ROBOTICS

Product manual

IRB 6710

Trace back information:
Workspace 23B version a13
Checked in 2023-06-21
Skribenta version 5.5.019

Product manual

IRB 6710

OmniCore

Document ID: 3HAC085695-001

Revision: A

The information in this manual is subject to change without notice and should not be construed as a commitment by ABB. ABB assumes no responsibility for any errors that may appear in this manual.

Except as may be expressly stated anywhere in this manual, nothing herein shall be construed as any kind of guarantee or warranty by ABB for losses, damage to persons or property, fitness for a specific purpose or the like.

In no event shall ABB be liable for incidental or consequential damages arising from use of this manual and products described herein.

This manual and parts thereof must not be reproduced or copied without ABB's written permission.

Keep for future reference.

Additional copies of this manual may be obtained from ABB.

Original instructions.

Table of contents

This page is intentionally left blank

Overview of this manual

About this manual

This manual contains instructions for:

- mechanical and electrical installation of the IRB 6710
- maintenance of the IRB 6710
- mechanical and electrical repair of the IRB 6710

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 6710. Some variants and designs may have been removed from the business offer and are no longer available for purchase.

Usage

This manual should 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 must:

- 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.

Continues on next page

Continued

References

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

Document name	Document ID
Product manual, spare parts - IRB 6710	*3HAC085696-001*
Product specification - IRB 6710	*3HAC085703-001*
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*
Product manual - DressPack IRB 6710	*3HAC088410-001*
Product manual - OmniCore V250XT Type A	*3HAC084692-001*
Circuit diagram - IRB 6710/IRB 6720/IRB 6730/IRB 6740	*3HAC086333-001*
Technical reference manual - System parameters	*3HAC065041-001*
Operating manual - Service Information System	*3HAC050944-001*

Tip

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

Revisions

Revision	Description
A	First edition.

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/SpotPack, 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

Continued

- 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.

This page is intentionally left blank

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*.

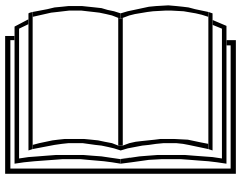
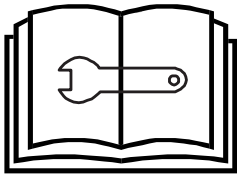
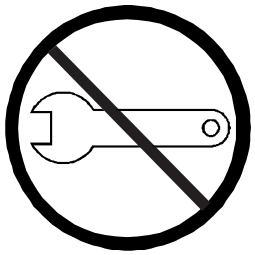
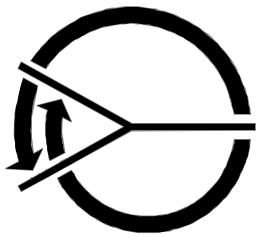
The information labels can contain information in text.

Symbols on safety labels

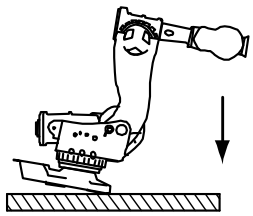
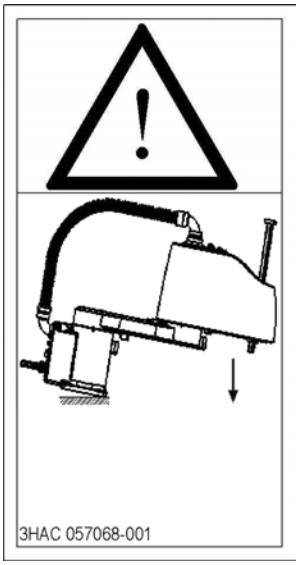
Symbol	Description
 xx0900000812	**Warning!** Warns that an accident *may* occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical 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

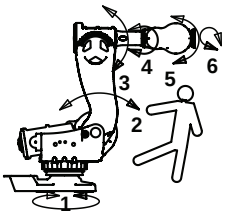
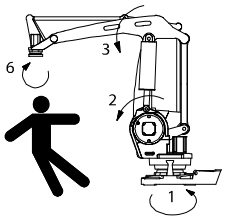
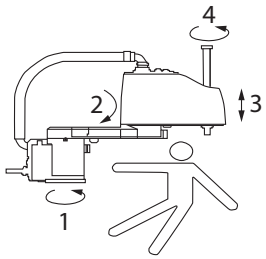
Symbol	Description
 xx0900000813	**See user documentation** Read user documentation for details. Which manual to read is defined by the symbol: • No text: *Product manual*.
 xx0900000816	**Before disassembly, see product manual**
 xx0900000815	**Do not disassemble** Disassembling this part can cause 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

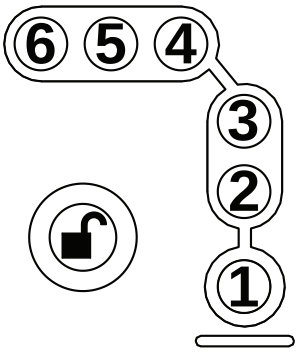
Symbol	Description
 xx0900000810  xx1500002402	**Tip risk when loosening bolts** The robot can tip over if the bolts are not securely fastened.
  xx0900000817	**Crush** Risk of crush injuries.

Continues on next page

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)
 xx0900000819  xx1000001141  xx1500002616	**Moving robot** The robot can move unexpectedly.

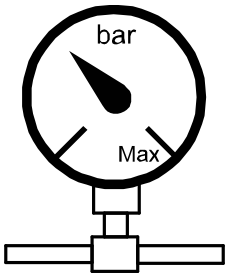
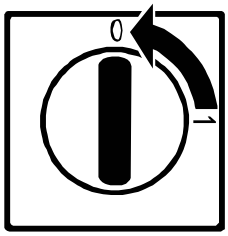
Continues on next page

Symbol	Description
 xx2100002463	**Brake release buttons**
 xx0900000821	**Lifting bolt**
 xx1000001242	**Adjustable chain sling with shortener**
 xx0900000822	**Lifting of robot**
 xx0900000823	**Oil** Can be used in combination with prohibition if oil is not allowed.
 xx0900000824	**Mechanical stop**

Continues on next page

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:

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 616* 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

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.

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 loose screws, turnings, or other unexpected parts remaining after work on the robot has been performed.

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

1.6.1 Safety during maintenance and repair
Continued

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 lubricant to spray from the opening.	Open the plug carefully and keep away from the opening. Do not overfill the gearbox when filling.
 **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 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

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 72*.

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.

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 615*.

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.

This page is intentionally left blank

2 Manipulator description

2.1 Technical data

Weight, robot

The table shows the weight of the robot.

Robot model	Nominal weight
IRB 6710-210/2.65	1,140 kg
IRB 6710-200/2.95	1,150 kg
IRB 6710-175/2.65 LID	1,200 kg
IRB 6710-175/2.95 LID	1,210 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°

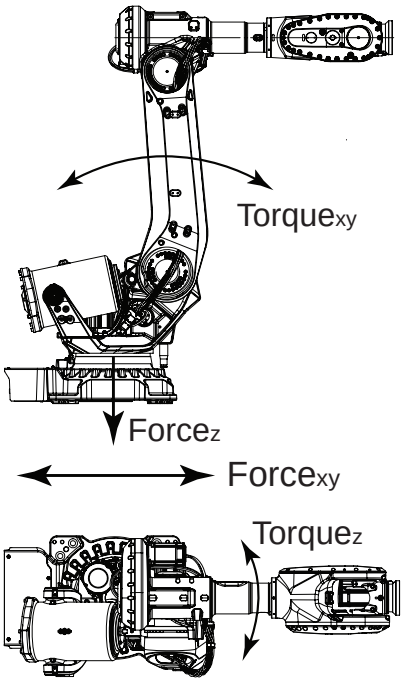
Note

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

The illustration shows the directions of the robots stress forces.



xx2200001958

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	±7.4 kN	±19.4 kN
Force z	14.1 ±4.2 kN	14.1 ±16.3 kN
Torque xy	±19.5 kNm	±35.8 kNm
Torque z	±5 kNm	±12.3 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.

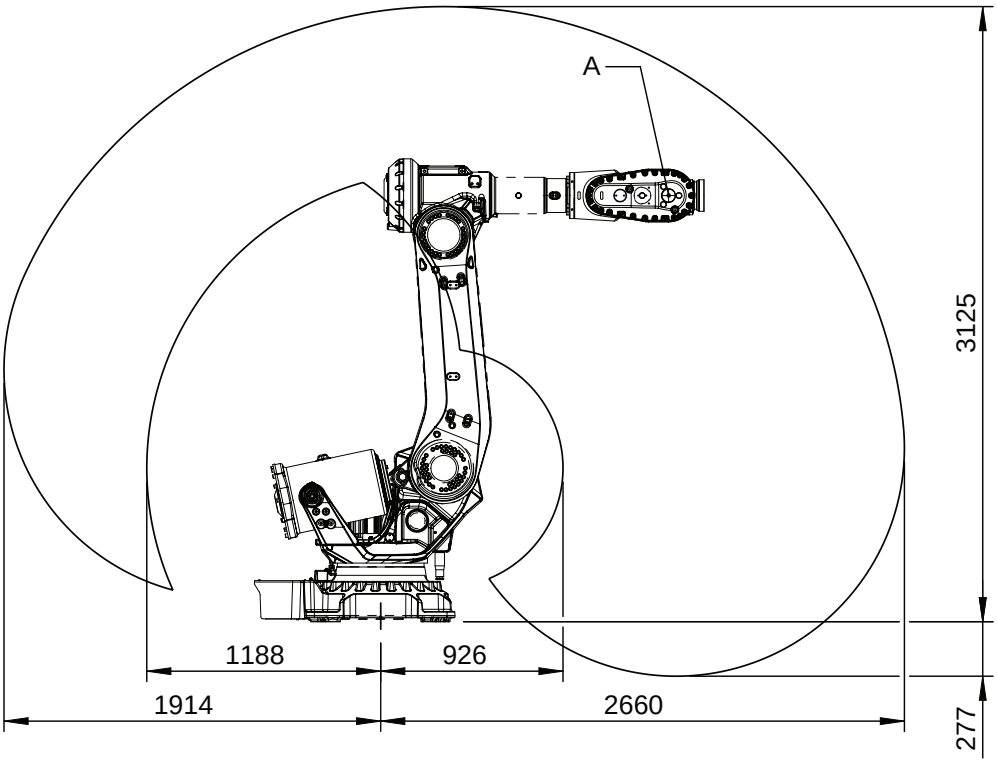
Environmental information

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 6710-210/2.65

This illustration shows the unrestricted working range of the robot.



xx2200001961

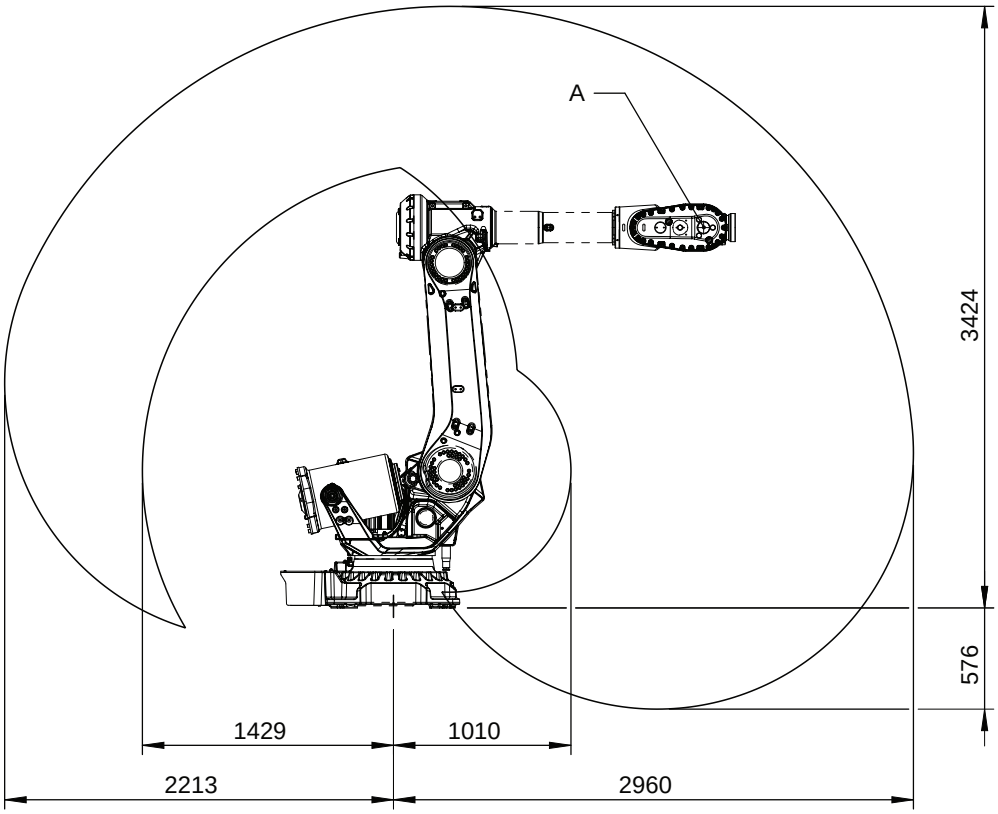
A	Path intersect with axis-5 center

Continues on next page

2.2 Working range
Continued

Illustration, working range IRB 6710-200/2.95

This illustration shows the unrestricted working range of the robot.



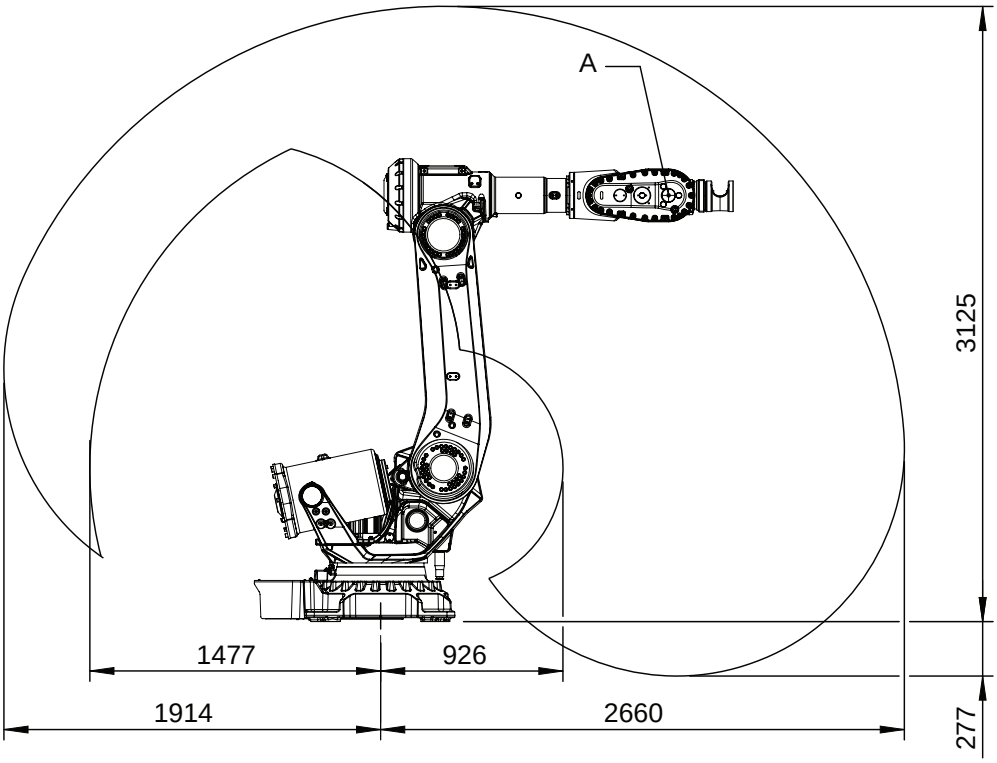
xx2200001962

A	Path intersect with axis-5 center

Continues on next page

Illustration, working range IRB 6710-175/2.65 LID

This illustration shows the unrestricted working range of the robot.



xx2200001963

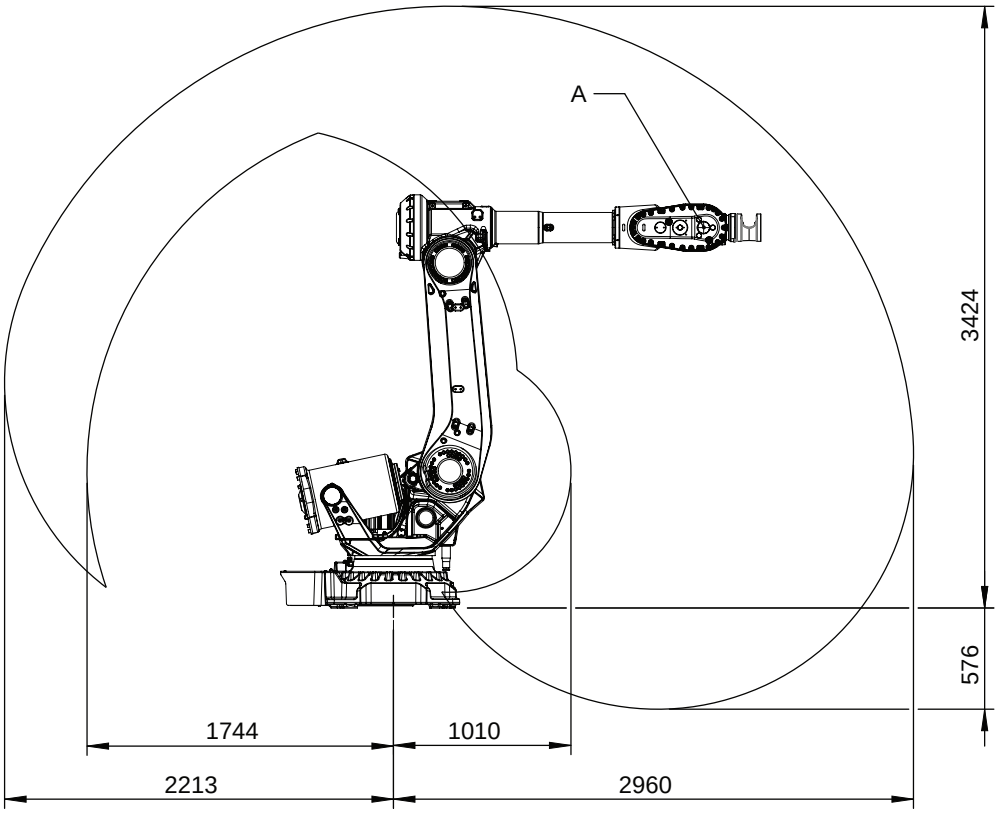
A	Path intersect with axis-5 center

Continues on next page

2.2 Working range
Continued

Illustration, working range IRB 6710-175/2.95 LID

This illustration shows the unrestricted working range of the robot.



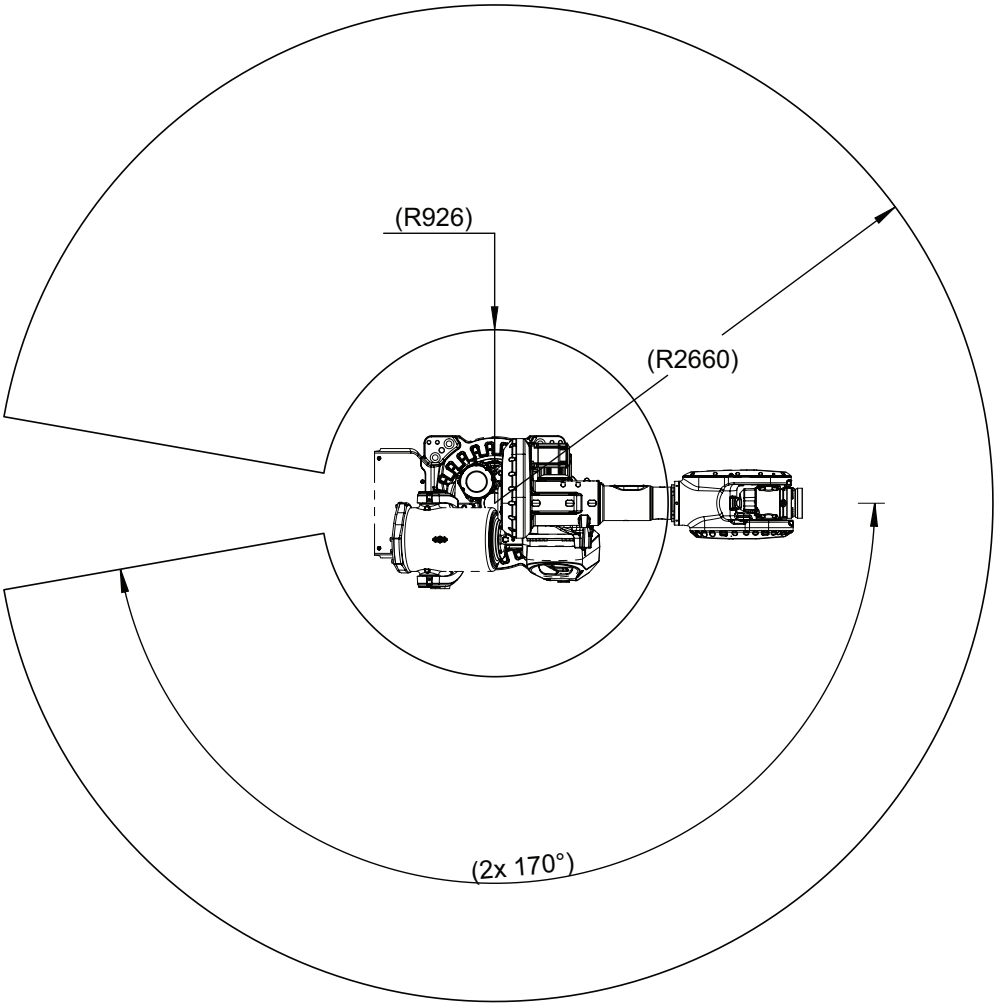
xx2200001964

A	Path intersect with axis-5 center

Continues on next page

Top view of working range

IRB 6710-210/2.65, IRB 6710-175/2.65 LID

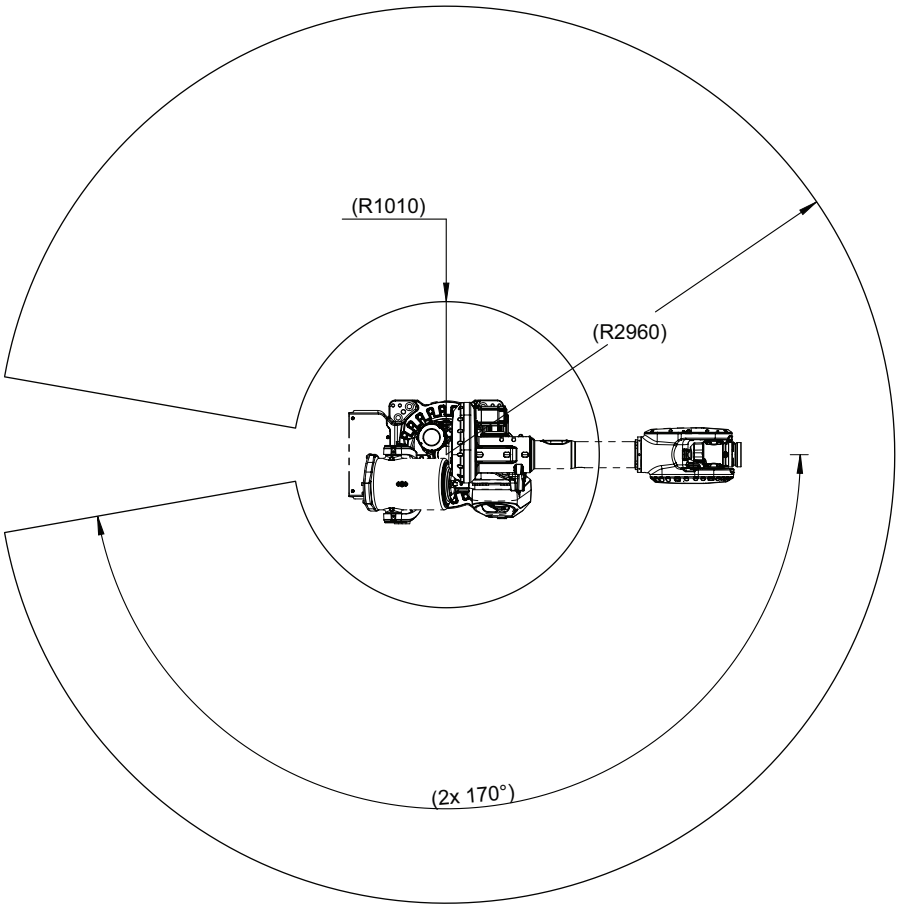


xx2200001985

Continues on next page

2.2 Working range
Continued

IRB 6710-200/2.95, IRB 6710-175/2.95 LID



xx2200001986

Working range

Axis	Working range	Note
Axis 1	±170°	
	±220° i	The default working range for axis 1 can be extended as an option. See *Extended working range, axis 1 (option) on page 89*.
Axis 2	-65°/+85°	
Axis 3	-180° ii/+70°	IRB 6710-210/2.65, IRB 6710-200/2.95
	-160°/+70°	IRB 6710-175/2.65 LID, IRB 6710-175/2.95 LID
Axis 4	±300°	
Axis 5	±130°	IRB 6710-210/2.65, IRB 6710-200/2.95
	±120° iii	IRB 6710-175/2.65 LID, IRB 6710-175/2.95 LID
Axis 6	±360°	IRB 6710-210/2.65, IRB 6710-200/2.95
	±220° *iii*	IRB 6710-175/2.65 LID, IRB 6710-175/2.95 LID

i *Option Extended Working Range Axis 1 (3324-1)*
Not valid with DressPack SW.
ii -160° if lower arm DressPack is installed

Continues on next page

iii 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 85*.

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 6710 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.
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 51*
10	When these prerequisites are met, the robot can be taken to its installation site as described in section: *On-site installation on page 53*
11	Install required equipment, if any.

3.2.2 Risk of tipping/stability

Risk of tipping

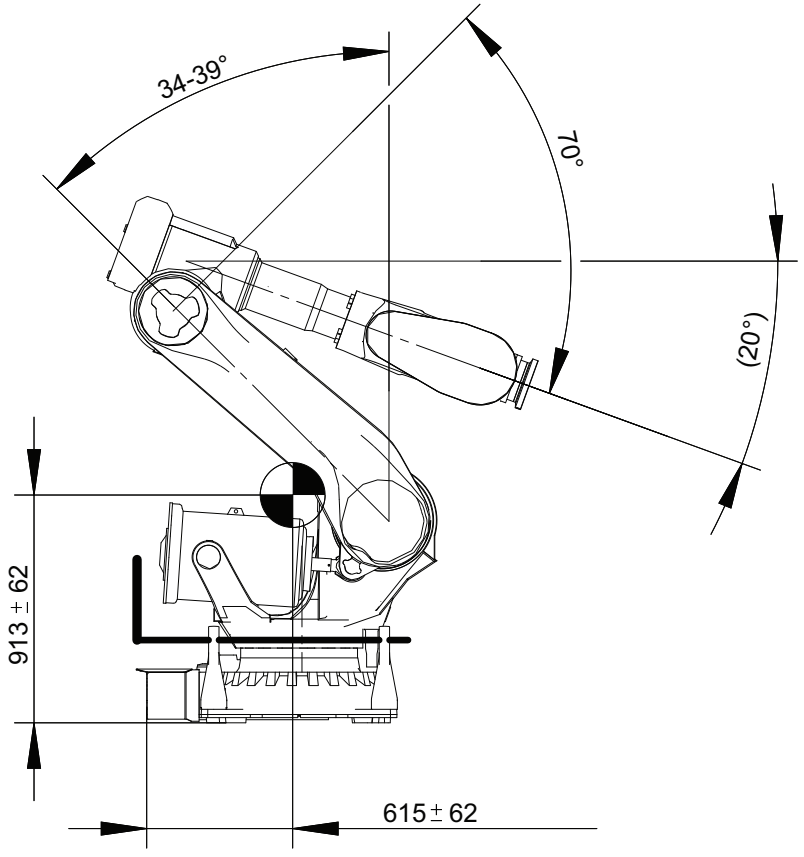
If the robot is not fastened to the foundation while moving the arm, the robot is not stable in the whole working area. Moving the arm will displace the center of gravity, which may cause the robot to tip over.

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.



xx2200001841

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°
Axis 2	-34° to -39°
Axis 3	+70°
Axis 4	0°

Continues on next page

3.2.2 Risk of tipping/stability
Continued

Axis number	Angle of axis
Axis 5	0°
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 50*.

First installation

Use these procedures to install the IRB 6710.

	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 54*.
3	Lift and secure the manipulator to the platform/foundation.	See *Lifting the robot on page 62*. See *Orienting and securing the robot on page 69*.
4	Connect the manipulator to the controller.	See • *Product manual - OmniCore V250XT Type A*
5	Configure the safety settings.	See • *Product manual - OmniCore V250XT Type A*
6	How to start and run the robot is described in the product manual for the controller.	See • *Product manual - OmniCore V250XT Type A*
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 94*.	

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

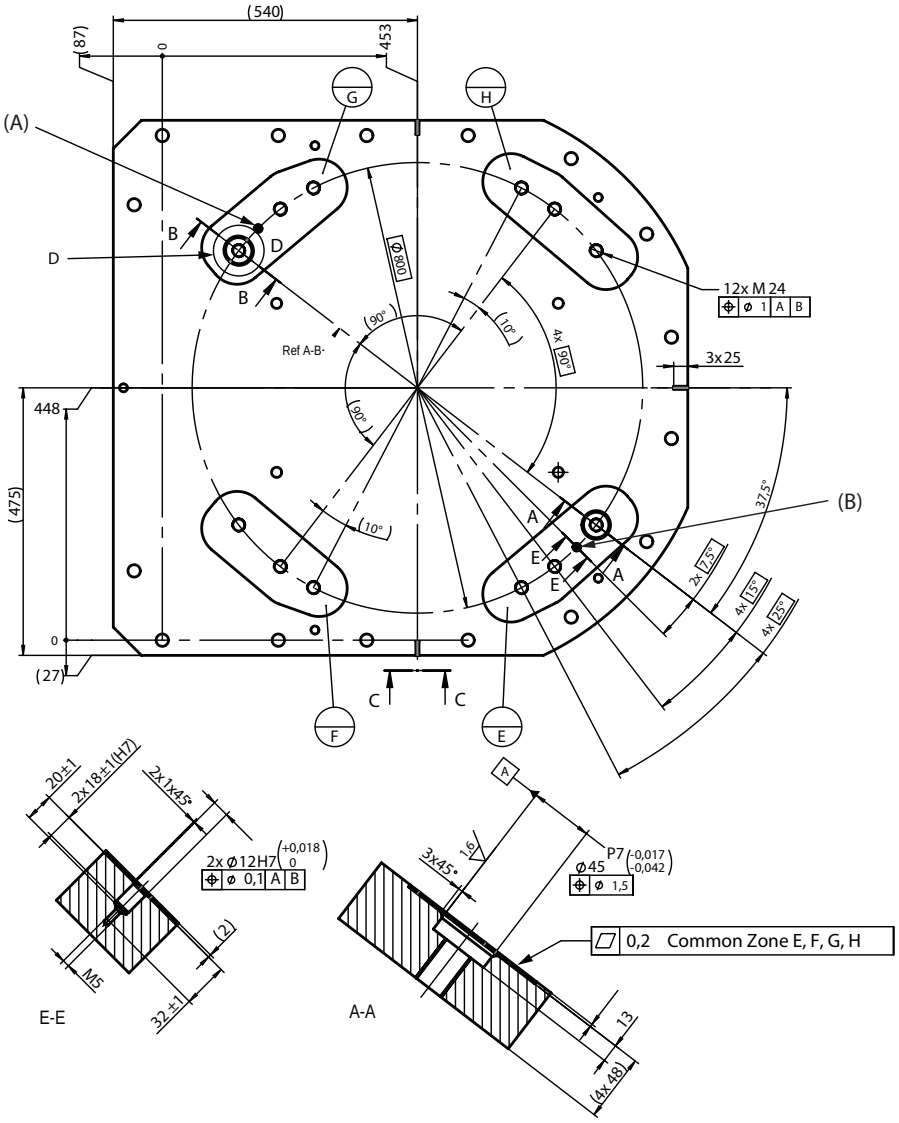
Note

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

Continues on next page

Base plate drawing

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



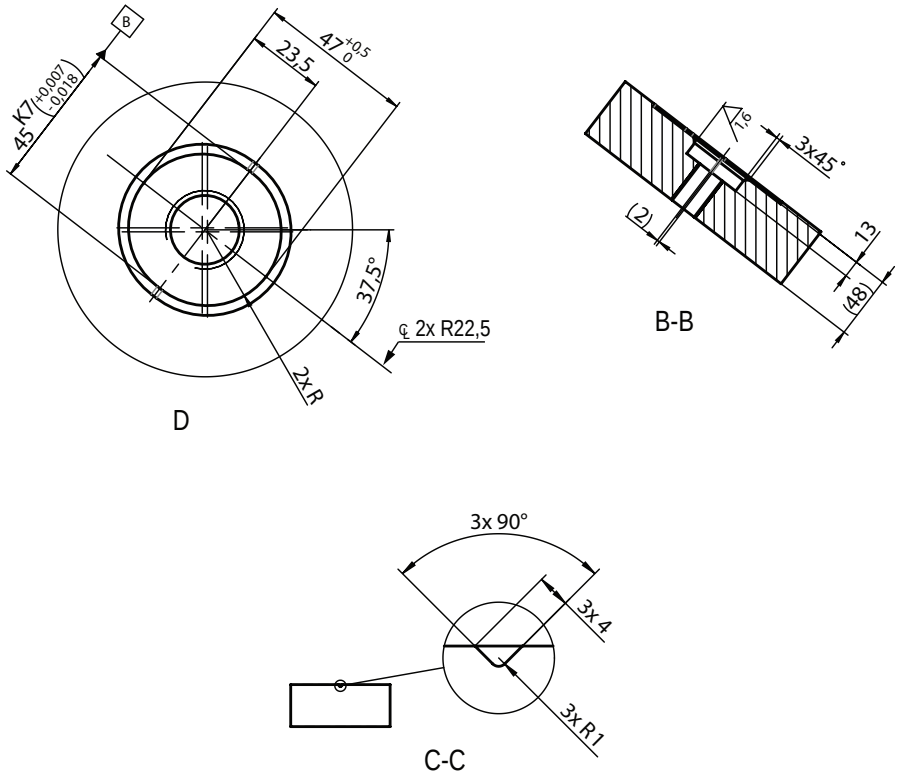
xx1500000246

Pos	Description
A, B	Hole for guide pin, cylindrical, see *Guide pins on page 58*
E, F, G, H	Common tolerance zone (accuracy all over the base plate from one contact surface to the other)

Continues on next page

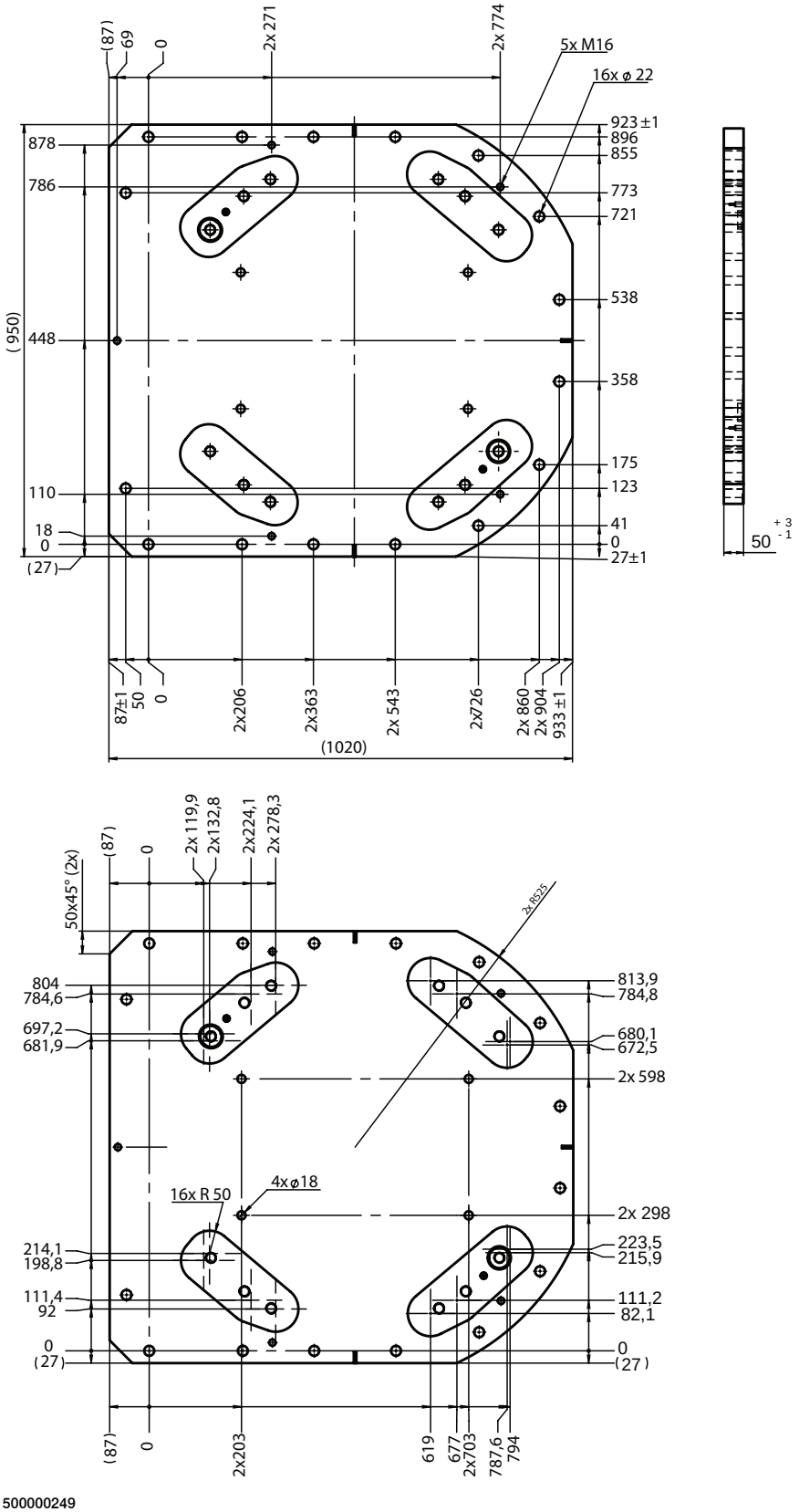
3.3.2 Installing a base plate

Continued



xx1500000247

Continues on next page

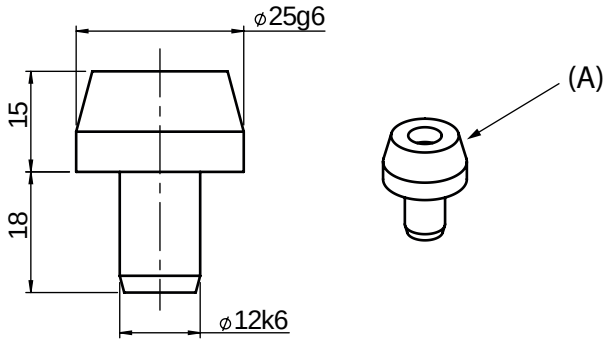


xx1500000249

Continues on next page

3.3.2 Installing a base plate
Continued

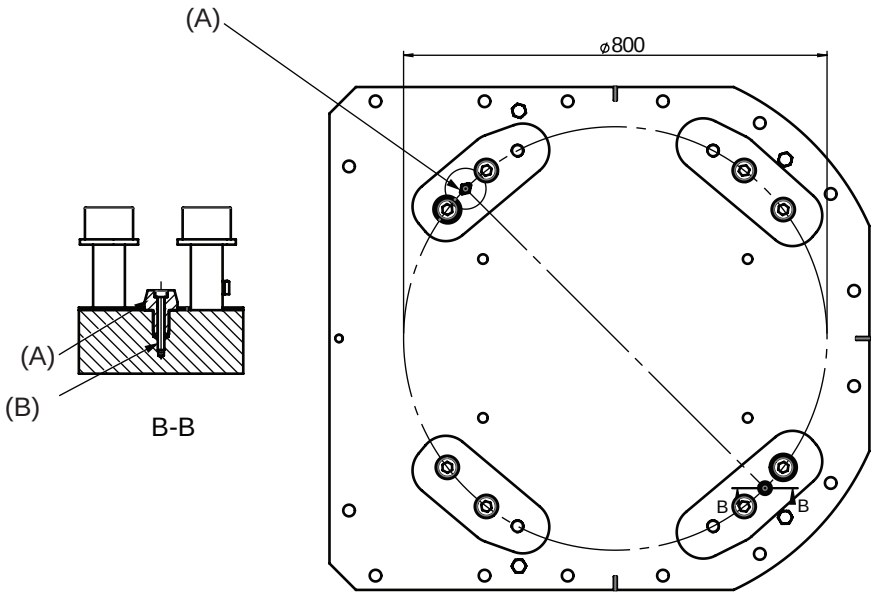
Guide pins



XX1500000248

Pos	Description
A	Cylindrical guide pin (x2) (Requires attachment screws, see *Assembly of guide pins on page 58*.)

Assembly of guide pins

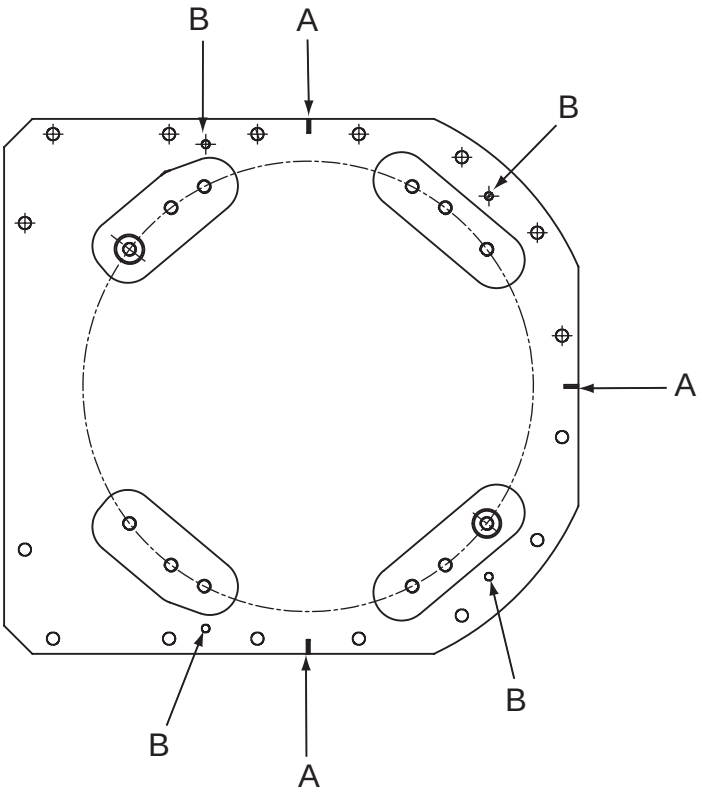


Pos	Description
A	Cylindrical guide pin (x2)
B	M5 x 40. Tightening torque 6 Nm. (x2)

Continues on next page

Base plate, orienting grooves and leveling bolts

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



xx1500000312

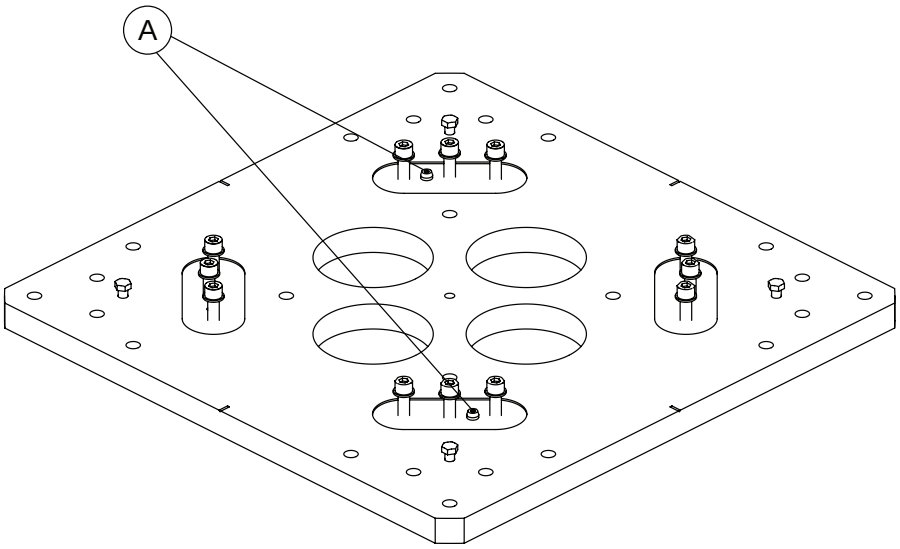
A	Orienting grooves (3 pcs)
B	Levelling bolts, attachment holes (4 pcs)

Continues on next page

3.3.2 Installing a base plate
Continued

Base plate, locating pins

The illustration below shows the locating pins in the base plate.

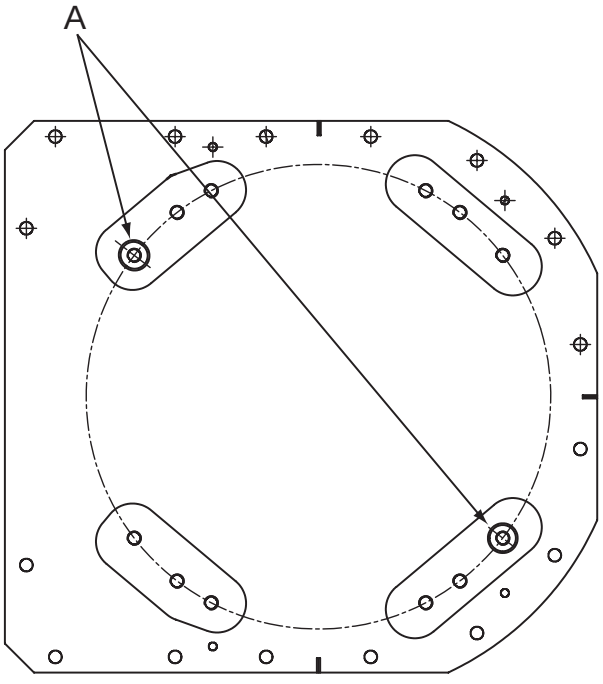


xx1700001591

A	Locating pins (2 pcs)

Base plate, guide sleeve holes

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



xx0300000045

A	Guide sleeve holes (2 pcs)

Continues on next page

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 59*.
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 59*.
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.	
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 robot with lifting accessory (recommended lifting method)

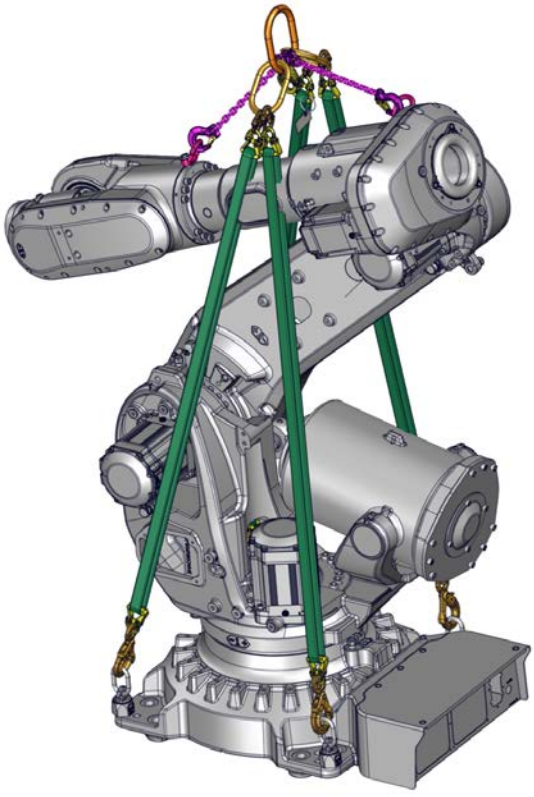
General

This section contains a general overview of how to lift the complete robot using special lifting accessory.

Illustration, lifting accessory

The following figure shows the principle for how to use and lift the entire robot with lifting accessory. For a more detailed instruction, see the user instructions enclosed with the accessory.

> **Note**
>
> The user manual may be out of date. The latest revision is available for download via myABB Business Portal, *www.abb.com/myABB*.



xx2200002013

Required equipment

Equipment	Article number	Note
Lifting accessory, robot	3HAC15607-1	Includes user instructions 3HAC15971-2

Continues on next page

Slings attached directly onto robot

This section details how to lift and move the robot using lifting slings when these are attached directly onto the robot.

Note

Please refer to the enclosed user instruction for instruction how to place the manipulator in an correct position. Attempting to lift a manipulator in any other position may result in the robot tipping over, causing severe damage or injury!

	Action	Note
1	Run the overhead crane to a position above the robot.	
2	Position the robot as detailed in enclosed instruction!	Article number is specified in *Required equipment on page 62*. Release the brakes, if required, as detailed in section *Manually releasing the brakes on page 72*.
3	Fit the *lifting accessory* to the robot as described in the enclosed instruction! Go to the user instructions enclosed with the lifting accessory. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Article number is specified in *Required equipment on page 62*.
4	**CAUTION** The IRB 6710 robot weighs . IRB 6710-210/2.65: 1,140 kg IRB 6710-200/2.95: 1,150 kg IRB 6710-175/2.65 LID: 1,200 kg IRB 6710-175/2.95 LID: 1,210 kg All lifting accessories used must be sized accordingly!	
5	**WARNING** Personnel must not, under any circumstances, be present under the suspended load!	
6	Raise overhead crane to lift the robot.	Make sure all hooks and attachments maintain their correct positions while lifting the robot! Always move the robot at very low speeds, making sure it does not tip.

3.3.3.2 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 according to the user instructions enclosed with the fork lift accessory.	

3.3.3.3 Lifting the robot with roundslings

Recommended lifting method

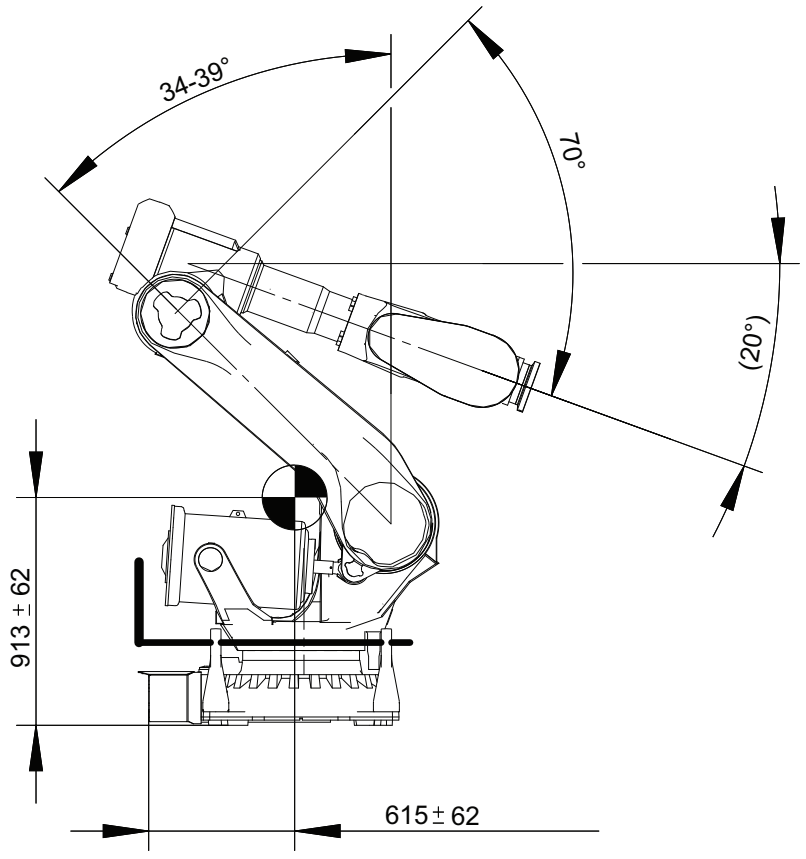
Recommended lifting method for the robot includes one of following lifting accessories:

- Lifting accessory set: 3HAC15607-1. See *Lifting robot with lifting accessory (recommended lifting method) on page 62*.
- Fork lift accessory set: 3HAC047054-003. See *Lifting the robot with fork lift on page 64*.

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.



xx2200001841

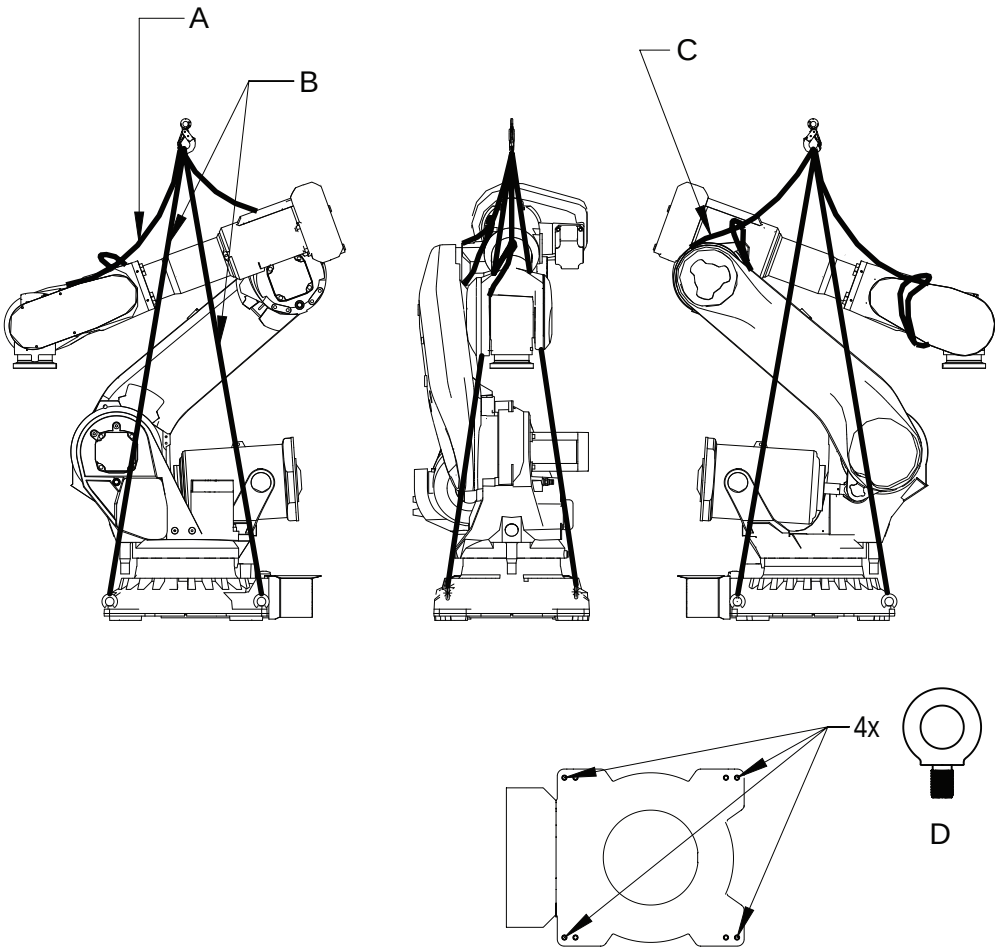
DANGER

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

3.3.3.3 Lifting the robot with roundslings
Continued

Illustration - attaching the roundslings



xx2200001829

Pos	Description	Note	Quantity
A	Roundsling	2 -3 m depending on robot variant. [i]	1 pcs
B	Roundsling	2.5 m	4 pcs
C	Roundsling	2 - 2.5 m depending on robot variant. [ii]	1 pcs
D	Lifting eye M20		4 pcs

i Fit the roundsling with slack. They prevent the robot from rotating if there is a sudden stop during transport.

ii Fit the roundsling with slack. They prevent the robot from rotating if there is a sudden stop during transport.

CAUTION

The weight of the IRB 6710 robot is

IRB 6710-210/2.65: 1,140 kg

IRB 6710-200/2.95: 1,150 kg

IRB 6710-175/2.65 LID: 1,200 kg

IRB 6710-175/2.95 LID: 1,210 kg

All lifting accessories used must be sized accordingly.

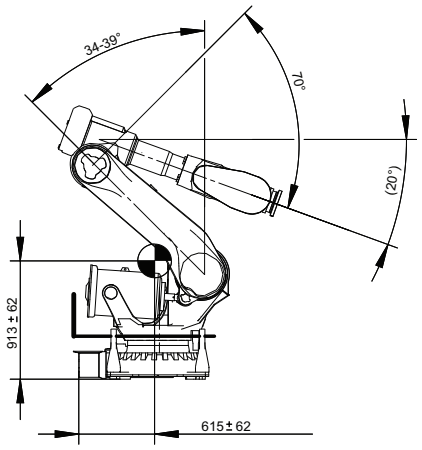
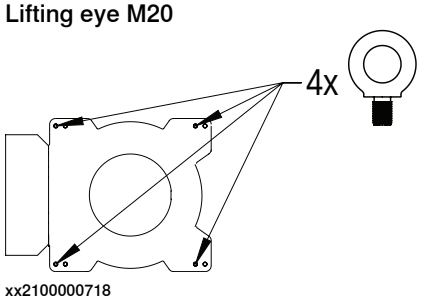
Continues on next page

Required tools and equipment

Equipment	Article number	Note
Overhead crane	-	
Roundslings and lifting eyes	-	See *Illustration - attaching the roundslings on page 66*.

Lifting the robot with roundslings

Use this procedure to lift the robot with roundslings.

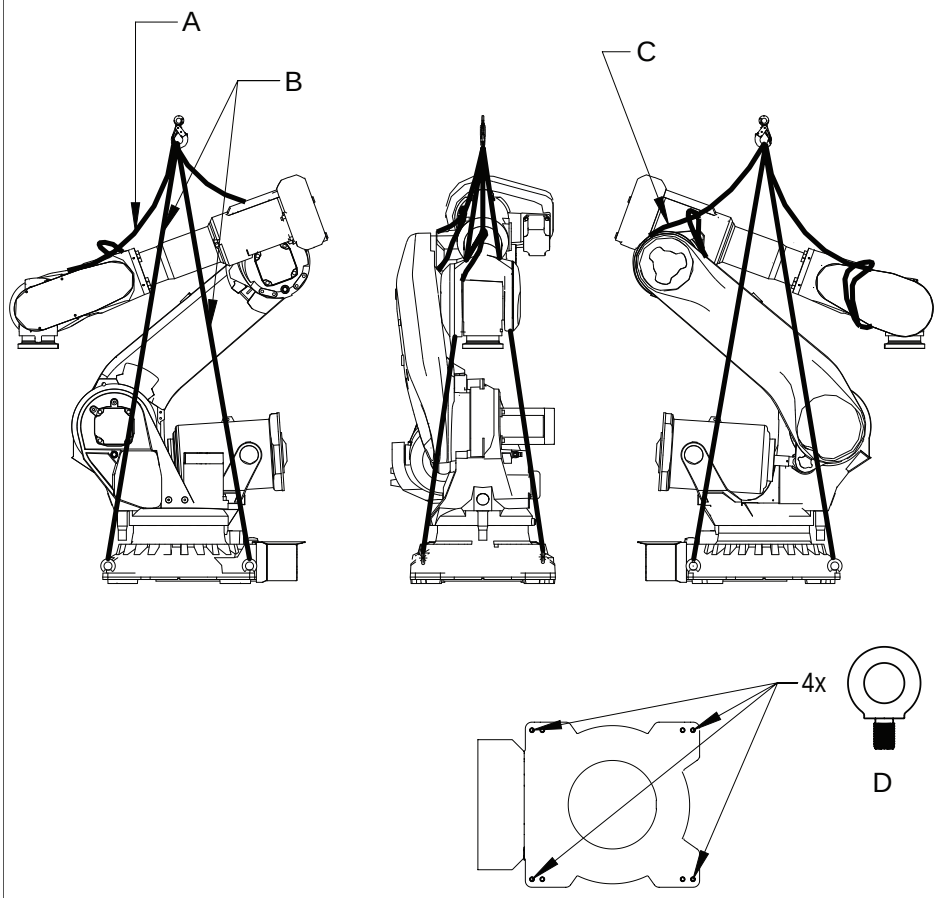
	Action	Note
1	Make sure the robot is positioned in the recommended position for transportation and lifting. **WARNING** The robot is mechanically unstable if not secured to the foundation.	 xx2200001841
2	**CAUTION** The weight of the IRB 6710 robot is IRB 6710-210/2.65: 1,140 kg IRB 6710-200/2.95: 1,150 kg IRB 6710-175/2.65 LID: 1,200 kg IRB 6710-175/2.95 LID: 1,210 kg All lifting accessories used must be sized accordingly.	
3	Fit four lifting eyes to the base of the robot.	Lifting eye M20  xx2100000718

Continues on next page

3.3.3.3 Lifting the robot with roundslings

Continued

	Action	Note
4	Attach the roundslings to the robot according to the figure. Make sure the roundslings do not rub against any sharp edges. Fit roundslings A and C with slack. They prevent the robot from rotating if there is a sudden stop during transport.	
5	**WARNING** Personnel must not, under any circumstances, be present under the suspended load.	
6	Raise the overhead crane to lift the robot.	



xx2200001829

Pos	Description	Note	Quantity
A	Roundsling	2 -3 m depending on robot variant. [i]	1 pcs
B	Roundsling	2.5 m	4 pcs
C	Roundsling	2 - 2.5 m depending on robot variant. [ii]	1 pcs
D	Lifting eye M20		4 pcs

i Fit the roundsling with slack. They prevent the robot from rotating if there is a sudden stop during transport.

ii Fit the roundsling with slack. They prevent the robot from rotating if there is a sudden stop during transport.

3.3.4 Orienting and securing the robot

General

This section describes how to orient and secure the robot to the base plate or 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/foundation.

Suitable screws	M24 x 100
Quantity	8 pcs
Quality	8.8
Suitable washer	4 mm flat washer
Guide pins	Guide pins are required if mounting the manipulator to a track motion or to a base plate. For more information, see *Guide pins on page 58*.
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. The foundation surface must be clean and unpainted. If using a base plate: fit two guide sleeves to the guide sleeve holes in the base plate. See *Base plate, guide sleeve holes on page 60*.	The hole configuration of the base is shown in the figure in *Hole configuration, base on page 71*.
3	**CAUTION** The weight of the IRB 6710 robot is IRB 6710-210/2.65: 1,140 kg IRB 6710-200/2.95: 1,150 kg IRB 6710-175/2.65 LID: 1,200 kg IRB 6710-175/2.95 LID: 1,210 kg All lifting accessories used must be sized accordingly.	

Continues on next page

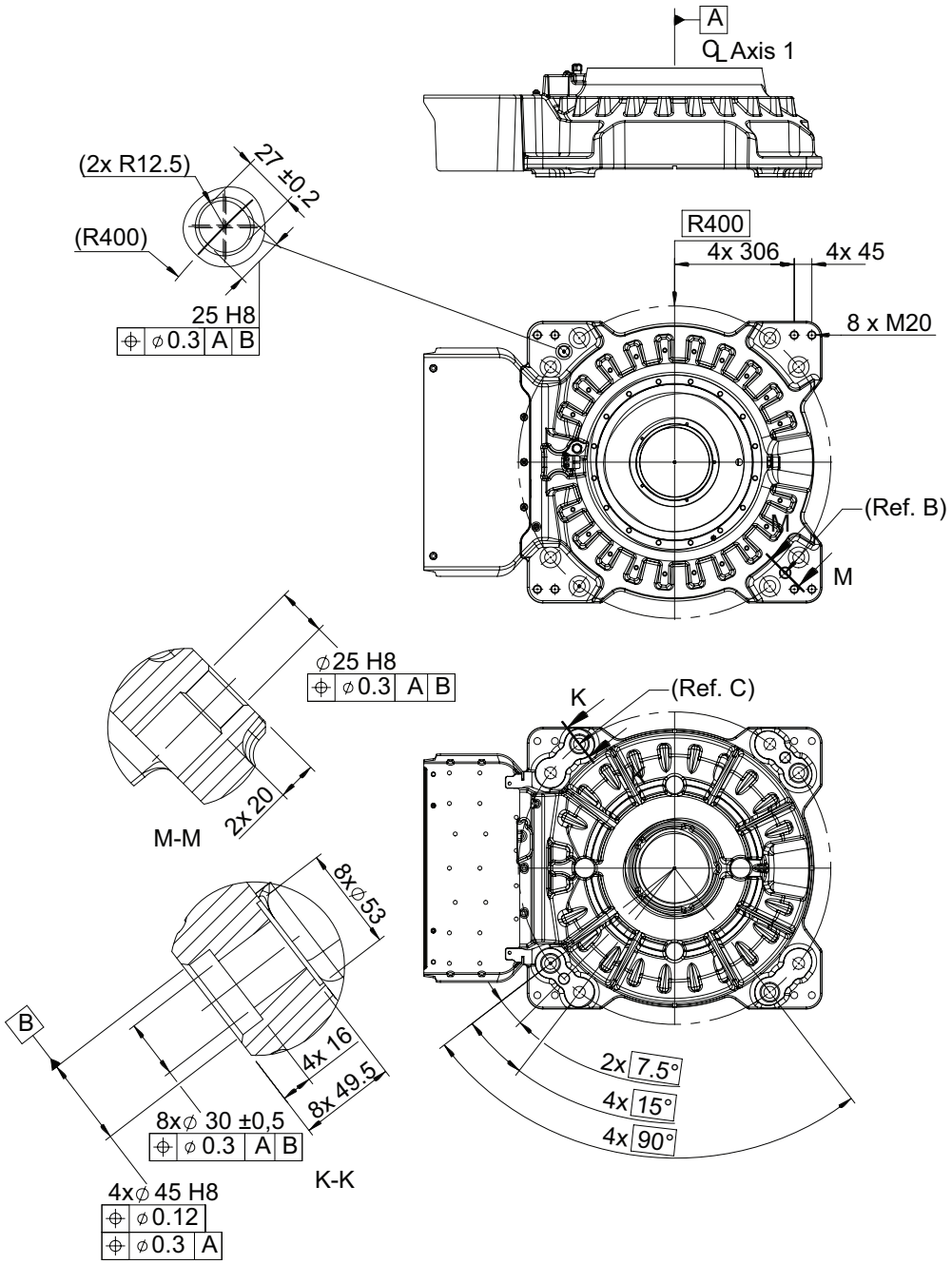
3.3.4 Orienting and securing the robot
Continued

	Action	Note
4	**CAUTION** When the robot is put down after being lifted or transported, there is a risk of it tipping, if not properly secured.	
5	Lift the robot.	See *Lifting the robot on page 62*.
6	Fit two pins to the holes in the base.	Guide pins are required if mounting the manipulator to a track motion or to a base plate. For more information, see *Guide pins on page 58*.
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, 8 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.



xx2200001840

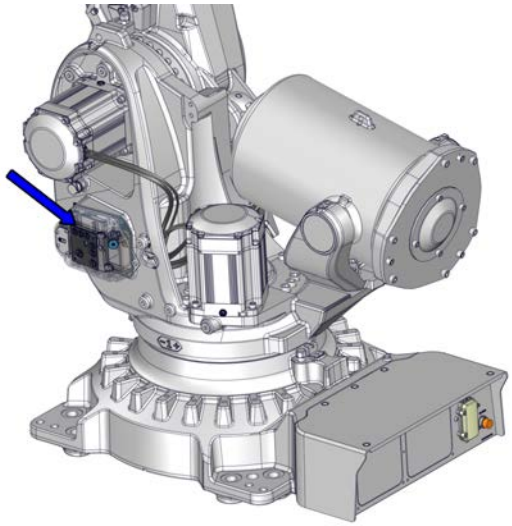
3.3.5 Manually releasing the brakes

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.



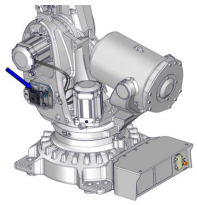
xx2200001727

Releasing the brakes

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

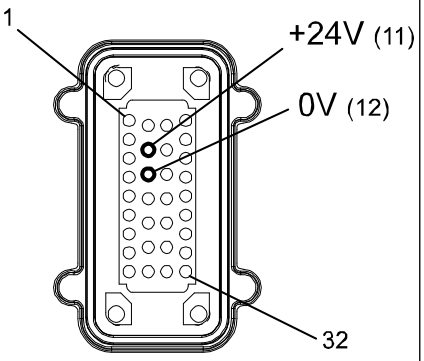
	Action	Note
1	The internal brake release unit is equipped with buttons for controlling the axes brakes. The buttons are numbered according to the numbers of the axes. **Note** If the robot is not connected to the controller, power must be supplied to the connector R1.MP according to the section *Supplying power to connector R1.MP on page 73*.	
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

	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.	 xx2200001727

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 72*.	

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.

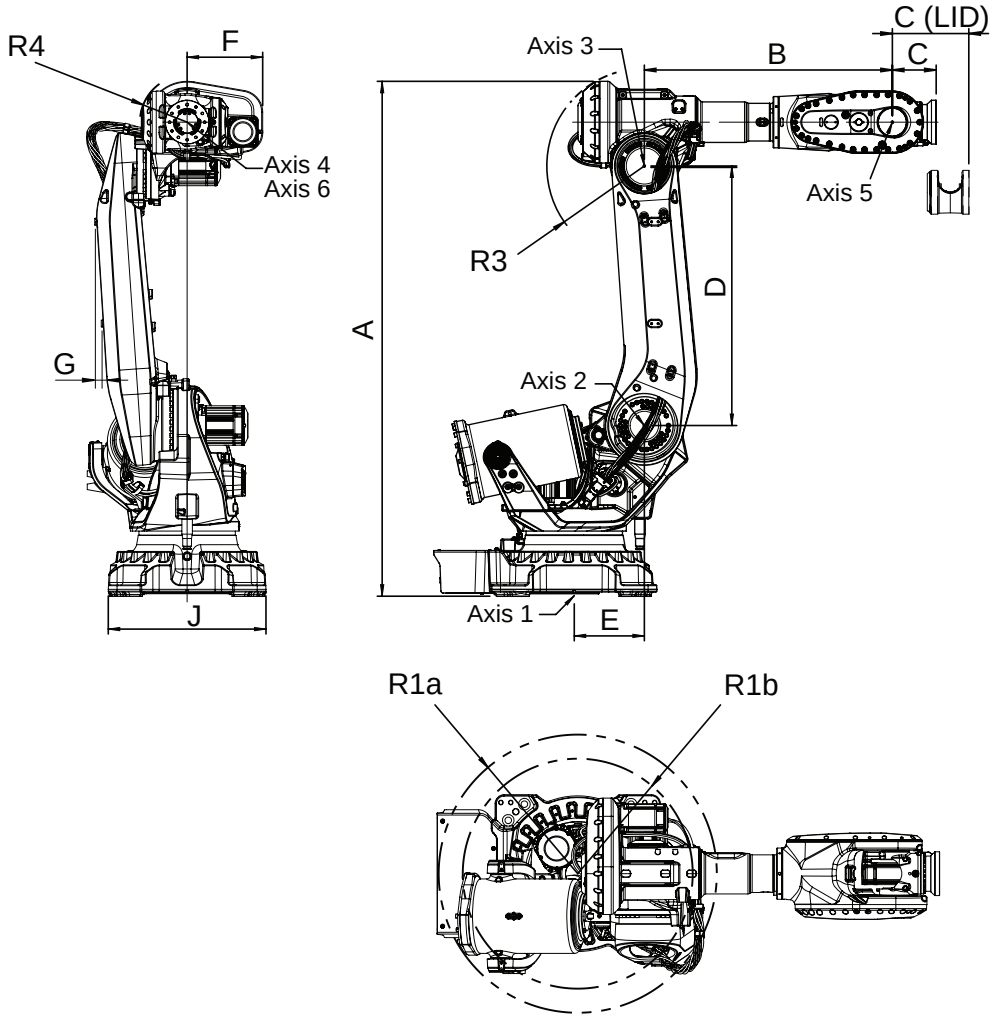
Stopping time and braking distances

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



xx2200002031

R1a	Smallest circumscribed radius around axis 1 (back side)
R1b	Smallest circumscribed radius around axis 1 (front side)
R3	Smallest circumscribed radius around axis 3
R4	Smallest circumscribed radius around axis 4

Measurements

The measurements are given in mm.

Variant	A	B	C	D	E	F	G	R1a	R1b	R3	R4
IRB 6710-210/2.65	2,351.5	1,142.5	180	1,185	320	345	30	634	525	446	200
IRB 6710-200/2.95	2,351.5	1,445.5	180	1,185	320	345	30	634	525	446	200
IRB 6710-175/2.65 LID	2,351.5	1,142.5	346	1,185	320	345	30	634	525	446	200

Continues on next page

3.3.7 Fitting equipment on the robot (robot dimensions)
Continued

Variant	A	B	C	D	E	F	G	R1a	R1b	R3	R4
IRB 6710-175/2.95 LID	2,351.5	1,445.5	346	1,185	320	345	30	634	525	446	200

Extra load on the robot

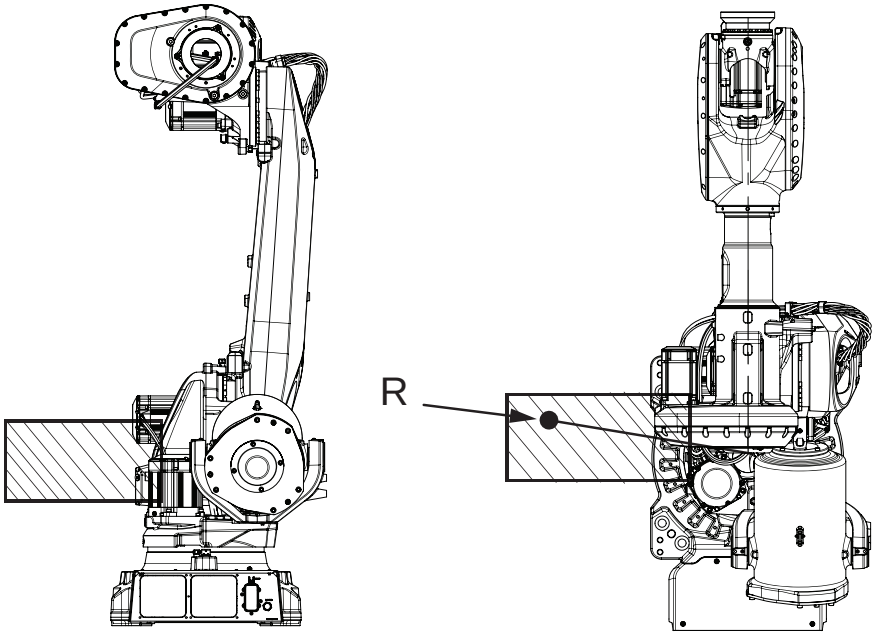
Extra loads can be mounted on robot. Definitions of dimensions and masses are shown in the following figures. The robot is supplied with holes for fitting extra equipment.

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)

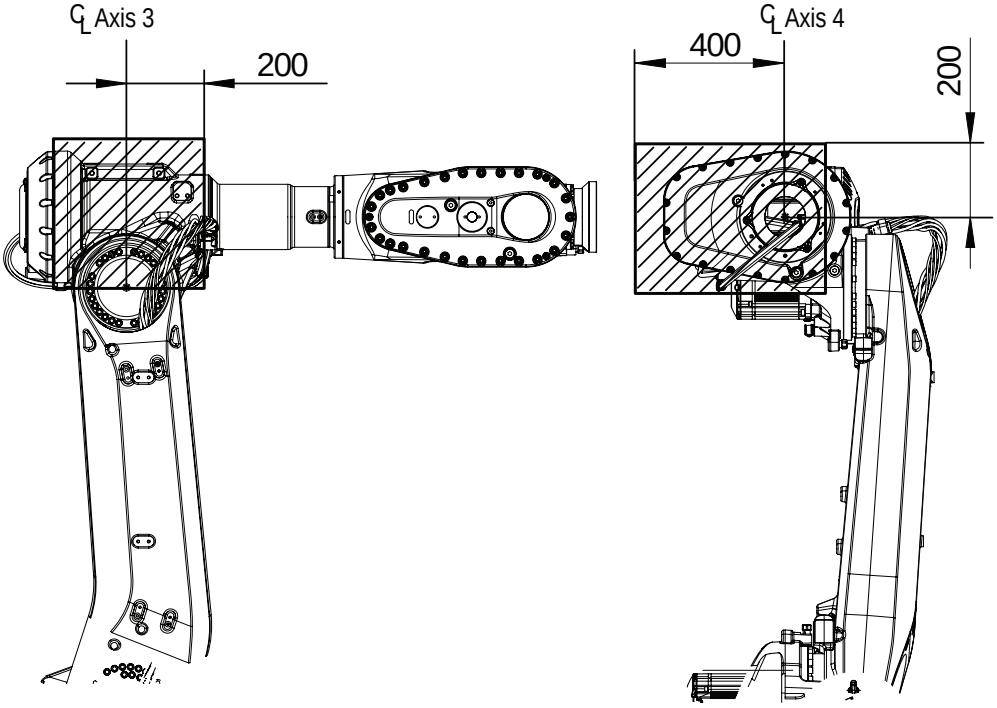


xx2300000346

Continues on next page

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.



xx2200002036

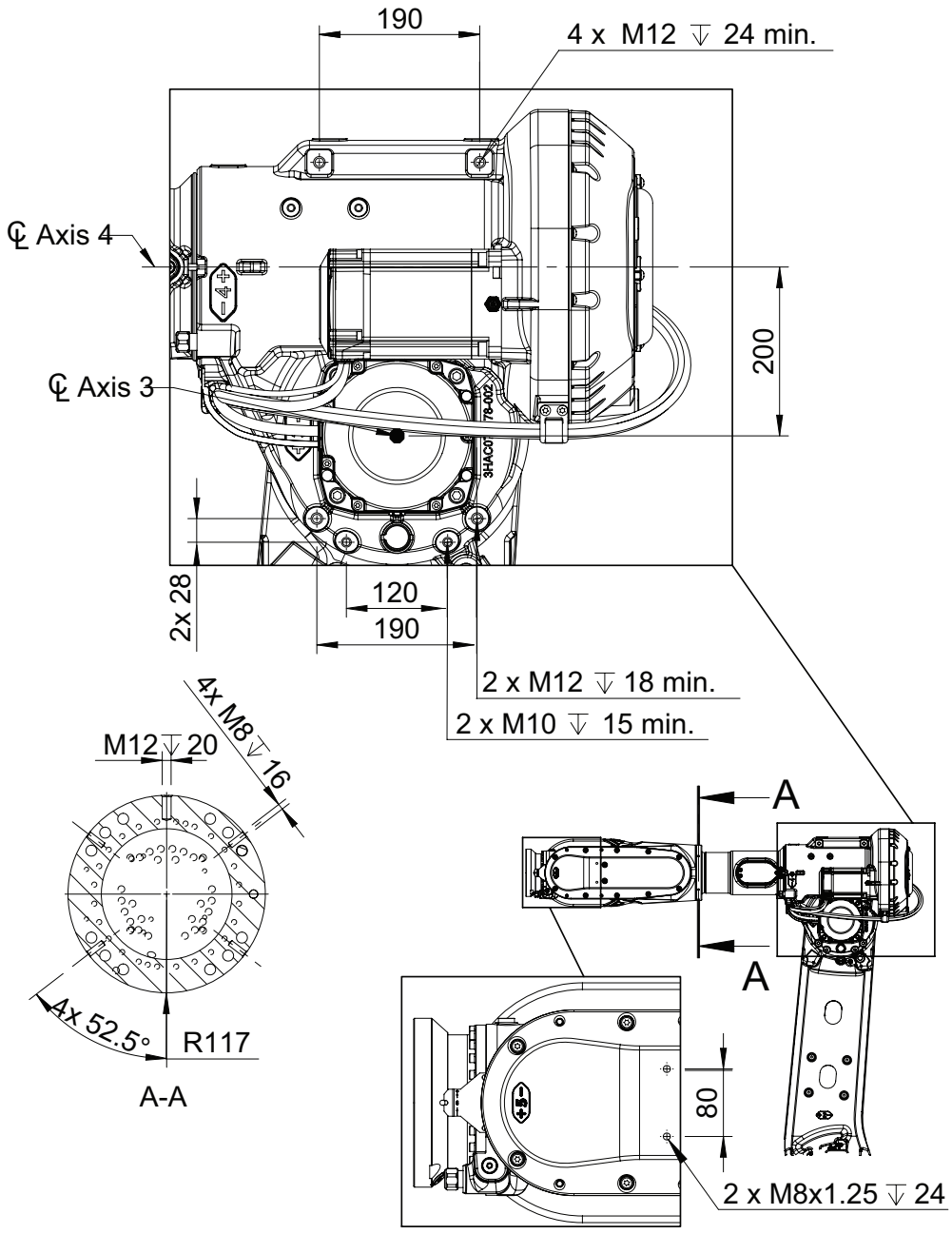
Continues on next page

3.3.7 Fitting equipment on the robot (robot dimensions)
Continued

Attachment holes for fitting extra equipment

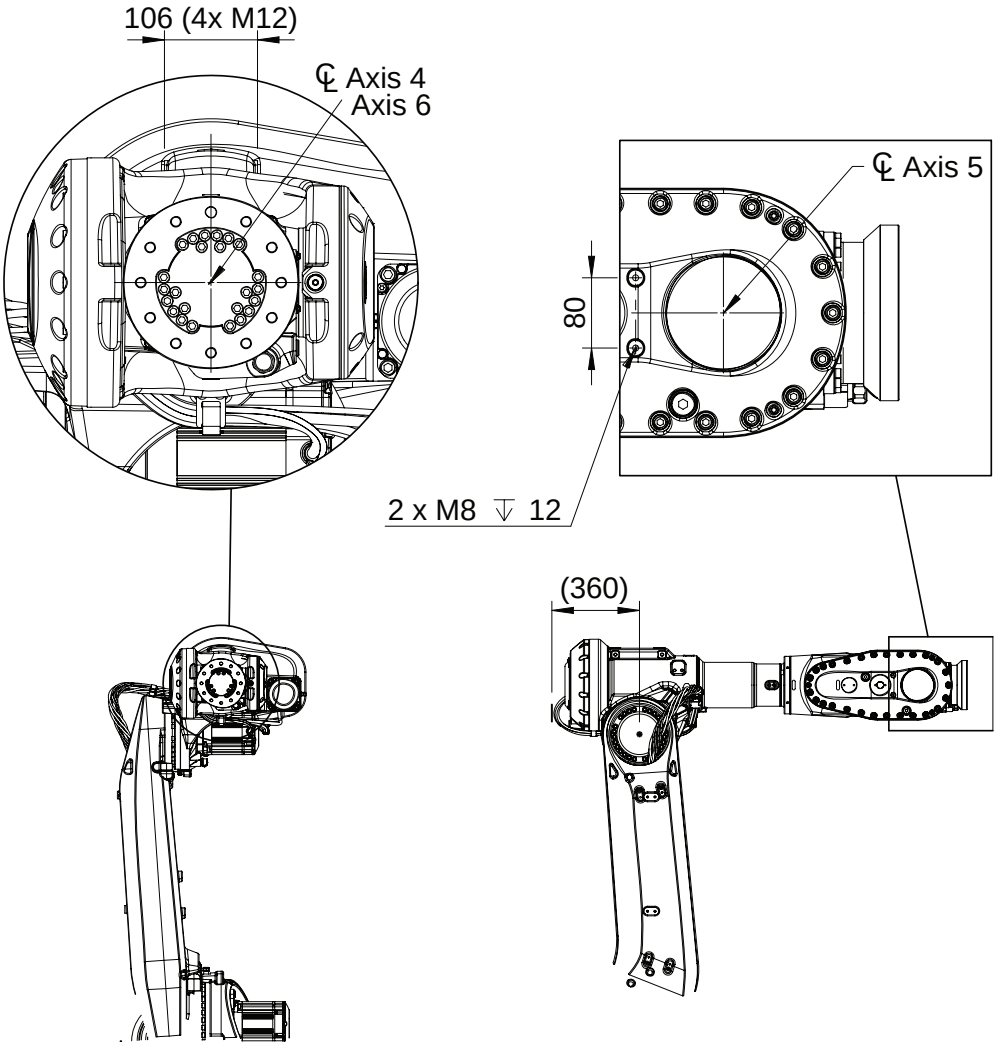
The robot is supplied with holes for fitting extra equipment.

Upper arm



xx2200002039

Continues on next page

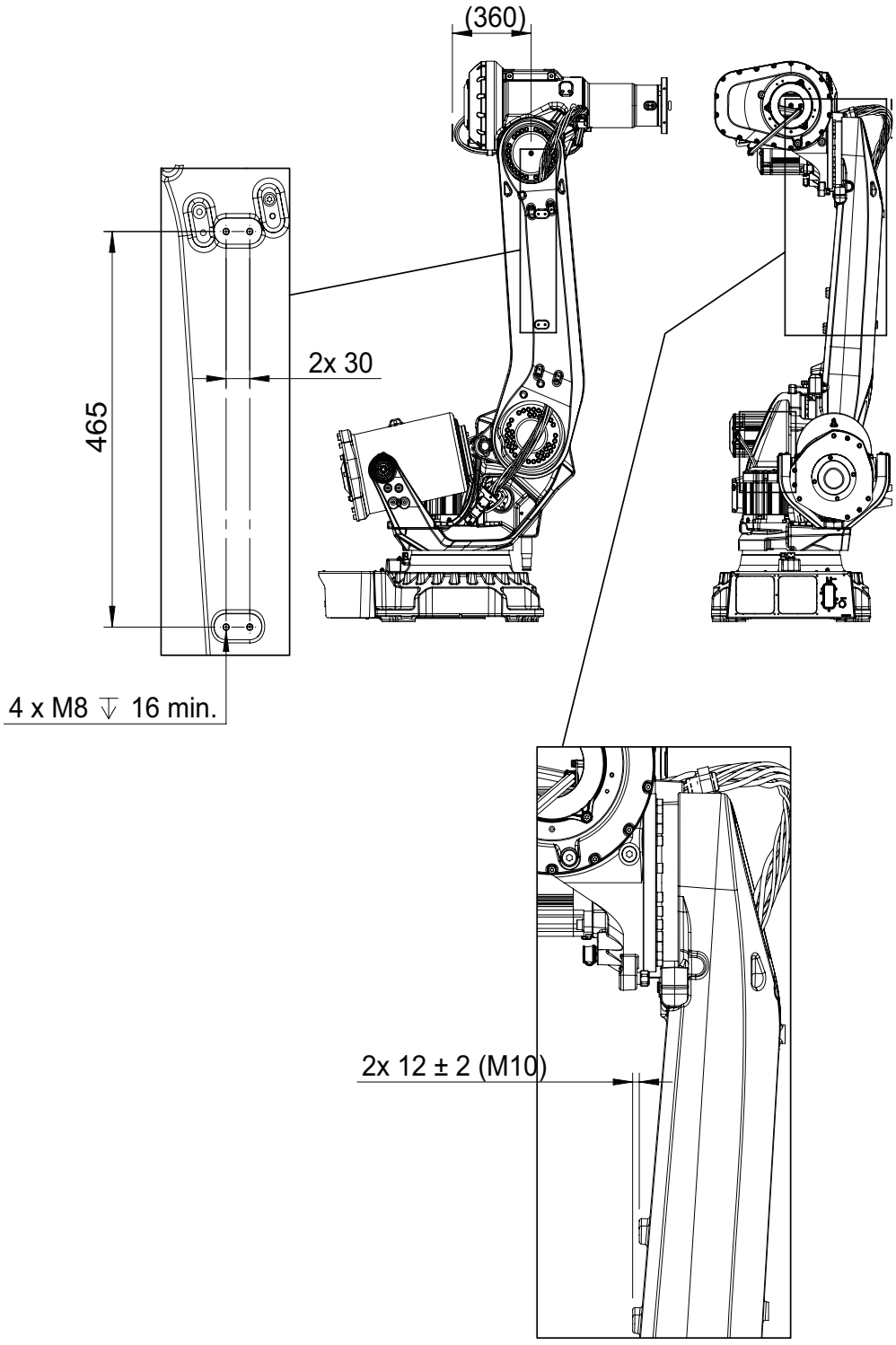


xx2200002040

Continues on next page

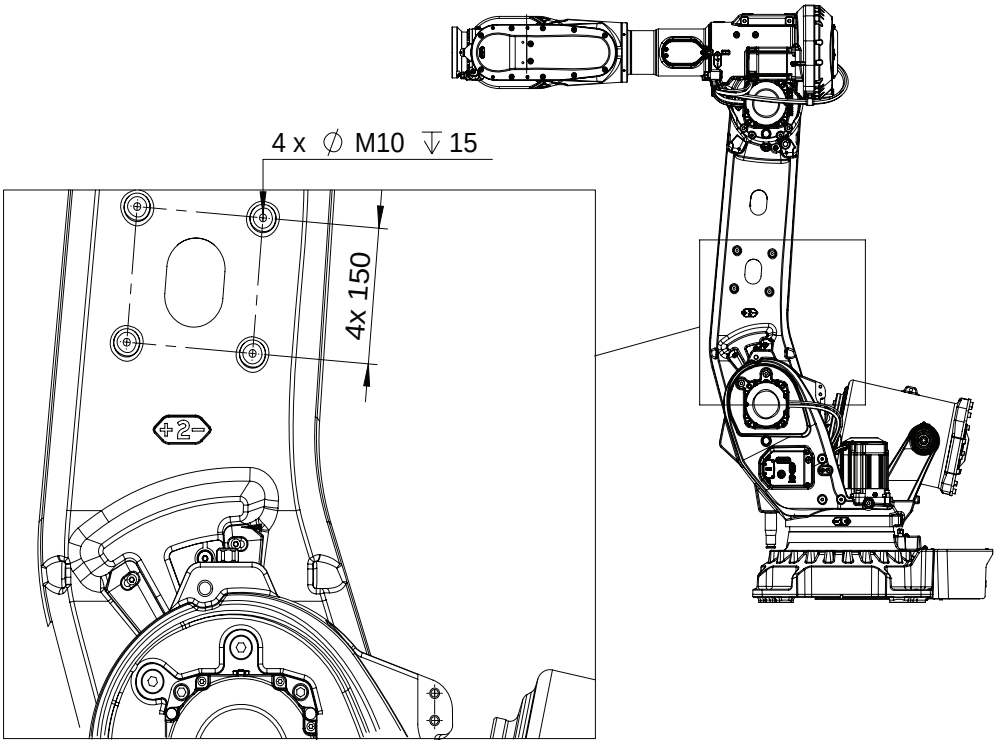
3.3.7 Fitting equipment on the robot (robot dimensions)
Continued

Lower arm



xx2200002055

Continues on next page

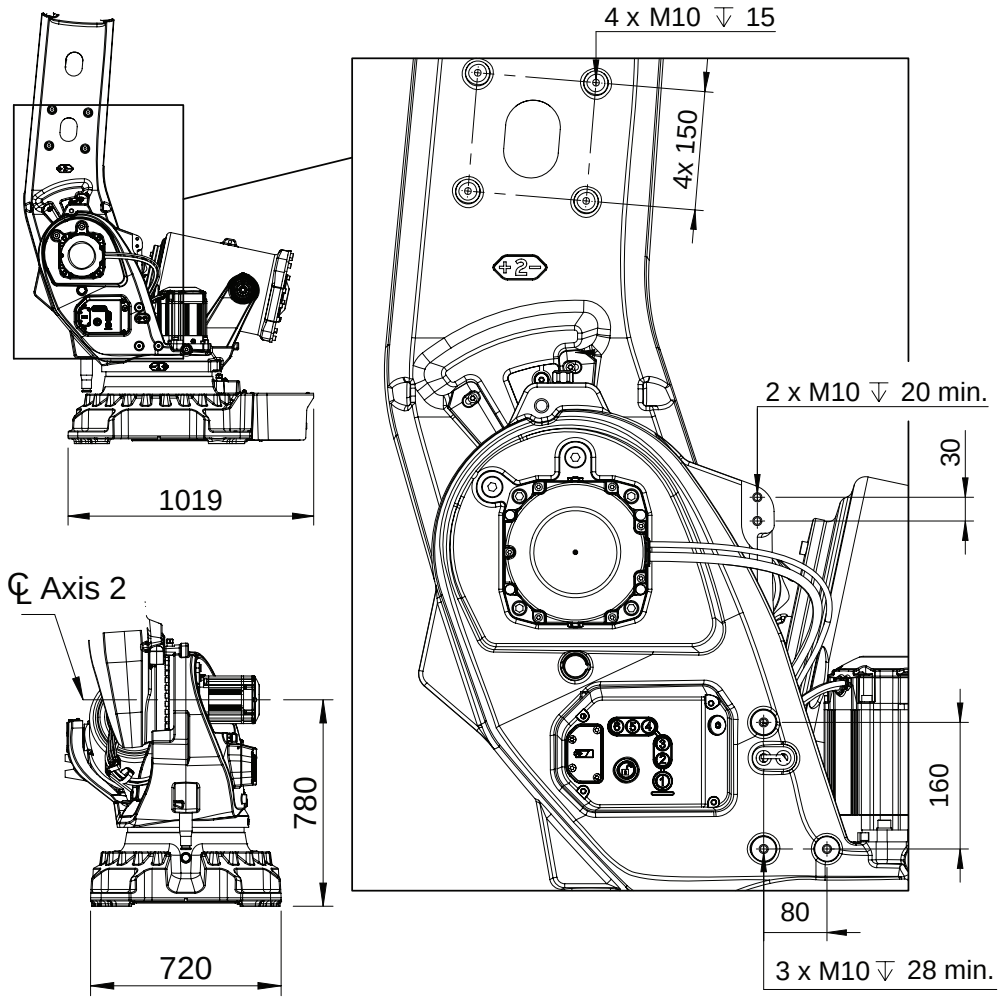


xx2200002056

Continues on next page

3.3.7 Fitting equipment on the robot (robot dimensions)
Continued

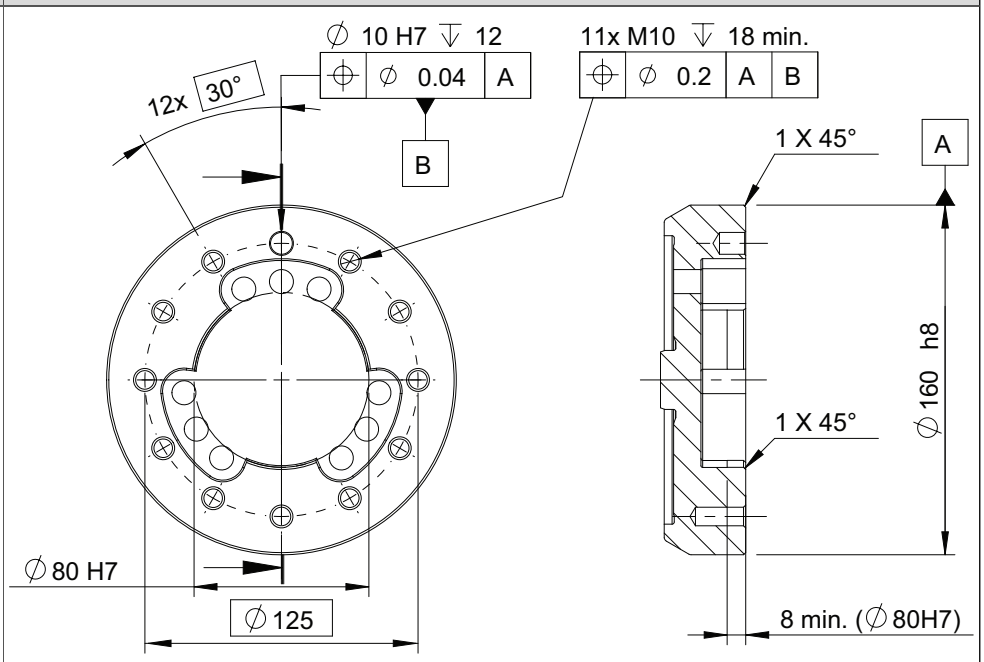
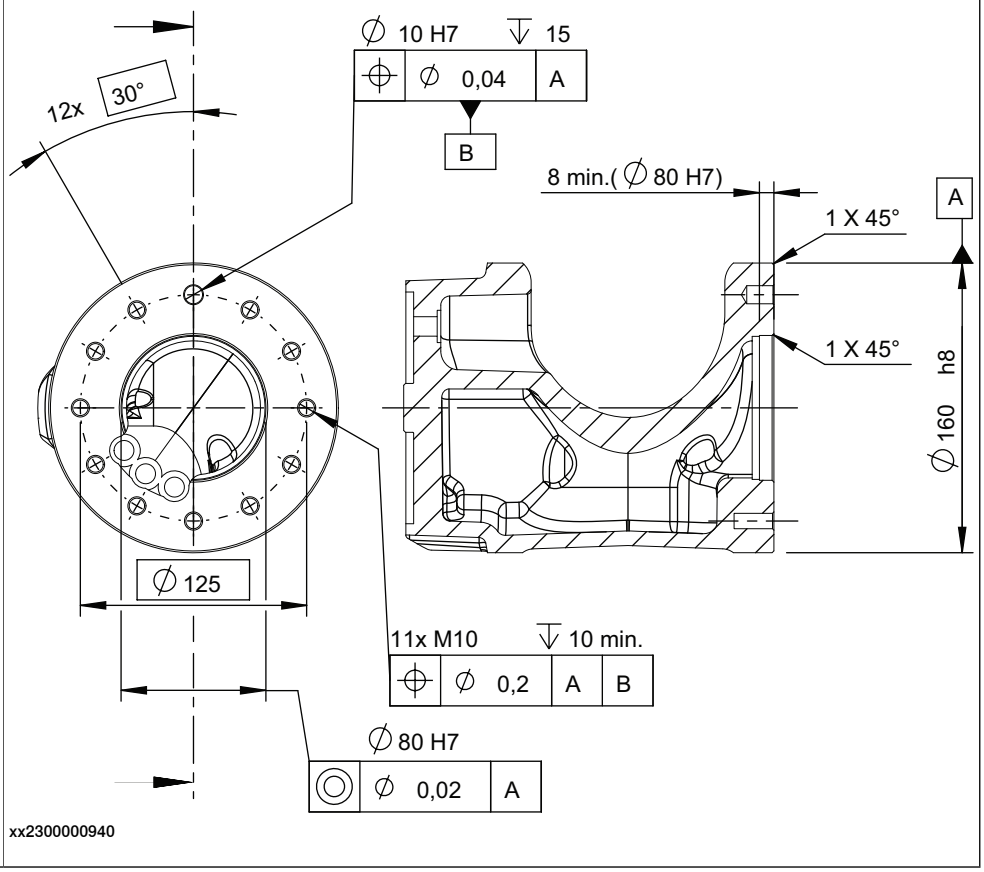
Frame



xx2200002057

Continues on next page

Tool flange dimensions

Robot variant	Tool flange dimension
IRB 6710-210/2.65 IRB 6710-200/2.95	
IRB 6710-175/2.65 LID IRB 6710-175/2.95 LID	

Fastener quality

Continues on next page

3.3.7 Fitting equipment on the robot (robot dimensions)
Continued

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.

3.4 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 46*.

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 86*. 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)

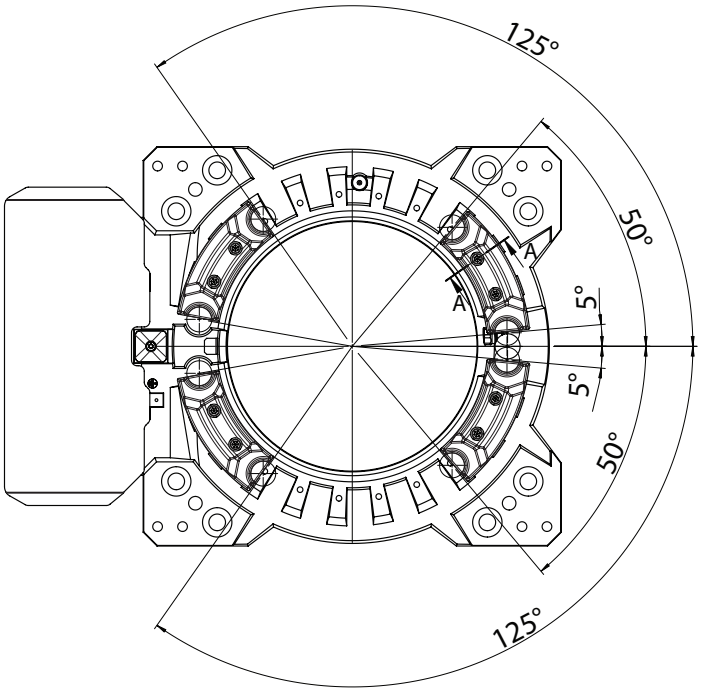
Reduction of the axis-1 working range

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°	from ±5° and ±125° in both directions

Illustration, reduced working range



xx2100000973

WARNING

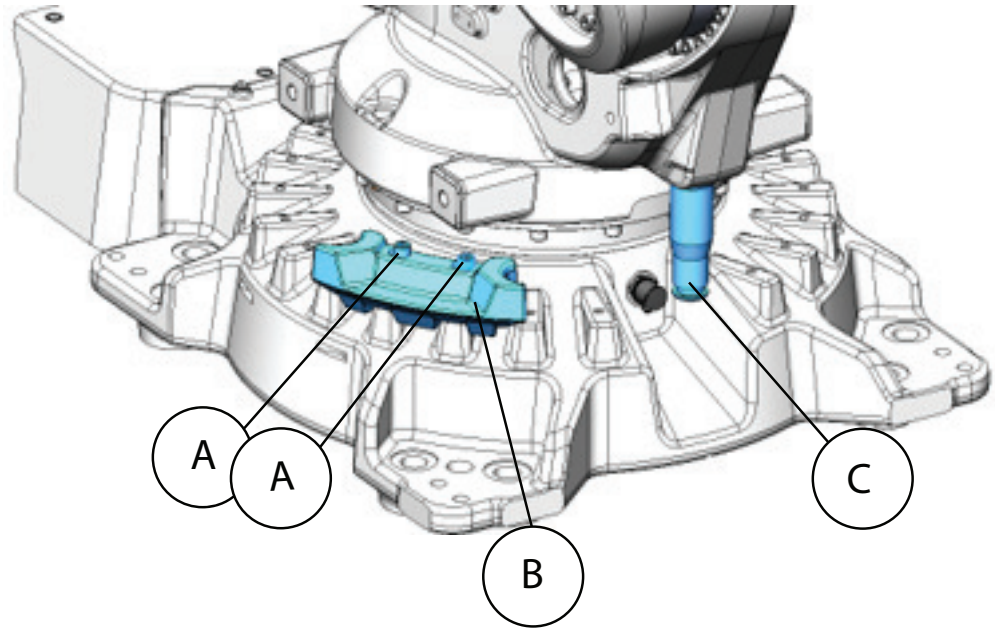
If the mechanical stop pin is deformed after a hard collision, it must be replaced!

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

Continues on next page

Location of the mechanical stops

The mechanical stops are located as shown in the figure.



xx2100002647

A[i]	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

i There is a need to drill and make threaded M12 holes in base.
Use the movable mechanical stop or the dents in the casting as a guide to drill.

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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note
Movable mechanical stop set, axis 1	3HAC048533-003	Screws and washers are enclosed

Required tools and equipment

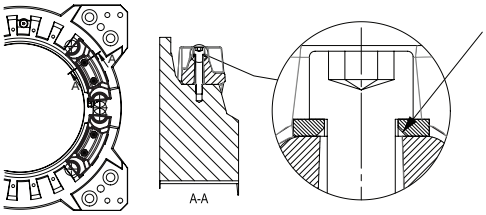
Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Continues on next page

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

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 87*.
3	Fit the additional mechanical stops according to the figure *Location of the mechanical stops on page 87*. **Note** Install the washer with the chamfer turned downwards.  xx2100000974	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 94*.	

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

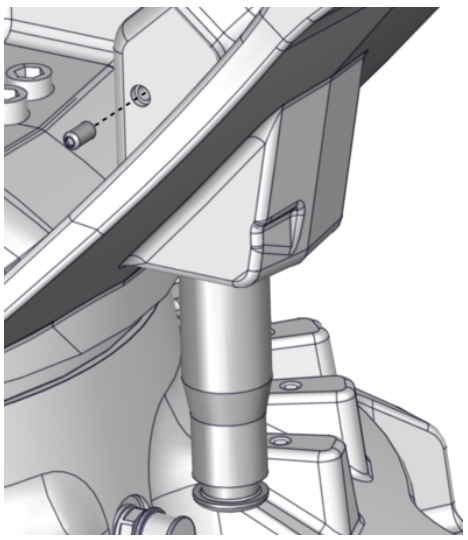
The option *Extended work range* enables an extension of the working range for axis 1, through a software configuration. With this option installed, the working range can exceed the range limited by the mechanical stop on axis 1. The working range shall be limited through the option SafeMove.

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.	 xx2200001398

Continues on next page

3.4.3 Extended working range, axis 1 (option)
Continued

	Action	Note/Illustration
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.

Related information

The system parameters are described in detail in the reference manual, see *References on page 10*.

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

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 robot 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 91*.
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

Robot cable, power

Power cable length	Article number
Power cable 7 m	3HAC026787-001
Power cable 15 m	3HAC026787-002

Continues on next page

3.5.1 Robot cabling and connection points
Continued

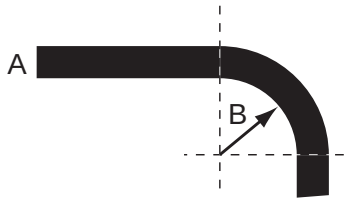
Power cable length	Article number
Power cable 22 m	3HAC026787-003
Power cable 30 m	3HAC026787-004

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.



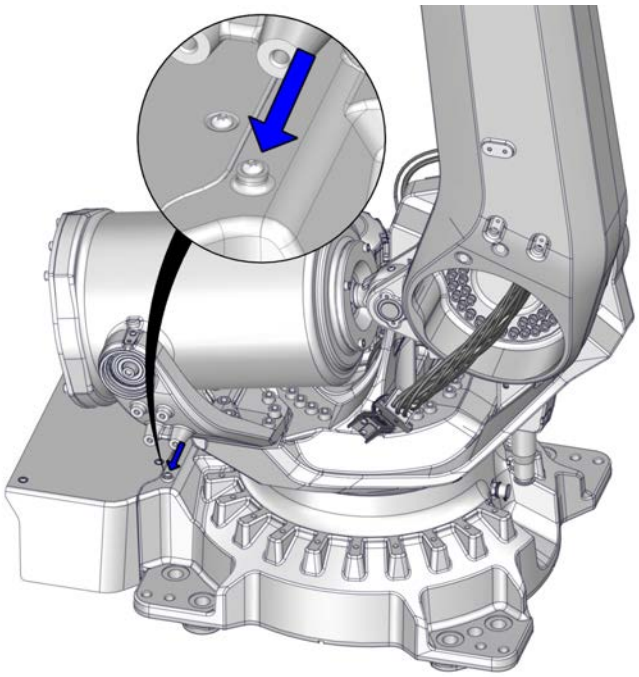
xx1600002016

A	Diameter
B	Diameter x10

Continues on next page

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.



xx2200002064

Customer cables - CP/CS cable

CP/CS cable length	Article number
Harness CP/CS: 7 m	3HAC085739-001
Harness CP/CS: 15 m	3HAC085739-002
Harness CP/CS: 22 m	3HAC085739-003
Harness CP/CS: 30 m	3HAC085739-004

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: 22 m	3HAC079476-003
Ethernet cable: 30 m	3HAC079476-004

3.6 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.

4 Maintenance

4.1 Introduction

Structure of this chapter

This chapter describes all the maintenance activities recommended for the IRB 6710.

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 service 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 service 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 6710:

- 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 damages 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 99*

Maintenance schedule

Maintenance activities	Regularly	After first 150 hours	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		x								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 6710 on page 173*
Inspecting the balancing device				x						*Inspecting the balancing device on page 102*
Inspecting the dampers				x						*Inspecting the dampers on page 109*
Inspecting the information labels				x						*Inspecting the information labels on page 111*
Inspecting the mechanical stop				x						*Inspecting the axis-1 mechanical stop on page 114*
Inspecting the motor seal				x						*Inspecting the motor seal on page 100*
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 106*

Continues on next page

4.2.2 Maintenance schedule

Continued

Maintenance activities	Regularly	After first 150 hours	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 138*
Changing the oil in axis-2 gearbox								x		*Changing the oil in axis-2 gearbox on page 144*
Changing the oil in axis-3 gearbox								x		*Changing the oil in axis-3 gearbox on page 149*
Changing the oil in axis-4 gearbox								x		*Changing the oil in axis-4 gearbox on page 154*
Changing the oil in axis-5 gearbox								x		*Changing the oil in axis-5 gearbox on page 159*
Changing the oil in axis-6 gearbox								x		*Changing the oil in axis-6 gearbox on page 163*
Replacing the SMB battery pack					x [iii]					*Replacing the SMB battery on page 168*
Lubricating the balancing device bearings							x [iv]			*Lubricating the spherical roller bearing, balancing device on page 171*

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 99*.

iii The battery is to be replaced at given maintenance interval or at battery low alert.

iv Always lubricate the front eye bearing after refitting the shaft of 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 - Service Information System*.
Balancing device	40,000 hours [iv]	

[i] Examples of "normal usage" in regard to movement: most material handling applications and limited use of bending backwards mode of axis 3.

[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 and major use of bending backwards of axis 3.

[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

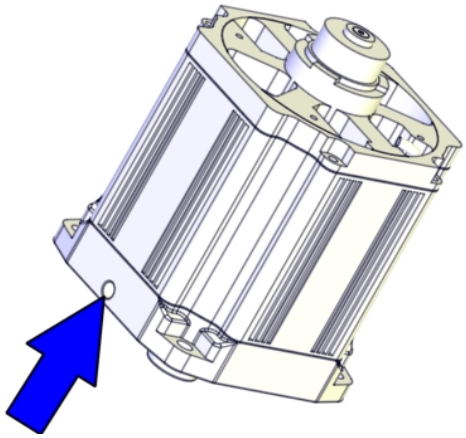
4.3.1 Inspecting the motor seal

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.



xx1500001057

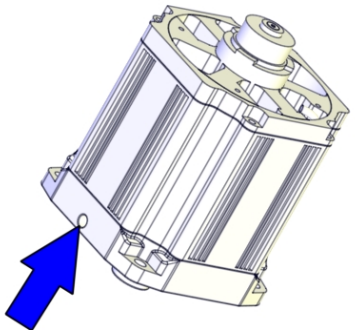
Plug in the evacuation hole

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.

xx2200002188

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 29*.	
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.	 xx1500001057 Replacing of motors is described in the repair chapter *Motors on page 348*.

4.3.2 Inspecting the balancing device

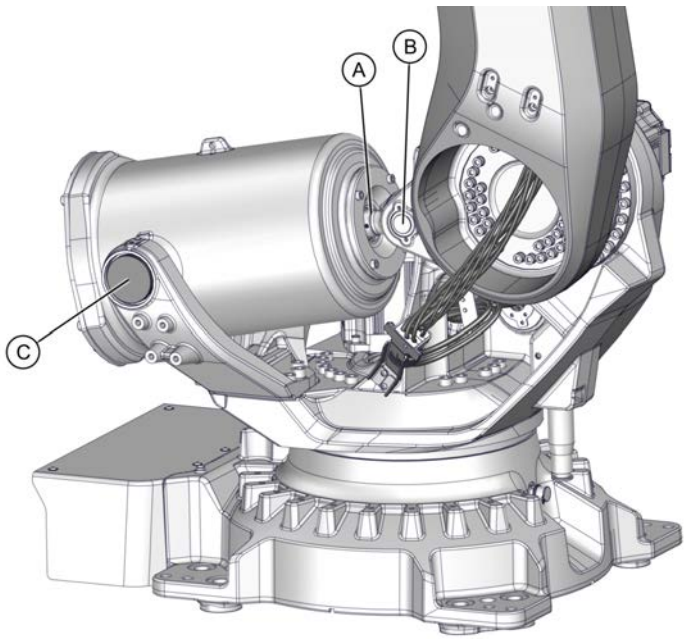
General

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
- contamination / lack of free space.

Inspection points, balancing device

The balancing device is located at the top rear of the frame as shown in the figure. The figure also shows the inspection points, further described in the instructions.



xx2200001850

A	Piston rod (inside balancing device)
B	Link ear
C	Rear attachments of the balancing device (rear bearing)

Required tools

Visual inspection, no tools are required.

Continues on next page

Required consumables and wear parts

Wear part	Article number	Note
Maintenance set, cradle	3HAC087164-001	The maintenance set contains: • radial sealing with dust lip, 2 pcs • groove ball bearing complete, 2 pcs • retaining ring, bore, 2 pcs • VK-cover, 2 pcs (3HAA2166-13)
Maintenance set, link ear	3HAC087168-001	The maintenance kit contains: • End cover • Radial sealing with dust lip, (2 pcs) • O-ring • Spherical roller bearing • Washer

Check for dissonance

The check points are shown in the figure *Inspection points, balancing device on page 102*.

	Check points	Action
1	Check for dissonance from the bearing at the link ear and the bearings at the rear attachments.	If dissonance is detected, perform maintenance according to maintenance kits and instructions in section *Replacing spherical roller bearing, balancing device link ear on page 204* and *Replacing the rear bearings on the balancing device on page 219*.
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 on page 186*. 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.

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 102*.

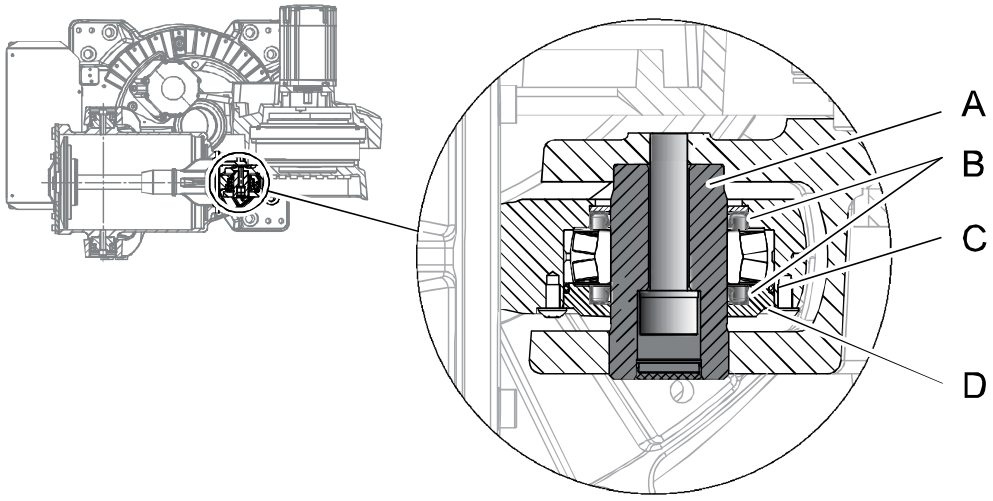
	Check points	Action
1	Check for damage on the part of the piston rod that is visible at the front of the balancing device.	If damage is detected, perform maintenance according to given instructions in Maintenance kit, complete.

Continues on next page

4.3.2 Inspecting the balancing device
Continued

Check for leakage

Leaks at o-rings, radial sealings etc. are not acceptable and must be attended to immediately to avoid damage to the bearing.



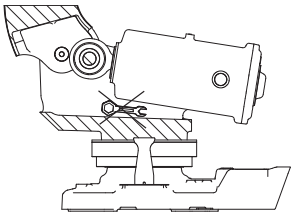
xx1000000207

A	Shaft
B	Radial sealing with dust lip, 50x68x8 (2 pcs)
C	O-ring, 85x3
D	End cover

	Action	Note
1	Clean the area at the front 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.	
4	Check the area around the o-ring and radial sealings at the front ear, for leakage.	
5	Replace o-ring and radial sealings if leaks are detected.	Maintenance set, link ear: 3HAC087168-001 Replacement of the complete bearing is described in section *Replacing spherical roller bearing, balancing device link ear on page 204*.

Continues on next page

Check for contamination / lack of free space

	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 that there are no obstacles inside the frame, that could prevent the balancing device from moving freely. Keep the areas around the balancing device clean and free from objects, such as service tools.	 xx1300000423

4.3.3 Inspecting the cable harness

Location of cable harness

The cable harness is located as shown in the figure.

xx2200001729

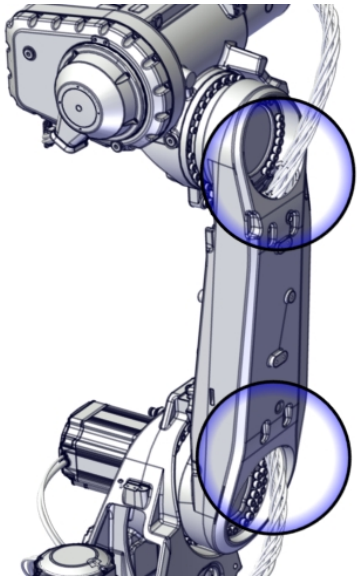
Required tools

Visual inspection, no tools are needed.

Continues on next page

Inspecting the cable harness

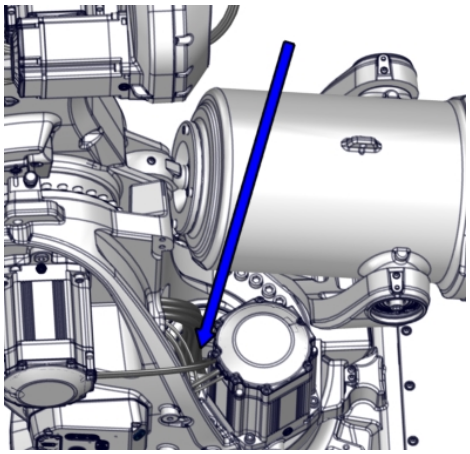
Use this procedure to inspect cable harness of axes 1-6.

	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.	 xx2100001472
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

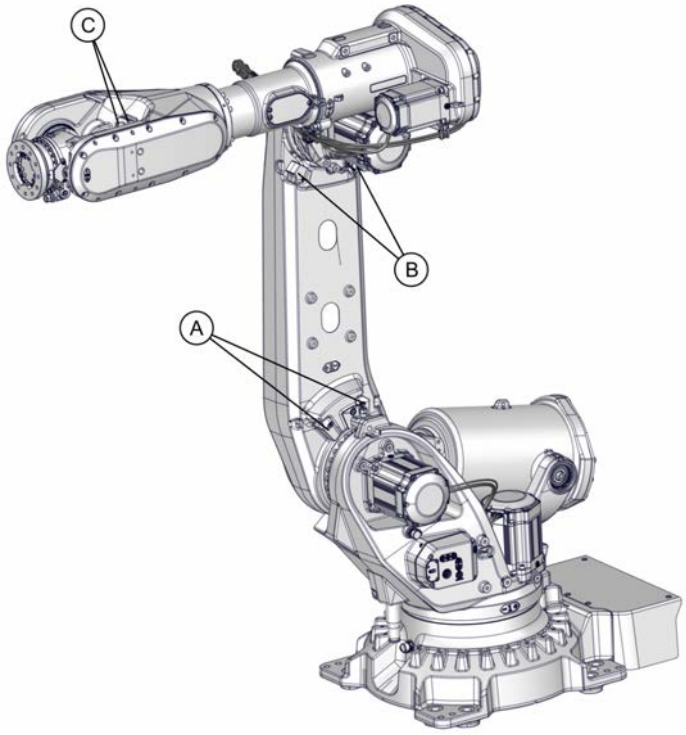
Continued

	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.	 xx2200001791
7	Replace the cable harness if wear, cracks or damage is detected.	See *Removing the cable harness on page 286*.

4.3.4 Inspecting the dampers

Location of the dampers

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



xx2200001753

A	Axis-2 dampers
B	Axis-3 dampers
C	Axis-5 dampers

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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note
Damper	3HAC046884-001	Axis 2
Damper	3HAC12320-1	Axis 3
Damper	3HAC054956-001	Axis 5

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) Axis 5: M6x25 A2-70 (9ADA619-58) 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 94*.	

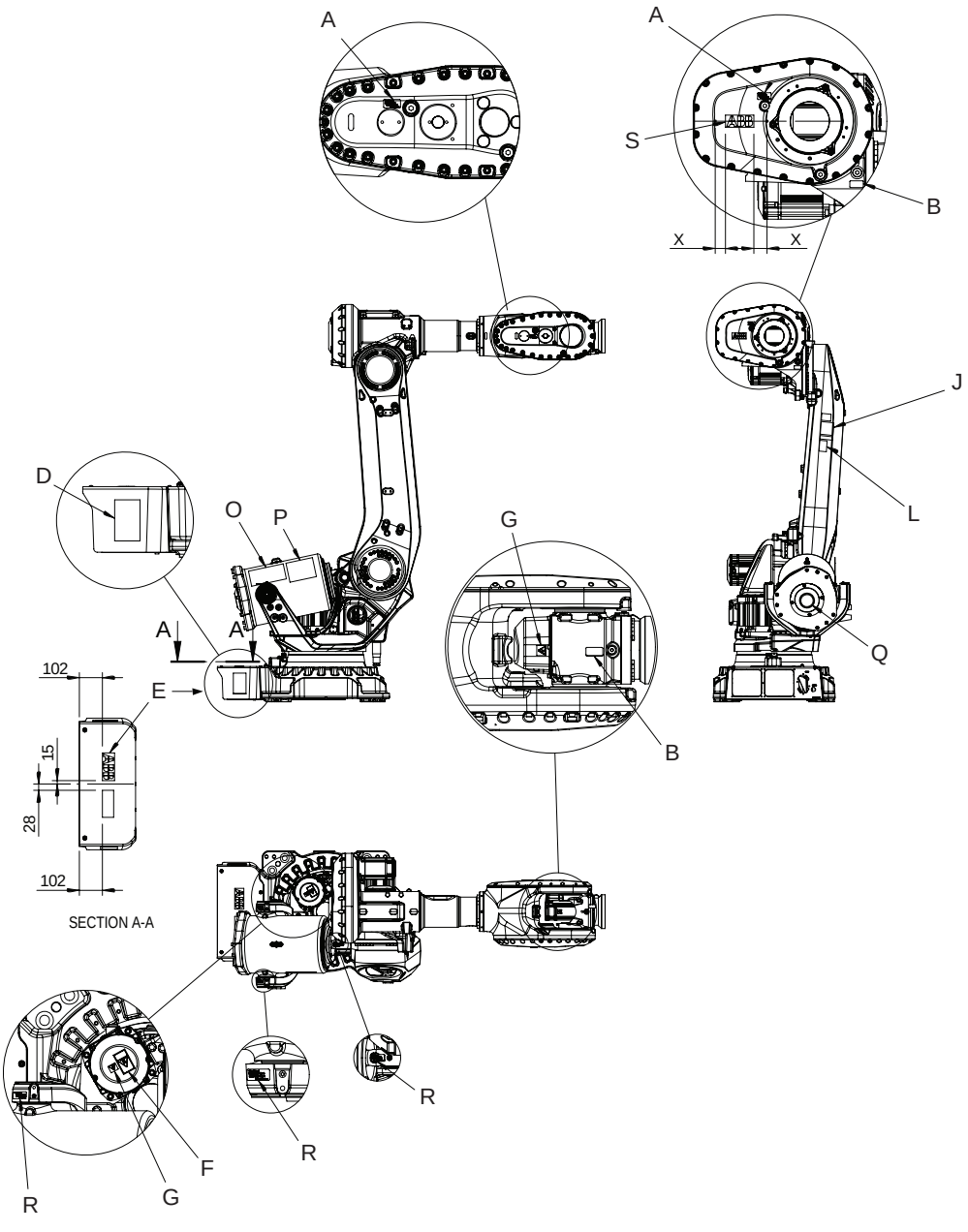
4.3.5 Inspecting the information labels

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 6710 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*.

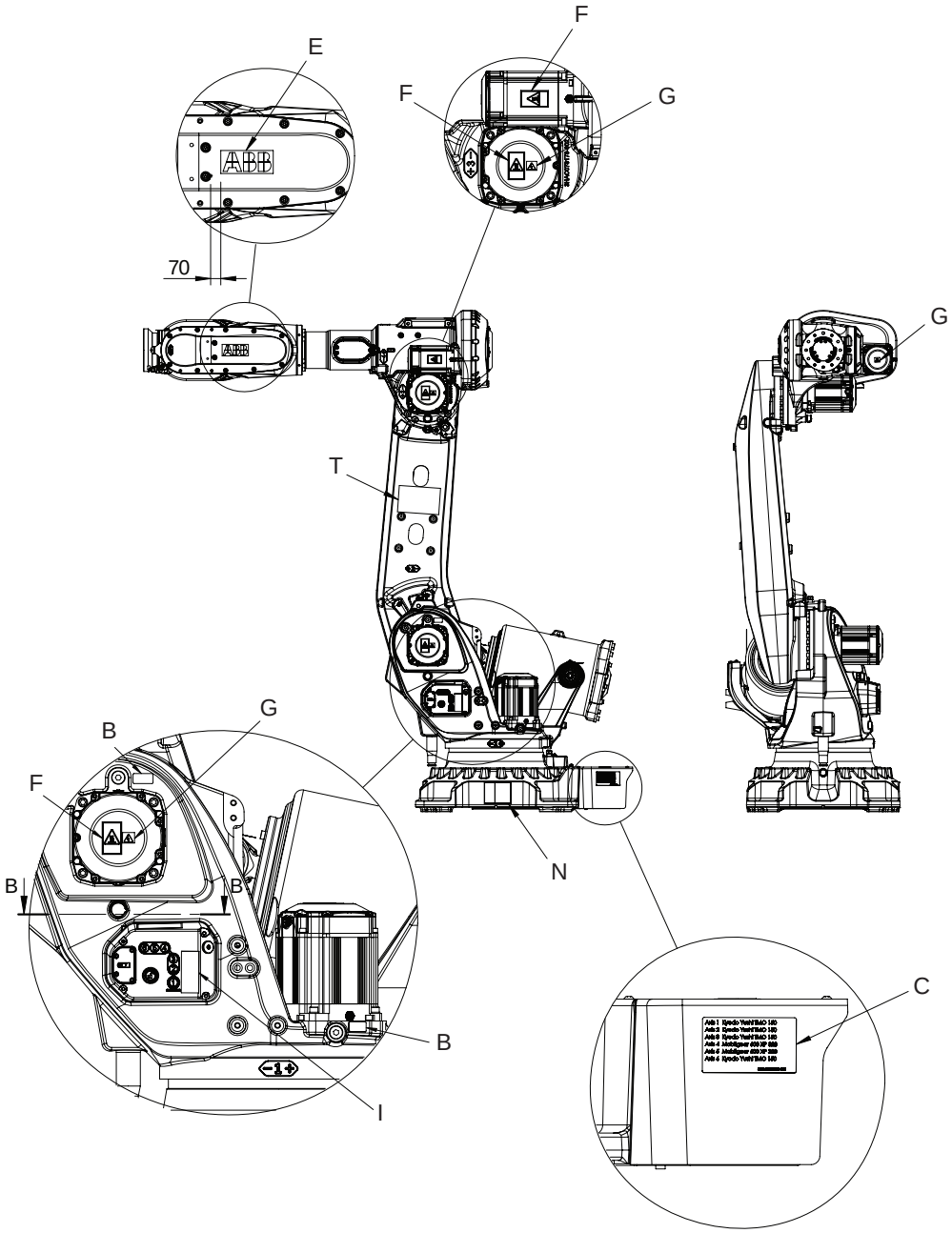


xx2200001845

Continues on next page

4.3.5 Inspecting the information labels

Continued



xx2200001842

	Spare part number	Description
A	3HAC021485-001	Lubrication label Mobilgear 600 XP 320
B	3HAC032726-001	Lubrication label Kyodo Yushi TMO 150
C	3HAC032905-001	Lubrication label
D	3HAC9191-1	Warning label Tipping robot
E	3HAC0453-5 / 3HAC077301-002	ABB logotype label

Continues on next page

	Spare part number	Description
F	29454489-16	Warning label Hot surface
G	3HAC1589-1	Warning label Electrical (flash)
H	3HAC076756-001	Warning label / Instruction label Moving robot / MOTORS OFF
I	3HAC076755-001	Instruction label Brake release
J	3HAB9549-1	Rating label
K	3HAC067800-001	Waste Electrical & Electronic Equipment (WEEE) label
L	3HAC13488-1	Calibration label
M	3HAC14257-1	ABB information sign
N	3HAC021761-001	Warning label Extended working range
O	3HAC020611-001	Warning label Balancing device - no tools
P	3HAC4591-1	Instruction label Before disassembly, see product manual
Q	3HAC9526-1	Warning label Stored energy
R	3HAC021525-001	Lubrication label Optimol longtime PD 0
S	3HAC0453-2 / 3HAC5127-1	ABB logotype label
T	3HAC046732-001	Instruction label Lifting of robot

Required tools and equipment

Visual inspection, no tools are required.

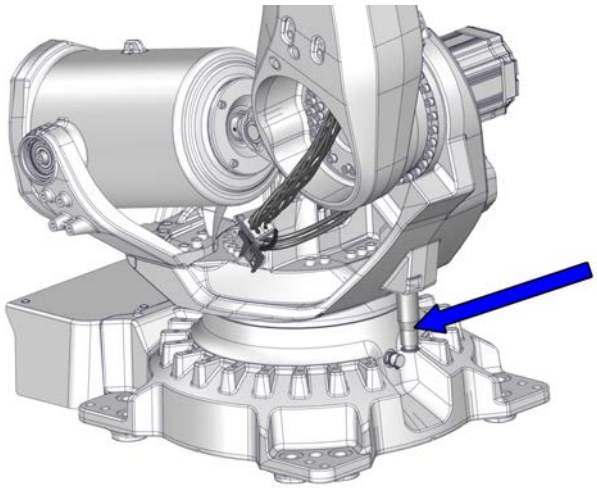
Inspecting, labels

	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 111*.

4.3.6 Inspecting the axis-1 mechanical stop

Location of mechanical stop pin

The mechanical stop is located as shown in the figure.



xx2200001771

Required equipment

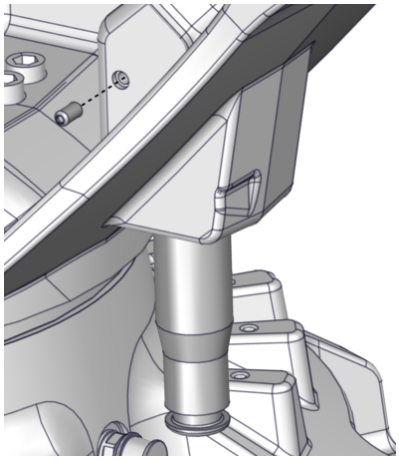
Visual inspection, no tools are required.

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: 3HAC024014-001

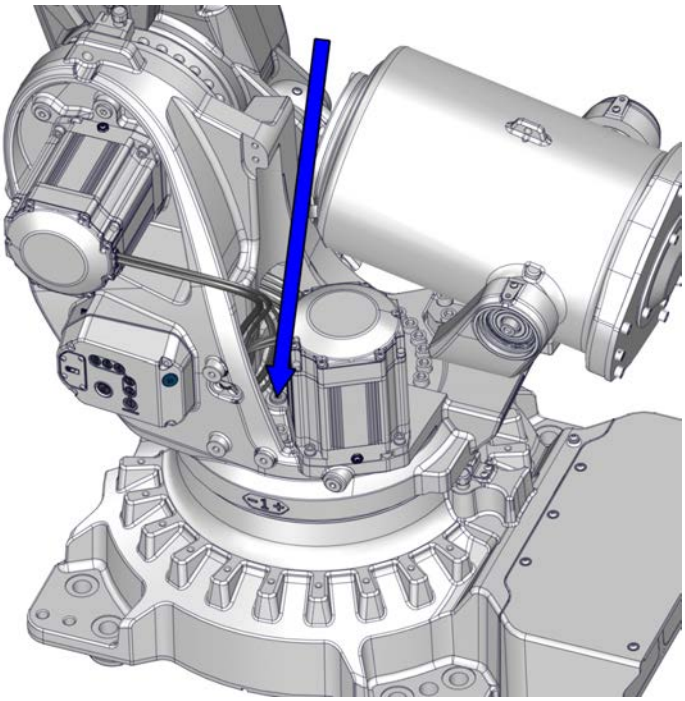
Continues on next page

	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) The attachment screw is accessed from the side.  xx2200001398
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

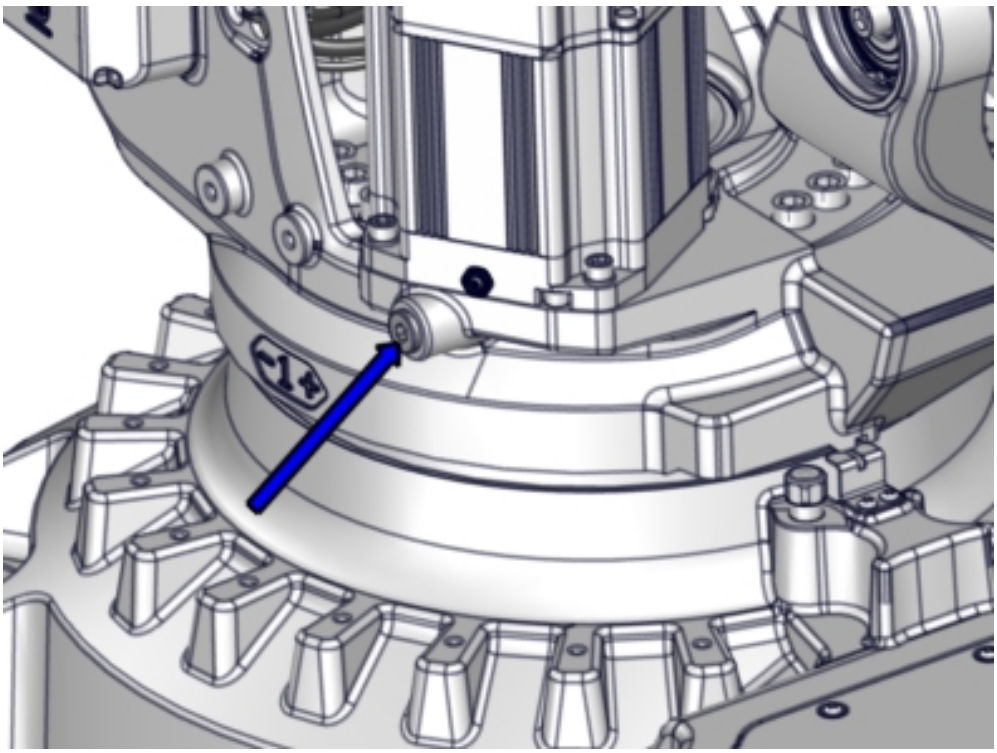
The oil plug for inspection is located as shown in the figure.



xx2200001754

Continues on next page

If there is a risk of debris falling into the gear when opening the oil plug for inspection, it is instead recommended to use the vent hole for oil level inspection:



xx2200002147

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 136*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

Required documents

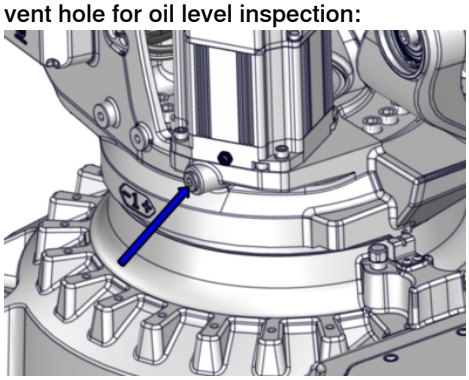
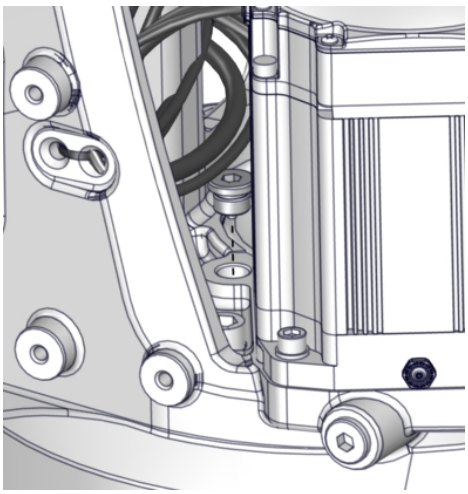
Document name	Document number
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*

Continues on next page

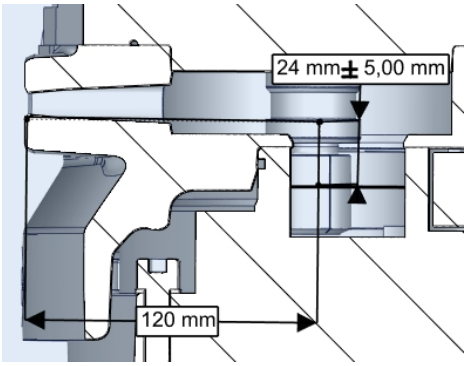
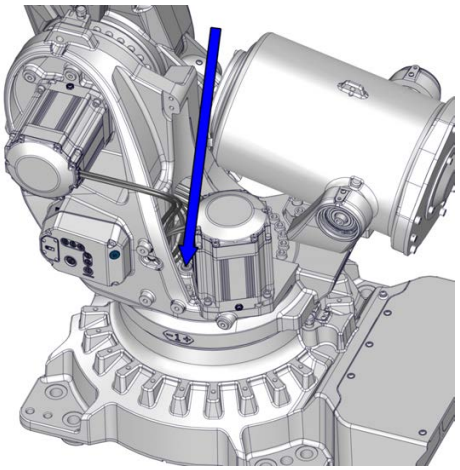
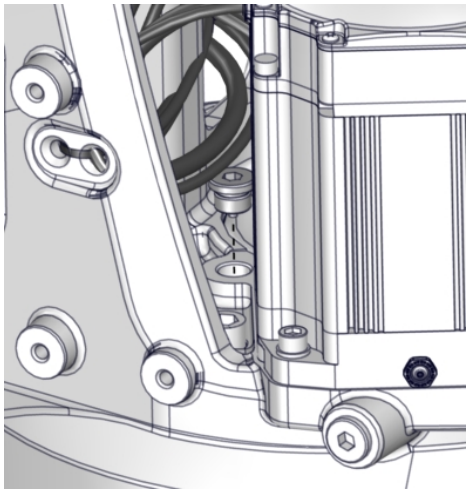
4.3.7 Inspecting the oil level in axis-1 gearbox
Continued

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 29*.	
3	Make sure that the oil temperature is +25 °C ± 10 °C.	
4	Open the oil plug. If there is a risk of debris falling into the gear when opening the oil plug for inspection, it is instead recommended to use the vent hole for oil level inspection:  xx2200002147	 xx2200001795

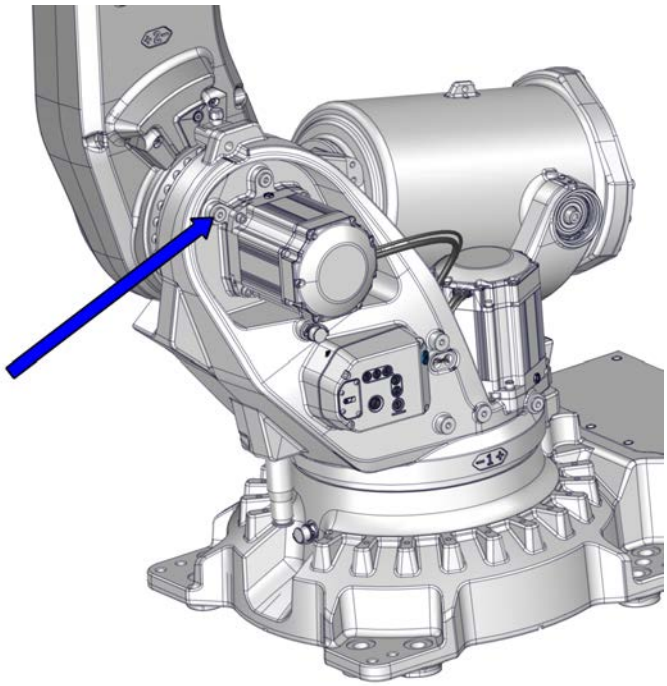
Continues on next page

	Action	Note
5	Check the oil level. Required oil level is: 53-63 mm below the machined surface at the oil plug hole. Alternative measurement; required oil level at vent hole is: 24 mm ± 5 mm below the oil plug hole  xx2300000001	 xx2200001754
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 138*.
7	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2200001795
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 94*.	

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.



xx2200001758

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 136*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

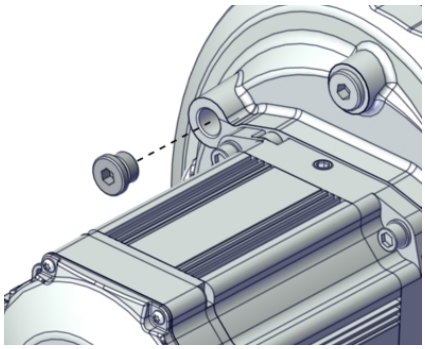
Required documents

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

Continues on next page

Inspecting the oil level in axis-2 gearbox

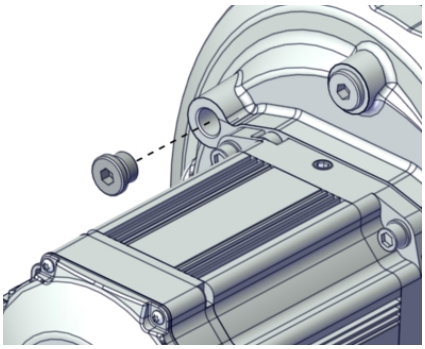
Use this procedure to inspect the oil level in the gearbox.

	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 29*.	
3	Make sure that the oil temperature is +25 °C ± 10 °C.	
4	Open the oil plug.	 xx2100002059
5	Check the oil level. Required oil level is: 0-10 mm below oil plug hole (floor-mounted robot).	
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 144*.

Continues on next page

4.3.8 Inspecting the oil level in axis-2 gearbox

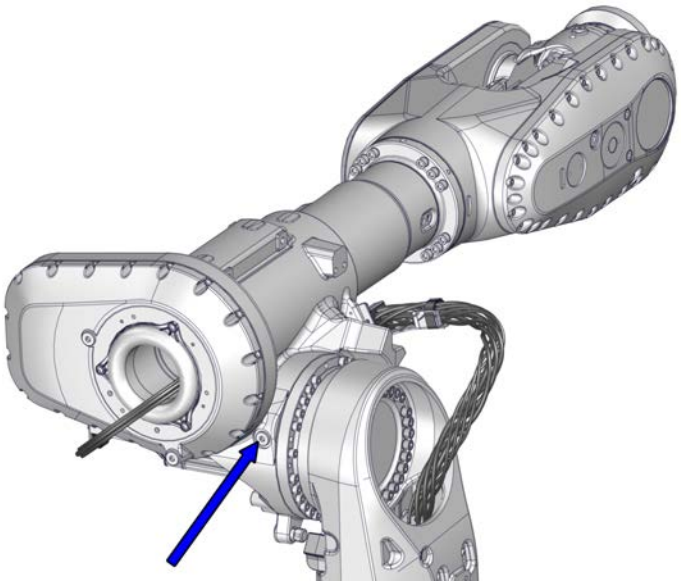
Continued

	Action	Note
7	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2100002059
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 94*.	

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.



xx2200001762

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 136*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

Required documents

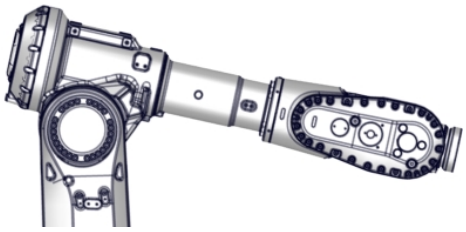
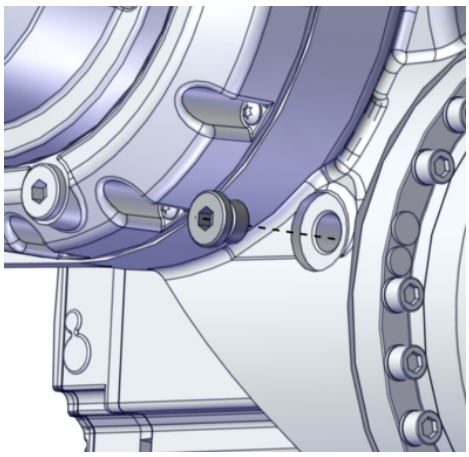
Document name	Document number
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*

Continues on next page

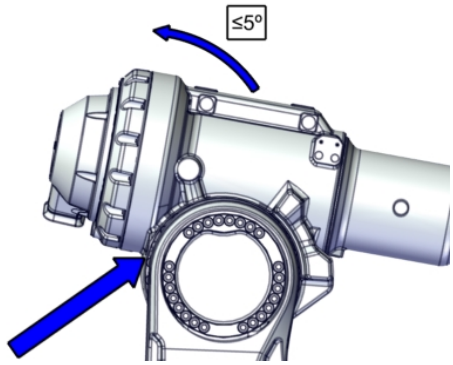
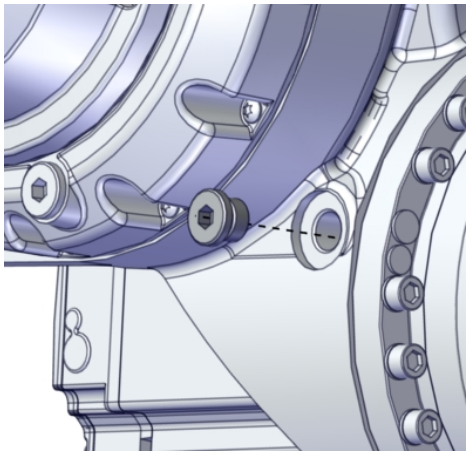
4.3.9 Inspecting the oil level in axis-3 gearbox
Continued

Inspecting the oil level in axis-3 gearbox

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

	Action	Note
1	Jog the robot into position: • Axis 1: no significance • Axis 2: 0° • Axis 3: +10° • Axis 4: no significance • Axis 5: no significance • Axis 6: no significance	 xx2200002136
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 29*.	
5	Open the oil plug.	 xx2100002064
6	Turn on the power to the robot temporarily.	

Continues on next page

	Action	Note
7	Check the oil level. Rotate axis 3 up to 5°, if needed, to achieve correct oil level measurement. Required oil level: in level with the oil plug hole when axis 3 is in position +10° to +5°.	 xx2200001816
8	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
9	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-3 gearbox on page 149*.
10	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2100002064

Continues on next page

4.3.9 Inspecting the oil level in axis-3 gearbox

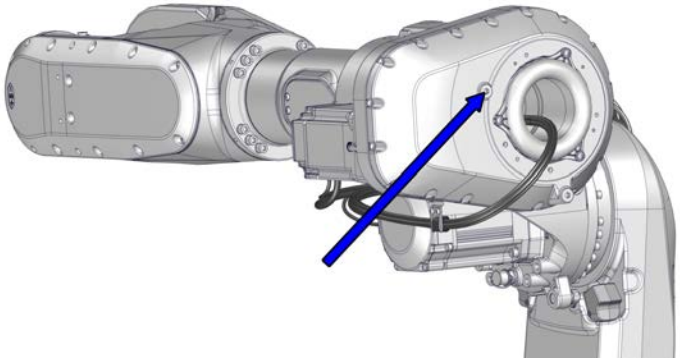
Continued

	Action	Note
11	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 94*.	

4.3.10 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.



xx2200001764

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 136*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

Required documents

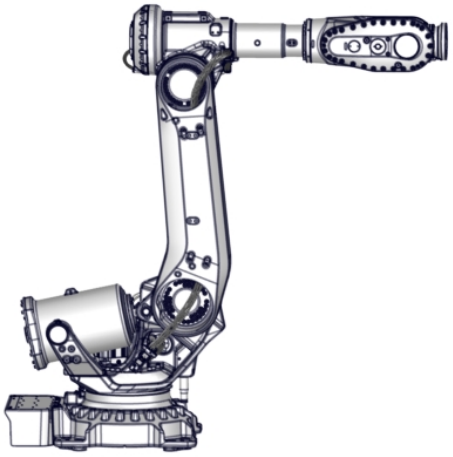
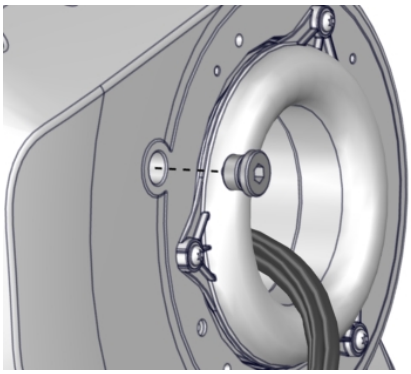
Document name	Document number
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*

Continues on next page

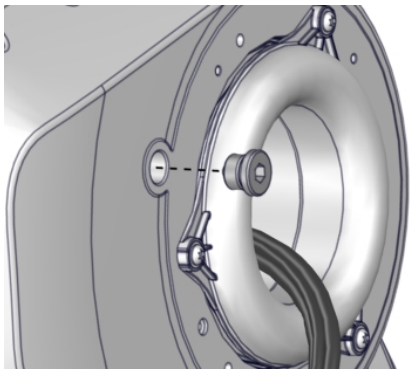
4.3.10 Inspecting the oil level in axis-4 gearbox
Continued

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 calibration position.	 xx2200001458
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 29*.	
5	Open the oil plug.	 xx2200001796

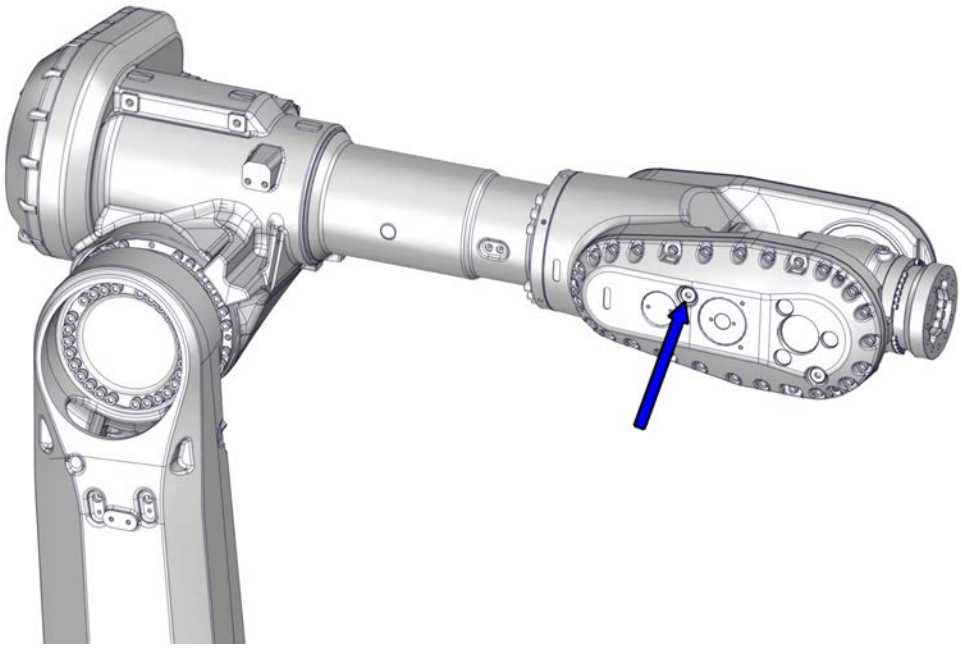
Continues on next page

	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-4 gearbox on page 154*.
8	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2200001796
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 94*.	

4.3.11 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.



xx2200002135

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 136*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

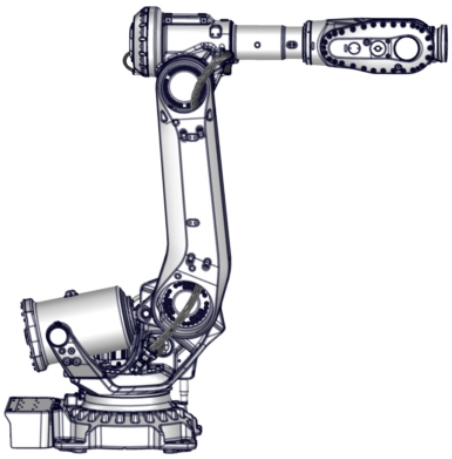
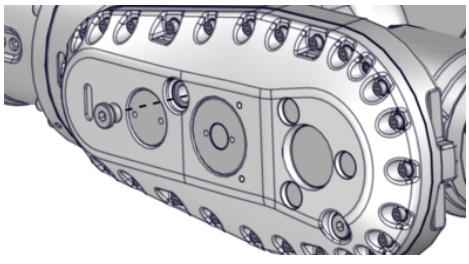
Required documents

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

Continues on next page

Inspecting the oil level in axis-5 gearbox

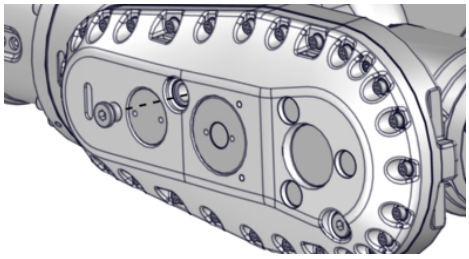
Use this procedure to inspect the oil level in the gearbox.

	Action	Note
1	Run the robot to calibration position.	 xx2200001458
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 29*.	
5	Open the oil plug.	 xx2200002137
6	Check the oil level. Required oil level is: 0-10 mm below oil plug hole.	

Continues on next page

4.3.11 Inspecting the oil level in axis-5 gearbox

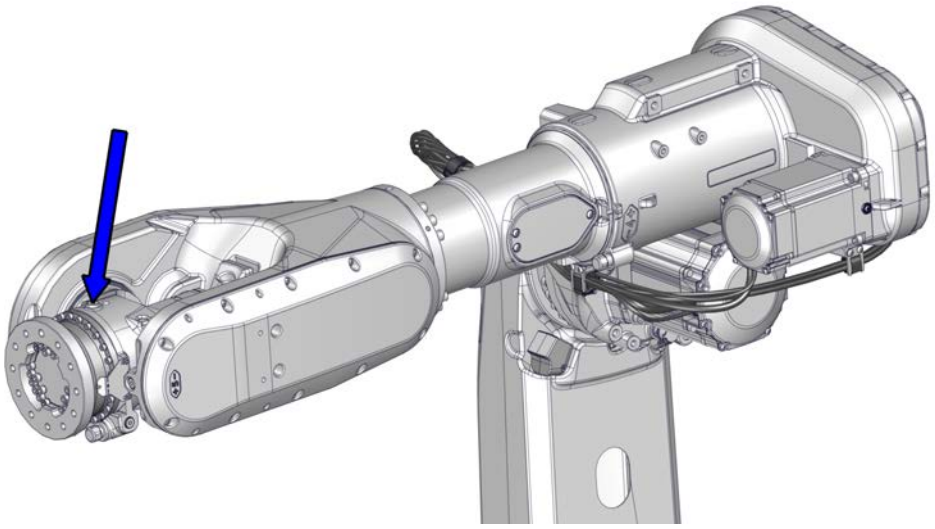
Continued

	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-5 gearbox on page 159*.
8	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2200002137
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 94*.	

4.3.12 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.



xx2200001769

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 136*.
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.

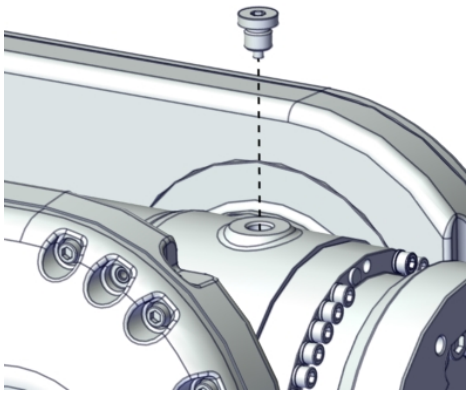
The procedure includes two alternative positions for axis 5, where one of the positions makes it possible to use the filling plug as a level plug.

	Action	Note
1	Run the robot to calibration position.	

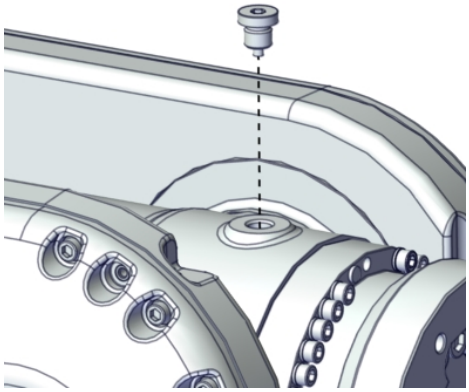
Continues on next page

4.3.12 Inspecting the oil level in axis-6 gearbox

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	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 29*.	
5	Open the oil plug.	 xx2100002077
6	**Method 1** Check the oil level. Required oil level is: 57-64 mm below oil plug hole	
7	**Method 2** Rotate axis 5 to +75°. Required oil level is: oil is visible through the oil plug hole. If the oil level is not visible, rotate axis 5 up to additionally 5°, to achieve visual check of oil level.	
8	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 163*.

Continues on next page

	Action	Note
9	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 20 Nm.  xx2100002077
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 94*.	

4.4 Replacement/changing activities

4.4.1 Type of lubrication in gearboxes

Introduction

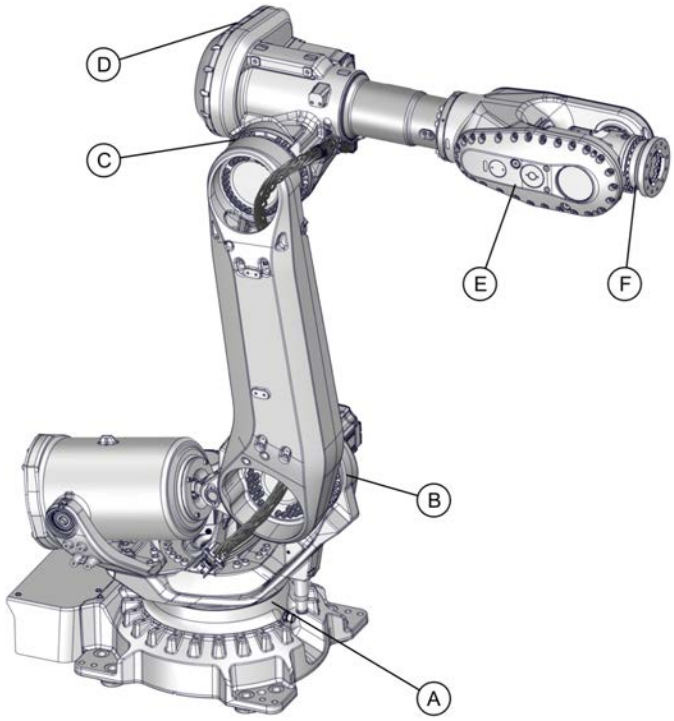
This section describes where to find information about the type of lubrication, article number and the amount of lubrication in the specific gearbox. It also describes the equipment needed when working with lubrication.

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.



xx2200001901

A	Axis-1 gearbox
B	Axis-2 gearbox
C	Axis-3 gearbox
D	Axis-4 gearbox
E	Axis-5 gearbox
F	Axis-6 gearbox

Continues on next page

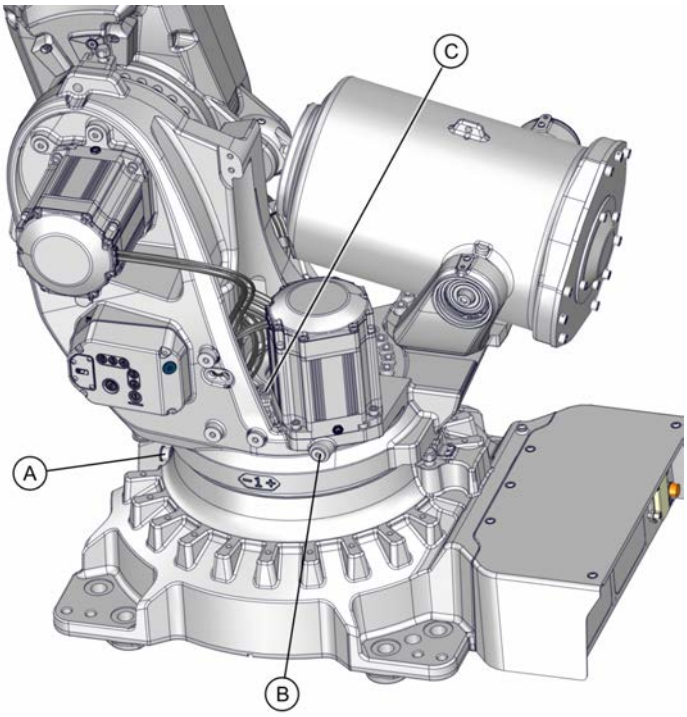
Equipment

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	

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.



xx2200001757

A	Oil nipple for draining and filling with an oil dispenser
B	Oil plug hole for venting and alternative for inspection
C	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 136*.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 136*.

Continues on next page

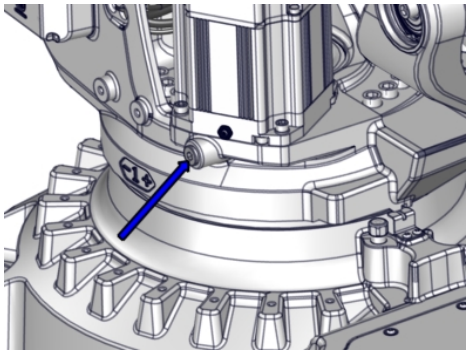
Wear part	Article number	Note
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

Required documents

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

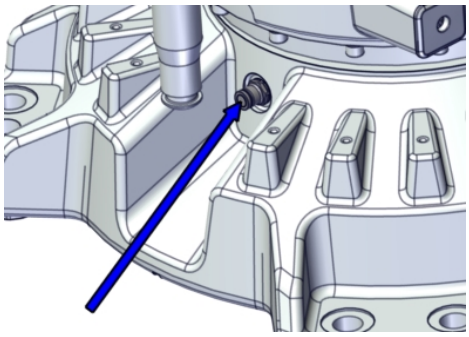
Floor-mounted robot: Draining the axis-1 gearbox

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 29*.	
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.	 xx2200002147

Continues on next page

4.4.2 Changing the oil in axis-1 gearbox
Continued

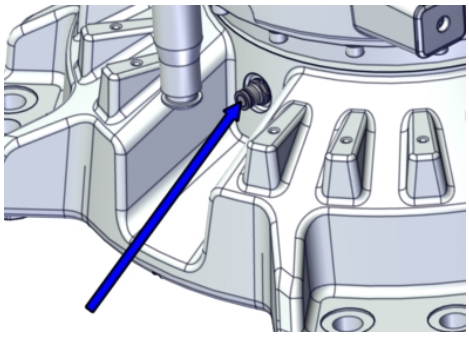
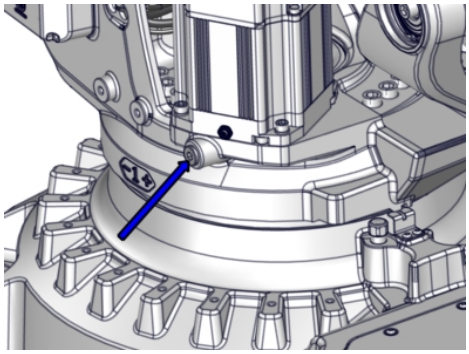
	Action	Note
6	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx2100001476
7	Suck out the oil with the oil dispenser. **Note** There will be some oil left in the gear after draining.	
8	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 615* 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 29*.	

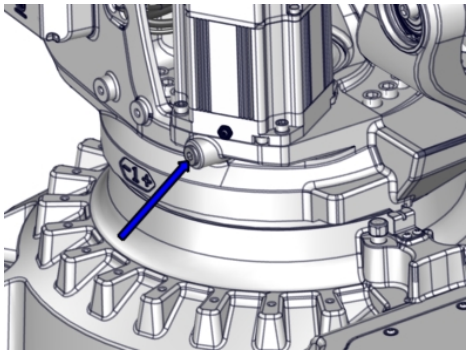
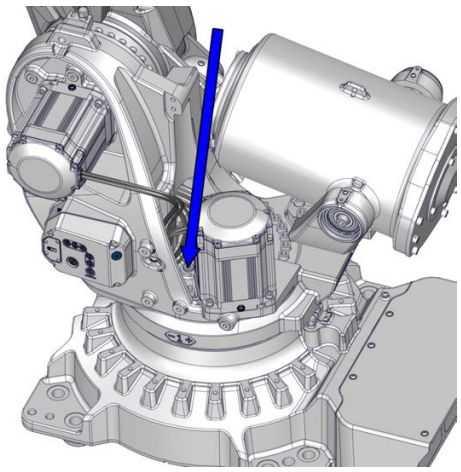
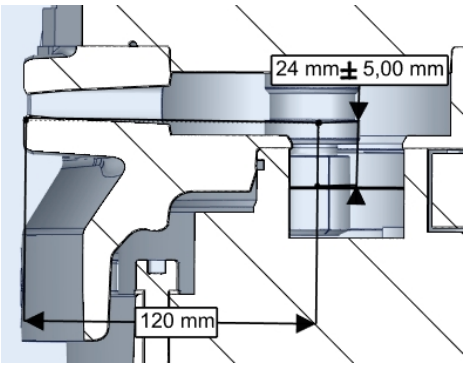
Continues on next page

	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.	 xx2200002147
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*.

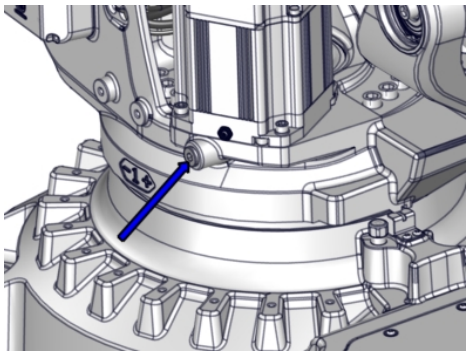
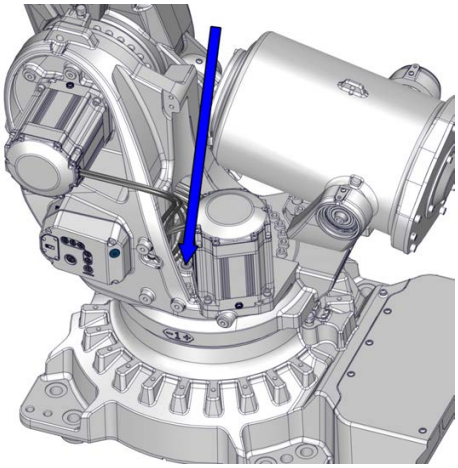
Continues on next page

4.4.2 Changing the oil in axis-1 gearbox

Continued

	Action	Note
6	Inspect the oil level through the inspection hole. **Tip** If there is a risk of debris falling into the gear when opening the oil plug for inspection, it is instead recommended to use the vent hole for oil level inspection:  xx2200002147 **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: 53-63 mm below the machined surface at the oil plug hole  xx2200001754 Required oil level at vent hole is: 24 mm ± 5 mm below the oil plug hole  xx2300000001
7	Remove the oil dispenser and refit the protective cap to the nipple.	

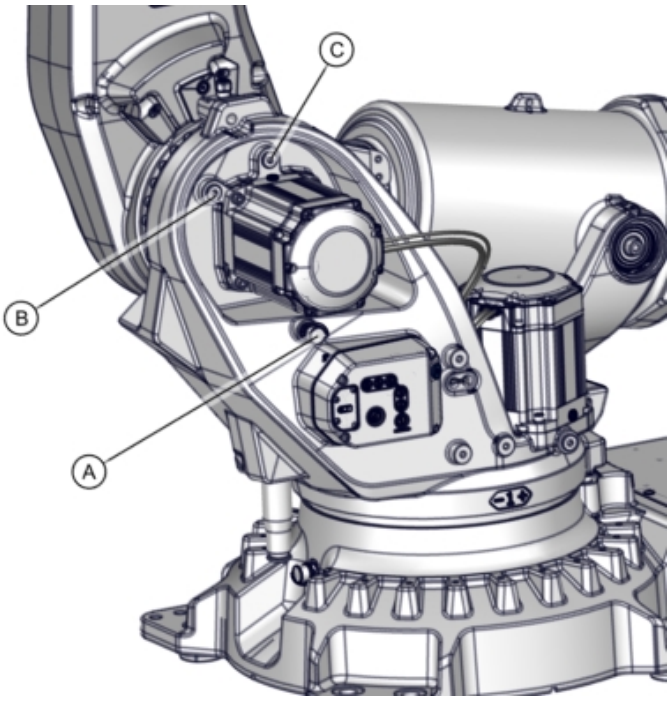
Continues on next page

	Action	Note
8	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2200002147  xx2200001754
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 94*.	

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.



xx2200001760

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

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 136*.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 136*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

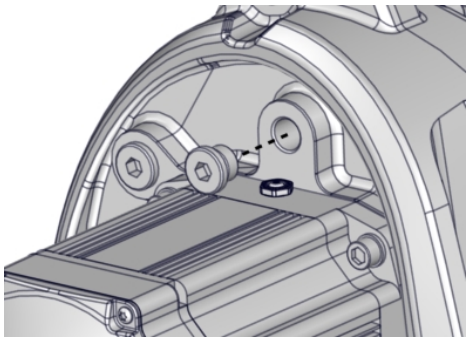
Continues on next page

Required documents

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

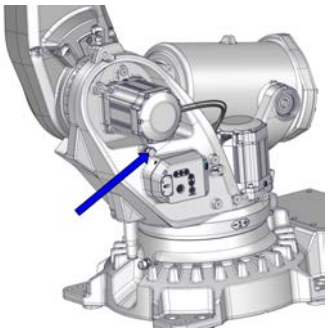
Draining the axis-2 gearbox

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 29*.	
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.	 xx2300000002

Continues on next page

4.4.3 Changing the oil in axis-2 gearbox
Continued

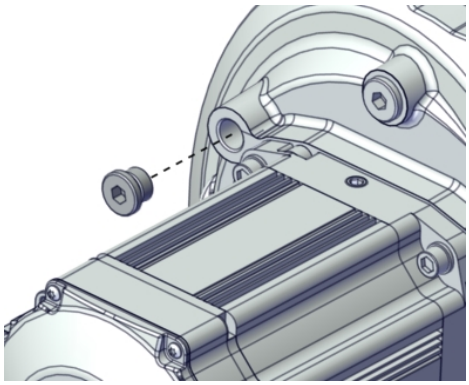
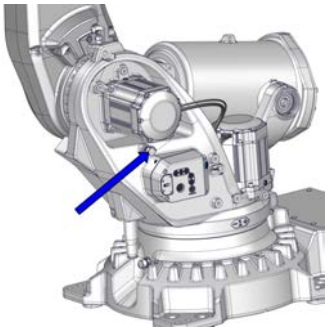
	Action	Note
5	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx2200001759
6	Suck out the oil with the oil dispenser. **Note** There will be some oil left in the gear after draining.	
7	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 615* for more information.	

Filling oil into the axis-2 gearbox

Use this procedure to refill the gearbox with oil.

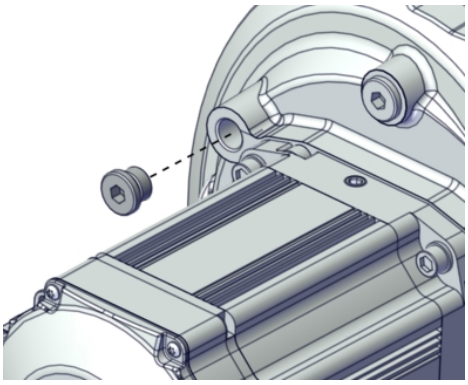
	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 29*.	

Continues on next page

	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.	 xx2100002059
4	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx2200001759
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 121*.
7	Remove the oil dispenser. Refit the protective cap on the nipple.	

Continues on next page

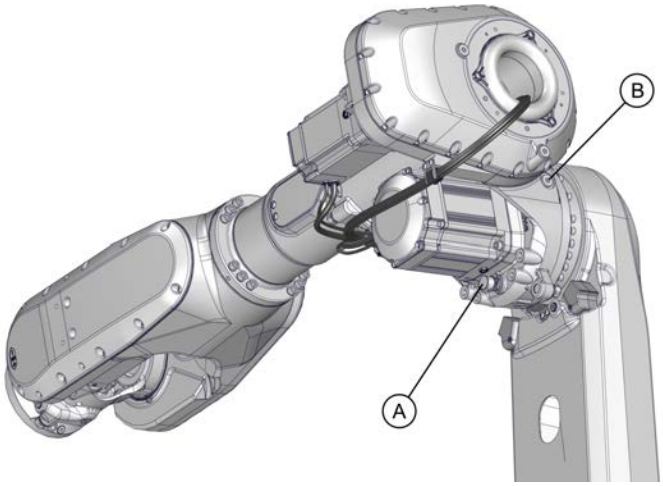
4.4.3 Changing the oil in axis-2 gearbox
Continued

	Action	Note
8	Refit all removed oil plugs with new o-rings.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2100002059
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 94*.	

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.



xx2200001763

A	Oil plug with nipple for draining and filling with an oil dispenser
B	Oil plug hole for ventilation 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 136*.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 136*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

Required documents

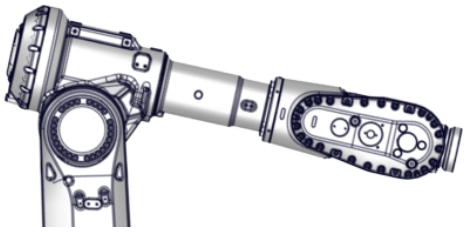
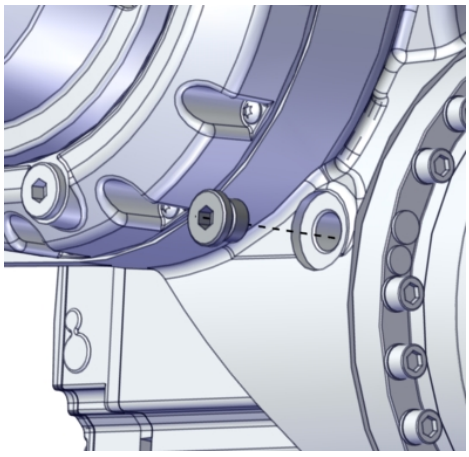
Document name	Document number	Note
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*	

Continues on next page

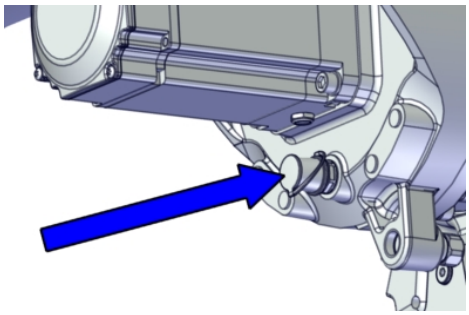
4.4.4 Changing the oil in axis-3 gearbox
Continued

Draining the axis-3 gearbox

Use this procedure to drain the gearbox.

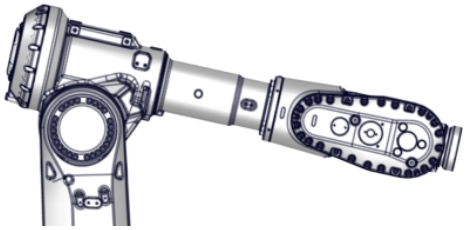
	Action	Note
1	Jog the robot into position: • Axis 1: no significance • Axis 2: 0° • Axis 3: +10° • Axis 4: no significance • Axis 5: no significance • Axis 6: no significance	 xx2200002136
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 29*.	
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 ventilation hole. **WARNING** Let the venting hole stay open during draining and filling using the dispenser, to avoid damaging vital parts in the gearbox.	 xx2100002064

Continues on next page

	Action	Note
6	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx2100002093
7	Turn on the power supply to the robot temporarily	
8	Suck out the oil with the oil dispenser. Run axis 3 to 0° while draining, to reach all oil. **Note** There will be some oil left in the gear after draining.	
9	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 615* for more information.	

Filling oil into the axis-3 gearbox

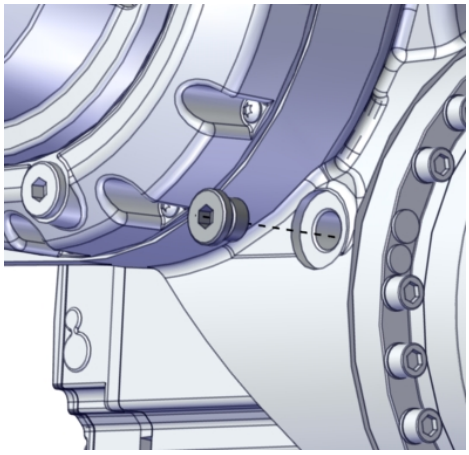
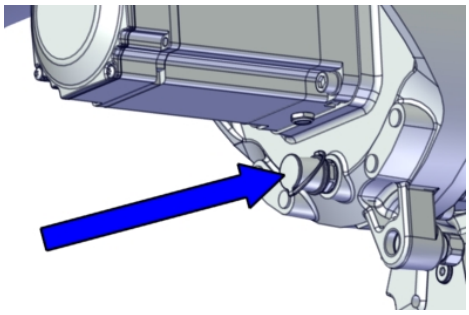
Use this procedure to refill the gearbox with oil.

	Action	Note
1	Jog the robot into position: • Axis 1: no significance • Axis 2: 0° • Axis 3: +10° • Axis 4: no significance • Axis 5: no significance • Axis 6: no significance	 xx2200002136
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

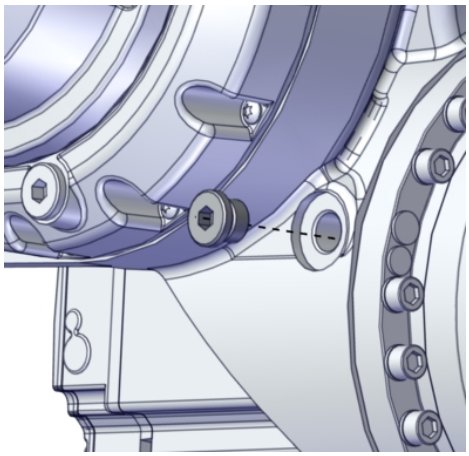
Continues on next page

4.4.4 Changing the oil in axis-3 gearbox

Continued

	Action	Note
3	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 29*.	
4	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.	 xx2100002064
5	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx2100002093
6	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*.
7	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.	More information is found in *Inspecting the oil level in axis-3 gearbox on page 124*.
8	Remove the oil dispenser. Refit the protective cap on the nipple.	

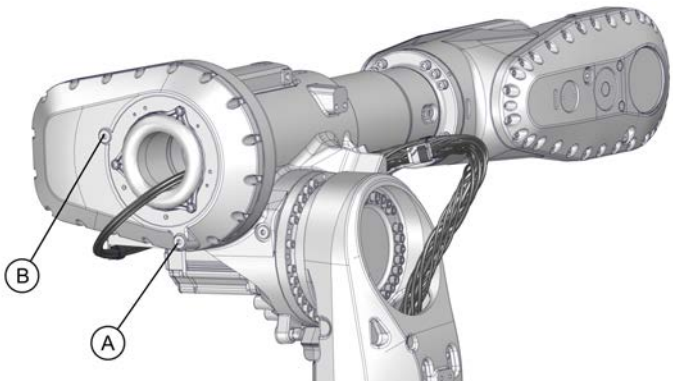
Continues on next page

	Action	Note
9	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2100002064
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 94*.	

4.4.5 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.



xx2200001765

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

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 136*.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 136*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

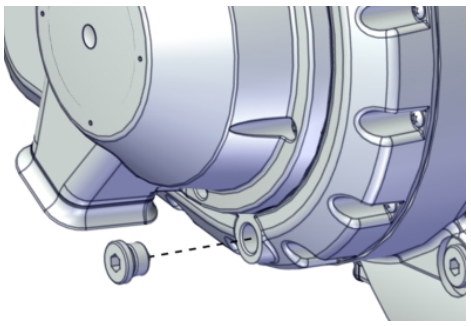
Required documents

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

Continues on next page

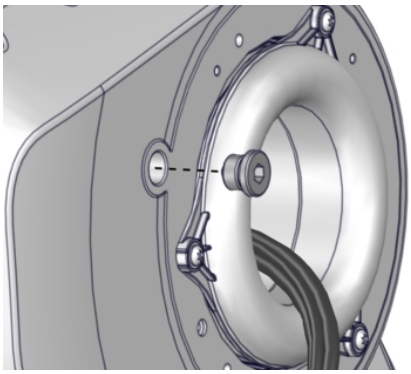
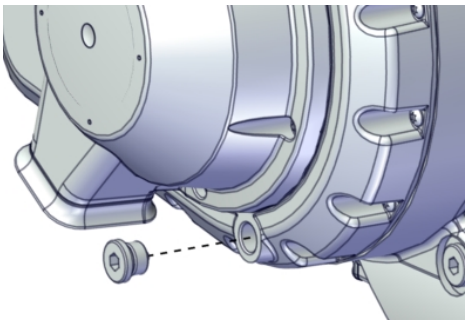
Draining the axis-4 gearbox

Use this procedure to drain the gearbox.

	Action	Note
1	Run the robot to 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 29*.	
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	Place the oil collecting vessel underneath the oil drain plug.	
6	Remove the oil plug from the drain hole and let the oil run into the vessel.	 xx2100002095

Continues on next page

4.4.5 Changing the oil in axis-4 gearbox
Continued

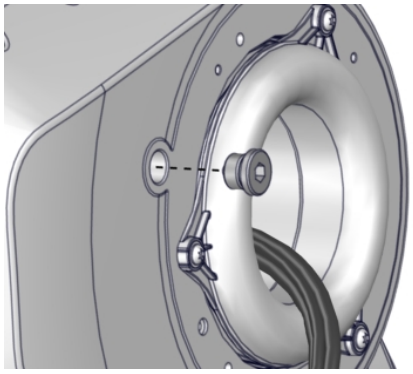
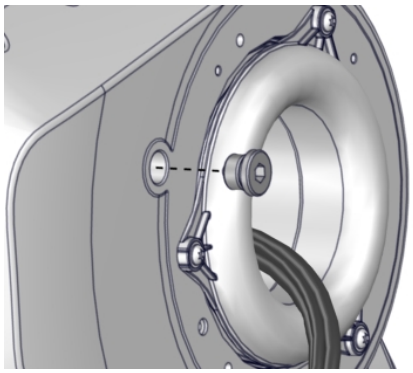
	Action	Note
7	Remove the oil plug from the fill/level hole. **Note** The oil plug hole is opened to speed up the drainage.	 xx2200001796
8	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 615* for more information.	
9	Refit the oil plug for the drainage hole, with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2100002095

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.	

Continues on next page

	Action	Note
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 29*.	
3	Open the fill/level plug.	 xx2200001796
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 128*.
6	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2200001796

Continues on next page

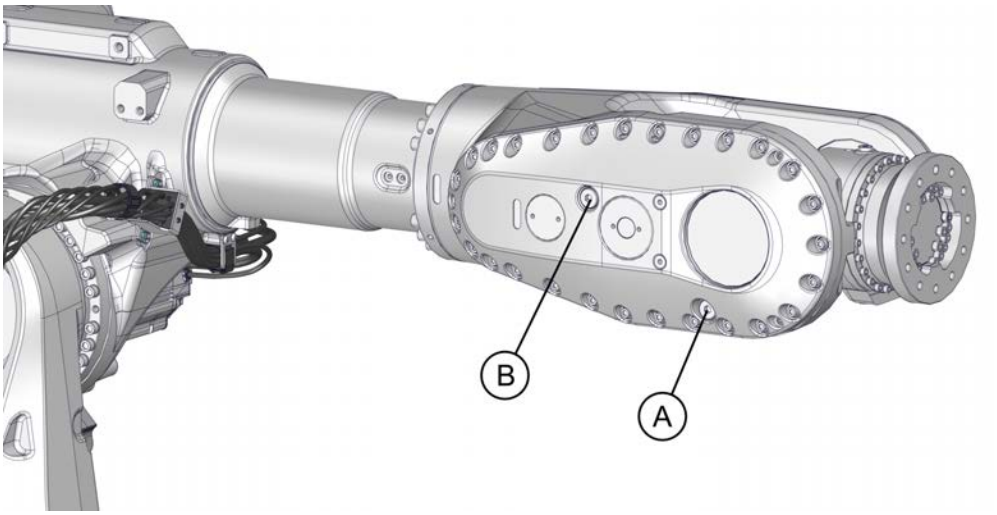
4.4.5 Changing the oil in axis-4 gearbox
Continued

	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 94*.	

4.4.6 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.



xx2200001767

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

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 136*.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 136*.
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.

Required documents

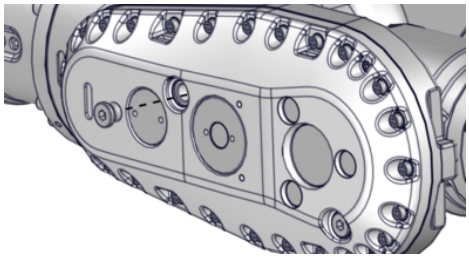
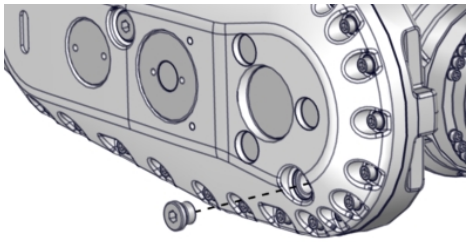
Document name	Document number	Note
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*	

Continues on next page

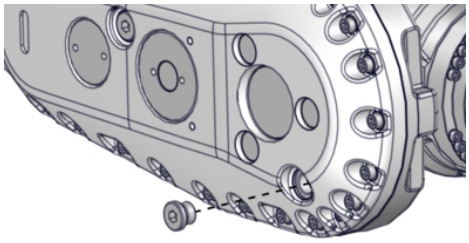
4.4.6 Changing the oil in axis-5 gearbox
Continued

Draining the axis-5 gearbox

Use this procedure to drain the gearbox.

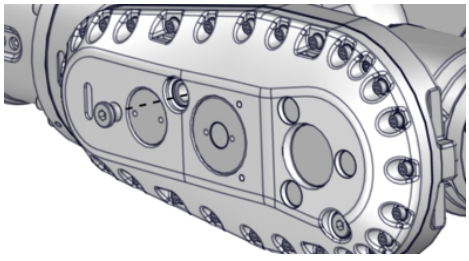
	Action	Note
1	Jog the robot to calibration position.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 29*.	
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.	 xx2200002137
6	Place the oil collecting vessel underneath the oil drain plug.	
7	Remove the oil plug from the drain hole and let the oil run into the vessel.	 xx2200002138

Continues on next page

	Action	Note
8	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 615* 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.  xx2200002138

Filling oil into the axis-5 gearbox

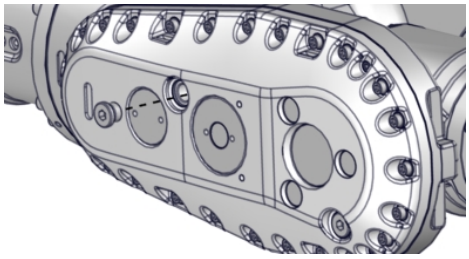
Use this procedure to refill the gearbox with oil.

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 29*.	
3	Open the fill/level plug.	 xx2200002137

Continues on next page

4.4.6 Changing the oil in axis-5 gearbox

Continued

	Action	Note
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 131*.
6	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2200002137
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 94*.	

4.4.7 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.

xx2200002139

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 136*.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Required consumables and wear parts

Wear part	Article number	Note
Lubricating oil	-	See *Type of lubrication in gearboxes on page 136*.
O-ring, G 1/4"	3HAC061327-060	Used on oil plug. Always replace when refitting oil plug.

Required documents

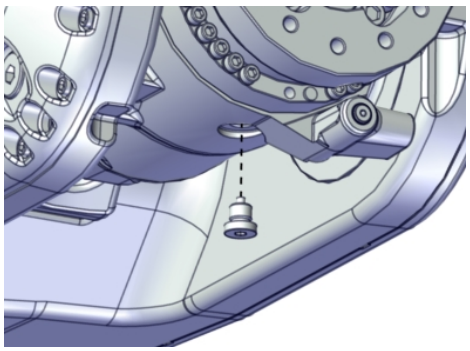
Document name	Document number	Note
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*	

Continues on next page

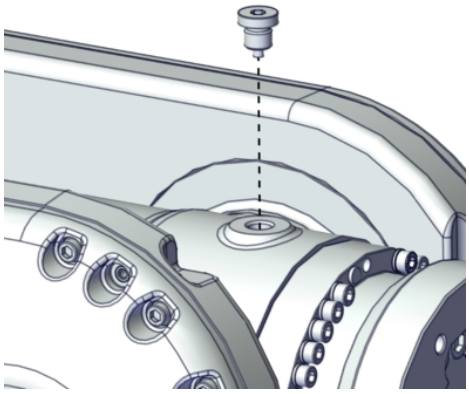
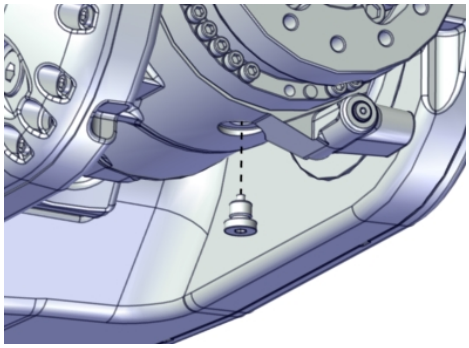
4.4.7 Changing the oil in axis-6 gearbox
Continued

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 29*.	
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	Place the oil collecting vessel underneath the oil drain plug.	
6	Remove the oil plug from the drain hole and let the oil run into the vessel.	 xx2100002101

Continues on next page

	Action	Note
7	Remove the oil plug from the fill hole. **Note** The oil plug hole is opened to speed up the drainage.	 xx2100002077
8	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 615* 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.  xx2100002101

Filling oil into the axis-6 gearbox

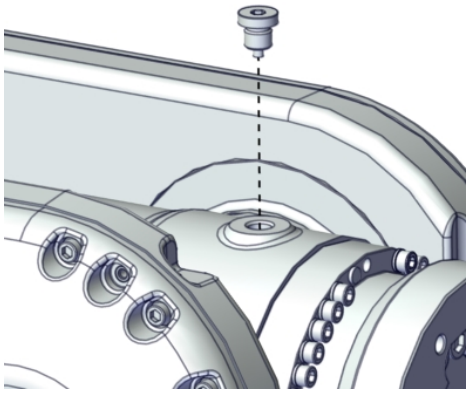
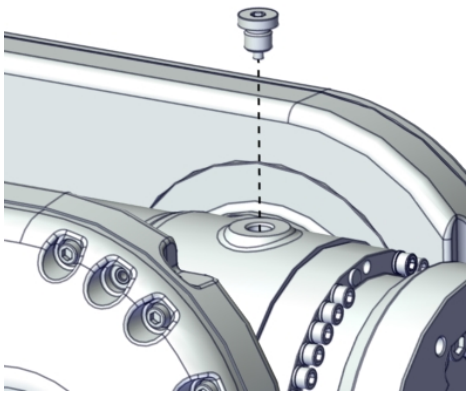
Use this procedure to refill the gearbox with oil.

	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

4.4.7 Changing the oil in axis-6 gearbox

Continued

	Action	Note
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 29*.	
3	Open the fill plug.	 xx2100002077
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.	See *Inspecting the oil level in axis-6 gearbox on page 133*.
6	Refit the oil plug with a new o-ring.	O-ring, G 1/4": 3HAC061327-060 Tightening torque: 20 Nm.  xx2100002077

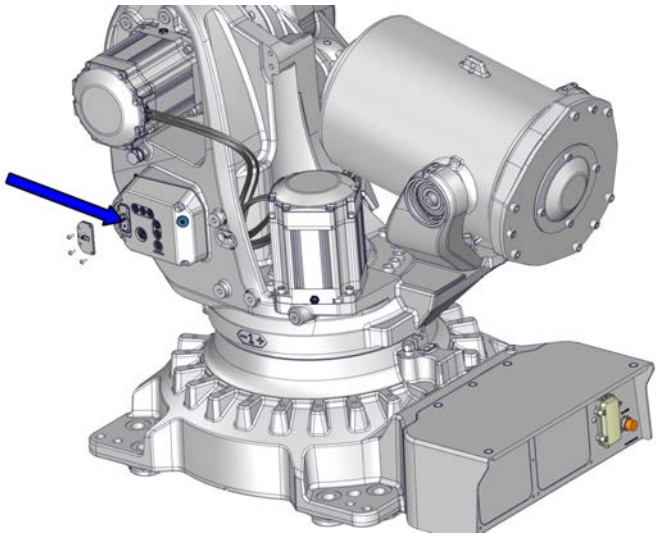
Continues on next page

	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 94*.	

4.4.8 Replacing the SMB battery

Location of the SMB battery

The SMB battery is located as shown in the figure.



xx2200001777

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 6710 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

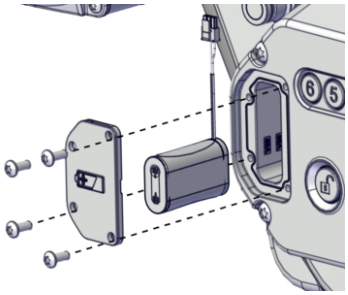
Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

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

	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 48*.	
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

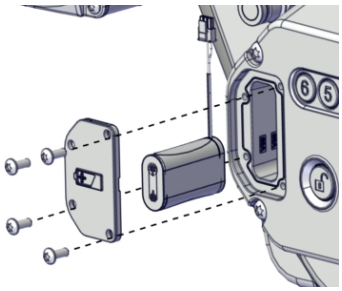
Use this procedure to refit the SMB battery.

	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

4.4.8 Replacing the SMB battery

Continued

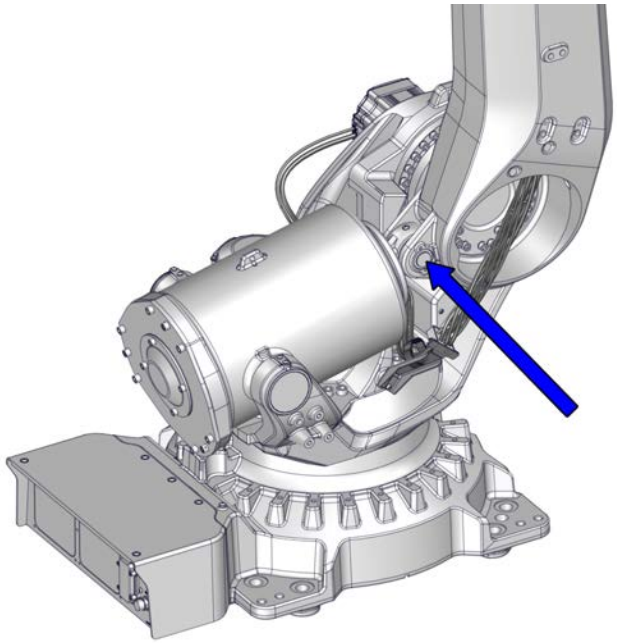
	Action	Note
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 48*.	
3	Connect the battery cable and install the battery pack into the SMB/battery recess. **Note** Make sure that the connector 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 592*.
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 94*.	

4.5 Lubrication activities

4.5.1 Lubricating the spherical roller bearing, balancing device

Location of spherical roller bearing

The spherical roller bearing is located in the link ear of the balancing device.



xx2200001324

Required consumables and wear parts

Wear part	Article number	Note
Grease	3HAA1001-294	Tribol GR 100-0 PD, 50 ml

Lubricating the spherical roller bearing

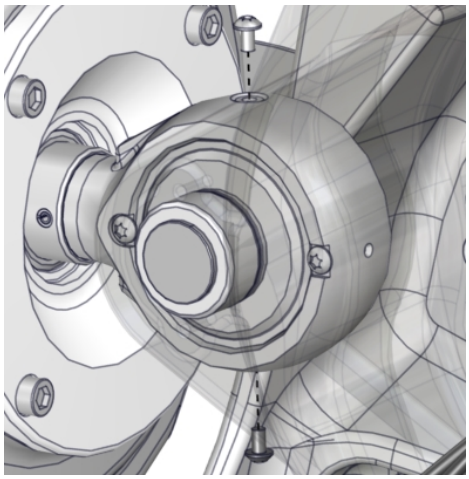
Use this procedure to lubricate the spherical roller bearing.

	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

4.5.1 Lubricating the spherical roller bearing, balancing device

Continued

	Action	Note
2	Unscrew both screws in link ear and fill the bearing with grease from the upper hole until new grease appears in the lower hole. Use a grease nipple.	Grease: 3HAA1001-294  xx2200001477
3	Refit the two screws and wipe clean from residual grease.	

4.6 Cleaning activities

4.6.1 Cleaning the IRB 6710

General

To secure high uptime it is important that the IRB 6710 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 6710.

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 100*
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.
- Do not remove any covers or other protective devices before cleaning the robot.

Continues on next page

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 light 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 light 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.

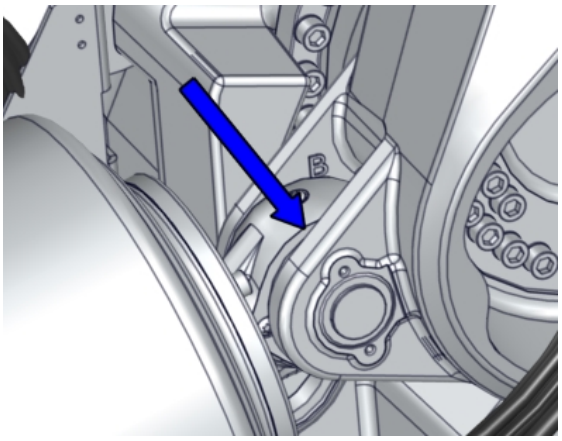
Cleaning with water and steam

Instructions for rinsing with water

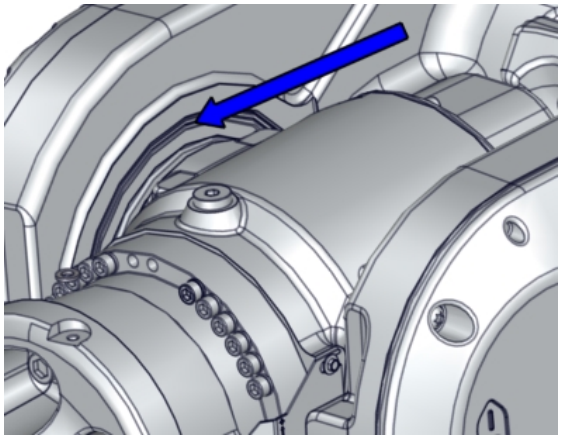
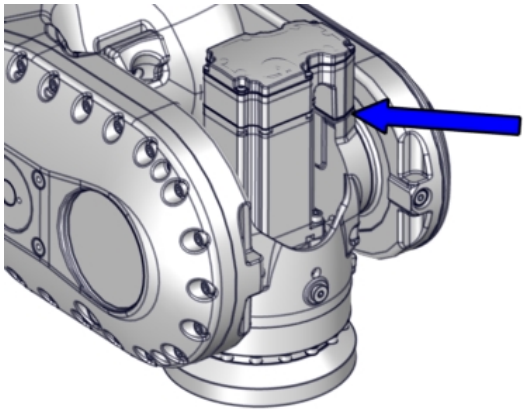
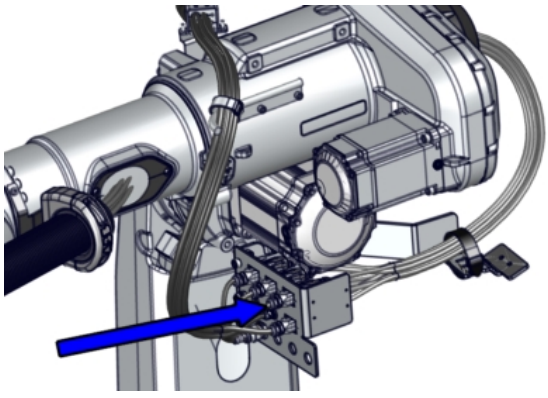
ABB robots with protection types *Standard* or *Foundry Plus* can be cleaned by rinsing with water (water cleaner).

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):

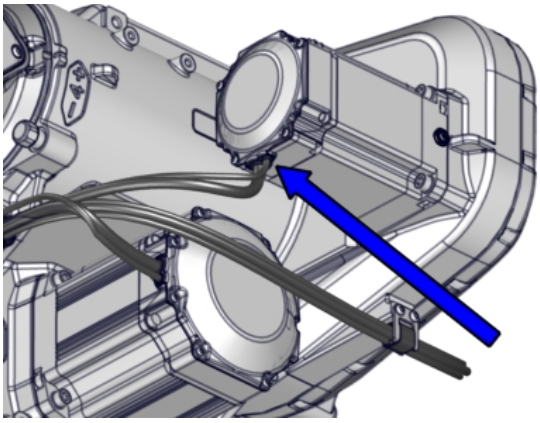
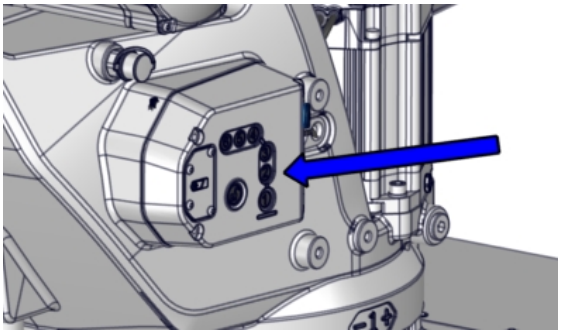
Position	Example of position
Joints	 xx2300001054

Continues on next page

Position	Example of position
Rotational sealings	 xx2300001055
Gaskets	 xx2300001056
Connectors	 xx2300001057

Continues on next page

4.6.1 Cleaning the IRB 6710
Continued

Position	Example of position
Cable inlets	 xx2300001058
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.

5 Repair

5.1 Introduction

Structure of this chapter

This chapter describes repair activities for the IRB 6710. 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 6710, 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 General procedures

5.2.1 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.	

5.2.2 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

5.2.2 Mounting instructions for bearings
Continued

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.

5.2.3 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.

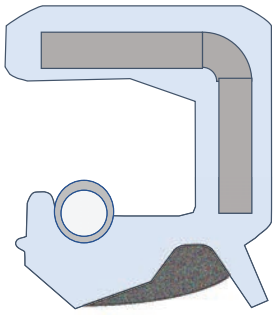
CAUTION

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.

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.



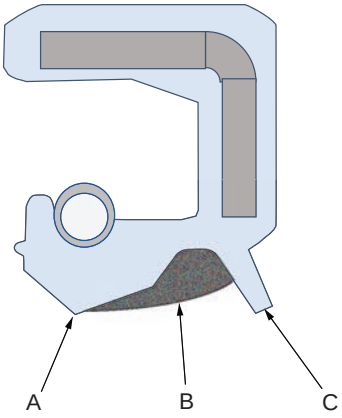
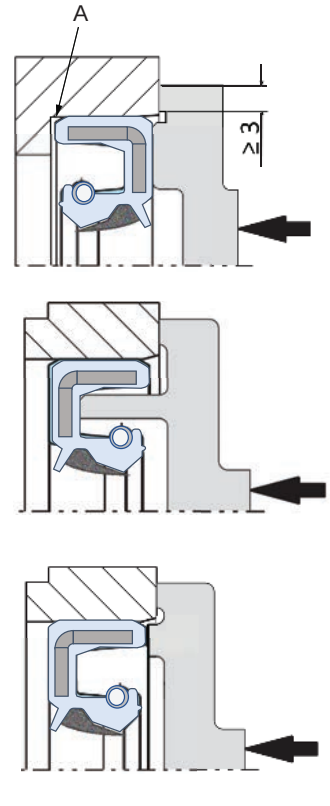
xx2300000433

	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.	

Continues on next page

5.2.3 Mounting instructions for sealings

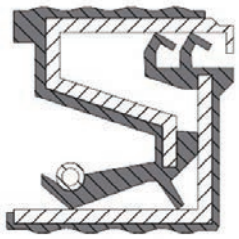
Continued

	Action	Note
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 181*.  xx2000000071 A Main lip B Grease C Dust lip
4	Mount the sealing correctly with a mounting tool. Never hammer directly on the sealing as this may result in leakage.	 xx2000000072 A Gap

Continues on next page

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.	
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.

Continues on next page

5.2.3 Mounting instructions for sealings
Continued

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.	

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

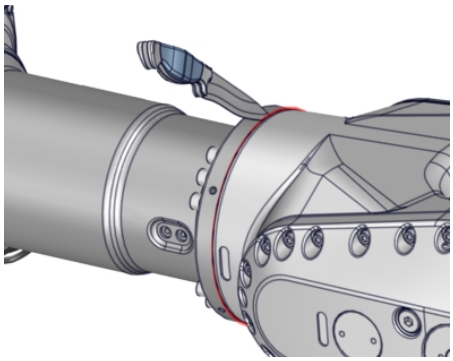
General

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

Removing

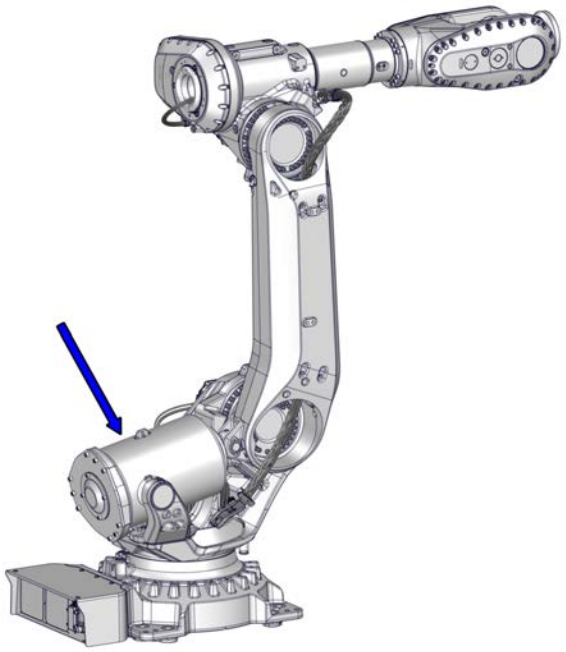
	Action	Description
1	Cut the paint with a knife in the joint between the part that will be removed and the structure, to avoid that the paint cracks.	 xx2300000950
2	Carefully grind the paint edge that is left on the structure to a smooth surface.	

5.3 Balancing device

5.3.1 Replacing the balancing device

Location of the balancing device

The balancing device is located as shown in the figure.



xx2200001331

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 shaft in the front link ear.
3. Replace the balancing device.

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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note
Balancing device	3HAC032124-003 (Graphite White) 3HAC032124-005 (ABB Orange)	

Continues on next page

Required service parts

Consumable	Article number	Note
Protection plug	3HAC4836-26	Located at the front link ear of the balancing device. Replace if damaged.
VK cover, 100x10	3HAA2166-13	Located at the cradle of the balancing device. 2 pcs required. Replace if damaged.
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)
Rust preventive	3HAC034903-001	Mercasol 3110 Waxcoat. Recommended drying time is 24h.
Flange sealant for conical fittings	-	Loctite 5400 (or equivalent Loctite 577)
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

Required tools and equipment

Equipment	Article number	Note
Lock screw, M16x120	-	Used to secure lower arm.
Hydraulic press equipment, balancing device	3HAC074411-001	Used to unload or restore a balancing device. User instructions are enclosed with the tool.
Dismantle and mounting tool	3HAC028920-001	Used for removing and fitting shaft and bearings. User instructions are enclosed with the tool.
Hydraulic pump 80 MPa	3HAC13086-1	To be used with the press and puller tools. See technical specifications in the user instructions for the press equipment.
Hydraulic cylinder	3HAC11731-1	To be used with the press and puller tools. See technical specifications in the user instructions for the press equipment.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Lifting shackle	-	SA-10-8-NA1
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

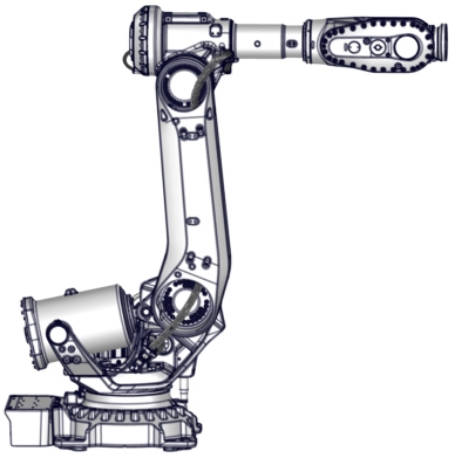
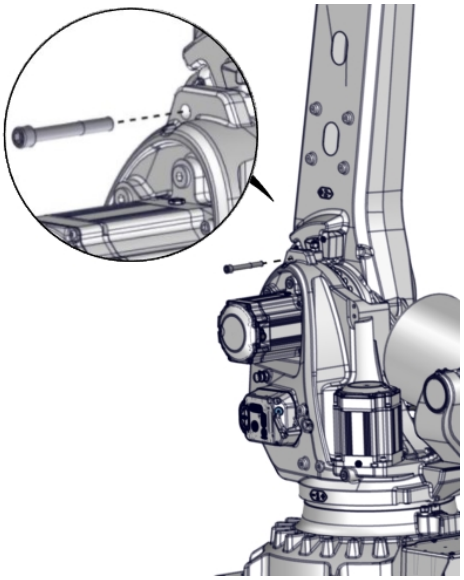
Continues on next page

5.3.1 Replacing the balancing device
Continued

Removing the balancing device

Use these procedures to remove the balancing device.

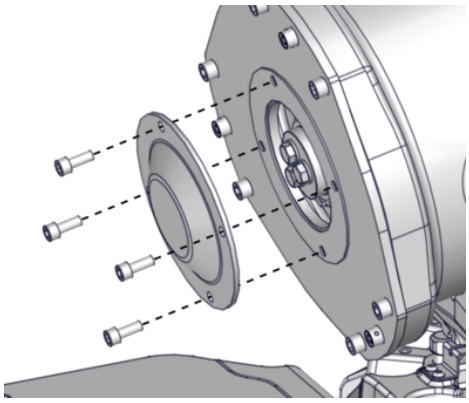
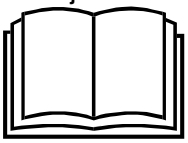
Preparations before removing the balancing device

	Action	Note
1	Jog axis-2 to the calibration position.	 xx2200001458
2	Fit a lock screw through the hole for the lock screw in the frame and into the lower arm to secure the weight of the lower and upper arms. **CAUTION** Do not tighten the lock screw, since too hard tightening could damage the gear.	Lock screw, M16x120  xx2200001332
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
4	Remove any installed equipment on or close to the balancing device.	

Continues on next page

Unloading the balancing device springs and locking position with the Hydraulic press equipment, balancing device

Use this procedure to unload and lock the balancing device in unloaded position with the Hydraulic press equipment, balancing device (3HAC074411-001).

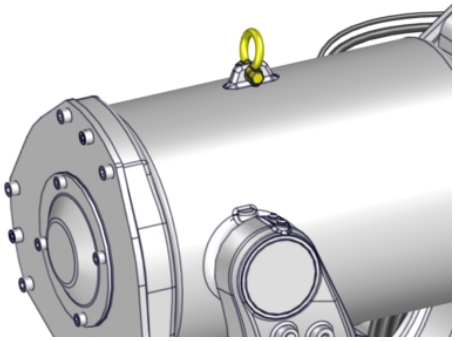
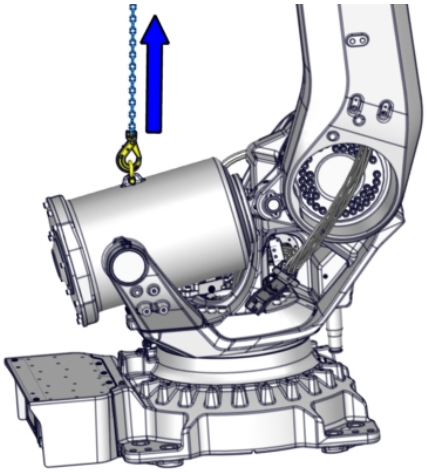
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the cover plate on the back of the balancing device. **DANGER** DO NOT remove any other screws than the rear cover attachment screws.	 xx2200001330
3	Unload the balancing device with the press equipment, to make the piston rod and front ear adjustable when pulling the shaft out.  xx0900000813 Go to the user instructions enclosed with the press tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Hydraulic press equipment, balancing device: 3HAC074411-001 User instructions are enclosed with the tool.

Attaching lifting accessory to the balancing device

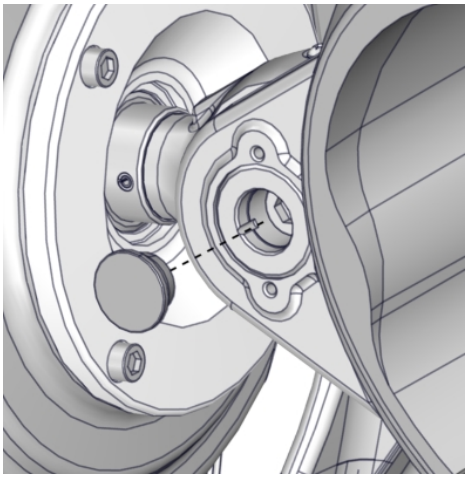
	Action	Note
1	**CAUTION** The weight of the balancing device (excluding cradle) is 140 kg All lifting accessories used must be sized accordingly.	

Continues on next page

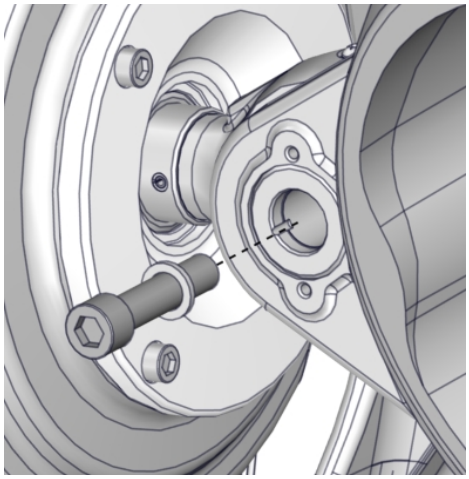
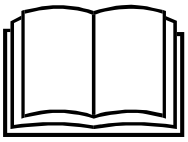
5.3.1 Replacing the balancing device
Continued

	Action	Note
2	Fit a lifting shackle to the balancing device.	Lifting shackle: SA-10-8-NA1  xx2200001355
3	Fit the lifting accessory to the shackle and raise to unload the weight.	Lifting accessory (chain): 3HAC15556-1  xx2200001459

Removing the shaft in the front (link ear)

	Action	Note
1	Remove the protection plug at the link ear.	 xx2200001460

Continues on next page

	Action	Note
2	Unscrew the attachment screw and washer.	Hex socket head cap screw: M16x70 8.8-A3F Washer: Steel 17x25x3  xx2200001461
3	Pull the shaft out using the dismantle and mounting tool, according to user instructions enclosed with the equipment.  xx0900000813 Go to the user instructions enclosed with the press tool.  **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Dismantle and mounting tool: 3HAC028920-001 User instructions are enclosed with the tool.

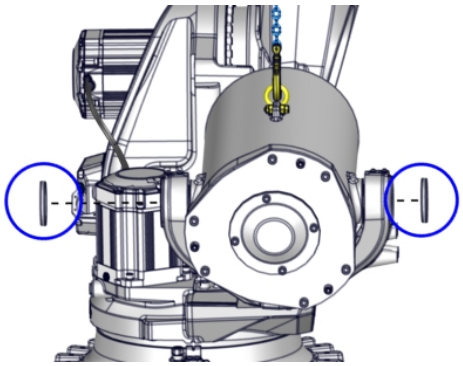
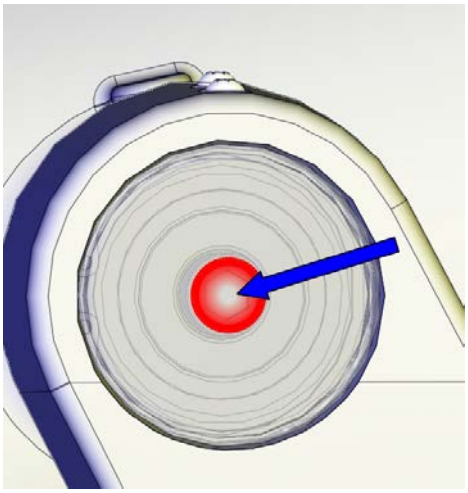
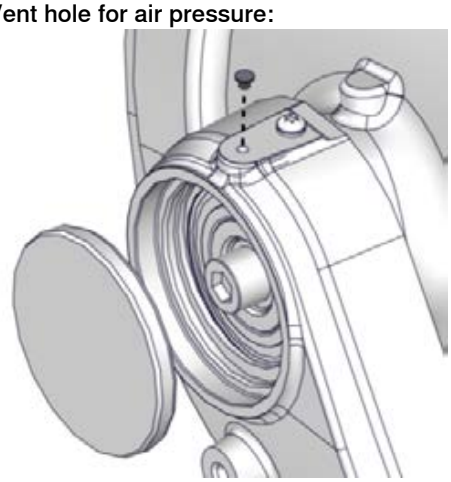
Continues on next page

5.3.1 Replacing the balancing device

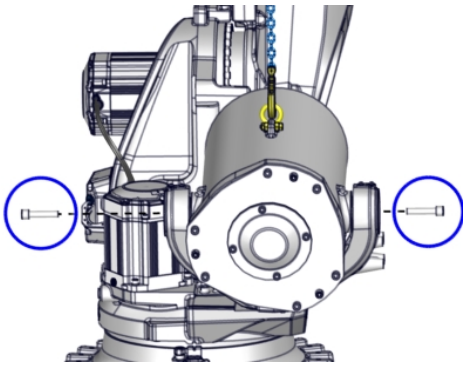
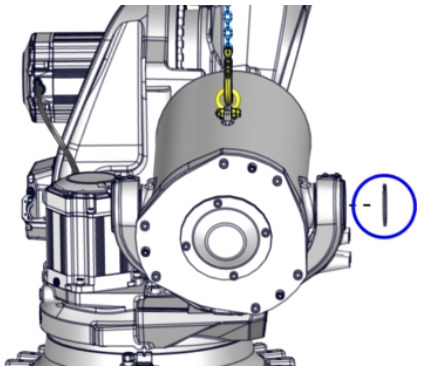
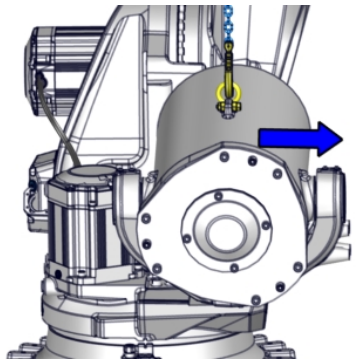
Continued

Removing the balancing device

Perform this procedure on both sides.

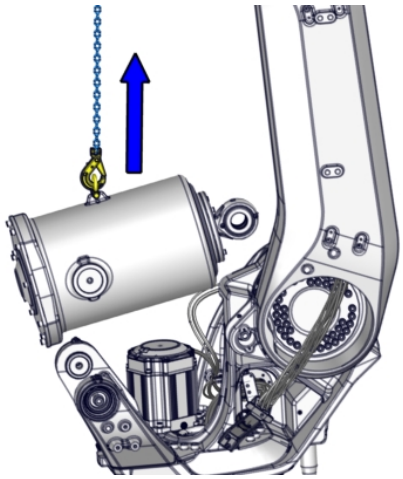
	Action	Note
1	Remove the both VK covers using one of the recommended methods: • Drive a screwdriver (or similar) through the VK cover, as close as possible to the center of the VK cover, and bend out the cover. It is important to make the hole as close to the center as possible, otherwise there is a risk of damaging the bearing inside. The damaged VK cover must be replaced with a new. • Remove the protection plug from the vent hole and use air pressure through the hole to blow out the cover. The cover can be reused if not damaged.	 xx2200001464 VK cover, 100x10: 3HAA2166-13 Position for screwdriver:  xx1300000662 Vent hole for air pressure:  xx2300000003
2	Wipe off any residual grease inside the recess.	

Continues on next page

	Action	Note
3	Unscrew the attachment screws on each shaft.	 xx2200001465 M16x70 quality steel 12.9 Gleitmo 603
4	Remove the retaining ring on one side.	 xx2200001466
5	Push the balancing device against the side where the retaining ring is removed, to push in the shaft end and make the balancing device go free. If this is not possible, the shaft end must be pulled out a bit with the dismantle and mounting tool, see *Removing the shaft end, cradle on page 223*.	 xx2200001467
6	**CAUTION** The weight of the balancing device (excluding cradle) is 140 kg All lifting accessories used must be sized accordingly.	

Continues on next page

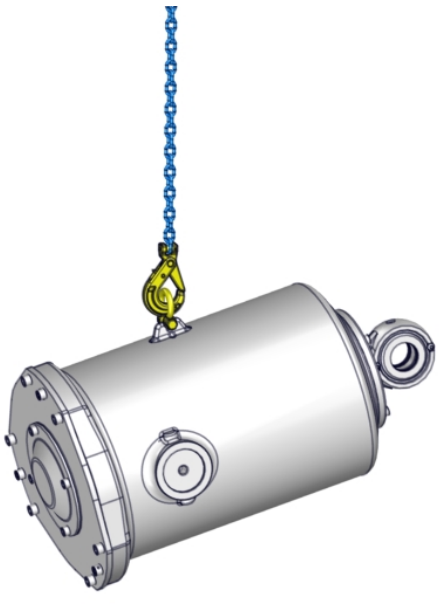
5.3.1 Replacing the balancing device
Continued

	Action	Note
7	Lift the balancing device away.	 xx2200001468

Refitting the balancing device

Use this procedure to refit the balancing device.

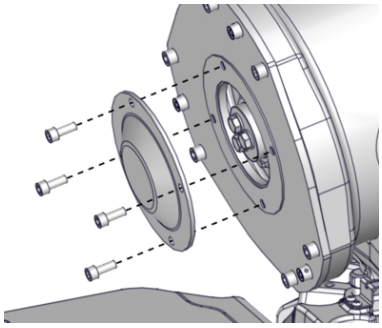
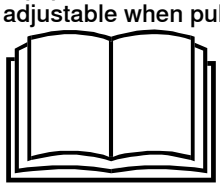
Attaching lifting accessory to the balancing device

	Action	Note
1	**CAUTION** The weight of the balancing device (excluding cradle) is 140 kg All lifting accessories used must be sized accordingly.	
2	Fit a lifting shackle to the balancing device.	Lifting shackle: SA-10-8-NA1 Lifting accessory (chain): 3HAC15556-1
3	Fit the lifting accessory to the shackle.	 xx2200001915

Continues on next page

Unloading a new spare part, balancing device

Before a new spare part balancing device is fitted, the springs must be unloaded using the Hydraulic press equipment, balancing device (3HAC074411-001).

	Action	Note
1	Remove the cover plate on the back of the balancing device. **DANGER** DO NOT remove any other screws than the rear cover attachment screws.	 xx2200001330
2	Unload the balancing device with the press equipment, to make the piston rod and front ear adjustable when pulling the shaft out.  xx0900000813 Go to the user instructions enclosed with the press tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Hydraulic press equipment, balancing device: 3HAC074411-001 User instructions are enclosed with the tool.

Refitting the balancing device

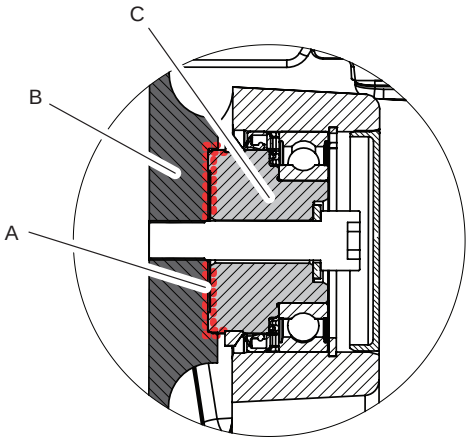
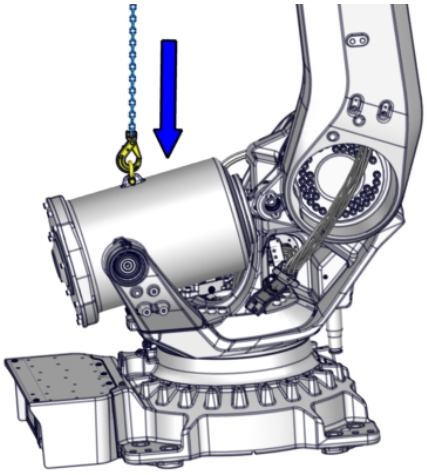
Perform this procedure on both sides.

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

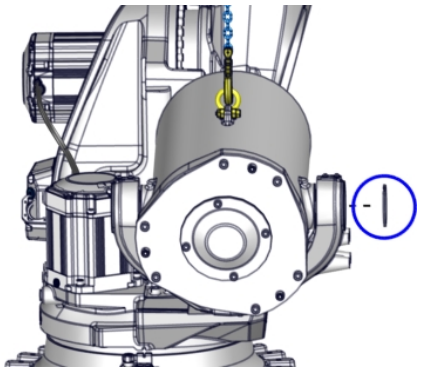
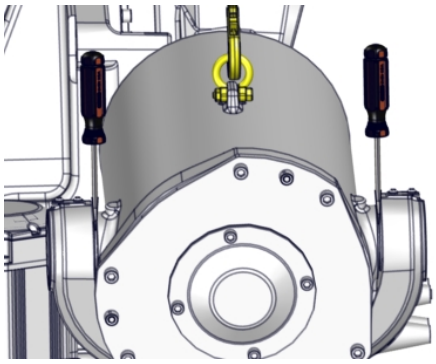
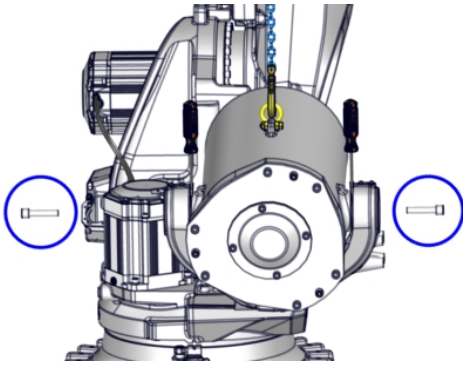
Continues on next page

5.3.1 Replacing the balancing device

Continued

	Action	Note
2	*Foundry Plus:* Apply Mercasol on matching surfaces on the shaft end in the cradle and the balancing device. See the figure!	 xx1400000367 A Mercasol (red dotted lines) B Balancing device C Shaft end in the cradle
3	**CAUTION** The weight of the balancing device (excluding cradle) is 140 kg All lifting accessories used must be sized accordingly.	
4	Lift the balancing device into position in the cradle.	 xx2200001469

Continues on next page

	Action	Note
5	Fit the retaining ring. **Tip** The bearing may need to be pushed in past the retaining ring groove before the retaining ring can be fitted.	 xx2200001466
6	Hold a big screwdriver between the cradle and the balancing device while securing each screw in following step. This is done to keep the distance between the balancing device and the bearing while tightening the screw.	 xx2200001470
7	Apply locking liquid on the screws, insert them on both sides and tighten by hand. The screws are not possible to torque tighten at this point, since the front ear is not fastened to the lower arm.	Hex socket head cap screw: M16x70 12.9 Gleitmo 603+Geomet 500 Washer: 3HAC047681-001 Locking liquid: Loctite 2400 (or equivalent Loctite 243)  xx2200001475

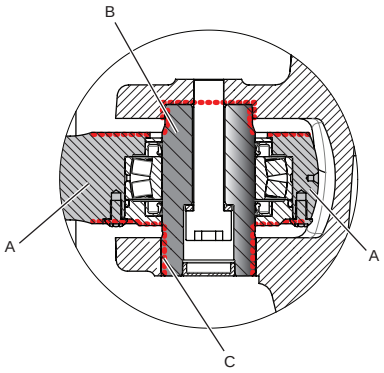
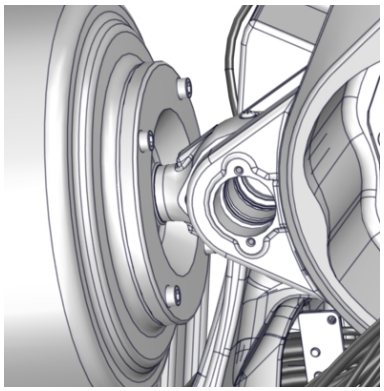
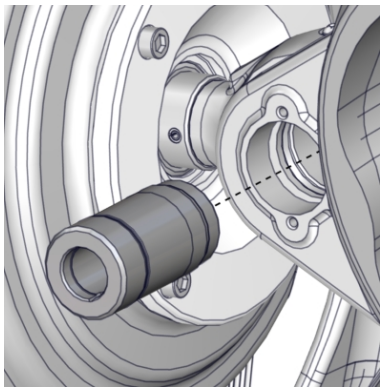
Refitting the front shaft of the balancing device

	Action	Note
1	Apply the lifting accessory to the balancing device (if not already done).	Lifting shackle: SA-10-8-NA1 Lifting accessory (chain): 3HAC15556-1
2	Remove all residue of Loctite in the screw hole of the shaft.	

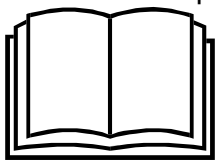
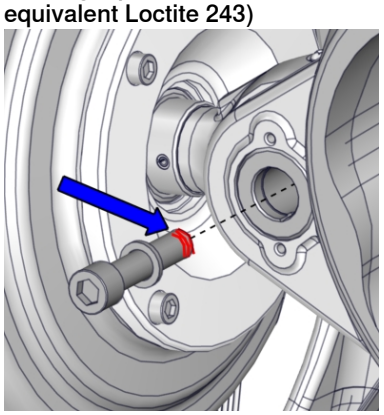
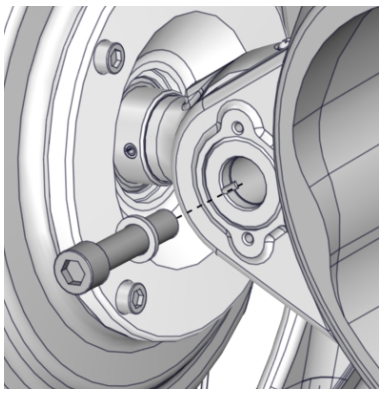
Continues on next page

5.3.1 Replacing the balancing device

Continued

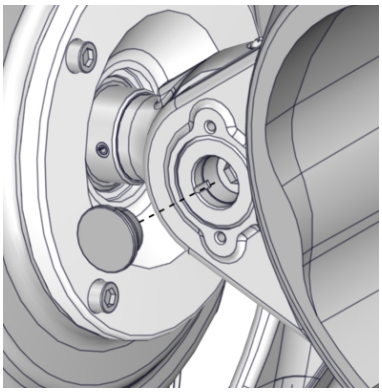
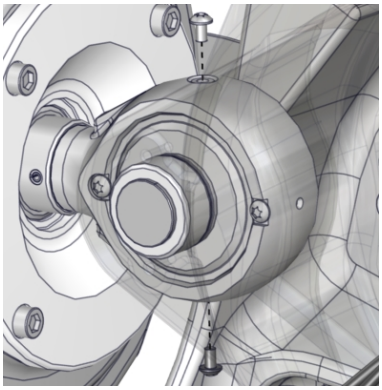
	Action	Note
3	Wipe all contact surfaces inside the recess clean from contamination.	
4	*Foundry Plus:* Apply Mercasol on the surfaces on the shaft and front ear.	 xx1400000368 A Front link ear B Shaft C Mercasol (red dotted lines)
5	Align the balancing device link ear with the hole in the lower arm. **Note** Verify that the link ear is correctly turned.	 xx2200001918
6	Lubricate the shaft and place it to the front ear. **Note** *Foundry Plus*: Do not lubricate surfaces where Mercasol is applied.	 xx2200001917

Continues on next page

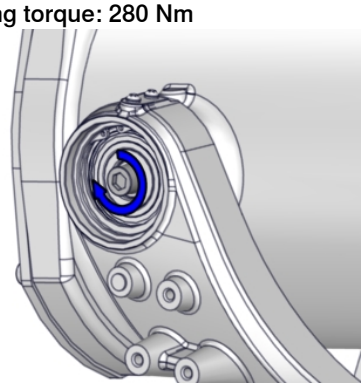
	Action	Note
7	Press in the shaft using the dismantle and mounting tool, according to user instructions enclosed with the equipment.  xx0900000813 Go to the user instructions enclosed with the press tool.  **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Dismantle and mounting tool: 3HAC028920-001 User instructions are enclosed with the tool.
8	Apply locking liquid on the first threads of the screw.	Hex socket head cap screw: M16x70 8.8-A3F Washer: Steel 17x25x3 Locking liquid: Loctite 2400 (or equivalent Loctite 243)  xx2200001916
9	Secure the shaft with screw and washer.	Tightening torque: 200 Nm  xx2200001461

Continues on next page

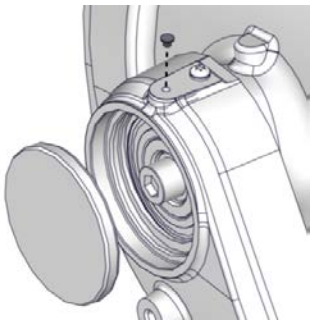
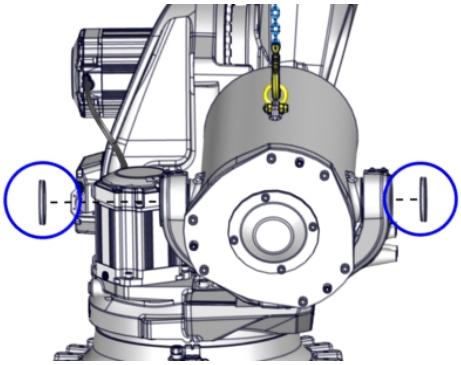
5.3.1 Replacing the balancing device
Continued

	Action	Note
10	Fit the protection plug.	 xx2200001460
11	Unscrew both screws in link ear and fill the bearing with grease from the upper hole until the grease appears in the lower hole.	Grease: 3HAA1001-294  xx2200001477
12	Refit the two screws and wipe clean from residual grease.	
13	Remove the lifting accessory from the balancing device.	

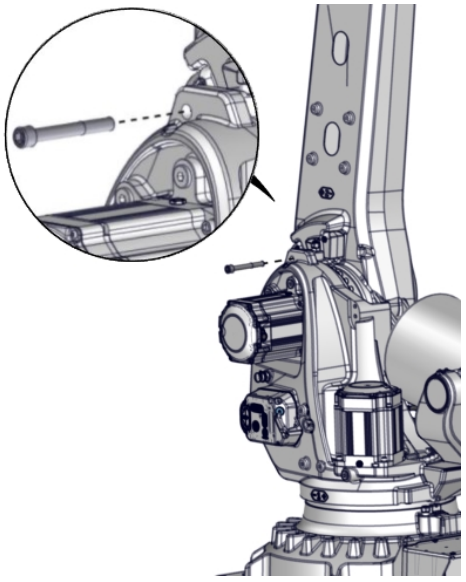
Securing the shaft ends

	Action	Note
1	Secure both shaft end screws with tightening torque.	Tightening torque: 280 Nm  xx2200001471

Continues on next page

	Action	Note
2	Refit new VK covers or reuse the old covers if they are undamaged. **Note** Temporarily remove the protection plug on the cradle to let go of overpressure if the VK covers are hard to fit.  xx2300000003	VK cover, 100x10, 3HAA2166-13  xx2200001464

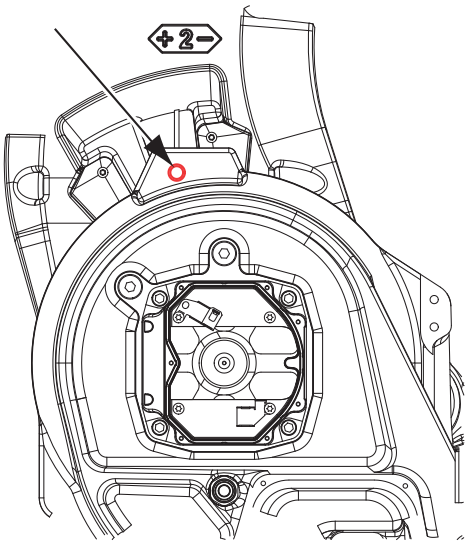
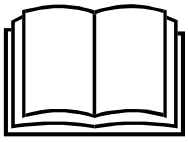
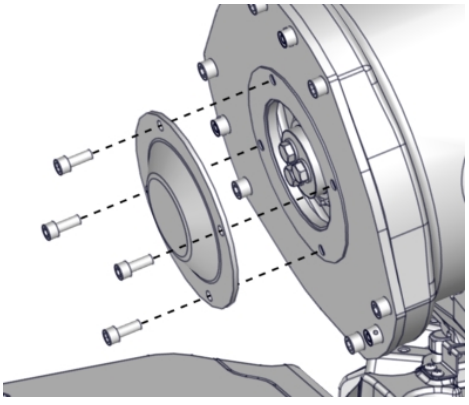
Concluded refitting of the front shaft

	Action	Note
1	Remove the locking screw (M16x120).	 xx2200001332

Continues on next page

5.3.1 Replacing the balancing device

Continued

	Action	Note
2	*Foundry Plus*: Apply Mercasol in the hole for the locking screw.	 xx1400000372
3	Restore the balancing device according to instructions for the press equipment.  xx0900000813 Go to the user instructions enclosed with the press tool.  **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	User instructions are enclosed with the tool.
4	Apply flange sealant and refit the cover plate on the back of the balancing device.	Hex socket head cap screw: M10x25 8.8-A3F. Tightening torque: 50 Nm. Flange sealant for conical fittings: Loctite 5400 (or equivalent Loctite 577).  xx2200001330

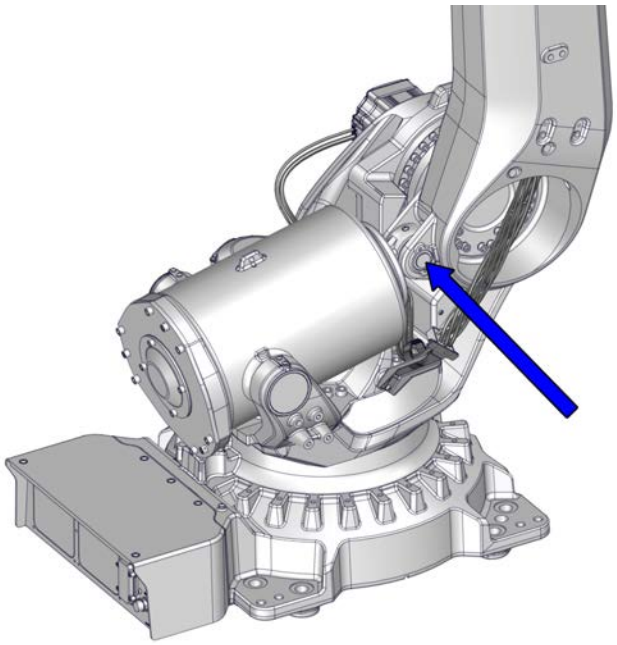
Continues on next page

	Action	Note
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 94*.	

5.3.2 Replacing spherical roller bearing, balancing device link ear

Location of spherical roller bearing

The spherical roller bearing is located in the link ear of the balancing device.



xx2200001324

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 shaft in the front link ear.
3. Replace the spherical roller bearing.
4. Restore the balancing device.

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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Continues on next page

Spare part	Article number	Note
Maintenance set, link ear	3HAC087168-001	The maintenance kit contains: • End cover • Radial sealing with dust lip, (2 pcs) • O-ring • Spherical roller bearing • Washer

Required tools and equipment

Equipment	Article number	Note
Lock screw, M16x120	-	Used to secure lower arm.
Hydraulic press equipment, balancing device	3HAC074411-001	Used to unload or restore a balancing device. User instructions are enclosed with the tool.
Dismantle and mounting tool	3HAC028920-001	Used for removing and fitting shaft and bearings. User instructions are enclosed with the tool.
Hydraulic cylinder	3HAC11731-1	To be used with the press and puller tools. See technical specifications in the user instructions for the press equipment.
Hydraulic pump 80 MPa	3HAC13086-1	To be used with the press and puller tools. See technical specifications in the user instructions for the press equipment.
Lifting shackle	-	SA-10-8-NA1
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Required service parts

Consumable	Article number	Note
Protection plug	3HAC4836-26	Located at the front link ear of the balancing device. Replace if damaged.
Grease	3HAA1001-294	Tribol GR 100-0 PD
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

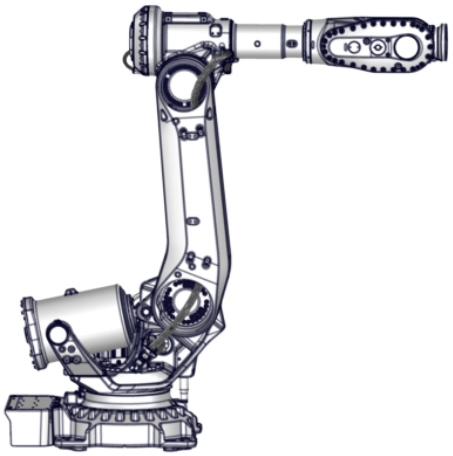
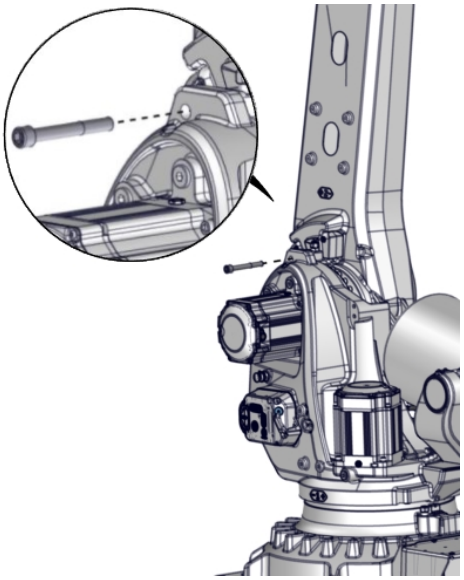
Continues on next page

5.3.2 Replacing spherical roller bearing, balancing device link ear
Continued

Removing the spherical roller bearing

Use these procedures to remove the spherical roller bearing in the link ear.

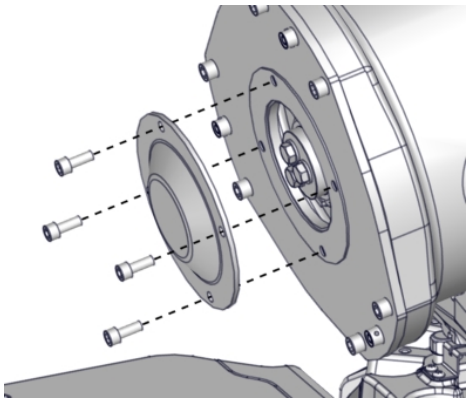
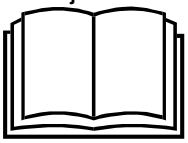
Preparations before removing the spherical roller bearing

	Action	Note
1	Jog axis-2 to the calibration position.	 xx2200001458
2	Fit a lock screw through the hole for the lock screw in the frame and into the lower arm to secure the weight of the lower and upper arms. **CAUTION** Do not tighten the lock screw, since too hard tightening could damage the gear.	Lock screw, M16x120  xx2200001332
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
4	Remove any installed equipment on or close to the balancing device.	

Continues on next page

Unloading the balancing device springs and locking position with the Hydraulic press equipment, balancing device

Use this procedure to unload and lock the balancing device in unloaded position with the Hydraulic press equipment, balancing device (3HAC074411-001).

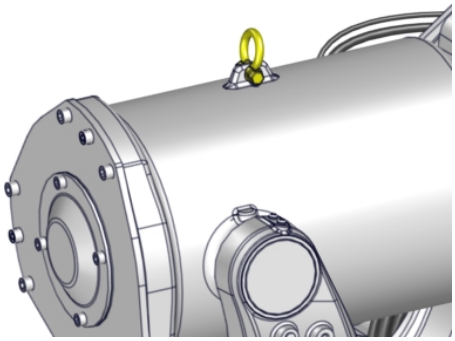
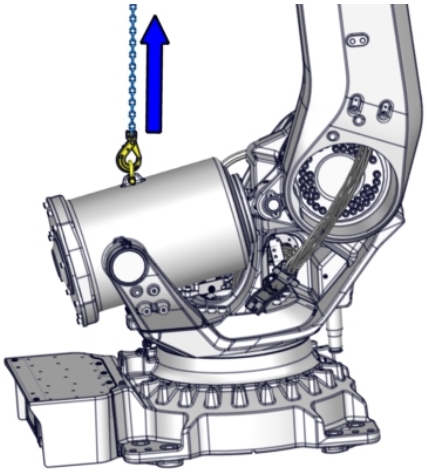
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the cover plate on the back of the balancing device. **DANGER** DO NOT remove any other screws than the rear cover attachment screws.	 xx2200001330
3	Unload the balancing device with the press equipment, to make the piston rod and front ear adjustable when pulling the shaft out.  xx0900000813 Go to the user instructions enclosed with the press tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Hydraulic press equipment, balancing device: 3HAC074411-001 User instructions are enclosed with the tool.

Attaching lifting accessory to the balancing device

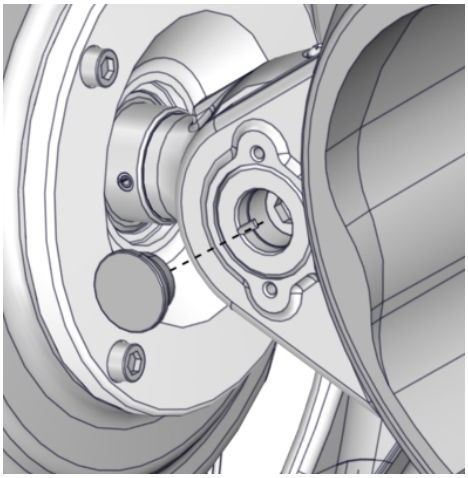
	Action	Note
1	**CAUTION** The weight of the balancing device (excluding cradle) is 140 kg All lifting accessories used must be sized accordingly.	

Continues on next page

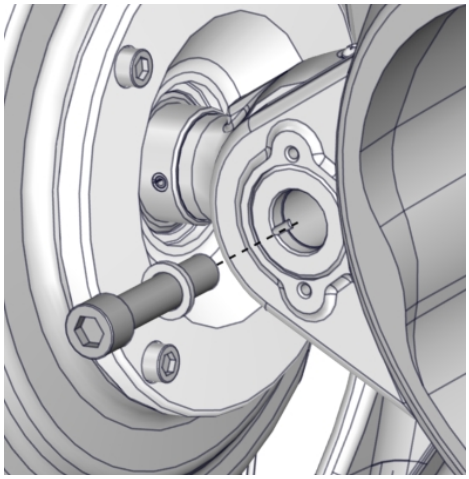
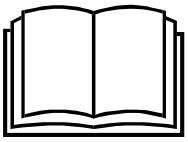
5.3.2 Replacing spherical roller bearing, balancing device link ear
Continued

	Action	Note
2	Fit a lifting shackle to the balancing device.	Lifting shackle: SA-10-8-NA1  xx2200001355
3	Fit the lifting accessory to the shackle and raise to unload the weight.	Lifting accessory (chain): 3HAC15556-1  xx2200001459

Removing the shaft in the front (link ear)

	Action	Note
1	Remove the protection plug at the link ear.	 xx2200001460

Continues on next page

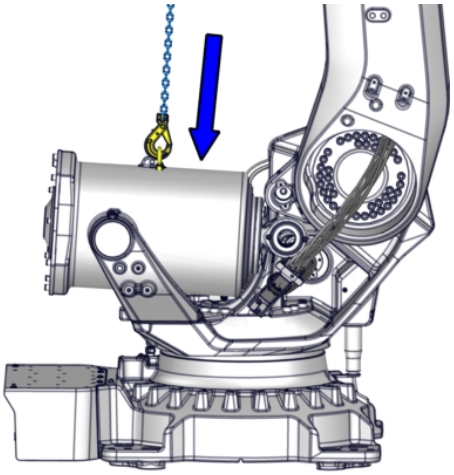
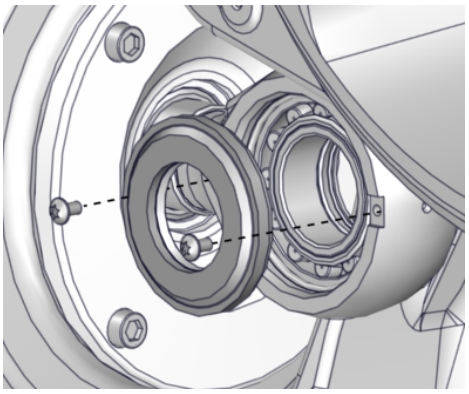
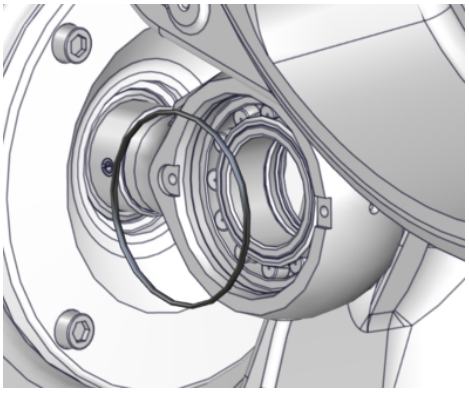
	Action	Note
2	Unscrew the attachment screw and washer.	Hex socket head cap screw: M16x70 8.8-A3F Washer: Steel 17x25x3  xx2200001461
3	Pull the shaft out using the dismantle and mounting tool, according to user instructions enclosed with the equipment.  xx0900000813 Go to the user instructions enclosed with the press tool.  **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Dismantle and mounting tool: 3HAC028920-001 User instructions are enclosed with the tool.

Continues on next page

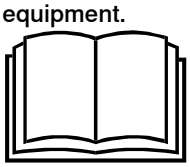
5.3.2 Replacing spherical roller bearing, balancing device link ear

Continued

Removing the spherical roller bearing, link ear

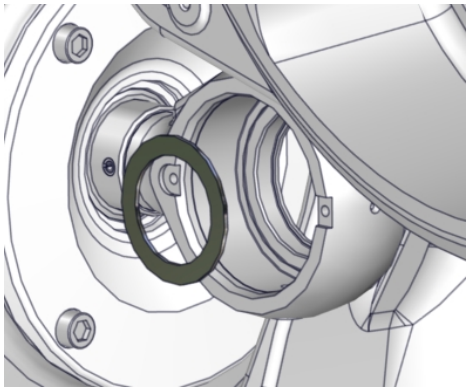
	Action	Note
1	Lower the balancing device to a position where it is possible to apply the dismantle and mounting tool to the link ear.	 xx2200001493
2	Unscrew the attachment screws securing the end cover, remove end cover and radial sealing with a screwdriver.	 xx2200001494
3	Remove the o-ring.	 xx2200001495

Continues on next page

	Action	Note
4	Pull the spherical roller bearing out together with the radial sealing and washer using the dismantle and mounting tool, according to user instructions enclosed with the equipment.  xx0900000813 Go to the user instructions enclosed with the press tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Dismantle and mounting tool: 3HAC028920-001 User instructions are enclosed with the tool.

Refitting the spherical roller bearing

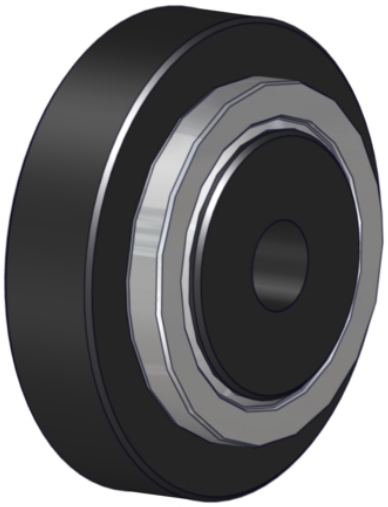
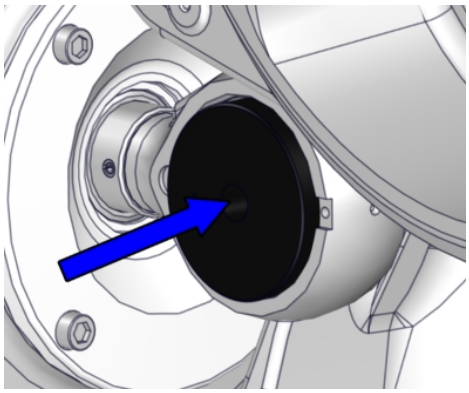
Refitting the spherical roller bearing, link ear

	Action	Note
1	Wipe clean all contact surfaces from residual grease.	
2	Refit the washer.	 xx2200001496

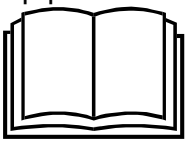
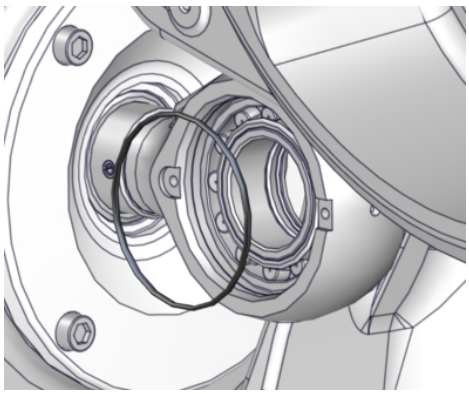
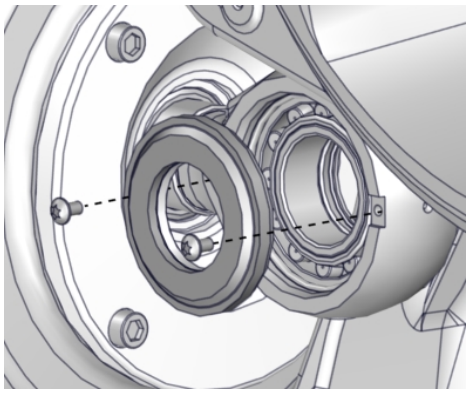
Continues on next page

5.3.2 Replacing spherical roller bearing, balancing device link ear

Continued

	Action	Note
3	Put the radial sealing on the Press tool J. **Note** Make sure that the sealing is turned according to the figure.	Press tool J included in tool set Dismantle and mounting tool: 3HAC028920-001  xx2200001497
4	Use a plastic mallet or similar on the Press tool J and refit the radial sealing.	 xx2200001498
5	Apply some grease on the surface for the bearing.	

Continues on next page

	Action	Note
6	Press in the spherical roller bearing using the dismantle and mounting tool, according to user instructions enclosed with the equipment.  xx0900000813 Go to the user instructions enclosed with the press tool.  **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Dismantle and mounting tool: 3HAC028920-001 User instructions are enclosed with the tool.
7	Refit the o-ring.	 xx2200001495
8	Secure the end cover including the radial sealing ring with the screws.	 xx2200001494

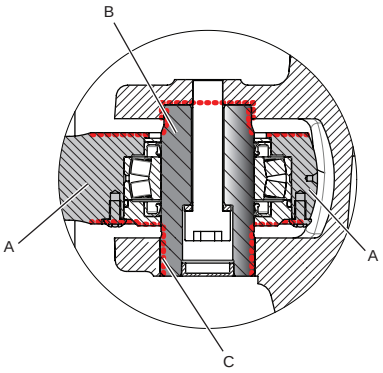
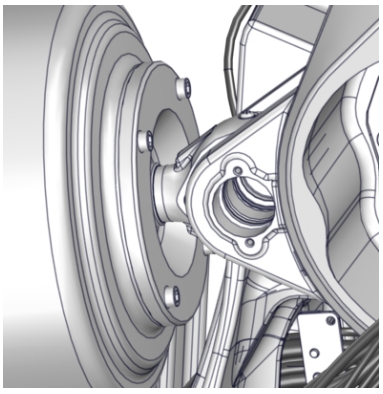
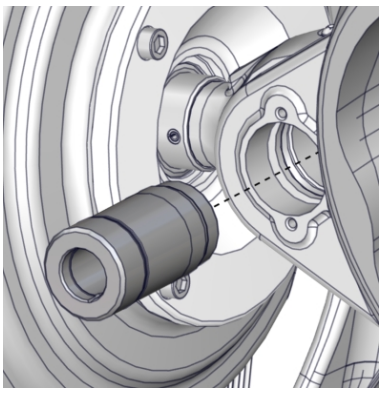
Refitting the front shaft of the balancing device

	Action	Note
1	Apply the lifting accessory to the balancing device (if not already done).	Lifting shackle: SA-10-8-NA1 Lifting accessory (chain): 3HAC15556-1

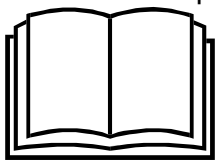
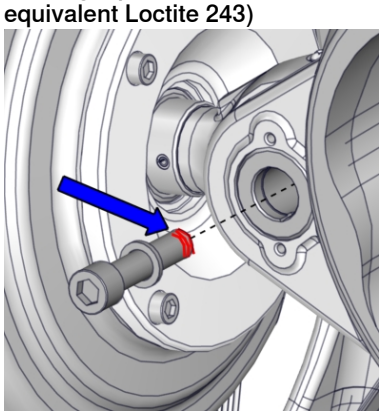
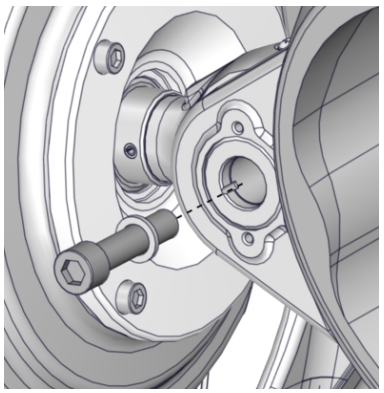
Continues on next page

5.3.2 Replacing spherical roller bearing, balancing device link ear

Continued

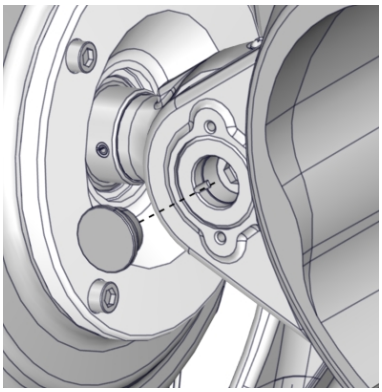
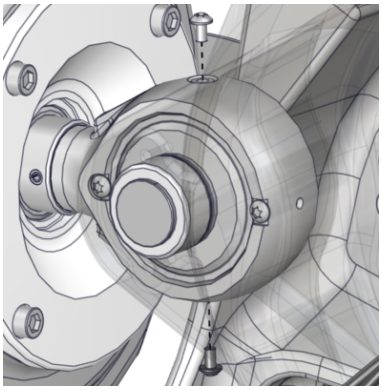
	Action	Note
2	Remove all residue of Loctite in the screw hole of the shaft.	
3	Wipe all contact surfaces inside the recess clean from contamination.	
4	*Foundry Plus:* Apply Mercasol on the surfaces on the shaft and front ear.	 xx1400000368 A Front link ear B Shaft C Mercasol (red dotted lines)
5	Align the balancing device link ear with the hole in the lower arm. **Note** Verify that the link ear is correctly turned.	 xx2200001918
6	Lubricate the shaft and place it to the front ear. **Note** *Foundry Plus*: Do not lubricate surfaces where Mercasol is applied.	 xx2200001917

Continues on next page

	Action	Note
7	Press in the shaft using the dismantle and mounting tool, according to user instructions enclosed with the equipment.  xx0900000813 Go to the user instructions enclosed with the press tool.  **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Dismantle and mounting tool: 3HAC028920-001 User instructions are enclosed with the tool.
8	Apply locking liquid on the first threads of the screw.	Hex socket head cap screw: M16x70 8.8-A3F Washer: Steel 17x25x3 Locking liquid: Loctite 2400 (or equivalent Loctite 243)  xx2200001916
9	Secure the shaft with screw and washer.	Tightening torque: 200 Nm  xx2200001461

Continues on next page

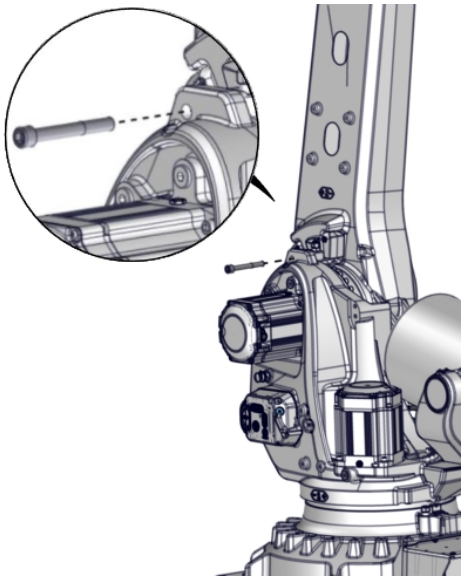
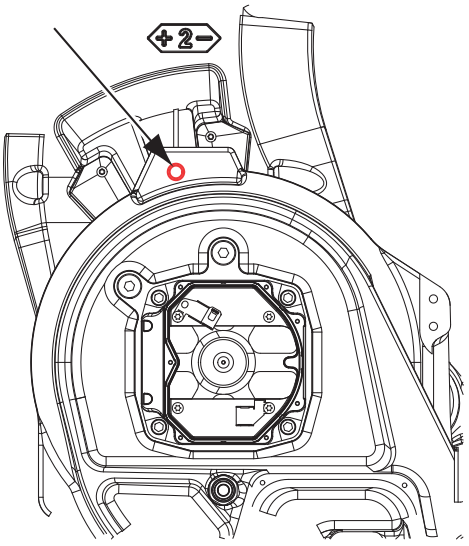
5.3.2 Replacing spherical roller bearing, balancing device link ear
Continued

	Action	Note
10	Fit the protection plug.	 xx2200001460
11	Unscrew both screws in link ear and fill the bearing with grease from the upper hole until the grease appears in the lower hole.	Grease: 3HAA1001-294  xx2200001477
12	Refit the two screws and wipe clean from residual grease.	
13	Remove the lifting accessory from the balancing device.	

Removing the lifting accessory and locking screw

	Action	Note
1	Remove the lifting accessory from the balancing device.	

Continues on next page

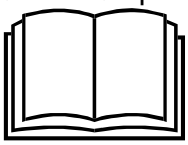
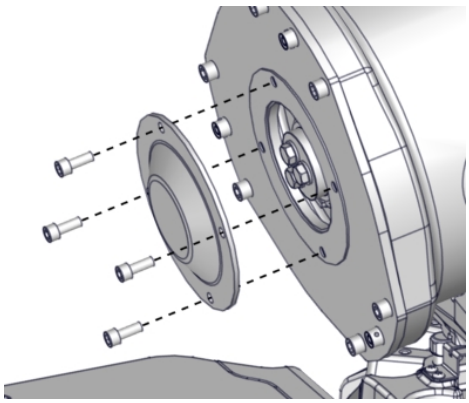
	Action	Note
2	Remove the lock screw (M16x120).	 xx2200001332
3	*Foundry Plus*: Apply Mercasol in the hole for the locking screw.	 xx1400000372

Continues on next page

5.3.2 Replacing spherical roller bearing, balancing device link ear

Continued

Restoring the balancing device and removing the Hydraulic press equipment, balancing device

	Action	Note
	Restore the balancing device and remove the press equipment according to instructions for the press equipment.  xx0900000813 Go to the user instructions enclosed with the press tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	User instructions are enclosed with the tool.
1	Apply flange sealant and refit the cover plate on the back of the balancing device.	Hex socket head cap screw: M10x25 8.8-A3F. Tightening torque: 50 Nm. Flange sealant for conical fittings: Loctite 5400 (or equivalent Loctite 577).  xx2200001330

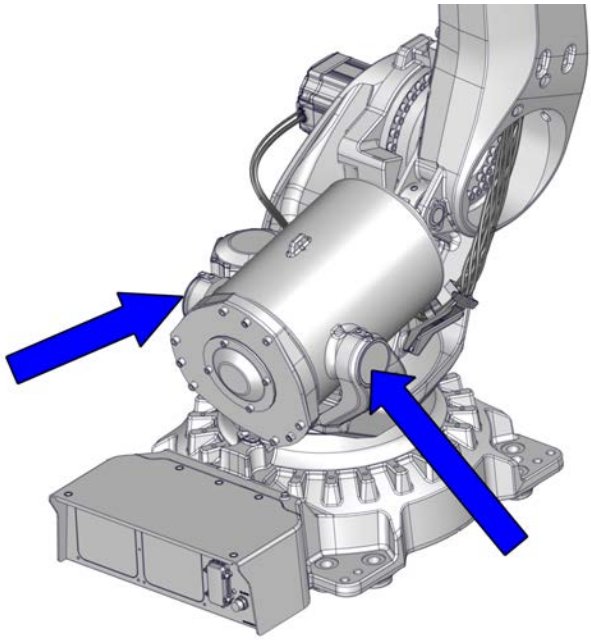
Concluding procedure

	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 94*.	

5.3.3 Replacing the rear bearings on the balancing device

Location of rear bearings, balancing device

The rear bearings of the balancing device are located in the cradle, one on each side, as shown in the figure.



xx2200001359

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. Replace the rear bearing.
3. Restore the balancing device.

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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Continues on next page

5.3.3 Replacing the rear bearings on the balancing device
Continued

Spare part	Article number	Note
Maintenance set, cradle	3HAC087164-001	The maintenance set contains: • radial sealing with dust lip, 2 pcs • groove ball bearing complete, 2 pcs • retaining ring, bore, 2 pcs • VK-cover, 2 pcs (3HAA2166-13)

Required tools and equipment

Equipment	Article number	Note
Lock screw, M16x120	-	Used to secure lower arm.
Hydraulic press equipment, balancing device	3HAC074411-001	Used to unload or restore a balancing device. User instructions are enclosed with the tool.
Dismantle and mounting tool	3HAC028920-001	Used for removing and fitting shaft and bearings. User instructions are enclosed with the tool.
Hydraulic pump 80 MPa	3HAC13086-1	To be used with the press and puller tools. See technical specifications in the user instructions for the press equipment.
Hydraulic cylinder	3HAC11731-1	To be used with the press and puller tools. See technical specifications in the user instructions for the press equipment.
Lifting shackle	-	SA-10-8-NA1
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Required service parts

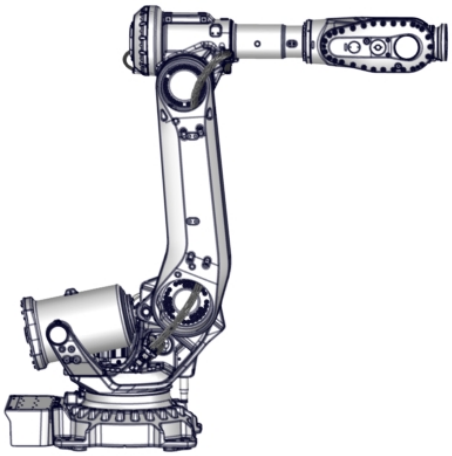
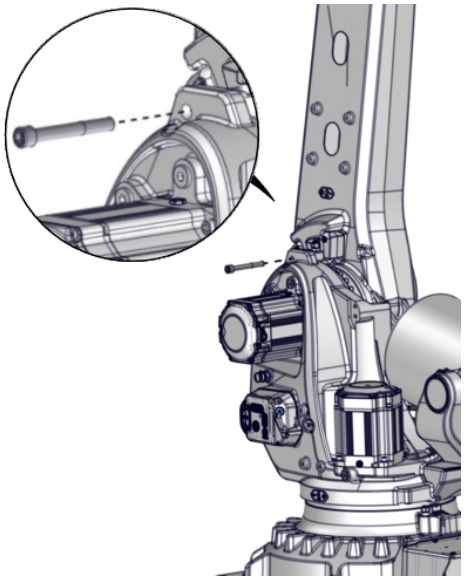
Equipment	Article number	Note
VK cover, 100x10	3HAA2166-13	Located at the cradle of the balancing device. 2 pcs required. Replace if damaged.
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)
Grease	3HAC042536-001	Shell Gadus S2

Continues on next page

Removing the bearing, cradle

Use these procedures to remove the bearing in the cradle.

Preparations before removing the rear bearings

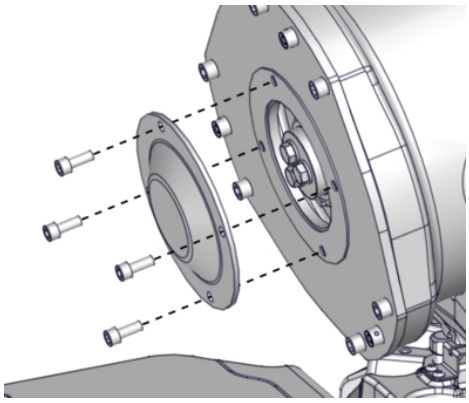
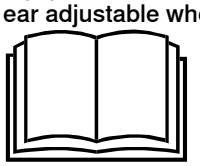
	Action	Note
1	Jog axis-2 to the calibration position.	 xx2200001458
2	Fit a lock screw through the hole for the lock screw in the frame and into the lower arm to secure the weight of the lower and upper arms. **CAUTION** Do not tighten the lock screw, since too hard tightening could damage the gear.	Lock screw, M16x120  xx2200001332
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
4	Remove any installed equipment on or close to the balancing device.	

Continues on next page

5.3.3 Replacing the rear bearings on the balancing device
Continued

Unloading the balancing device springs and locking position with the Hydraulic press equipment, balancing device

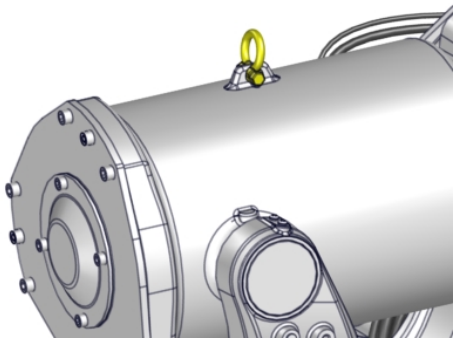
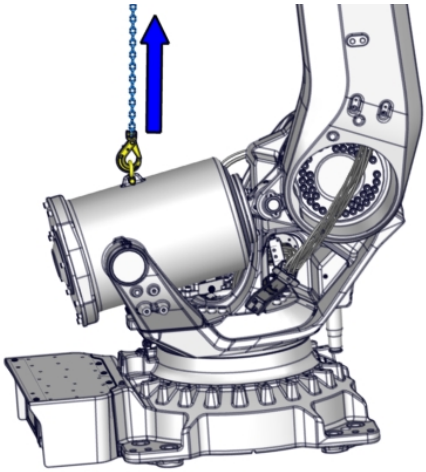
Use this procedure to unload and lock the balancing device in unloaded position with the Hydraulic press equipment, balancing device (3HAC074411-001).

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the cover plate on the back of the balancing device. **DANGER** DO NOT remove any other screws than the rear cover attachment screws.	 xx2200001330
3	Unload the balancing device with the press equipment, to make the piston rod and front ear adjustable when pulling the shaft out.  xx0900000813 Go to the user instructions enclosed with the press tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Hydraulic press equipment, balancing device: 3HAC074411-001 User instructions are enclosed with the tool.

Attaching lifting accessory to the balancing device

	Action	Note
1	**CAUTION** The weight of the balancing device (excluding cradle) is 140 kg All lifting accessories used must be sized accordingly.	

Continues on next page

	Action	Note
2	Fit a lifting shackle to the balancing device.	Lifting shackle: SA-10-8-NA1  xx2200001355
3	Fit the lifting accessory to the shackle and raise to unload the weight.	Lifting accessory (chain): 3HAC15556-1  xx2200001459

Removing the shaft end, cradle

The procedure of removing the shaft end in the cradle is the same on both sides.

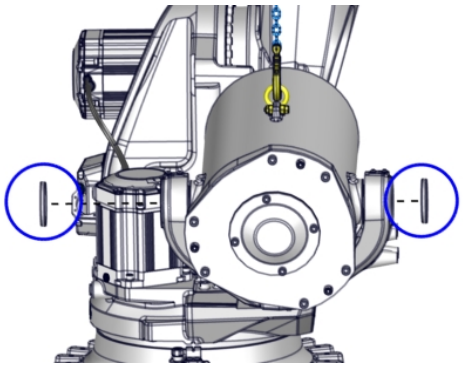
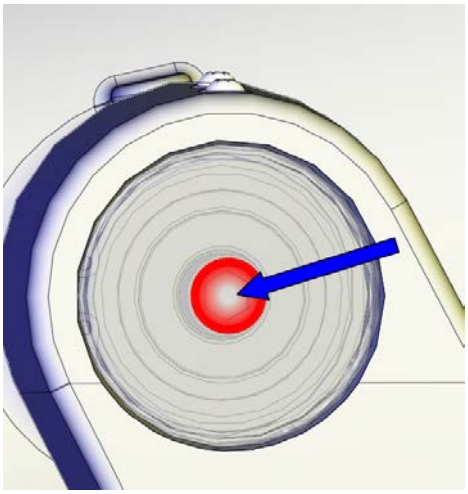
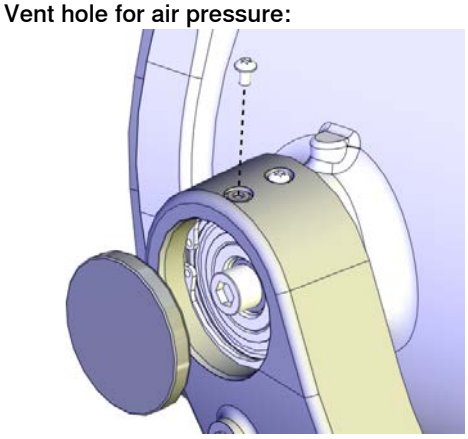
Note

Remove one shaft end at a time!

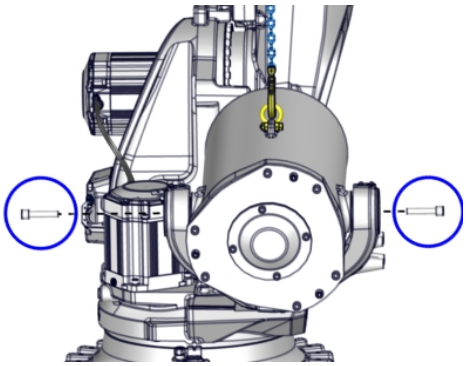
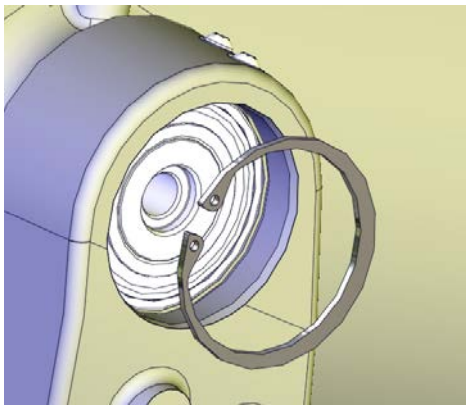
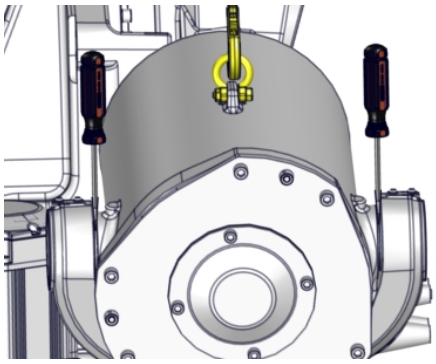
Continues on next page

5.3.3 Replacing the rear bearings on the balancing device

Continued

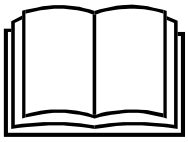
	Action	Note
1	Remove the VK cover using one of the recommended methods: • Drive a screwdriver (or similar) through the VK cover, as close as possible to the center of the VK cover, and bend out the cover. If not making a hole in the center of the VK cover, there is a risk of damaging the bearing inside. The damaged VK cover must be replaced with a new. • Remove the protection screw from the vent hole and use air pressure through the hole to blow out the cover. The cover can be reused if not damaged.	 xx2200001464 VK cover, 100x10: 3HAA2166-13 Position for screwdriver:  xx1300000662 Vent hole for air pressure:  xx1700002189
2	Wipe off all residual grease inside the recess.	

Continues on next page

	Action	Note
3	Unscrew the attachment screw securing the shaft.	 xx2200001465
4	Remove the retaining ring bore.	 xx1300000664
5	Before pulling out the shaft end, put a big screw driver between the cradle and balancing device and use it as a distance tool.	 xx2200001470

Continues on next page

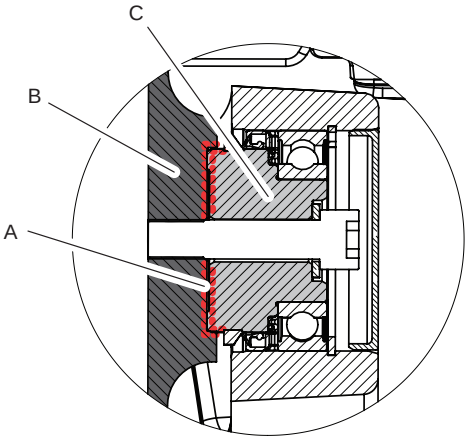
5.3.3 Replacing the rear bearings on the balancing device
Continued

	Action	Note
6	Pull out the shaft end with bearing, sealing and distance using the dismantle and mounting tool, according to user instructions enclosed with the equipment.  xx0900000813 Go to the user instructions enclosed with the press tool.  **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Dismantle and mounting tool: 3HAC028920-001 User instructions are enclosed with the tool.

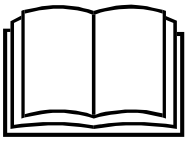
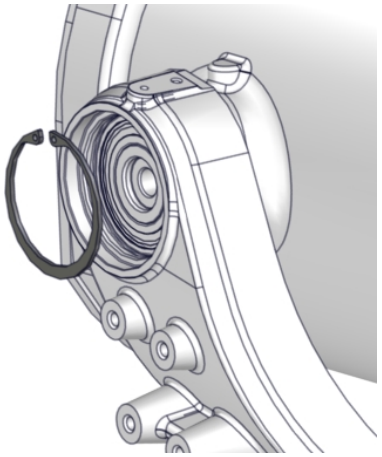
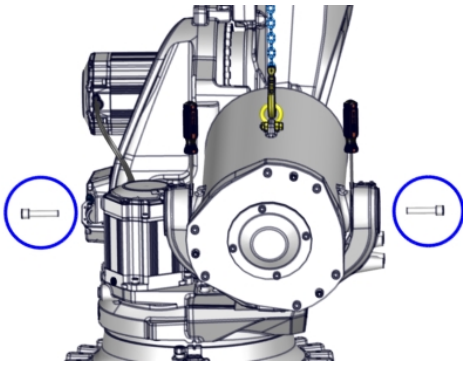
Refitting the bearing, cradle

Use these procedures to refit the bearing in the cradle.

Refitting the shaft end and rear bearings

	Action	Note
1	Wipe clean all contact surfaces from residual grease and other contamination inside the recess.	
2	*Foundry Plus:* Apply Mercasol on matching surfaces on the axis and balancing device. See the figure.	 xx1400000367 A Mercasol (red dotted lines) B Balancing device C Shaft
3	Apply some grease in the hole for the bearing in the cradle.  **Note** Do not apply grease on surfaces with Mercasol.	

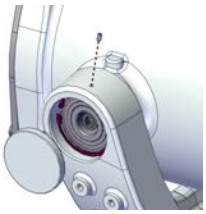
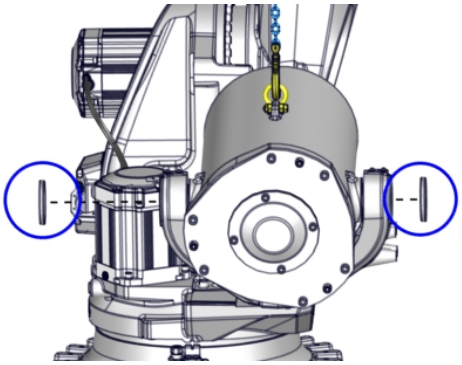
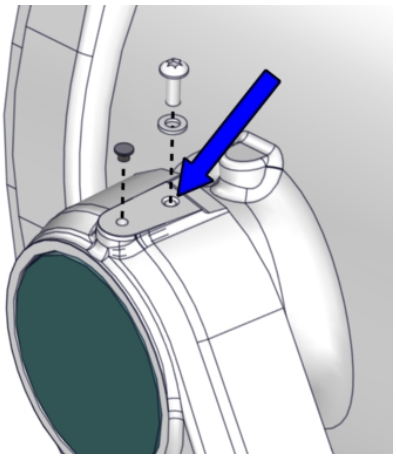
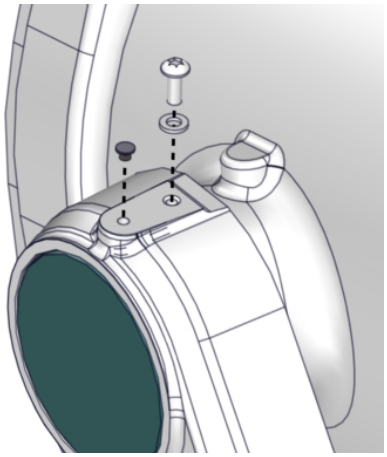
Continues on next page

	Action	Note
4	Apply a threaded bar into the hole in the balancing device and use the dismantle and mounting tool, according to user instructions enclosed with the equipment.  xx0900000813 Go to the user instructions enclosed with the press tool.  **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Dismantle and mounting tool: 3HAC028920-001 User instructions are enclosed with the tool.
5	Fit the retaining ring bore.	 xx2300000006
6	Apply locking liquid on the attachment screw.	Hex socket head cap screw: M16x70 12.9 Gleitmo 603+Geomet 500 Washer: 3HAC047681-001 Locking liquid: Loctite 2400 (or equivalent Loctite 243)
7	While using the screw driver between the cradle and balancing device as a distance tool, tighten the attachment screw completely. Secure the balancing device.	Tightening torque: 280 Nm.  xx2200001475

Continues on next page

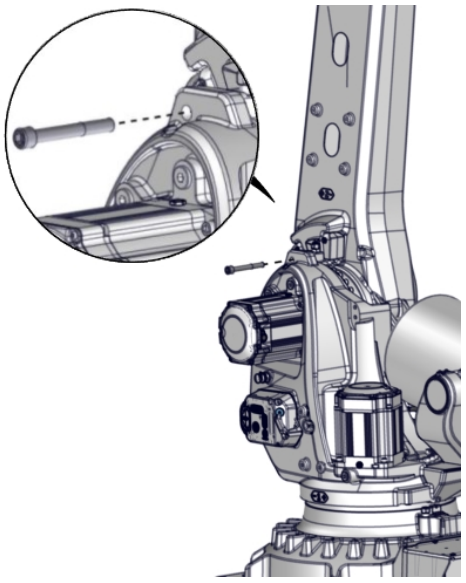
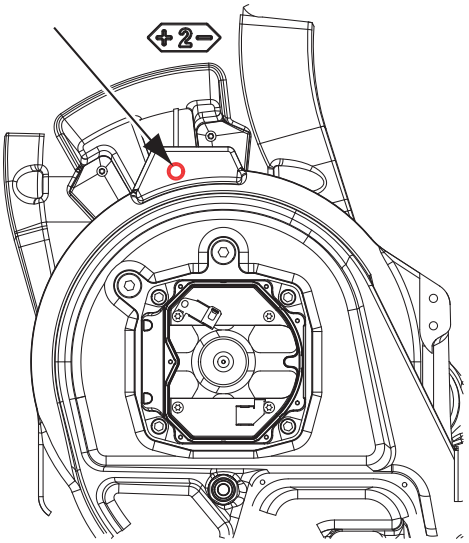
5.3.3 Replacing the rear bearings on the balancing device

Continued

	Action	Note
8	Refit the VK-cover. **Note** Temporarily remove the screw on the cradle to let go of overpressure if the VK covers are hard to fit.  xx1700001800	VK cover, 100x10, 3HAA2166-13  xx2200001464
9	Remove both the screw and the protection plug, then refill grease from the inner hole (See figure).	Grease: 3HAA1001-294  xx2300000004
10	Refit the screw (including washer) and the protection plug.	 xx2300000005
11	Wipe clean from residual grease.	

Continues on next page

Removing the lifting accessory and locking screw

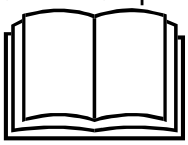
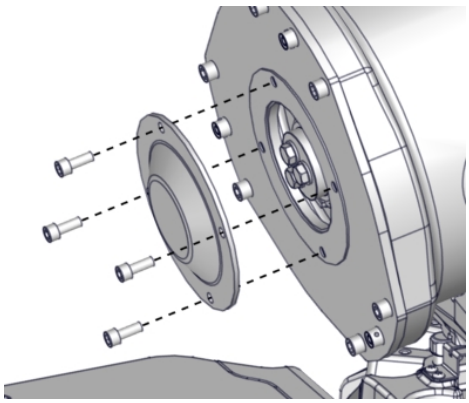
	Action	Note
1	Remove the lifting accessory from the balancing device.	
2	Remove the lock screw (M16x120).	 xx2200001332
3	*Foundry Plus*: Apply Mercasol in the hole for the locking screw.	 xx1400000372

Continues on next page

5.3.3 Replacing the rear bearings on the balancing device

Continued

Restoring the balancing device and removing the Hydraulic press equipment, balancing device

	Action	Note
	Restore the balancing device and remove the press equipment according to instructions for the press equipment.  xx0900000813 Go to the user instructions enclosed with the press tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	User instructions are enclosed with the tool.
1	Apply flange sealant and refit the cover plate on the back of the balancing device.	Hex socket head cap screw: M10x25 8.8-A3F. Tightening torque: 50 Nm. Flange sealant for conical fittings: Loctite 5400 (or equivalent Loctite 577).  xx2200001330

Concluding procedure

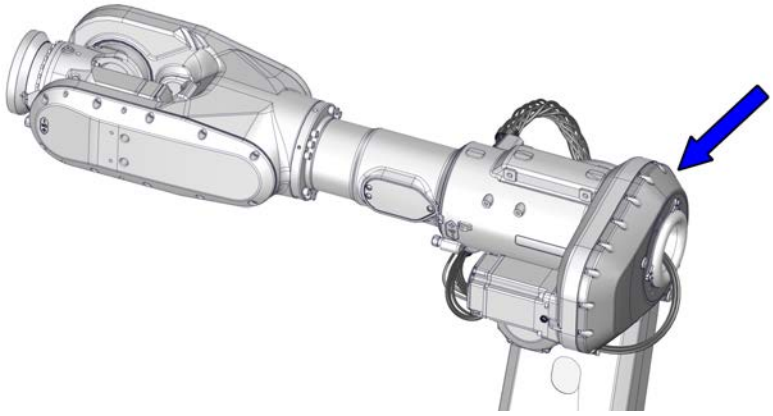
	Action	Note
1	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 94*.	

5.4 Axes 3 and 4

5.4.1 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.



xx2300000030

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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Arm house cover including cassette sealing	3HAC077945-003 (Graphite White) 3HAC077945-004 (ABB Orange)	Gasket and cassette sealing included	L2

Continues on next page

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

Required service parts

Consumable	Article number	Note
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 136*.

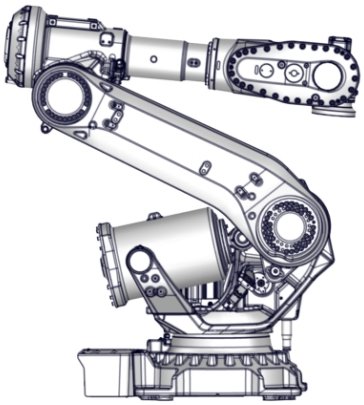
Required tools and equipment

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 628*.

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

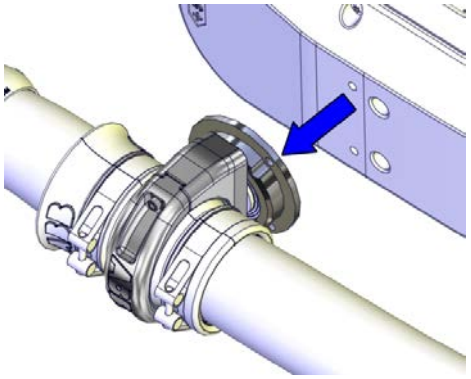
	Action	Note
1	Drain the axis-4 gearbox.	See *Draining the axis-4 gearbox on page 155*.
2	Jog the robot to the specified position: • Axis 1: 0° • Axis 2: -60° • Axis 3: +60° • Axis 4: 0° • Axis 5: +90° • Axis 6: No significance. **Note** The specified position is a recommended position for service. Axis-5 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.	 xx2200001615

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.	

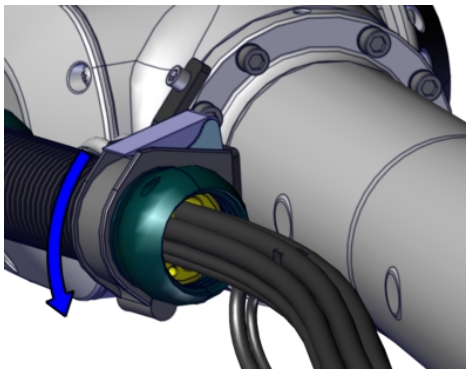
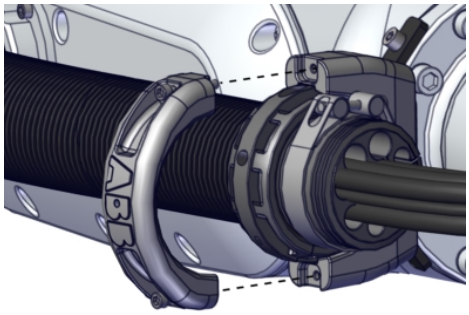
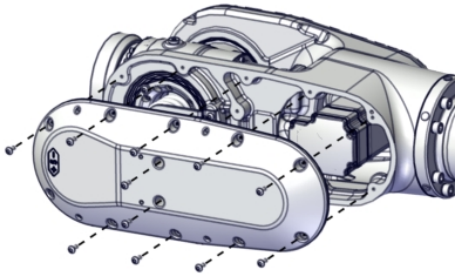
Retrieving access to the wrist cabling

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 is installed: • Remove the bracket with the complete ball joint housing still fitted, as shown in the figure. This is done to be able to reach the two hidden screws that secure the wrist cover.	 xx1400000355

Continues on next page

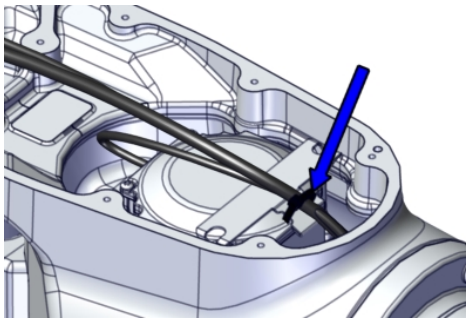
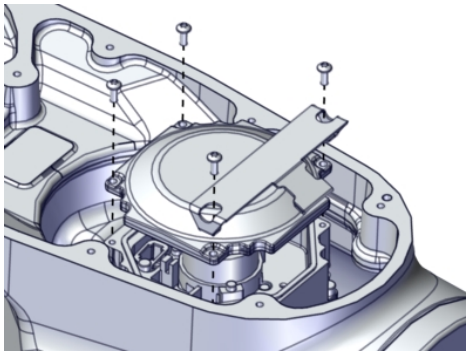
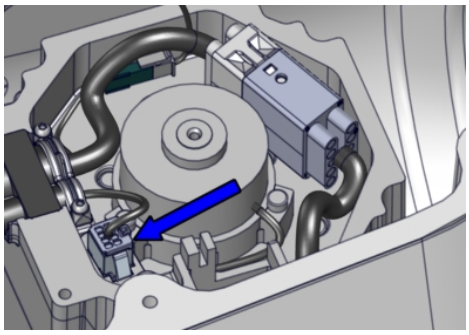
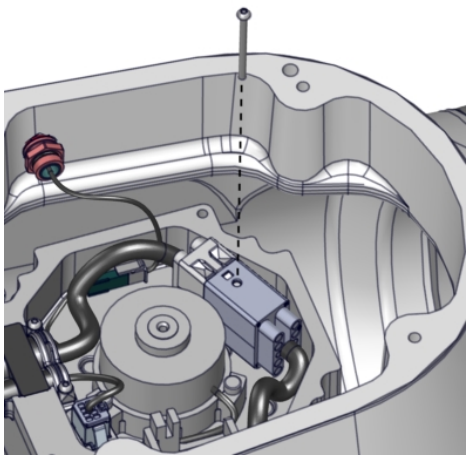
5.4.1 Replacing the arm house cover including the axis-4 cassette sealing
Continued

	Action	Note
3	If DressPack is installed: Open the ball joint housing on the arm tube and remove the DressPack cable package.	IRB 6710-xx/ LID  xx2100002733 IRB 6710-xx/ LID:  xx2100002709
4	Remove the wrist cover.	 xx2000000373

Disconnecting the axis-5 motor cables

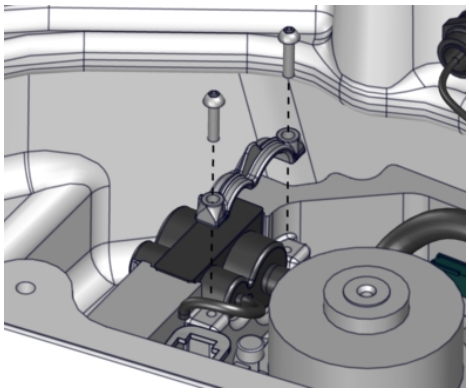
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

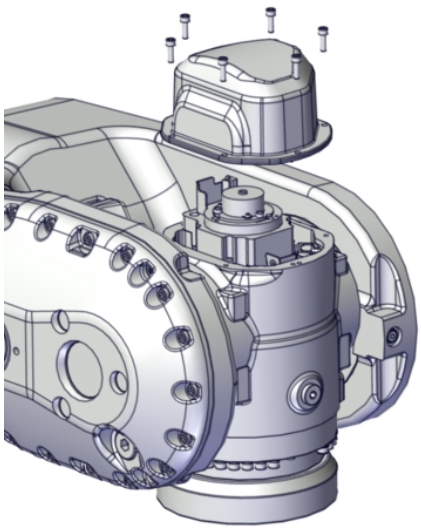
	Action	Note
2	Cut the cable tie.	 xx2100002625
3	Remove the motor cover by removing the screws.	 xx2100002495
4	Disconnect the signal cable connector.	 xx2200001734
5	Disconnect the power cable connector by removing the attachment screw.	 xx2200001733

Continues on next page

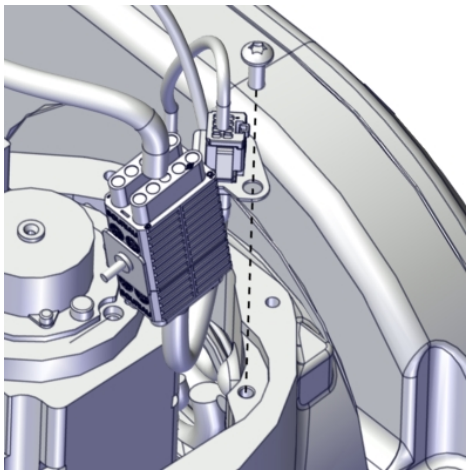
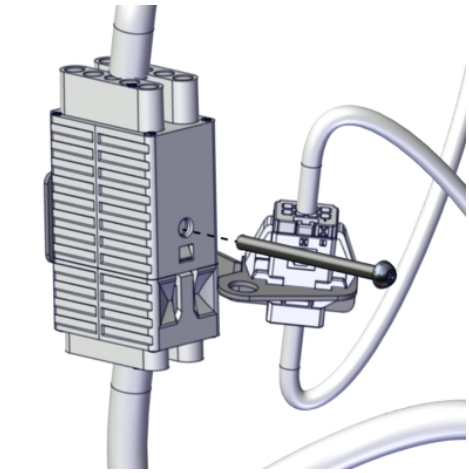
5.4.1 Replacing the arm house cover including the axis-4 cassette sealing
Continued

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

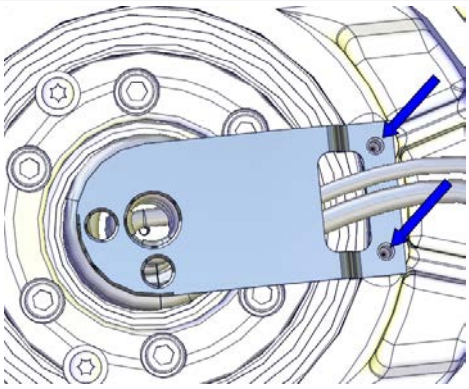
Disconnecting the axis-6 motor cables

	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.	 xx2000000376

Continues on next page

	Action	Note
3	Remove the connector bracket.	 xx2000000375
4	Remove the connector screw.	 xx2200001919
5	Disconnect the motor cables.	

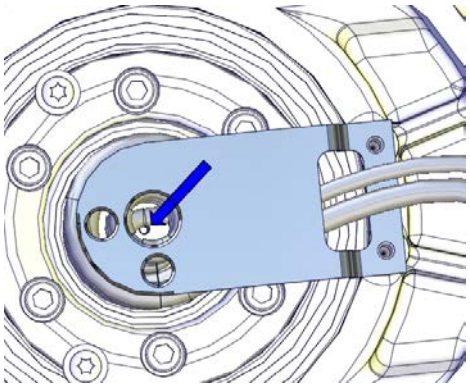
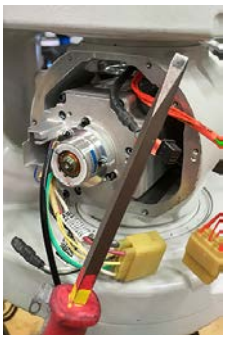
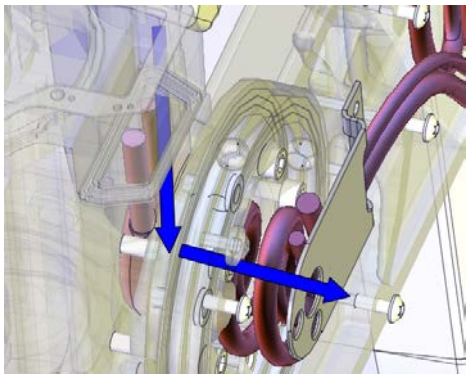
Pushing out the axis-6 motor cables

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

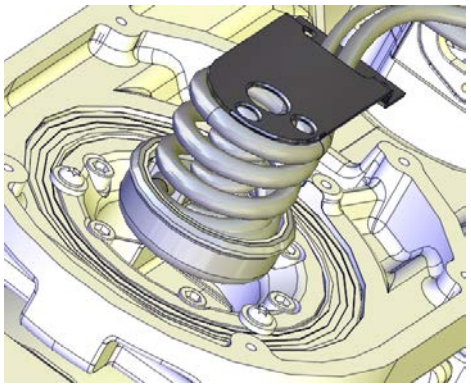
Continues on next page

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

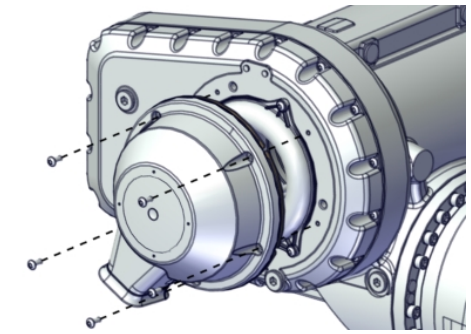
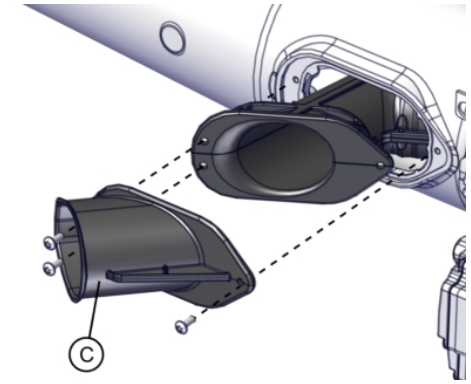
Continued

	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. **CAUTION** Assist by using a flat-head screwdriver or similar to push out the carrier from the motor housing side, to avoid damaging the cables by pulling them too hard.  xx2300000057  xx2300000058  xx2300000059  xx2300000060	 xx1300000666

Continues on next page

	Action	Note
4	Lift out the carrier from its position.	 xx1300001113

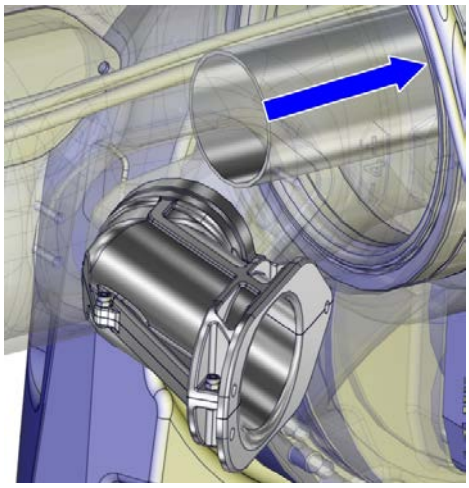
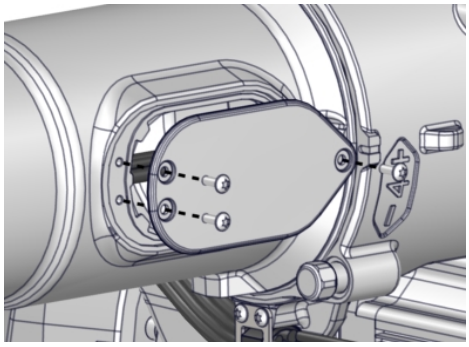
Removing the cable harness from the wrist and upper arm

	Action	Note
1	*Foundry Plus*, *DressPack:* Remove the cover. **Note** Use caution not to damage the gasket.	 xx2000000422
2	*DressPack* If used, loosen the insert. (Cable guard (C) is available for Foundry cable guard.)	 xx2100002677

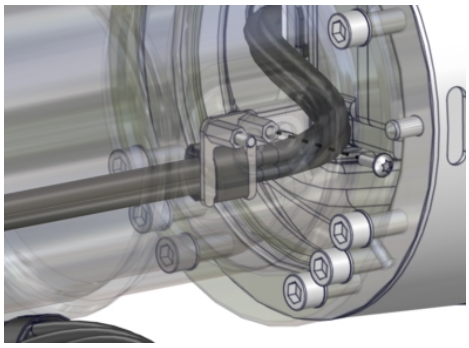
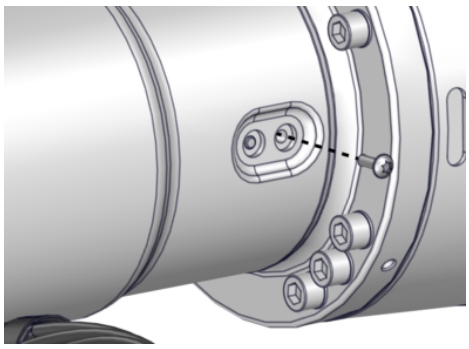
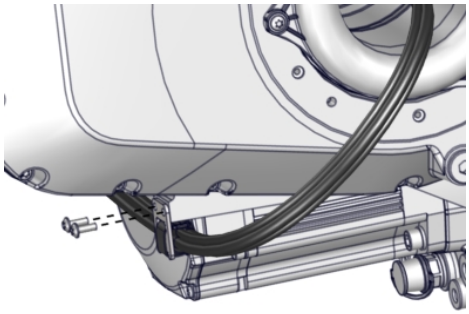
Continues on next page

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

Continued

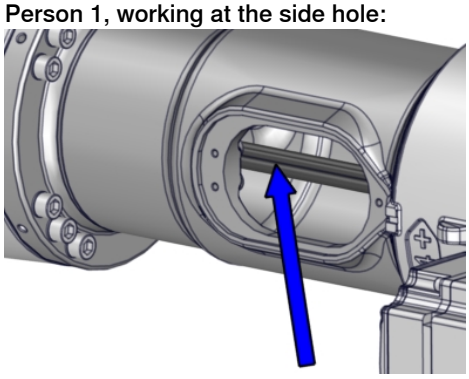
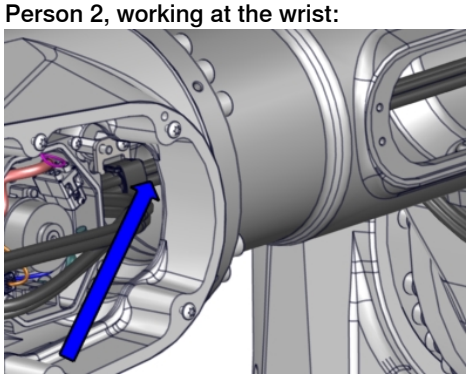
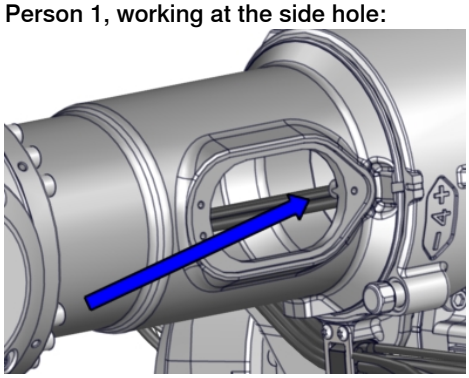
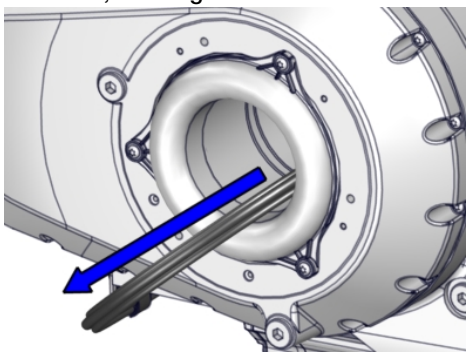
	Action	Note
3	*DressPack* If used, push the DressPack tube a little backwards.	 xx1400000720
4	**Tip** Use tape and tie the axis-5 and axis-6 connectors and carrier into a bundle (if not already done). This is done to facilitate the removal and to avoid damaging the parts. This will also make it easier 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.	 xx2200002142

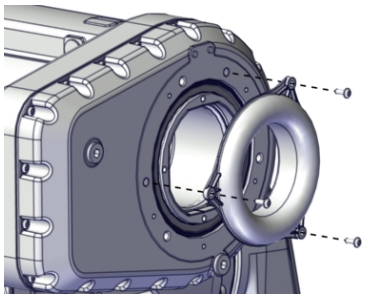
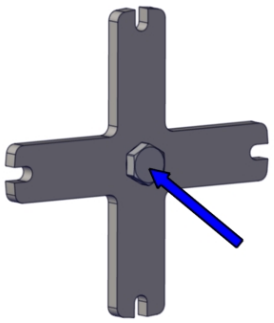
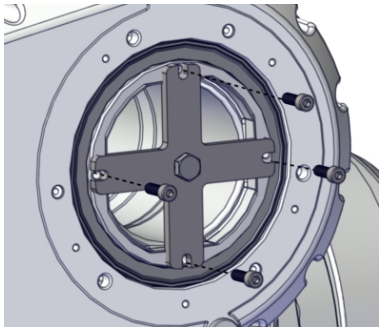
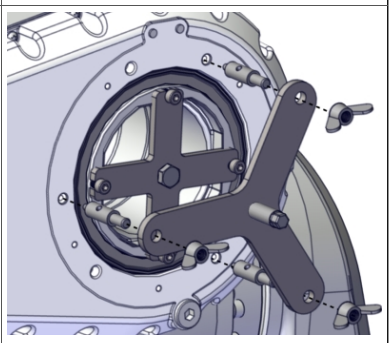
Continues on next page

5.4.1 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

Continues on next page

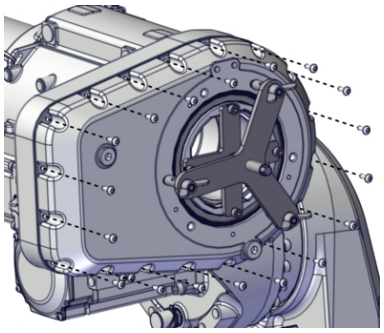
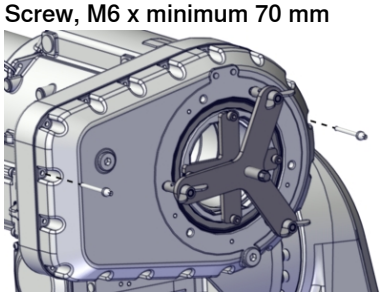
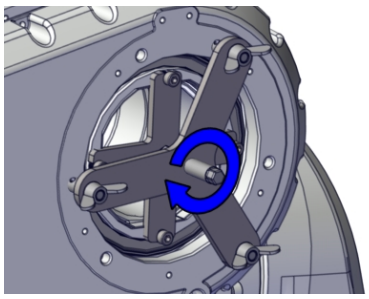
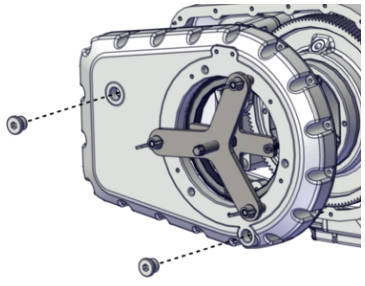
Removing the arm house cover including the cassette sealing

	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

Continues on next page

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

Continued

	Action	Note
5	Remove the arm house cover screws.	 xx2100001255
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	Fit the M12 bolt and rotate it to press out the complete cover.	 xx2100001256
8	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. **WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 29*. **WARNING** Used oil is hazardous material and must be disposed of in a safe way. See *Decommissioning on page 615* for more information.	 xx2100001286

Continues on next page

	Action	Note
9	Remove the tool from the arm house cover. The tool on the tube shaft can stay fitted.	

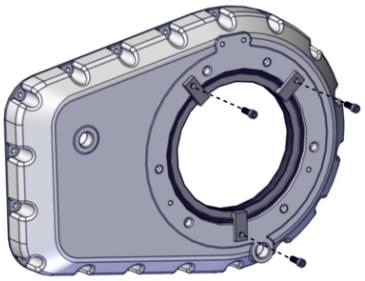
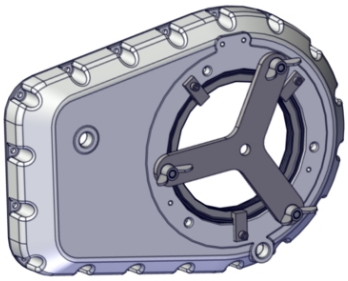
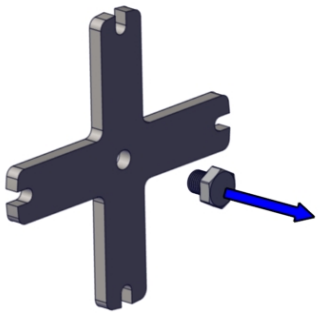
Refitting the arm house cover including the cassette sealing

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.	

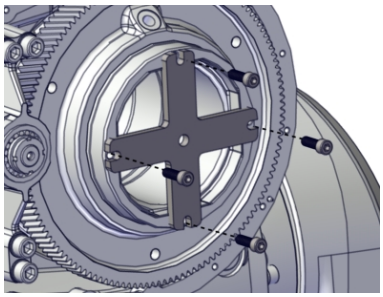
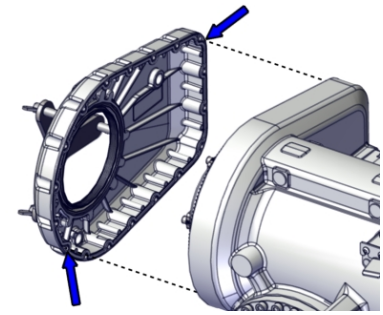
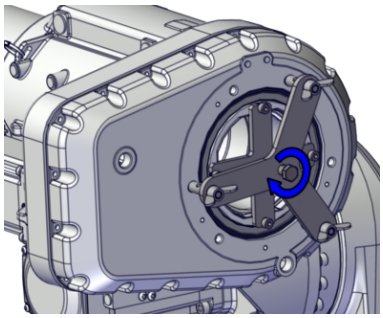
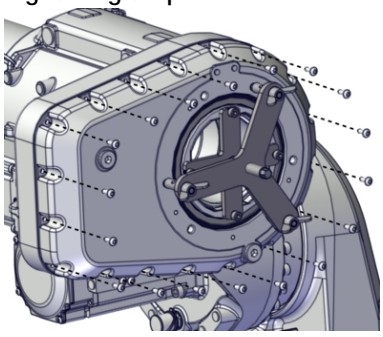
Refitting the arm house cover including the cassette sealing

	Action	Note
1	Fit three holders to the arm house cover, to hold the cassette sealing in place during refitting of cover.	Replacement tool for arm house cover: 3HAC079878-001 Use the holders marked with **2**.  xx2100001266
2	Fit the three armed tool part with three screws.	 xx2100001267
3	Prepare the refitting tool by removing the middle screw from the part of the tool designed as a cross.	 xx2100001265

Continues on next page

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

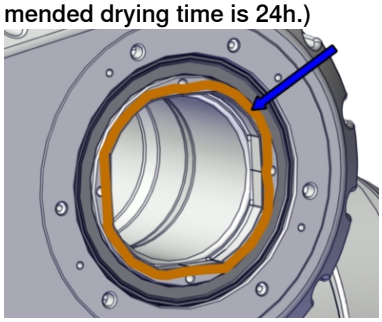
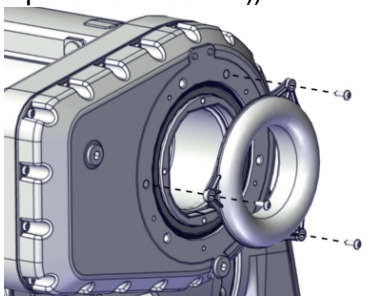
Continued

	Action	Note
4	Fit the cross to the tube shaft with four M8 screws. **CAUTION** Center the cross on the tube shaft, to not damage the sealing.	 xx2100001264
5	Fit the arm house cover to the arm house with guidance from the two guide pins in the cover.	 xx2100001269
6	Fit the M12 screw to the tool and pull the cover and cassette sealing into place by rotating the screw. Check that the guide pins are inserted in the arm house.	 xx2100001270
7	Secure the cover with the attachment screws. Use locking liquid. Ensure gap closure between cover and arm house.	Torx pan head screw: M6x16 Stainless steel A2-70 Locking liquid: - (Loctite 2400 (or equivalent Loctite 243)) Tightening torque: 10 Nm  xx2100001255
8	Remove the tool.	

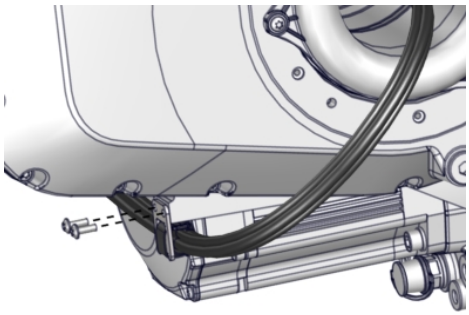
Continues on next page

	Action	Note
9	Perform a leak-down test.	See *Performing a leak-down test on page 178*.

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. Use locking liquid.	Torx pan head screw: M6x16 Stainless steel A2-70 Locking liquid: - (Loctite 2400 (or equivalent Loctite 243))  xx2100001242

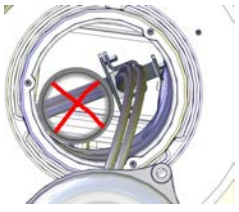
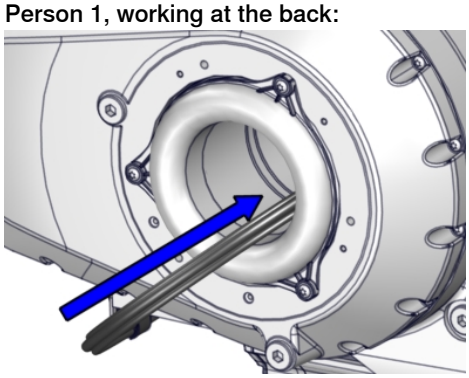
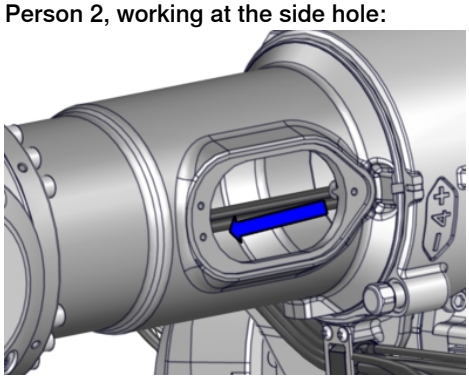
Refitting the cable harness to the upper arm

	Action	Note
1	Refit the metal clamp beneath the arm house.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2200002142

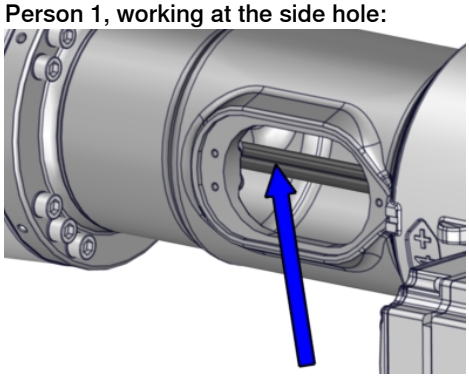
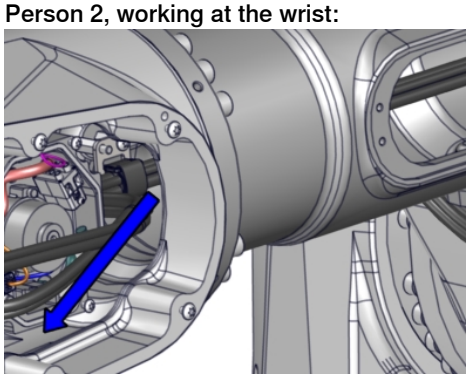
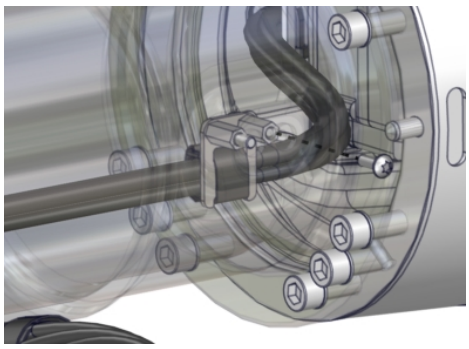
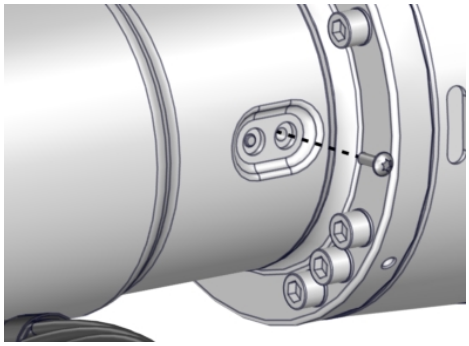
Continues on next page

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

Continued

	Action	Note
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
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

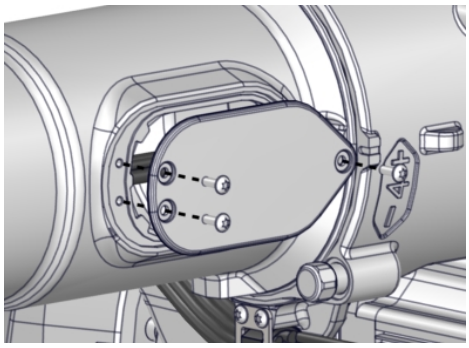
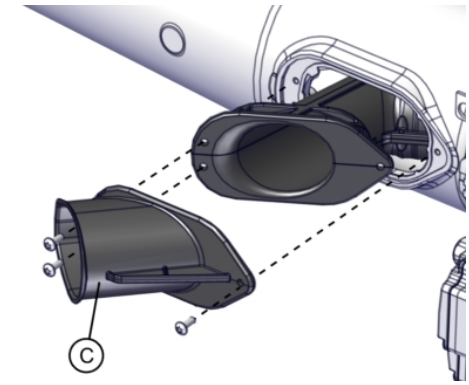
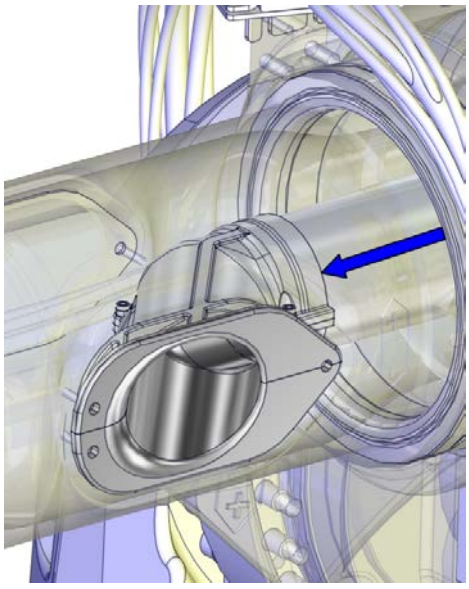
Continues on next page

	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

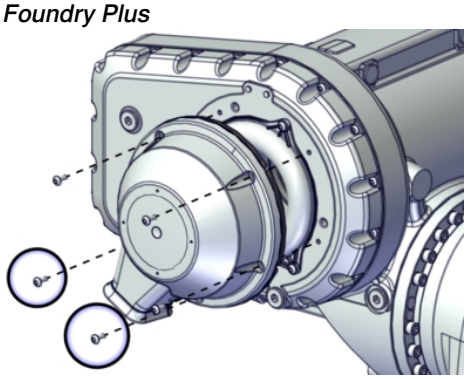
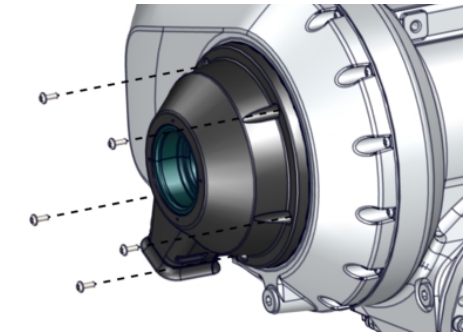
Continues on next page

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

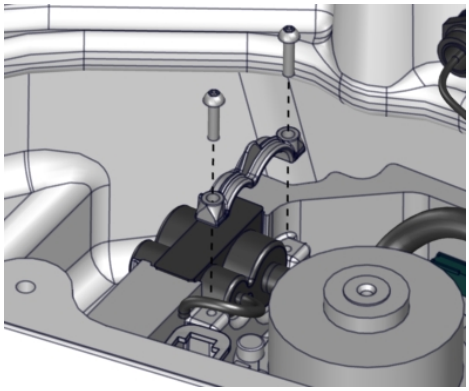
Continued

	Action	Note
6	Refit the side cover. **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	If used, 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	If used, refit the tube containing the DressPack into the insert.	 xx1400000092

Continues on next page

	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.	Torx pan head screw: M6x16 Stainless steel A2-70 Tightening torque: 10 Nm. *Foundry Plus*  xx2100002636 *DressPack*  xx2300001040

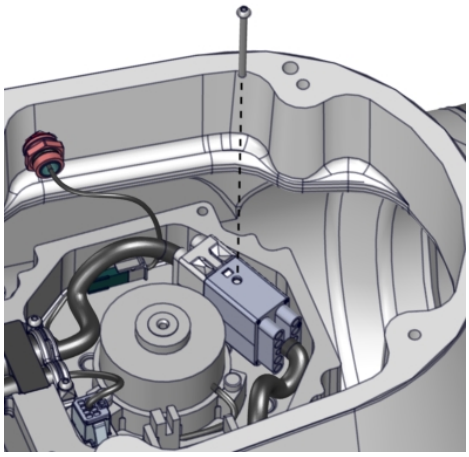
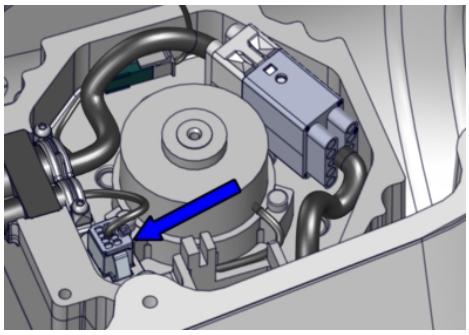
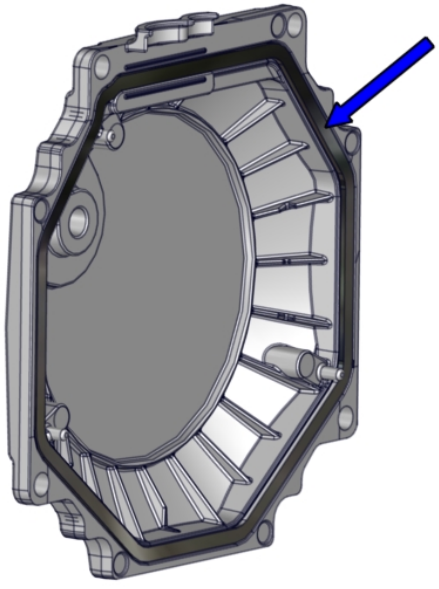
Connecting the axis-5 motor cables

	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

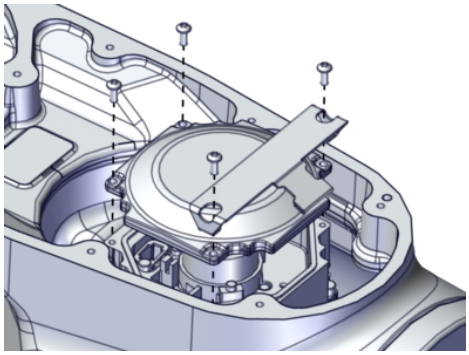
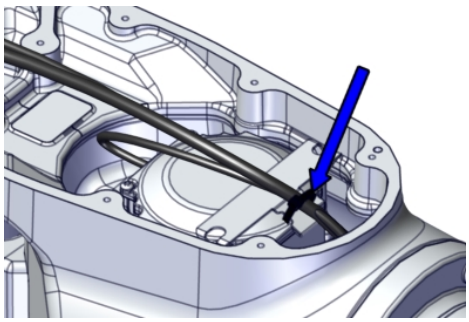
Continues on next page

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

Continued

	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  xx2200002141

Continues on next page

	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.  xx2100002495
8	Secure the cabling with a cable strap.	Cable strap, outdoor: 3HAC057966-003  xx2100002625

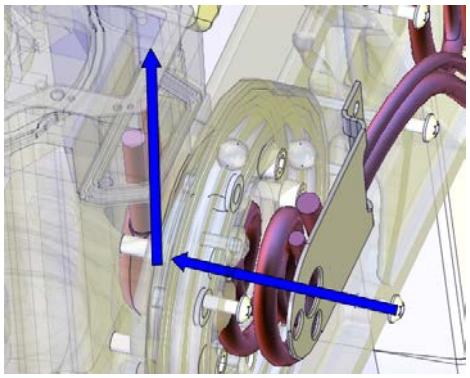
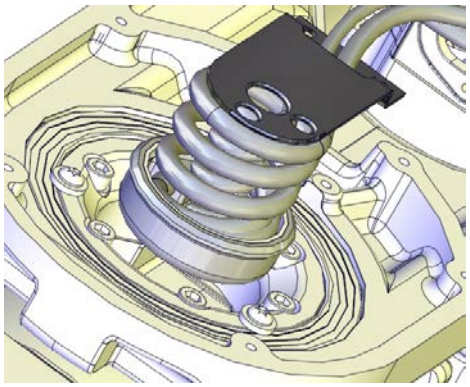
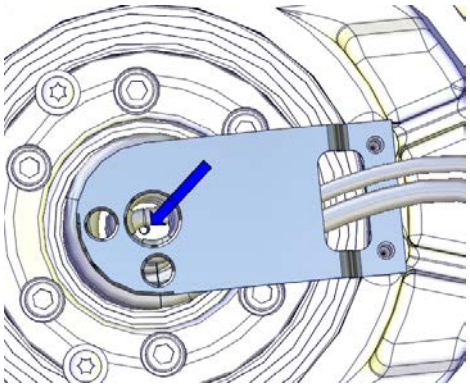
Inserting the axis-6 motor cables

	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°.	

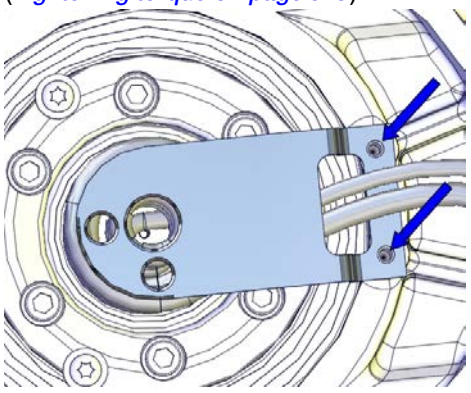
Continues on next page

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

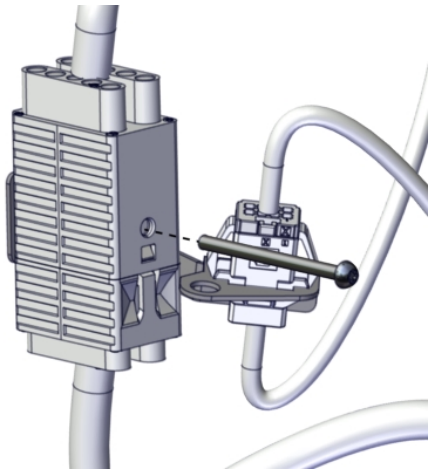
Continued

	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

Continues on next page

	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 625*)..  xx1300000484

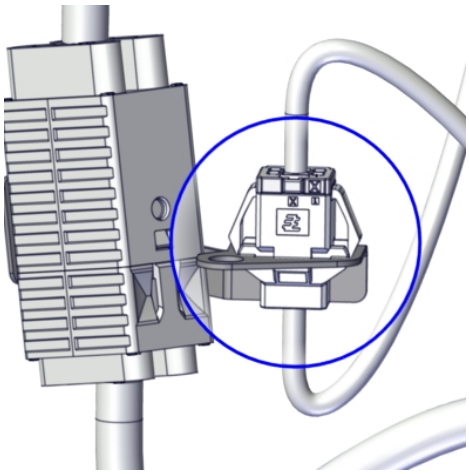
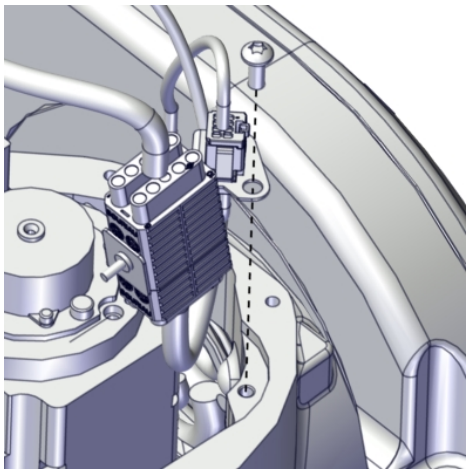
Connecting the axis-6 motor cables

	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  xx2200001919

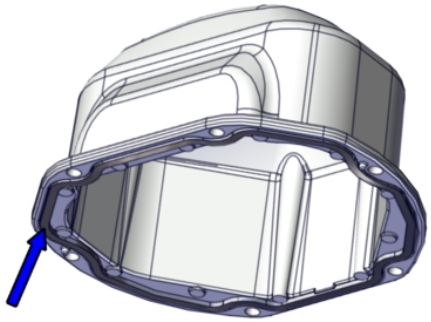
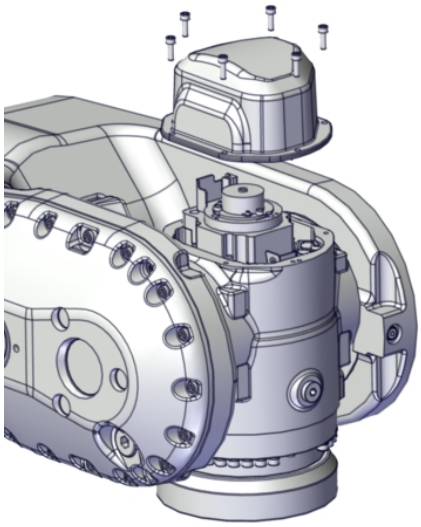
Continues on next page

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

Continued

	Action	Note
3	Snap the signal connectors to each other in the bracket.	 xx2200001920
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  xx2000000375
5	Verify correct cable layout as shown in the figure. **CAUTION** Route the signal cabling correctly to avoid cable damage.	 xx2100001293

Continues on next page

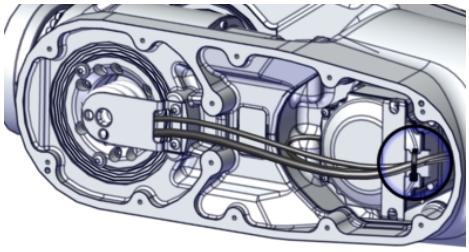
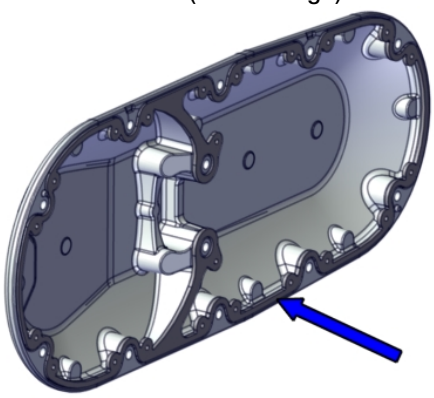
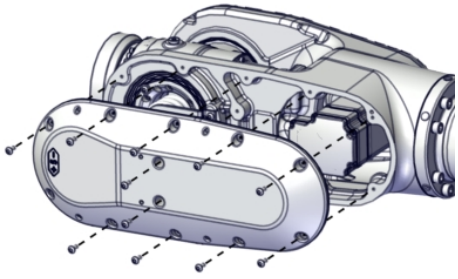
	Action	Note
6	Inspect the gasket. Replace if damaged.	Gasket, tilt housing cover: 3HAC074482-001  xx2100001287
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8	Refit the motor cover.	Hex socket head cap screw: M5x16 12.9 Lafre 2C2B/FC6.9 (6 pcs) Tightening torque: 4 Nm.  xx2000000376

Continues on next page

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

Continued

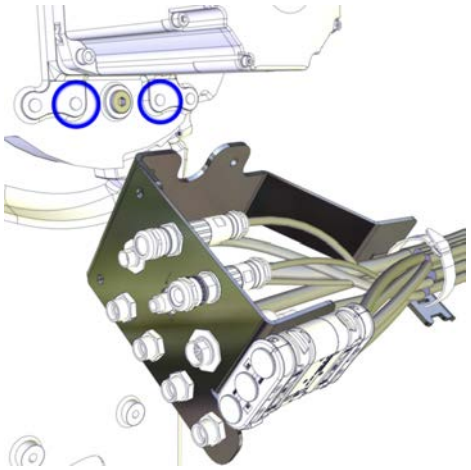
Refitting the wrist cover

	Action	Note
1	Make sure that the cable harness is routed and secured as shown in the figure.	 xx2100002626 :
2	*Foundry Plus:* Inspect the gasket. Replace the complete cover if the gasket is damaged.	Wrist cover: 3HAC074181-002 (Graphite White) 3HAC074181-004 (ABB Orange)  xx2100001407
3	Refit the wrist cover and secure with screws. *Foundry Plus:* Fit all the screws first, then torque tighten.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2000000373

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.

Continues on next page

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

Concluding procedure

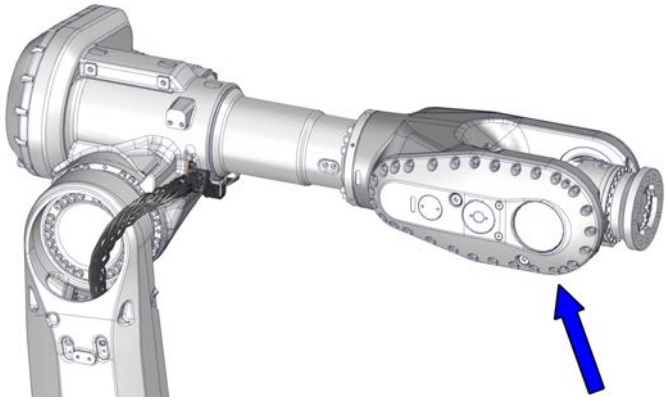
	Action	Note
1	Refill oil to the axis-4 gearbox.	See *Filling oil into the axis-4 gearbox on page 156*.
2	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 94*.	

5.5 Wrist

5.5.1 Replacing the wrist

Location of the wrist

The wrist is located as shown in the figure.



xx2300000048

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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Wrist	3HAC074235-002 (Graphite White) 3HAC074235-003 (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.
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 628*.

Continues on next page

Required service parts

Consumable	Article number	Note
Tilt housing cover with gasket	3HAC074958-003 (Graphite White) 3HAC074958-004 (ABB Orange)	Replace if damaged. On axis-6 motor
Connection box cover with gasket	3HAC072863-003	Replace if damaged. On axis-5 motor
Wrist cover	3HAC074181-002 (Graphite White) 3HAC074181-004 (ABB Orange)	Replace if damaged.
Cable strap, outdoor	3HAC057966-003	

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 595*.
	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.

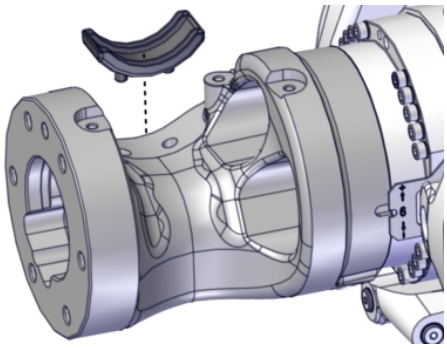
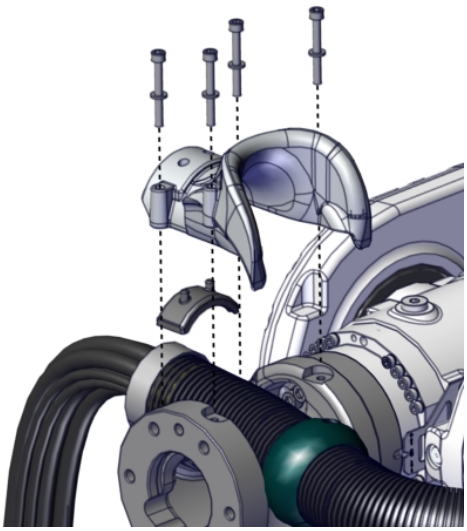
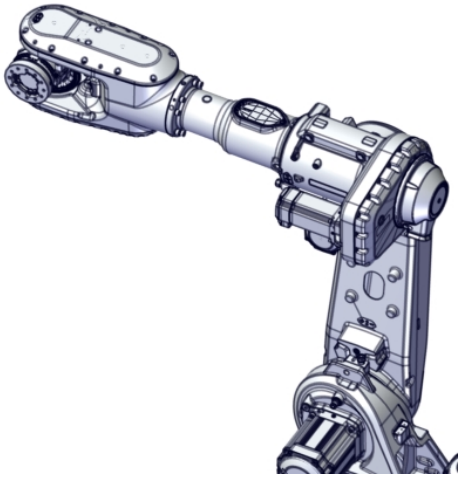
Preparations before removing the wrist

	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.	

Continues on next page

5.5.1 Replacing the wrist

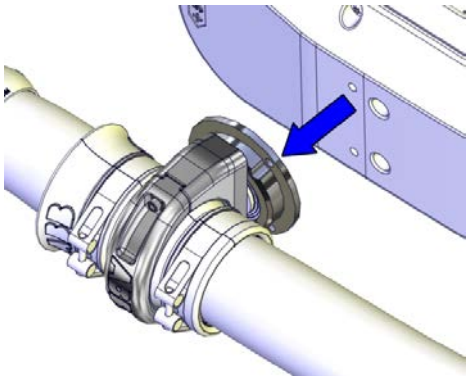
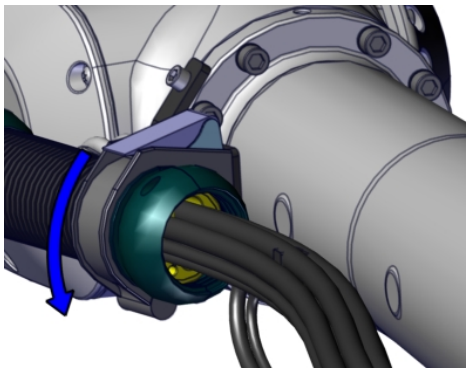
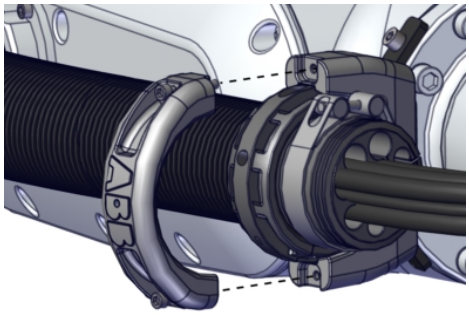
Continued

	Action	Note
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	 xx2100002715
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	 xx2100002164
5	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safe-guarded space.	

Continues on next page

Retrieving access to the wrist cabling

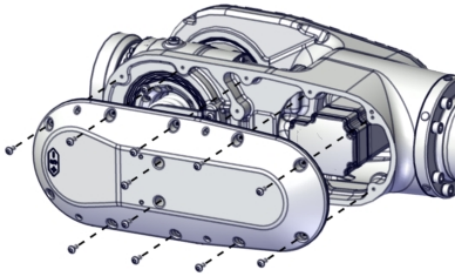
Use this procedure to remove the wrist cover.

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	If DressPack is installed: • Remove the bracket with the complete ball joint housing still fitted, as shown in the figure. This is done to be able to reach the two hidden screws that secure the wrist cover.	 xx1400000355
3	If DressPack is installed: Open the ball joint housing on the arm tube and remove the DressPack cable package.	IRB 6710-xx/ LID  xx2100002733 IRB 6710-xx/ LID:  xx2100002709

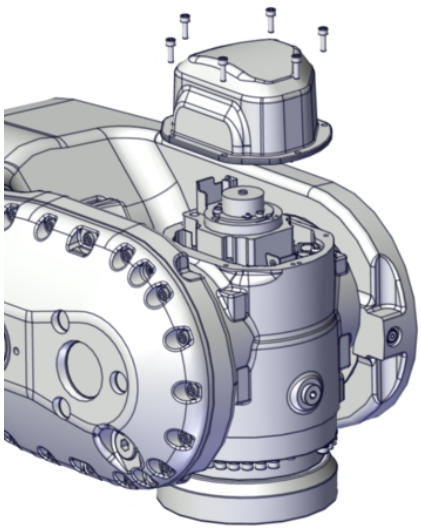
Continues on next page

5.5.1 Replacing the wrist

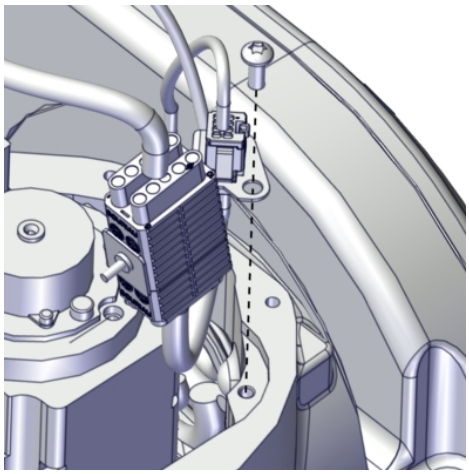
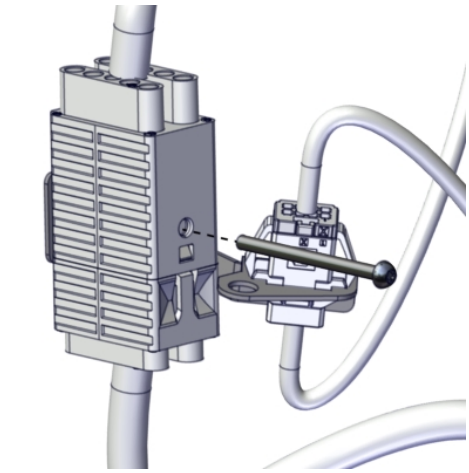
Continued

	Action	Note
4	Remove the wrist cover.	 xx2000000373

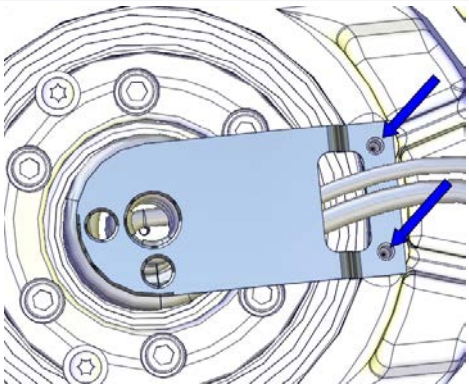
Disconnecting the axis-6 motor cables

	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.	 xx2000000376

Continues on next page

	Action	Note
3	Remove the connector bracket.	 xx2000000375
4	Remove the connector screw.	 xx2200001919
5	Disconnect the motor cables.	

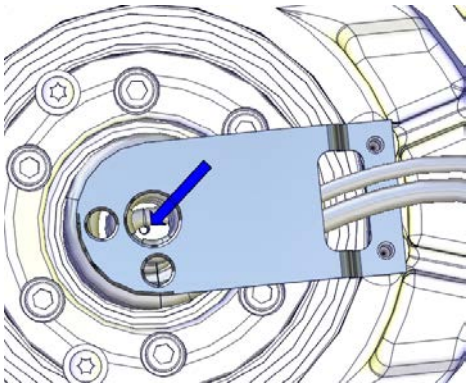
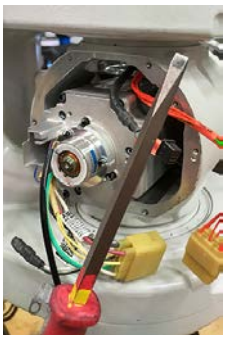
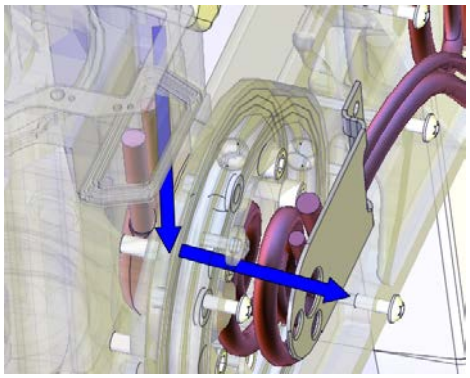
Pushing out the axis-6 motor cables

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

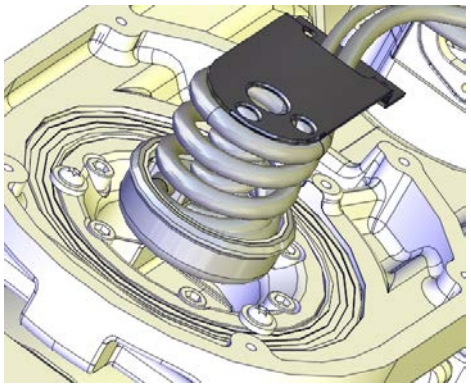
Continues on next page

5.5.1 Replacing the wrist

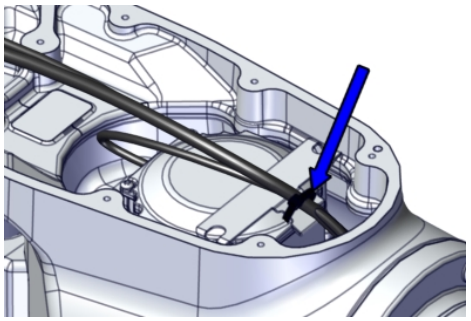
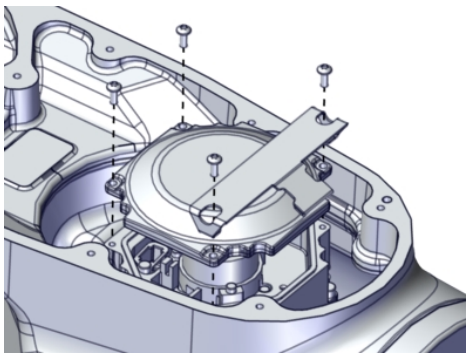
Continued

	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. **CAUTION** Assist by using a flat-head screwdriver or similar to push out the carrier from the motor housing side, to avoid damaging the cables by pulling them too hard.  xx2300000057  xx2300000058  xx2300000059  xx2300000060	 xx1300000666

Continues on next page

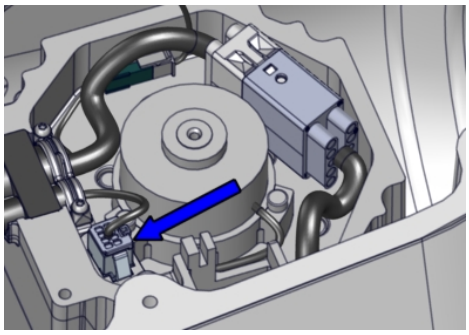
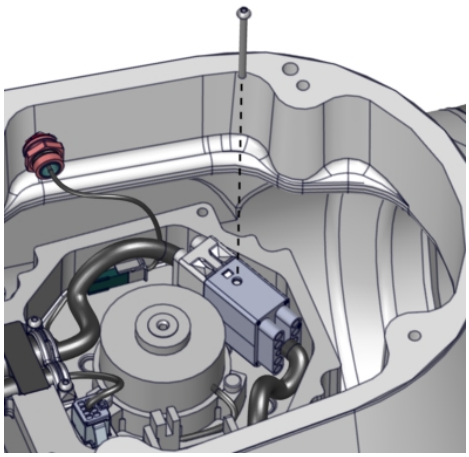
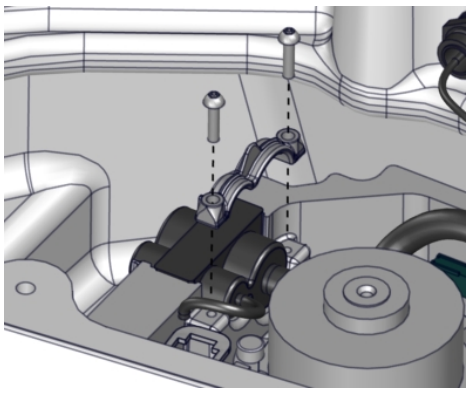
	Action	Note
4	Lift out the carrier from its position.	 xx1300001113

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.	
2	Cut the cable tie.	 xx2100002625
3	Remove the motor cover by removing the screws.	 xx2100002495

Continues on next page

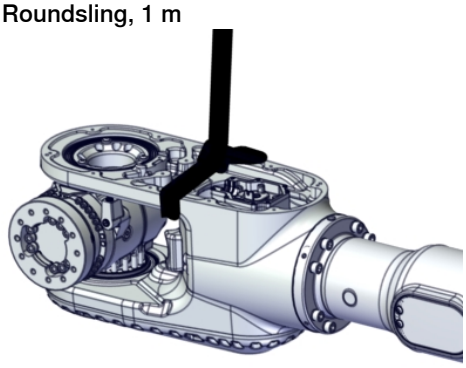
5.5.1 Replacing the wrist
Continued

	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.	

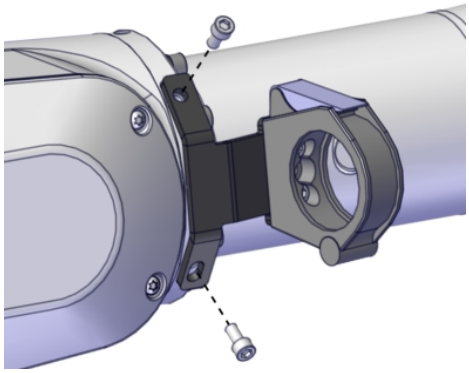
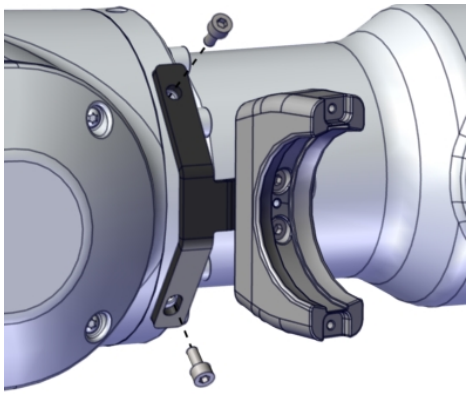
Attaching the lifting accessories to the wrist

	Action	Note
1	**CAUTION** The weight of the wrist is 90 kg All lifting accessories used must be sized accordingly.	

Continues on next page

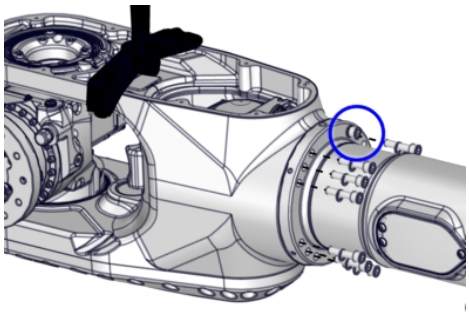
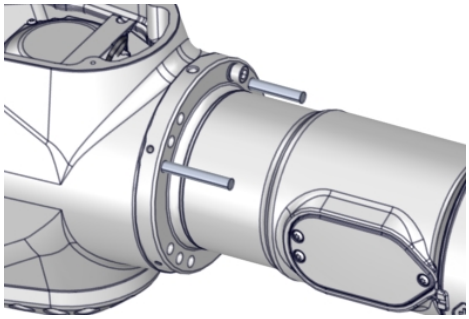
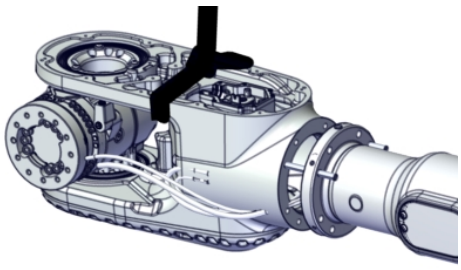
	Action	Note
2	Attach a roundsling to the wrist as shown in the figure. **CAUTION** The roundsling placement shown in the figure keeps the wrist balanced when lifted, which reduces risk of damage or injury. Do not attach the roundsling around the axis-5 gearbox!	Roundsling, 1 m  xx2100001290
3	Stretch the roundsling so it carries 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.	IRB 5710-70/2.7 LID  xx2100002804 IRB 5710-90/2.3 LID  xx2100002805

Continues on next page

5.5.1 Replacing the wrist
Continued

	Action	Note
2	Remove all attachment screws but leave one.	 xx2300000015
3	Fit guide pins to the wrist unit and then remove the remaining screw.	Guide pin, M12x150: 3HAC13056-2  xx2300000016
4	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)  xx2100001289
5	Lift away the wrist.	

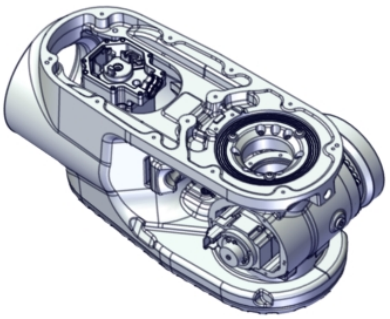
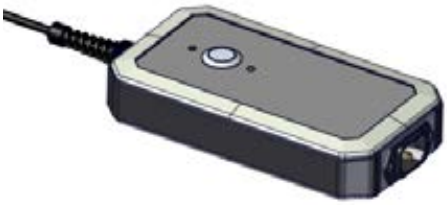
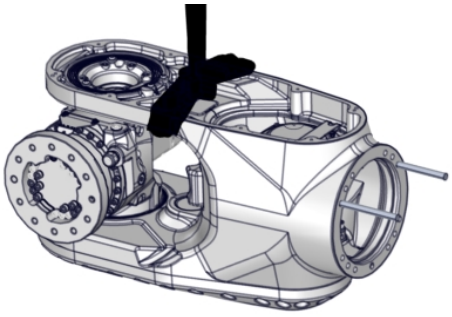
Refitting the wrist

These procedures describes how to refit the wrist.

Preparations before refitting the wrist

	Action	Note
1	Wipe clean all contact surfaces.	

Continues on next page

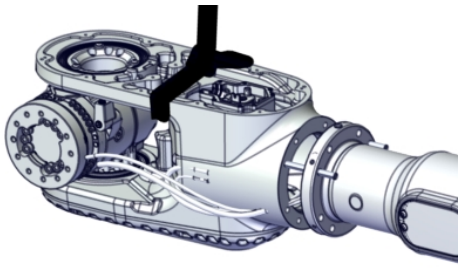
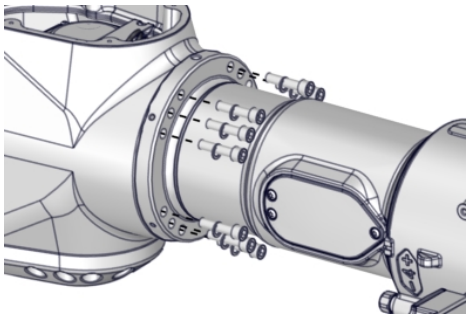
	Action	Note
2	Prepare the new wrist spare part by removing the wrist cover and the motor covers.	 xx2100001292
3	If axis 5 is not already in position +90°, connect the brake release tool, release the brakes and move the axis manually into that position. Release the brakes of the axis-5 motor with the 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

Continues on next page

5.5.1 Replacing the wrist

Continued

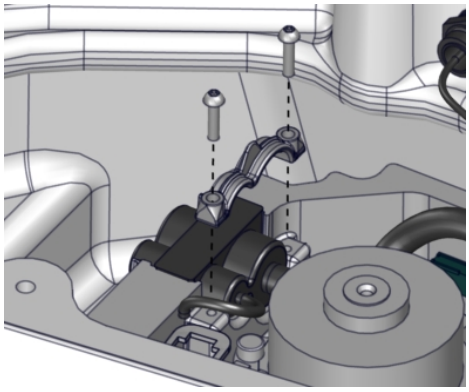
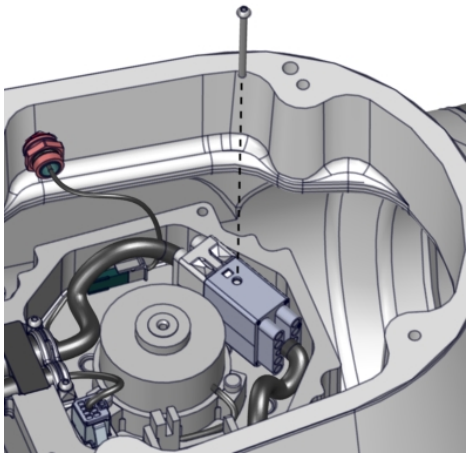
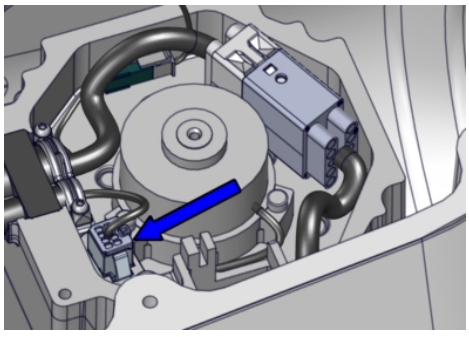
Refitting the wrist

	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.	 xx2100001289
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)  xx2300000020
4	Tighten the attachment screws.	Tightening torque: standard torque 120 Nm (*Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws on page 626*)..

Connecting the axis-5 motor cables

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

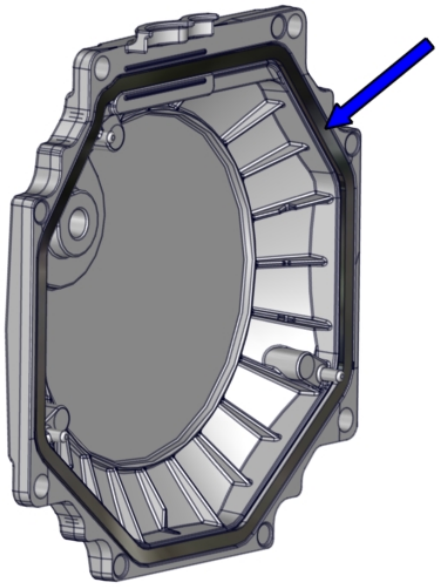
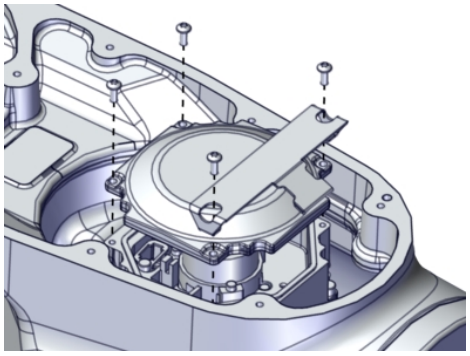
Continues on next page

	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

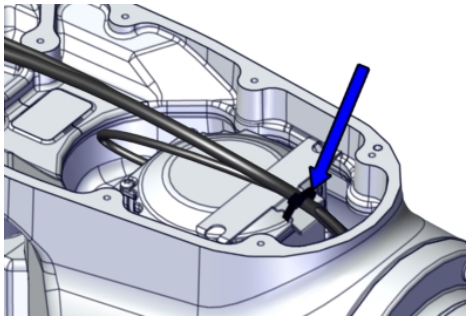
Continues on next page

5.5.1 Replacing the wrist

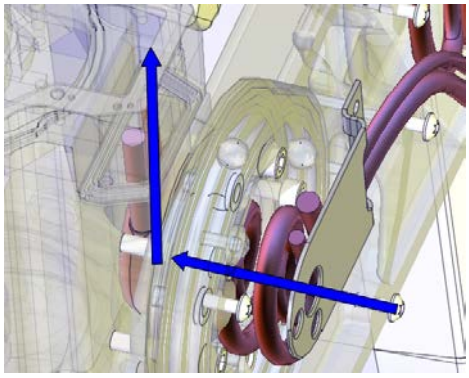
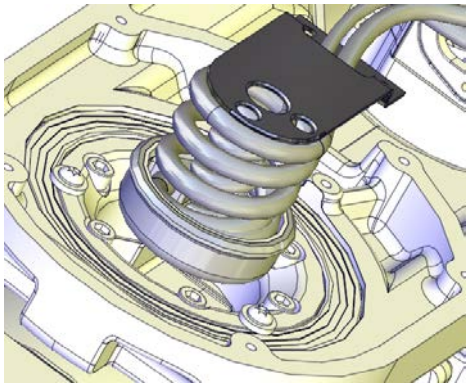
Continued

	Action	Note
5	Inspect the gasket. Replace if damaged.	Connection box cover with gasket: 3HAC072863-003  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.  xx2100002495

Continues on next page

	Action	Note
8	Secure the cabling with a cable strap.	Cable strap, outdoor: 3HAC057966-003  xx2100002625

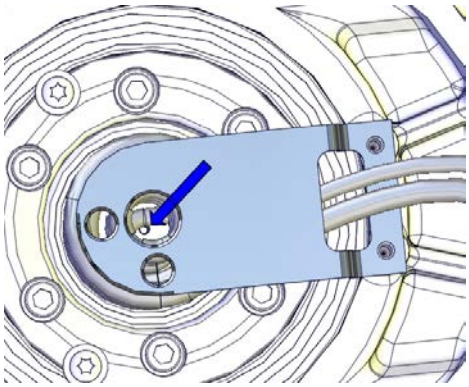
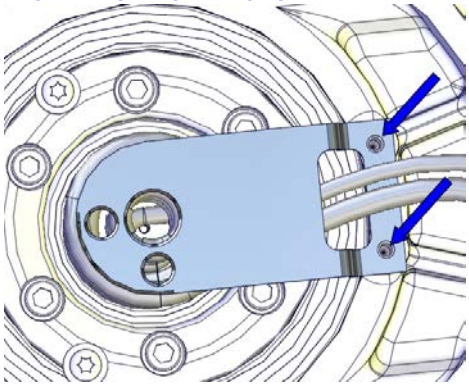
Inserting the axis-6 motor cables

	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
3	Push the carrier carefully into position.	 xx1300001113

Continues on next page

5.5.1 Replacing the wrist

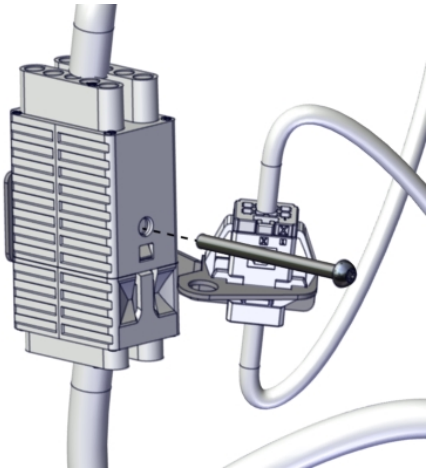
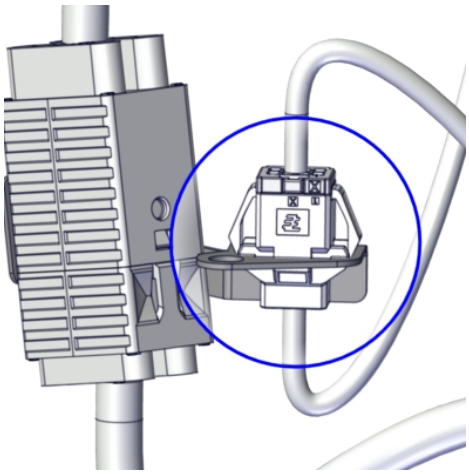
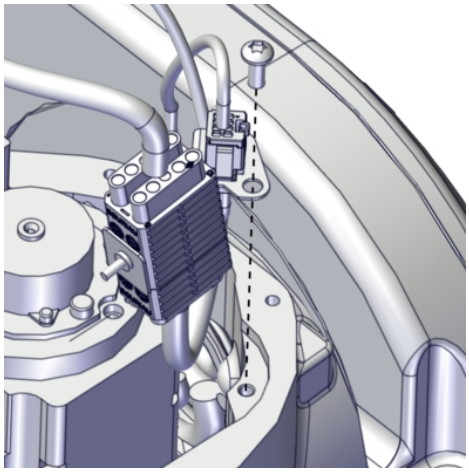
Continued

	Action	Note
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 625*)..  xx1300000484

Connecting the axis-6 motor cables

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

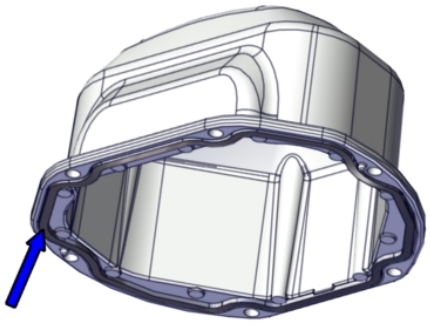
Continues on next page

	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  xx2200001919
3	Snap the signal connectors to each other in the bracket.	 xx2200001920
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  xx2000000375

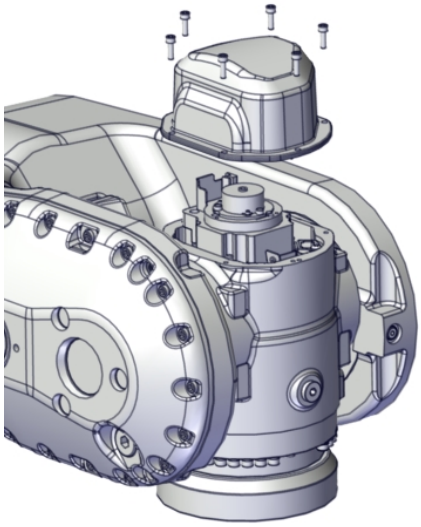
Continues on next page

5.5.1 Replacing the wrist

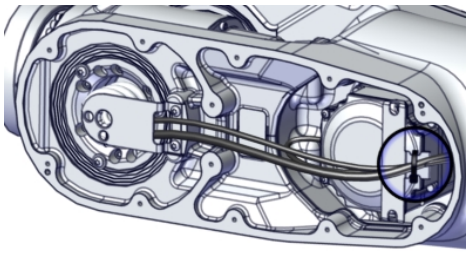
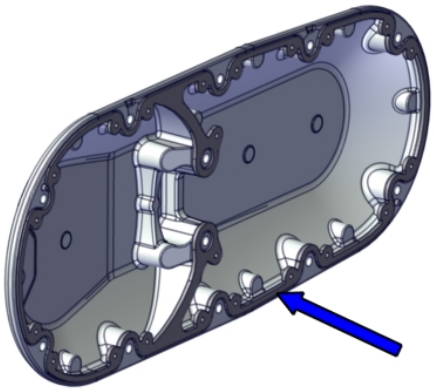
Continued

	Action	Note
5	Verify correct cable layout as shown in the figure. **CAUTION** Route the signal cabling correctly to avoid cable damage.	 xx2100001293
6	Inspect the gasket. Replace if damaged.	Gasket, tilt housing cover: 3HAC074482-001  xx2100001287
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	

Continues on next page

	Action	Note
8	Refit the motor cover.	Hex socket head cap screw: M5x16 12.9 Lafre 2C2B/FC6.9 (6 pcs) Tightening torque: 4 Nm.  xx2000000376

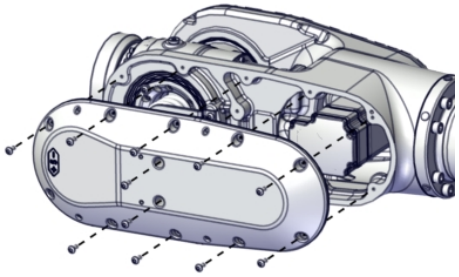
Refitting the wrist cover

	Action	Note
1	Make sure that the cable harness is routed and secured as shown in the figure.	 xx2100002626 :
2	*Foundry Plus:* Inspect the gasket. Replace the complete cover if the gasket is damaged.	Wrist cover: 3HAC074181-002 (Graphite White) 3HAC074181-004 (ABB Orange)  xx2100001407

Continues on next page

5.5.1 Replacing the wrist

Continued

	Action	Note
3	Refit the wrist cover and secure with screws. *Foundry Plus:* Fit all the screws first, then torque tighten.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2000000373

Concluding procedure

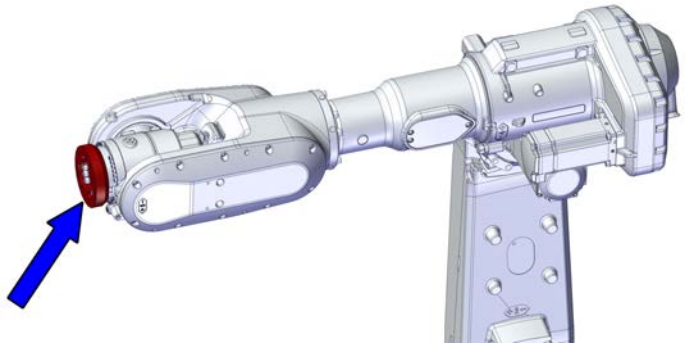
	Action	Note
1	*Foundry Plus:* Refit protection plugs.	
2	If used, refit the DressPack cable package on the wrist.	See product manual for the DressPack.
3	Calibrate the robot.	See *Calibration on page 585*.
4	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 94*.	

5.5.2 Replacing the turning disc

Location of the turning disc

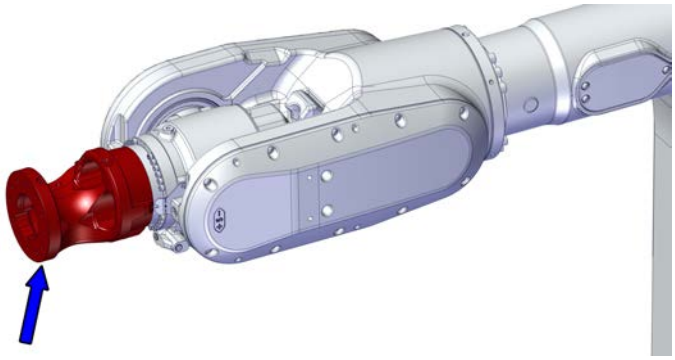
The turning disc is located as shown in the figure.

IRB 6710-210/2.65, IRB 6710-200/2.95:



xx2100002166

IRB 6710-175/2.65 LID, IRB 6710-175/2.95 LID:



xx2100002628

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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Turning disc	3HAC077309-002		L2
Process turning disc	3HAC070389-004	**IRB 6710-175/2.65 LID** **IRB 6710-175/2.95 LID**	L2

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Continues on next page

5.5.2 Replacing the turning disc
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 595*.
	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

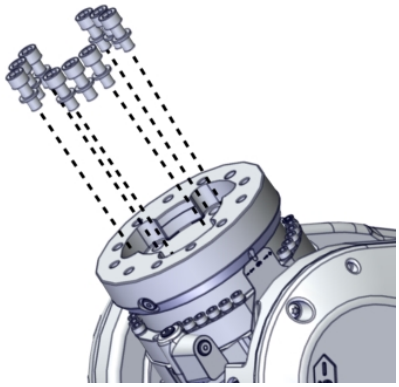
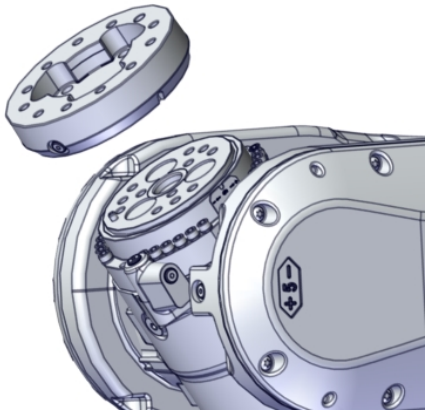
Use these procedures to remove the turning disc.

Preparations before removing the turning disc

	Action	Note
1	Run the robot to a position most comfortable for the removal of the turning disc.	
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.	

Continues on next page

Removing the turning disc

	Action	Note
1	Remove the screws and washers, that secure the turning disc.	 xx2100002167
2	Remove the turning disc.	 xx2100002168

Refitting the turning disc

Use these procedures to refit the turning disc.

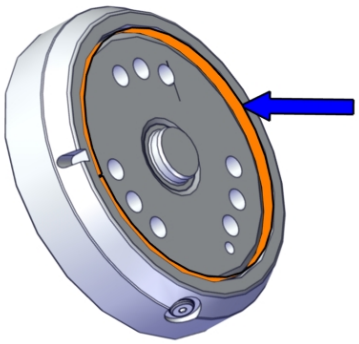
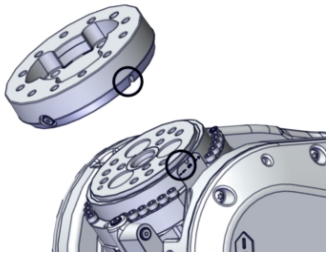
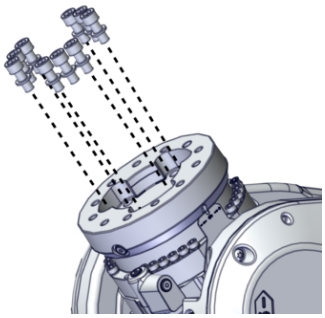
Refitting the turning disc

	Action	Note
1	Wipe clean the contact surfaces.	

Continues on next page

5.5.2 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.	 xx2100002169
4	Secure the turning disc with its attachment screws and washers.	Hex socket head cap screw: M10x25 12.9 Gleitmo 603+Geomet 500 Washer: 3HAB4233-1 Tightening torque: standard torque 70 Nm (*Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws on page 626*)..  xx2100002167

Continues on next page

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 94*.	

5.6 Electronic parts

5.6.1 Removing the cable harness

Location of the cable harness

The cable harness is located as shown in the figure.

xx2200001729

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 6710 via myABB Business Portal, *www.abb.com/myABB*.

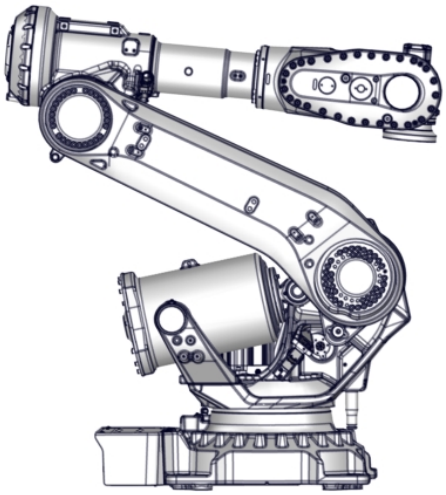
Continues on next page

Spare part	Article number	Note	Level
Cable harness	3HAC083039-001 (CH31)	IRB 6710-210/2.65 IRB 6710-175/2.65 LID	L2
Cable harness	3HAC078462-001 (CH31-L)	IRB 6710-200/2.95 IRB 6710-175/2.95 LID	L2

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

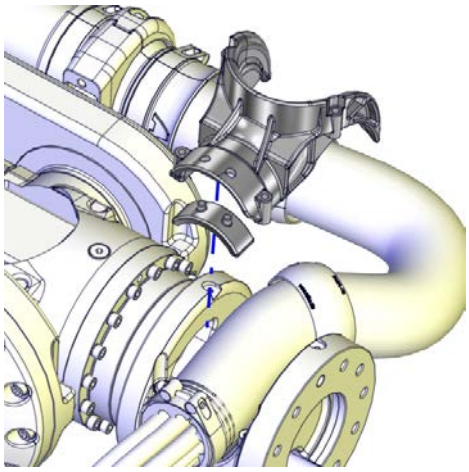
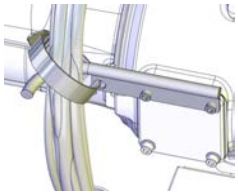
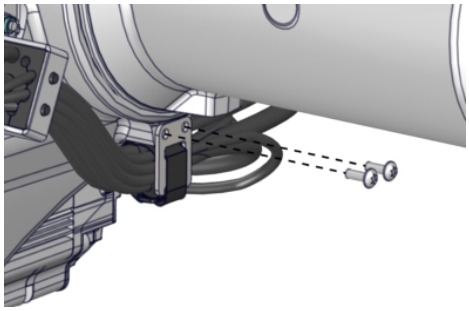
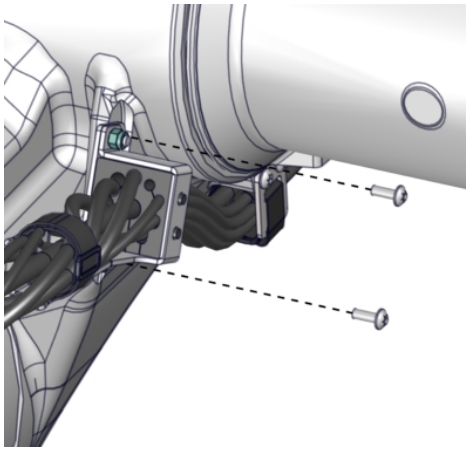
Preparations before removing the cable harness

	Action	Note
1	*Floor-standing robot:* Jog the robot to the specified position: • Axis 1: 0° • Axis 2: -60° • Axis 3: +60° • 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.	 xx2200001615
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

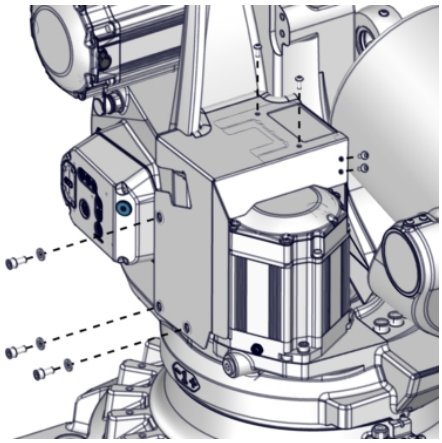
Continues on next page

5.6.1 Removing the cable harness

Continued

	Action	Note
3	**Note** If only the manipulator harness shall be removed, the DressPack cable package can stay fitted on the process turning disk.	 xx1400000208
4	Remove the cable bracket underneath the tube shaft. **Note** If DressPack is fitted, the cable fixing bracket is replaced by the cable guide.  xx1300001973	 xx2200001432
5	Remove the metal clamp at the arm house.	 xx2200001433

Continues on next page

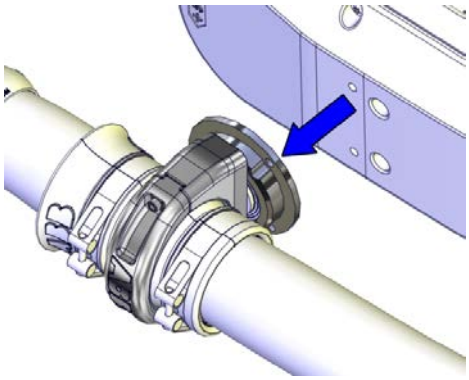
	Action	Note
6	*Protection type Foundry Plus* Remove the axis-1 cable protection plates by removing the attachment screws.	 xx2200001430

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

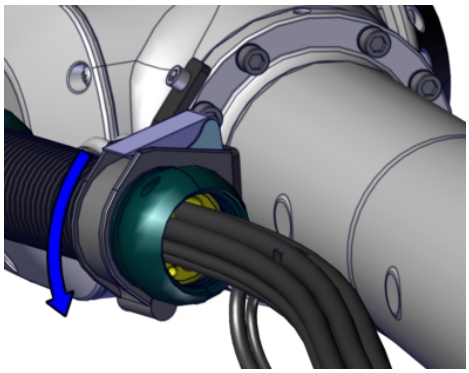
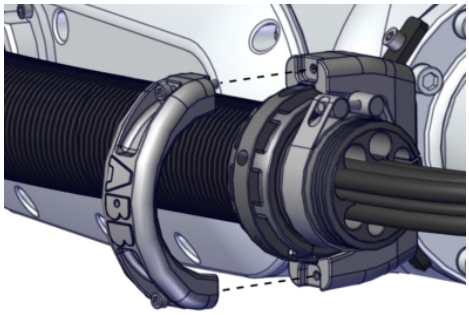
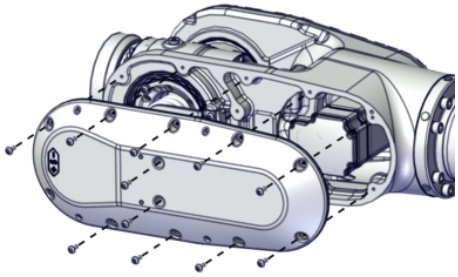
Use this procedure to remove the wrist cover.

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	If DressPack is installed: • Remove the bracket with the complete ball joint housing still fitted, as shown in the figure. This is done to be able to reach the two hidden screws that secure the wrist cover.	 xx1400000355

Continues on next page

5.6.1 Removing the cable harness

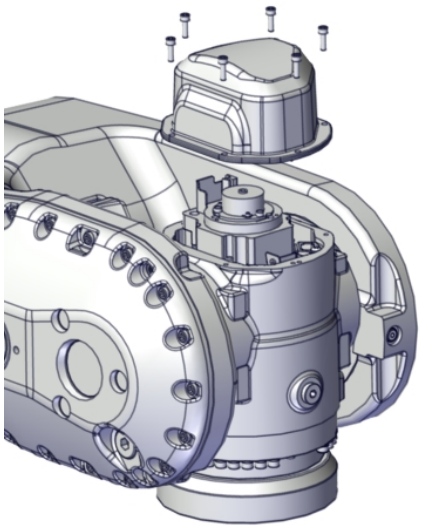
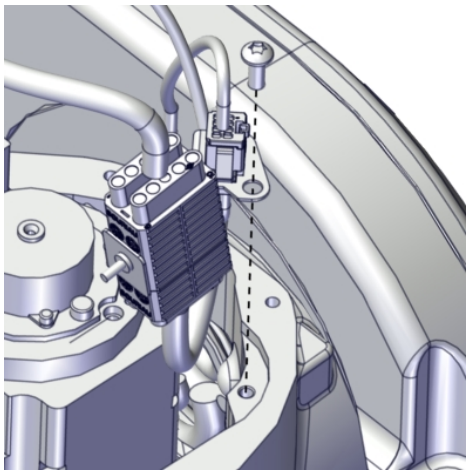
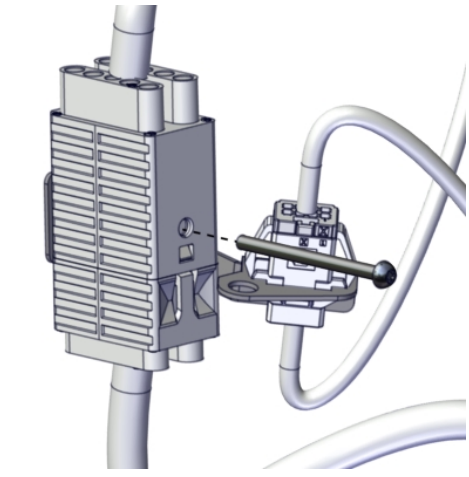
Continued

	Action	Note
3	If DressPack is installed: Open the ball joint housing on the arm tube and remove the DressPack cable package.	IRB 6710-xx/ LID  xx2100002733 IRB 6710-xx/ LID:  xx2100002709
4	Remove the wrist cover.	 xx2000000373

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

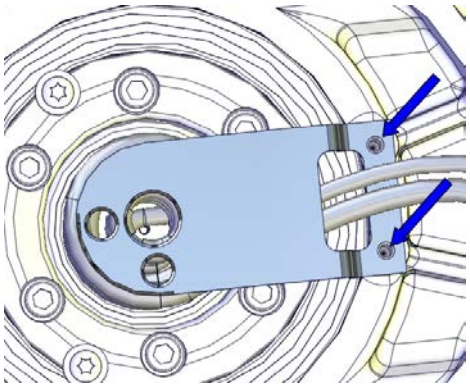
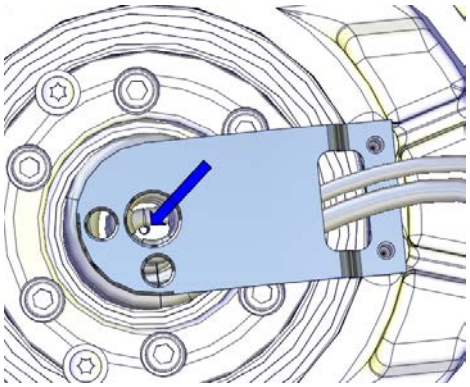
	Action	Note
2	Unscrew the attachment screws and remove the motor cover.	 xx2000000376
3	Remove the connector bracket.	 xx2000000375
4	Remove the connector screw.	 xx2200001919
5	Disconnect the motor cables.	

Continues on next page

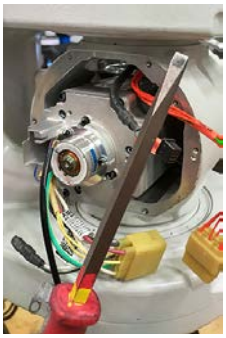
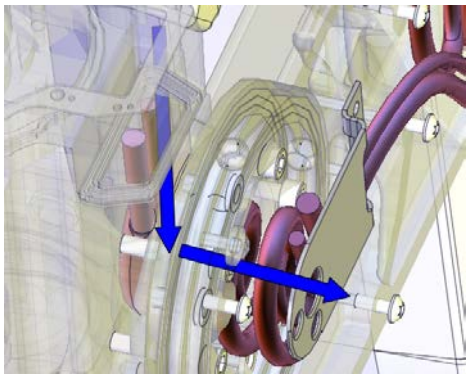
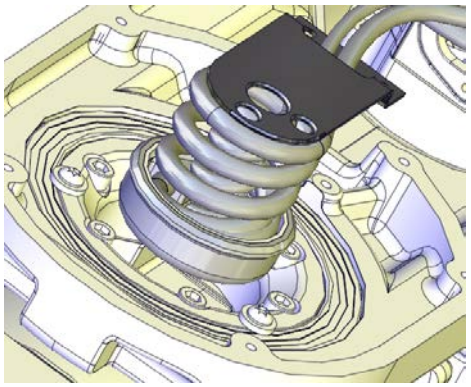
5.6.1 Removing the cable harness

Continued

Pushing out the axis-6 motor cables

	Action	Note
1	Unscrew the attachment screws that hold the cable bracket.	 xx1300000484
2	Unscrew the M4 screw that holds the carrier. **Note** The screw is located at the bottom of the carrier.	 xx1300000485

Continues on next page

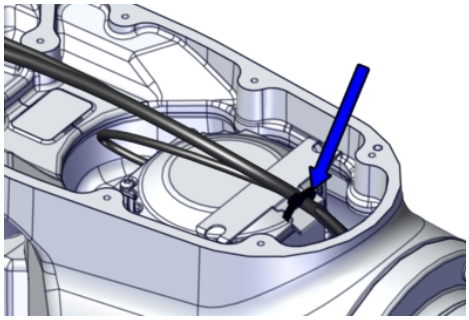
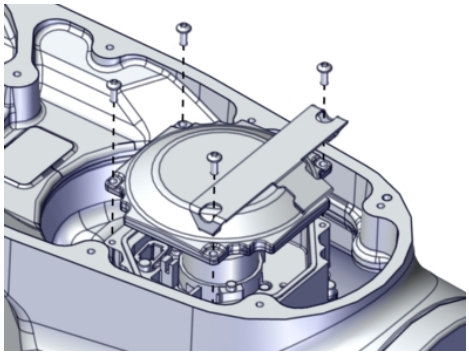
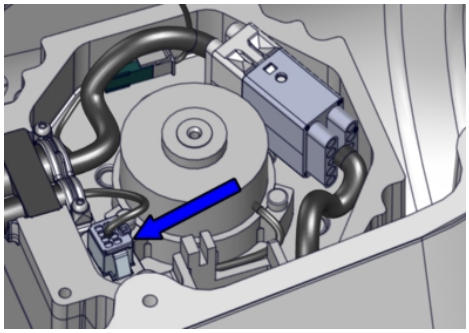
	Action	Note
3	Lift out the axis-6 motor cables by holding the cables with one hand at the motor and the other at the carrier. **CAUTION** Assist by using a flat-head screwdriver or similar to push out the carrier from the motor housing side, to avoid damaging the cables by pulling them too hard.  xx2300000057  xx2300000058  xx2300000059  xx2300000060	 xx1300000666
4	Lift out the carrier from its position.	 xx1300001113

Continues on next page

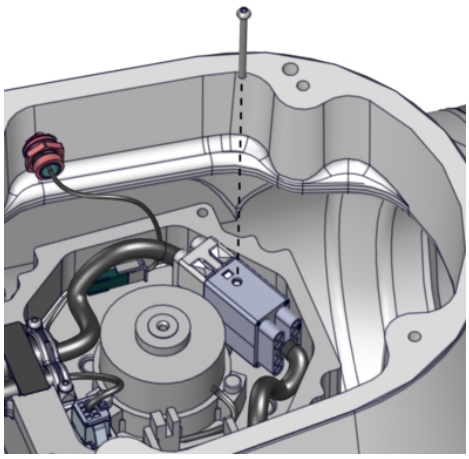
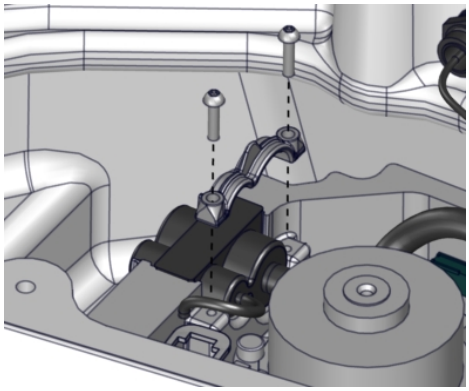
5.6.1 Removing the cable harness

Continued

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.	 xx2100002625
3	Remove the motor cover by removing the screws.	 xx2100002495
4	Disconnect the signal cable connector.	 xx2200001734

Continues on next page

	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.	

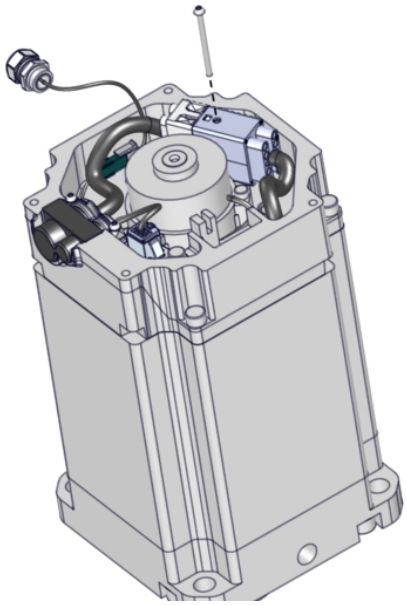
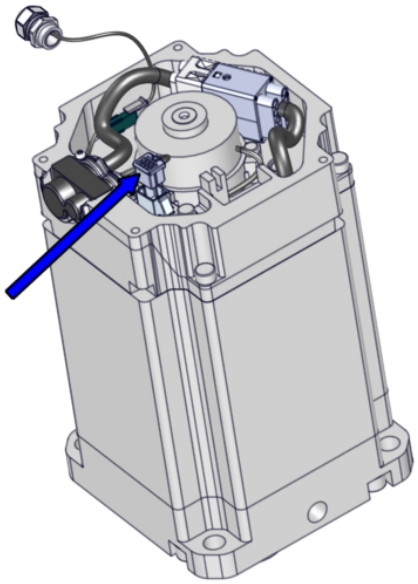
Disconnecting the axis-3 and axis-4 motor cables

	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.	

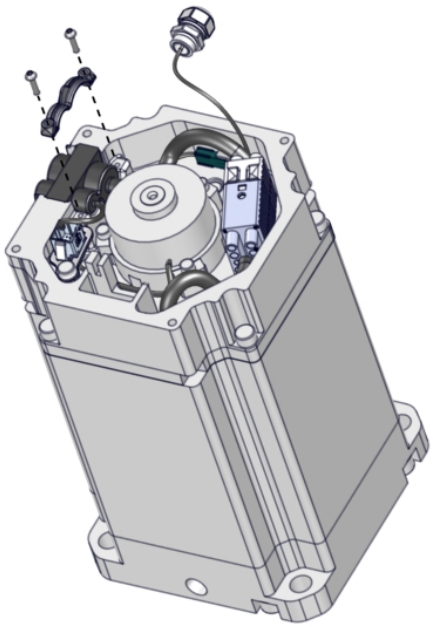
Continues on next page

5.6.1 Removing the cable harness

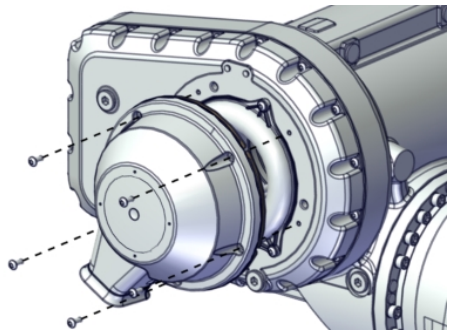
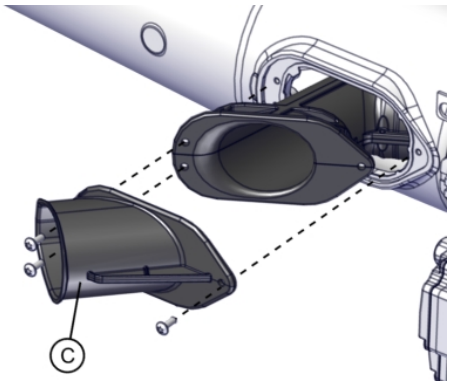
Continued

	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

Continues on next page

	Action	Note
5	Remove the cable bracket by removing the screws.	 xx2200001738
6	Remove the motor cables from the motor.	

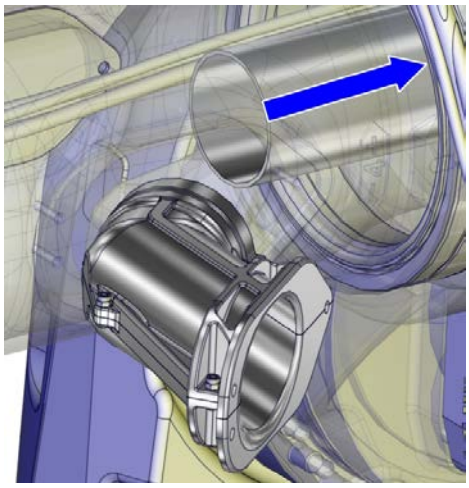
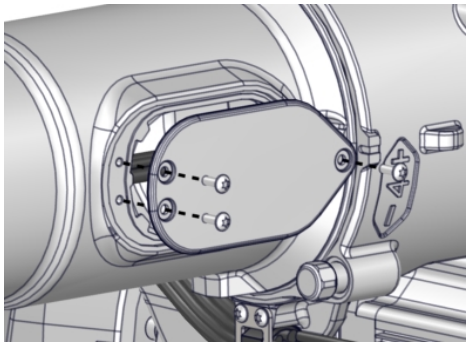
Removing the cable harness from the wrist and upper arm

	Action	Note
1	*Foundry Plus*, *DressPack:* Remove the cover. **Note** Use caution not to damage the gasket.	 xx2000000422
2	*DressPack* If used, loosen the insert. (Cable guard (C) is available for Foundry cable guard.)	 xx2100002677

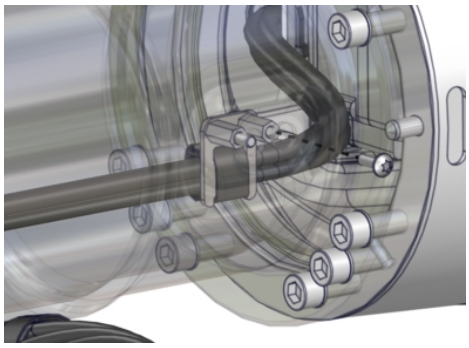
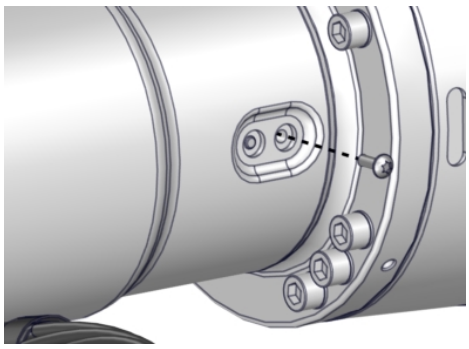
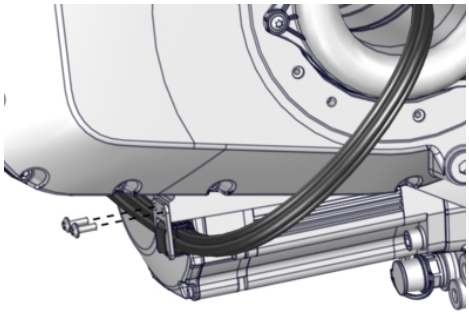
Continues on next page

5.6.1 Removing the cable harness

Continued

	Action	Note
3	*DressPack* If used, 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

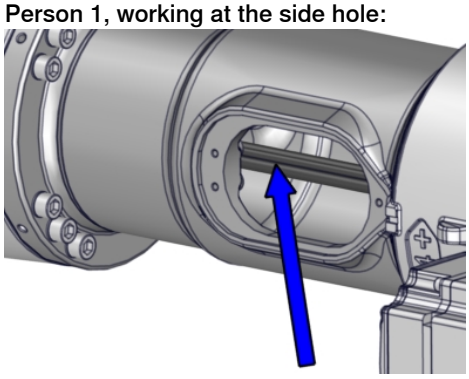
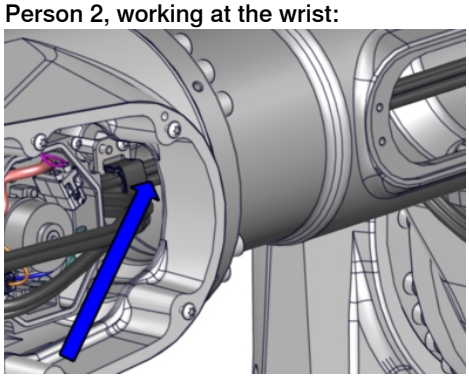
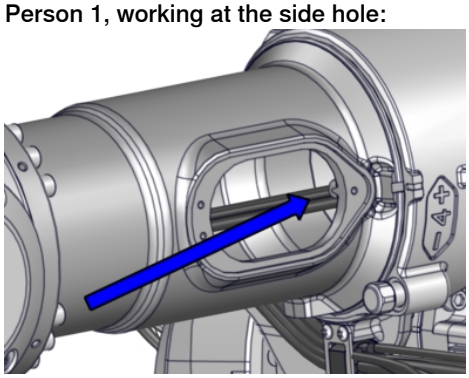
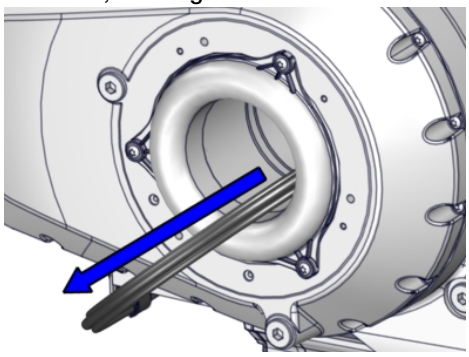
Continues on next page

	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.	 xx2200002142

Continues on next page

5.6.1 Removing the cable harness

Continued

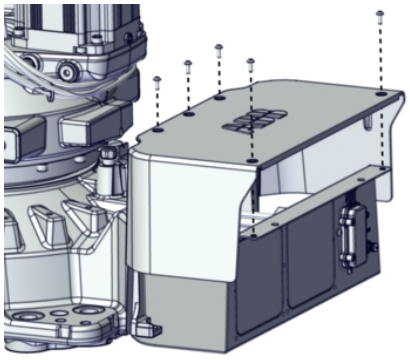
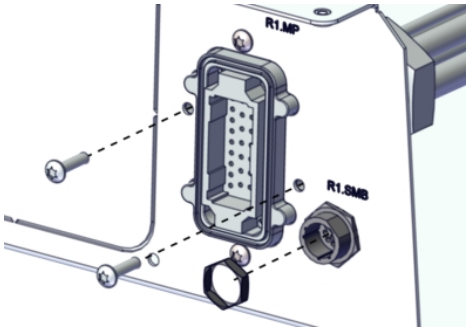
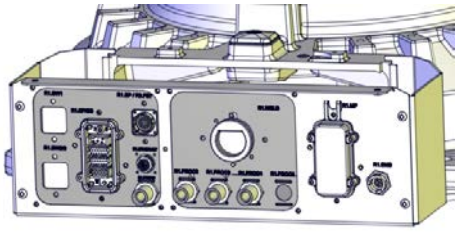
	Action	Note
8	Remove the cable harness out from the wrist. **Tip** This step is best performed by two persons working together: • Person 1: Put one hand inside the side hole and take a hold of the cable harness. • Person 2: Take a hold on the cable harness inside the wrist. • Together: Move the cable 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

Continues on next page

Removing the cable harness - base, frame and lower arm

These procedures describes how to remove the cable harness from base, frame and lower arm.

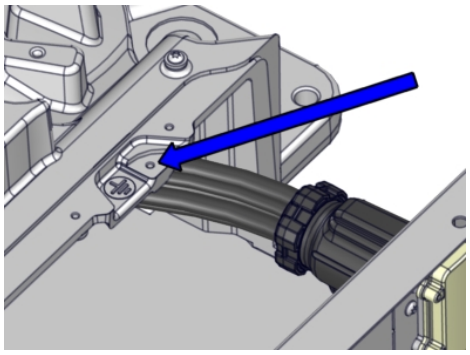
Preparations before removing the cable harness in the base

	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.	 xx1400000366

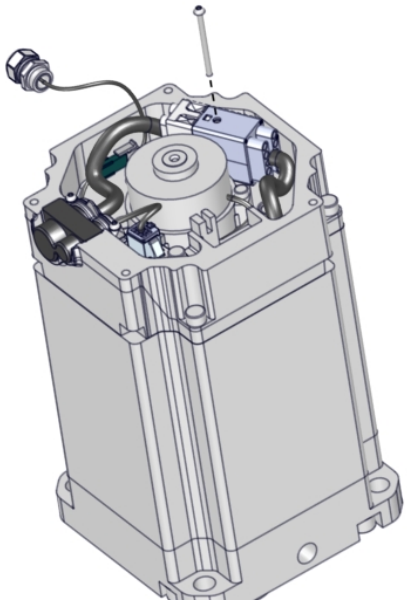
Continues on next page

5.6.1 Removing the cable harness

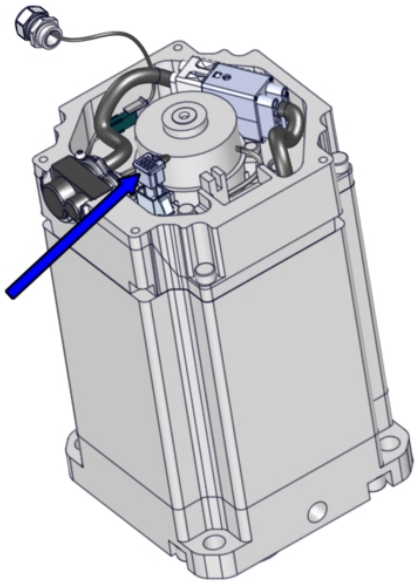
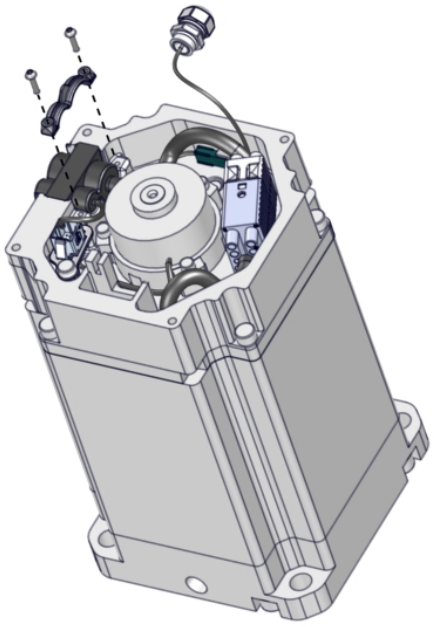
Continued

	Action	Note
5	Disconnect the earth cable.	 xx2200001790

Disconnecting the axis-1 and 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.	
3	Disconnect the power cable connector by first removing the attachment screw and then parting the connector.	 xx2200001736

Continues on next page

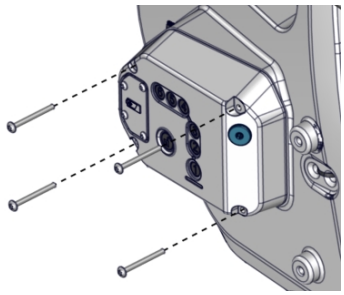
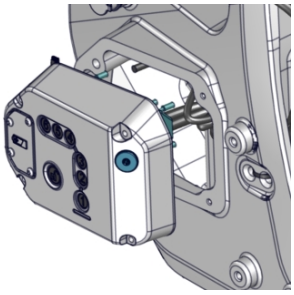
	Action	Note
4	Disconnect the signal cable connector by pulling it out.	 xx2200001737
5	Remove the cable bracket by removing the screws.	 xx2200001738
6	Remove the motor cables from the motor.	

Removing the electronic box

	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 Removing the cable harness
Continued

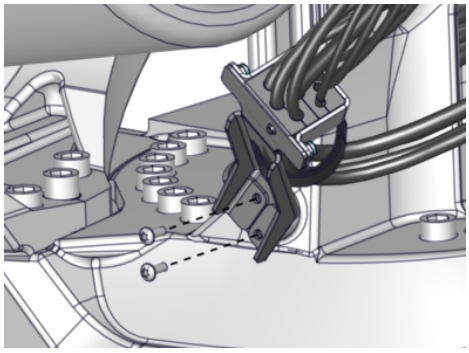
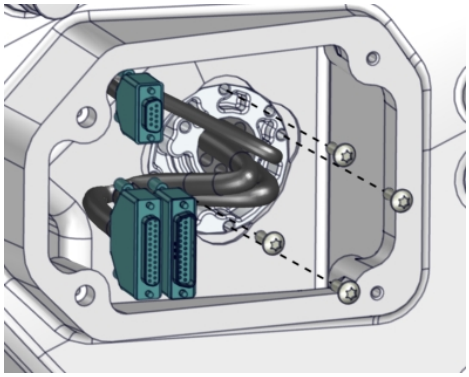
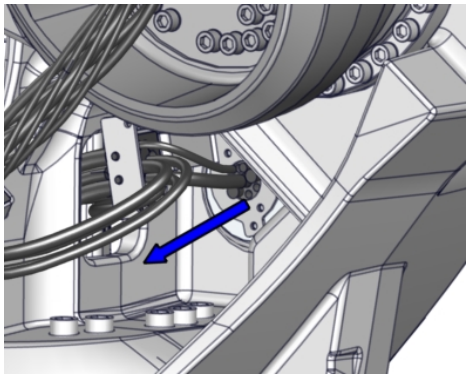
	Action	Note
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 48*.	
3	Remove the electronic box screws.	 xx2200001721
4	Remove the electronic box, including all internal equipment. **CAUTION** 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 48*.	
2	Disconnect all connectors from the SMB board.	
3	Disconnect the connectors R2.BU1 and R2.BU2 from the brake release board.	

Continues on next page

Removing the cable harness from the frame

	Action	Note
1	Loosen the cable bracket from the frame by removing the screws.	 xx2200001388
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.	 xx2200001739

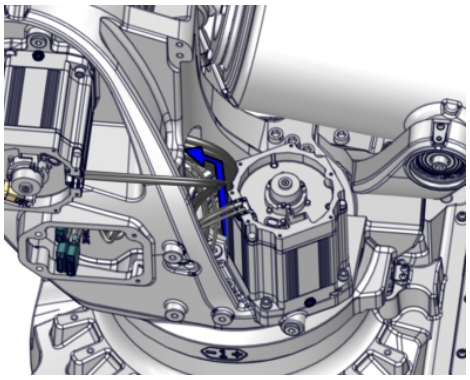
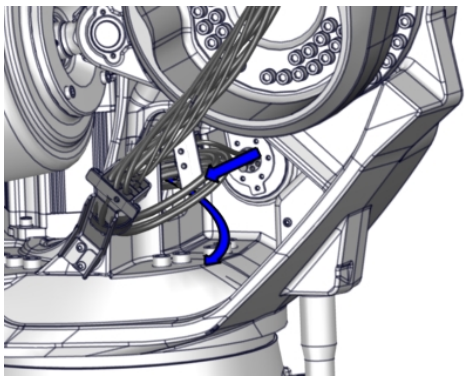
Removing the cable harness from the base

	Action	Note
1	If equipped with DressPack, pull out the DressPack cables through the protection tube.	

Continues on next page

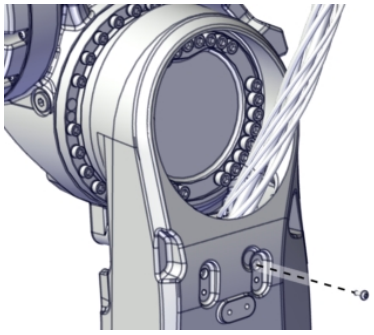
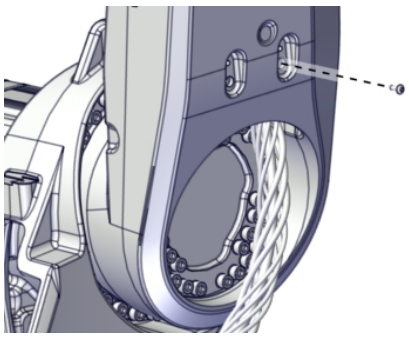
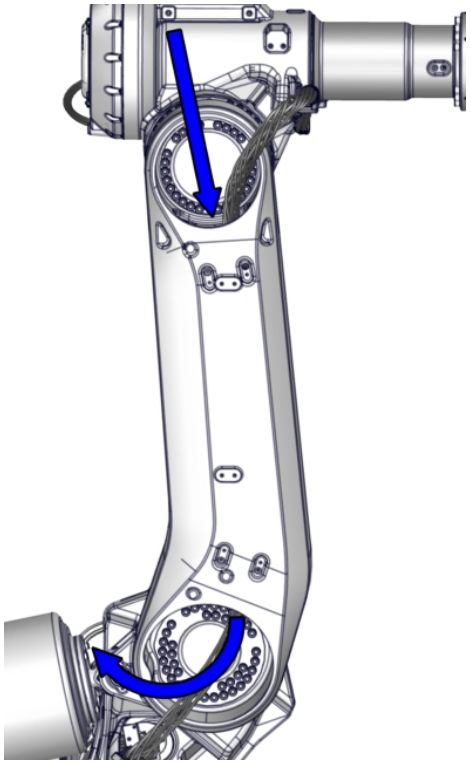
5.6.1 Removing the cable harness

Continued

	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.	 xx2200001740  xx2200001741
3	Place the cable harness over the balancing device.	

Continues on next page

Removing the cable harness from the lower arm

	Action	Note
1	Loosen the upper and lower cable clamps inside the lower arm by removing the attachment screws. **Note** The screws are reached from the outside of the lower arm.	 xx2100002182  xx2100002183
2	Use caution and pull the cable harness out.	 xx2300000052

5.6.2 Refitting the cable harness

Location of the cable harness

The cable harness is located as shown in the figure.

xx2200001729

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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Cable harness	3HAC083039-001 (CH31)	IRB 6710-210/2.65 IRB 6710-175/2.65 LID	L2

Continues on next page

Spare part	Article number	Note	Level
Cable harness	3HAC078462-001 (CH31-L)	IRB 6710-200/2.95 IRB 6710-175/2.95 LID	L2

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
Connection box cover FS180 with gasket	3HAC074336-004 (Graphite White) 3HAC074336-005 (ABB Orange)	Replace if damaged. On axis-3 motor
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	Replace if damaged. On axis-5 motor
Tilt housing cover with gasket	3HAC074958-003 (Graphite White) 3HAC074958-004 (ABB Orange)	Replace if damaged. On axis-6 motor
Wrist cover	3HAC074181-002 (Graphite White) 3HAC074181-004 (ABB Orange)	Replace if damaged.
Cover, electronics	3HAC081189-003 (Graphite White) 3HAC081189-004 (ABB Orange)	Includes gasket. Replace if damaged.
Cable strap, outdoor	3HAC057966-003	
Metal strap	3HAC033886-001	
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 628*.

Continues on next page

5.6.2 Refitting the cable harness
Continued

Refitting the cable harness - base, frame and lower arm

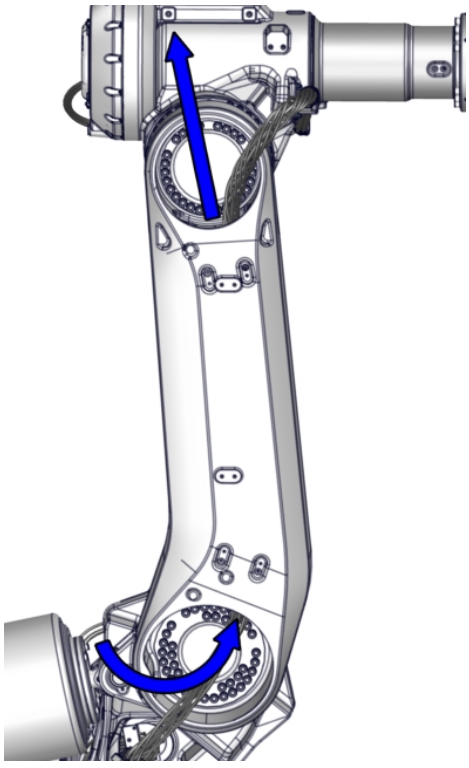
These procedures describes how to refit the cable harness in base, frame and lower arm.

Preparations before refitting the cable harness

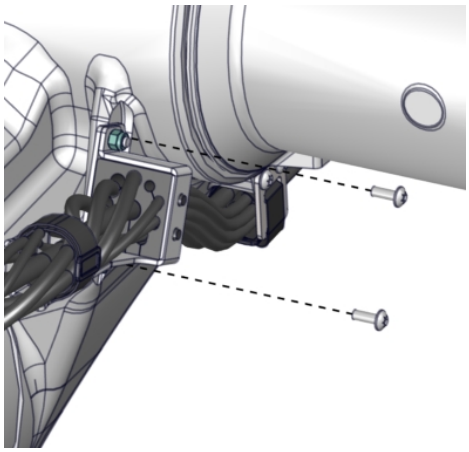
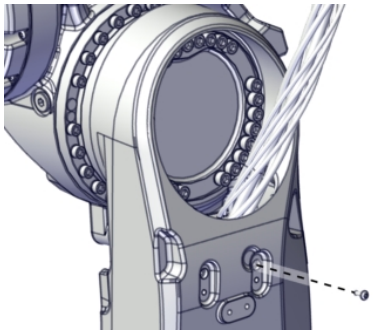
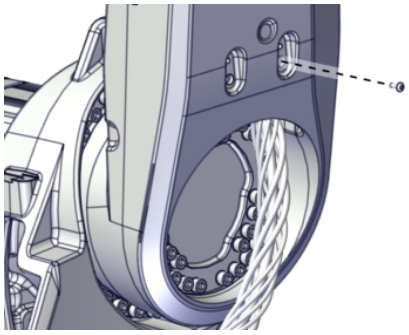
Use this procedure to understand the layout of the new cable harness spare part.

	Action	Note
1	*Floor-standing robot:* 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.	 xx2300000053

Continues on next page

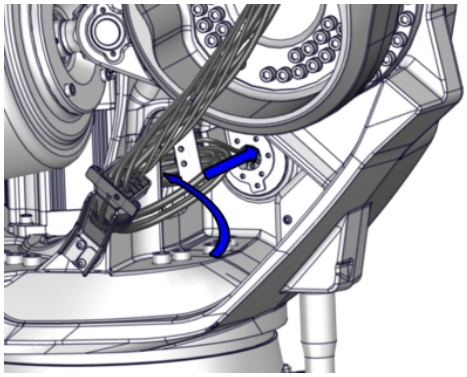
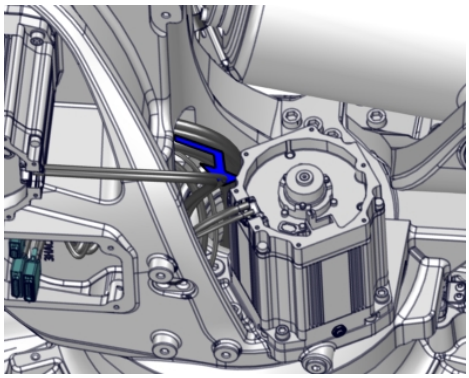
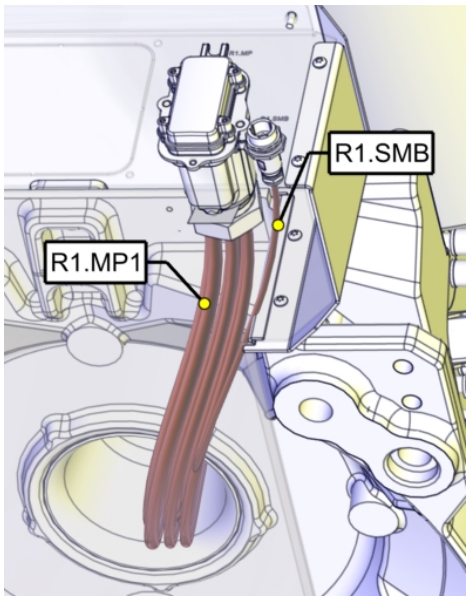
	Action	Note
3	Refit the metal clamp to the arm house.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2200001433
4	Secure the upper and lower cable clamps inside the lower arm with the attachment screws. **Note** The screws are reached from the outside of the lower arm. **Note** Check that the cabling will stay a little bit twisted between the cable clamps. Do not change the position of the brackets!  xx1300000595	Torx pan head screw: M6x16 A4-80 Tightening torque: 6 Nm.  xx2100002182  xx2100002183

Continues on next page

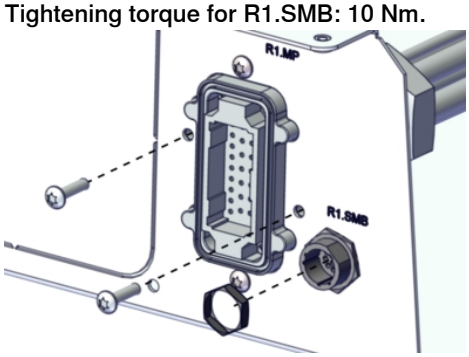
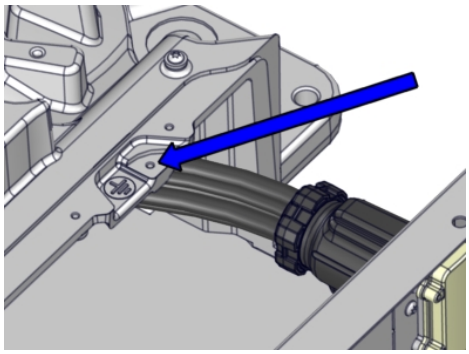
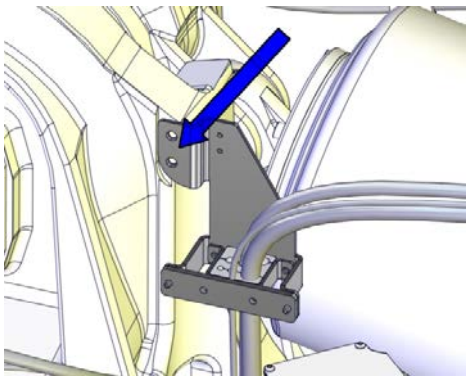
5.6.2 Refitting the cable harness

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. Guide the SMB cables into the SMB recess at the same time.	 xx2200001923  xx2200001924
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.	

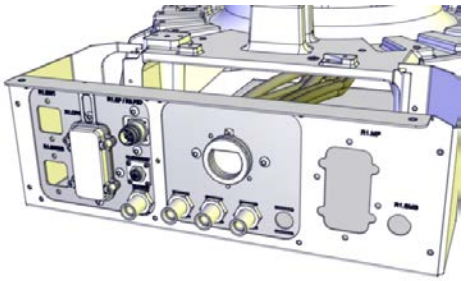
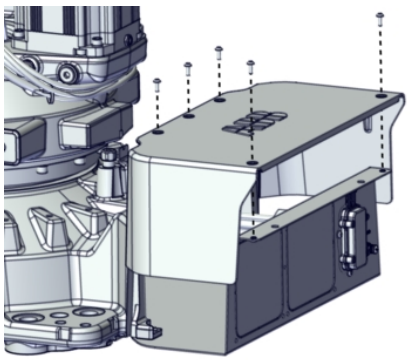
Continues on next page

	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 cables through the protection tube in the base. If necessary, lubricate the cables with grease to make them run more smoothly.	
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, fit the bracket that hold the DressPack to the frame.	 xx1400000078

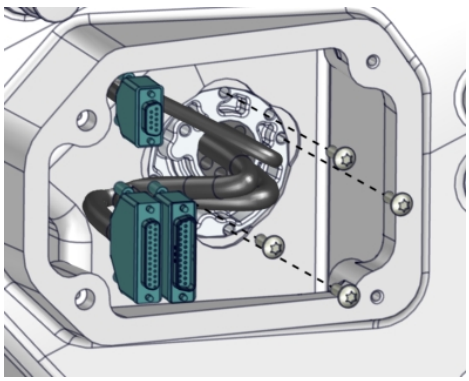
Continues on next page

5.6.2 Refitting the cable harness

Continued

	Action	Note
9	If used, connect the DressPack cable package on the base plate.	 xx1200000052
10	Refit the base cover.	Torx pan head screw: M6x16 Stainless steel A2-70 (5 pcs) Tightening torque: 10 Nm.  xx2100000981

Refitting the SMB cabling

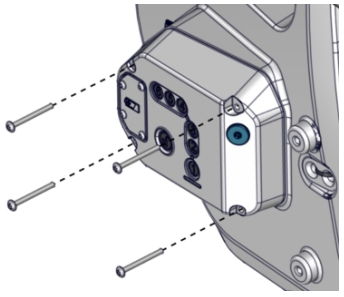
	Action	Note
1	Refit and secure the cable inlet with the screws inside the SMB recess	 xx2200001725
2	Seal the cable inlet with sealing compound.	Sealing compound: 3HAC026759-002 () Sikaflex 521 FC

Continues on next page

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 48*.	
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

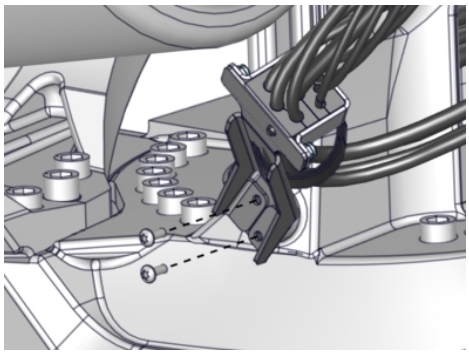
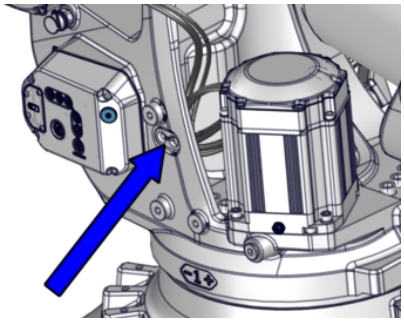
	Action	Note
1	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 48*.	
2	Refit the electronic box with the attachment screws.	Torx pan head screw: M6x60 (4 pcs) Tightening torque: 10 Nm.  xx2200001721

Continues on next page

5.6.2 Refitting the cable harness

Continued

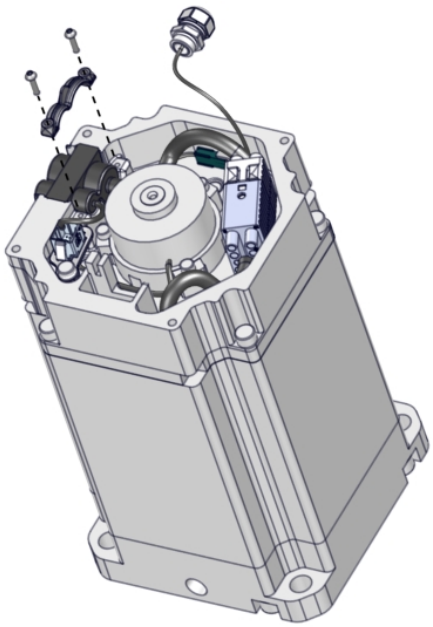
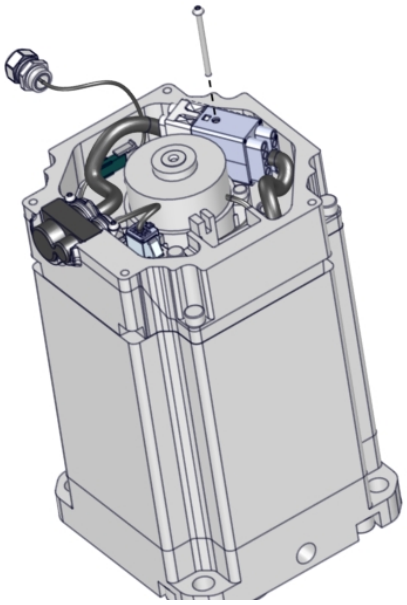
Refitting the cable harness to the frame

	Action	Note
1	Refit the cable brackets to the frame.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2200001388
2	Collect the cables for axis-1 and axis-2 motors, and secure them at the frame with straps.	Cable strap, outdoor: 3HAC057966-003 (1 pcs)  xx2200001752

Reconnecting the axis-1 and axis-2 motor cables

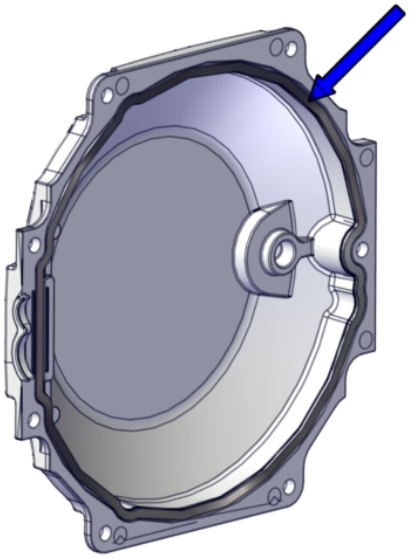
	Action	Note
1	Put the motor cables in place in the opening.	

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

Continues on next page

5.6.2 Refitting the cable harness
Continued

	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1 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-2 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-3 Connection box cover FS180 with gasket: 3HAC074336-004 (Graphite White) 3HAC074336-005 (ABB Orange) 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.	

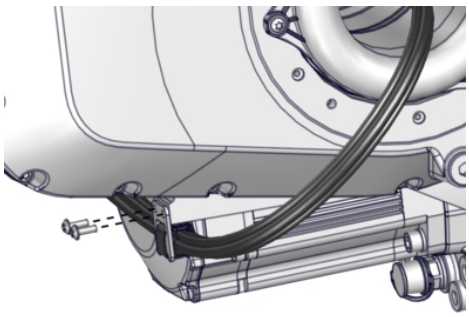
Continues on next page

	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.

Refitting the cable harness - upper arm and wrist

These procedures describes how to refit the cable harness in upper arm and wrist.

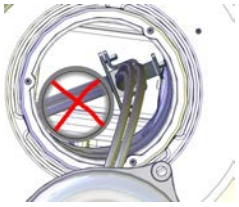
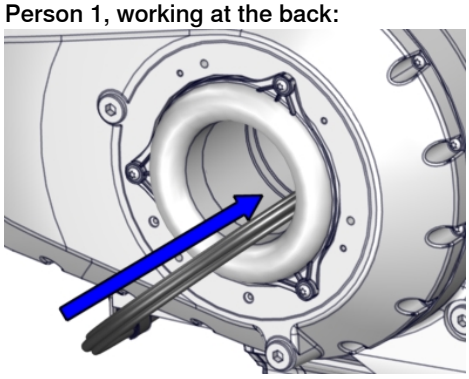
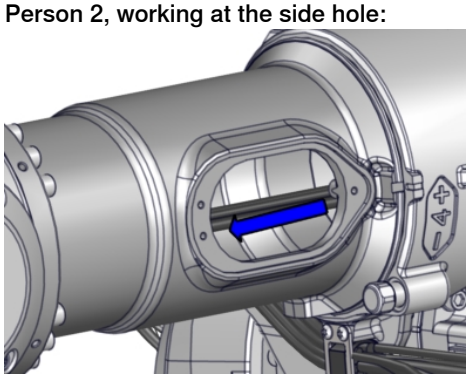
Refitting the cable harness to the upper arm

	Action	Note
1	Refit the metal clamp beneath the arm house.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2200002142
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

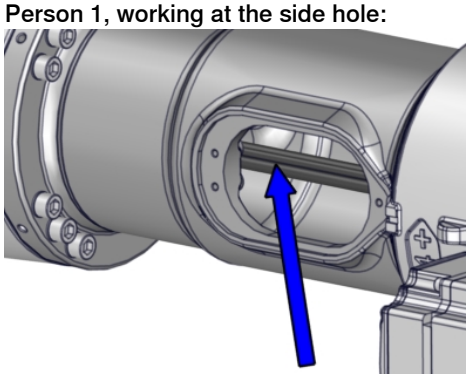
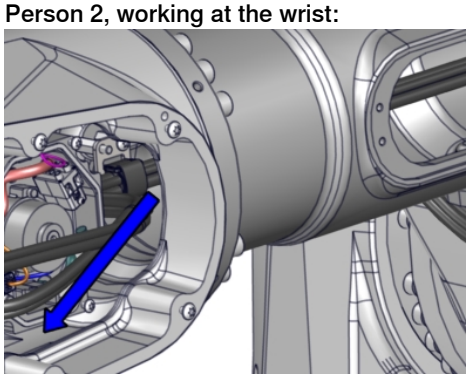
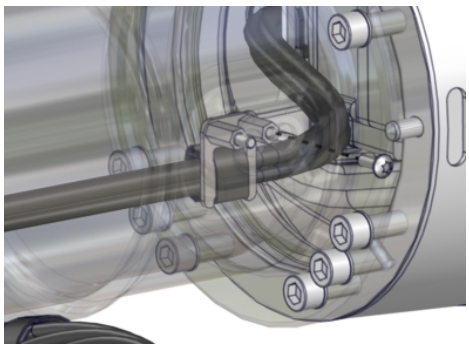
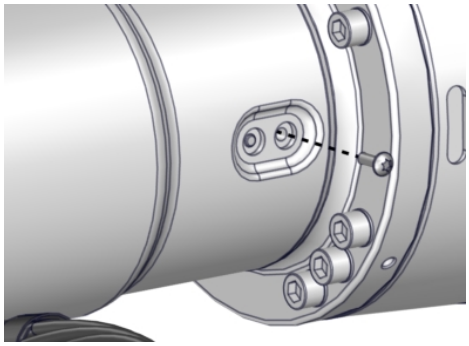
Continues on next page

5.6.2 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

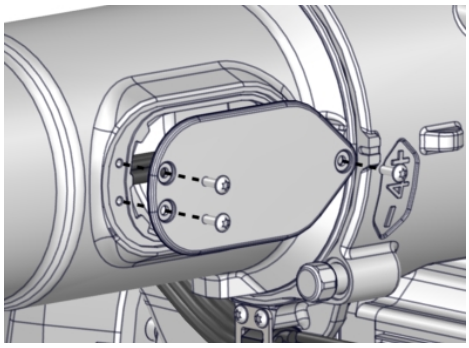
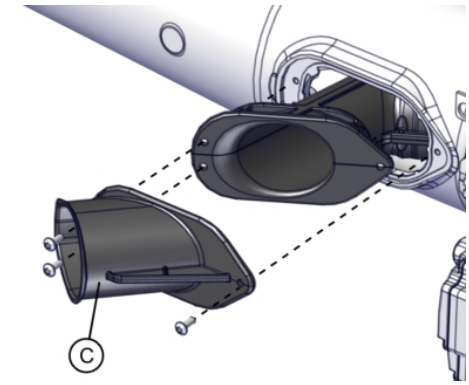
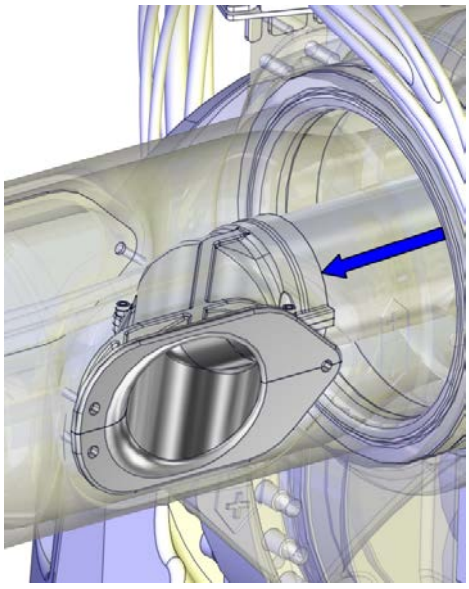
Continues on next page

	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

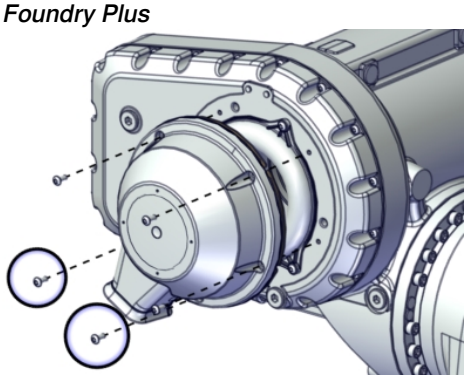
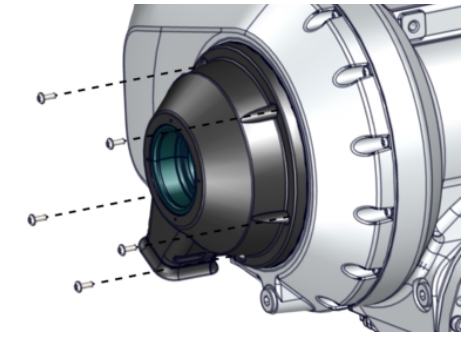
Continues on next page

5.6.2 Refitting the cable harness

Continued

	Action	Note
6	Refit the side cover. **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	If used, 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	If used, refit the tube containing the DressPack into the insert.	 xx1400000092

Continues on next page

	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.	Torx pan head screw: M6x16 Stainless steel A2-70 Tightening torque: 10 Nm. *Foundry Plus*  xx2100002636 *DressPack*  xx2300001040

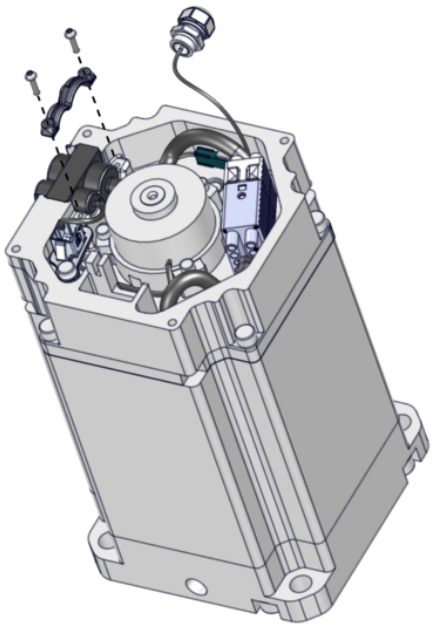
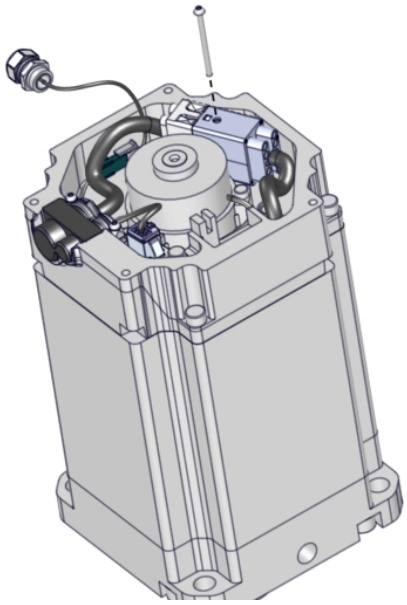
Reconnecting the axis-3 and axis-4 motor cables

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

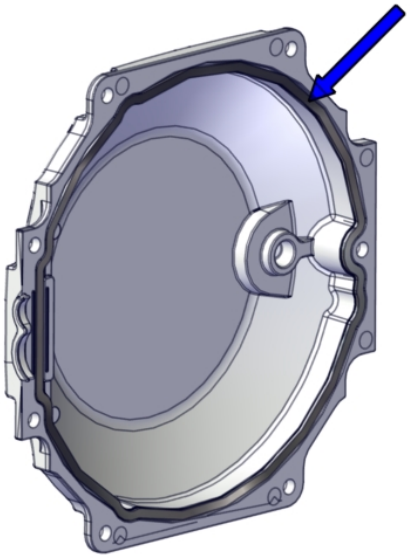
Continues on next page

5.6.2 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

Continues on next page

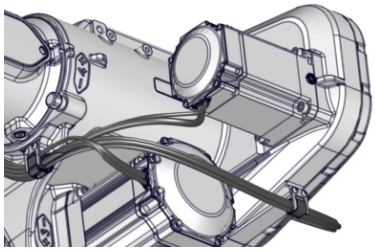
	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1 Connection box cover FS180 with gasket: 3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection) Axis-2 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-3 Connection box cover FS180 with gasket: 3HAC074336-004 (Graphite White) 3HAC074336-005 (ABB Orange) 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

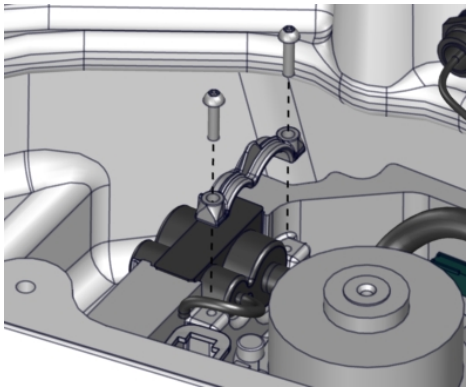
5.6.2 Refitting the cable harness

Continued

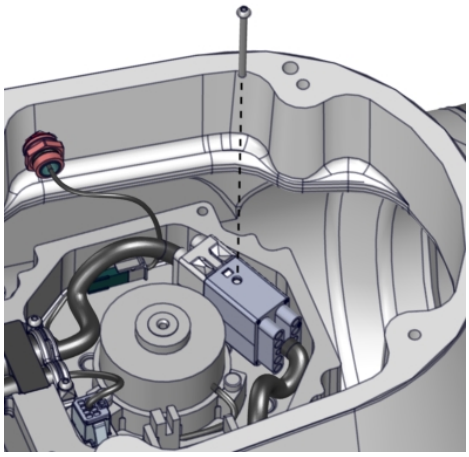
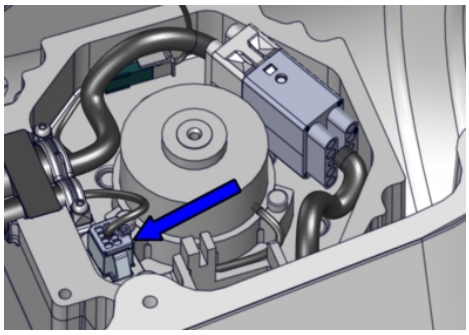
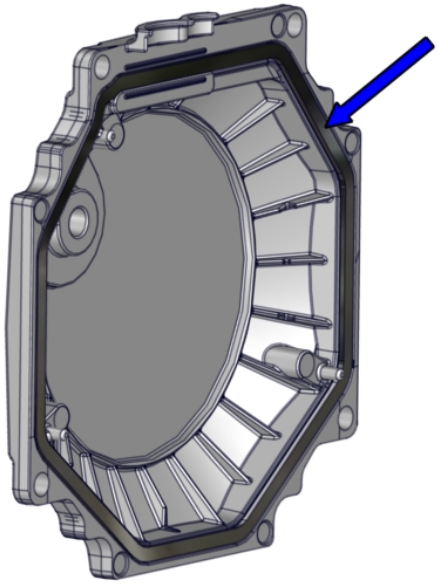
	Action	Note
7	Refit the motor cover with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.

	Action	Note
1	Verify that the cables are connected and routed correctly to each motor according to the figure and according to the markings on the connectors.	 xx2300000014

Connecting the axis-5 motor cables

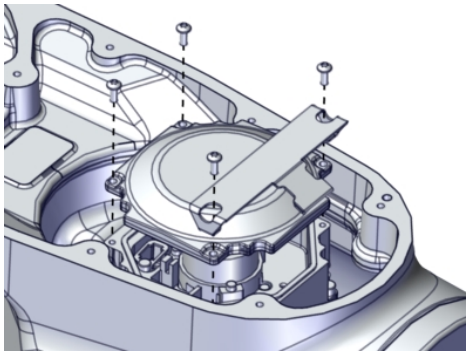
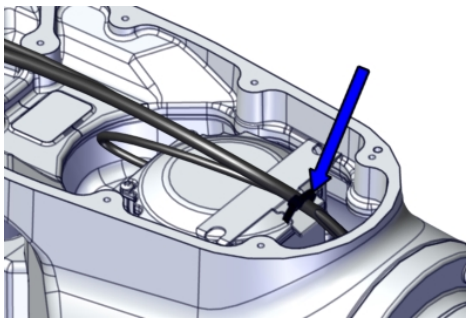
	Action	Note
1	Put the motor cables in place in the opening.	
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001735

Continues on next page

	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  xx2200002141

Continues on next page

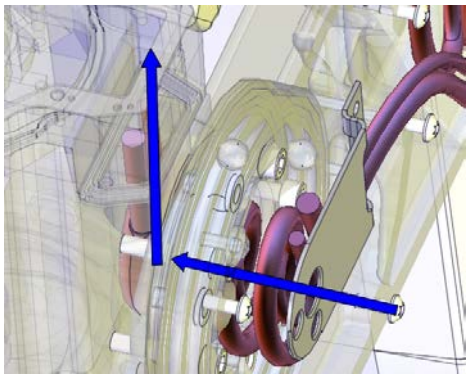
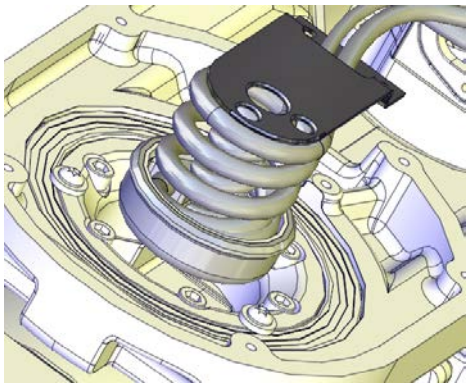
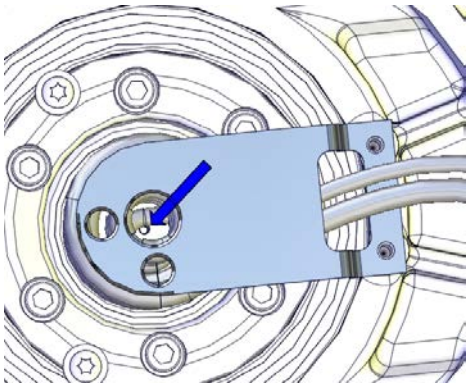
5.6.2 Refitting the cable harness
Continued

	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.  xx2100002495
8	Secure the cabling with a cable strap.	Cable strap, outdoor: 3HAC057966-003  xx2100002625

Inserting the axis-6 motor cables

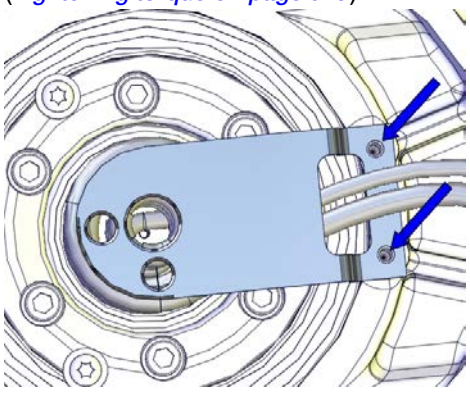
	Action	Note
1	**Note** Axis 5 must be in position +90° (or as close as possible) for a correct installation of the cable harness in the wrist. If not, connect the brake release tool to the axis-5 motor connector, release the brakes and move axis 5 manually to +90°.	

Continues on next page

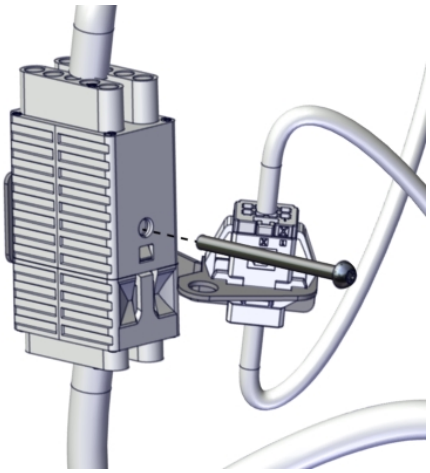
	Action	Note
2	Push the cable harness into the wrist recess and up into the axis-6 motor. **Tip** Moisten the rubber carrier slightly with water or grease around the contact surface, to make it easier to fit into place.	 xx1300000667
3	Push the carrier carefully into position.	 xx1300001113
4	Secure the 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

Continues on next page

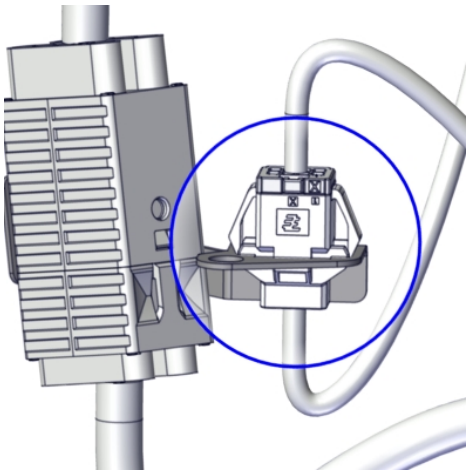
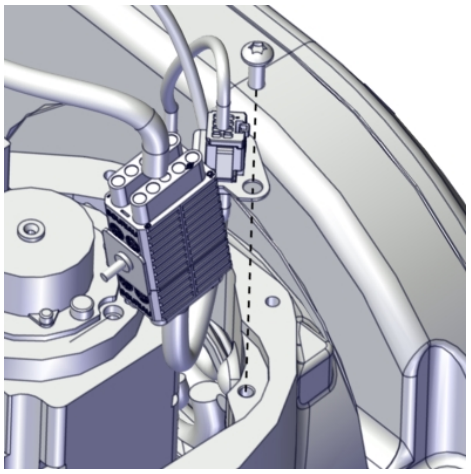
5.6.2 Refitting the cable harness
Continued

	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 625*)..  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  xx2200001919

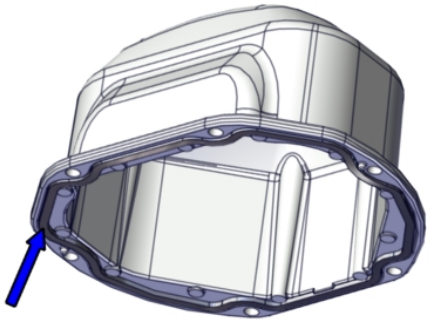
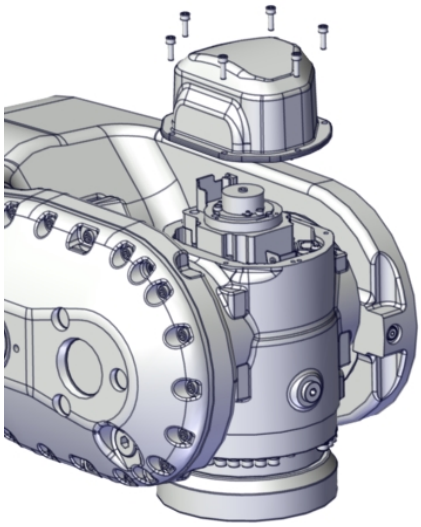
Continues on next page

	Action	Note
3	Snap the signal connectors to each other in the bracket.	 xx2200001920
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  xx2000000375
5	Verify correct cable layout as shown in the figure. **CAUTION** Route the signal cabling correctly to avoid cable damage.	 xx2100001293

Continues on next page

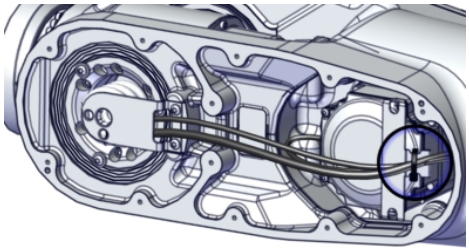
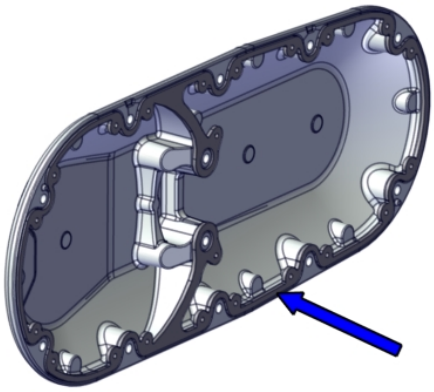
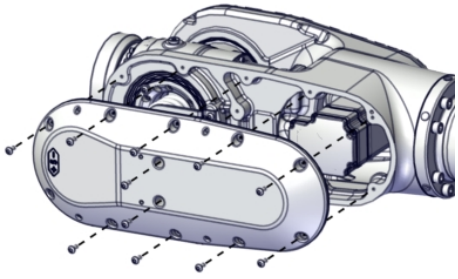
5.6.2 Refitting the cable harness

Continued

	Action	Note
6	Inspect the gasket. Replace if damaged.	Gasket, tilt housing cover: 3HAC074482-001  xx2100001287
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8	Refit the motor cover.	Hex socket head cap screw: M5x16 12.9 Lafre 2C2B/FC6.9 (6 pcs) Tightening torque: 4 Nm.  xx2000000376

Continues on next page

Refitting the wrist cover

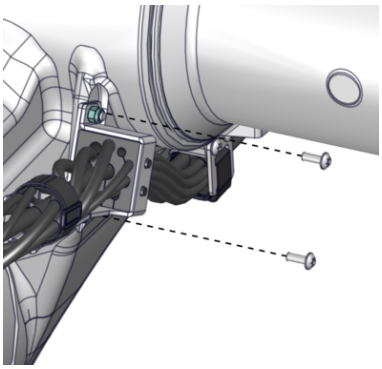
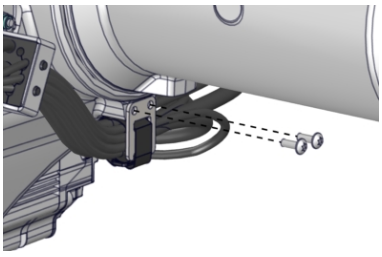
	Action	Note
1	Make sure that the cable harness is routed and secured as shown in the figure.	 xx2100002626 :
2	*Foundry Plus:* Inspect the gasket. Replace the complete cover if the gasket is damaged.	Wrist cover: 3HAC074181-002 (Graphite White) 3HAC074181-004 (ABB Orange)  xx2100001407
3	Refit the wrist cover and secure with screws. *Foundry Plus:* Fit all the screws first, then torque tighten.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2000000373

Continues on next page

5.6.2 Refitting the cable harness

Continued

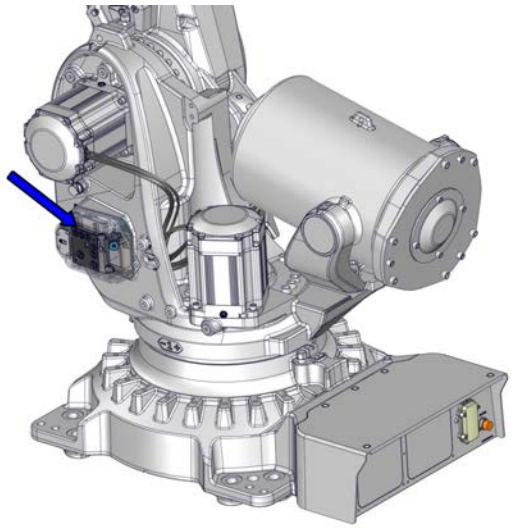
Concluding procedure

	Action	Note
1	If not already fitted, refit the metal clamp to the arm house.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2200001433
2	Refit the cable bracket underneath the tube shaft.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm  xx2200001432
3	If used, refit the DressPack cable package on the wrist.	See product manual for the DressPack.
4	Make an overall inspection of the installed cable harness.	See *Inspecting the cable harness on page 106*.
5	Update the revolution counters.	See *Updating revolution counters on page 592*.
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 94*.	

5.6.3 Replacing the brake release unit

Location of the brake release unit

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



xx2200001727

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 6710 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 628*.

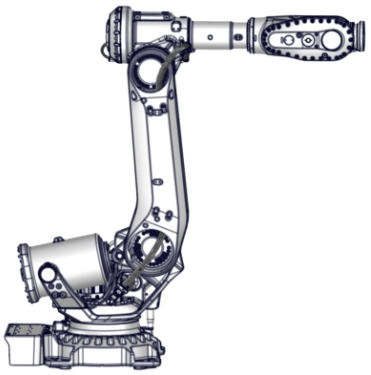
Continues on next page

5.6.3 Replacing the brake release unit
Continued

Removing the brake release unit

Use this procedure to remove the brake release unit.

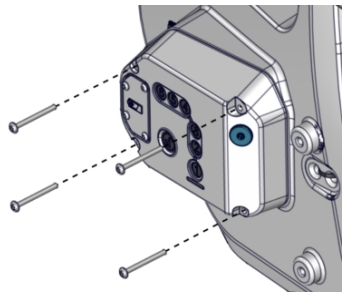
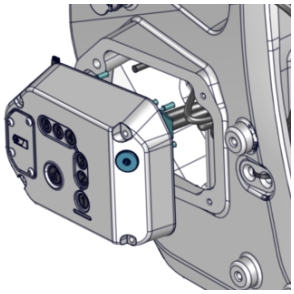
Preparations before removing the brake release unit

	Action	Note
1	Jog the robot to calibration position, if possible. This position facilitates updating of the revolution counters afterwards.	 xx2200001458
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

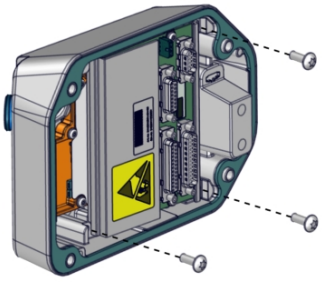
Removing the electronic box

	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 48*.	

Continues on next page

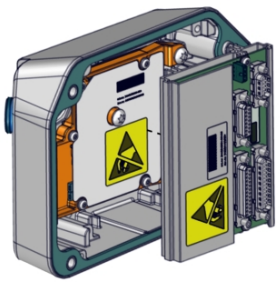
	Action	Note
3	Remove the electronic box screws.	 xx2200001721
4	Remove the electronic box, including all internal equipment. **CAUTION** Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.	 xx2200001720

Disconnecting and removing the SMB unit

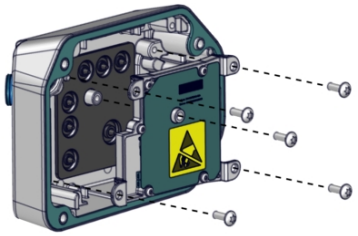
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 48*.	
3	Disconnect all connectors from the SMB board.	
4	Remove the screws that secure the SMB unit.	 xx2200001723

Continues on next page

5.6.3 Replacing the brake release unit
Continued

	Action	Note
5	Snap loose and remove the SMB unit. Put the unit in an ESD bag.	 xx2200001724

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 48*.	
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

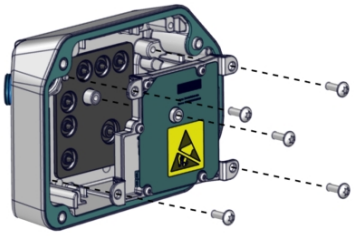
Refitting the brake release unit

Use this procedure to refit the brake release unit.

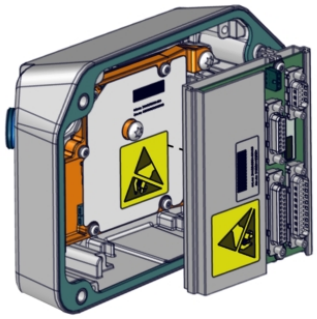
Refitting the brake release unit

	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 48*.	

Continues on next page

	Action	Note
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

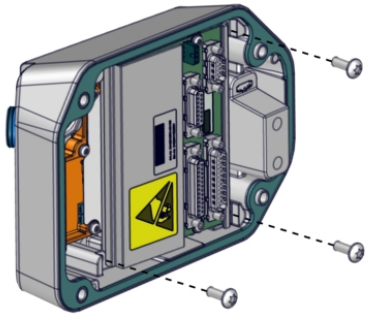
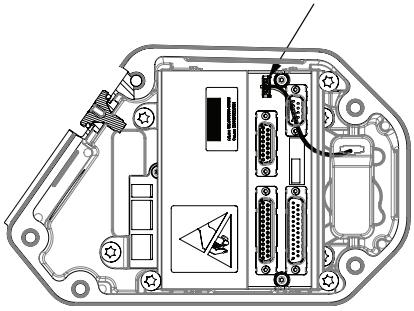
Refitting and connecting the SMB unit

	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 48*.	
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

Continues on next page

5.6.3 Replacing the brake release unit

Continued

	Action	Note
5	Secure the SMB unit with the attachment screws.	Torx pan head tapping screw: Steel-Fe/Zn 8c M6x16 Tightening torque: 10 Nm.  xx2200001723
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

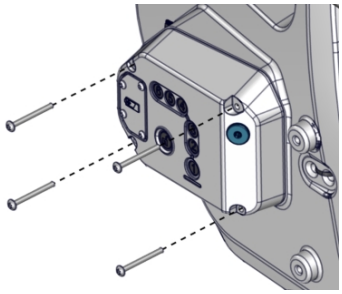
Reconnecting the brake release unit

	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 48*.	

Continues on next page

	Action	Note
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 48*.	
2	Refit the electronic box with the attachment screws.	Torx pan head screw: M6x60 (4 pcs) Tightening torque: 10 Nm.  xx2200001721

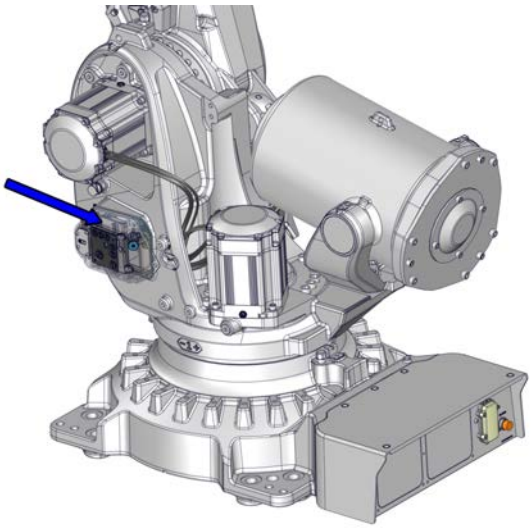
Concluding procedures

	Action	Note
1	Update the revolution counters if the battery has been disconnected.	See *Updating revolution counters on page 592*.
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 94*.	

5.6.4 Replacing the SMB unit

Location of the SMB unit

The SMB unit is located as shown in the figure.



xx2200001719

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 6710 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

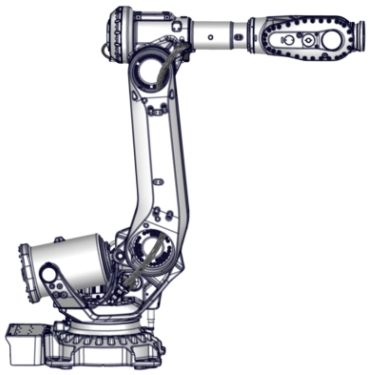
Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 628*.

Continues on next page

Removing the SMB unit

Use these procedures to disconnect and remove the SMB unit.

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.	 xx2200001458
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

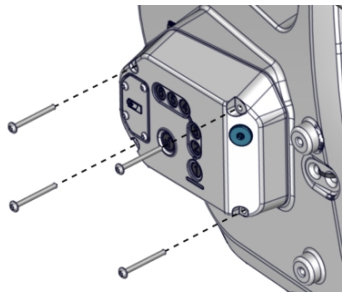
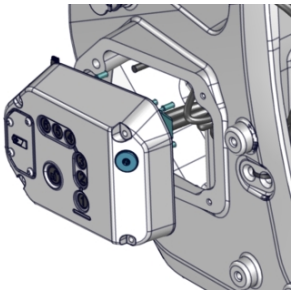
Removing the electronic box

	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 48*.	

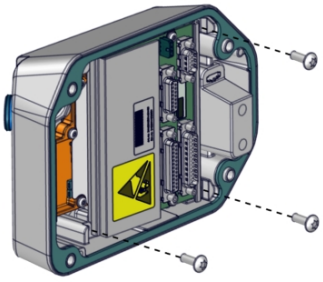
Continues on next page

5.6.4 Replacing the SMB unit

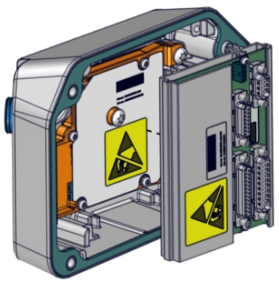
Continued

	Action	Note
3	Remove the electronic box screws.	 xx2200001721
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

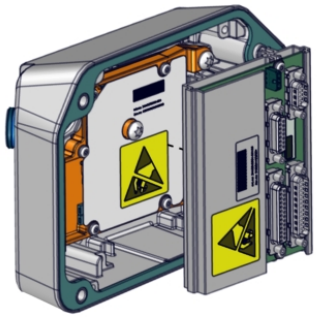
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 48*.	
3	Disconnect all connectors from the SMB board.	
4	Remove the screws that secure the SMB unit.	 xx2200001723

Continues on next page

	Action	Note
5	Snap loose and remove the SMB unit. Put the unit in an ESD bag.	 xx2200001724

Refitting the SMB unit

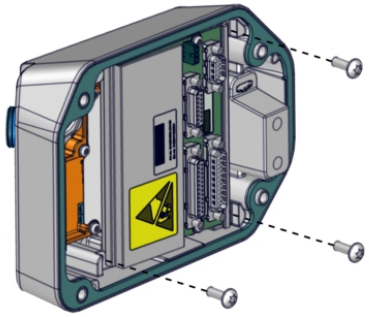
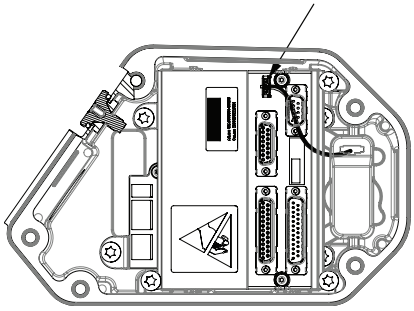
Refitting and connecting the SMB unit

	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 48*.	
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

Continues on next page

5.6.4 Replacing the SMB unit

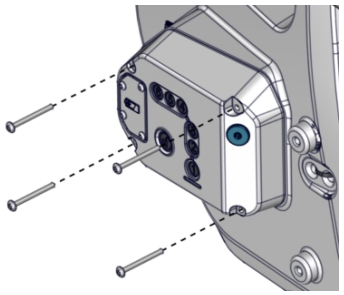
Continued

	Action	Note
5	Secure the SMB unit with the attachment screws.	Torx pan head tapping screw: Steel-Fe/Zn 8c M6x16 Tightening torque: 10 Nm.  xx2200001723
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 48*.	

Continues on next page

	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

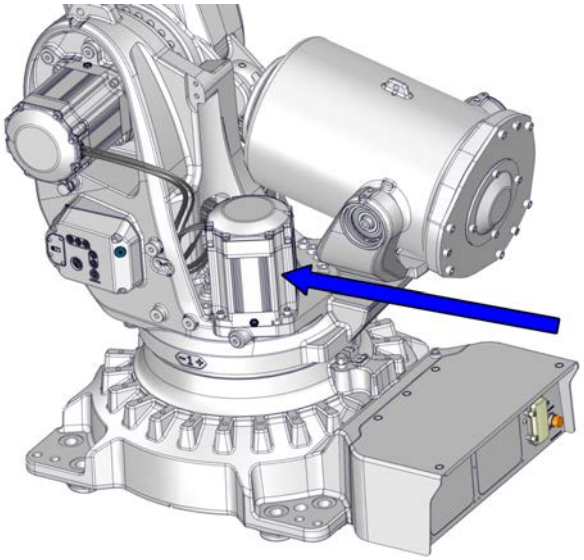
	Action	Note
1	Update the revolution counters.	See *Updating revolution counters on page 592*.
2	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 94*.	

5.7 Motors

5.7.1 Replacing the axis-1 motor

Location of the motor

The motor is located as shown in the figure.



xx2200001774

Summary of the replacement procedure

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

1 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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Motor unit (including connection box and pinion)	3HAC081261-003 (Graphite White) 3HAC081261-004 (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
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.
Rotation tool M4	3HAB7887-1	Used to rotate the motor pinion. Add screw M4.
Calibration toolbox, Axis Calibration	3HAC074564-001 (axes 1, 2, 3 and 4) 3HAC074119-001 (axes 5 and 6)	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 628*.

Continues on next page

5.7.1 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 595*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

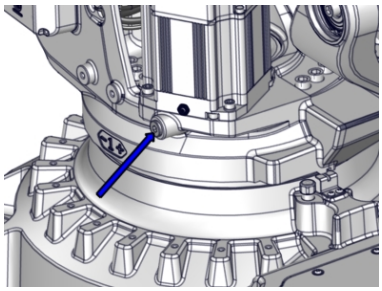
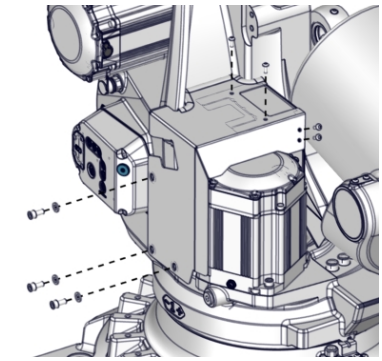
Removing the motor

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

	Action	Note
4	Remove the plug from the venting hole. This is done to evacuate air during refitting of the motor.	 xx2200002147
5	*Protection type Foundry Plus* Remove the axis-1 cable protection plates by removing the attachment screws.	 xx2200001430

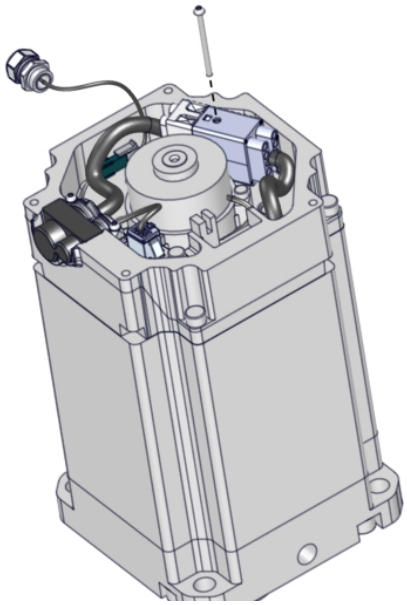
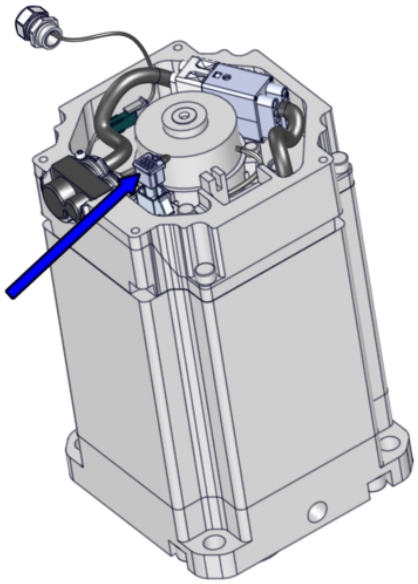
Floor-mounted robot: Disconnecting the axis-1 motor cables

	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.	

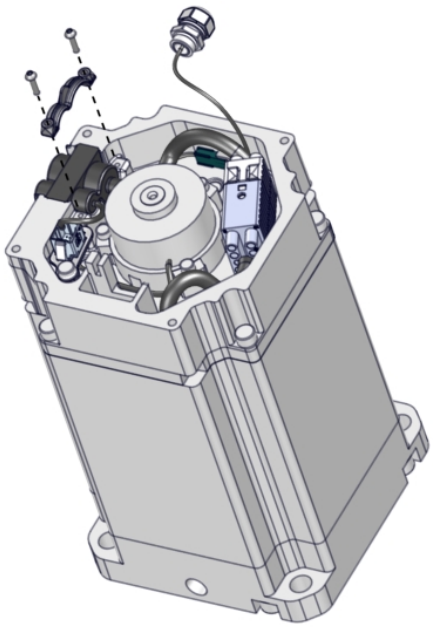
Continues on next page

5.7.1 Replacing the axis-1 motor

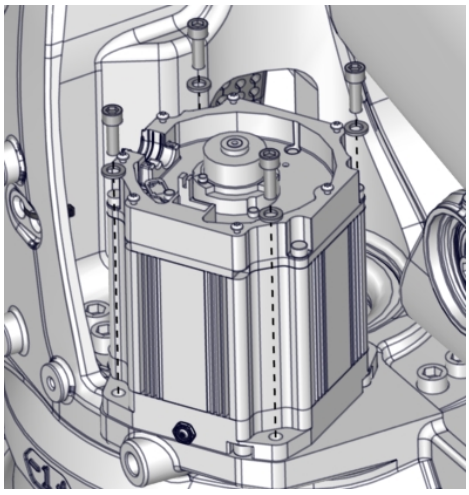
Continued

	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

Continues on next page

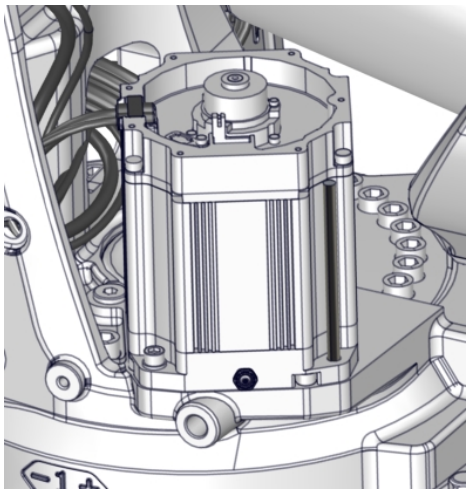
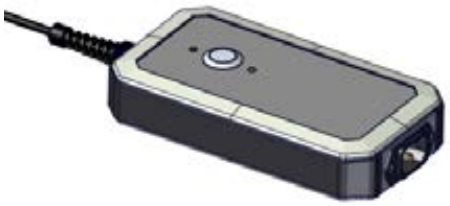
	Action	Note
5	Remove the cable bracket by removing the screws.	 xx2200001738
6	Remove the motor cables from the motor.	

Floor-mounted robot: Removing the axis-1 motor

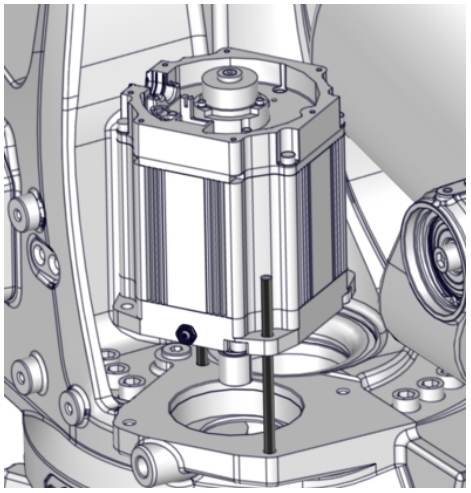
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws and washers. Use a bits extender to reach the screws.	Bits extender: 3HAC12342-1  xx2200001794

Continues on next page

5.7.1 Replacing the axis-1 motor
Continued

	Action	Note
3	Fit guide pins in the non-threaded holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs. Removal tool motor M12: 3HAC14631-1 Always use removal tools in pairs.  xx2200001820
4	Fit removal tools in the threaded holes.	
5	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
6	**CAUTION** The weight of the motor is 19 kg	

Continues on next page

	Action	Note
7	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
8	Press the motor out of its position by using the removal tools.	 xx2200001793
9	Use caution and lift the motor straight up to get the pinion parted from the gear.	
10	Disconnect the brake release tool.	

Refitting the motor

Use these procedures to refit the motor.

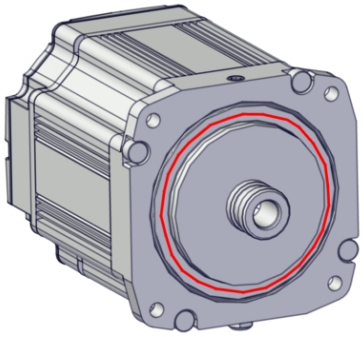
Preparations prior to refitting motor

	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

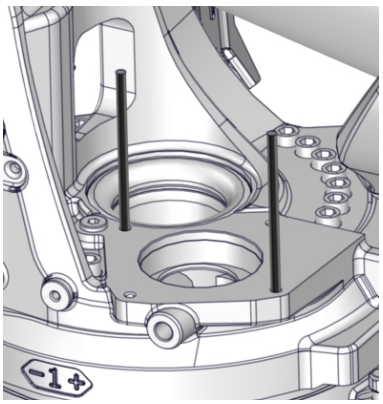
Continues on next page

5.7.1 Replacing the axis-1 motor

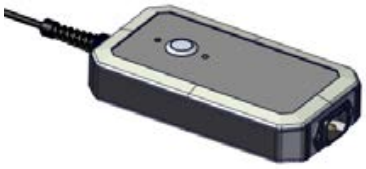
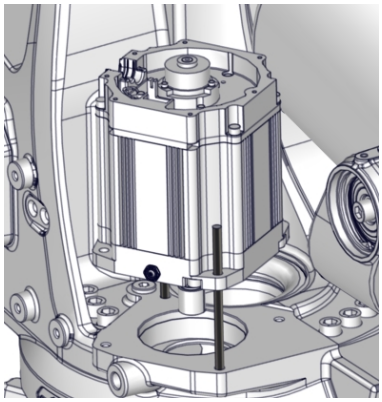
Continued

	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.	

Floor-mounted robot: Refitting the axis-1 motor

	Action	Note
1	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.  xx2200001819
2	**CAUTION** The weight of the motor is 19 kg	
3	Fit the rotation tool.	Rotation tool M4: 3HAB7887-1

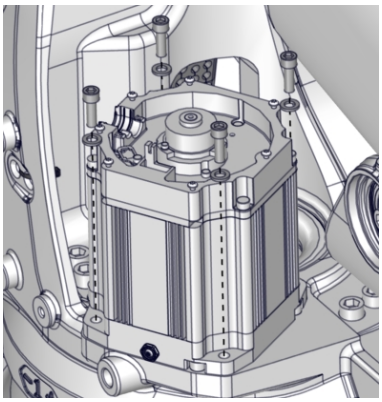
Continues on next page

	Action	Note
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
5	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
6	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.	 xx2200001793

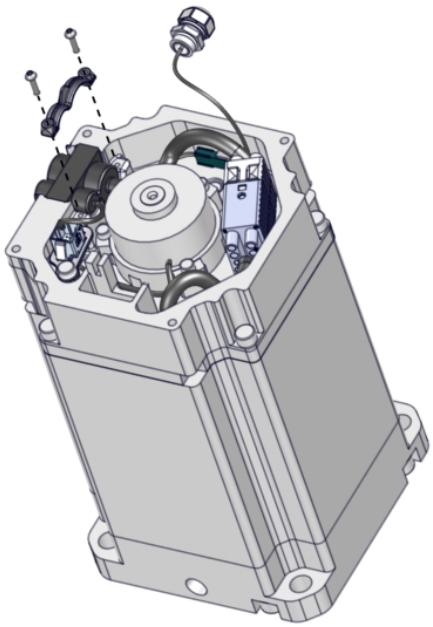
Continues on next page

5.7.1 Replacing the axis-1 motor

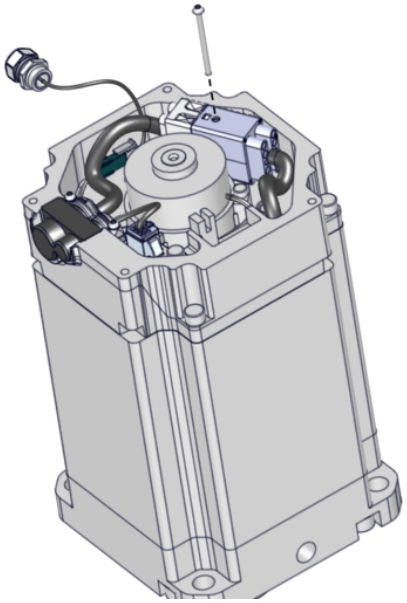
Continued

	Action	Note
7	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.  xx2200001794
8	Disconnect the brake release tool.	
9	Perform a leak-down test.	See *Performing a leak-down test on page 178*.

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

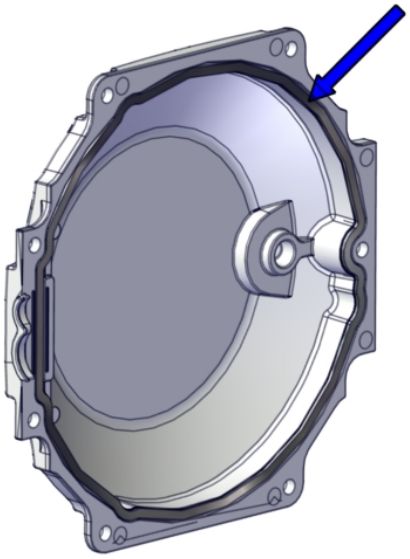
Continues on next page

	Action	Note
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

Continues on next page

5.7.1 Replacing the axis-1 motor

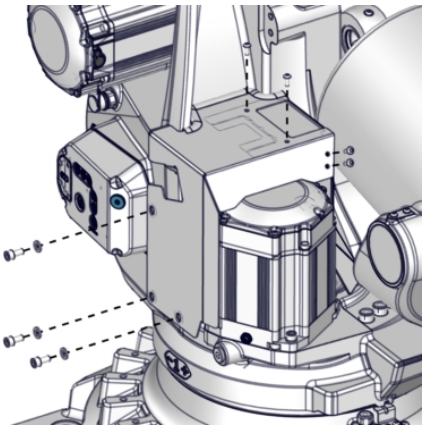
Continued

	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1 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-2 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-3 Connection box cover FS180 with gasket: 3HAC074336-004 (Graphite White) 3HAC074336-005 (ABB Orange) 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

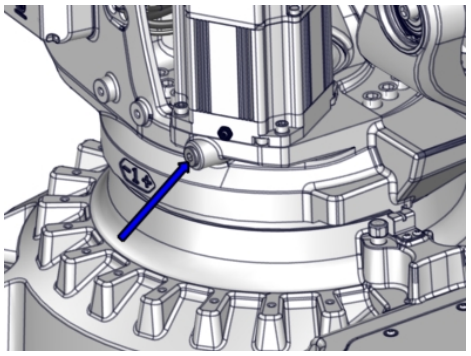
	Action	Note
7	Refit the motor cover with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.

Refitting the covers for Foundry Plus and floor mounted robots

	Action	Note
1	*Protection type Foundry Plus* Refit the axis-1 cable protection plates with the attachment screws.	Torx pan head screw: M6x16 A4-80 (4 pcs) Hex socket head cap screw: M10x16 stainless steel A2-70 (3 pcs)  xx2200001430

Concluding procedure

Use this procedure for the concluding refitting.

	Action	Note
1	Refit the oil plug with a new o-ring.	O-ring, G 1/2": 3HAC061327-059 Tightening torque: 24 Nm.  xx2200002147
2	Re-calibrate the robot.	See *Calibration on page 585*.

Continues on next page

5.7.1 Replacing the axis-1 motor

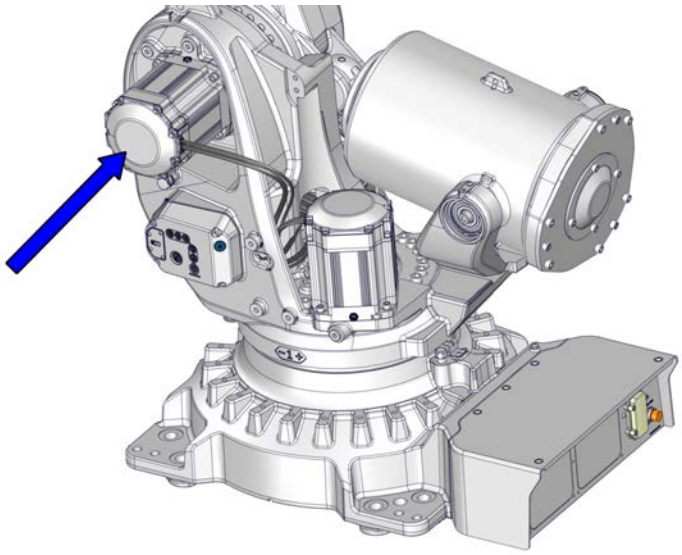
Continued

	Action	Note
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 94*.	

5.7.2 Replacing the axis-2 motor

Location of the motor

The motor is located as shown in the figure.



xx2200001775

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 axis-2 gearbox.
2. Secure the lower arm.
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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Motor unit (including connection box and pinion)	3HAC081262-003 (Graphite White) 3HAC081262-004 (ABB Orange)		L2

Continues on next page

5.7.2 Replacing the axis-2 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 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 136*.
Flange sealant	-	Loctite 5800

Required tools and equipment

Equipment	Article number	Note
Lock screw, M16x120	-	Used to secure lower arm.
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.
Rotation tool M4	3HAB7887-1	Used to rotate the motor pinion. Add screw M4.
Calibration toolbox, Axis Calibration	3HAC074564-001 (axes 1, 2, 3 and 4) 3HAC074119-001 (axes 5 and 6)	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 628*.

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 595*.
	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.

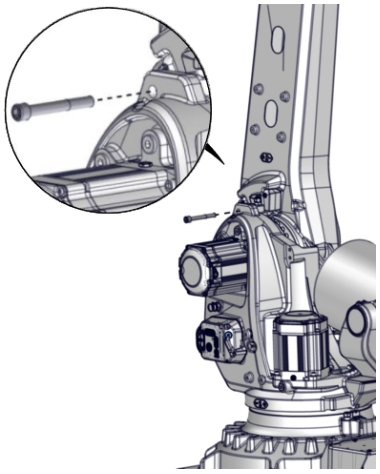
Preparations before removing the motor

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Jog the robot to the synchronization position.	

Continues on next page

5.7.2 Replacing the axis-2 motor

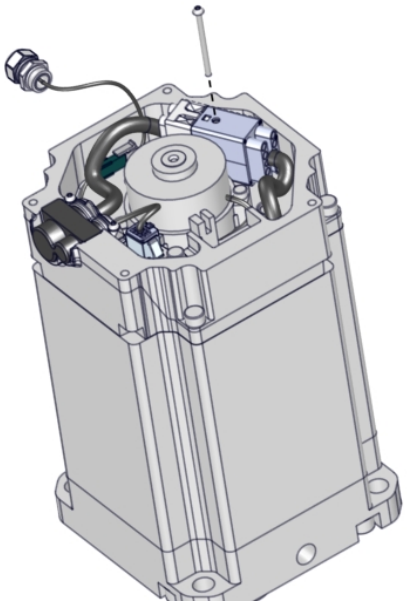
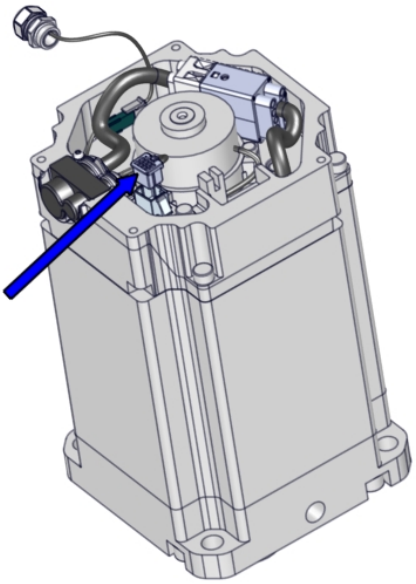
Continued

	Action	Note
3	Insert the lock screw into the frame. If needed, adjust the position of axis-2 to make it possible to insert the lock screw. The lock screw is used to secure the weight of the lower arm, in order to avoid accidents or damage. **Note** Tighten the lock screw manually, no tools needed.	Lock screw, M16x120  xx2200001332
4	Drain the oil from the gearbox.	See *Changing the oil in axis-2 gearbox on page 144*.
5	**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

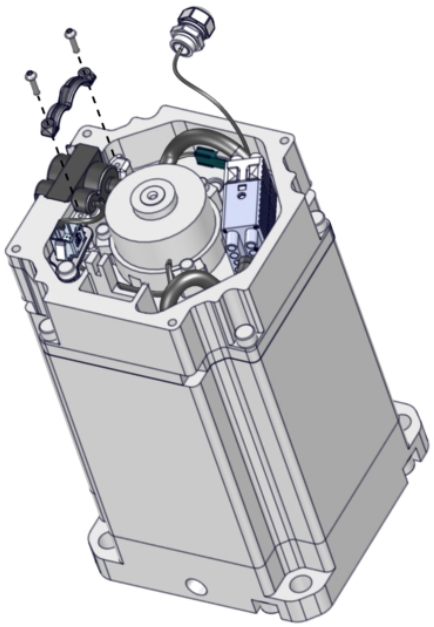
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the motor cover by removing the screws.	

Continues on next page

	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

Continues on next page

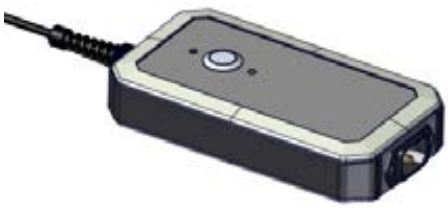
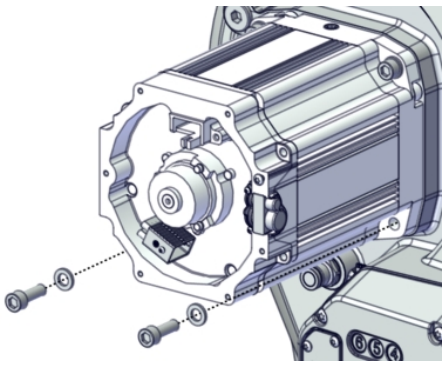
5.7.2 Replacing the axis-2 motor
Continued

	Action	Note
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.	
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.	

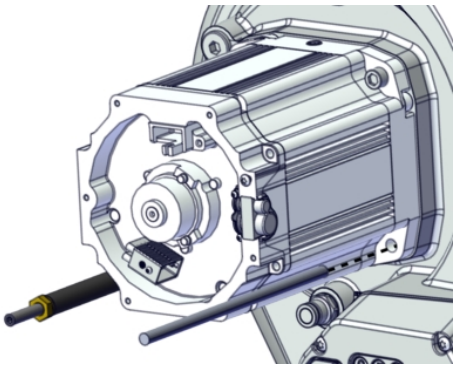
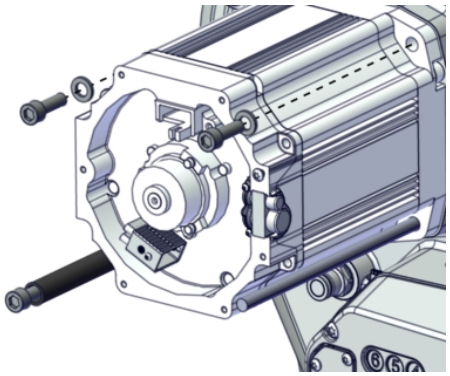
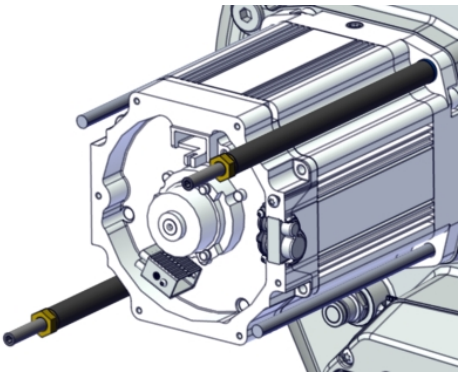
Continues on next page

	Action	Note
3	**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 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
4	Remove the two lower screws. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx2000000468

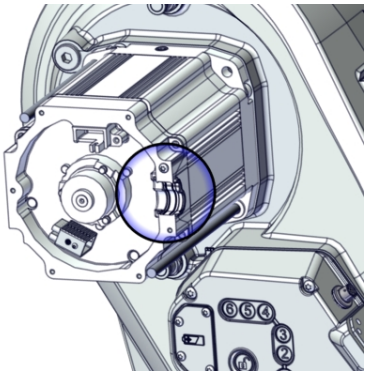
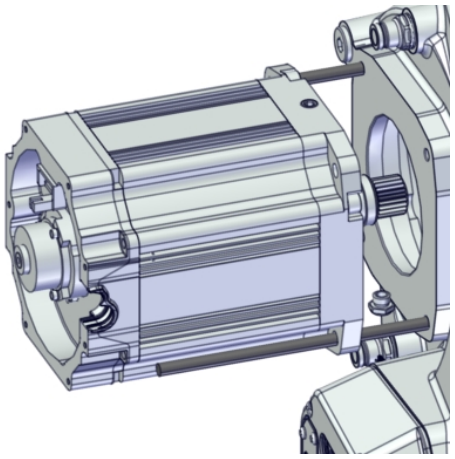
Continues on next page

5.7.2 Replacing the axis-2 motor

Continued

	Action	Note
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
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.

Continues on next page

	Action	Note
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 21 kg	
12	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	 xx2000000457 Make sure the pinion is not damaged.

Refitting the motor

Use these procedures to refit the axis-2 motor.

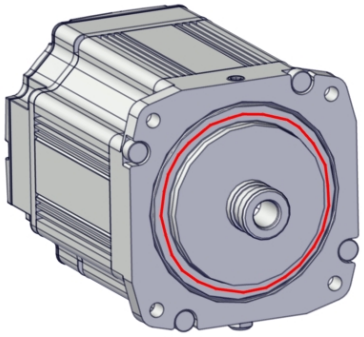
Preparations prior to refitting motor

	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

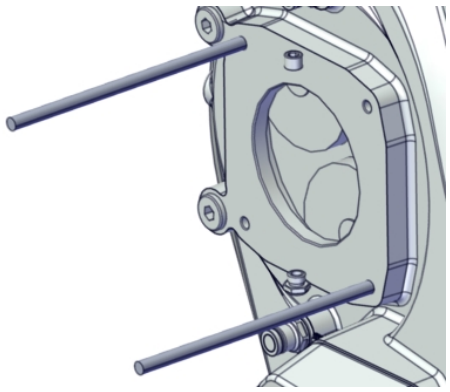
Continues on next page

5.7.2 Replacing the axis-2 motor

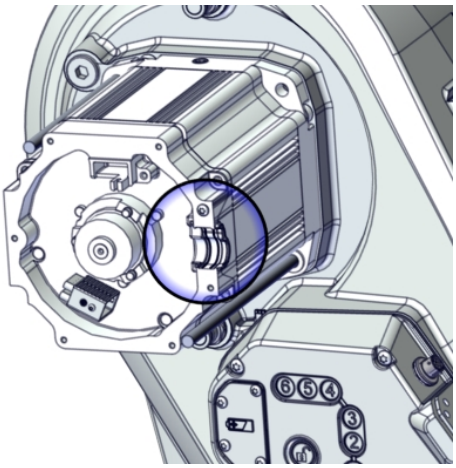
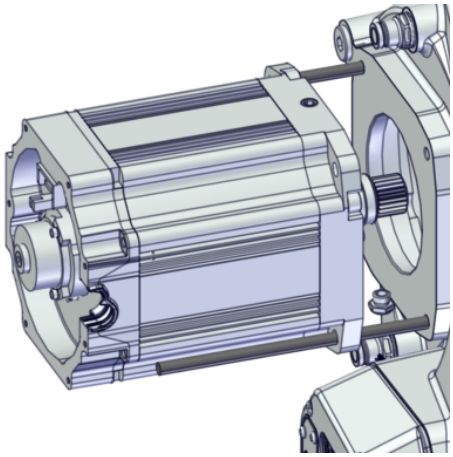
Continued

	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.	

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 21 kg	

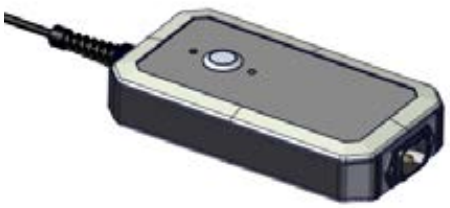
Continues on next page

	Action	Note
3	**Note** Make sure the cable gland opening is turned the correct way.	 xx2100000595
4	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.	 xx2000000457

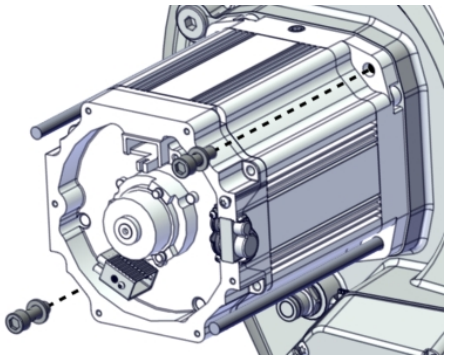
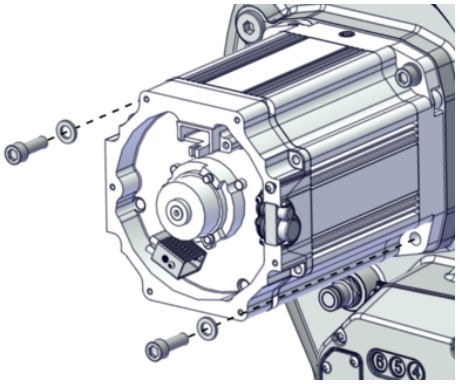
Continues on next page

5.7.2 Replacing the axis-2 motor

Continued

	Action	Note
5	Release the brakes of the axis-2 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** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
7	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

Continues on next page

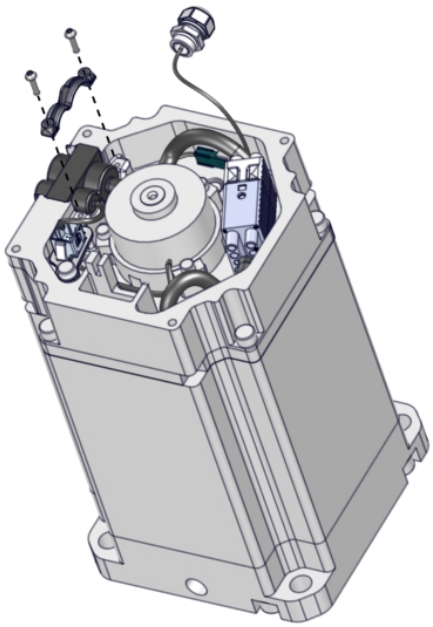
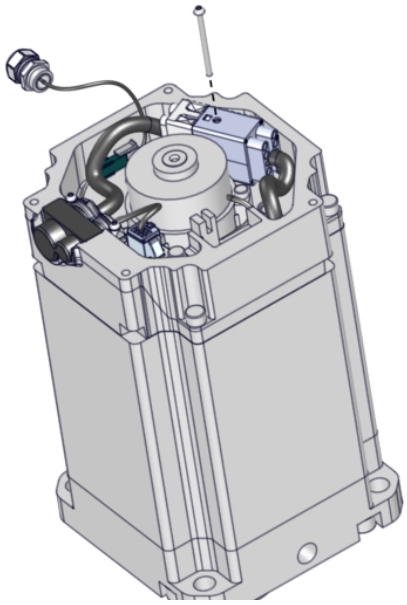
	Action	Note
8	Fit two of the attachment screws and washers. Use a bits extender in order to reach the screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (2 pcs) Bits extender: 3HAC12342-1  xx2000000467
9	Remove the guide pins and refit the remaining attachment screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (2 pcs)  xx2300000044
10	Tighten the screws.	Tightening torque: 50 Nm.
11	Disconnect the brake release tool.	
12	Perform a leak-down test.	See *Performing a leak-down test on page 178*.

Connecting the motor cables

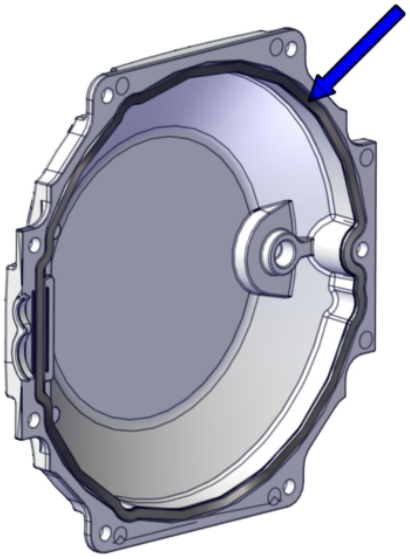
	Action	Note
1	Put the motor cables in place in the opening.	

Continues on next page

5.7.2 Replacing the axis-2 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

Continues on next page

	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1 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-2 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-3 Connection box cover FS180 with gasket: 3HAC074336-004 (Graphite White) 3HAC074336-005 (ABB Orange) 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.	

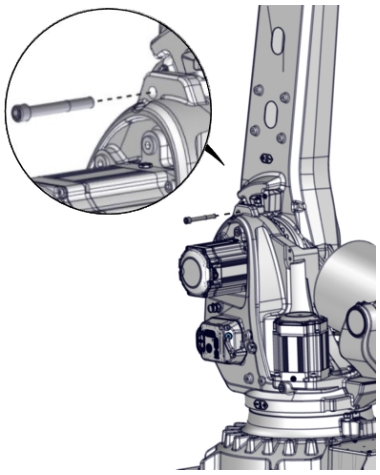
Continues on next page

5.7.2 Replacing the axis-2 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.

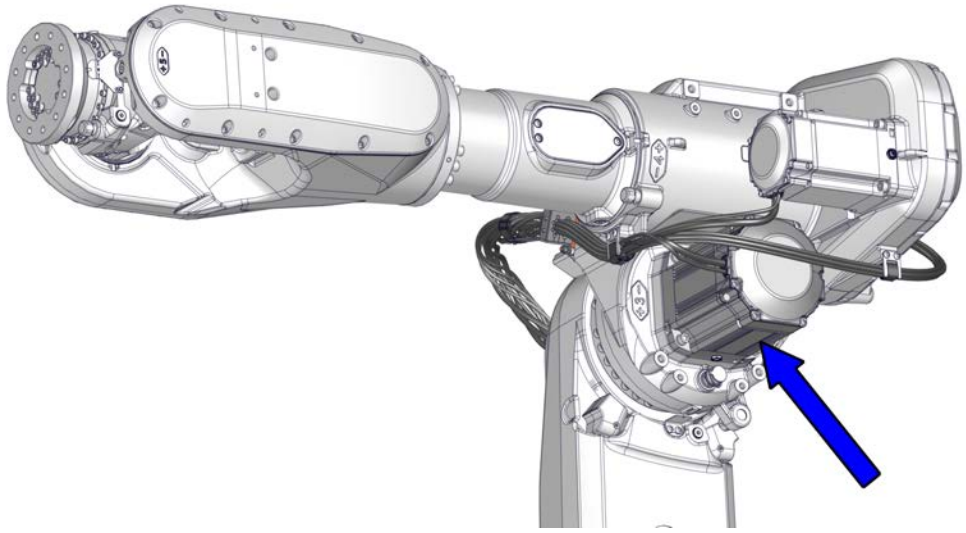
Concluding procedure

	Action	Note
1	Use caution and jog axis-2 a little to facilitate the removal of the lock screw that secures the lower arm.	
2	Remove the lock screw.	 xx2200001332
3	Refill the gearbox with oil.	See *Filling oil into the axis-2 gearbox on page 146*.
4	Re-calibrate the robot.	See *Calibration on page 585*.
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 94*.	

5.7.3 Replacing the axis-3 motor

Location of the motor

The motor is located as shown in the figure.



xx2300000055

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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Motor unit (including connection box and pinion)	3HAC081262-005 (Graphite White) 3HAC081262-006 (ABB Orange)		L2

Required service parts

Consumable	Article number	Note
Connection box cover FS180 with gasket	3HAC074336-004 (Graphite White) 3HAC074336-005 (ABB Orange)	Replace if damaged. On 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 gear-boxes on page 136*.

Continues on next page

5.7.3 Replacing the axis-3 motor
Continued

Consumable	Article number	Note
Flange sealant	-	Loctite 5800

Required tools and equipment

Equipment	Article number	Note
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
Rotation tool M4	3HAB7887-1	Used to rotate the motor pinion. Add screw M4.
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.
Calibration toolbox, Axis Calibration	3HAC074564-001 (axes 1, 2, 3 and 4) 3HAC074119-001 (axes 5 and 6)	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 628*.

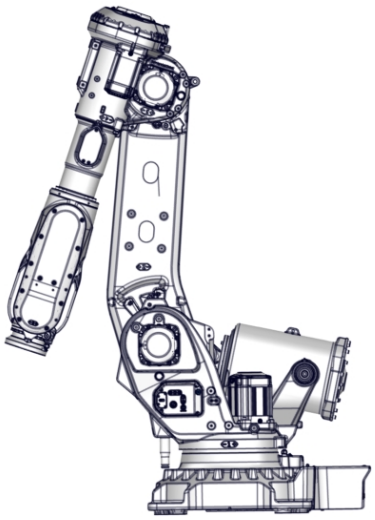
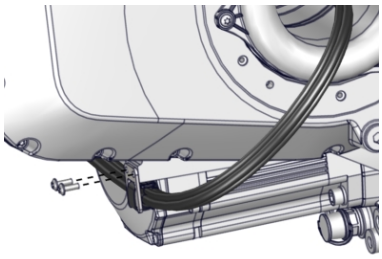
Removing the motor

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	Drain the axis-3 gearbox.	See *Draining the axis-3 gearbox on page 150*.

Continues on next page

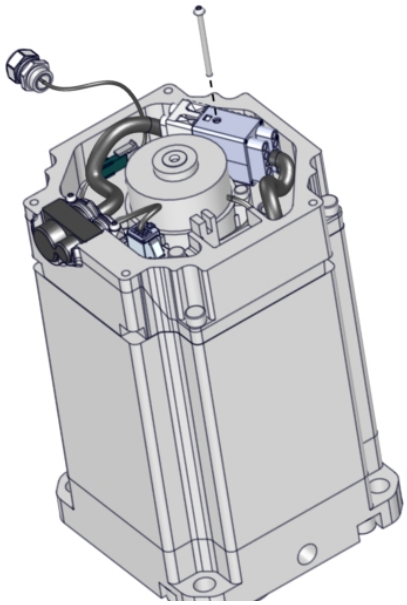
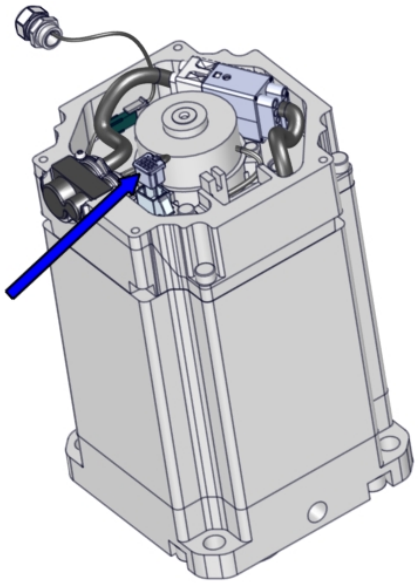
	Action	Note
3	Unload the upper arm using one of these methods: • Use caution and jog axis-3 to maximum + position. Release the brakes and let the upper arm rest against the axis-3 damper. Position shown in figure. • Robot in synchronization position: use a fork lift to rest the upper arm onto. • Robot in synchronization position: use lifting slings and an overhead crane to rest the upper arm onto.	 xx2200001810
4	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
5	Remove the cable bracket underneath the arm house.	 xx2200002142

Disconnecting the motor cables

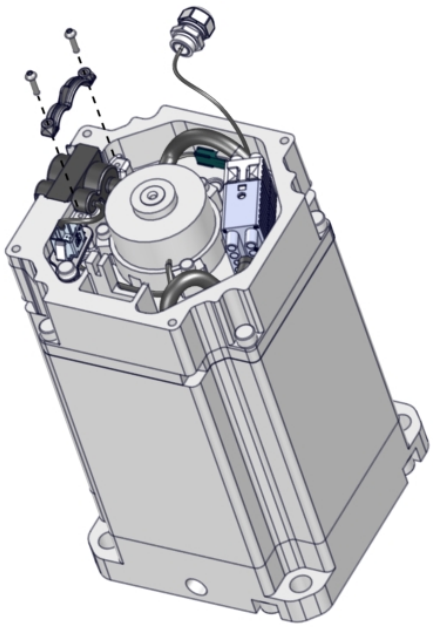
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the motor cover by removing the screws.	

Continues on next page

5.7.3 Replacing the axis-3 motor
Continued

	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

Continues on next page

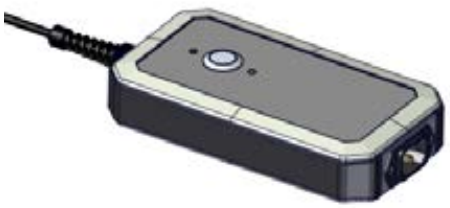
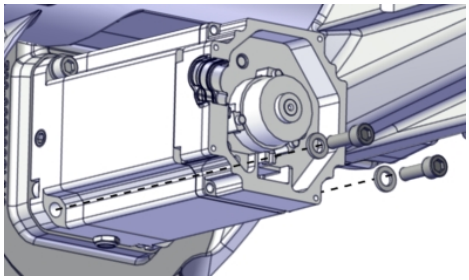
	Action	Note
5	Remove the cable bracket by removing the screws.	 xx2200001738
6	Remove the motor cables from the motor.	

Removing the axis-3 motor

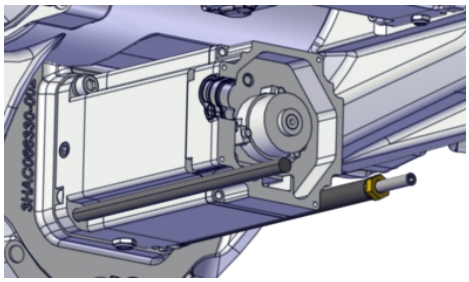
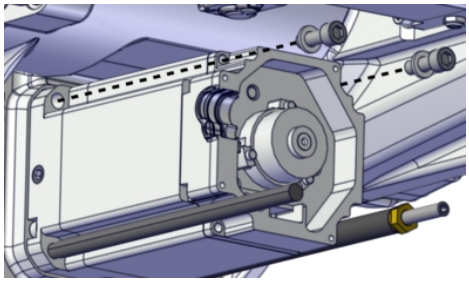
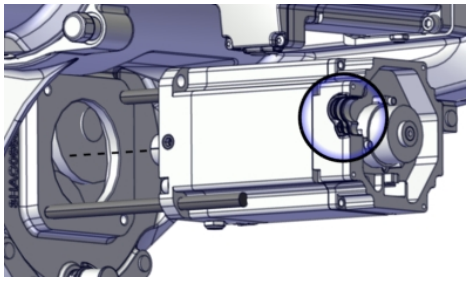
	Action	Note
1	Before removing the motor, make sure that the gearbox is completely drained.	
2	**DANGER** When releasing the holding brakes of the motor, the upper arm will be movable and falls down if not secured. Verify that the upper arm is secured as previously described, before continuing.	

Continues on next page

5.7.3 Replacing the axis-3 motor
Continued

	Action	Note
3	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-3 motor results in weight transfer of upper arm weight. Verify that the upper arm rests against the mechanical stop or installed lifting accessories, before releasing the brakes. **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	Remove the two lower screws. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx2300000045

Continues on next page

	Action	Note
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  xx2100002148
6	Remove the remaining two screws.	 xx2300000046
7	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
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 21 kg	
12	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.	 xx2100002149 Make sure the pinion is not damaged.

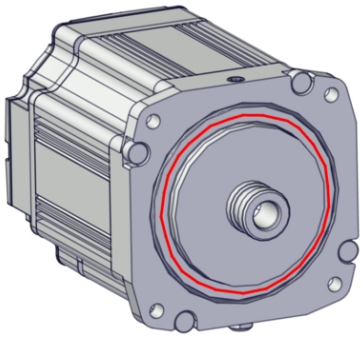
Continues on next page

5.7.3 Replacing the axis-3 motor
Continued

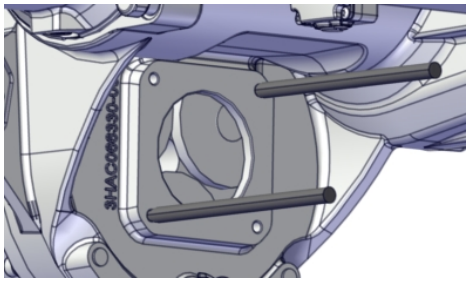
Refitting the motor

Use these procedures to refit the motor.

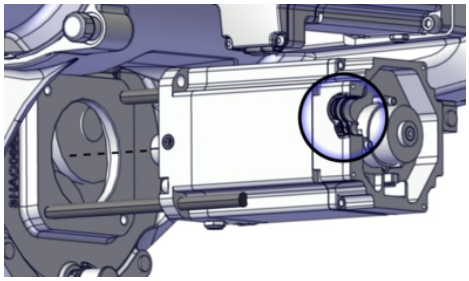
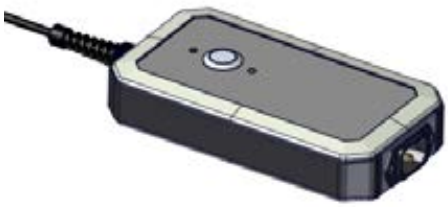
Preparations prior to refitting motor

	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.	

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.  xx2100002151

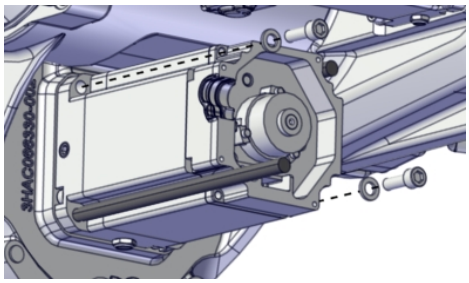
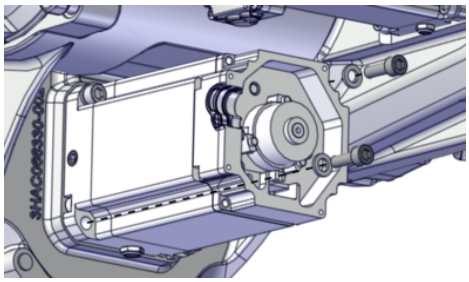
Continues on next page

	Action	Note
2	**CAUTION** The weight of the motor is 21 kg	
3	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. **Note** Make sure the cable gland opening is turned the correct way.	 xx2100002149
4	Release the brakes of the axis-3 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

5.7.3 Replacing the axis-3 motor

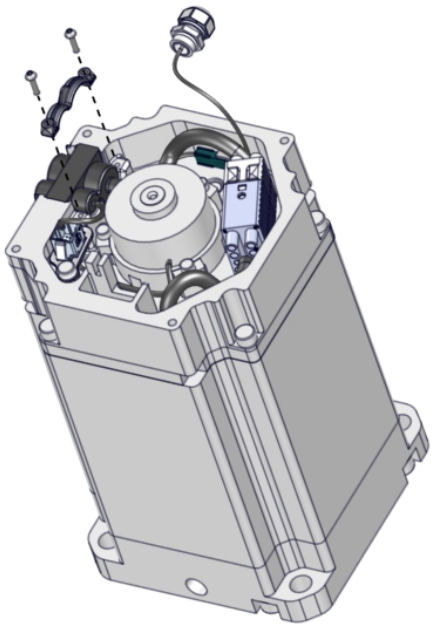
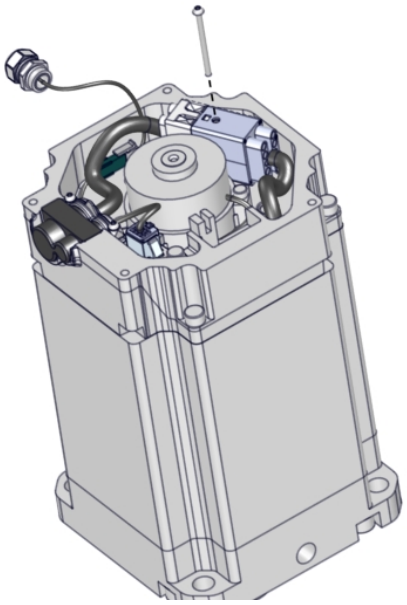
Continued

	Action	Note
6	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
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  xx2100002152
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)  xx2100002153
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 178*.

Connecting the motor cables

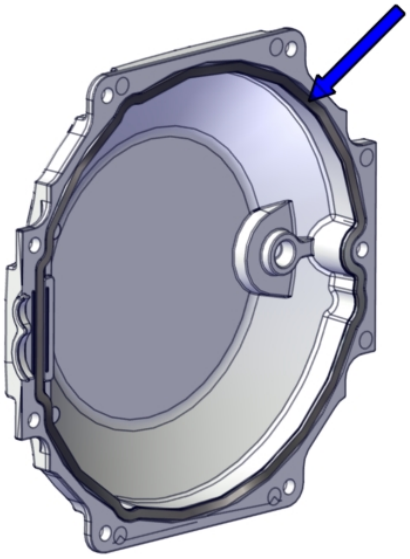
	Action	Note
1	Put the motor cables in place in the opening.	

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

Continues on next page

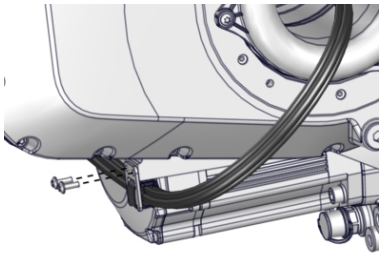
5.7.3 Replacing the axis-3 motor
Continued

	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1 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-2 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-3 Connection box cover FS180 with gasket: 3HAC074336-004 (Graphite White) 3HAC074336-005 (ABB Orange) 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.

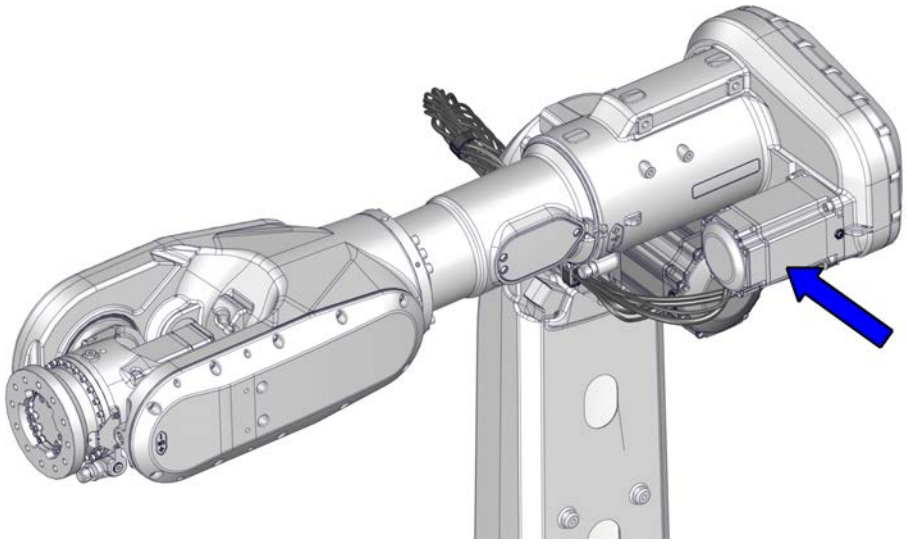
Concluding procedure

	Action	Note
1	Remove the equipment used to unload the upper arm.	
2	Refit the metal clamp beneath the arm house.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2200002142
3	Refill the gearbox with oil.	See *Filling oil into the axis-3 gearbox on page 151*.
4	Re-calibrate the robot.	See *Calibration on page 585*.
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 94*.	

5.7.4 Replacing the axis-4 motor

Location of the motor

The motor is located as shown in the figure.



xx2300000056

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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Motor unit (including connection box and pinion)	3HAC082787-003 (Graphite White) 3HAC082787-004 (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

Continues on next page

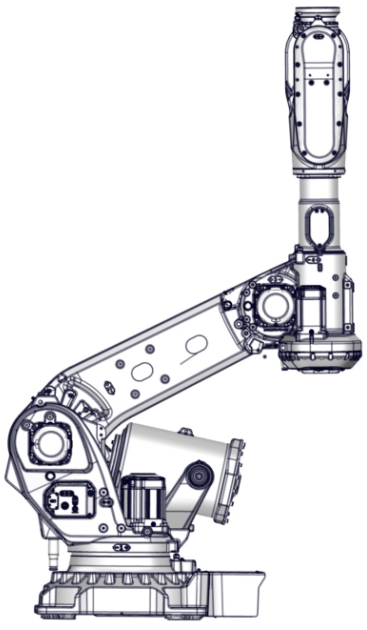
Required tools and equipment

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 (axes 1, 2, 3 and 4) 3HAC074119-001 (axes 5 and 6)	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 628*.

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: -65° • Axis 3: upper arm pointing straight up (if possible). • Axis 4: no significance • Axis 5: no significance • Axis 6: no significance With the robot in this position, there is no need to drain oil from the axis-4 gearbox when the motor is replaced.	 xx2200001812

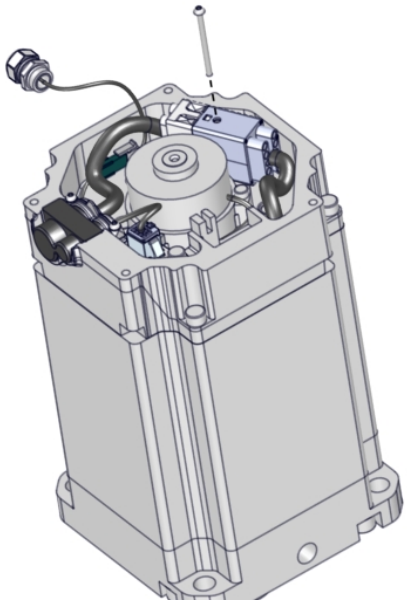
Continues on next page

5.7.4 Replacing the axis-4 motor

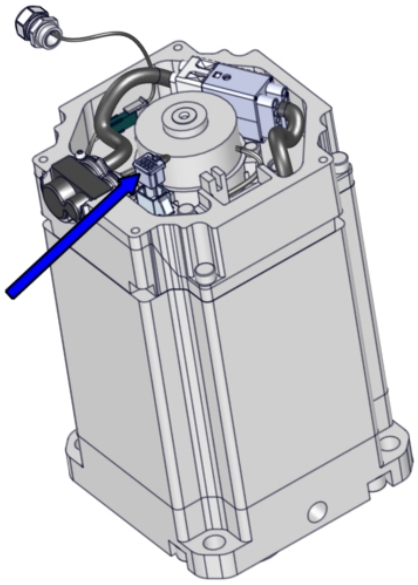
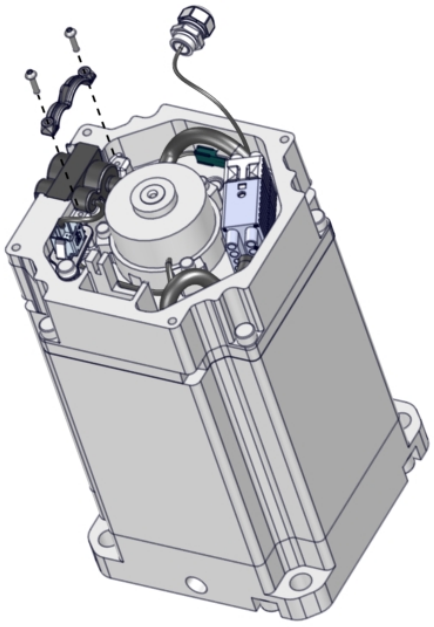
Continued

	Action	Note
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
4	If there is no space to position the upper arm pointed straight up, drain the axis-4 gearbox.	See *Draining the axis-4 gearbox on page 155*.

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.	
3	Disconnect the power cable connector by first removing the attachment screw and then parting the connector.	 xx2200001736

Continues on next page

	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.	

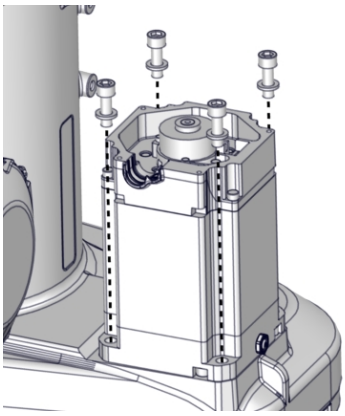
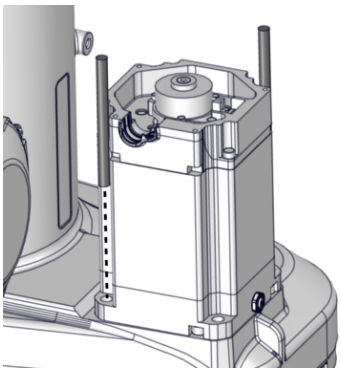
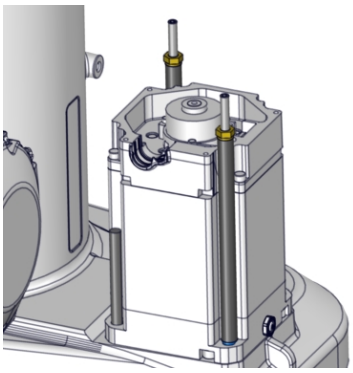
Removing the axis-4 motor

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

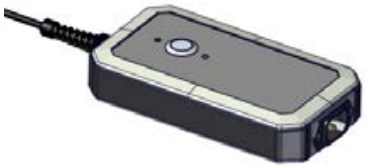
Continues on next page

5.7.4 Replacing the axis-4 motor

Continued

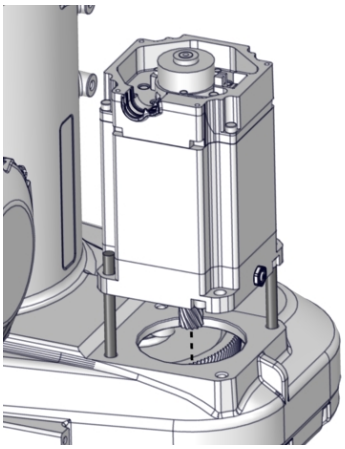
	Action	Note
2	Unscrew the attachment screws that secure the motor.	 xx2300000008
3	Fit guide pins in the non-threaded holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.  xx2300000009
4	Fit removal tools in the threaded holes.	Removal tool motor M12: 3HAC14631-1 Used to push out the motor, if necessary. Always use removal tools in pairs.  xx2300000047

Continues on next page

	Action	Note
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. **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
6	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
7	Press the motor out of its position by using the removal tools.	
8	**CAUTION** The weight of the motor is 12 kg	

Continues on next page

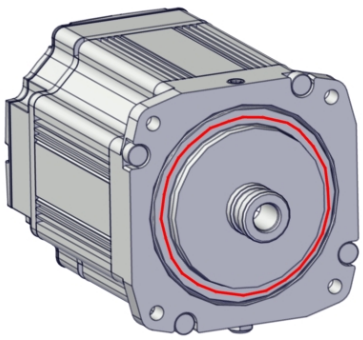
5.7.4 Replacing the axis-4 motor
Continued

	Action	Note
9	Remove the motor by carefully lifting it straight out/straight up (if the upper arm points upwards). Make sure the pinion is not damaged.	 xx2300000007

Refitting the motor

Use these procedures to refit the motor.

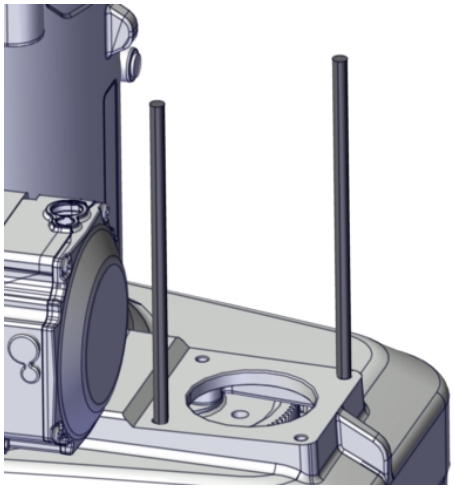
Preparations prior to refitting motor

	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

Continues on next page

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

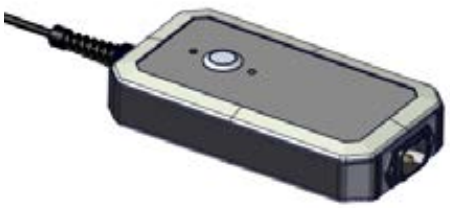
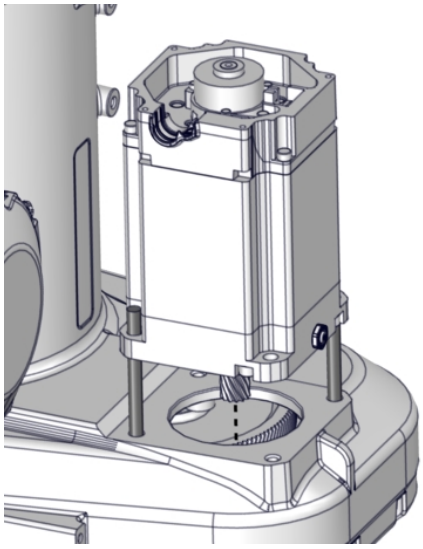
Refitting the axis-4 motor

	Action	Note
1	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.  xx2100002201
2	**CAUTION** The weight of the motor is 12 kg	
3	Apply the rotation tool.	Rotation tool M4: 3HAB7887-1

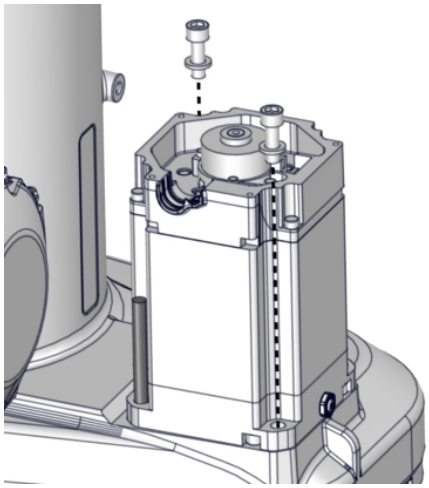
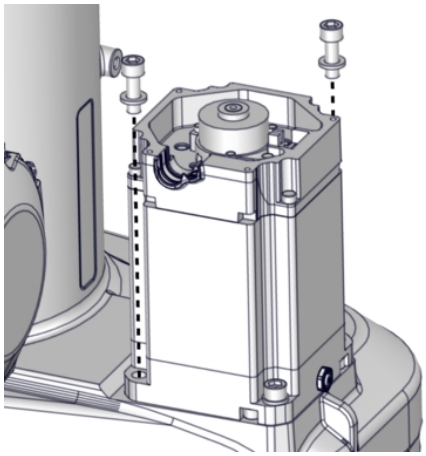
Continues on next page

5.7.4 Replacing the axis-4 motor

Continued

	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.	 xx2300000007
6	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

Continues on next page

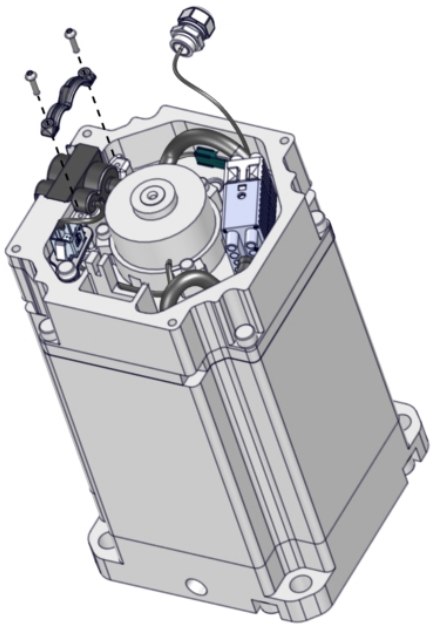
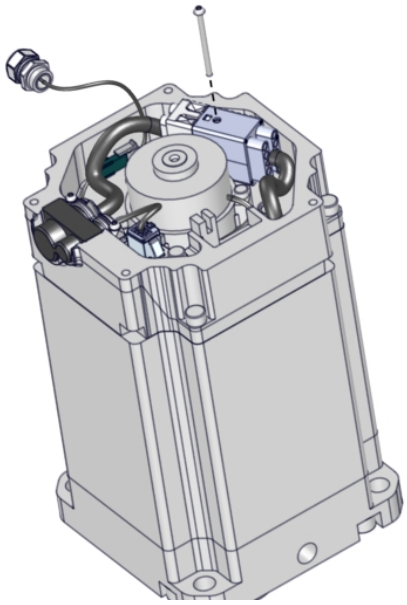
	Action	Note
7	Fit two of the attachment screws and washers. Use a bits extender in order to reach the screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (2 pcs) Bits extender: 3HAC12342-1  xx2300000010
8	Remove the guide pins and replace with the remaining attachment screws.	Hex socket head cap screw: M10x30 12.9 Gleitmo 603+Geomet 500 (2 pcs)  xx2300000011
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 178*.

Connecting the motor cables

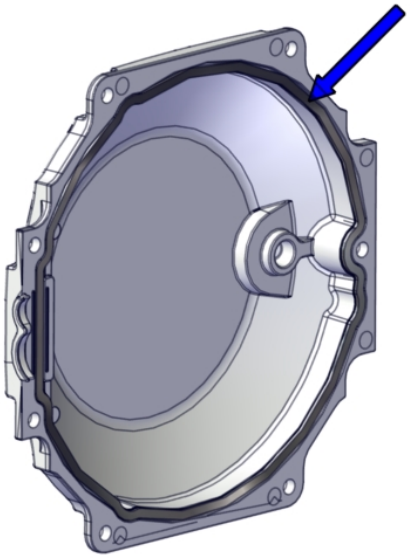
	Action	Note
1	Put the motor cables in place in the opening.	

Continues on next page

5.7.4 Replacing the axis-4 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

Continues on next page

	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1 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-2 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-3 Connection box cover FS180 with gasket: 3HAC074336-004 (Graphite White) 3HAC074336-005 (ABB Orange) 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

5.7.4 Replacing the axis-4 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.

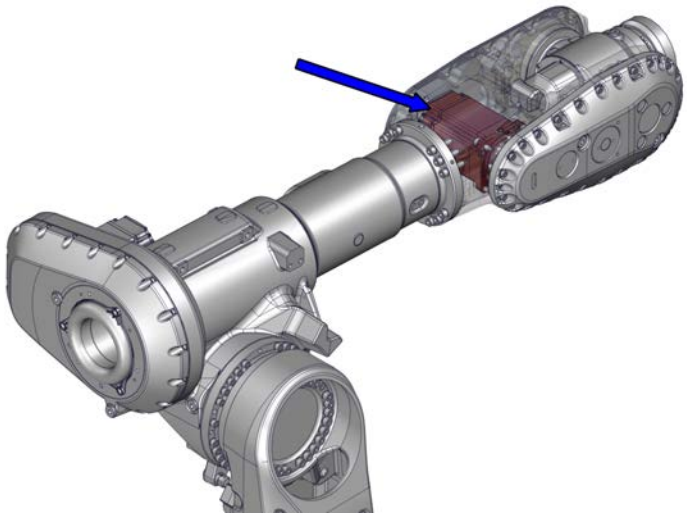
Concluding procedure

	Action	Note
1	Refill the gearbox with oil, if drained.	See *Filling oil into the axis-4 gearbox on page 156*.
2	Re-calibrate the robot.	See *Calibration on page 585*.
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 94*.	

5.7.5 Replacing the axis-5 motor

Location of the motor

The motor is located as shown in the figure.



xx2200002143

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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Motor unit (including connection box and pinion)	3HAC071373-003		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	Replace if damaged. On axis-5 motor
Cable strap, outdoor	3HAC057966-003	

Required tools and equipment

Equipment	Article number	Note
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.

Continues on next page

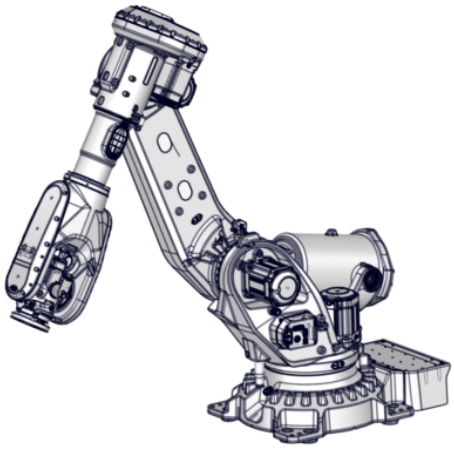
5.7.5 Replacing the axis-5 motor
Continued

Equipment	Article number	Note
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 (axes 1, 2, 3 and 4) 3HAC074119-001 (axes 5 and 6)	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 628*.

Removing the motor

Use these procedures to remove the motor.

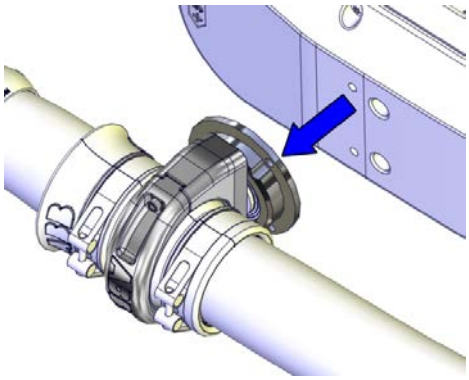
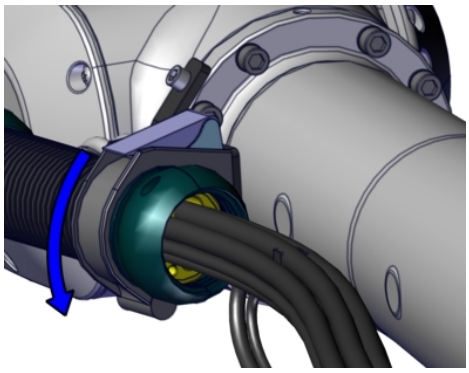
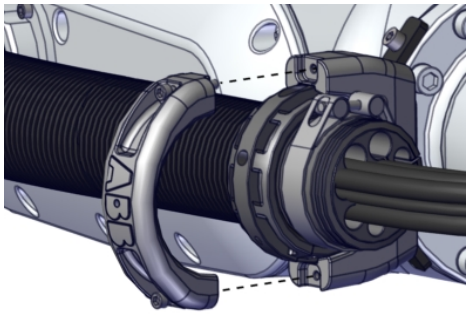
Preparations before removing the axis-5 motor

	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: +35°) • 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.	 xx2200001814
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

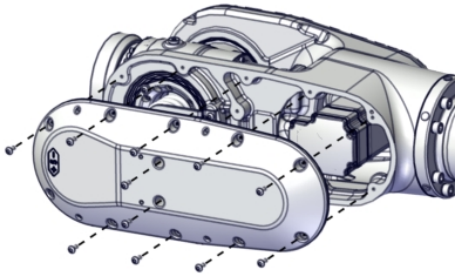
Retrieving access to the wrist cabling

Use this procedure to remove the wrist cover.

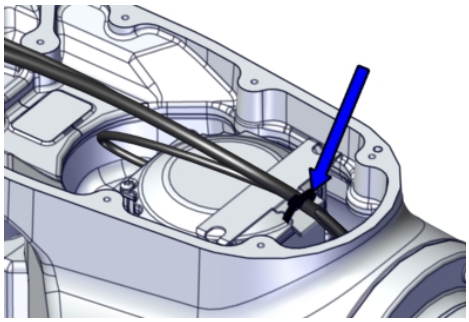
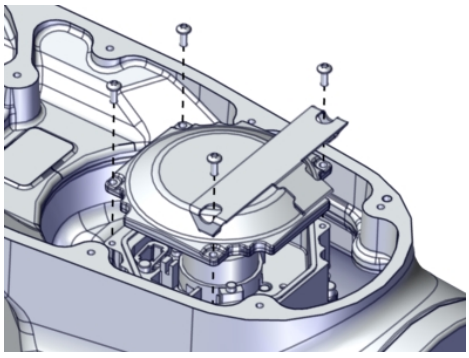
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	If DressPack is installed: • Remove the bracket with the complete ball joint housing still fitted, as shown in the figure. This is done to be able to reach the two hidden screws that secure the wrist cover.	 xx1400000355
3	If DressPack is installed: Open the ball joint housing on the arm tube and remove the DressPack cable package.	IRB 6710-xx/ LID  xx2100002733 IRB 6710-xx/ LID:  xx2100002709

Continues on next page

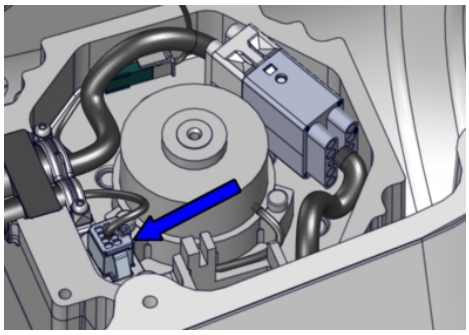
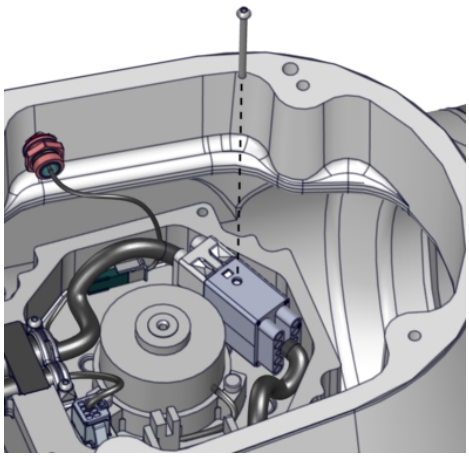
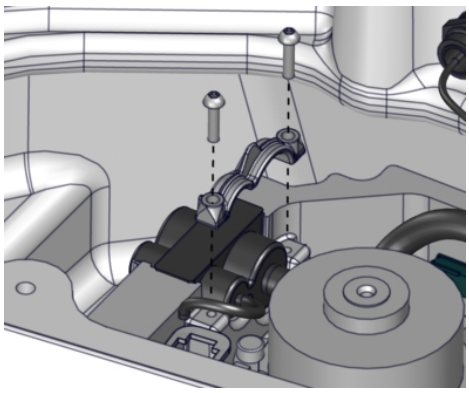
5.7.5 Replacing the axis-5 motor
Continued

	Action	Note
4	Remove the wrist cover.	 xx2000000373

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.	 xx2100002625
3	Remove the motor cover by removing the screws.	 xx2100002495

Continues on next page

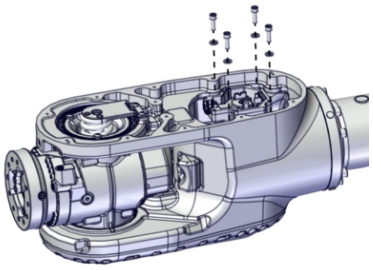
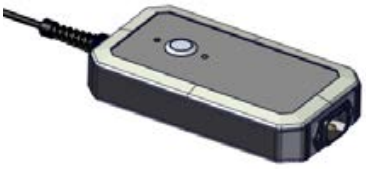
	Action	Note
4	Disconnect the signal cable connector.	 xx2200001734
5	Disconnect the power cable connector by removing the attachment screw.	 xx2200001733
6	Remove the cable bracket by removing the screws.	 xx2200001735
7	Remove the motor cables.	

Removing the axis-5 motor

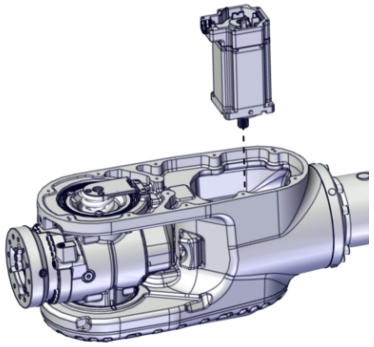
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

5.7.5 Replacing the axis-5 motor
Continued

	Action	Note
2	Unscrew the attachment screws that secure the motor, using a bits extender.	Bits extender: 3HAC12342-1  xx2100002204
3	Fit removal tools in the threaded holes.	Removal tool motor M12 3HAC14631-1
4	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
5	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.
6	**CAUTION** The weight of the motor is 11 kg All lifting accessories used must be sized accordingly.	
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. **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

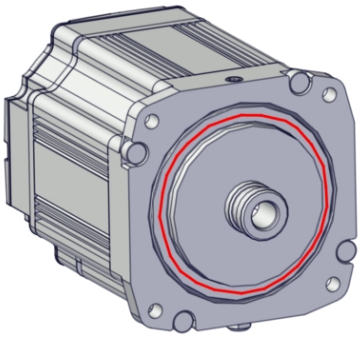
Continues on next page

	Action	Note
8	Remove the motor by carefully lifting it straight out/straight up. Make sure the pinion is not damaged.	 xx2100002205

Refitting the motor

Use these procedures to refit the motor.

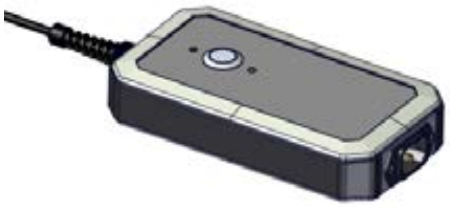
Preparations prior to refitting motor

	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.	

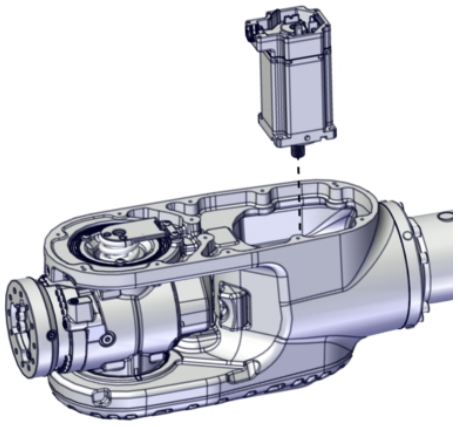
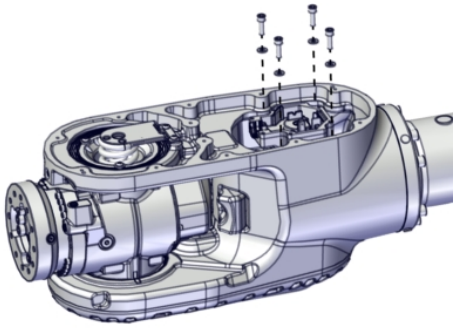
Continues on next page

5.7.5 Replacing the axis-5 motor
Continued

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
5	**CAUTION** The weight of the motor is 11 kg All lifting accessories used must be sized accordingly.	

Continues on next page

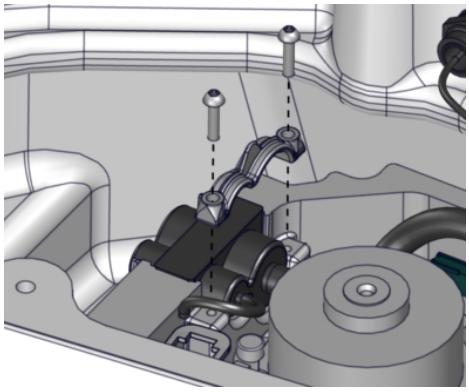
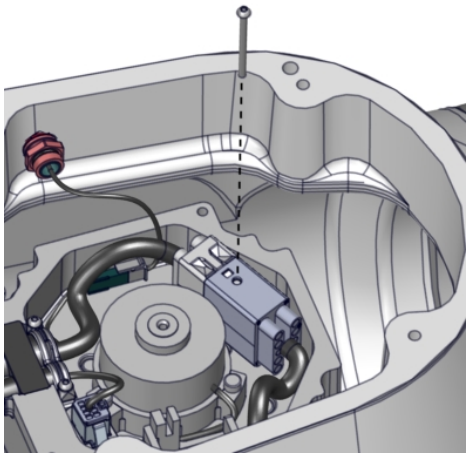
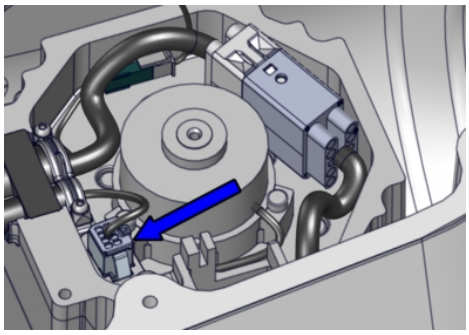
	Action	Note
6	Use caution and lower the motor into position on the guide pins, while at the same time rotating the motor pinion slightly. Make sure that: • the motor pinion is properly mated to the gear of the gearbox. • the motor pinion does not get damaged. • the direction of the cable exit is facing the same way as before removal.	Rotation tool M4, 3HAB7887-1  xx2100002205
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: 24 Nm.  xx2100002204
9	Perform a leak-down test.	See *Performing a leak-down test on page 178*.
10	Disconnect the brake release tool.	

Connecting the axis-5 motor cables

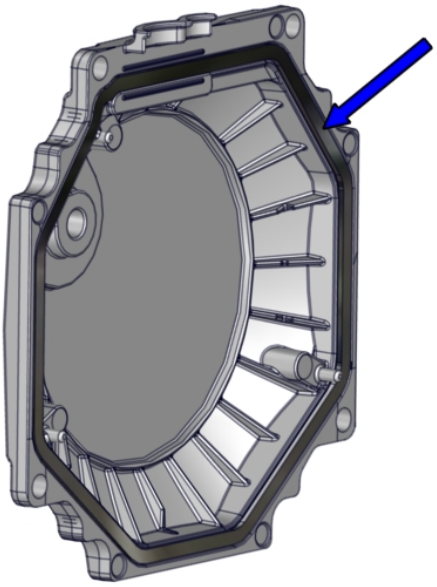
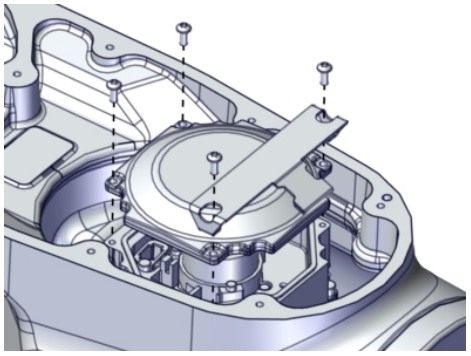
	Action	Note
1	Put the motor cables in place in the opening.	

Continues on next page

5.7.5 Replacing the axis-5 motor
Continued

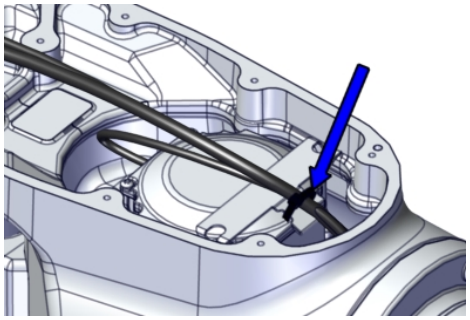
	Action	Note
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001735
3	Connect the power cable connector and secure with a screw. Connect in accordance with the markings on the connectors. **Note** The purpose of the screw is to secure the mating of the 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

Continues on next page

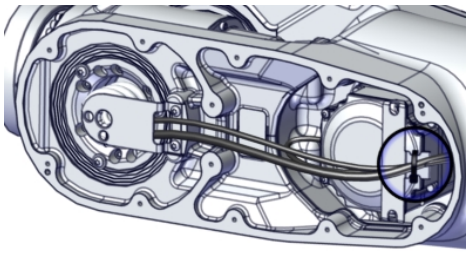
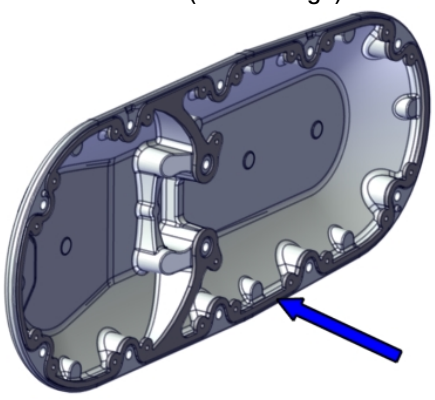
	Action	Note
5	Inspect the gasket. Replace if damaged.	Connection box cover with gasket: 3HAC072863-003  xx2200002141
6	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
7	Refit the motor cover and the cable protection with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: - (Loctite 2400 (or equivalent Loctite 243)) Tightening torque: 6 Nm.  xx2100002495

Continues on next page

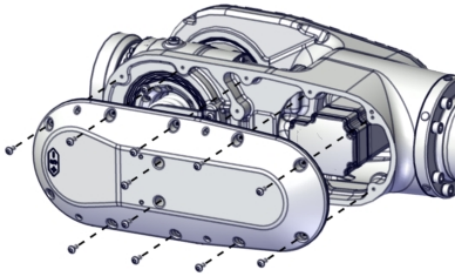
5.7.5 Replacing the axis-5 motor
Continued

	Action	Note
8	Secure the cabling with a cable strap.	Cable strap, outdoor: 3HAC057966-003  xx2100002625

Refitting the wrist cover

	Action	Note
1	Make sure that the cable harness is routed and secured as shown in the figure.	 xx2100002626 :
2	*Foundry Plus:* Inspect the gasket. Replace the complete cover if the gasket is damaged.	Wrist cover: 3HAC074181-002 (Graphite White) 3HAC074181-004 (ABB Orange)  xx2100001407

Continues on next page

	Action	Note
3	Refit the wrist cover and secure with screws. *Foundry Plus:* Fit all the screws first, then torque tighten.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2000000373

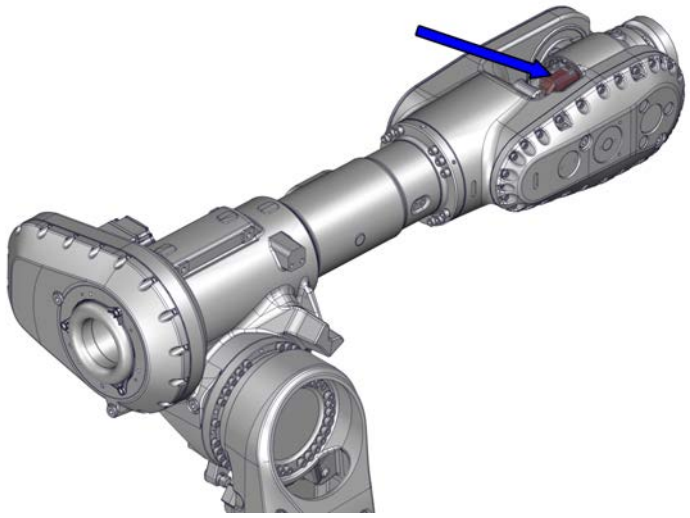
Concluding procedure

	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 161*.
3	Re-calibrate the robot.	See *Calibration on page 585*.
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 94*.	

5.7.6 Replacing the axis-6 motor

Location of the motor

The motor is located as shown in the figure.



xx2200002145

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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Motor unit (including connection box and pinion)	3HAC071374-003		L2

Required service parts

Consumable	Article number	Note
Tilt housing cover with gasket	3HAC074958-003 (Graphite White) 3HAC074958-004 (ABB Orange)	Replace if damaged. On axis-6 motor
Cleaning agent	-	Loctite 7200
Cleaning agent	-	Loctite 7063
Gasket, tilt housing cover	3HAC074482-001	Replace if damaged.
Flange sealant	-	Loctite 5800

Continues on next page

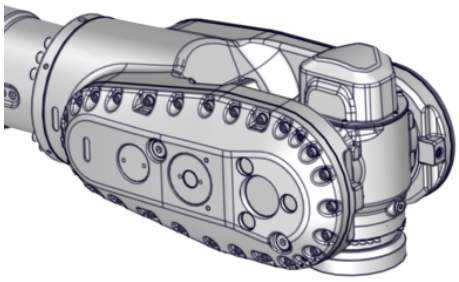
Required tools and equipment

Equipment	Article number	Note
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
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 (axes 1, 2, 3 and 4) 3HAC074119-001 (axes 5 and 6)	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 628*.

Removing the motor

Use these procedures to remove the motor.

Preparations before removing the axis-6 motor

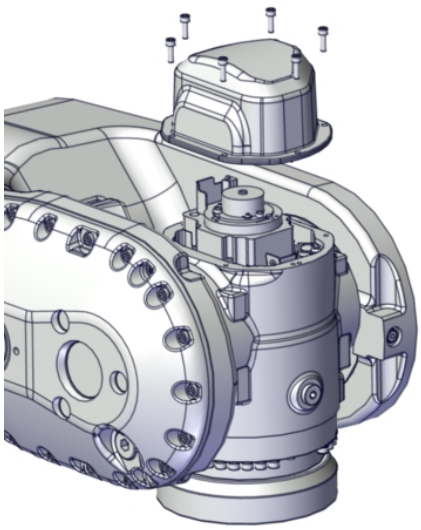
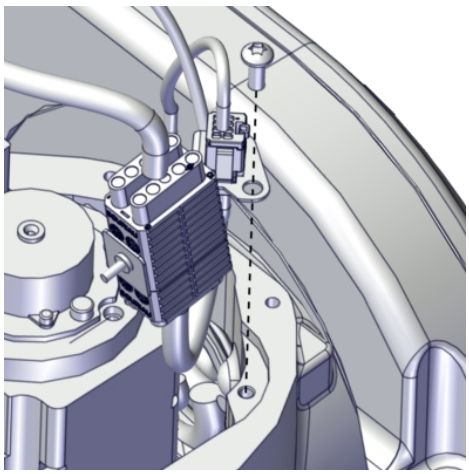
	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Jog the robot to a position where axis 5 can be positioned with the axis-6 motor pointing straight up at an acceptable working position. With axis 5 in this position it is possible to replace the axis-6 motor without draining the oil from the axis-6 gearbox.	 xx2200002146
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

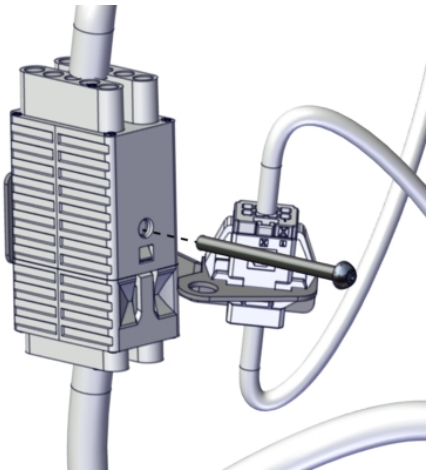
5.7.6 Replacing the axis-6 motor

Continued

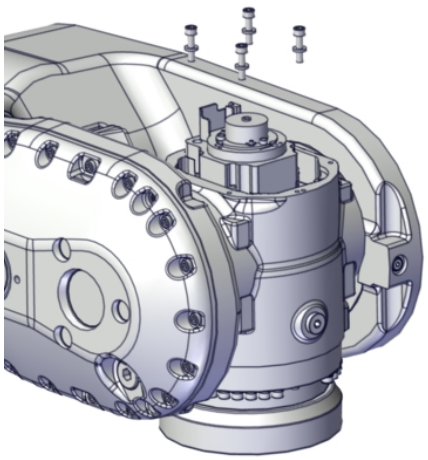
Disconnecting the axis-6 motor cables

	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.	 xx2000000376
3	Remove the connector bracket.	 xx2000000375

Continues on next page

	Action	Note
4	Remove the connector screw.	 xx2200001919
5	Disconnect the motor cables.	

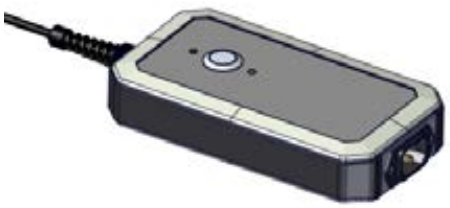
Removing the axis-6 motor

	Action	Note
1	Unscrew the motor attachment screws.	 xx2000000377
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

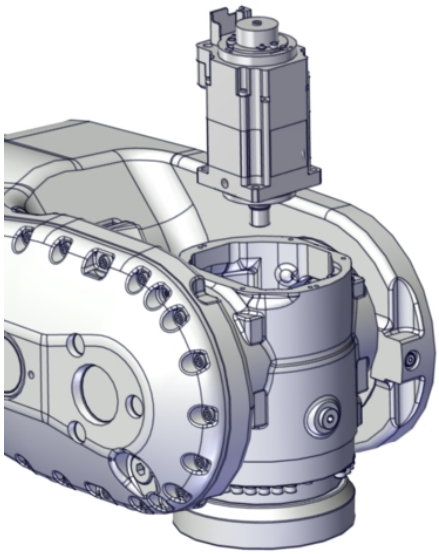
Continues on next page

5.7.6 Replacing the axis-6 motor

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	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
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 kg	

Continues on next page

	Action	Note
8	Remove the motor by lifting it straight up from the gear. Make sure the motor pinion is not damaged!	 xx2000000378
9	Disconnect the brake release tool.	

Refitting the motor

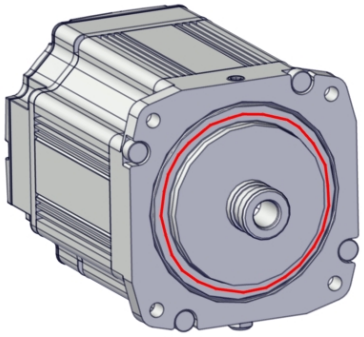
Use these procedures to refit the motor.

Preparations prior to refitting motor

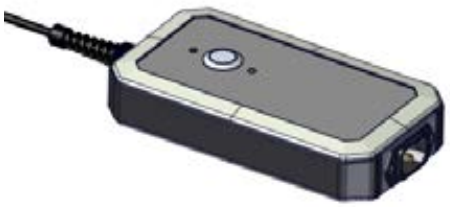
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove any old paint or flange sealant residues or other contamination from the contact surfaces on both the motor and the mating parts. **Tip** Remove flange sealant residues with Loctite 7200. Then use Loctite 7063 for cleaning the mating surface.	Cleaning agent: Loctite 7200, Loctite 7063

Continues on next page

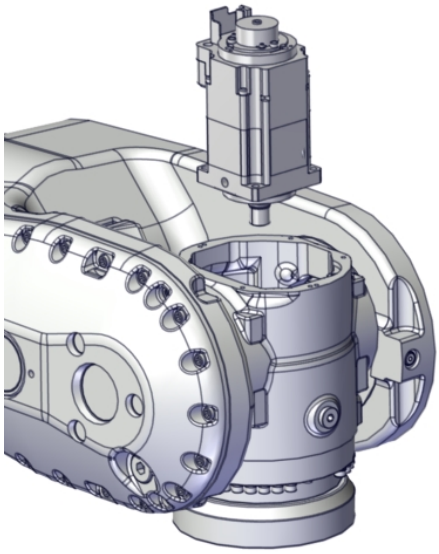
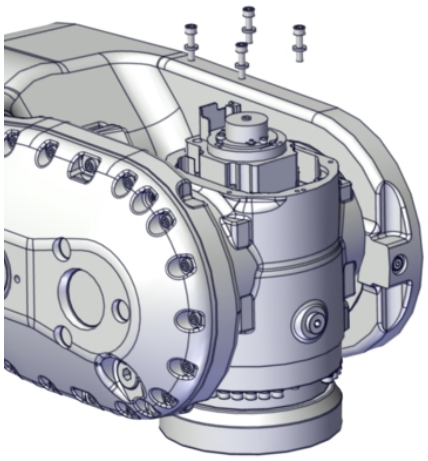
5.7.6 Replacing the axis-6 motor
Continued

	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.	

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.	
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

Continues on next page

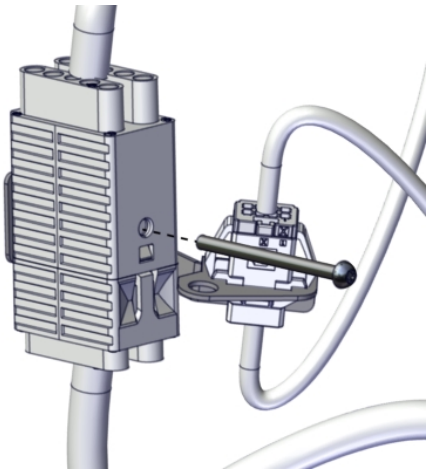
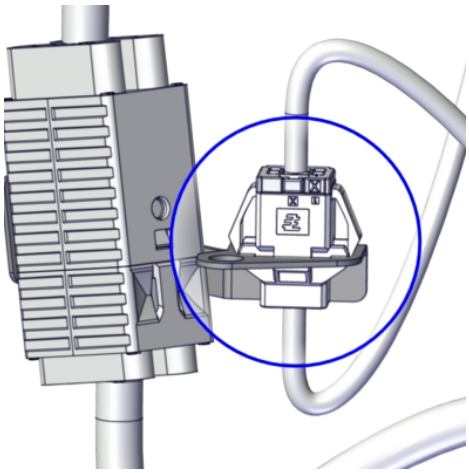
	Action	Note
4	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
5	Use caution and lower the motor into position on the guide pins, while at the same time rotating the motor pinion slightly. Make sure that: • the motor pinion is properly mated to the gear of the gearbox. • the motor pinion does not get damaged.	Rotation tool M3, 3HAB7887-1  xx2000000378
6	Remove the guide pins.	
7	Secure the motor with its attachment screws.	Hex socket head cap screw: M8x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 10 Nm  xx2000000377
8	Perform a leak-down test.	See *Performing a leak-down test on page 178*.

Continues on next page

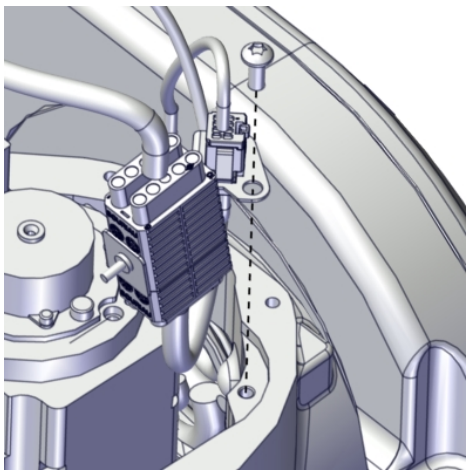
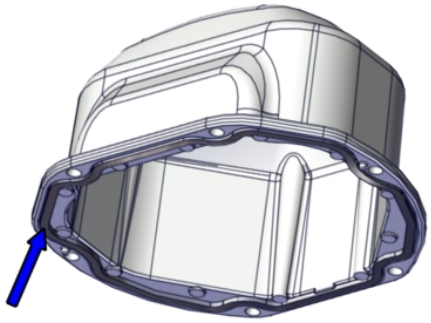
5.7.6 Replacing the axis-6 motor

Continued

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  xx2200001919
3	Snap the signal connectors to each other in the bracket.	 xx2200001920

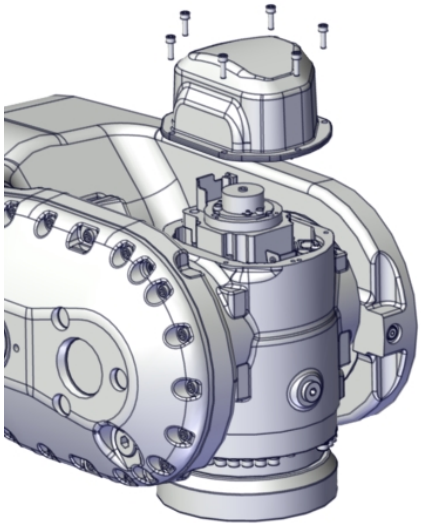
Continues on next page

	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  xx2000000375
5	Verify correct cable layout as shown in the figure. **CAUTION** Route the signal cabling correctly to avoid cable damage.	 xx2100001293
6	Inspect the gasket. Replace if damaged.	Gasket, tilt housing cover: 3HAC074482-001  xx2100001287
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	

Continues on next page

5.7.6 Replacing the axis-6 motor

Continued

	Action	Note
8	Refit the motor cover.	Hex socket head cap screw: M5x16 12.9 Lafre 2C2B/FC6.9 (6 pcs) Tightening torque: 4 Nm.  xx2000000376

Concluding procedure

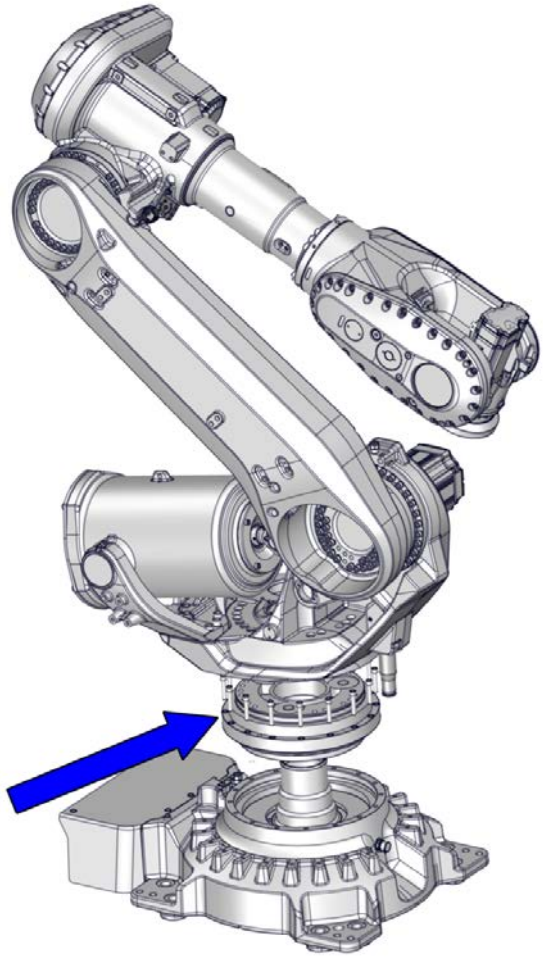
	Action	Note
1	If used, refit the DressPack cable package on the wrist.	See product manual for the DressPack.
2	Re-calibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 594*. General calibration information is included in section *Calibration on page 585*.
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 94*.	

5.8 Gears

5.8.1 Replacing the axis-1 gearbox

Location of the gearbox

The gearbox is located as shown in the figure.



xx2200001406

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-1 gearbox.
2. Remove the cabling from the base.
3. Remove the axis-1 motor.
4. Remove the complete arm system (complete robot excluding the base and axis-1 gearbox) as an assembly.
5. Replace the axis-1 gearbox.

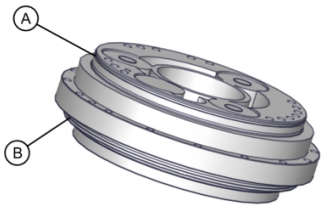
Continues on next page

5.8.1 Replacing the axis-1 gearbox
Continued

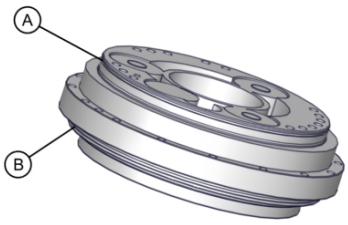
Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Gearbox	3HAC081259-003 (Graphite White) 3HAC081259-004 (ABB Orange)	Includes o-rings: A 3HAB3772-164 B 3HAC061327-065  xx2200001407	L2

Required service parts

Consumable	Article number	Note
O-ring	A 3HAB3772-164 B 3HAC061327-065	On gearbox. Included in gearbox spare part, but replace if damaged.  xx2200001407
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
O-ring	3HAB3772-58	On axis-1 protection ring.
Radial sealing with dust lip	3HAB3701-46	
Cleaning agent	-	Isopropanol
Rust preventive	3HAC034903-001	Mercasol 3110 Waxcoat. Recommended drying time is 24h.

Continues on next page

Consumable	Article number	Note
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*.
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)
Lubricating oil	-	See *Type of lubrication in gearboxes on page 136*.

Required tools and equipment

Equipment	Article number	Note
Lifting eye	3HAC16131-1	M12, 2 pcs
Lifting shackle	-	SA-10-8-NA1
Roundsling, 0.5 m	-	Length: 0.5 m.
Roundsling, 1 m	-	Length: 1 m.
Roundsling, 2 m	-	Length: 2 m.
Fender washer	-	Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Guide pin, M12x200	3HAC13056-3	Always use guide pins in pairs.
Guide pin, M16x120 / Guide pin, M16x250	3HAC062397-001 / 3HAC062398-001	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.
Bit holder and hexagon bit SW10		Bit holder dimension: 5/16" (14x18 mm) Used for screw access in narrow locations.
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
Bits extender	3HAC12342-1	300 mm, bits 1/2"
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.

Continues on next page

5.8.1 Replacing the axis-1 gearbox
Continued

Equipment	Article number	Note
Calibration toolbox, Axis Calibration	3HAC074564-001 (axes 1, 2, 3 and 4) 3HAC074119-001 (axes 5 and 6)	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 628*.

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 595*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Removing the gearbox

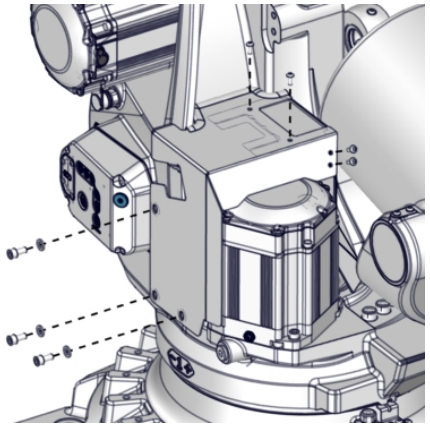
These procedures describe how to remove the gearbox.

Removing tools and equipment from the turning disc

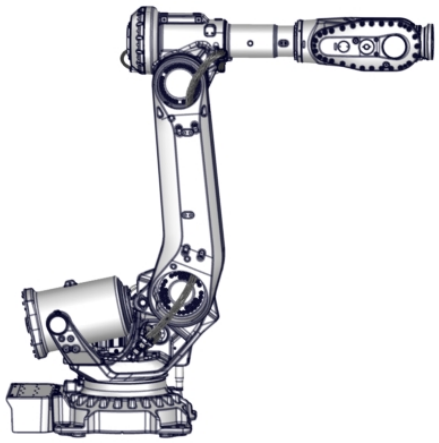
	Action	Note
1	Remove tools and other equipment fitted on the turning disc. DressPack can stay fitted for the time being.	This is done to achieve the best stability of the complete arm system, when it is resting by itself after removal.

Continues on next page

Removing the covers for Foundry Plus and floor mounted robots

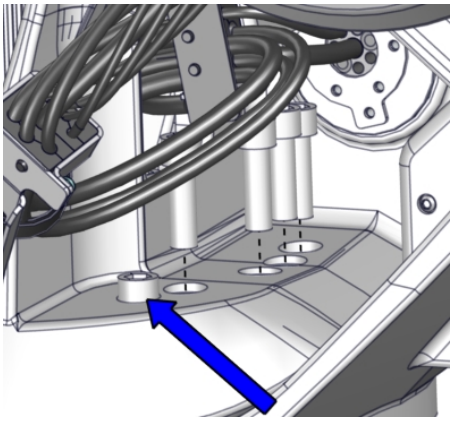
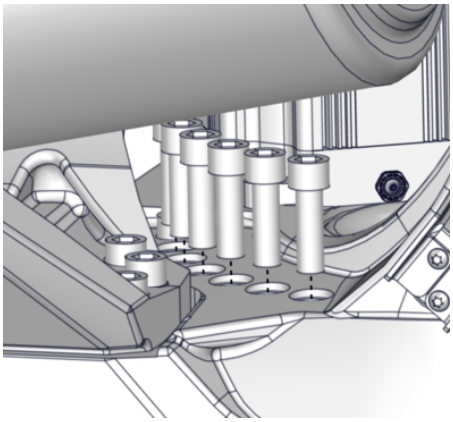
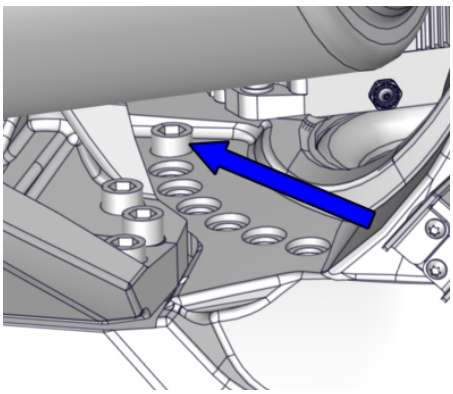
	Action	Note
1	*Protection type Foundry Plus* Remove the axis-1 cable protection plates by removing the attachment screws.	 xx2200001430

Removing the frame attachment screws

	Action	Note
1	Jog the robot into calibration position.	 xx2200001458
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

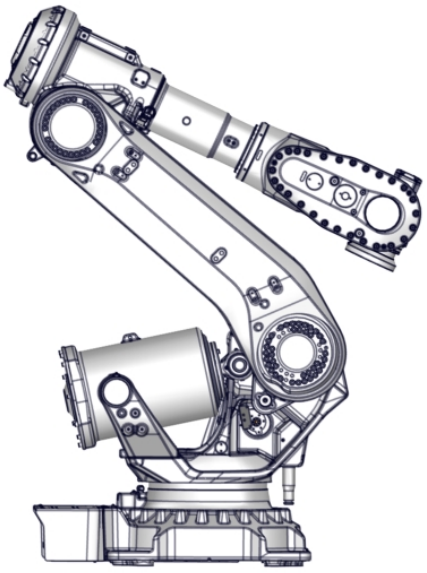
5.8.1 Replacing the axis-1 gearbox
Continued

	Action	Note
3	Remove four of the five attachment screws inside the frame recess, that secure the frame to the gearbox. **Note** Leave the outermost screw fitted as a safety precaution.	 xx2200001399
4	Remove six of the seven attachment screws under the balancing device. **Note** Leave the screw closest to the axis-1 motor fitted.	 xx2200001401  xx2200001402

Position for the floor mounted robot

	Action	Note
1	Turn on the power to the robot temporarily.	

Continues on next page

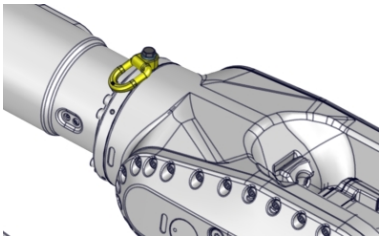
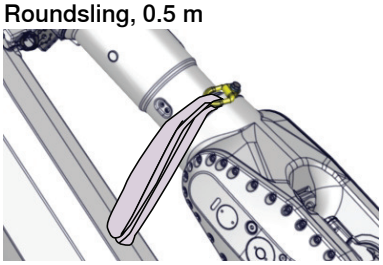
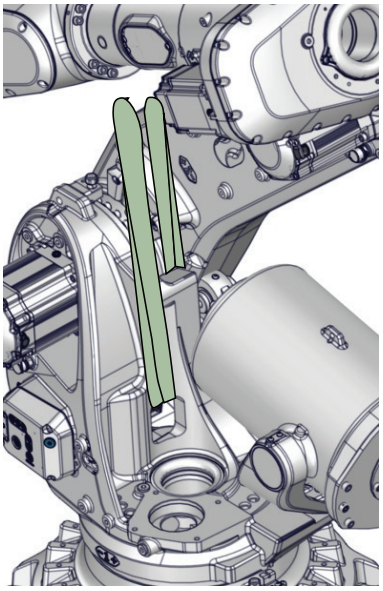
	Action	Note
2	Jog the robot into position: • Axis 1: no significance • Axis 2: -45° • Axis 3: +70° • Axis 4: calibration position (0°) • Axis 5: +90° • Axis 6: no significance.	 xx2200001521
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Attaching the lifting accessories to the arm system

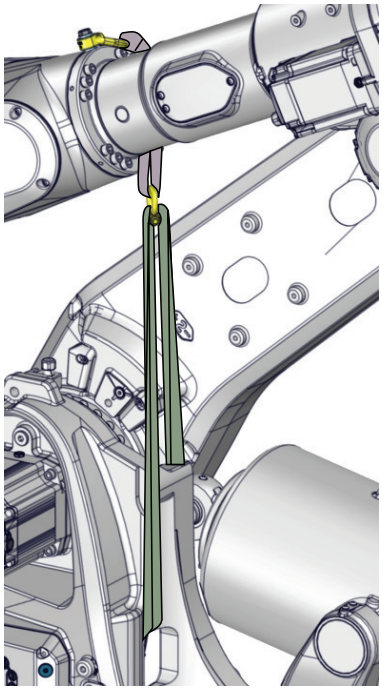
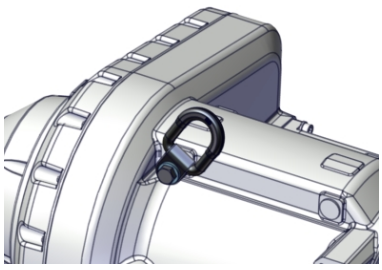
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**CAUTION** The weight of the complete arm system is 865 kg All lifting accessories must be sized accordingly.	

Continues on next page

5.8.1 Replacing the axis-1 gearbox
Continued

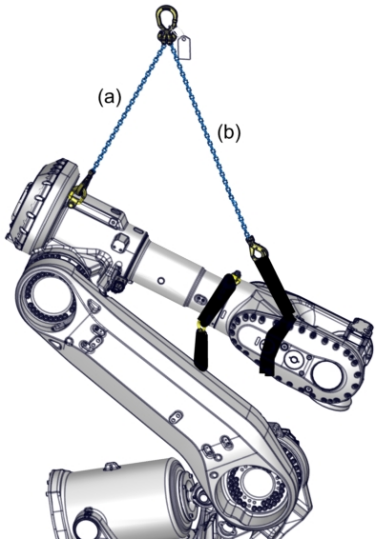
	Action	Note
3	Fit a lifting eye to the wrist.	Lifting eye: 3HAC16131-1  xx2200001522
4	Fit a roundsling to the lifting eye.	Roundsling, 0.5 m  xx2200001523
5	Run a roundsling through the hole in the frame.	Roundsling, 2 m  xx2200001524

Continues on next page

	Action	Note
6	Connect the two roundslings with a shackle.	Lifting shackle: SA-10-8-NA1
7	Turn on the power to the robot and jog axis-3 slowly until the roundsling is stretched (approximately +65°), to carry the weight of the lower arm and frame. **WARNING** Without the roundsling the weight of the lower arm and frame is applied to the axis-3 gear during lifting, which risks to damage the gear.	 xx2200001525
8	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
9	Fit a lifting eye in the arm house, with a fender washer underneath.  xx1400002196 Fender washer	Lifting eye: 3HAC16131-1 Fender washer. Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.  xx2100002146

Continues on next page

5.8.1 Replacing the axis-1 gearbox
Continued

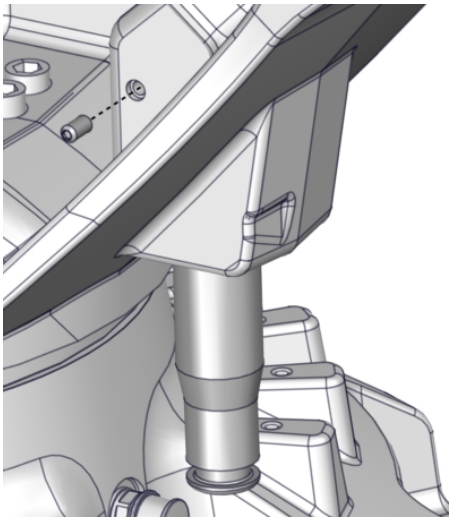
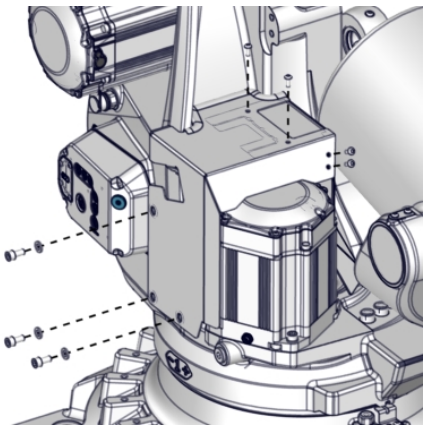
	Action	Note
10	Attach the Lifting accessory (chain) to an overhead crane (or similar) and then to the lifting eye in the arm house and to a roundsling run through the wrist.	Lifting accessory (chain): 3HAC15556-1 Roundsling, 1 m
11	Adjust the chain lengths to make the lift as level as possible.	 xx2200001526 The figure shows an example of lifting chain lengths. Keep chain (a) shorter than chain (b).

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.	

Continues on next page

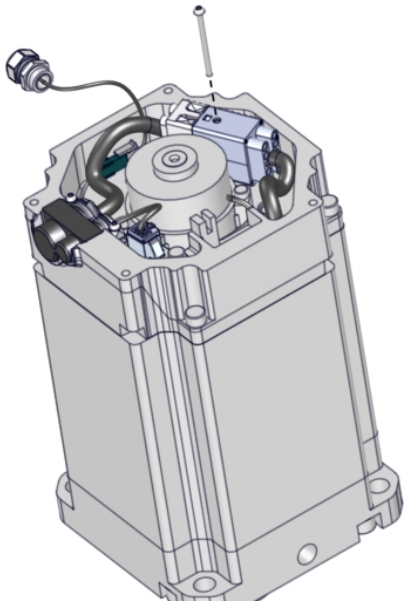
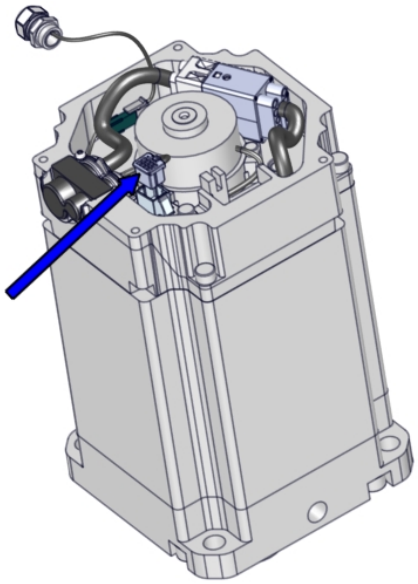
	Action	Note
3	Hold the mechanical stop pin in a firm grip, and remove it by unscrewing the set screw.	 xx2200001398
4	*Foundry Plus* Remove the axis-1 cable protection plate by removing the attachment screws.	 xx2200001430
5	Begin draining the axis-1 gearbox. **Note** There will be some oil left in the gear after draining.	See *Floor-mounted robot: Draining the axis-1 gearbox on page 139*.

Disconnecting the axis-1 motor cables

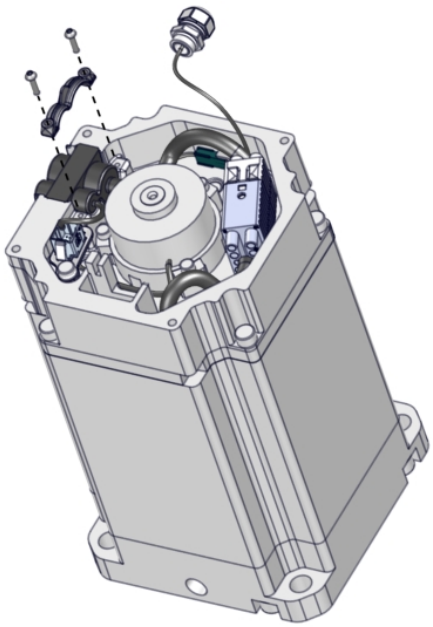
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the motor cover by removing the screws.	

Continues on next page

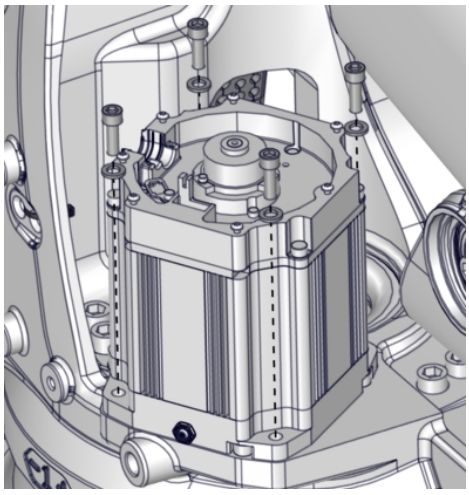
5.8.1 Replacing the axis-1 gearbox
Continued

	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

Continues on next page

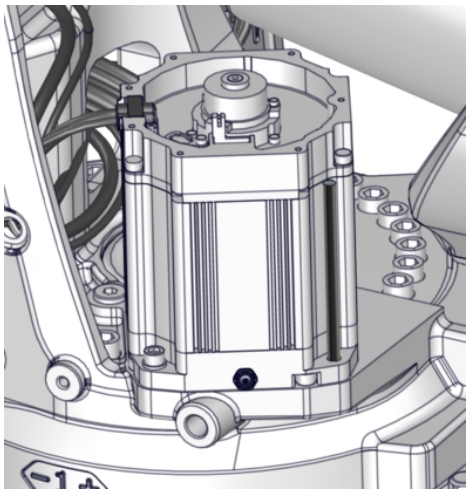
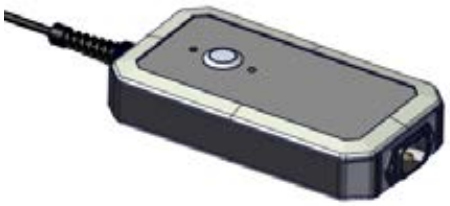
	Action	Note
5	Remove the cable bracket by removing the screws.	 xx2200001738
6	Remove the motor cables from the motor.	

Removing the axis-1 motor

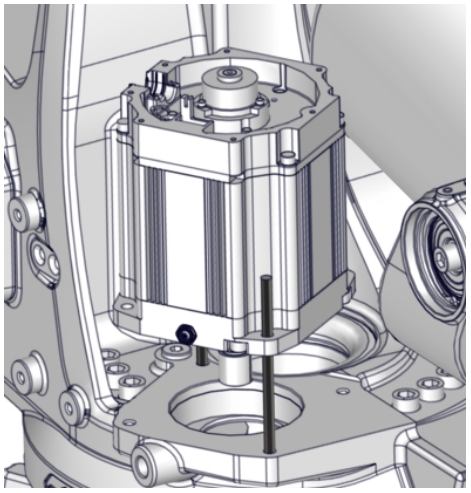
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws and washers. Use a bits extender to reach the screws.	Bits extender: 3HAC12342-1  xx2200001794

Continues on next page

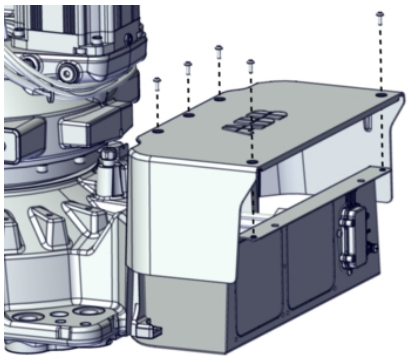
5.8.1 Replacing the axis-1 gearbox
Continued

	Action	Note
3	Fit guide pins in the non-threaded holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs. Removal tool motor M12: 3HAC14631-1 Always use removal tools in pairs.  xx2200001820
4	Fit removal tools in the threaded holes.	
5	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
6	**CAUTION** The weight of the motor is 19 kg	

Continues on next page

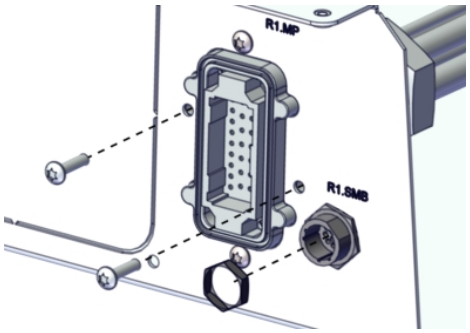
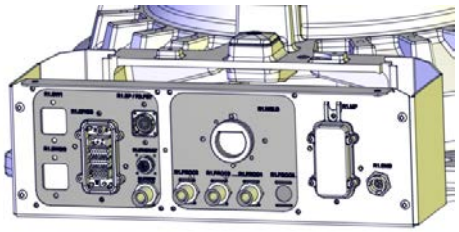
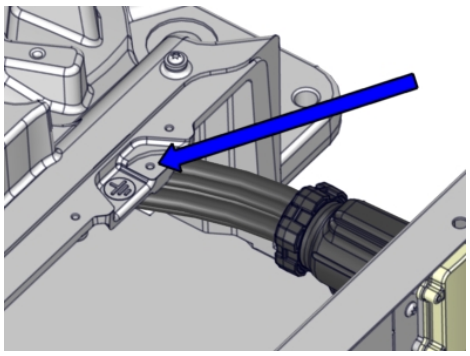
	Action	Note
7	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
8	Press the motor out of its position by using the removal tools.	 xx2200001793
9	Use caution and lift the motor straight up to get the pinion parted from the gear.	
10	Disconnect the brake release tool.	

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

Continues on next page

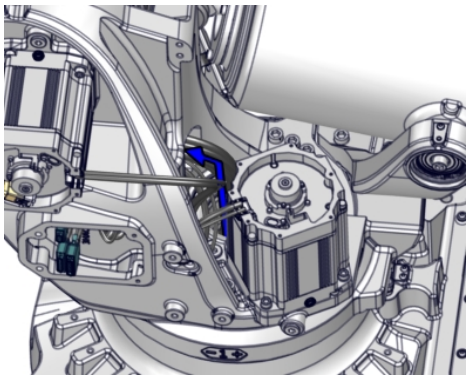
5.8.1 Replacing the axis-1 gearbox
Continued

	Action	Note
3	Loosen the connectors: • R1.MP • R1.SMB	 xx2100001109
4	If used, disconnect the DressPack hoses in the base.	 xx1400000366
5	Disconnect the earth cable.	 xx2200001790

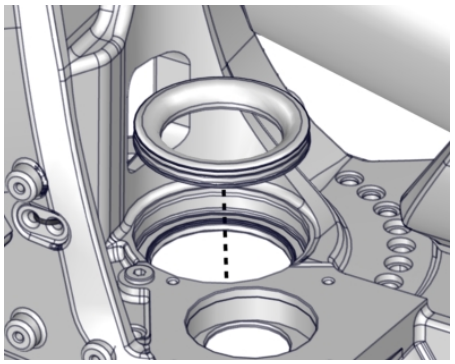
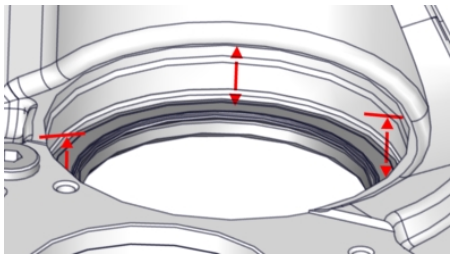
Removing the cable harness from the base

	Action	Note
1	If equipped with DressPack, pull out the DressPack cables through the protection tube.	

Continues on next page

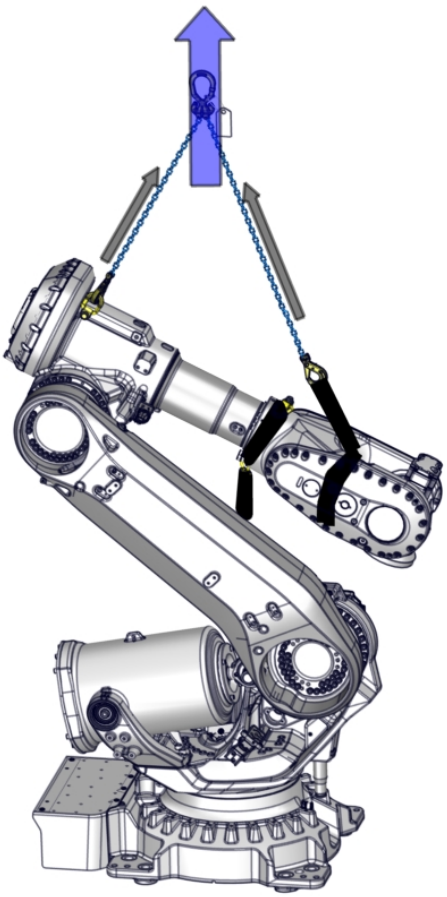
	Action	Note
2	Pull out the robot cable harness through the protection tube.	 xx2200001740
3	Place the cable harness safely on the frame or on the axis-2 motor.	

Lifting away the complete arm system

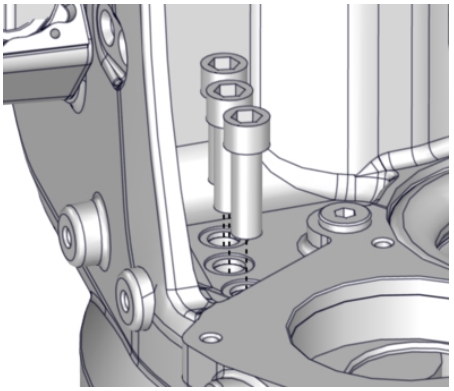
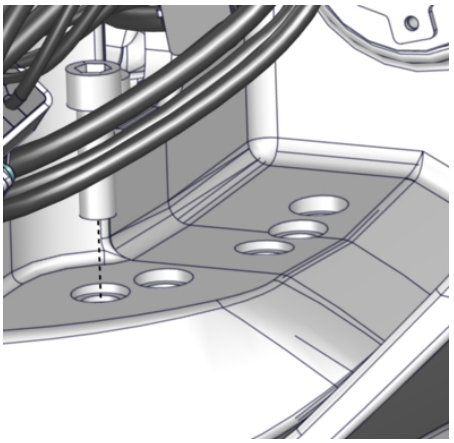
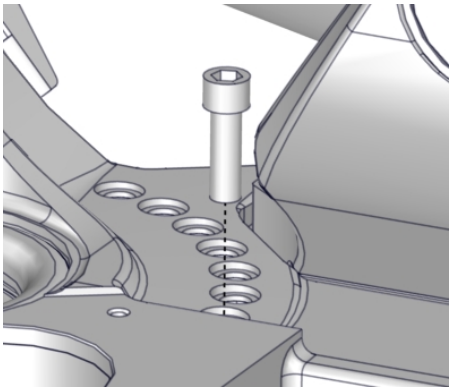
	Action	Note
1	Check that the axis-1 gearbox is drained and then remove the draining equipment.	
2	Remove the protection ring from the frame.	 xx2200001610
3	Measure the distance from the edge of the frame to the radial sealing at three different locations and make notes. The measurement is used as a verification after the arm system has been refitted.	 xx2200001611

Continues on next page

5.8.1 Replacing the axis-1 gearbox
Continued

	Action	Note
4	Raise the overhead crane to stretch all lifting accessories.	 xx2300000034

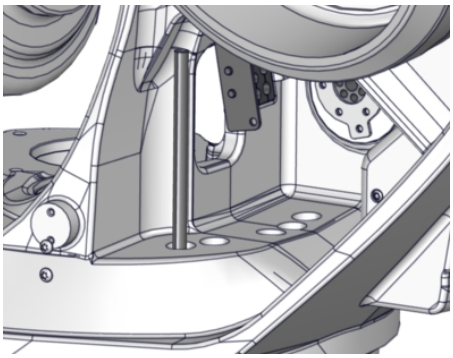
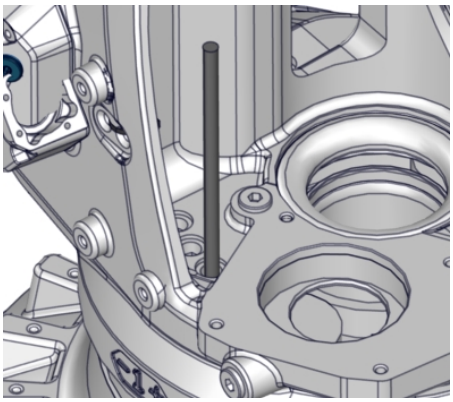
Continues on next page

	Action	Note
5	Remove the remaining attachment screws that hold the frame to the axis-1 gearbox.	 xx2200001403  xx2200001405  xx2200001404

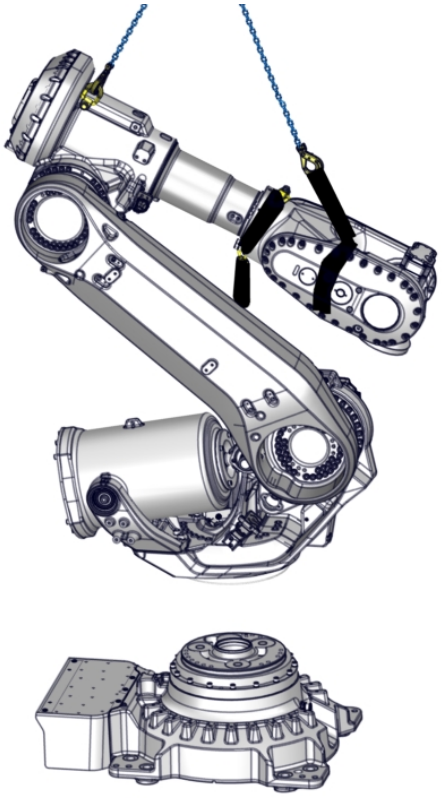
Continues on next page

5.8.1 Replacing the axis-1 gearbox

Continued

	Action	Note
6	Install guide pins to the frame. **Tip** Lubricate the guide pins with some grease to make the frame slide better.	Guide pin, M16x120 / Guide pin, M16x250: 3HAC062397-001 / 3HAC062398-001 Always use guide pins in pairs.  xx2200001423  xx2200001424
7	**CAUTION** The weight of the complete arm system is 865 kg All lifting accessories must be sized accordingly.	

Continues on next page

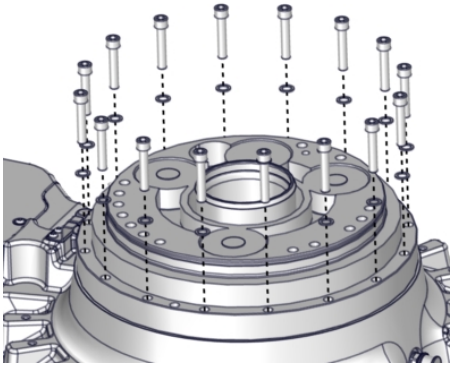
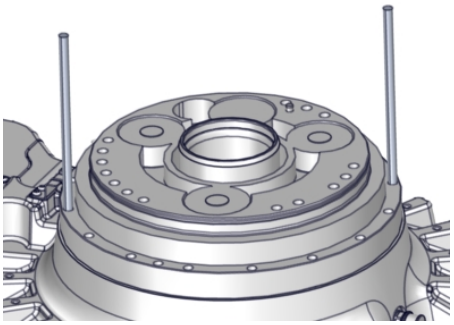
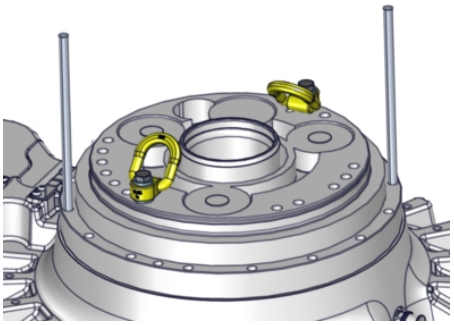
	Action	Note
8	Lift away the complete arm system. **CAUTION** When the arm system has left the guide pins it can move. Use caution in order to avoid injury or damage! **Note** There will be some oil spill!	 xx2200001792
9	Put down the arm system on the floor.	
10	**DANGER** When the complete arm system 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.	

Continues on next page

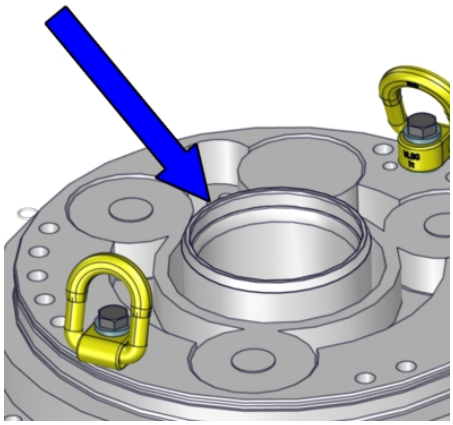
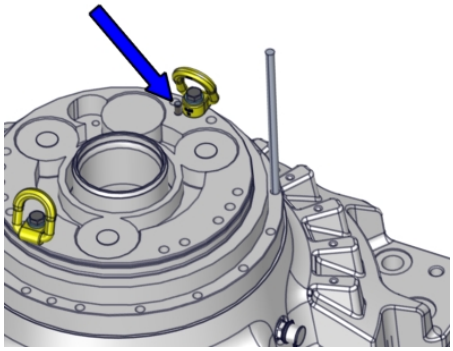
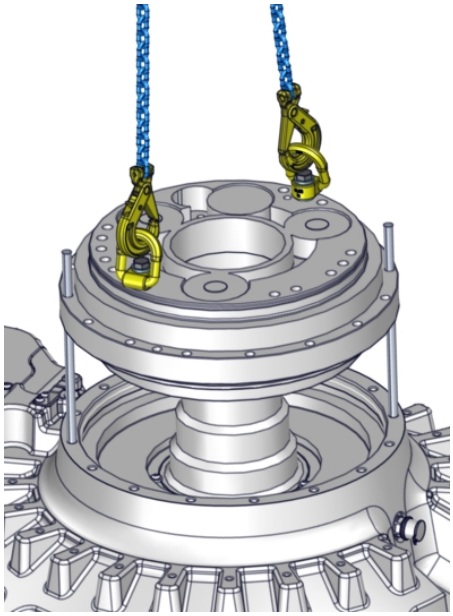
5.8.1 Replacing the axis-1 gearbox

Continued

Removing the axis-1 gearbox

	Action	Note
1	Remove the attachment screws and washers that secure the gearbox to the base.	 xx2200001408
2	Fit two guide pins in opposite holes. **Tip** Lubricate the guide pins with some grease to make the gearbox slide better.	Guide pin, M12x200: 3HAC13056-3 Always use guide pins in pairs.  xx2200001409
3	Fit two lifting eyes manually in opposite holes in the gearbox. **CAUTION** Leave a couple of millimeters of space between the lifting accessory and the surface of the gearbox. This is done in order not to damage the surface of the gearbox which is a sealing surface.	Lifting eye: 3HAC16131-1  xx2200001410
4	**CAUTION** The weight of the gearbox is 85 kg All lifting accessories used must be sized accordingly.	

Continues on next page

	Action	Note
5	Protect the sealing areas on top of the tube, to avoid damaging them.	 xx2200001412
6	Notice in what direction the guiding pin is located, to refit the gearbox in same orientation. Important when refitting the arm system, if it needs to be installed in the same orientation as removed.	 xx2200001608
7	Attach the lifting accessory (chain) to the lifting eyes and lift away the gearbox.	Lifting accessory (chain): 3HAC15556-1  xx2200001411

Continues on next page

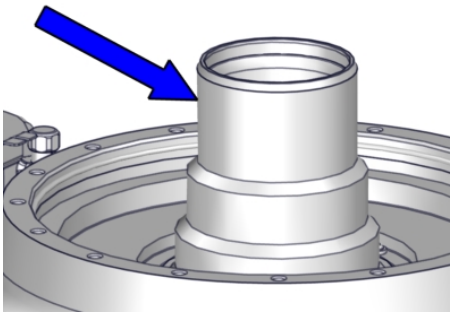
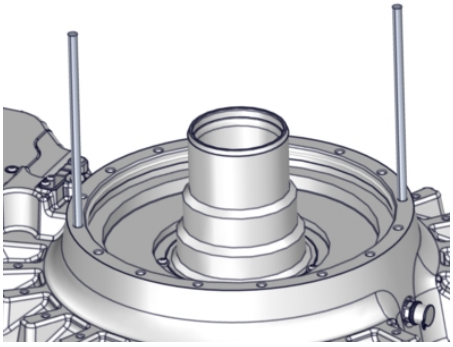
5.8.1 Replacing the axis-1 gearbox
Continued

Refitting the gearbox

These procedures describe how to refit the axis-1 gearbox.

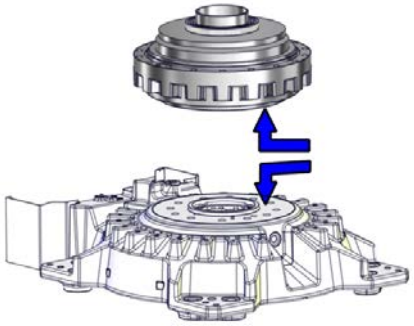
Preparations of the robot base

Use this procedure to do the necessary preparations before refitting the gearbox.

	Action	Note
1	Check the sealing tube for damages. Especially check the sealing surface. See figure! Replace if damaged.	 xx2200001414
2	Fit guide pins in opposite holes in the base. **Tip** Lubricate the guide pins with some grease to make the gearbox slide better.	Guide pin, M12x200: 3HAC13056-3 Always use guide pins in pairs.  xx2200001415
3	Wipe clean the contact surfaces on the base and the surfaces of the sealing tube from any contamination.	
4	Put grease on the sealing tube.	

Continues on next page

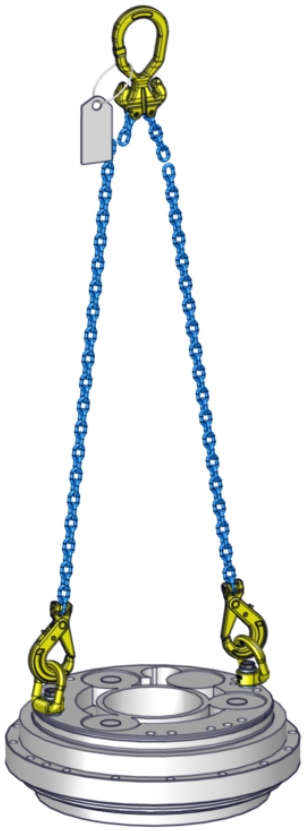
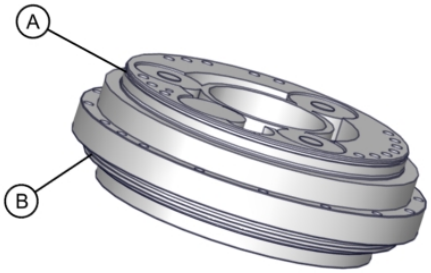
Preparations before refitting the axis-1 gearbox

	Action	Note
1	Wipe the contact surfaces between gearbox and base clean from any contamination.	Cleaning agent: Isopropanol  xx1700000567
2	Fit the lifting accessories in opposite holes in the gearbox. **CAUTION** Leave a couple of millimeters of space between the lifting accessory and the surface of the gearbox. This is done in order not to damage the surface of the gearbox which is a sealing surface.	Lifting eye: 3HAC16131-1  xx2200001416
3	**CAUTION** The weight of the gearbox is 85 kg All lifting accessories used must be sized accordingly.	

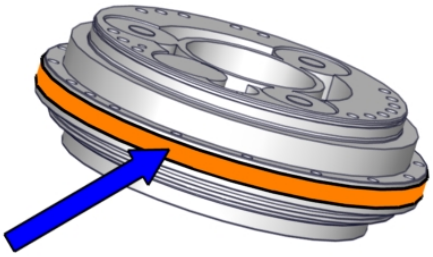
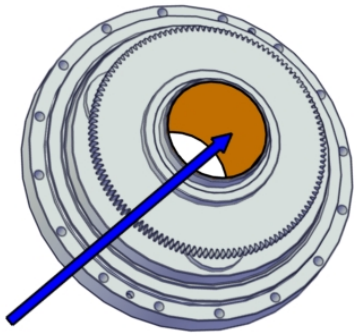
Continues on next page

5.8.1 Replacing the axis-1 gearbox

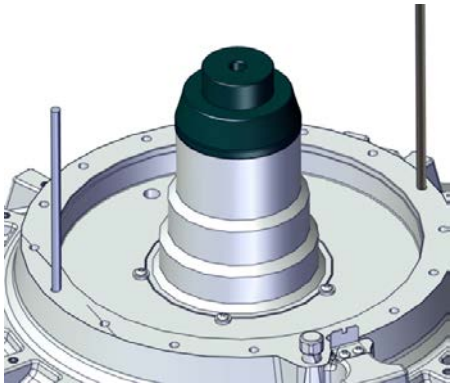
Continued

	Action	Note
4	Attach the lifting accessory and lift the gearbox.	Lifting accessory (chain): 3HAC15556-1  xx2200001417
5	Check the o-ring and lubricate. Replace if damaged.	O-ring: A 3HAB3772-164 B 3HAC061327-065 Grease, Shell Gadus S2: 3HAC042536-001.  xx2200001407

Continues on next page

	Action	Note
6	Apply rust preventive to the gearbox surface shown in the figures.	Rust preventive: 3HAC034903-001 (Mercasol 3110 Waxcoat. Recommended drying time is 24h.)  xx2200001418
7	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

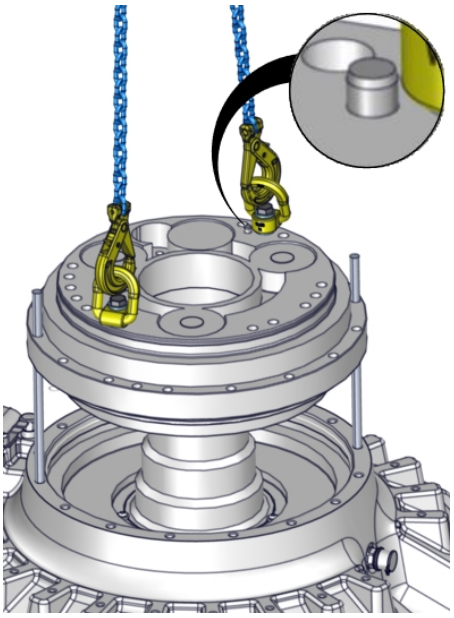
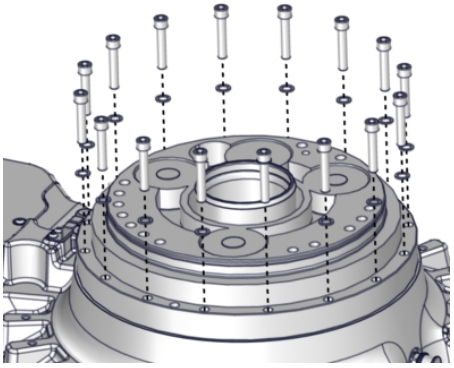
Refitting the axis-1 gearbox to the base

	Action	Note
1	Fit the guide for the gear on top of the sealing tube. It protects the tube from getting damaged when the gearbox is being fitted and later the radial sealing from getting damaged when the arm system is fitted.	Guide for reduction gear: 3HAC043870-009.  xx1700002037

Continues on next page

5.8.1 Replacing the axis-1 gearbox

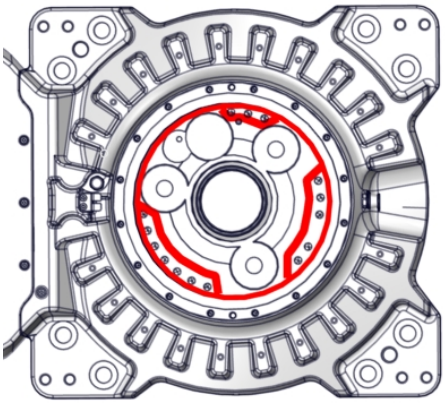
Continued

	Action	Note
2	Lower the gearbox very carefully onto the guide pins and onto the sealing tube. **Note** Check that the gearbox is oriented in the same direction as the old gearbox, by checking the orientation of the guiding pin. **Note** Make sure that the o-ring is still fitted correctly when the gearbox is being fitted.	 xx2300000012
3	Remove the guide pins.	
4	Remove the lifting accessory and the lifting eyes.	
5	Fit the attachment screws and washers. Tighten by hand.	Attachment screws: M12x60 12.9 Gleitmo 603+Geomet 500 (16 pcs).  xx2200001408
6	Torque tighten all screws.	Tightening torque: standard torque 120 Nm (*Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws on page 626*)..

Preparations before refitting the arm system

	Action	Note
1	Wipe clean the contact surfaces from any contamination.	

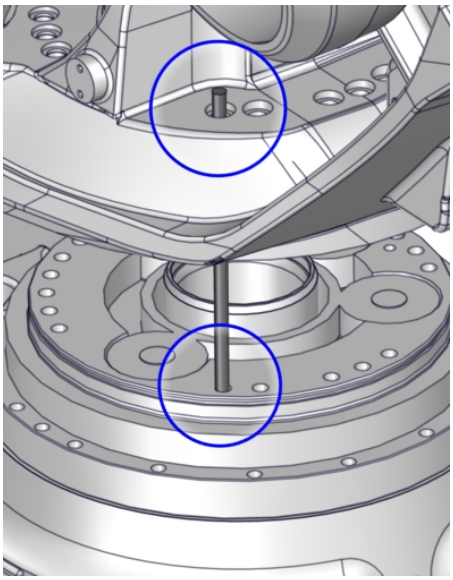
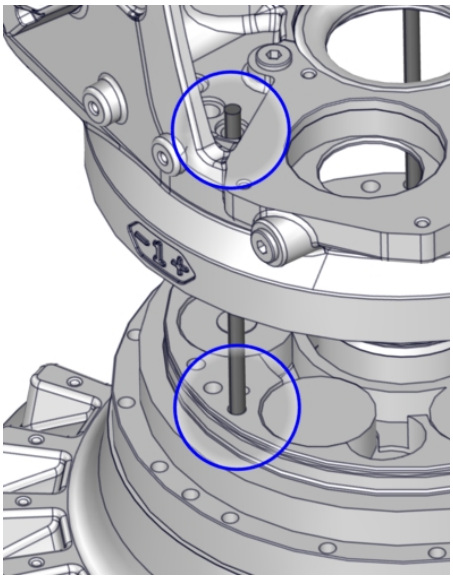
Continues on next page

	Action	Note
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)  xx2200001609
3	Apply some grease on: • the edge of the sealing tube • the edge around the gearbox.	

Continues on next page

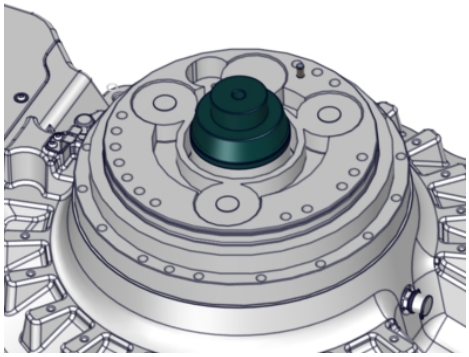
5.8.1 Replacing the axis-1 gearbox

Continued

	Action	Note
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, M16x120 / Guide pin, M16x250: 3HAC062397-001 / 3HAC062398-001 Always use guide pins in pairs.  xx2200001419  xx2200001420

Continues on next page

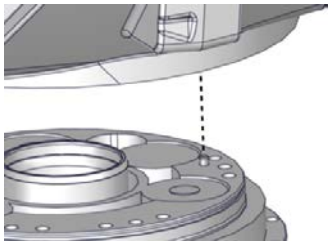
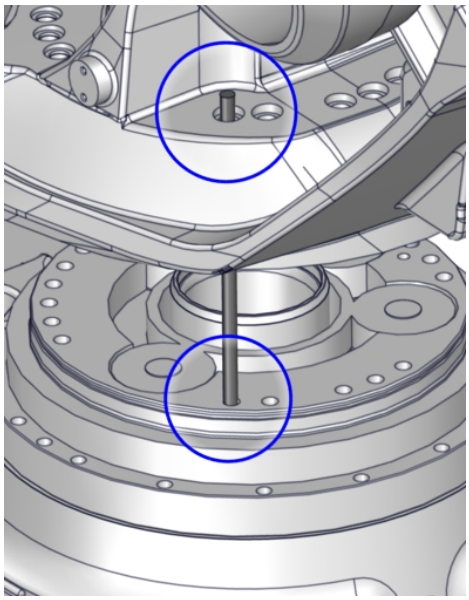
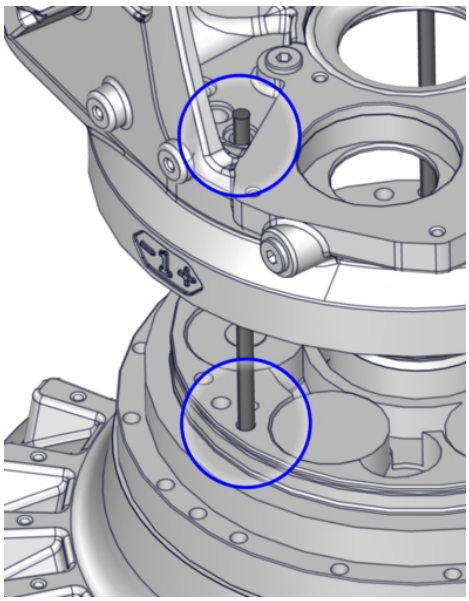
Refitting the arm system

	Action	Note
1	Verity that the guide for the gear is still placed on the protection tube.	 xx2200001612
2	**CAUTION** The weight of the complete arm system is 865 kg All lifting accessories must be sized accordingly.	
3	Make sure that all lifting accessories still is fitted correctly on the arm system.	
4	Lift the arm system up to reach the contact surfaces underneath the frame.	
5	Wipe clean the contact surfaces from any remaining contamination.	
6	Lubricate the radial sealing.	Grease, Shell Gadus S2: 3HAC042536-001.

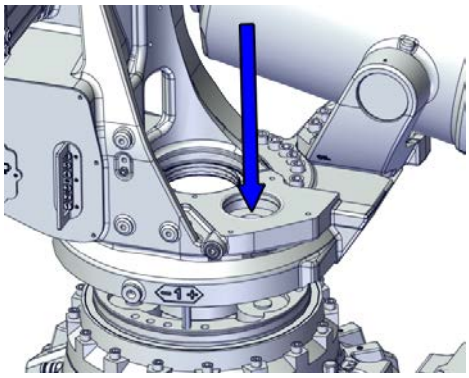
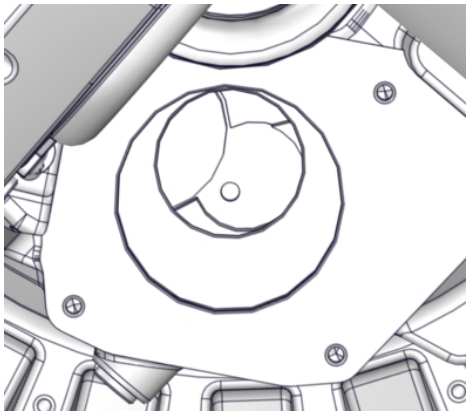
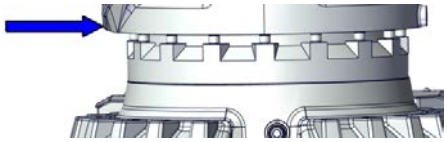
Continues on next page

5.8.1 Replacing the axis-1 gearbox

Continued

	Action	Note
7	Lift the arm system to mounting position, and verify that the hole pattern match and that the guide pins will enter the correct holes in the frame. **Note** Also check that the guiding pin in the gearbox is aligned with the pin hole in the frame.  xx2300000013	 xx2200001419
8	Lower the arm system to align the longest guide pin into the hole.	
9	Lower the arm system to align the other guide pin into the hole.	 xx2200001420

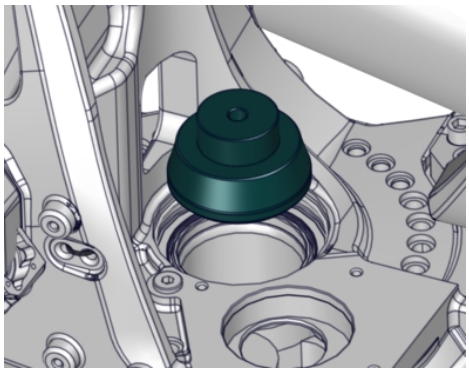
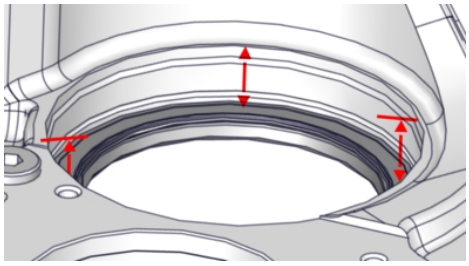
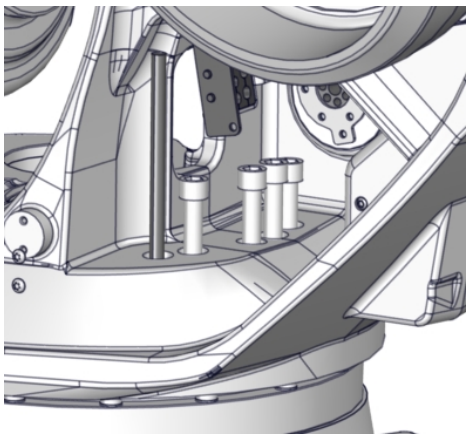
Continues on next page

	Action	Note
10	Visually verify through the axis-1 motor hole that the hole is aligned with the pinion hole in the gearbox.	 xx1700002040  xx2200001613
11	Lower the arm system slowly until the heads of the gearbox attachment screws are starting to disappear inside the frame edge. Verify visually from the side and from the front/back that the frame is coming down completely level against the gearbox. If the frame is somewhat tilted, adjust the lifting position with the overhead crane. **Note** While lowering the complete arm system, check that the cylindrical pin is fitted correctly.	 xx1700002042  xx1700002043
12	Lower the complete arm system into position on top of the gearbox.	

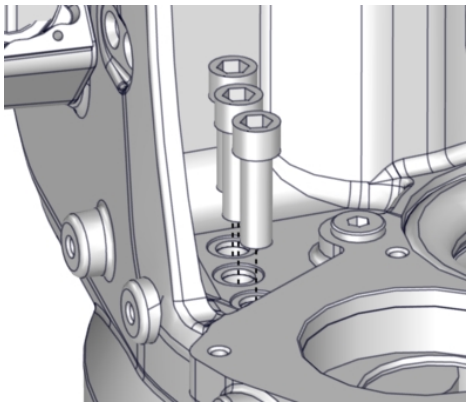
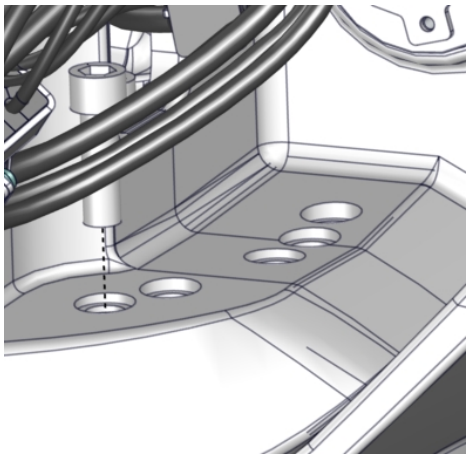
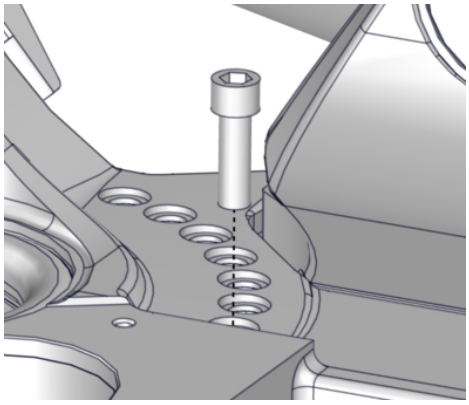
Continues on next page

5.8.1 Replacing the axis-1 gearbox

Continued

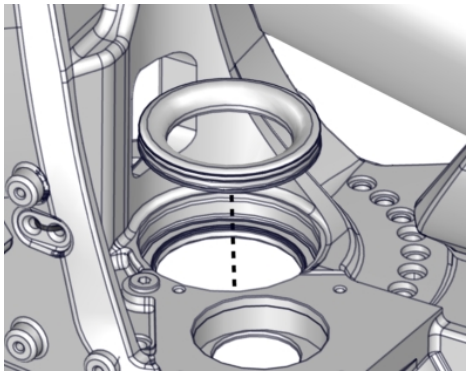
	Action	Note
13	Remove the guide for the reduction gear.	 xx2200001614
14	Measure the distance from the edge of the frame to the radial sealing at three different locations (same locations as before removing the arm system). Compare to the measurements made prior the arm system was refitted to the base. Adjust alignment of the sealing if needed.	 xx2200001611
15	Fit and tighten the accessible attachment screws to secure the frame to the axis-1 gearbox.	Hex socket head cap screw: M16x50 12.9 Gleitmo 603+Geomet 500 Tightening torque: standard torque 300 Nm (*Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws on page 626*).  xx2200001421

Continues on next page

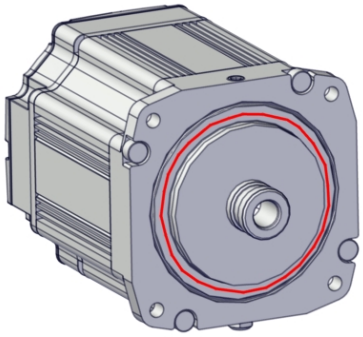
	Action	Note
16	Remove the two guide pins and refit remaining attachment screws. Tighten the remaining, accessible attachment screws.	Tightening torque: standard torque 300 Nm (*Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws on page 626*).  xx2200001403  xx2200001405  xx2200001404

Continues on next page

5.8.1 Replacing the axis-1 gearbox
Continued

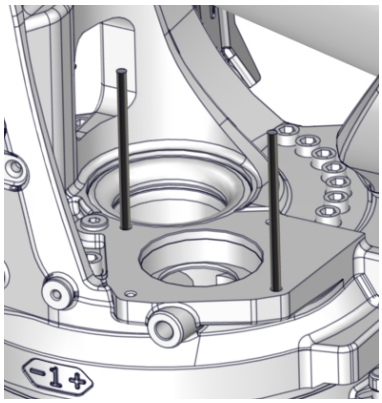
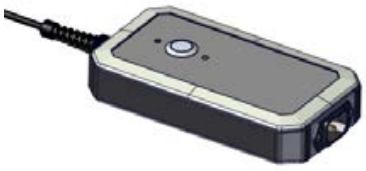
	Action	Note
17	Refit the protection ring. Verify that the o-ring is undamaged and placed in its groove on the protection ring. Replace if damaged.	O-ring: 3HAB3772-58  xx2200001610

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.	

Continues on next page

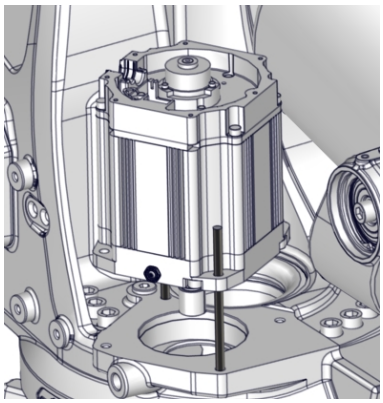
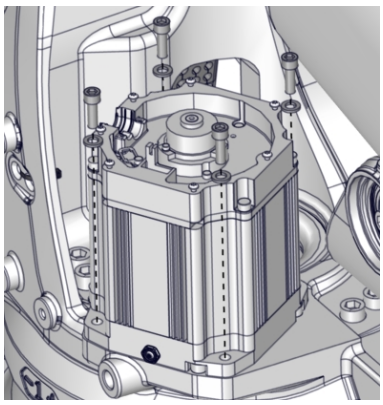
Floor-mounted robot: Refitting the axis-1 motor

	Action	Note
1	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.  xx2200001819
2	**CAUTION** The weight of the motor is 19 kg	
3	Fit the rotation tool.	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
5	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

Continues on next page

5.8.1 Replacing the axis-1 gearbox

Continued

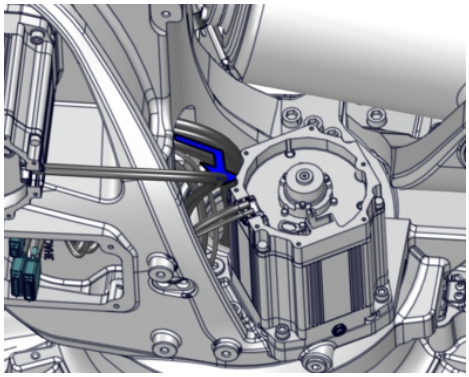
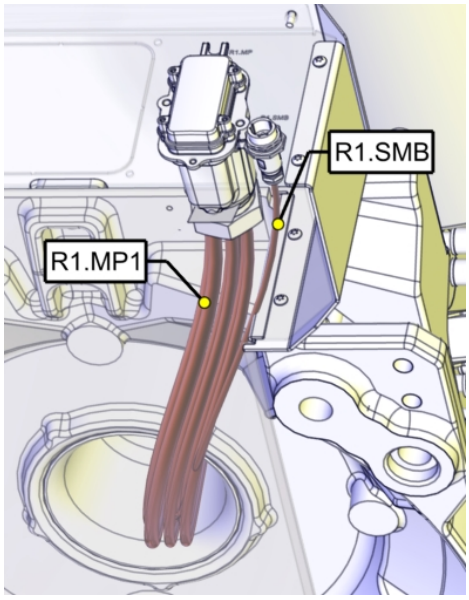
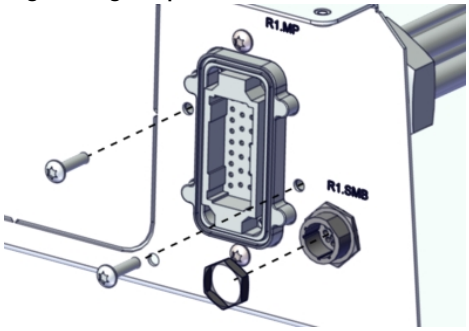
	Action	Note
6	Lower the motor into position. • Make sure that the motor pinion is properly mated to the gear in the gearbox. • Make sure that the motor pinion does not get damaged. • Make sure that the direction of the cable gland exit is facing the correct way.	 xx2200001793
7	Secure the motor with 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.  xx2200001794
8	Disconnect the brake release tool.	
9	Perform a leak-down test.	See *Performing a leak-down test on page 178*.

Refilling oil in the gearbox

	Action	Note
1	Refill oil in the gearbox.	See *Changing the oil in axis-1 gearbox on page 138*.

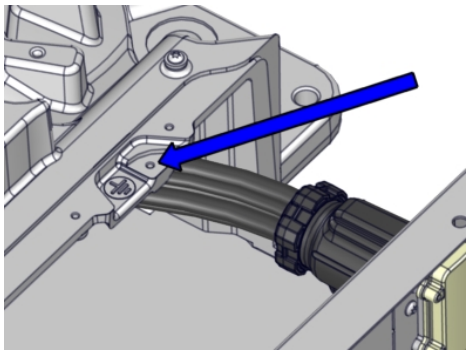
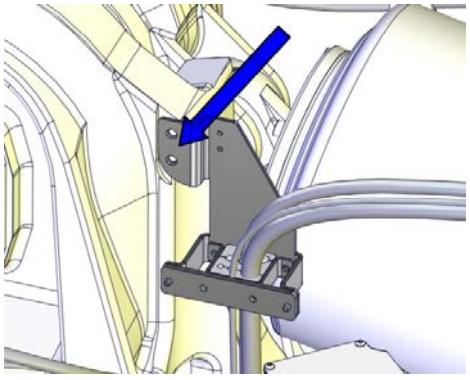
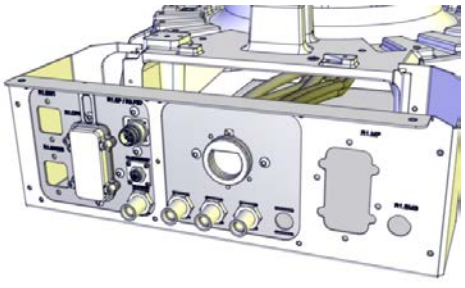
Continues on next page

Refitting the cable harness in the base

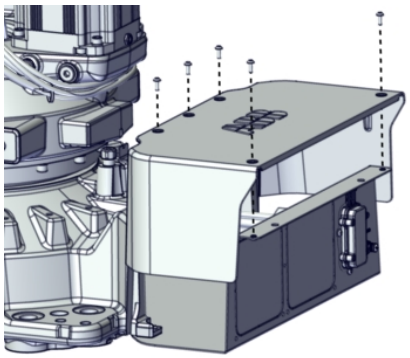
	Action	Note
1	Run the robot cable harness through the frame recess and down through the protection tube.	 xx2200001924
2	Run the cabling through the base. • Make sure that the cables are not twisted. Each cable must be in line with its position on the base plate. • Make sure that the R1.SMB cable will 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

Continues on next page

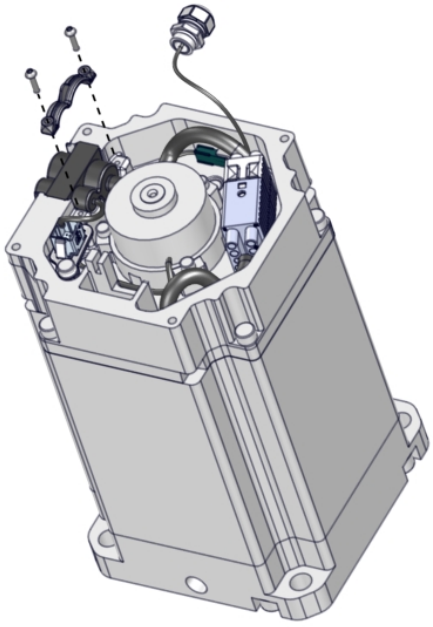
5.8.1 Replacing the axis-1 gearbox
Continued

	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.	
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, fit the bracket that hold the DressPack to the frame.	 xx1400000078
9	If used, connect the DressPack cable package on the base plate.	 xx1200000052

Continues on next page

	Action	Note
10	Refit the base cover.	Torx pan head screw: M6x16 Stainless steel A2-70 (5 pcs) Tightening torque: 10 Nm.  xx2100000981

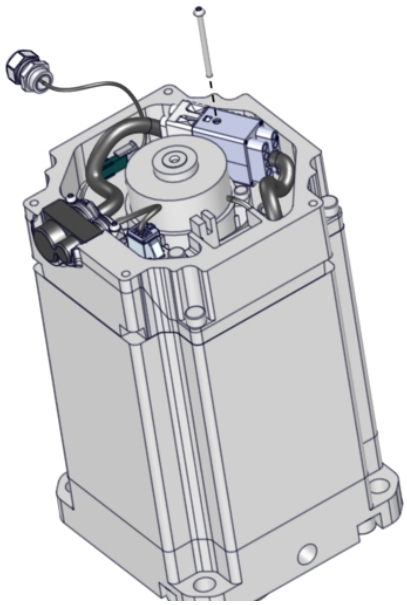
Connecting the axis-1 motor cables

	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.	

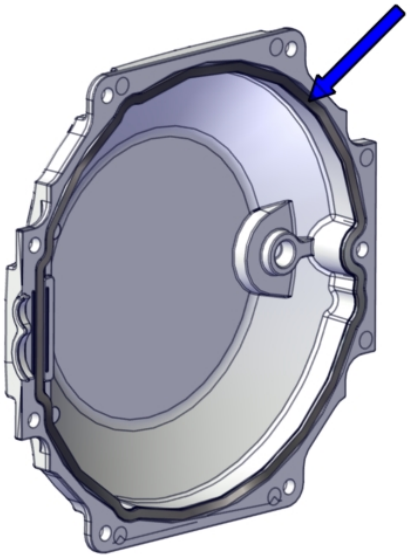
Continues on next page

5.8.1 Replacing the axis-1 gearbox

Continued

	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

Continues on next page

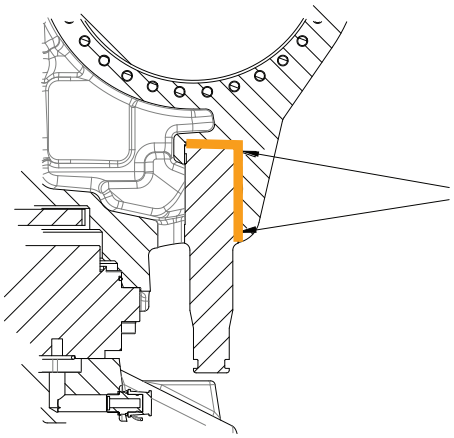
	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1 Connection box cover FS180 with gasket: 3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection) Axis-2 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-3 Connection box cover FS180 with gasket: 3HAC074336-004 (Graphite White) 3HAC074336-005 (ABB Orange) 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

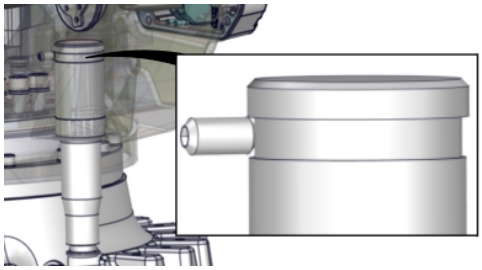
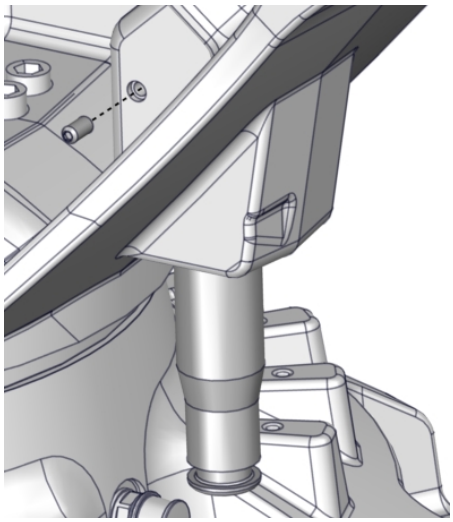
5.8.1 Replacing the axis-1 gearbox
Continued

	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.

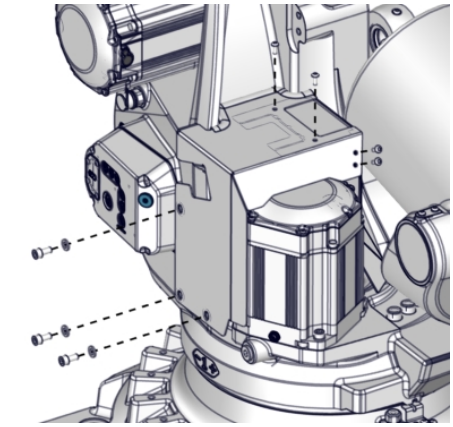
Refitting the mechanical stop

	Action	Note
1	*Protection type Foundry Plus* 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.)  xx2100001139

Continues on next page

	Action	Note
2	Refit the mechanical stop pin and secure it with the attachment screw. Apply locking liquid on the screw. **Note** Do not overtighten the attachment screw, use specified tightening torque. **CAUTION** 1 Push the stop pin all the way up against the frame, and only tighten slightly by hand. 2 Feel that the stop pin can move some millimeters in vertical direction. This verifies that the screw is inserted in the groove, and not against the flange. 3 Tighten the screw with tightening torque.  xx2200001500	Hex socket screw with cup: M10x20 Stainless Steel Locking liquid: - (Loctite 2400 (or equivalent Loctite 243)) Tightening torque: 10 Nm  xx2200001398

Refitting the covers for Foundry Plus and floor mounted robots

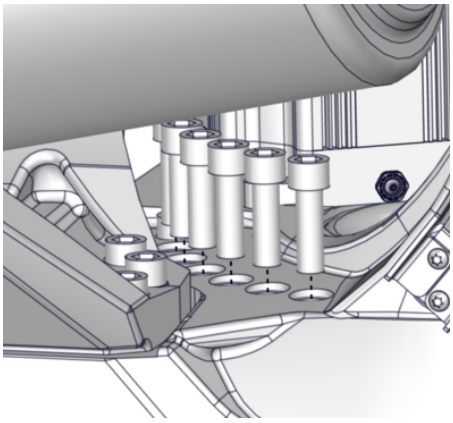
	Action	Note
1	*Protection type Foundry Plus* Refit the axis-1 cable protection plates with the attachment screws.	Torx pan head screw: M6x16 A4-80 (4 pcs) Hex socket head cap screw: M10x16 stainless steel A2-70 (3 pcs)  xx2200001430

Continues on next page

5.8.1 Replacing the axis-1 gearbox

Continued

Concluding procedure

	Action	Note
1	Remove the lifting accessories.	
2	Turn on the power to the robot and jog the robot to calibration position.	
3	Refit the attachment screws underneath the balancing device.	Hex socket head cap screw: M16x50 12.9 Gleitmo 603+Geomet 500 (15 pcs) Tightening torque: standard torque 300 Nm (*Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws on page 626*).  xx2200001401
4	Calibrate the robot.	See *Calibration on page 585*.
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 94*.	

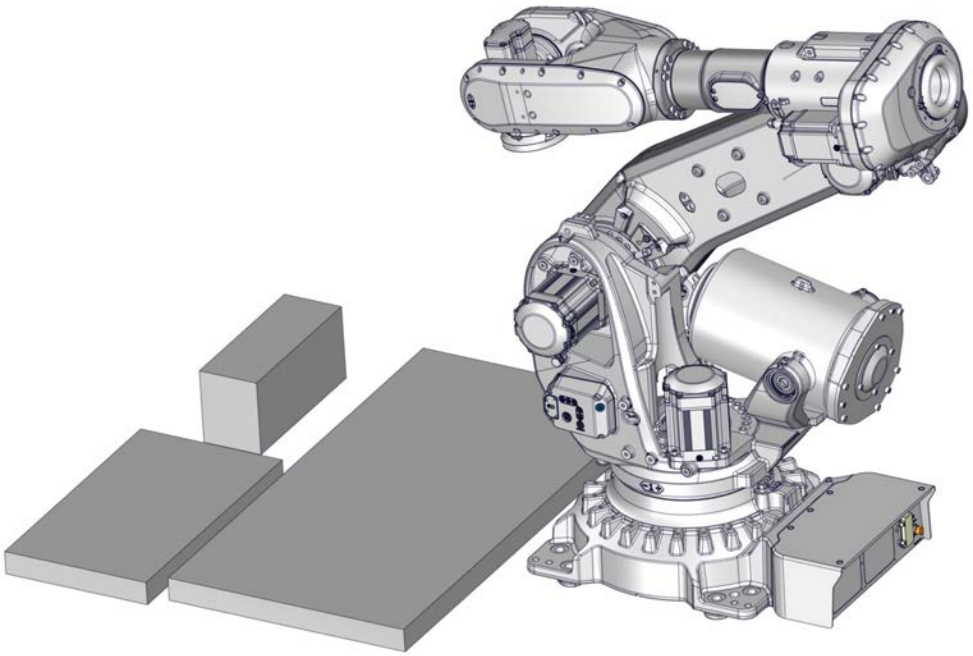
5.8.2 Replacing the axis-2 gearbox

Space required nearby robot

This section describes how to replace the gearbox without needing to remove the cable harness and DressPack cable package (if installed) from the robot.

The described procedure requires free space on the floor nearby the robot. There should be enough space to place foam boards, pallets or similar protective material nearby the robot.

If needed, run axis-1 into a position that gives the required space. The figure shows an example.



xx2300000026

Note

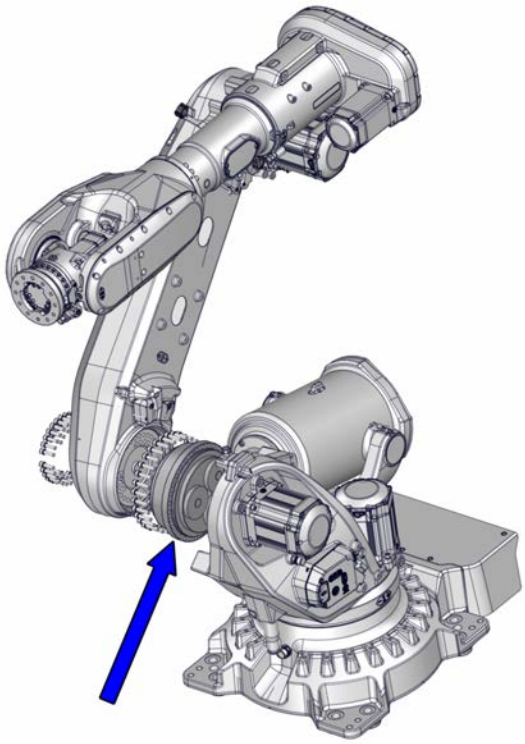
Keeping the cable harness and DressPack fitted on the robot during gearbox replacement is only a recommendation. If it is not possible to put the lower and upper arm close enough to the robot, the cable harness and DressPack in the base and in the frame must be removed first.

Continues on next page

5.8.2 Replacing the axis-2 gearbox
Continued

Location of the gearbox

The gearbox is located as shown in the figure.



xx2200001390

Summary of the replacement procedure

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

1. Remove the balancing device link ear shaft.
2. Drain the axis-2 gearbox.
3. Loosen the cabling brackets inside the lower arm and on the frame.
4. Remove the upper and lower arm mounted together, as an assembly.
5. Remove the axis-2 motor.
6. 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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Continues on next page

Spare part	Article number	Note	Level
Gearbox	3HAC082815-003 (Graphite White) 3HAC082815-004 (ABB Orange)	Includes o-ring	L2

Required tools and equipment

Equipment	Article number	Note
Hydraulic press equipment, balancing device	3HAC074411-001	Used to unload or restore a balancing device. User instructions are enclosed with the tool.
Dismantle and mounting tool	3HAC028920-001	Used for removing and fitting shaft and bearings. User instructions are enclosed with the tool.
Hydraulic pump 80 MPa	3HAC13086-1	To be used with the press and puller tools. See technical specifications in the user instructions for the press equipment.
Hydraulic cylinder	3HAC11731-1	To be used with the press and puller tools. See technical specifications in the user instructions for the press equipment.
Lifting eye	3HAC16131-1	M12, 2 pcs
Lifting shackle	-	SA-10-8-NA1
Fender washer	-	Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Roundsling, 1.5 m	-	Length: 1.5 m.
Roundsling, 1 m	-	Length: 1 m.
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
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.
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Guide pin, M12x150 / Guide pin, M12x200	3HAC13056-2 / 3HAC13056-3	Always use guide pins in pairs.
Screws M10x80, fully threaded	-	Used to push out the gearbox, if necessary.
Lifting accessory for gear	3HAC081585-001	For lifting the gearbox

Continues on next page

5.8.2 Replacing the axis-2 gearbox
Continued

Equipment	Article number	Note
Rotation tool M4	3HAB7887-1	Used to rotate the motor pinion. Add screw M4.
Adjustment tool for gear	3HAC080331-001	Used to rotate the gear for matching hole pattern with frame.
Calibration toolbox, Axis Calibration	3HAC074564-001 (axes 1, 2, 3 and 4) 3HAC074119-001 (axes 5 and 6)	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 628*.

Required service parts

Consumable	Article number	Note
O-ring	3HAC061327-066	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-2 motor
O-ring, G 1/2"	3HAC061327-059	Used on oil plug. Always replace when refitting oil plug.
Cleaning agent	-	Isopropanol
Grease	3HAC042536-001	Shell Gadus S2
Rust preventive	3HAC034903-001	Mercasol 3110 Waxcoat. Recommended drying time is 24h.
Cleaning agent	-	Loctite 7200
Cleaning agent	-	Loctite 7063
Flange sealant	-	Loctite 5800
Lubricating oil	-	See *Type of lubrication in gearboxes on page 136*.
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

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 595*.
	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 gearbox.

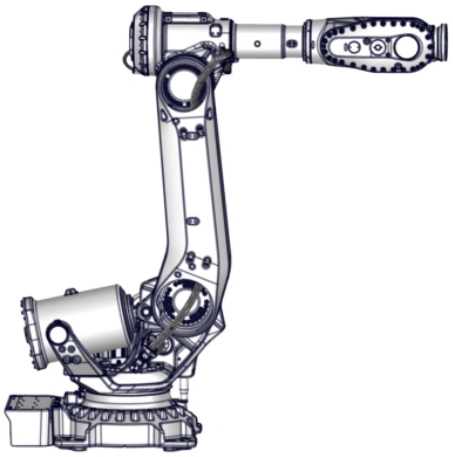
CAUTION

When performing these procedures, the cable harness will still be fitted or partly fitted to the robot. Use extreme caution not to cause any damage to the cable harness.

Continues on next page

5.8.2 Replacing the axis-2 gearbox
Continued

Preparations before unloading the balancing device

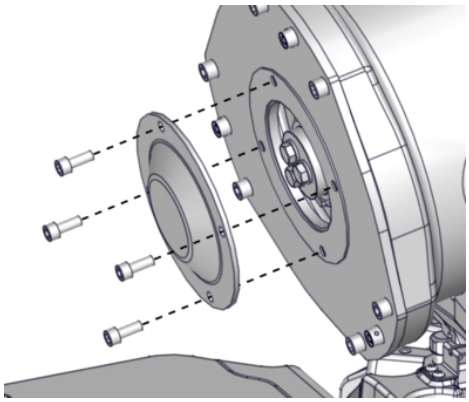
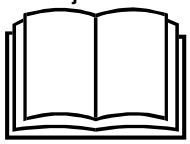
	Action	Note
1	Jog axis-2 to the calibration position.	 xx2200001458
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Unloading the balancing device springs and locking position with the Hydraulic press equipment, balancing device

Use this procedure to unload and lock the balancing device in unloaded position with the Hydraulic press equipment, balancing device (3HAC074411-001).

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

Continues on next page

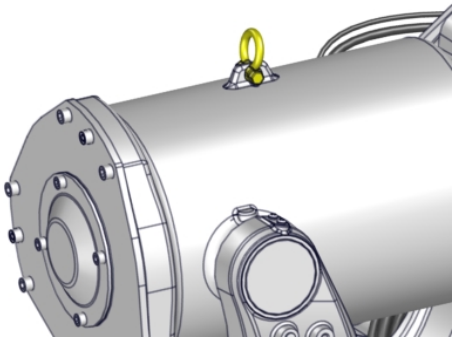
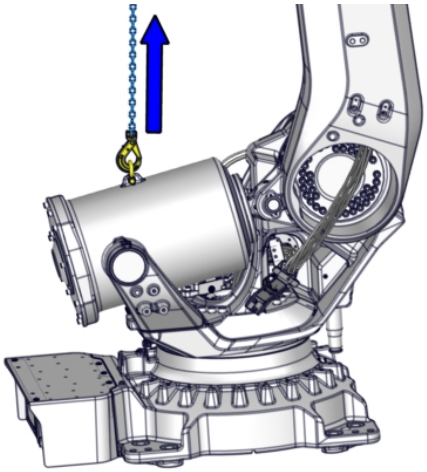
	Action	Note
2	Remove the cover plate on the back of the balancing device. **DANGER** DO NOT remove any other screws than the rear cover attachment screws.	 xx2200001330
3	Unload the balancing device with the press equipment, to make the piston rod and front ear adjustable when pulling the shaft out.  xx0900000813 Go to the user instructions enclosed with the press tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Hydraulic press equipment, balancing device: 3HAC074411-001 User instructions are enclosed with the tool.

Attaching lifting accessory to the balancing device

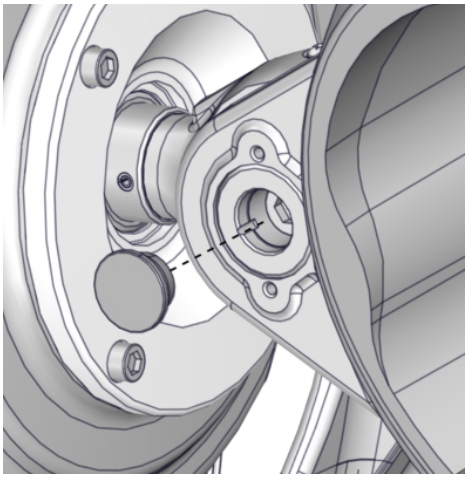
	Action	Note
1	**CAUTION** The weight of the balancing device (excluding cradle) is 140 kg All lifting accessories used must be sized accordingly.	

Continues on next page

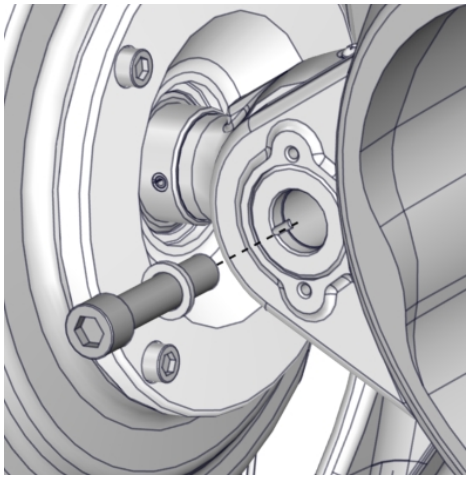
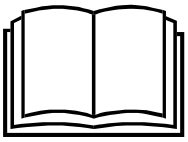
5.8.2 Replacing the axis-2 gearbox
Continued

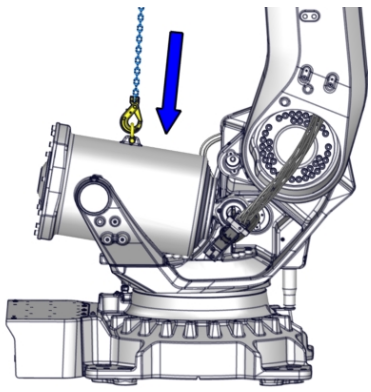
	Action	Note
2	Fit a lifting shackle to the balancing device.	Lifting shackle: SA-10-8-NA1  xx2200001355
3	Fit the lifting accessory to the shackle and raise to unload the weight.	Lifting accessory (chain): 3HAC15556-1  xx2200001459

Removing the shaft in the front (link ear)

	Action	Note
1	Remove the protection plug at the link ear.	 xx2200001460

Continues on next page

	Action	Note
2	Unscrew the attachment screw and washer.	Hex socket head cap screw: M16x70 8.8-A3F Washer: Steel 17x25x3  xx2200001461
3	Pull the shaft out using the dismantle and mounting tool, according to user instructions enclosed with the equipment.  xx0900000813 Go to the user instructions enclosed with the press tool.  **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Dismantle and mounting tool: 3HAC028920-001 User instructions are enclosed with the tool.

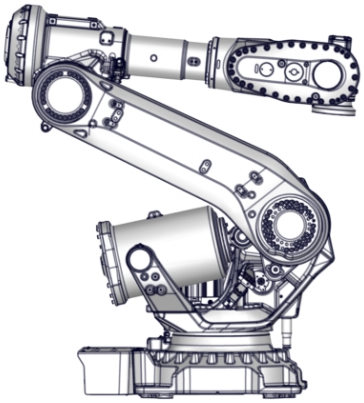
	Action	Note
1	Put down the balancing device and let it rest on the frame.	 xx2200001462

Continues on next page

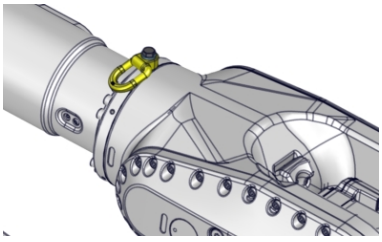
5.8.2 Replacing the axis-2 gearbox

Continued

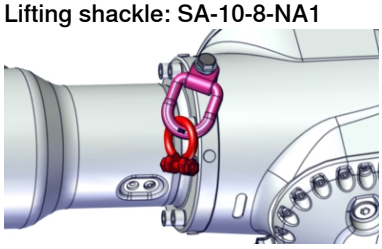
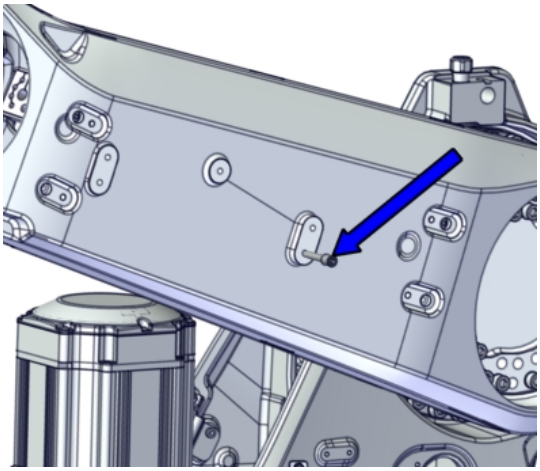
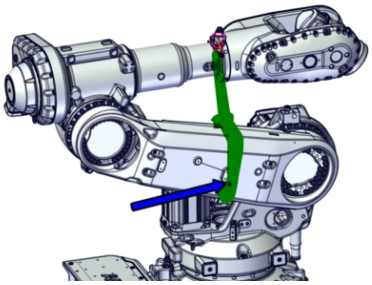
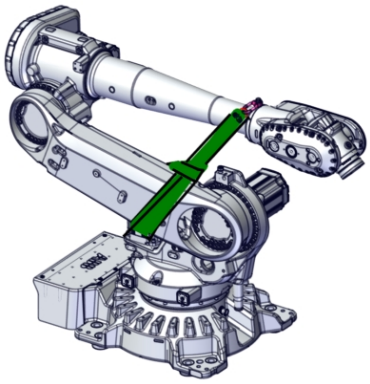
Preparations before removing the gearbox

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Jog the robot into position: • Axis 1: 0° • Axis 2: -60° • Axis 3: +65° (approximately) • Axis 4: 0° • Axis 5: +90° • Axis 6: +90° (if DressPack is installed) **CAUTION** Check that the balancing device ear does not collide with the ear on the lower arm when jogging the axis-2 into position.	 xx2200001615
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
4	Begin draining the gearbox.	See *Draining the axis-2 gearbox on page 145*.

Attaching lifting accessories to the lower and upper arm

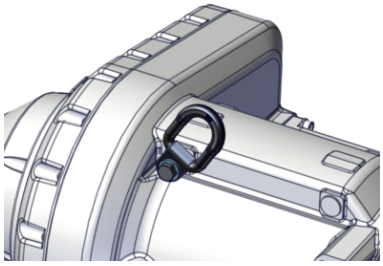
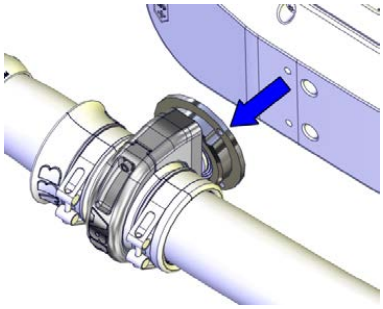
	Action	Note
1	**CAUTION** The weight of the complete upper and lower arm together is 470 kg All lifting accessories used must be sized accordingly.	
2	Fit a lifting eye to the wrist.	Lifting eye: 3HAC16131-1  xx2200001522

Continues on next page

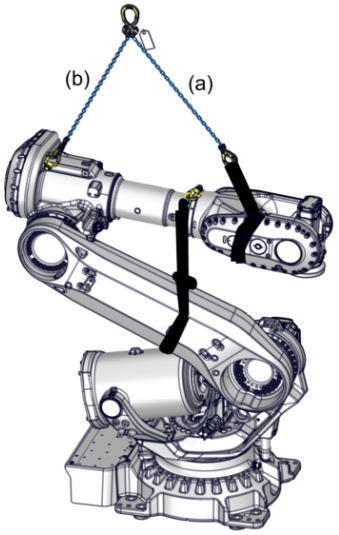
	Action	Note
3	Fit a lifting shackle in the wrist lifting eye.	Lifting shackle: SA-10-8-NA1  xx2100001414
4	Run a roundsling around the lower arm. If DressPack cable package is installed: place the roundsling beneath the ball joint housing on the outside of the lower arm instead.	Roundsling, 1.5 m Example where securing screw is needed:
5	Attach the roundsling to the shackle on the wrist. If there is a risk that the roundsling will slide (depends on robot variant), insert a M12x50 securing screw, not more than 10-15 mm, into the screw hole shown in the figure. If DressPack cable package is installed: use the ball joint housing instead, in the same way.  xx2100001412	 xx2100001415 Example where securing screw is not needed:  xx2100001469
6	Stretch the roundsling between the wrist and the lower arm by slowly jogging the axis-3. **Note** Make sure the roundsling is stretched, in order to carry the weight of the lower arm.	

Continues on next page

5.8.2 Replacing the axis-2 gearbox
Continued

	Action	Note
7	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
8	Fit a lifting eye in the arm house, with a fender washer underneath.	Lifting eye: 3HAC16131-1 Fender washer: Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.  xx2100002146
9	If the robot is equipped with DressPack, unscrew the attachment screws of the bracket that holds the ball joint housings on the wrist. The DressPack can stay fitted in the ball joint housing.	 xx1400000355
10	Move the DressPack cable package over to the other side of where the lifting accessory will be attached to the shackle on the arm house.	

Continues on next page

	Action	Note
11	Attach the Lifting accessory (chain) to an overhead crane (or similar), then to the lifting eye in the arm house and to a roundsling run through the wrist. Adjust the chain lengths to make the lift as level as possible.	Lifting accessory (chain): 3HAC15556-1 Roundsling, 1 m  xx2200001619 The figure shows an example of lifting chain lengths. Keep chain (a) shorter than chain (b).
12	Raise the overhead crane to stretch the chains and roundslings. Verify that the roundsling between the wrist and the lower arm is stretched.	

Loosening the cable brackets

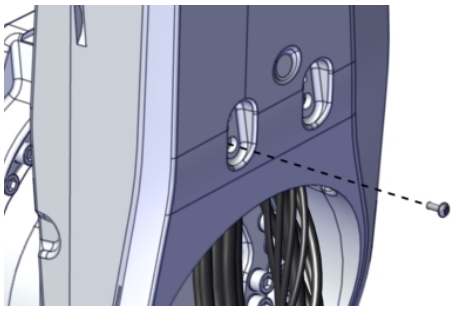
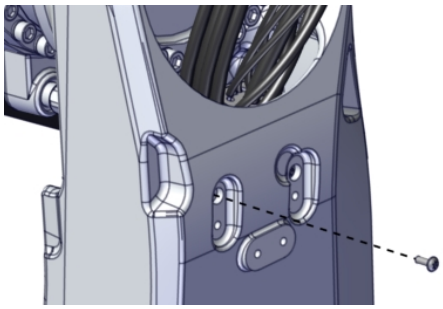
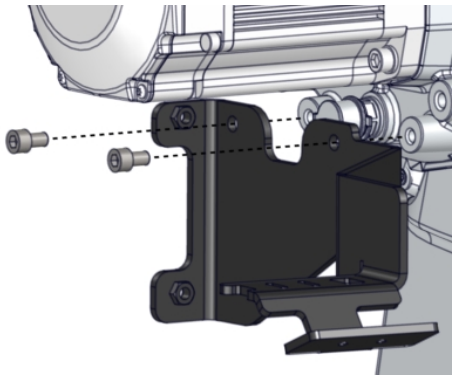
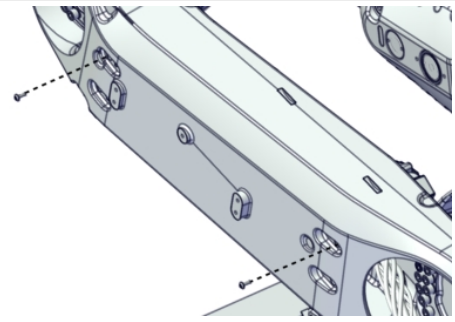
Use this procedure to lift the lower and upper arm mounted together, with the cable harness and DressPack kept installed in the base and in the frame.

Note

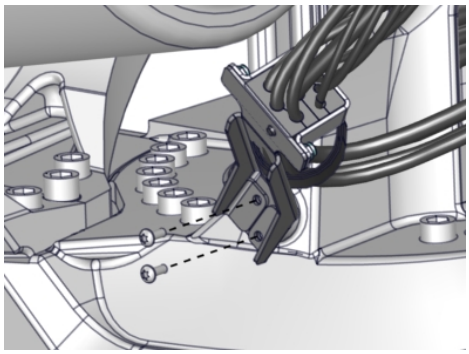
Keeping the cable harness and DressPack fitted on the robot during gearbox replacement is only a recommendation. If it is not possible to put the lower and upper arm close enough to the robot, the cable harness and DressPack in the base and in the frame must be removed first.

Continues on next page

5.8.2 Replacing the axis-2 gearbox
Continued

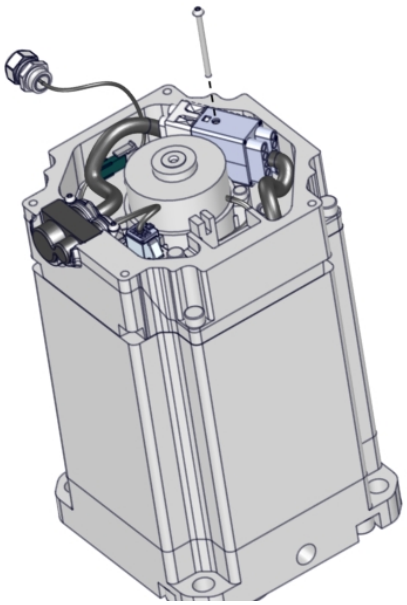
	Action	Note
1	If robot is equipped with DressPack: Remove the cable brackets inside the lower arm, by removing the attachment screws.	 xx2100002702  xx2100002701
2	If robot is equipped with DressPack: Remove the mounting plate from the arm house.	 xx2300001036
3	Unscrew the attachment screws that secure the axis-2 lower arm metal clamp and the axis-3 lower arm metal clamp located on the inside of the lower arm by removing the attachment screws.	 xx2100001104

Continues on next page

	Action	Note
4	Loosen the cable bracket from the frame by removing the nuts. Let it hang loose.	 xx2200001388

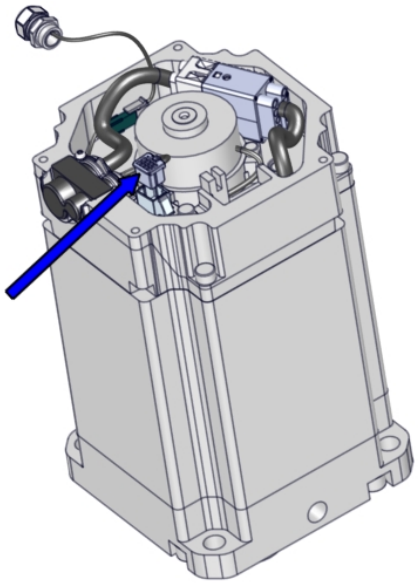
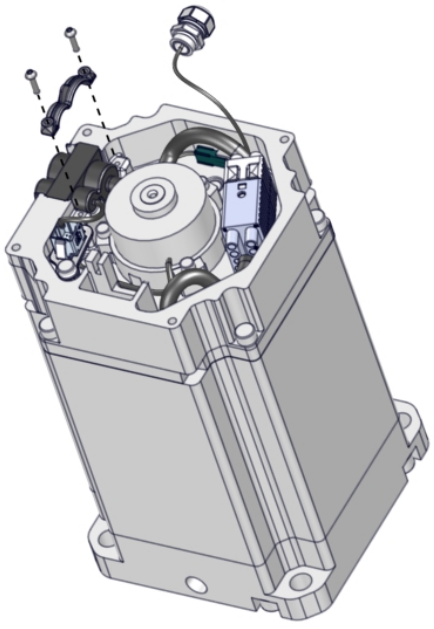
Disconnecting the axis-2 motor cables

Use this procedure to disconnect 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.	
3	Disconnect the power cable connector by first removing the attachment screw and then parting the connector.	 xx2200001736

Continues on next page

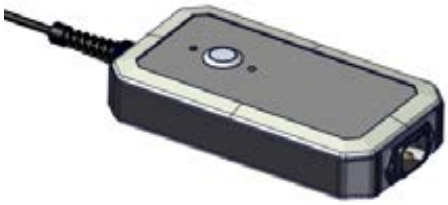
5.8.2 Replacing the axis-2 gearbox
Continued

	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-2 motor

	Action	Note
1	Before removing the motor, make sure that the gearbox is completely drained.	

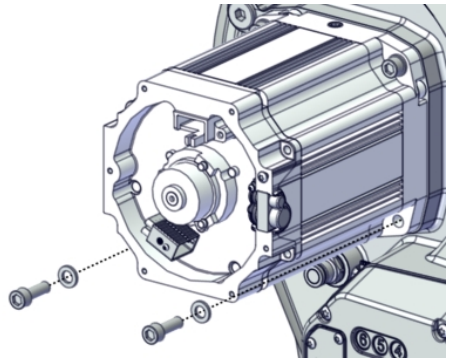
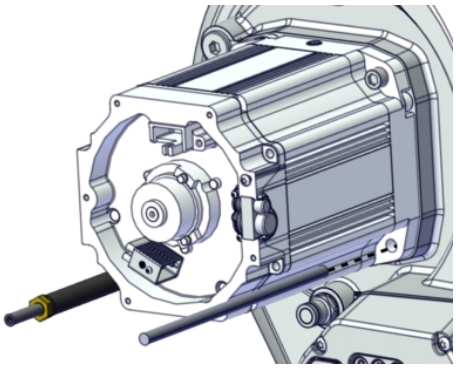
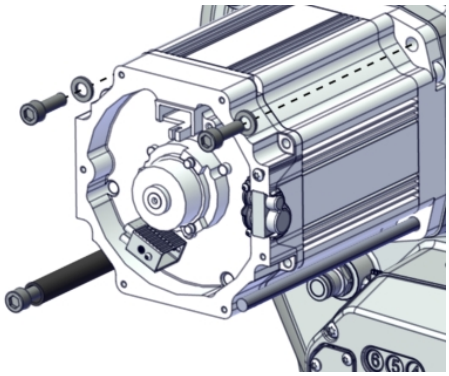
Continues on next page

	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 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

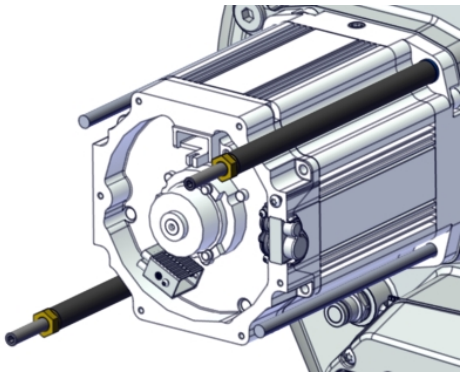
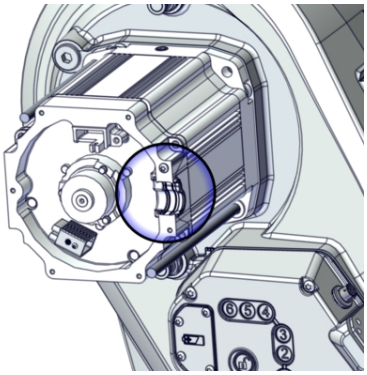
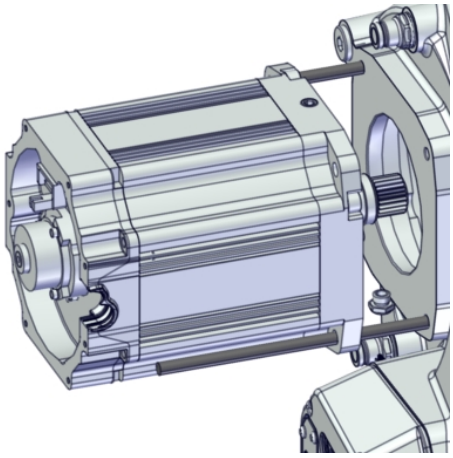
Continues on next page

5.8.2 Replacing the axis-2 gearbox

Continued

	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

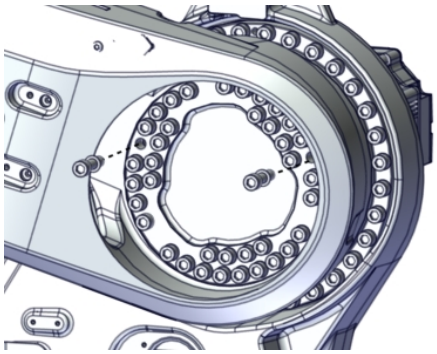
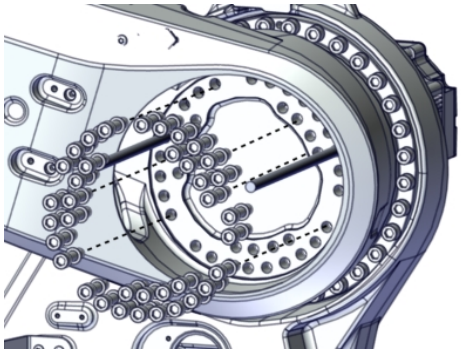
	Action	Note
7	Fit a guide pin in the non-threaded hole. Fit a removal tool in the threaded hole. **Tip** Lubricate the guide pins with some grease to make the motor slide better.	Guide pin, M10x150: 3HAC15521-2 Removal tool motor M12: 3HAC14631-1  xx2300000043
8	**CAUTION** Whenever parting/mating motor 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 21 kg	
12	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	 xx2000000457 Make sure the pinion is not damaged.

Continues on next page

5.8.2 Replacing the axis-2 gearbox
Continued

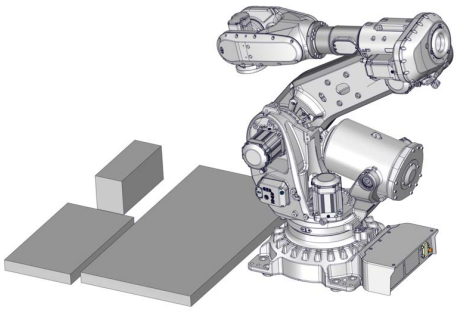
Removing and lifting away the lower and upper arms un-separated (Step 1)

Use this procedure for the first step of removing and lifting away the lower and upper arm un-separated.

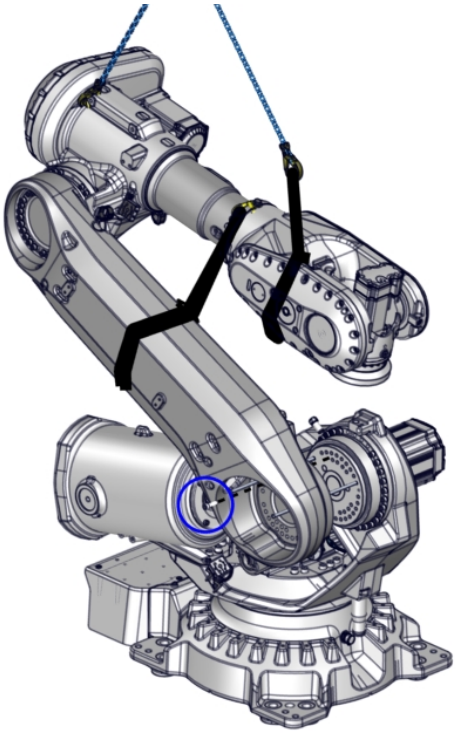
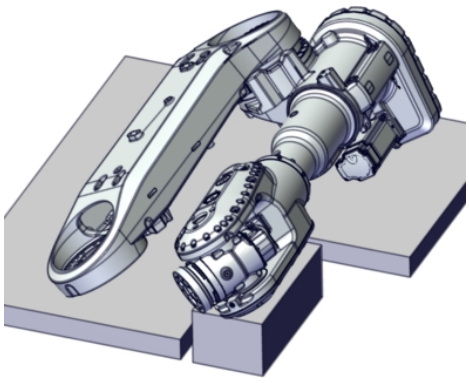
	Action	Note
1	Remove two attachment screws in opposite holes and replace them with guide pins. **Tip** Use different lengths on the guide pins to simplify guidance. **Tip** Lubricate the guide pins with some grease to make the lower arm slide better.	Guide pin, M12x150 / Guide pin, M12x200: 3HAC13056-2 / 3HAC13056-3 Always use guide pins in pairs.  xx2000000458
2	Remove all but one of the remaining attachment screws that secure the lower arm to the axis-2 gearbox.	 xx2000000459

Removing and lifting away the lower and upper arms un-separated (Step 2)

Use this procedure for the second step to remove and lift the lower and upper arm un-separated.

	Action	Note
1	Put two foam boards, pallets or similar protective material on the floor, somewhere close to the robot. Put one higher foam block as protection for the wrist. If needed, move axis-1 into a position that gives the required space. **Note** Keeping the cable harness and DressPack fitted on the robot during gearbox replacement is only a recommendation. If it is not possible to put the lower and upper arm close enough to the robot, the cable harness and DressPack in the base and in the frame must be removed first.	 xx2300000026

Continues on next page

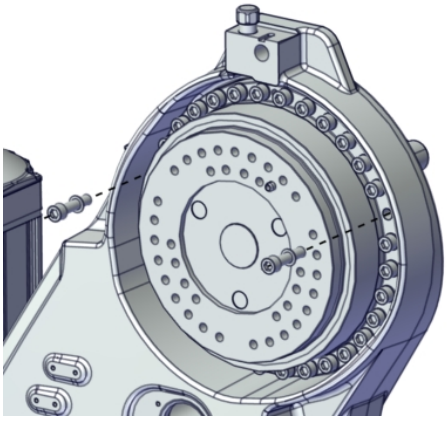
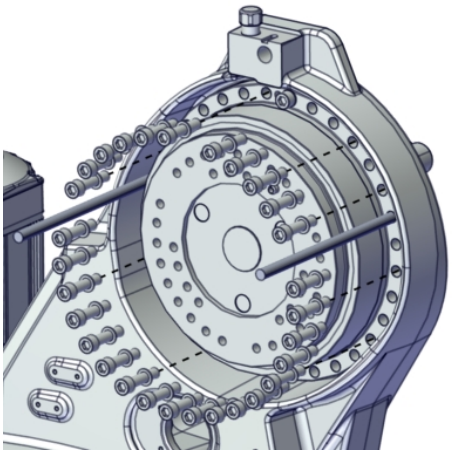
	Action	Note
2	**CAUTION** The weight of the complete upper and lower arm together is 470 kg All lifting accessories used must be sized accordingly.	
3	Remove the remaining screw and slowly lift away the lower and upper arm together. Let the cabling run in the lower arm. Make sure not to stretch any cabling! **CAUTION** Use extreme caution when lifting away the arms. The cable harness is still partly connected.	Image does not show the installed cable harness.  xx2300000029
4	Lift the arm system and lay it down safely on the boards. Use a higher block as support under the wrist unit when the arms are put down on the boards. **CAUTION** Check that the cable bracket underneath the arm housing is not damaged.	 xx2100001103

Continues on next page

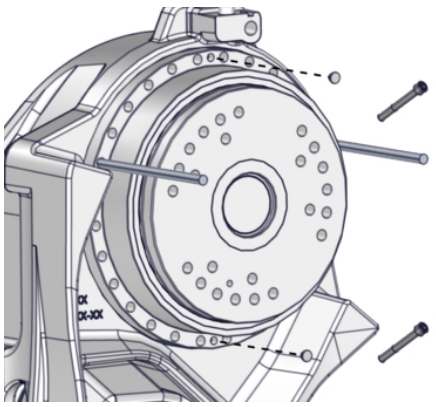
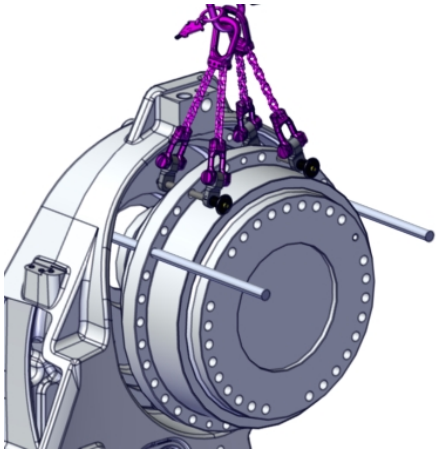
5.8.2 Replacing the axis-2 gearbox

Continued

Removing the axis-2 gearbox

	Action	Note
1	Remove two attachment screws from opposite positions and replace them with guide pins. **CAUTION** Use stoppers on the guide pins. **Tip** Use different lengths on the guide pins to simplify guidance. **Tip** Lubricate the guide pins with some grease to make the lower arm slide better.	Guide pin, M12x150 / Guide pin, M12x200: 3HAC13056-2 / 3HAC13056-3 Always use guide pins in pairs.  xx2000000464
2	Leave one of the upper attachment screws and remove the rest. The remaining screw is used to prevent the gearbox from falling down.	 xx2000000465
3	**CAUTION** The weight of the gearbox is 60 kg All lifting accessories used must be sized accordingly.	
4	Remove the remaining screw left in the gearbox.	

Continues on next page

	Action	Note
5	Remove the two protection plugs and use removal tools to press the gearbox out of position.	Screws M10x80, fully threaded: -  xx2300000159
6	Use caution and let the gearbox slide out on the guide pins. **CAUTION** Use stoppers on the guide pins.	Lifting accessory for gear: 3HAC081585-001  xx2100002414
7	Attach the lifting accessory to the gearbox.	
8	Remove the stoppers from the guide pins and remove the gearbox.	

Refitting the gearbox

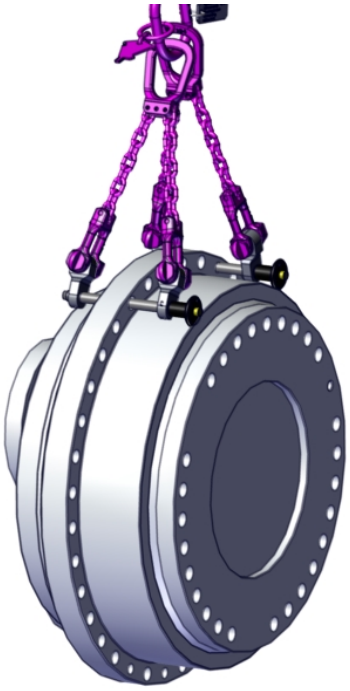
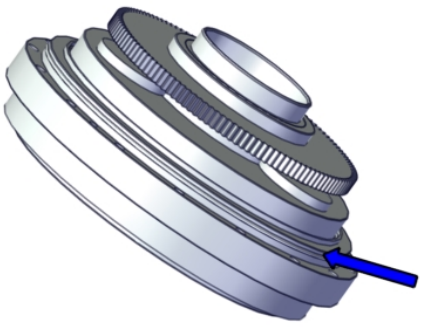
Use these procedures to refit the gearbox.

Preparations before refitting the axis-2 gearbox

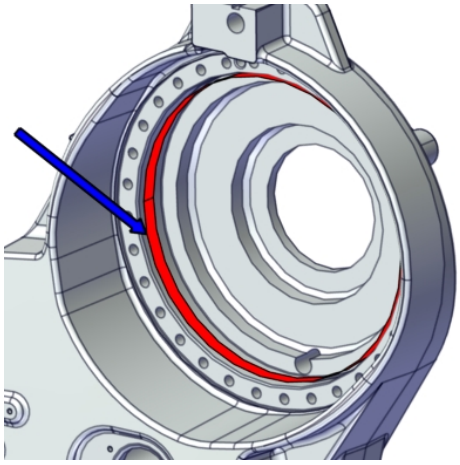
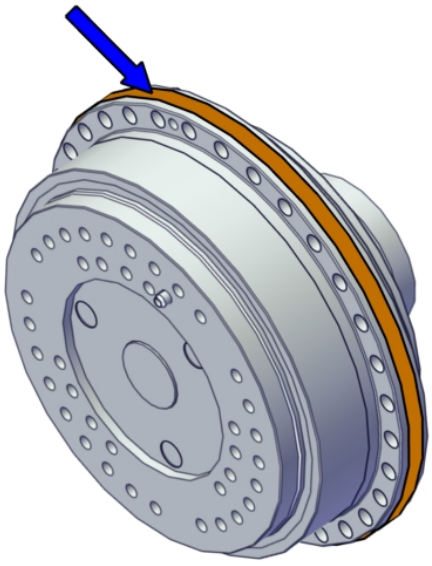
	Action	Note
1	**CAUTION** The weight of the gearbox is 60 kg All lifting accessories used must be sized accordingly.	

Continues on next page

5.8.2 Replacing the axis-2 gearbox
Continued

	Action	Note
2	Apply the lifting accessory to the gearbox.	Lifting accessory for gear: 3HAC081585-001  xx2100002416
3	Lift the gearbox so that it rests on its side.	
4	Wipe clean the contact surfaces on both the gearbox and the frame from any contamination. **Note** Also wipe clean the o-ring groove.	Cleaning agent: Isopropanol
5	Check the o-ring. Replace if damaged.	O-ring: 3HAC061327-066  xx2100001132

Continues on next page

	Action	Note
6	Lubricate the contact surface (where the o-ring is seated) on the gearbox with grease.	Grease, Shell Gadus S2: 3HAC042536-001.  xx2100002792
7	Apply rust preventive to the gearbox surface shown in the figures.	Rust preventive: 3HAC034903-001 (Mercasol 3110 Waxcoat. Recommended drying time is 24h.)  xx2100001105

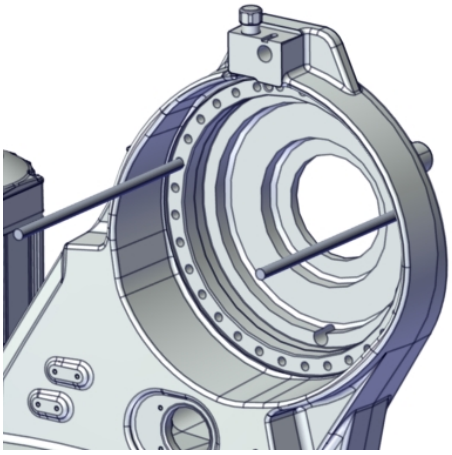
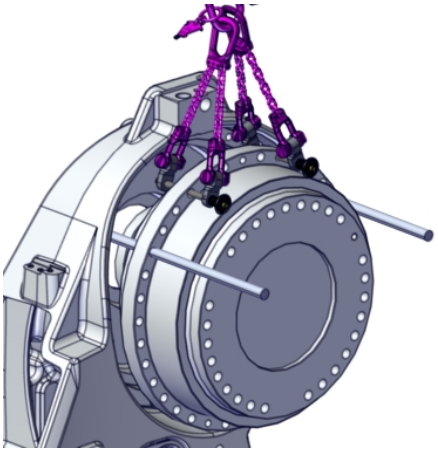
Refitting the axis-2 gearbox

Use this procedure to refit the gearbox.

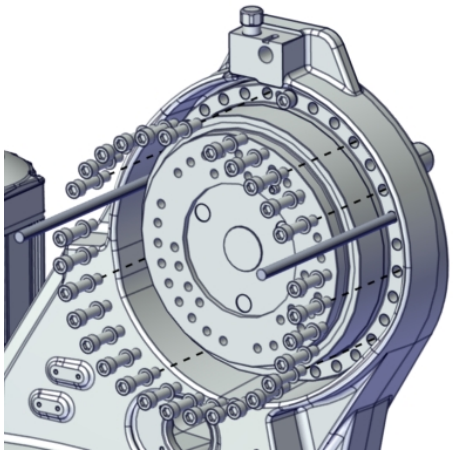
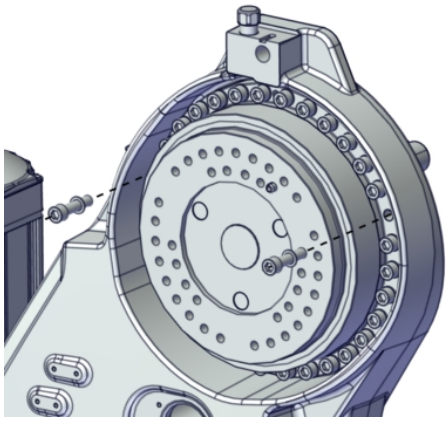
	Action	Note
1	**CAUTION** The weight of the gearbox is 60 kg All lifting accessories used must be sized accordingly.	

Continues on next page

5.8.2 Replacing the axis-2 gearbox
Continued

	Action	Note
2	Fit two guide pins in opposite holes. **Tip** Use different lengths on the guide pins to simplify guidance. **Tip** Lubricate the guide pins with some grease to make the gearbox slide better.	Guide pin, M12x150 / Guide pin, M12x200: 3HAC13056-2 / 3HAC13056-3 Always use guide pins in pairs.  xx2000000466
3	Lift the gearbox and let it rest on the guide pins. **CAUTION** Use stoppers on the guide pins.	 xx2100002414
4	Remove the lifting accessory. **DANGER** There is a risk that the gearbox may glide out and fall down if it is too far out to on the guide pins and no stoppers are used.	

Continues on next page

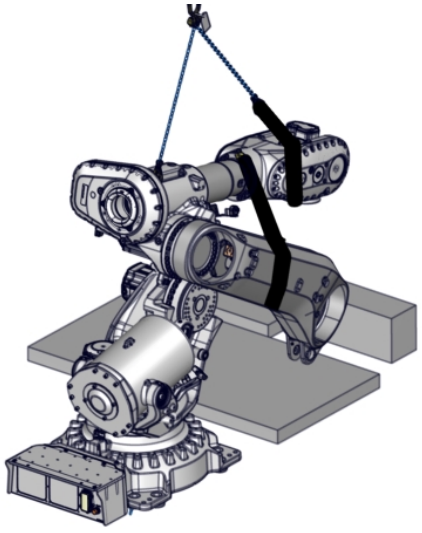
	Action	Note
5	Slide the gearbox into position and fit the attachment screws and washers.	Hex socket head cap screw: M12x50 12.9 Gleitmo 603+Geomet 500 (32 pcs).  xx2000000465
6	Remove the guide pins and fit the remaining attachment screws and washers.	 xx2000000464
7	Tighten the attachment screws.	Tightening torque: standard torque 120 Nm (*Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws on page 626*)..

Continues on next page

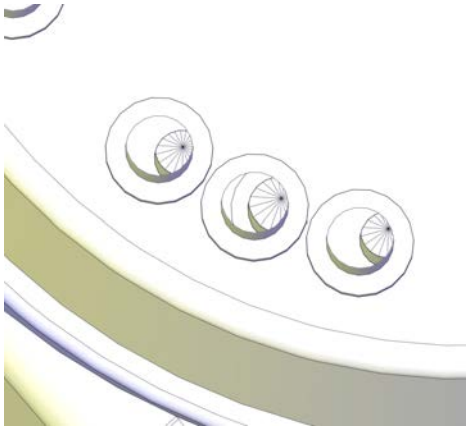
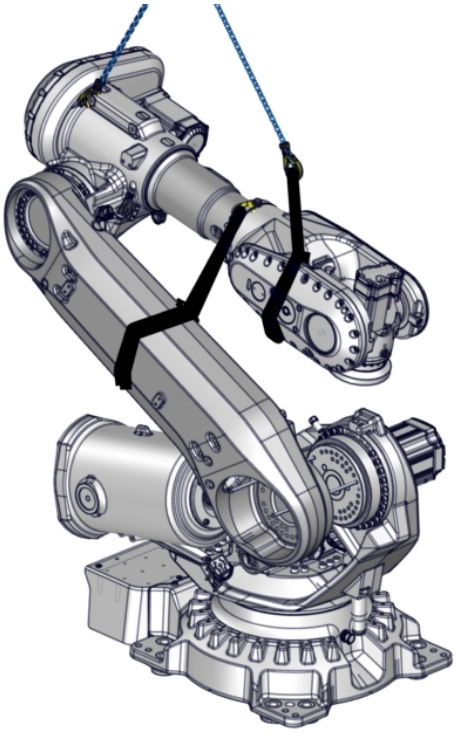
5.8.2 Replacing the axis-2 gearbox
Continued

Lifting back and refitting the lower and upper arm

Use this procedure to lift back and refit the lower and upper arm mounted together.

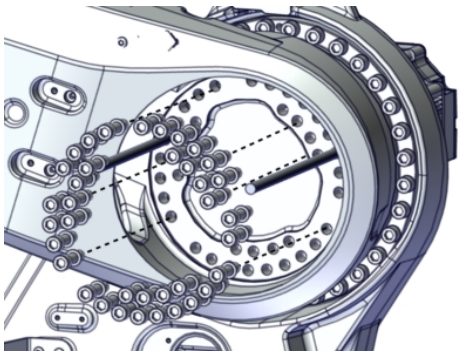
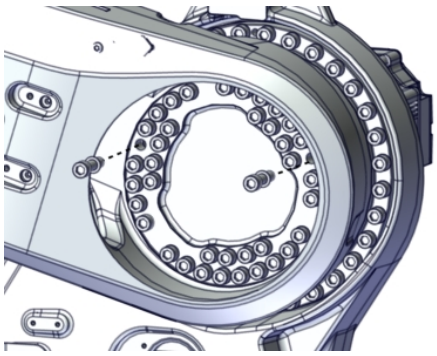
	Action	Note
1	Fit two guide pins in opposite holes in the axis-2 gearbox. **Tip** Use different lengths on the guide pins to simplify guidance. **Tip** Lubricate the guide pins with some grease to make the lower arm slide better.	Guide pin, M12x150 / Guide pin, M12x200: 3HAC13056-2 / 3HAC13056-3 Always use guide pins in pairs.  xx2100001217
2	**CAUTION** The weight of the complete upper and lower arm together is 470 kg All lifting accessories used must be sized accordingly.	
3	Attach the lifting accessories to the arm assembly, if not already fitted.	
4	Use caution and slowly lift the lower and upper arm together. Make sure: • not to stretch any of the cables • that the arm package is level when lifted.	 xx2300000027

Continues on next page

	Action	Note
5	Guide the lower arm onto the guide pins and check if the hole pattern between the gearbox and the lower arm matches. If the hole pattern does not match, use the adjustment tool in the axis-2 gear and rotate until a matching hole pattern is achieved.  xx1300000819	Adjustment tool for gear: 3HAC080331-001
6	Slide the arms into position on the guide pins.	 xx2300000028

Continues on next page

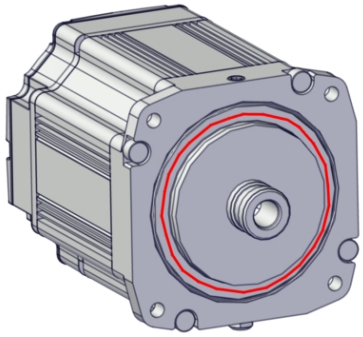
5.8.2 Replacing the axis-2 gearbox
Continued

	Action	Note
7	Fit all now accessible attachment screws and washers.	Screws: M12x40 12.9 Gleitmo 603+Geomet 500 (39 pcs)  xx2000000459
8	Remove the two guide pins and replace with the remaining attachment screws and washers.	Screws: M12x40 12.9 Gleitmo 603+Geomet 500  xx2000000458
9	Tighten the attachment screws.	Tightening torque: standard torque 120 Nm (*Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws on page 626*).
10	Remove the lifting accessories.	

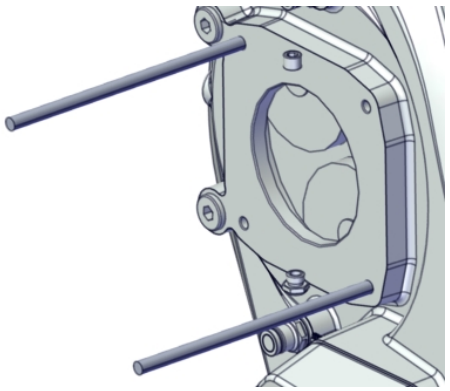
Preparations prior to refitting motor

	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

	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.	

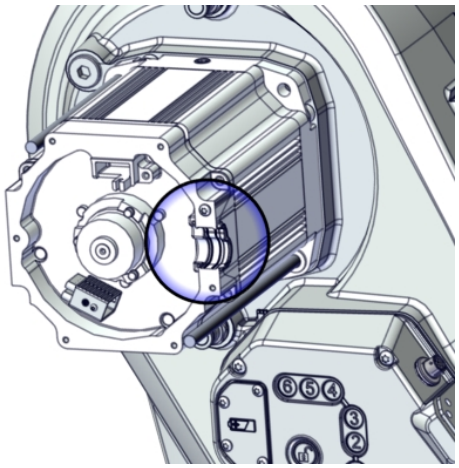
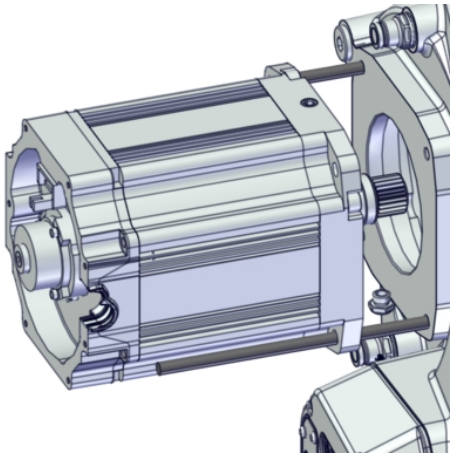
Refitting the axis-2 motor

	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 21 kg	

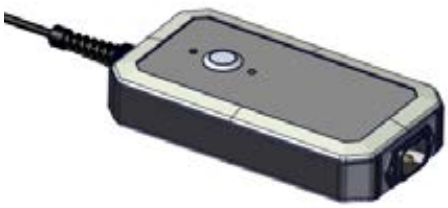
Continues on next page

5.8.2 Replacing the axis-2 gearbox

Continued

	Action	Note
3	**Note** Make sure the cable gland opening is turned the correct way.	 xx2100000595
4	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.	 xx2000000457

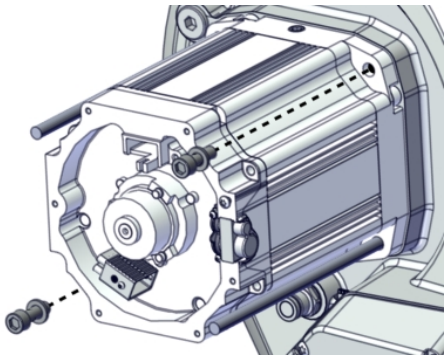
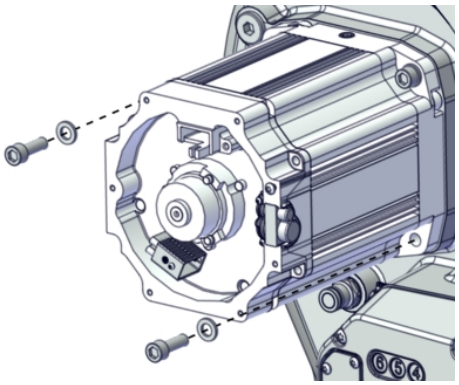
Continues on next page

	Action	Note
5	Release the brakes of the axis-2 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** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
7	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

Continues on next page

5.8.2 Replacing the axis-2 gearbox

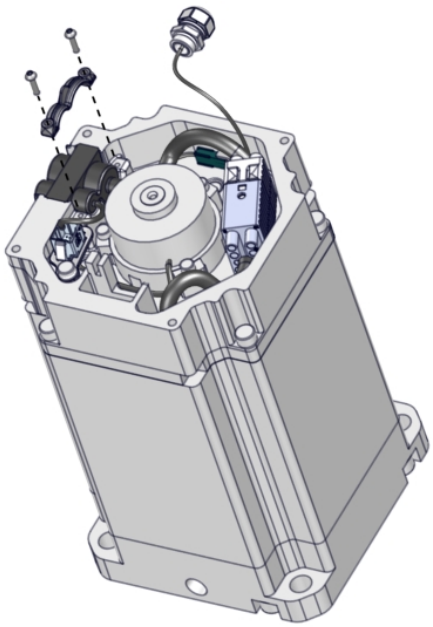
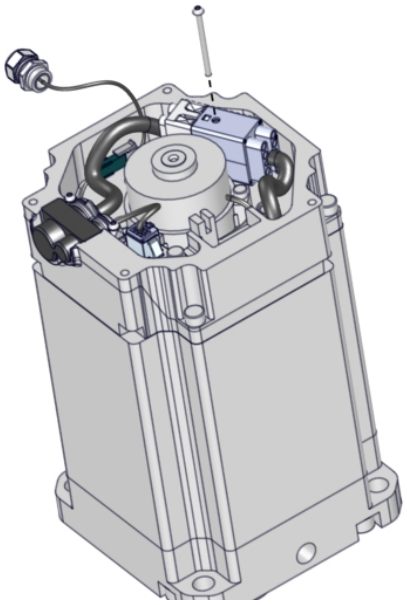
Continued

	Action	Note
8	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
9	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
10	Tighten the screws.	Tightening torque: 50 Nm.
11	Disconnect the brake release tool.	
12	Perform a leak-down test.	See *Performing a leak-down test on page 178*.

Connecting the axis-2 motor cables

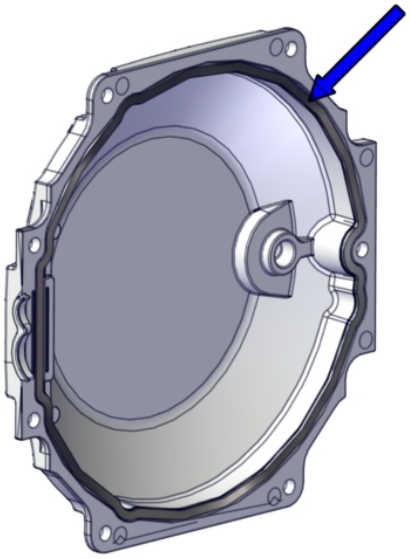
	Action	Note
1	Put the motor cables in place in the opening.	

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

Continues on next page

5.8.2 Replacing the axis-2 gearbox
Continued

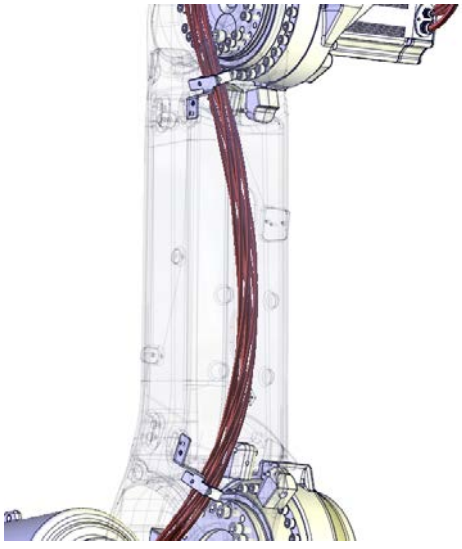
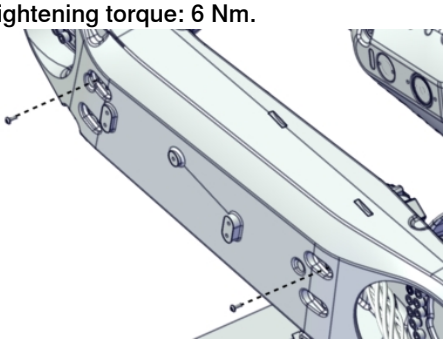
	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1 Connection box cover FS180 with gasket: 3HAC072864-003 (Graphite White) 3HAC072864-005 (ABB Orange) 3HAC074336-004 (Graphite White, threaded connection) 3HAC074336-005 (ABB Orange, threaded connection) Axis-2 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-3 Connection box cover FS180 with gasket: 3HAC074336-004 (Graphite White) 3HAC074336-005 (ABB Orange) 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.

Refitting the cabling

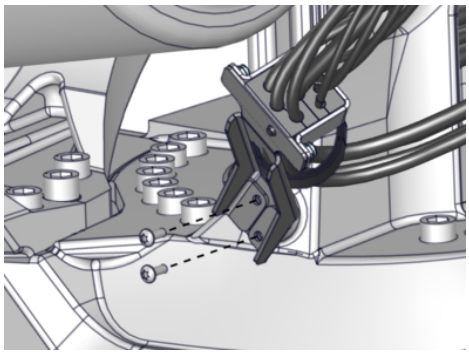
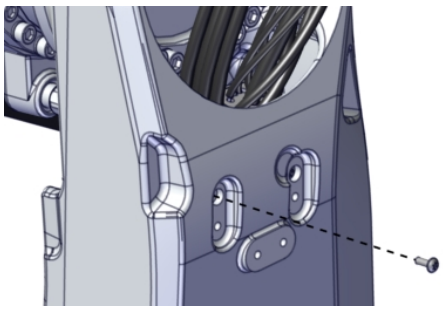
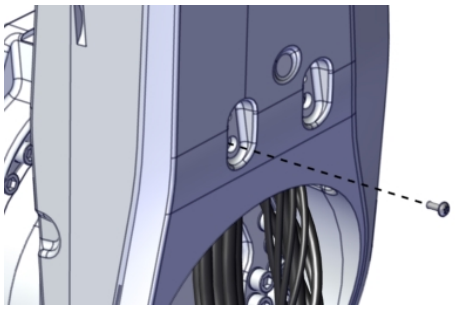
Use this procedure to refit the cabling.

	Action	Note
1	Use caution and push the cable harness into the lower arm.	
2	Secure the upper and lower cable clamps inside the lower arm with the attachment 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	Torx pan head screw: M6x16 A4-80 Tightening torque: 6 Nm.  xx2100001104

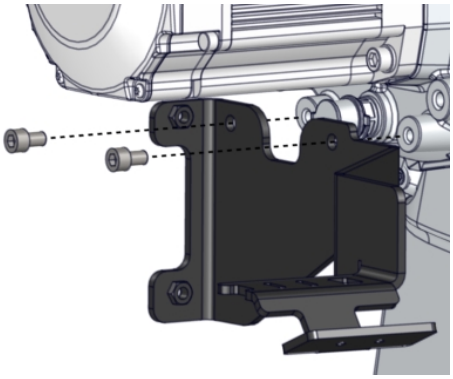
Continues on next page

5.8.2 Replacing the axis-2 gearbox

Continued

	Action	Note
3	Refit the cable bracket on the frame.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2200001388
4	If robot is equipped with DressPack. Fit the upper and lower bracket on the inside of the lower arm with attachment screws. Use locking liquid. The dress pack cables between the upper and lower bracket may not be twisted more than 1/2 turn.	See product manual for the DressPack. For article number see *References on page 10*. Locking liquid: - (Loctite 2400 (or equivalent Loctite 243))  xx2100002701  xx2100002702 Torx pan head screw: M6x16 Stainless steel A2-70 (2 pcs)

Continues on next page

	Action	Note
5	If robot is equipped with DressPack. Fit the mounting plate to the arm house. Use locking liquid.	Locking liquid: - (Loctite 2400 (or equivalent Loctite 243))  xx2300001036 Hex socket head cap screw: M10x16 8.8-A3F (2 pcs)

Positioning the robot for refitting of the balancing device front shaft

	Action	Note
1	Turn the power to the robot on temporarily.	
2	Use caution and jog the robot to the calibration position.	
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

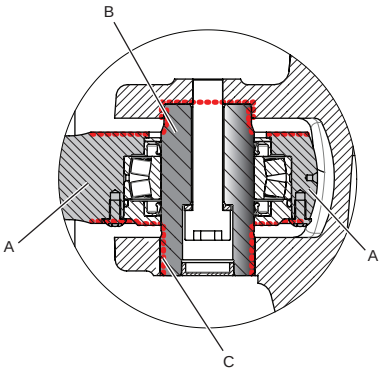
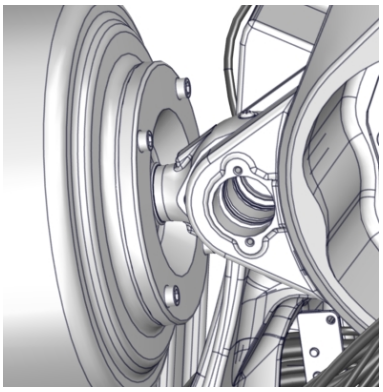
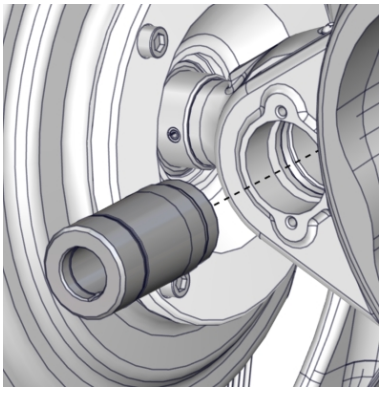
Refitting the front shaft of the balancing device

	Action	Note
1	Apply the lifting accessory to the balancing device (if not already done).	Lifting shackle: SA-10-8-NA1 Lifting accessory (chain): 3HAC15556-1
2	Remove all residue of Loctite in the screw hole of the shaft.	
3	Wipe all contact surfaces inside the recess clean from contamination.	

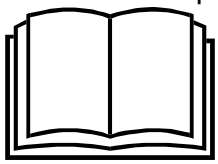
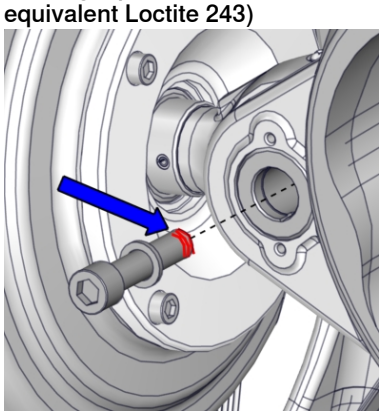
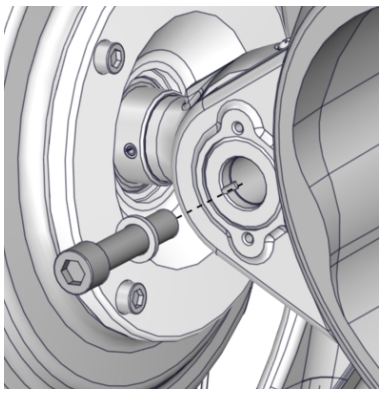
Continues on next page

5.8.2 Replacing the axis-2 gearbox

Continued

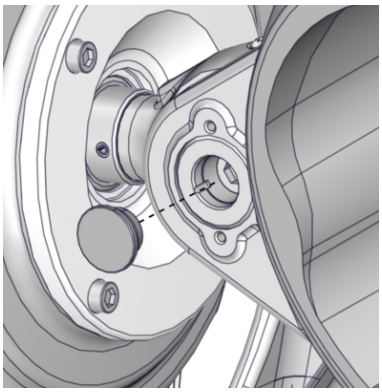
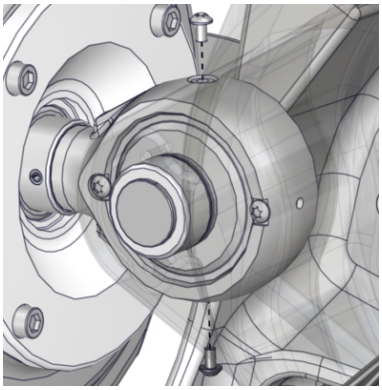
	Action	Note
4	*Foundry Plus:* Apply Mercasol on the surfaces on the shaft and front ear.	 xx1400000368 A Front link ear B Shaft C Mercasol (red dotted lines)
5	Align the balancing device link ear with the hole in the lower arm. **Note** Verify that the link ear is correctly turned.	 xx2200001918
6	Lubricate the shaft and place it to the front ear. **Note** *Foundry Plus*: Do not lubricate surfaces where Mercasol is applied.	 xx2200001917

Continues on next page

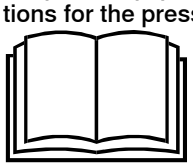
	Action	Note
7	Press in the shaft using the dismantle and mounting tool, according to user instructions enclosed with the equipment.  xx0900000813 Go to the user instructions enclosed with the press tool.  **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	Dismantle and mounting tool: 3HAC028920-001 User instructions are enclosed with the tool.
8	Apply locking liquid on the first threads of the screw.	Hex socket head cap screw: M16x70 8.8-A3F Washer: Steel 17x25x3 Locking liquid: Loctite 2400 (or equivalent Loctite 243)  xx2200001916
9	Secure the shaft with screw and washer.	Tightening torque: 200 Nm  xx2200001461

Continues on next page

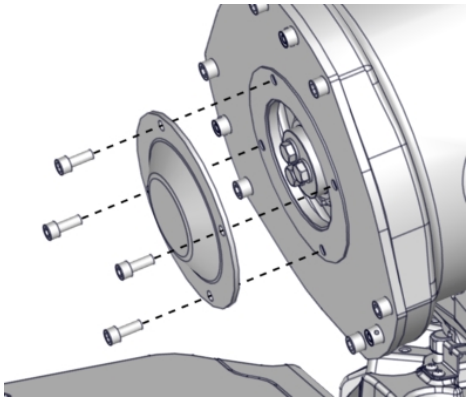
5.8.2 Replacing the axis-2 gearbox
Continued

	Action	Note
10	Fit the protection plug.	 xx2200001460
11	Unscrew both screws in link ear and fill the bearing with grease from the upper hole until the grease appears in the lower hole.	Grease: 3HAA1001-294  xx2200001477
12	Refit the two screws and wipe clean from residual grease.	
13	Remove the lifting accessory from the balancing device.	

Restoring the balancing device and removing the Hydraulic press equipment, balancing device

	Action	Note
	Restore the balancing device and remove the press equipment according to instructions for the press equipment.  xx0900000813 Go to the user instructions enclosed with the press tool.  **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool.	User instructions are enclosed with the tool.

Continues on next page

	Action	Note
1	Apply flange sealant and refit the cover plate on the back of the balancing device.	Hex socket head cap screw: M10x25 8.8-A3F. Tightening torque: 50 Nm. Flange sealant for conical fittings: Loctite 5400 (or equivalent Loctite 577).  xx2200001330

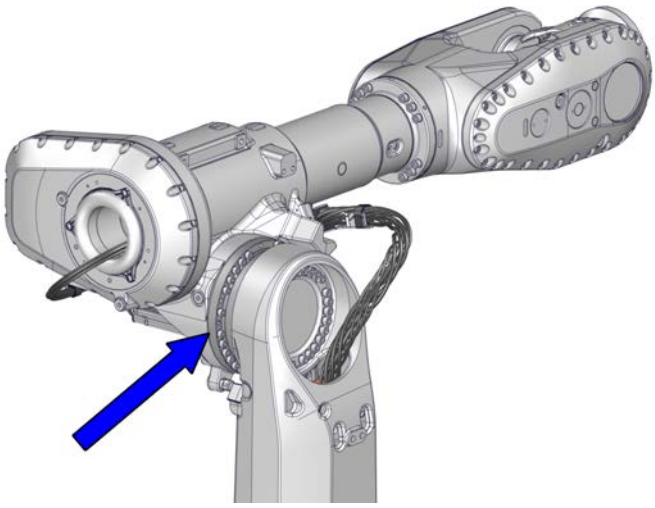
Concluding procedure

	Action	Note
1	If the robot is equipped with DressPack, refit the brackets of the ball joint housings on the wrist.	
2	Remove the lifting accessory from the balancing device.	
3	Refill oil to the axis-2 gearbox.	See *Filling oil into the axis-2 gearbox on page 146*.
4	Calibrate the robot.	See *Calibration on page 585*.
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 94*.	

5.8.3 Replacing the axis-3 gearbox

Location of the gearbox

The gearbox is located as shown in the figure.



xx2200001499

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. Remove the cable harness from the upper arm.
3. Remove the axis-3 motor.
4. Remove the upper arm and place on a prepared service area.
5. 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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Gearbox	3HAC081174-003 (Graphite White) 3HAC081174-004 (ABB Orange)	Includes o-ring	L2

Required service parts

Consumable	Article number	Note
O-ring	3HAC061327-063	

Continues on next page

Consumable	Article number	Note
Cleaning agent	-	Isopropanol
Cleaning agent	-	Loctite 7200
Cleaning agent	-	Loctite 7063
Flange sealant	-	Loctite 5800

Required tools and equipment

Equipment	Article number	Note
Lifting eye	3HAC16131-1	M12, 2 pcs
Fender washer	-	Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.
Roundsling, 1 m	-	Length: 1 m.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
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.
Guide pin, M12x150	3HAC13056-2	Always use guide pins in pairs.
Lifting accessory for gear	3HAC081585-001	For lifting the gearbox
Screws M8x75, fully threaded	-	Used to push out the gearbox, if necessary.
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 (axes 1, 2, 3 and 4) 3HAC074119-001 (axes 5 and 6)	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 628*.

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 595*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

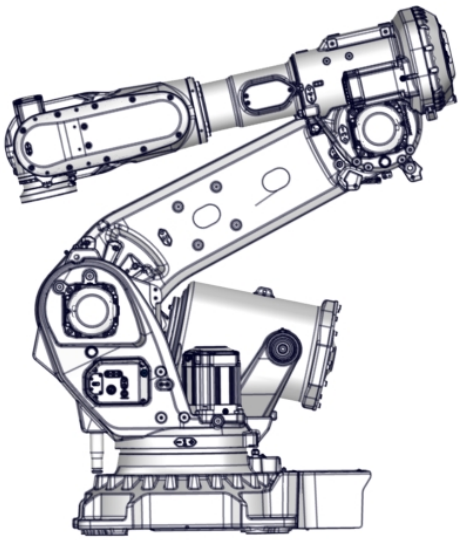
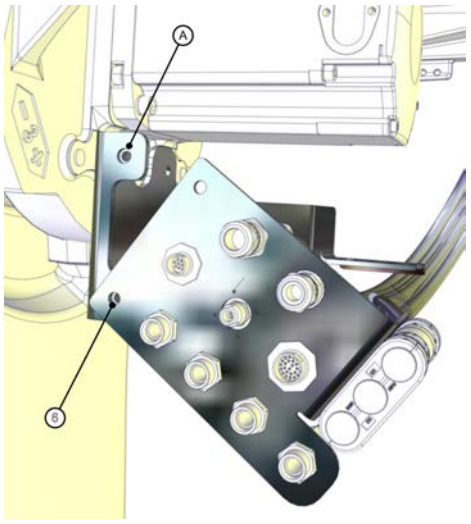
Removing the gearbox

Use these procedures to remove the gearbox.

Preparations before removing the axis-3 gearbox

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Drain the axis-3 gearbox.	See *Draining the axis-3 gearbox on page 150*.

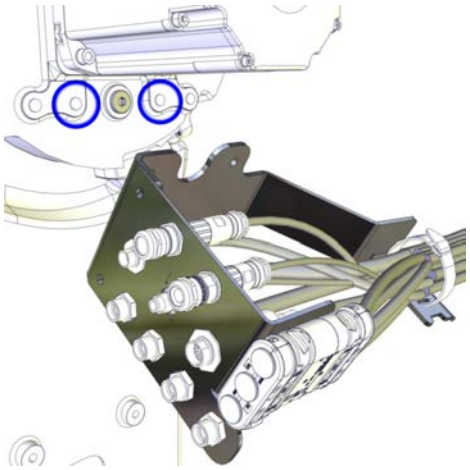
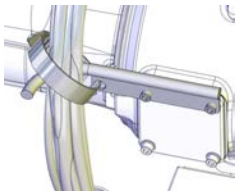
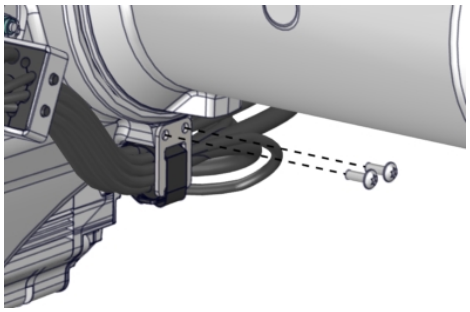
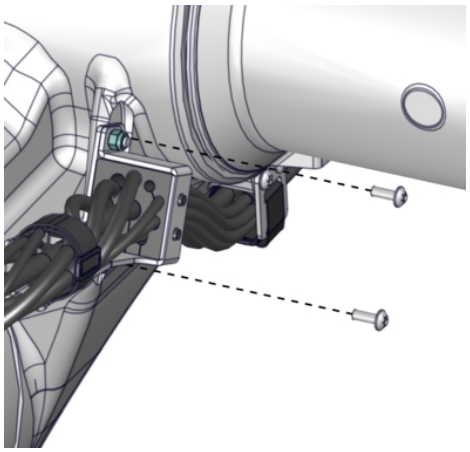
Continues on next page

	Action	Note
3	Jog the robot into position: • Axis 1: no significance • Axis 2: -65° • Axis 3: maximum position in positive direction, upper arm resting against the mechanical stop (approximately +70°) • Axis 4: 0° • Axis 5: +90° • Axis 6: 0°	If needed, run the axis-1 into a position that gives the required space (space to place two pallets in a row) at the right-hand side of the robot, as seen from behind.  xx2200001811
4	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
5	If robot is equipped with DressPack: Unscrew the uppermost attachment screw that holds the bracket of the DressPack cable package, and let it "fall down". See figure! **Note** It is not needed to disconnect the lower end connectors of the DressPack (as the figure shows). Connectors are only hidden to get a better view of which screw to be removed.	 xx1200001331 A Attachment screw to be removed B Attachment screw not to be removed

Continues on next page

5.8.3 Replacing the axis-3 gearbox

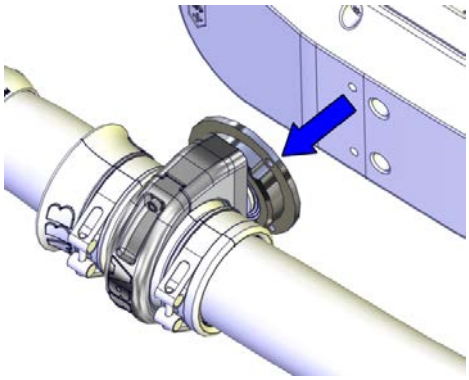
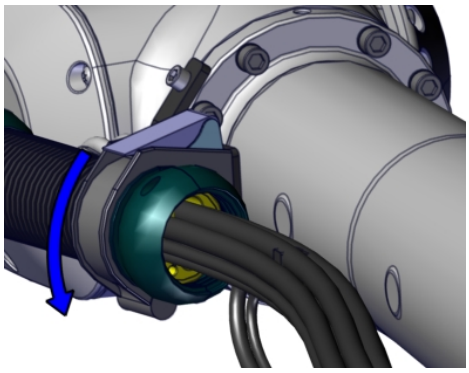
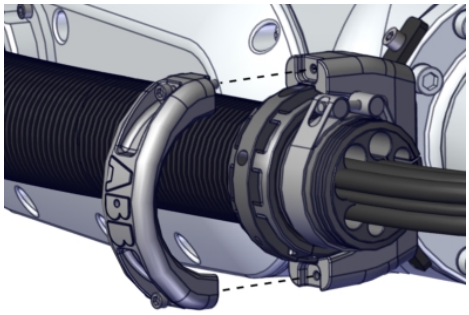
Continued

	Action	Note
6	If robot is equipped with DressPack: Unscrew the two attachment screws that holds the bracket of the DressPack cable package (if one is fitted), and let it hang down together with the rest of the DressPack cable package.	 xx1200001332
7	Remove the cable bracket underneath the tube shaft. **Note** If DressPack is fitted, the cable fixing bracket is replaced by the cable guide.  xx1300001973	 xx2200001432
8	Remove the metal clamp at the arm house.	 xx2200001433

Continues on next page

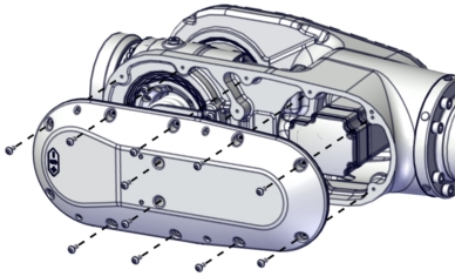
Retrieving access to the wrist cabling

Use this procedure to remove the wrist cover.

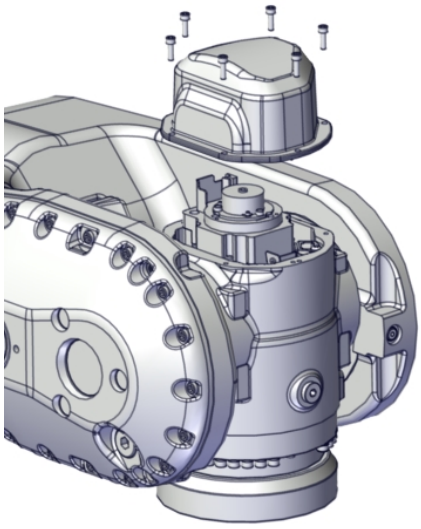
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	If DressPack is installed: • Remove the bracket with the complete ball joint housing still fitted, as shown in the figure. This is done to be able to reach the two hidden screws that secure the wrist cover.	 xx1400000355
3	If DressPack is installed: Open the ball joint housing on the arm tube and remove the DressPack cable package.	IRB 6710-xx/ LID  xx2100002733 IRB 6710-xx/ LID:  xx2100002709

Continues on next page

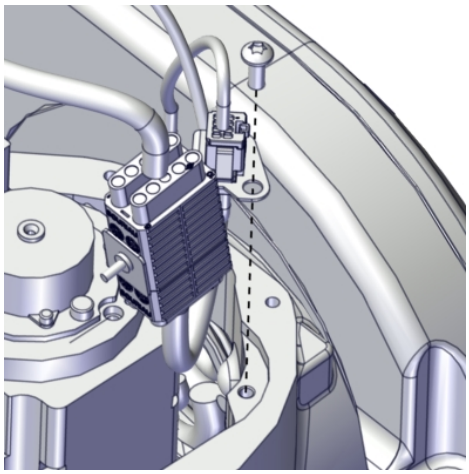
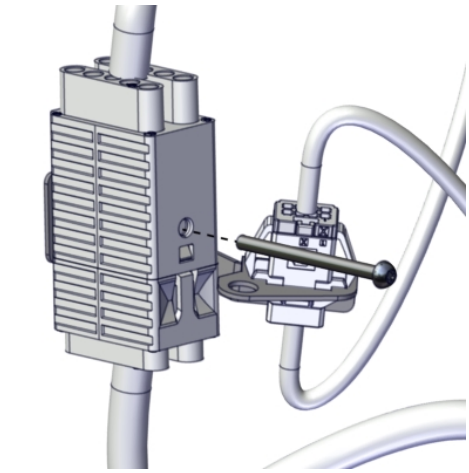
5.8.3 Replacing the axis-3 gearbox
Continued

	Action	Note
4	Remove the wrist cover.	 xx2000000373

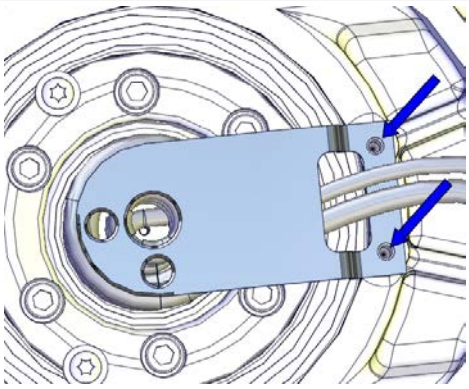
Disconnecting the axis-6 motor cables

	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.	 xx2000000376

Continues on next page

	Action	Note
3	Remove the connector bracket.	 xx2000000375
4	Remove the connector screw.	 xx2200001919
5	Disconnect the motor cables.	

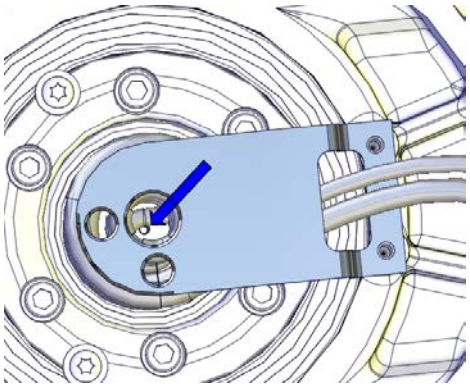
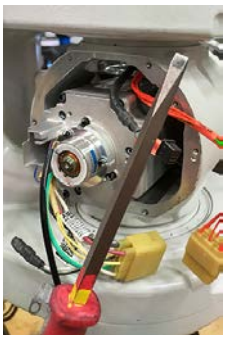
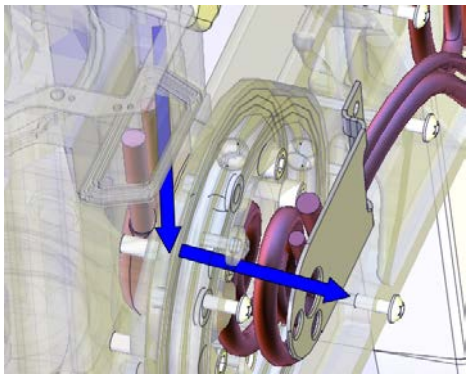
Pushing out the axis-6 motor cables

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

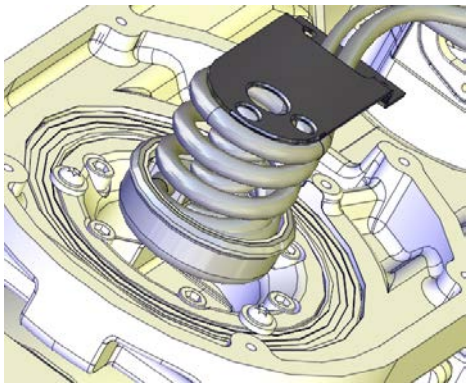
Continues on next page

5.8.3 Replacing the axis-3 gearbox

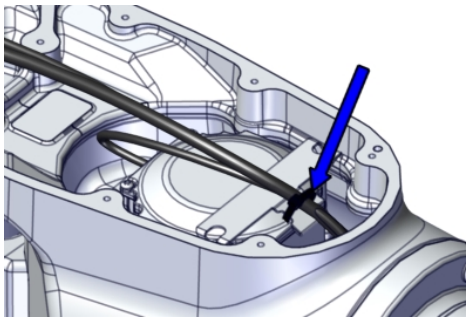
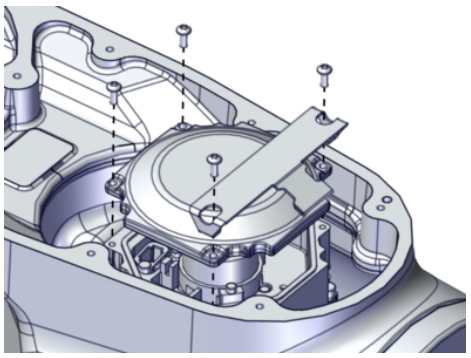
Continued

	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. **CAUTION** Assist by using a flat-head screwdriver or similar to push out the carrier from the motor housing side, to avoid damaging the cables by pulling them too hard.  xx2300000057  xx2300000058  xx2300000059  xx2300000060	 xx1300000666

Continues on next page

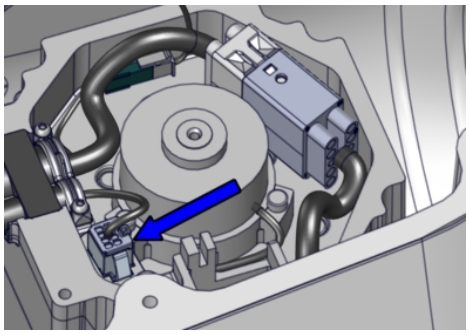
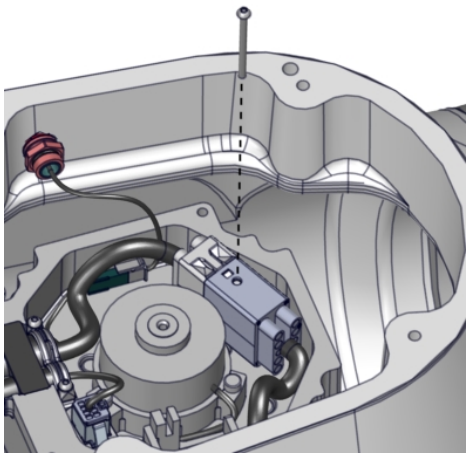
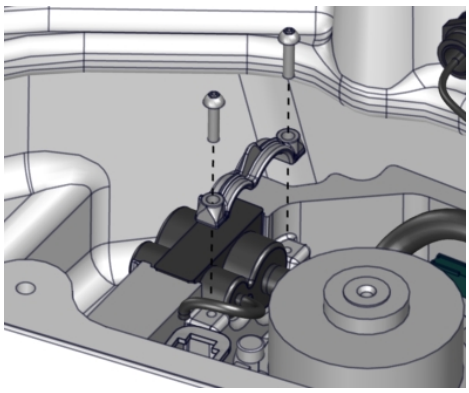
	Action	Note
4	Lift out the carrier from its position.	 xx1300001113

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.	
2	Cut the cable tie.	 xx2100002625
3	Remove the motor cover by removing the screws.	 xx2100002495

Continues on next page

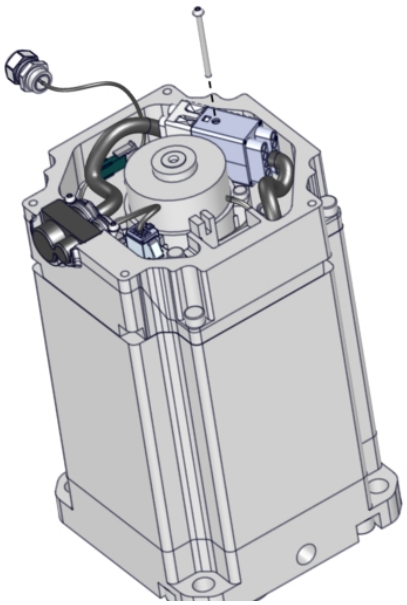
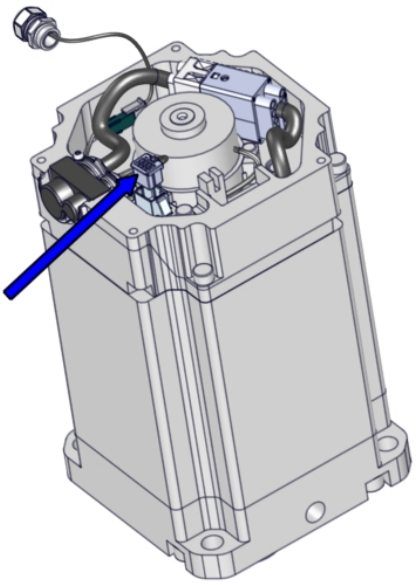
5.8.3 Replacing the axis-3 gearbox
Continued

	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.	

Disconnecting the axis-3 and axis-4 motor cables

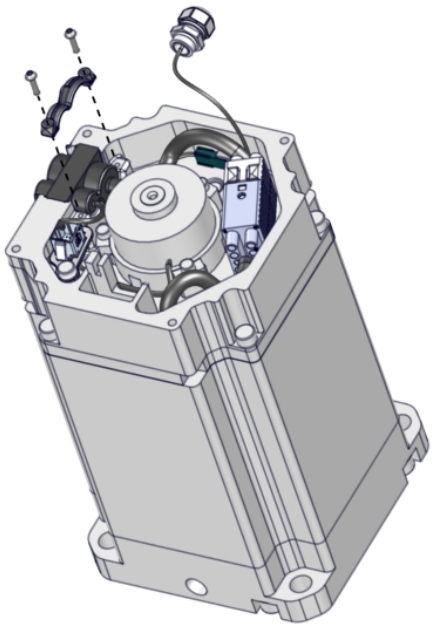
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

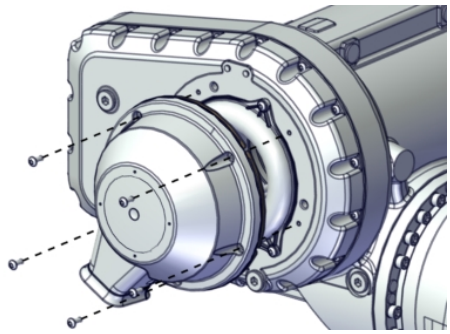
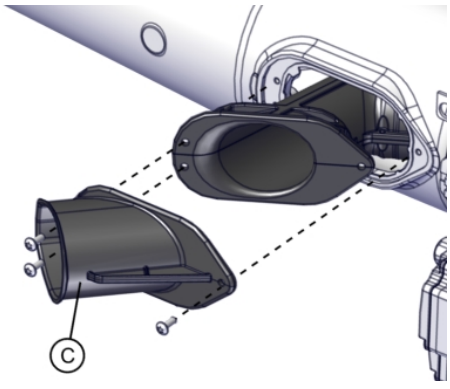
	Action	Note
2	Remove the motor cover by removing the screws.	
3	Disconnect the power cable connector by first removing the attachment screw and then parting the connector.	 xx2200001736
4	Disconnect the signal cable connector by pulling it out.	 xx2200001737

Continues on next page

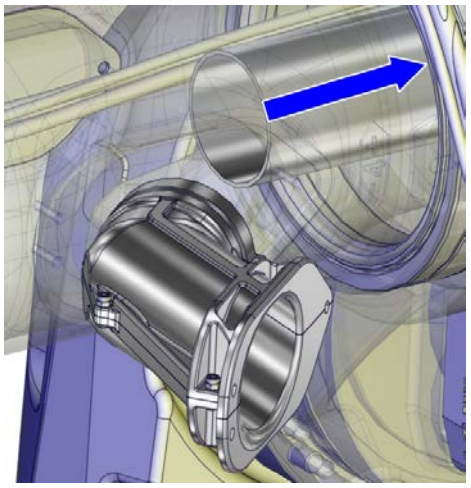
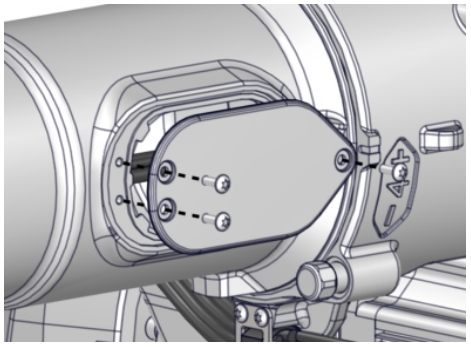
5.8.3 Replacing the axis-3 gearbox
Continued

	Action	Note
5	Remove the cable bracket by removing the screws.	 xx2200001738
6	Remove the motor cables from the motor.	

Removing the cable harness from the wrist and upper arm

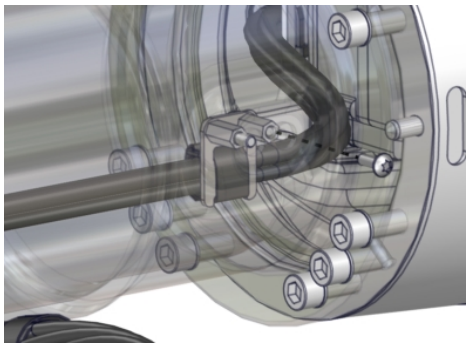
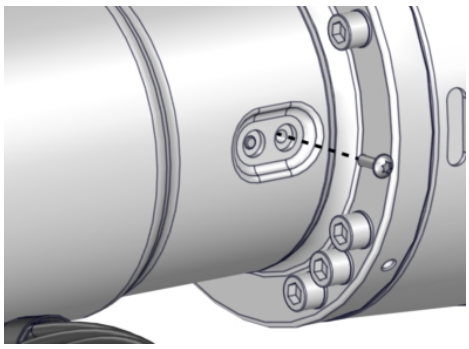
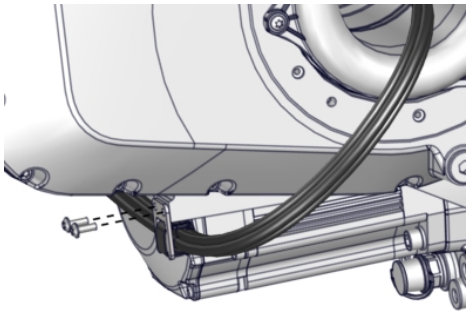
	Action	Note
1	*Foundry Plus*, *DressPack:* Remove the cover. **Note** Use caution not to damage the gasket.	 xx2000000422
2	*DressPack* If used, loosen the insert. (Cable guard (C) is available for Foundry cable guard.)	 xx2100002677

Continues on next page

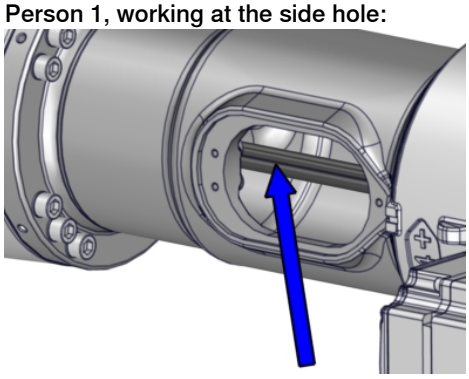
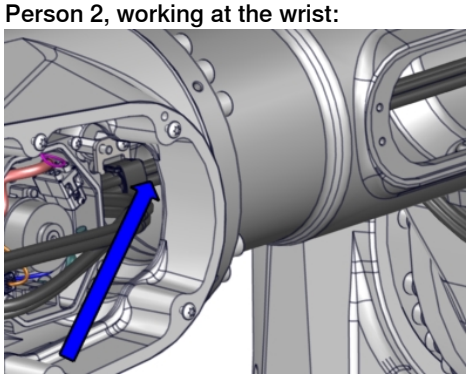
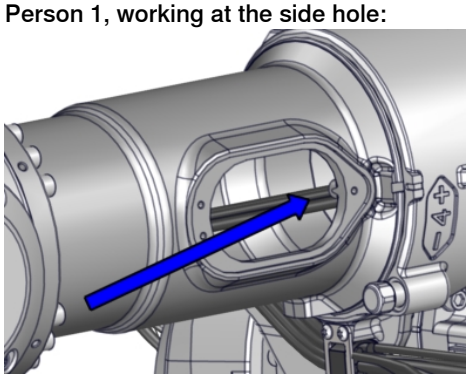
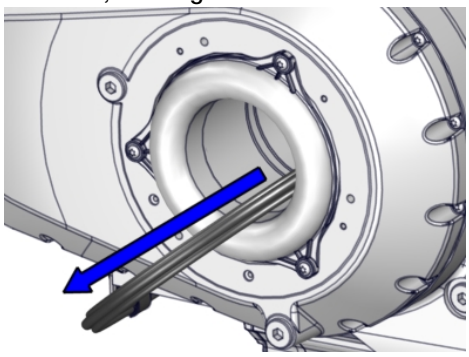
	Action	Note
3	*DressPack* If used, push the DressPack tube a little backwards.	 xx1400000720
4	**Tip** Use tape and tie the axis-5 and axis-6 connectors and carrier into a bundle (if not already done). This is done to facilitate the removal and to avoid damaging the parts. This will also make it easier 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

5.8.3 Replacing the axis-3 gearbox
Continued

	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.	 xx2200002142

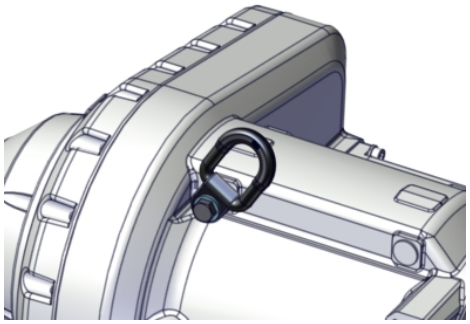
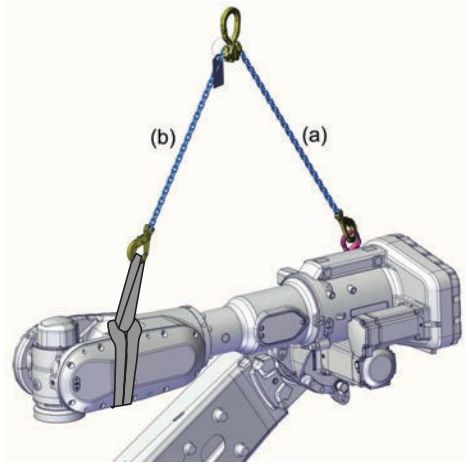
Continues on next page

	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

Continues on next page

5.8.3 Replacing the axis-3 gearbox
Continued

Attaching the lifting accessories to the upper arm

	Action	Note
1	**CAUTION** The weight of the complete upper arm (including the wrist) is 330 kg All lifting accessories used must be sized accordingly.	
2	Fit a lifting eye in the arm house, with a fender washer underneath.  xx1400002196	Lifting eye: 3HAC16131-1 Fender washer: Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.  xx2100002146
3	Attach the Lifting accessory (chain) to an overhead crane (or similar), then to the lifting eye in the arm house and to a roundsling run through the wrist. Adjust the chain lengths to make the lift as level as possible.	Lifting accessory (chain): 3HAC15556-1 Roundsling, 1 m  xx2100002145 The figure shows an example of lifting chain lengths. Keep chain (b) shorter than chain (a).
4	Raise the lifting accessories to take the weight of the upper arm.	

Continues on next page

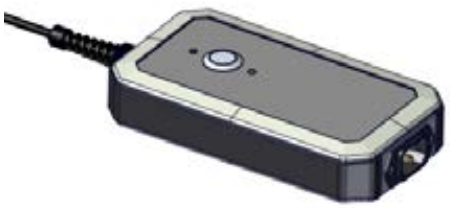
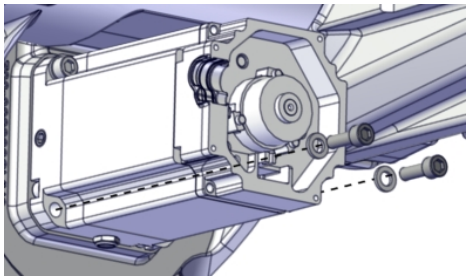
	Action	Note
5	In case of necessary adjustments, use the shortening loops on the lifting accessory (chain) to find the level position.	 xx1400002197

Removing the axis-3 motor

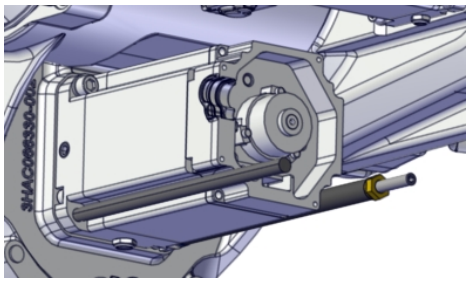
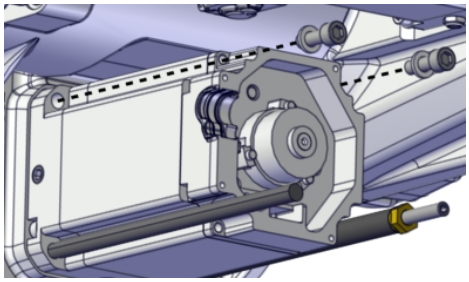
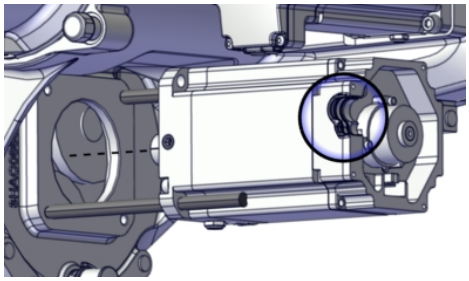
	Action	Note
1	Before removing the motor, make sure that the gearbox is completely drained.	
2	**DANGER** When releasing the holding brakes of the motor, the upper arm will be movable and falls down if not secured. Verify that the upper arm is secured as previously described, before continuing.	

Continues on next page

5.8.3 Replacing the axis-3 gearbox
Continued

	Action	Note
3	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-3 motor results in weight transfer of upper arm weight. Verify that the upper arm rests against the mechanical stop or installed lifting accessories, before releasing the brakes. **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	Remove the two lower screws. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx2300000045

Continues on next page

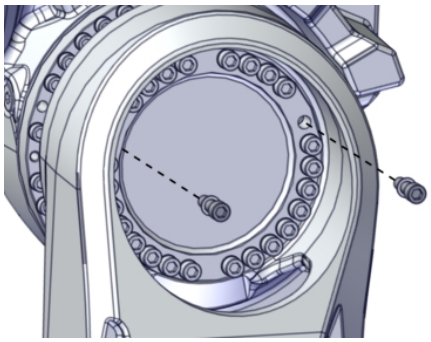
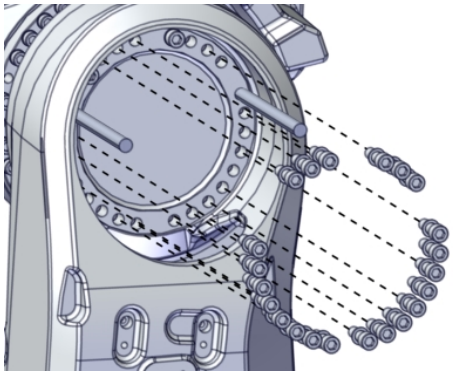
	Action	Note
5	Fit a guide pin in the non-threaded hole. Fit a removal tool in the threaded hole. **Tip** Lubricate the guide pins with some grease to make the motor slide better.	Guide pin, M10x150: 3HAC15521-2 Removal tool motor M12: 3HAC14631-1  xx2100002148
6	Remove the remaining two screws.	 xx2300000046
7	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
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 21 kg	
12	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.	 xx2100002149 Make sure the pinion is not damaged.

Continues on next page

5.8.3 Replacing the axis-3 gearbox

Continued

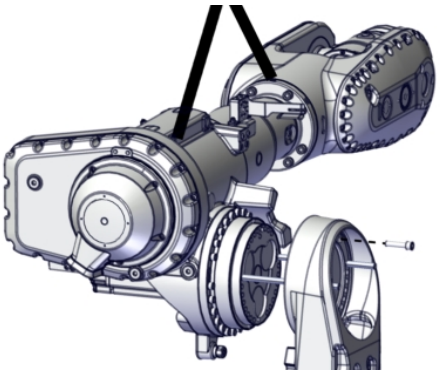
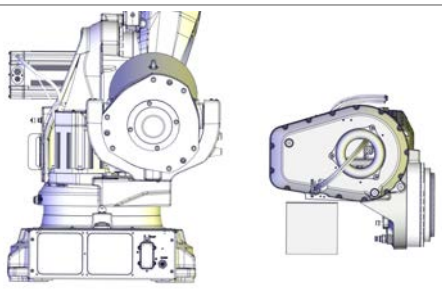
Preparations before removing the upper arm

	Action	Note
1	Remove two attachment screws in opposite holes and replace them with guide pins. **Tip** Lubricate the guide pins with some grease to make the upper arm slide better.	Guide pin, M12x150: 3HAC13056-2 Always use guide pins in pairs.  xx2100002444
2	Leave one of the remaining attachment screws fitted, remove the other screws.	 xx2100002443

Removing the upper arm

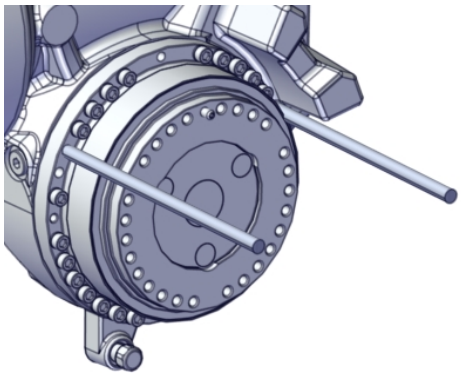
	Action	Note
1	**Note** Make sure the lift is done completely leveled! In case of necessary adjustments, use the shortening loops on the lifting accessory (chain), and make sure to place the chain the right way through the loops.	 xx1400002197

Continues on next page

	Action	Note
2	Remove the remaining attachment screw and let the upper arm slide out from the lower arm with support from the guide pins.	 xx2000000394
3	Lift the upper arm and place it on the prepared area.	
4	*This step is only valid when the upper arm is removed due to replacement of the axis-3 gearbox:* Place pieces of wood (or similar) under arm house and wrist. Lower the upper arm, and let the upper arm rest as shown in the figure. This is done in order to keep the axis-3 gearbox in a vertical position and to get the best position to replace the axis-3 gearbox, if applicable.	 xx1300000553

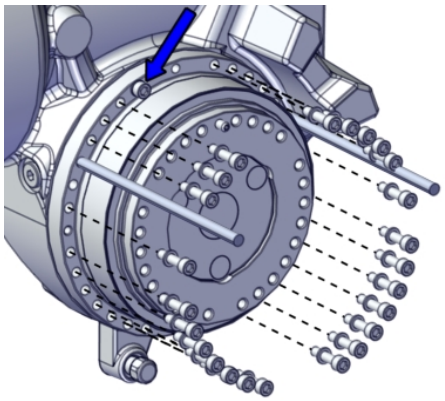
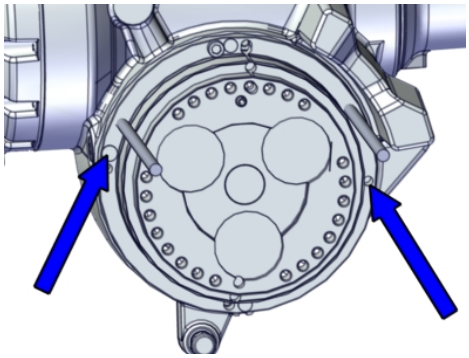
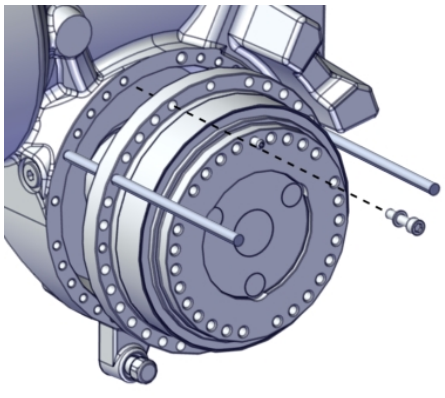
Removing the axis-3 gearbox

Use this procedure to remove the gearbox.

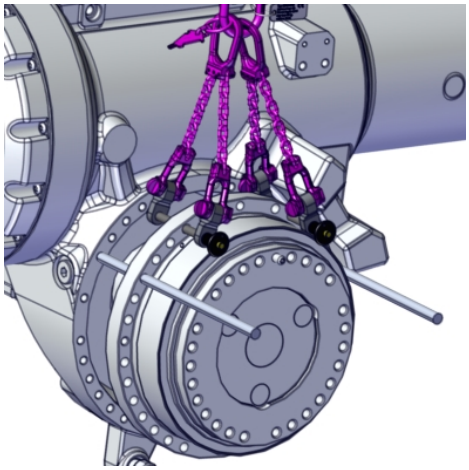
	Action	Note
1	Remove two attachment screws in opposite holes and replace them with guide pins. **Tip** Lubricate the guide pins with some grease to make the gearbox slide better.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.  xx2100002450

Continues on next page

5.8.3 Replacing the axis-3 gearbox
Continued

	Action	Note
2	Remove all but one of the remaining attachment screws and washers.	 xx2100002447
3	Fit two fully threaded screws in the press out holes.	Screws M8x75, fully threaded: -  xx2100001224
4	**Note** There will be some oil spill when the gearbox is removed. Put some oil absorbent cloth or paper below the gearbox.	
5	Remove the remaining attachment screw and loosen the gearbox with help of the removal tools. Only pull out the gearbox a little bit on the guide pins. **DANGER** There is a risk that the gearbox may glide out and fall down if it is too far out to on the guide pins and no stoppers are used.	 xx2100002448

Continues on next page

	Action	Note
6	**CAUTION** The weight of the gearbox is 45 kg All lifting accessories used must be sized accordingly.	
7	Apply the lifting accessory to the gearbox.	Lifting accessory for gear: 3HAC081585-001  xx2100002460
8	With the gearbox attached to the lifting accessory, remove the gearbox by letting it slide out on the guide pins.	
9	Remove the gearbox.	

Refitting the gearbox

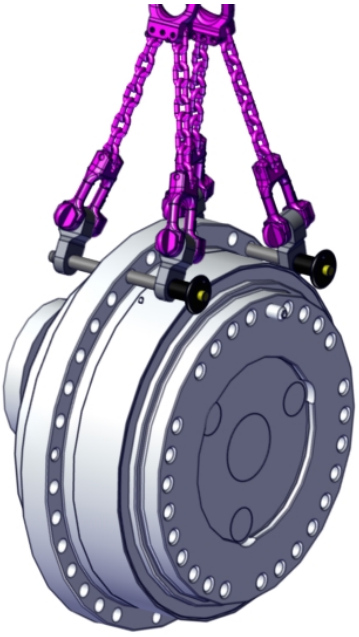
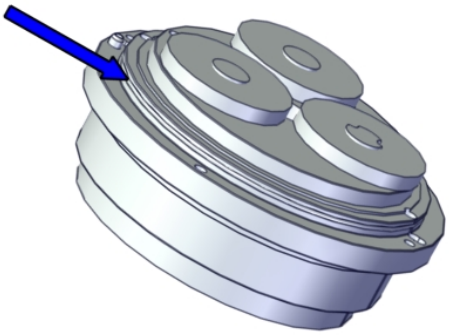
Use these procedures to refit the axis-3 gearbox.

Preparations before refitting the axis-3 gearbox

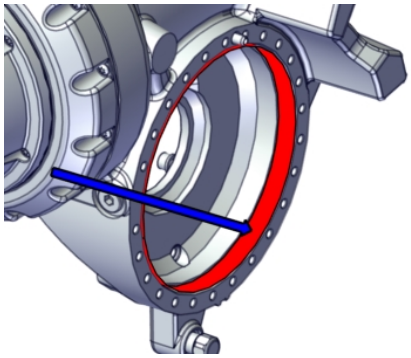
	Action	Note
1	**CAUTION** The weight of the gearbox is 45 kg All lifting accessories used must be sized accordingly.	

Continues on next page

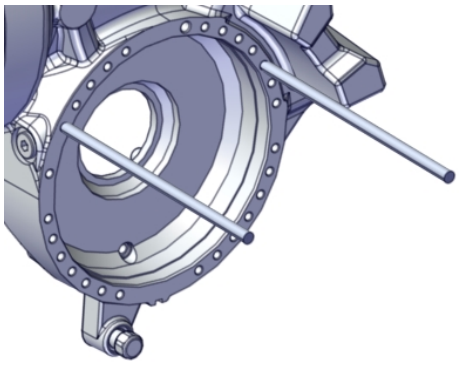
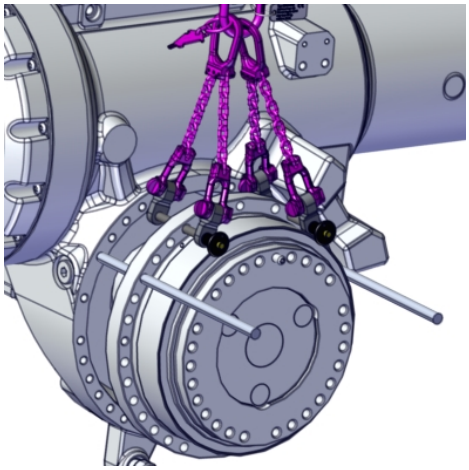
5.8.3 Replacing the axis-3 gearbox
Continued

	Action	Note
2	Apply the lifting accessory to the gearbox.	Lifting accessory for gear: 3HAC081585-001  xx2100002461
3	Lift the gearbox so that it rests on its side.	
4	Wipe clean the contact surfaces of both the gearbox and the upper arm from any contamination.	Cleaning agent: Isopropanol
5	Check the o-ring. Replace if damaged.	O-ring: 3HAC061327-063  xx2100001237

Continues on next page

	Action	Note
6	Lubricate the contact surface inside the upper arm with grease.	Grease, Shell Gadus S2: 3HAC042536-001.  xx2100002775

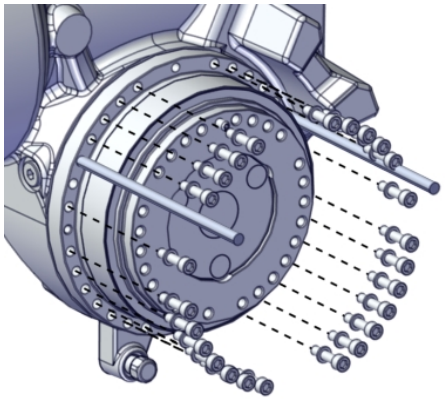
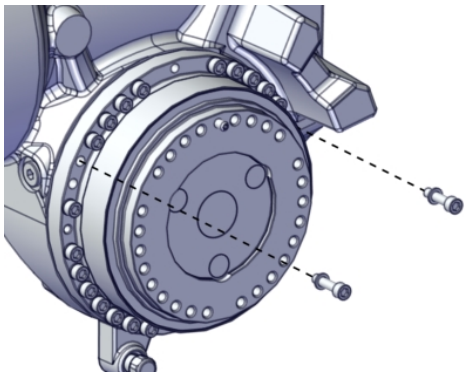
Refitting the axis-3 gearbox

	Action	Note
1	Fit two guide pins in opposite holes. **Tip** Use different lengths on the guide pins to simplify guidance. **Tip** Lubricate the guide pins with some grease to make the lower arm slide better.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.  xx2100002462
2	Lift the gearbox and let it rest on the guide pins.	 xx2100002460
3	Remove the lifting accessory. **DANGER** There is a risk that the gearbox may glide out and fall down if it is too far out to on the guide pins and no stoppers are used.	

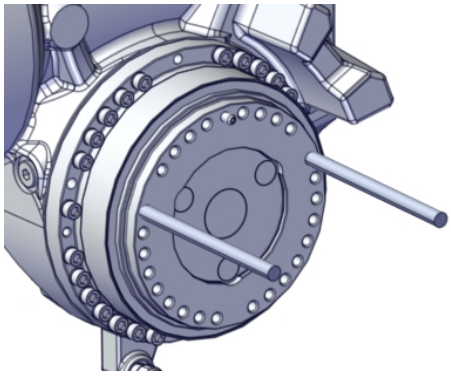
Continues on next page

5.8.3 Replacing the axis-3 gearbox

Continued

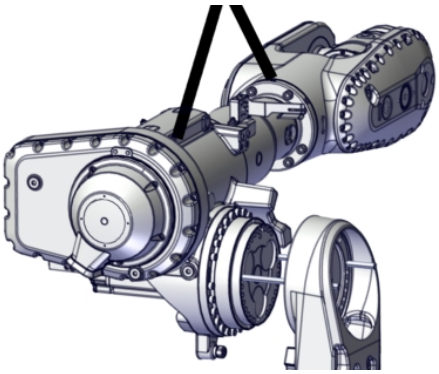
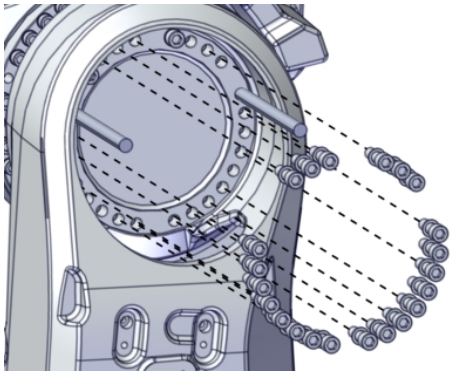
	Action	Note
4	Slide the gearbox into position and fit the attachment screws and washers.	Hex socket head cap screw : M10x40 12.9 Gleitmo 603+Geomet 500 (27 pcs).  xx2100002449
5	Remove the guide pins and fit the remaining attachment screws and washers.	 xx2100002446
6	Tighten the attachment screws.	Tightening torque: standard torque 70 Nm (*Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws on page 626*).

Preparations before refitting the upper arm

	Action	Note
1	Wipe clean all contact surfaces.	
2	Fit two guide pins in opposite M12 holes in the axis-3 gearbox. **Tip** Lubricate the guide pins with some grease to make the upper arm slide better.	Guide pin, M12x150: 3HAC13056-2 Always use guide pins in pairs.  xx2100002445

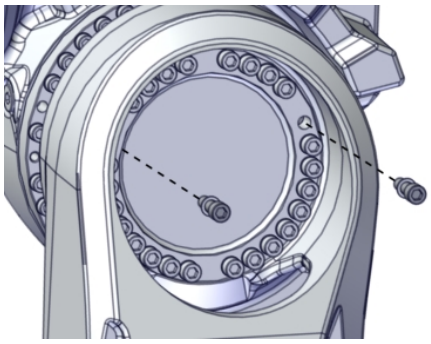
Continues on next page

Securing the upper arm

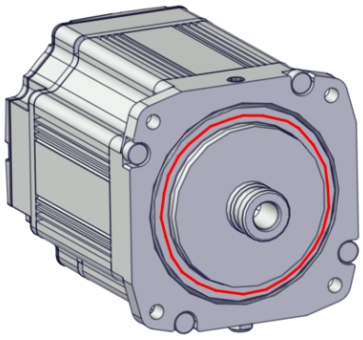
	Action	Note
1	**CAUTION** The weight of the complete upper arm (including the wrist) is 330 kg All lifting accessories used must be sized accordingly.	
2	Attach the lifting accessories, if not already fitted.	See *Attaching the lifting accessories to the upper arm on page 534*.
3	Lift the upper arm to mounting position.	
4	Use the adjustment tool to rotate the axis-3 gearbox and find the correct position for the guide pins in the lower arm. Fit the upper arm to the lower arm. **CAUTION** Do not damage the cabling with the guide pins during refitting.	Adjustment tool for gear: 3HAC080331-001  xx2000000395
5	Insert all but two of the screws and washers.	Hex socket head cap screw: M12x40 12.9 Gleitmo 603+Geomet 500 (26 pcs). Washer: Steel 13x19x1.5 (26 pcs).  xx2100002443

Continues on next page

5.8.3 Replacing the axis-3 gearbox
Continued

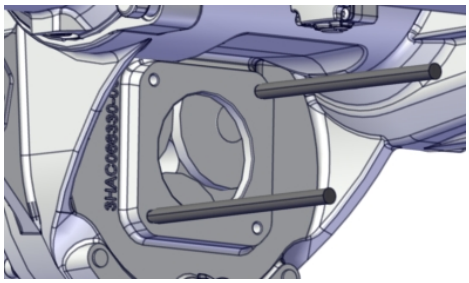
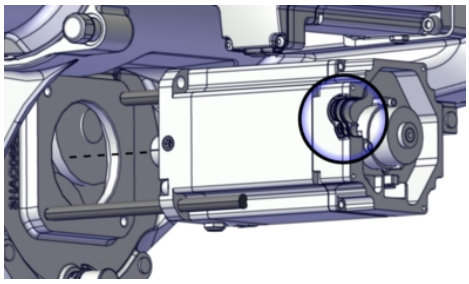
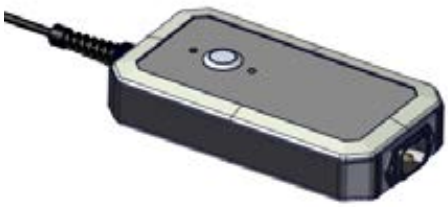
	Action	Note
6	Remove the guide pins and fit the two remaining screws and washers.	 xx2100002444
7	Tighten the attachment screws.	Tightening torque: standard torque 120 Nm (*Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws on page 626*)..

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.	

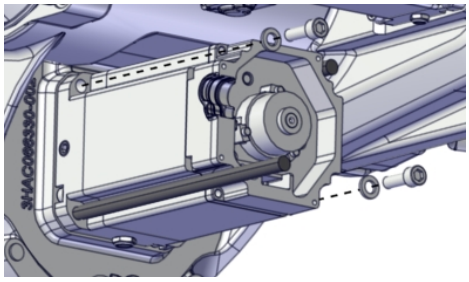
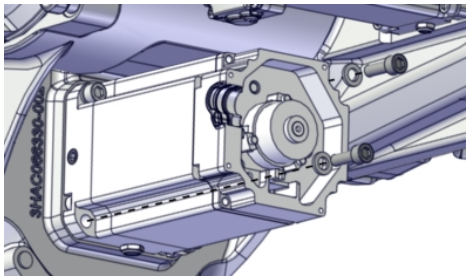
Continues on next page

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.  xx2100002151
2	**CAUTION** The weight of the motor is 21 kg	
3	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. **Note** Make sure the cable gland opening is turned the correct way.	 xx2100002149
4	Release the brakes of the axis-3 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

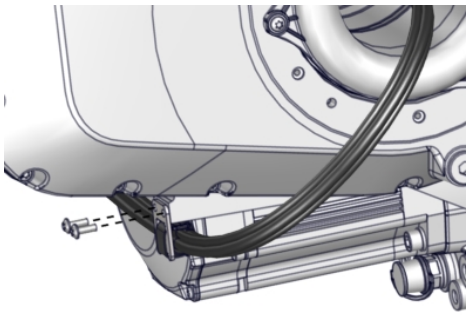
Continues on next page

5.8.3 Replacing the axis-3 gearbox
Continued

	Action	Note
5	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
6	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
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  xx2100002152
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)  xx2100002153
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 178*.

Continues on next page

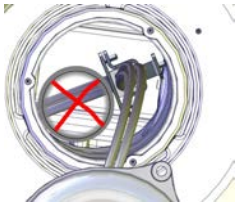
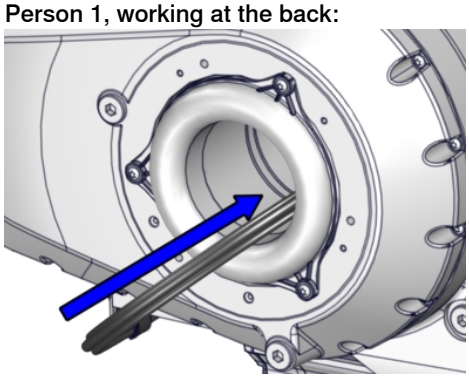
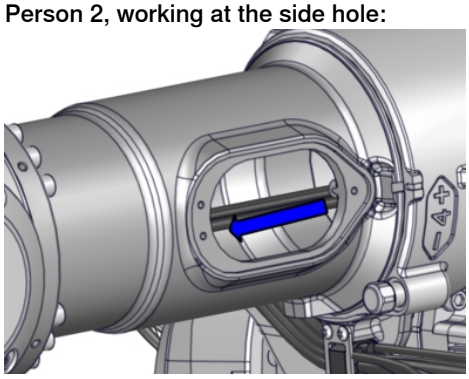
Refitting the cable harness to the upper arm

	Action	Note
1	Refit the metal clamp beneath the arm house.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2200002142
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

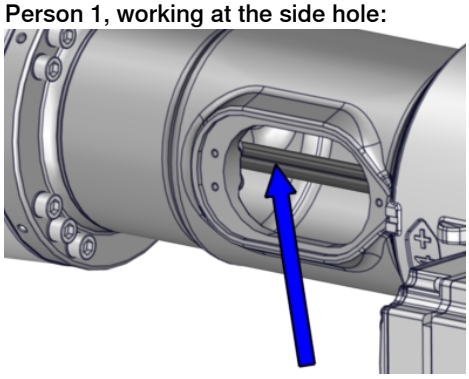
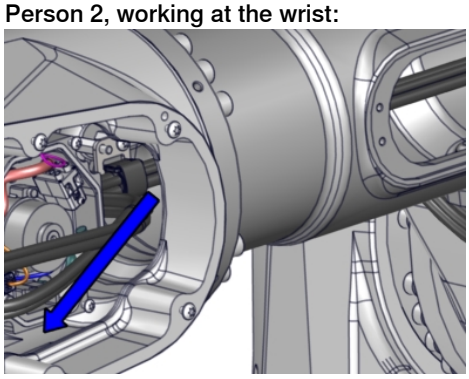
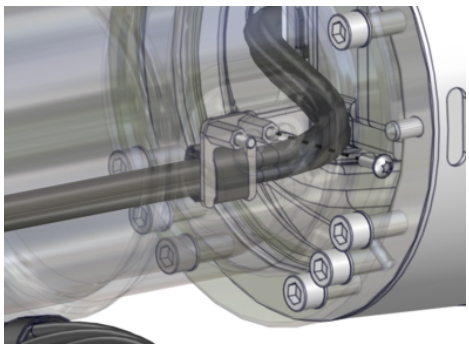
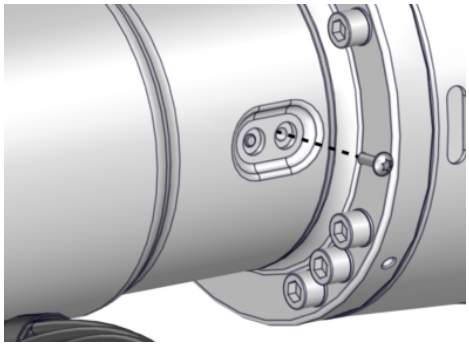
Continues on next page

5.8.3 Replacing the axis-3 gearbox

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

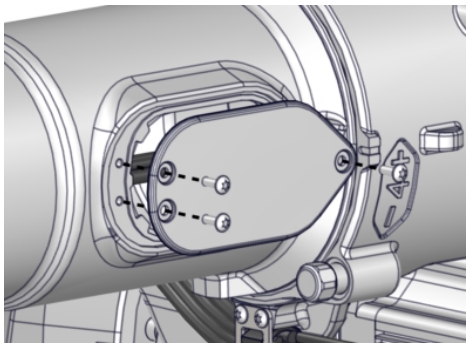
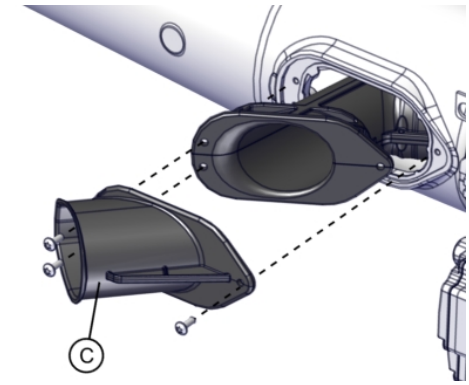
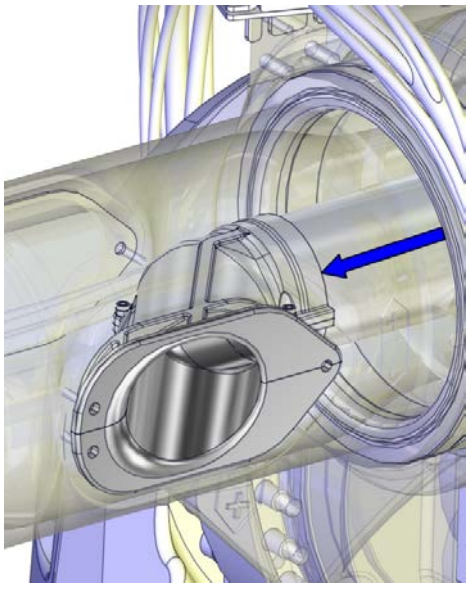
Continues on next page

	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

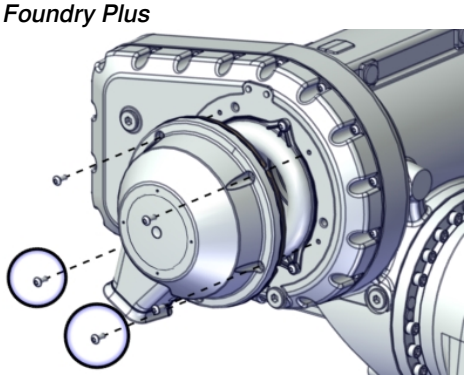
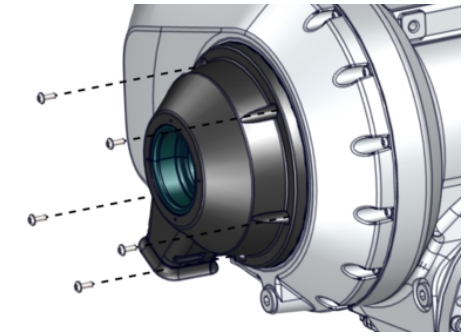
Continues on next page

5.8.3 Replacing the axis-3 gearbox

Continued

	Action	Note
6	Refit the side cover. **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	If used, 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	If used, refit the tube containing the DressPack into the insert.	 xx1400000092

Continues on next page

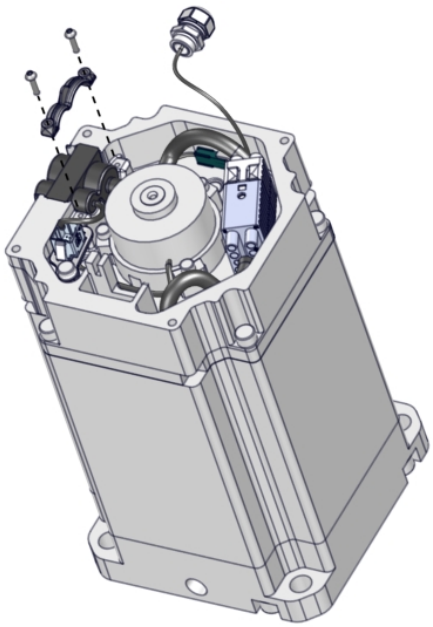
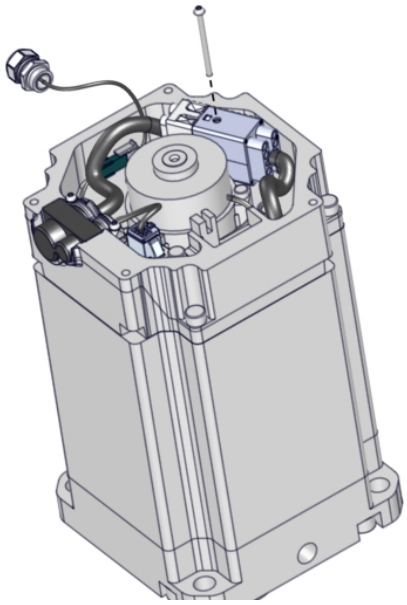
	Action	Note
9	*DressPack* or *Foundry Plus*: Refit the back cover with the attachment screws. Tighten the two screws closest to the outlet first (shown in figure), to avoid deformation.	Torx pan head screw: M6x16 Stainless steel A2-70 Tightening torque: 10 Nm. *Foundry Plus*  xx2100002636 *DressPack*  xx2300001040

Reconnecting the axis-3 and axis-4 motor cables

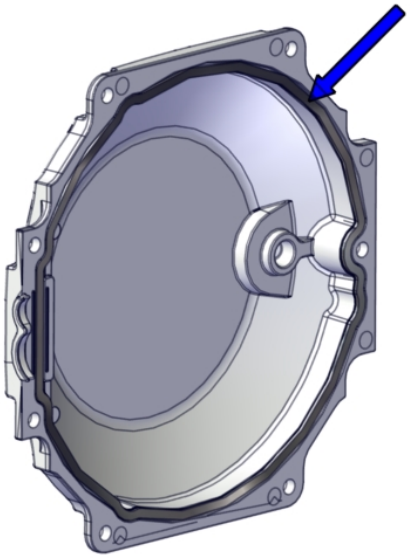
	Action	Note
1	Put the motor cables in place in the opening.	

Continues on next page

5.8.3 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

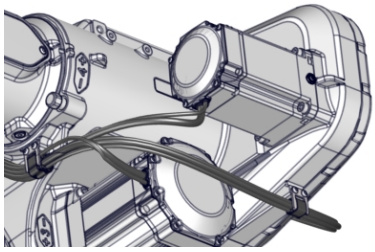
Continues on next page

	Action	Note
5	Inspect the gasket. Replace the complete cover if the gasket is damaged.	Axis-1 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-2 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-3 Connection box cover FS180 with gasket: 3HAC074336-004 (Graphite White) 3HAC074336-005 (ABB Orange) 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.	

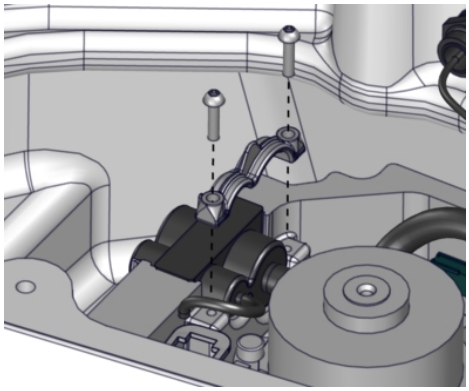
Continues on next page

5.8.3 Replacing the axis-3 gearbox
Continued

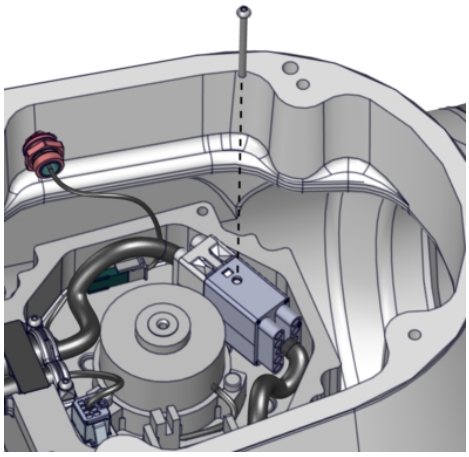
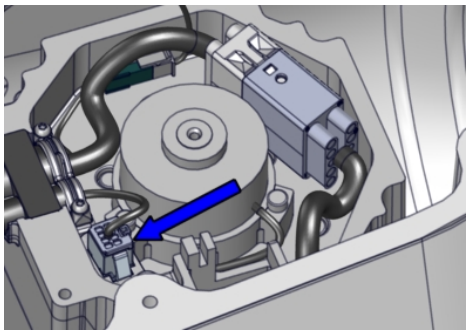
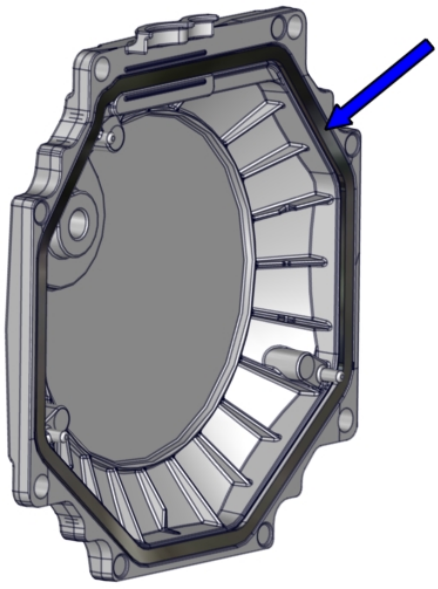
	Action	Note
7	Refit the motor cover with its attachment screws. Use locking liquid.	Torx pan head screw: M5x12 Stainless steel A2-70 Locking liquid: Loctite 2400 (or equivalent Loctite 243) Tightening torque: 6 Nm.

	Action	Note
1	Verify that the cables are connected and routed correctly to each motor according to the figure and according to the markings on the connectors.	 xx2300000014

Connecting the axis-5 motor cables

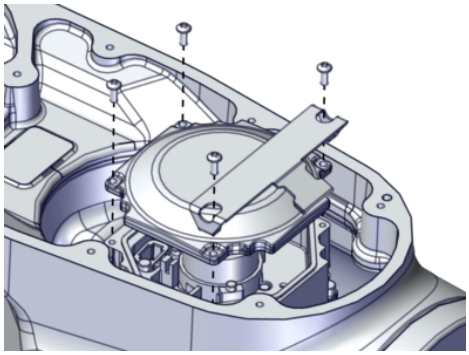
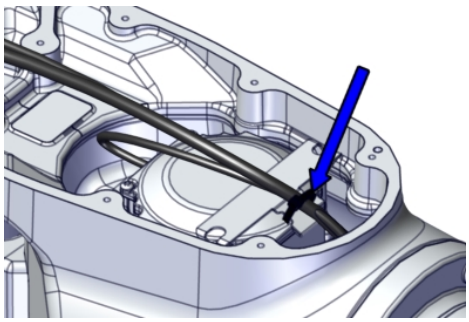
	Action	Note
1	Put the motor cables in place in the opening.	
2	Refit the cable bracket with the screws.	Torx pan head screw: M3x12 Stainless steel A2-70  xx2200001735

Continues on next page

	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  xx2200002141

Continues on next page

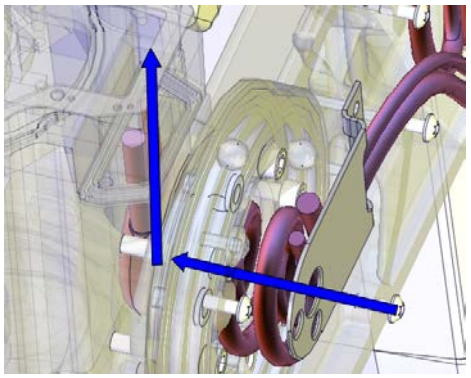
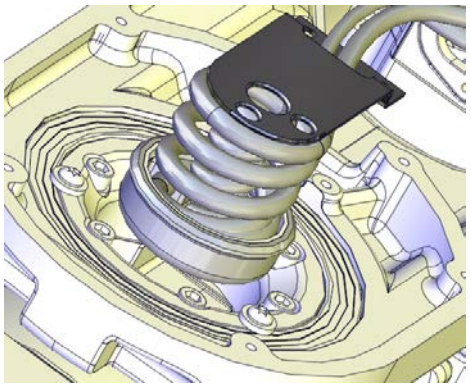
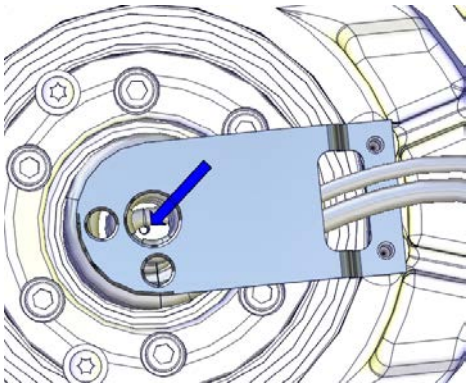
5.8.3 Replacing the axis-3 gearbox
Continued

	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.  xx2100002495
8	Secure the cabling with a cable strap.	Cable strap, outdoor: 3HAC057966-003  xx2100002625

Inserting the axis-6 motor cables

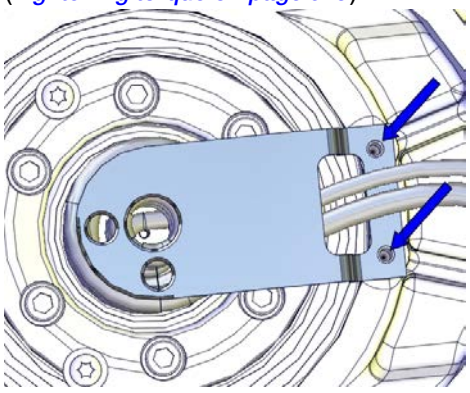
	Action	Note
1	**Note** Axis 5 must be in position +90° (or as close as possible) for a correct installation of the cable harness in the wrist. If not, connect the brake release tool to the axis-5 motor connector, release the brakes and move axis 5 manually to +90°.	

Continues on next page

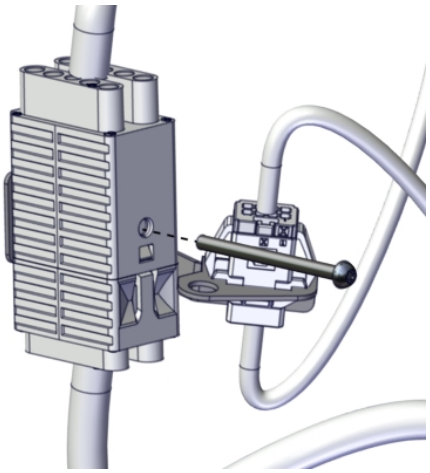
	Action	Note
2	Push the cable harness into the wrist recess and up into the axis-6 motor. **Tip** Moisten the rubber carrier slightly with water or grease around the contact surface, to make it easier to fit into place.	 xx1300000667
3	Push the carrier carefully into position.	 xx1300001113
4	Secure the 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

Continues on next page

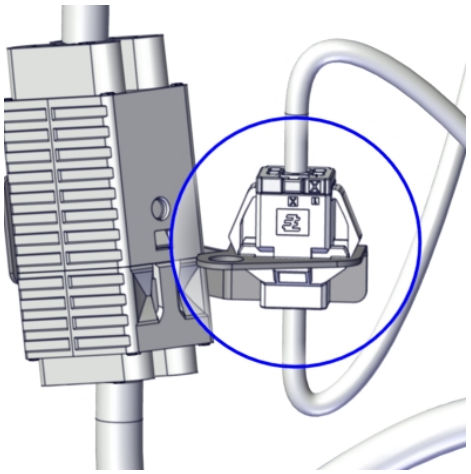
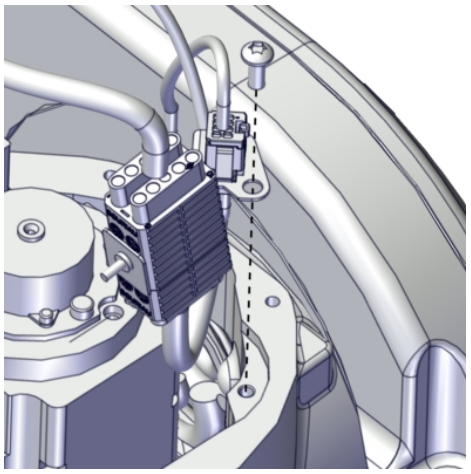
5.8.3 Replacing the axis-3 gearbox
Continued

	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 625*)..  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  xx2200001919

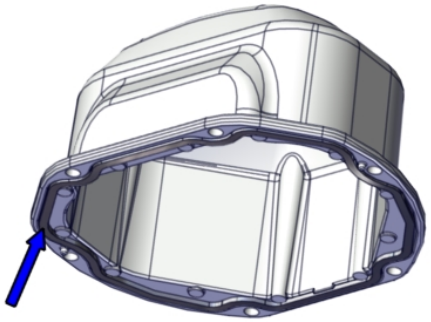
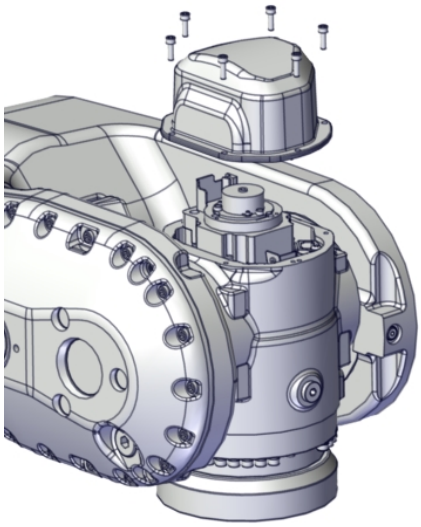
Continues on next page

	Action	Note
3	Snap the signal connectors to each other in the bracket.	 xx2200001920
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  xx2000000375
5	Verify correct cable layout as shown in the figure. **CAUTION** Route the signal cabling correctly to avoid cable damage.	 xx2100001293

Continues on next page

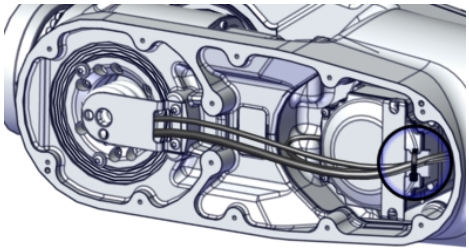
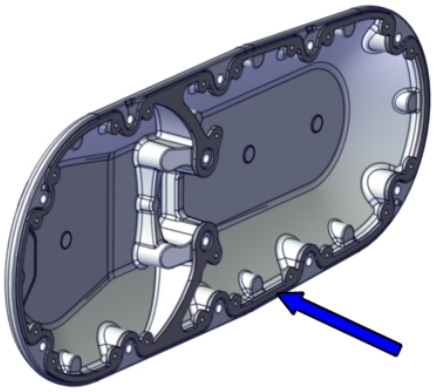
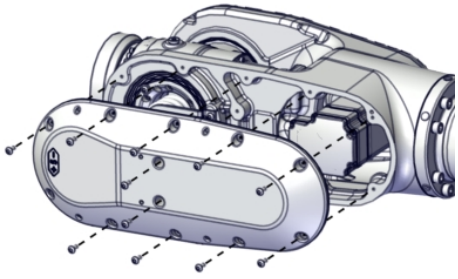
5.8.3 Replacing the axis-3 gearbox

Continued

	Action	Note
6	Inspect the gasket. Replace if damaged.	Gasket, tilt housing cover: 3HAC074482-001  xx2100001287
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8	Refit the motor cover.	Hex socket head cap screw: M5x16 12.9 Lafre 2C2B/FC6.9 (6 pcs) Tightening torque: 4 Nm.  xx2000000376

Continues on next page

Refitting the wrist cover

	Action	Note
1	Make sure that the cable harness is routed and secured as shown in the figure.	 xx2100002626 :
2	*Foundry Plus:* Inspect the gasket. Replace the complete cover if the gasket is damaged.	Wrist cover: 3HAC074181-002 (Graphite White) 3HAC074181-004 (ABB Orange)  xx2100001407
3	Refit the wrist cover and secure with screws. *Foundry Plus:* Fit all the screws first, then torque tighten.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2000000373

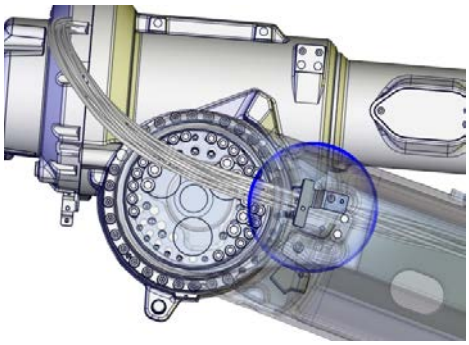
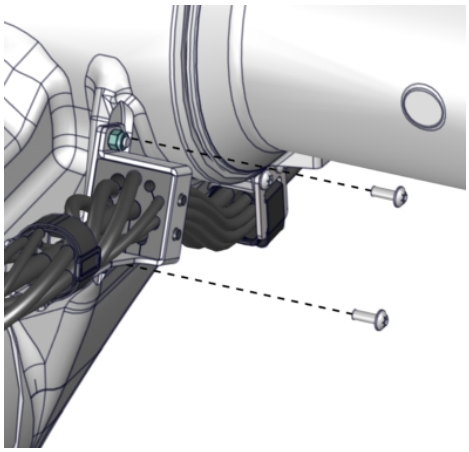
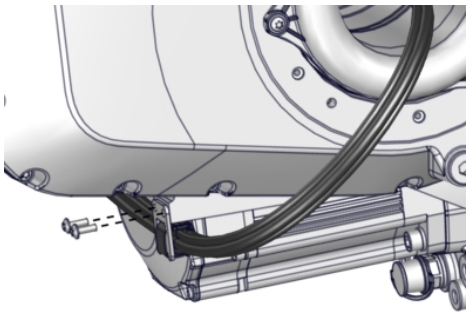
Refitting cable brackets

Use this procedure to refit the cable brackets.

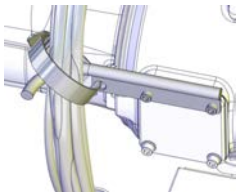
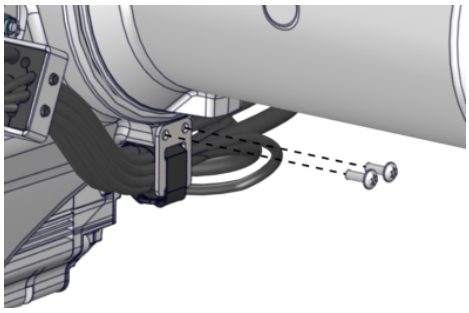
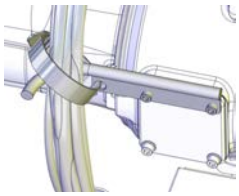
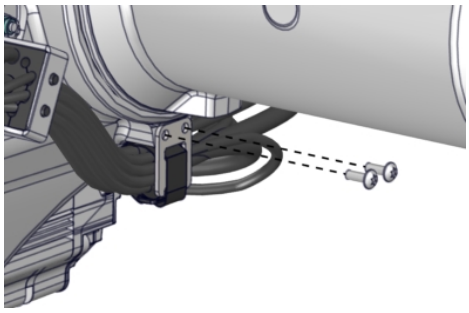
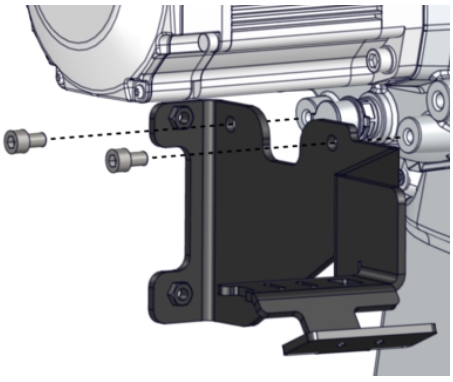
	Action	Note
1	Remove the lifting accessories.	
2	Move the cable harness and DressPack back to the correct side of the robot.	

Continues on next page

5.8.3 Replacing the axis-3 gearbox
Continued

	Action	Note
3	Refit the axis-3 lower arm metal clamp (the one closest to the axis-3 gearbox) located on the inside of the lower arm. **Note** The screw is reached from the outside of the lower arm!	 xx1800000042
4	Refit the metal clamp to the arm house.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2200001433
5	Refit the metal clamp beneath the arm house.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2200002142

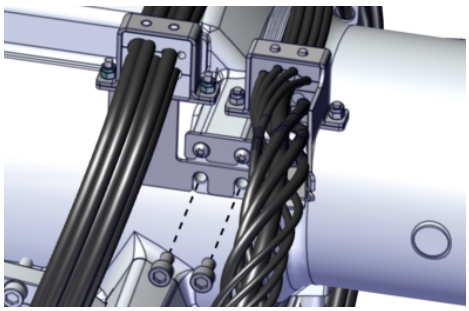
Continues on next page

	Action	Note
6	Refit the cable bracket underneath the tube shaft. **Note** If DressPack is fitted, the cable fixing bracket is replaced by the cable guide.  xx1300001973	Torx pan head screw: M6x16 A4-80 (2 pcs) Tightening torque: 10 Nm  xx2200001432
7	Secure the cable harness to the arm house eyelet with a cable tie. **Note** If DressPack is fitted, the cable fixing bracket is replaced by the cable guide.  xx1300001973	 xx2200001432
8	If robot is equipped with DressPack. Fit the mounting plate to the arm house. Use locking liquid.	Locking liquid: - (Loctite 2400 (or equivalent Loctite 243))  xx2300001036 Hex socket head cap screw: M10x16 8.8-A3F (2 pcs)

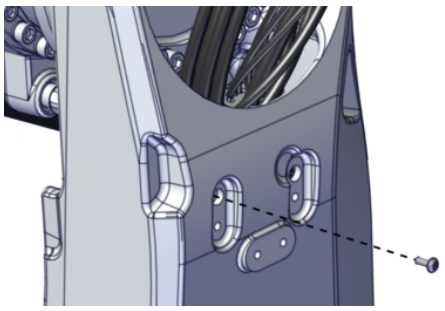
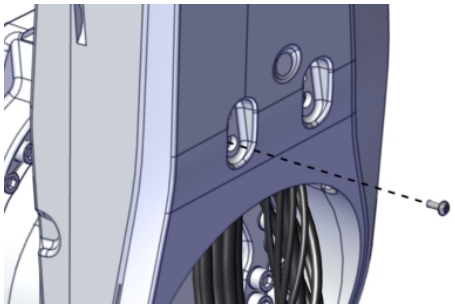
Continues on next page

5.8.3 Replacing the axis-3 gearbox

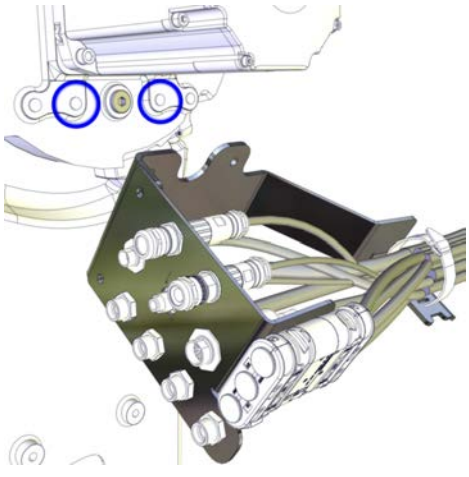
Continued

	Action	Note
9	If robot is equipped with DressPack. Fit the cable package bracket to the arm house with the attachment screws. Twist the dress pack cables between the upper and lower arm according to the picture.  xx1900001684	Locking liquid: - (Loctite 2400 (or equivalent Loctite 243))  xx2100002703 Hex socket head cap screw: M10x16 8.8-A3F (2 pcs)

Continues on next page

	Action	Note
10	If robot is equipped with DressPack. Fit the upper and lower bracket on the inside of the lower arm with attachment screws. Use locking liquid. The dress pack cables between the upper and lower bracket may not be twisted more than 1/2 turn.	See product manual for the DressPack. For article number see *References on page 10*. Locking liquid: Loctite 2400 (or equivalent Loctite 243)  xx2100002701  xx2100002702 Torx pan head screw: M6x16 Stainless steel A2-70 (2 pcs)

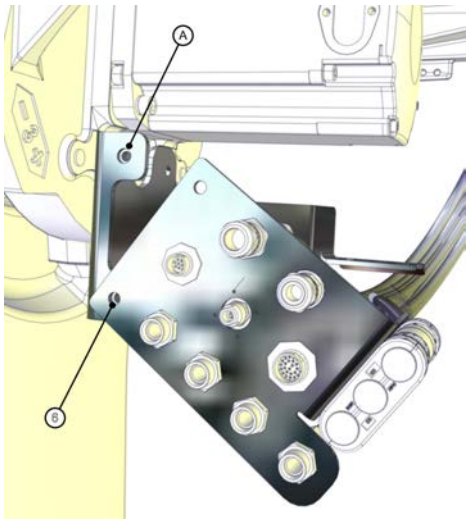
Refitting DressPack cable packages

	Action	Note
1	Fit the bracket of the DressPack cable package (if one is fitted) under the arm house with its screws.	 xx1200001332

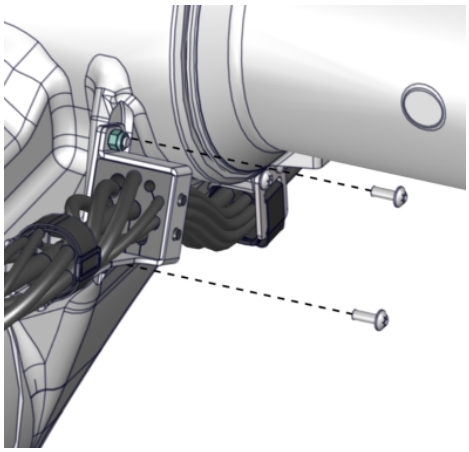
Continues on next page

5.8.3 Replacing the axis-3 gearbox

Continued

	Action	Note
2	Secure the bracket of the DressPack cable package (if one is fitted) with its attachment screws. **Note** It is not needed to disconnect the lower end of the DressPack as the figure shows. Connectors are only hidden here to get a better view of which screw to refit.	 xx1200001331 A Removed screw. B Screw unscrewed but not removed.

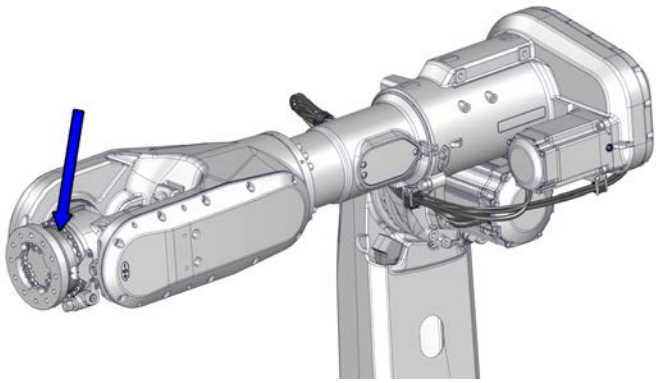
Concluding procedures

	Action	Note
1	Refit the metal clamp to the arm house.	Torx pan head screw: M6x16 A4-80 Tightening torque: 10 Nm.  xx2200001433
2	Refill oil in the gearbox.	See *Filling oil into the axis-3 gearbox on page 151*.
3	Calibrate the robot.	See *Calibration on page 585*.
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 94*.	

5.8.4 Replacing the axis-6 gearbox

Location of the gearbox

The gearbox is located as shown in the figure.



xx2200001768

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 6710 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Gearbox	3HAC074187-003 (Graphite White) 3HAC074187-004 (ABB Orange)	Includes o-ring	L2

Required service parts

Consumable	Article number	Note
O-ring	3HAC061327-070	Replace if damaged.
Gasket, tilt housing cover	3HAC074482-001	Replace if damaged.
O-ring, G 1/4"	3HAC061327-060	Used on oil plug. Always replace when refitting oil plug.
Cleaning agent	-	Isopropanol
P-80 rubber lubration gel	3HAC074427-001	P-80 Emulsion IFC
Flange sealant	-	Loctite 5800
Rust preventive	3HAC034903-001	Mercasol 3110 Waxcoat. Recommended drying time is 24h.
Lubricating oil	-	See *Type of lubrication in gearboxes on page 136*.

Continues on next page

5.8.4 Replacing the axis-6 gearbox
Continued

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 (axes 1, 2, 3 and 4) 3HAC074119-001 (axes 5 and 6)	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 628*.

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 595*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

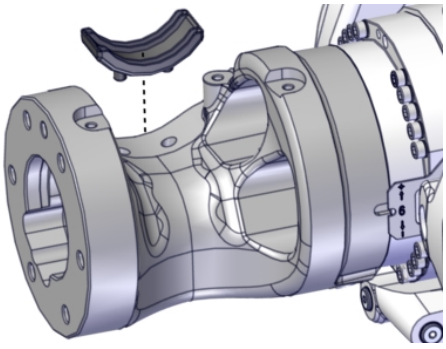
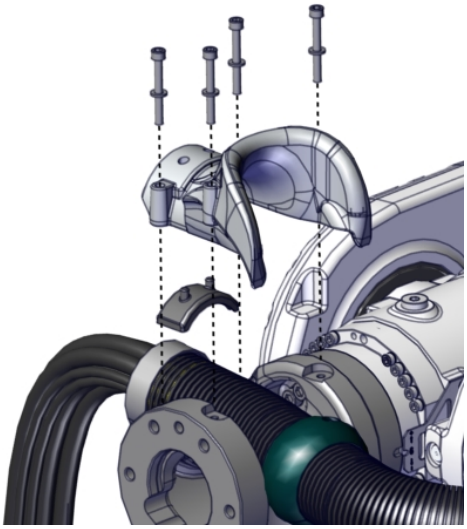
Removing the gearbox

Use these procedures to remove the axis-6 gearbox.

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.	

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	Drain the gearbox.	See *Draining the axis-6 gearbox on page 164*.
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	 xx2100002715
6	Jog the robot into position: • Axis 1 = no significance • Axis 2 = suitable working position to replace axis-6 gearbox (for example: +25°) • Axis 3 = suitable working position to replace axis-6 gearbox (for example: +20°) • Axis 4 = 0° • Axis 5 = -55° • Axis 6 = 0°	

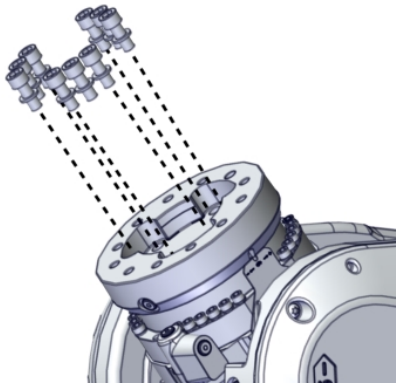
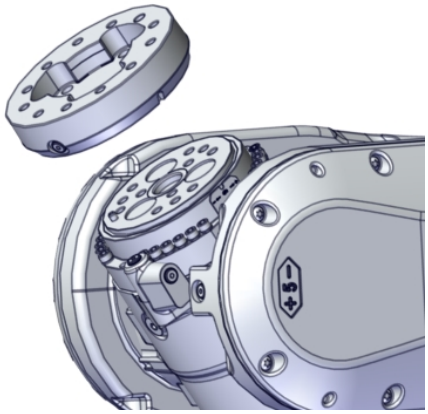
Continues on next page

5.8.4 Replacing the axis-6 gearbox

Continued

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

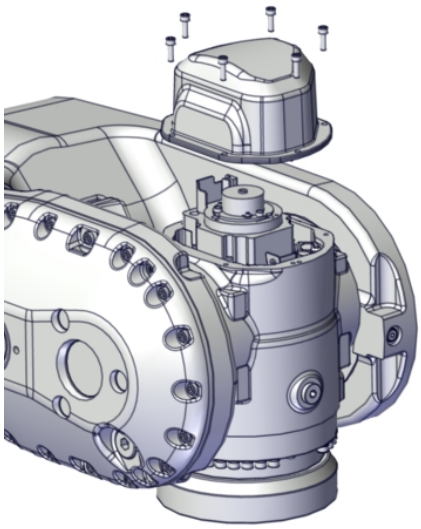
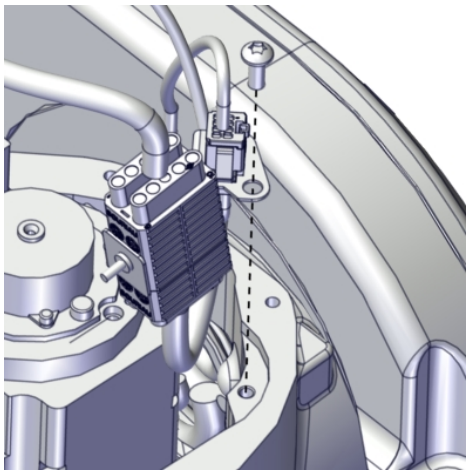
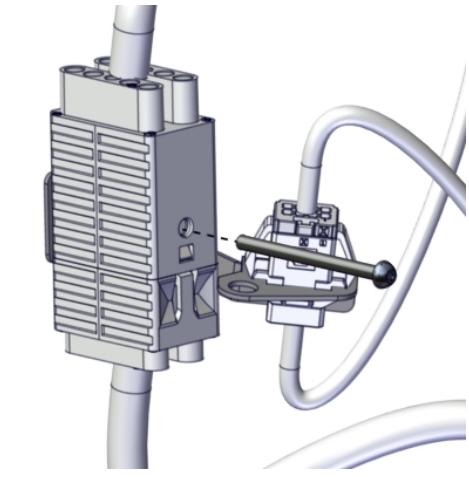
Removing the turning disc

	Action	Note
1	Remove the screws and washers, that secure the turning disc.	 xx2100002167
2	Remove the turning disc.	 xx2100002168

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

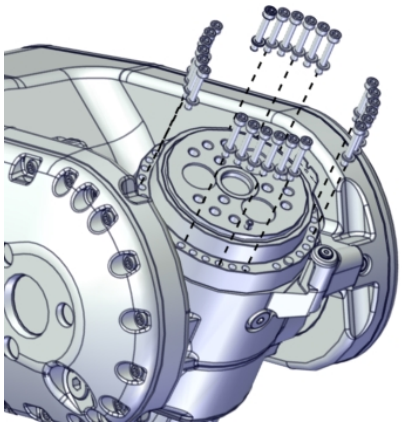
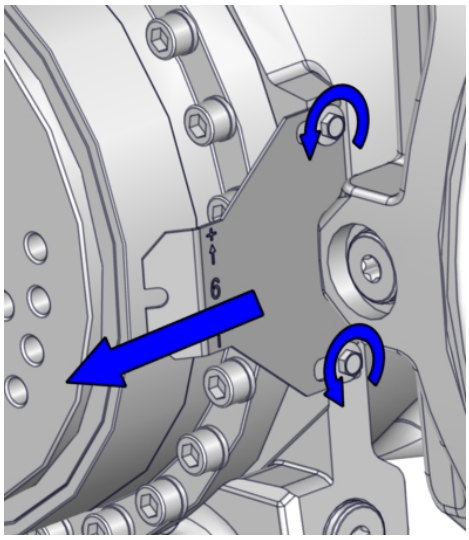
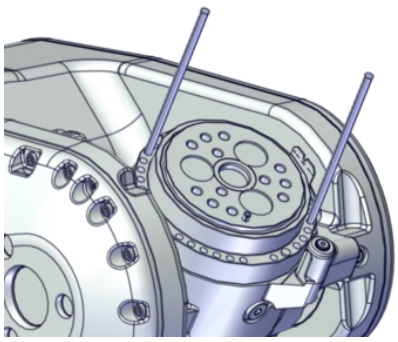
	Action	Note
2	Unscrew the attachment screws and remove the motor cover.	 xx2000000376
3	Remove the connector bracket.	 xx2000000375
4	Remove the connector screw.	 xx2200001919
5	Disconnect the motor cables.	

Continues on next page

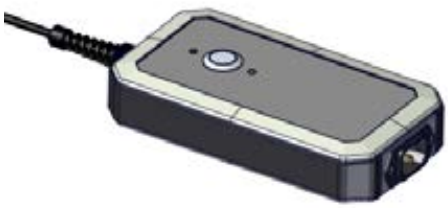
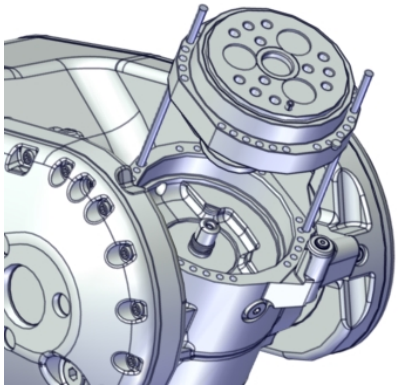
5.8.4 Replacing the axis-6 gearbox

Continued

Removing the axis-6 gearbox

	Action	Note
1	Unscrew the attachment screws that secure the axis-6 gearbox.	 xx2100002227
2	Remove the synchronization plate axis-6.	 xx2300001096
3	Fit guide pins.	Guide pin, M6x150: 3HAC080345-001 Always use guide pins in pairs.  xx2100002228

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.	 xx2100002259

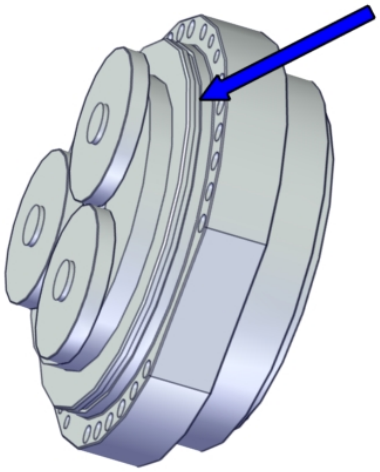
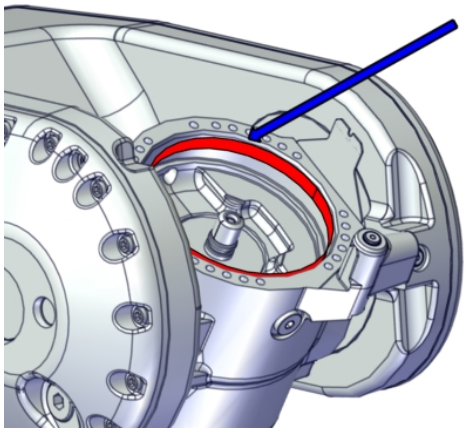
Continues on next page

5.8.4 Replacing the axis-6 gearbox
Continued

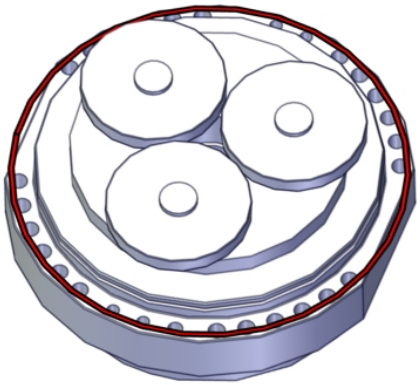
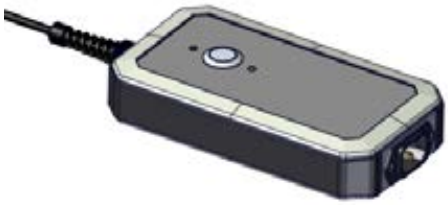
Refitting the gearbox

Use these procedures to refit the gearbox.

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: 3HAC061327-070  xx2100002258
4	Lubricate the contact surface inside the wrist with grease.	P-80 rubber lubration gel: 3HAC074427-001  xx2100002791

Continues on next page

	Action	Note
5	*Protection type Foundry Plus*: Apply flange sealant on the surface shown in the figure.	Flange sealant: Loctite 5800  xx2100002233
6	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

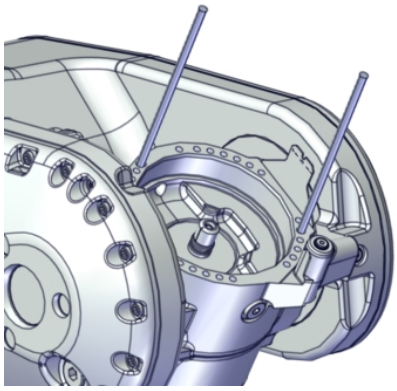
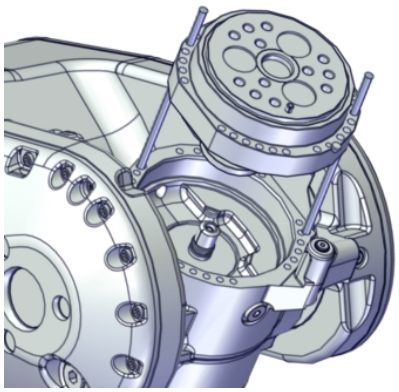
Refitting the axis-6 gearbox

	Action	Note
1	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

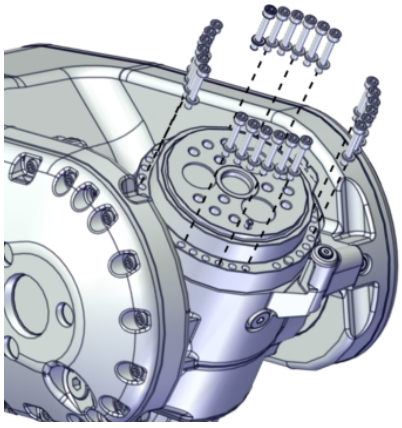
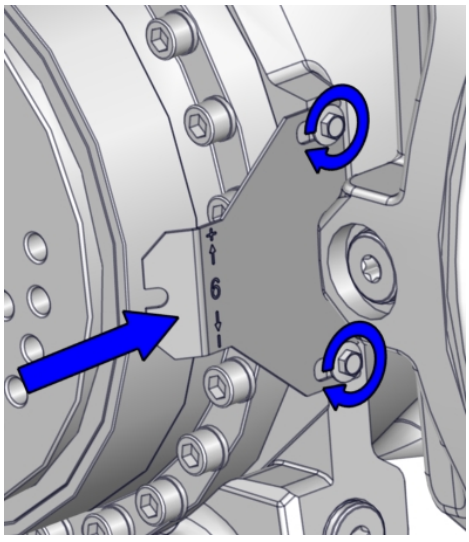
Continues on next page

5.8.4 Replacing the axis-6 gearbox

Continued

	Action	Note
2	Fit guide pins.	Guide pin, M6x150: 3HAC080345-001 Always use guide pins in pairs.  xx2200001237
3	Apply the rotation tool to the motor.	Rotation tool M3: 3HAB7887-1
4	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.	 xx2100002259

Continues on next page

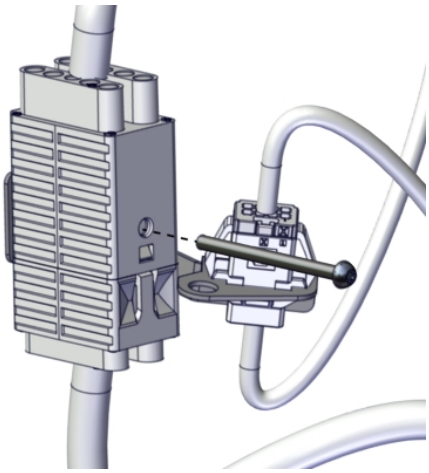
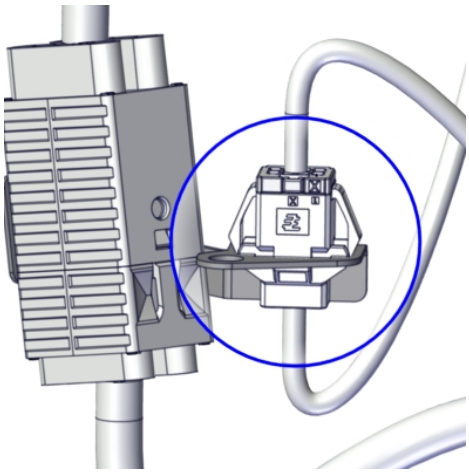
	Action	Note
5	Secure the gearbox with its attachment screws.	Hex socket head cap screw: M6x25 12.9 Gleitmo 603+Geomet 500 Washer: 3HAC045621-001, 24 pcs Tightening torque: standard torque 14 Nm (*Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws on page 626*).  xx2100002227
6	Disconnect the brake release tool.	
7	Perform a leak-down test.	See *Performing a leak-down test on page 178*.
8	Jog axis-5 to horizontal position.	
9	Refill oil in the gearbox.	See *Filling oil into the axis-6 gearbox on page 165*.
10	Refit the synchronization plate axis-6.	 xx2300001097

Continues on next page

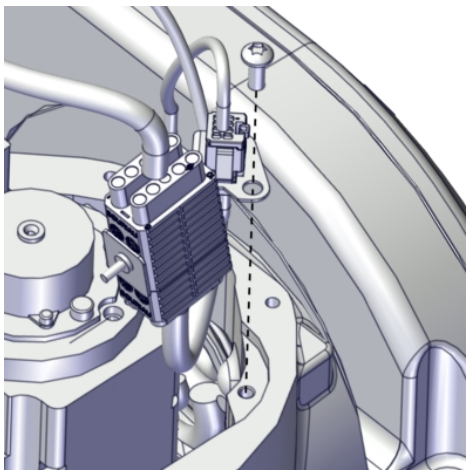
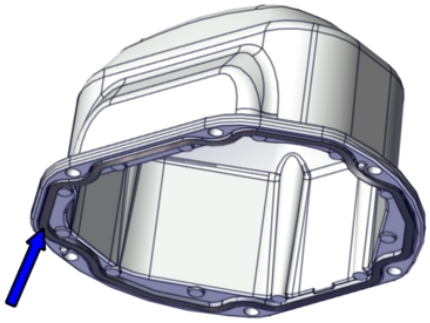
5.8.4 Replacing the axis-6 gearbox

Continued

Connecting the axis-6 motor cables

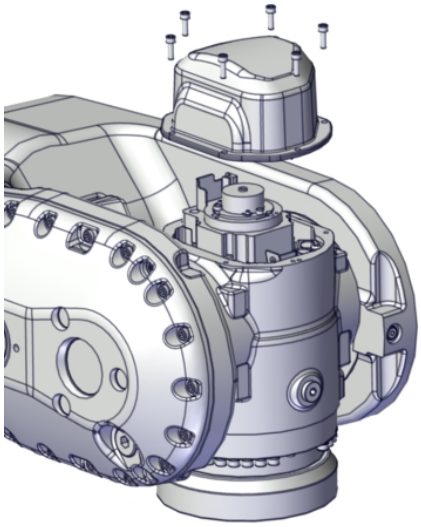
	Action	Note
1	Connect the motor cables. Connect in accordance with the markings on the connectors.	
2	Position the power connector to the bracket with a screw. **Note** The purpose of the screw is to secure the mating of the connectors and the positioning of the connector in the connection box. It is 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  xx2200001919
3	Snap the signal connectors to each other in the bracket.	 xx2200001920

Continues on next page

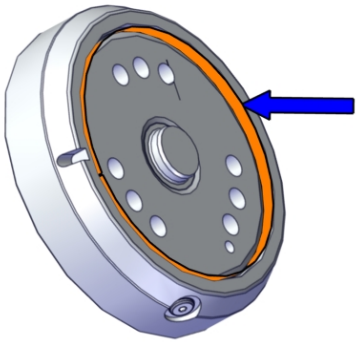
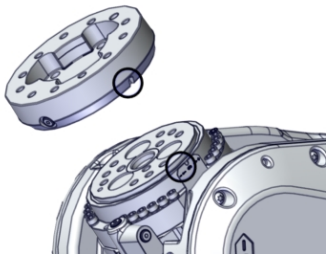
	Action	Note
4	Refit the connector bracket assembly to the motor. **CAUTION** The cabling is sensitive to mechanical damage. Handle it with care to avoid damage to the cabling or the connector, avoid any kind of tilt or skew.	Torx pan head screw: M5x12 Stainless steel A2-70  xx2000000375
5	Verify correct cable layout as shown in the figure. **CAUTION** Route the signal cabling correctly to avoid cable damage.	 xx2100001293
6	Inspect the gasket. Replace if damaged.	Gasket, tilt housing cover: 3HAC074482-001  xx2100001287
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	

Continues on next page

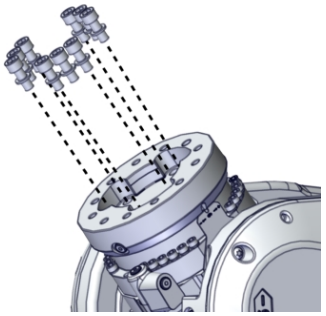
5.8.4 Replacing the axis-6 gearbox
Continued

	Action	Note
8	Refit the motor cover.	Hex socket head cap screw: M5x16 12.9 Lafre 2C2B/FC6.9 (6 pcs) Tightening torque: 4 Nm.  xx2000000376

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.	 xx2100002169

Continues on next page

	Action	Note
4	Secure the turning disc with its attachment screws and washers.	Hex socket head cap screw: M10x25 12.9 Gleitmo 603+Geomet 500 Washer: 3HAB4233-1 Tightening torque: standard torque 70 Nm (*Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws on page 626*)..  xx2100002167

Concluding procedure

	Action	Note
1	Calibrate the robot.	See *Calibration on page 585*.
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 94*.	

This page is intentionally left blank

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 594*.

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 6710. 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 594*.

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 629*.

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 592*. 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.

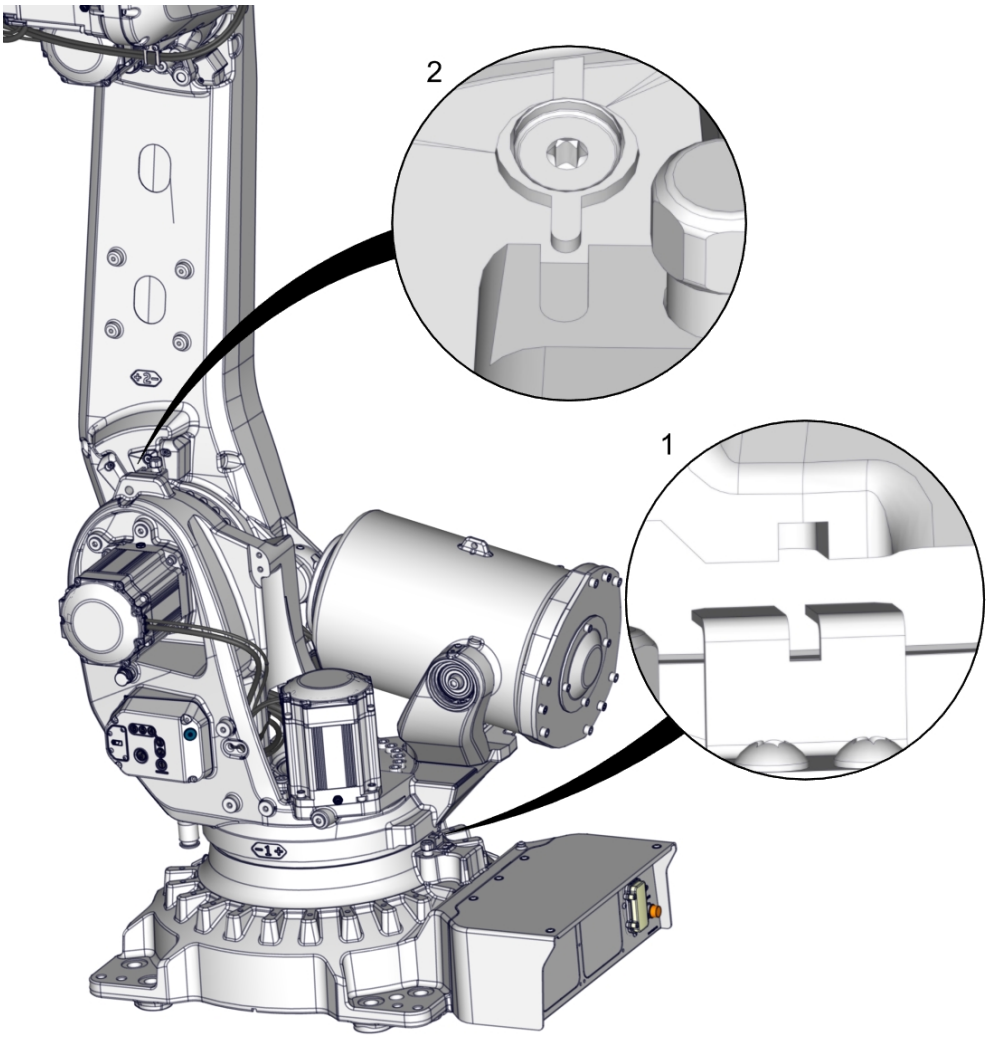
6.2 Synchronization marks and axis movement directions

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.

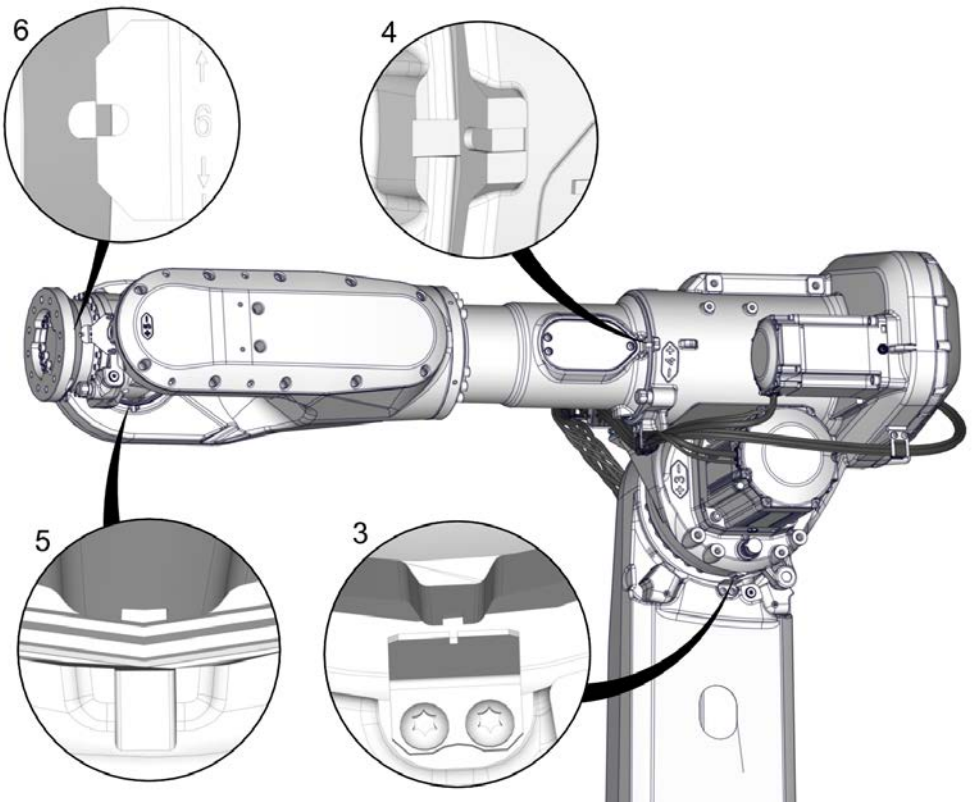
Synchronization marks, IRB 6710, IRB 6720, IRB 6730, IRB 6740



xx2200002087

Continues on next page

6.2.1 Synchronization marks and synchronization position for axes
Continued



xx2200002088

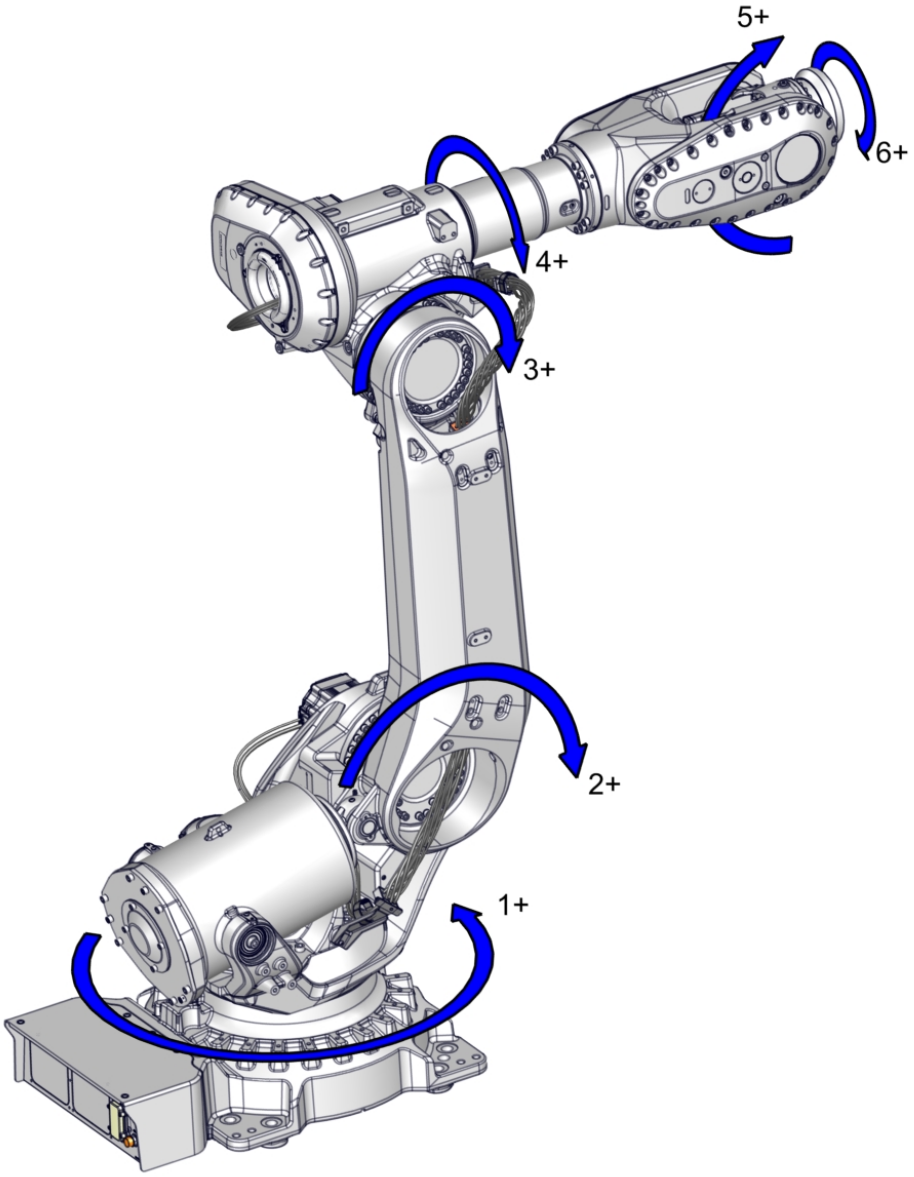
6.2.2 Calibration movement directions for all axes

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



xx2200002089

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 589*.
3	When all axes are positioned, update the revolution counter.	*Step 2 - Updating the revolution counter with the FlexPendant on page 592*.

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**.
2	Select **Calibration** from the menu. The **Mechanical Units** page displays a list of available mechanical units. **Note** This step is required only if you are not already in the **Mechanical Unit** page when you open **Calibrate**. **Note** The **Mechanical Unit** page is displayed only if there are more than one mechanical unit available. Otherwise, the calibration summary page for the available mechanical unit is displayed.
3	Select the mechanical unit for which revolution counter need to be updated.
4	The calibration summary page for the selected mechanical unit is displayed. Calibration method used at factory for each axis is shown, as well as calibration method used during last field calibration.
5	Tap **Calibration Methods** on the right pane. The calibration options are displayed.
6	Tap **Revolution Counters**.
7	In the **Selection** column select the axes for which revolution counters need to be updated.

Continues on next page

	Action
8	Tap **Update**. A dialog box is displayed, warning that the updating operation cannot be undone: • Tap **Update** to proceed with updating the revolution counters. • Tap **Cancel** to cancel updating the revolution counters. Tapping **Update** and a confirmation window is displayed.
9	Tap **OK**. The revolution counter for the selected axes is updated.
10	**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 608*.

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

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

6.4.1 Description of Axis Calibration
Continued

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 (axes 1, 2, 3 and 4) 3HAC074119-001 (axes 5 and 6)	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.

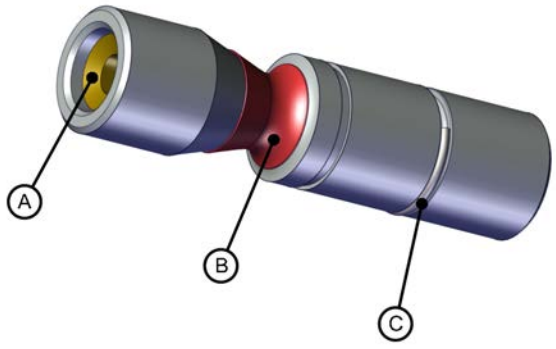
Examining the calibration tool

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

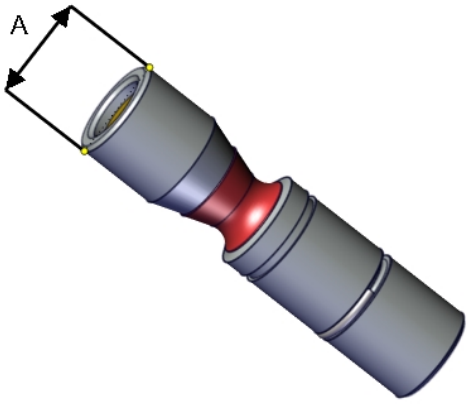
Continues on next page

6.4.2 Calibration tools for Axis Calibration
Continued

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.	

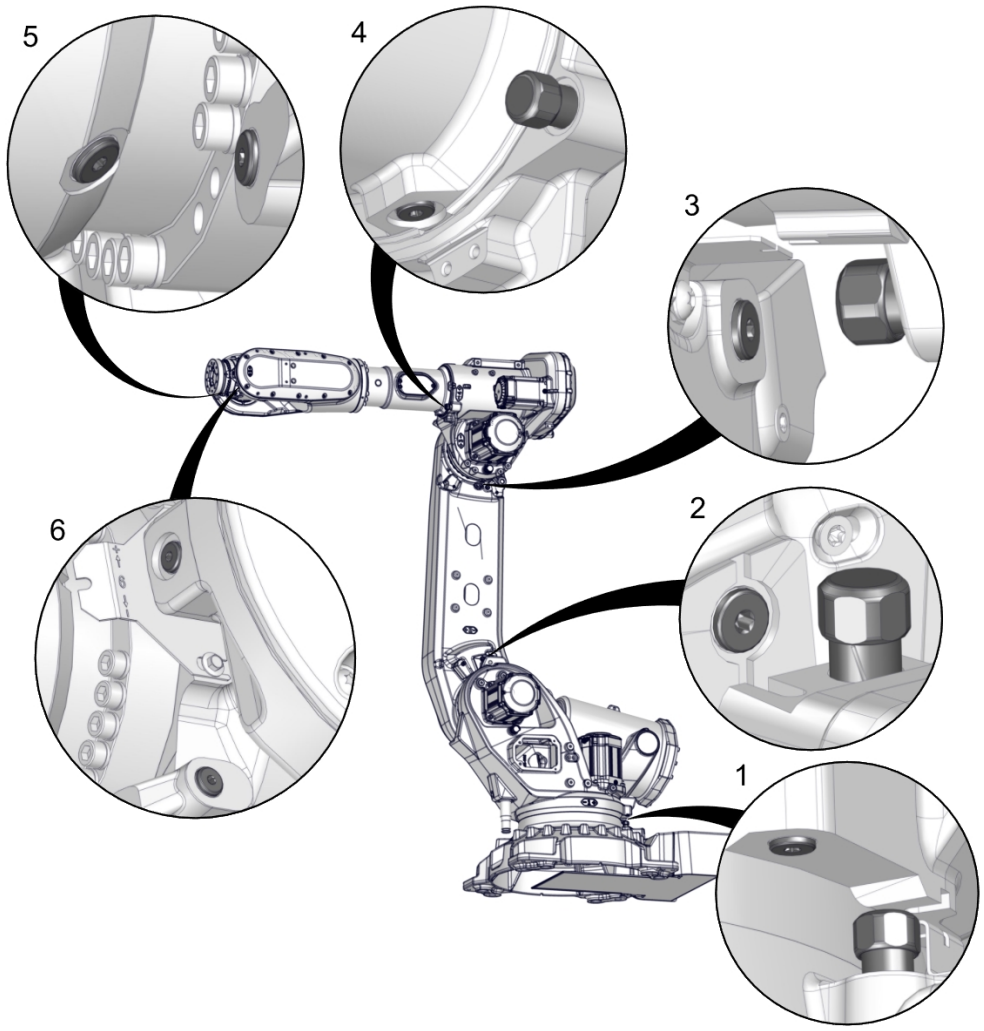
6.4.3 Installation locations for the calibration tools

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.



xx2300000257

Continues on next page

6.4.3 Installation locations for the calibration tools
Continued

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 (axes 1, 2, 3 and 4) 3HAC074119-001 (axes 5 and 6)	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 595*.
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

	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 601*.

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 591*

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.

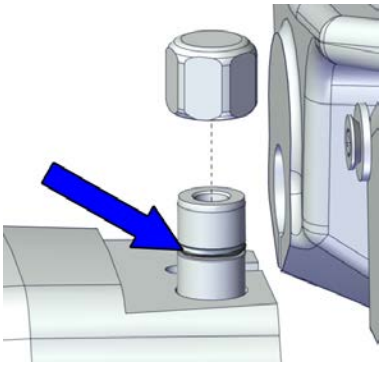
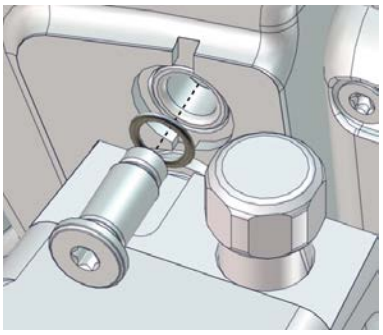
CAUTION

SafeMove must be synchronized after the calibration is completed.

Continues on next page

6.4.4 Axis Calibration - Running the calibration procedure
Continued

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 silver label (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 label for resolver values with new 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 605*).

Example "Adjust axis 4":

1. Create a backup.

Continues on next page

6.4.5 Reference calibration
Continued

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 608*.
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 589*.
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.

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 589* and *Updating revolution counters on page 592*.

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 589* and *Updating revolution counters on page 592*.

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.

Note

During troubleshooting with power on, the internal fan might cause dust to enter the cabinet.

CAUTION

During troubleshooting with power on, make sure not to place your head too close to the internal fan located on the door.

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.

Continues on next page

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.
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 6710 on page 173*. 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 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.

This page is intentionally left blank

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 616*.

Transportation

Prepare the robot or parts before transport, this to avoid hazards.

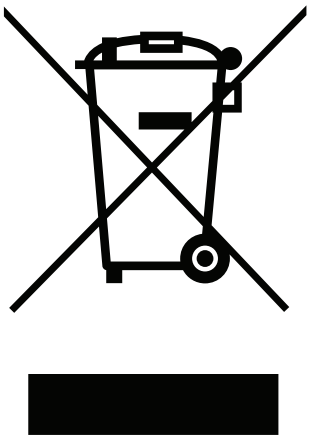
8.2 Environmental information

Introduction

ABB robots contain components in different materials. During decommissioning, all materials should 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.

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, tilt house, covers, connection box, motor housing
Batteries, Lithium	Serial measurement board
Brass, zink alloys	Calibration protection cap and plug and couplings, connectors and nuts in cable harness
Cast iron/nodular iron	Structural parts (base, frame, lower arm, arm house, tube shaft, process turning disc)
Circuit boards	Serial measurement unit, brake release unit
Copper	Cables, motor wiring, pins, sockets
Dysprosium	Motor magnets
Lithium	Battery
Neodymium	Motor magnets

Continues on next page

Material	Example application
Nickel	Coating of turning disc, calibration caps, quick coupling, connectors, pins, sockets
Oil, grease	Gearboxes
Steel	Turning disc, gears, shafts, bearings, motors, brackets, screws, washers
Thermo plastics	Protection tubes, protection covers, plugs, cable jackets, cable filler, connectors
Thermo setting polymers	Motor winding, cable jackets, hoses, clamps, dampers, o-rings, sealings, 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 628*.
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.

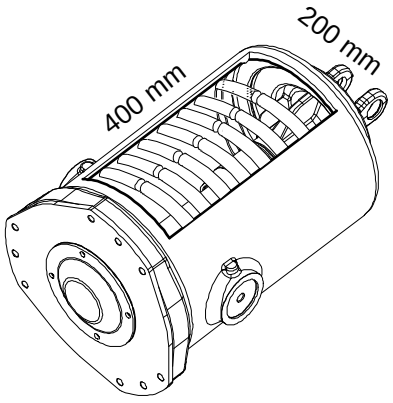
	Action	Note
1	Remove the balancing device from the robot.	Detailed in section *Replacing the balancing device on page 186*.
2	Send the device to a decommissioning company.	Make sure the decommissioning company is well informed about the stored energy built up by high tensioned compression springs and that the device contains some grease. 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	**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!	
4	Cut a hole in the housing as shown in the figure.	Use a cutting torch with a long shaft. The measurements shown below are maximum values.  xx0700000391
5	Cut the coils of the springs inside the housing as specified below: • Outer spring: cut at least five coils! • Middle spring: cut at least four coils! • Inner spring: cut at least four coils!	Use a cutting torch with a long shaft.
6	Double-check the number of coils cut and make sure all the tension in the springs is removed.	

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

Region specific standards and regulations

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
CAN/CSA Z 434-03 CAN/CSA Z 434-14	Industrial robots and robot Systems - General safety requirements
EN ISO 10218-1	Robots and robotic devices — Safety requirements for industrial robots — Part 1: Robots

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

Stainless steel screws

Stainless steel screws should be secured by hand at least 2 turns before using an electric screwdriver.

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.

Continues on next page

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.

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

Continues on next page

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
M12	82	115	140
M16	200	290	340
M20	400	560	670
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

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

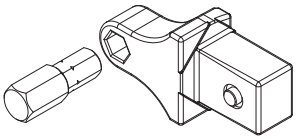
General

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	Bit holder and hexagon bit SW10, Bit holder dimension: 5/16" (14x18 mm) Used for screw access in narrow locations.	Used for screw access in narrow locations (for example the screws for axis-1 gearbox/frame and wrist/arm tube).  xx2200001085
1	Socket head cap 2.5-17 mm	
1	Torx socket no: 10-30	
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	Hexagon socket spanner no. 8	Screwdriver for hexagon screws, used for the power cable connector at the base.
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 628*, and of special tools, listed directly in the instructions and also gathered in this section.

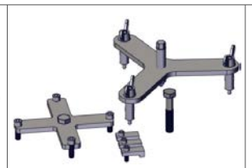
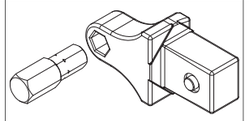
Special tools

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-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	Balancing device rear bearings (in cradle)	Balancing device front bearing (in link ear)	Wrist
Removal/refitting tools																	
3HAC079878-001	Replacement tool for arm house cover	 xx2100002289							1								
3HAC028920-001	Dismantle and mounting tool										1			1	1	1	
3HAC14631-1	Removal tool motor M12		2	2	2	2	2			2	2	2					
3HAC14972-1	Removal tool motor M10							2									
3HAC080346-001	Removal tool motor M8																
-	Screws M8x75, fully threaded											2					
-	Screws M10x80, fully threaded										2						
3HAC12342-1	Bits extender		1	1	1	1	1			1	1	1					
	Bit holder and hexagon bit SW10	 xx2200001085								1							1
3HAC074411-001	Hydraulic press equipment, balancing device	 xx2000001376									1			1	1	1	
3HAC13086-1	Hydraulic pump 80 MPa										1			1	1	1	
3HAC11731-1	Hydraulic cylinder										1			1	1	1	
Lifting accessories																	
-	Roundsling, 0.5 m									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-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	Balancing device rear bearings (in cradle)	Balancing device front bearing (in link ear)	Wrist
-	Roundsling, 1 m									1	1	1					1
-	Roundsling, 1.5 m										1						
-	Roundsling, 2 m									1							
3HAC081585-001	Lifting accessory for gear	 xx2100002415									1	1					
-	Fender washer									1	1	1					
3HAC15556-1	Lifting accessory (chain)	 xx1200001241		1						1	1	1		1	1	1	
3HAC16131-1	Lifting eye	 xx1200001242								2	2	1					
-	Lifting shackle	 xx1200001243								1	1			1	1	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					
3HAC13056-2	Guide pin, M12x150									2	1	2					2
3HAC13056-3	Guide pin, M12x200										1						
3HAC062397-001	Guide pin, M16x120									1							

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-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	Balancing device rear bearings (in cradle)	Balancing device front bearing (in link ear)	Wrist
3HAC062398-001	Guide pin, M16x250									1							
Brake release																	
3HAC081310-001	Brake release tool	 xx2100000666	1	1	1	1	1	1		1	1	1	1				(1)
Calibration tools																	
3HAC074564-001 (axes 1, 2, 3 and 4) 3HAC074119-001 (axes 5 and 6)	Calibration toolbox, Axis Calibration		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					
3HAB7887-1	Rotation tool M3							1					1				
3HAC080331-001	Adjustment tool for gear										1	1					
-	Lock screw, M16x120			1										1	1	1	
-	Screw, M6 x minimum 70 mm								2								
3HAC043870-009	Guide for reduction gear	 xx1700002195															
										1							

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.

This page is intentionally left blank

Index

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 201319, 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

3HAC085695-001, Rev A, en