ROBOTICS

Product manual

IRB 8700

Trace back information:
Workspace 24D version a6
Checked in 2024-12-13
Skribenta version 5.6.018

Product manual

IRB 8700 - 550/4.20
IRB 8700 - 800/3.50

IRC5, OmniCore

Document ID: 3HAC052853-001

Revision: V

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Keep for future reference.

Additional copies of this manual may be obtained from ABB.

Original instructions.

Table of contents

Overview of this manual

About this manual

This manual contains instructions for:

- mechanical and electrical installation of the IRB 8700
- maintenance of the IRB 8700
- mechanical and electrical repair of the IRB 8700

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

- *Foundry Plus*

This manual describes the manipulator using either the IRC5 or the OmniCore controller.

Product manual scope

The manual covers all variants and designs of the IRB 8700. 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.

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References

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

General

Document name	Document ID
Product manual, spare parts - IRB 8700	*3HAC052854-001*
Circuit diagram - IRB 8700	*3HAC051028-002*
Product manual - DressPack IRB 8700	*3HAC055802-001*
Safety manual for robot - Manipulator and IRC5 or OmniCore controller [i]	*3HAC031045-001*
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*

[i] This manual contains all safety instructions from the product manuals for the manipulators and the controllers.

OmniCore robots

Document name	Document ID
Product specification - IRB 8700	*3HAC087213-001*
Product manual - OmniCore V400XT	*3HAC081697-001*
Operating manual - OmniCore	*3HAC065036-001*
Technical reference manual - System parameters	*3HAC065041-001*
Application manual - Additional axes	*3HAC082287-001*

IRC5 robots

Document name	Document ID
Product specification - IRB 8700	*3HAC052852-001*
Product manual - IRC5 IRC5 with main computer DSQC1000 or later.	*3HAC047136-001*
Operating manual - IRC5 with FlexPendant	*3HAC050941-001*
Operating manual - Service Information System	*3HAC050944-001*
Technical reference manual - System parameters	*3HAC050948-001*
Application manual - Additional axes and standalone controller	*3HAC051016-001*
Application manual - CalibWare Field	*3HAC030421-001*

Revisions

Revision	Description
-	First edition.
A	The following updates are made in this revision: • Repair chapter added • Edited information regarding deciding calibration routine in each repair section. • Added a warning that calibration pin must be inserted in the calibration bushing until it snaps, see *Description of Axis Calibration on page 688*. • Added warning regarding risk of pinching, in *Description of Axis Calibration on page 688*.

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Revision	Description
	• Added information about inspection of calibration tool prior to usage, see *Examining the calibration tool on page 691*. • Added information about the calibration procedure, see *Overview of the calibration procedure on the FlexPendant on page 695*, *Restarting an interrupted calibration procedure on page 697*. • Added information about Axis Calibration when SafeMove is installed, see *Axis Calibration with SafeMove option on page 697*. • Turn motion axis-6 updated to ±360°, see *Working range on page 47*.
B	The following updates are made in this revision: • Illustrations added throughout the manual. • Minor updates throughout the manual.
C	Published in release R16.2. The following updates are made in this revision: • Drawing of the base plate is updated. • Drawing of base plate is not available for purchase, faulty information removed in *Securing the base plate on page 61*. • Bearing grease 3HAC9408-1 changed name from Longtime PD2 to Tribol GR 100-2 PD • Fork lift accessory descriptions updated. • Working range updated. • Main dimensions updated. • Updated spare parts due to sealing upgrade in the motors: - Motors - Upper arm excluding wrist - Wrist - Axis 6 complete
D	Published in release R17.1. The following updates are made in this revision: • Updates in procedure Replacing the axis-1 gearbox, *Replacing the axis-1 gearbox on page 530* • Figures in Filling oil into axis-1 gearbox updated. • Caution with figures to ensure relieving pressure on the correct balancing device added. • Grease for cross roller bearing changed (from Tribol GR 100-0 PD to Mobilux EP2). • Bending radius for static floor cables added. • Motors updated, M12 instead of M14 holes for removal tool on motors axis 1-3. • Removal tool changed from 14 to 12 in required tools on axis 4 and 5. • Added information that re-calibration is needed after replacement of hub. • Added replacement information in Replacing the hub, *Replacing the hub on page 523*.
E	Published in release R17.2. The following updates are made in this revision: • Caution about removing metal residues added in sections about SMB boards. • Information about minimum resonance frequency added. • Base plate article number updated. (Is 3HAC053772-003, was 3HAC053772-002) • Orange spare parts added. • Installation drawing updated.

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Revision	Description
	• Replacement methods for following spare parts are updated/completed: - axis-1 gearbox - axis-2 gearbox - axis-3 gearbox - axis-6 gearbox - upper arm - brake release board - balancing device - cable harness - lower arm - hub • Illustrations and data for information labels corrected. • Added text regarding overhaul in section specification of maintenance intervals. • Added article number for Grease Castrol Molub-Alloy 777-1 (used with Hub splines). • Section *Start of robot in cold environments on page 96* added. • Updated information regarding disconnecting and reconnecting battery cable to serial measurement board. • Added figures and corrected information regarding inspection of oil level and change of oil in axis-6 gearbox. • Changed amount of screws and image for removal/refitting of axis-6 unit support shaft. • Definition of reference calibration clarified. • Updated maintenance schedule.
F	Published in release R18.1. The following updates are made in this revision: • Information added about fatigue to Axis Calibration tool, see *Calibration tools for Axis Calibration on page 691*. • Added sections in *General procedures on page 187*. • Added reference manual for DressPack. • Safety restructured. • Updated spare parts number brake release board unit (was BRK001, is DSQC1052). • Note added to calibration chapter to emphasize the requirement of equally dressed robot when using previously created reference calibration values. • Information about myABB Business Portal added. • Added Nickel in Environmental information. • Added article numbers for cooling fan cabling between robot base and control cabinet.
G	Published in release 19B. The following updates are made in this revision: • Lifting capacity of roundslings updated. Suggested lifting equipment is according to local regulations. • Special tools list updated. • Replacement methods for following spare parts are updated: - parallel rod - upper arm - balancing device • Corrected dimension of support screw for parallel rod during removal/refitting of shaft. • Added guide pin in cross roller bearing axis 1.

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Revision	Description
	• New touch up color Graphite White available. See *Cut the paint or surface on the robot before replacing parts on page 194*. • Information about a mandatory check of cable harness added to *Updating revolution counters on IRC5 robots on page 682*.
H	Published in release 19C. The following updates are made in this revision: • Added a revision note to the history for revision G regarding mandatory check of cable harness. • Changed information regarding refitting of revolution indicator, during removal of gear Z3. • Changed order in axis-2 gearbox replacement regarding removal of motor flange prior to removing the gearbox. • Removed information regarding the revolution indicator throughout the manual. • Added KM sleeve to replacement procedure for the balancing devices. • Note added about the need to calibrate if the robot is other than floor mounted. See *When to calibrate on page 679*. • Clarified reference to external user instructions for press tools, regarding replacement of upper arm shafts and KM nuts, parallel rod shafts and bearings. In the same time deleted duplicated information, so that all information regarding the replacements are now only found in the tools user instructions.
J	Published in release 19D. The following updates are made in this revision: • Added references to DressPack manual in *Robot cabling and connection points on page 89*. • Added information about grounding point. See *Robot cabling and connection points on page 89*. • Removed article number for leak-down tester.
K	Published in release R20A. The following updates are made in this revision: • Minor editions throughout the manual (added caution when putting down balancing device during removal rotating lifting eye, added note VLBG to lifting eye 3HAC16131-1) • Added article numbers for floor cabling. • Replaced article number and name of grease, previously 3HAB3537-1. • Clarified and added information in mounting instructions for rotating sealings, see *Mounting instructions for sealings on page 190*. • Clarified text about position of robot and added table with dependencies between axes during Axis Calibration.
L	Published in release R20B. The following updates are made in this revision: • Added information about Wrist Optimization in calibration chapter.
M	Published in release R20C. The following updates are made in this revision: • Added hub tool to the replacement procedure for the hub. • Pallet removed from required tools tables. • Added information about motor units and gear units in *Installation*.
N	Published in release 21C. The following updates are made in this revision: • Text regarding fastener quality is updated, see *Fastener quality on page 82*. • Info about option Extended working range included, see *Extended working range, axis 1 (option) on page 83*.

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Revision	Description
P	Published in release 22C. The following updates are done in this revision: • Updated information about Gleitmo treated screws, see *Screw joints on page 716*. • Replacement methods for following spare parts are updated/completed: - axis-1 gearbox - axis-2 gearbox - axis-6 motor - upper arm - cable harness
Q	Published in release 23B. The following updates are done in this revision: • Added a step for overall inspection of cabling after cable harness has been replaced. • Missing chapter "Test run after installation, maintenance, or repair" added. • Removed tools for parallel arm replacement from the special tools list. • Added axis positions for most stable transport position and removed information about shipping position. • Updated the removal tools when removing motor 1-5. • Greasing method for cross roller bearing updated.
R	Published in release 23C. The following updates are done in this revision: • Added the section Replacing the cross roller bearing.
S	Published in release 23D. The following updates are done in this revision: • Removed the section Replacing the axis-4 primary gearbox. • Added illustrations to cleaning section. • Updated the section Replacing the cross roller bearing.
T	Published in release 24A. The following updates are done in this revision: • Updated the section Replacing the cross roller bearing. • Updated information about the transportation pallet from factory.
U	Published in release 24B. The following updates are made in this revision: • Updated all spare part lists with spare part level and added a spare part level definition to the manual. • Removed the section *Replacing the lower arm*. It is redefined as an L3 spare part. • Added information for the OmniCore robot controller. • Added hole dimension for lubrication of balancing device bearings.
V	Published in release 24D. The following updates are made in this revision: • Added missing hub tool in list of required equipment in section *Replacing the axis-4 motor flange on page 309*. • Spare part numbers for parallel bar parts added. • Removed detailed instructions of how to use the fork lift device and instead added references to the fork lift user documentation (enclosed with the fork lift set).

Product documentation

Categories for user documentation from ABB Robotics

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

Tip

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

Product manuals

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

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

Technical reference manuals

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

Application manuals

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

An application manual generally contains information about:

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

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- 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 19*.

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.

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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.

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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 23*.

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.

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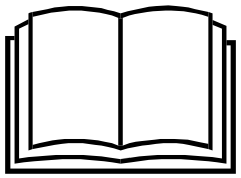
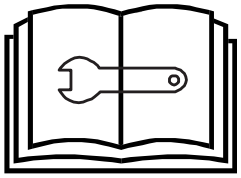
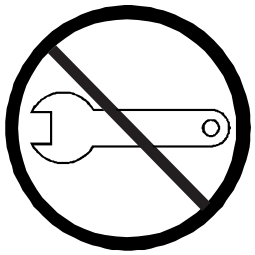
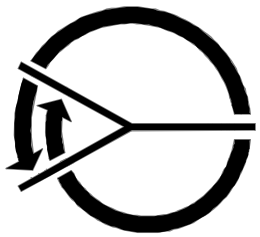
1.2.2 Safety symbols on manipulator labels
Continued

Symbol	Description
 xx0900000813	**See user documentation** Read user documentation for details. Which manual to read is defined by the symbol: • No text: *Product manual*. • EPS: *Application manual - Electronic Position Switches*.
 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.

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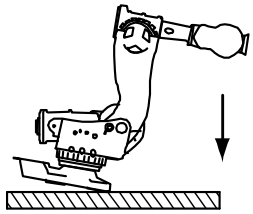
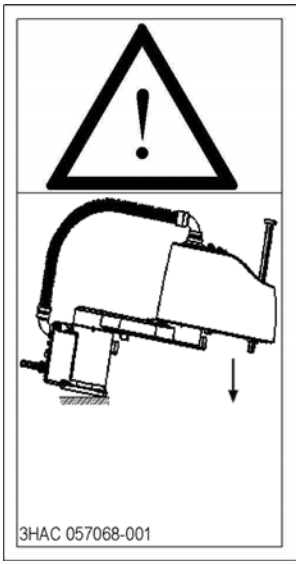
Symbol	Description
 xx0900000810  xx1500002402	**Tip risk when loosening bolts** The robot can tip over if the bolts are not securely fastened.
  xx0900000817	**Crush** Risk of crush injuries.

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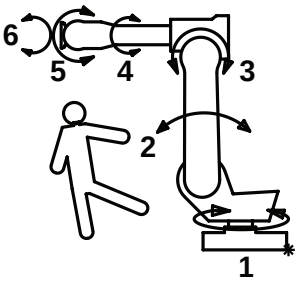
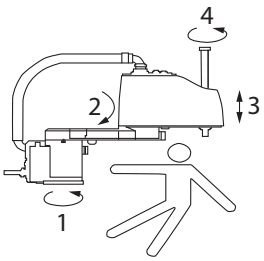
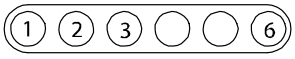
1.2.2 Safety symbols on manipulator labels

Continued

Symbol	Description
 xx0900000818  xx1300001087	**Heat** Risk of heat that can cause burns. (Both signs are used)
 xx2400000736  xx1500002616	**Moving robot** The robot can move unexpectedly.
 xx0900000820  xx1000001140	**Brake release buttons**

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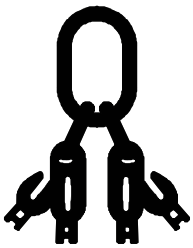
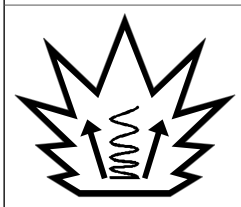
Symbol	Description
 xx0900000821	**Lifting bolt**
 xx1000001242	**Adjustable chain sling with shortener**
 xx0900000822	**Lifting of robot**
 xx0900000823	**Oil** Can be used in combination with prohibition if oil is not allowed.
 xx0900000824	**Mechanical stop**
 xx1000001144	**No mechanical stop**
 xx0900000825	**Stored energy** Warns that this part contains stored energy. Used in combination with *Do not disassemble* symbol.

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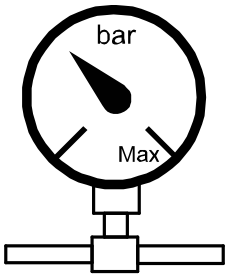
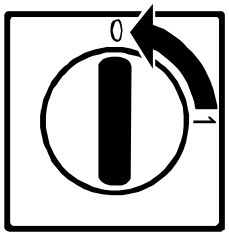
1.2.2 Safety symbols on manipulator labels

Continued

Symbol	Description
 xx0900000826	**Pressure** Warns that this part is pressurized. Usually contains additional text with the pressure level.
 xx0900000827	**Shut off with handle** Use the power switch on the controller.
 xx1400002648	**Do not step** Warns that stepping on these parts can cause damage to the parts.

1.3 Robot stopping functions

Protective stop and emergency stop

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

For more information see:

- *Product manual - OmniCore V400XT*
- *Product manual - IRC5*

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 708* 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.

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Using lifting accessories and other external equipment

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

Electrical safety

Incoming mains must be installed to fulfill national regulations.

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

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

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

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

Note

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

Safety devices

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

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

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

Other hazards

A robot may perform unexpected limited movement.

WARNING

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

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

- Water
- Compressed air
- Hydraulics

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

Continues on next page

Pneumatic or hydraulic related hazards

Note

The pressure in the complete pneumatic or hydraulic systems must be released before service and maintenance.

All components in the robot system that remain pressurized after switching off the power to the robot must be marked with clearly visible drain facilities and a warning sign that indicates the hazard of stored energy.

Loss of pressure in the robot system may cause parts or objects to drop.

Dump valves should be used in case of emergency.

Shot bolts should be used to prevent tools, etc., from falling due to gravity.

All pipes, hoses, and connections have to be inspected regularly for leaks and damage. Damage must be repaired immediately.

Verify the safety functions

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

1.5 Safety during operation

Automatic operation

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

Unexpected movement of robot arm

WARNING

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

A robot may perform unexpected limited movement.

WARNING

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

1.6 Safety during maintenance and repair

1.6.1 Safety during maintenance and repair

General

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

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

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

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

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

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

Hot surfaces

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

Allergic reaction

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

Gearbox lubricants (oil or grease)

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

Note

Take special care when handling hot lubricants.

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

Continues on next page

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

Continues on next page

1.6.1 Safety during maintenance and repair
Continued

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

Hazards related to batteries

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

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

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

Operating temperatures are listed in *Operating conditions, robot on page 45*.

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 70*.

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 707*.

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

Unexpected movement of robot arm

WARNING

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

A robot may perform unexpected limited movement.

WARNING

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

2 Installation and commissioning

2.1 Introduction to installation and commissioning

General

This chapter contains assembly instructions and information for installing the IRB 8700 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 43*.

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 19* before performing any installation work.

Note

Always connect the IRB 8700 and the robot to protective earth and residual current device (RCD) before connecting to power and starting any installation work.

For more information see:

- *Product manual - OmniCore V400XT*
- *Product manual - IRC5*

2.2 Unpacking

2.2.1 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 43*
6	If the robot is not installed directly, it must be stored as described in: *Storage conditions, robot on page 45*
7	Make sure that the expected operating environment of the robot conforms to the specifications as described in: *Operating conditions, robot on page 45*
8	Before taking the robot to its installation site, make sure that the site conforms to: • *Loads on foundation, robot on page 44* • *Protection classes, robot on page 46* • *Requirements, foundation on page 45*
9	Before moving the robot, please observe the stability of the robot: *Risk of tipping/stability on page 50*
10	When these prerequisites are met, the robot can be taken to its installation site as described in section: *On-site installation on page 54*
11	Install required equipment, if any. • *Safety lamp (option for IRC5) on page 93*

2.2.2 Technical data

Weight, robot

The table shows the weight of the robot.

The weight does not include the weight of the DressPack.

Robot model	Weight
IRB 8700	4,750 kg

Note

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

The weight does not include the weight of the DressPack.

Mounting positions

The table shows valid mounting options for the manipulator.

Mounting option	Installation angle	Note
Floor mounted	0°	

Note

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

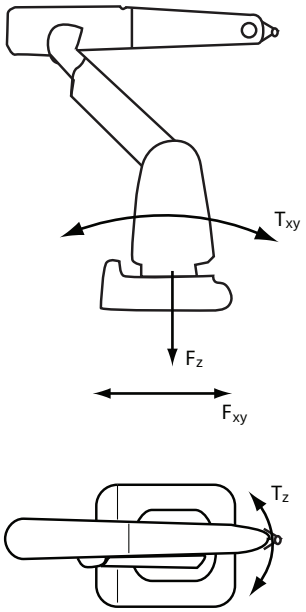
Continues on next page

2.2.2 Technical data
Continued

Loads on foundation, robot

The illustration shows the directions of the robots stress forces.

The directions are valid for all floor mounted, suspended and inverted robots.



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F_{xy}	Force in any direction in the XY plane
F_z	Force in the Z plane
T_{xy}	Bending torque in any direction in the XY plane
T_z	Bending torque in the Z plane

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)	Max. load (emergency stop)
Force xy	±13.5 kN	±50.3 kN
Force z	52.2 ±13.7 kN	52.2 ±41.9 kN
Torque xy	±77.7 kNm	±146.9 kNm
Torque z	±9.2 kNm	±31.8 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 application manual of the controller software, section *Motion Process Mode*.

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 (-13°F)
Maximum ambient temperature	+55°C (+131°F)
Maximum ambient temperature (less than 24 hrs)	+70°C (+158°F)
Maximum ambient humidity	Maximum 95% at constant temperature.

Operating conditions, robot

The table shows the allowed operating conditions for the robot:

Parameter	Value
Minimum ambient temperature	+5°C i (41°F)
Maximum ambient temperature	+50°C (122°F)

Continues on next page

2.2.2 Technical data
Continued

Parameter	Value
Maximum ambient humidity	Maximum 95% at constant temperature.

i At low environmental temperature (below 10° C) a warm-up phase is recommended to be run with the robot. Otherwise there is a risk that the robot stops or runs with lower performance due to temperature dependent oil and grease viscosity.

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 Foundry Plus	IP67

i According to IEC 60529.

2.2.3 Working range

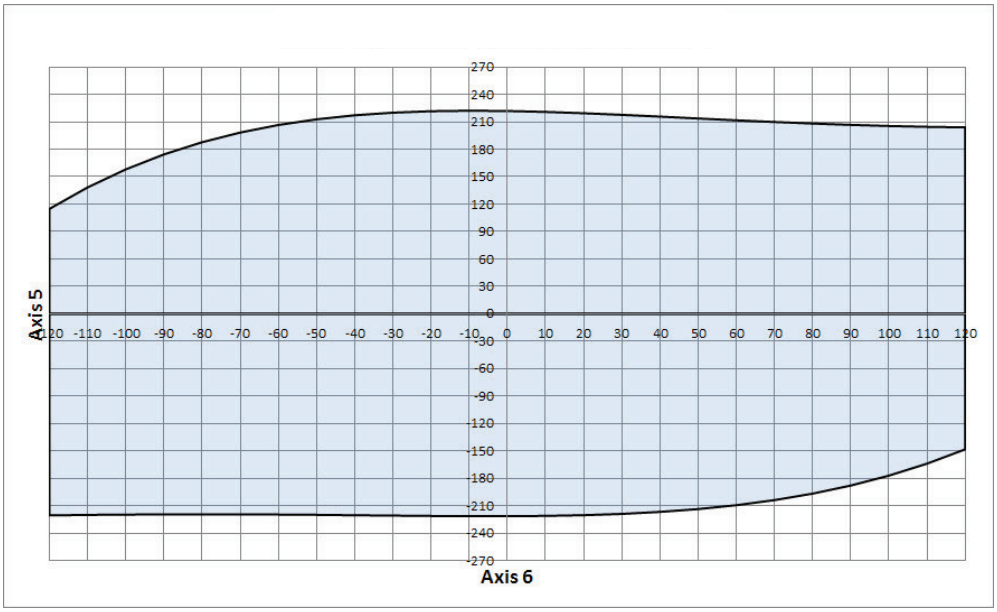
Variants

Variants IRB 8700 - 550/4.20, - 800/3.50

Axis	Type of motion	Working range	Note
Axis 1	Rotation motion	±170°	
		±220°	Option
Axis 2	Arm motion	-65°/+90°	Restrictions with SW DressPack fitted.
Axis 3	Arm motion	-30°/+132°	Restrictions with SW DressPack fitted.
Axis 4	Wrist motion	±300°	
Axis 5	Bend motion	±130°	
Axis 6	Turn motion	±360°	
		±93.7 revolutions	Maximum value. The default working range for axis 6 can be extended by changing parameter values in the software. Option 610-1 Independent axis can be used for resetting the revolution counter after the axis has been rotated (no need for "rewinding" the axis).

Working range axis 5 and axis 6 for LeanID, option 780-4

Allowed working area for axis 6 related to axis 5 position is shown in the figure.



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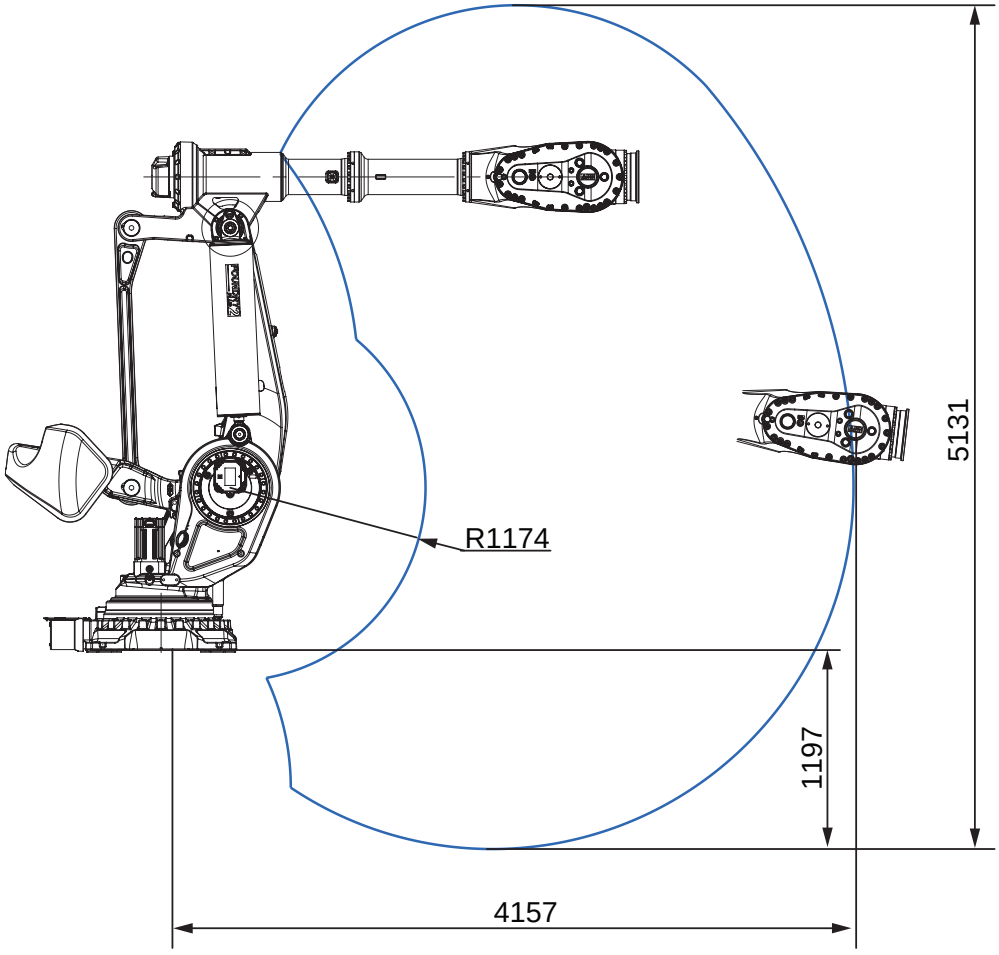
2.2.3 Working range
Continued

Illustration, working range IRB 8700 - 550/4.20

This illustration shows the unrestricted working range of the robot.



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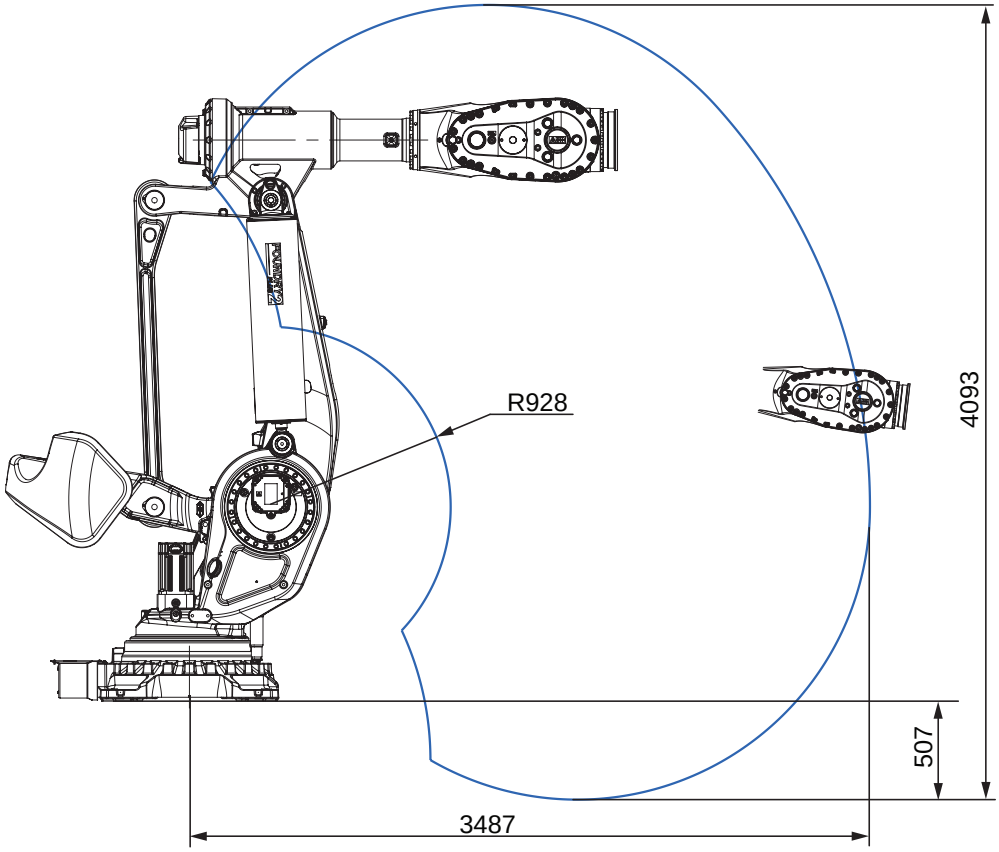
Illustration, working range IRB 8700 - 800/3.50

This illustration shows the unrestricted working range of the robot.



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2.2.4 Risk of tipping/stability

Risk of tipping

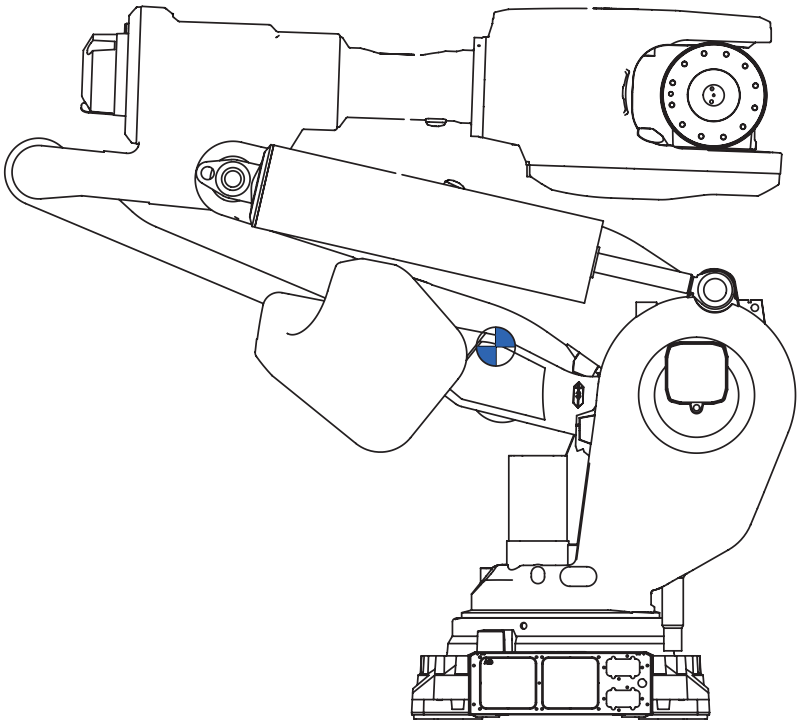
If the robot is not fastened to the foundation while moving the arm, the robot is not stable in the whole working area. Moving the arm will displace the center of gravity, which may cause the robot to tip over.

The transportation position is the most stable position.

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

Transportation position

This figure shows the robot in its transportation position.



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Axis number	Angle of axis
Axis 1	-90°
Axis 2	-65°
Axis 3	2°
Axis 4	90°
Axis 5	-90°
Axis 6	0°

Note

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

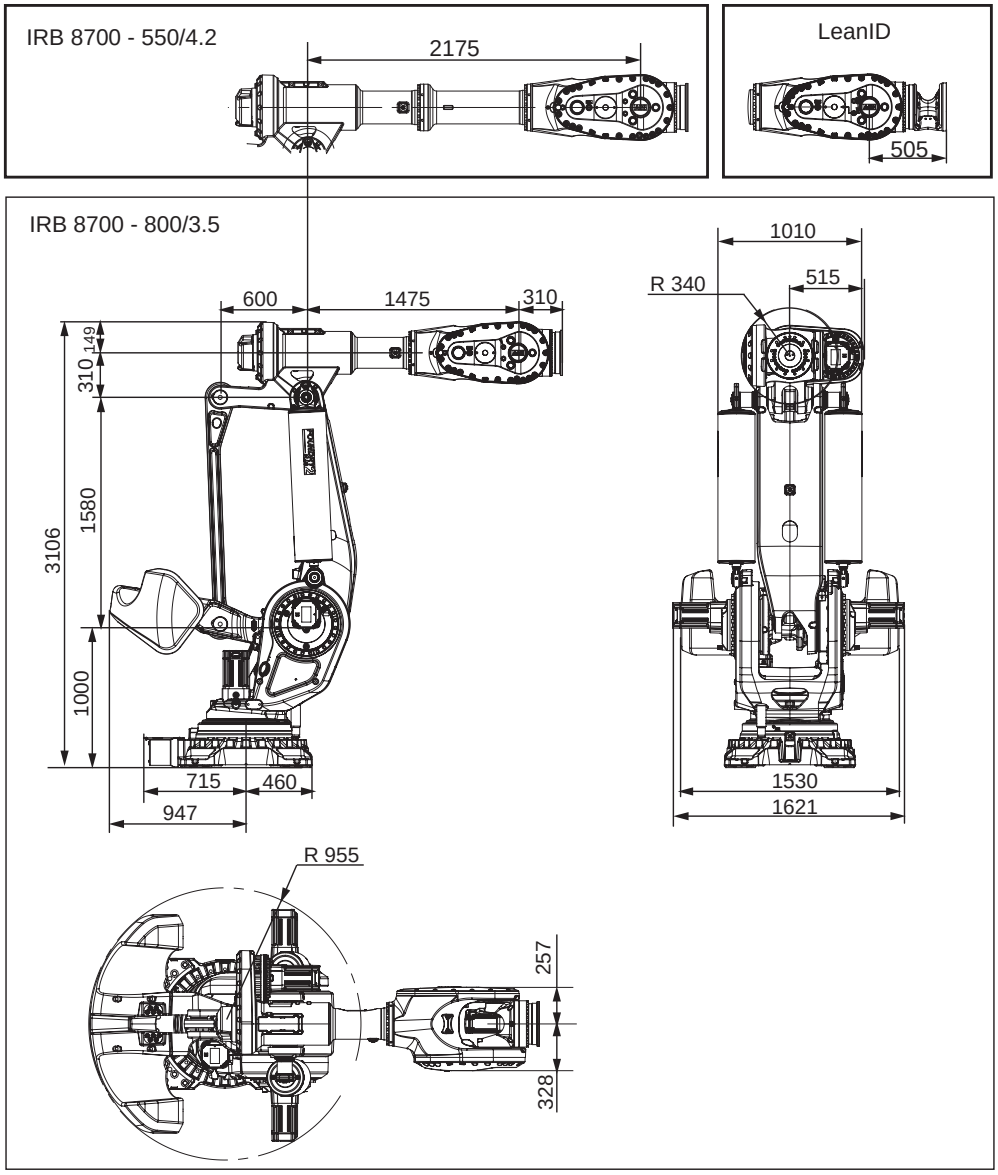
Continues on next page

WARNING

The robot will be mechanically unstable if not properly secured to the foundation.

2.2.5 Main dimensions

Illustration



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2.2.6 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.

2.3 On-site installation

2.3.1 Lifting the robot with fork lift accessory set installed

Introduction

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.

> **DANGER**
>
> Never use the fork lift accessory pockets to fit roundslings or lifting chains, in order to lift the complete robot! The Fork lift accessory set 3HAC053662-003 shall *only* be used to lift the robot with a fork lift truck..

Safety and limitations of use

When using the fork lift accessory set, the following must be considered:

- This Fork lift accessory set (3HAC053662-003) is only allowed for the use of lifting the IRB 8700. All other usage is prohibited.
- Lifting a robot with the Fork lift accessory set is only allowed if lifting is done using all four fork lift accessories.
- Do not lift a robot with the Fork lift accessory set if any of the pockets or attachment screws are damaged or missing.
- The operator of the fork lift truck, must be fully trained and authorized to operate a fork lift truck.
- The fork lift truck being used, must have the lifting capacity to handle the weight (4,750 kg) of the robot being lifted and transported.
- The forks of the truck must have the sufficient length to be inserted completely into all four fork lift pockets.
- Before lifting, make sure that the truck is as close as possible to the robot. If not, there is a risk that the truck and the robot will tip over, resulting in possible injury or damage.

Required tools and equipment

Equipment	Article number	Note
Fork lift accessory set	3HAC053662-003	Contains fork lift pockets and all required hardware for installation on robot base. User instructions are enclosed with the tool.

Continues on next page

Required documents

Document	Document number
Directions for use - Fork lift accessory set 3HAC053662-003	3HAC055664-001

Lifting the robot

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

2.3.2 Attaching the robot and removing the fork lift accessory set

Introduction

When the robot has been moved and attached to the foundation, the fork lift accessory set must be removed from the robot. If not the counterweight will collide with the fork lift accessory set, in certain positions.

This section describes how to reattach the robot to the foundation and the removal of the fork lift accessory set from the robot.

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

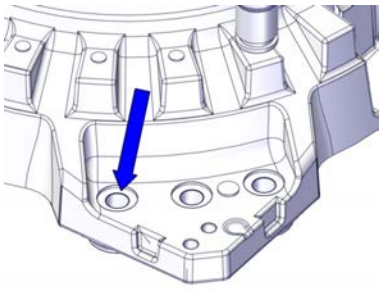
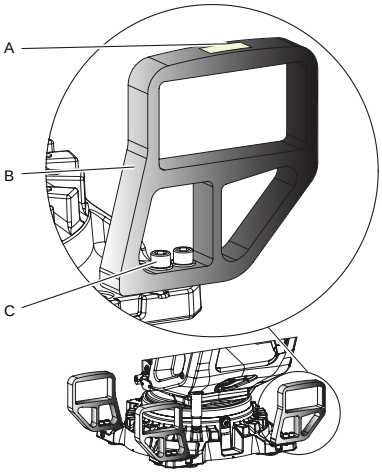
Required consumable

Consumable	Article number	Note
Molykote 1000		For lubricating screws

Reattaching the robot and removal of the fork lift accessory set

	Action	Note
1	**CAUTION** Make sure that the foundation, on which the robot shall be placed, is clean. Make sure that all foreign objects has been removed, prior to putting down the robot.	
2	Use caution and put down the robot in its new location.	
3	Lubricate the attachment screws used to secure the robot to the foundation.	Molykote 1000

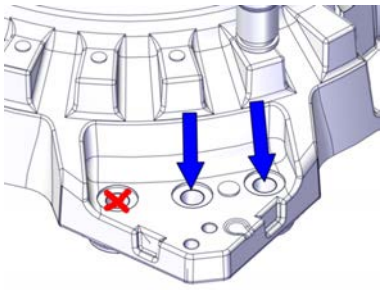
Continues on next page

	Action	Note
4	Secure the robot to the foundation while the fork lift truck is still holding the robot in the fork lift pockets. Fasten the attachment screws furthest away from the fork lift accessories. **DANGER** DO NOT power up the robot until it is secured to the foundation with all 12 attachment screws.	Attachment screws: M24x100 (one in each pocket) Tightening torque, Lubricated screws (Molykote 1000): 550 Nm Tightening torque, not/lightly lubricated screws: 600-750 Nm, typical 650 Nm  xx1500002296
5	Use caution and move the truck out off the fork lift accessory set.	
6	Remove the four fork lift accessories. **CAUTION** Each fork lift accessory pocket weighs 18 kg. Use caution when handling them. **CAUTION** The fork lift accessory set must always be removed from the robot before powering up the robot. If not, the counterweight will collide with the fork lift accessory pockets, in certain positions.	 xx1400002588 A – CE label B – Fork lift accessory pocket (4 pcs) C – Attachment screws MC6S 20x60 8.8 (2 pcs x4)

Continues on next page

2.3.2 Attaching the robot and removing the fork lift accessory set

Continued

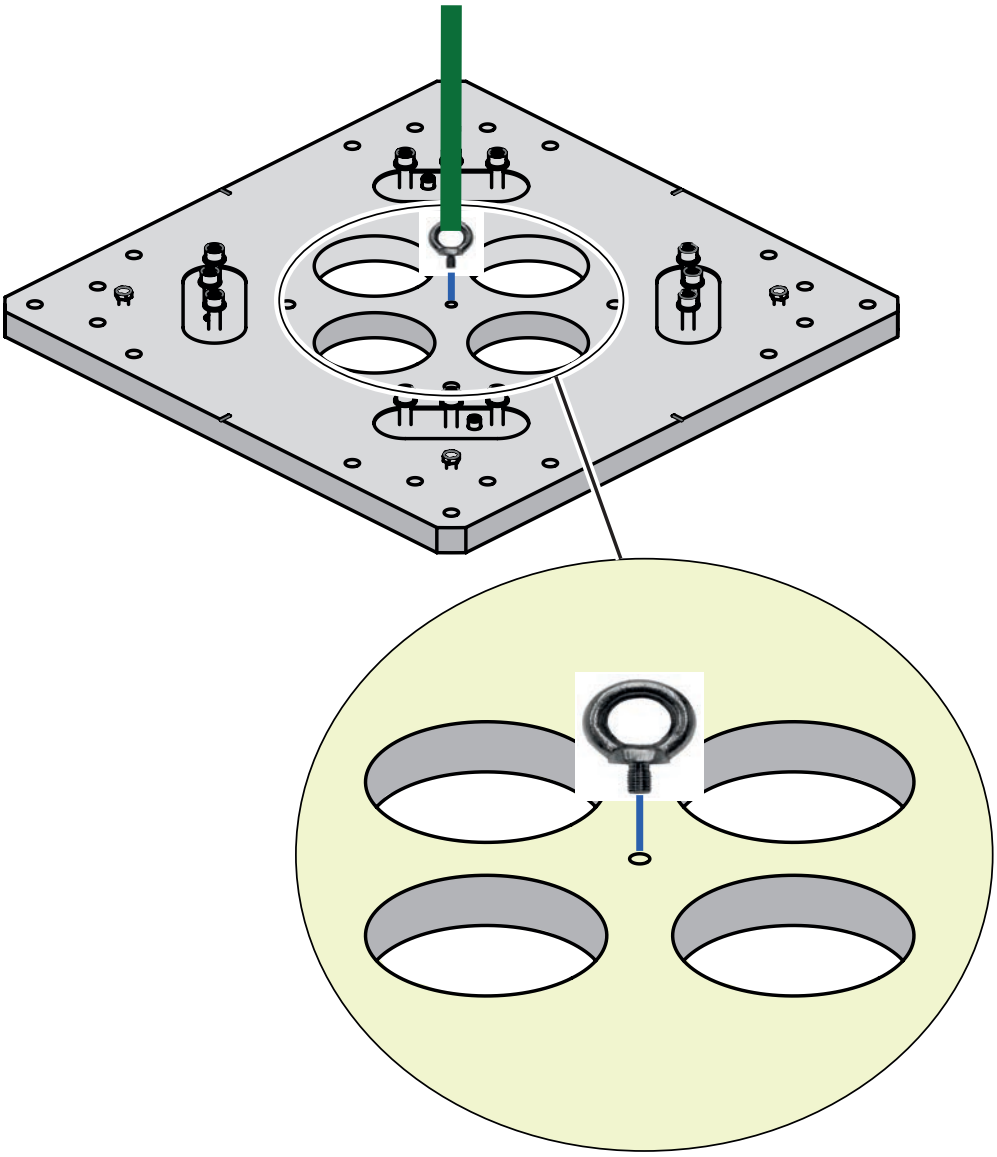
	Action	Note
7	Secure the robot to the foundation with the remaining attachment screws. **DANGER** DO NOT power up the robot until it is secured to the foundation with all 12 attachment screws.	Attachment screws: M24x100 (one in each pocket) Tightening torque, Lubricated screws (Molykote 1000): 550 Nm Tightening torque, not/lightly lubricated screws: 600-750 Nm, typical 650 Nm  xx1500002295
8	Attach the protection plugs in the holes for the fork lift accessory set.	
9	Keep the fork lift accessory set together with the manual "Directions for use, Fork lift accessory set IRB 8700".	

2.3.3 Lifting the base plate

Required equipment

Equipment	Article number	Note
Lifting eye, M24		1 pc
Lifting slings		1 pc Length: approx. 2 m

Hole configuration



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2.3.3 Lifting the base plate
Continued

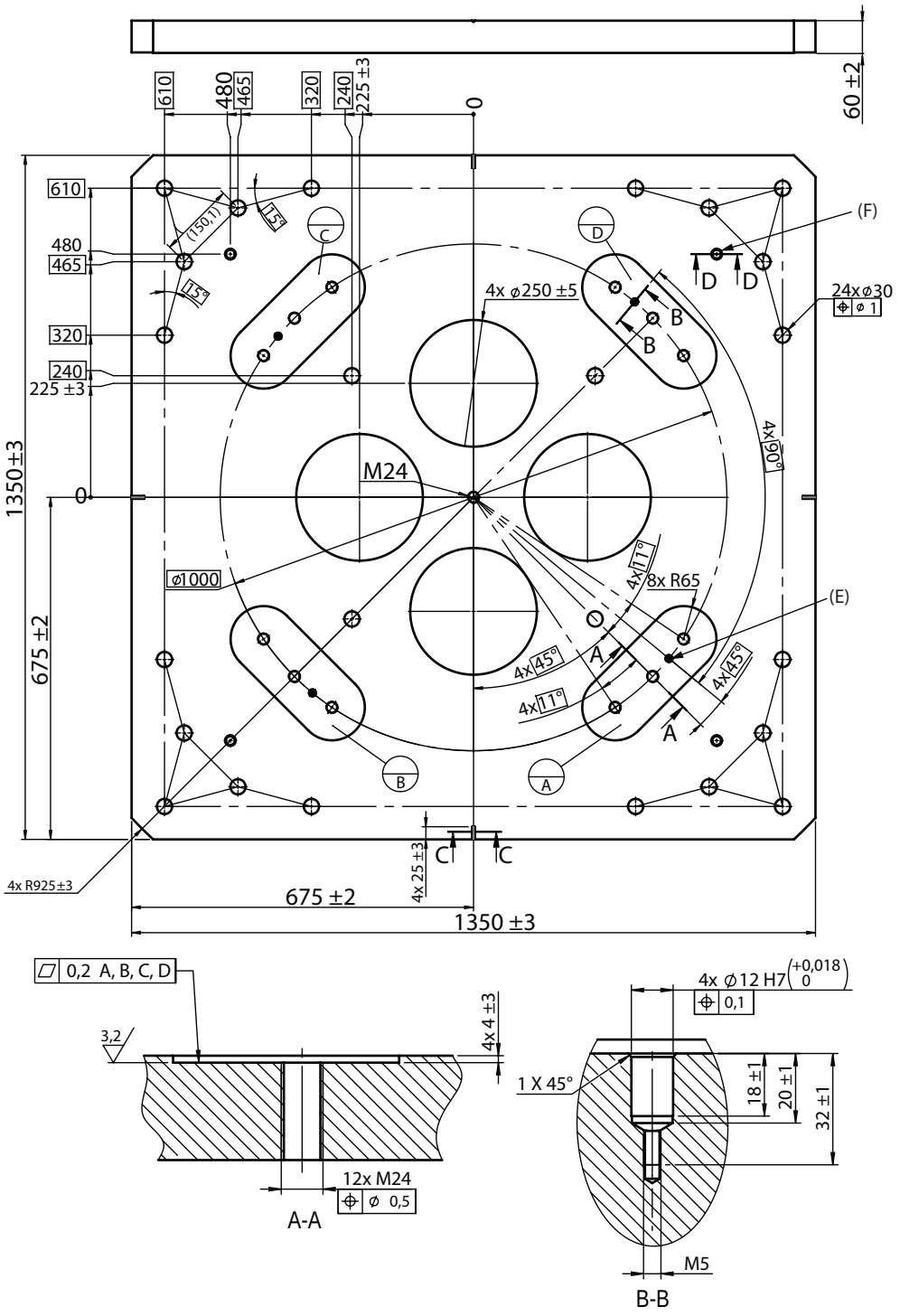
Lifting, base plate

	Action	Note
1	**CAUTION** The base plate weighs 760 kg. All lifting accessories used must be sized accordingly.	
2	Fit a lifting eye in the center hole of the base plate.	Shown in figure *Hole configuration on page 59*.
3	Fit the roundsling to the lifting eye and lifting accessory. Use caution and lift the base plate. **CAUTION** Lift and move the base plate very slowly. If the base plate starts to swing it is a risk for injuries or damage.	

2.3.4 Securing the base plate

Base plate drawing

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



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A, B, C, D	Common tolerance zone (accuracy all over the base plate from one contact surface to the other).

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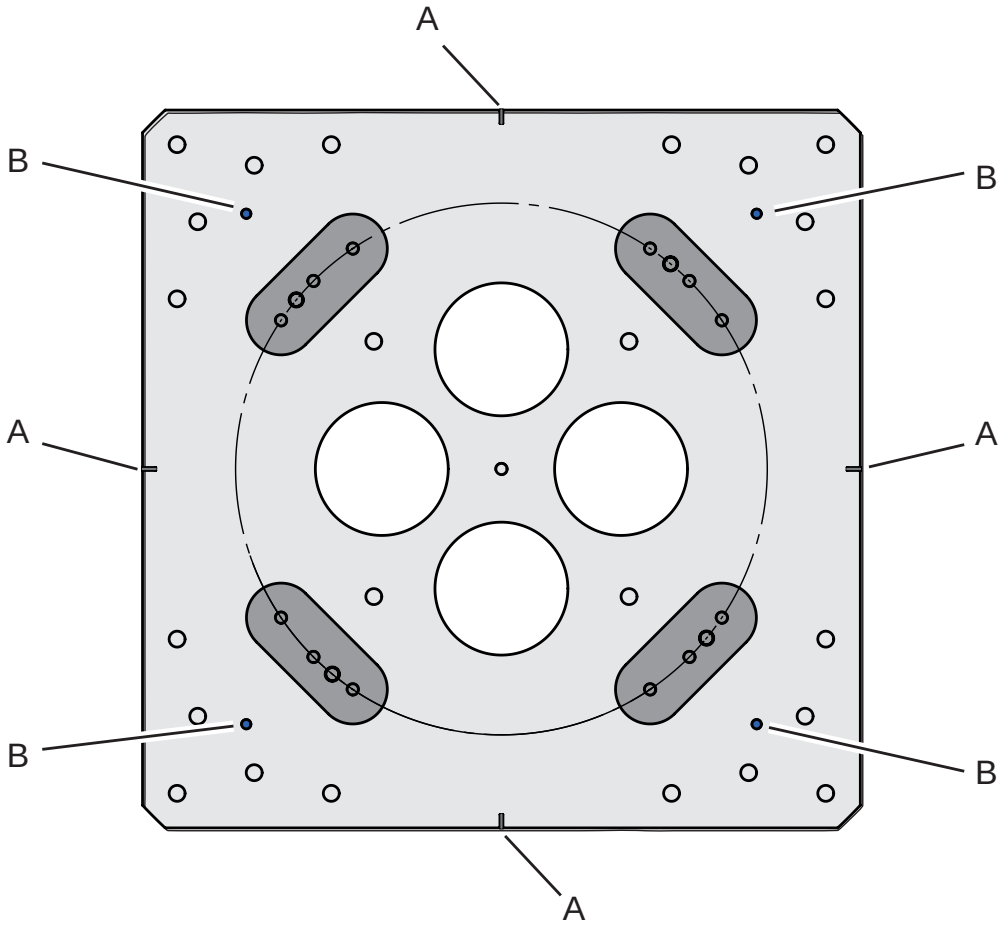
2.3.4 Securing the base plate
Continued

Base plate, orienting grooves and leveling bolts

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



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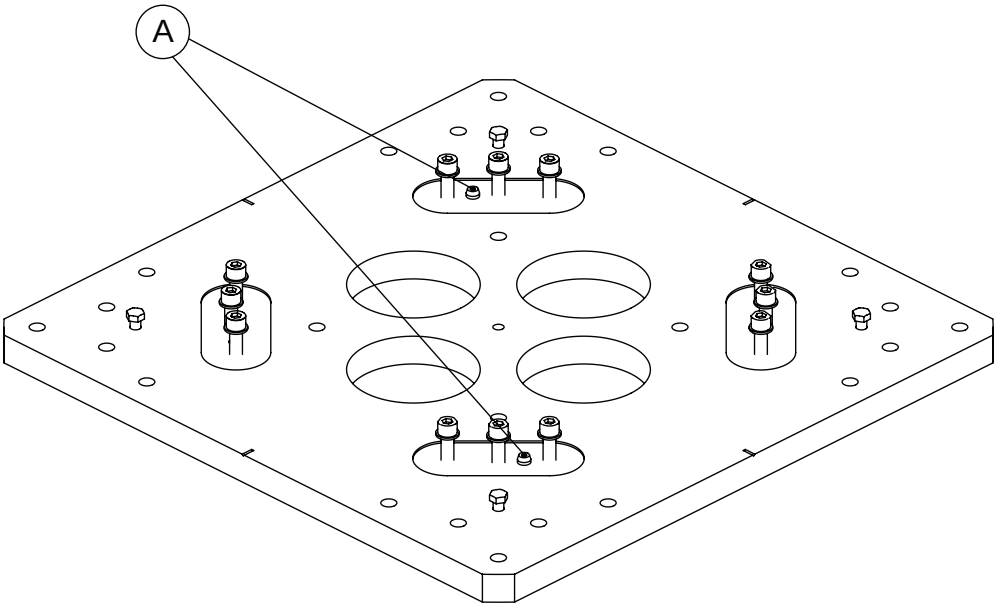
A	Orienting grooves (4 pcs)
B	Levelling bolts, attachment holes M20 through (4 pcs)

Continues on next page

Base plate, locating pins

The illustration below shows the orienting grooves and the locating pins in the base plate.



xx1700001591

A	Locating pins (2 pcs)

Required equipment

Equipment	Article number	Note
Base plate	3HAC053722-003	Includes • locating pin, 3HAC051645-001 • hex socket head cap screw, M5x40 • attachment screws and washers for securing the robot to the base plate.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.
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.

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** The base plate weighs 760 kg! All lifting accessories used must be sized accordingly!	

Continues on next page

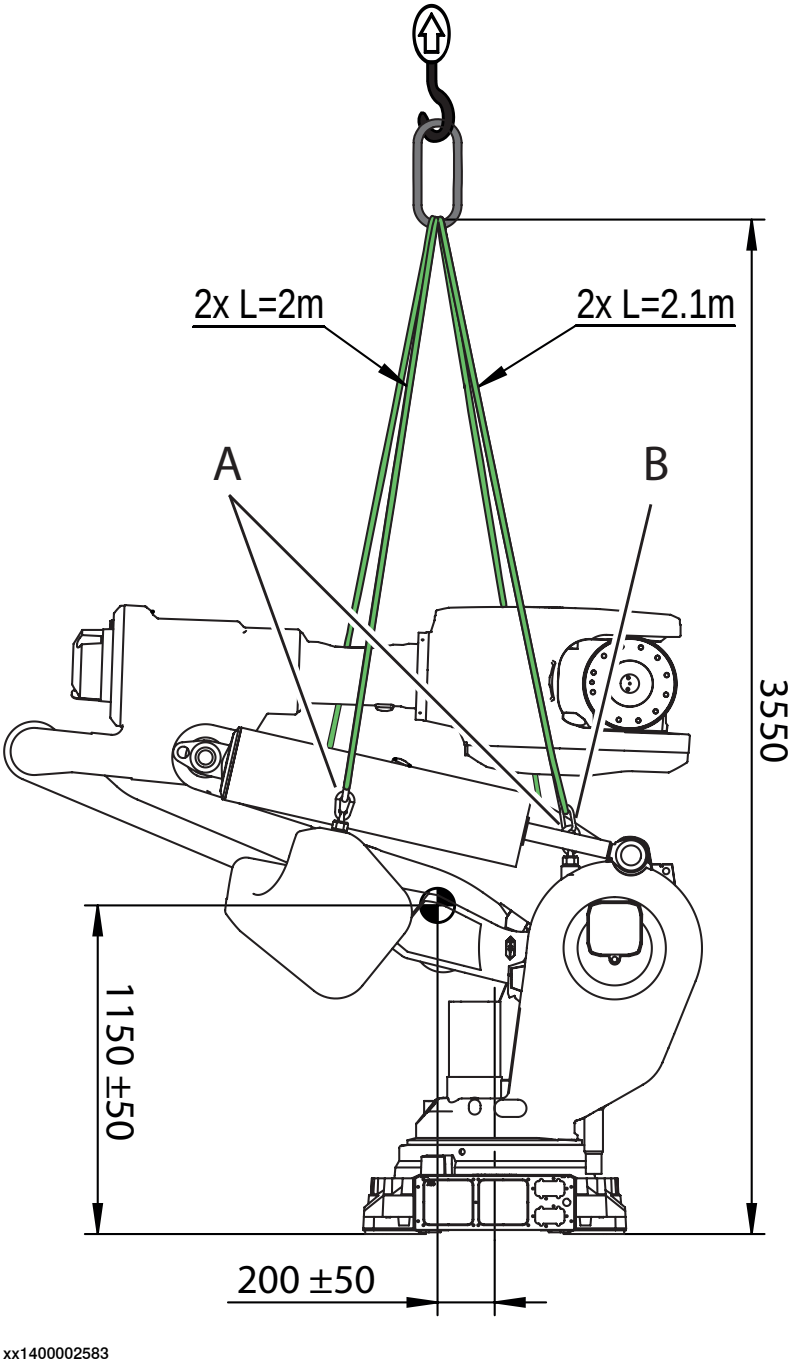
2.3.4 Securing the base plate

Continued

	Action	Note
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 62*.
4	Lift the base plate to its mounting position.	See *Lifting the base plate on page 59*.
5	Use the base plate as a template and drill attachment holes as required by the selected bolt dimension.	Attachment holes: 20 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 62*.
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.

2.3.5 Lifting the robot with roundslings

Attaching the roundslings

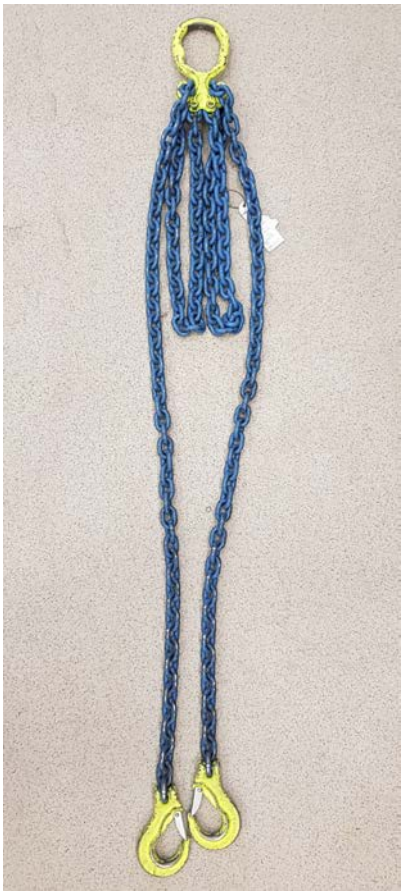


xx1400002583

Continues on next page

2.3.5 Lifting the robot with roundslings
Continued

To reach the length of 2.1 m, use roundslings 2.0 m and lengthen them to 2.1 m with lifting chains, for example using the type showed below. By using two lifting chains it is possible to achieve 1 dm difference.



xx1900000775

Required equipment

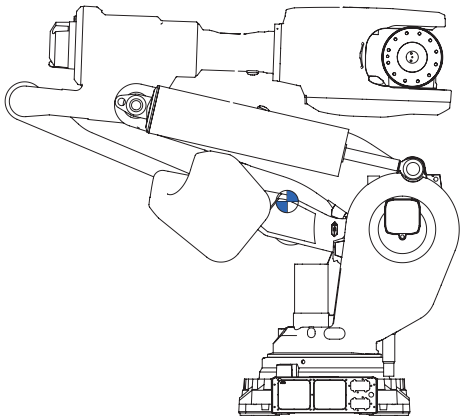
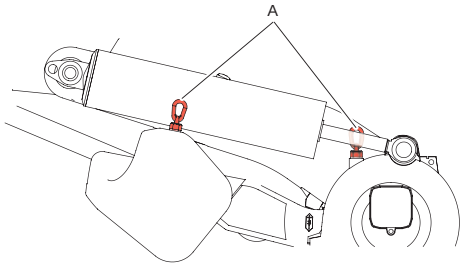
Equipment	Article number	Note
Overhead crane	-	
Lifting eyes, M24	3HAC038295-003	Certex TPG-4 or equivalent
Roundsling 2 m	-	Lifting capacity: 5,000 kg (4 pcs) i
Adjustable lifting chain	-	When lifting, use them to lengthen the roundsling to 2.1 m.

i This is a recommendation according to standard EN 1492. Always conform to local regulations.

Continues on next page

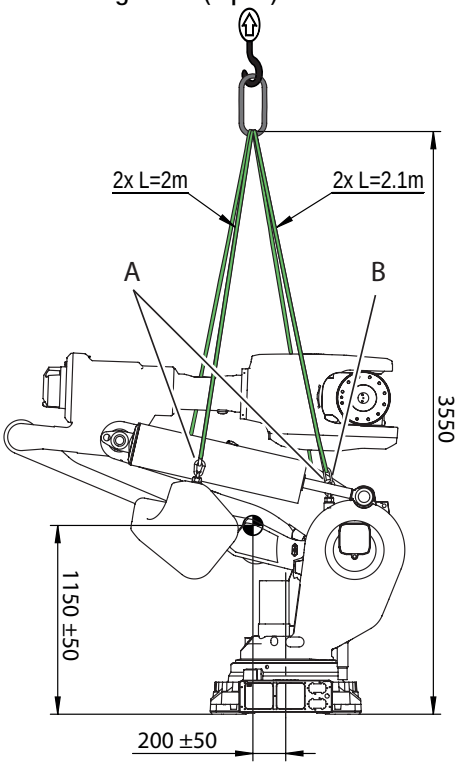
Lifting the robot with roundslings

Use this procedure to lift the robot with roundslings.

	Action	Note
1	Jog the robot into position: • Axis 1: -90° (optional) • Axis 2: -65° • Axis 3: +2° • Axis 4: +90° • Axis 5: -90° • Axis 6: 0°. **WARNING** The robot is mechanically unstable if not secured to the foundation.	 xx1400002584
2	**CAUTION** The weight of the IRB 8700 robot is 4,750 kg All lifting accessories used must be sized accordingly.	
3	Fit lifting eyes to the holes on frame and counter weight respectively.	 xx1400002590 A Lifting eye: M24 (4 pcs)

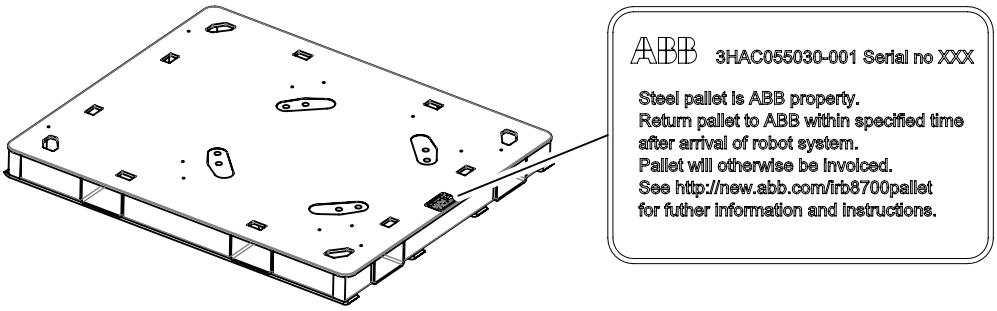
Continues on next page

2.3.5 Lifting the robot with roundslings
Continued

	Action	Note
4	Run roundslings through the lifting eyes and fasten them in the adjustable lifting chain in an overhead crane. Adjust the length of the lifting tools. Make sure the roundslings do not rub against any sharp edges. **Note** Run the roundslings as shown in the figure: • roundslings fitted to the lifting eyes on the frame, on the *inside* of the balancing devices shafts • roundslings fitted to the lifting eyes on the counter weight, on the *outside* of the balancing devices. **CAUTION** If the lifting eyes have sharp edges that might damage the roundslings, lifting shackles must be used to attach the roundslings to the lifting eyes.	Roundsling 2.5 m (4 pcs)  xx1400002583
5	Stretch the roundslings to take the weight of the robot.	
6	**WARNING** Personnel must not, under any circumstances, be present under the suspended load.	
7	Use caution and raise the overhead crane to lift the robot.	

2.3.6 Returning of the ABB steel pallet

Location of information label on the steel pallet



xx1500002073

The steel pallet is the property of ABB

Note

The steel pallet the robot is delivered on, is the property of ABB. It must therefore be returned within the specified time, after the arrival of the robot system. If the pallet is not returned, it will be invoiced.

For more information and instructions, see **http://new.abb.com/Irb8700pallet**.

A wooden pallet from ABB does not need to be returned.

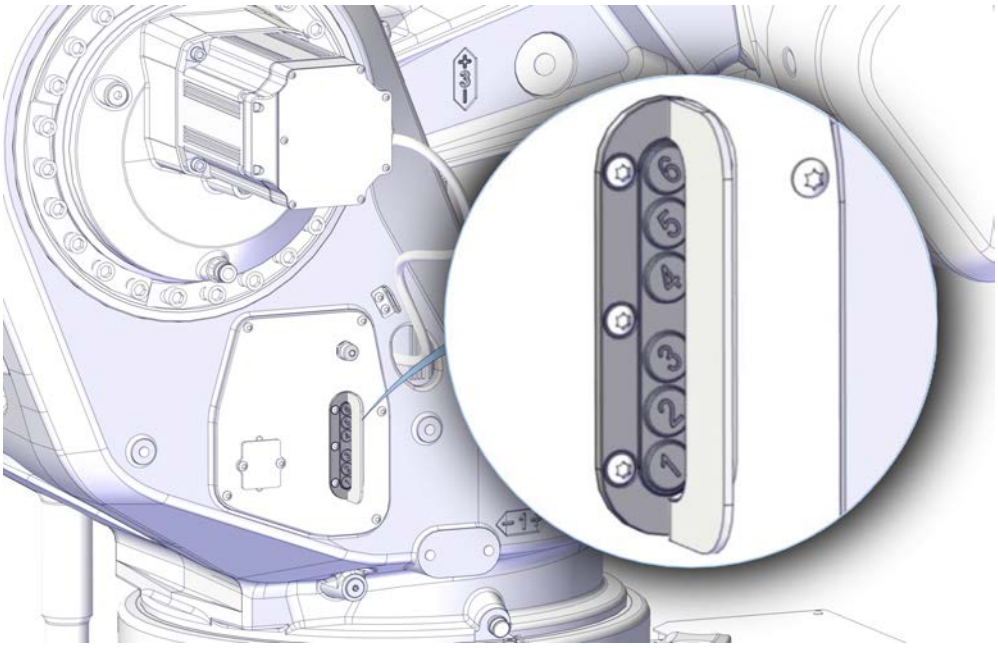
2.3.7 Manually releasing the brakes

Introduction to manually releasing the brakes

This section describes how to release the holding brakes for the motors of each axis.

Location of brake release unit

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



xx1500001988

Releasing the brakes

This procedure details how to release the holding brakes when the robot is equipped with an internal 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. 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 71*. **Note** The IRB 8700 has two R1.MP connectors: R1.MP-A and R1.MP-B. How to supply power to the connectors is described in *Supplying power to connector R1.MP on page 71*.	Buttons are shown in figure *Location of brake release unit on page 70*.

Continues on next page

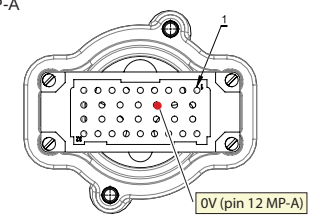
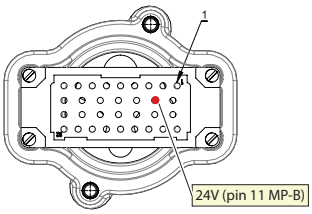
	Action	Note
2	**DANGER** When releasing the holding brakes, the robot axes may move very quickly and sometimes in unexpected ways. Make sure no personnel is near or beneath the robot.	
3	Release the holding brake on a particular robot axis by pressing the corresponding button on the internal brake release unit. The brake will function again as soon as the button is released.	

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.

Note

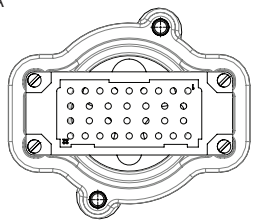
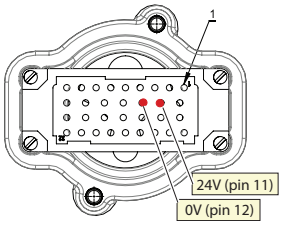
The IRB 8700 has two R1.MP connectors: R1.MP-A and R1.MP-B. See table how to supply power to the connectors.

	Action	Note
1	**DANGER** Incorrect connections, such as supplying power to the wrong pin, may cause all brakes to be released simultaneously!	
2	**Valid for axes-1, -2, and -3!** Supply 0V on pin 12 R1.MP-A. Supply 24V on pin 11 R1.MP-B. **Note** Both R1.MP-A and R1.MP-B contacts are used when relasing the brakes on axis-1, -2, and -3.	MP-A  MP-B  xx1500001989

Continues on next page

2.3.7 Manually releasing the brakes

Continued

	Action	Note
3	**Valid for axes-4, -5, and -6!** Supply 0V on pin 12 R1.MP-B. Supply 24V on pin 11 R1.MP-B. **Note** Only R1.MP-B contact is used when relasing the brakes on axis-4, -5, and -6.	MP-A  MP-B  xx1500001990

2.3.8 Orienting and securing the robot

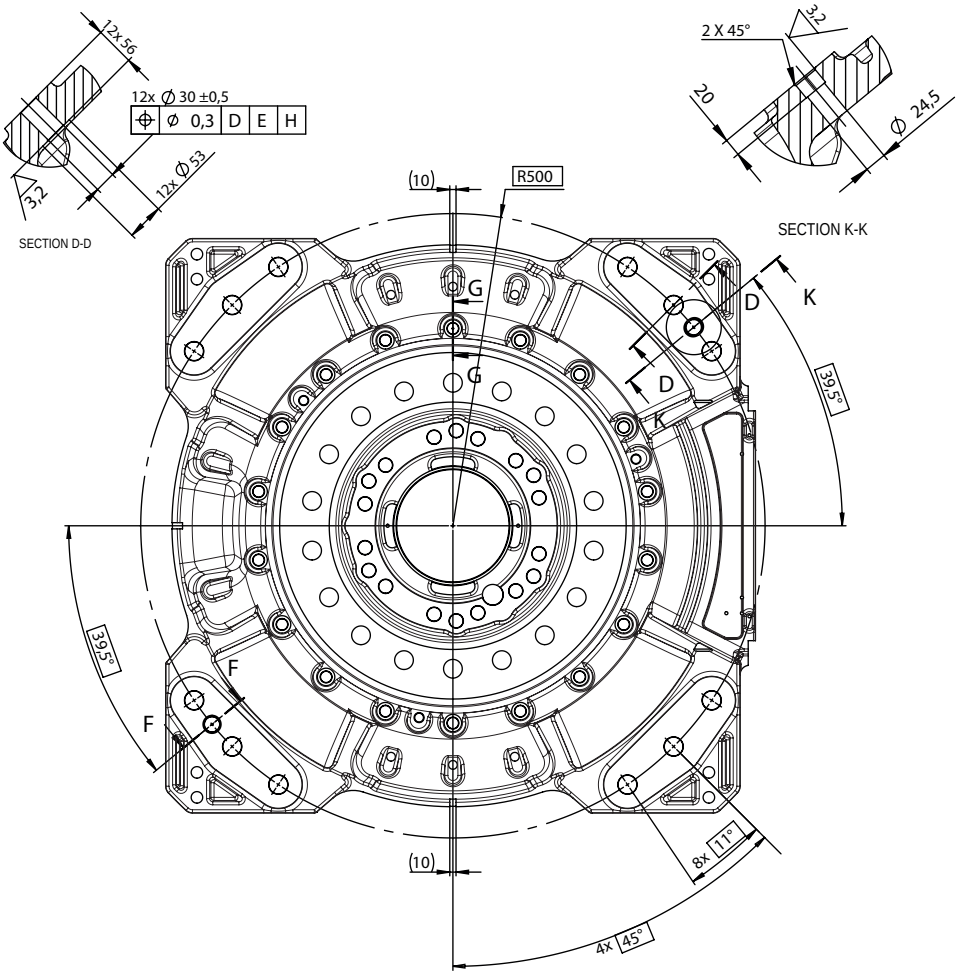
General

This section details how to orient and secure the robot to the base plate in order to run the robot safely.

Hole configuration, base

The figure shows the hole configuration used when positioning and securing the robot.

Note! Seen from below.



xx1700000972

Pos	Description
Section K-K	Holes for guide pins (x2)

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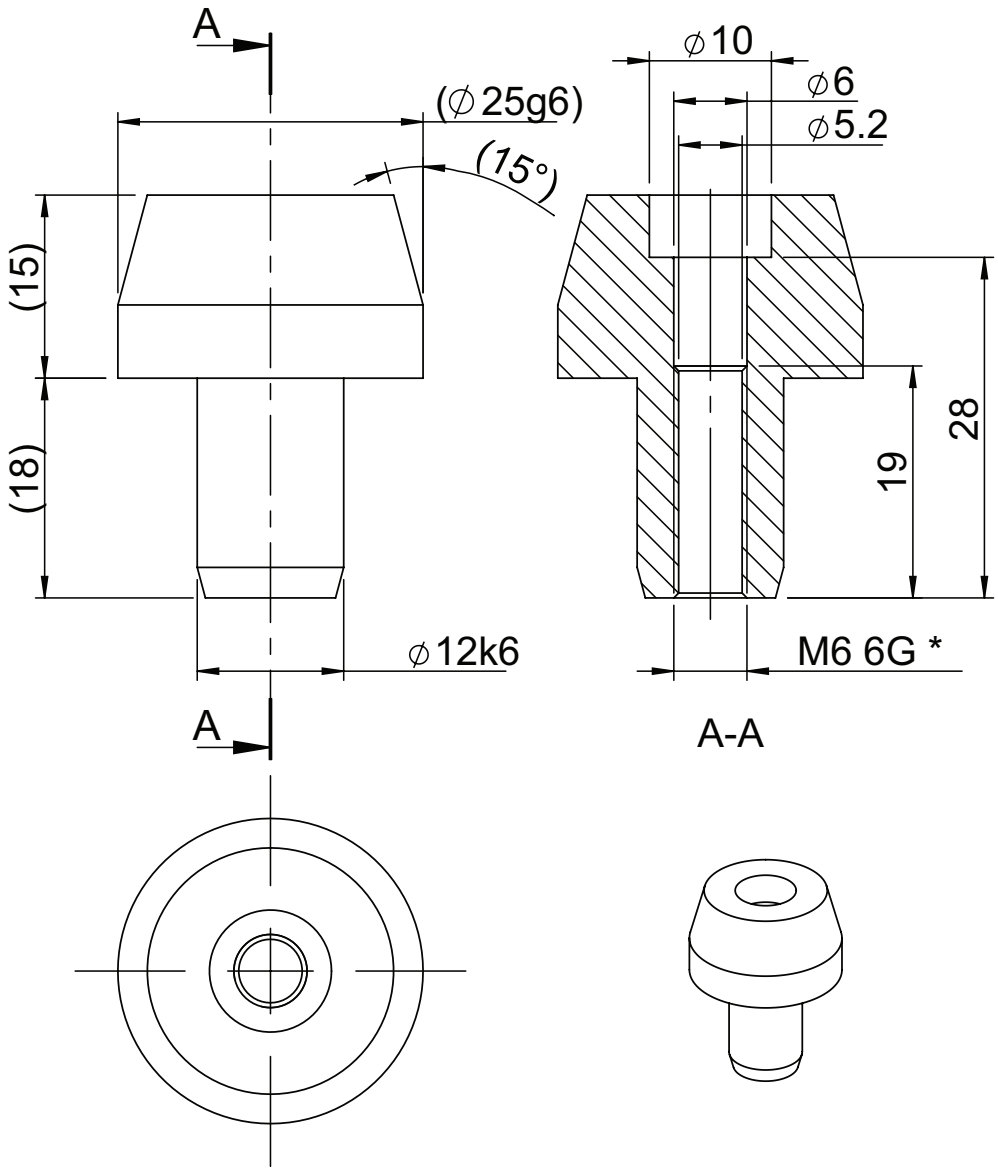
2.3.8 Orienting and securing the robot
Continued

Required equipment

It is necessary to use guide pins when securing the robot to a base plate.



XX1500000248

A	Cylindrical guide pin

Attachment screws

Securing the robot to the base plate/foundation

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

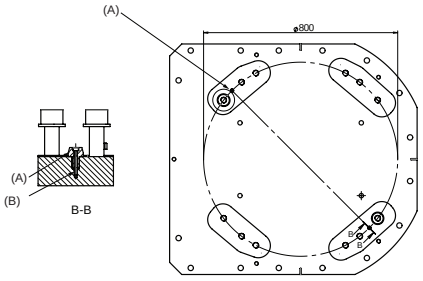
Suitable screws, lightly lubricated:	M24 x 100
Quantity:	12 pcs
Quality:	8.8

Continues on next page

Screw tightening yield point utilization factor (v) (according to VDI2230):	90% (v=0.9)
Suitable washer:	4 mm flat washer
Tightening torque:	550 Nm (screws lubricated with Molykote 1000) 600-725 Nm, typical 650 Nm (screws none or lightly lubricated)

Securing the robot

Use this procedure to secure robot to base plate after fitting plate to the foundation.

	Action	Note
1	Fit two guide pins to the guide pin holes in the base plate. **Note** All screws and pins are delivered in a plastic bag together with the base plate.	 xx1500000250 A Cylindrical guide pin (2 pcs) B M5 x 40. Tightening torque 6 Nm. (x2)
2	Lift the robot.	See *Lifting the robot with roundslings on page 65*.
3	Move robot close to its installation location.	
4	Guide the robot gently using two M24 screws while lowering it into its mounting position.	Make sure the robot base is correctly fitted onto the guide sleeves!
5	Fit the bolts and washers in the base attachment holes. **Note** Lightly lubricate screws before assembly!	Specified in *Attachment screws on page 74*.
6	Tighten bolts in a crosswise pattern to ensure that the base is not distorted.	

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

General

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.

References

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

- *Operating manual - IRC5 with FlexPendant*
- *Operating manual - OmniCore*

Stopping time and braking distances

The performance of the motor brake depends on if there are any loads attached to the robot. For more information, see product specification listed in *References on page 10*.

2.3.10 Fitting equipment

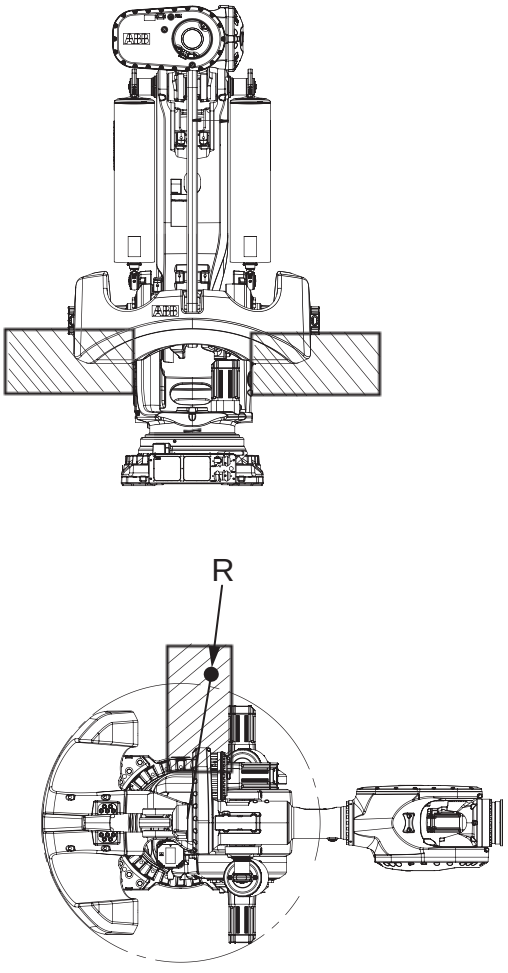
General

Extra loads can be fitted on the upper arm housing, the lower arm, and on the frame. Definitions of distances and masses are shown in the following figures. The robot is supplied with holes for fitting extra equipment (see figure in *Holes for fitting extra equipment on page 79*). Maximum allowed arm load depends on center of gravity of arm load and robot payload.

Frame (hip load)

Extra load can be fitted on the frame.

	Description
Permitted extra load on frame	$J_H = 200\ kgm^2$
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 (≤ 500 kg)



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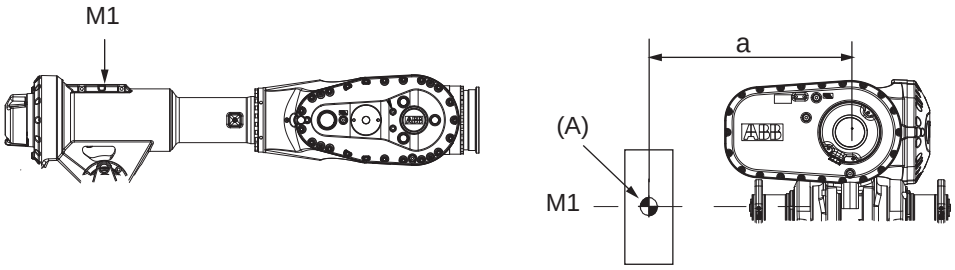
2.3.10 Fitting equipment
Continued

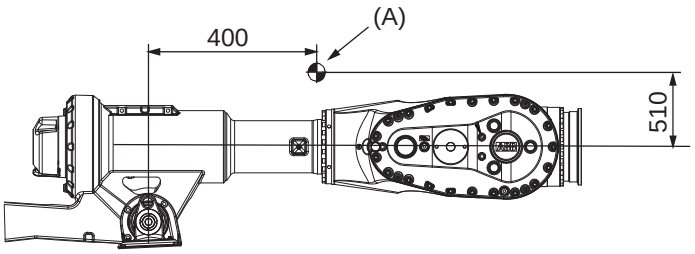
Upper arm

Allowed extra load on the upper arm housing, in addition to the maximum handling weight, is M1 ≤ 50 kg with a distance (a) ≤ 500 mm from the center of gravity in the axis-3 extension.



xx1400002874

A	Mass center



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A	Center of gravity 50 kg

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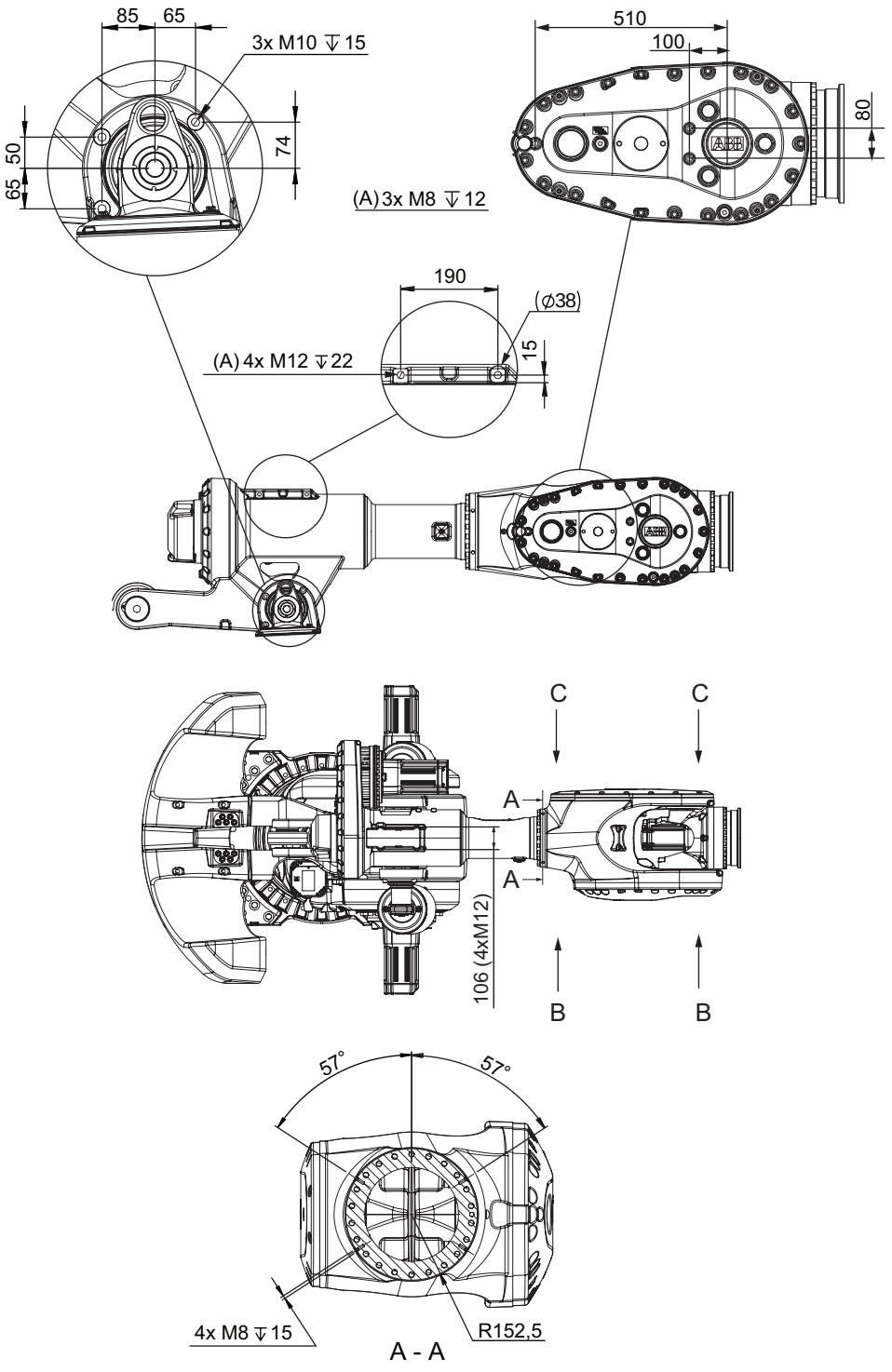
Holes for fitting extra equipment

Upper arm



xx1400002876

A	Holes located on both sides.

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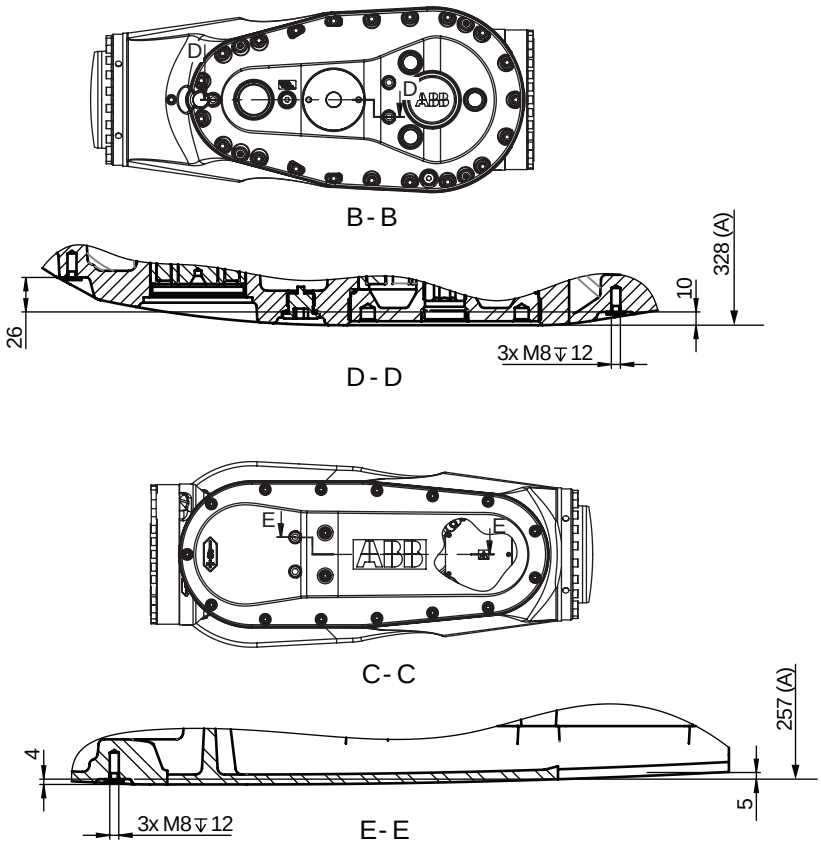
2.3.10 Fitting equipment
Continued



xx1500000869

A	Measure from center axis 6

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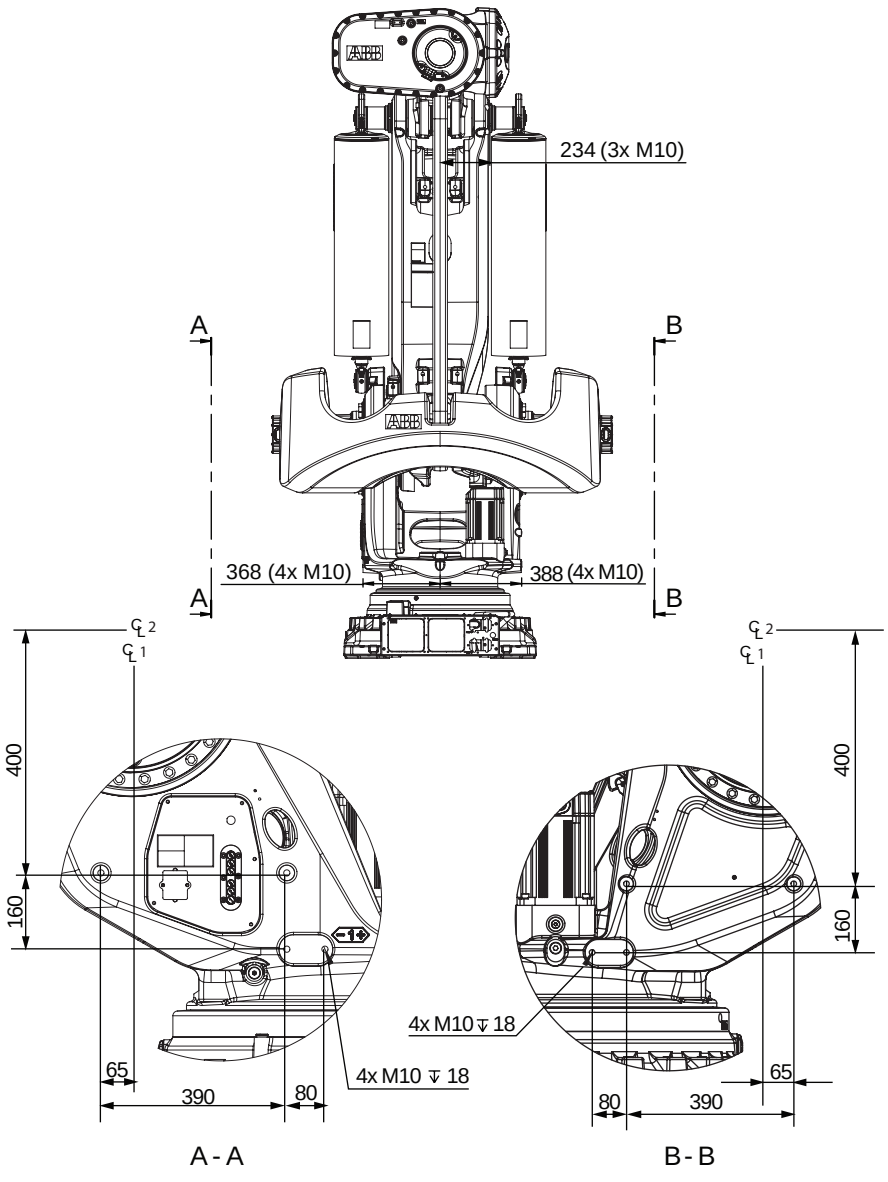
Frame



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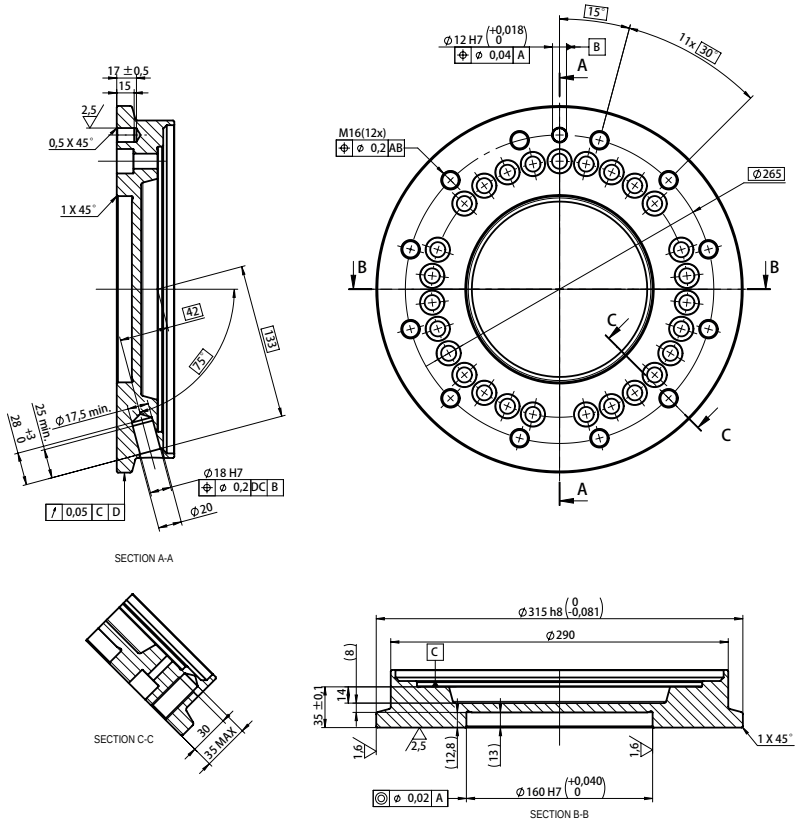
2.3.10 Fitting equipment
Continued

Tool flange, standard and LeanID



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Fastener quality

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

2.3.11 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 SafeMove2* (IRC5) or *Application manual - Functional safety and SafeMove* (OmniCore).

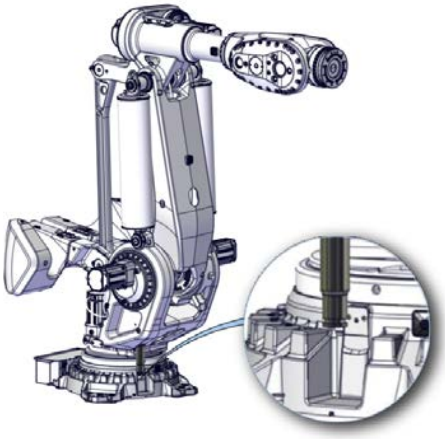
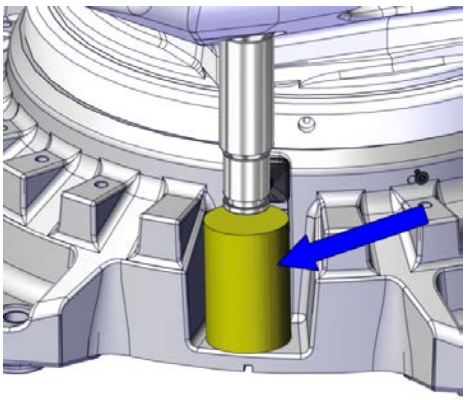
If the mechanical stop is removed, then the manipulator should have a marking for this, for example, a label. If the robot is delivered with the option *Extended work range*, then such a label is included on delivery.

Extending the working range

	Action	Note/Illustration
1	Configure the safety setup and verify it by test.	

Continues on next page

2.3.11 Extended working range, axis 1 (option)
Continued

	Action	Note/Illustration
2	Hold the mechanical stop pin in a firm grip, and remove it by unscrewing the attachment screw.	Jog axis-1 to the position where it is possible to replace the mechanical stop pin.  xx1500002093 **CAUTION** The mechanical stop pin weighs 13 kg. Put a piece of wood (or similar) underneath the stop pin, to prevent it from falling down uncontrolled, when the set screw is removed.  xx1500002091
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 SafeMove2* (IRC5) or *Application manual - Functional safety and SafeMove* (OmniCore).

2.4 Restricting the working range

2.4.1 Axes with restricted working range

General

When installing the robot, make sure that it can move freely within its entire working space. If there is a risk that it may collide with other objects, its working space should be limited.

The working range of the following axes may be restricted:

- Axis 1, hardware (mechanical stop)

This section describes how to install hardware that restricts the working range.

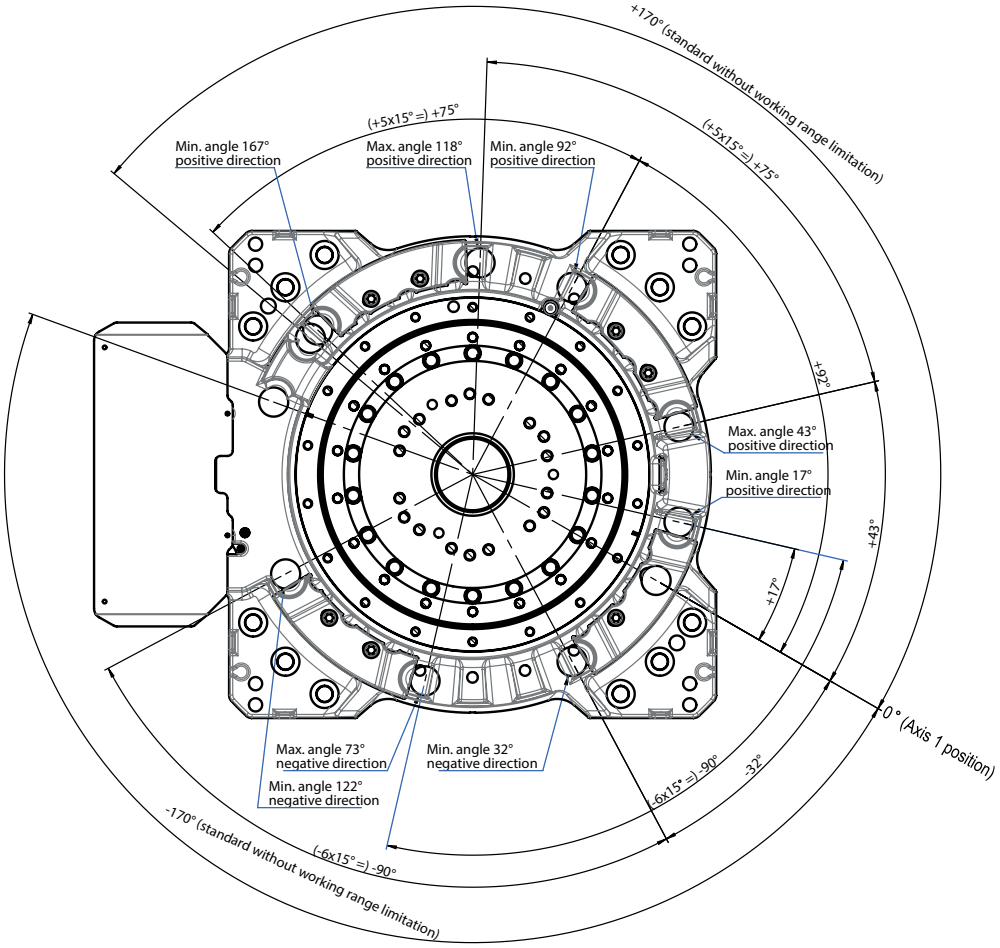
Note

Adjustments must also be made in the robot configuration software (system parameters). References to relevant manuals are included in the installation procedures.

2.4.2 Mechanically restricting the working range of axis 1

General

The working range of axis 1 is limited by fixed mechanical stops. The working range can be reduced by adding additional mechanical stops giving partly a 15° graduation, up to 75° -6x15° negative direction and 118° -5x15° in positive direction. See figure!



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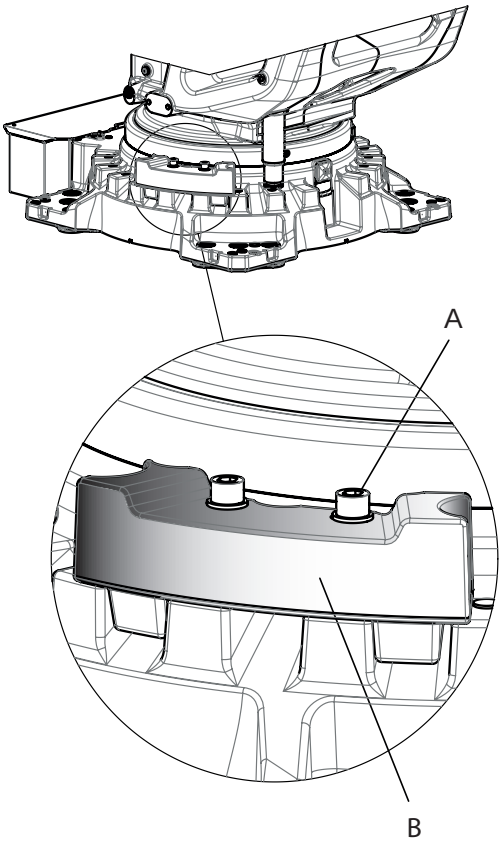
Mechanical stops, axis 1

The illustration shows the mounting position of the stop pin and one of the additional mechanical stops available for axis 1.



xx1400002592

Required equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	
Technical reference manual - System parameters	-	Article number is specified in section *References on page 10*.

Installation, mechanical stops axis 1

Use this procedure to fit the additional mechanical stops to axis 1 of the robot. An assembly drawing is also enclosed with the product.

	Action	Note
1	**DANGER** Turn off all: • electric power supply to the robot • hydraulic pressure supply to the robot • air pressure supply to the robot Before entering the robot working area.	

Continues on next page

2.4.2 Mechanically restricting the working range of axis 1

Continued

	Action	Note
2	Fit the additional mechanical stop to the frame according to the figure *Mechanical stops, axis 1 on page 87*.	Tightening torque: 300 Nm.
3	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*.
4	**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.	

2.5 Electrical connections

2.5.1 Robot cabling and connection points

Introduction

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

DANGER

Turn off the main power before connecting any cables.

CAUTION

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

Main cable categories

All cables between the robot and controller are divided into the following categories:

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.
Fan cables (option)	Handles supply to and feedback from any cooling fan on the robot. Specified in the table *Fan cables (option) on page 91*.
Customer cables (option)	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*.
DressPack cables (option)	Handles signals, process media and power feeding for customer use, regarding material handling or spot welding. See the *Product manual - DressPack IRB 8700*, 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 cable, power	Transfers drive power from the drive units in the controller to the robot motors.	XS1 XS11	R1.MP-A R1.MP-B
Robot cable, signals	Transfers resolver data from and power supply to the serial measurement board.	XS2	R1.SMB

Continues on next page

2.5.1 Robot cabling and connection points
Continued

Robot cable, power

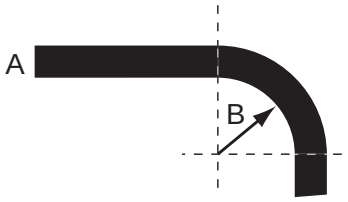
Power cable length	Article number
7 m	3HAC026787-001
15 m	3HAC026787-002
22 m	3HAC026787-003
30 m	3HAC026787-004

Robot cable, signals

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

Bending radius for static floor cables

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



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A	Diameter
B	Diameter x10

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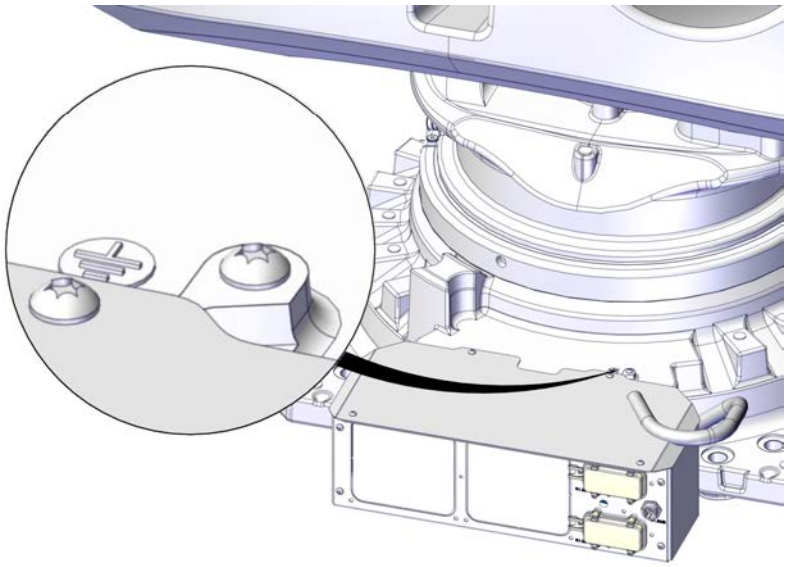
Grounding and bonding point on manipulator

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



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Note

How to ground DressPack/SpotPack cables is detailed in the *Product manual - DressPack IRB 8700*, see the document number in *References on page 10*.

Fan cables (option)

These cables are only included in the delivery, if the fan option is ordered. The cables are pre-manufactured and ready to plug in.

Cabling to be installed on the robot is specified in section *Installing the motor cooling fans on page 94*.

Cabling between robot base and control cabinet, cooling fans

The following cables are used when the robot is equipped with cooling fans. The cabling for the cooling fans run from the robot base to the controller cabinet, and connecting inside with a distribution cable. For instructions on how to connect the distribution cable inside the controller, see the product manual for the robot controller.

Fans can also be ordered without cables.

Continues on next page

2.5.1 Robot cabling and connection points
Continued

If cooling fans are added to an existing installation, use the cabling specified below.

Cable	Art. no.	Connection point
Harness - cooling, 7 m	3HAC022723-001	Distributing cable: R1.FAN.SW2/3 Inside cabinet: A43.X10 and A43.X11 (IRC5) Inside cabinet: A43.X10/A43.X11 - A2.X23 (OmniCore)
Harness - cooling, 15 m	3HAC022723-004	Distributing cable: R1.FAN.SW2/3 Inside cabinet: A43.X10 and A43.X11 (IRC5) Inside cabinet: A43.X10/A43.X11 - A2.X23 (OmniCore)
Harness - cooling, 22 m	3HAC022723-005	Distributing cable: R1.FAN.SW2/3 Inside cabinet: A43.X10 and A43.X11 (IRC5) Inside cabinet: A43.X10/A43.X11 - A2.X23 (OmniCore)
Harness - cooling, 30 m	3HAC022723-006	Distributing cable: R1.FAN.SW2/3 Inside cabinet: A43.X10 and A43.X11 (IRC5) Inside cabinet: A43.X10/A43.X11 - A2.X23 (OmniCore)

2.6 Installation of options

2.6.1 Safety lamp (option for IRC5)

Description

A signal lamp with a yellow fixed light can be mounted on the robot, as a safety device.

Installation

See the assembly instruction delivered with the signal lamp.

Function

The lamp is active in MOTORS ON mode.

Further information

Further information about the MOTORS ON/MOTORS OFF mode may be found in the product manual for the controller.

2.6.2 Installing the motor cooling fans

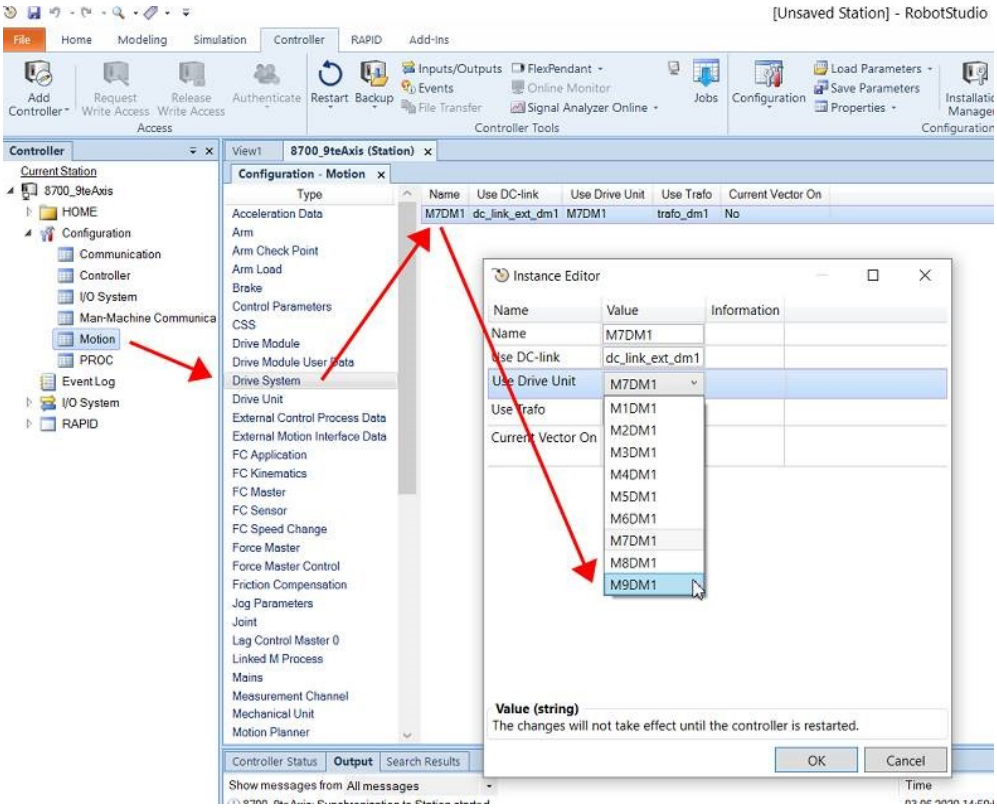
Installation information

All required installation information is enclosed with the fan packages sent from ABB Service.

2.6.3 Installing additional motor units or gear units

Installation information

If using IRB 8700 together with MUGU (motor unit or gear unit) the system parameter configuration must manually be changed from first ADU to third ADU because the manipulator uses the two first. See type *Drive Unit* in topic *Motion*, in *Technical reference manual - System parameters*.



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2.7 Start of robot in cold environments

Introduction

This section describes how to start the robot in a cold environment if it is not starting the normal way.

Problems with starting the robot

Event message from Motion Supervision

Use this procedure if an event message indicates a problem with Motion supervision at start-up. More information about Motion Supervision is found in *Technical reference manual - System parameters*.

	Action	Note
1	Turn off Motion Supervision.	
2	Start the robot.	
3	When the robot has reached normal working temperature, the Motion Supervision can be turned on again.	

Robot stopping with other event message

Use this procedure if the robot is not starting.

	Action	Note
1	Start the robot with its normal program but with reduced speed.	The speed can be regulated with the RAPID instruction `VelSet`.

Adjusting the speed and acceleration during warm-up

Depending on how cold the environment is and what program is being used, the speed might need to be ramped up until reached maximum. The table shows examples of how to adjust the speed:

Work cycles	`AccSet`	Speed/velocity
3 Work cycles	20, 20	v100 (100 mm/s)
5 Work cycles	40, 40	v400 (400 mm/s)
5 Work cycles	60, 60	v600 (600 mm/s)
5 Work cycles	100, 100	v1000 (1000 mm/s)
More than 5 Work cycles	100, 100	Max.

If the program consists of large wrist movements, it is possible that the reorientation velocity, which is always high in predefined velocities, needs to be included in the ramping up.

2.8 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.

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3 Maintenance

3.1 Introduction

Structure of this chapter

This chapter describes all the maintenance activities recommended for the IRB 8700.

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

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

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

Safety information

Observe all safety information before conducting any maintenance work.

There are general safety aspects that must be read through, as well as more specific safety information that describes the danger and safety risks when performing the procedures. Read the chapter *Safety on page 19* before performing any maintenance work.

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

Note

If the IRB 8700 is connected to power, always make sure that the IRB 8700 is connected to protective earth and a residual current device (RCD) before starting any maintenance work.

For more information see:

- *Product manual - OmniCore V400XT*
- *Product manual - IRC5*
- *Robot cabling and connection points on page 89*.

3.2 Maintenance schedule and expected component life

3.2.1 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 8700:

- 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.

Overhaul

Depending on application and operational environment a complete overhaul may be necessary in average around 40000 hours.

ABB Connected Services and its Assessment tools can help you to identify the real stress level of your robot, and define the optimal ABB support to maintain your robot working.

Contact your local ABB Customer Service to get more information.

3.2.2 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 104*

Activities and intervals, standard equipment

The table below specifies the required maintenance activities and intervals:

Maintenance activities	Regularly	Every 12 months	Every 36 months	Every 12,000 hours [i]	Every 20,000 hours [i]	Every 40,000 hours [i]	Reference
Cleaning activities							
Cleaning the robot	x						*Cleaning the IRB 8700 on page 180*
Inspection activities							
Inspecting the oil level in axis-1 gearbox		x					*Inspecting the oil level in axis-1 gearbox on page 105*
Inspecting the oil level in axis-2 gearbox		x					*Inspecting the oil level in axis-2 and 3 gearboxes on page 108*
Inspecting the oil level in axis-3 gearbox		x					*Inspecting the oil level in axis-2 and 3 gearboxes on page 108*
Inspecting the oil level in axis-4 primary gearbox		x					*Inspecting the oil level in axis-4 primary gearbox on page 111*
Inspecting the oil level in axis-4 Secondary gearbox		x					*Inspecting the oil level in axis-4 secondary gearbox on page 114*
Inspecting the oil level in axis-5 gearbox		x					*Inspecting the oil level in axis-5 gearbox on page 116*
Inspecting the oil level in axis-6 gearbox		x					*Inspecting the oil level in axis-6 gearbox on page 118*
Inspecting the transparent plugs	x						
Inspecting the balancing device		x					*Inspecting the balancing devices on page 123*
Inspecting the robot harness		x [ii]					*Inspecting the cable harness on page 126*

Continues on next page

3.2.2 Maintenance schedule

Continued

Maintenance activities	Regularly	Every 12 months	Every 36 months	Every 12,000 hours [i]	Every 20,000 hours [i]	Every 40,000 hours [i]	Reference
Inspecting the information labels		x					*Inspecting the information labels on page 128*
Inspecting the dampers		x					*Inspecting dampers on page 139*
Inspecting the mechanical stop		x					*Inspecting the additional mechanical stops on page 134*
Replacement/changing activities							
Changing the oil in axis-1 gearbox					x		*Changing oil, axis-1 gearbox on page 141*
Changing the oil in axis-2 gearbox					x		*Changing oil in axis-2 and axis-3 gearbox on page 147*
Changing the oil in axis-3 gearbox					x		*Changing oil in axis-2 and axis-3 gearbox on page 147*
Changing the oil in axis-4 primary gearbox					x		*Changing oil, axis-4 primary gearbox on page 153*
Changing the oil in axis-4 secondary gearbox					x		*Changing oil, axis-4 secondary gearbox on page 159*
Changing the oil in axis-5 gearbox					x		*Changing oil, axis-5 gearbox on page 164*
Changing the oil in axis-6 gearbox					x		*Changing oil, axis-6 gearbox on page 168*
Replacing the SMB battery pack			x [iii]				*Replacing the SMB battery on page 173*
Lubrication activities							
Lubricating the balancing device bearings				x [iv]			*Lubricating the spherical roller bearings, balancing device on page 176*
Lubricating the cross roller bearing		x [v]					*Lubricating the cross roller bearing on page 178*
Overhaul							
Overhaul of complete robot						x [vi]	Contact your local ABB Customer Service office. www.abb.com/robotics.

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 104*.

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.

v The cross roller bearing needs to be lubricated every 6 months if the robot is placed in a harsh environment. Examples of harsh environments are forging or foundry applications that contain the risk of contamination of fluids and/or particles.

Continues on next page

[vi] Depending on application and the operating environment, an overhaul may be necessary after 40,000 hours. To get a correct assessment of the robot's status and about which parts that needs to be overhauled or replaced, contact your local ABB Customer Service office.

3.2.3 Expected component life

General

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

Expected component life - protection type Standard

Component	Expected life	Note
Cable harness Normal usage [i]	40,000 hours [ii]	Not including: • Possible SpotPack harnesses • Optional upper arm harnesses
Cable harness Extreme usage [iii]	20,000 hours [ii]	Not including: • Possible SpotPack harnesses • Optional upper arm harnesses
Balancing device	40,000 hours [iv]	
Gearboxes [v]	40,000 hours	

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

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

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

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

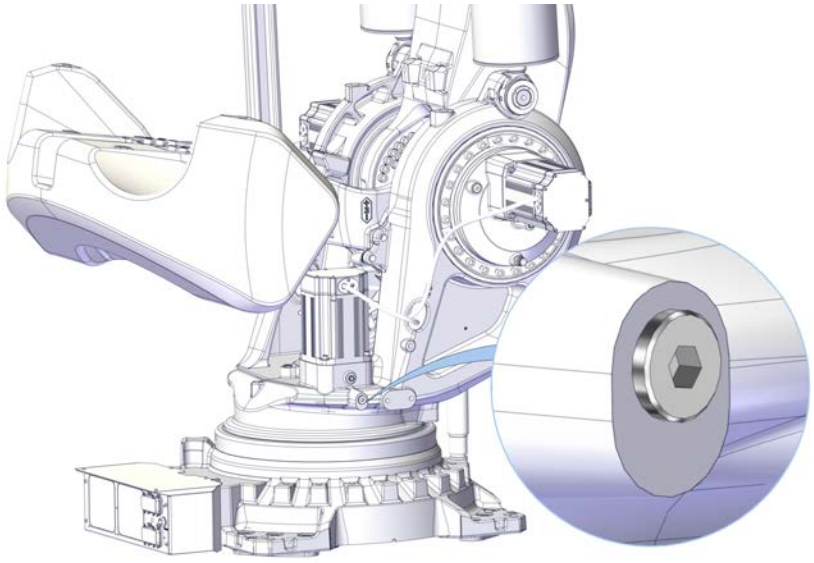
v The SIS for an IRC5 system is described in the *Operating manual - Service Information System*.

3.3 Inspection activities

3.3.1 Inspecting the oil level in axis-1 gearbox

Location of oil plugs

The oil plug through which the oil is inspected is located as shown in the figure.



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Required tools

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumable

Consumable	Article number	Note
Lubrication oil	-	Information about the oil is found in *Technical reference manual - Lubrication in gearboxes*.

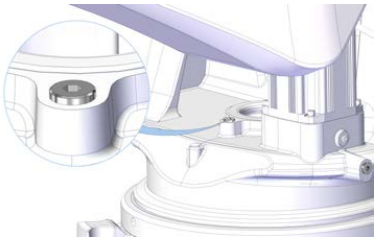
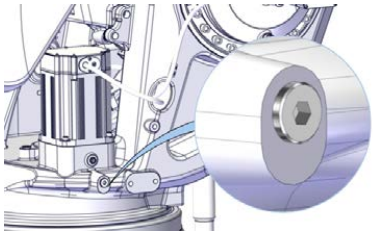
Required documents

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

Continues on next page

3.3.1 Inspecting the oil level in axis-1 gearbox
Continued

Inspecting the oil level in axis-1 gearbox

	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 34*.	
3	**CAUTION** The gearbox can contain an *excessive pressure* that can be hazardous. Use caution when the oil plug is opened, in order to let out the excess pressure.	
4	Open the ventilation plug. **Note** The ventilation plug shall be opened prior to the inspection plug, in order to release possible pressure inside.	 xx1500001993
5	Open the inspection plug.	 xx1500001992
6	Inspect the oil level.	
7	Required oil level is a few millimeters below the lower edge of the inspection hole.	
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 oil, axis-1 gearbox on page 141*.
9	Refit the oil plugs.	Tightening torque: 24 Nm.

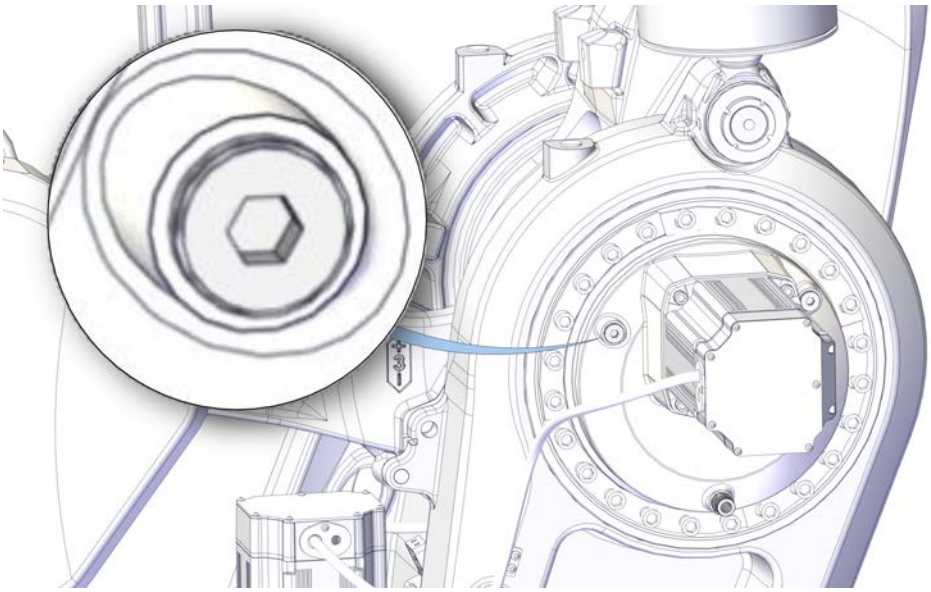
Continues on next page

	Action	Note
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 97*.	

3.3.2 Inspecting the oil level in axis-2 and 3 gearboxes

Location of oil plugs

The oil plug through which the oil is inspected is located as shown in the figure.



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Required tools

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumable

Consumable	Article number	Note
Lubrication oil	-	Information about the oil is found in *Technical reference manual - Lubrication in gearboxes*.

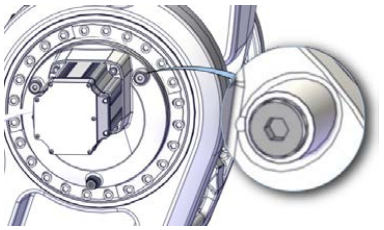
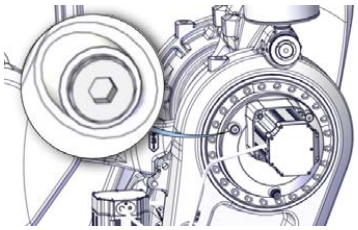
Required documents

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

Continues on next page

Inspecting the oil level in axis-2 and axis-3 gearboxes

The procedure to inspect oil in the axis-2 and axis-3 gearboxes is the same.

	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 34*.	
3	**CAUTION** The gearbox can contain an *excess of pressure* that can be hazardous. Use caution when the oil plug is opened, in order to let out the excess pressure.	
4	Open the ventilation plug. **Note** The ventilation plug shall be opened prior to the inspection plug, in order to release possible pressure inside.	 xx1500001994
5	Open the inspection plug.	 xx1500001995
6	Inspect the oil level.	
7	Required oil level is a few millimeters below the lower edge of the inspection hole.	
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 oil in axis-2 and axis-3 gearbox on page 147*.
9	Refit the oil plugs.	Tightening torque: 24 Nm.

Continues on next page

3.3.2 Inspecting the oil level in axis-2 and 3 gearboxes

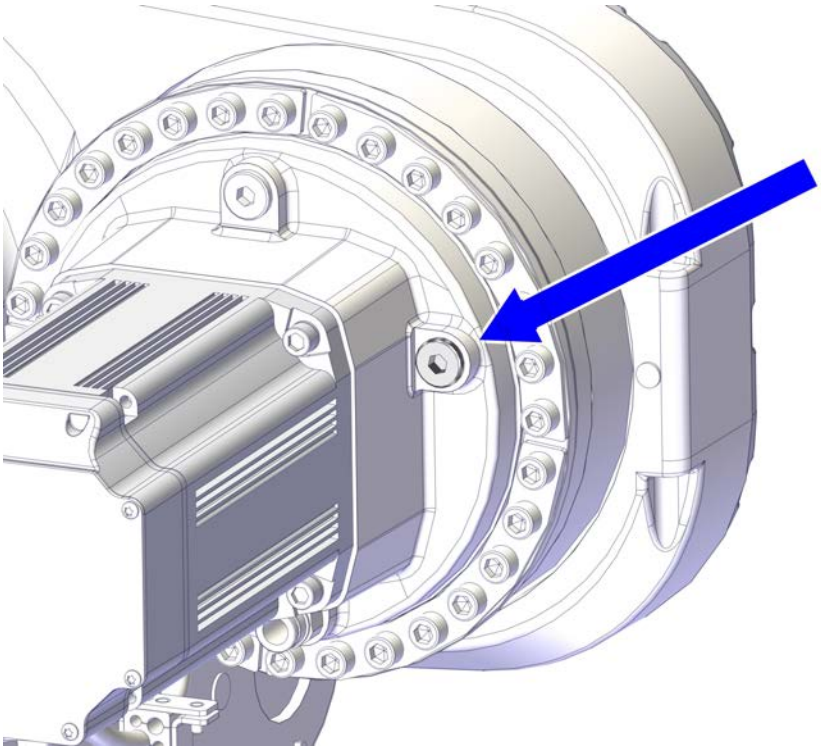
Continued

	Action	Note
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 97*.	

3.3.3 Inspecting the oil level in axis-4 primary gearbox

Location of oil plug

The oil plug through which the oil is inspected is located as shown in the figure.



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Required tools

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumable

Consumable	Article number	Note
Lubrication oil	-	Information about the oil is found in *Technical reference manual - Lubrication in gearboxes*.

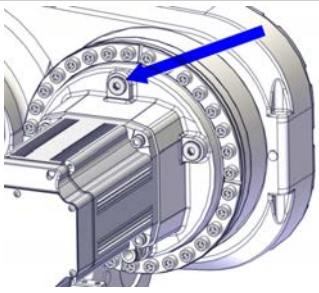
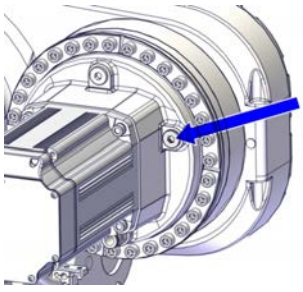
Required documents

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

Continues on next page

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

Inspecting the oil level in axis-4 primary gearbox

	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 34*.	
3	**CAUTION** The gearbox can contain an *excess of pressure* that can be hazardous. Use caution when the oil plug is opened, in order to let out the excess pressure.	
4	Open the ventilation plug. **Note** The ventilation plug shall be opened prior to the inspection plug, in order to release possible pressure inside.	 xx1500001999
5	Open the inspection plug.	 xx1500001998
6	Inspect the oil level.	
7	Required oil level is a few millimeters below the lower edge of the inspection hole.	

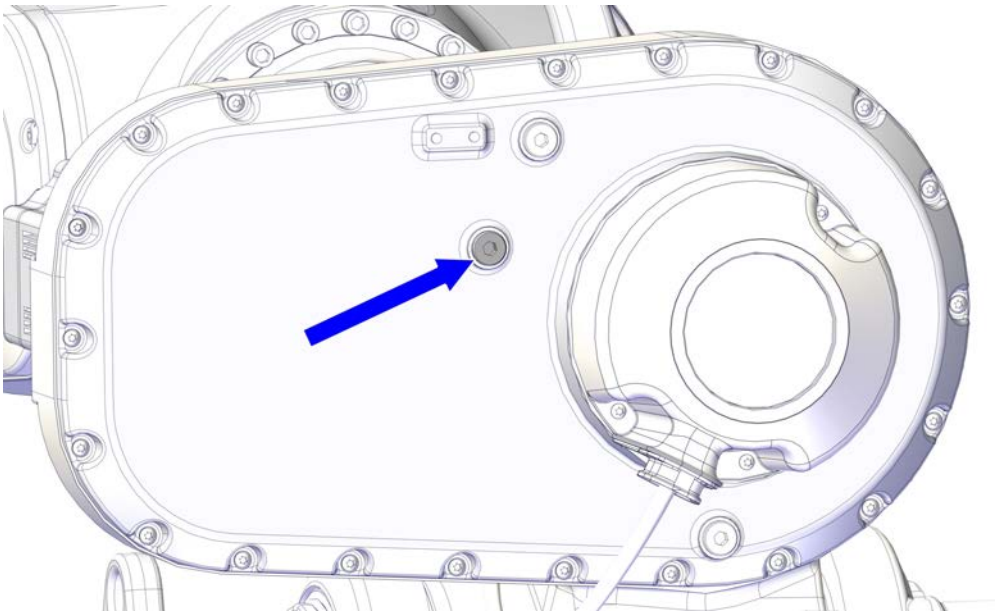
Continues on next page

	Action	Note
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 oil, axis-4 primary gearbox on page 153*.
9	Refit the oil plugs.	Tightening torque: 24 Nm.
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 97*.	

3.3.4 Inspecting the oil level in axis-4 secondary gearbox

Location of oil plug

The oil plug through which the oil is inspected is located as shown in the figure.



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Required tools

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumable

Consumable	Article number	Note
Lubrication oil	-	Information about the oil is found in *Technical reference manual - Lubrication in gearboxes*.

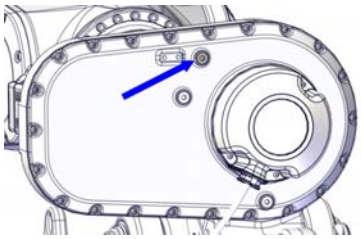
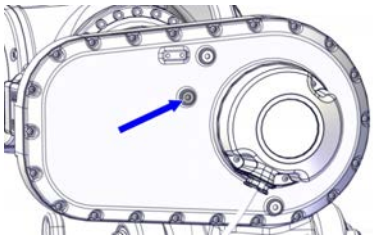
Required documents

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

Inspecting the oil level in axis-4 secondary gearbox

	Action	Note
1	Jog axis-2 to -60° position approximately.	
2	Jog axis-3 to +10° position approximately.	

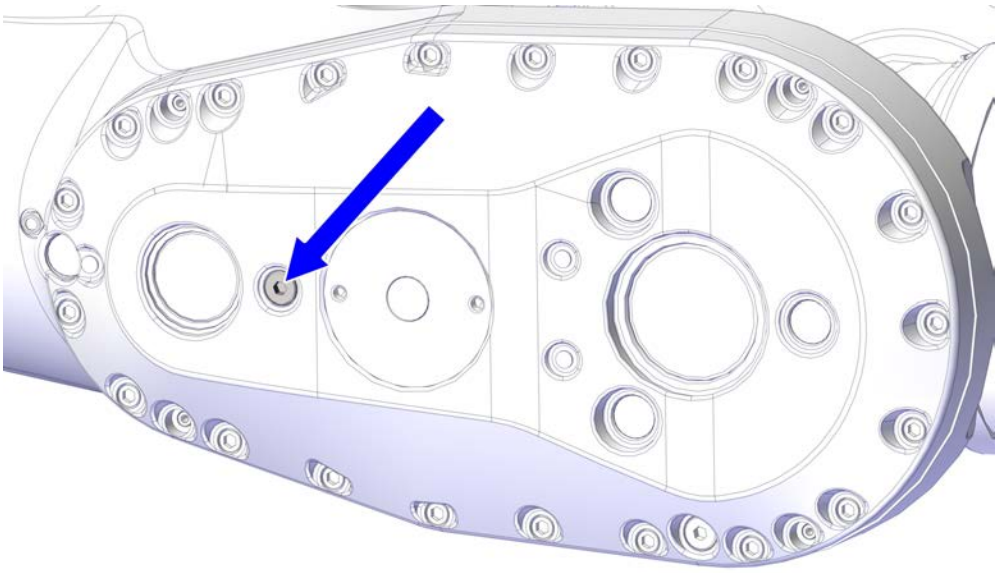
Continues on next page

	Action	Note
3	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 34*.	
4	**CAUTION** The gearbox can contain an *excess of pressure* that can be hazardous. Use caution when the oil plug is opened, in order to let out the excess pressure.	
5	Open the ventilation plug. **Note** The ventilation plug shall be opened prior to the inspection plug, in order to release possible pressure inside.	 xx1500002002
6	Open the inspection plug.	 xx1500002001
7	Inspect the oil level by using caution and jogging axis-3 very slowly to approximately +3.5° position, until oil starts to spill out.	
8	Required oil level is when oil starts to spill out with axis-3 in +3.5° position.	
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 oil, axis-4 secondary gearbox on page 159*.
10	Refit the oil plugs.	Tightening torque: 24 Nm.
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 97*.	

3.3.5 Inspecting the oil level in axis-5 gearbox

Location of oil plug

The oil plug through which the oil is inspected is located as shown in the figure.



xx1500002003

Required tools

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumable

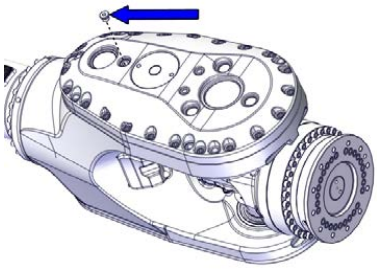
Consumable	Article number	Note
Lubrication oil	-	Information about the oil is found in *Technical reference manual - Lubrication in gearboxes*.

Required documents

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

Continues on next page

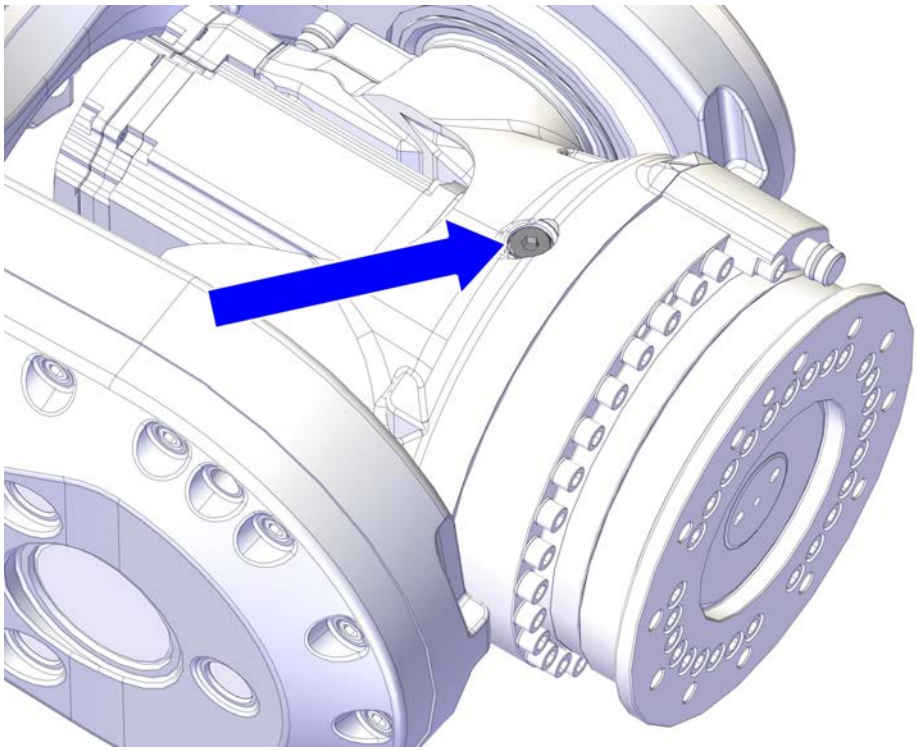
Inspecting the oil level in axis-5 gearbox

	Action	Note
1	Jog the robot to the specified position: • Axis-1: no significance (as long as the robot is secured to the foundation) • Axis-2: as far forward as possible • Axis-3: 0° • Axis-4: -60° approximately • Axis-5: 0° • Axis-6: no significance	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 34*.	
3	**CAUTION** The gearbox can contain an *excess of pressure* that can be hazardous. Use caution when the oil plug is opened, in order to let out the excess pressure.	
4	Use caution and open the combined inspection and ventilation plug. **Note** Open the plug with caution! There may be some pressure inside that will be released when the plug is opened.	 xx1700001461
5	Jog axis-4 very slowly until oil is visible in the inspection hole (approximately -54° position).	
6	Inspect the oil level.	
7	Required oil level is when the oil level is visible just below the lower edge of the inspection hole, with axis-4 approximately in -54° position.	
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 oil, axis-5 gearbox on page 164*.
9	Refit the oil plug.	Tightening torque: 24 Nm.
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 97*.	

3.3.6 Inspecting the oil level in axis-6 gearbox

Location of oil plug

The oil plug through which the oil is inspected is located as shown in the figure.



xx1500002006

Required tools

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumable

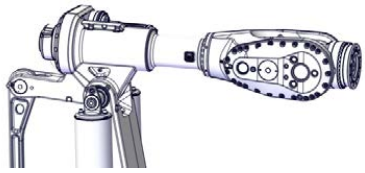
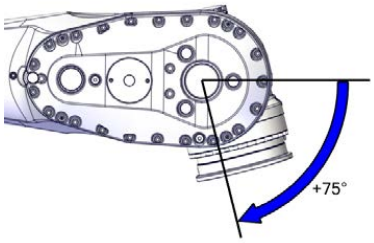
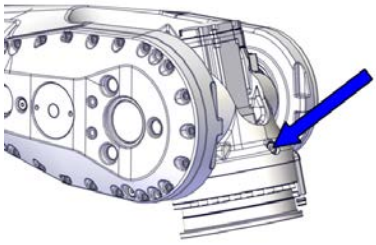
Consumable	Article number	Note
Lubrication oil	-	Information about the oil is found in *Technical reference manual - Lubrication in gearboxes*.

Required documents

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

Continues on next page

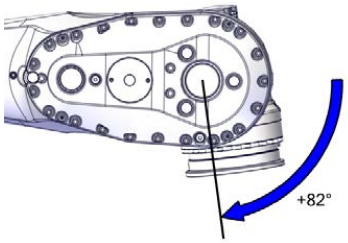
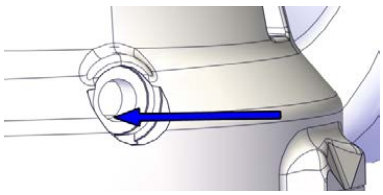
Inspecting the oil level in axis-6 gearbox

	Action	Note
1	Jog the robot to a comfortable working position in regard of getting access to the axis-6 gearbox.	
2	Jog axis 5 so that the tilt house is horizontal (turning disk points straight forward).	The figure shows axis 5 in position 0° if also axis 2 and axis 3 are standing in 0°. The upcoming figures in this procedure are based on this starting position.  xx1700001291
3	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 34*.	
4	Jog axis-5 approximately +75°.	 xx1700001288
5	**CAUTION** The gearbox can contain an *excess of pressure* that can be hazardous. Use caution when the oil plug is opened, in order to let out the excess pressure.	
6	Open the combined inspection and ventilation plug.	 xx1700001289

Continues on next page

3.3.6 Inspecting the oil level in axis-6 gearbox

Continued

	Action	Note
7	Inspect the oil level by slowly jogging the axis-5 further 7° to approximately +82° totally. **CAUTION** Excessive oil can be spilled!	 xx1700001290
8	Required oil level is when the oil level is visible just below the lower edge of the inspection hole, with axis-5 approximately jogged +82° from the starting position.	 xx1700001292
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 oil, axis-6 gearbox on page 168*.
10	Refit the oil plug.	Tightening torque: 24 Nm.
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 97*.	

3.3.7 Inspecting the transparent plugs

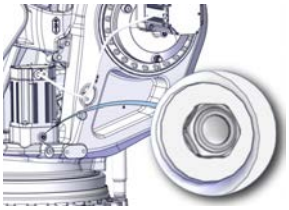
Introduction

The gearboxes are equipped with transparent plugs, through which an oil leakage from the hubs can be detected.

Location of the transparent plugs

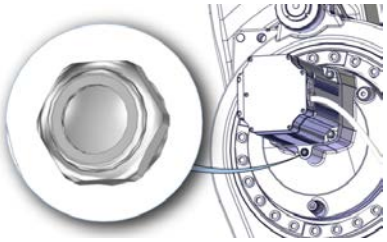
The location of the transparent plugs are located at the six gearboxes, as shown in the figure.

Axis-1



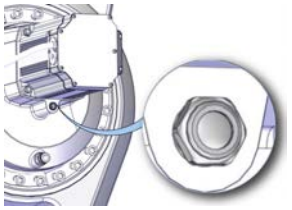
xx1500002044

Axis-2



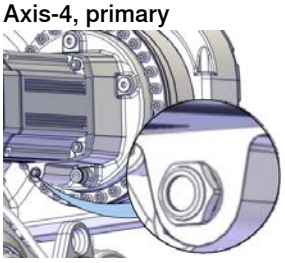
xx1500002050

Axis-3



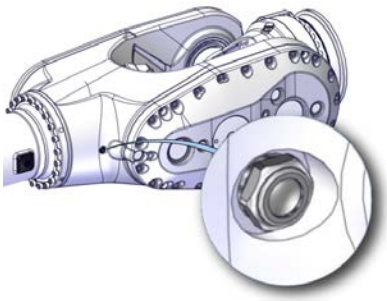
xx1500002043

Axis-4, primary



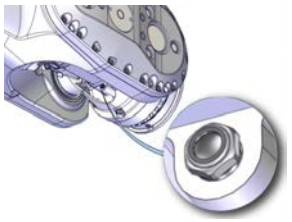
xx1500002042

Axis-5



xx1500002041

Axis-6



xx1500002040

Required tools

Visual inspection, no tools are required.

Inspecting the transparent oil plugs

The gearboxes are equipped with transparent plugs, through which oil leakage from the hubs can be detected. If an oil leakage is detected, remove the hub and replace the defective part (radial sealing or o-ring).

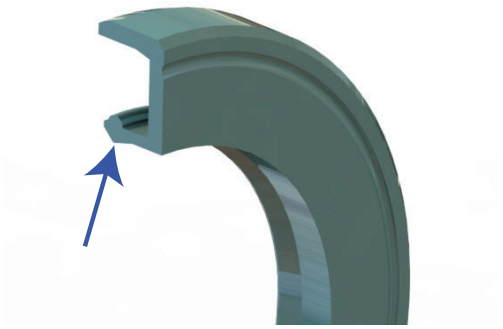
Note

If only a few drops of oil are detected, is not necessarily a sign of an oil leakage. A few drops of oil inside can normally be released from the hub. But if oil increases, this is not the case.

Continues on next page

3.3.7 Inspecting the transparent plugs
Continued

If the radial sealing needs to be replaced, it is important that the main lip of the new sealing is not located axially in the same position as the main lip of the defective sealing.



xx1500002025

Sealing, main lip

Tip

Add an extra 2 mm shim between the hub and the radial sealing to eliminate the problem

Tip

In a clean environment the transparent oil plugs can be removed. Do not remove the transparent oil plugs in other than clean environments!

3.3.8 Inspecting the balancing devices

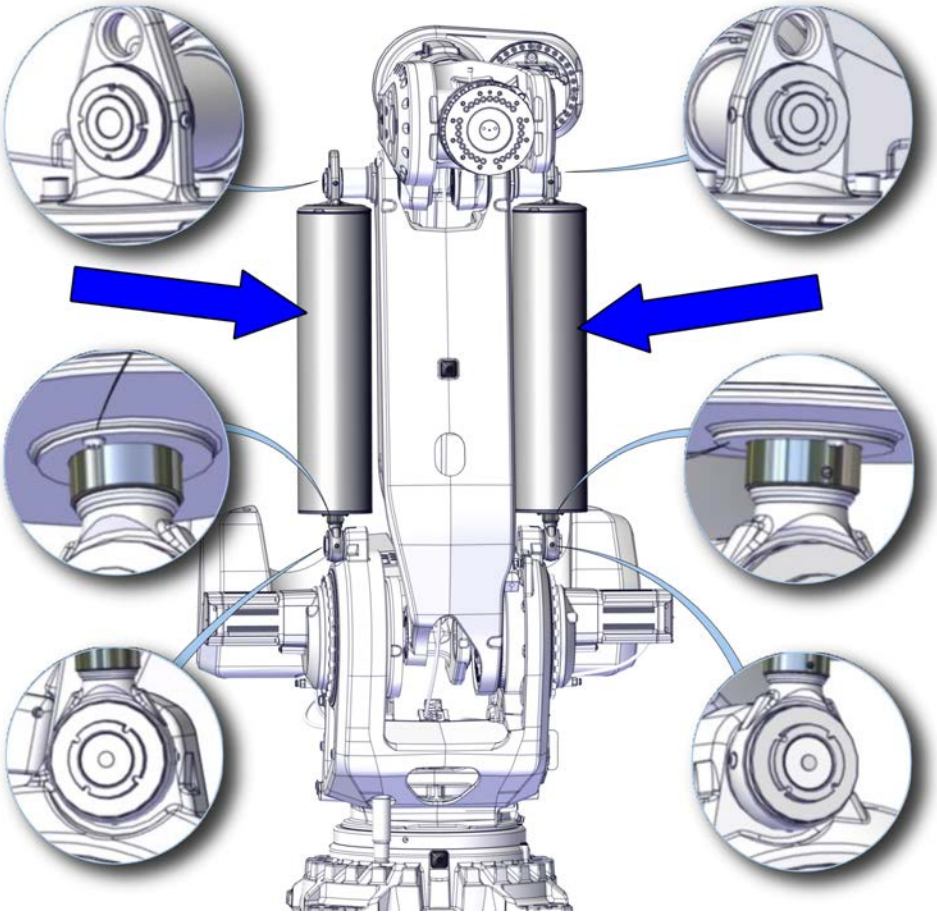
General

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

- dissonance
- damage
- leakage
- contamination/lack of free space.

Inspection points, balancing devices

The balancing devices are located on either side of the lower arm, as shown in the figure. The figure also shows the inspection points, further described in the instructions.



xx1500002076

Required tools

Visual inspection, no tools are required.

Continues on next page

3.3.8 Inspecting the balancing devices
Continued

Required equipment

Equipment	Article number	Note
Balancing device material set	3HAC048239-006	

Inspection for dissonance

	Inspection points	Action
1	Check for dissonance from the upper and lower bearing.	If dissonance is detected, perform maintenance according to given instructions in the maintenance set.
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 Robotics. How to replace the balancing device, see *Replacing the balancing devices on page 414*
3	Check for dissonance from the piston rod (a squeaking sound 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.

Inspection for damage

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

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

Inspection for leakage

The upper and lower ears of the balancing devices are lubricated with grease.

Leaks at V-rings etc. are not acceptable and must be attended to immediately to avoid damage to the bearing.

	Action	Note
1	Wipe clean the area at the upper and lower ears 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 robot working area.	

Continues on next page

	Action	Note
4	Inspect the area around the lock nut and V-ring at the upper and lower ear for leakage.	
5	Replace V-ring if leaks are detected.	V-ring is included in the Maintenance set.

Inspection for contamination/lack of space

	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	Keep the areas around the balancing devices clean and free from objects, such as service tools etc.	

3.3.9 Inspecting the cable harness

Location of cable harness

The location of the cable harness is located as shown in the figure.

xx1500001878

Required tools

Visual inspection, no tools are required.

Inspecting the cable harness

	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	Perform 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. Make sure the cabling is not damaged in any way, between the cable brackets in these areas.

Continues on next page

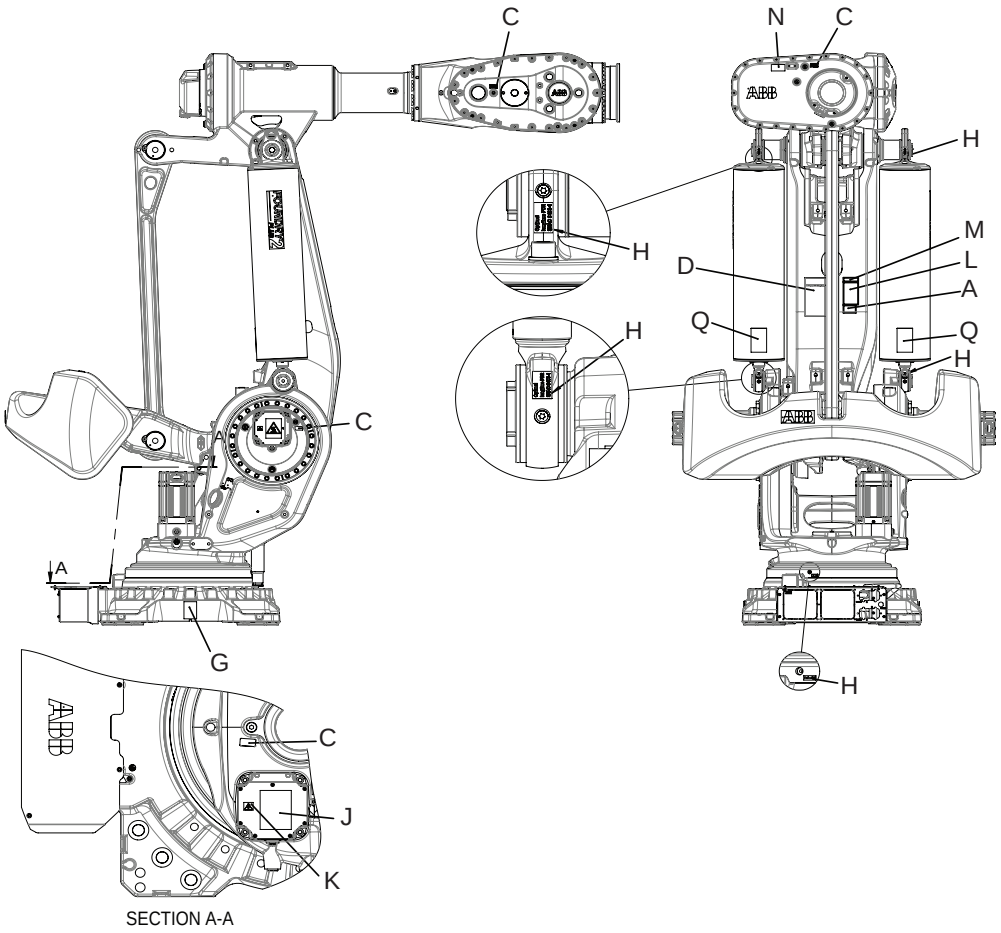
	Action	Note
3	Follow the cable harness from the base of the robot to the wrist, making sure that all cable brackets, velcro straps and other attachments are properly secured.	
4	Inspect the motor cables for any damage.	
5	Inspect the connectors at the base for any damage.	
6	Inspect the cable harness running through the protection tube in the frame, to detect possible cable chafing. Use a hand inside the tube to feel the cables. Ensure that the cables are undamaged. Remove any objects that may cause possible cable chafing!	
7	Replace the cable harness if wear, cracks or other damage is detected!	

3.3.10 Inspecting the information labels

Location of labels

These figures show the location of the information labels to be inspected. The symbols are described in section *Safety symbols on manipulator labels on page 23*.

Illustration 1



xx1700000986

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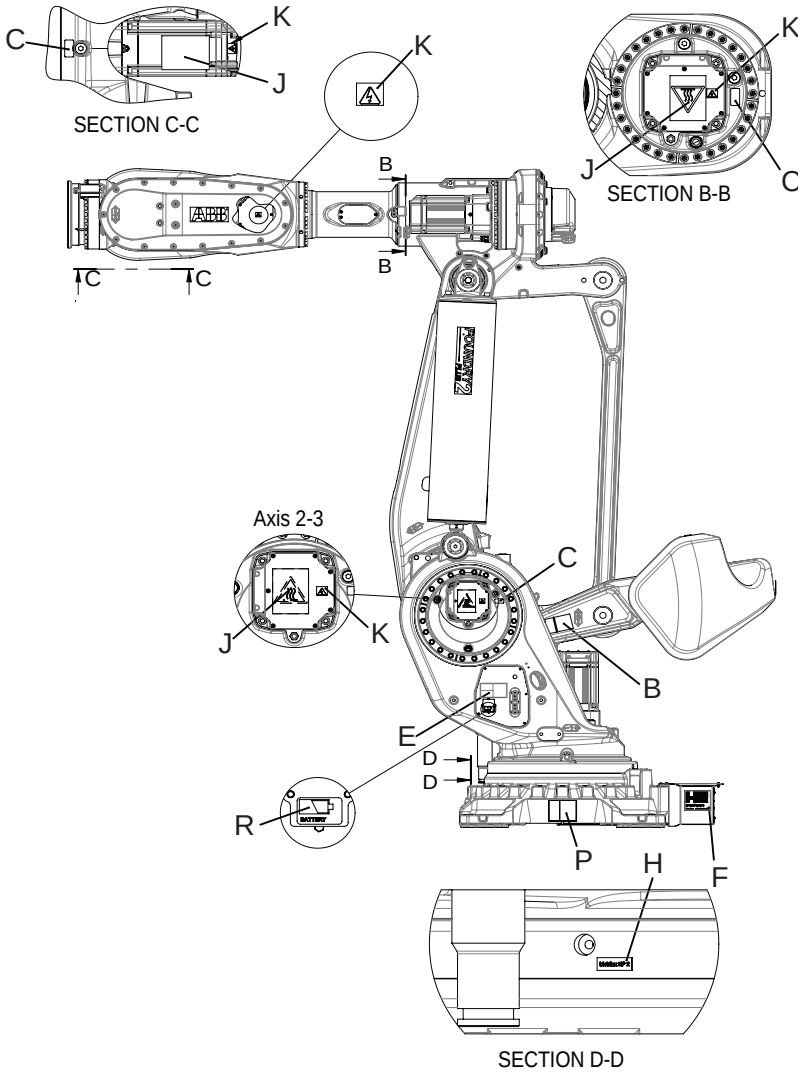
Illustration 2



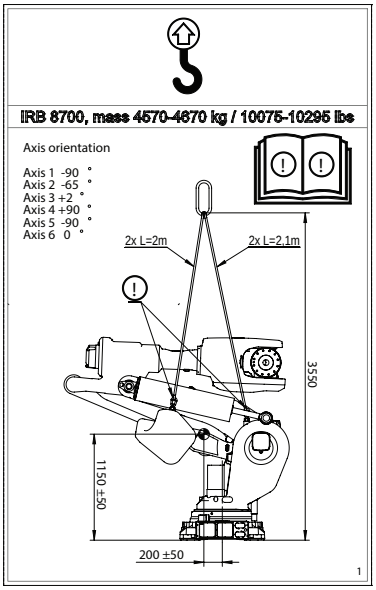
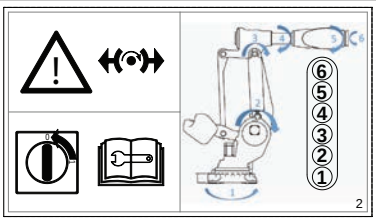
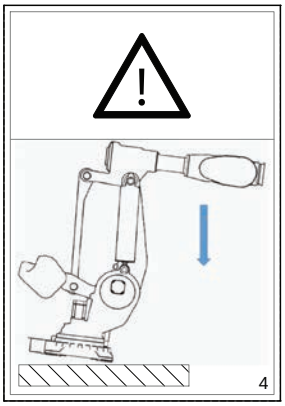
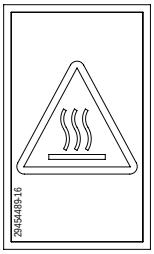
xx1700000979

A	Calibration label	
B	Warning label Risk of crush injuries	 xx1700000980
C	Oil specification label	

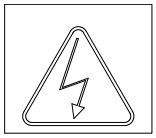
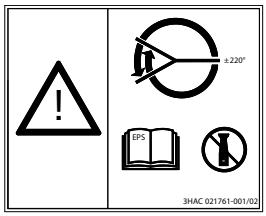
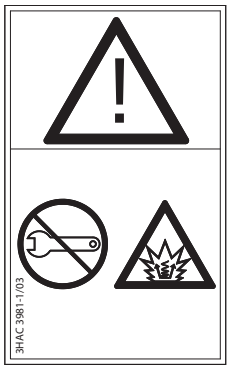
Continues on next page

3.3.10 Inspecting the information labels

Continued

D	Instruction label Lifting of robot	 xx1700000982
E	Instruction label Brake release Shut off with handle See user documentation Moving robot Brake release buttons	 xx1700000983
F	Complete oil specification	
G	Warning label Tip risk when loosening bolts	 xx1700000981
H	Grease specification label	
J	Instruction plate Heat	 xx1700000984

Continues on next page

K	Warning label Flash	 xx1300001091
L	Rating label	
M	Absolute accuracy label	
N	UL label	
P	Label Extended rotation No mechanical stop See user documentation	 xx1300001092
Q	Warning label Do not dismantle Stored energy	 xx1700000985
R	Battery label	

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 *Spare parts on page 729*.

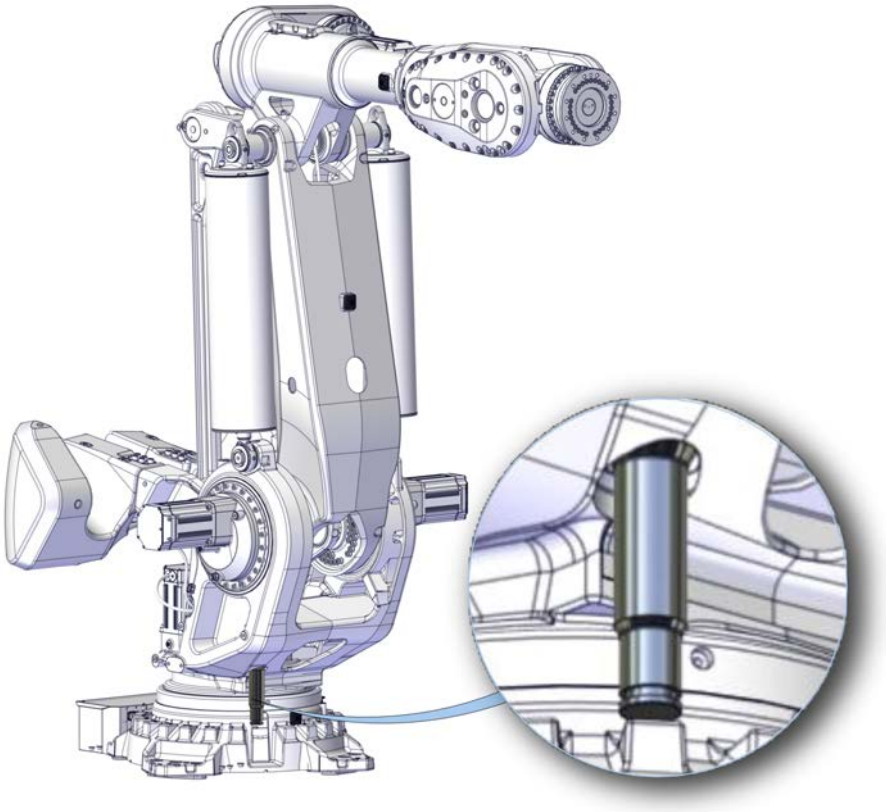
3.3.11 Inspecting the axis-1 mechanical stop pin

WARNING

Mechanical stop pin can not be fitted onto robot if the option 561-1 *Extended working range* is used for axis 1.

Location of mechanical stop pin

The axis-1 mechanical stop is located as shown in the figure.



xx1500002077

Required equipment

Visual inspection, no tools are required.

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Inspecting, mechanical stop pin

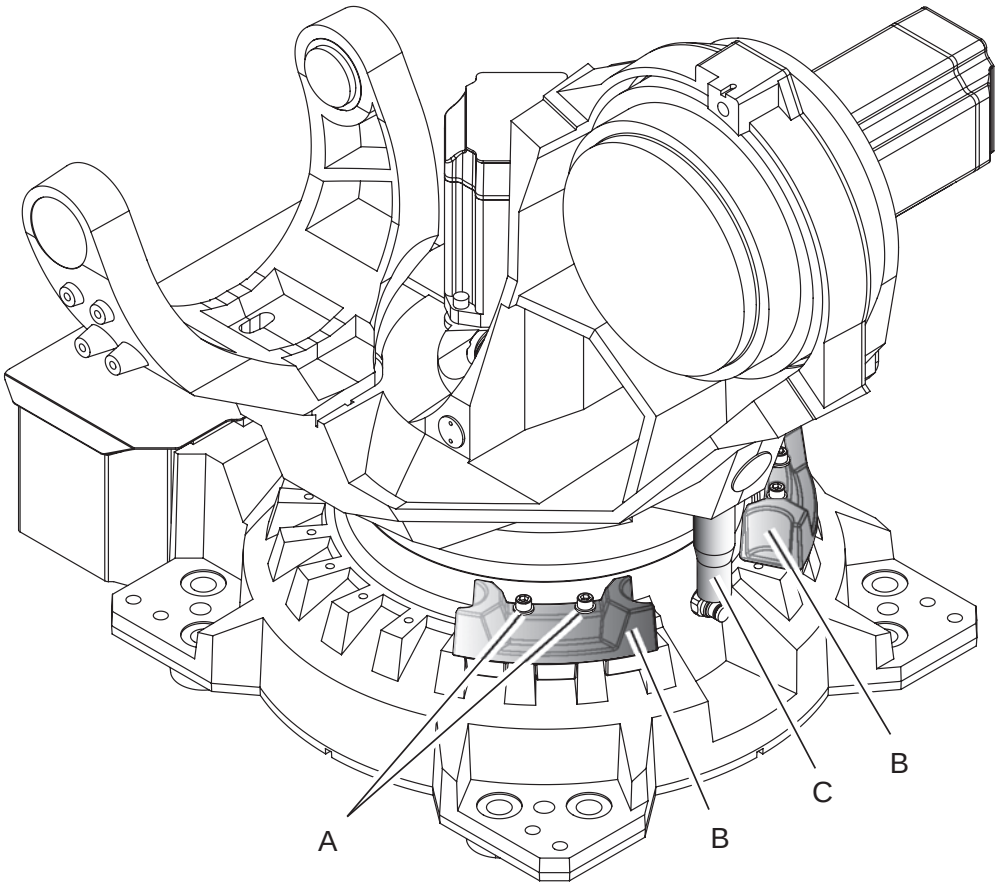
Use this procedure to inspect the axis-1 mechanical stop pin.

	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.	

3.3.12 Inspecting the additional mechanical stops

Location of mechanical stops

The figure shows the location of additional mechanical stops.



xx1300001971

A	Attachment screws M16x90 quality 12.9 Gleitmo 603 (2 pcs per additional mechanical stop)
B	Movable mechanical stop
C	Mechanical stop pin axis-1

Required equipment

Equipment etc.	Article number	Note
Movable mechanical stop axis 1	3HAC053706-001	Includes: • Mechanical stop (2 pcs) • Attachment screw and washer (4+4 pcs) • Document for mechanical stop pin
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Continues on next page

Inspecting, mechanical stops

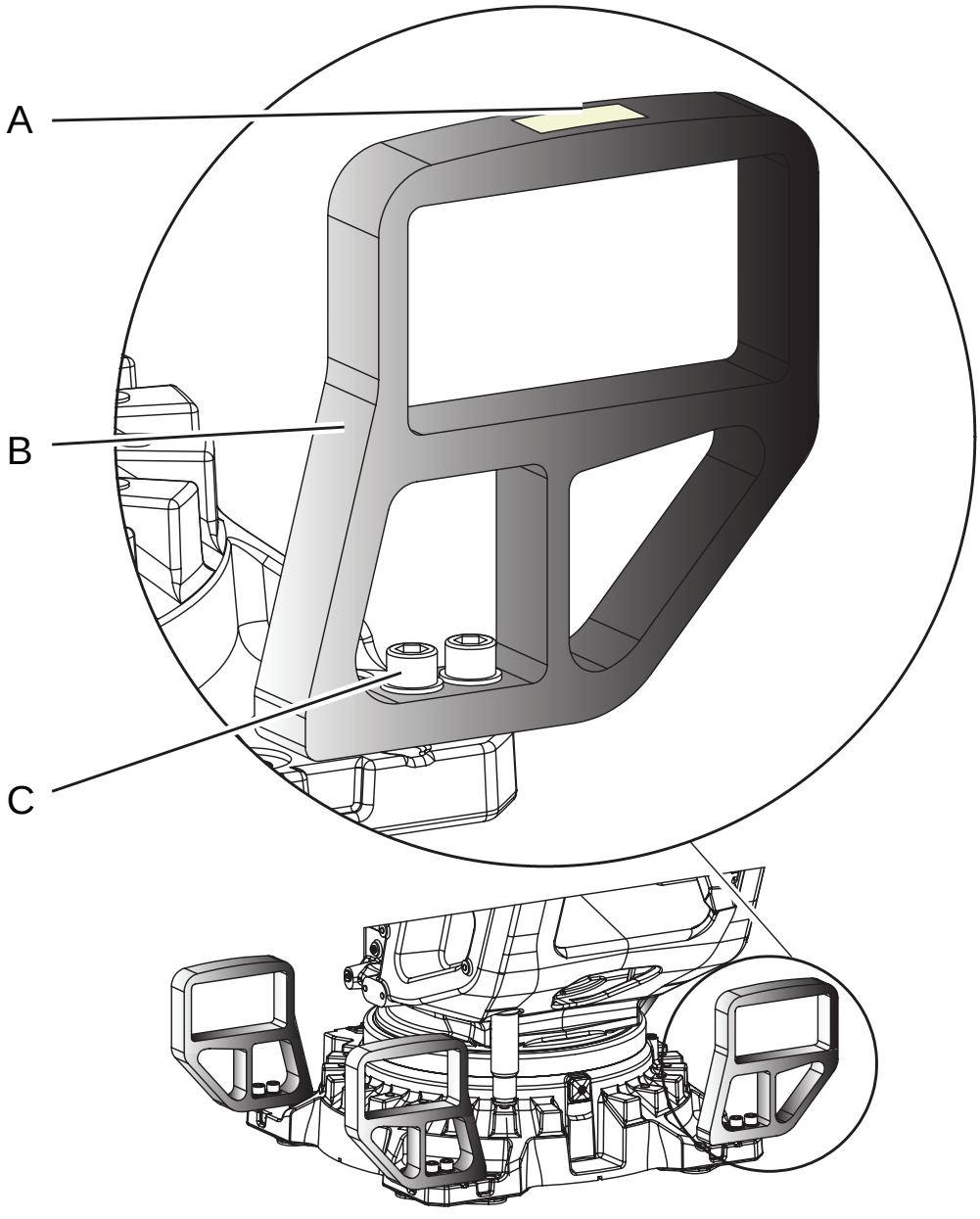
Use this procedure to inspect the additional mechanical stops.

	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	Make sure no additional stops are damaged.	Shown in figure *Location of mechanical stops on page 134*.
3	Make sure the stops are properly attached. Correct tightening torque, additional mechanical stops: • Axis 1 = 300 Nm.	
4	If any damage is detected, the mechanical stops must be replaced. Correct attachment screws: • M16x90 quality 12.9 Gleitmo 603 (2 pcs per additional mechanical stop)	Article number is specified in *Required equipment on page 134*.

3.3.13 Inspecting the fork lift accessories

Location of the fork lift accessories

The fork lift accessory is fitted to the robot as shown in the figure.



xx1400002588

A	CE label
B	Fork lift pocket (4 pcs)
C	Attachment screws MC6S 20x60 8.8 (2x4 pcs)

Continues on next page

Required equipment

Equipment	Article number	Note
Fork lift accessory	3HAC053662-003	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Inspecting, fork lift device set

	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	Inspect the fork lift accessory pockets for damage.	
3	Inspect the attachment screws for deformation and other type of damage.	
4	Make sure the fork lift pockets are properly attached (4 pcs).	Tightening torque: 300 Nm
5	If any damage is detected, the fork lift pockets and attachment screws must be replaced.	Article number is specified in *Required equipment on page 134*. Attachment screws: M20x60 quality steel 8.8-A3F

3.3.14 Inspecting the signal lamp (option)

Location of signal lamp

The signal lamp is located as shown in this figure.

Required tools and equipment

Equipment	Article number	Note
Signal lamp kit	See *Spare parts on page 729*.	To be replaced if damage is detected.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Inspecting, signal lamp

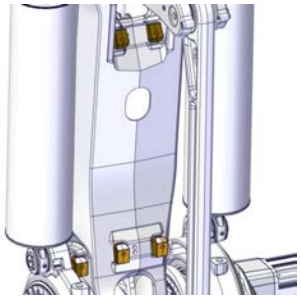
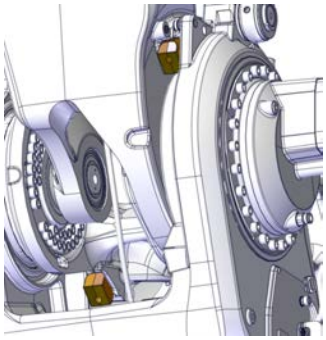
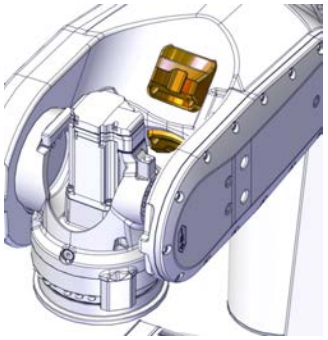
Use this procedure to inspect the function of the signal lamp.

	Action	Note
1	Inspect that signal lamp is lit when motors are put in operation ("MOTORS ON").	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	If the lamp is not lit, trace the fault by: • inspecting whether the signal lamp is broken. If so, replace it. • inspecting cable connections. • inspecting the cabling. Replace the cabling if a fault is detected.	Article number is specified in *Required tools and equipment on page 138*.

3.3.15 Inspecting dampers

Location of dampers

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

Lower arm	Parallel and lower arms	Wrist
 xx1500002008	 xx1500002009	 xx1500002010

Required equipment

Visual inspection, no tools are required.

Inspecting, 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 robot working area.	
2	Inspect all dampers for damage, cracks or existing impressions larger than 1 mm.	
3	Inspect the attachment screws for deformation.	
4	If any damage is detected, the damper and/or screws must be replaced with new ones.	Damper, lower and parallel arms: 3HAC12991-1 (7 pcs) Attachment screws: M6x20 (1x7 pcs) Damper, wrist: 3HAC050601-001 (2 pcs) Attachment screws: M6x16 (2+2 pcs)

3.4 Replacement/changing activities

3.4.1 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.

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	

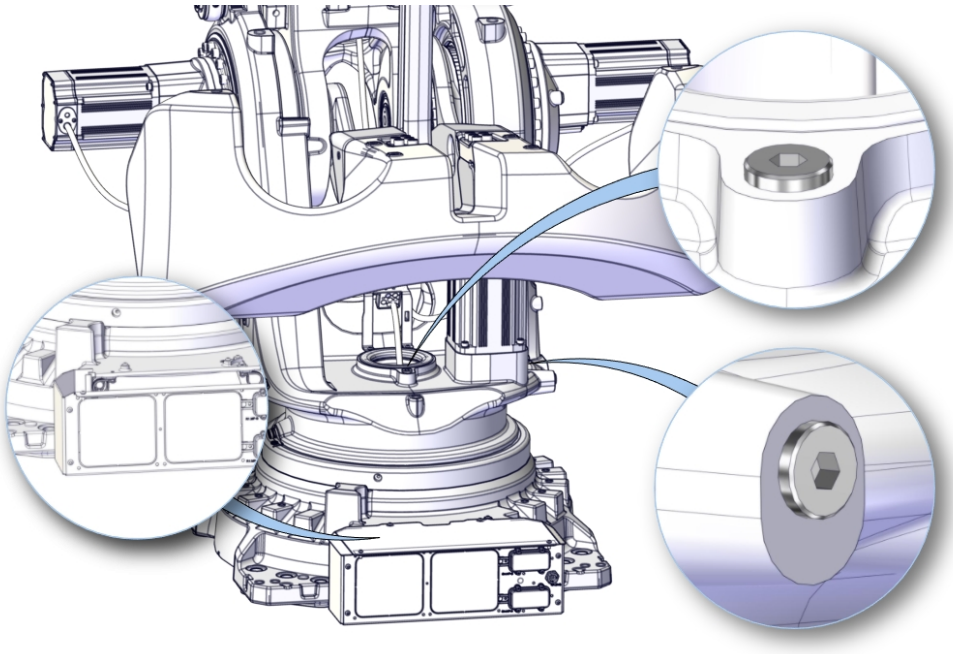
3.4.2 Changing oil, axis-1 gearbox

Usage of dispenser

The oil change procedure in this section describes usage of an oil dispenser.

Location of oil plugs

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



xx1500002011

Top right	Ventilation plug (can also be used for filling oil, when not using an oil dispenser)
Bottom right	Inspection plug
Left	Draining and filling (fitted with nipple intended for use of a oil dispenser when filling or draining oil)

Required consumable

Material	Note
Lubricating oil	Information about the oil is found in *Technical reference manual - Lubrication in gearboxes*. See *Type and amount of oil in gearboxes on page 140*.

Required tools and equipment

Equipment, etc.	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.

Continues on next page

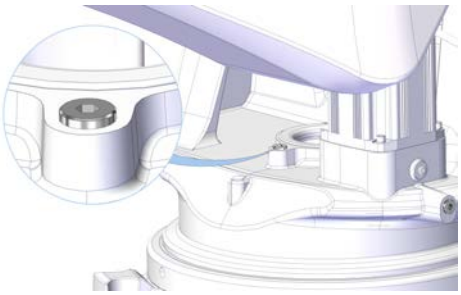
3.4.2 Changing oil, axis-1 gearbox
Continued

Required documents

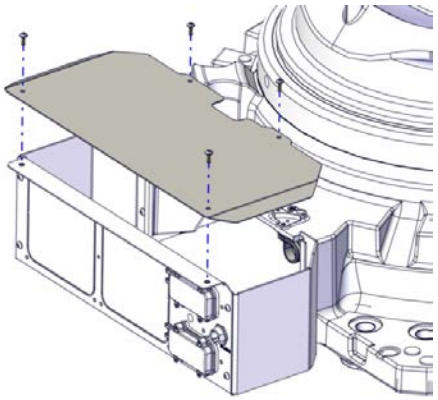
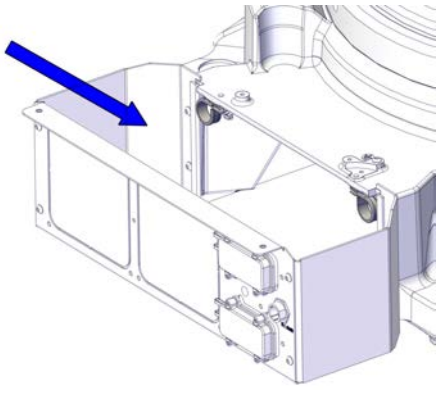
Document name	Document number	Note
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*	

Draining the axis-1 gearbox

Use this procedure to drain the gearbox.

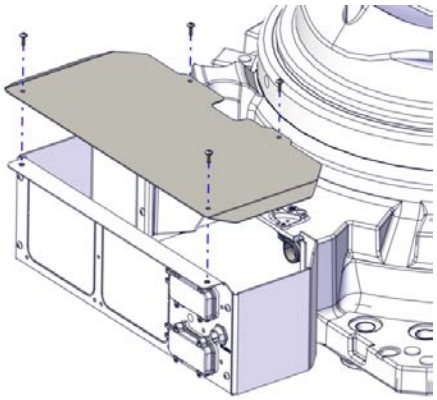
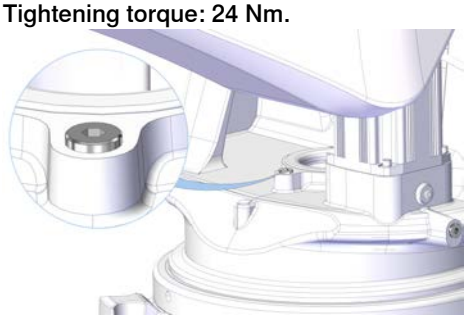
	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 34*.	
3	**CAUTION** The gearbox may contain an *excessive pressure* that can be hazardous. Open the oil plug carefully to let the excess pressure out.	
4	Open the ventilation plug. **WARNING** If the ventilation hole is closed when the oil dispenser is in use, there is a risk of damaging vital parts in the gear.	 xx1500001993

Continues on next page

	Action	Note
5	Remove the base cover.	 xx1500003082
6	Pull out the oil hose next to the connections and attach the nipple. Connect the oil dispenser.	
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 section *Decommissioning on page 707* for more information.	
9	Remove the oil dispenser.	
10	Remove the oil filling nipple, put the protective cap on and put the oil filling hose into the connection box.	 xx1600001405

Continues on next page

3.4.2 Changing oil, axis-1 gearbox
Continued

	Action	Note
11	Refit the base cover.	 xx1500003082
12	Refit the ventilation plug.	Tightening torque: 24 Nm.  xx1500001993

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 robot working area.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 34*.	

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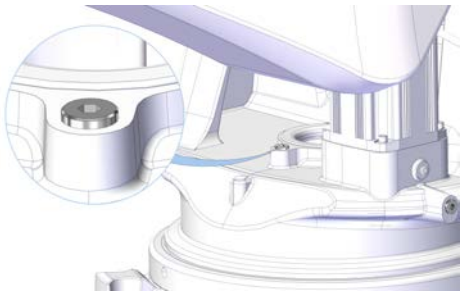
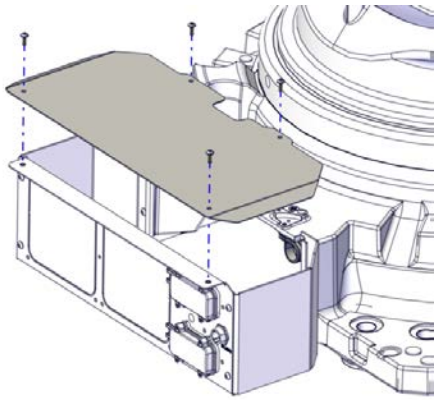
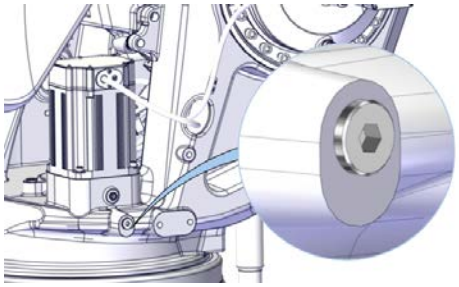
	Action	Note
3	Remove the ventilation plug. **Note** The ventilation hole must be opened to let out air during the filling process.	 xx1500001993
4	Remove the base cover.	 xx1500003082
5	Pull out the oil hose next to the connections and attach the nipple. Connect the oil dispenser.	
6	Refill the gearbox with oil, by using 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 described in *Technical reference manual - Lubrication in gearboxes*. See *Type and amount of oil in gearboxes on page 140*.
7	Inspect the oil level.	 xx1500001992 Required oil level: 58 mm ± 5 mm below the sealing surface of the oil plug.
8	Remove the oil dispenser.	

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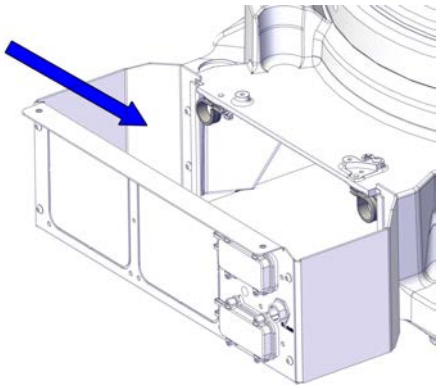
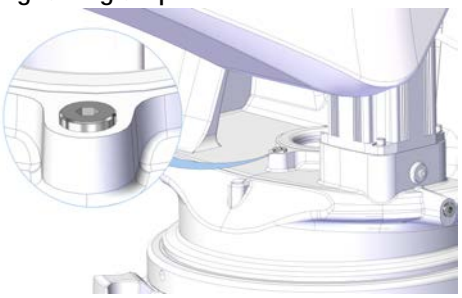
3.4.2 Changing oil, axis-1 gearbox

Continued

	Action	Note
9	Remove the oil filling nipple, put the protective cap on and put the oil filling hose into the connection box.	 xx1600001405
10	Refit the ventilation plug.	Tightening torque: 24 Nm  xx1500001993
11	**Note** After all repair and maintenance work involving oil, always wipe the robot clean from all surplus oil. The robot color may otherwise discolor.	
12	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 97*.	

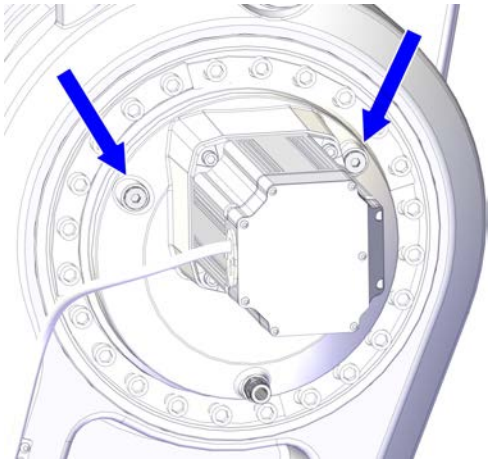
3.4.3 Changing oil in axis-2 and axis-3 gearbox

Usage of oil dispenser

The oil change procedure in this section describes usage of an oil dispenser.

Location of oil plugs

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

<table>
<tr><td> 
xx1500002014</td><td> 
xx1500002013</td></tr>
<tr><td>Oil filling and draining hole, with nipple
Used with an oil dispenser.</td><td>• - Left = Inspection hole
- Right = Ventilation hole</td></tr>
<tr><td>Tightening torque: N/A</td><td>Tightening torque: 24 Nm.</td></tr>
</table>

Required consumable

Material	Note
Lubricating oil	Information about the oil is found in *Technical reference manual - Lubrication in gearboxes*. See *Type and amount of oil in gearboxes on page 140*.

Required tools and equipment

Equipment, etc.	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 140*.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required documents

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

Continues on next page

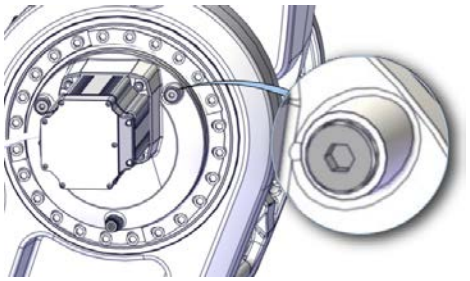
3.4.3 Changing oil in axis-2 and axis-3 gearbox
Continued

Draining the axis-2 and axis-3 gearboxes

Use this procedure to drain the gearbox.

Note

The procedure to change oil in axis-2 and axis-3 is the same.

	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 34*.	
3	**CAUTION** The gearbox can contain an *excess of pressure* that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
4	Remove the plug from the ventilation hole. **WARNING** If the ventilation hole is not open when the oil dispenser is working, there is a risk of damaging vital parts in the gear!	 xx1500001994

Continues on next page

	Action	Note
5	Remove the protection cap from the nipple of the oil draining plug and connect the oil dispenser.	 xx1500002014
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 section *Decommissioning on page 707* for more information.	
8	Remove the oil dispenser and refit the protection cap to the nipple of the oil draining plug.	 xx1500002014

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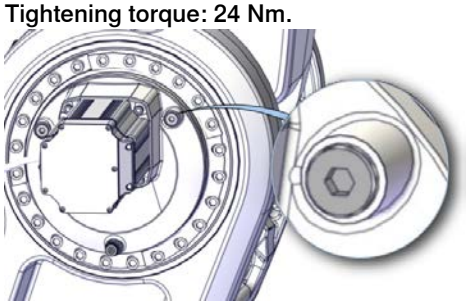
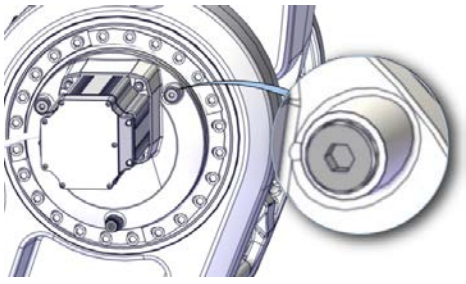
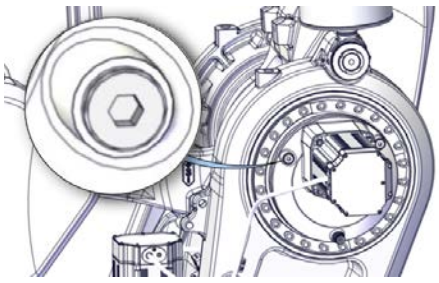
3.4.3 Changing oil in axis-2 and axis-3 gearbox
Continued

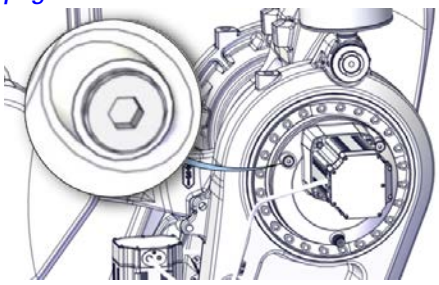
	Action	Note
9	Refit the ventilation plug.	Tightening torque: 24 Nm.  xx1500001994

Filling oil into the axis-2 and axis-3 gearboxes

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 robot working area.	
2	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 34*.	
3	Remove the ventilation plug. **Note** The ventilation plug is opened to let out air during the filling process.	 xx1500001994
4	Remove the inspection plug.	 xx1500001995

Continues on next page

	Action	Note
5	Remove the protection cap from the nipple of the oil filling plug and connect the oil dispenser.	 xx1500002014
6	Refill the gearbox with oil, using 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*. See *Type of lubrication in gearboxes on page 140*.
7	Inspect the oil level at the oil inspection plug.	Required oil level is: A few millimeters below the lower edge of the inspection hole. More information is found in *Inspecting the oil level in axis-2 and 3 gearboxes on page 108*.  xx1500001995

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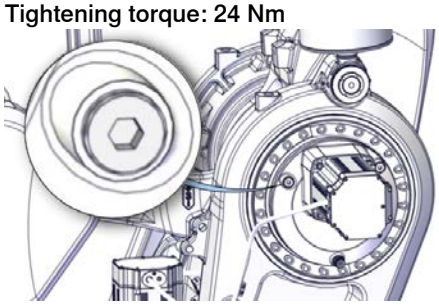
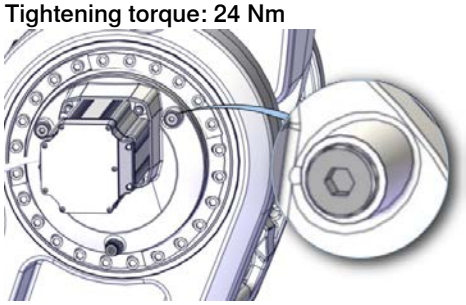
3.4.3 Changing oil in axis-2 and axis-3 gearbox
Continued

	Action	Note
8	Remove the oil dispenser and refit the protection cap to the nipple of the oil filling plug.	 xx1500002014
9	Refit the inspection plug.	Tightening torque: 24 Nm  xx1500001995
10	Refit the ventilation plug.	Tightening torque: 24 Nm  xx1500001994
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 97*.	

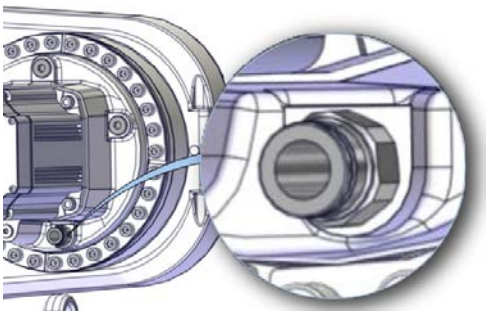
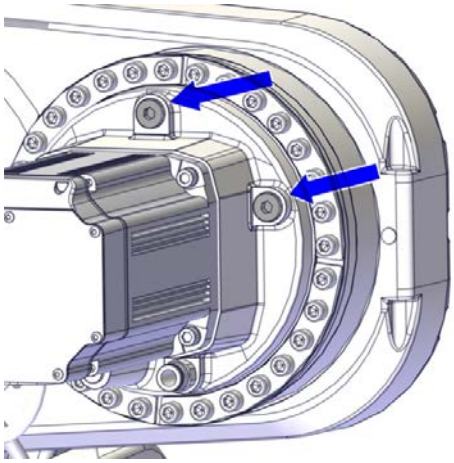
3.4.4 Changing oil, axis-4 primary gearbox

Usage of oil dispenser

The oil change procedure in this section describes usage of an oil dispenser.

Location of oil plugs

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

<table>
<tr><td> 
xx1500002016</td><td> 
xx1500002015</td></tr>
<tr><td>Oil filling and draining hole, with nipple.
Used with an oil dispenser.</td><td>• Left = Ventilation hole
• Right = Inspection hole</td></tr>
<tr><td>Tightening torque: N/A.</td><td>Tightening torque: 24 Nm.</td></tr>
</table>

Required consumable

Material	Note
Lubricating oil	Information about the oil is found in *Technical reference manual - Lubrication in gearboxes*. See *Type and amount of oil in gearboxes on page 140*.

Required tools and equipment

Equipment, etc.	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 140*.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

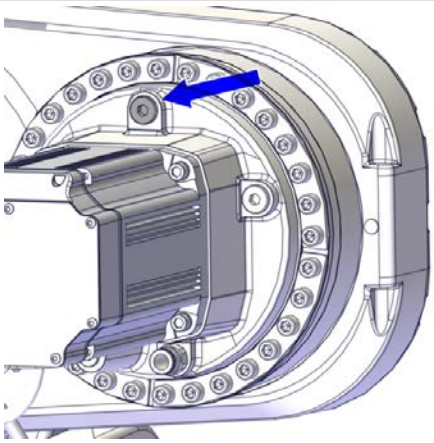
Required documents

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

Continues on next page

3.4.4 Changing oil, axis-4 primary gearbox
Continued

Draining the axis-4 primary gearbox

	Action	Note
1	Jog the robot to a comfortable working position.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
3	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 34*.	
4	**CAUTION** The gearbox can contain an *excess of pressure* that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
5	Remove the plug from the ventilation hole. **WARNING** If the ventilation hole is not open when the oil dispenser is working, there is a risk of damaging vital parts in the gear!	 xx1500002017

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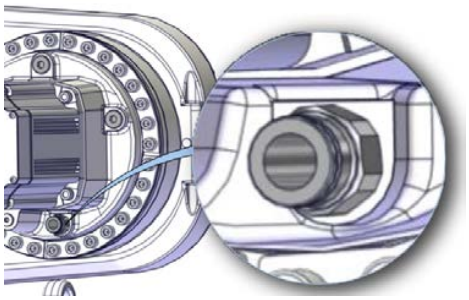
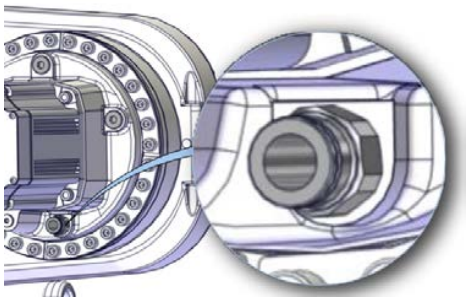
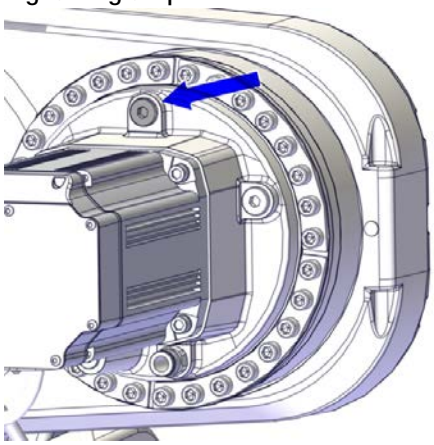
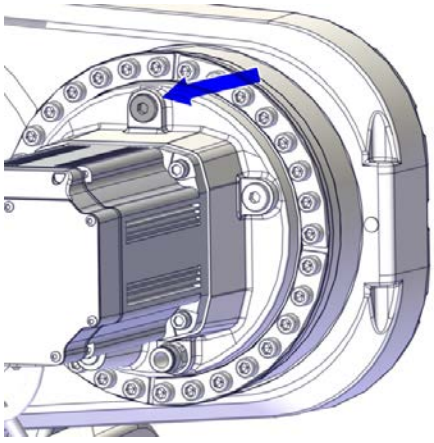
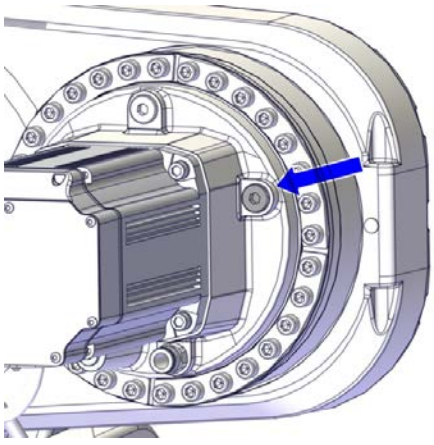
	Action	Note
6	Remove the protection cap from the nipple of the oil draining plug and connect the oil dispenser.	 xx1500002016
7	Suck out the oil using the oil dispenser. **Note** There will be some oil left in the gear after draining.	
8	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See section *Decommissioning on page 707* for more information.	
9	Remove the oil dispenser and refit the protection cap to the nipple of the oil draining plug.	 xx1500002016
10	Refit the ventilation plug.	Tightening torque: 24 Nm.  xx1500002017

Continues on next page

3.4.4 Changing oil, axis-4 primary gearbox
Continued

Filling oil into the axis-4 primary gearbox

	Action	Note
1	Jog the robot to a comfortable working position.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
3	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 34*.	
4	Open the ventilation plug. **Note** The ventilation plug is opened to let out air during the filling process. **WARNING** If the ventilation hole is not open when the oil dispenser is working, there is a risk of damaging vital parts in the gear!	 xx1500002017
5	Open the inspection plug.	 xx1500002018

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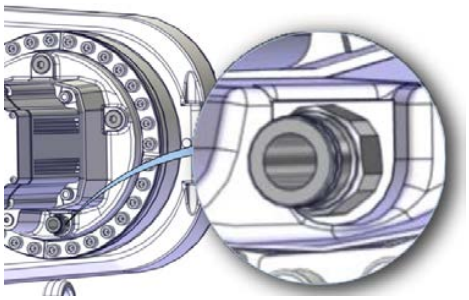
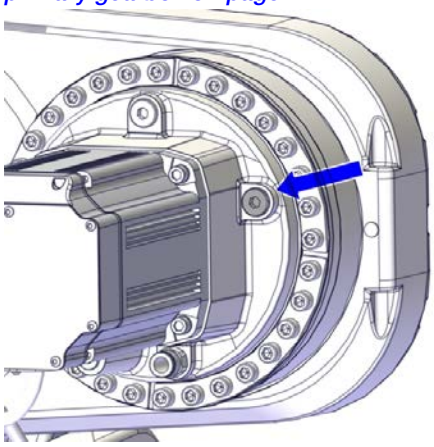
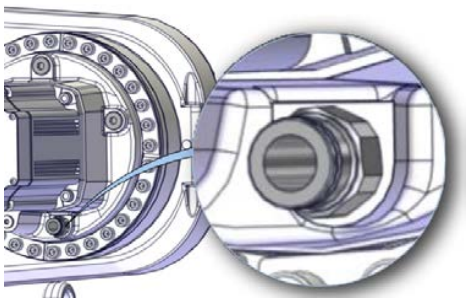
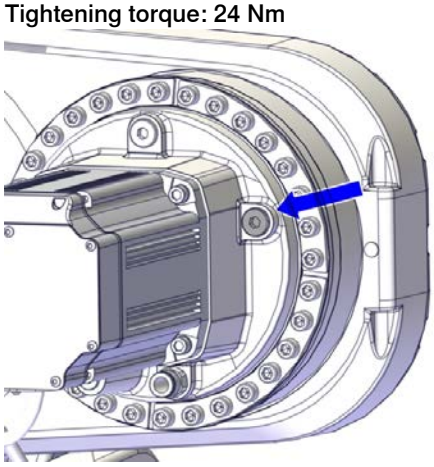
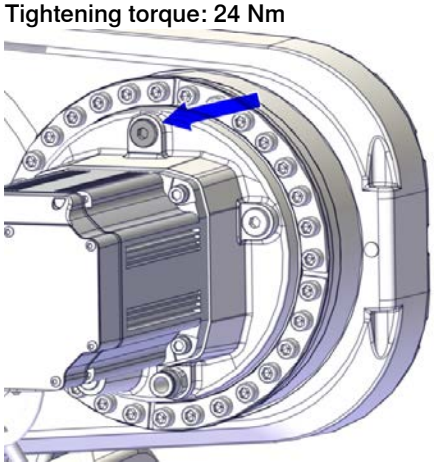
	Action	Note
6	Remove the protection cap from the nipple of the oil filling plug and connect the oil dispenser.	 xx1500002016
7	Refill the gearbox with oil, using the oil dispenser. **Note** The amount of oil to be filled depends on the amount previously being drained.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*. See *Type and amount of oil in gearboxes on page 140*.
8	Inspect the oil level.	Required oil level is: 0 - 10 mm below the oil plug hole. See *Inspecting the oil level in axis-4 primary gearbox on page 111*.  xx1500002018
9	Remove the oil dispenser and refit the protection cap to the nipple of the oil filling plug.	 xx1500002016

Continues on next page

3.4.4 Changing oil, axis-4 primary gearbox

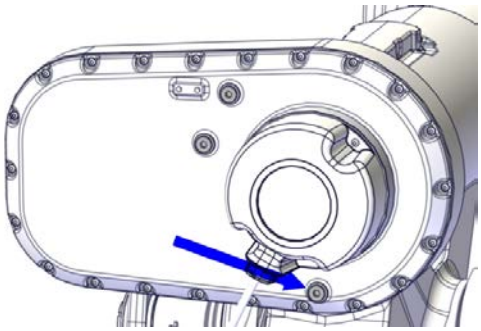
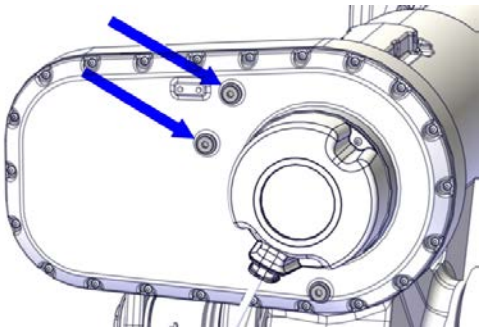
Continued

	Action	Note
10	Refit the inspection plug.	Tightening torque: 24 Nm  xx1500002018
11	Refit the ventilation plug.	Tightening torque: 24 Nm  xx1500002017
12	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 97*.	

3.4.5 Changing oil, axis-4 secondary gearbox

Location of oil plugs

The oil plugs of the gearbox are located as shown in the figures.

 xx1500002020	 xx1500002019
Draining plug	• Top = Ventilation plug • Bottom = Inspection plug
Tightening torque: 24 Nm.	Tightening torque: 24 Nm.

Required consumable

Material	Note
Lubricating oil	Information about the oil is found in *Technical reference manual - Lubrication in gearboxes*. See *Type and amount of oil in gearboxes on page 140*.

Required tools and equipment

Equipment, etc.	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

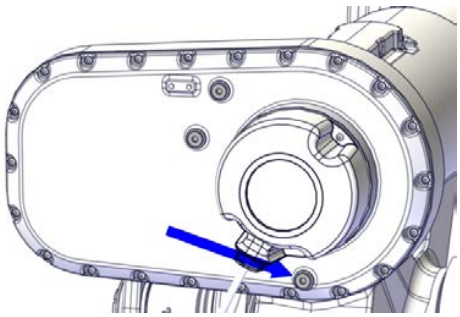
Required documents

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

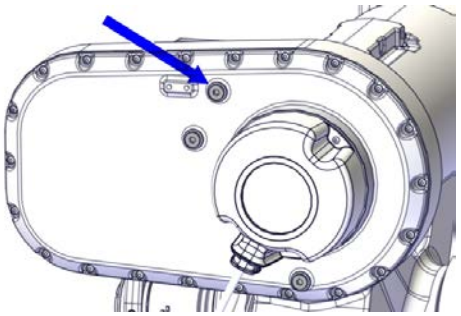
Continues on next page

3.4.5 Changing oil, axis-4 secondary gearbox
Continued

Draining the axis-4 secondary gearbox

	Action	Note
1	Jog the robot to a comfortable position. In order to facilitate draining, jog the axis-3 a few degrees upwards, from calibration position. • Ax1 = No significance (as long as the robot is secured to the foundation) • Ax2 = comfortable working position • Ax3 = a few degrees upwards, from calibration position • Ax4 = 0° • Ax5 = 0° • Ax6 = No significance	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
3	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 34*.	
4	**CAUTION** The gearbox can contain an *excess of pressure* that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
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.	 xx1500002020

Continues on next page

	Action	Note
7	Use caution and remove the oil plug from the fill hole. **Note** The fill hole is opened to speed up the drainage.	 xx1500002021
8	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See section *Decommissioning on page 707* for more information.	
9	Refit the oil plugs.	Tightening torque: 24 Nm.

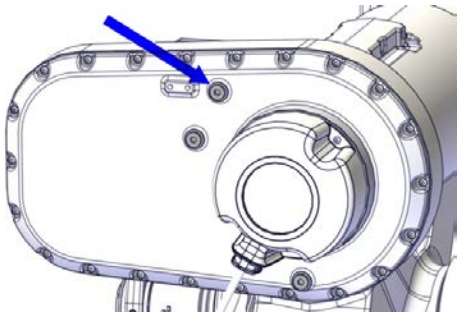
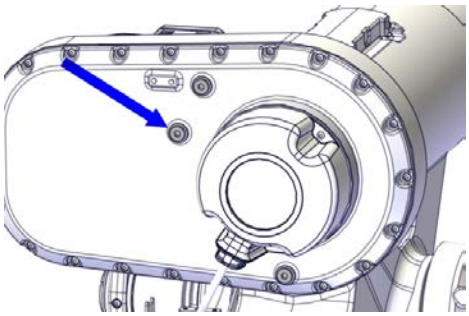
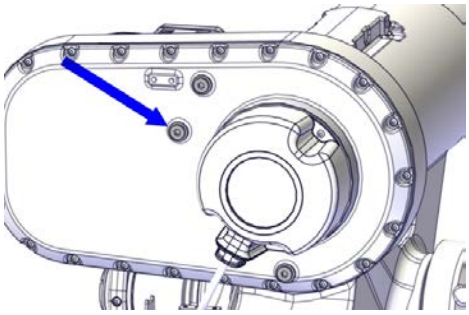
Filling oil into the axis-4 secondary gearbox

	Action	Note
1	Run the robot to calibration position. • Ax1 = No significance (as long as the robot is secured to the foundation) • Ax2 = comfortable working position • Ax3 = +3.5° • Ax4 = 0° • Ax5 = 0° • Ax6 = No significance	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
3	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 34*.	

Continues on next page

3.4.5 Changing oil, axis-4 secondary gearbox

Continued

	Action	Note
4	Open the fill plug.	 xx1500002021
5	Open the inspection plug.	 xx1500002022
6	Refill the gearbox with oil. **Note** The amount of oil to be filled depends on the amount previously being drained. Some oil always remains in the gearbox after draining.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*. See *Type and amount of oil in gearboxes on page 140*.
7	Inspect the oil level.	The level is measured at the fill hole.  xx1500002022 Required oil level is: 0 - 10 mm below the oil plug hole. See *Inspecting the oil level in axis-4 secondary gearbox on page 114*.
8	Refit the oil plugs.	Tightening torque: 24 Nm

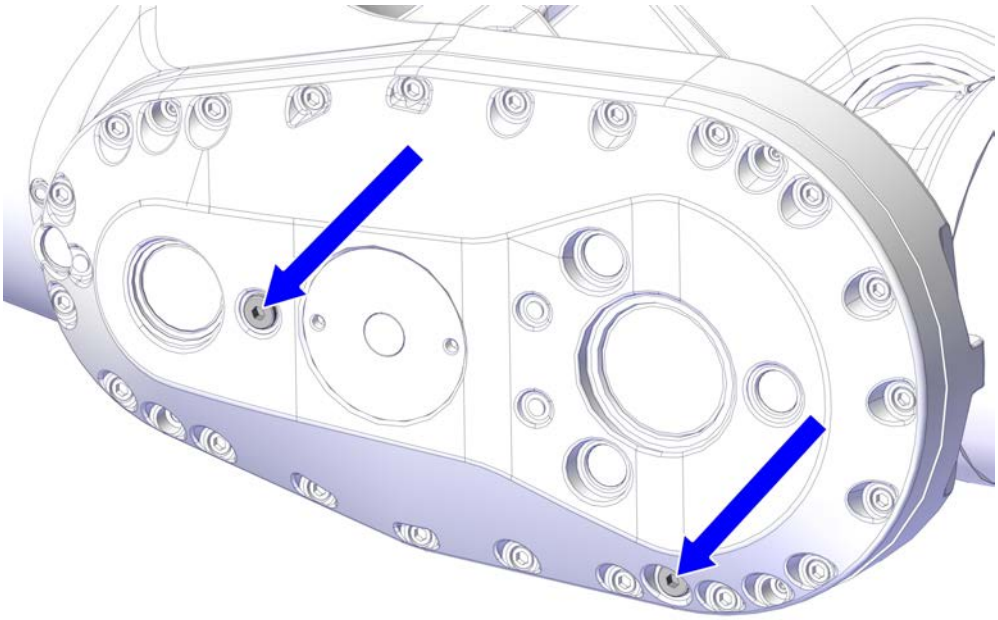
Continues on next page

	Action	Note
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 97*.	

3.4.6 Changing oil, axis-5 gearbox

Location of oil plugs

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



xx1500002023

Left plug	Right plug
Combined oil plug filling/ventilation/inspection	Oil plug draining
Tightening torque: 24 Nm.	Tightening torque: 24 Nm.

Required consumable

Material	Note
Lubricating oil	Information about the oil is found in *Technical reference manual - Lubrication in gearboxes*. See *Type and amount of oil in gearboxes on page 140*.

Required tools and equipment

Equipment, etc.	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Continues on next page

Required documents

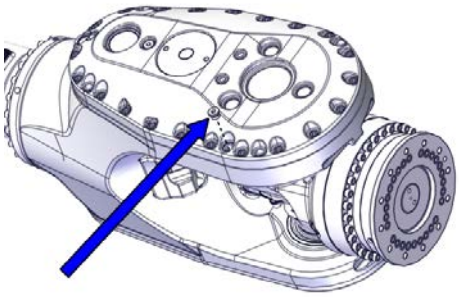
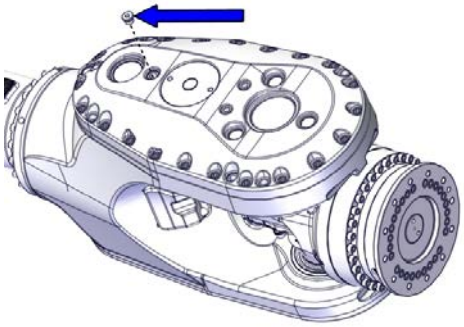
Document name	Document number	Note
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*	

Draining the axis-5 gearbox

	Action	Note
1	Run the robot to the specified position: • Axis-1: no significance (as long as the robot is secured to the foundation) • Axis-2: comfortable working position • Axis-3: 0° • Axis-4: -60° approximately • Axis-5: 0° • Axis-6: no significance	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
3	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 34*.	
4	**CAUTION** The gearbox may contain an overpressure that can be hazardous. Open the oil plug carefully to let the excess pressure out.	
5	Place the oil collecting vessel underneath the oil draining plug.	

Continues on next page

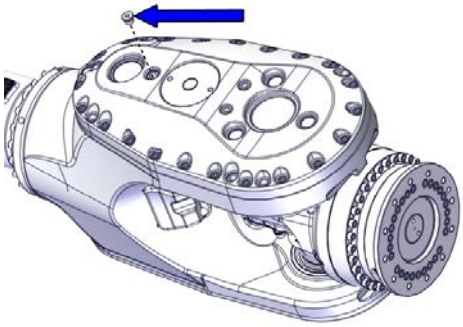
3.4.6 Changing oil, axis-5 gearbox
Continued

	Action	Note
6	Remove the oil draining plug and let the oil run into the vessel.	 xx1700001460
7	Remove the combined oil filling/inspection/ventilation plug. **Note** The combined filling/inspection/ventilation plug is opened to speed up the drainage.	 xx1700001461
8	Jog axis 4 very slowly towards +10°, while the oil is running out throughout the drainage hole. Keep an eye on the ventilation hole, so the oil does not start running out there.	
9	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See section *Decommissioning on page 707* for more information.	
10	Refit the oil plugs.	Tightening torque: 24 Nm.

Filling oil into the axis-5 gearbox

	Action	Note
1	Jog the robot to the specified position: • Axis-1: no significance (as long as the robot is secured to the foundation) • Axis-2: as far forward as possible • Axis-3: 0° • Axis-4: -60° approximately • Axis-5: 0° • Axis-6: no significance	

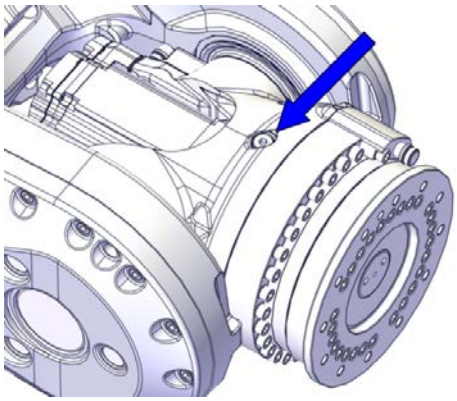
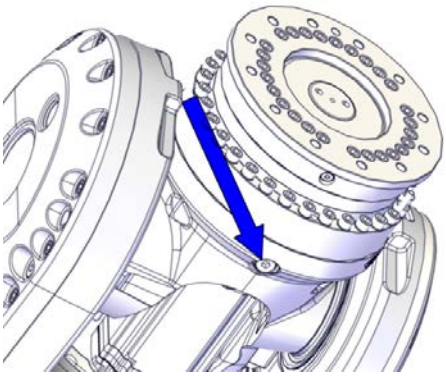
Continues on next page

	Action	Note
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
3	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 34*.	
4	Open the combined oil filling/inspection/ventilation plug.	 xx1700001461
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*. See *Type and amount of oil in gearboxes on page 140*.
6	Inspect the oil level at the combined oil filling/inspection/ventilation hole.	See *Inspecting the oil level in axis-5 gearbox on page 116*.
7	Refit the oil plugs.	Tightening torque: 24 Nm
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 97*.	

3.4.7 Changing oil, axis-6 gearbox

Location of oil plugs

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

 xx1500002034	 xx1500002035
Combined oil filling/inspection/ventilation hole	Draining hole
Tightening torque: 24 Nm.	Tightening torque: 24 Nm.

Required consumable

Material	Note
Lubricating oil	Information about the oil is found in *Technical reference manual - Lubrication in gearboxes*. See *Type and amount of oil in gearboxes on page 140*.

Required tools and equipment

Equipment, etc.	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

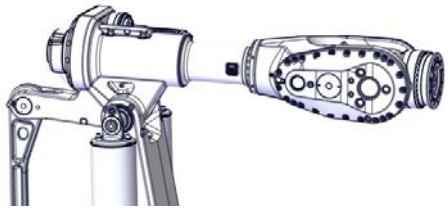
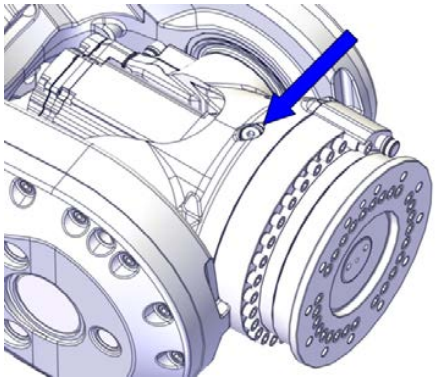
Required documents

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

Draining the axis-6 gearbox

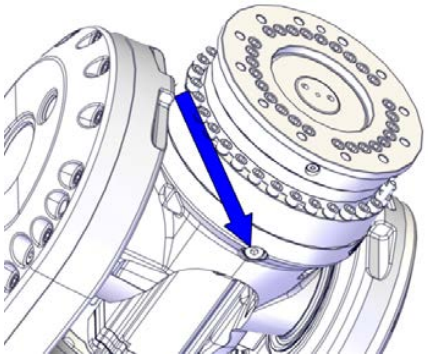
	Action	Note
1	Jog the robot to a comfortable working position in regard of getting access to the axis-6 gearbox.	

Continues on next page

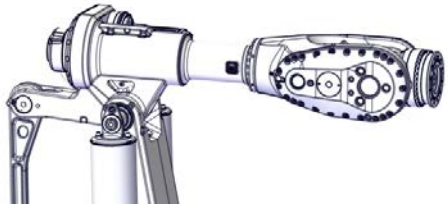
	Action	Note
2	Jog axis 5 so that the tilt house is horizontal (turning disc points straight forward).	The figure shows axis 5 in position 0° if also axis 2 and axis 3 are standing in 0°. The upcoming figures in this procedure are based on this starting position.  xx1700001291
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
4	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 34*.	
5	Place the oil collecting vessel underneath the oil draining plug.	
6	**CAUTION** The gearbox may contain an overpressure that can be hazardous. Open the oil plug carefully to let the excess pressure out.	
7	Remove the oil plug from the combined filling/inspection/ventilation hole. **Note** The plug is opened to speed up the drainage.	 xx1500002034

Continues on next page

3.4.7 Changing oil, axis-6 gearbox
Continued

	Action	Note
8	Remove the oil draining plug and let the oil run into the vessel.	 xx1500002035
9	**WARNING** Used oil is hazardous material and must be disposed of in a safe way. See section *Decommissioning on page 707* for more information.	
10	Refit the oil plugs.	Tightening torque: 24 Nm.

Filling oil into the axis-6 gearbox

	Action	Note
1	Jog the robot to a comfortable working position in regard of getting access to the axis-6 gearbox.	
2	Jog axis 5 so that the tilt house is horizontal (turning disc points straight forward).	The figure shows axis 5 in position 0° if also axis 2 and axis 3 are standing in 0°. The upcoming figures in this procedure are based on this starting position.  xx1700001291
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

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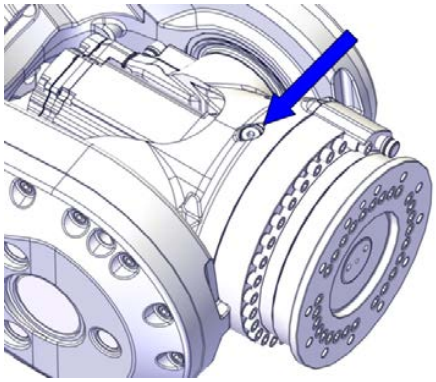
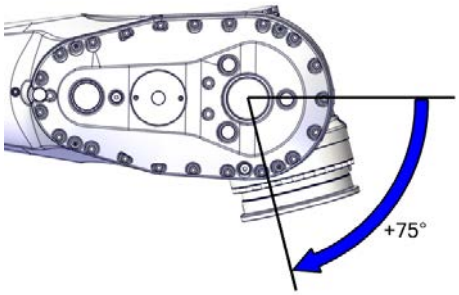
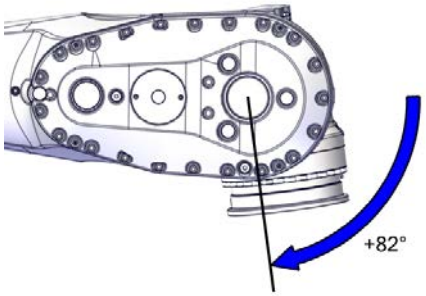
	Action	Note
4	**WARNING** Handling gearbox oil involves several safety risks, see *Gearbox lubricants (oil or grease) on page 34*.	
5	Open the oil filling plug.	 xx1500002034
6	Refill the gearbox with oil. **Note** The amount of oil to be filled depends on the amount previously being drained.	Type of oil and total amount is detailed in *Technical reference manual - Lubrication in gearboxes*. See *Type and amount of oil in gearboxes on page 140*.
7	Jog axis-5 approximately +75°.	 xx1700001288
8	Inspect the oil level by slowly jogging the axis-5 further 7° to approximately +82° totally. **CAUTION** Excessive oil can be spilled!	 xx1700001290

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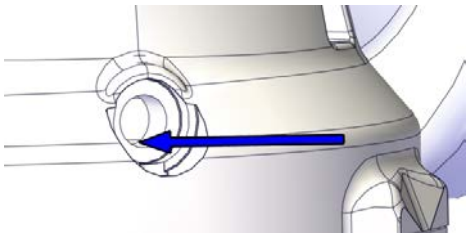
3.4.7 Changing oil, axis-6 gearbox

Continued

	Action	Note
9	Required oil level is when the oil level is visible just below the lower edge of the inspection hole, with axis-5 approximately jogged +82° from the starting position.	 xx1700001292
10	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 oil, axis-6 gearbox on page 168*.
11	Refit the oil plug.	Tightening torque: 24 Nm
12	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 97*.	

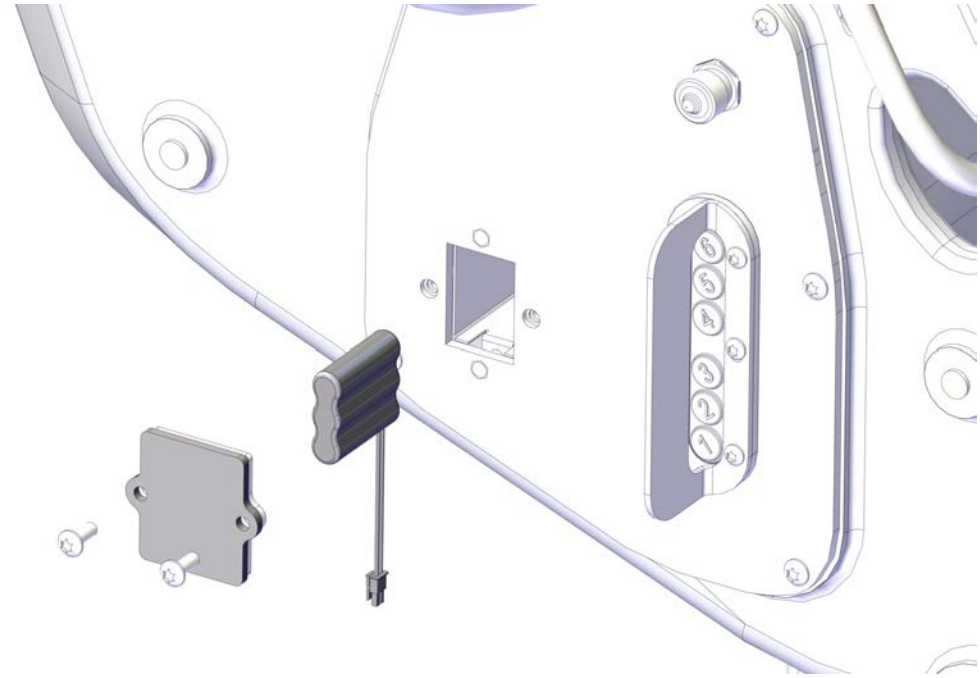
3.4.8 Replacing the SMB battery

WARNING

See *Hazards related to batteries on page 36*.

Location of SMB battery

The SMB battery (SMB = serial measurement board) is located on the left hand side of the frame as shown in the figure below.



xx1500002051

Note

The battery low alert (38213 **Battery charge low**) is displayed when the battery needs to be replaced. The recommendation to avoid an unsynchronized robot is to keep the power to the controller turned on until the battery is to be replaced.

Required tools

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Continues on next page

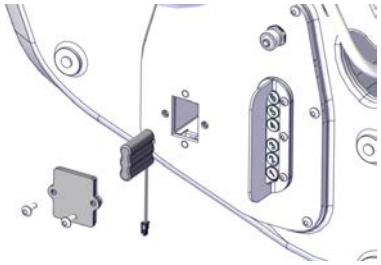
3.4.8 Replacing the SMB battery
Continued

Required spare parts

Spare part	Article number	Note
Battery pack	For spare part number, see: • *Spare parts on page 729*	Battery includes protection circuits. Only replace with a specified spare part or an ABB-approved equivalent.

Removing, battery

Use this procedure to remove the SMB battery.

	Action	Note
1	Move the robot to its calibration position.	This is done in order to facilitate updating of the revolution counter.
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
3	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit please read the safety information in the section *The unit is sensitive to ESD on page 53*	
4	Remove the SMB battery cover. **CAUTION** Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.	 xx1500002052
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.	
7	**WARNING** A used battery is hazardous material and shall be disposed of in a safe way. See section *Decommissioning on page 707* for more information.	

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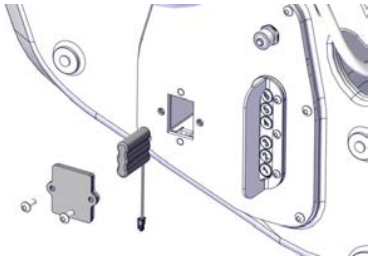
Refitting, battery

Use this procedure to refit the SMB battery.

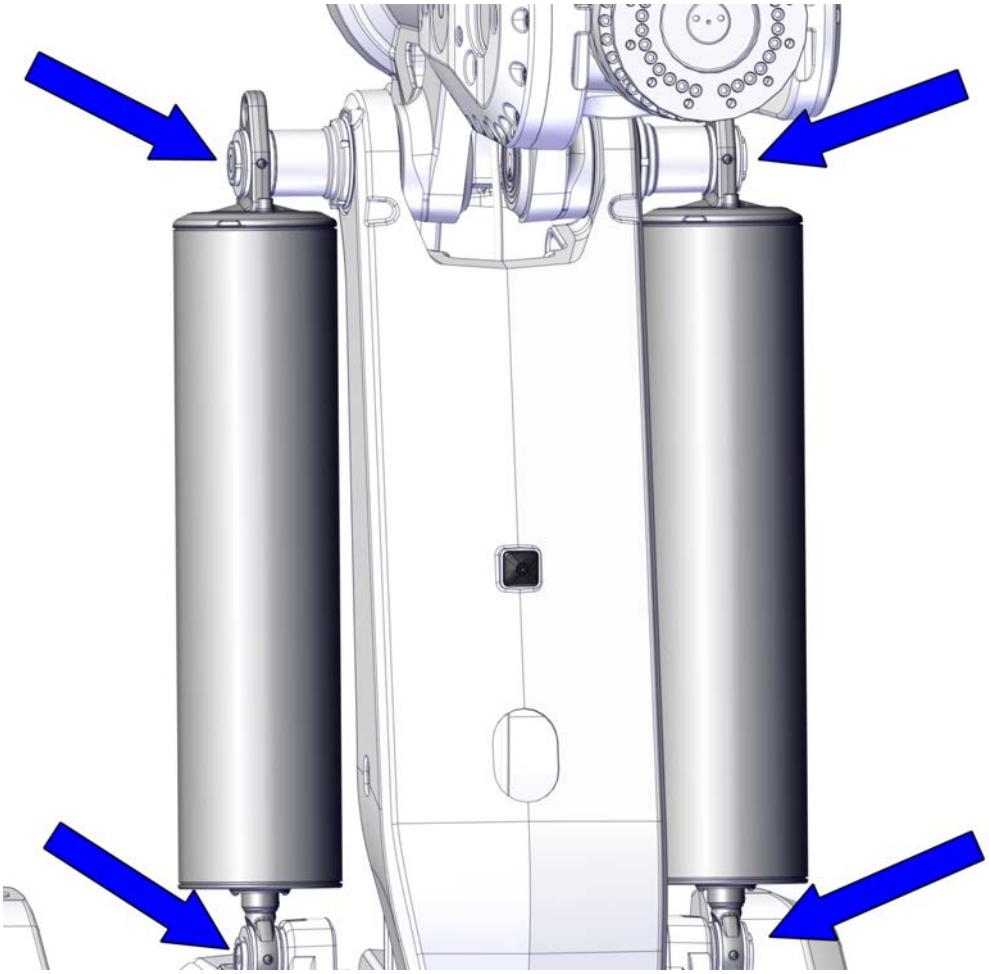
	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit please read the safety information in the section *The unit is sensitive to ESD on page 53*	
3	Reconnect the battery cable and install the battery pack into the SMB/battery recess.	 xx1500002052
4	Secure the SMB battery cover with its attachment screws.	
5	Update the revolution counters.	See *Updating revolution counters on IRC5 robots on page 682*.
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 97*.	

3.5 Lubrication activities

3.5.1 Lubricating the spherical roller bearings, balancing device

Location of spherical roller bearings

The spherical roller bearings are located in the upper and lower ends of the balancing devices.



xx1500002056

Consumable

Equipment, etc.	Article number	Note
Grease	3HAC073286-001	Tribol GR 100-2 PD, 25 ml / bearing Used for lubrication of the spherical roller bearing.

Required equipment

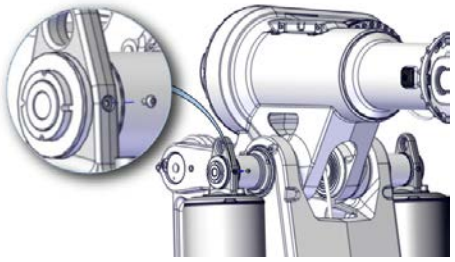
Equipment, etc.	Article number	Note
Grease nipple	-	M6

Continues on next page

Lubricating the spherical roller bearings

Use this procedure to lubricate the spherical roller bearings.

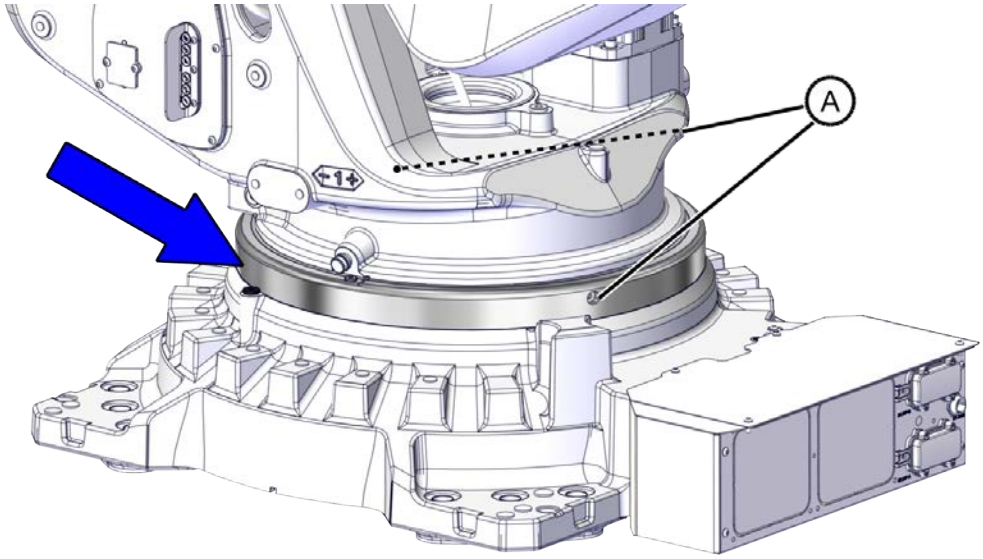
The procedure to lubricate the upper and lower spherical roller bearing is the same.

	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	Unscrew both screws on either side of the bearing and fill grease from one of the holes until grease appears in the other hole.	Hole dimension: M6. Grease: 3HAC073286-001  xx1500002055
3	Refit the two screws.	
4	Wipe clean from residual grease.	
5	**Note** Inspect the bearings after a few days running. Some of the refilled grease may have emerged from the bearing. Wipe clean from residual grease.	

3.5.2 Lubricating the cross roller bearing

Location of the cross roller bearing and grease nipples

The cross roller bearing is equipped with two grease nipples and is located between the frame and the base.



xx2300001006

A	Two grease nipples. One on each side of the cross roller bearing.

Consumable

Consumable	Article number	Note
Grease		Mobillux EP2 Used for lubrication of the cross roller bearing.

Lubricating the cross roller bearing

Use this procedure to lubricate the cross roller bearing.

	Action	Note
1	Position axis 1 in synchronization position, see *Synchronization marks and synchronization position for axes on page 680*.	
2	Connect a grease gun to each of the two grease nipples on the cross bearing roller.	
3	Insert 3 gram of grease into each nipple. **Note** Grease may emerge under the robot base during time and that is to be considered normal.	Mobillux EP2
4	Rotate the robot 20°.	

Continues on next page

	Action	Note
5	Repeat *step 3* and *step 4* until axis 1 reaches the mechanical stop.	
6	Position axis 1 in synchronization position.	
7	Rotate the robot 20° in the opposite direction.	
8	Insert 3 gram of grease into each nipple.	
9	Repeat *step 7* and *step 8* until axis 1 reaches the mechanical stop.	
10	Disconnect the grease gun from the cross bearing roller.	
11	Position axis 1 in the synchronization position.	

3.6 Cleaning activities

3.6.1 Cleaning the IRB 8700

DANGER

Turn off all:

- electric power supply
- hydraulic pressure supply
- air pressure supply

to the robot, before entering the safeguarded space.

General

To secure high uptime it is important that the IRB 8700 is cleaned regularly. The frequency of cleaning depends on the environment in which the product works.

Different cleaning methods are allowed depending on the type of protection of the IRB 8700.

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.

1. Inspect that the oil level in the suspected gearbox is according to the recommendations, see *Inspection activities on page 105*.
2. Write down the oil level.
3. Inspect the oil level again after, for example, 6 months.
4. If the oil level is decreased then replace the gearbox.

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.
- Never point the water jet at connectors, joints, sealings, or gaskets.
- Do not use compressed air to clean the robot.
- Never use solvents that are not approved by ABB to clean the robot.
- Do not spray from a distance closer than 0.4 m.
- Do not remove any covers or other protective devices before cleaning the robot.

Continues on next page

Cleaning methods

The following table defines what cleaning methods are allowed depending on the protection type.

Protection type	Cleaning method			
	Vacuum cleaner	Wipe with cloth	Rinse with water	High pressure water or steam
Foundry Plus	Yes	Yes. With light cleaning detergent or spirit.	Yes. It is highly recommended that the water contains a rust-prevention solution.	Yes[i]. It is highly recommended that the water and steam contains rust preventive, without cleaning detergents.

[i] Perform according to section *Cleaning with water and steam on page 181*.

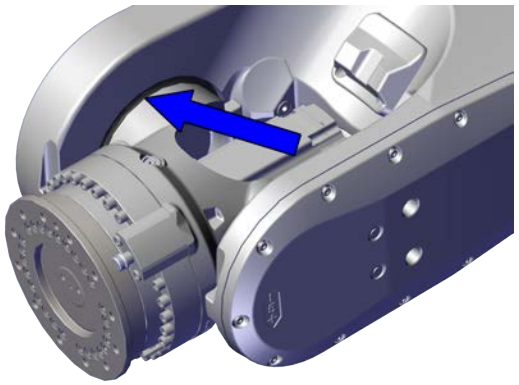
Cleaning with water and steam

Instructions for rinsing with water

ABB robots with protection types *Standard*, *Foundry Plus*, *Wash*, or *Foundry Prime* can be cleaned by rinsing with water (water cleaner), provided that the robot is not equipped with the option of motor cooling fans.[1]

The following list defines the prerequisites:

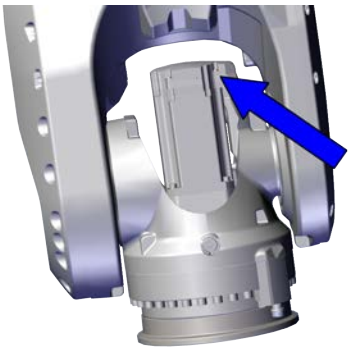
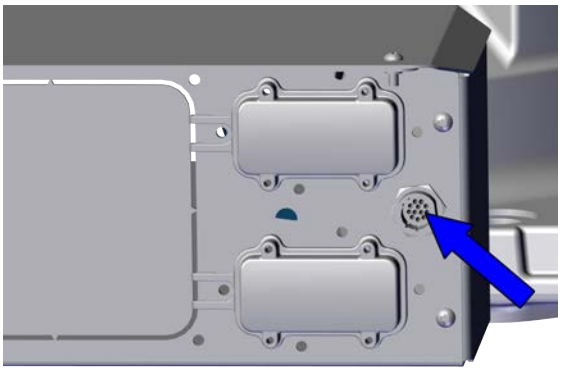
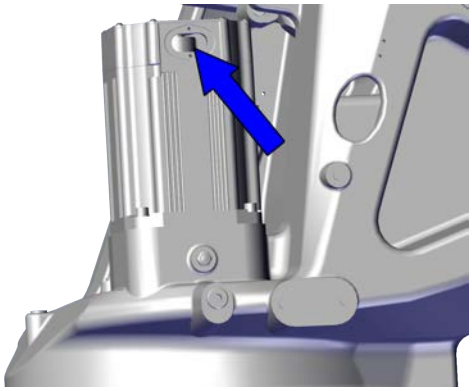
- Maximum water pressure at the nozzle: 700 kN/m^2 (7 bar) [I]
- Fan jet nozzle should be used, min. 45° spread
- Minimum distance from nozzle to encapsulation: 0.4 meters
- Maximum flow: 20 liters/min[I]
- Never point the nozzle at the following positions (example images):

Position	Example of position
Rotational sealings	 xx2300001631

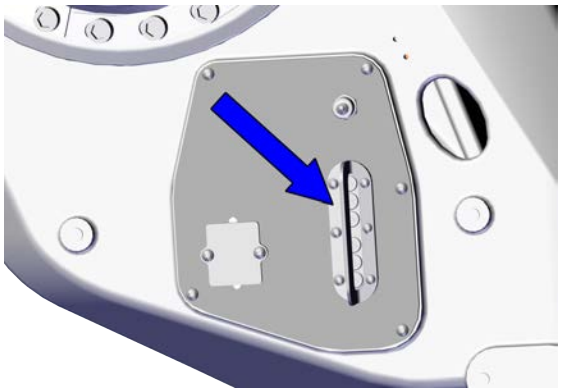
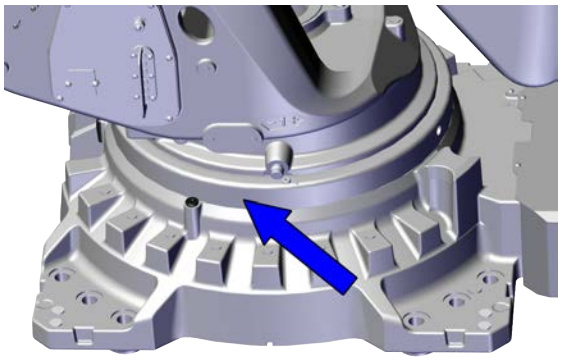
[1] See *Cleaning methods on page 181* for exceptions.

Continues on next page

3.6.1 Cleaning the IRB 8700
Continued

Position	Example of position
Gaskets	 xx2300001632
Connectors	 xx2300001633
Cable inlets	 xx2300001634

Continues on next page

Position	Example of position
Brake release buttons	 xx2300001635
Cross roller bearing	 xx2300001636

I Typical tap water pressure and flow

Instructions for steam or high pressure water cleaning

ABB robots with protection types *Foundry Plus*, *Wash*, or *Foundry Prime* can be cleaned using a steam cleaner or high pressure water cleaner.[2]

The following list defines the prerequisites:

- Maximum water pressure at the nozzle: 2500 kN/m^2 (25 bar)
- Fan jet nozzle should be used, min. 45° spread
- Minimum distance from nozzle to encapsulation: 0.4 meters
- Maximum water temperature: 80° C

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.

2 See *Cleaning methods on page 181* for exceptions.

Continues on next page

3.6.1 Cleaning the IRB 8700
Continued

Cooling fans

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

4 Repair

4.1 Introduction

Structure of this chapter

This chapter describes repair activities for the IRB 8700. 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 8700, 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 19* before commencing any service work.

> **Note**
>
> If the IRB 8700 is connected to power, always make sure that the IRB 8700 is connected to protective earth and a residual current device (RCD) before starting any repair work.
>
> For more information see:
>
> - *Product manual - OmniCore V400XT*
> - *Product manual - IRC5*

4.2 Definition of spare part levels

Spare part level

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

- L1 spare parts

  The L1 parts can be replaced in the field. The maintenance and replacement instructions given in the related product manuals must be strictly followed. If there are any problems, contact your local ABB for support.
- L2 spare parts

  To replace the L2 parts require specialized training and might need special tools. Only ABB field service personnel or qualified personnel trained by ABB can replace L2 parts.
- L3 spare parts

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

4.3 General procedures

4.3.1 Performing a leak-down test

When to perform a leak-down test

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

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

Required equipment

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

Performing a leak-down test

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

4.3.2 Mounting instructions for bearings

General

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

Equipment

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

Assembly of all bearings

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

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

Assembly of tapered bearings

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

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

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

Greasing of bearings

Note

This instruction is not valid for solid oil bearings.

Continues on next page

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

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

Grease the different types of bearings as following description:

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

4.3.3 Mounting instructions for sealings

General

This section describes how to mount different types of sealings.

Equipment

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

Rotating sealings

The following procedures describe how to fit rotating sealings.

CAUTION

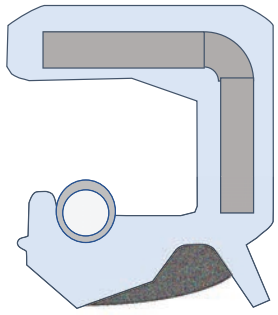
Please observe the following before commencing any assembly of sealings:

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

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

Radial sealings

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



xx2300000433

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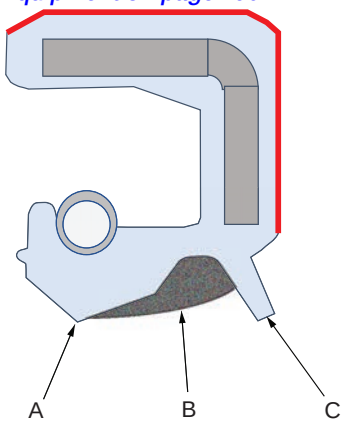
	Action	Note
1	Check the sealing to ensure that: • The sealing is of the correct type. • There is no damage on the main lip.	
2	Inspect the shaft surface before mounting. If scratches or damage are found, the shaft must be replaced since it may result in future leakage. Do not try to grind or polish the shaft surface to get rid of the defect.	
3	Lubricate the sealing with grease just before fitting. (Not too early - there is a risk of dirt and foreign particles adhering to the sealing.) Fill 2/3 of the space between the dust lip and the main lip with grease. If the sealing is without dust lip, just lubricate the main lip with a thin layer of grease.	Article number is specified in *Equipment on page 190*.  xx2000000071 A Main lip B Grease C Dust lip **Note** Ensure that no grease is applied to the red marked surface.

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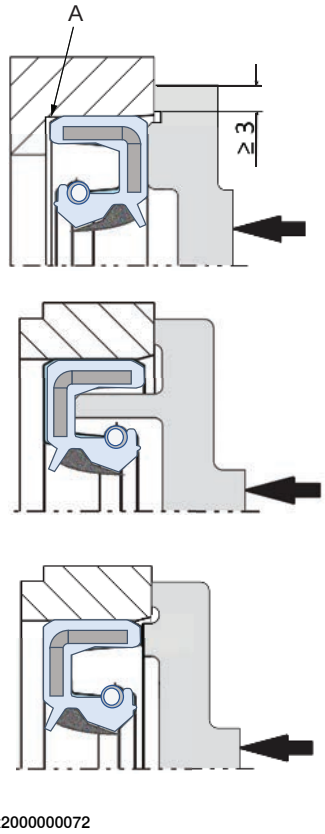
4.3.3 Mounting instructions for sealings
Continued

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

Flange sealings and static sealings

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

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

O-rings

The following procedure describes how to fit o-rings.

	Action	Note
1	Ensure that the correct o-ring size is used.	
2	Check the o-ring for surface defects, burrs, shape accuracy, or deformation.	Defective o-rings, including damaged or deformed o-rings, may not be used.

Continues on next page

	Action	Note
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.	

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

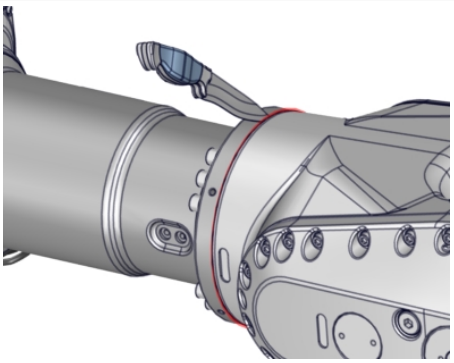
General

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

Required equipment

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

Removing

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

4.3.5 The brake release buttons may be jammed after service work

Description

The brake release unit has push-buttons for the brake release of each axis motor. When service work is performed inside the SMB recess that includes removal and refitting of the brake release unit, the brake release buttons may be jammed after refitting.

DANGER

If the power is turned on while a brake release button is jammed in depressed position, the affected motor brake is released. This may cause serious personal injuries and damage to the robot.

Elimination

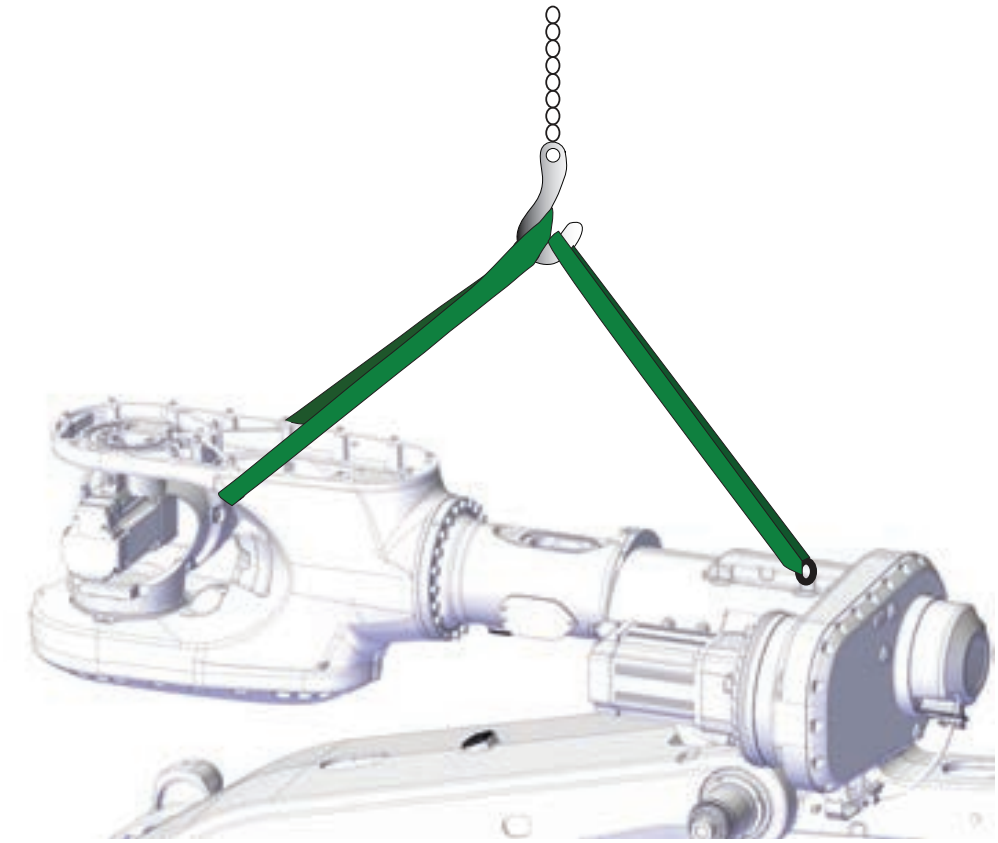
To eliminate the danger after service work has been performed inside the SMB recess, follow the procedure below.

	Action
1	Make sure the power is turned off.
2	Remove the push-button guard, if necessary.
3	Verify that the push-buttons of the brake release unit are working by pressing them down, one by one. Make sure none of the buttons are jammed in the tube.
4	If a button gets jammed in the depressed position, the alignment of the brake release unit must be adjusted so that the buttons can move freely in their tubes.

4.4 Attaching lifting accessories

4.4.1 Attaching lifting accessories to the upper arm

Attachment points of lifting accessory



xx1500002724

Required tools and equipment

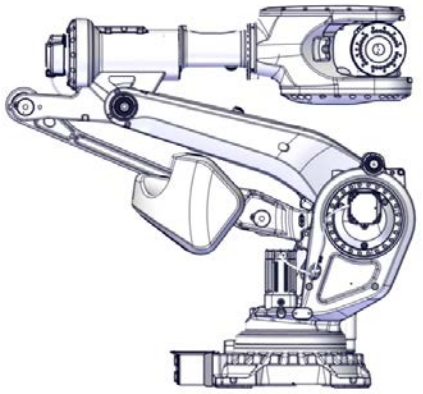
Equipment, etc.	Article number	Note
Roundsling 2.5 m (1 pcs) Roundsling 3 m (1 pcs)	-	Used for lifting upper arm. Lifting capacity: 2,000 kg on each roundsling.
Lifting eye	3HAC16131-1	VLBG M12
Fender washer	-	Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.

Continues on next page

Attaching the lifting accessories

Use these procedures to attach the lifting accessories.

Robot position when removing the upper arm

	Action	Note
1	Turn on the power and jog the robot to the specified position: • Axis 1: no significance as long as the robot is fitted to the foundation. • Axis 2: -65° • Axis 3: approximately +2° (upper arm as horizontal as possible to the foundation) • Axis 4: +90° • Axis 5: approximately -90° (to balance the weight of the upper arm) • Axis 6: no significance.	 xx1700001306
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Attaching lifting accessories to the upper arm complete

	Action	Note
1	**CAUTION** The complete upper arm weighs 900 kg. All lifting accessories used must be sized accordingly.	
2	If needed, use a Mobile platform ladder (or similar) to attach the lifting accessories. **DANGER** Never use the robot as ladder.	Mobile platform ladder

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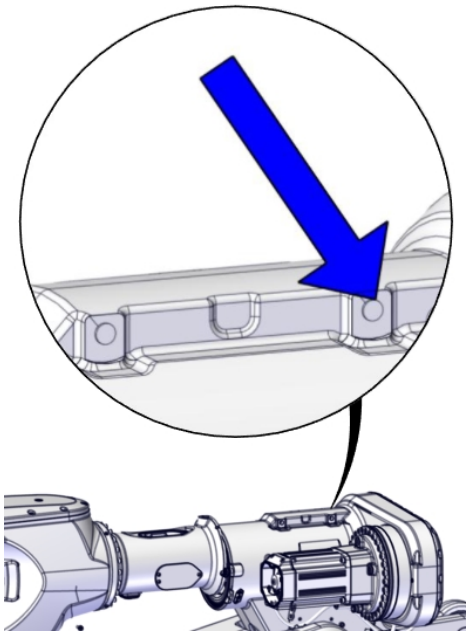
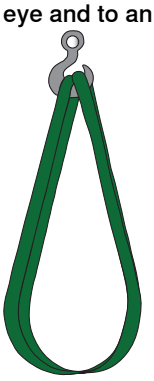
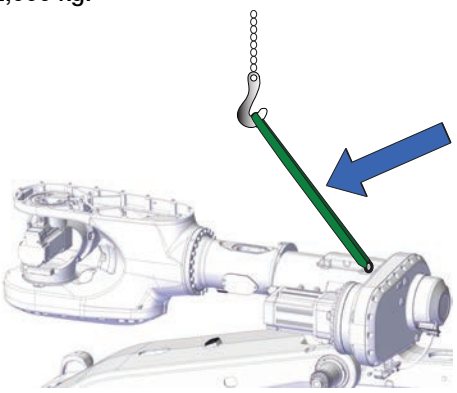
4.4.1 Attaching lifting accessories to the upper arm

Continued

	Action	Note
3	Remove the plastic plug from the back hole of the arm housing.	 xx1500002712 Lifting eye: 3HAC16131-1 (VLBG M12) Fender washer: Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.
4	Attach a Lifting eye to the hole in the arm housing with a Fender washer underneath.  xx1400002196	
5	Attach a roundsling looped to the Lifting eye and to an overhead crane (or similar).  xx1400002599	Roundsling 2.5 m with lifting capacity: 2,000 kg.[I]  xx1500002713

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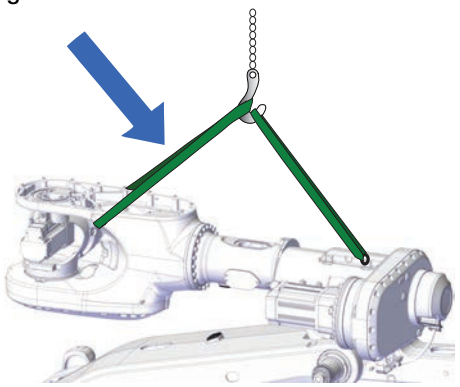
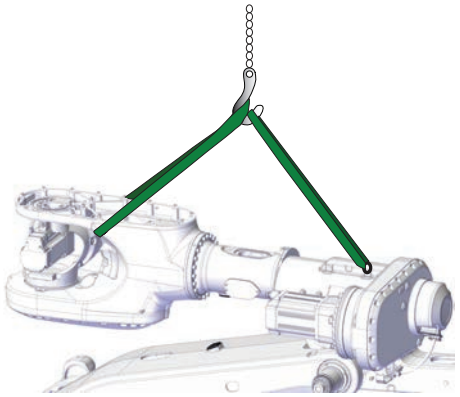
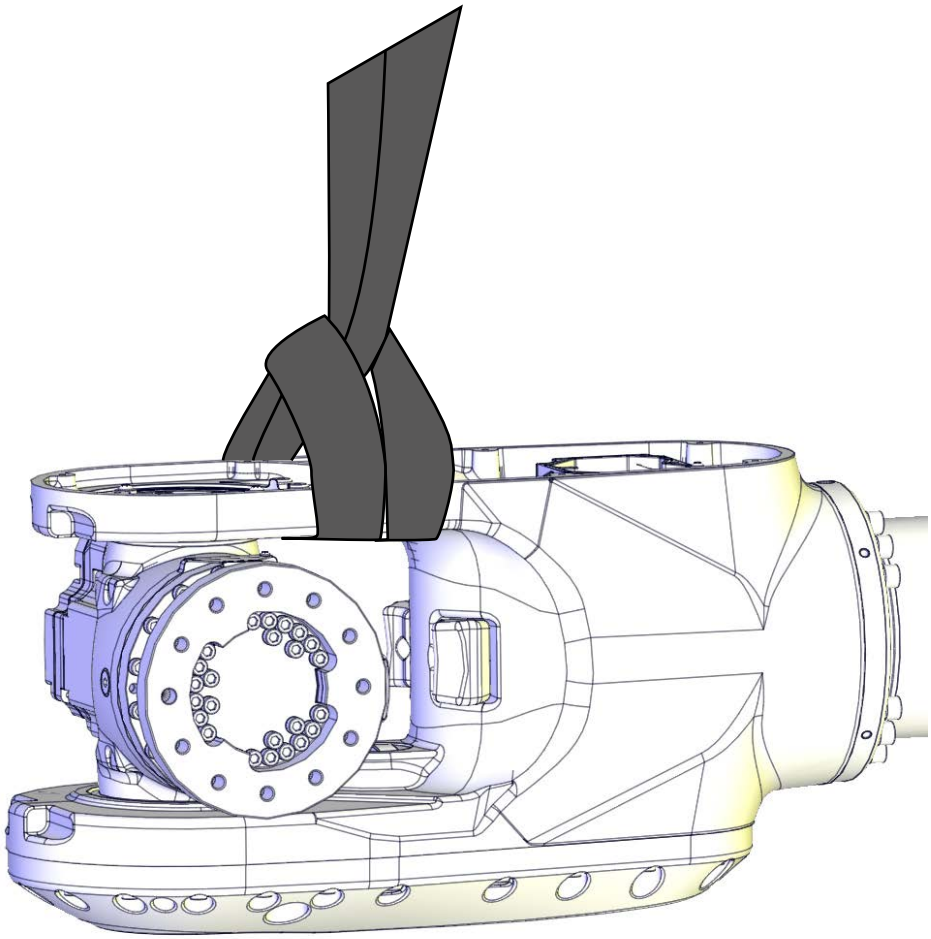
	Action	Note
6	Attach a roundsling looped to the wrist and to an overhead crane (or similar).	Roundsling 3 m with lifting capacity: 2,000 kg. *i*  xx1500002714
7	Stretch the lifting accessories to take the weight of the upper arm.	 xx1500002724
8	Adjust the lifting accessories, if needed.	

i This is a recommendation according to standard EN 1492. Always conform to local regulations.

4.4.2 Attaching lifting accessories to the wrist

Attachment points of lifting accessories



xx1300000673

The figure show IRB 6700, but the principle is the same.

Required tools and equipment

Equipment, etc.	Article number	Note
Roundsling 1 m	-	Lifting capacity: 1,000 kg

Continues on next page

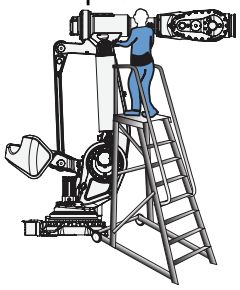
Attaching lifting accessories

Use these procedures to remove the wrist.

Robot position

	Action	Note
1	Jog the robot to the specified position: • Axis 1: no significance (as long as the robot is secured to the foundation) • Axis 2: comfortable working position • Axis 3: comfortable working position • Axis 4: +90° • Axis 5: 0° • Axis 6: no significance.	

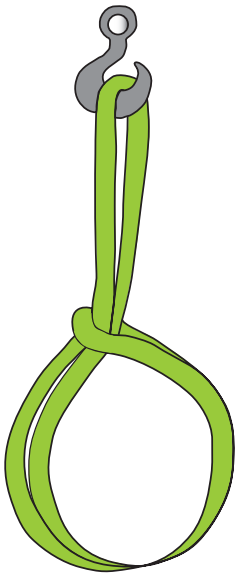
Attaching lifting accessories to the wrist

	Action	Note
1	**CAUTION** The complete wrist weighs 500 kg. All lifting accessories used must be sized accordingly.	
2	Use a Mobile platform ladder (or similar) to attach the lifting accessories. **DANGER** Never use the robot as ladder!	Mobile platform ladder  xx1500001985

Continues on next page

4.4.2 Attaching lifting accessories to the wrist

Continued

	Action	Note
3	Attach a roundsling choked around the wrist and to an overhead crane (or similar).  xx1400000730	Roundsling 1 m: Lifting capacity: 1,000 kg[i]
4	Stretch the lifting accessories to take the weight of the wrist.	
5	Adjust the lifting accessories, if needed.	

[i] This is a recommendation according to standard EN 1492. Always conform to local regulations.

4.5 Cable harness

4.5.1 Removing the cable harness

Location of the cable harness

The cable harness is located as shown in the figure.

xx1500001878

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Cable harness	3HAC050792-001		L2

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.
ESD bag		

Continues on next page

4.5.1 Removing the cable harness
Continued

Equipment, etc.	Article number	Note
Hexagon socket spanner, socket size 14 mm	-	Used to remove and refit the R1.SMB in the base.

Removing the cable harness

Use these procedures to remove the cable harness.

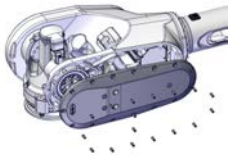
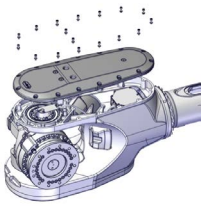
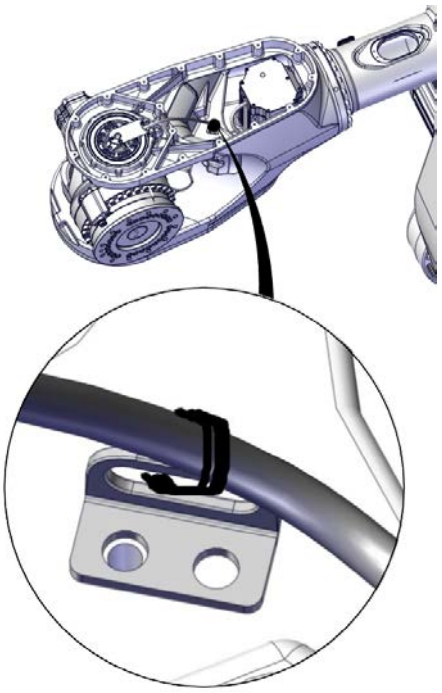
Preparations before removing the cable harness

	Action	Note
1	**Note** The specified position is a recommended position. Depending on what tool is used, one or more axes need to be jogged into another position.	
2	**Note** In order to avoid that the spiral of the cable harness in the carrier is being unwound or placed in the wrong position, keep axis-5 as close as possible to +90°.	
3	Jog the robot to the specified position: • Axis 1: 0° • Axis 2: comfortable working position • Axis 3: comfortable working position • Axis 4: 0° • Axis 5: +90° • Axis 6: Depending on which tool is used, if still fitted.	
4	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Retrieving access to the wrist cabling

	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 wrist cover. **Note** Do not damage the sealing. Replace if damaged. **Note** The position of axis-4 depends on the on-going procedure.	 xx1500003100  xx1500002330
3	Cut the cable tie that secures the axis-6 motor cable.	 xx1500002331

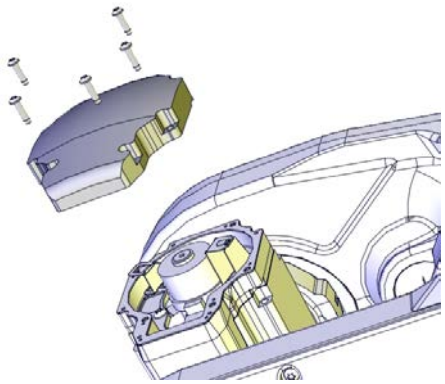
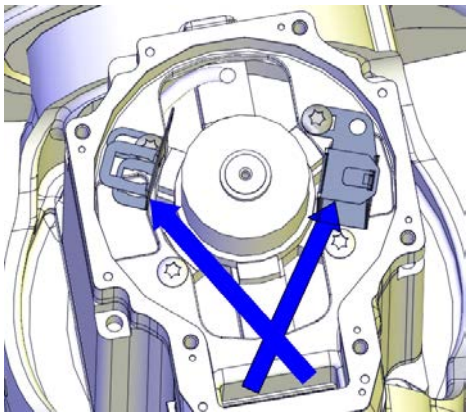
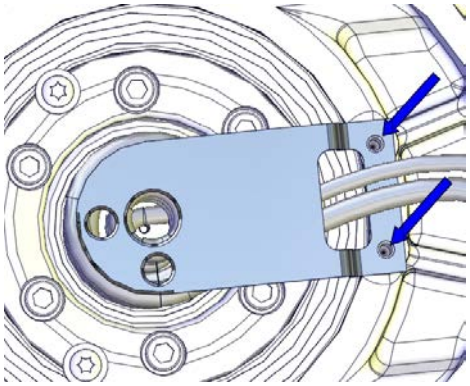
Disconnecting the axis-6 motor cables

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

Continues on next page

4.5.1 Removing the cable harness

Continued

	Action	Note
2	Make sure that the axis-5 is as close to +90° or -90° position as possible, depending on what repair work is being done. **Note** Not needed if only replacing the axis-6 unit.	
3	Unscrew the attachment screws and remove the motor cover. **Note** Do not damage the gasket. Replace if damaged.	 xx1200001080
4	Disconnect the motor cables.	 xx1300000488
5	Unscrew the attachment screws holding the cable bracket.	 xx1300000484

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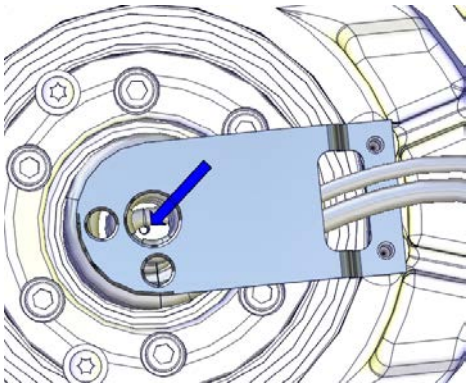
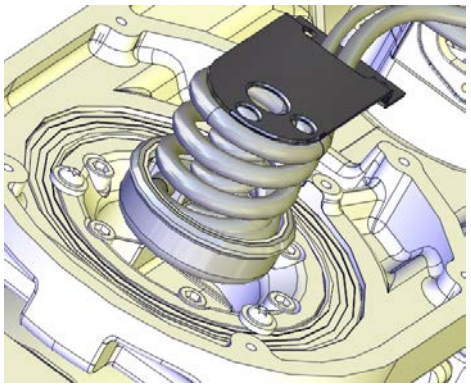
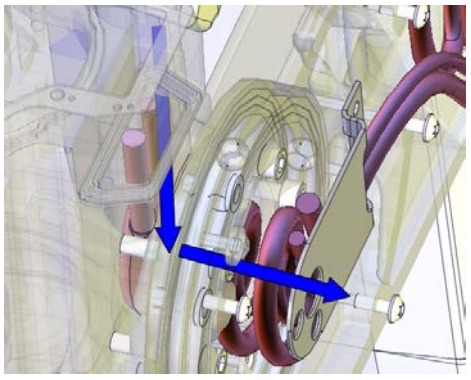
	Action	Note
6	Unscrew the screw holding the carrier. **Note** The screw is located at the bottom of the carrier.	 xx1300000485
7	Use caution and pull out the carrier. **Tip** If needed, use a screwdriver to help pulling out the carrier.	 xx1300001113
8	Use caution and pull out the axis-6 motor cables by holding the cables at the motor with one hand, and the other one at the carrier.	 xx1300000666

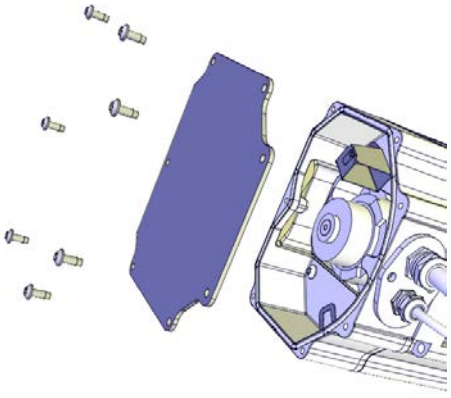
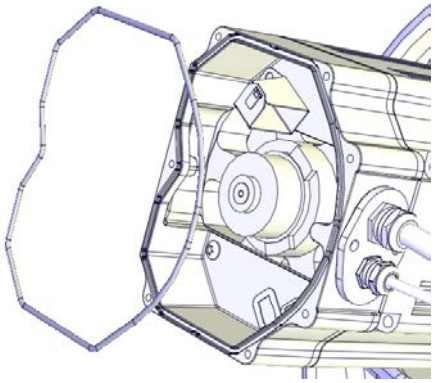
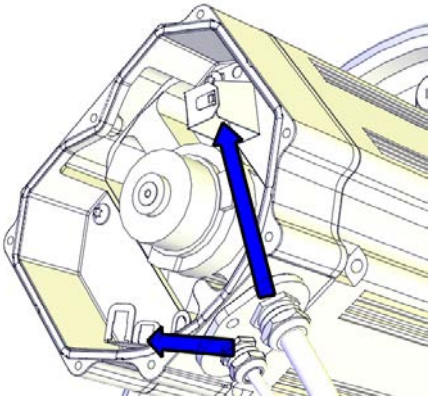
Disconnecting the axis-5 motor cables

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

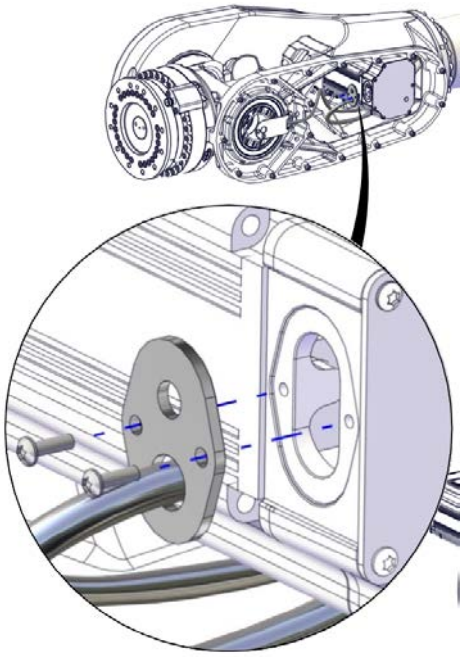
Continues on next page

4.5.1 Removing the cable harness

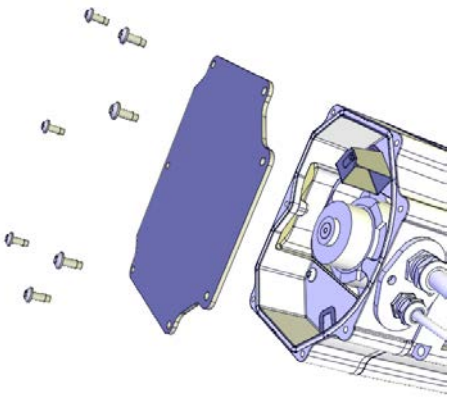
Continued

	Action	Note
2	Unscrew the attachment screws with washers and remove the motor cover.	 xx1200001135
3	**Note** Make sure the o-ring is present when removing the cover.	 xx1200001070
4	Disconnect the motor cables.	 xx1200001066

Continues on next page

	Action	Note
5	Remove the cable gland cover. **Tip** Make a note in which direction the cable exit hole is facing, if the motor shall be removed too. The motor shall be refitted in the same position.	 xx1500002717
6	Use caution and pull out the motor cables.	

Disconnecting the axis-1, axis-2, 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	Unscrew the attachment screws with washers and remove the motor cover.	 xx1200001135

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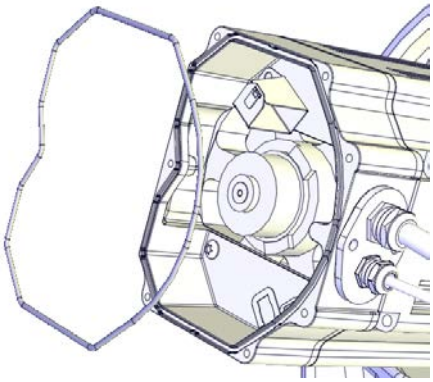
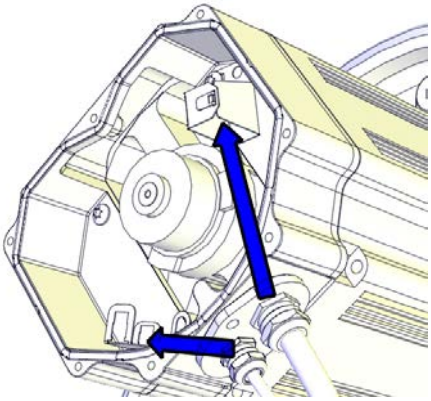
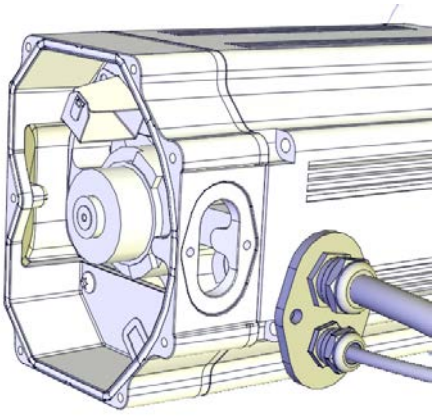
4.5.1 Removing the cable harness

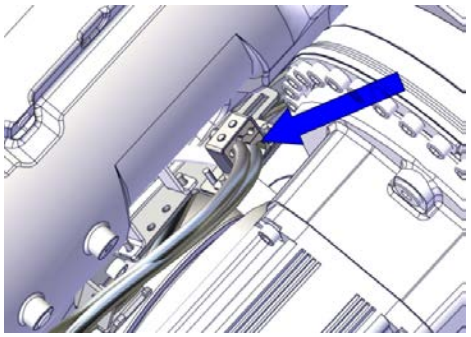
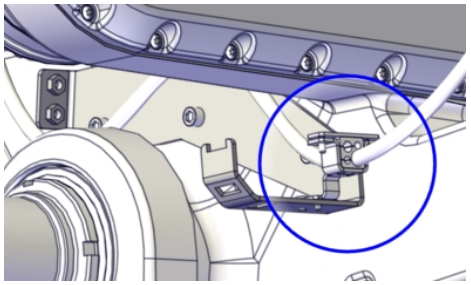
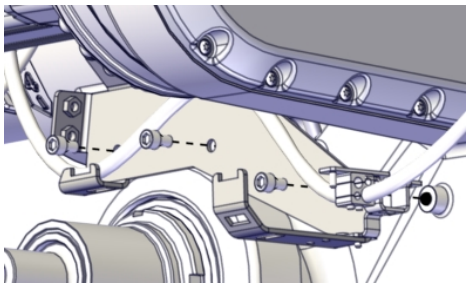
Continued

	Action	Note
3	**Note** Make sure the o-ring is not lost when removing the cover.	 xx1200001070
4	Disconnect the motor cables.	 xx1200001066
5	Remove the cable gland cover. Inspect the gasket. **Note** Replace if damaged. **Tip** Make a note in which direction the cable exit hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.	 xx1200001067
6	Use caution and pull out the motor cables.	

Removing the cable harness in the upper arm

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

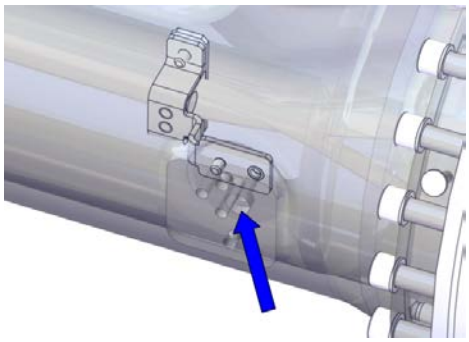
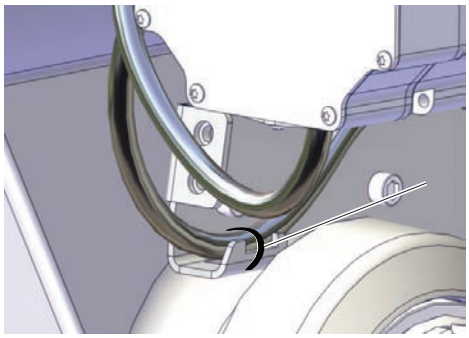
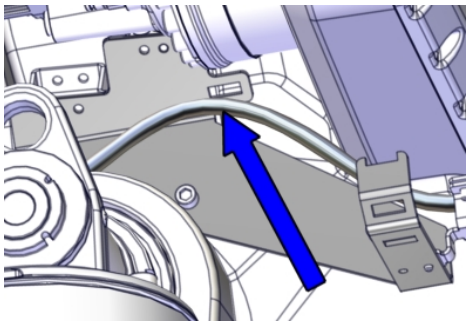
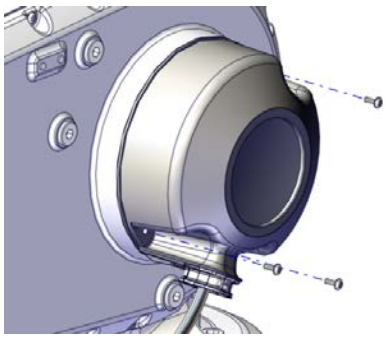
Continues on next page

	Action	Note
2	Remove the upper cable clamp from the axis-3 bracket (between axis-4 motor and arm housing).	 xx1500003092
3	Remove the lower cable clamp from the bracket.	 xx2200000929
4	Remove the cable bracket.	 xx2200000926
5	Remove the protection cover. Make sure not to damage the surface exposed.	 xx1500002719

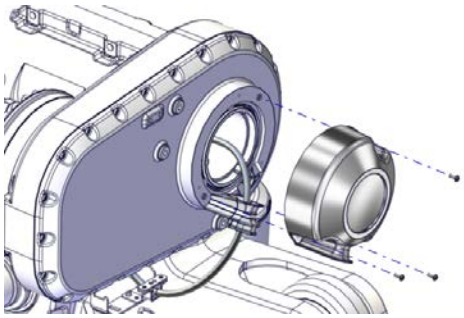
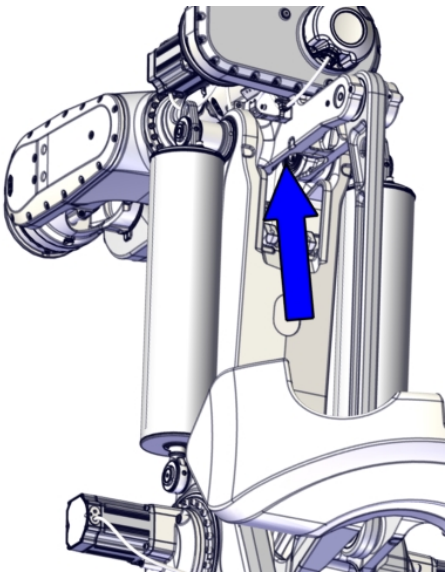
Continues on next page

4.5.1 Removing the cable harness

Continued

	Action	Note
6	Unscrew the nut holding the bracket inside the upper arm. **Note** The screw is reached from the outside.	 xx1500002720
7	Cut the cable ties located underneath the axis-4 motor and to the axis-3 bracket.	 xx1500002721  xx2200000932
8	Unscrew the screws that secure the cover.	 xx1500002722

Continues on next page

	Action	Note
9	Remove the cover.	 xx1500002723
10	Remove the black cable guide from inside the upper arm attachment by pressing it together and pulling it down.	 xx2200000939
11	Use caution and remove the cable harness out of the upper arm.	

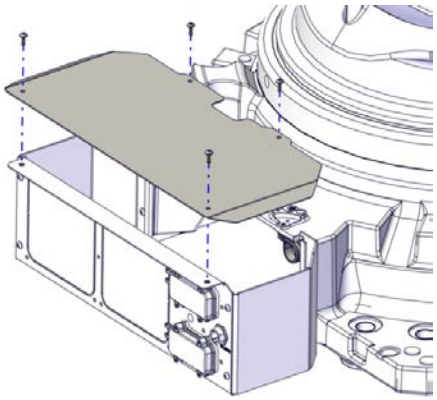
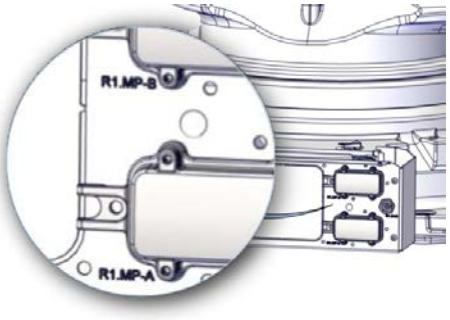
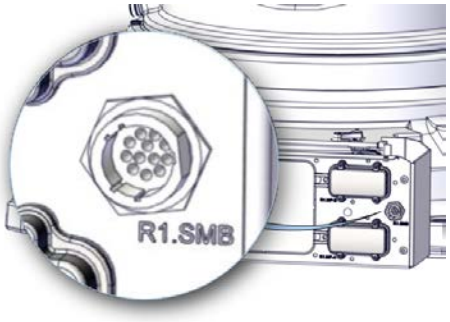
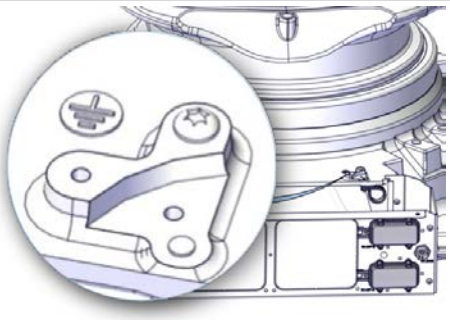
Disconnecting the cable harness in the base

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

Continues on next page

4.5.1 Removing the cable harness

Continued

	Action	Note
2	Remove the base cover.	 xx1500003082
3	Disconnect R1.MP-A and R1.MP-B.	 xx1500003083
4	Disconnect R1.SMB.	Hexagon socket spanner, socket size 14 mm  xx1500003084
5	Remove the two earth cables.	 xx1500003085

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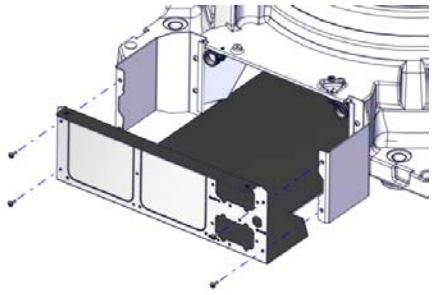
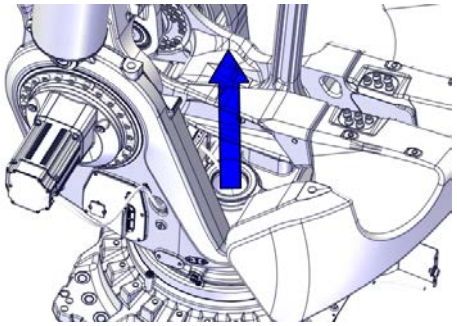
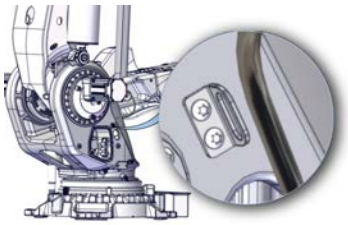
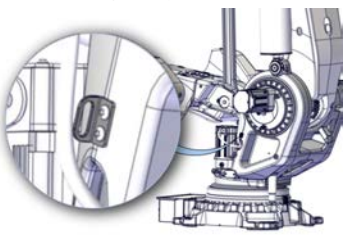
	Action	Note
6	For easier access: Remove connection plate and bottom plate.	 xx1500003088
7	Use caution and pull out the cable harness from the base, up through the frame.	 xx1700001299

Removing the cable harness in the frame

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Cut the cable ties that secure the axis-2 and axis-3 motor cables to the cable fixing brackets.	Axis-2 motor cable  xx1500003091 Axis-3 motor cable  xx1500003090

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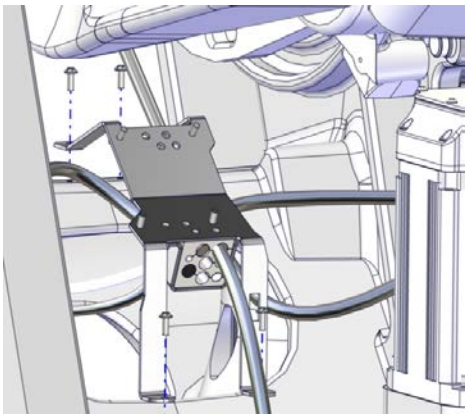
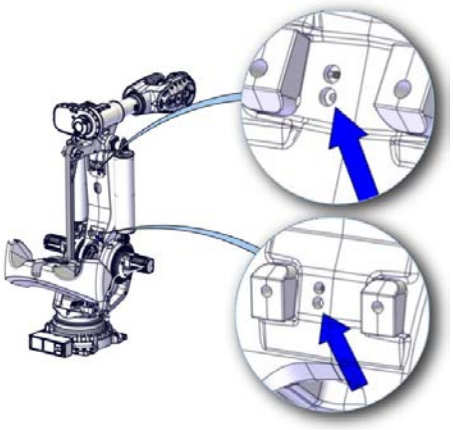
4.5.1 Removing the cable harness

Continued

	Action	Note
3	Cut the cable ties that secure the axis-1, axis-2 and axis-3 motor cables to the axis-1 bracket.	
4	Unscrew the screws that hold the axis-1 bracket (4 pcs).	 xx1500002372
5	Use caution and pull out the cables from the axis-1, axis-2 and axis-3 motors.	

Removing the cable harness in the lower arm

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	If not already done, unscrew the screws that hold the two cable brackets inside the lower arm. **Note** The screws are reached from the outside.	 xx1500002695

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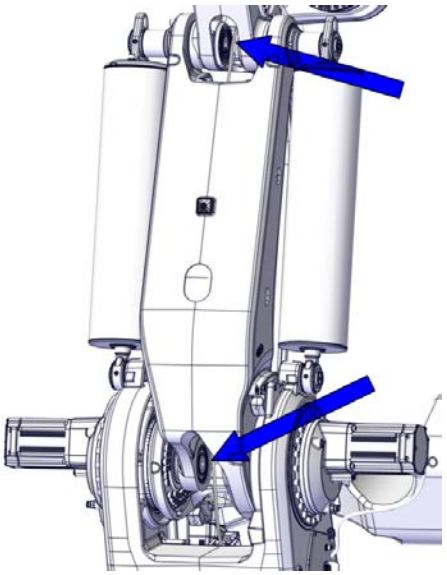
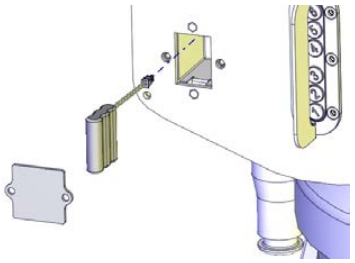
	Action	Note
3	Remove the upper and lower cable guides.	 xx1600000075 The figure show the positions of the cable guides.
4	Use caution and remove the cable harness from the lower arm.	

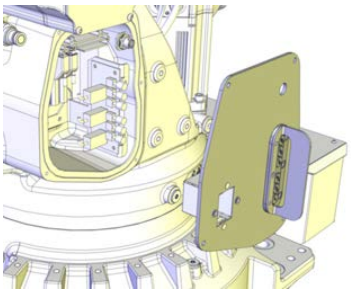
Preparations before disconnecting cables from the SMB and BU units

	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	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit please read the safety information in the section *The unit is sensitive to ESD on page 53*	
3	Open the small battery cover on the SMB cover, disconnect the battery cable and remove the battery.	 xx1300000829

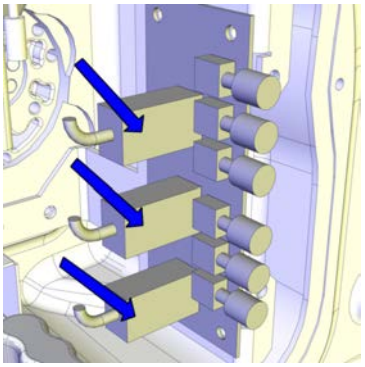
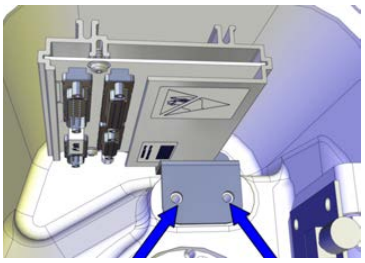
Continues on next page

4.5.1 Removing the cable harness

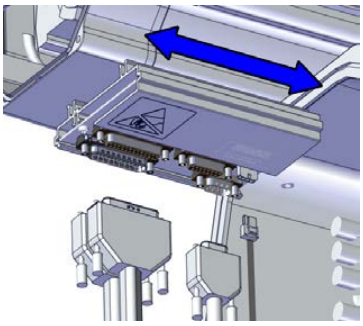
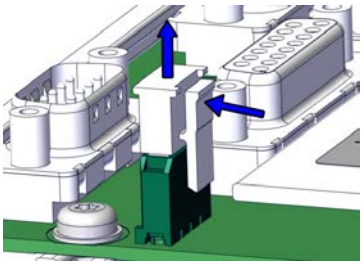
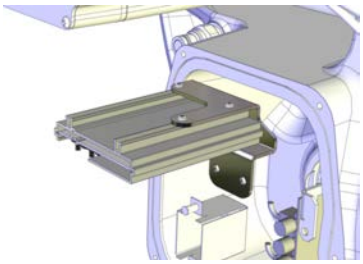
Continued

	Action	Note
4	Remove the SMB cover. **CAUTION** Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.	 xx1300000669

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 please read the safety information in the section *The unit is sensitive to ESD on page 53*	
3	If needed, disconnect the brake release unit (connectors X8, X9 and X10).	 xx1300000670
4	Remove the screws with washers that hold bracket with the SMB unit.	 xx1300000730

Continues on next page

	Action	Note
5	Carefully pull the SMB unit out a little and disconnect the connectors from the SMB board: • R1.SMB1-3, R1.SMB4-6 and R2.SMB • Battery cable connector R2.G. Disconnect the battery cable by pressing down the upper lip of the R2.G connector to release the lock while pulling the connector upwards.	 xx1300000728  xx1700000993
6	Use caution and remove the SMB unit.	 xx1300000731
7	Keep the SMB unit in an ESD bag until it shall be re-fitted.	ESD bag

Removing the SMB/BU cables

	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 please read the safety information in the section *The unit is sensitive to ESD on page 53*	

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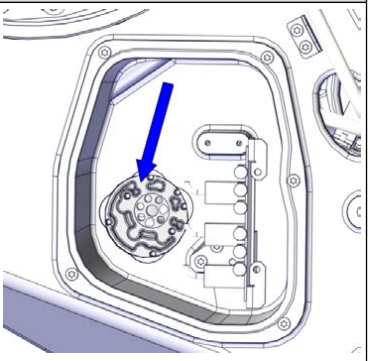
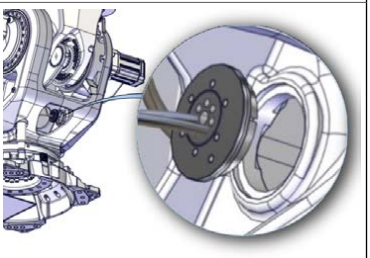
4.5.1 Removing the cable harness

Continued

	Action	Note
3	Unscrew the attachment screws that hold the SMB/BU cover from inside the SMB recess.	 xx1500003086
4	Use caution and pull out the cable harness from the SMB recess.	 xx1500003089

Concluding procedure

	Action	Note
1	Use caution and remove the cable harness from the robot.	

4.5.2 Refitting the cable harness

Location of the cable harness

The cable harness is located as shown in the figure.

xx1500001878

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Cable harness	3HAC050792-001		L2
Sealing	3HAA1001-628	Replace if damaged	L2

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.
Hexagon socket spanner, socket size 14 mm	-	Used to remove and refit the R1.SMB in the base.

Continues on next page

4.5.2 Refitting the cable harness
Continued

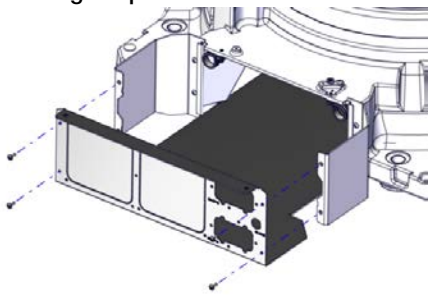
Required consumables

Consumable	Article number	Note
Cable ties	-	
Loctite 574		Flange sealant
Sikaflex		

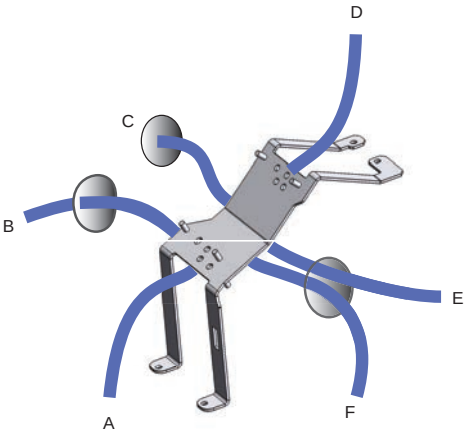
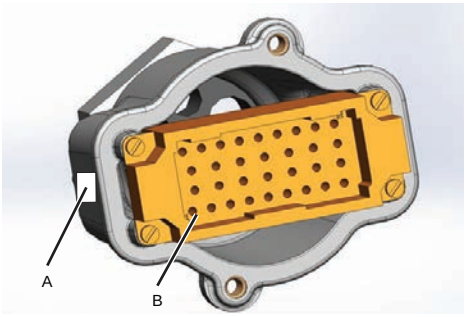
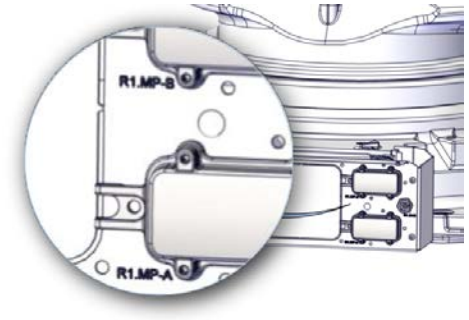
Refitting the cable harness

Use these procedures to refit the cable harness.

Refitting 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	Refit the connection plate in the base (if it has been removed).	Attachment screws: M6x16 stainless steel A2-70 (4 pcs) Tightening torque: 6 Nm  xx1500003088
3	Use caution and run the cable harness through the hole in the frame and out to the base plate.	

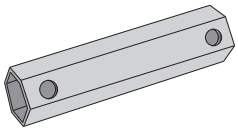
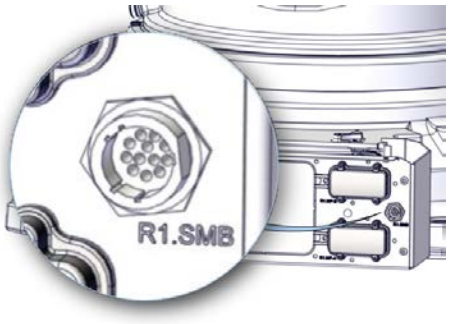
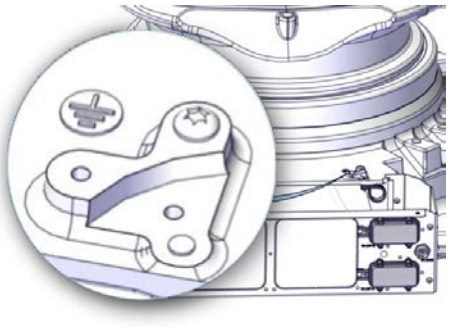
Continues on next page

	Action	Note
4	Make sure that the cables from the axis-1 bracket, runs untangled to all connection points: • down through the hole in the frame to the base plate, • to the axis-1 motor, • to the axis-2 motor, • to the axis-3 motor • to the SMB/BU recess. Adjust the cables if needed. The different cables must not be twisted or tangled. Do not fasten the axis-1 bracket yet.	 xx1500003081 A Cables down through hole in frame, to base plate B Axis-2 motor cables C SMB/BU cables D Cables up through lower arm and onwards E Axis-3 motor cables F Axis-1 motor cables
5	Before refitting the R1.MP-A and R1.MP-B contacts make sure that the hole for pin 1, as well as the bar code, will be on the left side. See figure.	 xx1600000078 A Bar code B Hole for pin 1
6	Refit the R1.MP-A and R1.MP-B contacts. **Note** Run the cables on top of each other, through the base, without being twisted.	 xx1500003083 Screws M6x20 stainless steel (4 pcs)
7	Make sure the signal cable R1.SMB runs under the oil hose and above the R1.MP cables, through the base.	

Continues on next page

4.5.2 Refitting the cable harness

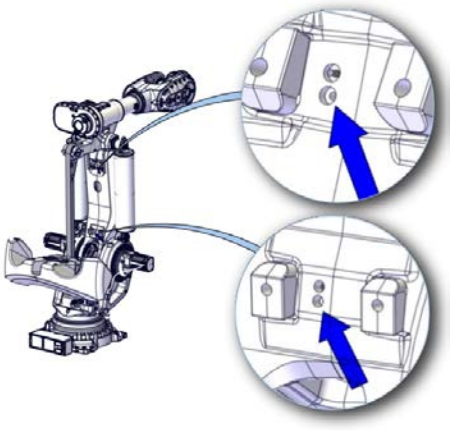
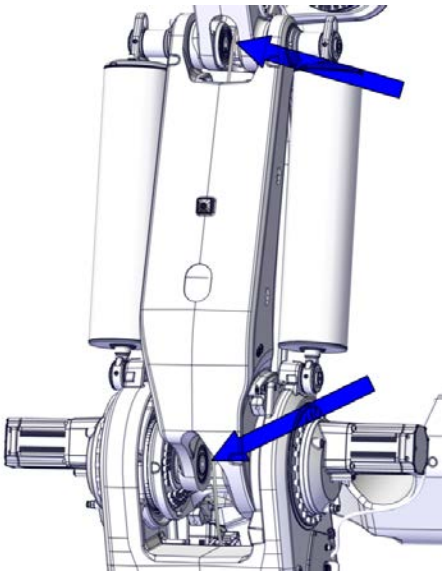
Continued

	Action	Note
8	Refit the R1.SMB cable, with the large recess pointing upwards to the right. **Tip** Use a Hexagon socket spanner, socket size 14 mm (or similar).  xx1200000888	Hexagon socket spanner, socket size 14 mm  xx1500003084
9	Refit the two earth cables.	Attachment screw: M6x16 stainless steel A2-70  xx1500003085

Refitting the cable harness in the lower arm

	Action	Note
1	Run the cable harness up through the lower arm.	
2	**Note** Make sure the cable harness is rotated one revolution between the upper and lower bracket inside the lower arm, when refitted.	

Continues on next page

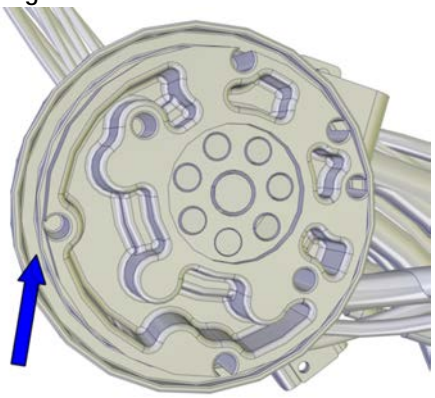
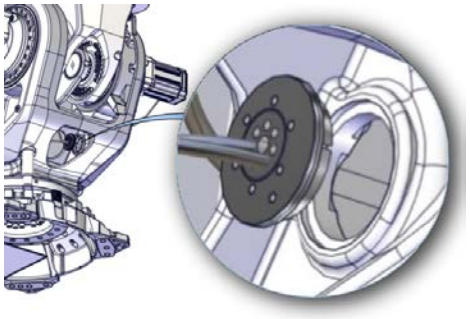
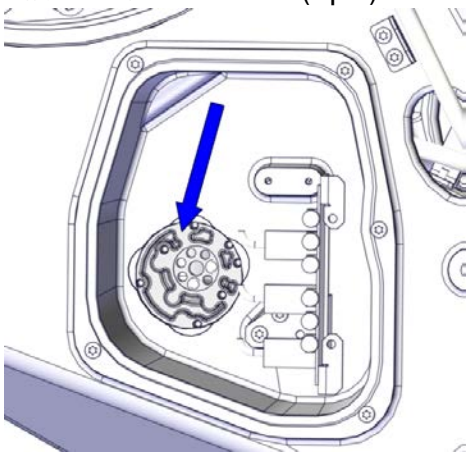
	Action	Note
3	Refit the two cable brackets inside the lower arm. **Note** The screws are reached from the outside.	Screws M6x16 (4 pcs)  xx1500002695
4	Refit upper and lower cable guides.	 xx1600000075 The figure show the positions of the cable guides.

Continues on next page

4.5.2 Refitting the cable harness

Continued

Refitting the SMB/BU cables

	Action	Note
1	Inspect the o-ring located on the SMB/BU cover is undamaged. Replace if damaged.	O-ring: 21522012-429  xx1300000737
2	Wipe clean the contact surfaces of the cover as well as the hole it shall fit in.	
3	Fit the o-ring.	
4	Apply Sikaflex on top of the o-ring, on the SMB/BU cover.	Sikaflex
5	Carefully run the cables for SMB and brake release units into the SMB recess.	 xx1500003089
6	Use caution and refit the SMB/BU cover in its hole from inside the SMB recess without damaging the o-ring. **Note** Do not tighten the screws fully. It must still be possible to adjust the position of the cable harness by rotating the SMB/BU cover in its hole a little.	Attachment screws M6x16 (4 pcs)  xx1500003086

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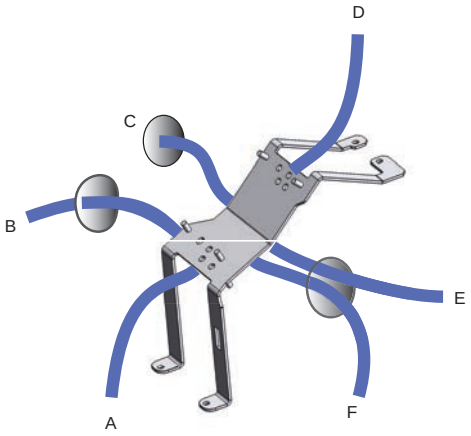
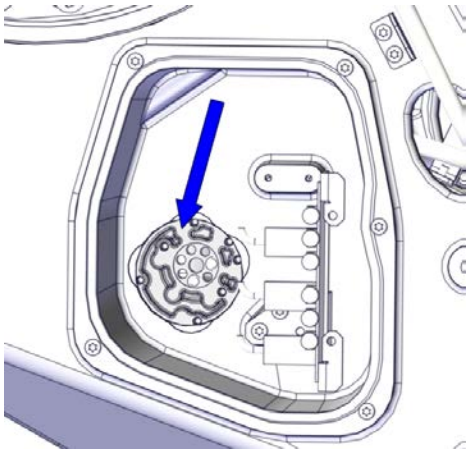
	Action	Note
7	Adjust the cables from the axis-1 bracket. **Note** The cables must be placed so that they don't rub against any part of the robot.	 xx1500003081 A Cables down through hole in frame, to base plate B Axis-2 motor cables C SMB/BU cables D Cables up through lower arm and onwards E Axis-3 motor cables F Axis-1 motor cables
8	Secure the SMB/BU cover from inside the SMB recess.	 xx1500003086

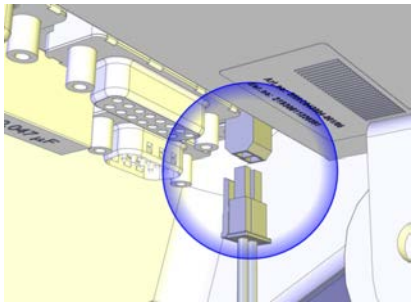
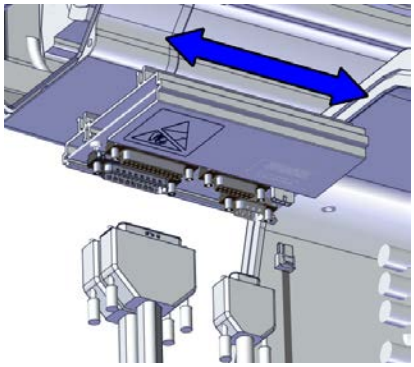
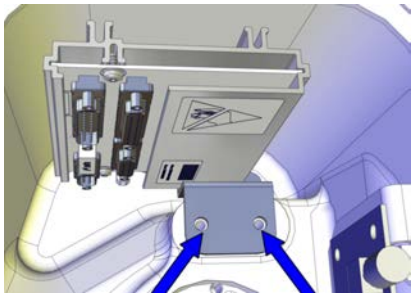
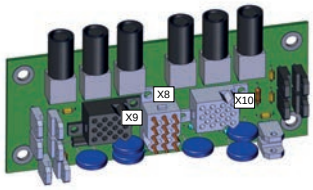
Refitting the SMB unit

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

Continues on next page

4.5.2 Refitting the cable harness

Continued

	Action	Note
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit please read the safety information in the section *The unit is sensitive to ESD on page 53*	
3	Connect the battery cable to the SMB unit. Make sure the lock snaps into place during refitting.	 xx1300000729
4	Connect all connectors to the SMB board: R1.SMB1-3, R1.SMB4-6 and R2.SMB	 xx1300000728
5	Carefully push the SMB unit into position and refit the bracket.	 xx1300000730
6	If disconnected, reconnect the connectors X8, X9 and X10 to the brake release board. Be careful not to damage the sockets or pins. Make sure the connector and its locking arms are snapped down properly.	 xx1700000978

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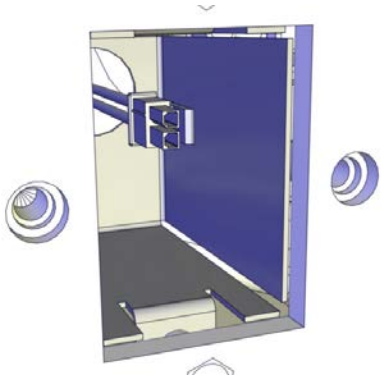
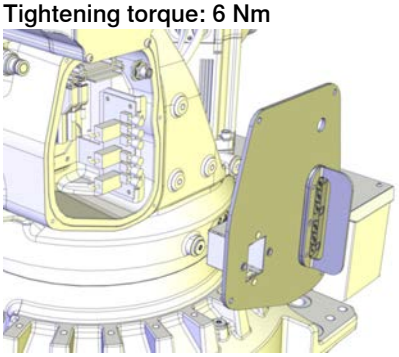
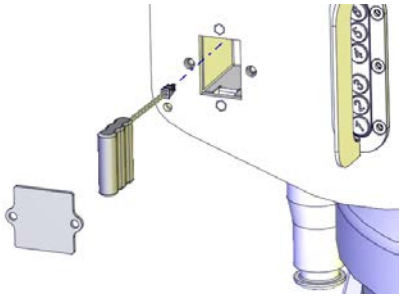
	Action	Note
7	Take a hold of the SMB cover and pull the battery cable out through the recess for the battery.	 xx1300000834
8	Secure the SMB cover.	Attachment screws: M6x16 8.8 (5 pcs) Tightening torque: 6 Nm  xx1300000669
9	If cabling is used for 7th axis (option), refit the connector R2.FB7 to the SMB cover and tighten with 6 Nm.	

Refitting the SMB battery

	Action	Note
1	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit please read the safety information in the section *The unit is sensitive to ESD on page 53*	
2	Get a hold of the battery cable in the recess for the battery and reconnect.	
3	Place the battery in the recess.	 xx1300000829

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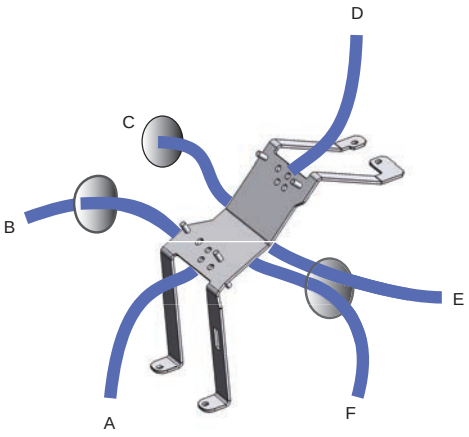
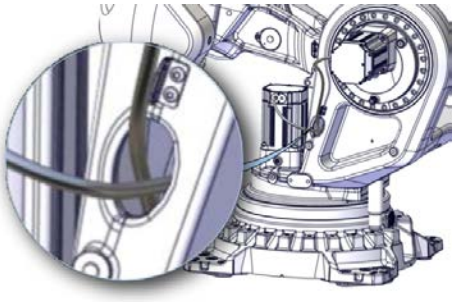
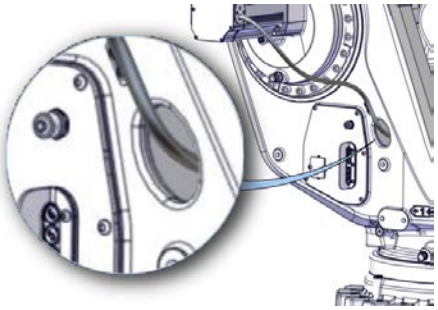
4.5.2 Refitting the cable harness

Continued

	Action	Note
4	Refit the battery cover.	Attachment screws: M6x16 8.8 (2 pcs) Tightening torque: 6 Nm

Refitting the cable harness in frame

	Action	Note
1	Make sure that the cables from the axis-1 bracket, runs untangled to all connection points: • down through the hole in the frame to the base plate, • to the axis-1 motor, • to the axis-2 motor, • to the axis-3 motor • to the SMB/BU recess. Adjust the cables if needed. The different cables must not be twisted or tangled. Do not fasten the axis-1 bracket yet.	 xx1500003081 A Cables down through hole in frame, to base plate B Axis-2 motor cables C SMB/BU cables D Cables up through lower arm and onwards E Axis-3 motor cables F Axis-1 motor cables
2	Run the cables to axis-1 and axis-3 motors through the hole on the right side of the frame.	 xx1600000080
3	Run the cables to axis-2 motor through the hole on the left side of the frame.	 xx1600000079

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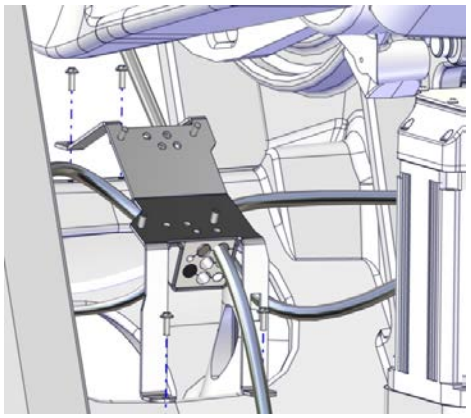
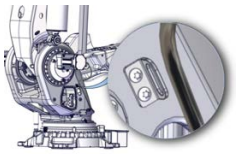
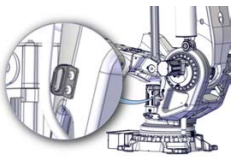
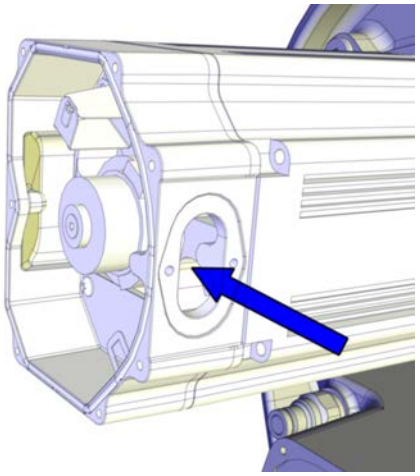
	Action	Note
4	Make sure the cables to SMB/BU units through the hole to the SMB recess, are fitted correctly.	
5	Refit the axis-1 bracket.	 xx1500002372
6	Secure the axis-2 and axis-3 motor cables with cable ties.	 xx1500003091  xx1500003090

Connecting the axis-1, axis-2, axis-3 and axis-4 motor cables

	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1300000738

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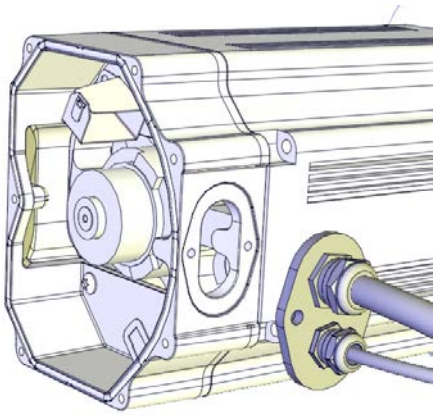
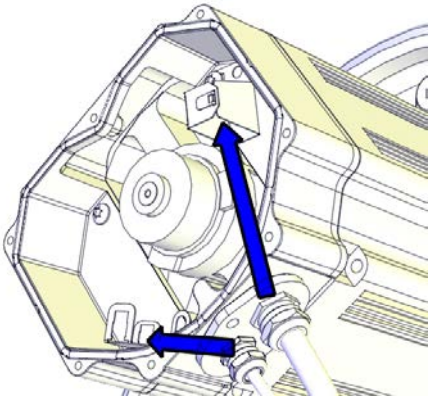
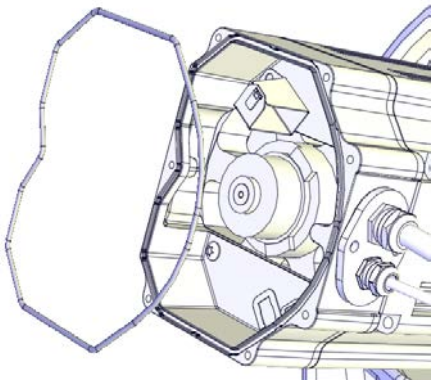
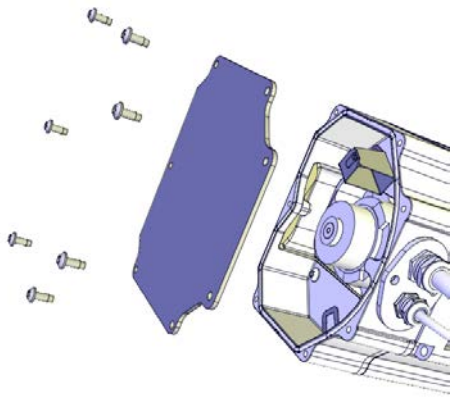
4.5.2 Refitting the cable harness

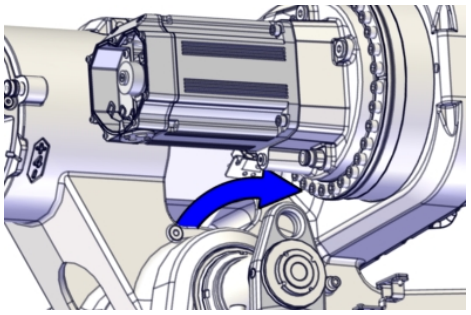
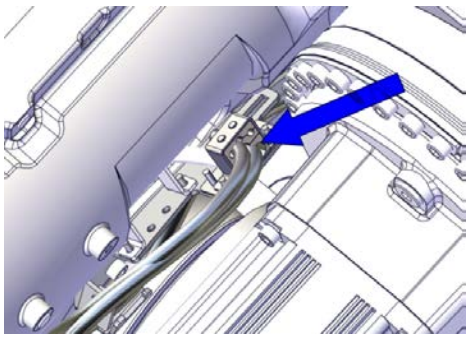
Continued

	Action	Note
2	Refit the cable gland cover. **Note** Replace the gasket if damaged.	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on connectors.	 xx1200001066
4	Wipe clean o-ring and o-ring groove.	
5	Inspect the o-ring. **Note** Replace if damaged.	 xx1200001070 O-ring: 3HAC054692-002
6	Refit the o-ring.	
7	**CAUTION** When refitting the motor cover, make sure none of the cables inside will be damaged!	

Continues on next page

	Action	Note
8	Refit the motor cover. **Note** Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged. **Note** Make sure the o-ring is undamaged and properly fitted.	Attachment screws: M5x12 (7 pcs)  xx1200001135
9	Make sure the cover is tightly sealed.	

Refitting the cable harness in the upper arm

	Action	Note
1	Push the cable harness in through the arm house and out at the axis-4 motor.	 xx2200000928
2	Lift the axis-3 cable bracket into position between axis-4 motor and arm housing and fasten the cable clamp to it with the nuts. Wait to tighten the nuts after the cable bracket is secured.	 xx1500003092

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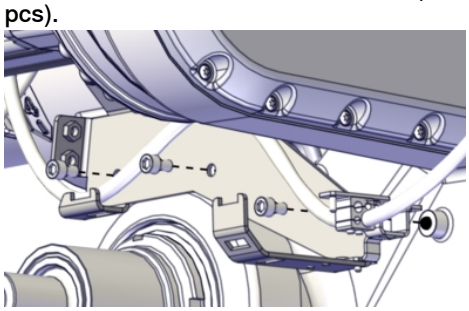
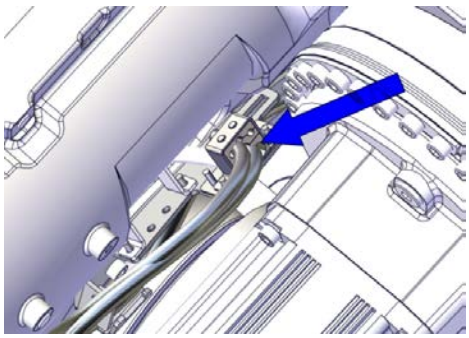
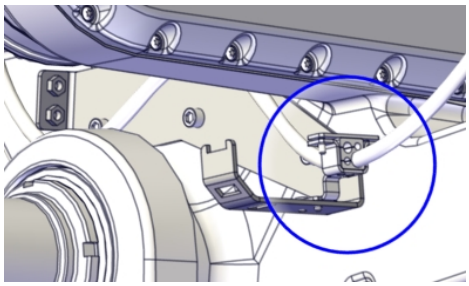
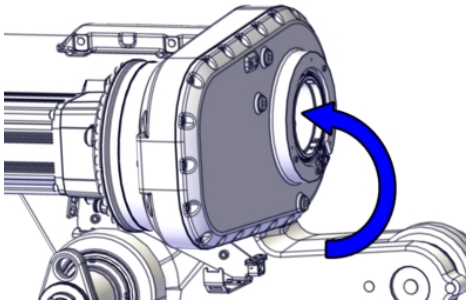
4.5.2 Refitting the cable harness

Continued

	Action	Note
3	Secure the axis-3 cable bracket beneath the arm house with the screws.	Attachment screws: M10x16 8.8-A3F (3 pcs).  xx2200000926
4	Tighten the cable clamp nuts to secure the cable clamp to the bracket.	 xx1500003092
5	Fit and secure the lower cable clamp to the bracket.	 xx2200000929
6	Push the cable harness in through the upper arm, slightly twisted, and out of the wrist.	 xx2200000930

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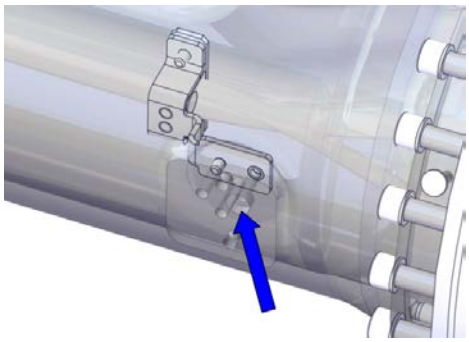
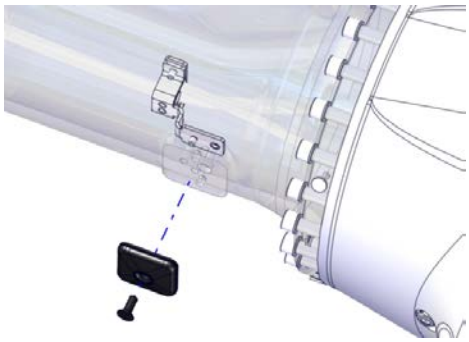
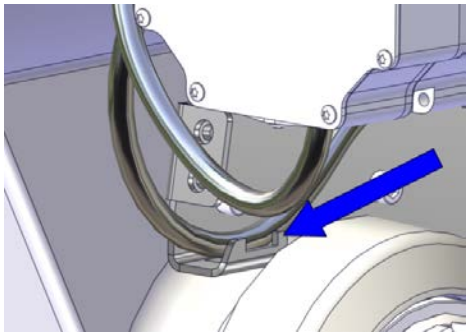
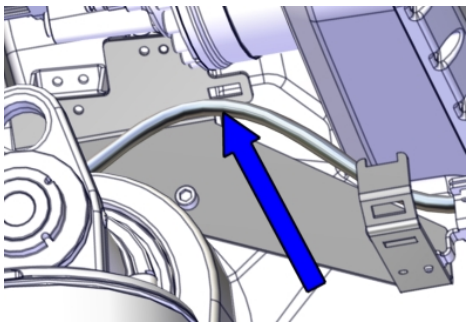
	Action	Note
7	Refit the cable clamp inside the upper arm with a screw from the outside.	 xx1500002720
8	Refit the protection cover.	Attachment screw: M8  xx1500002719
9	Secure the cable harness to the axis-3 bracket with cable ties.	Cable tie  xx1500003093  xx2200000932

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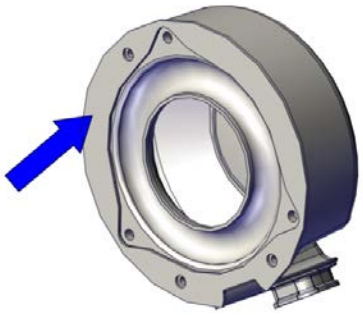
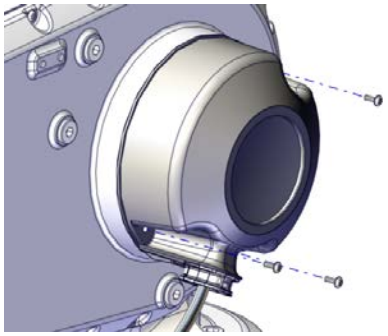
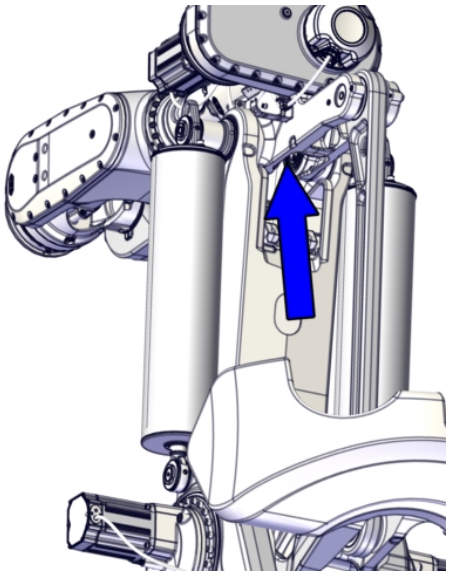
4.5.2 Refitting the cable harness

Continued

	Action	Note
10	Make sure that the sealing on the cover is correctly fitted. **Note** Replace if damaged. The sealing is covered with adhesive on the side facing the upper arm cover. The three washers are pressed into the holes in the gasket. Make sure all three washers are fitted.	Sealing: 3HAA1001-628  xx1500003094
11	Refit the cover.	 xx1500002722
12	Refit the black cable guide to inside the upper arm attachment by pressing it together and pushing it into place.	 xx2200000939

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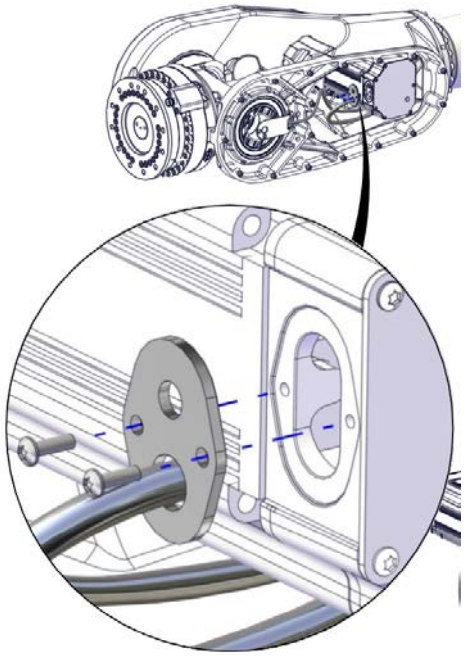
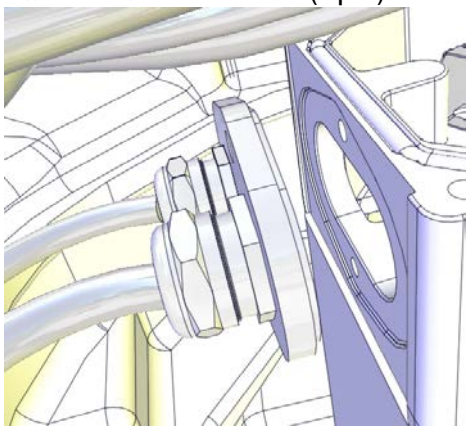
Connecting the axis-5 motor cables

	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1500002717
2	Refit the cable gland cover. **Note** Replace the gasket if damaged.	Attachment screws: M5x16 (2 pcs)  xx1200001016

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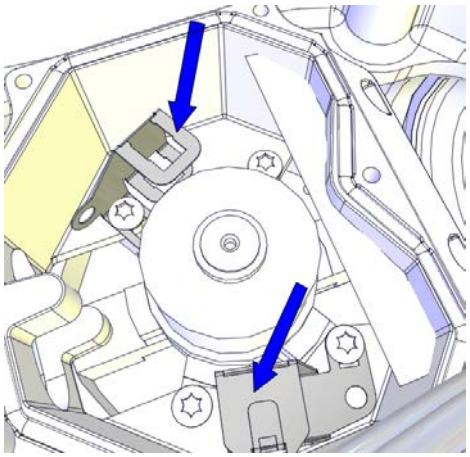
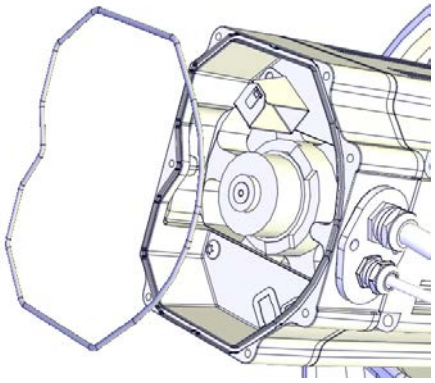
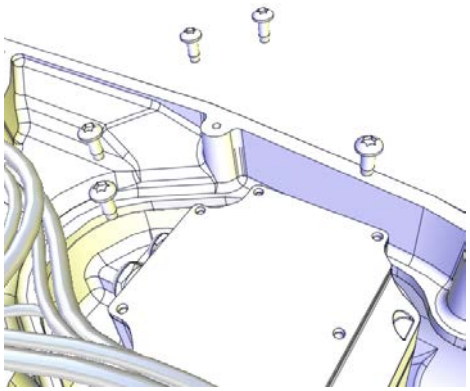
4.5.2 Refitting the cable harness

Continued

	Action	Note
3	Connect the connectors. Connect in accordance with the markings on the connectors.	 xx1200001015
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring: 3HAC054692-002  xx1200001070
5	**CAUTION** When refitting the motor cover, make sure that none of the cables inside will be damaged.	
6	Refit the motor cover. **Note** Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged. **Note** Make sure the o-ring is properly fitted and undamaged.	Attachment screws: M5x12 8.8 (7 pcs)  xx1200001013

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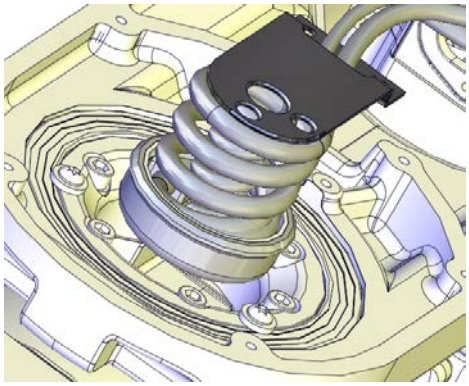
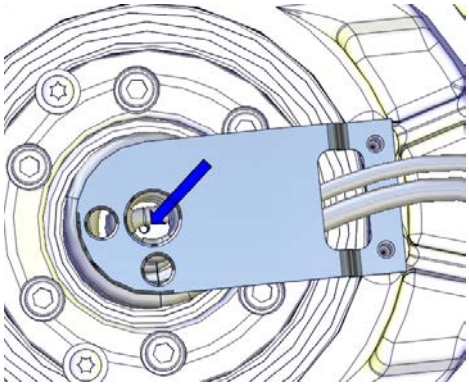
	Action	Note
7	Make sure that the cover is tightly sealed.	

Connecting the axis-6 motor cables

	Action	Note
1	Make sure that the axis-5 is in +90 position, before continuing. If not, the cable spiral will be attached in the wrong position and cause damage to the cable harness. **CAUTION** Make sure that the cable spiral is not turned an extra revolution. The result will be damage to the cable harness.	
2	Use caution and push the carrier into position.	 xx1300001113
3	Secure the carrier with the M4 screw. **Note** The screw is located at the bottom of the carrier. **Tip** The screw that secure the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.	Attachment screws: M4x10  xx1300000485

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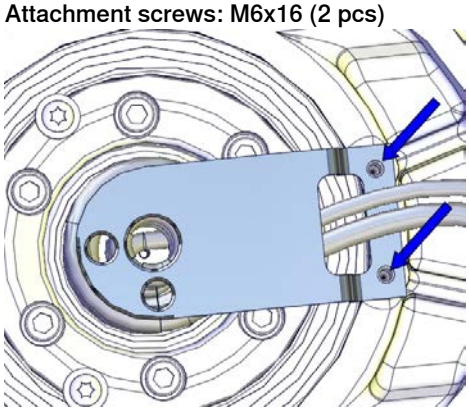
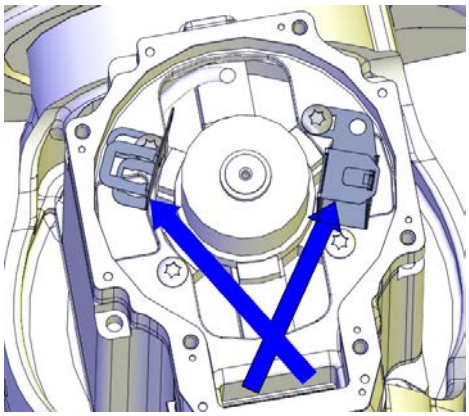
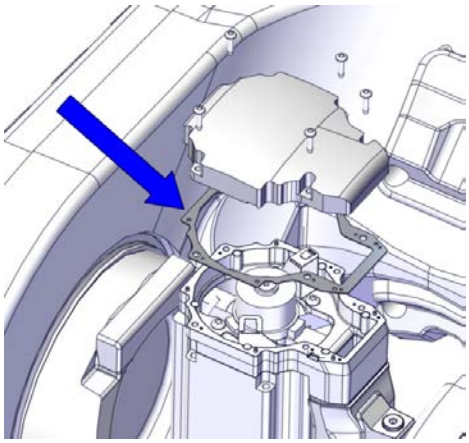
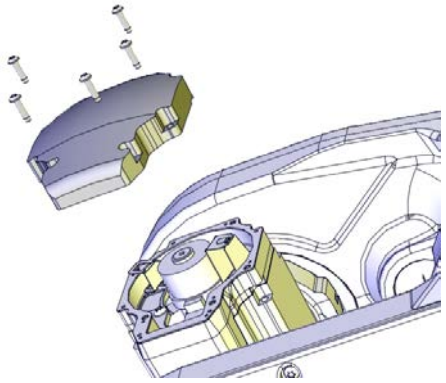
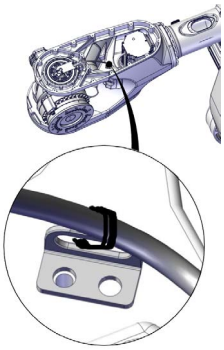
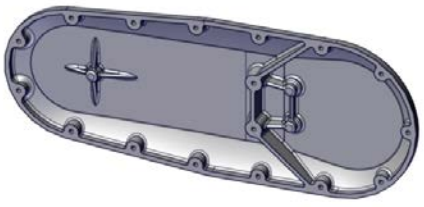
4.5.2 Refitting the cable harness

Continued

	Action	Note
4	Secure the cable bracket with its attachment screws.	Attachment screws: M6x16 (2 pcs)  xx1300000484
5	Reconnect the connectors to the axis-6 motor. **Note** Place the resolver cable underneath the motor cable.	 xx1300000488
6	Make sure the gasket on the motor cover is undamaged. **Note** Replace if damaged.	 xx1500003095
7	**CAUTION** Make sure not to damage the cables inside the motor when refitting the motor cover.	

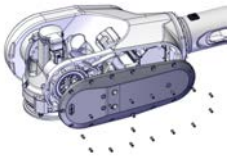
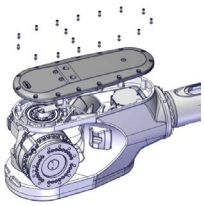
Continues on next page

	Action	Note
8	Refit the motor cover.	Attachment screws: M5x20 (5 pcs)  xx1200001080
9	Secure the axis-6 motor cable to the cable fixing bracket with a cable tie. **Note** The position of axis-4 depends on the ongoing procedure.	 xx1500003101  xx1500002331
10	Remove all residues of old sealant and other contamination from the contact surfaces of the wrist cover.	
11	Make sure the contact surface of the wrist cover is undamaged.	 xx1600000046
12	Apply flange sealant on the wrist cover flange.	Loctite 574
13	Place the cable harness so it will not be damaged when fitting the cover.	

Continues on next page

4.5.2 Refitting the cable harness

Continued

	Action	Note
14	Refit the wrist cover and tighten all screws alternately. Repeat once. **Note** The position of axis-4 depends on the ongoing procedure.	 xx1500003100  xx1500002330 Screws M8x25 12.9 (17 pcs) Tightening torque: 24 Nm

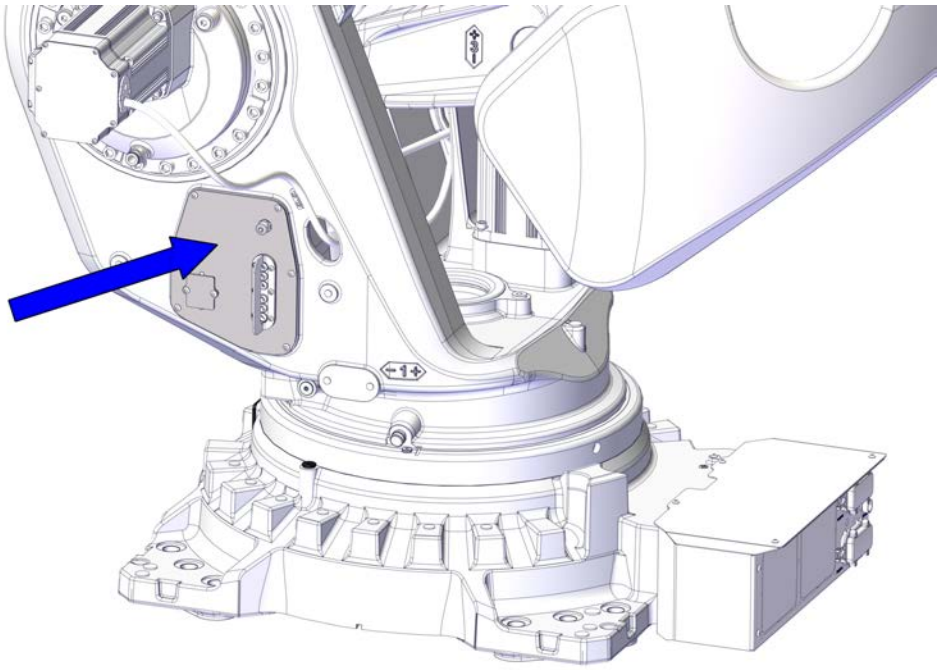
Concluding procedure

	Action	Note
1	Make an overall inspection of the installed cable harness.	See *Inspecting the cable harness on page 126*.
2	Update the revolution counters.	See *Updating revolution counters on IRC5 robots on page 682*.
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 97*.	

4.5.3 Replacing the SMB

Location of the SMB

The SMB unit is located inside.



xx1500003096

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
SMB	3HAC043904-001	RMU102	L2

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.
ESD bag		

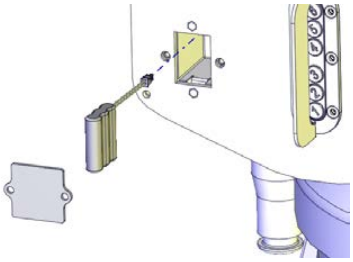
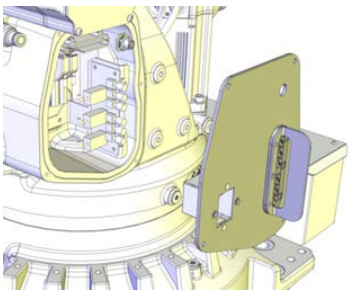
Continues on next page

4.5.3 Replacing the SMB
Continued

Removing the SMB unit

Use these procedures to remove the SMB unit.

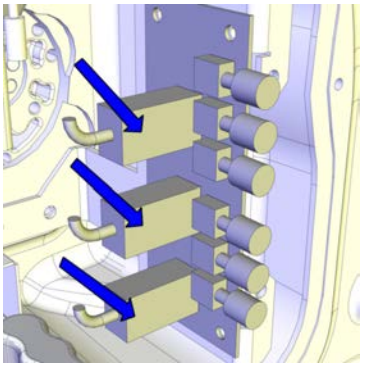
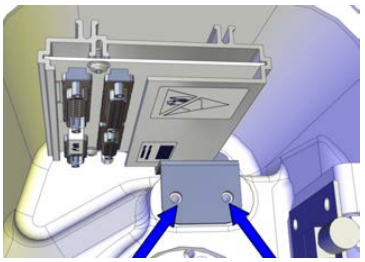
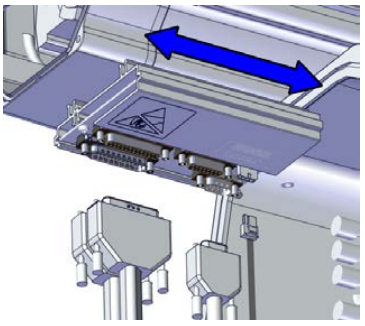
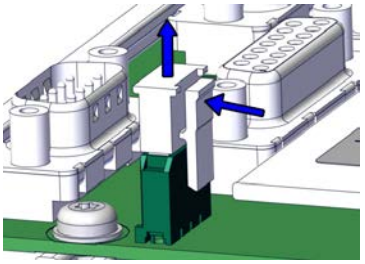
Preparations before disconnecting cables from the SMB and BU units

	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	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit please read the safety information in the section *The unit is sensitive to ESD on page 53*	
3	Open the small battery cover on the SMB cover, disconnect the battery cable and remove the battery.	 xx1300000829
4	Remove the SMB cover. **CAUTION** Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.	 xx1300000669

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.	

Continues on next page

	Action	Note
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit please read the safety information in the section *The unit is sensitive to ESD on page 53*	
3	If needed, disconnect the brake release unit (connectors X8, X9 and X10).	 xx1300000670
4	Remove the screws with washers that hold bracket with the SMB unit.	 xx1300000730
5	Carefully pull the SMB unit out a little and disconnect the connectors from the SMB board: • R1.SMB1-3, R1.SMB4-6 and R2.SMB • Battery cable connector R2.G. Disconnect the battery cable by pressing down the upper lip of the R2.G connector to release the lock while pulling the connector upwards.	 xx1300000728  xx1700000993

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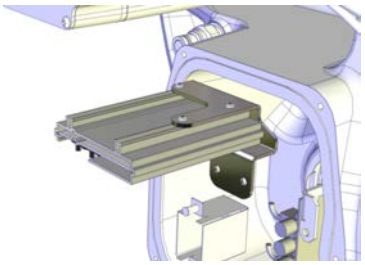
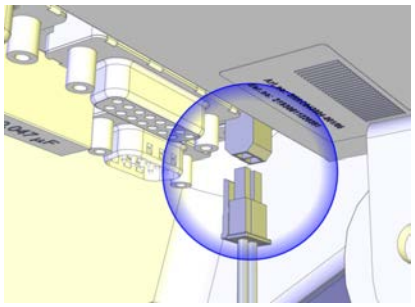
4.5.3 Replacing the SMB
Continued

	Action	Note
6	Use caution and remove the SMB unit.	 xx1300000731
7	Keep the SMB unit in an ESD bag until it shall be refitted.	ESD bag

Refitting the SMB unit

Use these procedures to refit the SMB unit.

Refitting 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 please read the safety information in the section *The unit is sensitive to ESD on page 53*	
3	Connect the battery cable to the SMB unit. Make sure the lock snaps into place during refitting.	 xx1300000729

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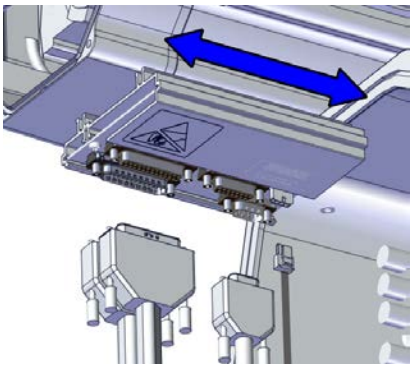
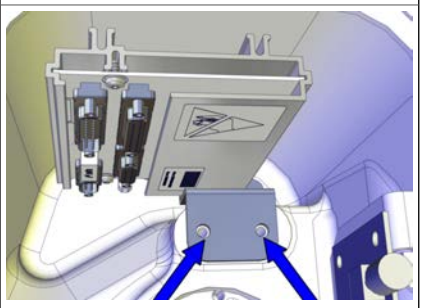
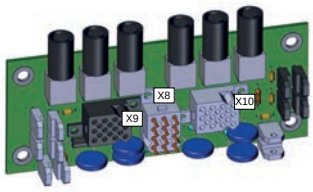
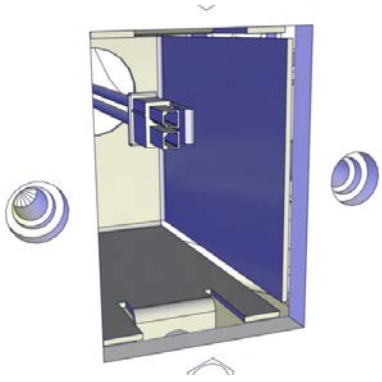
	Action	Note
4	Connect all connectors to the SMB board: R1.SMB1-3, R1.SMB4-6 and R2.SMB	 xx1300000728
5	Carefully push the SMB unit into position and refit the bracket.	 xx1300000730
6	If disconnected, reconnect the connectors X8, X9 and X10 to the brake release board. Be careful not to damage the sockets or pins. Make sure the connector and its locking arms are snapped down properly.	 xx1700000978
7	Take a hold of the SMB cover and pull the battery cable out through the recess for the battery.	 xx1300000834

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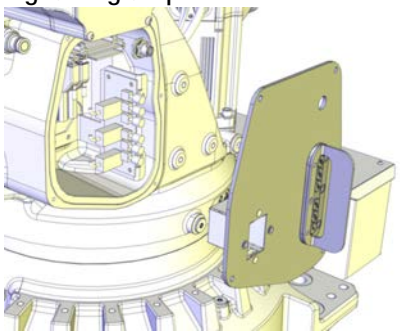
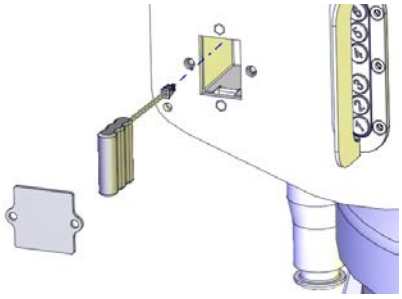
4.5.3 Replacing the SMB
Continued

	Action	Note
8	Secure the SMB cover.	Attachment screws: M6x16 8.8 (5 pcs) Tightening torque: 6 Nm  xx1300000669
9	If cabling is used for 7th axis (option), refit the connector R2.FB7 to the SMB cover and tighten with 6 Nm.	

Refitting the SMB battery

	Action	Note
1	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit please read the safety information in the section *The unit is sensitive to ESD on page 53*	
2	Get a hold of the battery cable in the recess for the battery and reconnect.	
3	Place the battery in the recess.	 xx1300000829
4	Refit the battery cover.	Attachment screws: M6x16 8.8 (2 pcs) Tightening torque: 6 Nm

Concluding procedure

	Action	Note
1	Update the revolution counter.	See *Updating revolution counters on IRC5 robots on page 682*.

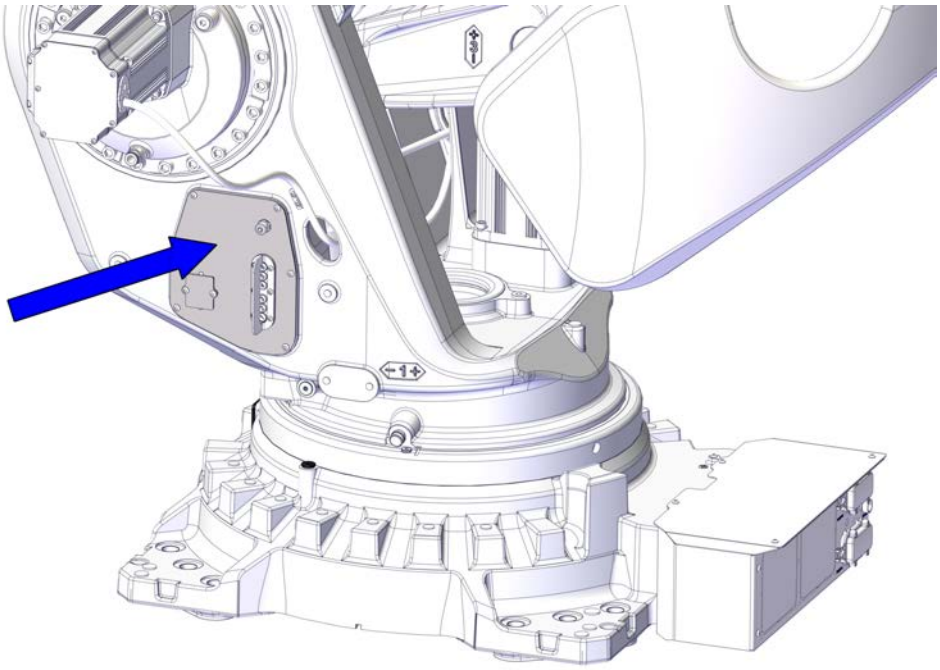
Continues on next page

	Action	Note
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 97*.	

4.5.4 Replacing the brake release unit

Location of the brake release unit

The brake release unit is located inside cover.



xx1500003096

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Brake release unit	3HAC065021-001	Brake release unit DSQC1052 and harness	L2

Required tools and equipment

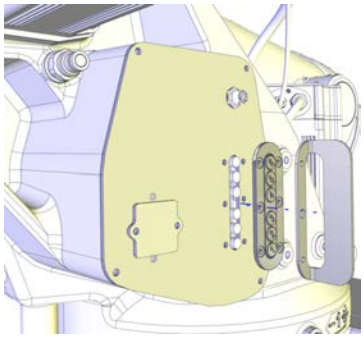
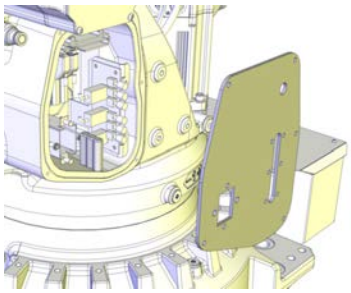
Equipment, etc.	Article number	Note
ESD bag		
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Continues on next page

Removing the brake release unit

Use these procedures to remove the brake release unit.

Preparations

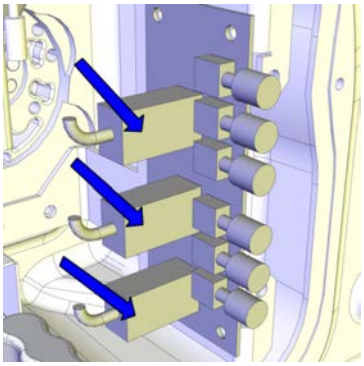
	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
2	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit please read the safety information in the section *The unit is sensitive to ESD on page 53*	
3	Remove the push button guard from the SMB cover. The push button guard must be removed to ensure a correct refitting of the brake release unit.	 xx1300000743
4	Remove the SMB cover.	 xx1300000742
5	The battery can stay connected, to avoid needing to synchronize the robot. **CAUTION** Carefully put the SMB cover down to avoid damaging the battery cable connectors.	

Continues on next page

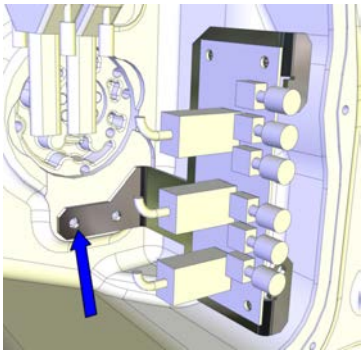
4.5.4 Replacing the brake release unit

Continued

Disconnecting 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 53*.	
3	Take a picture or make notes of how the robot cabling is positioned in regard to the brake release board.	
4	Use caution and remove the connectors X8, X9 and X10 from the brake release board.	 xx1300000670

Removing the brake release unit

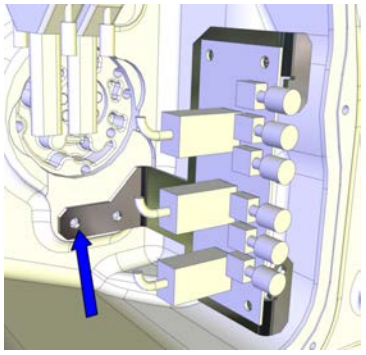
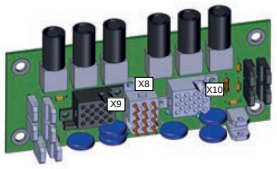
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws securing the brake release unit bracket.	
3	Remove the bracket with the brake release unit fitted.	 xx1300000744

Continues on next page

	Action	Note
4	Remove the brake release unit from the bracket, if it should be replaced.	

Refitting the brake release unit

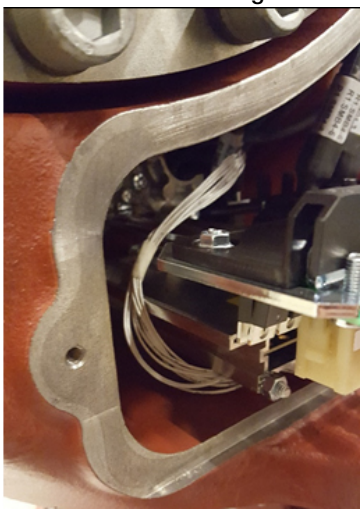
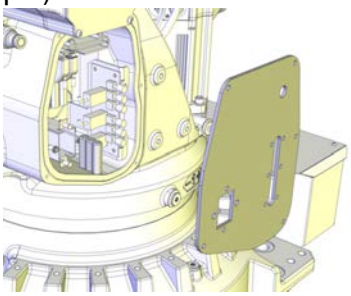
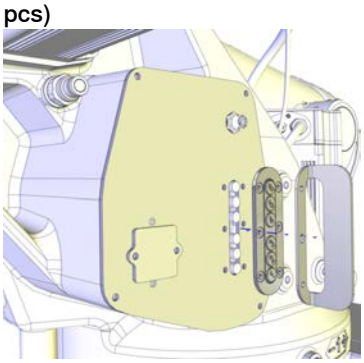
Use these procedures to refit the brake release unit.

	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 53*.	
2	Fasten the brake release unit to the bracket.	Maximum tightening torque: 5 Nm.
3	Refit the bracket with the brake release unit fitted. Make sure the unit is placed as straight as possible on the bracket. The push buttons can otherwise get jammed when the SMB cover is refitted.	 xx1300000744
4	Reconnect the connectors X8, X9 and X10 to the brake release unit. Be careful not to damage the sockets or pins. Make sure the connector and its locking arms are snapped down properly.	 xx1700000978

Continues on next page

4.5.4 Replacing the brake release unit

Continued

	Action	Note
5	Verify that the robot cabling is positioned correctly, according to previously taken picture/notes. **WARNING** Screened cables must not get in contact with the brake release board after installation. Eliminate all risks of contact between screened cables and the brake release board.	Make sure that the white cables run like shown in the figure.  xx1700001155
6	Refit the SMB cover with its attachment screws. **Note** Do not refit the push button guard at this point.	Attachment screws: M6x16 8.8 (6 pcs)  xx1300000742
7	**WARNING** Before continuing any service work, follow the safety procedure in section *The brake release buttons may be jammed after service work on page 195*!	
8	Refit the push button guard to the SMB cover.	Attachment screws: M5x16 8.8 (6 pcs)  xx1300000743

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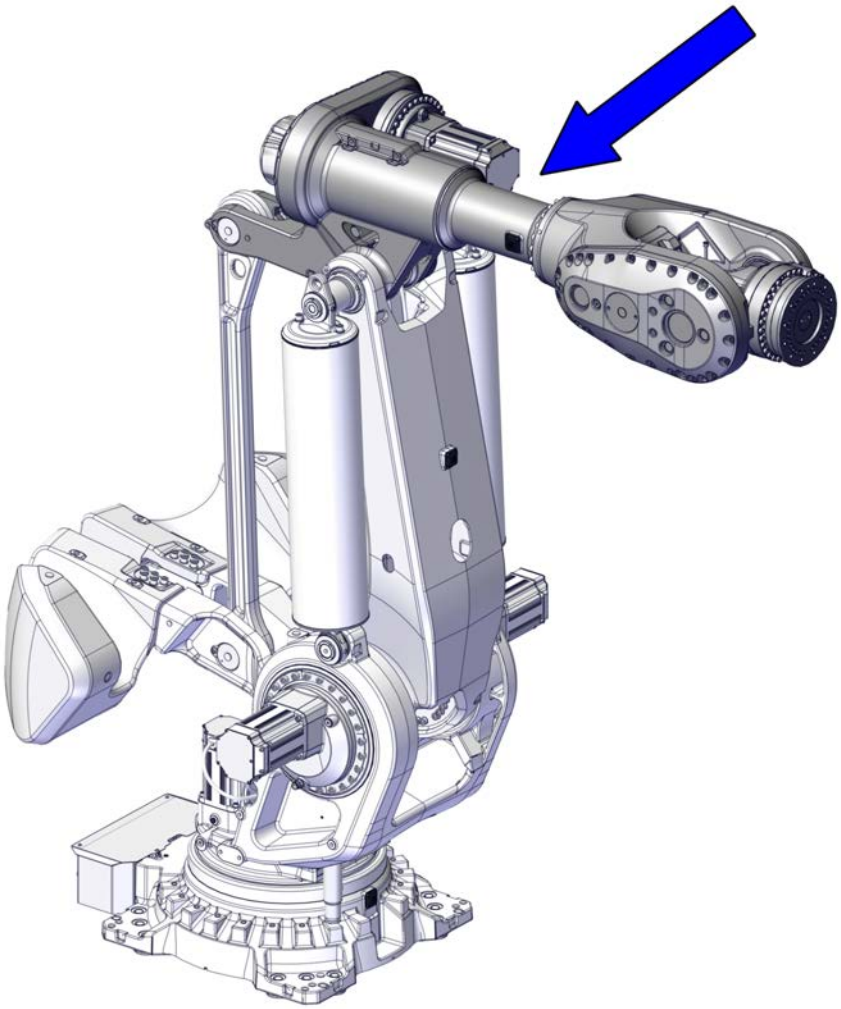
	Action	Note
9	Press the push buttons 1 to 6, one at a time, to make sure that the buttons are moving freely and do not stay in any locked position.	
10	The revolution counters must be updated if the battery has been disconnected.	See *Updating revolution counters on IRC5 robots on page 682*.
11	 **DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 97*.	

4.6 Upper and lower arms

4.6.1 Replacing the upper arm

Location of the upper arm

The upper arm is located as shown in the figure.



xx1500002060

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Upper arm excluding wrist	3HAC048079-006		L2

Continues on next page

Spare part	Article number	Note	Level
Sealing	3HAA1001-628	Replace if damaged	L2

Required tools and equipment

Equipment, etc.	Article number	Note
Mobile platform ladder	-	
Screw M16x80	-	Fully threaded, 2 pcs
Roundsling 1 m	-	Lifting capacity: 1,000 kg
Lifting accessory, balancing device	3HAC054236-001	Required to lift the balancing device on the axis-4 motor side.
Bearing puller	-	Used when removing the balancing device.
Roundsling 2.5 m (1 pcs) Roundsling 3 m (1 pcs)	-	Used for lifting upper arm. Lifting capacity: 2,000 kg on each roundsling.
Lifting eye	3HAC16131-1	VLBG M12
Fender washer	-	Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.
Lock screw, quality 12.9, M20x150	-	Used to secure lower arm to frame (to lock axis 2) or parallel arm to frame (to lock axis 3).
Fixing screw, M10x80 (4 pcs)	-	Fully threaded. Used to hold parallel rod in position.
Press tools, parallel rod shaft	3HAC071354-001	User instructions (3HAC071354-002) are enclosed with the tool.
Hydraulic pump, 700 bar	-	To be used with the hydraulic cylinder. Maximum allowed working pressure 700 bar.
Piece of wood	-	Used when replacing the parallel rod and mechanical stop pin as a safety measure
Sleeve KM nut	3HAC069154-009	D=152 L=220
Glycerine adapter	-	Used to replace upper arm shafts together with a glycerine press tool.
Press tools, upper arm shaft	3HAC069154-001	Set of tools. User instructions (3HAC069154-038) are enclosed with the tool.
Velcro strap	-	
Brake release tool	3HAC081310-001	Used to release the motor brakes. User instructions are enclosed with the tool. Alternative tool: 24 VDC power supply
Dial gauge		
Press tools, balancing device upper end	3HAC057130-015	
Press tools, balancing device lower end	3HAC057130-016	

Continues on next page

4.6.1 Replacing the upper arm
Continued

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumable

Consumable	Article number	Note
Molykote 1000	-	To be used on attachment screws.
Scotch-Brite	-	Abrasive cleaning hand pads. To be used to clean the axis-4 shafts.
Isopropanol	-	
Glycerine		
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)
Flange sealant	-	Loctite 574 (or equivalent)
Rust preventive	3HAC034903-001	Mercasol 3110 Waxcoat. Recommended drying time is 24h.
Grease	3HAC042534-001	Tribol GR 100-0 2PD
Bearing grease	3HAC9408-1	Tribol GR 100-2 PD

Required documents

Document	Document number	Note
User instructions, upper arm shaft press tools	3HAC069154-038	Enclosed with the toolkit.
User instructions, parallel rod shaft press tools	3HAC071354-002	Enclosed with the toolkit.

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.	

Continues on next page

	Action	Note
	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 689*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Removing the upper arm

Use these procedures to remove the upper arm.

Preparations before removing the upper arm

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Remove any tool or other equipment fitted to the robot.	

Preparations before unloading the pressure of balancing device

	Action	Note
1	Jog the robot to calibration position.	 xx1500002310
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

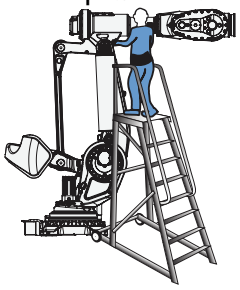
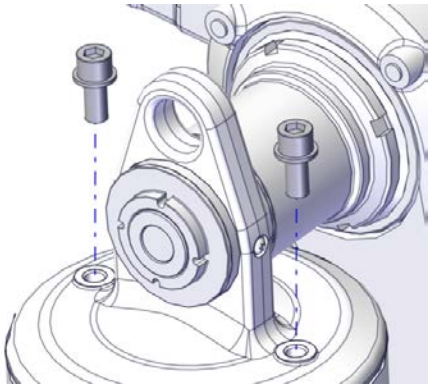
Continues on next page

4.6.1 Replacing the upper arm

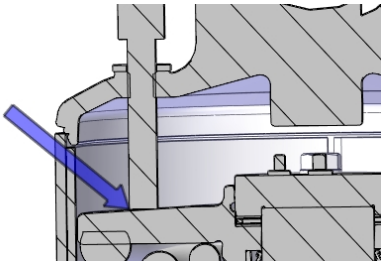
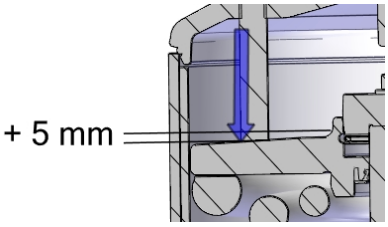
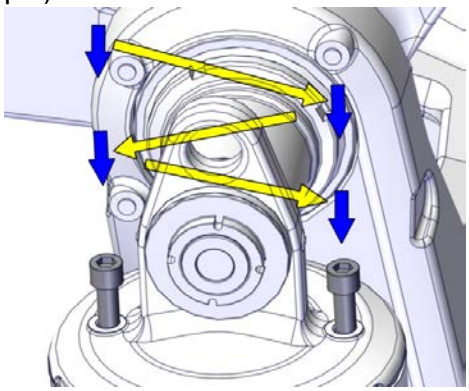
Continued

Unloading the pressure of the balancing devices

Use this procedure to unload both balancing devices.

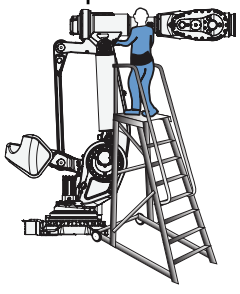
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Use a mobile platform ladder (or similar) to reach the upper end of the balancing device. **DANGER** Do not use the robot as ladder!	Mobile platform ladder  xx1500001985
3	Remove the screws, fitted in the screw holes on top of the balancing device. **Note** Keep the screws. They shall be refitted after the work is done.	 xx1500001971 M16x35
4	Apply some Molykote on threads and at the bottom end of two fully threaded screws, used for unloading the balancing device.	Screw M16x80 (Fully threaded, 2 pcs, 2 pcs) Apply Molykote on colored areas.  xx1500002303

Continues on next page

	Action	Note
5	Unload the pressure of the balancing device by inserting the screws. 1 Attach the screws until the screws reaches the piston.  xx1900001209 2 Then, alternately little by little, attach the screws at least another *five* millimeters. The pressure is now unloaded.  xx1900001210	Screw M16x80 (Fully threaded, 2 pcs, 2 pcs)  xx1500002309
6	In a procedure where both balancing devices shall be removed, unload the pressure of the other in the same way.	

Removing both balancing devices

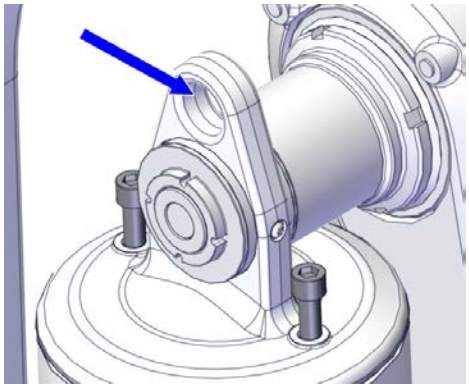
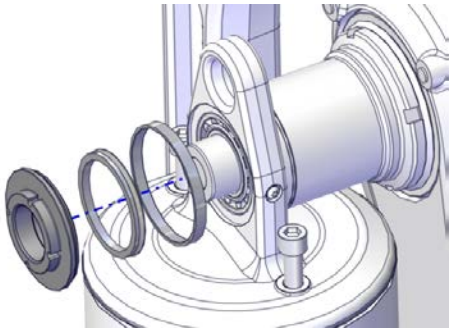
Use this procedure to remove both balancing devices.

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Use a mobile platform ladder to reach the upper end of the balancing device. **DANGER** Do not use the robot as a ladder.	Mobile platform ladder  xx1500001985

Continues on next page

4.6.1 Replacing the upper arm

Continued

	Action	Note
3	**CAUTION** The balancing device weights 200 kg. All lifting accessories used must be sized accordingly.	
4	Attach a roundsling to the lifting hole on top of the balancing device and to an overhead crane (or similar). A lifting tool is required on the axis-4 motor side, to avoid pressure on the motor during lifting.	Roundsling 1 m: Lifting capacity: 1,000 kg Lifting accessory, balancing device: Required to lift the balancing device on the axis-4 motor side.  xx1500001983
5	Stretch the lifting accessories to unload the balancing device weight.	
6	Remove upper and lower KM-nuts, V-rings and support rings.	Sleeve KM nut M10: 3HAC071313-001  xx1500001973

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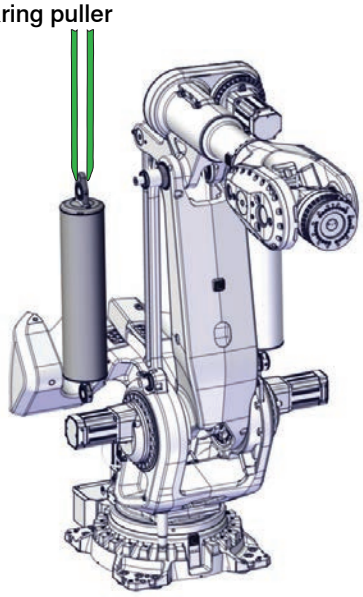
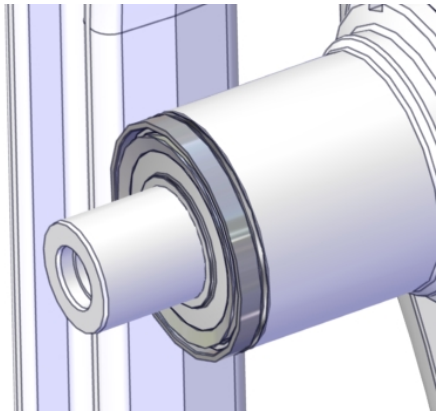
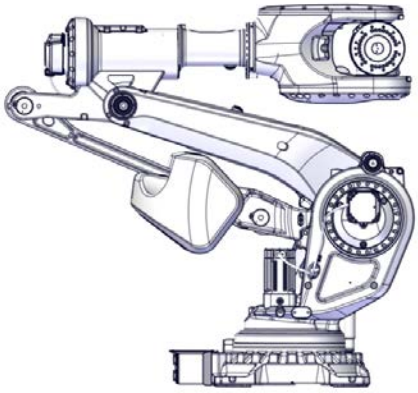
	Action	Note
7	Use caution and lift the balancing device off. **Tip** If needed, use a bearing puller, to carefully help pressing the balancing device out.	Bearing puller  xx1500002735
8	Verify that the support ring, V-ring and spacer ring are present on the shaft. No need to remove. If a bearing remains seated on the shaft, remove it according to *Replacing the balancing device bearings on page 420*.	 xx1500001976
9	Put the balancing device down. **CAUTION** Be careful when putting down the balancing device. The balancing device ear and piston rod should not take any weight. **Tip** Turn a pallet upside down and place the balancing device in the opening for the trucks forks. This will prevent the balancing device from starting to move unexpectedly.	Pallet

Continues on next page

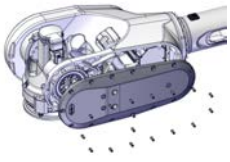
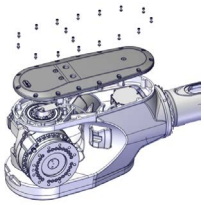
4.6.1 Replacing the upper arm

Continued

Robot position when removing the upper arm

	Action	Note
1	Turn on the power and jog the robot to the specified position: • Axis 1: no significance as long as the robot is fitted to the foundation. • Axis 2: -65° • Axis 3: approximately +2° (upper arm as horizontal as possible to the foundation) • Axis 4: +90° • Axis 5: approximately -90° (to balance the weight of the upper arm) • Axis 6: no significance.	 xx1700001306
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Retrieving access to the wrist cabling

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the wrist cover. **Note** Do not damage the sealing. Replace if damaged. **Note** The position of axis-4 depends on the ongoing procedure.	 xx1500003100  xx1500002330

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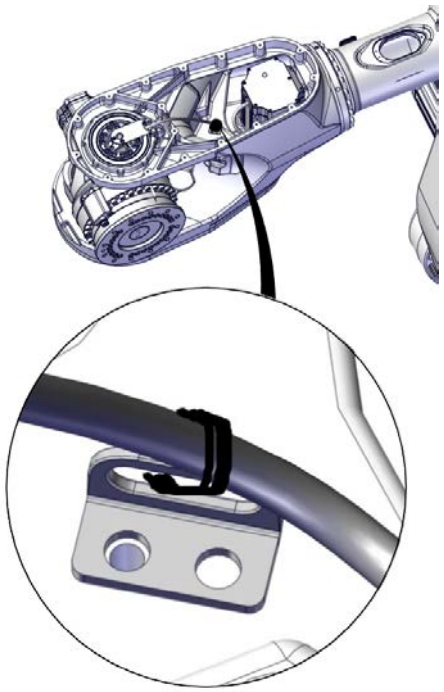
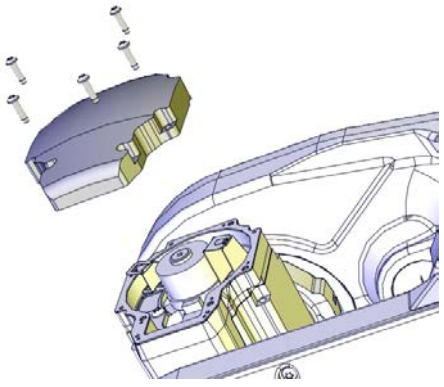
	Action	Note
3	Cut the cable tie that secures the axis-6 motor cable.	 xx1500002331

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	Make sure that the axis-5 is as close to +90° or -90° position as possible, depending on what repair work is being done. **Note** Not needed if only replacing the axis-6 unit.	
3	Unscrew the attachment screws and remove the motor cover. **Note** Do not damage the gasket. Replace if damaged.	 xx1200001080

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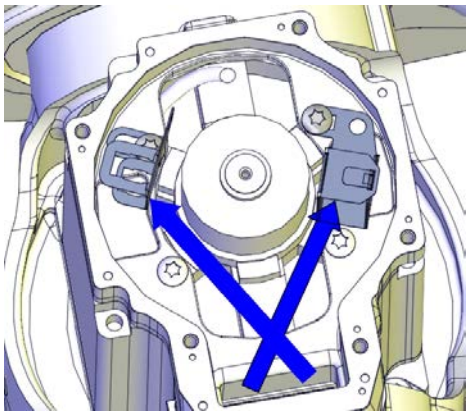
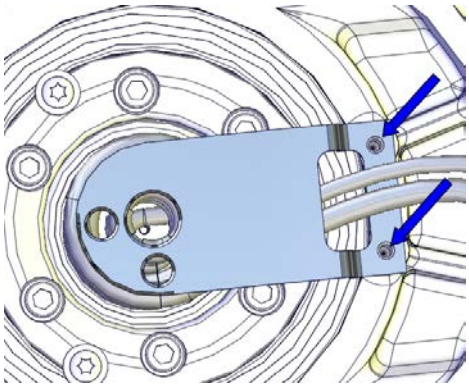
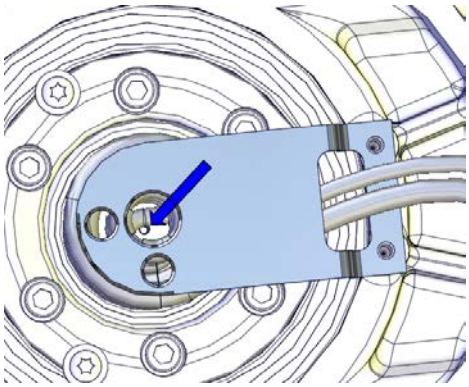
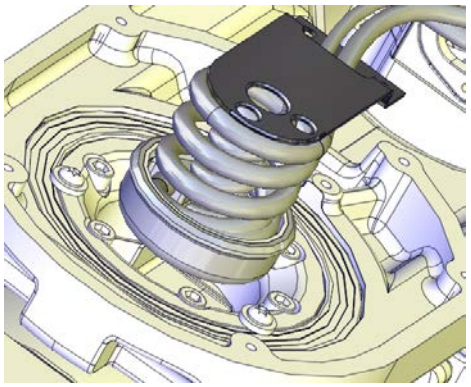
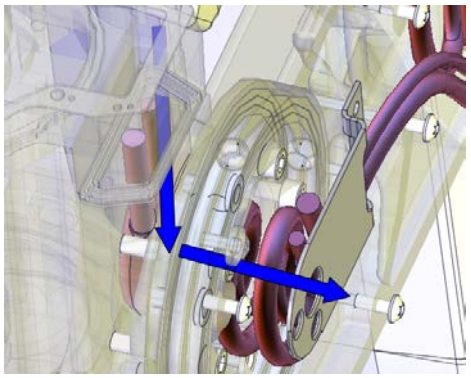
4.6.1 Replacing the upper arm

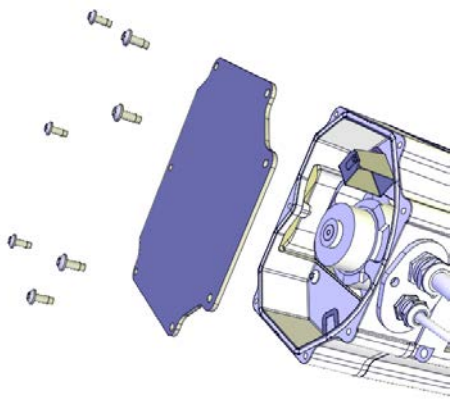
Continued

	Action	Note
4	Disconnect the motor cables.	 xx1300000488
5	Unscrew the attachment screws holding the cable bracket.	 xx1300000484
6	Unscrew the screw holding the carrier. **Note** The screw is located at the bottom of the carrier.	 xx1300000485

Continues on next page

	Action	Note
7	Use caution and pull out the carrier. **Tip** If needed, use a screwdriver to help pulling out the carrier.	 xx1300001113
8	Use caution and pull out the axis-6 motor cables by holding the cables at the motor with one hand, and the other one at the carrier.	 xx1300000666

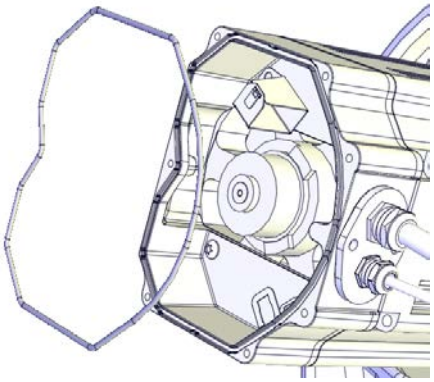
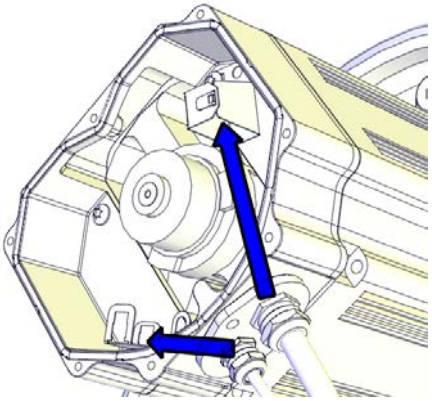
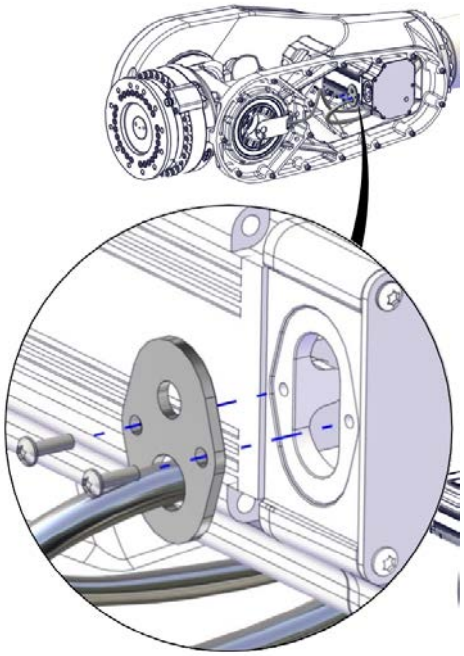
Disconnecting the axis-5 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws with washers and remove the motor cover.	 xx1200001135

Continues on next page

4.6.1 Replacing the upper arm

Continued

	Action	Note
3	**Note** Make sure the o-ring is present when removing the cover.	 xx1200001070
4	Disconnect the motor cables.	 xx1200001066
5	Remove the cable gland cover. **Tip** Make a note in which direction the cable exit hole is facing, if the motor shall be removed too. The motor shall be refitted in the same position.	 xx1500002717
6	Use caution and pull out the motor cables.	

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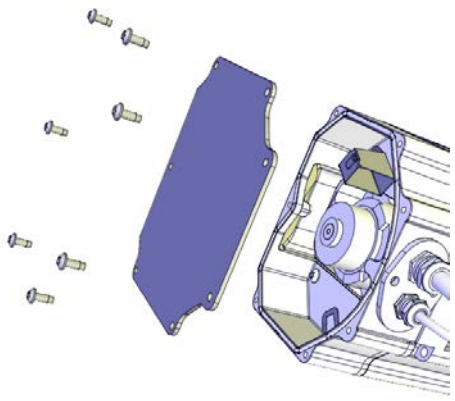
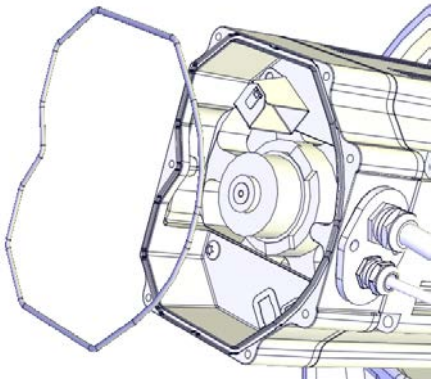
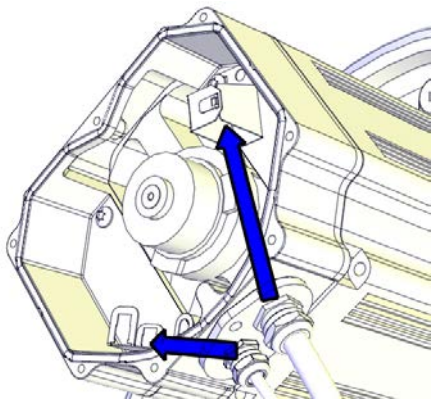
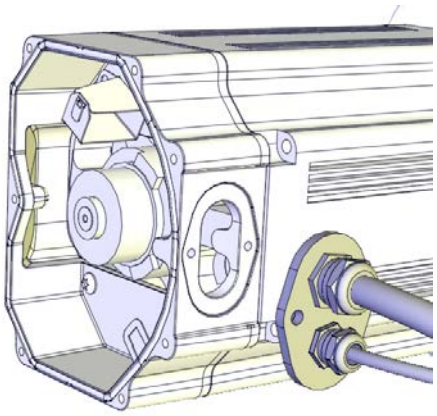
Disconnecting the axis-4 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135
3	Make sure the o-ring is present.	 xx1200001070
4	Disconnect the motor cables.	 xx1200001066

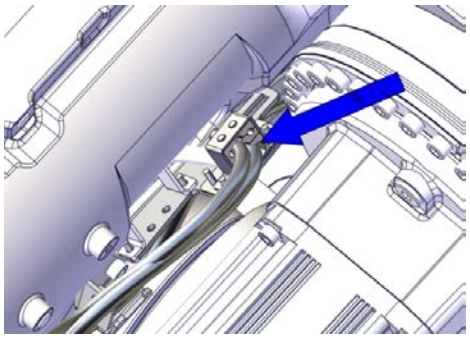
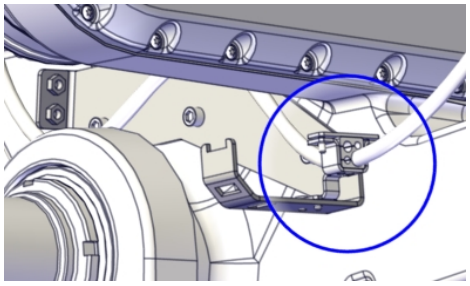
Continues on next page

4.6.1 Replacing the upper arm

Continued

	Action	Note
5	Remove the cable gland cover. Make sure the gasket is not damaged. **Tip** Make a note in which direction the cable gland hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.	 xx1200001067
6	Use caution and pull out the motor cables.	

Removing the cable harness in the upper arm

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the upper cable clamp from the axis-3 bracket (between axis-4 motor and arm housing).	 xx1500003092
3	Remove the lower cable clamp from the bracket.	 xx2200000929

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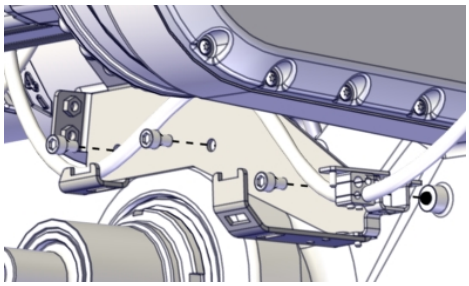
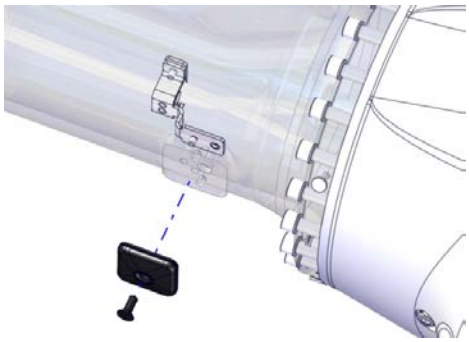
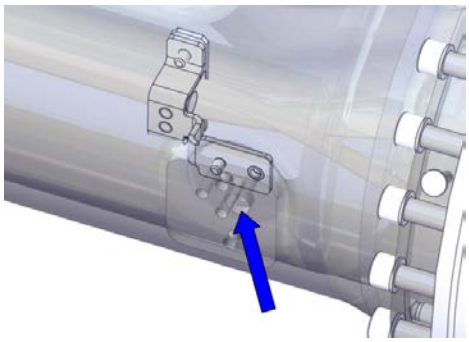
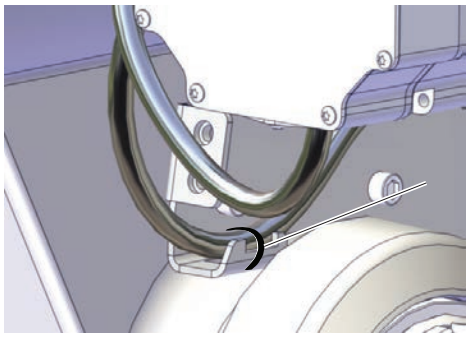
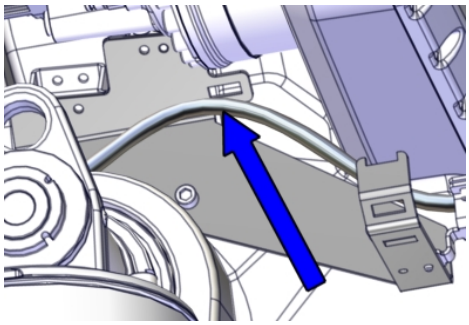
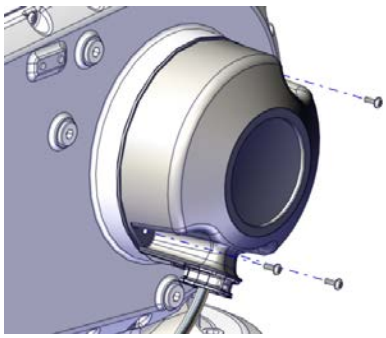
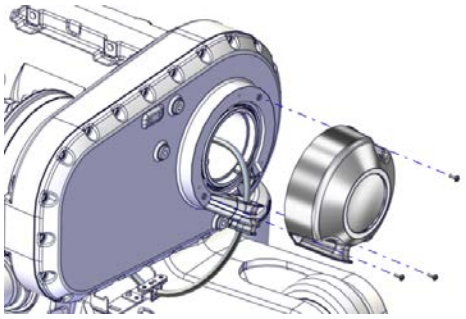
	Action	Note
4	Remove the cable bracket.	 xx2200000926
5	Remove the protection cover. Make sure not to damage the surface exposed.	 xx1500002719
6	Unscrew the nut holding the bracket inside the upper arm. **Note** The screw is reached from the outside.	 xx1500002720

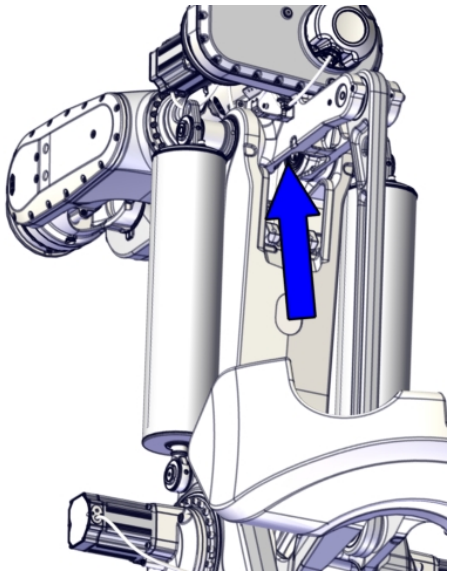
Continues on next page

4.6.1 Replacing the upper arm

Continued

	Action	Note
7	Cut the cable ties located underneath the axis-4 motor and to the axis-3 bracket.	 xx1500002721  xx2200000932
8	Unscrew the screws that secure the cover.	 xx1500002722
9	Remove the cover.	 xx1500002723

Continues on next page

	Action	Note
10	Remove the black cable guide from inside the upper arm attachment by pressing it together and pulling it down.	 xx2200000939
11	Use caution and remove the cable harness out of the upper arm.	

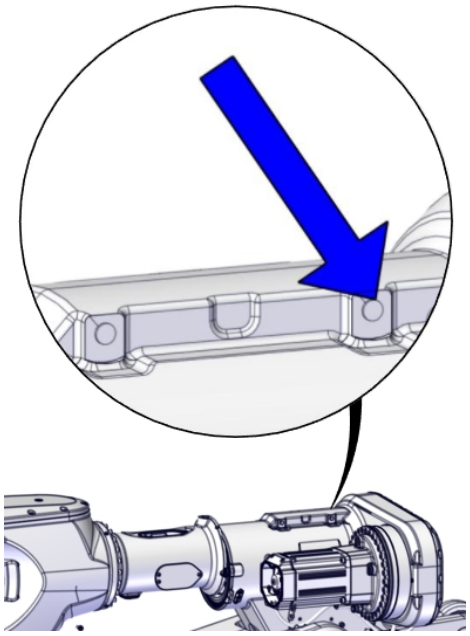
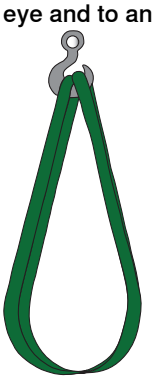
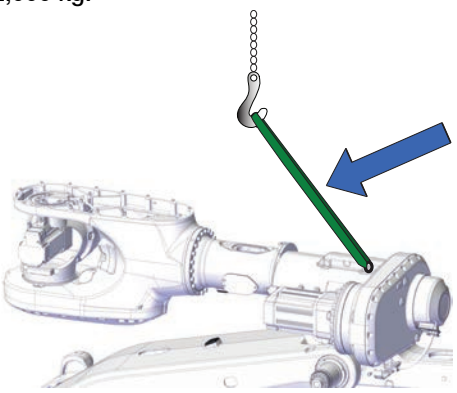
Attaching lifting accessories to the upper arm complete

	Action	Note
1	**CAUTION** The complete upper arm weighs 900 kg. All lifting accessories used must be sized accordingly.	
2	If needed, use a Mobile platform ladder (or similar) to attach the lifting accessories. **DANGER** Never use the robot as ladder.	Mobile platform ladder

Continues on next page

4.6.1 Replacing the upper arm

Continued

	Action	Note
3	Remove the plastic plug from the back hole of the arm housing.	 xx1500002712 Lifting eye: 3HAC16131-1 (VLBG M12) Fender washer: Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.
4	Attach a Lifting eye to the hole in the arm housing with a Fender washer underneath.  xx1400002196	
5	Attach a roundsling looped to the Lifting eye and to an overhead crane (or similar).  xx1400002599	Roundsling 2.5 m with lifting capacity: 2,000 kg.[I]  xx1500002713

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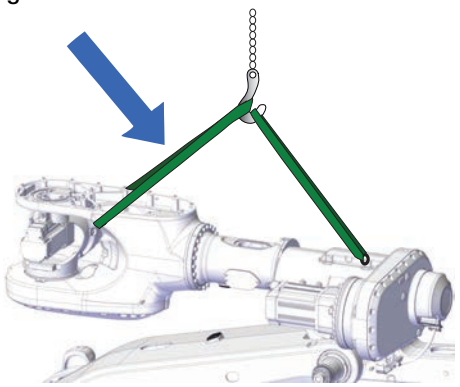
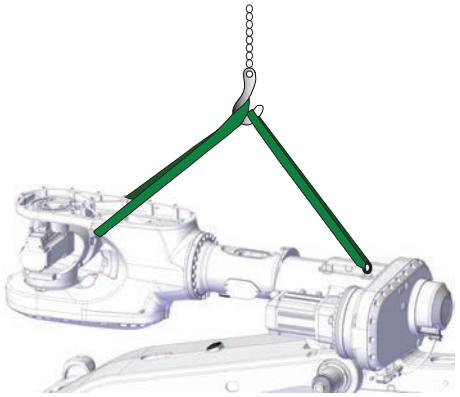
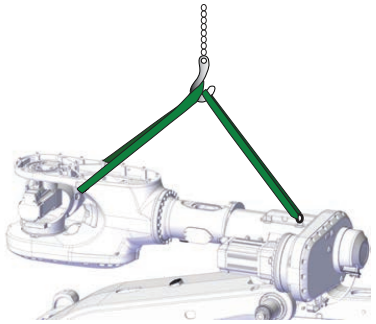
	Action	Note
6	Attach a roundsling looped to the wrist and to an overhead crane (or similar).	Roundsling 3 m with lifting capacity: 2,000 kg. *i*  xx1500002714
7	Stretch the lifting accessories to take the weight of the upper arm.	 xx1500002724
8	Adjust the lifting accessories, if needed.	

i This is a recommendation according to standard EN 1492. Always conform to local regulations.

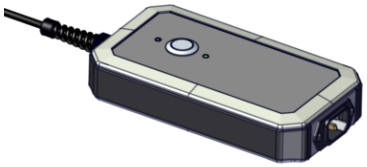
Releasing the brakes on the axis-2 motor

	Action	Note
1	Before continuing, make sure that the upper arm is secured in the lifting accessories and overhead crane. Stretch the lifting accessories to unload the upper arm weight. **CAUTION** The upper arm including the wrist weighs approximately 900 kg. All lifting accessories must be sized accordingly.	 xx1500002724

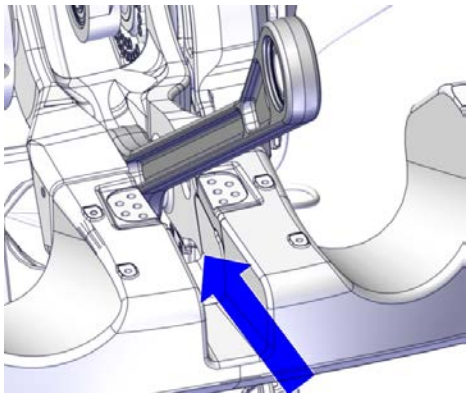
Continues on next page

4.6.1 Replacing the upper arm

Continued

	Action	Note
2	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 R2.MP2 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP2: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
3	Release the brakes on axis-2 to allow the lower arm to position according to the lifting force applied from the overhead crane. This eliminates any strain in the upper arm shafts.	
4	Remove the brake release from R2.MP2.	

Removing the parallel rod, upper end

	Action	Note
1	Put a piece of wood (or similar) between parallel arm and parallel rod, used as protection to prevent the rod from moving unexpectedly during the continued procedure.	 xx1500001963

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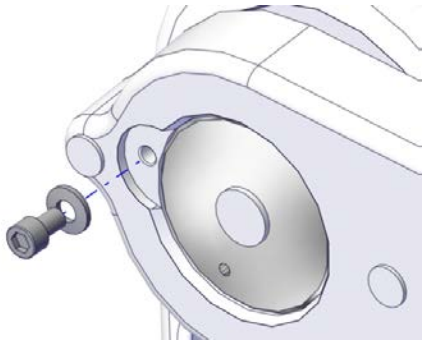
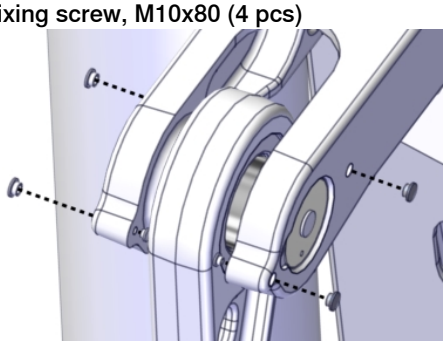
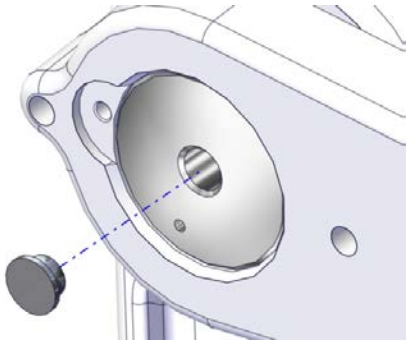
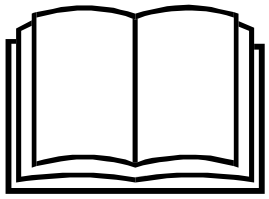
	Action	Note
2	Remove the attachment screw with washer that secure the rod shaft.	 xx1400002600
3	Remove the protection plugs (4 + 4 pcs) and fit 2 + 2 M10x80 screws in the holes. Adjust the screws against the parallel rod from both sides. **Note** Keep the protection plugs. They shall be refitted when the work is done.	This is done to prevent the upper arm wings from pinching when pressing the shaft and thereby making it more difficult to press the shaft in or out. Fixing screw, M10x80 (4 pcs)  xx1500001961

Continues on next page

4.6.1 Replacing the upper arm

Continued

	Action	Note
4	Remove the protection plug. **Note** Keep the protection plug. It shall be refitted when the work is done.	 xx1500001967


xx0900000813

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

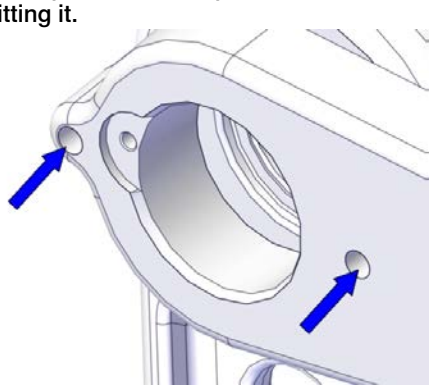
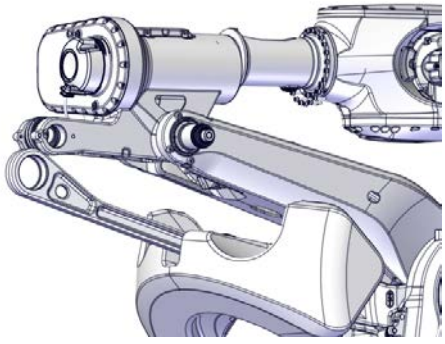
Press tools, parallel rod shaft: 3HAC071354-001

User instructions, parallel rod shaft press tools: 3HAC071354-002

WARNING

Handling the tool incorrectly may cause serious injury.

Read and follow enclosed user instructions for the tool.

	Action	Note
5	Unscrew two of the M10x80 screws, approximately 5 mm, on one side of the parallel rod. Leave the screws on the other side.	This is to be able to remove the parallel rod without problems and to be able to find the correct position of the parallel rod, when refitting it.  xx1500002710
6	Move the parallel rod down and let it rest on the piece of wood, which was put there earlier.	 xx1500001965

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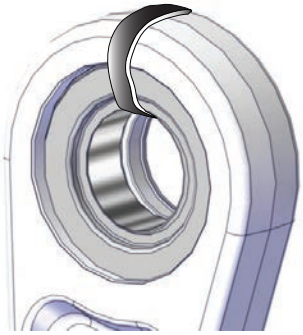
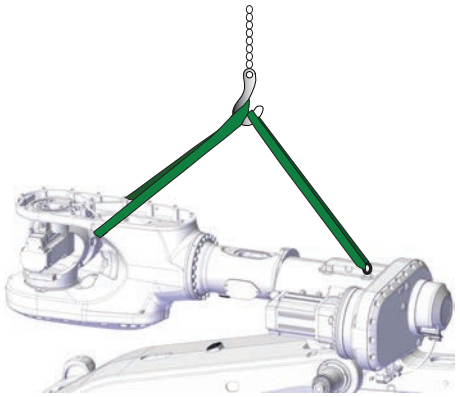
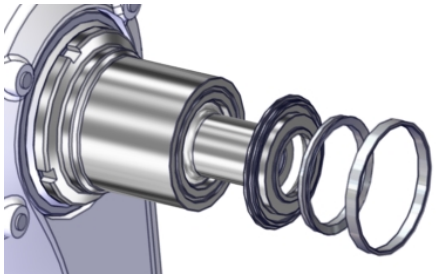
	Action	Note
7	Secure bearing, thrust washer and cover washer with a strap (or similar) to prevent them from dropping out of its position.	Strap  xx1500002716

Removing the upper arm shafts

	Action	Note
1	Verify that the upper arm weight is unloaded by stretched lifting accessories, according to prior procedure.	 xx1500002724
2	Remove the support ring, V-ring and spacer ring from the axis-2 and axis-3 shafts.	 xx2200000925

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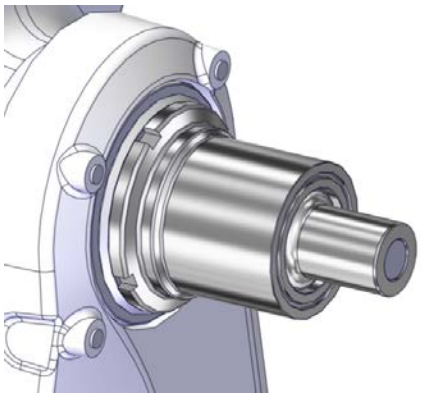
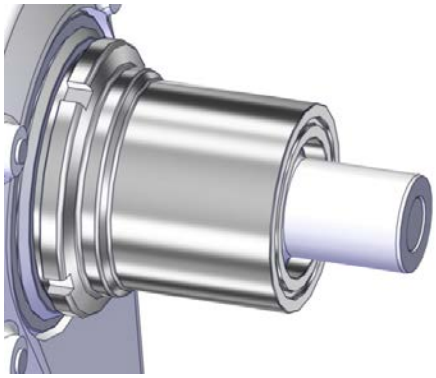
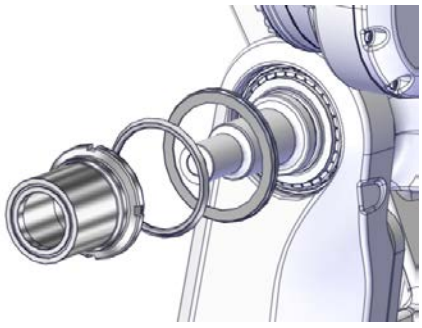
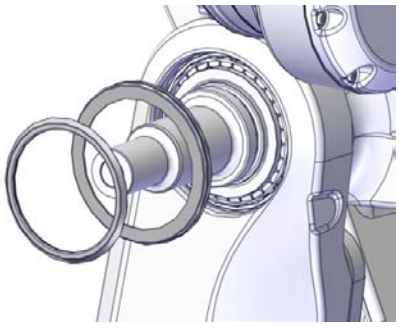
4.6.1 Replacing the upper arm

Continued

	Action	Note
3	Remove grease and other contamination from the axis-2 and axis-3 shaft ends and around the KM nuts, on both sides.	 xx1500002725
4	Use a Sleeve KM nut to release the torque on one of the KM nuts. **Note** Do not remove this KM nut at this point. Only release the torque.	Sleeve KM nut D=152 L=220: 3HAC069154-009  xx1500002726
5	Use the Sleeve KM nut, open and remove the KM nut on the *other side*.	 xx1500002727
6	Remove gamma sealing and sealing ring.	 xx1500002728

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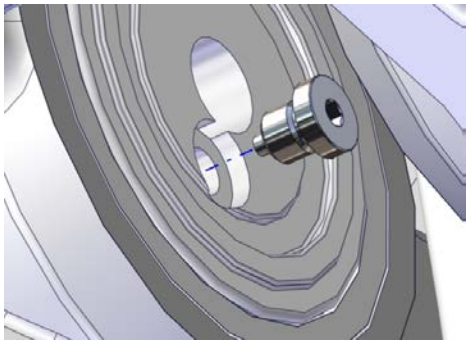
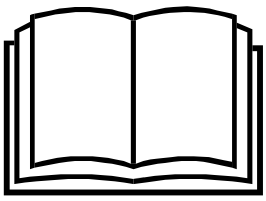
	Action	Note
7	**Note** Continue the removal on the same side until the shaft is removed completely. Leave the other shaft fitted for now!	
8	Remove the magnetic plug and wipe hole and shaft end meticulously clean.	 xx1500003125
9	**CAUTION** The upper arm shaft weighs approximately 19 kg.	


xx0900000813

Go to the user instructions enclosed with the press tool to remove the upper arm shafts.

Press tools, upper arm shaft: 3HAC069154-001

User instructions, upper arm shaft press tools: 3HAC069154-038

WARNING

Handling the tool incorrectly may cause serious injury.

Read and follow enclosed user instructions for the tool.

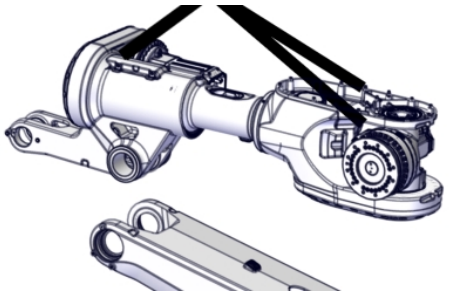
Removing the upper arm

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Make sure that the roundslings are stretched and so that they will carry the weight of the upper arm.	

Continues on next page

4.6.1 Replacing the upper arm

Continued

	Action	Note
3	Lift away the upper arm.	 xx1500002732
4	Put the upper arm down on two pallets.	Pallet (2 pcs)

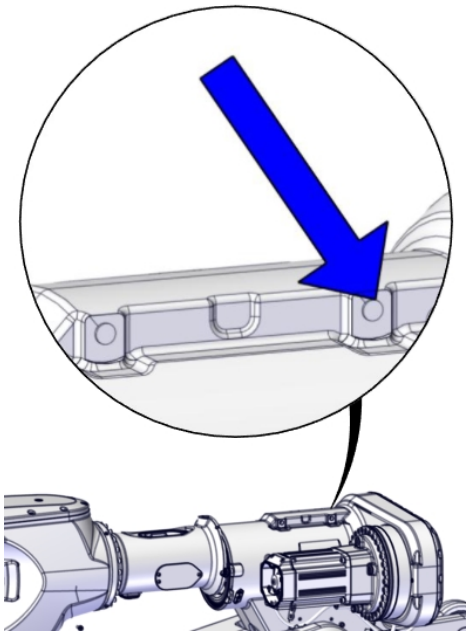
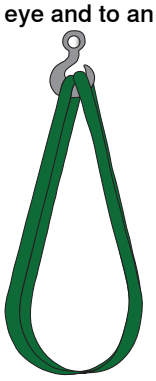
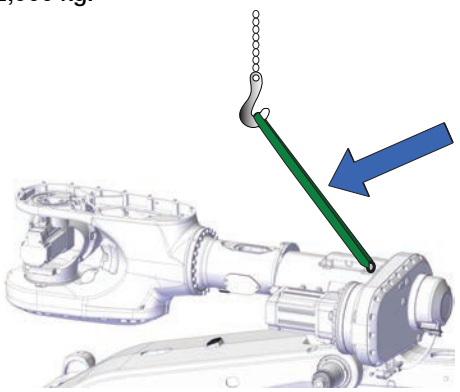
Refitting the upper arm

Use these procedures to refit the upper arm.

Attaching lifting accessories to the upper arm complete

	Action	Note
1	**CAUTION** The complete upper arm weighs 900 kg. All lifting accessories used must be sized accordingly.	
2	If needed, use a Mobile platform ladder (or similar) to attach the lifting accessories. **DANGER** Never use the robot as ladder.	Mobile platform ladder

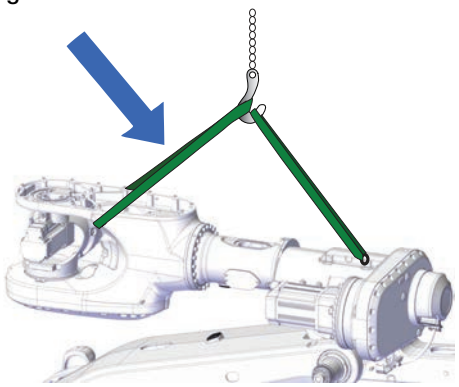
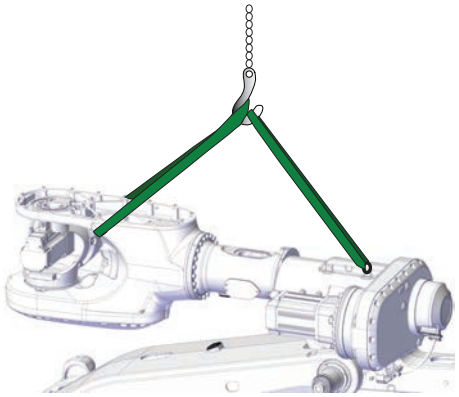
Continues on next page

	Action	Note
3	Remove the plastic plug from the back hole of the arm housing.	 xx1500002712 Lifting eye: 3HAC16131-1 (VLBG M12) Fender washer: Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.
4	Attach a Lifting eye to the hole in the arm housing with a Fender washer underneath.  xx1400002196	
5	Attach a roundsling looped to the Lifting eye and to an overhead crane (or similar).  xx1400002599	Roundsling 2.5 m with lifting capacity: 2,000 kg.[I]  xx1500002713

Continues on next page

4.6.1 Replacing the upper arm

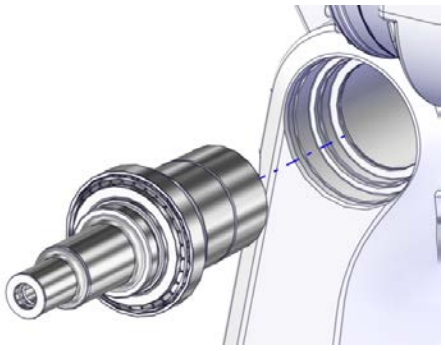
Continued

	Action	Note
6	Attach a roundsling looped to the wrist and to an overhead crane (or similar).	Roundsling 3 m with lifting capacity: 2,000 kg.[i]  xx1500002714
7	Stretch the lifting accessories to take the weight of the upper arm.	 xx1500002724
8	Adjust the lifting accessories, if needed.	

i This is a recommendation according to standard EN 1492. Always conform to local regulations.

Preparations before refitting the upper arm shafts

Make the preparations on both sides of the robot and on both upper arm shafts.

	Action	Note
1	Remove residues of Loctite and other contamination from the shafts and in the holes where the shafts will be refitted.	 xx1500002731

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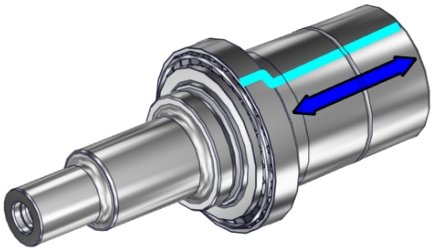
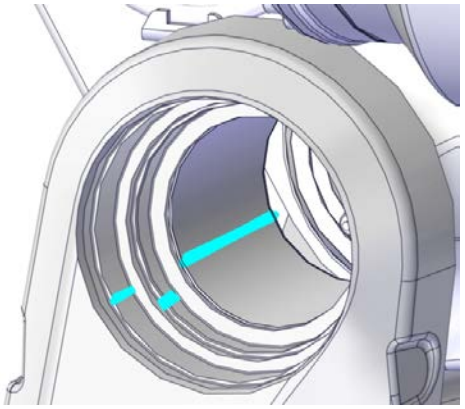
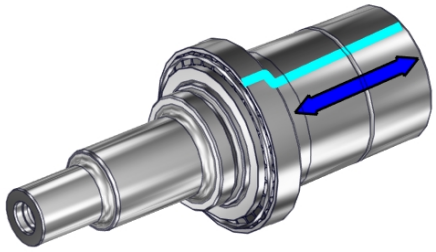
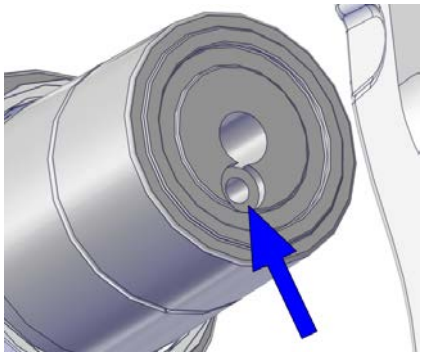
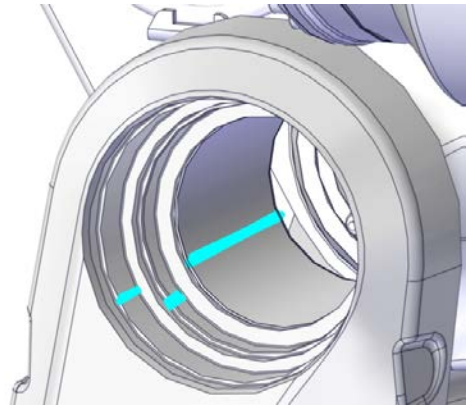
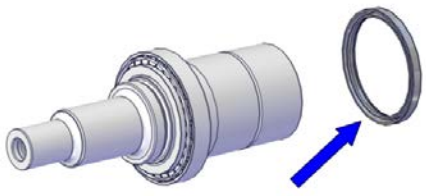
	Action	Note
2	Use a Scotch-brite abrasive cleaning hand pad and rub the contact surfaces on following parts: • contact surfaces on the shafts • contact surfaces in the holes for the shafts, outer ring of bearings and sealing rings.	Scotch-brite abrasive cleaning hand pad  xx1500002749  xx1500002750

Continues on next page

4.6.1 Replacing the upper arm

Continued

	Action	Note
3	Use Isopropanol to wipe clean the surfaces of following parts: • contact surfaces and the glycerin adapter connection on the shaft • contact surfaces in the holes for the shafts, outer ring of bearings and sealing rings. **Note** Do not touch the cleaned surfaces with anything after cleaning.	Isopropanol  xx1500002749  xx1500002979  xx1500002750
4	Inspect the sealing rings and then wipe them clean with Isopropanol. Replace if damaged.	 xx1500002748

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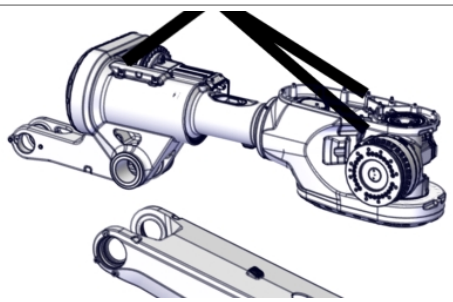
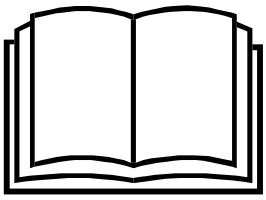
Refitting the upper arm and the upper arm shafts

Note

Start the refitting of the shafts on the axis-2 side!

	Action	Note
1	**CAUTION** The upper arm complete weighs 900 kg. All lifting accessories used must be sized accordingly! **CAUTION** The shaft weighs 19 kg.	
2	Lift the upper arm into mounting position to prepare to fit the upper arm shafts. **Note** Start the refitting of the shafts on the axis-2 side!	 xx1500002732


xx0900000813

Go to the user instructions enclosed with the press tool to refit the sealing rings, the upper arm shafts and the KM nuts.

Press tools, upper arm shaft: 3HAC069154-001

User instructions, upper arm shaft press tools: 3HAC069154-038

WARNING

Handling the tool incorrectly may cause serious injury.

Read and follow enclosed user instructions for the tool.

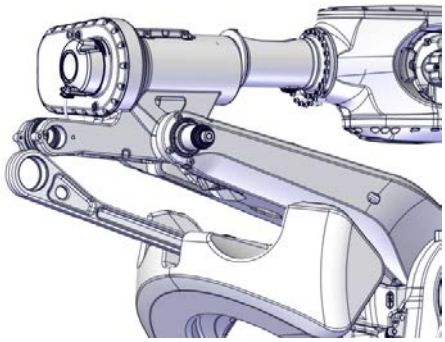
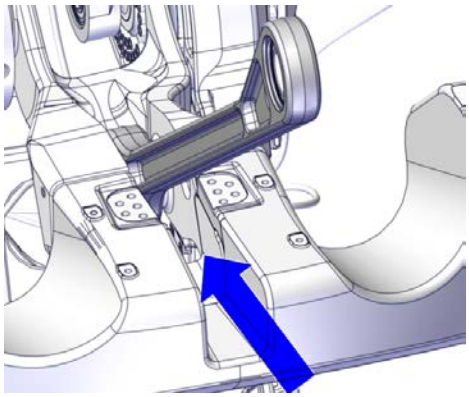
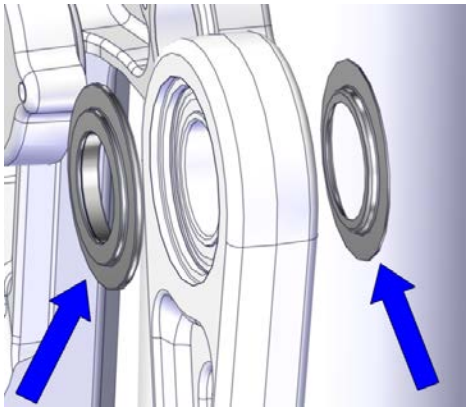
Refitting parallel rod, upper end

	Action	Note
8	**Note** If the parallel rod has been removed from the robot, always start refitting at the lower end!	

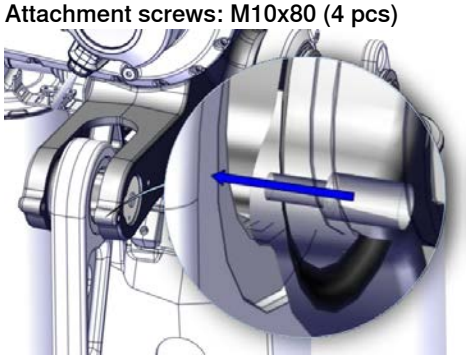
Continues on next page

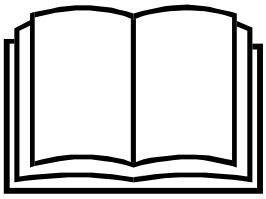
4.6.1 Replacing the upper arm

Continued

	Action	Note
9	Take a firm grip of the parallel rod and lift it up into mounting position.	 xx1500001965
10	Put a piece of wood (or similar) between parallel arm and parallel rod, used as protection to prevent the rod from moving unexpectedly during the procedure.	 xx1500001963
11	Place the thrust washer and cover washer on either side of the bearing and make sure that they are correctly fitted. **Note** Make sure that the washers are on the correct sides of the bearing.	 xx1500001964 **Left side** / **Right side** Thrust washer / Cover washer
12	Unscrew two of the M10x80 screws only on one side of the parallel rod, approximately 5 mm. Leave the screws fastened on the other side. **Note** This is done to be able to refit the parallel rod without problems and to be able to find the correct position of the parallel rod.	

Continues on next page

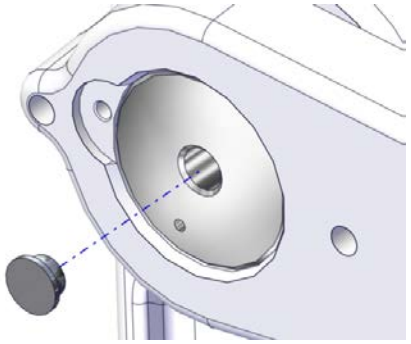
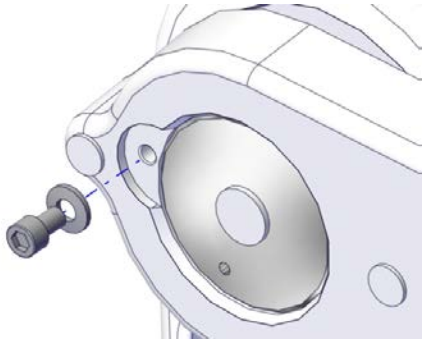
	Action	Note
13	Place the parallel rod into position and reattach the two M10x80 screws against the parallel rod. **Note** This is done to prevent the arm housing from being deformed when pressing the shaft and thereby making it more difficult to press the shaft in or out.	Attachment screws: M10x80 (4 pcs)  xx1500002300


xx0900000813

Go to the user instructions enclosed with the press tool to refit the parallel rod shaft.
Press tools, parallel rod shaft: 3HAC071354-001
User instructions, parallel rod shaft press tools: 3HAC071354-002

WARNING

Handling the tool incorrectly may cause serious injury.
Read and follow enclosed user instructions for the tool.

	Action	Note
14	Refit the protection plug.	 xx1500001967
15	Apply locking liquid on the attachment screw and secure shaft.	Attachment screw: M10x16 8.8 Loctite 243  xx1400002600

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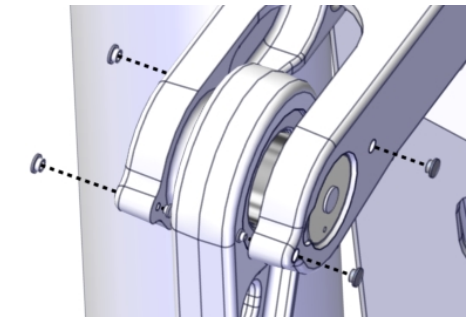
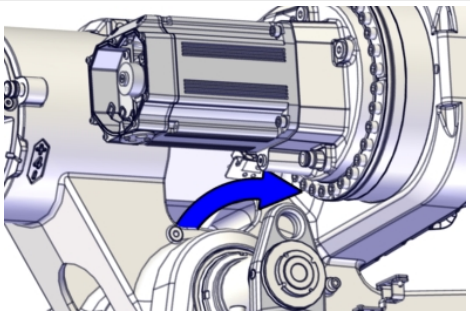
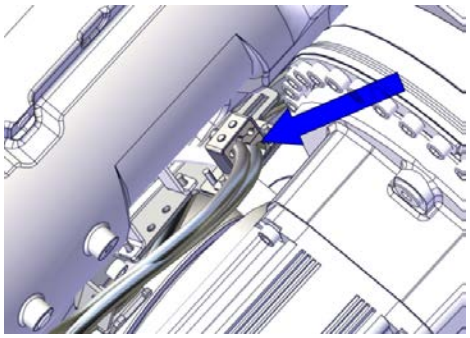
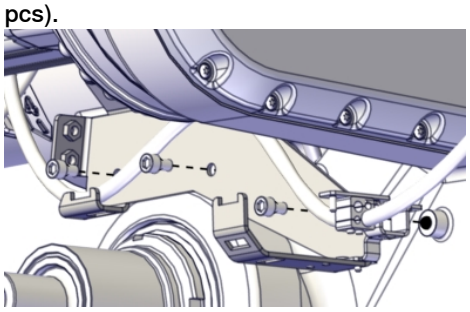
4.6.1 Replacing the upper arm
Continued

	Action	Note
16	Remove the four M10x80 screws and refit the protection plugs (4+4 pcs).	 xx1500001961

Refitting the cable harness in the upper arm

	Action	Note
1	Push the cable harness in through the arm house and out at the axis-4 motor.	 xx2200000928
2	Lift the axis-3 cable bracket into position between axis-4 motor and arm housing and fasten the cable clamp to it with the nuts. Wait to tighten the nuts after the cable bracket is secured.	 xx1500003092
3	Secure the axis-3 cable bracket beneath the arm house with the screws.	Attachment screws: M10x16 8.8-A3F (3 pcs).  xx2200000926

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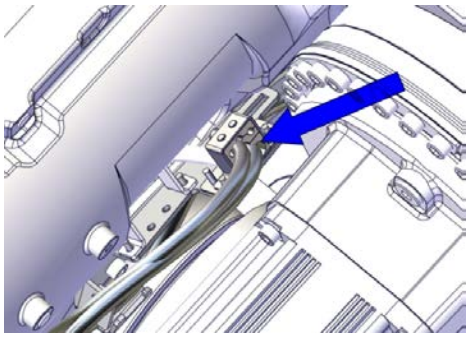
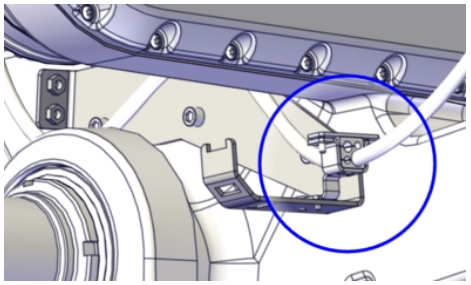
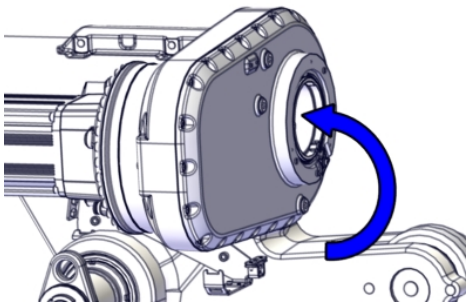
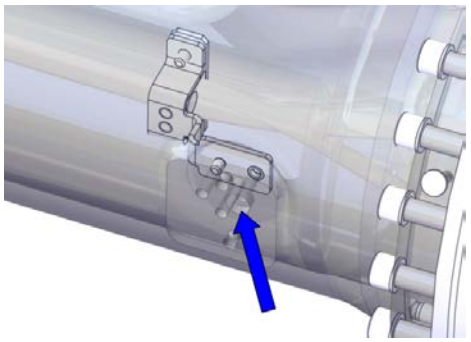
	Action	Note
4	Tighten the cable clamp nuts to secure the cable clamp to the bracket.	 xx1500003092
5	Fit and secure the lower cable clamp to the bracket.	 xx2200000929
6	Push the cable harness in through the upper arm, slightly twisted, and out of the wrist.	 xx2200000930
7	Refit the cable clamp inside the upper arm with a screw from the outside.	 xx1500002720

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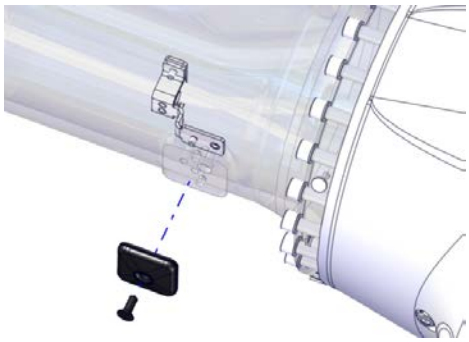
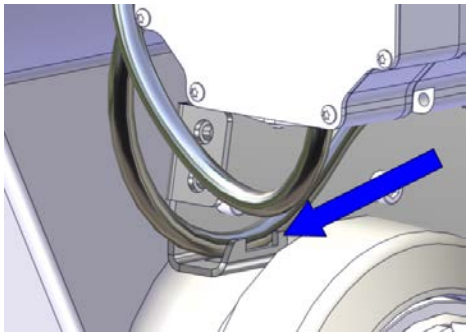
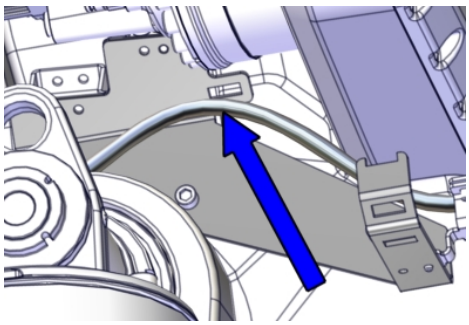
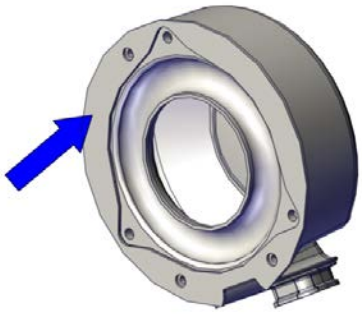
4.6.1 Replacing the upper arm

Continued

	Action	Note
8	Refit the protection cover.	Attachment screw: M8  xx1500002719
9	Secure the cable harness to the axis-3 bracket with cable ties.	Cable tie  xx1500003093  xx2200000932
10	Make sure that the sealing on the cover is correctly fitted. **Note** Replace if damaged. The sealing is covered with adhesive on the side facing the upper arm cover. The three washers are pressed into the holes in the gasket. Make sure all three washers are fitted.	Sealing: 3HAA1001-628  xx1500003094

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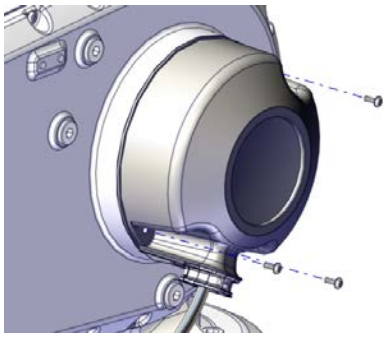
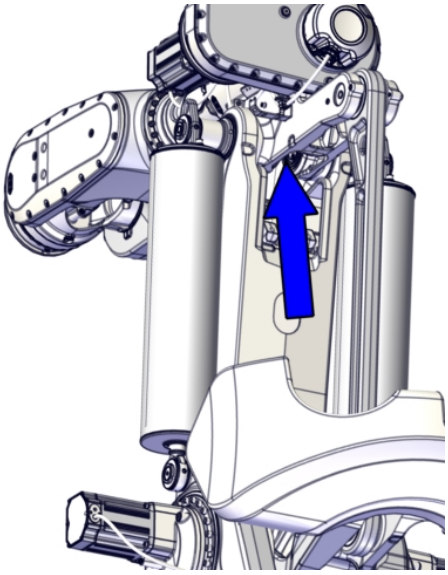
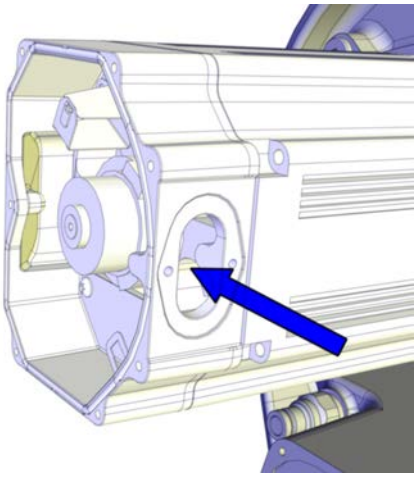
	Action	Note
11	Refit the cover.	 xx1500002722
12	Refit the black cable guide to inside the upper arm attachment by pressing it together and pushing it into place.	 xx2200000939

Connecting the axis-4 motor cables

	Action	Note
1	Push the motor cables through the cable gland opening.	 xx1300000738

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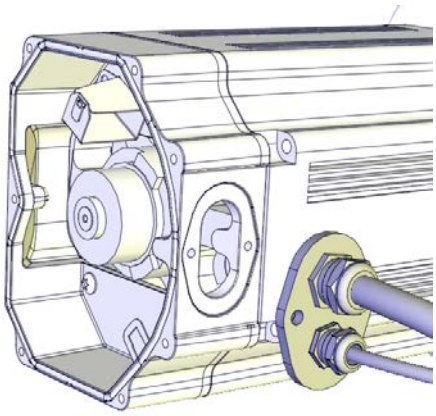
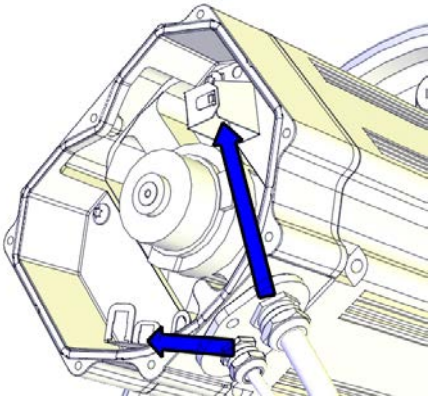
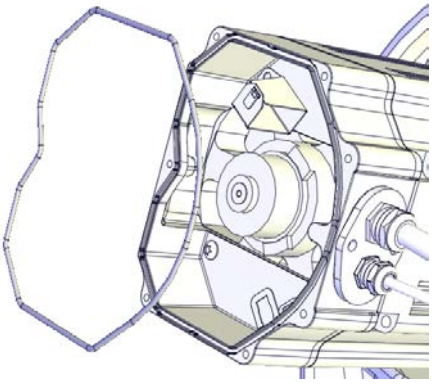
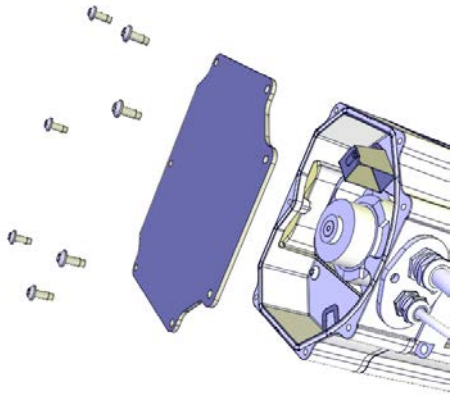
4.6.1 Replacing the upper arm

Continued

	Action	Note
2	Refit the cable gland cover. **Note** Replace the gasket if damaged.	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-002  xx1200001070
5	Wipe clean o-ring and o-ring groove.	

Continues on next page

	Action	Note
6	Refit the o-ring. **Tip** Lubricate the o-ring with some grease for a better fitting in the groove.	
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8	Refit the motor cover with it's attachment screws. **Note** Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged. **Note** Make sure the o-ring is undamaged and properly fitted.	Attachment screws: M5x12 8.8 (7 pcs)  xx1200001135
9	Make sure that the covers are tightly sealed.	

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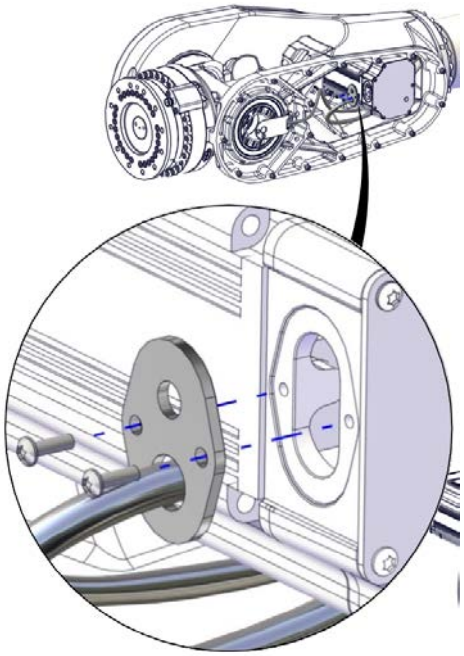
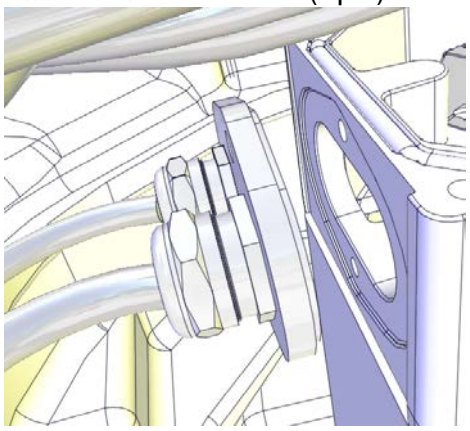
4.6.1 Replacing the upper arm

Continued

Connecting the axis-5 motor cables

	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1500002717
2	Refit the cable gland cover. **Note** Replace the gasket if damaged.	Attachment screws: M5x16 (2 pcs)  xx1200001016

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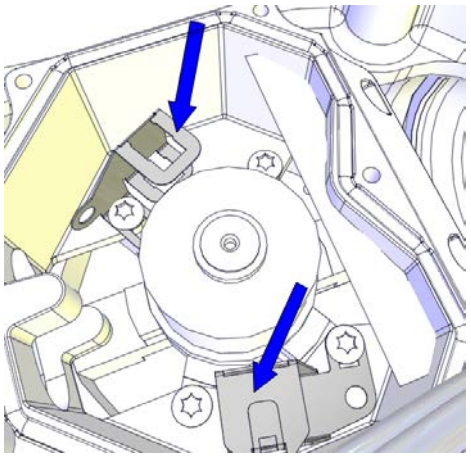
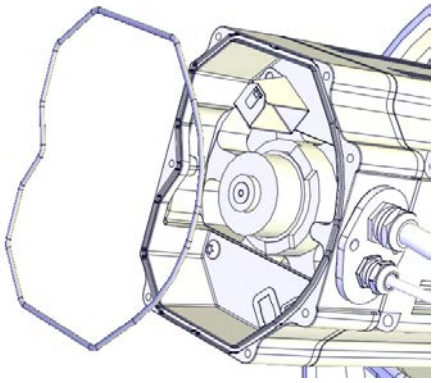
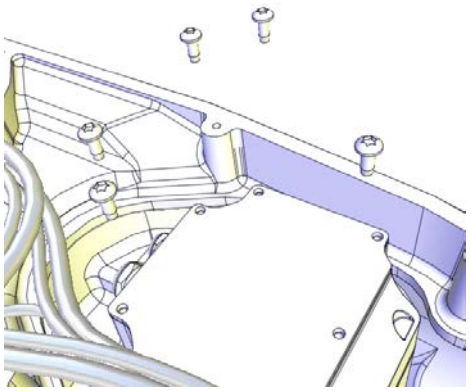
	Action	Note
3	Connect the connectors. Connect in accordance with the markings on the connectors.	 xx1200001015
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring: 3HAC054692-002  xx1200001070
5	**CAUTION** When refitting the motor cover, make sure that none of the cables inside will be damaged.	
6	Refit the motor cover. **Note** Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged. **Note** Make sure the o-ring is properly fitted and undamaged.	Attachment screws: M5x12 8.8 (7 pcs)  xx1200001013

Continues on next page

4.6.1 Replacing the upper arm

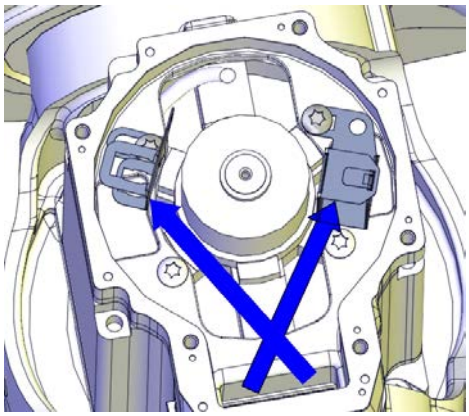
Continued

	Action	Note
7	Make sure that the cover is tightly sealed.	

Connecting the axis-6 motor cables - Step 1

Note

Since this procedure requires the axis-5 to be put in -90° position, the connecting and refitting of the axis-6 motor cables must be done in two steps. This procedure describes the first of these steps.

	Action	Note
1	With axis-5 in -90° position, use caution and temporarily connect the axis-6 motor cables outside the motor.	
2	Reconnect the connectors to the axis-6 motor.	 xx1300000488
3	**Note** Do not refit anything else of the axis-6 motor cables at this point. The remaining refitting must wait until the axis-5 has been moved into +90° position. Axis-5 must be in +90° position when the carrier and cable bracket are refitted. If not, the spiral of the cable harness will be in the wrong position and it will be damaged when axis-5 is moving.	

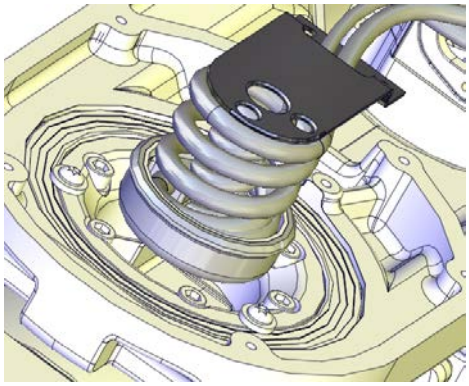
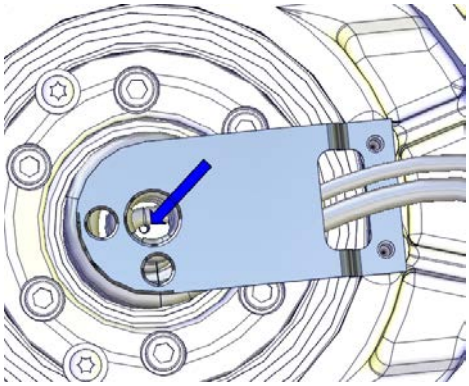
Robot position when refitting the axis-6 motor cables

	Action	Note
1	Turn on the power, use caution and jog axis-5 slowly to +90° position. **CAUTION** Make sure not to touch or damage any of the axis-6 motor cables.	

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 robot working area.	
3	Disconnect the axis-6 motor cables.	

Connecting the axis-6 motor cables - Step 2

	Action	Note
1	Make sure that the axis 5 now is in +90° position before continuing. If not, the cable spiral will be attached in the wrong position and the result will be damage to the cable harness. **CAUTION** Make sure that the cable spiral is not twisted an extra revolution. The result will be damage to the cable harness.	
2	Use caution and push the carrier into position.	 xx1300001113
3	Secure the carrier with the M4 screw. **Note** The screw is located at the bottom of the carrier. **Tip** The attachment screw that secure the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.	Attachment screw: M4x10  xx1300000485

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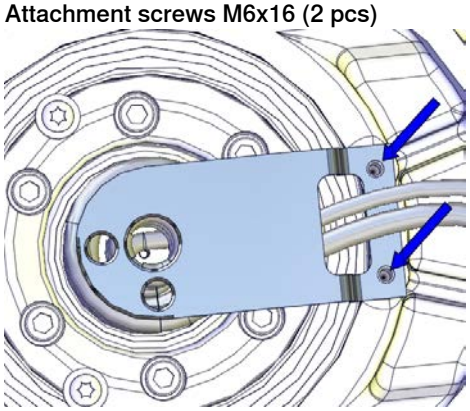
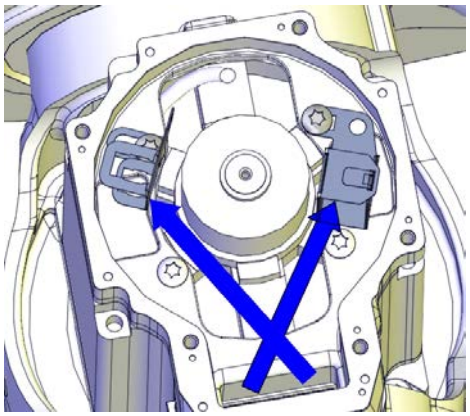
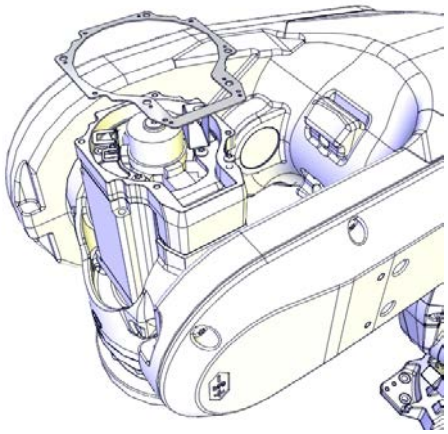
4.6.1 Replacing the upper arm

Continued

	Action	Note
4	Secure the cable bracket with its attachment screws.	Attachment screws M6x16 (2 pcs)  xx1300000484
5	Inspect the connectors to the axis-6 motor and make sure they are connected. **Note** The resolver cable shall be placed underneath the motor cable.	 xx1300000488
6	Inspect the gasket. **Note** Replace if damaged.	Gasket, 3HAC033489-001  xx1200001095

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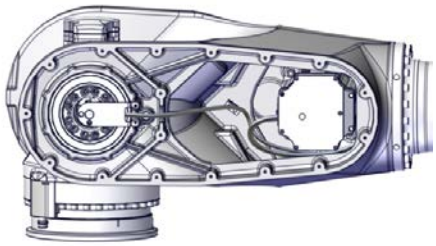
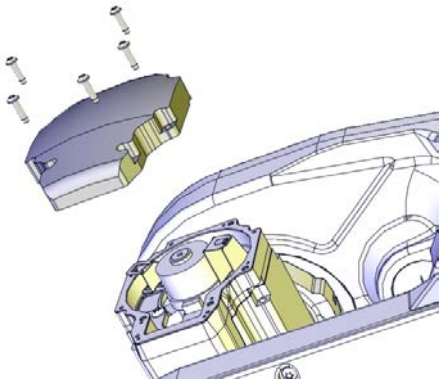
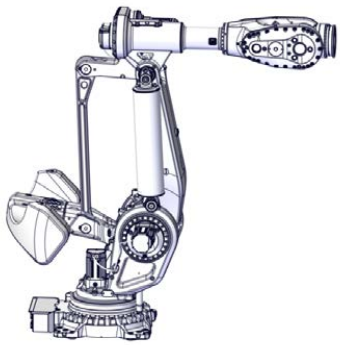
	Action	Note
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	 xx1600000047
8	Refit the motor cover.	Attachment screws: M5x20 (5 pcs)  xx1200001080

Robot position when replacing the balancing device

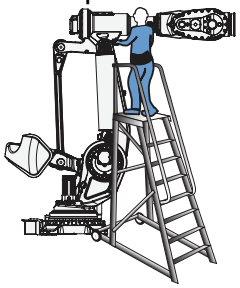
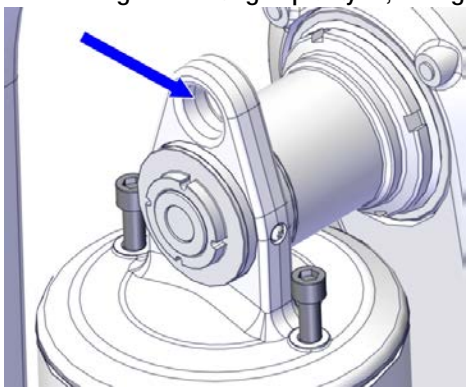
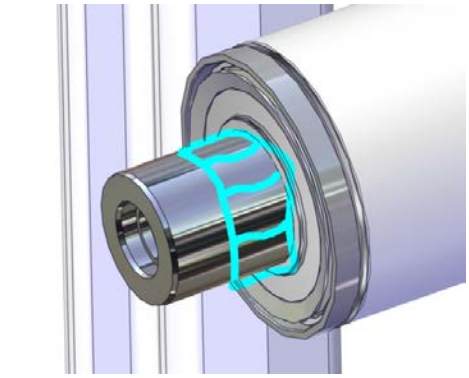
	Action	Note
1	Jog the robot to calibration position.	 xx1500002310
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Continues on next page

4.6.1 Replacing the upper arm

Continued

Preparations before refitting the balancing device

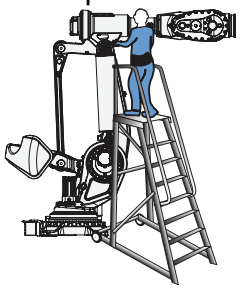
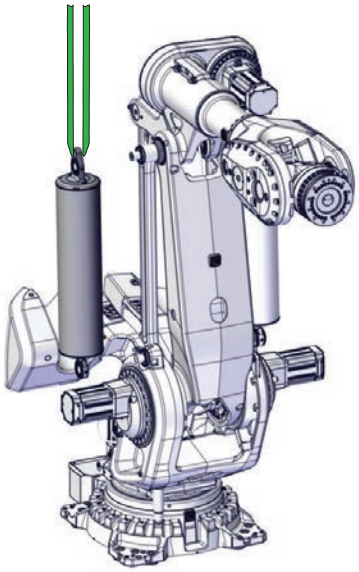
	Action	Note
1	**CAUTION** The balancing device weighs 200 kg. All lifting accessories used must be sized accordingly!	
2	Use a Mobile platform ladder (or similar), to reach the upper end of the balancing device. **DANGER** Do not use the robot as ladder.	Mobile platform ladder  xx1500001985
3	Attach a roundsling to the lifting hole on top of the balancing device and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg  xx1500001983
4	Use caution and lift the balancing device up an let it hang in the lifting accessories.	
5	Wipe clean the contact surfaces.	
6	Apply some grease on shafts and in bearing holes. **Note** Do not apply any grease on the threads for the KM-nut.	Grease  xx1500002304

Continues on next page

	Action	Note
7	If needed, fit bearings into the balancing device ears, according to *Replacing the balancing device bearings on page 420*.	

Refitting the balancing devices

Use this procedure to refit both balancing devices.

	Action	Note
1	Use a Mobile platform ladder (or similar), to reach the upper end of the balancing device. **DANGER** Do not use the robot as ladder.	Mobile platform ladder  xx1500001985
2	Use caution and raise the balancing device into mounting position.	 xx1500002735

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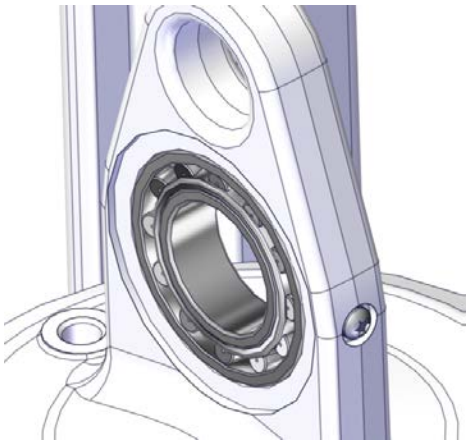
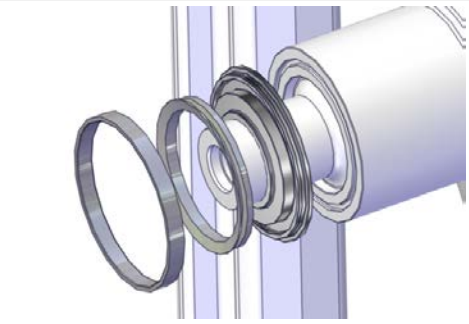
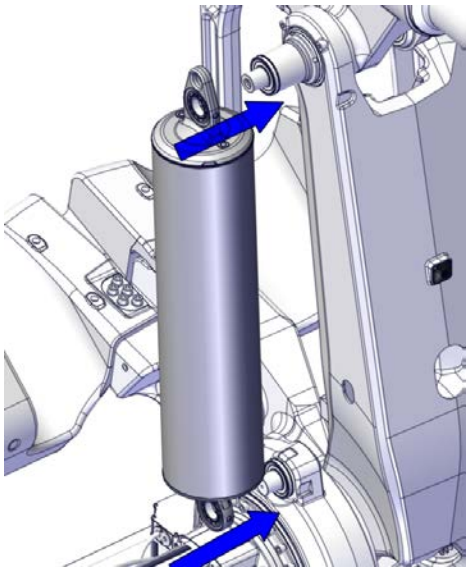
4.6.1 Replacing the upper arm

Continued

	Action	Note
3	**Note** Make sure the bearings are axially centered in the balancing device ears, before putting them on the shafts.	 xx1500002306
4	Make sure that the spacer ring with V-ring and the support ring are placed correctly on the shafts before the balancing device is put on the shafts.	 xx1500001975
5	Use caution and put the balancing device onto upper and lower shafts. Press the upper and lower part onto the shafts using the press tool.	Press tools, balancing device upper end: 3HAC057130-015 Press tools, balancing device lower end: 3HAC057130-015  xx1500002305

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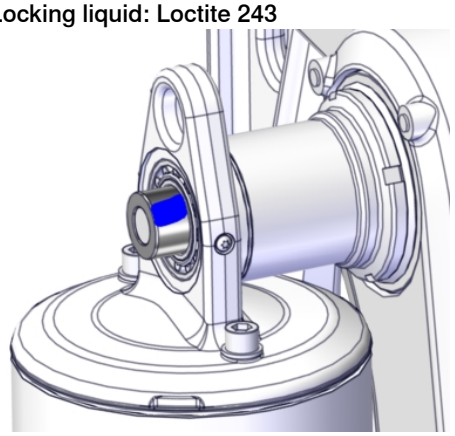
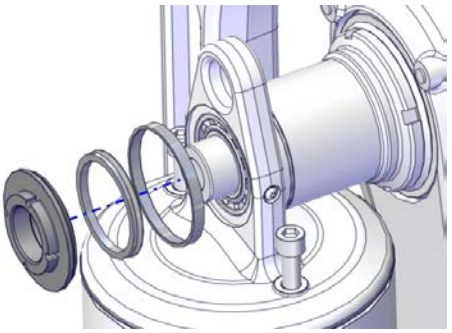
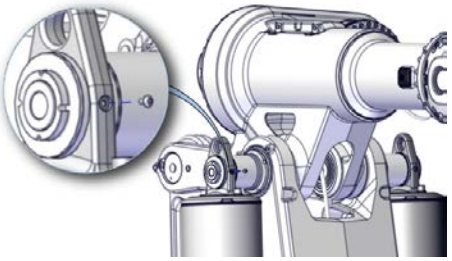
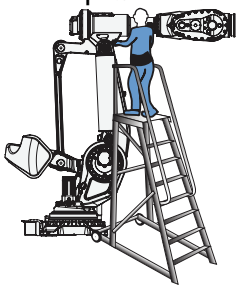
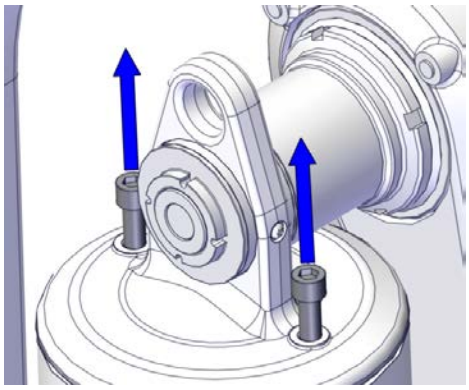
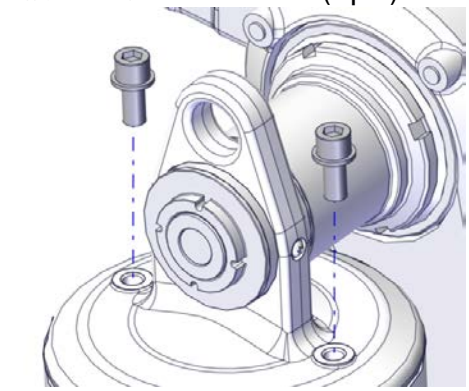
	Action	Note
6	Apply locking liquid on the threads of the lock nuts.	Locking liquid: Loctite 243  xx1900001235
7	Inspect that the bearings are axially centered in the balancing device ears.	
8	Secure the balancing device with the two lock nuts, using a sleeve. **Note** Make sure that the V-ring and support ring are fitted correctly.	Tightening torque: 120 Nm Sleeve KM nut M10: 3HAC071313-001  xx1500001973
9	Remove the lifting accessories.	
10	Remove the M6x10 torx pan head screws on either side of the balancing device bearings. Lubricate each bearing with 30 gram of bearing grease.	Bearing grease: Tribol GR 100-2 PD  xx1500002055
11	Wipe away surplus grease and refit the M6x10 screws.	
12	If both balancing devices shall be refitted, refit the other in the same way.	

Continues on next page

4.6.1 Replacing the upper arm

Continued

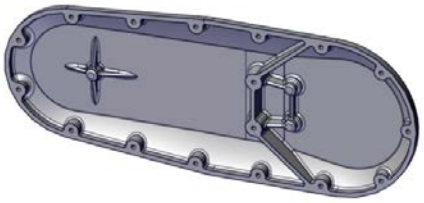
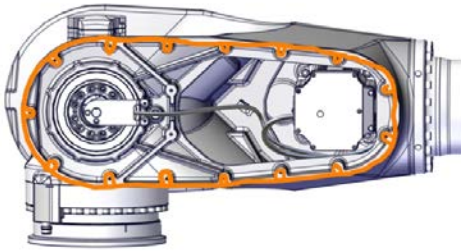
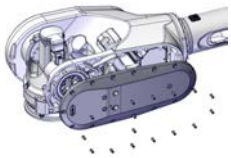
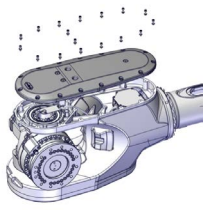
Restoring the pressure of the balancing device

	Action	Note
1	Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device. **DANGER** Do not use the robot as ladder.	Mobile platform ladder  xx1500001985
2	Restore the pressure of the balancing device by unscrewing the two M16x80 screws alternately little by little.	 xx1500002308
3	Remove the screws.	
4	Refit the M16x35 screws in the holes on top of the balancing device.	Attachment screws: M16x35 (2 pcs)  xx1500001971

Concluding procedure

	Action	Note
1	Clean the wrist cover from residues of sealant and other contamination.	

Continues on next page

	Action	Note
2	Make sure the contact surface on the wrist cover is undamaged.	 xx1600000046
3	Apply flange sealant (Loctite 574) on the wrist cover flange.	Loctite 574  xx1600000048
4	Make sure that the cable harness will be placed in a way that it will not be damaged when the cover is fitted.	
5	Refit the wrist cover and tighten all screws alternately and repeat once. **Note** The position of axis-4 depends on the on-going procedure.	Attachment screws: M8x25 8.8 (17 pcs) Tightening torque: 24 Nm  xx1500003100  xx1500002330
6	Recalibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 688*. General calibration information is included in section *Calibration on page 675*.

Continues on next page

4.6.1 Replacing the upper arm

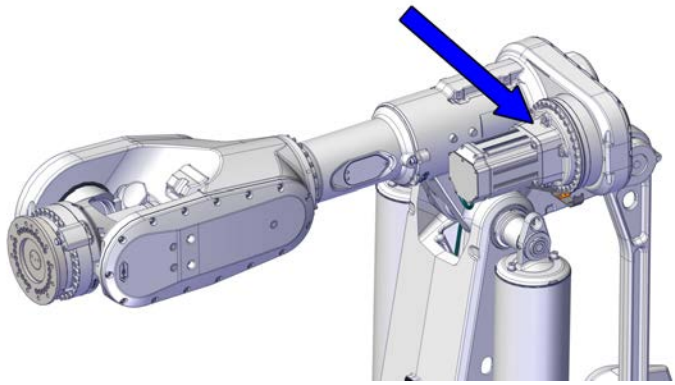
Continued

	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 97*.	

4.6.2 Replacing the axis-4 motor flange

Location of the axis-4 motor flange

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



xx2400000677

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note
Motor flange	3HAC048254-006 Graphite White 3HAC048254-007 ABB Orange	

Required tools and equipment

Equipment, etc.	Article number	Note
Brake release tool	3HAC081310-001	Used to release the motor brakes. User instructions are enclosed with the tool. Alternative tool: 24 VDC power supply
Removal tool 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	3HAC13056-2	Always use guide pins in pairs.
Guide pin, M12x200	3HAC13056-3	Always use guide pins in pairs.
Lifting accessory, motor	3HAC15534-1	Lifting instruction 3HAC15640-2 enclosed.
Rotation tool	3HAC7887-1	Used to rotate the motor pinion.

Continues on next page

4.6.2 Replacing the axis-4 motor flange
Continued

Equipment, etc.	Article number	Note
Removal tool M14	3HAC047108-001	Used to push out the motor if necessary. Always use removal tools in pairs.
Hub tool	3HAC071355-001	Used for removal and refitting of the hub.
Leak-down tester	-	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumables

Consumable	Article number	Note
Grease	3HAC063069-001	Castrol Molub. Alloy 777-1 NG, 5 ml. To be used on hub splines to prevent from fretting corrosion.
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)
Flange sealant	-	Loctite 574 (or equivalent)

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 689*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Continues on next page

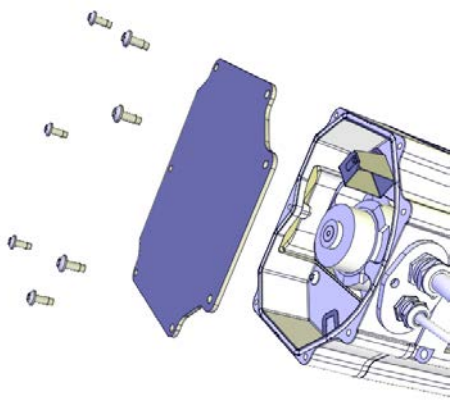
Removing the motor flange

Use these procedures to remove the motor flange.

Preparations before removing the motor flange

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Jog the robot to the most comfortable position for removing the axis-4 motor flange.	
3	Jog axis 4 to +90°.	
4	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
5	Remove any tool or other equipment fitted to the turning disk.	
6	Start draining the oil in the axis-4 primary and secondary gearboxes.	See *Draining the axis-4 primary gearbox on page 154*.

Disconnecting the 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	Unscrew the attachment screws with washers and remove the motor cover.	 xx1200001135

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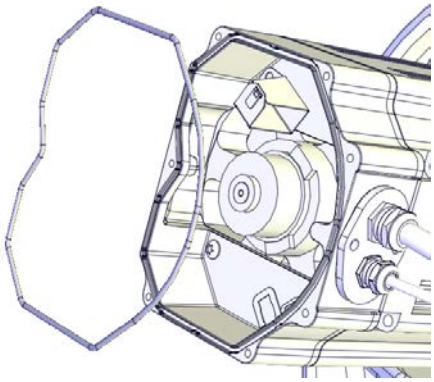
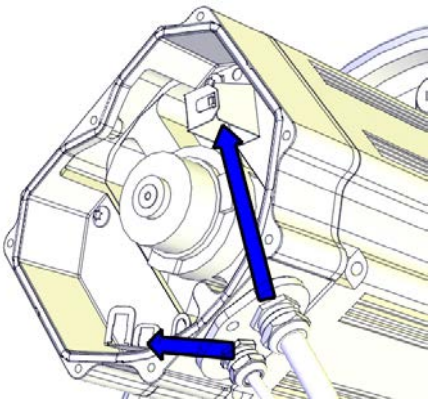
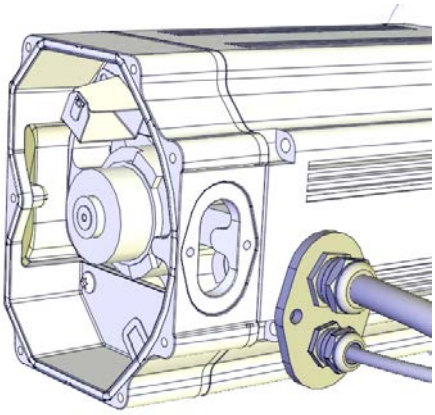
4.6.2 Replacing the axis-4 motor flange

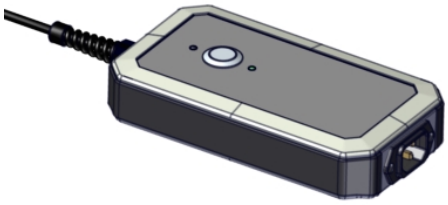
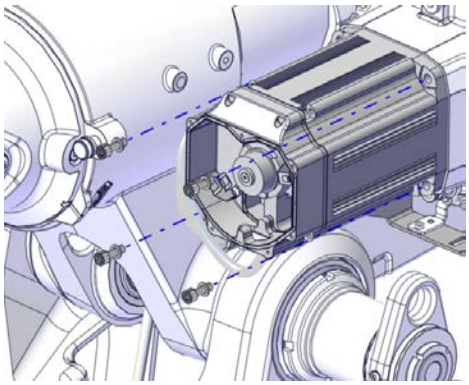
Continued

	Action	Note
3	Make sure the o-ring is present.	 xx1200001070
4	Disconnect the motor cables.	 xx1200001066
5	Remove the cable gland cover. Inspect the gasket. **Note** Replace if damaged. **Tip** Make a note in which direction the cable exit hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.	 xx1200001067
6	Use caution and pull out the motor cables.	

Removing the axis-4 motor

	Action	Note
1	**CAUTION** Use caution when releasing the brakes! Axis-4 can move unexpectedly, depending on the position of axis-5!	

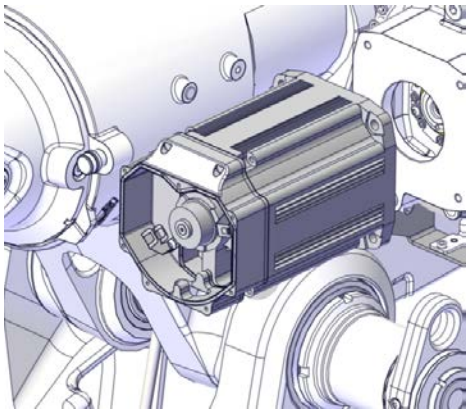
Continues on next page

	Action	Note
2	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 R2.MP4 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP4: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
3	Unscrew the attachment screws with washers, that secure the motor.	 xx1600000064
4	Attach two guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
5	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
6	Press the motor out of position by fitting the removal tool in the remaining attachment holes for the motor.	Removal tool M12: 3HAC14631-1 Always use removal tools in pairs.
7	**CAUTION** The motor weighs 27 kg. All lifting accessories used must be sized accordingly.	

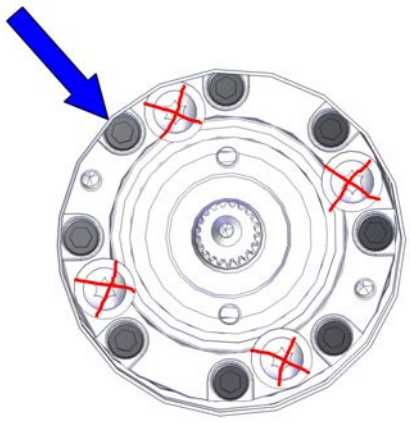
Continues on next page

4.6.2 Replacing the axis-4 motor flange

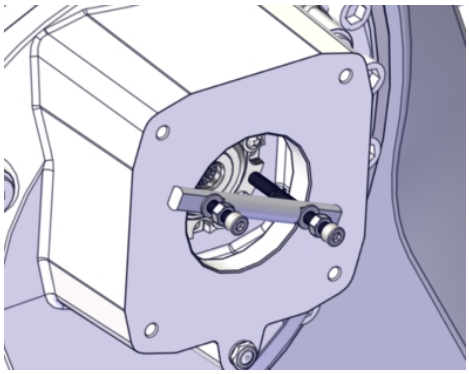
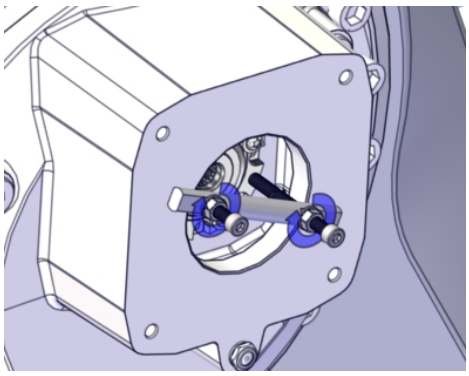
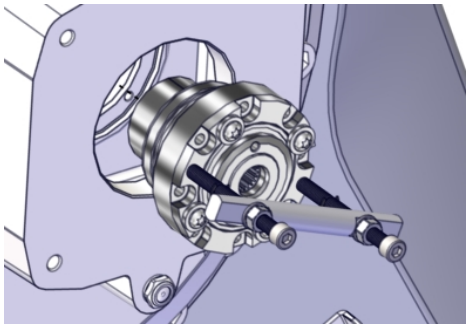
Continued

	Action	Note
8	Attach the lifting accessories to the motor.	Lifting accessory, motor
9	Use caution and remove the motor by lifting it straight out. Make sure the pinion is not damaged.	 xx1600000065
10	Disconnect the brake release tool / 24 VDC power supply.	

Removing the hub

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the M6x30 hex socket head cap screws that secure the hub. **Note** Do not remove the M6x16 torx pan head screws.	 xx1500002038
3	**CAUTION** Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	

Continues on next page

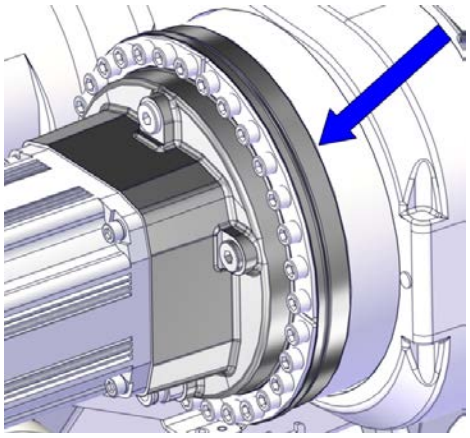
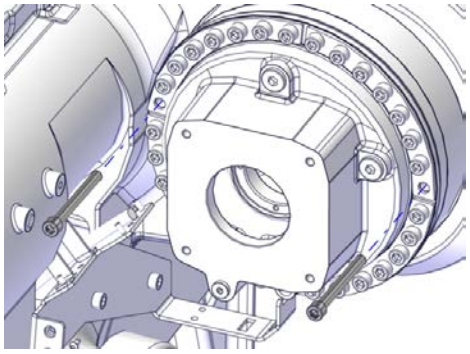
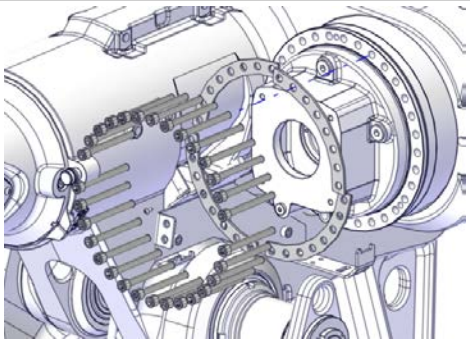
	Action	Note
4	Fit the two threaded rods of the hub tool into the attachment holes in the hub.	Hub tool: 3HAC071355-001  xx2000001379
5	Alternately thread the nuts clockwise on the two rods to pull out the hub from the gear.	 xx2000001380
6	Lift out the hub carefully.	 xx2000001381
7	Cover the hole to avoid getting debris into the gearbox during remaining service work.	

Continues on next page

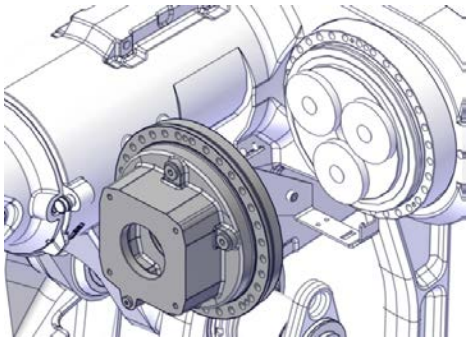
4.6.2 Replacing the axis-4 motor flange

Continued

Removing the motor flange

	Action	Note
1	Cut the paint and Sikaflex with a knife in the slot between motor flange and gearbox.	 xx1600000072
2	Remove two attachment screws in opposite holes.	 xx1500002993
3	Attach guide pins in the holes. **Tip** Apply some grease on the guide pins for a better fitting.	Guide pins: 3HAC13056-2 M12x150 mm Guide pins: 3HAC13056-3 M12x200 mm
4	Remove the remaining attachment screws and the six-hole washers (4 pcs).	 xx1500002994
5	**Note** There will be some oil spill when the motor cover is removed. Put some paper (or similar) to absorb the surplus oil.	

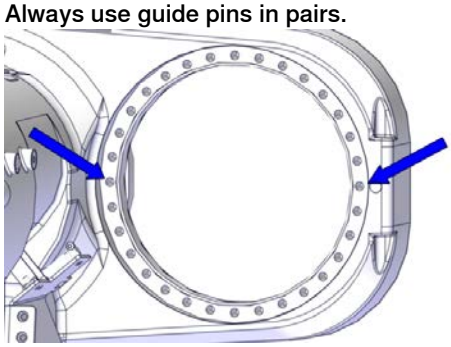
Continues on next page

	Action	Note
6	Use caution and remove the motor flange out from the guide pins.	 xx1500002995

Refitting the motor flange

Use these procedures to refit the motor flange.

Preparations before refitting the motor flange

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Attach guide pins in opposite holes. **Tip** Put some grease on the guide pins for a better fitting.	Guide pin, M12x150, 3HAC13056-2 Guide pin, M12x200, 3HAC13056-3 Always use guide pins in pairs.  xx1500002998

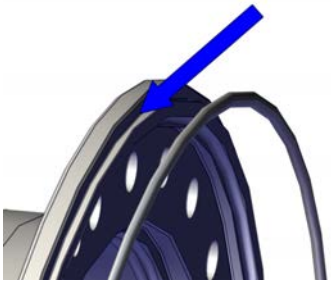
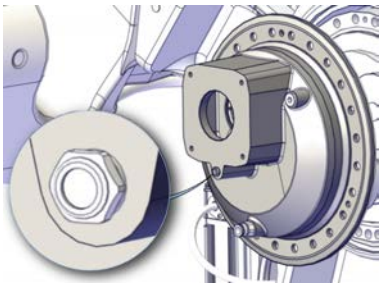
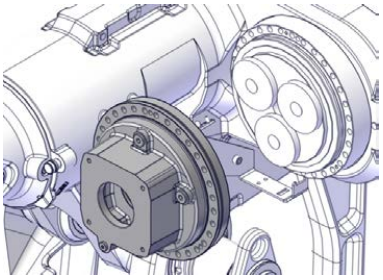
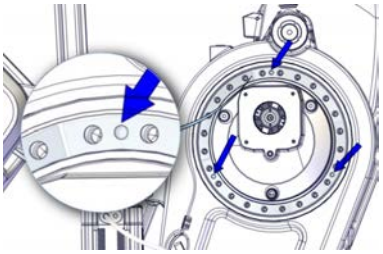
Refitting the motor flange

	Action	Note
1	Clean the contact surfaces on gearbox and motor flange.	

Continues on next page

4.6.2 Replacing the axis-4 motor flange

Continued

	Action	Note
2	Clean o-ring and o-ring groove on motor flange.	 xx1500003074
3	Inspect the o-ring. **Note** Replace if damaged.	
4	Put some grease on the o-ring and fit it into its groove.	
5	Make sure the oil inspection glass is facing at six o'clock before lifting the motor flange onto the guide pins.	 xx1500003075
6	Lift the motor flange onto the guide pins.	 xx1500002995
7	Make sure the o-ring is in position and slide the motor flange into position.	
8	**Note** When the four six-hole washers are fitted, make sure that the three holes in the gearbox are covered.	 xx1600000068

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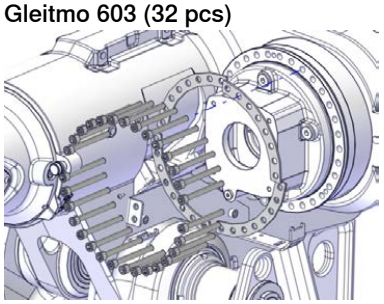
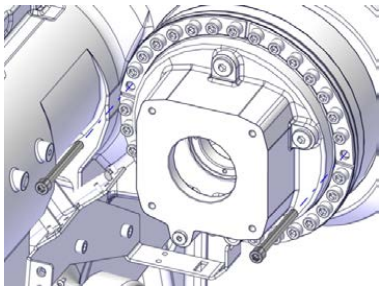
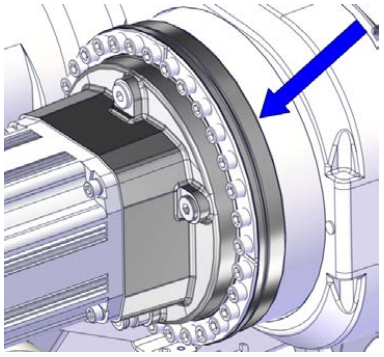
	Action	Note
9	Attach 30 of the 32 attachment screws with the four six-hole washers.	Attachment screws: M12x110 12.9 Gleitmo 603 (32 pcs)  xx1500002994
10	Remove the guide pins and fit the remaining screws.	 xx1500002993
11	Apply Sikaflex in the slot between motor flange and gearbox.	 xx1600000072

Securing the motor flange together with gearbox

	Action	Note
1	Secure motor flange together with the axis-4 primary gearbox.	Tightening torque: 120 Nm

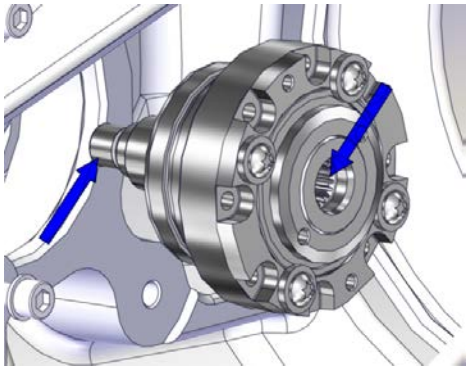
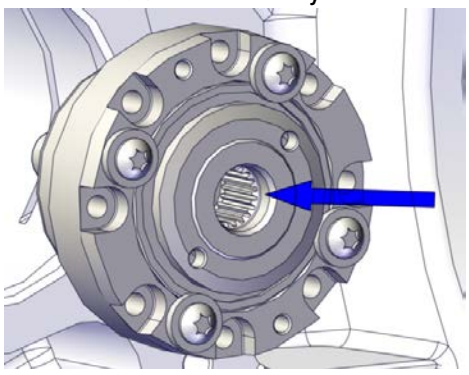
Preparations before refitting the hub

	Action	Note
1	Wipe the hub clean.	
2	Inspect the hole where the hub shall be refitted. Wipe clean if needed.	

Continues on next page

4.6.2 Replacing the axis-4 motor flange

Continued

	Action	Note
3	Make sure the o-ring on the hub is undamaged. **Note** Replace if damaged.	 xx1500002039
4	Apply some grease on the o-ring for a better fitting.	
5	Examine the pinion and the splines in the hub for damages.	 xx1500002082
6	Make sure that there is enough grease on the splines before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346

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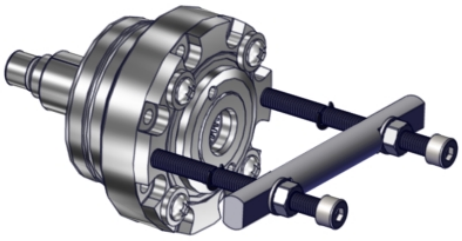
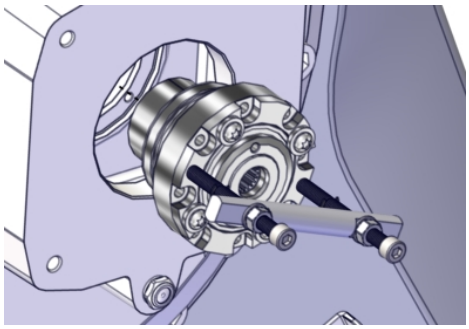
Refitting the hub

	Action	Note
1	Fit the hub tool.	Hub tool: 3HAC071355-001  xx2000001377
2	**CAUTION** Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	
3	Lift the hub to the gear, and mate the pinon carefully into the gear.	 xx2000001381
4	Remove the hub tool and fit the attachment screws for the hub. Apply locking liquid (Loctite 2400 (or equivalent Loctite 243)) on the screws. **Note** The number of attachment screws differ depending on gearbox.	Attachment screws: M6x30 12.9. Loctite 2400 (or equivalent Loctite 243) Quantity: • Axis-1 = 6 pcs • Axis-2 = 8 pcs • Axis-3 = 8 pcs • Axis-4 = 4 pcs • Axis-5 = 6 pcs • Axis-6 = 4 pcs
5	Secure the hub.	Tightening torque: 14 Nm.

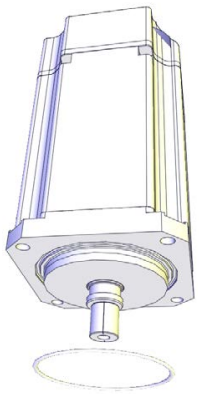
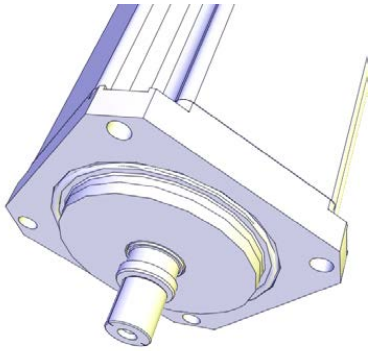
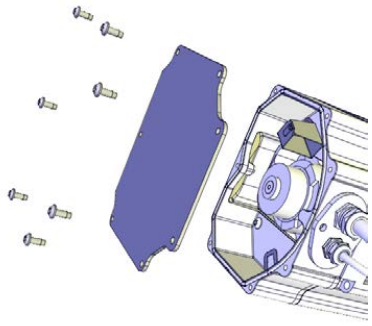
Preparations before refitting the axis-4 motor

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

Continues on next page

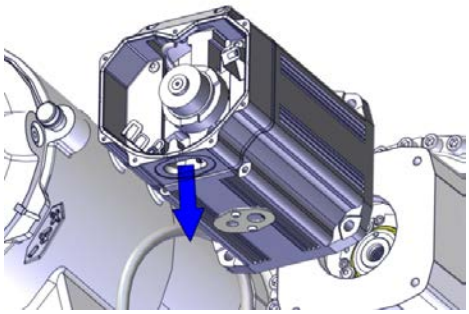
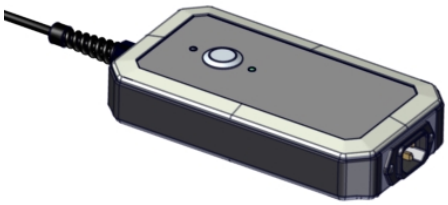
4.6.2 Replacing the axis-4 motor flange

Continued

	Action	Note
2	Remove old paint residues and other contamination from the contact surfaces on both motor and gearbox.	
3	Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
5	Make sure the o-ring is seated in the groove. **Tip** Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020
6	If the motor is a new spare part, remove the cover.	 xx1200001135

Continues on next page

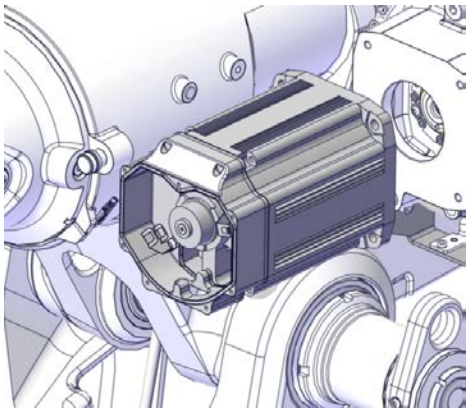
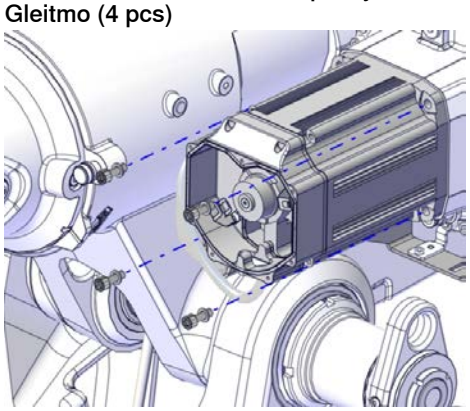
Securing the axis-4 motor

	Action	Note
1	Apply two guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
2	Put the motor onto the guide pins.	
3	**Note** Make sure the cable exit hole are turned the correct way.	 xx1600000066
4	**CAUTION** The motor weighs 27 kg. All lifting accessories used must be sized accordingly.	
5	Apply the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool: 3HAC7887-1
6	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 R2.MP4 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP4: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
7	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

Continues on next page

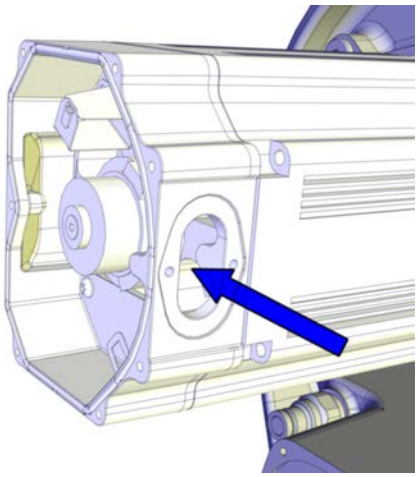
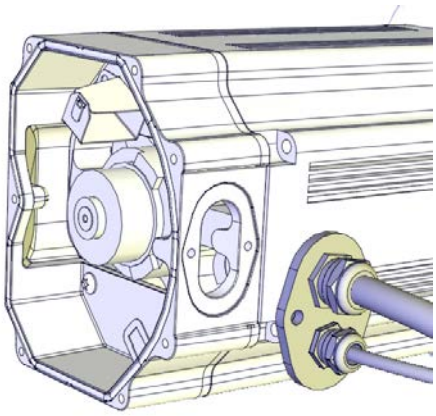
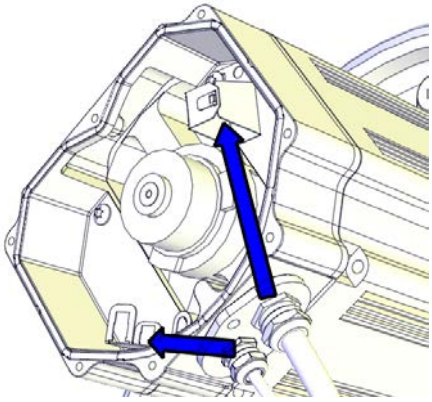
4.6.2 Replacing the axis-4 motor flange

Continued

	Action	Note
8	Use caution and push the motor in position while at the same time the motor pinion is slightly rotated. • 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.	 xx1600000065
9	Remove the guide pins.	
10	Secure the motor with its attachment screws and washers.	Tightening torque: 50 Nm. Screw dimension: M10x30 quality 12.9 Gleitmo (4 pcs)  xx1600000064
11	Perform a leak-down test.	See *Performing a leak-down test on page 187*.
12	Disconnect the brake release tool / 24 VDC power supply.	

Continues on next page

Connecting the axis-4 motor cables

	Action	Note
1	Push the motor cables through the cable gland opening.	 xx1300000738
2	Refit the cable gland cover. **Note** Replace the gasket if damaged.	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066

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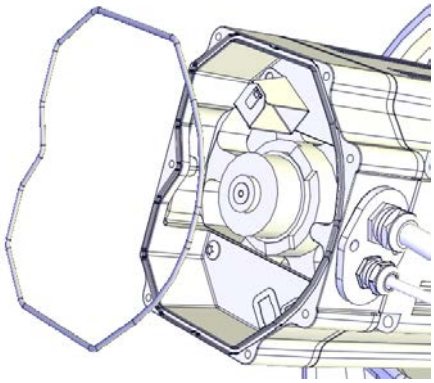
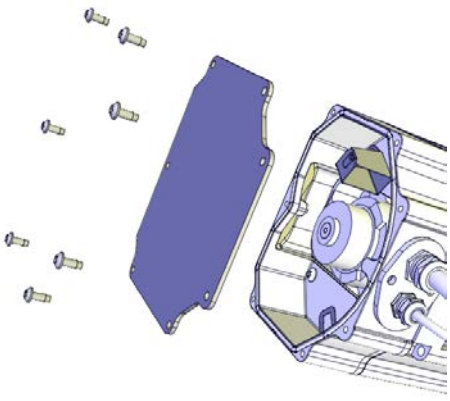
4.6.2 Replacing the axis-4 motor flange

Continued

	Action	Note
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring: 3HAC054692-002  xx1200001070
5	Wipe clean o-ring and o-ring groove.	
6	Refit the o-ring.	
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside are damaged.	
8	Refit the motor cover with its attachment screws. **Note** Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged. **Note** Make sure the o-ring is undamaged and properly fitted.	Attachment screws: M5x12 8.8 (7 pcs)  xx1200001135
9	Make sure that the covers are tightly sealed.	

Concluding procedure

	Action	Note
1	Refill oil in the axis-4 primary gearbox.	See *Changing oil, axis-4 primary gearbox on page 153*.
2	Refill oil in the axis-4 secondary gearbox.	See *Changing oil, axis-4 secondary gearbox on page 159*.

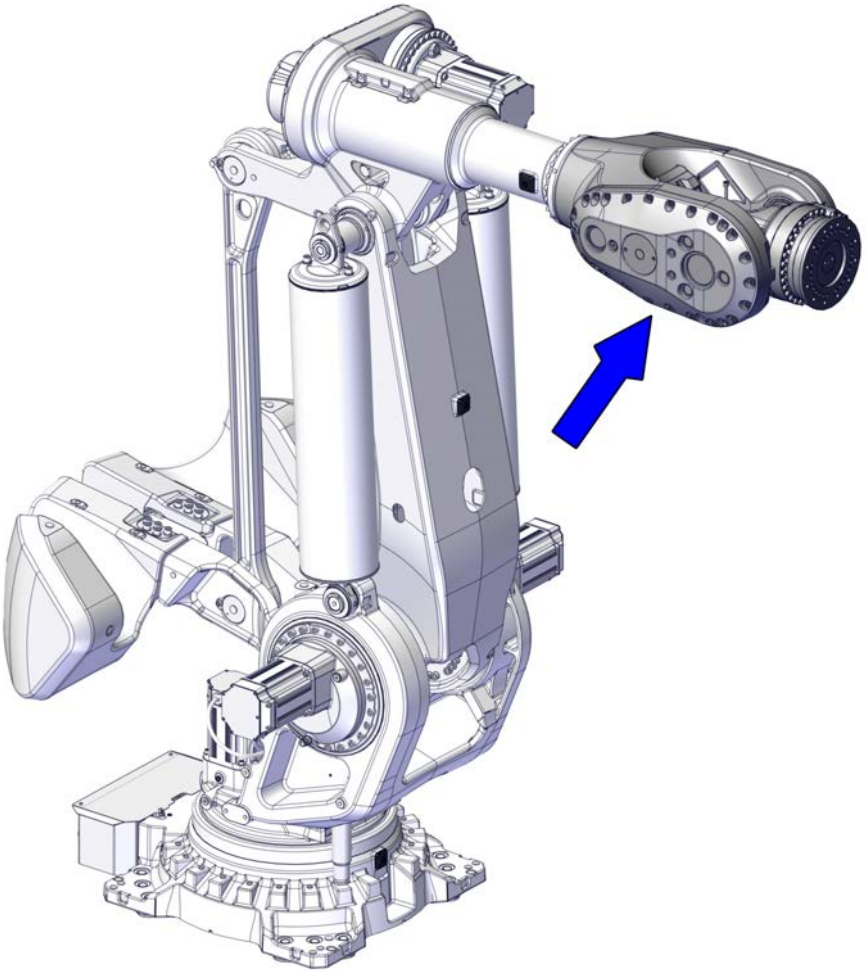
Continues on next page

	Action	Note
3	Re-calibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 688*. General calibration information is included in section *Calibration on page 675*.
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 97*.	

4.6.3 Replacing the wrist

Location of the wrist

The wrist is located as shown in the figure.



xx1500002057

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Color	Article number	Note	Level
Wrist	Graphite White	3HAC048653-006		L2
Wrist	ABB Orange	3HAC048653-004		L2

Continues on next page

Required tools and equipment

Equipment, etc.	Article number	Note
Mobile platform ladder	-	
Roundsling 1 m	-	Lifting capacity: 1,000 kg
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumables

Consumable	Article number	Note
Grease		
Flange sealant	-	Loctite 574 (or equivalent)

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 689*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Removing the wrist

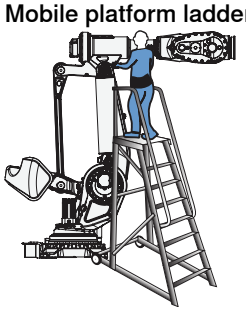
Use these procedures to remove the wrist.

Preparations before removing the wrist

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

Continues on next page

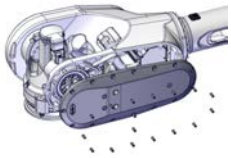
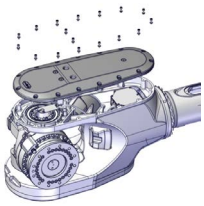
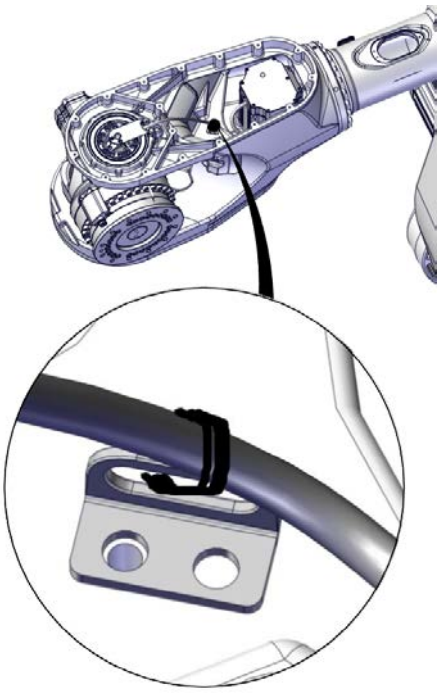
4.6.3 Replacing the wrist
Continued

	Action	Note
2	Remove any tool or other equipment fitted on the turning disk or wrist.	
3	Jog the robot to the specified position: • Axis 1: no significance (as long as the robot is secured to the foundation) • Axis 2: -65° • Axis 3: +65° (horizontal to the foundation) • Axis 4: +90° • Axis 5: +90° • Axis 6: No significance. The position of axis 2 and axis 3 is a recommendation to get a good position for service work on the wrist.	
4	Use a Mobile platform ladder (or similar) to reach the wrist. **DANGER** Do not use the robot as ladder!	Mobile platform ladder  xx1500001985
5	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Retrieving access to the wrist cabling

	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 wrist cover. **Note** Do not damage the sealing. Replace if damaged. **Note** The position of axis-4 depends on the on-going procedure.	 xx1500003100  xx1500002330
3	Cut the cable tie that secures the axis-6 motor cable.	 xx1500002331

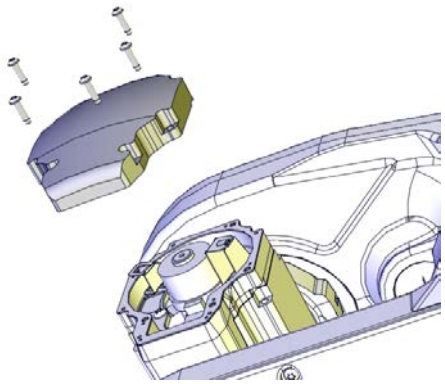
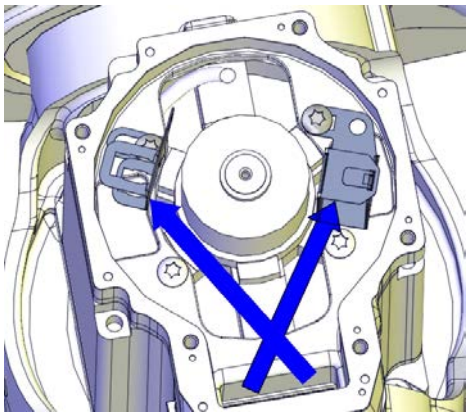
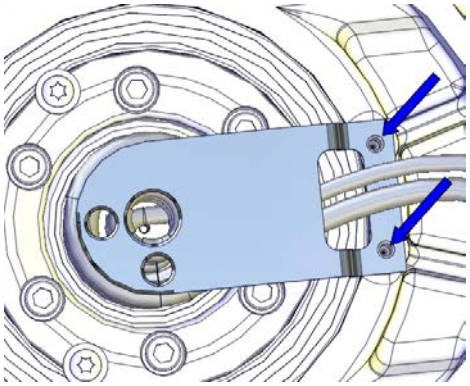
Disconnecting the axis-6 motor cables

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

Continues on next page

4.6.3 Replacing the wrist

Continued

	Action	Note
2	Make sure that the axis-5 is as close to +90° or -90° position as possible, depending on what repair work is being done. **Note** Not needed if only replacing the axis-6 unit.	
3	Unscrew the attachment screws and remove the motor cover. **Note** Do not damage the gasket. Replace if damaged.	 xx1200001080
4	Disconnect the motor cables.	 xx1300000488
5	Unscrew the attachment screws holding the cable bracket.	 xx1300000484

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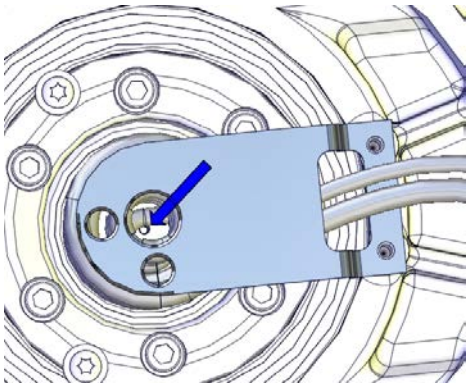
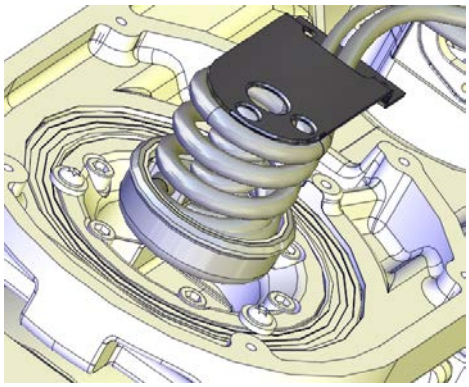
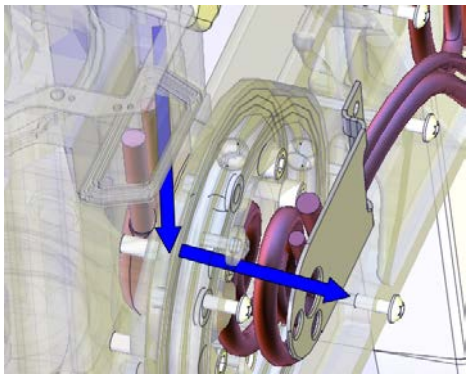
	Action	Note
6	Unscrew the screw holding the carrier. **Note** The screw is located at the bottom of the carrier.	 xx1300000485
7	Use caution and pull out the carrier. **Tip** If needed, use a screwdriver to help pulling out the carrier.	 xx1300001113
8	Use caution and pull out the axis-6 motor cables by holding the cables at the motor with one hand, and the other one at the carrier.	 xx1300000666

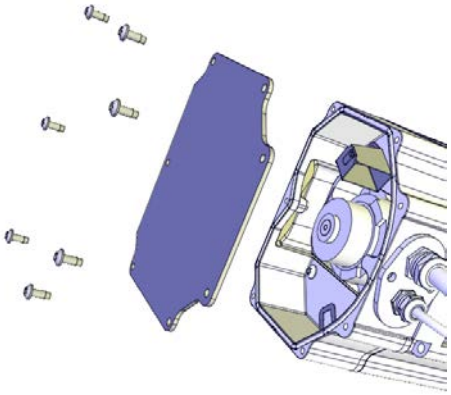
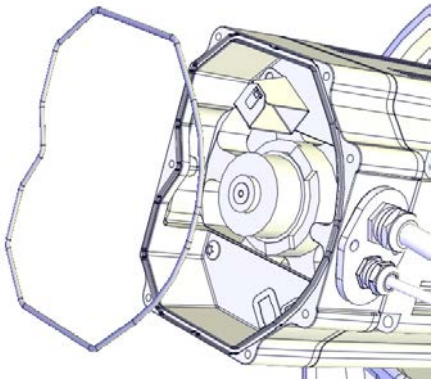
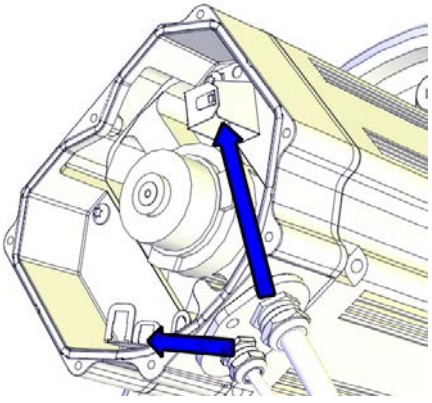
Disconnecting the axis-5 motor cables

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

Continues on next page

4.6.3 Replacing the wrist

Continued

	Action	Note
2	Unscrew the attachment screws with washers and remove the motor cover.	 xx1200001135
3	**Note** Make sure the o-ring is present when removing the cover.	 xx1200001070
4	Disconnect the motor cables.	 xx1200001066

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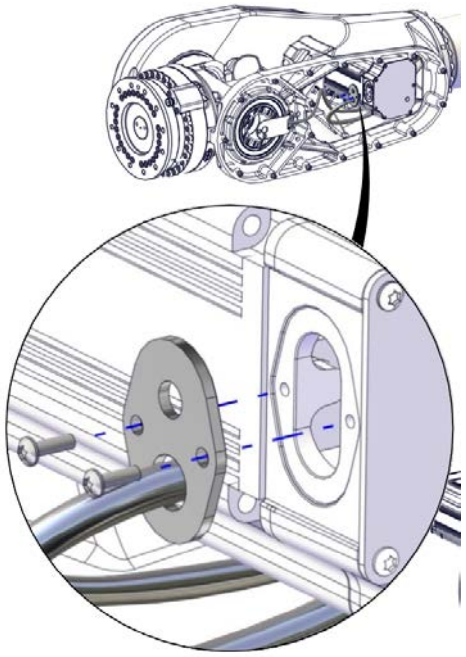
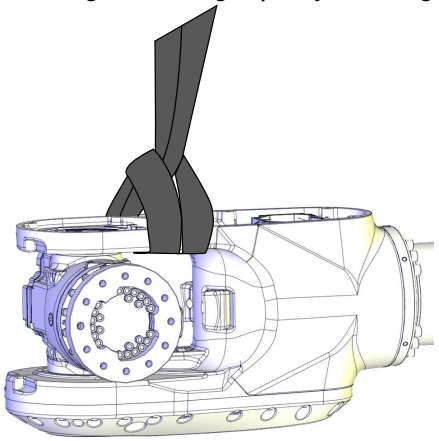
	Action	Note
5	Remove the cable gland cover. **Tip** Make a note in which direction the cable exit hole is facing, if the motor shall be removed too. The motor shall be refitted in the same position.	 xx1500002717
6	Use caution and pull out the motor cables.	

Attaching lifting accessories, wrist

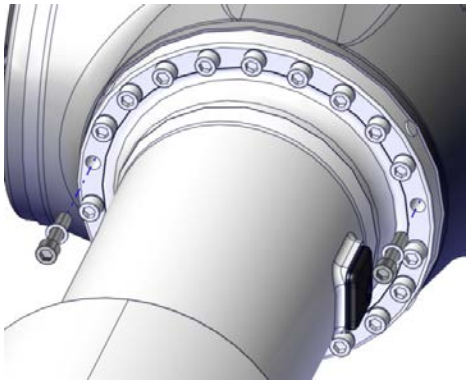
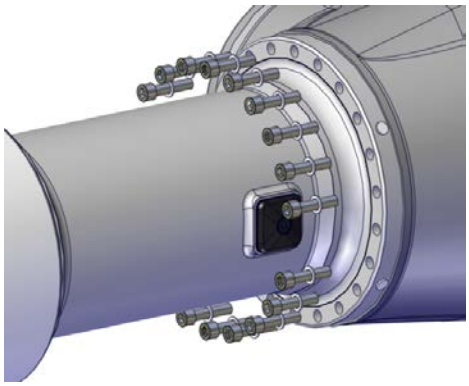
	Action	Note
1	**CAUTION** The complete wrist weighs 500 kg. All lifting accessories used must be sized accordingly!	
2	Attach a roundsling choked, as shown in the figure. **CAUTION** It is very important that the roundsling is placed as shown in the figure, in order to keep the wrist balanced when it is removed. Placed at a different position, there is a risk of sudden change in the balance, which may cause damage or injury. **WARNING** Do not attach the roundsling around the axis-5 gearbox!	Roundsling 1 m: Lifting capacity: 1,000 kg  xx1300000673 The figure show the IRB 6700 but the principle is the same.

Continues on next page

4.6.3 Replacing the wrist
Continued

	Action	Note
3	**Note** Make sure the roundsling is stretched, so it can carry the weight of the wrist.	

Removing the wrist

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove two attachment screws in opposite holes and replace them with guide pins. **Tip** Lubricate the guide pins with some grease to make the wrist slide better.	 xx1500003103
3	Remove the remaining attachment screws.	 xx1500003104

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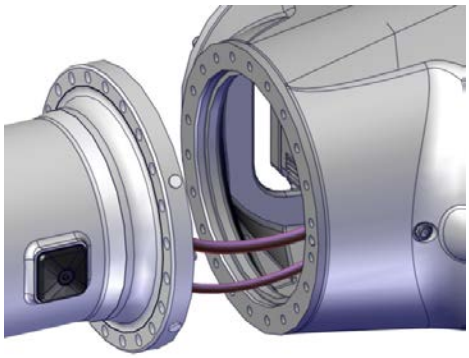
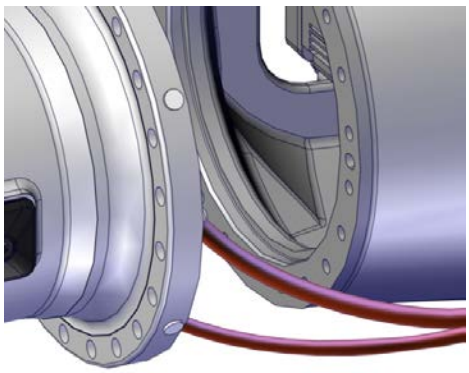
	Action	Note
4	Use caution and pull out the wrist a little onto the guide pins. **CAUTION** Make sure that the cabling does not get damaged.	This is done to be able to remove the cable harness from the wrist.  xx1500003105
5	Use caution and pull out the cabling from the wrist unit.	 xx1500003106
6	**CAUTION** When the wrist is hanging free, the front end will tend to lean slightly downwards.	 xx1500003107
7	Put down the wrist on a pallet (or similar).	

Refitting the wrist

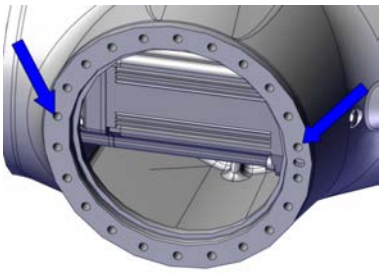
Use these procedures to refit the wrist.

Preparations before refitting the wrist

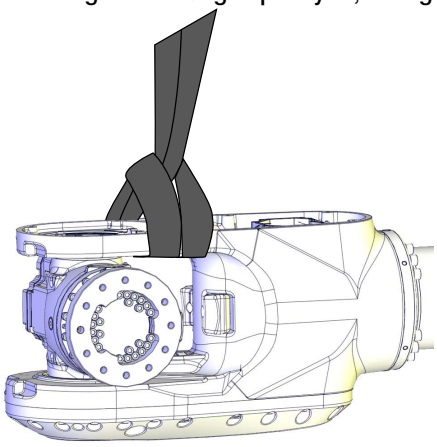
	Action	Note
1	Clean the contact surfaces on wrist and arm tube flange.	

Continues on next page

4.6.3 Replacing the wrist
Continued

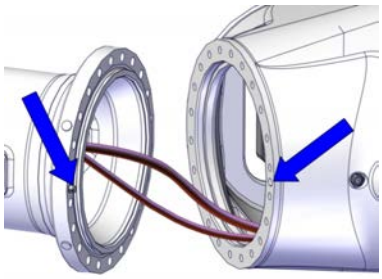
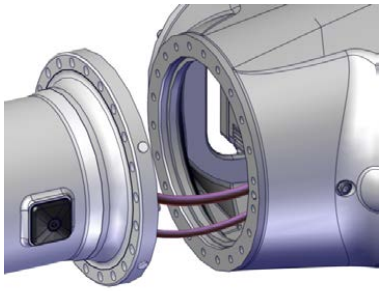
	Action	Note
2	Put two guide pins in opposite holes of the wrist. **Tip** Lubricate the guide pins with some grease to make the wrist slide better.	 xx1500003108

Attaching lifting accessories, wrist

	Action	Note
1	**CAUTION** The complete wrist weighs 500 kg. All lifting accessories used must be sized accordingly!	
2	Attach a roundsling choked, as shown in the figure. **CAUTION** It is very important that the roundsling is placed as shown in the figure in order to keep the wrist balanced when it is removed. Placed at a different position, there is a risk of sudden change in the balance, which can cause damage or injury. **CAUTION** Make sure the roundsling is fitted as tightly as possible, in order not to risk that the wrist starts moving out of position.	Roundsling 1 m: Lifting capacity: 1,000 kg  xx1300000673 The figure show the IRB 6700 but the principle is the same.
3	**Note** Make sure the roundsling is stretched, so it can carry the weight of the wrist.	

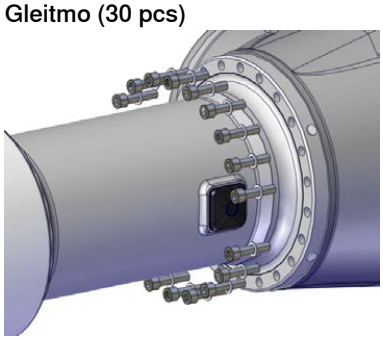
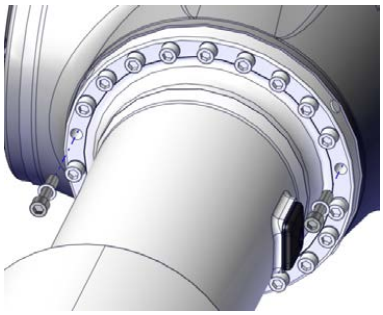
Continues on next page

Refitting the wrist

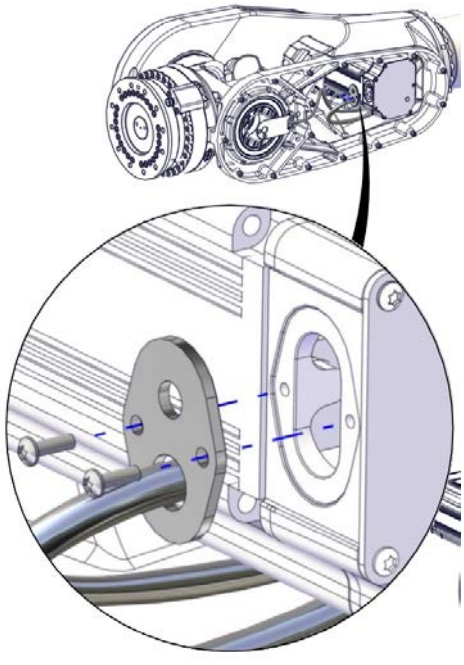
	Action	Note
1	Make sure that the guiding pin in the arm tube match its hole in the wrist.	 xx1500003109
2	Use caution and lift the wrist up onto the guide pins, leaving an opening between wrist and arm tube flange.	This is done to be able to run the cable harness into the wrist.  xx1500003105
3	**CAUTION** When the wrist is hanging free, the front end will tend to lean slightly downwards.	 xx1500003107
4	Run the cable harness into the wrist carefully.	
5	Use caution and slide the wrist into fitting position against the arm tube flange. **CAUTION** Make sure not to damage any parts of the cable harness.	

Continues on next page

4.6.3 Replacing the wrist
Continued

	Action	Note
6	Fit 28 of the 30 attachment screws.	Attachment screws: M12x50 12.9 Gleitmo (30 pcs)  xx1500003104
7	Remove the guide pins and replace them with the remaining screws.	 xx1500003103
8	Secure the wrist.	Tightening torque: 120 Nm
9	Remove the lifting accessories.	

Connecting the axis-5 motor cables

	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1500002717

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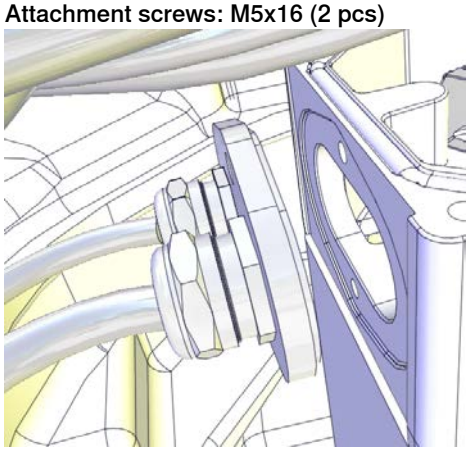
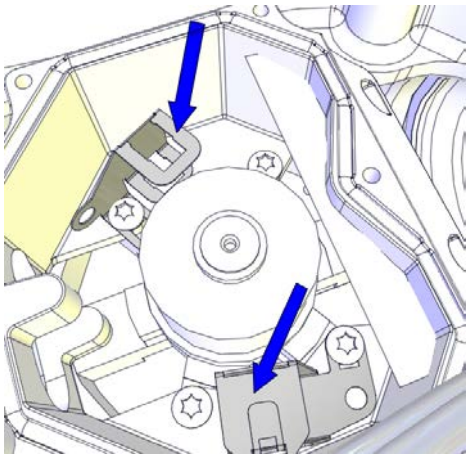
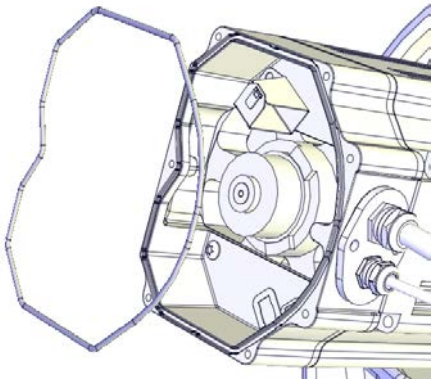
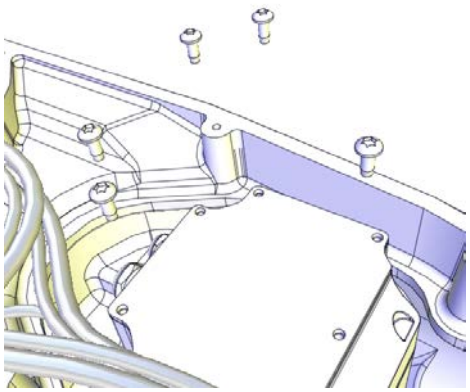
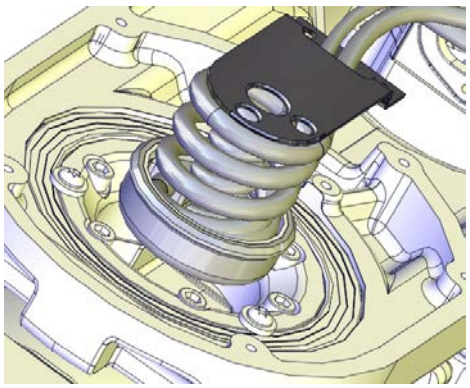
	Action	Note
2	Refit the cable gland cover. **Note** Replace the gasket if damaged.	Attachment screws: M5x16 (2 pcs)  xx1200001016
3	Connect the connectors. Connect in accordance with the markings on the connectors.	 xx1200001015
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring: 3HAC054692-002  xx1200001070
5	**CAUTION** When refitting the motor cover, make sure that none of the cables inside will be damaged.	

Continues on next page

4.6.3 Replacing the wrist
Continued

	Action	Note
6	Refit the motor cover. **Note** Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged. **Note** Make sure the o-ring is properly fitted and undamaged.	Attachment screws: M5x12 8.8 (7 pcs)  xx1200001013
7	Make sure that the cover is tightly sealed.	

Connecting the axis-6 motor cables

	Action	Note
1	Make sure that the axis-5 is in +90 position, before continuing. If not, the cable spiral will be attached in the wrong position and cause damage to the cable harness. **CAUTION** Make sure that the cable spiral is not turned an extra revolution. The result will be damage to the cable harness.	
2	Use caution and push the carrier into position.	 xx1300001113

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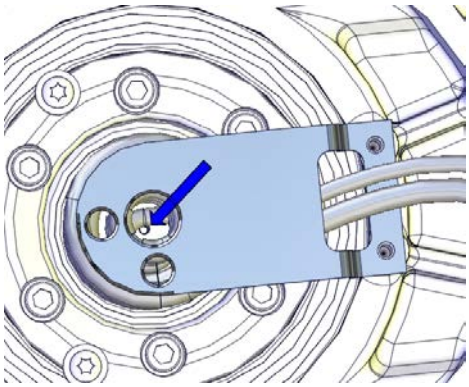
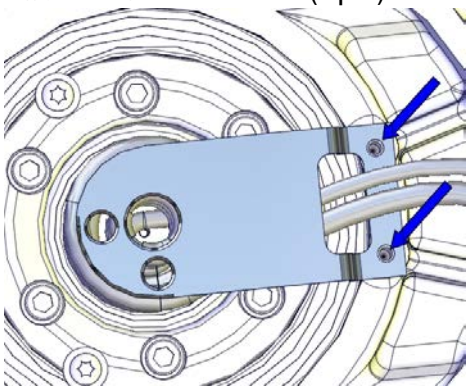
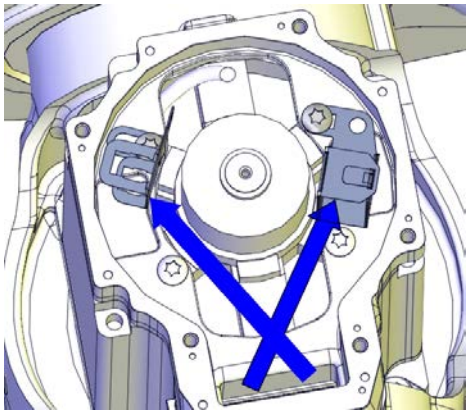
	Action	Note
3	Secure the carrier with the M4 screw. **Note** The screw is located at the bottom of the carrier. **Tip** The screw that secure the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.	Attachment screws: M4x10  xx1300000485
4	Secure the cable bracket with its attachment screws.	Attachment screws: M6x16 (2 pcs)  xx1300000484
5	Reconnect the connectors to the axis-6 motor. **Note** Place the resolver cable underneath the motor cable.	 xx1300000488

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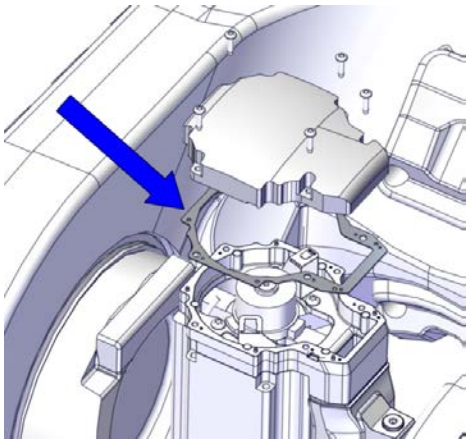
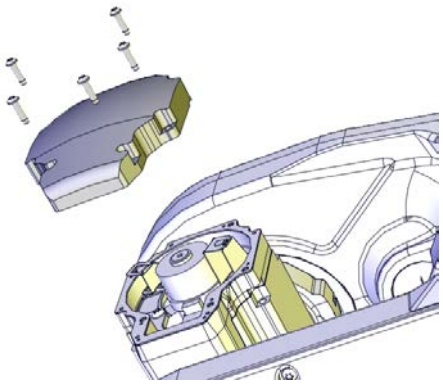
4.6.3 Replacing the wrist

Continued

	Action	Note
6	Make sure the gasket on the motor cover is undamaged. **Note** Replace if damaged.	 xx1500003095
7	**CAUTION** Make sure not to damage the cables inside the motor when refitting the motor cover.	
8	Refit the motor cover.	Attachment screws: M5x20 (5 pcs)  xx1200001080

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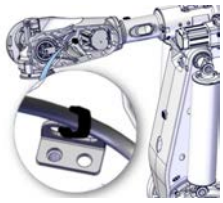
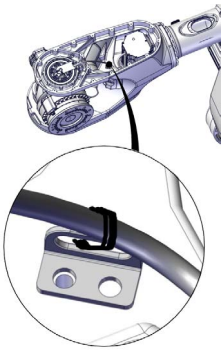
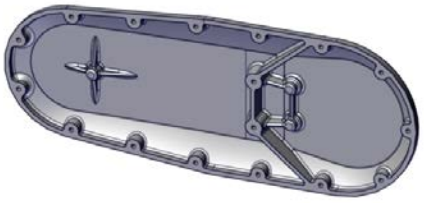
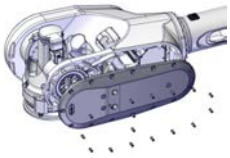
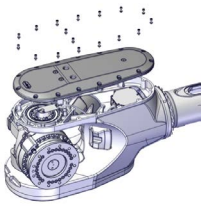
	Action	Note
9	Secure the axis-6 motor cable to the cable fixing bracket with a cable tie. **Note** The position of axis-4 depends on the ongoing procedure.	 xx1500003101  xx1500002331
10	Remove all residues of old sealant and other contamination from the contact surfaces of the wrist cover.	
11	Make sure the contact surface of the wrist cover is undamaged.	 xx1600000046
12	Apply flange sealant on the wrist cover flange.	Loctite 574
13	Place the cable harness so it will not be damaged when fitting the cover.	

Continues on next page

4.6.3 Replacing the wrist

Continued

	Action	Note
14	Refit the wrist cover and tighten all screws alternately. Repeat once. **Note** The position of axis-4 depends on the ongoing procedure.	 xx1500003100  xx1500002330 Screws M8x25 12.9 (17 pcs) Tightening torque: 24 Nm

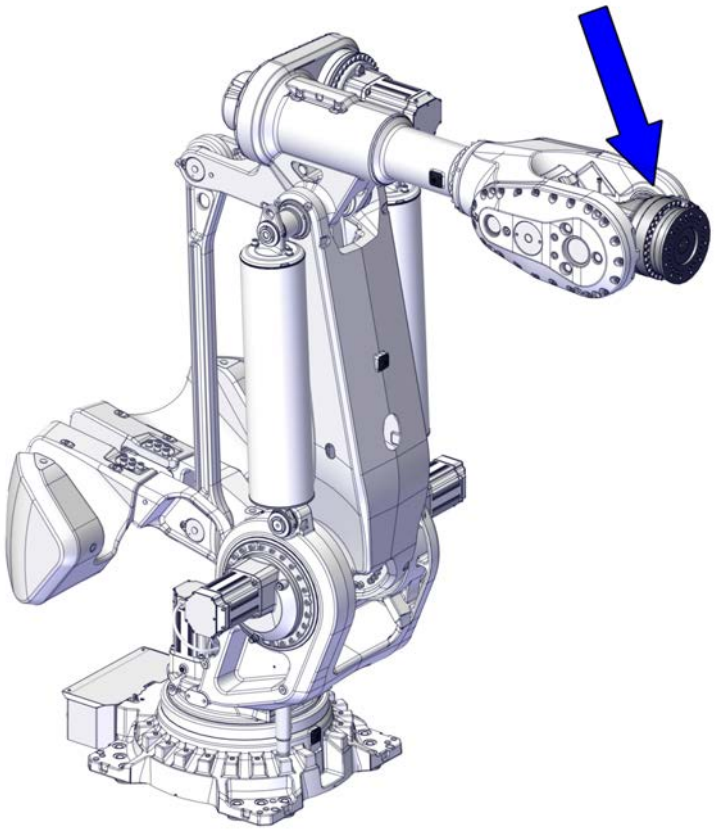
Concluding procedure

	Action	Note
1	Re-calibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 688*. General calibration information is included in section *Calibration on page 675*.
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 97*.	

4.6.4 Replacing the axis-6 unit

Location of the axis-6 unit

The axis-6 unit is located as shown in the figure.



xx1500002058

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Axis 6 Unit	3HAC048651-006		L2

Continues on next page

4.6.4 Replacing the axis-6 unit
Continued

Required tools and equipment

Equipment, etc.	Article number	Note
Brake release tool	3HAC081310-001	Used to release the motor brakes. User instructions are enclosed with the tool. Alternative tool: 24 VDC power supply
Lifting eye, with swivel	-	Working load limit: 2,000 kg
Roundsling 1 m	-	Lifting capacity: 1,000 kg
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumables

Consumable	Article number	Note
Flange sealant	-	Loctite 574 (or equivalent)
Cable ties		
VK cover (3 pcs)	3HAA2166-18	VK 35x8

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 689*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Continues on next page

Removing the axis-6 unit

Use these procedures to remove the axis-6 unit.

Preparations before removing the axis-6 unit

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Remove any tool or other equipment fitted on the wrist.	
3	Jog the robot to the specified position: • Axis-1: no significance, as long as the robot is secured to the foundation • Axis-2: +60° • Axis-3: +35° • Axis-4: 0° • Axis-5: +50° • Axis-6: no significance	
4	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

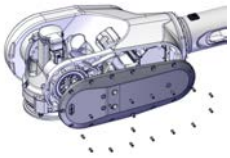
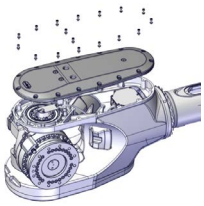
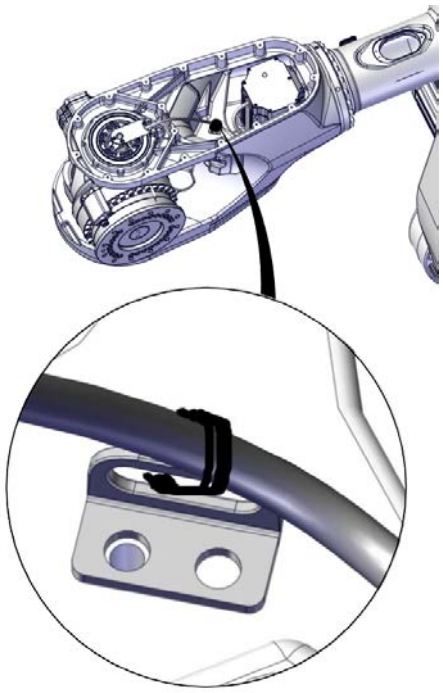
Retrieving access to the wrist cabling

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

Continues on next page

4.6.4 Replacing the axis-6 unit

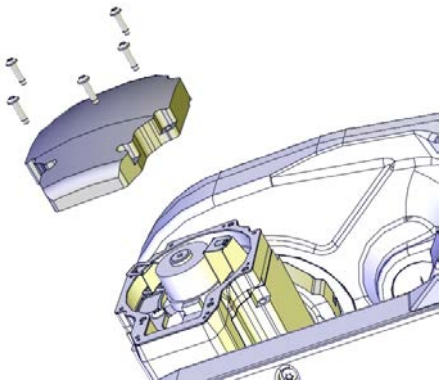
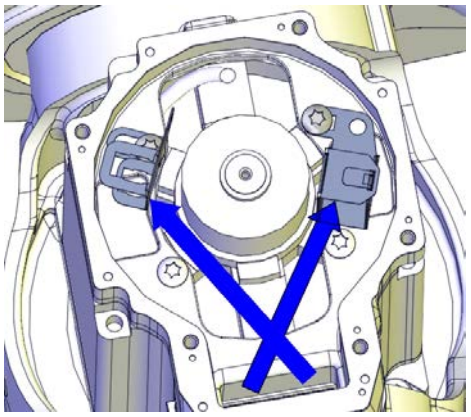
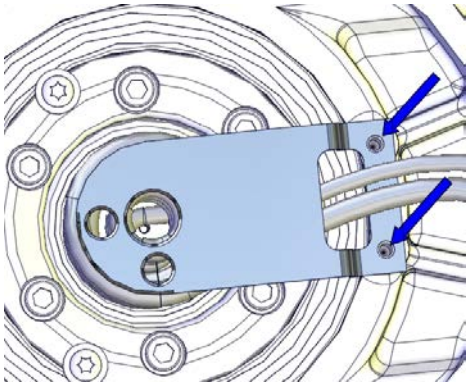
Continued

	Action	Note
2	Remove the wrist cover. **Note** Do not damage the sealing. Replace if damaged. **Note** The position of axis-4 depends on the on-going procedure.	 xx1500003100  xx1500002330
3	Cut the cable tie that secures the axis-6 motor cable.	 xx1500002331

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	Make sure that the axis-5 is as close to +90° or -90° position as possible, depending on what repair work is being done. **Note** Not needed if only replacing the axis-6 unit.	
3	Unscrew the attachment screws and remove the motor cover. **Note** Do not damage the gasket. Replace if damaged.	 xx1200001080
4	Disconnect the motor cables.	 xx1300000488
5	Unscrew the attachment screws holding the cable bracket.	 xx1300000484

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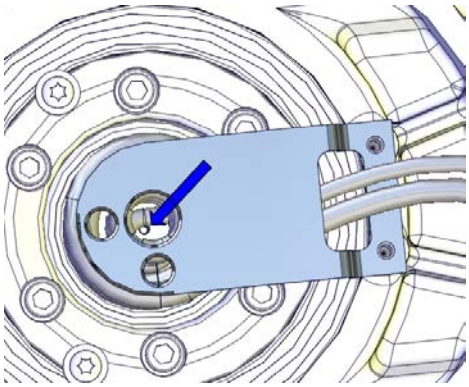
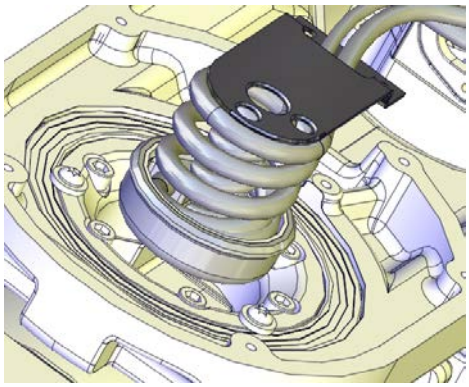
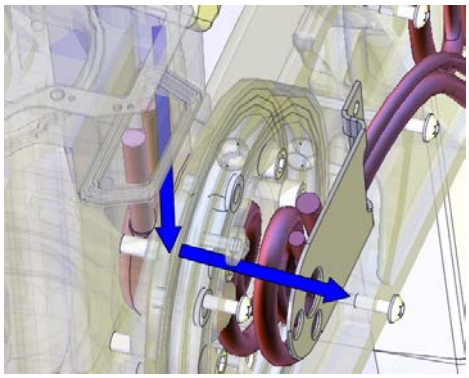
4.6.4 Replacing the axis-6 unit

Continued

	Action	Note
6	Unscrew the screw holding the carrier. **Note** The screw is located at the bottom of the carrier.	 xx1300000485
7	Use caution and pull out the carrier. **Tip** If needed, use a screwdriver to help pulling out the carrier.	 xx1300001113
8	Use caution and pull out the axis-6 motor cables by holding the cables at the motor with one hand, and the other one at the carrier.	 xx1300000666

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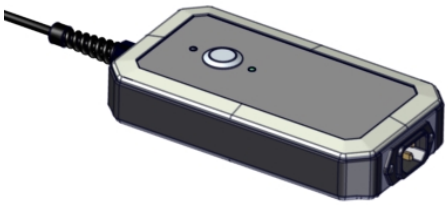
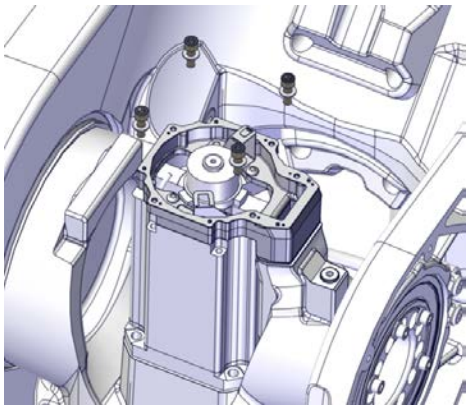
Removing the axis-6 motor

	Action	Note
1	Release the brakes of the axis-6 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the R2.MP6 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP6: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
2	Unscrew the attachment screws with washers.	 xx1500003097
3	**CAUTION** Parting/mating motor pinion and hub, may damage the splines if excessive force is used.	
4	If required, press the motor out of position by fitting the removal tool, to the attachment holes of the motor.	Removal tool M10
5	**CAUTION** The motor weighs 14 kg.	

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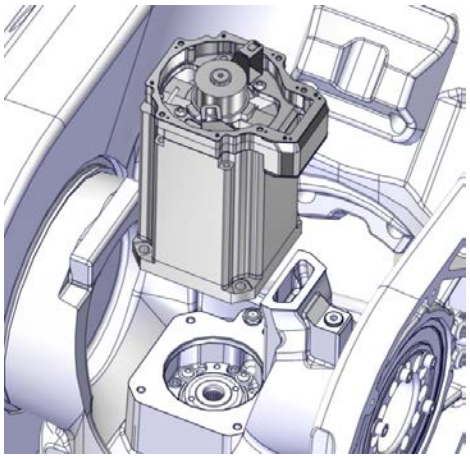
4.6.4 Replacing the axis-6 unit

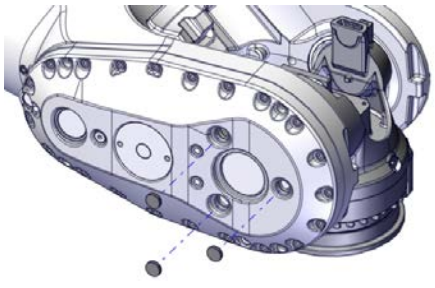
Continued

	Action	Note
6	Remove the motor by lifting it straight up from the gear. Make sure the motor pinion is not damaged.	 xx1500003098
7	Disconnect the brake release tool / 24 VDC power supply.	

Attaching lifting accessories to the axis-6 unit

	Action	Note
1	**CAUTION** The axis-6 unit weighs 165 kg. All lifting accessories must be sized accordingly.	
2	Attach lifting eyes with swivel in opposite holes of the turning disk with axis-5 +90°.	Lifting eyes with swivel M12
3	Attach a roundsling to the axis-6 unit and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg
4	Stretch the lifting accessories to take the weight of the axis-6 unit, axis-5 still in +90° position.	

Unscrewing the axis-5 gearbox side

	Action	Note
1	Remove the three small VK-covers on the axis-5 gearbox cover. Always replace VK-covers with a new one. **Note** Do not remove any other VK-cover.	 xx1600000194

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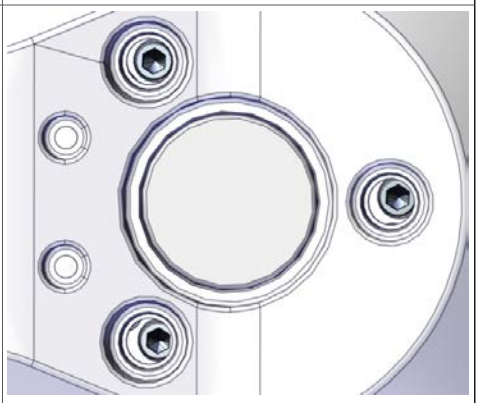
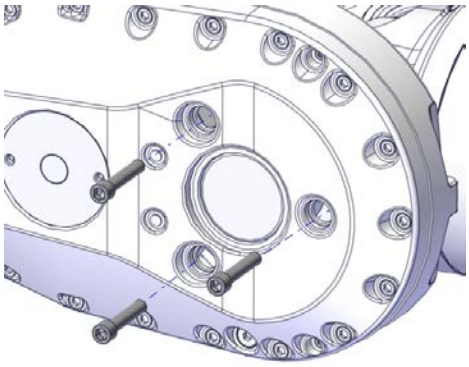
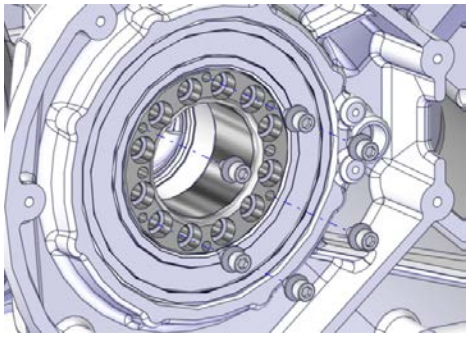
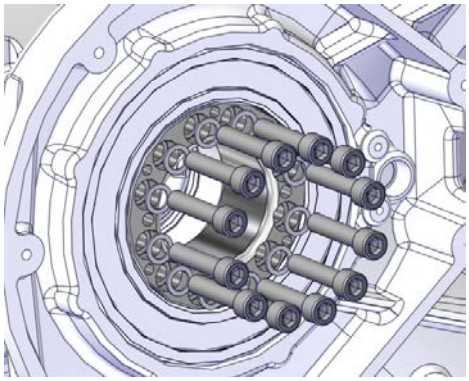
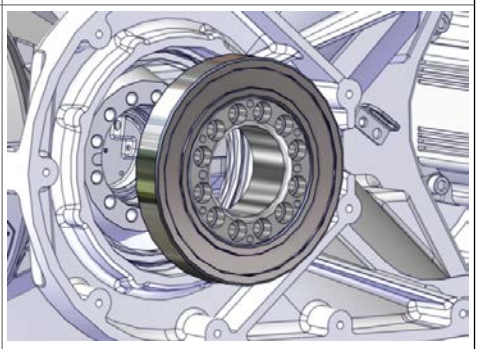
	Action	Note
2	**Note** Before removing the attachment screws on the axis-5 side, plan in advance in which order the screws are removed. When the last three of the 21 screws is removed, the turning disc on the axis-6 unit shall be facing upwards.	
3	Slowly rotate the axis-6 unit upwards until the first three (of 21) screws are possible to remove.	 xx1600000195
4	Unscrew and remove the first three screws.	 xx1600000196
5	Slowly rotate the axis-6 unit upwards, until the next three screws are possible to remove.	
6	Continue to rotate the axis-6 unit in steps in the same way, until the remaining screws are removed. **DANGER** When the last screw is removed, the axis-6 unit will only be supported by the support shaft with bearing on the other side of the wrist. If the lifting accessory does not support the axis-6 unit weight, the unit will start to rotate uncontrolled. Make sure that the axis-6 unit is securely attached to the lifting accessory before the last screw is removed.	

Continues on next page

4.6.4 Replacing the axis-6 unit

Continued

Removing the axis-6 unit

	Action	Note
1	Make sure the lifting accessories still are attached securely and takes the weight of the axis-6 unit.	
2	Unscrew the attachment screws (6 pcs) that secure the bearing.	This is done to be able to reach the attachment screws that secure the axis-6 unit.  xx1600000197
3	Unscrew the attachment screws and washers (12 pcs) that hold the support shaft.	 xx1600000198
4	Remove the support shaft. **Tip** If needed, insert two screws and use them as removal tools.	 xx1600000199

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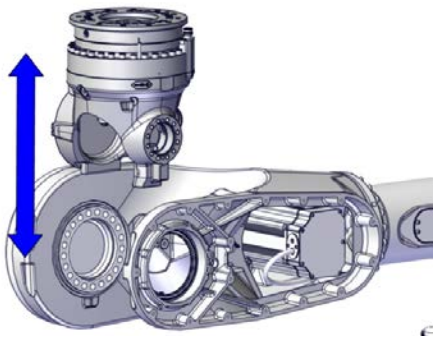
	Action	Note
5	Use caution and lift the axis-6 unit off.	 xx1600000200
6	Put a pallet (or similar) on the floor, to be used for putting the axis-6 unit on.	
7	Lower the axis-6 unit towards the pallet. Grab the roundslings by hand to be able to force the axis-6 unit to lay on the side on the pallet. **CAUTION** Be very careful not to damage the motor (if still fitted). The axis-6 must never rest on the motor.	

Refitting the axis-6 unit

Use these procedures to refit the axis-6 unit.

Attaching lifting accessories, axis-6 unit

	Action	Note
1	**CAUTION** The axis-6 unit weighs 165 kg. All lifting accessories must be sized accordingly.	
2	Attach lifting eyes with swivel in opposite holes of the turning disc.	Lifting eyes, swivel (2 pcs)
3	Attach the lifting accessories to the axis-6 unit and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg
4	Use caution and raise the axis-6 unit up and let it hang in the lifting accessories.	

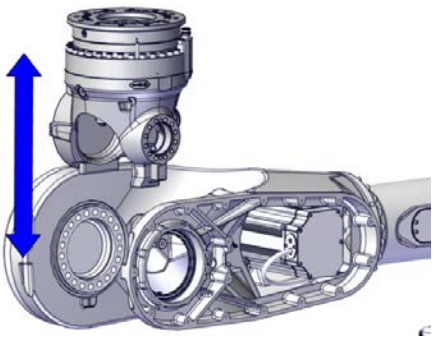
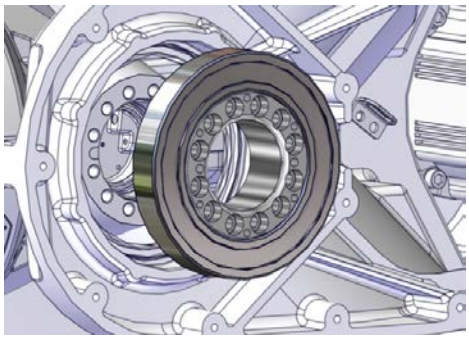
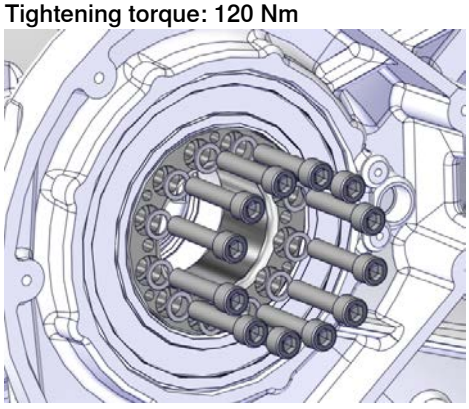
Refitting the support shaft side

	Action	Note
1	Wipe clean all contact surfaces including the o-ring grooves.	

Continues on next page

4.6.4 Replacing the axis-6 unit

Continued

	Action	Note
2	Use caution and move the axis-6 unit to its mounting position.	 xx1600000200
3	Wipe clean and inspect the o-rings. Replace damaged o-rings.	
4	Refit the o-rings in the grooves. **Tip** Lubricate the o-ring with some grease for a better fitting in the groove.	
5	Refit the support shaft.	 xx1600000199
6	Refit and secure the support shaft with screws and washers.	Attachment screws, M12x55 (12 pcs) Tightening torque: 120 Nm  xx1600000198

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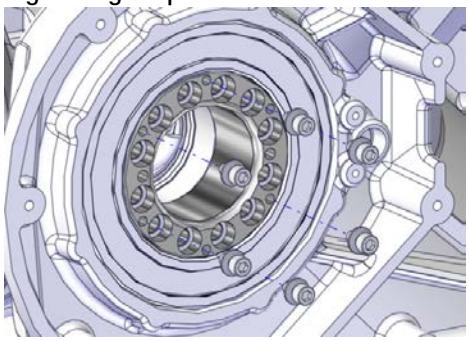
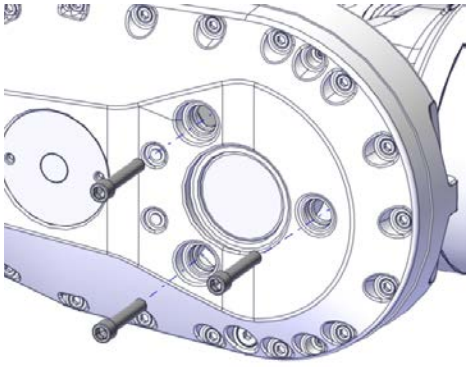
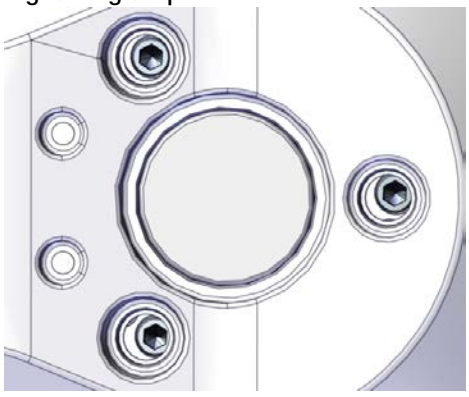
	Action	Note
7	Secure the bearing.	Attachment screws: M8x16 (6 pcs) Tightening torque: 24 Nm  xx1600000197

Refitting the axis-5 gearbox side

	Action	Note
1	Refitting of the axis-6 unit must start with the turning disc facing upwards. When the last screws are attached, the axis-5 shall be as close as possible to +90° position.	
2	Find the hole pattern for the first three of the 21 screws.	 xx1600000196
3	Attach and secure these three screws.	Attachment screws, M16x80 Tightening torque: 300 Nm  xx1600000195
4	Lower the axis-6 unit until it is possible to attach the next three screws.	

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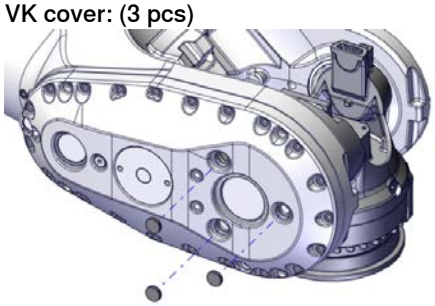
4.6.4 Replacing the axis-6 unit

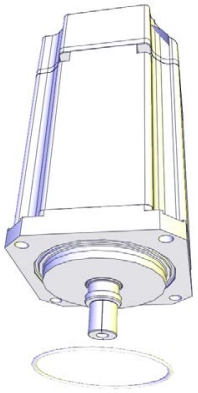
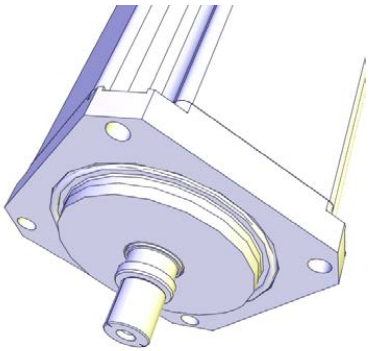
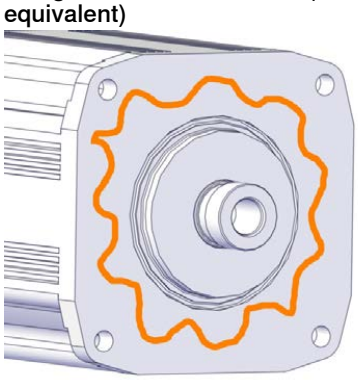
Continued

	Action	Note
5	Attach and secure these three screws.	Attachment screws, M16x80 Tightening torque: 300 Nm
6	Continue to lower the axis-6 unit in steps, until all 21 screws are attached and secured in the same way.	
7	**Note** Make sure that all 21 screws are attached and secured before removing the lifting accessories and continuing the procedure.	
8	Refit the VK covers.	VK cover: (3 pcs)  xx1600000194
9	Remove lifting accessories and lifting eyes.	

Preparations before refitting the axis-6 motor

	Action	Note
10	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
11	Remove old paint residues and other contamination from the contact surfaces on both motor and gearbox.	
12	Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	

Continues on next page

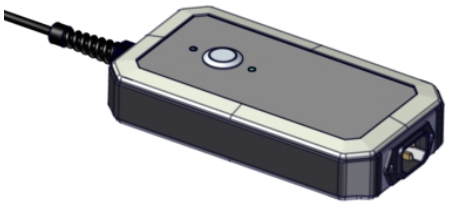
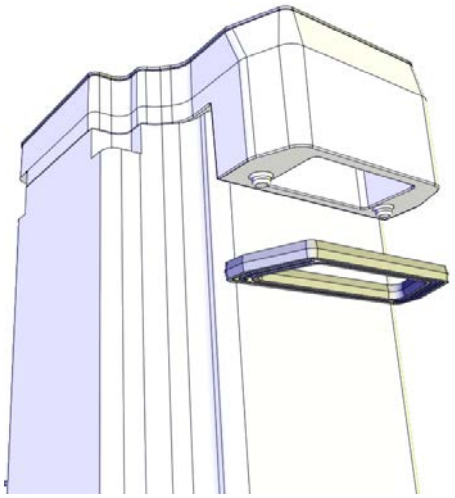
	Action	Note
13	Make sure the o-ring is undamaged. Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
14	Make sure the o-ring is seated in the groove. **Tip** Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020
15	Apply flange sealant on the motor flange.	Flange sealant: Loctite 574 (or equivalent)  xx1500002357
16	If the motor is a new spare part, remove the motor cover.	

Continues on next page

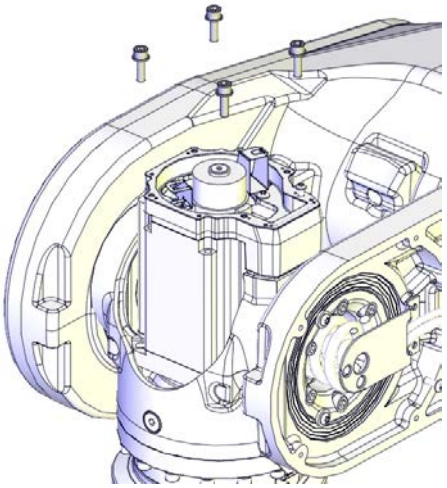
4.6.4 Replacing the axis-6 unit

Continued

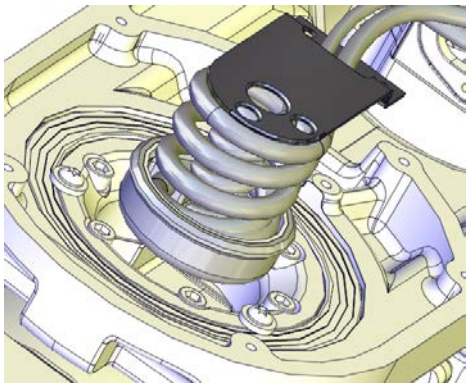
Securing the axis-6 motor

	Action	Note
1	Release the brakes of the axis-6 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the R2.MP6 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP6: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
2	**CAUTION** Parting/mating motor pinion and hub, may damage the splines if excessive force is used!	
3	Inspect the gasket. Replace if damaged.	 xx1200001094
4	**CAUTION** The motor weighs 14 kg.	

Continues on next page

	Action	Note
5	Secure the motor with its attachment screws. Make sure that the gasket is fitted correctly.	Tightening torque: 24 Nm Screw dimension: M8x25 quality 12.9 Gleitmo (4 pcs)  xx1200001090
6	Disconnect the 24 V DC power supply.	

Connecting the axis-6 motor cables

	Action	Note
1	Make sure that the axis-5 is in +90 position, before continuing. If not, the cable spiral will be attached in the wrong position and cause damage to the cable harness. **CAUTION** Make sure that the cable spiral is not turned an extra revolution. The result will be damage to the cable harness.	
2	Use caution and push the carrier into position.	 xx1300001113

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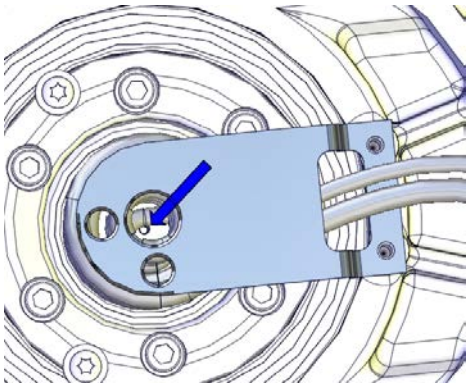
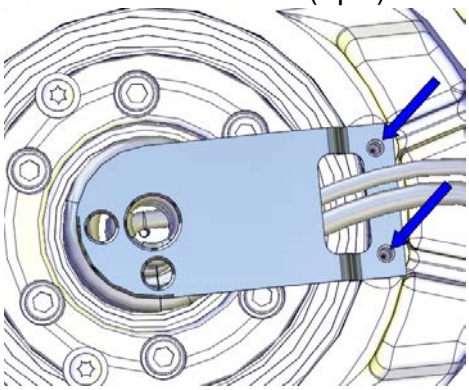
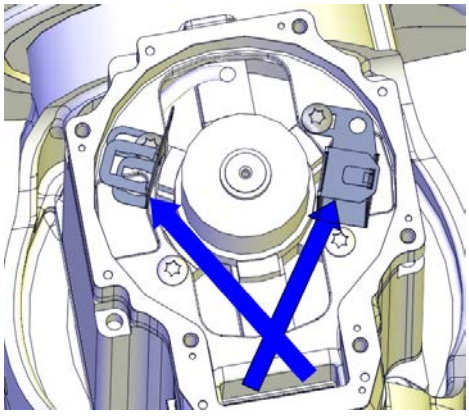
4.6.4 Replacing the axis-6 unit

Continued

	Action	Note
3	Secure the carrier with the M4 screw. **Note** The screw is located at the bottom of the carrier. **Tip** The screw that secure the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.	Attachment screws: M4x10  xx1300000485
4	Secure the cable bracket with its attachment screws.	Attachment screws: M6x16 (2 pcs)  xx1300000484
5	Reconnect the connectors to the axis-6 motor. **Note** Place the resolver cable underneath the motor cable.	 xx1300000488

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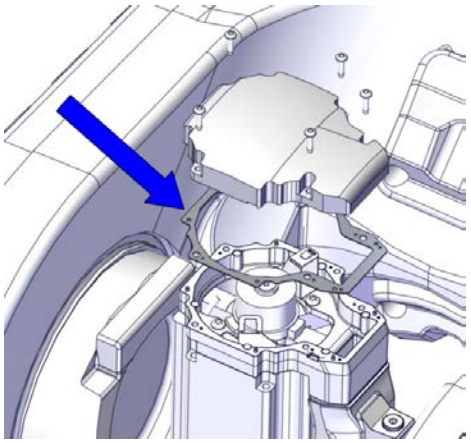
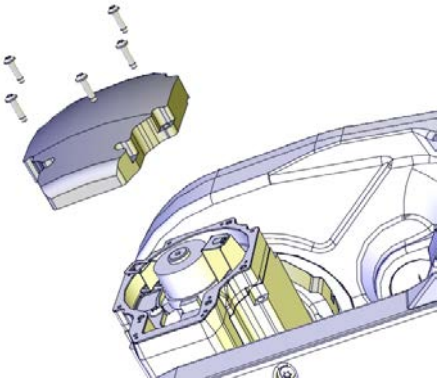
	Action	Note
6	Make sure the gasket on the motor cover is undamaged. **Note** Replace if damaged.	 xx1500003095
7	**CAUTION** Make sure not to damage the cables inside the motor when refitting the motor cover.	
8	Refit the motor cover.	Attachment screws: M5x20 (5 pcs)  xx1200001080

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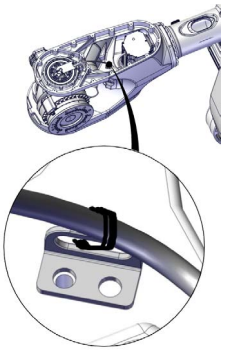
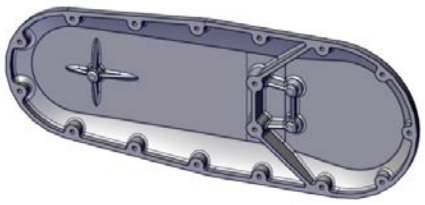
4.6.4 Replacing the axis-6 unit

Continued

	Action	Note
9	Secure the axis-6 motor cable to the cable fixing bracket with a cable tie. **Note** The position of axis-4 depends on the ongoing procedure.	 xx1500003101  xx1500002331
10	Remove all residues of old sealant and other contamination from the contact surfaces of the wrist cover.	
11	Make sure the contact surface of the wrist cover is undamaged.	 xx1600000046
12	Apply flange sealant on the wrist cover flange.	Loctite 574
13	Place the cable harness so it will not be damaged when fitting the cover.	

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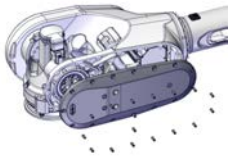
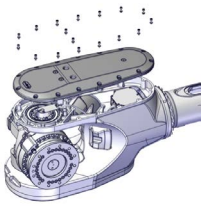
	Action	Note
14	Refit the wrist cover and tighten all screws alternately. Repeat once. **Note** The position of axis-4 depends on the on-going procedure.	 xx1500003100  xx1500002330 Screws M8x25 12.9 (17 pcs) Tightening torque: 24 Nm

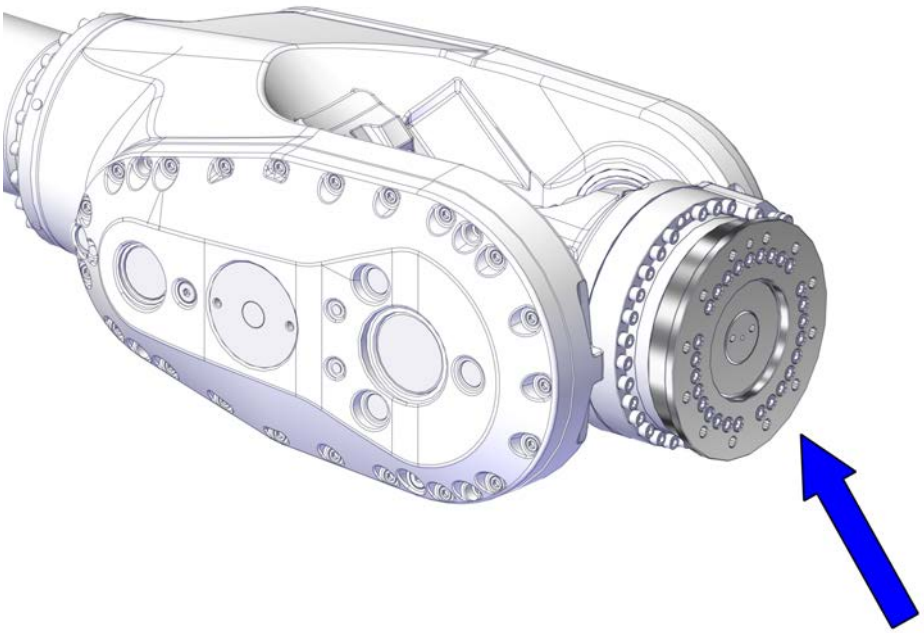
Concluding procedure

	Action	Note
1	Re-calibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 688*. General calibration information is included in section *Calibration on page 675*.
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 97*.	

4.6.5 Replacing the turning disc

Location of the turning disc

The turning disc is located as shown in the figure.



xx1500002059

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Turning disc	3HAC048445-003		L2

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Continues on next page

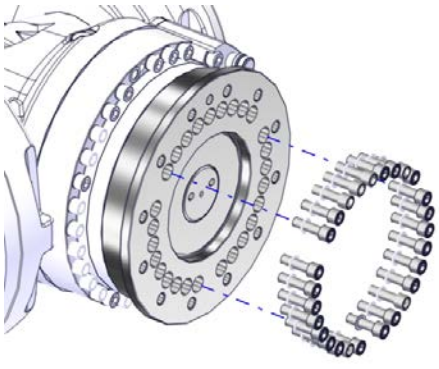
Removing the turning disc

Use these procedures to remove the turning disc.

Preparations before removing the turning disc

	Action	Note
1	Jog the robot to a comfortable position for removing the turning disc.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
3	Remove any tools or other equipment fitted to the turning disc.	

Removing the turning disc

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the 27 M12x40 screws and washers that secure the turning disc.	 xx1500002318

Continues on next page

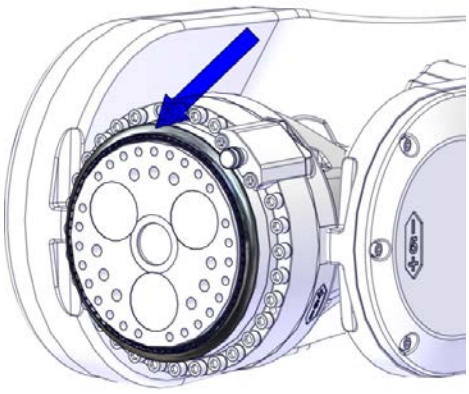
4.6.5 Replacing the turning disc
Continued

	Action	Note
3	Remove the turning disc.	 xx1500002319

Refitting the turning disc

Use these procedures to refit the turning disc.

Refitting the turning disc

	Action	Note
1	Wipe clean the contact surfaces.	 xx1500002319
2	Make sure the sealing ring is fitted.	 xx1500002984

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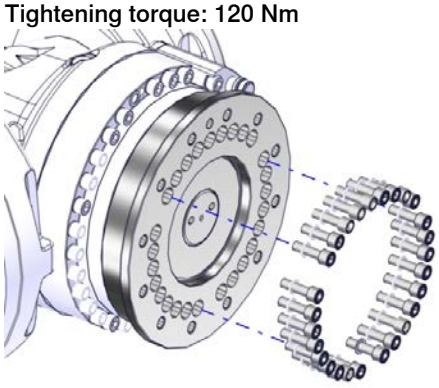
	Action	Note
3	Secure the turning disc with its attachment screws and washers.	Attachment screws, M12x40 12.9 Gleitmo 603 (27 pcs) Tightening torque: 120 Nm  xx1500002318

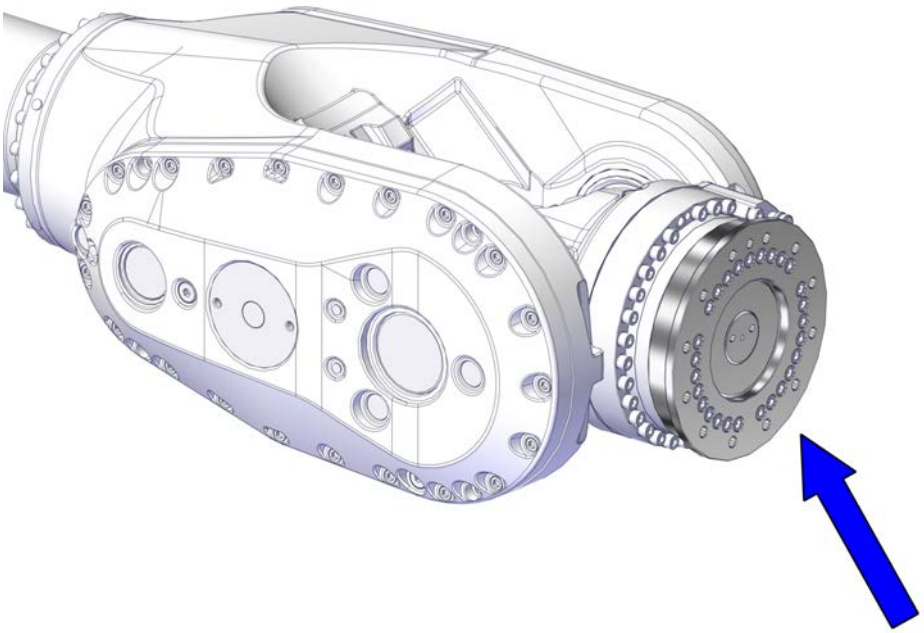
Concluding procedure

	Action	Note
1	Re-calibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section *Calibration on page 675*.
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 97*.	

4.6.6 Replacing the process turning disc

Location of the process turning disc

The process turning disc is located as shown in the figure.



xx1500002059

Note! The image shows a regular turning disc.

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Process turning disc	3HAC051003-005		L2

Required tools and equipment

Equipment, etc.	Article number	Note
Roundsling 1 m	-	Lifting capacity: 1,000 kg
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Continues on next page

Removing the process turning disc

Use these procedures to remove the process turning disc.

Preparations before removing the process turning disc

	Action	Note
1	Jog the robot to a comfortable position for removing the process turning disc.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
3	Remove any tools or other equipment (including the DressPack) fitted to the process turning disc.	

Removing the process turning disc

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**CAUTION** The process turning disk weighs 50 kg. All lifting accessories must be sized accordingly.	
3	Attach the a roundsling to the process turning disc and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg
4	Stretch the lifting accessories to take the weight of the process turning disc.	
5	Unscrew the 22 attachment screws and washers that secure the process turning disc.	
6	Remove the process turning disc.	

Continues on next page

4.6.6 Replacing the process turning disc
Continued

Refitting the process turning disc

Use these procedures to refit the process turning disc.

Refitting the process turning disc

	Action	Note
1	**CAUTION** The process turning disc weigh 50 kg. All lifting accessories must be sized accordingly.	
2	Attach a roundsling to the process turning disk and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg
3	Wipe clean the contact surfaces.	
4	Make sure the process turning disc is refitted in the correct position.	
5	Secure the process turning disc with its attachment screws and washers.	Attachment screws: M12x40, 12.9 Gleitmo 603 (22 pcs) Tightening torque: 120 Nm

Concluding procedure

	Action	Note
1	Re-calibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section *Calibration on page 675*.
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 97*.	

4.6.7 Replacing the complete lower arm

L3 spare part

The lower arm assembly is classified as L3 spare part. The repair procedures are therefor not described in the product manual. Contact ABB Service for replacement.

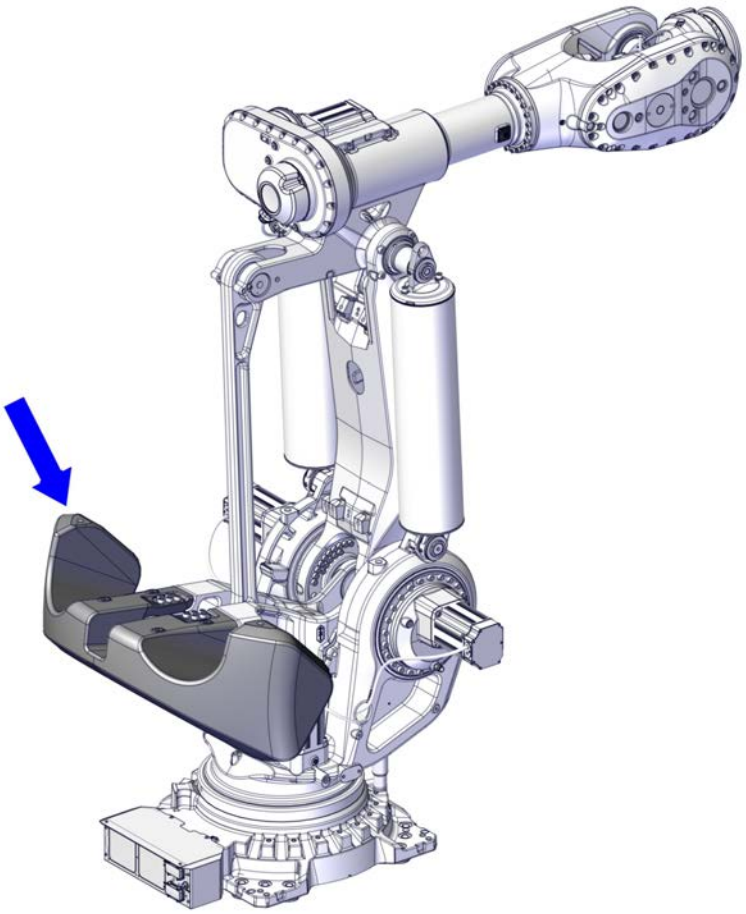
See *Spare part level on page 186*.

4.7 Frame and base

4.7.1 Replacing the counterweight

Location of the counterweight

The counterweight is located as shown in the figure.



xx1500001977

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

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Spare part	Article number	Note	Level
Counterweight	3HAC048154-004		L2

Required tools and equipment

Equipment, etc.	Article number	Note
Lifting eye	3HAC14457-4	M16
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

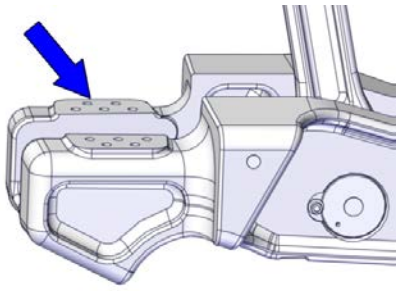
Required consumables

Consumables	Article number	Note
Flange sealant	-	Loctite 574 (or equivalent)

Removing the counterweight

Use these procedures to remove the counterweight.

Robot position when removing the counterweight

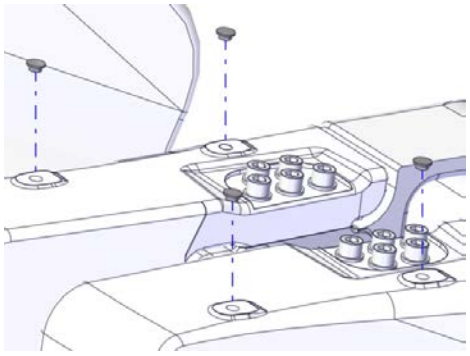
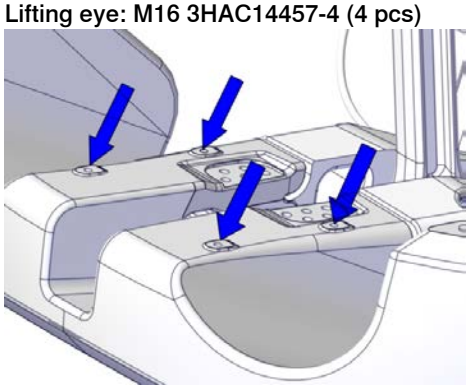
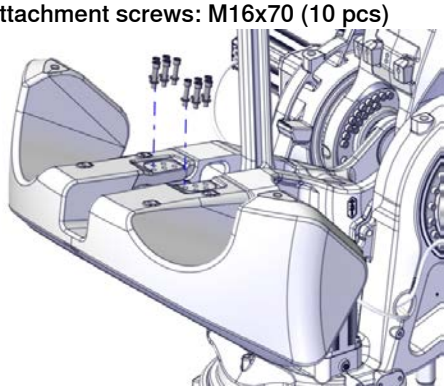
	Action	Note
1	Jog the robot to a position so that the area where the counterweight is fitted to the parallel arm, is horizontal to the foundation.	 xx1500002096
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Continues on next page

4.7.1 Replacing the counterweight

Continued

Removing the counterweight

	Action	Note
1	**CAUTION** The counterweight weighs 1200 kg. All lifting accessories used must be sized accordingly!	
2	If used, remove the plastic plugs covering the holes for the lifting eyes. **Note** Keep the plastic plugs. They shall be refitted.	 xx1500001980
3	Attach lifting eyes.	Lifting eye: M16 3HAC14457-4 (4 pcs)  xx1500002087
4	Attach the lifting accessory chain (with four chains), to the lifting eyes.	Lifting accessory (chain): 3HAC15556-1 (4 chains required.) Lifting instruction 3HAC15880-2 enclosed.
5	Stretch the lifting accessory to take the weight of the counterweight.	
6	Unscrew the attachment screws with washers, that hold the counterweight.	Attachment screws: M16x70 (10 pcs)  xx1500001981

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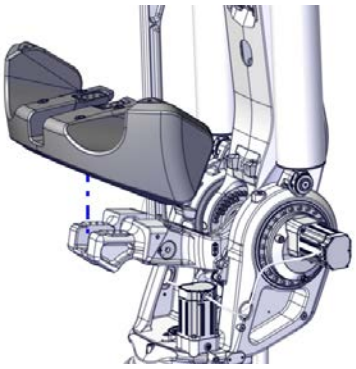
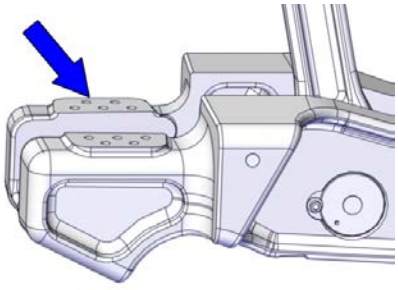
	Action	Note
7	Use caution, lift the counterweight off.	 xx1500001982
8	**CAUTION** The counterweight will start to lean backwards when laying it down, before it is resting on the floor.	 xx1500002095

Refitting the counterweight

Use these procedures to refit the counterweight.

Robot position when refitting the counterweight

	Action	Note
1	If not already in this position, turn on the power and jog to a position where the area the counterweight is fitted to the parallel arm, is horizontal to the foundation.	 xx1500002096

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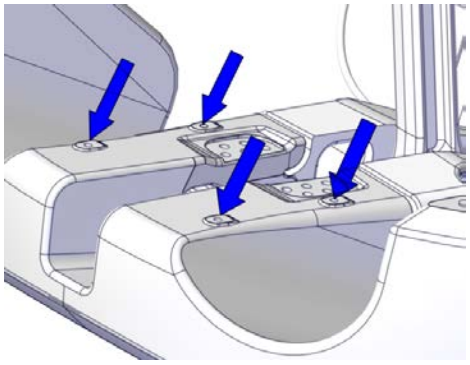
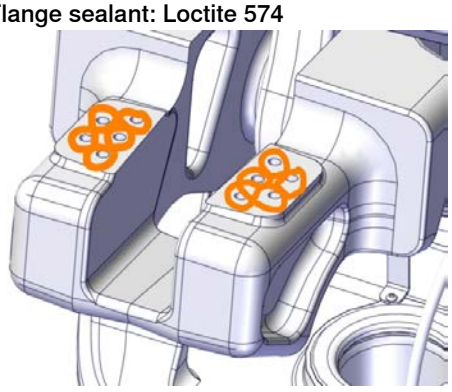
4.7.1 Replacing the counterweight

Continued

	Action	Note
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Refitting the counterweight

	Action	Note
1	**CAUTION** The counter weight weighs 1200 kg. All lifting accessories used must be sized accordingly!	
2	Attach lifting eyes, if not already done.	 xx1500002087
3	Attach the lifting accessory chain (with four chains), to the lifting eyes.	Lifting accessory (chain): 3HAC15556-1 Lifting instruction 3HAC15880-2 enclosed.
4	Stretch the lifting accessory to take the weight of the counterweight.	
5	Apply flange sealant (Loctite 574) on the contact surface between parallel arm and counterweight.	Flange sealant: Loctite 574  xx1600000049

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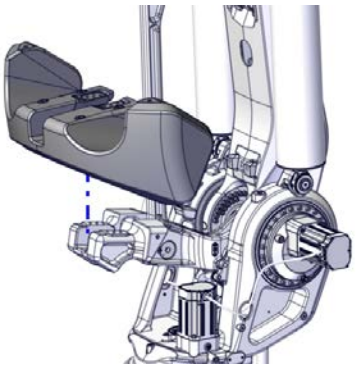
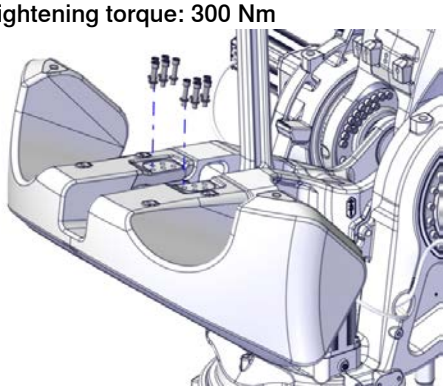
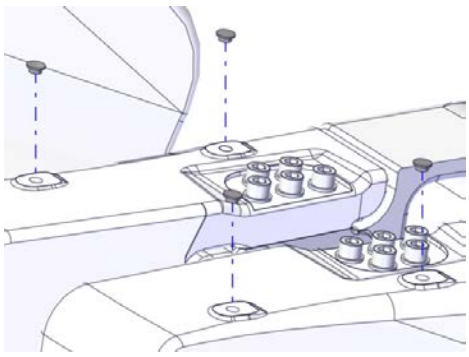
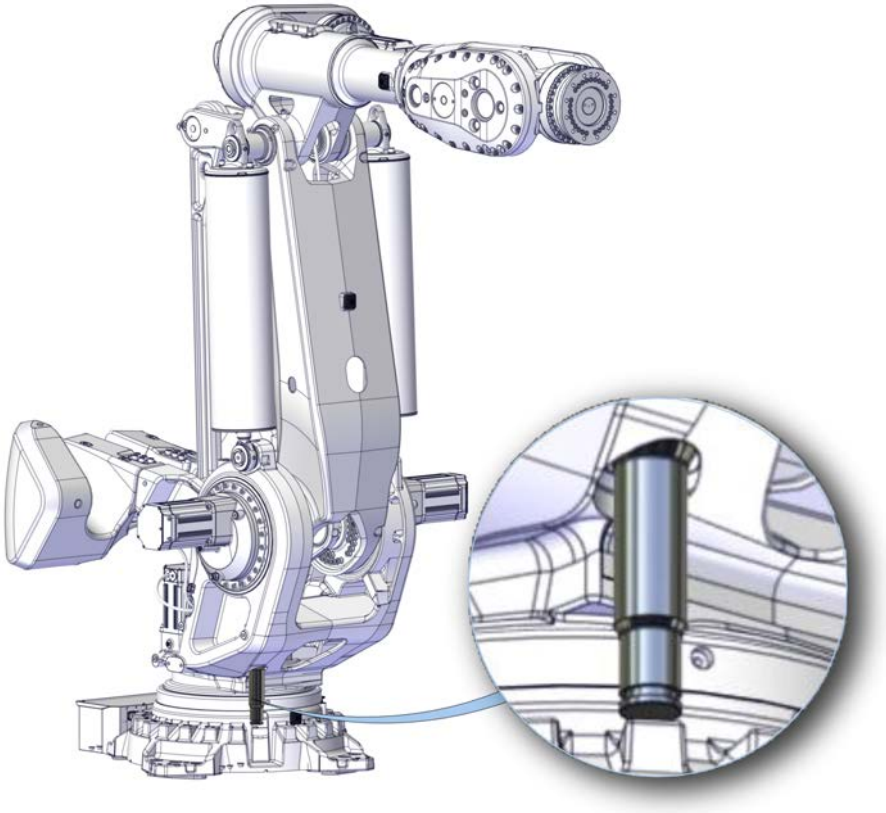
	Action	Note
6	Use caution and lift the counterweight up onto the parallel arm.	 xx1500001982
7	Fit attachment screws with washers and secure the counterweight to the parallel arm.	Attachment screws: M16x70 Gleitmo (10 pcs) Tightening torque: 300 Nm  xx1500001981
8	Remove lifting accessories; lifting chains and the lifting eyes.	
9	If used, refit the plastic plugs in the holes for the lifting eyes.	 xx1500001980

4.7.2 Replacing the mechanical stop pin

Location of the mechanical stop pin

The mechanical stop pin is located as shown in the figure.



xx1500002077

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Mechanical stop pin	3HAC048180-001		L1

Required tools and equipment

Equipment, etc.	Article number	Note
Piece of wood	-	Used when replacing the parallel rod and mechanical stop pin as a safety measure

Continues on next page

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

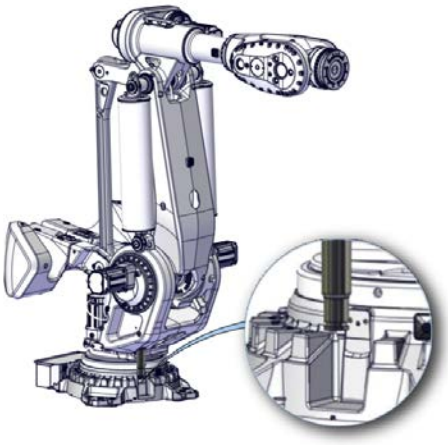
Required consumables

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

Removing the mechanical stop pin

Use these procedures to remove the mechanical stop pin.

Robot position when replacing the mechanical stop pin

	Action	Note
1	Jog axis-1 to the position where it is possible to replace the mechanical stop pin.	 xx1500002093
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

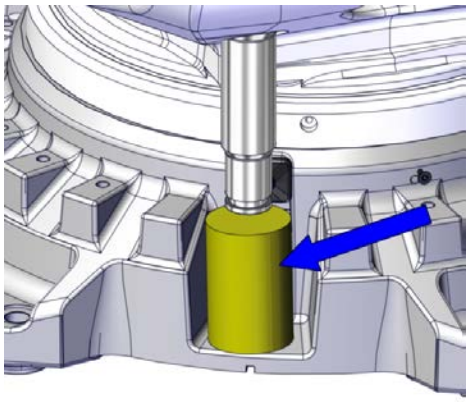
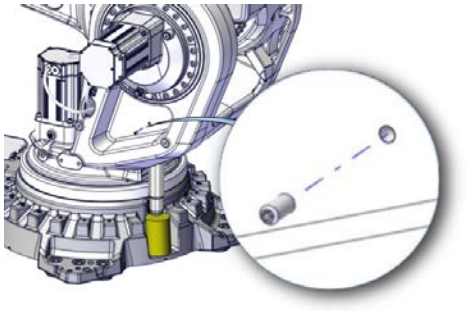
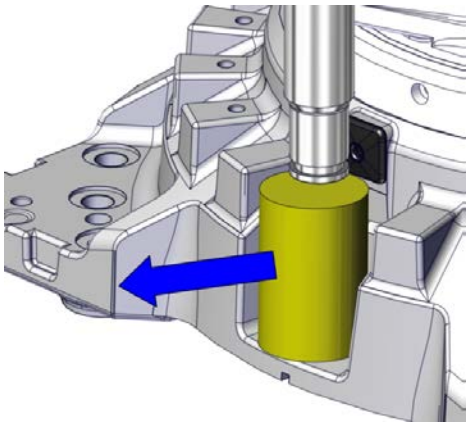
Removing the mechanical stop pin

	Action	Note
1	**CAUTION** The mechanical stop pin weighs 13 kg.	

Continues on next page

4.7.2 Replacing the mechanical stop pin

Continued

	Action	Note
2	Put a piece of wood (or similar) underneath the stop pin, to prevent it from falling down uncontrolled, when the set screw is removed.	 xx1500002091
3	Take a firm grip on the stop pin with one hand.	
4	Unscrew the set screw with the other hand. **Note** Always use a flat head Allen key, to not damage the screw head.	 xx1500002090
5	Hold the stop pin with one hand and remove the piece of wood (or similar) with the other hand.	 xx1500002299

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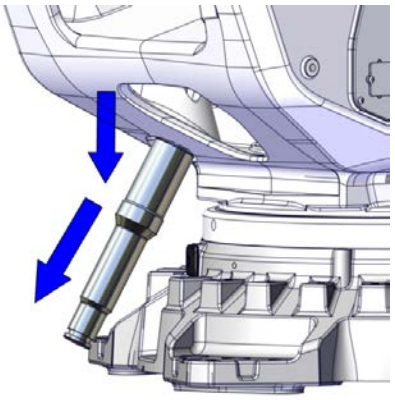
	Action	Note
6	Remove the stop pin by sliding it down, out off its hole and moving it slightly forwards.	 xx1500002089

Refitting the mechanical stop pin

Use these procedures to refit the mechanical stop pin.

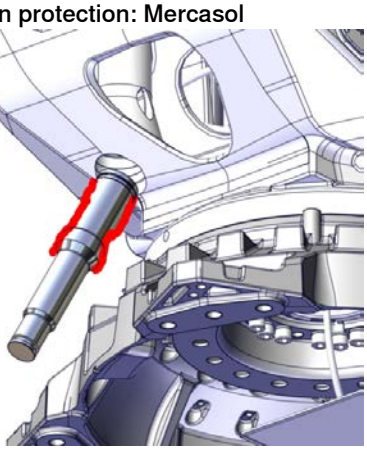
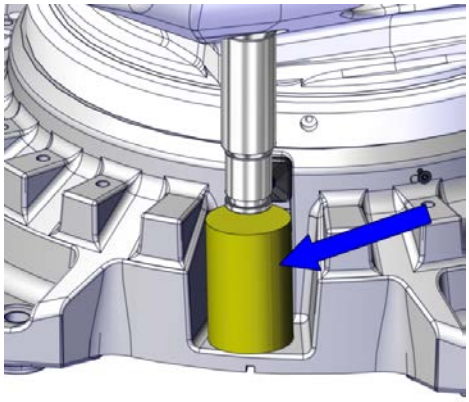
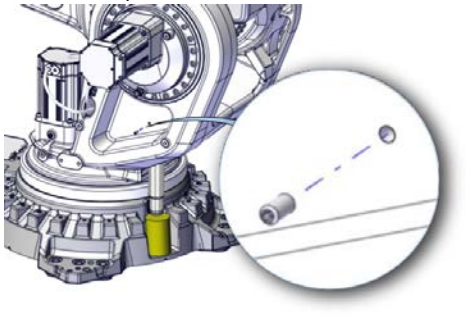
Refitting the mechanical stop pin

	Action	Note
1	Make sure that axis-1 is in the position where it will be possible to replace the mechanical stop pin. If not, turn on the power, use caution and jog axis-1 to that position.	 xx1500002093
2	Clean the stop pin, as well as the hole for it.	

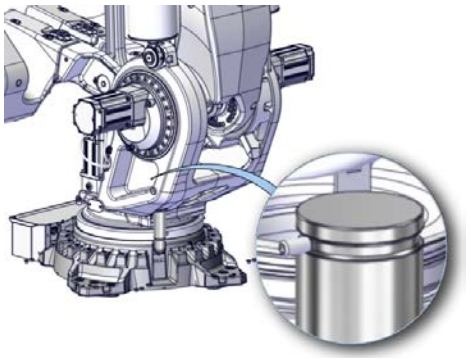
Continues on next page

4.7.2 Replacing the mechanical stop pin

Continued

	Action	Note
3	Apply corrosion protection on the marked area on the stop pin and on the matching area in the hole.	Corrosion protection: Mercasol  xx1500002094
4	**CAUTION** The mechanical stop pin weighs 13 kg.	
5	Put a piece of wood (or similar) underneath the stop pin, to prevent it from falling down uncontrolled when the set screw is refitted.	 xx1500002091
6	Apply locking liquid (Loctite 2400 (or equivalent Loctite 243)) on the set screw.	Locking liquid: Loctite 2400 (or equivalent Loctite 243)  xx1500002090

Continues on next page

	Action	Note
7	Make sure that the set screw will find the groove in the stop pin, before securing the mechanical stop pin. **Note** Always use a flat head Allen key, to not damage the screw head. **Tip** Use caution and move the stop pin a little up and down while at the same time carefully fitting the set screw, making sure that the screw will secure the stop pin in the groove.	 xx1500002092
8	Secure the mechanical stop pin with the set screw.	Tightening torque: 35 Nm

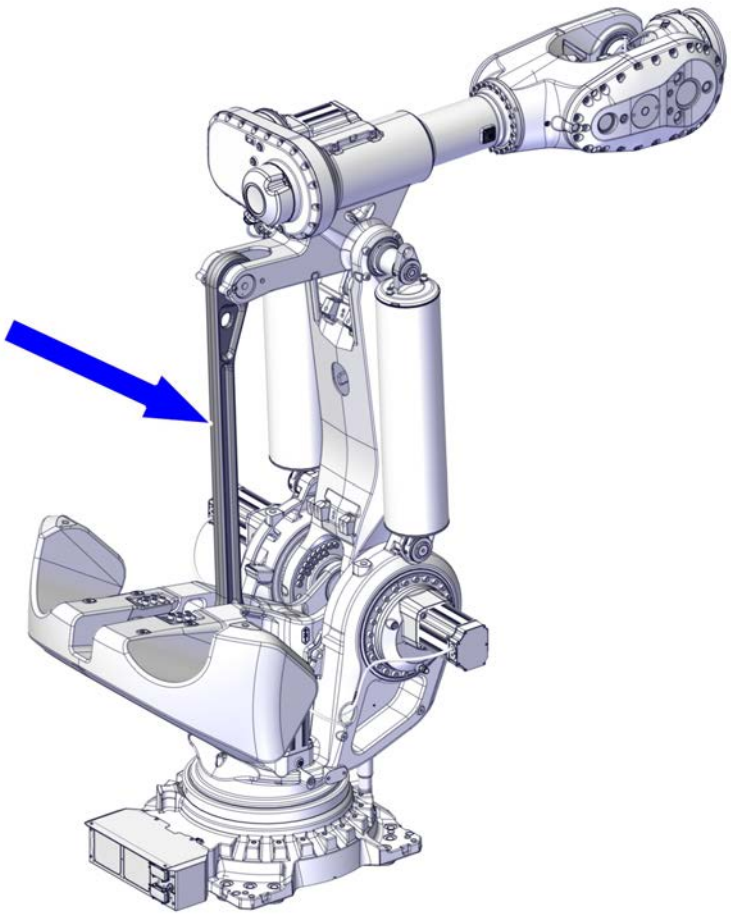
Concluding procedure

	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 97*.	

4.7.3 Replacing the parallel rod

Location of the parallel rod

The parallel rod is located as shown in the figure.



xx1500001978

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Color	Article number	Note	Level
Parallel bar	Graphite White	3HAC048077-003		L2
Parallel bar	ABB Orange	3HAC048077-004		L2

Continues on next page

Spare part	Color	Article number	Note	Level
Shaft		3HAC048837-001	Replace if damaged.	L2
Cover washer		3HAC048835-001	Replace if damaged.	L2
Thrust washer		3HAC048836-001	Replace if damaged.	L2
Hex socket head cap screw	M10x16 8.8-A3F	9ADA183-48	Replace if damaged.	L2
Spring washer, conical	10.5x23x2.5 Steel-mZn12c	9ADA334-8	Replace if damaged.	L2

Required tools and equipment

Equipment, etc.	Article number	Note
Mobile platform ladder	-	
Lifting eye	3HAC16131-1	VLBG M12
Fender washer	-	Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.
Roundsling 2.5 m (1 pcs) Roundsling 3 m (1 pcs)	-	Used for lifting upper arm. Lifting capacity: 2,000 kg on each roundsling.
Brake release tool	3HAC081310-001	User instructions are enclosed with the tool.
Piece of wood	-	Used when replacing the parallel rod and mechanical stop pin as a safety measure
Fixing screw, M10x80 (4 pcs)	-	Fully threaded. Used to hold parallel rod in position.
Press tools, parallel rod shaft	3HAC071354-001	User instructions (3HAC071354-002) are enclosed with the tool.
Hydraulic cylinder, parallel rod shaft	3HAC071378-001	User instructions (3HAC071378-002) are enclosed with the tool.
Hydraulic pump, 700 bar	-	To be used with the hydraulic cylinder. Maximum allowed working pressure 700 bar.
Velcro strap	-	
Roundsling 1 m	-	Lifting capacity: 1,000 kg
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumables

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

Continues on next page

4.7.3 Replacing the parallel rod
Continued

Required documents

Document	Document number	Note
User instructions, parallel rod shaft press tools	3HAC071354-002	Enclosed with the toolkit.

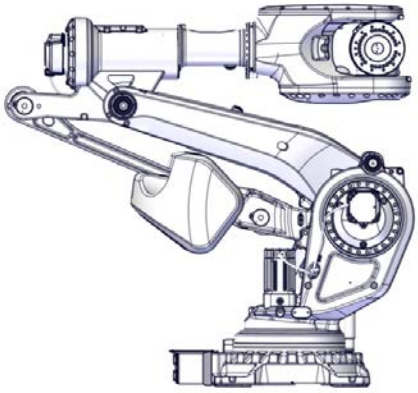
Removing the parallel rod

Use these procedures to remove the parallel rod.

Note

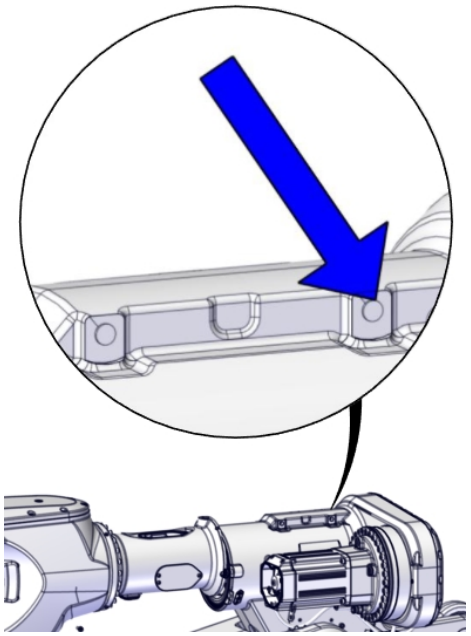
If the parallel rod shall be removed from the robot, always disassemble the upper end shaft first.

Robot position when removing the parallel rod

	Action	Note
1	If not already in this position, jog the robot to the specified position: • Axis 1: No significance, as long as the robot is secured to the foundation. • Axis 2: Comfortable working position. Figure shows -65°. • Axis 3: Comfortable working position. Figure shows approximately +2°. • Axis 4: +90° (only needed if the cable harness shall be removed later in the procedure) • Axis 5: -90° (only needed if the cable harness shall be removed later in the procedure) • Axis 6: No significance.	**Note** The upper arm shall be in **horizontal position** against the foundation. The figure shows a suggestion of robot position that gives a comfortable working position and does not require the axis 2 to be secured with a lock screw.  xx1700001306
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Continues on next page

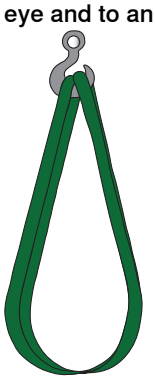
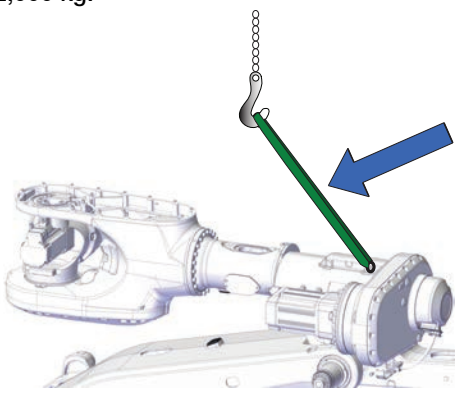
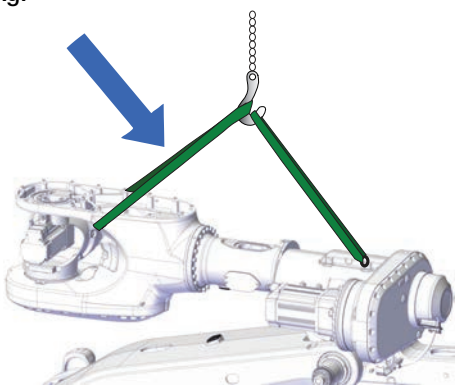
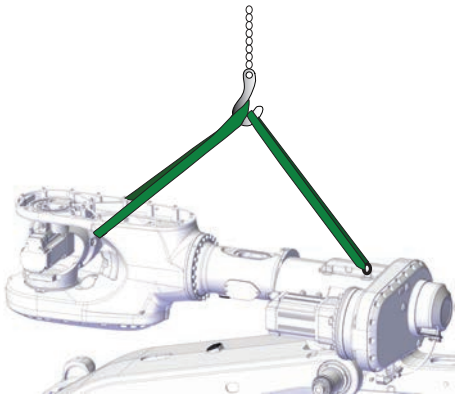
Attaching lifting accessories to the upper arm complete

	Action	Note
1	**CAUTION** The complete upper arm weighs 900 kg. All lifting accessories used must be sized accordingly.	
2	If needed, use a Mobile platform ladder (or similar) to attach the lifting accessories. **DANGER** Never use the robot as ladder.	Mobile platform ladder
3	Remove the plastic plug from the back hole of the arm housing.	 xx1500002712 Lifting eye: 3HAC16131-1 (VLBG M12) Fender washer: Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.
4	Attach a Lifting eye to the hole in the arm housing with a Fender washer underneath.  xx1400002196	

Continues on next page

4.7.3 Replacing the parallel rod

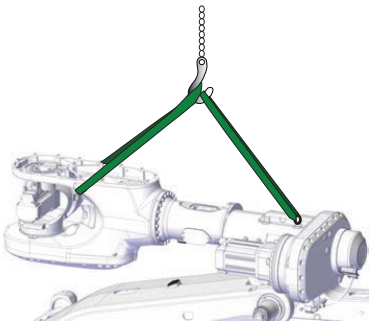
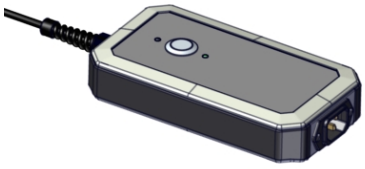
Continued

	Action	Note
5	Attach a roundsling looped to the Lifting eye and to an overhead crane (or similar).  xx1400002599	Roundsling 2.5 m with lifting capacity: 2,000 kg.[i]  xx1500002713
6	Attach a roundsling looped to the wrist and to an overhead crane (or similar).	Roundsling 3 m with lifting capacity: 2,000 kg.[i]  xx1500002714
7	Stretch the lifting accessories to take the weight of the upper arm.	 xx1500002724
8	Adjust the lifting accessories, if needed.	

i This is a recommendation according to standard EN 1492. Always conform to local regulations.

Continues on next page

Releasing the brakes on the axis-2 motor

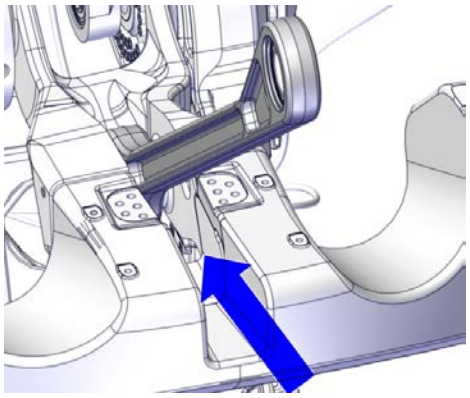
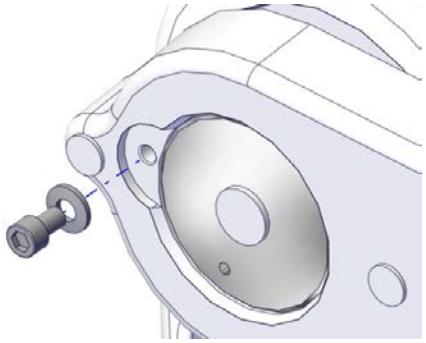
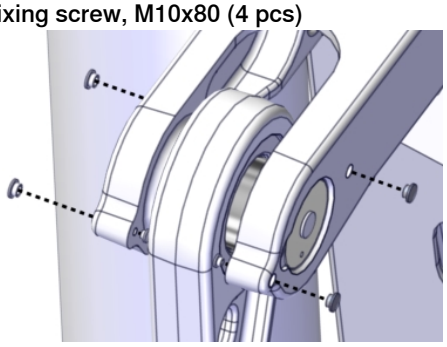
	Action	Note
1	Before continuing, make sure that the upper arm is secured in the lifting accessories and overhead crane. Stretch the lifting accessories to unload the upper arm weight. **CAUTION** The upper arm including the wrist weighs approximately 900 kg. All lifting accessories must be sized accordingly.	 xx1500002724
2	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 R2.MP2 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP2: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
3	Release the brakes on axis-2 to allow the lower arm to position according to the lifting force applied from the overhead crane. This eliminates any strain in the upper arm shafts.	
4	Remove the brake release from R2.MP2.	

Continues on next page

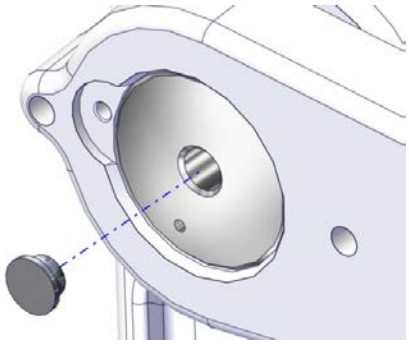
4.7.3 Replacing the parallel rod

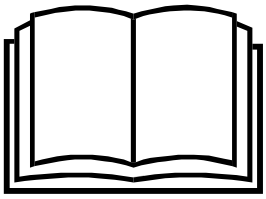
Continued

Removing the parallel rod, upper end

	Action	Note
17	Put a piece of wood (or similar) between parallel arm and parallel rod, used as protection to prevent the rod from moving unexpectedly during the continued procedure.	 xx1500001963
18	Remove the attachment screw with washer that secure the rod shaft.	 xx1400002600
19	Remove the protection plugs (4 + 4 pcs) and fit 2 + 2 M10x80 screws in the holes. Adjust the screws against the parallel rod from both sides. **Note** Keep the protection plugs. They shall be refitted when the work is done.	This is done to prevent the upper arm wings from pinching when pressing the shaft and thereby making it more difficult to press the shaft in or out. Fixing screw, M10x80 (4 pcs)  xx1500001961

Continues on next page

	Action	Note
20	Remove the protection plug. **Note** Keep the protection plug. It shall be refitted when the work is done.	 xx1500001967


xx0900000813

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

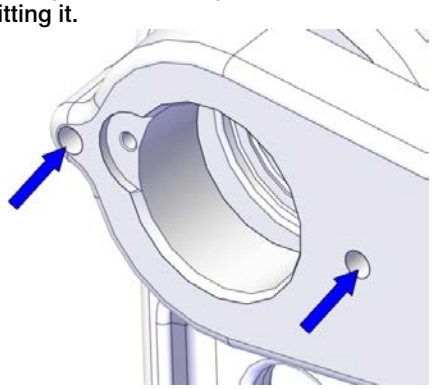
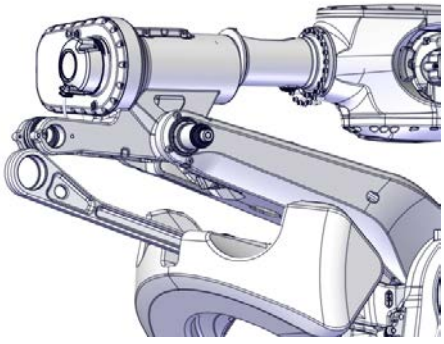
Press tools, parallel rod shaft: 3HAC071354-001

User instructions, parallel rod shaft press tools: 3HAC071354-002

WARNING

Handling the tool incorrectly may cause serious injury.

Read and follow enclosed user instructions for the tool.

	Action	Note
21	Unscrew two of the M10x80 screws, approximately 5 mm, on one side of the parallel rod. Leave the screws on the other side.	This is to be able to remove the parallel rod without problems and to be able to find the correct position of the parallel rod, when refitting it.  xx1500002710
22	Move the parallel rod down and let it rest on the piece of wood, which was put there earlier.	 xx1500001965

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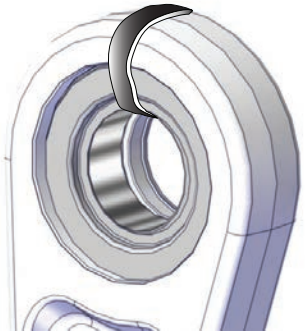
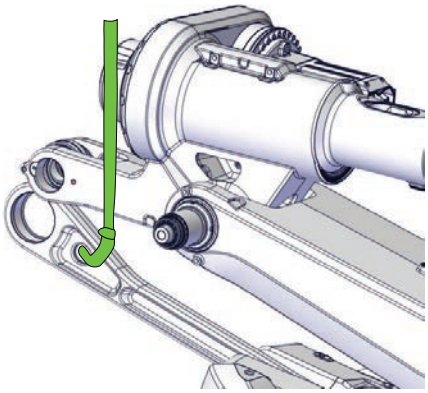
4.7.3 Replacing the parallel rod
Continued

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

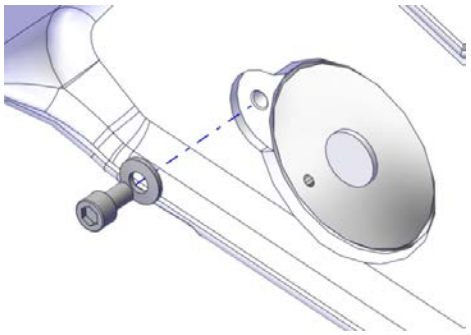
Removing the parallel rod, lower end

Note

If the parallel rod shall be removed from the robot, always disassemble the upper end shaft first.

	Action	Note
24	**CAUTION** The parallel rod weighs 55 kg. All lifting accessories used must be sized accordingly.	
25	Attach a roundsling, looped through the parallel rod and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg  xx1500002698
26	Stretch the roundsling to start taking the weight of the parallel rod.	

Continues on next page

	Action	Note
27	Remove the attachment screw with washer that secure the rod shaft.	 xx1500001966

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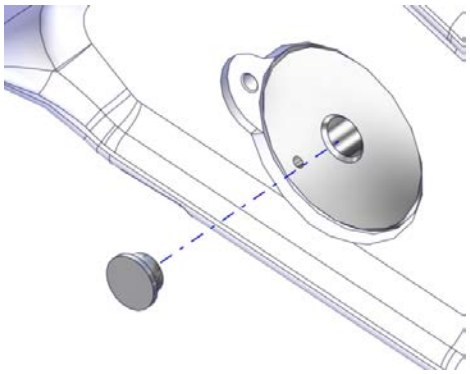
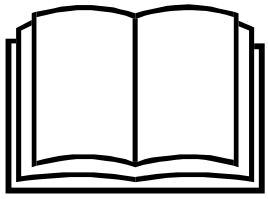
4.7.3 Replacing the parallel rod

Continued

	Action	Note
28	Remove the protection plug. **Note** Keep the protection plug. It shall be refitted when the work is done.	 xx1500001968



xx0900000813

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

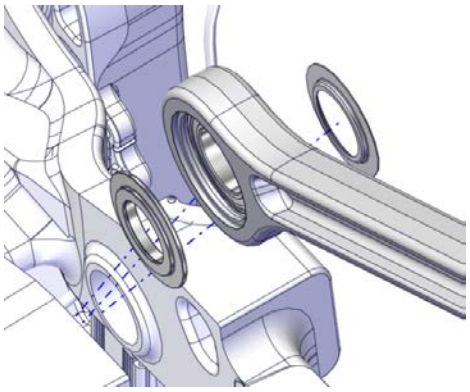
Press tools, parallel rod shaft: 3HAC071354-001

User instructions, parallel rod shaft press tools: 3HAC071354-002

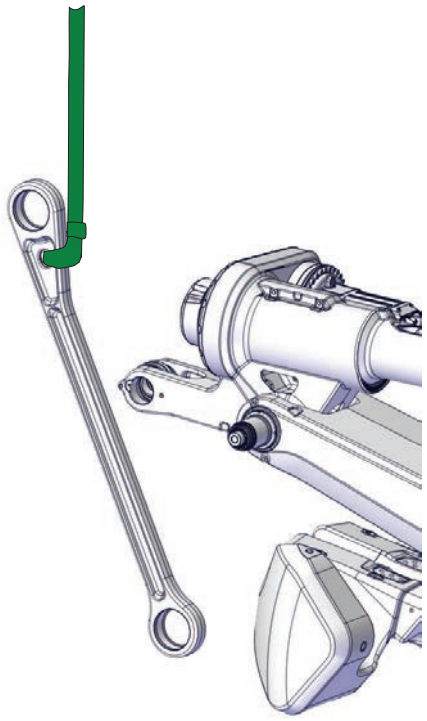
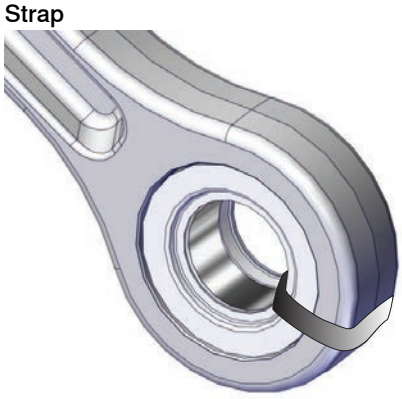
WARNING

Handling the tool incorrectly may cause serious injury.

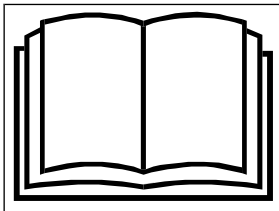
Read and follow enclosed user instructions for the tool.

	Action	Note
29	Make sure the thrust washer and cover washer on either side of the bearing are present. **Tip** Make a note on which side the respective washer is fitted, for a correct assembly later.	 xx1500002098 **Left side** / **Right side** Thrust washer / Cover washer

Continues on next page

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

Replacing the parallel rod bearing


xx0900000813

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

Press tools, parallel rod bearing: 3HAC071353-001

User instructions, parallel rod bearing press tools: 3HAC071353-002

WARNING

Handling the tool incorrectly may cause serious injury.

Read and follow enclosed user instructions for the tool.

Continues on next page

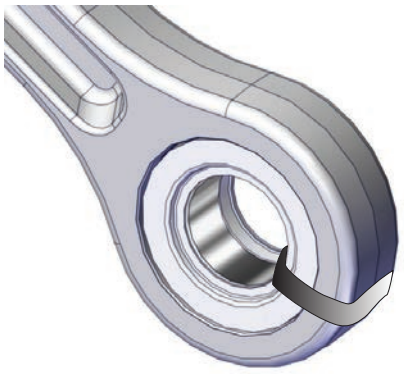
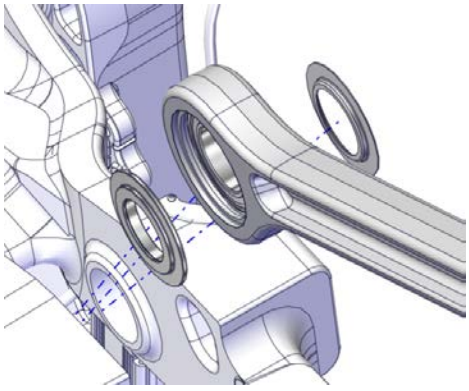
4.7.3 Replacing the parallel rod
Continued

Refitting the parallel rod

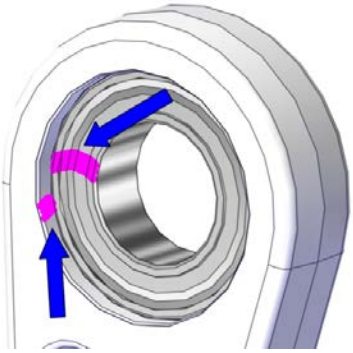
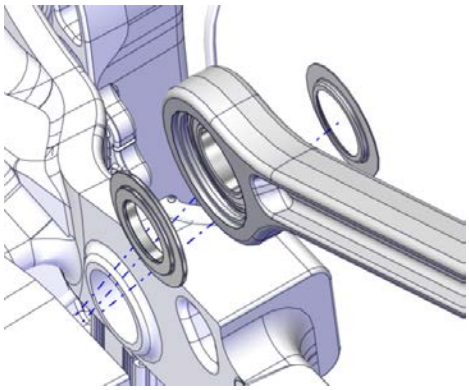
Use these procedures to refit the parallel rod.

> **Note**
>
> If the shafts in both upper and lower ends of the parallel rod shall be refitted, start refitting in the lower end.

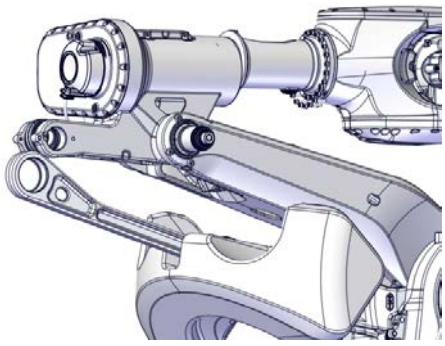
Preparations before refitting the parallel rod, lower end

	Action	Note
1	Remove the strap which was used to keep bearing, thrust washer and cover washer in position.	 xx1500002744
2	Remove the thrust washer and cover washer, and wipe them clean. **Note** Make a note on which side the covers are placed.	 xx1500002098 **Left side** / **Right side**: Thrust washer / Cover washer
3	Wipe the shafts and the holes for the shafts clean.	

Continues on next page

	Action	Note
4	Apply corrosion protection on both sides of the bearings, and on all machined surfaces on the parallel rod.	Mercasol  xx1500002100
5	Put back the thrust washer (left side) and cover washer (right side).	 xx1500002098 <table><tr><th>Left side</th><th>Right side</th></tr><tr><td>Thrust washer</td><td>Cover washer</td></tr></table>

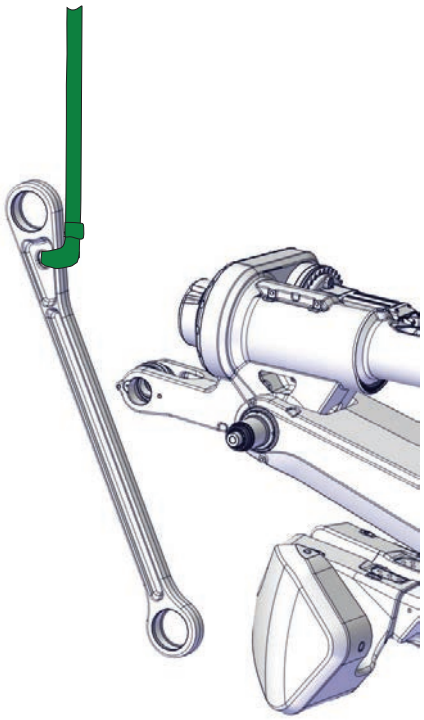
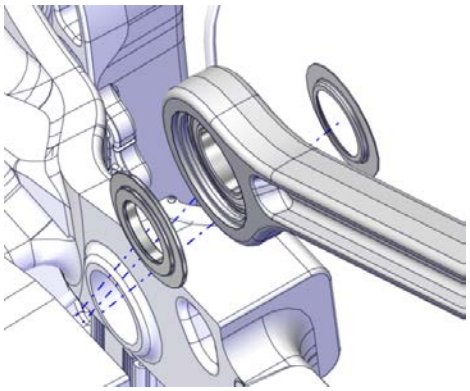
Refitting the parallel rod, lower end

	Action	Note
32	**Note** If the parallel rod has been removed from the robot, always start refitting at the lower end!	 xx1500001965
33	**CAUTION** The parallel rod weighs 55 kg.	

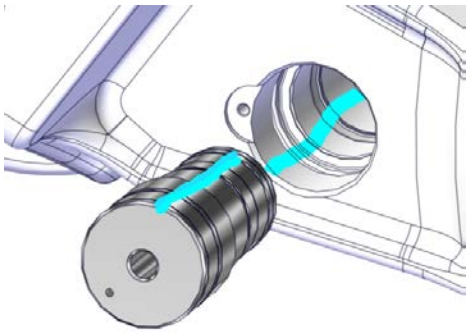
Continues on next page

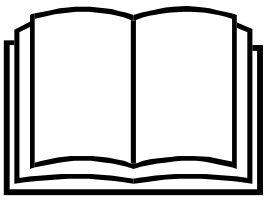
4.7.3 Replacing the parallel rod

Continued

	Action	Note
34	Attach a roundsling to the parallel rod and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg
35	Use caution, stretch the roundsling and lift the parallel rod into mounting position.	 xx1500002745
36	Place the lower end at mounting position and apply the press tool parts (Assembly tool, Press plate and Round plate).	
37	Make sure that the thrust washer and cover washer on either side of the bearing, are in position. **Note** Make sure that the washers are on the correct sides of the bearing.	Thrust washer: 3HAC048836-001 Cover washer: 3HAC048835-001  xx1500002098 Left side: Thrust washer Right side: Cover washer

Continues on next page

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


xx0900000813

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

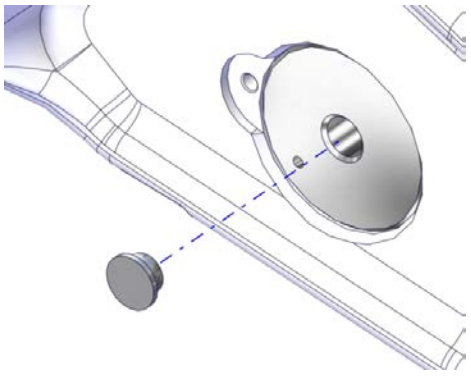
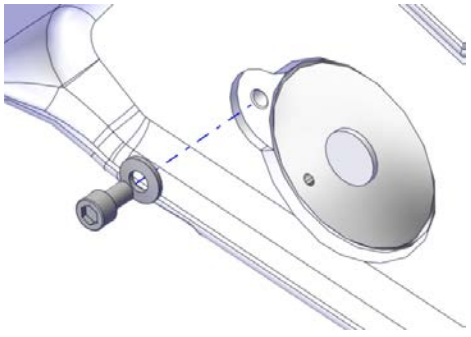
Press tools, parallel rod shaft: 3HAC071354-001

User instructions, parallel rod shaft press tools: 3HAC071354-002

WARNING

Handling the tool incorrectly may cause serious injury.

Read and follow enclosed user instructions for the tool.

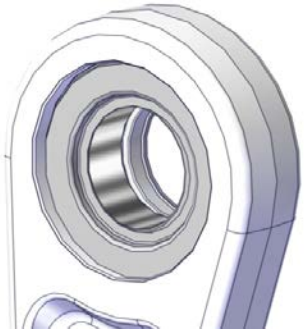
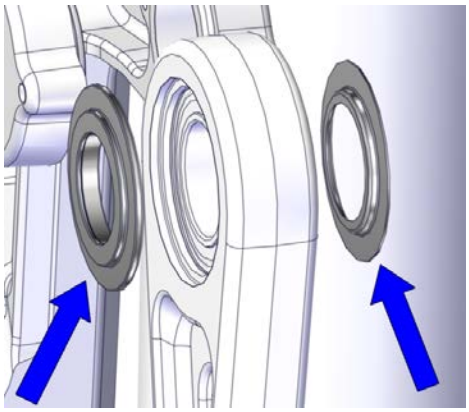
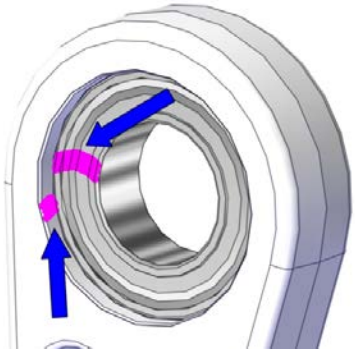
	Action	Note
39	Refit the protection plug.	 xx1500001968
40	Apply locking liquid on the screw and secure the shaft.	Hex socket head cap screw: 9ADA183-48 Spring washer, conical: 9ADA334-8 Loctite 243  xx1500001966

Continues on next page

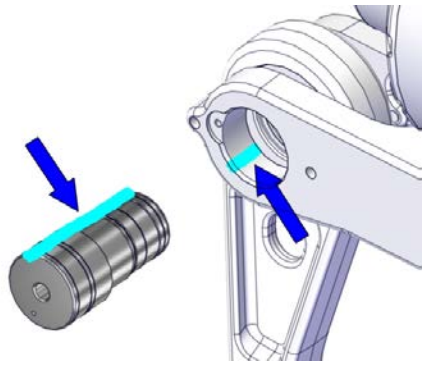
4.7.3 Replacing the parallel rod

Continued

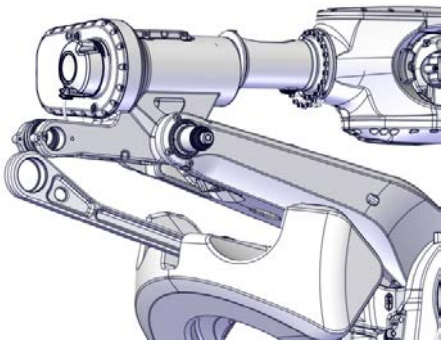
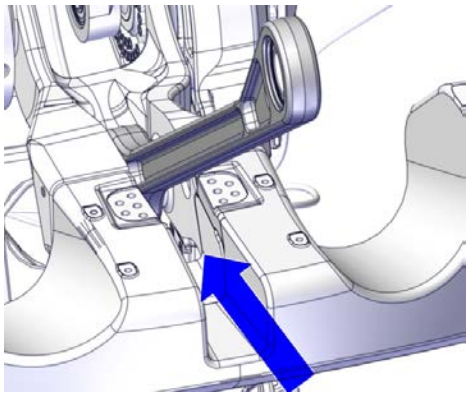
Preparations before refitting the parallel rod, upper end

	Action	Note
1	Remove the strap, which was used to keep bearing, thrust washer and cover washer in position.	 xx1500002097
2	Remove thrust washer and cover washers, and wipe them clean.	 xx1500001964 Left side – Thrust washer Right side – Cover washer
3	Wipe clean the shafts and the holes for the shafts.	
4	Apply corrosion protection (Mercasol) on both sides of the bearings, and on all machined surfaces on the parallel rod.	Mercasol  xx1500002100

Continues on next page

	Action	Note
5	Apply some grease on the shafts and in both upper arm mounting holes.	 xx1500002293

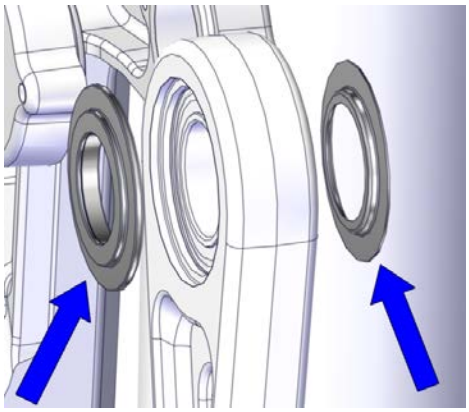
Refitting parallel rod, upper end

	Action	Note
41	**Note** If the parallel rod has been removed from the robot, always start refitting at the lower end!	
42	Take a firm grip of the parallel rod and lift it up into mounting position.	 xx1500001965
43	Put a piece of wood (or similar) between parallel arm and parallel rod, used as protection to prevent the rod from moving unexpectedly during the procedure.	 xx1500001963

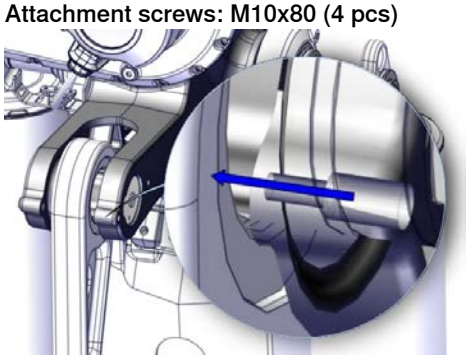
Continues on next page

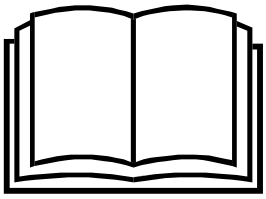
4.7.3 Replacing the parallel rod

Continued

	Action	Note
44	Place the thrust washer and cover washer on either side of the bearing and make sure that they are correctly fitted. **Note** Make sure that the washers are on the correct sides of the bearing.	 xx1500001964 **Left side**: Thrust washer **Right side**: Cover washer
45	Unscrew two of the M10x80 screws only on one side of the parallel rod, approximately 5 mm. Leave the screws fastened on the other side. **Note** This is done to be able to refit the parallel rod without problems and to be able to find the correct position of the parallel rod.	

Continues on next page

	Action	Note
46	Place the parallel rod into position and reattach the two M10x80 screws against the parallel rod. **Note** This is done to prevent the arm housing from being deformed when pressing the shaft and thereby making it more difficult to press the shaft in or out.	Attachment screws: M10x80 (4 pcs)  xx1500002300



xx0900000813

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

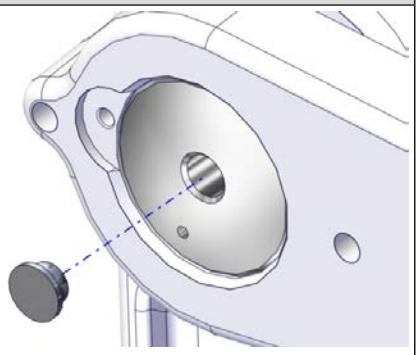
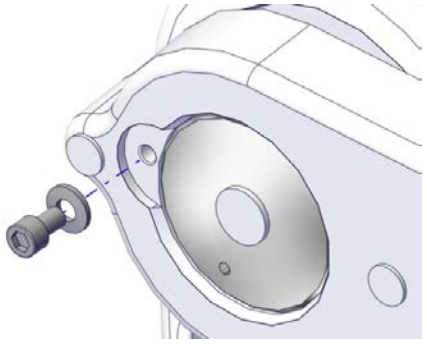
Press tools, parallel rod shaft: 3HAC071354-001

User instructions, parallel rod shaft press tools: 3HAC071354-002

WARNING

Handling the tool incorrectly may cause serious injury.

Read and follow enclosed user instructions for the tool.

	Action	Note
47	Refit the protection plug.	 xx1500001967
48	Apply locking liquid on the attachment screw and secure shaft.	Attachment screw: M10x16 8.8 Loctite 243  xx1400002600

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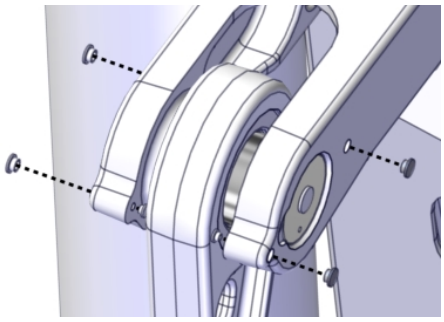
4.7.3 Replacing the parallel rod
Continued

	Action	Note
49	Remove the four M10x80 screws and refit the protection plugs (4+4 pcs).	 xx1500001961

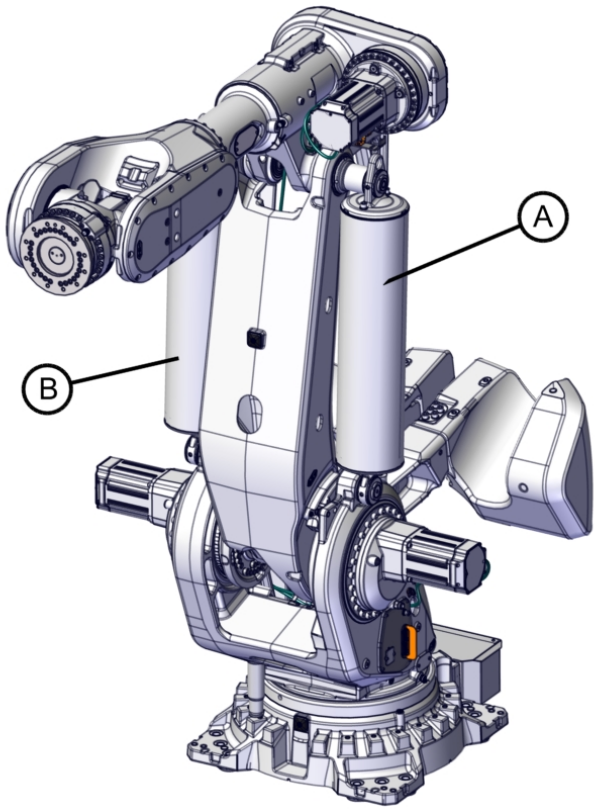
Concluding procedure

	Action	Note
1	Re-calibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section *Calibration on page 675*.
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 97*.	

4.7.4 Unloading and restoring the balancing device

Location of the balancing device

The balancing device is located as shown in the figure.



xx1600001406

A	Axis-2 balancing device
B	Axis-3 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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Color	Article number	Note
Balancing device	Graphite White	3HAC048239-003	
Balancing device	ABB Orange	3HAC048239-004	
Balancing device material set	-	3HAC048239-006	

Continues on next page

4.7.4 Unloading and restoring the balancing device

Continued

Required tools and equipment

Equipment, etc.	Article number	Note
Mobile platform ladder	-	
Screw M16x80	-	Fully threaded, 2 pcs
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

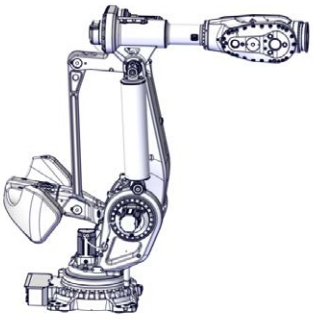
Required consumables

Consumable	Article number	Note
Molykote 1000		

Unloading the pressure of the balancing device

Use these procedures to unload the pressure of the balancing device.

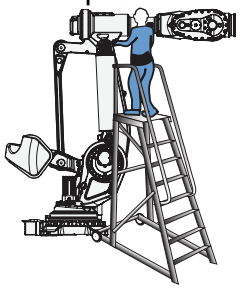
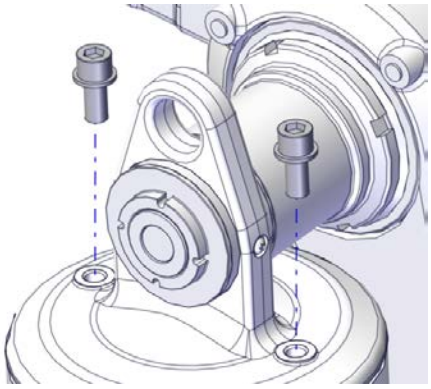
Preparations before unloading the pressure of balancing device

	Action	Note
1	Jog the robot to calibration position.	 xx1500002310
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Unloading the pressure of the balancing device

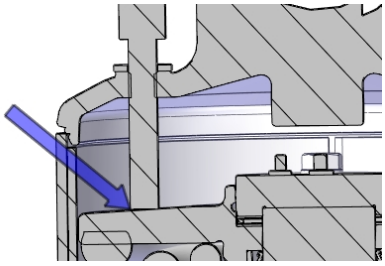
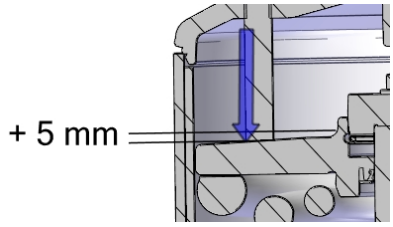
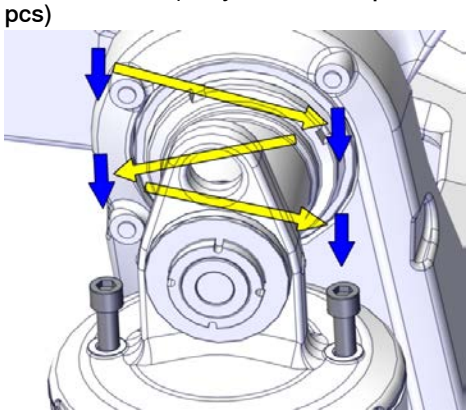
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

	Action	Note
2	Use a mobile platform ladder (or similar) to reach the upper end of the balancing device. **DANGER** Do not use the robot as ladder!	Mobile platform ladder  xx1500001985
3	Remove the screws, fitted in the screw holes on top of the balancing device. **Note** Keep the screws. They shall be refitted after the work is done.	 xx1500001971 M16x35
4	Apply some Molykote on threads and at the bottom end of two fully threaded screws, used for unloading the balancing device.	Screw M16x80 (Fully threaded, 2 pcs, 2 pcs) Apply Molykote on colored areas.  xx1500002303

Continues on next page

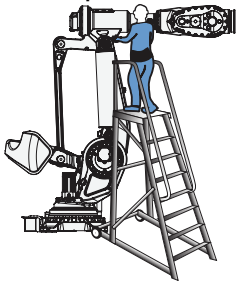
4.7.4 Unloading and restoring the balancing device
Continued

	Action	Note
5	Unload the pressure of the balancing device by inserting the screws. 1 Attach the screws until the screws reaches the piston.  xx1900001209 2 Then, alternately little by little, attach the screws at least another *five* millimeters. The pressure is now unloaded.  xx1900001210	Screw M16x80 (Fully threaded, 2 pcs, 2 pcs)  xx1500002309
6	In a procedure where both balancing devices shall be removed, unload the pressure of the other in the same way.	

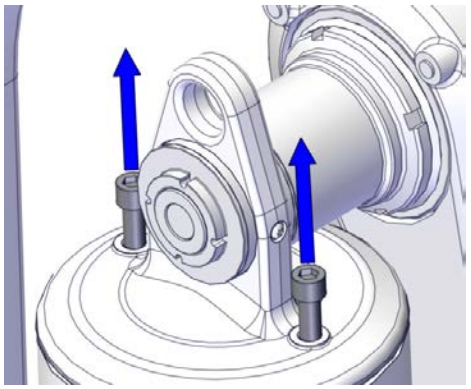
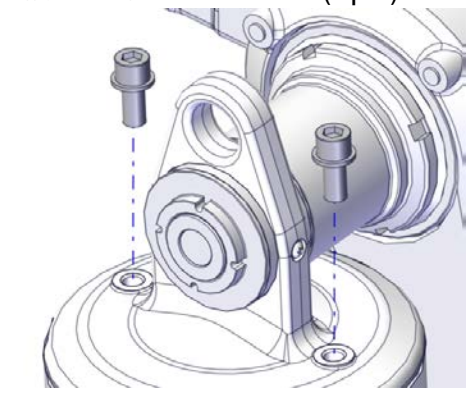
Restoring the pressure of the balancing device

Use these procedures to restore the pressure of the balancing device.

Restoring the pressure of the balancing device

	Action	Note
1	Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device. **DANGER** Do not use the robot as ladder.	Mobile platform ladder  xx1500001985

Continues on next page

	Action	Note
2	Restore the pressure of the balancing device by unscrewing the two M16x80 screws alternately little by little.	 xx1500002308
3	Remove the screws.	
4	Refit the M16x35 screws in the holes on top of the balancing device.	Attachment screws: M16x35 (2 pcs)  xx1500001971

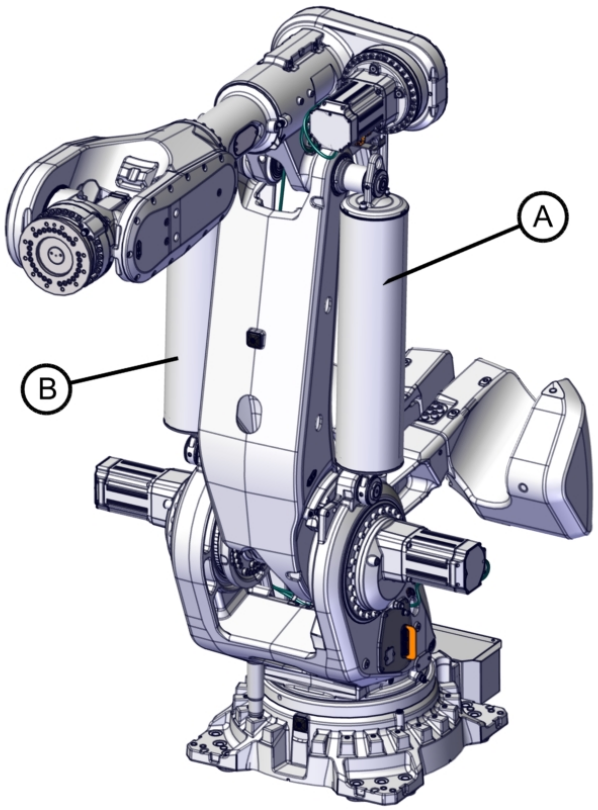
Concluding procedure

	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 97*.	

4.7.5 Replacing the balancing devices

Location of the balancing devices

The balancing devices are located as shown in the figure.



xx1600001406

A	Axis-2 balancing device
B	Axis-3 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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Color	Article number	Note	Level
Balancing device	Graphite White	3HAC048239-003		L2
Balancing device	ABB Orange	3HAC048239-004		L2
Balancing device material set	-	3HAC048239-006		L2

Continues on next page

Required tools and equipment

Equipment, etc.	Article number	Note
Mobile platform ladder	-	
Screw M16x80	-	Fully threaded, 2 pcs
Roundsling 1 m	-	Lifting capacity: 1,000 kg
Lifting accessory, balancing device	3HAC054236-001	Required to lift the balancing device on the axis-4 motor side.
Sleeve KM nut M10	3HAC071313-001	
Bearing puller	-	Used when removing the balancing device.
Press tools, balancing device bearing	3HAC071352-001	User instructions (3HAC071352-002) are enclosed with the tool.
Hydraulic cylinder, bearing	3HAC071377-001	User instructions (3HAC071377-002) are enclosed with the tool.
Hydraulic pump, 700 bar	-	To be used with the hydraulic cylinder. Maximum allowed working pressure 700 bar.
Press tools, balancing device upper end	3HAC057130-015	
Press tools, balancing device lower end	3HAC057130-016	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumables

Consumable	Article number	Note
Bearing grease	3HAC9408-1	Bearing grease
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)
Molykote 1000		

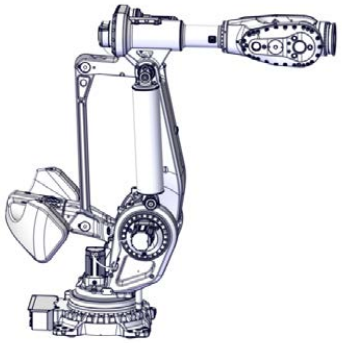
Continues on next page

4.7.5 Replacing the balancing devices
Continued

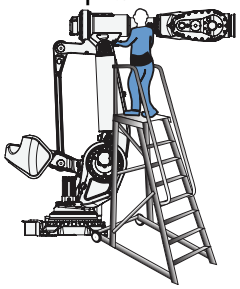
Removing the balancing device

Use these procedures to remove the balancing device.

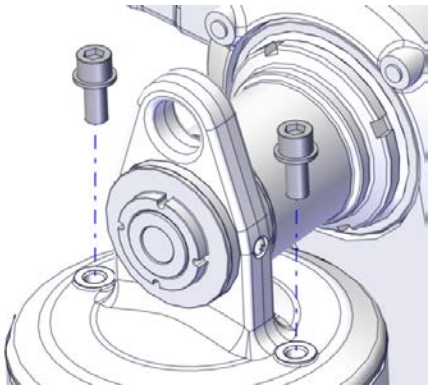
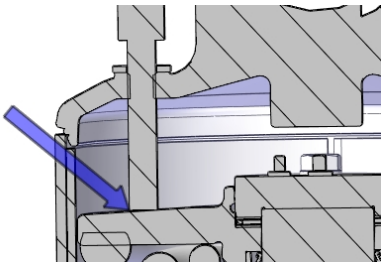
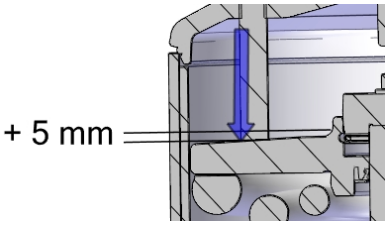
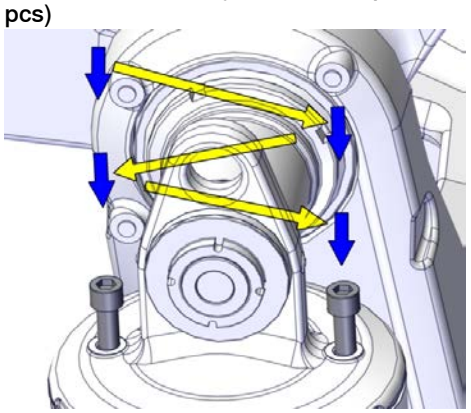
Robot position when replacing the balancing device

	Action	Note
1	Jog the robot to calibration position.	 xx1500002310
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Unloading the pressure of the balancing device

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Use a mobile platform ladder (or similar) to reach the upper end of the balancing device. **DANGER** Do not use the robot as ladder!	Mobile platform ladder  xx1500001985

Continues on next page

	Action	Note
3	Remove the screws, fitted in the screw holes on top of the balancing device. **Note** Keep the screws. They shall be refitted after the work is done.	 xx1500001971 M16x35
4	Apply some Molykote on threads and at the bottom end of two fully threaded screws, used for unloading the balancing device.	Screw M16x80 (Fully threaded, 2 pcs, 2 pcs) Apply Molykote on colored areas.  xx1500002303
5	Unload the pressure of the balancing device by inserting the screws. 1 Attach the screws until the screws reaches the piston.  xx1900001209 2 Then, alternately little by little, attach the screws at least another *five* millimeters. The pressure is now unloaded.  xx1900001210	Screw M16x80 (Fully threaded, 2 pcs, 2 pcs)  xx1500002309

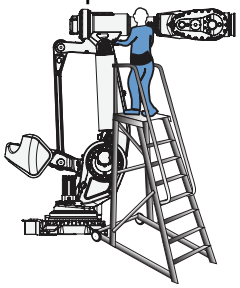
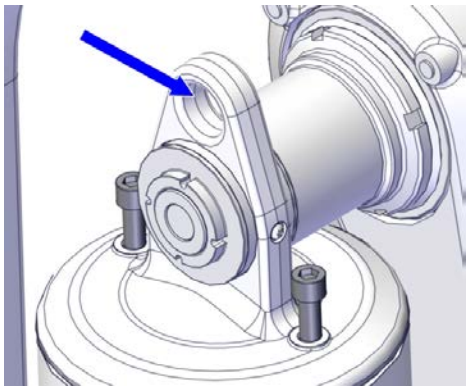
Continues on next page

4.7.5 Replacing the balancing devices

Continued

	Action	Note
6	In a procedure where both balancing devices shall be removed, unload the pressure of the other in the same way.	

Removing the balancing device

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Use a mobile platform ladder to reach the upper end of the balancing device. **DANGER** Do not use the robot as a ladder.	Mobile platform ladder  xx1500001985
3	**CAUTION** The balancing device weights 200 kg. All lifting accessories used must be sized accordingly.	
4	Attach a roundsling to the lifting hole on top of the balancing device and to an overhead crane (or similar). A lifting tool is required on the axis-4 motor side, to avoid pressure on the motor during lifting.	Roundsling 1 m: Lifting capacity: 1,000 kg Lifting accessory, balancing device: Required to lift the balancing device on the axis-4 motor side.  xx1500001983
5	Stretch the lifting accessories to unload the balancing device weight.	

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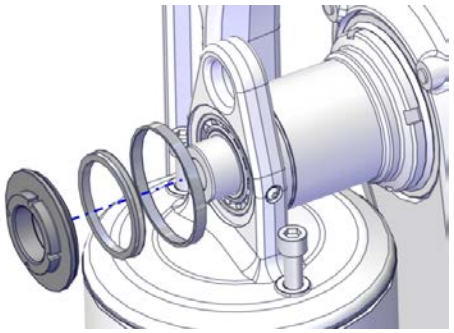
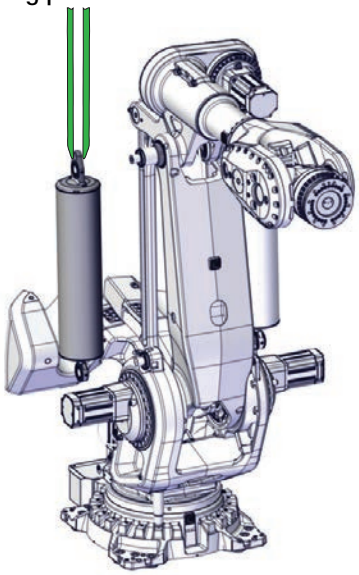
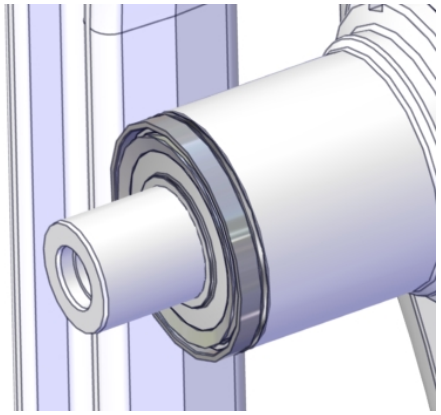
	Action	Note
6	Remove upper and lower KM-nuts, V-rings and support rings.	Sleeve KM nut M10: 3HAC071313-001  xx1500001973
7	Use caution and lift the balancing device off. **Tip** If needed, use a bearing puller, to carefully help pressing the balancing device out.	Bearing puller  xx1500002735
8	Verify that the support ring, V-ring and spacer ring are present on the shaft. No need to remove. If a bearing remains seated on the shaft, remove it according to *Replacing the balancing device bearings on page 420*.	 xx1500001976

Continues on next page

4.7.5 Replacing the balancing devices
Continued

	Action	Note
9	Put the balancing device down.  **CAUTION** Be careful when putting down the balancing device. The balancing device ear and piston rod should not take any weight.  **Tip** Turn a pallet upside down and place the balancing device in the opening for the trucks forks. This will prevent the balancing device from starting to move unexpectedly.	Pallet

Replacing the balancing device bearings

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

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

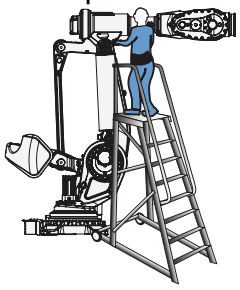
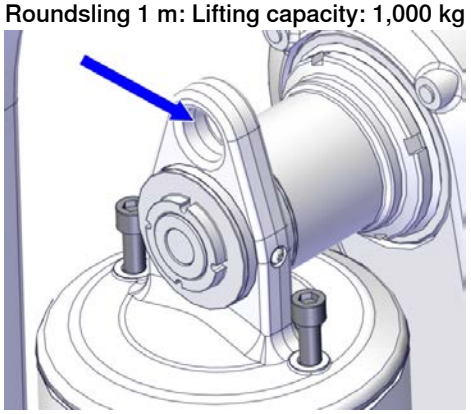
	Action	Note
1	Remove the old bearing.	If the bearing is seated inside the balancing device ear, use the press tool kit and a hydraulic cylinder. Press tools, balancing device bearing: 3HAC071352-001 User instructions (3HAC071352-002) are enclosed with the tool. Hydraulic cylinder, bearing: 3HAC071377-001
		If the bearing remains fitted to the shaft, use a bearing puller. Bearing puller
2	Fit new bearings to the balancing device ears, using the press tool kit and a hydraulic cylinder. The lubrication holes in the bearing must be aligned with the lubrication holes inside the balancing device ear.  **Note** Make sure the bearings are axially centered in the balancing device ears, before putting them on the shafts.	New bearing is included in: Balancing device material set: 3HAC048239-006 Press tools, balancing device bearing: 3HAC071352-001 User instructions (3HAC071352-002) are enclosed with the tool. Hydraulic cylinder, bearing: 3HAC071377-001

Continues on next page

Refitting the balancing device

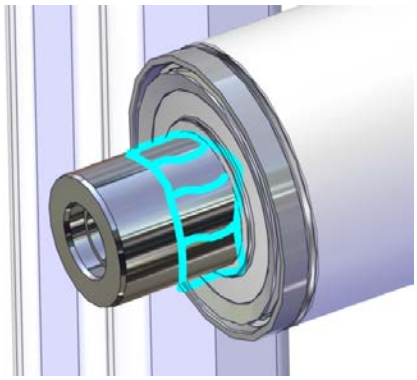
Use these procedures to refit the balancing device.

Preparations before refitting the balancing device

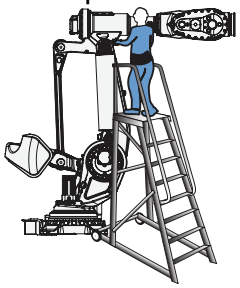
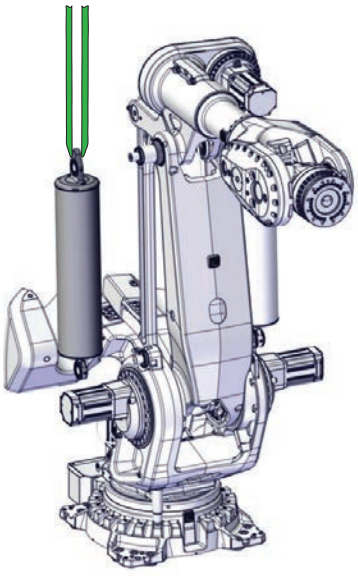
	Action	Note
1	**CAUTION** The balancing device weighs 200 kg. All lifting accessories used must be sized accordingly!	
2	Use a Mobile platform ladder (or similar), to reach the upper end of the balancing device. **DANGER** Do not use the robot as ladder.	Mobile platform ladder  xx1500001985
3	Attach a roundsling to the lifting hole on top of the balancing device and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg  xx1500001983
4	Use caution and lift the balancing device up an let it hang in the lifting accessories.	
5	Wipe clean the contact surfaces.	

Continues on next page

4.7.5 Replacing the balancing devices
Continued

	Action	Note
6	Apply some grease on shafts and in bearing holes. **Note** Do not apply any grease on the threads for the KM-nut.	Grease  xx1500002304
7	If needed, fit bearings into the balancing device ears, according to *Replacing the balancing device bearings on page 420*.	

Refitting the balancing device

	Action	Note
1	Use a Mobile platform ladder (or similar), to reach the upper end of the balancing device. **DANGER** Do not use the robot as ladder.	Mobile platform ladder  xx1500001985
2	Use caution and raise the balancing device into mounting position.	 xx1500002735

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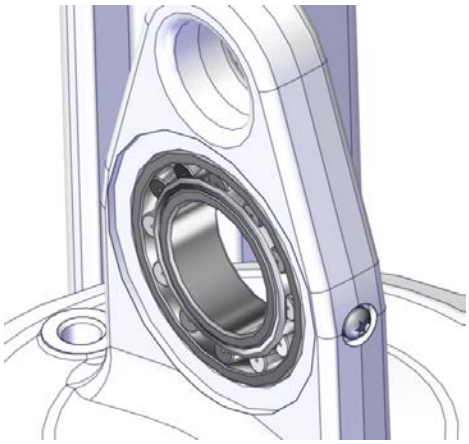
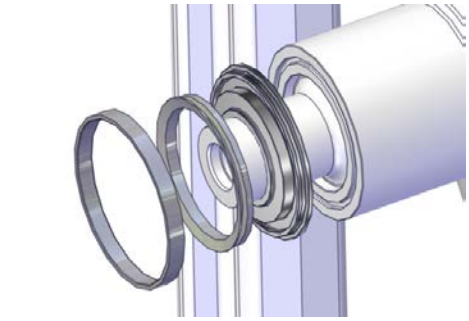
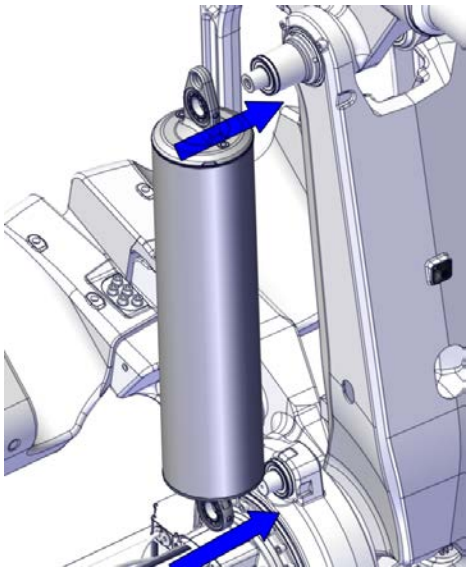
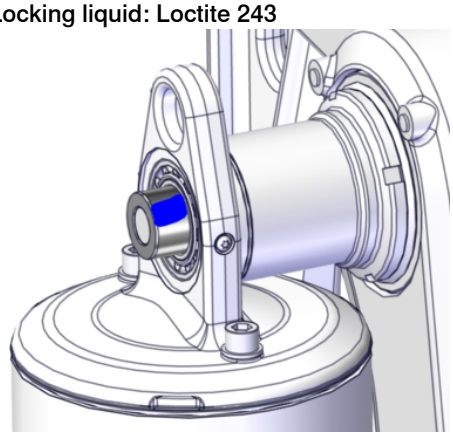
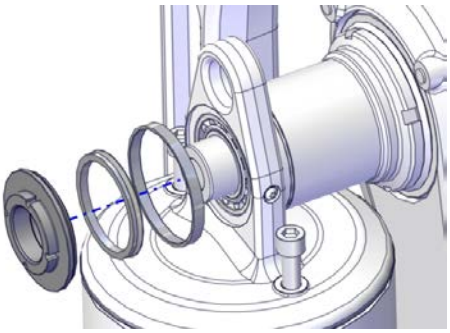
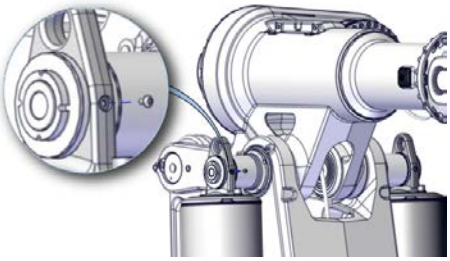
	Action	Note
3	**Note** Make sure the bearings are axially centered in the balancing device ears, before putting them on the shafts.	 xx1500002306
4	Make sure that the spacer ring with V-ring and the support ring are placed correctly on the shafts before the balancing device is put on the shafts.	 xx1500001975
5	Use caution and put the balancing device onto upper and lower shafts. Press the upper and lower part onto the shafts using the press tool.	Press tools, balancing device upper end: 3HAC057130-015 Press tools, balancing device lower end: 3HAC057130-015  xx1500002305

Continues on next page

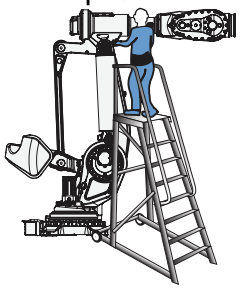
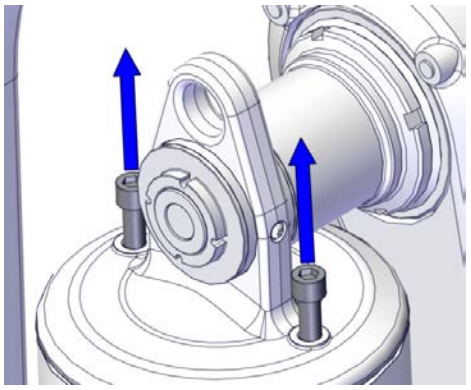
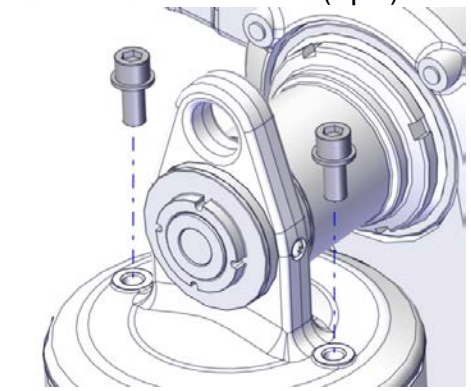
4.7.5 Replacing the balancing devices

Continued

	Action	Note
6	Apply locking liquid on the threads of the lock nuts.	Locking liquid: Loctite 243  xx1900001235
7	Inspect that the bearings are axially centered in the balancing device ears.	
8	Secure the balancing device with the two lock nuts, using a sleeve. **Note** Make sure that the V-ring and support ring are fitted correctly.	Tightening torque: 120 Nm Sleeve KM nut M10: 3HAC071313-001  xx1500001973
9	Remove the lifting accessories.	
10	Remove the M6x10 torx pan head screws on either side of the balancing device bearings. Lubricate each bearing with 30 gram of bearing grease.	Bearing grease: Tribol GR 100-2 PD  xx1500002055
11	Wipe away surplus grease and refit the M6x10 screws.	
12	If both balancing devices shall be refitted, refit the other in the same way.	

Continues on next page

Restoring the pressure of the balancing device

	Action	Note
1	Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device. **DANGER** Do not use the robot as ladder.	Mobile platform ladder  xx1500001985
2	Restore the pressure of the balancing device by unscrewing the two M16x80 screws alternately little by little.	 xx1500002308
3	Remove the screws.	
4	Refit the M16x35 screws in the holes on top of the balancing device.	Attachment screws: M16x35 (2 pcs)  xx1500001971

Concluding procedure

	Action	Note
1	Re-calibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section *Calibration on page 675*.

Continues on next page

4.7.5 Replacing the balancing devices

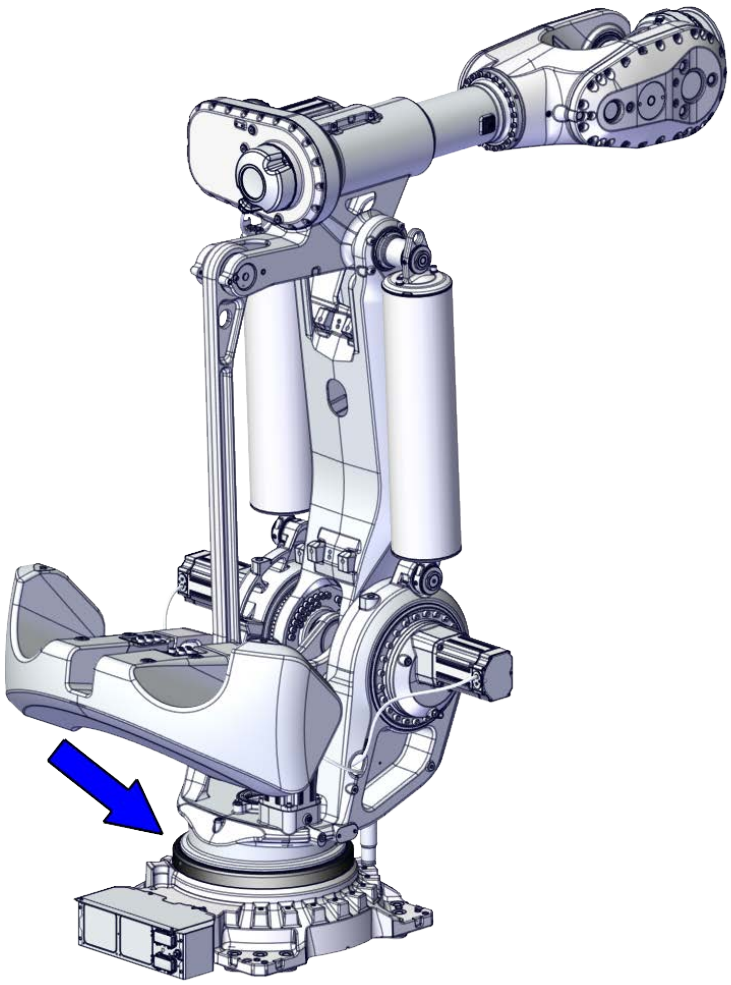
Continued

	Action	Note
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 97*.	

4.7.6 Replacing the cross roller bearing

Location of the cross roller bearing

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



xx2300001287

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Color	Article number	Note	Level
Cross roller bearing	Graphite White	3HAC067294-003		L2
Cross roller bearing	ABB Orange	3HAC067294-004		L2

Continues on next page

4.7.6 Replacing the cross roller bearing
Continued

Required tools and equipment

Equipment, etc.	Article number	Note
Lifting chains with shortener	-	
Lifting eye	3HAC038295-003	M24
Supporting pillars	3HAC061213-001	Used for elevation of the robot to remove and refit axis-1 gearbox. Includes: • Supporting pillars (4 pcs) • User instructions (3HAC062411-002) • Screws 3HAC061400-001 (4 pcs)
Hexagon socket spanner, socket size 14 mm	-	Used to remove and refit the R1.SMB in the base.
Mounting/Dismounting tools for Cross roller bearing	3HAC086258-001	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

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 689*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Continues on next page

Removing the cross roller bearing

Use these procedures to remove the cross roller bearing.

Preparations

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Remove any tool or other equipment fitted on the turning disc.	
3	Begin draining the oil.	See *Draining the axis-1 gearbox on page 142*.

Robot position when replacing the mechanical stop pin

	Action	Note
1	Jog axis-1 to the position where it is possible to replace the mechanical stop pin.	 xx1500002093
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

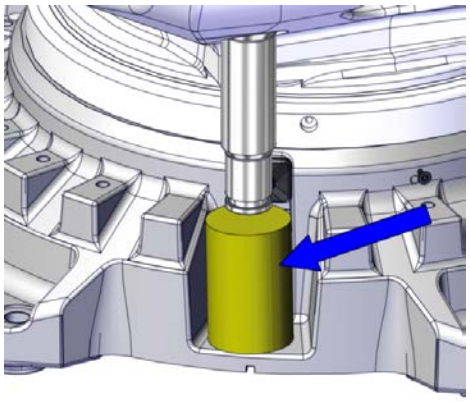
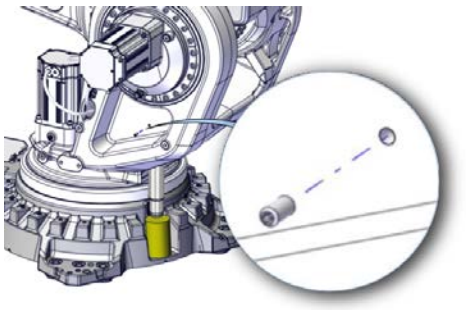
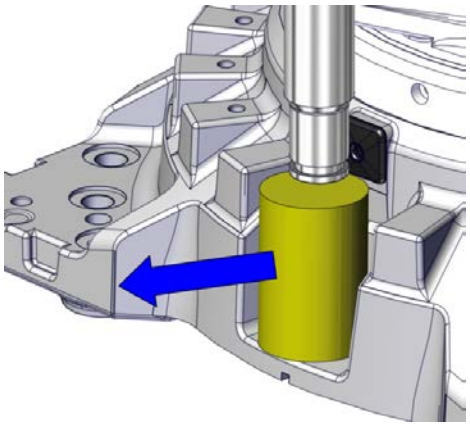
Removing the mechanical stop pin

	Action	Note
1	**CAUTION** The mechanical stop pin weighs 13 kg.	

Continues on next page

4.7.6 Replacing the cross roller bearing

Continued

	Action	Note
2	Put a piece of wood (or similar) underneath the stop pin, to prevent it from falling down uncontrolled, when the set screw is removed.	 xx1500002091
3	Take a firm grip on the stop pin with one hand.	
4	Unscrew the set screw with the other hand. **Note** Always use a flat head Allen key, to not damage the screw head.	 xx1500002090
5	Hold the stop pin with one hand and remove the piece of wood (or similar) with the other hand.	 xx1500002299

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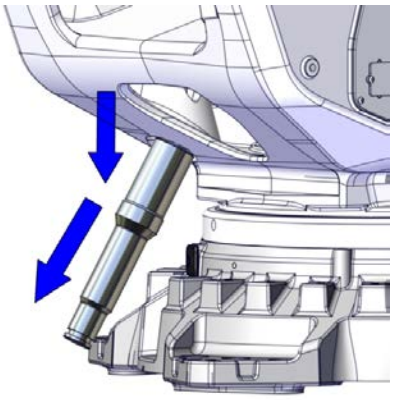
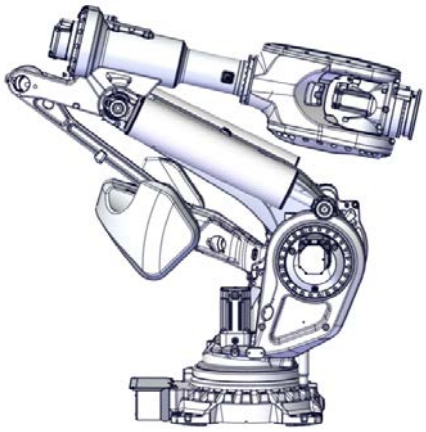
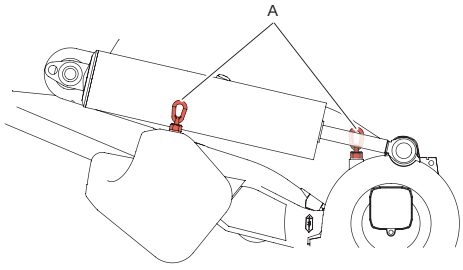
	Action	Note
6	Remove the stop pin by sliding it down, out off its hole and moving it slightly forwards.	 xx1500002089

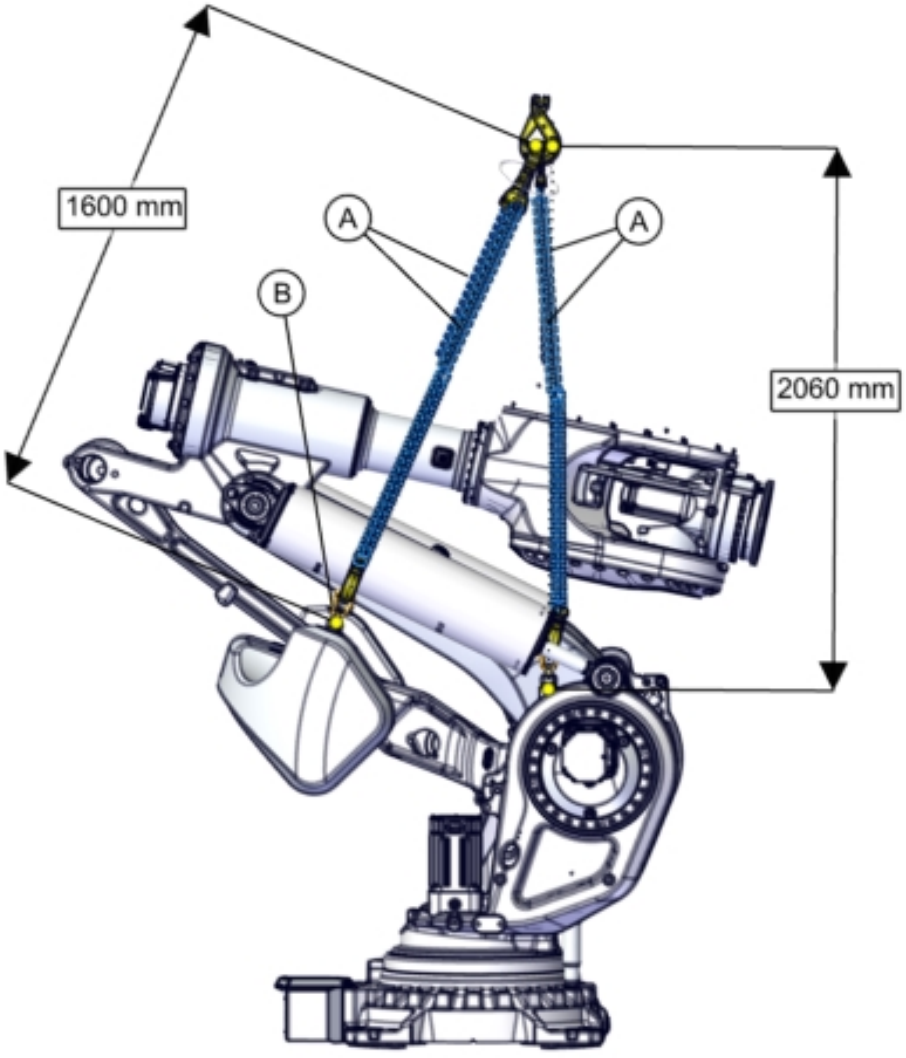
Attaching lifting accessories, complete robot

	Action	Note
1	Jog the robot into position: • Axis 1: 0° • Axis 2: -51° • Axis 3: +13° • Axis 4: -90° (to give more space to the roundslings) • Axis 5: 0° • Axis 6: 0°	 xx1700000968
2	**CAUTION** The weight of the IRB 8700 robot is 4,750 kg All lifting accessories used must be sized accordingly.	
3	Fit two lifting eyes to the holes in the frame and two lifting eyes to the holes in the counter weight. **DANGER** Never use the robot as ladder. Use a Mobile platform ladder (or similar) to reach.	 xx1400002590 A Lifting eye: M24 (4 pcs)

Continues on next page

4.7.6 Replacing the cross roller bearing

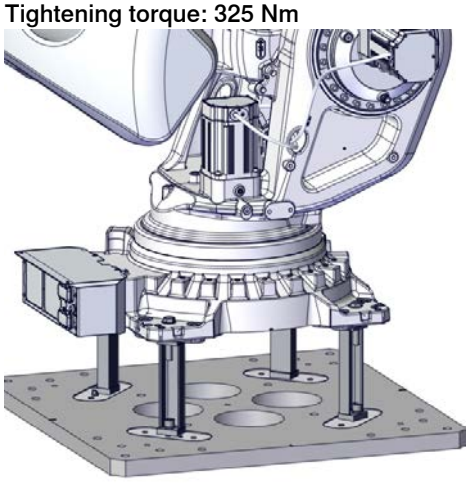
Continued

	Action	Note
4	Attach chains to the lifting eyes at the counter weights, run the chains on the outside of the balancing devices, and to an overhead crane. Attach chains to the lifting eyes at the frame, on the inside of the balancing devices shafts, and to an overhead crane. Protect the surfaces of the robot from scratches.  xx1700000969 A Lifting chains with shortener (4 pcs) B Lifting eye, M24: 3HAC038295-003 (4 pcs)	
5	Stretch the lifting accessories to take the weight of the robot.	

Lifting the complete robot onto the supporting pillars

	Action	Note
1	**CAUTION** Make sure that the robot is secured in the lifting accessories.	

Continues on next page

	Action	Note
2	Unscrew the attachment screws that secure the robot to the foundation.	
3	Use caution and lift the complete robot up, high enough to be able to attach the supporting pillars to the foundation.	Supporting pillars: 3HAC061213-001
4	Fit the supporting pillars to the foundation with the enclosed attachment screws.	Follow user instructions enclosed with the pillars. Tightening torque: 325 Nm
5	Use caution and lower the robot slowly down onto the supporting pillars, making sure the holes in robot base will match the holes in the pillars.	
6	Secure the base to the supporting pillars with the robot attachment screws.	Follow user instructions enclosed with the pillars. Tightening torque: 325 Nm  xx1700000928

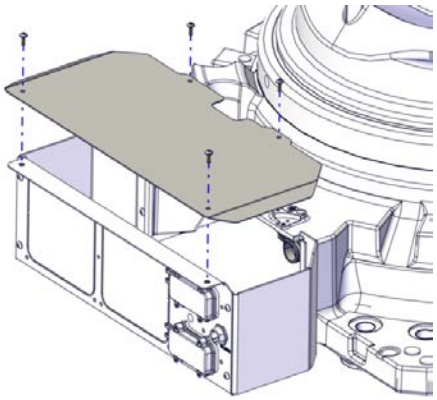
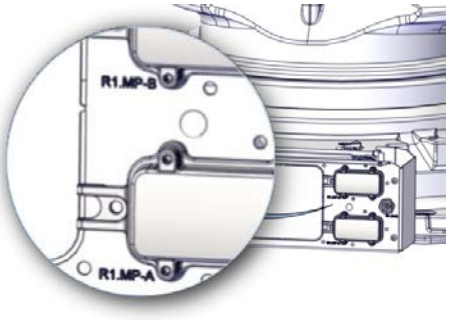
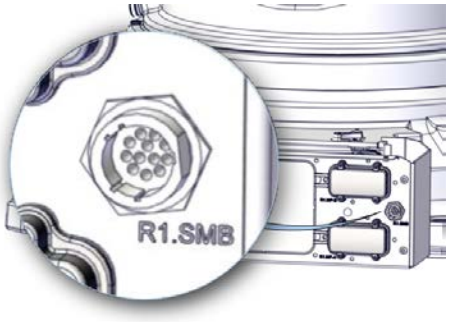
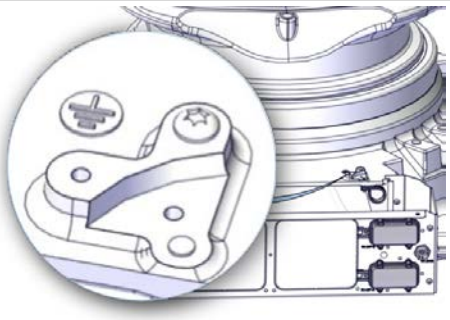
Disconnecting the cable harness in the base

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

Continues on next page

4.7.6 Replacing the cross roller bearing

Continued

	Action	Note
2	Remove the base cover.	 xx1500003082
3	Disconnect R1.MP-A and R1.MP-B.	 xx1500003083
4	Disconnect R1.SMB.	Hexagon socket spanner, socket size 14 mm  xx1500003084
5	Remove the two earth cables.	 xx1500003085

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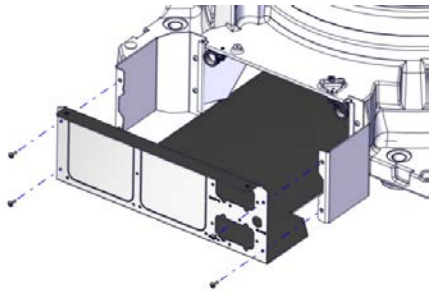
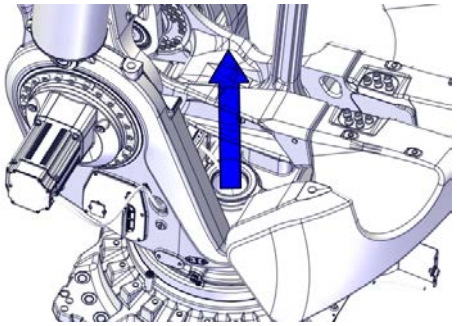
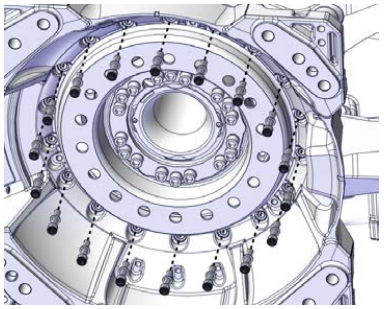
	Action	Note
6	For easier access: Remove connection plate and bottom plate.	 xx1500003088
7	Use caution and pull out the cable harness from the base, up through the frame.	 xx1700001299

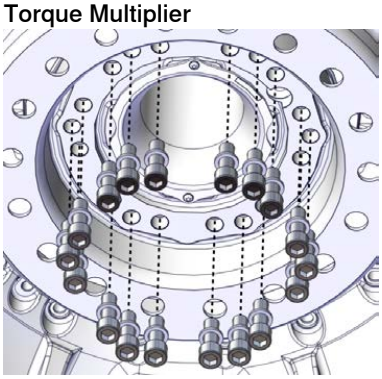
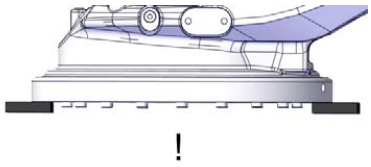
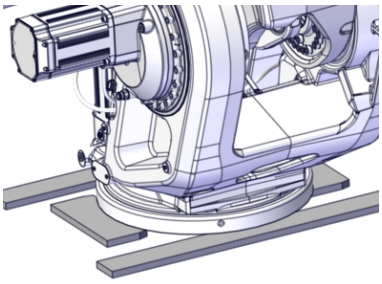
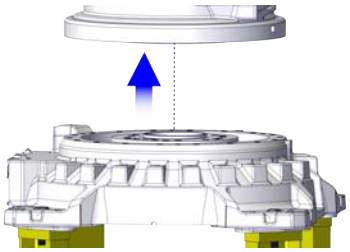
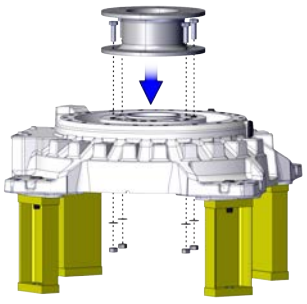
Removing the cross roller bearing

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	With lifting accessories stretched, unscrew the M16x70 screws (18 pcs) that secure the cross roller bearing to the base. **Tip** This procedure is best done with two persons working together: • Person one: working under the base, holding the torque wrench in place, and making sure the bit is correctly fitted. • Person two: working beside the robot, working with the torque wrench.	 xx1500003120

Continues on next page

4.7.6 Replacing the cross roller bearing

Continued

	Action	Note
3	Unscrew the M20x60 screws that secure the axis-1 gearbox to the base. **Tip** Use a Torque Multiplier between the screw and the torque wrench, to facilitate the removal.	Torque Multiplier  xx1500003122
4	Prepare an area where to put down the arm system after removal. The screw heads of the cross roller bearing will stick out further down than the outer flange, so if placing down the arm system on a flat surface, the arm system will rest on the screw heads and be unstable. Use for example four wooden planks of hardwood on which the flange can rest.	 xx1700000930  xx1700000931
5	Lift the arm system and make sure that the arm system is secured on the prepared area.	 xx2300001246
6	Attach the 4 screws that secure the cylinder fixture to the robot base.	 xx2300001247

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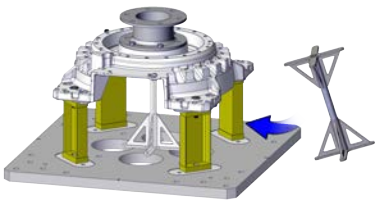
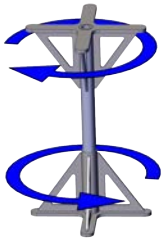
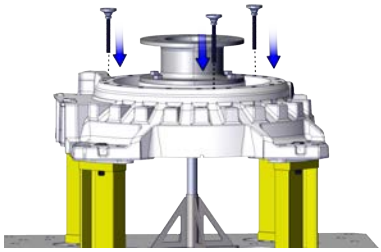
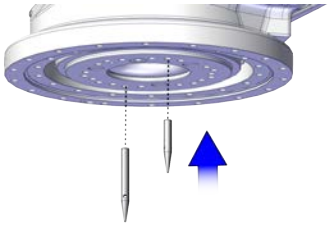
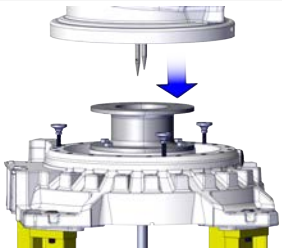
	Action	Note
7	Position the adjustable support stand in the center between the base plate and the robot foot.	 xx2300001248
8	Rotate the upper and lower part of the adjustable support stand to secure the stand between the base plate and robot foot.	 xx2300001249
9	Attach the 3 support screws into the robot foot. **Note** The height of the support screws must not exceed 10 cm above the robot foot.	 xx2300001250
10	Attach the 2 guiding pins into the gearbox of the arm system.	 xx2300001251
11	Lower the arm system onto the cylinder fixture. **Note** Do not rest the arm system on the support screws.	 xx2300001252

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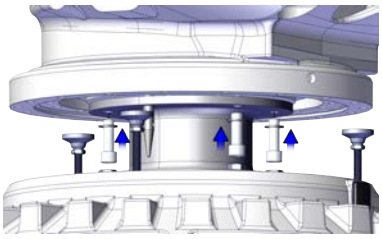
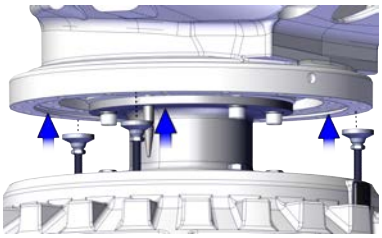
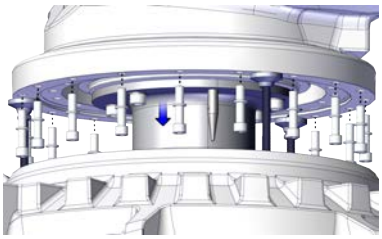
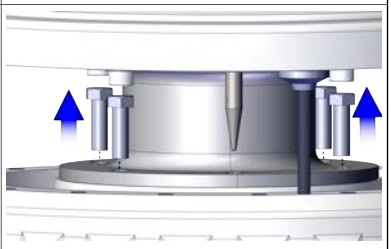
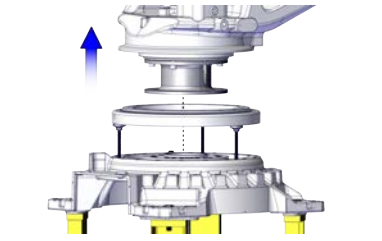
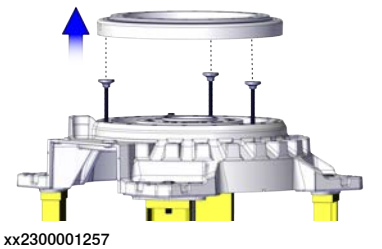
4.7.6 Replacing the cross roller bearing

Continued

	Action	Note
12	Attach the 4 screws that secure the cylinder fixture to the gearbox and the arm system.	 xx2300001253
13	Rotate the 3 support screws until the screws are aligned with the cross roller bearing.	 xx2300001428
14	Remove the M16x70 screws that secure the cross roller bearing to the frame.	 xx2300001254
15	Remove the screws that secure the cylinder fixture to the robot base.	 xx2300001255
16	Lift the arm system and secure the arm system on the prepared area.	 xx2300001256
17	Remove the cross roller bearing.	 xx2300001257

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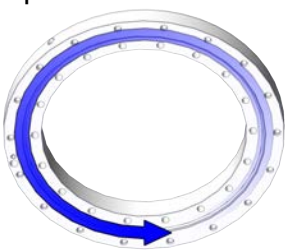
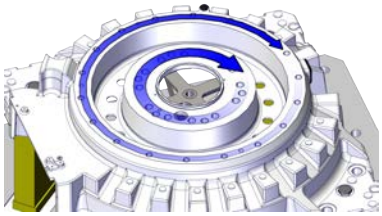
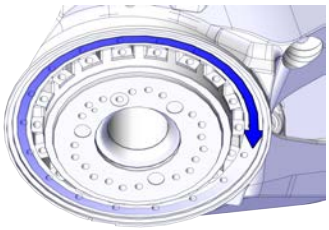
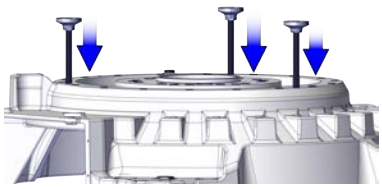
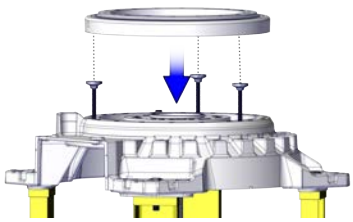
Refitting the cross roller bearing

Use these procedures to refit the cross roller bearing.

Preparations before fitting the cross roller bearing

	Action	Note
1	Clean the underside of the cross roller bearing.	Isopropanol  xx2300001258
2	Clean the contact surfaces between the cross roller bearing and the robot base.	 xx2300001259  xx2300001260

Fitting the cross roller bearing

	Action	Note
1	Lower the 3 support screws 2 cm.	 xx2300001261
2	Position the cross roller bearing onto the support screws.	 xx2300001709

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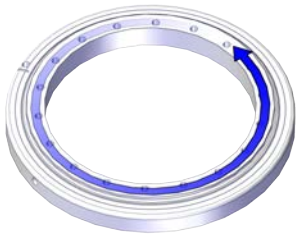
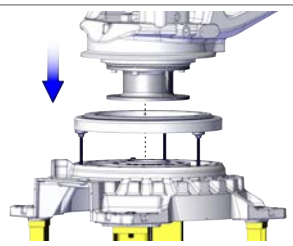
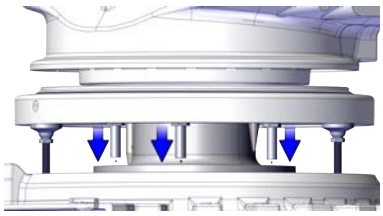
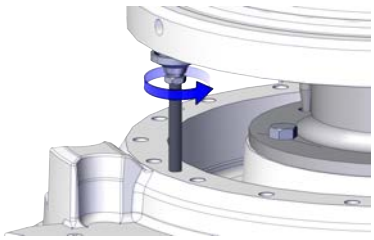
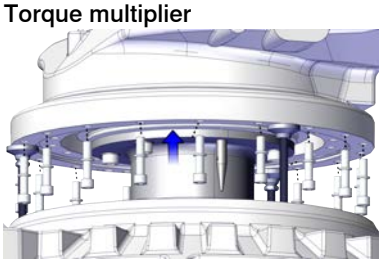
4.7.6 Replacing the cross roller bearing

Continued

	Action	Note
3	Clean the upper side of the cross roller bearing.	 xx2300001262
4	Lower the arm system onto the robot base.	 xx2300001263
5	Secure the cylinder fixture to the robot base with the 4 screws.	 xx2300001433
6	Rotate the 3 support screws until the cross roller bearing is aligned with the arm system.	 xx2300001264
7	Attach the M16x70 screws (18 pcs) that secure the cross roller to the frame. Secure the cross roller bearing to the frame in two steps; • Tighten the 18 attachment screws cross-wise to 100 Nm. • Tighten the screws crosswise to 300 Nm. **Tip** Use a torque converter between the screw and the torque wrench, to facilitate the tightening of the screws.	Tightening torque, step 1: 100 Nm Tightening torque, step 2: 300 Nm Torque multiplier  xx2300001265

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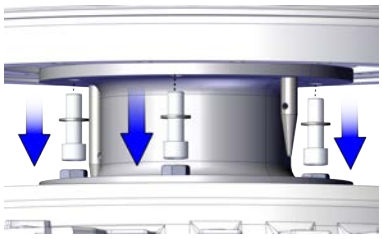
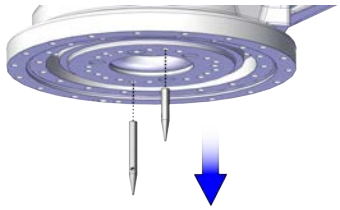
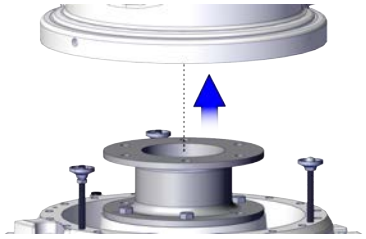
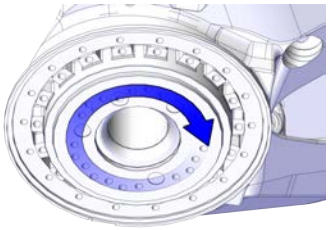
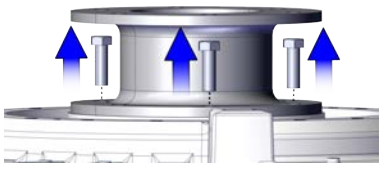
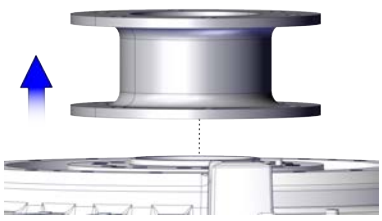
	Action	Note
8	Remove the screws that secure the cylinder fixture to the frame.	 xx2300001266
9	Remove the 2 guiding pins from the gearbox.	 xx2300001336
10	Lift the arm system and secure the arm system on the prepared area.	 xx2300001267
11	Clean the contact surface of the gearbox.	 xx2300001312
12	Remove the screws that secure the cylinder fixture to the robot base.	 xx2300001268
13	Remove the cylinder fixture from the robot base.	 xx2300001269

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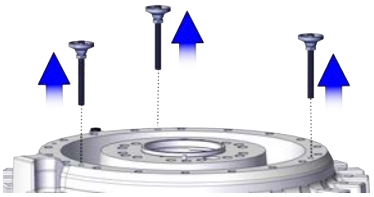
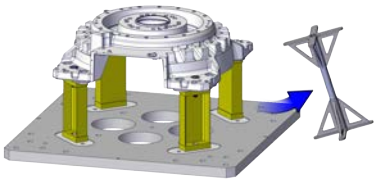
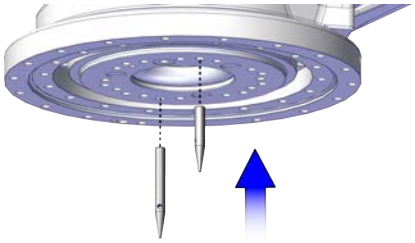
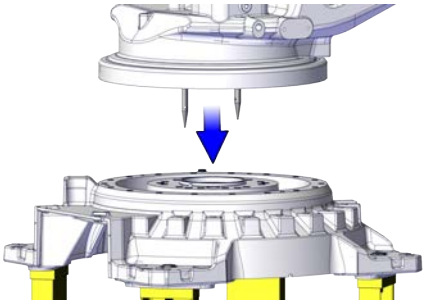
4.7.6 Replacing the cross roller bearing
Continued

	Action	Note
14	Remove the 3 support screws from the robot base.	 xx2300001270
15	Remove the support stand.	 xx2300001271

Securing the complete arm system to the robot base

	Action	Note
1	Attach the 2 guiding pins into the gearbox.	 xx2300001273
2	Lower the arm system onto the robot base. **Note** Use the parallel pin to align the arm system with the robot base.	 xx2300001274

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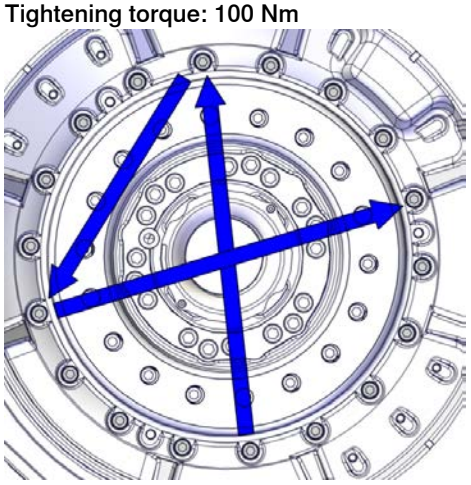
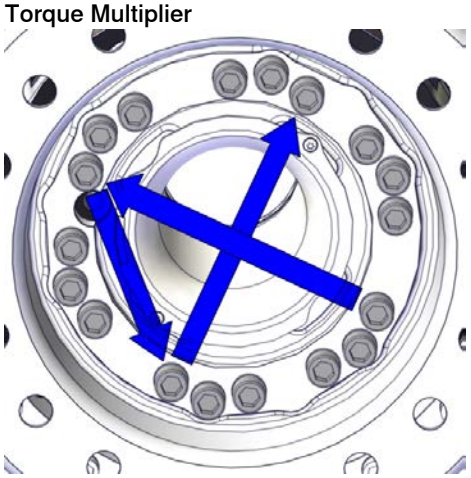
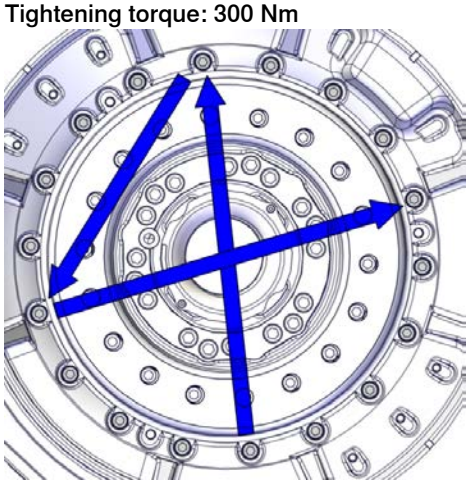
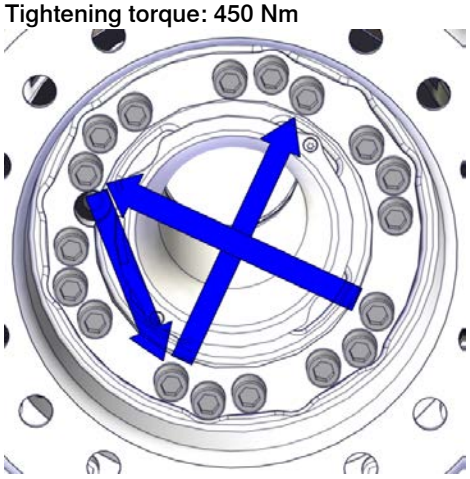
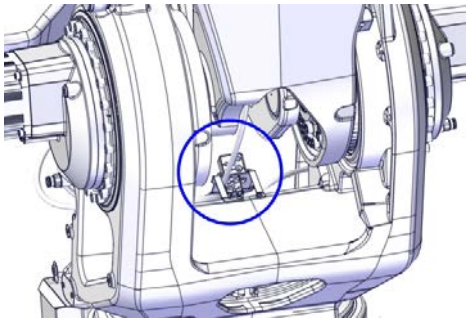
	Action	Note
3	Tighten the 18 attachment screws crosswise to 100 Nm to secure the cross roller bearing to the frame.	Tightening torque: 100 Nm  xx1600000041
4	Tighten the 16 of the 18 attachment screws crosswise to 100 Nm to secure the gearbox to the frame.	Tightening torque: 100 Nm Torque Multiplier  xx1500003127
5	Remove the guide pins from the gearbox.	
6	Tighten the remaining attachment screws (2 pcs) that secure the gearbox to the frame.	

Continues on next page

4.7.6 Replacing the cross roller bearing

Continued

	Action	Note
7	Secure all the screws in the cross roller bearing crosswise to 300 Nm.	Tightening torque: 300 Nm  xx1600000041
8	Secure all the screws in the gearbox crosswise to 450 Nm.	Tightening torque: 450 Nm  xx1500003127
9	Refit the cable bracket inside the frame.	 xx1700000934

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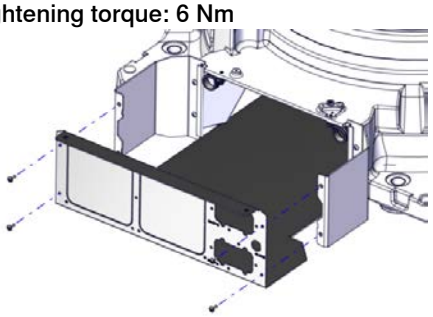
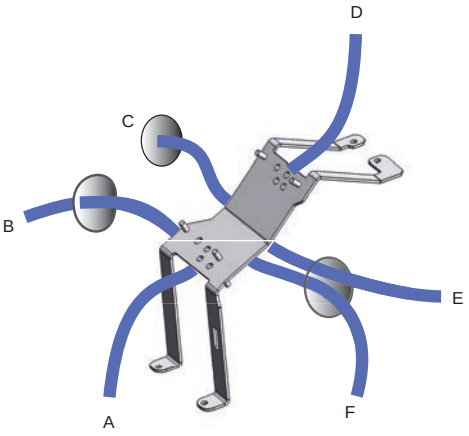
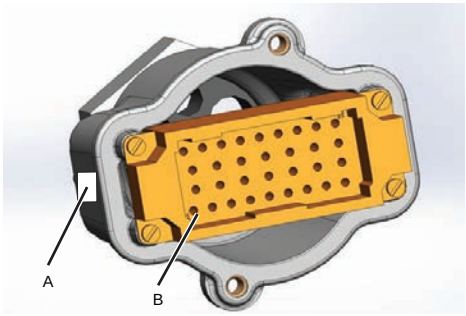
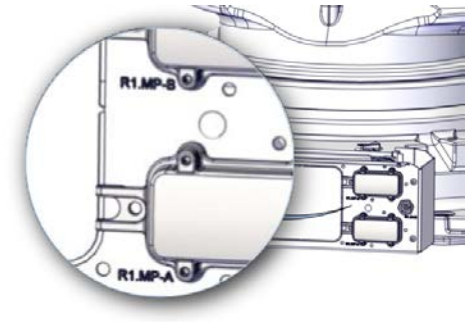
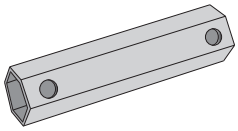
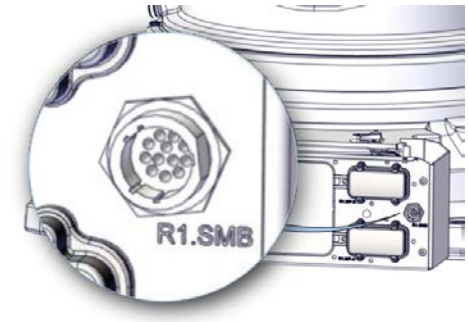
Refitting the cable harness in the base

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Refit the connection plate in the base (if it has been removed).	Attachment screws: M6x16 stainless steel A2-70 (4 pcs) Tightening torque: 6 Nm  xx1500003088
3	Use caution and run the cable harness through the hole in the frame and out to the base plate.	
4	Make sure that the cables from the axis-1 bracket, runs untangled to all connection points: • down through the hole in the frame to the base plate, • to the axis-1 motor, • to the axis-2 motor, • to the axis-3 motor • to the SMB/BU recess. Adjust the cables if needed. The different cables must not be twisted or tangled. Do not fasten the axis-1 bracket yet.	 xx1500003081 A Cables down through hole in frame, to base plate B Axis-2 motor cables C SMB/BU cables D Cables up through lower arm and onwards E Axis-3 motor cables F Axis-1 motor cables

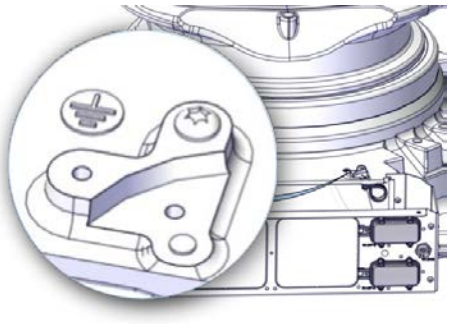
Continues on next page

4.7.6 Replacing the cross roller bearing

Continued

	Action	Note
5	Before refitting the R1.MP-A and R1.MP-B contacts make sure that the hole for pin 1, as well as the bar code, will be on the left side. See figure.	 xx1600000078 A Bar code B Hole for pin 1
6	Refit the R1.MP-A and R1.MP-B contacts. **Note** Run the cables on top of each other, through the base, without being twisted.	 xx1500003083 Screws M6x20 stainless steel (4 pcs)
7	Make sure the signal cable R1.SMB runs under the oil hose and above the R1.MP cables, through the base.	
8	Refit the R1.SMB cable, with the large recess pointing upwards to the right. **Tip** Use a Hexagon socket spanner, socket size 14 mm (or similar).  xx1200000888	Hexagon socket spanner, socket size 14 mm  xx1500003084

Continues on next page

	Action	Note
9	Refit the two earth cables.	Attachment screw: M6x16 stainless steel A2-70  xx1500003085

Attaching lifting accessories, complete robot

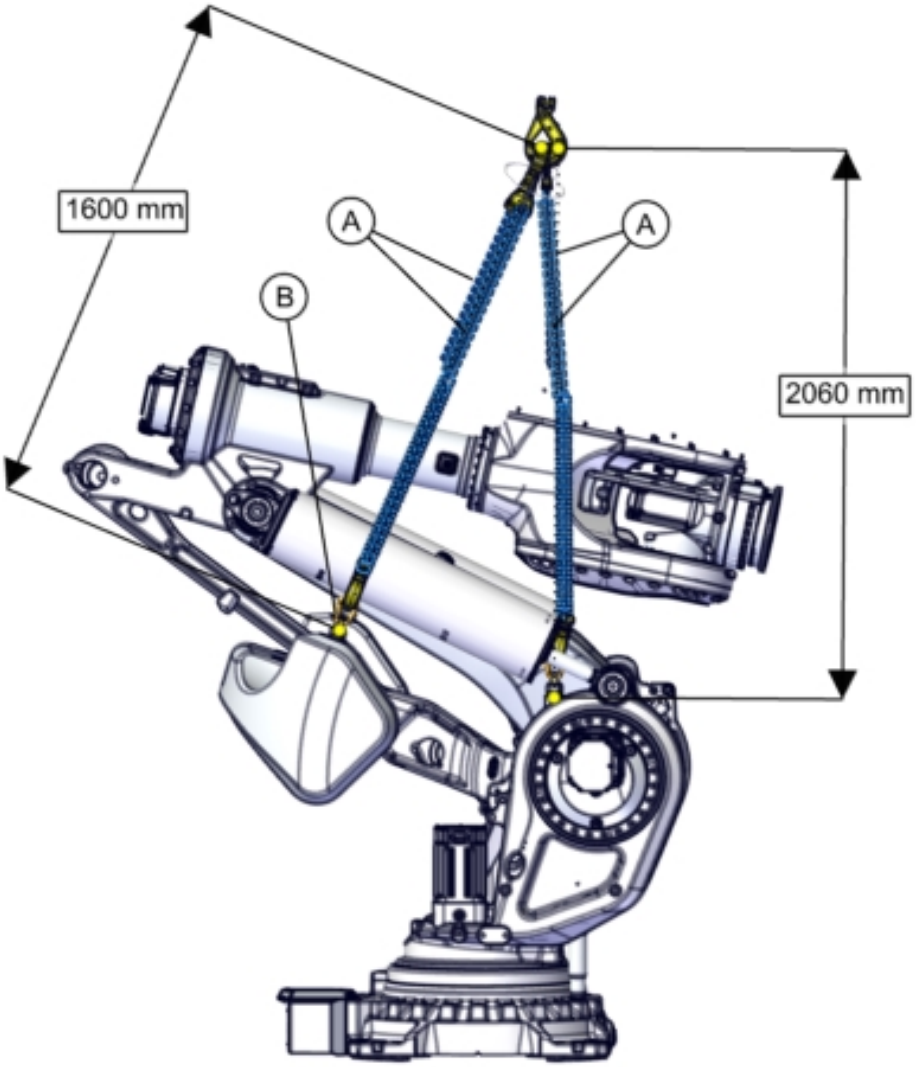
If the lifting accessories have been removed from the arm system, refit them accordingly:

	Action	Note
1	**CAUTION** The complete armsystem weighs 4,300 kg. All lifting accessories used must be sized accordingly!	

Continues on next page

4.7.6 Replacing the cross roller bearing

Continued

	Action	Note
2	Attach chains to the lifting eyes at the counter weights, run the chains on the outside of the balancing devices, and to an overhead crane. Attach chains to the lifting eyes at the frame, on the inside of the balancing devices shafts, and to an overhead crane. Protect the surfaces of the robot from scratches.  xx1700000969 A Lifting chains with shortener (4 pcs) B Lifting eye, M24: 3HAC038295-003 (4 pcs)	
3	Stretch the lifting accessories and stretch the lifting accessories to take the weight of the robot. Adjust if needed to make the lift level.	

Continues on next page

	Action	Note
4	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Removing the supporting pillars

	Action	Note
1	Unscrew the attachment screws that secure the robot base to the supporting pillars.	
2	Use caution and lift the robot up from the supporting pillars.	
3	Unscrew the attachment screws that secure the supporting pillars to the foundation.	
4	Remove the supporting pillars.	
5	Lower the robot onto the foundation and secure.	Screws: M24 x 100 (12 pcs), 8.8. Washers: 4 mm flat washer Tightening torque: 550 Nm (screws lubricated with Molykote 1000) 600-725 Nm, typical 650 Nm (screws none or lightly lubricated)

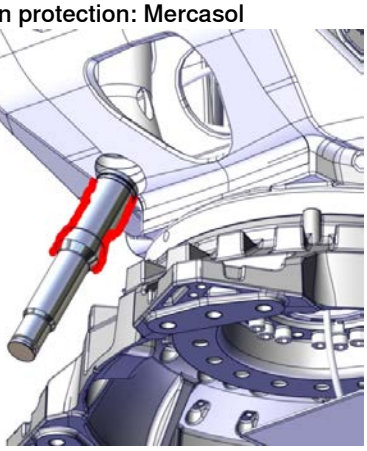
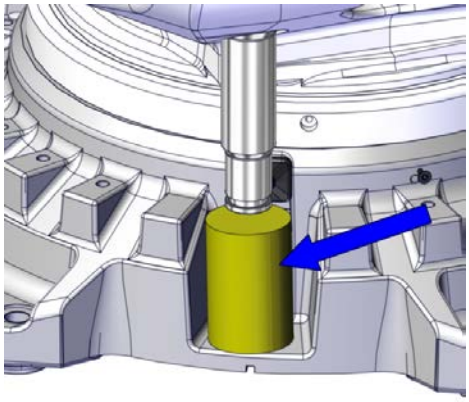
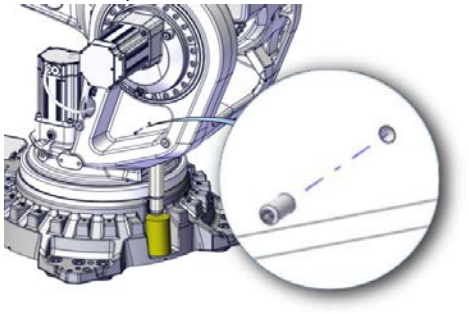
Refitting the mechanical stop pin

	Action	Note
1	Make sure that axis-1 is in the position where it will be possible to replace the mechanical stop pin. If not, turn on the power, use caution and jog axis-1 to that position.	 xx1500002093
2	Clean the stop pin, as well as the hole for it.	

Continues on next page

4.7.6 Replacing the cross roller bearing

Continued

	Action	Note
3	Apply corrosion protection on the marked area on the stop pin and on the matching area in the hole.	Corrosion protection: Mercasol  xx1500002094
4	**CAUTION** The mechanical stop pin weighs 13 kg.	
5	Put a piece of wood (or similar) underneath the stop pin, to prevent it from falling down uncontrolled when the set screw is refitted.	 xx1500002091
6	Apply locking liquid (Loctite 2400 (or equivalent Loctite 243)) on the set screw.	Locking liquid: Loctite 2400 (or equivalent Loctite 243)  xx1500002090

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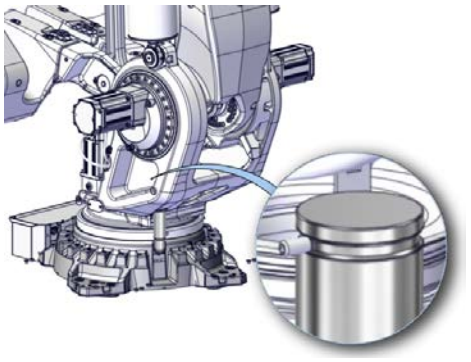
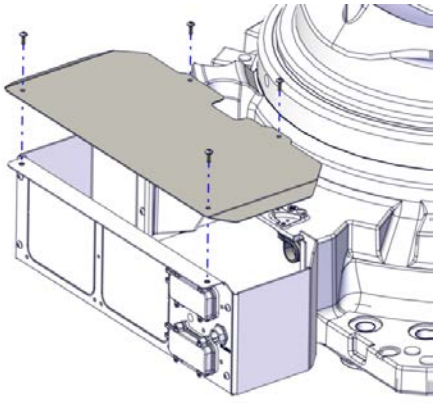
	Action	Note
7	Make sure that the set screw will find the groove in the stop pin, before securing the mechanical stop pin. **Note** Always use a flat head Allen key, to not damage the screw head. **Tip** Use caution and move the stop pin a little up and down while at the same time carefully fitting the set screw, making sure that the screw will secure the stop pin in the groove.	 xx1500002092
8	Secure the mechanical stop pin with the set screw.	Tightening torque: 35 Nm

Concluding procedure

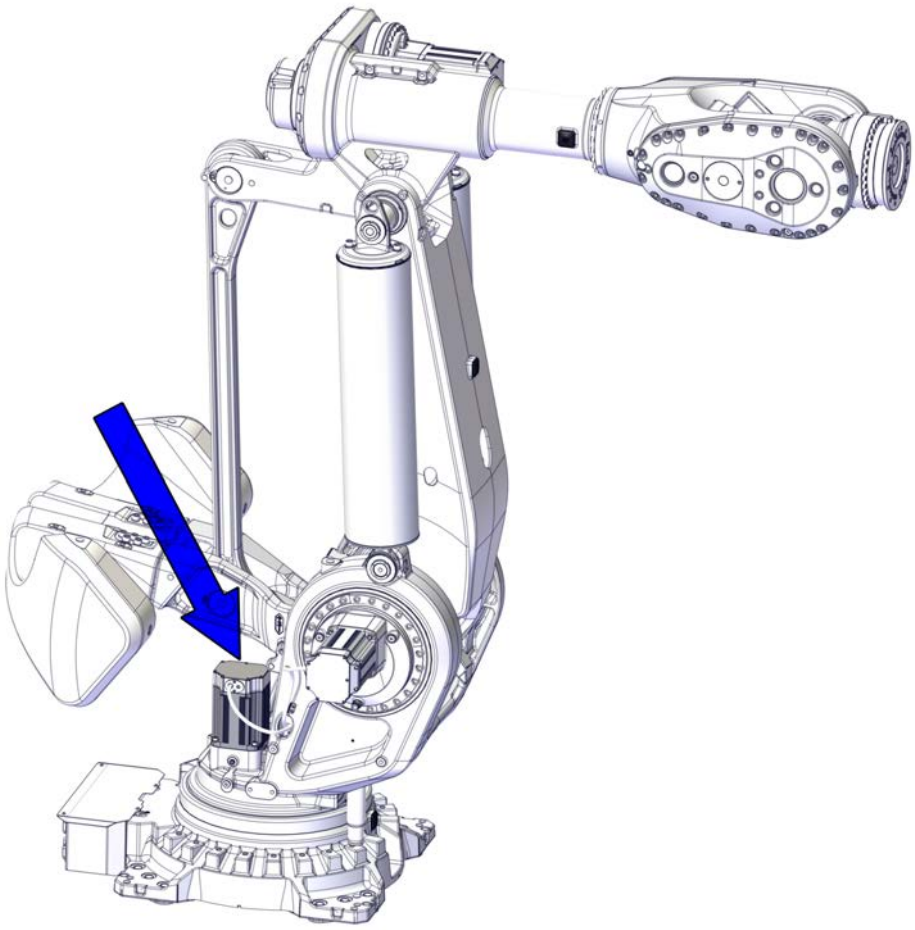
	Action	Note
1	Refill oil in the gearbox.	See *Changing oil, axis-1 gearbox on page 141*.
2	Fasten the base cover.	 xx1500003082
3	Re-calibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 688*. General calibration information is included in section *Calibration on page 675*.
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 97*.	

4.8 Motors

4.8.1 Replacing the axis-1 motor

Location of the axis-1 motor

The axis-1 motor is located as shown in the figure.



xx1500002063

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Color	Article number	Note	Level
Rotating AC motor (including pinion)	Graphite White	3HAC058949-003		L2

Continues on next page

Spare part	Color	Article number	Note	Level
Rotating AC motor (including pinion)	ABB Orange	3HAC048393-004		L2

Required tools and equipment

Equipment, etc.	Article number	Note
Lifting accessory, motor	3HAC14459-1	
Brake release tool	3HAC081310-001	Used to release the motor brakes. User instructions are enclosed with the tool. Alternative tool: 24 VDC power supply
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Removal tool M12	3HAC14631-1	Used to push out the motor if necessary. Always use removal tools in pairs.
Removal tool M14	3HAC047108-001	Used to push out the motor if necessary. Always use removal tools in pairs.
Rotation tool	3HAC7887-1	Used to rotate the motor pinion.
Leak-down tester	-	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumables

Consumable	Article number	Note
Grease	3HAC063069-001	Castrol Molub. Alloy 777-1 NG, 5 ml. To be used on hub splines to prevent from fretting corrosion.
Flange sealant	-	Loctite 574 (or equivalent)

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.	

Continues on next page

4.8.1 Replacing the axis-1 motor
Continued

	Action	Note
	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 689*.
	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 axis-1 motor.

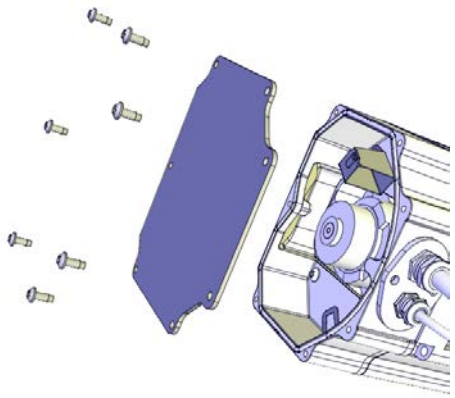
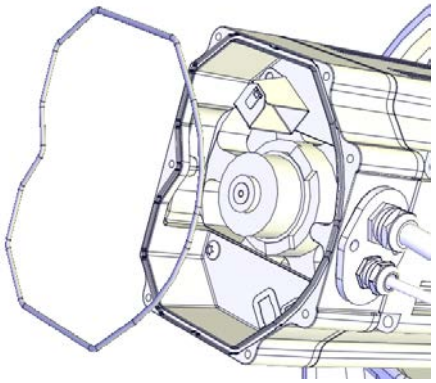
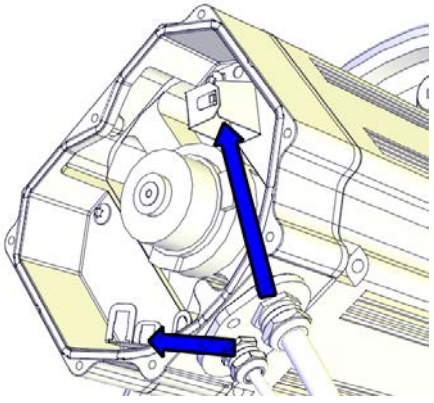
Preparations before removing the axis-1 motor

	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 calibration position.	
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Disconnecting the motor cables

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

Continues on next page

	Action	Note
2	Unscrew the attachment screws with washers and remove the motor cover.	 xx1200001135
3	Make sure the o-ring is present.	 xx1200001070
4	Disconnect the motor cables.	 xx1200001066

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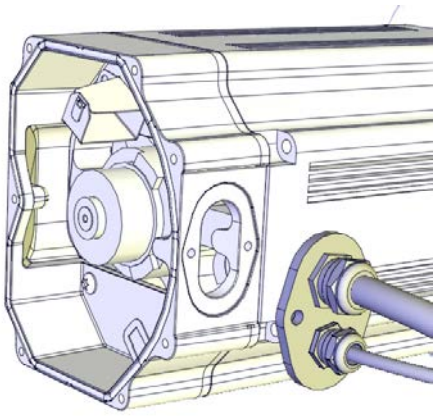
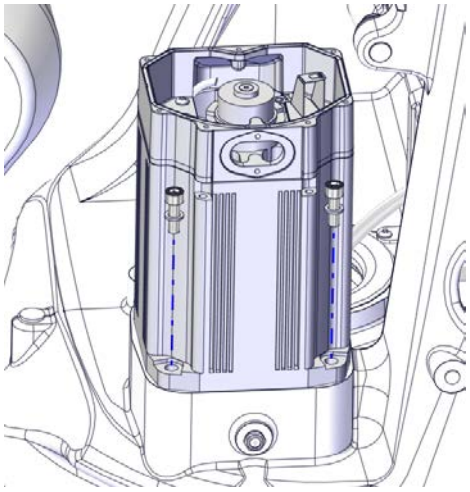
4.8.1 Replacing the axis-1 motor

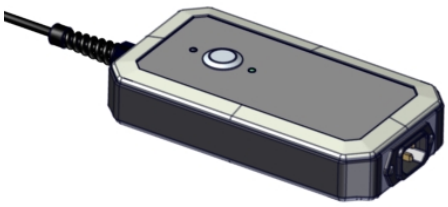
Continued

	Action	Note
5	Remove the cable gland cover. Inspect the gasket. **Note** Replace if damaged. **Tip** Make a note in which direction the cable exit hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.	 xx1200001067
6	Use caution and pull out the motor cables.	

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	Remove the attachment screws that secure the motor. **Tip** Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx1500002083
3	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
4	**CAUTION** Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.	

Continues on next page

	Action	Note
5	If needed, use removal tools to help loosen the motor.	Removal tool motor M12 / Removal tool M14: 3HAC14631-1 / 3HAC047108-001 Used to push out the motor, if necessary. Always use removal tools in pairs. Different motor versions have different dimensions on the motor flange holes. Use appropriate removal tool depending on current motor version.
6	**CAUTION** The weight of the motor is 27 kg All lifting accessories used must be sized accordingly.	
7	Attach the lifting accessories. Tie the two roundslings together to one long roundsling and run it between the lower arm and the balancing device, and attach it to the lifting accessory. (The space between the lower arm and the balancing device is narrow and only roundslings with dimension 1 meter fit.)	Roundsling 1 m (2 pcs) Lifting accessory, motor: 3HAC14459-1.
8	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 R2.MP1 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP1: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666

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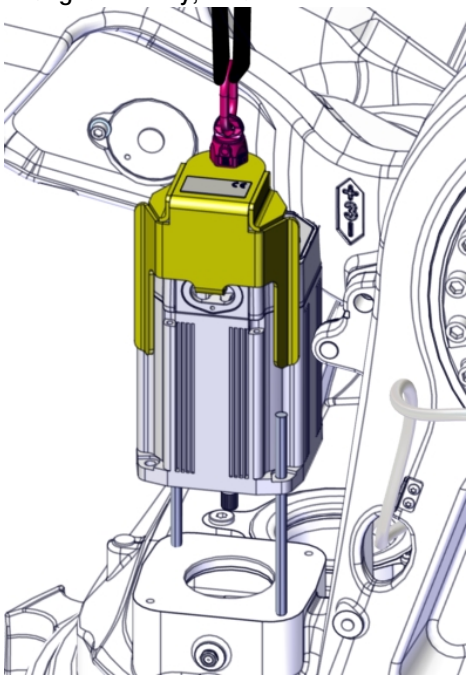
4.8.1 Replacing the axis-1 motor
Continued

	Action	Note
9	Use caution and lift the motor straight up to get the pinion parted from the gear. Guide the motor to a work bench placed beside the robot, while lowering the motor.	Roundsling 1 m (2 pcs) Lifting accessory, motor: 3HAC14459-1.  xx1500002084
10	Disconnect the brake release tool / 24 VDC power supply.	

Refitting the motor

Use these procedures to refit the motor.

Preparations before refitting 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	Remove old paint residues and other contamination from the contact surfaces on both motor and gearbox.	
3	Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	

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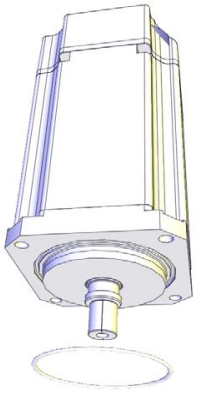
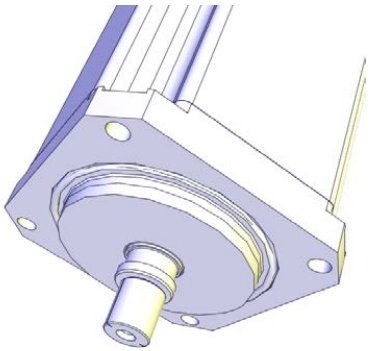
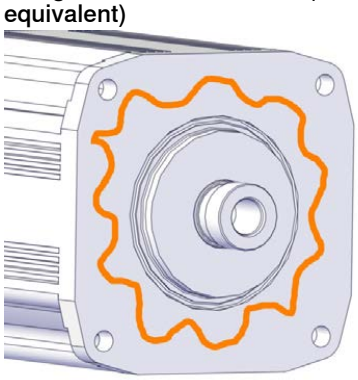
	Action	Note
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
5	Make sure the o-ring is seated in the groove. **Tip** Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020
6	Apply flange sealant on the motor flange.	Flange sealant: Loctite 574 (or equivalent)  xx1500002357

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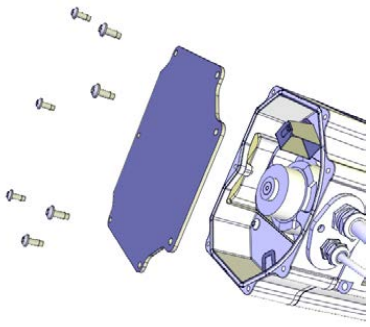
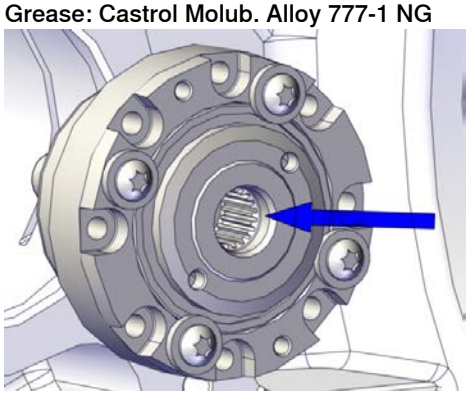
4.8.1 Replacing the axis-1 motor

Continued

	Action	Note
7	If the motor is a new spare part, remove the cover.	 xx1200001135

Securing the axis-1 motor

	Action	Note
1	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
2	**CAUTION** The motor weighs 27 kg. All lifting accessories used must be sized accordingly.	
3	Apply the lifting accessory.	Lifting accessory, motor: 3HAC14459-1.
4	Fit the rotation tool.	Rotation tool: 3HAC7887-1
5	Make sure that there is enough grease on the splines, before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346

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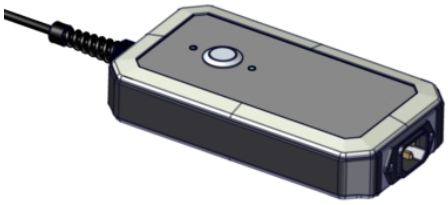
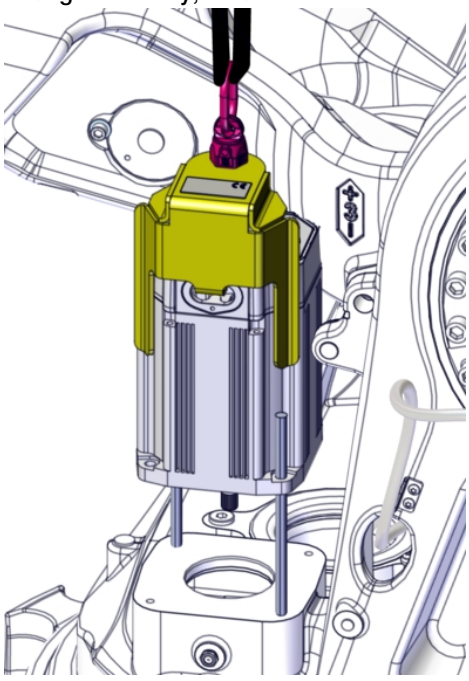
	Action	Note
6	Release the brakes of the axis-1 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the R2.MP1 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP1: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
7	**CAUTION** Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.	
8	Lower the motor into position. • Make sure that the motor pinion is properly mated into the hub. • 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.	Lifting accessory (chain): 3HAC15556-1 Lifting accessory, motor: 3HAC14459-1.  xx1500002084

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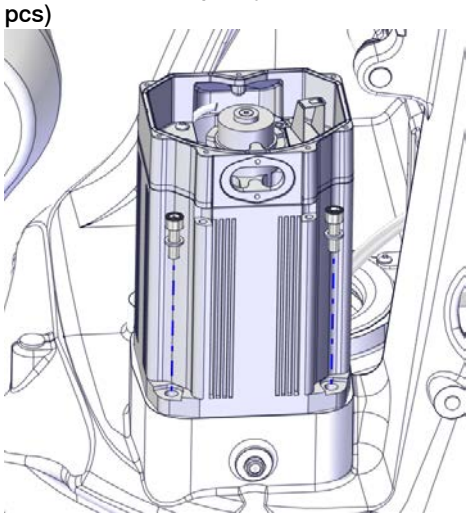
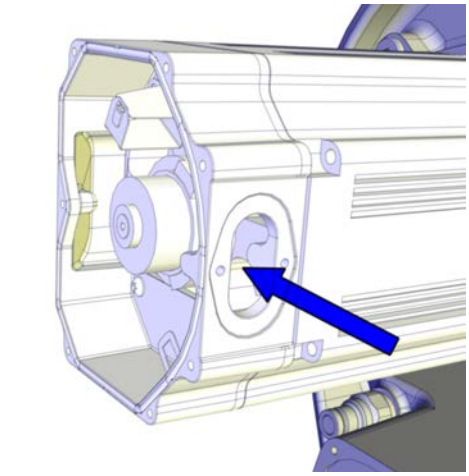
4.8.1 Replacing the axis-1 motor

Continued

	Action	Note
9	Secure the motor with its attachment screws and washers. Use a bits extender to reach the screws.	Bits extender: 3HAC12342-1 Tightening torque: 50 Nm. Screws: M10x40 quality 12.9 Gleitmo (4 pcs)  xx1500002083
10	Perform a leak-down test (if not already done).	See *Performing a leak-down test on page 187*.
11	Disconnect the brake release tool / 24 VDC power supply.	

Connecting the motor cables

	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1300000738

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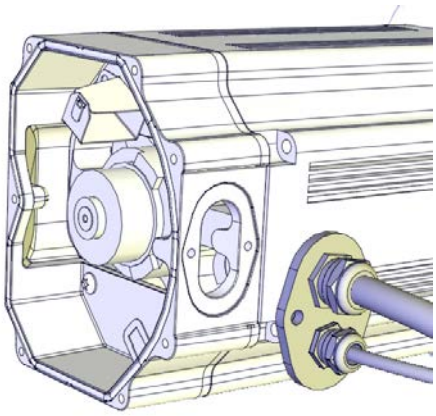
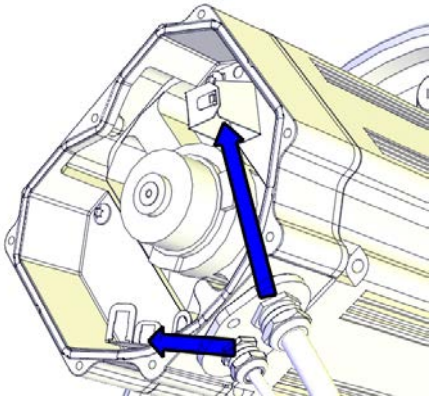
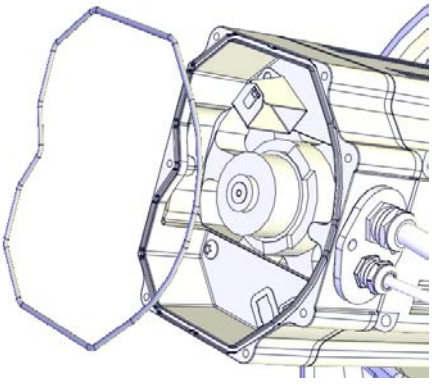
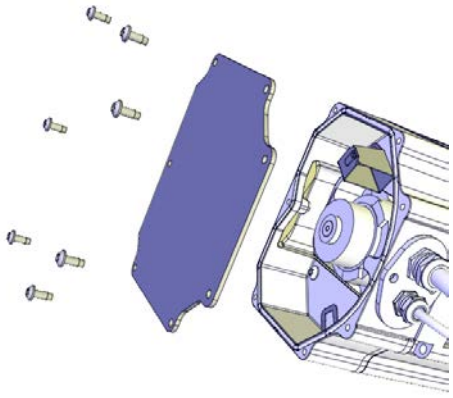
	Action	Note
2	Refit the cable gland cover. **Note** Replace the gasket if damaged.	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring: 3HAC054692-002  xx1200001070
5	Wipe clean o-ring and o-ring groove.	
6	Refit the o-ring.	
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	

Continues on next page

4.8.1 Replacing the axis-1 motor

Continued

	Action	Note
8	Refit the motor cover with its attachment screws. **Note** Do not reuse the self-threading attachment screws! Replace with standard attachment screws or the threads will be damaged. **Note** Make sure the o-ring is undamaged and properly fitted.	Attachment screws: M5x12 8.8 (7 pcs)  xx1200001135
9	Make sure that the covers are tightly sealed.	

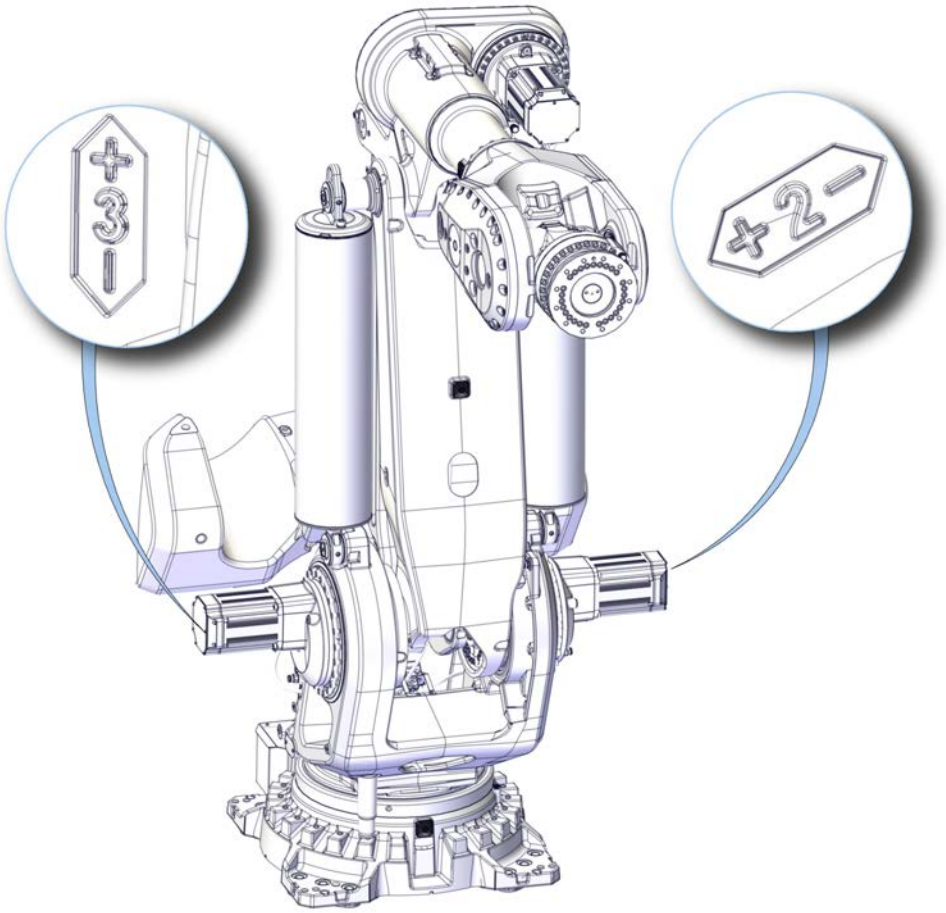
Concluding procedure

	Action	Note
1	Re-calibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 688*. General calibration information is included in section *Calibration on page 675*.
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 97*.	

4.8.2 Replacing the axis-2 and axis-3 motors

Location of the axis-2 and axis-3 motors

The axis-2 and axis-3 motors are located as shown in the figure.



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Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Color	Article number	Note	Level
Rotating AC motor (including pinion)	Graphite White	3HAC058949-003		L2
Rotating AC motor (including pinion)	ABB Orange	3HAC048393-004		L2

Continues on next page

4.8.2 Replacing the axis-2 and axis-3 motors
Continued

Required tools and equipment

Equipment, etc.	Article number	Note
Lifting accessory, motor	3HAC15534-1	Lifting instruction 3HAC15640-2 enclosed.
Brake release tool	3HAC081310-001	Used to release the motor brakes. User instructions are enclosed with the tool. Alternative tool: 24 VDC power supply
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Lock screw, quality 12.9, M20x150	-	Used to secure lower arm to frame (to lock axis 2) or parallel arm to frame (to lock axis 3).
Removal tool M12	3HAC14631-1	Used to push out the motor if necessary. Always use removal tools in pairs.
Removal tool M14	3HAC047108-001	Used to push out the motor if necessary. Always use removal tools in pairs.
Rotation tool	3HAC7887-1	Used to rotate the motor pinion.
Leak-down tester	-	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumables

Consumable	Article number	Note
Grease	3HAC063069-001	Castrol Molub. Alloy 777-1 NG, 5 ml. To be used on hub splines to prevent from fretting corrosion.
Flange sealant	-	Loctite 574 (or equivalent)

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.	

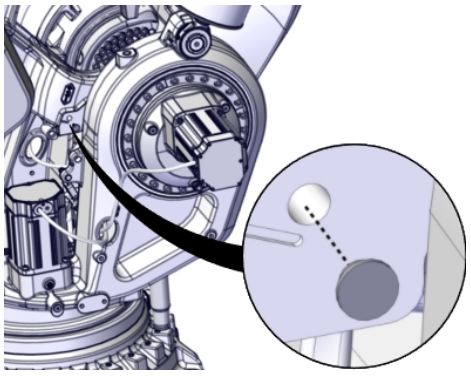
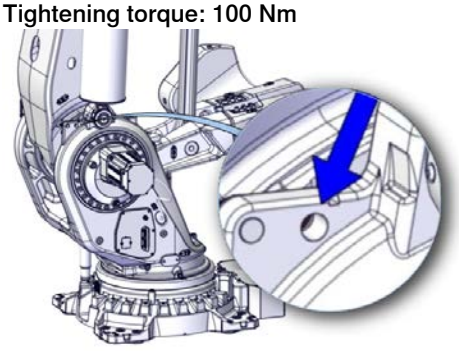
Continues on next page

	Action	Note
	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 689*.
	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 axis-2 and axis-3 motors.

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	**Valid for replacement of the axis-2 motor.** Remove the plastic plug from the lower arm. If needed, jog the robot so that the plug is accessible.	 xx1500002366
3	**Valid for replacement of the axis-2 motor.** Insert the lock screw through the frame and into the hole in the lower arm, to secure the weight of the lower arm. If needed, adjust the position of axis 2 to make it possible to insert the lock screw. **Note** Tighten the lock screw manually. No tools needed. **DANGER** Failure to secure the weight of the lower arm, will cause the lower arm to fall when the brakes of the axis-2 motor are released.	Lock screw, quality 12.9, M20x150 Tightening torque: 100 Nm  xx1500002322

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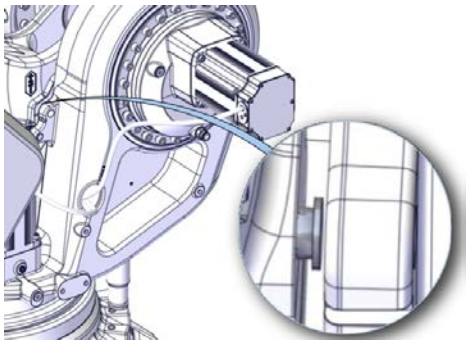
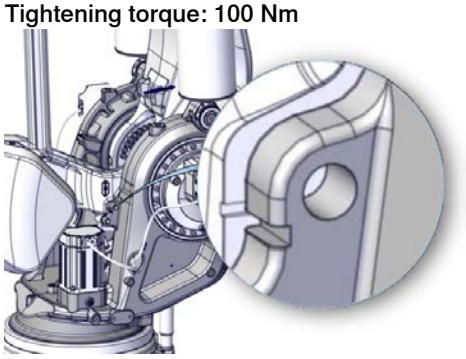
4.8.2 Replacing the axis-2 and axis-3 motors

Continued

	Action	Note
4	**Valid for replacement of the axis-3 motor.** Remove the plastic plug from the parallel arm. If needed, jog the robot so that the plug is accessible.	 xx1500002365
5	**Valid for replacement of the axis-3 motor.** Insert the lock screw through the frame and into the hole in the parallel arm, to secure the weight of the parallel arm. If needed, adjust the position of axis 3 to make it possible to insert the lock screw. **Note** Tighten the lock screw manually. No tools needed. **DANGER** Failure to secure the weight of the parallel arm, will cause the parallel arm to fall when the brakes of the axis-3 motor are released.	Lock screw, quality 12.9, M20x150 Tightening torque: 100 Nm  xx1500002321
6	Jog the robot to the calibration position.	 xx1500002085

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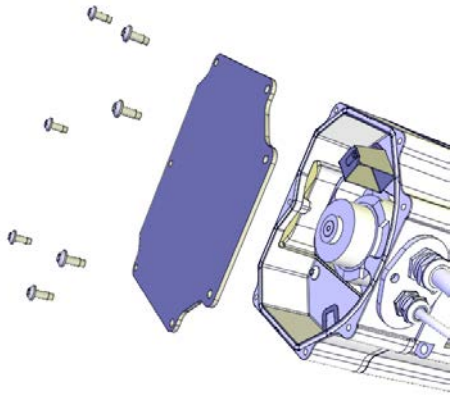
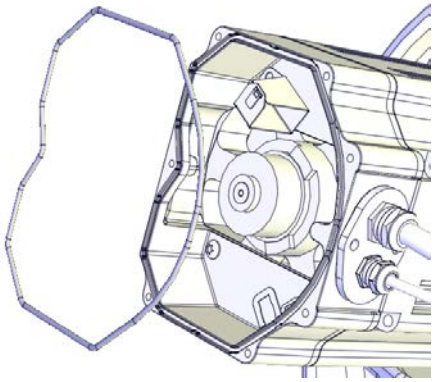
	Action	Note
7	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
8	Remove any equipment that obstructs access to the motor.	

Disconnecting the axis-2 or axis-3 motor cables

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135
3	Make sure the o-ring is present.	 xx1200001070

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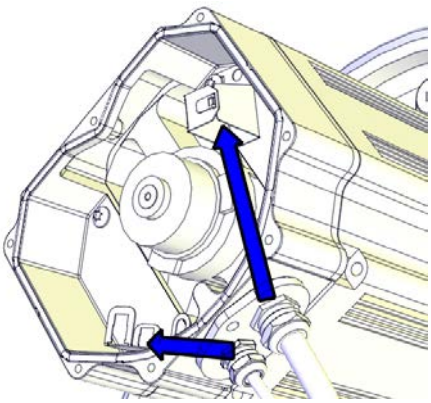
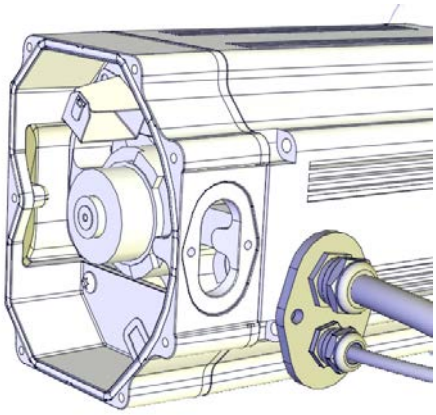
4.8.2 Replacing the axis-2 and axis-3 motors

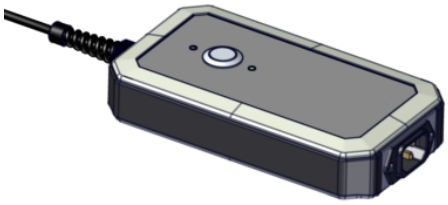
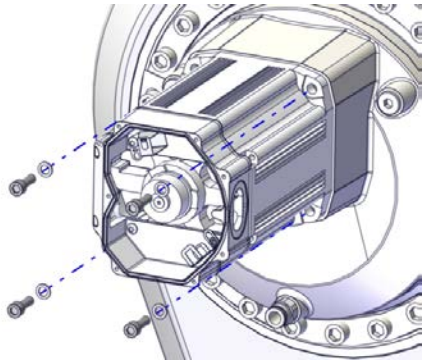
Continued

	Action	Note
4	Disconnect the motor cables.	 xx1200001066
5	Remove the cable gland cover. Make sure the gasket is not damaged. **Tip** Make a note in which direction the cable gland hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.	 xx1200001067
6	Use caution and pull out the motor cables.	

Removing the axis-2 or axis-3 motor

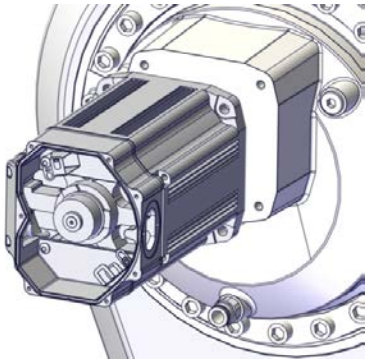
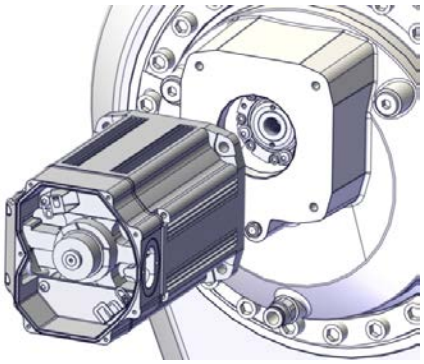
	Action	Note
1	**DANGER** When releasing the holding brakes of the motor, the lower arm and/or the parallel arm will move and may fall down! Before continuing, make sure the lower arm and/or parallel arm are secured with lock screws.	

Continues on next page

	Action	Note
2	Release the brakes of the axis-2/3 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the R2.MP2 (axis-2 motor) or R2.MP3 (axis-3 motor) connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP2 / R2.MP3: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
3	Remove the attachment screws that secure the motor. **Tip** Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx1500002323
4	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
5	**CAUTION** Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used!	
6	If required, press the motor out of position by using the removal tool in opposite holes of the motor.	Removal tool M12: 3HAC14631-1 Removal tool M14: 3HAC047108-001 Different motor versions have different dimensions on the motor flange holes. Use appropriate removal tool depending on current motor version.

Continues on next page

4.8.2 Replacing the axis-2 and axis-3 motors
Continued

	Action	Note
7	**CAUTION** The motor weighs 27 kg. All lifting accessories used must be sized accordingly!	
8	Attach the lifting accessory.	Lifting accessory, motor: 3HAC15534-1
9	Use caution and lift the motor out on the guide pins, in order to get the pinion away from the hub. Let the motor rest on the guide pins.	 xx1500002325
10	Disconnect the brake release tool / 24 VDC power supply.	
11	Use caution and remove the motor by sliding it out on the guide pins.	 xx1500002324

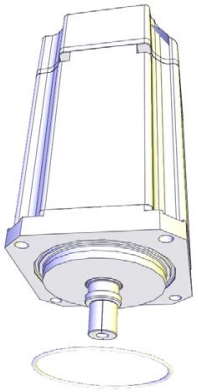
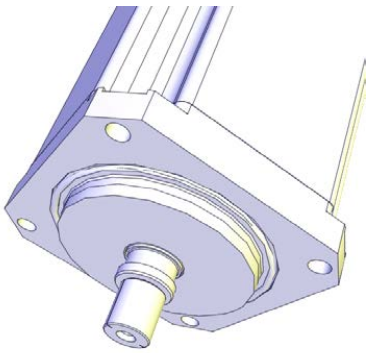
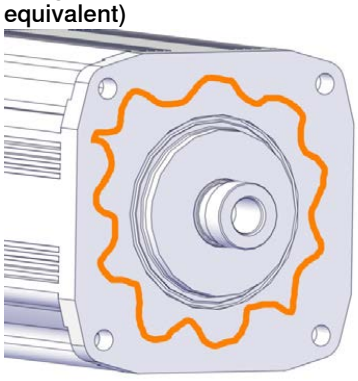
Refitting the motor

Use these procedures to refit the motor.

Preparations before refitting the motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove old paint residues and other contamination from the contact surfaces on both motor and gearbox.	

Continues on next page

	Action	Note
3	Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
5	Make sure the o-ring is seated in the groove. **Tip** Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020
6	Apply flange sealant on the motor flange.	Flange sealant: Loctite 574 (or equivalent)  xx1500002357

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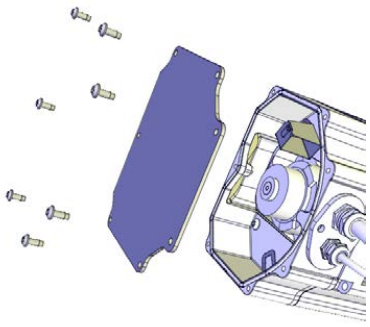
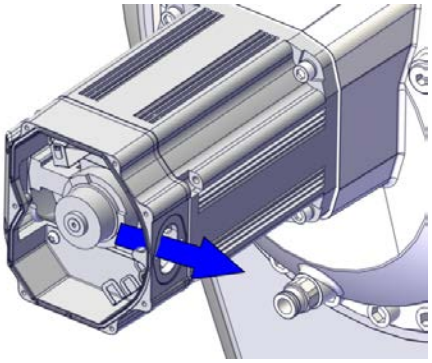
4.8.2 Replacing the axis-2 and axis-3 motors

Continued

	Action	Note
7	If the motor is a new spare part, remove the cover.	 xx1200001135

Securing the motor

	Action	Note
1	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
2	**CAUTION** The motor weighs 27 kg. All lifting accessories used must be sized accordingly!	
3	Apply the lifting accessory.	Lifting accessory, motor: 3HAC15534-1
4	**Note** Make sure the cable exit hole is turned the correct way.	 xx1600000050
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.	

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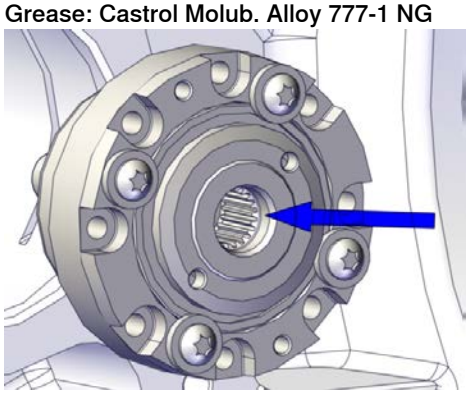
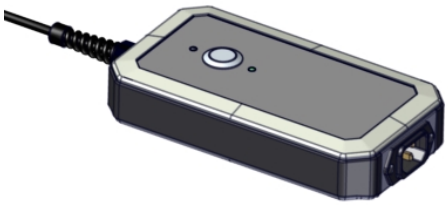
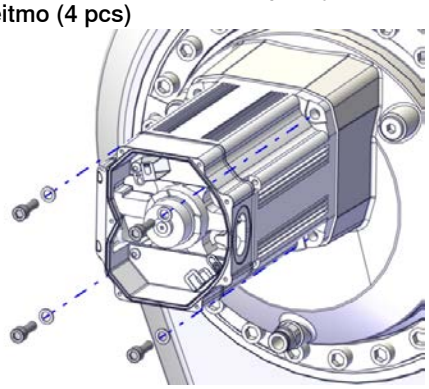
	Action	Note
6	Make sure that there is enough grease on the splines, before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346
7	Remove the lifting accessory and allow the motor to rest on the guide pins.	
8	Apply the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool: 3HAC7887-1
9	Release the brakes of the axis-2/3 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the R2.MP2 (axis-2 motor) or R2.MP3 (axis-3 motor) connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP2 / R2.MP3: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
10	**CAUTION** Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used!	

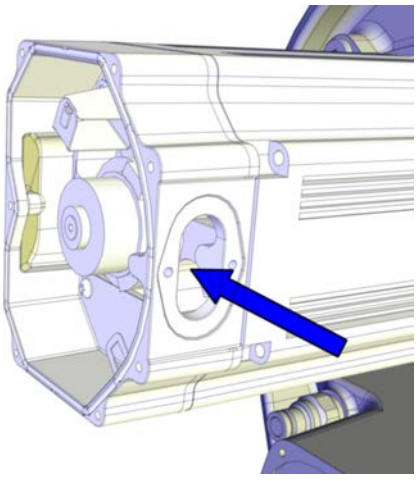
Continues on next page

4.8.2 Replacing the axis-2 and axis-3 motors

Continued

	Action	Note
11	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 into the hub. • Make sure that the motor pinion does not get damaged. • Make sure that the direction of the cable exit is facing the correct way.	
12	Fit two of the attachment screws.	Screw dimension: M10x40 quality 12.9 Gleitmo (4 pcs)
13	Remove the guide pins and replace with the remaining attachment screws.	
14	Secure the motor with its attachment screws and washers. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1 Tightening torque: 50 Nm. Screw dimension: M10x40 quality 12.9 Gleitmo (4 pcs)  xx1500002323
15	Disconnect the brake release tool / 24 VDC power supply.	

Connecting the axis-2 or axis-3 motor cables

	Action	Note
1	Push the motor cables through the cable gland opening.	 xx1300000738

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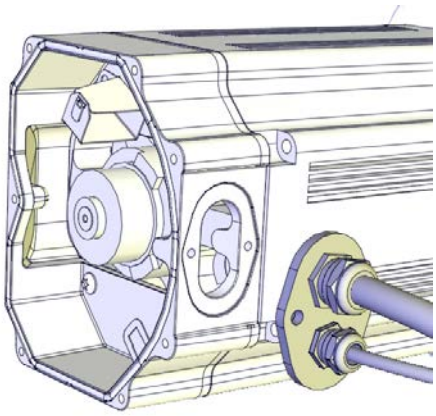
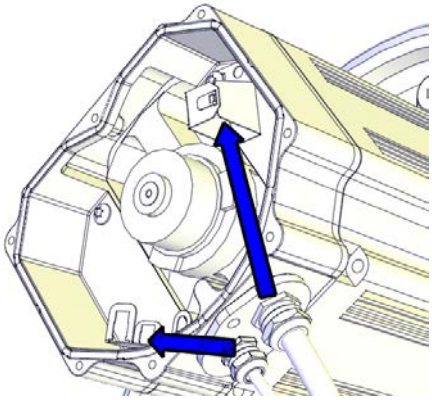
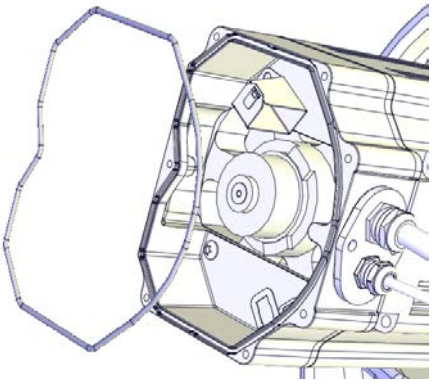
	Action	Note
2	Refit the cable gland cover. **Note** Replace the gasket if damaged.	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-002  xx1200001070
5	Wipe clean o-ring and o-ring groove.	

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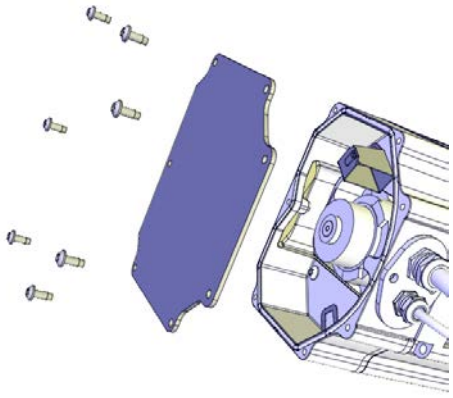
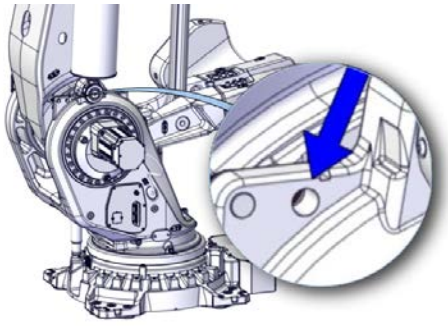
4.8.2 Replacing the axis-2 and axis-3 motors

Continued

	Action	Note
6	Refit the o-ring. **Tip** Lubricate the o-ring with some grease for a better fitting in the groove.	
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8	Refit the motor cover with it's attachment screws. **Note** Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged. **Note** Make sure the o-ring is undamaged and properly fitted.	Attachment screws: M5x12 8.8 (7 pcs)  xx1200001135
9	Make sure that the covers are tightly sealed.	

Concluding procedure

	Action	Note
1	**Valid for replacement of the axis-2 motor.** Use caution and jog axis-2 until it is possible to remove the lock screw.	 xx1500002322

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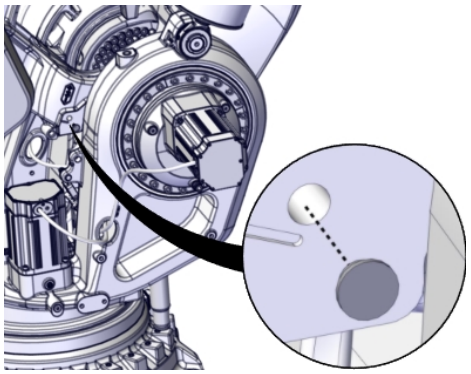
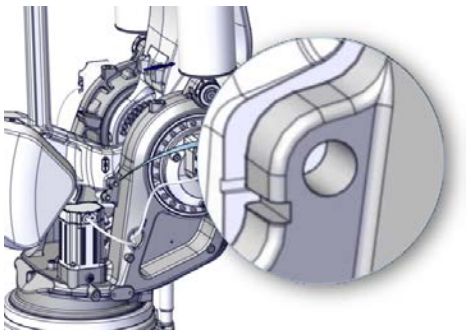
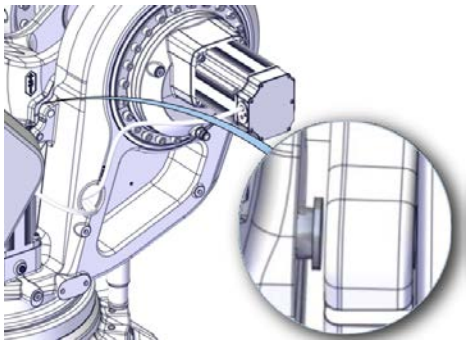
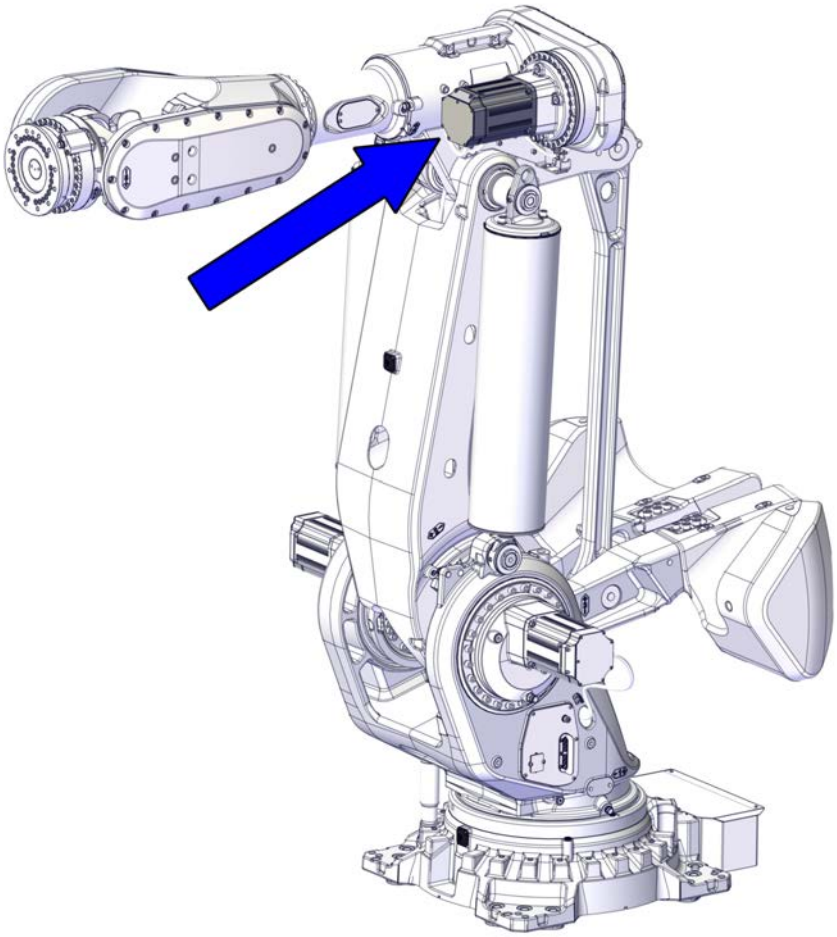
	Action	Note
2	**Valid for replacement of the axis-2 motor.** Refit the plastic plug in lower arm.	 xx1500002366
3	**Valid for replacement of the axis-3 motor.** Use caution and jog axis-3 until it is possible to remove the lock screw.	 xx1500002321
4	**Valid for replacement of the axis-3 motor.** Refit the plastic plug in parallel arm.	 xx1500002365
5	Re-calibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 688*. General calibration information is included in section *Calibration on page 675*.
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 97*.	

4.8.3 Replacing the axis-4 motor

Location of the axis-4 motor

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



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Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Rotating AC motor (including pinion)	3HAC058950-003 Graphite White 3HAC049837-003 ABB Orange		L2

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Required tools and equipment

Equipment, etc.	Article number	Note
Lifting accessory, motor	3HAC15534-1	Lifting instruction 3HAC15640-2 enclosed.
Brake release tool	3HAC081310-001	Used to release the motor brakes. User instructions are enclosed with the tool. Alternative tool: 24 VDC power supply
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Removal tool M12	3HAC14631-1	Used to push out the motor if necessary. Always use removal tools in pairs.
Removal tool M14	3HAC047108-001	Used to push out the motor if necessary. Always use removal tools in pairs.
Rotation tool	3HAC7887-1	Used to rotate the motor pinion.
Leak-down tester	-	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumables

Consumable	Article number	Note
Grease	3HAC063069-001	Castrol Molub. Alloy 777-1 NG, 5 ml. To be used on hub splines to prevent from fretting corrosion.
Flange sealant	-	Loctite 574 (or equivalent)

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.	

Continues on next page

4.8.3 Replacing the axis-4 motor
Continued

	Action	Note
	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 689*.
	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 axis-4 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 the best position for replacing the axis-4 motor.	
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Disconnecting the axis-4 motor cables

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

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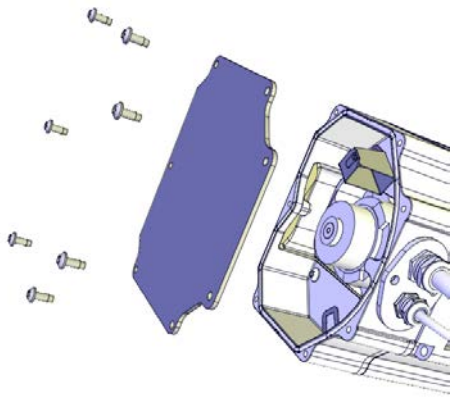
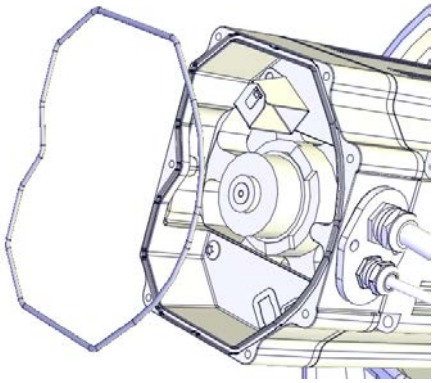
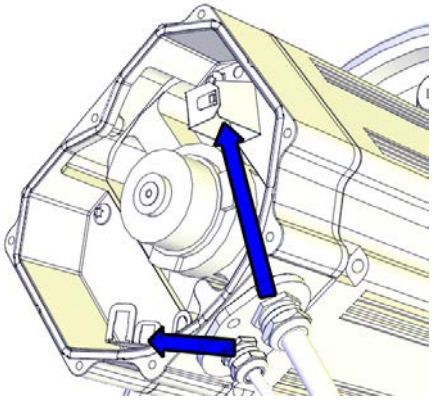
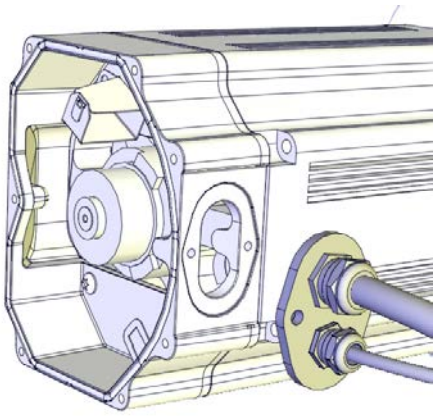
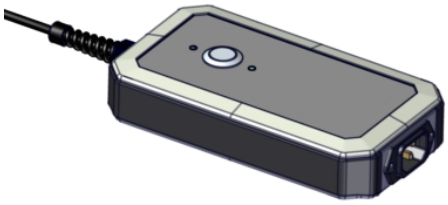
	Action	Note
2	Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135
3	Make sure the o-ring is present.	 xx1200001070
4	Disconnect the motor cables.	 xx1200001066

Continues on next page

4.8.3 Replacing the axis-4 motor
Continued

	Action	Note
5	Remove the cable gland cover. Make sure the gasket is not damaged. **Tip** Make a note in which direction the cable gland hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.	 xx1200001067
6	Use caution and pull out the motor cables.	

Removing the axis-4 motor

	Action	Note
1	**CAUTION** Use caution when releasing the brakes! Axis-4 can move unexpectedly!	
2	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 R2.MP4 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP4: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666

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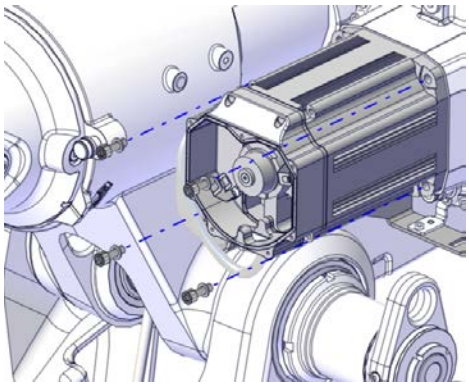
	Action	Note
3	Remove the attachment screws that secure the motor. **Tip** Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx1600000064
4	Attach two guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
5	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	
6	Press the motor out of position by fitting the removal tool in the remaining attachment holes for the motor.	Removal tool M12: 3HAC14631-1 Removal tool M14: 3HAC047108-001 Different motor versions have different dimensions on the motor flange holes. Use appropriate removal tool depending on current motor version. Always use removal tools in pairs.
7	**CAUTION** The motor weighs 27 kg. All lifting accessories used must be sized accordingly!	
8	Attach the lifting accessory.	Lifting accessory, motor: 3HAC15534-1
9	Disconnect the brake release tool / 24 VDC power supply.	

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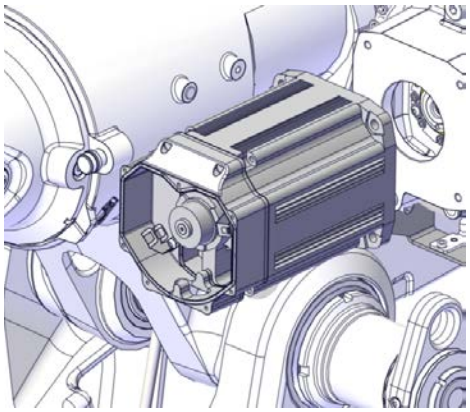
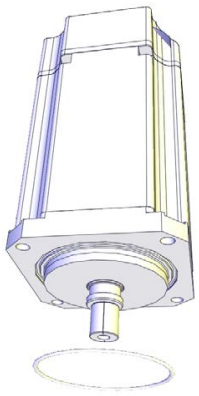
4.8.3 Replacing the axis-4 motor
Continued

	Action	Note
10	Remove the motor by carefully lifting it straight out. Make sure the pinion is not damaged in the process.	 xx1600000065

Refitting the motor

Use these procedures to refit the motor.

Preparations before refitting the axis-4 motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove old paint residues and other contamination from the contact surfaces on both motor and gearbox.	
3	Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4	Make sure the o-ring is undamaged. **Note** Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019

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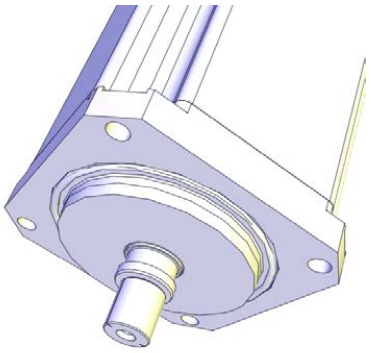
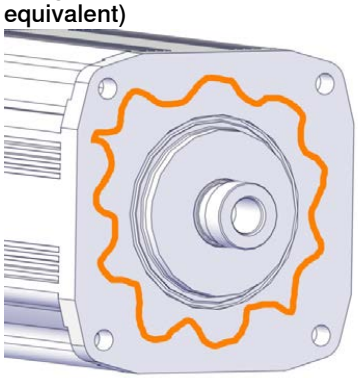
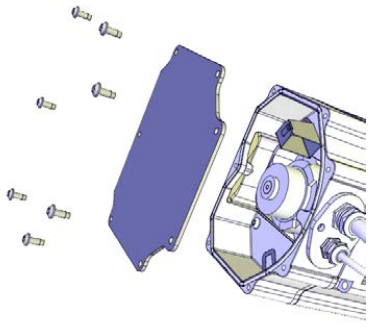
	Action	Note
5	Make sure the o-ring is seated in the groove. **Tip** Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020
6	Apply flange sealant on the motor flange.	Flange sealant: Loctite 574 (or equivalent)  xx1500002357
7	If the motor is a new spare part, remove the cover.	 xx1200001135

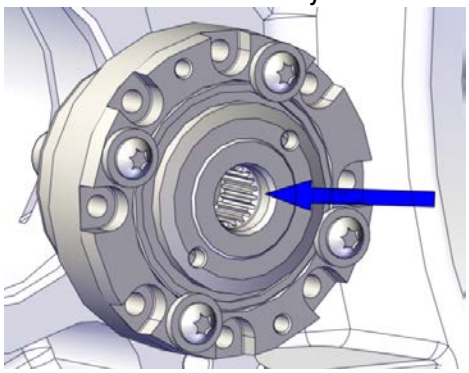
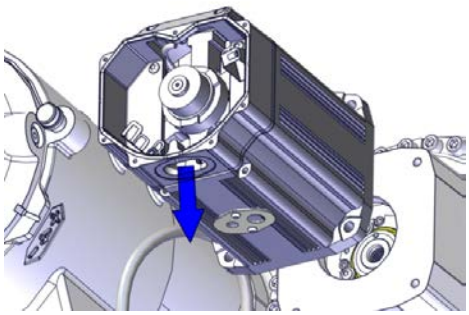
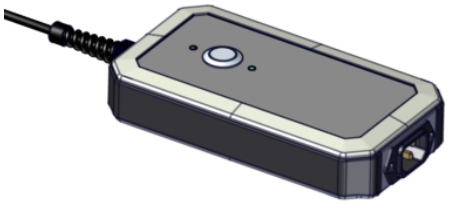
Securing the axis-4 motor

	Action	Note
1	Apply two guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
2	**CAUTION** The motor weighs 27 kg. All lifting accessories used must be sized accordingly.	Lifting accessory, motor: 3HAC15534-1

Continues on next page

4.8.3 Replacing the axis-4 motor

Continued

	Action	Note
3	Attach the lifting accessory and lift the motor up.	
4	Make sure that there is enough grease on the splines before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346
5	Put the motor onto the guide pins.	
6	**Note** Make sure the cable exit hole will be turned the correct way.	 xx1600000066
7	Attach the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool: 3HAC7887-1
8	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 R2.MP4 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP4: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666

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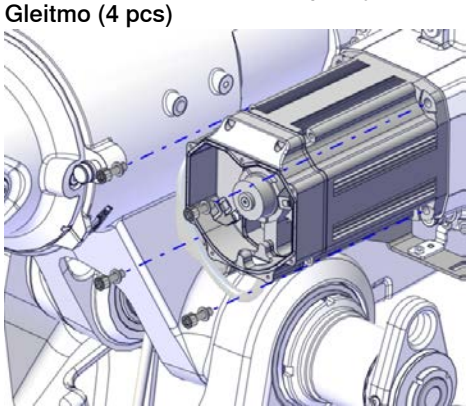
	Action	Note
9	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	
10	Push the motor carefully in position while at the same time the motor pinion is slightly rotated. • Make sure that the motor pinion is properly mated into the hub. • Make sure that the motor pinion does not get damaged. • Make sure that the direction of the cable exit is facing the correct way.	
11	Remove the guide pins.	
12	Secure the motor with its attachment screws and washers. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1 Tightening torque: 50 Nm. Screw dimension: M10x30 quality 12.9 Gleitmo (4 pcs)  xx1600000064
13	Disconnect the brake release tool / 24 VDC power supply.	

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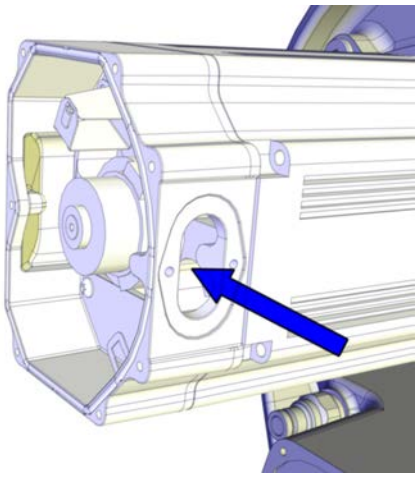
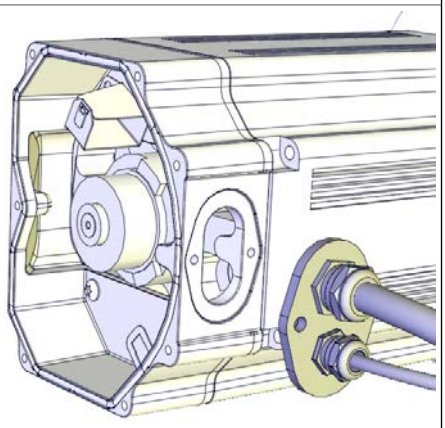
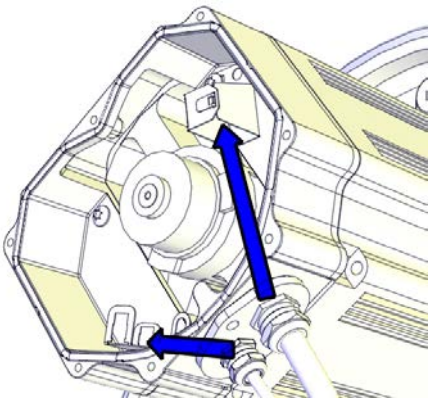
4.8.3 Replacing the axis-4 motor

Continued

Connecting the axis-4 motor cables

	Action	Note
1	Push the motor cables through the cable gland opening.	 xx1300000738
2	Refit the cable gland cover. **Note** Replace the gasket if damaged.	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066

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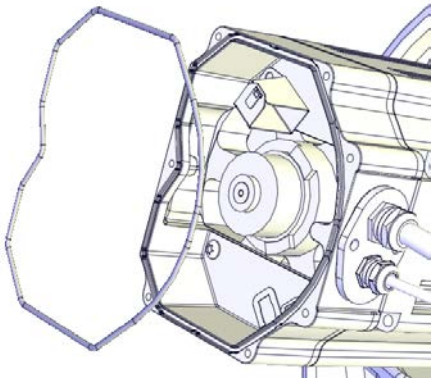
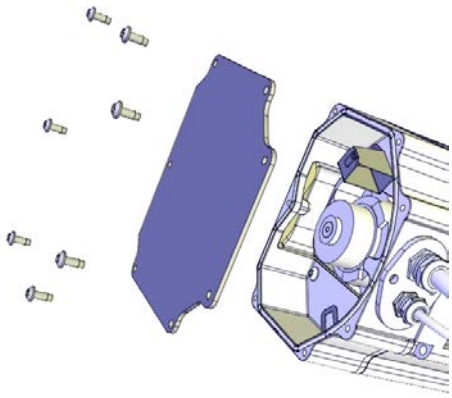
	Action	Note
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-002  xx1200001070
5	Wipe clean o-ring and o-ring groove.	
6	Refit the o-ring. **Tip** Lubricate the o-ring with some grease for a better fitting in the groove.	
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8	Refit the motor cover with it's attachment screws. **Note** Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged. **Note** Make sure the o-ring is undamaged and properly fitted.	Attachment screws: M5x12 8.8 (7 pcs)  xx1200001135
9	Make sure that the covers are tightly sealed.	

Continues on next page

4.8.3 Replacing the axis-4 motor

Continued

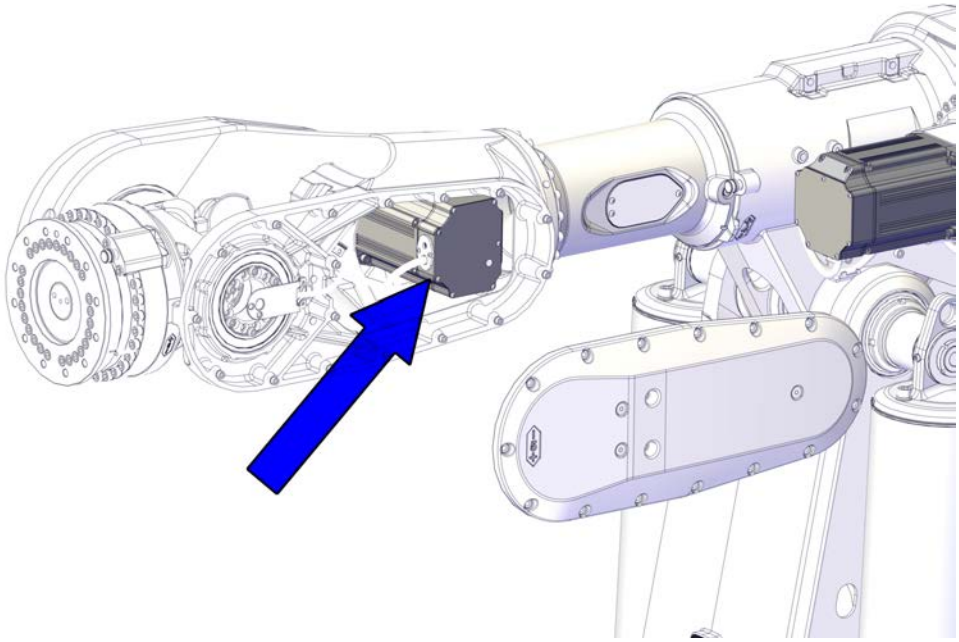
Concluding procedure

	Action	Note
1	Re-calibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 688*. General calibration information is included in section *Calibration on page 675*.
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 97*.	

4.8.4 Replacing the axis-5 motor

Location of the axis-5 motor

The axis-5 motor is located as shown in the figure.



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Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Color	Article number	Note	Level
Rotating AC motor (including pinion)	Graphite White	3HAC058949-003		L2
Rotating AC motor (including pinion)	ABB Orange	3HAC048393-004		L2

Required tools and equipment

Equipment, etc.	Article number	Note
Lifting accessory, motor	3HAC14459-1	
Brake release tool	3HAC081310-001	Used to release the motor brakes. User instructions are enclosed with the tool. Alternative tool: 24 VDC power supply

Continues on next page

4.8.4 Replacing the axis-5 motor
Continued

Equipment, etc.	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 M12	3HAC14631-1	Used to push out the motor if necessary. Always use removal tools in pairs.
Removal tool M14	3HAC047108-001	Used to push out the motor if necessary. Always use removal tools in pairs.
Rotation tool	3HAC7887-1	Used to rotate the motor pinion.
Leak-down tester	-	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumables

Consumable	Article number	Note
Grease	3HAC063069-001	Castrol Molub. Alloy 777-1 NG, 5 ml. To be used on hub splines to prevent from fretting corrosion.
Flange sealant	-	Loctite 574 (or equivalent)
Cable ties	-	

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 689*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Continues on next page

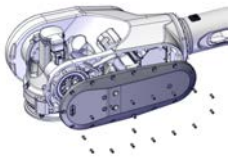
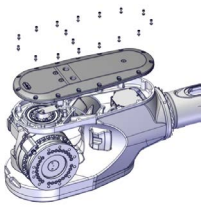
Removing the motor

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 to the specified position: • Axis 1: no significance, as long as the robot is secured to the foundation • Axis 2: comfortable working position • Axis 3: comfortable working position • Axis 4: +90° • Axis 5: no significance • Axis 6: no significance.	
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Retrieving access to the wrist cabling

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the wrist cover. **Note** Do not damage the sealing. Replace if damaged. **Note** The position of axis-4 depends on the ongoing procedure.	 xx1500003100  xx1500002330

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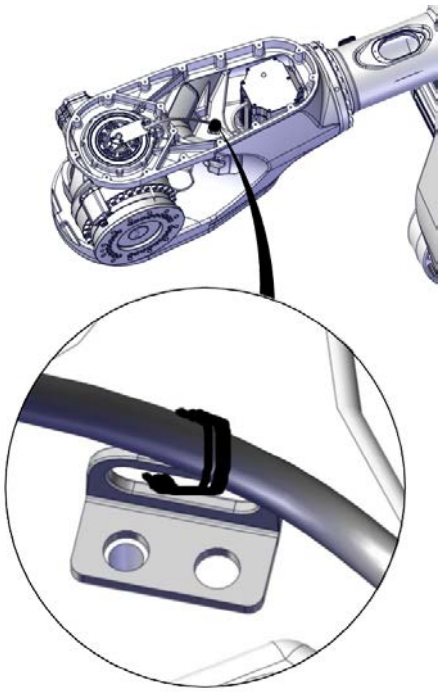
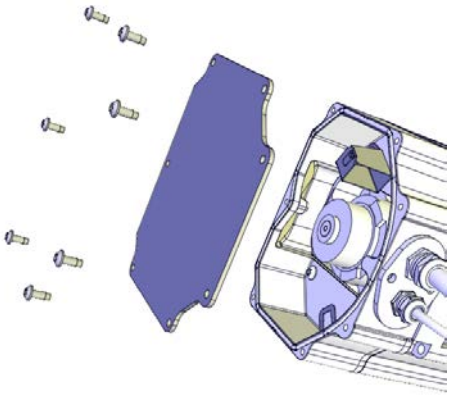
4.8.4 Replacing the axis-5 motor
Continued

	Action	Note
3	Cut the cable tie that secures the axis-6 motor cable.	 xx1500002331

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	Unscrew the attachment screws with washers and remove the motor cover.	 xx1200001135

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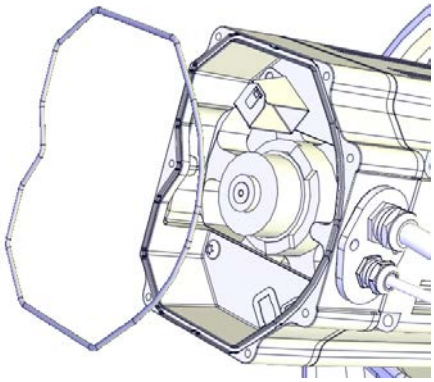
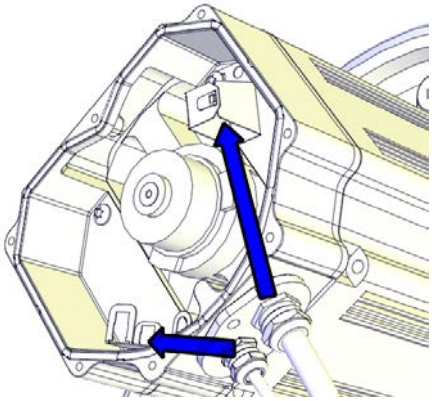
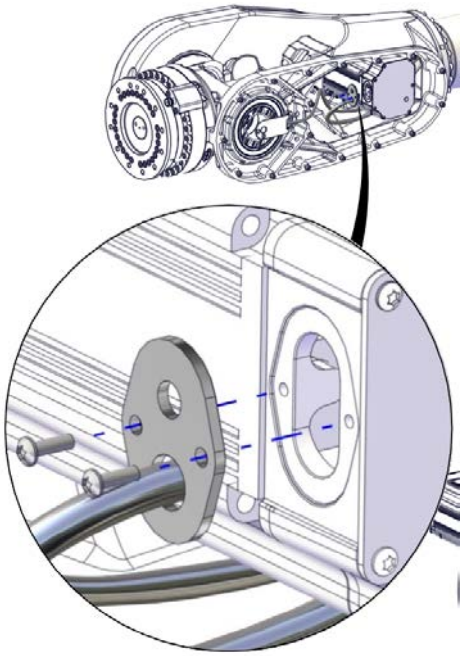
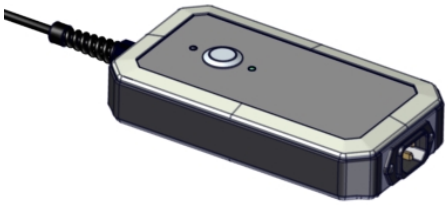
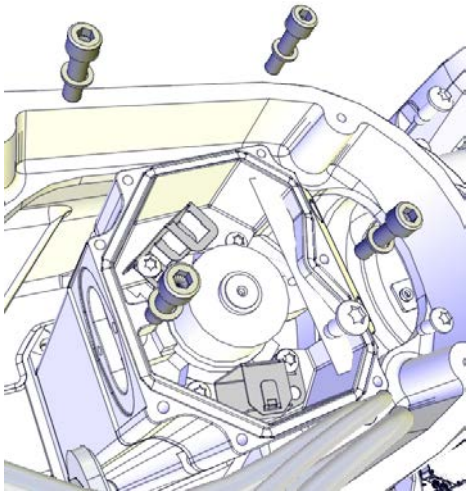
	Action	Note
3	**Note** Make sure the o-ring is present when removing the cover.	 xx1200001070
4	Disconnect the motor cables.	 xx1200001066
5	Remove the cable gland cover. **Tip** Make a note in which direction the cable exit hole is facing, if the motor shall be removed too. The motor shall be refitted in the same position.	 xx1500002717
6	Use caution and pull out the motor cables.	

Continues on next page

4.8.4 Replacing the axis-5 motor

Continued

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.	
2	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 R2.MP5 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP5: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
3	Remove the attachment screws that secure the motor. **Tip** Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx1200001017

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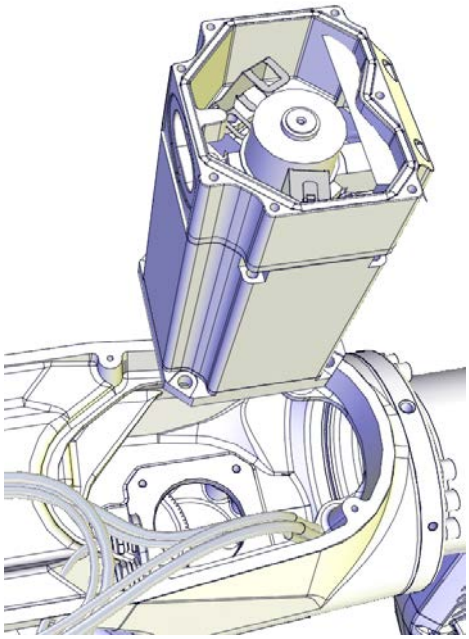
	Action	Note
4	**CAUTION** Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used!	
5	If needed fit removal tools in opposite holes.	Removal tool M12: 3HAC14631-1 Removal tool M14: 3HAC047108-001 Different motor versions have different dimensions on the motor flange holes. Use appropriate removal tool depending on current motor version.
6	**CAUTION** The motor weighs 27 kg. All lifting accessories used must be sized accordingly.	
7	Attach the lifting accessory to the motor.	Lifting accessory, motor: 3HAC14459-1
8	Use caution and lift the motor out.	 xx1200001018

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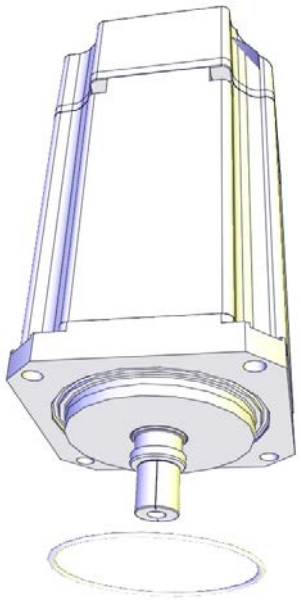
4.8.4 Replacing the axis-5 motor
Continued

Refitting the motor

Use these procedures to refit the motor.

Preparations before refitting the axis-5 motor

	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 from any contamination. Also wipe clean the o-ring groove.	 xx1200001019
3	Make sure the o-ring is undamaged. **Note** Replace if damaged.	O-ring: 3HAB3772-107
4	Lubricate the o-ring with some grease.	

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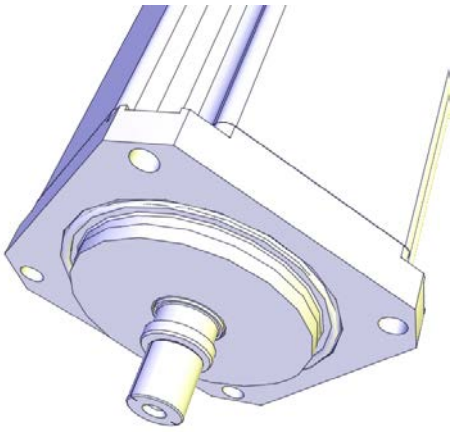
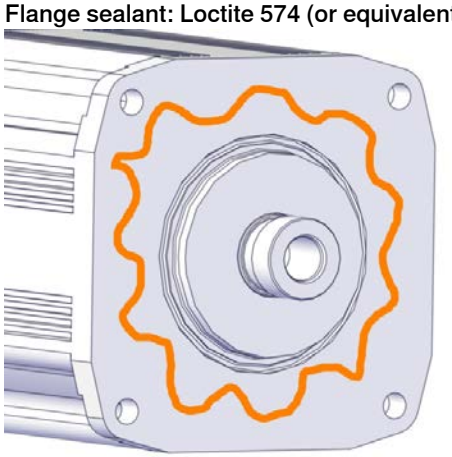
	Action	Note
5	Make sure the o-ring is seated in the groove.	 xx1200001020
6	Apply flange sealant on the motor flange.	Flange sealant: Loctite 574 (or equivalent)  xx1500002357
7	Attach two guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2

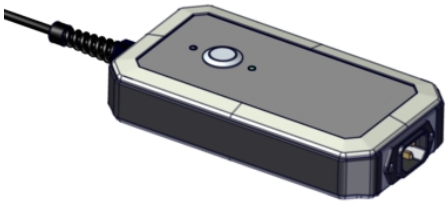
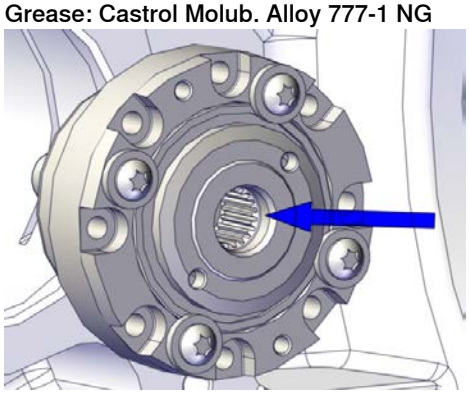
Securing the axis-5 motor

	Action	Note
1	**CAUTION** Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used!	
2	Attach the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool: 3HAC7887-1

Continues on next page

4.8.4 Replacing the axis-5 motor

Continued

	Action	Note
3	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 R2.MP5 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP5: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
4	**CAUTION** The motor weighs 27 kg. All lifting accessories used must be sized accordingly!	
5	Attach the lifting accessory and lift the motor up.	
6	Make sure that there is enough grease on the splines before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346

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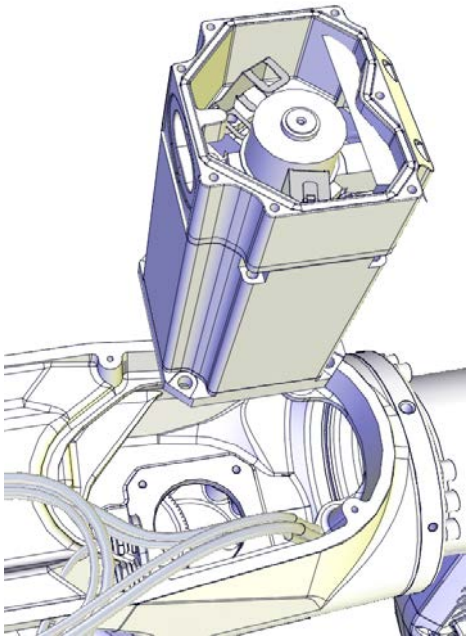
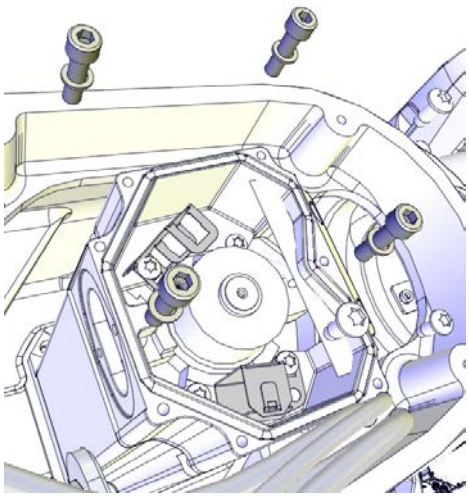
	Action	Note
7	Use caution and lower the motor into position on the guide pins, while at the same time rotating the motor pinion slightly. Make sure that: • the motor pinion is properly mated into the hub. • the motor pinion does not get damaged. • the direction of the cable exit is facing the correct way.	**Note** Make sure the cable exit hole is turned the correct way.  xx1200001018
8	Remove the guide pins.	
9	Secure the motor with its attachment screws and washers, using a bits extender.	Bits extender: 3HAC12342-1 Tightening torque: 50 Nm. Screw dimension: M10x30 quality 12.9 Gleitmo(4 pcs)  xx1200001017
10	Disconnect the brake release tool / 24 VDC power supply.	

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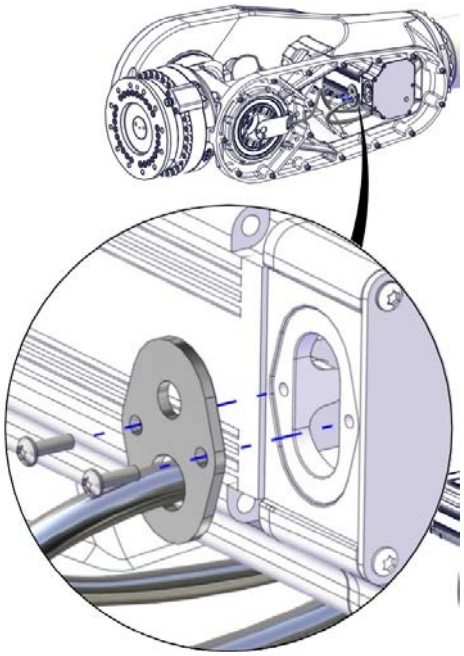
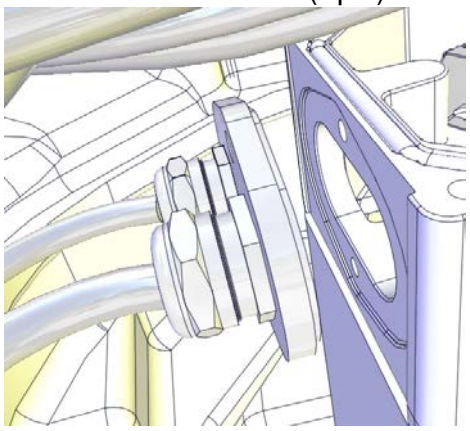
4.8.4 Replacing the axis-5 motor

Continued

Connecting the axis-5 motor cables

	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1500002717
2	Refit the cable gland cover. **Note** Replace the gasket if damaged.	Attachment screws: M5x16 (2 pcs)  xx1200001016

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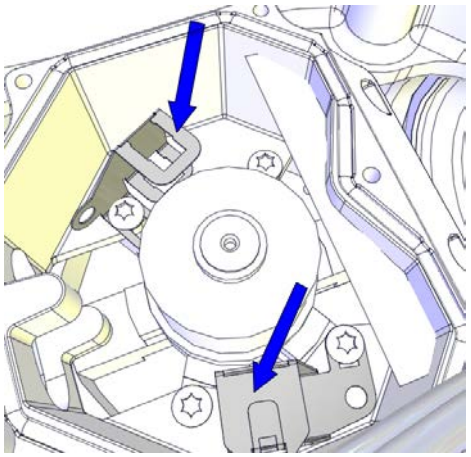
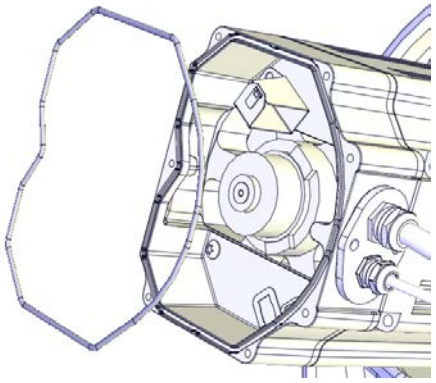
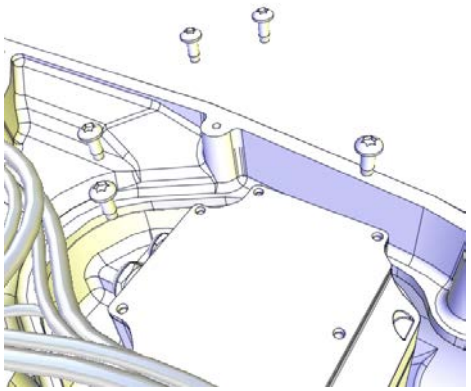
	Action	Note
3	Connect the connectors. Connect in accordance with the markings on the connectors.	 xx1200001015
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring: 3HAC054692-002  xx1200001070
5	**CAUTION** When refitting the motor cover, make sure that none of the cables inside will be damaged.	
6	Refit the motor cover. **Note** Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged. **Note** Make sure the o-ring is properly fitted and undamaged.	Attachment screws: M5x12 8.8 (7 pcs)  xx1200001013

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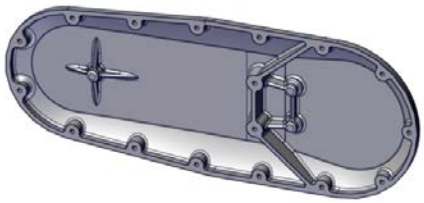
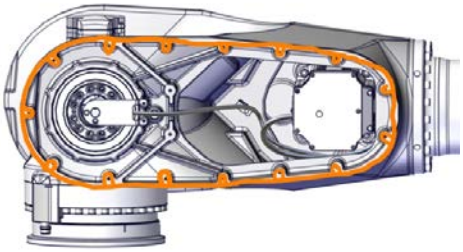
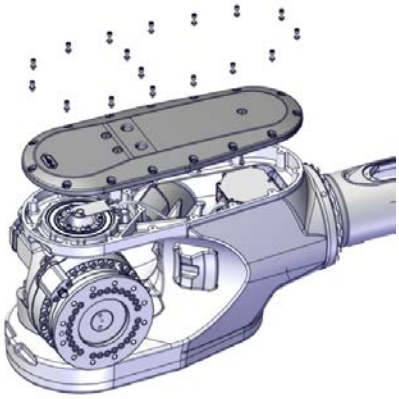
4.8.4 Replacing the axis-5 motor

Continued

	Action	Note
7	Make sure that the cover is tightly sealed.	

Concluding procedure

	Action	Note
1	Make sure the contact surface on the wrist cover is undamaged.	 xx1600000046
2	Apply flange sealant (Loctite 574) on the wrist cover flange.	Loctite 574  xx1600000048
3	Place the cable harness in a way so it will not be damaged when the wrist cover is fitted.	
4	Refit the wrist cover and tighten all screws alternately and repeat once.	Attachment screws: M8x25 8.8 (17 pcs) Tightening torque: 24 Nm  xx1500002330
5	Re-calibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 688*. General calibration information is included in section *Calibration on page 675*.

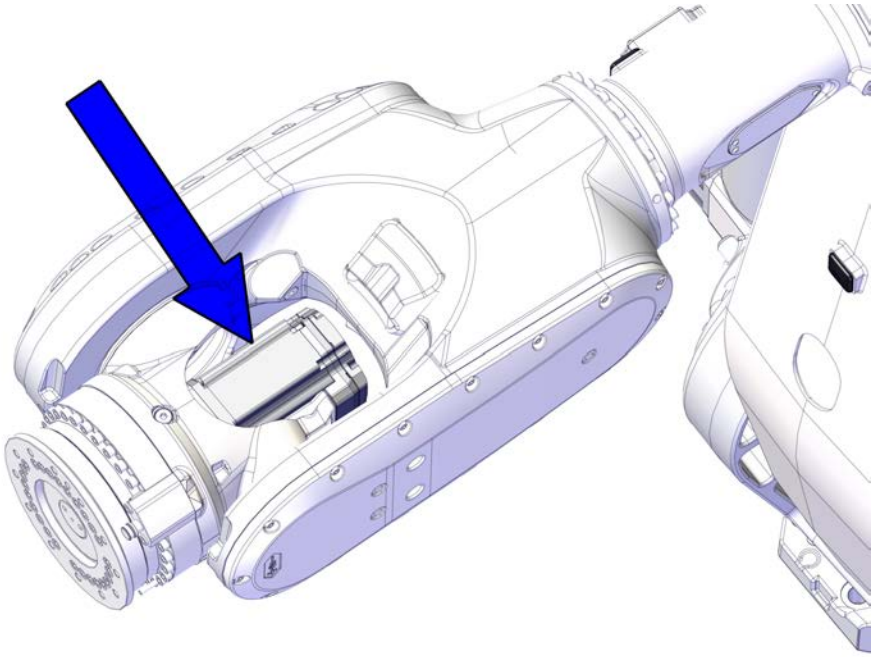
Continues on next page

	Action	Note
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 97*.	

4.8.5 Replacing the axis-6 motor

Location of the axis-6 motor

The axis-6 motor is located as shown in the figure.



xx1500002067

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Rotating AC motor (including pinion)	3HAC058951-003 Graphite White 3HAC049875-004 ABB Orange		L2

Required tools and equipment

Equipment, etc.	Article number	Note
Brake release tool	3HAC081310-001	Used to release the motor brakes. User instructions are enclosed with the tool. Alternative tool: 24 VDC power supply
Removal tool M10	-	Used to push out the motor if necessary.

Continues on next page

Equipment, etc.	Article number	Note
Leak-down tester	-	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumables

Consumable	Article number	Note
Grease	3HAC063069-001	Castrol Molub. Alloy 777-1 NG, 5 ml. To be used on hub splines to prevent from fretting corrosion.
Flange sealant	-	Loctite 574 (or equivalent)
Cable ties	-	

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 689*.
	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 axis-6 motor

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

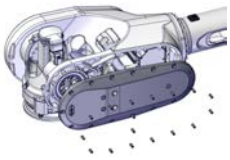
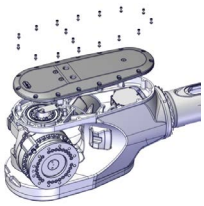
Continues on next page

4.8.5 Replacing the axis-6 motor

Continued

	Action	Note
2	Jog the robot to the specified position: • Axis 1: No significance (as long as the robot is secured to the foundation) • Axis 2: Comfortable working position • Axis 3: Comfortable working position • Axis 4: +90° • Axis 5: +90° • Axis 6: No significance.	
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Retrieving access to the wrist cabling

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the wrist cover. **Note** Do not damage the sealing. Replace if damaged. **Note** The position of axis-4 depends on the ongoing procedure.	 xx1500003100  xx1500002330

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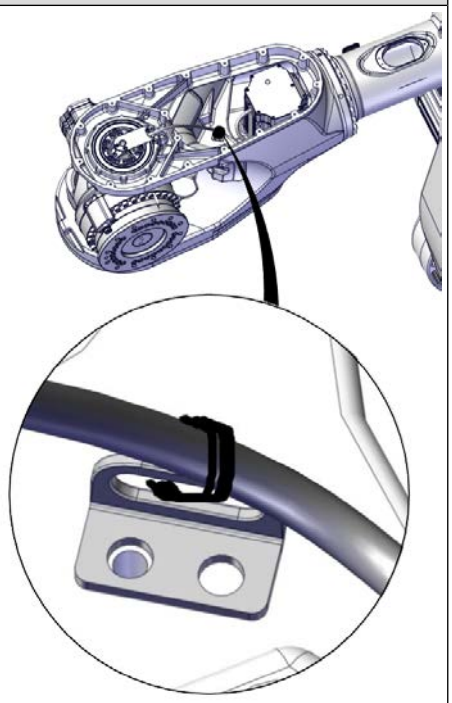
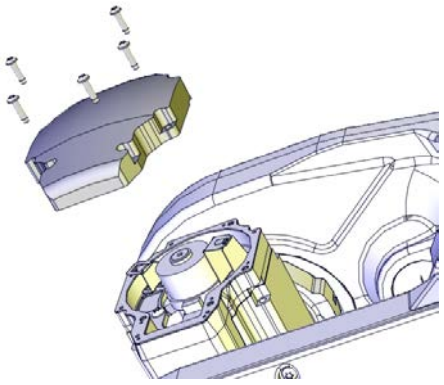
	Action	Note
3	Cut the cable tie that secures the axis-6 motor cable.	 xx1500002331

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	Make sure that the axis-5 is as close to +90° or -90° position as possible, depending on what repair work is being done. **Note** Not needed if only replacing the axis-6 unit.	
3	Unscrew the attachment screws and remove the motor cover. **Note** Do not damage the gasket. Replace if damaged.	 xx1200001080

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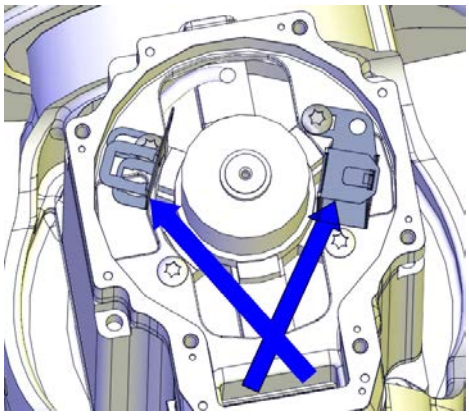
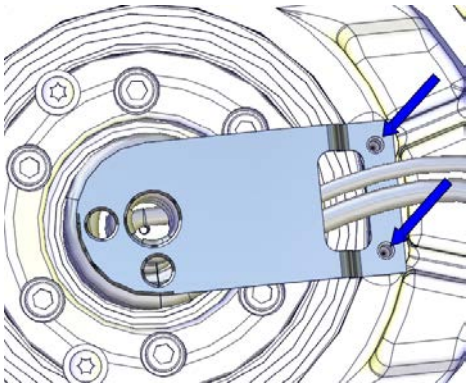
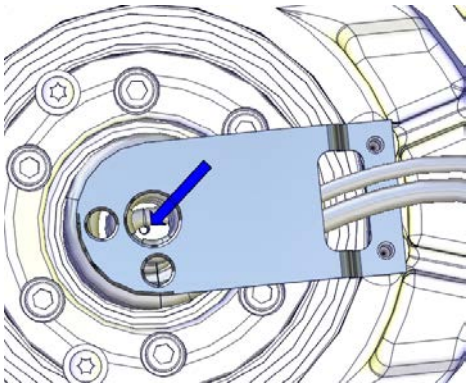
4.8.5 Replacing the axis-6 motor

Continued

	Action	Note
4	Disconnect the motor cables.	 xx1300000488
5	Unscrew the attachment screws holding the cable bracket.	 xx1300000484
6	Unscrew the screw holding the carrier. **Note** The screw is located at the bottom of the carrier.	 xx1300000485

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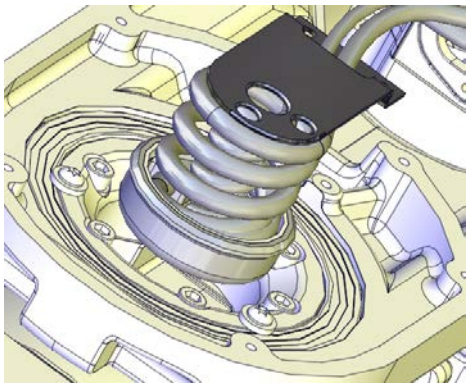
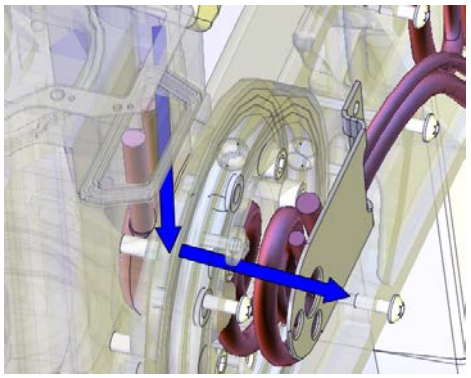
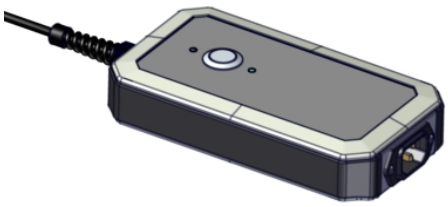
	Action	Note
7	Use caution and pull out the carrier. **Tip** If needed, use a screwdriver to help pulling out the carrier.	 xx1300001113
8	Use caution and pull out the axis-6 motor cables by holding the cables at the motor with one hand, and the other one at the carrier.	 xx1300000666

Removing the axis-6 motor

	Action	Note
1	Release the brakes of the axis-6 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the R2.MP6 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP6: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666

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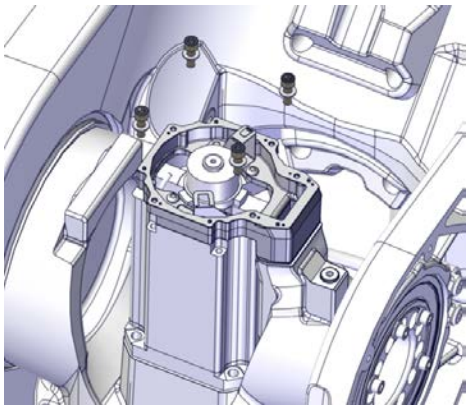
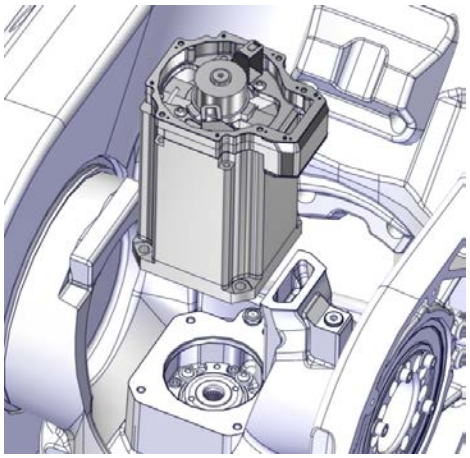
4.8.5 Replacing the axis-6 motor
Continued

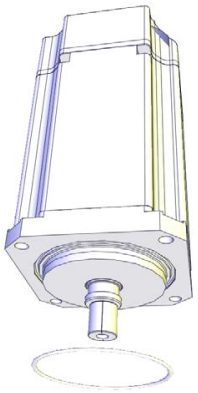
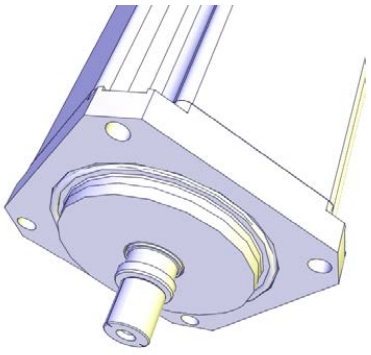
	Action	Note
2	Unscrew the attachment screws with washers.	 xx1500003097
3	**CAUTION** Parting/mating motor pinion and hub, may damage the splines if excessive force is used.	
4	If required, press the motor out of position by fitting the removal tool, to the attachment holes of the motor.	Removal tool M10
5	**CAUTION** The motor weighs 14 kg.	
6	Remove the motor by lifting it straight up from the gear. Make sure the motor pinion is not damaged.	 xx1500003098
7	Disconnect the brake release tool / 24 VDC power supply.	

Continues on next page

Refitting the motor

Use these procedures to refit the motor.

Preparations before refitting the axis-6 motor

	Action	Note
10	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
11	Remove old paint residues and other contamination from the contact surfaces on both motor and gearbox.	
12	Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
13	Make sure the o-ring is undamaged. Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
14	Make sure the o-ring is seated in the groove. **Tip** Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020

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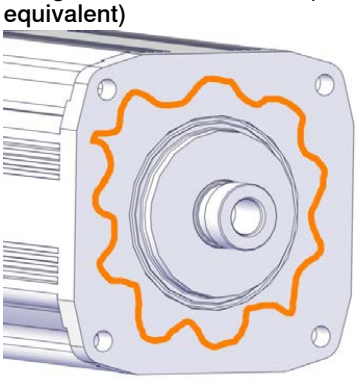
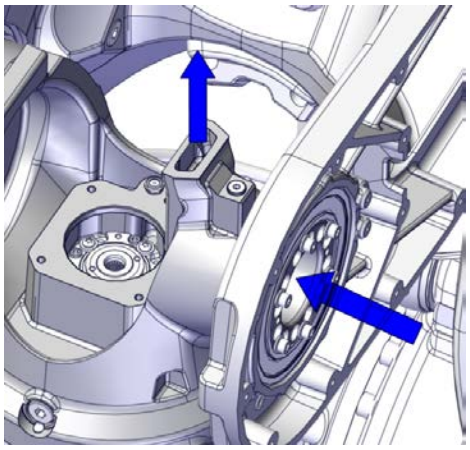
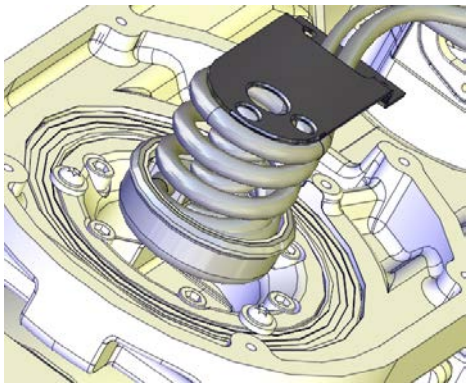
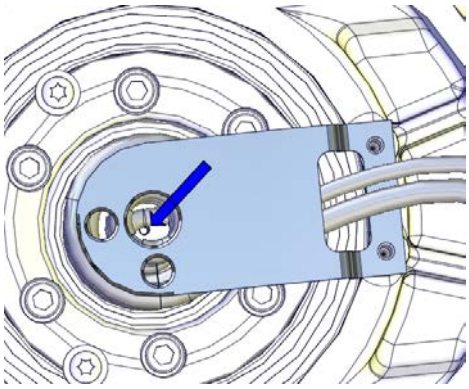
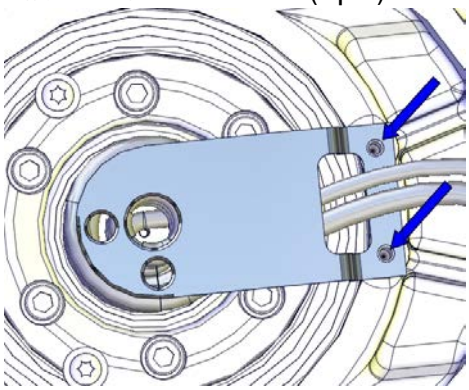
4.8.5 Replacing the axis-6 motor
Continued

	Action	Note
15	Apply flange sealant on the motor flange.	Flange sealant: Loctite 574 (or equivalent)  xx1500002357
16	If the motor is a new spare part, remove the motor cover.	

Connecting the axis-6 motor cables - step 1

	Action	Note
1	**Note** Axis-5 must be in position +90° (or as close as possible) for a correct installation of the cable harness spiral in the wrist. If not, connect the brake release tool / 24 VDC power supply, release the brakes and move axis-5 manually to +90°.	
2	Use caution and push the cable harness in through the wrist recess.	 xx1500003099

Continues on next page

	Action	Note
3	Use caution and push the carrier into position. **Tip** Use a screwdriver (or similar) to press the carrier into position.	 xx1300001113
4	Secure the carrier with the M4 screw. **Note** The M4 screw is located at the bottom of the carrier. **Tip** The M4 screw may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.	Attachment screw: M4x10  xx1300000485
5	Secure the cable bracket.	Attachment screws: M6x12 (2 pcs)  xx1300000484

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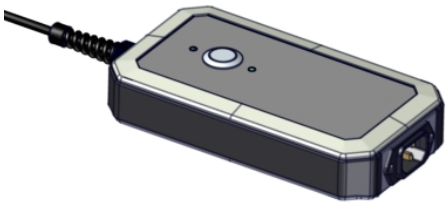
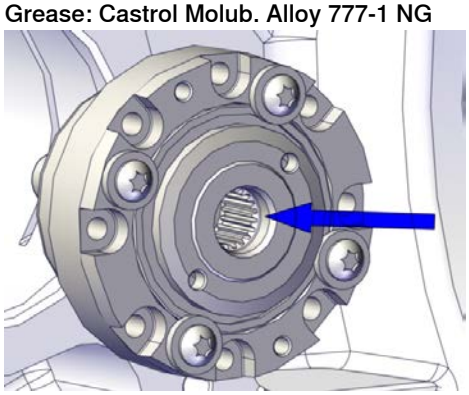
4.8.5 Replacing the axis-6 motor

Continued

Securing the axis-6 motor

	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	Release the brakes of the axis-6 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the R2.MP6 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP6: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
3	Make sure that there is enough grease on the splines, before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346
4	**CAUTION** Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.	

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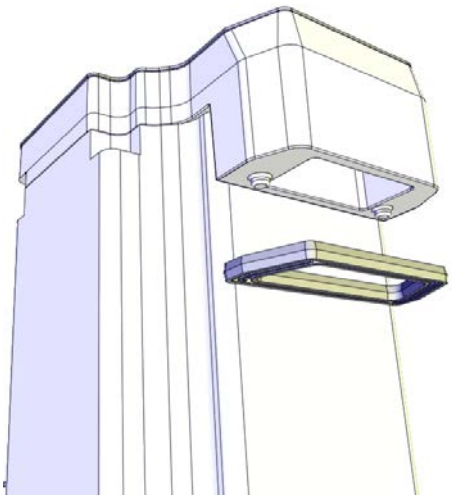
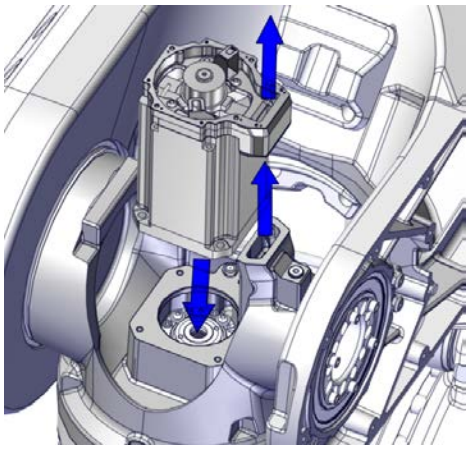
	Action	Note
5	Inspect the gasket. **Note** Replace if damaged.	 xx1200001094
6	**CAUTION** The motor weighs 14 kg. All lifting accessories used must be sized accordingly!	
7	Put the motor into its mounting position, while at the same time, pushing the motor cables in through the cable gland recess. Make sure the motor pinion is properly mated into the hub. Make sure the motor pinion is not damaged.	 xx1500003102

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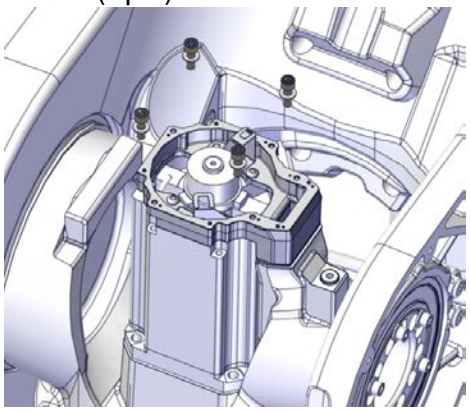
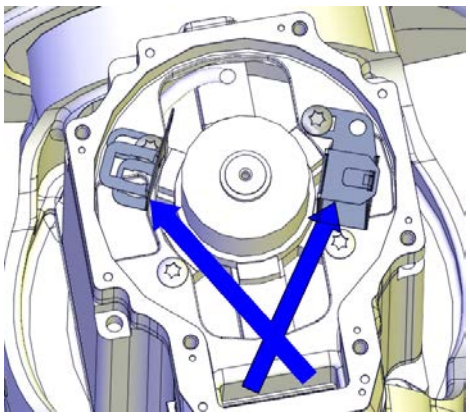
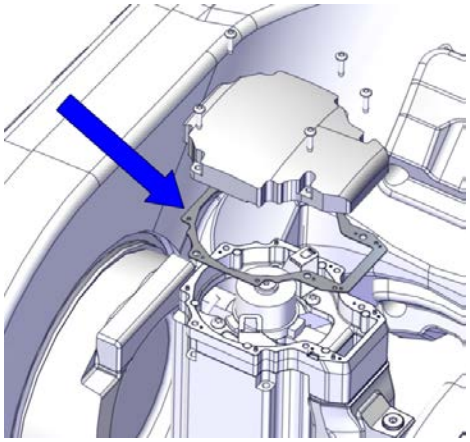
4.8.5 Replacing the axis-6 motor
Continued

	Action	Note
8	Secure the motor. Make sure that the gasket is fitted correctly.	Tightening torque: 24 Nm Screw dimension: M8x25 quality 12.9 Gleitmo (4 pcs)  xx1500003097
9	Disconnect the 24 V DC power supply.	

Connecting the axis-6 motor cables - step 2

	Action	Note
1	Reconnect the the axis-6 motor connectors. **Note** Place the resolver cable underneath the motor cable.	 xx1300000488
2	Make sure the gasket on the motor cover is undamaged. **Note** Replace if damaged.	 xx1500003095

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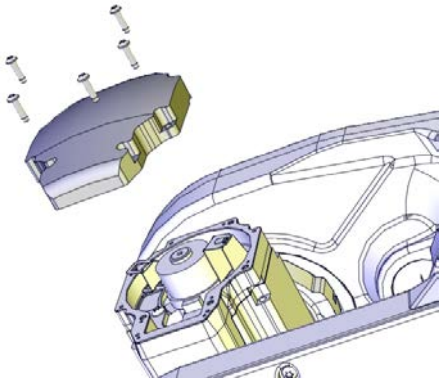
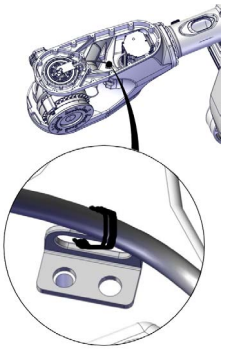
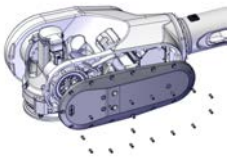
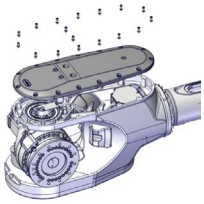
	Action	Note
3	**CAUTION** When refitting the motor cover, make sure that none of the cables inside will be damaged.	
4	Refit the motor cover.	Attachment screws: M5x20 (5 pcs)  xx1200001080
5	Secure the axis-6 motor cable to the cable fixing bracket, with a cable tie. **Note** The position of axis-4 depends on the ongoing procedure.	Cable tie  xx1500003101  xx1500002331
6	Remove all residues of old sealant and other contamination from the wrist cover contact surfaces.	
7	Apply flange sealant (Loctite 574) on the wrist cover flange.	Flange sealant: Loctite 574 (or equivalent)

Continues on next page

4.8.5 Replacing the axis-6 motor

Continued

	Action	Note
8	Refit the wrist cover and tighten all screws alternately and repeat once. **Note** The position of axis-4 depends on the on-going procedure.	Attachment screws: M8x25 8.8 (17 pcs) Tightening torque: 24 Nm  xx1500003100  xx1500002330

Concluding procedure

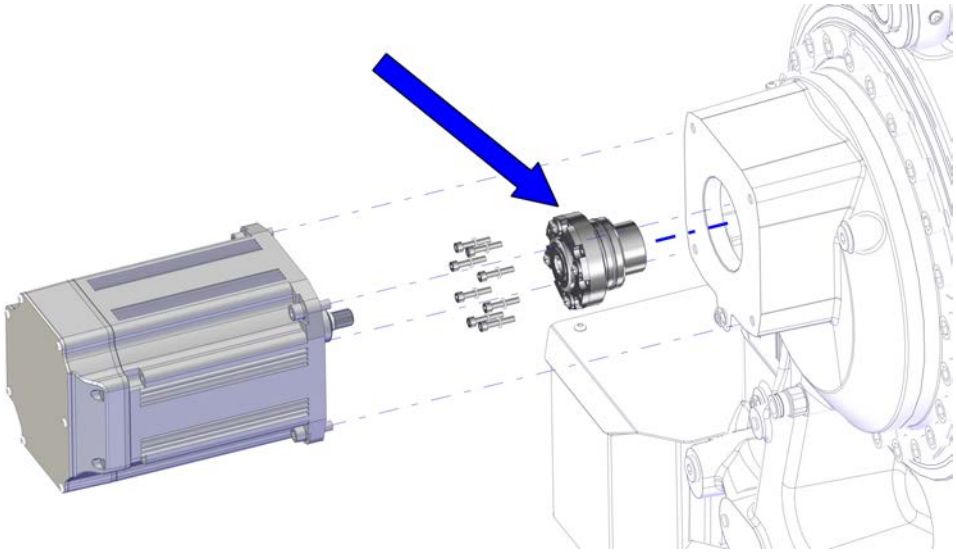
	Action	Note
1	Re-calibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 688*. General calibration information is included in section *Calibration on page 675*.
2	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 97*.	

4.9 Gearboxes

4.9.1 Replacing the hub

Location of the hub

The hub is located as shown in the figure.



xx1500002036

The location of the hub is inbetween motor and gearbox on all six axes. The figure shows one example, but the principle is the same for all axes. The number of attachment screws and pinion differ.

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Hub with pinion	3HAC049795-003		L2

Required tools and equipment

Equipment, etc.	Article number	Note
Hub tool	3HAC071355-001	Used for removal and refitting of the hub.
Leak-down tester	-	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Continues on next page

4.9.1 Replacing the hub
Continued

Required consumables

Consumable	Article number	Note
Grease	3HAC063069-001	Castrol Molub. Alloy 777-1 NG, 5 ml. To be used on hub splines to prevent from fretting corrosion.
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

Hub specification

Quantity of attachment screws

The number of attachment screws that secure the hub, differ depending on gearbox. The number of holes in the hub is the same on the three types of hub. The table shows the number of screws used on the different axes.

Axis-1	Axis-2	Axis-3	Axis-4	Axis-5	Axis-6
6 pcs	8 pcs	8 pcs	4 pcs	6 pcs	4 pcs

Pinion on the hub

There are three different pinions on the hub.

Pinion axis-1, axis-2 and axis-3	Pinion axis-4 and axis-6	Pinion axis-5
 xx1500002976	 xx1500002977	 xx1500002978

Removing the hub

Use these procedures to remove the hub.

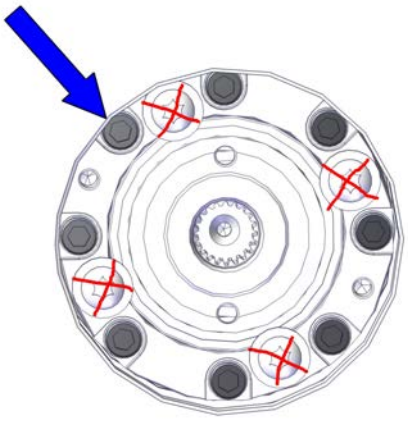
Preparations before removing the hub

	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

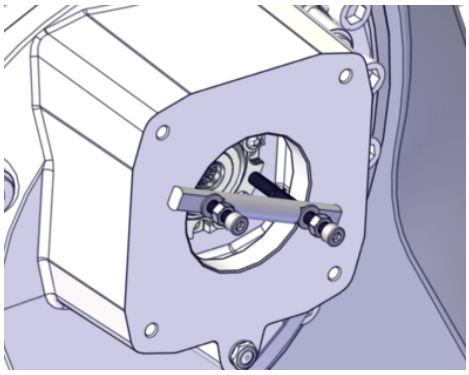
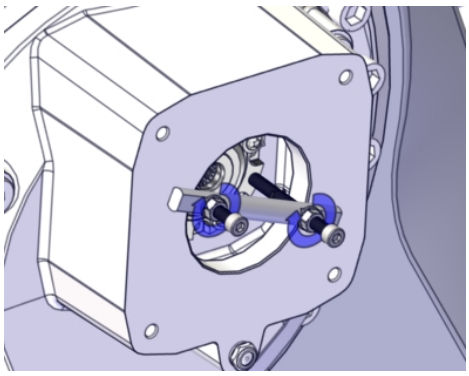
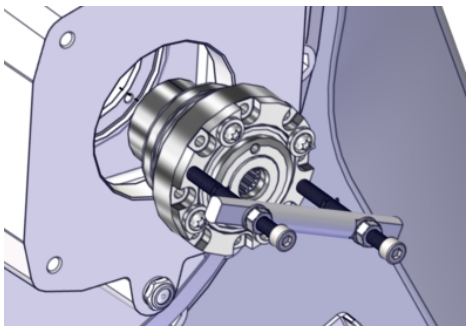
	Action	Note
2	Drain the gearbox in question. **Note** Axis-1 does not need to be drained. Axis-4, axis-5 and axis-6 gearboxes do not need to be drained, if the axes are positioned with the motor upwards and gearbox downwards.	See procedures in *Replacement/changing activities on page 140*.
3	Remove the motor of the axis in question.	See procedures in *Motors on page 452*.

Removing the hub

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the M6x30 hex socket head cap screws that secure the hub. **Note** Do not remove the M6x16 torx pan head screws.	 xx1500002038
3	**CAUTION** Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	

Continues on next page

4.9.1 Replacing the hub
Continued

	Action	Note
4	Fit the two threaded rods of the hub tool into the attachment holes in the hub.	Hub tool: 3HAC071355-001  xx2000001379
5	Alternately thread the nuts clockwise on the two rods to pull out the hub from the gear.	 xx2000001380
6	Lift out the hub carefully.	 xx2000001381
7	Cover the hole to avoid getting debris into the gearbox during remaining service work.	

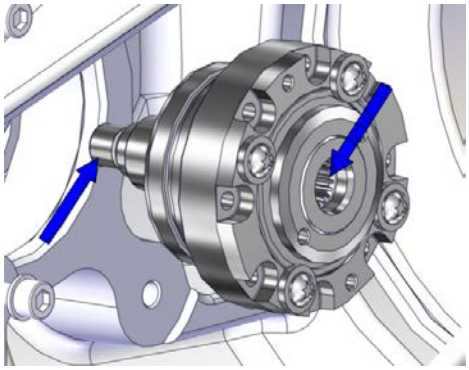
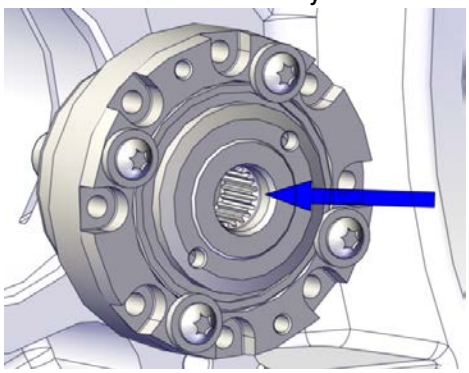
Refitting the hub

Use these procedures to refit the hub.

Preparations before refitting the hub

	Action	Note
1	Wipe the hub clean.	
2	Inspect the hole where the hub shall be refitted. Wipe clean if needed.	

Continues on next page

	Action	Note
3	Make sure the o-ring on the hub is undamaged. **Note** Replace if damaged.	 xx1500002039
4	Apply some grease on the o-ring for a better fitting.	
5	Examine the pinion and the splines in the hub for damages.	 xx1500002082
6	Make sure that there is enough grease on the splines before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346

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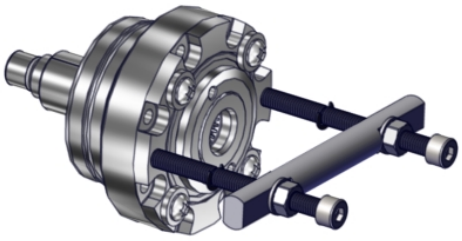
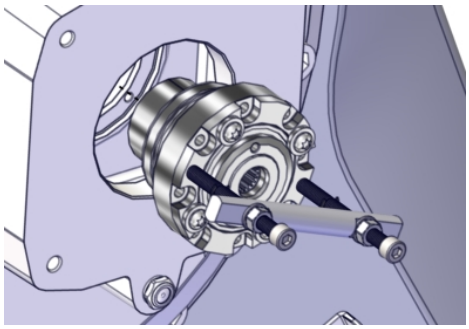
4.9.1 Replacing the hub

Continued

Refitting the hub

	Action	Note
1	Fit the hub tool.	Hub tool: 3HAC071355-001  xx2000001377
2	**CAUTION** Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	
3	Lift the hub to the gear, and mate the pinon carefully into the gear.	 xx2000001381
4	Remove the hub tool and fit the attachment screws for the hub. Apply locking liquid (Loctite 2400 (or equivalent Loctite 243)) on the screws. **Note** The number of attachment screws differ depending on gearbox.	Attachment screws: M6x30 12.9. Loctite 2400 (or equivalent Loctite 243) Quantity: • Axis-1 = 6 pcs • Axis-2 = 8 pcs • Axis-3 = 8 pcs • Axis-4 = 4 pcs • Axis-5 = 6 pcs • Axis-6 = 4 pcs
5	Secure the hub.	Tightening torque: 14 Nm.

Concluding procedure

	Action	Note
1	Perform a leak-down test.	See *Performing a leak-down test on page 187*.
2	Refit the motor of the axis in question.	See procedures in *Motors on page 452*.
3	Refill oil in the gearbox in question.	See procedures in *Replacement/changing activities on page 140*.

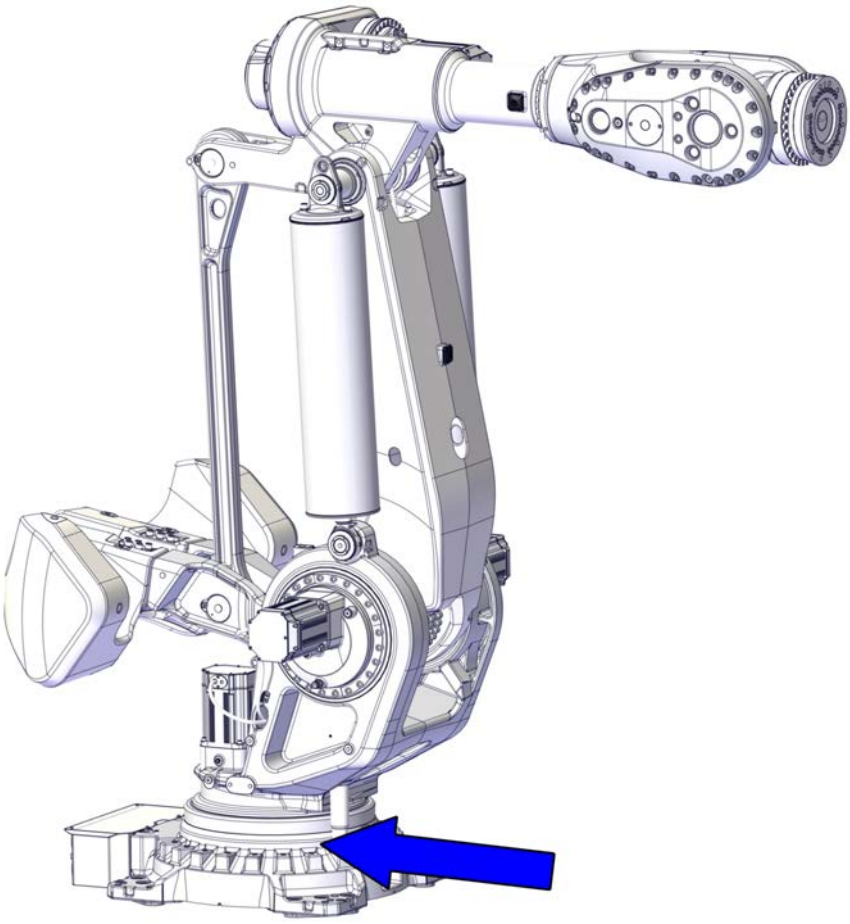
Continues on next page

	Action	Note
4	Re-calibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 688*. General calibration information is included in section *Calibration on page 675*.
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 97*.	

4.9.2 Replacing the axis-1 gearbox

Location of the axis-1 gearbox

The axis-1 gearbox is located as shown in the figure.



xx1500002068

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Reduction gear RV 700CS	3HAC048963-002		L2

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Required tools and equipment

Equipment, etc.	Article number	Note
Mobile platform ladder	-	
Roundsling 2 m	-	Lifting capacity: 5,000 kg
Lifting chains with shortener	-	
Lifting eye	3HAC038295-003	M24
Supporting pillars	3HAC061213-001	Used for elevation of the robot to remove and refit axis-1 gearbox. Includes: • Supporting pillars (4 pcs) • User instructions (3HAC062411-002) • Screws 3HAC061400-001 (4 pcs)
Hexagon socket spanner, socket size 14 mm	-	Used to remove and refit the R1.SMB in the base.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Roundsling 1 m	-	Lifting capacity: 1,000 kg
Lifting accessory, motor	3HAC15534-1	Lifting instruction 3HAC15640-2 enclosed.
Brake release tool	3HAC081310-001	Used to release the motor brakes. User instructions are enclosed with the tool. Alternative tool: 24 VDC power supply
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Guide pin, M10x100	3HAC15521-1	Always use guide pins in pairs.
Removal tool M12	3HAC14631-1	Used to push out the motor if necessary. Always use removal tools in pairs.
Screw M6x110	-	2 pcs. Fully threaded. Used as removal tools when removing the hub.
Guide pin, M16x300	3HAC13120-5	Always use guide pins in pairs.
Lifting eye	3HAC14457-4	M16
Torque Multiplier	-	Nova Torque
Guide pin, M16x200	3HAC13120-3	Always use guide pins in pairs.
Guide pin, M16x300	3HAC13120-5	Always use guide pins in pairs.
Rotation tool	3HAC7887-1	Used to rotate the motor pinion.
Removal tool M14	3HAC047108-001	Used to push out the motor if necessary. Always use removal tools in pairs.
Leak-down tester	-	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

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Required consumables

Consumable	Article number	Note
Mercasol		
Grease		
Grease	3HAC063069-001	Castrol Molub. Alloy 777-1 NG, 5 ml. To be used on hub splines to prevent from fretting corrosion.
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)
Flange sealant	-	Loctite 574 (or equivalent)

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 689*.
	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

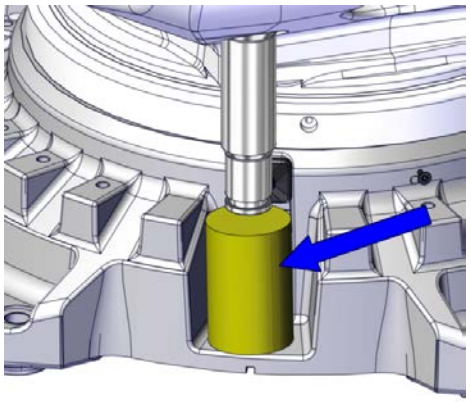
	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Remove any tool or other equipment fitted on the turning disc.	
3	Begin draining the oil.	See *Draining the axis-1 gearbox on page 142*.

Continues on next page

Robot position when replacing the mechanical stop pin

	Action	Note
1	Jog axis-1 to the position where it is possible to replace the mechanical stop pin.	 xx1500002093
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Removing the mechanical stop pin

	Action	Note
1	**CAUTION** The mechanical stop pin weighs 13 kg.	
2	Put a piece of wood (or similar) underneath the stop pin, to prevent it from falling down uncontrolled, when the set screw is removed.	 xx1500002091
3	Take a firm grip on the stop pin with one hand.	

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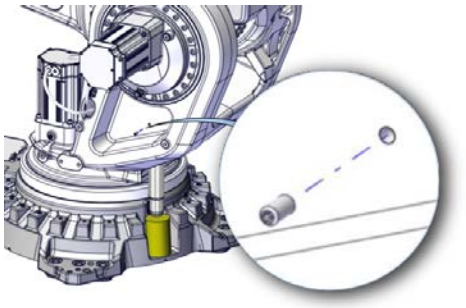
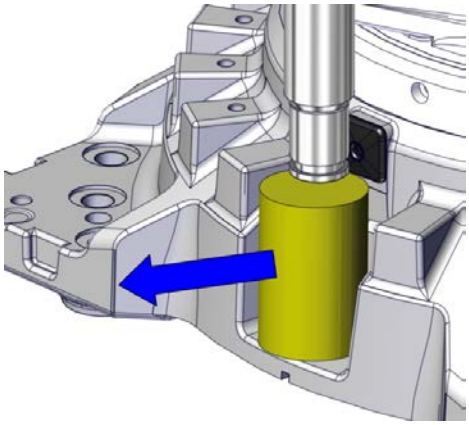
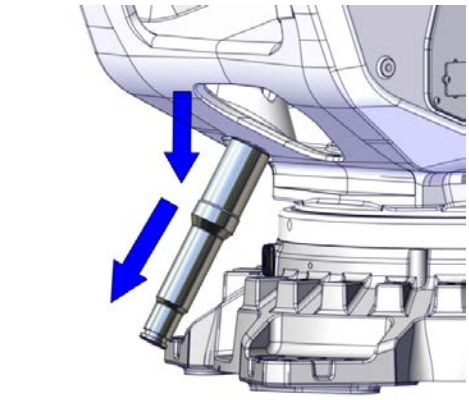
4.9.2 Replacing the axis-1 gearbox
Continued

	Action	Note
4	Unscrew the set screw with the other hand. **Note** Always use a flat head Allen key, to not damage the screw head.	 xx1500002090
5	Hold the stop pin with one hand and remove the piece of wood (or similar) with the other hand.	 xx1500002299
6	Remove the stop pin by sliding it down, out off its hole and moving it slightly forwards.	 xx1500002089

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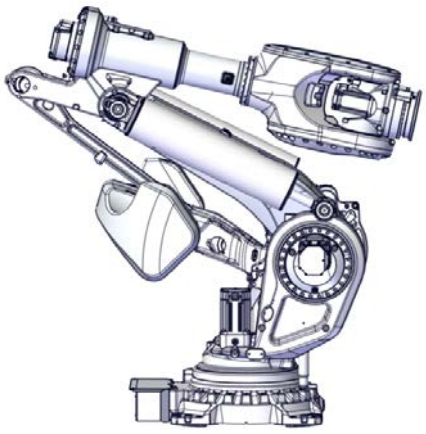
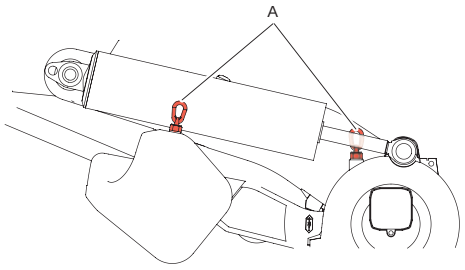
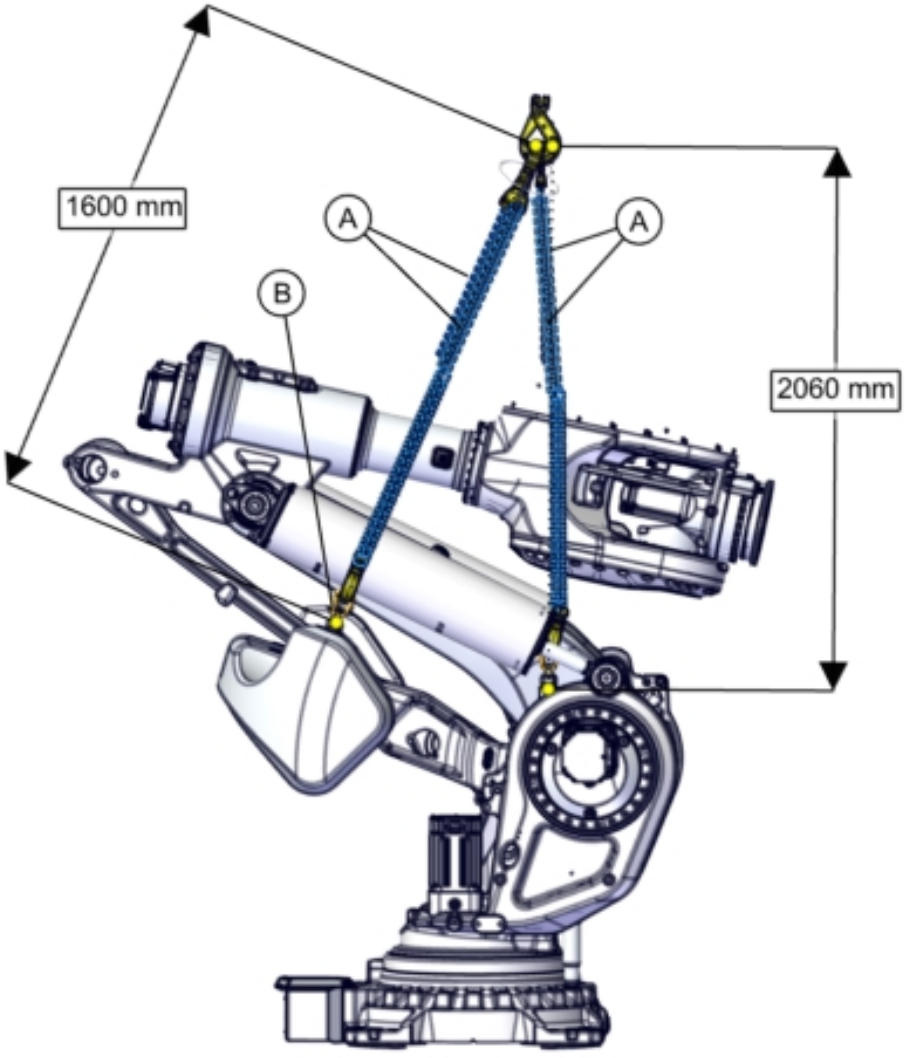
Attaching lifting accessories, complete robot

	Action	Note
1	Jog the robot into position: • Axis 1: 0° • Axis 2: -51° • Axis 3: +13° • Axis 4: -90° (to give more space to the roundslings) • Axis 5: 0° • Axis 6: 0°	 xx1700000968
2	**CAUTION** The weight of the IRB 8700 robot is 4,750 kg All lifting accessories used must be sized accordingly.	
3	Fit two lifting eyes to the holes in the frame and two lifting eyes to the holes in the counter weight. **DANGER** Never use the robot as ladder. Use a Mobile platform ladder (or similar) to reach.	 xx1400002590 A Lifting eye: M24 (4 pcs)

Continues on next page

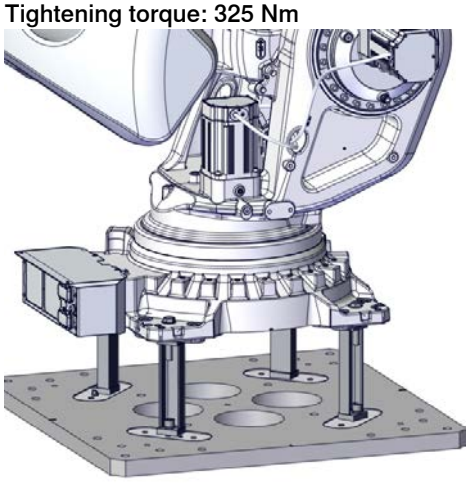
4.9.2 Replacing the axis-1 gearbox
Continued

	Action	Note
4	Attach chains to the lifting eyes at the counter weights, run the chains on the outside of the balancing devices, and to an overhead crane. Attach chains to the lifting eyes at the frame, on the inside of the balancing devices shafts, and to an overhead crane. Protect the surfaces of the robot from scratches.  xx1700000969 A Lifting chains with shortener (4 pcs) B Lifting eye, M24: 3HAC038295-003 (4 pcs)	
5	Stretch the lifting accessories to take the weight of the robot.	

Lifting the complete robot onto the supporting pillars

	Action	Note
1	**CAUTION** Make sure that the robot is secured in the lifting accessories.	

Continues on next page

	Action	Note
2	Unscrew the attachment screws that secure the robot to the foundation.	
3	Use caution and lift the complete robot up, high enough to be able to attach the supporting pillars to the foundation.	Supporting pillars: 3HAC061213-001
4	Fit the supporting pillars to the foundation with the enclosed attachment screws.	Follow user instructions enclosed with the pillars. Tightening torque: 325 Nm
5	Use caution and lower the robot slowly down onto the supporting pillars, making sure the holes in robot base will match the holes in the pillars.	
6	Secure the base to the supporting pillars with the robot attachment screws.	Follow user instructions enclosed with the pillars. Tightening torque: 325 Nm  xx1700000928

Disconnecting 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.	

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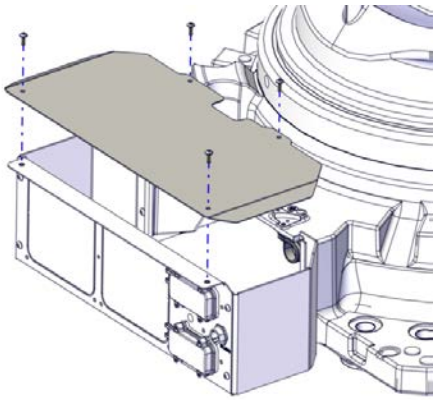
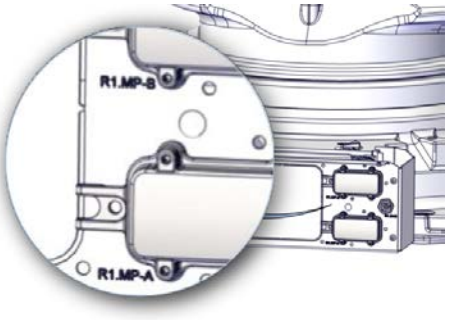
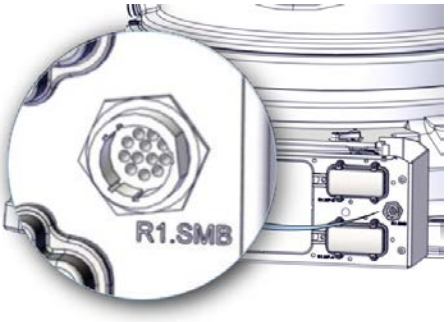
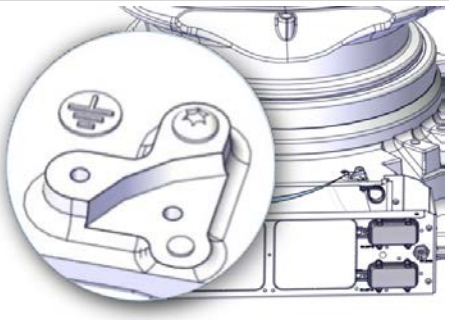
4.9.2 Replacing the axis-1 gearbox

Continued

	Action	Note
2	Remove the base cover.	 xx1500003082
3	Disconnect R1.MP-A and R1.MP-B.	 xx1500003083
4	Disconnect R1.SMB.	Hexagon socket spanner, socket size 14 mm  xx1500003084
5	Remove the two earth cables.	 xx1500003085

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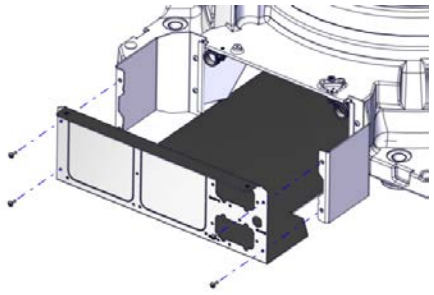
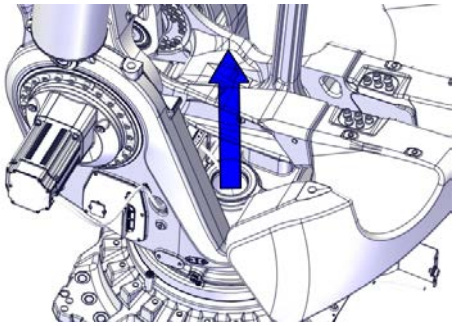
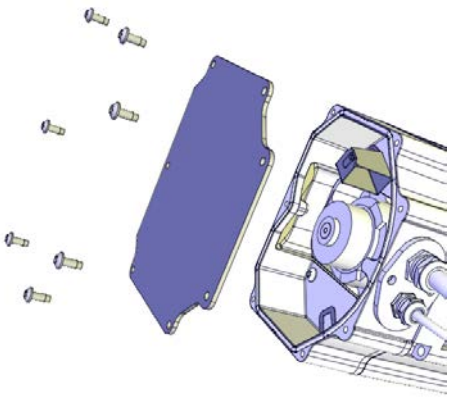
	Action	Note
6	For easier access: Remove connection plate and bottom plate.	 xx1500003088
7	Use caution and pull out the cable harness from the base, up through the frame.	 xx1700001299

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	Unscrew the attachment screws with washers and remove the motor cover.	 xx1200001135

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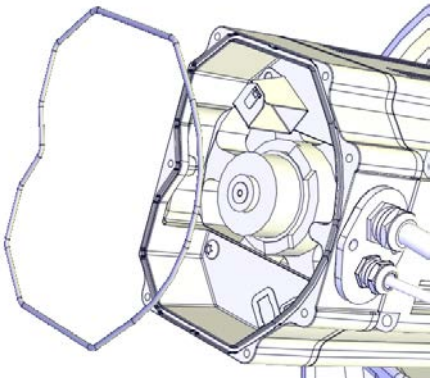
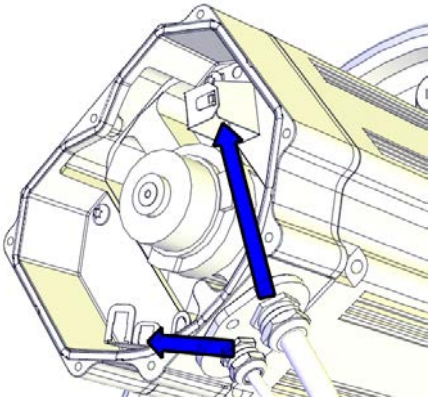
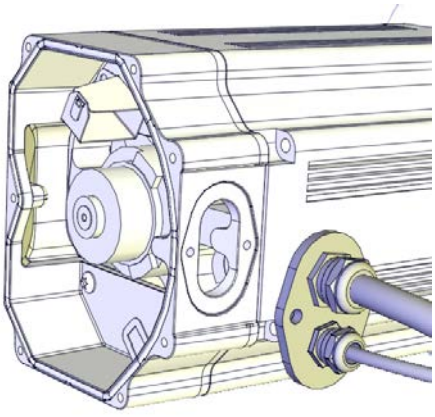
4.9.2 Replacing the axis-1 gearbox
Continued

	Action	Note
3	**Note** Make sure the o-ring is not lost when removing the cover.	 xx1200001070
4	Disconnect the motor cables.	 xx1200001066
5	Remove the cable gland cover. Inspect the gasket. **Note** Replace if damaged. **Tip** Make a note in which direction the cable exit hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.	 xx1200001067
6	Use caution and pull out the motor cables.	

Removing the axis-1 motor

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

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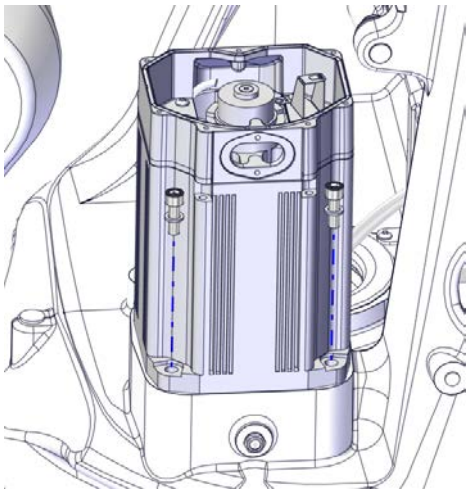
	Action	Note
2	Remove the attachment screws that secure the motor. **Tip** Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx1500002083
3	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
4	**CAUTION** Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.	
5	If needed, use removal tools to help loosen the motor.	Removal tool motor M12 / Removal tool M14: 3HAC14631-1 / 3HAC047108-001 Used to push out the motor, if necessary. Always use removal tools in pairs. Different motor versions have different dimensions on the motor flange holes. Use appropriate removal tool depending on current motor version.
6	**CAUTION** The weight of the motor is 27 kg All lifting accessories used must be sized accordingly.	
7	Attach the lifting accessories. Tie the two roundslings together to one long roundsling and run it between the lower arm and the balancing device, and attach it to the lifting accessory. (The space between the lower arm and the balancing device is narrow and only roundslings with dimension 1 meter fit.)	Roundsling 1 m (2 pcs) Lifting accessory, motor: 3HAC14459-1.

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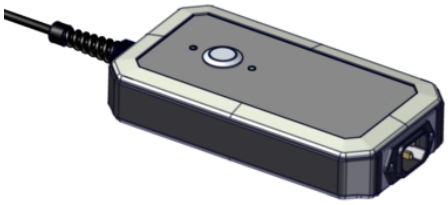
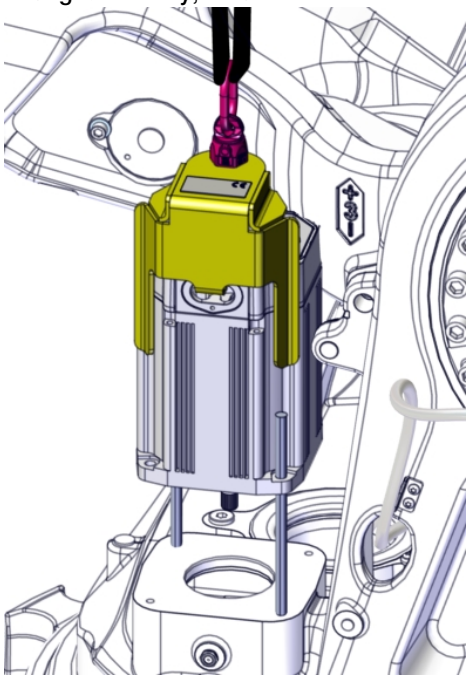
4.9.2 Replacing the axis-1 gearbox
Continued

	Action	Note
8	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 R2.MP1 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP1: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
9	Use caution and lift the motor straight up to get the pinion parted from the gear. Guide the motor to a work bench placed beside the robot, while lowering the motor.	Roundsling 1 m (2 pcs) Lifting accessory, motor: 3HAC14459-1.  xx1500002084
10	Disconnect the brake release tool / 24 VDC power supply.	

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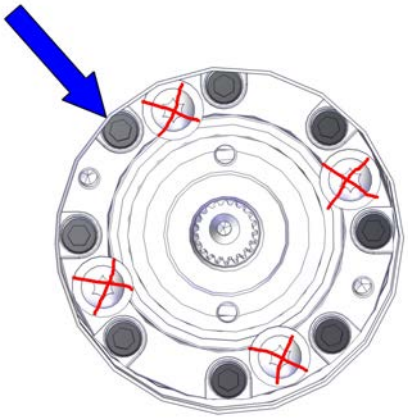
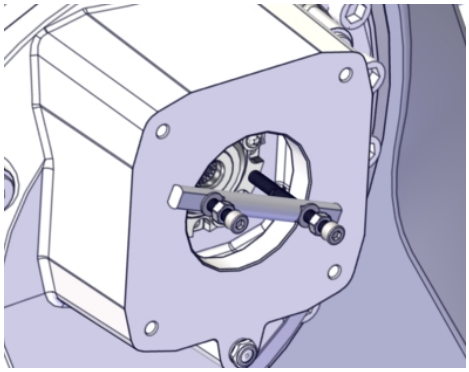
Removing the hub

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the M6x30 hex socket head cap screws that secure the hub. **Note** Do not remove the M6x16 torx pan head screws.	 xx1500002038
3	**CAUTION** Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	
4	Fit the two threaded rods of the hub tool into the attachment holes in the hub.	Hub tool: 3HAC071355-001  xx2000001379

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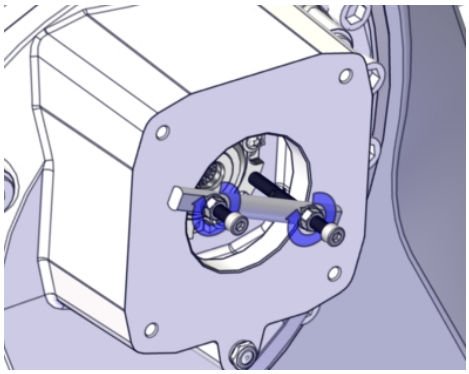
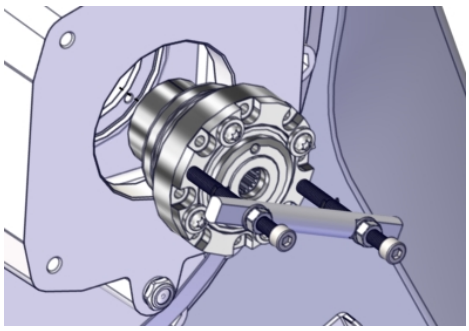
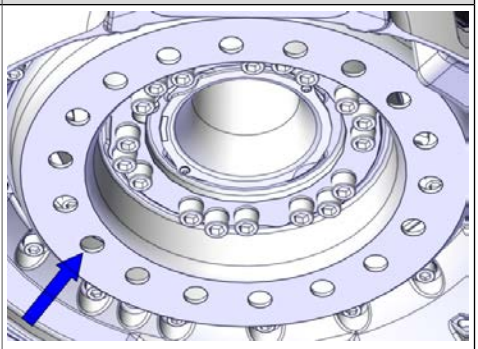
4.9.2 Replacing the axis-1 gearbox
Continued

	Action	Note
5	Alternately thread the nuts clockwise on the two rods to pull out the hub from the gear.	 xx2000001380
6	Lift out the hub carefully.	 xx2000001381
7	Cover the hole to avoid getting debris into the gearbox during remaining service work.	

Separating base, including gearbox, from the arm system

	Action	Note
1	Remove the plastic plugs covering the M16x110 screws.	 xx1500003118

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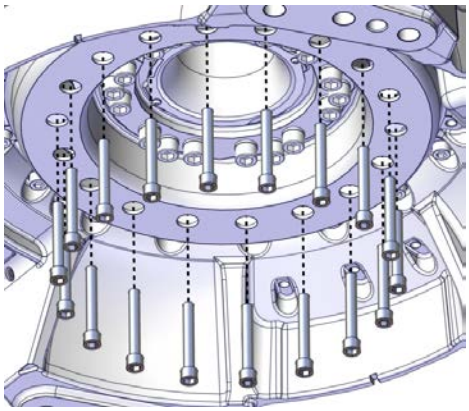
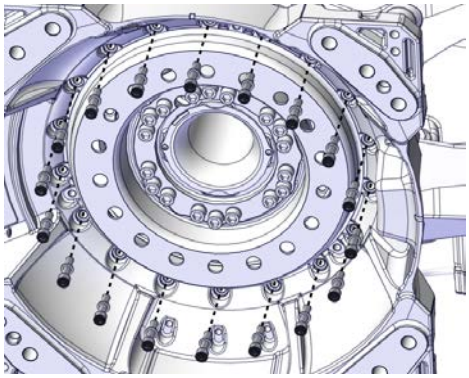
	Action	Note
2	Unscrew the M16x110 screws (18 pcs) that secure the gearbox to the frame. **Tip** This procedure is best done with two persons working together: • Person one: working under the base, holding the torque wrench in place, and making sure the bit is correctly fitted. • Person two: working beside the robot, working with the torque wrench.	 xx1500003119
3	With lifting accessories stretched, unscrew the M16x70 screws (18 pcs) that secure the cross roller bearing to the frame. **Tip** This procedure is best done with two persons working together: • Person one: working under the base, holding the torque wrench in place, and making sure the bit is correctly fitted. • Person two: working beside the robot, working with the torque wrench.	 xx1500003120
4	Make sure that all screws have been removed and that the lifting accessories are fastened correctly.	

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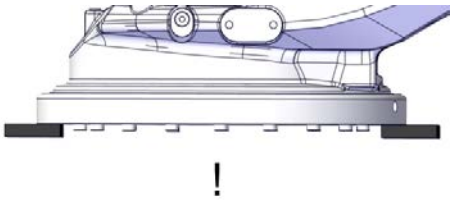
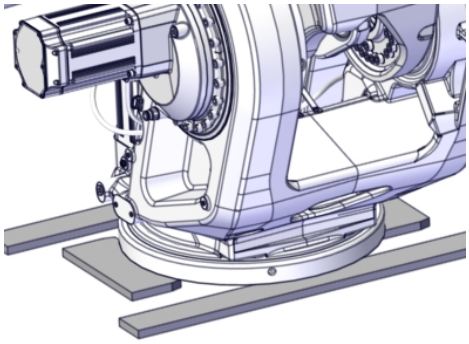
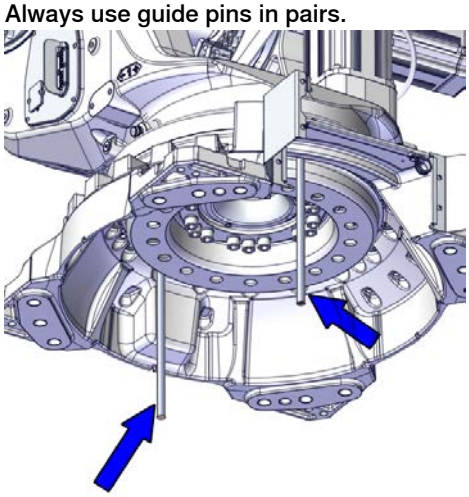
4.9.2 Replacing the axis-1 gearbox

Continued

Lifting the complete arm system off

	Action	Note
1	Prepare an area where to put down the arm system after removal. The screw heads of the cross roller bearing will stick out further down than the outer flange, so if placing down the arm system on a flat surface, the arm system will rest on the screw heads and be unstable. Use for example four wooden planks of hardwood on which the flange can rest.	 xx1700000930  xx1700000931
2	Fit two guide pins in opposite holes of the cross roller bearing.	Guide pin, M16x300 (2 pcs) Always use guide pins in pairs.  xx1700000929
3	**CAUTION** The complete arm system weighs 4,300 kg. All lifting accessories used must be sized accordingly.	

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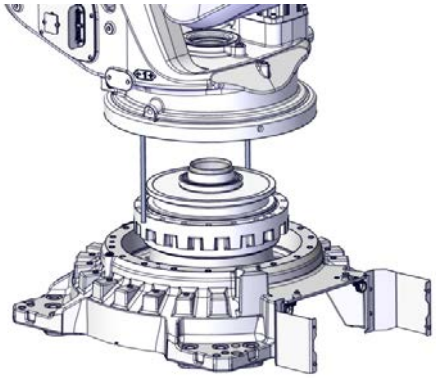
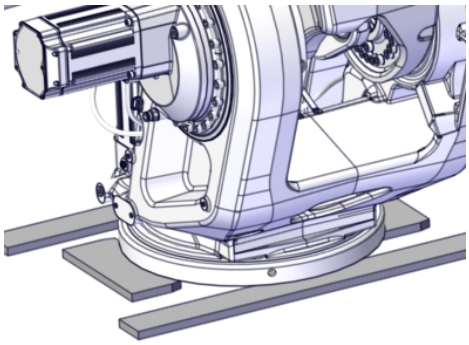
	Action	Note
4	Use caution and lift the complete arm system up. **Note** Lifting height needed from the foundation up to the lifting hook, for the complete arm system to go free from the axis-1 gearbox: 4.1 m.	The cross roller bearing is still fitted to the frame and the axis-1 gearbox is still fitted to the base.  xx1500003121
5	Remove the guide pins before the arm system is put down.	
6	Put down the arm system on the prepared surface. **DANGER** DO NOT remove the lifting accessories until it is tested that the arm system is stable. Lower the lifting accessory a little, while at the same time using force to test if the arm system remains stable.	 xx1700000931
7	Remove the lifting accessories. **WARNING** The robot is likely to be mechanically unstable if not secured to the foundation. Test if the robot is stable, before the lifting accessories are removed.	

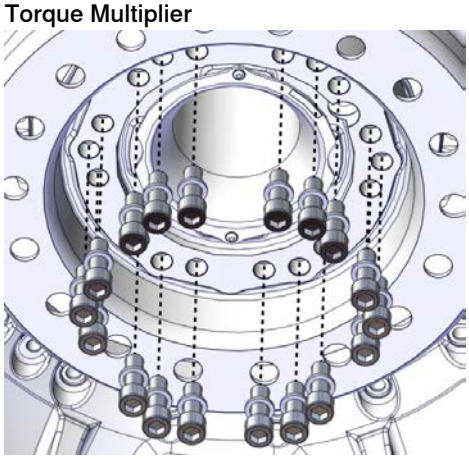
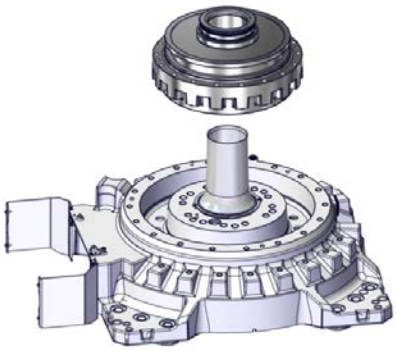
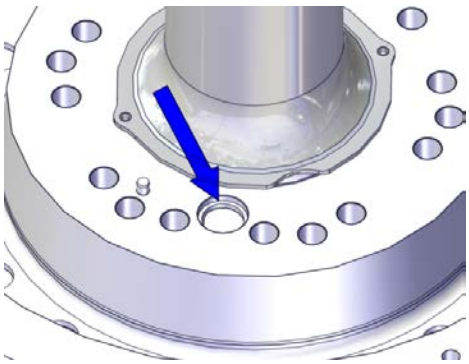
Removing the axis-1 gearbox

	Action	Note
1	Fit lifting eyes in opposite holes. **Note** Do not tighten the lifting eyes completely against the gearbox. Leave a 5 mm gap, or the sealing surface on the gearbox will be damaged.	Lifting eye: M16 3HAC14457-4 (2 pcs)

Continues on next page

4.9.2 Replacing the axis-1 gearbox

Continued

	Action	Note
2	**CAUTION** The gearbox weighs 150 kg. All lifting accessories used must be sized accordingly.	
3	Attach the lifting accessories to the axis-1 gearbox.	
4	Stretch the lifting accessory (chain) to take the weight of the axis-1 gearbox.	
5	Unscrew the M20x60 screws that secure the axis-1 gearbox to the base. **Tip** Use a Torque Multiplier between the screw and the torque wrench, to facilitate the removal.	Torque Multiplier  xx1500003122
6	Use caution and lift the gearbox off.	 xx1500003123
7	Make sure not to loose the small o-ring between base and gearbox.	 xx1500003124

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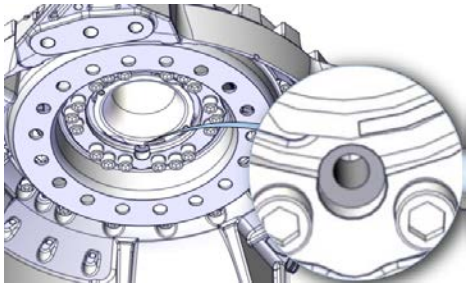
Refitting the gearbox

Use these procedures to fit the gearbox.

Preparations before fitting the gearbox

	Action	Note
1	**CAUTION** The gearbox weighs 150 kg. All lifting accessories used must be sized accordingly.	
2	Fit lifting eyes in opposite holes. **Note** Do not tighten the lifting eyes completely against the gearbox. Leave a 5 mm gap, or the sealing surface on the gearbox will be damaged.	Lifting eye: M16 3HAC14457-4 (2 pcs)
3	Attach the lifting accessory (chain) to the axis-1 gearbox.	3HAC15556-1 Lifting accessory (chain)
4	Stretch the lifting chain and lift the axis-1 gearbox up.	
5	Remove old residues of sealant and other contamination from the axis-1 gearbox and base. **DANGER** Let only one hand stay underneath the hanging gearbox while cleaning.	
6	Clean the contact surfaces between gearbox and base. **DANGER** Let only one hand stay underneath the hanging gearbox while cleaning.	

Fitting the axis-1 gearbox

	Action	Note
1	Clean the groove for the small o-ring.	 xx1600000042

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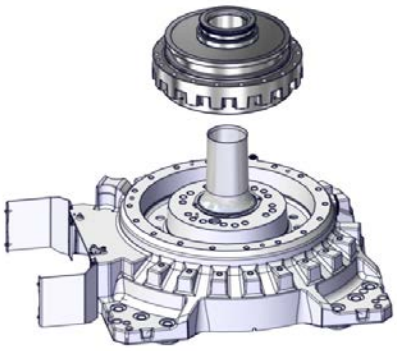
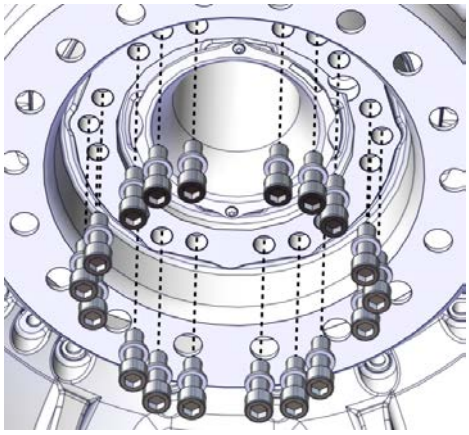
4.9.2 Replacing the axis-1 gearbox

Continued

	Action	Note
2	Inspect the o-ring. **Note** Replace if damaged.	
3	Put some grease on the o-ring and fit it in the oil hose groove.	
4	Attach two guide pins in opposite holes of the gearbox. One of the guide pins shall be fitted in the hole closest to the guiding pin.	
5	Before fitting the gearbox, make sure that the guiding pin and the oil canal will match the holes in the frame.	
6	Use caution and lift the gearbox onto the guide pins.	 xx1500003123
7	Attach the 16 of the 18 attachment screws that will secure the gearbox to the base. **Tip** This procedure is best done with two persons working together: • Person one: working under the base, holding the torque wrench in place, making sure the bit is correctly fitted. • Person two: working beside the robot, working with the torque wrench.	Attachment screws: M20x60 12.9 Gleitmo  xx1500003122
8	Remove the guide pins and attach the remaining screws.	

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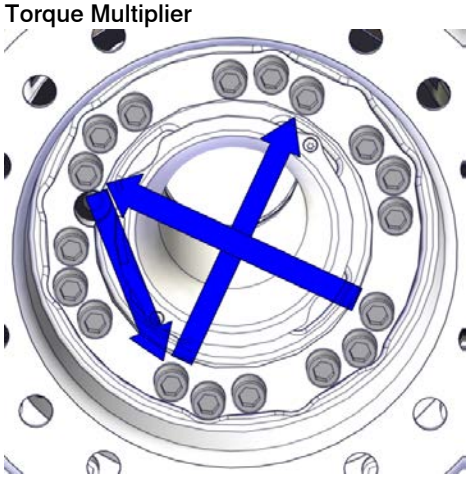
	Action	Note
9	Secure the gearbox to the base in two steps; • Secure the 18 attachment screws crosswise to 100 Nm. • Secure the screws crosswise to 450 Nm. **Tip** Use a torque converter between the screw and the torque wrench, to facilitate the tightening of the screws.	Tightening torque, step 1: 100 Nm Tightening torque, step 2: 450 Nm Torque Multiplier  xx1500003127

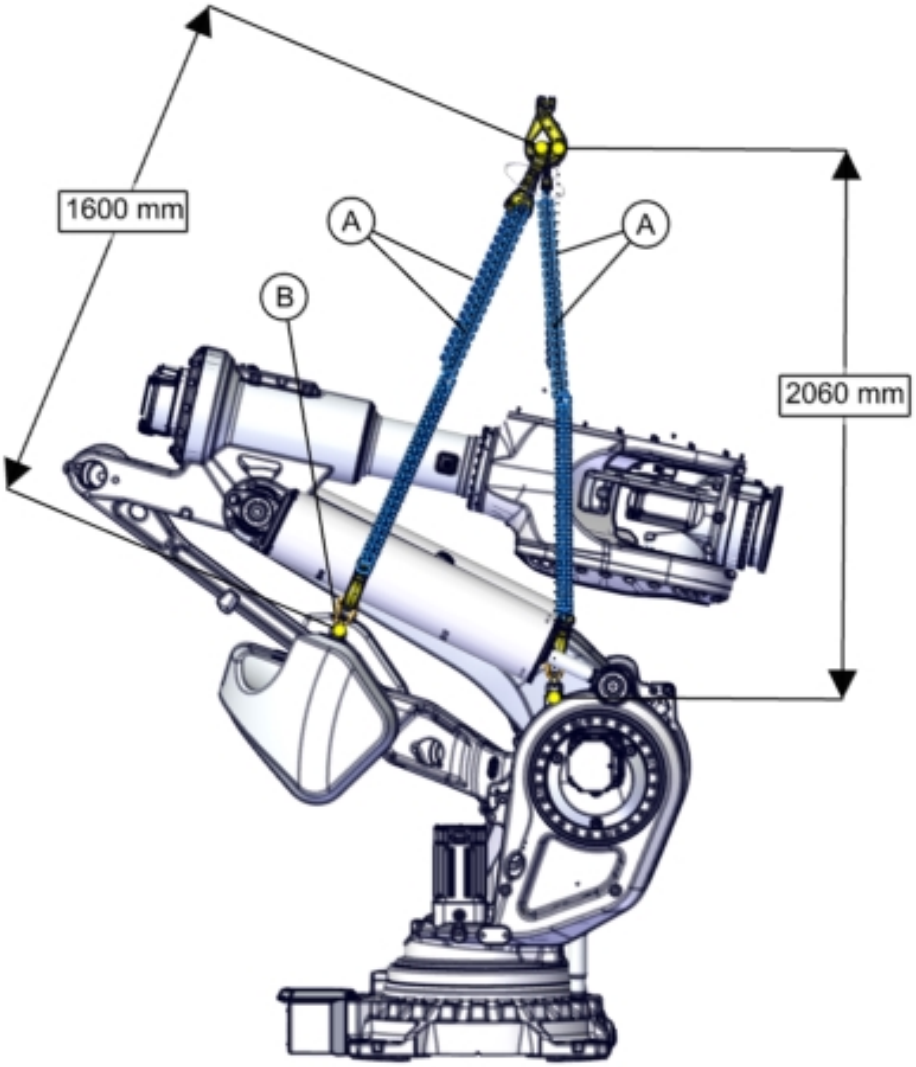
Attaching lifting accessories, complete arm system

If the lifting accessories have been removed from the arm system, refit them accordingly:

	Action	Note
1	**CAUTION** The complete armsystem weighs 4,300 kg. All lifting accessories used must be sized accordingly!	

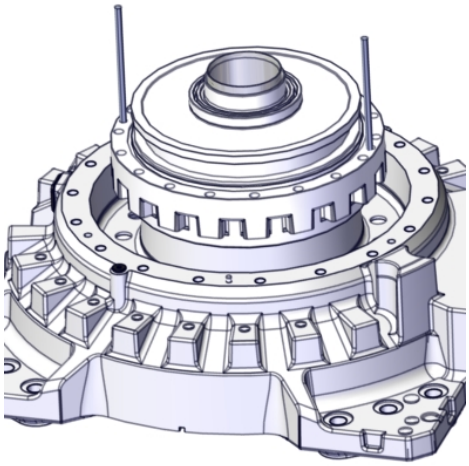
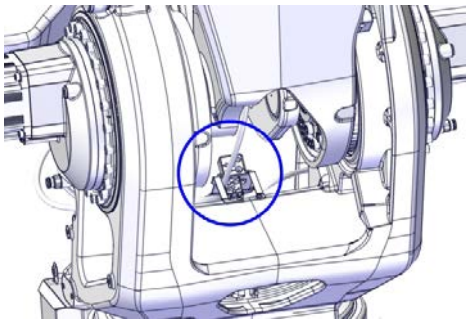
Continues on next page

4.9.2 Replacing the axis-1 gearbox
Continued

	Action	Note
2	Attach chains to the lifting eyes at the counter weights, run the chains on the outside of the balancing devices, and to an overhead crane. Attach chains to the lifting eyes at the frame, on the inside of the balancing devices shafts, and to an overhead crane. Protect the surfaces of the robot from scratches.  xx1700000969 A Lifting chains with shortener (4 pcs) B Lifting eye, M24: 3HAC038295-003 (4 pcs)	
3	Stretch the lifting accessories and adjust if needed to make the lift level.	

Continues on next page

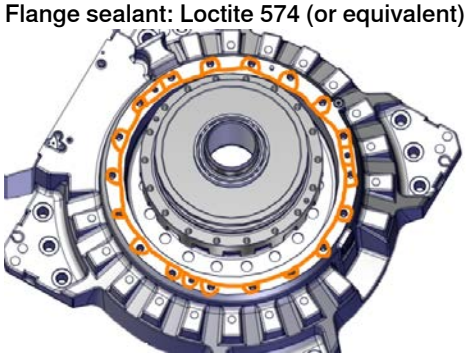
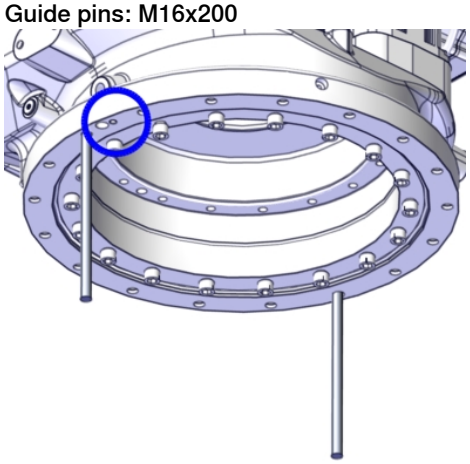
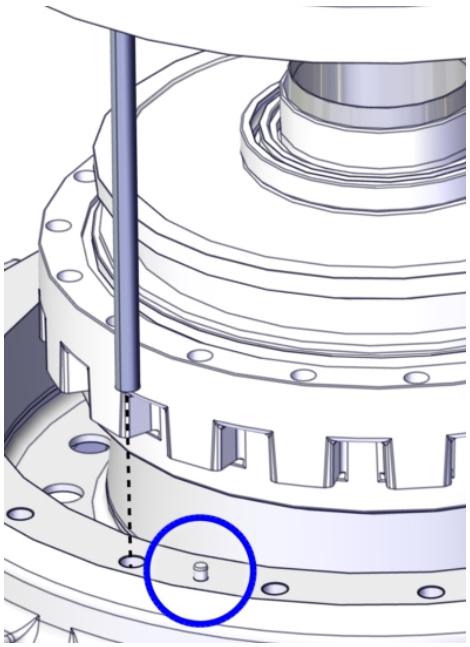
Lifting complete arm system onto base and axis-1 gearbox

	Action	Note
1	Attach two guide pins in opposite threaded holes of the gearbox.	Guide pins: M16x300  xx2200000915
2	Loosen the cable bracket in the frame, to give space to the guide pin in the gearbox during refitting of arm system.	 xx1700000934
3	**CAUTION** The complete armsystem weighs 4,300 kg. All lifting accessories used must be sized accordingly.	
4	Use caution and lift the complete arm system up.	
5	Clean all contact surfaces between the base and the arm system (gearbox, cross roller bearing and frame). **DANGER** Let only one hand stay underneath the hanging arm system while cleaning.	

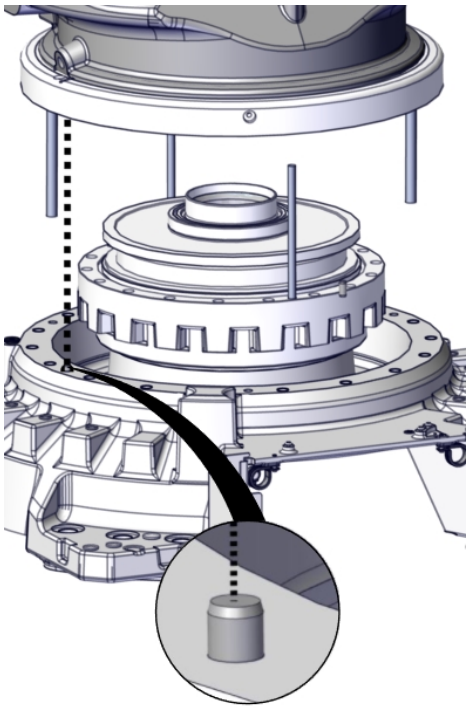
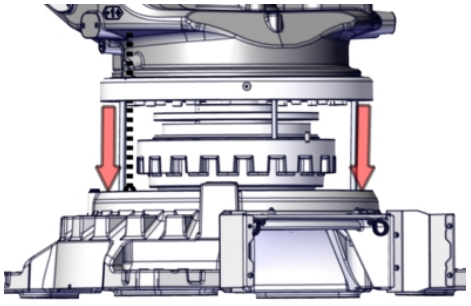
Continues on next page

4.9.2 Replacing the axis-1 gearbox

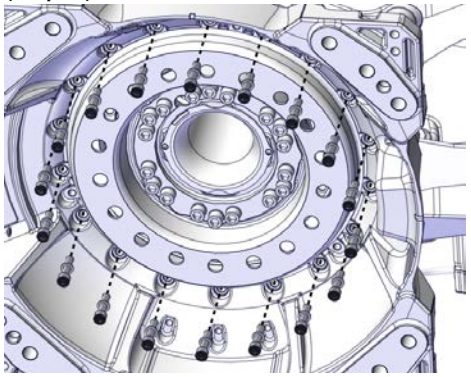
Continued

	Action	Note
6	Apply flange sealant (Loctite 574 (or equivalent)) on the sealing surface for the cross roller bearing on the base.	Flange sealant: Loctite 574 (or equivalent)  xx1600000045
7	Attach guide pins in opposite holes of the cross roller bearing in the frame, one of them in front of the orientation hole for the mating dowel pin.	Guide pins: M16x200  xx1700000932  xx1700000933

Continues on next page

	Action	Note
8	Move the arm system assembly into installation position above the base with the overhead crane.	 xx2200000914
9	Lower the arm system slowly onto the long guide pins. Pause and check the alignment of the guide pins and dowel pin in the cross roller bearing and base. If necessary, rotate the cross roller bearing and gearbox by hand, to match the guide pins/dowel pin.	
10	Slowly lower the arm system, while checking the position of the small dowel pin and the guide pins. Also check the levelness between the mating surfaces. **The mating must be done completely level.**	 xx2200000940

Securing the complete arm system to base and axis-1 gearbox

	Action	Note
1	Attach the screws that hold the cross roller bearing to the frame. Do not tighten yet. **Tip** This procedure is best done with two persons working together: • Person one: working under the base, holding the torque wrench in place, making sure the bit is correctly fitted. • Person two: working beside the robot, working with the torque wrench.	Attachment screws: M16x70 12.9 Gleitmo (18 pcs)  xx1500003120

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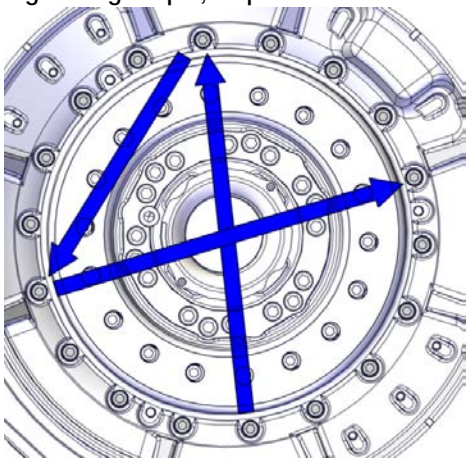
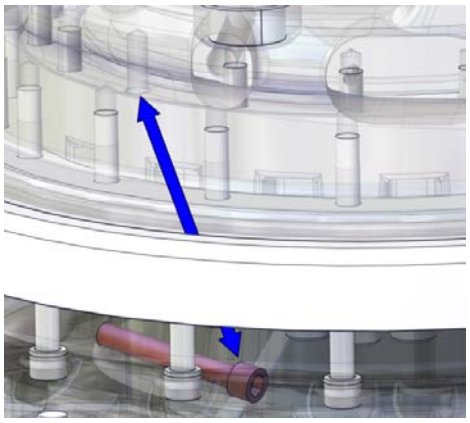
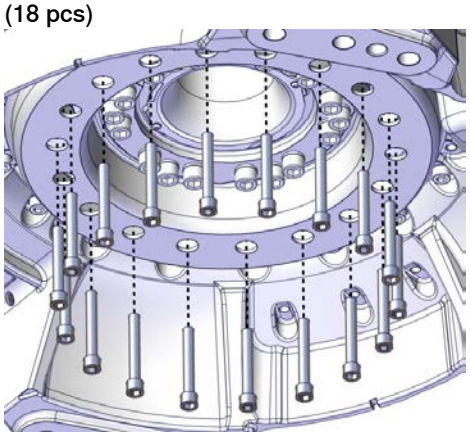
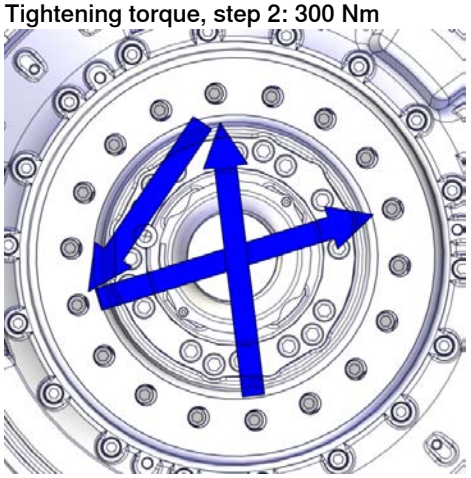
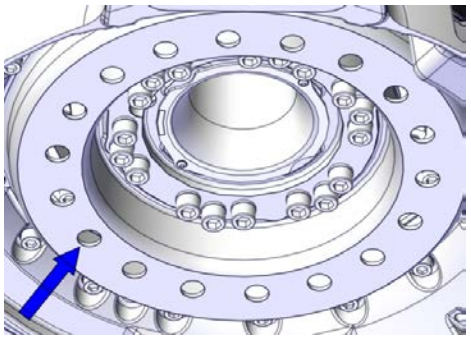
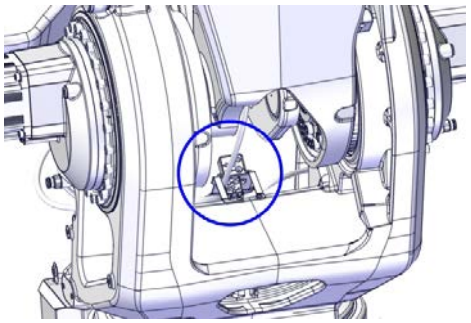
4.9.2 Replacing the axis-1 gearbox

Continued

	Action	Note
2	Secure the cross roller bearing to the frame in two steps; • Tighten the 18 attachment screws crosswise to 100 Nm. • Tighten the screws crosswise to 300 Nm. **Tip** Use a torque converter between the screw and the torque wrench, to facilitate the tightening of the screws.	Tightening torque, step 1: 100 Nm Tightening torque, step 2: 300 Nm  xx1600000041
3	**Note** Use caution when attaching the screws that secure the gearbox. If a screw is dropped, it will probably end up in the recess underneath the gearbox and be very difficult to reach. Using a magnet will probably be the only way to get hold of the lost screw.	 xx1500002980
4	Remove the guide pins and attach the remaining screws.	
5	Fit the attachment screws that hold the gearbox to the frame. Do not tighten yet. **Tip** This procedure is best done with two persons working together: • Person one: working under the base, holding the torque wrench in place, making sure the bit is correctly fitted. • Person two: working beside the robot, working with the torque wrench.	Attachment screws: M16x110 12.9 Gleitmo (18 pcs)  xx1500003119

Continues on next page

	Action	Note
6	Secure the gearbox to the frame in two steps; • Tighten the 18 attachment screws crosswise to 100 Nm. • Tighten the screws crosswise to 300 Nm. **Tip** Use a torque converter between the screw and the torque wrench, to facilitate the tightening of the screws.	Tightening torque, step 1: 100 Nm Tightening torque, step 2: 300 Nm  xx1600000040
7	Refit the plastic plugs.	 xx1500003118
8	Refit the cable bracket inside the frame.	 xx1700000934

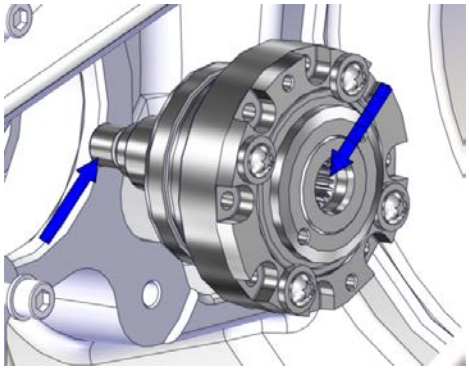
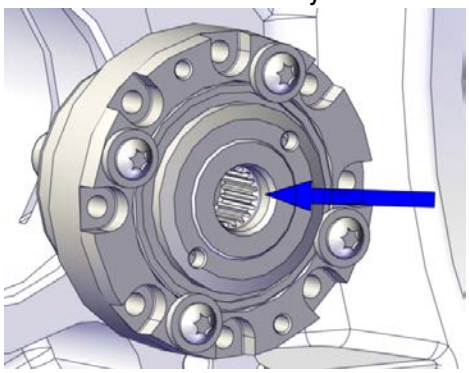
Preparations before refitting the hub

	Action	Note
1	Wipe the hub clean.	
2	Inspect the hole where the hub shall be refitted. Wipe clean if needed.	

Continues on next page

4.9.2 Replacing the axis-1 gearbox

Continued

	Action	Note
3	Make sure the o-ring on the hub is undamaged. **Note** Replace if damaged.	 xx1500002039
4	Apply some grease on the o-ring for a better fitting.	
5	Examine the pinion and the splines in the hub for damages.	 xx1500002082
6	Make sure that there is enough grease on the splines before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346

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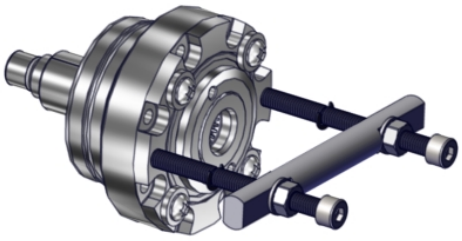
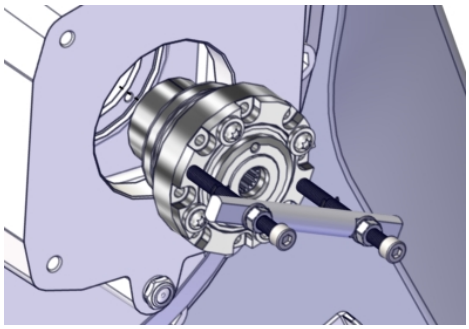
Refitting the hub

	Action	Note
1	Fit the hub tool.	Hub tool: 3HAC071355-001  xx2000001377
2	**CAUTION** Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	
3	Lift the hub to the gear, and mate the pinon carefully into the gear.	 xx2000001381
4	Remove the hub tool and fit the attachment screws for the hub. Apply locking liquid (Loctite 2400 (or equivalent Loctite 243)) on the screws. **Note** The number of attachment screws differ depending on gearbox.	Attachment screws: M6x30 12.9. Loctite 2400 (or equivalent Loctite 243) Quantity: • Axis-1 = 6 pcs • Axis-2 = 8 pcs • Axis-3 = 8 pcs • Axis-4 = 4 pcs • Axis-5 = 6 pcs • Axis-6 = 4 pcs
5	Secure the hub.	Tightening torque: 14 Nm.

Performing a leak-down test

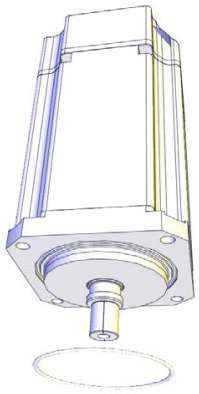
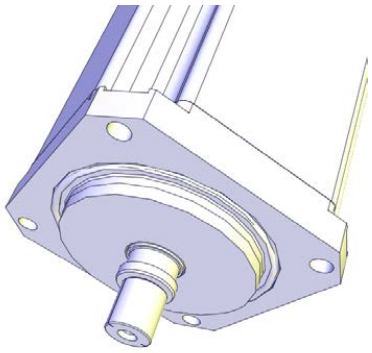
	Action	Note
1	Perform a leak-down test.	See *Performing a leak-down test on page 187*.

Continues on next page

4.9.2 Replacing the axis-1 gearbox

Continued

Preparations before refitting 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	Remove old paint residues and other contamination from the contact surfaces on both motor and gearbox.	
3	Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
5	Make sure the o-ring is seated in the groove. **Tip** Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020

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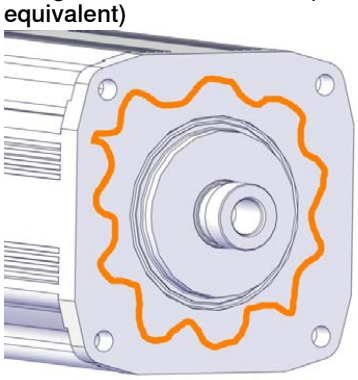
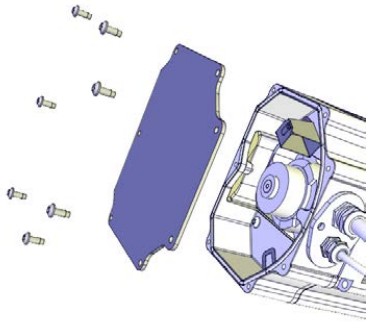
	Action	Note
6	Apply flange sealant on the motor flange.	Flange sealant: Loctite 574 (or equivalent)  xx1500002357
7	If the motor is a new spare part, remove the cover.	 xx1200001135

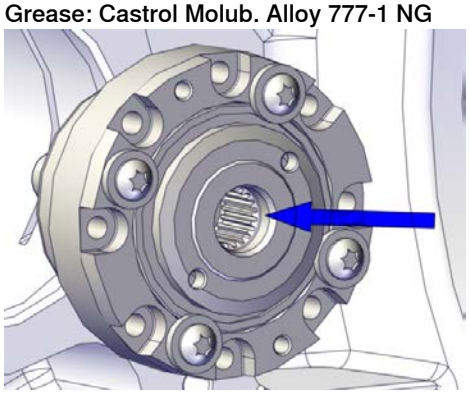
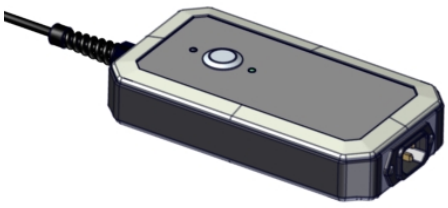
Securing the axis-1 motor

	Action	Note
1	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
2	**CAUTION** The motor weighs 27 kg. All lifting accessories used must be sized accordingly.	
3	Apply the lifting accessory.	Lifting accessory, motor: 3HAC14459-1.
4	Fit the rotation tool.	Rotation tool: 3HAC7887-1

Continues on next page

4.9.2 Replacing the axis-1 gearbox

Continued

	Action	Note
5	Make sure that there is enough grease on the splines, before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346
6	Release the brakes of the axis-1 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the R2.MP1 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP1: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
7	**CAUTION** Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.	

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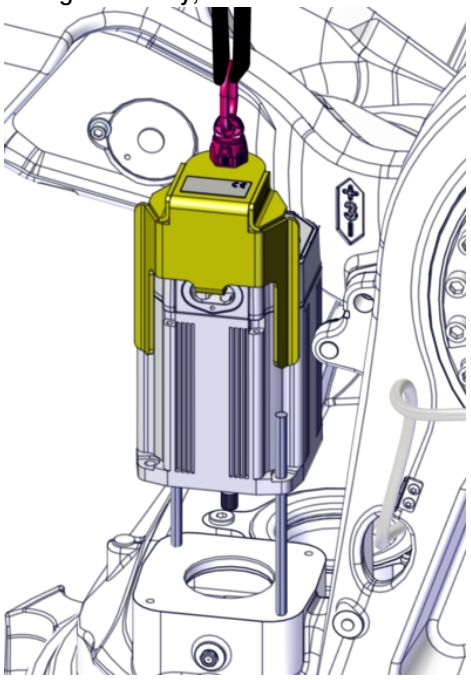
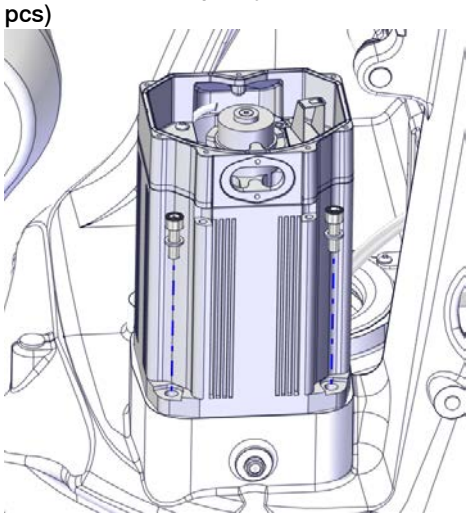
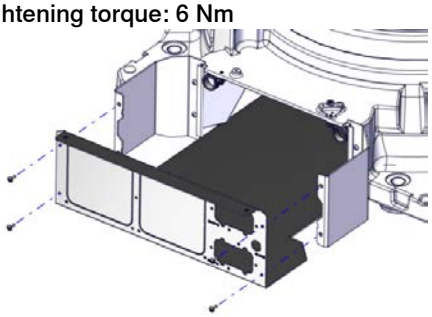
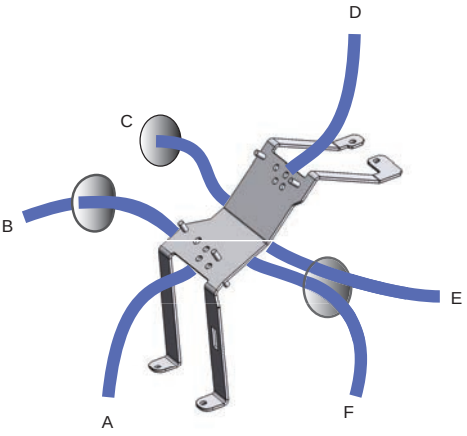
	Action	Note
8	Lower the motor into position. • Make sure that the motor pinion is properly mated into the hub. • Make sure that the motor pinion does not get damaged. • Make sure that the direction of the cable gland exit is facing the correct way.	Lifting accessory (chain): 3HAC15556-1 Lifting accessory, motor: 3HAC14459-1.  xx1500002084
9	Secure the motor with its attachment screws and washers. Use a bits extender to reach the screws.	Bits extender: 3HAC12342-1 Tightening torque: 50 Nm. Screws: M10x40 quality 12.9 Gleitmo (4 pcs)  xx1500002083
10	Perform a leak-down test (if not already done).	See *Performing a leak-down test on page 187*.
11	Disconnect the brake release tool / 24 VDC power supply.	

Continues on next page

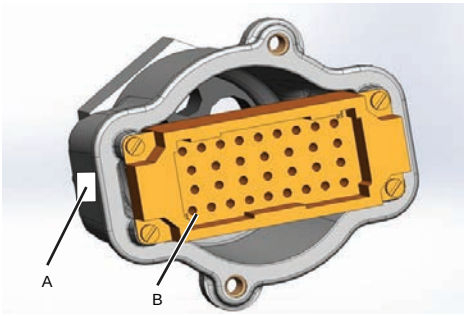
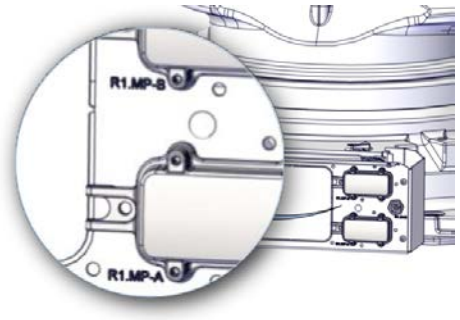
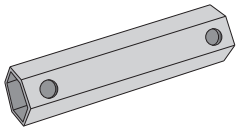
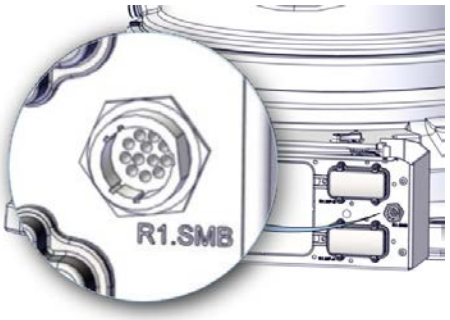
4.9.2 Replacing the axis-1 gearbox

Continued

Refitting 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	Refit the connection plate in the base (if it has been removed).	Attachment screws: M6x16 stainless steel A2-70 (4 pcs) Tightening torque: 6 Nm  xx1500003088
3	Use caution and run the cable harness through the hole in the frame and out to the base plate.	
4	Make sure that the cables from the axis-1 bracket, runs untangled to all connection points: • down through the hole in the frame to the base plate, • to the axis-1 motor, • to the axis-2 motor, • to the axis-3 motor • to the SMB/BU recess. Adjust the cables if needed. The different cables must not be twisted or tangled. Do not fasten the axis-1 bracket yet.	 xx1500003081 A Cables down through hole in frame, to base plate B Axis-2 motor cables C SMB/BU cables D Cables up through lower arm and onwards E Axis-3 motor cables F Axis-1 motor cables

Continues on next page

	Action	Note
5	Before refitting the R1.MP-A and R1.MP-B contacts make sure that the hole for pin 1, as well as the bar code, will be on the left side. See figure.	 xx1600000078 A Bar code B Hole for pin 1
6	Refit the R1.MP-A and R1.MP-B contacts. **Note** Run the cables on top of each other, through the base, without being twisted.	 xx1500003083 Screws M6x20 stainless steel (4 pcs)
7	Make sure the signal cable R1.SMB runs under the oil hose and above the R1.MP cables, through the base.	
8	Refit the R1.SMB cable, with the large recess pointing upwards to the right. **Tip** Use a Hexagon socket spanner, socket size 14 mm (or similar).  xx1200000888	Hexagon socket spanner, socket size 14 mm  xx1500003084

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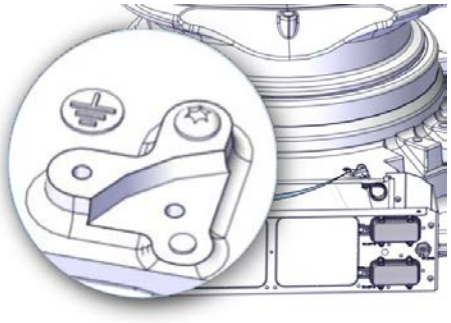
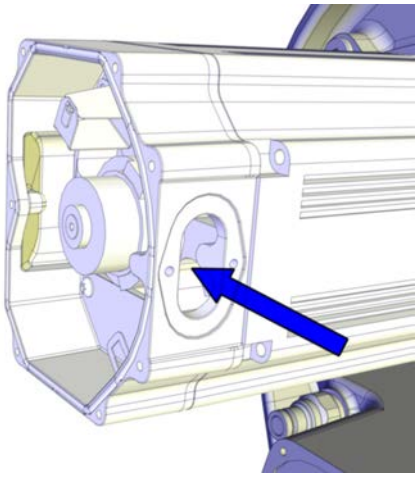
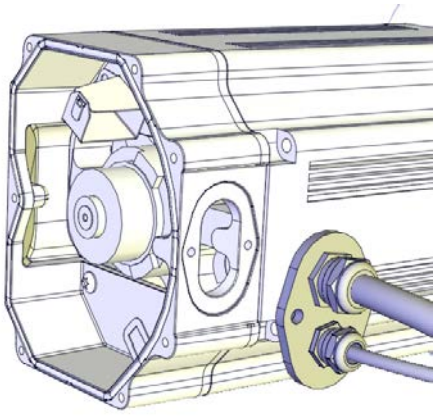
4.9.2 Replacing the axis-1 gearbox

Continued

	Action	Note
9	Refit the two earth cables.	Attachment screw: M6x16 stainless steel A2-70  xx1500003085

Connecting the motor cables

	Action	Note
1	Push the motor cables through the cable gland opening.	 xx1300000738
2	Refit the cable gland cover. **Note** Replace the gasket if damaged.	 xx1200001067

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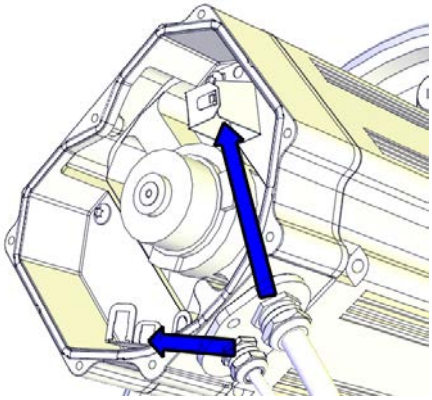
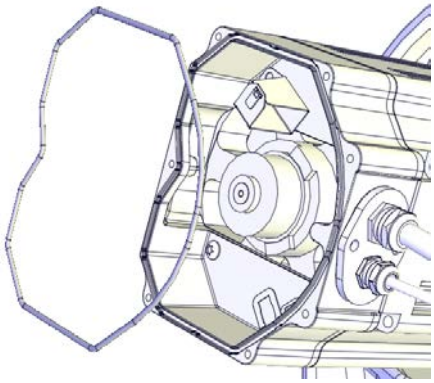
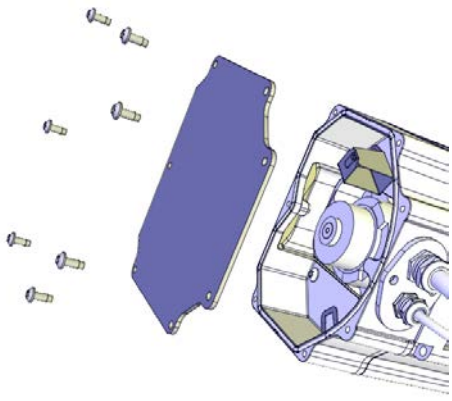
	Action	Note
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring: 3HAC054692-002  xx1200001070
5	Wipe clean o-ring and o-ring groove.	
6	Refit the o-ring.	
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8	Refit the motor cover with its attachment screws. **Note** Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged. **Note** Make sure the o-ring is undamaged and properly fitted.	 xx1200001135

Continues on next page

4.9.2 Replacing the axis-1 gearbox
Continued

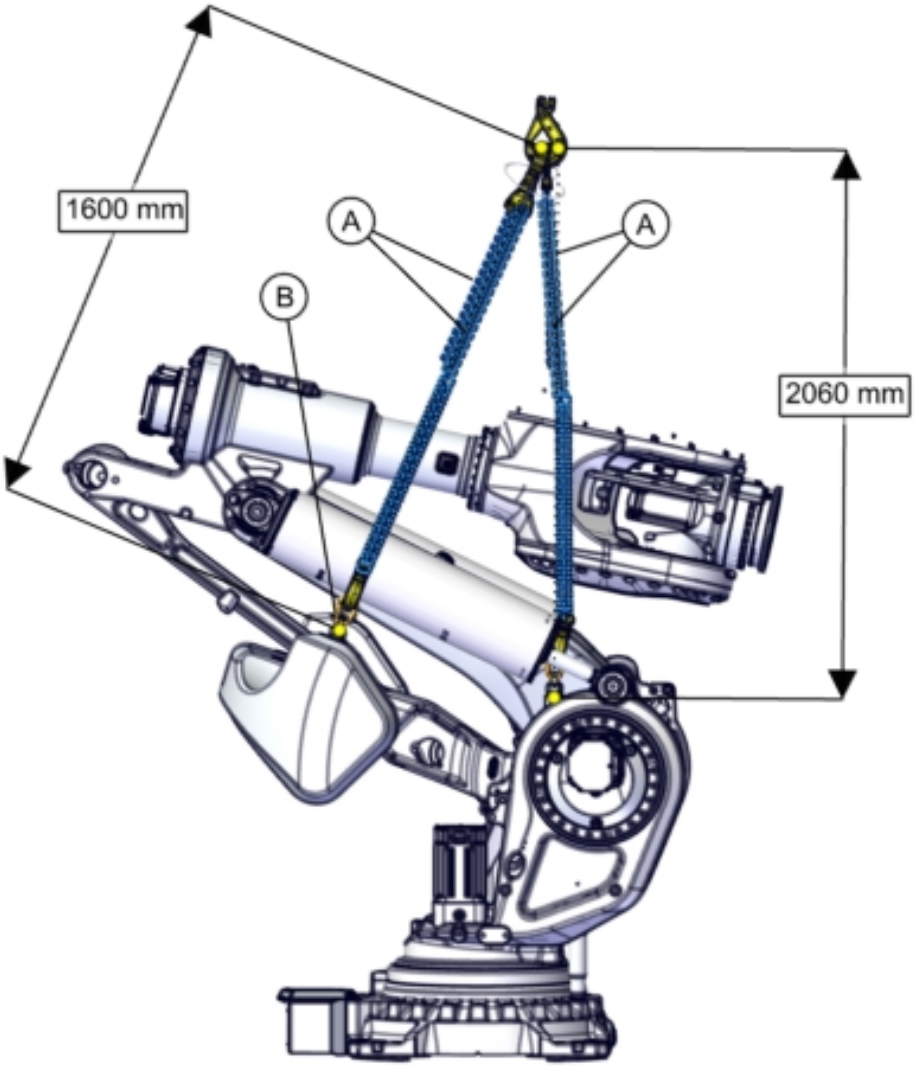
	Action	Note
9	Make sure that the covers are tightly sealed.	

Attaching lifting accessories, complete robot

If the lifting accessories have been removed from the arm system, refit them accordingly:

	Action	Note
1	**CAUTION** The complete armsystem weighs 4,300 kg. All lifting accessories used must be sized accordingly!	

Continues on next page

	Action	Note
2	Attach chains to the lifting eyes at the counter weights, run the chains on the outside of the balancing devices, and to an overhead crane. Attach chains to the lifting eyes at the frame, on the inside of the balancing devices shafts, and to an overhead crane. Protect the surfaces of the robot from scratches.  xx1700000969 A Lifting chains with shortener (4 pcs) B Lifting eye, M24: 3HAC038295-003 (4 pcs)	
3	Stretch the lifting accessories and stretch the lifting accessories to take the weight of the robot. Adjust if needed to make the lift level.	

Continues on next page

4.9.2 Replacing the axis-1 gearbox
Continued

	Action	Note
4	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

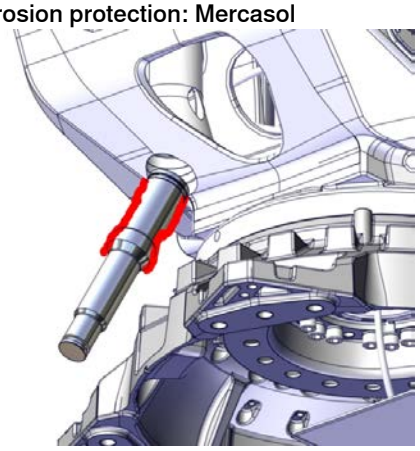
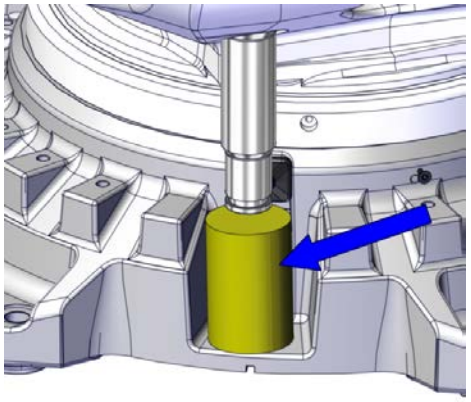
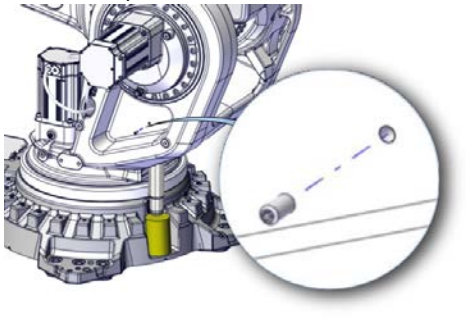
Removing the supporting pillars

	Action	Note
1	Unscrew the attachment screws that secure the robot base to the supporting pillars.	
2	Use caution and lift the robot up from the supporting pillars.	
3	Unscrew the attachment screws that secure the supporting pillars to the foundation.	
4	Remove the supporting pillars.	
5	Lower the robot onto the foundation and secure.	Screws: M24 x 100 (12 pcs), 8.8. Washers: 4 mm flat washer Tightening torque: 550 Nm (screws lubricated with Molykote 1000) 600-725 Nm, typical 650 Nm (screws none or lightly lubricated)

Refitting the mechanical stop pin

	Action	Note
1	Make sure that axis-1 is in the position where it will be possible to replace the mechanical stop pin. If not, turn on the power, use caution and jog axis-1 to that position.	 xx1500002093
2	Clean the stop pin, as well as the hole for it.	

Continues on next page

	Action	Note
3	Apply corrosion protection on the marked area on the stop pin and on the matching area in the hole.	Corrosion protection: Mercasol  xx1500002094
4	**CAUTION** The mechanical stop pin weighs 13 kg.	
5	Put a piece of wood (or similar) underneath the stop pin, to prevent it from falling down uncontrolled when the set screw is refitted.	 xx1500002091
6	Apply locking liquid (Loctite 2400 (or equivalent Loctite 243)) on the set screw.	Locking liquid: Loctite 2400 (or equivalent Loctite 243)  xx1500002090

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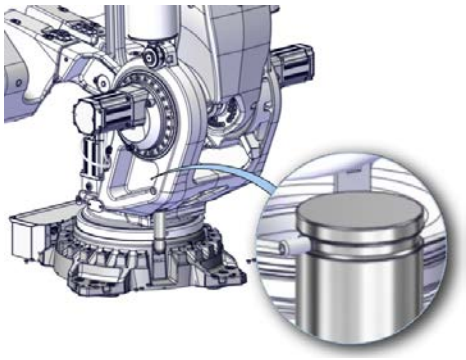
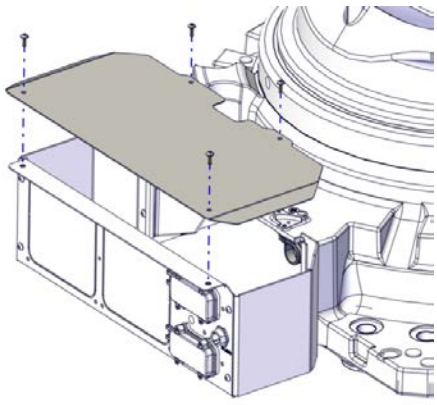
4.9.2 Replacing the axis-1 gearbox

Continued

	Action	Note
7	Make sure that the set screw will find the groove in the stop pin, before securing the mechanical stop pin. **Note** Always use a flat head Allen key, to not damage the screw head. **Tip** Use caution and move the stop pin a little up and down while at the same time carefully fitting the set screw, making sure that the screw will secure the stop pin in the groove.	 xx1500002092
8	Secure the mechanical stop pin with the set screw.	Tightening torque: 35 Nm

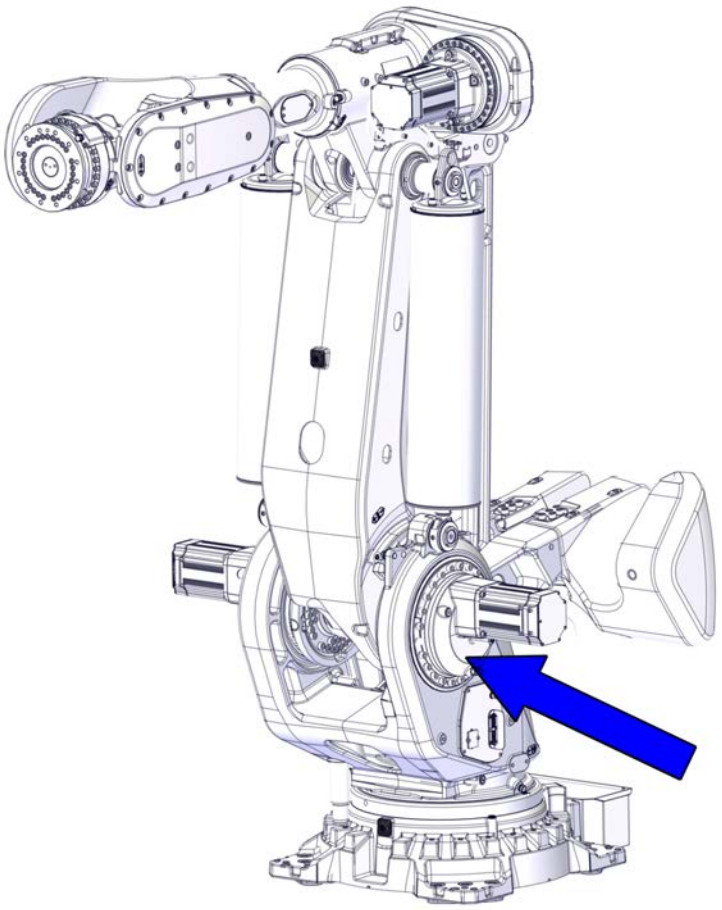
Concluding procedure

	Action	Note
1	Refill oil in the gearbox.	See *Changing oil, axis-1 gearbox on page 141*.
2	Fasten the base cover.	 xx1500003082
3	Re-calibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 688*. General calibration information is included in section *Calibration on page 675*.
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 97*.	

4.9.3 Replacing the axis-2 gearbox

Location of the axis-2 gearbox

The axis-2 gearbox is located as shown in the figure.



xx1500002069

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Reduction gear RV 900N incl. input gear	3HAC048392-003		L2
Sealing ring	3HAC052423-001		L2

Continues on next page

4.9.3 Replacing the axis-2 gearbox
Continued

Required tools and equipment

Equipment, etc.	Article number	Note
Brake release tool	3HAC081310-001	Used to release the motor brakes. User instructions are enclosed with the tool. Alternative tool: 24 VDC power supply
Lock screw, quality 12.9, M20x150	-	Used to secure lower arm to frame (to lock axis 2) or parallel arm to frame (to lock axis 3).
Screw M6x110	-	2 pcs. Fully threaded. Used as removal tools when removing the hub.
Screw M16x80	-	Fully threaded, 2 pcs
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Guide pin, M16x150	3HAC13120-2	Always use guide pins in pairs.
Guide pin, M16x200	3HAC13120-3	Always use guide pins in pairs.
Lifting accessory, motor	3HAC15534-1	Lifting instruction 3HAC15640-2 enclosed.
Removal tool M12	3HAC14631-1	Used to push out the motor if necessary. Always use removal tools in pairs.
Removal tool M14	3HAC047108-001	Used to push out the motor if necessary. Always use removal tools in pairs.
Lifting accessory, gearbox	3HAC081585-001 (recommended) or 3HAC054404-001 (alternative)	Used to lift the axis-2 or axis-3 gearbox.
Lifting shackle	-	SA-10-8-NA1
Mounting set gear (axis 2 and 3)	3HAC059801-001	Always use guide pins in pairs. Used to slide the axis-2 or axis-3 gearbox in/out.
Mobile platform ladder	-	
Roundsling 2 m	-	Lifting capacity: 5,000 kg
Roundsling 2.5 m	-	Lifting capacity: 5,000 kg
Lifting eye	3HAC14457-4	M16
Lifting eye	3HAC038295-003	M24
Rotation tool	3HAC7887-1	Used to rotate the motor pinion.
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Leak-down tester	-	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumables

Consumable	Article number	Note
Molykote 1000		

Continues on next page

Consumable	Article number	Note
Grease		Shell Alvania WR2 (or similar)
Grease	3HAC063069-001	Castrol Molub. Alloy 777-1 NG, 5 ml. To be used on hub splines to prevent from fretting corrosion.
Rust preventive	3HAC034903-001	Mercasol 3110 Waxcoat. Recommended drying time is 24h.
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)
Flange sealant	-	Loctite 574 (or equivalent)

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 689*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Removing the gearbox

Use these procedures to remove the axis-2 gearbox.

DANGER

Never remove both the axis-2 and axis-3 gearboxes at the same time.

One of the gearboxes must stay fitted when the other one is replaced, or the complete arm system will not have any secure connection to the frame. A serious accident will most probably happen.

Continues on next page

4.9.3 Replacing the axis-2 gearbox
Continued

Note

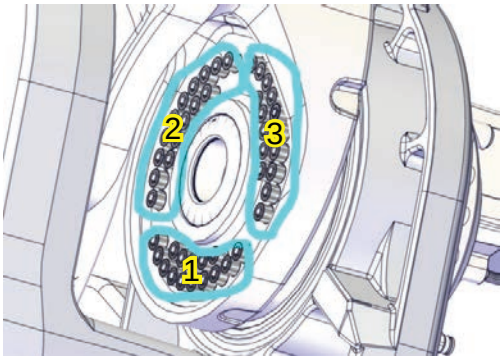
The attachment screws that secure the gearboxes are arranged in three areas, with 15 screws in each area. It will not be possible to reach all screws with the robot in only one position. Removal and refitting must be performed with the robot in several positions, which are described in the procedures.

Preparations

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Remove any tool or other equipment fitted on the turning disc.	
3	Drain the oil.	See *Draining the axis-2 and axis-3 gearboxes on page 148*.

The three areas of screws that secure axis-2 gearbox to lower arm

The axis-2 gearbox is attached to the lower arm with attachment screws arranged in three areas. Use this figure to understand the position of the three areas, when performing this procedure.



xx1500002975

The order when removing the attachment screws: area 1, then area 2, and last area 3.

The order when attaching the axis-2 gearbox to the lower arm is reversed: area 3, then area 2, and last area 1.

Continues on next page

Robot position when removing screws in area 1

With the robot in this position it is possible to reach the screws in area 1 of screws that secure the axis-2 gearbox to the lower arm.

	Action	Note
1	Jog the robot to the specified position: • Axis 1: no significance as long as the robot is secured to the foundation. • Axis 2: 0° • Axis 3: +66° • Axis 4: 0° • Axis 5: 0° • Axis 6: No significance.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Removing the axis-2 gearbox screws in area 1

Note

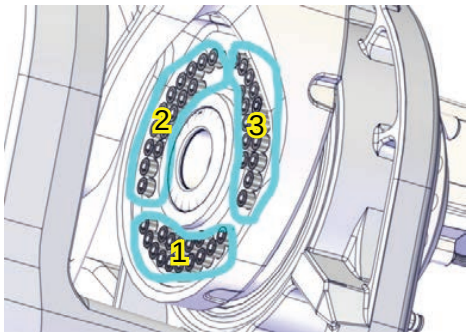
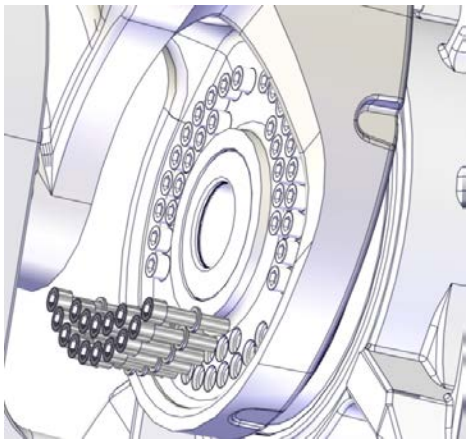
The 45 attachment screws are arranged in three areas with 15 screws in each area. All attachment screws can not be reached with the robot in the same position. This procedure describes how to reach the screws in area 1.

	Action	Note
1	**DANGER** Never remove the screws on both axis-2 and axis-3 at the same time. One side must always be attached when the gearbox on the other side is removed. If not, there is a potential risk that a severe accident will happen.	

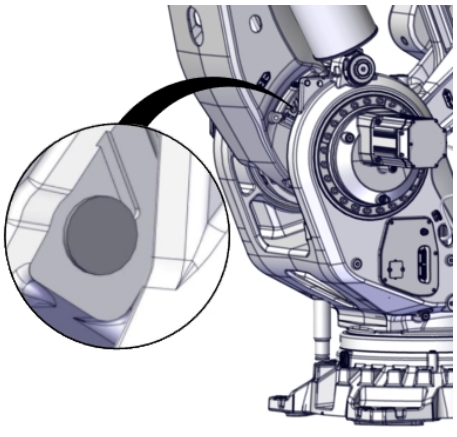
Continues on next page

4.9.3 Replacing the axis-2 gearbox

Continued

	Action	Note
2	Find area 1. **Note** Do not remove screws in area 2 or area 3 at this point.	 xx1500002975
3	Remove the screws in area 1.	 xx1500003110

Removing the plastic plugs of axis 2 and axis 3 lock screw holes

	Action	Note
1	Turn the power to the robot on.	
2	Jog axis-2 to a position where the plastic plugs are accessible.	 xx2200000920

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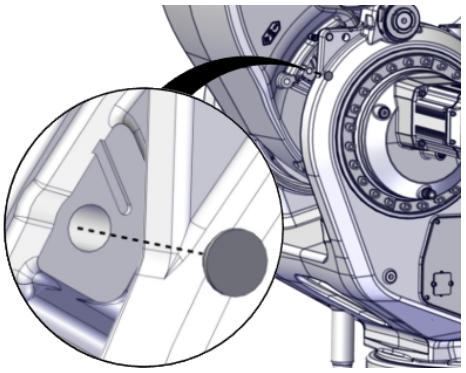
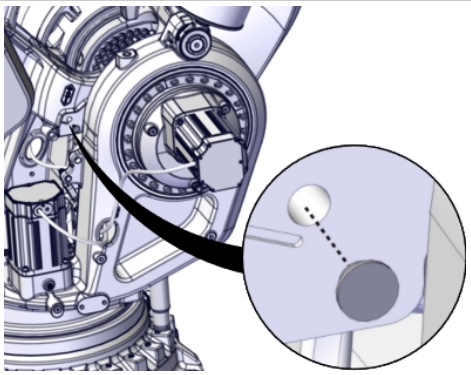
	Action	Note
3	Remove the plastic plug that covers the axis-2 lock screw hole. **Note** Keep the plastic plugs. They must be refitted after the work is done.	 xx1500002335
4	Remove the plastic plug that covers the axis-3 lock screw hole. **Note** Keep the plastic plugs. They must be refitted after the work is done.	 xx1500002366

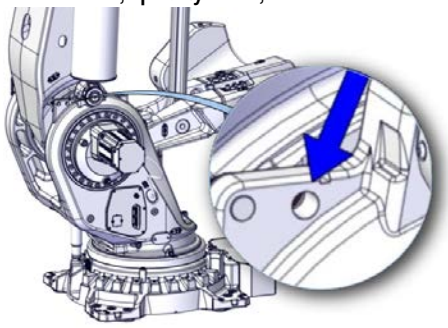
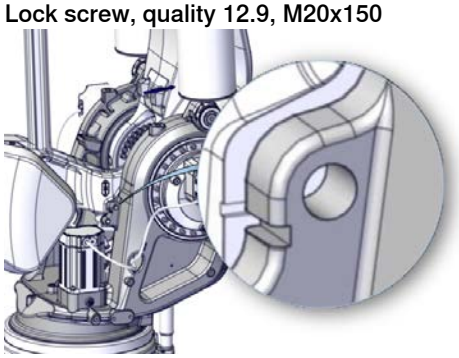
Attaching lock screws to axis-2 and axis-3

	Action	Note
1	Jog the robot to calibration position.	 xx1500002310

Continues on next page

4.9.3 Replacing the axis-2 gearbox

Continued

	Action	Note
2	Secure the axis-2 with a lock screw.	Tightening torque: 100 Nm Lock screw, quality 12.9, M20x150  xx1500002322
3	Release the brakes on axis-2 using the brake release button, and let the axis rest on the lock screw.	
4	Secure axis-3 with a lock screw.	Tightening torque: 100 Nm Lock screw, quality 12.9, M20x150  xx1500002321
5	Release the brakes on axis-3 using the brake release button, and let the axis rest on the lock screw.	
6	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

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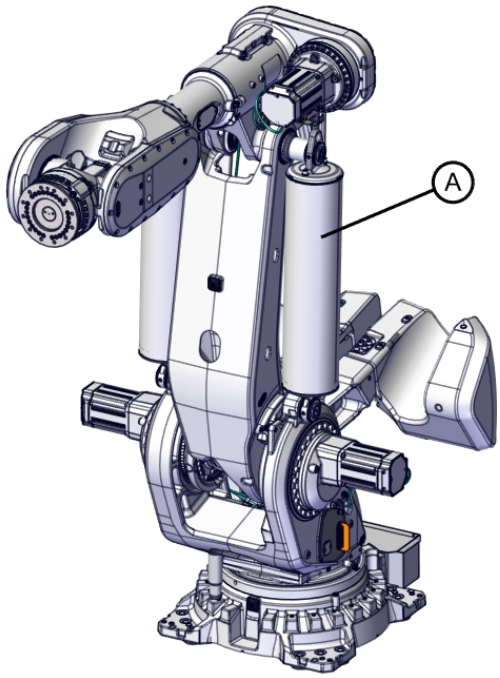
Unloading the pressure of the axis-2 balancing device

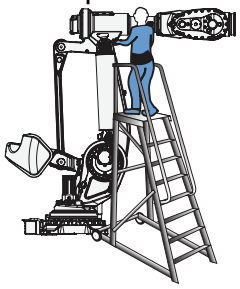
CAUTION

Make sure to relief the pressure of the correct balancing device. Relief pressure on axis 2 side when changing axis-2 gearbox.



xx1700001308

A	Axis-2 balancing device

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Use a mobile platform ladder (or similar) to reach the upper end of the balancing device. **DANGER** Do not use the robot as ladder!	Mobile platform ladder  xx1500001985

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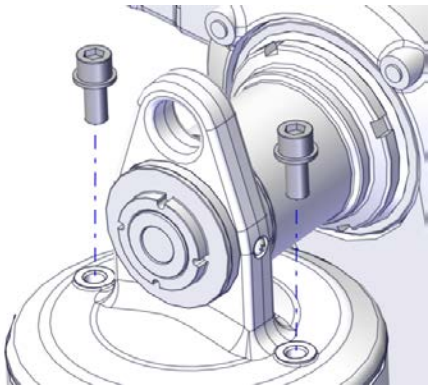
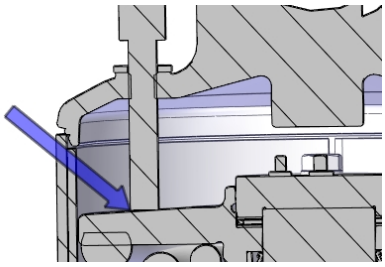
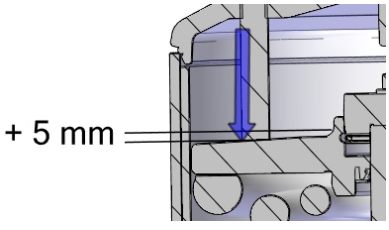
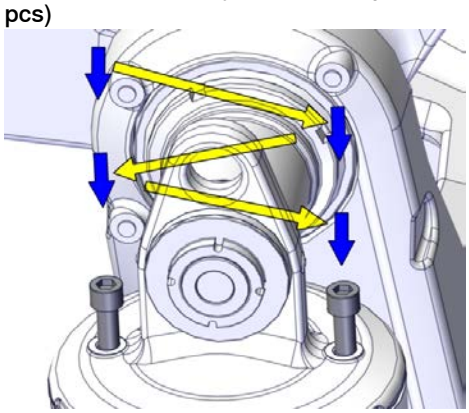
4.9.3 Replacing the axis-2 gearbox

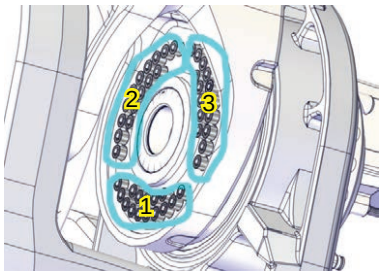
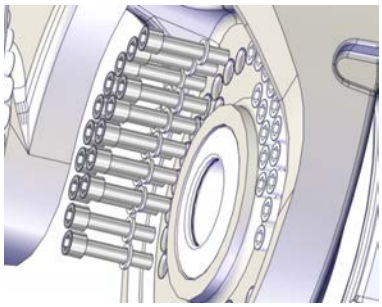
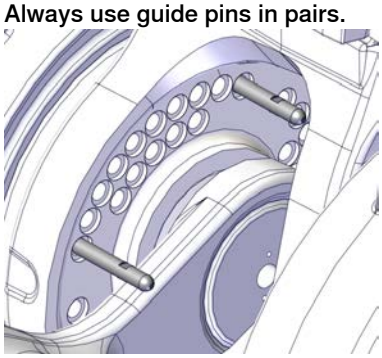
Continued

	Action	Note
3	Remove the screws, fitted in the screw holes on top of the balancing device. **Note** Keep the screws. They shall be refitted after the work is done.	 xx1500001971 M16x35
4	Apply some Molykote on threads and at the bottom end of two fully threaded screws, used for unloading the balancing device.	Screw M16x80 (Fully threaded, 2 pcs, 2 pcs) Apply Molykote on colored areas.  xx1500002303
5	Unload the pressure of the balancing device by inserting the screws. 1 Attach the screws until the screws reaches the piston.  xx1900001209 2 Then, alternately little by little, attach the screws at least another *five* millimeters. The pressure is now unloaded.  xx1900001210	Screw M16x80 (Fully threaded, 2 pcs, 2 pcs)  xx1500002309

Continues on next page

	Action	Note
6	In a procedure where both balancing devices shall be removed, unload the pressure of the other in the same way.	

Removing the axis-2 gearbox screws in area 2

	Action	Note
1	Find area 2.	 xx1500002975
2	Remove the attachment screws in area 2.	 xx1500003111
3	Attach guide pins in the outer holes of the area 2 screws. **Note** It is possible to move the left guide pin to the second hole if the space is tight against the frame.	Guide pin, M16x150 3HAC13120-2 Always use guide pins in pairs.  xx1700000935

Disconnecting the axis-2 motor cables

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

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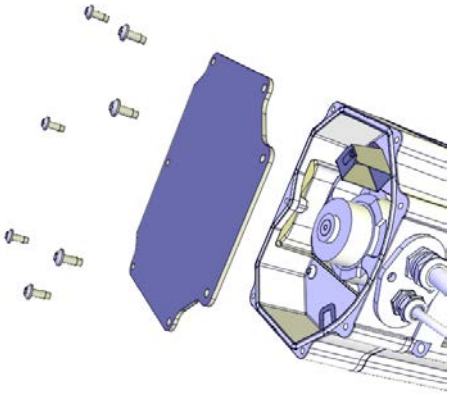
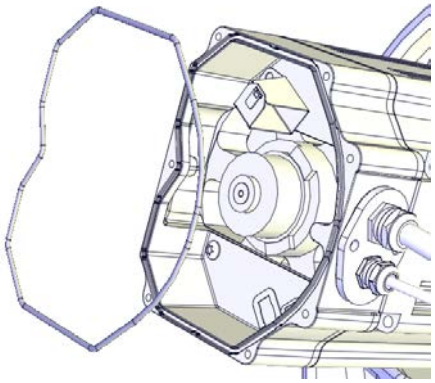
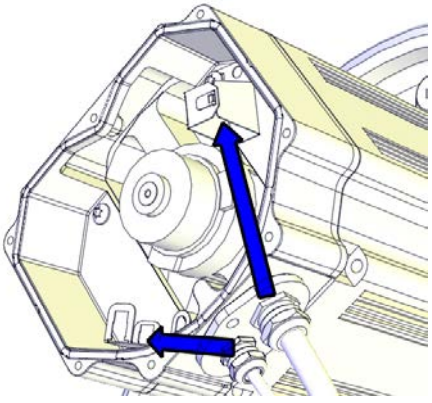
4.9.3 Replacing the axis-2 gearbox

Continued

	Action	Note
2	Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135
3	Make sure the o-ring is present.	 xx1200001070
4	Disconnect the motor cables.	 xx1200001066

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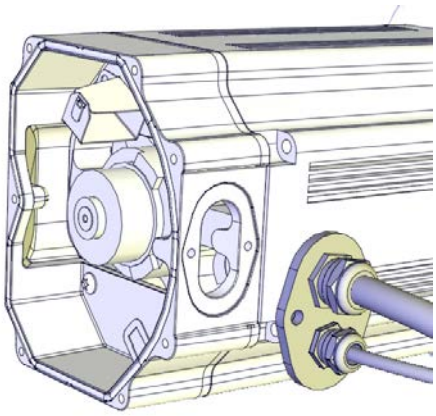
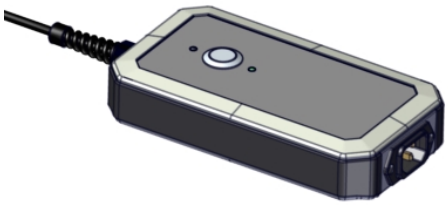
	Action	Note
5	Remove the cable gland cover. Make sure the gasket is not damaged. **Tip** Make a note in which direction the cable gland hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.	 xx1200001067
6	Use caution and pull out the motor cables.	

Removing the axis-2 motor

	Action	Note
1	**DANGER** When releasing the holding brakes of the motor, the lower arm and/or the parallel arm will move and may fall down! Before continuing, make sure the lower arm and/or parallel arm are secured with lock screws.	
2	Release the brakes of the axis-2/3 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the R2.MP2 (axis-2 motor) or R2.MP3 (axis-3 motor) connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP2 / R2.MP3: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666

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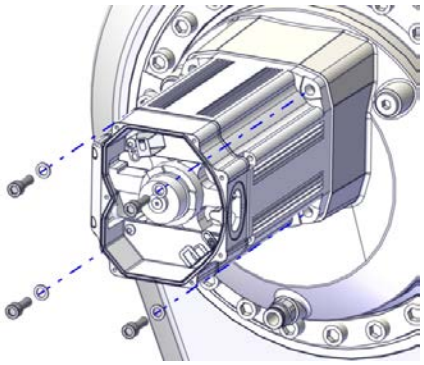
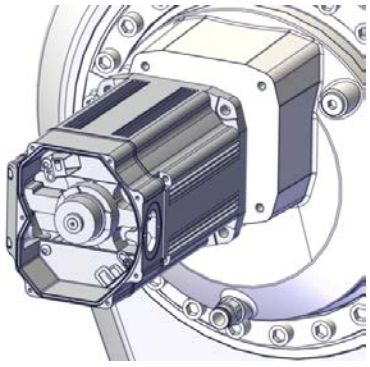
4.9.3 Replacing the axis-2 gearbox

Continued

	Action	Note
3	Remove the attachment screws that secure the motor. **Tip** Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx1500002323
4	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
5	**CAUTION** Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used!	
6	If required, press the motor out of position by using the removal tool in opposite holes of the motor.	Removal tool M12: 3HAC14631-1 Removal tool M14: 3HAC047108-001 Different motor versions have different dimensions on the motor flange holes. Use appropriate removal tool depending on current motor version.
7	**CAUTION** The motor weighs 27 kg. All lifting accessories used must be sized accordingly!	
8	Attach the lifting accessory.	Lifting accessory, motor: 3HAC15534-1
9	Use caution and lift the motor out on the guide pins, in order to get the pinion away from the hub. Let the motor rest on the guide pins.	 xx1500002325
10	Disconnect the brake release tool / 24 VDC power supply.	

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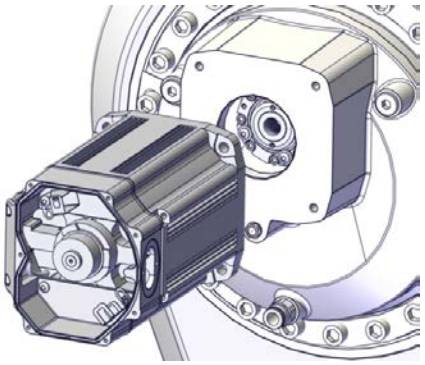
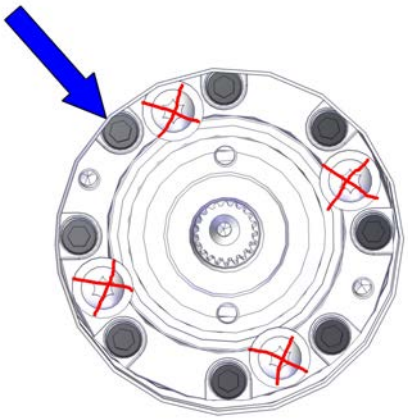
	Action	Note
11	Use caution and remove the motor by sliding it out on the guide pins.	 xx1500002324

Removing the hub

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the M6x30 hex socket head cap screws that secure the hub. **Note** Do not remove the M6x16 torx pan head screws.	 xx1500002038
3	**CAUTION** Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	

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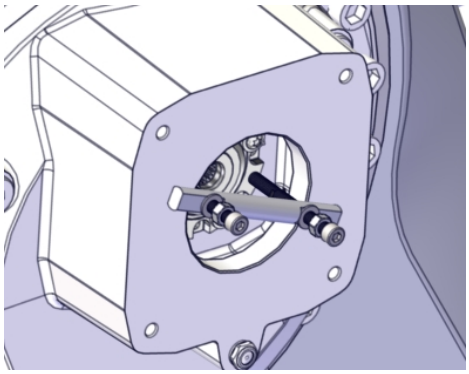
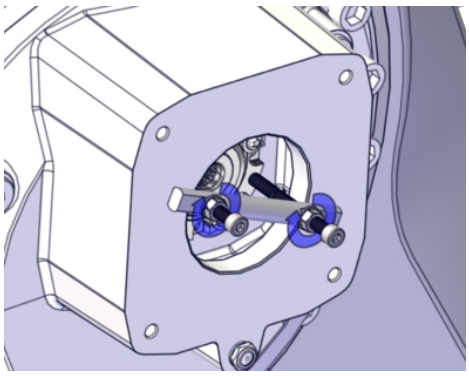
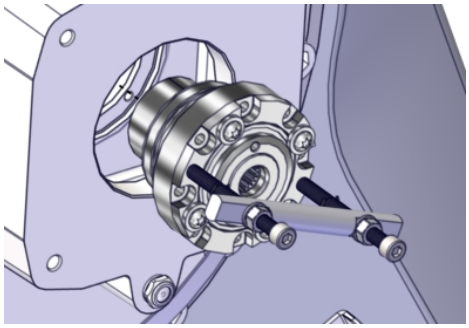
4.9.3 Replacing the axis-2 gearbox

Continued

	Action	Note
4	Fit the two threaded rods of the hub tool into the attachment holes in the hub.	Hub tool: 3HAC071355-001  xx2000001379
5	Alternately thread the nuts clockwise on the two rods to pull out the hub from the gear.	 xx2000001380
6	Lift out the hub carefully.	 xx2000001381
7	Cover the hole to avoid getting debris into the gearbox during remaining service work.	

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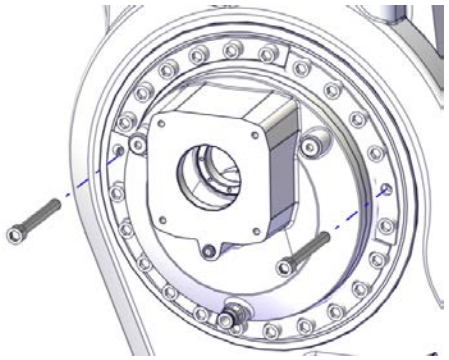
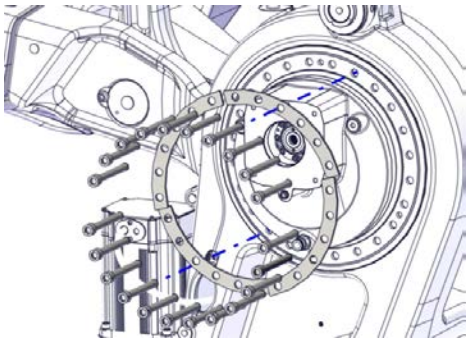
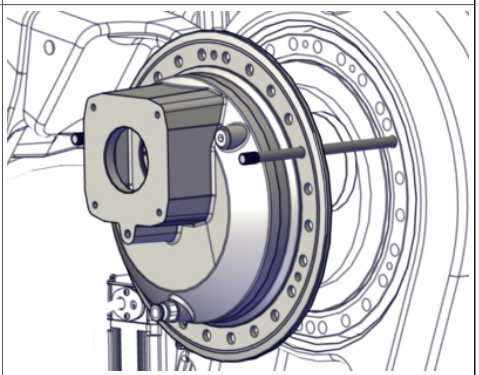
Removing the motor flange

	Action	Note
1	Remove two attachment screws in opposite holes.	 xx1500002333
2	Fit guide pins in the holes.	Mounting set gear (axis 2 and 3), 3HAC059801-001
3	Remove the remaining attachment screws (22 pcs) and the six-hole washers (4 pcs).	 xx1500002315
4	**Note** There will be some oil spill when the motor flange is removed. Put some paper (or similar) to absorb the surplus oil.	
5	Move the motor flange out over the guide pins.	 xx1500002314

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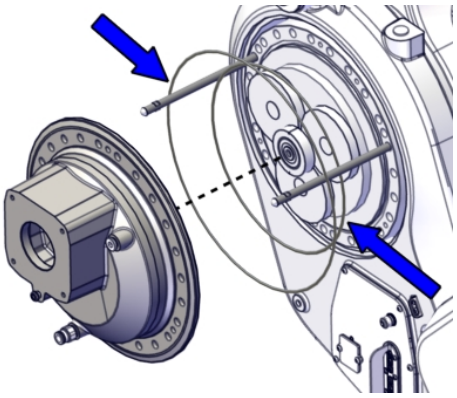
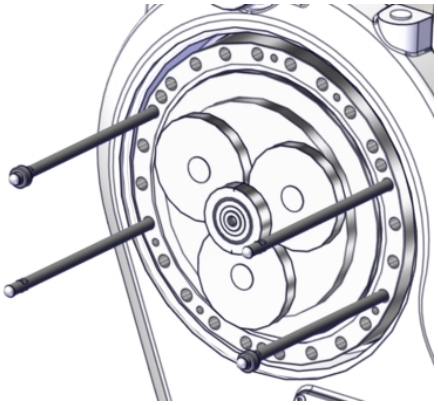
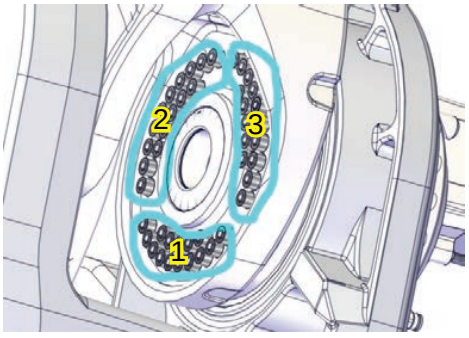
4.9.3 Replacing the axis-2 gearbox
Continued

	Action	Note
6	Remove the motor flange. Make sure the o-rings are present.	 xx1500002316

Installing guide pins

	Action	Note
1	Attach two additional guide pins in opposite holes, below the present ones. Fasten set collars on two of the guide pins.	Mounting set gear (axis 2 and 3), 3HAC059801-001  xx1600001553

Removing the axis-2 gearbox screws in area 3

	Action	Note
1	Find area 3.	 xx1500002975

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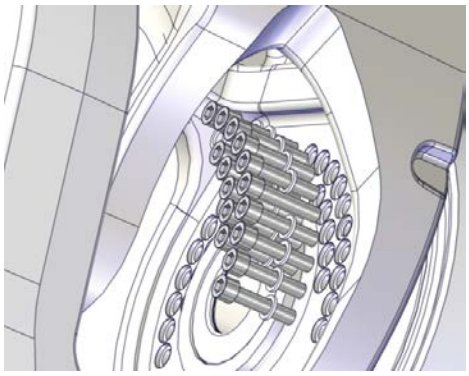
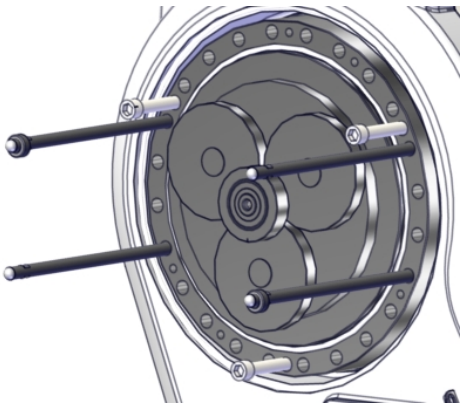
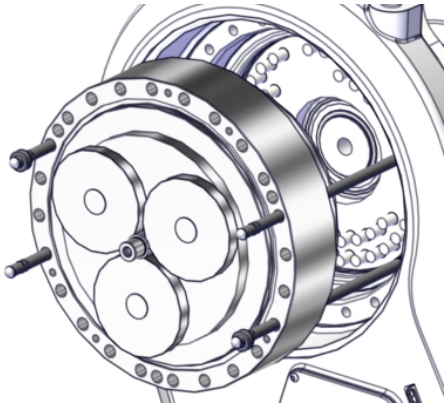
	Action	Note
2	Remove the attachment screws that secure the gearbox to the lower arm in area 3.	 xx1500003112

Removing the axis-2 gearbox from the lower arm

	Action	Note
1	Attach three screws in a triangle and screw them in to push out the gearbox.	 xx1500002337
2	After the gearbox has been pushed out, screw out the screws enough to use them to pull the gearbox further out.	
3	Pull and slide the gearbox out on the four guide pins, just enough to be able to attach the lifting accessories.	 xx1500002338
4	**CAUTION** The gearbox weighs 160 kg. All lifting accessories used must be sized accordingly.	

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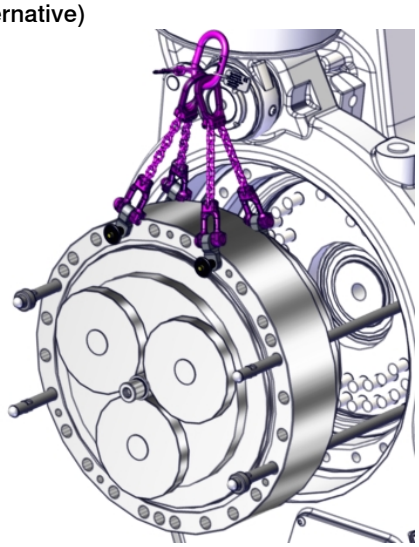
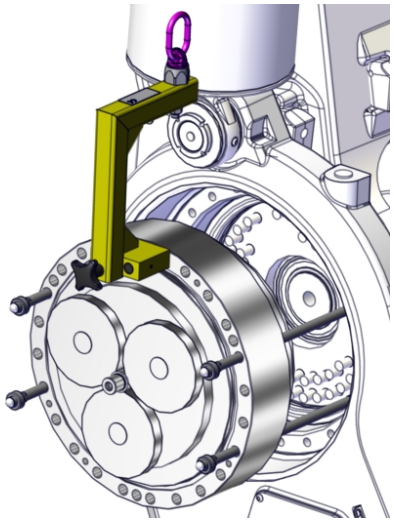
4.9.3 Replacing the axis-2 gearbox

Continued

	Action	Note
5	Attach the lifting accessories.	Lifting accessory, gearbox: 3HAC081585-001 (recommended) or 3HAC054404-001 (alternative)  xx2200001075 3HAC081585-001  xx1600001554 3HAC054404-001
6	Attach a roundsling to the lifting accessory.	Roundsling 2 m: Lifting capacity: 5,000 kg

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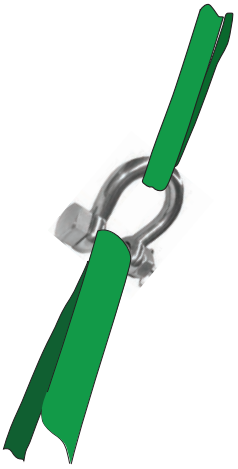
	Action	Note
7	Connect another roundsling to the first one with a shackle.	Roundsling 2 m: Lifting capacity: 5,000 kg Shackle: SA-10-8-NA1  xx1400000729
8	Attach the roundslings to an overhead crane (or similar) and raise to take the weight of the gearbox.	
9	Remove the set collars.	
10	Lift the gearbox off.	

Refitting the gearbox

Use these procedures to refit the axis-2 gearbox.

DANGER

Never remove both the axis-2 and axis-3 gearboxes at the same time. One of the gearboxes must stay fitted when the other one is replaced. The complete arm system will loose its connection to the frame and thereby be a great security risk.

Note

The attachment screws that secure the gearboxes, are arranged in three areas, with 15 screws in each area. It will not be possible to reach all screws with the robot in only one position. Removal and refitting must be performed with the robot in two different positions described in the procedures.

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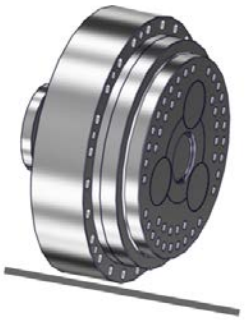
4.9.3 Replacing the axis-2 gearbox

Continued

Robot position

	Action	Note
1	Make sure that the position of the robot has not been changed. Correct position is calibration position.	 xx1500002085

Preparations before refitting the gearbox

	Action	Note
1	Use caution and lift the gearbox up and let it rest on its side. **CAUTION** Make sure the gearbox is resting in a stable position.	 xx1500002342
2	Fit a new sealing ring.	Sealing ring 3HAC052423-001  xx1600000067
3	Clean the contact surfaces between gearbox and frame.	

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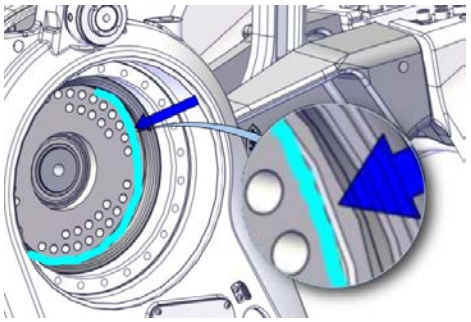
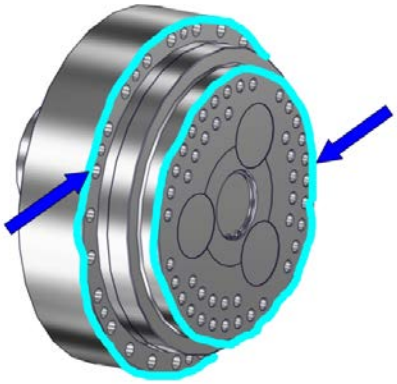
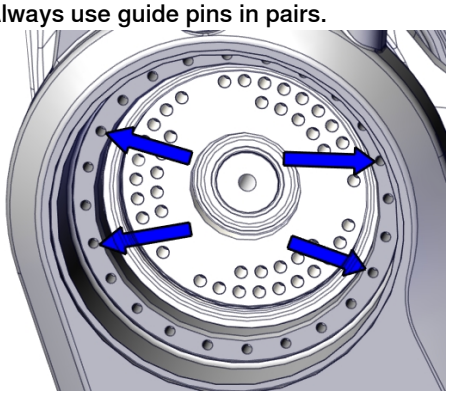
	Action	Note
4	Apply some grease on the thin chamfer on the lower arm.	Grease  xx1500002340
5	Apply some grease on the thin chamfer on the gearbox.	Grease  xx1500002341
6	Fit guide pins as shown in the figure.	Guide pin, M16x400 (2+2 pcs) Always use guide pins in pairs.  xx1500002343

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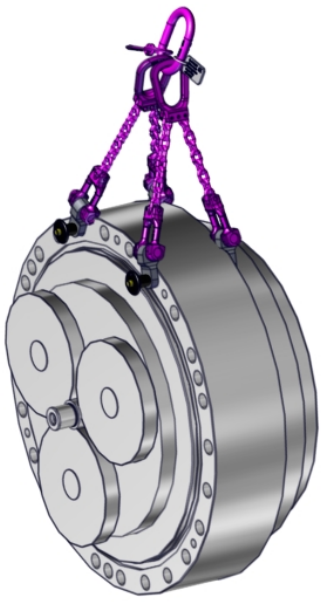
4.9.3 Replacing the axis-2 gearbox

Continued

	Action	Note
7	Fit guide pins to the back of the gearbox (if replaced).	Guide pin, M16x150 (2 pcs) 3HAC13120-2 Always use guide pins in pairs.  xx1700000936
8	Apply some grease on the guide pins for a better fitting.	

Attaching lifting accessories to the gearbox

	Action	Note
1	**CAUTION** The gearbox weighs 160 kg. All lifting accessories used must be sized accordingly!	
2	Attach the lifting accessory to the gearbox.	Lifting accessory, gearbox: 3HAC081585-001 (recommended) or 3HAC054404-001 (alternative)  xx2200001079 3HAC081585-001

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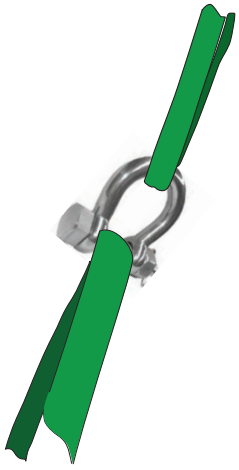
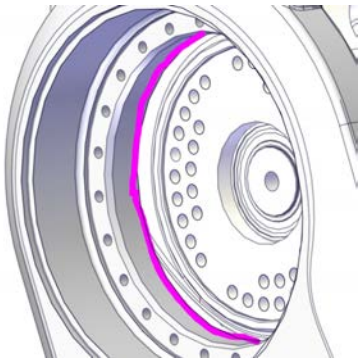
	Action	Note
3	Attach a roundsling to the lifting accessory.	Roundsling 2 m: Lifting capacity: 5,000 kg (2 pcs)
4	Connect another roundsling to the first one with a shackle.	Shackle: SA-10-8-NA1  xx1400000729
5	Attach the roundslings to an overhead crane (or similar) and raise to take the weight of the gearbox.	

Refitting the axis-2 gearbox to frame

	Action	Note
1	Apply Mercasol (40 mm from the lower arm side) on the contact surface.	Mercasol  xx1500002349 **Note** Area where to apply Mercasol, 40 mm wide, from the lower arm side.

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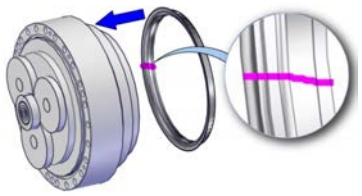
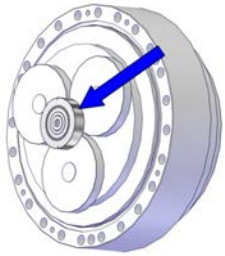
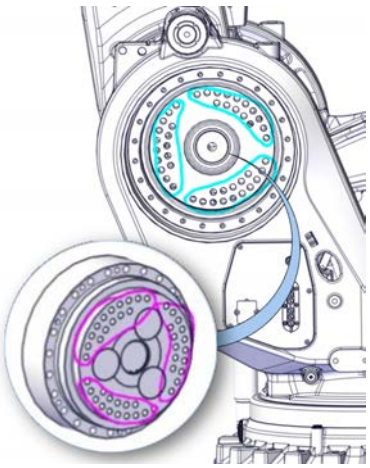
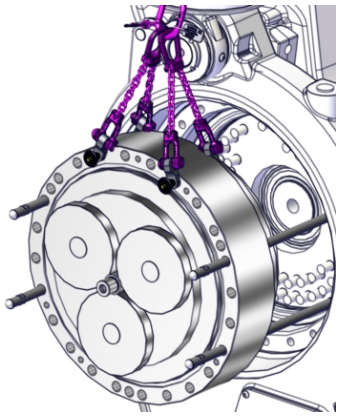
4.9.3 Replacing the axis-2 gearbox

Continued

	Action	Note
2	Apply Mercasol on the surface of the sealing ring and attach it on the gearbox. **Note** Make sure that the sealing ring is attached correctly on the gearbox.	Mercasol  xx1500002350
3	Orient the gearbox to match the hole patterns before lifting the gearbox onto the guide pins. If the hole pattern does not match, carefully turn the small gear in the gearbox very slowly, in order to find the hole pattern.  xx1500002345	 xx1500002344
4	Lift the gearbox onto the guide pins.	 xx2200000927

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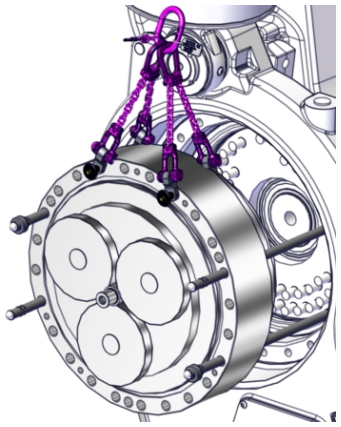
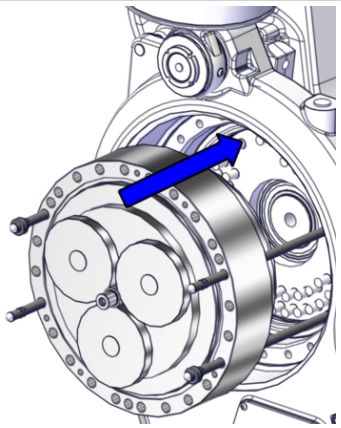
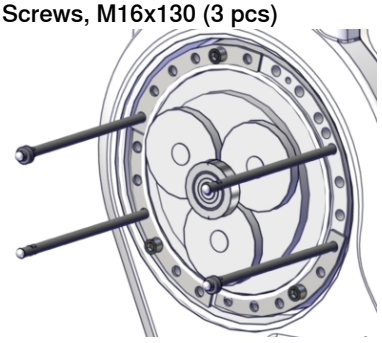
	Action	Note
5	Fasten set collars on two of the guide pins.	 xx2200001075
6	Remove the lifting accessories and push in the gearbox into the frame.	 xx2200001078
7	Attach three M16x130 screws with six-hole washers underneath, in a triangle and use them alternately to press the gearbox into position. **Note** The six-hole washers are needed for protection of the gearbox surface, when the screws are attached.	Tightening torque: 100 Nm Screws, M16x130 (3 pcs)  xx1500002368

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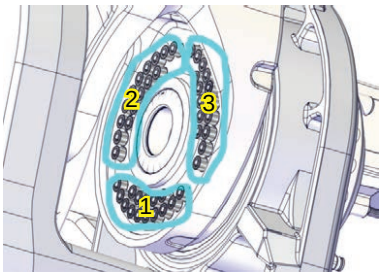
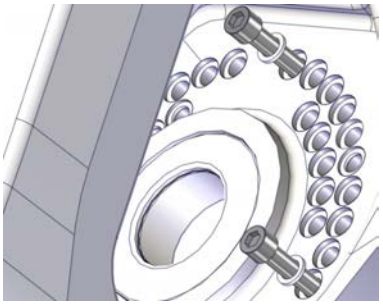
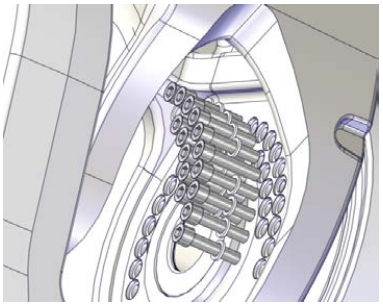
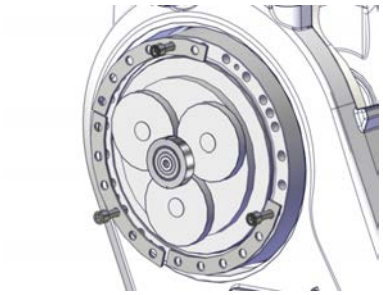
4.9.3 Replacing the axis-2 gearbox

Continued

Refitting the axis-2 gearbox screws in area 3

	Action	Note
1	Find area 3.	 xx1500002975
2	Begin attaching the screws (M16x70) in the outermost holes of the outer ring of holes. **Tip** Make sure that the hole pattern match. If needed, use extreme caution and turn the small gear in the gearbox to find the hole pattern.	 xx1500003113
3	Attach the screws with washers, in area 3. **Note** Do not torque the screws at this point.	Attachment screws, M16x70 12.9 Gleitmo  xx1500003112

Refitting the motor flange

	Action	Note
1	Remove the three M16x130 screws and six-hole washers, previously attached in a triangle.	 xx1500002347
2	Clean the contact surfaces on gearbox and motor flange.	

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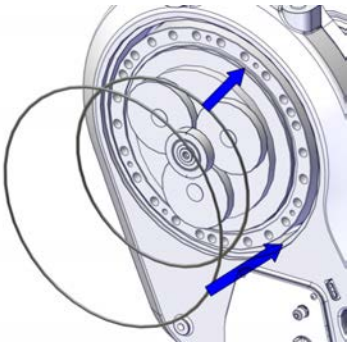
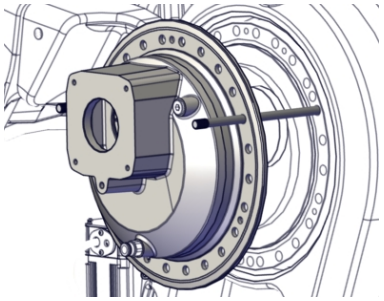
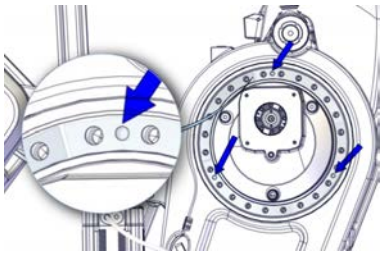
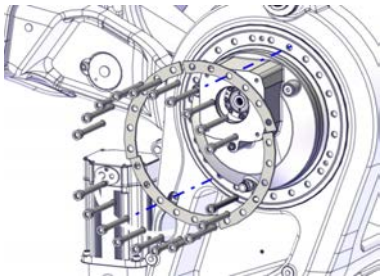
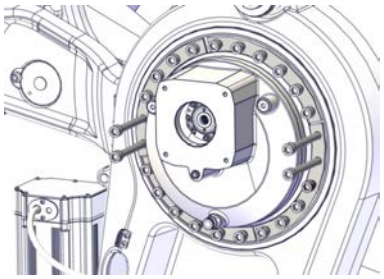
	Action	Note
3	Clean o-rings and o-ring groove on gearbox.	 xx1500002353
4	Inspect the o-rings. **Note** Replace if damaged.	
5	Apply some grease on the o-rings.	Grease
6	Attach the smaller o-ring in the gearbox groove.	
7	Attach the larger o-ring on the motor flange.	
8	Before lifting the motor flange onto the guide pins, make sure the oil inspection glass is facing at six o'clock.	 xx1500002354
9	Lift the motor flange onto the guide pins.	 xx1500002314
10	Make sure the o-rings are in position and slide the motor flange into position.	

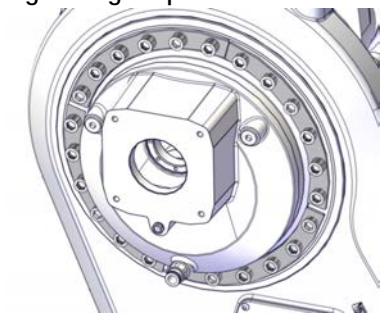
Continues on next page

4.9.3 Replacing the axis-2 gearbox

Continued

	Action	Note
11	**Note** Make sure that the three holes in the gearbox are covered when the four six-hole washers are fitted. .	 xx1600000068
12	Attach 20 of the 24 attachment screws with the four six-hole washers.	Attachment screws: M16x130 12.9 Gleitmo 603  xx1500002355
13	Remove the guide pins and attach the remaining screws.	 xx1500002356

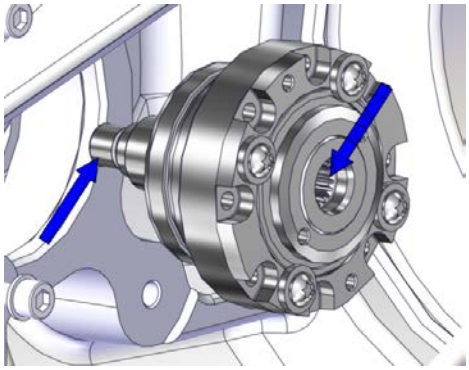
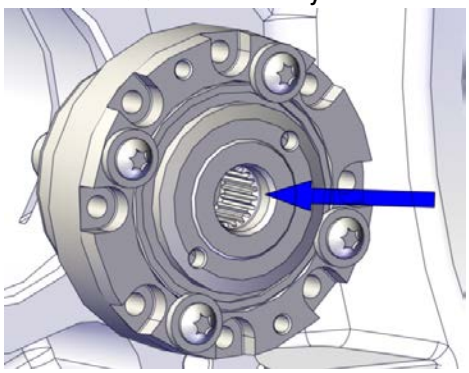
Securing the motor flange and gearbox

	Action	Note
1	Tighten the motor flange screws.	Tightening torque: 300 Nm  xx1500002373

Preparations before refitting the hub

	Action	Note
1	Wipe the hub clean.	
2	Inspect the hole where the hub shall be refitted. Wipe clean if needed.	

Continues on next page

	Action	Note
3	Make sure the o-ring on the hub is undamaged. **Note** Replace if damaged.	 xx1500002039
4	Apply some grease on the o-ring for a better fitting.	
5	Examine the pinion and the splines in the hub for damages.	 xx1500002082
6	Make sure that there is enough grease on the splines before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346

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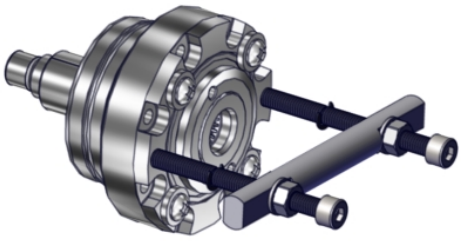
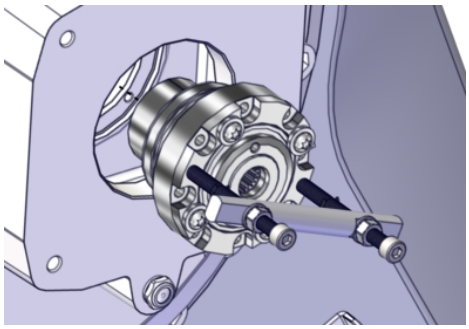
4.9.3 Replacing the axis-2 gearbox

Continued

Refitting the hub

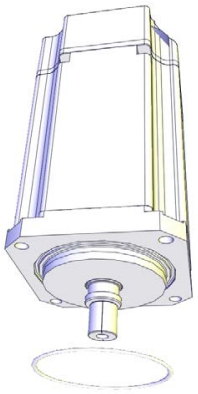
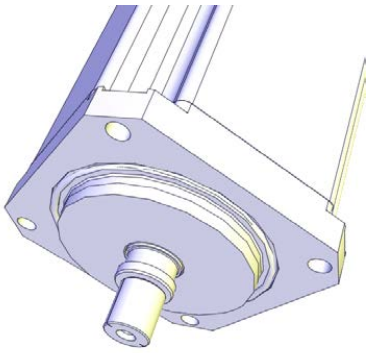
	Action	Note
1	Fit the hub tool.	Hub tool: 3HAC071355-001  xx2000001377
2	**CAUTION** Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	
3	Lift the hub to the gear, and mate the pinon carefully into the gear.	 xx2000001381
4	Remove the hub tool and fit the attachment screws for the hub. Apply locking liquid (Loctite 2400 (or equivalent Loctite 243)) on the screws. **Note** The number of attachment screws differ depending on gearbox.	Attachment screws: M6x30 12.9. Loctite 2400 (or equivalent Loctite 243) Quantity: • Axis-1 = 6 pcs • Axis-2 = 8 pcs • Axis-3 = 8 pcs • Axis-4 = 4 pcs • Axis-5 = 6 pcs • Axis-6 = 4 pcs
5	Secure the hub.	Tightening torque: 14 Nm.

Performing a leak-down test

	Action	Note
1	Perform a leak-down test.	See *Performing a leak-down test on page 187*.

Continues on next page

Preparations before refitting the motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove old paint residues and other contamination from the contact surfaces on both motor and gearbox.	
3	Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
5	Make sure the o-ring is seated in the groove. **Tip** Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020

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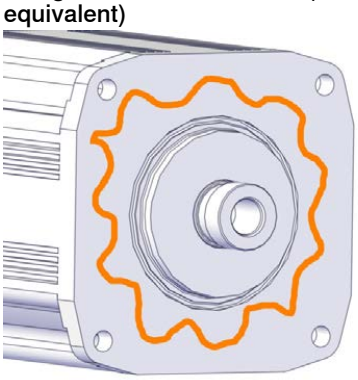
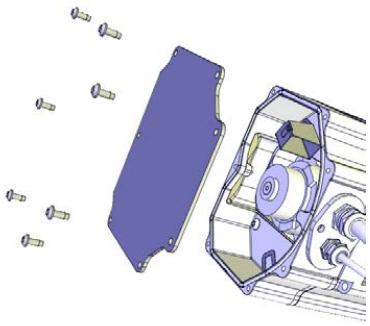
4.9.3 Replacing the axis-2 gearbox
Continued

	Action	Note
6	Apply flange sealant on the motor flange.	Flange sealant: Loctite 574 (or equivalent)  xx1500002357
7	If the motor is a new spare part, remove the cover.	 xx1200001135

Securing the axis-2 motor

	Action	Note
1	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
2	**CAUTION** The motor weighs 27 kg. All lifting accessories used must be sized accordingly!	
3	Apply the lifting accessory.	Lifting accessory, motor: 3HAC15534-1

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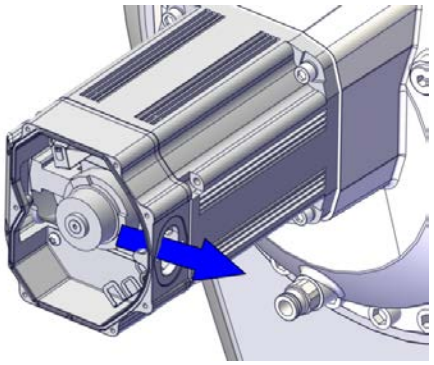
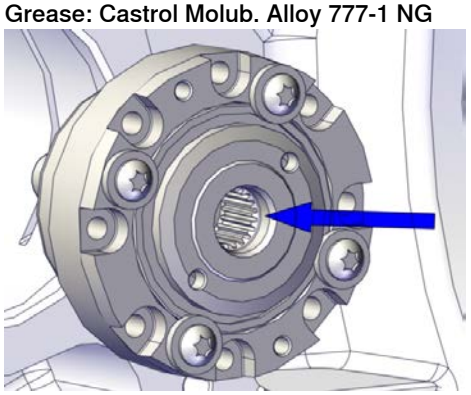
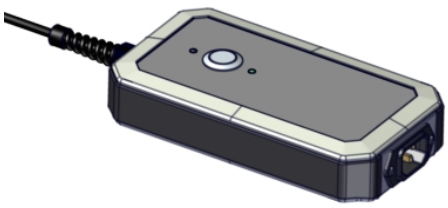
	Action	Note
4	**Note** Make sure the cable exit hole is turned the correct way.	 xx1600000050
5	Lift the motor and put it on the guide pins as close as possible to its final position without pushing the motor pinion into the gear.	
6	Make sure that there is enough grease on the splines, before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346
7	Remove the lifting accessory and allow the motor to rest on the guide pins.	
8	Apply the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool: 3HAC7887-1

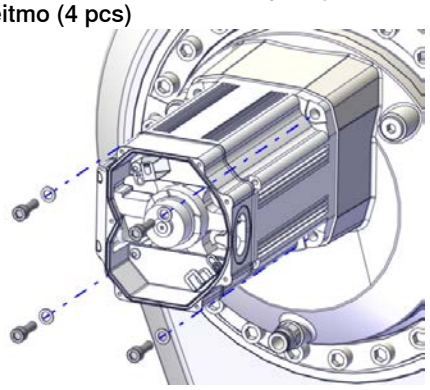
Continues on next page

4.9.3 Replacing the axis-2 gearbox

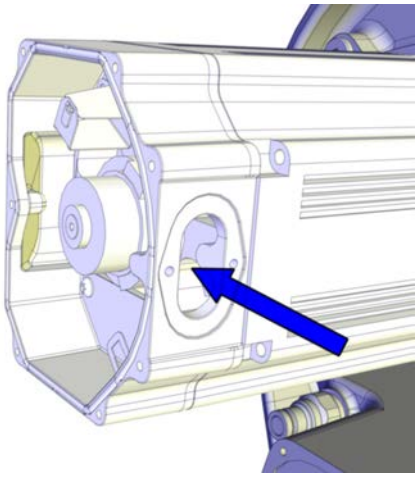
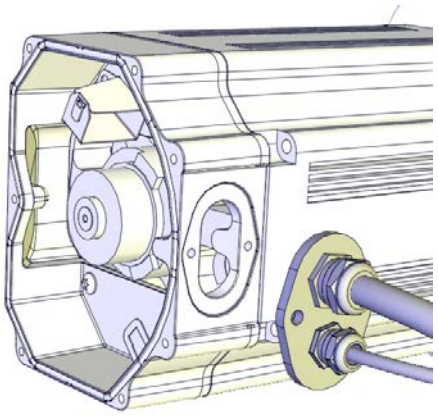
Continued

	Action	Note
9	Release the brakes of the axis-2/3 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the R2.MP2 (axis-2 motor) or R2.MP3 (axis-3 motor) connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP2 / R2.MP3: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
10	**CAUTION** Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used!	
11	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 into the hub. • Make sure that the motor pinion does not get damaged. • Make sure that the direction of the cable exit is facing the correct way.	
12	Fit two of the attachment screws.	Screw dimension: M10x40 quality 12.9 Gleitmo (4 pcs)
13	Remove the guide pins and replace with the remaining attachment screws.	

Continues on next page

	Action	Note
14	Secure the motor with its attachment screws and washers. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1 Tightening torque: 50 Nm. Screw dimension: M10x40 quality 12.9 Gleitmo (4 pcs)  xx1500002323
15	Disconnect the brake release tool / 24 VDC power supply.	

Connecting the axis-2 cables

	Action	Note
1	Push the motor cables through the cable gland opening.	 xx1300000738
2	Refit the cable gland cover. **Note** Replace the gasket if damaged.	 xx1200001067

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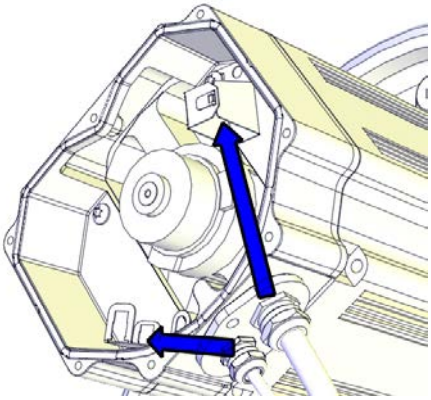
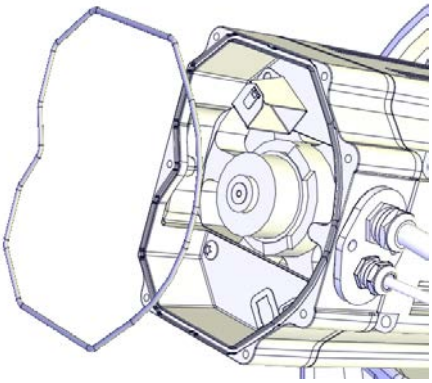
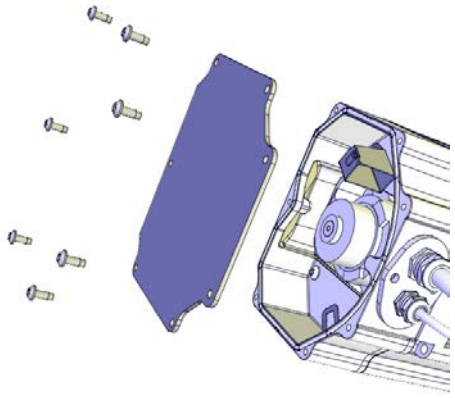
4.9.3 Replacing the axis-2 gearbox

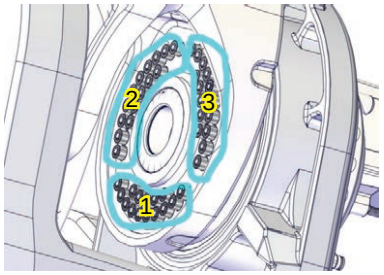
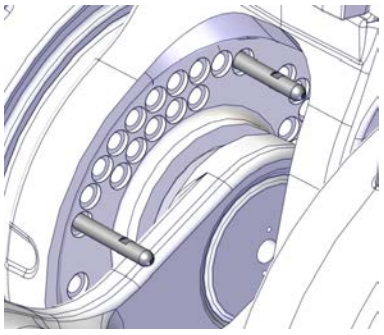
Continued

	Action	Note
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-002  xx1200001070
5	Wipe clean o-ring and o-ring groove.	
6	Refit the o-ring. **Tip** Lubricate the o-ring with some grease for a better fitting in the groove.	
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 with it's attachment screws. **Note** Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged. **Note** Make sure the o-ring is undamaged and properly fitted.	Attachment screws: M5x12 8.8 (7 pcs)  xx1200001135
9	Make sure that the covers are tightly sealed.	

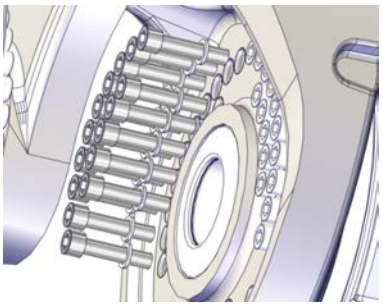
Refitting the axis-2 gearbox screws in area 2

	Action	Note
1	Find area 2.	 xx1500002975
2	Remove the guide pins.	 xx1700000935
3	Begin attaching the screws (M16x70) in the outermost holes of the outer ring of holes. **Tip** Make sure that the hole pattern match. If needed, use extreme caution and turn the small gear in the gearbox to find the hole pattern.	

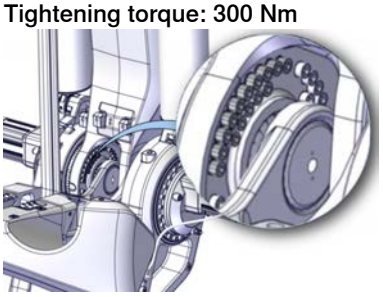
Continues on next page

4.9.3 Replacing the axis-2 gearbox

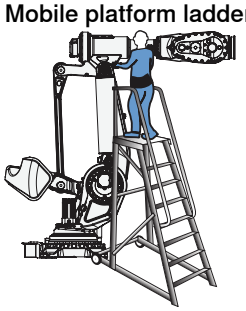
Continued

	Action	Note
4	Attach the screws with washers, in area 2. **Note** Do not torque the screws at this point.	Attachment screws, M16x70 12.9 Gleitmo  xx1500003111

Securing the axis-2 gearbox screws in areas 2 and 3

	Action	Note
1	Tighten the attachment screws in area 3 and 2 that are possible to reach. • Start with area 3, • finish with area 2.	Tightening torque: 300 Nm  xx1500002339

Restoring the pressure of the balancing device

	Action	Note
1	Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device. **DANGER** Do not use the robot as ladder.	Mobile platform ladder  xx1500001985

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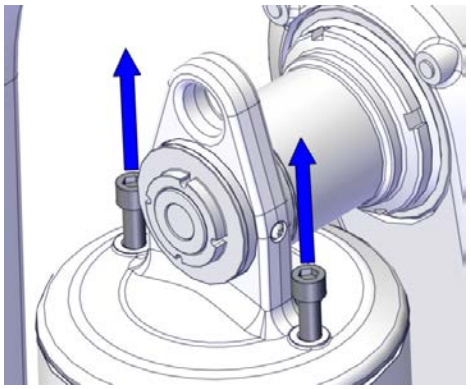
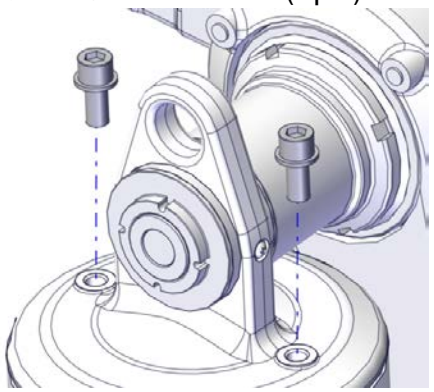
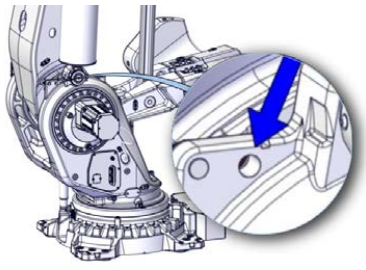
	Action	Note
2	Restore the pressure of the balancing device by unscrewing the two M16x80 screws alternately little by little.	 xx1500002308
3	Remove the screws.	
4	Refit the M16x35 screws in the holes on top of the balancing device.	Attachment screws: M16x35 (2 pcs)  xx1500001971

Removing lock screws

	Action	Note
1	Turn on the power.	
2	Begin unscrewing the axis-2 lock screw, while at the same time very slowly jogging axis-2, until it is possible to unscrew the lock screw completely.	 xx1500002322

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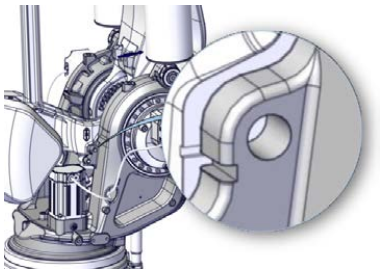
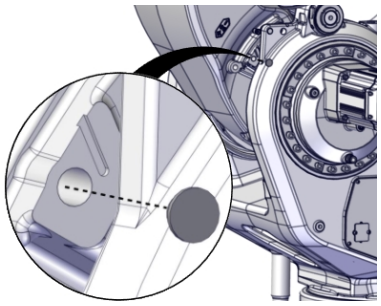
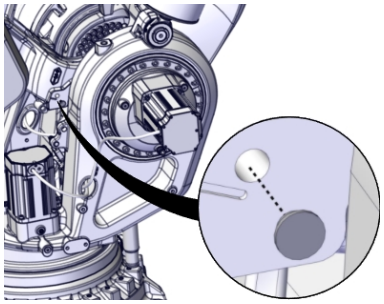
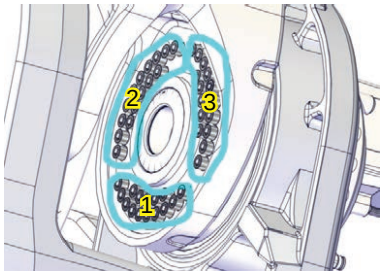
4.9.3 Replacing the axis-2 gearbox
Continued

	Action	Note
3	Begin unscrewing the axis-3 lock screw, while at the same time very slowly jogging axis-3, until it is possible to unscrew the lock screw completely.	 xx1500002321
4	Jog axis-2 to be able to attach the plastic plug.	 xx1500002335
5	Jog axis-3 to be able to attach the plastic plug.	 xx1500002366

Refitting the axis-2 gearbox screws in area 1

	Action	Note
1	Jog the robot to the specified position: • Axis 1: No significance (as long as the robot is secured to the foundation) • Axis 2: 0° • Axis 3: +66° • Axis 4: 0° • Axis 5: 0° • Axis 6: No significance.	
2	Find area 1.	 xx1500002975

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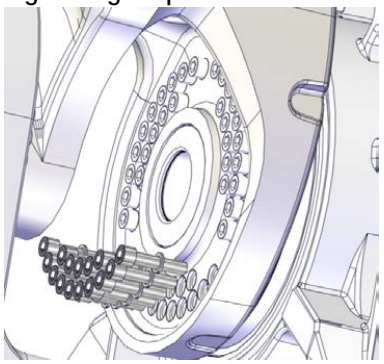
	Action	Note
3	Refit and tighten the screws in area 1. **Tip** Mark the screw with a marker pen after each torque. This is to make sure that all screws have been torqued.	Attachment screws: M16x70 Tightening torque: 300 Nm  xx1500003110
4	Examine that all screws have been torqued.	

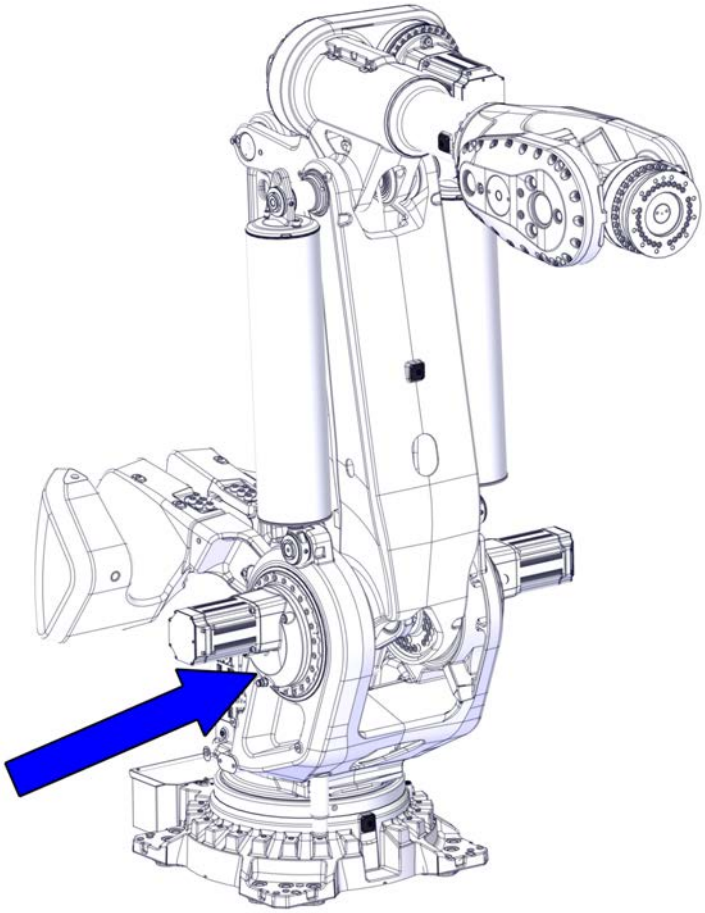
Concluding procedure

	Action	Note
1	Perform a leak-down test (if not already done).	See *Performing a leak-down test on page 187*.
2	Refill the gearbox with oil.	See *Changing oil in axis-2 and axis-3 gearbox on page 147*.
3	Re-calibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 688*. General calibration information is included in section *Calibration on page 675*.
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 97*.	

4.9.4 Replacing the axis-3 gearbox

Location of the axis-3 gearbox

The axis-3 gearbox is located as shown in the figure.



xx1500002070

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Reduction gear RV 900N incl input gear	3HAC048392-003		L2
Sealing ring	3HAC052423-001		L2

Continues on next page

Required tools and equipment

Equipment, etc.	Article number	Note
Brake release tool	3HAC081310-001	Used to release the motor brakes. User instructions are enclosed with the tool. Alternative tool: 24 VDC power supply
Lock screw, quality 12.9, M20x150	-	Used to secure lower arm to frame (to lock axis 2) or parallel arm to frame (to lock axis 3).
Screw M6x110	-	2 pcs. Fully threaded. Used as removal tools when removing the hub.
Screw M16x80	-	Fully threaded, 2 pcs
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Guide pin, M16x150	3HAC13120-2	Always use guide pins in pairs.
Guide pin, M16x200	3HAC13120-3	Always use guide pins in pairs.
Removal tool M12	3HAC14631-1	Used to push out the motor if necessary. Always use removal tools in pairs.
Removal tool M14	3HAC047108-001	Used to push out the motor if necessary. Always use removal tools in pairs.
Lifting accessory, motor	3HAC15534-1	Lifting instruction 3HAC15640-2 enclosed.
Lifting accessory, gearbox	3HAC081585-001 (recommended) or 3HAC054404-001 (alternative)	Used to lift the axis-2 or axis-3 gearbox.
Mounting set gear (axis 2 and 3)	3HAC059801-001	Always use guide pins in pairs. Used to slide the axis-2 or axis-3 gearbox in/out.
Mobile platform ladder	-	
Roundsling 2 m	-	Lifting capacity: 5,000 kg
Roundsling 2.5 m	-	Lifting capacity: 5,000 kg
Lifting eye	3HAC14457-4	M16
Lifting eye	3HAC038295-003	M24
Rotation tool	3HAC7887-1	Used to rotate the motor pinion.
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Leak-down tester	-	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumables

Consumable	Article number	Note
Molykote 1000		
Grease		

Continues on next page

4.9.4 Replacing the axis-3 gearbox
Continued

Consumable	Article number	Note
Grease	3HAC063069-001	Castrol Molub. Alloy 777-1 NG, 5 ml. To be used on hub splines to prevent from fretting corrosion.
Rust preventive	3HAC034903-001	Mercasol 3110 Waxcoat. Recommended drying time is 24h.
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)
Flange sealant	-	Loctite 574 (or equivalent)

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 689*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Removing the gearbox

Use these procedures to remove the axis-3 gearbox.

DANGER

Never remove both the axis-2 and axis-3 gearboxes at the same time.

One of the gearboxes must stay fitted when the other one is replaced, or the complete arm system will not have any secure connection to the frame. A serious accident will most probably happen.

Continues on next page

Note

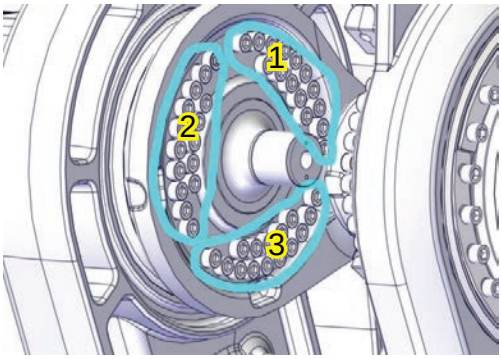
The attachment screws that secure the gearboxes are arranged in three areas, with 15 screws in each area. It will not be possible to reach all screws with the robot in only one position. Removal and refitting must be performed with the robot in more than one position. These positions are described in the procedures.

Preparations

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Remove any tool or other equipment fitted on the turning disc.	
3	Begin draining the oil.	See *Draining the axis-2 and axis-3 gearboxes on page 148*.

The three areas of screws that secure axis-3 gearbox to parallel arm

The axis-3 gearbox is attached to the parallel arm with attachment screws arranged in three areas. Use this figure to understand the position of the three areas, when performing this procedure.



xx1500002974

The order when removing the attachment screws that secure the axis-3 gearbox to the parallel arm are removed is: area 1, area 2, and then area 3.

The order when attaching the axis-3 gearbox to the parallel arm is reversed: area 3, area 2, and then area 1.

Continues on next page

4.9.4 Replacing the axis-3 gearbox
Continued

Robot position when removing screws in area 1

With the robot in this position it is possible to reach the screws in the first of the three areas of screws that secure the axis-3 gearbox to the parallel arm.

	Action	Note
1	Jog the robot to the specified position: • Axis 1: no significance as long as the robot is secured to the foundation. • Axis 2: +48° • Axis 3: 0° • Axis 4: 0° • Axis 5: 0° • Axis 6: No significance.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Removing the axis-3 gearbox screws in area 1

DANGER

When removing the axis-3 gearbox, let the axis-2 gearbox stay fitted! Only remove the screws that **either** secure the axis-2 gearbox to the lower arm, **or** the screws that secure the axis-3 gearbox to the parallel arm, depending on which gearbox shall be removed.

Note

The 45 attachment screws are arranged in three areas with 15 screws in each area. All attachment screws can not be reached with the robot in the same position. This procedure describes how to reach the screws in the first area. Only remove the screws in this area, at this point.

Use this procedure to remove the screws that secure the axis-3 gearbox to the parallel arm, in area 1.

	Action	Note
1	**DANGER** Never remove the screws on both axis-2 and axis-3 at the same time. One side must always be attached when the gearbox on the other side is removed. If not, there is a potential risk that a severe accident will happen.	

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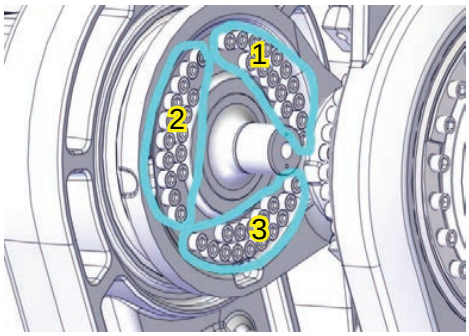
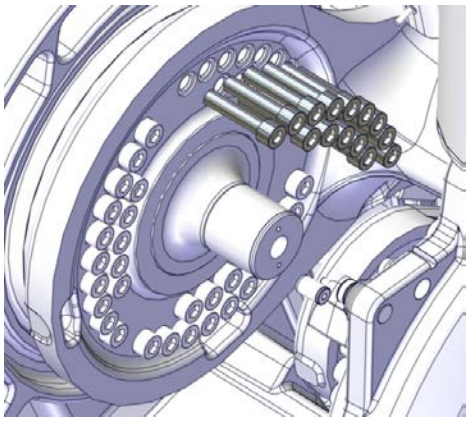
	Action	Note
2	Find area 1.	 xx1500002974
3	Remove the screws in area 1.	 xx1500003114 Lower arm is hidden in this figure, to get a better view.

Robot position when removing screws in area 2

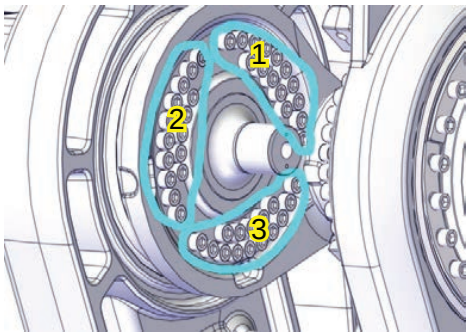
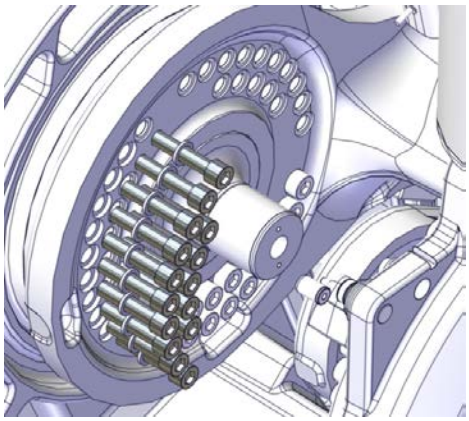
	Action	Note
1	Turn on the power and jog the robot to the specified position: • Axis 1: no significance as long as the robot is fitted to the foundation. • Axis 2: -65° • Axis 3: 0° • Axis 4: 0° • Axis 5: 0° • Axis 6: No significance.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Continues on next page

4.9.4 Replacing the axis-3 gearbox
Continued

Removing the axis-3 gearbox screws in area 2

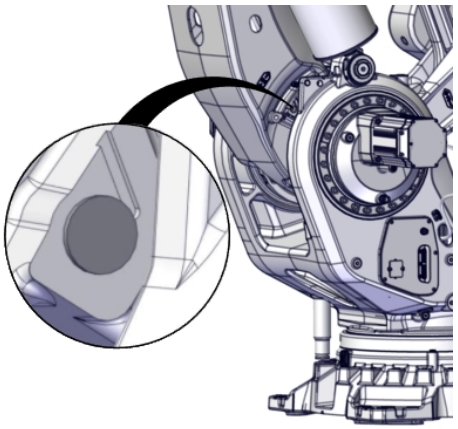
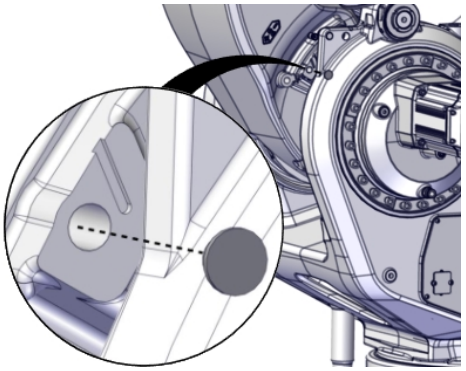
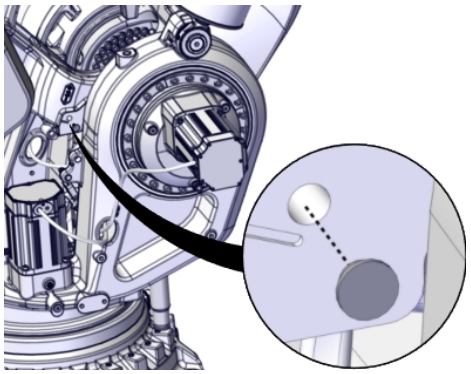
Use this procedure to remove the screws that secure the axis-3 gearbox to the parallel arm, in area 2.

	Action	Note
1	**DANGER** Never remove the screws on both axis-2 and axis-3 at the same time! One side must always be attached when the gearbox on the other side is removed. If not, there is a potential risk that a severe will accident happen.	
2	Find area 2.	 xx1500002974
3	Remove the screws in area 2.	 xx1500003115 Lower arm is hidden in this figure, to get a better view.

Removing the plastic plugs of axis 2 and axis 3 lock screw holes

	Action	Note
1	Turn the power to the robot on.	

Continues on next page

	Action	Note
2	Jog axis-2 to a position where the plastic plugs are accessible.	 xx2200000920
3	Remove the plastic plug that covers the axis-2 lock screw hole. **Note** Keep the plastic plugs. It shall be refitted after the work is done.	 xx1500002335
4	Remove the plastic plug that covers the axis-3 lock screw hole. **Note** Keep the plastic plugs. It shall be refitted after the work is done.	 xx1500002366

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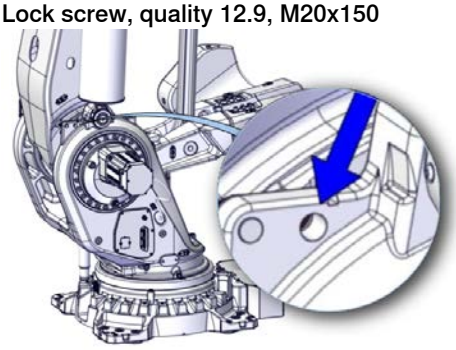
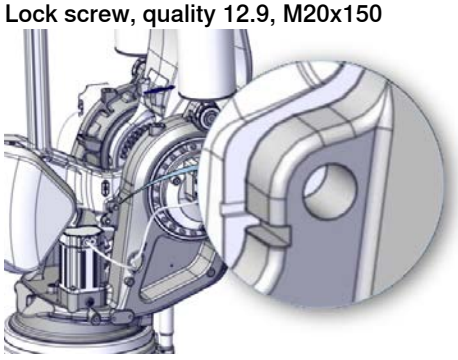
4.9.4 Replacing the axis-3 gearbox

Continued

Attaching lock screws to axis-2 and axis-3

	Action	Note
1	Jog the robot to calibration position.	 xx1500002310
2	Secure the axis-2 with a lock screw.	Tightening torque: 100 Nm Lock screw, quality 12.9, M20x150  xx1500002322
3	Release the brakes on axis-2 using the brake release button, and let the axis rest on the lock screw.	
4	Secure axis-3 with a lock screw.	Tightening torque: 100 Nm Lock screw, quality 12.9, M20x150  xx1500002321
5	Release the brakes on axis-3 using the brake release button, and let the axis rest on the lock screw.	

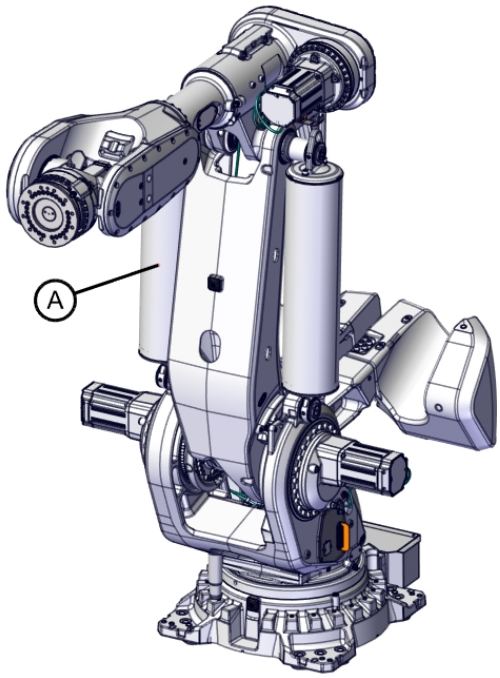
Continues on next page

	Action	Note
6	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Unloading the pressure of the axis-3 balancing device

CAUTION

Make sure to relief the pressure of the correct balancing device. Relief pressure on axis 3 side when changing axis-3 gearbox.



xx1700001309

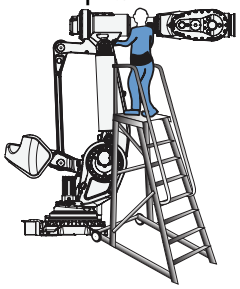
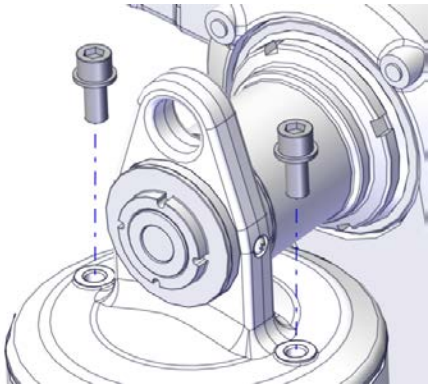
A	Axis-3 balancing device

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

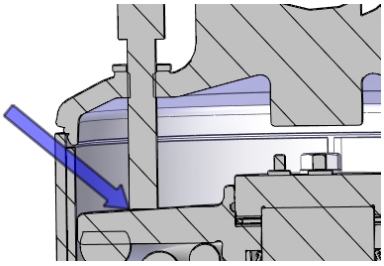
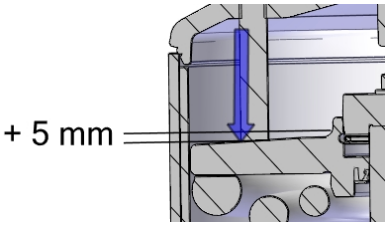
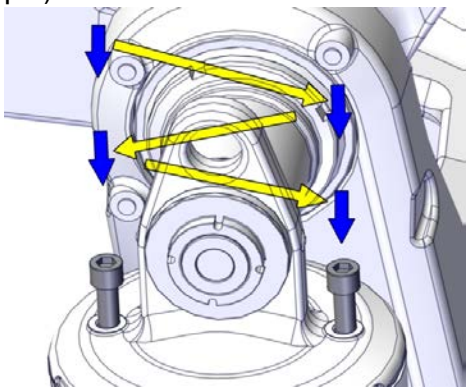
Continues on next page

4.9.4 Replacing the axis-3 gearbox

Continued

	Action	Note
2	Use a mobile platform ladder (or similar) to reach the upper end of the balancing device. **DANGER** Do not use the robot as ladder!	Mobile platform ladder  xx1500001985
3	Remove the screws, fitted in the screw holes on top of the balancing device. **Note** Keep the screws. They shall be refitted after the work is done.	 xx1500001971 M16x35
4	Apply some Molykote on threads and at the bottom end of two fully threaded screws, used for unloading the balancing device.	Screw M16x80 (Fully threaded, 2 pcs, 2 pcs) Apply Molykote on colored areas.  xx1500002303

Continues on next page

	Action	Note
5	Unload the pressure of the balancing device by inserting the screws. 1 Attach the screws until the screws reaches the piston.  xx1900001209 2 Then, alternately little by little, attach the screws at least another *five* millimeters. The pressure is now unloaded.  xx1900001210	Screw M16x80 (Fully threaded, 2 pcs, 2 pcs)  xx1500002309
6	In a procedure where both balancing devices shall be removed, unload the pressure of the other in the same way.	

Disconnecting the axis-3 motor cables

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

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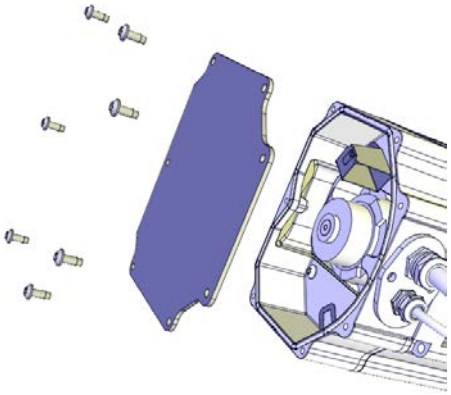
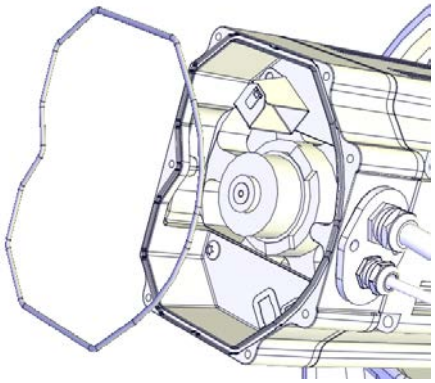
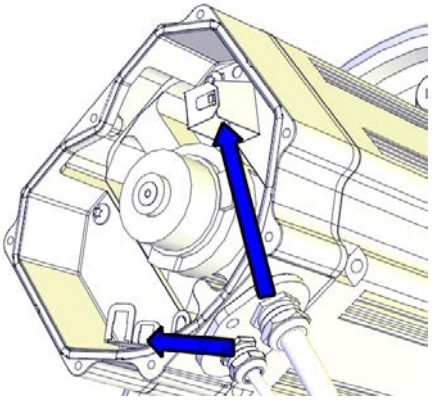
4.9.4 Replacing the axis-3 gearbox

Continued

	Action	Note
2	Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135
3	Make sure the o-ring is present.	 xx1200001070
4	Disconnect the motor cables.	 xx1200001066

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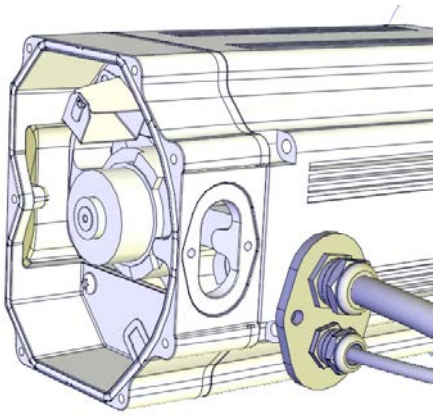
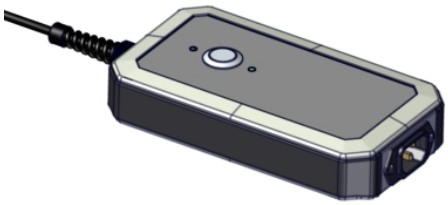
	Action	Note
5	Remove the cable gland cover. Make sure the gasket is not damaged. **Tip** Make a note in which direction the cable gland hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.	 xx1200001067
6	Use caution and pull out the motor cables.	

Removing the axis-3 motor

	Action	Note
1	**DANGER** When releasing the holding brakes of the motor, the lower arm and/or the parallel arm will move and may fall down! Before continuing, make sure the lower arm and/or parallel arm are secured with lock screws.	
2	Release the brakes of the axis-2/3 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the R2.MP2 (axis-2 motor) or R2.MP3 (axis-3 motor) connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP2 / R2.MP3: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666

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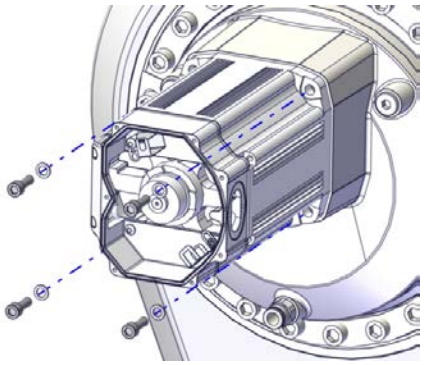
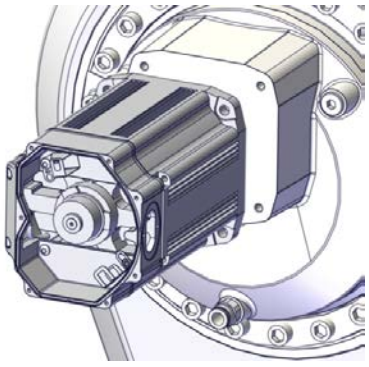
4.9.4 Replacing the axis-3 gearbox

Continued

	Action	Note
3	Remove the attachment screws that secure the motor. **Tip** Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx1500002323
4	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
5	**CAUTION** Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used!	
6	If required, press the motor out of position by using the removal tool in opposite holes of the motor.	Removal tool M12: 3HAC14631-1 Removal tool M14: 3HAC047108-001 Different motor versions have different dimensions on the motor flange holes. Use appropriate removal tool depending on current motor version.
7	**CAUTION** The motor weighs 27 kg. All lifting accessories used must be sized accordingly!	
8	Attach the lifting accessory.	Lifting accessory, motor: 3HAC15534-1
9	Use caution and lift the motor out on the guide pins, in order to get the pinion away from the hub. Let the motor rest on the guide pins.	 xx1500002325
10	Disconnect the brake release tool / 24 VDC power supply.	

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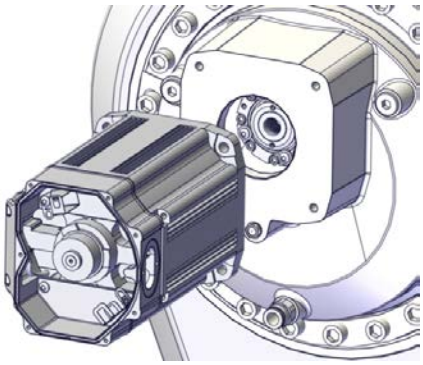
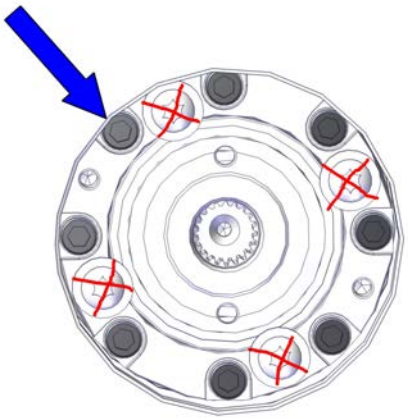
	Action	Note
11	Use caution and remove the motor by sliding it out on the guide pins.	 xx1500002324

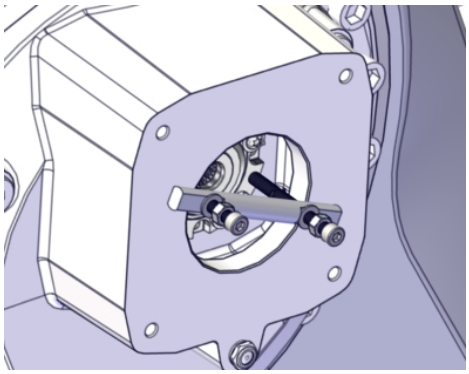
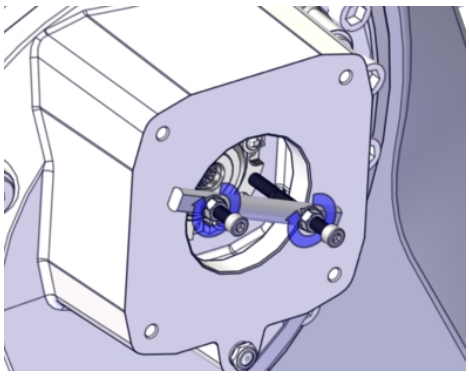
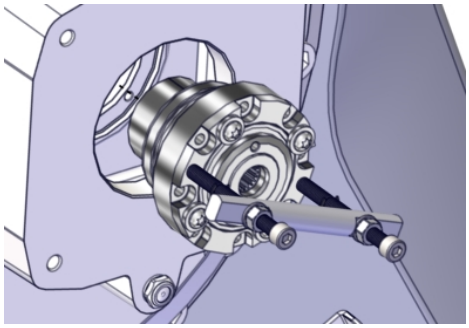
Removing the hub

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the M6x30 hex socket head cap screws that secure the hub. **Note** Do not remove the M6x16 torx pan head screws.	 xx1500002038
3	**CAUTION** Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	

Continues on next page

4.9.4 Replacing the axis-3 gearbox

Continued

	Action	Note
4	Fit the two threaded rods of the hub tool into the attachment holes in the hub.	Hub tool: 3HAC071355-001  xx2000001379
5	Alternately thread the nuts clockwise on the two rods to pull out the hub from the gear.	 xx2000001380
6	Lift out the hub carefully.	 xx2000001381
7	Cover the hole to avoid getting debris into the gearbox during remaining service work.	

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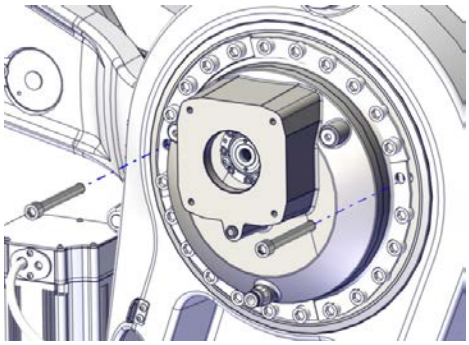
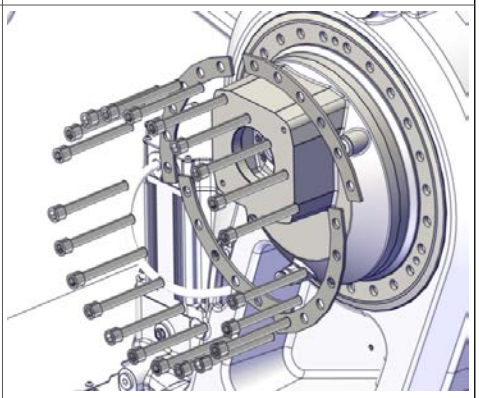
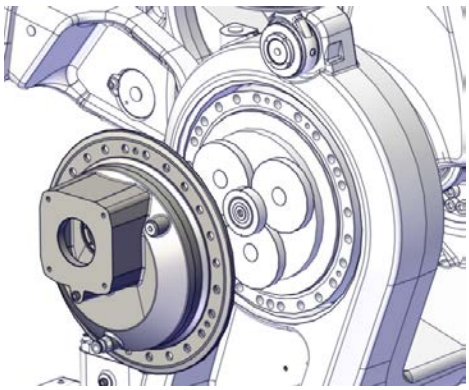
Removing the motor flange

	Action	Note
1	Remove two attachment screws in opposite holes.	 xx1500002358
2	Fit guide pins in the holes.	Mounting set gear (axis 2 and 3), 3HAC059801-001
3	Remove the remaining attachment screws and the six-hole washers (4 pcs).	 xx1500002359
4	**Note** There will be some oil spill when the motor flange is removed. Put some paper (or similar) to absorb the surplus oil.	
5	Use caution and move the motor flange out over the guide pins.	 xx1500002360

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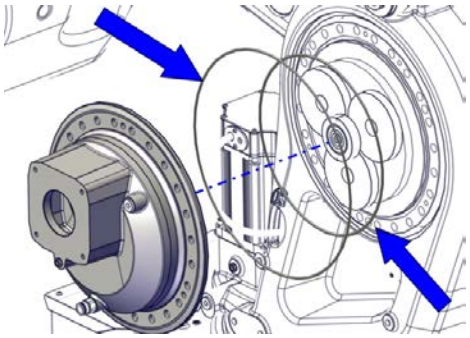
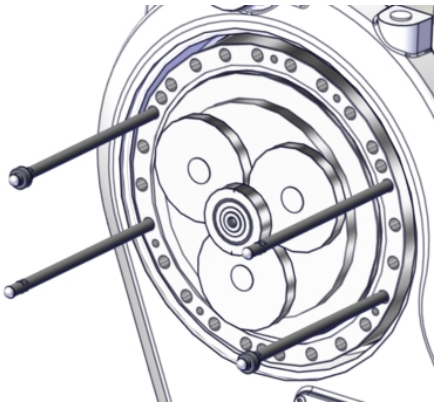
4.9.4 Replacing the axis-3 gearbox

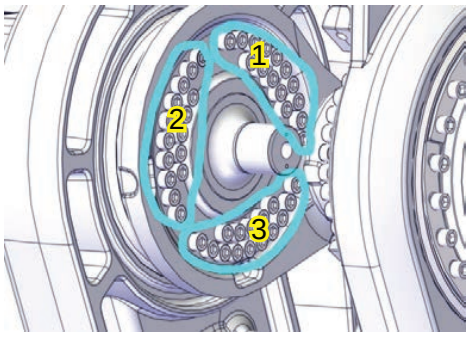
Continued

	Action	Note
6	Make sure the o-rings are present.	 xx1500002317

Installing guide pins

	Action	Note
1	Attach two additional guide pins in opposite holes, below the present ones. Fasten set collars on two of the guide pins.	Mounting set gear (axis 2 and 3), 3HAC059801-001  xx1600001553

Removing the axis-3 gearbox screws in area 3

	Action	Note
1	Find area 3.	 xx1500002974

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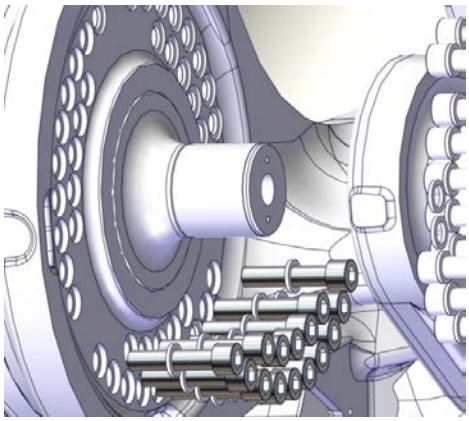
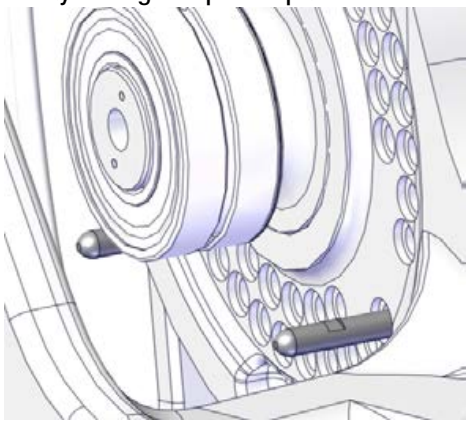
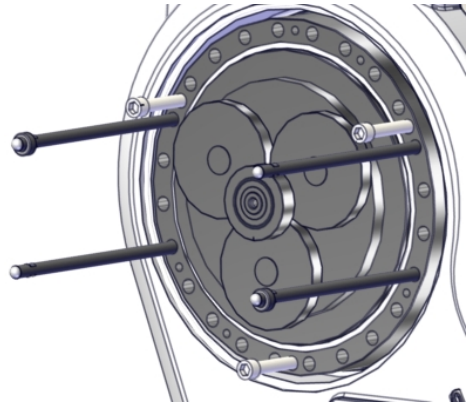
	Action	Note
2	Remove the attachment screws in area 3.	 xx1500003116
3	Attach guide pins in the outer holes of the area 3 screws.	Guide pin, M16x150 3HAC13120-2 Always use guide pins in pairs.  xx1700000937 Note! Lower arm removed to better show guide pin placement.

Removing the axis-3 gearbox from parallel arm

	Action	Note
1	Attach three screws in a triangle and use as removal tools for the gearbox.	 xx1500002337

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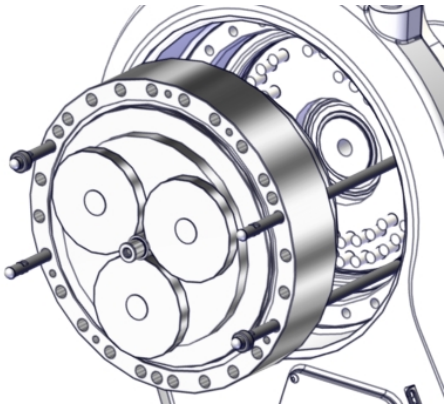
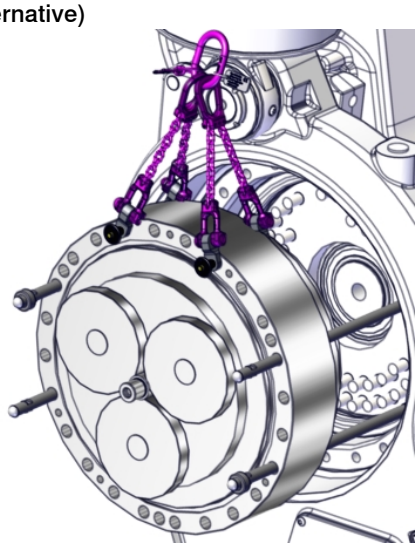
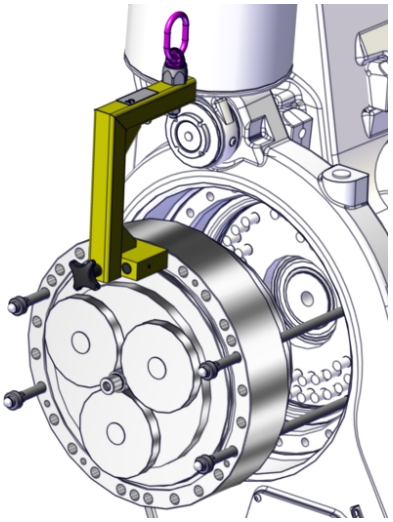
4.9.4 Replacing the axis-3 gearbox

Continued

	Action	Note
2	Slide the gearbox out on the four guide pins, just enough to be able to attach the lifting accessories.	 xx1500002338
3	**CAUTION** The gearbox weighs 160 kg. All lifting accessories used must be sized accordingly.	

Continues on next page

	Action	Note
4	Attach the lifting accessories.	Lifting accessory, gearbox: 3HAC081585-001 (recommended) or 3HAC054404-001 (alternative)  xx2200001075 3HAC081585-001  xx1600001554 3HAC054404-001
5	Attach a roundsling to the lifting accessories.	Roundsling 2 m: Lifting capacity: 5,000 kg (2 pcs)
6	Attach the roundslings to an overhead crane (or similar) and raise to take the weight of the gearbox.	
7	Lift the gearbox off.	

Continues on next page

4.9.4 Replacing the axis-3 gearbox
Continued

Refitting the gearbox

Use these procedures to refit the axis-3 gearbox.

DANGER

Never remove both the axis-2 and axis-3 gearboxes at the same time! One of the gearboxes must stay fitted when the other is replaced. If not, the complete arm system will not have any secure connection to the frame and thereby be a great security risk. A serious accident will most probably happen.

Note

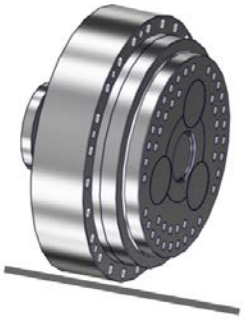
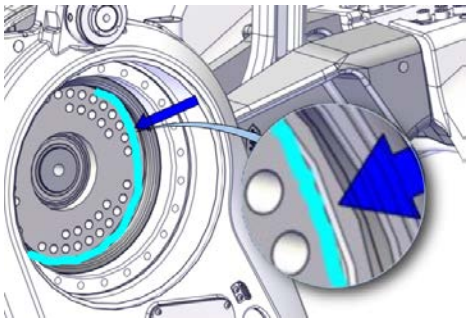
The attachment screws that secure the gearboxes to the lower arm or to the parallel arm, are arranged in three areas, with 15 screws in each area. It will not be possible to reach all screws with the robot in only one position. Removal and refitting must be performed with the robot in more than one position. These positions are described in the procedures.

Robot position

	Action	Note
1	Make sure that the position of the robot has not been changed. Correct position is calibration position.	**Note** 

Continues on next page

Preparations before refitting the gearbox

	Action	Note
1	Use caution and lift the gearbox up and let it rest on its side. **CAUTION** Make sure the gearbox is resting in a stable position.	 xx1500002342
2	Fit a new sealing ring.	Sealing ring 3HAC052423-001  xx1600000067
3	Clean the contact surfaces between gearbox and frame.	
4	Apply some grease on the thin chamfer on the parallel arm. The area where the gearbox will enter.	Grease  xx1500002340

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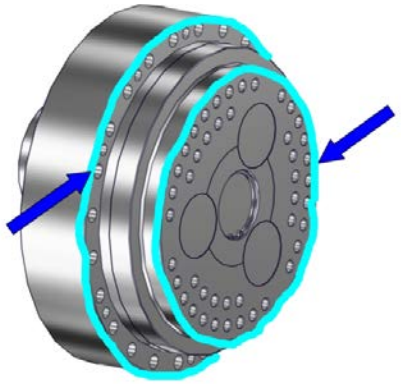
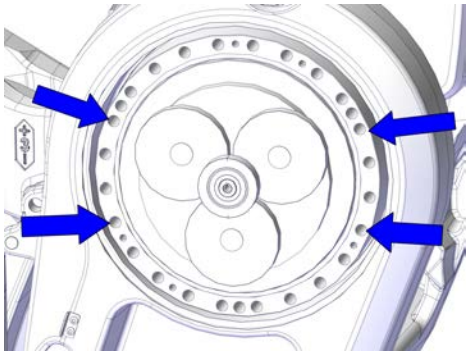
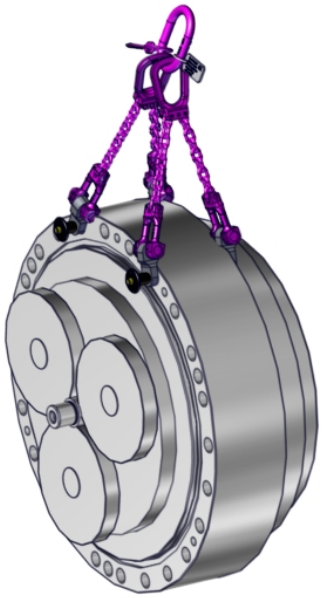
4.9.4 Replacing the axis-3 gearbox

Continued

	Action	Note
5	Apply some grease on the thin chamfer on the gearbox.	Grease  xx1500002341
6	Fit guide pins as shown in the figure.	Mounting set gear (axis 2 and 3), 3HAC059801-001  xx1500002361
7	Fit guide pins to the back of the gearbox (if replaced).	Guide pin, M16x150 (2 pcs) 3HAC13120-2 Always use guide pins in pairs.  xx1700000936
8	Apply some grease on the guide pins for a better fitting.	

Continues on next page

Attaching lifting accessories to the gearbox

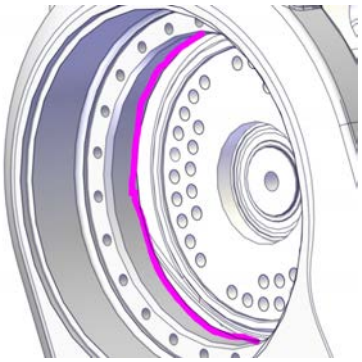
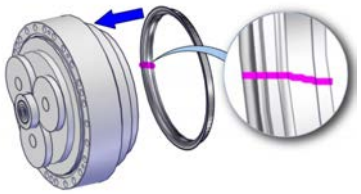
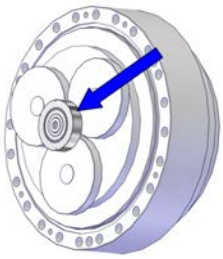
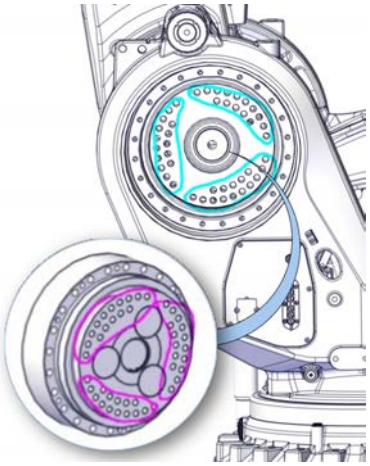
	Action	Note
1	**CAUTION** The gearbox weighs 160 kg. All lifting accessories used must be sized accordingly!	
2	Attach the lifting accessories to the gearbox.	Lifting accessory, gearbox: 3HAC081585-001 (recommended) or 3HAC054404-001 (alternative)  xx2200001079 3HAC081585-001
3	Attach a roundsling to the lifting accessories.	Roundsling 2 m: Lifting capacity: 5,000 kg (2 pcs)
4	Attach the roundslings to an overhead crane (or similar) and raise to take the weight of the gearbox.	

Continues on next page

4.9.4 Replacing the axis-3 gearbox

Continued

Refitting the axis-3 gearbox to frame

	Action	Note
1	Apply Mercasol, 40 mm from the parallel arm side, on the contact surface.	Mercasol  xx1500002349 Area where to apply Mercasol, 40 mm wide from the parallel arm side.
2	Apply Mercasol on the surface of the sealing ring. **Note** Make sure that the sealing ring is attached correctly on the gearbox.	Mercasol  xx1500002350
3	Orient the gearbox to match the hole patterns before lifting the gearbox onto the guide pins. If the hole pattern does not match, carefully turn the small gear in the gearbox very slowly, in order to find the hole pattern.  xx1500002345	 xx1500002344

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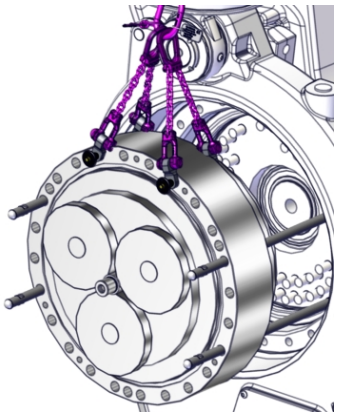
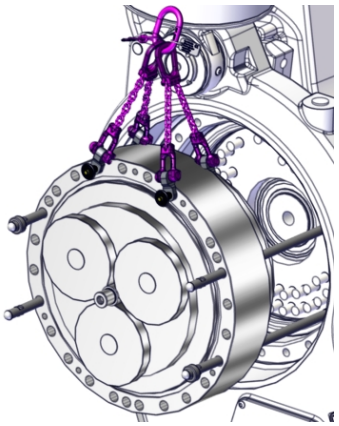
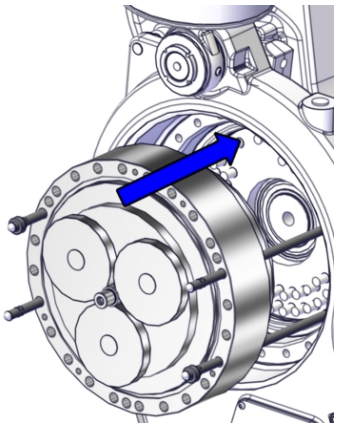
	Action	Note
4	Lift the gearbox up onto the guide pins.	 xx2200000927
5	Fasten set collars on two of the guide pins.	 xx2200001075
6	Remove the lifting accessories and push in the gearbox into the frame.	 xx2200001078

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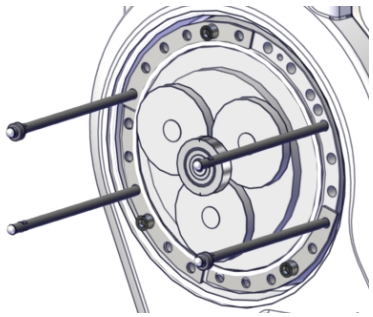
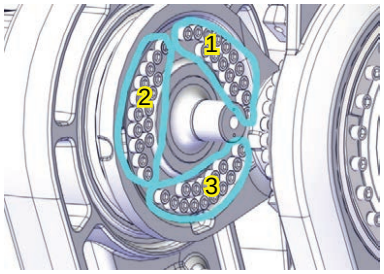
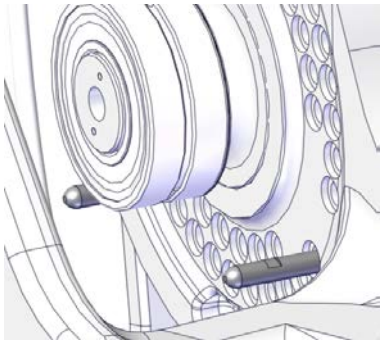
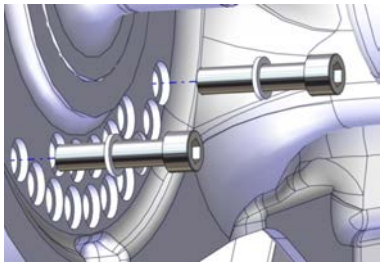
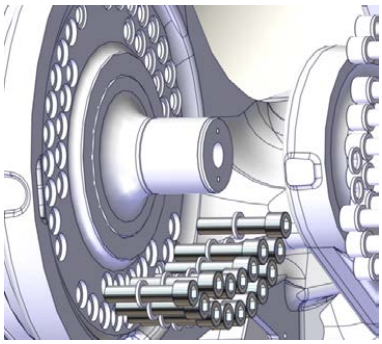
4.9.4 Replacing the axis-3 gearbox
Continued

	Action	Note
7	Attach three M16x130 screws with six-hole washers underneath, in a triangle and use them alternately to press the gearbox into position. **Note** The six-hole washers are needed for protection of the gearbox surface, when screws are attached.	Tightening torque: 100 Nm Attachment screws: M16x130 12.9 Gleitmo  xx1500002368

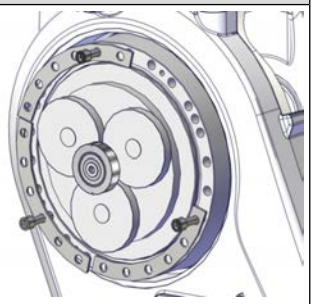
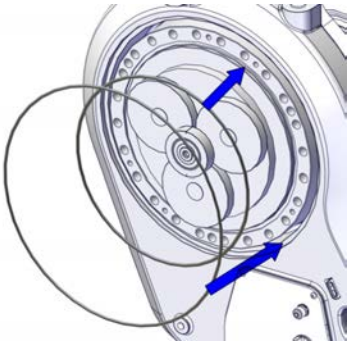
Securing the axis-3 gearbox screws in area 3

	Action	Note
1	Find area 3.	 xx1500002974
2	Remove the guide pins.	 xx1700000937 Lower arm is hidden in this figure, to get a better view.
3	Attach the screws in area 3, in the outermost holes, of the outer ring of holes.	Attachment screws: M16x70 12.9 Gleitmo  xx1500003117

Continues on next page

	Action	Note
4	Attach the remaining attachment screws with washers, in area 3. **Note** Do not torque the screws at this point!	Attachment screws: M16x70 12.9 Gleitmo  xx1500003116 Lower arm is hidden in this figure, to get a better view.

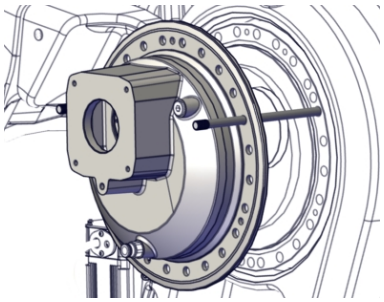
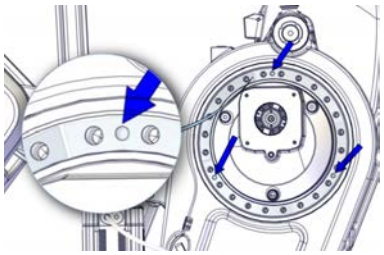
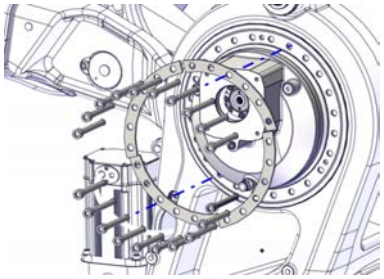
Refitting the motor flange

	Action	Note
1	Remove the three M16x130 screws and six-hole washers, previously attached in a triangle.	 xx1500002347
2	Clean the contact surfaces on gearbox and motor flange.	
3	Clean o-rings and o-ring groove on gearbox.	 xx1500002353
4	Inspect the o-rings. Replace if damaged!	
5	Apply some grease on the o-rings.	Grease
6	Attach the smaller o-ring in the gearbox groove.	
7	Attach the larger o-ring on the motor flange.	

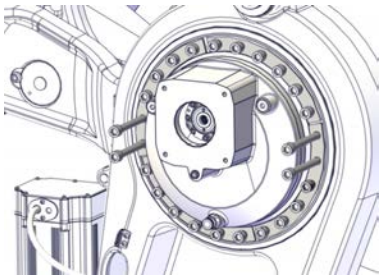
Continues on next page

4.9.4 Replacing the axis-3 gearbox

Continued

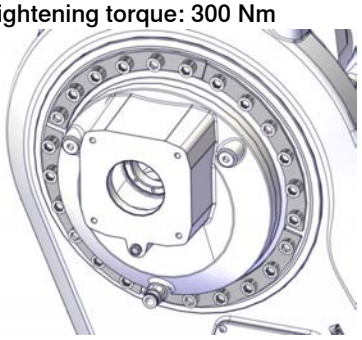
	Action	Note
8	Before lifting the motor flange onto the guide pins, make sure the oil inspection glass is facing at six o'clock. See figure.	 xx1500002354
9	Lift the motor flange onto the guide pins.	 xx1500002314
10	Make sure the o-rings are in position and slide the motor flange into position.	
11	**Note** When the four six-hole washers are fitted, make sure that the three holes in the gearbox will be covered. See figure!	 xx1600000068
12	Attach 20 of the 24 attachment screws with the four six-hole washers.	Attachment screws: M16x130 12.9 Gleitmo 603  xx1500002355

Continues on next page

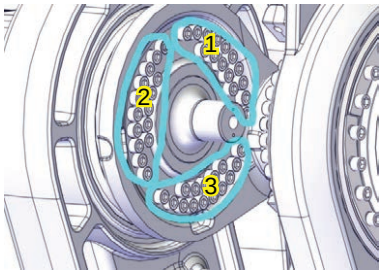
	Action	Note
13	Remove the guide pins and attach the remaining screws.	 xx1500002356

Securing the motor flange and gearbox

Use this procedure to secure the axis-3 gearbox, together with the motor flange, to the frame.

	Action	Note
1	Tighten the motor flange screws.	Tightening torque: 300 Nm  xx1500002373

Tighten the axis-3 gearbox screws in area 3

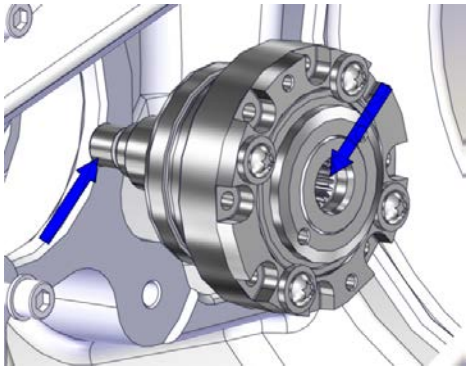
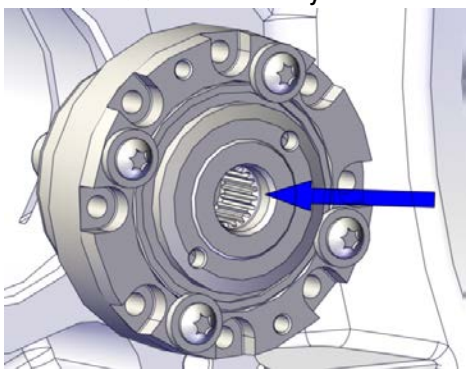
	Action	Note
1	Find area 3.	 xx1500002974
2	Tighten the already attached screws, in area 3.	Tightening torque: 300 Nm
3	**Tip** To make sure that all screws in this area are torqued, use a marker pen and mark each screw after it has been torqued.	
4	Examine that all screws in this area now has been torqued.	

Continues on next page

4.9.4 Replacing the axis-3 gearbox

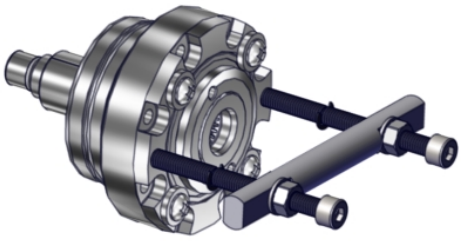
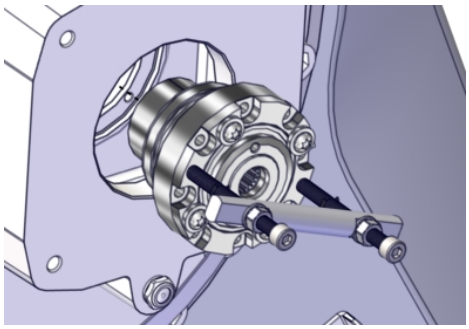
Continued

Preparations before refitting the hub

	Action	Note
1	Wipe the hub clean.	
2	Inspect the hole where the hub shall be refitted. Wipe clean if needed.	
3	Make sure the o-ring on the hub is undamaged. **Note** Replace if damaged.	 xx1500002039
4	Apply some grease on the o-ring for a better fitting.	
5	Examine the pinion and the splines in the hub for damages.	 xx1500002082
6	Make sure that there is enough grease on the splines before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346

Continues on next page

Refitting the hub

	Action	Note
1	Fit the hub tool.	Hub tool: 3HAC071355-001  xx2000001377
2	**CAUTION** Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	
3	Lift the hub to the gear, and mate the pinon carefully into the gear.	 xx2000001381
4	Remove the hub tool and fit the attachment screws for the hub. Apply locking liquid (Loctite 2400 (or equivalent Loctite 243)) on the screws. **Note** The number of attachment screws differ depending on gearbox.	Attachment screws: M6x30 12.9. Loctite 2400 (or equivalent Loctite 243) Quantity: • Axis-1 = 6 pcs • Axis-2 = 8 pcs • Axis-3 = 8 pcs • Axis-4 = 4 pcs • Axis-5 = 6 pcs • Axis-6 = 4 pcs
5	Secure the hub.	Tightening torque: 14 Nm.

Performing a leak-down test

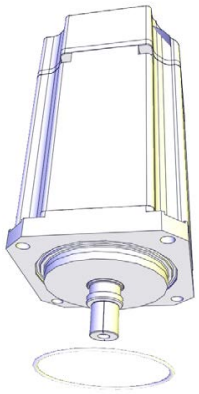
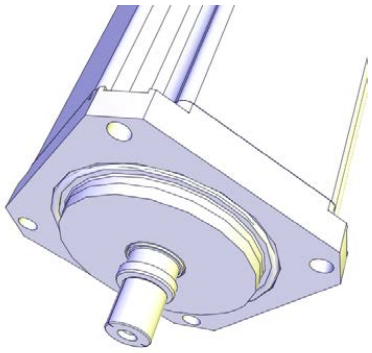
	Action	Note
1	Perform a leak-dowm test.	See *Performing a leak-down test on page 187*.

Continues on next page

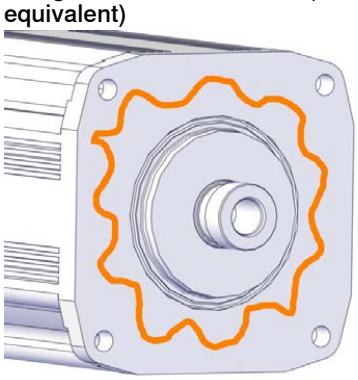
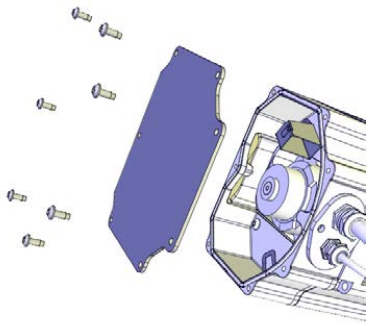
4.9.4 Replacing the axis-3 gearbox

Continued

Preparations before refitting the motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove old paint residues and other contamination from the contact surfaces on both motor and gearbox.	
3	Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
5	Make sure the o-ring is seated in the groove. **Tip** Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020

Continues on next page

	Action	Note
6	Apply flange sealant on the motor flange.	Flange sealant: Loctite 574 (or equivalent)  xx1500002357
7	If the motor is a new spare part, remove the cover.	 xx1200001135

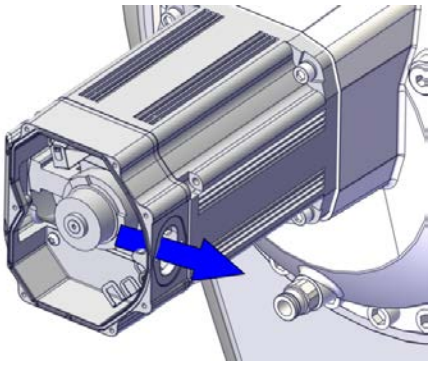
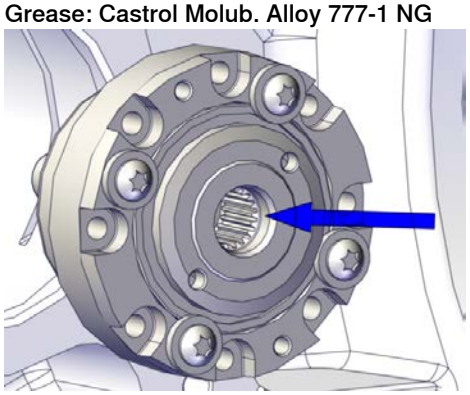
Securing the axis-3 motor

	Action	Note
1	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
2	**CAUTION** The motor weighs 27 kg. All lifting accessories used must be sized accordingly!	
3	Apply the lifting accessory.	Lifting accessory, motor: 3HAC15534-1

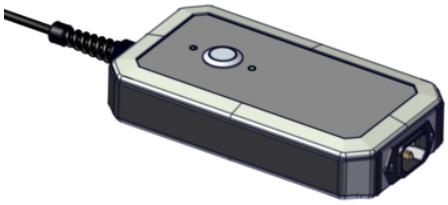
Continues on next page

4.9.4 Replacing the axis-3 gearbox

Continued

	Action	Note
4	**Note** Make sure the cable exit hole is turned the correct way.	 xx1600000050
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.	
6	Make sure that there is enough grease on the splines, before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346
7	Remove the lifting accessory and allow the motor to rest on the guide pins.	
8	Apply the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool: 3HAC7887-1

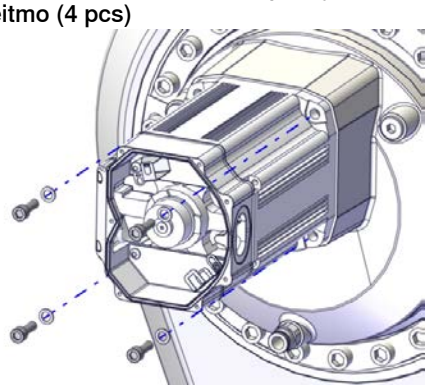
Continues on next page

	Action	Note
9	Release the brakes of the axis-2/3 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the R2.MP2 (axis-2 motor) or R2.MP3 (axis-3 motor) connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP2 / R2.MP3: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
10	**CAUTION** Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used!	
11	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 into the hub. • Make sure that the motor pinion does not get damaged. • Make sure that the direction of the cable exit is facing the correct way.	
12	Fit two of the attachment screws.	Screw dimension: M10x40 quality 12.9 Gleitmo (4 pcs)
13	Remove the guide pins and replace with the remaining attachment screws.	

Continues on next page

4.9.4 Replacing the axis-3 gearbox

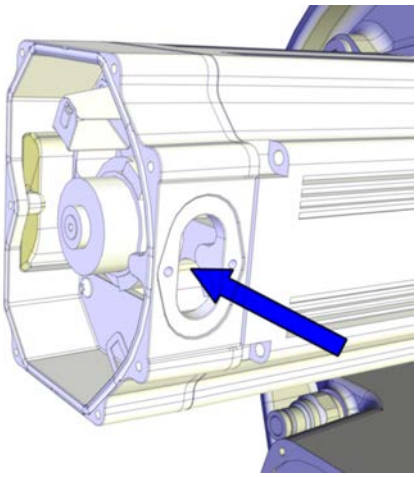
Continued

	Action	Note
14	Secure the motor with its attachment screws and washers. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1 Tightening torque: 50 Nm. Screw dimension: M10x40 quality 12.9 Gleitmo (4 pcs)  xx1500002323
15	Disconnect the brake release tool / 24 VDC power supply.	

Performing a leak-down test

	Action	Note
1	Perform a leak-dowm test.	See *Performing a leak-down test on page 187*.

Connecting the axis-3 motor cables

	Action	Note
1	Push the motor cables through the cable gland opening.	 xx1300000738

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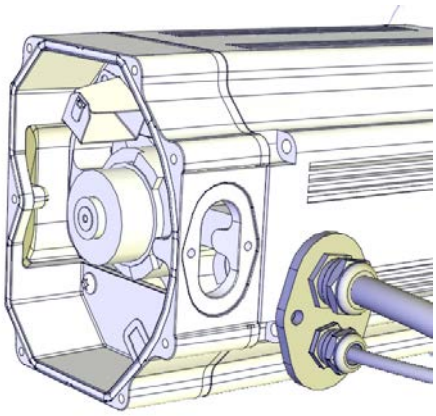
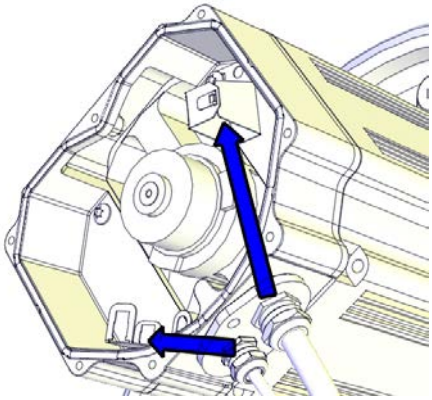
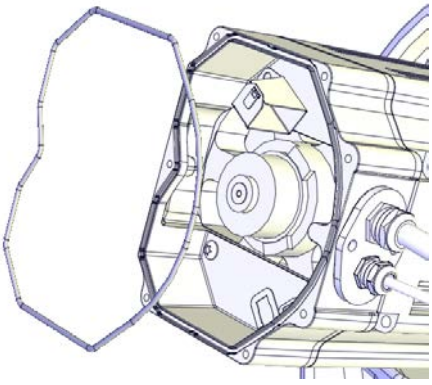
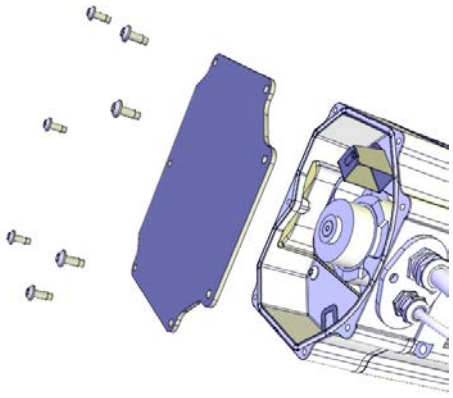
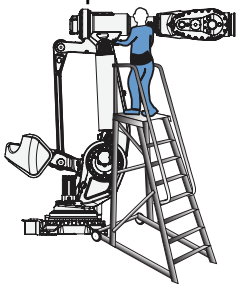
	Action	Note
2	Refit the cable gland cover. **Note** Replace the gasket if damaged.	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066
4	Inspect the o-ring. **Note** Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-002  xx1200001070
5	Wipe clean o-ring and o-ring groove.	

Continues on next page

4.9.4 Replacing the axis-3 gearbox
Continued

	Action	Note
6	Refit the o-ring. **Tip** Lubricate the o-ring with some grease for a better fitting in the groove.	
7	**CAUTION** When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8	Refit the motor cover with it's attachment screws. **Note** Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged. **Note** Make sure the o-ring is undamaged and properly fitted.	Attachment screws: M5x12 8.8 (7 pcs)  xx1200001135
9	Make sure that the covers are tightly sealed.	

Restoring the pressure of the balancing device

	Action	Note
1	Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device. **DANGER** Do not use the robot as ladder.	Mobile platform ladder  xx1500001985

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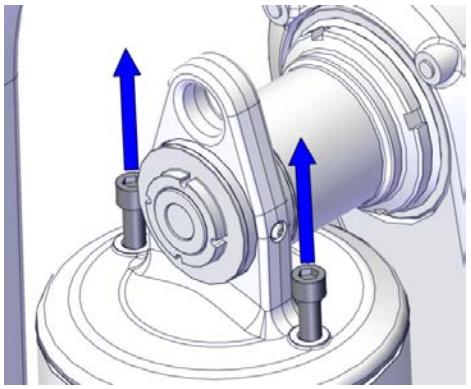
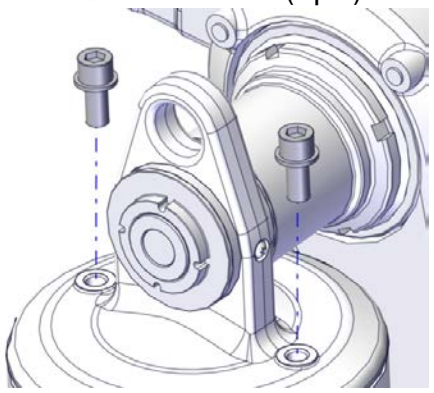
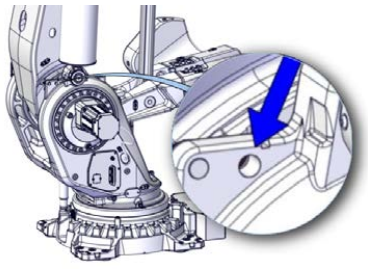
	Action	Note
2	Restore the pressure of the balancing device by unscrewing the two M16x80 screws alternately little by little.	 xx1500002308
3	Remove the screws.	
4	Refit the M16x35 screws in the holes on top of the balancing device.	Attachment screws: M16x35 (2 pcs)  xx1500001971

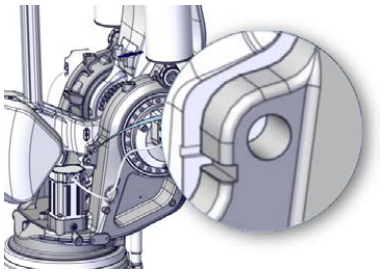
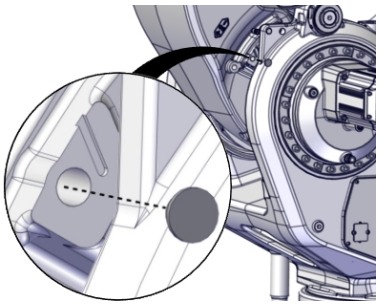
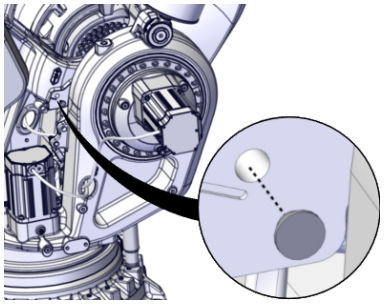
Removing lock screws

	Action	Note
1	Turn on the power.	
2	Use caution and start unscrewing the axis-2 lock screw, while at the same time very slowly jogging axis-2, until it is possible to unscrew the lock screw completely.	 xx1500002322

Continues on next page

4.9.4 Replacing the axis-3 gearbox

Continued

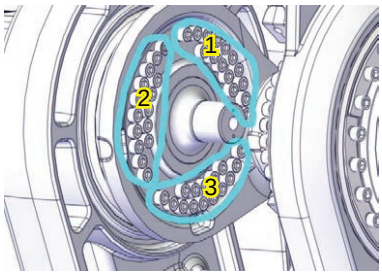
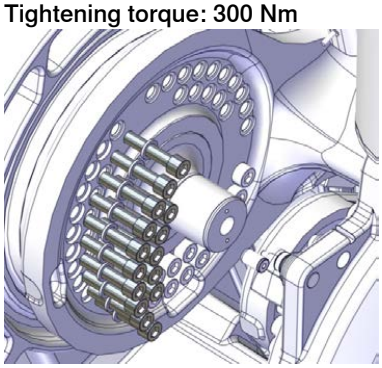
	Action	Note
3	Use caution and start unscrewing the axis-3 lock screw, while at the same time very slowly jogging axis-3, until it is possible to unscrew the lock screw completely.	 xx1500002321
4	Jog axis-2 to the position where it is possible to attach the plastic plug and attach the plug.	 xx1500002335
5	Jog axis-3 to the position where it is possible to attach the plastic plug and attach the plug.	 xx1500002366

Robot position when attaching the screws in area 2

	Action	Note
1	Jog the robot to the specified position: • Axis 1: no significance as long as the robot is fitted to the foundation. • Axis 2: -65° • Axis 3: 0° • Axis 4: 0° • Axis 5: 0° • Axis 6: No significance.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Continues on next page

Refitting the axis-3 gearbox screws in area 2

	Action	Note
1	Find area 2.	 xx1500002974
2	Attach and secure the screws in area 2.	Attachment screws: M16x70 12.9 Gleitmo Tightening torque: 300 Nm  xx1500003115 Lower arm is hidden in this figure, to get a better view.
3	**Tip** To make sure that all screws in this area are torqued, use a marker pen and mark each screw after it has been torqued.	
4	Examine that all screws in this area has been torqued.	

Robot position when attaching the screws in area 1

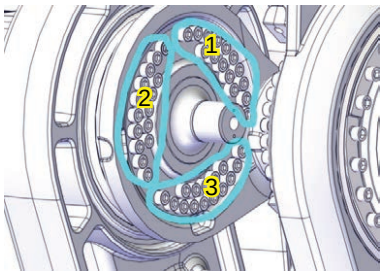
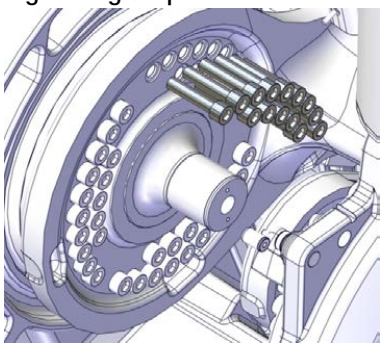
	Action	Note
1	Jog the robot to the specified position: • Axis 1: no significance as long as the robot is fitted to the foundation. • Axis 2: +48° • Axis 3: 0° • Axis 4: 0° • Axis 5: 0° • Axis 6: No significance.	

Continues on next page

4.9.4 Replacing the axis-3 gearbox
Continued

	Action	Note
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Refitting the axis-3 gearbox screws in area 1

	Action	Note
1	Find area 1.	 xx1500002974
2	Attach and secure the screws in area 1.	Attachment screws: M16x70 12.9 Gleitmo Tightening torque: 300 Nm  xx1500003114 Lower arm is hidden in this figure, to get a better view.
3	**Tip** To make sure that all screws in this area are torqued, use a marker pen and mark each screw after it has been torqued.	
4	Examine that all screws in this area now has been torqued.	

Continues on next page

Concluding procedure

	Action	Note
1	Perform a leak-down test (if not already done).	See *Performing a leak-down test on page 187*.
2	Refill the gearbox with oil.	See *Changing oil in axis-2 and axis-3 gearbox on page 147*.
3	Re-calibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 688*. General calibration information is included in section *Calibration on page 675*.
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 97*.	

4.9.5 Replacing the axis-4 gearbox and gear Z3

L3 spare part

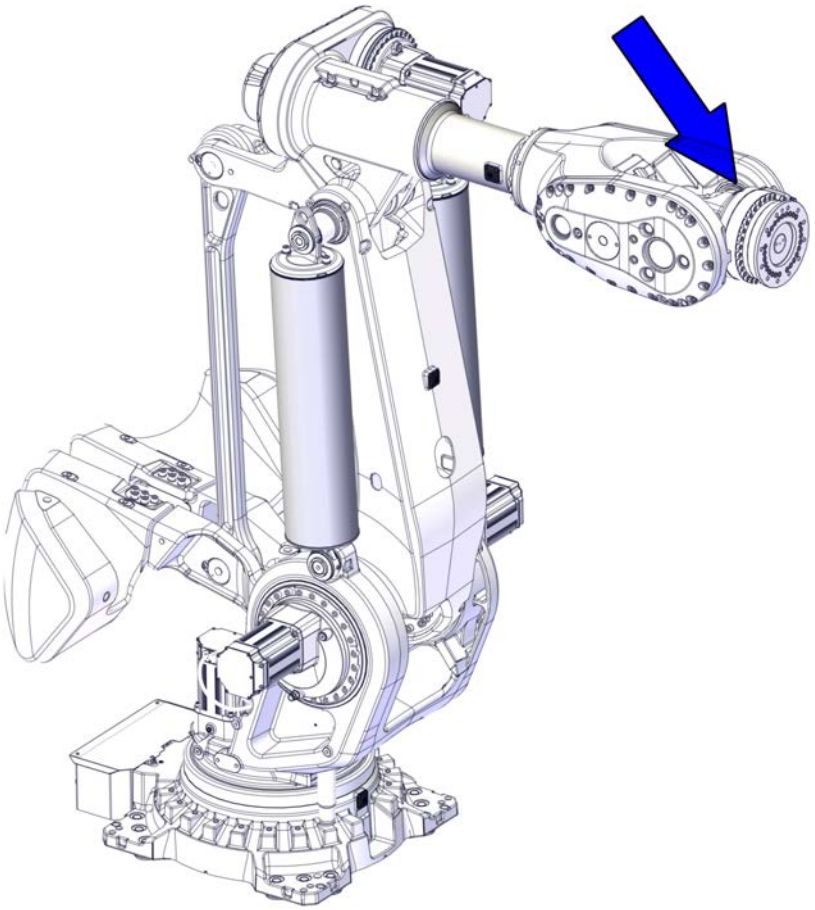
The axis-4 gearbox and the cylindrical gear Z3 are classified as L3 spare parts. The repair procedures are therefor not described in the product manual. Contact ABB Service for replacement.

See *Spare part level on page 186*.

4.9.6 Replacing the axis-6 gearbox

Location of the axis-6 gearbox

The axis-6 gearbox is located as shown in the figure.



xx1500002072

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 8700 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Reduction Gear RV-500N-236.36	3HAC043073-003 Graphite White 3HAC048293-001 ABB Orange		L2

Continues on next page

Spare part	Article number	Note	Level
Sealing ring	3HAC052423-002		L2

Required tools and equipment

Equipment, etc.	Article number	Note
Brake release tool	3HAC081310-001	Used to release the motor brakes. User instructions are enclosed with the tool. Alternative tool: 24 VDC power supply
Roundsling 1 m	-	Lifting capacity: 1,000 kg
Removal tool M14	3HAC047108-001	Used to push out the motor if necessary. Always use removal tools in pairs.
Leak-down tester	-	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 720*.

Required consumables

Consumable	Article number	Note
Grease	3HAC063069-001	Castrol Molub. Alloy 777-1 NG, 5 ml. To be used on hub splines to prevent from fretting corrosion.

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 689*.
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Continues on next page

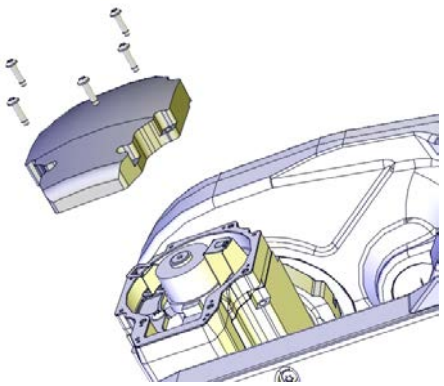
Removing the gearbox

Use these procedures to remove the gearbox.

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 to a comfortable position for removing the turning disc. This is especially important when removing the heavier process turning disc.	
3	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
4	Remove all tools and other equipment fitted to the turning disc.	
5	Drain the axis-6 gearbox.	See *Changing oil, axis-6 gearbox on page 168*.

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. **Note** Do not damage the gasket. Replace if damaged.	 xx1200001080

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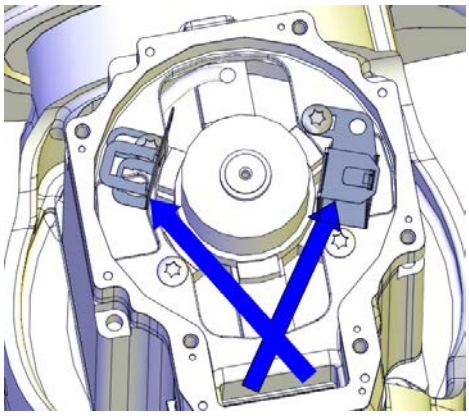
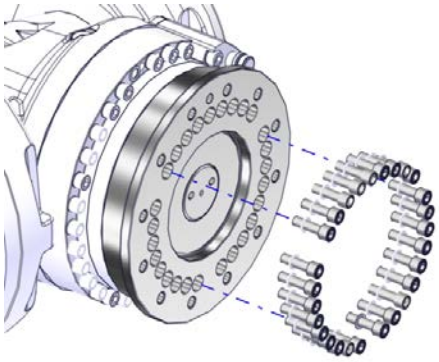
4.9.6 Replacing the axis-6 gearbox

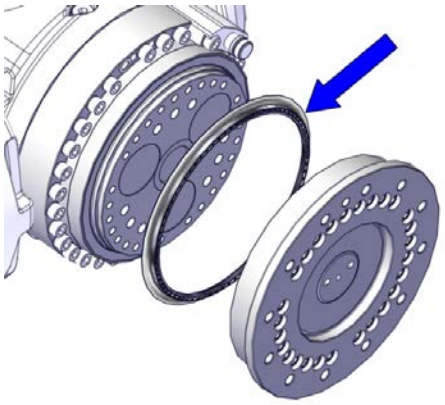
Continued

	Action	Note
3	Disconnect the motor cables.	 xx1300000488

Removing the turning disc

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the 27 M12x40 screws and washers that secure the turning disc.	 xx1500002318
3	Remove the turning disc.	 xx1500002319

Continues on next page

	Action	Note
4	When the gearbox is removed, make sure not to loose the sealing ring. It must be fitted on the gearbox when the turning disc is refitted. **Note** On a new gearbox, the sealing ring must be removed from the old gearbox, and fitted on the new one.	 xx1600000074

Removing the process turning disc

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**CAUTION** The process turning disc weighs 50 kg. All lifting accessories must be sized accordingly.	
3	Attach a roundsling to the process turning disc and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg
4	Stretch the roundsling to take the weight of the process turning diss.	
5	Unscrew the 22 attachment screws and washers that secure the process turning disc.	
6	Remove the process turning disc.	

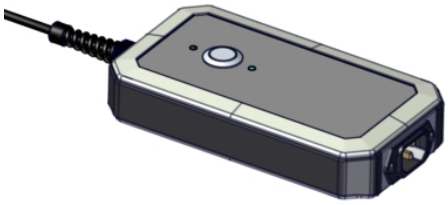
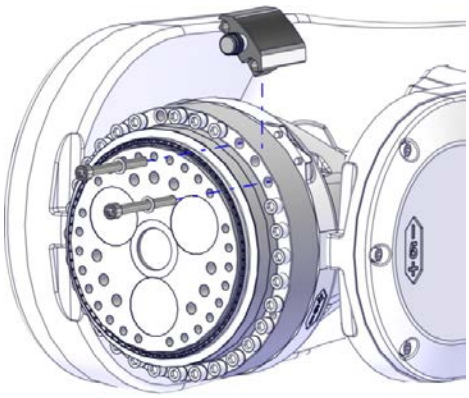
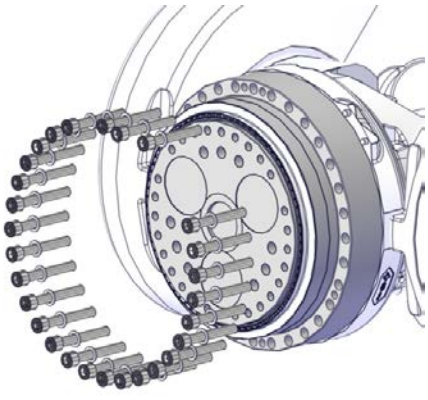
Removing the axis-6 gearbox

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

Continues on next page

4.9.6 Replacing the axis-6 gearbox

Continued

	Action	Note
2	Release the brakes of the axis-6 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the R2.MP6 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP6: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
3	Remove the calibration pin holder, by unscrewing the two M12x110 screws. **Note** Use caution not to damage the guiding pins.	 xx1500002981
4	Unscrew the attachment screws that secure the axis-6 gearbox.	 xx1500002982

Continues on next page

	Action	Note
5	**CAUTION** Whenever parting/mating hub and gearbox, the splines may be damaged if excessive force is used.	
6	If required, fit two attachment screws in opposite holes and use them to press out the gearbox.	
7	Use caution and remove the gearbox.	 xx1500002983

Refitting the gearbox

Use these procedures to refit the gearbox.

Preparations before refitting the axis-6 gearbox

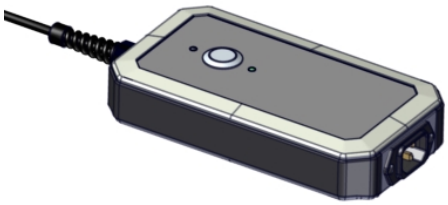
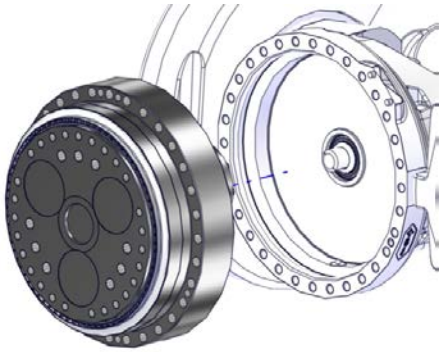
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Wipe clean all contact surfaces.	
3	Fit a new sealing ring.	Sealing ring 3HAC052423-001  xx1600000067

Continues on next page

4.9.6 Replacing the axis-6 gearbox

Continued

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	**CAUTION** Whenever parting/mating hub and gearbox, the splines may be damaged if excessive force is used!	
3	Release the brakes of the axis-6 motor with the brake release tool. 1 Turn off the brake release tool. 2 Connect the tool to the R2.MP6 connector. 3 Release the brakes by turning on the brake release tool and pressing the brake release button on the tool. **DANGER** Handling the tool incorrectly will cause serious injury. Read and follow enclosed user instructions for the tool. **Note** If a 24 VDC power supply is used instead of the brake release tool, connect it to connector R2.MP6: • pin 2 = 24V • pin 5 = 0V	Brake release tool: 3HAC081310-001 User instructions are enclosed with the tool.  xx2100000666
4	Use caution and refit the gearbox.	 xx1500002983

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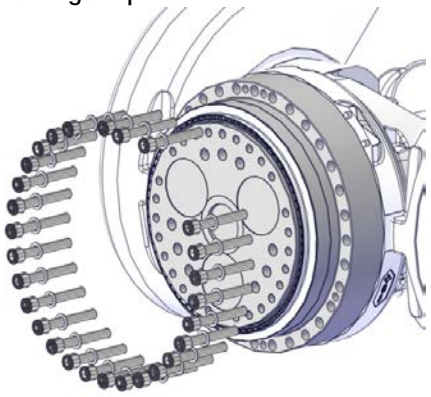
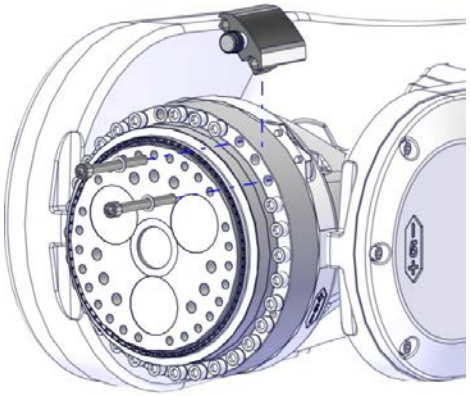
	Action	Note
5	Secure the gearbox with its attachment screws and washers. **Note** Do not refit any of the M12x80 screws where the pin holder will be refitted with the M12x110 screws.	Attachment screws: M12x80 12.9 Gleitmo (29 pcs) Tightening torque: 120 Nm  xx1500002982
6	Secure the pin holder with its attachment screws and washers.	Attachment screws: M12x110 12.9 Gleitmo (2 pcs) Tightening torque: 120 Nm  xx1500002981
7	Perform a leak-down test.	See *Performing a leak-down test on page 187*.

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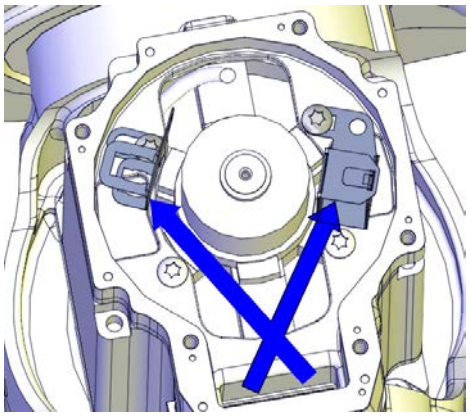
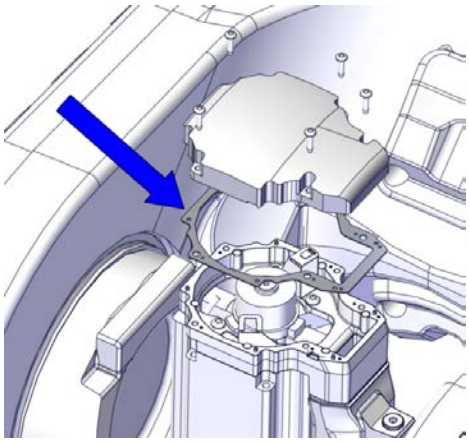
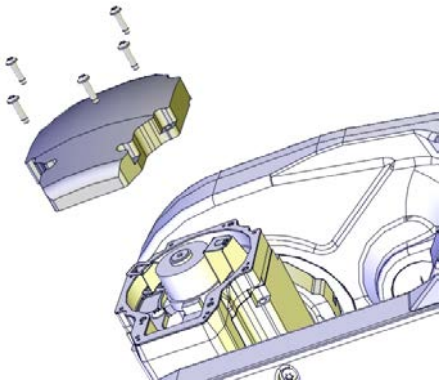
4.9.6 Replacing the axis-6 gearbox

Continued

Connecting the axis-6 motor cables

	Action	Note
1	Reconnect the the axis-6 motor connectors. **Note** Place the resolver cable underneath the motor cable.	 xx1300000488
2	Make sure the gasket on the motor cover is undamaged. **Note** Replace if damaged.	 xx1500003095
3	**CAUTION** When refitting the motor cover, make sure that none of the cables inside will be damaged.	
4	Refit the motor cover.	Attachment screws: M5x20 (5 pcs)  xx1200001080

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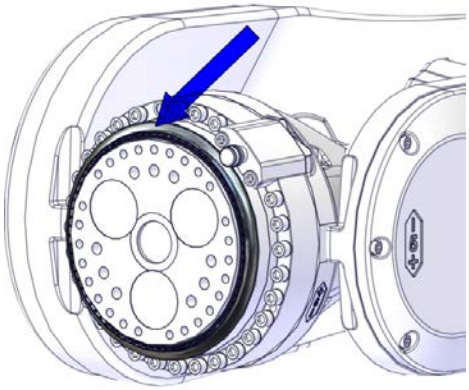
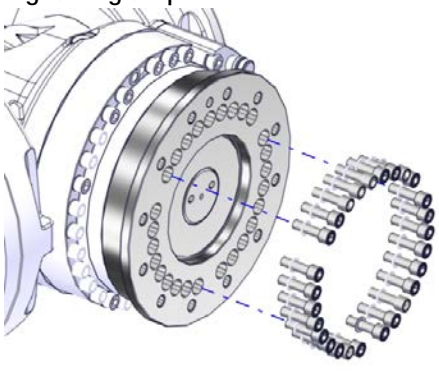
Refitting the turning disc

	Action	Note
1	Wipe clean the contact surfaces and refit the axis-6 gearbox.	 xx1500002319
2	Make sure the sealing ring is fitted on the gearbox.	 xx1500002984
3	Secure the turning disc with its attachment screws and washers.	Attachment screws: M12x40 12.9 Gleitmo 603 (27 pcs) Tightening torque: 120 Nm  xx1500002318

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4.9.6 Replacing the axis-6 gearbox

Continued

Refitting the process turning disc

	Action	Note
1	**CAUTION** The process turning disc weighs 50 kg. All lifting accessories must be sized accordingly.	
2	Attach the lifting accessories to the process turning disc.	
3	Wipe clean the contact surfaces.	
4	Make sure the process turning disc is refitted in the correct position.	
5	Secure the process turning disc with its attachment screws and washers.	Attachment screws: M12x40 12.9 Gleitmo 603 (22 pcs) Tightening torque: 120 Nm

Concluding procedure

	Action	Note
1	Refill the gearbox with oil.	See *Changing oil, axis-6 gearbox on page 168*.
2	Re-calibrate the robot.	Axis Calibration is described in *Calibrating with Axis Calibration method on page 688*. General calibration information is included in section *Calibration on page 675*.
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 97*.	

5 Calibration

5.1 Introduction to calibration

5.1.1 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 688*.

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.

5.1.2 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. For IRC5 robots, the absolute accuracy calibration data is delivered in a file, absacc.cfg, supplied with the robot at delivery. The file replaces the calib.cfg file and identifies motor positions as well as absolute accuracy compensation parameters. A robot calibrated with Absolute accuracy has a sticker next to the identification plate of the robot (IRC5). 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.  xx0400001197	CalibWare

Continues on next page

Type of calibration	Description	Calibration method
Optimization	Optimization of TCP reorientation performance. The purpose is to improve reorientation accuracy for continuous processes like welding and gluing. Wrist optimization will update standard calibration data for axes 4 and 5. **Note** For advanced users, it is also possible to use the do the wrist optimization using the RAPID instruction `WristOpt`, see *Technical reference manual - RAPID Instructions, Functions and Data types*. This instruction is only available for OmniCore robots.	Wrist Optimization

Brief description of calibration methods

Axis Calibration method

Axis Calibration is a standard calibration method for calibration of IRB 8700. 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 688*.

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.

Wrist Optimization method

Wrist Optimization is a method for improving reorientation accuracy for continuous processes like welding and gluing and is a complement to the standard calibration method.

The actual instructions of how to perform the wrist optimization procedure is given on the FlexPendant.

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.

Continues on next page

5.1.2 Calibration methods
Continued

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 721*.

5.1.3 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 682*. 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.

5.2 Synchronization marks and axis movement directions

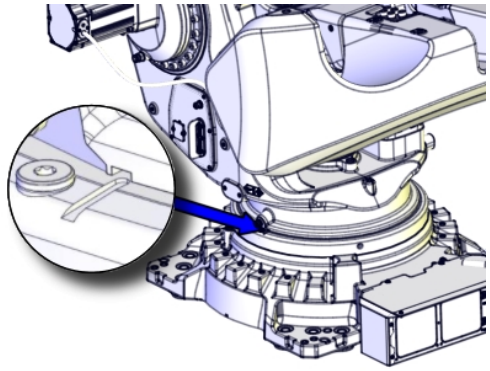
5.2.1 Synchronization marks and synchronization position for axes

Introduction

This section shows the position of the synchronization marks and the synchronization position for each axis.

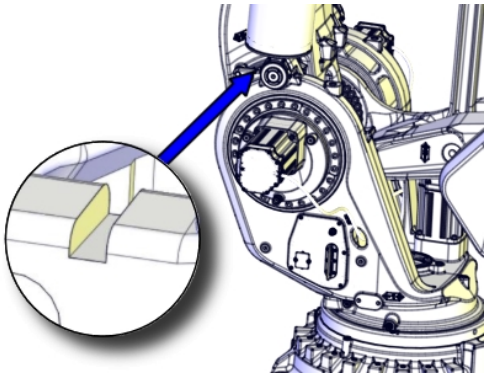
Synchronization marks, IRB 8700

Axis 1



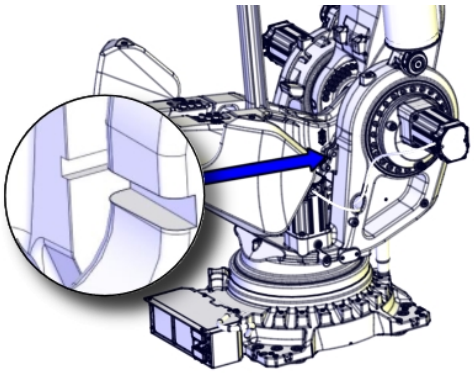
xx1500000945

Axis 2



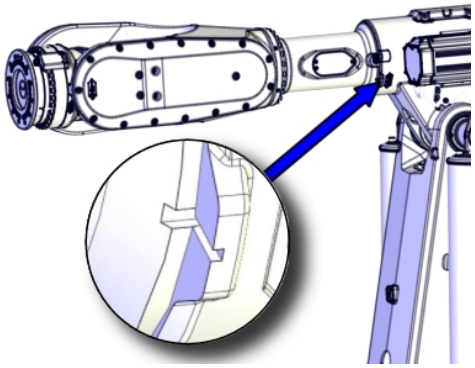
xx1500000946

Axis 3



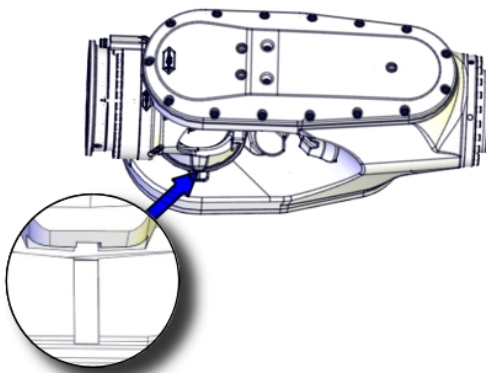
xx1500000947

Axis 4



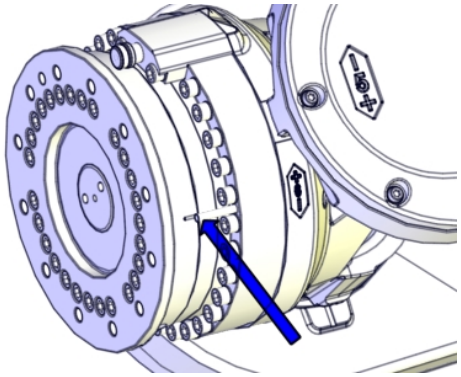
xx1500000948

Axis 5



xx1500000949

Axis 6



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5.2.2 Calibration movement directions for all axes

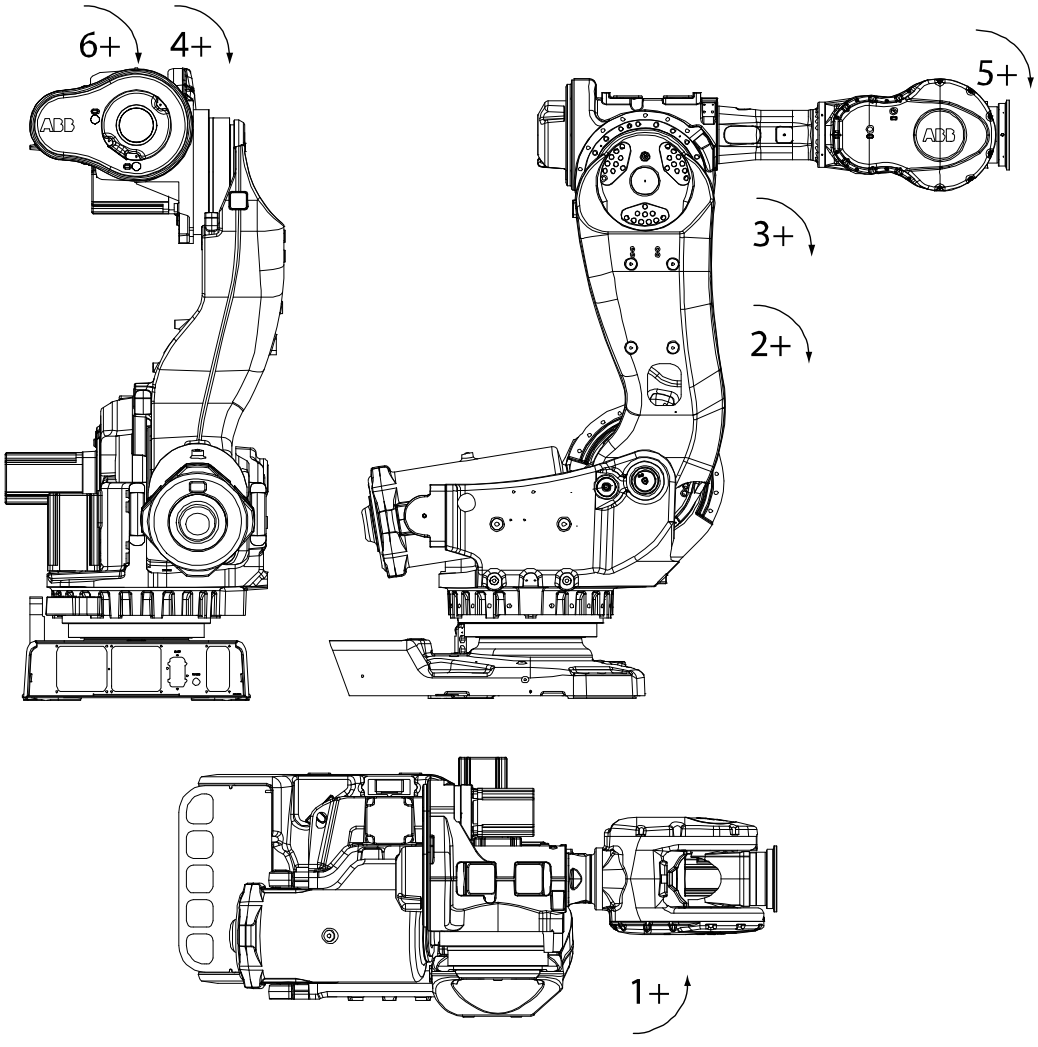
Overview

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, 6 axes

Note! The graphic shows an IRB 7600. The positive direction is the same for all 6-axis robots, except the positive direction of axis 3 for IRB 6400R, which is in the opposite direction!



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5.3 Updating revolution counters

5.3.1 Updating revolution counters on IRC5 robots

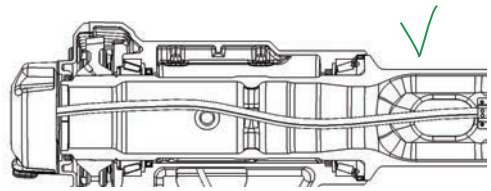
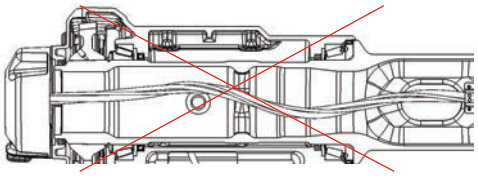
Introduction

This section describes how to do a rough calibration of each manipulator axis by updating the revolution counter for each axis, using the FlexPendant.

Mandatory check of cable harness prior to revolution counter update or calibration

Before updating the revolution counter or performing calibration, the status of the cable harness in the tubular shaft must be checked. There is a possibility that axis 4 has been rotated more than ±360° and therefor is positioned incorrectly (at wrong turn), causing the cable harness inside the tubular shaft to be twisted, which can damage the cabling.

Check the cable harness using a flashlight into the tubular shaft. Check that the cable harness is not twisted inside the tubular shaft.

Cabling is straight = axis 4 is positioned at correct turn	Cabling is twisted = axis 4 is positioned at wrong turn (rotated more than ±360°)
 xx1900001237	 xx1900001236

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. **CAUTION** Check the position of axis 4 before continuing, see *Mandatory check of cable harness prior to revolution counter update or calibration on page 682*.	See *Synchronization marks and synchronization position for axes on page 680*.
3	When all axes are positioned, update the revolution counter.	*Step 2 - Updating the revolution counter with the FlexPendant on page 683*.

Correct calibration position of axis 4 and 6

When jogging the manipulator to synchronization position, it is extremely important to make sure that axes 4 and 6 of the following mentioned manipulators are positioned correctly. The axes can be calibrated at the wrong turn, resulting in an incorrect manipulator calibration.

Continues on next page

Make sure the axes are positioned according to the correct calibration values, not only according to the synchronization marks. The correct values are found on a label, located either on the lower arm, underneath the flange plate on the base or on the frame.

At delivery the manipulator is in the correct position. Do NOT rotate axis 4 or 6 at power up before the revolution counters are updated.

If one of the following mentioned axes are rotated one or more turns from its calibration position before updating the revolution counter, the correct calibration position will be lost due to non-integer gear ratio. This affects the following manipulators:

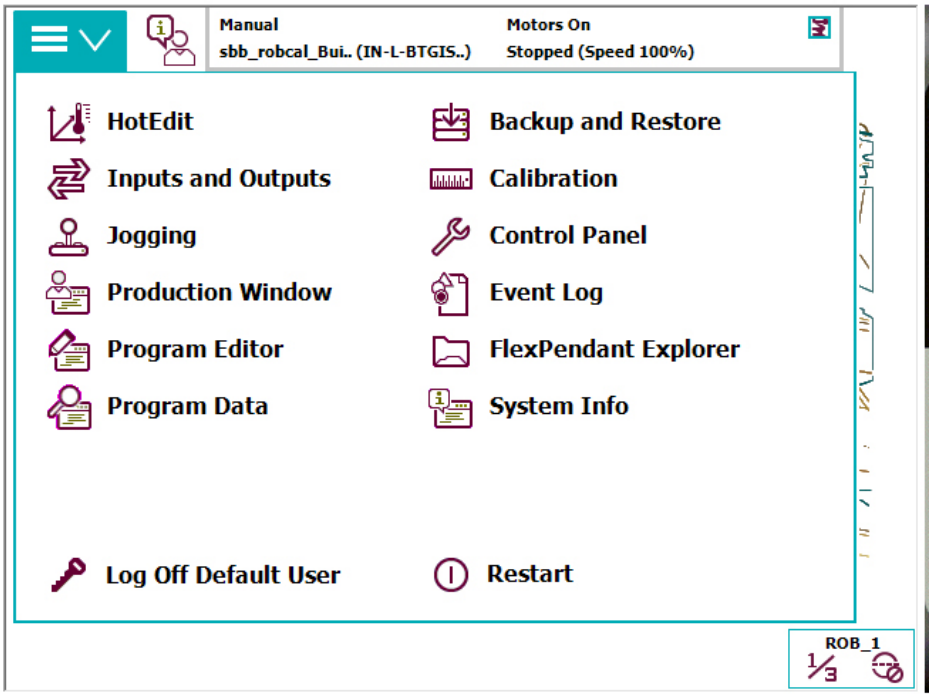
Manipulator variant	Axis 4	Axis 6
IRB 8700	Yes	Yes

If the synchronization marks seem to be wrong (even if the motor calibration data is correct), try to rotate the axis one turn, update the revolution counter and check the synchronization marks again (try both directions, if needed).

Step 2 - Updating the revolution counter with the FlexPendant

Use this procedure to update the revolution counter with the FlexPendant (IRC5).

	Action
1	On the **ABB** menu, tap **Calibration**.



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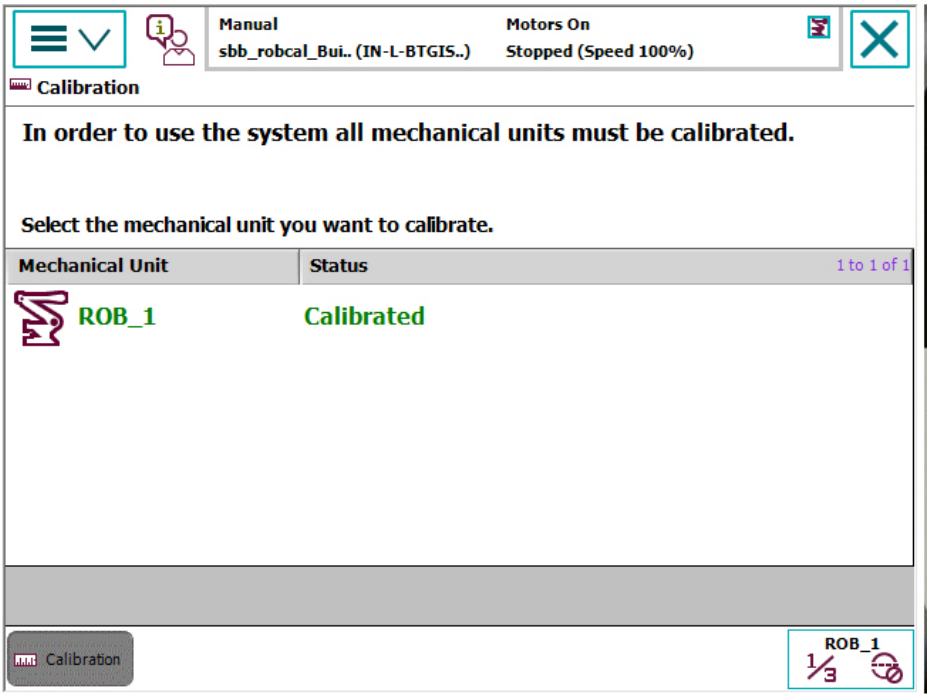
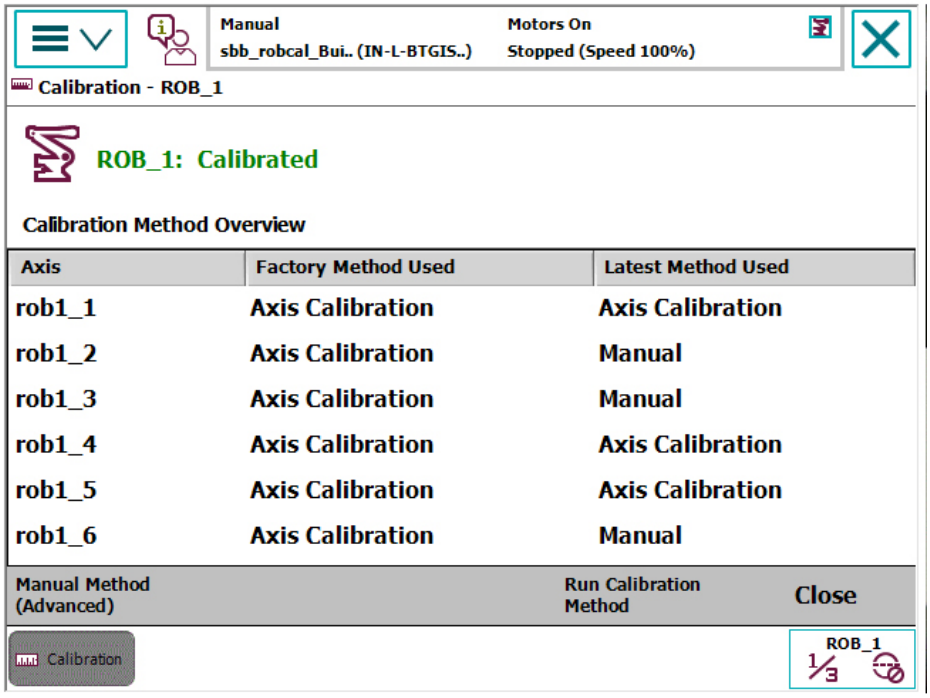
5.3.1 Updating revolution counters on IRC5 robots
Continued

	Action
2	All mechanical units connected to the system are shown with their calibration status. Tap the mechanical unit in question.  xx1500000943
3	**This step is valid for RobotWare 6.02 and later.** Calibration method used at factory for each axis is shown, as well as calibration method used during last field calibration. Tap **Manual Method (Advanced)**.  xx1500000944

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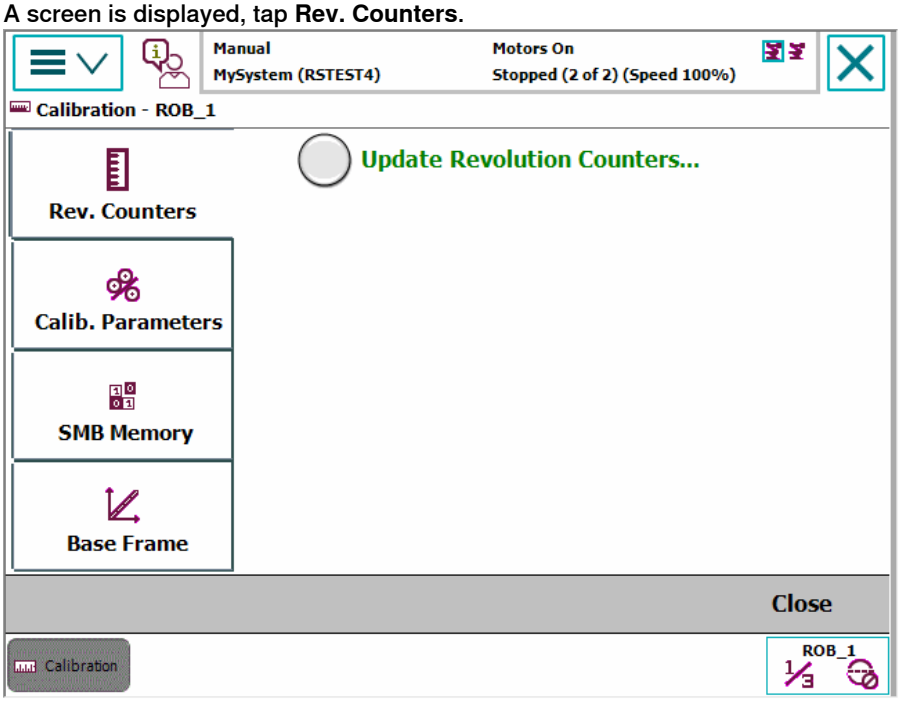
	Action
4	A screen is displayed, tap **Rev. Counters**.  en0400000771
5	Tap **Update Revolution Counters...**. A dialog box is displayed, warning that updating the revolution counters may change programmed robot positions: • Tap **Yes** to update the revolution counters. • Tap **No** to cancel updating the revolution counters. Tapping **Yes** displays the axis selection window.
6	Select the axis to have its revolution counter updated by: • Ticking in the box to the left • Tapping **Select all** to update all axes. Then tap **Update**.
7	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** updates the selected revolution counters and removes the tick from the list of axes.
8	**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 704*.

5.3.2 Updating revolution counters on OmniCore robots

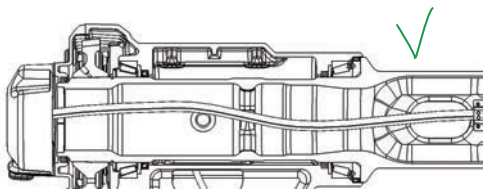
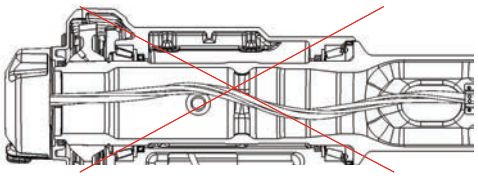
Introduction

This section describes how to do a rough calibration of each manipulator axis by updating the revolution counter for each axis, using the FlexPendant.

Mandatory check of cable harness prior to revolution counter update or calibration

Before updating the revolution counter or performing calibration, the status of the cable harness in the tubular shaft must be checked. There is a possibility that axis 4 has been rotated more than ±360° and therefor is positioned incorrectly (at wrong turn), causing the cable harness inside the tubular shaft to be twisted, which can damage the cabling.

Check the cable harness using a flashlight into the tubular shaft. Check that the cable harness is not twisted inside the tubular shaft.

Cabling is straight = axis 4 is positioned at correct turn	Cabling is twisted = axis 4 is positioned at wrong turn (rotated more than ±360°)
 xx1900001237	 xx1900001236

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 680*.
3	When all axes are positioned, update the revolution counter.	*Step 2 - Updating the revolution counter with the FlexPendant on page 687*.

Correct calibration position of axis 4 and 6

When jogging the manipulator to synchronization position, it is extremely important to make sure that axes 4 and 6 of the following mentioned manipulators are positioned correctly. The axes can be calibrated at the wrong turn, resulting in an incorrect manipulator calibration.

Make sure the axes are positioned according to the correct calibration values, not only according to the synchronization marks. The correct values are found on a label, located either on the lower arm, underneath the flange plate on the base or on the frame.

At delivery the manipulator is in the correct position. Do NOT rotate axis 4 or 6 at power up before the revolution counters are updated.

Continues on next page

If one of the following mentioned axes are rotated one or more turns from its calibration position before updating the revolution counter, the correct calibration position will be lost due to non-integer gear ratio. This affects the following manipulators:

If the synchronization marks seem to be wrong (even if the motor calibration data is correct), try to rotate the axis one turn, update the revolution counter and check the synchronization marks again (try both directions, if needed).

Step 2 - Updating the revolution counter with the FlexPendant

Use this procedure to update the revolution counter with the FlexPendant (OmniCore).

	Action
1	On the start screen, tap **Calibrate**. The calibration summary page for the mechanical unit is displayed.
2	In the **Calibration Methods** menu, select **Revolution Counters**.
3	In the **Selection** column select the axes for which revolution counters need to be updated.
4	Tap **Update**. A dialog box is displayed warning that the updating operation cannot be undone.
5	Tap **OK** to update the revolution counter.
6	**CAUTION** If a revolution counter is incorrectly updated, it will cause incorrect manipulator positioning, which in turn may cause damage or injury! Check the synchronization position very carefully after each update. See *Checking the synchronization position on page 704*.

5.4 Calibrating with Axis Calibration method

5.4.1 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

5.4.1 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.

For robots with EPS, the same applies as for SafeMove.

5.4.2 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 tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.

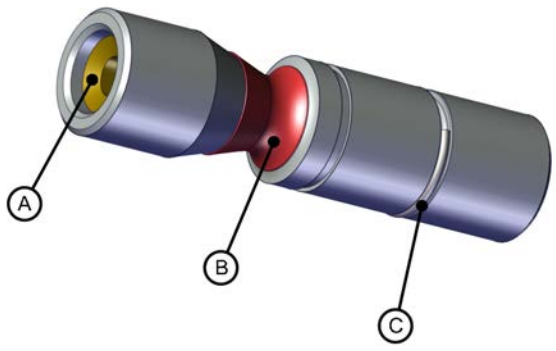
Examining the calibration tool

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.



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A	Tube insert
B	Plastic protection
C	Steel spring ring

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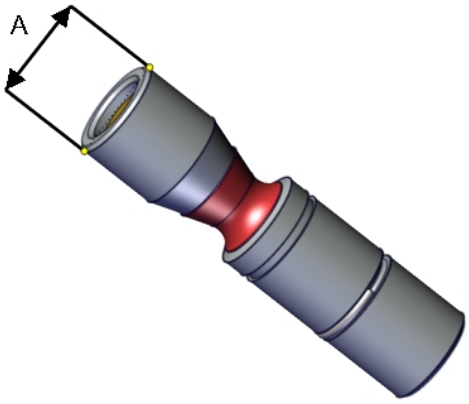
5.4.2 Calibration tools for Axis Calibration
Continued

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.



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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.

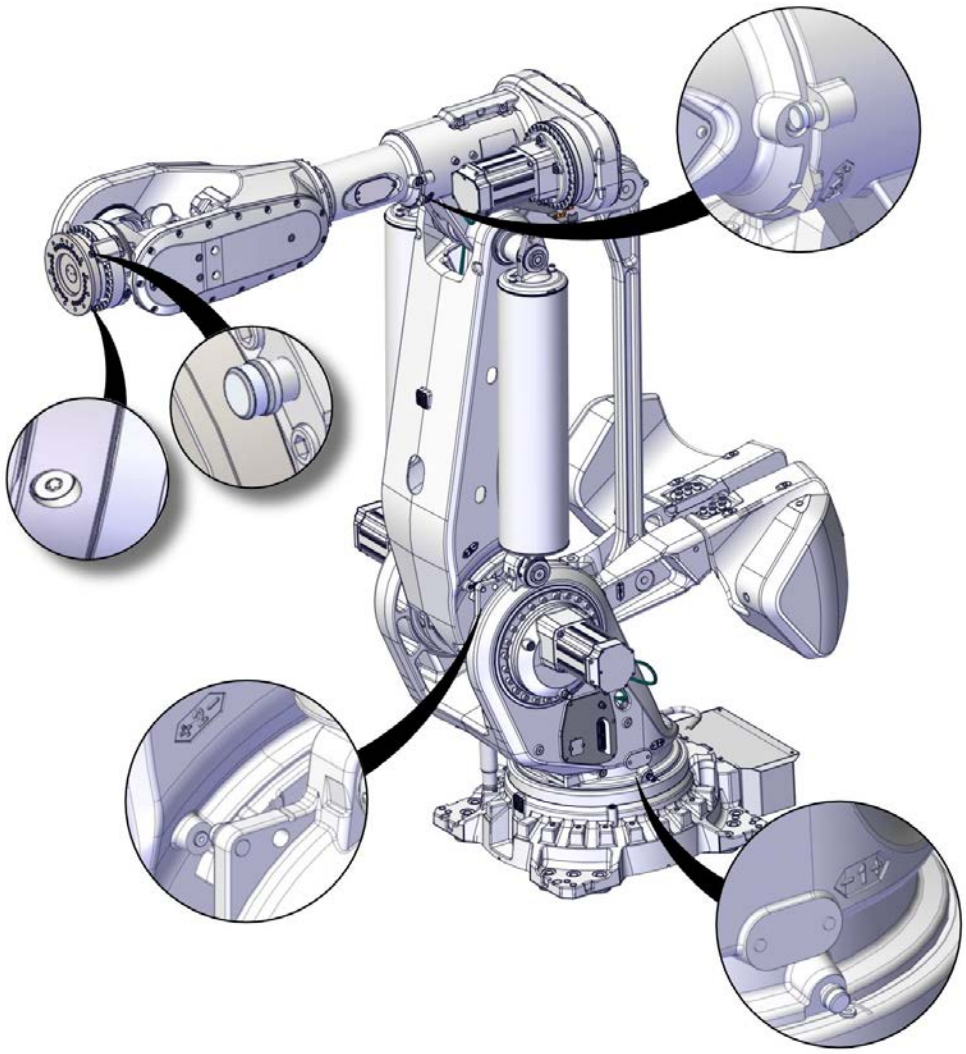
	Action	Note
1	It is possible to use any RFID solution, with the correct dimensions. ABB has verifed function on some suppliers fulfilling the requirements of NFC compatible devices (13.56 Mhz) according to ISO 14443 or ISO 15693. **Note** The maximum dimensions on the RFID chip must not exceed Ø7.9 mm 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.	

5.4.3 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.



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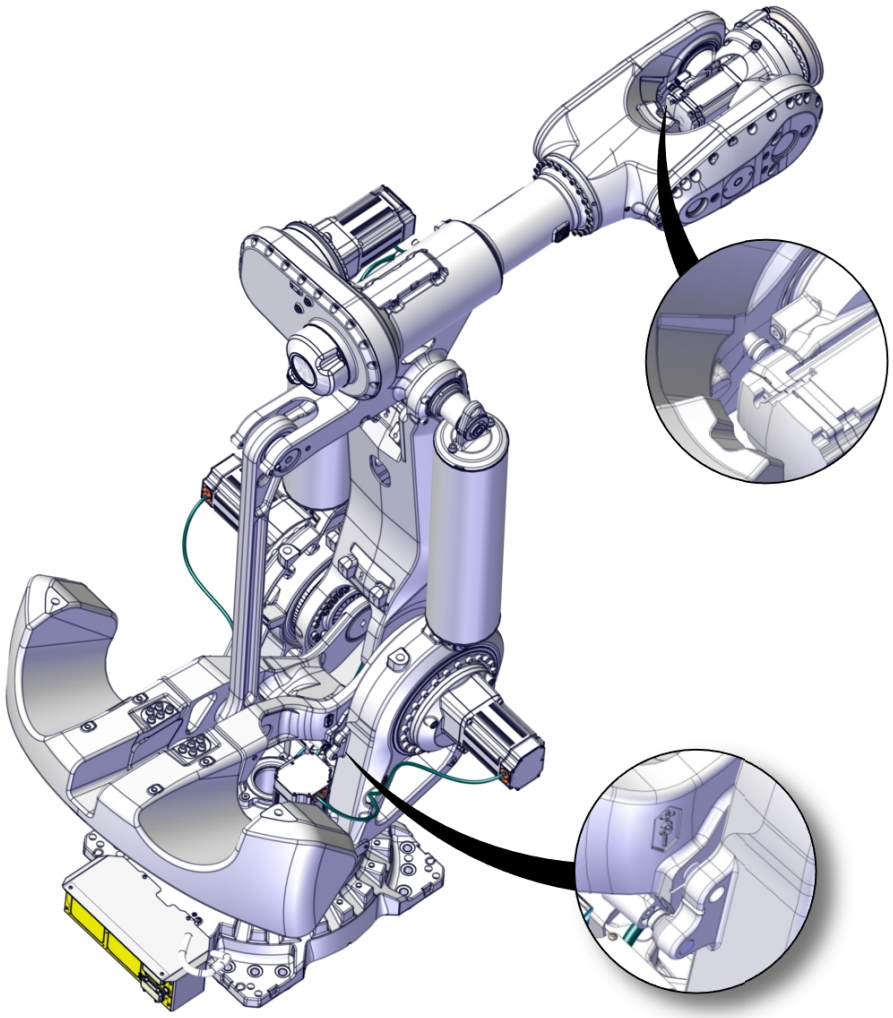
5.4.3 Installation locations for the calibration tools
Continued



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Spare parts

When calibration is not being performed, a protective cover and an o-ring should always be installed on the fixed calibration pin as well as a protective plug, included a sealing, in the bushing. Replace damaged parts with new.

Spare part	Article number	Note
Protection cover and plug set	3HAC056806-001	Contains replacement calibration pin covers and protective plugs for the bushing.

5.4.4 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 tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.

Required consumables

Consumable	Article number	Note
Clean cloth	-	

Spare parts

Spare part	Article number	Note
Protection cover and plug set	3HAC056806-001	Contains replacement calibration pin covers and protective plugs for the bushing.

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 689*.
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.
7. The robot performs a measurement sequence by rotating the axis back and forth.

Continues on next page

5.4.4 Axis Calibration - Running the calibration procedure
Continued

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.
3	Check if the standard calibration data for axes 4 or 5 are updated with wrist optimization. This is shown in the calibration overview/summary window on the FlexPendant.	If the data is optimized, the calibration routine **Wrist Optimization** must be re-run after standard calibration. See *Calibrating with Wrist Optimization method on page 701*.

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.

Continues on next page

	Action	Note
4	**Valid for RobotWare 6** Tap **Call Calibration Method**. The software will automatically call for the procedure for the valid calibration method. If not, tap **Call Routine** and then tap **Axis calibration**.	
5	**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.	
6	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 695*.

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 681*

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.

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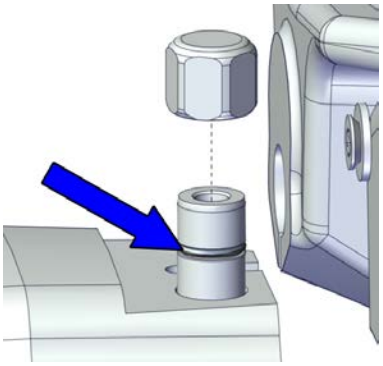
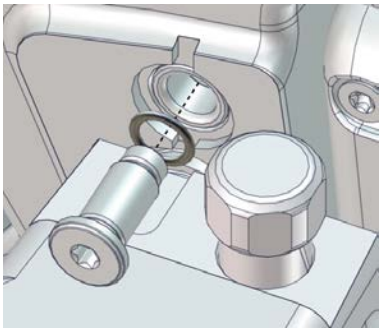
5.4.4 Axis Calibration - Running the calibration procedure
Continued

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: 3HAC056806-001.
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: 3HAC056806-001.
4	If the standard calibration data for axes 4, 5 or 6 should be updated with wrist optimization, run the calibration routine **Wrist Optimization**.	See *Calibrating with Wrist Optimization method on page 701*.

5.4.5 Reference calibration

Brief introduction to Reference Calibration

Reference calibration is a faster method compared to Fine calibration, as it refers to a previously made calibration.

1. Create a backup of the current robot system.
2. Check that the active calibration offset values corresponds to the values on the calibration label (located on the lower arm or the base).
3. Jog the manipulator so that all axes are in zero position (ex use `MoveAbsJ` instruction). Check that all axis scales are aligned with calibration marks.
4. If the scales differ from calibration marks it might depend on wrong turns of the revolution counters. Make a marker line on the corresponding axis to be able to validate the result of the calibration. If more than one motor revolutions are wrong, the calibration will fail.
5. Use a verification position. This is especially recommended if all axes were not aligned with the synchronization marks (step 3). Reuse an existing position that is suitable and accurate so it can be used to validate the repair. Use a position where a deviation in axis calibration gives a big deviation in positioning. Note! Check the position after each repair in one axis.
6. Use Reference calibration to save reference values for all axes that is to be replaced. Make sure that the values are saved in RobotStudio or FTP program. The files are located in "Active system folder name/HOME/RefCalibFiles".
7. Perform the repair.
8. Make sure that the tooling and process equipment are the same as when creating the reference. Use Reference calibration to update the system with new calibration offset value for the repaired axis.
9. Check the position against the verification position (step 5).
10. Proceed with the repair of the next axis, if necessary, and repeat (step 8-9) for every axis.
11. (For system containing SafeMove or EPS) Download new calibration values to SafeMove. Use Visual SafeMove in RobotStudio.(For system containing SafeMove) Download new calibration values to SafeMove. Use Visual SafeMove in RobotStudio.
12. (For system containing SafeMove or EPS) Synchronize SafeMove to activate SafeMove.(For system containing SafeMove) Synchronize SafeMove to activate SafeMove.
13. Perform test run.
14. Update the calibration label with new resolver values (calibration values).

Manual tuning of calibration offset

Manual tuning of calibration offset is normally not needed, but can be useful in some situations. The requirement to do manual tuning is that there is a known accurate position, that worked accurately before the repair (step 5, see *Brief introduction to Reference Calibration on page 699*).

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5.4.5 Reference calibration
Continued

Example "Adjust axis 4":

1. Create a backup.
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.

5.5 Calibrating with Wrist Optimization method

When to run Wrist Optimization

Wrist Optimization routine is run to improve TCP reorientation performance.

Calibrating the robot with standard calibration method overwrites the optimized positions of axes 4, 5. Re-run the **Wrist Optimization** routine after standard calibration to re-achieve the optimized positions of the wrist axes.

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 sequence.

After the calibration method has been called for on the FlexPendant, the following sequence will be run.

1 Choose calibration routine Wrist Optimization.

2 Modify targets for 4-point tool frame definition, in Wrist Optimization routine.

> **Tip**
>
> Select positions with large reorientations around the TCP. For best results, make sure that axis 4 and 5 have large movements.

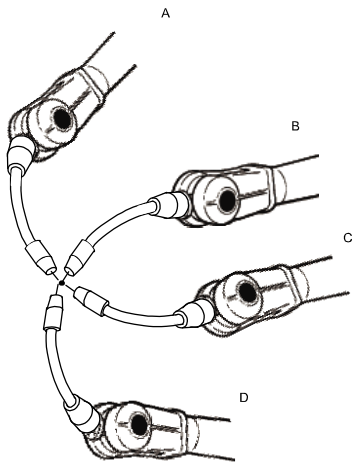
a Jog the robot to an appropriate position, A, for the first approach point.

Use small increments to accurately position the tool tip as close to the reference point as possible.

b Tap **Modify Position** to define the point.

c Repeat for each approach point to be defined, positions B, C, and D.

Jog away from the fixed world point to achieve the best result. Just changing the tool orientation will not give as good a result.



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3 Improved calibration data to the wrist axes is identified and presented.

4 Optimized positions for the wrist axes are presented.

Continues on next page

5 The robot moves to the optimized positions for the wrist axes and automatically overwrites previous calibration data.

WARNING

Robot moves automatically when pressing **Calibrate**.

6 Wrist optimization is finished.

7 Redefine / verify TCP for all tools.

5.6 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 704*.
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 680*.
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.	

5.7 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 **Jogging** window on the FlexPendant.Using the **Jog** window on the FlexPendant.

Continues on next page

5.7.1 Checking the synchronization position on IRC5 robots

Using a MoveAbsJ instruction

Use this procedure to create a program that runs all the robot axes to their synchronization position.

	Action	Note
1	On ABB menu tap **Program editor**.	
2	Create a new program.	
3	Use **MoveAbsJ** in the **Motion&Proc** 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 680* and *Updating revolution counters on page 682*.

Using the jogging window

Use this procedure to jog the robot to the synchronization position of all axes.

	Action	Note
1	On the **ABB** menu, tap **Jogging**.	
2	Tap **Motion mode** to select group of axes to jog.	
3	Tap to select the axis to jog, axis 1, 2, or 3.	
4	Manually run the robots axes to a position where the axis position value read on the FlexPendant, is equal to zero.	
5	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 680* and *Updating revolution counters on page 682*.

5.7.2 Checking the synchronization position on OmniCore robots

Using a MoveAbsJ instruction

Use this procedure to create a program that runs all the robot axes to their synchronization position.

	Action	Note
1	Tap **Code**.	
2	Create a new program.	
3	Use **MoveAbsJ** in the **Add Instruction** menu.	

4	Create the following program:
	`MoveAbsJ [[0,0,0,0,0,0],`
	`[9E9,9E9,9E9,9E9,9E9,9E9]]`
	`\NoEOffs, v1000, fine, tool0`	

5	Run the program in manual mode.	
6	Check that the synchronization marks for the axes align correctly. If they do not, update the revolution counters.	See *Synchronization marks and synchronization position for axes on page 680* and *Updating revolution counters on page 682*.

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 680* and *Updating revolution counters on page 682*.

6 Decommissioning

6.1 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 708*.

Transportation

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

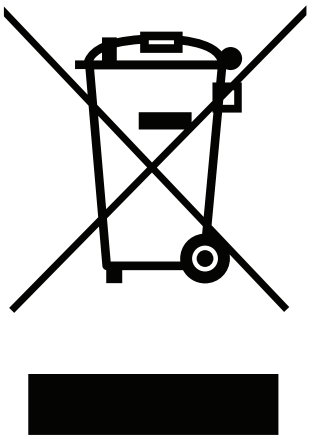
6.2 Environmental information

Introduction

ABB robots contain components in different materials. During decommissioning, all materials shall be dismantled, recycled, or reused responsibly, according to the relevant laws and industrial standards. Robots or parts that can be reused or upcycled helps to reduce the usage of natural resources.

Disposal symbol

The following symbol indicates that the product must not be disposed of as common garbage. Handle each product according to local regulations for the respective content (see table below).



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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	Covers, synchronization brackets
Batteries, Lithium	Serial measurement board
Cast iron/nodular iron	Base, lower arm, upper arm
Copper	Cables, motors
Neodymium	Brakes, motors
Nickel	Turning disc (foundry)
Oil, grease	Gearboxes
Plastic/rubber	Cables, connectors, drive belts, and so on.
Steel	Gears, screws, base frame, and so on.

Continues on next page

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.

6.3 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.

6.4 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 720*.
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 devices on page 414*.
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

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.
5		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.	

7 Reference information

7.1 Introduction

General

This chapter includes general information, complementing the more specific information in the different procedures in the manual.

7.2 Applicable standards

General

The product is compliant with ISO 10218-1:2011, *Robots for industrial environments - Safety requirements - Part 1 Robots*, and applicable parts in the normative references, as referred to from ISO 10218-1:2011. In case of deviation from ISO 10218-1:2011, these are listed in the declaration of incorporation. The declaration of incorporation is part of the delivery.

Robot standards

Standard	Description
ISO 9283	Manipulating industrial robots – Performance criteria and related test methods
ISO 9787	Robots and robotic devices – Coordinate systems and motion nomenclatures
ISO 9946	Manipulating industrial robots – Presentation of characteristics

Other standards used in design

Standard	Description
IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements, normative reference from ISO 10218-1
IEC 61000-6-2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
IEC 61000-6-4	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
ISO 13849-1:2006	Safety of machinery - Safety related parts of control systems - Part 1: General principles for design, normative reference from ISO 10218-1
UL 1740 (option) CSA Z434 (option)	Standards For Safety - Robots and Robotic Equipment Industrial robots and robot Systems - General safety requirements Valid for USA and Canada.

7.3 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	

7.4 Screw joints

General

This section describes how to tighten the various types of screw joints on ABB robots.

The instructions and torque values are valid for screw joints comprised of metallic materials and do *not* apply to soft or brittle materials.

UNBRAKO screws

UNBRAKO is a special type of screw recommended by ABB for certain screw joints. It features special surface treatment (Gleitmo as described below) and is extremely resistant to fatigue.

Whenever used, this is specified in the instructions, and in such cases, *no other type of replacement screw* is allowed. Using other types of screws will void any warranty and may potentially cause serious damage or injury.

Gleitmo treated screws

Gleitmo is a special surface treatment to reduce the friction when tightening the screw joint. It is recommended by ABB for M6-M20 screw joints. Screws treated with Gleitmo may be reused 3-4 times before the coating disappears. After this the screw must be discarded and replaced with a new one.

When handling screws treated with Gleitmo, protective gloves of **nitrile rubber** type should be used.

Generally, screws are lubricated with *Gleitmo 603* mixed with *Geomet 500* or *Geomet 702* in proportion 1:3. *Geomet* thickness varies according to screw dimensions, refer to the following.

Dimension	Lubricant	Geomet thickness
M6-M20 (any length except M20x60)	*Gleitmo 603 + Geomet 500*	3-5 µm
M6-M20 (any length except M20x60)	*Gleitmo 603 + Geomet 720*	3-5 µm
M20x60	*Gleitmo 603 + Geomet 500*	8-12 µm
M20x60	*Gleitmo 603 + Geomet 720*	6-10 µm

Screws lubricated in other ways

Screws lubricated with Molykote 1000 or Molykote P1900 should *only* be used when specified in the repair, maintenance or installation procedure descriptions.

In such cases, proceed as follows:

1. Apply lubricant to the screw thread.
2. Apply lubricant between the plain washer and screw head.
3. Screw dimensions of M8 or larger must be tightened with a torque wrench. Screw dimensions of M6 or smaller may be tightened without a torque wrench *if* this is done by trained and qualified personnel.

Continues on next page

Lubricant	Article number
Molykote 1000 (molybdenum disulphide grease)	3HAC042472-001
Molykote P1900 (molybdenum disulphide grease)	3HAC070875-001

Tightening torque

Before tightening any screw, note the following:

- Determine whether a **standard** tightening torque or **special** torque is to be applied. The **standard torques** are specified in the following tables. Any **special torques** are specified in the repair, maintenance or installation procedure descriptions. **Any special torque specified overrides the standard torque!**
- Use the *correct tightening torque* for each type of screw joint.
- Only use *correctly calibrated* torque keys.
- Always *tighten the joint by hand,* and never use pneumatic tools.
- Use the *correct tightening technique*, that is *do not* jerk. Tighten the screw in a slow, flowing motion.
- Maximum allowed total deviation from the specified value is **10%**!

Tightening torque for oil-lubricated screws with slotted or cross-recess head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws* with *slotted or cross-recess head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Tightening torque for oil-lubricated screws with allen head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws* with *allen head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque (Nm) Class 8.8, oil-lubricated	Tightening torque (Nm) Class 10.9, oil-lubricated	Tightening torque (Nm) Class 12.9, oil-lubricated
M5	6	-	-
M6	10	-	-
M8	24	34	40
M10	47	67	80
M12	82	115	140
M16	200	290	340
M20	400	560	670

Continues on next page

7.4 Screw joints
Continued

Dimension	Tightening torque (Nm) Class 8.8, oil-lubricated	Tightening torque (Nm) Class 10.9, oil-lubricated	Tightening torque (Nm) Class 12.9, oil-lubricated
M24	680	960	1150

Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws

The following table specifies the recommended standard tightening torque for *screws lubricated with Molycote 1000, Gleitmo 603 or equivalent* with *allen head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque (Nm) Class 10.9, lubricated [i]	Tightening torque (Nm) Class 12.9, lubricated [i]
M5		8
M6		14
M8	28	35
M10	55	70
M12	96	120
M16	235	300
M20	460	550
M24	790	950

i Lubricated with Molycote 1000, Gleitmo 603 or equivalent

Water and air connectors

The following table specifies the recommended standard tightening torque for *water and air connectors*.

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Material	Tightening torque Nm - Nominal	Tightening torque Nm - Min.	Tightening torque Nm - Max.
ALL	Mixed	The lower tightening torque of the two materials.		
1/8	Brass only	12	8	15
1/4	Brass only	15	10	20
3/8	Brass only	20	15	25
1/2	Brass only	40	30	50
1/2	Stainless steel only	49	47	59
3/4	Brass only	70	55	90

7.5 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.	

7.6 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	Comment
1	Ring-open-end spanner 8-19 mm	
1	Socket head cap 2.5-17 mm	
1	Torx socket no: 20-60	
1	Box spanner set	
1	Torque wrench 10-100 Nm	
1	Torque wrench 75-400 Nm	
1	Ratchet head for torque wrench 1/2	
2	Hexagon-headed screw M10x100	
1	Hexagon-headed screw M16x90	
1	Hex bit socket head cap no. 14 socket 40 mm L=100 mm	
1	Hex bit socket head cap no. 14 socket 40 mm L=20 mm	To be shortened to 12 mm
1	Hex bit socket head cap no. 6 socket 40 mm L=145 mm	
1	Hex bit socket head cap no. 6 socket 40mm bit L=220 mm	
1	Hexagon socket spanner, socket size 14 mm	Used to remove and refit the R1.SMB in the base.
1	Plastic mallet	

7.7 Special tools

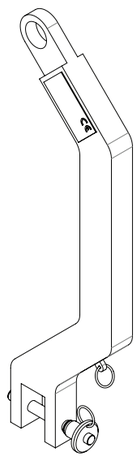
General

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 720*, and of special tools, listed directly in the instructions and also gathered in this section.

Special tools

Continues on next page

7.7 Special tools

Tools and equipment with spare part number: (These tools can be ordered from ABB)			Complete robot	Cable harness	Base plate	SMB	Brake release unit	Lower arm	Parallel arm	Parallel rod	Counterweight	Upper arm	Wrist	Axis-6 unit	Turning disc/ Process turning disc	Balancing devices	Balancing device bearing (link ear)	Axis 1 motor	Axis 2 motor	Axis 3 motor	Axis 4 motor	Axis 5 motor	Axis 6 motor	Hub	Axis 1 gearbox	Axis 2 gearbox	Axis 3 gearbox	Axis 4 primary gearbox	Axis 4 secondary gearbox	Axis 5 gearbox	Axis 6 gearbox
Guide pins																															
3HAC15521-1	Guide pin, M10x100																	2							2						
3HAC15521-2	Guide pin, M10x150																		2	2	2	2				2	2	2			
3HAC13056-2	Guide pin, M12x150																											2			
3HAC13056-3	Guide pin, M12x200																											2			
3HAC13120-2	Guide pin, M16x150																									2	2				
3HAC13120-3	Guide pin, M16x200																								2	2					
3HAC059801-001	Mounting set gear (axis 2 and 3)																									x	x				
Lifting accessories																															
3HAC053662-003	Fork lift accessory set		x																												
3HAC054236-001	Lifting accessory, balancing device	 xx1900001211						x	x			x				x[i]															
3HAC15556-1	Lifting accessory (chain)	 xx1200001241						2[ii]	x		x							x							x						
3HAC14459-1	Lifting accessory, motor																	x				x			x						
3HAC15534-1	Lifting accessory, motor																		x	x	x					x	x	x	x			

Continues on next page

Tools and equipment with spare part number: (These tools can be ordered from ABB)			Complete robot	Cable harness	Base plate	SMB	Brake release unit	Lower arm	Parallel arm	Parallel rod	Counterweight	Upper arm	Wrist	Axis-6 unit	Turning disc/ Process turning disc	Balancing devices	Balancing device bearing (link ear)	Axis 1 motor	Axis 2 motor	Axis 3 motor	Axis 4 motor	Axis 5 motor	Axis 6 motor	Hub	Axis 1 gearbox	Axis 2 gearbox	Axis 3 gearbox	Axis 4 primary gearbox	Axis 4 secondary gearbox	Axis 5 gearbox	Axis 6 gearbox
3HAC081585-001 (recommended) or 3HAC054404-001 (alternative)	Lifting accessory, gearbox																									x	x				
3HAC046128-001	Lifting accessory, gearbox																											x			
3HAC16131-1	Lifting eye VLBG M12	 xx1200001242						x	x			x																			
-	Lifting eye, with swivel Working load limit: 2,000 kg	 xx1200001242												2																		
3HAC14457-4	Lifting eye M16	 xx1200001242						4	4		4														2	x	x				
3HAC038295-003	Lifting eye M24	 xx1200001242	4		x																										
-	Lifting shackle SA-10-8-NA1	 xx1200001243																								x					
-	Fender washer Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.							x	x			x																			

Continues on next page

7.7 Special tools

Tools and equipment with spare part number: (These tools can be ordered from ABB)			Complete robot	Cable harness	Base plate	SMB	Brake release unit	Lower arm	Parallel arm	Parallel rod	Counterweight	Upper arm	Wrist	Axis-6 unit	Turning disc/ Process turning disc	Balancing devices	Balancing device bearing (link ear)	Axis 1 motor	Axis 2 motor	Axis 3 motor	Axis 4 motor	Axis 5 motor	Axis 6 motor	Hub	Axis 1 gearbox	Axis 2 gearbox	Axis 3 gearbox	Axis 4 primary gearbox	Axis 4 secondary gearbox	Axis 5 gearbox	Axis 6 gearbox
-	Roundsling 3 m Lifting capacity: 2,000 kg							x	x			x																			
-	Roundsling 2.5 m Lifting capacity: 5,000 kg		4					x	x			x														x	x				
-	Roundsling 2 m Lifting capacity: 5,000 kg				x			x	x																x	x	x	x			
-	Roundsling 1.5 m Lifting capacity: 2,000 kg																														
-	Roundsling 1 m Lifting capacity: 1,000 kg							x	x	x		x	x	x	x	x									2						x
Press, puller and unloading tools																															
-	Bearing puller							x	x			x				x															
3HAC071378-001	Hydraulic cylinder, parallel rod shaft							x	x	x		x																			
3HAC069154-017	Hydraulic cylinder, upper arm shaft							x	x	x		x																			
3HAC071377-001	Hydraulic cylinder, bearing							x	x	x		x					x														
-	Hydraulic pump, 700 bar							x	x	x		x																			
-	Glycerine pump, 1,500 bar							x																							
3HAC069154-009	Sleeve KM nut D=152 L=220							x	x	x																					
3HAC071313-001	Sleeve KM nut M10															x															
3HAC071352-001	Press tools, balancing device bearing																x														
3HAC069154-001	Press tools, upper arm shaft							x	x	x		x																			
3HAC071354-001	Press tools, parallel rod shaft							x	x	x		x																			
3HAC071353-001	Press tools, parallel rod bearing							x	x	x		x																			
Removal tools																															
-	Removal tool M10													x									x								
3HAC14631-1	Removal tool M12																	2	2	2	2	2			2	2		2			
3HAC047108-001	Removal tool M14																										2				

Continues on next page

Tools and equipment with spare part number: (These tools can be ordered from ABB)			Complete robot	Cable harness	Base plate	SMB	Brake release unit	Lower arm	Parallel arm	Parallel rod	Counterweight	Upper arm	Wrist	Axis-6 unit	Turning disc/ Process turning disc	Balancing devices	Balancing device bearing (link ear)	Axis 1 motor	Axis 2 motor	Axis 3 motor	Axis 4 motor	Axis 5 motor	Axis 6 motor	Hub	Axis 1 gearbox	Axis 2 gearbox	Axis 3 gearbox	Axis 4 primary gearbox	Axis 4 secondary gearbox	Axis 5 gearbox	Axis 6 gearbox
3HAC071355-001	Hub tool	 xx2000001378																								2				
Other tools																															
3HAC081310-001	Brake release tool							x	x	x		x		x				x	x	x	x	x	x		x	x	x	x	x	x	x
3HAC12342-1	Bits extender																	x	x	x	x	x			x	x					
3HAC055412-001	Calibration tool box, Axis Calibration Delivered as a set of calibration tools.							x	x	x	x	x	x	x				x	x	x	x	x	x		x	x	x	x			x
-	Leak-down tester																	x	x	x	x	x	x		x	x	x	x			x
-	Fixing screw, M10x80 (4 pcs)							4																							
-	Screw M16x80 Fully threaded, 2 pcs							2																							
-	Lock screw, quality 12.9, M20x150							x											x	x						x	x				
-	Oil collecting vessel																								x	x	x	x	x	x	x
-	Oil dispenser																		x	x					x	x	x				x
3HAC061213-001	Supporting pillars Used for elevation of the robot to remove and refit axis-1 gearbox. Includes: • Supporting pillars (4 pcs) • User instructions (3HAC062411-002) • Screws 3HAC061400-001 (4 pcs)																								x						
3HAC7887-1	Rotation tool																	x	x	x	x	x			x	x	x	x			
-	Hexagon socket spanner, socket size 14 mm			x																											
	ESD bag			x		x	x																								
-	Crowbar (small)							x	x			x																			
-	Glycerine adapter Used to replace upper arm shafts together with a glycerine press tool.							x	x	x		x																			
	Dial gauge							x	x	x		x																x			

Continues on next page

7.7 Special tools

Tools and equipment with spare part number: (These tools can be ordered from ABB)			Complete robot	Cable harness	Base plate	SMB	Brake release unit	Lower arm	Parallel arm	Parallel rod	Counterweight	Upper arm	Wrist	Axis-6 unit	Turning disc/ Process turning disc	Balancing devices	Balancing device bearing (link ear)	Axis 1 motor	Axis 2 motor	Axis 3 motor	Axis 4 motor	Axis 5 motor	Axis 6 motor	Hub	Axis 1 gearbox	Axis 2 gearbox	Axis 3 gearbox	Axis 4 primary gearbox	Axis 4 secondary gearbox	Axis 5 gearbox	Axis 6 gearbox
-	Mobile platform ladder							x	x	x		x														x	x	x			
-	Endless ratchet lashing belt							x	x	x																					

i On axis-4 motor side.
ii 4 chains required.

Continues on next page

7.8 Lifting accessories and lifting instructions

General

Many repair and maintenance activities require different pieces of lifting accessories, which are specified in each procedure.

The use of each piece of lifting accessories is *not* detailed in the activity procedure, but in the instruction delivered with each piece of lifting accessories.

The instructions delivered with the lifting accessories should be stored for later reference.

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8 Spare parts

8.1 Spare part lists and illustrations

Location

Spare parts and exploded views are not included in the manual but delivered as a separate document for registered users on myABB Business Portal, *www.abb.com/myABB*.

Tip

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

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9 Circuit diagrams

9.1 Circuit diagrams

Overview

The circuit diagrams are not included in this manual, but are available for registered users on myABB Business Portal, *www.abb.com/myABB*.

See the article numbers in the tables below.

Controllers

Product	Article numbers for circuit diagrams
Circuit diagram - OmniCore V400XT	*3HAC082020-008*
Circuit diagram - IRC5	*3HAC024480-011*

Manipulators

Product	Article numbers for circuit diagrams
Circuit diagram - IRB 120	*3HAC031408-003*
Circuit diagram - IRB 140 type C	*3HAC6816-3*
Circuit diagram - IRB 260	*3HAC025611-001*
Circuit diagram - IRB 360	*3HAC028647-009*
Circuit diagram - IRB 390	*3HAC060545-009*
Circuit diagram - IRB 460	*3HAC036446-005*
Circuit diagram - IRB 660	*3HAC025691-001*
Circuit diagram - IRB 760	*3HAC025691-001*
Circuit diagram - IRB 1200	*3HAC046307-003*
Circuit diagram - IRB 1410	*3HAC2800-3*
Circuit diagram - IRB 1600/1660	*3HAC021351-003*
Circuit diagram - IRB 1510	*3HAC087368-003*
Circuit diagram - IRB 1520	*3HAC039498-007*
Circuit diagram - IRB 2400	*3HAC6670-3*
Circuit diagram - IRB 2600	*3HAC029570-007*
Circuit diagram - IRB 4400/4450S	*3HAC9821-1*
Circuit diagram - IRB 4600	*3HAC029038-003*
Circuit diagram - IRB 6620	*3HAC025090-001*
Circuit diagram - IRB 6620 / IRB 6620LX	*3HAC025090-001*
Circuit diagram - IRB 6640	*3HAC025744-001*
Circuit diagram - IRB 6650S	*3HAC13347-1* *3HAC025744-001*
Circuit diagram - IRB 6660	*3HAC025744-001* *3HAC029940-001*

Continues on next page

9.1 Circuit diagrams
Continued

Product	Article numbers for circuit diagrams
Circuit diagram - IRB 6700 / IRB 6790	*3HAC043446-005*
Circuit diagram - IRB 7600	*3HAC13347-1* *3HAC025744-001*
Circuit diagram - IRB 14000	*3HAC050778-003*
Circuit diagram - IRB 910SC	*3HAC056159-002*

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3HAC052853-001, Rev V, en