the remaining two screws.	Bits extender: 3HAC12342-1  xx2200001150

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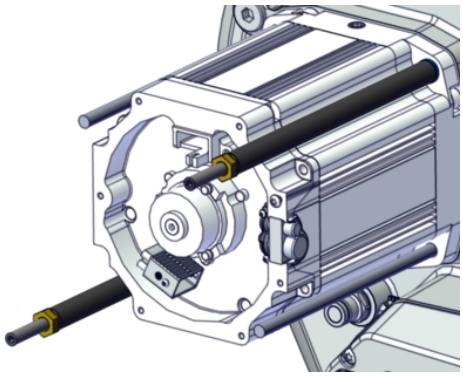
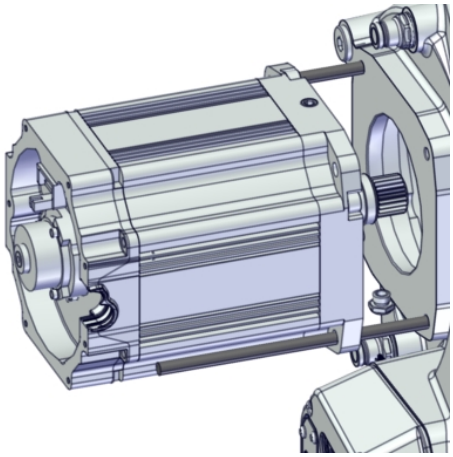
5.11.3 Replacing the axis-3 gearbox

Continued

	Action	Note
7	Fit a guide pin in the non-threaded hole. Fit a removal tool in the threaded hole. **Tip** Lubricate the guide pins with some grease to make the motor slide better.	Guide pin, M10x150: 3HAC15521-2 Removal tool motor M12: 3HAC14631-1  xx2300000043
8	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
9	Activate the brake release tool again (release the brakes).	The power is only applied for 180 seconds after activation.
10	Press the motor out of its position by using the removal tools. Remove the removal tools.	Used to push out the motor, if necessary. Always use removal tools in pairs.
11	**CAUTION** The weight of the motor is 24 kg All lifting accessories used must be sized accordingly.	
12	Carefully lift the motor out on the guide pins, in order to get the pinion away from the gear and let it rest on the guide pins.	 xx2000000457
13	Disconnect the brake release tool.	

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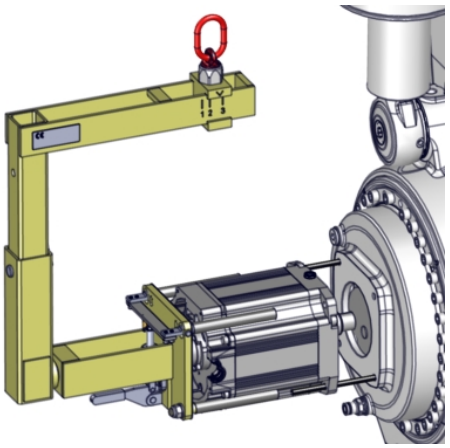
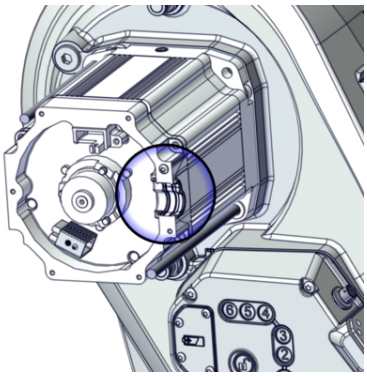
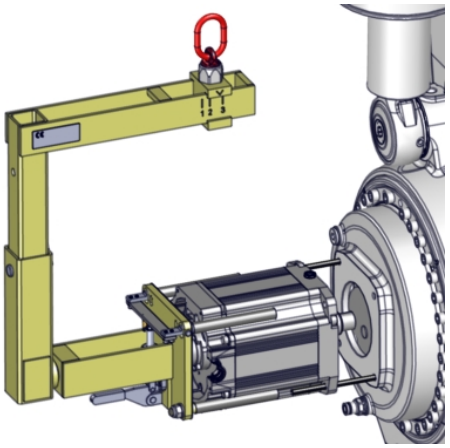
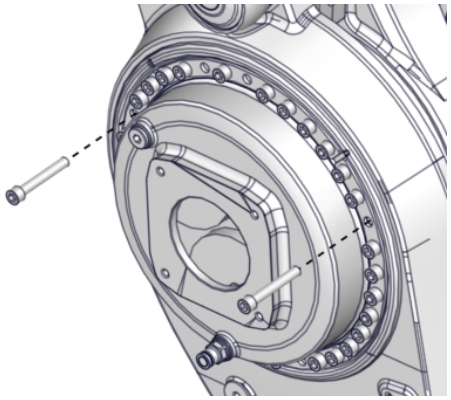
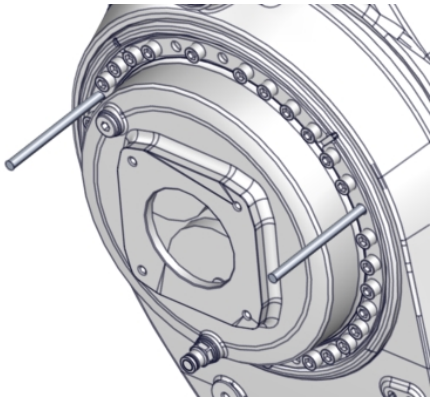
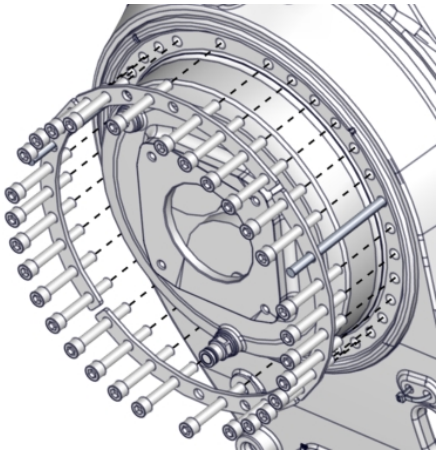
	Action	Note
14	Fasten the lifting accessory. Attach the lifting chain to the accessory and an overhead crane.	Lifting accessory, motor: 3HAC15534-1 Lifting accessory (chain): 3HAC15556-1  xx2400000263
15	Remove the motor by sliding it out on the guide pins and lift it off. **Tip** Make a note in which direction the cable gland hole is facing. The motor shall be refitted in the same position.  xx2100000595	 xx2400000263 Make sure the pinion is not damaged.

Continues on next page

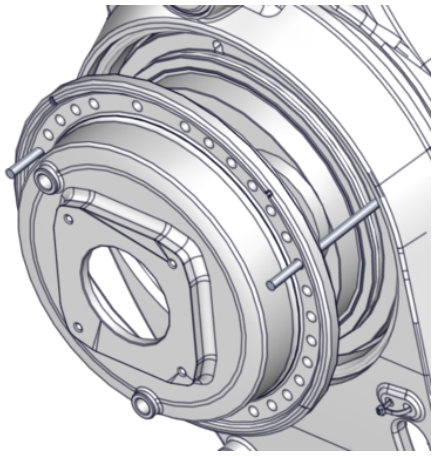
5.11.3 Replacing the axis-3 gearbox

Continued

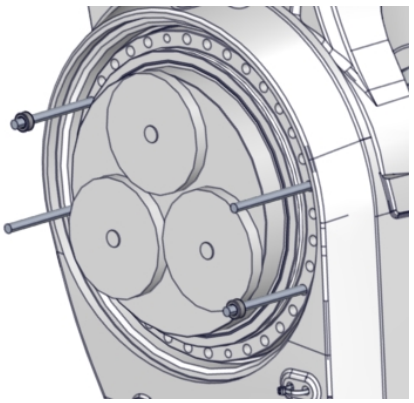
Removing the motor flange

	Action	Note
1	Remove two attachment screws in opposite holes.	 xx2300001863
2	Fit guide pins in the holes.	Guide pin, M12x200 / Guide pin, M12x250, 3HAC13056-3  xx2300001864
3	Remove the remaining attachment screws and the washers.	 xx2300001865
4	**Note** There will be some oil spill when the motor flange is removed. Put some paper (or similar) to absorb the surplus oil.	

Continues on next page

	Action	Note
5	Remove the motor flange.	 xx2300001866
6	Make sure the o-ring is present.	 xx2300001867

Installing guide pins

	Action	Note
1	Attach two additional guide pins in opposite holes, below the present ones. Fasten set collars on two of the guide pins.	Guide pin, M12x200 / Guide pin, M12x250, 3HAC13056-3  xx2400000343

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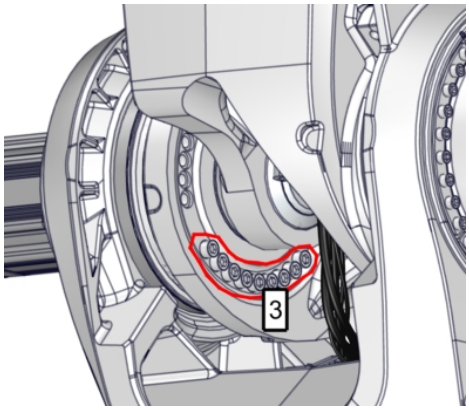
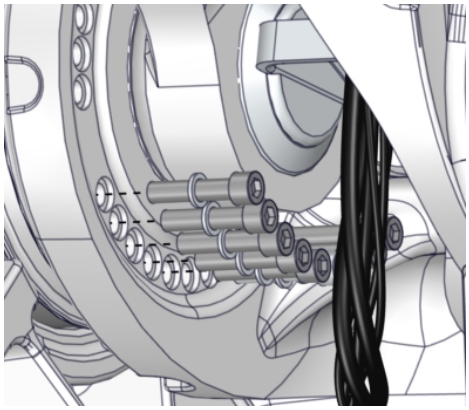
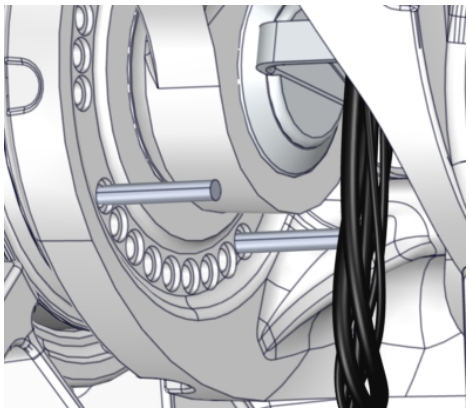
5.11.3 Replacing the axis-3 gearbox

Continued

Removing the axis-3 gearbox screws in area 3

	Action	Note
1	Find area 3.	 xx2400000363
2	Remove the attachment screws that secure the gearbox to the parallel arm in area 3.	 xx2400000364
3	Attach two guide pins in the holes of the area 3 screws.	Guide pin, M12x150: 3HAC13056-2 Always use guide pins in pairs.  xx2400000362

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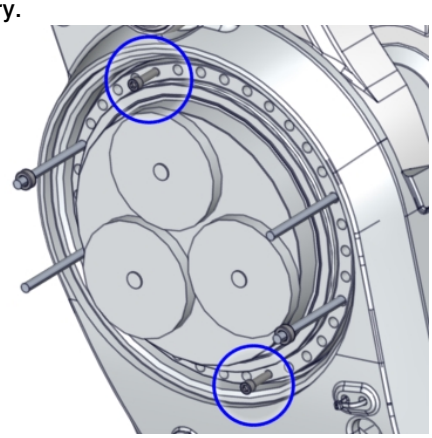
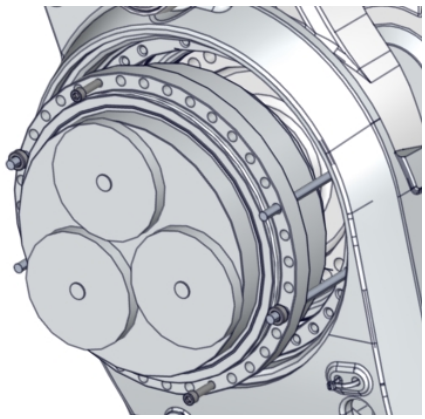
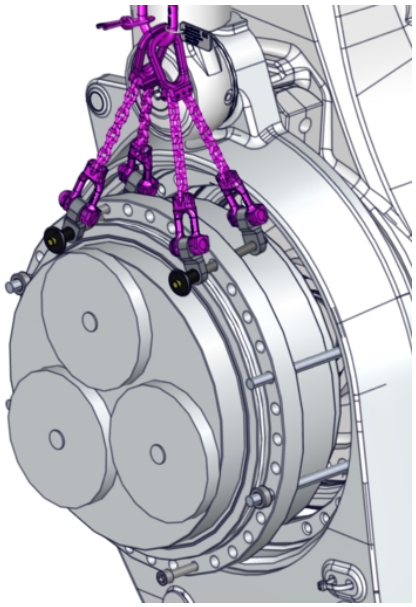
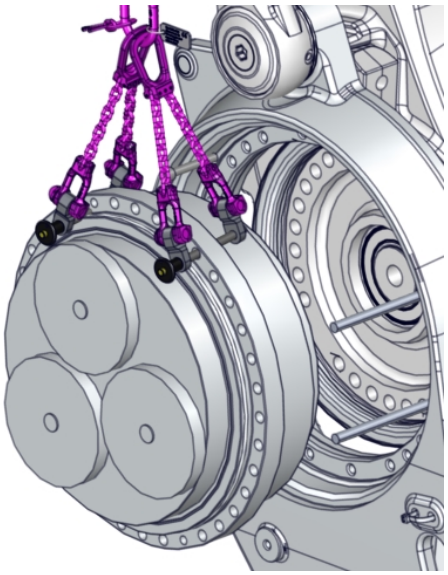
Removing the axis-3 gearbox

	Action	Note
1	Attach two screws and screw them in to push out the gearbox.	Screws M12x100, fully threaded: Used to push out and push in the gearbox, if necessary.  xx2400000344
2	After the gearbox has been pushed out, screw out the screws enough to use them to pull the gearbox further out.	
3	Pull and slide the gearbox out on the four guide pins, just enough to be able to attach the lifting accessories.	 xx2400000345
4	**CAUTION** The weight of the gearbox is 98 kg All lifting accessories used must be sized accordingly.	

Continues on next page

5.11.3 Replacing the axis-3 gearbox
Continued

	Action	Note
5	Attach the lifting accessories to the gearbox.	Lifting accessory for gear: 3HAC081585-001  xx2400000346
6	Remove the stoppers from the guide pins and remove the gearbox.	 xx2400000388

Refitting the gearbox

Use these procedures to refit the axis-3 gearbox.

DANGER

Never remove both the axis-2 and axis-3 gearboxes at the same time.

One side must always be attached when the gearbox on the other side is removed. If not, there is a potential risk that a severe accident will happen.

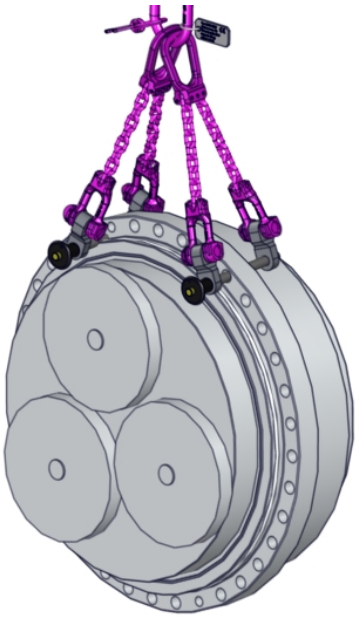
Continues on next page

Note

The gearbox attachment screws are arranged in three areas. It will not be possible to reach all screws with the robot in only one position.

Removal and refitting must be performed with the robot in several positions, which are described in the procedures.

Preparations before refitting the gearbox

	Action	Note
1	**CAUTION** The weight of the gearbox is 98 kg All lifting accessories used must be sized accordingly.	
2	Attach the lifting accessory and lift the gearbox.	Lifting accessory for gear: 3HAC081585-001  xx2400000347

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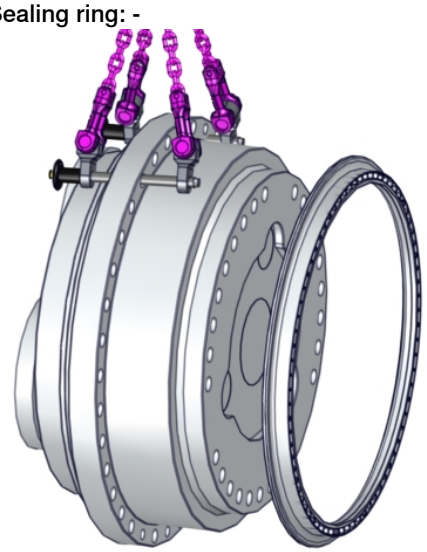
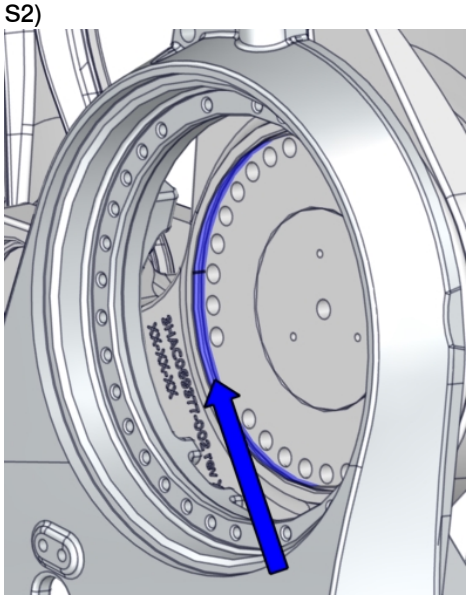
5.11.3 Replacing the axis-3 gearbox

Continued

	Action	Note
3	Fit the sealing ring. Replace if damaged.	Sealing ring: -  xx2400000348
4	Wipe the contact surfaces between gearbox and frame clean from any contamination.	
5	Apply some grease on the thin chamfer on the parallel arm.	Grease: 3HAC042536-001 (Shell Gadus S2)  xx2400000390

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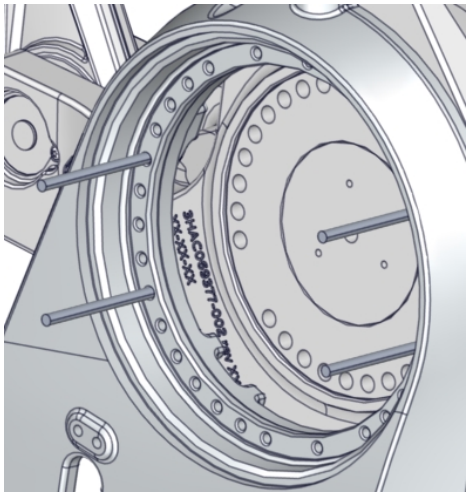
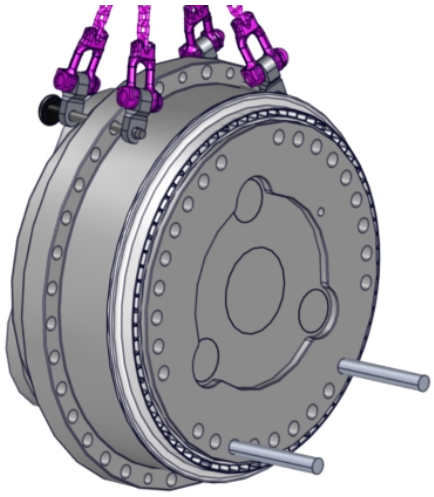
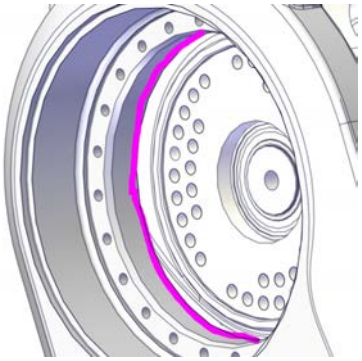
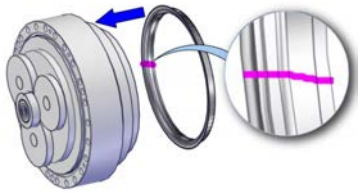
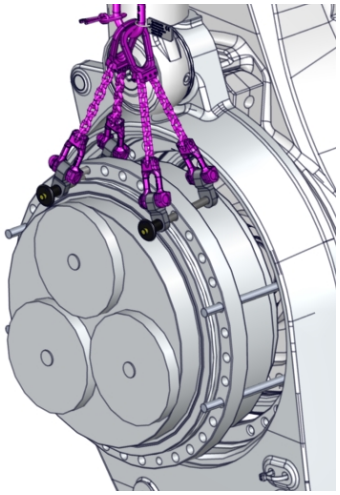
	Action	Note
6	Fit guide pins in the frame. **Tip** Lubricate the guide pins with some grease to make the gearbox/gear slide better.	Guide pin, M12x200 / Guide pin, M12x250, 3HAC13056-3 (4 pcs) Always use guide pins in pairs.  xx2400000391
7	Fit guide pins to the back of the gearbox. **Tip** Lubricate the guide pins with some grease to make the gearbox/gear slide better.	Guide pin, M12x150: 3HAC13056-2 (2 pcs) Always use guide pins in pairs.  xx2400000392

Continues on next page

5.11.3 Replacing the axis-3 gearbox

Continued

Refitting the axis-3 gearbox to frame

	Action	Note
1	Apply Mercasol (40 mm from the lower arm side) on the contact surface.	Mercasol  xx1500002349 **Note** Area where to apply Mercasol, 40 mm wide, from the lower arm side.
2	Apply Mercasol on the surface of the sealing ring and attach it on the gearbox. **Note** Make sure that the sealing ring is attached correctly on the gearbox.	Mercasol  xx1500002350
3	Lift the gearbox onto the guide pins.	 xx2400000349

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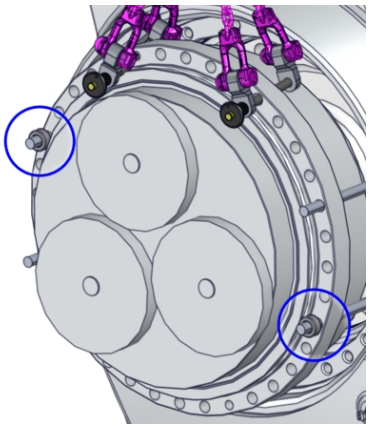
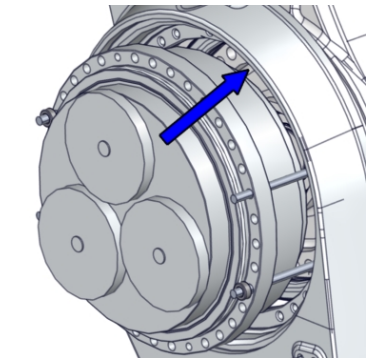
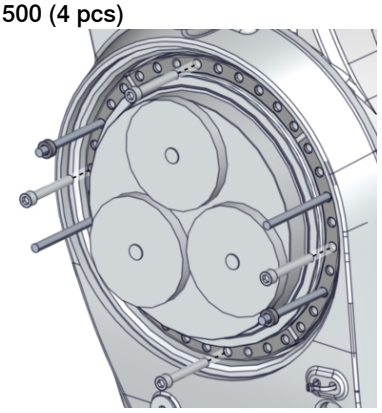
	Action	Note
4	Fasten set collars on two of the guide pins.	 xx2400000350
5	If the hole pattern does not match, use the adjustment tool to turn the gear to find the hole pattern.	Adjustment tool for gear: 3HAC080331-001
6	Remove the lifting accessories and push in the gearbox into the frame.	 xx2400000351
7	Attach four attachment screws with nine-hole washers underneath, in a square and use them alternately to press the gearbox into position. **Note** The six-hole washers are needed for protection of the gearbox surface, when the screws are attached.	Tightening torque: 100 Nm Hex socket head cap screw: M12x80 12.9 Gleitmo 603+Geomet 500 (4 pcs)  xx2400000352

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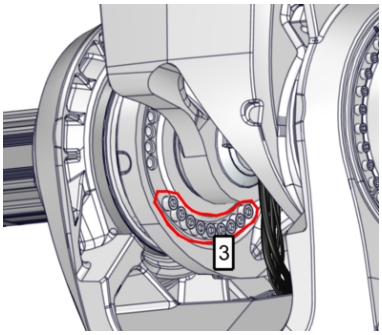
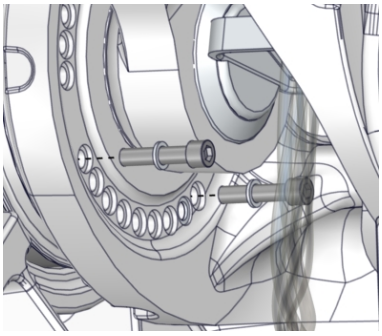
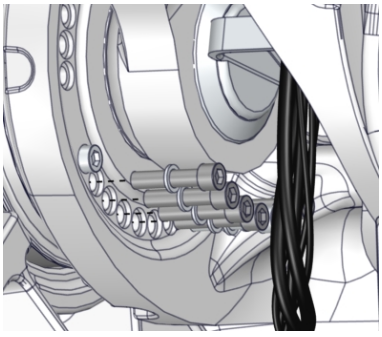
5.11.3 Replacing the axis-3 gearbox
Continued

Refitting the axis-3 gearbox screws in area 3

	Action	Note
1	Find area 3.	 xx2400000363
2	Begin by fitting the screws and washers in the outermost holes. **Tip** Make sure that the hole pattern match. If needed, use the adjustment tool in the gearbox to find the hole pattern.	Hex socket head cap screw: M12x80 12.9 Gleitmo 603+Geomet 500 (2 pcs)  xx2400000365
3	Then attach the remaining screws with washers, in area 3. **Note** Do not torque the screws at this point.	Hex socket head cap screw: M12x80 12.9 Gleitmo 603+Geomet 500 (7 pcs)  xx2400000366

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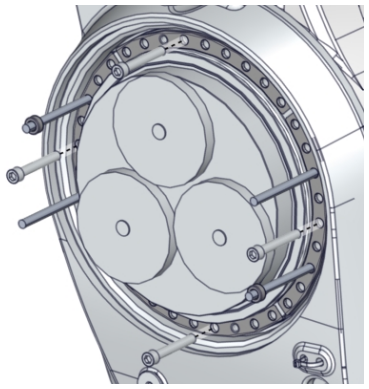
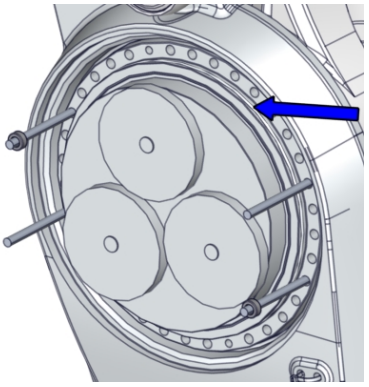
Refitting the motor flange

	Action	Note
1	Remove the four attachment screws and nine-hole washers, previously attached in a square.	 xx2400000352
2	Clean the contact surfaces on gearbox and motor flange.	
3	Clean the o-ring and the o-ring groove on gearbox.	 xx2400000353
4	Lubricate the o-ring and fit to the gearbox. Replace if damaged.	Grease, Shell Gadus S2: 3HAC042536-001. O-ring: 3HAC061327-067
5	Check the motor flange o-ring. Replace if damaged.	O-ring: 3HAB3772-160  xx2300001867

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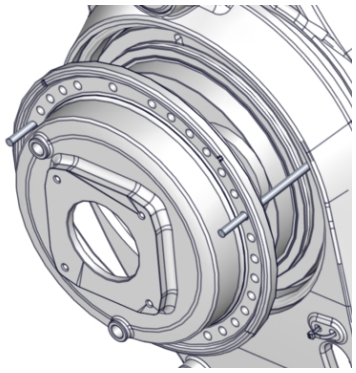
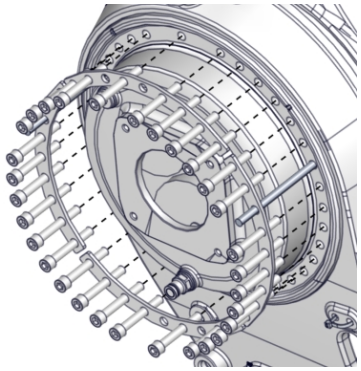
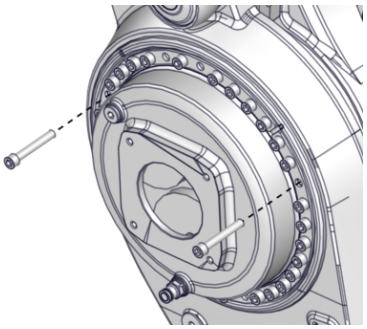
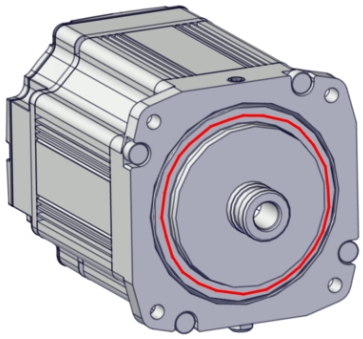
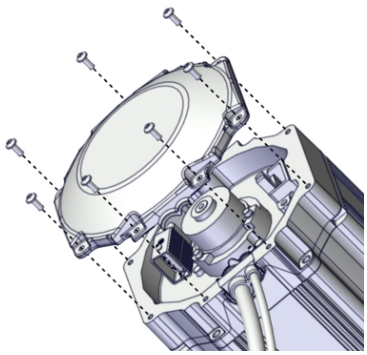
5.11.3 Replacing the axis-3 gearbox

Continued

	Action	Note
6	Lift the motor flange onto the guide pins.	 xx2300001866
7	Make sure the o-rings are in position and slide the motor flange into position.	
8	Fit the attachment screws with the four six-hole washers.	Hex socket head cap screw: M12x80 12.9 Gleitmo 603+Geomet 500  xx2300001865
9	Remove the guide pins and attach the remaining screws.	 xx2300001863
10	Tighten all motor flange screws.	Tightening torque: standard torque 120 Nm (*Tightening torque on page 661*).
11	Perform a leak-down test.	See *Performing a leak-down test on page 197*.

Continues on next page

Preparations prior to refitting motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove any old paint or flange sealant residues or other contamination from the contact surfaces on both the motor and the mating parts. **Tip** Remove flange sealant residues with Loctite 7200. Then use Loctite 7063 for cleaning the mating surface.	Cleaning agent: Loctite 7200, Loctite 7063
3	Apply a continuous bead of flange sealant, 1-2 mm wide, inside of the groove on the motor contact surface. **Note** The purpose of the groove is to catch excess sealant. No o-ring is used.	Flange sealant: Loctite 5800  xx2100000520
4	Remove the cover, if fitted to the new spare part motor.	 xx2100000596

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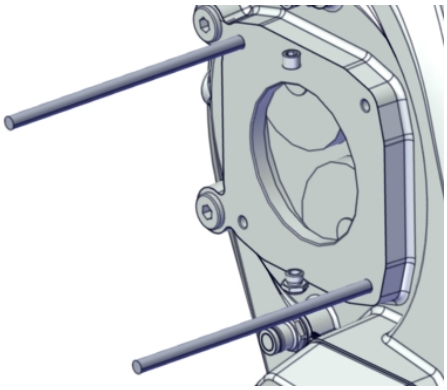
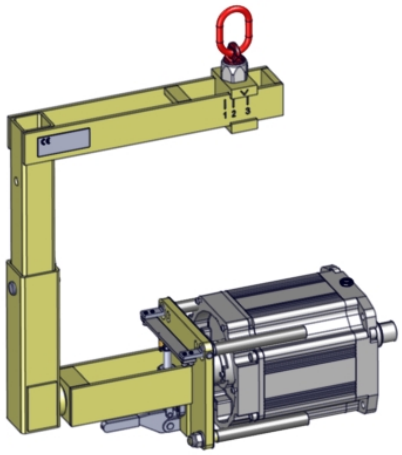
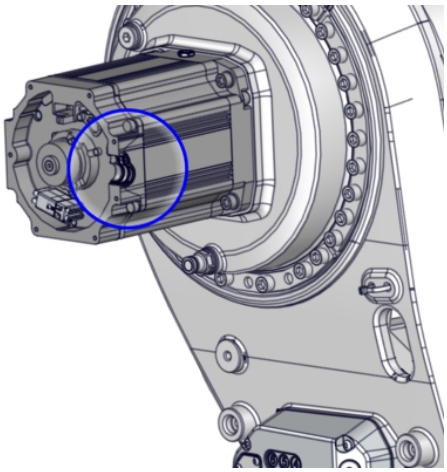
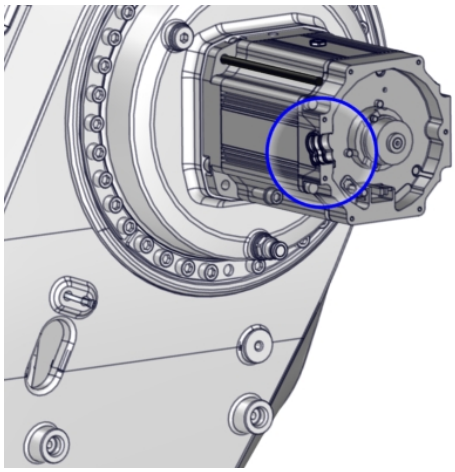
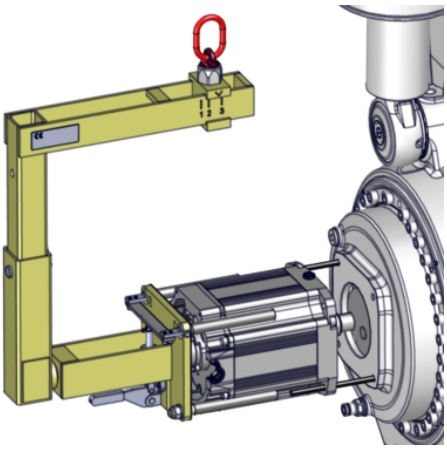
5.11.3 Replacing the axis-3 gearbox

Continued

Refitting the axis-3 motor

	Action	Note
1	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.  xx2100000593
2	**CAUTION** The weight of the motor is 24 kg All lifting accessories used must be sized accordingly.	
3	Apply the lifting accessory.	Lifting accessory, motor: 3HAC15534-1 Lifting accessory (chain): 3HAC15556-1  xx2400000264

Continues on next page

	Action	Note
4	**Note** Make sure the cable gland opening is turned the correct way.	Axis-2 motor:  xx2400000265 Axis-3 motor:  xx2400000266
5	Lift the motor and put it on the guide pins as close as possible to its final position without pushing the motor pinion into the gear.	 xx2400000263

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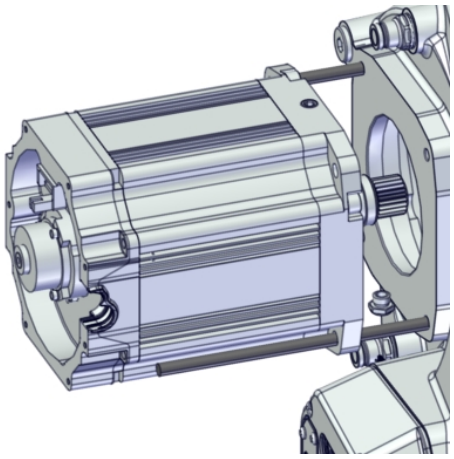
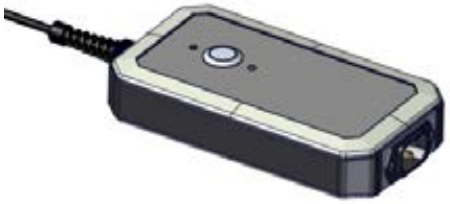
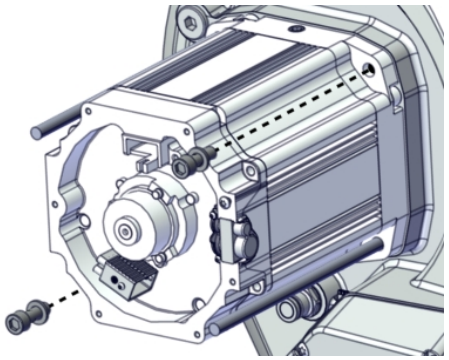
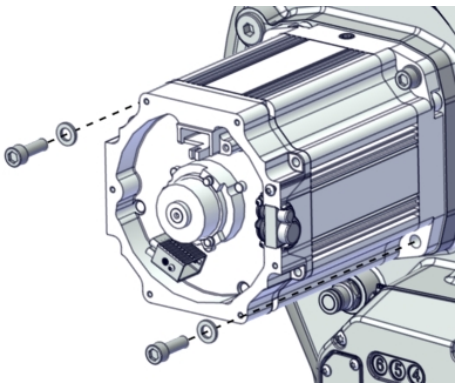
5.11.3 Replacing the axis-3 gearbox

Continued

	Action	Note
6	Remove the lifting accessory and allow the motor to rest on the guide pins.	 xx2000000457
7	Release the brakes of the motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
8	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

Continues on next page

	Action	Note
9	Apply the rotation tool. Use caution and fit the motor in its final position while at the same time rotating the motor pinion slightly using the rotation tool. • Make sure that the motor pinion is properly mated to the gear of the gearbox. • Make sure that the motor pinion does not get damaged. • Make sure that the direction of the cable exit is facing the correct way.	Rotation tool M4: 3HAB7887-1
10	Fit two of the attachment screws and washers. Use a bits extender in order to reach the screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (2 pcs) Bits extender: 3HAC12342-1  xx2000000467
11	Remove the guide pins and refit the remaining attachment screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (2 pcs)  xx2300000044
12	Tighten the screws.	Tightening torque: 50 Nm.
13	Disconnect the brake release tool.	
14	Perform a leak-down test.	See *Performing a leak-down test on page 197*.

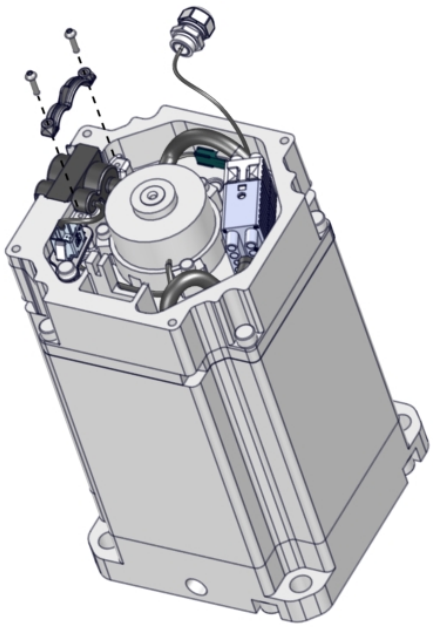
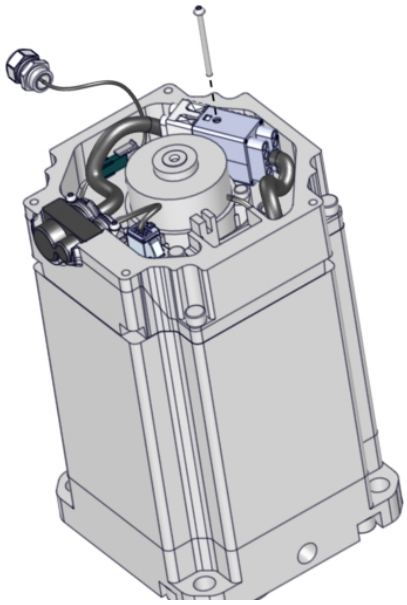
Connecting the motor cables

	Action	Note
1	Put the motor cables in place in the opening.	

Continues on next page

5.11.3 Replacing the axis-3 gearbox

Continued

	Action	Note
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001738
3	Connect the motor cables. **Note** Connect in accordance with the markings on the connectors.	
4	Fit a screw to the power connector. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001736

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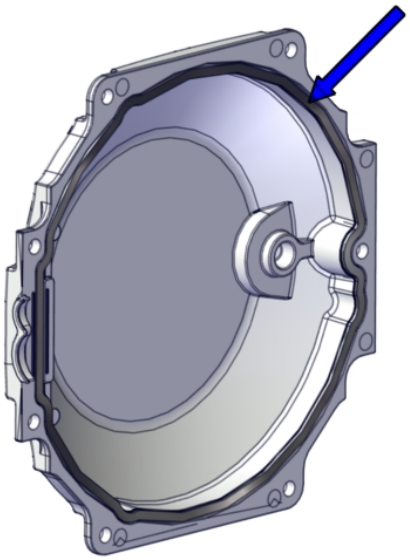
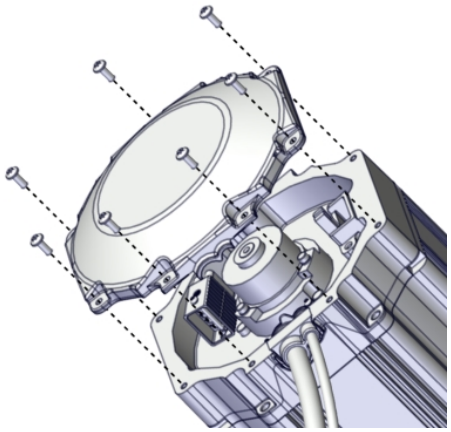
	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1, axis-2 and axis-3: Connection box cover FS180 with gasket: 3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection) Axis-4: Connection box cover FS130 with gasket: 3HAC072863-003 (Graphite White) 3HAC072863-005 (ABB Orange)  xx2100000600
6	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	

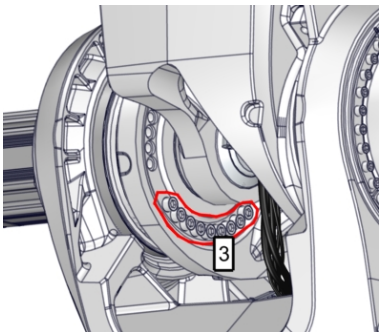
Continues on next page

5.11.3 Replacing the axis-3 gearbox

Continued

	Action	Note
7	Refit the motor cover with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.  xx2100000596

Securing the axis-3 gearbox screws in area 3

	Action	Note
1	Tighten the attachment screws in area 3.	Tightening torque: standard torque 300 Nm (*Tightening torque on page 661*).  xx2400000363

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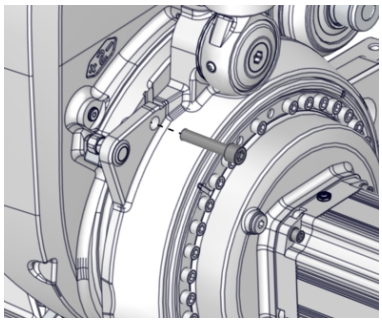
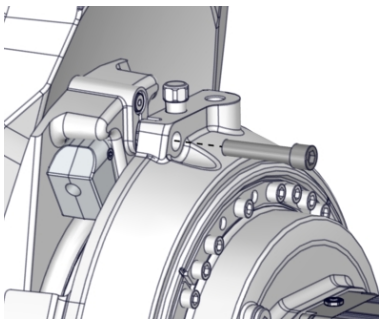
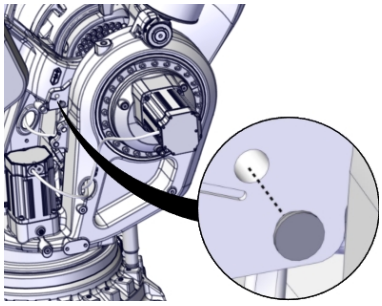
Removing the lock screws

	Action	Note
1	Remove the axis-2 and the axis-3 lock screws. **Note** If the screws are jammed, turn on the power to the robot temporarily and carefully jog the axes 2 and 3, until it is possible to unscrew the lock screws completely.	 xx2400000355  xx2400000369
2	Jog axis-3 to be able to attach the plastic plug.	 xx1500002366

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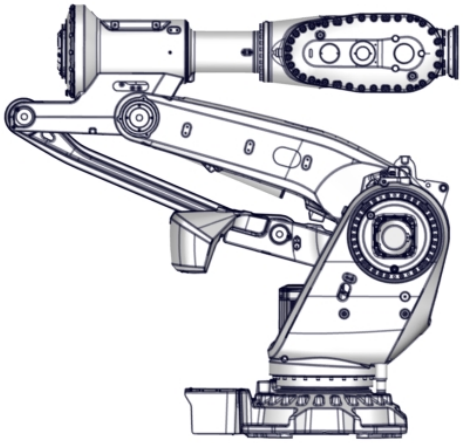
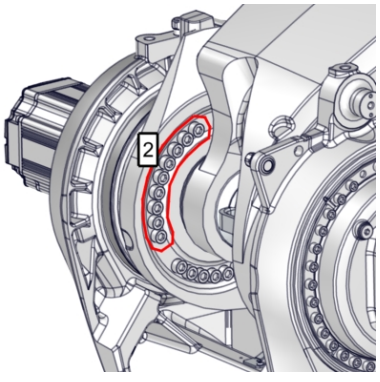
5.11.3 Replacing the axis-3 gearbox
Continued

Robot position for access to screws in area 2

With the robot in this position it is possible to reach the screws in area 2 of screws that secure the axis-3 gearbox to the parallel arm.

	Action	Note
1	Jog the robot into position: • Axis 1: no significance • Axis 2: -65° • Axis 3: 0° • Axis 4: 0° • Axis 5: no significance • Axis 6: no significance.	 xx2400000339
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Refitting the axis-3 gearbox screws in area 2

	Action	Note
1	Find area 2.	 xx2400000360

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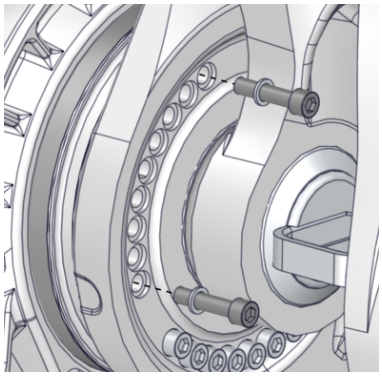
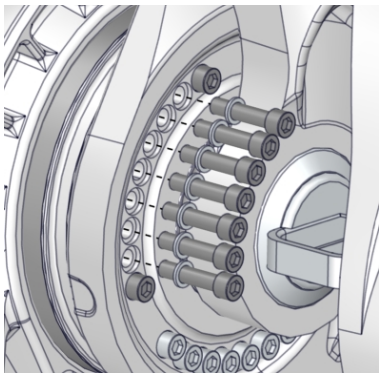
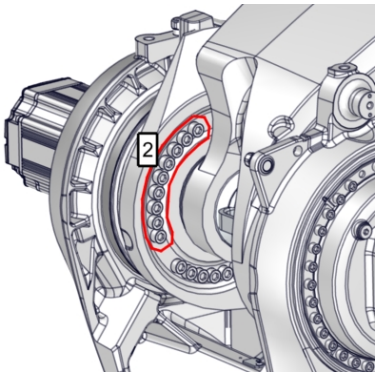
	Action	Note
2	Begin by fitting the screws and washers in the outermost holes.	Hex socket head cap screw: M12x80 12.9 Gleitmo 603+Geomet 500 (2 pcs)  xx2400000367
3	Then attach the remaining screws with washers, in area 2.	Hex socket head cap screw: M12x80 12.9 Gleitmo 603+Geomet 500 (7 pcs)  xx2400000368
4	Tighten the attachment screws in area 2.	Tightening torque: standard torque 300 Nm (*Tightening torque on page 661*).  xx2400000360

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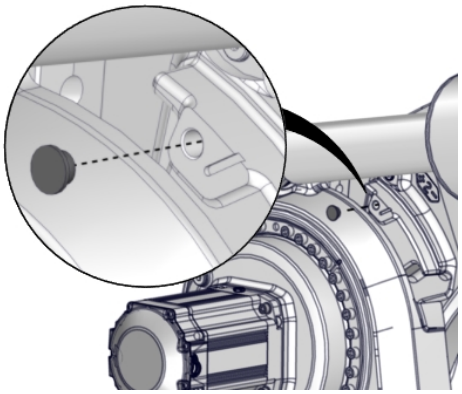
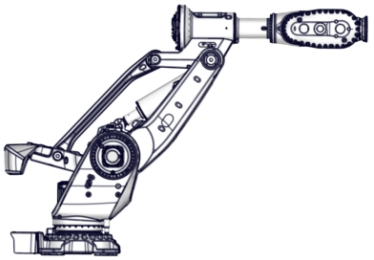
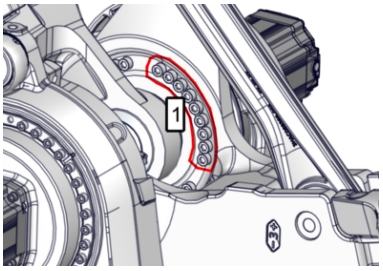
5.11.3 Replacing the axis-3 gearbox
Continued

Refitting the plastic plug to the axis-2 lock screw hole

	Action	Note
1	Refit the plastic plug to the axis-2 lock screw hole.	 xx2400001682

Refitting the axis-3 gearbox screws in area 1

	Action	Note
1	Jog the robot into position: • Axis 1: no significance • Axis 2: +45° • Axis 3: 0° • Axis 4: 0° • Axis 5: 0° • Axis 6: no significance.	 xx2400000357
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Find area 1.	 xx2400000358

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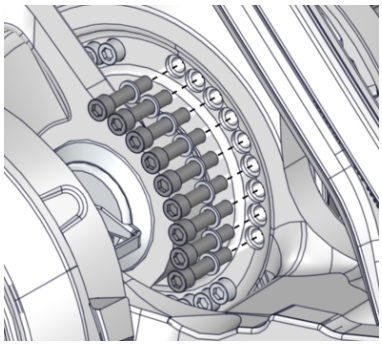
	Action	Note
4	Refit and tighten the screws in area 1.	Hex socket head cap screw: M12x80 12.9 Gleitmo 603+Geomet 500 (9 pcs) Tightening torque: standard torque 300 Nm (*Tightening torque on page 661*).  xx2400000359
5	Examine that all screws have been torqued.	

Concluding procedure

	Action	Note
1	Refill the gearbox with oil.	See *Changing the oil in axis-3 gearbox on page 159*.
2	Calibrate the robot.	See *Calibration on page 619*.
3	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

5.11.4 Replacing the axis-4 gearbox and gear

L3 spare part

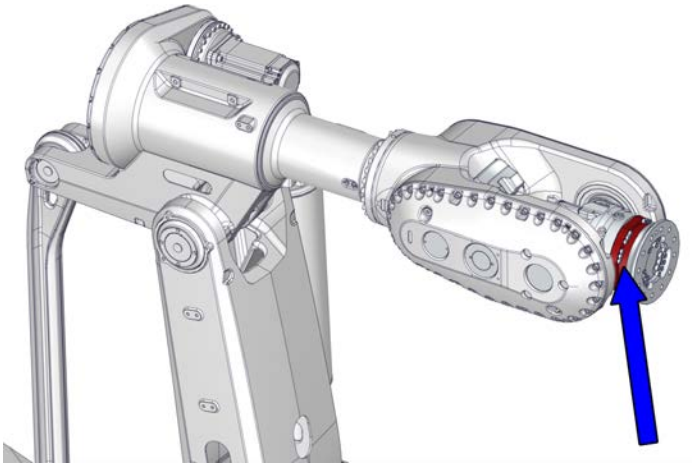
The axis-4 gearbox and the cylindrical gear Z3 are classified as L3 spare parts. The repair procedure is not described in the product manual. Contact ABB Service for replacement.

See *Spare part level on page 196*.

5.11.5 Replacing the axis-6 gearbox

Location of the gearbox

The gearbox is located as shown in the figure.



xx2300001599

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 7710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Gearbox	3HAC075792-002 (Graphite White) 3HAC075792-003 (ABB Orange)	Includes o-ring 3HAC061327-078	L2

Required service parts

Consumable	Article number	Note
O-ring	3HAC061327-078	Included in gearbox spare part, but replace if damaged.
Connection box cover with gasket	3HAC079381-003 (Graphite White) 3HAC079381-004 (ABB Orange)	Replace if damaged. On axis-6 motor
O-ring, G 1/4"	3HAC061327-060	Used on oil plug. Always replace when refitting oil plug.
Cleaning agent	-	Isopropanol
P-80 rubber lubrication gel	3HAC074427-001	P-80 Emulsion IFC
Flange sealant	-	Loctite 5800

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5.11.5 Replacing the axis-6 gearbox
Continued

Consumable	Article number	Note
Rust preventive	3HAC034903-001	Mercasol 3110 Waxcoat. Recommended drying time is 24h.
Lubricating oil	-	See *Type of lubrication in gearboxes on page 147*.

Required tools and equipment

Equipment	Article number	Note
Guide pin, M6x150	3HAC080345-001	Always use guide pins in pairs.
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
Rotation tool M3	3HAB7887-1	Used to rotate the motor pinion. Add screw M3.
Calibration toolbox, Axis Calibration	3HAC074564-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.

Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

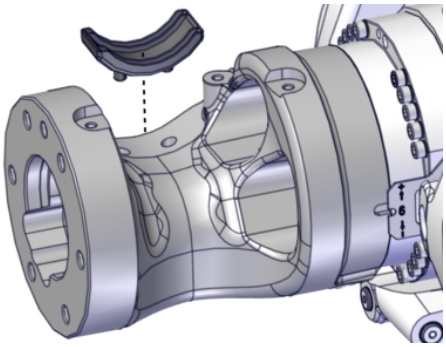
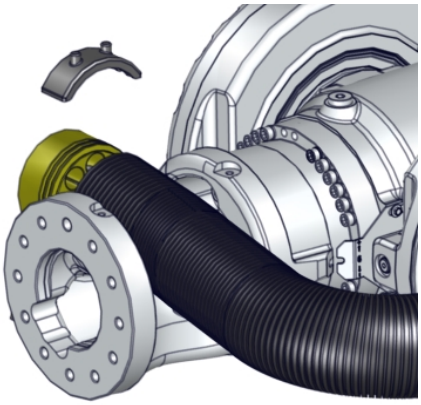
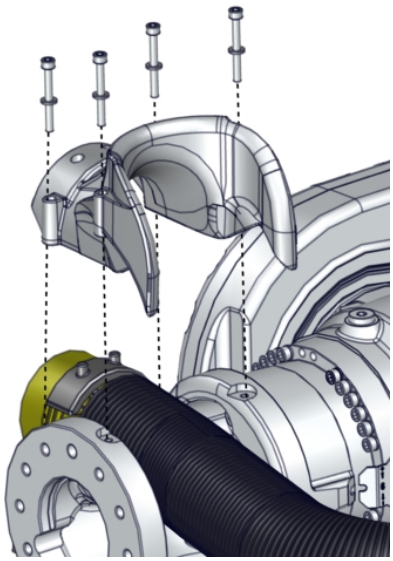
	Action	Note
1	Decide which calibration routine to use for calibrating the robot. • Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot. • Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.	
	If the robot is to be calibrated with reference calibration: Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in *Reference calibration routine on page 628*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Removing the gearbox

Use these procedures to remove the axis-6 gearbox.

Continues on next page

Preparations before removing the axis-6 gearbox

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Drain the gearbox.	See *Draining the axis-6 gearbox on page 179*.
4	Remove all equipment fitted on the turning disc.	
5	If used, open the DressPack axis-6 cable support and remove the DressPack cable package from the process turning disk. **Note** Use caution not to lose the two clamp jaws on either side of the DressPack cable package.  xx2100002712	 xx2300001210  xx2300001211

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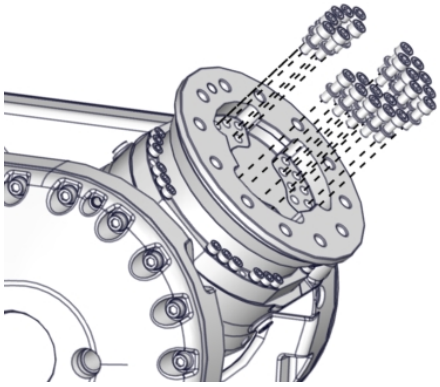
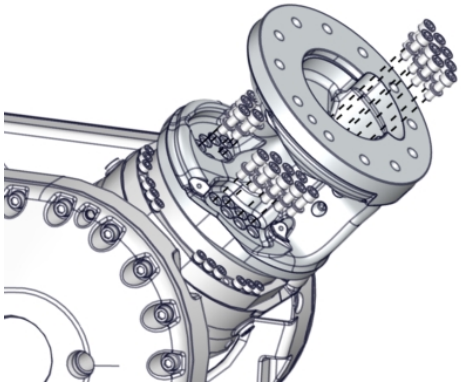
5.11.5 Replacing the axis-6 gearbox

Continued

	Action	Note
6	Jog the robot into position: • Axis 1 = no significance • Axis 2 = suitable working position to replace axis-6 gearbox • Axis 3 = suitable working position to replace axis-6 gearbox • Axis 4 = 0° • Axis 5 = -55° • Axis 6 = 0°	
7	 **DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Continues on next page

Removing the turning disc

	Action	Note
1	Remove the screws and washers, that secure the turning disc.	IRB 7710-500/2.85 IRB 7710-430/3.1 IRB 7710-360/3.3 IRB 7710-310/3.5:  xx2400000167 IRB 7710-400/2.85 LID IRB 7710-390/3.1 LID IRB 7710-325/3.3 LID IRB 7710-280/3.5 LID:  xx2400000172

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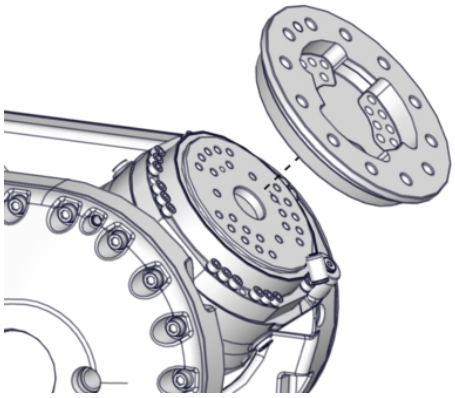
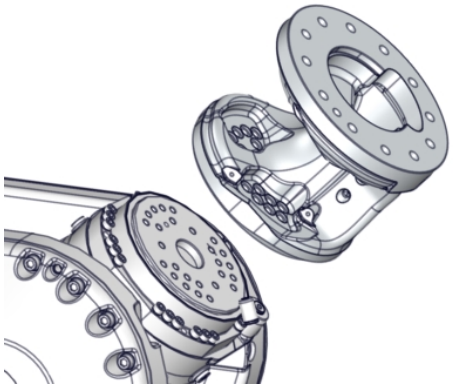
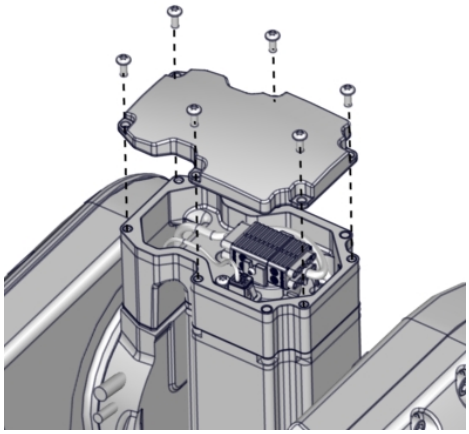
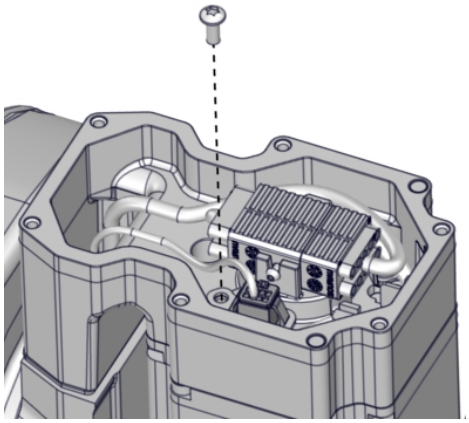
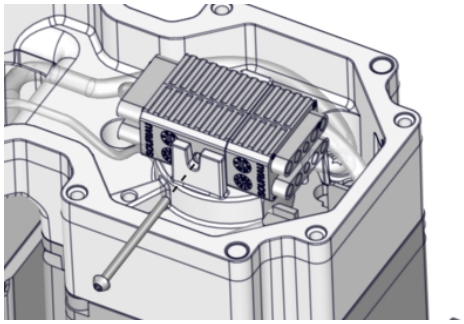
5.11.5 Replacing the axis-6 gearbox
Continued

	Action	Note
2	Remove the turning disc.	IRB 7710-500/2.85 IRB 7710-430/3.1 IRB 7710-360/3.3 IRB 7710-310/3.5:  xx2400000174 IRB 7710-400/2.85 LID IRB 7710-390/3.1 LID IRB 7710-325/3.3 LID IRB 7710-280/3.5 LID:  xx2400000176

Disconnecting the axis-6 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

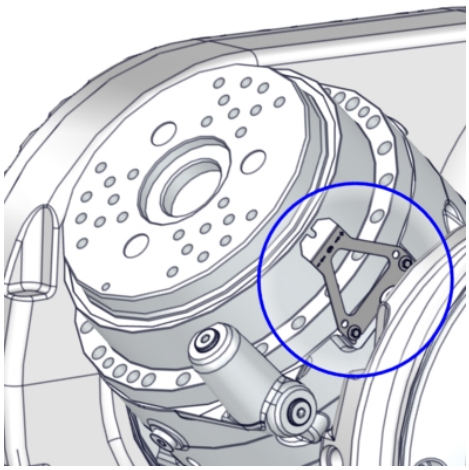
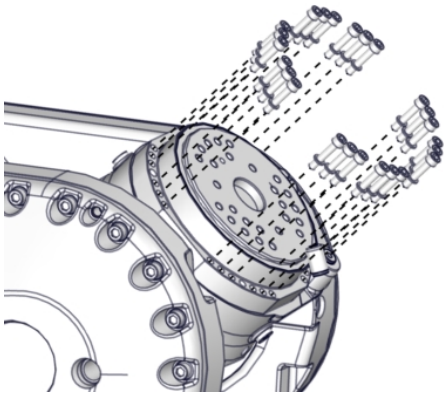
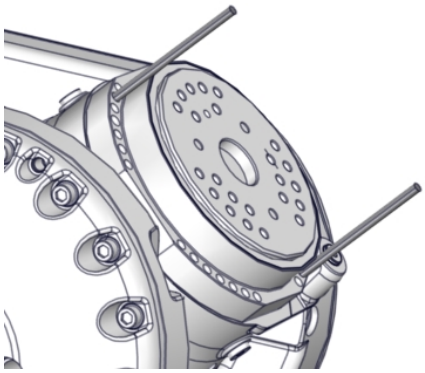
	Action	Note
2	Unscrew the attachment screws and remove the motor cover.	 xx2200001434
3	Remove the connector bracket.	 xx2200001730
4	Remove the connector screw.	 xx2200001731
5	Disconnect the motor cables.	

Continues on next page

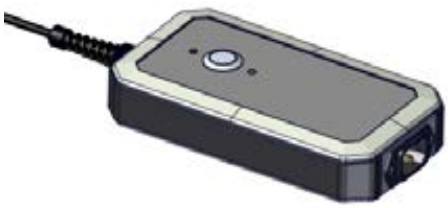
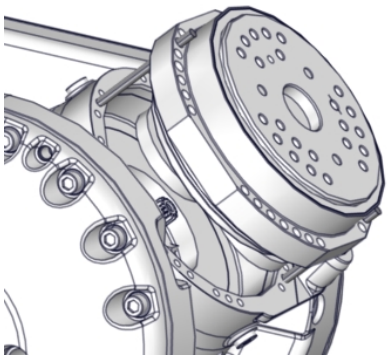
5.11.5 Replacing the axis-6 gearbox

Continued

Removing the axis-6 gearbox

	Action	Note
1	Remove the axis-6 synchronization plate.	 xx2400000372
2	Unscrew the attachment screws that secure the axis-6 gearbox.	 xx2400000370
3	Fit guide pins.	Guide pin, M6x150: 3HAC080345-001 Always use guide pins in pairs.  xx2400000373

Continues on next page

	Action	Note
4	Release the brakes on the axis-6 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
5	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
6	Remove the gearbox. If required fit two attachment screws and press out the gearbox.	 xx2400000374

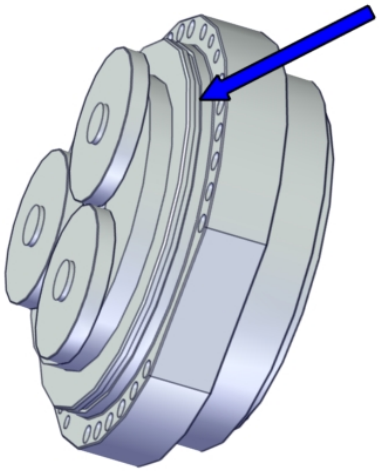
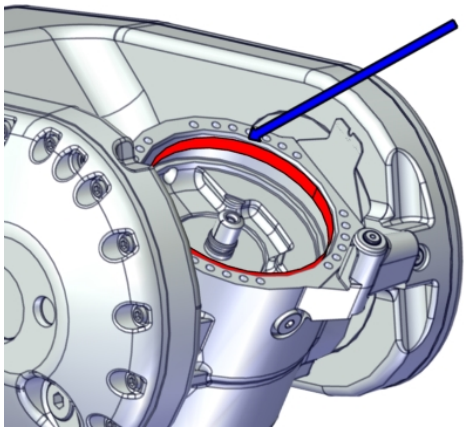
Refitting the gearbox

Use these procedures to refit the gearbox.

Continues on next page

5.11.5 Replacing the axis-6 gearbox
Continued

Preparations before refitting the axis-6 gearbox

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Wipe clean the contact surfaces of both gearbox and wrist from any contamination.	Cleaning agent: Isopropanol
3	Check the o-ring. Replace if damaged.	O-ring: 3HAC061327-078  xx2100002258
4	Lubricate the contact surface inside the wrist with grease.	P-80 rubber lubrication gel: 3HAC074427-001  xx2100002791

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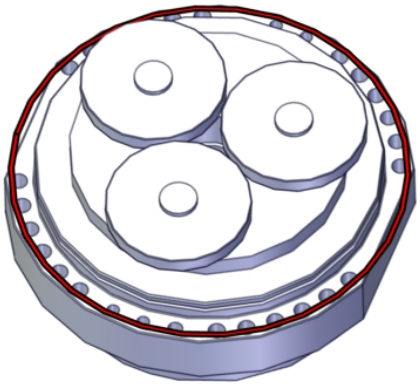
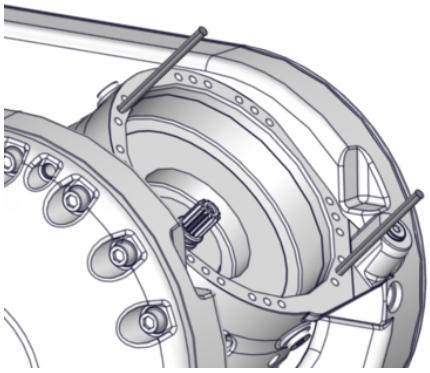
	Action	Note
5	*Protection type Foundry Plus*: Apply flange sealant on the surface shown in the figure.	Flange sealant: Loctite 5800  xx2100002233

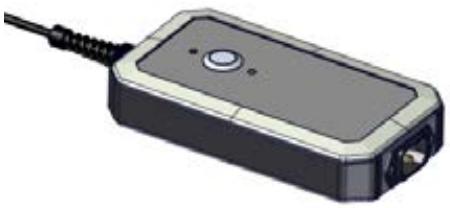
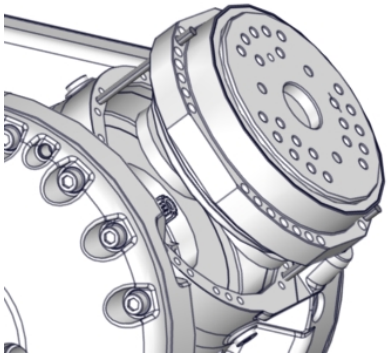
Refitting the axis-6 gearbox

	Action	Note
1	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
2	Fit guide pins.	Guide pin, M6x150: 3HAC080345-001 Always use guide pins in pairs.  xx2400000375
3	Apply the rotation tool to the motor.	Rotation tool M3: 3HAB7887-1

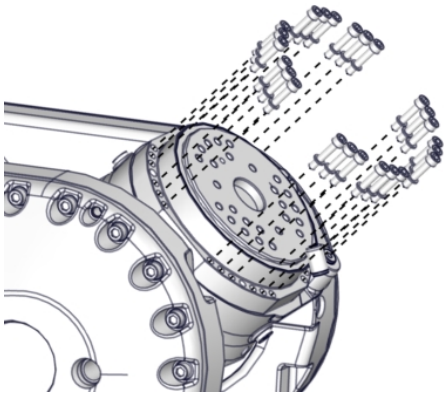
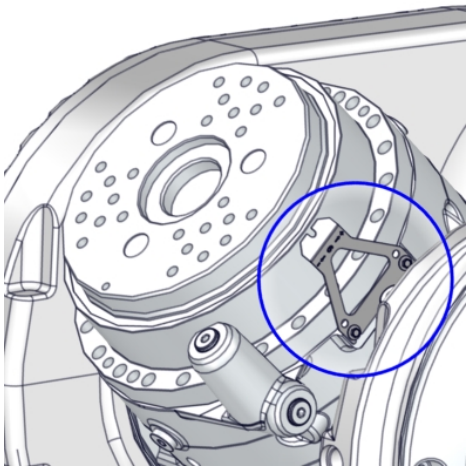
Continues on next page

5.11.5 Replacing the axis-6 gearbox

Continued

	Action	Note
4	Release the brakes on the axis-6 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the motor power connector (MP). 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. The power for brake release is only applied for 180 seconds after activation. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **WARNING** Electrical damage to the motor may occur if 24V is supplied to the motor connector for more than 30 seconds. Use the specified brake release tool to eliminate the risk.	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
5	Fit the gearbox while at the same time rotating the motor pinion slightly using the rotation tool. Make sure that the motor pinion is properly mated to the gear of the gearbox. **CAUTION** Be careful not to damage motor pinion or gears! **Tip** Verify that the oil plug is removed so the air can be pressed out during fitting of the gearbox.	 xx2400000374

Continues on next page

	Action	Note
6	Secure the gearbox with its attachment screws.	Hex socket head cap screw: M8x40 12.9 Gleitmo 603+Geomet 500 Washer: 3HAC045621-001, 24 pcs Tightening torque: standard torque 35 Nm (*Tightening torque on page 661*)  xx2400000370
7	Disconnect the brake release tool.	
8	Perform a leak-down test.	See *Performing a leak-down test on page 197*.
9	Refit the axis-6 synchronization plate.	 xx2400000372

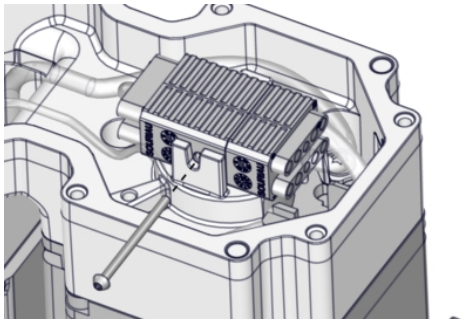
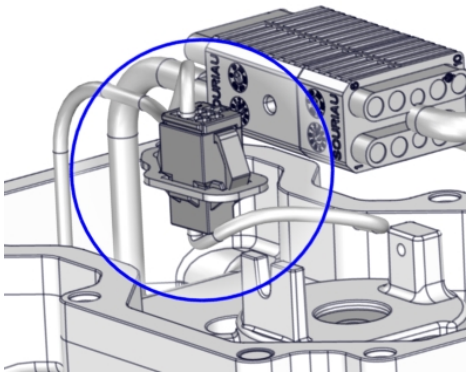
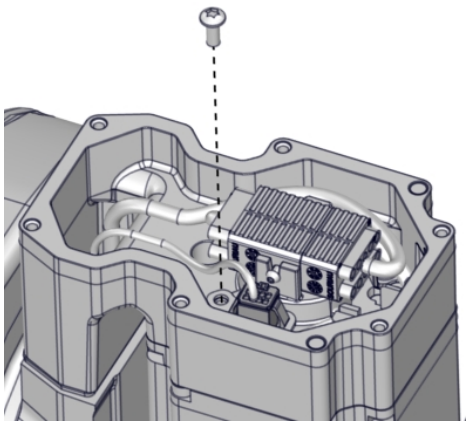
Connecting the axis-6 motor cables

	Action	Note
1	Connect the motor cables. Connect in accordance with the markings on the connectors.	

Continues on next page

5.11.5 Replacing the axis-6 gearbox

Continued

	Action	Note
2	Position the power connector to the bracket with a screw. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is normal that the connector can be moved back and forth after the screw has been tightened according to the torque specification and, in some connection boxes, that the screw is not even fully inserted when it bottoms.	Tightening torque: 1 Nm  xx2200001731
3	Snap the signal connectors to each other in the bracket.	 xx2200001921
4	Refit the connector bracket assembly to the motor. **CAUTION** The cabling is sensitive to mechanical damage. Handle it with care to avoid damage to the cabling or the connector, avoid any kind of tilt or skew.	Torx pan head screw: M5x12 Stainless steel A2-70  xx2200001730

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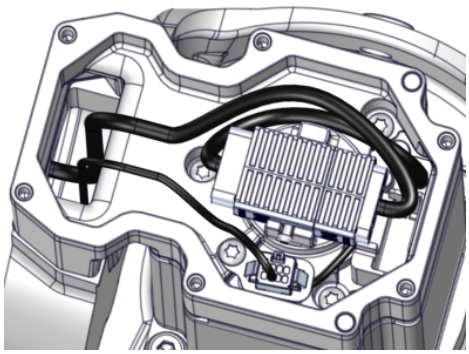
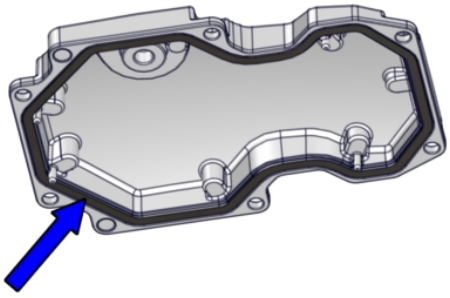
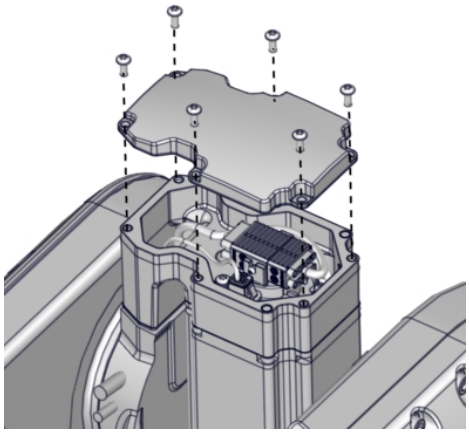
	Action	Note
5	Verify correct cable layout as shown in the figure. **CAUTION** Route the signal cabling correctly to avoid cable damage.	 xx2300000920
6	Inspect the gasket. Replace if damaged.	Connection box cover with gasket: 3HAC079381-003 (Graphite White) 3HAC079381-004 (ABB Orange)  xx2200001922
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8	Refit the motor cover.	Torx pan head screw, M5x12 Stainless steel A2-70, 6 pcs Tightening torque: 6 Nm.  xx2200001434

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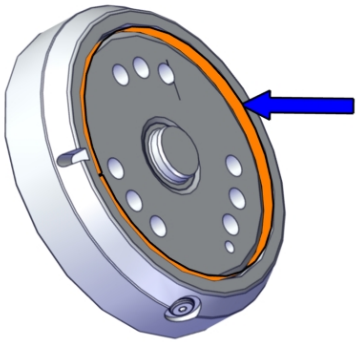
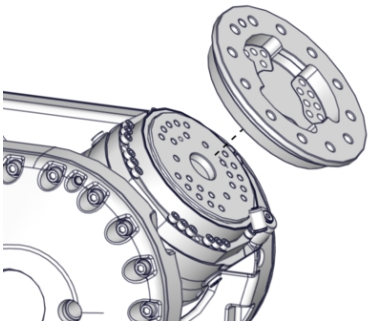
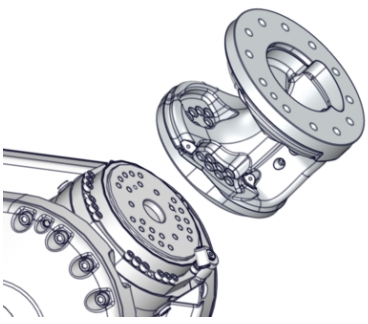
5.11.5 Replacing the axis-6 gearbox

Continued

Refitting the turning disc

	Action	Note
1	Wipe clean the contact surfaces.	
2	*Protection type Foundry Plus*: Apply rust preventive to the surface shown in the figure.	Rust preventive: 3HAC034903-001 (Mercasol 3110 Waxcoat. Recommended drying time is 24h.)  xx2100002232
3	Fit the turning disc to the wrist. Orient the disc according to the synchronization marks.	IRB 7710-500/2.85 IRB 7710-430/3.1 IRB 7710-360/3.3 IRB 7710-310/3.5:  xx2400000174 IRB 7710-400/2.85 LID IRB 7710-390/3.1 LID IRB 7710-325/3.3 LID IRB 7710-280/3.5 LID:  xx2400000176

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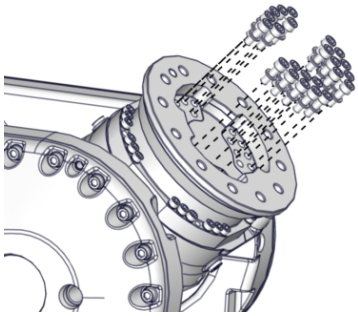
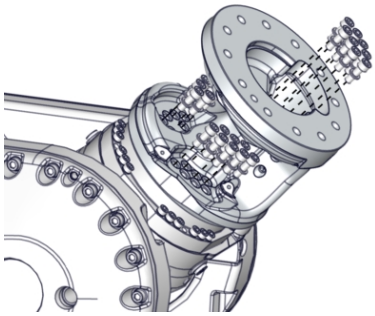
	Action	Note
4	Secure the turning disc with its attachment screws and washers.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 Washers: 3HAB4233-1 Tightening torque: standard torque 70 Nm (*Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws on page 662*).. IRB 7710-500/2.85 IRB 7710-430/3.1 IRB 7710-360/3.3 IRB 7710-310/3.5:  xx2400000167 IRB 7710-400/2.85 LID IRB 7710-390/3.1 LID IRB 7710-325/3.3 LID IRB 7710-280/3.5 LID:  xx2400000172

Concluding procedure

	Action	Note
1	Jog axis-5 to horizontal position.	
2	Refill oil in the gearbox.	See *Filling oil into the axis-6 gearbox on page 180*.
3	Calibrate the robot.	See *Calibration on page 619*.

Continues on next page

5.11.5 Replacing the axis-6 gearbox
Continued

	Action	Note
4	 **DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 92*.	

6 Calibration

6.1 Introduction to calibration

6.1.1 Introduction and calibration terminology

Calibration information

This chapter includes general information about the recommended calibration methods and also the detailed procedures for updating the revolution counters, checking the calibration position etc.

Detailed instructions of how to perform Axis Calibration are given on the FlexPendant during the calibration procedure. To prepare calibration with Axis Calibration method, see *Calibrating with Axis Calibration method on page 627*.

Calibration terminology

Term	Definition
Calibration method	A collective term for several methods that might be available for calibrating the ABB robot. Each method contains calibration routines.
Synchronization position	Known position of the complete robot where the angle of each axis can be checked against visual synchronization marks.
Calibration position	Known position of the complete robot that is used for calibration of the robot.
Standard calibration	A generic term for all calibration methods that aim to move the robot to calibration position.
Fine calibration	A calibration routine that generates a new zero position of the robot.
Reference calibration	A calibration routine that in the first step generates a reference to current zero position of the robot. The same calibration routine can later on be used to recalibrate the robot back to the same position as when the reference was stored. This routine is more flexible compared to fine calibration and is used when tools and process equipment are installed. Requires that a reference is created before being used for recalibrating the robot. Requires that the robot is dressed with the same tools and process equipment during calibration as during creation of the reference values.
Update revolution counter	A calibration routine to make a rough calibration of each manipulator axis.
Synchronization mark	Visual marks on the robot axes. When marks are aligned, the robot is in synchronization position.

6.1.2 Calibration methods

Overview

This section specifies the different types of calibration and the calibration methods that are supplied by ABB.

Types of calibration

Type of calibration	Description	Calibration method
Standard calibration	The calibrated robot is positioned at calibration position. Standard calibration data is found on the SMB (serial measurement board) or EIB in the robot.	Axis Calibration
Absolute accuracy calibration (optional)	Based on standard calibration, and besides positioning the robot at synchronization position, the Absolute accuracy calibration also compensates for: • Mechanical tolerances in the robot structure • Deflection due to load Absolute accuracy calibration focuses on positioning accuracy in the Cartesian coordinate system for the robot. Absolute accuracy calibration data is found on the serial measurement board (SMB) or other robot memory. A robot calibrated with Absolute accuracy has the option information printed on its name plate (OmniCore). To regain 100% Absolute accuracy performance, the robot must be recalibrated for absolute accuracy after repair or maintenance that affects the mechanical structure.	CalibWare

Brief description of calibration methods

Axis Calibration method

Axis Calibration is a standard calibration method for calibration of IRB 7710. It is the recommended method in order to achieve proper performance.

The following routines are available for the Axis Calibration method:

- Fine calibration
- Update revolution counters
- Reference calibration

The calibration equipment for Axis Calibration is delivered as a toolkit.

An introduction to the calibration method is given in this manual, see *Calibrating with Axis Calibration method on page 627*.

The actual instructions of how to perform the calibration procedure and what to do at each step is given on the FlexPendant. You will be guided through the calibration procedure, step by step.

Continues on next page

CalibWare - Absolute Accuracy calibration

The CalibWare tool guides through the calibration process and calculates new compensation parameters. This is further detailed in the *Application manual - CalibWare Field*.

If a service operation is done to a robot with the option Absolute Accuracy, a new absolute accuracy calibration is required in order to establish full performance. For most cases after replacements that do not include taking apart the robot structure, standard calibration is sufficient.

The Absolute Accuracy option varies according to the robot mounting position. This is printed on the robot name plate for each robot. The robot must be in the correct mounting position when it is recalibrated for absolute accuracy.

References

Article numbers for the calibration tools are listed in the section *Special tools on page 665*.

6.1.3 When to calibrate

When to calibrate

The system must be calibrated if any of the following situations occur.

The resolver values are changed

If resolver values are changed, the robot must be re-calibrated using the calibration methods supplied by ABB. Calibrate the robot carefully with standard calibration, according to information in this manual.

If the robot has *absolute accuracy* calibration, it is also recommended, but not always necessary to calibrate for new absolute accuracy.

The resolver values will change when parts affecting the calibration position are replaced on the robot, for example motors or parts of the transmission.

The revolution counter memory is lost

If the revolution counter memory is lost, the counters must be updated. See *Updating revolution counters on page 626*. This will occur when:

- The battery is discharged
- A resolver error occurs
- The signal between a resolver and measurement board is interrupted
- A robot axis is moved with the control system disconnected

The revolution counters must also be updated after the robot and controller are connected at the first installation.

The robot is rebuilt

If the robot is rebuilt, for example, after a crash or when the reachability of a robot is changed, it needs to be re-calibrated for new resolver values.

If the robot has *absolute accuracy* calibration, it needs to be calibrated for new absolute accuracy.

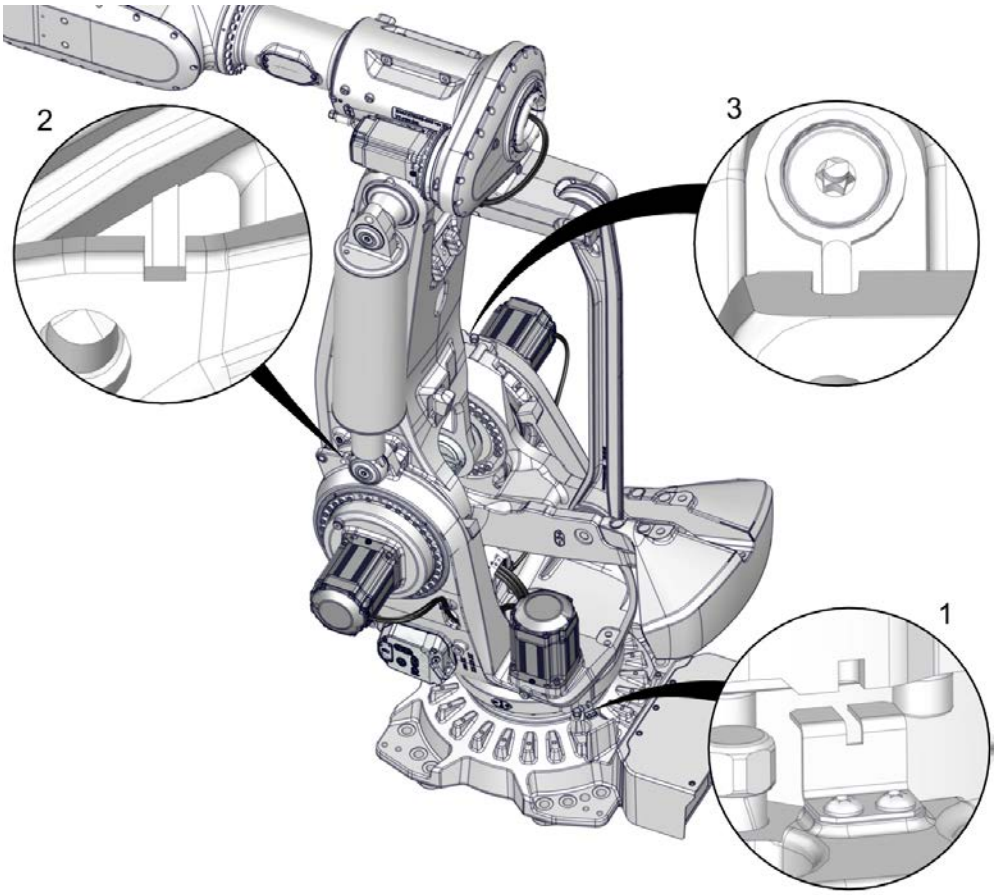
6.2 Synchronization marks and axis movement directions

6.2.1 Synchronization marks and synchronization position for axes

Introduction

This section shows the position of the synchronization marks and the synchronization position for each axis.

Synchronization marks, IRB 7710, IRB 7720



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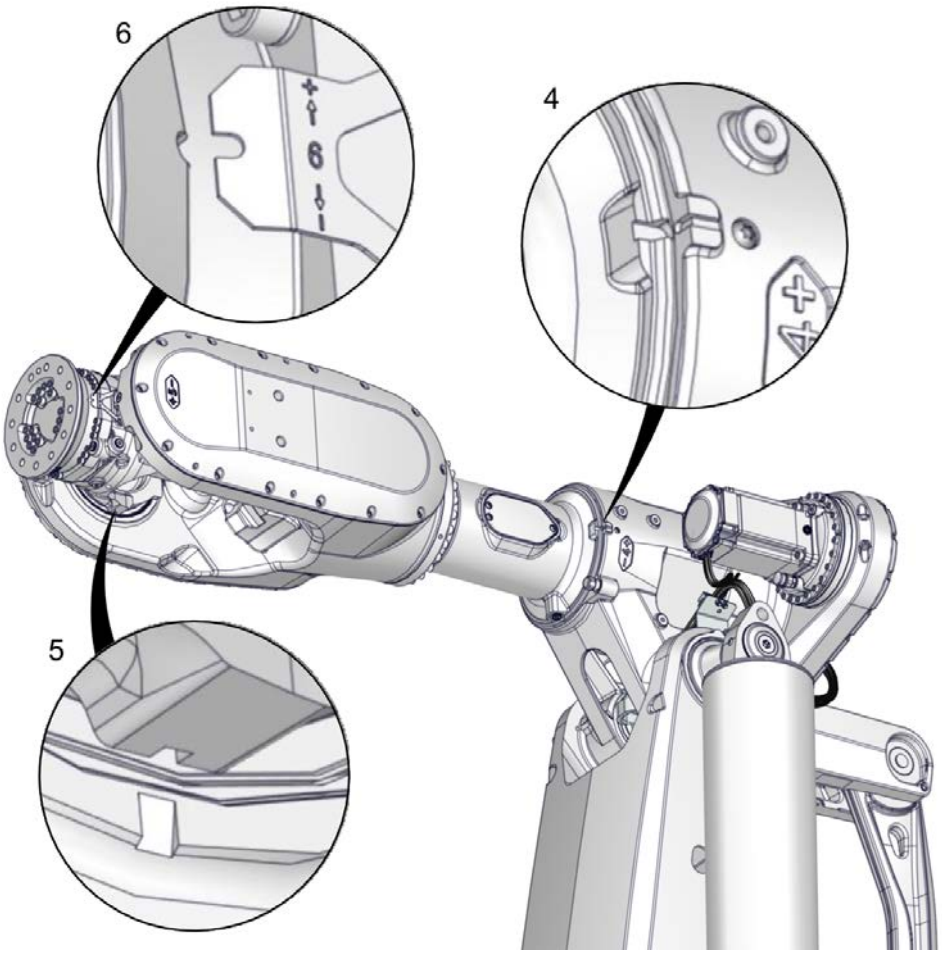
6.2.1 Synchronization marks and synchronization position for axes
Continued



xx2400000018

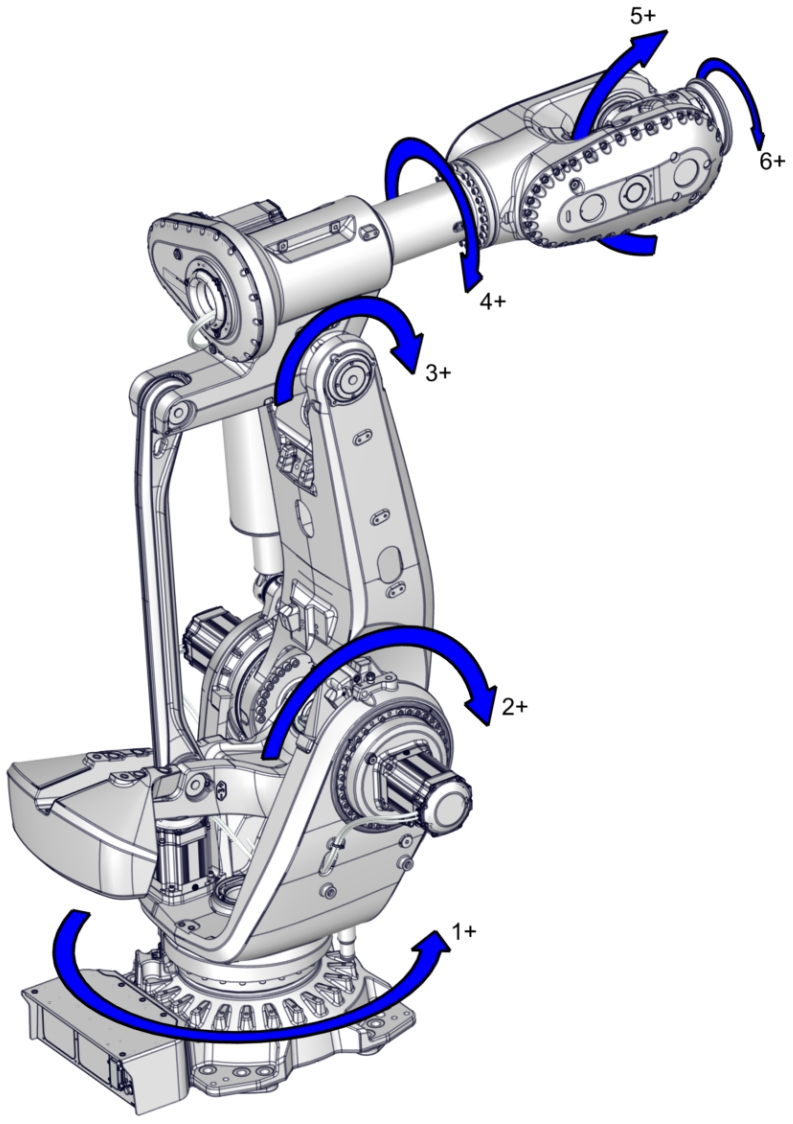
6.2.2 Calibration movement directions for all axes

Overview

When calibrating, the axis must consistently be run towards the calibration position in the same direction in order to avoid position errors caused by backlash in gears and so on. Positive directions are shown in the graphic below.

Calibration service routines will handle the calibration movements automatically and these might be different from the positive directions shown below.

Manual movement directions



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6.3 Updating revolution counters

6.3.1 Updating revolution counters on OmniCore robots

Introduction

This section describes how to do a rough calibration of each manipulator axis by updating the revolution counter for each axis, using the FlexPendant.

Step 1 - Manually running the manipulator to the synchronization position

Use this procedure to manually run the manipulator to the synchronization position.

	Action	Note
1	Select axis-by-axis motion mode.	
2	Jog the manipulator to align the synchronization marks.	See *Synchronization marks and synchronization position for axes on page 623*.
3	When all axes are positioned, update the revolution counter.	*Step 2 - Updating the revolution counter with the FlexPendant on page 626*.

Step 2 - Updating the revolution counter with the FlexPendant

Use this procedure to update the revolution counter with the FlexPendant (OmniCore).

	Action
1	On the start screen, tap **Calibrate**. The calibration summary page for the mechanical unit is displayed.
2	In the **Calibration Methods** menu, select **Revolution Counters**.
3	In the **Selection** column select the axes for which revolution counters need to be updated.
4	Tap **Update**. A dialog box is displayed warning that the updating operation cannot be undone.
5	Tap **OK** to update the revolution counter.
6	**CAUTION** If a revolution counter is incorrectly updated, it will cause incorrect manipulator positioning, which in turn may cause damage or injury! Check the synchronization position very carefully after each update. See *Checking the synchronization position on page 641*.

6.4 Calibrating with Axis Calibration method

6.4.1 Description of Axis Calibration

Instructions for Axis Calibration procedure given on the FlexPendant

The actual instructions of how to perform the calibration procedure and what to do at each step is given on the FlexPendant. You will be guided through the calibration procedure, step by step.

This manual contains a brief description of the method, additional information to the information given on the FlexPendant, article number for the tools and images of where to fit the calibration tools on the robot.

Overview of the Axis Calibration procedure

The Axis Calibration procedure applies to all axes, and is performed on one axis at the time. The robot axes are both manually and automatically moved into position, as instructed on the FlexPendant.

A fixed calibration pin/bushing is installed on each robot axis at delivery.

The Axis Calibration procedure described roughly:

1 A removable calibration tool is inserted by the operator into a calibration bushing on the axis chosen for calibration, according to instructions on the FlexPendant.

> **WARNING**
>
> Calibrating the robot with Axis Calibration requires special calibration tools from ABB. Using other pins in the calibration bushings may cause severe damage to the robot and/or personnel.

> **WARNING**
>
> The calibration tool must be fully inserted into the calibration bushing, until the steel spring ring snaps into place.

2 During the calibration procedure, RobotWare moves the robot axis chosen for calibration so that the calibration tools get into contact. RobotWare records values of the axis position and repeats the coming-in-contact procedure several times to get an exact value of the axis position.

> **WARNING**
>
> Risk of pinching! The contact force for large robots can be up to 150 kg. Keep a safe distance to the robot.

3 The axis position is stored in RobotWare with an active choice from the operator.

Continues on next page

6.4.1 Description of Axis Calibration
Continued

Routines in the calibration procedure

The following routines are available in the Axis Calibration procedure, given at the beginning of the procedure on the FlexPendant.

Fine calibration routine

Choose this routine to calibrate the robot when there are no tools, process cabling or equipment fitted to the robot.

Reference calibration routine

Choose this routine to create reference values and to calibrate the robot when the robot is dressed with tools, process cabling or other equipment.

Note

When calibrating the robot with the reference calibration routine, the robot must be dressed with the same tools, process cabling and any other equipment as when the reference values were created.

Note

When using reference calibration with some tools, typically large or flexible tools, oscillations in the robot can cause issues leading to failure of the calibration.

If calibrating the robot with reference calibration there must be reference values created before repair is made to the robot, if values are not already available. Creating new values requires possibility to move the robot. The reference values contain positions of all axes, torque of axes and technical data about the tool installed. A benefit with reference calibration is that the current state of the robot is stored and not the state when the robot left the ABB factory. The reference value will be named according to tool name, date etc.

Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values.

When reference calibration is performed, the robot is restored to the status given by the reference values.

Update revolution counters

Choose this routine to make a rough calibration of each manipulator axis by updating the revolution counter for each axis, using the FlexPendant.

Validation

In the mentioned routines, it is also possible to validate the calibration data.

Position of robot axes

The robot axes should be positioned close to 0 degrees before commencing the calibration program. The axis chosen for calibration is then automatically run by the calibration program to its exact calibration position during the calibration procedure.

It is possible to position some of the other axes in positions different from 0 degrees. Information about which axes are allowed to be jogged is given on the FlexPendant.

Continues on next page

These axes are marked with **Unrestricted** in the FlexPendant window. Also the following table shows the dependencies between the axes.

Requirements for axis positioning during calibration

	Axis to calibrate					
Required position of axis	**Axis 1**	**Axis 2**	**Axis 3**	**Axis 4**	**Axis 5**	**Axis 6**
Axis 1	-	*	*	*	*	*
Axis 2	0	-	0	*	*	*
Axis 3	0	0	-	*	*	*
Axis 4	*	*	*	-	*	*
Axis 5	*	*	*	*	-	*
Axis 6	*	*	*	*	*	-

-	Axis to be calibrated
*	Unrestricted. Axis is allowed to be jogged to other position than 0 degrees.
0	Axis must be put in position 0 degrees.

System containing SafeMove

SafeMove will lose its synchronization to the controller if a new calibration is done. New calibration values have to be downloaded to SafeMove, and a new SafeMove calibration has to be done. Make sure that the user rights admit to change the safety settings and to synchronize SafeMove.

6.4.2 Calibration tools for Axis Calibration

Calibration tool set

The calibration tools used for Axis Calibration are designed to meet requirements for calibration performance, durability and safety in case of accidental damage.

The calibration tool will eventually break from fatigue after longer period of use and then needs to be replaced. There is no risk for bad calibrations as long as the calibration tool is in one piece.

WARNING

Calibrating the robot with Axis Calibration requires special calibration tools from ABB. Using other pins in the calibration bushings may cause severe damage to the robot and/or personnel.

Equipment, etc.	Article number	Note
Calibration toolbox, Axis Calibration	3HAC074564-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.

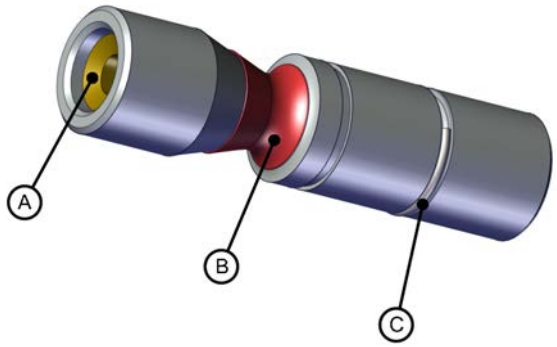
Examining the calibration tool

Check prior to usage

Before using the calibration tool, make sure that the tube insert, the plastic protection and the steel spring ring are present.

WARNING

If any part is missing or damaged, the tool must be replaced immediately.



xx1500001914

A	Tube insert
B	Plastic protection
C	Steel spring ring

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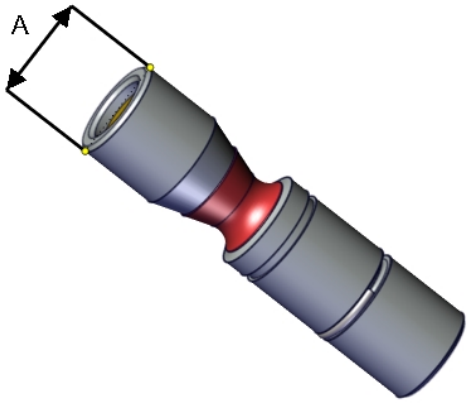
Periodic check of the calibration tool

If including the calibration tool in a local periodic check system, the following measures should be checked.

- Outer diameter within Ø12g4 mm, Ø8g4 mm or Ø6g5 mm (depending on calibration tool size).
- Straightness within 0.005 mm.



xx1500000951

A	Outer diameter

Identifying the calibrating tools

It is possible to make the calibration tool identifiable with, for example, an RFID chip. The procedure of how to install an RFID chip is described below.

Note

The tool identifier is NOT delivered from ABB, it is a customized solution.

	Action	Note
1	It is possible to use any RFID solution, with the correct dimensions. ABB has verifed function on some suppliers fulfilling the requirements of NFC compatible devices (13.56 Mhz) according to ISO 14443 or ISO 15693. **Note** The maximum dimensions on the RFID chip must not exceed Ø7.9 mm x 8.0 mm, Ø5.9 mm x 8.0 mm or Ø3.9 mm x 8.0 mm (depending on calibration tool size).	
2	There is a cavity on one end of the calibration tool in which the RFID chip can be installed. Install the RFID chip according to supplier instructions. Install the chip in flush with the tool end.	

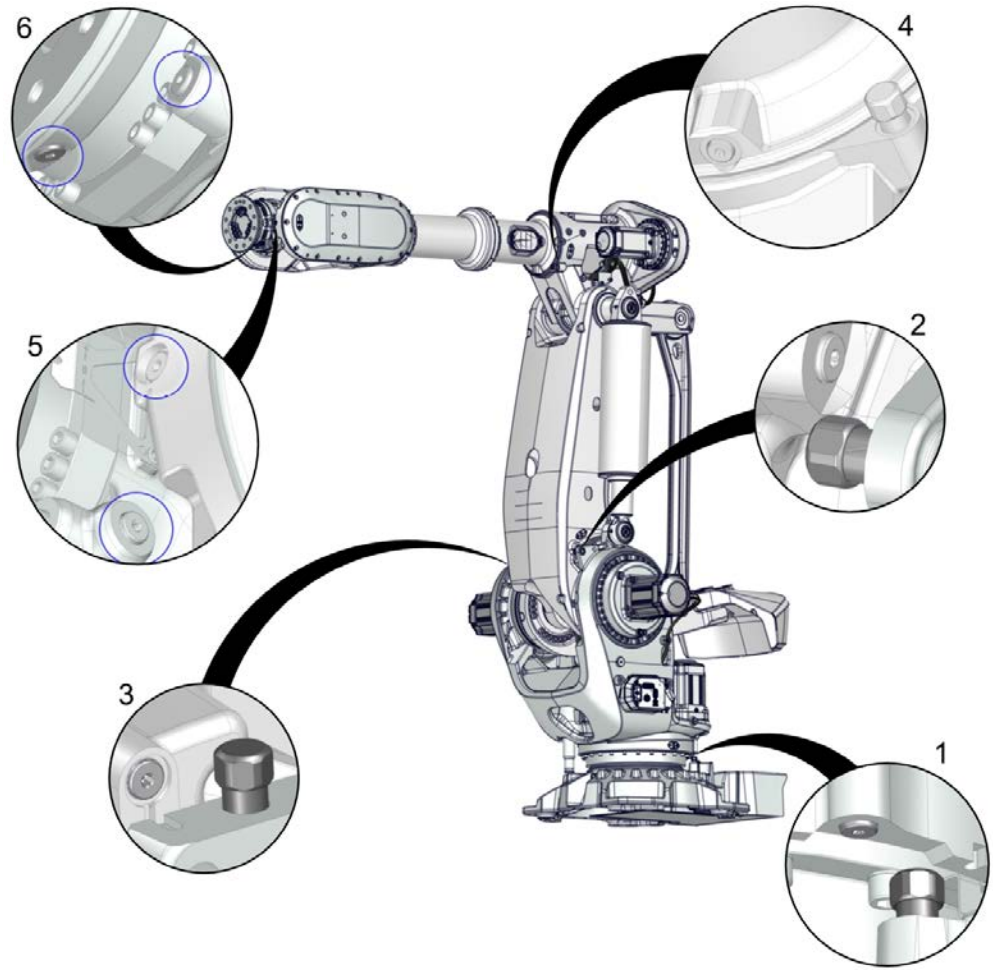
6.4.3 Installation locations for the calibration tools

Location of fixed calibration items

This section shows how the robot is equipped with items for installation of calibration tools for Axis Calibration (fixed calibration pins and/or bushings). Installed calibration tools are not shown.

A fixed calibration pin and a bushing for the movable calibration tool are located on each axis as follows.

If there is not enough space on an axis to install a fixed calibration pin, the axis is equipped with two bushings instead, for installation of two calibration tools when calibration is carried out. This is shown in the figure.



xx2400000288

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Spare parts

When calibration is not being performed, a protective cover and an o-ring should always be installed on the fixed calibration pin as well as a protective plug, included a sealing, in the bushing. Replace damaged parts with new.

Spare part	Article number	Note
Protection cover and plug set	3HAC064875-001 (axes 1, 2, 3 and 4) 3HAC059487-001 (axes 5 and 6)	Contains replacement calibration pin covers and protective plugs for the bushings.

6.4.4 Axis Calibration - Running the calibration procedure

Required tools

The calibration tools used for Axis Calibration are designed to meet requirements for calibration performance, durability and safety in case of accidental damage.

WARNING

Calibrating the robot with Axis Calibration requires special calibration tools from ABB. Using other pins in the calibration holes may cause severe damage to the robot and/or personnel.

Equipment, etc.	Article number	Note
Calibration toolbox, Axis Calibration	3HAC074564-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.

Required consumables

Consumable	Article number	Note
Clean cloth	-	

Spare parts

Spare part	Article number	Note
Protection cover and plug set	3HAC064875-001 (axes 1, 2, 3 and 4) 3HAC059487-001 (axes 5 and 6)	Contains replacement calibration pin covers and protective plugs for the bushings.

Overview of the calibration procedure on the FlexPendant

The actual instructions of how to perform the calibration procedure and what to do at each step is given on the FlexPendant. You will be guided through the calibration procedure, step by step.

Use the following list to learn about the calibration procedure before running the RobotWare program on the FlexPendant. It gives you a brief overview of the calibration procedure.

After the calibration method has been started on the FlexPendant, the following sequence will be run.

1. Choose calibration routine. The routines are described in *Routines in the calibration procedure on page 628*.
2. Choose which axis/axes to calibrate.
3. The robot moves to synchronization position.
4. Validate the synchronization marks.
5. The robot moves to preparation position.
6. Remove the protective cover from the fixed pin and the protection plug from the bushing, if any, and install the calibration tool.

Continues on next page

7 The robot performs a measurement sequence by rotating the axis back and forth.
8 Remove the calibration tool and reinstall the protective cover on the fixed pin and the protection plug in the bushing, if any.
9 The robot moves to verify that the calibration tool is removed.
10 Choose whether to save the calibration data or not.

Calibration of the robot is not finished until the calibration data is saved, as last step of the calibration procedure.

Preparation prior to calibration

The calibration procedure is described in the FlexPendant while conducting it.

	Action	Note
1	**DANGER** While conducting the calibration, the robot needs to be connected to power. Make sure that the robot's working area is empty, as the robot can make unpredictable movements.	
2	Wipe the calibration tool clean. **Note** The calibration method is exact. Dust, dirt or color flakes will affect the calibration value.	Use a clean cloth.

Starting the calibration procedure

Use this procedure to start the Axis Calibration routine on the FlexPendant.

	Action	Note
1	Tap the calibration icon and enter the calibration main page.	
2	All mechanical units connected to the system are shown with their calibration status. Tap the mechanical unit in question. **Note** For RobotWare 7, the mechanical unit page is displayed only if there is more than one mechanical unit available.	
3	The calibration method used at ABB factory for each axis is shown, as well as calibration method used for the robot during last field calibration.	The FlexPendant will give all information needed to proceed with Axis Calibration.
4	**Valid for RobotWare 7** Tap **Calibration Methods** on the right pane and then tap **Calibration**. The software will automatically call for the procedure for the valid calibration method.	

Continues on next page

6.4.4 Axis Calibration - Running the calibration procedure
Continued

	Action	Note
5	Follow the instructions given on the FlexPendant.	A brief overview of the sequence that will be run on the FlexPendant is given in *Overview of the calibration procedure on the FlexPendant on page 634*.

Restarting an interrupted calibration procedure

If the Axis Calibration procedure is interrupted before the calibration is finished, the RobotWare program needs to be started again. Use this procedure to take required action.

Situation	Action
The three-position enabling device on the FlexPendant has been released during robot movement.	Press and hold the three-position enabling device and press **Play**.
The RobotWare program is terminated with **PP to Main**.	Remove the calibration tool, if it is installed, and restart the calibration procedure from the beginning. See *Starting the calibration procedure*. If the calibration tool is in contact the robot axis needs to be jogged in order to release the calibration tool. Jogging the axis in wrong direction will cause the calibration tool to break. Directions of axis movement is shown in *Calibration movement directions for all axes on page 625*

Axis Calibration with SafeMove option

To be able to run Axis Calibration, SafeMove needs to be unsynchronized. The Axis Calibration routine recognizes if the robot is equipped with SafeMove and will force SafeMove to unsynchronize automatically.

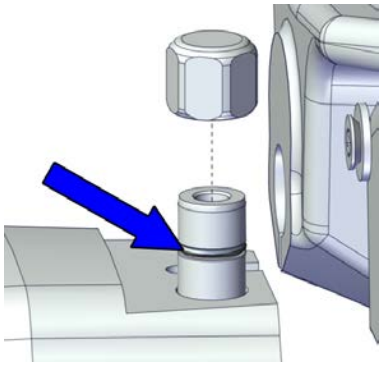
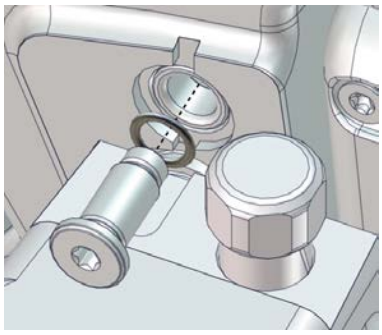
However, SafeMove may generate other warning messages anytime during the Axis Calibration routine. When a warning message is displayed, tap **Acknowledge** to confirm the unsynchronized state and continue Axis Calibration procedure.

CAUTION

SafeMove must be synchronized after the calibration is completed.

Continues on next page

After calibration

	Action	Note
1	Check the o-ring on the fixed calibration pin. Replace if damaged or missing.	 xx1600002102 Protection cover and plug set: . 3HAC064875-001 (axes 1, 2, 3 and 4) 3HAC059487-001 (axes 5 and 6)
2	Reinstall the protective cover on the fixed calibration pin on each axis, directly after the axis has been calibrated. Replace the cover with new spare part, if missing or damaged.	
3	Reinstall the protective plug and sealing in the bushing on each axis, directly after the axis has been calibrated. Ensure that the sealing is not damaged. Replace the plug and the sealing with new spare part, if missing or damaged.	 xx1500000952 Protection cover and plug set: . 3HAC064875-001 (axes 1, 2, 3 and 4) 3HAC059487-001 (axes 5 and 6)

6.4.5 Reference calibration

Brief introduction to Reference Calibration

Reference calibration is a faster method compared to Fine calibration, as it refers to a previously made calibration.

1. Create a backup of the current robot system.
2. Check that the active calibration offset values corresponds to the values on the calibration label (located on the lower arm or the base).
3. Jog the manipulator so that all axes are in zero position (ex use `MoveAbsJ` instruction). Check that all axis scales are aligned with calibration marks.
4. If the scales differ from calibration marks it might depend on wrong turns of the revolution counters. Make a marker line on the corresponding axis to be able to validate the result of the calibration. If more than one motor revolutions are wrong, the calibration will fail.
5. Use a verification position. This is especially recommended if all axes were not aligned with the synchronization marks (step 3). Reuse an existing position that is suitable and accurate so it can be used to validate the repair. Use a position where a deviation in axis calibration gives a big deviation in positioning. Note! Check the position after each repair in one axis.
6. Use Reference calibration to save reference values for all axes that is to be replaced. Make sure that the values are saved in RobotStudio or FTP program. The files are located in "Active system folder name/HOME/RefCalibFiles".
7. Perform the repair.
8. Make sure that the tooling and process equipment are the same as when creating the reference. Use Reference calibration to update the system with new calibration offset value for the repaired axis.
9. Check the position against the verification position (step 5).
10. Proceed with the repair of the next axis, if necessary, and repeat (step 8-9) for every axis.
11. (For system containing SafeMove) Download new calibration values to SafeMove. Use Visual SafeMove in RobotStudio.
12. (For system containing SafeMove) Synchronize SafeMove to activate SafeMove.
13. Perform test run.
14. Update the calibration label with new resolver values (calibration values).

Manual tuning of calibration offset

Manual tuning of calibration offset is normally not needed, but can be useful in some situations. The requirement to do manual tuning is that there is a known accurate position, that worked accurately before the repair (step 5, see *Brief introduction to Reference Calibration on page 638*).

Example "Adjust axis 4":

1. Create a backup.

Continues on next page

2 Run the manipulator to the verification position. (The manipulator position is now deviating from the verification position.)
3 Read and note current axis 4 value in degrees (example: 96.3 degrees).
4 Manually jog, only axis 4, so that the manipulator is correctly positioned to the verification position.
5 Read and note current axis 4 value in degrees (example: 94.2 degrees).
6 Move the manipulator to its calibration position.
7 Calculate the angle difference (ie 96.3-94.2=2.1 degrees).
8 Manually jog axis 4 the calculated angle difference (-2.1). NOTE! The direction +/- shall be the same direction as the direction used when axis 4 was manually jogged to coincide with the verification process. In the example -2.1 degrees.
9 Make a new manual fine calibration of axis 4 with axis in -2.1 degrees position.
10 Check again against the verification position.
11 Repeat the manual tuning if needed.
12 Create a new reference if the intention is to use the reference in the future.

6.5 Verifying the calibration

Introduction

Always verify the results after calibrating *any* robot axis to verify that all calibration positions are correct.

Verifying the calibration

Use this procedure to verify the calibration result.

	Action	Note
1	Run the calibration home position program twice. Do not change the position of the robot axes after running the program!	See *Checking the synchronization position on page 641*.
2	Adjust the *synchronization marks* when the calibration is done, if necessary.	This is detailed in section *Synchronization marks and synchronization position for axes on page 623*.
3	Write down the values on a new label and stick it on top of the calibration label. The label is located on the lower arm.	

6.6 Checking the synchronization position

Introduction

Check the synchronization position of the robot before beginning any programming of the robot system. This may be done:

- Using a `MoveAbsJ` instruction with argument zero on all axes.
- Using the **Jog** window on the FlexPendant.

Continues on next page

6.6.1 Checking the synchronization position on OmniCore robots

Using a MoveAbsJ instruction

Use this procedure to create a program that runs all the robot axes to their synchronization position.

	Action	Note
1	Tap **Code**.	
2	Create a new program.	
3	Use **MoveAbsJ** in the **Add Instruction** menu.	

4	Create the following program:
	`MoveAbsJ [[0,0,0,0,0,0],`
	`[9E9,9E9,9E9,9E9,9E9,9E9]]`
	`\NoEOffs, v1000, fine, tool0`	

5	Run the program in manual mode.	
6	Check that the synchronization marks for the axes align correctly. If they do not, update the revolution counters.	See *Synchronization marks and synchronization position for axes on page 623* and *Updating revolution counters on page 626*.

Using the jogging window

Use this procedure to jog the robot to the synchronization position of all axes.

	Action	Note
1	Tap **Jog**.	
2	From the **Mechanical unit** list select a mechanical unit.	
3	From the **Motion mode** section, select an axis-set that need to be jogged. For example, to jog axis 2, select the axis set **Axis 1-3**.	
4	Follow the screen instruction on joystick movements to understand the direction of the axis that you want to move and move the joystick.	
5	Manually run the robots axes to a position where the axis position value read on the FlexPendant, is equal to zero.	
6	Check that the synchronization marks for the axes align correctly. If they do not, update the revolution counters.	See *Synchronization marks and synchronization position for axes on page 623* and *Updating revolution counters on page 626*.

7 Troubleshooting

7.1 Introduction to troubleshooting

Introduction

The product manual and the circuit diagram contains information that can be good when troubleshooting.

For OmniCore, all event logs from the software can be seen on the FlexPendant, or in *Technical reference manual - Event logs for RobotWare 7*.

Make sure to read through the section *Safety on page 15* before starting.

Troubleshooting strategies

1. Isolate the fault to pinpoint the cause of the problem from consequential problems.
2. Divide the fault chain in two.
3. Check communication parameters and cables.
4. Check that the software version is compatible with the hardware.

Work systematically

1. Take a look around to make sure that all screws, connectors, and cables are secured, and that the robot and other parts are clean, not damaged, and correctly fitted.
2. Replace one thing at a time.
3. Do not replace units randomly.
4. Make sure that there are no loose screws, turnings, or other unexpected parts remaining after work has been performed.
5. When the work is completed, verify that the safety functions are working as intended.

Keep a track of history

- Make a historical fault log to keep track of problems over time.
- Consult those working with the robot when the problem occurred.

Basic scenarios

What to look for during troubleshooting depends on when the fault occurred. Was the robot recently installed or was it recently repaired? The following table gives hints on what to look for in specific situations.

The robot has recently been installed	Check: • the configuration files • connectors • options and their configuration • changes in the robot working space/movements.

Continues on next page

Continued

The robot has recently been repaired	Check: • all connections to the replaced part • power supplies • that the correct part has been fitted • the last repair documents.
The robot recently had a software upgrade	Check: • software versions • compatibilities between hardware and software • options and their configuration
The robot has recently been moved from one site to another (an already working robot)	Check: • connections • software versions

7.2 Oil and grease stains on motors and gearboxes

Description

The area surrounding the motor or gearbox shows signs of oil leaks. This can be at the base, closest to the mating surface, or at the furthest end of the motor at the resolver.

Consequences

Besides the dirty appearance, in most cases there are no serious consequences if the leaked amount of oil is very small.

Possible causes

The symptom can be caused by:

- Leakage of rust preventives or mounting grease. This should be wiped off.
- Leaking sealing between gearbox and motor.
- Gearbox overfilled with oil.
- Gearbox oil too hot.

Recommended actions

The following actions are recommended:

	Action	Information
1	**CAUTION** Allow hot parts to cool down.	
2	Wipe off the oil or grease, see *Cleaning the IRB 7710 on page 190*. Monitor the robot over time to see if new oil or grease occurs.	If the oil spill is small, this step is sufficient.
3	Check the gearbox oil level.	
4	Too hot gearbox oil may be caused by: • Incorrect oil quality or level. • The robot work cycle runs a specific axis too hard. Investigate whether it is possible to program small "cooling periods" into the application. • Overpressure created inside gearbox.	Robots performing certain, extremely heavy duty work cycles may be fitted with vented oil plugs. These are not fitted to normal duty robots, but can be purchased from your local ABB representative.
5	Inspect all sealings and gaskets between motor and gearbox. Replace broken parts.	

7.3 Mechanical noise or dissonance

Description

Mechanical noise or dissonance that has not been observed before can indicate problems in bearings, motors, gearboxes, or similar. Be observant of changes over time.

A faulty bearing often emits scraping, grinding, or clicking noises shortly before failing.

Consequences

Failing bearings cause the path accuracy to become inconsistent, and in severe cases, the joint can seize completely.

Possible causes

The symptom can be caused by:

- Worn bearings.
- Contaminations have entered the bearing grooves.
- Loss of lubrication in bearings.
- Loose heat sinks, fans, or metal parts.

If the noise is emitted from a gearbox, the following can also apply:

- Overheating.

Recommended actions

The following actions are recommended:

	Action	Information
1	**CAUTION** Allow hot parts to cool down.	
2	Verify that the service is done according to the maintenance schedule.	
3	If a bearing is emitting the noise, determine which one and make sure that it has sufficient lubrication.	
4	If possible, disassemble the joint and measure the clearance.	
5	Bearings inside motors are not to be replaced individually, but the complete motor is replaced.	
6	Make sure the bearings are fitted correctly.	
7	Tighten the screws if a heat sink, fan, or metal sheet is loose.	

7.4 Troubleshooting too hot gearboxes

Description

The robot reports event message 50263 *Duty factor is too high*.

Consequences

The gearboxes become hot enough to cause burns when touched.

The expected lifetime of the gearbox can be reduced.

Possible causes

The symptom can be caused by:

- Incorrectly defined ambient temperature for the robot.
- Too high duty cycles, with intensive motion (high average speed and/or high average torque and/or short wait time).
- Incorrectly defined payloads.

Recommended actions

The following actions are recommended:

	Action	Information
1	Run the add-in Mechanical Analysis in RobotStudio to get additional insights and recommendations.	The Gearbox Heat Estimation tool helps to estimate heat problems in the gearboxes.
2	Verify that the maximum ambient temperature is correctly defined.	The system parameters are configured in RobotStudio. Topic *Motion*, type *Motion System*, parameter *Max Ambient Temperature Robot*.
3	Consider if the movement can be modified to reduce the average speed on the affected axis.	The average speed has highest contribution to the gearbox temperature, but the average torque also contributes.
4	Install a motor cooling fan on the affected axis.	If cooling fans are added, RobotWare 7.17 or later is required to enable SIS to supervise the temperature.

7.5 Manipulator collapses on power down

Description

The manipulator is able to work correctly while Motors ON is active, but when Motors OFF is active, one or more axes drops or collapses under its own weight.

The holding brakes (normally one in each motor), is not able to hold the weight of the manipulator arm.

Consequences

For a heavy robot, the collapse can cause severe injury to personnel working in the area or severe damage to the robot and/or surrounding equipment.

For a small robot, the collapse can cause injury to personnel working close to the robot or damage to the robot and/or surrounding equipment.

Possible causes

The symptom can be caused by:

- Faulty brake.
- Faulty power supply to the brake.

Recommended actions

The following actions are recommended:

	Action	Information
1	Determine which motor(s) causes the robot to collapse.	
2	Check the brake power supply to the collapsing motor during the Motors OFF state.	See the circuit diagram.
3	Remove the resolver or resolver cover of the motor to see if there are any signs of oil leaks.	If found faulty, the motor must be replaced as a complete unit.
4	Remove the motor from the gearbox to inspect it from the drive side.	If found faulty, the motor must be replaced as a complete unit.

8 Decommissioning

8.1 Introduction to decommissioning

Introduction

This section contains information to consider when taking a product, robot or controller, out of operation.

It deals with how to handle potentially dangerous components and potentially hazardous materials.

> **Note**
>
> The decommissioning process shall be preceded by a risk assessment.

Disposal of materials used in the robot

All used grease/oils and dead batteries **must** be disposed of in accordance with the current legislation of the country in which the robot and the control unit are installed.

If the robot or the control unit is partially or completely disposed of, the various parts **must** be grouped together according to their nature (which is all iron together and all plastic together), and disposed of accordingly. These parts **must** also be disposed of in accordance with the current legislation of the country in which the robot and control unit are installed.

See also *Environmental information on page 650*.

Transportation

Prepare the robot or parts before transport, this to avoid hazards.

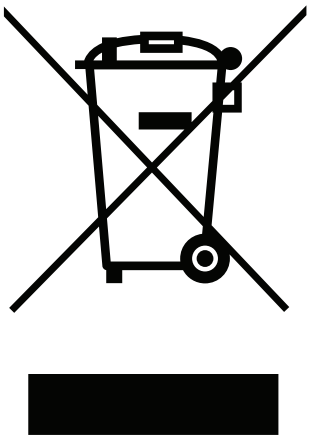
8.2 Environmental information

Introduction

ABB robots contain components in different materials. During decommissioning, all materials shall be dismantled, recycled, or reused responsibly, according to the relevant laws and industrial standards. Robots or parts that can be reused or upcycled helps to reduce the usage of natural resources.

Disposal symbol

The following symbol indicates that the product must not be disposed of as common garbage. Handle each product according to local regulations for the respective content (see table below).



xx1800000058

Materials used in the product

The table specifies some of the materials in the product and their respective use throughout the product.

Dispose components properly according to local regulations to prevent health or environmental hazards.

Material	Example application
Aluminium	Wrist house, covers, motor flange, motor house
Batteries, Lithium	Serial measurement board
Brass, zink alloys	Calibration protection cap and plug and couplings, connectors and nuts in cable harnesses
Cast iron/nodular iron	Base, frame, lower arm, arm house, tilt house, tube shaft, parallel arm, parallel bar, counterweight
Circuit boards	Serial measurement unit, brake release unit
Copper	Motor wiring, cables, pins and sockets
Dysprosium	Motor magnets
Lithium	Battery
Neodymium	Motor magnets
Nickel	Coating on protection caps

Continues on next page

Material	Example application
Oil, grease	Gearboxes
Steel	Gears, shafts, turning discs, spring, bearings, motors, screws, washers
Thermo plastics (ETFE, PA, PC, PE, PET, POM, PP, PVC, TPE)	Protection tubes, protection covers, plugs, cable jackets, cable filler, connectors, labels
Thermo setting polymers (CR, Epoxy, FKM, NBR, PUR)	Motor winding, cable jackets, hoses, clamps, dampers, o-rings, sealings and gaskets

Oil and grease

Where possible, arrange for oil and grease to be recycled. Dispose of via an authorized person/contractor in accordance with local regulations. Do not dispose of oil and grease near lakes, ponds, ditches, down drains, or onto soil. Incineration must be carried out under controlled conditions in accordance with local regulations.

Also note that:

- Spills can form a film on water surfaces causing damage to organisms. Oxygen transfer could also be impaired.
- Spillage can penetrate the soil causing ground water contamination.

8.3 Scrapping of robot

Note

The decommissioning process shall be preceded by a risk assessment.

Important when scrapping the robot

DANGER

The risk assessment should consider hazards arising in the decommissioning, such as, but not limited to:

- Always remove all batteries. If a battery is exposed to heat, for example from a blow torch, it will explode.
- Always remove all oil/grease in gearboxes. If exposed to heat, for example from a blow torch, the oil/grease will catch fire.
- When motors are removed from the robot, the robot will collapse if it is not properly supported before the motor is removed.
- A used robot does not have the same performance as on delivery. Springs, brakes, bearings, and other parts might be worn or broken.

8.4 Decommissioning of balancing device

General

There is much energy stored in the balancing device. Therefore a special procedure is required to disassemble it. The coil springs inside the balancing device exert a potentially lethal force unless disassembled properly.

The device must be disassembled by a decommissioning company.

Required equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 664*.
Protective clothing that also covers face and hands	-	Must protect against spatter of sparks and flames.
Cutting torch with a long shaft	-	For opening housing and cutting coils. The long shaft is a safety requirement.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.

DANGER

Do not, under any circumstances, deal with the balancing device in any other way than that detailed in the product documentation! For example, attempting to open the balancing device is potentially lethal!

Action on field, decommissioning

The procedure below details the actions to perform on field, when the balancing device is to be decommissioned.

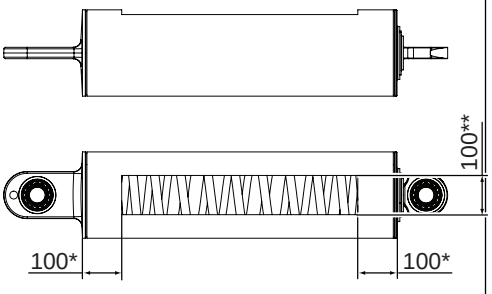
	Action	Note
1	Remove the balancing device from the robot.	Detailed in section *Replacing the balancing device and balancing device bearings on page 236*.
2	Send the device to a decommissioning company.	Make sure the decommissioning company is well informed about the stored energy built up by high tensioned compression springs and that the device contains some grease and plastic. The following procedure contains useful information about decommissioning.

Continues on next page

8.4 Decommissioning of balancing device
Continued

Decommissioning at decommissioning company, balancing device

The instruction below details how to decommission the balancing device. Contact ABB Robotics for further consultation.

	Action	Note
1	**DANGER** There is stored energy built up by high tensioned compression springs inside the balancing device! When a coil is cut the released tension creates a spatter of sparks and flames. The working area must be free of flammable materials. Position the balancing device so that the spatter will be directed away from personnel.	
2	Clamp the device at the working location. Place the device at ground level so that the hole and spring coils are cut from a safe distance and somewhat from above.	
3	**WARNING** There is some grease and a plastic layer inside the balancing device. When opening a hole in the device, the cutting torch will cause the plastic and the grease to start to burn. Wear protective clothing! Make sure that the working area is well ventilated!	
4	**DANGER** The hole must be cut as specified in the figure. Pieces of the spring can be thrown out from the cylinder at high speed if the hole is cut larger than specified!	
5	Cut a hole in the housing as shown in the figure.	Use a cutting torch with a long shaft.  xx1100000098 * Minimum measure, in millimeters. ** Maximum measure, in millimeters.

Continues on next page

	Action	Note
6	Cut the coils of the springs inside the housing as specified below: • Outer spring: cut at least eight coils! • Inner spring: cut at least eight coils!	Use a cutting torch with a long shaft.
7	Double-check the number of coils cut and make sure all the tension in the springs is removed.	

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9 Reference information

9.1 Introduction

General

This chapter includes general information, complementing the more specific information in the different procedures in the manual.

9.2 Applicable standards

General

The product is compliant with ISO 10218-1:2011, *Robots for industrial environments - Safety requirements - Part 1 Robots*, and applicable parts in the normative references, as referred to from ISO 10218-1:2011. In case of deviation from ISO 10218-1:2011, these are listed in the declaration of incorporation. The declaration of incorporation is part of the delivery.

Robot standards

Standard	Description
ISO 9283	Manipulating industrial robots – Performance criteria and related test methods
ISO 9787	Robots and robotic devices – Coordinate systems and motion nomenclatures
ISO 9946	Manipulating industrial robots – Presentation of characteristics

Other standards used in design

Standard	Description
IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements, normative reference from ISO 10218-1
IEC 61000-6-2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
IEC 61000-6-4	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
ISO 13849-1:2006	Safety of machinery - Safety related parts of control systems - Part 1: General principles for design, normative reference from ISO 10218-1
UL 1740 (option) CSA Z434 (option)	Standards For Safety - Robots and Robotic Equipment Industrial robots and robot Systems - General safety requirements Valid for USA and Canada.

9.3 Unit conversion

Converter table

Use the following table to convert units used in this manual.

Quantity	Units		
Length	1 m	3.28 ft.	39.37 in
Weight	1 kg	2.21 lb.	
Weight	1 g	0.035 ounces	
Pressure	1 bar	100 kPa	14.5 psi
Force	1 N	0.225 lbf	
Moment	1 Nm	0.738 lbf-ft	
Volume	1 L	0.264 US gal	

9.4 Screw joints

General

This section describes how to tighten the various types of screw joints on ABB robots.

The instructions and torque values are valid for screw joints comprised of metallic materials and do *not* apply to soft or brittle materials.

UNBRAKO screws

UNBRAKO is a special type of screw recommended by ABB for certain screw joints. It features special surface treatment (Gleitmo as described below) and is extremely resistant to fatigue.

Whenever used, this is specified in the instructions, and in such cases, *no other type of replacement screw* is allowed. Using other types of screws will void any warranty and may potentially cause serious damage or injury.

Gleitmo treated screws

Gleitmo is a special surface treatment to reduce the friction when tightening the screw joint. It is recommended by ABB for M6-M20 screw joints. Screws treated with Gleitmo may be reused 3-4 times before the coating disappears. After this the screw must be discarded and replaced with a new one.

When handling screws treated with Gleitmo, protective gloves of **nitrile rubber** type should be used.

Generally, screws are lubricated with *Gleitmo 603* mixed with *Geomet 500* or *Geomet 702* in proportion 1:3. *Geomet* thickness varies according to screw dimensions, refer to the following.

Dimension	Lubricant	Geomet thickness
M6-M20 (any length except M20x60)	*Gleitmo 603 + Geomet 500*	3-5 µm
M6-M20 (any length except M20x60)	*Gleitmo 603 + Geomet 720*	3-5 µm
M20x60	*Gleitmo 603 + Geomet 500*	8-12 µm
M20x60	*Gleitmo 603 + Geomet 720*	6-10 µm

Screws lubricated in other ways

Screws lubricated with Molykote 1000 or Molykote P1900 should *only* be used when specified in the repair, maintenance or installation procedure descriptions.

In such cases, proceed as follows:

1. Apply lubricant to the screw thread.
2. Apply lubricant between the plain washer and screw head.
3. Screw dimensions of M8 or larger must be tightened with a torque wrench. Screw dimensions of M6 or smaller may be tightened without a torque wrench *if* this is done by trained and qualified personnel.

Continues on next page

Lubricant	Article number
Molykote 1000 (molybdenum disulphide grease)	3HAC042472-001
Molykote P1900 (molybdenum disulphide grease)	3HAC070875-001

Tightening torque

Before tightening any screw, note the following:

- Determine whether a **standard** tightening torque or **special** torque is to be applied. The **standard torques** are specified in the following tables. Any **special torques** are specified in the repair, maintenance or installation procedure descriptions. **Any special torque specified overrides the standard torque!**
- Use the *correct tightening torque* for each type of screw joint.
- Only use *correctly calibrated* torque keys.
- Always *tighten the joint by hand,* and never use pneumatic tools.
- Use the *correct tightening technique*, that is *do not* jerk. Tighten the screw in a slow, flowing motion.
- Maximum allowed total deviation from the specified value is **10%**!

Tightening torque for oil-lubricated screws with slotted or cross-recess head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws* with *slotted or cross-recess head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Tightening torque for oil-lubricated screws with allen head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws* with *allen head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque (Nm) Class 8.8, oil-lubricated	Tightening torque (Nm) Class 10.9, oil-lubricated	Tightening torque (Nm) Class 12.9, oil-lubricated
M5	6	-	-
M6	10	-	-
M8	24	34	40
M10	47	67	80
M12	82	115	140
M16	200	290	340
M20	400	560	670

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9.4 Screw joints
Continued

Dimension	Tightening torque (Nm) Class 8.8, oil-lubricated	Tightening torque (Nm) Class 10.9, oil-lubricated	Tightening torque (Nm) Class 12.9, oil-lubricated
M24	680	960	1150

Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws

The following table specifies the recommended standard tightening torque for *screws lubricated with Molycote 1000, Gleitmo 603 or equivalent* with *allen head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque (Nm) Class 10.9, lubricated [i]	Tightening torque (Nm) Class 12.9, lubricated [i]
M5		8
M6		14
M8	28	35
M10	55	70
M12	96	120
M16	235	300
M20	460	550
M24	790	950

i Lubricated with Molycote 1000, Gleitmo 603 or equivalent

Water and air connectors

The following table specifies the recommended standard tightening torque for *water and air connectors*.

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Material	Tightening torque Nm - Nominal	Tightening torque Nm - Min.	Tightening torque Nm - Max.
ALL	Mixed	The lower tightening torque of the two materials.		
1/8	Brass only	12	8	15
1/4	Brass only	15	10	20
3/8	Brass only	20	15	25
1/2	Brass only	40	30	50
1/2	Stainless steel only	49	47	59
3/4	Brass only	70	55	90

9.5 Weight specifications

Definition

In installation, repair, and maintenance procedures, weights of the components handled are sometimes specified. All components exceeding 22 kg (50 lbs) are highlighted in this way.

To avoid injury, ABB recommends the use of a lifting accessory when handling components with a weight exceeding 22 kg. A wide range of lifting accessories and devices are available for each manipulator model.

Example

Following is an example of a weight specification in a procedure:

	Action	Note
	CAUTION The arm weighs 25 kg. All lifting accessories used must be sized accordingly.	

9.6 Standard toolkit

General

All service (repairs, maintenance, and installation) procedures contains lists of tools required to perform the specified activity.

All special tools required are listed directly in the procedures while all the tools that are considered standard are gathered in the standard toolkit and defined in the following table.

This way, the tools required are the sum of the standard toolkit and any tools listed in the instruction.

Contents, standard toolkit

Qty	Tool	Rem.
1	Ring-open-end spanner 8-19 mm	
1	Socket head cap 2.5-17 mm	
1	Torx socket no: 20-60	
1	Box spanner set	
1	Torque wrench 10-100 Nm	
1	Torque wrench 75-400 Nm	
1	Ratchet head for torque wrench 1/2	
2	Hexagon-headed screw M10x100	
1	Hexagon-headed screw M16x90	
1	Hex bit socket head cap no. 14 socket 40 mm L=100 mm	
1	Hex bit socket head cap no. 14 socket 40 mm L=20 mm	To be shortened to 12 mm
1	Hex bit socket head cap no. 6 socket 40 mm L=145 mm	
1	Hex bit socket head cap no. 6 socket 40mm bit L=220 mm	
1	Plastic mallet	

9.7 Special tools

General

All service instructions contain lists of tools required to perform the specified activity. The required tools are a sum of standard tools, defined in the section *Standard toolkit on page 664*, and of special tools, listed directly in the instructions and also gathered in this section.

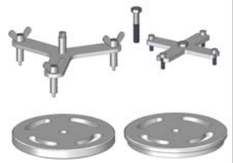
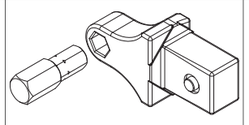
Special tools

Note

If the replacing procedure is not listed in the table below, only standard tools are needed for the procedure.

Continues on next page

9.7 Special tools

Tools and equipment with spare part number: (These tools can be ordered from ABB)			Axis-1 motor	Axis-2 motor	Axis-3 motor	Axis-4 motor	Axis-4 motor flange	Axis-5 motor	Axis-6 motor	Axis-4 cassette sealing (including arm house cover)	Axis-1 gearbox	Axis-2 gearbox	Axis-3 gearbox	Axis-6 gearbox	Balancing device and balancing device bearings	Counter balancing weight	Parallel rod	Wrist
Removal/refitting tools																		
3HAC079878-001	Replacement tool for arm house cover	 xx2100002289								1								
3HAC093483-001	Press tools, parallel rod shaft and bearing																1	
3HAC14631-1	Removal tool motor M12		2	2	2	2	2	2			2	2	2					
3HAC14972-1	Removal tool motor M10								2									
-	Screws M12x100, fully threaded											2	2					
3HAC12342-1	Bits extender		1	1	1	1	1	1			1	1	1					
	Bit holder and hexagon bit SW10	 xx2200001085									1							1
3HAC092177-001	Lock nut socket														1			
-	Screw, M12 x minimum 50 mm											1	1		1			
-	Hydraulic pump																1	
3HAC071378-001	Hydraulic cylinder																1	
Lifting accessories																		
-	Roundsling and adjustable lifting chain										1							
-	Roundsling and adjustable lifting chain										1							
-	Roundsling										1							
-	Roundsling, 1 m																1	1
-	Roundsling, 2 m																1	
3HAC076550-001	Lifting accessory, motor		1								1							
3HAC15534-1	Lifting accessory, motor			1	1							1	1					

Continues on next page

Tools and equipment with spare part number: (These tools can be ordered from ABB)			Axis-1 motor	Axis-2 motor	Axis-3 motor	Axis-4 motor	Axis-4 motor flange	Axis-5 motor	Axis-6 motor	Axis-4 cassette sealing (including arm house cover)	Axis-1 gearbox	Axis-2 gearbox	Axis-3 gearbox	Axis-6 gearbox	Balancing device and balancing device bearings	Counter balancing weight	Parallel rod	Wrist
3HAC081585-001	Lifting accessory for gear	 xx2100002415										1	1					
-	Fender washer																1	
3HAC15556-1	Lifting accessory (chain)	 xx1200001241		1	1						1	1	1			1		
3HAC16131-1	Lifting eye	 xx1200001242									2[i]						1	
3HAC14457-4	Lifting eye M16															1		
-	Swivel eye bolt M20										4							
3HAC054236-001	Lifting accessory for balancing device														1			
Guide pins																		
3HAC080345-001	Guide pin, M6x150													2				
3HAC15520-2	Guide pin, M8x150								2									
3HAC15521-2	Guide pin, M10x150		2	2	2	2	2	2			2	2	2					
3HAC13056-2	Guide pin, M12x150										1	2	2					2
3HAC13056-3	Guide pin, M12x200										1	1	1					
3HAC13056-4	Guide pin, M12x250											1	1					
Brake release																		

Continues on next page

9.7 Special tools

Tools and equipment with spare part number: (These tools can be ordered from ABB)			Axis-1 motor	Axis-2 motor	Axis-3 motor	Axis-4 motor	Axis-4 motor flange	Axis-5 motor	Axis-6 motor	Axis-4 cassette sealing (including arm house cover)	Axis-1 gearbox	Axis-2 gearbox	Axis-3 gearbox	Axis-6 gearbox	Balancing device and balancing device bearings	Counter balancing weight	Parallel rod	Wrist
3HAC081310-001	Brake release tool	 xx2100000666	1	1	1	1	1	1	1		1	1	1	1			1	(1)
Calibration tools																		
3HAC074564-001	Calibration toolbox, Axis Calibration		1	1	1	1	1	1	1		1	1	1	1				
Adjustment and fixing tools																		
3HAB7887-1	Rotation tool M4		1	1	1	1	1	1			1	1	1					
3HAB7887-1	Rotation tool M3								1					1				
3HAC080331-001	Adjustment tool for gear											1	1					
-	Lock screw, M16x80			1	1							1	1					
-	Screw, M6 x minimum 70 mm									2								
-	Screw, M10 x minimum 80 mm																2	
3HAC061213-001	Supporting pillars										4							
3HAC043870-009	Guide for reduction gear	 xx1700002195									1							

i Use M12 washers beneath the lifting eyes, if the lifting eyes need to be elevated somewhat not to damage the o-ring on the gearbox.

Continues on next page

9.8 Lifting accessories and lifting instructions

General

Many repair and maintenance activities require different pieces of lifting accessories, which are specified in each procedure.

The use of each piece of lifting accessories is *not* detailed in the activity procedure, but in the instruction delivered with each piece of lifting accessories.

The instructions delivered with the lifting accessories should be stored for later reference.

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ABB AB
Robotics & Discrete Automation
S-721 68 VÄSTERÅS, Sweden
Telephone +46 10-732 50 00

ABB AS
Robotics & Discrete Automation
Nordlysvegen 7, N-4340 BRYNE, Norway
Box 265, N-4349 BRYNE, Norway
Telephone: +47 22 87 2000

ABB Engineering (Shanghai) Ltd.
Robotics & Discrete Automation
No. 4528 Kangxin Highway
PuDong New District
SHANGHAI 201315, China
Telephone: +86 21 6105 6666

ABB Inc.
Robotics & Discrete Automation
1250 Brown Road
Auburn Hills, MI 48326
USA
Telephone: +1 248 391 9000

abb.com/robotics

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