



Product manual

IRB 8700

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Overview of this manual

About this manual

This manual contains instructions for:

- mechanical and electrical installation of the robot
 - maintenance of the robot
 - mechanical and electrical repair of the robot.
-

Usage

This manual should be used during:

- installation, from lifting the robot to its work site and securing it to the foundation, to making it ready for operation
 - maintenance work
 - repair work and calibration.
-

Who should read this manual?

This manual is intended for:

- installation personnel
 - maintenance personnel
 - repair personnel.
-

Prerequisites

A maintenance/repair/installation personnel working with an ABB Robot must:

- be trained by ABB and have the required knowledge of mechanical and electrical installation/repair/maintenance work.
-

Organization of chapters

The manual is organized in the following chapters:

Chapter	Contents
Safety	Safety information that must be read through before performing any installation or service work on robot. Contains general safety aspects as well as more specific information on how to avoid personal injuries and damage to the product.
Installation and commissioning	Required information about lifting and installation of the robot.
Maintenance	Step-by-step procedures that describe how to perform maintenance of the robot. Based on a maintenance schedule that may be used to plan periodical maintenance.
Repair	Step-by-step procedures that describe how to perform repair activities of the robot. Based on available spare parts.
Calibration	Calibration procedures and general information about calibration.
Decommissioning	Environmental information about the robot and its components.
Reference information	Useful information when performing installation, maintenance or repair work. Includes lists of necessary tools, additional documents, safety standards, etc.

Continues on next page

Overview of this manual

Continued

Chapter	Contents
Spare parts	Reference to the spare part list for the robot.
Circuit diagram	Reference to the circuit diagram for the robot.

References

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

Document name	Document ID
<i>Product manual, spare parts - IRB 8700</i>	3HAC052854-001
<i>Product specification - IRB 8700</i>	3HAC052852-001
<i>Circuit diagram - IRB 8700</i>	3HAC051028-002
<i>Product manual - IRC5</i>	3HAC047136-001
<i>Operating manual - IRC5 with FlexPendant</i>	3HAC050941-001
<i>Technical reference manual - Lubrication in gearboxes</i>	3HAC042927-001
<i>Technical reference manual - System parameters</i>	3HAC050948-001

Revisions

Revision	Description
-	First edition.
A	The following updates are done in this revision: <ul style="list-style-type: none">• 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 799.• Added warning regarding risk of pinching, in Description of Axis Calibration on page 799.• Added information about inspection of calibration tool prior to usage, see Examining the calibration tool on page 801.• Added information about the calibration procedure, see Overview of the calibration procedure on the FlexPendant on page 805, Restarting an interrupted calibration procedure on page 807.• Added information about Axis Calibration when SafeMove is installed, see Axis Calibration with SafeMove option on page 808.• Turn motion axis-6 updated to $\pm 360^\circ$, see Working range on page 60.
B	The following updates are done in this revision: <ul style="list-style-type: none">• Illustrations added throughout the manual.• Minor updates throughout the manual.

Continues on next page

Revision	Description
C	<p>Published in release R16.2. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • 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 77. • 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: <ul style="list-style-type: none"> - Motors - Upper arm excluding wrist - Wrist - Axis 6 complete
D	<p>Published in release R17.1. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • Updates in procedure Replacing the axis-1 gearbox, Replacing the axis-1 gearbox on page 637 • 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 631.

Product documentation, IRC5

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.

All documents listed can be ordered from ABB on a DVD. The documents listed are valid for IRC5 robot systems.

Product manuals

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

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

Technical reference manuals

The technical reference manuals describe reference information for robotics products.

- *Technical reference manual - Lubrication in gearboxes*: Description of types and volumes of lubrication for the manipulator gearboxes.
- *Technical reference manual - RAPID overview*: An overview of the RAPID programming language.
- *Technical reference manual - RAPID Instructions, Functions and Data types*: Description and syntax for all RAPID instructions, functions, and data types.
- *Technical reference manual - RAPID kernel*: A formal description of the RAPID programming language.
- *Technical reference manual - System parameters*: Description of system parameters and configuration workflows.

Continues on next page

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, DVD with PC software).
- How to install included or required hardware.
- How to use the application.
- 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 trouble shooters.

The group of manuals includes (among others):

- *Operating manual - Emergency safety information*
- *Operating manual - General safety information*
- *Operating manual - Getting started, IRC5 and RobotStudio*
- *Operating manual - IRC5 Integrator's guide*
- *Operating manual - IRC5 with FlexPendant*
- *Operating manual - RobotStudio*
- *Operating manual - Trouble shooting IRC5*

How to read the product manual

Reading the procedures

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

Safety information

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

Read more in the chapter [Safety on page 15](#).

Illustrations

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

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

1 Safety

1.1 Introduction to safety information

Overview

The safety information in this manual is divided into the following categories:

- General safety aspects, important to attend to before performing any service work on the robot. These are applicable for all service work and are found in [General safety information on page 16](#).
- Safety signals and symbols shown in the manual and on the robot, warning for different types of dangers, are found in [Safety signals and symbols on page 37](#).
- Specific safety information, pointed out in the procedures. How to avoid and eliminate the danger is either described directly in the procedure, or in specific instructions in the section [Safety related instructions on page 45](#).

1 Safety

1.2.1 Introduction to general safety information

1.2 General safety information

1.2.1 Introduction to general safety information

Definitions

This section details general safety information for personnel performing installation, repair and maintenance work.

Sections

The general safety information is divided into the following sections.

Section	Examples of content
<i>Safety in the manipulator system on page 17</i>	This section describes the following: <ul style="list-style-type: none">• safety, service• limitation of liability• related information
<i>Protective stop and emergency stop on page 19</i>	This section describes protective stop and emergency stop.
<i>Safety risks on page 20</i>	This section lists dangers relevant when working with the product. The dangers are split into different categories. <ul style="list-style-type: none">• safety risks during installation or service• risks associated with live electrical parts
<i>Safety actions on page 29</i>	This section describes actions which may be taken to remedy or avoid dangers. <ul style="list-style-type: none">• fire extinguishing• safe use of the teach pendant or jogging device

1.2.2 Safety in the manipulator system

Validity and responsibility

The information does not cover how to design, install and operate a complete system, nor does it cover all peripheral equipment that can influence the safety of the entire system. To protect personnel, the complete system must be designed and installed in accordance with the safety requirements set forth in the standards and regulations of the country where the robot is installed.

The users of ABB industrial robots are responsible for ensuring that the applicable safety laws and regulations in the country concerned are observed and that the safety devices necessary to protect people working with the robot system are designed and installed correctly. Personnel working with robot must be familiar with the operation and handling of the industrial robot as described in the applicable documents, for example:

- *Operating manual - IRC5 with FlexPendant*
- *Operating manual - General safety information*¹
- *Product manual*

¹ This manual contains all safety instructions from the product manuals for the robots and the controllers.

The robot system shall be designed and constructed in such a way as to allow safe access to all areas where intervention is necessary during operation, adjustment, and maintenance.

Where it is necessary to perform tasks within the safeguarded space there shall be safe and adequate access to the task locations.

Users shall not be exposed to hazards, including slipping, tripping, and falling hazards.

Connection of external safety devices

Apart from the built-in safety functions, the robot is also supplied with an interface for the connection of external safety devices. An external safety function can interact with other machines and peripheral equipment via this interface. This means that control signals can act on safety signals received from the peripheral equipment as well as from the robot.

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.

Related information

Type of information	Detailed in document	Section
Installation of safety devices	<i>Product manual for the robot</i>	Installation and commissioning
Changing operating modes	<i>Operating manual - IRC5 with FlexPendant</i> <i>Operator's Manual - IRC5P</i>	Operating modes

Continues on next page

1 Safety

1.2.2 Safety in the manipulator system

Continued

Type of information	Detailed in document	Section
Restricting the working space	<i>Product manual for the robot</i>	Installation and commissioning

1.2.3 Protective stop and emergency stop

Overview

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

1 Safety

1.2.4.1 Safety risks during installation and service work on robots

1.2.4 Safety risks

1.2.4.1 Safety risks during installation and service work on robots

Overview

This section includes information on general safety risks to be considered when performing installation and service work on the robot.

These safety instructions have to be read and followed by any person who deals with the installation and maintenance of the robot. Only persons who know the robot and are trained in the operation and handling of the robot are allowed to maintain the robot. Persons who are under the influence of alcohol, drugs or any other intoxicating substances are not allowed to maintain, repair, or use the robot.

General risks during installation and service

- The instructions in the product manual in the chapters *Installation and commissioning*, and *Repair* must always be followed.
- Emergency stop buttons must be positioned in easily accessible places so that the robot can be stopped quickly.
- Those in charge of operations must make sure that safety instructions are available for the installation in question.
- Those who install or service/maintain the robot must have the appropriate training for the equipment in question and in any safety matters associated with it.

Spare parts and special equipment

ABB does not supply spare parts and special equipment which have not been tested and approved by ABB. The installation and/or use of such products could negatively affect the structural properties of the robot and as a result of that affect the active or passive safety operation. ABB is not liable for damages caused by the use of non-original spare parts and special equipment. ABB is not liable for damages or injuries caused by unauthorized modifications to the robot system.

Personal protective equipment

Always use suitable personal protective equipment, based on the risk assessment for the robot installation.

Nation/region specific regulations

To prevent injuries and damages during the installation of the robot, the regulations applicable in the country concerned and the instructions of ABB Robotics must be complied with.

Non-voltage related risks

- Make sure that no one else can turn on the power to the controller and robot while you are working with the system. A good method is to always lock the main switch on the controller cabinet with a safety lock.

Continues on next page

1.2.4.1 Safety risks during installation and service work on robots

Continued

- Safety zones, which must be crossed before admittance, must be set up in front of the robot's working space. Light beams or sensitive mats are suitable devices.
- Turntables or the like should be used to keep the operator out of the robot's working space.
- If the robot is installed at a height, hanging, or other than standing directly on the floor, there may be additional risks than those for a robot standing directly on the floor.
- The axes are affected by the force of gravity when the brakes are released. In addition to the risk of being hit by moving robot parts, there is a risk of being crushed by the parallel arm (if there is one).
- Energy stored in the robot for the purpose of counterbalancing certain axes may be released if the robot, or parts thereof, are dismantled.
- When dismantling/assembling mechanical units, watch out for falling objects.
- Be aware of stored heat energy in the controller.
- Never use the robot as a ladder, which means, do not climb on the robot motors or other parts during service work. There is a serious risk of slipping because of the high temperature of the motors and oil spills that can occur on the robot.
- Never use the robot as a ladder, which means, do not climb on the manipulator motors or other parts during service work. There is a risk of the robot being damaged.

To be observed by the supplier of the complete system

When integrating the robot with external devices and machines:

- The supplier of the complete system must ensure that all circuits used in the safety function are interlocked in accordance with the applicable standards for that function.
- The supplier of the complete system must ensure that all circuits used in the emergency stop function are interlocked in a safe manner, in accordance with the applicable standards for the emergency stop function.

Complete robot

Safety risk	Description
Hot components!	 CAUTION Motors and gearboxes are HOT after running the robot! Touching motors and gearboxes may result in burns! With a higher environment temperature, more surfaces on the manipulator will get HOT and may also result in burns.

Continues on next page

1 Safety

1.2.4.1 Safety risks during installation and service work on robots

Continued

Safety risk	Description
Removed parts may result in collapse of the robot!	 WARNING Take any necessary measures to ensure that the robot does not collapse as parts are removed. For example, secure the lower arm according to the repair instruction if removing the axis-2 motor.
Removed cables to the measurement system	 WARNING If the internal cables for the measurement system have been disconnected during repair or maintenance, then the revolution counters must be updated.

Cabling

Safety risk	Description
Cable packages are sensitive to mechanical damage!	 CAUTION The cable packages are sensitive to mechanical damage. Handle the cable packages and the connectors with care in order to avoid damage.

Gearboxes and motors

Safety risk	Description
Gears may be damaged if excessive force is used!	 CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!

Balancing device

Safety risk	Description
Dangerous balancing device!	 WARNING <i>Do not</i> , under any circumstances, deal with the balancing device in any other way than that described in the product documentation! For example, attempting to open the balancing device is potentially lethal!

1.2.4.2 CAUTION - Hot parts may cause burns!

1.2.4.2 CAUTION - Hot parts may cause burns!**Description**

During normal operation, many robot parts become hot, especially the drive motors and gearboxes. Sometimes areas around these parts also become hot. Touching these may cause burns of various severity.

Because of a higher environment temperature, more surfaces on the robot get hot and may result in burns.

Elimination

The following instructions describe how to avoid the dangers specified above:

	Action	Information
1	Always use your hand, at some distance, to feel if heat is radiating from the potentially hot component before actually touching it.	
2	Wait until the potentially hot component has cooled if it is to be removed or handled in any other way.	

1 Safety

1.2.4.3 Safety risks related to tools/work pieces

1.2.4.3 Safety risks related to tools/work pieces

Safe handling

It must be possible to safely turn off tools, such as milling cutters, etc. Make sure that guards remain closed until the cutters stop rotating.

It should be possible to release parts by manual operation (valves).

Safe design

Grippers/end effectors must be designed so that they retain work pieces in the event of a power failure or a disturbance to the controller.

Unauthorized modifications of the originally delivered robot are prohibited. Without the consent of ABB it is forbidden to attach additional parts through welding, riveting, or drilling of new holes into the castings. The strength could be affected.



CAUTION

Ensure that a gripper is prevented from dropping a work piece, if such is used.

1.2.4.4 Safety risks related to pneumatic/hydraulic systems

General

Special safety regulations apply to pneumatic and hydraulic systems.



Note

All components that remain pressurized after separating the machine from the power supply must be provided with clearly visible drain facilities and a warning sign that indicates the need for pressure relief before adjustments or performing any maintenance on the robot system.

Residual energy

- Residual energy can be present in these systems. After shutdown, particular care must be taken.
- The pressure must be released in the complete pneumatic or hydraulic systems before starting to repair them.
- Work on hydraulic equipment may only be performed by persons with special knowledge and experience of hydraulics.
- All pipes, hoses, and connections have to be inspected regularly for leaks and damage. Damage must be repaired immediately.
- Splashed oil may cause injury or fire.

Safe design

- Gravity may cause any parts or objects held by these systems 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.

1 Safety

1.2.4.5 Safety risks during operational disturbances

General

- The industrial robot is a flexible tool that can be used in many different industrial applications.
- All work must be carried out professionally and in accordance with the applicable safety regulations.
- Care must be taken at all times.

Qualified personnel

Corrective maintenance must only be carried out by qualified personnel who are familiar with the entire installation as well as the special risks associated with its different parts.

Extraordinary risks

If the working process is interrupted, extra care must be taken due to risks other than those associated with regular operation. Such an interruption may have to be rectified manually.

1.2.4.6 Risks associated with live electric parts

Voltage related risks, general

Work on the electrical equipment of the robot must be performed by a qualified electrician in accordance with electrical regulations.

- Although troubleshooting may, on occasion, need to be carried out while the power supply is turned on, the robot must be turned off (by setting the main switch to OFF) when repairing faults, disconnecting electric leads and disconnecting or connecting units.
- The main supply to the robot must be connected in such a way that it can be turned off from outside the working space of the robot.
- Make sure that no one else can turn on the power to the controller and robot while you are working with the system. A good method is to always lock the main switch on the controller cabinet with a safety lock.

The necessary protection for the electrical equipment and robot system during construction, commissioning, and maintenance is guaranteed if the valid regulations are followed.

All work must be performed:

- by qualified personnel
- on machine/robot system in deadlock
- in an isolated state, disconnected from power supply, and protected against reconnection.

Voltage related risks, IRC5 controller

A danger of high voltage is associated with, for example, the following parts:

- Be aware of stored electrical energy (DC link, Ultracapacitor bank unit) in the controller.
- Units such as I/O modules, can be supplied with power from an external source.
- The main supply/main switch
- The transformers
- The power unit
- The control power supply (230 VAC)
- The rectifier unit (262/400-480 VAC and 400/700 VDC. Note: capacitors!)
- The drive unit (400/700 VDC)
- The drive system power supply (230 VAC)
- The service outlets (115/230 VAC)
- The customer power supply (230 VAC)
- The power supply unit for additional tools, or special power supply units for the machining process.
- The external voltage connected to the controller remains live even when the robot is disconnected from the mains.
- Additional connections.

Continues on next page

1 Safety

1.2.4.6 Risks associated with live electric parts

Continued

Voltage related risks, robot

A danger of high voltage is associated with the robot in:

- The power supply for the motors (up to 800 VDC).
 - The user connections for tools or other parts of the installation (max. 230 VAC).
-

Voltage related risks, tools, material handling devices, etc.

Tools, material handling devices, etc., may be live even if the robot system is in the OFF position. Power supply cables which are in motion during the working process may be damaged.

1.2.5 Safety actions

1.2.5.1 Safety fence dimensions

General

Install a safety cell around the robot to ensure safe robot installation and operation.

Dimensioning

The fence or enclosure must be dimensioned to withstand the force created if the load being handled by the robot is dropped or released at maximum speed.

Determine the maximum speed from the maximum velocities of the robot axes and from the position at which the robot is working in the work cell (see the section *Robot motion* in the *Product specification*).

Also consider the maximum possible impact caused by a breaking or malfunctioning rotating tool or other device fitted to the robot.

1 Safety

1.2.5.2 Fire extinguishing



Note

Use a CARBON DIOXIDE (CO₂) extinguisher in the event of a fire in the robot or controller!

1.2.5.3 Emergency release of the robot arm

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 detailed in the section:

- [Manually releasing the brakes on page 85.](#)

The robot arm 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 arms does not increase the pressure on the trapped person, further increasing any injury!



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 arm.

1 Safety

1.2.5.4 Brake testing

1.2.5.4 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 robot axis to a position where the combined weight of the robot arm 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 robot does not change position as the motors are switched off, then the brake function is adequate.

1.2.5.5 Risk of disabling function "Reduced speed 250 mm/s"



Note

Do not change *Transm gear ratio* or other kinematic system parameters from the FlexPendant or a PC. This will affect the safety function "Reduced speed 250 mm/s".

1 Safety

1.2.5.6 Safe use of the jogging device

1.2.5.6 Safe use of the jogging device

Three-position enabling device

The three-position enabling device is a manually operated, constant pressure push-button which, when continuously activated in one position only, allows potentially hazardous functions but does not initiate them. In any other position, hazardous functions are stopped safely.

The three-position enabling device is of a specific type where you must press the push-button only half-way to activate it. In the fully in and fully out positions, operating the robot is impossible.



Note

The three-position enabling device is a push-button located on the jogging device which, when pressed halfway in, switches the system to MOTORS ON. When the enabling device is released or pushed all the way in, the manipulator switches to the MOTORS OFF state.

To ensure safe use of the jogging device, the following must be implemented:

- The enabling device must never be rendered inoperational in any way.
- During programming and testing, the enabling device must be released as soon as there is no need for the robot to move.
- Anyone entering the working space of the robot must always bring the jogging device with him/her. This is to prevent anyone else from taking control of the robot without his/her knowledge.

Hold-to-run function

The hold-to-run function allows movement when a button connected to the function is actuated manually and immediately stops any movement when released. The hold-to-run function can only be used in manual mode.

How to operate the hold-to-run function for IRC5 is described in *Operating manual - IRC5 with FlexPendant*.

1.2.5.7 Work inside the working range of the robot



WARNING

If work must be carried out within the work area of the robot, then the following points must be observed:

- The operating mode selector on the controller must be in the manual mode position to render the three-position enabling device operational and to block operation from a computer link or remote control panel.
- The maximum speed of the robot is limited to 250 mm/s when the operating mode selector is in the position *Manual mode with reduced speed*. This should be the normal position when entering the working space.
The position *Manual mode with full speed (100%)* may only be used by trained personnel who are aware of the risks that this entails. *Manual mode with full speed (100%)* is not available in USA or Canada.
- Pay attention to the rotating axes of the robot. Keep away from axes to not get entangled with hair or clothing. Also, be aware of any danger that may be caused by rotating tools or other devices mounted on the robot or inside the cell.
- Test the motor brake on each axis, according to the section [Brake testing on page 32](#).
- To prevent anyone else from taking control of the robot, always put a safety lock on the cell door and bring the three-position enabling device with you when entering the working space.



WARNING

NEVER, under any circumstances, stay beneath any of the robot's axes! There is always a risk that the robot will move unexpectedly when robot axes are moved using the three-position enabling device or during other work inside the working range of the robot.

1 Safety

1.2.5.8 Signal lamp (optional)

1.2.5.8 Signal lamp (optional)

Description

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

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.

1.3 Safety signals and symbols

1.3.1 Safety signals in the manual

Introduction to safety signals

This section specifies all dangers that can arise when doing the work described in the user manuals. Each danger consists of:

- A caption specifying the danger level (DANGER, WARNING, or CAUTION) and the type of danger.
- A brief description of what will happen if the operator/service personnel do not eliminate the danger.
- Instruction about how to eliminate danger to simplify doing the work.

Danger levels

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

Symbol	Designation	Significance
 xx0200000022	DANGER	Warns that an accident <i>will</i> occur if the instructions are not followed, resulting in a serious or fatal injury and/or severe 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, and so on.
 xx0100000002	WARNING	Warns that an accident <i>may</i> 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.
 xx0200000024	ELECTRICAL SHOCK	Warns for electrical hazards which could result in severe personal injury or death.
 xx0100000003	CAUTION	Warns that an accident <i>may</i> 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.
 xx0200000023	ELECTROSTATIC DISCHARGE (ESD)	Warns for electrostatic hazards which could result in severe damage to the product.

Continues on next page

1 Safety

1.3.1 Safety signals in the manual

Continued

Symbol	Designation	Significance
 xx010000004	NOTE	Describes important facts and conditions.
 xx0100000098	TIP	Describes where to find additional information or how to do an operation in an easier way.

1.3.2 Safety symbols on product labels

Introduction to labels

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

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 safety and health symbols on the labels on the product must be observed. Additional safety information given by the system builder or integrator must also be observed.

Types of labels

Both the robot and the controller are marked with several safety and information labels, containing important information about the product. The information is useful for all personnel handling the robot system, for example during installation, service, or operation.

The safety labels are language independent, they only use graphics. See [Symbols on safety labels on page 39](#).

The information labels can contain information in text (English, German, and French).

Symbols on safety labels

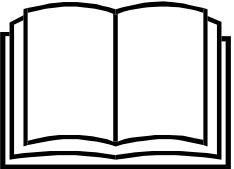
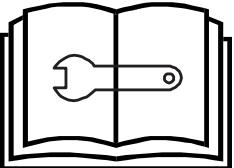
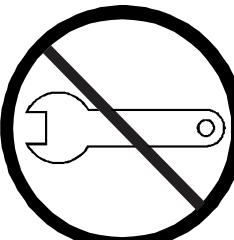
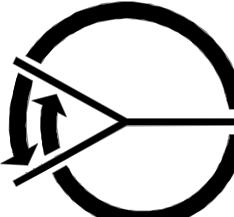
Symbol	Description
	Warning! Warns that an accident <i>may</i> occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, etc. xx0900000812
	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. xx0900000811
	Prohibition Used in combinations with other symbols. xx0900000839

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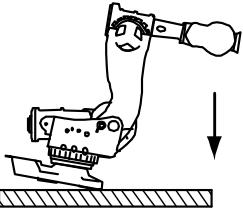
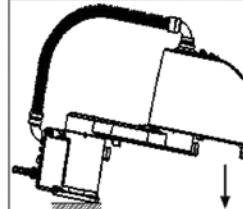
1 Safety

1.3.2 Safety symbols on product labels

Continued

Symbol	Description
 xx0900000813	See user documentation Read user documentation for details. Which manual to read is defined by the symbol: <ul style="list-style-type: none">• No text: <i>Product manual</i>.• EPS: <i>Application manual - Electronic Position Switches</i>.
 xx0900000816	Before disassemble, see product manual
 xx0900000815	Do not disassemble Disassembling this part can cause injury.
 xx0900000814	Extended rotation This axis has extended rotation (working area) compared to standard.
 xx0900000808	Brake release Pressing this button will release the brakes. This means that the robot arm can fall down.

Continues on next page

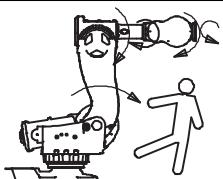
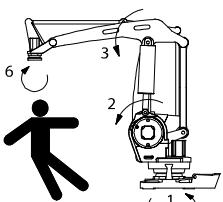
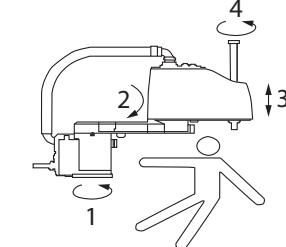
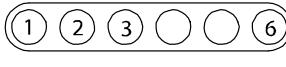
Symbol	Description
 xx0900000810	Tip risk when loosening bolts The robot can tip over if the bolts are not securely fastened.
  3HAC 057068-001	
  xx0900000817	Crush Risk of crush injuries.
 xx0900000818	Heat Risk of heat that can cause burns.

Continues on next page

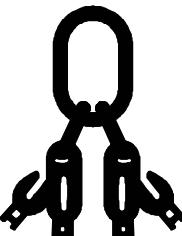
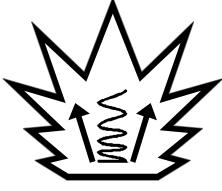
1 Safety

1.3.2 Safety symbols on product labels

Continued

Symbol	Description
 xx0900000819	Moving robot The robot can move unexpectedly.
 xx1000001141	
 xx1500002616	
 xx0900000820	Brake release buttons
 xx1000001140	
 xx0900000821	Lifting bolt

Continues on next page

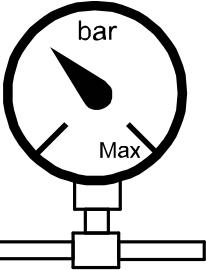
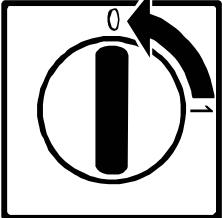
Symbol	Description
 xx1000001242	Chain sling with shortener
 xx0900000822	Lifting of robot
 xx0900000823	Oil Can be used in combination with prohibition if oil is not allowed.
 xx0900000824	Mechanical stop
 xx1000001144	No mechanical stop
 xx0900000825	Stored energy Warns that this part contains stored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

Continues on next page

1 Safety

1.3.2 Safety symbols on product 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.

1.4.1 DANGER - Moving robots are potentially lethal!

1.4 Safety related instructions

1.4.1 DANGER - Moving robots are potentially lethal!

Description

Any moving robot is a potentially lethal machine.

When running, the robot may perform unexpected and sometimes irrational movements. Moreover, all movements are performed with great force and may seriously injure any personnel and/or damage any piece of equipment located within the working range of the robot.

Elimination

	Action	Note
1	Before attempting to run the robot, make sure all emergency stop equipment is correctly installed and connected.	Emergency stop equipment such as gates, tread mats, light curtains, etc.
2	Usually the hold-to-run function is active only in manual full speed mode. To increase safety it is also possible to activate hold-to-run for manual reduced speed with a system parameter. The hold-to-run function is used in manual mode, not in automatic mode.	How to use the hold-to-run function is described in section <i>How to use the hold-to-run function</i> in the <i>Operating manual - IRC5 with FlexPendant</i> .
3	Make sure no personnel are present within the working range of the robot before pressing the start button.	

1 Safety

1.4.2 DANGER - First test run may cause injury or damage!

Description

Since performing a service activity often requires disassembly of the robot, there are several safety risks to take into consideration before the first test run.

Elimination

Follow the procedure below when performing the first test run after a service activity, such as repair, installation, or maintenance.



DANGER

Running the robot without fulfilling the following aspects, may cause severe damage to the robot.

	Action
1	Remove all service tools and foreign objects from the robot and its working area.
2	Verify that the robot is secured to its position, see installation section in the product manual for the robot.
3	Verify that any safety equipment installed to secure the robot arm position or restrict the robot arm motion during service activity is removed.
4	Verify that the fixture and work piece are well secured, if applicable.
5	Install all safety equipment properly.
6	Make sure all personnel are standing at a safe distance from the robot, that is out of its reach behind safety fences, and so on.
7	Pay special attention to the function of the part that previously was serviced.

Collision risks



CAUTION

When programming the movements of the robot, always identify potential collision risks before the first test run.

1.4.3 WARNING - The brake release buttons may be jammed after service work

1.4.3 WARNING - 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!

1 Safety

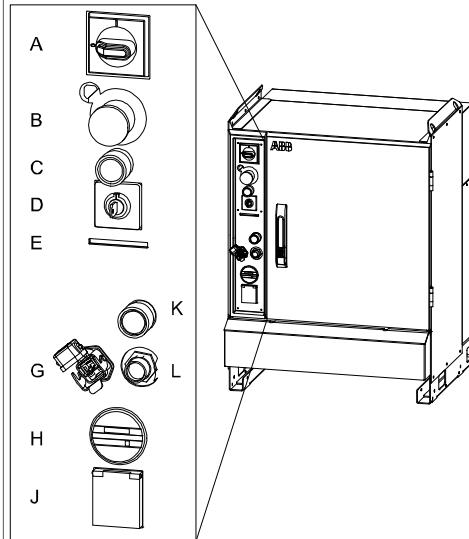
1.4.4 DANGER - Make sure that the main power has been switched off!

1.4.4 DANGER - Make sure that the main power has been switched off!

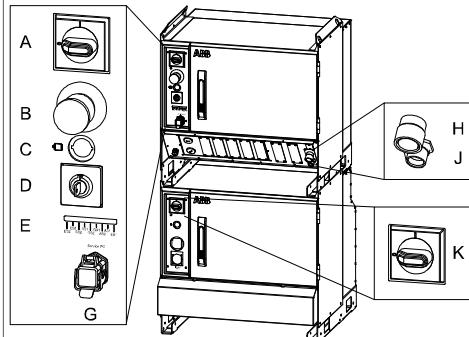
Description

Working with high voltage is potentially lethal. Persons subjected to high voltage may suffer cardiac arrest, burn injuries, or other severe injuries. To avoid these dangers, do not proceed working before eliminating the danger as detailed below.

Elimination, IRC5 Single Cabinet Controller

	Action	Note/illustration
1	Switch off the main switch on the controller cabinet.	 xx0600002782 A: Main switch

Elimination, IRC5 Dual Cabinet Controller

	Action	Note/illustration
1	Switch off the main switch on the Drive Module.	 xx0600002783 K: Main switch, Drive Module
2	Switch off the main switch on the Control Module.	A: Main switch, Control Module

1.4.5 WARNING - The unit is sensitive to ESD!

1.4.5 WARNING - 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.

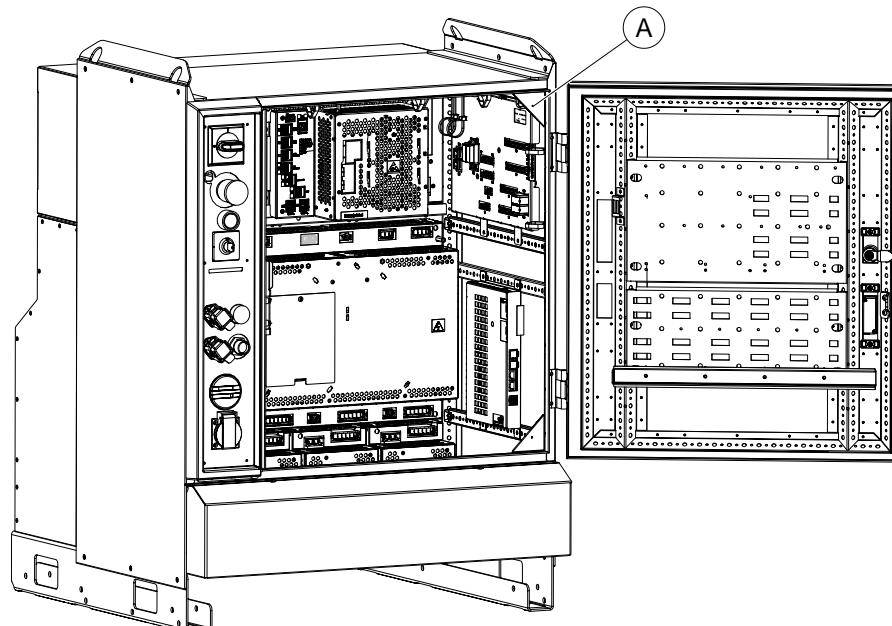
Elimination

	Action	Note
1	Use a wrist strap.	Wrist straps must be tested frequently to ensure that they are not damaged and are operating correctly.
2	Use an ESD protective floor mat.	The mat must be grounded through a current-limiting resistor.
3	Use a dissipative table mat.	The mat should provide a controlled discharge of static voltages and must be grounded.

Location of wrist strap button

The location of the wrist strap button is shown in the following illustration.

IRC5



A	Wrist strap button
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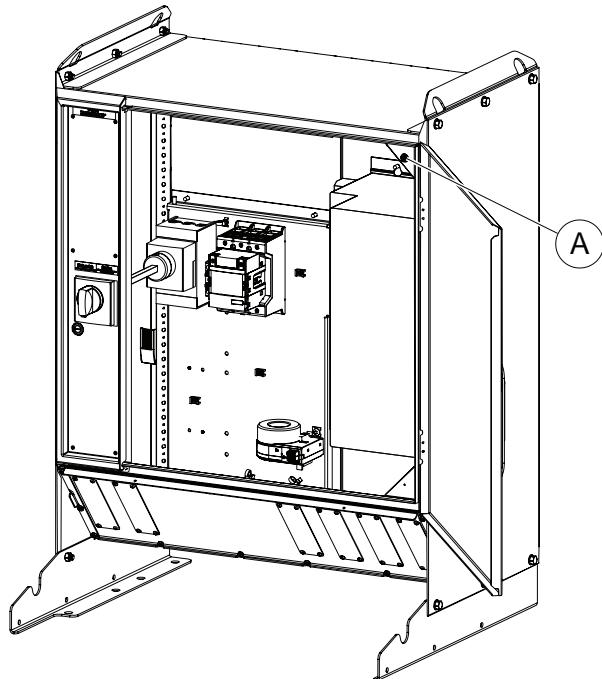
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1 Safety

1.4.5 **WARNING** - The unit is sensitive to ESD!

Continued

Spot welding cabinet



xx1600000253

1.4.6 WARNING - Safety risks during handling of batteries

Description

Under normal conditions of use, the electrode materials and liquid electrolyte in the batteries are not exposed to the outside, provided the battery integrity is maintained and seals remain intact.

There is a risk of exposure only in case of abuse (mechanical, thermal, electrical) which leads to the activation of safety valves and/or the rupture of the battery container. Electrolyte leakage, electrode materials reaction with moisture/water or battery vent/explosion/fire may follow, depending upon the circumstances.



Note

Appropriate disposal regulations must be observed.

Elimination

	Action	Note
1	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 Pre-installation procedure on page 56 .
2	Use safety glasses when handling the batteries.	
3	In the event of leakage, wear gloves and chemical apron.	
4	In the event of fire, use self-contained breathing apparatus.	

1 Safety

1.4.7 WARNING - Safety risks during work with gearbox lubricants (oil or grease)

Description

When handling gearbox lubricants, there is a risk of both personal injury and product damage occurring. The following safety information must be regarded before performing any work with lubricants in the gearboxes.



Note

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



Note

When aggressive media is handled, an appropriate skin protection must be provided. Gloves and goggles are recommended.



Note

Appropriate disposal regulations must be observed.



Note

Take special care when handling hot lubricants.

Warnings and elimination

Warning	Description	Elimination/Action
 xx0100000002 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.
 xx0100000002 Allergic reaction	When working with gearbox lubricant there is a risk of an allergic reaction.	Make sure that protective gear like goggles and gloves are always worn.
 xx0100000002 Possible pressure build-up in gearbox	When opening the oil or grease plug, there may be pressure present in the gearbox, causing lubricant to spray from the opening.	Open the plug carefully and keep away from the opening. Do not overfill the gearbox when filling.

Continues on next page

1.4.7 WARNING - Safety risks during work with gearbox lubricants (oil or grease)

Continued

Warning	Description	Elimination/Action
 xx0100000002 Do not overfill	<p>Overfilling of gearbox lubricant can lead to internal over-pressure inside the gearbox which in turn may:</p> <ul style="list-style-type: none"> • damage seals and gaskets • completely press out seals and gaskets • prevent the robot from moving freely. 	<p>Make sure not to overfill the gearbox when filling it with oil or grease!</p> <p>After filling, verify that the level is correct.</p>
 xx0100000002 Do not mix types of oil	<p>Mixing types of oil may cause severe damage to the gearbox.</p>	<p>When filling gearbox oil, do not mix different types of oil unless specified in the instructions. Always use the type of oil specified by the manufacturer!</p>
 xx0100000098 Heat up the oil	<p>Warm oil drains quicker than cold oil.</p>	<p>When changing gearbox oil, first run the robot for a time to heat up the oil.</p>
 xx0100000004 Specified amount depends on drained volume	<p>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.</p>	<p>After filling, verify that the level is correct.</p>
 xx0100000003 Contaminated oil in gear boxes	<p>When draining the oil make sure that as much oil as possible is drained from the gearbox. The reason for this is to drain as much oil sludge and metal chips as possible from the gearbox. The magnetic oil plugs will take care of any remaining metal chips.</p>	

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2 Installation and commissioning

2.1 Introduction

General

This chapter contains assembly instructions and information for installing the IRB 8700 at the working site.

More detailed technical data can be found in the *Product specification* for the IRB 8700, such as:

- Load diagram
- Permitted extra loads (equipment), if any
- Location of extra loads (equipment), if any.

Safety information

Before any installation work is commenced, it is extremely important that all safety information is observed!

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



Note

If the IRB 8700 is connected to power, always make sure that the robot is connected to *protective earth* before starting any installation work!

For more information see:

- *Product manual - IRC5*

2 Installation and commissioning

2.2.1 Pre-installation procedure

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 is suitable to handle the weight of the robot as specified in: Weight, robot on page 57
6	If the robot is not installed directly, it must be stored as described in: Storage conditions, robot on page 58
7	Make sure that the expected operating environment of the robot conforms to the specifications as described in: Operating conditions, robot on page 58
8	Before taking the robot to its installation site, make sure that the site conforms to: <ul style="list-style-type: none">• Loads on foundation, robot on page 57• Protection classes, robot on page 59• Requirements, foundation on page 58
9	Before moving the robot, please observe the stability of the robot: Risk of tipping/stability on page 63
10	When these prerequisites are met, the robot can be taken to its installation site as described in section: On-site installation on page 65
11	Install required equipment, if any. <ul style="list-style-type: none">• Installing the signal lamp (option) on page 104

Continues on next page

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**

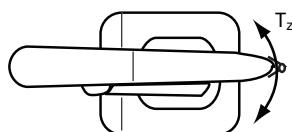
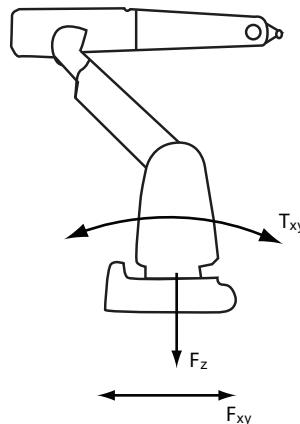
The weight does not include tools and other equipment fitted on the robot!

The weight does not include the weight of the DressPack.

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.



xx1100000521

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!

Continues on next page

2 Installation and commissioning

2.2.1 Pre-installation procedure

Continued

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

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.
Maximum tilt	0°	
Minimum resonance frequency	22 Hz	

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)
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.

Continues on next page

Protection classes, robot

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

Protection type	Protection class
Manipulator, protection type Foundry Plus	IP67

2 Installation and commissioning

2.2.2 Working range

2.2.2 Working range

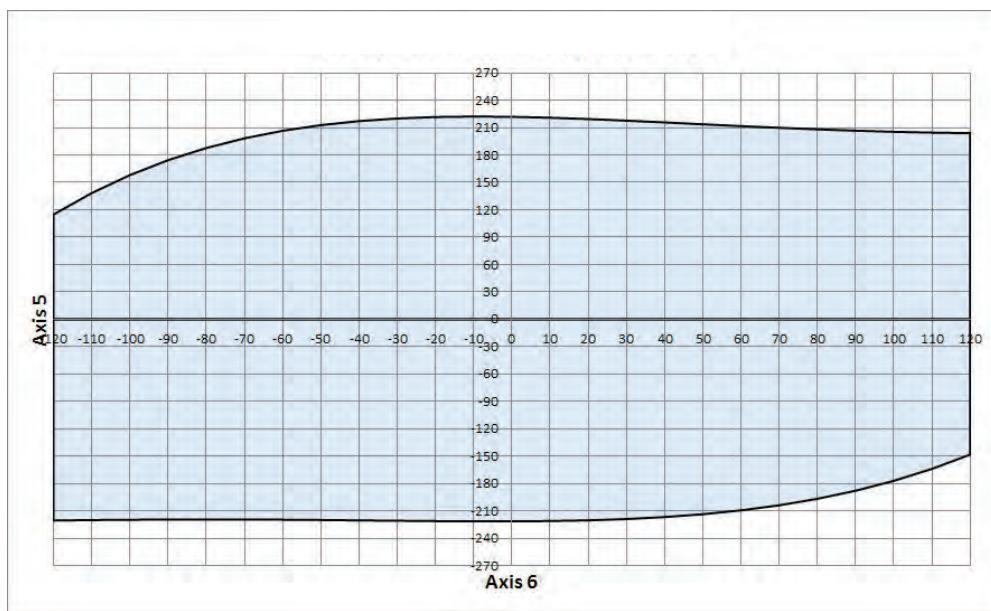
Variants

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

Axis	Type of motion	Working range	Note
Axis 1	Rotation motion	$\pm 170^\circ$	
		$\pm 220^\circ$	Option
Axis 2	Arm motion	$-65^\circ/+90^\circ$	Restrictions with SW DressPack fitted.
Axis 3	Arm motion	$-30^\circ/+132^\circ$	Restrictions with SW DressPack fitted.
Axis 4	Wrist motion	$\pm 300^\circ$	
Axis 5	Bend motion	$\pm 130^\circ$	
Axis 6	Turn motion	$\pm 360^\circ$	
		± 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.

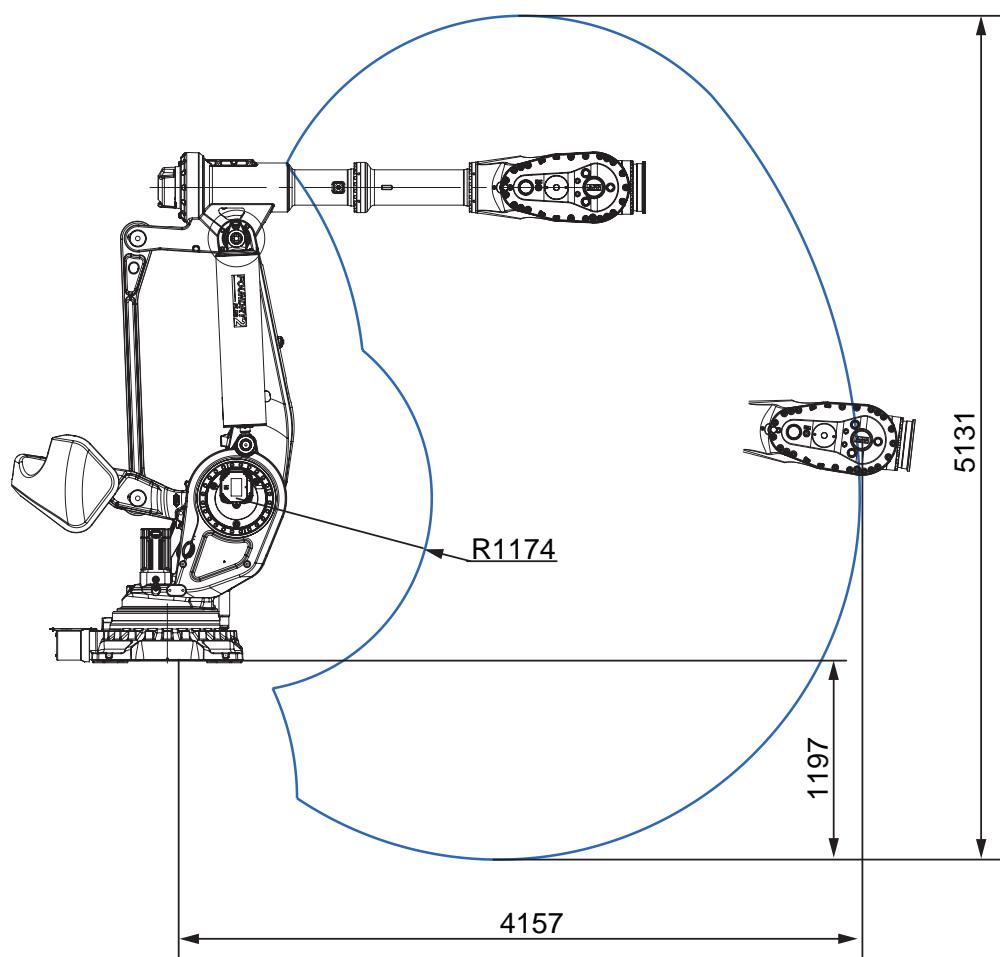


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Illustration, working range IRB 8700 - 550/4.20

This illustration shows the unrestricted working range of the robot.



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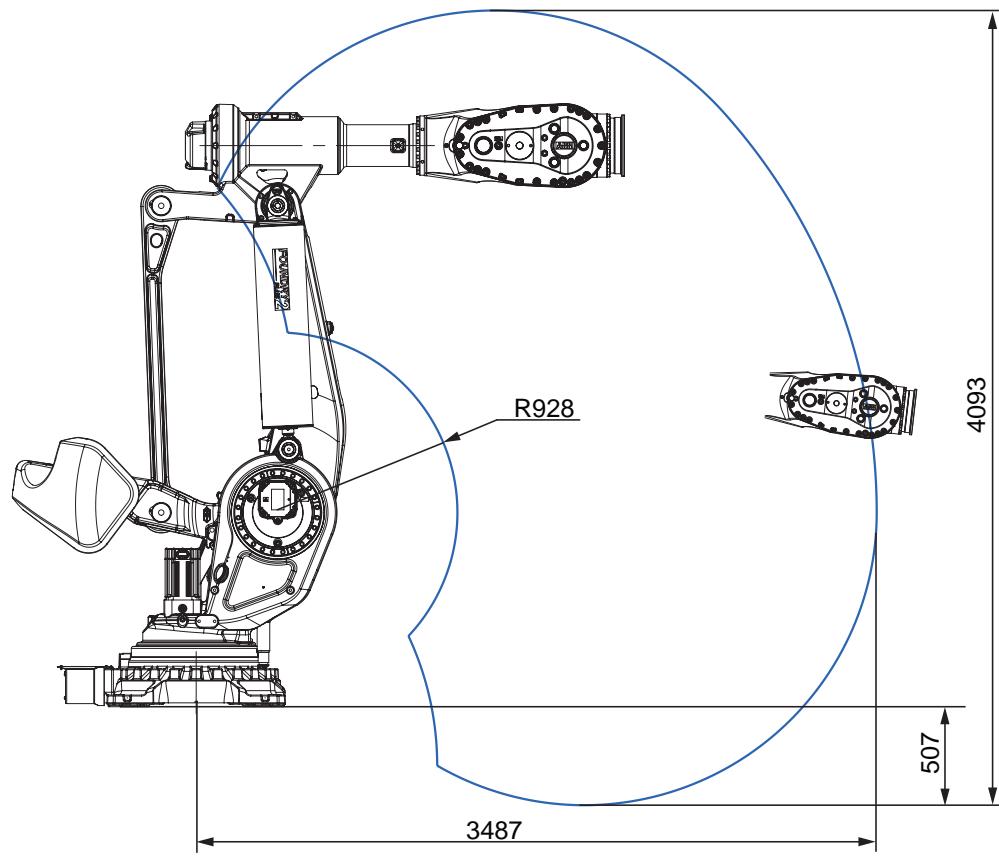
2 Installation and commissioning

2.2.2 Working range

Continued

Illustration, working range IRB 8700 - 800/3.50

This illustration shows the unrestricted working range of the robot.



2.2.3 Risk of tipping/stability

Risk of tipping

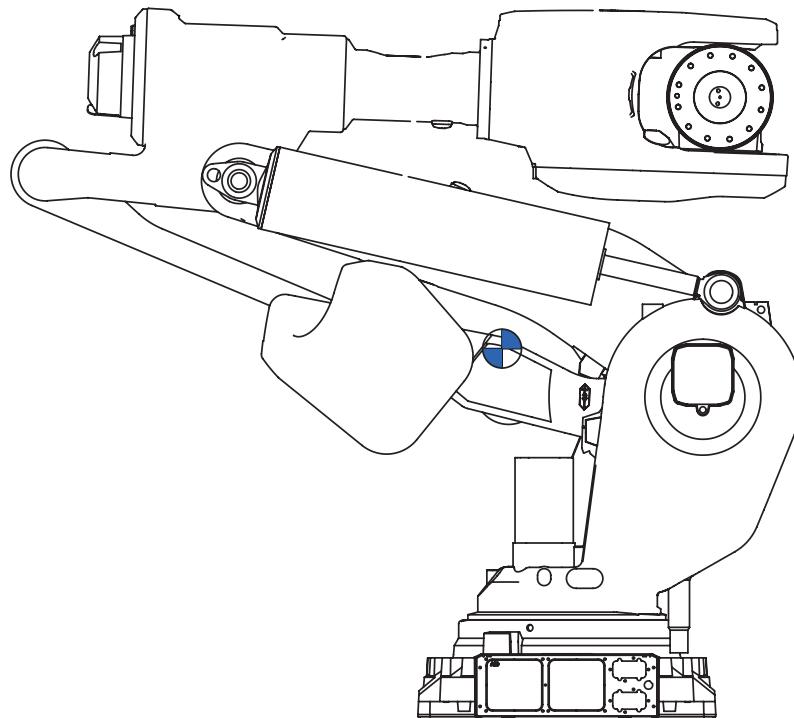
If the robot is not fastened to the foundation while moving the arm, the robot is not stable in the whole working area. Moving the arm will displace the center of gravity, which may cause the robot to tip over.

The shipping position is the most stable position.

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

Shipping and transportation position

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



xx1400002584

Move the robot to this position:

Axis-1	-90°
Axis-2	-65°
Axis-3	2°
Axis-4	90°
Axis-5	-90°
Axis-6	0°



WARNING

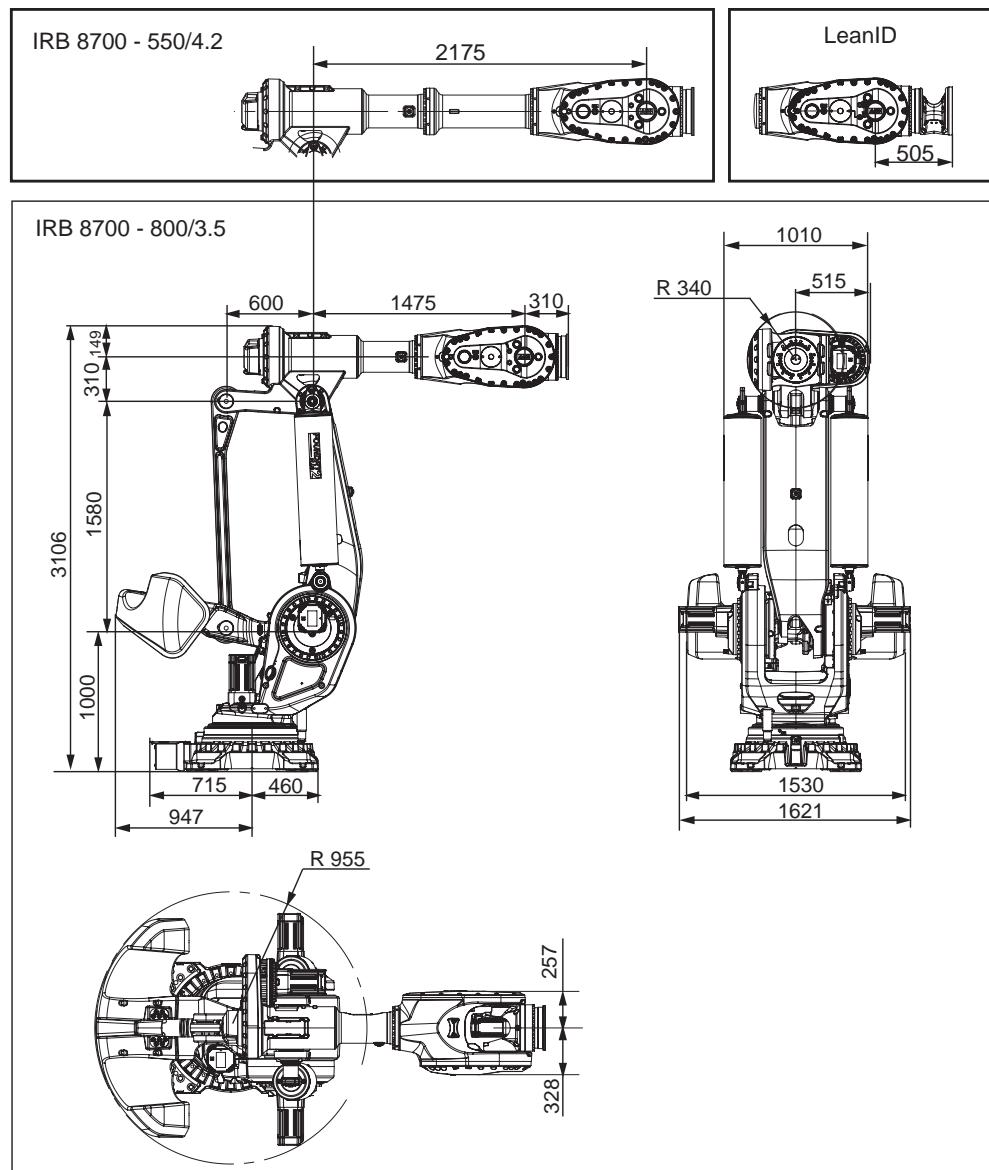
The robot is likely to be mechanically unstable if not secured to the foundation.

2 Installation and commissioning

2.2.4 Main dimensions

2.2.4 Main dimensions

Illustration



xx1400002868

2.3.1 Lifting the robot with fork lift accessory set installed

2.3 On-site installation

2.3.1 Lifting the robot with fork lift accessory set installed

Introduction

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

This section describes how to attach the fork lift accessory set to the robot.



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.

Continues on next page

2 Installation and commissioning

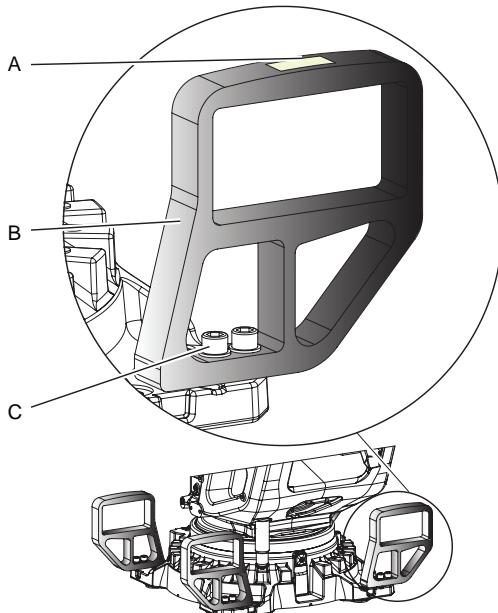
2.3.1 Lifting the robot with fork lift accessory set installed

Continued

Attaching the fork lift accessory set

Location of the fork lift accessory set

The fork lift accessories are located in the four corners of the base.



xx1400002588

A	CE label
B	Fork lift accessory (4 pcs)
C	Screws MC6S 20x60 8.8 (2 pcs x4)

Required tools and equipment

Equipment, etc.	Article number	Note
Fork lift accessory set	3HAC053662-003	
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required document

Document	Article number	Note
Directions for use Fork lift accessory for IRB 8700	3HAC055664-001	Delivered with the fork lift accessory.

Preparations before attaching the fork lift accessory set

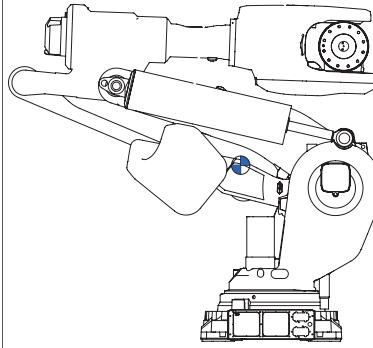
	Action	Note
1	<p>Remove any tool attached on the turning disc.</p> <p> Note</p> <p>No tool is permitted to be fitted on the robot, when lifting the robot with the fork lift accessory set.</p>	<p> Note</p> <p>No extra load is permitted on the robot.</p> <p>DressPack cable package can stay fitted as long as the tool has been removed.</p>

Continues on next page

2 Installation and commissioning

2.3.1 Lifting the robot with fork lift accessory set installed

Continued

Action	Note
<p>2 Jog the robot to its shipping position:</p> <ul style="list-style-type: none"> • Axis-1: -90° or 90° • Axis-2: -65° • Axis-3: 2° • Axis-4: • Axis-5: 90° • Axis-6: -90° <p>Note</p> <p>The figure shows the shipping position of an undressed robot. If the robot is dressed, this must be taken in consideration when the robot is lifted.</p>	 xx1400002584
<p>3</p> <p>DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	

Attachment points for the fork lift accessory set

Action	Note
<p>1 The attachment points for the fork lift accessory set, can be found in the four corners of the base.</p>	 xx1500002297

Attaching the fork lift accessory set

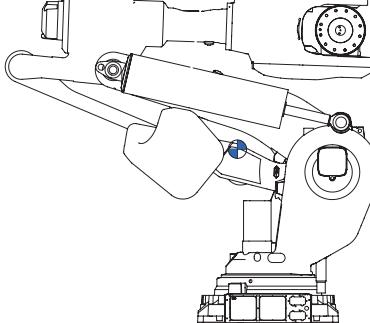
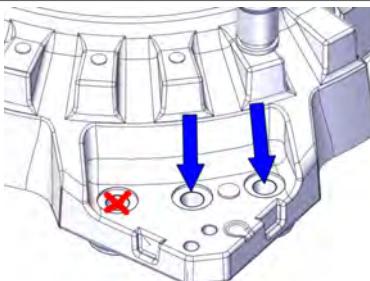
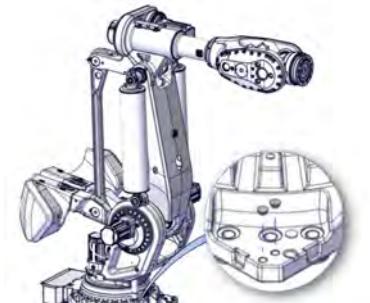
Action	Note
<p>1</p> <p>CAUTION</p> <p>Each fork lift accessory pocket weights 18 kg. Use caution when handling them.</p>	

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2 Installation and commissioning

2.3.1 Lifting the robot with fork lift accessory set installed

Continued

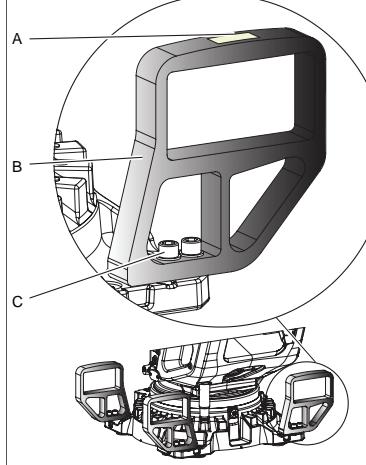
Action	Note
2  DANGER Make sure that the robot is placed in its shipping position, before removing any of the screws that secure the robot to the foundation. If not, there is a risk that the robot will tip over, resulting in injury or damage.	 xx1400002584
3 Unscrew the two attachment screws with washers that secure the robot to the foundation, situated closest to where the fork lift accessory pockets will be attached.	 xx1500002295
4 Remove the protection plugs.	 xx1500002294

Continues on next page

2 Installation and commissioning

2.3.1 Lifting the robot with fork lift accessory set installed

Continued

Action	Note						
5 Attach the fork lift accessory pockets (4 pcs).	<p>Note</p> <p>Make sure that the original screws are used. If need to replace any of the screws, use screws with equivalent quality.</p> <p>DANGER</p> <p>Never attach a fork lift pocket with only one attachment screw.</p>  <p>xx1400002588</p> <table border="1"> <tr> <td>A</td> <td>CE label</td> </tr> <tr> <td>B</td> <td>Fork lift accessory pocket (4 pcs)</td> </tr> <tr> <td>C</td> <td>Attachment screws MC6S 20x60 8.8 (2 pcs x4)</td> </tr> </table>	A	CE label	B	Fork lift accessory pocket (4 pcs)	C	Attachment screws MC6S 20x60 8.8 (2 pcs x4)
A	CE label						
B	Fork lift accessory pocket (4 pcs)						
C	Attachment screws MC6S 20x60 8.8 (2 pcs x4)						
6 Secure the fork lift accessory pockets.	Tightening torque: 300 Nm						
7	<p>CAUTION</p> <p>Do not lift the robot at this point; the robot is still secured to the foundation.</p> <p>The remaining attachment screws, that secure the robot to the foundation, will be removed after the fork lift truck has its forks inserted into the fork lift accessory pockets.</p>						

Lifting with the fork lift accessory set

Preparations before lifting

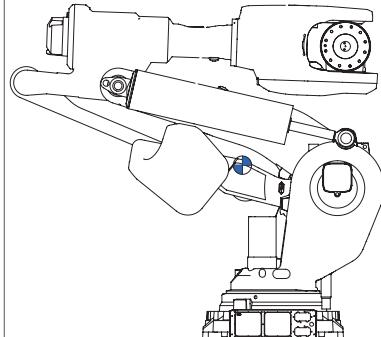
Action	Note
1 Make sure that any tool attached on the turning disc, has been removed before lifting.	<p>Note</p> <p>No extra load is permitted on the robot.</p> <p>DressPack cable package can stay fitted as long as the tool has been removed.</p>

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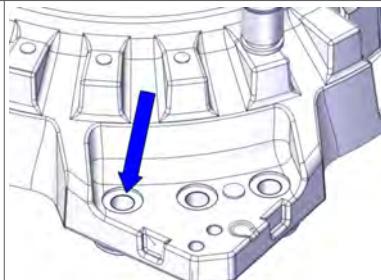
2 Installation and commissioning

2.3.1 Lifting the robot with fork lift accessory set installed

Continued

Action	Note
<p>2 Make sure that the robot is in its shipping position. If not there is a risk that the robot will tip over when the remaining screws are removed, resulting in injury or damage.</p> <ul style="list-style-type: none"> • Axis-1: -90° or +90° • Axis-2: -65° • Axis-3: +2° • Axis-4: • Axis-5: +90° • Axis-6: -90° <p> Note</p> <p>The figure shows the shipping position of an undressed robot. If the robot is dressed, this must be taken in consideration when the robot is lifted.</p>	 xx1400002584
<p>3  DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	
4 Verify that the fork lift accessory set is properly attached and secured before lifting.	

Lifting the robot

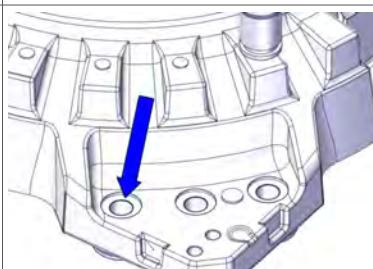
Action	Note
<p>1  DANGER</p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
<p>2  DANGER</p> <p>DO NOT unscrew the attachment screws completely, but only a few millimeters. At this point, the remaining screws are used as a safety measure, until the forks of the truck has been inserted into the fork lift accessory pockets.</p>	 xx1500002296

Continues on next page

2 Installation and commissioning

2.3.1 Lifting the robot with fork lift accessory set installed

Continued

Action	Note
<p>3  DANGER Turn off all:<ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.</p>	
<p>4  CAUTION The IRB 8700 robot weighs 4,750 kg. All lifting accessories used must be sized accordingly.</p>	
<p>5 Use caution and insert the trucks forks into the fork lift accessory pockets, without damaging anything on the robot or other equipment.</p>	 CAUTION Lifting the robot using the fork lift accessory set, shall only be done with the trucks forks completely inserted in all four pockets. If not, there is a risk of injury or damage when the robot is lifted up.
<p>6 Use caution and lift the forks of the truck up, until they start touching the fork lift accessory set, but not taking the weight of the robot.</p> <p> CAUTION Do not lift up too much! This will make it more difficult to remove the remaining attachment screws, that secure the robot to the foundation.</p>	
<p>7 Unscrew the remaining screws (4 pcs) that secure the robot to the foundation.</p>	 <p>xx1500002296</p>

Continues on next page

2 Installation and commissioning

2.3.1 Lifting the robot with fork lift accessory set installed

Continued

	Action	Note
8	<p>Use caution and lift the robot up.</p> <p> WARNING</p> <p>People must under no circumstances, be present underneath a suspended load!</p>	 xx1500002294
9	Use caution and move the robot with low speed to its new location.	
10	<p> Note</p> <p>If the robot shall be stored or later be further transported, make sure to follow appropriate safety measures.</p>	

2.3.2 Attaching the robot and removing the fork lift accessory set

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.

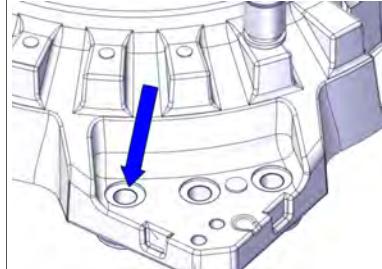
Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumable

Consumable	Article number	Note
Molykote 1000		For lubricating screws

Reattaching the robot and removal of the fork lift accessory set

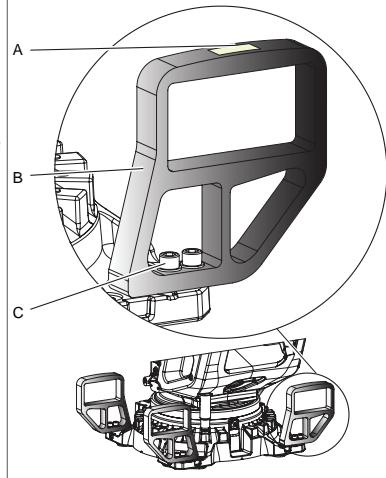
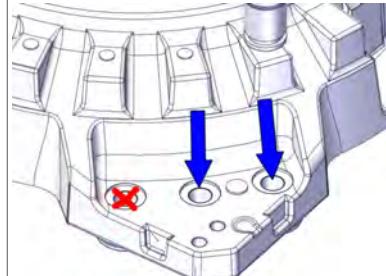
	Action	Note
1	<p> CAUTION</p> <p>Make sure that the foundation, on which the robot shall be placed, is clean. Make sure that all foreign objects have been removed, prior to putting down the robot.</p>	
2	Use caution and put down the robot in its new location.	
3	Lubricate the attachment screws used to secure the robot to the foundation.	Molykote 1000
4	<p>Secure the robot to the foundation while the fork lift truck is still holding the robot in the fork lift pockets.</p> <p>Fasten the attachment screws furthest away from the fork lift accessories.</p> <p> DANGER</p> <p>DO NOT power up the robot until it is secured to the foundation with all 12 attachment screws.</p>	<p>Attachment screws: M24x100 (one in each pocket)</p> <p>Tightening torque, Lubricated screws (Molykote 1000): 550 Nm</p> <p>Tightening torque, not/lightly lubricated screws: 600-750 Nm, typical 650 Nm</p>  <p>xx1500002296</p>

Continues on next page

2 Installation and commissioning

2.3.2 Attaching the robot and removing the fork lift accessory set

Continued

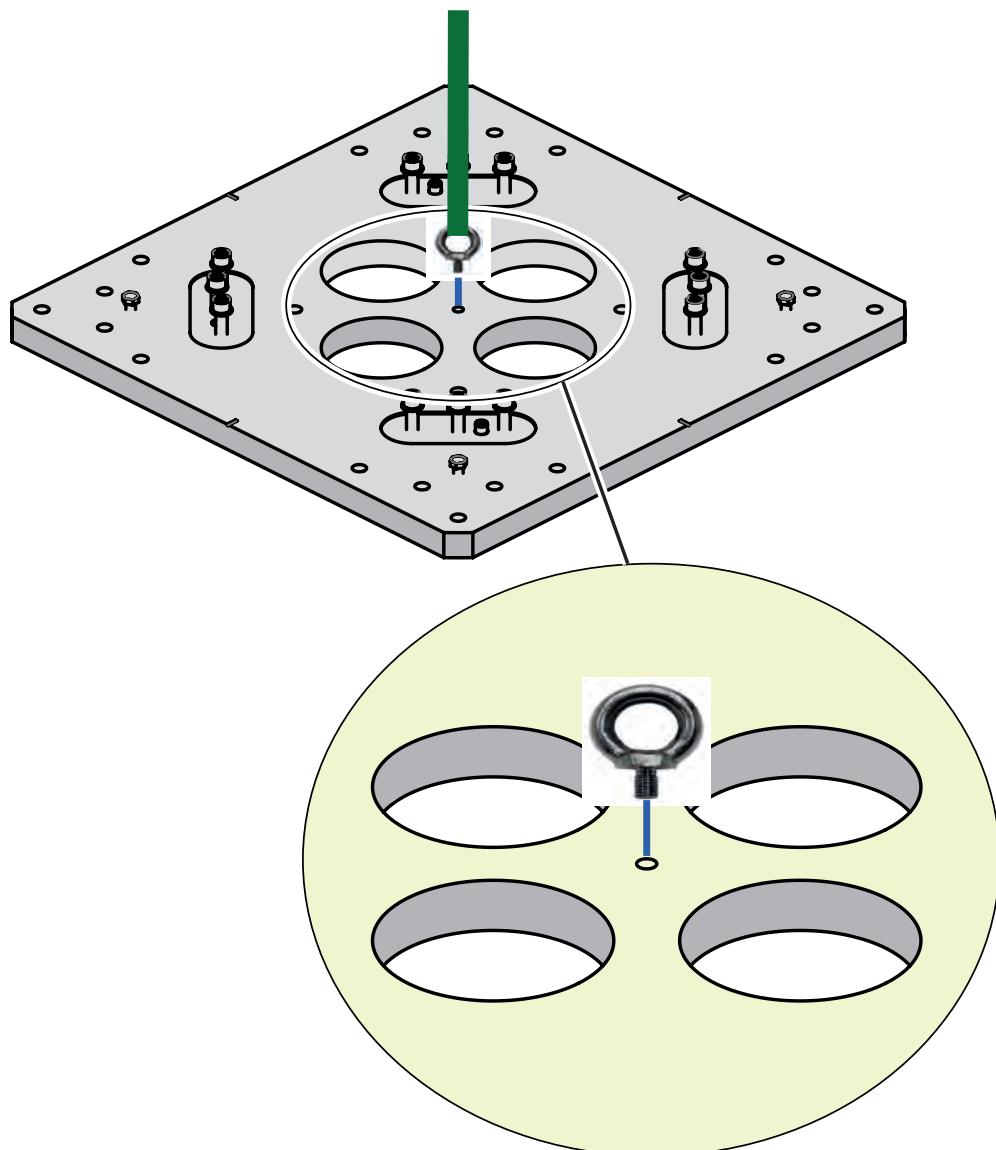
Action	Note						
5 Use caution and move the truck out off the fork lift accessory set.							
6 Remove the four fork lift accessories.  CAUTION Each fork lift accessory pocket weighs 18 kg. Use caution when handling them.  CAUTION The fork lift accessory set must always be removed from the robot before powering up the robot. If not, the counterweight will collide with the fork lift accessory pockets, in certain positions.	 xx1400002588 <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <table border="1"> <tr> <td>A</td> <td>CE label</td> </tr> <tr> <td>B</td> <td>Fork lift accessory pocket (4 pcs)</td> </tr> <tr> <td>C</td> <td>Attachment screws MC6S 20x60 8.8 (2 pcs x4)</td> </tr> </table> </div>	A	CE label	B	Fork lift accessory pocket (4 pcs)	C	Attachment screws MC6S 20x60 8.8 (2 pcs x4)
A	CE label						
B	Fork lift accessory pocket (4 pcs)						
C	Attachment screws MC6S 20x60 8.8 (2 pcs x4)						
7 Secure the robot to the foundation with the remaining 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 Installation and commissioning

2.3.3 Lifting the base plate

Continued

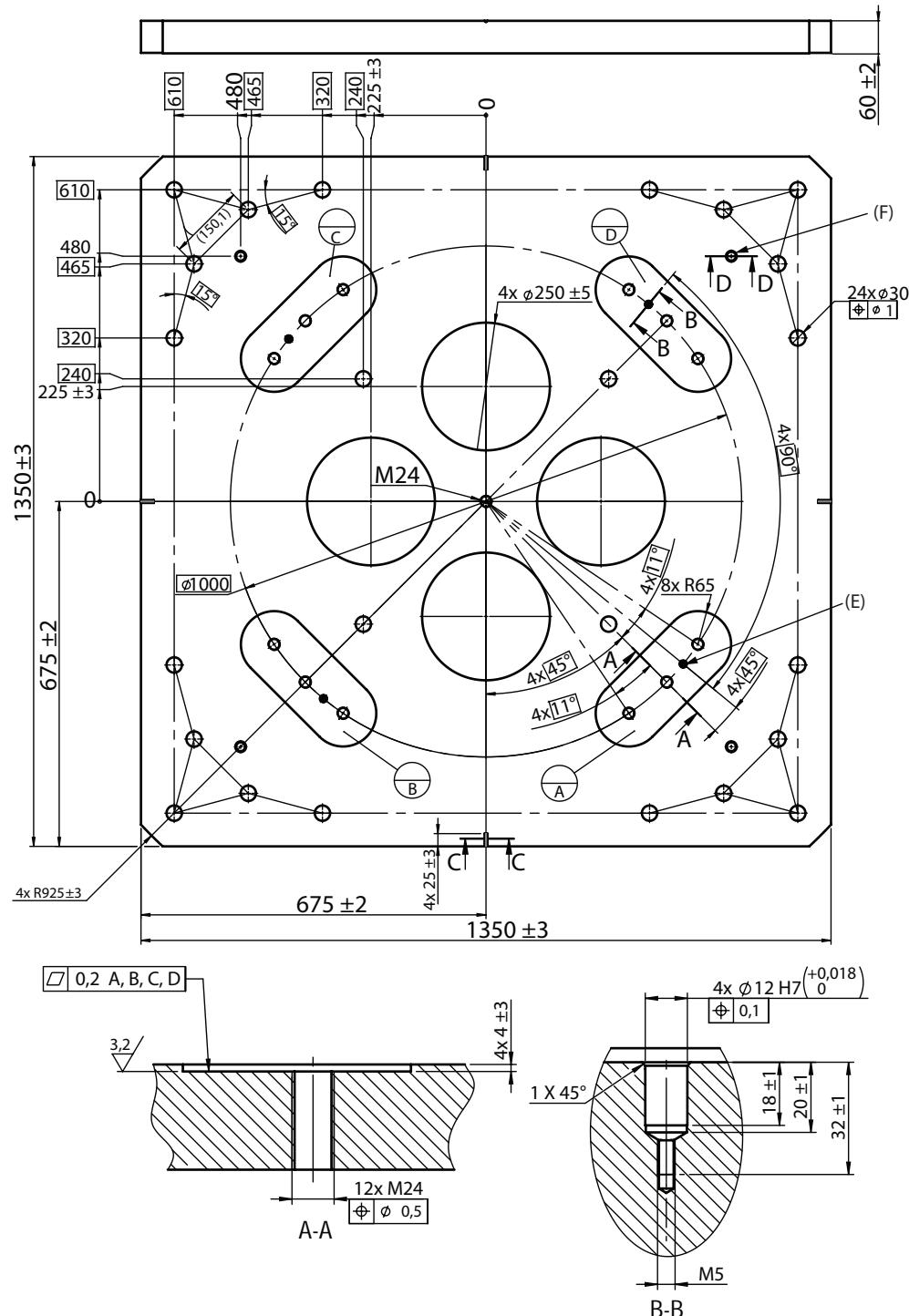
Lifting, base plate

	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 75 .
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.)



xx1500000820

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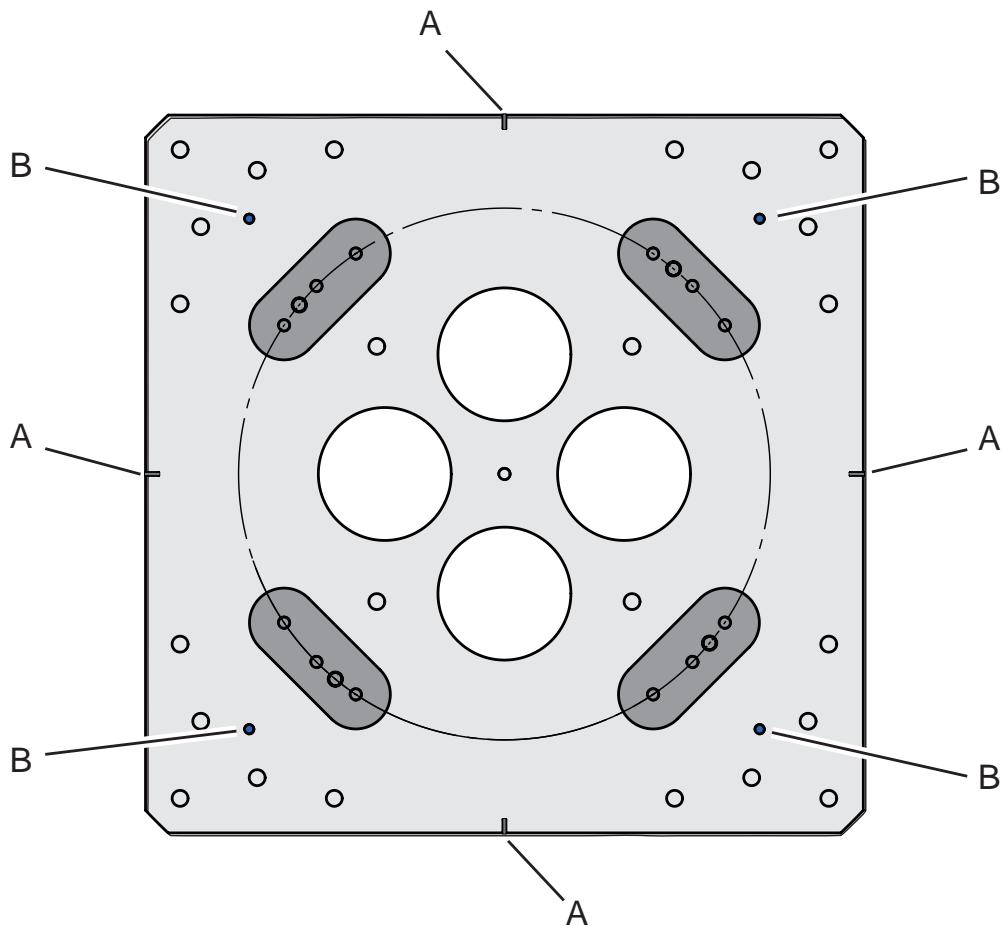
2 Installation and commissioning

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.



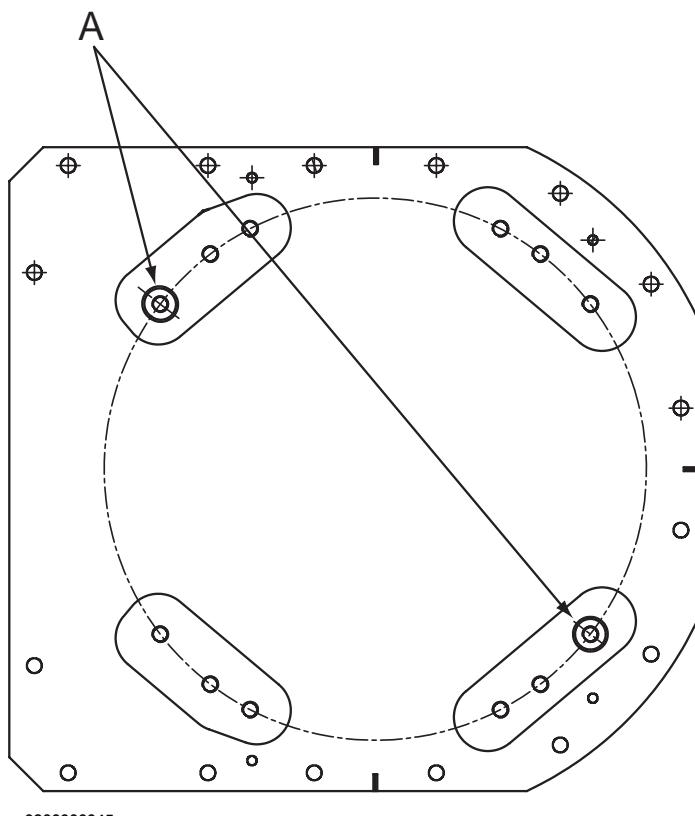
xx1400002594

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

Continues on next page

Base plate, guide sleeve holes

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



xx030000045

A	Guide sleeve holes (2 pcs)
---	----------------------------

Required equipment

Equipment	Article number	Note
Base plate	3HAC053722-002	Includes <ul style="list-style-type: none"> • 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 825 .
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.

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2 Installation and commissioning

2.3.4 Securing the base plate

Continued

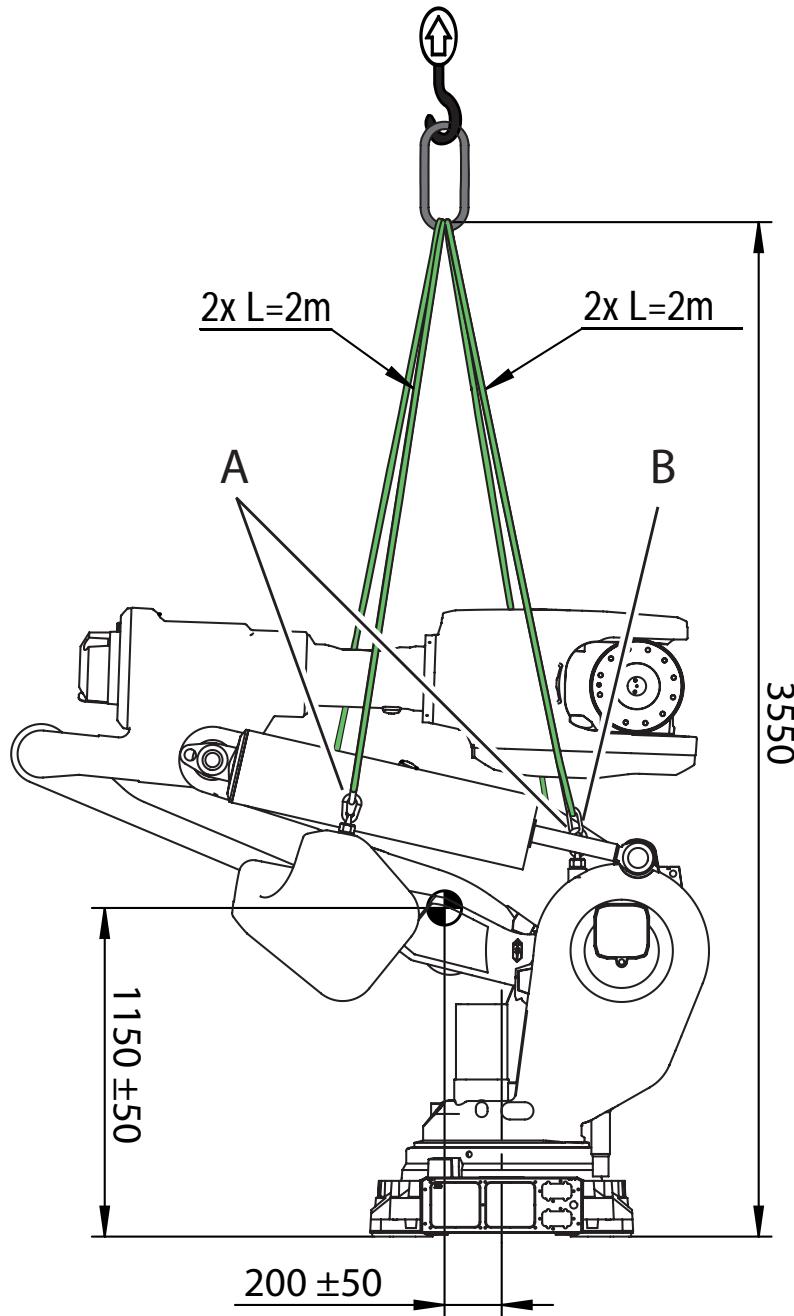
Base plate

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!	
3	Position base plate in relation to the robot work location using the <i>grooves</i> in the base plate.	Shown in figure Base plate, orienting grooves and leveling bolts on page 78 .
4	Lift the base plate to its mounting position.	See Lifting the base plate on page 75 .
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 78 .
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

To reach the length of 2.1 m, use roundslings 2.5 m and shorten them to 2.1 m.



Tip

Lifting chains with shorteners is an alternative.

Continues on next page

2 Installation and commissioning

2.3.5 Lifting the robot with roundslings

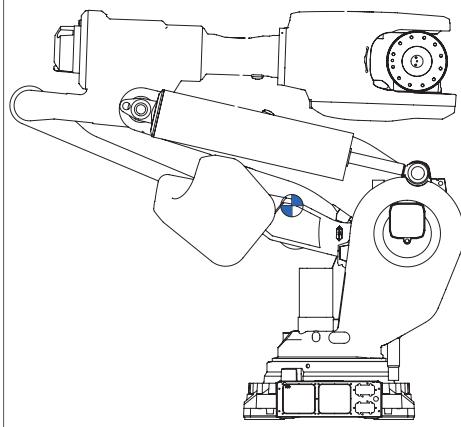
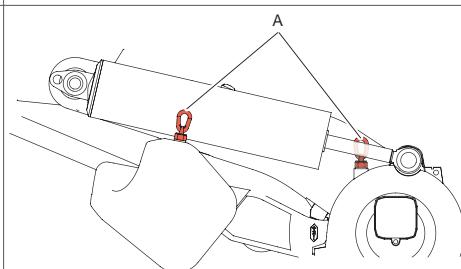
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Required equipment

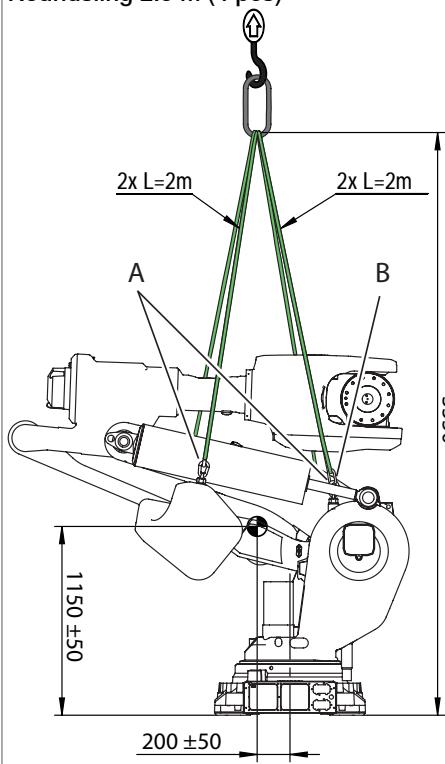
Equipment	Article number	Note
Overhead crane	-	
Lifting eyes, M24	3HAC038295-003	Certex TPG-4 or equivalent
Roundsling 2 m	-	Lifting capacity: 2,000 kg (2 pcs)
Roundsling 2.5 m	-	Lifting capacity: 2,000 kg (2 pcs) When lifting, shorten this roundsling to 2.1 m.

Lifting the robot with roundslings

Use this procedure to lift the robot with roundslings.

Action	Note		
<p>1 Jog the robot into position:</p> <ul style="list-style-type: none">• Axis 1: -90° (optional)• Axis 2: -65°• Axis 3: +2°• Axis 4: +90°• Axis 5: -90°• Axis 6: 0°. <p> WARNING</p> <p>The robot is likely to be mechanically unstable if not secured to the foundation.</p>	 xx1400002584		
<p>2  CAUTION</p> <p>The IRB 8700 robot weighs 4,750 kg. All lifting accessories used must be sized accordingly.</p>			
<p>3 Fit lifting eyes to the holes on frame and counter weight respectively.</p>	 xx1400002590 <table border="1"><tr><td>A</td><td>Lifting eyes M24</td></tr></table>	A	Lifting eyes M24
A	Lifting eyes M24		

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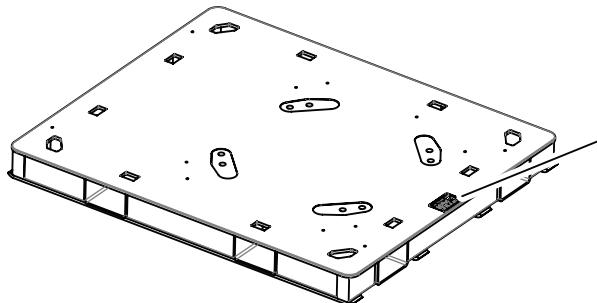
Action	Note
4 Run roundslings through the lifting eyes and fasten them in an overhead crane. Make sure the roundslings do not rub against any sharp edges.	Roundsling 2.5 m (4 pcs)  xx1400002583
5 Stretch the roundslings to take the weight of the robot.	
6	WARNING Personnel must not, under any circumstances, be present under the suspended load.
7	Use caution and raise the overhead crane to lift the robot.

2 Installation and commissioning

2.3.6 Returning of the ABB pallet

2.3.6 Returning of the ABB pallet

Location of information label on the steel pallet



xx1500002073

ABB 3HAC055030-001 Serial no XXX

Steel pallet is ABB property.
Return pallet to ABB within specified time
after arrival of robot system.
Pallet will otherwise be invoiced.
See <http://new.abb.com/lrb8700pallet>
for further information and instructions.

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/lrb8700pallet>.

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	<p>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.</p> <p>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 86.</p> <p> Note</p> <p>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 86.</p>	Buttons are shown in figure Location of brake release unit on page 85 .

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2 Installation and commissioning

2.3.7 Manually releasing the brakes

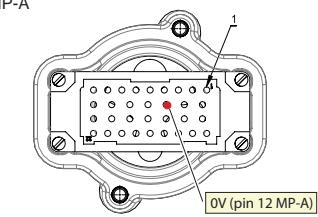
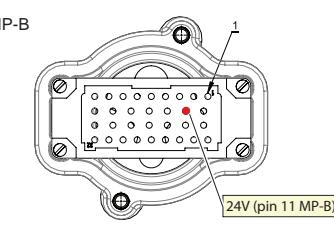
Continued

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 arm.	
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.	

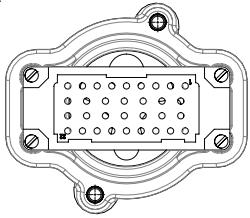
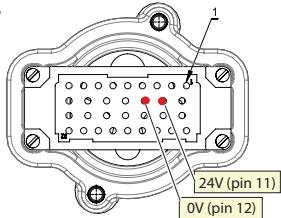
Supplying power to connector R1.MP

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 releasing the brakes on axis-1, -2, and -3.	  xx1500001989

Continues on next page

Action	Note
<p>3 Valid for axes-4, -5, and -6! Supply 0V on pin 12 R1.MP-B. Supply 24V on pin 11 R1.MP-B.</p> <p> Note</p> <p>Only R1.MP-B contact is used when releasing the brakes on axis-4, -5, and -6.</p>	  <p>MP-B</p> <p>xx1500001990</p> <p>24V (pin 11) 0V (pin 12)</p>

2 Installation and commissioning

2.3.8 Orienting and securing the robot

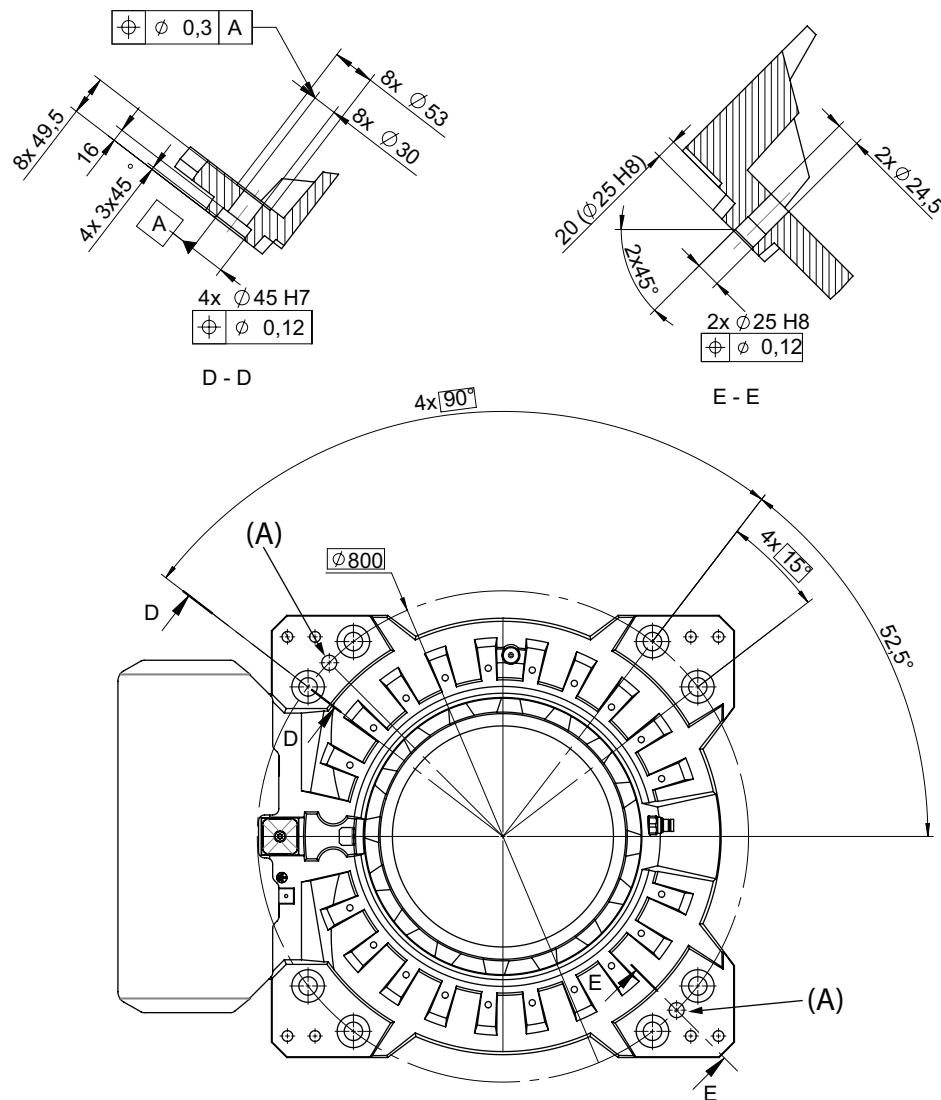
2.3.8 Orienting and securing the robot

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.



xx1300000243

Pos	Description
A	Holes for guide pins (x2)

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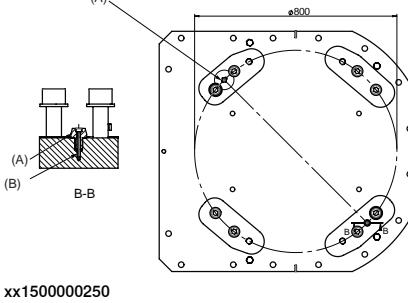
Attachment screws

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

Suitable screws, lightly lubricated:	M24 x 100
Quantity:	12 pcs
Quality:	8.8
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 B M5 x 40. Tightening torque 6 Nm. (x2)
2 Lift the robot.	See Lifting the robot with roundslings on page 81 .
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.	Specified in Attachment screws on page 89 .  Note Lightly lubricate screws before assembly!
6 Tighten bolts in a crosswise pattern to ensure that the base is not distorted.	

2 Installation and commissioning

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 also be defined in the software as detailed in:

- *Operating manual - IRC5 with FlexPendant*

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 for the robot.

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 94](#)). 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.

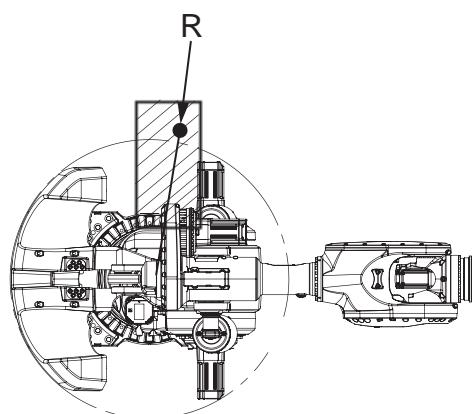
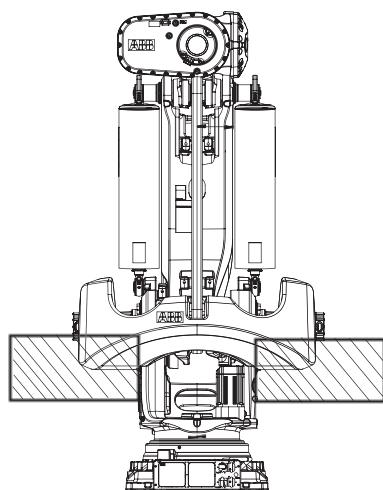
	Description
Permitted extra load on frame	$J_H = 200 \text{ kgm}^2$
Recommended position (see the following figure)	$J_H = J_{H0} + M_4 \times R^2$ where: <ul style="list-style-type: none">• J_{H0} is the moment of inertia of the equipment• R is the radius (m) from the center of axis 1• M_4 is the total mass (kg) of the equipment including bracket and harness ($\leq 500 \text{ kg}$)

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2 Installation and commissioning

2.3.10 Fitting equipment

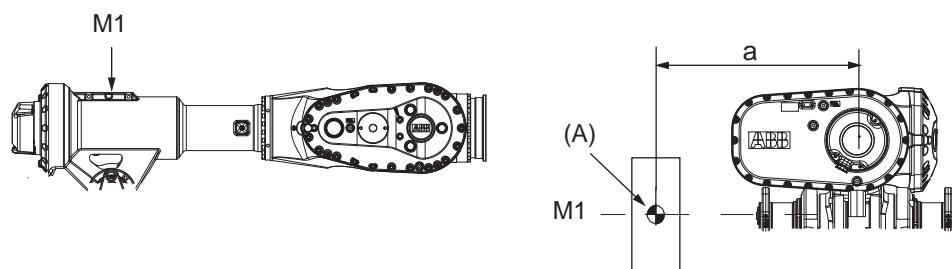
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Upper arm

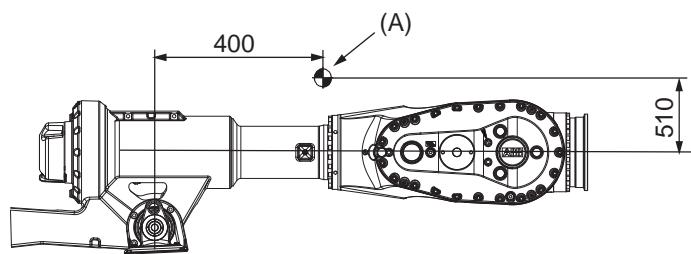
Allowed extra load on the upper arm housing, in addition to the maximum handling weight, is $M_1 \leq 50$ kg with a distance $(a) \leq 500$ mm from the center of gravity in the axis-3 extension.



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A	Mass center
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A	Center of gravity 50 kg
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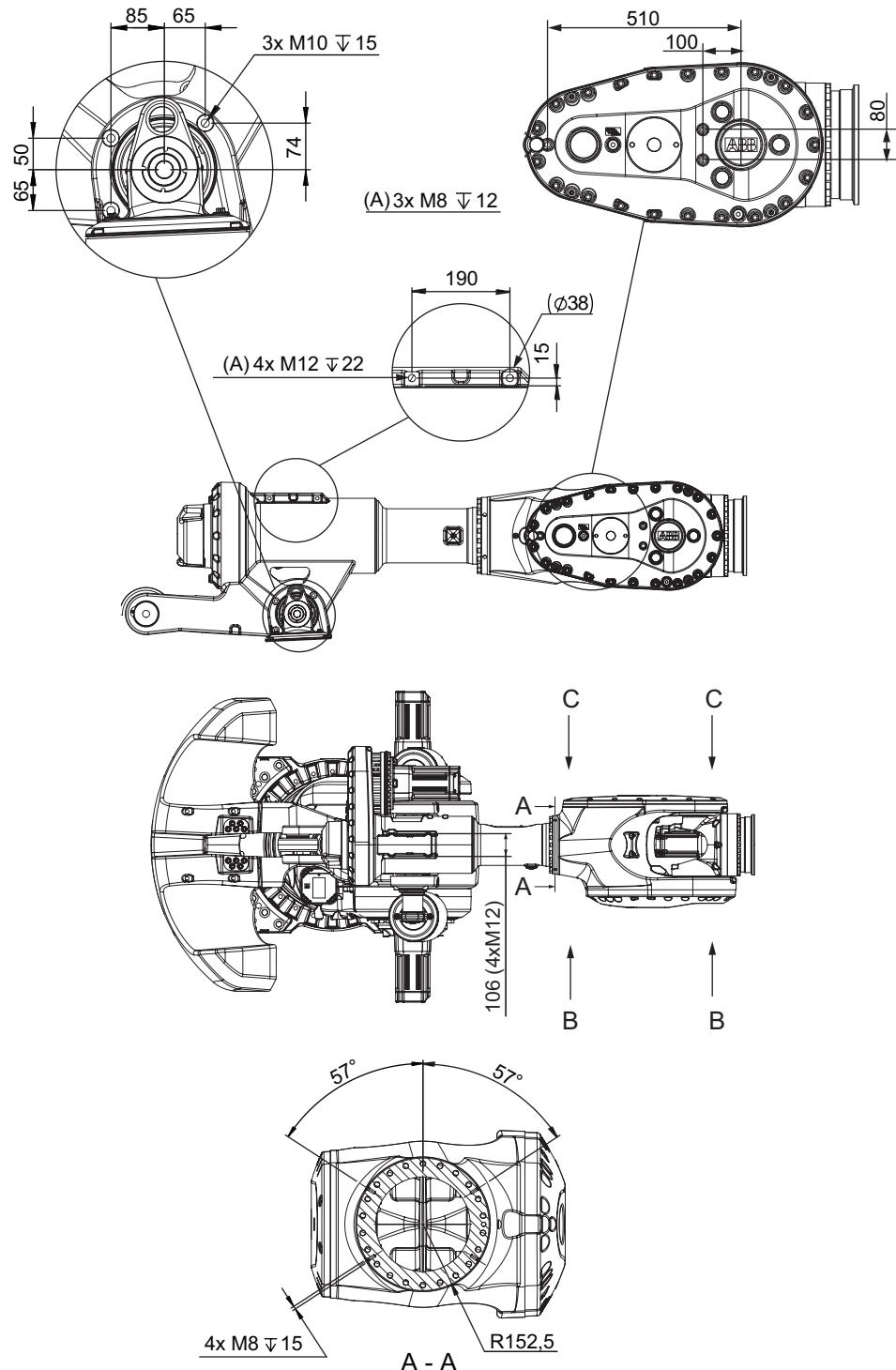
2 Installation and commissioning

2.3.10 Fitting equipment

Continued

Holes for fitting extra equipment

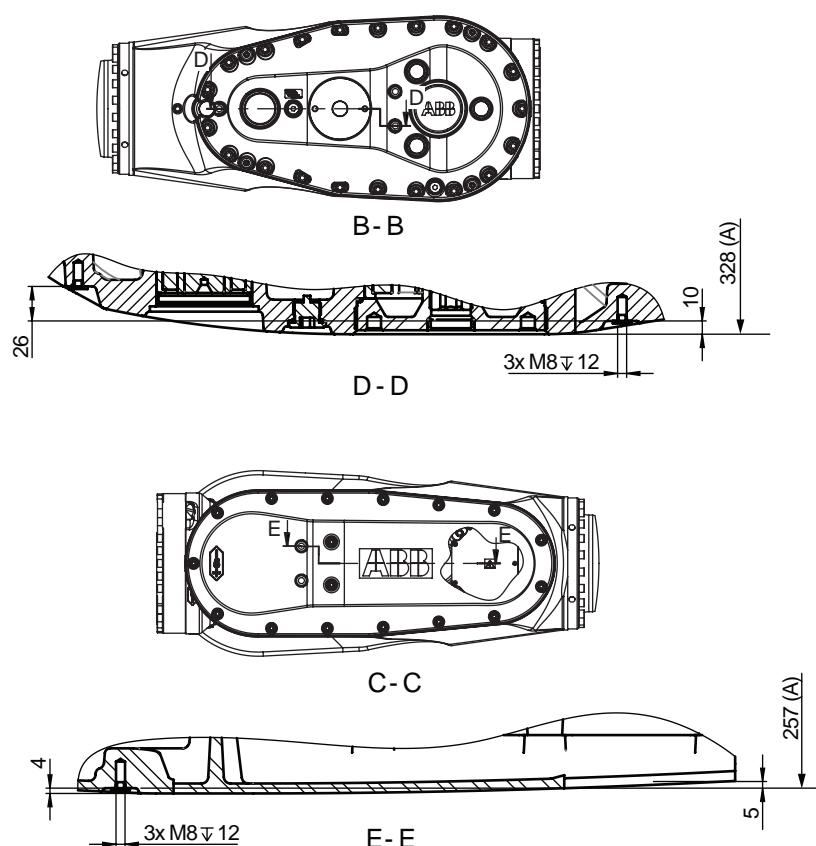
Upper arm



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A	Holes located on both sides.
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A	Measure from center axis 6
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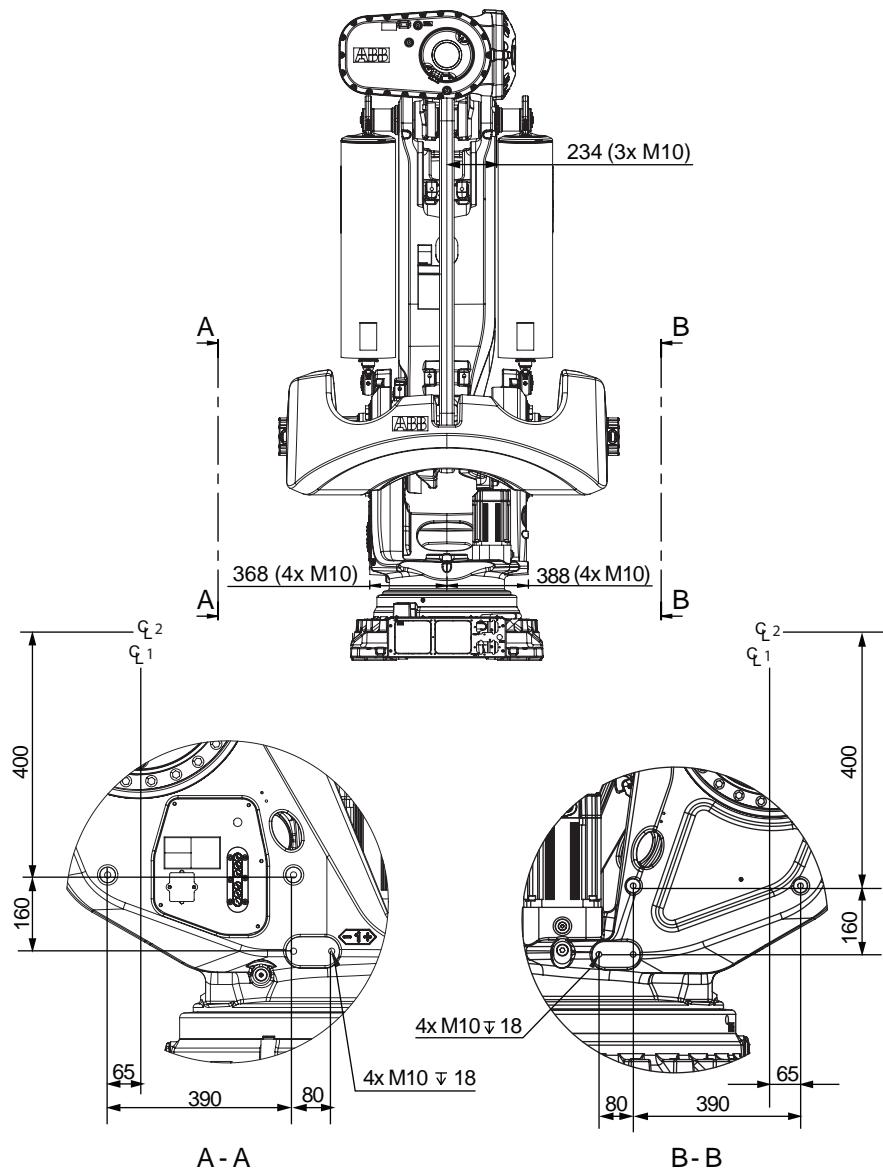
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2 Installation and commissioning

2.3.10 Fitting equipment

Continued

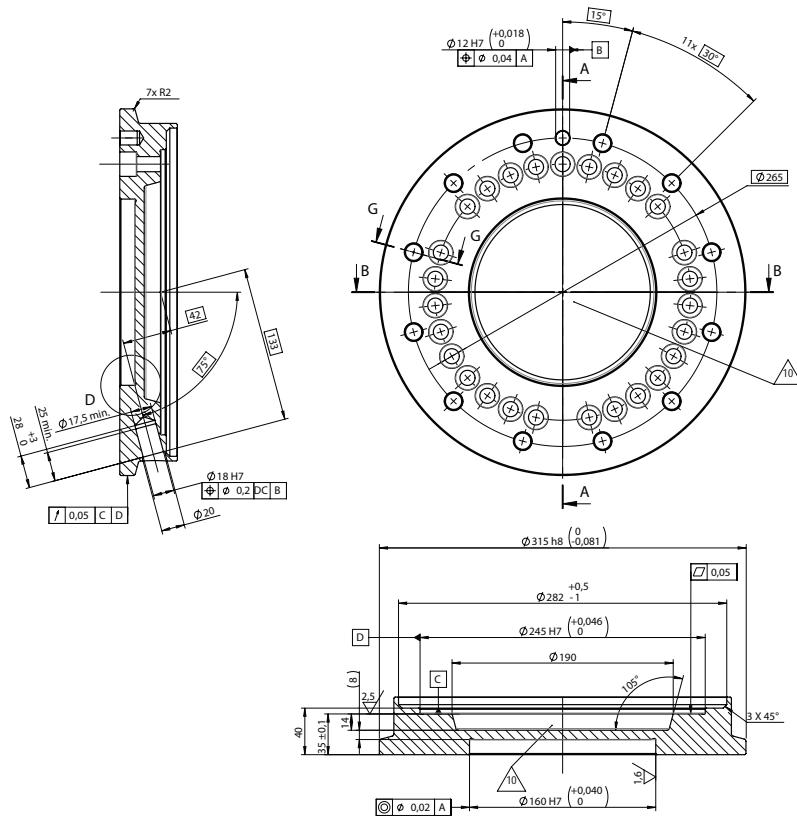
Frame



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Continues on next page

Tool flange, standard and LeanID



xx1400002878

Fastener quality

Use suitable screws and tightening torque for your application.

2 Installation and commissioning

2.4.1 Axes with restricted working range

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

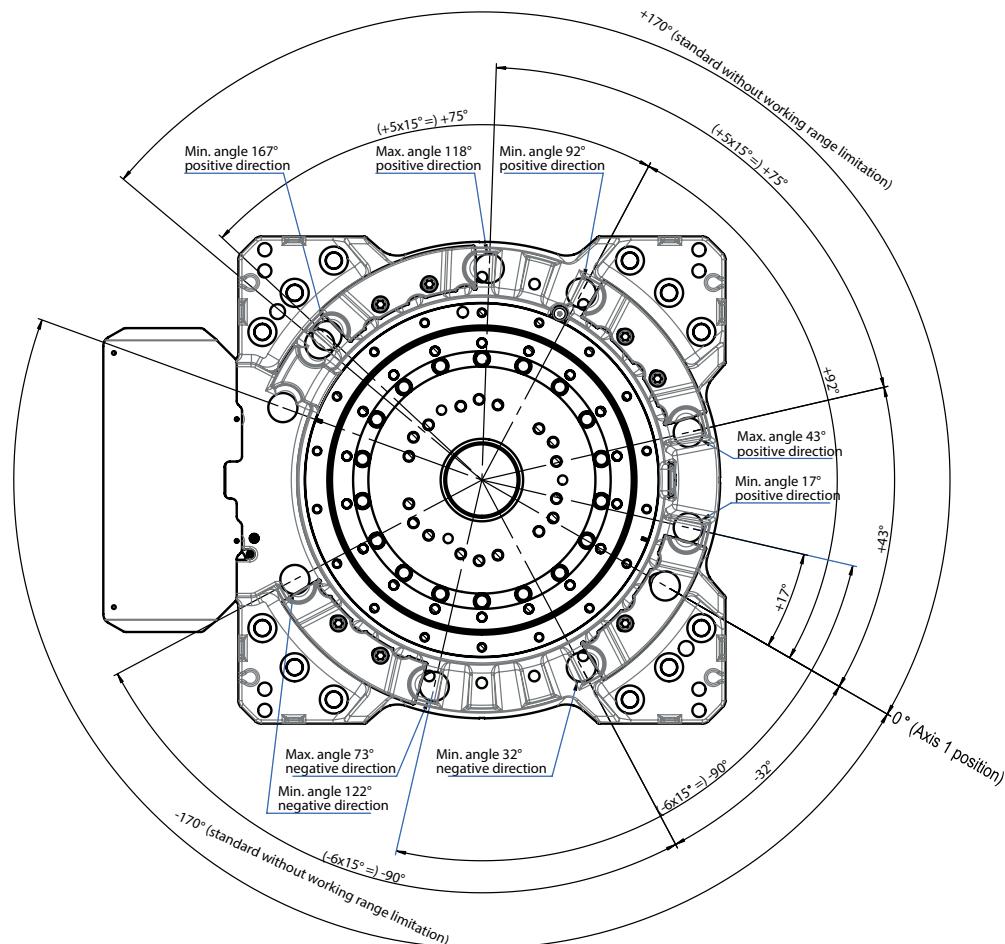
Adjustments must also be made in the robot configuration software (system parameters). References to relevant manuals are included in the installation procedures.

2.4.2 Mechanically restricting the working range of axis 1

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° - $6 \times 15^\circ$ negative direction and 118° - $5 \times 15^\circ$ in positive direction. See figure!



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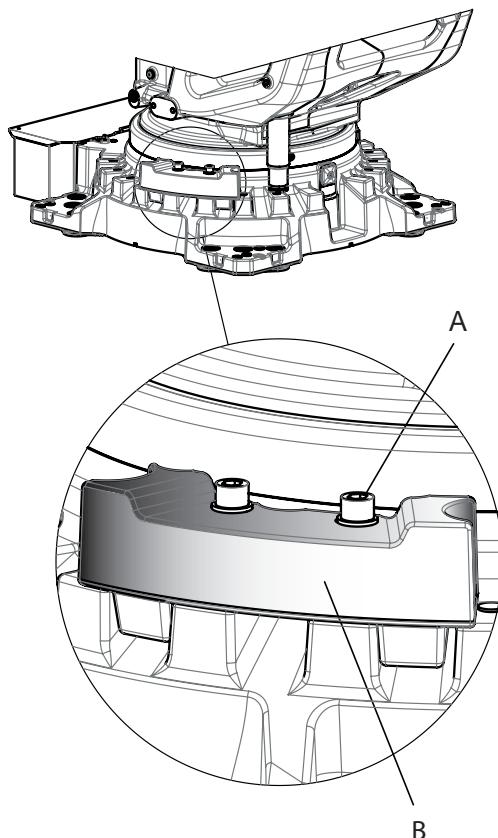
2 Installation and commissioning

2.4.2 Mechanically restricting the working range of axis 1

Continued

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	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none">• electric power supply to the robot• hydraulic pressure supply to the robot• air pressure supply to the robot <p>Before entering the robot working area.</p>	

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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 100 .	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 (<i>Upper joint bound</i> and <i>Lower joint bound</i>) are described in <i>Technical reference manual - System parameters</i> .
4  WARNING If the mechanical stop pin is deformed after a hard collision, it must be replaced! Deformed <i>movable stops</i> and/or <i>additional stops</i> as well as deformed <i>attachment screws</i> must also be replaced after a hard collision.	

2 Installation and commissioning

2.5.1 Robot cabling and connection points

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.

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.
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 .

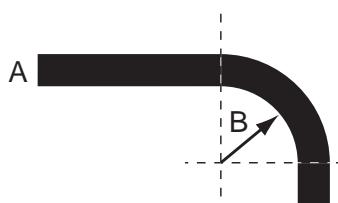
Robot cables

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

Cable sub-category	Description	Connection point, cabinet	Connection point, robot
Robot cables, power	Transfers drive power from the drive units in the control cabinet to the robot motors.	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

Bending radius for static floor cables

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



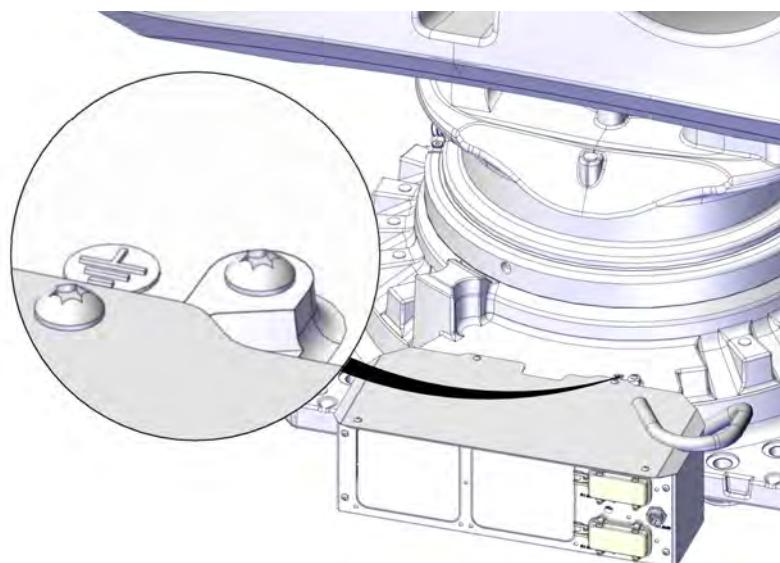
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A	Diameter
B	Diameter x10

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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.



xx1500001602

2 Installation and commissioning

2.6.1 Installing the signal lamp (option)

2.6 Installation of options

2.6.1 Installing the signal lamp (option)

Signal lamp

See the assembly instruction delivered with the signal lamp.

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 service work!

There are general safety aspects that must be read through, as well as more specific safety information that describes the danger and safety risks when performing the procedures. Read the chapter [Safety on page 15](#) before performing any service work!



Note

If the IRB 8700 is connected to power, always make sure that the IRB 8700 is connected to protective earth before starting any maintenance work!

For more information see:

- *Product manual - IRC5*

3 Maintenance

3.2.1 Specification of maintenance intervals

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.

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 109](#)

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 185
Inspection activities							
Inspecting the oil level in axis-1 gearbox		x					Inspecting the oil level in axis-1 gearbox on page 110
Inspecting the oil level in axis-2 gearbox		x					Inspecting the oil level in axis-2 and 3 gearboxes on page 113
Inspecting the oil level in axis-3 gearbox		x					Inspecting the oil level in axis-2 and 3 gearboxes on page 113
Inspecting the oil level in axis-4 primary gearbox		x					Inspecting the oil level in axis-4 primary gearbox on page 116
Inspecting the oil level in axis-4 Secondary gearbox		x					Inspecting the oil level in axis-4 secondary gearbox on page 119
Inspecting the oil level in axis-5 gearbox		x					Inspecting the oil level in axis-5 gearbox on page 121
Inspecting the oil level in axis-6 gearbox		x					Inspecting the oil level in axis-6 gearbox on page 124
Inspecting the transparent plugs	x						
Inspecting the balancing device		x					Inspecting the balancing devices on page 128
Inspecting the robot harness		x ⁱⁱ					Inspecting the cable harness on page 131

Continues on next page

3 Maintenance

3.2.2 Maintenance schedule

Continued

Maintenance activities	Regularly	Every 12 months	Every 36 months	Every 12,000 hours ⁱ	Every 20,000 hours ^j	Every 40,000 hours ⁱ	Reference
Inspecting the information labels		x					<i>Inspecting the information labels on page 133</i>
Inspecting the dampers		x					<i>Inspecting the additional mechanical stops on page 139</i>
Inspecting the mechanical stop		x					<i>Inspecting dampers on page 144</i>
Replacement/changing activities							
Changing the oil in axis-1 gearbox				x			<i>Changing oil, axis-1 gearbox on page 146</i>
Changing the oil in axis-2 gearbox				x			<i>Changing oil in axis-2 and axis-3 gearbox on page 152</i>
Changing the oil in axis-3 gearbox				x			<i>Changing oil in axis-2 and axis-3 gearbox on page 152</i>
Changing the oil in axis-4 primary gearbox				x			<i>Changing oil, axis-4 primary gearbox on page 158</i>
Changing the oil in axis-4 secondary gearbox				x			<i>Changing oil, axis-4 secondary gearbox on page 164</i>
Changing the oil in axis-5 gearbox				x			<i>Changing oil, axis-5 gearbox on page 169</i>
Changing the oil in axis-6 gearbox				x			<i>Changing oil, axis-6 gearbox on page 173</i>
Replacing the SMB battery pack			x ⁱⁱⁱ				<i>Replacing the SMB battery on page 178</i>
Lubrication activities							
Lubricating the balancing device bearings				x ^{iv}			<i>Lubricating the spherical roller bearings, balancing device on page 181</i>
Lubricating the cross roller bearing			x				<i>Lubricating the cross roller bearing on page 183</i>
Overhaul							
Overhaul of complete robot					x ^v		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 109*.

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 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 Maintenance

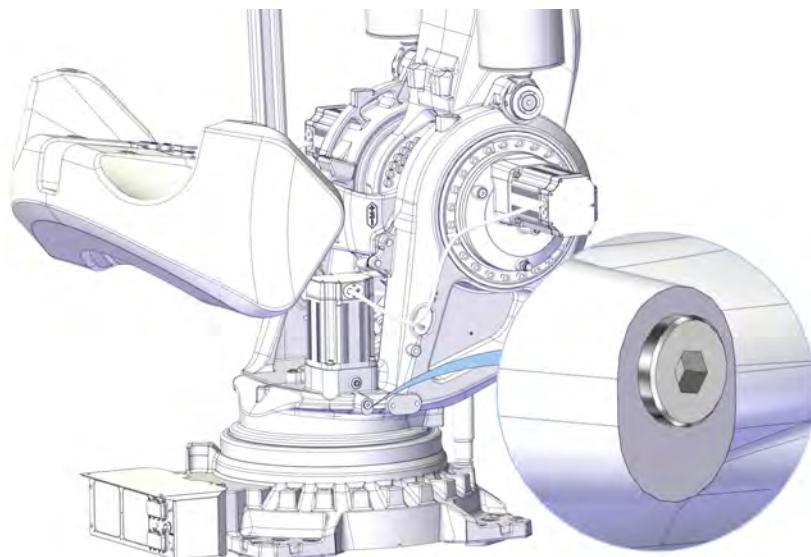
3.3.1 Inspecting the oil level in axis-1 gearbox

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.



xx1500001991

Required tools

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumable

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

Required documents

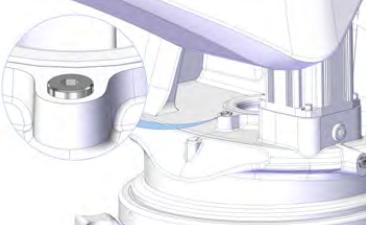
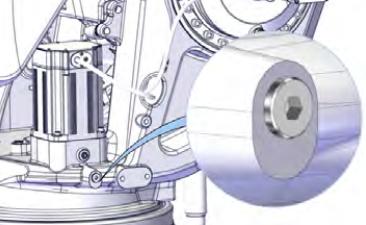
Document	Document number	Note
Technical reference manual - Lubrication in gearboxes		3HAC042927-001

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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: <ul style="list-style-type: none"> • 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. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	
3	 CAUTION The gearbox can contain an <i>excessive pressure</i> 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.	

Continues on next page

3 Maintenance

3.3.1 Inspecting the oil level in axis-1 gearbox

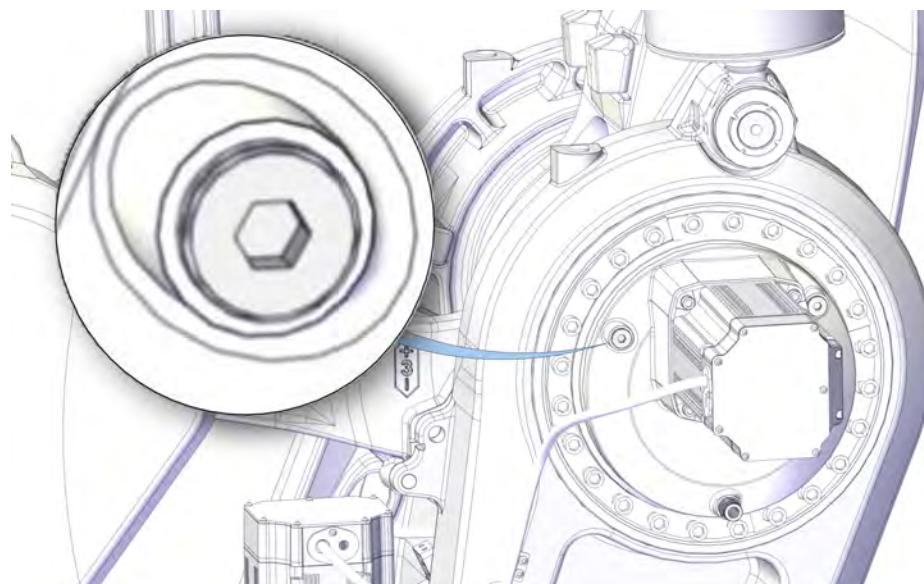
Continued

	Action	Note
8	Add or drain oil, if required.	Type of oil and total amount is detailed in <i>Technical reference manual - Lubrication in gearboxes</i> . Further information about how to drain or fill with oil is found in section Changing oil, axis-1 gearbox on page 146 .
9	Refit the oil plugs.	Tightening torque: 24 Nm.
10	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

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

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.



xx1500001996

Required tools

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumable

Consumable	Article number	Note
Lubrication oil	-	Information about the oil is found in <i>Technical reference manual - Lubrication in gearboxes</i> .

Required documents

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

Continues on next page

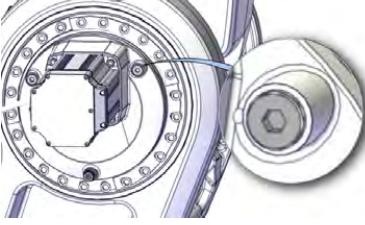
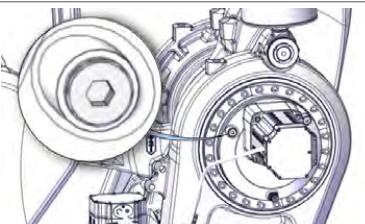
3 Maintenance

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

Continued

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: <ul style="list-style-type: none">• 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. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	
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.	

Continues on next page

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

Continued

	Action	Note
8	Add or drain oil, if required.	Type of oil and total amount is detailed in <i>Technical reference manual - Lubrication in gearboxes</i> . 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 152 .
9	Refit the oil plugs.	Tightening torque: 24 Nm.
10	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <i>DANGER - First test run may cause injury or damage!</i> on page 46 .	

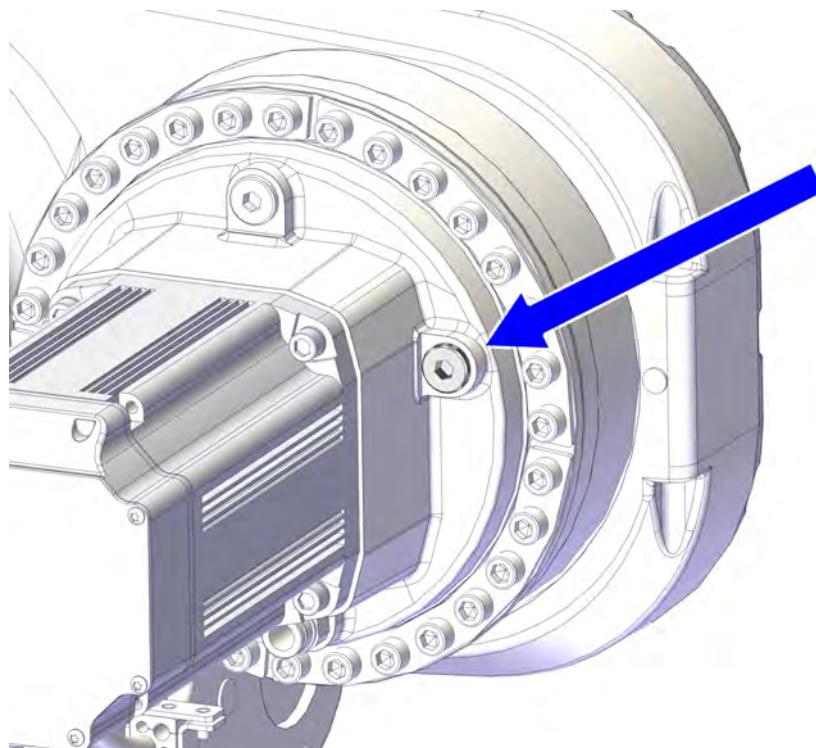
3 Maintenance

3.3.3 Inspecting the oil level in axis-4 primary gearbox

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.



xx1500001997

Required tools

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumable

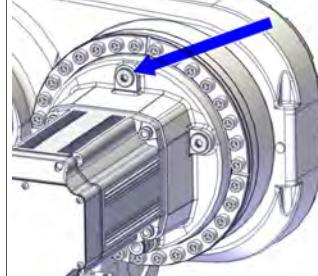
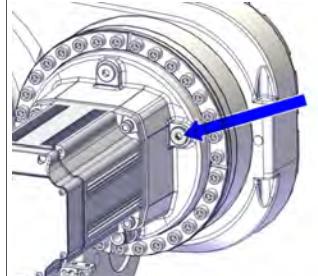
Consumable	Article number	Note
Lubrication oil	-	Information about the oil is found in <i>Technical reference manual - Lubrication in gearboxes</i> .

Required documents

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

Continues on next page

Inspecting the oil level in axis-4 primary gearbox

	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • 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. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52.	
3	 CAUTION The gearbox can contain an <i>excess of pressure</i> 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

3 Maintenance

3.3.3 Inspecting the oil level in axis-4 primary gearbox

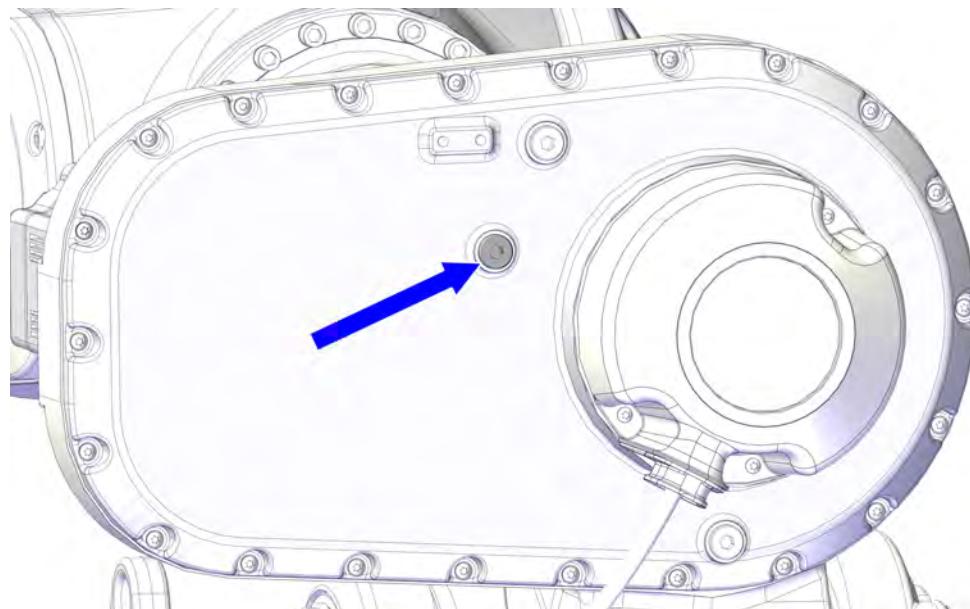
Continued

	Action	Note
8	Add or drain oil, if required.	Type of oil and total amount is detailed in <i>Technical reference manual - Lubrication in gearboxes</i> . Further information about how to drain or fill with oil is found in section Changing oil, axis-4 primary gearbox on page 158 .
9	Refit the oil plugs.	Tightening torque: 24 Nm.
10	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

3.3.4 Inspecting the oil level in axis-4 secondary gearbox

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.



xx1500002000

Required tools

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumable

Consumable	Article number	Note
Lubrication oil	-	Information about the oil is found in <i>Technical reference manual - Lubrication in gearboxes</i> .

Required documents

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

Inspecting the oil level in axis-4 secondary gearbox

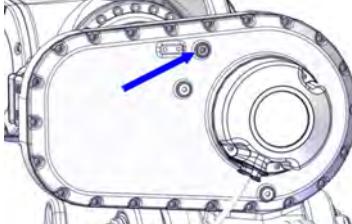
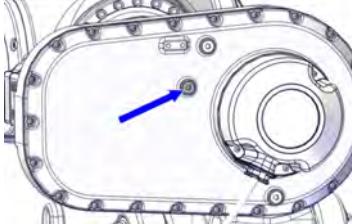
	Action	Note
1	Jog axis-2 to -60° position approximately.	
2	Jog axis-3 to +10° position approximately.	

Continues on next page

3 Maintenance

3.3.4 Inspecting the oil level in axis-4 secondary gearbox

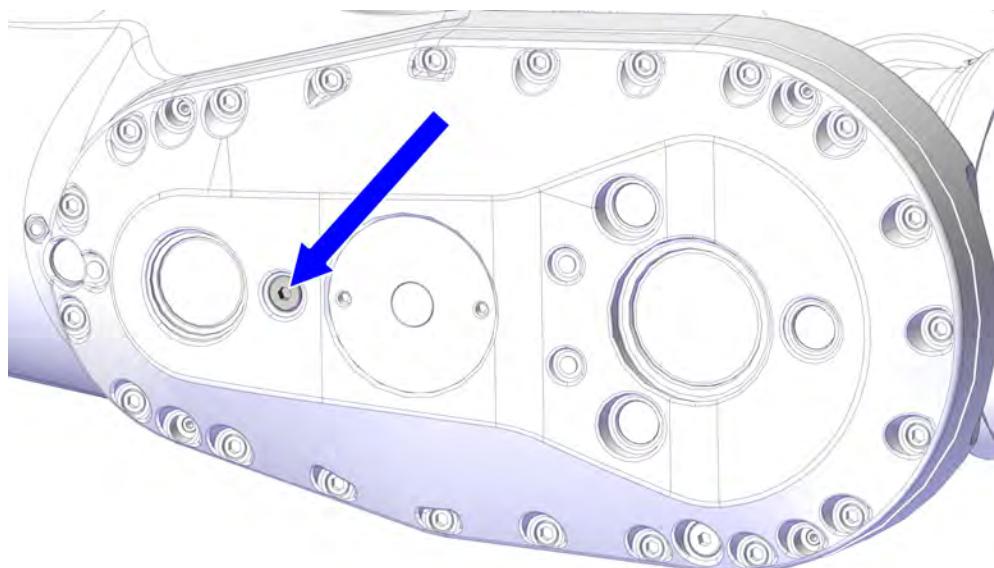
Continued

Action	Note
3	 WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52.
4	 CAUTION The gearbox can contain an <i>excess of pressure</i> 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 <i>Technical reference manual - Lubrication in gearboxes</i> . Further information about how to drain or fill with oil is found in section Changing oil, axis-4 secondary gearbox on page 164.
10	Refit the oil plugs.
	Tightening torque: 24 Nm.
11	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.

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 825 .

Required consumable

Consumable	Article number	Note
Lubrication oil	-	Information about the oil is found in <i>Technical reference manual - Lubrication in gearboxes</i> .

Required documents

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

Continues on next page

3 Maintenance

3.3.5 Inspecting the oil level in axis-5 gearbox

Continued

Inspecting the oil level in axis-5 gearbox

Action	Note
1 Jog the robot to the specified position: <ul style="list-style-type: none">• 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. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	
3  CAUTION The gearbox can contain an <i>excess of pressure</i> 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.	
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 <i>Technical reference manual - Lubrication in gearboxes</i> . Further information about how to drain or fill with oil is found in section Changing oil, axis-5 gearbox on page 169 .
9 Refit the oil plug.	Tightening torque: 24 Nm.

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	Action	Note
10	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.	

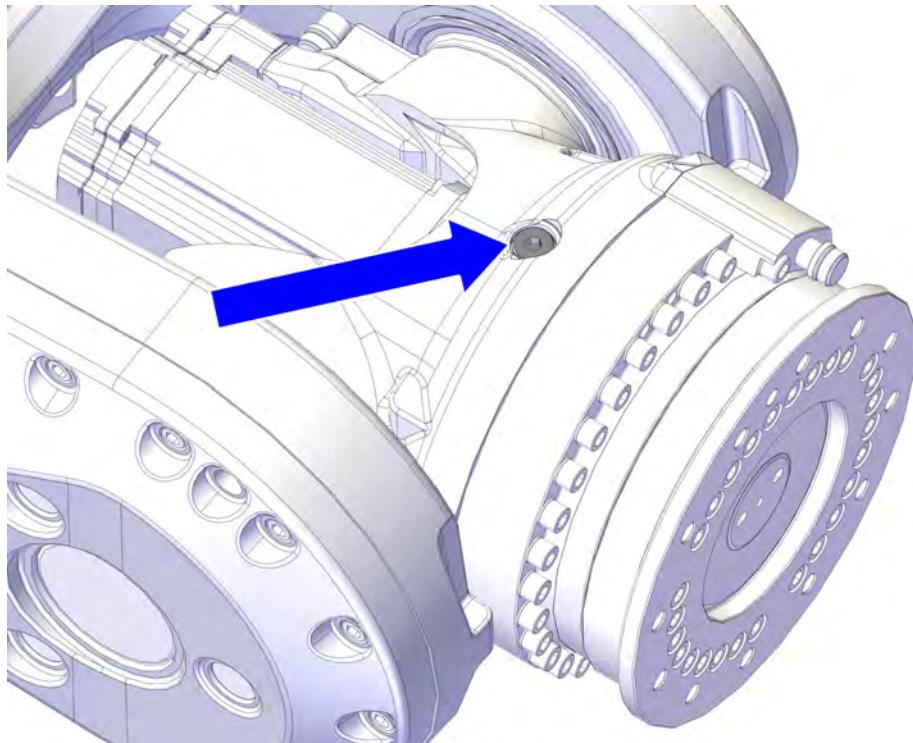
3 Maintenance

3.3.6 Inspecting the oil level in axis-6 gearbox

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 825 .

Required consumable

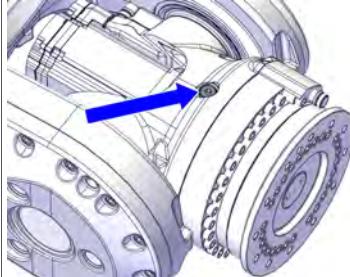
Consumable	Article number	Note
Lubrication oil	-	Information about the oil is found in Technical reference manual - Lubrication in gearboxes .

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.	Figure
2	Jog axis-5 to calibration position.	Figure
3	 WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	
4	 CAUTION The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Use caution when the oil plug is opened, in order to let out the excess pressure.	
5	Jog axis-5 to approximately +75° position 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.	 xx1500002007
6	Inspect the oil level by slowly jogging the axis-5 to +82° position approximately.	Figure
7	Required oil level is when the oil level is visible just below the lower edge of the inspection hole, with axis-5 approximately in +82° position.	Figure
8	Add or drain oil, if required.	Type of oil and total amount is detailed in <i>Technical reference manual - Lubrication in gearboxes</i> . Further information about how to drain or fill with oil is found in section Changing oil, axis-6 gearbox on page 173 .
9	Refit the oil plug.	Tightening torque: 24 Nm.
10	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

3 Maintenance

3.3.7 Inspecting the transparent plugs

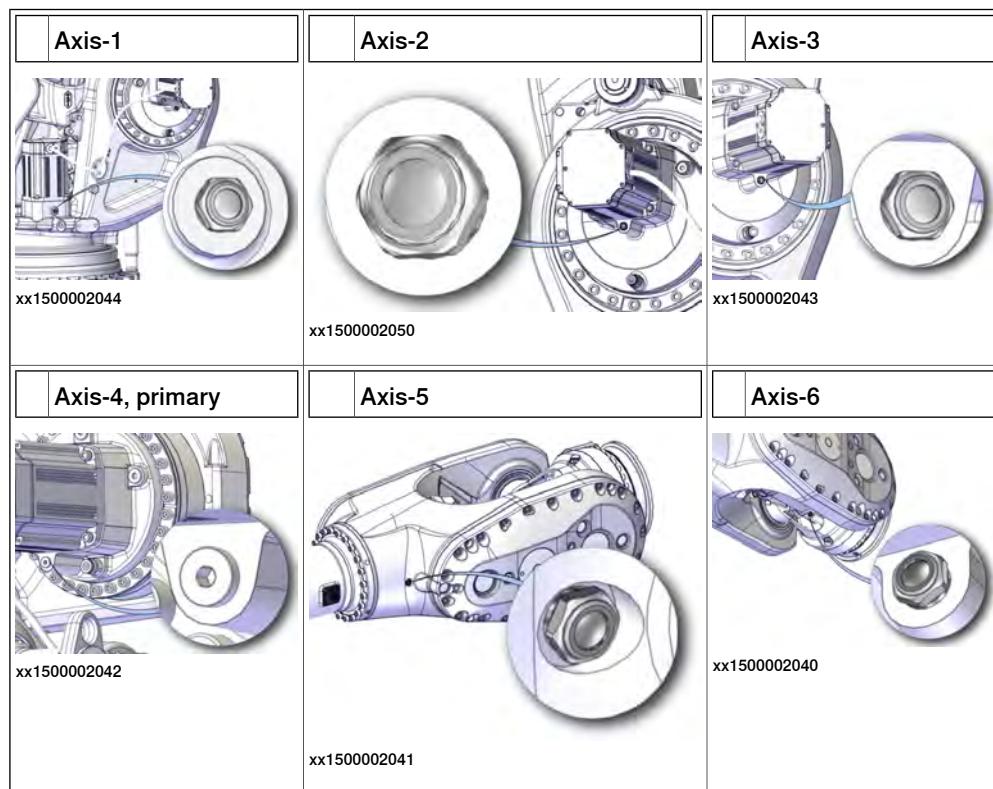
3.3.7 Inspecting the transparent plugs

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.



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).



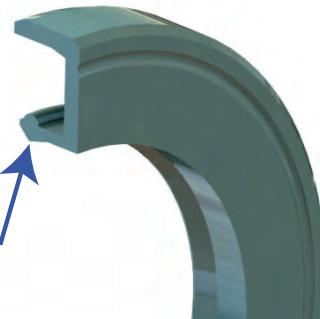
Note

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 Maintenance

3.3.8 Inspecting the balancing devices

3.3.8 Inspecting the balancing devices

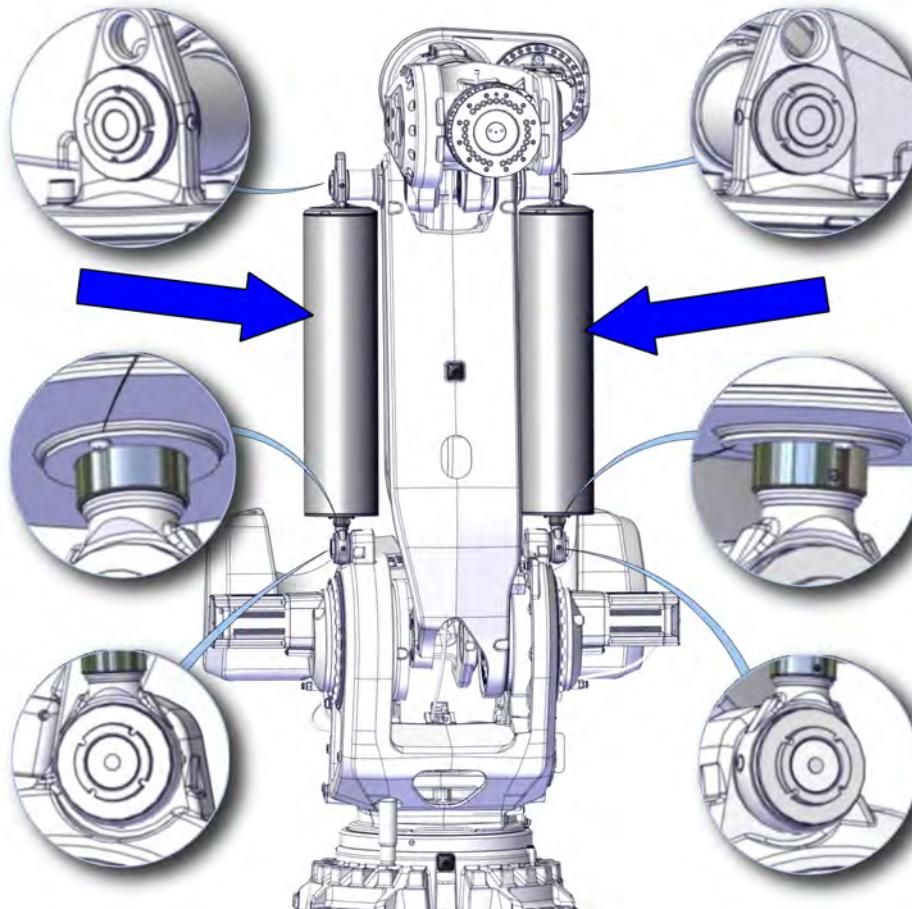
General

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

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 555
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, 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: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
4	Inspect the area around the lock nut and V-ring at the upper and lower ear for leakage.	

Continues on next page

3 Maintenance

3.3.8 Inspecting the balancing devices

Continued

	Action	Note
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: <ul style="list-style-type: none">• 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: <ul style="list-style-type: none"> • 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

3 Maintenance

3.3.9 Inspecting the cable harness

Continued

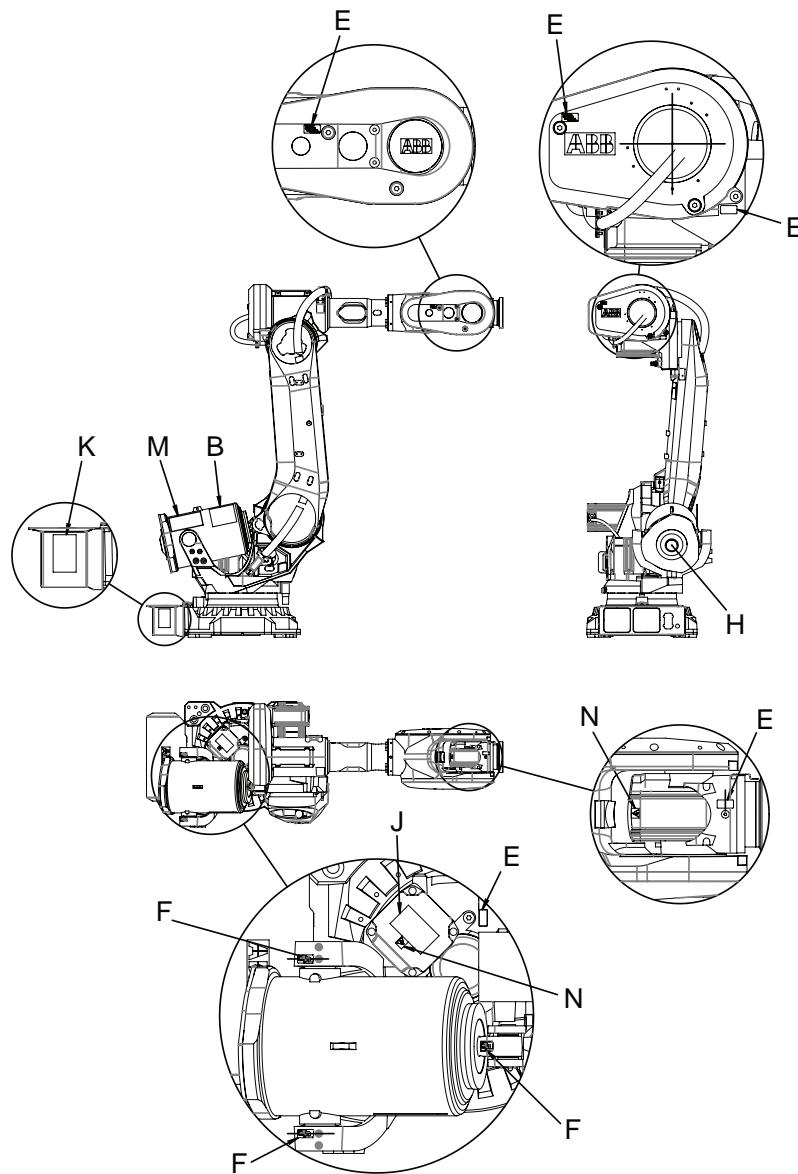
	Action	Note
3	Follow the cable harness from the base of the robot to the wrist, making sure that all cable brackets, velcro straps and other attachments are properly secured.	
4	Inspect the motor cables for any damage.	
5	Inspect the connectors at the base for any damage.	
6	Inspect the cable harness 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 product labels on page 39](#).

Illustration 1



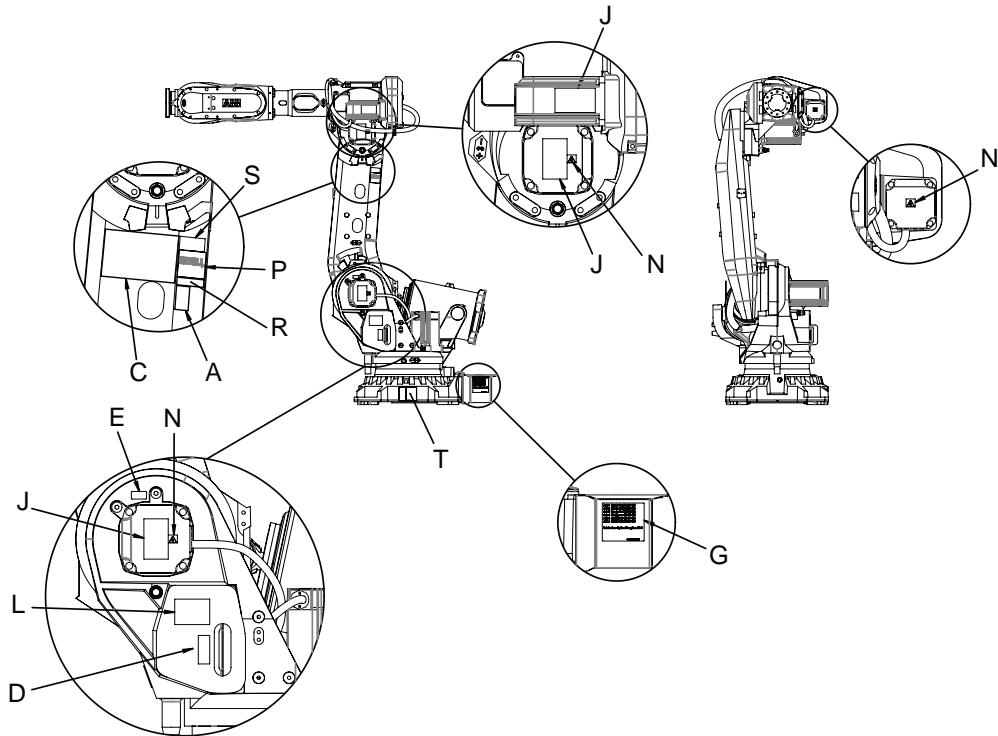
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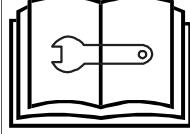
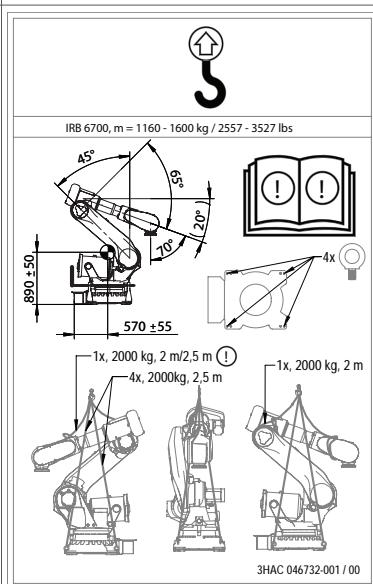
3 Maintenance

3.3.10 Inspecting the information labels

Continued

Illustration 2



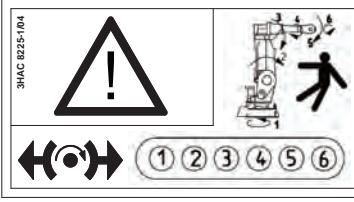
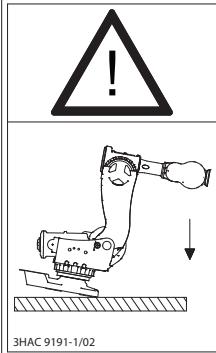
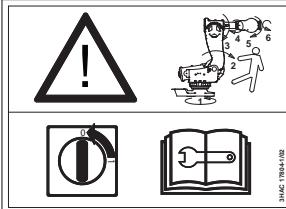
	Description	Illustration
A	Calibration label	
B	Instruction label Before dismantling see product manual	 xx0900000816
C	Instruction label Lifting of robot	 xx1300001084

Continues on next page

3 Maintenance

3.3.10 Inspecting the information labels

Continued

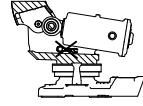
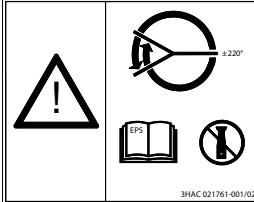
D	Instruction label Brake release Moving robot Brake release buttons	 xx1300001083
E	Oil specification label	
F	Grease specification label	
G	Complete oil specification	
H	Warning label Do not dismantle Stored energy	 xx1300001086
J	Warning label Heat	 xx1300001087
K	Warning label Tip risk when loosening bolts	 xx1300001088
L	Warning label Moving robot Shut off with handle Before dismantling see product manual	 xx1300001089

Continues on next page

3 Maintenance

3.3.10 Inspecting the information labels

Continued

M	Warning label Keep areas around the balancing device free from objects	  xx1300001090
N	Warning label Flash	 xx1300001091
P	Rating label	
R	Absolute accuracy label	
S	UL label	
T	Label Extended rotation No mechanical stop See user documentation	 xx1300001092

Required tools and equipment

Visual inspection, no tools are required.

Inspecting, labels

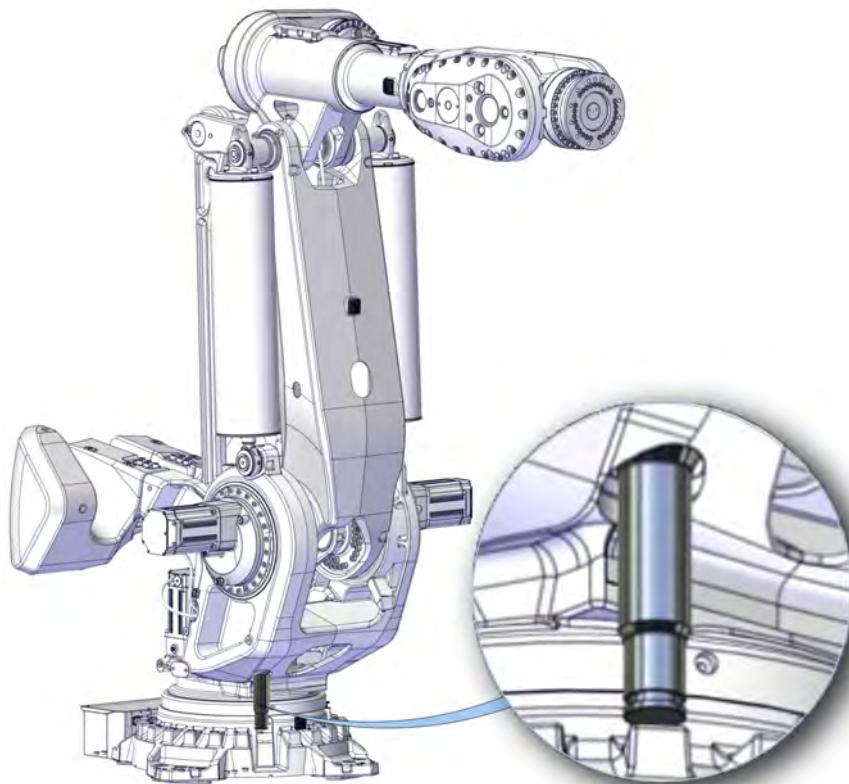
Action	Note
1  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
2 Inspect the labels, located as shown in the figures.	
3 Replace any missing or damaged labels.	Article numbers for the labels and plate set is specified in Spare parts on page 831 .

3.3.11 Inspecting the axis-1 mechanical stop pin

3.3.11 Inspecting the axis-1 mechanical stop pin

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.

Inspecting, mechanical stop pin

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

	Action	Note
1	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	

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3 Maintenance

3.3.11 Inspecting the axis-1 mechanical stop pin

Continued

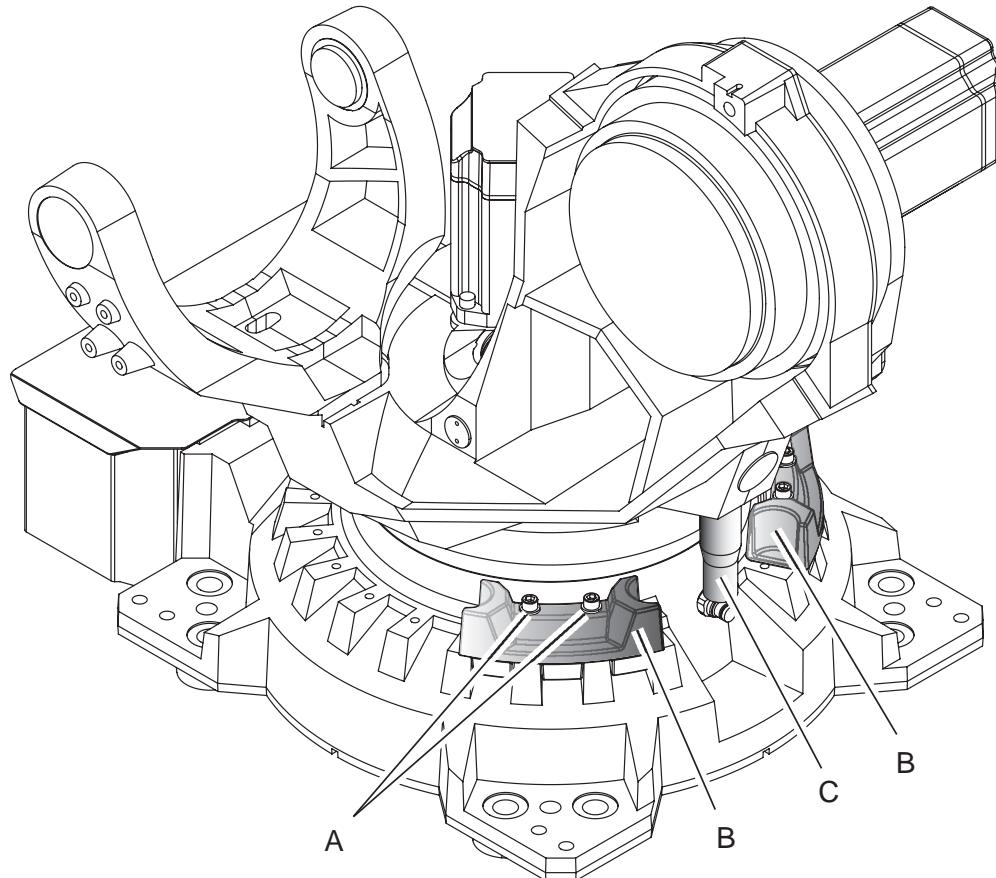
	Action	Note
2	<p>Inspect the axis-1 mechanical stop pin. If the mechanical stop pin is bent or damaged, it must be replaced.</p> <p> Note</p> <p>The expected life of gearboxes can be reduced after collision with the mechanical stop.</p>	

3.3.12 Inspecting the additional mechanical stops

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: <ul style="list-style-type: none"> • 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 825 .

Continues on next page

3 Maintenance

3.3.12 Inspecting the additional mechanical stops

Continued

Inspecting, mechanical stops

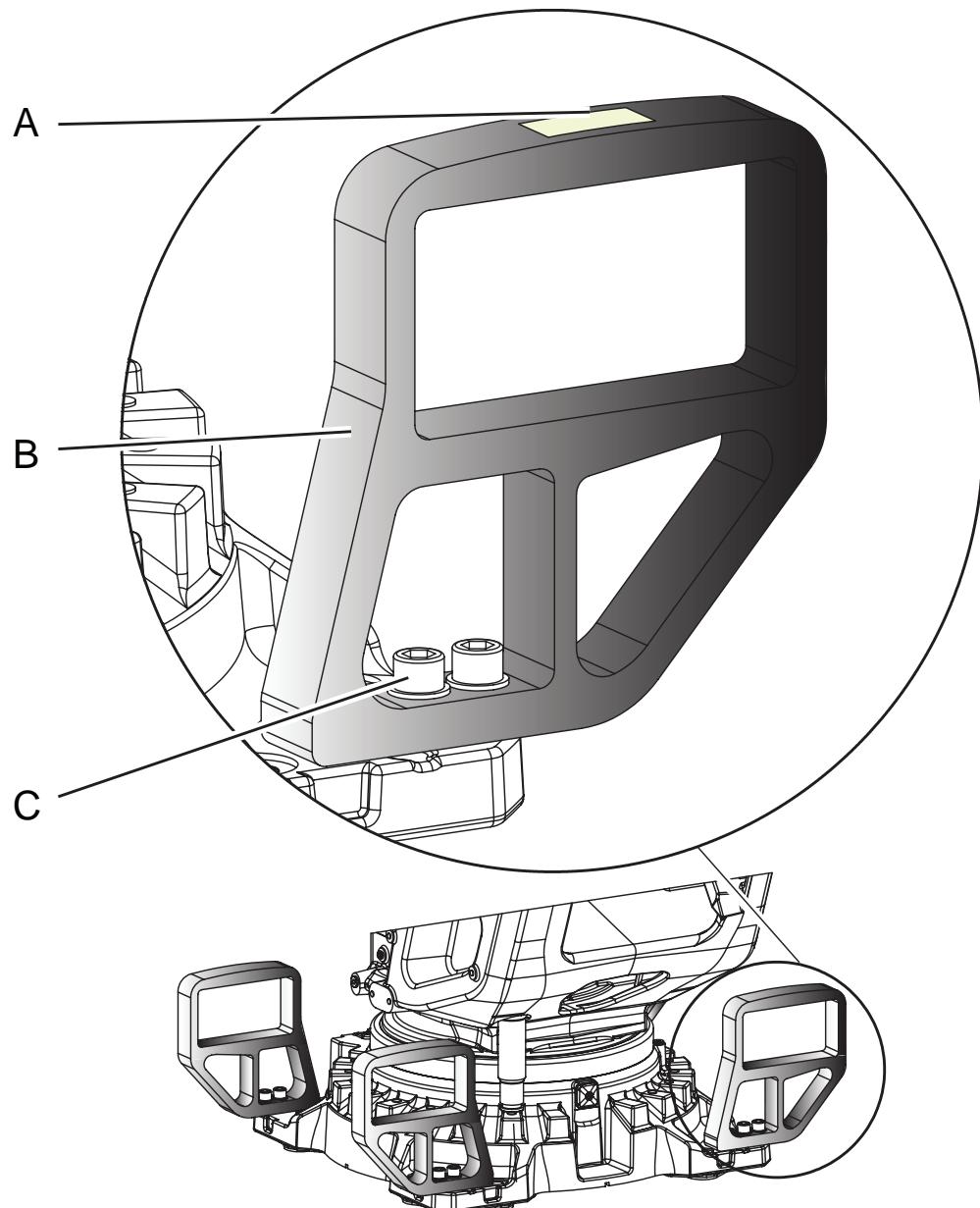
Use this procedure to inspect the additional mechanical stops.

Action	Note
1  DANGER Turn off all: <ul style="list-style-type: none">• 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 139 .
3 Make sure the stops are properly attached. Correct tightening torque, additional mechanical stops: <ul style="list-style-type: none">• Axis 1 = 280 Nm	
4 If any damage is detected, the mechanical stops must be replaced! Correct attachment screws: <ul style="list-style-type: none">• M16x90 quality 12.9 Gleitmo 603 (2 pcs per additional mechanical stop)	Article number is specified in Required equipment on page 139 .

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

3 Maintenance

3.3.13 Inspecting the fork lift accessories

Continued

Required equipment

Equipment	Article number	Note
Fork lift device set	3HAC053662-003	
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Inspecting, fork lift device set

Action	Note
1  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
2 Inspect the fork lift devices for damage.	
3 Inspect the attachment screws for deformation and other type of damage.	
4 Make sure the fork lift devices are properly attached (4 pcs). Correct tightening torque, fork lift devices: <ul style="list-style-type: none">• 280 Nm	
5 If any damage is detected, the fork lift device and attachment screws must be replaced! Correct attachment screws: <ul style="list-style-type: none">• M20x60 quality steel 8.8-A3F (2 pcs per additional mechanical stop)	Article number is specified in Required equipment on page 139 .

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 831	To be replaced if damage is detected.
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

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: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
3	If the lamp is not lit, trace the fault by: <ul style="list-style-type: none"> • 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 143 .

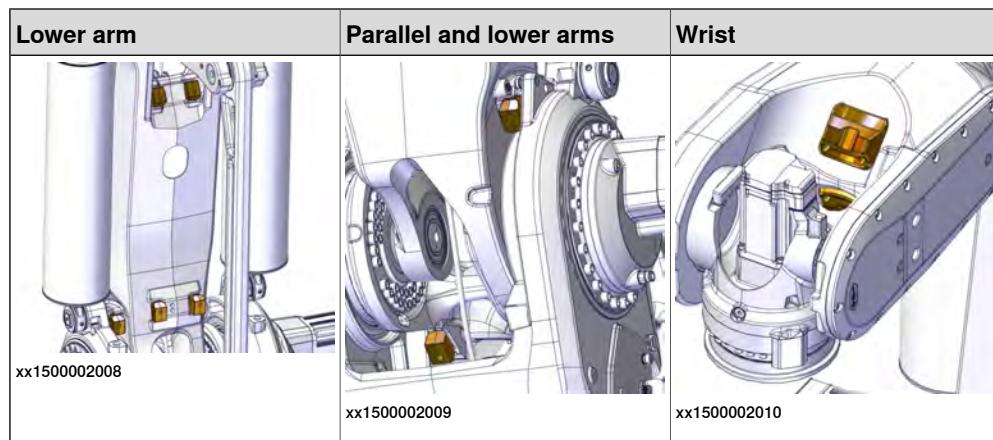
3 Maintenance

3.3.15 Inspecting dampers

3.3.15 Inspecting dampers

Location of dampers

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



Required equipment

Visual inspection, no tools are required.

Inspecting, dampers



Note

A damaged damper must be replaced!

	Action	Note
1	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply <p>to the robot, before entering the robot working area.</p>	
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* on the Documentation DVD (released twice a year). The revision of the manual published on the Documentation DVD, will contain the latest updates when the Documentation DVD is released.

Before starting any inspection, maintenance, or changing activities of lubrication, always contact the local ABB Service organization for more information.

For ABB personnel: Always check ABB Library for the latest revision of the manual *Technical reference manual - Lubrication in gearboxes*, in order to always get the latest information of updates about lubrication in gearboxes. A new revision will be published on ABB Library immediately after any updates. Therefore the manual published on the documentation DVD may not contain the latest updates about lubrication.

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: <ul style="list-style-type: none">Orion OriCan article number 22590 (pneumatic)
Nipple for quick connect fitting, with o-ring	

3 Maintenance

3.4.2 Changing oil, axis-1 gearbox

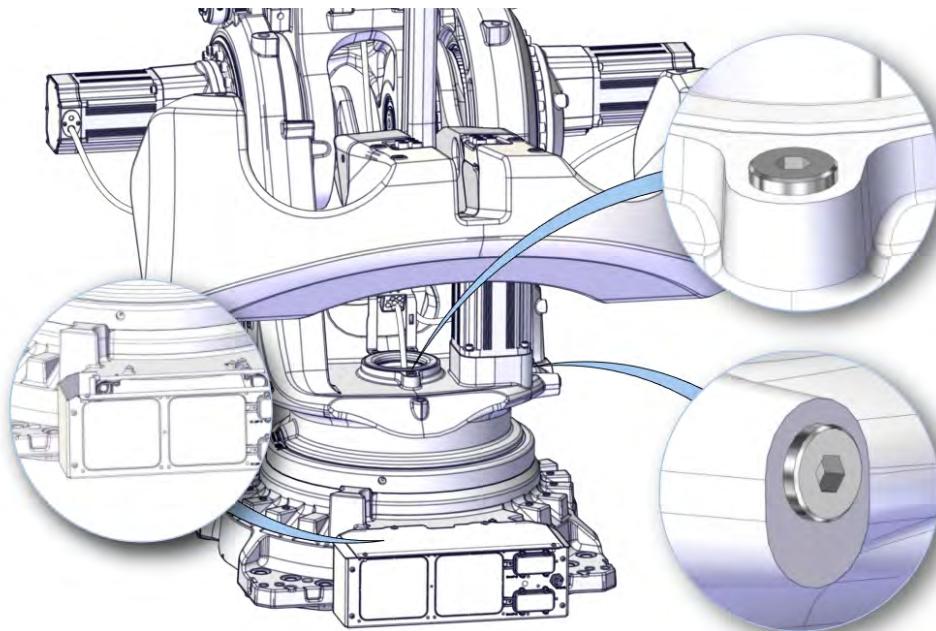
3.4.2 Changing oil, axis-1 gearbox

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 <i>Technical reference manual - Lubrication in gearboxes</i> . See Type and amount of oil in gearboxes on page 145 .

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.

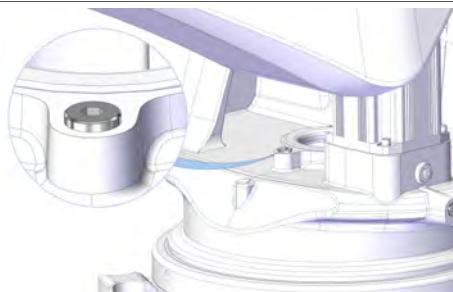
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Required documents

Document name	Document number	Note
<i>Technical reference manual - Lubrication in gearboxes</i>	3HAC042927-001	

Draining the axis-1 gearbox

Use this procedure to drain the gearbox.

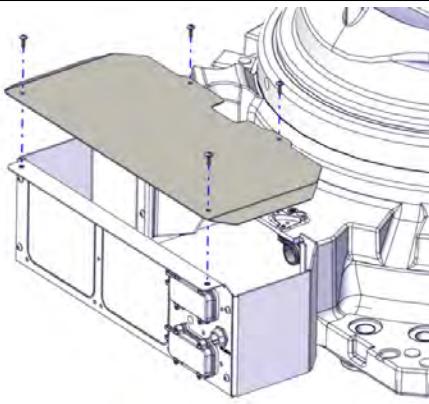
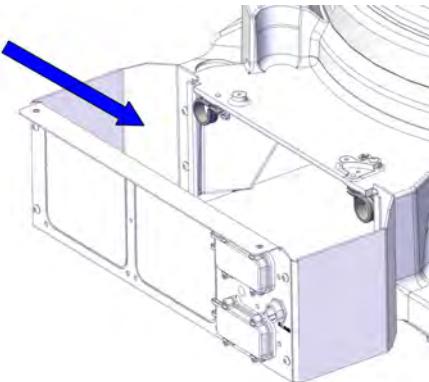
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
2	 WARNING Handling gearbox oil involves several safety risks. Before proceeding, read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52.	
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

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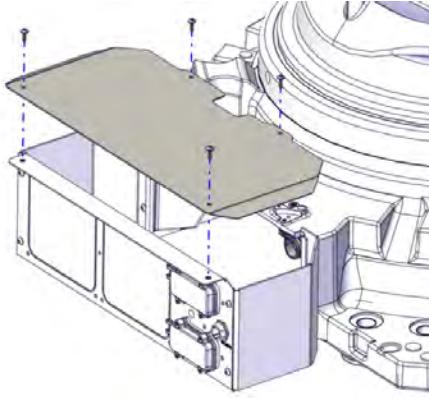
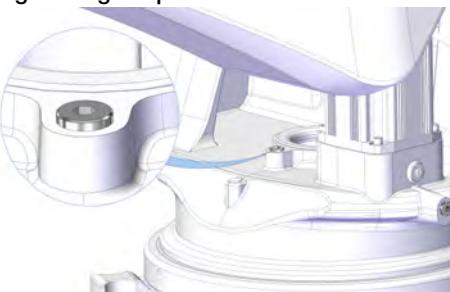
3 Maintenance

3.4.2 Changing oil, axis-1 gearbox

Continued

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 813 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

	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.

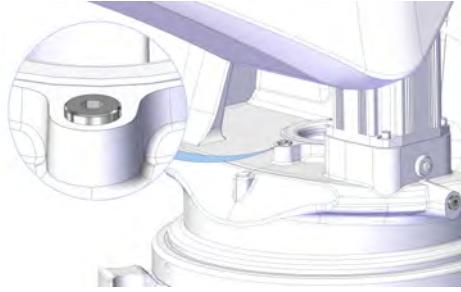
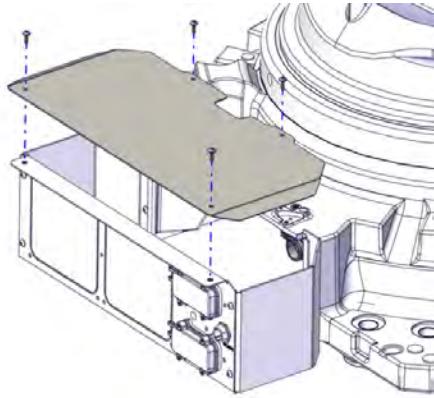
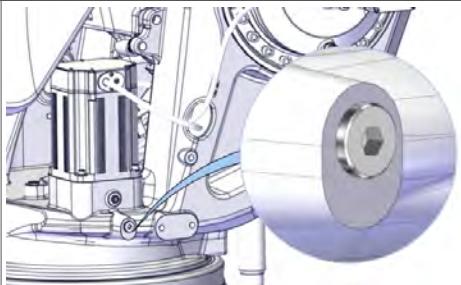
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
2	 WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52.	

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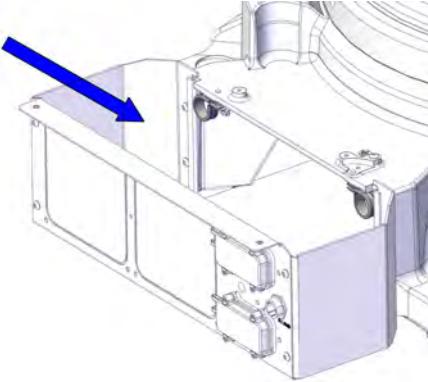
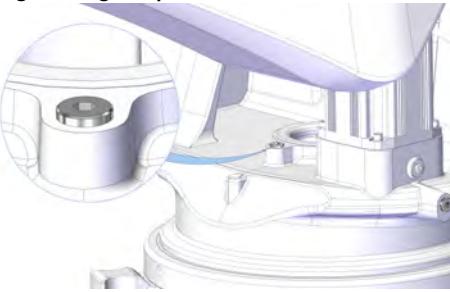
3 Maintenance

3.4.2 Changing oil, axis-1 gearbox

Continued

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 <i>Technical reference manual - Lubrication in gearboxes</i> . See Type and amount of oil in gearboxes on page 145 .
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.	

Continues on next page

	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 <p>After all repair and maintenance work involving oil, always wipe the robot clean from all surplus oil. The robot color may otherwise discolor.</p>	
12	 DANGER <p>Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.</p>	

3 Maintenance

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

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.

 xx1500002014	 xx1500002013
Oil filling and draining hole, with nipple Used with an oil dispenser.	<ul style="list-style-type: none">• - Left = Inspection hole- Right = Ventilation hole
Tightening torque: N/A	Tightening torque: 24 Nm.

Required consumable

Material	Note
Lubricating oil	Information about the oil is found in <i>Technical reference manual - Lubrication in gearboxes</i> . See Type and amount of oil in gearboxes on page 145 .

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 145 .
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required documents

Document name	Document number	Note
<i>Technical reference manual - Lubrication in gearboxes</i>	3HAC042927-001	

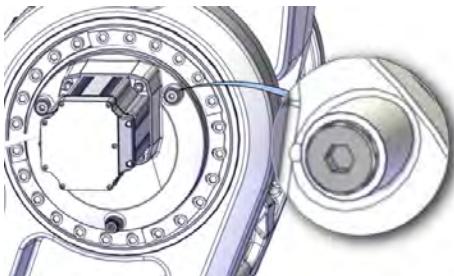
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Draining the axis-2 and axis-3 gearboxes

Use this procedure to drain the gearbox.

**Note**

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

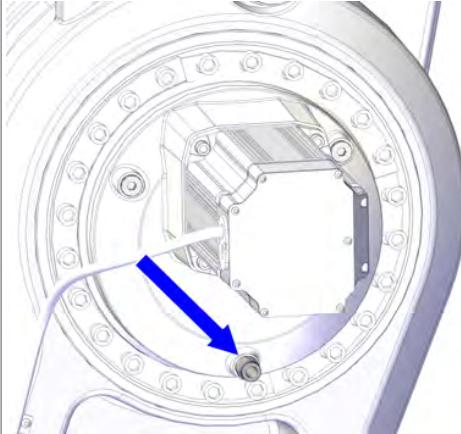
	Action	Note
1	<p></p> <p>DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	
2	<p></p> <p>WARNING</p> <p>Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52.</i></p>	
3	<p></p> <p>CAUTION</p> <p>The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.</p>	
4	<p>Remove the plug from the ventilation hole.</p> <p></p> <p>WARNING</p> <p>If the ventilation hole is not open when the oil dispenser is working, there is a risk of damaging vital parts in the gear!</p>	 <p>xx1500001994</p>

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3 Maintenance

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

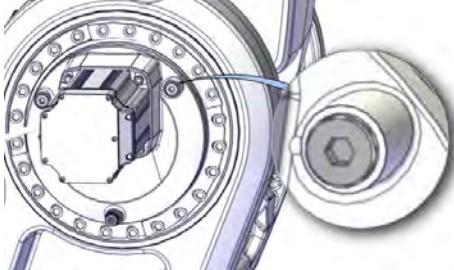
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Action	Note
5 Remove the protection cap from the nipple of the oil draining plug and connect the oil dispenser.	 xx1500002014
6 Suck out the oil with the oil dispenser.  Note There will be some oil left in the gear after draining.	
7  WARNING Used oil is hazardous material and must be disposed of in a safe way. See section Decommissioning on page 813 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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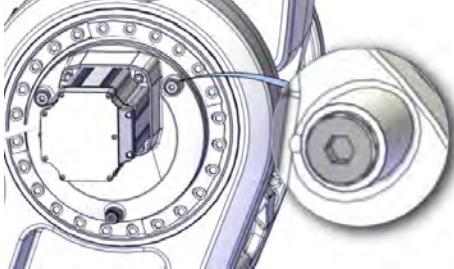
3.4.3 Changing oil in axis-2 and axis-3 gearbox

Continued

	Action	Note
9	Refit the ventilation plug.	<p>Tightening torque: 24 Nm.</p> 

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

Use this procedure to refill the gearbox with oil.

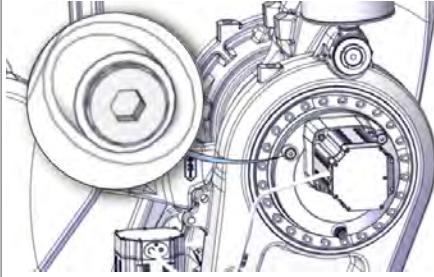
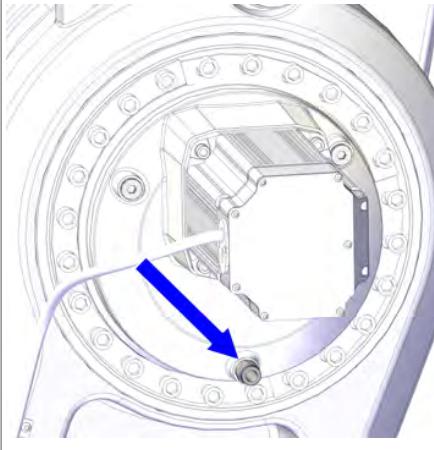
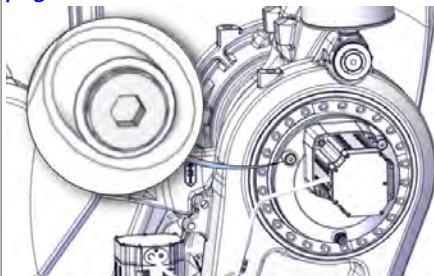
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
2	 WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	
3	 Note The ventilation plug is opened to let out air during the filling process.	

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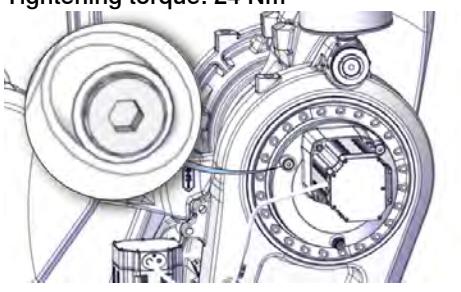
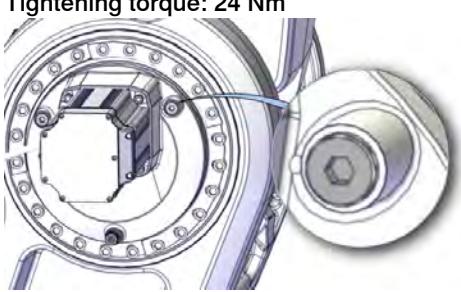
3 Maintenance

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

Continued

Action	Note
4 Remove the inspection plug.	 xx1500001995
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 <i>Technical reference manual - Lubrication in gearboxes</i> . See Type of lubrication in gearboxes on page 145 .
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 113 .  xx1500001995

Continues on next page

	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. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.	

3 Maintenance

3.4.4 Changing oil, axis-4 primary gearbox

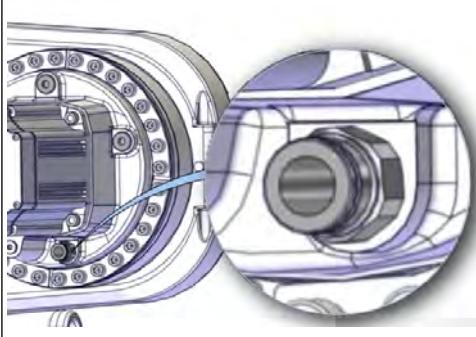
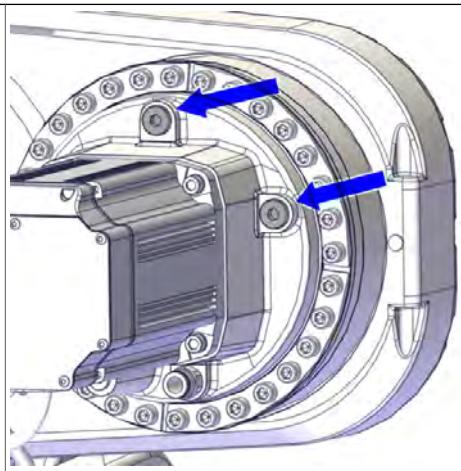
3.4.4 Changing oil, axis-4 primary gearbox

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.

 xx1500002016	 xx1500002015
Oil filling and draining hole, with nipple. Used with an oil dispenser.	<ul style="list-style-type: none">• Left = Ventilation hole• Right = Inspection hole
Tightening torque: N/A.	Tightening torque: 24 Nm.

Required consumable

Material	Note
Lubricating oil	Information about the oil is found in <i>Technical reference manual - Lubrication in gearboxes</i> . See Type and amount of oil in gearboxes on page 145 .

Required tools and equipment

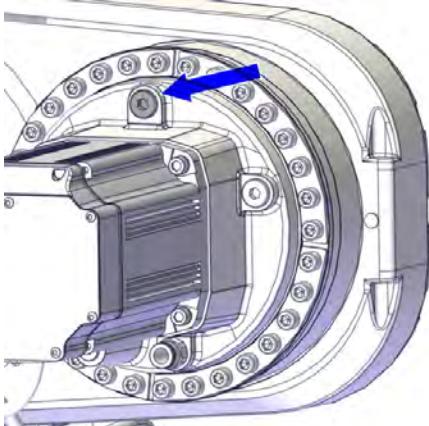
Equipment, etc.	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section Type of lubrication in gearboxes on page 145 .
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required documents

Document name	Document number	Note
<i>Technical reference manual - Lubrication in gearboxes</i>	3HAC042927-001	

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Draining the axis-4 primary gearbox

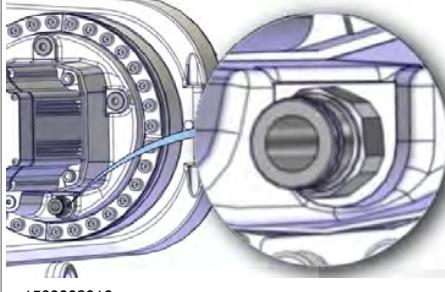
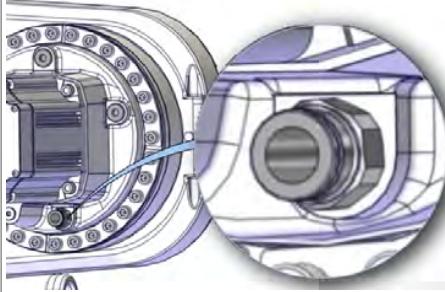
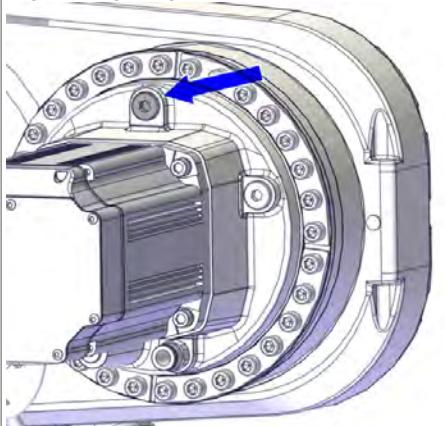
	Action	Note
1	Jog the robot to a comfortable working position.	
2	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	
3	<p> WARNING</p> <p>Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52.</p>	
4	<p> CAUTION</p> <p>The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.</p>	
5	<p> WARNING</p> <p>If the ventilation hole is not open when the oil dispenser is working, there is a risk of damaging vital parts in the gear!</p>	 <p>xx1500002017</p>

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3 Maintenance

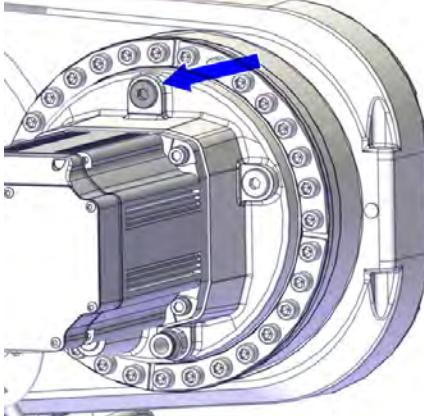
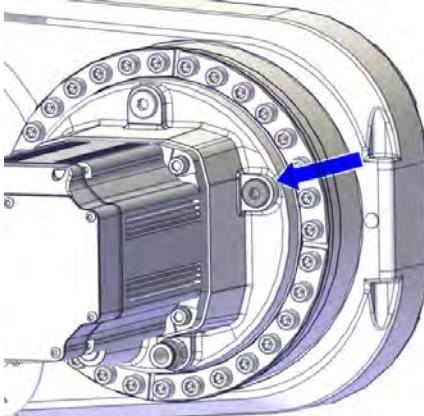
3.4.4 Changing oil, axis-4 primary gearbox

Continued

Action	Note
6 Remove the protection cap from the nipple of the oil draining plug and connect the oil dispenser.	
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 813 for more information.	
9 Remove the oil dispenser and refit the protection cap to the nipple of the oil draining plug.	
10 Refit the ventilation plug.	Tightening torque: 24 Nm. 

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Filling oil into the axis-4 primary gearbox

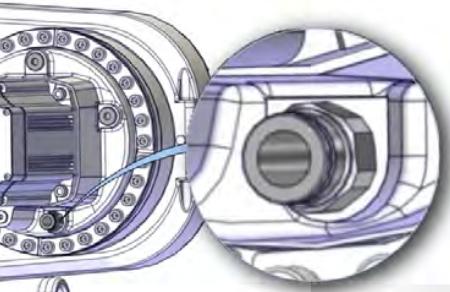
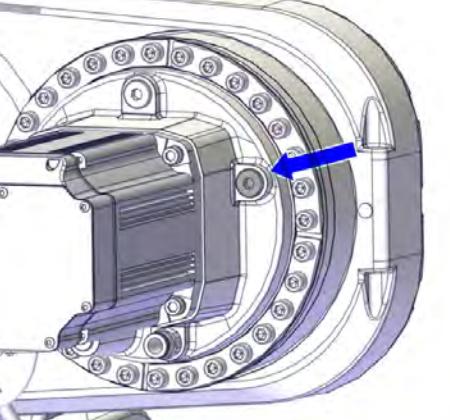
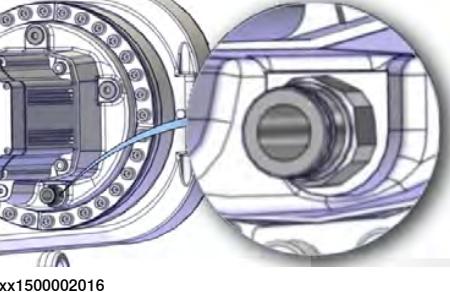
	Action	Note
1	Jog the robot to a comfortable working position.	
2	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	
3	<p> WARNING</p> <p>Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52.</p>	
4	<p>Open the ventilation plug.</p> <p> Note</p> <p>The ventilation plug is opened to let out air during the filling process.</p> <p> WARNING</p> <p>If the ventilation hole is not open when the oil dispenser is working, there is a risk of damaging vital parts in the gear!</p>	 xx1500002017
5	Open the inspection plug.	 xx1500002018

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3 Maintenance

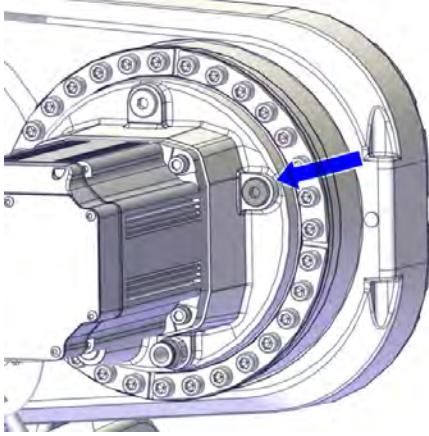
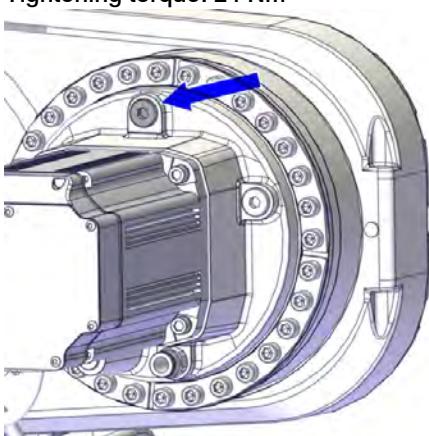
3.4.4 Changing oil, axis-4 primary gearbox

Continued

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 <i>Technical reference manual - Lubrication in gearboxes</i> . See Type and amount of oil in gearboxes on page 145 .
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 116 .	 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.	<p>Tightening torque: 24 Nm</p>  <p>xx1500002018</p>
11	Refit the ventilation plug.	<p>Tightening torque: 24 Nm</p>  <p>xx1500002017</p>
12	<p> DANGER</p> <p>Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.</p>	

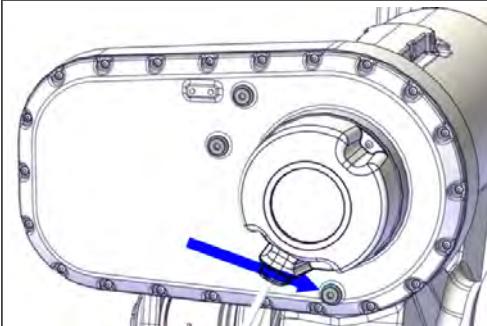
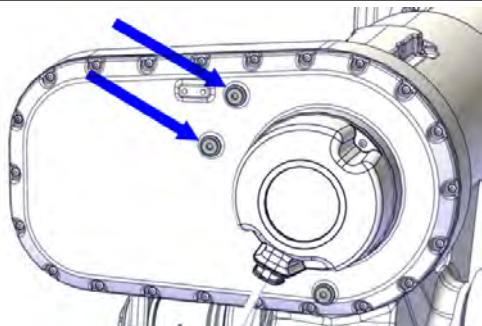
3 Maintenance

3.4.5 Changing oil, axis-4 secondary gearbox

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	<ul style="list-style-type: none">• 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 <i>Technical reference manual - Lubrication in gearboxes</i> . See Type and amount of oil in gearboxes on page 145 .

Required tools and equipment

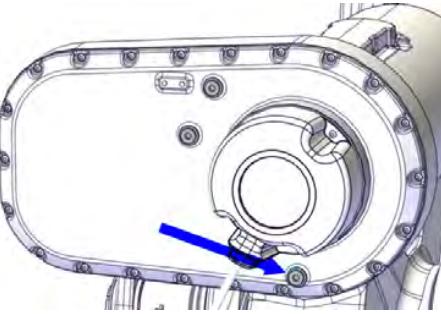
Equipment, etc.	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required documents

Document name	Document number	Note
<i>Technical reference manual - Lubrication in gearboxes</i>	3HAC042927-001	

Continues on next page

Draining the axis-4 secondary gearbox

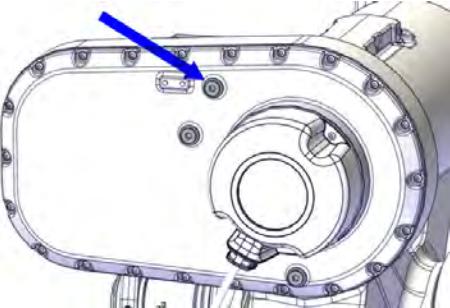
	Action	Note
1	<p>Jog the robot to a comfortable position. In order to facilitate draining, jog the axis-3 a few degrees upwards, from calibration position.</p> <ul style="list-style-type: none"> • Ax1 = No significance (as long as the robot is secured to the foundation) • Ax2 = comfortable working position • Ax3 = a few degrees upwards, from calibration position • Ax4 = 0° • Ax5 = 0° • Ax6 = No significance 	
2	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	
3	<p> WARNING</p> <p>Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52.</i></p>	
4	<p> CAUTION</p> <p>The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.</p>	
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

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3 Maintenance

3.4.5 Changing oil, axis-4 secondary gearbox

Continued

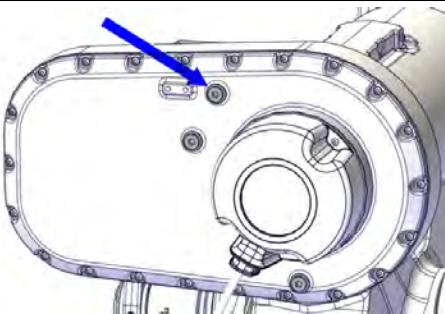
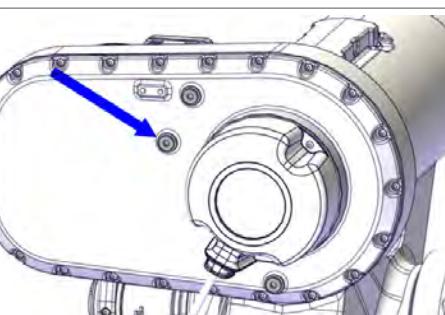
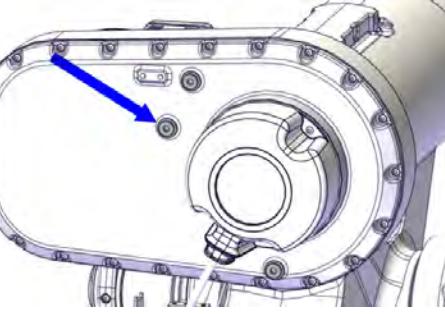
Action	Note
7 Use caution and remove the oil plug from the fill hole.  Note The fill hole is opened to speed up the drainage.	 xx1500002021
8  WARNING Used oil is hazardous material and must be disposed of in a safe way. See section Decommissioning on page 813 for more information.	
9 Refit the oil plugs.	Tightening torque: 24 Nm.

Filling oil into the axis-4 secondary gearbox

Action	Note
1 Run the robot to calibration position. <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52.	

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 <i>Technical reference manual - Lubrication in gearboxes</i> . See Type and amount of oil in gearboxes on page 145 .
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 119 .
8	Refit the oil plugs.	Tightening torque: 24 Nm

Continues on next page

3 Maintenance

3.4.5 Changing oil, axis-4 secondary gearbox

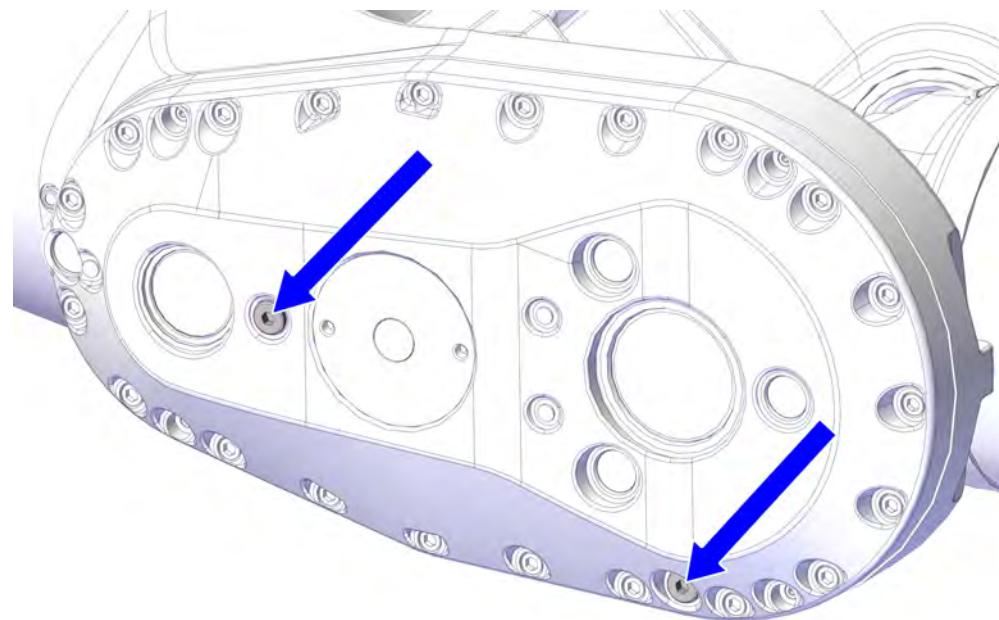
Continued

	Action	Note
9	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.	

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 <i>Technical reference manual - Lubrication in gearboxes</i> . See Type and amount of oil in gearboxes on page 145 .

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 825 .

Continues on next page

3 Maintenance

3.4.6 Changing oil, axis-5 gearbox

Continued

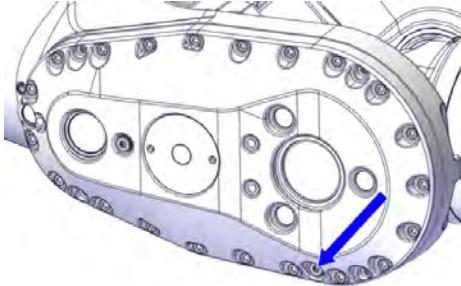
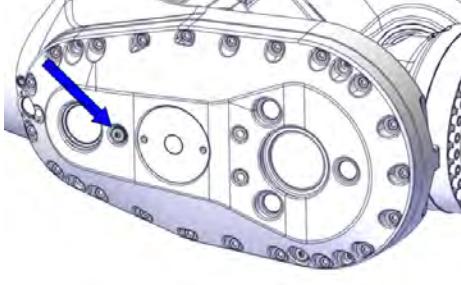
Required documents

Document name	Document number	Note
<i>Technical reference manual - Lubrication in gearboxes</i>	3HAC042927-001	

Draining the axis-5 gearbox

	Action	Note
1	<p>Run the robot to the specified position:</p> <ul style="list-style-type: none">• Axis-1: no significance (as long as the robot is secured to the foundation)• Axis-2: comfortable working position• Axis-3: 0°• Axis-4: -10° approximately• Axis-5: 0°• Axis-6: no significance	
2	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply <p>to the robot, before entering the robot working area.</p>	
3	<p> WARNING</p> <p>Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52.</i></p>	
4	<p> CAUTION</p> <p>The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.</p>	
5	Place the oil collecting vessel underneath the oil draining plug.	

Continues on next page

	Action	Note
6	Remove the oil draining plug and let the oil run into the vessel.	 xx1500002074
7	Use caution and remove the combined oil filling/inspection/ventilation plug.  Note The combined filling/inspection/ventilation plug is opened to speed up the drainage.	 xx1500002024
8	 WARNING Used oil is hazardous material and must be disposed of in a safe way. See section Decommissioning on page 813 for more information.	
9	Refit the oil plugs.	Tightening torque: 24 Nm.

Filling oil into the axis-5 gearbox

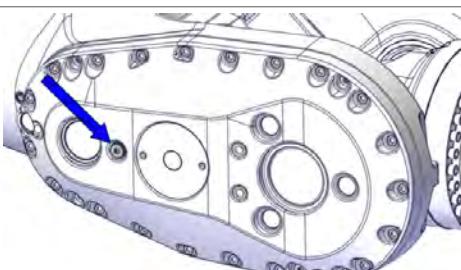
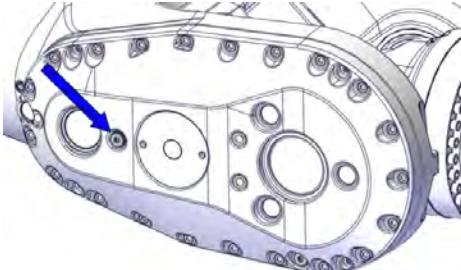
	Action	Note
1	Jog the robot to the specified position: <ul style="list-style-type: none"> • Axis-1: no significance (as long as the robot is secured to the foundation) • Axis-2: as far forward as possible • Axis-3: 0° • Axis-4: -60° approximately • Axis-5: 0° • Axis-6: no significance 	
2	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

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3 Maintenance

3.4.6 Changing oil, axis-5 gearbox

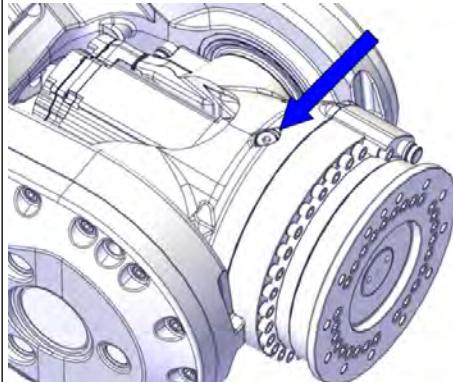
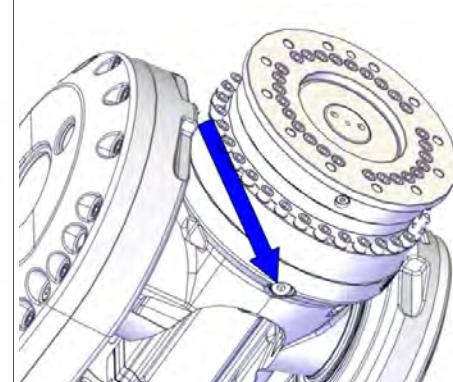
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Action	Note
3  WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52.	
4 Open the combined oil filling/inspection/ventilation plug.	 xx1500002024
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 <i>Technical reference manual - Lubrication in gearboxes</i> . See Type and amount of oil in gearboxes on page 145.
6 Inspect the oil level at the combined oil filling/inspection/ventilation hole.	 xx1500002024 Required oil level is: 0 - 10 mm below the oil plug hole. More information is found in Inspecting the oil level in axis-5 gearbox on page 121.
7 Refit the oil plugs.	Tightening torque: 24 Nm
8  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.	

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 <i>Technical reference manual - Lubrication in gearboxes</i> . See Type and amount of oil in gearboxes on page 145 .

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 825 .

Required documents

Document name	Document number	Note
<i>Technical reference manual - Lubrication in gearboxes</i>	3HAC042927-001	

Draining the axis-6 gearbox

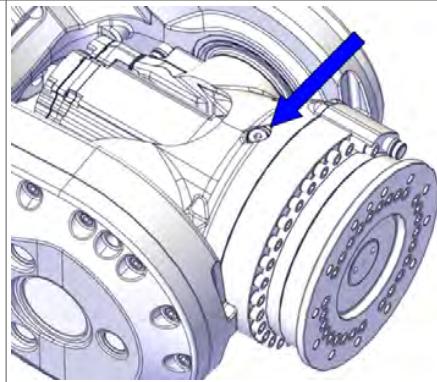
	Action	Note
1	Jog the robot to calibration position.	

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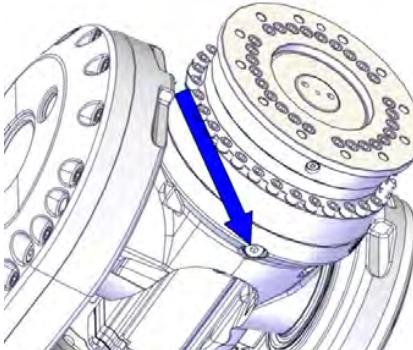
3 Maintenance

3.4.7 Changing oil, axis-6 gearbox

Continued

Action	Note
2  DANGER Turn off all: <ul style="list-style-type: none">• 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. Before proceeding, please read the safety information in the section <i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52.</i>	
4 Place the oil collecting vessel underneath the oil draining plug.	
5  CAUTION The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
6 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

Action	Note
7 Remove the oil draining plug and let the oil run into the vessel.	 xx1500002035
8  WARNING Used oil is hazardous material and must be disposed of in a safe way. See section Decommissioning on page 813 for more information.	
9 Refit the oil plugs.	Tightening torque: 24 Nm.

Filling oil into the axis-6 gearbox

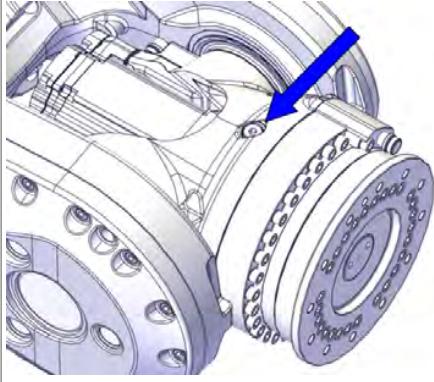
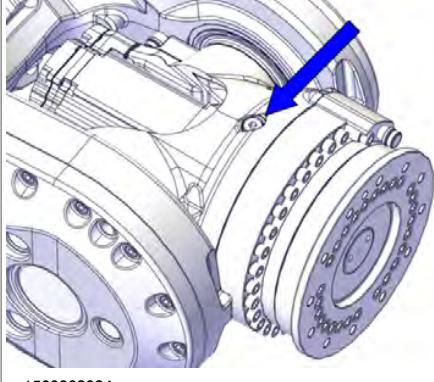
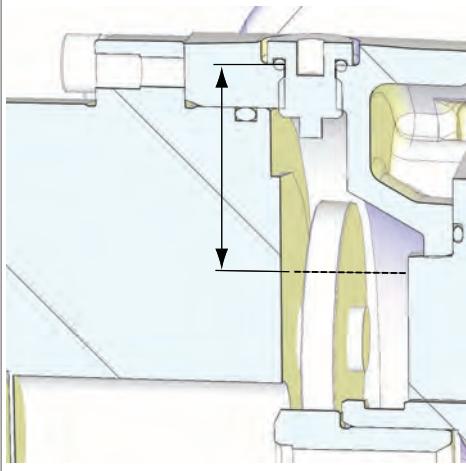
Action	Note
1 Jog the robot to a comfortable working position.	Figure
2 Jog axis 5 to +82° position.	Figure
3  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
4  WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	

Continues on next page

3 Maintenance

3.4.7 Changing oil, axis-6 gearbox

Continued

Action	Note
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 <i>Technical reference manual - Lubrication in gearboxes</i> . See <i>Type and amount of oil in gearboxes on page 145</i> .
7 Inspect the oil level.	 xx1500002034 <p>Required oil level is: 50 mm ± 5 mm below the sealing surface of the oil plug.</p>  xx1300000693 <p>More information is found in <i>Inspecting the oil level in axis-6 gearbox on page 124</i>.</p>

Continues on next page

	Action	Note
8	Refit the oil plug.	Tightening torque: 24 Nm
9	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.	

3 Maintenance

3.4.8 Replacing the SMB battery

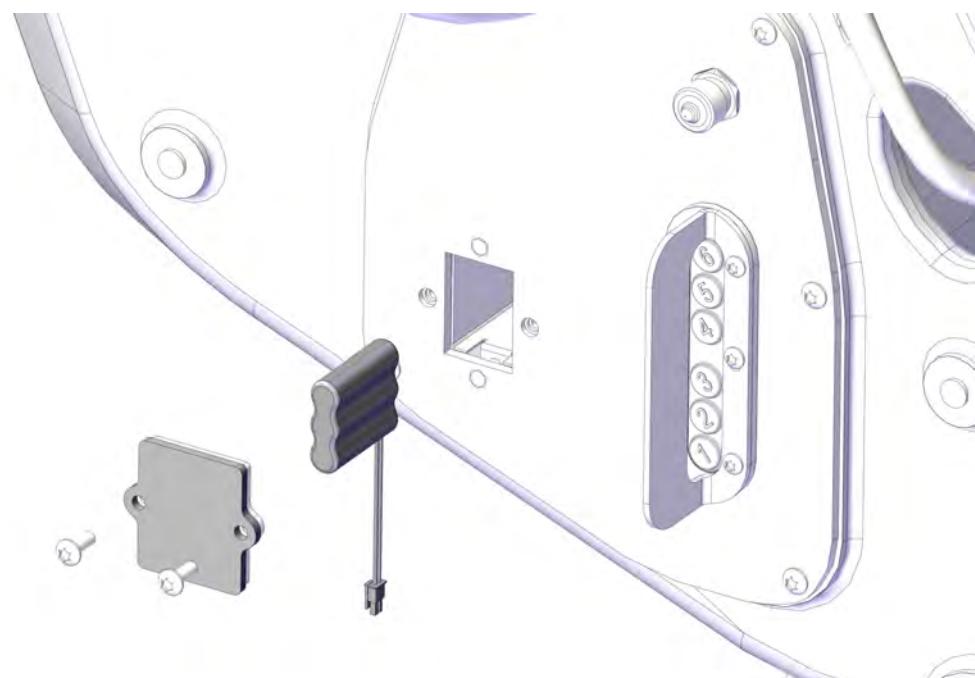


WARNING

See instructions for batteries, [WARNING - Safety risks during handling of batteries on page 51](#).

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 825 .

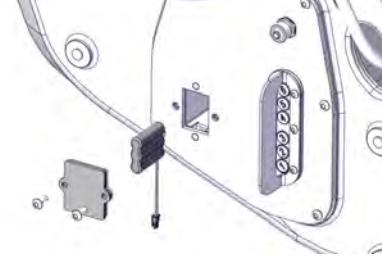
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Required spare parts

Spare part	Article number	Note
Battery pack	For spare part number, see: • Spare parts on page 831	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: <ul style="list-style-type: none"> • 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 WARNING - The unit is sensitive to ESD! on page 49	
4	Remove the SMB battery cover.	
5	Pull out the battery and disconnect the battery cable.	
6	 Note Battery includes protection circuits. Only replace with a specified spare part or with an ABB-approved equivalent.	 xx1500002052
7	 WARNING A used battery is hazardous material and shall be disposed of in a safe way. See section Decommissioning on page 813 for more information.	

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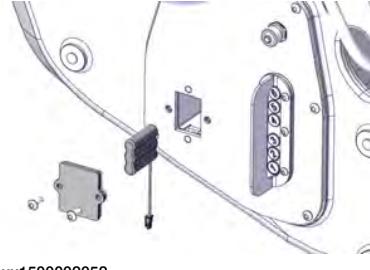
3 Maintenance

3.4.8 Replacing the SMB battery

Continued

Refitting, battery

Use this procedure to refit the SMB battery.

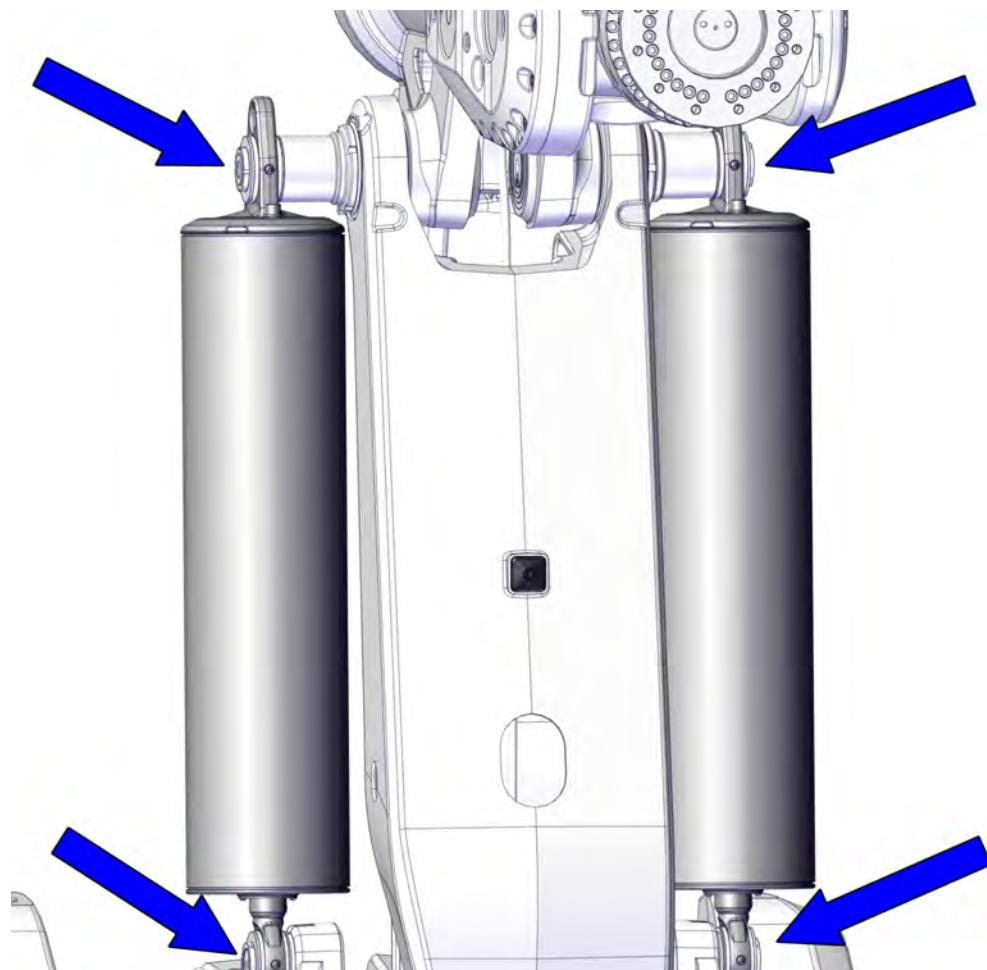
Action	Note
<p>1  DANGER Turn off all:<ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supplyto the robot, before entering the robot working area.</p>	
<p>2  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 49</p>	
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 page 795 .
6  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

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	3HAC042534-001	Tribol GR 100-0 PD, 50 ml Used for lubrication of the spherical roller bearing.

Continues on next page

3 Maintenance

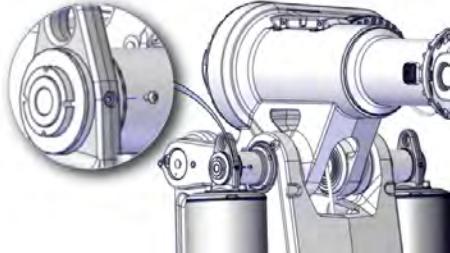
3.5.1 Lubricating the spherical roller bearings, balancing device

Continued

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.

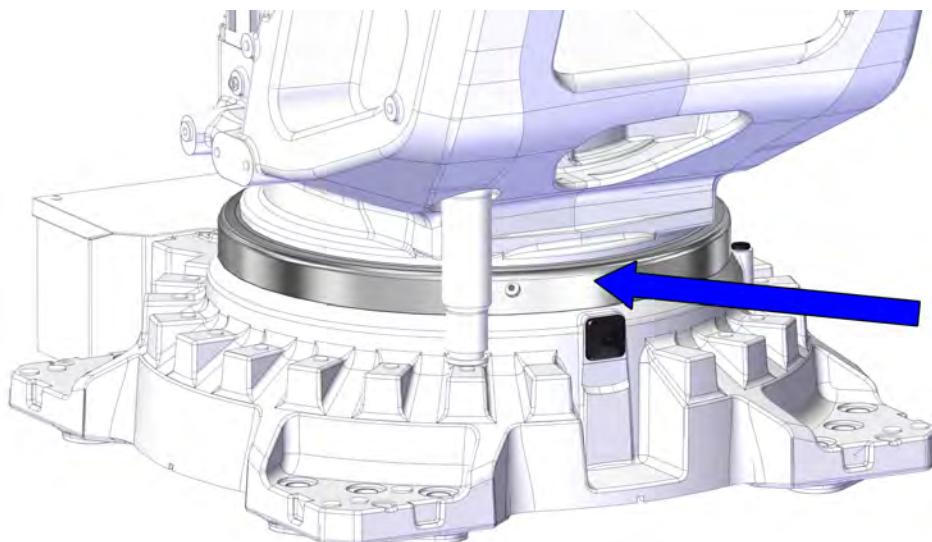
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
2	Unscrew both screws on either side of the bearing and fill grease from one of the holes until grease appears in the other hole.	Grease: 3HAC042534-001  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

3.5.2 Lubricating the cross roller bearing

Location of the cross roller bearing

The cross roller bearing is located between frame and base.



xx1500002053

Consumable

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

Lubricating the cross roller bearing

Use this procedure to lubricate the cross roller bearing.

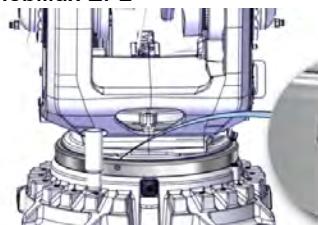
	Action	Note
1	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	

Continues on next page

3 Maintenance

3.5.2 Lubricating the cross roller bearing

Continued

Action	Note
2 Unscrew both screws on either side of the cross roller bearing and fill grease from one of the holes until grease appears in the other hole.	Mobilux EP2  xx1500002054
3 Refit the two screws.	
4 Wipe clean from residual grease.	
5  Note Inspect the cross roller bearing after a few days running. Some of the refilled grease may have emerged from the bearing. Wipe clean from residual grease.	

3.6 Cleaning activities

3.6.1 Cleaning the IRB 8700



WARNING

Turn off all electrical power supplies to the manipulator before entering its work 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 manipulator 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 110](#).
- 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.

Oil spills discolors painted surfaces

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



Note

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

Dos and don'ts!

This section specifies some special considerations when cleaning the robot.

Always!

- 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!

Continues on next page

3 Maintenance

3.6.1 Cleaning the IRB 8700

Continued

Never!

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

Cleaning methods

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

Protection type	Cleaning method			
	Vacuum cleaner	Wipe with cloth	Rinse with water	High pressure water 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 186](#).

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).¹

The following list defines the prerequisites:

- Maximum water pressure at the nozzle: 700 kN/m² (7 bar)¹
- Fan jet nozzle should be used, min. 45° spread
- Minimum distance from nozzle to encapsulation: 0.4 meters
- Maximum flow: 20 liters/min¹

¹ 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/m² (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

¹ See [Cleaning methods on page 186](#) for exceptions.

² See [Cleaning methods on page 186](#) for exceptions.

Continues on next page

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.

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4 Repair

4.1 Introduction

Structure of this chapter

This chapter describes all repair activities recommended for the IRB 8700 and any external unit.

It is made up of separate procedures, each describing a specific repair activity. Each procedure contains all 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. Otherwise damage to the mechanics and electronics may occur.

Required equipment

The details of the equipment required to perform a specific repair activity are listed in the respective procedures.

The details of equipment are also available in different lists in the chapter [Reference information on page 817](#).

Safety information

There are general safety information and specific safety information. The specific safety information describes the danger and safety risks while performing specific steps in a procedure. Make sure to read through the chapter [Safety on page 15](#) before commencing any service work.



Note

If the IRB 8700 is connected to power, always make sure that the IRB 8700 is connected to earth before starting any repair work.

For more information see:

- *Product manual - IRC5*

4 Repair

4.2.1 Performing a leak-down test

4.2 General procedures

4.2.1 Performing a leak-down test

When to perform a leak-down test

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

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.	
2 Remove the topmost oil plug on the gear and replace it with the <i>leak-down tester</i> . 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.	

4.2.2 Mounting instructions for bearings

General

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

Equipment

Equipment, etc.	Article number	Note
Grease	3HAB3537-1	Used to grease the bearings, if not specified otherwise.

Assembly of all bearings

Follow 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

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.

Continues on next page

4 Repair

4.2.2 Mounting instructions for bearings

Continued

- 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.

4.2.3 Mounting instructions for seals

General

This section describes how to mount different types of seals onto the robot.

Equipment

Equipment, etc.	Article number	Note
Grease	3HAB3537-1	Used to lubricate the seals.

Rotating seals

The procedure below describes how to fit rotating seals.



CAUTION

Please observe the following before commencing any assembly of seals:

- Protect the sealing surfaces during transport and mounting.
- Keep the seal in its original wrappings or protect it well before actual mounting.
- The fitting of seals and gears must be carried out on clean workbenches.
- Use a protective sleeve for the sealing lip during mounting, when sliding over threads, keyways, etc.

	Action	Note
1	Check the seal to ensure that: <ul style="list-style-type: none"> • The seal is of the correct type (provided with cutting edge). • There is no damage to the sealing edge (feel with a fingernail). 	
2	Inspect the sealing surface before mounting. If scratches or damage are found, the seal must be replaced since it may result in future leakage.	
3	Lubricate the seal with grease just before fitting. (Not too early - there is a risk of dirt and foreign particles adhering to the seal.) Fill 2/3 of the space between the dust tongue and sealing lip with grease. The rubber coated external diameter must also be greased, unless otherwise specified.	Article number is specified in Equipment on page 193 .
4	Mount the seal correctly with a mounting tool. Never hammer directly on the seal as this may result in leakage.	

Continues on next page

4 Repair

4.2.3 Mounting instructions for seals

Continued

Flange seals and static seals

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

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, preferably with a brush.
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, and so on.	Defective o-rings may not be used.
3 Check the o-ring grooves. The grooves must be geometrically correct and should be free of pores and contamination.	Defective o-rings may not be used.
4 Lubricate the o-ring with grease.	
5 Tighten the screws evenly while assembling.	

4.3 Attaching lifting accessories

4.3.1 Attaching lifting accessories to complete arm system

4.3 Attaching lifting accessories

4.3.1 Attaching lifting accessories to complete arm system

Definition of the complete arm system

The complete arm system consists of the following parts:

- upper arm
- wrist
- lower arm
- frame.

Attachment points of lifting accessory



Note

Section not ready yet. Will be published in the next edition. Please contact ABB for advice.

Required tools and equipment

Equipment, etc.	Article number	Note
Roundsling 2 m	-	Lifting capacity: 2,000 kg (2 pcs)
Roundsling 2.5 m	-	Lifting capacity: 2,000 kg (2 pcs)
Lifting eye	3HAC038295-003	M24 (4 pcs)

Attaching the lifting accessories

Use these procedures to attach the lifting accessories.

Robot position



Note

Not ready yet. Will be published in the next edition. Please contact ABB for advice.

Attaching lifting accessories to the complete arm system



Note

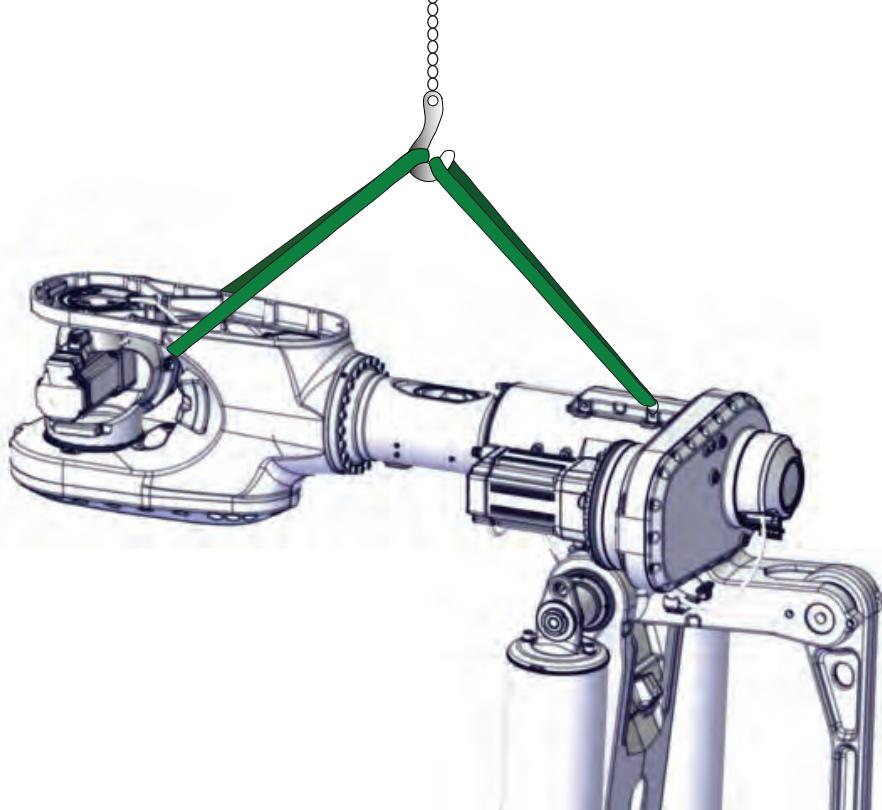
Not ready yet. Will be published in the next edition. Please contact ABB for advice.

4 Repair

4.3.2 Attaching lifting accessories to the upper arm

4.3.2 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	-	Lifting capacity: 2,000 kg
Roundsling 3 m	-	Lifting capacity: 2,000 kg
Lifting eye	3HAC16131-1	M12
Fender washer	-	Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.

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4.3.2 Attaching lifting accessories to the upper arm

Continued

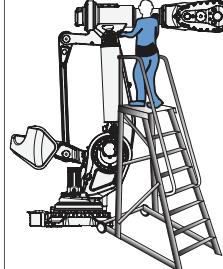
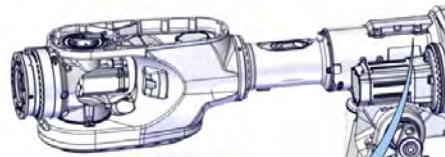
Attaching the lifting accessories

Use these procedures to attach the lifting accessories.

Robot position

	Action	Note
1	Jog the robot to the specified position: <ul style="list-style-type: none"> • Axis 1: no significance (as long as the robot is secured to the foundation) • Axis 2: -65° • Axis 3: upper arm horizontal against the foundation • Axis 4: +90° • Axis 5: -90° • Axis 6: No significance. 	

Attaching lifting accessories to the upper arm complete

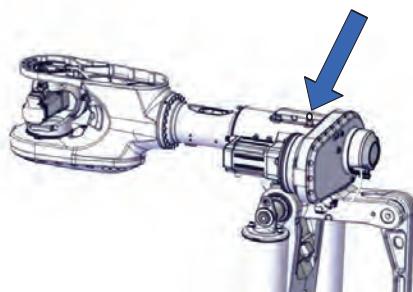
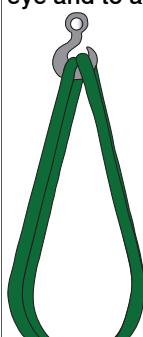
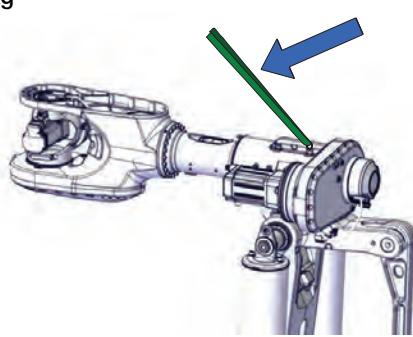
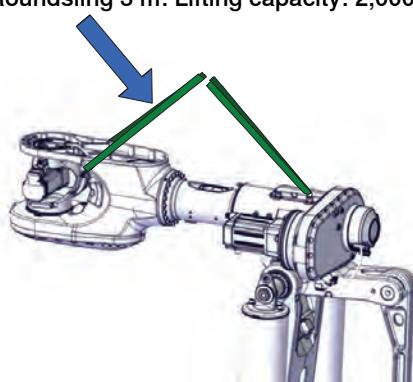
	Action	Note
1	 CAUTION The complete upper arm weighs 900 kg. All lifting accessories used must be sized accordingly.	
2	<i>Only needed when the upper arm is fitted on the robot:</i> Use a Mobile platform ladder (or similar) to attach the lifting accessories.  DANGER Never use the robot as ladder.	Mobile platform ladder  xx1500001985
3	Remove the plastic plug in the hole shown in the figure.	  xx1500002712

Continues on next page

4 Repair

4.3.2 Attaching lifting accessories to the upper arm

Continued

Action	Note
4 Attach a Lifting eye to the hole in the arm housing with a Fender washer underneath.  xx1400002196	Lifting eye: M12 Fender washer: Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.  xx1500002715
5 Attach a roundsling looped to the Lifting eye and to an overhead crane (or similar).  xx1400002599	Roundsling 2.5 m: Lifting capacity: 2,000 kg  xx1500002713
6 Attach a roundsling looped to the wrist and to an overhead crane (or similar).	Roundsling 3 m: Lifting capacity: 2,000 kg  xx1500002714
7 Stretch the lifting accessories to take the weight of the upper arm.	
8 Only needed when the upper arm is fitted on the robot: In order to release the brakes, connect the 24 VDC power supply. Connect connector R2.MP2: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	

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4.3.2 Attaching lifting accessories to the upper arm

Continued

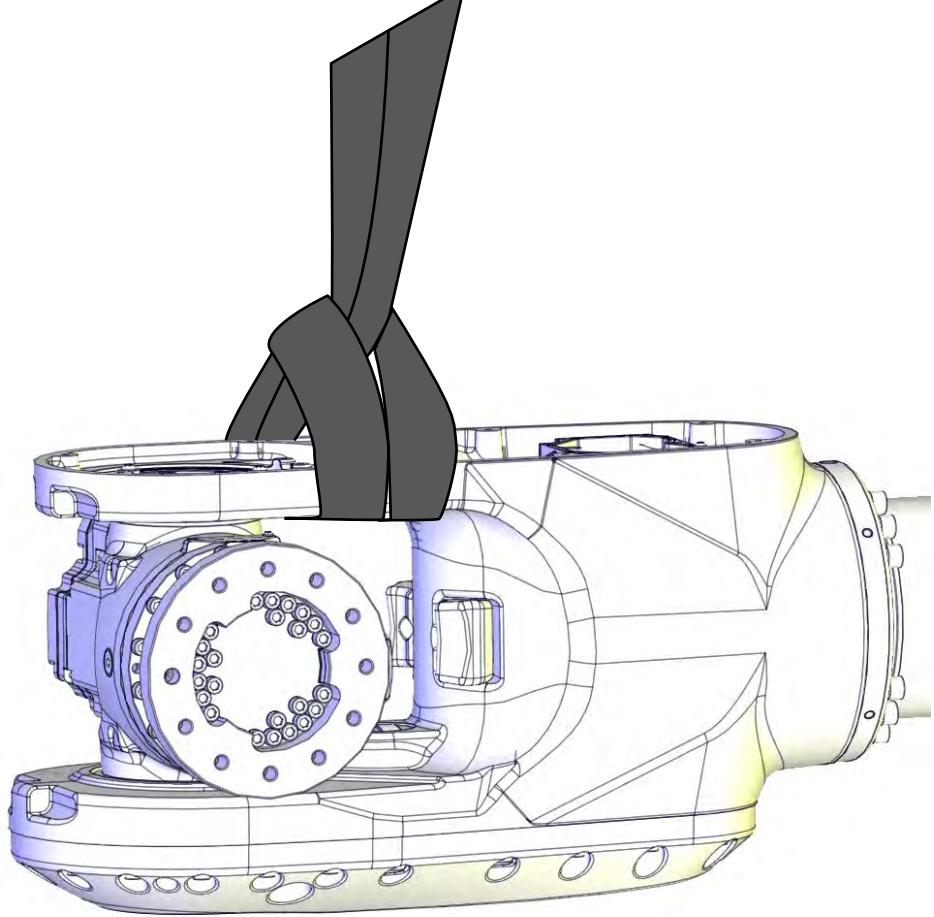
	Action	Note
9	<p><i>Only needed when the upper arm is fitted on the robot:</i></p> <p>Release the brakes on axis-2 to be sure that the lifting accessories are taking the weight of the upper arm.</p>	
10	Adjust the lifting accessories, if needed.	

4 Repair

4.3.3 Attaching lifting accessories to the wrist

4.3.3 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 2.5 m	-	Lifting capacity: 2,000 kg

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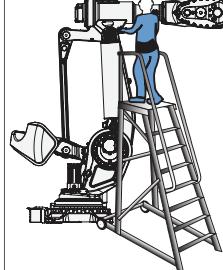
Attaching lifting accessories

Use these procedures to remove the wrist.

Robot position

	Action	Note
1	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none"> • 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

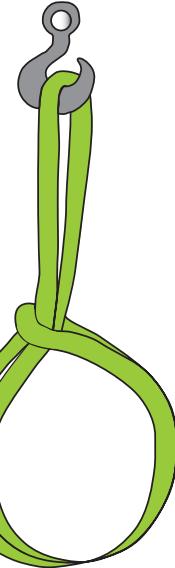
	Action	Note
1	<p> CAUTION</p> <p>The complete wrist weighs 500 kg. All lifting accessories used must be sized accordingly!</p>	
2	<p> DANGER</p> <p>Never use the robot as ladder!</p>	<p>Mobile platform ladder</p>  <p>xx1500001985</p>

Continues on next page

4 Repair

4.3.3 Attaching lifting accessories to the wrist

Continued

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

4.4 Cable harness

4.4.1 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Cable harness	3HAC050792-001	

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .
ESD bag		

Continues on next page

4 Repair

4.4.1 Removing the cable harness

Continued

Equipment, etc.	Article number	Note
Sparkplug wrench	-	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: <ul style="list-style-type: none">• 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: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

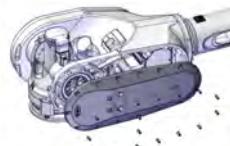
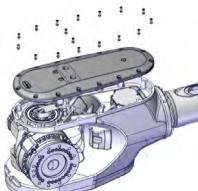
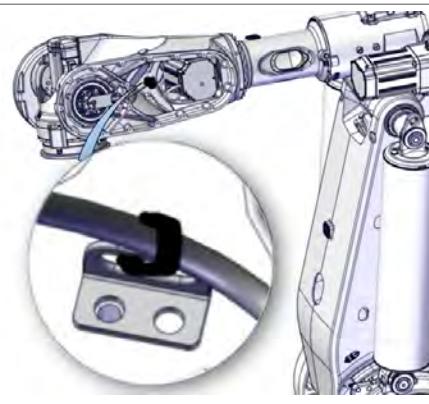
Retrieving access to the wrist cabling

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

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4.4.1 Removing the cable harness

Continued

	Action	Note
2	<p>Remove the wrist cover.</p> <p>Note Do not damage the sealing. Replace if damaged.</p> <p>Note The position of axis-4 depends on the on-going procedure.</p>	 
3	Cut the cable tie that secure the axis-6 motor cable.	

Disconnecting the axis-6 motor cables

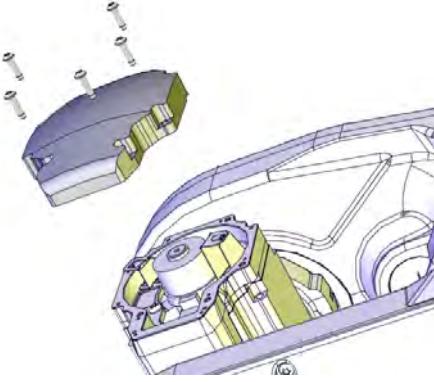
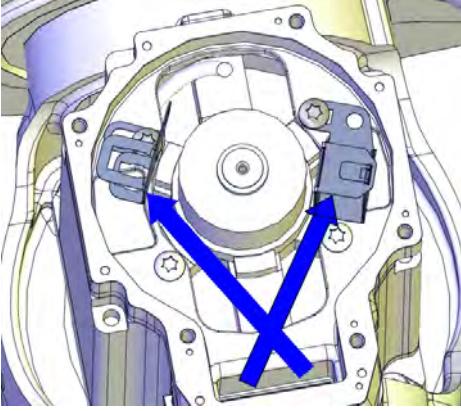
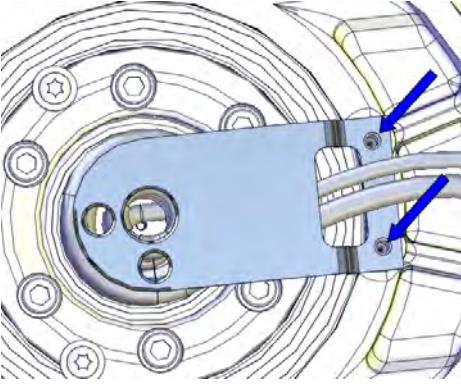
	Action	Note
1	<p>DANGER</p>  <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	<p>Make sure that the axis-5 is as close to +90° or -90° position as possible, depending on what repair work is being done.</p> <p>Note Not applicable when replacing the axis-6 unit.</p>	

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4 Repair

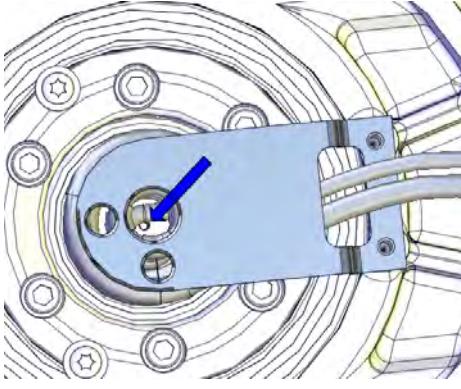
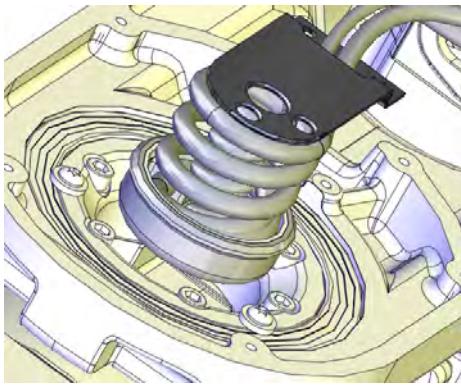
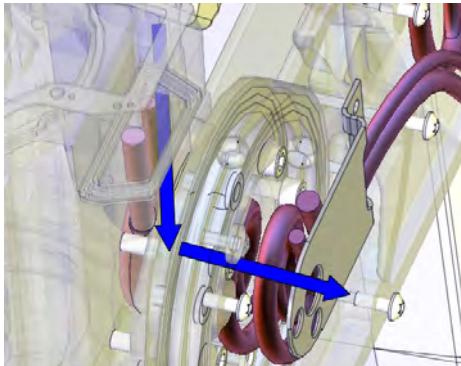
4.4.1 Removing the cable harness

Continued

Action	Note
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

Continues on next page

4.4.1 Removing the cable harness 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

Disconnecting the axis-5 motor cables

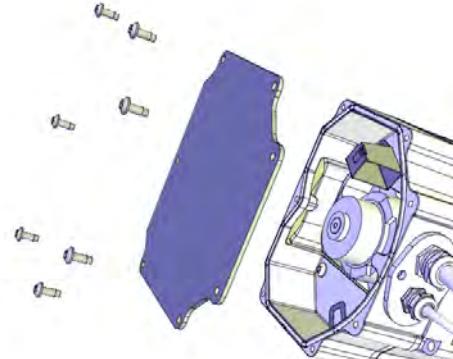
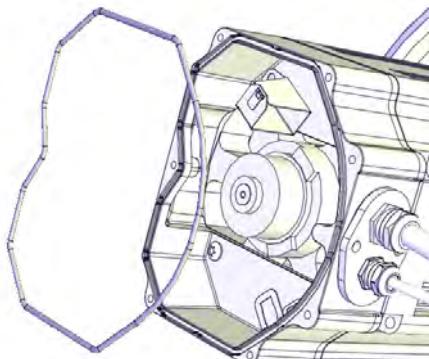
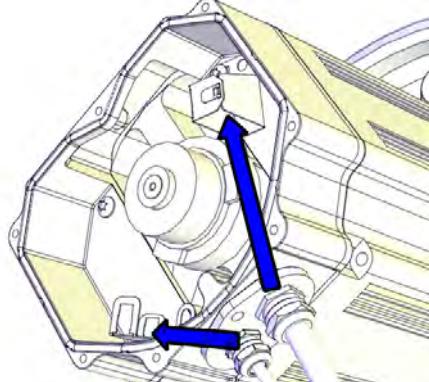
Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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4 Repair

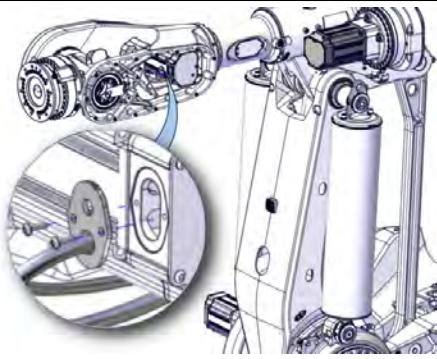
4.4.1 Removing the cable harness

Continued

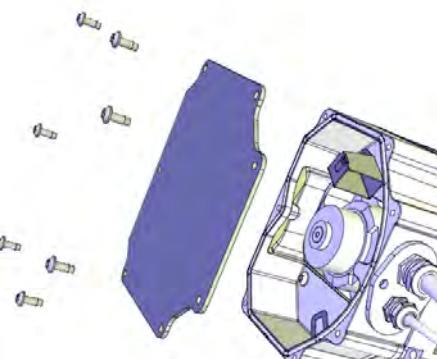
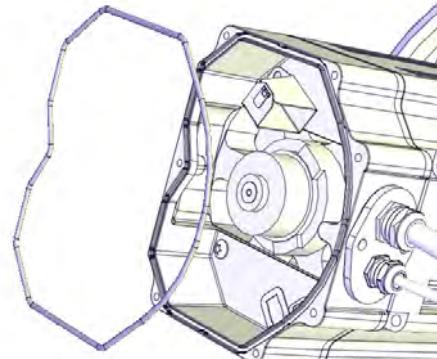
Action	Note
2 Unscrew the attachment screws with washers and remove the motor cover.	 xx1200001135
3  Note Make sure the o-ring is present when removing the cover.	 xx1200001070
4 Disconnect the motor cables.	 xx1200001066

Continues on next page

4.4.1 Removing the cable harness Continued

Action	Note
<p>5 Remove the cable gland cover.</p> <p> Tip</p> <p>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.</p>	 <p>xx1500002717</p>
6 Use caution and pull out the motor cables.	

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

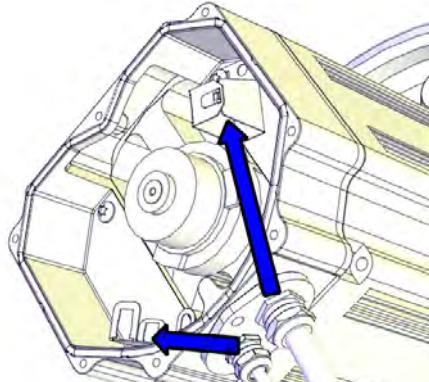
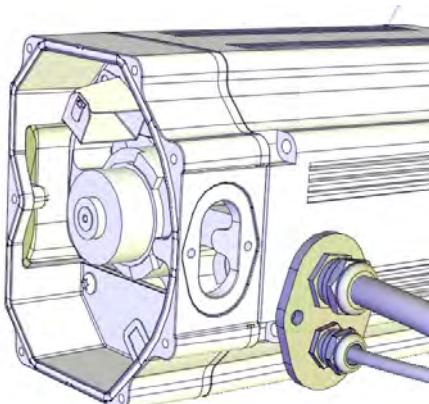
Action	Note
<p>1  DANGER</p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2 Unscrew the attachment screws with washers and remove the motor cover.	 <p>xx1200001135</p>
<p>3  Note</p> <p>Make sure the o-ring is not lost when removing the cover.</p>	 <p>xx1200001070</p>

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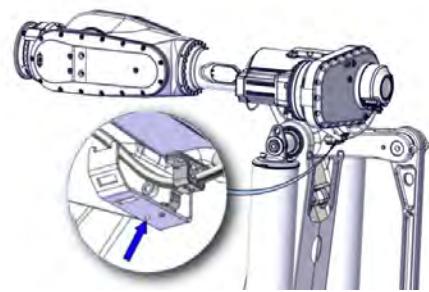
4 Repair

4.4.1 Removing the cable harness

Continued

Action	Note
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.	

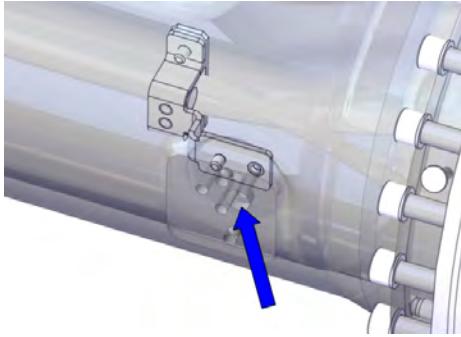
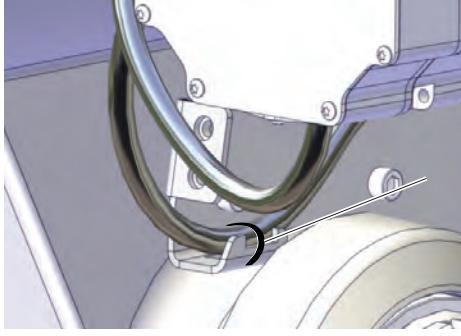
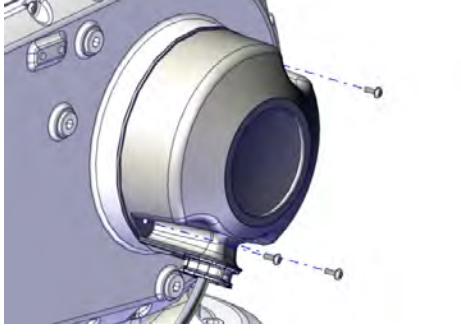
Removing the cable harness in the upper arm

Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Unscrew the screw that hold the cable clamp.	 xx1500002718

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4.4.1 Removing the cable harness

Continued

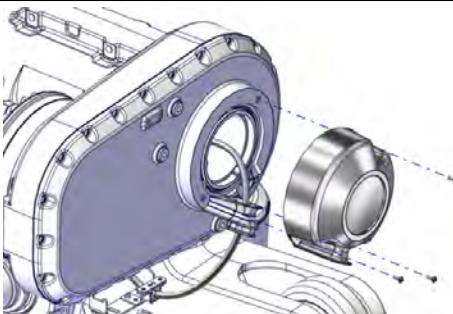
	Action	Note
3	Remove the protection cover. Make sure not to damage the surface exposed.	 xx1500002719
4	Unscrew the nut holding the bracket inside the upper arm. Note The nut is reached from the outside.	 xx1500002720
5	Cut the cable tie.	 xx1500002721
6	Unscrew the screws that secure the cover.	 xx1500002722

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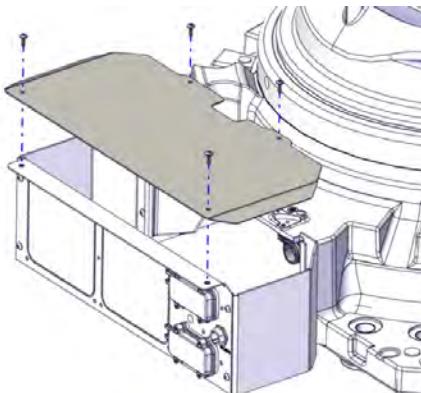
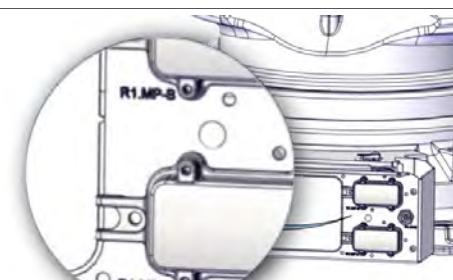
4 Repair

4.4.1 Removing the cable harness

Continued

Action	Note
7 Remove the cover.	 xx1500002723
8 Use caution and remove the cable harness out of the upper arm.	

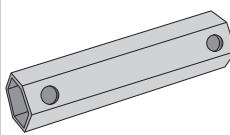
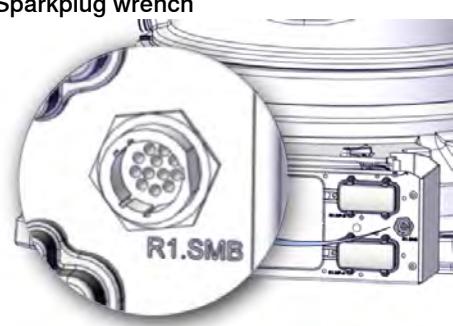
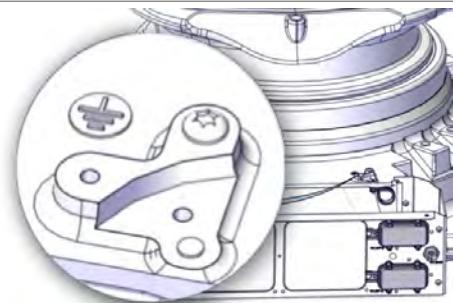
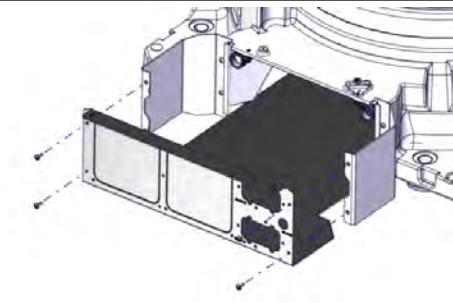
Disconnecting the cable harness in the base

Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Remove the base cover.	 xx1500003082
3 Disconnect R1.MP-A and R1.MP-B.	 xx1500003083

Continues on next page

4.4.1 Removing the cable harness

Continued

Action	Note
4 Disconnect R1.SMB. Tip Use a Sparkplug wrench (or similar).  xx1200000888	Sparkplug wrench  xx1500003084
5 Remove the two earth cables.	 xx1500003085
6 For easier access: Remove connection plate and bottom plate.	 xx1500003088
7 Use caution and pull out the cable harness from the base.	

Removing the cable harness in the frame

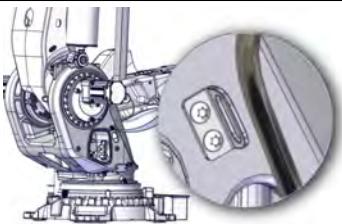
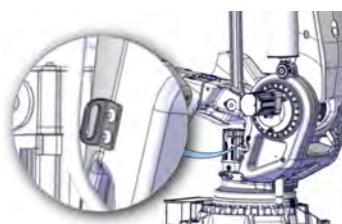
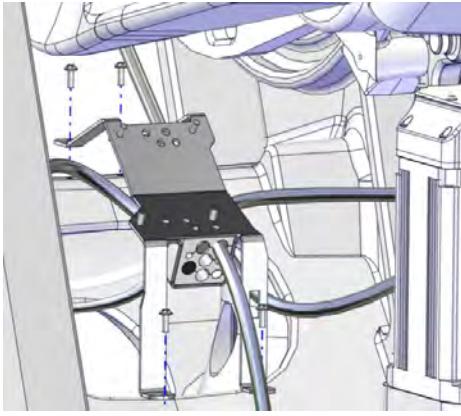
Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

4 Repair

4.4.1 Removing the cable harness

Continued

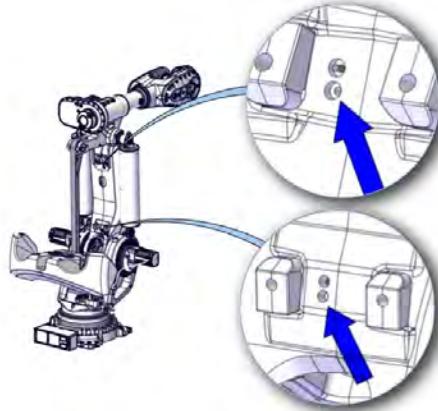
Action	Note
2 Cut the cable ties that secure the axis-2 and axis-3 motor cables to the cable fixing brackets.	 xx1500003091 <div style="border: 1px solid black; padding: 2px; display: inline-block;">Axis-2 motor cable</div>  xx1500003090 <div style="border: 1px solid black; padding: 2px; display: inline-block;">Axis-3 motor cable</div>
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

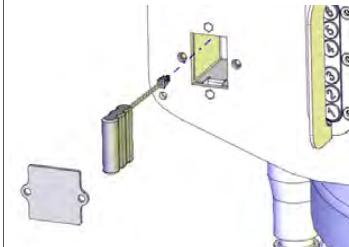
Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

4.4.1 Removing the cable harness Continued

Action	Note
<p>2 If not already done, unscrew the screws that hold the two cable brackets inside the lower arm.</p> <p> Note</p> <p>The screws are reached from the outside.</p>	 <p>xx1500002695</p>
3 Use caution and remove the cable harness from the lower arm.	

Preparations before disconnecting cables to the SMB and BU units

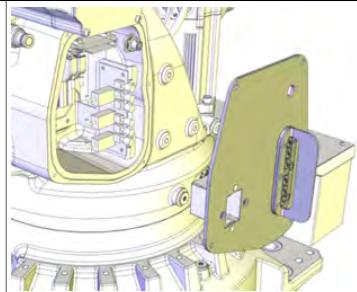
Action	Note
<p>1  DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	
<p>2  ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <i>WARNING - The unit is sensitive to ESD!</i> on page 49</p>	
3 Open the small battery cover on the SMB cover, disconnect the battery cable and remove the battery.	 <p>xx1300000829</p>

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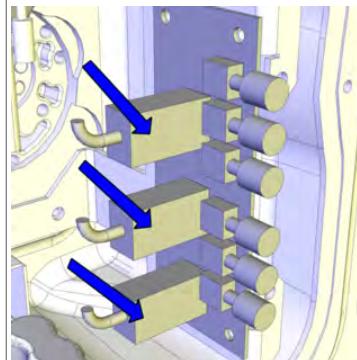
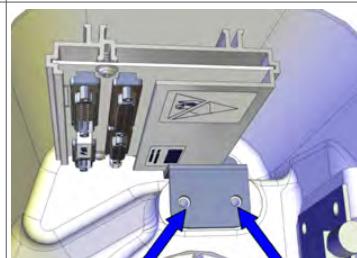
4 Repair

4.4.1 Removing the cable harness

Continued

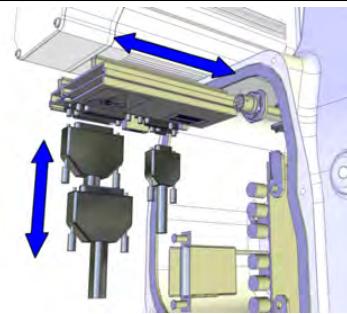
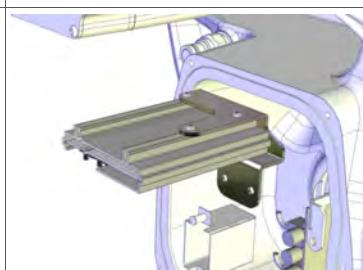
Action	Note
4 Remove the SMB cover.	 xx1300000669

Disconnecting and removing the SMB unit

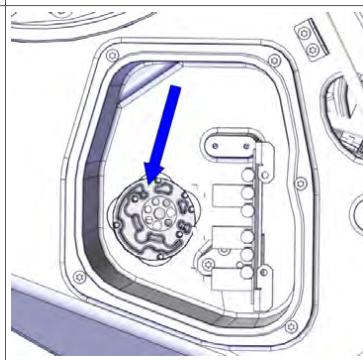
Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 49	
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

4.4.1 Removing the cable harness Continued

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	 xx1300000728
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

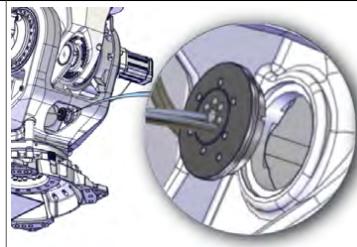
Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 49	
3 Unscrew the attachment screws that hold the SMB/BU cover from inside the SMB recess.	 xx1500003086

Continues on next page

4 Repair

4.4.1 Removing the cable harness

Continued

Action	Note
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 lower arm.	

4.4.2 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Cable harness	3HAC050792-001	

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .
Sparkplug wrench	-	Used to remove and refit the R1.SMB in the base.

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4 Repair

4.4.2 Refitting the cable harness

Continued

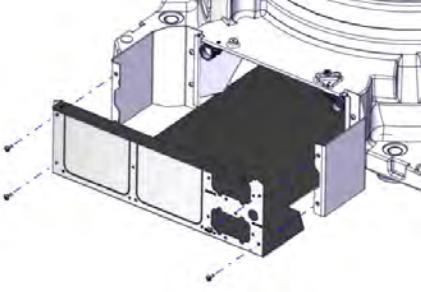
Required consumables

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

Refitting the cable harness

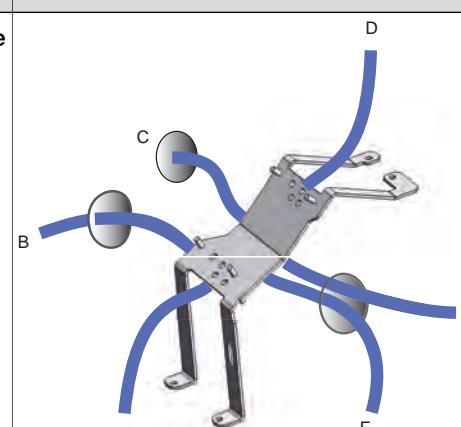
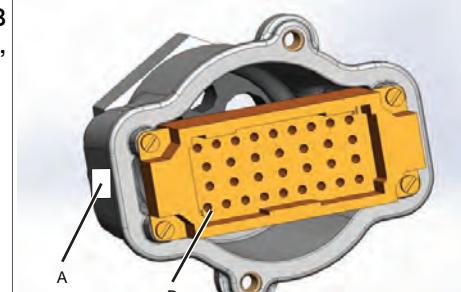
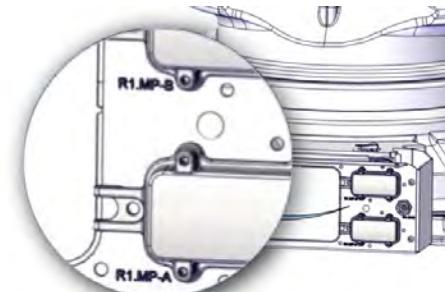
Use these procedures to refit the cable harness.

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.	

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4.4.2 Refitting the cable harness Continued

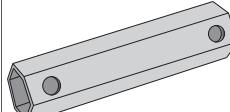
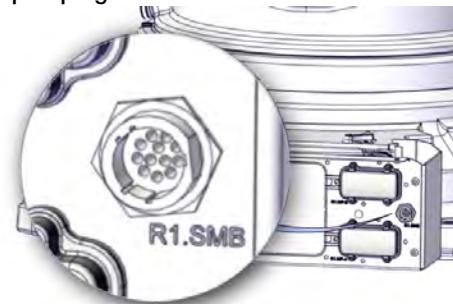
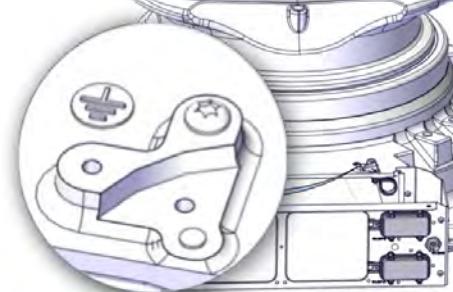
Action	Note												
4 Make sure that the cables running from the axis-1 bracket, runs untangled down through the hole in the frame to the base plate, to axis-1, axis-2 and axis-3 motors as well as to the SMB/BU recess. Adjust the cables if needed. The different cables must not be twisted or tangled.	 xx1500003081 <table border="1"> <tr> <td>A</td><td>Cables down through hole in frame, to base plate</td></tr> <tr> <td>B</td><td>Axis-2 motor cables</td></tr> <tr> <td>C</td><td>SMB/BU cables</td></tr> <tr> <td>D</td><td>Cables up through lower arm and onwards</td></tr> <tr> <td>E</td><td>Axis-3 motor cables</td></tr> <tr> <td>F</td><td>Axis-1 motor cables</td></tr> </table>	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
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 <table border="1"> <tr> <td>A</td><td>Bar code</td></tr> <tr> <td>B</td><td>Hole for pin 1</td></tr> </table>	A	Bar code	B	Hole for pin 1								
A	Bar code												
B	Hole for pin 1												
6 Refit the R1.MP-A and R1.MP-B contacts. i Note Run the cables on top of each other, through the base, without being twisted.	 xx1500003083 Screws M6x20 stainless steel (4 pcs)												

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4 Repair

4.4.2 Refitting the cable harness

Continued

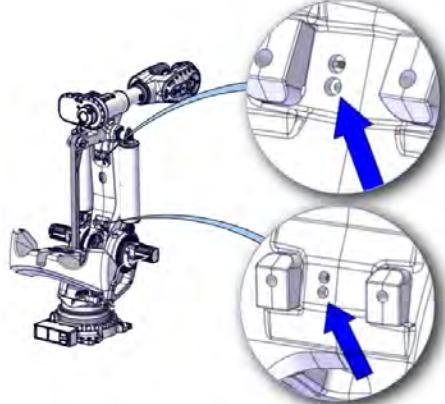
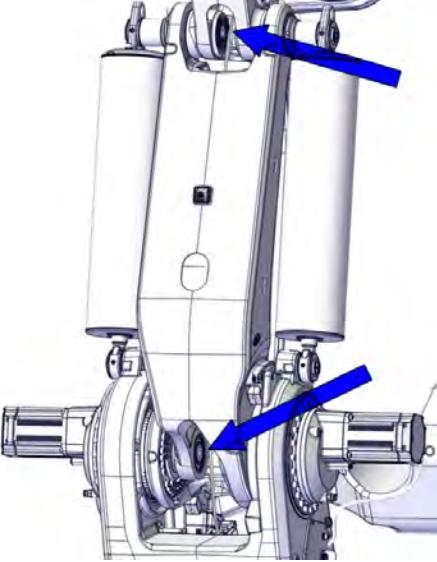
Action	Note
7 Make sure the signal cable R1.SMB runs under the oil hose and above the R1.MP cables, through the base.	
8 Refit the R1.SMB cable, with the large recess pointing upwards to the right.  Tip Use a Sparkplug wrench (or similar).  xx1200000888	Sparkplug wrench  xx1500003084
9 Refit the two 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

4.4.2 Refitting the cable harness
Continued

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

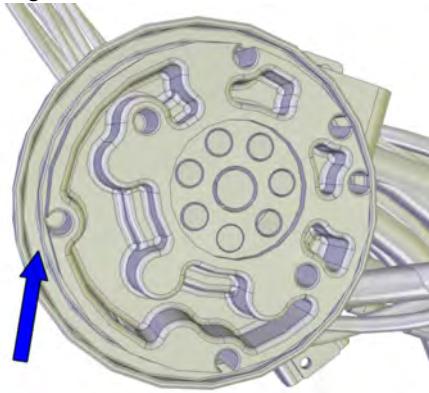
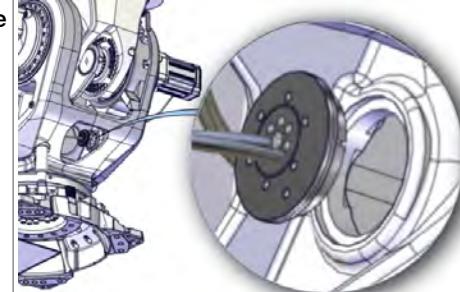
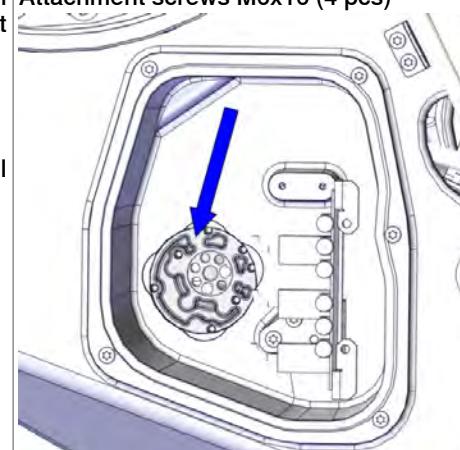
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4 Repair

4.4.2 Refitting the cable harness

Continued

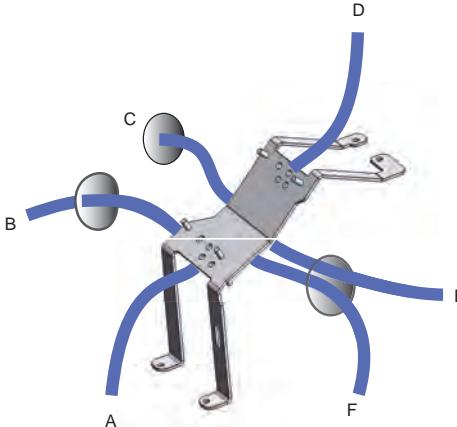
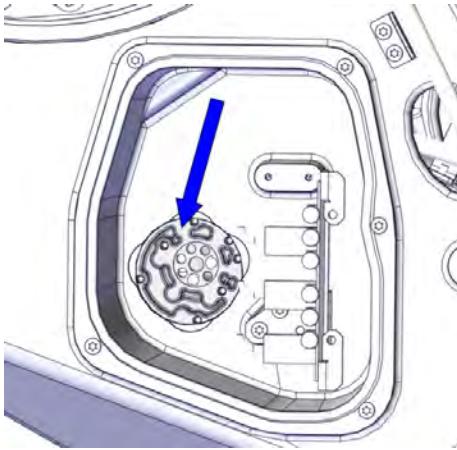
Refitting the SMB/BU cables

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.	Attachment screws M6x16 (4 pcs)  xx1500003086
<p> Note</p> <p>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.</p>	

Continues on next page

4.4.2 Refitting the cable harness

Continued

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
8 Secure the SMB/BU cover from inside the SMB recess.	 xx1500003086

Refitting the SMB unit

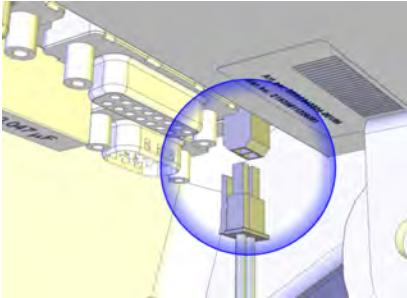
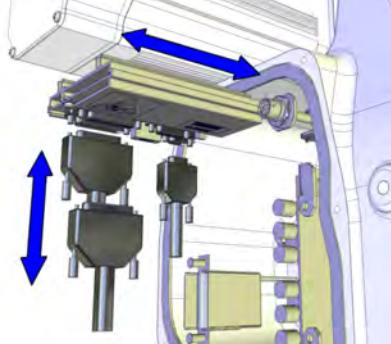
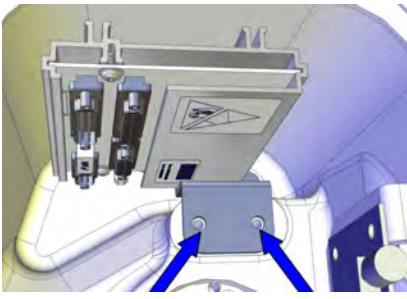
Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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4 Repair

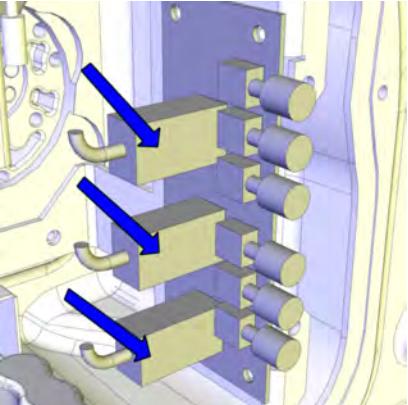
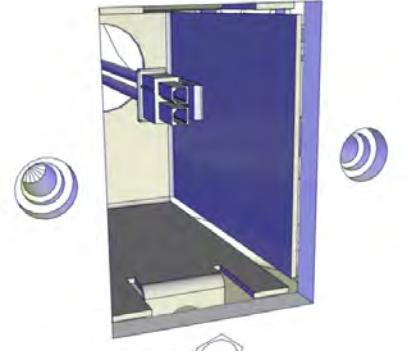
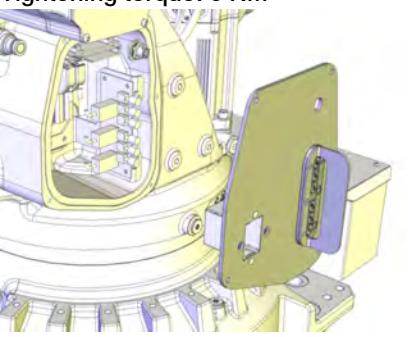
4.4.2 Refitting the cable harness

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 WARNING - The unit is sensitive to ESD! on page 49	
3 Connect the battery cable to the SMB unit.	 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

Continues on next page

4.4.2 Refitting the cable harness
Continued

Action	Note
6 If disconnected, reconnect connectors X8, X9 and X10 to the brake release board.	 xx1300000670
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.	

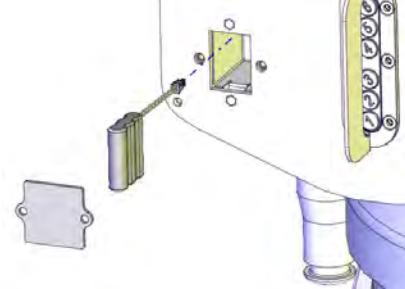
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4 Repair

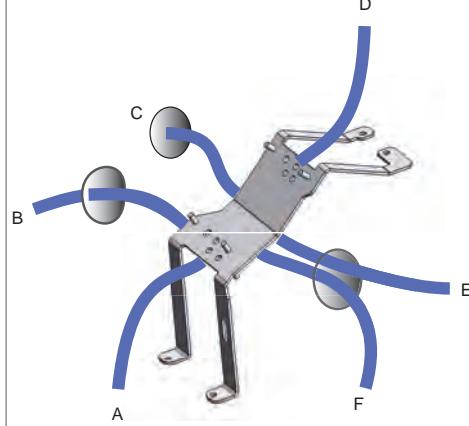
4.4.2 Refitting the cable harness

Continued

Refitting the SMB battery

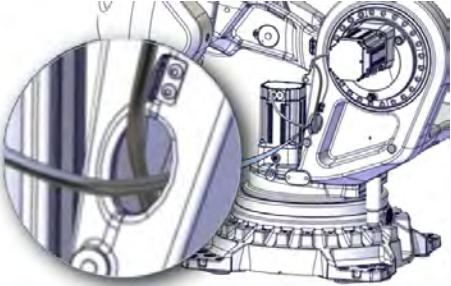
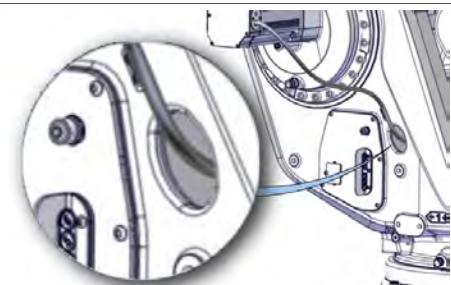
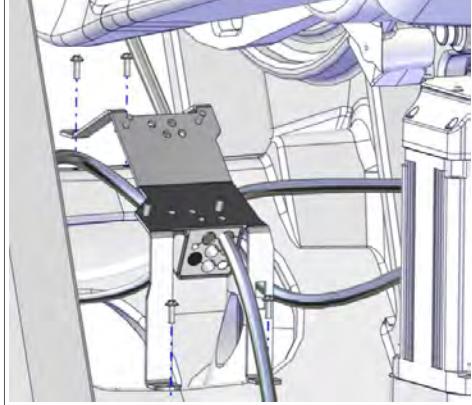
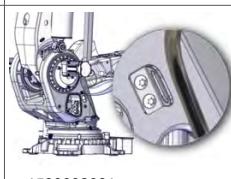
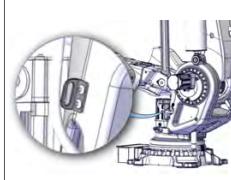
Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 49	
2 Get a hold of the battery cable in the recess for the battery and reconnect.	
3 Place the battery in the recess.	 xx1300000829
4 Refit the battery cover.	Attachment screws: M6x16 8.8 (2 pcs) Tightening torque: 6 Nm

Refitting the cable harness in frame

Action	Note												
1 Make sure that the cables running from the axis-1 bracket, runs untangled down the hole in the frame to the base plate, to axis-1, -2 and -3 motors as well as to the SMB/BU recess. Adjust the cables if needed. The different cables must not be twisted or tangled.	 xx1500003081												
	<table border="1"> <tr> <td>A</td> <td>Cables down through hole in frame, to base plate</td> </tr> <tr> <td>B</td> <td>Axis-2 motor cables</td> </tr> <tr> <td>C</td> <td>SMB/BU cables</td> </tr> <tr> <td>D</td> <td>Cables up through lower arm and onwards</td> </tr> <tr> <td>E</td> <td>Axis-3 motor cables</td> </tr> <tr> <td>F</td> <td>Axis-1 motor cables</td> </tr> </table>	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
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												

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4.4.2 Refitting the cable harness
Continued

	Action	Note
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
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

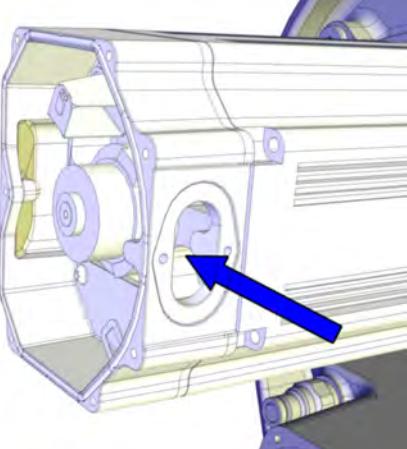
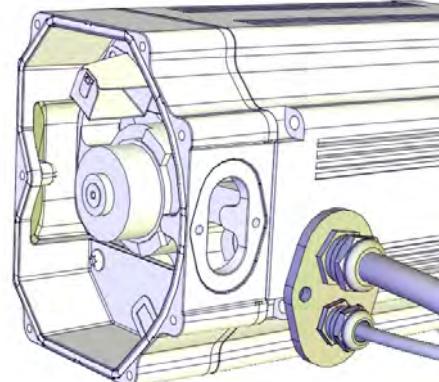
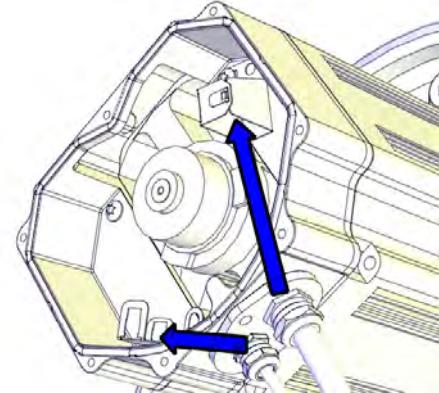
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4 Repair

4.4.2 Refitting the cable harness

Continued

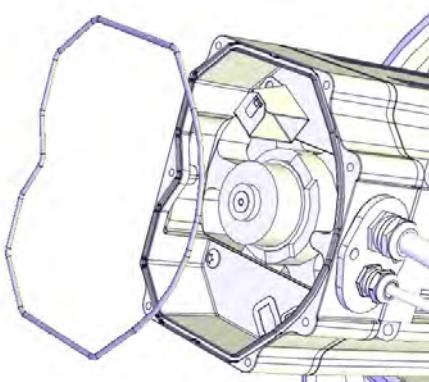
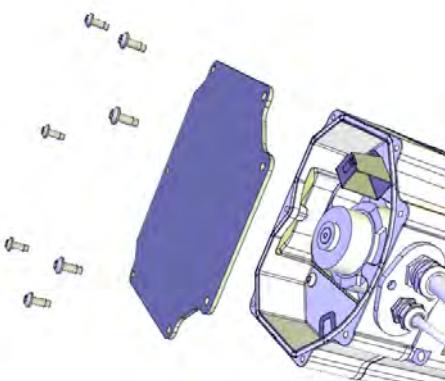
Connecting the axis-1, -2, -3 and -4 motor cables

Action	Note
1 Push the motor cables in 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 connectors.	 xx1200001066
4 Wipe clean o-ring and o-ring groove.	

Continues on next page

4.4.2 Refitting the cable harness

Continued

	Action	Note
5	<p>Inspect the o-ring.</p> <p>Note</p> <p>Replace if damaged.</p>	 <p>xx1200001070</p> <p>O-ring: 3HAC054692-002</p>
6	Refit the o-ring.	
7	<p>CAUTION</p> <p>When refitting the motor cover, make sure none of the cables inside will be damaged!</p>	
8	<p>Refit the motor cover.</p> <p>Note</p> <p>Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged.</p> <p>Note</p> <p>Make sure the o-ring is undamaged and properly fitted.</p>	Attachment screws: M5x12 (7 pcs)  <p>xx1200001135</p>
9	Make sure the cover is tightly sealed.	

Refitting the cable harness in the upper arm

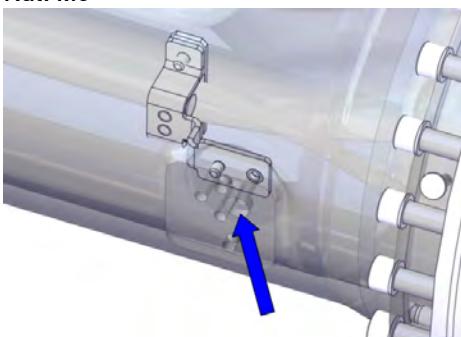
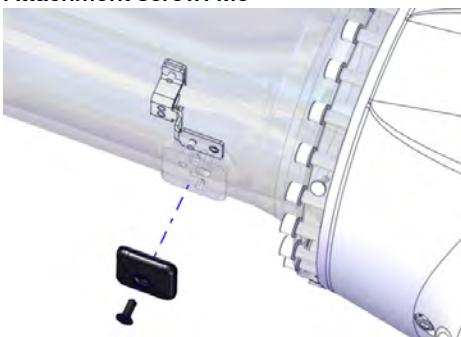
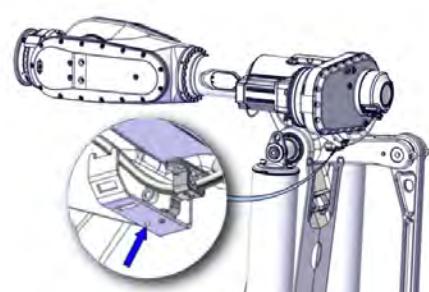
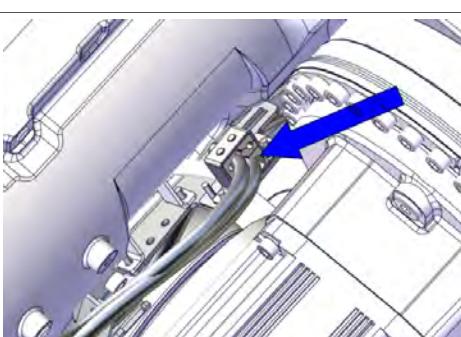
	Action	Note
1	Carefully push the cable harness in through the upper arm and out off the wrist.	

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4 Repair

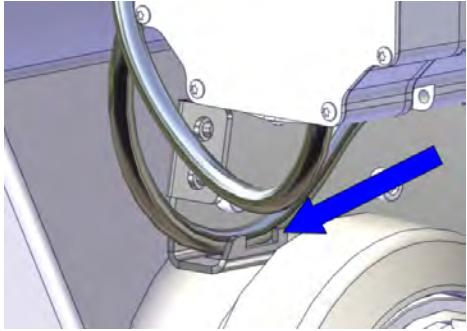
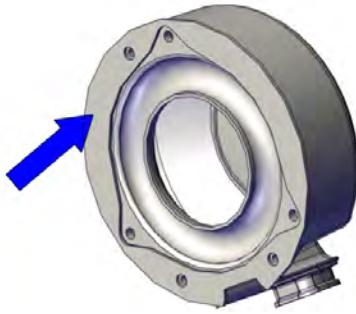
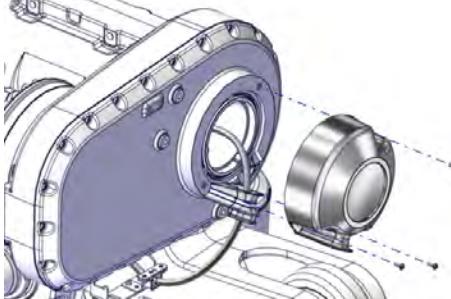
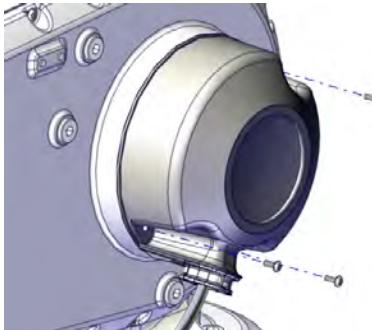
4.4.2 Refitting the cable harness

Continued

Action	Note
2 Refit the cable clamp inside the upper arm.	<p>Note The nut is attached from the outside.</p>  <p>xx1500002720</p>
3 Refit the protection cover.	<p>Attachment screw: M8</p>  <p>xx1500002719</p>
4 Refit the cable clamp on the axis-3 bracket.	 <p>xx1500002718</p>
5 Refit the cable clamp on the axis-3 bracket, between axis-4 motor and arm housing.	 <p>xx1500003092</p>

Continues on next page

4.4.2 Refitting the cable harness Continued

	Action	Note
6	Secure the cable harness with a cable tie.	 xx1500003093
7	Make sure that the gasket on the cover is correctly fitted. Note Replace if damaged. The gasket 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.	 xx1500003094
8	Refit the cable guide, if it has been removed.	 xx1500002723
9	Refit the cover.	 xx1500002722

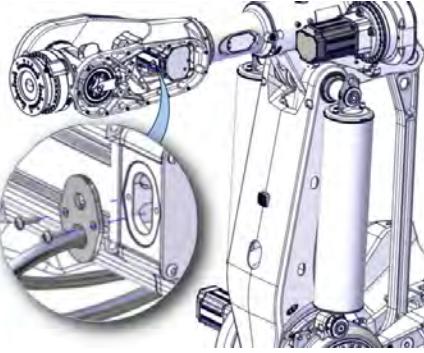
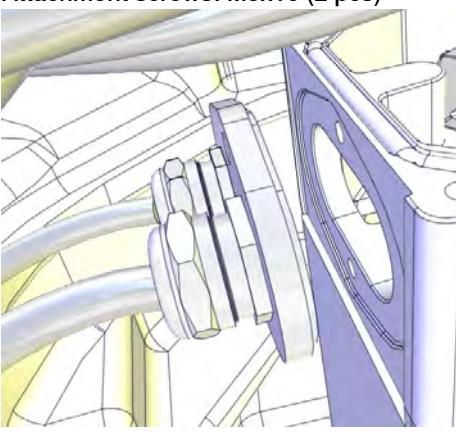
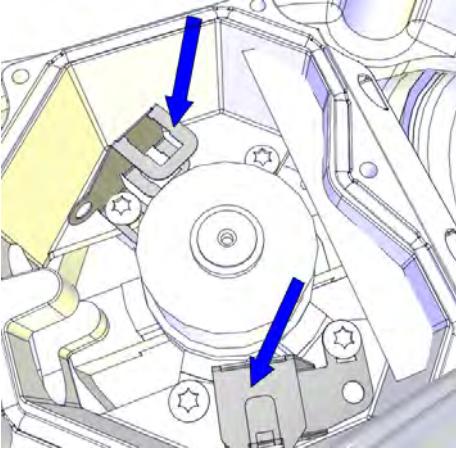
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4 Repair

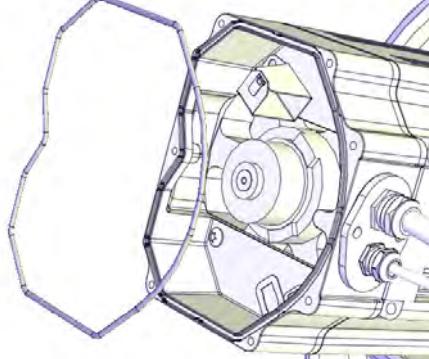
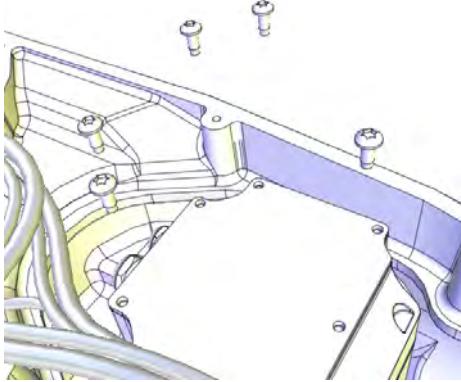
4.4.2 Refitting the cable harness

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
3 Connect the connectors. Connect in accordance with the markings on the connectors.	 xx1200001015

Continues on next page

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

Connecting the axis-6 motor cables

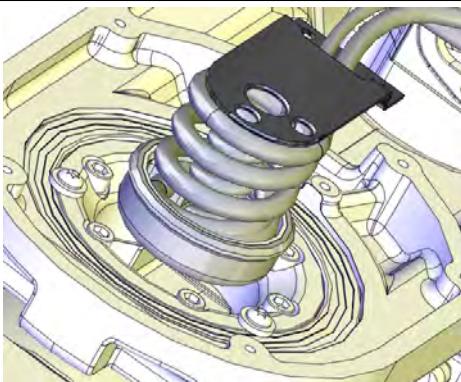
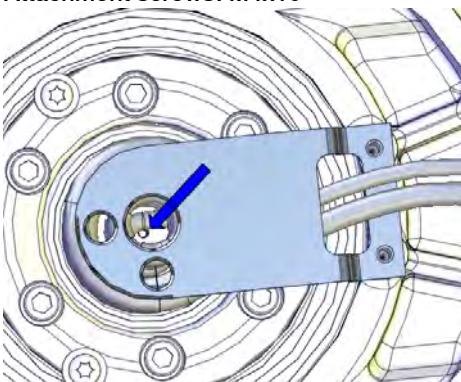
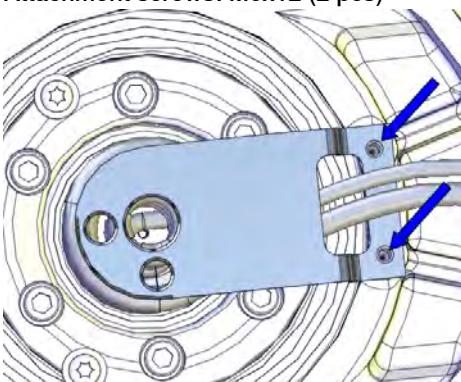
	Action	Note
1	<p>Make sure that the axis-5 is in +90 position, before continuing. If not, the cable spiral will be attached in the wrong position and cause damage to the cable harness.</p> <p>! CAUTION</p> <p>Make sure that the cable spiral is not turned an extra revolution. The result will be damage to the cable harness.</p>	

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4 Repair

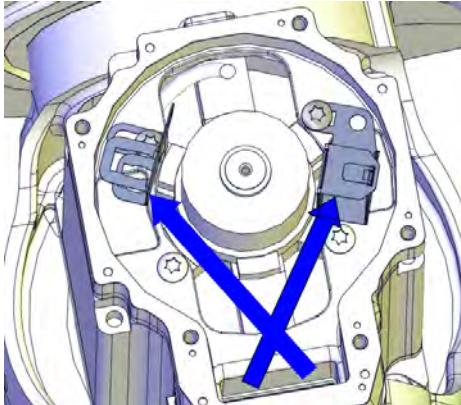
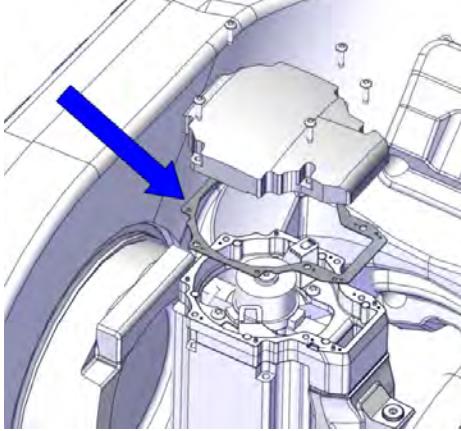
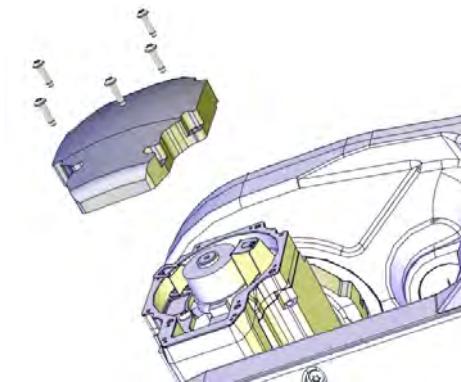
4.4.2 Refitting the cable harness

Continued

Action	Note
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
4 Secure the cable bracket with its attachment screws.	Attachment screws: M6x12 (2 pcs)  xx1300000484

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4.4.2 Refitting the cable harness Continued

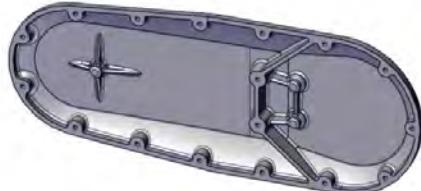
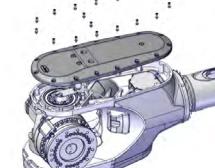
	Action	Note
5	<p>Reconnect the connectors to the axis-6 motor.</p> <p>Note</p> <p>Place the resolver cable underneath the motor cable.</p>	 <p>xx1300000488</p>
6	<p>Make sure the gasket on the motor cover is undamaged.</p> <p>Note</p> <p>Replace if damaged.</p>	 <p>xx1500003095</p>
7	<p>CAUTION</p> <p>Make sure not to damage the cables inside the motor when refitting the motor cover.</p>	
8	Refit the motor cover.	<p>Attachment screws: M5x20 (5 pcs)</p>  <p>xx1200001080</p>

Continues on next page

4 Repair

4.4.2 Refitting the cable harness

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.	
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

Continues on next page

Concluding procedure

	Action	Note
1	Update the revolution counters.	See Updating revolution counters on page 795 .
2	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.	

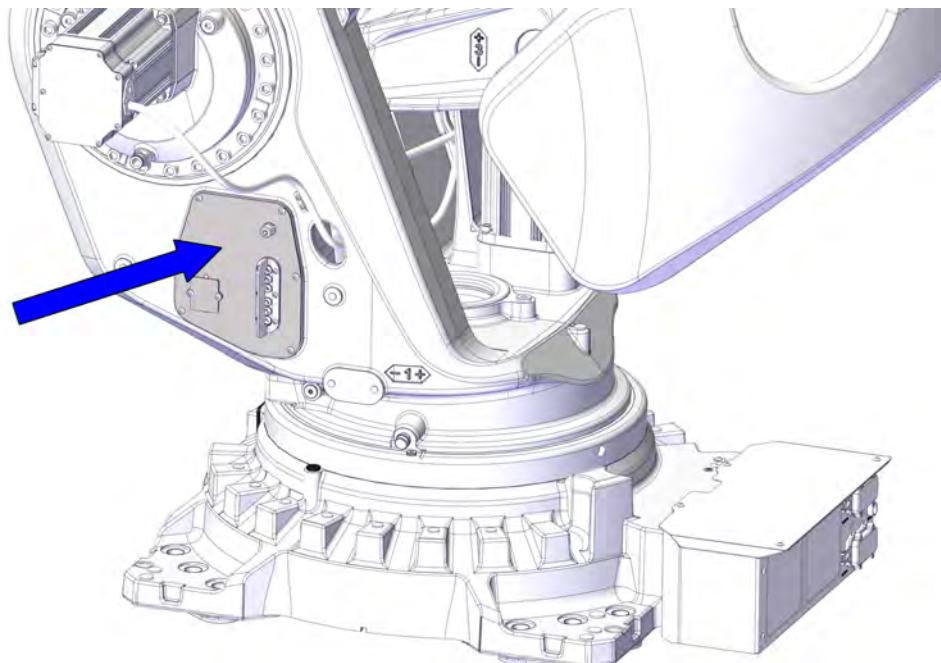
4 Repair

4.4.3 Replacing the SMB

4.4.3 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
SMB	3HAC043904-001	RMU102

Required tools and equipment

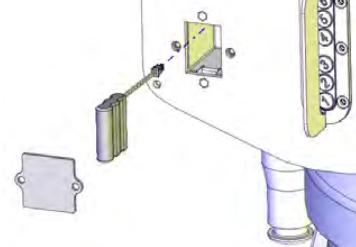
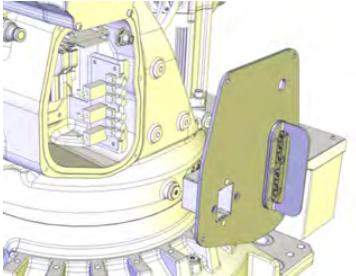
Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .
ESD bag		

Continues on next page

Removing the SMB unit

Use these procedures to remove the SMB unit.

Preparations before disconnecting cables to the SMB and BU units

Action	Note
 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <i>WARNING - The unit is sensitive to ESD! on page 49</i>	
3 Open the small battery cover on the SMB cover, disconnect the battery cable and remove the battery.	 xx1300000829
4 Remove the SMB cover.	 xx1300000669

Disconnecting and removing the SMB unit

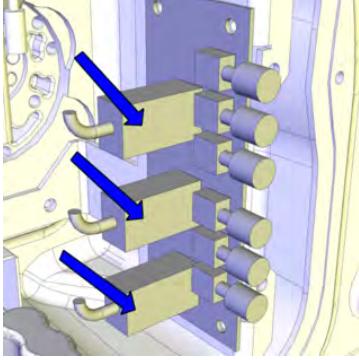
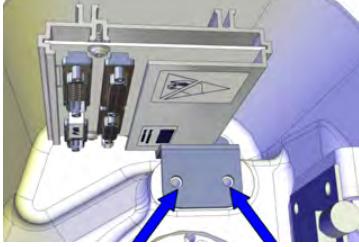
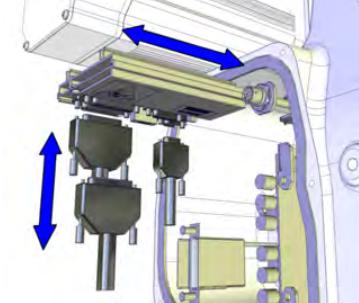
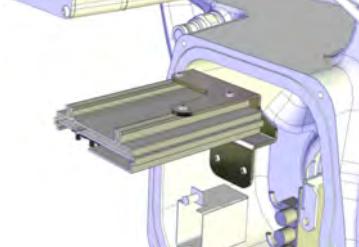
Action	Note
 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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4 Repair

4.4.3 Replacing the SMB

Continued

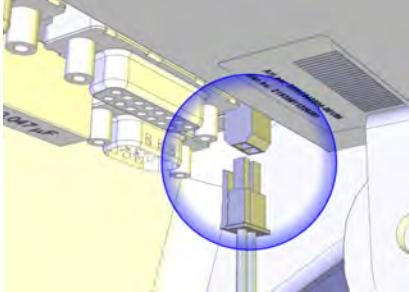
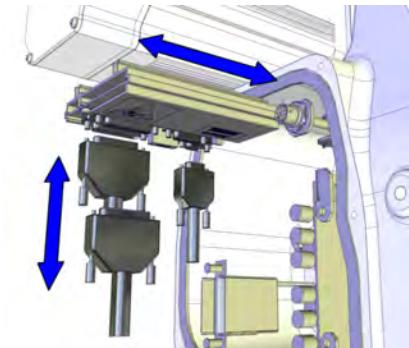
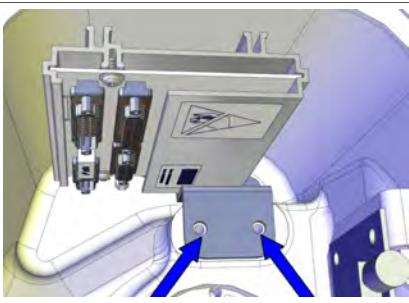
Action	Note
2  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 49	
3 If needed, disconnect the brake release unit (connectors X8, X9 and X10).	 xx1300000670
4 Remove 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	 xx1300000728
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

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Refitting the SMB unit

Use these procedures to refit the SMB unit.

Refitting the SMB unit

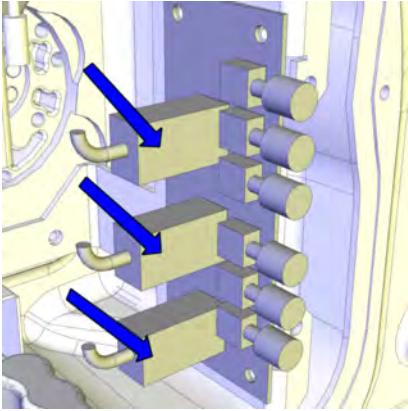
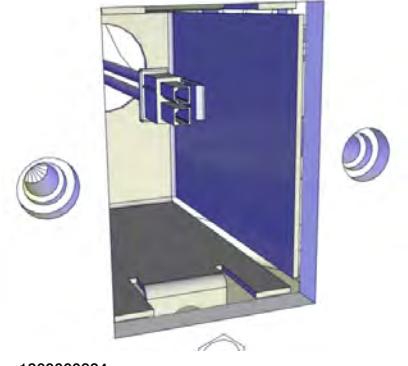
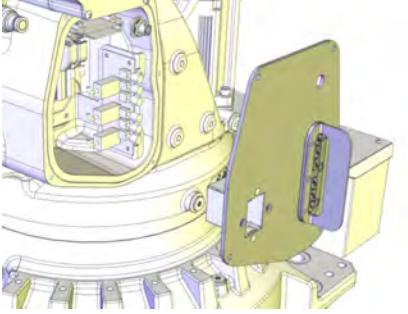
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 49	
3	Connect the battery cable to the SMB unit.	 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

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4 Repair

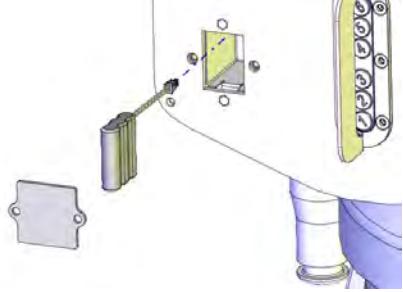
4.4.3 Replacing the SMB

Continued

Action	Note
6 If disconnected, reconnect connectors X8, X9 and X10 to the brake release board.	 xx1300000670
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.	

Continues on next page

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 WARNING - The unit is sensitive to ESD! on page 49	
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 page 795 .
2	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

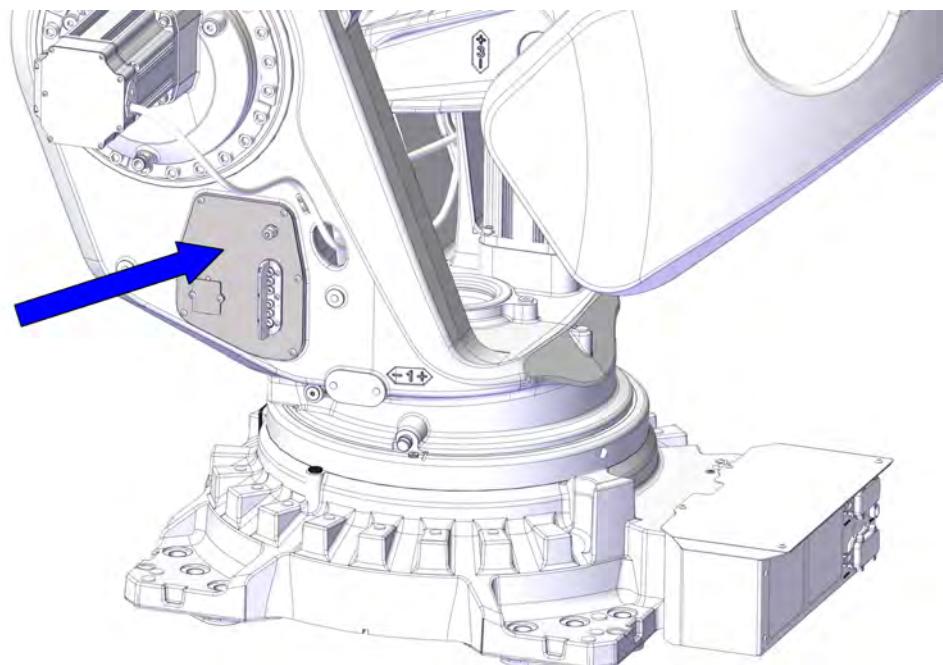
4 Repair

4.4.4 Replacing the brake release unit

4.4.4 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Brake release unit	3HAC046642-001	BRK001

Required tools and equipment

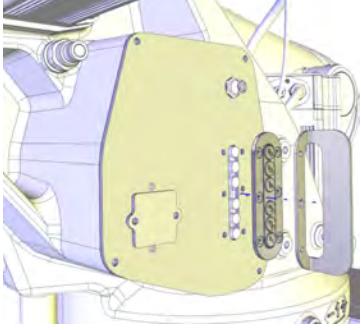
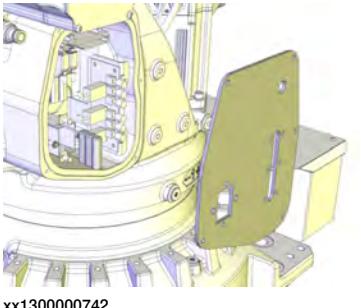
Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

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: <ul style="list-style-type: none"> • 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 <i>WARNING - The unit is sensitive to ESD! on page 49</i>	
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 the need of synchronizing the robot.  CAUTION Carefully put the SMB cover down to avoid damaging the battery cable connectors.	

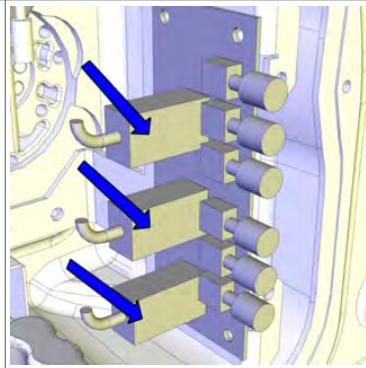
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4 Repair

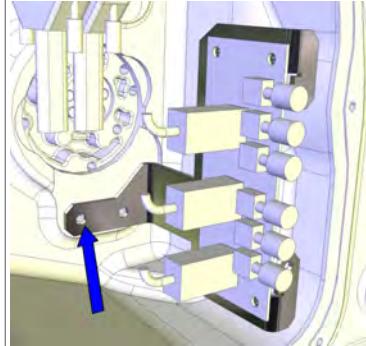
4.4.4 Replacing the brake release unit

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 please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 49	
3 Use caution and remove the connectors X8, X9 and X10 from the brake release board.	 xx1300000670

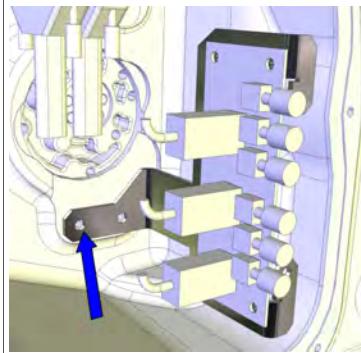
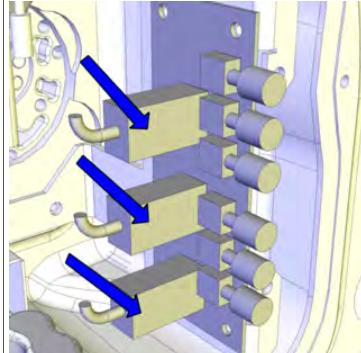
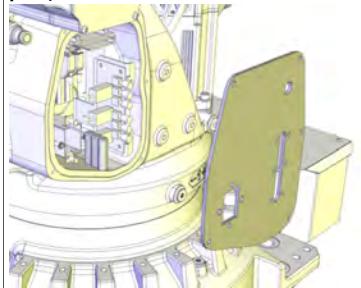
Concluding procedure

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 bracket with the brake release unit.	
3 Remove the bracket with the brake release unit fitted.	 xx1300000744

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Refitting the brake release unit

Use these procedures to refit the brake release unit.

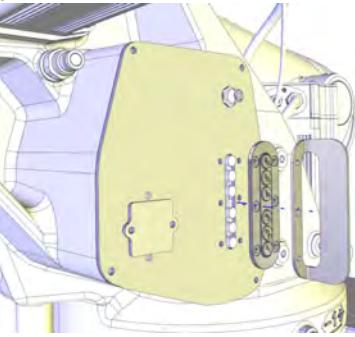
	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 49	
2	Refit the bracket with the brake release unit fitted. Make sure the unit is placed as straight as possible on the bracket. The push buttons can otherwise get jammed when the SMB cover is refitted.	 xx1300000744
3	Reconnect the connectors X8, X9 and X10 to the brake release unit.	 xx1300000670
4	 Note Do not refit the push button guard at this point.	Attachment screws: M6x16 8.8 (6 pcs)  xx1300000742

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4 Repair

4.4.4 Replacing the brake release unit

Continued

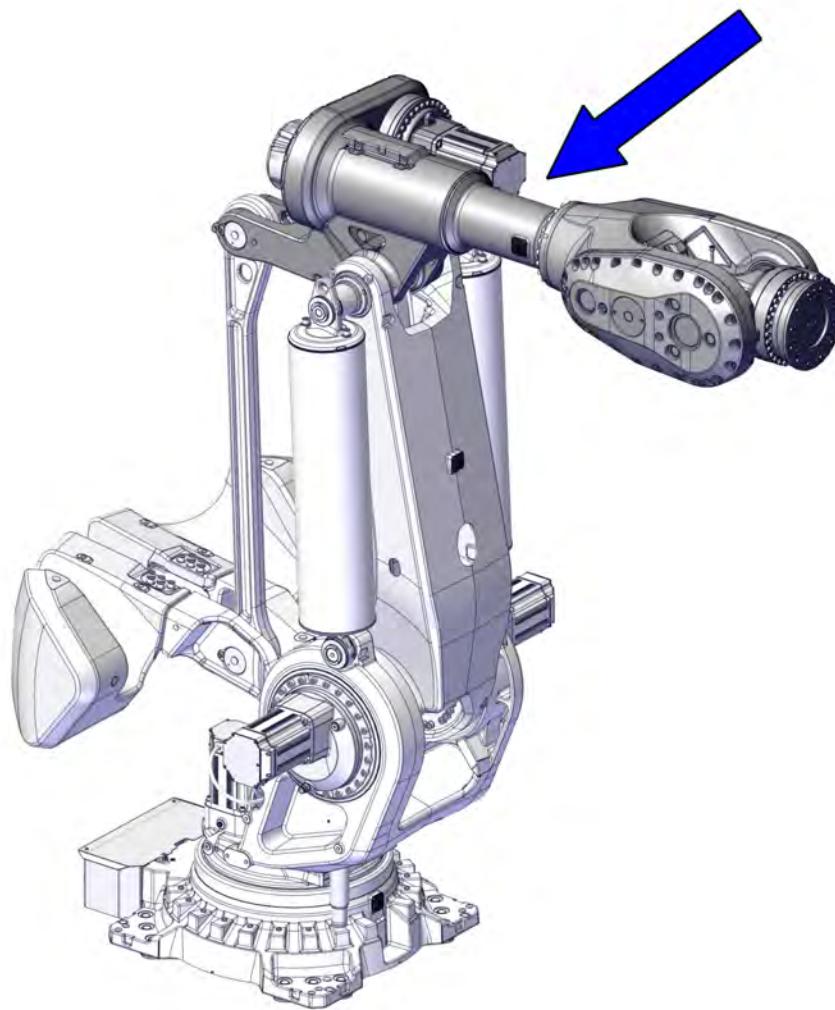
Action	Note
5  WARNING Before continuing any service work, please observe the safety information in section WARNING - The brake release buttons may be jammed after service work on page 47!	
6 Refit the push button guard to the SMB cover.	Attachment screws: M5x16 8.8 (6 pcs)  xx1300000743
7 The revolution counters must be updated if the battery has been disconnected.	See Updating revolution counters on page 795 .
8  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

4.5 Upper and lower arms

4.5.1 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

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

Continues on next page

4 Repair

4.5.1 Replacing the upper arm

Continued

Required tools and equipment

Equipment, etc.	Article number	Note
MobilePlatformLadder	-	
Fixing screw, M10x50 (4 pcs)	-	Used to holding parallel rod in position.
Screw M16x80	-	Fully threaded
Roundsling 1 m	-	Lifting capacity: 1,000 kg
Roundsling 2.5 m	-	Lifting capacity: 2,000 kg
Roundsling 3 m	-	Lifting capacity: 2,000 kg
Crowbar (small)	-	Used when removing parallel arm from lower arm
Pallet		Used for putting down removed parts from robot.
Lifting eye	3HAC16131-1	M12
Fender washer	-	Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.
Piece of wood	-	Used when replacing the parallel rod and mechanical stop pin as a safety measure
Assembly tool	3HAC051000-001	Used to disassemble and assemble the parallel rod
Press plate	3HAC050949-001	Used to disassemble and assemble the parallel rod
Round plate	-	Used to disassemble and assemble the parallel rod
Hydraulic cylinder	3HAC11731-1	To be used with the press tool.
Hydraulic pump 80 MPa	3HAC13086-1	To be used with the hydraulic cylinder.
Velcro strap	-	
Assembly tool	3HAC056095-002	Set of tools. Instruction 3HAC056526-002 enclosed.
Removal tool	3HAC056095-003	Set of tools. Instruction 3HAC056526-002 enclosed.
Glycerine adapter	-	Used to replace upper arm shafts together with a glycerine press tool.
24 VDC power supply	-	Used to release the motor brakes.
Dial gauge		
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

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.

Continues on next page

Consumable	Article number	Note
Isopropanol	-	
Glycerine		
Locking liquid	-	Loctite 243
Flange sealant		Loctite 574
Mercasol		3110 Waxcoat
Grease	3HAC042534-001	Tribol GR 100-0 PD
Bearing grease	3HAC9408-1	Tribol GR 100-2 PD

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. <ul style="list-style-type: none"> • 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 800 .
	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.	

Continues on next page

4 Repair

4.5.1 Replacing the upper arm

Continued

Preparations before unloading the pressure of balancing device

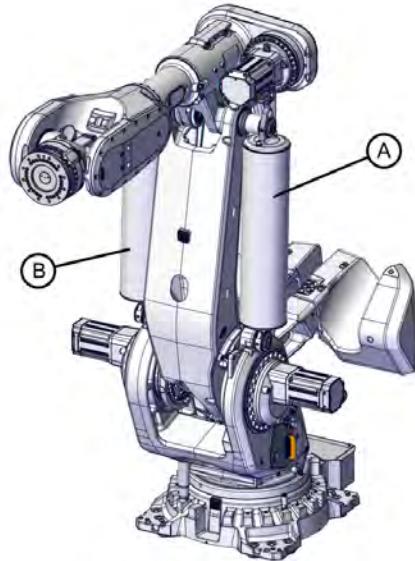
Action	Note
1 Jog the robot to calibration position.	 xx1500002310
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

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Unloading the pressure of the balancing device

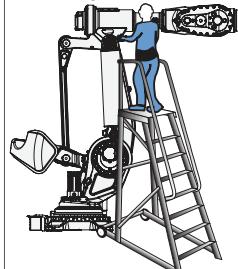
**CAUTION**

Make sure to relief the pressure of the correct balancing device. Relief pressure on axis 2 side when changing axis-2 gearbox, and relief pressure on axis 3 side when changing axis-3 gearbox.



xx1600001406

A	Axis-2 balancing device
B	Axis-3 balancing device

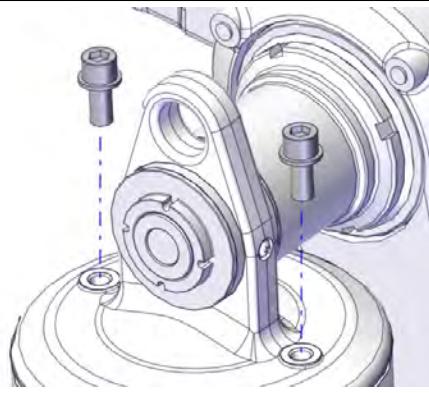
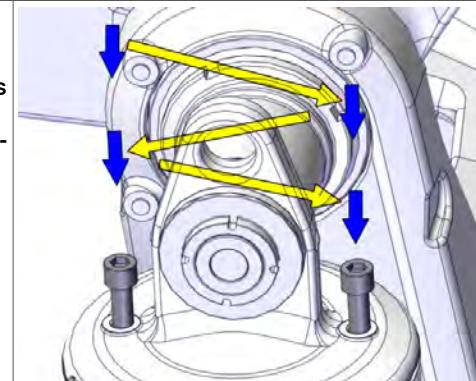
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	<i>Only needed when the upper arm is fitted on the robot:</i> Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device.  DANGER Do not use the robot as ladder!	Mobile platform ladder  xx1500001985

Continues on next page

4 Repair

4.5.1 Replacing the upper arm

Continued

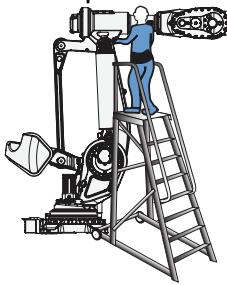
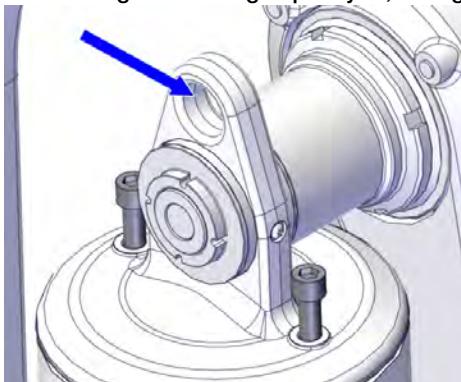
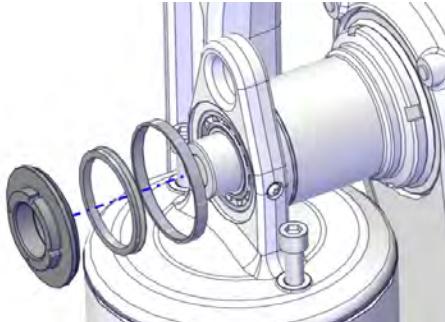
Action	Note
3 Remove the screws, fitted in the screw holes on top of the balancing device. Note Keep the screws. They shall be refitted after the work is done.	 xx1500001971 M16x35
4 Apply some Molykote on threads and at the bottom end of two fully threaded screws.	 xx1500002303 Screws M16x80 fully threaded
5 Unload the pressure of the balancing device by inserting the screws. Attach the screws until the screws reaches the piston. Then, alternately little by little, attach the screws at least another five millimeters. The pressure is now unloaded.	 xx1500002309 Screw M16x80 (2 pcs)
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.	

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4.5.1 Replacing the upper arm
Continued

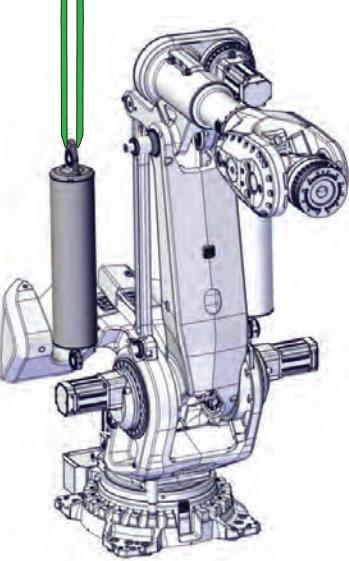
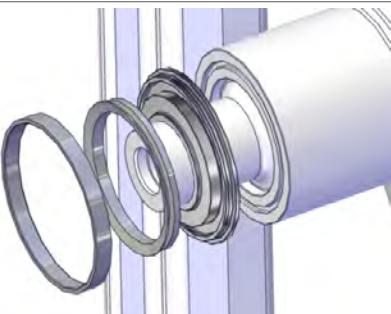
Action	Note
2 Use a Mobile platform ladder to reach the upper end of the balancing device.  DANGER Do not use the robot as a ladder.	Mobile platform ladder  xx1500001985
3  CAUTION The balancing device weights 200 kg. All lifting accessories used must be sized accordingly.	
4 Attach a roundsling to the lifting hole on top of the balancing device and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg  xx1500001983
5 Stretch the lifting accessories to take the weight of the balancing device.	
6 Remove upper and lower KM-nuts.  Note Make sure that V-ring or support ring are present.	  xx1500001973

Continues on next page

4 Repair

4.5.1 Replacing the upper arm

Continued

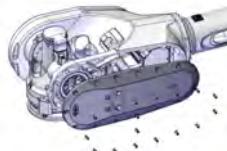
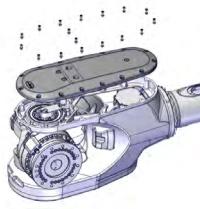
	Action	Note
7	<p>Use caution and lift the balancing device off.</p> <p> Tip</p> <p>If needed, use a Crowbar (small), to carefully help pressing the balancing device out. A suitable bearing puller is another alternative.</p>	<p>Crowbar (small)</p>  <p>xx1500002735</p>
8	<p> Note</p> <p>Make sure that the support ring and spacer ring with V-ring are present.</p>	 <p>xx1500001975</p>
9	<p>Put the balancing device down.</p> <p> Tip</p> <p>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.</p>	<p>Pallet</p>
10	If both balancing devices shall be removed, remove the other in the same way.	

Continues on next page

Robot position when removing the upper arm

	Action	Note
1	<p>Turn on the power and jog the robot to the specified position:</p> <ul style="list-style-type: none"> • Axis 1: no significance as long as the robot is fitted to the foundation. • Axis 2: -65° • Axis 3: 0° (horizontal to the foundation) • Axis 4: +90° • Axis 5: -90° • Axis 6: no significance. 	
2	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	

Retrieving access to the wrist cabling

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

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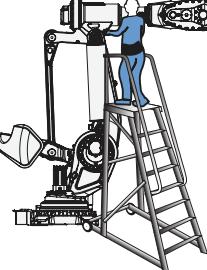
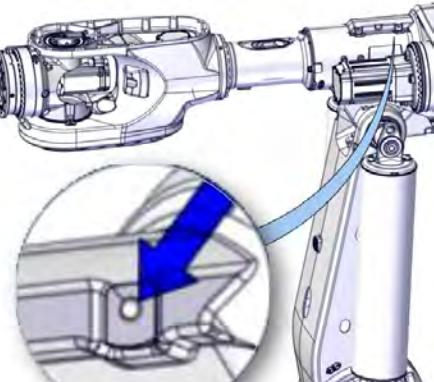
4 Repair

4.5.1 Replacing the upper arm

Continued

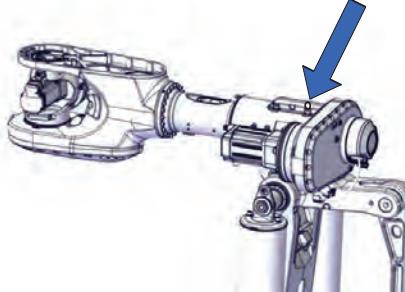
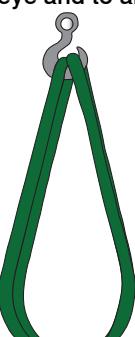
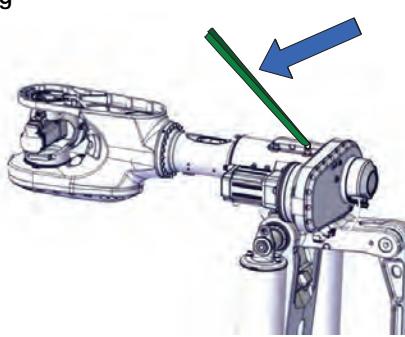
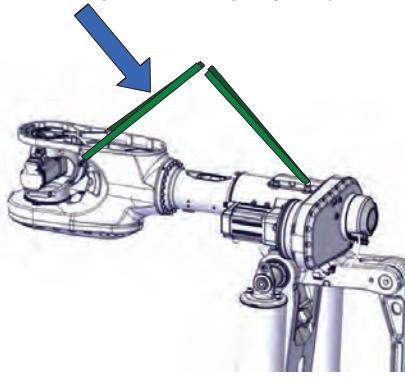
Action	Note
3 Cut the cable tie that secure the axis-6 motor cable.	 xx1500003101

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 <i>Only needed when the upper arm is fitted on the robot:</i> Use a Mobile platform ladder (or similar) to attach the lifting accessories.  DANGER Never use the robot as ladder.	Mobile platform ladder  xx1500001985
3 Remove the plastic plug in the hole shown in the figure.	 xx1500002712

Continues on next page

4.5.1 Replacing the upper arm Continued

	Action	Note
4	Attach a Lifting eye to the hole in the arm housing with a Fender washer underneath.  xx1400002196	Lifting eye: M12 Fender washer: Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.  xx1500002715
5	Attach a roundsling looped to the Lifting eye and to an overhead crane (or similar).  xx1400002599	Roundsling 2.5 m: Lifting capacity: 2,000 kg  xx1500002713
6	Attach a roundsling looped to the wrist and to an overhead crane (or similar).	Roundsling 3 m: Lifting capacity: 2,000 kg  xx1500002714
7	Stretch the lifting accessories to take the weight of the upper arm.	
8	<i>Only needed when the upper arm is fitted on the robot:</i> In order to release the brakes, connect the 24 VDC power supply. Connect connector R2.MP2: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	

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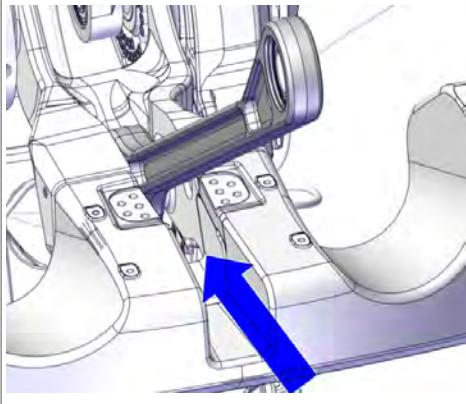
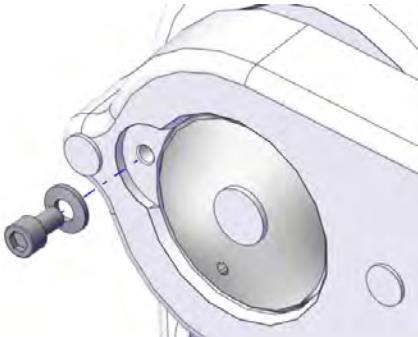
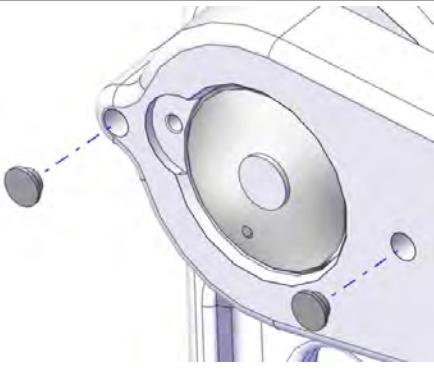
4 Repair

4.5.1 Replacing the upper arm

Continued

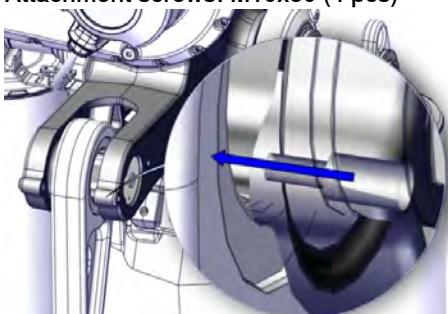
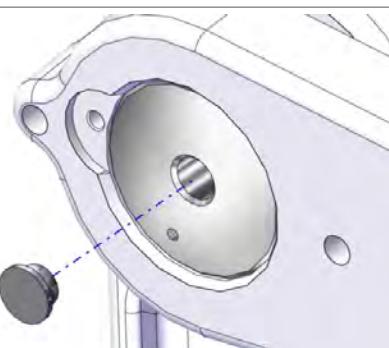
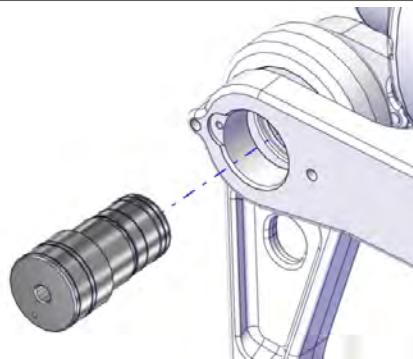
Action	Note
9 <i>Only needed when the upper arm is fitted on the robot:</i> Release the brakes on axis-2 to be sure that the lifting accessories are taking the weight of the upper arm.	
10 Adjust the lifting accessories, if needed.	

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
2 Remove the attachment screw with washer that secure the rod shaft.	 xx1400002600
3 Remove the protection plugs 4 + 4 (two on either side of the upper arm wings).  Note Keep the protection plugs. They shall be refitted when the work is done.	 xx1500001961

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4.5.1 Replacing the upper arm Continued

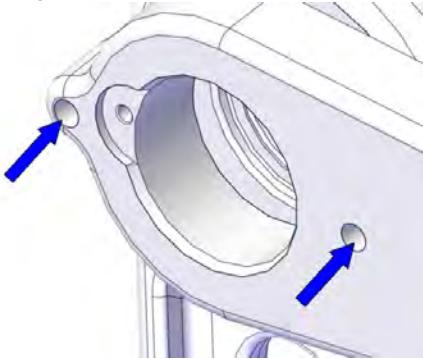
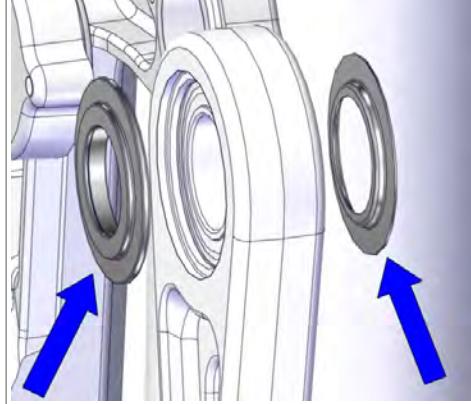
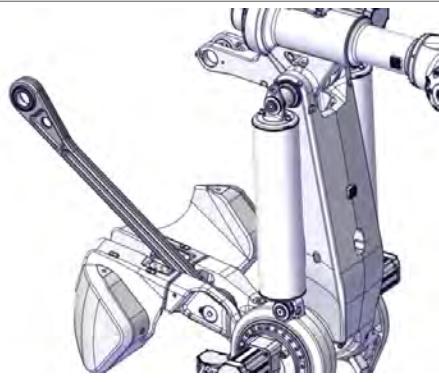
	Action	Note
4	Fit 2 + 2 M10x50 screws in the holes and adjust the screws against the parallel rod from both sides.	<p>This is done to prevent the upper arm wings from pinching when pressing the shaft and thereby making it more difficult to press the shaft in or out. Attachment screws: M10x50 (4 pcs)</p>  <p>xx1500002300</p>
5	Remove the protection plug.	<p> Note Keep the protection plug. It shall be refitted when the work is done.</p>  <p>xx1500001967</p>
6	Apply the press tool parts (Assembly tool, Press plate and Round plate).	<p>Assembly tool: 3HAC051000-001 Press plate: 3HAC050949-001 Round plate:</p>
7	Use the press tool and press the shaft out.	 <p>xx1500001962</p>

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4 Repair

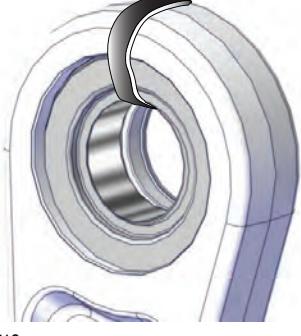
4.5.1 Replacing the upper arm

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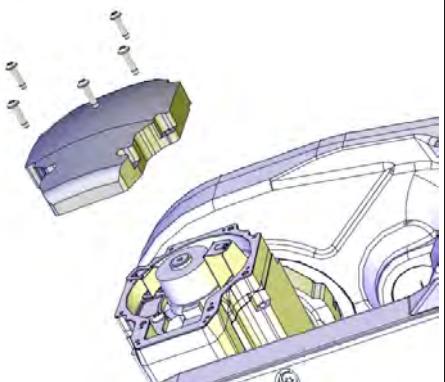
Action	Note				
8 Unscrew two of the M10x50 screws, approximately 5 mm, on one side of the parallel rod. Leave the screws on the other side.	<p>This is to be able to remove the parallel rod without problems and to be able to find the correct position of the parallel rod, when refitting it.</p>  <p>xx1500002710</p>				
9 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.	 <p>xx1500001964</p> <table border="1"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side				
Thrust washer	Cover washer				
10 Move the parallel rod down and let it rest on the piece of wood, which was put there earlier.	 <p>xx1500001965</p>				

Continues on next page

4.5.1 Replacing the upper arm
Continued

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

Disconnecting the axis-6 motor cables

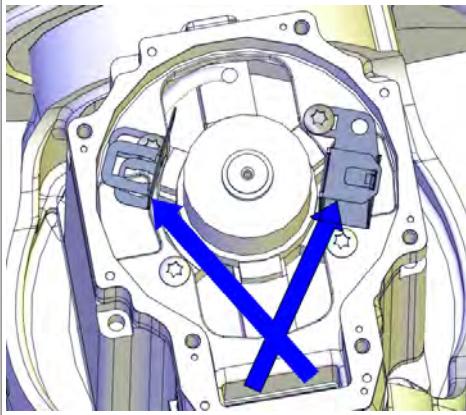
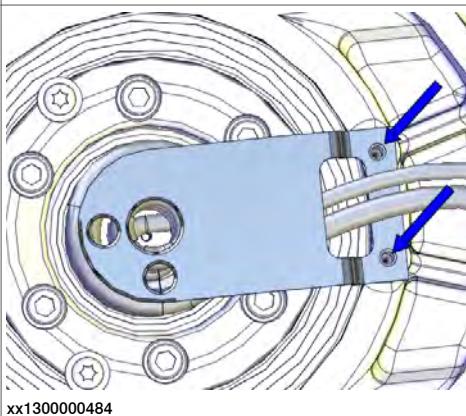
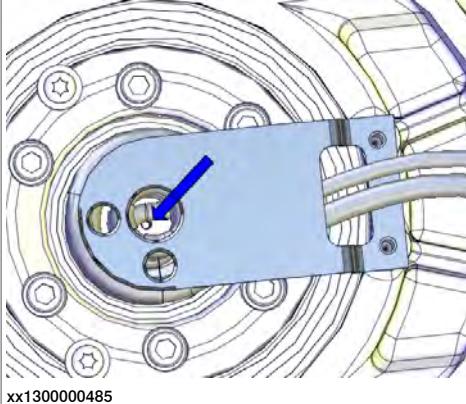
Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Make sure that the axis-5 is as close to +90° or -90° position as possible, depending on what repair work is being done.  Note Not applicable when replacing the axis-6 unit.	
3 Unscrew the attachment screws and remove the motor cover.  Note Do not damage the gasket. Replace if damaged.	 <p>xx1200001080</p>

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4 Repair

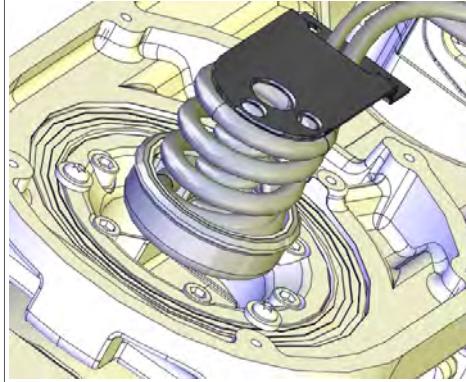
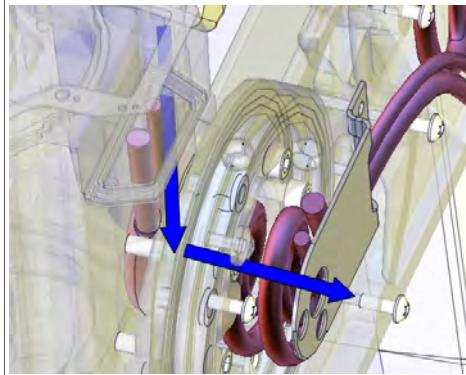
4.5.1 Replacing the upper arm

Continued

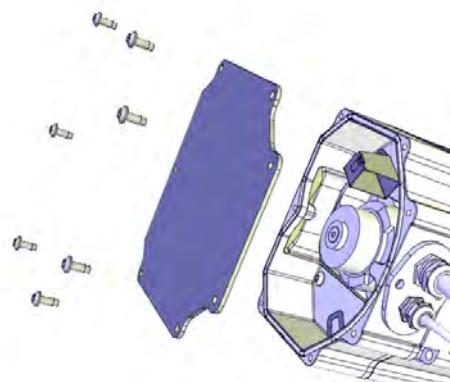
Action	Note
4	Disconnect the motor cables.
	 xx1300000488
5	Unscrew the attachment screws holding the cable bracket.
	 xx1300000484
6	Unscrew the screw holding the carrier.
	<p> Note The screw is located at the bottom of the carrier.</p>
	 xx1300000485

Continues on next page

4.5.1 Replacing the upper arm Continued

Action	Note
<p>7 Use caution and pull out the carrier.</p> <p> Tip</p> <p>If needed, use a screwdriver to help pulling out the carrier.</p>	 xx1300001113
<p>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.</p>	 xx1300000666

Disconnecting the axis-5 motor cables

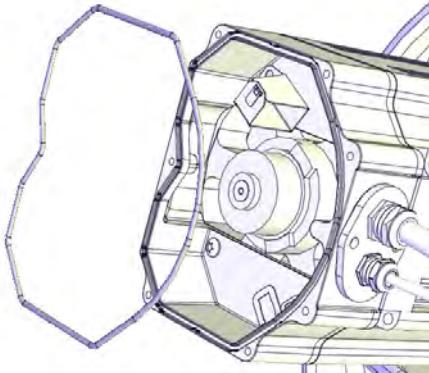
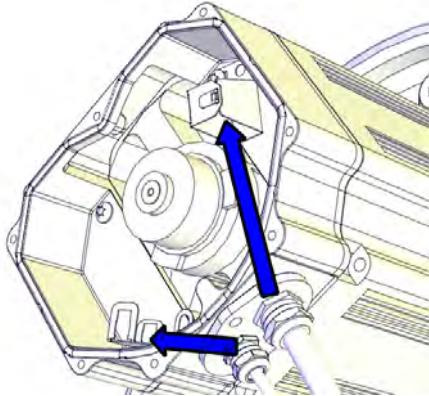
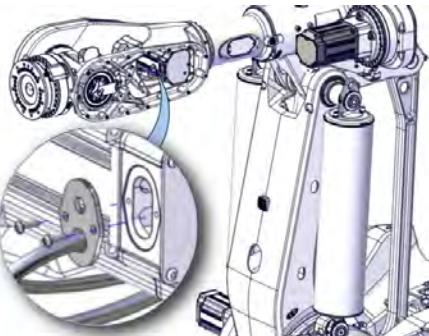
Action	Note
<p>1  DANGER</p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
<p>2 Unscrew the attachment screws with washers and remove the motor cover.</p>	 xx1200001135

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4 Repair

4.5.1 Replacing the upper arm

Continued

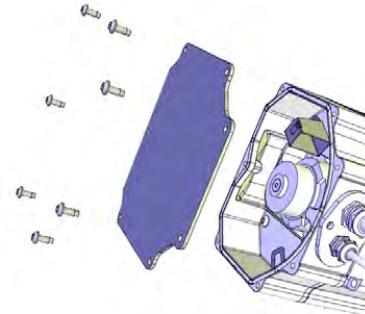
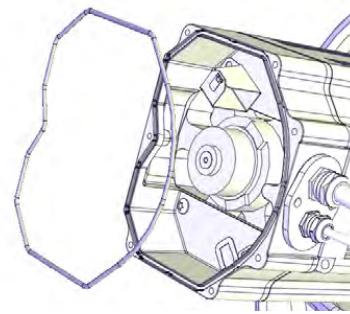
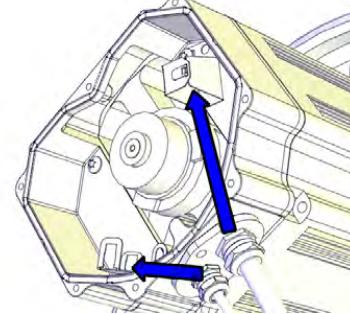
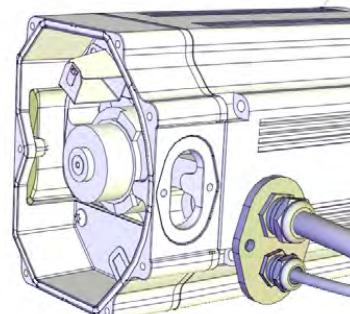
Action	Note
3  Note Make sure the o-ring is present when removing the cover.	 xx1200001070
4 Disconnect the motor cables.	 xx1200001066
5 Remove the cable gland cover.  Tip Make a note in which direction the cable exit hole is facing, if the motor shall be removed too. The motor shall be refitted in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

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.	

Continues on next page

4.5.1 Replacing the upper arm Continued

	Action	Note
2	Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135
3	 Note Make sure the o-ring is not lost.	 xx1200001070
4	Disconnect the motor cables.	 xx1200001066
5	Remove the cable gland cover. Inspect the gasket. 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.	

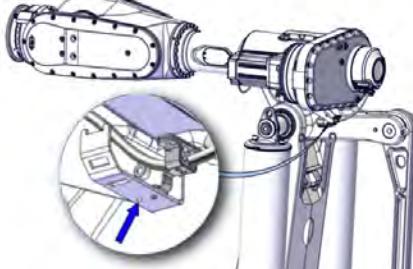
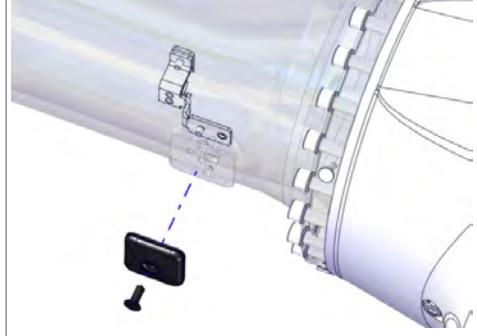
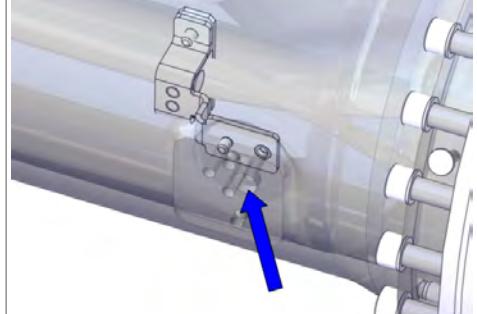
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4 Repair

4.5.1 Replacing the upper arm

Continued

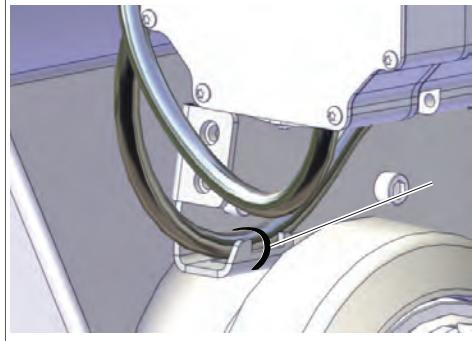
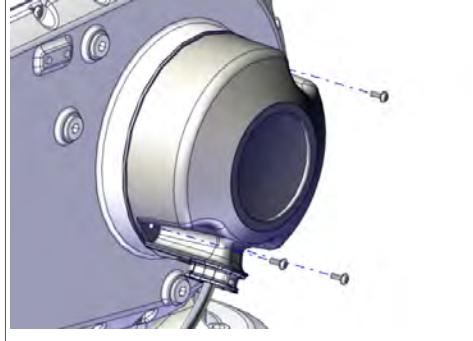
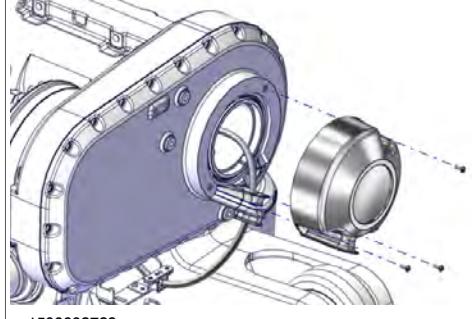
Removing the cable harness in the upper arm

	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the screw that hold the cable clamp.	 xx1500002718
3	Remove the protection cover. Make sure not to damage the surface exposed.	 xx1500002719
4	Unscrew the nut holding the bracket inside the upper arm.  Note The nut is reached from the outside.	 xx1500002720

Continues on next page

4.5.1 Replacing the upper arm

Continued

	Action	Note
5	Cut the cable tie.	 xx1500002721
6	Unscrew the screws that secure the cover.	 xx1500002722
7	Remove the cover.	 xx1500002723
8	Use caution and remove the cable harness out of the upper arm.	

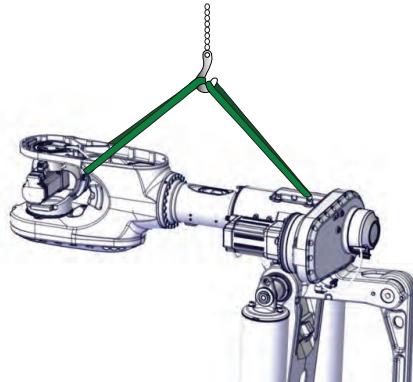
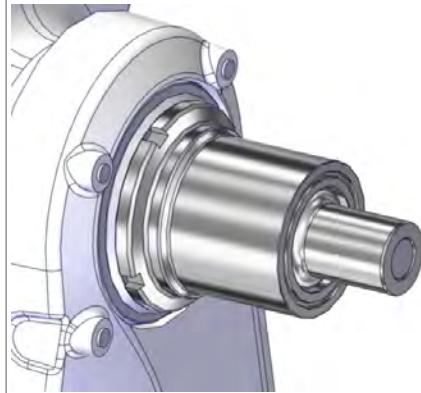
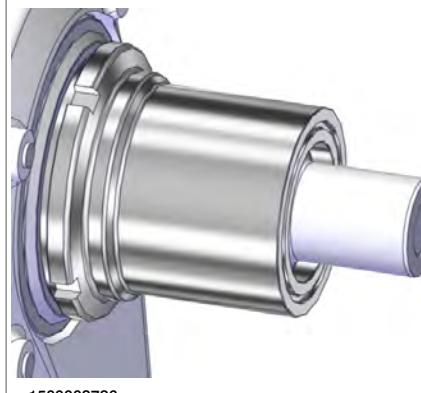
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4 Repair

4.5.1 Replacing the upper arm

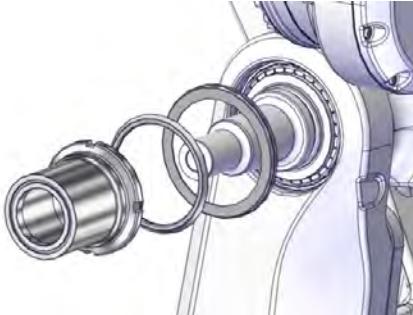
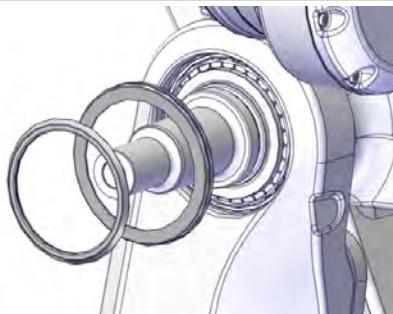
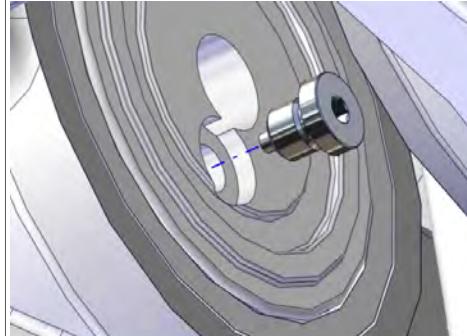
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Removing the shafts

	Action	Note
1	Before continuing, make sure that the upper arm is secured in the lifting accessories and overhead crane.	 xx1500002724
2	 CAUTION The upper arm including the wrist weighs approximately 900 kg. All lifting accessories must be sized accordingly.	
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: 3HAC038174-067  xx1500002726

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4.5.1 Replacing the upper arm Continued

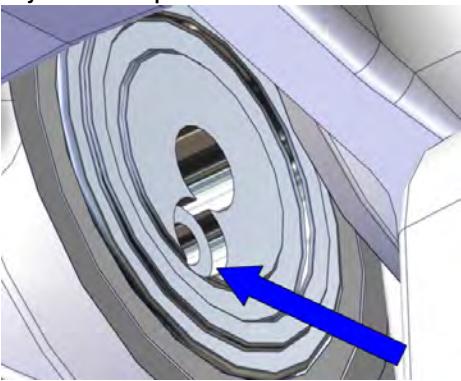
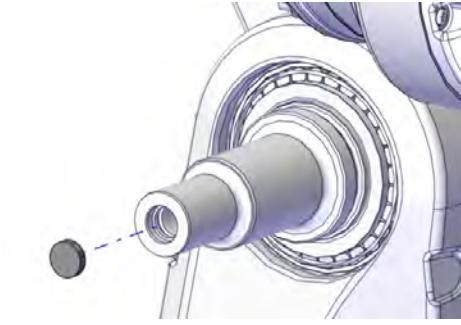
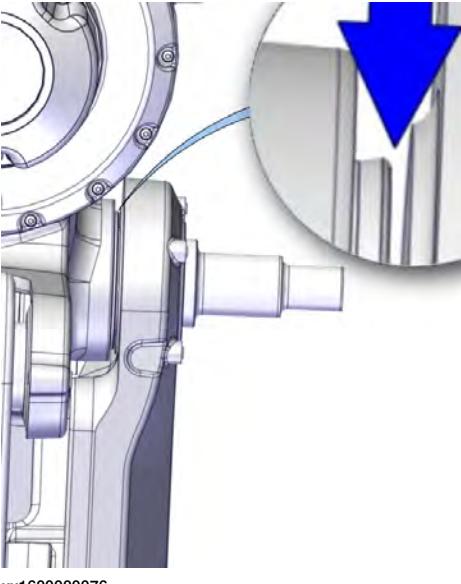
Action	Note
5 Use the Sleeve KM nut, open and remove the KM nut on the <i>other side</i> .  Note Make sure not to lose gamma sealing and sealing ring.	 xx1500002727
6  Note Continue the removal on the same side until the shaft is removed completely. Leave the other shaft fitted for now!	
7 Remove gamma sealing and sealing ring.	 xx1500002728
8 Remove the magnetic plug and wipe hole and shaft end meticulously clean.	 xx1500003125

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4 Repair

4.5.1 Replacing the upper arm

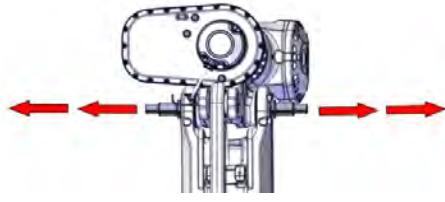
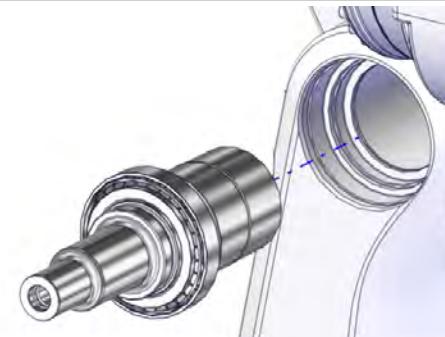
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Action	Note
9 Attach the Glycerine adapter.  Note Tighten the adapter very hard in order to avoid leakage.	Glycerine adapter  xx1600000081
10 Remove the small VK cover.	 xx1500002729
11 Attach a 2.5 mm shim between lower and upper arm, on the same side as the shaft being removed.	Horseshoe shims 2.5 mm: 3HAC038174-063  xx1600000076

Continues on next page

4.5.1 Replacing the upper arm

Continued

	Action	Note
12	<p>Attach the removal tool.</p> <p> Tip</p> <p>How to use the removal tool is described in the instruction 3HAC056526-002 delivered with the tool.</p>	Removal tool 3HAC056095-003 Set of tools. Instruction 3HAC056526-002 enclosed.
13	<p> CAUTION</p> <p>The shaft, including the removal tool, weighs approximately 25 kg.</p>	
14	<p>Secure the shaft and the removal tool to the upper arm using lifting eyes and a short roundsling. This is done as a safety precaution.</p> <p> Tip</p> <p>How to secure removal tool and shaft, is described in the instruction 3HAC056526-002 delivered with the tool.</p>	
15	<p> CAUTION</p> <p>Do not stand close to the robot on any side when the shaft is being removed.</p>	 xx1600000077
16	<p>Use caution and press the shaft out, using both the glycerine and hydraulic press tools:</p> <ol style="list-style-type: none"> 1 Pump up the glycerine pump to 500 bar. 2 Pump up the hydraulic pump to 500 bar. 3 Use caution and continue pumping up the pressure of the glycerine pump until the shaft is loose. 	 xx1500002731
17	Remove the other shaft in the same way.	

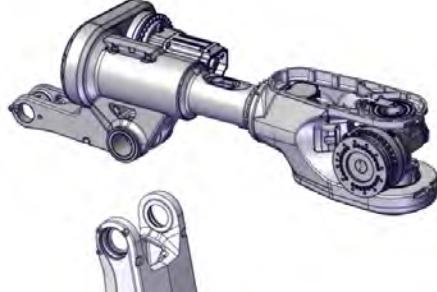
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4 Repair

4.5.1 Replacing the upper arm

Continued

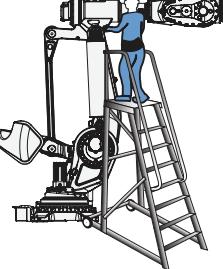
Removing the upper arm complete

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.	
3 Use caution and lift the upper arm complete off.	 xx1500002732
4 Put the upper arm complete down on two pallets.	Pallet (2 pcs)

Refitting the upper arm

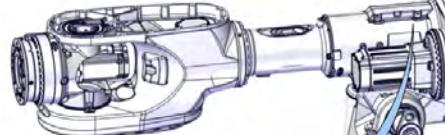
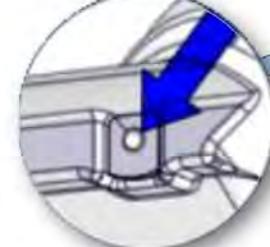
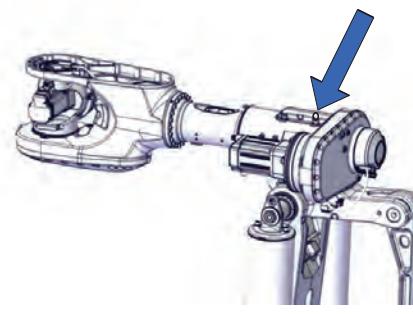
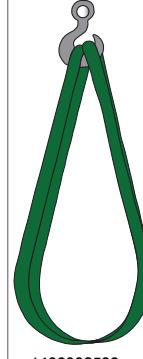
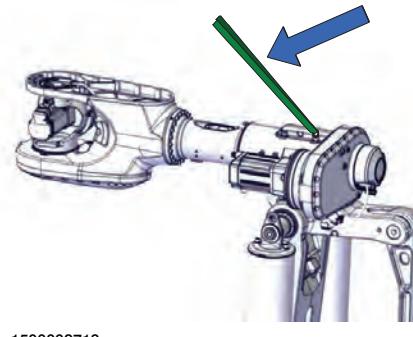
Use these procedures to refit the upper arm.

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 <i>Only needed when the upper arm is fitted on the robot:</i> Use a Mobile platform ladder (or similar) to attach the lifting accessories.  DANGER Never use the robot as ladder.	 xx1500001985

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4.5.1 Replacing the upper arm
Continued

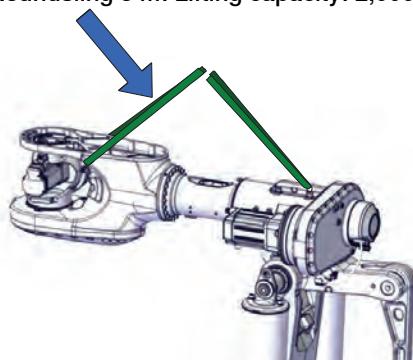
Action	Note
3 Remove the plastic plug in the hole shown in the figure.	  xx1500002712
4 Attach a Lifting eye to the hole in the arm housing with a Fender washer underneath.  xx1400002196	Lifting eye: M12 Fender washer: Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.  xx1500002715
5 Attach a roundsling looped to the Lifting eye and to an overhead crane (or similar).  xx1400002599	Roundsling 2.5 m: Lifting capacity: 2,000 kg  xx1500002713

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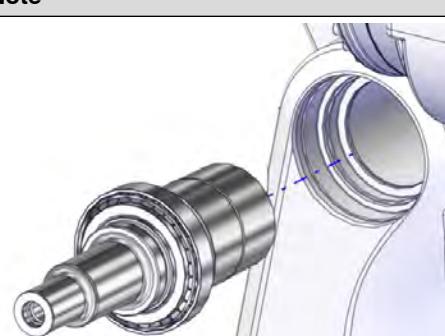
4 Repair

4.5.1 Replacing the upper arm

Continued

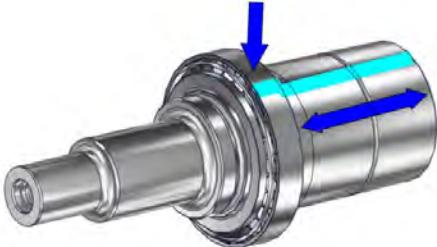
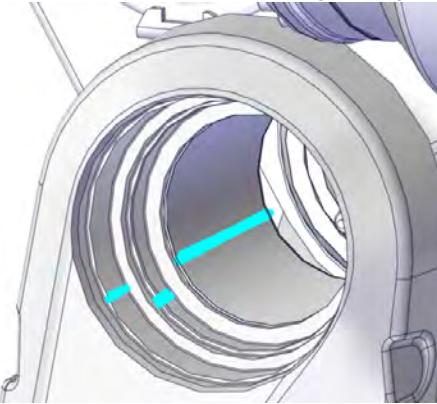
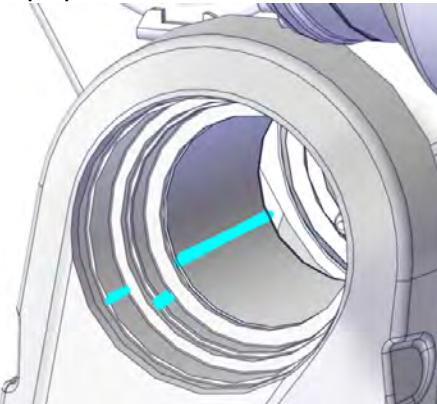
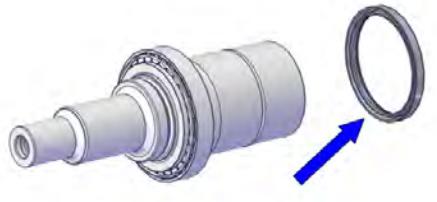
Action	Note
6 Attach a roundsling looped to the wrist and to an overhead crane (or similar).	<p>Roundsling 3 m: Lifting capacity: 2,000 kg</p>  <p>xx1500002714</p>
7 Stretch the lifting accessories to take the weight of the upper arm.	
8 <i>Only needed when the upper arm is fitted on the robot:</i> In order to release the brakes, connect the 24 VDC power supply. Connect connector R2.MP2: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	
9 <i>Only needed when the upper arm is fitted on the robot:</i> Release the brakes on axis-2 to be sure that the lifting accessories are taking the weight of the upper arm.	
10 Adjust the lifting accessories, if needed.	

Preparations before refitting the shafts

Action	Note
1 Remove residues of Loctite and other contamination from the shaft and in the hole where the shaft shall be refitted.	 <p>xx1500002731</p>

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4.5.1 Replacing the upper arm
Continued

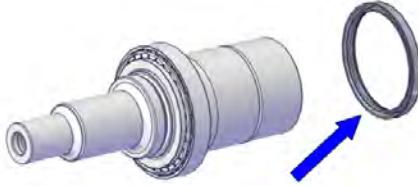
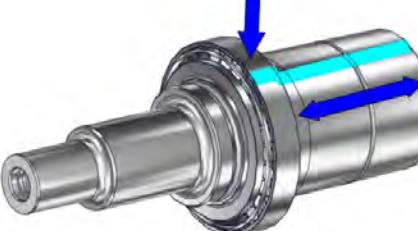
Action	Note
2 Use a Scotch-brite abrasive cleaning hand pad and rub the contact surfaces on shaft and outer ring of bearing.	 xx1500002749
3 Use a Scotch-brite abrasive cleaning hand pad and rub the contact surfaces in the hole for shaft, outer ring of bearing and sealing ring.	 xx1500002750
4 Wipe the surfaces for shaft, outer ring of bearing and sealing ring meticulously clean, with Isopropanol.	 xx1500002750
5 Inspect the sealing ring. Replace if damaged.	 xx1500002748

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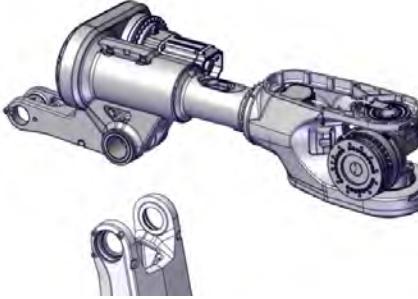
4 Repair

4.5.1 Replacing the upper arm

Continued

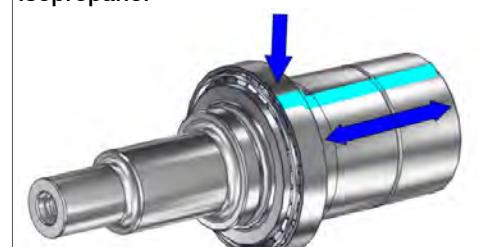
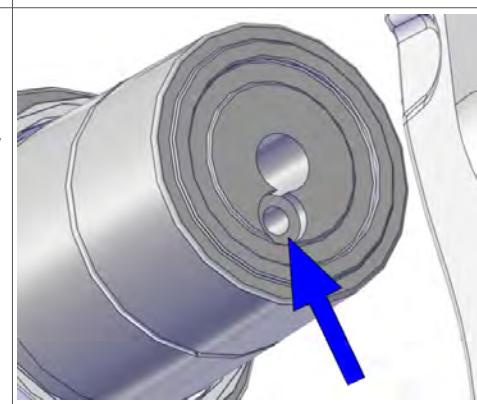
Action	Note
6 Wipe the sealing ring clean with Isopropanol.	Isopropanol  xx1500002748
7 Wipe the contact surfaces on shaft and outer ring of bearing meticulously clean with Isopropanol.  Note Do not touch the cleaned cone surface of the shaft with anything after cleaning.	Isopropanol  xx1500002749
8 Use caution and attach the sealing ring onto the shaft.	

Refitting the shaft

Action	Note
1 Fill the bearing with grease.	Tribol GR 100-2 PD
2 Lift the upper arm into mounting position.	 xx1500002732
3  CAUTION The upper arm complete weighs 900 kg. All lifting accessories used must be sized accordingly!	

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4.5.1 Replacing the upper arm Continued

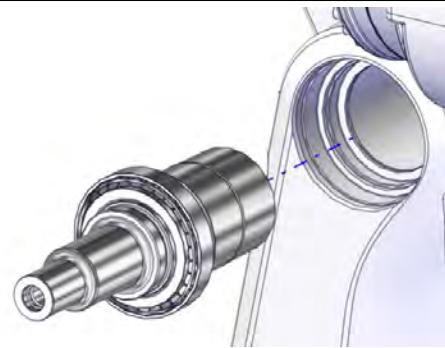
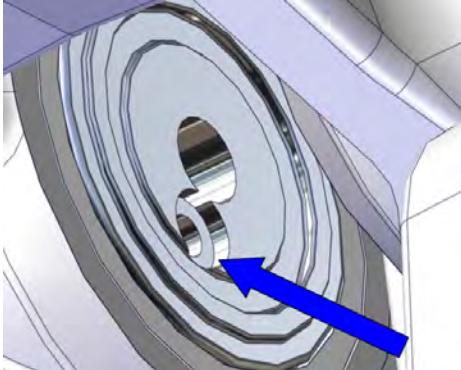
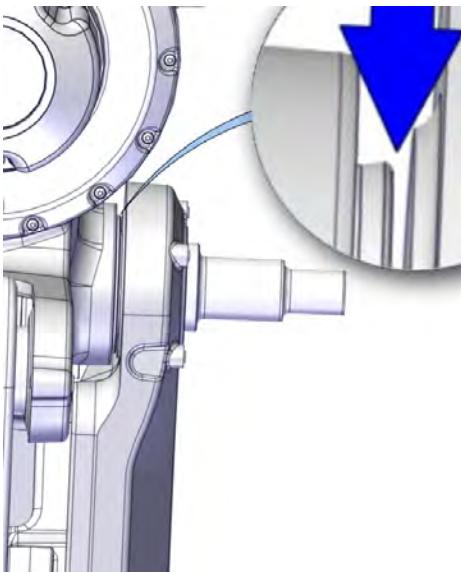
	Action	Note
4	<p>Wipe the contact surfaces in the upper arm, meticulously clean, with Isopropanol.</p> <p>Note</p> <p>Do not touch the cleaned cone surface of the shaft with anything after cleaning.</p>	Isopropanol  xx1500002750
5	<p>Wipe the contact surfaces on shaft, outer ring of bearing and sealing ring meticulously clean with Isopropanol.</p> <p>Note</p> <p>Do not touch the cleaned cone surface of the shaft with anything after cleaning.</p>	Isopropanol  xx1500002749
6	<p>Note</p> <p>Make sure that the hole for the Glycerine adapter on the shaft, will be facing as low as possible.</p>	 xx1500002979
7	<p>CAUTION</p> <p>The shaft weighs 19 kg.</p>	

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4 Repair

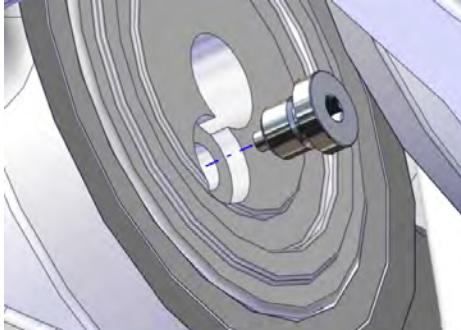
4.5.1 Replacing the upper arm

Continued

Action	Note
8 Use caution and lift the shaft into mounting position.	 Note Do not touch the surfaces cleaned with Isopropanol.  xx1500002731
9 Wipe the Glycerine adapter connection meticulously clean.	Glycerine adapter
10 Attach the Glycerine adapter.	 Note Tighten the adapter very hard in order to avoid leakage.  xx1600000081
11 Put a 2.5 mm horseshoe shim between lower and upper arm, on the the axis-3 side.	 Note Leave the shim in this position also when the axis-2 shaft is fitted.  xx1600000076 Horseshoe shim 2.5 mm: 3HAC038174-063
12 Attach a pull bar to the part of the press tool at the Glycerine adapter.	

Continues on next page

4.5.1 Replacing the upper arm
Continued

Action	Note
13 Attach the assembly tool. Tip How to use the assembly tool is described in the instruction 3HAC056526-002 delivered with the tool.	Assembly tool 3HAC056095-002 Set of tools. Instruction 3HAC056526-002 enclosed.
14 Put the hydraulic pump onto the pull bar.	
15 Manually tighten the adjustment nut against the hydraulic cylinder.	
16 Tighten the adjustment nut.	Tightening torque: 20 Nm
17 Attach a Dial gauge and put it in zero position.	Dial gauge
18 Use the assembly tool and the Glycerine adapter and press the shaft in 3.5 mm ±0.15.	
19 Wait one minute.	
20 Release the glycerine pressure.	
21 Wait one minute.	
22 Release the hydraulic pressure.	
23 Make sure the value 3.5 mm remains. If not, retighten the shaft as described above.	
24 Remove the hydraulic and glycerine tools.	
25 Refit the magnetic plug.	 xx1500003125
26 Refit the other shaft by repeating the procedure. Note Leave the horseshoe shim fitted on the axis-3 side also when fitting the axis-2 shaft! Do not move the shim or attach another one on the axis-2 side.	

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4 Repair

4.5.1 Replacing the upper arm

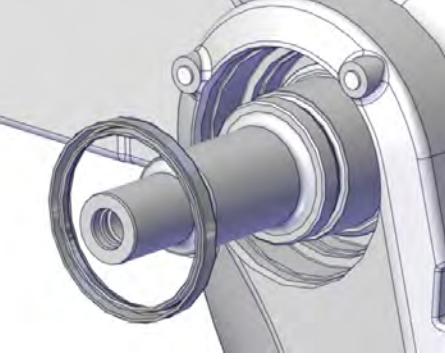
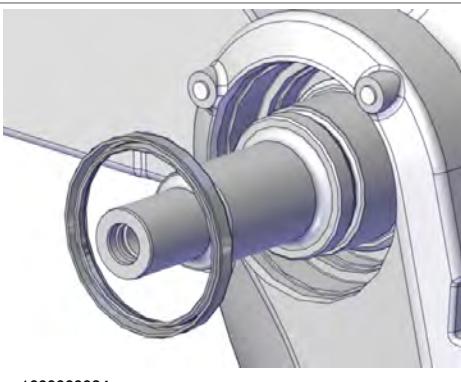
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Refitting the KM nut - axis-3 side



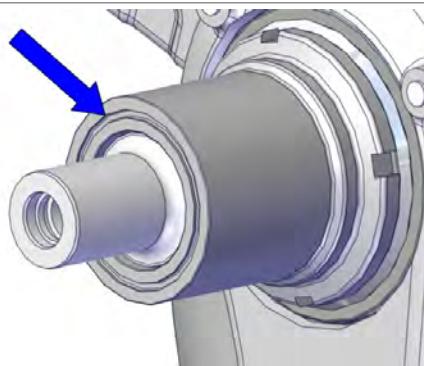
Note

Start refitting KM nut on the axis-3 side!

Action	Note
1 Inspect the pre-mounted gamma sealing on the KM nut.	 xx1600000083
2 Inspect sealing ring.	 xx1600000084
3 Refit sealing ring.	 xx1600000084

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4.5.1 Replacing the upper arm
Continued

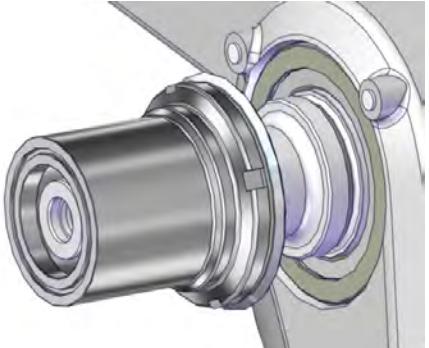
Action	Note
4 Wipe clean the KM nut.	 xx1600000193
5 Wipe clean the o-ring in the KM nut.	
6 Attach the o-ring in its groove in the KM nut.  Tip Put a little grease on the o-ring for a better fitting.	 xx1600000188
7 Apply locking liquid on the threads and refit the KM nut.	Loctite 243  xx1600000192

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4 Repair

4.5.1 Replacing the upper arm

Continued

Action	Note
8 Secure the KM nut with the Sleeve KM nut.	Sleeve KM nut D=152 L=220: 3HAC038174-067 Tightening torque: 300 Nm  xx1600000187
9 Wipe the shaft clean.	
10 Attach the attachment of the dial gauge in the holes on the axis-3 side, with the dial gauge against the axis-2 side.	Dial gauge

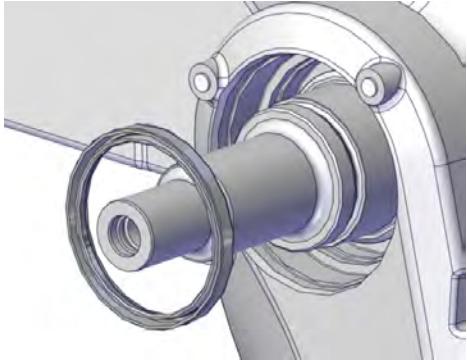
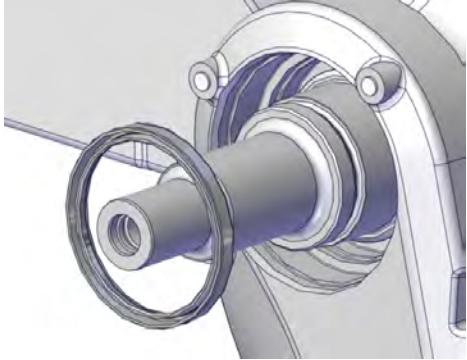
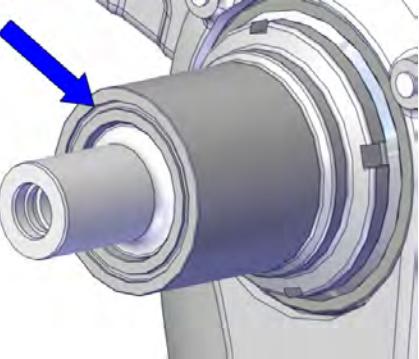
Refitting the KM nut - axis-2 side

Action	Note
1  Note Leave the 2.5 mm hoseshoe shim fitted on the axis-3 side, when refitting the KM nut on the axis-2 side. Do not remove or add another shim!	
2 Inspect the pre-mounted gamma sealing on the KM nut.	 xx1600000083

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4.5.1 Replacing the upper arm

Continued

	Action	Note
3	Inspect sealing ring.	 xx1600000084
4	Refit sealing ring.	 xx1600000084
5	Wipe clean the KM nut.	 xx1600000193
6	Wipe clean the o-ring in the KM nut.	
7	Attach the o-ring in its groove in the KM nut.  Tip Put a little grease on the o-ring for a better fitting.	 xx1600000188

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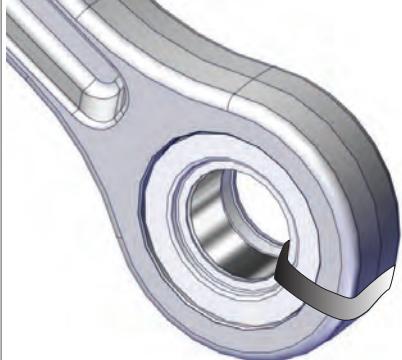
4 Repair

4.5.1 Replacing the upper arm

Continued

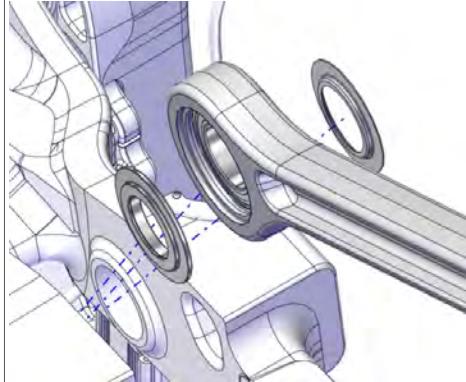
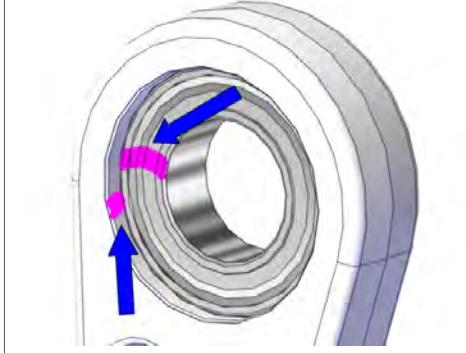
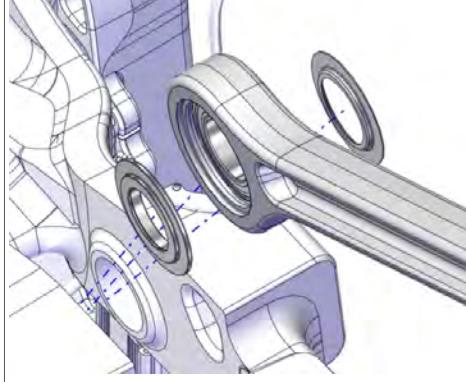
Action	Note
8 Apply locking liquid on the threads and refit the KM nut.	Locking liquid: Loctite 243  xx1600000192
9 Make sure that the dial gauge attachment is fitted.	
10 Secure the axis-2 KM nut with the Sleeve KM nut, until the dial gauge shows 0.38 mm.	Sleeve KM nut D=152 L=220: 3HAC038174-067
11 Wipe the shaft end clean.	
12 Remove the horseshoe shim.	

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

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4.5.1 Replacing the upper arm Continued

Action	Note				
2 Remove the thrust washer and cover washer, and wipe them clean.  Note Make a note on which side the covers are placed.	 xx1500002098 <table border="1"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side				
Thrust washer	Cover washer				
3 Wipe the shafts and the holes for the shafts clean.					
4 Apply corrosion protection on both sides of the bearings, and on all machined surfaces on the parallel rod.	Mercasol  xx1500002100				
5 Put back the thrust washer (left side) and cover washer (right side).	 xx1500002098 <table border="1"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side				
Thrust washer	Cover washer				

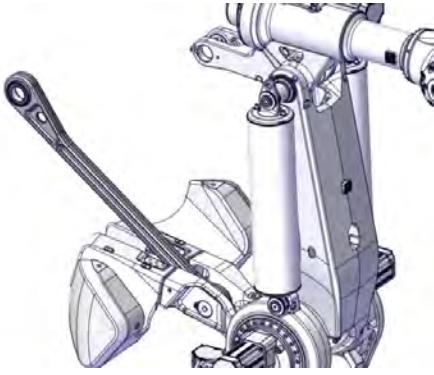
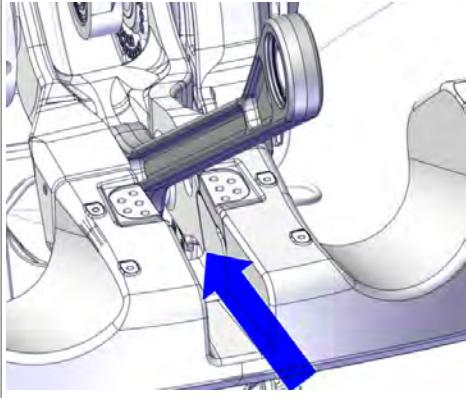
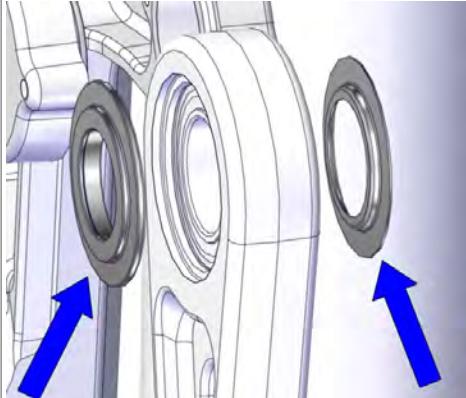
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4 Repair

4.5.1 Replacing the upper arm

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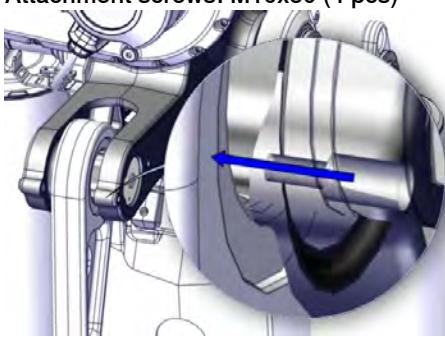
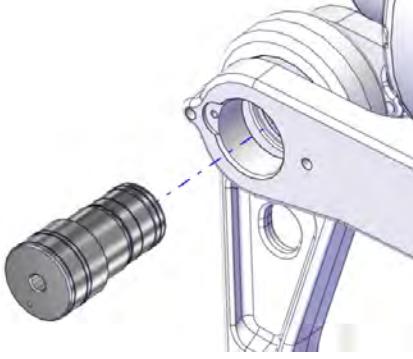
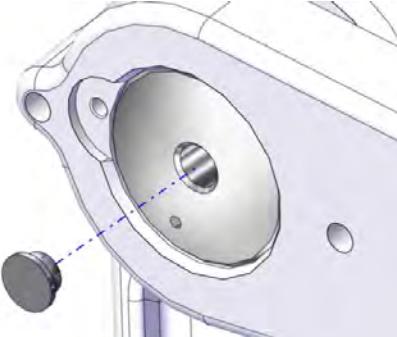
Refitting parallel rod, upper end

Action	Note				
<p>1</p>  Note If the parallel rod has been removed from the robot, always start refitting at the lower end!					
<p>2</p> Take a firm grip of the parallel rod and lift it up into mounting position.	 xx1500001965				
<p>3</p> 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				
<p>4</p> 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				
<table border="1"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>		Left side	Right side	Thrust washer	Cover washer
Left side	Right side				
Thrust washer	Cover washer				

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4.5.1 Replacing the upper arm

Continued

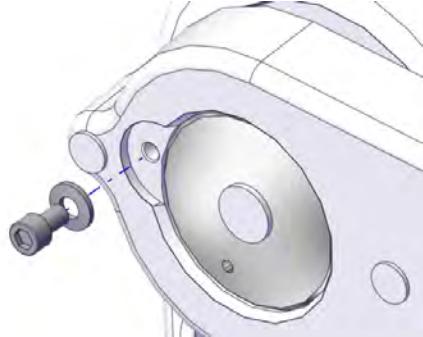
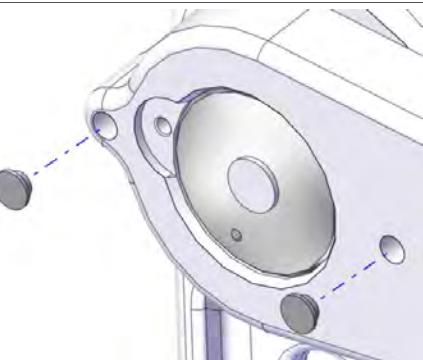
Action	Note
5 Unscrew two of the M10x50 screws only on one side of the parallel rod, approximately 5 mm. Leave the screws fastened on the other side.	<p>Note</p> <p>This is done to be able to refit the parallel rod without problems and to be able to find the correct position of the parallel rod.</p>
6 Place the parallel rod into position and reattach the two M10x50 screws against the parallel rod.	<p>Note</p> <p>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.</p> <p>Attachment screws: M10x50 (4 pcs)</p>  <p>xx1500002300</p>
7 Apply the press tool parts (Assembly tool, Press plate and Round plate).	
8 Use caution and press the shaft in.	 <p>xx1500001962</p>
9 Refit the protection plug.	 <p>xx1500001967</p>

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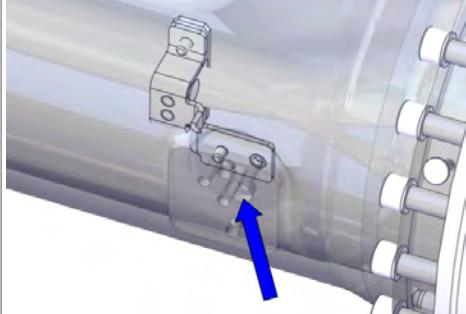
4 Repair

4.5.1 Replacing the upper arm

Continued

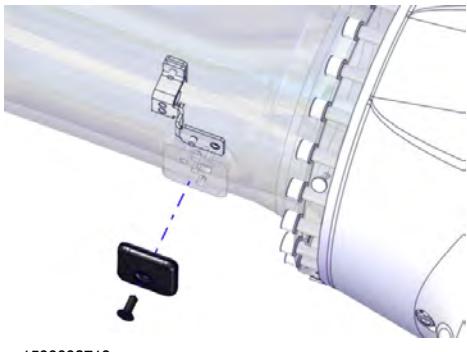
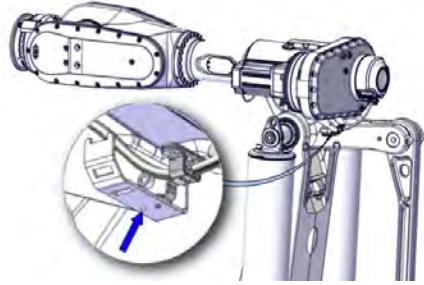
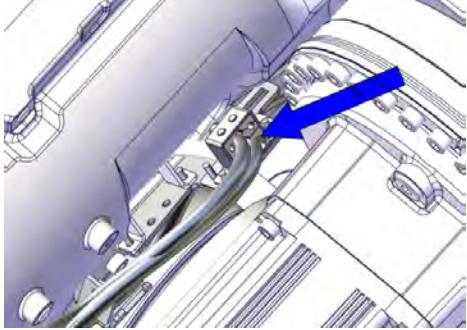
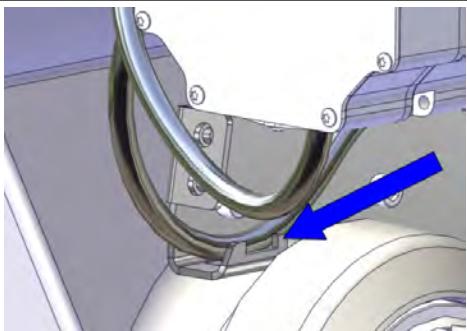
Action	Note
10 Apply locking liquid on the attachment screw and secure shaft.	Attachment screw: M10x16 8.8 Loctite 243  xx1400002600
11 Remove the four M10x50 screws and refit the protection plugs (4+4 pcs).	 xx1500001961

Refitting the cable harness in the upper arm

Action	Note
1 Carefully push the cable harness in through the upper arm and out off the wrist.	
2 Refit the cable clamp inside the upper arm.  Note The nut is attached from the outside.	Nut: M6  xx1500002720

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4.5.1 Replacing the upper arm
Continued

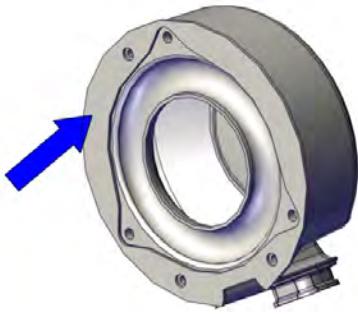
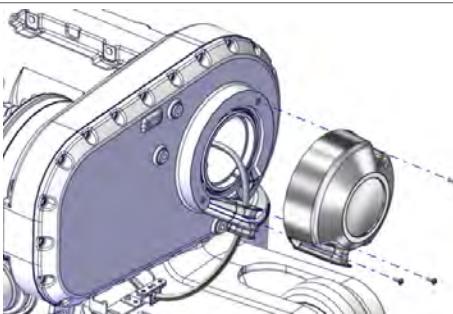
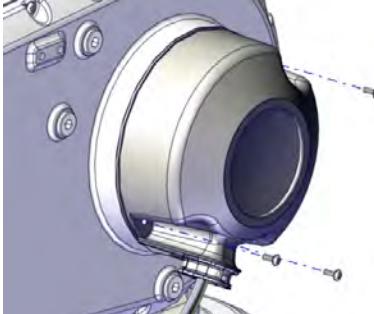
	Action	Note
3	Refit the protection cover.	<p>Attachment screw: M8</p>  <p>xx1500002719</p>
4	Refit the cable clamp on the axis-3 bracket.	 <p>xx1500002718</p>
5	Refit the cable clamp on the axis-3 bracket, between axis-4 motor and arm housing.	 <p>xx1500003092</p>
6	Secure the cable harness with a cable tie.	 <p>xx1500003093</p>

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4 Repair

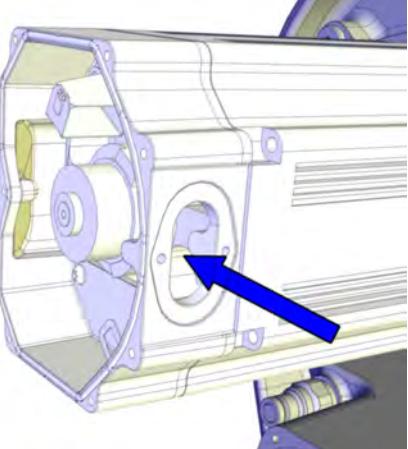
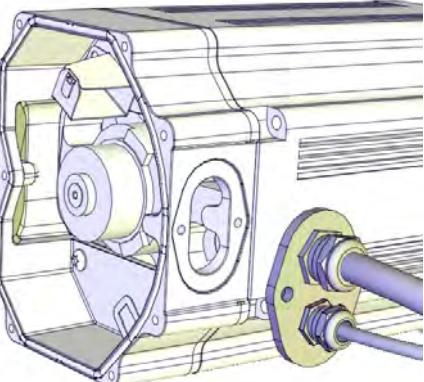
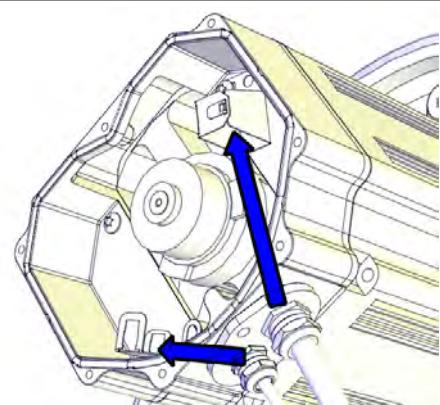
4.5.1 Replacing the upper arm

Continued

Action	Note
7 Make sure that the gasket on the cover is correctly fitted.  Note Replace if damaged. The gasket 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.	 xx1500003094
8 Refit the cable guide, if it has been removed.	 xx1500002723
9 Refit the cover.	 xx1500002722

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Connecting the axis-4 motor cables

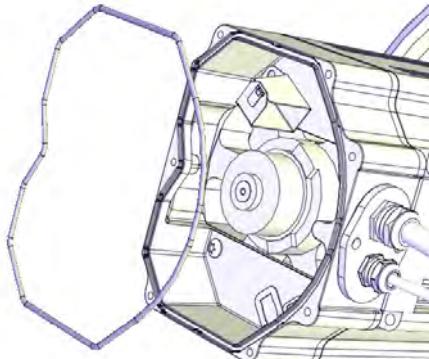
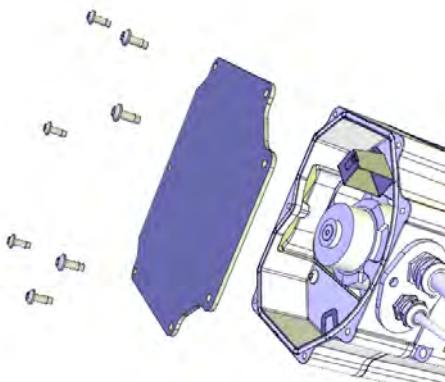
	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1300000738
2	Refit the cable gland cover. Note Replace the gasket if damaged!	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066

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4 Repair

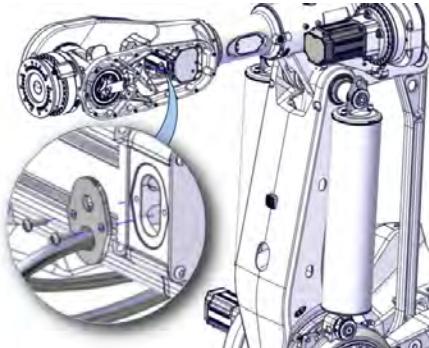
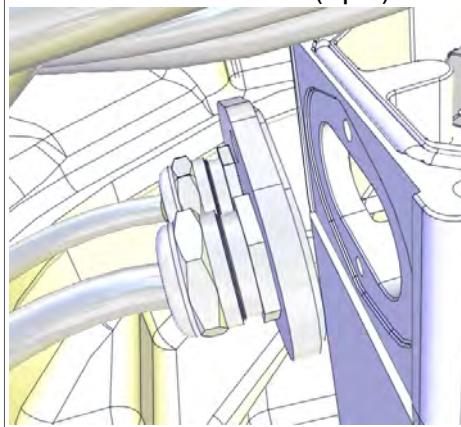
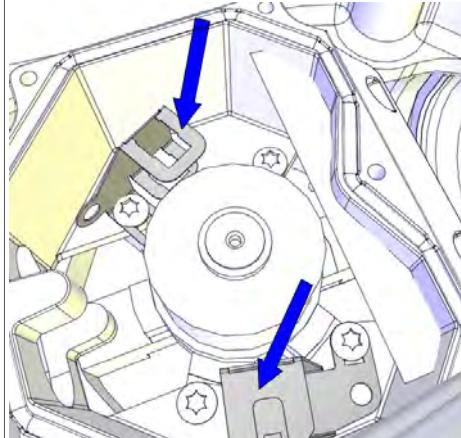
4.5.1 Replacing the upper arm

Continued

Action	Note
4 Inspect the o-ring. 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 refitting the motor cover, make sure none of the cables inside will be damaged.	
8 Refit the motor cover.  Note Do not reuse the self-threading attachment screws! Replace with standard attachment screws. The threads will otherwise be damaged.  Note Make sure the o-ring is undamaged and properly fitted!	 xx1200001135
9 Make sure that the cover is tightly sealed.	

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Connecting the axis-5 motor cables

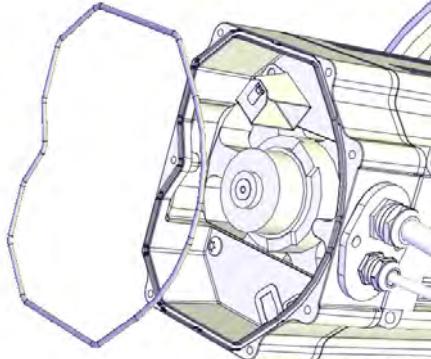
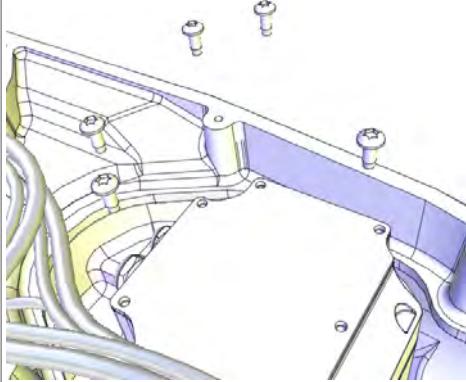
	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1500002717
2	Refit the cable gland cover.  Note Replace the gasket if damaged.	Attachment screws: M5x16 (2 pcs)  xx1200001016
3	Connect the connectors. Connect in accordance with the markings on the connectors.	 xx1200001015

Continues on next page

4 Repair

4.5.1 Replacing the upper arm

Continued

Action	Note
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 (6 pcs)  xx1200001013
7 Make sure that the cover is tightly sealed.	

Connecting the axis-6 motor cables - Step 1



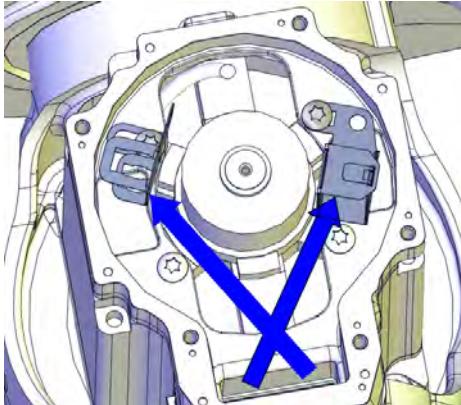
Note

Since it in this procedure is needed to keep the axis-5 in -90° position to get the most stable position for removal and refitting, 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.	

Continues on next page

4.5.1 Replacing the upper arm Continued

Action	Note
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.	
2  DANGER Turn off all: <ul style="list-style-type: none">• 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.	

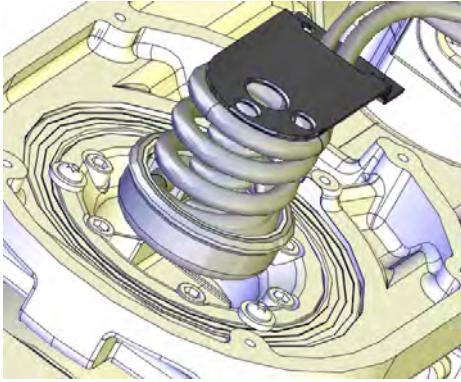
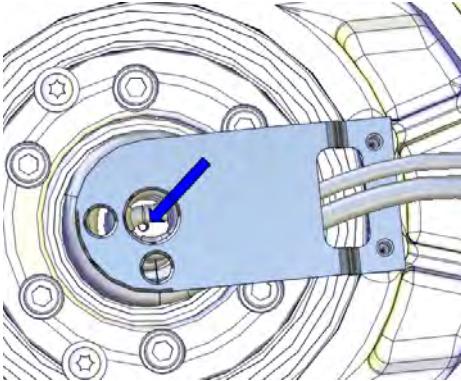
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4 Repair

4.5.1 Replacing the upper arm

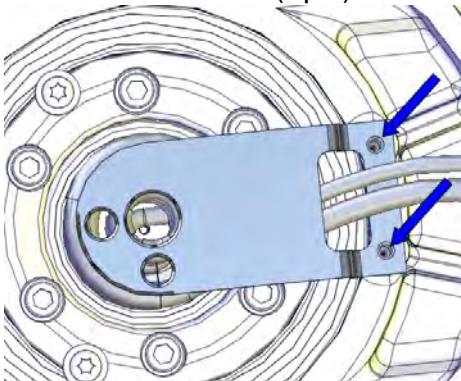
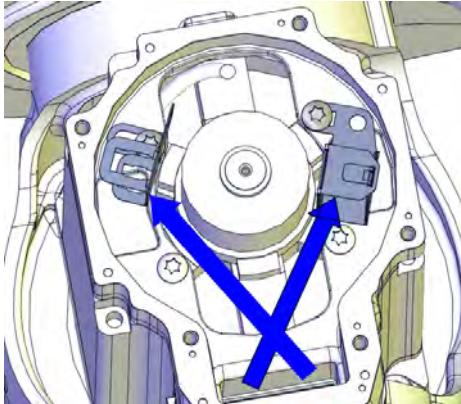
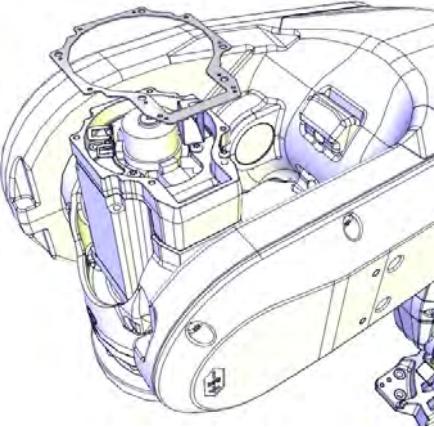
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Connecting the axis-6 motor cables - Step 2

Action	Note
<p>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.</p> <p> CAUTION</p> <p>Make sure that the cable spiral is not twisted an extra revolution. The result will be damage to the cable harness.</p>	
<p>2 Use caution and push the carrier into position.</p>	 xx1300001113
<p>3 Secure the carrier with the M4 screw.</p> <p> Note</p> <p>The screw is located at the bottom of the carrier.</p> <p> Tip</p> <p>The attachment screw that secure the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.</p>	<p>Attachment screw: M4x10</p>  xx1300000485

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4.5.1 Replacing the upper arm Continued

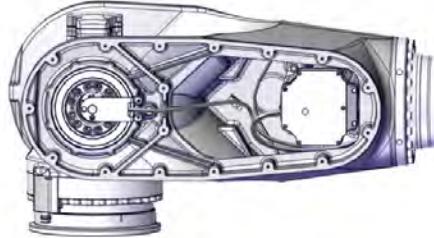
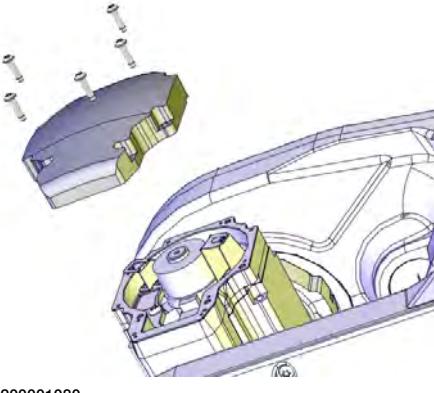
Action	Note
4 Secure the cable bracket with its attachment screws.	<p>Attachment screws M6x (2 pcs)</p>  <p>xx1300000484</p>
5 Inspect the connectors to the axis-6 motor and make sure they are connected. i Note The resolver cable shall be placed underneath the motor cable.	 <p>xx1300000488</p>
6 Inspect the gasket. i Note Replace if damaged.	<p>Gasket, 3HAC033489-001</p>  <p>xx1200001095</p>

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4 Repair

4.5.1 Replacing the upper arm

Continued

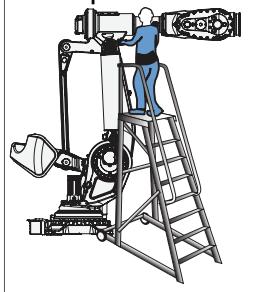
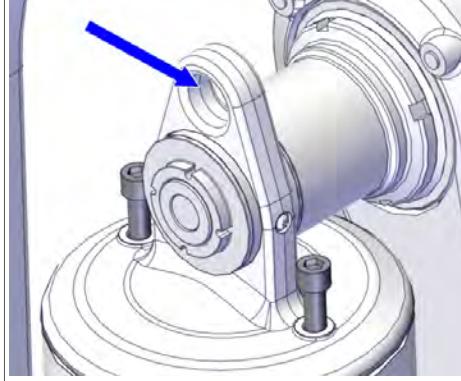
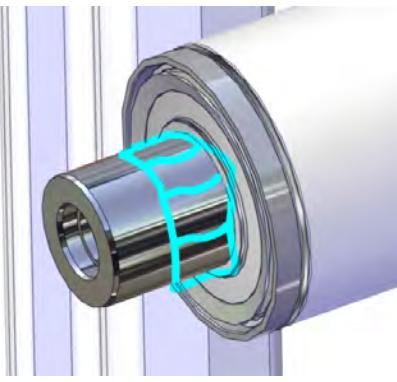
Action	Note
7  CAUTION When fitting the motor cover, make sure that none of the cables inside will be damaged.	 xx1600000047
8 Refit the motor cover.	 xx1200001080

Robot position when replacing the balancing device

Action	Note
1 Jog the robot to calibration position.	 xx1500002310
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

Continues on next page

Preparations before refitting the balancing device

	Action	Note
1	<p> CAUTION The balancing device weighs 200 kg. All lifting accessories used must be sized accordingly!</p>	
2	<p> DANGER Do not use the robot as ladder.</p>	 xx1500001985
3	Attach a roundsling to the lifting hole on top of the balancing device and to an overhead crane (or similar).	 xx1500001983
4	Use caution and lift the balancing device up and let it hang in the lifting accessories.	
5	Wipe clean the contact surfaces.	
6	<p> Note Do not apply any grease on the threads for the KM-nut.</p>	Grease  xx1500002304

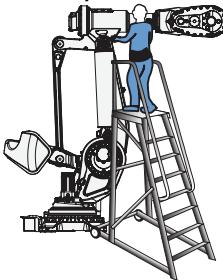
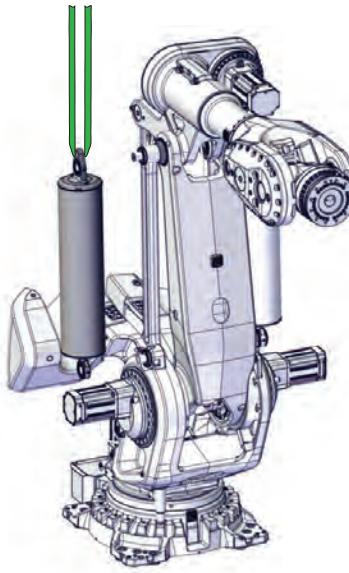
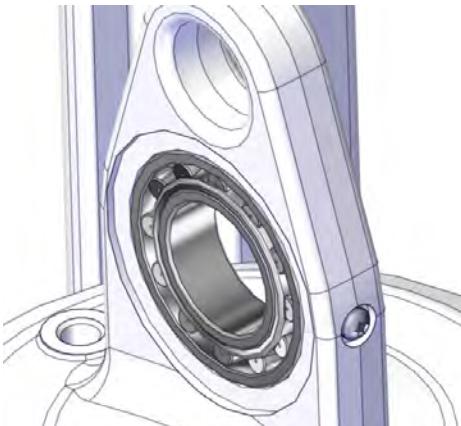
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4 Repair

4.5.1 Replacing the upper arm

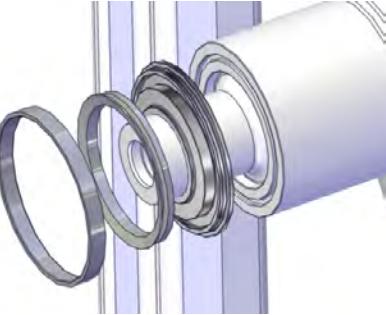
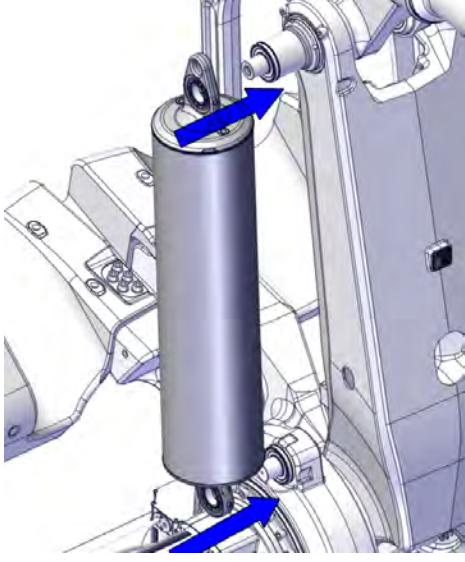
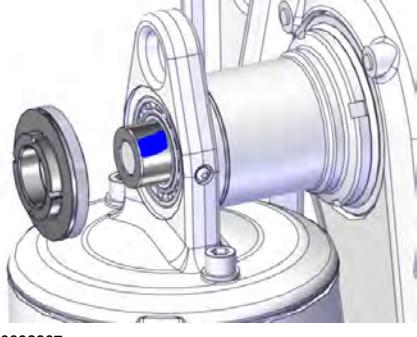
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Refitting the balancing device

	Action	Note
1	<p>Use a Mobile platform ladder (or similar), to reach the upper end of the balancing device.</p> <p> DANGER</p> <p>Do not use the robot as ladder.</p>	<p>Mobile platform ladder</p>  <p>xx1500001985</p>
2	<p>Use caution and raise the balancing device into mounting position.</p>	 <p>xx1500002735</p>
3	<p> Note</p> <p>Make sure the bearings are axially centered in the balancing device ears, before putting them on the shafts.</p>	 <p>xx1500002306</p>

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4.5.1 Replacing the upper arm
Continued

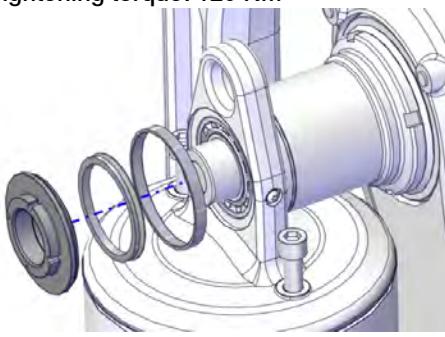
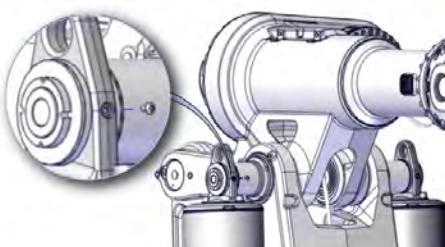
Action	Note
4 Make sure that the spacer ring with V-ring and the support ring are placed correctly on the shafts before the balancing device is put on the shafts.	 xx1500001975
5 Use caution and put the balancing device onto upper and lower shafts.	 xx1500002305
6 Apply locking liquid on the threads of the lock nuts.	Locking liquid: Loctite 243  xx1500002307
7 Inspect that the bearings are axially centered in the balancing device ears.	

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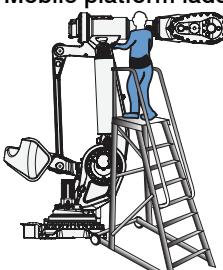
4 Repair

4.5.1 Replacing the upper arm

Continued

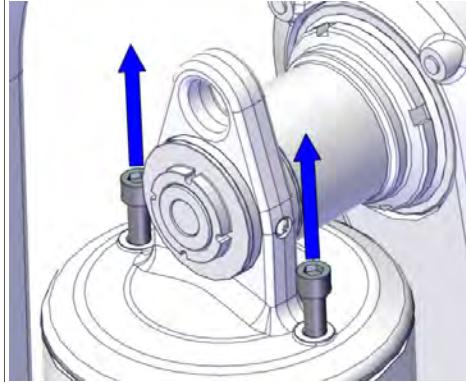
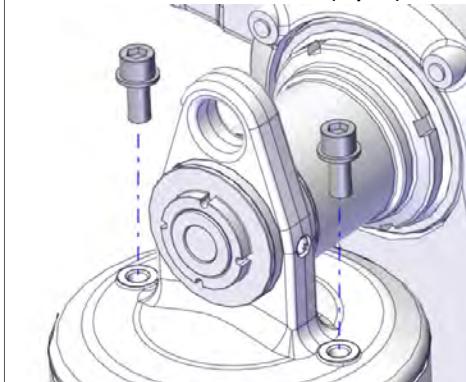
Action	Note
8 Secure the balancing device with the two lock nuts.  Note Make sure that the V-ring and support ring is fitted correctly.	Tightening torque: 120 Nm  xx1500001973
9 Remove the lifting accessories.	
10 Remove the M6x10 torx pan head screws on either side of the balancing device bearings. 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.	

Restoring the pressure of the balancing device

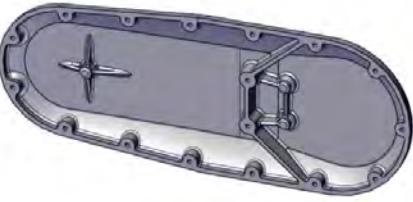
Action	Note
1 Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device.  DANGER Do not use the robot as ladder.	Mobile platform ladder  xx1500001985

Continues on next page

4.5.1 Replacing the upper arm
Continued

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

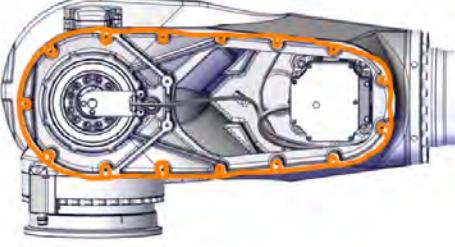
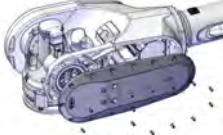
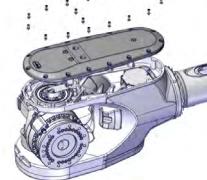
Action	Note
1 Clean the wrist cover from residues of sealant and other contamination.	
2 Make sure the contact surface on the wrist cover is undamaged.	 xx1600000046

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4 Repair

4.5.1 Replacing the upper arm

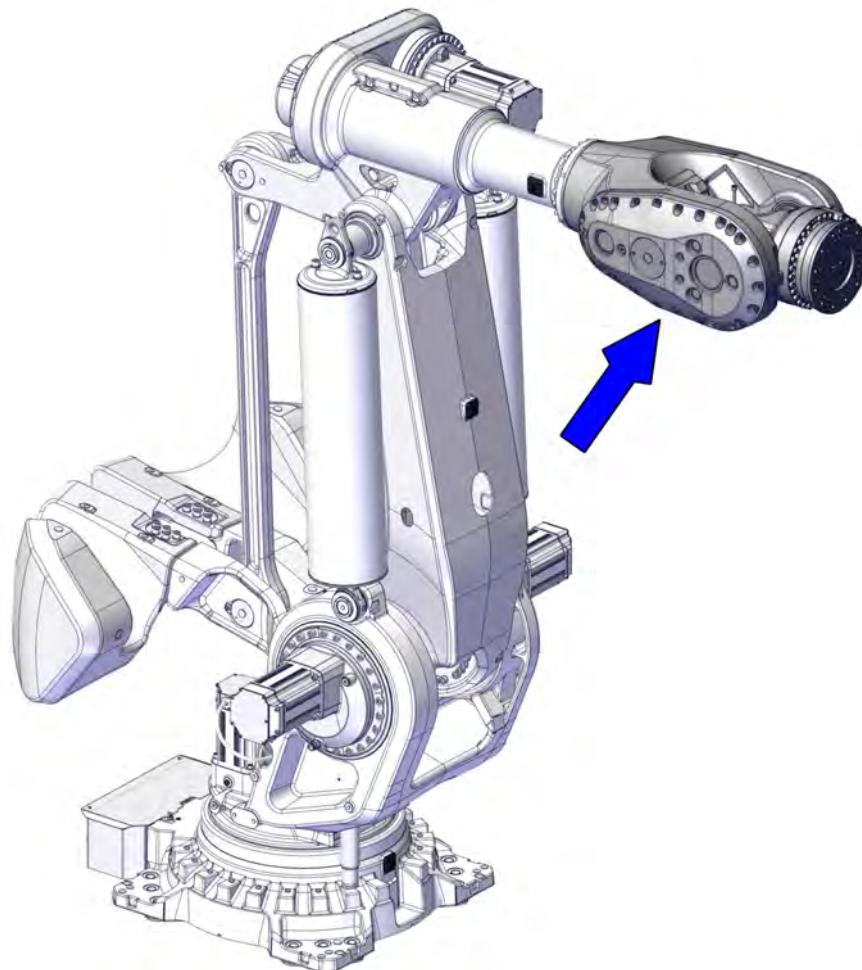
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Action	Note
3 Apply flange sealant (Loctite 574) on the wrist cover flange.	Loctite 574  xx1600000048
4 Make sure that the cable harness will be placed in a way that it will not be damaged when the cover is fitted.	
5 Refit the wrist cover and tighten all screws alternately and repeat once.  Note The position of axis-4 depends on the ongoing 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 799 . General calibration information is included in section Calibration on page 789 .
7  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

4.5.2 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Wrist	3HAC048653-006	

Required tools and equipment

Equipment, etc.	Article number	Note
MobilePlatformLadder	-	

Continues on next page

4 Repair

4.5.2 Replacing the wrist

Continued

Equipment, etc.	Article number	Note
Roundsling 1 m	-	Lifting capacity: 1,000 kg
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumables

Consumable	Article number	Note
Grease		
Flange sealant		Loctite 574

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. <ul style="list-style-type: none">• 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 800 .
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

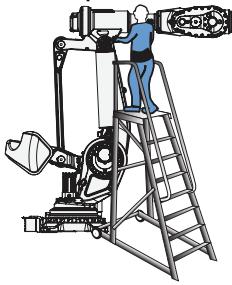
Removing the wrist

Use these procedures to remove the wrist.

Preparations before removing the wrist

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

Continues on next page

Action	Note
3 Jog the robot to the specified position: <ul style="list-style-type: none"> • Axis 1: no significance (as long as the robot is secured to the foundation) • Axis 2: -65° • Axis 3: 0° (horizontal to the foundation) • Axis 4: +90° • Axis 5: 0° • Axis 6: No significance. 	
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: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Retrieving access to the wrist cabling

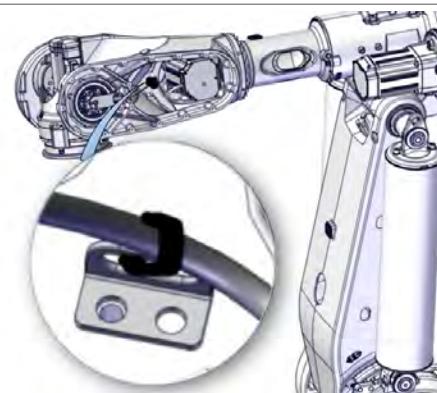
Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

4 Repair

4.5.2 Replacing the wrist

Continued

Action	Note
<p>2 Remove the wrist cover.</p> <p> Note Do not damage the sealing. Replace if damaged.</p> <p> Note The position of axis-4 depends on the ongoing procedure.</p>	 xx1500003100  xx1500002330
<p>3 Cut the cable tie that secure the axis-6 motor cable.</p>	 xx1500003101

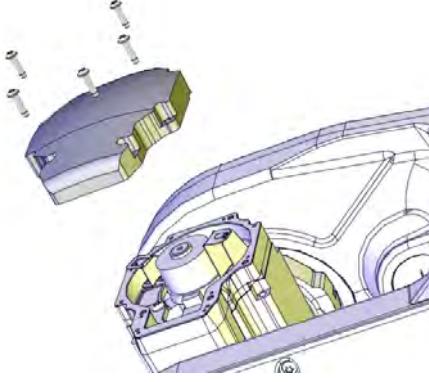
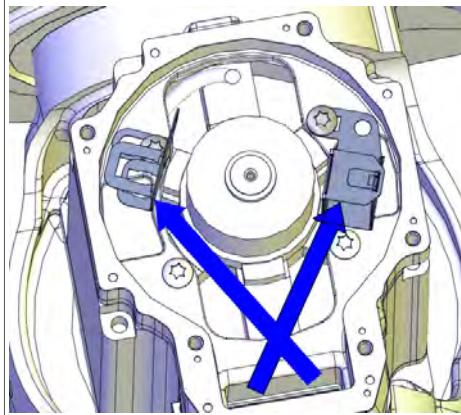
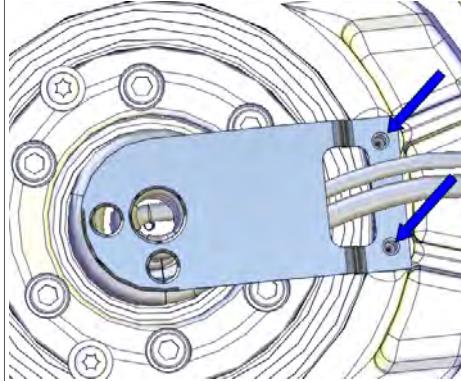
Disconnecting the axis-6 motor cables

Action	Note
<p>1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
<p>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.</p> <p> Note Not applicable when replacing the axis-6 unit.</p>	

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4.5.2 Replacing the wrist

Continued

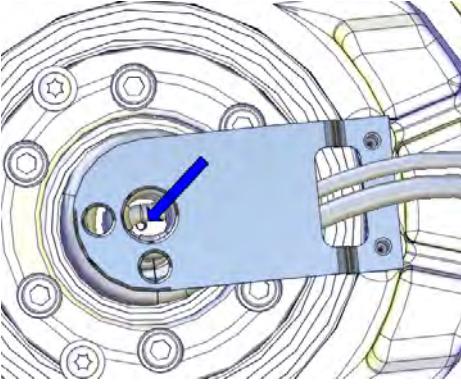
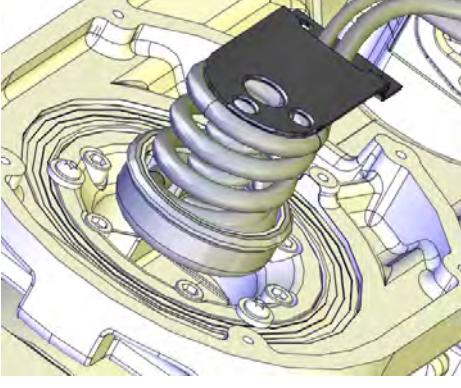
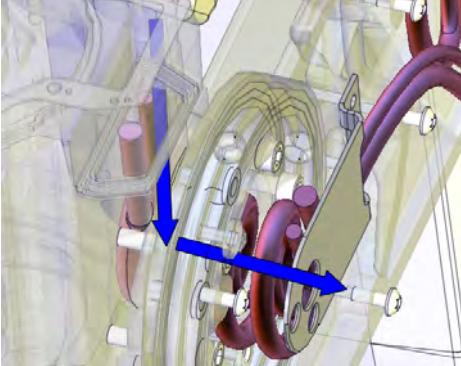
Action	Note
3 Unscrew the attachment screws and remove the motor cover.  Note Do not damage the gasket. Replace if damaged.	 xx1200001080
4 Disconnect the motor cables.	 xx1300000488
5 Unscrew the attachment screws holding the cable bracket.	 xx1300000484

Continues on next page

4 Repair

4.5.2 Replacing the wrist

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

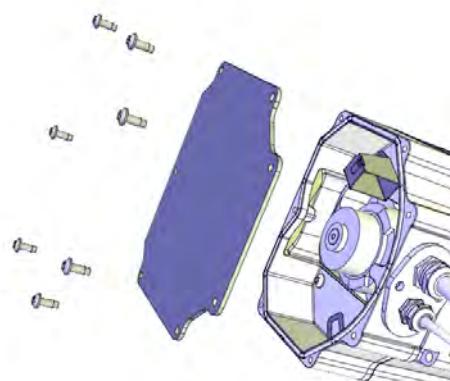
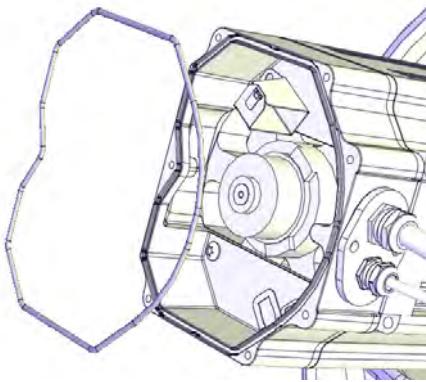
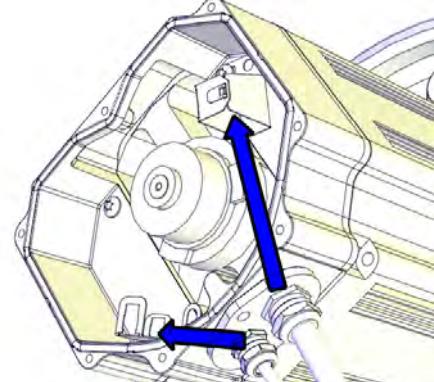
Disconnecting the axis-5 motor cables

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

Continues on next page

4.5.2 Replacing the wrist

Continued

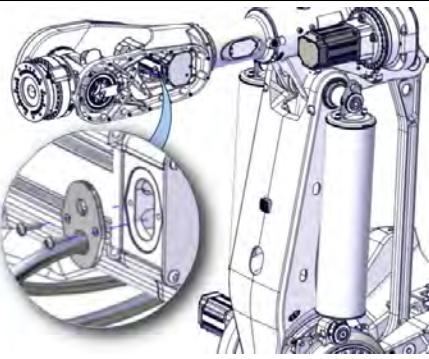
Action	Note
2 Unscrew the attachment screws with washers and remove the motor cover.	 xx1200001135
3  Note Make sure the o-ring is present when removing the cover.	 xx1200001070
4 Disconnect the motor cables.	 xx1200001066

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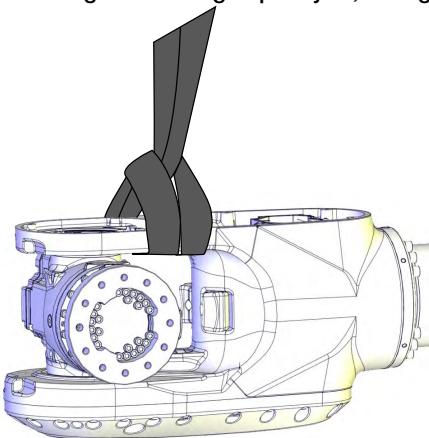
4 Repair

4.5.2 Replacing the wrist

Continued

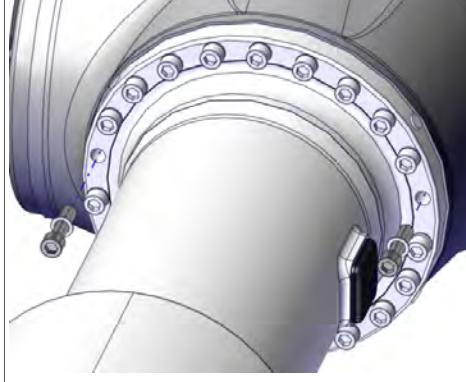
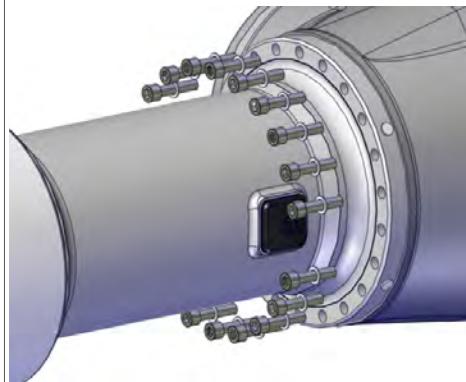
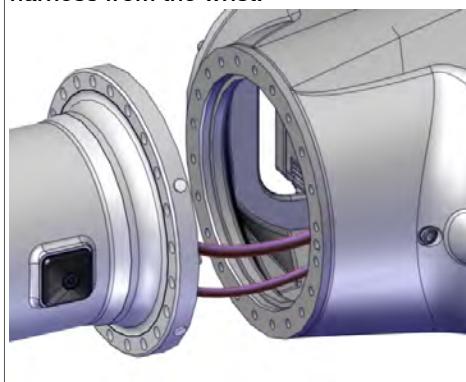
Action	Note
5 Remove the cable gland cover. Tip Make a note in which direction the cable exit hole is facing, if the motor shall be removed too. The motor shall be refitted in the same position.	 xx1500002717
6 Use caution and pull out the motor cables.	

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 shows 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.	

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Removing the wrist

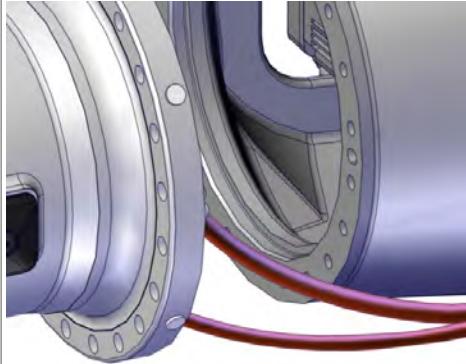
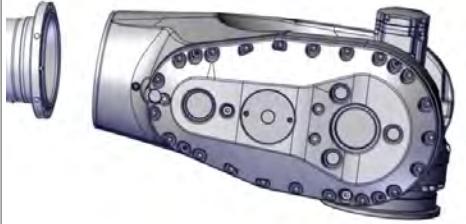
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 Tip Lubricate the guide pins with some grease to make the wrist slide better.	 xx1500003103
3	Remove the remaining attachment screws.	 xx1500003104
4	 CAUTION Use caution and pull out the wrist a little onto the guide pins. Make sure that the cabling does not get damaged.	This is done to be able to remove the cable harness from the wrist.
		 xx1500003105

Continues on next page

4 Repair

4.5.2 Replacing the wrist

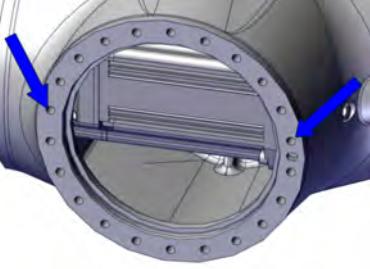
Continued

Action	Note
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

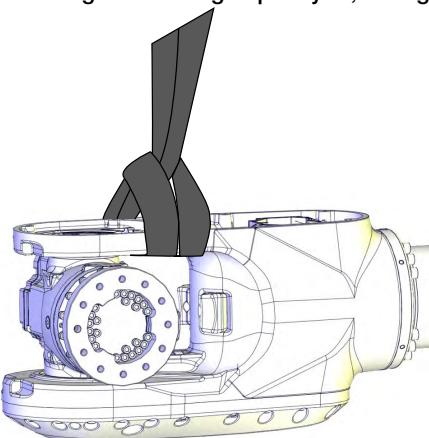
Use these procedures to refit the wrist.

Preparations before refitting the wrist

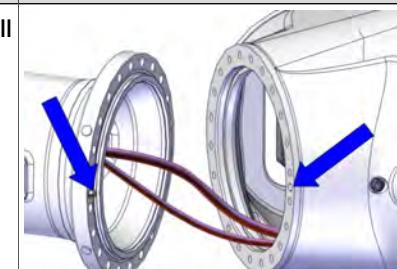
Action	Note
1 Clean the contact surfaces on wrist and arm tube flange.	
2 Put two guide pins in opposite holes of the wrist.  Tip Lubricate the guide pins with some grease to make the wrist slide better.	 xx1500003108

Continues on next page

Attaching lifting accessories, wrist

	Action	Note
1	<p>! CAUTION</p> <p>The complete wrist weighs 500 kg. All lifting accessories used must be sized accordingly!</p>	
2	<p>Attach a roundsling choked, as shown in the figure.</p> <p>! CAUTION</p> <p>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.</p> <p>! CAUTION</p> <p>Make sure the roundsling is fitted as tightly as possible, in order not to risk that the wrist starts moving out of position.</p>	<p>Roundsling 1 m: Lifting capacity: 1,000 kg</p>  <p>xx1300000673</p> <p>The figure shows the IRB 6700 but the principle is the same.</p>
3	<p>i Note</p> <p>Make sure the roundsling is stretched, so it can carry the weight of the wrist.</p>	

Refitting the wrist

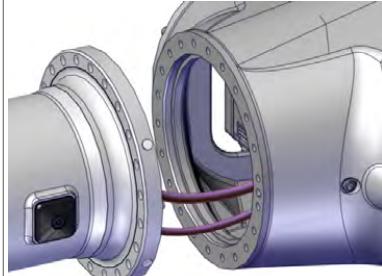
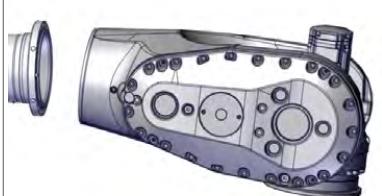
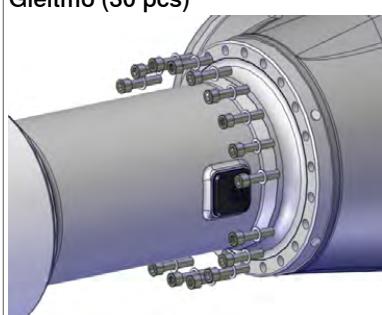
	Action	Note
1	Make sure that the guiding pin in the arm tube will match its hole in the wrist.	 <p>xx1500003109</p>

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4 Repair

4.5.2 Replacing the wrist

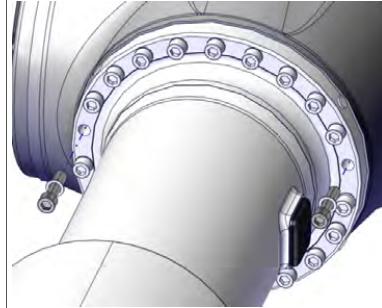
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	Action	Note
2	Use caution and lift the wrist up onto the guide pins, leaving an opening between wrist and arm tube flange.	<p>This is done to be able to run the cable harness into the wrist.</p>  <p>xx1500003105</p>
3	<p> CAUTION</p> <p>When the wrist is hanging free, the front end will tend to lean slightly downwards.</p>	 <p>xx1500003107</p>
4	Use caution and run the cable harness into the wrist.	
5	<p>Use caution and slide the wrist into fitting position against the arm tube flange.</p> <p> CAUTION</p> <p>Make sure not to damage any parts of the cable harness.</p>	
6	Fit 28 of the 30 attachment screws.	<p>Attachment screws: M12x50 12.9 Gleitmo (30 pcs)</p>  <p>xx1500003104</p>

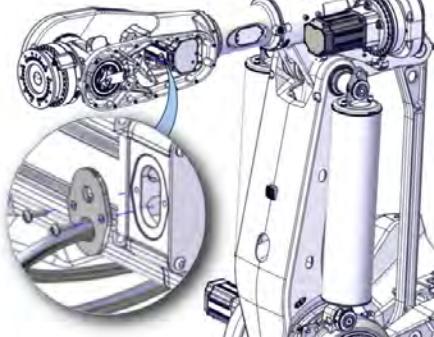
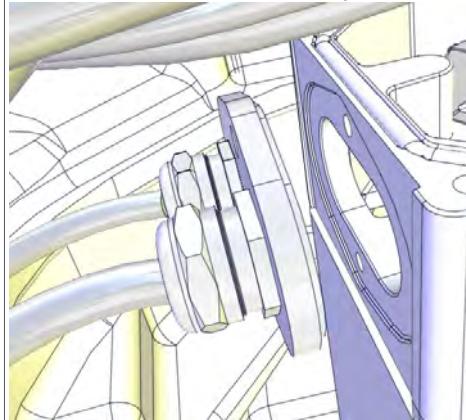
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4.5.2 Replacing the wrist

Continued

	Action	Note
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

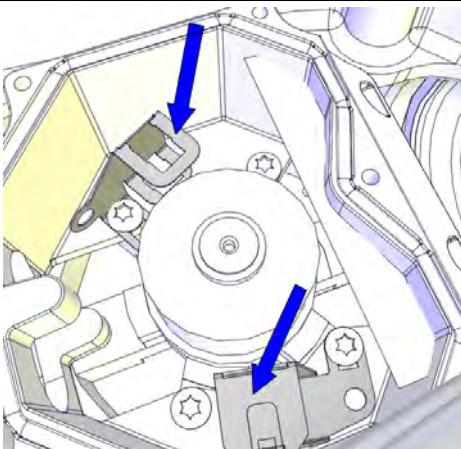
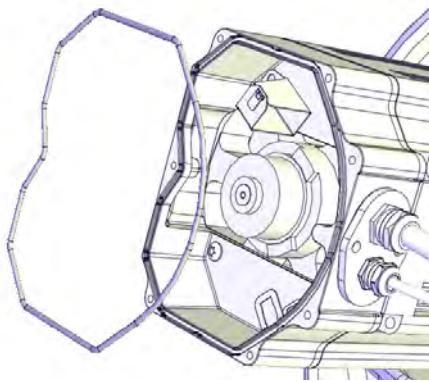
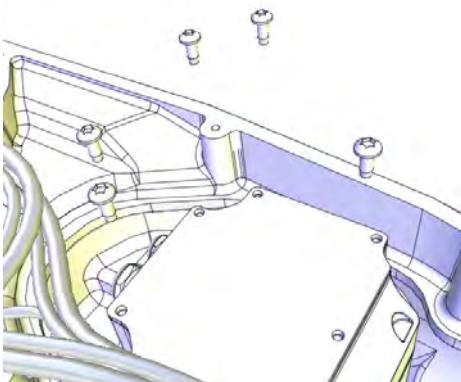
	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1500002717
2	Refit the cable gland cover.  Note Replace the gasket if damaged.	Attachment screws: M5x16 (2 pcs)  xx1200001016

Continues on next page

4 Repair

4.5.2 Replacing the wrist

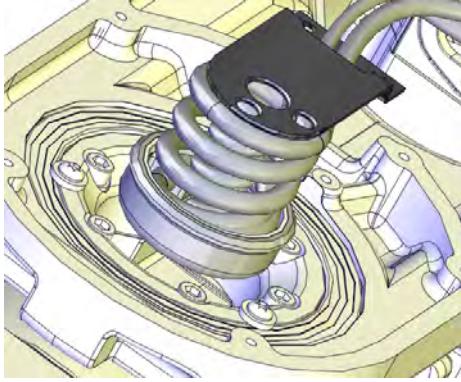
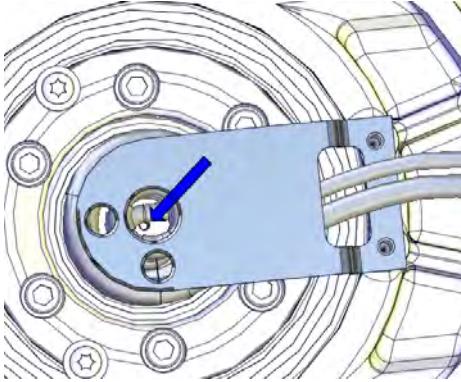
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Action	Note
3 Connect the connectors. Connect in accordance with the markings on the connectors.	
4 Inspect the o-ring.  Note Replace if damaged.	O-ring: 3HAC054692-002 
5  CAUTION When refitting the motor cover, make sure that none of the cables inside 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 (6 pcs) 

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

Connecting the axis-6 motor cables

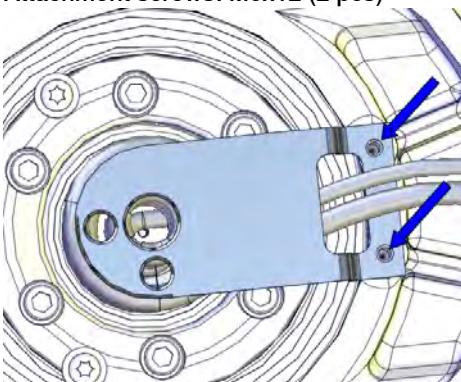
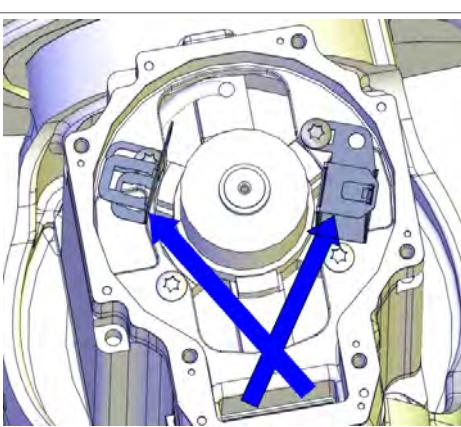
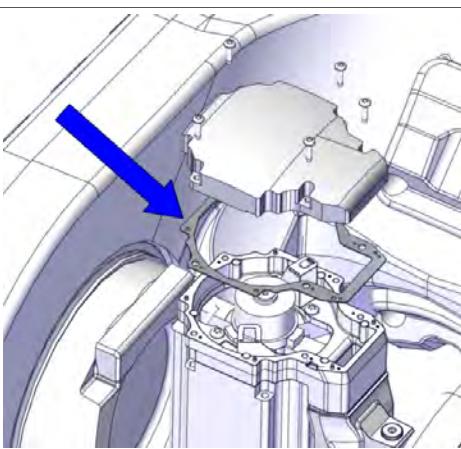
	Action	Note
1	<p>Make sure that the axis-5 is in +90 position, before continuing. If not, the cable spiral will be attached in the wrong position and cause damage to the cable harness.</p> <p>CAUTION</p> <p>Make sure that the cable spiral is not turned an extra revolution. The result will be damage to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

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4 Repair

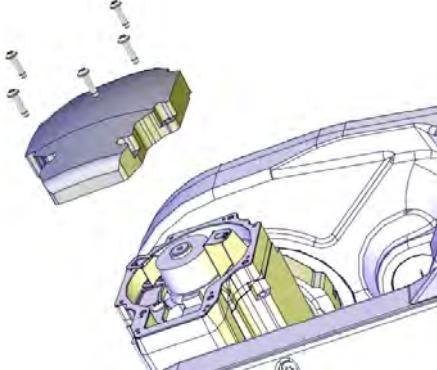
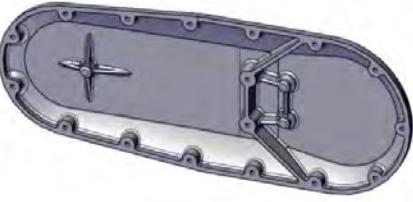
4.5.2 Replacing the wrist

Continued

Action	Note
4 Secure the cable bracket with its attachment screws.	 <p>Attachment screws: M6x12 (2 pcs)</p> <p>xx1300000484</p>
5 Reconnect the connectors to the axis-6 motor.	<p>Note</p> <p>Place the resolver cable underneath the motor cable.</p>  <p>xx1300000488</p>
6 Make sure the gasket on the motor cover is undamaged.	<p>Note</p> <p>Replace if damaged.</p>  <p>xx1500003095</p>
7  CAUTION	<p>Make sure not to damage the cables inside the motor when refitting the motor cover.</p>

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4.5.2 Replacing the wrist Continued

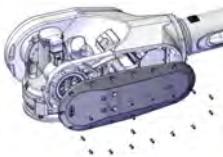
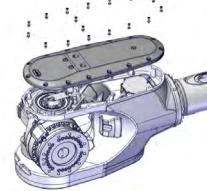
Action	Note
8 Refit the motor cover.	<p>Attachment screws: M5x20 (5 pcs)</p>  <p>xx1200001080</p>
9 Secure the axis-6 motor cable to the cable fixing bracket with a cable tie.	<p>Note</p> <p>The position of axis-4 depends on the on-going procedure.</p>  <p>xx1500003101</p> <p>xx1500002331</p>
10 Remove 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.	 <p>xx1600000046</p>
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 Repair

4.5.2 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 on-going procedure.	 xx1500003100  xx1500002330 Screws M8x25 12.9 (17 pcs) Tightening torque: 24 Nm

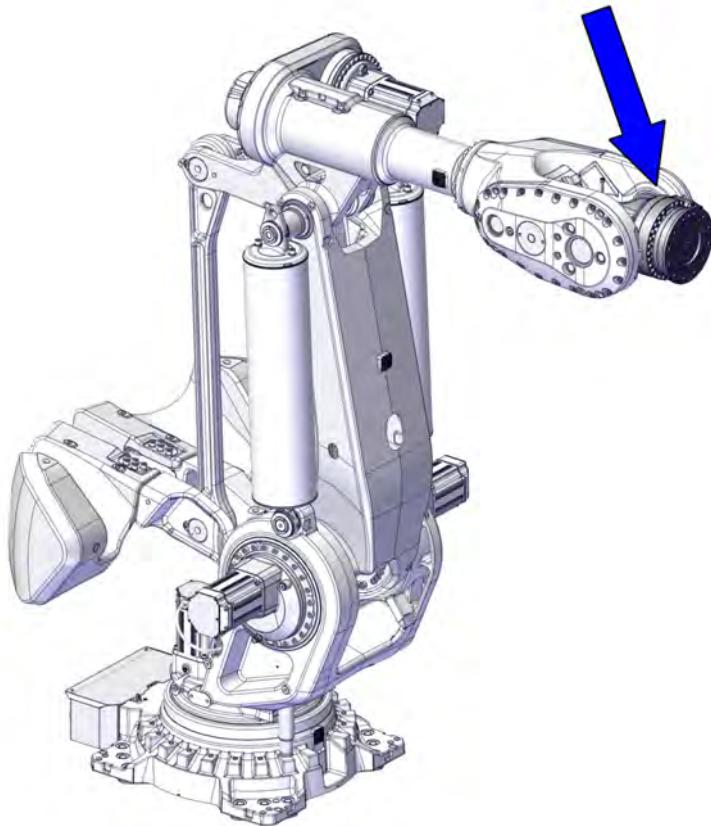
Concluding procedure

Action	Note
1 Recalibrate the robot.	Axis Calibration is described in Calibrating with Axis Calibration method on page 799 . General calibration information is included in section Calibration on page 789 .
2  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

4.5.3 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

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

Required tools and equipment

Equipment, etc.	Article number	Note
24 VDC power supply	-	Used to release the motor brakes.

Continues on next page

4 Repair

4.5.3 Replacing the axis-6 unit

Continued

Equipment, etc.	Article number	Note
Lifting eye, with swivel	-	Working load limit: 2,000 kg
Roundsling 1 m	-	Lifting capacity: 1,000 kg
Pallet		Used for putting down removed parts from robot.
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumables

Consumable	Article number	Note
Flange sealant		Loctite 574
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. <ul style="list-style-type: none">• 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 800 .
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Removing the axis-6 unit

Use these procedures to remove the axis-6 unit.

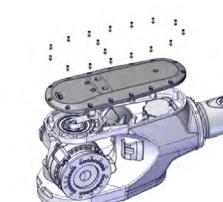
Preparations before removing the axis-6 unit

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

Continues on next page

Action	Note
2 Remove any tool or other equipment fitted on the wrist.	
3 Jog the robot to the specified position: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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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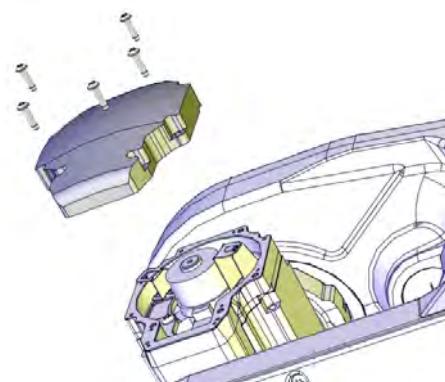
4 Repair

4.5.3 Replacing the axis-6 unit

Continued

Action	Note
3 Cut the cable tie that secure the axis-6 motor cable.	 xx1500003101

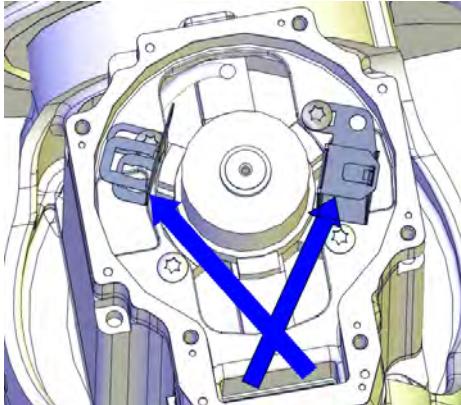
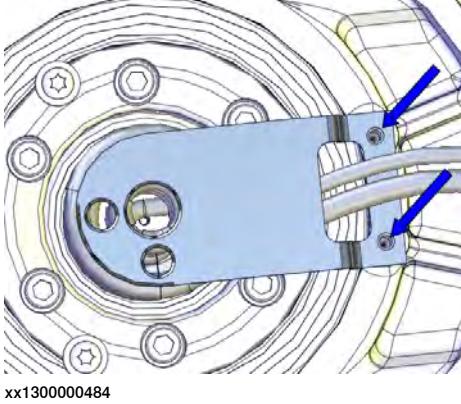
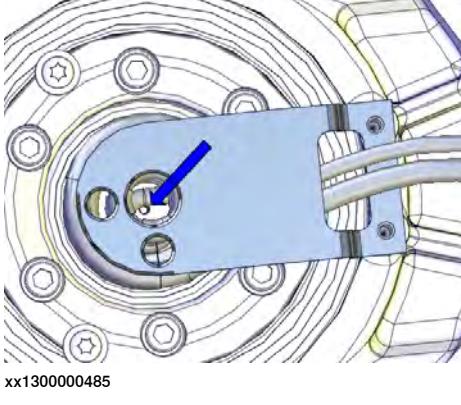
Disconnecting the axis-6 motor cables

Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2  Note Not applicable when 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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4.5.3 Replacing the axis-6 unit

Continued

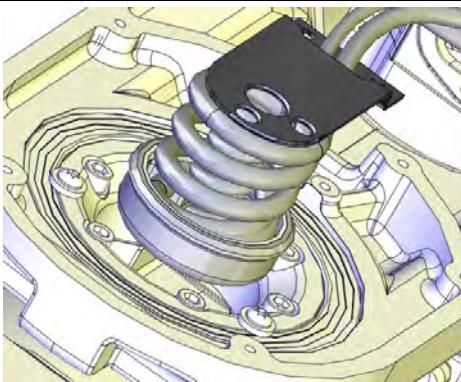
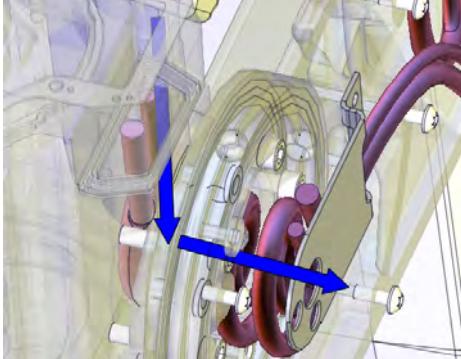
	Action	Note
4	Disconnect the motor cables.	 xx1300000488
5	Unscrew the attachment screws holding the cable bracket.	 xx1300000484
6	Unscrew the screw holding the carrier. Note The screw is located at the bottom of the carrier.	 xx1300000485

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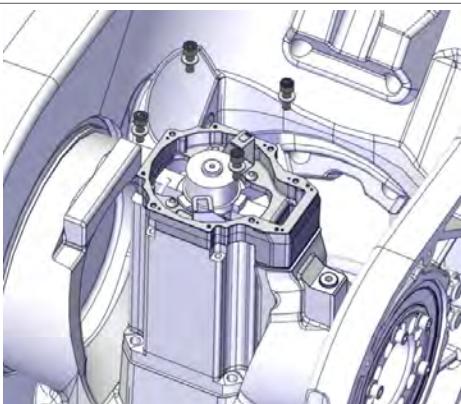
4 Repair

4.5.3 Replacing the axis-6 unit

Continued

Action	Note
<p>7 Use caution and pull out the carrier.</p> <p> Tip</p> <p>If needed, use a screwdriver to help pulling out the carrier.</p>	 xx1300001113
<p>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.</p>	 xx1300000666

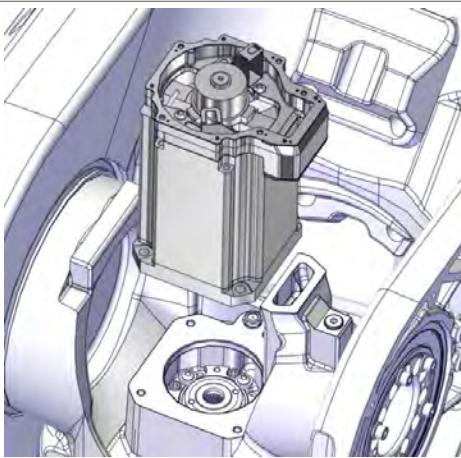
Removing the axis-6 motor

Action	Note
<p>1 To release the brakes, connect the 24 VDC power supply. Connect to R2.MP6-connector:</p> <ul style="list-style-type: none"> • pin 2 = 24V • pin 5 = 0V 	24 VDC power supply
<p>2 Unscrew the attachment screws with washers.</p>	 xx1500003097

Continues on next page

4.5.3 Replacing the axis-6 unit

Continued

	Action	Note
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 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.	

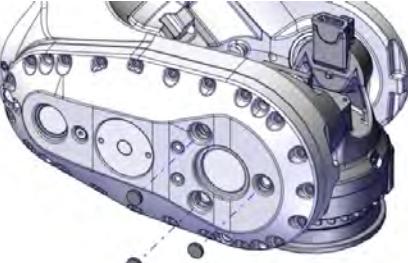
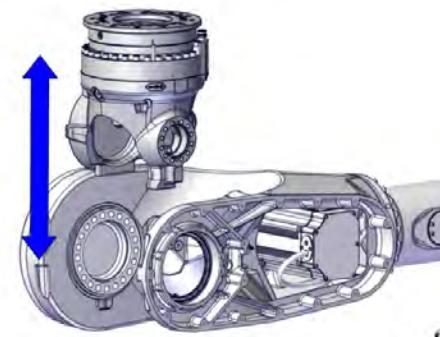
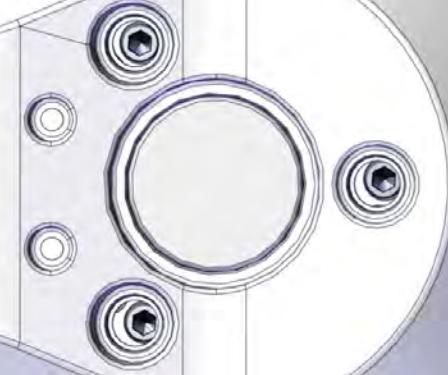
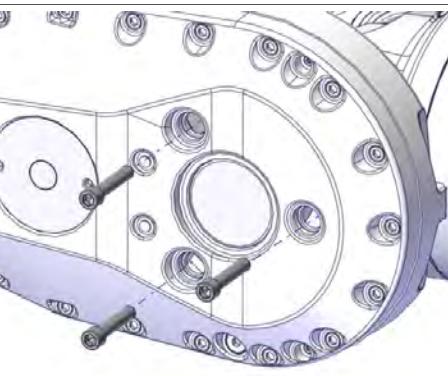
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4 Repair

4.5.3 Replacing the axis-6 unit

Continued

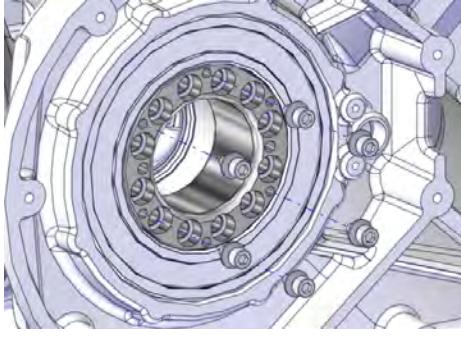
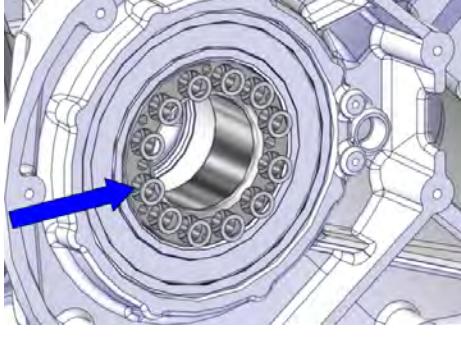
Unscrewing the axis-5 gearbox side

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
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.	 xx1600000200
3	Slowly lift the axis-6 unit up until the first three (of 21) screws are possible to remove.	 xx1600000195
4	Unscrew and remove the first three screws.	 xx1600000196

Continues on next page

Action	Note
5 Slowly lift the axis-6 unit up, until the next three screws are possible to remove.	
6 Continue to lift 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 now is removed, the axis-6 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.	

Removing the axis-6 unit

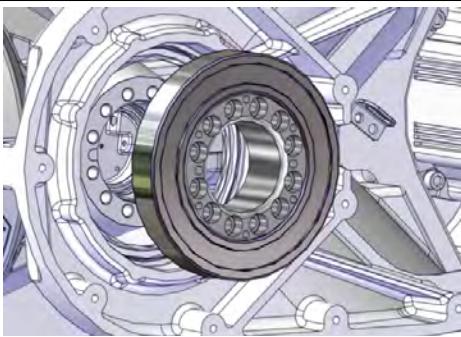
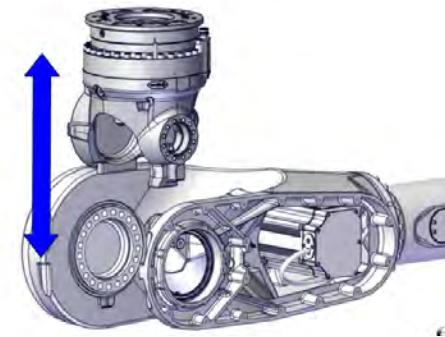
Action	Note
1 Make sure the lifting accessories still are attached securely and takes the weight of the axis-6 unit.	
2 Unscrew the attachment screws (6 pcs) that secure the bearing.	This is done to be able to reach the attachment screws that secure the axis-6 unit.  xx1600000197
3 Unscrew the attachment screws (11 pcs) that hold the support shaft.	 xx1600000198 (Screws not shown in the figure)

Continues on next page

4 Repair

4.5.3 Replacing the axis-6 unit

Continued

Action	Note
4 Remove the support shaft. Tip If needed, insert two screws and use them as removal tools.	 xx1600000199
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.

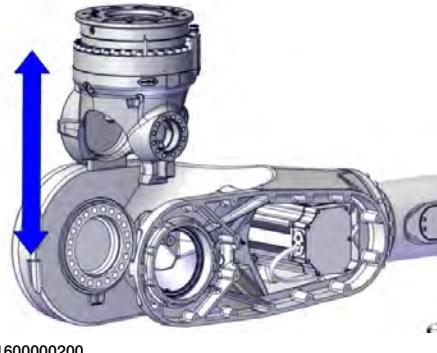
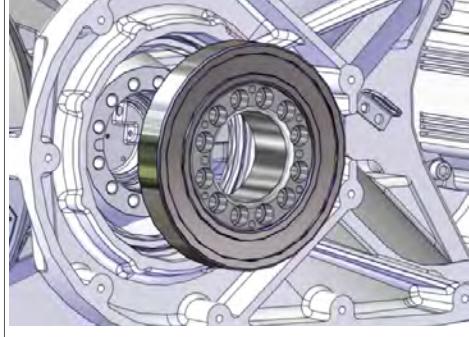
Attaching lifting accessories, axis-6 unit

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

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	Action	Note
4	Use caution and raise the axis-6 unit up and let it hang in the lifting accessories.	

Refitting the support shaft side

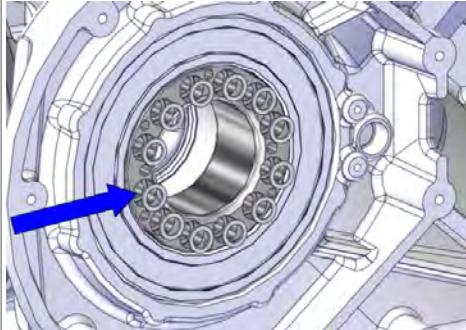
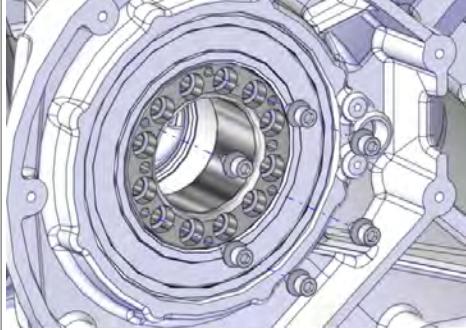
	Action	Note
1	Wipe clean all contact surfaces including the o-ring grooves.	
2	Use caution and move the axis-6 unit to its mounting position.  xx1600000200	
3	Wipe clean and inspect the o-rings. Replace damaged o-rings.	
4	Refit the o-rings in the grooves.  Tip Lubricate the o-ring with some grease for a better fitting in the groove.	
5	Refit the support shaft.  xx1600000199	

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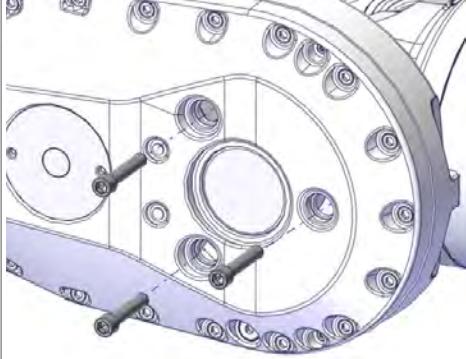
4 Repair

4.5.3 Replacing the axis-6 unit

Continued

Action	Note
6 Refit and secure the support shaft.	<p>Attachment screws, M12x55 (11 pcs) Tightening torque: 120 Nm</p>  <p>xx1600000198 (Screws not shown in the figure)</p>
7 Secure the bearing.	<p>Attachment screws: M8x16 (6 pcs) Tightening torque: 24 Nm</p>  <p>xx1600000197</p>

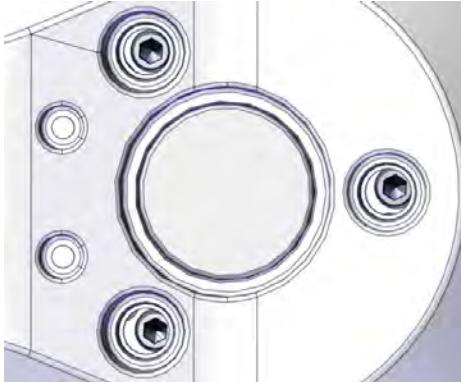
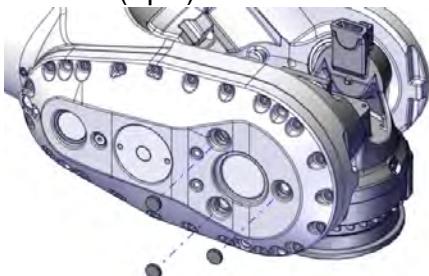
Refitting the axis-5 gearbox side

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.	 <p>xx1600000196</p>

Continues on next page

4.5.3 Replacing the axis-6 unit

Continued

	Action	Note
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.	
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

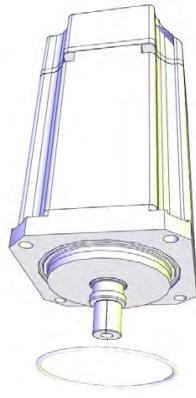
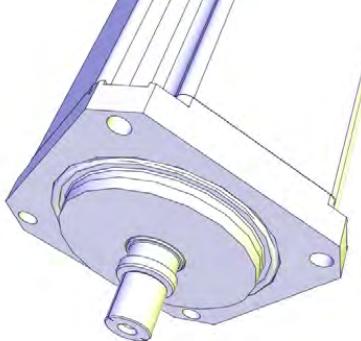
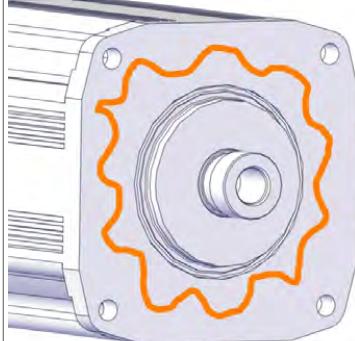
	Action	Note
10	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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4 Repair

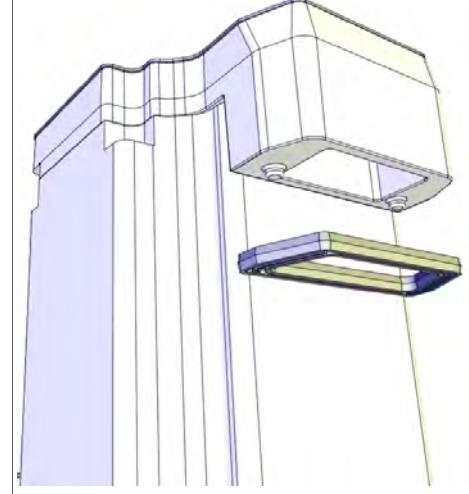
4.5.3 Replacing the axis-6 unit

Continued

	Action	Note
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
15	Apply flange sealant on the motor flange.	Flange sealant: Loctite 574  xx1500002357
16	If the motor is a new spare part, remove the motor cover.	

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Securing the axis-6 motor

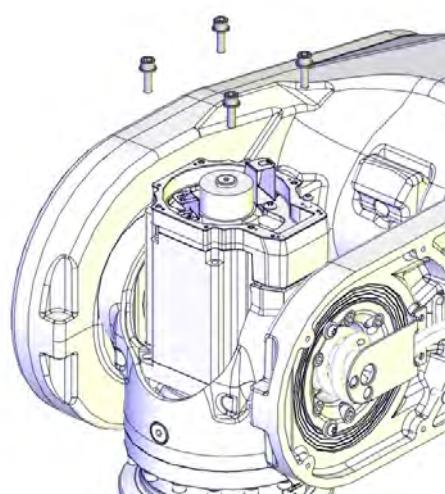
	Action	Note
1	To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP6: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	
2	 CAUTION Parting/mating motor pinion and hub, may damage the splines if excessive force is used!	
3	Inspect the gasket. Replace if damaged.	 xx1200001094
4	 CAUTION The motor weighs 14 kg.	

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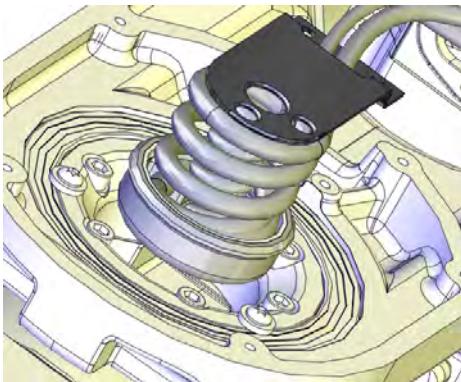
4 Repair

4.5.3 Replacing the axis-6 unit

Continued

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.	

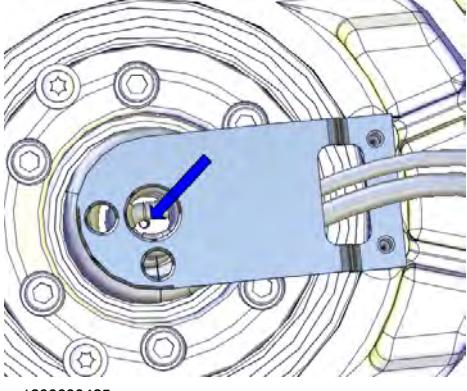
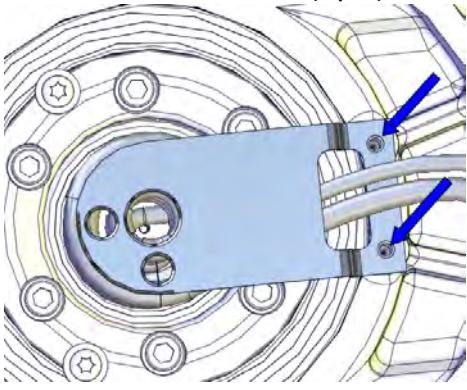
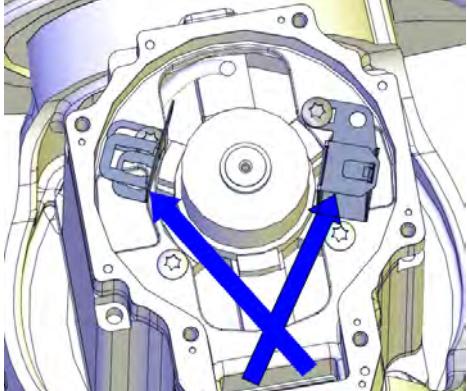
Connecting the axis-6 motor cables

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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4.5.3 Replacing the axis-6 unit

Continued

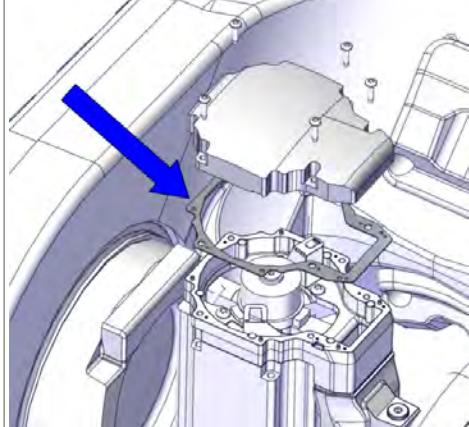
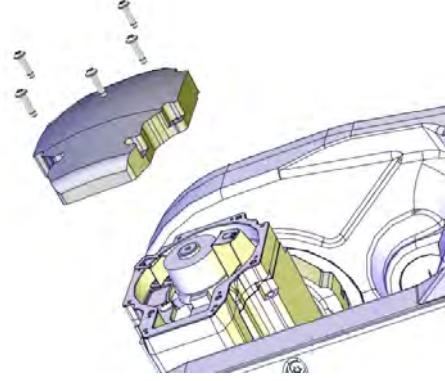
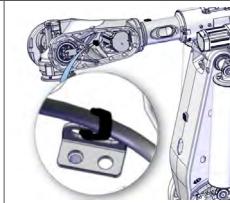
	Action	Note
3	<p>Secure the carrier with the M4 screw.</p> <p>Note The screw is located at the bottom of the carrier.</p> <p>Tip The screw that secure the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.</p>	<p>Attachment screws: M4x10</p> 
4	Secure the cable bracket with its attachment screws.	<p>Attachment screws: M6x12 (2 pcs)</p> 
5	<p>Reconnect the connectors to the axis-6 motor.</p> <p>Note Place the resolver cable underneath the motor cable.</p>	

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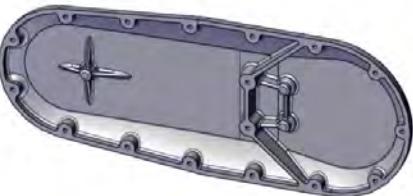
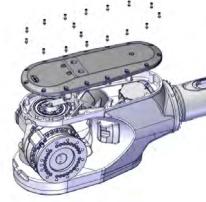
4 Repair

4.5.3 Replacing the axis-6 unit

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
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

Continues on next page

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

Concluding procedure

	Action	Note
1	Recalibrate the robot.	Axis Calibration is described in Calibrating with Axis Calibration method on page 799 . General calibration information is included in section Calibration on page 789 .
2	 DANGER <p>Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.</p>	

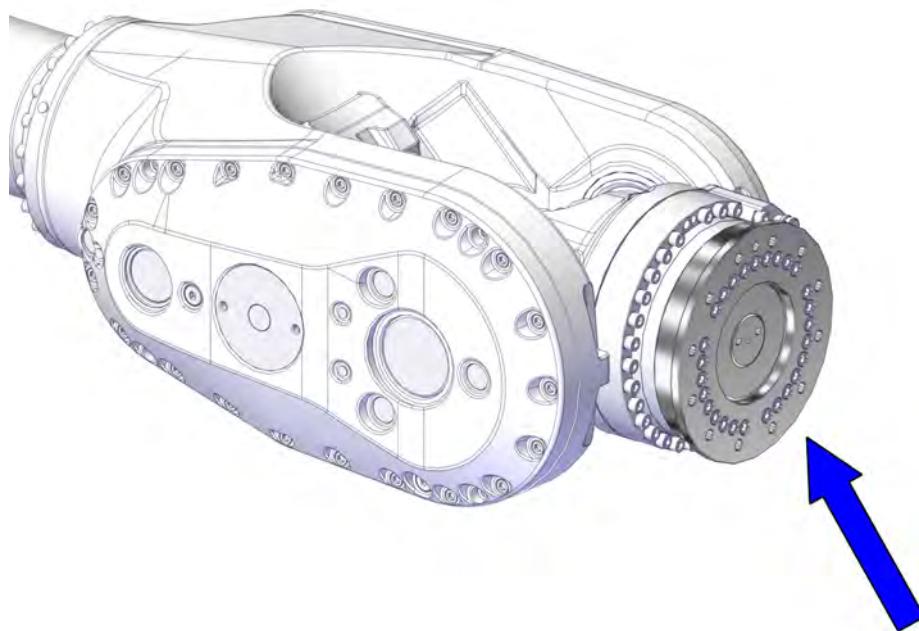
4 Repair

4.5.4 Replacing the turning disk

4.5.4 Replacing the turning disk

Location of the turning disk

The turning disk 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Turning disc	3HAC048445-003	

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

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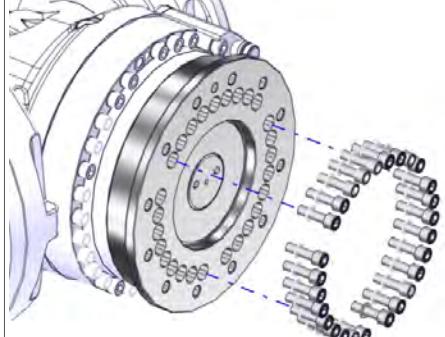
Removing the turning disk

Use these procedures to remove the turning disk.

Preparations before removing the turning disk

	Action	Note
1	Jog the robot to a comfortable position for removing the turning disk.	
2	 DANGER Turn off all: <ul style="list-style-type: none"> • 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 disk.	

Removing the turning disk

	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 disk.	 xx1500002318

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4 Repair

4.5.4 Replacing the turning disk

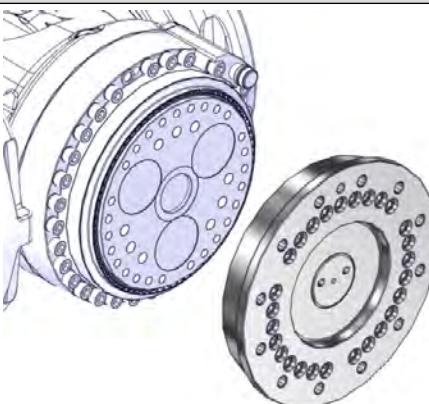
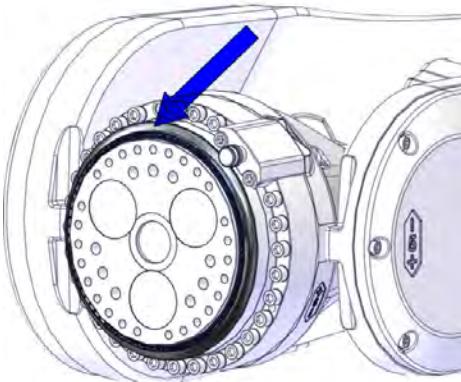
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Action	Note
3 Remove the turning disk.	 xx1500002319

Refitting the turning disk

Use these procedures to refit the turning disk.

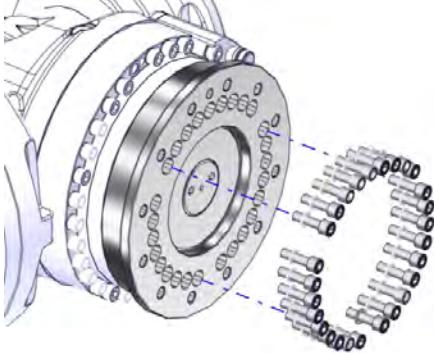
Refitting the turning disk

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

Continues on next page

4.5.4 Replacing the turning disk

Continued

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

Concluding procedure

Action	Note
1 Recalibrate the robot.	<p>Calibration is described in a separate calibration manual enclosed with the calibration tools.</p> <p>General calibration information is included in section Calibration on page 789.</p>
2  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

4 Repair

4.5.5 Replacing the process turning disk

4.5.5 Replacing the process turning disk

Location of the process turning disk

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

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest revision of *Product manual, spare parts - IRB 8700*on ABB Library.

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

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 825 .

Removing the process turning disk

Use these procedures to remove the process turning disc.

Preparations before removing the process turning disk

	Action	Note
1	Jog the robot to a comfortable position for removing the process turning disk.	
2	 DANGER Turn off all: <ul style="list-style-type: none">• 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 disk.	

Continues on next page

Removing the process turning disk

	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 roundsling to the process turning disk 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 disk.	
5	Unscrew the 22 attachment screws and washers that secure the process turning disk.	
6	Remove the process turning disk.	

Refitting the process turning disk

Use these procedures to refit the process turning disk.

Refitting the process turning disk

	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 disk is refitted in the correct position.	
5	Secure the process turning disk with its attachment screws and washers.	Attachment screws: M12x40 12.9 Gleitmo 603 (22 pcs) Tightening torque: 120 Nm

Continues on next page

4 Repair

4.5.5 Replacing the process turning disk

Continued

Concluding procedure

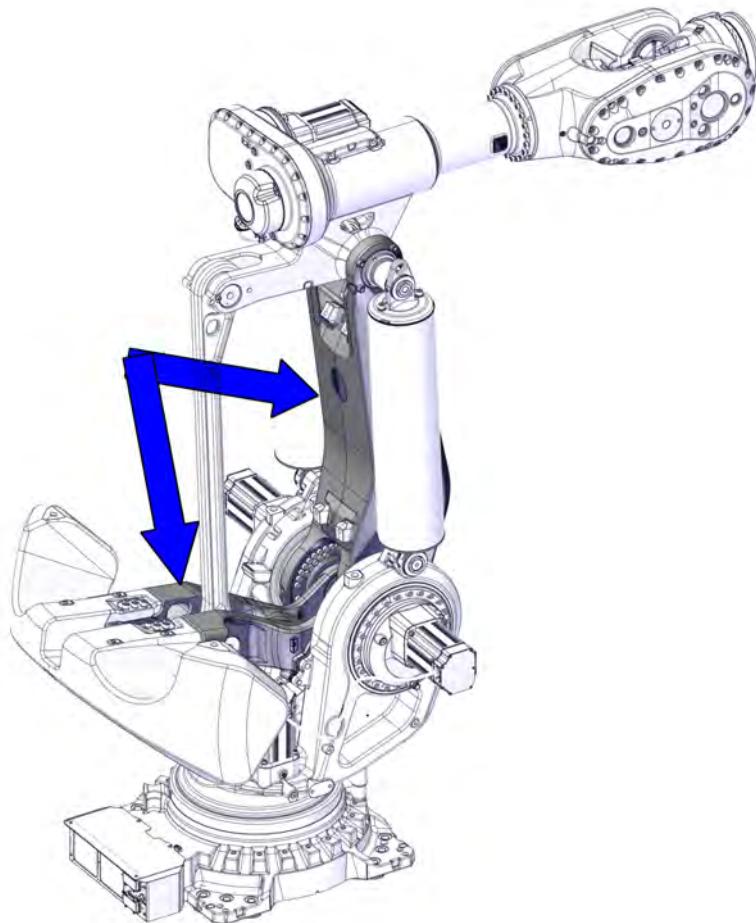
Action	Note
1 Recalibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section Calibration on page 789 .
2  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

4.5.6 Replacing the complete lower arm

Location of the complete lower arm

The complete lower arm is located as shown in the figure.

The complete lower arm consists of lower arm and parallel arm together.



xx1500002061

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest revision of *Product manual, spare parts - IRB 8700*on ABB Library.

Spare part	Article number	Note
Lower arm	3HAC048081-005	

Continues on next page

4 Repair

4.5.6 Replacing the complete lower arm

Continued

Required tools and equipment

Equipment, etc.	Article number	Note
MobilePlatformLadder	-	
Fixing screw, M10x50 (4 pcs)	-	Used to holding parallel rod in position.
Screw M16x80	-	Fully threaded
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Roundsling 1 m	-	Lifting capacity: 1,000 kg
Roundsling 2 m	-	Lifting capacity: 2,000 kg
Roundsling 2.5 m	-	Lifting capacity: 2,000 kg
Roundsling 3 m	-	Lifting capacity: 2,000 kg
Crowbar (small)	-	Used when removing parallel arm from lower arm
Pallet		Used for putting down removed parts from robot.
Lifting eye	3HAC16131-1	M12
Lifting eye	3HAC14457-4	M16
Fender washer	-	Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.
Piece of wood	-	Used when replacing the parallel rod and mechanical stop pin as a safety measure
Assembly tool	3HAC051000-001	Used to disassemble and assemble the parallel rod
Press plate	3HAC050949-001	Used to disassemble and assemble the parallel rod
Round plate	-	Used to disassemble and assemble the parallel rod
Hydraulic cylinder	3HAC11731-1	To be used with the press tool.
Hydraulic pump 80 MPa	3HAC13086-1	To be used with the hydraulic cylinder.
Velcro strap	-	
Assembly tool	3HAC056095-002	Set of tools. Instruction 3HAC056526-002 enclosed.
Removal tool	3HAC056095-003	Set of tools. Instruction 3HAC056526-002 enclosed.
Glycerine adapter	-	Used to replace upper arm shafts together with a glycerine press tool.
24 VDC power supply	-	Used to release the motor brakes.
Dial gauge		
Endless ratchet lashing belt	-	Used to secure the parallel arm against the lower arm
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Continues on next page

Required consumables

Consumable	Article number	Note
Molykote 1000		
Cable ties		
Corrosion protection		Mercasol
Bearing grease	3HAA 1001-294	Tribol GR 100-0 PD
Locking liquid		Loctite 243
Isopropanol		
Scotch-brite		Scotch-brite abrasive cleaning hand pad
Glycerine		

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	<p>Decide which calibration routine to use for calibrating the robot.</p> <ul style="list-style-type: none"> • 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. 	
	<p>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.</p>	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 800 .
	<p>If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.</p>	

Removing the complete lower arm

Use these procedures to remove the complete lower 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.	

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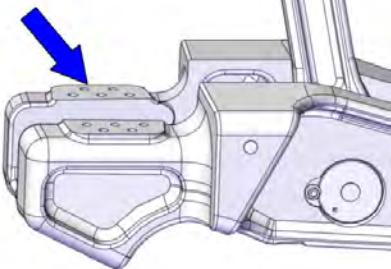
4 Repair

4.5.6 Replacing the complete lower arm

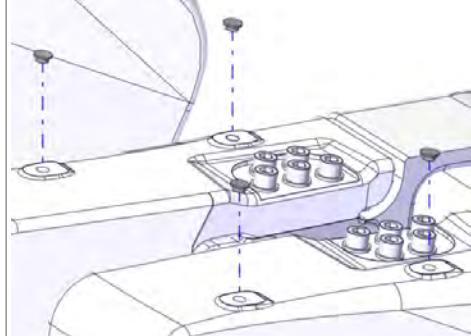
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Action	Note
2 Remove any tool or other equipment fitted to the robot.	

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 <p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	

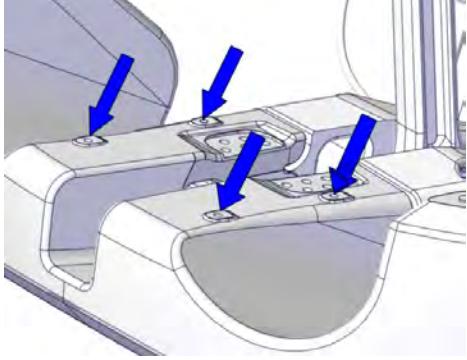
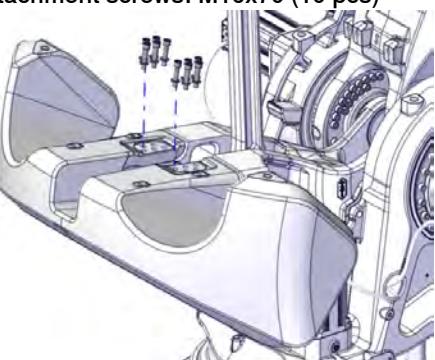
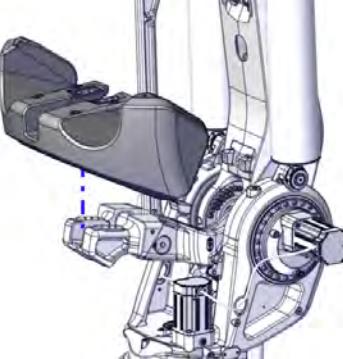
Removing the counterweight

Action	Note
1 <p> CAUTION</p> <p>The counterweight weighs 1200 kg. All lifting accessories used must be sized accordingly!</p>	
2 <p> Note</p> <p>If used, remove the plastic plugs covering the holes for the lifting eyes.</p> <p>Keep the plastic plugs. They shall be refitted.</p>	 xx1500001980

Continues on next page

4.5.6 Replacing the complete lower arm

Continued

Action	Note
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 (four chains)
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
7 Use caution, lift the counterweight off.	 xx1500001982

Continues on next page

4 Repair

4.5.6 Replacing the complete lower arm

Continued

Action	Note
8  CAUTION The counterweight will start to lean backwards when laying it down, before it is resting on the floor.	 xx1500002095

Preparations before unloading the pressure of balancing device

Action	Note
1 Jog the robot to calibration position.	 xx1500002310
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

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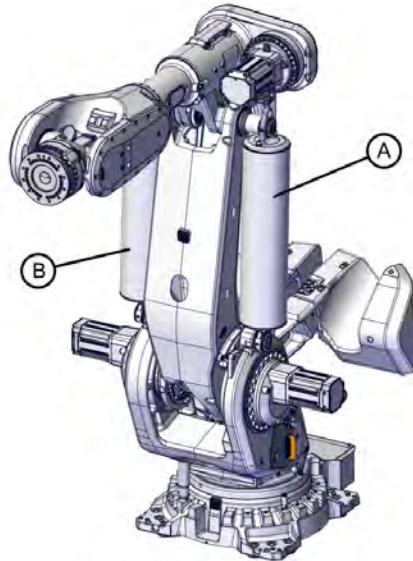
4.5.6 Replacing the complete lower arm

Continued

Unloading the pressure of the balancing device

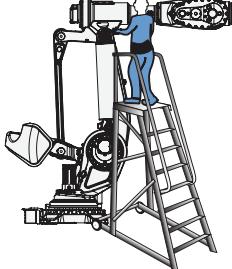
**CAUTION**

Make sure to relief the pressure of the correct balancing device. Relief pressure on axis 2 side when changing axis-2 gearbox, and relief pressure on axis 3 side when changing axis-3 gearbox.



xx1600001406

A	Axis-2 balancing device
B	Axis-3 balancing device

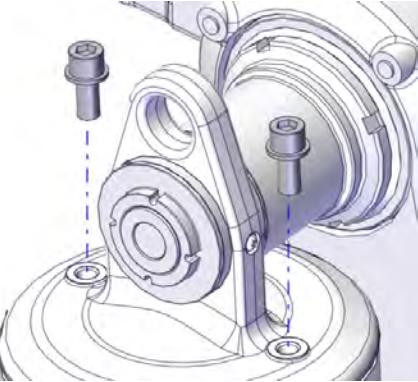
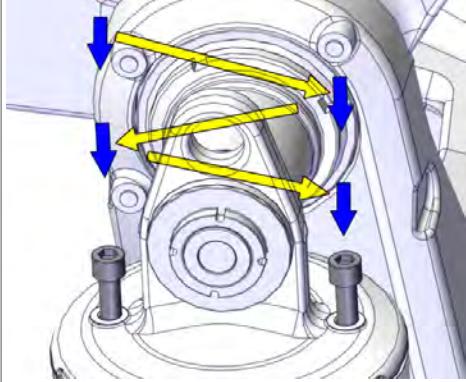
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	<i>Only needed when the upper arm is fitted on the robot:</i> Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device.  DANGER Do not use the robot as ladder!	Mobile platform ladder  xx1500001985

Continues on next page

4 Repair

4.5.6 Replacing the complete lower arm

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.	Apply Molykote on colored areas.  xx1500002303 Screws M16x80 fully threaded
5 Unload the pressure of the balancing device by inserting the screws. Attach the screws until the screws reaches the piston. Then, alternately little by little, attach the screws at least another five millimeters. The pressure is now unloaded.	 xx1500002309 Screw M16x80 (2 pcs)
6 In a procedure where both balancing devices shall be removed, unload the pressure of the other in the same way.	

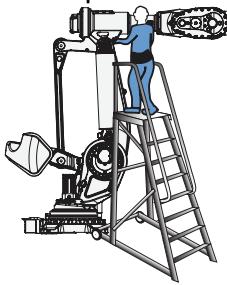
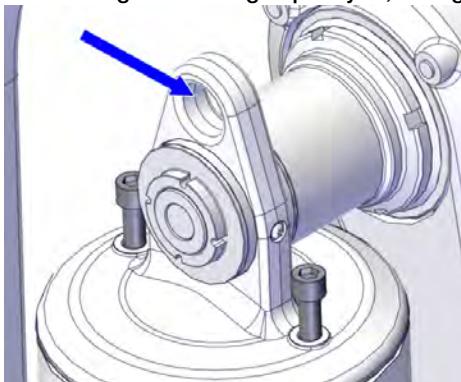
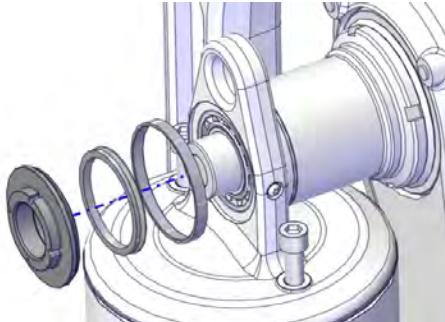
Removing the balancing device

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

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4.5.6 Replacing the complete lower arm

Continued

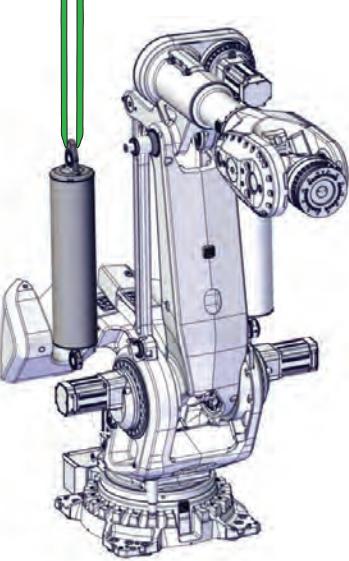
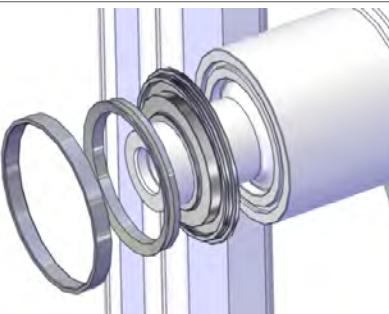
Action	Note
2 Use a Mobile platform ladder to reach the upper end of the balancing device.  DANGER Do not use the robot as a ladder.	Mobile platform ladder  xx1500001985
3  CAUTION The balancing device weights 200 kg. All lifting accessories used must be sized accordingly.	
4 Attach a roundsling to the lifting hole on top of the balancing device and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg  xx1500001983
5 Stretch the lifting accessories to take the weight of the balancing device.	
6 Remove upper and lower KM-nuts.  Note Make sure that V-ring or support ring are present.	 xx1500001973

Continues on next page

4 Repair

4.5.6 Replacing the complete lower arm

Continued

Action	Note
7 Use caution and lift the balancing device off.  Tip If needed, use a Crowbar (small), to carefully help pressing the balancing device out. A suitable bearing puller is another alternative.	Crowbar (small)  xx1500002735
8  Note Make sure that the support ring and spacer ring with V-ring are present.	 xx1500001975
9 Put the balancing device down.  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
10 If both balancing devices shall be removed, remove the other in the same way.	

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Robot position when removing screws in the first area

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-2 gearbox to the lower arm and the axis-3 gearbox to the parallel arm.

Action	Note
<p>1 Jog the robot to the specified position:</p> <ul style="list-style-type: none"> • Axis 1: no significance as long as the robot is fitted to the foundation. • Axis 2: +30° • Axis 3: -20° • Axis 4: 0° • Axis 5: 0° • Axis 6: No significance. 	
<p>2</p>  <p>DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	

Removing the attachment screws in the first area

Remove attachment screws in the first of the three areas of screws. Remove screws that secure the axis-2 gearbox to the lower arm, as well as the ones that secure the axis-3 gearbox to the parallel arm.

Action	Note
1 Unscrew and remove screws, that secure the axis-2 gearbox to the lower arm, now possible to reach.	
2 Unscrew and remove screws, that secure the axis-3 gearbox to the parallel arm, now possible to reach.	

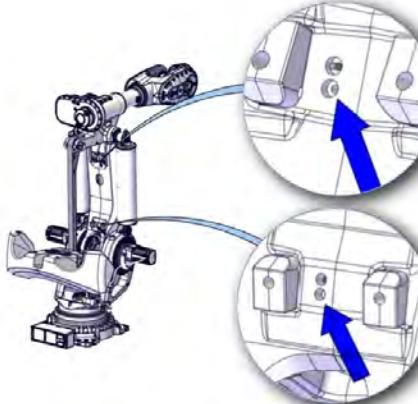
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4 Repair

4.5.6 Replacing the complete lower arm

Continued

Unscrewing the brackets that secure cable harness in lower arm

Action	Note
<p>1 In order to be able to remove the cable harness, it is necessary to unscrew the two brackets inside the lower arm at this stage. It will be very difficult to reach the bracket screws after the position of the robot is changed.</p>	 xx1500002694
<p>2 Unscrew the screws of the two brackets that secure the cable harness inside the lower arm.</p> <p> Note The screws are reached from the outside.</p>	 xx1500002695

Robot position when removing the upper arm

Action	Note
<p>1 Turn on the power and jog the robot to the specified position:</p> <ul style="list-style-type: none"> • Axis 1: no significance as long as the robot is fitted to the foundation. • Axis 2: -65° • Axis 3: 0° (horizontal to the foundation) • Axis 4: +90° • Axis 5: -90° • Axis 6: no significance. 	

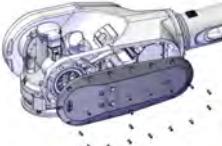
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4.5.6 Replacing the complete lower arm

Continued

Action	Note
<p>2</p> <p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	

Retrieving access to the wrist cabling

Action	Note
<p>1</p> <p> DANGER</p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
<p>2</p> <p>Remove the wrist cover.</p> <p> Note</p> <p>Do not damage the sealing. Replace if damaged.</p> <p> Note</p> <p>The position of axis-4 depends on the ongoing procedure.</p>	 
<p>3</p> <p>Cut the cable tie that secure the axis-6 motor cable.</p>	

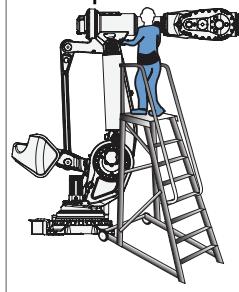
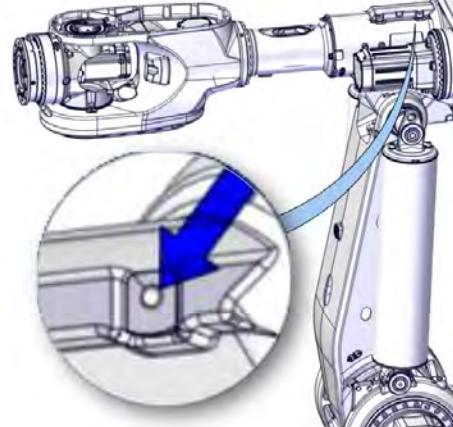
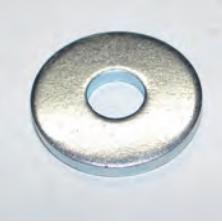
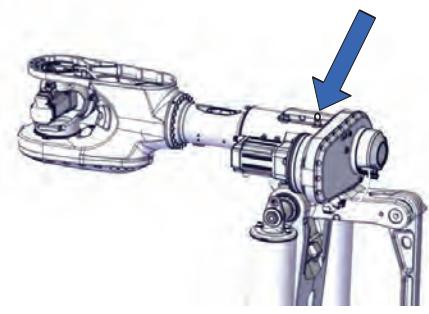
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4 Repair

4.5.6 Replacing the complete lower arm

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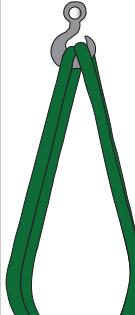
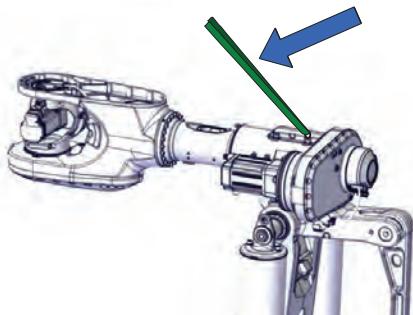
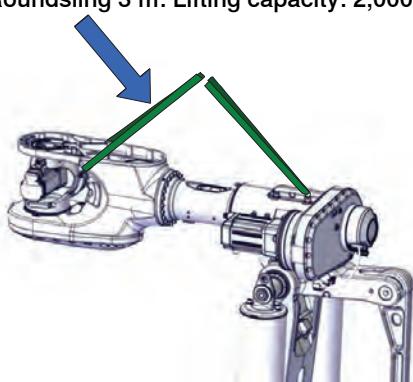
Attaching lifting accessories to the upper arm complete

Action	Note
<p>1  CAUTION The complete upper arm weighs 900 kg. All lifting accessories used must be sized accordingly.</p>	
<p>2 <i>Only needed when the upper arm is fitted on the robot:</i> Use a Mobile platform ladder (or similar) to attach the lifting accessories.</p> <p> DANGER Never use the robot as ladder.</p>	<p>Mobile platform ladder</p>  <p>xx1500001985</p>
<p>3 Remove the plastic plug in the hole shown in the figure.</p>	 <p>xx1500002712</p>
<p>4 Attach a Lifting eye to the hole in the arm housing with a Fender washer underneath.</p>  <p>xx1400002196</p>	<p>Lifting eye: M12 Fender washer: Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.</p>  <p>xx1500002715</p>

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4.5.6 Replacing the complete lower arm

Continued

Action	Note
5 Attach a roundsling looped to the Lifting eye and to an overhead crane (or similar).  xx1400002599	Roundsling 2.5 m: Lifting capacity: 2,000 kg  xx1500002713
6 Attach a roundsling looped to the wrist and to an overhead crane (or similar).	Roundsling 3 m: Lifting capacity: 2,000 kg  xx1500002714
7 Stretch the lifting accessories to take the weight of the upper arm.	
8 <i>Only needed when the upper arm is fitted on the robot:</i> In order to release the brakes, connect the 24 VDC power supply. Connect connector R2.MP2: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	
9 <i>Only needed when the upper arm is fitted on the robot:</i> Release the brakes on axis-2 to be sure that the lifting accessories are taking the weight of the upper arm.	
10 Adjust the lifting accessories, if needed.	

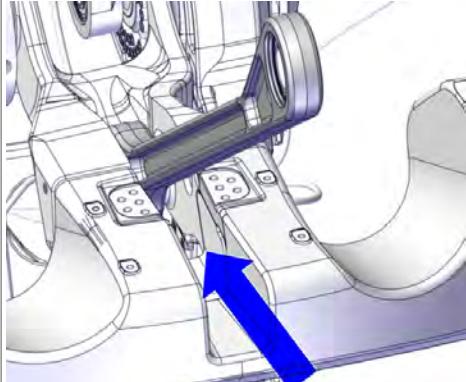
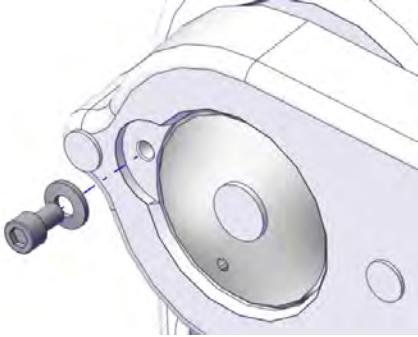
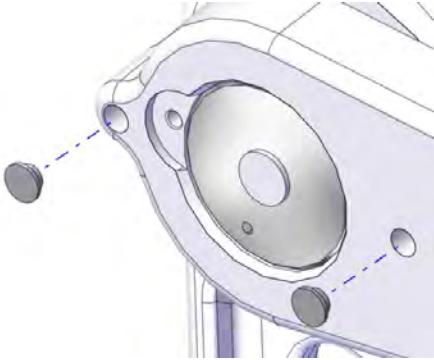
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4 Repair

4.5.6 Replacing the complete lower arm

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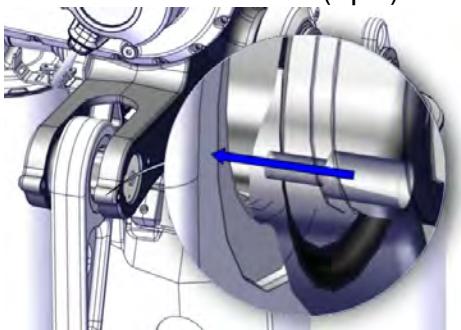
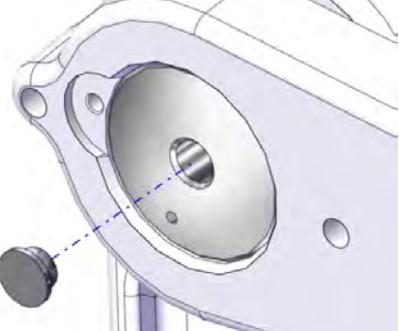
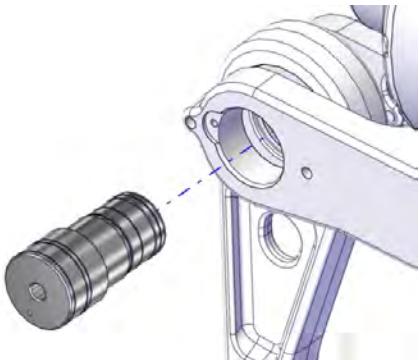
Removing the parallel rod, upper end

	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
2	Remove the attachment screw with washer that secure the rod shaft.	 xx1400002600
3	Remove the protection plugs 4 + 4 (two on either side of the upper arm wings).  Note Keep the protection plugs. They shall be refitted when the work is done.	 xx1500001961

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4.5.6 Replacing the complete lower arm

Continued

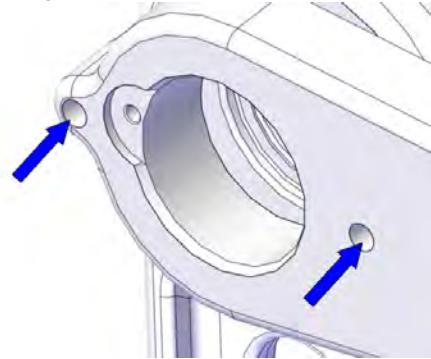
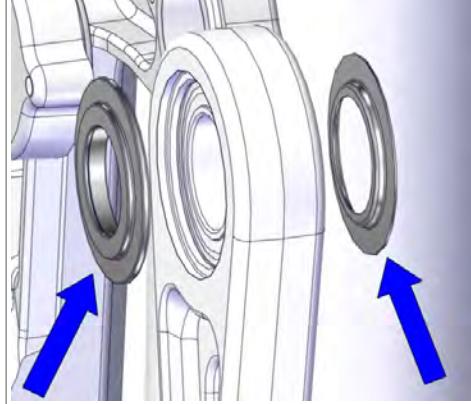
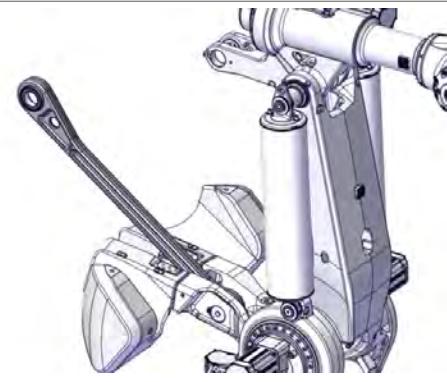
	Action	Note
4	Fit 2 + 2 M10x50 screws in the holes and adjust the screws against the parallel rod from both sides.	<p>This is done to prevent the upper arm wings from pinching when pressing the shaft and thereby making it more difficult to press the shaft in or out. Attachment screws: M10x50 (4 pcs)</p>  <p>xx1500002300</p>
5	<p>Remove the protection plug.</p> <p> Note</p> <p>Keep the protection plug. It shall be refitted when the work is done.</p>	 <p>xx1500001967</p>
6	Apply the press tool parts (Assembly tool, Press plate and Round plate).	<p>Assembly tool: 3HAC051000-001 Press plate: 3HAC050949-001 Round plate:</p>
7	Use the press tool and press the shaft out.	 <p>xx1500001962</p>

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4 Repair

4.5.6 Replacing the complete lower arm

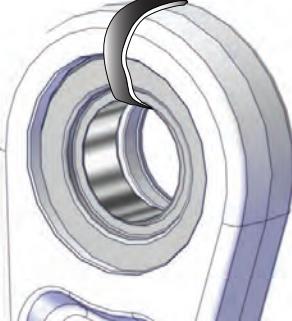
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Action	Note				
8 Unscrew two of the M10x50 screws, approximately 5 mm, on one side of the parallel rod. Leave the screws on the other side.	<p>This is to be able to remove the parallel rod without problems and to be able to find the correct position of the parallel rod, when refitting it.</p>  <p>xx1500002710</p>				
9 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.	 <p>xx1500001964</p> <table border="1"> <tr> <th>Left side</th> <th>Right side</th> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side				
Thrust washer	Cover washer				
10 Move the parallel rod down and let it rest on the piece of wood, which was put there earlier.	 <p>xx1500001965</p>				

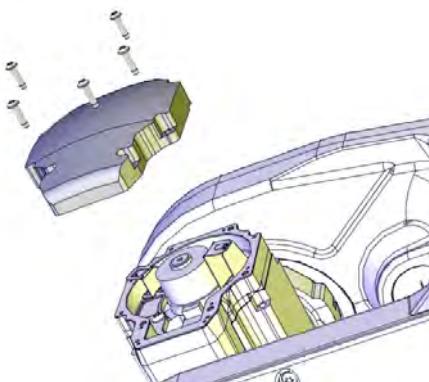
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4.5.6 Replacing the complete lower arm

Continued

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

Disconnecting the axis-6 motor cables

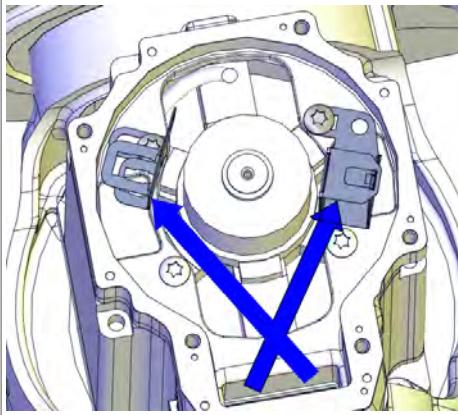
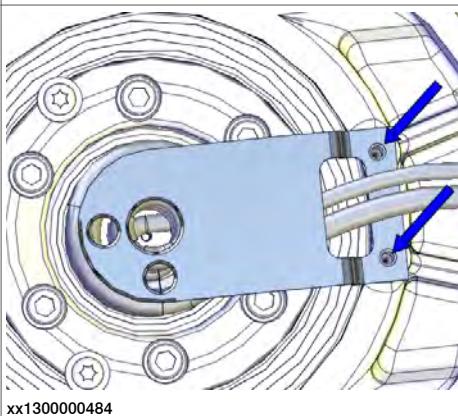
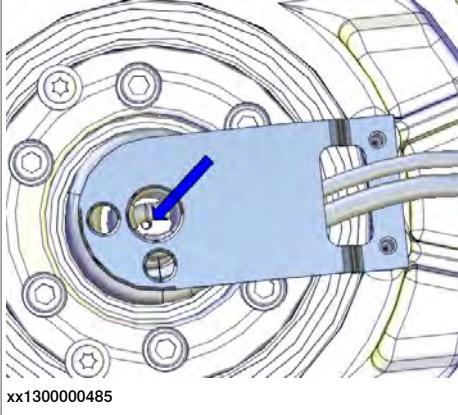
Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Make sure that the axis-5 is as close to +90° or -90° position as possible, depending on what repair work is being done.  Note Not applicable when replacing the axis-6 unit.	
3 Unscrew the attachment screws and remove the motor cover.  Note Do not damage the gasket. Replace if damaged.	 <p>xx1200001080</p>

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4 Repair

4.5.6 Replacing the complete lower arm

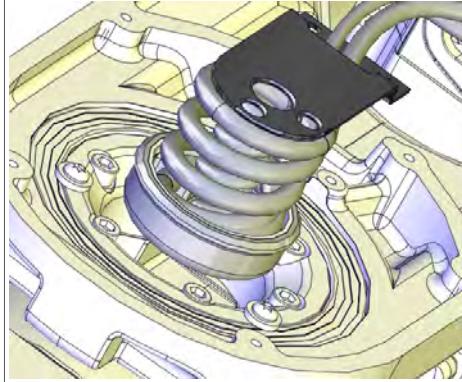
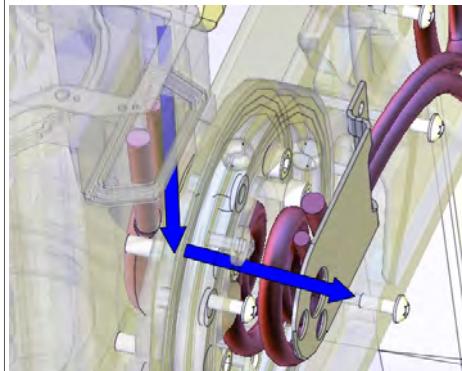
Continued

	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

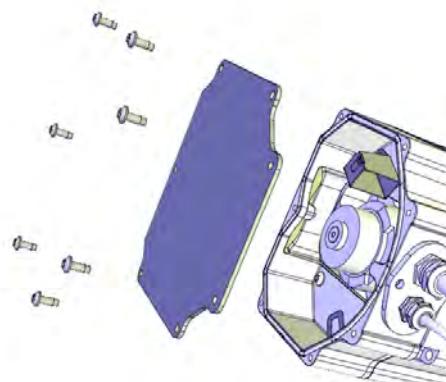
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4.5.6 Replacing the complete lower arm

Continued

Action	Note
<p>7 Use caution and pull out the carrier.</p> <p> Tip</p> <p>If needed, use a screwdriver to help pulling out the carrier.</p>	 xx1300001113
<p>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.</p>	 xx1300000666

Disconnecting the axis-5 motor cables

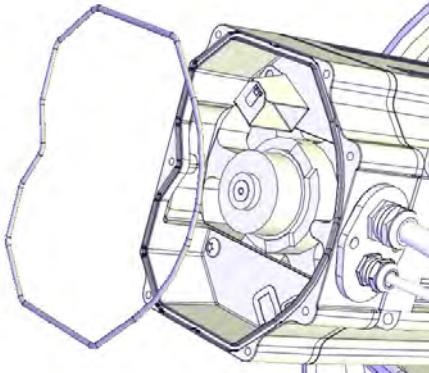
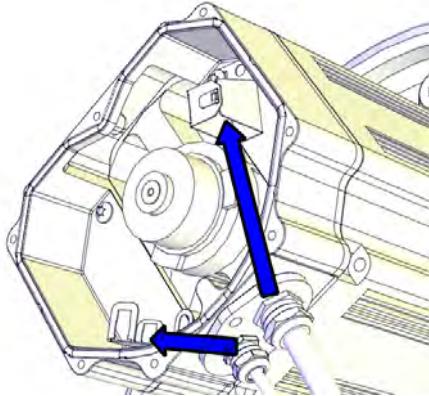
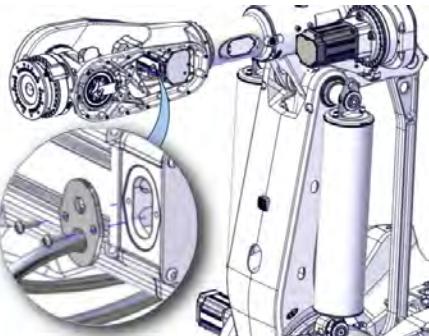
Action	Note
<p>1  DANGER</p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
<p>2 Unscrew the attachment screws with washers and remove the motor cover.</p>	 xx1200001135

Continues on next page

4 Repair

4.5.6 Replacing the complete lower 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.	

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.	

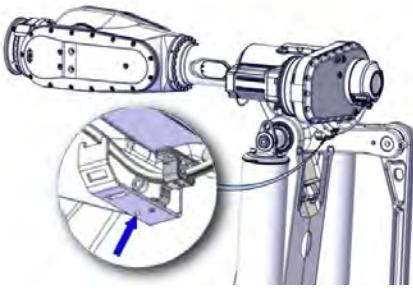
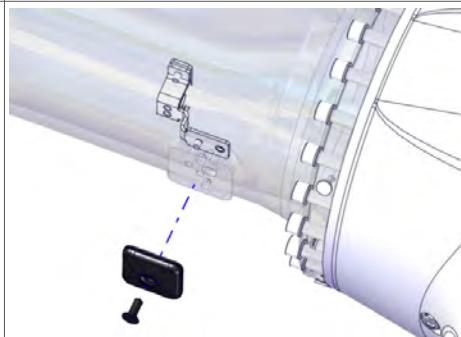
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4.5.6 Replacing the complete lower arm

Continued

Action	Note
2 Unscrew the attachment screws with washers and remove the motor cover.	
3 Make sure the o-ring is not lost.	
4 Disconnect the motor cables.	
5 Remove the cable gland cover. Inspect the gasket. 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.	
6 Use caution and pull out the motor cables.	

Removing the cable harness in the upper arm

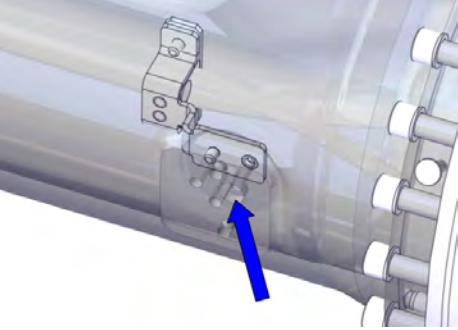
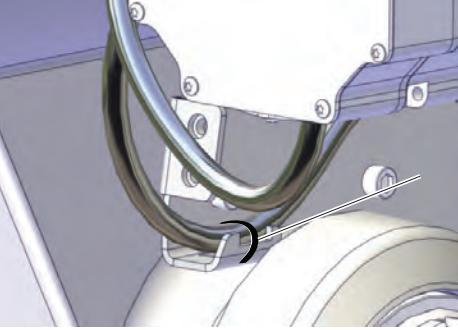
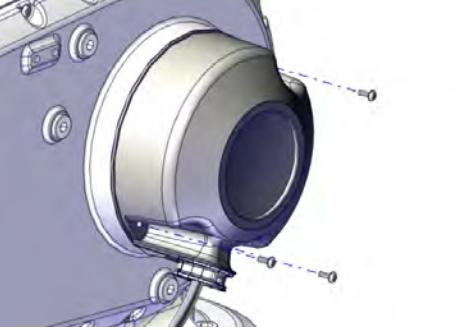
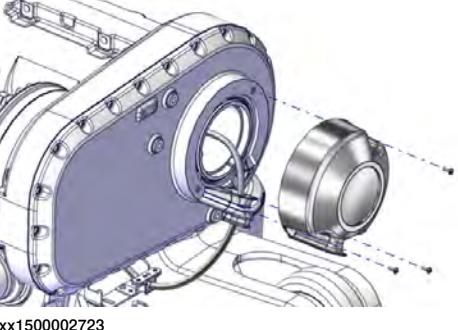
Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Unscrew the screw that hold the cable clamp.	 xx1500002718
3 Remove the protection cover. Make sure not to damage the surface exposed.	 xx1500002719

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4 Repair

4.5.6 Replacing the complete lower arm

Continued

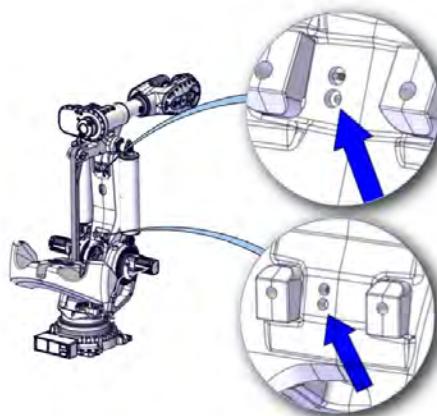
	Action	Note
4	<p>Unscrew the nut holding the bracket inside the upper arm.</p> <p> Note The nut is reached from the outside.</p>	 xx1500002720
5	Cut the cable tie.	 xx1500002721
6	Unscrew the screws that secure the cover.	 xx1500002722
7	Remove the cover.	 xx1500002723
8	Use caution and remove the cable harness out of the upper arm.	

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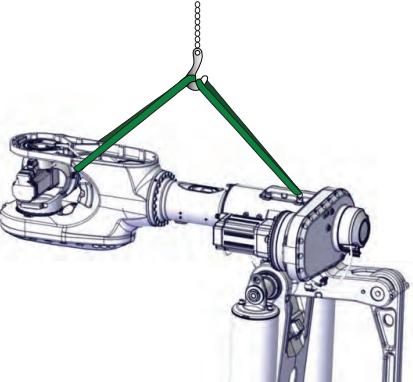
4.5.6 Replacing the complete lower arm

Continued

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	 Note If not already done, unscrew the screws that hold the two cable brackets inside the lower arm. The screws are reached from the outside.	 xx1500002695
3	Use caution and remove the cable harness from the lower arm.	

Removing the shafts

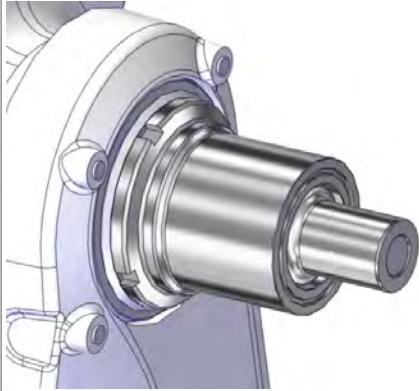
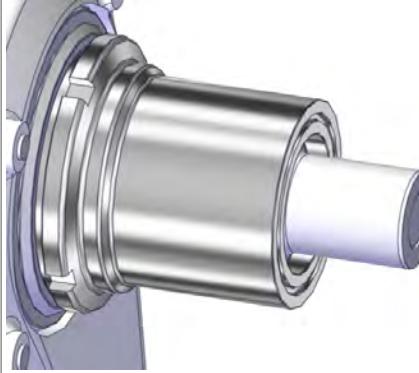
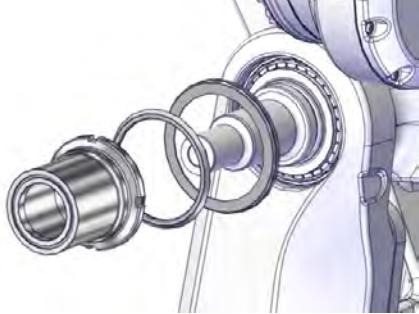
	Action	Note
1	Before continuing, make sure that the upper arm is secured in the lifting accessories and overhead crane.	 xx1500002724
2	 CAUTION The upper arm including the wrist weighs approximately 900 kg. All lifting accessories must be sized accordingly.	

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4 Repair

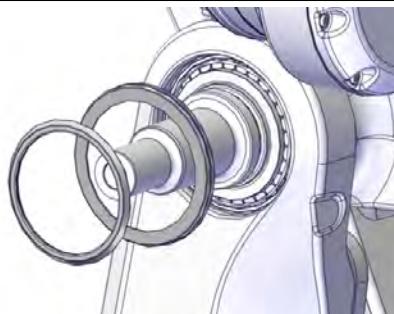
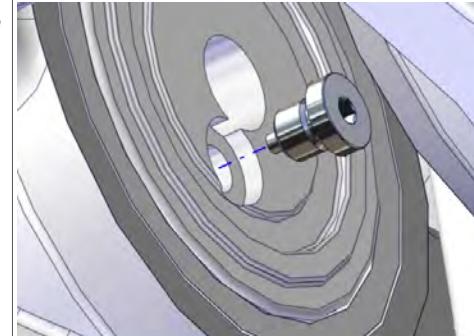
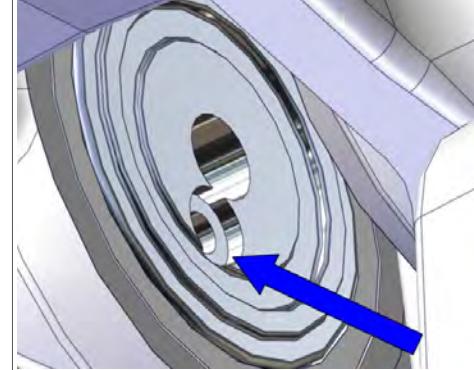
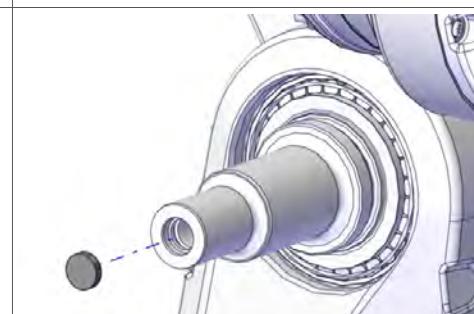
4.5.6 Replacing the complete lower arm

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: 3HAC038174-067  xx1500002726
5 Use the Sleeve KM nut, open and remove the KM nut on the <i>other side</i> .  Note Make sure not to lose gamma sealing and sealing ring.	 xx1500002727
6  Note Continue the removal on the same side until the shaft is removed completely. Leave the other shaft fitted for now!	

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4.5.6 Replacing the complete lower arm
Continued

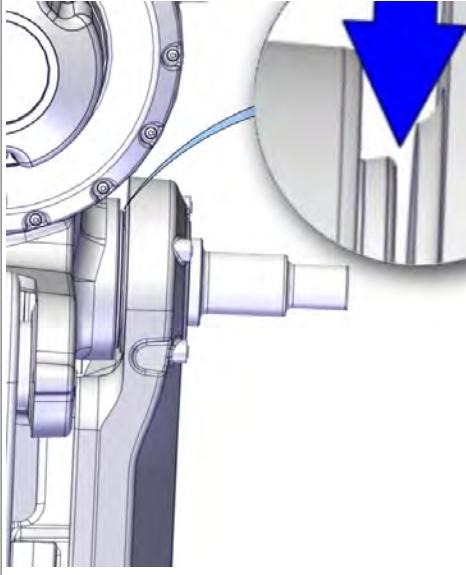
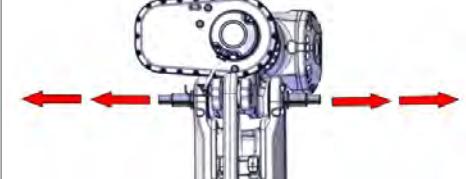
Action	Note
7 Remove gamma sealing and sealing ring.	 xx1500002728
8 Remove the magnetic plug and wipe hole and shaft end meticulously clean.	 xx1500003125
9 Attach the Glycerine adapter.  Note Tighten the adapter very hard in order to avoid leakage.	Glycerine adapter  xx1600000081
10 Remove the small VK cover.	 xx1500002729

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4 Repair

4.5.6 Replacing the complete lower arm

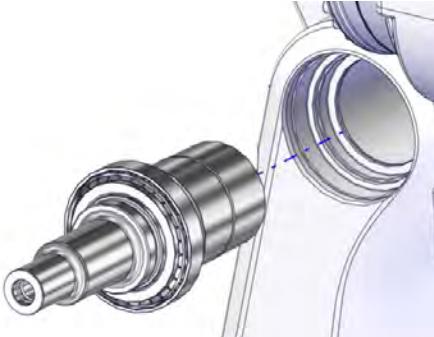
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Action	Note
11 Attach a 2.5 mm shim between lower and upper arm, on the same side as the shaft being removed.	Horseshoe shims 2.5 mm: 3HAC038174-063  xx1600000076
12 Attach the removal tool.  Tip How to use the removal tool is described in the instruction 3HAC056526-002 delivered with the tool.	Removal tool 3HAC056095-003 Set of tools. Instruction 3HAC056526-002 enclosed.
13  CAUTION The shaft, including the removal tool, weighs approximately 25 kg.	
14 Secure the shaft and the removal tool to the upper arm using lifting eyes and a short roundsling. This is done as a safety precaution.  Tip How to secure removal tool and shaft, is described in the instruction 3HAC056526-002 delivered with the tool.	
15  CAUTION Do not stand close to the robot on any side when the shaft is being removed.	 xx1600000077

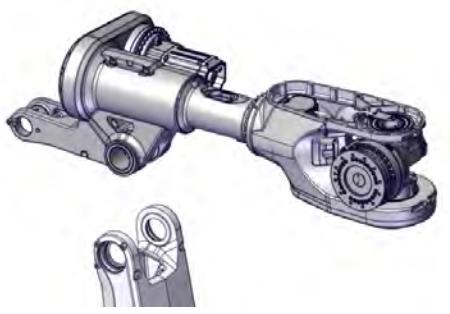
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4.5.6 Replacing the complete lower arm

Continued

Action	Note
16 Use caution and press the shaft out, using both the glycerine and hydraulic press tools: 1 Pump up the glycerine pump to 500 bar. 2 Pump up the hydraulic pump to 500 bar. 3 Use caution and continue pumping up the pressure of the glycerine pump until the shaft is loose.	 xx1500002731
17 Remove the other shaft in the same way.	

Removing the upper arm complete

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.	
3 Use caution and lift the upper arm complete off.	 xx1500002732
4 Put the upper arm complete down on two pallets.	Pallet (2 pcs)

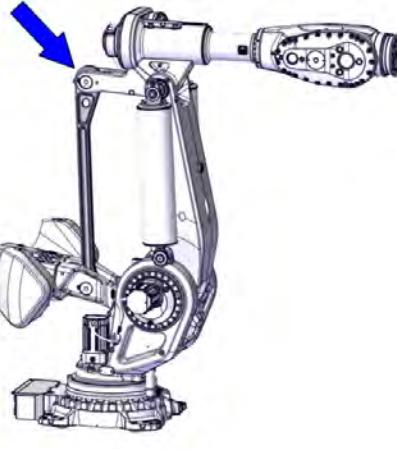
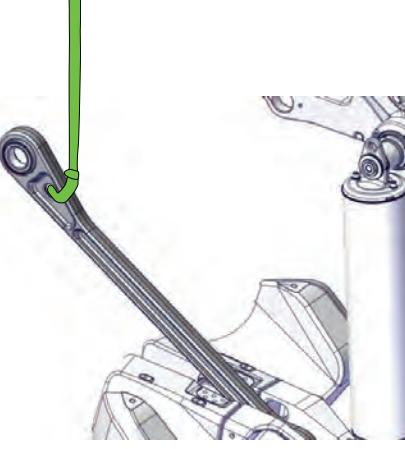
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4 Repair

4.5.6 Replacing the complete lower arm

Continued

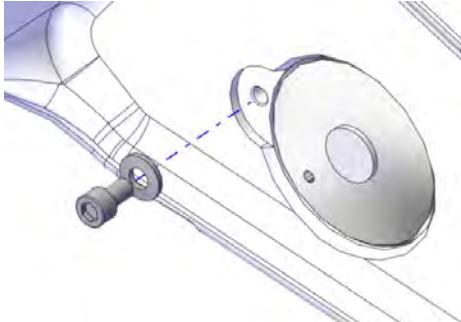
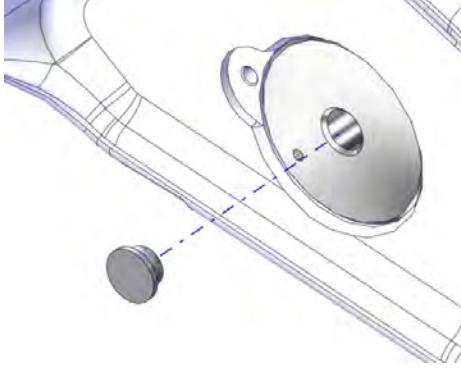
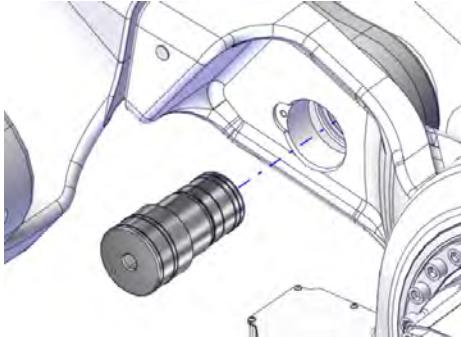
Removing the parallel rod, lower end

	Action	Note
1	 Note If the parallel rod shall be removed from the robot, always disassemble the upper end first.	 xx1500002736
2	 CAUTION The parallel rod weighs 55 kg. All lifting accessories used must be sized accordingly.	
3	Attach a roundsling, looped through the parallel rod and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg  xx1500002698
4	Stretch the roundsling to start taking the weight of the parallel rod.	

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4.5.6 Replacing the complete lower arm

Continued

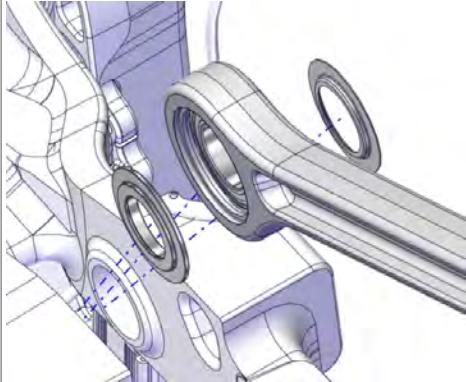
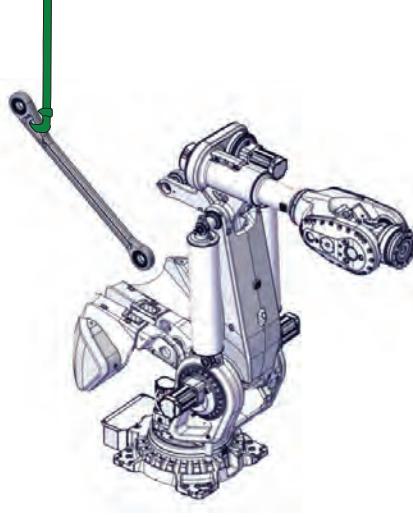
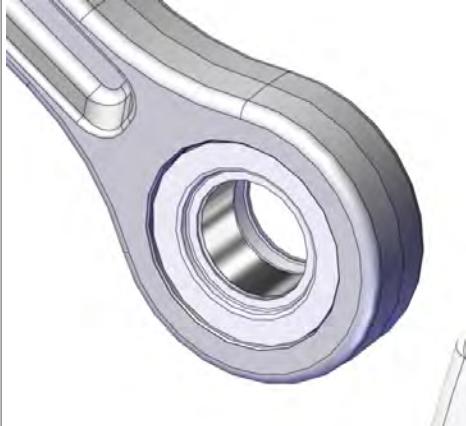
Action	Note
5 Remove the attachment screw with washer that secure the rod shaft.	 xx1500001966
6 Remove the protection plug.  Note Keep the protection plug. It shall be refitted when the work is done.	 xx1500001968
7 Apply the press tool parts (Assembly tool, Press plate and Round plate).	
8 Use the press tool and press the shaft out.	 xx1500001969

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4 Repair

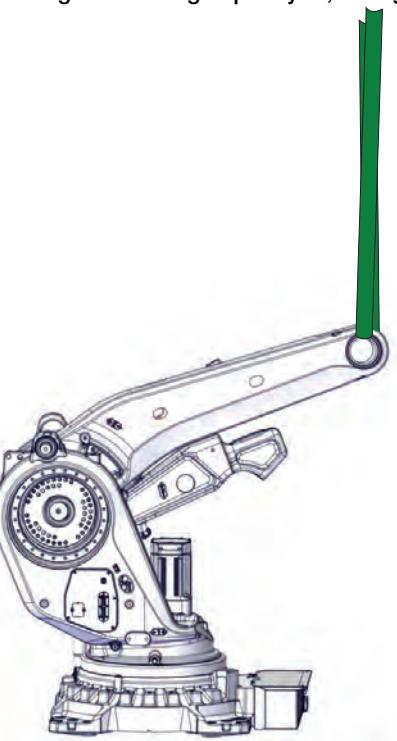
4.5.6 Replacing the complete lower arm

Continued

Action	Note				
<p>9 Make sure the thrust washer and cover washer on either side of the bearing are present.</p> <p> Tip</p> <p>Make a note on which side the respective washer is fitted, for a correct assembly later.</p>	 <p>xx1500002098</p> <table border="1"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side				
Thrust washer	Cover washer				
10 Use caution and lift the parallel rod off.	 <p>xx1500002745</p>				
11 Secure bearing, thrust washer and cover washer with a strap (or similar), to prevent them from dropping out of its position.	 <p>Strap</p> <p>xx1500002099</p>				

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Preparations of axis-2 before lifting the lower arm complete off

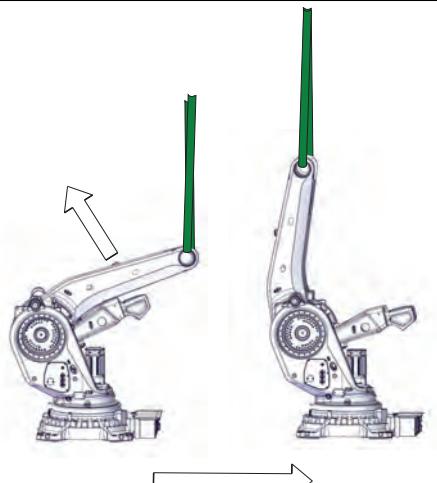
Action	Note
1  CAUTION The lower arm complete weighs 600 kg. All lifting accessories used must be sized accordingly!	
2 Attach a roundsling to the lower arm and to an overhead crane (or similar), with the robot in the current position.	Roundsling 2 m: Lifting capacity: 2,000 kg  xx1500002708
3 Stretch the lifting accessories to take the weight of the lower arm.	
4 To release the brakes on axis-2, connect the 24 VDC power supply. Connect to connector R2.MP2: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	

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4 Repair

4.5.6 Replacing the complete lower arm

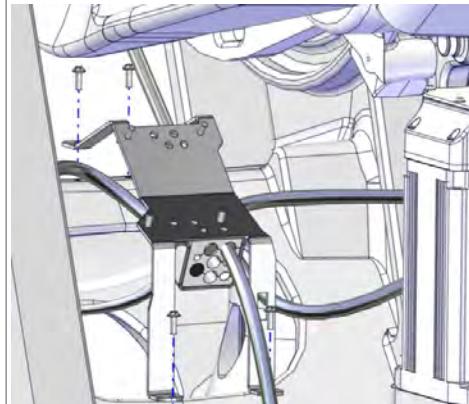
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Action	Note
5 Release the brakes on axis-2 and with the help of an overhead crane, lift the lower arm up as close as possible to calibration position.	

Unscrewing the axis-1 bracket

In order to protect the lower end of the cable harness, the axis-1 bracket shall be removed with the cable harness still attached to it.

 Note
There is no need to disconnect the motor cables to axis-1, 2 and 3 motors or to the SMB unit.

Action	Note
1 Unscrew the attachment screws that secure the axis-1 bracket. Leave the cables attached!	 xx1500002372
2 Remove the cable harness in the base.	

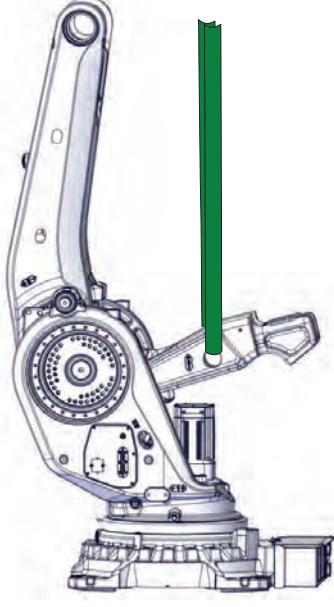
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4.5.6 Replacing the complete lower arm

Continued

Preparations of axis-3 before lifting away the lower arm complete

The lower arm complete consists of lower arm and parallel arm together.

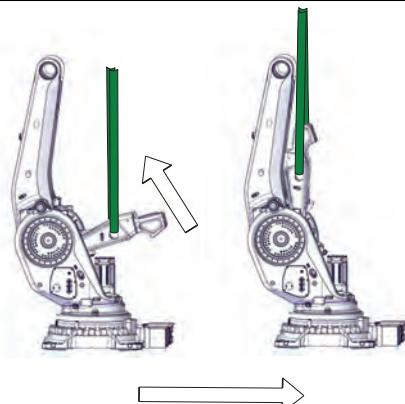
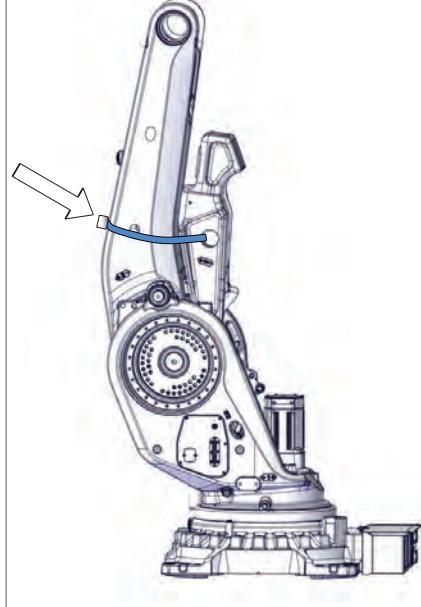
	Action	Note
1	Attach a roundsling to the parallel arm and to an overhead crane (or similar).	Roundsling 2 m: Lifting capacity: 2,000 kg  xx1500002707
2	CAUTION The parallel arm weighs 255 kg. All lifting accessories used must be sized accordingly!	
3	Stretch the lifting accessories to take the weight of the parallel arm.	
4	To release the brakes on axis-3, connect the 24 VDC power supply. Connect to connector R2.MP3: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	

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4 Repair

4.5.6 Replacing the complete lower arm

Continued

Action	Note
5 Use caution, release the brakes on the axis-3 and lift the parallel arm up as close as possible against the lower arm.	 xx1500002706
6 Secure the parallel arm to the lower arm with a Endless ratchet lashing belt.	Endless ratchet lashing belt  xx1500002709
7 With the brakes still released on axis-3, use the ratchet belt and manually move the parallel arm the last bit against the lower arm. Secure with the ratchet belt.	
8 Remove the 24 VDC power supply.	
9 Remove the lifting accessory from the parallel arm.	

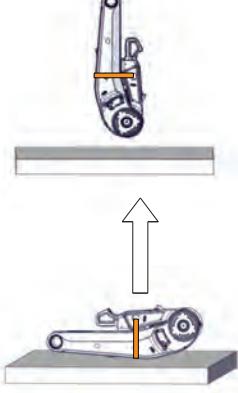
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4.5.6 Replacing the complete lower arm

Continued

Attaching lifting accessories, lower arm complete

The lower arm complete consists of lower arm and parallel arm together.

	Action	Note
1	 CAUTION The lower arm complete weighs 600 kg. All lifting accessories used must be sized accordingly!	
2	 DANGER Make sure that the parallel arm is secured to the lower arm with an Endless ratchet lashing belt to prevent the parallel arm from falling down uncontrolled, when the lower arm complete is lifted up.	Endless ratchet lashing belt
3	Attach a roundsling to the lower arm complete and to an overhead crane (or similar). Attach the roundsling through the holes, in the upper ends of the lower arm and parallel arm.	Roundsling 2 m: Lifting capacity: 2,000 kg
4	Use caution and lift the lower arm complete up to a vertical position.	 xx1500002739

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4 Repair

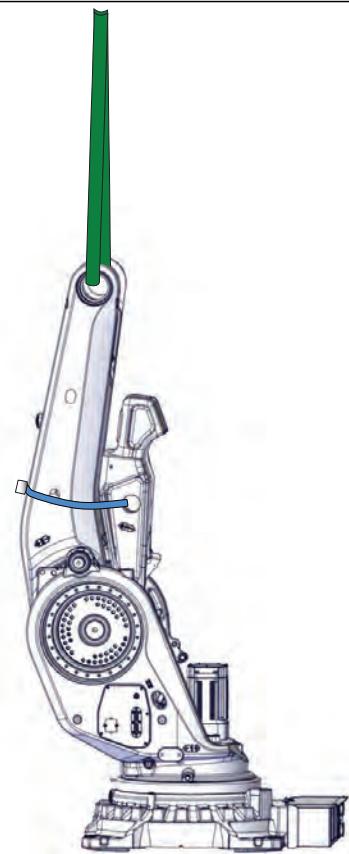
4.5.6 Replacing the complete lower arm

Continued

Action	Note
5 Use caution and move the lower arm complete into mounting position.	 xx1500002700

Removing the lower arm complete

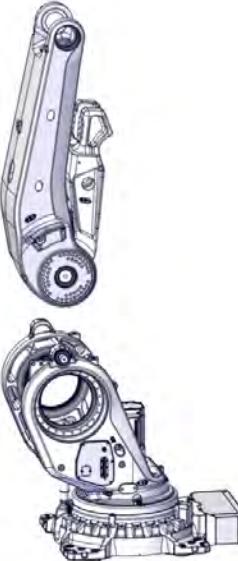
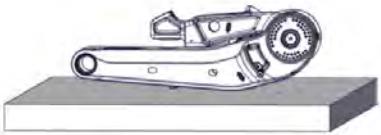
The lower arm complete consists of lower arm and parallel arm together.

Action	Note
1 Make sure that the lower arm complete is attached to the lifting accessories.	 xx1500002733

Continues on next page

4.5.6 Replacing the complete lower arm

Continued

Action	Note
2  DANGER Make absolutely sure that the parallel arm is secured against the lower arm with a ratchet lashing belt.	
3 Unscrew the remaining attachment screws that secure the lower arm to the axis-2 gearbox and the parallel arm to the axis-3 gearbox.	
4 Use a Crowbar (small) (or similar), and press the lower arm and parallel arm together as much as possible.	Crowbar (small)
5 Use caution and lift the lower arm complete off.	 xx1500002700
6 Put the complete lower arm down on two pallets.  Tip Put a piece of wood underneath the lower arm to avoid the plastic cover, fitted on the calibration surface, from being damaged.	Pallet (2 pcs)  xx1500002701
7 Remove the lifting accessories.	

Continues on next page

4 Repair

4.5.6 Replacing the complete lower arm

Continued

Refitting the lower arm complete

Use these procedures to refit the parallel arm.

Preparations

	Action	Note
1	Wipe clean all contact surfaces on parallel arm, lower arm and frame.	

Attaching lifting accessories, lower arm complete

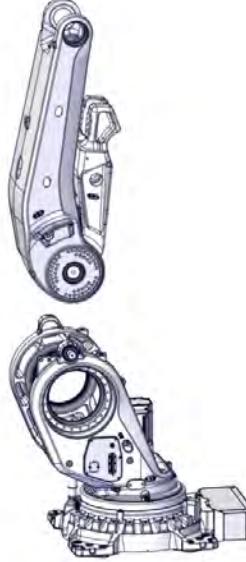
The lower arm complete consists of lower arm and parallel arm together.

	Action	Note
1	 CAUTION The lower arm complete weighs 600 kg. All lifting accessories used must be sized accordingly!	
2	 DANGER Make sure that the parallel arm is secured to the lower arm with an Endless ratchet lashing belt to prevent the parallel arm from falling down uncontrolled, when the lower arm complete is lifted up.	Endless ratchet lashing belt
3	Attach a roundsling to the lower arm complete and to an overhead crane (or similar). Attach the roundsling through the holes, in the upper ends of the lower arm and parallel arm.	Roundsling 2 m: Lifting capacity: 2,000 kg
4	Use caution and lift the lower arm complete up to a vertical position.	 xx1500002739

Continues on next page

4.5.6 Replacing the complete lower arm

Continued

Action	Note
5 Use caution and move the lower arm complete into mounting position.	 xx1500002700

Refitting the lower arm complete - step 1

The lower arm complete consists of lower arm and parallel arm together.

Action	Note
1 Find the hole pattern between lower arm and axis-2 gearbox, as well as between parallel arm and axis-3 gearbox. Make sure that all reachable screwholes will match, before refitting the attachment screws.  Tip Use caution and release the brakes if the hole pattern is not matching.	
2 Refit attachment screws in all holes possible to reach in this position.  Note Make sure not to torque the screws until all screws match.	Attachment screws: M16x70 12.9 Gleitmo
3 Secure the attachment screws.	Tightening torque: 300 Nm
4 Remove the endless ratchet lashing belt.	

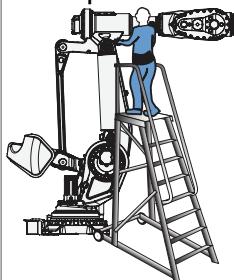
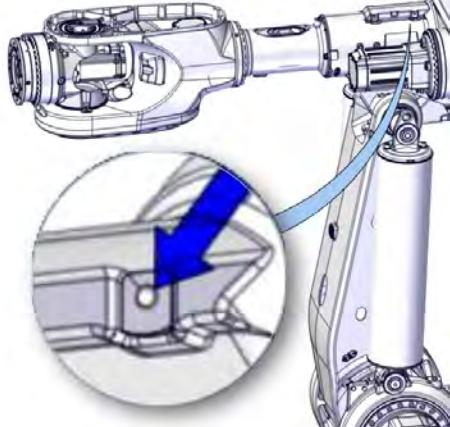
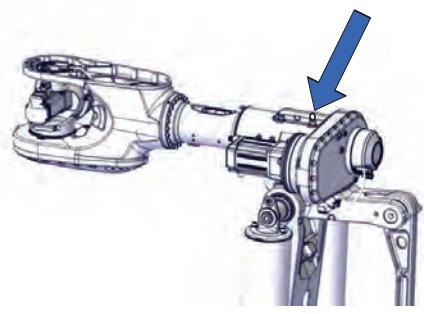
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4 Repair

4.5.6 Replacing the complete lower arm

Continued

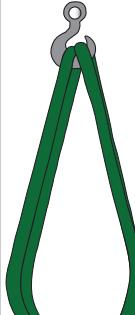
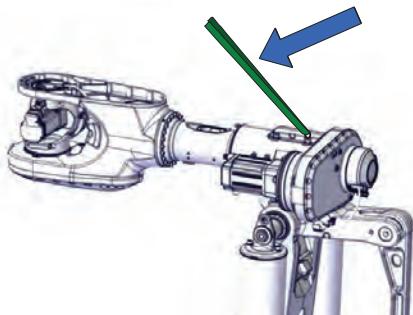
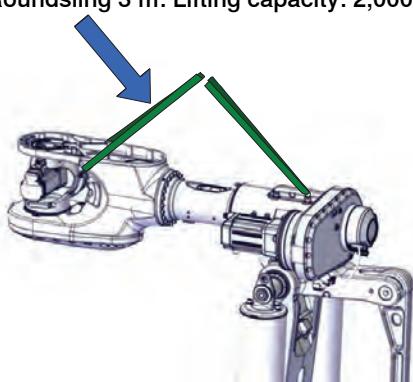
Attaching lifting accessories to the upper arm complete

Action	Note
<p>1  CAUTION The complete upper arm weighs 900 kg. All lifting accessories used must be sized accordingly.</p>	
<p>2 <i>Only needed when the upper arm is fitted on the robot:</i> Use a Mobile platform ladder (or similar) to attach the lifting accessories.</p> <p> DANGER Never use the robot as ladder.</p>	 xx1500001985
<p>3 Remove the plastic plug in the hole shown in the figure.</p>	 xx1500002712
<p>4 Attach a Lifting eye to the hole in the arm housing with a Fender washer underneath.</p>  xx1400002196	<p>Lifting eye: M12 Fender washer: Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.</p>  xx1500002715

Continues on next page

4.5.6 Replacing the complete lower arm

Continued

Action	Note
5 Attach a roundsling looped to the Lifting eye and to an overhead crane (or similar).  xx1400002599	Roundsling 2.5 m: Lifting capacity: 2,000 kg  xx1500002713
6 Attach a roundsling looped to the wrist and to an overhead crane (or similar).	Roundsling 3 m: Lifting capacity: 2,000 kg  xx1500002714
7 Stretch the lifting accessories to take the weight of the upper arm.	
8 <i>Only needed when the upper arm is fitted on the robot:</i> In order to release the brakes, connect the 24 VDC power supply. Connect connector R2.MP2: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	
9 <i>Only needed when the upper arm is fitted on the robot:</i> Release the brakes on axis-2 to be sure that the lifting accessories are taking the weight of the upper arm.	
10 Adjust the lifting accessories, if needed.	

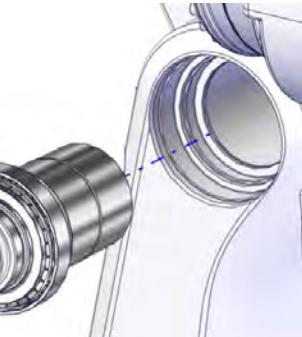
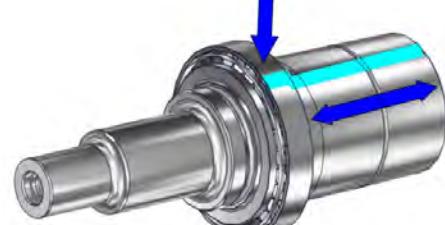
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4 Repair

4.5.6 Replacing the complete lower arm

Continued

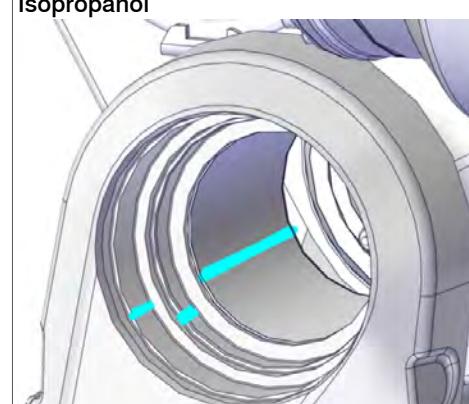
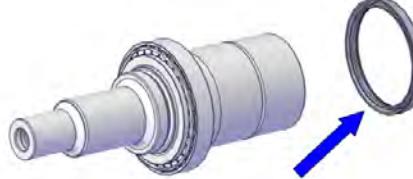
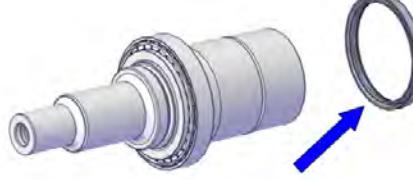
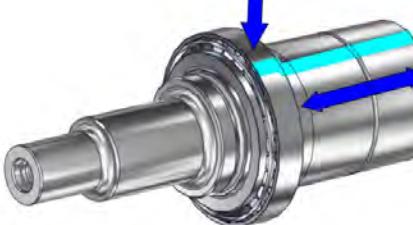
Preparations before refitting the shafts

	Action	Note
1	Remove residues of Loctite and other contamination from the shaft and in the hole where the shaft shall be refitted.	 xx1500002731
2	Use a Scotch-brite abrasive cleaning hand pad and rub the contact surfaces on shaft and outer ring of bearing.	Scotch-brite abrasive cleaning hand pad  xx1500002749
3	Use a Scotch-brite abrasive cleaning hand pad and rub the contact surfaces in the hole for shaft, outer ring of bearing and sealing ring.	Scotch-brite abrasive cleaning hand pad  xx1500002750

Continues on next page

4.5.6 Replacing the complete lower arm

Continued

Action	Note
4 Wipe the surfaces for shaft, outer ring of bearing and sealing ring meticulously clean, with Isopropanol.  Note Do not touch the cleaned surfaces with anything after cleaning.	Isopropanol  xx1500002750
5 Inspect the sealing ring. Replace if damaged.	 xx1500002748
6 Wipe the sealing ring clean with Isopropanol.	Isopropanol  xx1500002748
7 Wipe the contact surfaces on shaft and outer ring of bearing meticulously clean with Isopropanol.  Note Do not touch the cleaned cone surface of the shaft with anything after cleaning.	Isopropanol  xx1500002749
8 Use caution and attach the sealing ring onto the shaft.	

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4 Repair

4.5.6 Replacing the complete lower arm

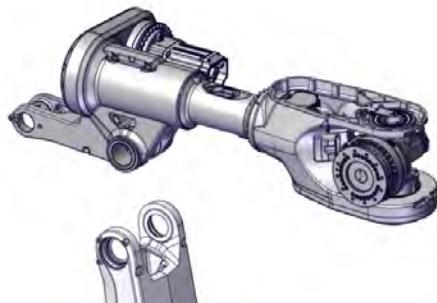
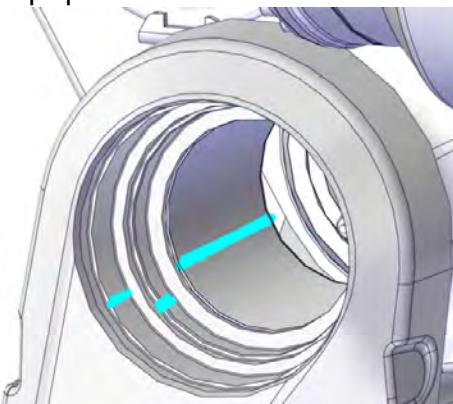
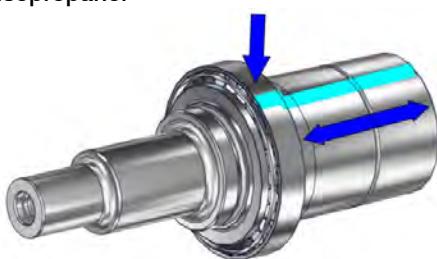
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Refitting the shaft



Note

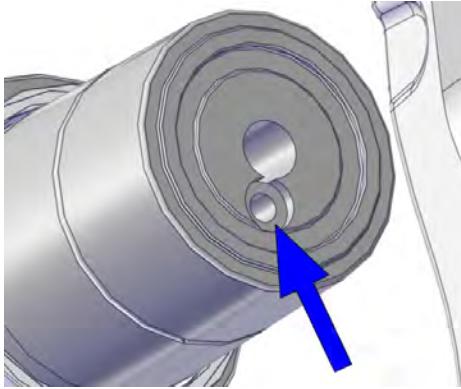
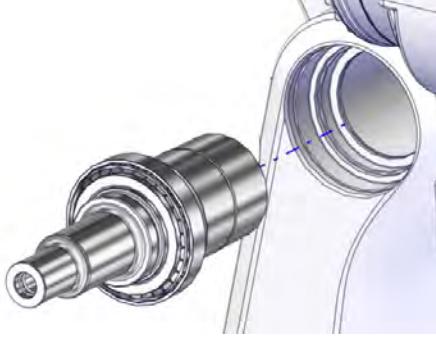
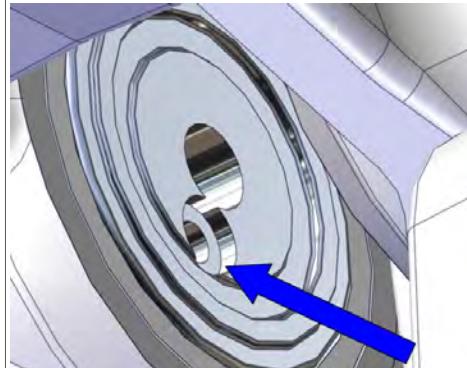
Start the refitting of the shafts on the axis-3 side!

	Action	Note
1	Fill the bearing with grease.	Tribol GR 100-2 PD
2	Lift the upper arm into mounting position.	 xx1500002732
3	 CAUTION The upper arm complete weighs 900 kg. All lifting accessories used must be sized accordingly!	
4	Wipe the contact surfaces in the upper arm, meticulously clean, with Isopropanol.  Note Do not touch the cleaned cone surface of the shaft with anything after cleaning.	 Isopropanol xx1500002750
5	Wipe the contact surfaces on shaft, outer ring of bearing and sealing ring meticulously clean with Isopropanol.  Note Do not touch the cleaned cone surface of the shaft with anything after cleaning.	 Isopropanol xx1500002749

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4.5.6 Replacing the complete lower arm

Continued

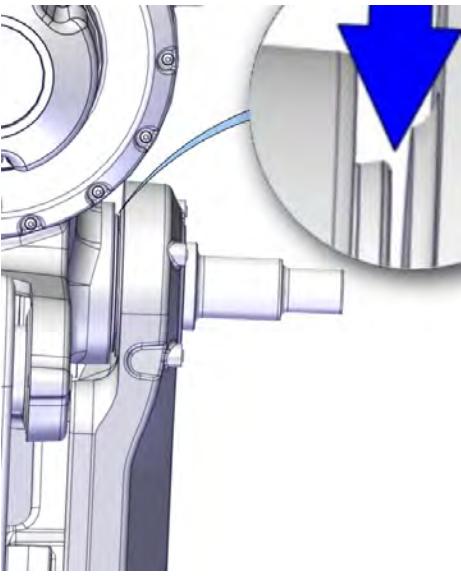
	Action	Note
6	<p> Note</p> <p>Make sure that the hole for the Glycerine adapter on the shaft, will be facing as low as possible.</p>	 <p>xx1500002979</p>
7	<p> CAUTION</p> <p>The shaft weighs 19 kg.</p>	
8	<p>Use caution and lift the shaft into mounting position.</p> <p> Note</p> <p>Do not touch the surfaces cleaned with Isopropanol.</p>	 <p>xx1500002731</p>
9	Wipe the Glycerine adapter connection meticulously clean.	Glycerine adapter
10	<p>Attach the Glycerine adapter.</p> <p> Note</p> <p>Tighten the adapter very hard in order to avoid leakage.</p>	 <p>xx1600000081</p>

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4 Repair

4.5.6 Replacing the complete lower arm

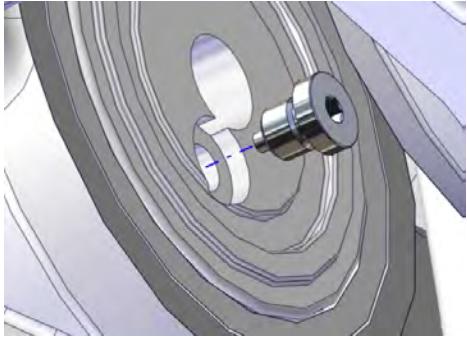
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Action	Note
11 Put a 2.5 mm horseshoe shim between lower and upper arm, on the axis-3 side.  Note Leave the shim in this position also when the axis-2 shaft is fitted.	Horseshoe shim 2.5 mm: 3HAC038174-063  xx1600000076
12 Attach a pull bar to the part of the press tool at the Glycerine adapter.	
13 Attach the assembly tool.  Tip How to use the assembly tool is described in the instruction 3HAC056526-002 delivered with the tool.	Assembly tool 3HAC056095-002 Set of tools. Instruction 3HAC056526-002 enclosed.
14 Put the hydraulic pump onto the pull bar.	
15 Manually tighten the adjustment nut against the hydraulic cylinder.	
16 Tighten the adjustment nut.	Tightening torque: 20 Nm
17 Attach a Dial gauge and put it in zero position.	Dial gauge
18 Use the assembly tool and the Glycerine adapter and press the shaft in 3.5 mm ±0.15.	
19 Wait one minute.	
20 Release the glycerine pressure.	
21 Wait one minute.	
22 Release the hydraulic pressure.	
23 Make sure the value 3.5 mm remains. If not, retighten the shaft as described above.	
24 Remove the hydraulic and glycerine tools.	

Continues on next page

4.5.6 Replacing the complete lower arm

Continued

Action	Note
25 Refit the magnetic plug.	 xx1500003125
26 Refit the other shaft by repeating the procedure.  Note Leave the horseshoe shim fitted on the axis-3 side also when fitting the axis-2 shaft! Do not move the shim or attach another one on the axis-2 side.	

Refitting the KM nut - axis-3 side

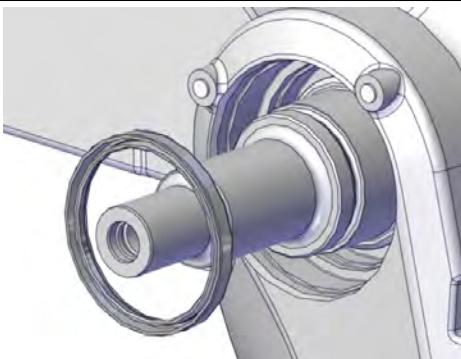
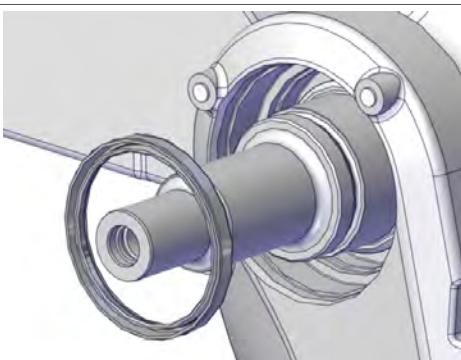
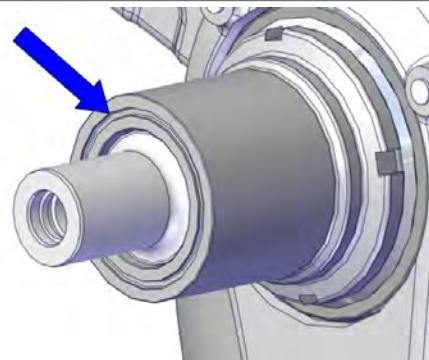
Action	Note
1 Inspect the pre-mounted gamma sealing on the KM nut.	 xx1600000083

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4 Repair

4.5.6 Replacing the complete lower arm

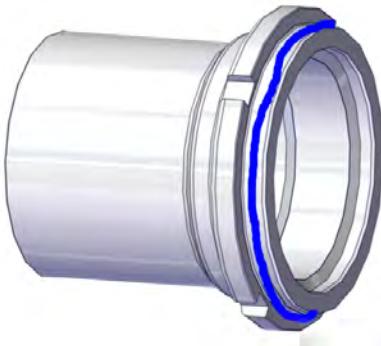
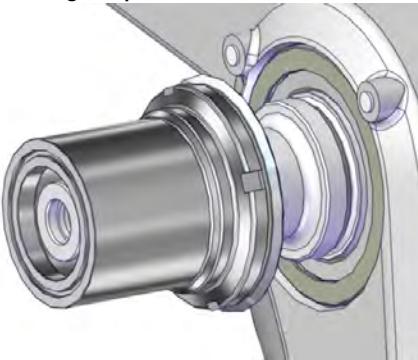
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Action	Note
2 Inspect sealing ring.	 xx1600000084
3 Refit sealing ring.	 xx1600000084
4 Wipe clean the KM nut.	 xx1600000193
5 Wipe clean the o-ring in the KM nut.	
6 Attach the o-ring in its groove in the KM nut.  Tip Put a little grease on the o-ring for a better fitting.	 xx1600000188

Continues on next page

4.5.6 Replacing the complete lower arm

Continued

	Action	Note
7	Apply locking liquid on the threads and refit the KM nut.	Loctite 243  xx1600000192
8	Secure the KM nut with the Sleeve KM nut.	Sleeve KM nut D=152 L=220: 3HAC038174-067 Tightening torque: 300 Nm  xx1600000187
9	Wipe the shaft clean.	
10	Attach the attachment of the dial gauge in the holes on the axis-3 side, with the dial gauge against the axis-2 side.	Dial gauge

Refitting the KM nut - axis-2 side

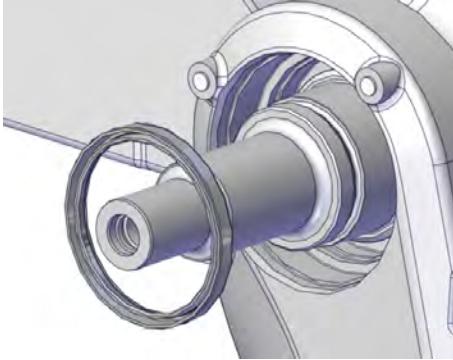
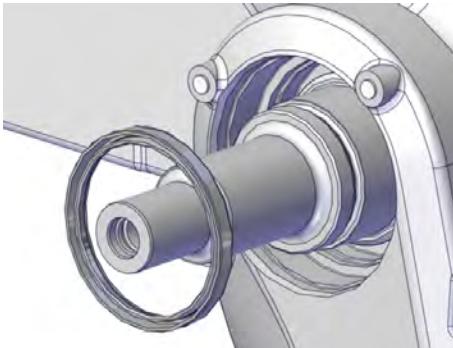
	Action	Note
1	 Note Leave the 2.5 mm hoseshoe shim fitted on the axis-3 side, when refitting the KM nut on the axis-2 side. Do not remove or add another shim!	

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4 Repair

4.5.6 Replacing the complete lower arm

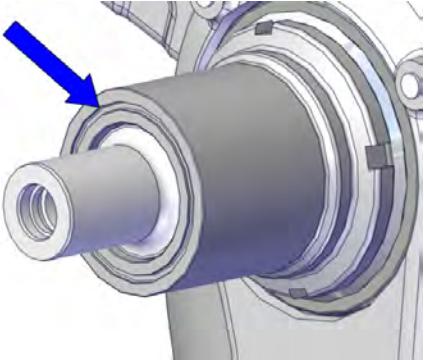
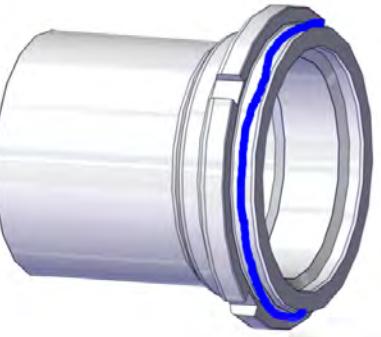
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Action	Note
2 Inspect the pre-mounted gamma sealing on the KM nut.	 xx1600000083
3 Inspect sealing ring.	 xx1600000084
4 Refit sealing ring.	 xx1600000084
5 Wipe clean the KM nut.	 xx1600000193
6 Wipe clean the o-ring in the KM nut.	

Continues on next page

4.5.6 Replacing the complete lower arm

Continued

Action	Note
7 Attach the o-ring in its groove in the KM nut. Tip Put a little grease on the o-ring for a better fitting.	 xx1600000188
8 Apply locking liquid on the threads and refit the KM nut.	Locking liquid: Loctite 243  xx1600000192
9 Make sure that the dial gauge attachment is fitted.	
10 Secure the axis-2 KM nut with the Sleeve KM nut, until the dial gauge shows 0.38 mm.	Sleeve KM nut D=152 L=220: 3HAC038174-067
11 Wipe the shaft end clean.	
12 Remove the horseshoe shim.	

Refitting the cable harness in the lower arm

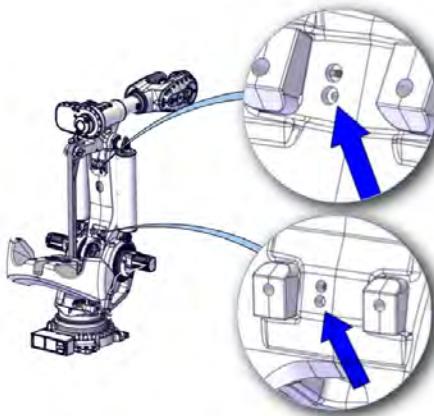
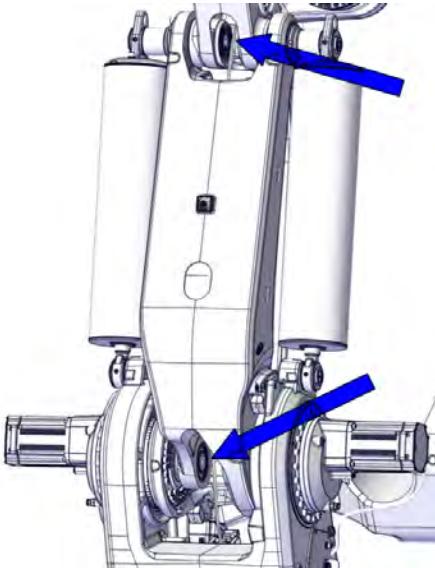
Action	Note
1 Run the cable harness up through the lower arm.	
2  Note Make sure the cable harness is rotated one revolution between the upper and lower bracket inside the lower arm, when refitted.	

Continues on next page

4 Repair

4.5.6 Replacing the complete lower arm

Continued

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

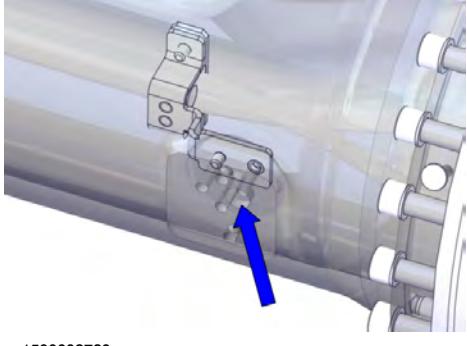
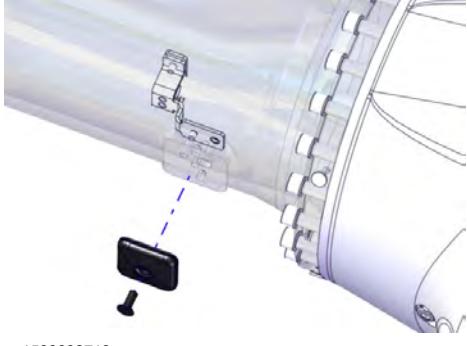
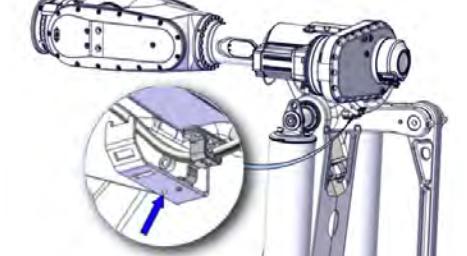
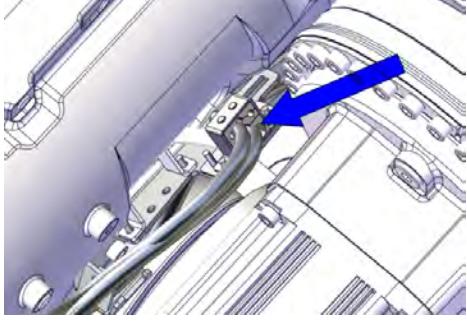
Refitting the cable harness in the upper arm

Action	Note
1 Carefully push the cable harness in through the upper arm and out off the wrist.	

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4.5.6 Replacing the complete lower arm

Continued

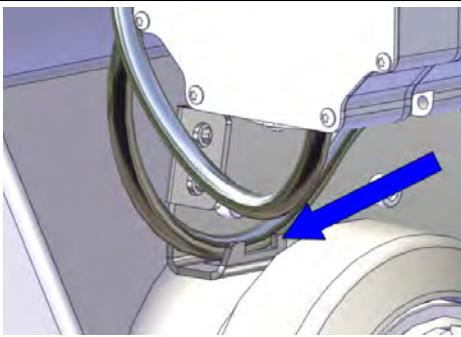
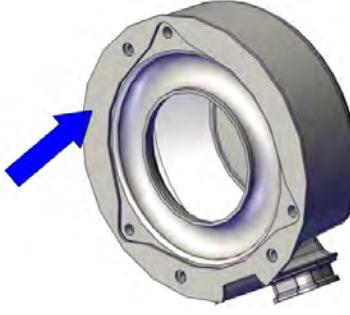
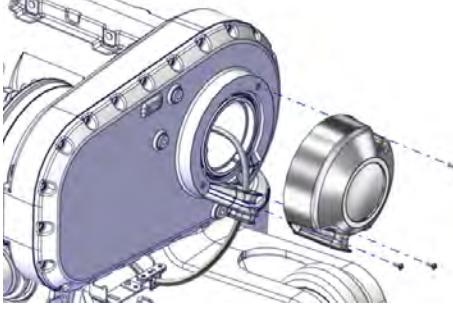
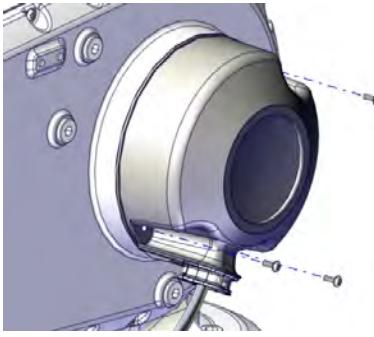
	Action	Note
2	<p>Refit the cable clamp inside the upper arm.</p> <p>Note The nut is attached from the outside.</p>	<p>Nut: M6</p>  <p>xx1500002720</p>
3	Refit the protection cover.	<p>Attachment screw: M8</p>  <p>xx1500002719</p>
4	Refit the cable clamp on the axis-3 bracket.	 <p>xx1500002718</p>
5	Refit the cable clamp on the axis-3 bracket, between axis-4 motor and arm housing.	 <p>xx1500003092</p>

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4 Repair

4.5.6 Replacing the complete lower arm

Continued

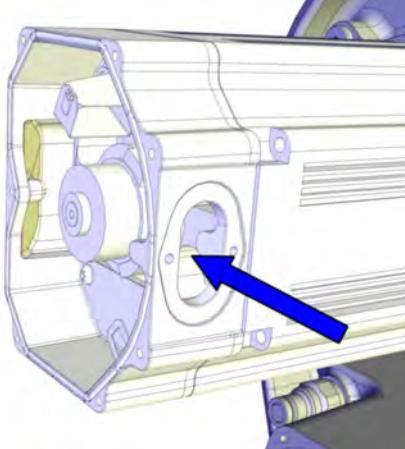
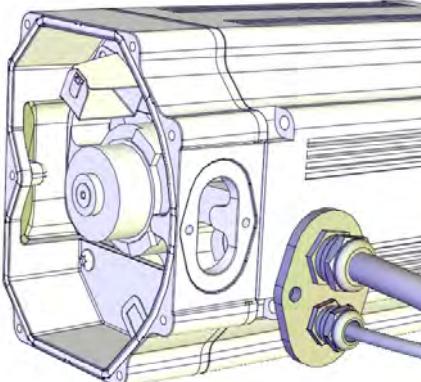
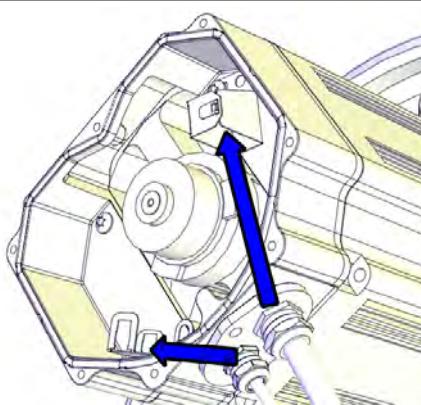
Action	Note
6 Secure the cable harness with a cable tie.	 xx1500003093
7 Make sure that the gasket on the cover is correctly fitted.  Note Replace if damaged. The gasket is covered with adhesive on the side facing the upper arm cover. The three washers are pressed into the holes in the gasket. Make sure all three washers are fitted.	 xx1500003094
8 Refit the cable guide, if it has been removed.	 xx1500002723
9 Refit the cover.	 xx1500002722

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4.5.6 Replacing the complete lower arm

Continued

Connecting the axis-4 motor cables

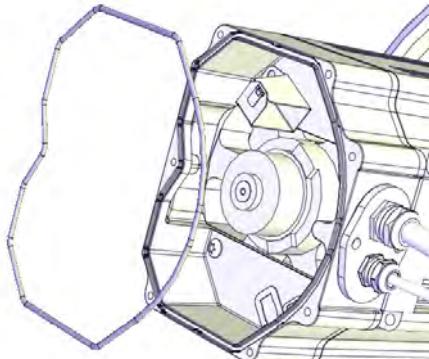
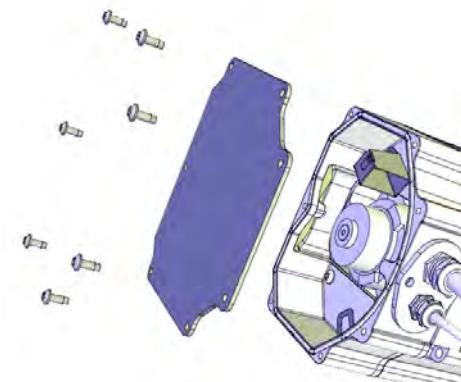
	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1300000738
2	Refit the cable gland cover. Note Replace the gasket if damaged.	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066

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4 Repair

4.5.6 Replacing the complete lower arm

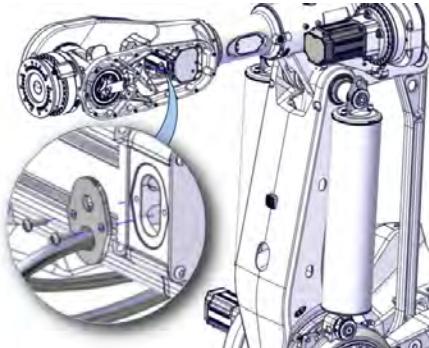
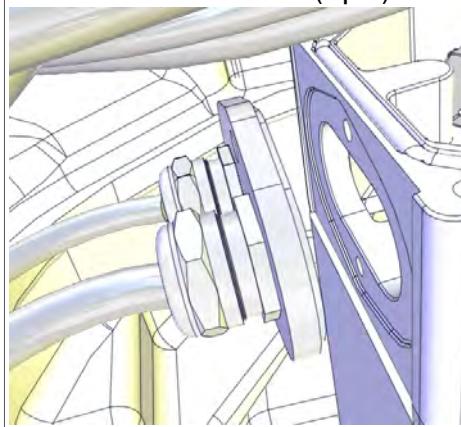
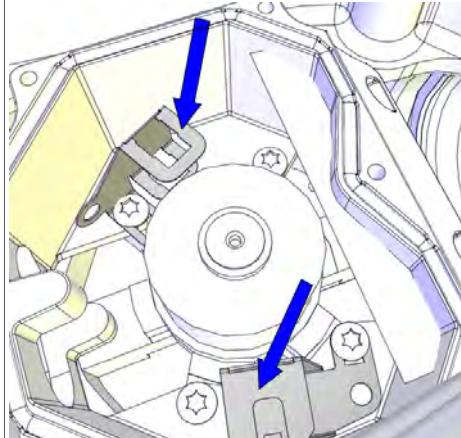
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Action	Note
4 Inspect the o-ring. Note Replace if damaged.	O-ring: 3HAC054692-002  xx1200001070
5 Wipe clean o-ring and o-ring groove.	
6 Refit the o-ring.	
7  CAUTION When refitting the motor cover, make sure none of the cables inside will be damaged.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

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4.5.6 Replacing the complete lower arm Continued

Connecting the axis-5 motor cables

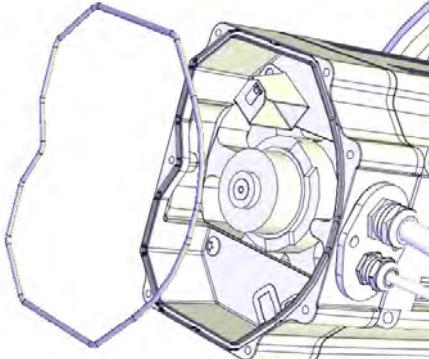
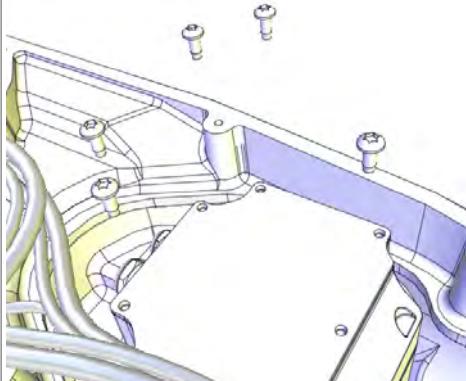
	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1500002717
2	Refit the cable gland cover. Note Replace the gasket if damaged.	Attachment screws: M5x16 (2 pcs)  xx1200001016
3	Connect the connectors. Connect in accordance with the markings on the connectors.	 xx1200001015

Continues on next page

4 Repair

4.5.6 Replacing the complete lower arm

Continued

Action	Note
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 (6 pcs)  xx1200001013
7 Make sure that the cover is tightly sealed.	

Connecting the axis-6 motor cables - Step 1



Note

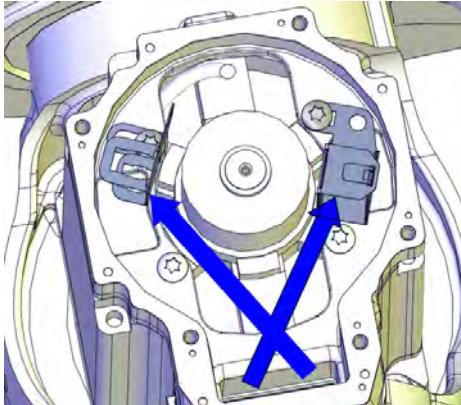
Since it in this procedure is needed to keep the axis-5 in -90° position to get the most stable position for removal and refitting, the connecting and refitting of the axis-6 motor cables must be done in two steps. This procedure describes the first of these steps.

Action	Note
1 With axis-5 in -90° position, use caution and temporarily connect the axis-6 motor cables outside the motor.	

Continues on next page

4.5.6 Replacing the complete lower arm

Continued

Action	Note
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.	
2  DANGER Turn off all: <ul style="list-style-type: none">• 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.	

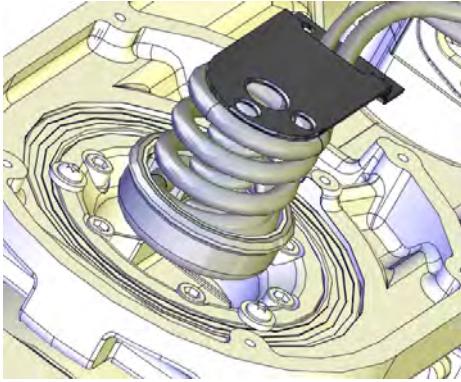
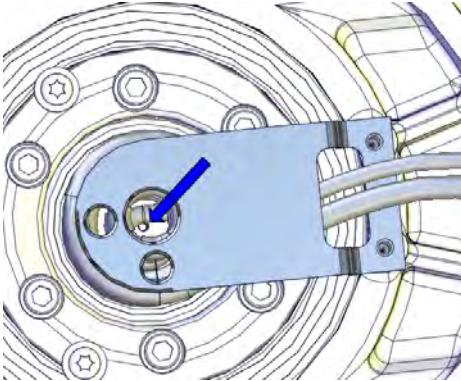
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4 Repair

4.5.6 Replacing the complete lower arm

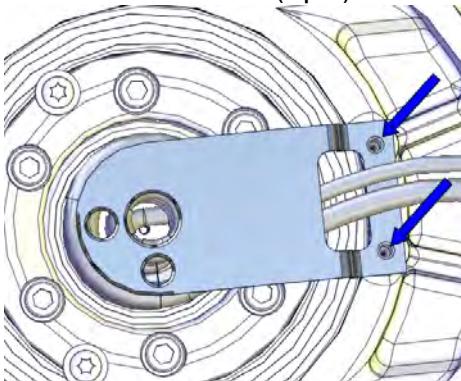
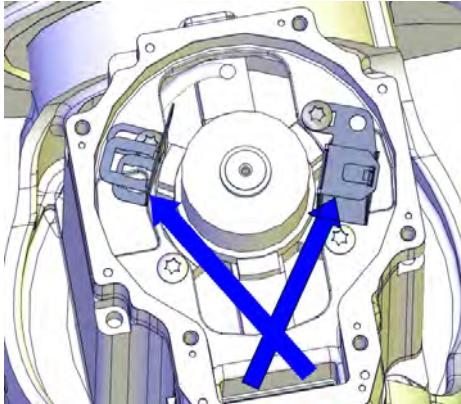
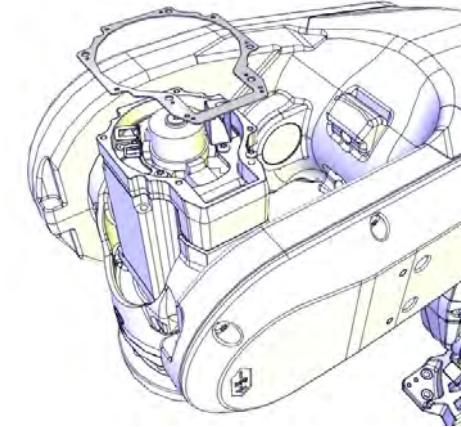
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Connecting the axis-6 motor cables - Step 2

Action	Note
<p>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.</p> <p> CAUTION</p> <p>Make sure that the cable spiral is not twisted an extra revolution. The result will be damage to the cable harness.</p>	
<p>2 Use caution and push the carrier into position.</p>	 xx1300001113
<p>3 Secure the carrier with the M4 screw.</p> <p> Note</p> <p>The screw is located at the bottom of the carrier.</p> <p> Tip</p> <p>The attachment screw that secure the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.</p>	<p>Attachment screw: M4x10</p>  xx1300000485

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4.5.6 Replacing the complete lower arm Continued

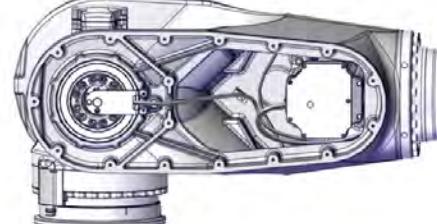
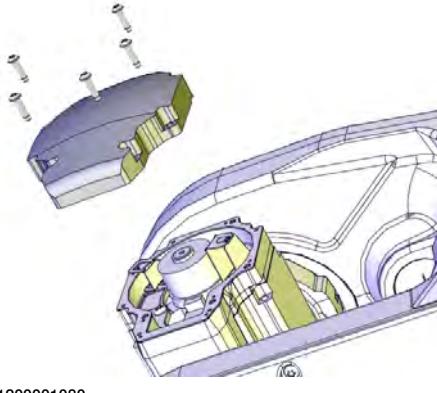
Action	Note
4 Secure the cable bracket with its attachment screws.	<p>Attachment screws M6x (2 pcs)</p>  <p>xx1300000484</p>
5 Inspect the connectors to the axis-6 motor and make sure they are connected. i Note The resolver cable shall be placed underneath the motor cable.	 <p>xx1300000488</p>
6 Inspect the gasket. i Note Replace if damaged.	<p>Gasket, 3HAC033489-001</p>  <p>xx1200001095</p>

Continues on next page

4 Repair

4.5.6 Replacing the complete lower arm

Continued

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.	 xx1200001080

Refitting the lower arm complete - step 2

The lower arm complete consists of lower arm and parallel arm together.

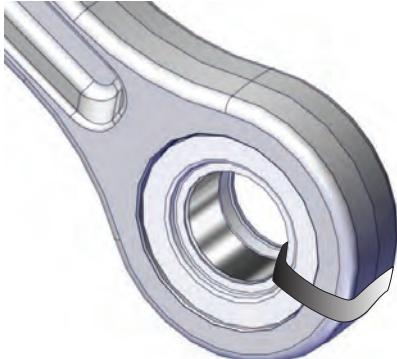
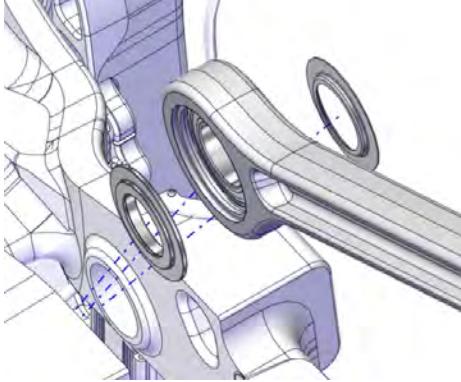
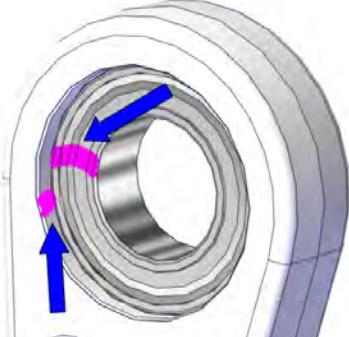
Action	Note
1 Turn on the power and jog the robot to the specified position: <ul style="list-style-type: none">• Axis-2: No significance (as long as the robot is secured to the foundation)• Axis-2: +20• Axis-3: 0• Axis-4: 0• Axis-5: 0• Axis-6: No significance	
2 Refit the remaining screws that secure the lower arm and parallel arm to the axis-2 and axis-3 gearboxes.	
3 Secure the attachment screws.	Attachment screws: M16x70 12.9 Gleitmo Tightening torque: 300 Nm

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4.5.6 Replacing the complete lower arm

Continued

Preparations before refitting the parallel rod, lower end

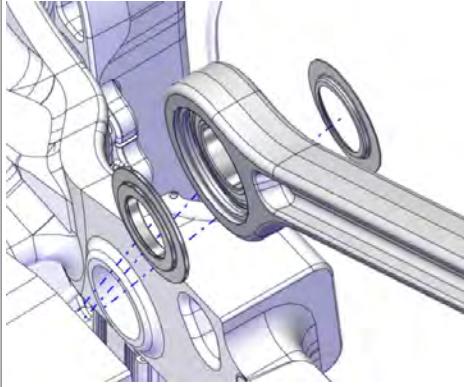
	Action	Note				
1	Remove the strap which was used to keep bearing, thrust washer and cover washer in position.	 xx1500002744				
2	Remove the thrust washer and cover washer, and wipe them clean. Note Make a note on which side the covers are placed.	 xx1500002098 <table border="1"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side					
Thrust washer	Cover washer					
3	Wipe the shafts and the holes for the shafts clean.					
4	Apply corrosion protection on both sides of the bearings, and on all machined surfaces on the parallel rod.	Mercasol  xx1500002100				

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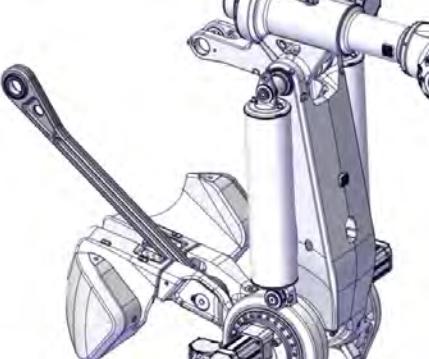
4 Repair

4.5.6 Replacing the complete lower arm

Continued

Action	Note				
5 Put back the thrust washer (left side) and cover washer (right side).	 xx1500002098 <table border="1"><tr><td>Left side</td><td>Right side</td></tr><tr><td>Thrust washer</td><td>Cover washer</td></tr></table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side				
Thrust washer	Cover washer				

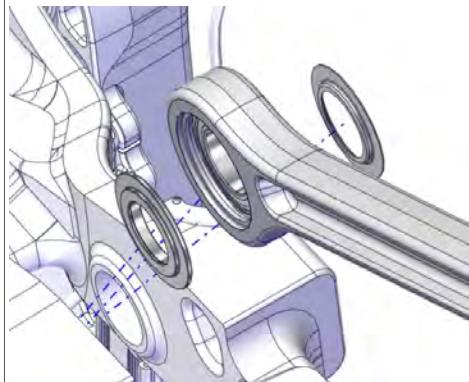
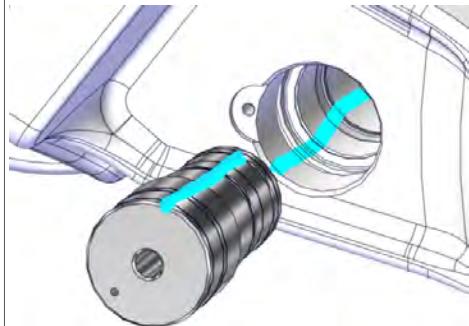
Refitting the parallel rod, lower end

Action	Note
1  Note If the parallel rod has been removed from the robot, always start refitting at the lower end!	 xx1500001965
2  CAUTION The parallel rod weighs 55 kg.	
3 Attach a roundsling to the parallel rod and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg

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4.5.6 Replacing the complete lower arm

Continued

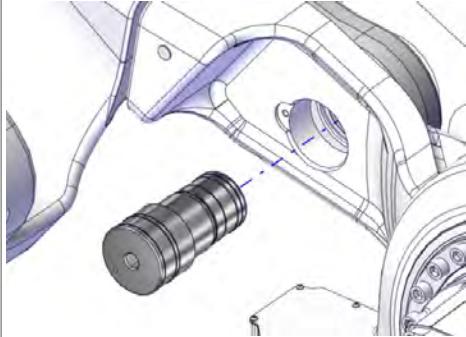
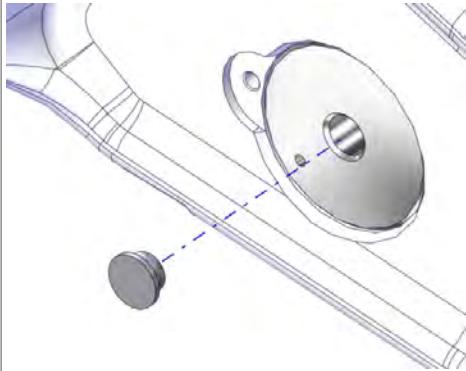
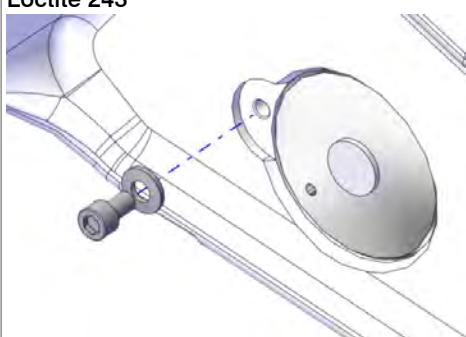
Action	Note				
4 Use caution, stretch the roundsling and lift the parallel rod into mounting position.	 xx1500002745				
5 Apply the press tool parts (Assembly tool, Press plate and Round plate).					
6 Make sure that the thrust washer and cover washer on either side of the bearing, are in position.  Note Make sure that the washers are on the correct sides of the bearing.	 xx1500002098 <table border="1"> <tr> <td>Left side</td> <td>Thrust washer</td> </tr> <tr> <td>Right side</td> <td>Cover washer</td> </tr> </table>	Left side	Thrust washer	Right side	Cover washer
Left side	Thrust washer				
Right side	Cover washer				
7 Apply some grease on the shafts and in the holes on both sides of parallel arm, as well as in the bearing hole.	 xx1500002301				

Continues on next page

4 Repair

4.5.6 Replacing the complete lower arm

Continued

Action	Note
8 Use caution and press the shaft in.	 xx1500001969
9 Refit the protection plug.	 xx1500001968
10 Apply locking liquid on the screw and secure the shaft.	Attachment screw: M10x16 8.8 Loctite 243  xx1500001966

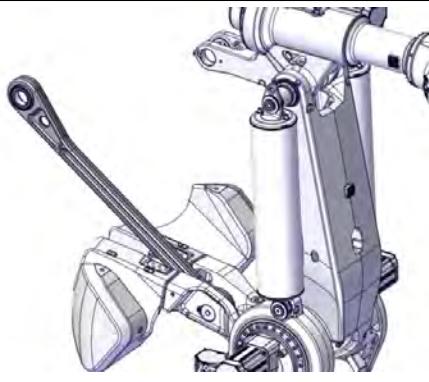
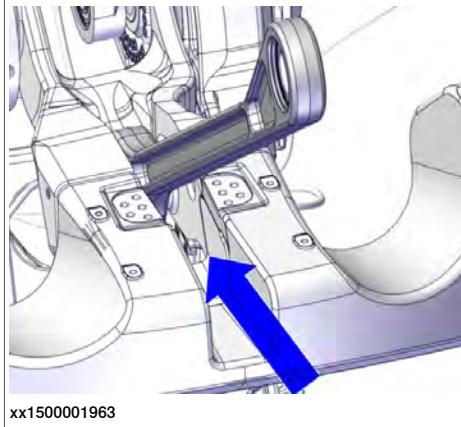
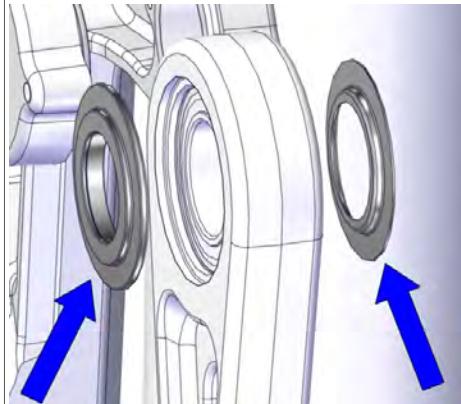
Refitting parallel rod, upper end

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

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4.5.6 Replacing the complete lower arm

Continued

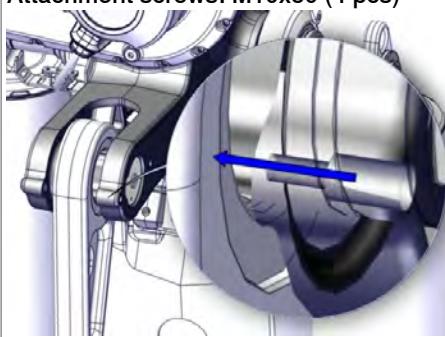
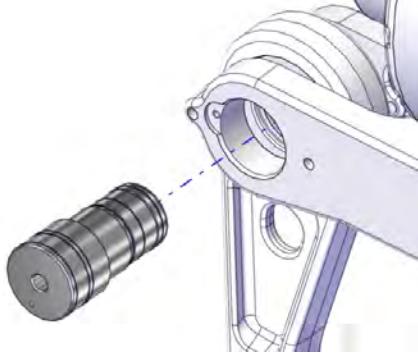
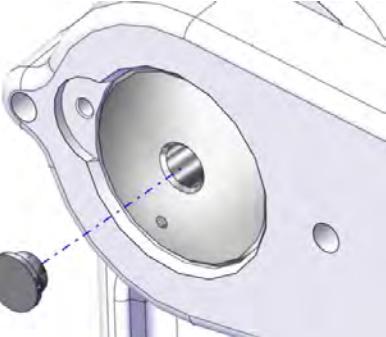
Action	Note				
2 Take a firm grip of the parallel rod and lift it up into mounting position.	 xx1500001965				
3 Put a piece of wood (or similar) between parallel arm and parallel rod, used as protection to prevent the rod from moving unexpectedly during the procedure.	 xx1500001963				
4 Place the 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 <table border="1"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side				
Thrust washer	Cover washer				

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4 Repair

4.5.6 Replacing the complete lower arm

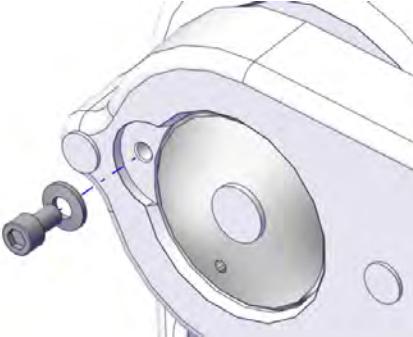
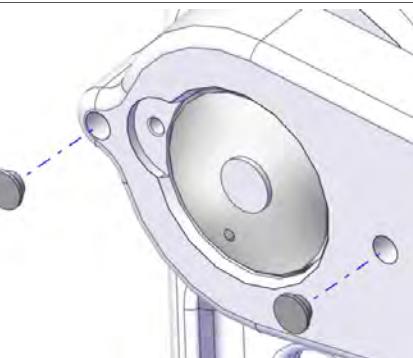
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Action	Note
5 Unscrew two of the M10x50 screws only on one side of the parallel rod, approximately 5 mm. Leave the screws fastened on the other side.	 Note This is done to be able to refit the parallel rod without problems and to be able to find the correct position of the parallel rod.
6 Place the parallel rod into position and reattach the two M10x50 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: M10x50 (4 pcs) <small>xx1500002300</small>
7 Apply the press tool parts (Assembly tool, Press plate and Round plate).	
8 Use caution and press the shaft in.	 <small>xx1500001962</small>
9 Refit the protection plug.	 <small>xx1500001967</small>

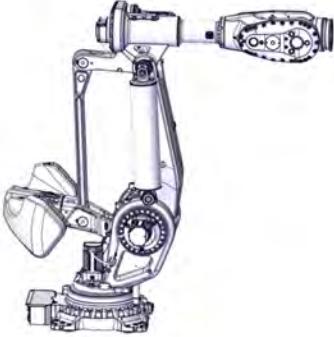
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4.5.6 Replacing the complete lower arm

Continued

Action	Note
10 Apply locking liquid on the attachment screw and secure shaft.	Attachment screw: M10x16 8.8 Loctite 243  xx1400002600
11 Remove the four M10x50 screws and refit the protection plugs (4+4 pcs).	 xx1500001961

Robot position when replacing the balancing device

Action	Note
1 Jog the robot to calibration position.	 xx1500002310
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

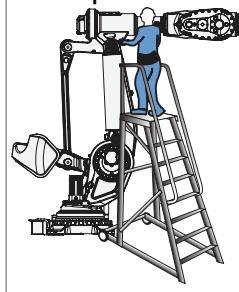
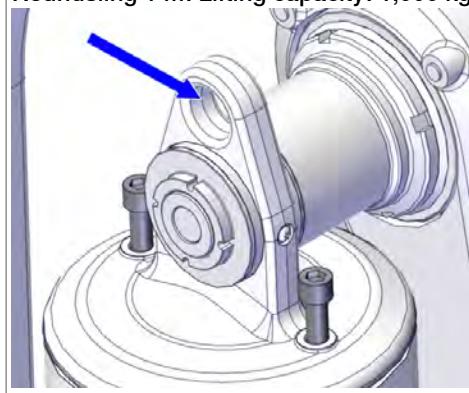
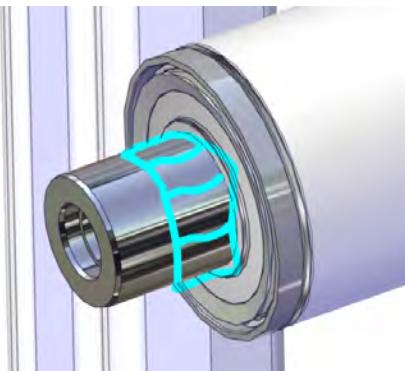
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4 Repair

4.5.6 Replacing the complete lower arm

Continued

Preparations before refitting the balancing device

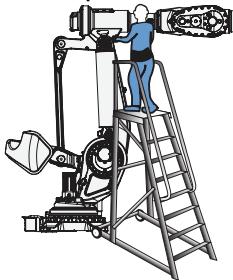
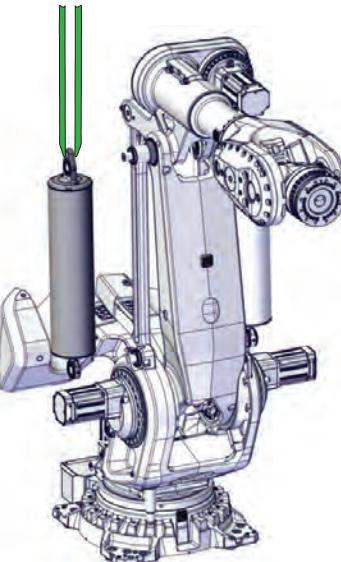
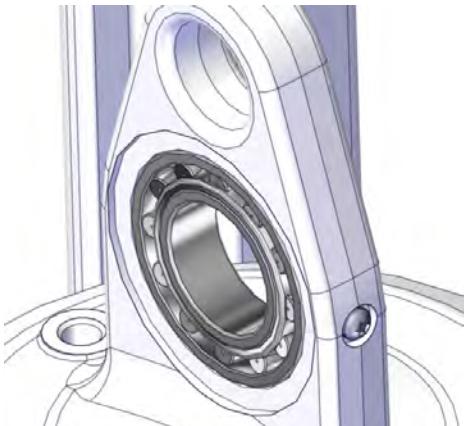
Action	Note
<p>1  CAUTION The balancing device weighs 200 kg. All lifting accessories used must be sized accordingly!</p>	
<p>2 Use a Mobile platform ladder (or similar), to reach the upper end of the balancing device.</p> <p> DANGER Do not use the robot as ladder.</p>	<p>Mobile platform ladder</p> 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

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4.5.6 Replacing the complete lower arm

Continued

Refitting the balancing device

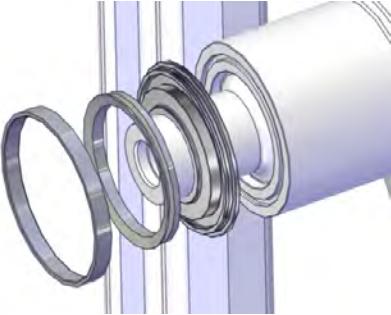
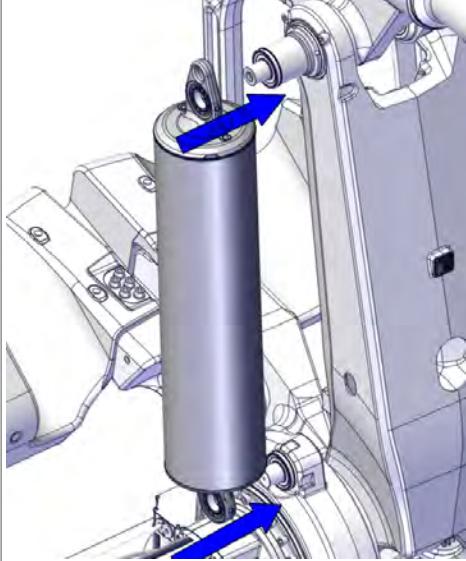
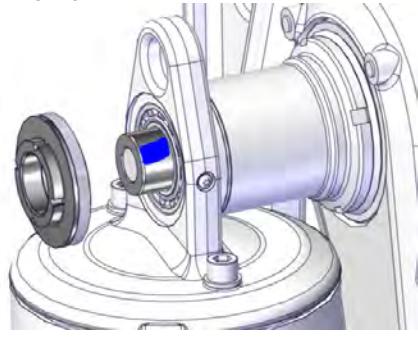
	Action	Note
1	<p>Use a Mobile platform ladder (or similar), to reach the upper end of the balancing device.</p> <p> DANGER</p> <p>Do not use the robot as ladder.</p>	<p>Mobile platform ladder</p>  <p>xx1500001985</p>
2	Use caution and raise the balancing device into mounting position.	 <p>xx1500002735</p>
3	<p> Note</p> <p>Make sure the bearings are axially centered in the balancing device ears, before putting them on the shafts.</p>	 <p>xx1500002306</p>

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4 Repair

4.5.6 Replacing the complete lower arm

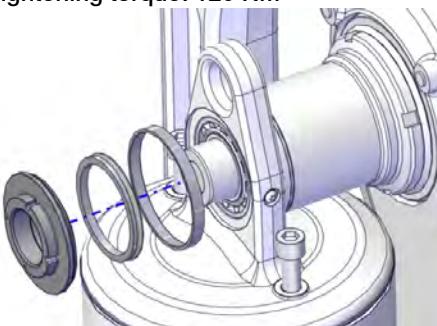
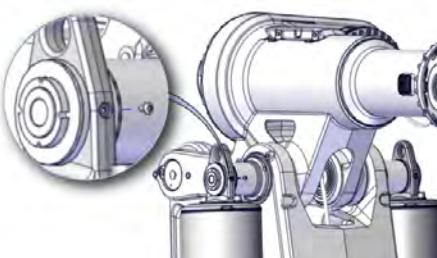
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Action	Note
4 Make sure that the spacer ring with V-ring and the support ring are placed correctly on the shafts before the balancing device is put on the shafts.	 xx1500001975
5 Use caution and put the balancing device onto upper and lower shafts.	 xx1500002305
6 Apply locking liquid on the threads of the lock nuts.	Locking liquid: Loctite 243  xx1500002307
7 Inspect that the bearings are axially centered in the balancing device ears.	

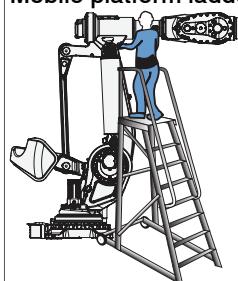
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4.5.6 Replacing the complete lower arm

Continued

Action	Note
8 Secure the balancing device with the two lock nuts.	Tightening torque: 120 Nm  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.	

Restoring the pressure of the balancing device

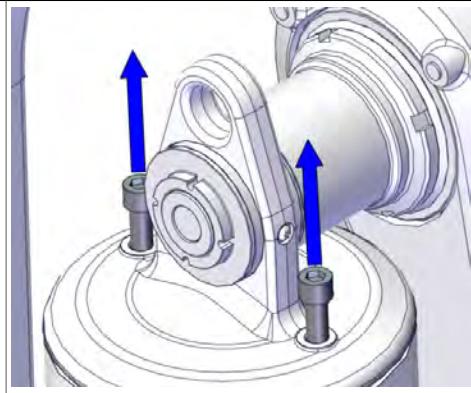
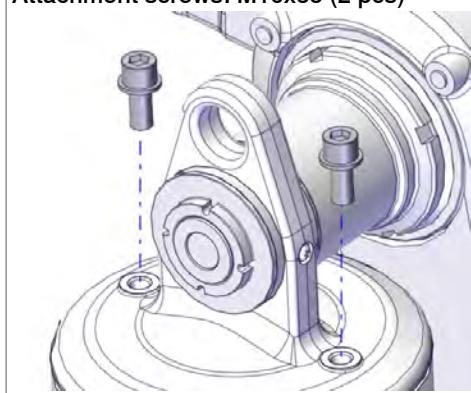
Action	Note
1 Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device.  DANGER Do not use the robot as ladder.	Mobile platform ladder  xx1500001985

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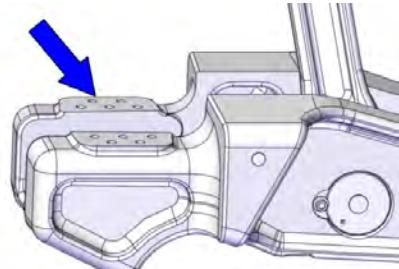
4 Repair

4.5.6 Replacing the complete lower arm

Continued

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

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

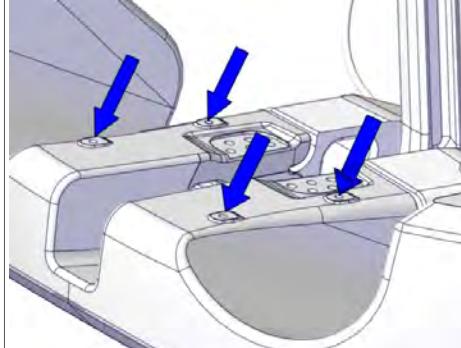
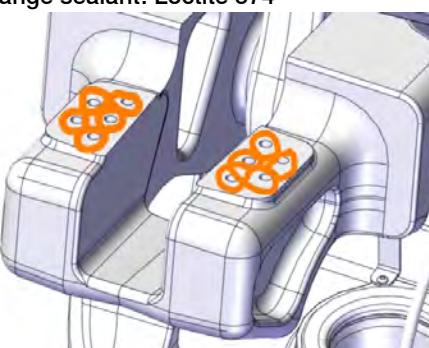
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4.5.6 Replacing the complete lower arm

Continued

Action	Note
<p>2  DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	

Refitting the counterweight

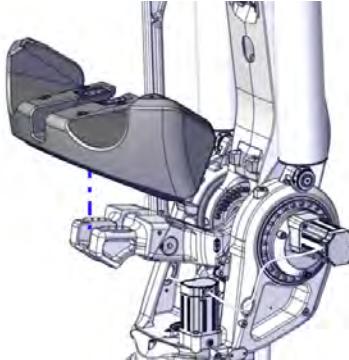
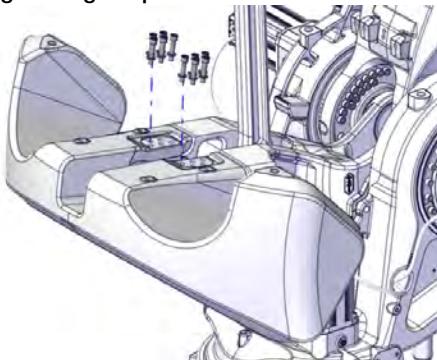
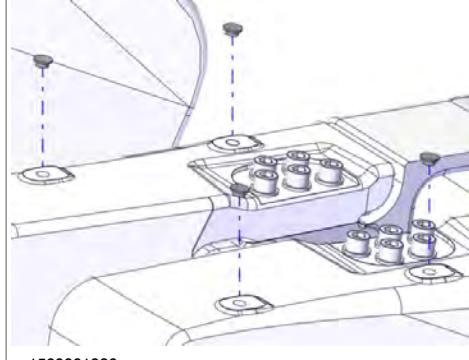
Action	Note
<p>1  CAUTION</p> <p>The counter weight weighs 1200 kg. All lifting accessories used must be sized accordingly!</p>	
2 Attach lifting eyes, if not already done.	 xx1500002087
3 Attach the lifting accessory chain (with four chains), to the lifting eyes.	Lifting accessory chain (with four chains)
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

Continues on next page

4 Repair

4.5.6 Replacing the complete lower arm

Continued

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

Concluding procedure

Action	Note
1 Recalibrate the robot.	Axis Calibration is described in Calibrating with Axis Calibration method on page 799 . General calibration information is included in section Calibration on page 789 .

Continues on next page

4.5.6 Replacing the complete lower arm

Continued

	Action	Note
2	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.	

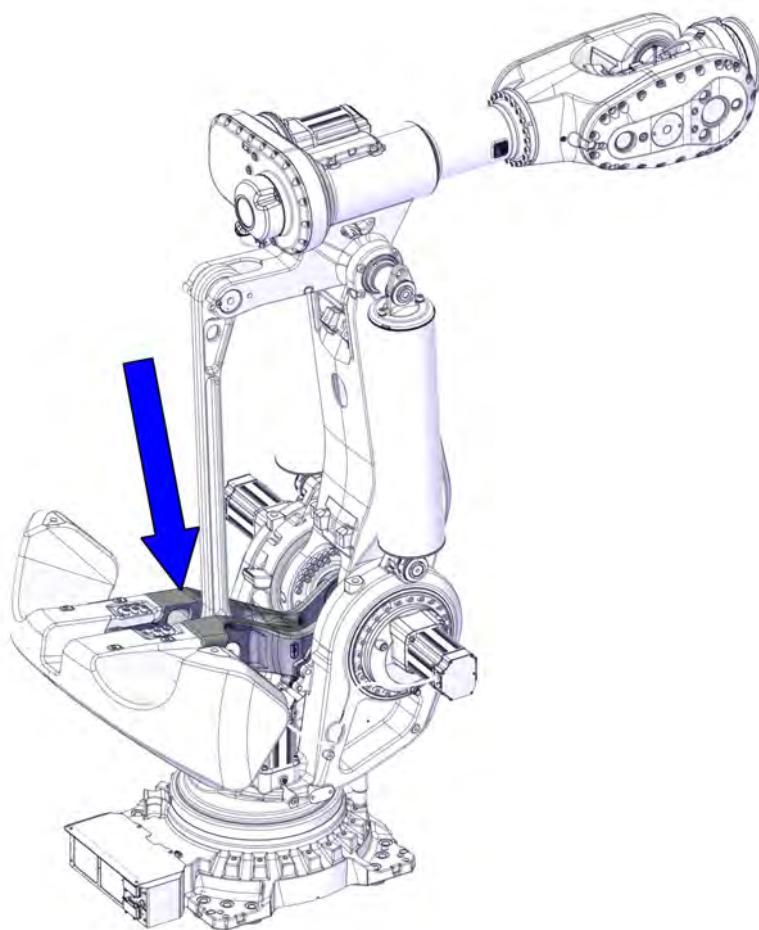
4 Repair

4.5.7 Replacing the parallel arm

4.5.7 Replacing the parallel arm

Location of the parallel arm

The parallel arm is located as shown in the figure.



xx1500002062

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Parallel arm	3HAC049074-003	

Required tools and equipment

Equipment, etc.	Article number	Note
MobilePlatformLadder	-	

Continues on next page

4.5.7 Replacing the parallel arm
Continued

Equipment, etc.	Article number	Note
Fixing screw, M10x50 (4 pcs)	-	Used to holding parallel rod in position.
Screw M10x50	-	Fully threaded
Screw M16x80	-	Fully threaded
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Roundsling 1 m	-	Lifting capacity: 1,000 kg
Roundsling 2 m	-	Lifting capacity: 2,000 kg
Roundsling 2.5 m	-	Lifting capacity: 2,000 kg
Roundsling 3 m	-	Lifting capacity: 2,000 kg
Crowbar (small)	-	Used when removing parallel arm from lower arm
Pallet		Used for putting down removed parts from robot.
Lifting eye	3HAC16131-1	M12
Lifting eye	3HAC14457-4	M16
Fender washer	-	Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.
Piece of wood	-	Used when replacing the parallel rod and mechanical stop pin as a safety measure
Assembly tool	3HAC051000-001	Used to disassemble and assemble the parallel rod
Press plate	3HAC050949-001	Used to disassemble and assemble the parallel rod
Round plate	-	Used to disassemble and assemble the parallel rod
Assembly tool, press plate	3HAC051101-001	Used on parallel arm for assembly of: <ul style="list-style-type: none"> • bearings • lower arm and parallel arm
Anvil	3HAC051099-001	Used on parallel arm for assembly of: <ul style="list-style-type: none"> • bearings • lower arm and parallel arm
Adjustment nut	3HAC12348-9	Used on parallel arm for assembly of: <ul style="list-style-type: none"> • bearings • lower arm and parallel arm
Center disc	3HAC051097-001	Used on parallel arm for assembly of: <ul style="list-style-type: none"> • lower arm and parallel arm
Press tool	3HACXXXXXX-XXX	Used to disassemble and assemble the parallel arm
Hydraulic cylinder	3HAC11731-1	To be used with the press tool.
Hydraulic pump 80 MPa	3HAC13086-1	To be used with the hydraulic cylinder.
Velcro strap	-	
Assembly tool	3HAC056095-002	Set of tools. Instruction 3HAC056526-002 enclosed.

Continues on next page

4 Repair

4.5.7 Replacing the parallel arm

Continued

Equipment, etc.	Article number	Note
Removal tool	3HAC056095-003	Set of tools. Instruction 3HAC056526-002 enclosed.
Glycerine adapter	-	Used to replace upper arm shafts together with a glycerine press tool.
24 VDC power supply	-	Used to release the motor brakes.
Dial gauge		
Endless ratchet lashing belt	-	Used to secure the parallel arm against the lower arm
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumables

Consumables	Article number	Note
Molykote 1000		
Cable ties		
Corrosion protection		Mercasol 3110 Waxcoat
Bearing grease		Tribol GR 100-0 PD
Locking liquid		Loctite 243
Isopropanol		
Scotch-brite		Scotch-brite abrasive cleaning hand pad
Glycerine		

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. <ul style="list-style-type: none">• 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 800 .

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

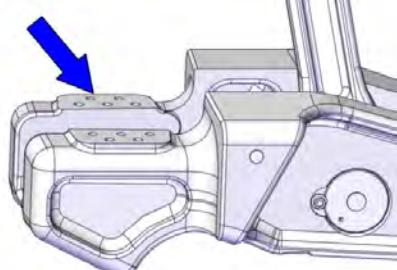
Removing the parallel arm

Use these procedures to remove the parallel 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.	

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: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

Removing the counterweight

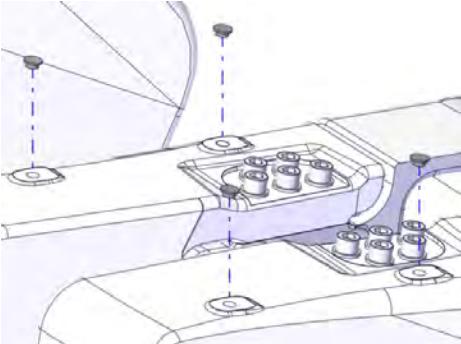
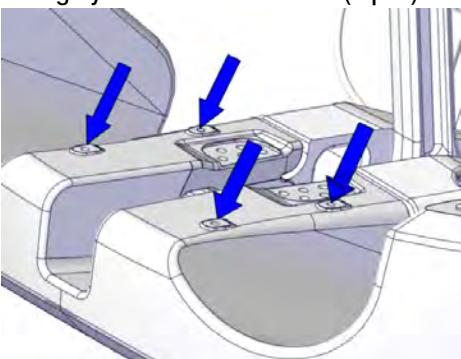
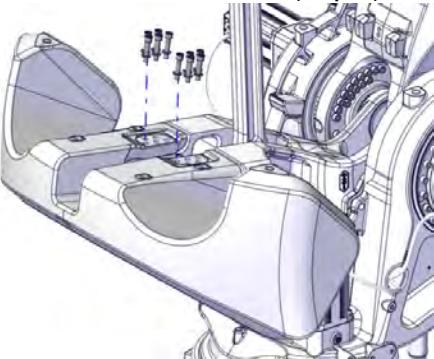
Action	Note
1  CAUTION The counterweight weighs 1200 kg. All lifting accessories used must be sized accordingly!	

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4 Repair

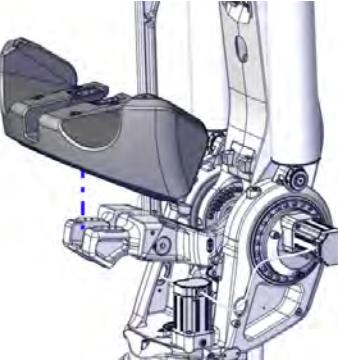
4.5.7 Replacing the parallel arm

Continued

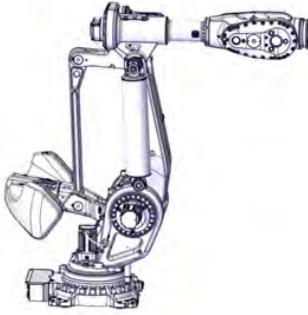
Action	Note
2 If used, remove the plastic plugs covering the holes for the lifting eyes.	 Note Keep the plastic plugs. They shall be refitted.  xx1500001980
3 Attach lifting eyes.	Lifting eye: M16 3HAC14457-4 (4 pcs)  xx1500002087
4 Attach the lifting accessory chain (with four chains), to the lifting eyes.	Lifting accessory (four chains)
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

Continues on next page

4.5.7 Replacing the parallel arm
Continued

	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

Preparations before unloading the pressure of balancing device

	Action	Note
1	Jog the robot to calibration position.	 xx1500002310
2	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

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4 Repair

4.5.7 Replacing the parallel arm

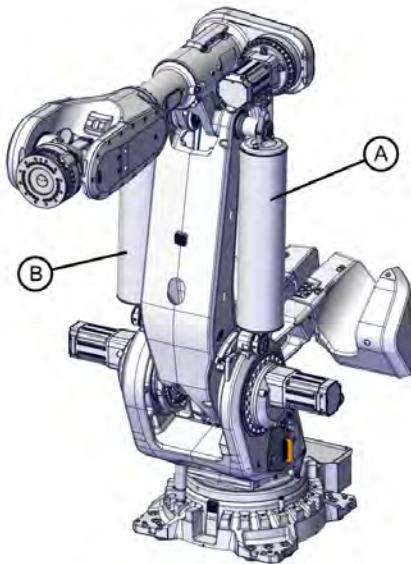
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Unloading the pressure of the balancing device



CAUTION

Make sure to relief the pressure of the correct balancing device. Relief pressure on axis 2 side when changing axis-2 gearbox, and relief pressure on axis 3 side when changing axis-3 gearbox.



xx1600001406

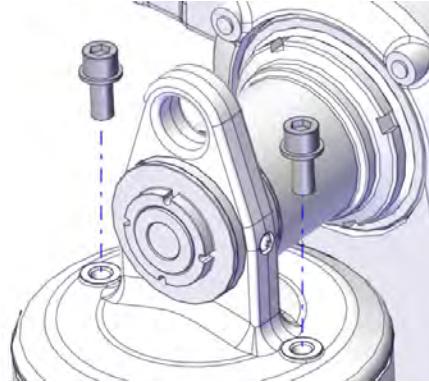
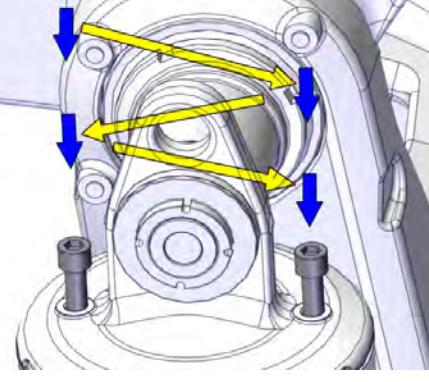
A	Axis-2 balancing device
B	Axis-3 balancing device

Action	Note
1 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 <i>Only needed when the upper arm is fitted on the robot:</i> 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

4.5.7 Replacing the parallel arm

Continued

	Action	Note
3	<p>Remove the screws, fitted in the screw holes on top of the balancing device.</p> <p>Note Keep the screws. They shall be refitted after the work is done.</p>	 <p>xx1500001971 M16x35</p>
4	<p>Apply some Molykote on threads and at the bottom end of two fully threaded screws.</p>	 <p>xx1500002303 Screws M16x80 fully threaded</p>
5	<p>Unload the pressure of the balancing device by inserting the screws. Attach the screws until the screws reaches the piston. Then, alternately little by little, attach the screws at least another five millimeters. The pressure is now unloaded.</p>	 <p>xx1500002309 Screw M16x80 (2 pcs)</p>
6	<p>In a procedure where both balancing devices shall be removed, unload the pressure of the other in the same way.</p>	

Removing the balancing device

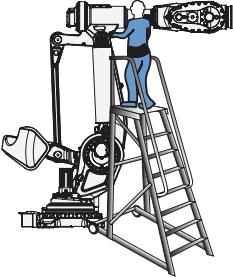
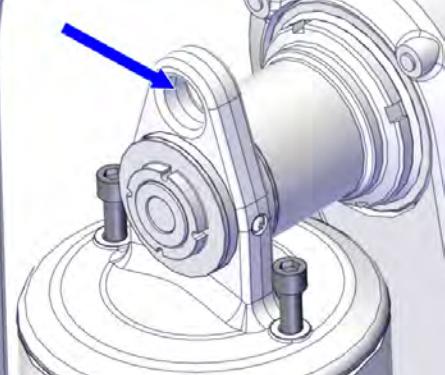
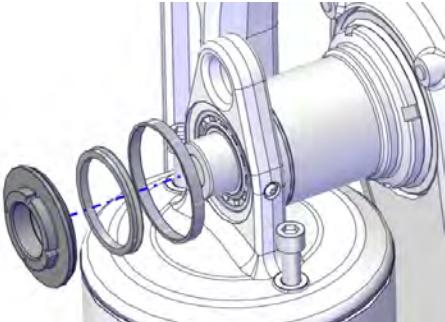
	Action	Note
1	 DANGER <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	

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4 Repair

4.5.7 Replacing the parallel arm

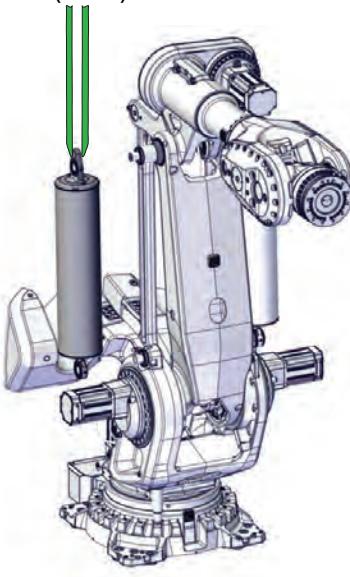
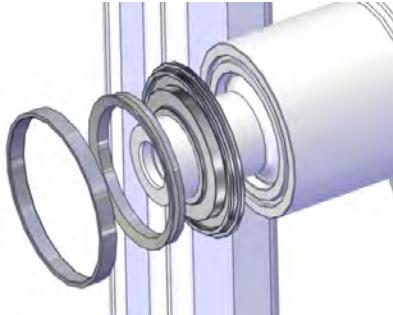
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Action	Note
2 Use a Mobile platform ladder to reach the upper end of the balancing device.  DANGER Do not use the robot as a ladder.	Mobile platform ladder  xx1500001985
3  CAUTION The balancing device weights 200 kg. All lifting accessories used must be sized accordingly.	
4 Attach a roundsling to the lifting hole on top of the balancing device and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg  xx1500001983
5 Stretch the lifting accessories to take the weight of the balancing device.	
6 Remove upper and lower KM-nuts.  Note Make sure that V-ring or support ring are present.	 xx1500001973

Continues on next page

4.5.7 Replacing the parallel arm

Continued

	Action	Note
7	<p>Use caution and lift the balancing device off.</p> <p> Tip</p> <p>If needed, use a Crowbar (small), to carefully help pressing the balancing device out. A suitable bearing puller is another alternative.</p>	<p>Crowbar (small)</p>  <p>xx1500002735</p>
8	<p> Note</p> <p>Make sure that the support ring and spacer ring with V-ring are present.</p>	 <p>xx1500001975</p>
9	<p>Put the balancing device down.</p> <p> Tip</p> <p>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.</p>	<p>Pallet</p>
10	If both balancing devices shall be removed, remove the other in the same way.	

Continues on next page

4 Repair

4.5.7 Replacing the parallel arm

Continued

Robot position when removing screws in the first area

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-2 gearbox to the lower arm and the axis-3 gearbox to the parallel arm.

Action	Note
1 Jog the robot to the specified position: <ul style="list-style-type: none">• Axis 1: no significance as long as the robot is fitted to the foundation.• Axis 2: +30°• Axis 3: -20°• Axis 4: 0°• Axis 5: 0°• Axis 6: No significance.	
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

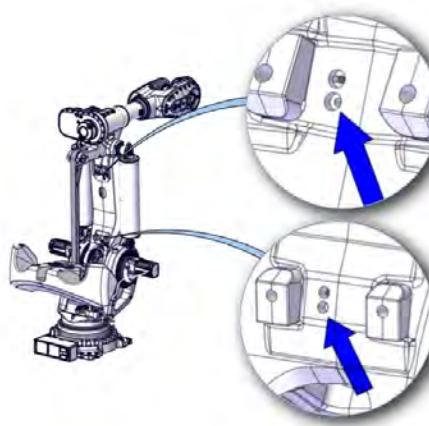
Removing the attachment screws in the first area

Remove attachment screws in the first of the three areas of screws. Remove screws that secure the axis-2 gearbox to the lower arm, as well as the ones that secure the axis-3 gearbox to the parallel arm.

Action	Note
1 Unscrew and remove screws, that secure the axis-2 gearbox to the lower arm, now possible to reach.	
2 Unscrew and remove screws, that secure the axis-3 gearbox to the parallel arm, now possible to reach.	

Continues on next page

Unscrewing the brackets that secure cable harness in lower arm

	Action	Note
1	In order to be able to remove the cable harness, it is necessary to unscrew the two brackets inside the lower arm at this stage. It will be very difficult to reach the bracket screws after the position of the robot is changed.	 xx1500002694
2	Unscrew the screws of the two brackets that secure the cable harness inside the lower arm. i Note The screws are reached from the outside.	 xx1500002695

Robot position when removing the upper arm

	Action	Note
1	Turn on the power and jog the robot to the specified position: <ul style="list-style-type: none"> • Axis 1: no significance as long as the robot is fitted to the foundation. • Axis 2: -65° • Axis 3: 0° (horizontal to the foundation) • Axis 4: +90° • Axis 5: -90° • Axis 6: no significance. 	

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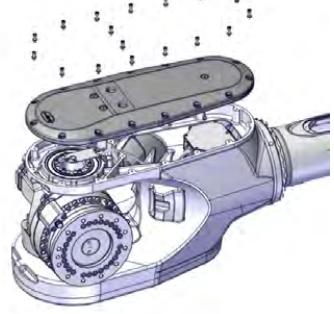
4 Repair

4.5.7 Replacing the parallel arm

Continued

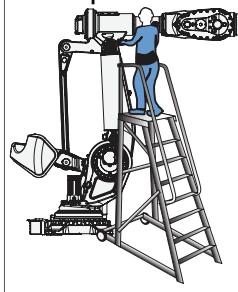
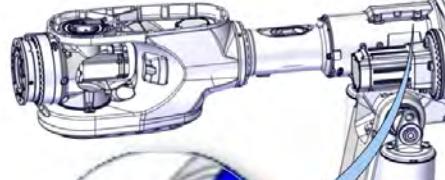
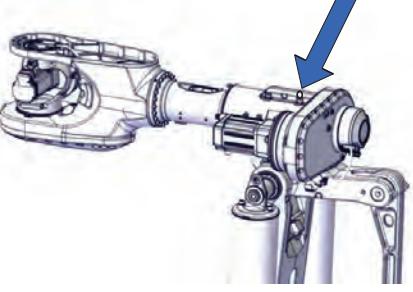
Action	Note
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

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.	 xx1500002330
3 Cut the cable tie that secure the axis-5 motor cable to the cable fixing bracket.	 xx1500002331

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Attaching lifting accessories to the upper arm complete

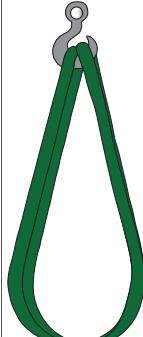
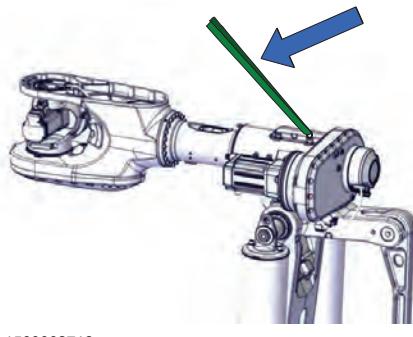
	Action	Note
1	 CAUTION The complete upper arm weighs 900 kg. All lifting accessories used must be sized accordingly.	
2	<i>Only needed when the upper arm is fitted on the robot:</i> Use a Mobile platform ladder (or similar) to attach the lifting accessories.  DANGER Never use the robot as ladder.	Mobile platform ladder  xx1500001985
3	Remove the plastic plug in the hole shown in the figure.	  xx1500002712
4	Attach a Lifting eye to the hole in the arm housing with a Fender washer underneath.  xx1400002196	Lifting eye: M12 Fender washer: Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.  xx1500002715

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4 Repair

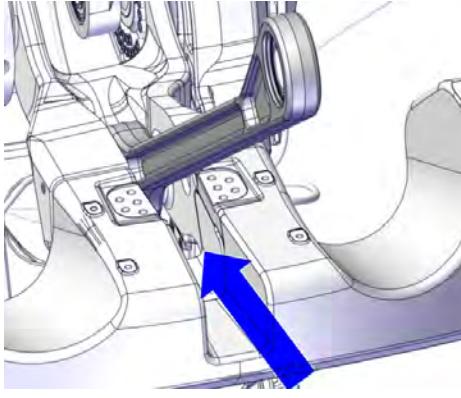
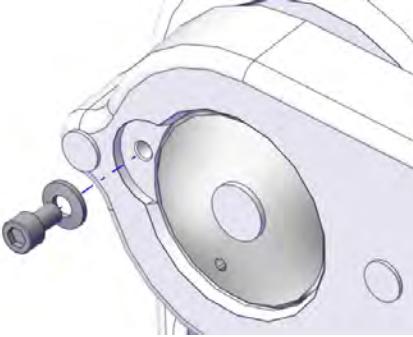
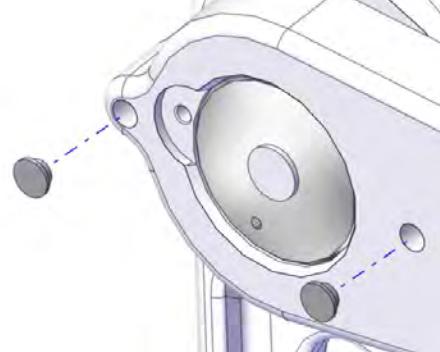
4.5.7 Replacing the parallel arm

Continued

Action	Note
5 Attach a roundsling looped to the Lifting eye and to an overhead crane (or similar).	Roundsling 2.5 m: Lifting capacity: 2,000 kg  xx1400002599
6 Attach a roundsling looped to the wrist and to an overhead crane (or similar).	Roundsling 3 m: Lifting capacity: 2,000 kg  xx1500002714
7 Stretch the lifting accessories to take the weight of the upper arm.	
8 <i>Only needed when the upper arm is fitted on the robot:</i> In order to release the brakes, connect the 24 VDC power supply. Connect connector R2.MP2: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	
9 <i>Only needed when the upper arm is fitted on the robot:</i> Release the brakes on axis-2 to be sure that the lifting accessories are taking the weight of the upper arm.	
10 Adjust the lifting accessories, if needed.	

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Removing the parallel rod, upper end

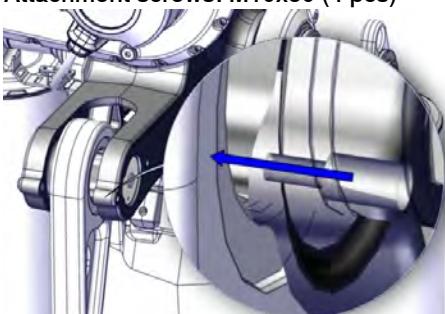
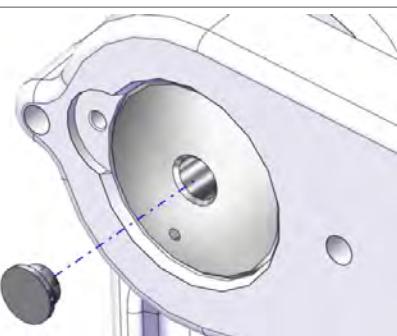
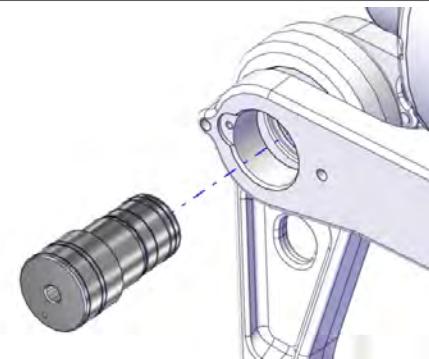
	Action	Note
1	Put a piece of wood (or similar) between parallel arm and parallel rod, used as protection to prevent the rod from moving unexpectedly during the continued procedure.	 xx1500001963
2	Remove the attachment screw with washer that secure the rod shaft.	 xx1400002600
3	Remove the protection plugs 4 + 4 (two on either side of the upper arm wings).  Note Keep the protection plugs. They shall be refitted when the work is done.	 xx1500001961

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4 Repair

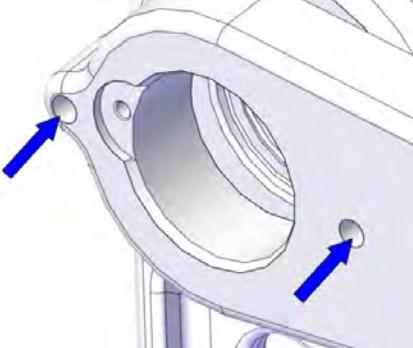
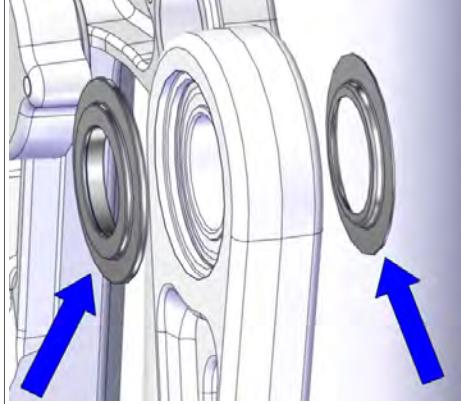
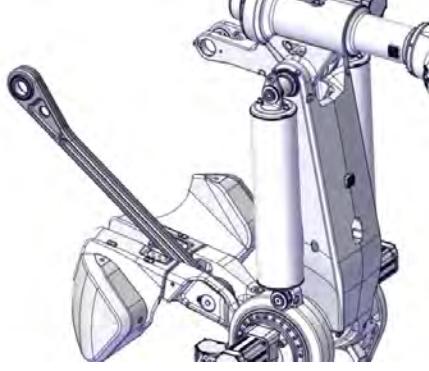
4.5.7 Replacing the parallel arm

Continued

Action	Note
4 Fit 2 + 2 M10x50 screws in the holes and adjust the screws against the parallel rod from both sides.	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. Attachment screws: M10x50 (4 pcs)  xx1500002300
5 Remove the protection plug.  Note Keep the protection plug. It shall be refitted when the work is done.	 xx1500001967
6 Apply the press tool parts (Assembly tool, Press plate and Round plate).	Assembly tool: 3HAC051000-001 Press plate: 3HAC050949-001 Round plate:
7 Use the press tool and press the shaft out.	 xx1500001962

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4.5.7 Replacing the parallel arm
Continued

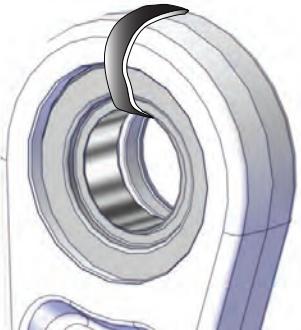
Action	Note				
8 Unscrew two of the M10x50 screws, approximately 5 mm, on one side of the parallel rod. Leave the screws on the other side.	<p>This is to be able to remove the parallel rod without problems and to be able to find the correct position of the parallel rod, when refitting it.</p>  <p>xx1500002710</p>				
9 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.	 <p>xx1500001964</p> <table border="1"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side				
Thrust washer	Cover washer				
10 Move the parallel rod down and let it rest on the piece of wood, which was put there earlier.	 <p>xx1500001965</p>				

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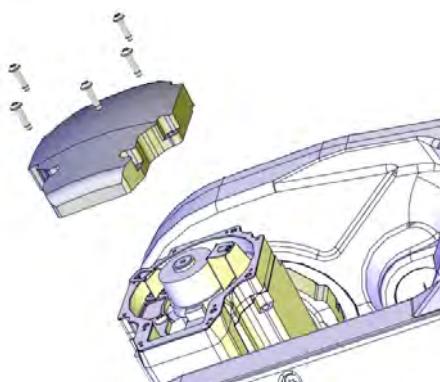
4 Repair

4.5.7 Replacing the parallel arm

Continued

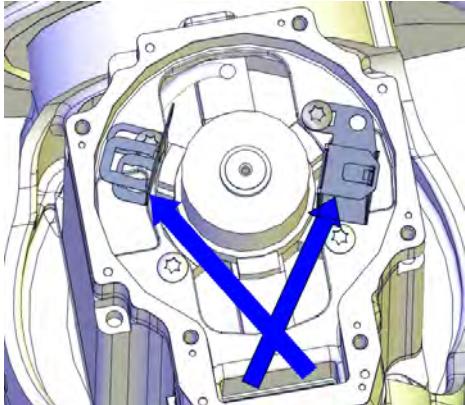
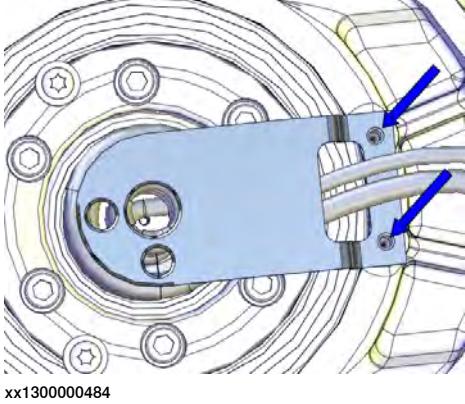
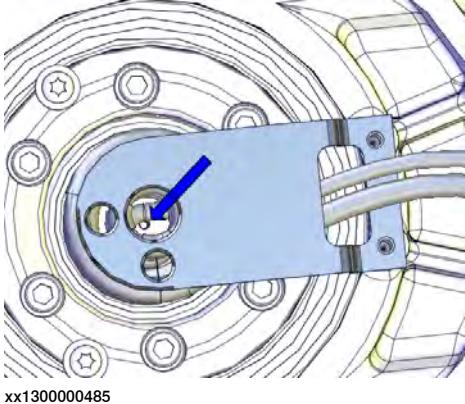
Action	Note
11 Secure bearing, thrust washer and cover washer with a strap (or similar) to prevent them from dropping out of its position.	Strap  xx1500002716

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 applicable when 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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4.5.7 Replacing the parallel arm
Continued

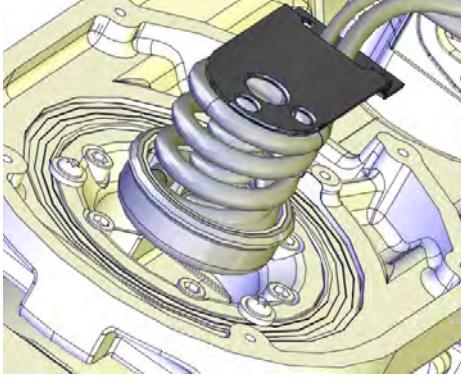
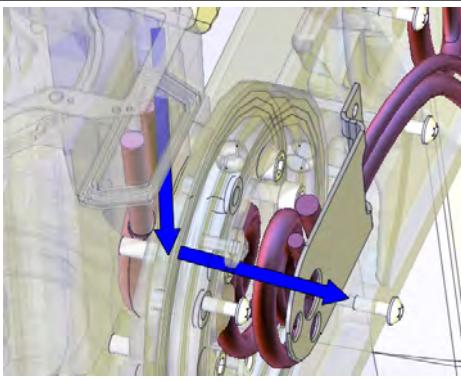
	Action	Note
4	Disconnect the motor cables.	 xx1300000488
5	Unscrew the attachment screws holding the cable bracket.	 xx1300000484
6	Unscrew the screw holding the carrier. Note The screw is located at the bottom of the carrier.	 xx1300000485

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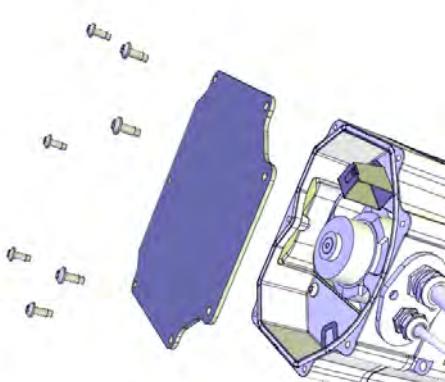
4 Repair

4.5.7 Replacing the parallel arm

Continued

Action	Note
<p>7 Use caution and pull out the carrier.</p> <p> Tip</p> <p>If needed, use a screwdriver to help pulling out the carrier.</p>	 xx1300001113
<p>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.</p>	 xx1300000666

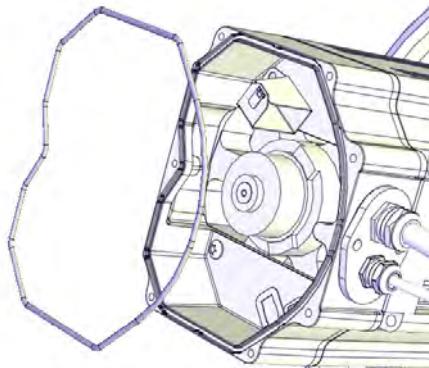
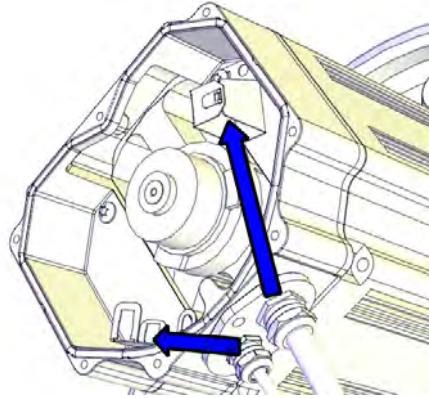
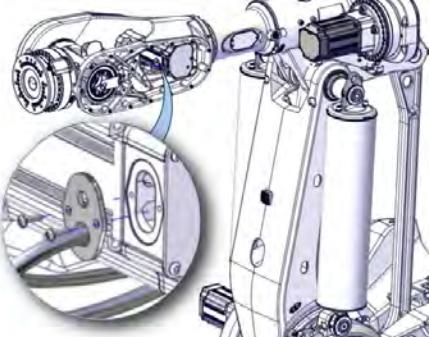
Disconnecting the axis-5 motor cables

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

Continues on next page

4.5.7 Replacing the parallel 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	 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-4 motor cables

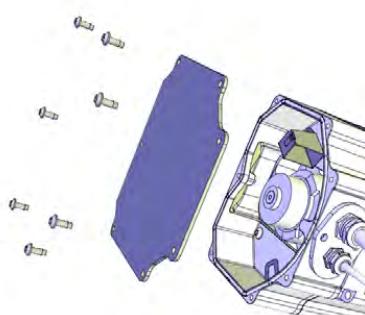
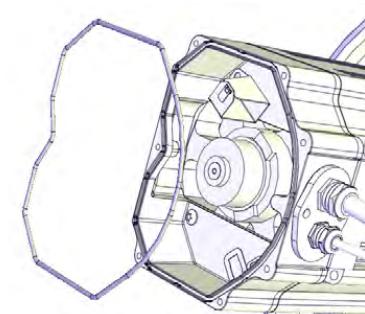
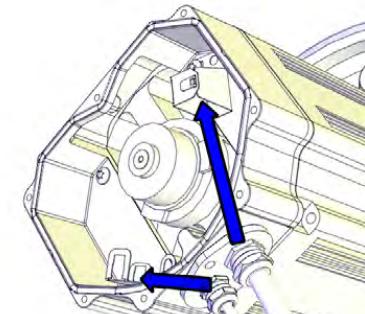
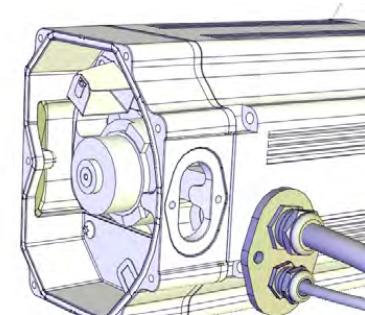
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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4 Repair

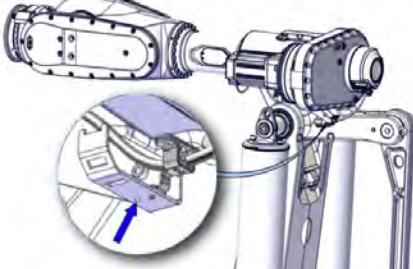
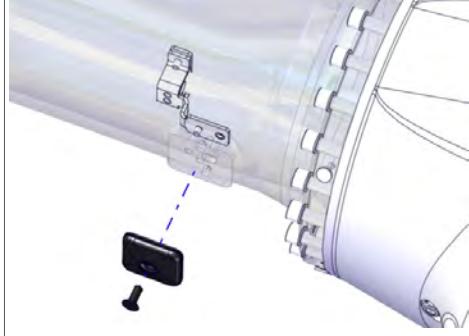
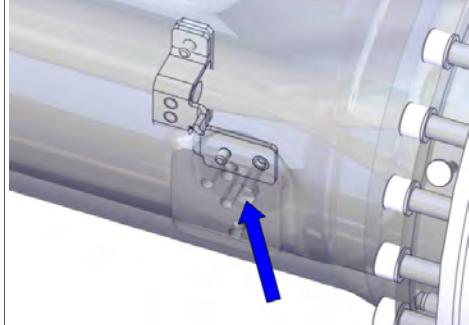
4.5.7 Replacing the parallel arm

Continued

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
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.	

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Removing the cable harness in the upper arm

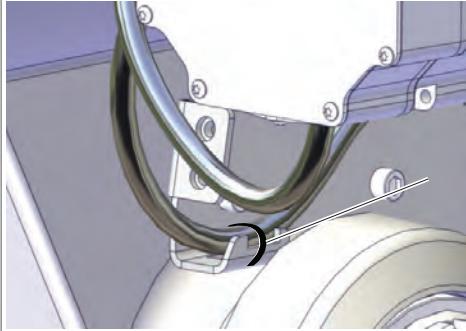
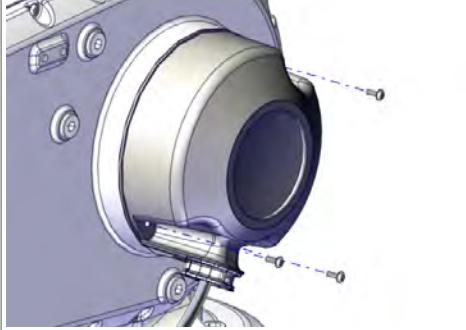
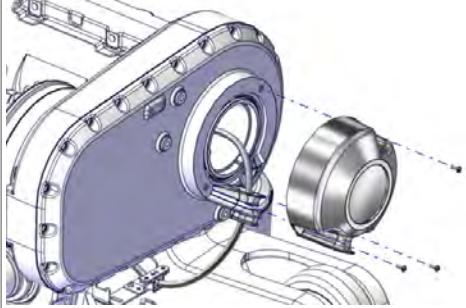
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the screw that hold the cable clamp.	 xx1500002718
3	Remove the protection cover. Make sure not to damage the surface exposed.	 xx1500002719
4	Unscrew the nut holding the bracket inside the upper arm.  Note The nut is reached from the outside.	 xx1500002720

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4 Repair

4.5.7 Replacing the parallel arm

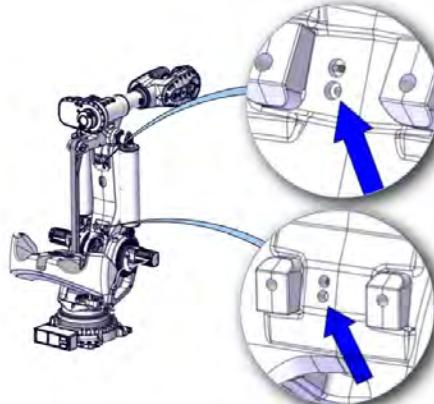
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Action	Note
5 Cut the cable tie.	 xx1500002721
6 Unscrew the screws that secure the cover.	 xx1500002722
7 Remove the cover.	 xx1500002723
8 Use caution and remove the cable harness out of the upper arm.	

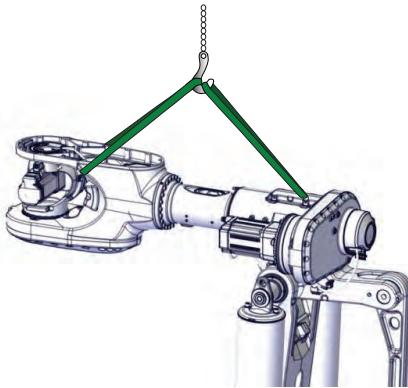
Removing the cable harness in the lower arm

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

Continues on next page

	Action	Note
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
3	Use caution and remove the cable harness from the lower arm.	

Removing the shafts

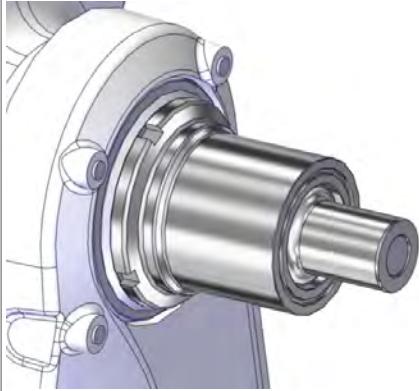
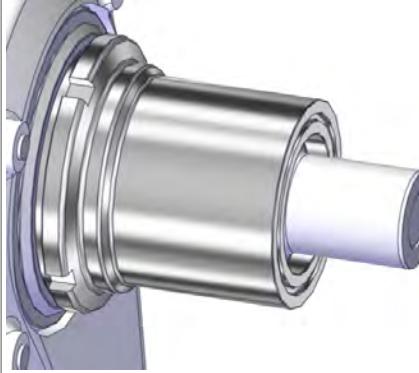
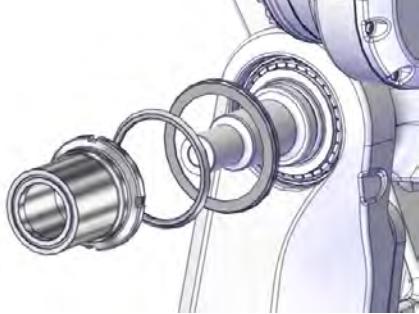
	Action	Note
1	Before continuing, make sure that the upper arm is secured in the lifting accessories and overhead crane.	 xx1500002724
2	 CAUTION The upper arm including the wrist weighs approximately 900 kg. All lifting accessories must be sized accordingly.	

Continues on next page

4 Repair

4.5.7 Replacing the parallel arm

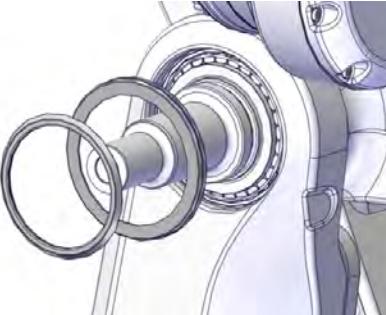
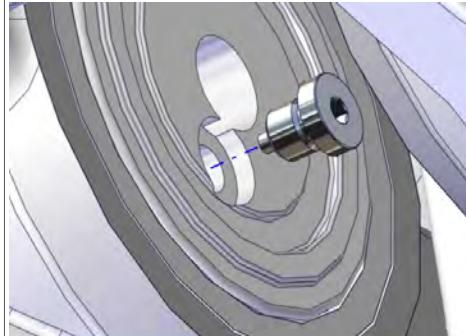
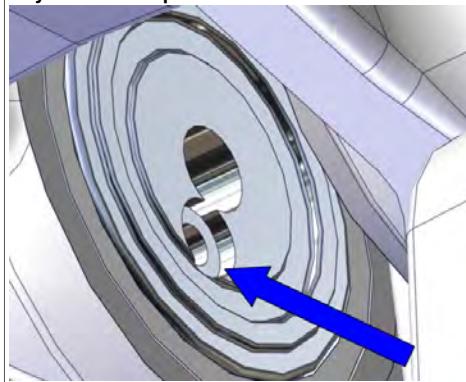
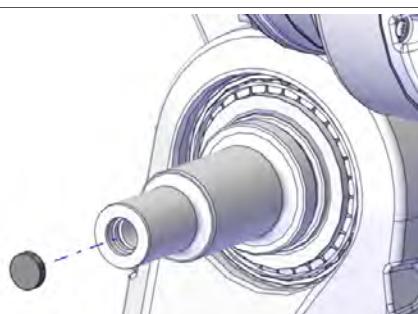
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Action	Note
3 Remove grease and other contamination from the axis-2 and axis-3 shaft ends and around the KM nuts, on both sides.	 xx1500002725
4 Use a Sleeve KM nut to release the torque on one of the KM nuts.  Note Do not remove this KM nut at this point. Only release the torque.	Sleeve KM nut D=152 L=220: 3HAC038174-067  xx1500002726
5 Use the Sleeve KM nut, open and remove the KM nut on the <i>other side</i> .  Note Make sure not to lose gamma sealing and sealing ring.	 xx1500002727
6  Note Continue the removal on the same side until the shaft is removed completely. Leave the other shaft fitted for now!	

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4.5.7 Replacing the parallel arm

Continued

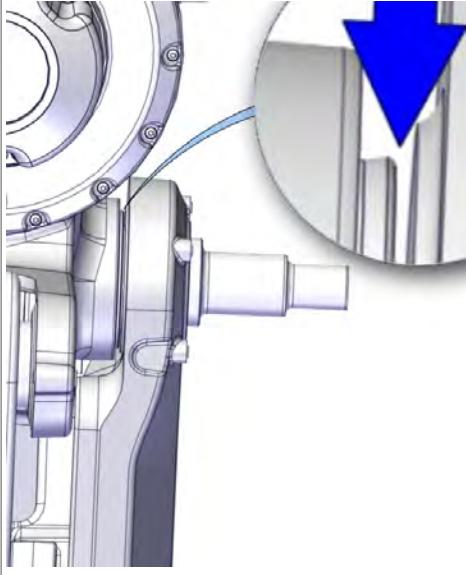
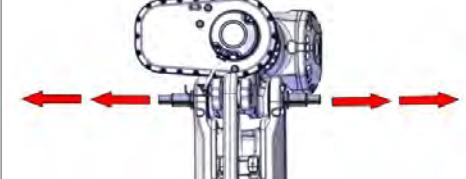
Action	Note
7 Remove gamma sealing and sealing ring.	 xx1500002728
8 Remove the magnetic plug and wipe hole and shaft end meticulously clean.	 xx1500003125
9 Attach the Glycerine adapter.  Note Tighten the adapter very hard in order to avoid leakage.	Glycerine adapter  xx1600000081
10 Remove the small VK cover.	 xx1500002729

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4 Repair

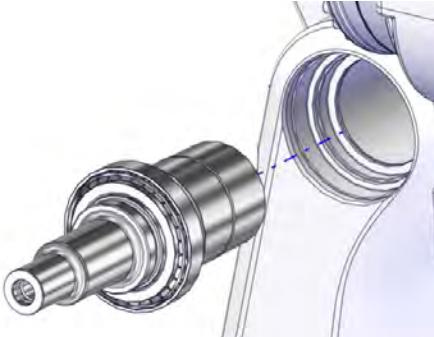
4.5.7 Replacing the parallel arm

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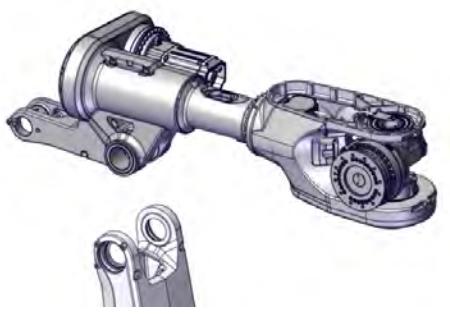
Action	Note
11 Attach a 2.5 mm shim between lower and upper arm, on the same side as the shaft being removed.	Horseshoe shims 2.5 mm: 3HAC038174-063  xx1600000076
12 Attach the removal tool.  Tip How to use the removal tool is described in the instruction 3HAC056526-002 delivered with the tool.	Removal tool 3HAC056095-003 Set of tools. Instruction 3HAC056526-002 enclosed.
13  CAUTION The shaft, including the removal tool, weighs approximately 25 kg.	
14 Secure the shaft and the removal tool to the upper arm using lifting eyes and a short roundsling. This is done as a safety precaution.  Tip How to secure removal tool and shaft, is described in the instruction 3HAC056526-002 delivered with the tool.	
15  CAUTION Do not stand close to the robot on any side when the shaft is being removed.	 xx1600000077

Continues on next page

4.5.7 Replacing the parallel arm
Continued

Action	Note
16 Use caution and press the shaft out, using both the glycerine and hydraulic press tools: 1 Pump up the glycerine pump to 500 bar. 2 Pump up the hydraulic pump to 500 bar. 3 Use caution and continue pumping up the pressure of the glycerine pump until the shaft is loose.	 xx1500002731
17 Remove the other shaft in the same way.	

Removing the upper arm complete

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.	
3 Use caution and lift the upper arm complete off.	 xx1500002732
4 Put the upper arm complete down on two pallets.	Pallet (2 pcs)

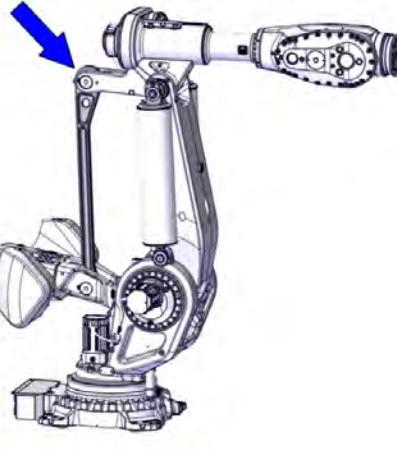
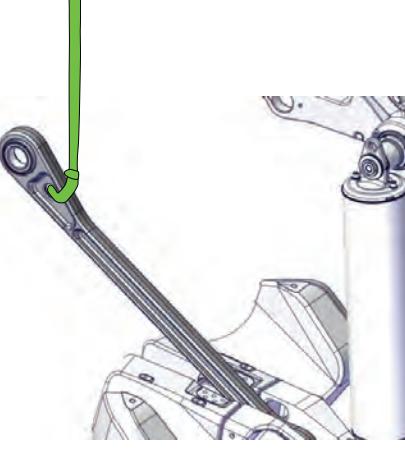
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4 Repair

4.5.7 Replacing the parallel arm

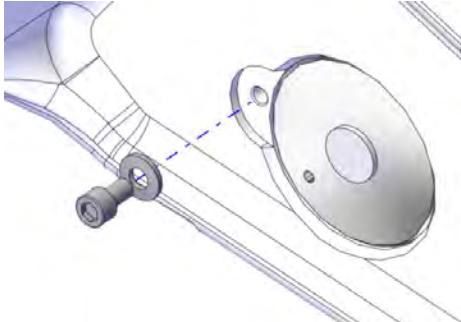
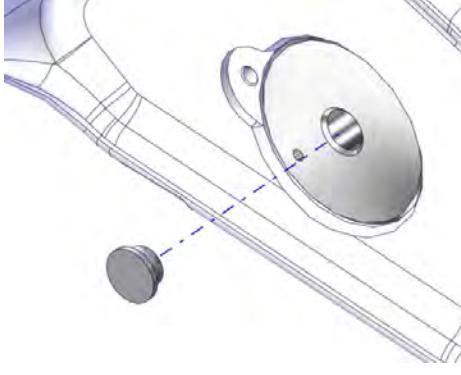
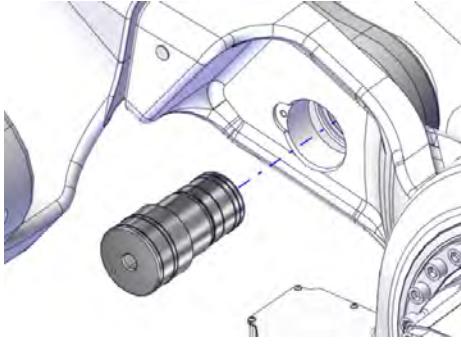
Continued

Removing the parallel rod, lower end

	Action	Note
1	 Note If the parallel rod shall be removed from the robot, always disassemble the upper end first.	 xx1500002736
2	 CAUTION The parallel rod weighs 55 kg. All lifting accessories used must be sized accordingly.	
3	Attach a roundsling, looped through the parallel rod and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg  xx1500002698
4	Stretch the roundsling to start taking the weight of the parallel rod.	

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4.5.7 Replacing the parallel arm
Continued

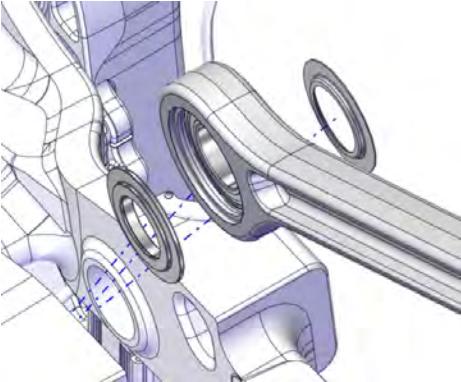
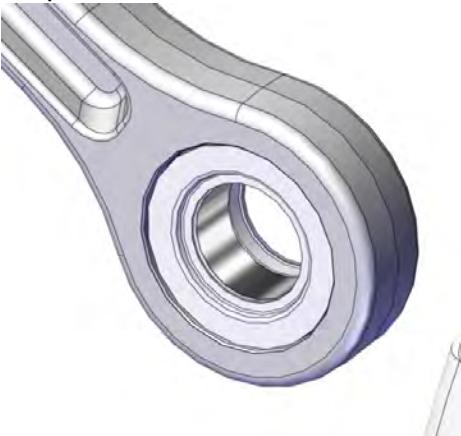
Action	Note
5 Remove the attachment screw with washer that secure the rod shaft.	 xx1500001966
6 Remove the protection plug.  Note Keep the protection plug. It shall be refitted when the work is done.	 xx1500001968
7 Apply the press tool parts (Assembly tool, Press plate and Round plate).	
8 Use the press tool and press the shaft out.	 xx1500001969

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4 Repair

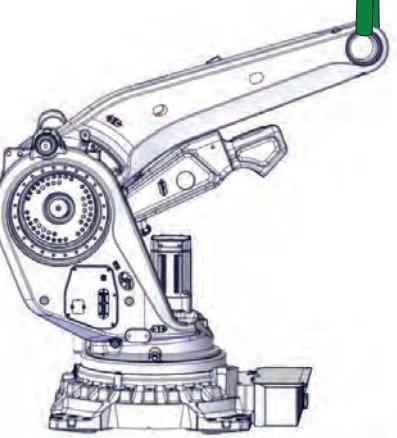
4.5.7 Replacing the parallel arm

Continued

Action	Note				
<p>9 Make sure the thrust washer and cover washer on either side of the bearing are present.</p> <p> Tip</p> <p>Make a note on which side the respective washer is fitted, for a correct assembly later.</p>	 <p>xx1500002098</p> <table border="1"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side				
Thrust washer	Cover washer				
10 Use caution and lift the parallel rod off.	 <p>xx1500002745</p>				
11 Secure bearing, thrust washer and cover washer with a strap (or similar), to prevent them from dropping out of its position.	 <p>Strap</p> <p>xx1500002099</p>				

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Preparations of axis-2 before lifting the lower arm complete off

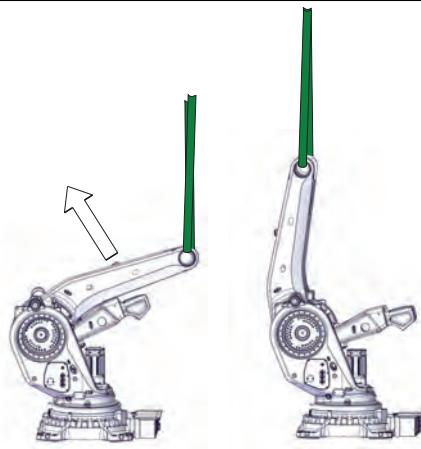
	Action	Note
1	 CAUTION The lower arm complete weighs 600 kg. All lifting accessories used must be sized accordingly!	
2	Attach a roundsling to the lower arm and to an overhead crane (or similar), with the robot in the current position.	Roundsling 2 m: Lifting capacity: 2,000 kg  xx1500002708
3	Stretch the lifting accessories to take the weight of the lower arm.	
4	To release the brakes on axis-2, connect the 24 VDC power supply. Connect to connector R2.MP2: <ul style="list-style-type: none"> • pin 2 = 24V • pin 5 = 0V 	

Continues on next page

4 Repair

4.5.7 Replacing the parallel arm

Continued

Action	Note
5 Release the brakes on axis-2 and with the help of an overhead crane, lift the lower arm up as close as possible to calibration position.	 xx1500002705

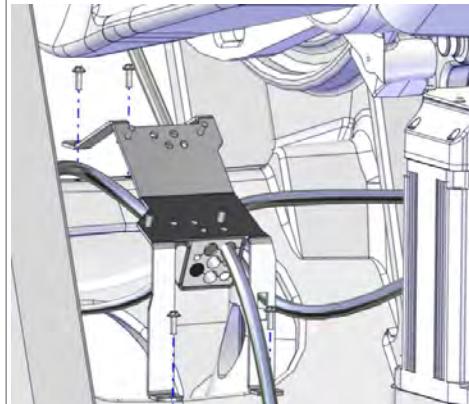
Unscrewing the axis-1 bracket

In order to protect the lower end of the cable harness, the axis-1 bracket shall be removed with the cable harness still attached to it.



Note

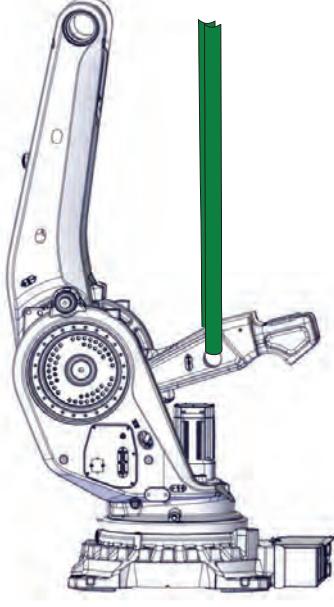
There is no need to disconnect the motor cables to axis-1, 2 and 3 motors or to the SMB unit.

Action	Note
1 Unscrew the attachment screws that secure the axis-1 bracket. Leave the cables attached!	 xx1500002372
2 Remove the cable harness in the base.	

Continues on next page

Preparations of axis-3 before lifting away the lower arm complete

The lower arm complete consists of lower arm and parallel arm together.

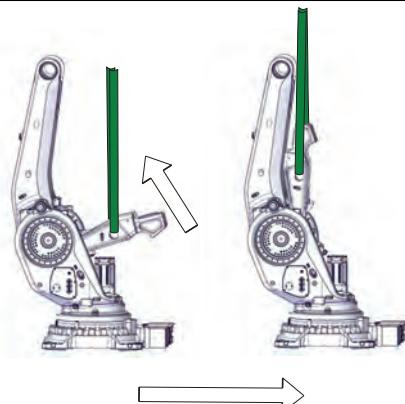
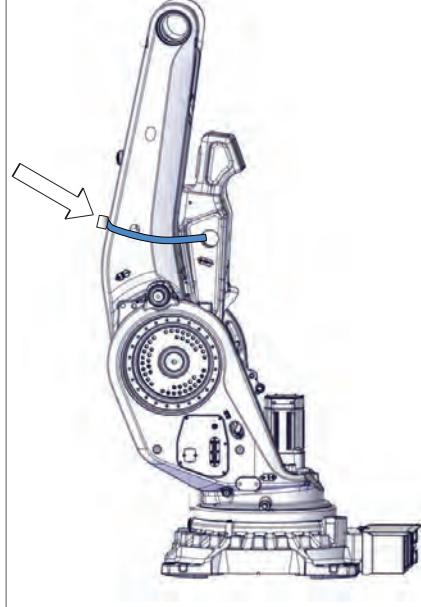
	Action	Note
1	Attach a roundsling to the parallel arm and to an overhead crane (or similar).	Roundsling 2 m: Lifting capacity: 2,000 kg  xx1500002707
2	 CAUTION The parallel arm weighs 255 kg. All lifting accessories used must be sized accordingly!	
3	Stretch the lifting accessories to take the weight of the parallel arm.	
4	To release the brakes on axis-3, connect the 24 VDC power supply. Connect to connector R2.MP3: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	

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4 Repair

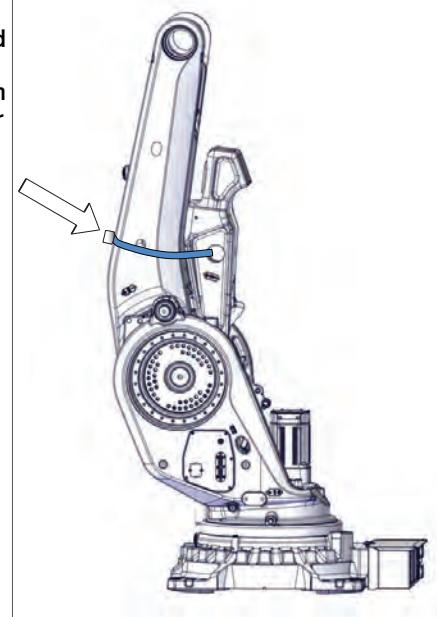
4.5.7 Replacing the parallel arm

Continued

Action	Note
5 Use caution, release the brakes on the axis-3 and lift the parallel arm up as close as possible against the lower arm.	 xx1500002706
6 Secure the parallel arm to the lower arm with a Endless ratchet lashing belt.	Endless ratchet lashing belt  xx1500002709
7 With the brakes still released on axis-3, use the ratchet belt and manually move the parallel arm the last bit against the lower arm. Secure with the ratchet belt.	
8 Remove the 24 VDC power supply.	
9 Remove the lifting accessory from the parallel arm.	

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Attaching lifting accessories to lower arm complete - removal

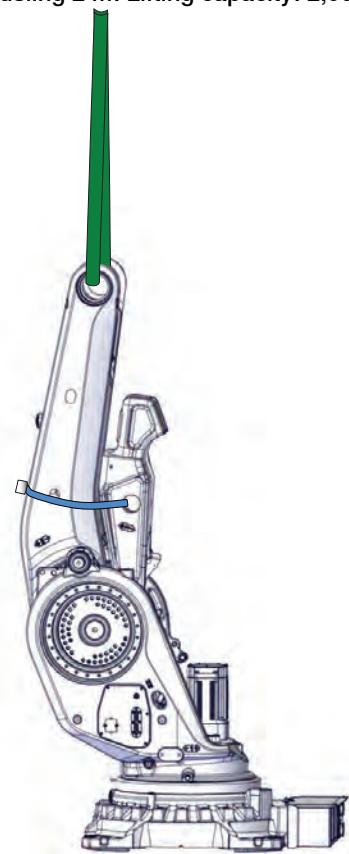
	Action	Note
1	 CAUTION The lower arm complete weighs 600 kg. All lifting accessories used must be sized accordingly!	
2	 DANGER Make sure that the parallel arm is secured to the lower arm with an Endless ratchet lashing belt to prevent the parallel arm from falling down, uncontrolled when the lower arm complete is lifted up.	Endless ratchet lashing belt  xx1500002709

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4 Repair

4.5.7 Replacing the parallel arm

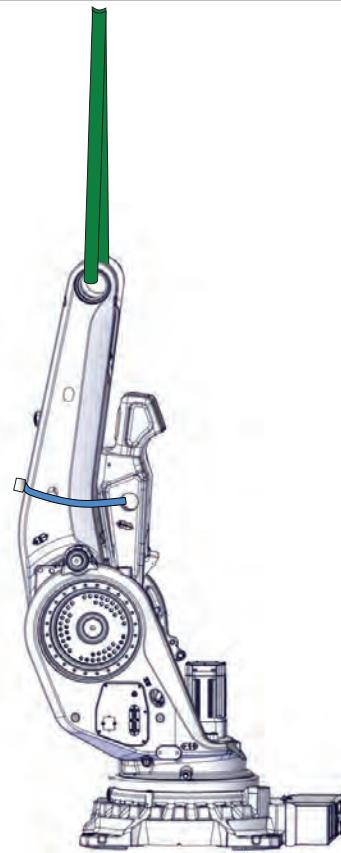
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Action	Note
3 Attach a roundsling to the lower arm complete and to an overhead crane (or similar). Attach the roundsling through the holes, in the upper ends of the lower arm and parallel arm.	Roundsling 2 m: Lifting capacity: 2,000 kg  xx1500002733

Continues on next page

Removing the lower arm complete

The lower arm complete consists of lower arm and parallel arm together.

	Action	Note
1	Make sure that the lower arm complete is attached to the lifting accessories.	 xx1500002733
2	 DANGER Make absolutely sure that the parallel arm is secured against the lower arm with a ratchet lashing belt.	
3	Unscrew the remaining attachment screws that secure the lower arm to the axis-2 gearbox and the parallel arm to the axis-3 gearbox.	
4	Use a Crowbar (small) (or similar), and press the lower arm and parallel arm together as much as possible.	Crowbar (small)

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4 Repair

4.5.7 Replacing the parallel arm

Continued

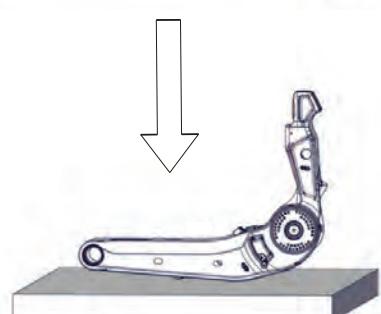
Action	Note
5 Use caution and lift the lower arm complete off.	 xx1500002700
6 Put the complete lower arm down on two pallets.  Tip Put a piece of wood underneath the lower arm to avoid the plastic cover, fitted on the calibration surface, from being damaged.	Pallet (2 pcs)  xx1500002701
7 Remove the lifting accessories.	

Removing the parallel arm

Action	Note
1 Remove the ratchet lashing belt.	
2  CAUTION The parallel arm weighs 255 kg. All lifting accessories used must be sized accordingly!	

Continues on next page

4.5.7 Replacing the parallel arm
Continued

	Action	Note
3	Attach a roundsling to the parallel arm and lift it to vertical position.	  xx1500002734
4	Use the press tool and disassemble the parallel arm from the lower arm.	Press tool:
5	Use caution and lift the parallel arm up from the lower arm.	 xx1500002703
6	If needed replace the bearings.	

Refitting the parallel arm

Use these procedures to refit the parallel arm.

Preparations

	Action	Note
1	Wipe clean all contact surfaces on parallel arm and lower arm.	
2	Remove residues of corrosion protection and other contamination on the bearings.	

Continues on next page

4 Repair

4.5.7 Replacing the parallel arm

Continued

	Action	Note
3	Examine the bearings for damage.  Note Replace if damaged.	For instructions how to replace bearings, see below.
4	Apply corrosion protection on the outer surface of the bearings.	Mercasol
5	Apply corrosion protection in the holes.	Mercasol

Replacing the bearings

	Action	Note
1	Remove the bearing.	
2	Remove the washer and remove all residues of old corrosion protection and other contamination from the washer.	
3	Remove residues of old corrosion protection and other contamination on the parallel arm shafts.	
4	Wipe clean all contact surfaces from residues of corrosion protection and other contamination.	
5	Apply new corrosion protection.	Mercasol
6	Refit the washer.	
7	Attach the pull bar, press plate, spherical roller bearing and dolly.	Press tool:
8	Secure a Hydraulic cylinder with a lock nut and press the bearings into position.	Hydraulic cylinder Lock nut:

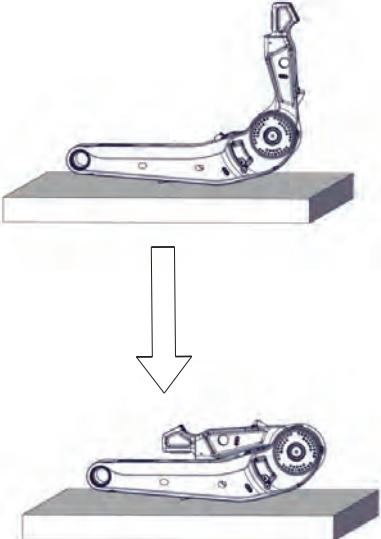
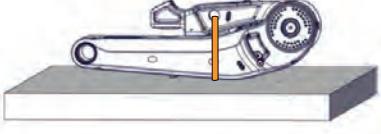
Refitting the parallel arm

	Action	Note
1	 CAUTION The parallel arm weighs 255 kg. All lifting accessories used must be sized accordingly!	
2	Attach the roundsling to the parallel arm and to an overhead crane (or similar), and lift it up to vertical position.	Roundsling 2 m: Roundsling 2 m

Continues on next page

4.5.7 Replacing the parallel arm

Continued

Action	Note
3 Use caution and move the parallel arm into mounting position.	 xx1500002703
4 Use the press tool and assemble the parallel arm and lower arm.	Press tool:
5 Use caution and lower the parallel arm until it rests on the lower arm.	 xx1500002737
6 Remove the lifting accessories.	
7 Secure the parallel arm to the lower arm with an Endless ratchet lashing belt.	Endless ratchet lashing belt  xx1500002738

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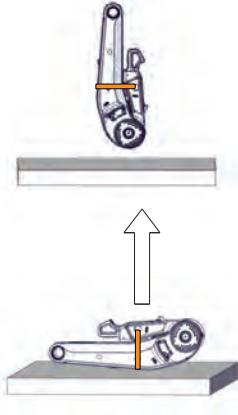
4 Repair

4.5.7 Replacing the parallel arm

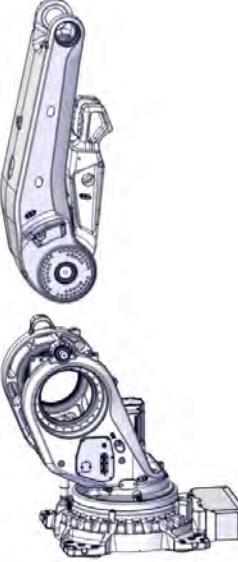
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Attaching lifting accessories, lower arm complete

The lower arm complete consists of lower arm and parallel arm together.

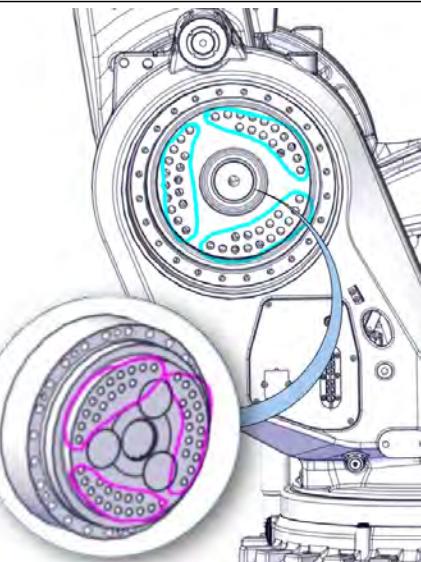
Action	Note
1  CAUTION The lower arm complete weighs 600 kg. All lifting accessories used must be sized accordingly!	
2  DANGER Make sure that the parallel arm is secured to the lower arm with an Endless ratchet lashing belt to prevent the parallel arm from falling down uncontrolled, when the lower arm complete is lifted up.	Endless ratchet lashing belt
3 Attach a roundsling to the lower arm complete and to an overhead crane (or similar). Attach the roundsling through the holes, in the upper ends of the lower arm and parallel arm.	Roundsling 2 m: Lifting capacity: 2,000 kg
4 Use caution and lift the lower arm complete up to a vertical position.	 xx1500002739

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Action	Note
5 Use caution and move the lower arm complete into mounting position.	 xx1500002700

Refitting the lower arm complete - step 1

The lower arm complete consists of lower arm and parallel arm together.

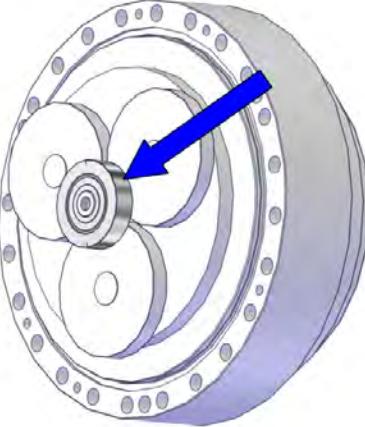
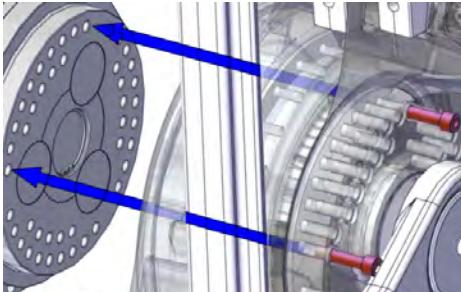
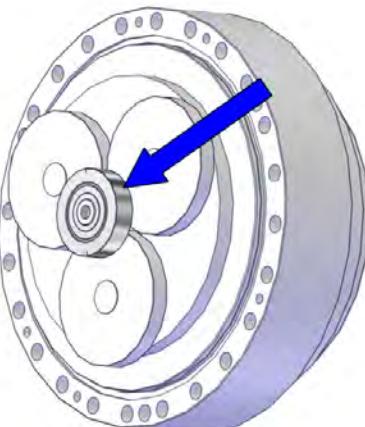
Action	Note
1 The hole pattern in gearboxes and robot is arranged in three areas. Find the hole pattern between lower arm and axis-2 gearbox, as well as between parallel arm and axis-3 gearbox. Make sure that all reachable screw holes will match, before securing any of the attachment screws.	 xx1500002344

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4 Repair

4.5.7 Replacing the parallel arm

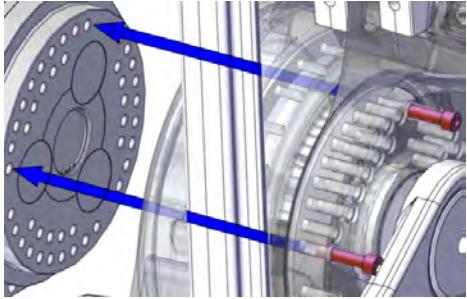
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Action	Note
<p>2 Release the brakes on axis-2 and find the hole pattern between lower arm and axis-2 gearbox.</p> <p> Tip</p> <p>Use caution and rotate the small gear on the axis-2 gearbox.</p>	 xx1500002345
<p>3 Attach as many screws as possible with the robot in this position.</p> <p> Tip</p> <p>Begin by fitting screws in the outer holes in the outer ring of holes, to make sure the hole pattern will match.</p> <p>If needed, carefully turn the small gear in the gearbox to find the hole pattern.</p>	 xx1500002740
4 Secure the attached screws that secure the lower arm to the axis-2 gearbox.	Tightening torque: 300 Nm
<p>5 Release the brakes on axis-3 and find the hole pattern between parallel arm and axis-3 gearbox.</p> <p> Tip</p> <p>Use caution and rotate the small gear on the axis-3 gearbox.</p>	 xx1500002345

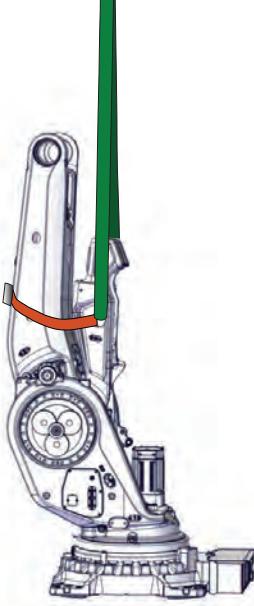
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4.5.7 Replacing the parallel arm

Continued

Action	Note
6 Attach as many screws as possible with the robot in this position. Tip Begin by fitting screws in the most outer holes in the outer ring of holes, to make sure the hole pattern will be matching. If needed use caution and turn the small gear in the gearbox to find the hole pattern.	 xx1500002740
7 Secure the attached screws that secure the parallel arm to the axis-3 gearbox.	Tightening torque: 300 Nm

Preparations of the parallel arm before the continued refitting

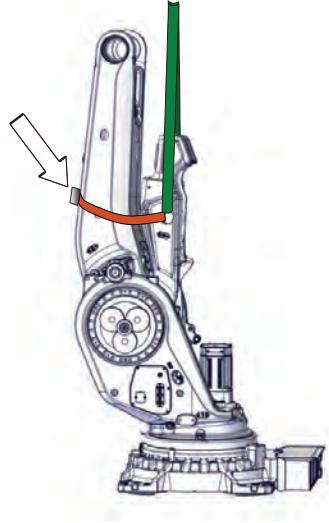
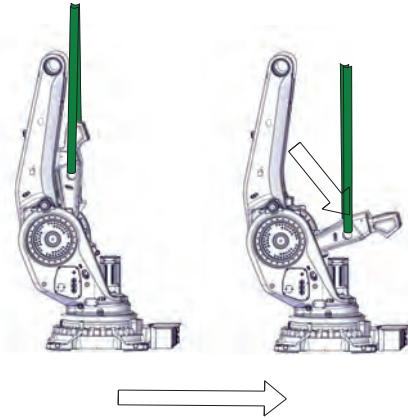
Action	Note
1 Attach a roundsling to the parallel arm.	Roundsling 2 m: Lifting capacity: 2,000 kg  xx1500002742

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4 Repair

4.5.7 Replacing the parallel arm

Continued

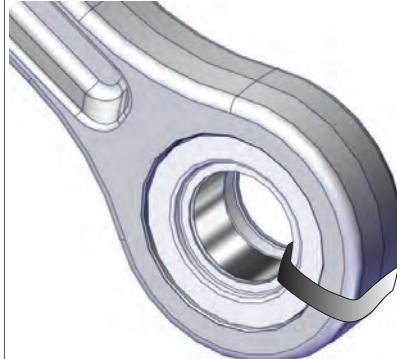
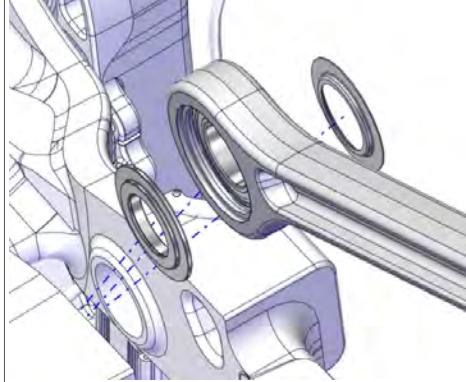
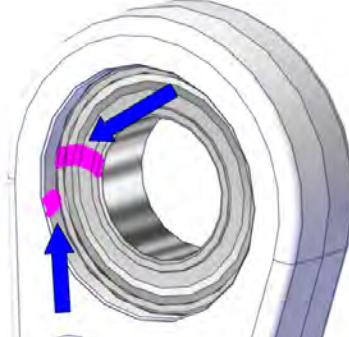
Action	Note
2 Remove the Endless ratchet lashing belt.	 xx1500002743
3 Stretch the roundsling to take the weight of the parallel arm.	
4 Release the brakes on axis-3 and lower the parallel arm to calibration position.	 xx1500002741

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4.5.7 Replacing the parallel arm

Continued

Preparations before refitting the parallel rod, lower end

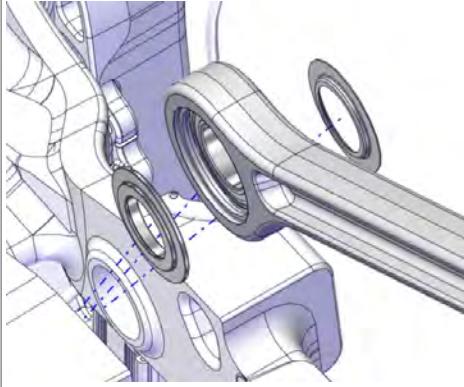
	Action	Note				
1	Remove the strap which was used to keep bearing, thrust washer and cover washer in position.	 xx1500002744				
2	Remove the thrust washer and cover washer, and wipe them clean. Note Make a note on which side the covers are placed.	 xx1500002098 <table border="1"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side					
Thrust washer	Cover washer					
3	Wipe the shafts and the holes for the shafts clean.					
4	Apply corrosion protection on both sides of the bearings, and on all machined surfaces on the parallel rod.	Mercasol  xx1500002100				

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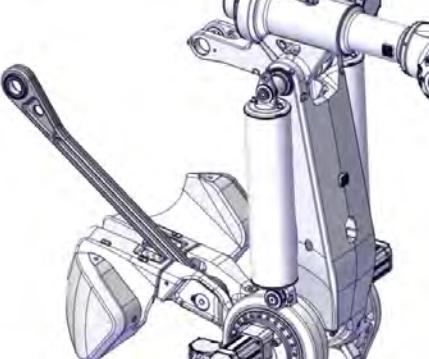
4 Repair

4.5.7 Replacing the parallel arm

Continued

Action	Note				
5 Put back the thrust washer (left side) and cover washer (right side).	 xx1500002098 <table border="1"><tr><td>Left side</td><td>Right side</td></tr><tr><td>Thrust washer</td><td>Cover washer</td></tr></table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side				
Thrust washer	Cover washer				

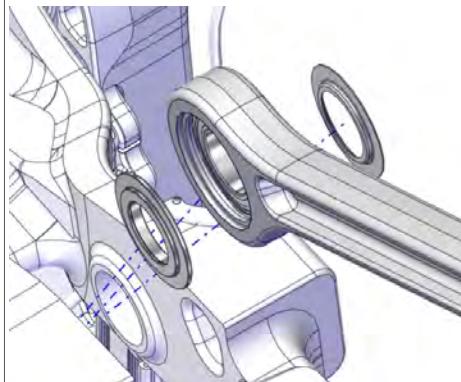
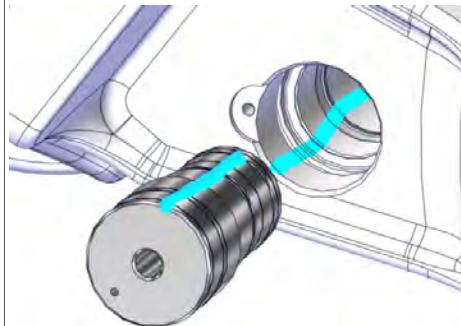
Refitting the parallel rod, lower end

Action	Note
1  Note If the parallel rod has been removed from the robot, always start refitting at the lower end!	 xx1500001965
2  CAUTION The parallel rod weighs 55 kg.	
3 Attach a roundsling to the parallel rod and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg

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4.5.7 Replacing the parallel arm

Continued

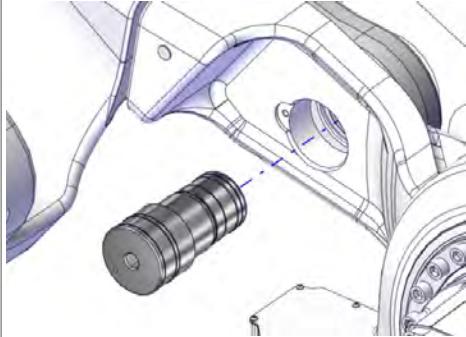
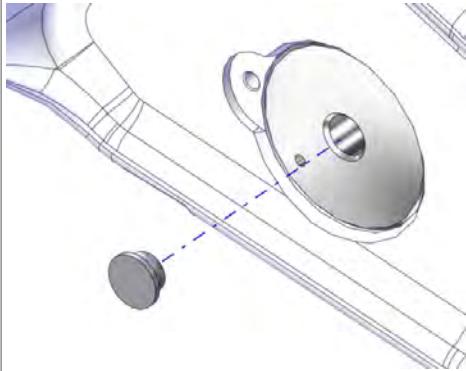
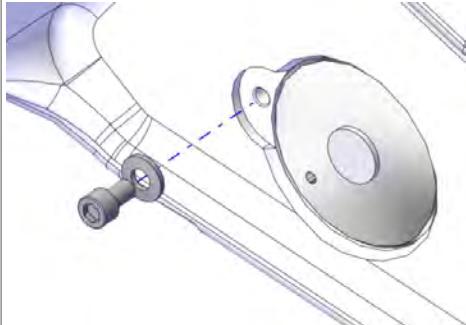
Action	Note				
4 Use caution, stretch the roundsling and lift the parallel rod into mounting position.	 xx1500002745				
5 Apply the press tool parts (Assembly tool, Press plate and Round plate).					
6 Make sure that the thrust washer and cover washer on either side of the bearing, are in position.  Note Make sure that the washers are on the correct sides of the bearing.	 xx1500002098 <table border="1"> <tr> <td>Left side</td> <td>Thrust washer</td> </tr> <tr> <td>Right side</td> <td>Cover washer</td> </tr> </table>	Left side	Thrust washer	Right side	Cover washer
Left side	Thrust washer				
Right side	Cover washer				
7 Apply some grease on the shafts and in the holes on both sides of parallel arm, as well as in the bearing hole.	 xx1500002301				

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4 Repair

4.5.7 Replacing the parallel arm

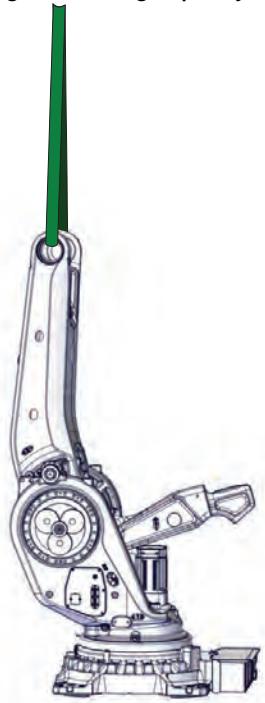
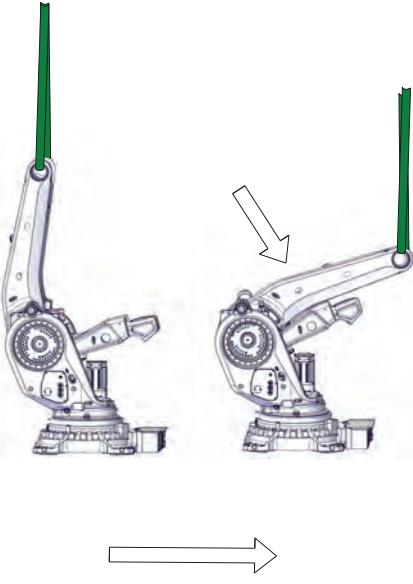
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	Action	Note
8	Use caution and press the shaft in.	 xx1500001969
9	Refit the protection plug.	 xx1500001968
10	Apply locking liquid on the screw and secure the shaft.	Attachment screw: M10x16 8.8 Loctite 243  xx1500001966

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4.5.7 Replacing the parallel arm
Continued

Preparations of the lower arm before the continued refitting

	Action	Note
1	Attach a roundsling to the lower arm.	<p>Roundsling 2 m: Lifting capacity: 2,000 kg</p>  <p>xx1500002747</p>
2	Stretch the roundsling to take the weight of the parallel arm.	
3	Release the brakes on axis-2 and lower the lower arm until the distance between the dampers on the lower arm and the parallel arm is approximately 30 mm.	 <p>xx1500002746</p>
4	Remove the 24 VDC power supply.	
5	Remove the lifting accessories.	

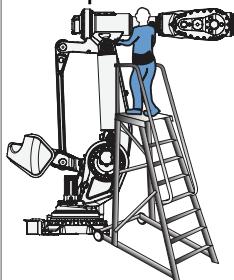
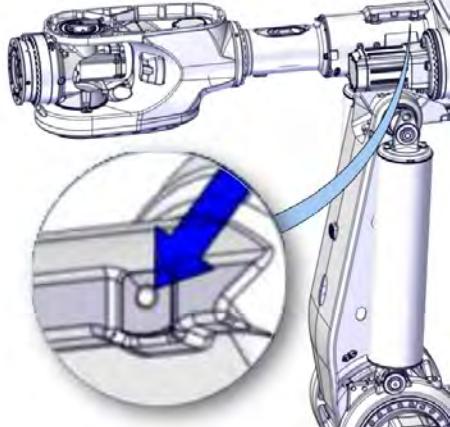
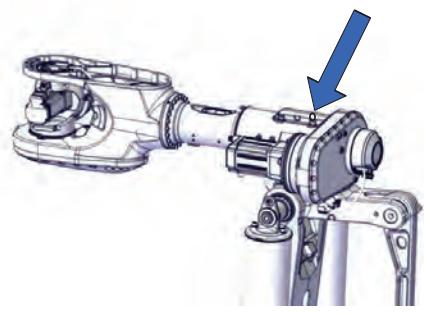
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4 Repair

4.5.7 Replacing the parallel arm

Continued

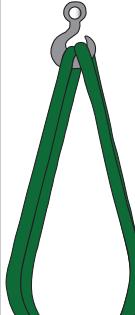
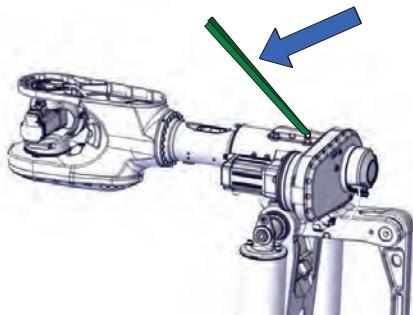
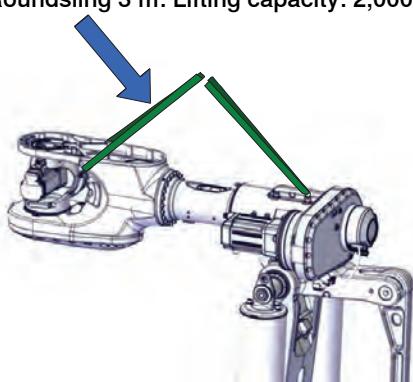
Attaching lifting accessories to the upper arm complete

Action	Note
<p>1  CAUTION The complete upper arm weighs 900 kg. All lifting accessories used must be sized accordingly.</p>	
<p>2 <i>Only needed when the upper arm is fitted on the robot:</i> Use a Mobile platform ladder (or similar) to attach the lifting accessories.</p> <p> DANGER Never use the robot as ladder.</p>	 xx1500001985
<p>3 Remove the plastic plug in the hole shown in the figure.</p>	 xx1500002712
<p>4 Attach a Lifting eye to the hole in the arm housing with a Fender washer underneath.</p>  xx1400002196	<p>Lifting eye: M12 Fender washer: Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.</p>  xx1500002715

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4.5.7 Replacing the parallel arm

Continued

Action	Note
5 Attach a roundsling looped to the Lifting eye and to an overhead crane (or similar).  xx1400002599	Roundsling 2.5 m: Lifting capacity: 2,000 kg  xx1500002713
6 Attach a roundsling looped to the wrist and to an overhead crane (or similar).	Roundsling 3 m: Lifting capacity: 2,000 kg  xx1500002714
7 Stretch the lifting accessories to take the weight of the upper arm.	
8 <i>Only needed when the upper arm is fitted on the robot:</i> In order to release the brakes, connect the 24 VDC power supply. Connect connector R2.MP2: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	
9 <i>Only needed when the upper arm is fitted on the robot:</i> Release the brakes on axis-2 to be sure that the lifting accessories are taking the weight of the upper arm.	
10 Adjust the lifting accessories, if needed.	

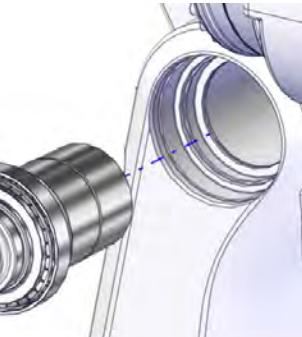
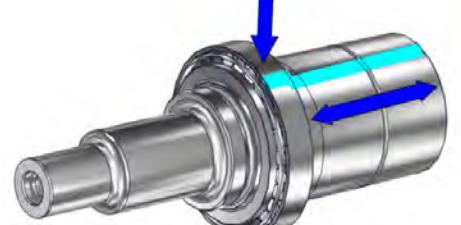
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4 Repair

4.5.7 Replacing the parallel arm

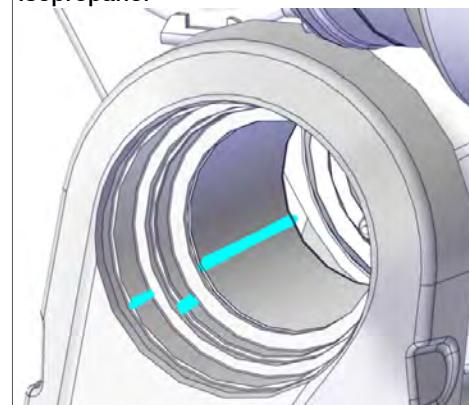
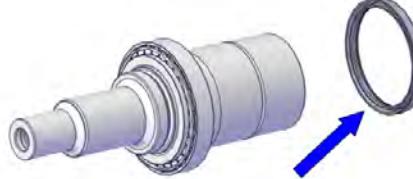
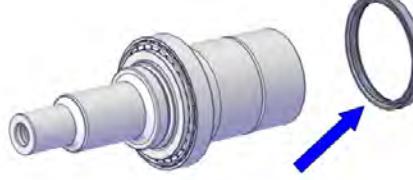
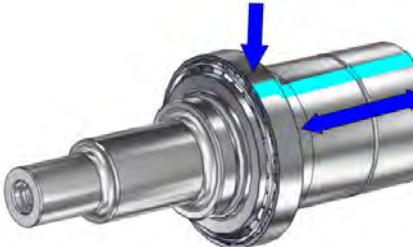
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Preparations before refitting the shafts

	Action	Note
1	Remove residues of Loctite and other contamination from the shaft and in the hole where the shaft shall be refitted.	 xx1500002731
2	Use a Scotch-brite abrasive cleaning hand pad and rub the contact surfaces on shaft and outer ring of bearing.	Scotch-brite abrasive cleaning hand pad  xx1500002749
3	Use a Scotch-brite abrasive cleaning hand pad and rub the contact surfaces in the hole for shaft, outer ring of bearing and sealing ring.	Scotch-brite abrasive cleaning hand pad  xx1500002750

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4.5.7 Replacing the parallel arm
Continued

Action	Note
4 Wipe the surfaces for shaft, outer ring of bearing and sealing ring meticulously clean, with Isopropanol.  Note Do not touch the cleaned surfaces with anything after cleaning.	Isopropanol  xx1500002750
5 Inspect the sealing ring. Replace if damaged.	 xx1500002748
6 Wipe the sealing ring clean with Isopropanol.	Isopropanol  xx1500002748
7 Wipe the contact surfaces on shaft and outer ring of bearing meticulously clean with Isopropanol.  Note Do not touch the cleaned cone surface of the shaft with anything after cleaning.	Isopropanol  xx1500002749
8 Use caution and attach the sealing ring onto the shaft.	

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4 Repair

4.5.7 Replacing the parallel arm

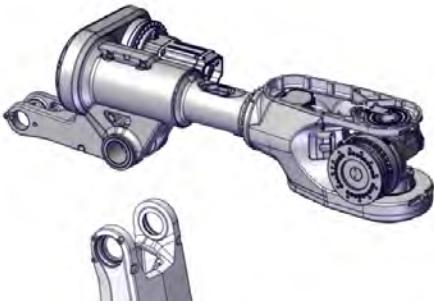
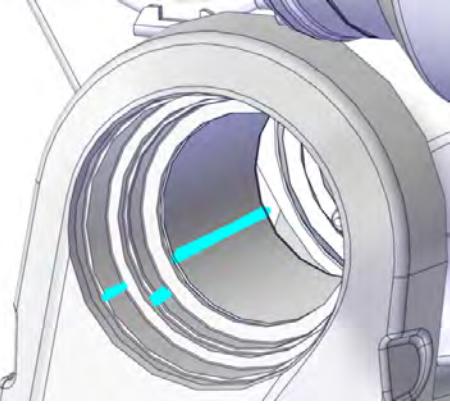
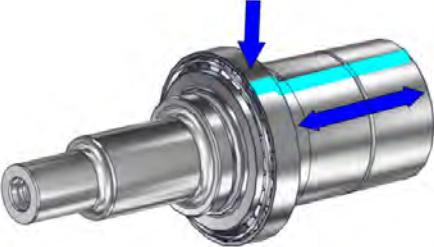
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Refitting the shaft



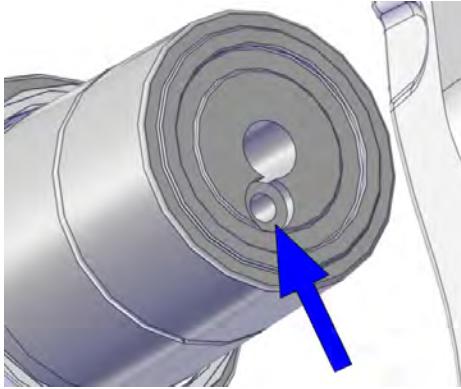
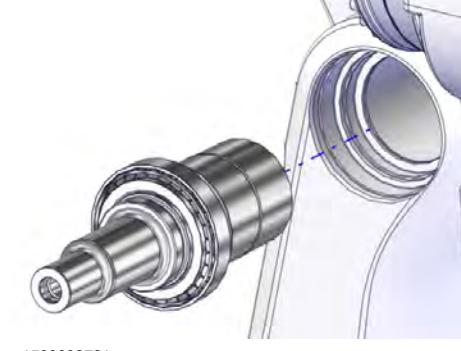
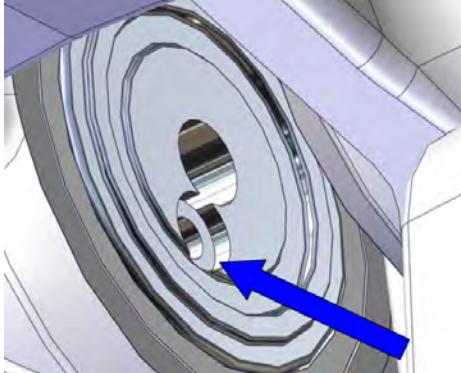
Note

Start the refitting of the shafts on the axis-3 side!

	Action	Note
1	Fill the bearing with grease.	Tribol GR 100-2 PD
2	Lift the upper arm into mounting position.	 xx1500002732
3	 CAUTION The upper arm complete weighs 900 kg. All lifting accessories used must be sized accordingly!	
4	Wipe the contact surfaces in the upper arm, meticulously clean, with Isopropanol.  Note Do not touch the cleaned cone surface of the shaft with anything after cleaning.	 Isopropanol xx1500002750
5	Wipe the contact surfaces on shaft, outer ring of bearing and sealing ring meticulously clean with Isopropanol.  Note Do not touch the cleaned cone surface of the shaft with anything after cleaning.	 Isopropanol xx1500002749

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4.5.7 Replacing the parallel arm
Continued

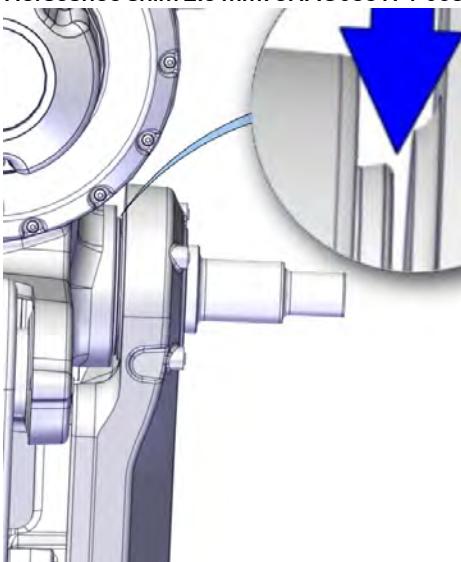
	Action	Note
6	 Note Make sure that the hole for the Glycerine adapter on the shaft, will be facing as low as possible.	 xx1500002979
7	 CAUTION The shaft weighs 19 kg.	
8	Use caution and lift the shaft into mounting position.  Note Do not touch the surfaces cleaned with Isopropanol.	 xx1500002731
9	Wipe the Glycerine adapter connection meticulously clean.	Glycerine adapter
10	Attach the Glycerine adapter.  Note Tighten the adapter very hard in order to avoid leakage.	 xx1600000081

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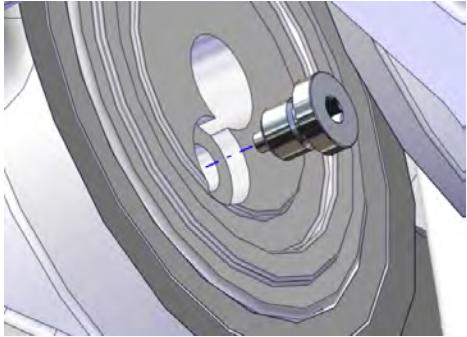
4 Repair

4.5.7 Replacing the parallel arm

Continued

Action	Note
11 Put a 2.5 mm horseshoe shim between lower and upper arm, on the axis-3 side.	Horseshoe shim 2.5 mm: 3HAC038174-063  xx1600000076
Note Leave the shim in this position also when the axis-2 shaft is fitted.	
12 Attach a pull bar to the part of the press tool at the Glycerine adapter.	
13 Attach the assembly tool. Tip How to use the assembly tool is described in the instruction 3HAC056526-002 delivered with the tool.	Assembly tool 3HAC056095-002 Set of tools. Instruction 3HAC056526-002 enclosed.
14 Put the hydraulic pump onto the pull bar.	
15 Manually tighten the adjustment nut against the hydraulic cylinder.	
16 Tighten the adjustment nut.	Tightening torque: 20 Nm
17 Attach a Dial gauge and put it in zero position.	Dial gauge
18 Use the assembly tool and the Glycerine adapter and press the shaft in 3.5 mm ±0.15.	
19 Wait one minute.	
20 Release the glycerine pressure.	
21 Wait one minute.	
22 Release the hydraulic pressure.	
23 Make sure the value 3.5 mm remains. If not, retighten the shaft as described above.	
24 Remove the hydraulic and glycerine tools.	

Continues on next page

	Action	Note
25	Refit the magnetic plug.	 xx1500003125
26	Refit the other shaft by repeating the procedure. Note Leave the horseshoe shim fitted on the axis-3 side also when fitting the axis-2 shaft! Do not move the shim or attach another one on the axis-2 side.	

Refitting the KM nut - axis-3 side

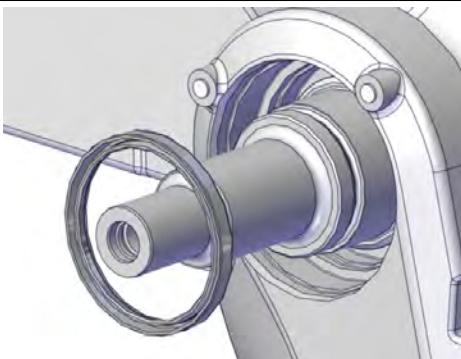
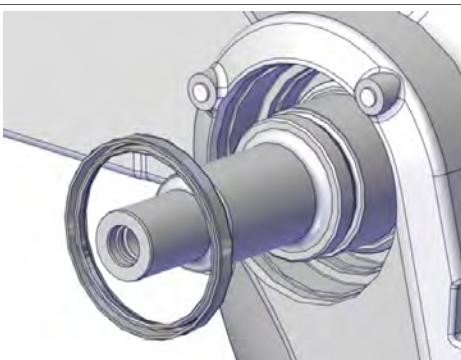
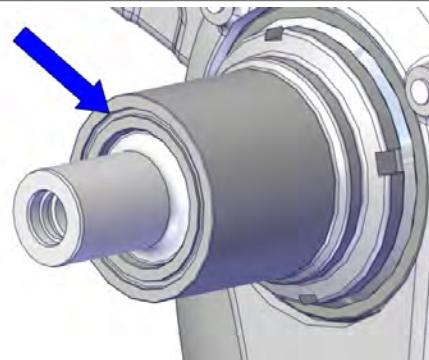
	Note Start refitting KM nut on the axis-3 side!	
1	Inspect the pre-mounted gamma sealing on the KM nut.	 xx1600000083

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4 Repair

4.5.7 Replacing the parallel arm

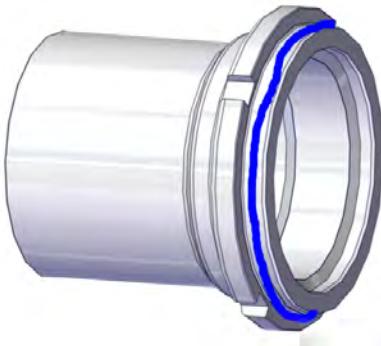
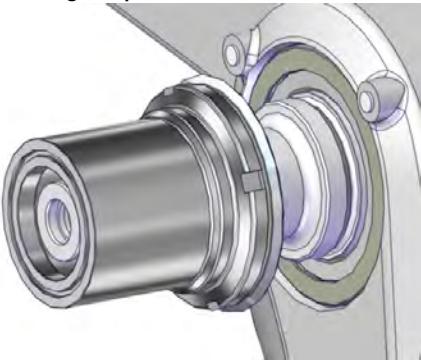
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Action	Note
2 Inspect sealing ring.	 xx1600000084
3 Refit sealing ring.	 xx1600000084
4 Wipe clean the KM nut.	 xx1600000193
5 Wipe clean the o-ring in the KM nut.	
6 Attach the o-ring in its groove in the KM nut.  Tip Put a little grease on the o-ring for a better fitting.	 xx1600000188

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4.5.7 Replacing the parallel arm

Continued

	Action	Note
7	Apply locking liquid on the threads and refit the KM nut.	Loctite 243  xx1600000192
8	Secure the KM nut with the Sleeve KM nut.	Sleeve KM nut D=152 L=220: 3HAC038174-067 Tightening torque: 300 Nm  xx1600000187
9	Wipe the shaft clean.	
10	Attach the attachment of the dial gauge in the holes on the axis-3 side, with the dial gauge against the axis-2 side.	Dial gauge

Refitting the KM nut - axis-2 side

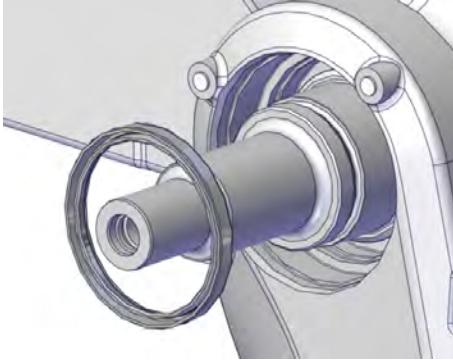
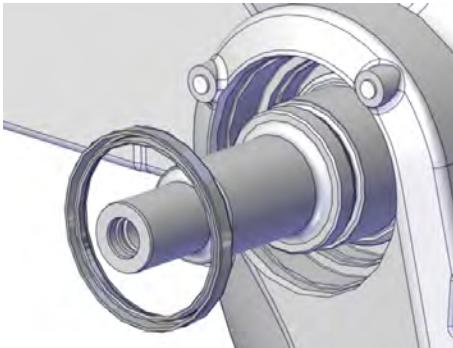
	Action	Note
1	 Note Leave the 2.5 mm hoseshoe shim fitted on the axis-3 side, when refitting the KM nut on the axis-2 side. Do not remove or add another shim!	

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4 Repair

4.5.7 Replacing the parallel arm

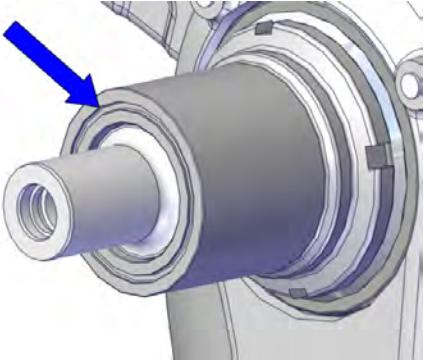
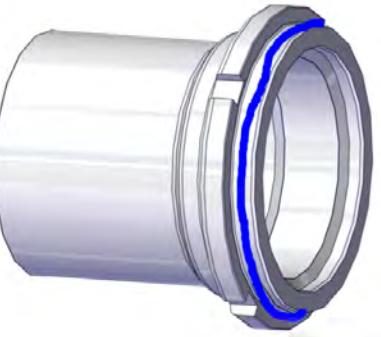
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Action	Note
2 Inspect the pre-mounted gamma sealing on the KM nut.	 xx1600000083
3 Inspect sealing ring.	 xx1600000084
4 Refit sealing ring.	 xx1600000084
5 Wipe clean the KM nut.	 xx1600000193
6 Wipe clean the o-ring in the KM nut.	

Continues on next page

4.5.7 Replacing the parallel arm

Continued

Action	Note
7 Attach the o-ring in its groove in the KM nut. Tip Put a little grease on the o-ring for a better fitting.	 xx1600000188
8 Apply locking liquid on the threads and refit the KM nut.	Locking liquid: Loctite 243  xx1600000192
9 Make sure that the dial gauge attachment is fitted.	
10 Secure the axis-2 KM nut with the Sleeve KM nut, until the dial gauge shows 0.38 mm.	Sleeve KM nut D=152 L=220: 3HAC038174-067
11 Wipe the shaft end clean.	
12 Remove the horseshoe shim.	

Refitting the cable harness in the lower arm

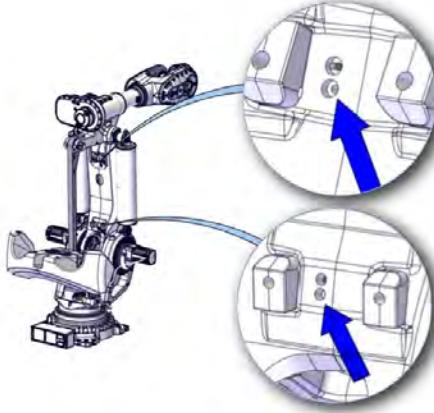
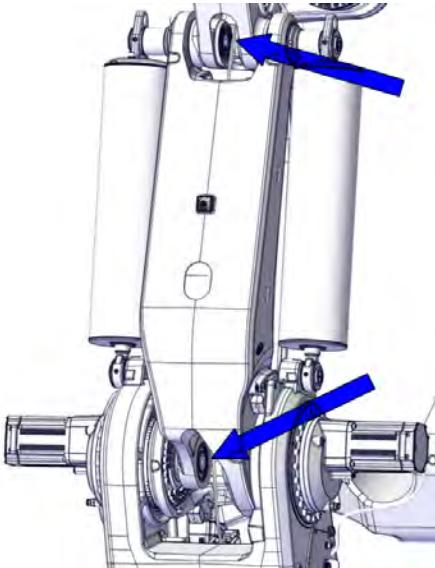
Action	Note
1 Run the cable harness up through the lower arm.	
2  Note Make sure the cable harness is rotated one revolution between the upper and lower bracket inside the lower arm, when refitted.	

Continues on next page

4 Repair

4.5.7 Replacing the parallel arm

Continued

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

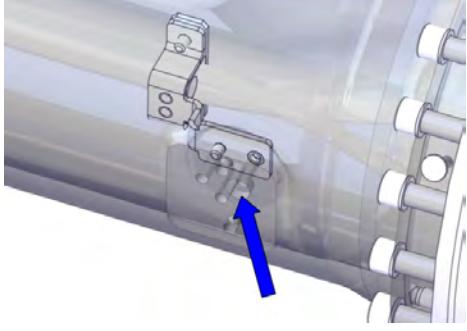
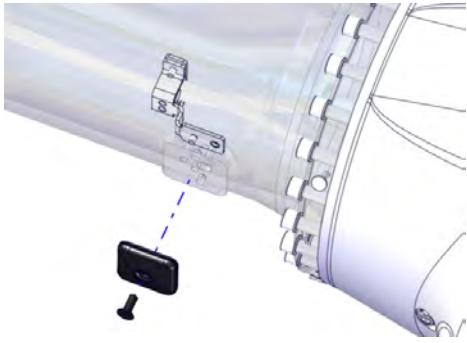
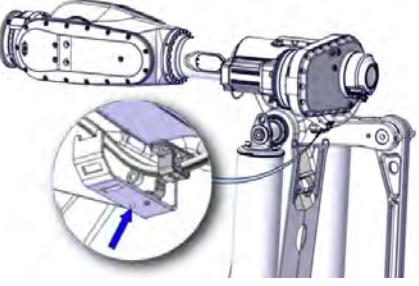
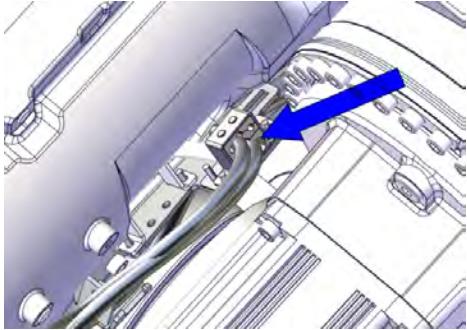
Refitting the cable harness in the upper arm

Action	Note
<p>1 Carefully push the cable harness in through the upper arm and out off the wrist.</p>	

Continues on next page

4.5.7 Replacing the parallel arm

Continued

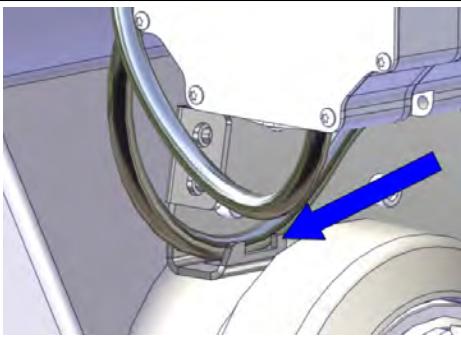
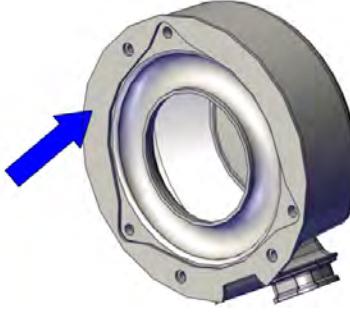
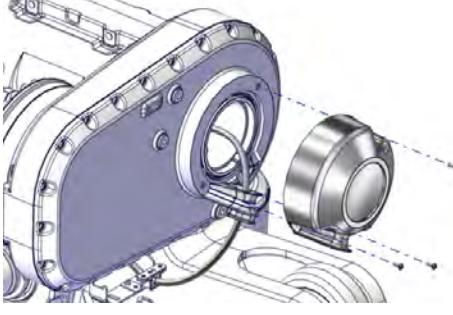
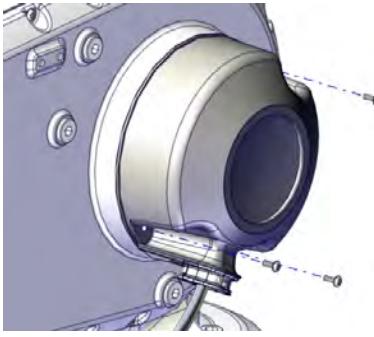
	Action	Note
2	<p>Refit the cable clamp inside the upper arm.</p> <p> Note</p> <p>The nut is attached from the outside.</p>	<p>Nut: M6</p>  <p>xx1500002720</p>
3	Refit the protection cover.	<p>Attachment screw: M8</p>  <p>xx1500002719</p>
4	Refit the cable clamp on the axis-3 bracket.	 <p>xx1500002718</p>
5	Refit the cable clamp on the axis-3 bracket, between axis-4 motor and arm housing.	 <p>xx1500003092</p>

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4 Repair

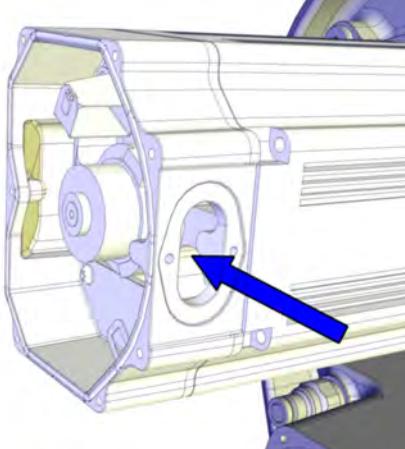
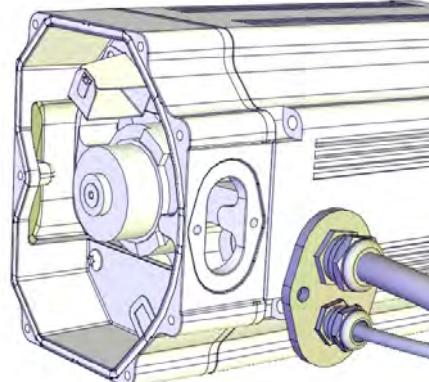
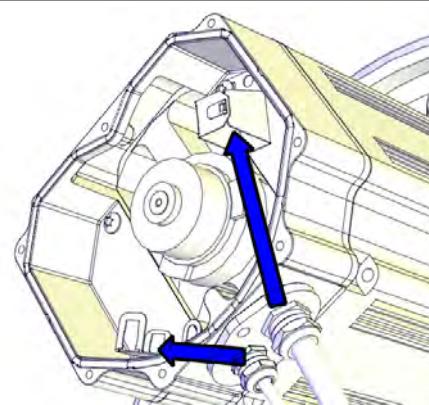
4.5.7 Replacing the parallel arm

Continued

Action	Note
6 Secure the cable harness with a cable tie.	 xx1500003093
7 Make sure that the gasket on the cover is correctly fitted.  Note Replace if damaged. The gasket 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.	 xx1500003094
8 Refit the cable guide, if it has been removed.	 xx1500002723
9 Refit the cover.	 xx1500002722

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Connecting the axis-4 motor cables

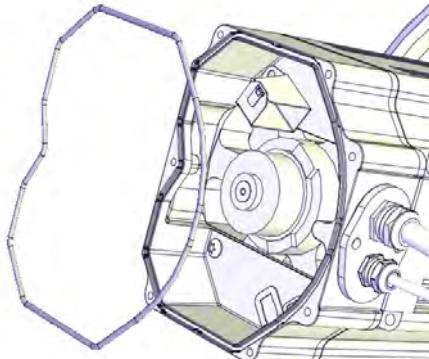
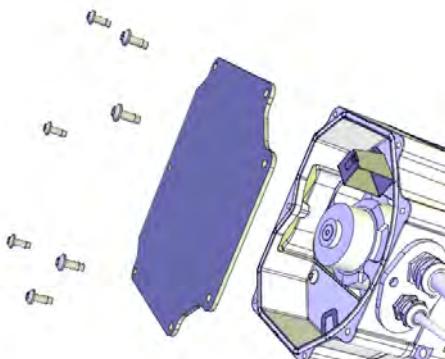
	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1300000738
2	Refit the cable gland cover. Note Replace the gasket if damaged!	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066

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4 Repair

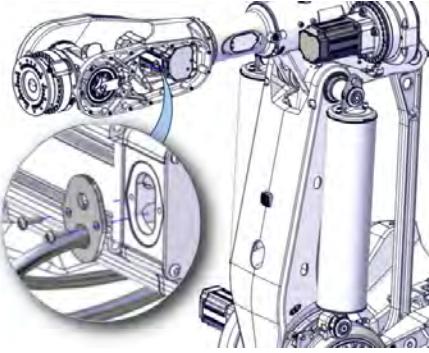
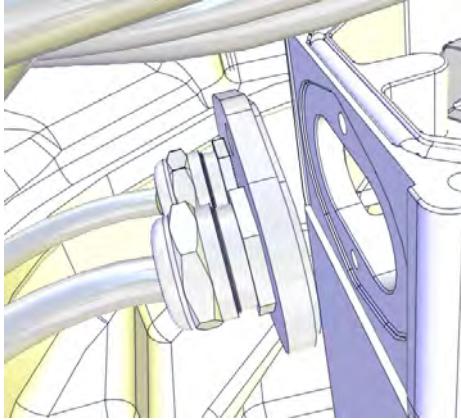
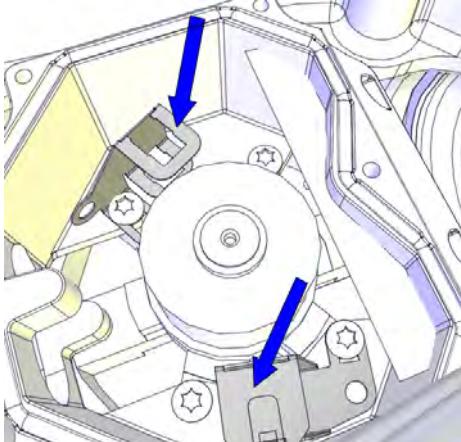
4.5.7 Replacing the parallel arm

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 refitting the motor cover, make sure none of the cables inside will be damaged.	
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.	 xx1200001135
9 Make sure that the cover is tightly sealed.	

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Connecting the axis-5 motor cables

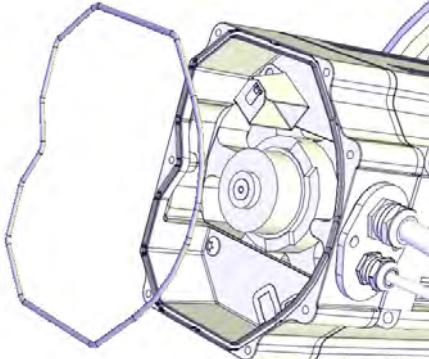
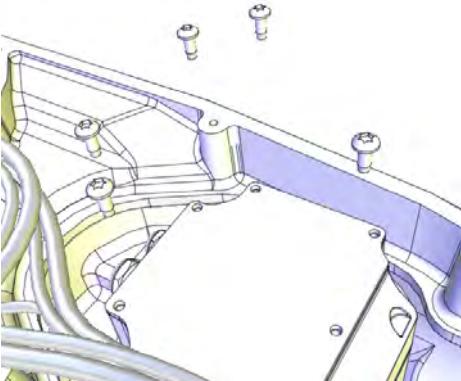
	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1500002717
2	Refit the cable gland cover.  Note Replace the gasket if damaged.	Attachment screws: M5x16 (2 pcs)  xx1200001016
3	Connect the connectors. Connect in accordance with the markings on the connectors.	 xx1200001015

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4 Repair

4.5.7 Replacing the parallel arm

Continued

Action	Note
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 (6 pcs)  xx1200001013
7 Make sure that the cover is tightly sealed.	

Connecting the axis-6 motor cables - Step 1

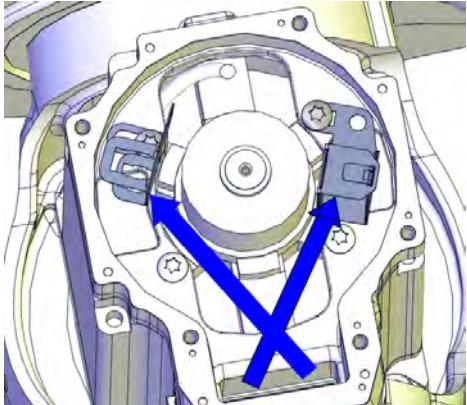


Note

Since it in this procedure is needed to keep the axis-5 in -90° position to get the most stable position for removal and refitting, 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.	

Continues on next page

Action	Note
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.	
2  DANGER Turn off all: <ul style="list-style-type: none">• 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.	

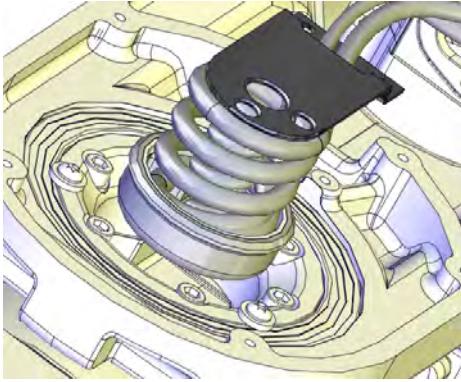
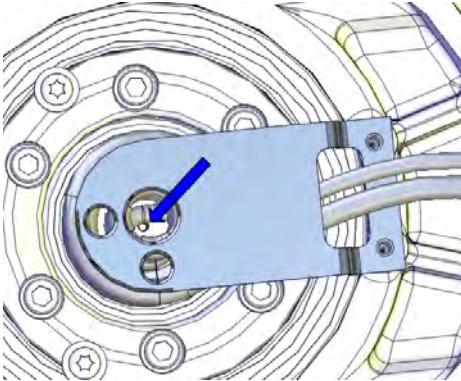
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4 Repair

4.5.7 Replacing the parallel arm

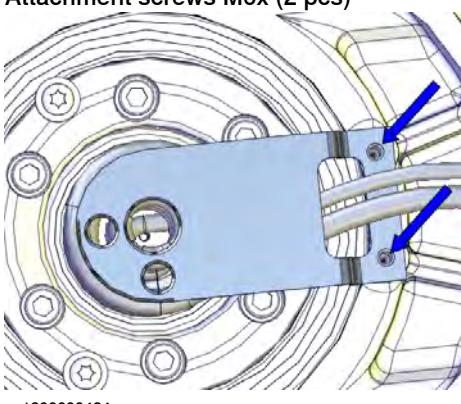
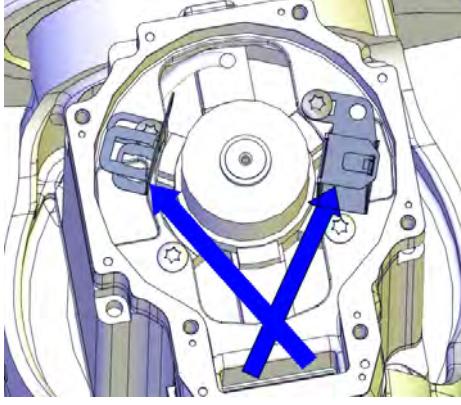
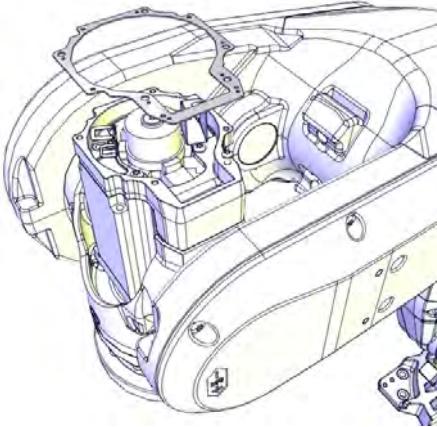
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Connecting the axis-6 motor cables - Step 2

Action	Note
<p>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.</p> <p> CAUTION</p> <p>Make sure that the cable spiral is not twisted an extra revolution. The result will be damage to the cable harness.</p>	
<p>2 Use caution and push the carrier into position.</p>	 xx1300001113
<p>3 Secure the carrier with the M4 screw.</p> <p> Note</p> <p>The screw is located at the bottom of the carrier.</p> <p> Tip</p> <p>The attachment screw that secure the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.</p>	<p>Attachment screw: M4x10</p>  xx1300000485

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4.5.7 Replacing the parallel arm
Continued

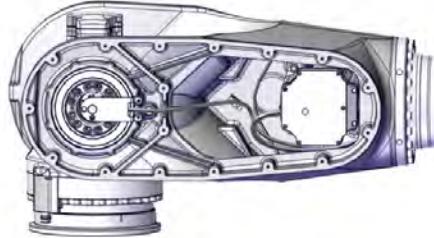
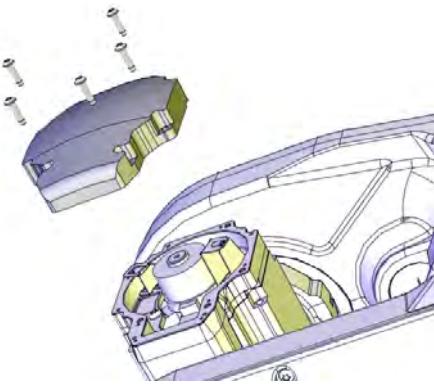
	Action	Note
4	Secure the cable bracket with its attachment screws.	 <p>Attachment screws M6x (2 pcs)</p> <p>xx1300000484</p>
5	<p>Inspect the connectors to the axis-6 motor and make sure they are connected.</p> <p> Note</p> <p>The resolver cable shall be placed underneath the motor cable.</p>	 <p>xx1300000488</p>
6	<p>Inspect the gasket.</p> <p> Note</p> <p>Replace if damaged.</p>	<p>Gasket, 3HAC033489-001</p>  <p>xx1200001095</p>

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4 Repair

4.5.7 Replacing the parallel arm

Continued

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.	 xx1200001080

Refitting the remaining screws securing the lower arm complete - step 2

The lower arm complete consists of lower arm and parallel arm together.

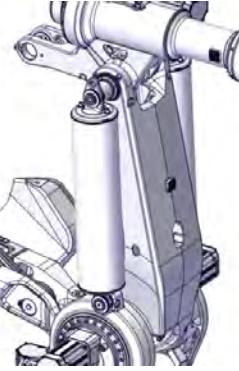
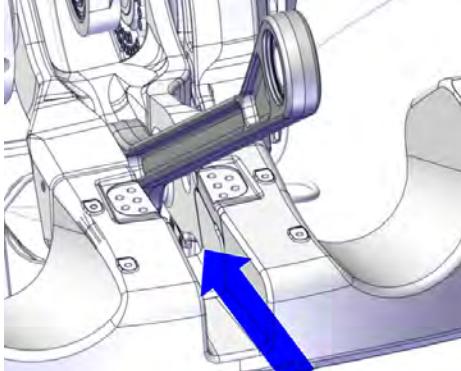
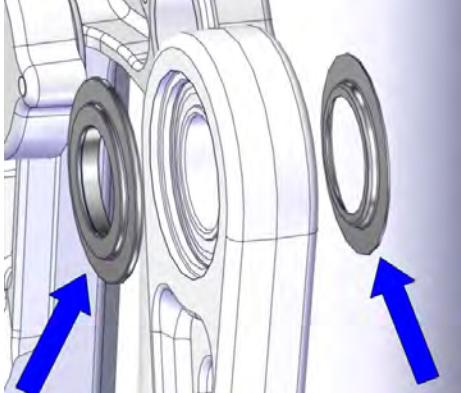
Action	Note
1 Turn on the power and jog the robot to the specified position: <ul style="list-style-type: none"> • Axis-2: No significance (as long as the robot is secured to the foundation) • Axis-2: +20 • Axis-3: 0 • Axis-4: 0 • Axis-5: 0 • Axis-6: No significance 	
2 Refit the remaining screws that secure the lower arm and parallel arm to the axis-2 and axis-3 gearboxes.	
3 Secure the attachment screws.	Tightening torque: 300 Nm

Refitting parallel rod, upper end

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

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4.5.7 Replacing the parallel arm
Continued

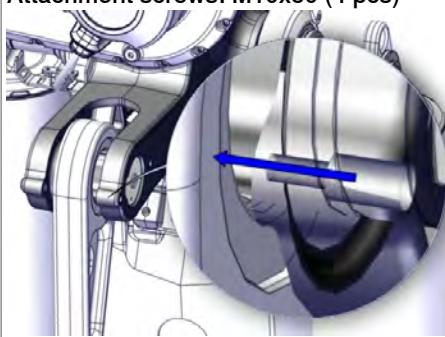
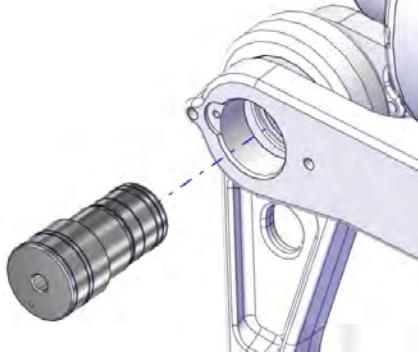
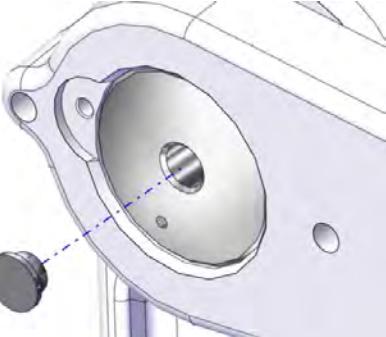
	Action	Note				
2	Take a firm grip of the parallel rod and lift it up into mounting position.	 xx1500001965				
3	Put a piece of wood (or similar) between parallel arm and parallel rod, used as protection to prevent the rod from moving unexpectedly during the procedure.	 xx1500001963				
4	Place the 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 <table border="1"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side					
Thrust washer	Cover washer					

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4 Repair

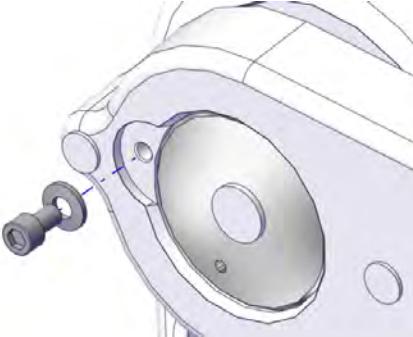
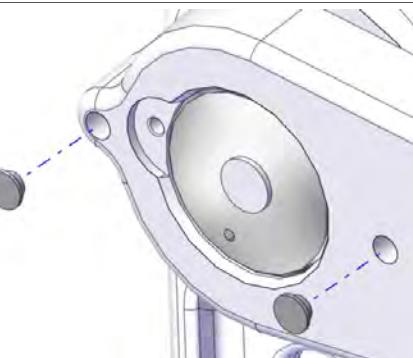
4.5.7 Replacing the parallel arm

Continued

Action	Note
5 Unscrew two of the M10x50 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.
6 Place the parallel rod into position and reattach the two M10x50 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: M10x50 (4 pcs) <small>xx1500002300</small>
7 Apply the press tool parts (Assembly tool, Press plate and Round plate).	
8 Use caution and press the shaft in.	 <small>xx1500001962</small>
9 Refit the protection plug.	 <small>xx1500001967</small>

Continues on next page

4.5.7 Replacing the parallel arm
Continued

Action	Note
10 Apply locking liquid on the attachment screw and secure shaft.	Attachment screw: M10x16 8.8 Loctite 243  xx1400002600
11 Remove the four M10x50 screws and refit the protection plugs (4+4 pcs).	 xx1500001961

Robot position when replacing the balancing device

Action	Note
1 Jog the robot to calibration position.	 xx1500002310
2  DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

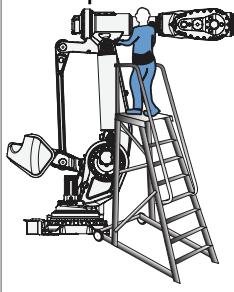
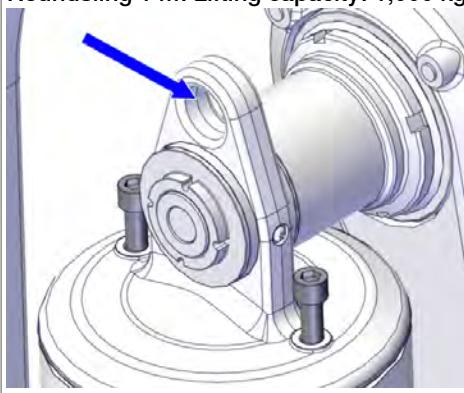
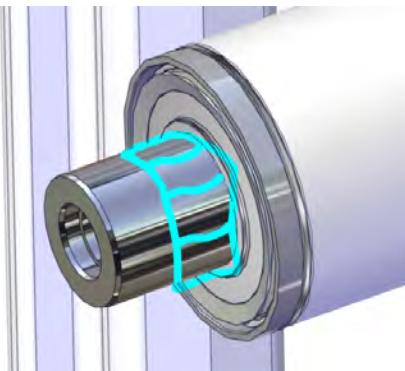
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4 Repair

4.5.7 Replacing the parallel arm

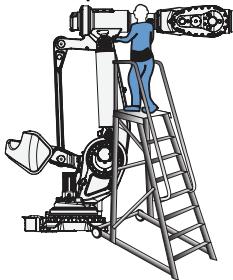
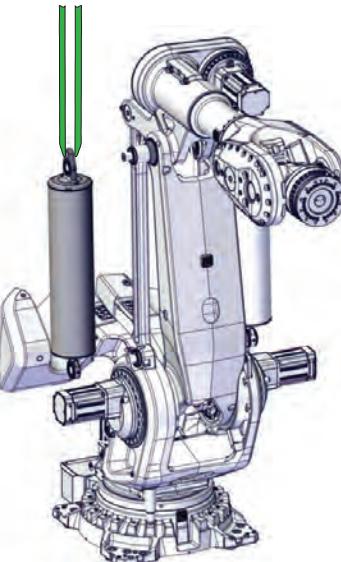
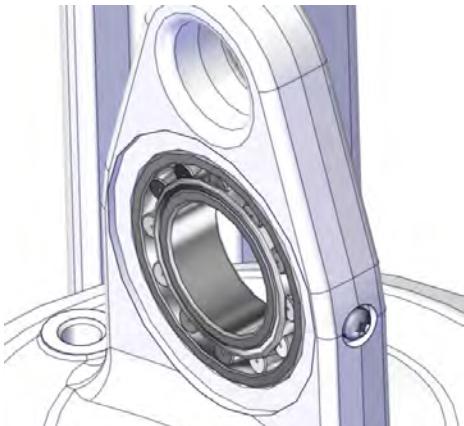
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Preparations before refitting the balancing device

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

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Refitting the balancing device

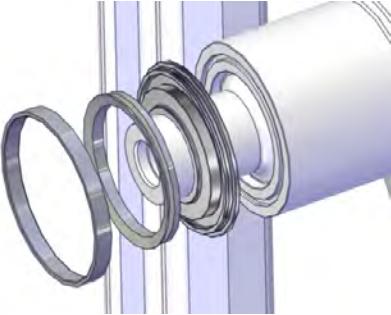
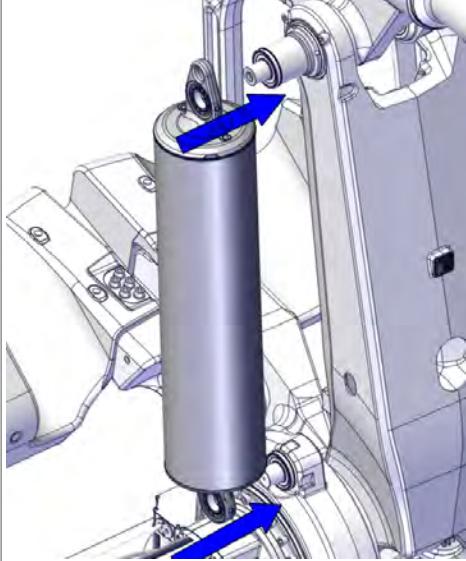
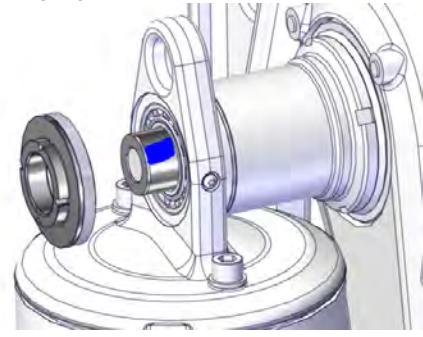
	Action	Note
1	<p>Use a Mobile platform ladder (or similar), to reach the upper end of the balancing device.</p> <p> DANGER</p> <p>Do not use the robot as ladder.</p>	<p>Mobile platform ladder</p>  <p>xx1500001985</p>
2	Use caution and raise the balancing device into mounting position.	 <p>xx1500002735</p>
3	<p> Note</p> <p>Make sure the bearings are axially centered in the balancing device ears, before putting them on the shafts.</p>	 <p>xx1500002306</p>

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4 Repair

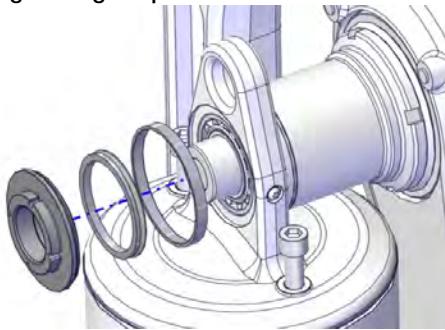
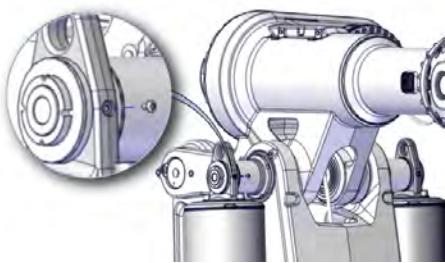
4.5.7 Replacing the parallel arm

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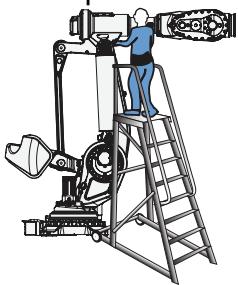
Action	Note
4 Make sure that the spacer ring with V-ring and the support ring are placed correctly on the shafts before the balancing device is put on the shafts.	 xx1500001975
5 Use caution and put the balancing device onto upper and lower shafts.	 xx1500002305
6 Apply locking liquid on the threads of the lock nuts.	Locking liquid: Loctite 243  xx1500002307
7 Inspect that the bearings are axially centered in the balancing device ears.	

Continues on next page

4.5.7 Replacing the parallel arm Continued

	Action	Note
8	Secure the balancing device with the two lock nuts.  Note Make sure that the V-ring and support ring is fitted correctly.	Tightening torque: 120 Nm  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.	

Restoring the pressure of the balancing device

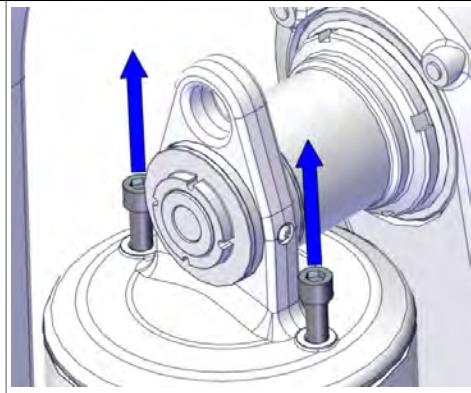
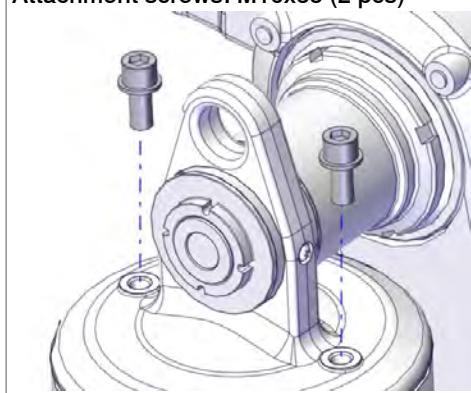
	Action	Note
1	Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device.  DANGER Do not use the robot as ladder.	Mobile platform ladder  xx1500001985

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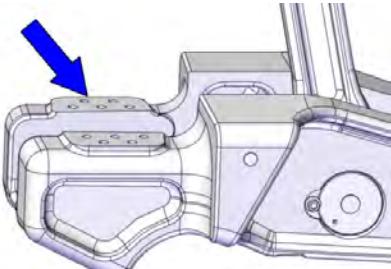
4 Repair

4.5.7 Replacing the parallel arm

Continued

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

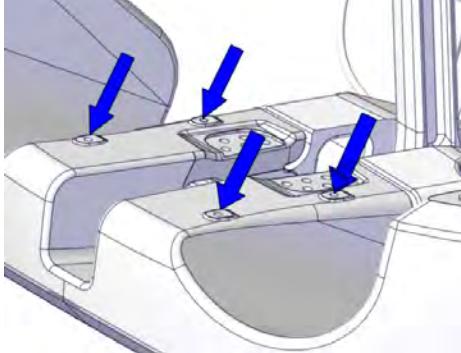
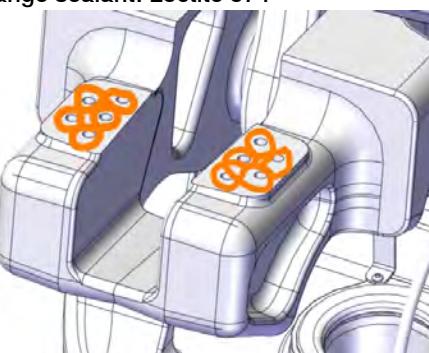
Robot position when refitting the counterweight

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

Continues on next page

	Action	Note
2	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Refitting the counterweight

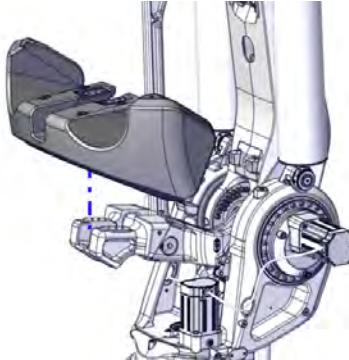
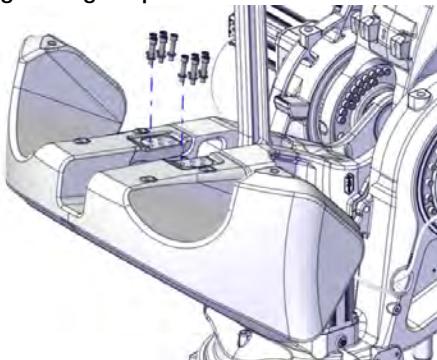
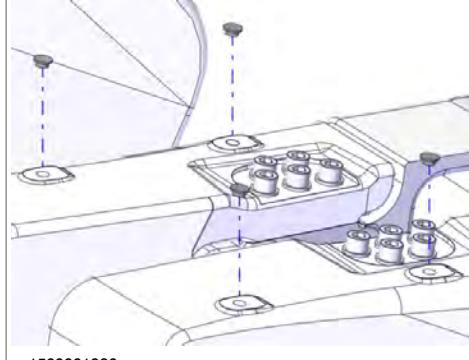
	Action	Note
1	 CAUTION The counter weight weighs 1200 kg. All lifting accessories used must be sized accordingly!	
2	Attach lifting eyes, if not already done.	 xx1500002087
3	Attach the lifting accessory chain (with four chains), to the lifting eyes.	Lifting accessory chain (with four chains)
4	Stretch 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

Continues on next page

4 Repair

4.5.7 Replacing the parallel arm

Continued

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

Concluding procedure

Action	Note
1 Recalibrate the robot.	Axis Calibration is described in Calibrating with Axis Calibration method on page 799 . General calibration information is included in section Calibration on page 789 .

Continues on next page

	Action	Note
2	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.	

4 Repair

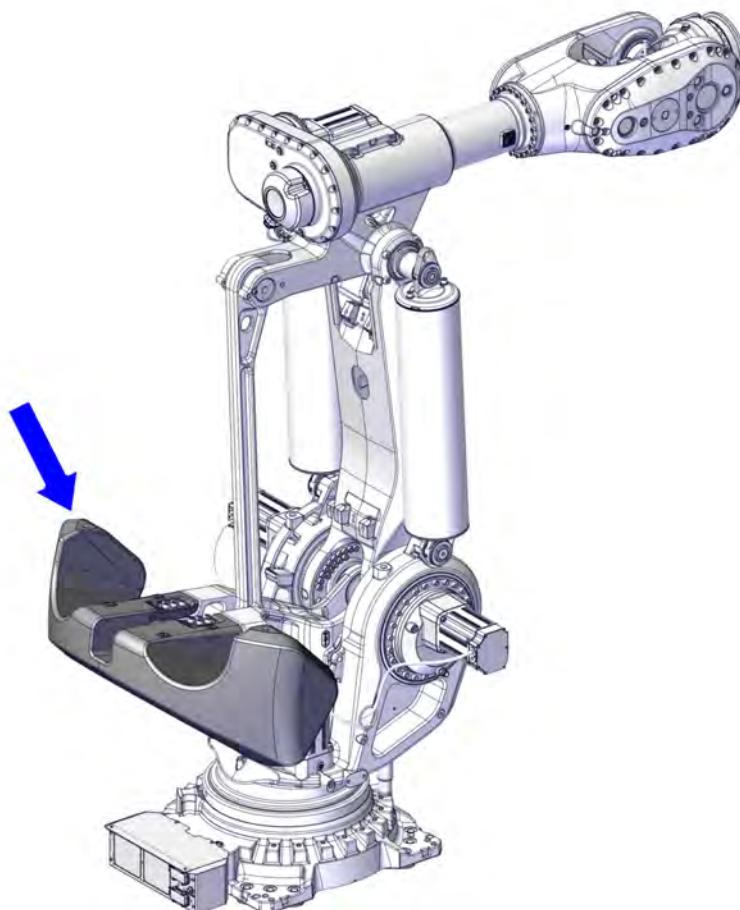
4.6.1 Replacing the counterweight

4.6 Frame and base

4.6.1 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Counterweight	3HAC048154-004	

Continues on next page

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 825 .

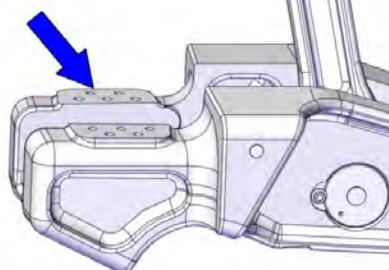
Required consumables

Consumables	Article number	Note
Loctite 574		Flange sealant

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: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Removing the counterweight

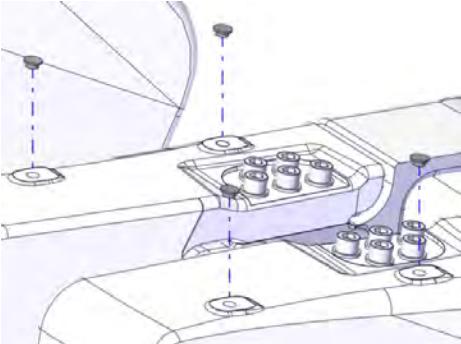
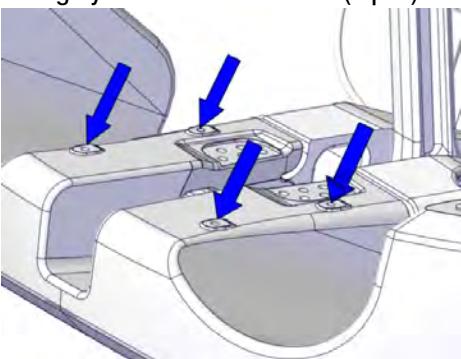
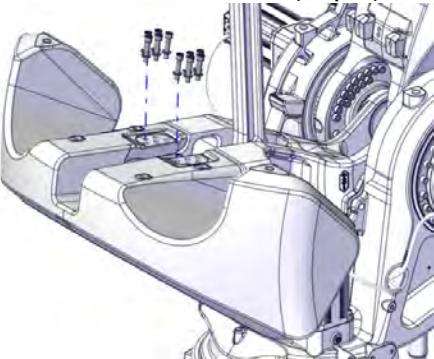
	Action	Note
1	 CAUTION The counterweight weighs 1200 kg. All lifting accessories used must be sized accordingly!	

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4 Repair

4.6.1 Replacing the counterweight

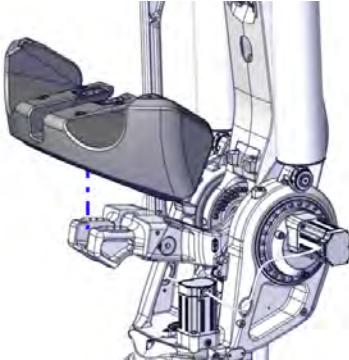
Continued

Action	Note
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 (four chains)
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

Continues on next page

4.6.1 Replacing the counterweight

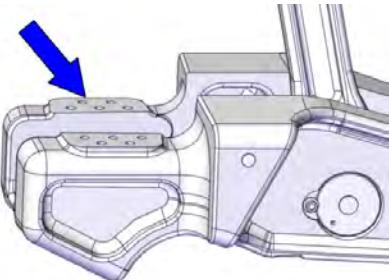
Continued

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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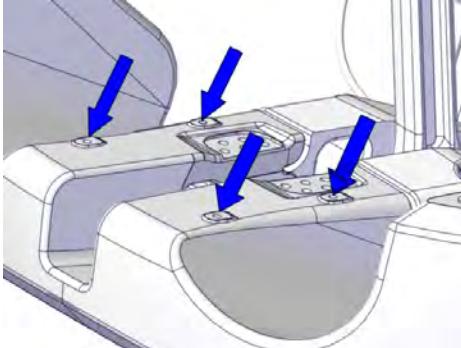
4 Repair

4.6.1 Replacing the counterweight

Continued

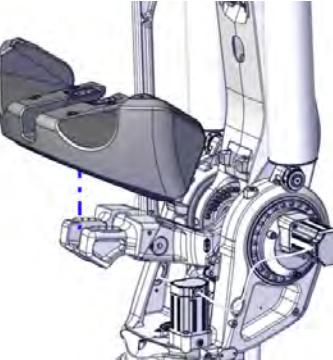
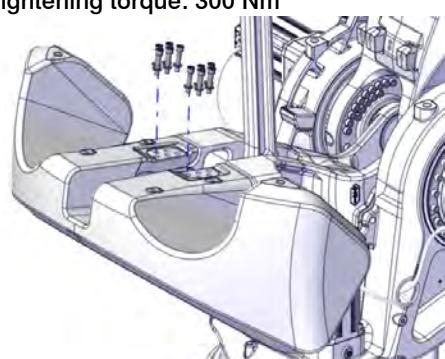
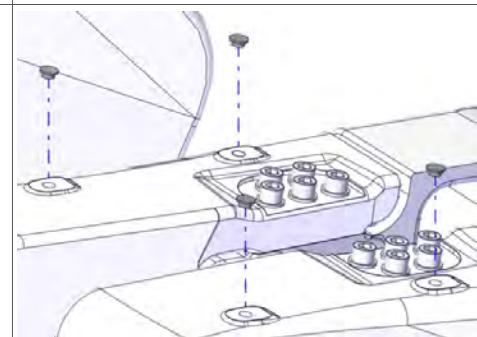
Action	Note
<p>2  DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	

Refitting the counterweight

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

Continues on next page

4.6.1 Replacing the counterweight
Continued

	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

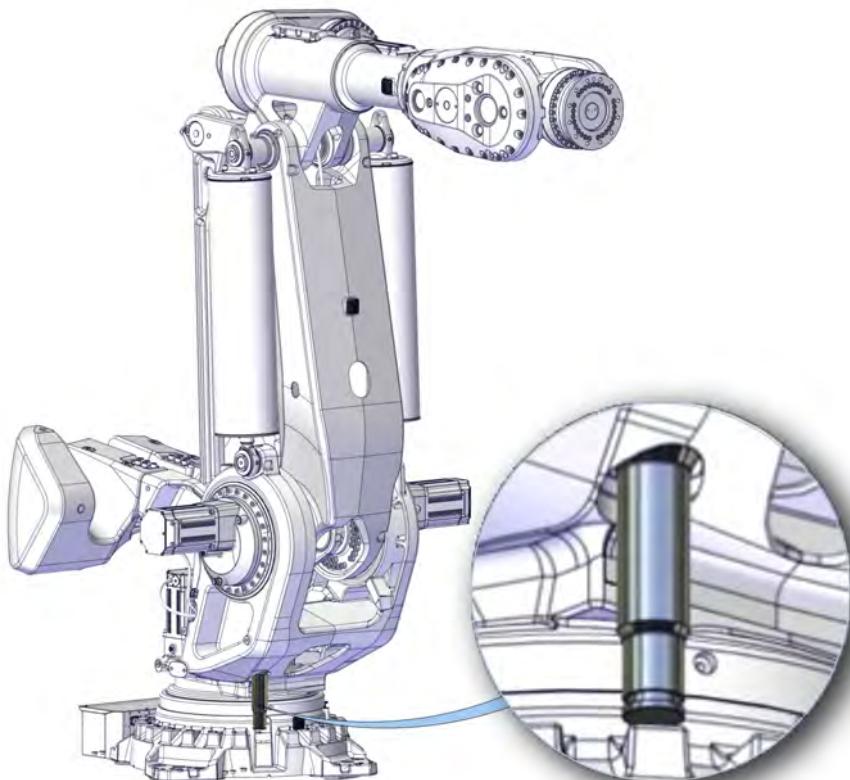
4 Repair

4.6.2 Replacing the mechanichal stop pin

4.6.2 Replacing the mechanichal 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

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

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

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4.6.2 Replacing the mechanical stop pin

Continued

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

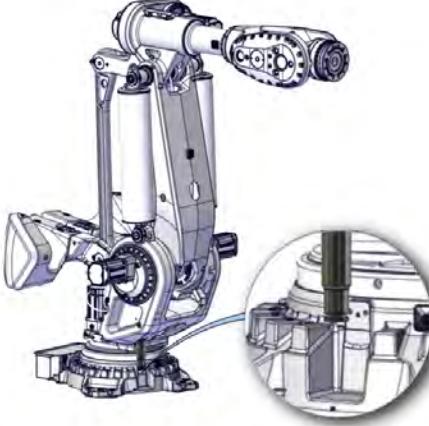
Required consumables

Consumable	Article number	Note
Locking liquid	3HAB7116-1	Loctite 243
Corrosion protection		Mercasol

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: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Removing the mechanical stop pin

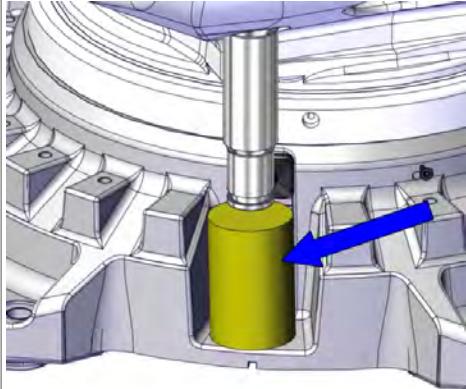
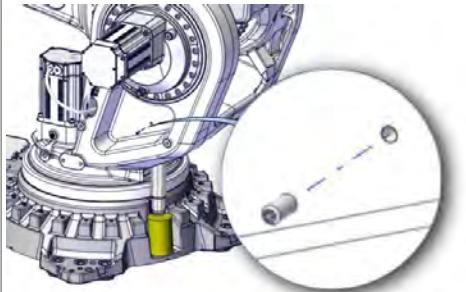
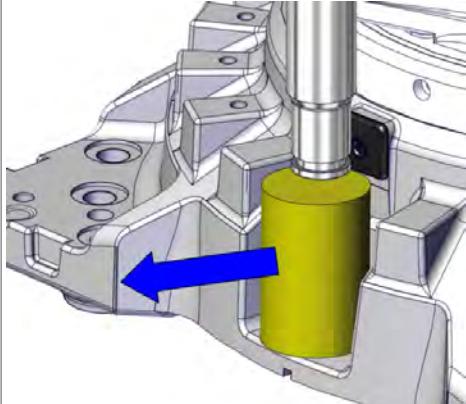
	Action	Note
1	 CAUTION The mechanical stop pin weighs 13 kg.	

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4 Repair

4.6.2 Replacing the mechanical stop pin

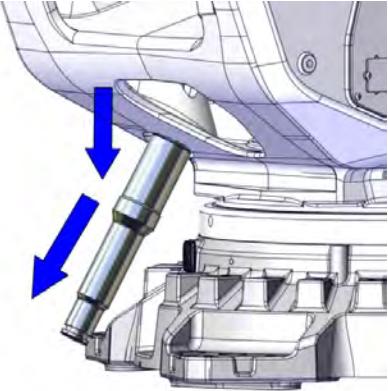
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Action	Note
2 Put a piece of wood (or similar) underneath the stop pin, to prevent it from falling down uncontrolled, when the set screw is removed.	 xx1500002091
3 Take a firm grip on the stop pin with one hand.	
4 Unscrew the set screw with the other hand.	 xx1500002090
5 Hold the stop pin with one hand and remove the piece of wood (or similar) with the other hand.	 xx1500002299

Continues on next page

4.6.2 Replacing the mechanical stop pin

Continued

Action	Note
6 Remove the stop pin by sliding it down, out of 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

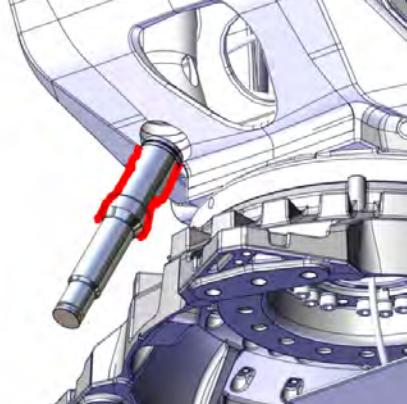
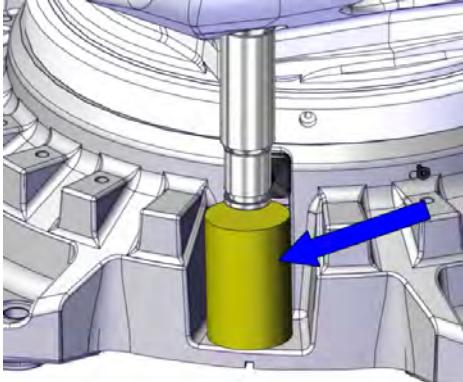
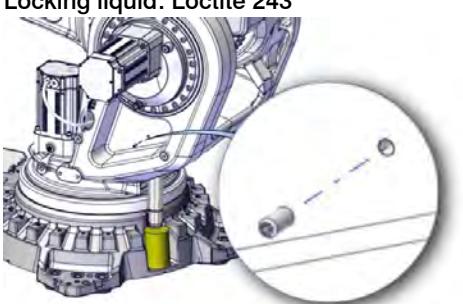
Action	Note
1 Make sure that axis-1 is in the position where it will be possible to replace the mechanical stop pin. If not, turn on the power, use caution and jog axis-1 to that position.	 xx1500002093
2 Clean the stop pin, as well as the hole for it.	

Continues on next page

4 Repair

4.6.2 Replacing the mechanical stop pin

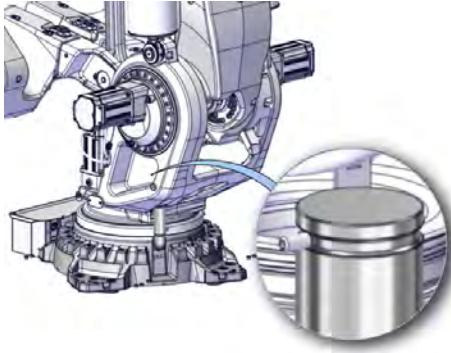
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Action	Note
3 Apply corrosion protection on the marked area on the stop pin and on the matching area in the hole.	Corrosion protection: Mercasol  xx1500002094
4  CAUTION The mechanical stop pin weighs 13 kg.	
5 Put a piece of wood (or similar) underneath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

Continues on next page

4.6.2 Replacing the mechanical stop pin

Continued

Action	Note
<p>7 Make sure that the set screw will find the groove in the stop pin, before securing the mechanical stop pin.</p> <p> Tip</p> <p>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.</p>	 xx1500002092
8 Secure the mechanical stop pin with the set screw.	Tightening torque: 35 Nm

Concluding procedure

Action	Note
<p>1  DANGER</p> <p>Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.</p>	

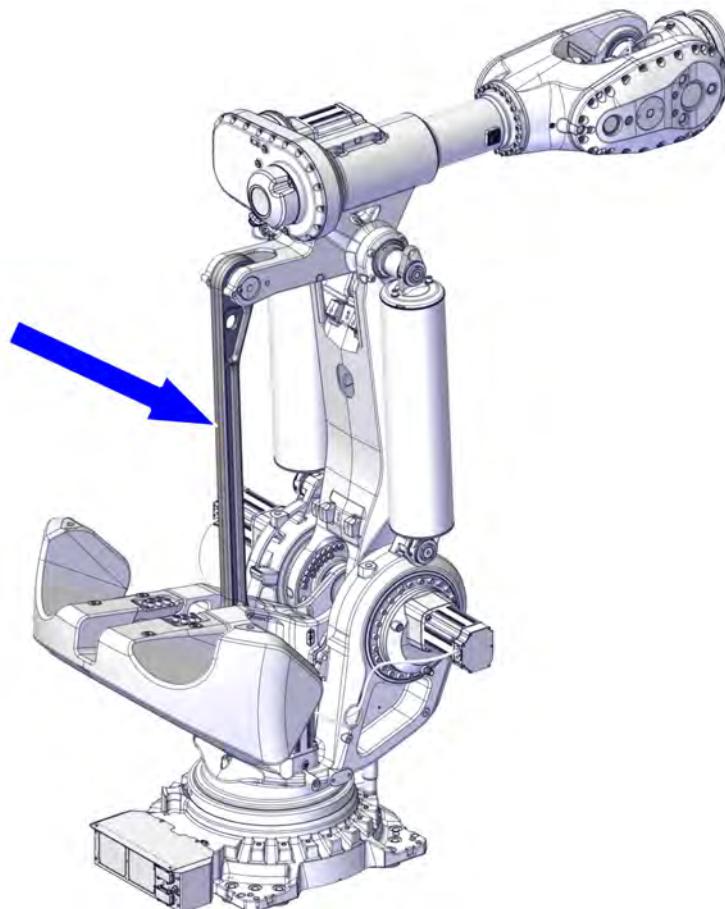
4 Repair

4.6.3 Replacing the parallel rod

4.6.3 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Parallel bar	3HAC048077-003	

Continues on next page

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
Screw M10x50	-	Fully threaded
Assembly tool	3HAC051000-001	Used to disassemble and assemble the parallel rod
Press plate	3HAC050949-001	Used to disassemble and assemble the parallel rod
Round plate	-	Used to disassemble and assemble the parallel rod
Hydraulic cylinder	3HAC11731-1	To be used with the press tool.
Hydraulic pump 80 MPa	3HAC13086-1	To be used with the hydraulic cylinder.
Velcro strap	-	
Roundsling 1 m	-	Lifting capacity: 1,000 kg
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumables

Consumable	Article number	Note
Grease		
Mercasol		
Locking liquid	3HAB7116-1	Loctite 243

Removing the parallel rod

Use these procedures to remove the parallel rod.

**Note**

If the shafts in both upper and lower ends of the parallel rod shall be removed, start removing in the upper end.

Continues on next page

4 Repair

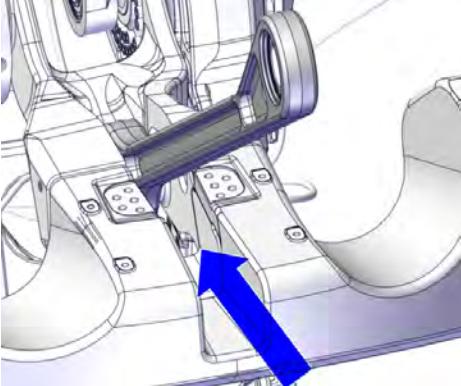
4.6.3 Replacing the parallel rod

Continued

Robot position when removing the parallel rod

Action	Note
1 If not already in this position, jog the robot to the specified position: <ul style="list-style-type: none">• 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° (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.	<p> Note</p> <p>The upper arm shall be in horizontal position against the foundation.</p>
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

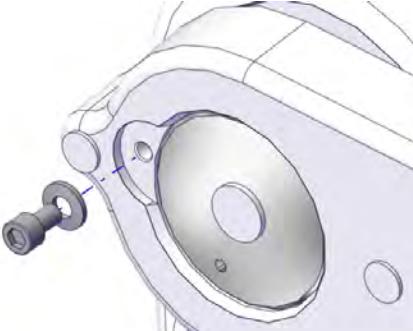
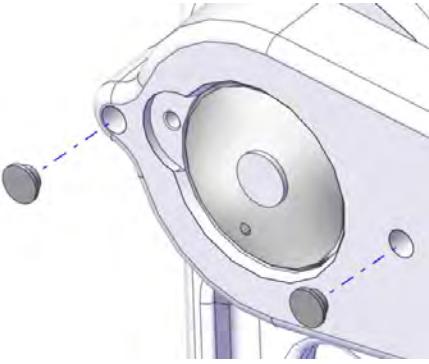
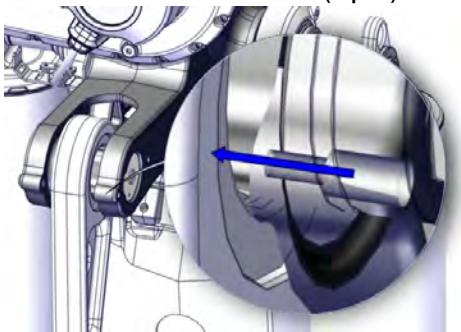
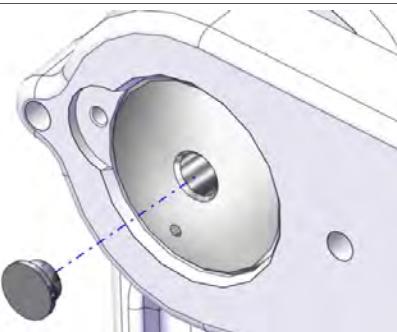
Removing the parallel rod, upper end

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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4.6.3 Replacing the parallel rod

Continued

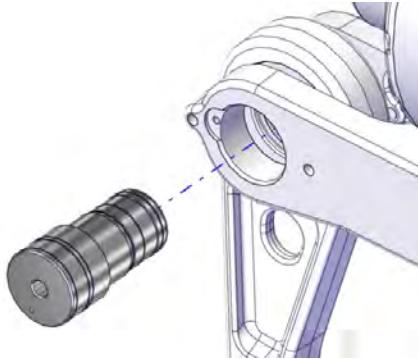
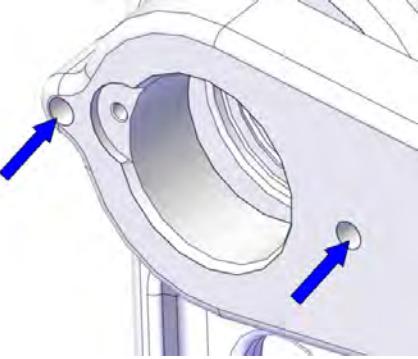
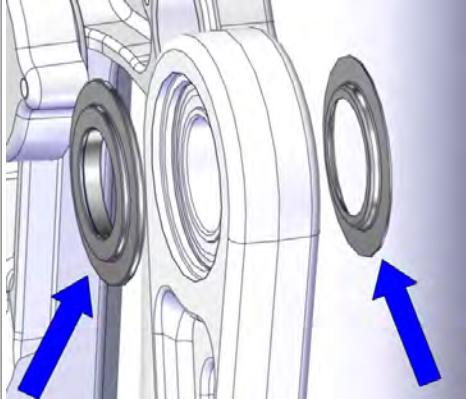
Action	Note
2 Remove the attachment screw with washer that secure the rod shaft.	 xx1400002600
3 Remove the protection plugs 4 + 4 (two on either side of the upper arm wings).  Note Keep the protection plugs. They shall be refitted when the work is done.	 xx1500001961
4 Fit 2 + 2 M10x50 screws in the holes and adjust the screws against the parallel rod from both sides. 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. Attachment screws: M10x50 (4 pcs)	 xx1500002300
5 Remove the protection plug.  Note Keep the protection plug. It shall be refitted when the work is done.	 xx1500001967

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4 Repair

4.6.3 Replacing the parallel rod

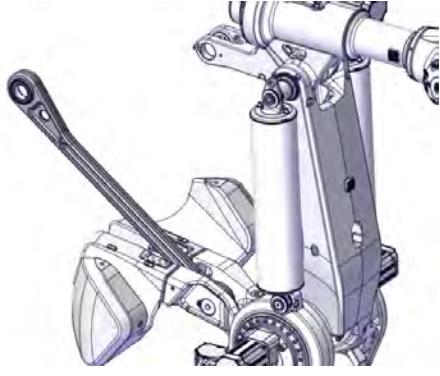
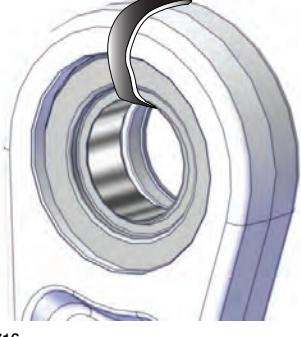
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Action	Note				
6 Apply the press tool parts (Assembly tool, Press plate and Round plate).	Assembly tool: 3HAC051000-001 Press plate: 3HAC050949-001 Round plate:				
7 Use the press tool and press the shaft out.	 xx1500001962				
8 Unscrew two of the M10x50 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				
9 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.	 xx1500001964 <table border="1"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side				
Thrust washer	Cover washer				

Continues on next page

4.6.3 Replacing the parallel rod

Continued

Action	Note
10 Move the parallel rod down and let it rest on the piece of wood, which was put there earlier.	 xx150001965
11 Secure bearing, thrust washer and cover washer with a strap (or similar) to prevent them from dropping out of its position.	Strap  xx150002716

Removing the parallel rod, lower end

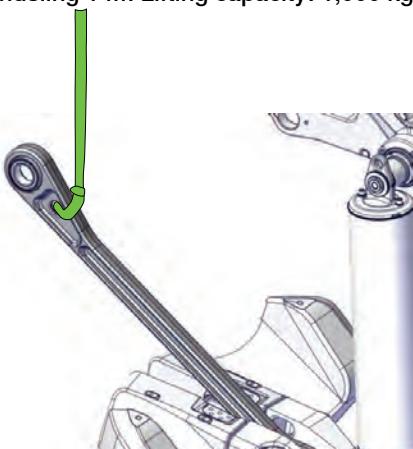
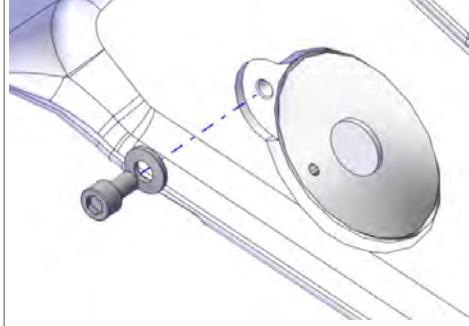
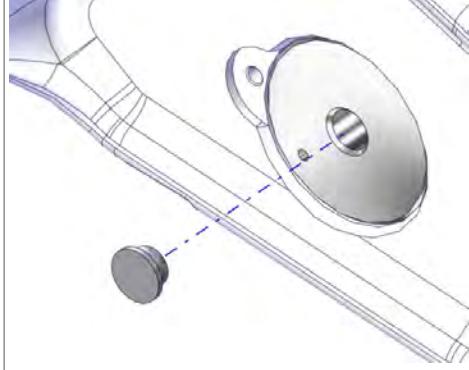
Action	Note
1  Note If the parallel rod shall be removed from the robot, always disassemble the upper end first.	 xx150002736

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4 Repair

4.6.3 Replacing the parallel rod

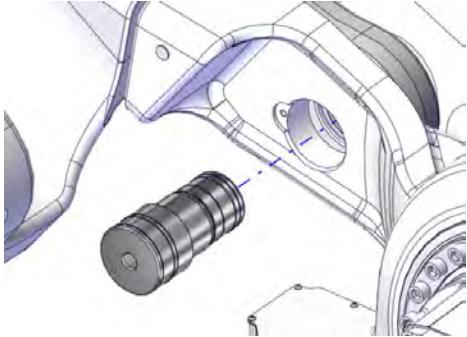
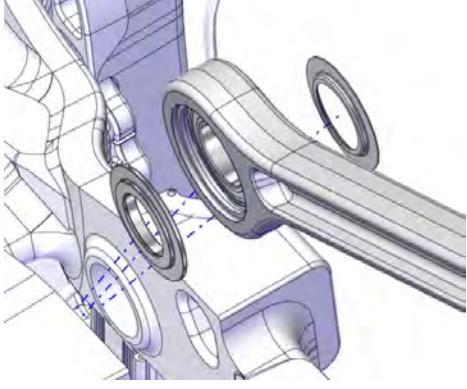
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	Action	Note
2	 CAUTION	
	<p>The parallel rod weighs 55 kg. All lifting accessories used must be sized accordingly.</p>	
3	<p>Attach a roundsling, looped through the parallel rod and to an overhead crane (or similar).</p>	<p>Roundsling 1 m: Lifting capacity: 1,000 kg</p> 
4	<p>Stretch the roundsling to start taking the weight of the parallel rod.</p>	
5	<p>Remove the attachment screw with washer that secure the rod shaft.</p>	
6	<p>Remove the protection plug.</p>	
7	<p> Note Keep the protection plug. It shall be refitted when the work is done.</p>	

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4.6.3 Replacing the parallel rod

Continued

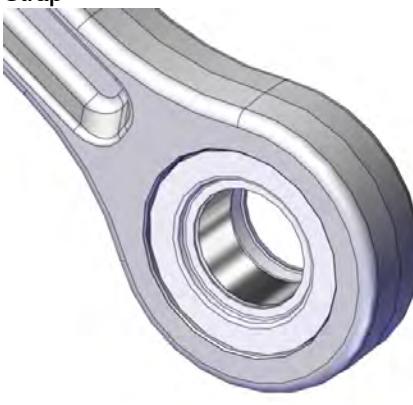
Action	Note				
8 Use the press tool and press the shaft out.	 xx1500001969				
9 Make sure the thrust washer and cover washer on either side of the bearing are present.  Tip Make a note on which side the respective washer is fitted, for a correct assembly later.	 xx1500002098				
10 Use caution and lift the parallel rod off.	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>  xx1500002745	Left side	Right side	Thrust washer	Cover washer
Left side	Right side				
Thrust washer	Cover washer				

Continues on next page

4 Repair

4.6.3 Replacing the parallel rod

Continued

Action	Note
11 Secure bearing, thrust washer and cover washer with a strap (or similar), to prevent them from dropping out of its position.	Strap  xx1500002099

Refitting the parallel rod

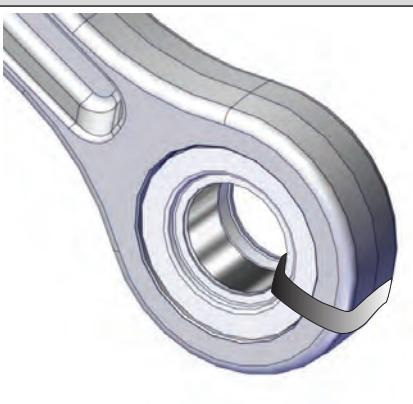
Use these procedures to refit the parallel rod.



Note

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

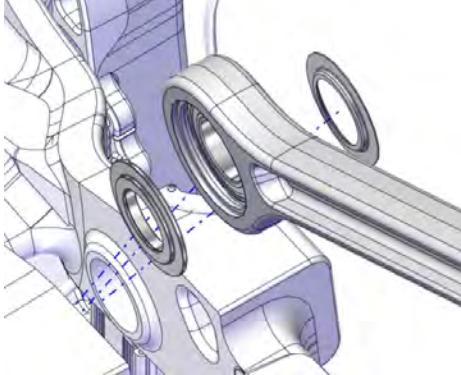
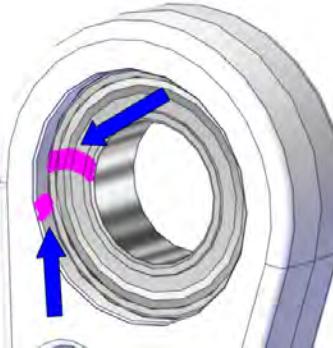
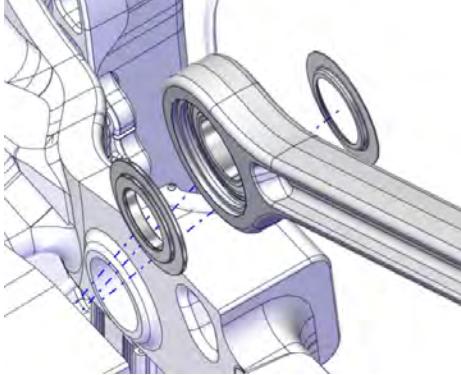
Preparations before refitting the parallel rod, lower end

Action	Note
1 Remove the strap which was used to keep bearing, thrust washer and cover washer in position.	 xx1500002744

Continues on next page

4.6.3 Replacing the parallel rod

Continued

	Action	Note				
2	<p>Remove the thrust washer and cover washer, and wipe them clean.</p> <p>Note</p> <p>Make a note on which side the covers are placed.</p>	 xx1500002098 <table border="1"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side					
Thrust washer	Cover washer					
3	Wipe the shafts and the holes for the shafts clean.					
4	Apply corrosion protection on both sides of the bearings, and on all machined surfaces on the parallel rod.	Mercasol  xx1500002100				
5	Put back the thrust washer (left side) and cover washer (right side).	 xx1500002098 <table border="1"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>	Left side	Right side	Thrust washer	Cover washer
Left side	Right side					
Thrust washer	Cover washer					

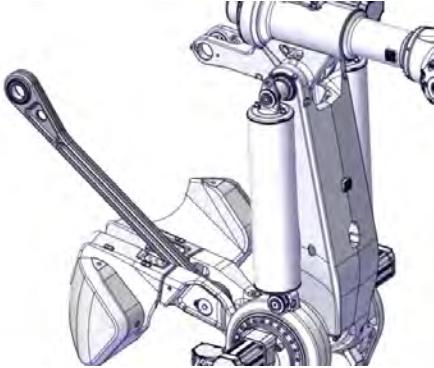
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4 Repair

4.6.3 Replacing the parallel rod

Continued

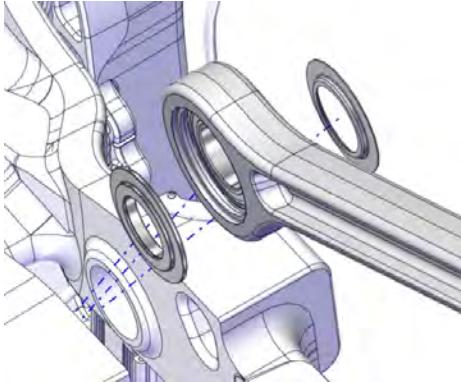
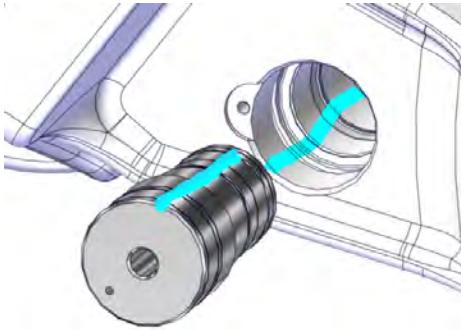
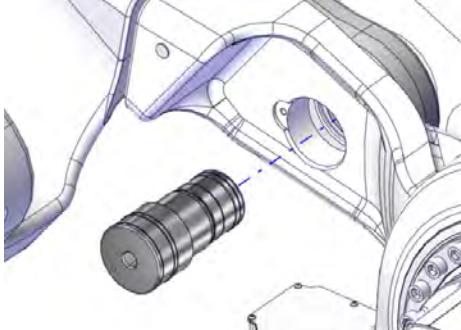
Refitting the parallel rod, lower end

	Action	Note
1	 Note If the parallel rod has been removed from the robot, always start refitting at the lower end!	 xx1500001965
2	 CAUTION The parallel rod weighs 55 kg.	
3	Attach a roundsling to the parallel rod and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg
4	Use caution, stretch the roundsling and lift the parallel rod into mounting position.	 xx1500002745
5	Apply the press tool parts (Assembly tool, Press plate and Round plate).	

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4.6.3 Replacing the parallel rod

Continued

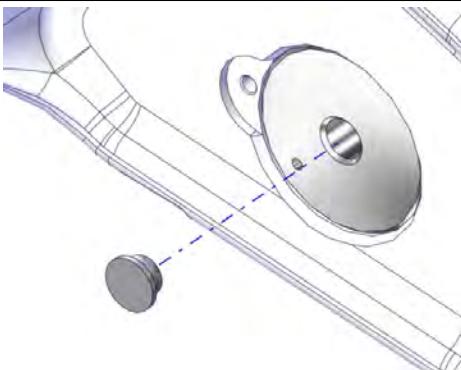
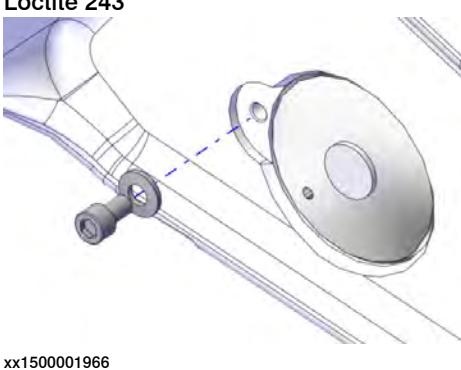
Action	Note				
6 Make sure that the thrust washer and cover washer on either side of the bearing, are in position.  Note Make sure that the washers are on the correct sides of the bearing.	 xx1500002098 <table border="1"> <tr> <td>Left side</td> <td>Thrust washer</td> </tr> <tr> <td>Right side</td> <td>Cover washer</td> </tr> </table>	Left side	Thrust washer	Right side	Cover washer
Left side	Thrust washer				
Right side	Cover washer				
7 Apply some grease on the shafts and in the holes on both sides of parallel arm, as well as in the bearing hole.	 xx1500002301				
8 Use caution and press the shaft in.	 xx1500001969				

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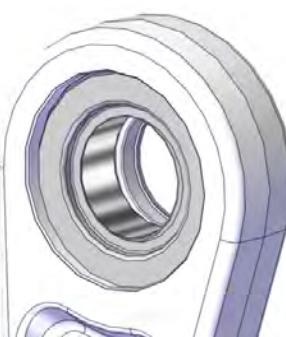
4 Repair

4.6.3 Replacing the parallel rod

Continued

Action	Note
9 Refit the protection plug.	 xx1500001968
10 Apply locking liquid on the screw and secure the shaft.	Attachment screw: M10x16 8.8 Loctite 243  xx1500001966

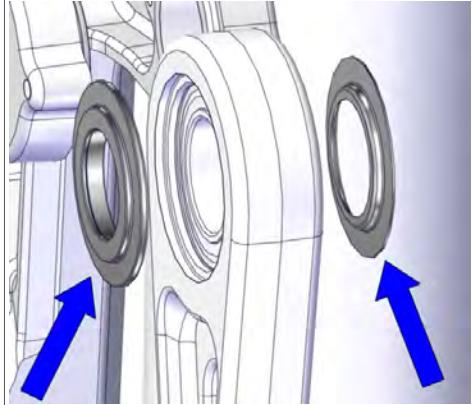
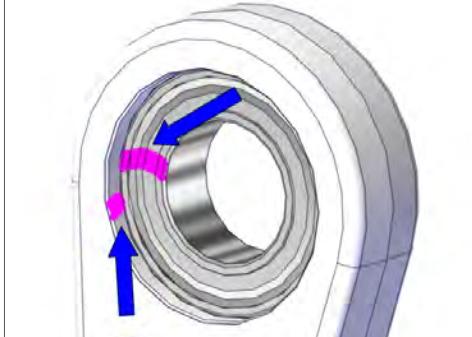
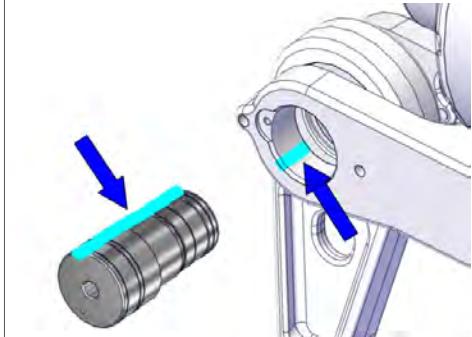
Preparations before refitting the parallel rod, upper end

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

Continues on next page

4.6.3 Replacing the parallel rod

Continued

Action	Note				
2 Remove thrust washer and cover washers, and wipe them clean.	 xx1500001964 <table border="1"> <tr> <td>Left side</td> <td>Thrust washer</td> </tr> <tr> <td>Right side</td> <td>Cover washer</td> </tr> </table>	Left side	Thrust washer	Right side	Cover washer
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 arm.	Mercasol  xx1500002100				
5 Apply some grease on shafts and in holes of both sides of parallel rod.	 xx1500002293				

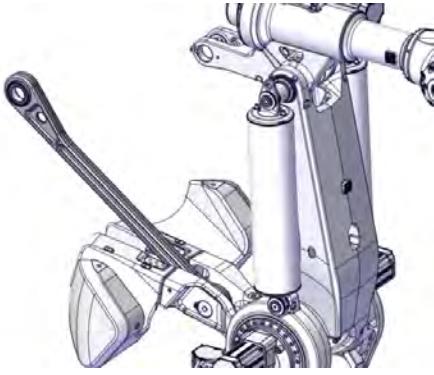
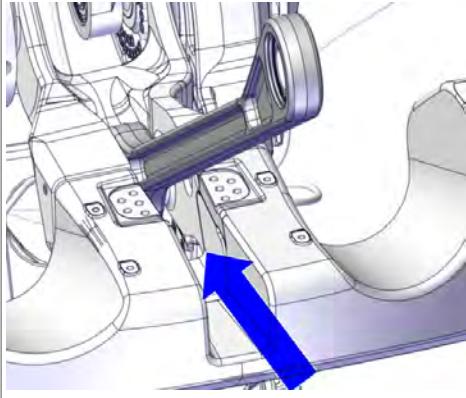
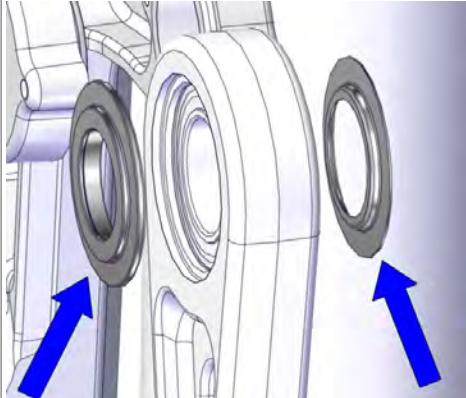
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4 Repair

4.6.3 Replacing the parallel rod

Continued

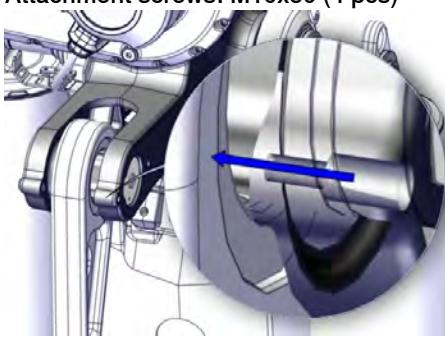
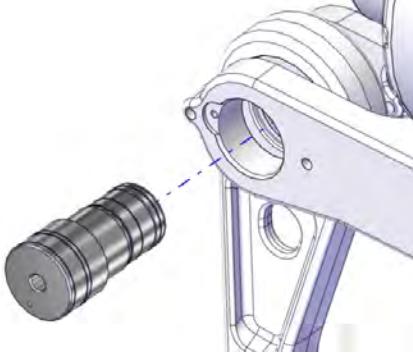
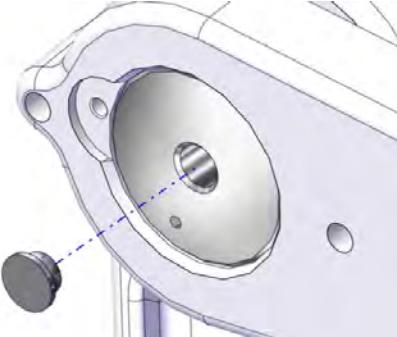
Refitting parallel rod, upper end

Action	Note				
<p>1</p>  Note If the parallel rod has been removed from the robot, always start refitting at the lower end!					
<p>2</p> Take a firm grip of the parallel rod and lift it up into mounting position.	 xx1500001965				
<p>3</p> 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				
<p>4</p> 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				
<table border="1"> <tr> <td>Left side</td> <td>Right side</td> </tr> <tr> <td>Thrust washer</td> <td>Cover washer</td> </tr> </table>		Left side	Right side	Thrust washer	Cover washer
Left side	Right side				
Thrust washer	Cover washer				

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4.6.3 Replacing the parallel rod

Continued

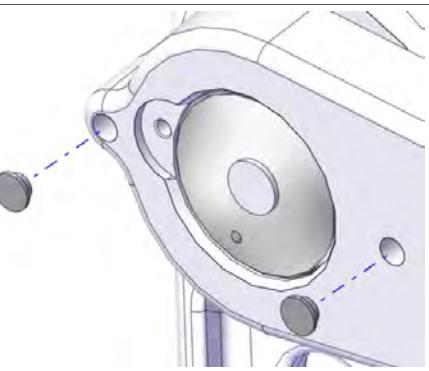
Action	Note
5 Unscrew two of the M10x50 screws only on one side of the parallel rod, approximately 5 mm. Leave the screws fastened on the other side.	<p>Note</p> <p>This is done to be able to refit the parallel rod without problems and to be able to find the correct position of the parallel rod.</p>
6 Place the parallel rod into position and reattach the two M10x50 screws against the parallel rod.	<p>Note</p> <p>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.</p> <p>Attachment screws: M10x50 (4 pcs)</p>  <p>xx1500002300</p>
7 Apply the press tool parts (Assembly tool, Press plate and Round plate).	
8 Use caution and press the shaft in.	 <p>xx1500001962</p>
9 Refit the protection plug.	 <p>xx1500001967</p>

Continues on next page

4 Repair

4.6.3 Replacing the parallel rod

Continued

Action	Note
10 Apply locking liquid on the attachment screw and secure shaft.	Attachment screw: M10x16 8.8 Loctite 243  xx1400002600
11 Remove the four M10x50 screws and refit the protection plugs (4+4 pcs).	 xx1500001961

Concluding procedure

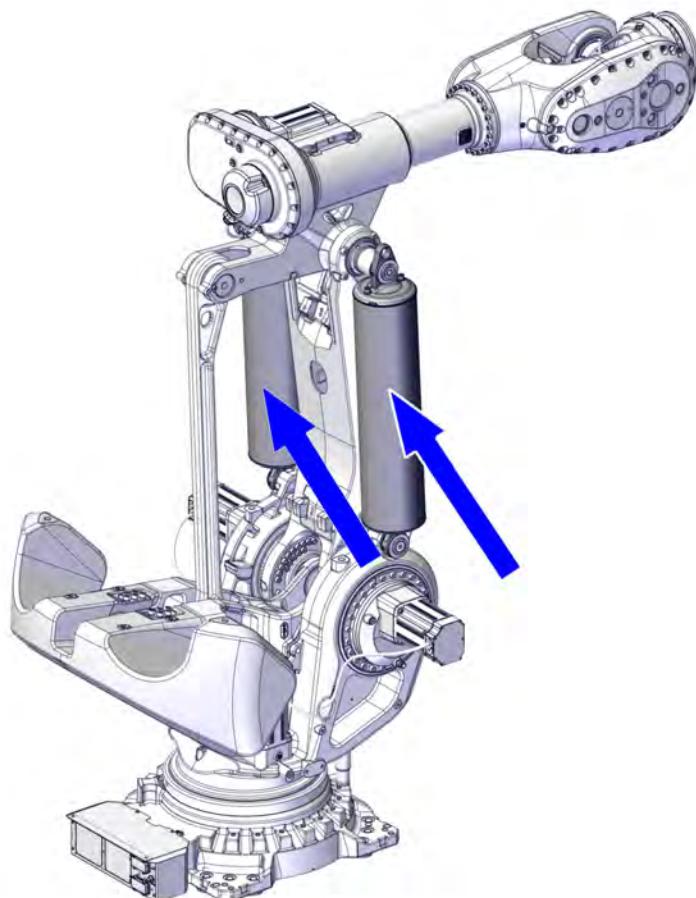
Action	Note
1 Recalibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section Calibration on page 789 .
2  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

4.6.4 Unloading and restoring the balancing device

4.6.4 Unloading and restoring the balancing device

Location of the balancing device

The balancing device is located as shown in the figure.



xx1500001979

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Balancing device	3HAC048239-003	

Continues on next page

4 Repair

4.6.4 Unloading and restoring the balancing device

Continued

Required tools and equipment

Equipment, etc.	Article number	Note
MobilePlatformLadder	-	
Screw M16x80	-	Fully threaded
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

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: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

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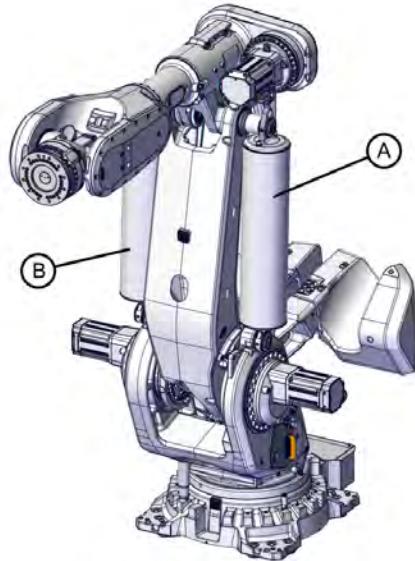
4.6.4 Unloading and restoring the balancing device

Continued

Unloading the pressure of the balancing device

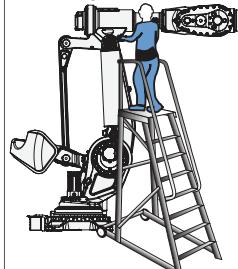
**CAUTION**

Make sure to relief the pressure of the correct balancing device. Relief pressure on axis 2 side when changing axis-2 gearbox, and relief pressure on axis 3 side when changing axis-3 gearbox.



xx1600001406

A	Axis-2 balancing device
B	Axis-3 balancing device

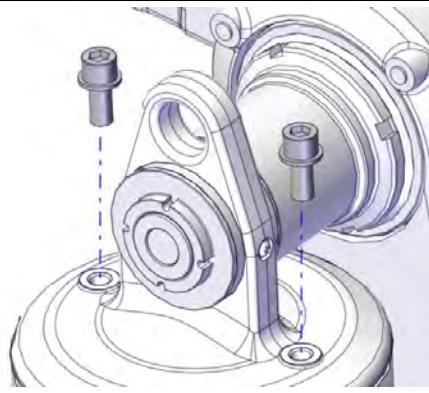
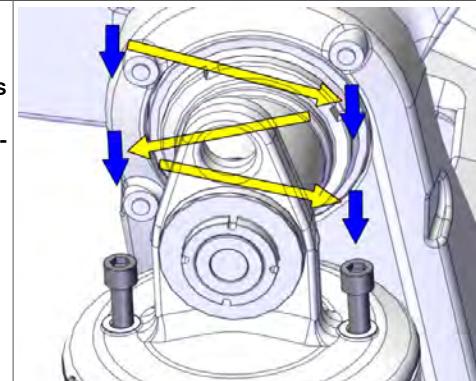
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	<i>Only needed when the upper arm is fitted on the robot:</i> Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device.  DANGER Do not use the robot as ladder!	Mobile platform ladder  xx1500001985

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4 Repair

4.6.4 Unloading and restoring the balancing device

Continued

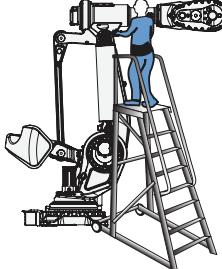
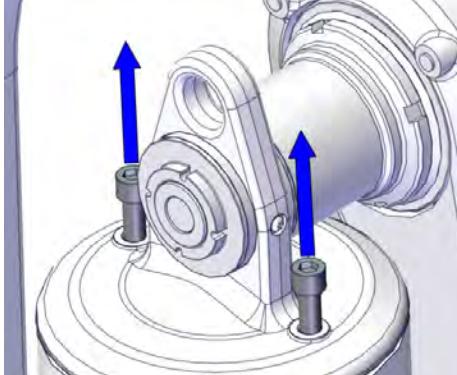
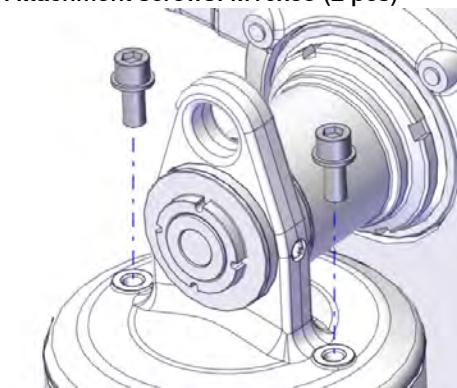
Action	Note
3 Remove the screws, fitted in the screw holes on top of the balancing device. Note Keep the screws. They shall be refitted after the work is done.	 xx1500001971 M16x35
4 Apply some Molykote on threads and at the bottom end of two fully threaded screws.	 xx1500002303 Screws M16x80 fully threaded
5 Unload the pressure of the balancing device by inserting the screws. Attach the screws until the screws reaches the piston. Then, alternately little by little, attach the screws at least another five millimeters. The pressure is now unloaded.	 xx1500002309 Screw M16x80 (2 pcs)
6 In a procedure where both balancing devices shall be removed, unload the pressure of the other in the same way.	

Continues on next page

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	<p>Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device.</p> <p> DANGER</p> <p>Do not use the robot as ladder.</p>	 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.	<p>Attachment screws: M16x35 (2 pcs)</p>  xx1500001971

Concluding procedure

	Action	Note
1	Before starting up the robot, make sure to remove the M20x60 used as lock screw on axis-2 and/or axis-3.	

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4 Repair

4.6.4 Unloading and restoring the balancing device

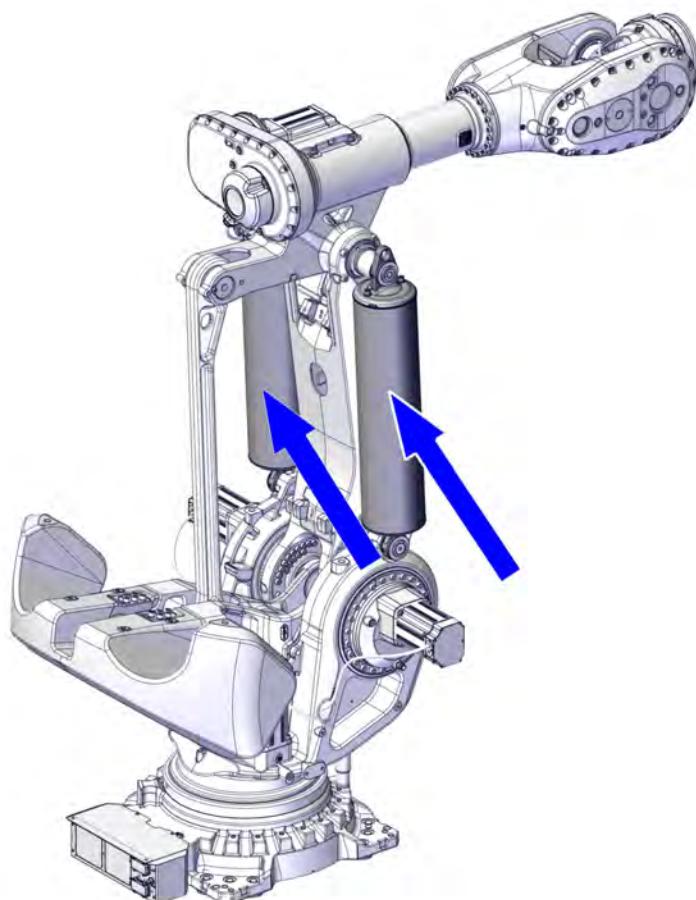
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Action	Note
2  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.	

4.6.5 Replacing the balancing devices

Location of the balancing devices

The balancing devices are located as shown in the figure.



xx1500001979

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Balancing device	3HAC048239-003	

Continues on next page

4 Repair

4.6.5 Replacing the balancing devices

Continued

Required tools and equipment

Equipment, etc.	Article number	Note
MobilePlatformLadder	-	
Screw M16x80	-	Fully threaded
Roundsling 1 m	-	Lifting capacity: 1,000 kg
Crowbar (small)	-	Used when removing parallel arm from lower arm
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumables

Consumable	Article number	Note
Bearing grease	3HAC9408-1	Bearing grease
Locking liquid	3HAB7116-1	Loctite 243
Molykote 1000		

Removing the balancing device

Use these procedures to remove the balancing device.

Robot position when replacing the balancing device

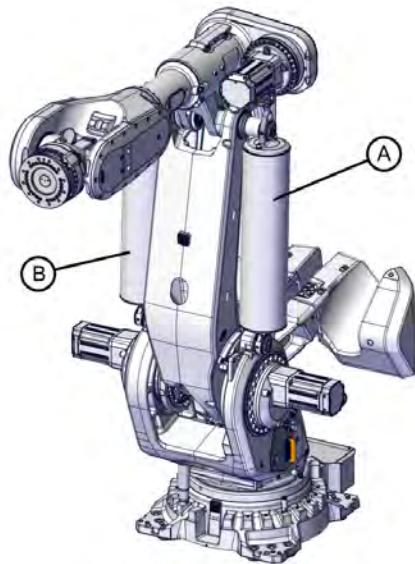
	Action	Note
1	Jog the robot to calibration position.	 xx1500002310
2	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

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Unloading the pressure of the balancing device

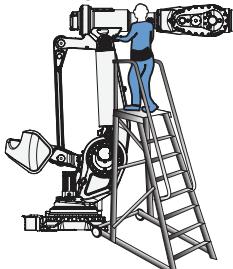
**CAUTION**

Make sure to relief the pressure of the correct balancing device. Relief pressure on axis 2 side when changing axis-2 gearbox, and relief pressure on axis 3 side when changing axis-3 gearbox.



xx1600001406

A	Axis-2 balancing device
B	Axis-3 balancing device

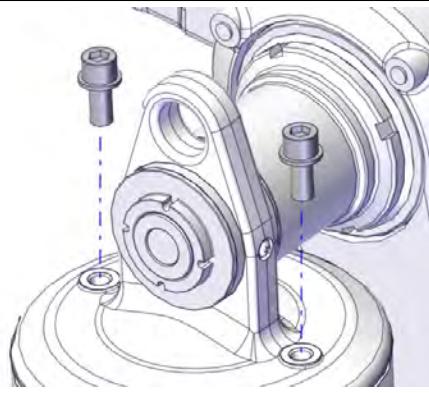
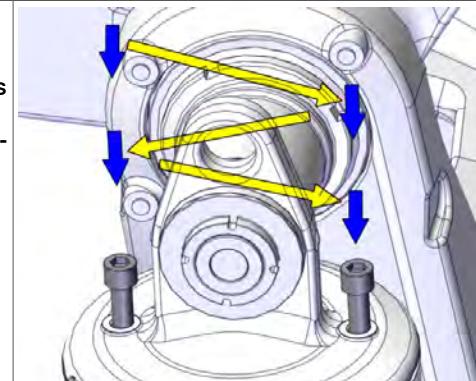
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	<i>Only needed when the upper arm is fitted on the robot:</i> Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device.  DANGER Do not use the robot as ladder!	Mobile platform ladder  xx1500001985

Continues on next page

4 Repair

4.6.5 Replacing the balancing devices

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.	 xx1500002303 Screws M16x80 fully threaded
5 Unload the pressure of the balancing device by inserting the screws. Attach the screws until the screws reaches the piston. Then, alternately little by little, attach the screws at least another five millimeters. The pressure is now unloaded.	 xx1500002309 Screw M16x80 (2 pcs)
6 In a procedure where both balancing devices shall be removed, unload the pressure of the other in the same way.	

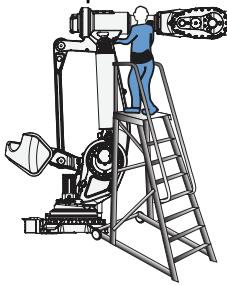
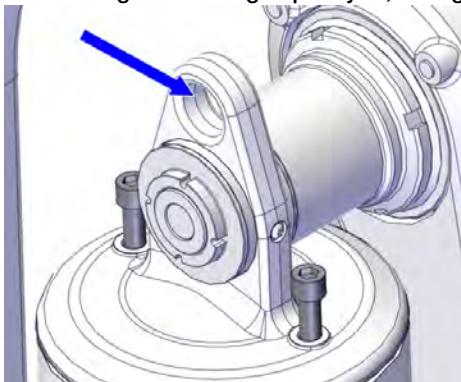
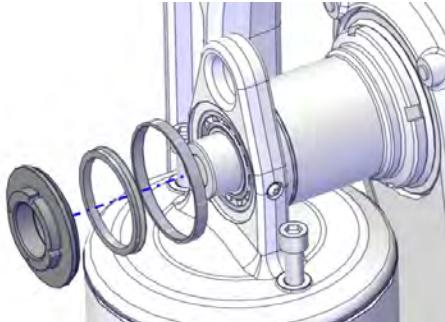
Removing the balancing device

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

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4.6.5 Replacing the balancing devices

Continued

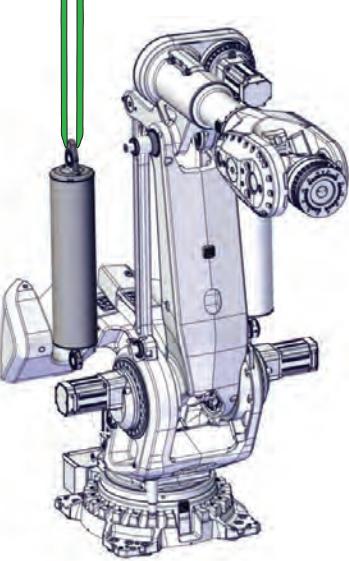
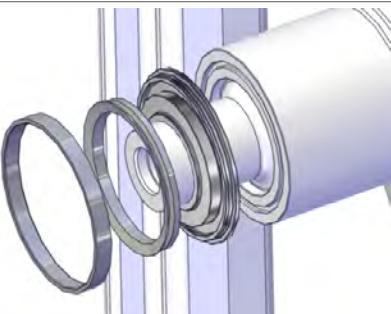
Action	Note
2 Use a Mobile platform ladder to reach the upper end of the balancing device.  DANGER Do not use the robot as a ladder.	Mobile platform ladder  xx1500001985
3  CAUTION The balancing device weights 200 kg. All lifting accessories used must be sized accordingly.	
4 Attach a roundsling to the lifting hole on top of the balancing device and to an overhead crane (or similar).	Roundsling 1 m: Lifting capacity: 1,000 kg  xx1500001983
5 Stretch the lifting accessories to take the weight of the balancing device.	
6 Remove upper and lower KM-nuts.  Note Make sure that V-ring or support ring are present.	 xx1500001973

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4 Repair

4.6.5 Replacing the balancing devices

Continued

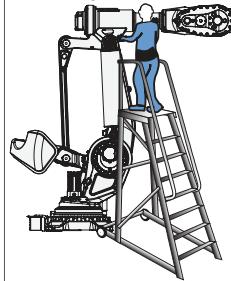
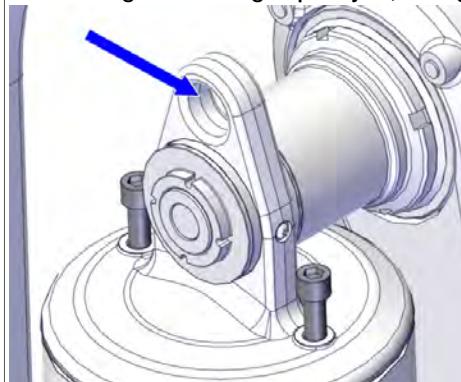
	Action	Note
7	<p>Use caution and lift the balancing device off.</p> <p> Tip</p> <p>If needed, use a Crowbar (small), to carefully help pressing the balancing device out. A suitable bearing puller is another alternative.</p>	<p>Crowbar (small)</p>  <p>xx1500002735</p>
8	<p> Note</p> <p>Make sure that the support ring and spacer ring with V-ring are present.</p>	 <p>xx1500001975</p>
9	<p>Put the balancing device down.</p> <p> Tip</p> <p>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.</p>	<p>Pallet</p>
10	If both balancing devices shall be removed, remove the other in the same way.	

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Refitting the balancing device

Use these procedures to refit the balancing device.

Preparations before refitting the balancing device

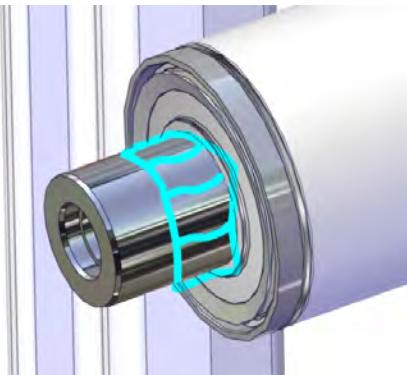
	Action	Note
1	 CAUTION The balancing device weighs 200 kg. All lifting accessories used must be sized accordingly!	
2	 DANGER Use a Mobile platform ladder (or similar), to reach the upper end of the balancing device. Do not use the robot as ladder.	Mobile platform ladder  <small>xx1500001985</small>
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  <small>xx1500001983</small>
4	Use caution and lift the balancing device up and let it hang in the lifting accessories.	
5	Wipe clean the contact surfaces.	

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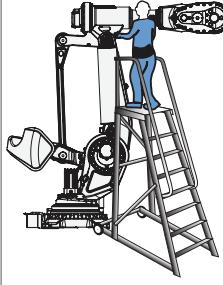
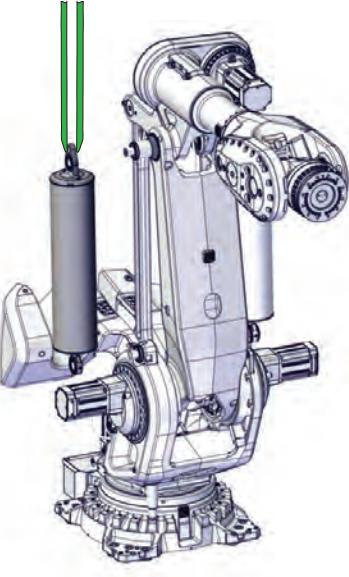
4 Repair

4.6.5 Replacing the balancing devices

Continued

Action	Note
<p>6 Apply some grease on shafts and in bearing holes.</p> <p> Note</p> <p>Do not apply any grease on the threads for the KM-nut.</p>	<p>Grease</p>  <p>xx1500002304</p>

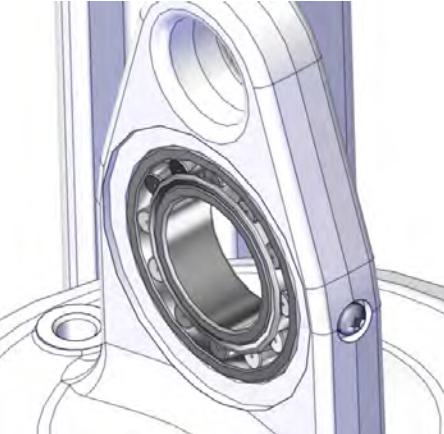
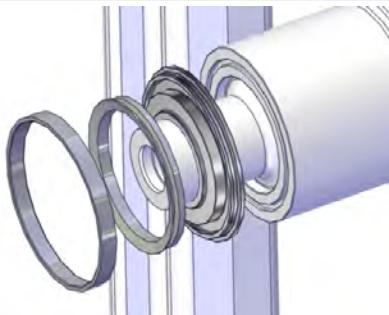
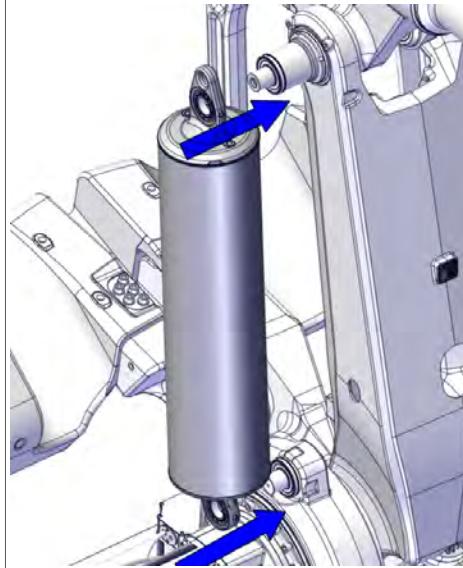
Refitting the balancing device

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

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4.6.5 Replacing the balancing devices

Continued

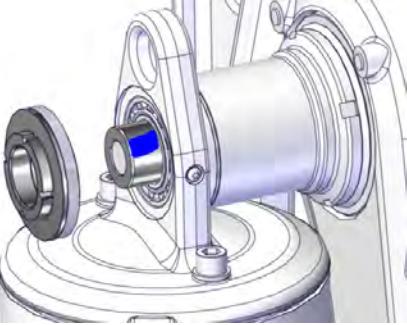
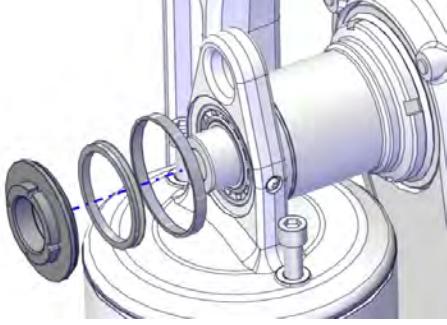
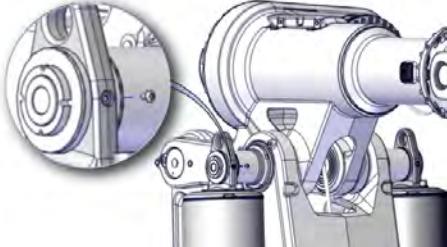
	Action	Note
3	 Note Make sure the bearings are axially centered in the balancing device ears, before putting them on the shafts.	 xx1500002306
4	Make sure that the spacer ring with V-ring and the support ring are placed correctly on the shafts before the balancing device is put on the shafts.	 xx1500001975
5	Use caution and put the balancing device onto upper and lower shafts.	 xx1500002305

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4 Repair

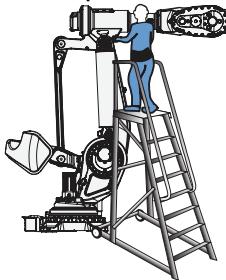
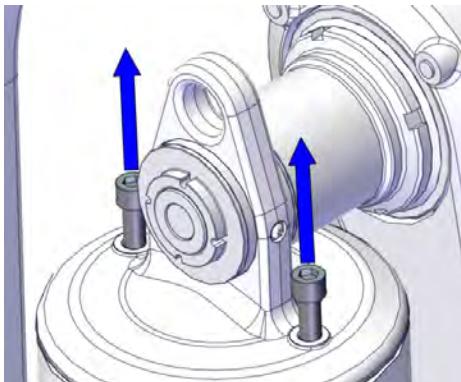
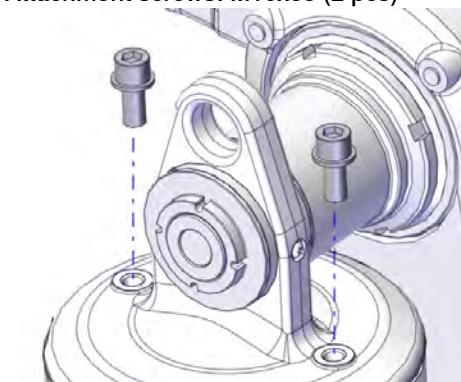
4.6.5 Replacing the balancing devices

Continued

Action	Note
6 Apply locking liquid on the threads of the lock nuts.	Locking liquid: Loctite 243  xx1500002307
7 Inspect that the bearings are axially centered in the balancing device ears.	
8 Secure the balancing device with the two lock nuts.  Note Make sure that the V-ring and support ring is fitted correctly.	Tightening torque: 120 Nm  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	<p>Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device.</p> <p> DANGER</p> <p>Do not use the robot as ladder.</p>	 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.	 xx1500001971

Concluding procedure

	Action	Note
1	Recalibrate the robot.	<p>Calibration is described in a separate calibration manual enclosed with the calibration tools.</p> <p>General calibration information is included in section Calibration on page 789.</p>

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4 Repair

4.6.5 Replacing the balancing devices

Continued

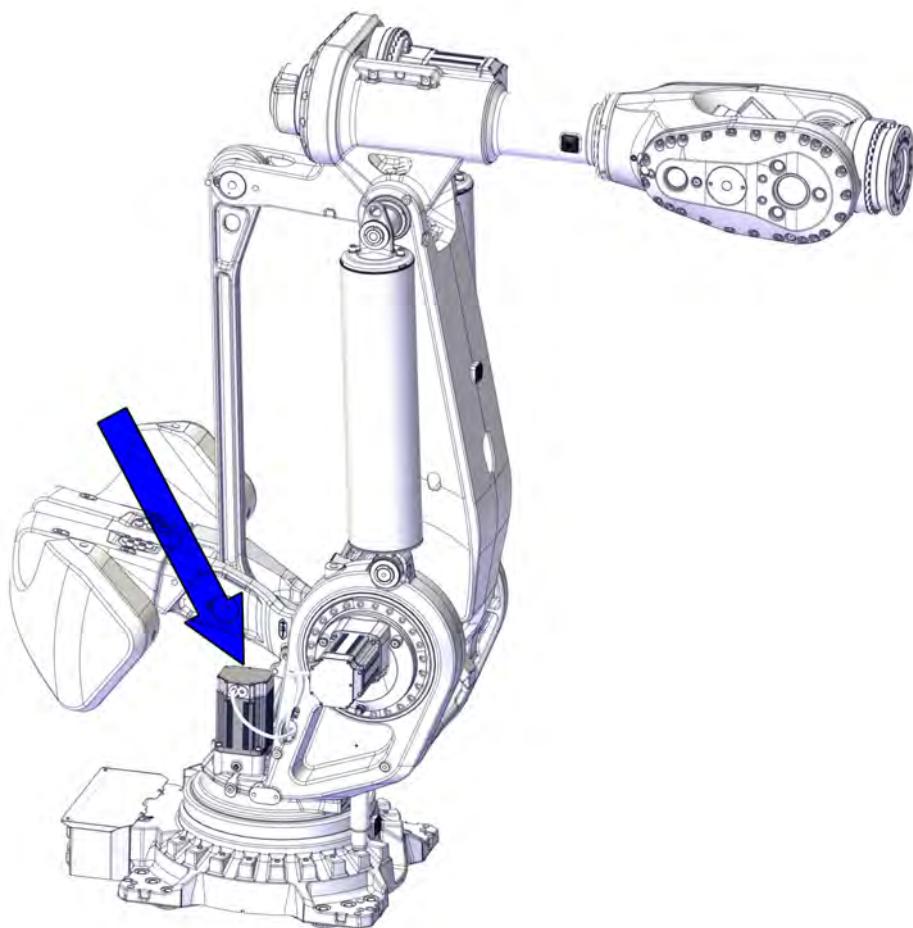
Action	Note
2  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.	

4.7 Motors

4.7.1 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Rotating AC motor (including pinion)	3HAC058949-003	

Continues on next page

4 Repair

4.7.1 Replacing the axis-1 motor

Continued

Required tools and equipment

Equipment, etc.	Article number	Note
Lifting accessory, Axis 1 motor	3HAC14459-1	
24 VDC power supply	-	Used to release the motor brakes.
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.
Rotation tool	3HAC7887-1	Used to rotate the motor pinion.
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumables

Consumable	Article number	Note
Grease		Castrol Molub. 777-1 NG: To be used on hub splines to prevent from fretting corrosion.
Flange sealant	12340011-116	Loctite 574

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. <ul style="list-style-type: none">• 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 800 .
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

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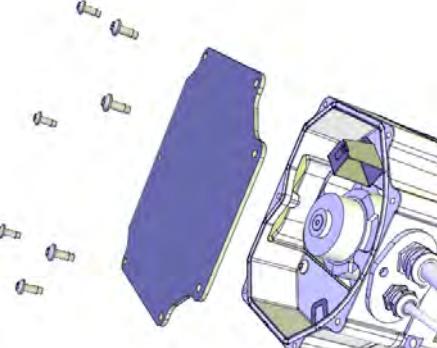
Removing the motor

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: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Disconnecting the motor cables

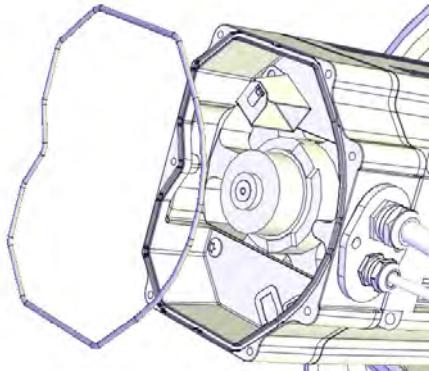
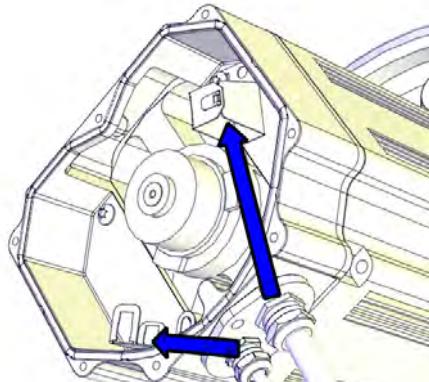
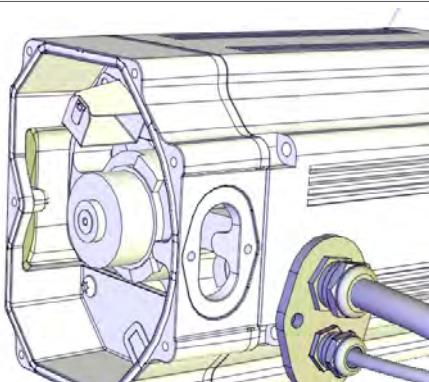
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws with washers and remove the motor cover.	 xx1200001135

Continues on next page

4 Repair

4.7.1 Replacing the axis-1 motor

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.	

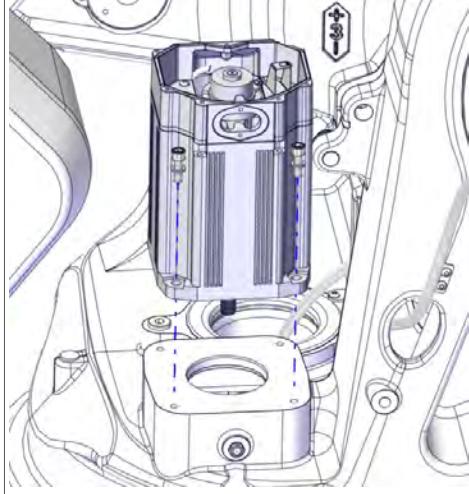
Removing the axis-1 motor

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

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4.7.1 Replacing the axis-1 motor

Continued

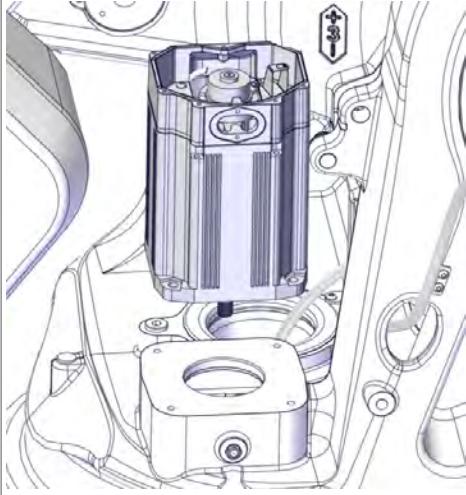
	Action	Note
2	Attach the lifting accessories.	Lifting accessory (chain): 3HAC15556-1 Lifting accessory, motor: 3HAC14459-1.
3	To release the brakes, connect the 24 VDC power supply. Connect to R2.MP1-connector: <ul style="list-style-type: none">• + = pin 2• - = pin 5	24 VDC power supply
4	 CAUTION The weight of the motor is 27 kg All lifting accessories used must be sized accordingly.	
5	Unscrew the attachment screws and washers. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx1500002083
6	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
7	 CAUTION Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.	
8	If needed, use removal tools to help remove the motor.	Removal tool M12: 3HAC14631-1

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4 Repair

4.7.1 Replacing the axis-1 motor

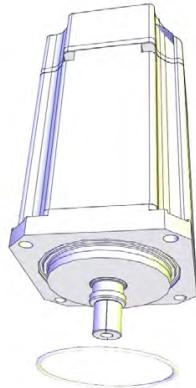
Continued

Action	Note
9 Use caution and lift the motor straight up to get the pinion parted from the gear.	
10 Disconnect the 24 VDC power supply.	

Refitting the motor

Use these procedures to refit the motor.

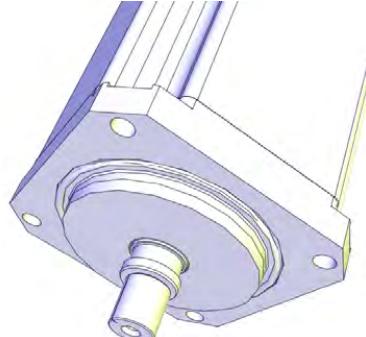
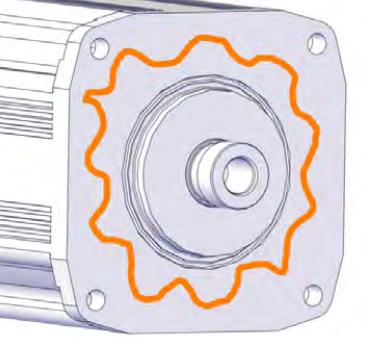
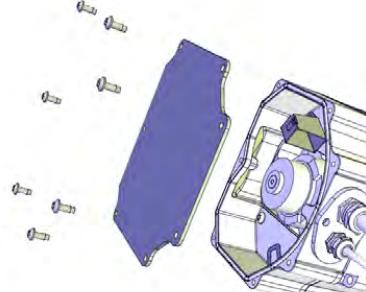
Preparations before refitting the axis-1 motor

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.	
4 Inspect the o-ring.  Note Replace if damaged.	O-ring, 3HAB3772-107 

Continues on next page

4.7.1 Replacing the axis-1 motor

Continued

Action	Note
<p>5 Make sure the o-ring is seated in the groove.</p> <p> Tip</p> <p>Lubricate the o-ring with some grease for a better fitting in the groove.</p>	 xx1200001020
<p>6 Apply flange sealant on the motor flange.</p>	<p>Flange sealant: Loctite 574</p>  xx1500002357
<p>7 If the motor is a new spare part, remove the cover.</p>	 xx1200001135

Securing the axis-1 motor

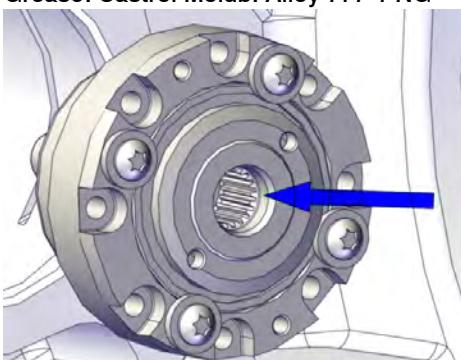
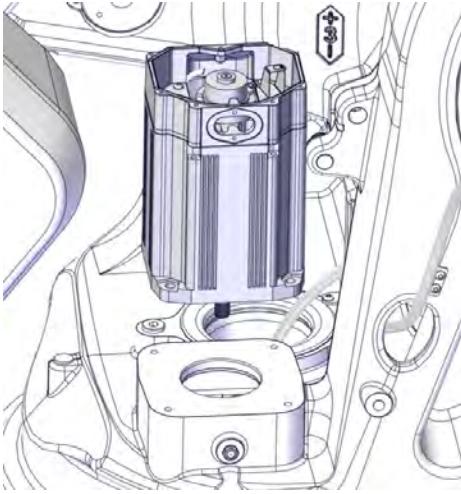
Action	Note
<p>1 Fit guide pins in opposite holes.</p>	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
<p>2  CAUTION</p> <p>The motor weighs 27 kg. All lifting accessories used must be sized accordingly.</p>	

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4 Repair

4.7.1 Replacing the axis-1 motor

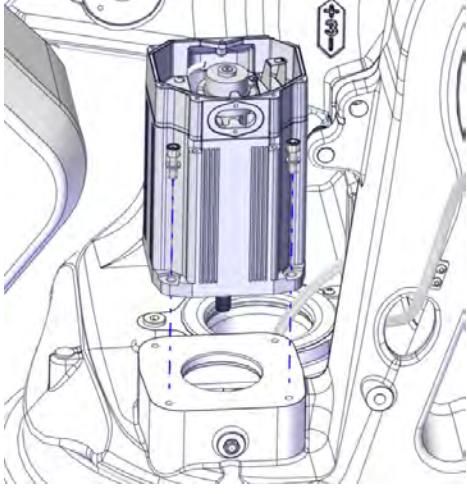
Continued

Action	Note
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
6 In order to release the brakes, connect the 24 VDC power supply. To release the brakes, connect the 24 VDC power supply as described in the list. Connect to R2.MP1-connector: <ul style="list-style-type: none">• + = pin 2• - = pin 5	
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. <ul style="list-style-type: none">• 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.	 xx1500002084

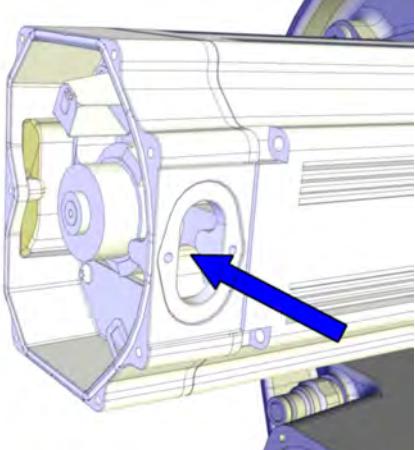
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4.7.1 Replacing the axis-1 motor

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. Screw dimension : 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 190 .
11 Disconnect the 24 VDC power supply.	

Connecting the motor cables

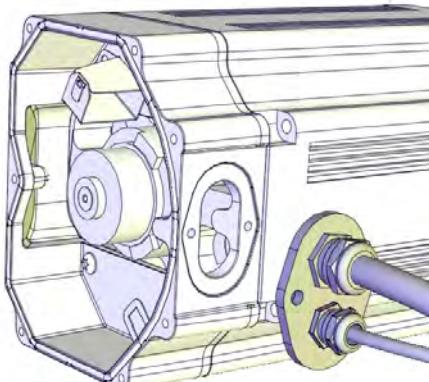
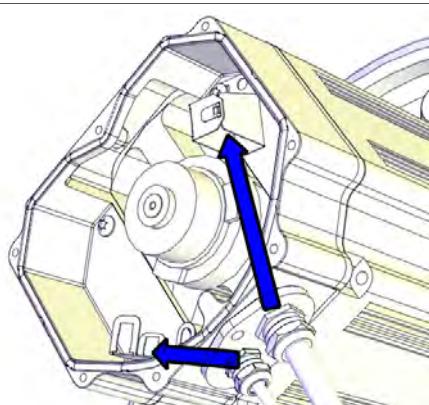
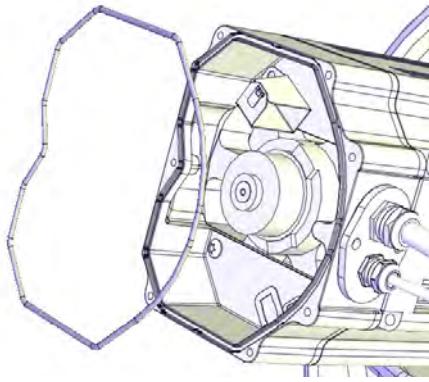
Action	Note
1 Push the motor cables in through the cable gland opening.	 xx1300000738

Continues on next page

4 Repair

4.7.1 Replacing the axis-1 motor

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: 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

4.7.1 Replacing the axis-1 motor

Continued

	Action	Note
8	<p>Refit the motor cover with its attachment screws.</p> <p>Note Do not reuse the self-threading attachment screws! Replace with standard attachment screws or the threads will be damaged.</p> <p>Note Make sure the o-ring is undamaged and properly fitted.</p>	 xx1200001135
9	Make sure that the covers are tightly sealed.	

Concluding procedure

	Action	Note
1	Recalibrate the robot.	Axis Calibration is described in Calibrating with Axis Calibration method on page 799 . General calibration information is included in section Calibration on page 789 .
2	<p> DANGER</p> <p>Make sure all safety requirements are met when performing the first test run. These are further described in the section DANGER - First test run may cause injury or damage! on page 46.</p>	

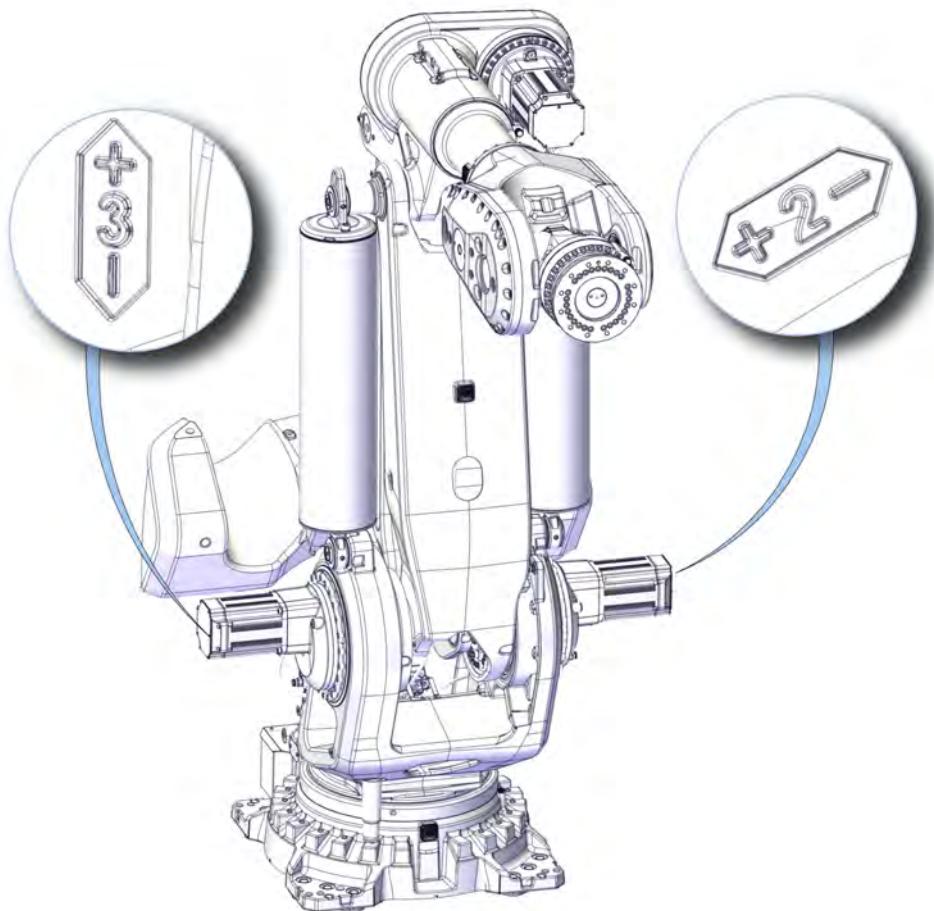
4 Repair

4.7.2 Replacing the axis-2 and axis-3 motors

4.7.2 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.



xx1500002064

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Equipment, etc.	Article number	Note
Rotating AC motor (including pinion)	3HAC058949-003	

Continues on next page

Required tools and equipment

Equipment, etc.	Article number	Note
Lifting accessory, motor	3HAC15534-1	Lifting instruction 3HAC15640-2 enclosed.
24 VDC power supply	-	Used to release the motor brakes.
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Lock screw, M20x150	-	Used to secure lower arm and parallel arm.
Removal tool M12	3HAC14631-1	Used to push out the motor if necessary. Always use removal tools in pairs.
Rotation tool	3HAC7887-1	Used to rotate the motor pinion.
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumables

Consumable	Article number	Note
Grease		Castrol Molub. 777-1 NG: To be used on hub splines to prevent from fretting corrosion.
Flange sealant	12340011-116	Loctite 574

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. <ul style="list-style-type: none"> • 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 800 .

Continues on next page

4 Repair

4.7.2 Replacing the axis-2 and axis-3 motors

Continued

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

Removing the 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 Jog the robot to the calibration position.	 xx1500002085
3 If needed adjust the position of axis-2 or axis-3, to make it possible to insert a lock screw, depending on which motor is replaced.	
4  DANGER Valid for the axis-2 motor. Secure the weight of the lower arm with a lock screw, before releasing the brakes on the axis-2 motor as well as before removing the axis-2 motor or the axis-2 gearbox. The lock screw is used to secure the weight of the lower arm, in order to avoid accidents or damage.	
5 Valid for the axis-2 motor. Insert the lock screw into the hole for the lock screw in the frame.  Note Tighten the lock screw manually. No tools needed.	Lock screw, M20x150

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	Action	Note
6	 DANGER Valid for the axis-3 motor. Secure the weight of the parallel arm with a lock screw, before releasing the brakes on the axis-3 motor as well as before removing the axis-3 motor or the axis-3 gearbox. The lock screw is used to secure the weight of the parallel arm, in order to avoid accidents or damage.	
7	Valid for the axis-3 motor. Insert the lock screw into the hole for the lock screw in the frame.  Note Tighten the lock screw manually. No tools needed.	Lock screw, M20x150
8	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
9	Remove any equipment that obstructs access to the motor.	

Disconnecting the motor cables

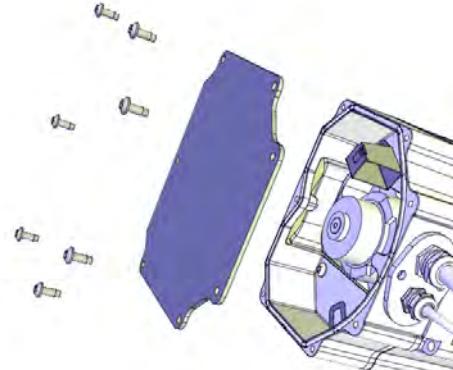
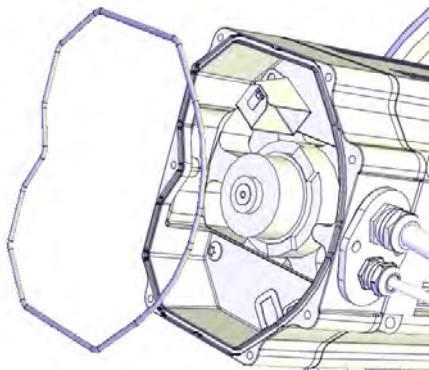
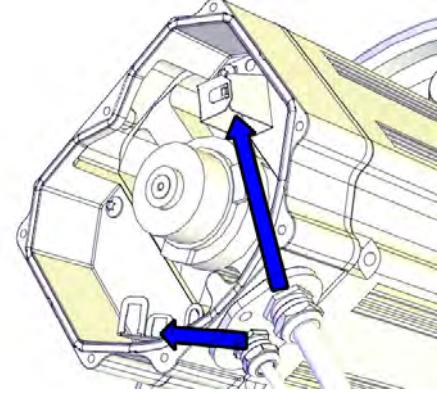
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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4 Repair

4.7.2 Replacing the axis-2 and axis-3 motors

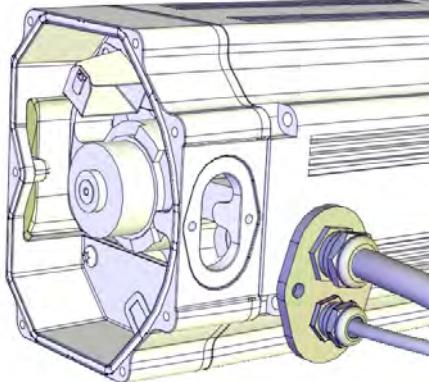
Continued

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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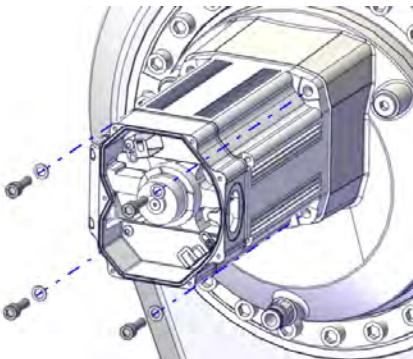
4.7.2 Replacing the axis-2 and axis-3 motors

Continued

	Action	Note
5	<p>Remove the cable gland cover. Inspect the gasket.</p> <p>Note Replace if damaged.</p> <p>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.</p>	 xx1200001067
6	Use caution and pull out the motor cables.	

Removing the axis-2 or axis-3 motor

Use this procedure to remove either the axis-2 or axis-3 motor, depending on which gearbox is being replaced.

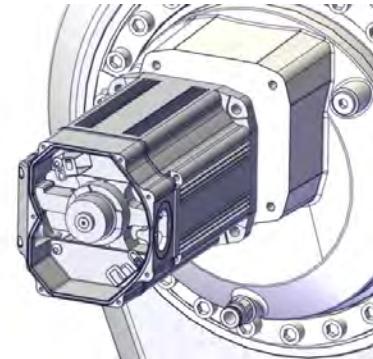
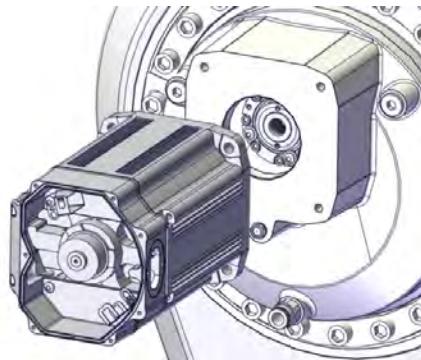
	Action	Note
1	<p>DANGER</p> <p>When releasing the holding brakes of the motor, the lower arm and/or the parallel arm will move and may fall down! Before continuing, make sure the lower arm and/or parallel arm are secured with lock screws.</p>	
2	<p>To release the brake, connect the 24 VDC power supply.</p> <p>Connect to connector R2.MP3:</p> <ul style="list-style-type: none"> • pin 2 = 24V • pin 5 = 0V 	
3	<p>Remove the attachment screws that secure the motor.</p> <p>Tip Use a bits extender in order to reach the screws.</p>	Bits extender: 3HAC12342-1  xx1500002323
4	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.

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4 Repair

4.7.2 Replacing the axis-2 and axis-3 motors

Continued

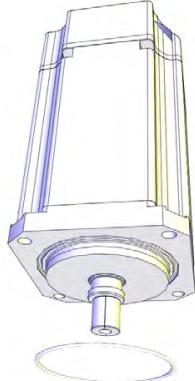
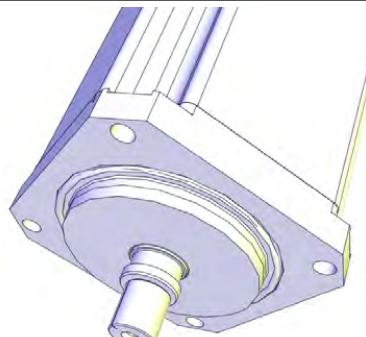
	Action	Note
5	 CAUTION Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used!	
6	If required, press the motor out of position by using the removal tool in opposite holes of the motor.	Removal tool M12: 3HAC14631-1
7	 CAUTION The motor weighs 27 kg. All lifting 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 gear.	 xx1500002325
10	Disconnect the 24 VDC power supply.	
11	Use caution and remove the motor by sliding it out on the guide pins.	 xx1500002324

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Refitting the motor

Use these procedures to refit the motor.

Preparations before refitting the motor

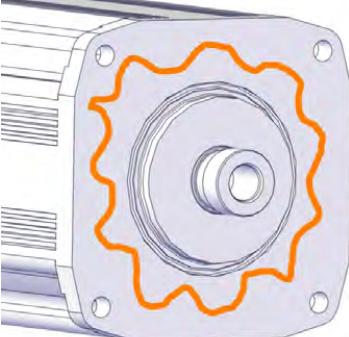
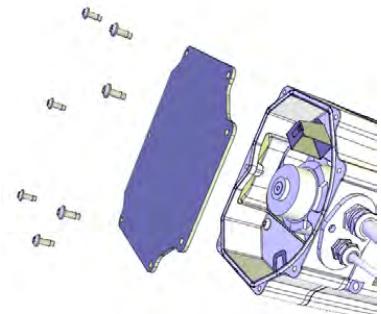
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove old paint residues and other contamination from the contact surfaces on both motor and gearbox.	
3	Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4	Inspect the o-ring.  Note Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
5	 Tip Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020

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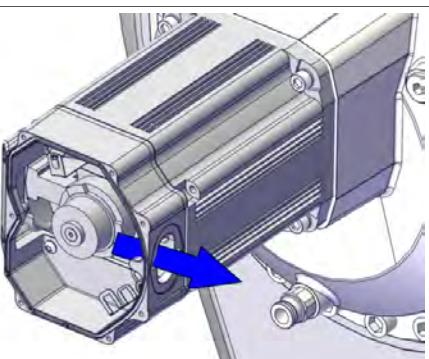
4 Repair

4.7.2 Replacing the axis-2 and axis-3 motors

Continued

Action	Note
6 Apply flange sealant on the motor flange.	<p>Flange sealant: Loctite 574</p>  <p>xx1500002357</p>
7 If the motor is a new spare part, remove the cover.	 <p>xx1200001135</p>

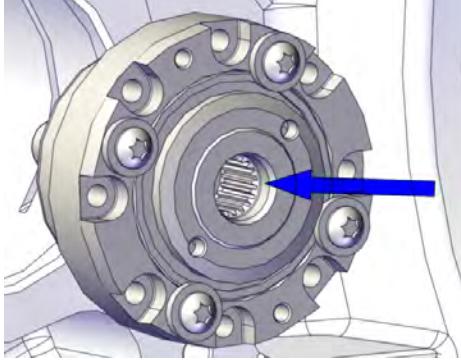
Securing the motor

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.	 <p>xx1600000050</p>

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4.7.2 Replacing the axis-2 and axis-3 motors

Continued

Action	Note
5 Lift the motor and put it on the guide pins as close as possible to its final position without pushing the motor pinion into the gear.	
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 Valid for the axis-2 motor: To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP2, axis-2 motor: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	
10 Valid for the axis-3 motor: To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP3: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	
11  CAUTION Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used!	
12 Use caution and fit the motor in its final position while at the same time rotating the motor pinion slightly using the rotation tool. <ul style="list-style-type: none">• 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.	
13 Fit two of the attachment screws.	Screw dimension: M10x40 quality 12.9 Gleitmo (4 pcs)

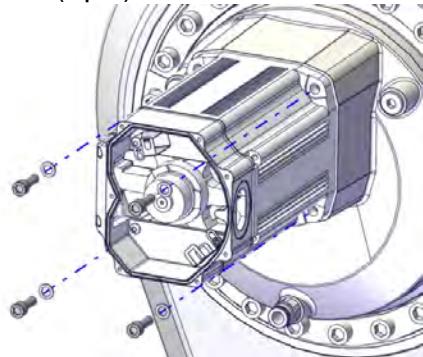
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4 Repair

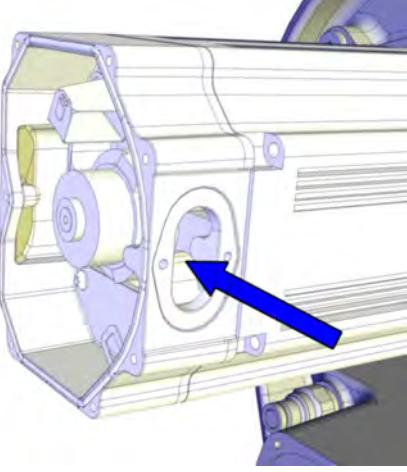
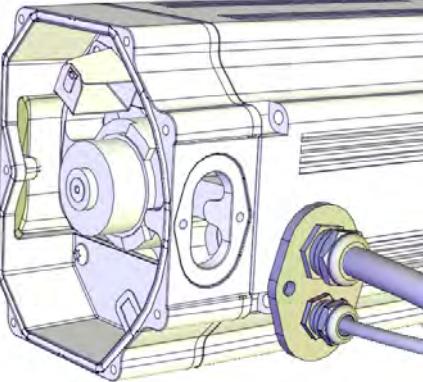
4.7.2 Replacing the axis-2 and axis-3 motors

Continued

Action	Note
14 Remove the guide pins and replace with the remaining attachment screws.	
15 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)



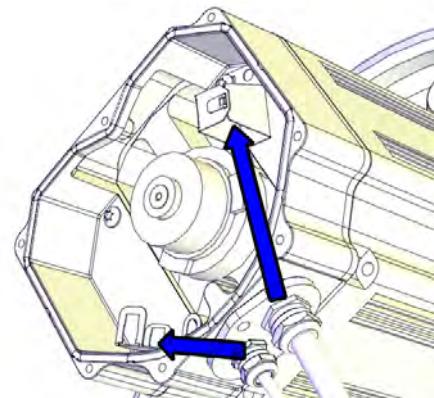
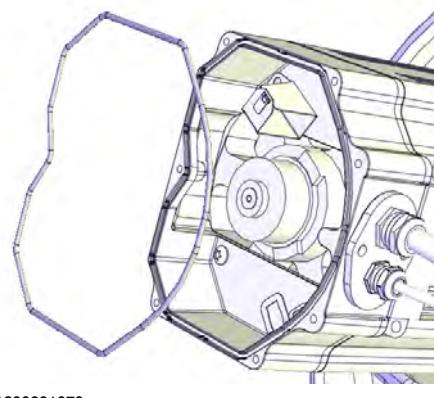
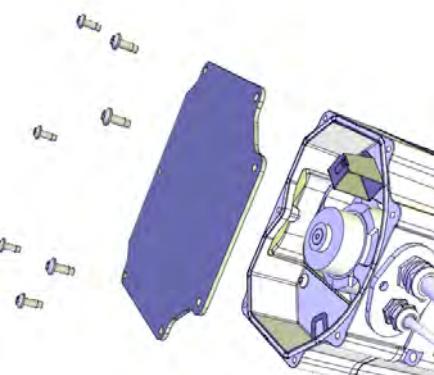
Connecting the motor cables

Action	Note
1 Push the motor cables in through the cable gland opening.	
2 Refit the cable gland cover.  Note Replace the gasket if damaged.	

Continues on next page

4.7.2 Replacing the axis-2 and axis-3 motors

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-2 & 3: 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

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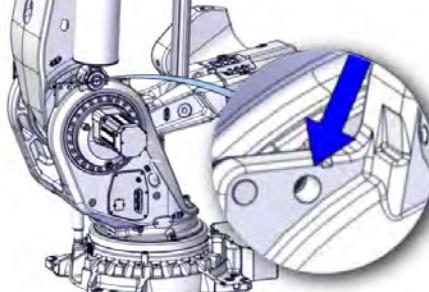
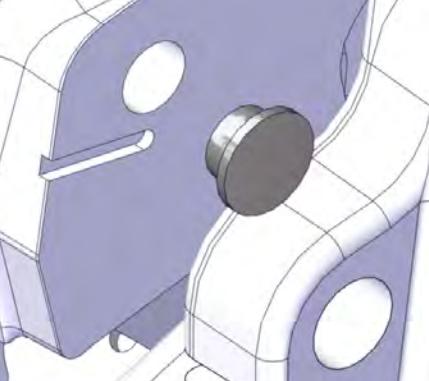
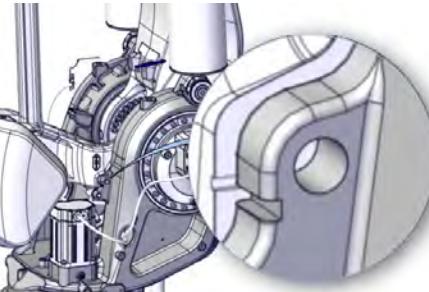
4 Repair

4.7.2 Replacing the axis-2 and axis-3 motors

Continued

Action	Note
9 Make sure that the covers are tightly sealed.	

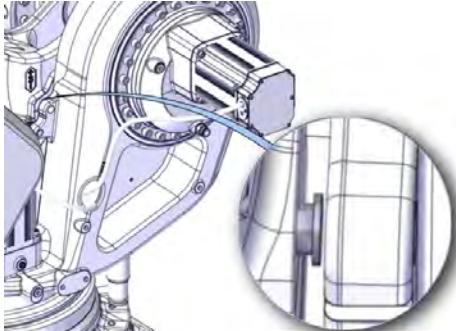
Concluding procedure

Action	Note
1 <i>Valid for the axis-2 motor:</i> Use caution and jog axis-2 until it is possible to remove the M16 lock screw.	 xx1500002322
2 Refit the plastic plug in lower arm.	 xx1500002366
3 <i>Valid for the axis-3 motor:</i> Use caution and jog axis-3 until it is possible to remove the M16 lock screw.	 xx1500002321

Continues on next page

4.7.2 Replacing the axis-2 and axis-3 motors

Continued

	Action	Note
4	Refit the plastic plug in parallel arm.	 xx1500002365
5	Recalibrate the robot.	Axis Calibration is described in Calibrating with Axis Calibration method on page 799 . General calibration information is included in section Calibration on page 789 .
6	 DANGER Make sure all safety requirements are met when performing the first test run. These are further described in the section DANGER - First test run may cause injury or damage! on page 46 .	

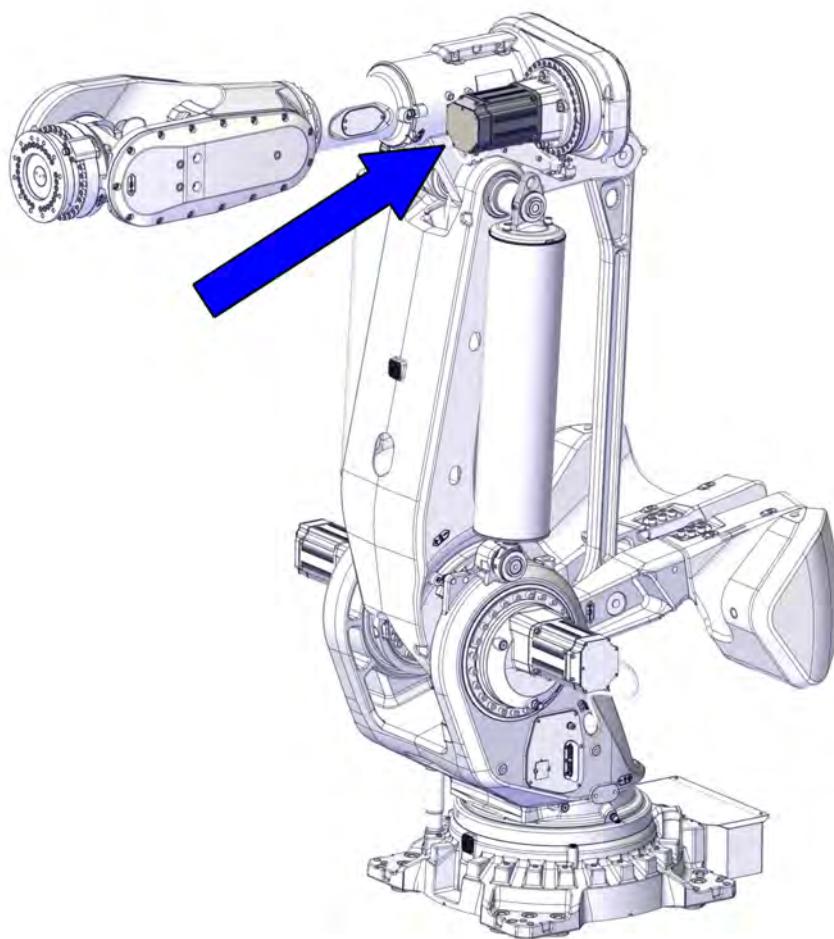
4 Repair

4.7.3 Replacing the axis-4 motor

4.7.3 Replacing the axis-4 motor

Location of the axis-4 motor

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



xx1500002065

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Rotating AC motor (including pinion)	3HAC058950-003	

Continues on next page

Required tools and equipment

Equipment, etc.	Article number	Note
Lifting accessory, motor	3HAC15534-1	Lifting instruction 3HAC15640-2 enclosed.
24 VDC power supply	-	Used to release the motor brakes.
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.
Rotation tool	3HAC7887-1	Used to rotate the motor pinion.
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumables

Consumable	Article number	Note
Grease		Castrol Molub. 777-1 NG: To be used on hub splines to prevent from fretting corrosion.
Flange sealant	12340011-116	Loctite 574

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. <ul style="list-style-type: none"> • 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 800 .
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

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4 Repair

4.7.3 Replacing the axis-4 motor

Continued

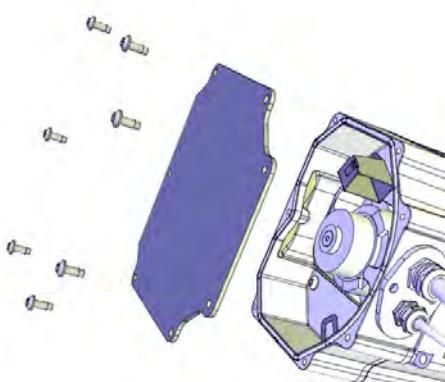
Removing the motor

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: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

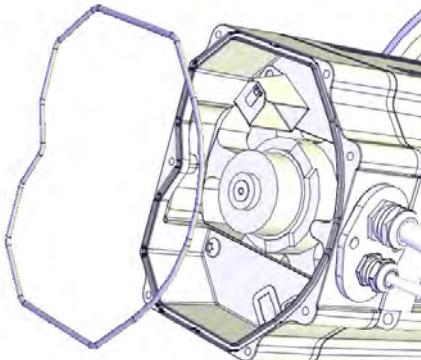
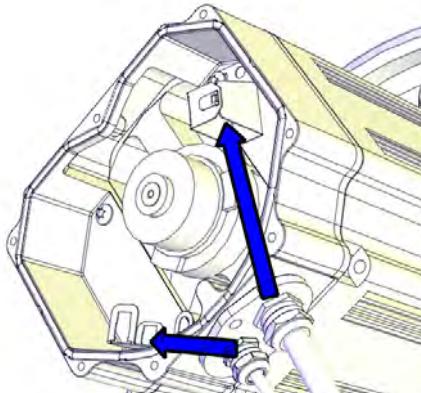
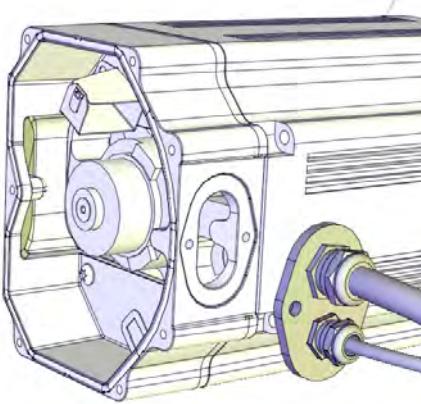
Disconnecting the motor cables

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

Continues on next page

4.7.3 Replacing the axis-4 motor

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

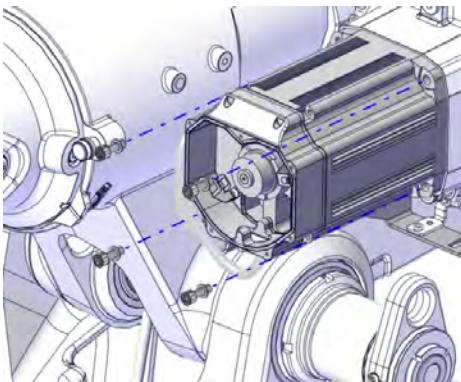
	Action	Note
1	CAUTION Use caution when releasing the brakes! Axis-4 can move unexpectedly!	

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4 Repair

4.7.3 Replacing the axis-4 motor

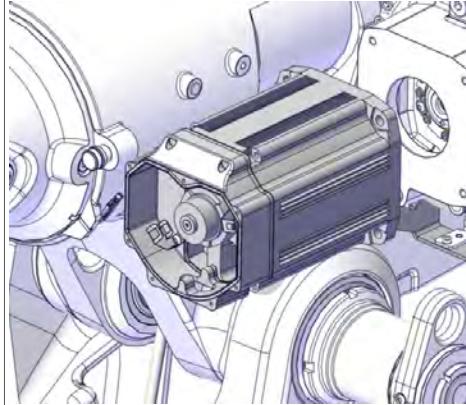
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Action	Note
2 To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP4: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	
3 Unscrew the attachment screws that secure the motor. Use a bits extender in order to reach 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 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 24 VDC power supply.	

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4.7.3 Replacing the axis-4 motor

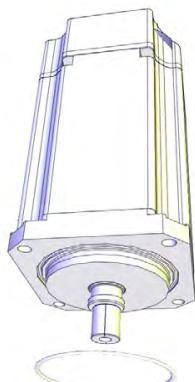
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Action	Note
10 Remove the motor by carefully lifting it straight out. Make sure the pinion is not damaged in the process.	 xx1600000065

Refitting the motor

Use these procedures to refit the motor.

Preparations before refitting the axis-4 motor

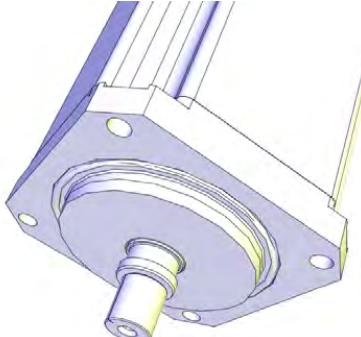
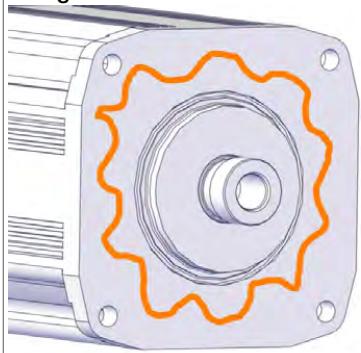
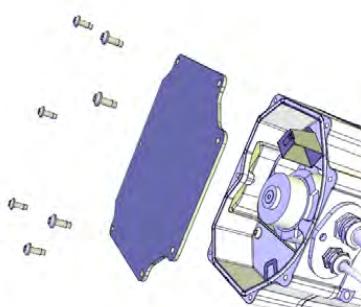
Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Remove old paint residues and other contamination from the contact surfaces on both motor and gearbox.	
3 Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4 Make sure the o-ring is undamaged.  Note Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019

Continues on next page

4 Repair

4.7.3 Replacing the axis-4 motor

Continued

	Action	Note
5	<p>Make sure the o-ring is seated in the groove.</p> <p> Tip</p> <p>Lubricate the o-ring with some grease for a better fitting in the groove.</p>	 xx1200001020
6	Apply flange sealant on the motor flange.	<p>Flange sealant: Loctite 574</p>  xx1500002357
7	If the motor is a new spare part, remove the cover.	 xx1200001135

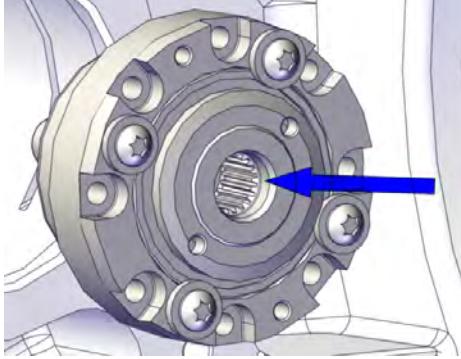
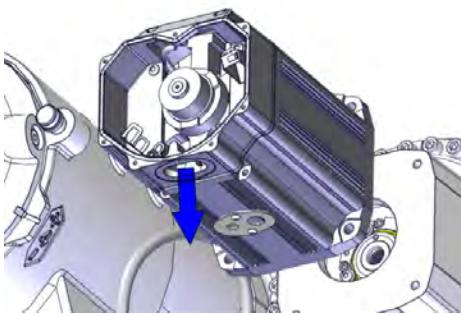
Securing the axis-4 motor

	Action	Note
1	Apply two guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
2	<p> CAUTION</p> <p>The motor weighs 27 kg. All lifting accessories used must be sized accordingly.</p>	Lifting accessory, motor: 3HAC15534-1

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4.7.3 Replacing the axis-4 motor

Continued

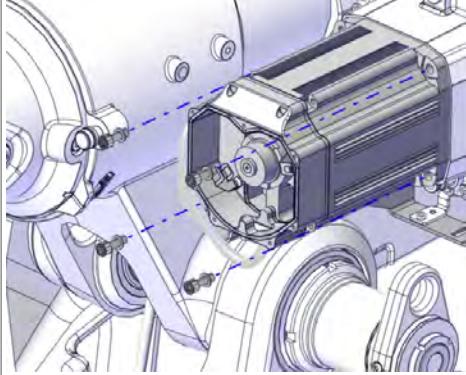
Action	Note
3 Attach the lifting accessory and lift the motor up.	
4 Make sure that there is enough grease on the splines before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346
5 Put the motor onto the guide pins.	
6  Note Make sure the cable exit hole will 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 To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP2: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	
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. <ul style="list-style-type: none">• 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.	

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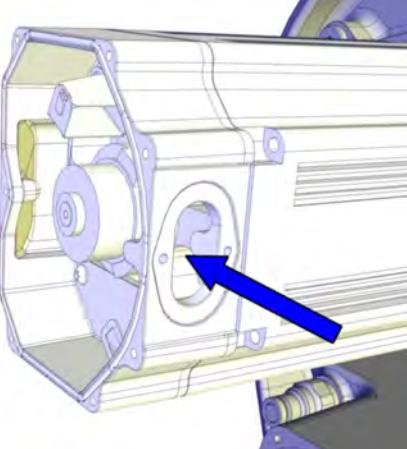
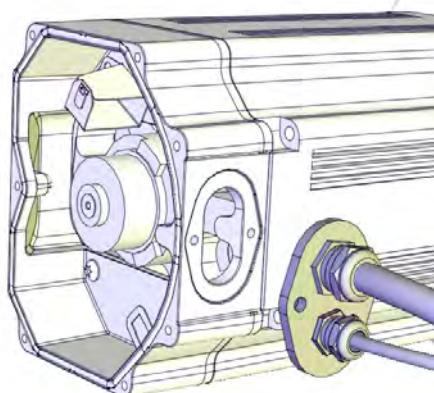
4 Repair

4.7.3 Replacing the axis-4 motor

Continued

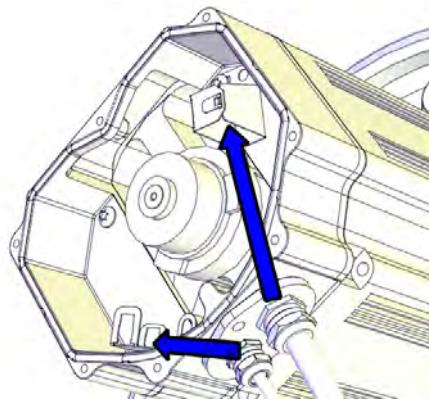
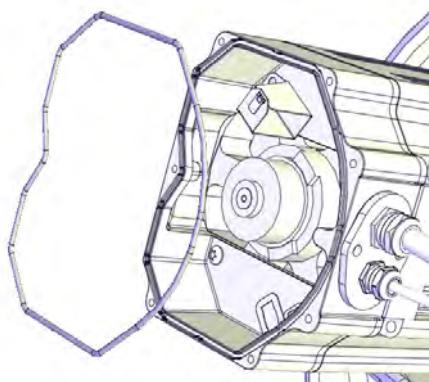
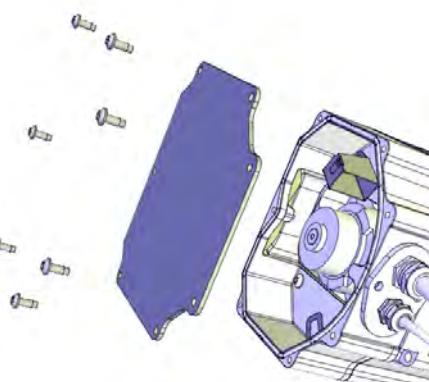
Action	Note
12 Secure the motor with its attachment screws and washers. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1 Tightening torque: 50 Nm. Screw dimension: M10x30 quality 12.9 Gleitmo (4 pcs)  xx1600000064
13 Disconnect the 24 VDC power supply.	

Connecting the motor cables

Action	Note
1 Push the motor cables in through the cable gland opening.	 xx1300000738
2 Refit the cable gland cover.  Note Replace the gasket if damaged.	 xx1200001067

Continues on next page

4.7.3 Replacing the axis-4 motor Continued

Action	Note
3 Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066
4 Make sure the o-ring is undamaged.  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 Repair

4.7.3 Replacing the axis-4 motor

Continued

	Action	Note
9	Make sure that the covers are tightly sealed.	

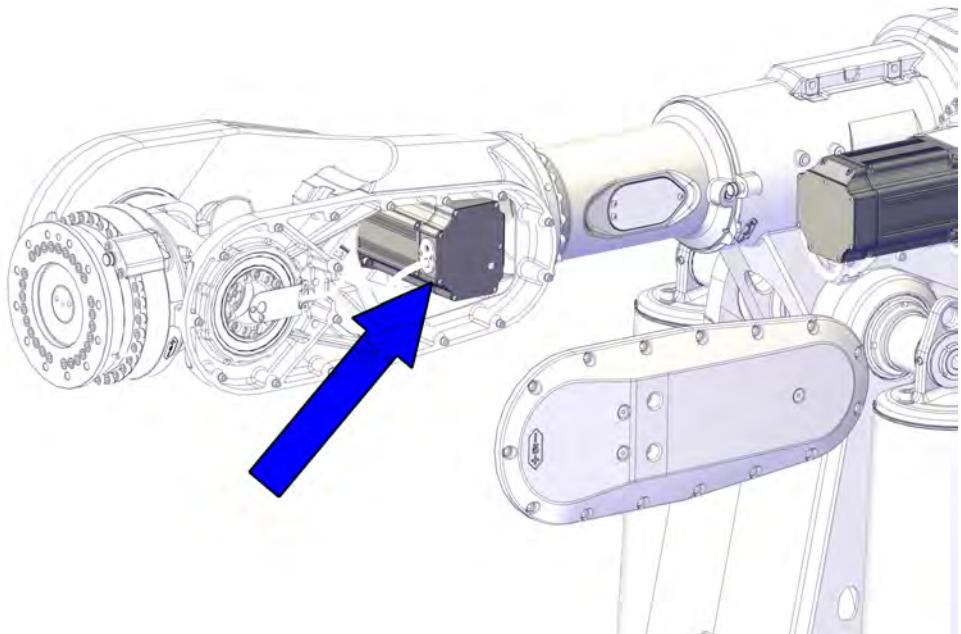
Concluding procedure

	Action	Note
1	Recalibrate the robot.	Axis Calibration is described in Calibrating with Axis Calibration method on page 799 . General calibration information is included in section Calibration on page 789 .
2	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

4.7.4 Replacing the axis-5 motor

Location of the axis-5 motor

The axis-5 motor is located as shown in the figure.



xx1500002066

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Rotating AC motor (including pinion)	3HAC058949-003	

Required tools and equipment

Equipment, etc.	Article number	Note
Lifting accessory, Axis 1 motor	3HAC14459-1	
24 VDC power supply	-	Used to release the motor brakes.
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.

Continues on next page

4 Repair

4.7.4 Replacing the axis-5 motor

Continued

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumables

Consumable	Article number	Note
Grease		Castrol Molub. 777-1 NG: To be used on hub splines to prevent from fretting corrosion.
Flange sealant	12340011-116	Loctite 574
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. <ul style="list-style-type: none">• 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 800 .
	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-5 motor

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

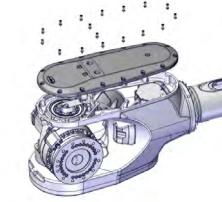
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4.7.4 Replacing the axis-5 motor

Continued

Action	Note
2 Jog the robot to the specified position: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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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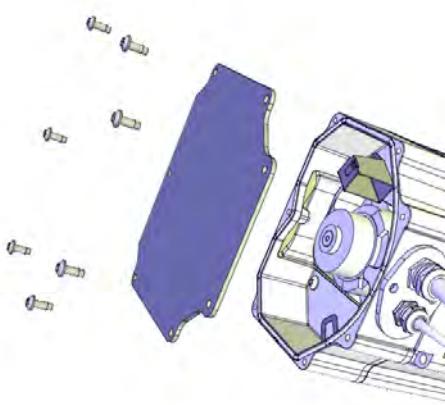
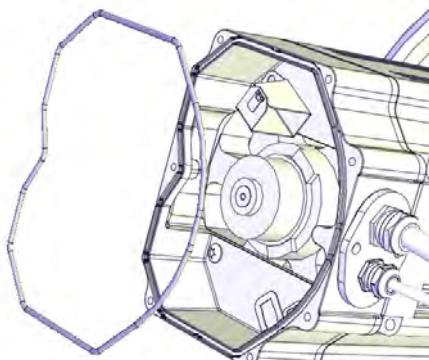
4 Repair

4.7.4 Replacing the axis-5 motor

Continued

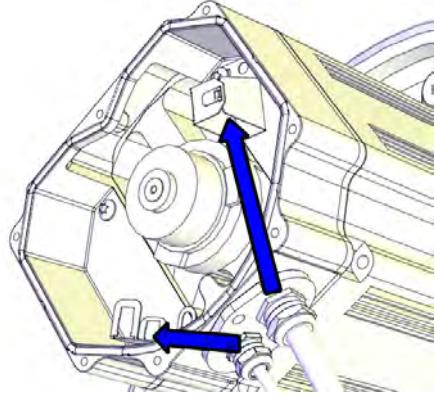
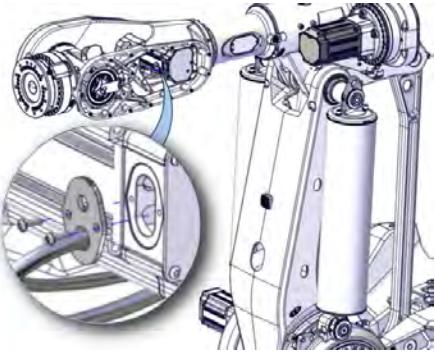
Action	Note
3 Cut the cable tie that secure the axis-6 motor cable.	 xx1500003101

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
3  Note Make sure the o-ring is present when removing the cover.	 xx1200001070

Continues on next page

4.7.4 Replacing the axis-5 motor Continued

	Action	Note
4	Disconnect the motor cables.	
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.	
6	Use caution and pull out the motor cables.	

Removing the axis-5 motor

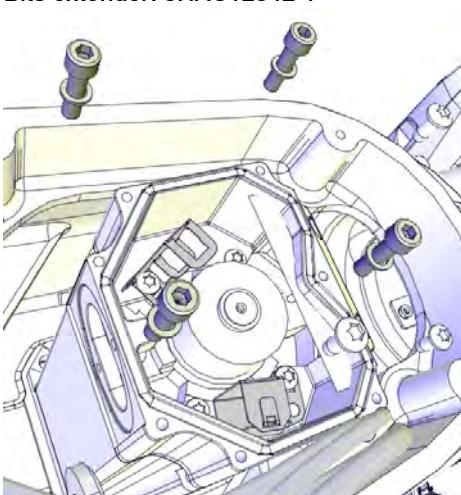
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP5: <ul style="list-style-type: none"> • pin 2 = 24V • pin 5 = 0V 	24 VDC power supply

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4 Repair

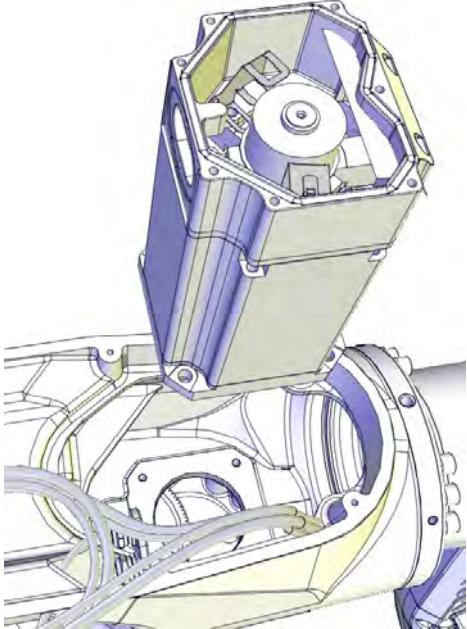
4.7.4 Replacing the axis-5 motor

Continued

Action	Note
3 Unscrew the attachment screws that secure the motor, using a bits extender.	Bits extender: 3HAC12342-1  xx1200001017
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
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

Continues on next page

4.7.4 Replacing the axis-5 motor
Continued

Action	Note
8 Use caution and lift the motor out.	 xx1200001018

Refitting the motor

Use these procedures to refit the motor.

Preparations before refitting the axis-5 motor

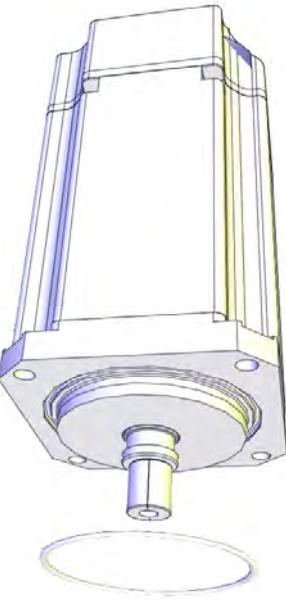
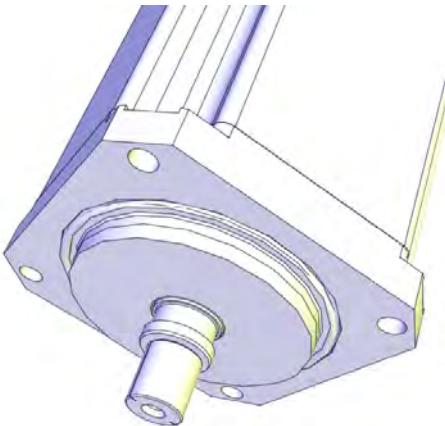
Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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4 Repair

4.7.4 Replacing the axis-5 motor

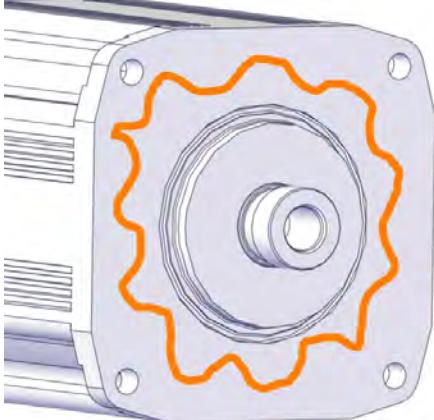
Continued

Action	Note
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.	
5 Make sure the o-ring is seated in the groove.	 xx1200001020

Continues on next page

4.7.4 Replacing the axis-5 motor

Continued

Action	Note
6 Apply flange sealant on the motor flange.	Flange sealant: Loctite 574  xx1500002357
7 Attach two guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2

Securing the axis-5 motor

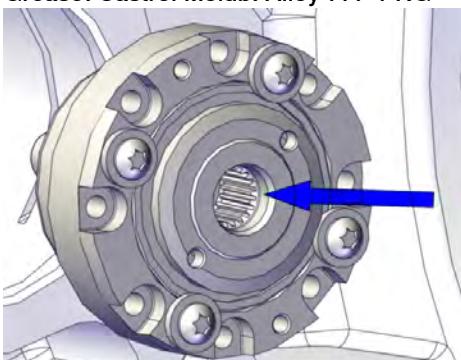
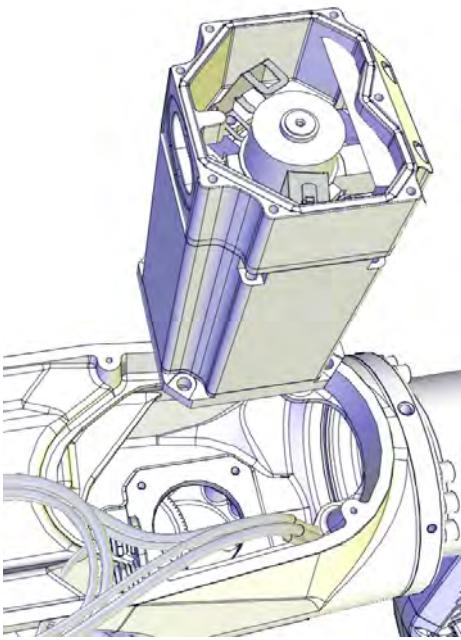
Action	Note
1  CAUTION Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used!	
2 Attach the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool: 3HAC7887-1
3 To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP5: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	24 VDC power supply
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.	

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4 Repair

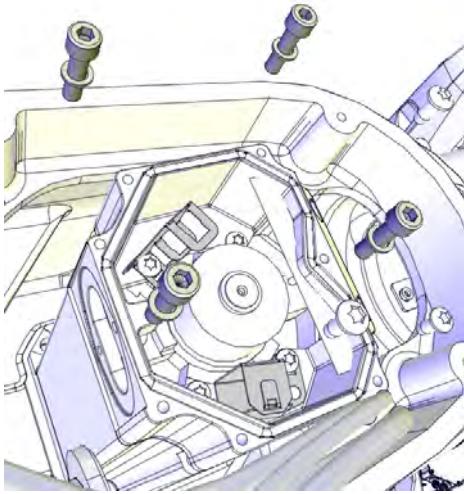
4.7.4 Replacing the axis-5 motor

Continued

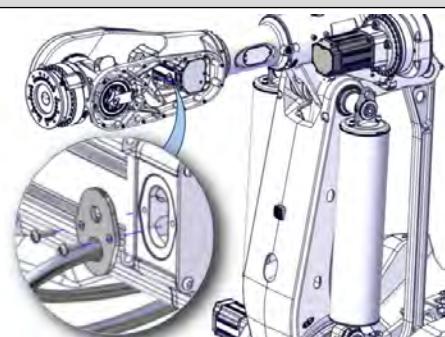
Action	Note
6 Make sure that there is enough grease on the splines before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346
7 Use caution and lower the motor into position on the guide pins, while at the same time rotating the motor pinion slightly. Make sure that: <ul style="list-style-type: none">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.	

Continues on next page

4.7.4 Replacing the axis-5 motor
Continued

	Action	Note
9	Secure the motor with its attachment screws and washers, using a bits extender.	<p>Bits extender: 3HAC12342-1 Tightening torque: 50 Nm. Screw dimension: M10x30 quality 12.9 Gleitmo(4 pcs)</p>  <p>xx1200001017</p>
10	Disconnect the 24 VDC power supply.	

Connecting the axis-5 motor cables

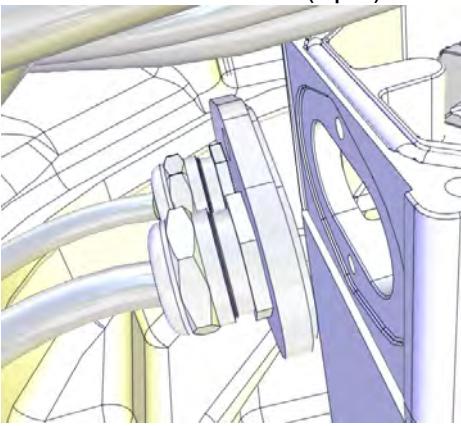
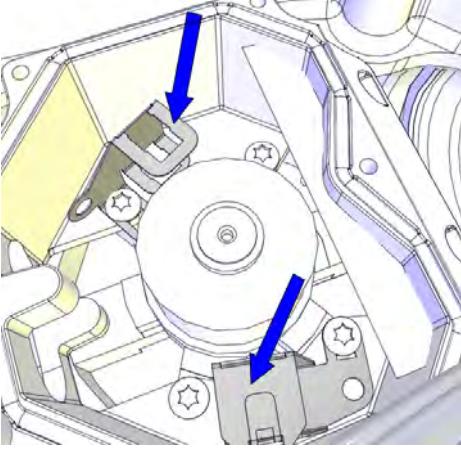
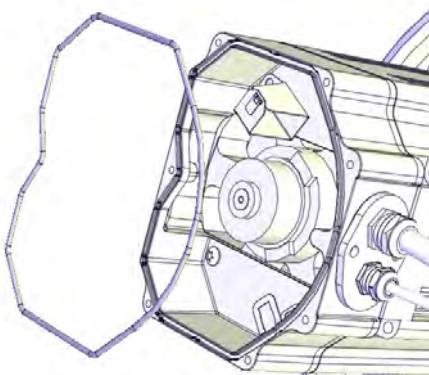
	Action	Note
1	Push the motor cables in through the cable gland opening.	 <p>xx1500002717</p>

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4 Repair

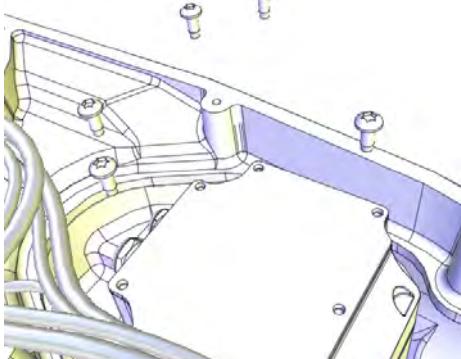
4.7.4 Replacing the axis-5 motor

Continued

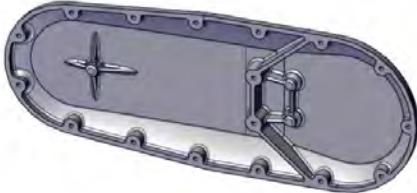
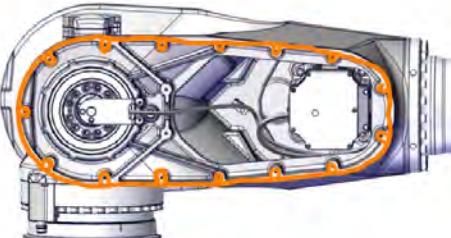
Action	Note
2 Refit the cable gland cover.	 Note Replace the gasket if damaged.
	 xx1200001016
3 Connect the connectors. Connect in accordance with the markings on the connectors.	
	 xx1200001015
4 Inspect the o-ring.	 Note Replace if damaged.
	O-ring: 3HAC054692-002  xx1200001070
5	 CAUTION When refitting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

Continues on next page

4.7.4 Replacing the axis-5 motor Continued

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

Concluding procedure

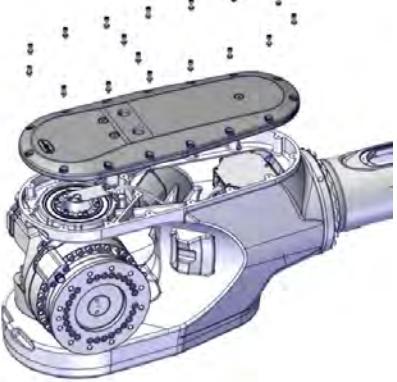
	Action	Note
1	Make sure the contact surface on the wrist cover is undamaged.	 xx1600000046
2	Apply flange sealant (Loctite 574) on the wrist cover flange.	Loctite 574  xx1600000048
3	Place the cable harness in a way so it will not be damaged when the wrist cover is fitted.	

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4 Repair

4.7.4 Replacing the axis-5 motor

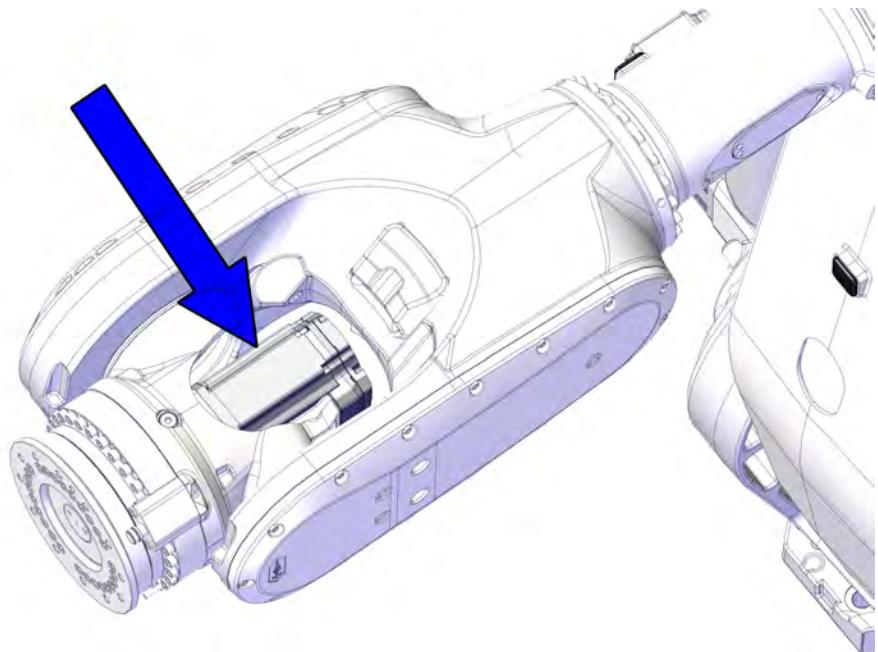
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Action	Note
4 Refit the wrist cover and tighten all screws alternately and repeat once.	Attachment screws: M8x25 8.8 (17 pcs) Tightening torque: 24 Nm  xx1500002330
5 Recalibrate the robot.	Axis Calibration is described in Calibrating with Axis Calibration method on page 799 . General calibration information is included in section Calibration on page 789 .
6  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

4.7.5 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Rotating AC motor (including pinion)	3HAC058951-003	

Required tools and equipment

Equipment, etc.	Article number	Note
24 VDC power supply	-	Used to release the motor brakes.
Removal tool M10	-	Used to push out the motor if necessary.
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Continues on next page

4 Repair

4.7.5 Replacing the axis-6 motor

Continued

Required consumables

Consumable	Article number	Note
Grease		Castrol Molub. 777-1 NG: To be used on hub splines to prevent from fretting corrosion.
Flange sealant	12340011-116	Loctite 574
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. <ul style="list-style-type: none">• 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 800 .
	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.

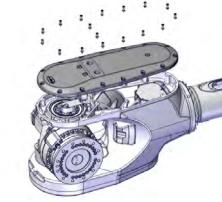
Preparations before removing the axis-6 motor

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

Continues on next page

Action	Note
2 Jog the robot to the specified position: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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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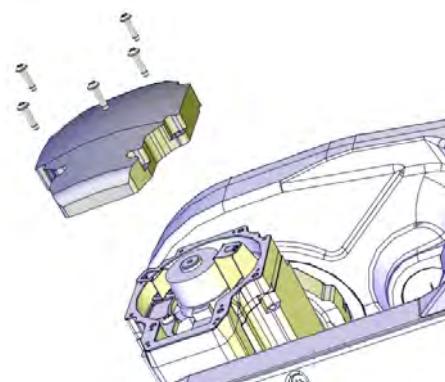
4 Repair

4.7.5 Replacing the axis-6 motor

Continued

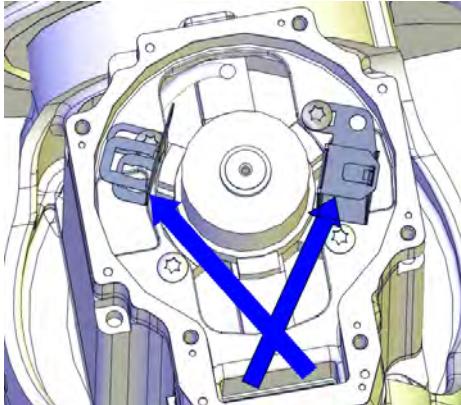
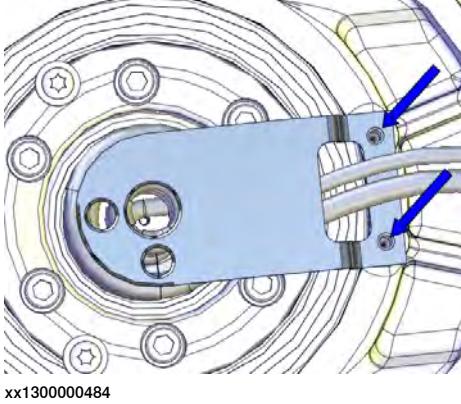
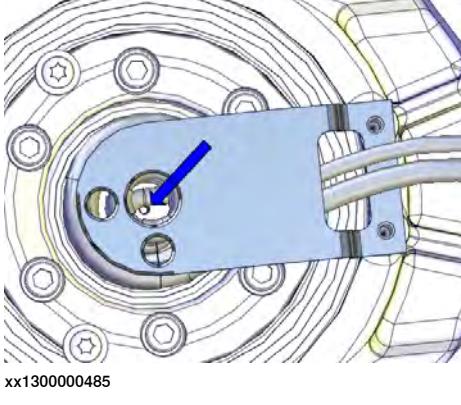
Action	Note
3 Cut the cable tie that secure the axis-6 motor cable.	 xx1500003101

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 applicable when 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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4.7.5 Replacing the axis-6 motor Continued

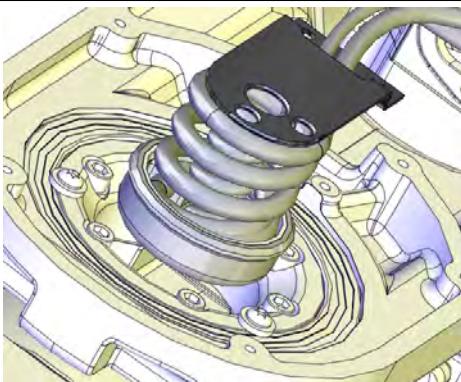
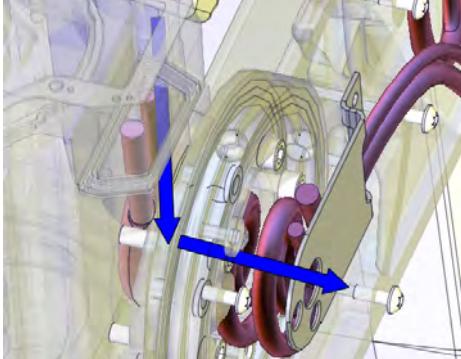
	Action	Note
4	Disconnect the motor cables.	 xx1300000488
5	Unscrew the attachment screws holding the cable bracket.	 xx1300000484
6	Unscrew the screw holding the carrier. Note The screw is located at the bottom of the carrier.	 xx1300000485

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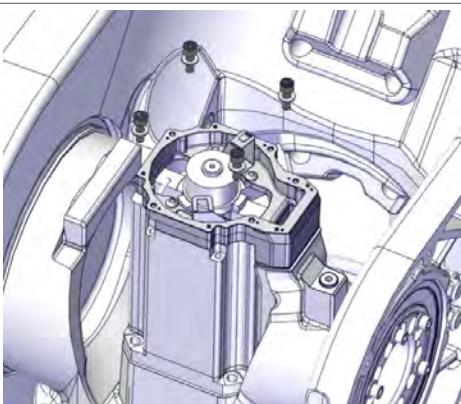
4 Repair

4.7.5 Replacing the axis-6 motor

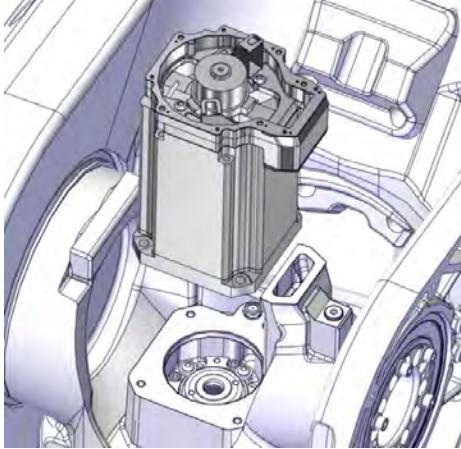
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Action	Note
<p>7 Use caution and pull out the carrier.</p> <p> Tip</p> <p>If needed, use a screwdriver to help pulling out the carrier.</p>	 xx1300001113
<p>8 Use caution and pull out the axis-6 motor cables by holding the cables at the motor with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

Removing the axis-6 motor

Action	Note
<p>1 To release the brakes, connect the 24 VDC power supply. Connect to R2.MP6-connector:</p> <ul style="list-style-type: none"> • pin 2 = 24V • pin 5 = 0V 	24 VDC power supply
<p>2 Unscrew the attachment screws with washers.</p>	 xx1500003097

Continues on next page

	Action	Note
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 24 VDC power supply.	

Refitting the motor

Use these procedures to refit the motor.

Preparations before refitting the axis-6 motor

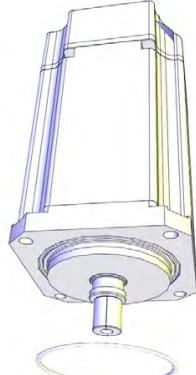
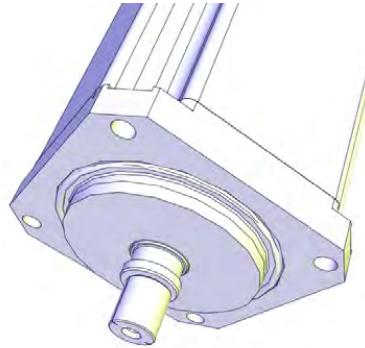
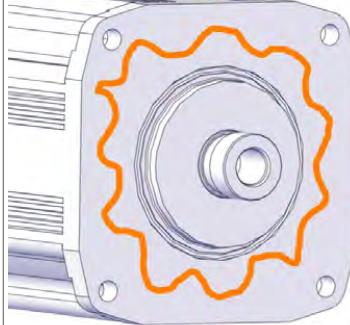
	Action	Note
10	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
11	Remove old paint residues and other contamination from the contact surfaces on both motor and gearbox.	
12	Wipe clean the contact surfaces from any remaining contamination.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

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4 Repair

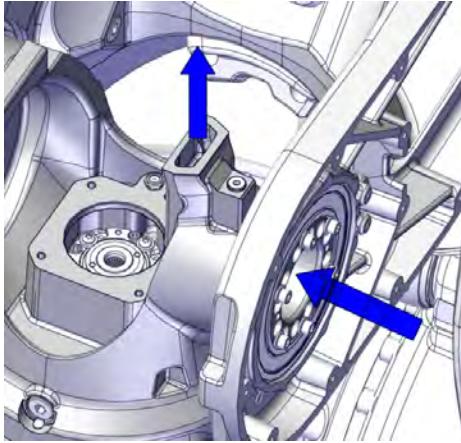
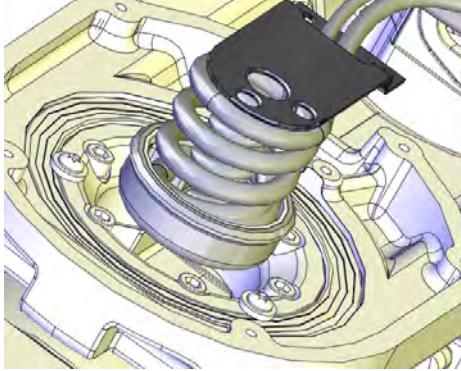
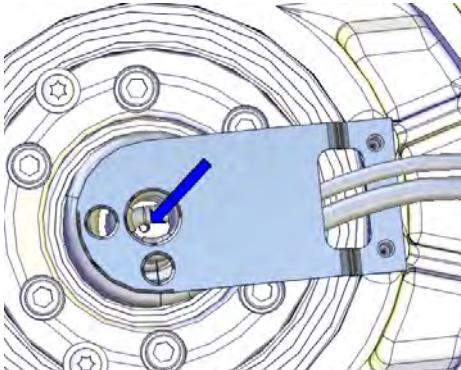
4.7.5 Replacing the axis-6 motor

Continued

	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  xx1500002357
16	If the motor is a new spare part, remove the motor cover.	

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Connecting the axis-6 motor cables - step 1

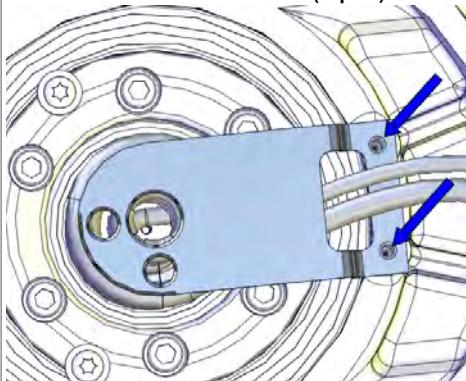
	Action	Note
1	<p>Note</p> <p>Axis-5 must be in position +90° (or as close as possible) for a correct installation of the cable harness spiral in the wrist. If not, connect the 24 VDC power supply, release the brakes and move axis-5 manually to +90°.</p>	
2	Use caution and push the cable harness in through the wrist recess.	 xx1500003099
3	<p>Tip</p> <p>Use a screwdriver (or similar) to press the carrier into position.</p>	 xx1300001113
4	<p>Note</p> <p>The M4 screw is located at the bottom of the carrier.</p> <p>Tip</p> <p>The M4 screw may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.</p>	<p>Attachment screw: M4x10</p>  xx1300000485

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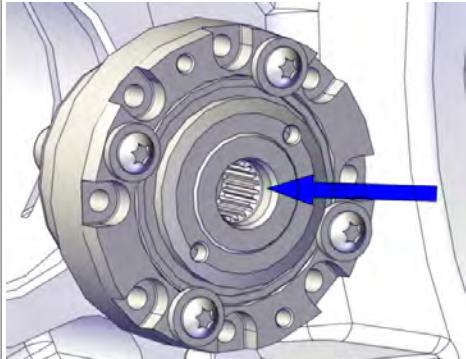
4 Repair

4.7.5 Replacing the axis-6 motor

Continued

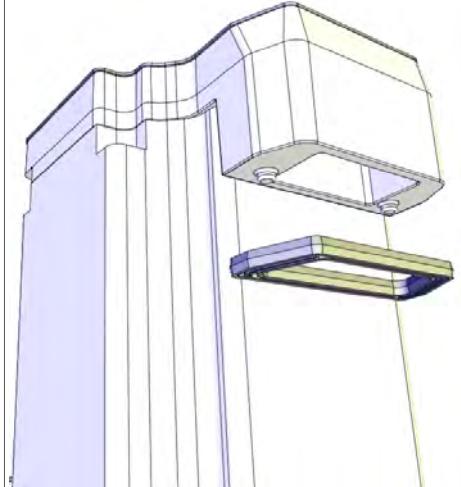
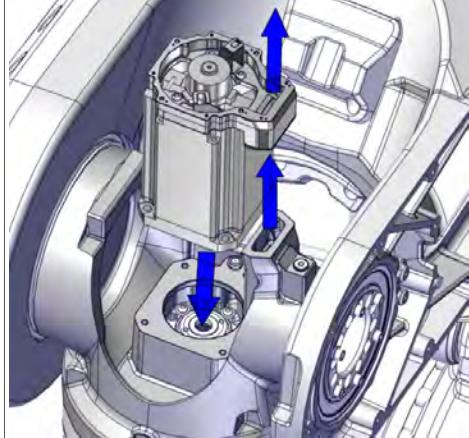
Action	Note
5 Secure the cable bracket.	<p>Attachment screws: M6x12 (2 pcs)</p> 

Securing the axis-6 motor

Action	Note
1  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
2 To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP6: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	
3 Make sure that there is enough grease on the splines, before fitting. If not, apply 1 gram of grease.	<p>Grease: Castrol Molub. Alloy 777-1 NG</p> 
4  CAUTION Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.	

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4.7.5 Replacing the axis-6 motor Continued

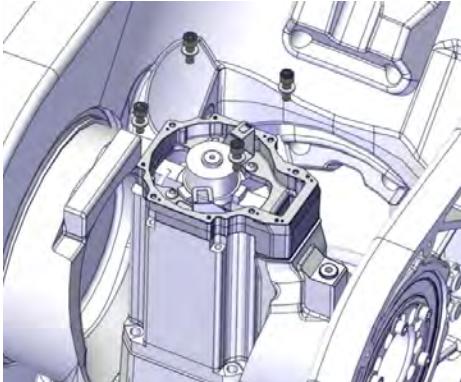
	Action	Note
5	<p>Inspect the gasket.</p> <p> Note</p> <p>Replace if damaged.</p>	 <p>xx1200001094</p>
6	<p> CAUTION</p> <p>The motor weighs 14 kg. All lifting accessories used must be sized accordingly!</p>	
7	<p>Put the motor into its mounting position, while at the same time, pushing the motor cables in through the cable gland recess.</p> <p>Make sure the motor pinion is properly mated into the hub.</p> <p>Make sure the motor pinion is not damaged.</p>	 <p>xx1500003102</p>

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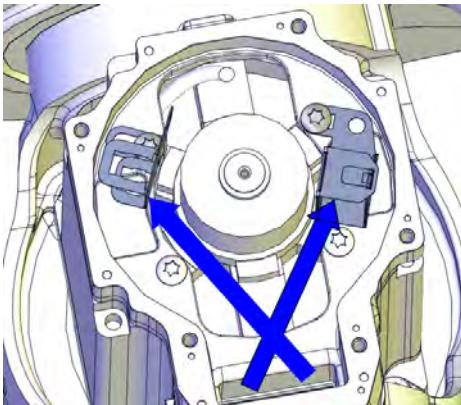
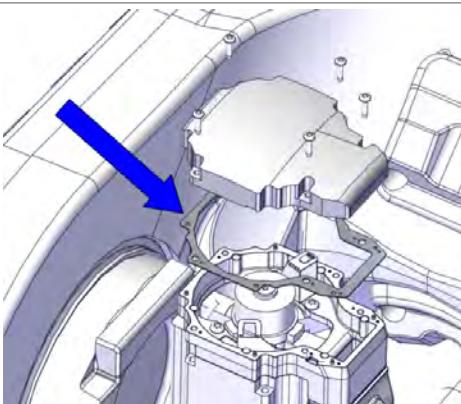
4 Repair

4.7.5 Replacing the axis-6 motor

Continued

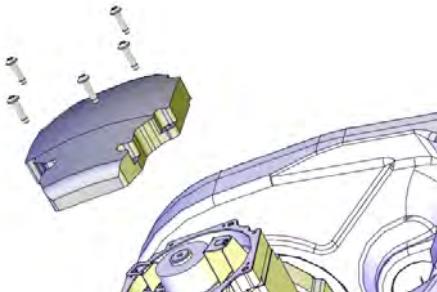
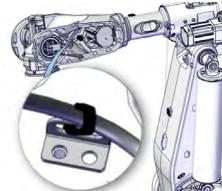
Action	Note
8 Secure the motor. Make sure that the gasket is fitted correctly.	Tightening torque: 24 Nm Screw dimension: M8x25 quality 12.9 Gleitmo (4 pcs)  xx1500003097
9 Disconnect the 24 V DC power supply.	

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

Continues on next page

4.7.5 Replacing the axis-6 motor Continued

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.	 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

Continues on next page

4 Repair

4.7.5 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

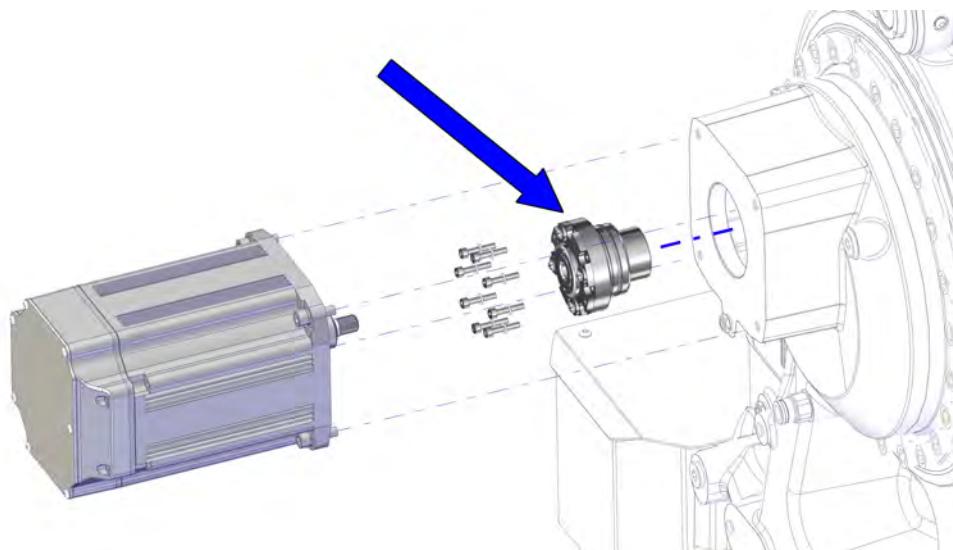
Action	Note
1 Recalibrate the robot.	Axis Calibration is described in Calibrating with Axis Calibration method on page 799 . General calibration information is included in section Calibration on page 789 .
2  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

4.8 Gearboxes

4.8.1 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Hub with pinion	3HAC049795-003	

Required tools and equipment

Equipment, etc.	Article number	Note
Screw M6x110	-	Fully threaded (2 pcs)
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 . (2 pcs)

Continues on next page

4 Repair

4.8.1 Replacing the hub

Continued

Required consumables

Consumable	Article number	Note
Grease		Castrol Molub. 777-1 NG: To be used on hub splines to prevent from fretting corrosion.
Locking liquid	3HAB7116-1	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.



Removing the hub

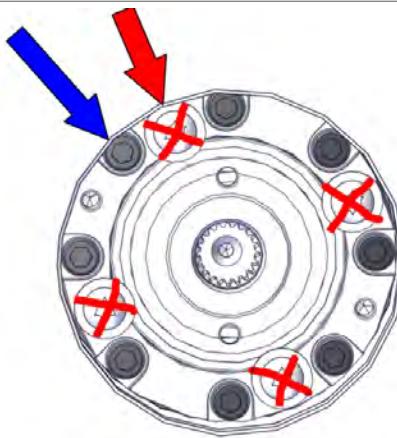
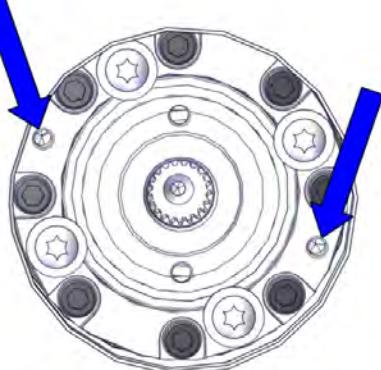
Use these procedures to remove the hub.

Preparations before removing the hub

	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
2	Drain the oil in axis-1 gearbox.	See Draining the axis-1 gearbox on page 147
3	Remove the axis-1 motor.	See Replacing the axis-1 motor on page 567

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Removing the hub

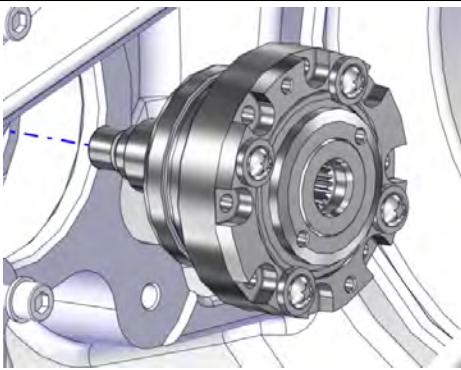
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the M6x30 hex socket head cap screws that secure the hub.  Note Do not remove the M6x16 torx pan head screws.	 xx1500002038
3	 CAUTION Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	
4	Fit two screws in opposite holes of the hub and use them as removal tools.	Attachment screws: M6x110 (2 pcs)  xx1500002081

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4 Repair

4.8.1 Replacing the hub

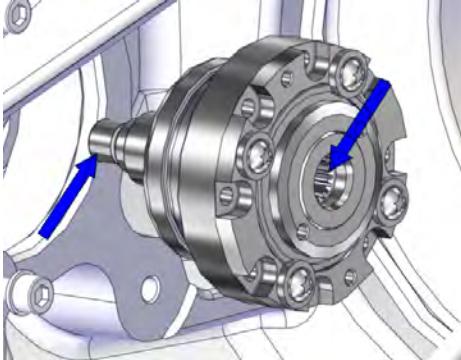
Continued

Action	Note
5 Lift out the hub carefully.	 xx1500002326

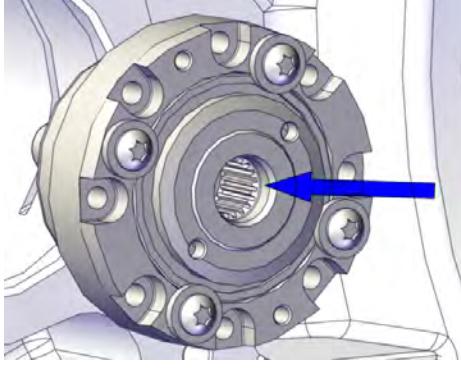
Refitting the hub

Use these procedures to refit the hub.

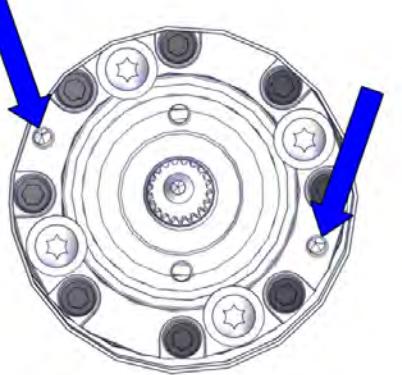
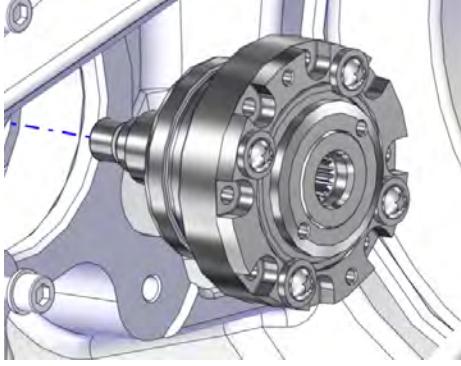
Preparations before refitting the hub

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

Continues on next page

Action	Note
6 Make sure that there is enough grease on the splines before fitting. If not, apply 3 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346

Refitting the hub

Action	Note
1 Attach two screws in opposite holes of the hub and use them as tools to fit the hub.	Attachment screws: M6x110 (2 pcs)  xx1500002081
2  CAUTION Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	
3 Refit the hub.	 xx1500002326

Continues on next page

4 Repair

4.8.1 Replacing the hub

Continued

Action	Note
4 Remove the two M6x110 and fit the attachment screws for the hub. Apply locking liquid (Loctite 243) on the screws.	Attachment screws: M6x30 12.9. Loctite 243 Quantity: <ul style="list-style-type: none">• 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.

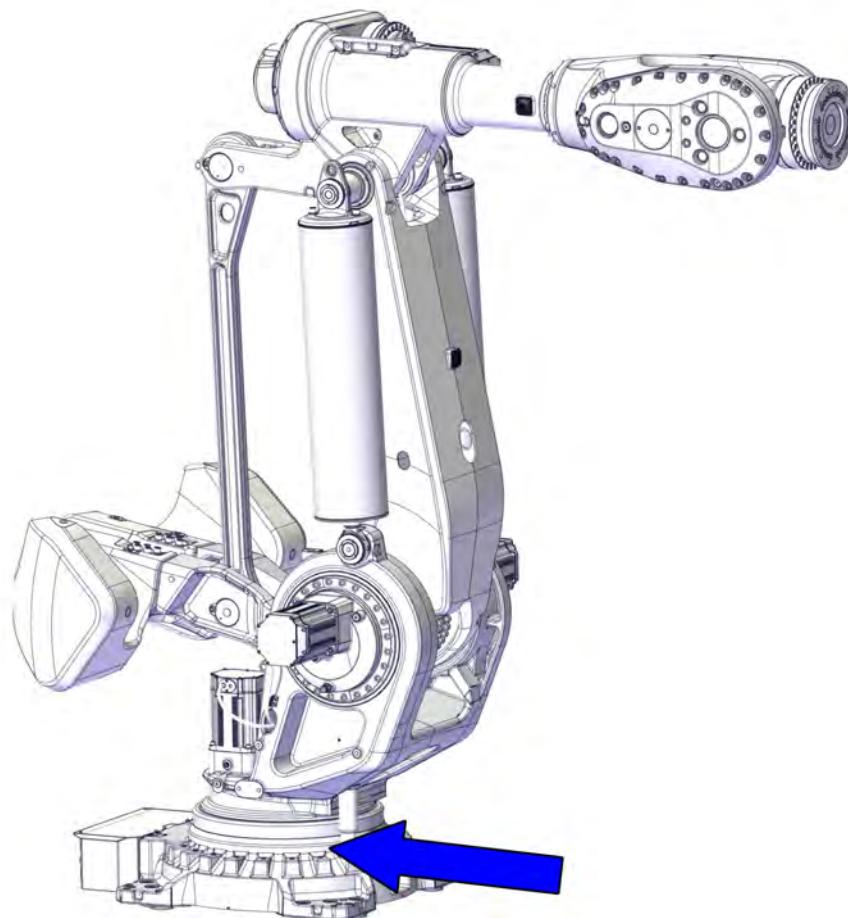
Concluding procedure

Action	Note
1 Refit the axis-1 motor.	See Replacing the axis-1 motor on page 567
2 Refill oil in axis-1 gearbox.	See Filling oil into the axis-1 gearbox on page 149
3 Re-calibrate the robot.	Axis Calibration is described in Calibrating with Axis Calibration method on page 799 . General calibration information is included in section Calibration on page 789 .
4  DANGER Make sure all safety requirements are met when performing the first test run. These are further described in DANGER - First test run may cause injury or damage! on page 46 .	

4.8.2 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Reduction gear RV 700CS	3HAC048963-002	

Continues on next page

4 Repair

4.8.2 Replacing the axis-1 gearbox

Continued

Required tools and equipment

Equipment, etc.	Article number	Note
MobilePlatformLadder	-	
Roundsling 2 m	-	Lifting capacity: 2,000 kg
Roundsling 2.5 m	-	Lifting capacity: 2,000 kg
Lifting eye	3HAC14457-4	M16
Lifting eye	3HAC038295-003	M24
Support legs	-	Used to elevate the base to remove and refit axis 1 gear box.
Attachment screw	-	For support legs
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Lifting accessory, motor	3HAC15534-1	Lifting instruction 3HAC15640-2 enclosed.
Bits extender	3HAC12342-1	300 mm, bits 1/2"
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.
Guide pin, M16x300	3HAC	Always use guide pins in pairs.
Guide pin, M20x200		Always use guide pins in pairs.
Removal tool M14	3HAC047108-001	Used to push out the motor if necessary. Always use removal tools in pairs.
Screw M6x110	-	Fully threaded
Torque Multiplier	-	Nova Torque
Rotation tool	3HAC7887-1	Used to rotate the motor pinion.
Sparkplug wrench	-	Used to remove and refit the R1.SMB in the base.
Piece of wood	-	Used when replacing the parallel rod and mechanical stop pin as a safety measure
24 VDC power supply	-	Used to release the motor brakes.
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumables

Consumable	Article number	Note
Grease		Castrol Molub. Alloy 777-1 NG: To be used on hub splines to prevent from fretting corrosion.
Locking liquid	3HAB7116-1	Loctite 243
Grease		
Mercasol		

Continues on next page

Consumable	Article number	Note
Flange sealant	12340011-116	Loctite 574

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	<p>Decide which calibration routine to use for calibrating the robot.</p> <ul style="list-style-type: none"> • 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. 	
	<p>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.</p>	<p>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 800.</p>
	<p>If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.</p>	

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 147 .

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4 Repair

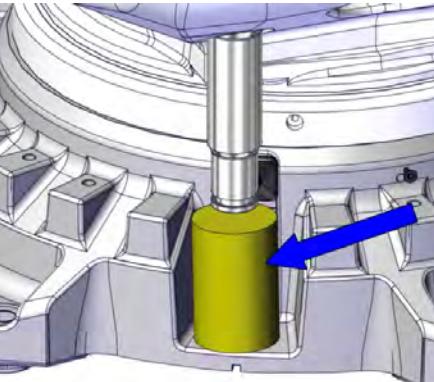
4.8.2 Replacing the axis-1 gearbox

Continued

Robot position when replacing the mechanical stop pin

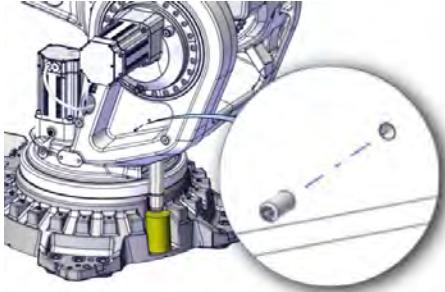
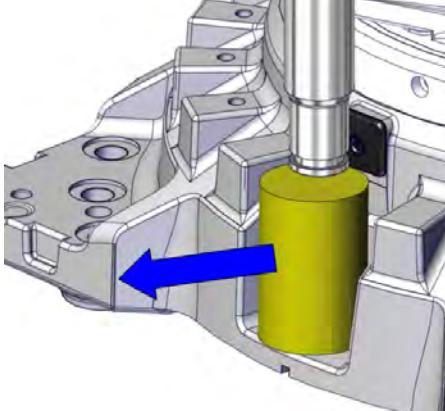
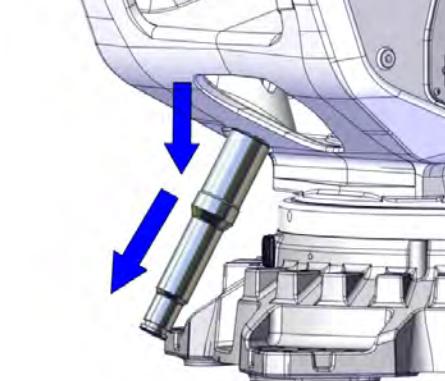
Action	Note
1 Jog axis-1 to the position where it is possible to replace the mechanical stop pin.	 xx1500002093
2 <p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	

Removing the mechanical stop pin

Action	Note
1 <p> CAUTION</p> <p>The mechanical stop pin weighs 13 kg.</p>	
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.	

Continues on next page

4.8.2 Replacing the axis-1 gearbox Continued

Action	Note
4 Unscrew the set screw with the other hand.	 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 of its hole and moving it slightly forwards.	 xx1500002089

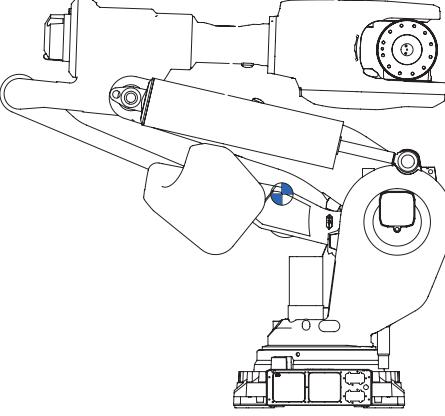
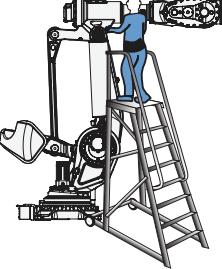
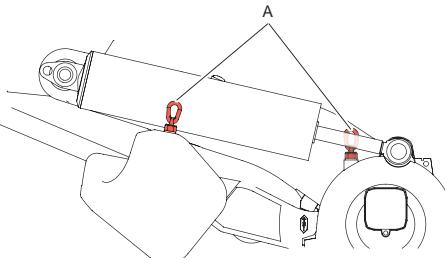
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4 Repair

4.8.2 Replacing the axis-1 gearbox

Continued

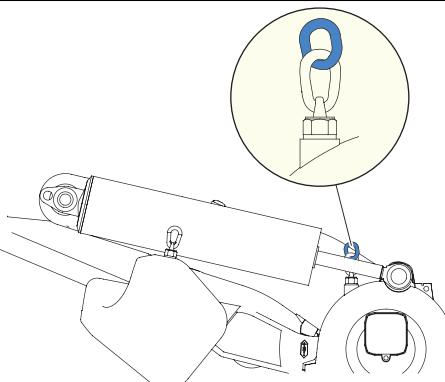
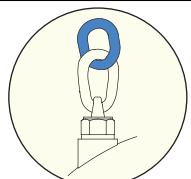
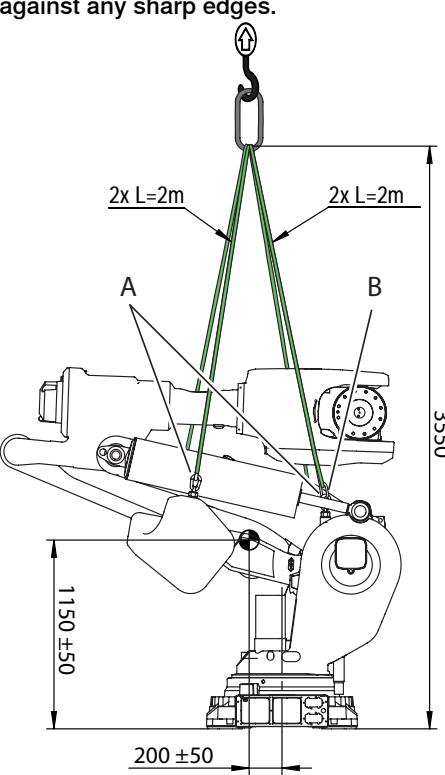
Attaching lifting accessories, complete robot

	Action	Note		
1	<p>Jog the robot into position:</p> <ul style="list-style-type: none"> • Axis 1: -90° (optional) • Axis 2: -65° • Axis 3: +2° • Axis 4: +90° • Axis 5: -90° • Axis 6: 0°. <p> WARNING</p> <p>The robot is likely to be mechanically unstable if not secured to the foundation.</p>	 xx1400002584		
2	<p> CAUTION</p> <p>The IRB 8700 robot weighs 4,750 kg. All lifting accessories used must be sized accordingly!</p>			
3	<p>Use a Mobile platform ladder (or similar) and attach the lifting accessories.</p> <p> DANGER</p> <p>Never use the robot as ladder.</p>	<p>Mobile platform ladder Roundsling 2 m: Lifting capacity: 2,000 kg (4 pcs) Shackle (2 pcs)</p>  xx1500001985		
4	<p>Fit lifting eyes to the holes on frame and counter weight respectively.</p>	 xx1400002590 <table border="1"> <tr> <td>A</td> <td>Lifting eye: M24 (4 pcs)</td> </tr> </table>	A	Lifting eye: M24 (4 pcs)
A	Lifting eye: M24 (4 pcs)			

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4.8.2 Replacing the axis-1 gearbox

Continued

Action	Note
5 Attach shackles to the lifting eyes in the frame.	  xx1500002369 <div style="border: 1px solid black; padding: 2px; display: inline-block;"> Shackle (2 pcs) </div>
6 Run roundslings through the lifting eyes and shackles, and attach them to an overhead crane.	<p>Note</p> <p>Make sure to run the roundslings as shown in the figure:</p> <ul style="list-style-type: none"> the ones fitted to the shackles on the frame, on the <i>inside</i> of the balancing devices shafts the ones fitted to the lifting eyes on the counter weight, on the <i>outside</i> of the balancing devices. <p>CAUTION</p> <p>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.</p>  <div style="border: 1px solid black; padding: 2px; display: inline-block;"> A Lifting eye: M24 (4 pcs) </div> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> B Shackle (2 pcs) </div>
7 Stretch the lifting accessories to take the weight of the robot.	

Continues on next page

4 Repair

4.8.2 Replacing the axis-1 gearbox

Continued

	Action	Note
8	 WARNING Personnel must not, under any circumstances, be present under the suspended load.	
9	Use caution and raise the overhead crane to lift the robot.	

Lifting the complete robot onto the support legs

	Action	Note
1	 CAUTION Make sure that the robot is secured in the lifting accessories.	
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 support legs.	Support legs
4	Fit the support legs to the foundation.	Tightening torque: 300 Nm
5	Use caution and lower the robot slowly down onto the support legs, making sure the holes in robot base will match the holes in the support legs.	
6	Secure the base to the support legs.	Attachment screws: Tightening torque: 300 Nm

Robot position when lifting off the complete arm system

The complete arm system consists of:

- upper arm, including wrist
- lower arm, including parallel arm
- frame
- counterweight

	Action	Note
1	Remove the roundslings from the overhead crane.	
2	 DANGER It is very important to change the position of axis-2 before lifting off the complete arm system. If not, the complete arm system will not be stable when it is resting on the foundation after it has been removed from the base.	

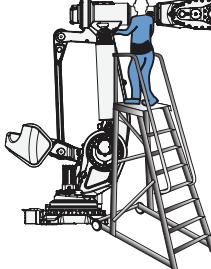
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	Action	Note
3	<p>Use caution and jog the robot slowly into the specified position:</p> <ul style="list-style-type: none"> • Axis 1: 0° • Axis 2: -51° • Axis 3: +13° • Axis 4: 0° • Axis 5: 0° • Axis 6: 0°. 	
4	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	

Attaching the lifting accessories, complete arm system

The complete arm system contains:

- upper arm, including wrist
- lower arm, including parallel arm
- frame
- counterweight

	Action	Note
1	<p> CAUTION</p> <p>The complete arm system weighs 4,300 kg. All lifting accessories used must be sized accordingly!</p>	
2	<p>Use a mobile platform ladder (or similar) and attach the lifting accessories.</p> <p> DANGER</p> <p>Never use the robot as ladder.</p>	Mobile platform ladder Roundsling 2 m: Lifting capacity: 2,000 kg (4 pcs) Lifting eye: M24 (4 pcs) Shackle: SA-10-8-NA1  xx1500001985
3	Stretch the lifting accessories to take the weight of the arm system.	
4	Adjust if needed.	

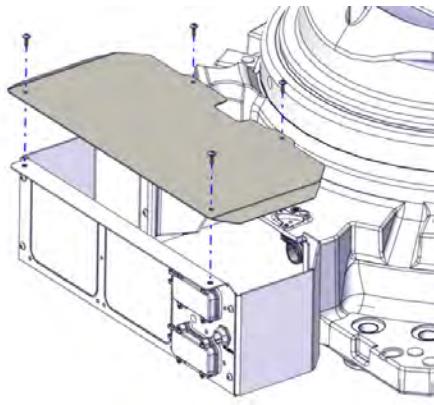
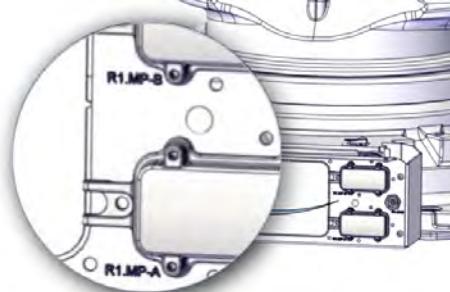
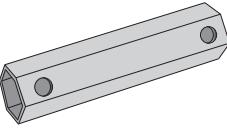
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4 Repair

4.8.2 Replacing the axis-1 gearbox

Continued

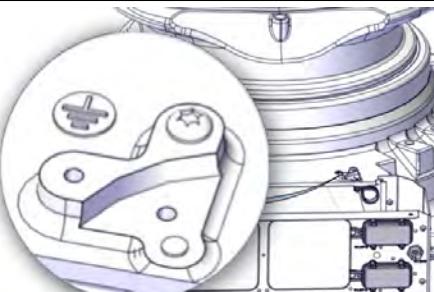
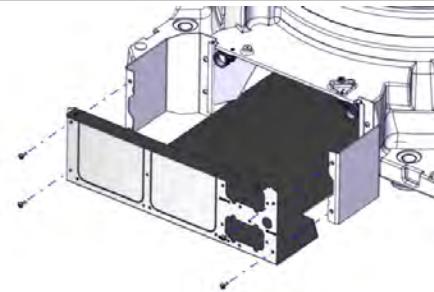
Disconnecting the cable harness in the base

	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the base cover.	 xx1500003082
3	Disconnect R1.MP-A and R1.MP-B.	 xx1500003083
4	Disconnect R1.SMB.  Tip Use a Sparkplug wrench (or similar).  xx1200000888	Sparkplug wrench  xx1500003084

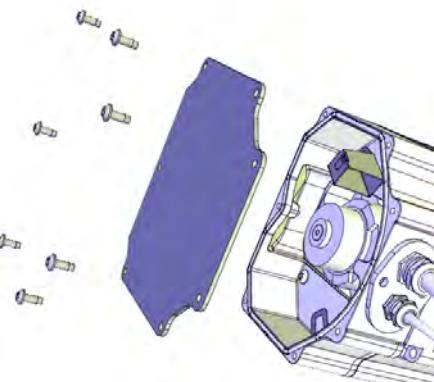
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4.8.2 Replacing the axis-1 gearbox

Continued

	Action	Note
5	Remove the two earth cables.	 xx1500003085
6	For easier access: Remove connection plate and bottom plate.	 xx1500003088
7	Use caution and pull out the cable harness from the base.	

Disconnecting the axis-1 motor cables

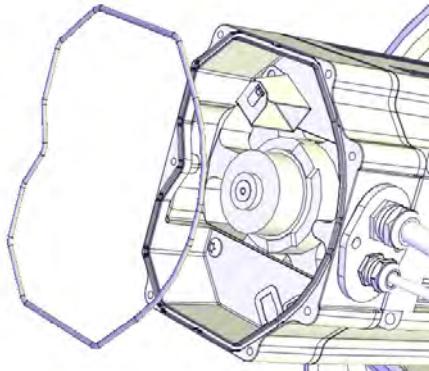
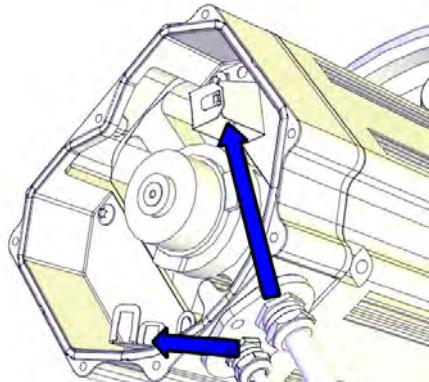
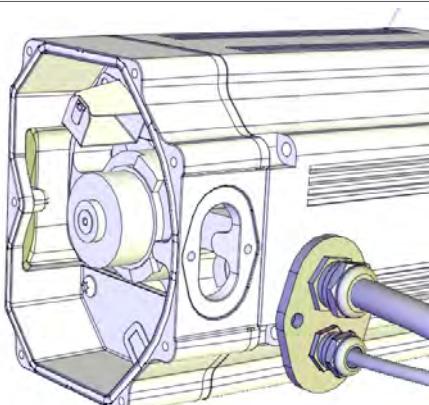
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws with washers and remove the motor cover.	 xx1200001135

Continues on next page

4 Repair

4.8.2 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.	

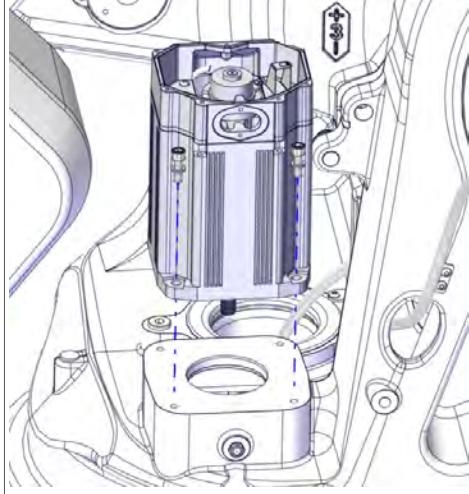
Removing the axis-1 motor

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

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4.8.2 Replacing the axis-1 gearbox

Continued

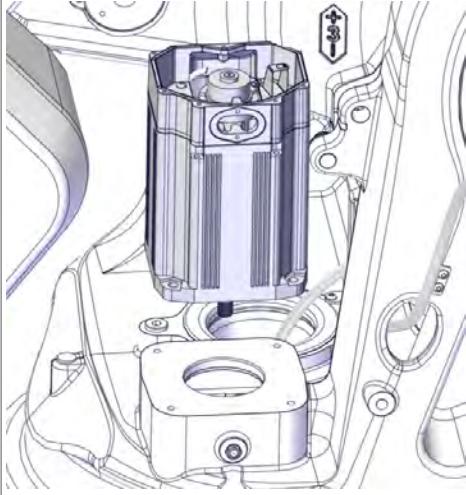
	Action	Note
2	Attach the lifting accessories.	Lifting accessory (chain): 3HAC15556-1 Lifting accessory, motor: 3HAC14459-1.
3	To release the brakes, connect the 24 VDC power supply. Connect to R2.MP1-connector: <ul style="list-style-type: none">• + = pin 2• - = pin 5	24 VDC power supply
4	 CAUTION The weight of the motor is 27 kg All lifting accessories used must be sized accordingly.	
5	Unscrew the attachment screws and washers. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx1500002083
6	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
7	 CAUTION Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.	
8	If needed, use removal tools to help remove the motor.	Removal tool M12: 3HAC14631-1

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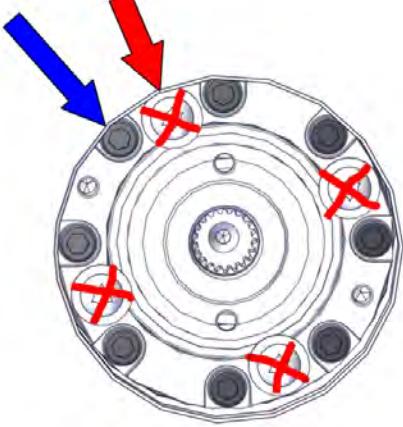
4 Repair

4.8.2 Replacing the axis-1 gearbox

Continued

Action	Note
9 Use caution and lift the motor straight up to get the pinion parted from the gear.	 xx1500002084
10 Disconnect the 24 VDC power supply.	

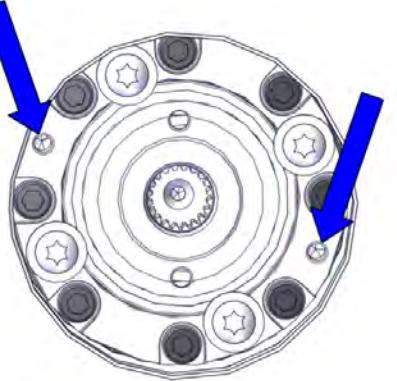
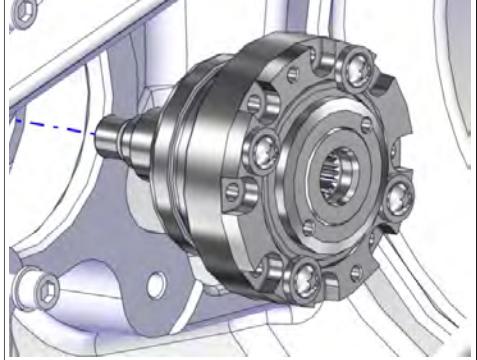
Removing the hub

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.	

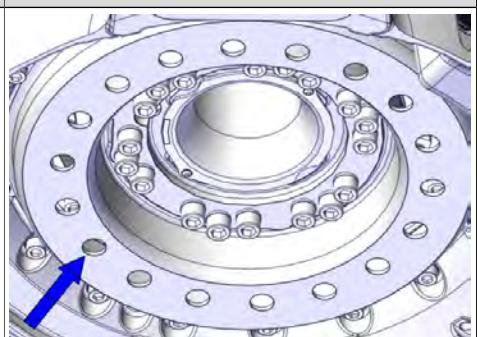
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4.8.2 Replacing the axis-1 gearbox

Continued

Action	Note
4 Fit two screws in opposite holes of the hub and use them as removal tools.	Attachment screws: M6x110 (2 pcs)  xx1500002081
5 Lift out the hub carefully.	 xx1500002326

Separating base, including gearbox, from the arm system

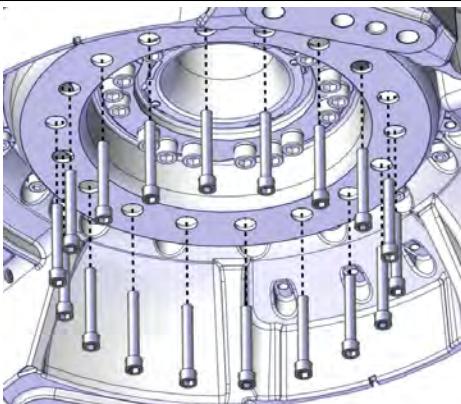
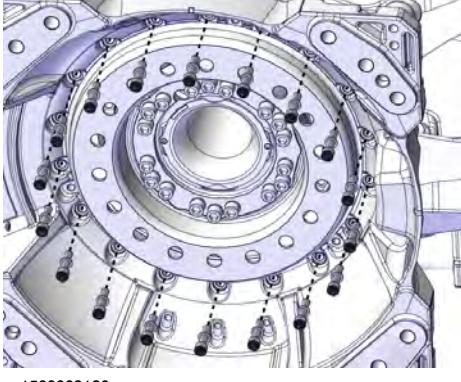
Action	Note
1 Remove the plastic plugs covering the M16x110 screws.	 xx1500003118

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4 Repair

4.8.2 Replacing the axis-1 gearbox

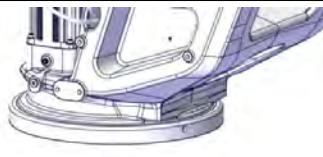
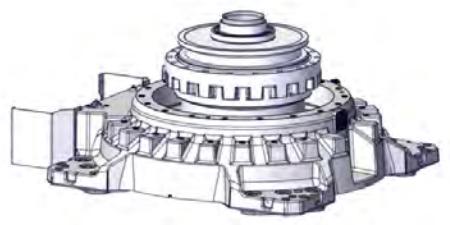
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Action	Note
2 Unscrew the M16x110 screws (18 pcs) that secure the gearbox to the frame.	 Tip This procedure is best done with two persons working together: <ul style="list-style-type: none"> • Person one: working under the base, holding the torque 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: <ul style="list-style-type: none"> • 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.	
5 It is now possible to lift the complete arm system off.	The cross roller bearing is still fitted to the frame and the axis-1 gearbox is still fitted to the base.

Lifting the complete arm system off

Action	Note
1 Fit two guide pins in opposite holes of the cross roller bearing.	Guide pin, M16x300 (2 pcs) Always use guide pins in pairs.
2  CAUTION The complete arm system weighs 4,300 kg. All lifting accessories used must be sized accordingly.	

Continues on next page

	Action	Note
3	<p>Use caution and lift the complete arm system up.</p> <p>Note</p> <p>Lifting height needed for the complete arm system to go free from the axis-1 gearbox: 375 cm.</p>	  <p>xx1500003121</p>
4	Remove the guide pins before the arm system is put down.	
5	<p>Put the arm system on a level foundation.</p> <p>DANGER</p> <p>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. If not, adjust the position of the robots axes.</p>	
6	<p>Remove the lifting accessories.</p> <p>WARNING</p> <p>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.</p>	

Removing the axis-1 gearbox

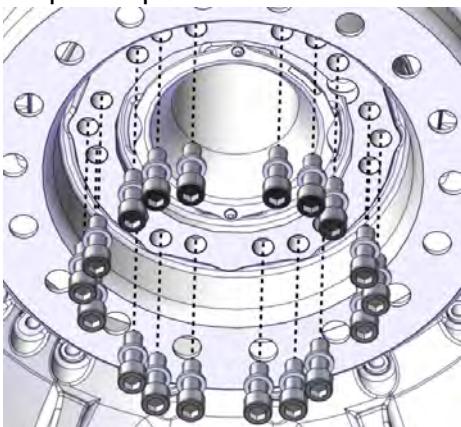
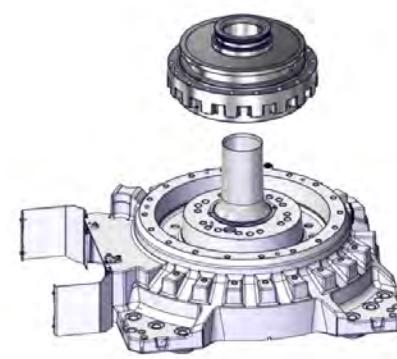
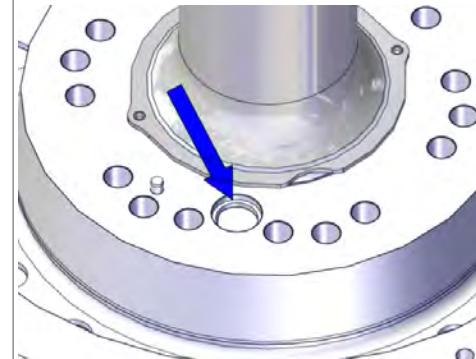
	Action	Note
1	<p>Fit lifting eyes in opposite holes.</p> <p>Note</p> <p>Do not tighten the lifting eyes completely against the gearbox. Leave a 5 mm gap, or the sealing surface on the gearbox will be damaged.</p>	Lifting eye: M16 3HAC14457-4 (2 pcs)
2	<p>CAUTION</p> <p>The gearbox weighs 150 kg. All lifting accessories used must be sized accordingly.</p>	

Continues on next page

4 Repair

4.8.2 Replacing the axis-1 gearbox

Continued

Action	Note
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 lose the small o-ring between base and gearbox.	 xx1500003124

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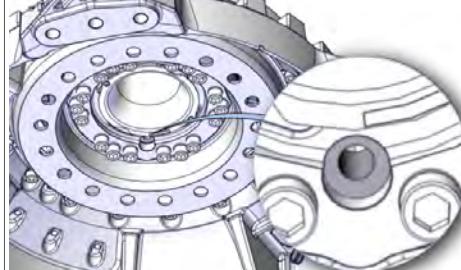
Refitting the gearbox

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	 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	 DANGER Let only one hand stay underneath the hanging gearbox while cleaning.	
6	 DANGER Let only one hand stay underneath the hanging gearbox while cleaning.	

Fitting the axis-1 gearbox

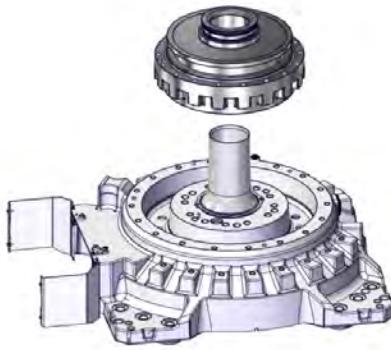
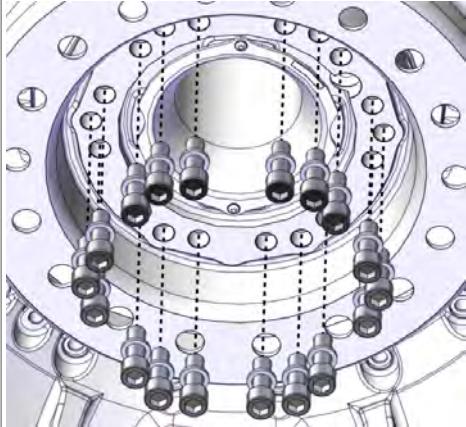
	Action	Note
1	Clean the groove for the small o-ring.	 xx1600000042

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4 Repair

4.8.2 Replacing the axis-1 gearbox

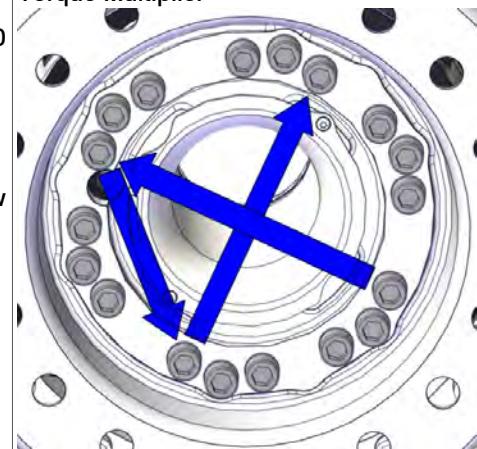
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Action	Note
2 Inspect the o-ring.	
 Note Replace if damaged.	
3 Put some grease on the o-ring and fit it in the oil hose groove.	
4 Attach two guide pins in opposite holes of the gearbox. One of the guide pins shall be fitted in the hole closest to 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: <ul style="list-style-type: none"> 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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4.8.2 Replacing the axis-1 gearbox

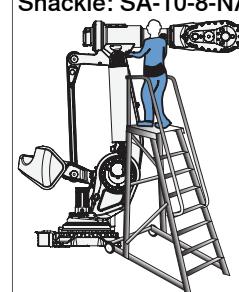
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Action	Note
<p>9 Secure the gearbox to the base in two steps:</p> <ul style="list-style-type: none"> Secure the 18 attachment screws crosswise to 100 Nm. Secure the screws crosswise to 450 Nm. <p>Tip</p> <p>Use a torque converter between the screw and the torque wrench, to facilitate the tightening of the screws.</p>	Tightening torque, step 1: 100 Nm Tightening torque, step 2: 450 Nm Torque Multiplier  xx1500003127

Attaching lifting accessories, complete arm system

The complete arm system contains:

- upper arm, including wrist
- lower arm, including parallel arm
- frame
- counterweight

Action	Note
<p>1 CAUTION</p> <p>The complete armsystem weighs 4,300 kg. All lifting accessories used must be sized accordingly!</p>	
<p>2 DANGER</p> <p>Never use the robot as ladder.</p>	Mobile platform ladder Roundsling 2 m: Lifting capacity: 2,000 kg (4 pcs) Lifting eye: M24 (4 pcs) Shackle: SA-10-8-NA1  xx1500001985
3 Stretch the lifting accessories to take the weight of the complete arm system.	

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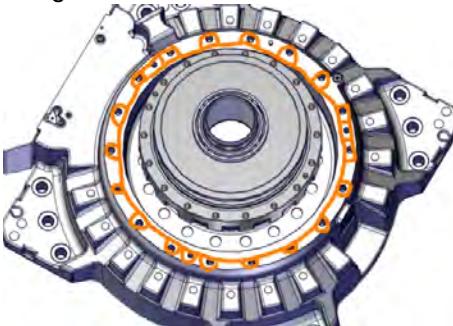
4 Repair

4.8.2 Replacing the axis-1 gearbox

Continued

	Action	Note
4	Adjust if needed.	

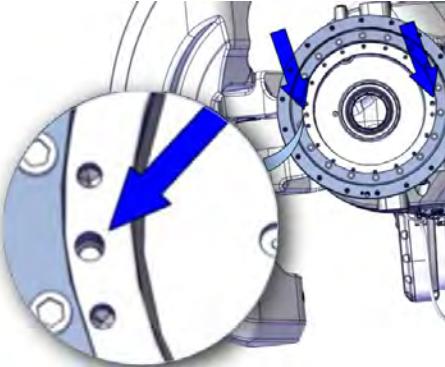
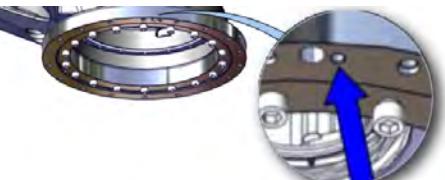
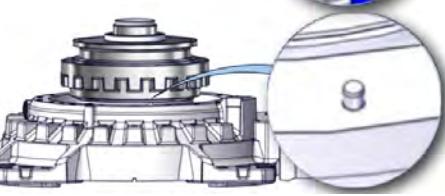
Lifting complete arm system onto base and axis-1 gearbox

	Action	Note
1	 CAUTION The complete armsystem weighs 4,300 kg. All lifting accessories used must be sized accordingly.	
2	Use caution and lift the complete arm system up.	
3	Clean contact surfaces between base including gearbox, cross roller bearing and frame.  DANGER Let only one hand stay underneath the hanging gearbox while cleaning.	
4	Apply flange sealant (Loctite 574) on the sealing surface for the cross roller bearing on the base.	Flange sealant: Loctite 574  xx1600000045
5	Attach guide pins in opposite holes of the cross roller bearing. One of the guide pins shall be attached in the hole closest to the small dowel pin.	Guide pins: M16x200
6	Attach two guide pins in opposite threaded holes of the gearbox.	Guide pins: M16x300

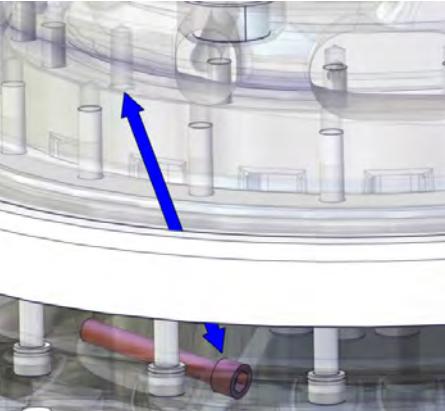
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4.8.2 Replacing the axis-1 gearbox

Continued

	Action	Note
7	Orient the small dowel pins in gearbox and frame, and at the same time, match cross roller bearing dowel pin to the hole in the base, while lowering the complete arm system carefully onto the long guide pins.  Note It is possible to rotate the cross roller bearing and the gearbox by hand, to match the small dowel pins.	 xx1600000043   xx1600000044
8	Slowly lower the complete arm system, while checking the position of the small dowel pins and the guide pins.	

Securing the complete arm system to base and axis-1 gearbox

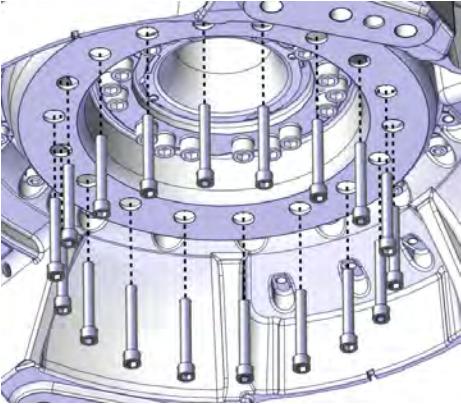
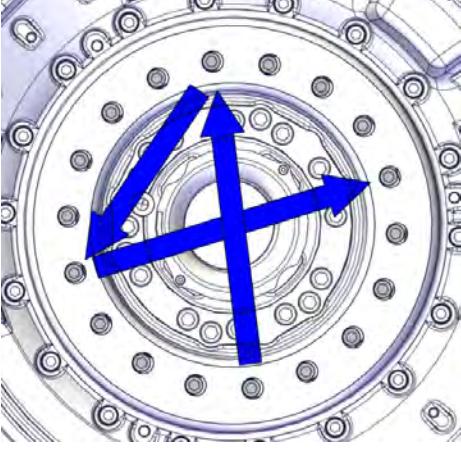
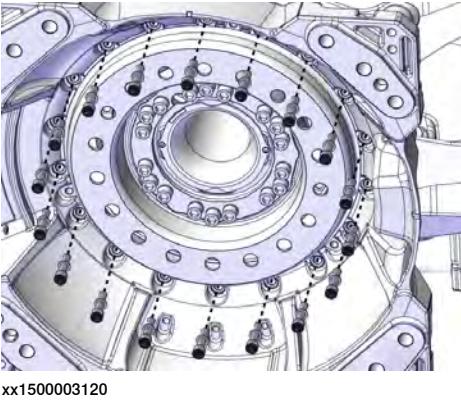
	Action	Note
1	 Note Use caution when attaching the screws that secure the gearbox. If a screw is dropped, it will probably end up in the recess underneath the gearbox and be very difficult to reach. Using a magnet will probably be the only way to get hold of the lost screw.	 xx1500002980

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4 Repair

4.8.2 Replacing the axis-1 gearbox

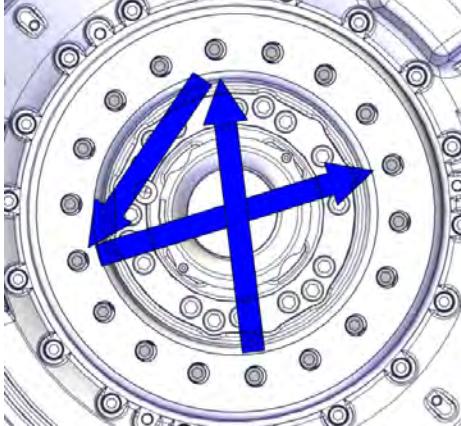
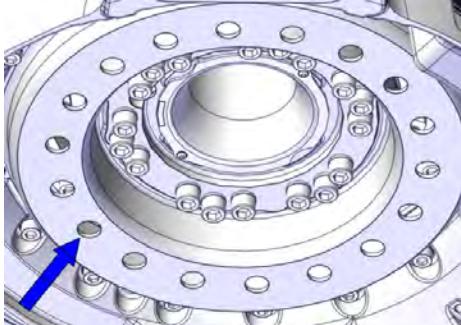
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Action	Note
<p>2 With the complete arm system resting on base and axis-1 gearbox, fit the attachment screws that hold the gearbox to the frame.</p> <p> Tip</p> <p>This procedure is best done with two persons working together:</p> <ul style="list-style-type: none"> • 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
3 Remove the guide pins and attach the remaining screws.	
<p>4 Secure the gearbox to the frame in two steps;</p> <ul style="list-style-type: none"> • Secure the 18 attachment screws crosswise to 100 Nm. • Secure the screws crosswise to 300 Nm. <p> Tip</p> <p>Use a torque converter between the screw and the torque wrench, to facilitate the tightening of the screws.</p>	Tightening torque, step 1: 100 Nm Tightening torque, step 2: 300 Nm  xx1600000040
<p>5 Attach the screws that hold the cross roller bearing to the frame.</p> <p> Tip</p> <p>This procedure is best done with two persons working together:</p> <ul style="list-style-type: none"> • 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

Continues on next page

4.8.2 Replacing the axis-1 gearbox

Continued

Action	Note
<p>6 Secure the cross roller bearing to the frame in two steps;</p> <ul style="list-style-type: none"> • Secure the 18 attachment screws crosswise to 100 Nm. • Secure the screws crosswise to 300 Nm. <p> Tip</p> <p>Use a torque converter between the screw and the torque wrench, to facilitate the tightening of the screws.</p>	Tightening torque, step 1: 100 Nm Tightening torque, step 2: 300 Nm  xx1600000040
7 Refit the plastic plugs.	 xx1500003118

Preparations before refitting the hub

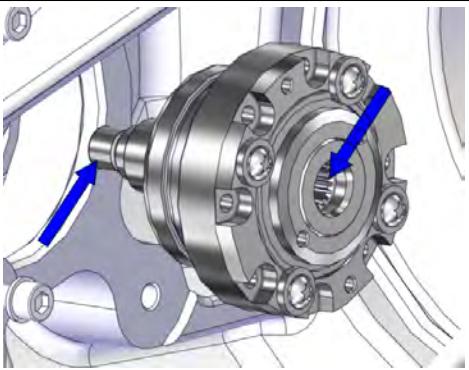
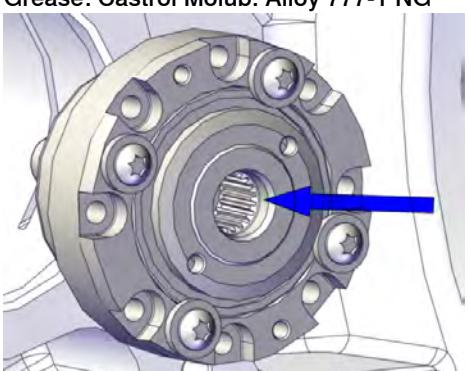
Action	Note
1 Wipe the hub clean.	
2 Inspect the hole where the hub shall be refitted. Wipe clean if needed.	
3 Make sure the o-ring on the hub is undamaged.  Note Replace if damaged.	 xx1500002039
4 Apply some grease on the o-ring for a better fitting.	

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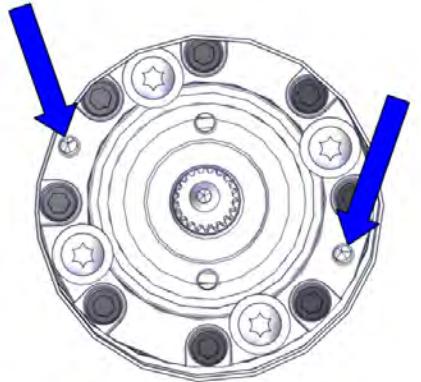
4 Repair

4.8.2 Replacing the axis-1 gearbox

Continued

Action	Note
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 3 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346

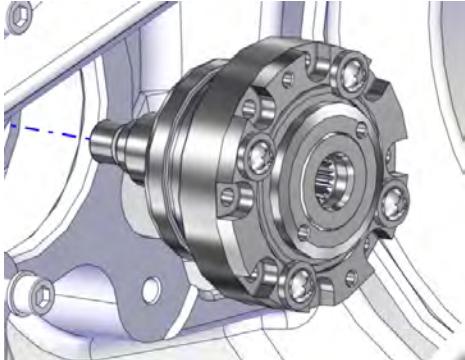
Refitting the hub

Action	Note
1 Attach two screws in opposite holes of the hub and use them as tools to fit the hub.	Attachment screws: M6x110 (2 pcs)  xx1500002081
2  CAUTION Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	

Continues on next page

4.8.2 Replacing the axis-1 gearbox

Continued

Action	Note
3 Refit the hub.	 xx1500002326
4 Remove the two M6x110 and fit the attachment screws for the hub. Apply locking liquid (Loctite 243) on the screws.  Note The number of attachment screws differ depending on gearbox.	Attachment screws: M6x30 12.9. Loctite 243 Quantity: <ul style="list-style-type: none"> • 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 190 .

Preparations before refitting the axis-1 motor

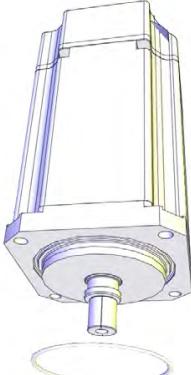
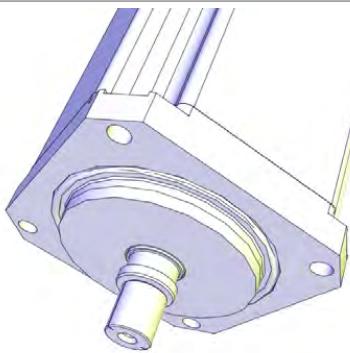
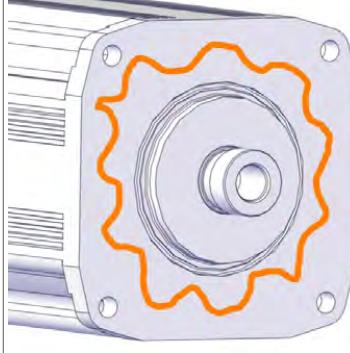
Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Remove old paint residues and other contamination from the contact surfaces on both motor and gearbox.	
3 Wipe clean the contact surfaces from any remaining contamination. Also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

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4 Repair

4.8.2 Replacing the axis-1 gearbox

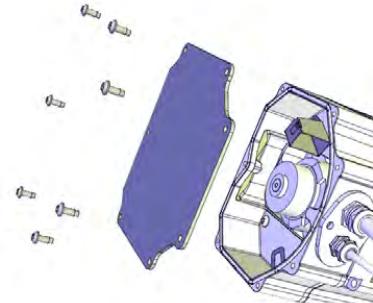
Continued

	Action	Note
4	<p>Inspect the o-ring.</p> <p> Note</p> <p>Replace if damaged.</p>	<p>O-ring, 3HAB3772-107</p>  <p>xx1200001019</p>
5	<p>Make sure the o-ring is seated in the groove.</p> <p> Tip</p> <p>Lubricate the o-ring with some grease for a better fitting in the groove.</p>	 <p>xx1200001020</p>
6	Apply flange sealant on the motor flange.	<p>Flange sealant: Loctite 574</p>  <p>xx1500002357</p>

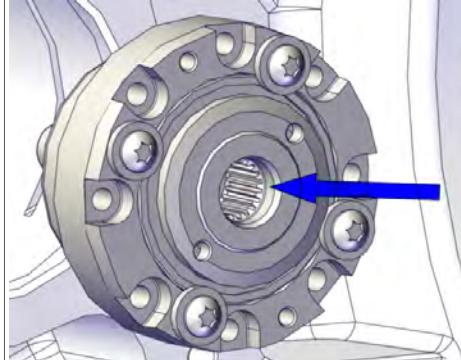
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4.8.2 Replacing the axis-1 gearbox

Continued

Action	Note
7 If the motor is a new spare part, remove the cover.	 xx1200001135

Securing the axis-1 motor

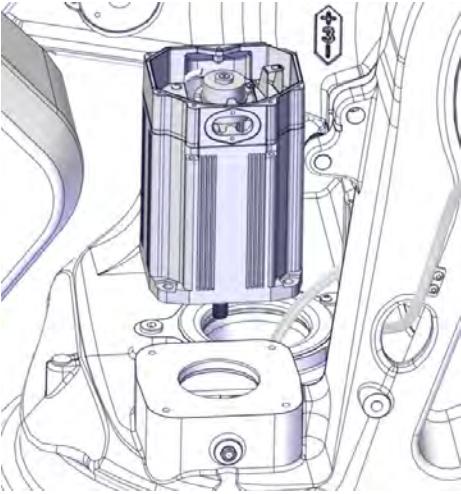
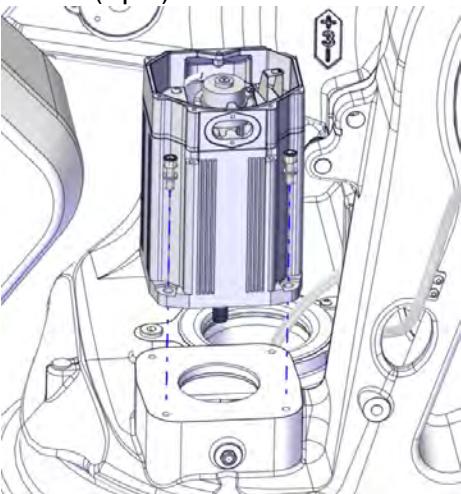
Action	Note
1 Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
2  CAUTION The motor weighs 27 kg. All lifting accessories used must be sized accordingly.	
3 Apply the lifting accessory.	Lifting accessory, motor: 3HAC14459-1.
4 Fit the rotation tool.	Rotation 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
6 In order to release the brakes, connect the 24 VDC power supply. To release the brakes, connect the 24 VDC power supply as described in the list. Connect to R2.MP1-connector: <ul style="list-style-type: none"> • + = pin 2 • - = pin 5 	

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4 Repair

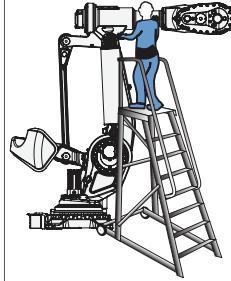
4.8.2 Replacing the axis-1 gearbox

Continued

Action	Note
7	<p>CAUTION</p> <p>Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.</p>
8	<p>Lower the motor into position.</p> <ul style="list-style-type: none"> • 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.
	 xx1500002084
9	<p>Secure the motor with its attachment screws and washers.</p> <p>Use a bits extender to reach the screws.</p>
	<p>Bits extender: 3HAC12342-1 Tightening torque: 50 Nm. Screw dimension : M10x40 quality 12.9 Gleitmo (4 pcs)</p>  xx1500002083
10	Perform a leak-down test (if not already done).
11	Disconnect the 24 VDC power supply.

Continues on next page

Attaching lifting accessories, complete robot

	Action	Note
1	 CAUTION The IRB 8700 robot weighs 4,750 kg. All lifting accessories used must be sized accordingly!	
2	 DANGER Use a mobile platform ladder (or similar) and attach the lifting accessories. Never use the robot as ladder.	Mobile platform ladder Roundsling 2 m: Lifting capacity: 2,000 kg (4 pcs) Shackle: SA-10-8-NA1  xx1500001985
3	Stretch the lifting accessories to take the weight of the robot.	
4	Adjust if needed.	
5	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Removing the support legs

	Action	Note
1	Unscrew the attachment screws that secure the support legs to the robot base.	
2	Use caution and lift the robot up from the support legs.	
3	Use caution and unscrew the attachment screws that secure the support legs to the foundation.	
4	Remove the support legs.	
5	Use caution and lower the robot onto the foundation.	

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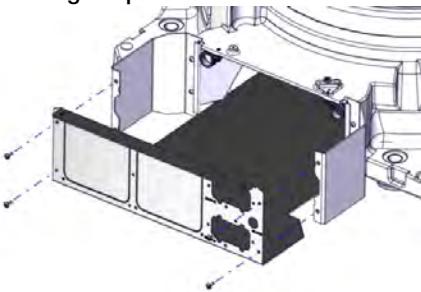
4 Repair

4.8.2 Replacing the axis-1 gearbox

Continued

Action	Note
6 Secure the robot to the foundation.	Tightening torque: 550 Nm (screws lubricated with Molykote 1000) 600-725 Nm, typical 650 Nm (screws none or lightly lubricated)

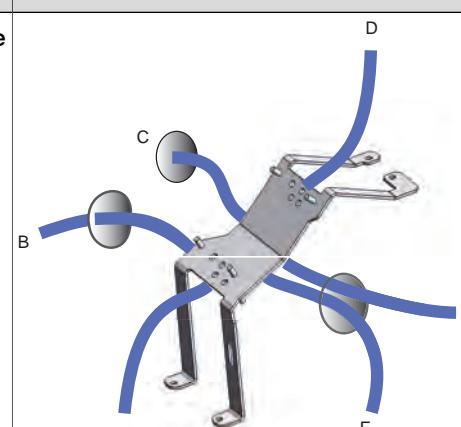
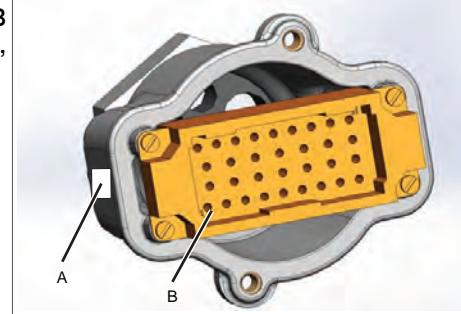
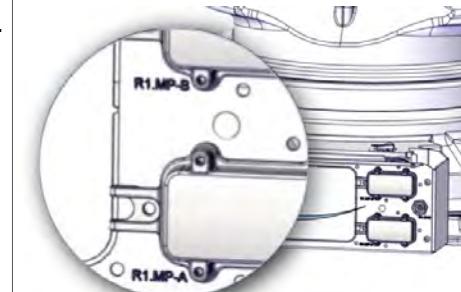
Refitting the cable harness in the base

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.	

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4.8.2 Replacing the axis-1 gearbox

Continued

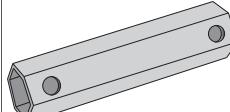
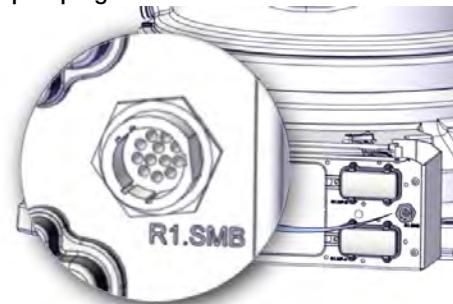
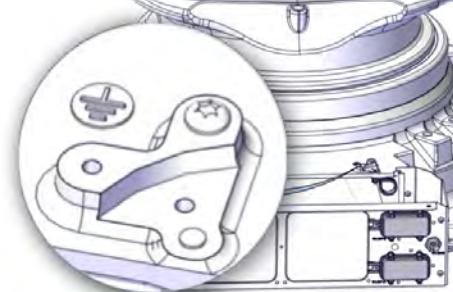
Action	Note												
<p>4 Make sure that the cables running from the axis-1 bracket, runs untangled down through the hole in the frame to the base plate, to axis-1, axis-2 and axis-3 motors as well as to the SMB/BU recess. Adjust the cables if needed. The different cables must not be twisted or tangled.</p>	 <p>xx1500003081</p> <table border="1"> <tr> <td>A</td><td>Cables down through hole in frame, to base plate</td></tr> <tr> <td>B</td><td>Axis-2 motor cables</td></tr> <tr> <td>C</td><td>SMB/BU cables</td></tr> <tr> <td>D</td><td>Cables up through lower arm and onwards</td></tr> <tr> <td>E</td><td>Axis-3 motor cables</td></tr> <tr> <td>F</td><td>Axis-1 motor cables</td></tr> </table>	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
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												
<p>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.</p>	 <p>xx1600000078</p> <table border="1"> <tr> <td>A</td><td>Bar code</td></tr> <tr> <td>B</td><td>Hole for pin 1</td></tr> </table>	A	Bar code	B	Hole for pin 1								
A	Bar code												
B	Hole for pin 1												
<p>6 Refit the R1.MP-A and R1.MP-B contacts.</p> <p>Note</p> <p>Run the cables on top of each other, through the base, without being twisted.</p>	 <p>xx1500003083</p> <p>Screws M6x20 stainless steel (4 pcs)</p>												

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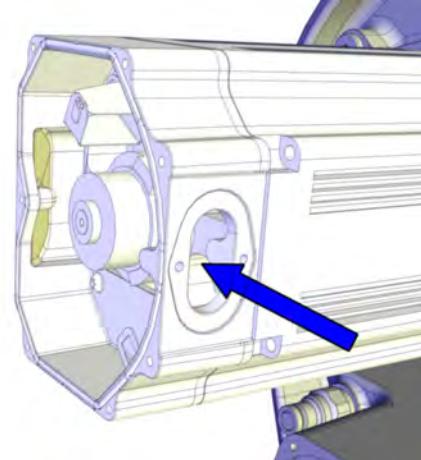
4 Repair

4.8.2 Replacing the axis-1 gearbox

Continued

Action	Note
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 Sparkplug wrench (or similar).  xx1200000888	Sparkplug wrench  xx1500003084
9 Refit the two earth cables.	Attachment screw: M6x16 stainless steel A2-70  xx1500003085

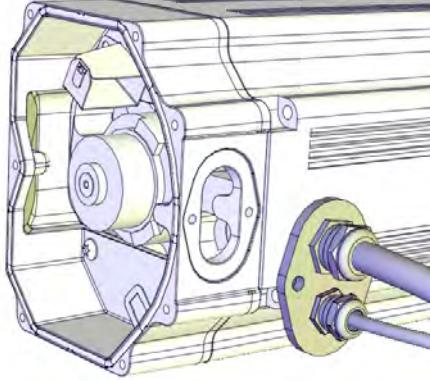
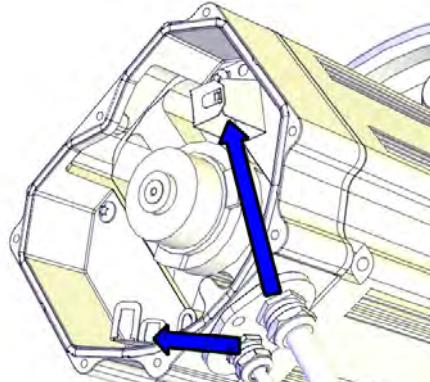
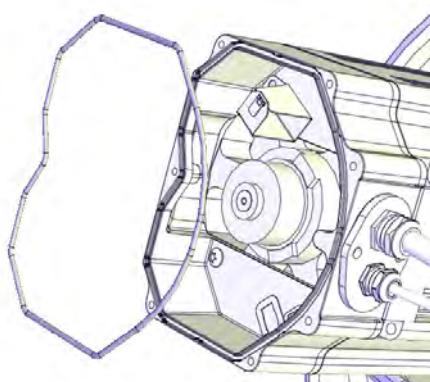
Connecting the motor cables

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

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4.8.2 Replacing the axis-1 gearbox

Continued

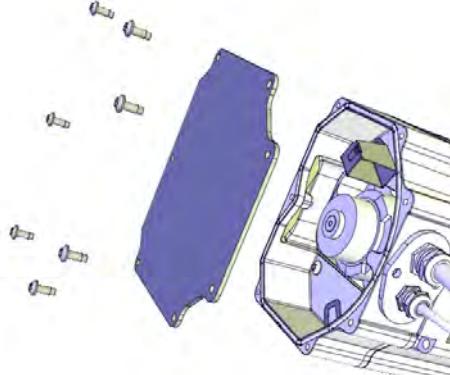
	Action	Note
2	<p>Refit the cable gland cover.</p> <p>Note</p> <p>Replace the gasket if damaged.</p>	 xx1200001067
3	<p>Connect the motor cables.</p> <p>Connect in accordance with the markings on the connectors.</p>	 xx1200001066
4	<p>Inspect the o-ring.</p> <p>Note</p> <p>Replace if damaged.</p>	<p>O-ring: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

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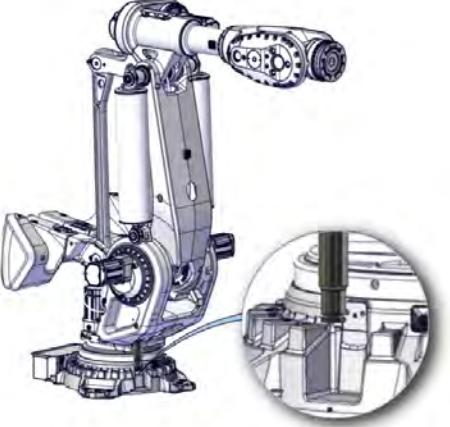
4 Repair

4.8.2 Replacing the axis-1 gearbox

Continued

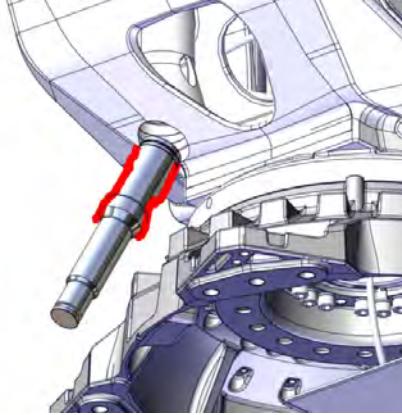
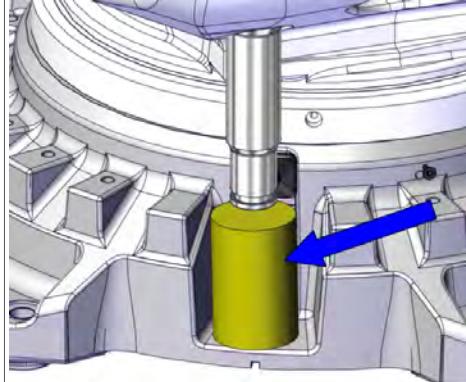
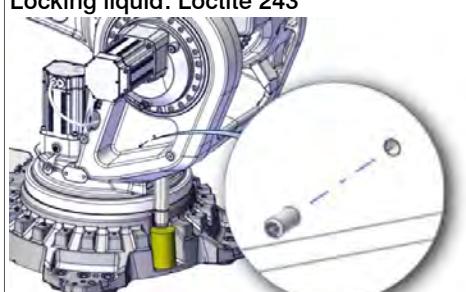
Action	Note
<p>8 Refit the motor cover with its attachment screws.</p> <p> Note Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged.</p> <p> Note Make sure the o-ring is undamaged and properly fitted.</p>	 xx1200001135
9 Make sure that the covers are tightly sealed.	

Refitting the mechanical stop pin

Action	Note
<p>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.</p>	 xx1500002093
2 Clean the stop pin, as well as the hole for it.	

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4.8.2 Replacing the axis-1 gearbox Continued

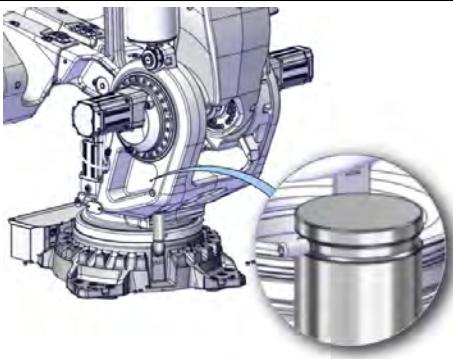
Action	Note
3 Apply corrosion protection on the marked area on the stop pin and on the matching area in the hole.	Corrosion protection: Mercasol  xx1500002094
4 CAUTION The mechanical stop pin weighs 13 kg.	
5 Put a piece of wood (or similar) underneath the stop pin, to prevent it from falling down uncontrolled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

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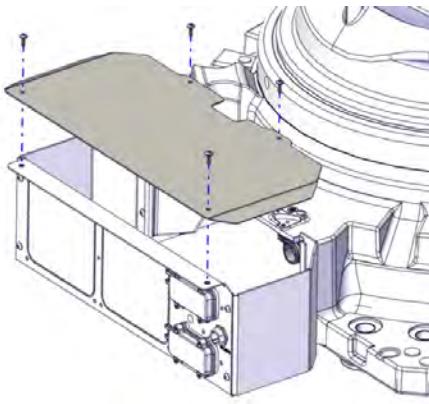
4 Repair

4.8.2 Replacing the axis-1 gearbox

Continued

Action	Note
<p>7 Make sure that the set screw will find the groove in the stop pin, before securing the mechanical stop pin.</p> <p> Tip</p> <p>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.</p>	 xx1500002092
8 Secure the mechanical stop pin with the set screw.	Tightening torque: 35 Nm

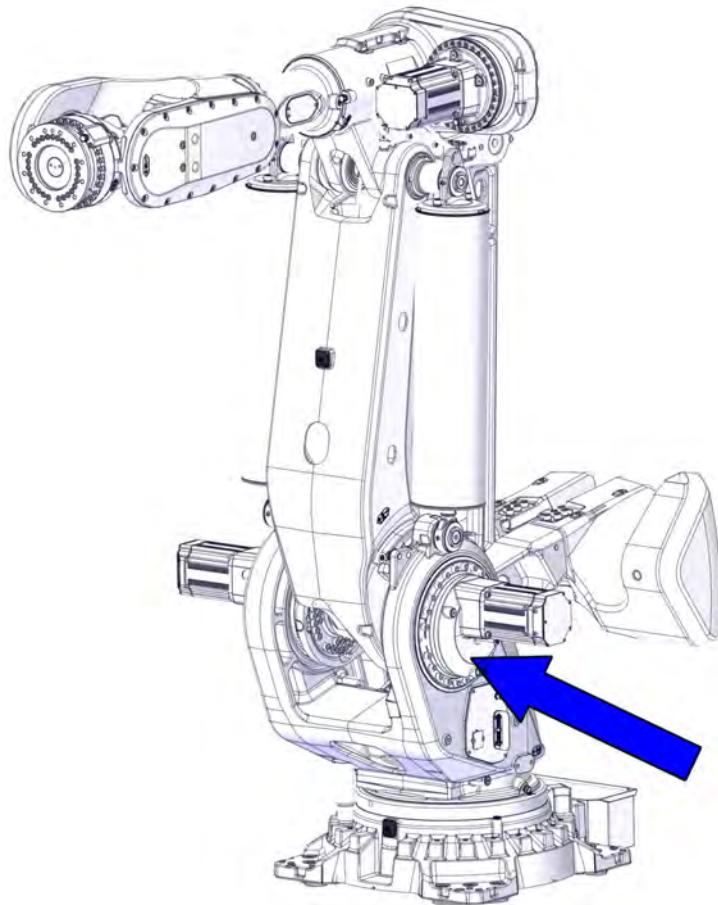
Concluding procedure

Action	Note
1 Refill oil in the gearbox.	See Changing oil, axis-1 gearbox on page 146 .
2 Fasten the base cover.	 xx1500003082
3 Re-calibrate the robot.	Axis Calibration is described in Calibrating with Axis Calibration method on page 799 . General calibration information is included in section Calibration on page 789 .
4  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

4.8.3 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Reduction gear RV 900N incl input gear	3HAC048392-003	

Continues on next page

4 Repair

4.8.3 Replacing the axis-2 gearbox

Continued

Required tools and equipment

Equipment, etc.	Article number	Note
24 VDC power supply	-	Used to release the motor brakes.
Lock screw, M20x150	-	Used to secure lower arm and parallel arm.
Screw M6x110	-	Fully threaded
Screw M16x80	-	Fully threaded
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.
Lifting accessory, gearbox	3HAC054404-001	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.
MobilePlatformLadder	-	
Roundsling 2 m	-	Lifting capacity: 2,000 kg
Roundsling 2.5 m	-	Lifting capacity: 2,000 kg
Lifting eye	3HAC14457-4	M16
Lifting eye	3HAC038295-003	M24
Rotation tool	3HAC7887-1	Used to rotate the motor pinion.
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumables

Consumable	Article number	Note
Grease		Castrol Molub. Alloy 777-1 NG: To be used on hub splines to prevent from fretting corrosion.
Molykote 1000		
Grease		Shell Alvania WR2 (or similar)
Mercasol		
Locking liquid	3HAB7116-1	Loctite 243
Flange sealant	12340011-116	Loctite 574

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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	<p>Decide which calibration routine to use for calibrating the robot.</p> <ul style="list-style-type: none"> • 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. 	
	<p>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.</p>	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 800 .
	<p>If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.</p>	

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.



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.	

Continues on next page

4 Repair

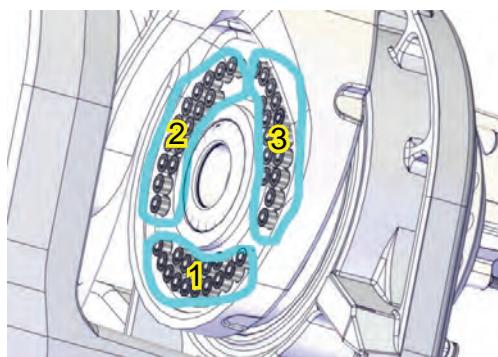
4.8.3 Replacing the axis-2 gearbox

Continued

Action	Note
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 153 .

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.

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: <ul style="list-style-type: none">• 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: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

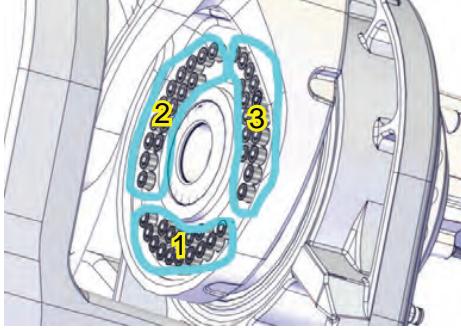
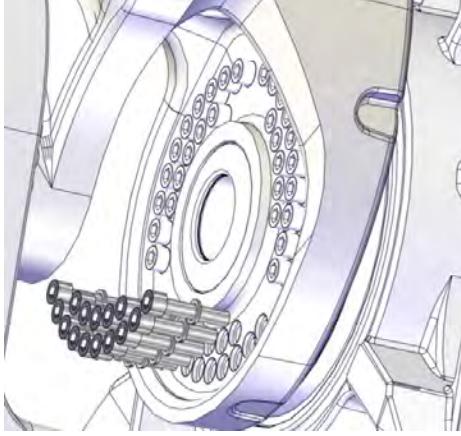
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Removing the axis-2 gearbox from the lower arm, step 1 - screws in area 1



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.	
2	Find area 1. Note Do not remove screws in area 2 or area 3 at this point.	 <small>xx1500002975</small>
3	Remove the screws in area 1.	 <small>xx1500003110</small>

Preparations before jogging the robot into calibration position

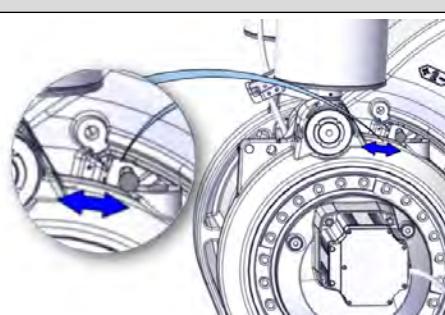
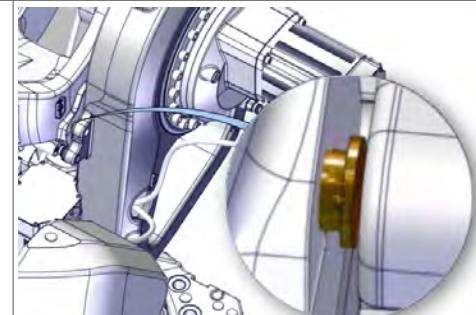
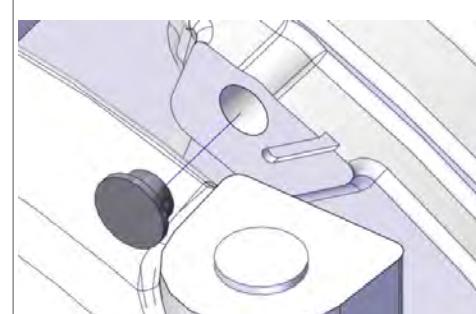
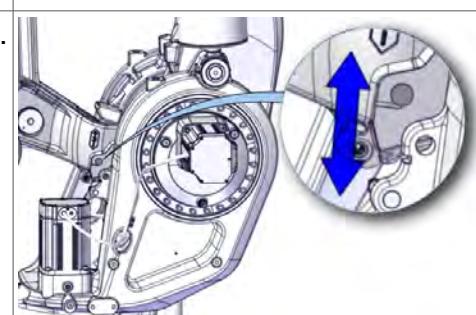
	Action	Note
1	Turn the power to the robot on.	

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4 Repair

4.8.3 Replacing the axis-2 gearbox

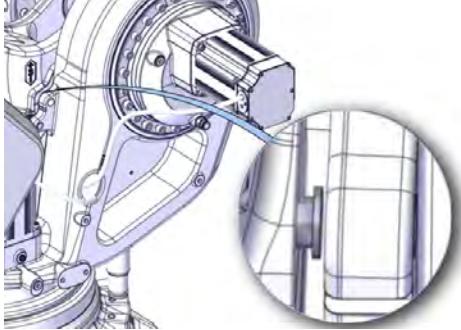
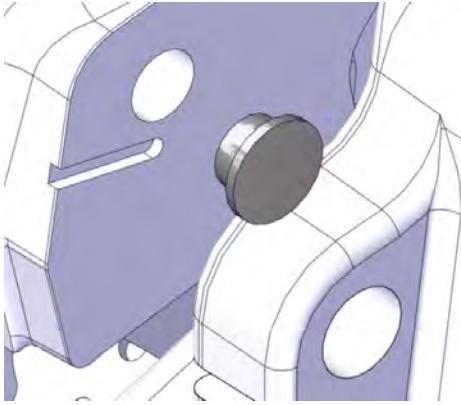
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Action	Note
2 Jog axis-2 to within the area shown in the figure.	 xx1500002334
3 Remove the plastic plugs covering axis-2 lock screw hole.  Note Keep the plastic plugs. It shall be refitted after the work is done.	 xx1500002320  xx1500002335
4 Jog axis-3 to the area shown in the figure.	 xx1500002367

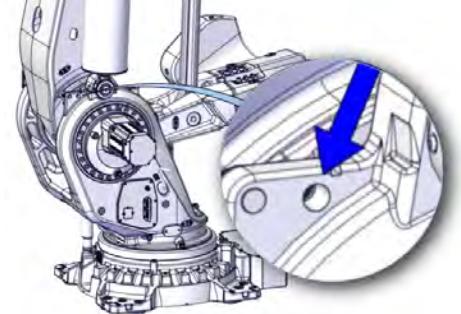
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4.8.3 Replacing the axis-2 gearbox

Continued

Action	Note
<p>5 Remove the axis-3 plastic plug.</p> <p>Note</p> <p>Keep the plastic plugs. It shall be refitted after the work is done.</p>	 <p>xx1500002365</p>  <p>xx1500002366</p>

Attaching lock screws to axis-2 and axis-3

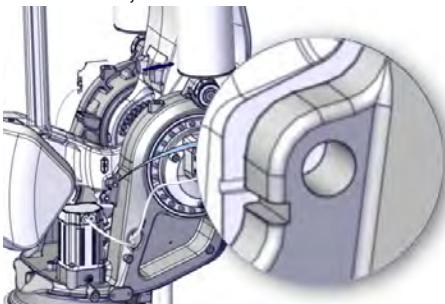
Action	Note
1 Jog the robot to calibration position.	 <p>xx1500002310</p>
2 Secure the axis-2 with a lock screw.	<p>Lock screw, M20x150</p>  <p>xx1500002322</p>

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4 Repair

4.8.3 Replacing the axis-2 gearbox

Continued

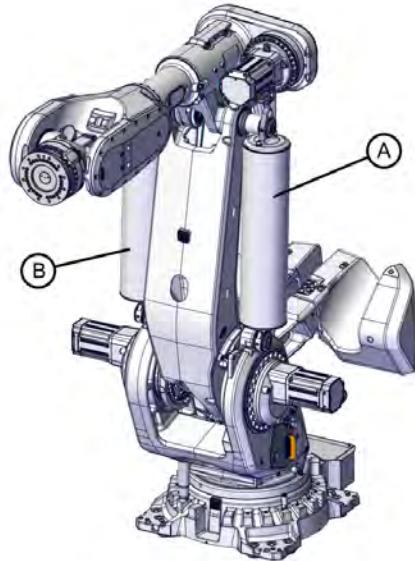
Action	Note
3 Release the brakes on axis-2 using the brake release button, and let the axis rest on the lock screw.	24 VDC power supply
4 Secure axis-3 with a lock screw.	Lock screw, M20x150 
5 Release the brakes on axis-3 using the brake release button, and let the axis rest on the lock screw.	24 VDC power supply
6 With the robot in this position it will be possible to reach the remaining attachment screws that secure the axis-2 gearbox to the parallel arm.	
7  DANGER Turn off all: <ul style="list-style-type: none">• 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 balancing device

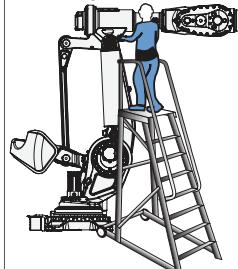
**CAUTION**

Make sure to relief the pressure of the correct balancing device. Relief pressure on axis 2 side when changing axis-2 gearbox, and relief pressure on axis 3 side when changing axis-3 gearbox.



xx1600001406

A	Axis-2 balancing device
B	Axis-3 balancing device

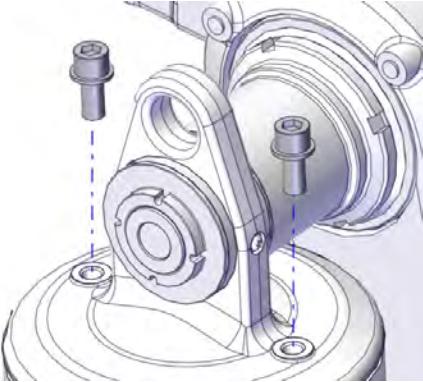
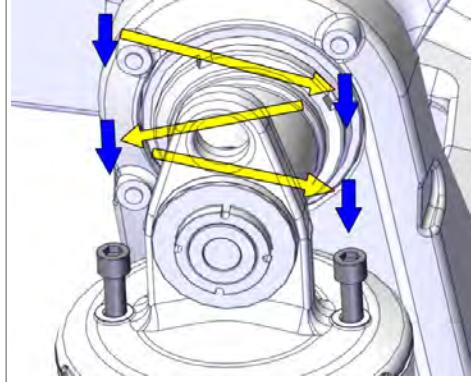
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	<i>Only needed when the upper arm is fitted on the robot:</i> Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device.  DANGER Do not use the robot as ladder!	Mobile platform ladder  xx1500001985

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4 Repair

4.8.3 Replacing the axis-2 gearbox

Continued

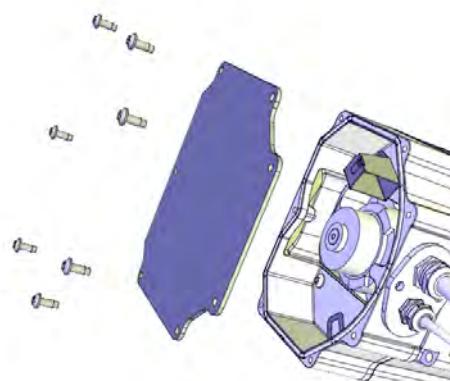
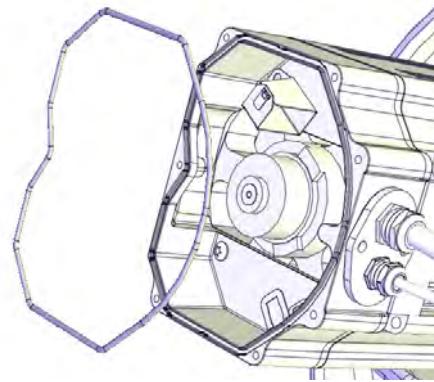
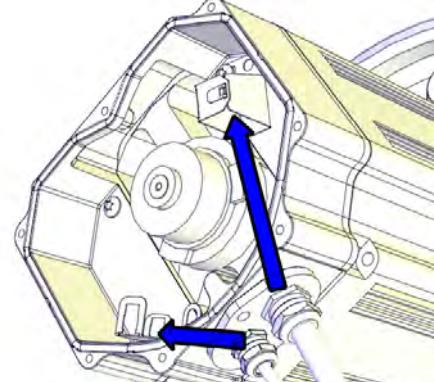
Action	Note
3 Remove the screws, fitted in the screw holes on top of the balancing device.  Note Keep the screws. They shall be refitted after the work is done.	 xx1500001971 M16x35
4 Apply some Molykote on threads and at the bottom end of two fully threaded screws.	Apply Molykote on colored areas.  xx1500002303 Screws M16x80 fully threaded
5 Unload the pressure of the balancing device by inserting the screws. Attach the screws until the screws reaches the piston. Then, alternately little by little, attach the screws at least another five millimeters. The pressure is now unloaded.	 xx1500002309 Screw M16x80 (2 pcs)
6 In a procedure where both balancing devices shall be removed, unload the pressure of the other in the same way.	

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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4.8.3 Replacing the axis-2 gearbox
Continued

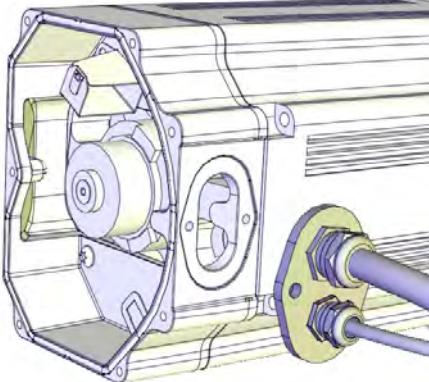
Action	Note
2 Unscrew the attachment screws with washers and remove the motor cover.	 xx1200001135
3 Make sure the o-ring is present.	 xx1200001070
4 Disconnect the motor cables.	 xx1200001066

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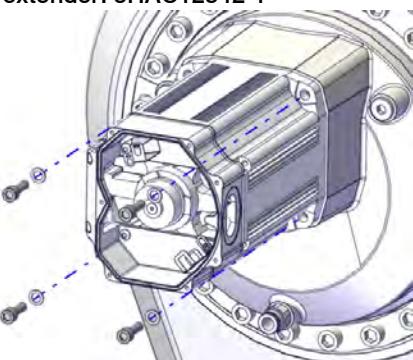
4 Repair

4.8.3 Replacing the axis-2 gearbox

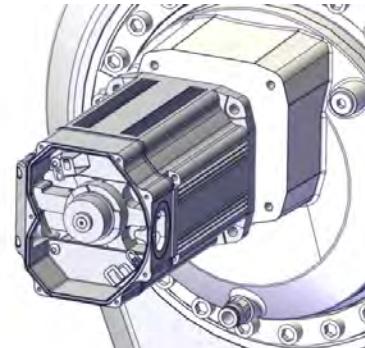
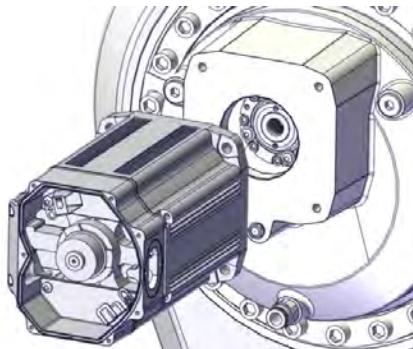
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Action	Note
<p>5 Remove the cable gland cover. Inspect the gasket.</p> <p> Note Replace if damaged.</p> <p> Tip Make a note in which direction the cable exit hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.</p>	 xx1200001067
6 Use caution and pull out the motor cables.	

Removing the motor

Action	Note
<p>1  DANGER When releasing the holding brakes of the motor, the lower arm and/or parallel arm will be movable and may fall down! Before continuing, the lower arm and parallel arm must be secured!</p>	
<p>2 In order to release the brakes, connect the 24 VDC power supply. Connect connector R2.MP2:<ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V</p>	24 VDC power supply
<p>3 Remove the attachment screws that secure the motor.</p> <p> Tip Use a bits extender in order to reach the screws.</p>	Bits extender: 3HAC12342-1  xx1500002323
4 Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15512-1 Always use guide pins in pairs!

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	Action	Note
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 tools in opposite holes of the motor.	Removal tool M14: 3HAC047108-001
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 24 VDC power supply.	
11	Use caution and remove the motor by sliding it out on the guide pins and then lifting it away and putting it somewhere clean and safe.	 xx1500002324

Removing the hub

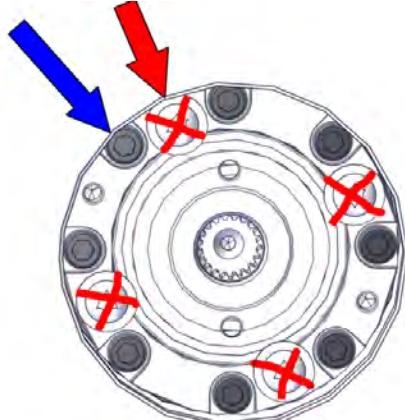
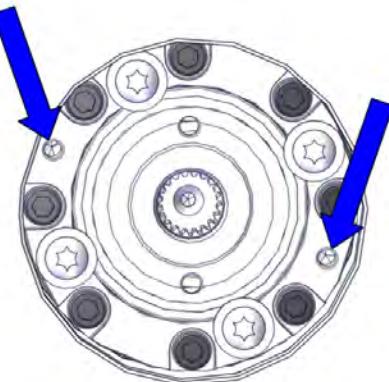
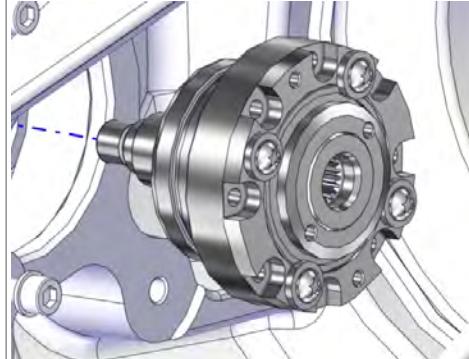
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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4 Repair

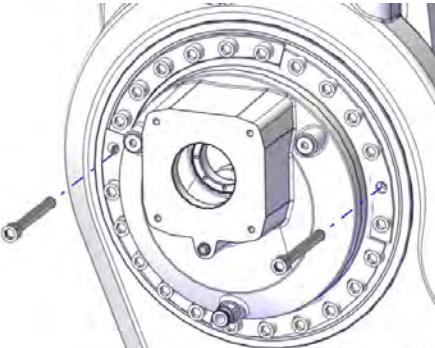
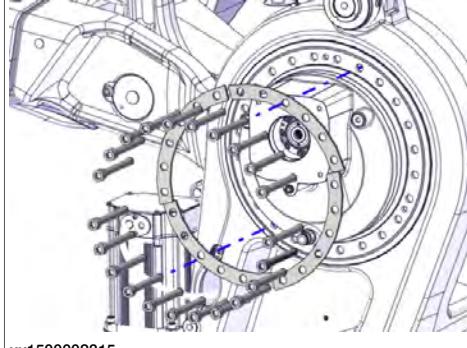
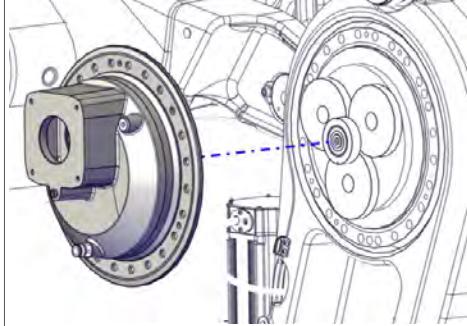
4.8.3 Replacing the axis-2 gearbox

Continued

Action	Note
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 two screws in opposite holes of the hub and use them as removal tools.	Attachment screws: M6x110 (2 pcs)  xx1500002081
5 Lift out the hub carefully.	 xx1500002326

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Removing the motor flange

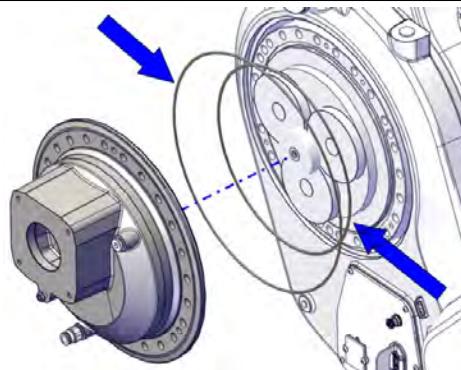
	Action	Note
1	Remove two attachment screws in opposite holes.	 xx1500002333
2	Fit guide pins in the holes.	Guide pin, M16x400 Always use guide pins in pairs.
3	Remove the remaining attachment screws (22 pcs) and the six-hole washers (4 pcs).	 xx1500002315
4	 Note There will be some oil spill when the motor flange is removed. Put some paper (or similar) to absorb the surplus oil.	
5	Use caution and move the motor flange out over the guide pins.	 xx1500002314

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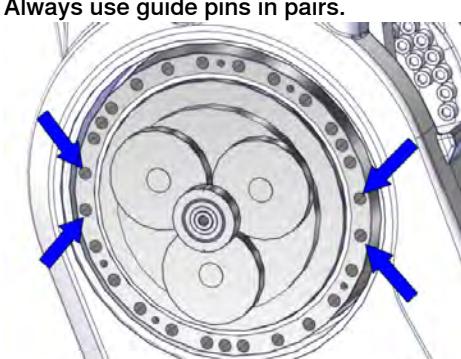
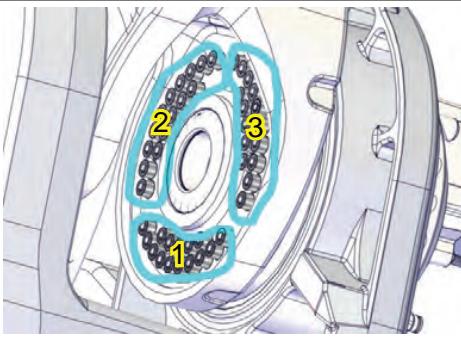
4 Repair

4.8.3 Replacing the axis-2 gearbox

Continued

Action	Note
6 Make sure the o-rings are present.	 xx1500002316

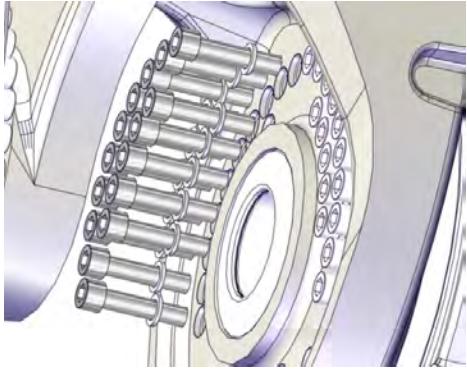
Removing the axis-2 gearbox from the lower arm, step 2 - screws in area 2

Action	Note
1 Attach two additional guide pins in opposite hole, below the present ones.	Guide pin, M16x400 Always use guide pins in pairs.  xx1500002336
2 Find area 2.	 xx1500002975

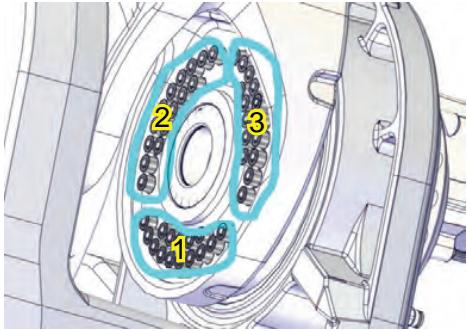
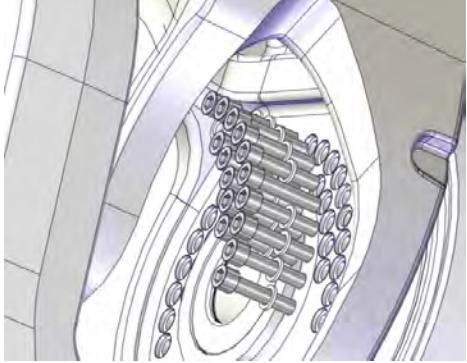
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4.8.3 Replacing the axis-2 gearbox

Continued

	Action	Note
3	Remove the attachment screws in area 2.	 xx1500003111

Removing the axis-2 gearbox from the lower arm, step 3 - screws in area 3

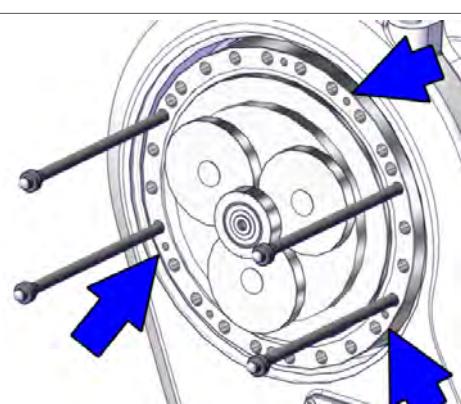
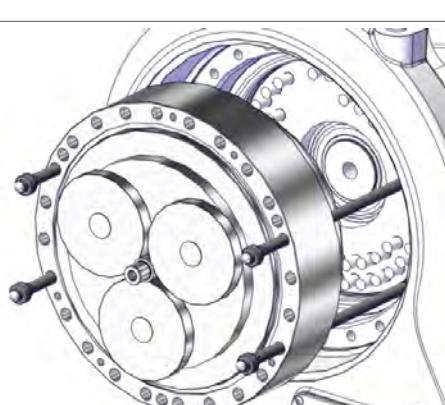
	Action	Note
1	Find area 3.	 xx1500002975
2	Remove the attachment screws that secure the gearbox to the lower arm in area 3.	 xx1500003112

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4 Repair

4.8.3 Replacing the axis-2 gearbox

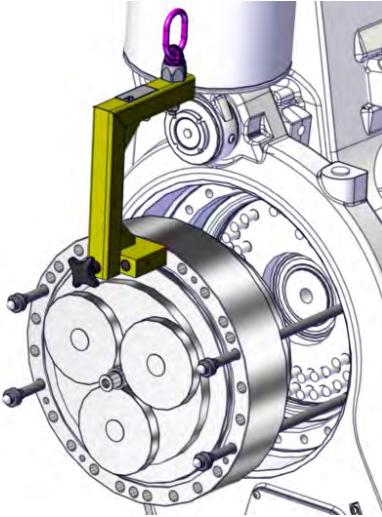
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Action	Note
3 Insert the guide pins in four of the screw holes. Fasten the set collars.	Mounting set gear (axis 2 and 3), 3HAC059801-001  xx1600001553
4 Attach three screws in a triangle and use them as removal tools.	 xx1500002337
5 Slide the gearbox out on the four guide pins, just enough to be able to attach the lifting accessories.	 xx1500002338

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4.8.3 Replacing the axis-2 gearbox

Continued

Action	Note
6 Attach the lifting accessories.	Lifting accessory, gearbox: 3HAC054404-001  xx1600001554
7 When the gearbox is removed, make sure to keep the sealing ring. It must be fitted when the gearbox is refitted.  Note On a new gearbox, the sealing ring must be removed from the old gearbox, and fitted on the new one.	 xx1600000067

Attaching lifting accessories and removal of gearbox

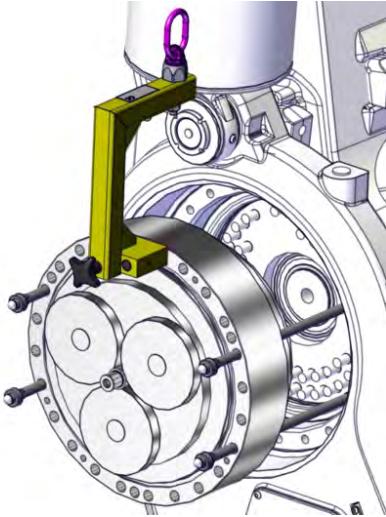
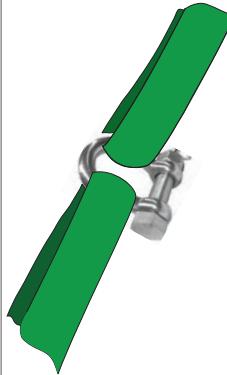
Action	Note
1  CAUTION The gearbox weighs 160 kg. All lifting accessories used must be sized accordingly.	

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4 Repair

4.8.3 Replacing the axis-2 gearbox

Continued

Action	Note
2 Attach the lifting accessory to the gearbox.	Lifting accessory, gearbox: 3HAC054404-001  xx1600001554
3 Attach a roundsling to the lifting accessory.	Roundsling 2 m: Lifting capacity: 2,000 kg
4 Connect another roundsling to the first one with a shackle.	Roundsling 2 m: Lifting capacity: 2,000 kg 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.	
6 Remove the set collars.	
7 Lift the gearbox off.	

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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 lose 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.

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

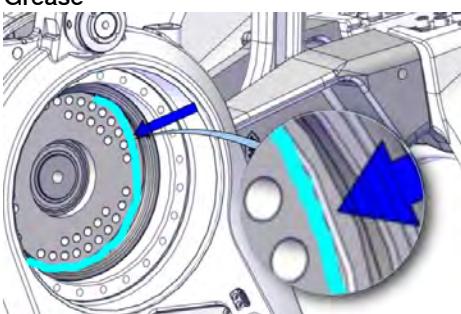
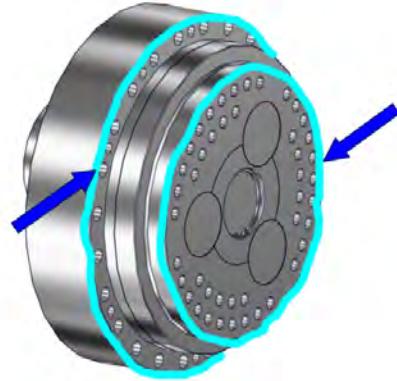
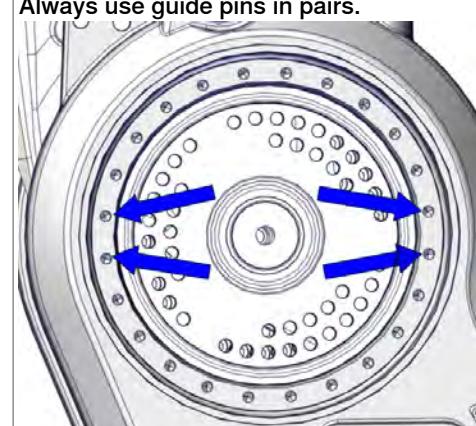
	Action	Note
1	Use caution and lift the gearbox up and let it rest on its side.  CAUTION Make sure the gearbox is resting in a stable position.	 xx1500002342

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4 Repair

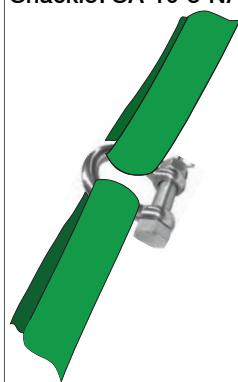
4.8.3 Replacing the axis-2 gearbox

Continued

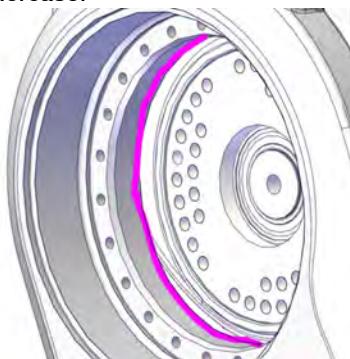
Action	Note
2 Clean the contact surfaces between gearbox and frame.	
3 Apply some grease on the thin chamfer on the lower arm.	Grease  xx1500002340
4 Apply some grease on the thin chamfer on the gearbox.	Grease  xx1500002341
5 Fit guide pins as shown in the figure.	Guide pin, M16x400 (2+2 pcs) Always use guide pins in pairs.  xx1500002343
6 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 accessory to the gearbox.	Lifting accessory, gearbox: 3HAC054404-001
3	Attach a roundsling to the lifting accessory.	Roundsling 2 m: Lifting capacity: 2,000 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.	

Attaching the axis-2 gearbox to frame, step 1

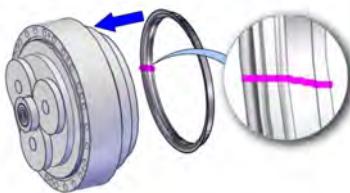
	Action	Note
1	Apply Mercasol (40 mm from the lower arm side) on the contact surface.	 xx1500002349  Note Area where to apply Mercasol, 40 mm wide, from the lower arm side.

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4 Repair

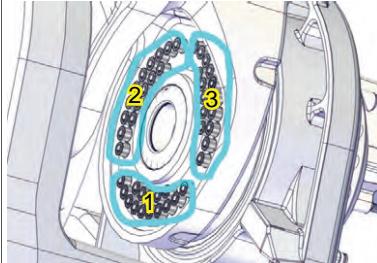
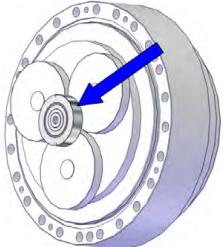
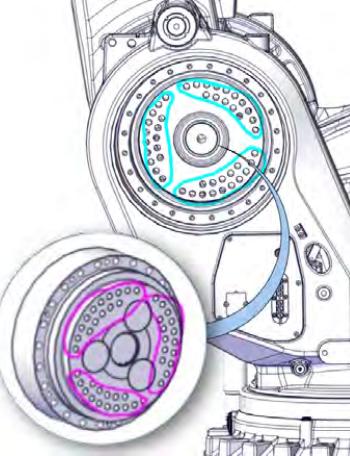
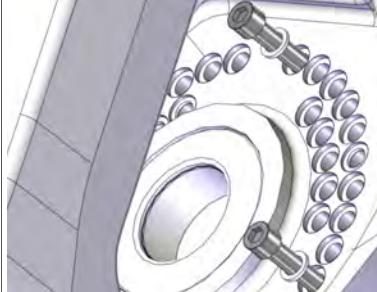
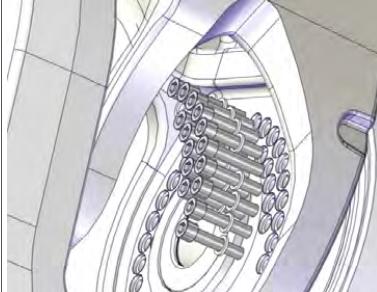
4.8.3 Replacing the axis-2 gearbox

Continued

	Action	Note
2	<p>Apply Mercasol on the surface of the sealing ring and attach it on the gearbox.</p> <p>Note Make sure that the sealing ring is attached correctly on the gearbox.</p>	<p>Mercasol</p>  <p>xx1500002350</p>
3	Lift the gearbox onto the guide pins.	 <p>xx1500002338</p>
4	<p>Note The axis-2 gearbox shall, on the side shown in the figure, be attached to the frame. The other side of the gearbox shall be attached to the lower arm.</p>	 <p>xx1500002347</p>
5	<p>Attach (but do not torque) three M16x130 screws with six-hole washers underneath, in a triangle and use them alternately to press the gearbox into position.</p> <p>Note The six-hole washers are needed for protection of the gearbox surface, when the screws are attached.</p>	<p>Attachment screws: M16x130</p>  <p>xx1500002368</p>

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Attaching the axis-2 gearbox to lower arm - screws in area 3

	Action	Note
1	Find area 3.	 xx1500002975
2	Make sure that the hole pattern of the three areas of attachment screws match 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
3	Begin attaching the screws (M16x70) in the outer-most 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
4	Attach the screws with washers, in area 3.  Note Do not torque the screws at this point.	Attachment screws: M16x70 12.9 Gleitmo  xx1500003112

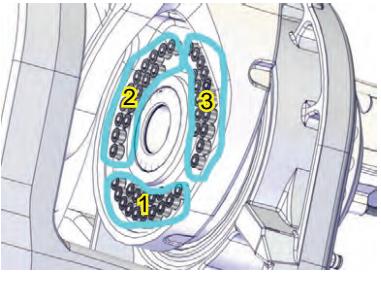
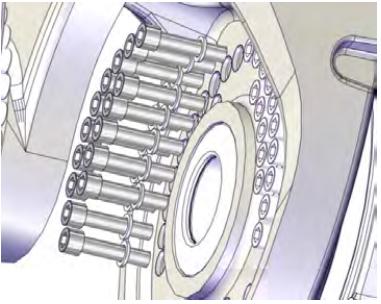
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4 Repair

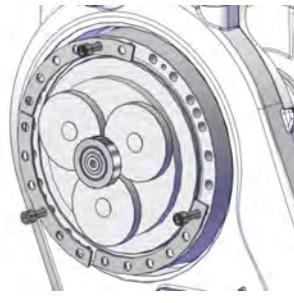
4.8.3 Replacing the axis-2 gearbox

Continued

Attaching the axis-2 gearbox to lower arm - screws in area 2

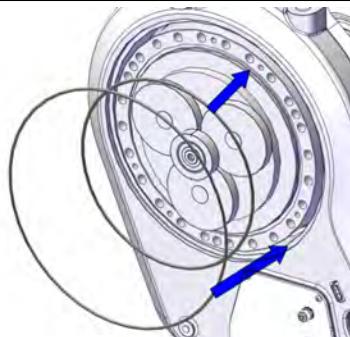
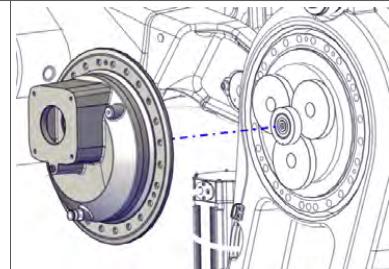
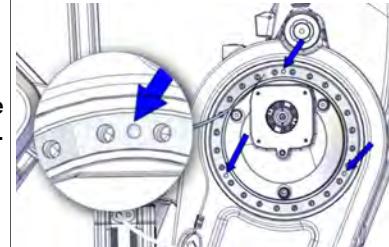
	Action	Note
1	Find area 2.	 xx1500002975
2	Begin attaching the screws (M16x70) in the outer-most holes of the outer ring of holes.  Tip Make sure that the hole pattern match. If needed, use extreme caution and turn the small gear in the gearbox to find the hole pattern.	
3	 Note Attach the screws with washers, in area 2. Do not torque the screws at this point.	Attachment screws: M16x70 12.9 Gleitmo  xx1500003111

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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4.8.3 Replacing the axis-2 gearbox Continued

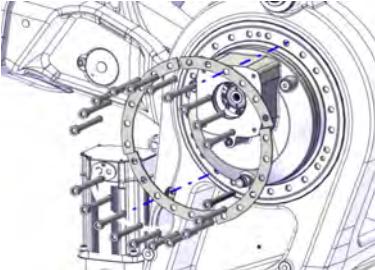
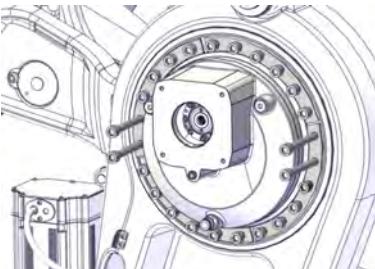
	Action	Note
3	Clean o-rings and o-ring groove on gearbox.	 xx1500002353
4	Inspect the o-rings.  Note Replace if damaged.	
5	Apply some grease on the o-rings.	Grease
6	Attach the smaller o-ring in the gearbox groove.	
7	Attach the larger o-ring on the motor flange.	
8	Before lifting the motor flange onto 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.	
11	  Note Make sure that the three holes in the gearbox are covered when the four six-hole washers are fitted.	 xx1600000068

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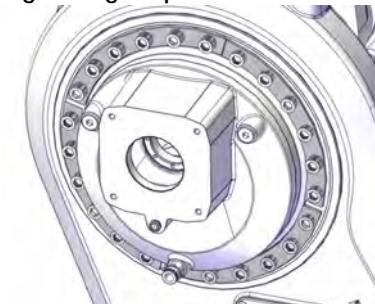
4 Repair

4.8.3 Replacing the axis-2 gearbox

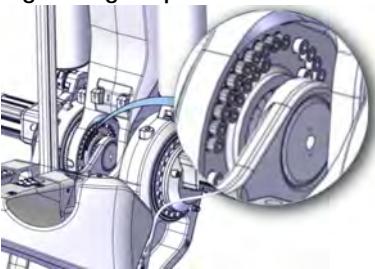
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	Action	Note
12	Attach 20 of the 24 attachment screws with the four six-hole washers.	Attachment screws: M16x130 12.9 Gleitmo 603  xx1500002355
13	Remove the guide pins and attach the remaining screws.	 xx1500002356

Securing the motor flange together with gearbox

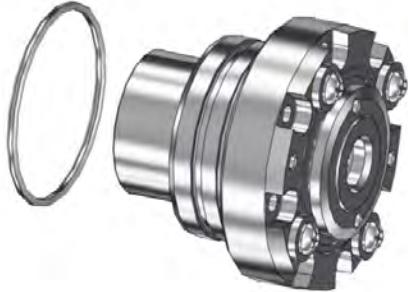
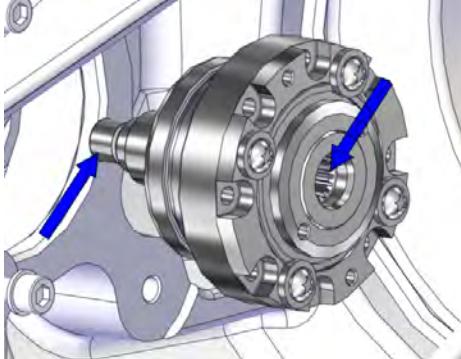
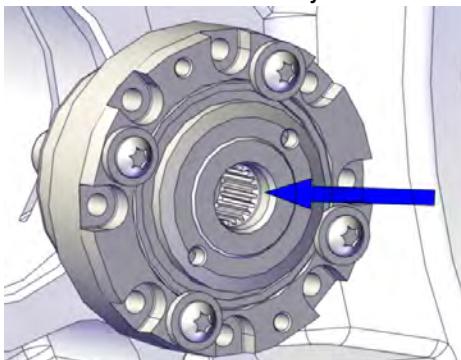
	Action	Note
1	Secure motor flange together with the gearbox, to the frame.	Tightening torque: 300 Nm  xx1500002373

Securing the axis-2 gearbox to lower arm - screws in areas 2 and 3

	Action	Note
1	Secure the gearbox to the lower arm, with the attachment screws now possible to reach.	Tightening torque: 300 Nm  xx1500002339

Continues on next page

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 3 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346

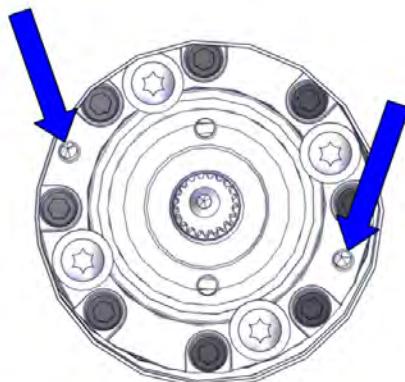
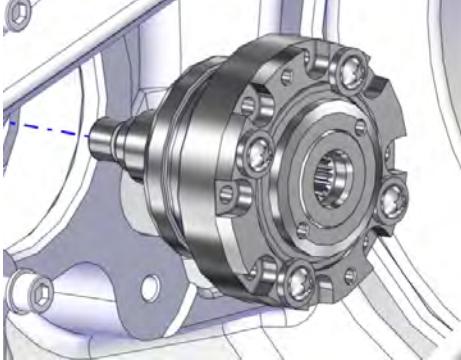
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4 Repair

4.8.3 Replacing the axis-2 gearbox

Continued

Refitting the hub

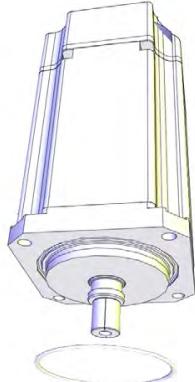
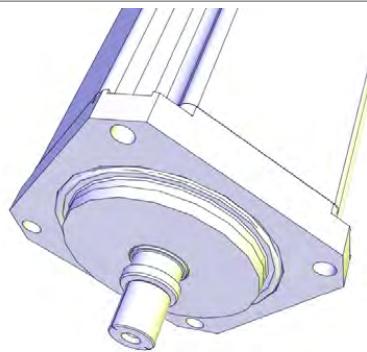
Action	Note
1 Attach two screws in opposite holes of the hub and use them as tools to fit the hub.	Attachment screws: M6x110 (2 pcs)  xx1500002081
2  CAUTION Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	
3 Refit the hub.	 xx1500002326
4 Remove the two M6x110 and fit the attachment screws for the hub. Apply locking liquid (Loctite 243) on the screws.  Note The number of attachment screws differ depending on gearbox.	Attachment screws: M6x30 12.9. Loctite 243 Quantity: <ul style="list-style-type: none">• 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.

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Performing a leak-down test

	Action	Note
1	Perform a leak-down test.	See Performing a leak-down test on page 190 .

Preparations before refitting the motor

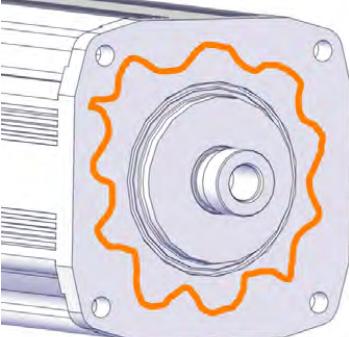
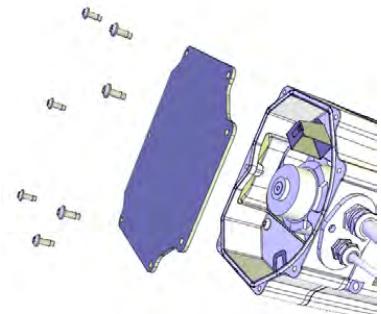
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove old paint residues and other contamination from the contact surfaces on both motor and gearbox.	
3	Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4	 Note Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
5	 Tip Lubricate the o-ring with some grease for a better fitting in the groove.	  xx1200001020

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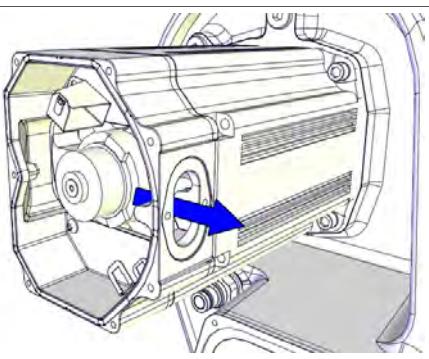
4 Repair

4.8.3 Replacing the axis-2 gearbox

Continued

Action	Note
6 Apply flange sealant on the motor flange.	<p>Flange sealant: Loctite 574</p>  <p>xx1500002357</p>
7 If the motor is a new spare part, remove the cover.	 <p>xx1200001135</p>

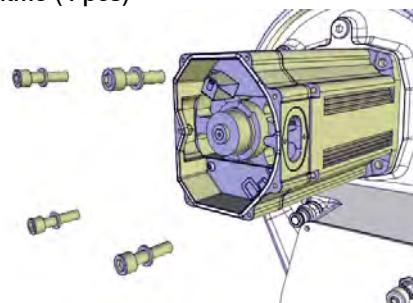
Securing the axis-2 motor

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 Attach the lifting accessory.	Lifting accessory, motor: 3HAC15534-1
4  Note Make sure the cable exit hole is turned the correct way.	 <p>xx1200001120</p>

Continues on next page

4.8.3 Replacing the axis-2 gearbox

Continued

Action	Note
5 Lift the motor and put it on the guide pins, as close as possible to its final position, without pushing the motor pinion into the gear.	
6 Remove the lifting accessory and allow the motor to rest on the guide pins.	
7 Apply the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool: 3HAC7887-1
8 To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP2: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	
9  CAUTION Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.	
10 Fit the motor in its final position while at the same time rotating the motor pinion slightly using the rotation tool. <ul style="list-style-type: none">• 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 Fit two of the attachment screws.	Screw dimension: M10x40 quality 12.9 Gleitmo (4 pcs)
12 Remove the guide pins and replace with the remaining attachment screws.	
13 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)  xx1200001117

Performing a leak-down test

Action	Note
1 Perform a leak-down test.	See Performing a leak-down test on page 190 .

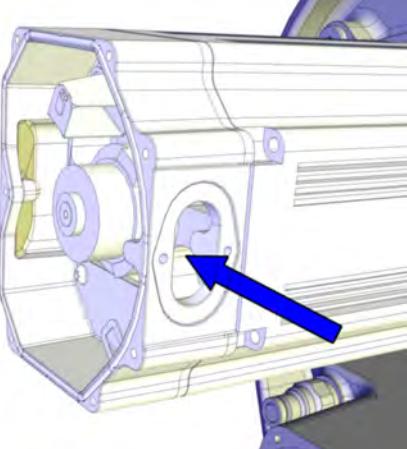
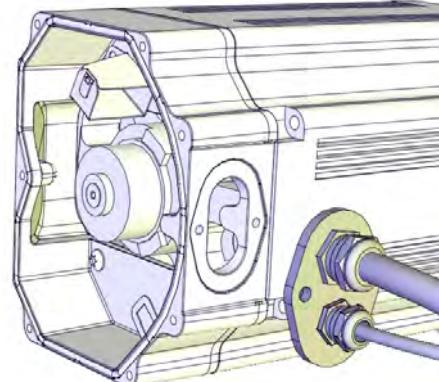
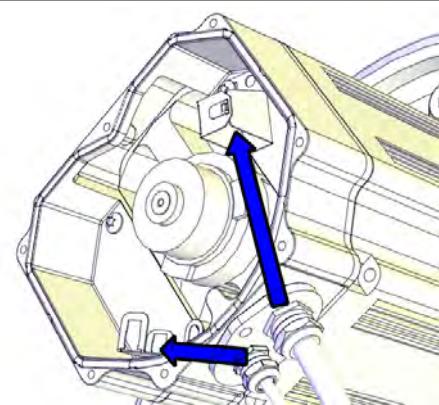
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4 Repair

4.8.3 Replacing the axis-2 gearbox

Continued

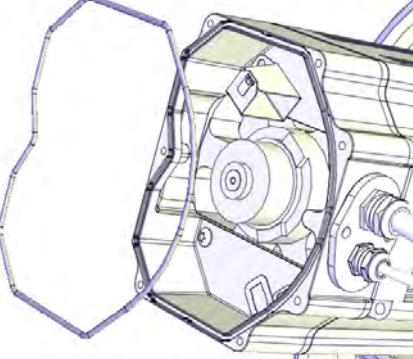
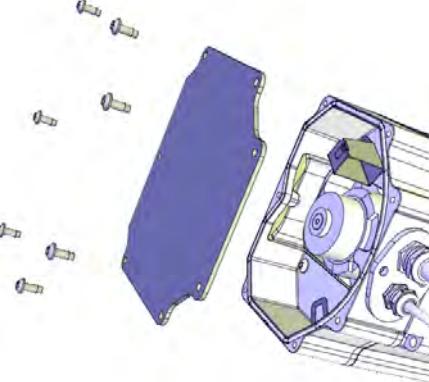
Connecting the axis-2 motor cables

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

Continues on next page

4.8.3 Replacing the axis-2 gearbox

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 not to damage the cables inside the motor.	
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
9 Make sure that the covers are tightly sealed.	

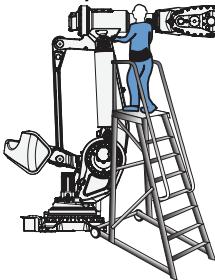
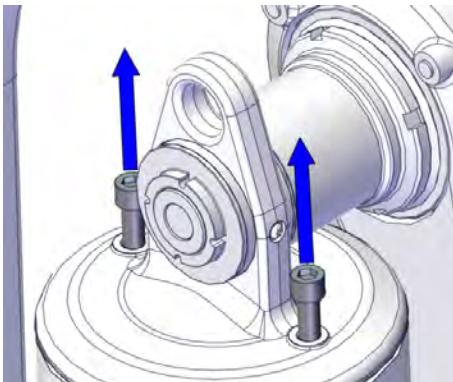
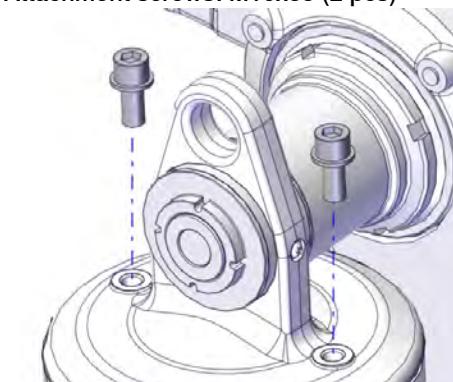
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4 Repair

4.8.3 Replacing the axis-2 gearbox

Continued

Restoring the pressure of the balancing device

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

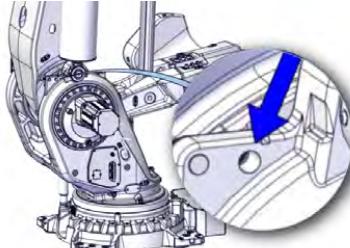
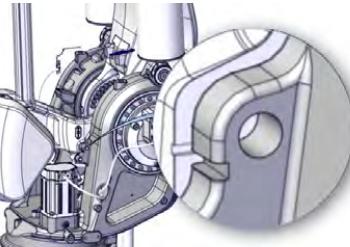
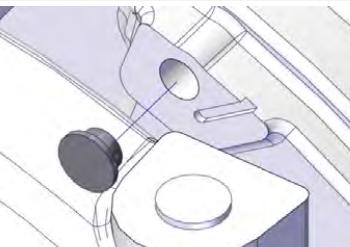
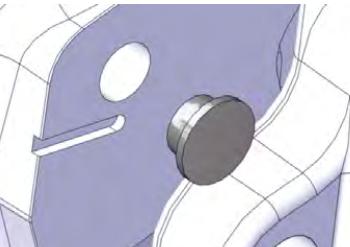
Removing lock screws

Action	Note
1 Turn on the power.	

Continues on next page

4.8.3 Replacing the axis-2 gearbox

Continued

Action	Note
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
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 to the lower arm - screws in area 1

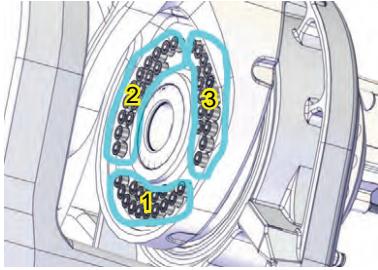
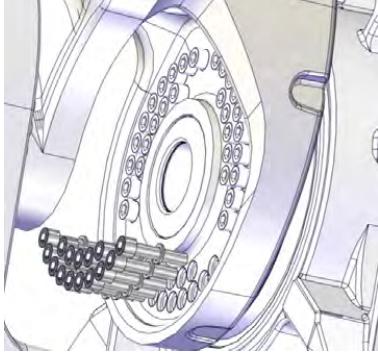
Action	Note
1 Jog the robot to the specified position: <ul style="list-style-type: none"> • Axis 1: No significance (as long as the robot is secured to the foundation) • Axis 2: 0° • Axis 3: +66° • Axis 4: 0° • Axis 5: 0° • Axis 6: No significance. 	

Continues on next page

4 Repair

4.8.3 Replacing the axis-2 gearbox

Continued

	Action	Note
2	Find area 1.	 xx1500002975
3	Secure 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.	

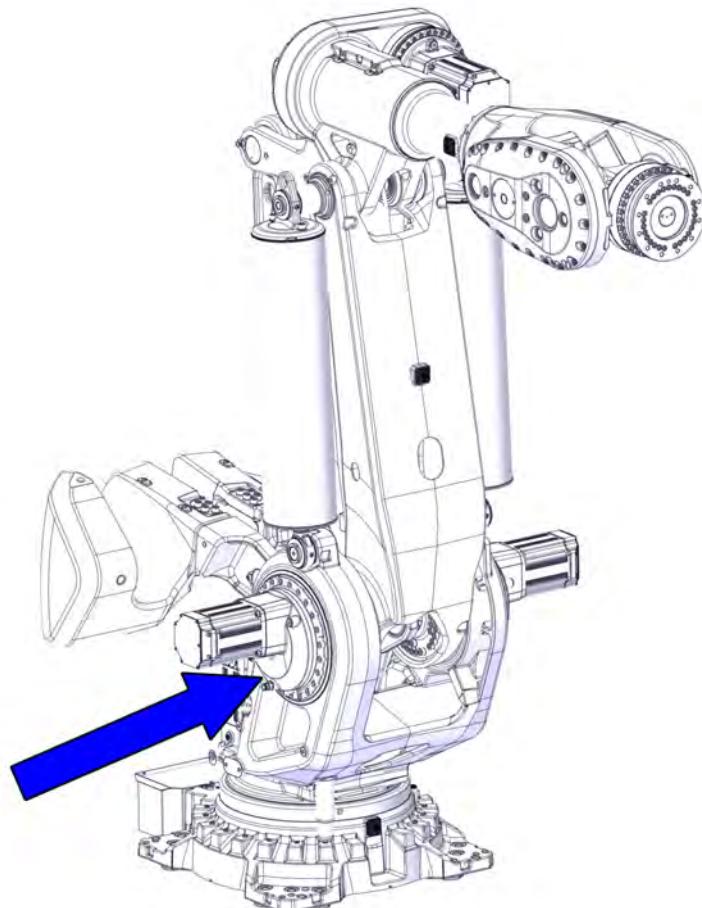
Concluding procedure

	Action	Note
1	Perform a leak-down test (if not already done).	See Performing a leak-down test on page 190 .
2	Refill the gearbox with oil.	See Changing oil in axis-2 and axis-3 gearbox on page 152 .
3	Recalibrate the robot.	Axis Calibration is described in Calibrating with Axis Calibration method on page 799 . General calibration information is included in section Calibration on page 789 .
4	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

4.8.4 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Reduction gear RV 900N incl input gear	3HAC048392-003	

Continues on next page

4 Repair

4.8.4 Replacing the axis-3 gearbox

Continued

Required tools and equipment

Equipment, etc.	Article number	Note
24 VDC power supply	-	Used to release the motor brakes.
Lock screw, M20x150	-	Used to secure lower arm and parallel arm.
Screw M6x110	-	Fully threaded
Screw M16x80	-	Fully threaded
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.
Lifting accessory, gearbox	3HAC054404-001	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.
MobilePlatformLadder	-	
Roundsling 2 m	-	Lifting capacity: 2,000 kg
Roundsling 2.5 m	-	Lifting capacity: 2,000 kg
Lifting eye	3HAC14457-4	M16
Lifting eye	3HAC038295-003	M24
Rotation tool	3HAC7887-1	Used to rotate the motor pinion.
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumables

Consumable	Article number	Note
Grease		Castrol Molub. Alloy 777-1 NG: To be used on hub splines to prevent from fretting corrosion.
Molykote 1000		
Grease		
Mercasol		3110 Waxcoat
Locking liquid	3HAB7116-1	Loctite 243
Flange sealant	12340011-116	Loctite 574

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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	<p>Decide which calibration routine to use for calibrating the robot.</p> <ul style="list-style-type: none"> • 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. 	
	<p>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.</p>	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 800 .
	<p>If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.</p>	

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.



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.	

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4 Repair

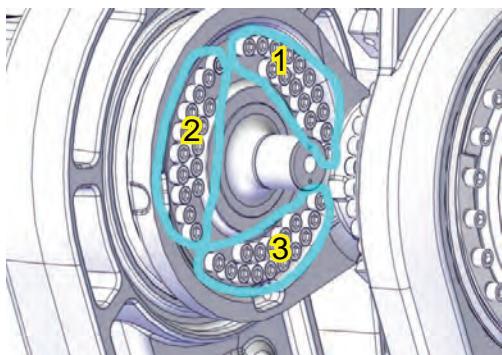
4.8.4 Replacing the axis-3 gearbox

Continued

Action	Note
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 153 .

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.

Robot position when removing axis-3 from parallel arm - 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: <ul style="list-style-type: none">• 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: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

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Removing the axis-3 gearbox from parallel arm, step 1 - screws in area 1



DANGER

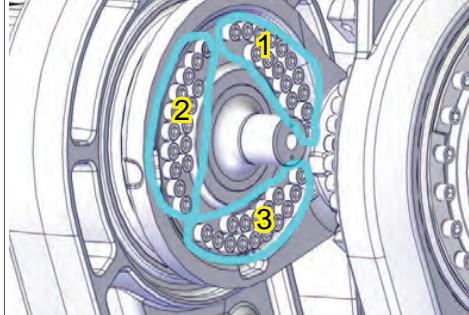
When removing the axis-3 gearbox, let the axis-2 gearbox stay fitted! Only remove the screws that either secure the axis-2 gearbox to the lower arm, or the screws that secure the axis-3 gearbox to the parallel arm, depending on which gearbox shall be removed.



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.

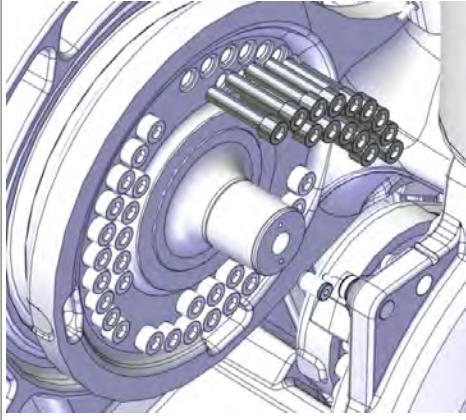
	Action	Note
1	DANGER Never remove the screws on both axis-2 and axis-3 at the same time. One side must always be attached when the gearbox on the other side is removed. If not, there is a potential risk that a severe accident will happen.	
2	Find area 1.	 <small>xx1500002974</small>

Continues on next page

4 Repair

4.8.4 Replacing the axis-3 gearbox

Continued

Action	Note
3 Remove the screws in area 1.	 xx1500003114 <p>Lower arm is hidden in this figure, to get a better view.</p>

Robot position when removing axis-3 from parallel arm - screws in area 2

Action	Note
1 Turn on the power and jog the robot to the specified position: <ul style="list-style-type: none"> 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 <p>Turn off all:</p> <ul style="list-style-type: none"> electric power supply hydraulic pressure supply air pressure supply <p>to the robot, before entering the robot working area.</p>	

Removing the axis-3 gearbox from parallel arm, step 2 - screws in area 2

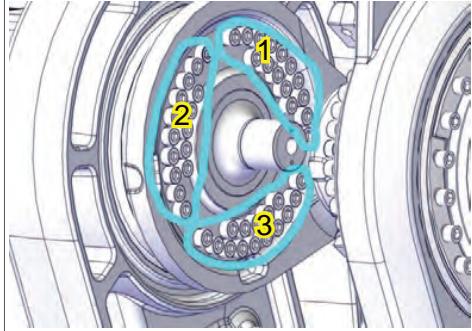
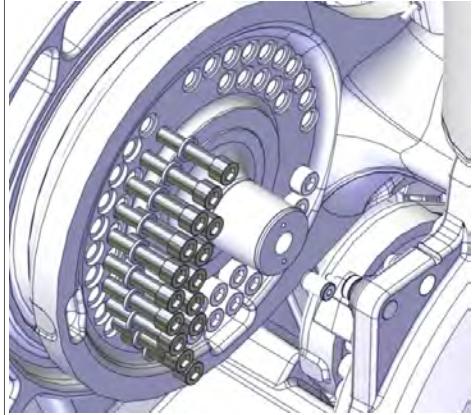
Use this procedure to remove the screws that secure the axis-3 gearbox to the parallel arm, in area 2.

Action	Note
1  DANGER <p>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.</p>	

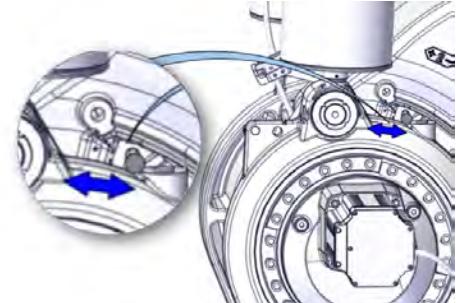
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4.8.4 Replacing the axis-3 gearbox

Continued

Action	Note
2 Find area 2.	 xx1500002974
3 Remove the screws in area 2.	 xx1500003115 <p>Lower arm is hidden in this figure, to get a better view.</p>

Preparations before jogging the robot into calibration position

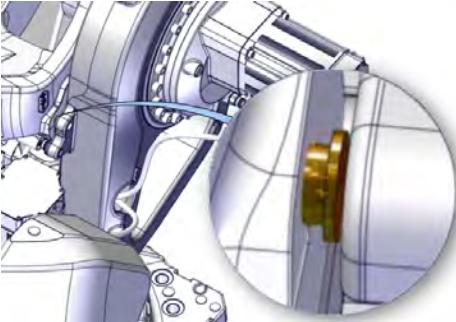
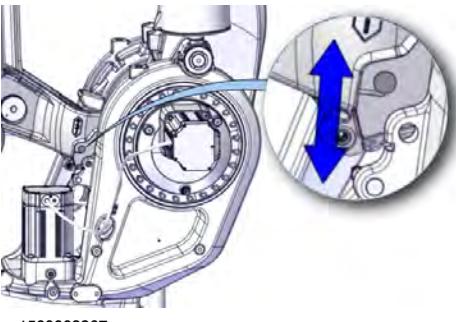
Action	Note
1 Turn the power to the robot on.	
2 Jog axis-2 to within the area shown in the figure.	 xx1500002334

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4 Repair

4.8.4 Replacing the axis-3 gearbox

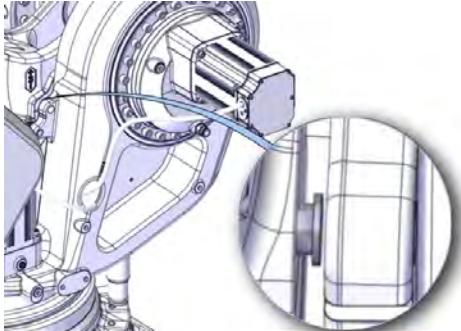
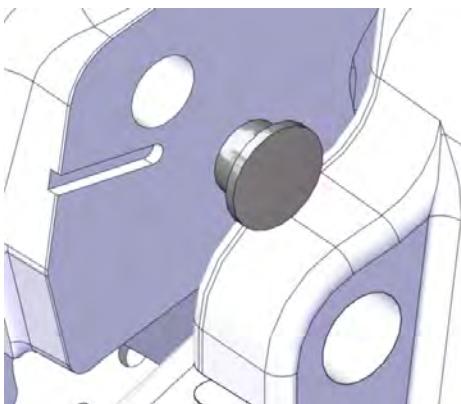
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Action	Note
3 Remove the plastic plugs covering axis-2 lock screw hole.  Note Keep the plastic plug. It shall be refitted after the work is done.	 xx1500002320  xx1500002335
4 Jog axis-3 to the area shown in the figure.	 xx1500002367

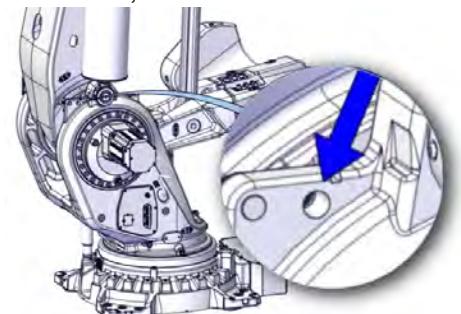
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4.8.4 Replacing the axis-3 gearbox

Continued

Action	Note
<p>5 Remove the axis-3 plastic plug.</p> <p>Note</p> <p>Keep the plastic plug. It shall be refitted after the work is done.</p>	 <p>xx1500002365</p>  <p>xx1500002366</p>

Attaching lock screws to axis-2 and axis-3

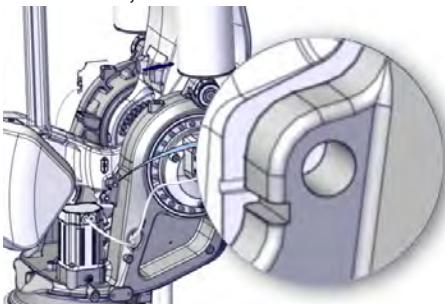
Action	Note
1 Jog the robot to calibration position.	 <p>xx1500002310</p>
2 Secure the axis-2 with a lock screw.	<p>Lock screw, M20x150</p>  <p>xx1500002322</p>

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4 Repair

4.8.4 Replacing the axis-3 gearbox

Continued

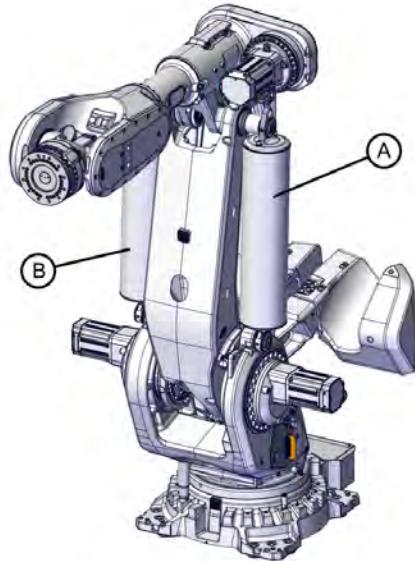
Action	Note
3 Release the brakes on axis-2 using the brake release button, and let the axis rest on the lock screw.	24 VDC power supply
4 Secure axis-3 with a lock screw.	Lock screw, M20x150 
5 Release the brakes on axis-3 using the brake release button, and let the axis rest on the lock screw.	24 VDC power supply
6 With the robot in this position it will be possible to reach the remaining attachment screws that secure the axis-3 gearbox to the parallel arm.	
7  DANGER Turn off all: <ul style="list-style-type: none">• 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 balancing device

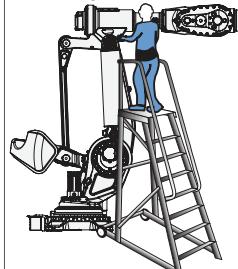
**CAUTION**

Make sure to relief the pressure of the correct balancing device. Relief pressure on axis 2 side when changing axis-2 gearbox, and relief pressure on axis 3 side when changing axis-3 gearbox.



xx1600001406

A	Axis-2 balancing device
B	Axis-3 balancing device

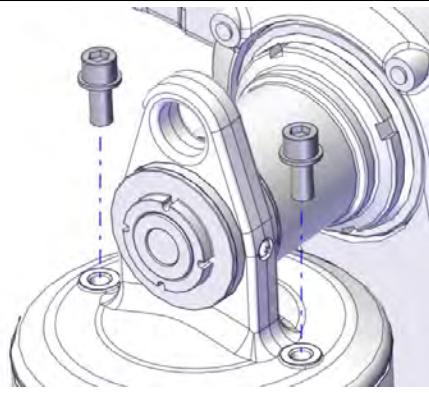
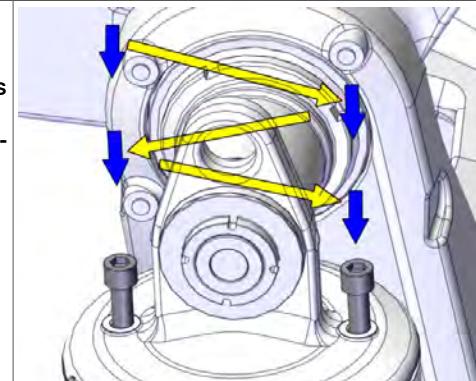
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	<i>Only needed when the upper arm is fitted on the robot:</i> Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device.  DANGER Do not use the robot as ladder!	Mobile platform ladder  xx1500001985

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4 Repair

4.8.4 Replacing the axis-3 gearbox

Continued

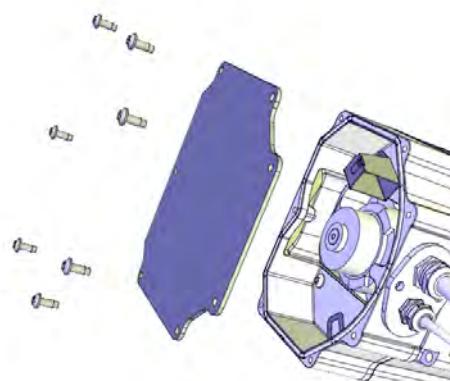
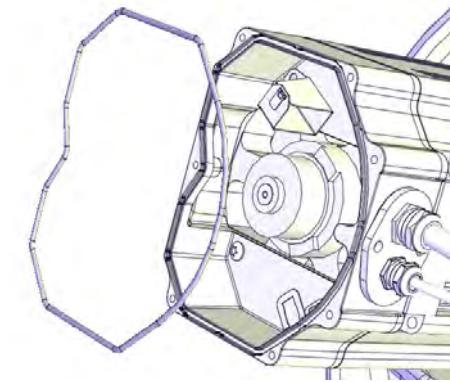
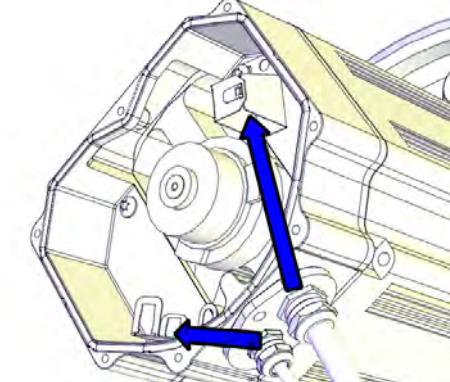
Action	Note
3 Remove the screws, fitted in the screw holes on top of the balancing device. Note Keep the screws. They shall be refitted after the work is done.	 xx1500001971 M16x35
4 Apply some Molykote on threads and at the bottom end of two fully threaded screws.	 xx1500002303 Screws M16x80 fully threaded
5 Unload the pressure of the balancing device by inserting the screws. Attach the screws until the screws reaches the piston. Then, alternately little by little, attach the screws at least another five millimeters. The pressure is now unloaded.	 xx1500002309 Screw M16x80 (2 pcs)
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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4.8.4 Replacing the axis-3 gearbox
Continued

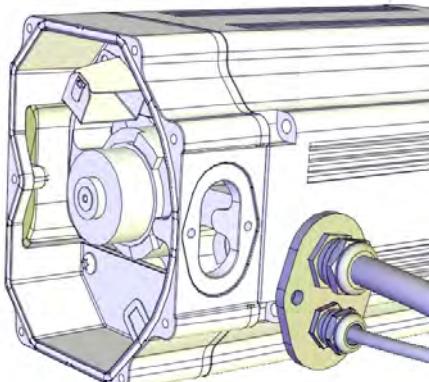
Action	Note
2 Unscrew the attachment screws with washers and remove the motor cover.	 xx1200001135
3 Make sure the o-ring is present.	 xx1200001070
4 Disconnect the motor cables.	 xx1200001066

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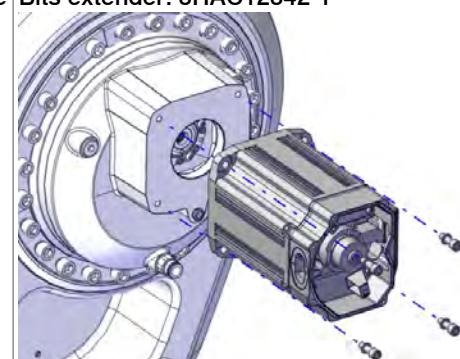
4 Repair

4.8.4 Replacing the axis-3 gearbox

Continued

Action	Note
<p>5 Remove the cable gland cover. Inspect the gasket.</p> <p>Note Replace if damaged.</p> <p>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.</p>	 xx1200001067
6 Use caution and pull out the motor cables.	

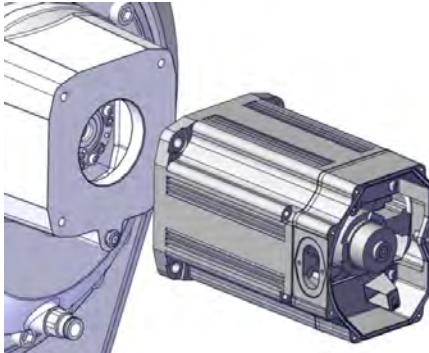
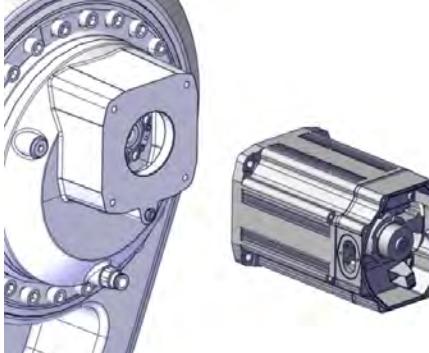
Removing the motor

Action	Note
<p>1 DANGER When releasing the holding brakes of the motor, the lower arm and/or parallel arm will be movable and may fall down! Before continuing, the lower arm and parallel arm must be secured!</p>	
<p>2 In order to release the brakes, connect the 24 VDC power supply. Connect connector R2.MP3:<ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V</p>	24 VDC power supply
<p>3 Remove the attachment screws that secure the motor.</p> <p>Tip Use a bits extender in order to reach the screws.</p>	Bits extender: 3HAC12342-1  xx1600000069
4 Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15512-1 Always use guide pins in pairs.

Continues on next page

4.8.4 Replacing the axis-3 gearbox

Continued

	Action	Note
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 tools in opposite holes of the motor.	Removal tool M14: 3HAC047108-001
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	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.	 xx1600000070
10	Disconnect the 24 VDC power supply.	
11	Remove the motor by sliding it out on the guide pins and then lifting it away.	 xx1600000071

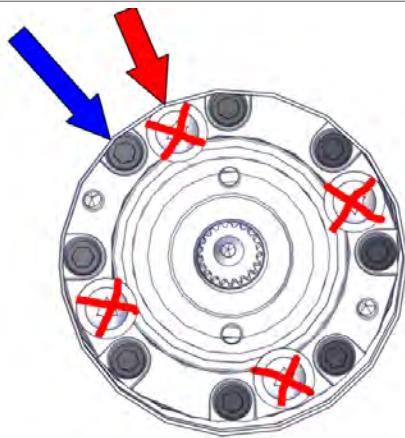
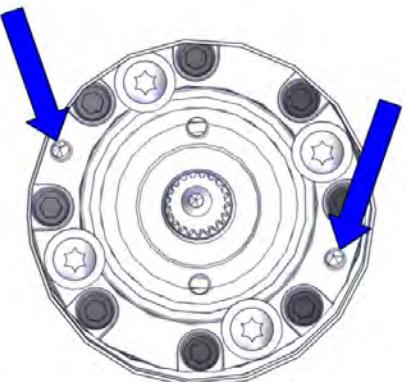
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4 Repair

4.8.4 Replacing the axis-3 gearbox

Continued

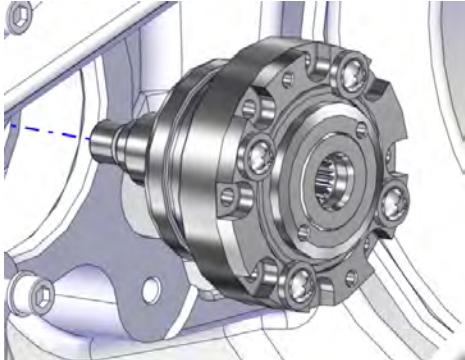
Removing the hub

Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2  Note Unscrew the M6x30 hex socket head cap screws that secure the hub. 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 two screws in opposite holes of the hub and use them as removal tools.	Attachment screws: M6x110 (2 pcs)  xx1500002081

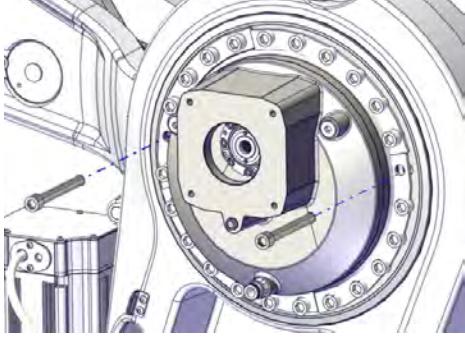
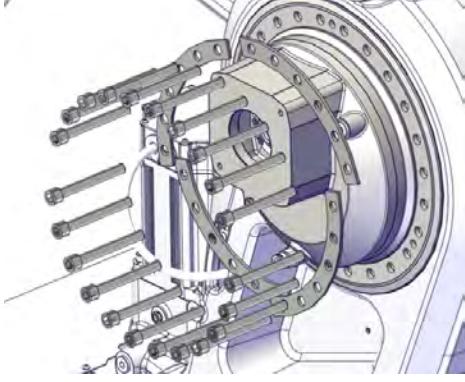
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4.8.4 Replacing the axis-3 gearbox

Continued

Action	Note
5 Lift out the hub carefully.	 xx1500002326

Removing the motor flange

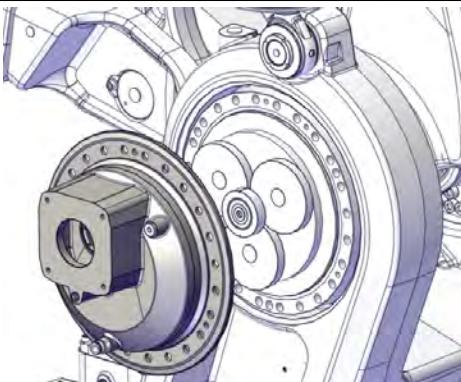
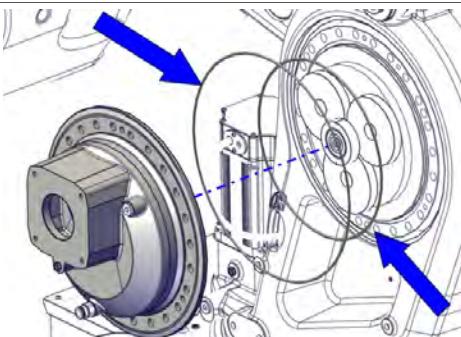
Action	Note
1 Remove two attachment screws in opposite holes.	 xx1500002358
2 Fit guide pins in the holes.	Mounting set gear (axis 2 and 3), 3HAC059801-001
3 Remove the remaining attachment screws and the six-hole washers (4 pcs).	 xx1500002359
4  Note	<p>There will be some oil spill when the motor flange is removed. Put some paper (or similar) to absorb the surplus oil.</p>

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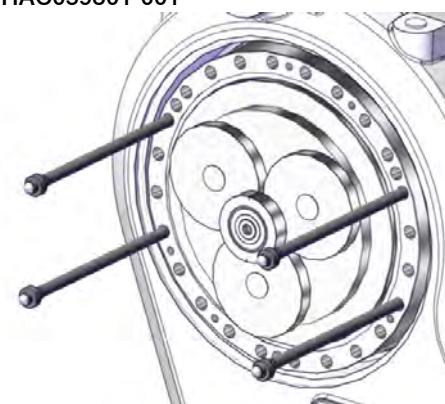
4 Repair

4.8.4 Replacing the axis-3 gearbox

Continued

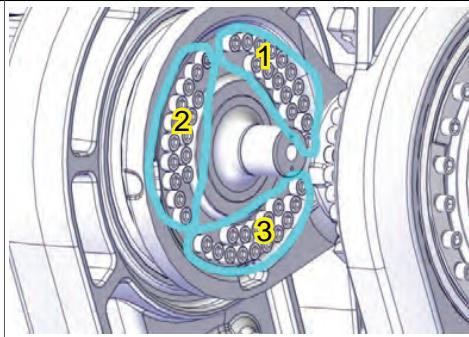
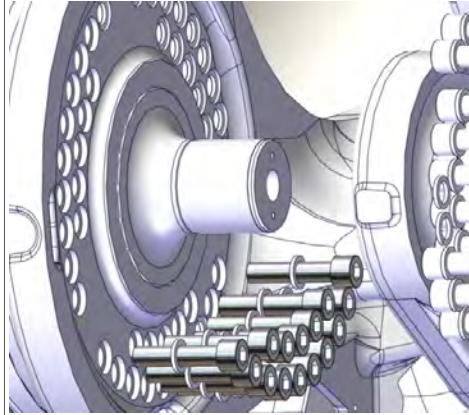
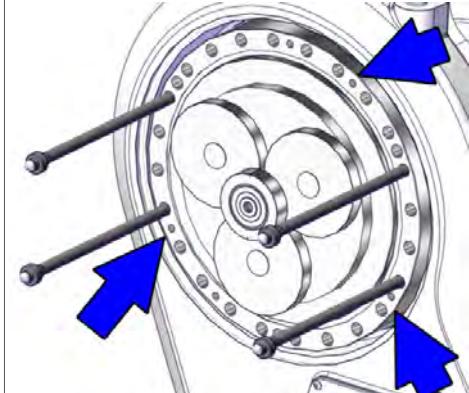
Action	Note
5 Use caution and move the motor flange out over the guide pins.	 xx1500002360
6 Make sure the o-rings are present.	 xx1500002317

Removing the axis-3 gearbox from parallel arm, step 3 - screws area 3

Action	Note
1 Attach two additional guide pins in opposite holes, below the present ones.	Mounting set gear (axis 2 and 3), 3HAC059801-001  xx1600001553

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4.8.4 Replacing the axis-3 gearbox
Continued

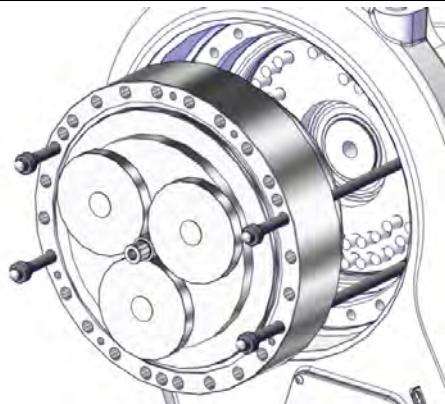
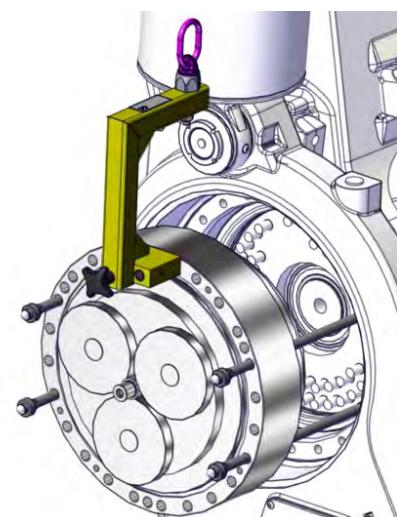
Action	Note
2 Find area 3.	 xx1500002974
3 Remove the attachment screws in area 3.	 xx1500003116
4 Attach three screws in a triangle and use as removal tools for the gearbox.	 xx1500002337

Continues on next page

4 Repair

4.8.4 Replacing the axis-3 gearbox

Continued

Action	Note
5 Slide the gearbox out on the four guide pins, just enough to be able to attach the lifting accessories.	 xx1500002338
6 Attach the lifting accessories.	Lifting accessory, gearbox: 3HAC054404-001  xx1600001554
7 Make sure to keep the sealing ring, when the gearbox is removed. It must be fitted on the gearbox when refitted.  Note On a new gearbox, the sealing ring must be removed from the old gearbox, and fitted on the new one.	 xx1600000067

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Attaching lifting accessories and removal of 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 accessories axes-2 and axis-3 gearboxes:
3	Attach a roundsling to the lifting accessories.	Roundsling 2 m: Lifting capacity: 2,000 kg (2 pcs)
4	Attach the roundslings to an overhead crane (or similar) and raise to take the weight of the gearbox.	
5	Lift the gearbox off.	

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 armsystem 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.

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4 Repair

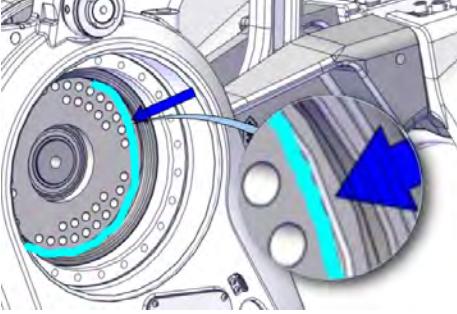
4.8.4 Replacing the axis-3 gearbox

Continued

Robot position

Action	Note
1 Make sure that the position of the robot has not been changed. Correct position is calibration position.	 Note 

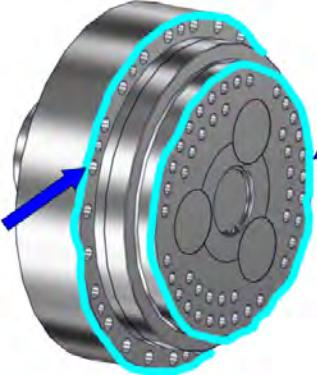
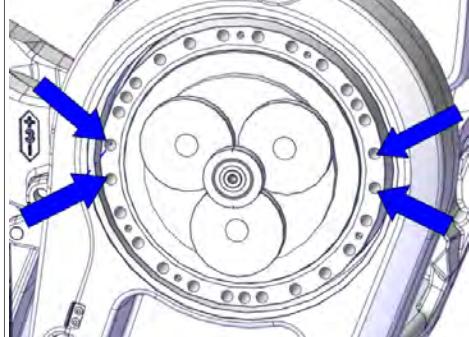
Preparations before refitting the gearbox

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 Clean the contact surfaces between gearbox and frame.	
3 Apply some grease on the thin chamfer on the parallel arm. The area where the gearbox will enter.	Grease  xx1500002340

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4.8.4 Replacing the axis-3 gearbox

Continued

Action	Note
4 Apply some grease on the thin chamfer on the gearbox.	Grease  xx1500002341
5 Fit guide pins as shown in the figure.	Mounting set gear (axis 2 and 3), 3HAC059801-001  xx1500002361
6 Apply some grease on the guide pins for a better fitting.	

Attaching lifting accessories to the gearbox

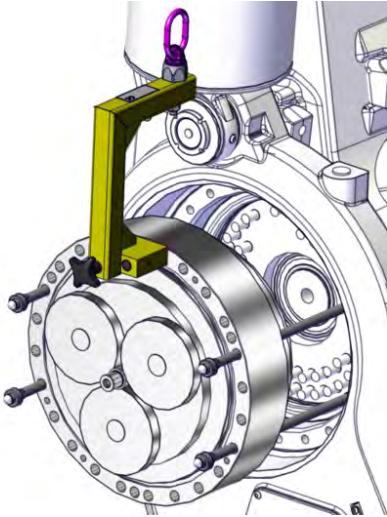
Action	Note
1  CAUTION The gearbox weighs 160 kg. All lifting accessories used must be sized accordingly!	

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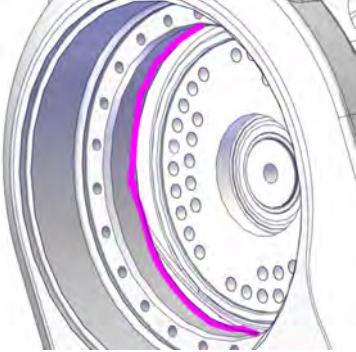
4 Repair

4.8.4 Replacing the axis-3 gearbox

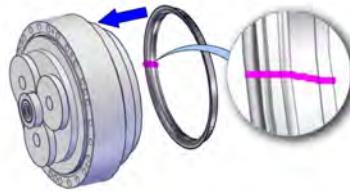
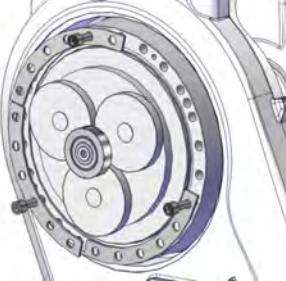
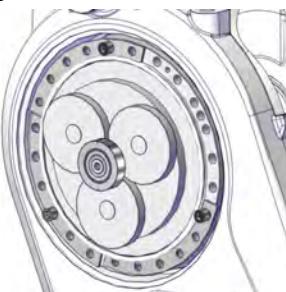
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Action	Note
2 Attach the lifting accessories to the gearbox.	Lifting accessory, gearbox: 3HAC054404-001  xx1600001554
3 Attach a roundsling to the lifting accessories.	Roundsling 2 m: Lifting capacity: 2,000 kg (2 pcs)
4 Attach the roundslings to an overhead crane (or similar) and raise to take the weight of the gearbox.	

Attaching the axis-3 gearbox to frame, step 1

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.

Continues on next page

	Action	Note
2	<p>Apply Mercasol on the surface of the sealing ring.</p> <p>Note</p> <p>Make sure that the sealing ring is attached correctly on the gearbox.</p>	<p>Mercasol</p>  <p>xx1500002350</p>
3	Lift the gearbox up onto the guide pins.	 <p>xx1500002338</p>
4	<p>Note</p> <p>The axis-3 gearbox shall, on the side shown in the figure, be attached to the frame. The other side of the gearbox will be attached to the parallel arm.</p>	 <p>xx1500002347</p>
5	<p>Attach (but do not torque) three M16x130 screws with six-hole washers underneath, in a triangle and use them alternately to press the gearbox into position.</p> <p>Note</p> <p>The six-hole washers are needed for protection of the gearbox surface, when screws are attached.</p>	<p>Attachment screws: M16x130 12.9 Gleitmo</p>  <p>xx1500002368</p>

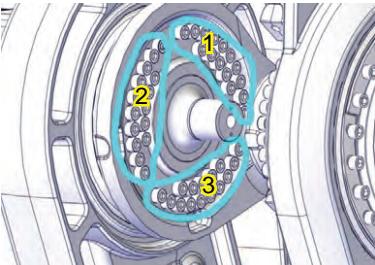
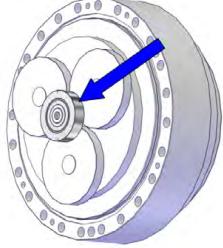
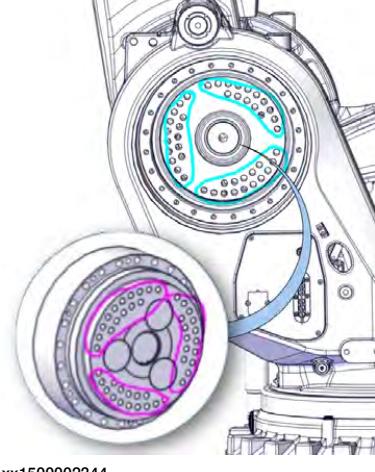
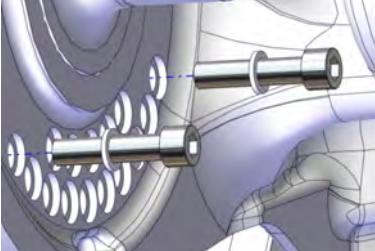
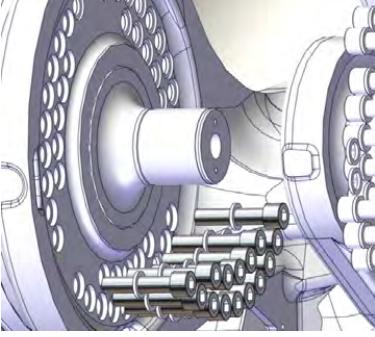
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4 Repair

4.8.4 Replacing the axis-3 gearbox

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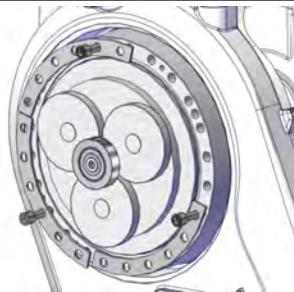
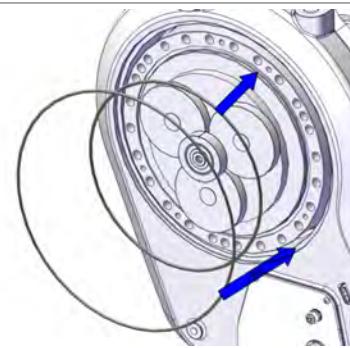
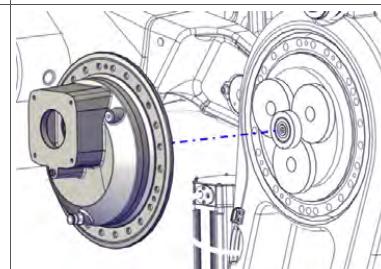
Attaching the axis-3 gearbox to parallel arm - screws in area 3

	Action	Note
1	Find area 3.	 xx1500002974
2	Make sure that the hole pattern of the three areas of attachment screws, will match. If the hole pattern is not matching, use extreme caution and turn the small gear in the gearbox very slowly, in order to find the hole pattern.  xx1500002345	 xx1500002344
3	When the hole pattern for the attachment screws that secure the gearbox to the parallel arm, is found, begin attaching screws in area 3, in the outermost holes, of the outer ring of holes. This is done to make sure the hole pattern will be matching in the three areas of screws. If needed, use extreme caution and turn the small gear in the gearbox very slowly, to find the hole pattern.	 xx1500003117
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.

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4.8.4 Replacing the axis-3 gearbox Continued

Refitting the motor flange

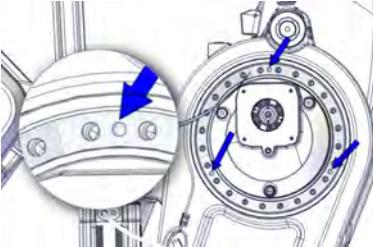
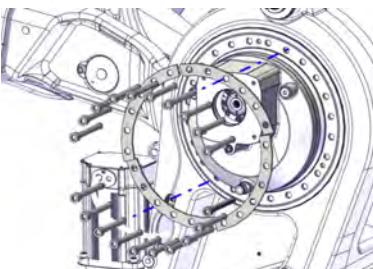
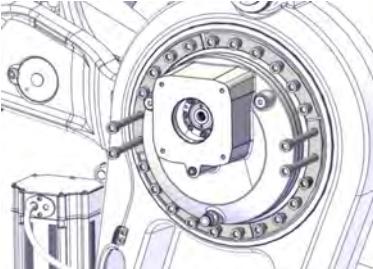
	Action	Note
1	Remove the three M16x130 screws and six-hole washers, previously attached in a triangle.	 xx1500002347
2	Clean the contact surfaces on gearbox and motor flange.	
3	Clean o-rings and o-ring groove on gearbox.	 xx1500002353
4	Inspect the o-rings. Replace if damaged!	
5	Apply some grease on the o-rings.	Grease
6	Attach the smaller o-ring in the gearbox groove.	
7	Attach the larger o-ring on the motor flange.	
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

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4 Repair

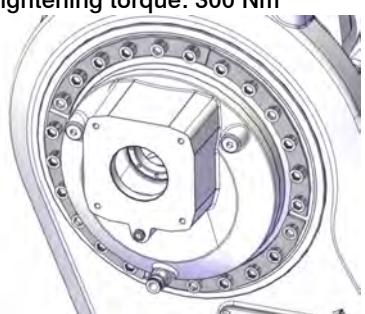
4.8.4 Replacing the axis-3 gearbox

Continued

	Action	Note
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
13	Remove the guide pins and attach the remaining screws.	 xx1500002356

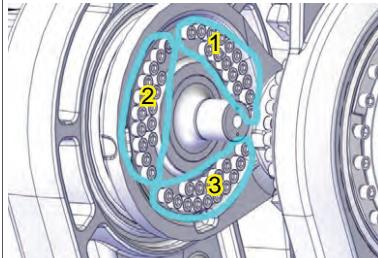
Attaching the axis-3 gearbox to frame, step 2

Use this procedure to secure the axis-3 gearbox, together with the motor flange, to the frame.

	Action	Note
1	Secure motor flange together with the gearbox, to the frame.	Tightening torque: 300 Nm  xx1500002373

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Securing the axis-3 gearbox to parallel arm - screws in area 3

	Action	Note
1	Find area 3.	 xx1500002974
2	Secure 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.	

Preparations before refitting the hub

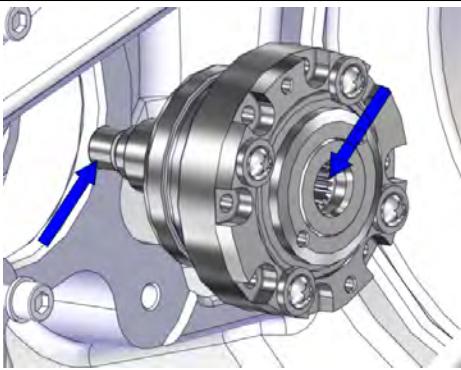
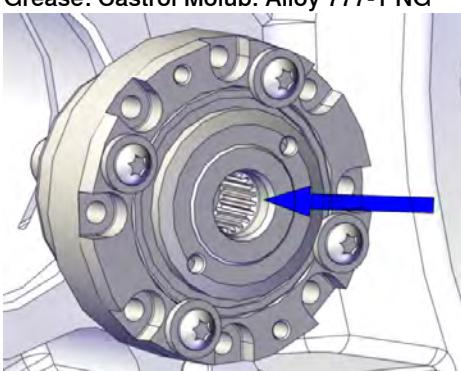
	Action	Note
1	Wipe the hub clean.	
2	Inspect the hole where the hub shall be refitted. Wipe clean if needed.	
3	 Note Replace if damaged.  xx1500002039	
4	Apply some grease on the o-ring for a better fitting.	

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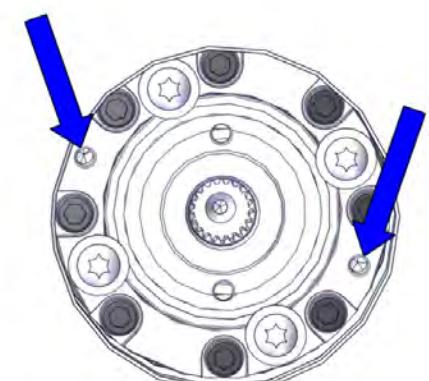
4 Repair

4.8.4 Replacing the axis-3 gearbox

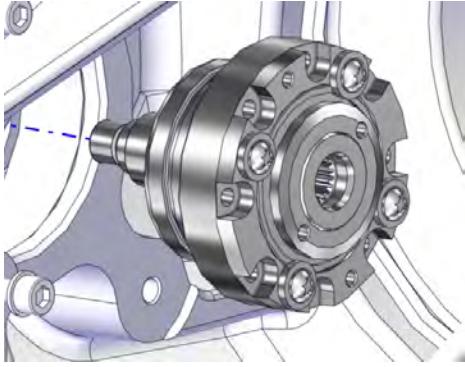
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Action	Note
5 Examine the pinion and the splines in the hub for damages.	 xx1500002082
6 Make sure that there is enough grease on the splines before fitting. If not, apply 3 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346

Refitting the hub

Action	Note
1 Attach two screws in opposite holes of the hub and use them as tools to fit the hub.	Attachment screws: M6x110 (2 pcs)  xx1500002081
2  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
3	Refit the hub.	 xx1500002326
4	Remove the two M6x110 and fit the attachment screws for the hub. Apply locking liquid (Loctite 243) on the screws. <p>Note</p> The number of attachment screws differ depending on gearbox.	Attachment screws: M6x30 12.9. Loctite 243 Quantity: <ul style="list-style-type: none"> • 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 190 .

Preparations before refitting the motor

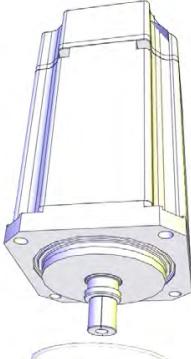
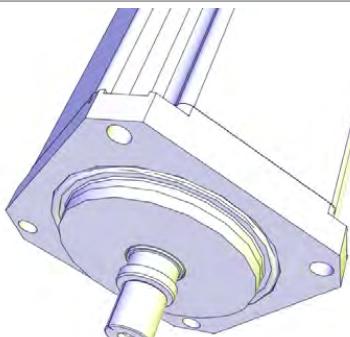
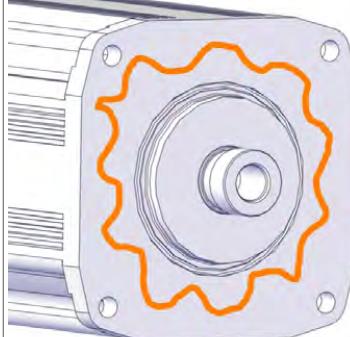
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove old paint residues and other contamination from the contact surfaces on both motor and gearbox.	
3	Wipe clean the contact surfaces from any remaining contamination. Also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

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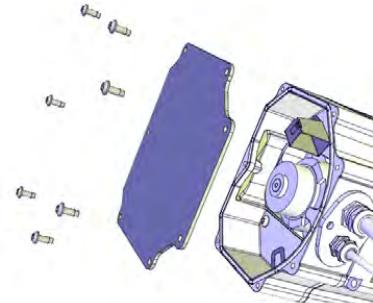
4 Repair

4.8.4 Replacing the axis-3 gearbox

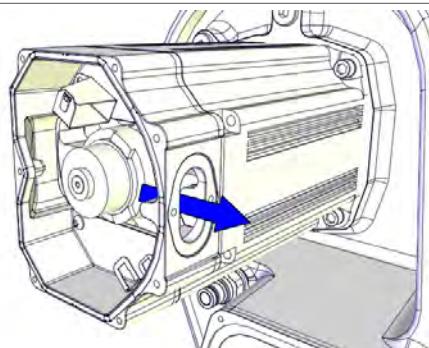
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	Action	Note
4	<p>Inspect the o-ring.</p> <p> Note</p> <p>Replace if damaged.</p>	<p>O-ring, 3HAB3772-107</p>  <p>xx1200001019</p>
5	<p>Make sure the o-ring is seated in the groove.</p> <p> Tip</p> <p>Lubricate the o-ring with some grease for a better fitting in the groove.</p>	 <p>xx1200001020</p>
6	Apply flange sealant on the motor flange.	<p>Flange sealant: Loctite 574</p>  <p>xx1500002357</p>

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	Action	Note
7	If the motor is a new spare part, remove the cover.	 xx1200001135

Securing the axis-3 motor

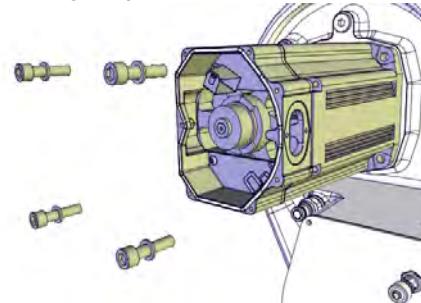
	Action	Note
1	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
2	 CAUTION The motor weighs 27 kg. All lifting accessories used must be sized accordingly!	
3	Apply the lifting accessory.	Lifting accessory, motor: 3HAC15534-1
4	 Note Make sure the cable exit hole is turned the correct way.	 xx1200001120
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	Remove the lifting accessory and allow the motor to rest on the guide pins.	
7	Apply the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool: 3HAC7887-1
8	To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP3: <ul style="list-style-type: none"> • pin 2 = 24V • pin 5 = 0V 	

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4 Repair

4.8.4 Replacing the axis-3 gearbox

Continued

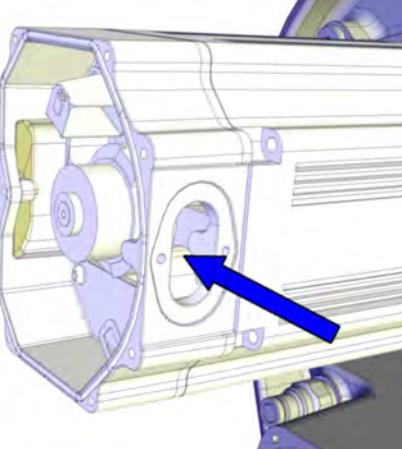
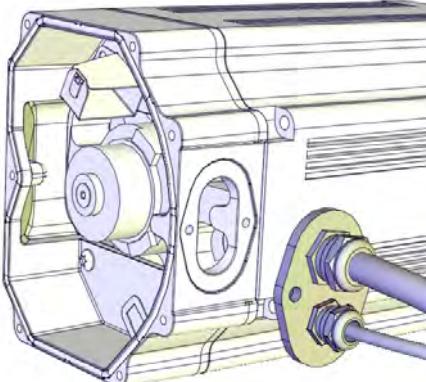
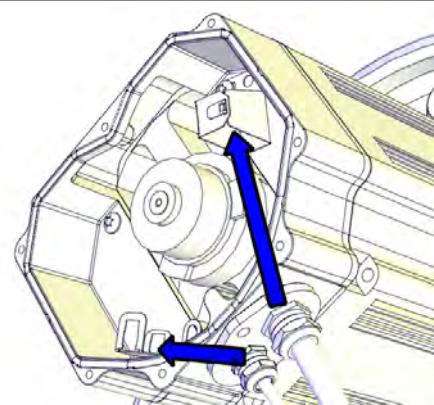
Action	Note
9  CAUTION Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used!	
10 Use caution and fit the motor in its final position while at the same time rotating the motor pinion slightly using the rotation tool. <ul style="list-style-type: none">• Make 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. See figure!	
11 Fit two of the attachment screws.	Screw dimension: M10x40 quality 12.9 Gleitmo (4 pcs)
12 Remove the guide pins and replace with the remaining attachment screws.	
13 Secure the motor with its attachment screws and washers. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1 Screw dimension: M10x40 quality 12.9 Gleitmo (4 pcs) Tightening torque: 50 Nm. 

Performing a leak-down test

Action	Note
1 Perform a leak-down test.	See Performing a leak-down test on page 190 .

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Connecting the axis-3 motor cables

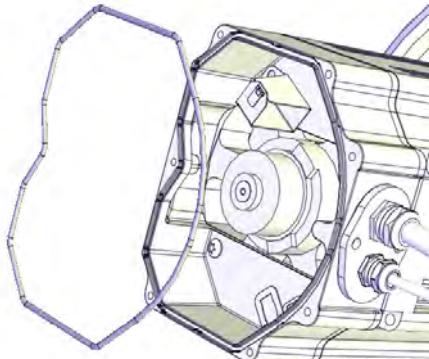
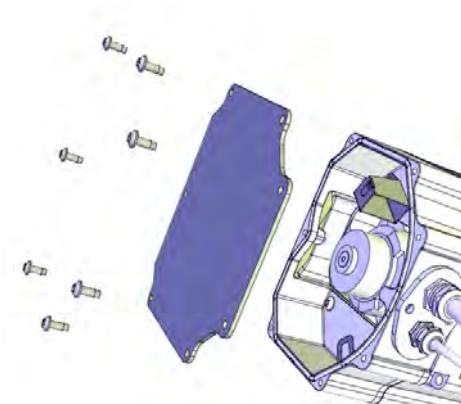
	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1300000738
2	Refit the cable gland cover. Note Replace the gasket if damaged!	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066

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4 Repair

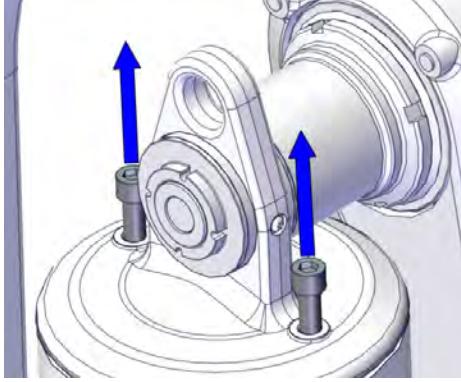
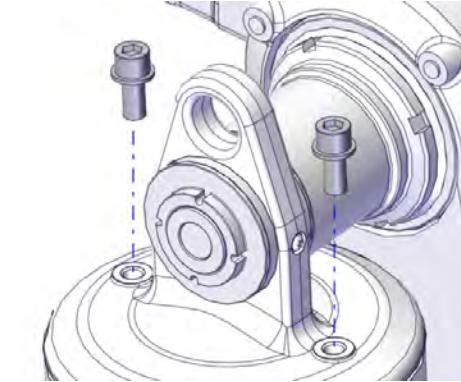
4.8.4 Replacing the axis-3 gearbox

Continued

Action	Note
4 Inspect the o-ring. 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. The threads will otherwise be damaged.  Note Make sure the o-ring is undamaged and properly fitted!	 xx1200001135
9 Make sure that the covers are tightly sealed.	

Continues on next page

Restoring the pressure of the balancing device

	Action	Note
1	<p>Use a Mobile platform ladder (or similar) to reach the upper end of the balancing device.</p> <p> DANGER</p> <p>Do not use the robot as ladder.</p>	 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.	 xx1500001971

Removing lock screws

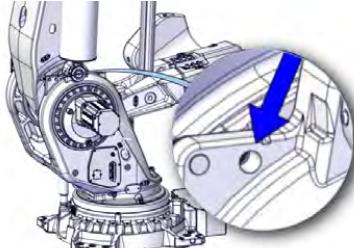
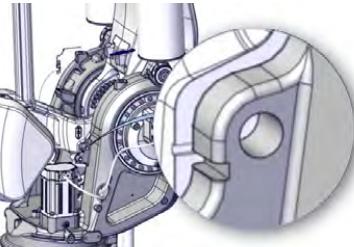
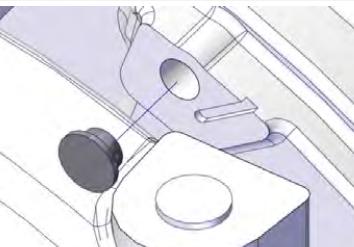
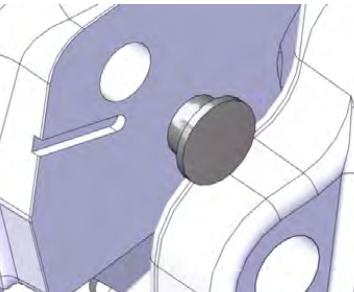
	Action	Note
1	Turn on the power.	

Continues on next page

4 Repair

4.8.4 Replacing the axis-3 gearbox

Continued

Action	Note
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
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: <ul style="list-style-type: none"> • 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. 	

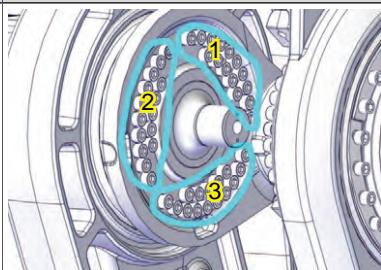
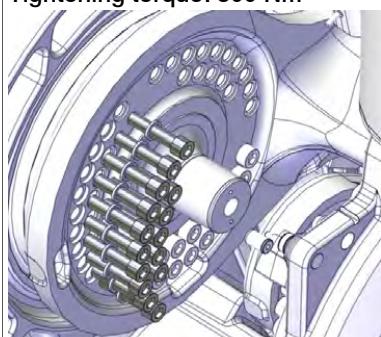
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4.8.4 Replacing the axis-3 gearbox

Continued

Action	Note
<p>2</p> <p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	

Refitting the axis-3 gearbox to parallel arm - screws in area 2

Action	Note
<p>1</p> <p>Find area 2. See figure. Do not attach and secure any screws in area 1 at this point!</p>	 <p>xx1500002974</p>
<p>2</p> <p>Attach and secure the screws, in area 2.</p>	<p>Tightening torque: 300 Nm</p>  <p>xx1500003115</p> <p>Lower arm is hidden in this figure, to get a better view.</p>
<p>3</p> <p> Tip</p> <p>To make sure that all screws in this area are torqued, use a marker pen and mark each screw after it has been torqued.</p>	
<p>4</p> <p>Examine that all screws in this area now has been torqued.</p>	

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4 Repair

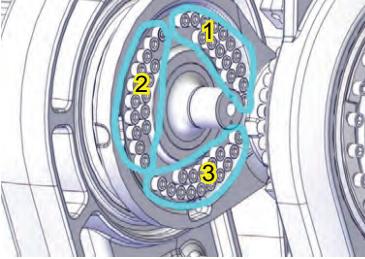
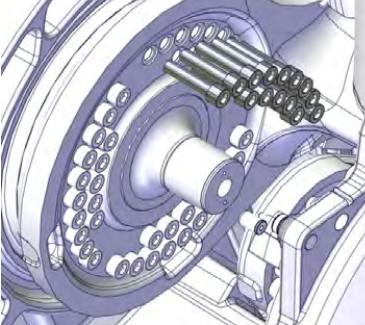
4.8.4 Replacing the axis-3 gearbox

Continued

Robot position when attaching the screws in area 1

Action	Note
1 Jog the robot to the specified position: <ul style="list-style-type: none">• 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.	
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

Refitting the axis-3 gearbox to parallel arm - screws in area 1

Action	Note
1 Find area 1.	 xx1500002974
2 Attach and secure the screws in area 1.	Tightening torque: 300 Nm  xx1500003114 Lower arm is hidden in this figure, to get a better view.

Continues on next page

	Action	Note
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.	

Concluding procedure

	Action	Note
1	Perform a leak-down test (if not already done).	See Performing a leak-down test on page 190 .
2	Refill the gearbox with oil.	See Changing oil in axis-2 and axis-3 gearbox on page 152 .
3	Recalibrate the robot.	Axis Calibration is described in Calibrating with Axis Calibration method on page 799 . General calibration information is included in section Calibration on page 789 .
4	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

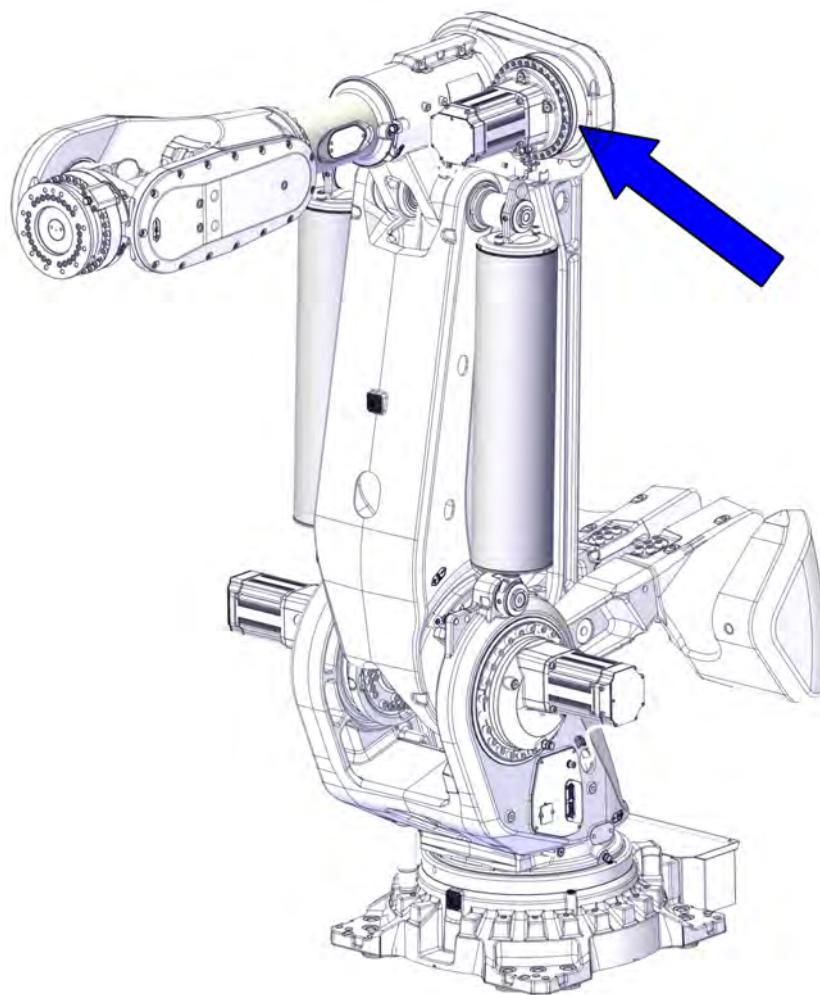
4 Repair

4.8.5 Replacing the axis-4 primary gearbox

4.8.5 Replacing the axis-4 primary gearbox

Location of the axis-4 primary gearbox

The axis-4 primary gearbox is located as shown in the figure.



xx1500002071

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Reduction Gear RV-500N-236.36	3HAC043073-003	

Continues on next page

Required tools and equipment

Equipment, etc.	Article number	Note
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.
Lifting accessory, gearbox	3HAC046128-001	
Screw M6x110	-	Fully threaded
Dial gauge		
Micrometer	-	
Rotation tool	3HAC7887-1	Used to rotate the motor pinion.
Standard toolkit	-	Content is defined in section Standard toolkit on page 825 .

Required consumables

Consumable	Article number	Note
Grease		Castrol Molub. Alloy 777-1 NG: To be used on hub splines to prevent from fretting corrosion.
Locking liquid	3HAB7116-1	Loctite 243
Flange sealant	12340011-116	Loctite 574

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. <ul style="list-style-type: none"> • 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 Repair

4.8.5 Replacing the axis-4 primary gearbox

Continued

Action	Note
<p>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.</p> <p>If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.</p>	<p>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 800.</p>
<p>If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.</p>	

Removing the axis-4 primary gearbox

Use these procedures to remove the gearbox.

Preparations before removing the gearbox

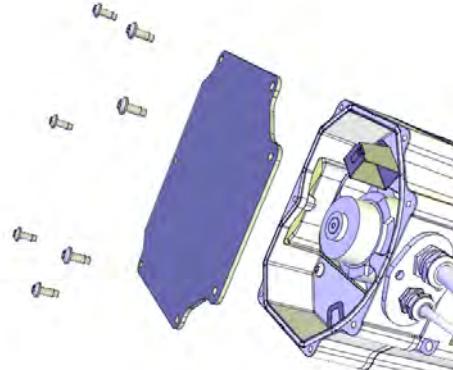
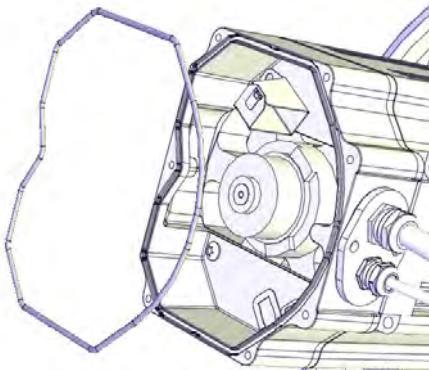
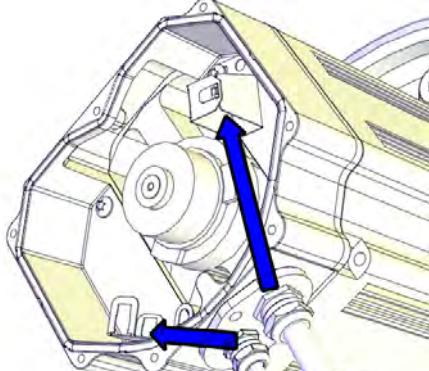
Action	Note
1 Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2 Jog the robot to the most comfortable position for removing the axis-4 primary gearbox.	
3  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
4 Start draining the oil in the axis-4 primary and secondary gearboxes.	See Draining the axis-4 primary gearbox on page 159 .

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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4.8.5 Replacing the axis-4 primary gearbox
Continued

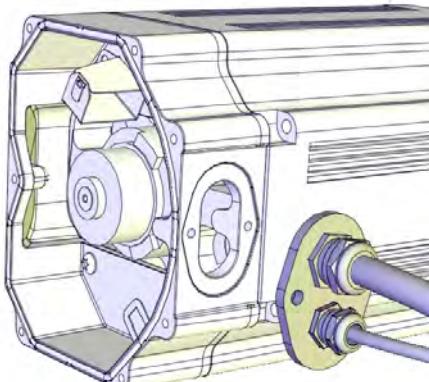
Action	Note
2 Unscrew the attachment screws with washers and remove the motor cover.	 xx1200001135
3 Make sure the o-ring is present.	 xx1200001070
4 Disconnect the motor cables.	 xx1200001066

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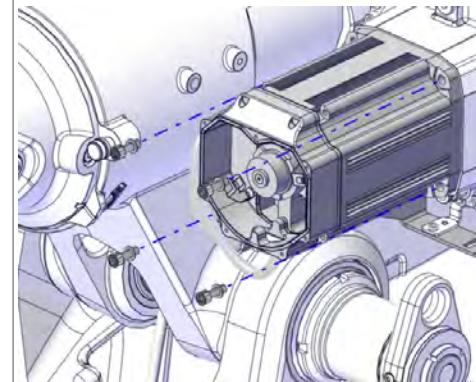
4 Repair

4.8.5 Replacing the axis-4 primary gearbox

Continued

Action	Note
<p>5 Remove the cable gland cover. Inspect the gasket.</p> <p>Note Replace if damaged.</p> <p>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.</p>	 xx1200001067
6 Use caution and pull out the motor cables.	

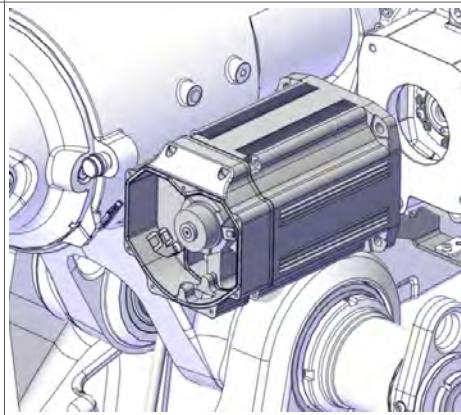
Removing the axis-4 motor

Action	Note
<p>1 CAUTION Use caution when releasing the brakes! Axis-4 can move unexpectedly, depending on the position of axis-5!</p>	
<p>2 To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP4: <ul style="list-style-type: none"> • pin 2 = 24V • pin 5 = 0V </p>	
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.
<p>5 CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.</p>	

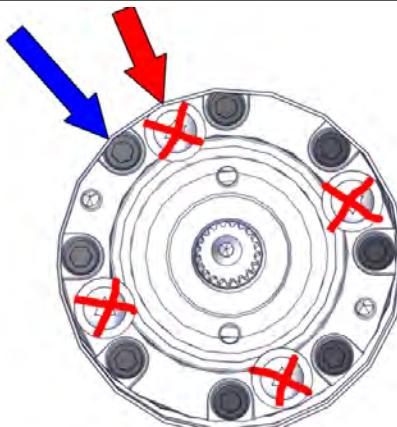
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4.8.5 Replacing the axis-4 primary gearbox

Continued

Action	Note
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.	
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.	 xx160000065
10 Disconnect the 24 VDC power supply.	

Removing the hub

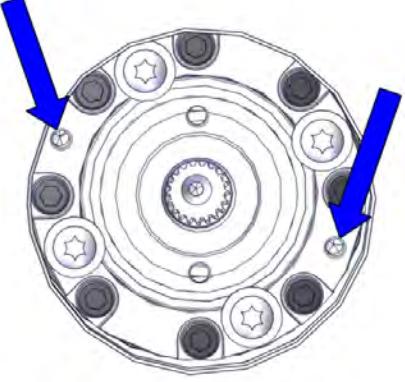
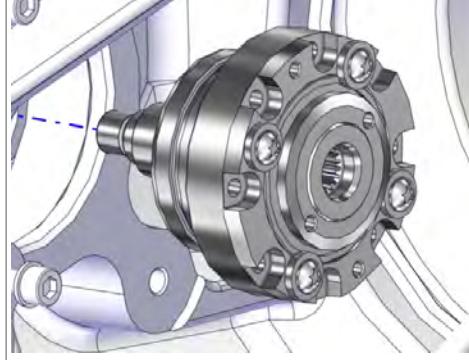
Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Unscrew the M6x30 hex socket head cap screws that secure the hub.  Note Do not remove the M6x16 torx pan head screws.	 xx1500002038

Continues on next page

4 Repair

4.8.5 Replacing the axis-4 primary gearbox

Continued

Action	Note
3  CAUTION Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	
4 Fit two screws in opposite holes of the hub and use them as removal tools.	Attachment screws: M6x110 (2 pcs)  xx1500002081
5 Lift out the hub carefully.	 xx1500002326

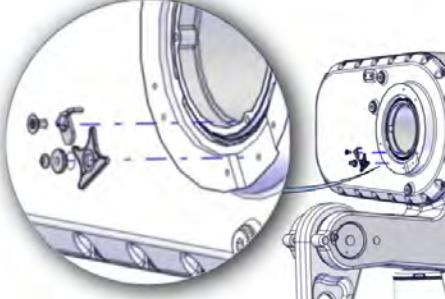
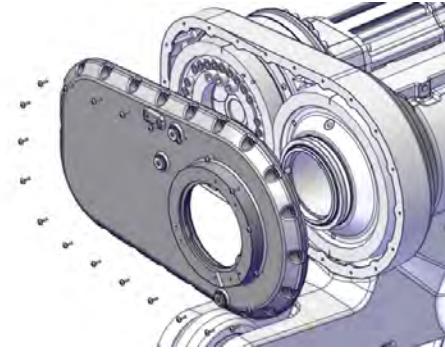
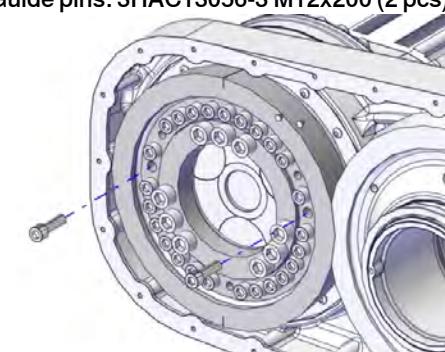
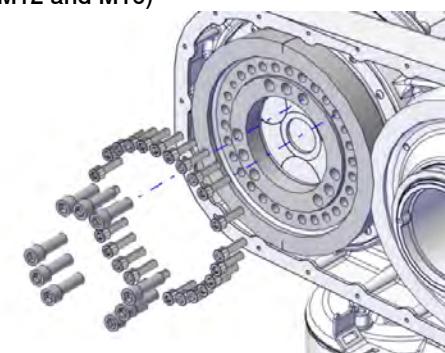
Removing the gear Z3

Action	Note
1 Make a note of the position of the revolution indicator on axis-4.  Tip Use a marker pen to indicate the position of axis-4, before the indicator is removed.	 xx1500002985

Continues on next page

4.8.5 Replacing the axis-4 primary gearbox

Continued

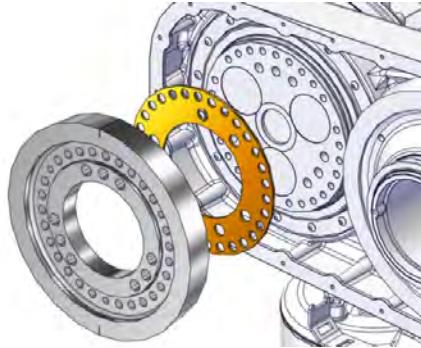
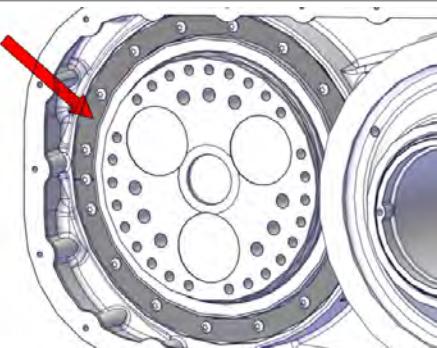
Action	Note
2 Remove the revolution indicator for axis-4.  Note Do not move axis-4 after the indicator has been removed. The indicator has to be re-fitted in the same position.	 xx1500002986
3 Remove the arm house cover.	 xx1500002987
4 Unscrew two M12 screws in opposite holes and replace them with guide pins.  Tip Put some grease on the guide pins for a better fitting.	Guide pins: 3HAC13056-3 M12x200 (2 pcs)  xx1500002988
5 Unscrew the attachment screws holding the gear.	(M12 and M16)  xx1500002989

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4 Repair

4.8.5 Replacing the axis-4 primary gearbox

Continued

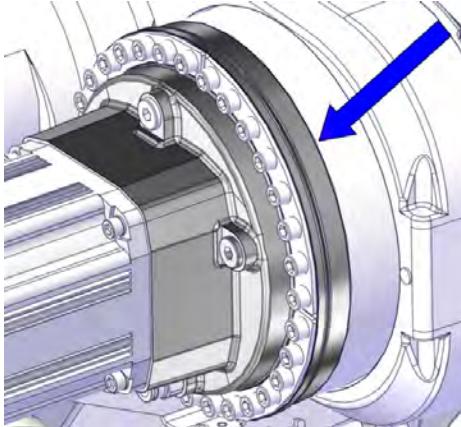
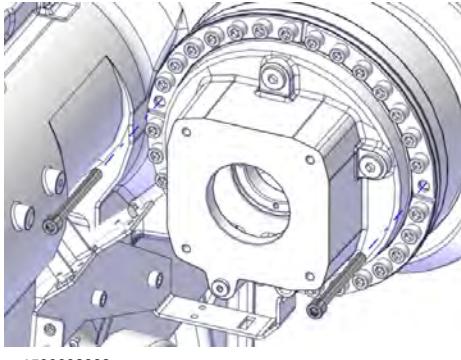
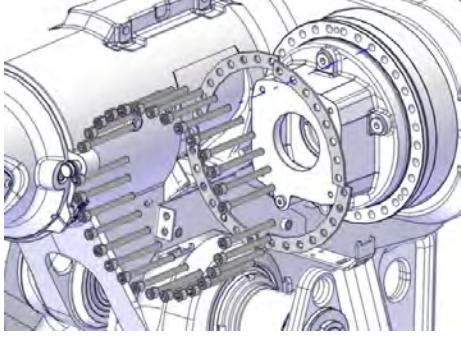
	Action	Note
6	 CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
7	 Note There is a set of shims behind the gear. Use caution when the gear is removed not to damage or drop the set of shims.	 xx1500002990
8	Use caution and remove the gear.  CAUTION The gear weighs 11 kg. All lifting accessories used must be sized accordingly.	
9	Use caution and lift the gear off.	
10	 Note Do not remove the washers shown in the figure. Underneath is a sealing which prevents oil from leaking through the screw holes that secure the axis-4 primary gearbox from the other side.	 xx1500002991

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4.8.5 Replacing the axis-4 primary gearbox

Continued

Removing the motor flange

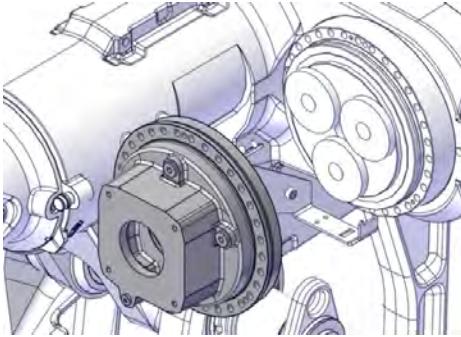
	Action	Note
1	Cut the paint and Sikaflex with a knife in the slot between motor flange and gearbox.	 xx1600000072
2	Remove two attachment screws in opposite holes.	 xx1500002993
3	Attach guide pins in the holes.  Tip Apply some grease on the guide pins for a better fitting.	Guide pins: 3HAC13056-2 M12x150 mm Guide pins: 3HAC13056-3 M12x200 mm
4	Remove the remaining attachment screws and the six-hole washers (4 pcs).	 xx1500002994

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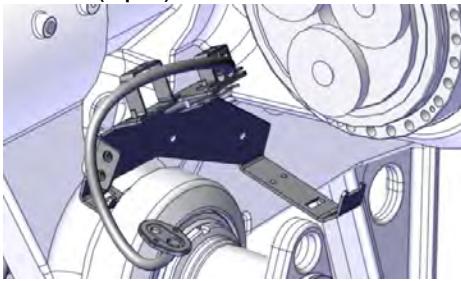
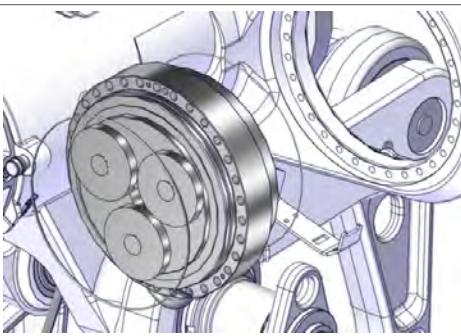
4 Repair

4.8.5 Replacing the axis-4 primary gearbox

Continued

Action	Note
5  Note There will be some oil spill when the motor cover is removed. Put some paper (or similar) to absorb the surplus oil.	
6 Use caution and remove the motor flange out from the guide pins.	 xx1500002995

Removing the axis-4 primary gearbox

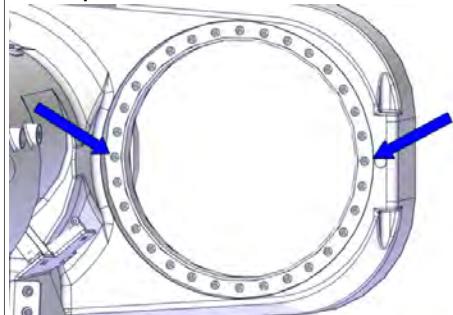
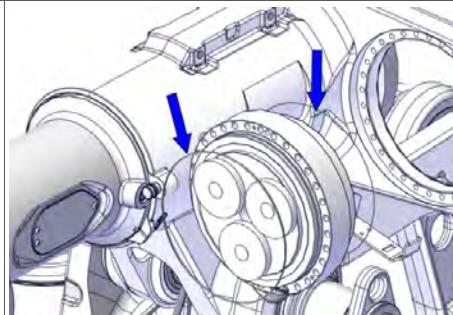
Action	Note
1 Unscrew the screws that hold the axis-3 bracket and let it hang free.	M10x16 (3 pcs)  xx1500002996
2 Attach the lifting accessories to the primary gearbox.	Lifting accessory axis-4 primary gearbox:
3 If needed, use removal tools to press out the gearbox.	
4 Lift the gearbox off.	 xx1500002997

Continues on next page

Refitting the axis-4 primary gearbox

Use these procedures to refit the gearbox.

Preparations before refitting the axis-4 primary 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 in the arm house.	
3	Wipe clean all contact surfaces on the axis-4 primary gearbox.	
4	 Tip Put some grease on the guide pins for a better fitting.	Guide pins: 3HAC13056-2 M12x150 Guide pins: 3HAC13056-3 M12x200 mm 
5	Clean the o-rings and o-ring grooves on the gearbox.	
6	 Note Replace if damaged.	

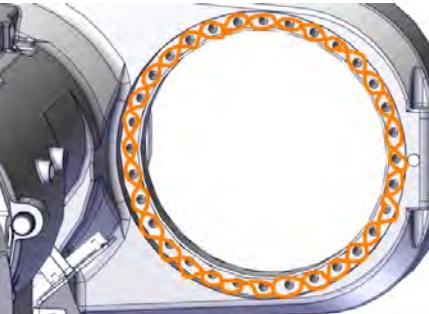
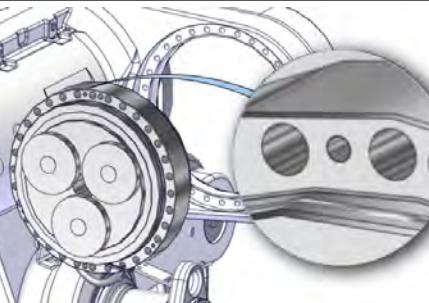
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4 Repair

4.8.5 Replacing the axis-4 primary gearbox

Continued

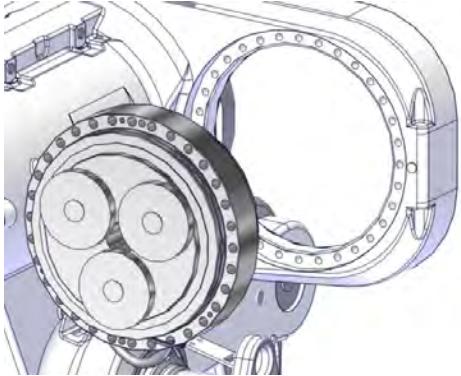
Refitting the axis-4 primary gearbox

Action	Note
1  CAUTION The axis-4 primary gearbox weighs 56 kg. All lifting accessories used must be sized accordingly.	
2 Attach the lifting accessories to the gearbox.	Lifting accessory: Roundsling 2 m: Roundsling 2 m
3 Fit the o-rings in its grooves.  Tip Put some grease on the o-ring for a better fitting.	 <small>xx1500003000</small>
4  CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
5 Apply flange sealant.	Loctite 574  <small>xx1600000073</small>
6 Make sure that one of the M8 holes in the gearbox, will be at twelve o'clock when lifting the gearbox onto the guide pins.	 <small>xx1500003072</small>

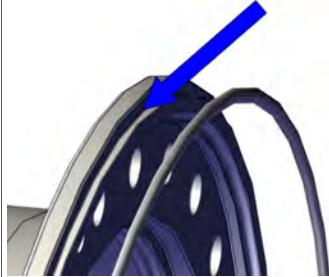
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4.8.5 Replacing the axis-4 primary gearbox

Continued

Action	Note
7 Use caution and lift the gearbox onto the guide pins.	 xx1500003073
8 Slide the gearbox on the guide pins into mounting position.  Note Do not secure the gearbox at this point. It will be secured together with the motor flange, when the motor flange is refitted.	
9 Remove the lifting accessories.	

Refitting the motor flange

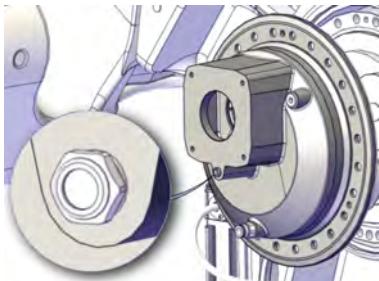
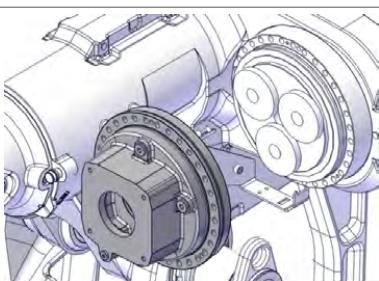
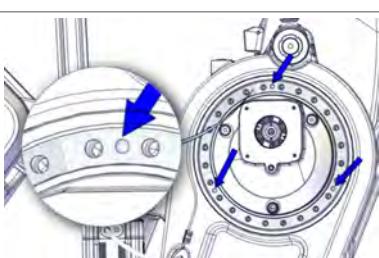
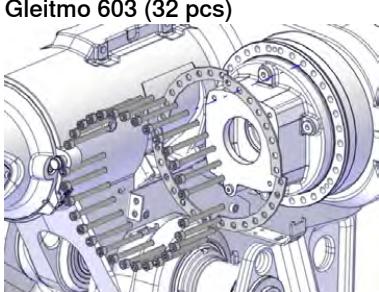
Action	Note
1 Clean the contact surfaces on gearbox and motor flange.	
2 Clean o-ring and o-ring groove on motor flange.	 xx1500003074
3 Inspect the o-ring.  Note Replace if damaged.	
4 Put some grease on the o-ring and fit it into its groove.	

Continues on next page

4 Repair

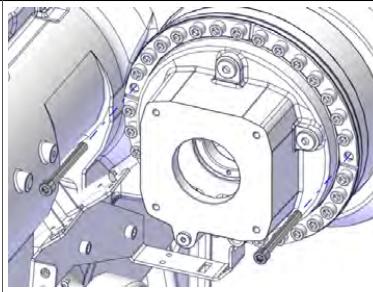
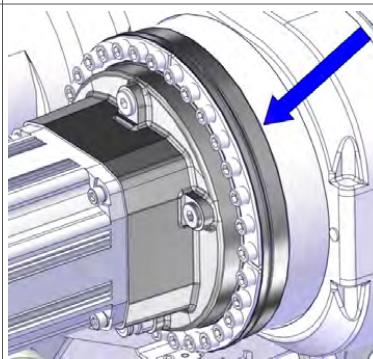
4.8.5 Replacing the axis-4 primary gearbox

Continued

	Action	Note
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
9	Attach 30 of the 32 attachment screws with the four six-hole washers.	Attachment screws: M12x110 12.9 Gleitmo 603 (32 pcs)  xx1500002994

Continues on next page

4.8.5 Replacing the axis-4 primary gearbox *Continued*

	Action	Note
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

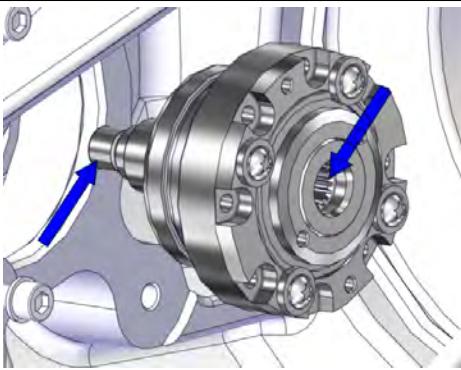
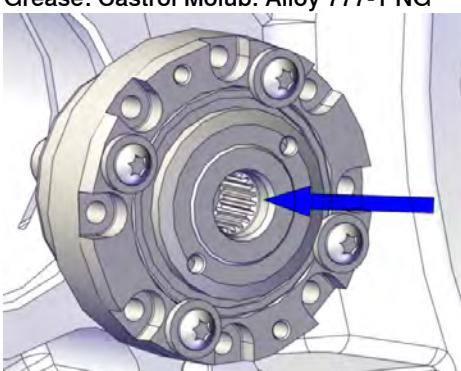
	Action	Note
1	Wipe the hub clean.	
2	Inspect the hole where the hub shall be refitted. Wipe clean if needed.	
3	<p>Make sure the o-ring on the hub is undamaged.</p> <p> Note</p> <p>Replace if damaged.</p>	 xx1500002039
4	Apply some grease on the o-ring for a better fitting.	

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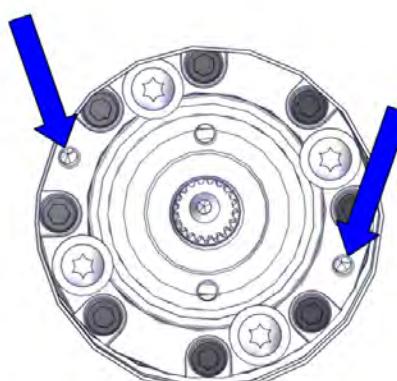
4 Repair

4.8.5 Replacing the axis-4 primary gearbox

Continued

Action	Note
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 3 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346

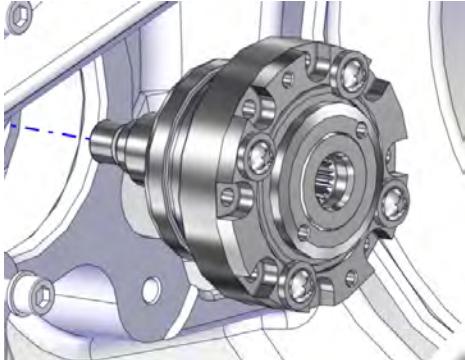
Refitting the hub

Action	Note
1 Attach two screws in opposite holes of the hub and use them as tools to fit the hub.	Attachment screws: M6x110 (2 pcs)  xx1500002081
2  CAUTION Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	

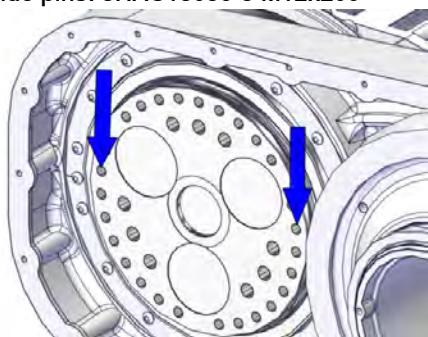
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4.8.5 Replacing the axis-4 primary gearbox

Continued

Action	Note
3 Refit the hub.	 xx1500002326
4 Remove the two M6x110 and fit the attachment screws for the hub. Apply locking liquid (Loctite 243) on the screws.  Note The number of attachment screws differ depending on gearbox.	Attachment screws: M6x30 12.9. Loctite 243 Quantity: <ul style="list-style-type: none">• 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.

Refitting the gear Z3 - step 1

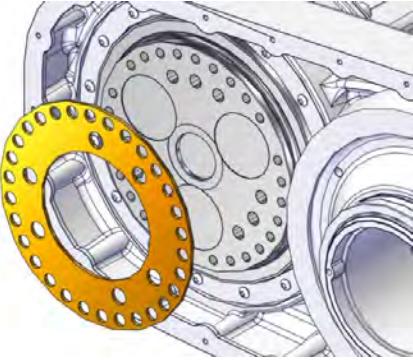
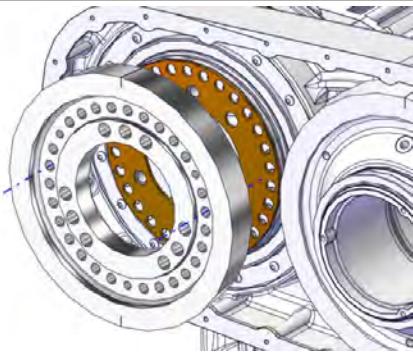
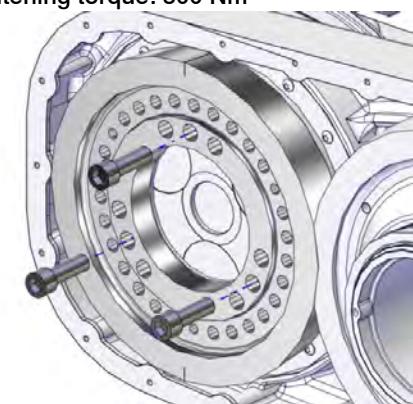
Action	Note
1 Wipe clean the contact surfaces.	
2 Attach guide pins in opposite holes.  Tip Put some grease on the guide pins for a better fitting.	Guide pins: 3HAC13056-2 M12x150 Guide pins: 3HAC13056-3 M12x200  xx1500003076

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4 Repair

4.8.5 Replacing the axis-4 primary gearbox

Continued

	Action	Note
3	<p>Put 6 mm of shims on the guide pins.</p> <p> Note</p> <p>The gear must never be attached with minus play. Always start with 6 mm shims.</p>	 xx1500003077
4	Put the axis-4 gear on the guide pins.	 xx1500003078
5	Secure the gear and shims with three of the nine M16x50 screws. Attach screws in a triangle.	Attachment screws: M16x50 12.9 Gleitmo 603 Tightening torque: 300 Nm  xx1500003079
6	Remove the guide pins.	

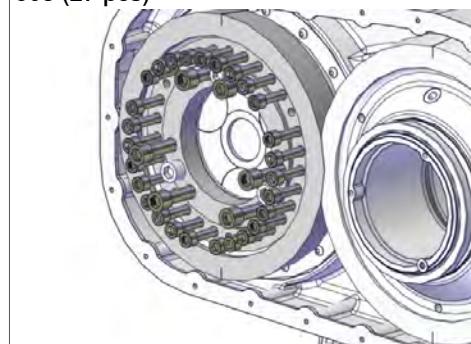
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Measuring the play

	Action	Note
1	Measure the play in three places, with a dial gauge with magnetic base.  Note It shall be 90° between the dial indicator arm and the magnetic base, and 90° between the arm to the dial indicator.	Dial gauge
2	Disassemble the gear.	
3	Use the instruction in this step and reduce the number of shims: Example: If the measured value is 0.14 mm and 1.4 mm of shims are removed, it will theoretically end up as zero. The value must never be lower than the minimum gap around a complete revolution or the gear.	
4	Put shims according to the obtained measurement and control with a micrometer that the value is correct.	Micrometer
5	Secure the gear with three of the M16x50 screws attached in a triangle.	Tightening torque: 300 Nm
6	Measure the play again. If the measured result deviates too much, the gear must be disassembled and the number of shims be adjusted.	

Refitting the axis-4 gear Z3 - Step 2

	Action	Note
1	When the play is measured and approved, fit the remaining attachment screws.	Attachment screws: M16x50 12.9 Gleitmo 603 (9 pcs) Attachment screws: M12x40 12.9 Gleitmo 603 (27 pcs)
2	Secure the M16 screws.	Tightening torque: 300 Nm
3	Secure the M12 screws.	Tightening torque: 120 Nm

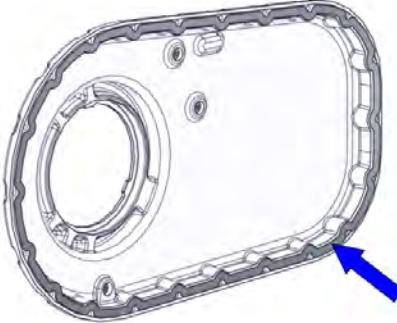
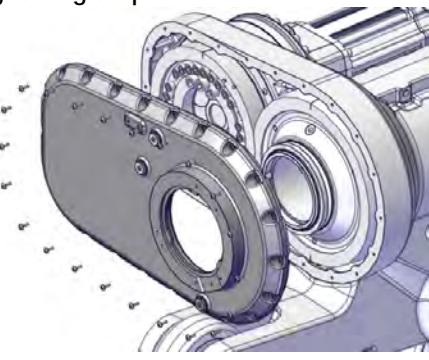


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4 Repair

4.8.5 Replacing the axis-4 primary gearbox

Continued

Action	Note
4 Inspect the gasket on the arm house cover.  Note Replace if damaged.	 xx1500002992
5 Apply flange sealant (Loctite 574) on the cover flange.	Loctite 574
6 Attach the arm house cover and tighten all screws alternately and repeat once. Apply locking liquid (Loctite 243) on the screws.	Attachment screws: M6x16 (22 pcs) Tightening torque: 10 Nm  xx1500002987
7 Perform a leak-down test.	See Performing a leak-down test on page 190 .

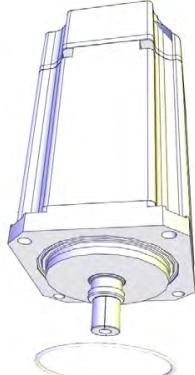
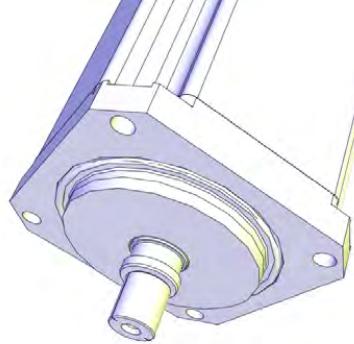
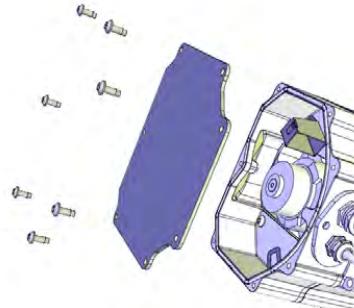
Preparations before refitting the axis-4 motor

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.	

Continues on next page

4.8.5 Replacing the axis-4 primary gearbox

Continued

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 If the motor is a new spare part, remove the cover.	 xx1200001135

Securing the axis-4 motor

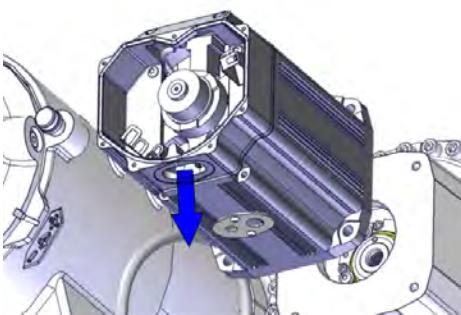
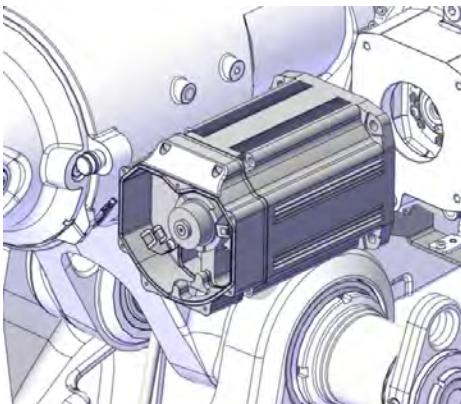
Action	Note
1 Apply two guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
2 Put the motor onto the guide pins.	

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4 Repair

4.8.5 Replacing the axis-4 primary gearbox

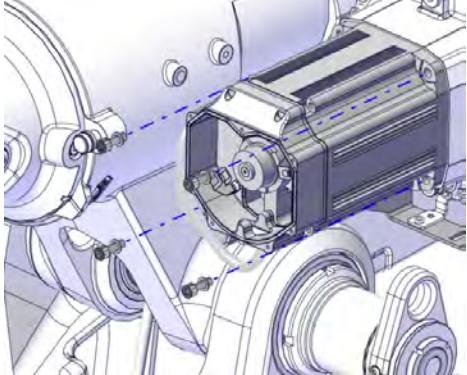
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Action	Note
3  Note Make sure the cable exit hole are turned the correct way.	 xx1600000066
4  CAUTION The motor weighs 27 kg. All lifting accessories used must be sized accordingly.	
5 Apply the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool: 3HAC7887-1
6 To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP2: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	
7  CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
8 Use caution and push the motor in position while at the same time the motor pinion is slightly rotated. <ul style="list-style-type: none">• 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.	

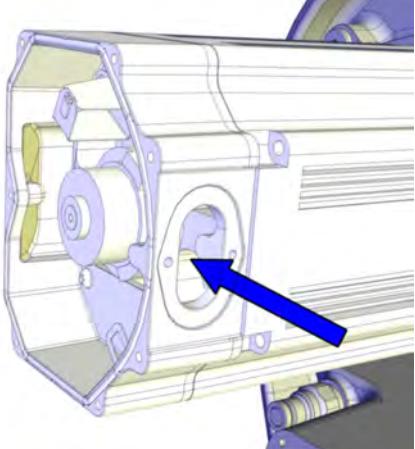
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4.8.5 Replacing the axis-4 primary gearbox

Continued

Action	Note
10 Secure the motor with its attachment screws and washers.	Tightening torque: 50 Nm. Screw dimension: M10x30 quality 12.9 Gleitmo (4 pcs)  xx160000064
11 Perform a leak-down test.	See Performing a leak-down test on page 190 .
12 Disconnect the 24 VDC power supply.	

Connecting the axis-4 motor cables

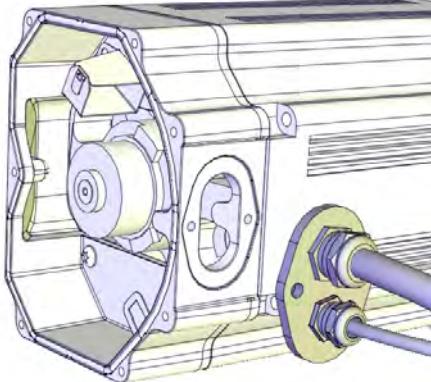
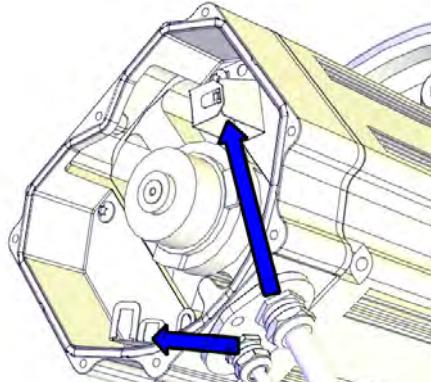
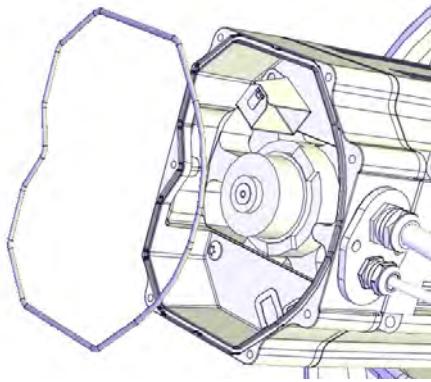
Action	Note
1 Push the motor cables through the cable gland opening.	 xx1300000738

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4 Repair

4.8.5 Replacing the axis-4 primary gearbox

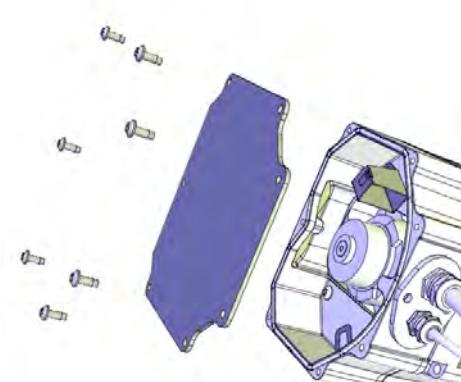
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Action	Note
2 Refit the cable gland cover.	 Note Replace the gasket if damaged.  xx1200001067
3 Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066
4 Inspect the o-ring.	 Note Replace if damaged. O-ring: 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 are damaged.	

Continues on next page

4.8.5 Replacing the axis-4 primary gearbox

Continued

	Action	Note
8	<p>Refit the motor cover with its attachment screws.</p> <p>Note Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged.</p> <p>Note Make sure the o-ring is undamaged and properly fitted.</p>	 <p>xx1200001135</p>
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 158 .
2	Refill oil in the axis-4 secondary gearbox.	See Changing oil, axis-4 secondary gearbox on page 164 .
3	Recalibrate the robot.	Axis Calibration is described in Calibrating with Axis Calibration method on page 799 . General calibration information is included in section Calibration on page 789 .
4	<p> DANGER</p> <p>Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46.</p>	

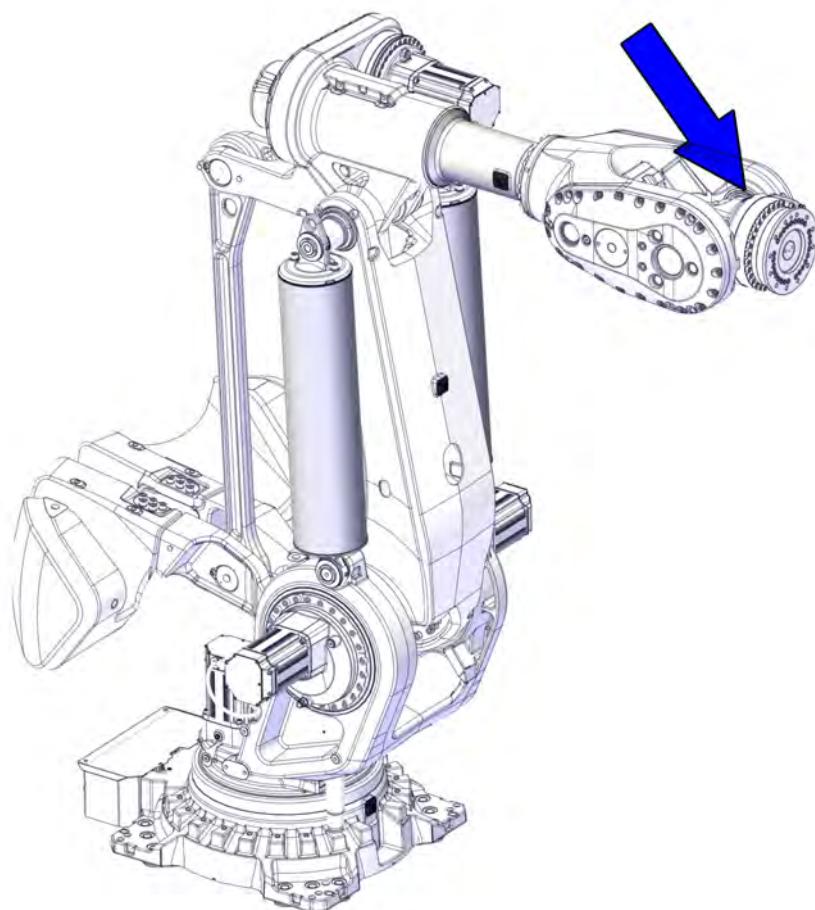
4 Repair

4.8.6 Replacing the axis-6 gearbox

4.8.6 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 revision of *Product manual, spare parts - IRB 8700* on ABB Library.

Spare part	Article number	Note
Reduction Gear RV-500N-236.36	3HAC043073-003	

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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 825 .

Required consumables

Consumable	Article number	Note
Grease		Castrol Molub. Alloy 777-1 NG: 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. <ul style="list-style-type: none"> • 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 800 .
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Removing the gearbox

Use these procedures to remove the gearbox.

Preparations before removing the gearbox

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

Continues on next page

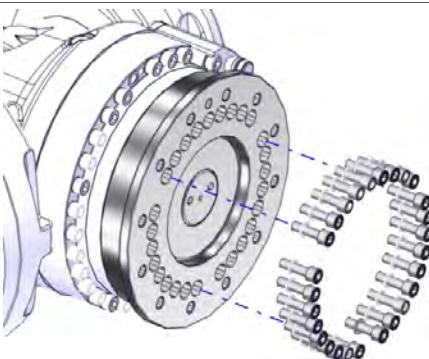
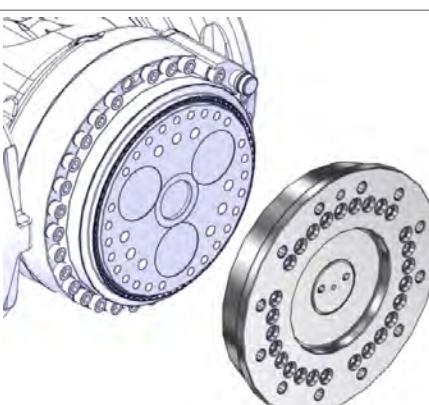
4 Repair

4.8.6 Replacing the axis-6 gearbox

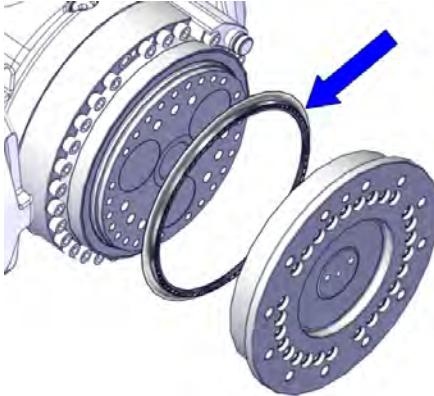
Continued

Action	Note
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 <p style="text-align: center;"> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	
4 Remove all tools and other equipment fitted to the turning disc.	

Removing the turning disc

Action	Note
1 <p style="text-align: center;"> DANGER</p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
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	<p>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.</p> <p> Note</p> <p>On a new gearbox, the sealing ring must be removed from the old gearbox, and fitted on the new one.</p>	 xx1600000074

Removing the process turning disc

	Action	Note
1	<p> DANGER</p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	<p> CAUTION</p> <p>The process turning disc weighs 50 kg. All lifting accessories must be sized accordingly.</p>	
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 disc.	
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

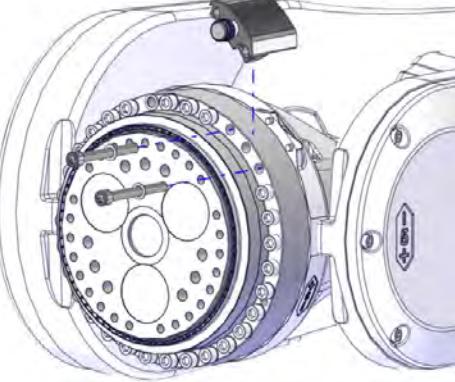
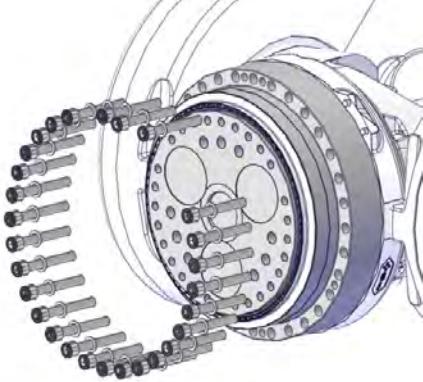
	Action	Note
1	<p> DANGER</p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	

Continues on next page

4 Repair

4.8.6 Replacing the axis-6 gearbox

Continued

Action	Note
2 To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP6: <ul style="list-style-type: none">• pin 2 = 24V• pin 5 = 0V	
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
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.	

Continues on next page

	Action	Note
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.	

Refitting the axis-6 gearbox

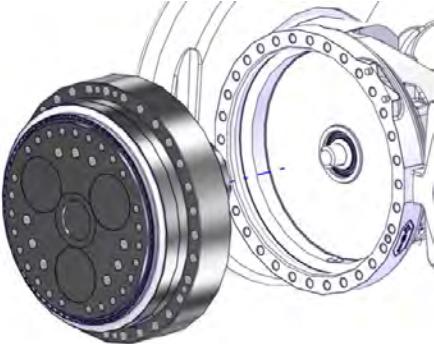
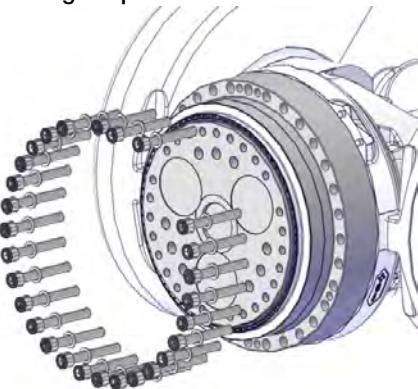
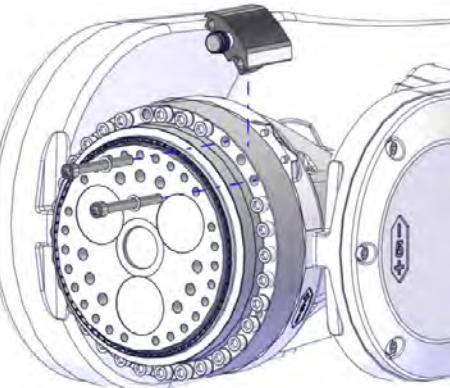
	Action	Note
1	 DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 CAUTION Whenever parting/mating hub and gearbox, the splines may be damaged if excessive force is used!	
3	To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP6: <ul style="list-style-type: none"> • pin 2 = 24V • pin 5 = 0V 	

Continues on next page

4 Repair

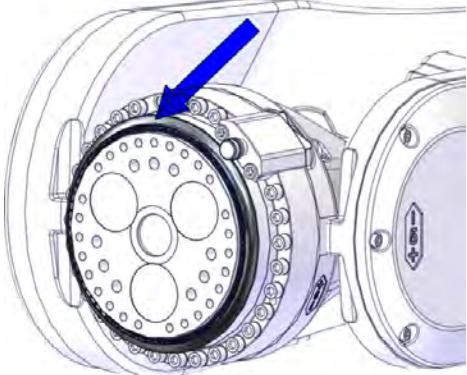
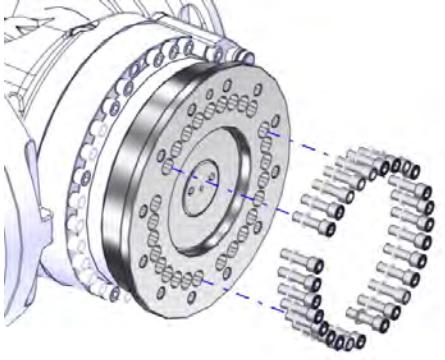
4.8.6 Replacing the axis-6 gearbox

Continued

Action	Note
4 Use caution and refit the gearbox.	 xx1500002983
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

Continues on next page

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

Continues on next page

4 Repair

4.8.6 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 Recalibrate the robot.	Axis Calibration is described in Calibrating with Axis Calibration method on page 799 . General calibration information is included in section Calibration on page 789 .
2  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 46 .	

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 799](#).

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 generates a new zero position of the robot. 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.
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 Calibration

5.1.2 Calibration methods

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	<p>The calibrated robot is positioned at calibration position.</p> <p>Standard calibration data is found on the SMB (serial measurement board) or EIB in the robot.</p> <p>For robots with RobotWare 5.04 or older, the calibration data is delivered in a file, calib.cfg, supplied with the robot at delivery. The file identifies the correct resolver/motor position corresponding to the robot home position.</p>	Axis Calibration
Absolute accuracy calibration (optional)	<p>Based on standard calibration, and besides positioning the robot at synchronization position, the Absolute accuracy calibration also compensates for:</p> <ul style="list-style-type: none">Mechanical tolerances in the robot structureDeflection due to load <p>Absolute accuracy calibration focuses on positioning accuracy in the Cartesian coordinate system for the robot.</p> <p>Absolute accuracy calibration data is found on the SMB (serial measurement board) in the robot.</p> <p>For robots with RobotWare 5.05 or older, 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.</p> <p>A robot calibrated with absolute accuracy has a sticker next to the identification plate of the robot.</p> <p>To regain 100% absolute accuracy performance, the robot must be recalibrated for absolute accuracy!</p>  <p>ABSOLUTE ACCURACY</p> <p>xx0400001197</p> <p>3HAC 14257-1</p>	CalibWare

Brief description of calibration methods

Axis Calibration method

Axis Calibration is a standard calibration method for calibration of IRB 8700 and is the most accurate method for the standard calibration. It is the recommended method in order to achieve proper performance.

Continues on next page

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 799](#).

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.

CalibWare - Absolute Accuracy calibration

To achieve a good positioning in the Cartesian coordinate system, Absolute Accuracy calibration is used as a TCP calibration. The CalibWare tool guides through the calibration process and calculates new compensation parameters. This is further detailed in the *Application manual - CalibWare Field 5.0*.

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 motor and transmission replacements that do not include taking apart the robot structure, standard calibration is sufficient. Standard calibration also supports wrist exchange.

References

Article numbers for the calibration tools are listed in the section [Special tools on page 826](#).

5 Calibration

5.1.3 When to calibrate

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 recalibrated 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 795](#). 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 reach ability of a robot is changed, it needs to be recalibrated 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

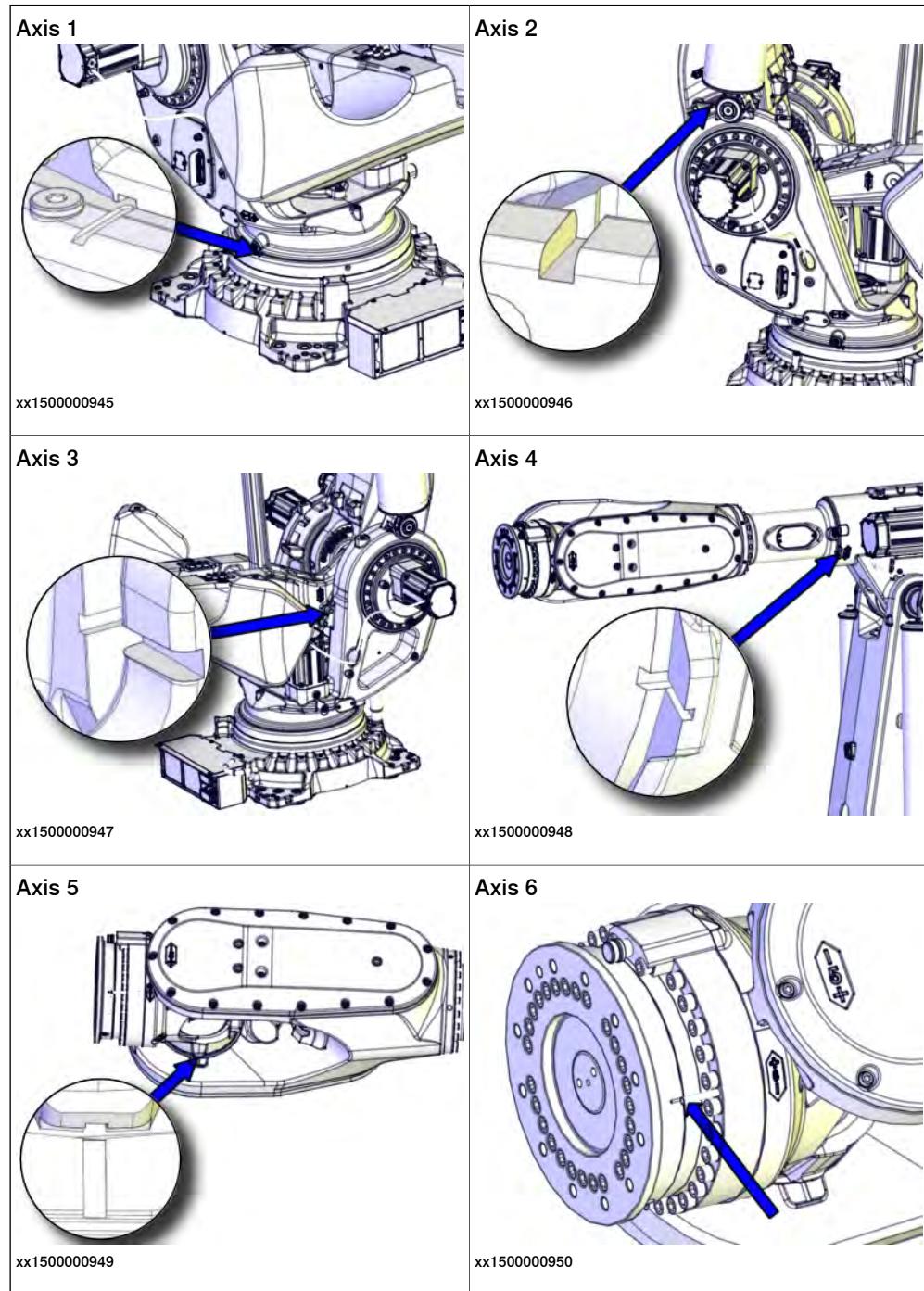
5.2 Synchronization marks and axis movement directions

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



5 Calibration

5.2.2 Calibration movement directions for all axes

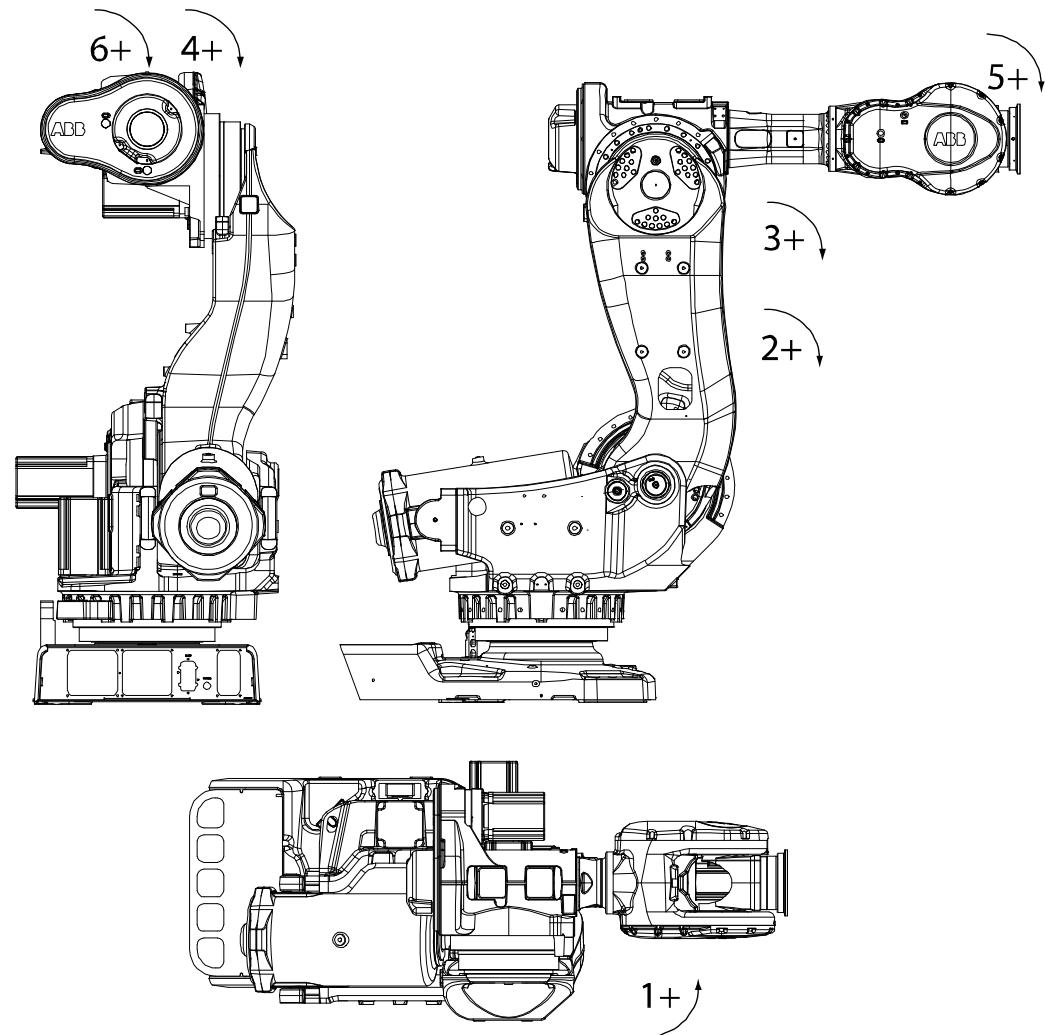
Overview

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!



xx0200000089

5.3 Updating revolution counters

Introduction

This section describes how to do a rough calibration of each manipulator axis by updating the revolution counter for each axis, using the FlexPendant.

Step 1 - Manually running the manipulator to the synchronization position

Use this procedure to manually run the manipulator to the synchronization position.

	Action	Note
1	Select axis-by-axis motion mode.	
2	Jog the manipulator to align the synchronization marks.	See Synchronization marks and synchronization position for axes on page 793 .
3	When all axes are positioned, update the revolution counter.	Step 2 - Updating the revolution counter with the FlexPendant on page 796 .

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.

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).

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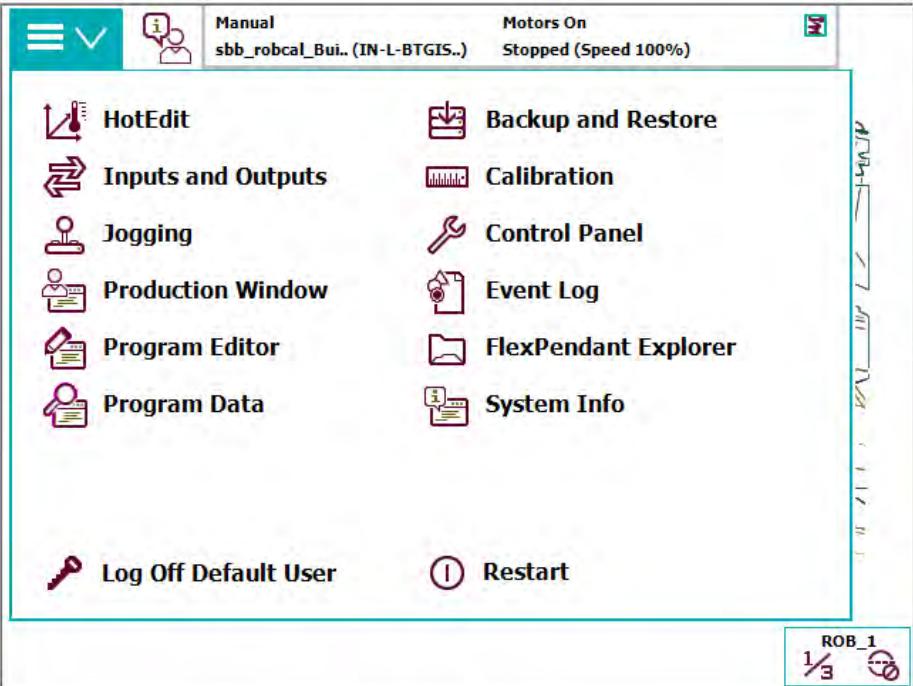
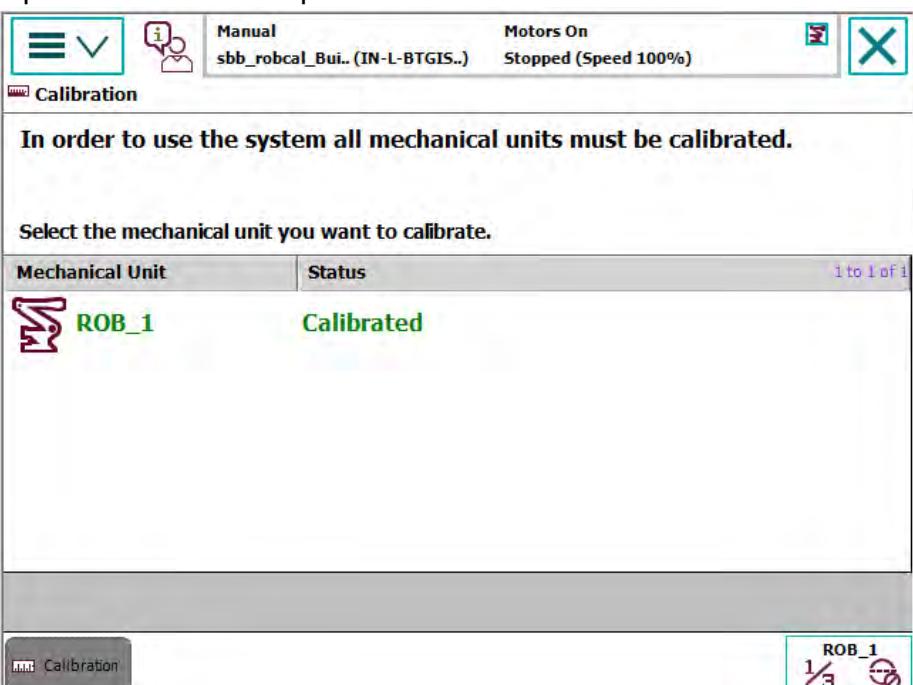
5 Calibration

5.3 Updating revolution counters

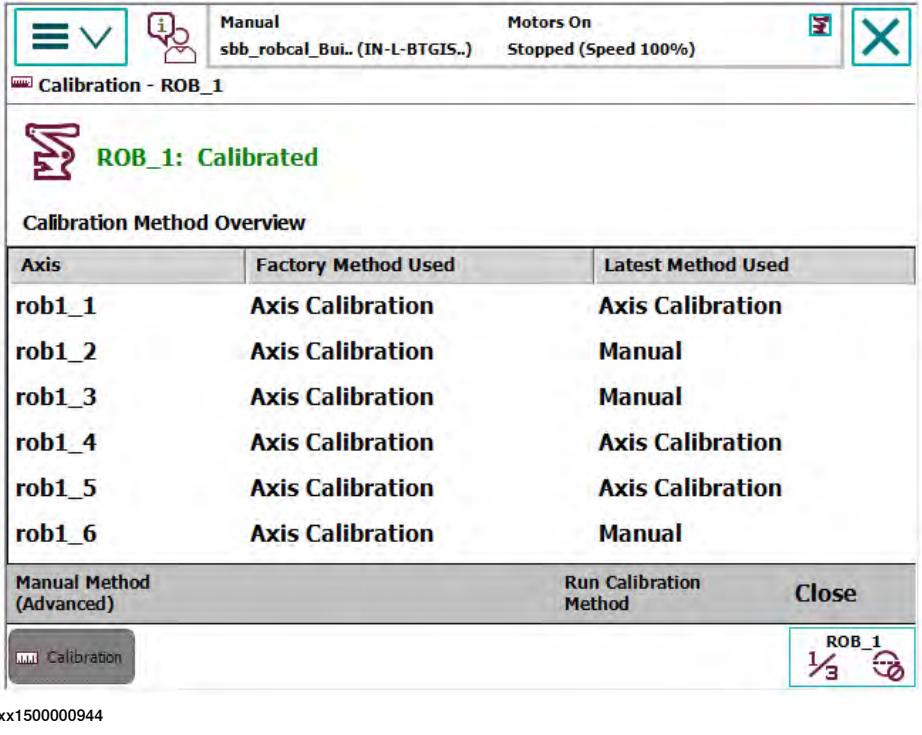
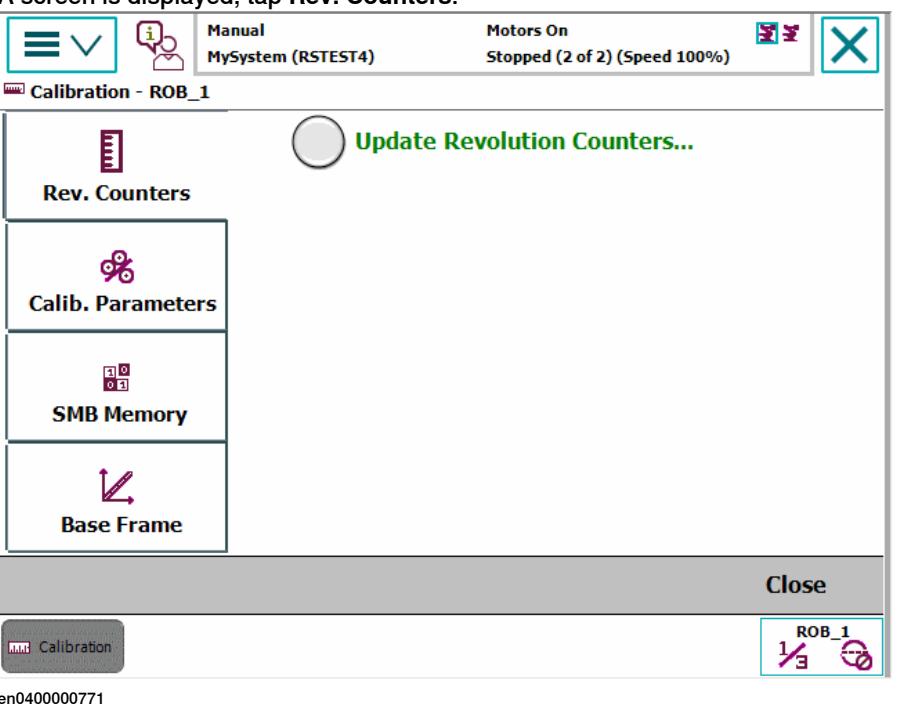
Continued

Step 2 - Updating the revolution counter with the FlexPendant

Use this procedure to update the revolution counter with the FlexPendant (IRC5).

	Action
1	<p>On the ABB menu, tap Calibration.</p>  <p>The screenshot shows the ABB menu interface. At the top, it says "Manual sbb_robcal_Bui.. (IN-L-BTGIS..)" and "Motors On Stopped (Speed 100%)". Below this is a grid of icons and labels: HotEdit, Backup and Restore; Inputs and Outputs, Calibration; Jogging, Control Panel; Production Window, Event Log; Program Editor, FlexPendant Explorer; Program Data, System Info. At the bottom are two buttons: "Log Off Default User" and "Restart". A status bar at the bottom left says "xx1500000942".</p>
2	<p>All mechanical units connected to the system are shown with their calibration status. Tap the mechanical unit in question.</p>  <p>The screenshot shows the "Calibration" screen. At the top, it says "Manual sbb_robcal_Bui.. (IN-L-BTGIS..)" and "Motors On Stopped (Speed 100%)". Below this is a table titled "Select the mechanical unit you want to calibrate." with columns "Mechanical Unit" and "Status". It shows one entry: "ROB_1" with "Calibrated" status. A large red "X" button is in the top right corner. A status bar at the bottom left says "xx1500000943".</p>

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	Action																					
3	<p>This step is valid for RobotWare 6.02 and later.</p> <p>Calibration method used at factory for each axis is shown, as well as calibration method used during last field calibration.</p> <p>Tap Manual Method (Advanced).</p>  <table border="1"> <thead> <tr> <th>Axis</th> <th>Factory Method Used</th> <th>Latest Method Used</th> </tr> </thead> <tbody> <tr> <td>rob1_1</td> <td>Axis Calibration</td> <td>Axis Calibration</td> </tr> <tr> <td>rob1_2</td> <td>Axis Calibration</td> <td>Manual</td> </tr> <tr> <td>rob1_3</td> <td>Axis Calibration</td> <td>Manual</td> </tr> <tr> <td>rob1_4</td> <td>Axis Calibration</td> <td>Axis Calibration</td> </tr> <tr> <td>rob1_5</td> <td>Axis Calibration</td> <td>Axis Calibration</td> </tr> <tr> <td>rob1_6</td> <td>Axis Calibration</td> <td>Manual</td> </tr> </tbody> </table>	Axis	Factory Method Used	Latest Method Used	rob1_1	Axis Calibration	Axis Calibration	rob1_2	Axis Calibration	Manual	rob1_3	Axis Calibration	Manual	rob1_4	Axis Calibration	Axis Calibration	rob1_5	Axis Calibration	Axis Calibration	rob1_6	Axis Calibration	Manual
Axis	Factory Method Used	Latest Method Used																				
rob1_1	Axis Calibration	Axis Calibration																				
rob1_2	Axis Calibration	Manual																				
rob1_3	Axis Calibration	Manual																				
rob1_4	Axis Calibration	Axis Calibration																				
rob1_5	Axis Calibration	Axis Calibration																				
rob1_6	Axis Calibration	Manual																				
4	<p>A screen is displayed, tap Rev. Counters.</p> 																					

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5 Calibration

5.3 Updating revolution counters

Continued

	Action
5	<p>Tap Update Revolution Counters....</p> <p>A dialog box is displayed, warning that updating the revolution counters may change programmed robot positions:</p> <ul style="list-style-type: none">• Tap Yes to update the revolution counters.• Tap No to cancel updating the revolution counters. <p>Tapping Yes displays the axis selection window.</p>
6	<p>Select the axis to have its revolution counter updated by:</p> <ul style="list-style-type: none">• Ticking in the box to the left• Tapping Select all to update all axes. <p>Then tap Update.</p>
7	<p>A dialog box is displayed, warning that the updating operation cannot be undone:</p> <ul style="list-style-type: none">• Tap Update to proceed with updating the revolution counters.• Tap Cancel to cancel updating the revolution counters. <p>Tapping Update updates the selected revolution counters and removes the tick from the list of axes.</p>
8	<p> CAUTION</p> <p>If a revolution counter is incorrectly updated, it will cause incorrect manipulator positioning, which in turn may cause damage or injury!</p> <p>Check the synchronization position very carefully after each update. See Checking the synchronization position on page 812.</p>

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:

- 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.

- 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.

- The axis position is stored in RobotWare with an active choice from the operator.

Continues on next page

5 Calibration

5.4.1 Description of Axis Calibration

Continued

Routines in the calibration procedure

The following routines are available in the Axis Calibration procedure, given at the beginning of the procedure on the FlexPendant.

Fine calibration routine

Choose this routine to calibrate the robot when there are no tools, process cabling or equipment fitted to the robot.

Reference calibration routine

Choose this routine to create reference values and to calibrate the robot when the robot is dressed with tools, process cabling or other equipment.

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. The reference value is unique for the current setup of the robot and 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 axis chosen for calibration is automatically run by the calibration program to its calibration position during the calibration procedure.

In order for the axis to be able to be moved to calibration position, or in order for getting proper access to the calibration bushing, other axes might need to be jogged to positions different from 0 degrees. Information about which axes are allowed to be jogged will be given on the FlexPendant. These axes are marked with **Unrestricted** in the FlexPendant window.

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.



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

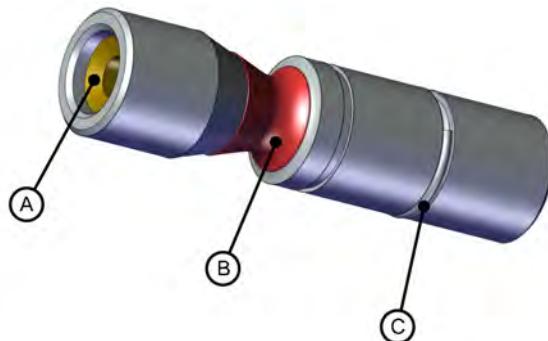
Check prior to usage

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.



xx1500001914

A	Tube insert
B	Plastic protection
C	Steel spring ring

Periodic check of the calibration tool

If including the calibration tool in a local periodic check system, the following measures should be checked.

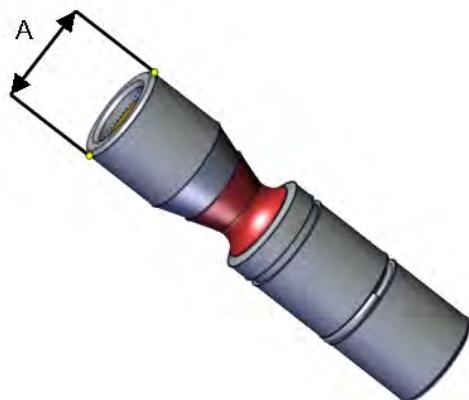
- Outer diameter within Ø12g4 mm, Ø8g4 mm or Ø6g5 mm (depending on calibration tool size).
- Straightness within 0.005 mm.

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5 Calibration

5.4.2 Calibration tools for Axis Calibration

Continued



xx1500000951

A	Outer diameter
---	----------------

Identifying the calibrating tools

It is possible to make the calibration tool identifiable with, for example, an RFID chip. The procedure of how to install an RFID chip is described below.



Note

The tool identifier is NOT delivered from ABB, it is a customized solution.

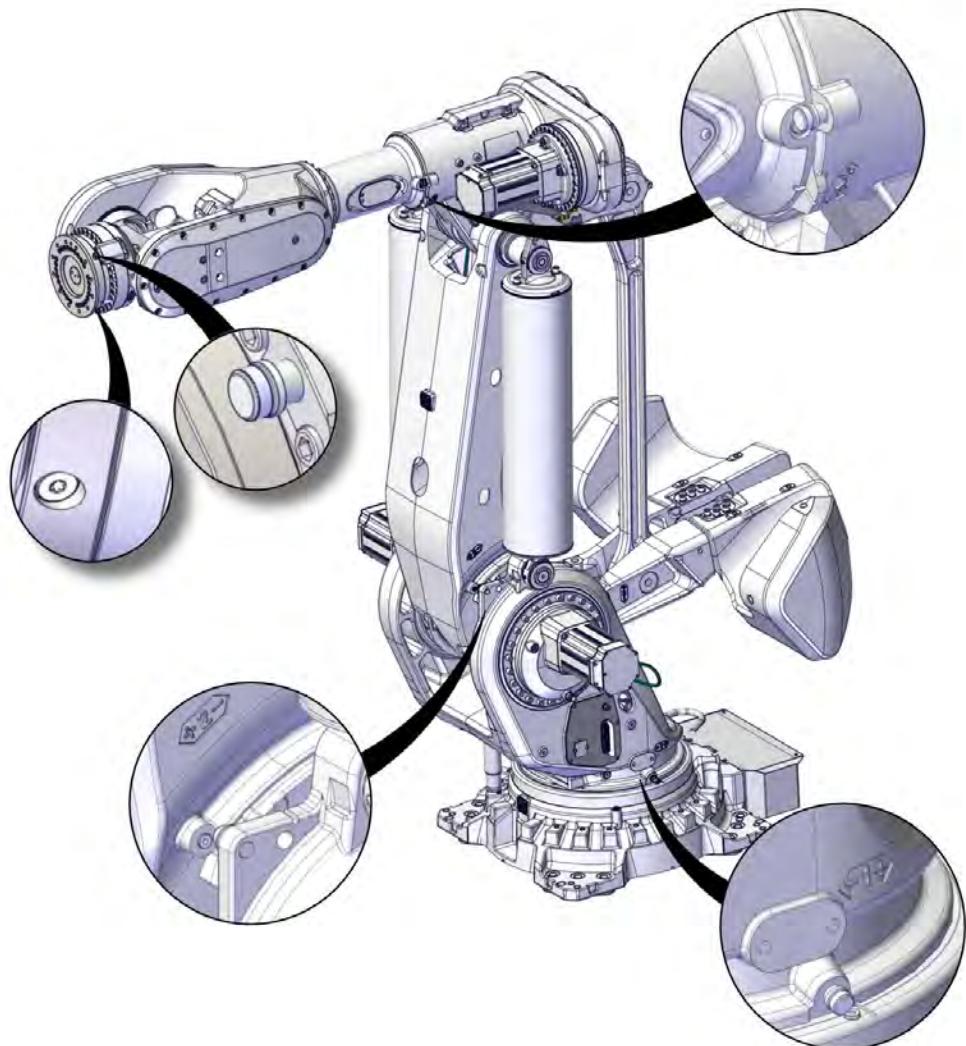
	Action	Note
1	<p>It is possible to use any RFID solution, with the correct dimensions. ABB has verified function on some suppliers fulfilling the requirements of NFC compatible devices (13.56 Mhz) according to ISO 14443 or ISO 15693.</p> <p> Note</p> <p>The maximum dimensions on the RFID chip must not 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).</p>	
2	<p>There is a cavity on one end of the calibration tool in which the RFID chip can be installed.</p> <p>Install the RFID chip according to supplier instructions.</p> <p>Install the chip in flush with the tool end.</p>	

5.4.3 Installation locations for the calibration tools

Location of fixed calibration items

The figure shows how the robot is equipped with items for installation of calibration tools for Axis Calibration (fixed calibration pins and/or bushings). The figure does not show installed calibration tools.

A fixed calibration pin and a bushing for the movable calibration tool are located on each axis as follows.



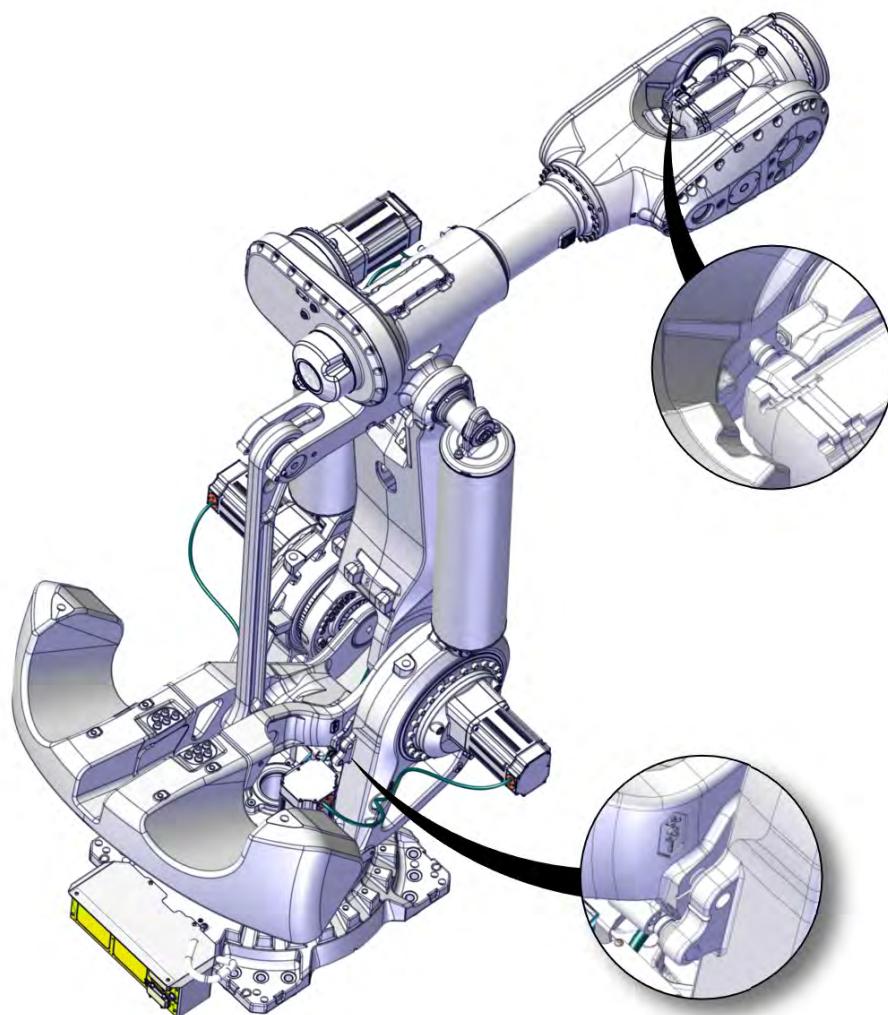
xx1500000786

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5 Calibration

5.4.3 Installation locations for the calibration tools

Continued



xx1500000787

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, if needed.

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 sequence.

After the calibration method has been called for 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 800](#).
- 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 Calibration

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.

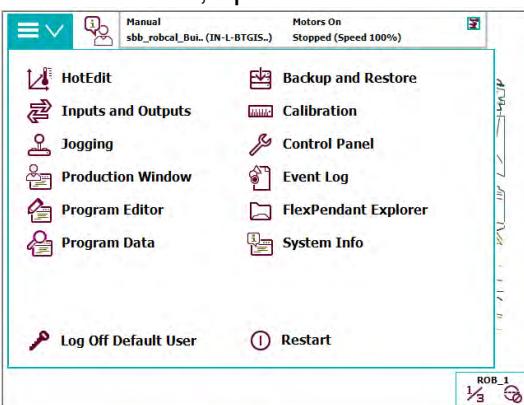
Preparation prior to calibration

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 robots working area is empty, as the robot can make unpredictable movements.	
2 Wipe the calibration tool clean.  Note The calibration method is exact. Dust, dirt or color flakes will affect the calibration value.	Use a clean cloth.

Starting the calibration procedure

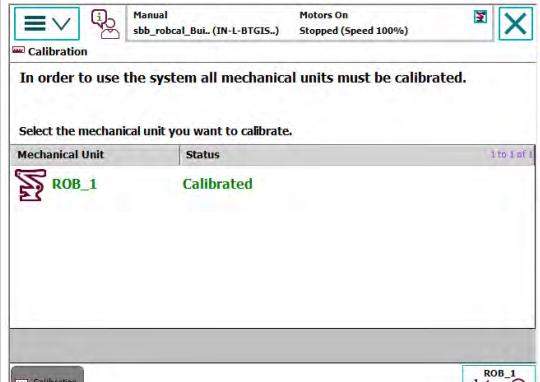
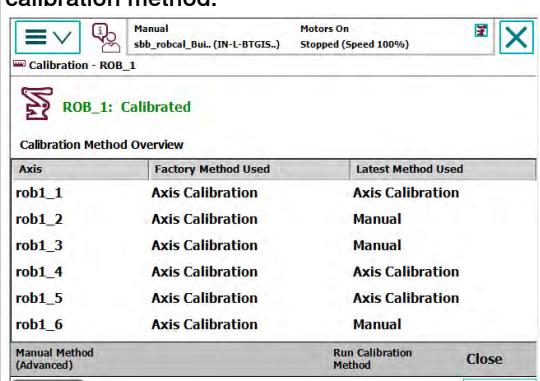
Use this procedure to call for the Axis Calibration method on the FlexPendant.

Action	Note
1 On the ABB menu, tap Calibration. 	

Continues on next page

5.4.4 Axis Calibration - Running the calibration procedure

Continued

Action	Note
<p>2 All mechanical units connected to the system are shown with their calibration status. Tap the mechanical unit in question.</p>  <p>xx1500000943</p>	
<p>3 Calibration method used at factory for each axis is shown, as well as calibration method used for the robot during last field calibration. Tap Run Calibration Method. The software will automatically call for the procedure for the valid calibration method.</p>  <p>xx1500000944</p>	<p>The FlexPendant will give all information needed to proceed with Axis Calibration.</p>
<p>4 Follow the instructions given on the FlexPendant.</p>	<p>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 805.</p>

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.

Continues on next page

5 Calibration

5.4.4 Axis Calibration - Running the calibration procedure

Continued

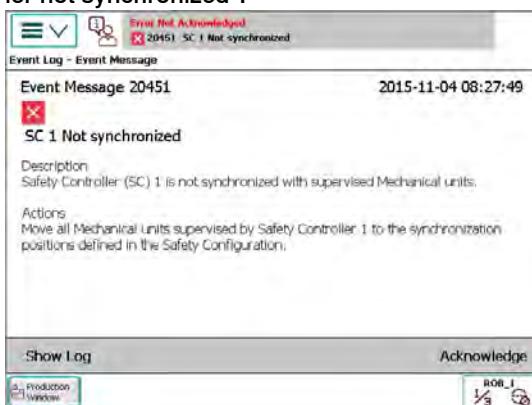
Situation	Action
The RobotWare program is terminated with PP to Main.	<p>Remove the calibration tool, if it is installed, and restart the calibration procedure from the beginning. See Starting the calibration procedure on page 806.</p> <p>If the calibration tool is in contact the robot axis needs to 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 794</p>

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.

Safety controller not synchronized - SafeMove message

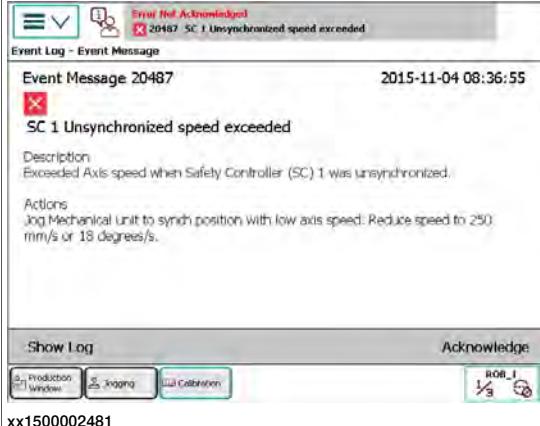
	Action	Note
1	<p>SafeMove generates the message "Safety controller not synchronized".</p>  <p>The screenshot shows the 'Event Log - Event Message' window. It displays a single event message: 'Event Message 20451' at '2015-11-04 08:27:49'. The message content is 'SC 1 Not synchronized'. Below the message, there are sections for 'Description' (mentioning Safety Controller SC 1 is not synchronized with supervised Mechanical units) and 'Actions' (suggesting to move all Mechanical Units supervised by Safety Controller 1 to the synchronization positions defined in the Safety Configuration). At the bottom of the window, there are buttons for 'Show Log' and 'Acknowledge', with the acknowledge button being highlighted.</p>	
2	Confirm unsynchronized state by pressing Acknowledge to continue Axis Calibration procedure.	
3	Restart Axis Calibration procedure by pressing Play.	

Continues on next page

5.4.4 Axis Calibration - Running the calibration procedure

Continued

Unsynchronized speed exceeded - SafeMove message while saving robot data

Action	Note
<p>1 SafeMove generates the message "Unsynchronized speed exceeded" while saving robot data.</p>  <p>The screenshot shows the 'Event Log - Event Message' window. It displays a single event message: 'Event Message 20487 SC 1 Unsynchronized speed exceeded'. The message details: 'Description: Exceeded Axis speed when Safety Controller (SC) 1 was unsynchronized.' and 'Actions: Jog Mechanical Unit to synch position with low axis speed. Reduce speed to 250 mm/s or 18 degrees/s.' Below the message, there are buttons for 'Show Log' and 'Acknowledge'. The 'Acknowledge' button is highlighted in green. The status bar at the bottom shows the message ID 'xx1500002481'.</p>	
2 Press Acknowledge to continue Axis Calibration procedure.	
3 Restart Axis Calibration procedure by pressing Play.	

Unsynchronized time limit expired - SafeMove message anytime during Axis Calibration routine

Action	Note
<p>1 SafeMove generates the message "Unsynchronized time limit expired" (anytime).</p>  <p>The screenshot shows the 'Event Log - Event Message' window. It displays a single event message: 'Event Message 20488 SC 1 Unsynchronized time limit expired'. The message details: 'Description: Available time to move the Robot when unsynchronized has expired for Safety Controller (SC) 1.' and 'Actions: 1. Do a Confirm stop by pressing the Motors ON push button or activate System Input. 2. Synchronize SC 1.' Below the message, there are buttons for 'Next', 'Previous', and 'OK'. The 'OK' button is highlighted in green. The status bar at the bottom shows the message ID 'xx1500002482'.</p>	
2 Press OK to continue Axis Calibration procedure.	
3 Restart Axis Calibration procedure by pressing Play.	

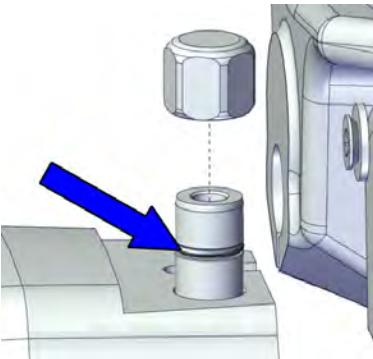
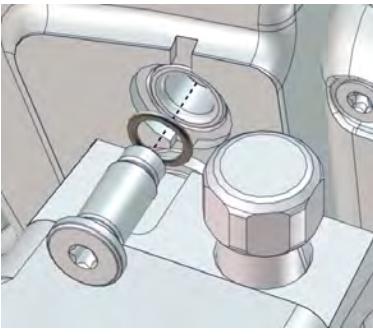
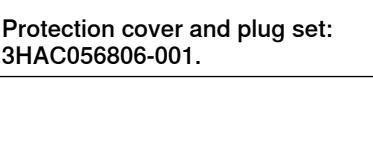
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5 Calibration

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.	 xx1500000952 Protection cover and plug set: 3HAC056806-001.
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.	

5.5 Verifying the calibration

Introduction

Always verify the results after calibrating *any* robot axis to verify that all calibration positions are correct.

Verifying the calibration

Use this procedure to verify the calibration result.

Action	Note
1 Run the calibration home position program twice. Do not change the position of the robot axes after running the program!	See Checking the synchronization position on page 812 .
2 Adjust the <i>synchronization marks</i> when the calibration is done, if necessary.	This is detailed in section Synchronization marks and synchronization position for axes on page 793 .
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.	
4 Remove any calibration equipment from the robot.	

5 Calibration

5.6 Checking the synchronization position

5.6 Checking the synchronization position

Introduction

Check the synchronization position of the robot before beginning any programming of the robot system. This may be done:

- Using a **MoveAbsJ** instruction with argument zero on all axes.
- Using the **Jogging** window on the FlexPendant.

Using a **MoveAbsJ** instruction

Use this procedure to create a program that runs all the robot axes to their synchronization position.

	Action	Note
1	On ABB menu tap Program editor .	
2	Create a new program.	
3	Use MoveAbsJ in the Motion&Proc menu.	
4	Create the following program: <pre>MoveAbsJ [[0,0,0,0,0,0], [9E9,9E9,9E9,9E9,9E9,9E9]] \NoEOffs, v1000, fine, tool0</pre>	
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 793 and Updating revolution counters on page 795 .

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 793 and Updating revolution counters on page 795 .

6 Decommissioning

6.1 Environmental information

Hazardous material

The table specifies some of the materials in the product and their respective use throughout the product.

Dispose components properly to prevent health or environmental hazards.

Material	Example application
Batteries, NiCad or Lithium	Serial measurement board
Copper	Cables, motors
Cast iron/nodular iron	Base, lower arm, upper arm
Steel	Gears, screws, base frame, and so on.
Neodymium	Brakes, motors
Plastic/rubber	Cables, connectors, drive belts, and so on.
Oil, grease	Gearboxes
Aluminium	Covers, synchronization brackets

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 Decommissioning

6.2 Scrapping of robot

6.2 Scrapping of robot

Important when scrapping the robot



DANGER

When a robot is disassembled while being scrapped, it is very important to remember the following before disassembling starts, in order to prevent injuries:

- Always remove all batteries from the robot. 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.

6.3 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 825 .
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 555 .
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

6 Decommissioning

6.3 Decommissioning of balancing device

Continued

Decommissioning at decommissioning company, balancing device

The instruction below details how to decommission the balancing device. Contact ABB Robotics for further consultation.

Action	Note
1  DANGER There is stored energy built up by high tensioned compression springs inside the balancing device! When a coil is cut the released tension creates a spatter of sparks and flames. The working area must be free of flammable materials. Position the balancing device so that the spatter will be directed away from personnel.	
2 Clamp the device at the working location. Place the device at ground level so that the hole and spring coils are cut from a safe distance and somewhat from above.	
3  DANGER The hole must be cut as specified in the figure. Pieces of the spring can be thrown out from the cylinder at high speed if the hole is cut larger than specified!	
4 Cut a hole in the housing as shown in the figure.	Use a cutting torch with a long shaft.
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 Reference information

7.2 Applicable standards

7.2 Applicable standards



Note

The listed standards are valid at the time of the release of this document. Phased out or replaced standards are removed from the list when needed.

Standards, EN ISO

The product is designed in accordance with the requirements of:

Standard	Description
EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN ISO 13849-1	Safety of machinery, safety related parts of control systems - Part 1: General principles for design
EN ISO 13850	Safety of machinery - Emergency stop - Principles for design
EN ISO 10218-1	Robots for industrial environments - Safety requirements -Part 1 Robot
EN ISO 9787	Robots and robotic devices -- Coordinate systems and motion nomenclatures
EN ISO 9283	Manipulating industrial robots, performance criteria, and related test methods
EN ISO 14644-1 ⁱ	Classification of air cleanliness
EN ISO 13732-1	Ergonomics of the thermal environment - Part 1
EN IEC 61000-6-4 (option 129-1)	EMC, Generic emission
EN IEC 61000-6-2	EMC, Generic immunity
EN IEC 60974-1 ⁱⁱ	Arc welding equipment - Part 1: Welding power sources
EN IEC 60974-10 ⁱⁱ	Arc welding equipment - Part 10: EMC requirements
EN IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1 General requirements
IEC 60529	Degrees of protection provided by enclosures (IP code)

ⁱ Only robots with protection Clean Room.

ⁱⁱ Only valid for arc welding robots. Replaces EN IEC 61000-6-4 for arc welding robots.

European standards

Standard	Description
EN 614-1	Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles
EN 574	Safety of machinery - Two-hand control devices - Functional aspects - Principles for design

Continues on next page

Other standards

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
ANSI/UL 1740	Safety standard for robots and robotic equipment
CAN/CSA Z 434-14	Industrial robots and robot Systems - General safety requirements

7 Reference information

7.3 Unit conversion

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 the IRB 8700.

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. 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.

Screws lubricated in other ways

Screws lubricated with Molycote 1000 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.

Lubricant	Article number
Molycote 1000 (molybdenum disulphide grease)	11712016-618

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.

Continues on next page

7 Reference information

7.4 Screw joints

Continued

- 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%!

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*. Any special torque specified in the repair, maintenance or installation procedure overrides the standard torque!

Oil-lubricated screws with allen head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws with allen head screws*. Any 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
M24	680	960	1150

Lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws

The following table specifies the recommended standard tightening torque for *screws lubricated with Molykote 1000, Gleitmo 603 or equivalent with allen head screws*. Any 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
M8	28	35
M10	55	70
M12	96	120
M16	235	280
M20	460	550
M24	790	950

ⁱ Lubricated with Molykote 1000, Gleitmo 603 or equivalent

Continues on next page

Water and air connectors

The following table specifies the recommended standard tightening torque for *water and air connectors* when *one or both* connectors are made of *brass*. Any special torque specified in the repair, maintenance or installation procedure overrides the standard torque!

Dimension	Tightening torque Nm - Nominal	Tightening torque Nm - Min.	Tightening torque Nm - Max.
1/8	12	8	15
1/4	15	10	20
3/8	20	15	25
1/2	40	30	50
3/4	70	55	90

7 Reference information

7.5 Weight specifications

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 robot weighs 4,750 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	Plastic mallet	

7 Reference information

7.7 Special tools

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 825*](#), and of special tools, listed directly in the instructions and also gathered in this section.

Special tools



Note

The list of special tools in this revision is not updated. A complete and updated list will be presented in the next revision.

Continues on next page

Tools and equipment with spare part number: (These tools can be ordered from ABB)			Cable harness	SMB	Brake release unit	Lower arm	Upper arm	Wrist	Turning disc	Balancing device	Spherical roller bearing (link ear)	Rear bearing (balancing device)	Axis 1 motor	Axis 2 motor	Axis 3 motor	Axis 4 motor	Axis 5 motor	Axis 6 motor	Axis 1 gearbox	Axis 2 gearbox	Axis 3 gearbox	Axis 6 gearbox
Guide pins																						
3HAC15521-2	Guide pin, M10x150																2			2		
3HAC13056-2	Guide pin, M12x150				x	x	2					2	2	2					x	x		
3HAC13056-3	Guide pin, M12x200				x	x												x	x	x		
3HAC13120-2	Guide pin, M16x150			x													x	x				
3HAC13120-3	Guide pin, M16x200		x														x	x				
Lifting accessories																						
3HAC15556-1	Lifting accessory (chain)	 xx1200001241			x	x					x					x	x	x				
3HAC14459-1	Lifting accessory, motor									x					x							
3HAC15534-1	Lifting accessory, motor									x	x					x						
3HAC05440-001	Lifting accessory, gearbox															x						
3HAC046128-001	Lifting accessory, gearbox															x						
3HAC16131-1	Lifting eye M12	 xx1200001242		2	2											2	2	2				
3HAC14457-4	Lifting eye M16	 xx1200001242														2	x					
-	Lifting shackle SA-10-8-NA1	 xx1200001243		x				x	x	x						x						
-	Fender washer Outer diameter: minimum 26 mm, hole diameter: 13 mm, thickness: 3 mm.			x	x											x	x	x				

Continues on next page

7 Reference information

7.7 Special tools

Tools and equipment with spare part number: (These tools can be ordered from ABB)		Cable harness	SMB	Brake release unit	Lower arm	Upper arm	Wrist	Turning disc	Balancing device	Spherical roller bearing (link ear)	Rear bearing (balancing device)	Axis 1 motor	Axis 2 motor	Axis 3 motor	Axis 4 motor	Axis 5 motor	Axis 6 motor	Axis 1 gearbox	Axis 2 gearbox	Axis 3 gearbox	Axis 6 gearbox
-	Roundsling 1.5 m Lifting capacity: 2,000 kg			x											x	x					
-	Roundsling 1 m Lifting capacity: 1,000 kg			x	x	x	x	x	x	x	x			x	x						
Press, puller and unloading tools																					
3HAC11731-1	Hydraulic cylinder						x	x	x							x					
3HAC13086-1	Hydraulic pump 80 MPa						x	x	x							x					
3HAC9909-15	Threaded bar, M16x340			x		x	x									x					
Removal tools																					
-	Removal tool M10																				
3HAC14631-1	Removal tool M12												x	x							
3HAC047108-001	Removal tool M14								x	x	x				x	x					
Other tools																					
-	24 VDC power supply			x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	
-	Long Allen Key Socket IN19L 6-140											x	x	x							
3HAC12342-1	Bits extender								x	x	x		x	x	x		x	x			
3HAC15716-1	Calibration Pendulum toolkit			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	
3HAC0207-1	Leak-down tester								x	x	x	x	x	x	x	x	x	x	x	x	
-	Lock screw, M20x150						x	x	x		x										
-	Oil collecting vessel									x	x		x	x		x	x	x	x	x	
-	Oil dispenser									x	x		x	x		x	x	x	x	x	
	Pallet			x	x	x										x	x				
3HAC7887-1	Rotation tool			x	x				x	x	x	x	x	x	x	x	x	x	x	x	

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.

This implies that 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 on the documentation DVD.

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9 Circuit diagrams

9.1 Circuit diagrams

Overview

The circuit diagrams are not included in this manual, but delivered as separate documents on the documentation DVD. See the article numbers in the tables below.

Controllers

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRC5</i>	<i>3HAC024480-011</i>
<i>Circuit diagram - IRC5 Compact</i>	<i>3HAC049406-003</i>
<i>Circuit diagram - IRC5 Panel Mounted Controller</i>	<i>3HAC026871-020</i>
<i>Circuit diagram - Euromap</i>	<i>3HAC024120-004</i>
<i>Circuit diagram - Spot welding cabinet</i>	<i>3HAC057185-001</i>

Robots

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRB 120</i>	<i>3HAC031408-003</i>
<i>Circuit diagram - IRB 140 type C</i>	<i>3HAC6816-3</i>
<i>Circuit diagram - IRB 260</i>	<i>3HAC025611-001</i>
<i>Circuit diagram - IRB 360</i>	<i>3HAC028647-009</i>
<i>Circuit diagram - IRB 460</i>	<i>3HAC036446-005</i>
<i>Circuit diagram - IRB 660</i>	<i>3HAC025691-001</i>
<i>Circuit diagram - IRB 760</i>	<i>3HAC025691-001</i>
<i>Circuit diagram - IRB 1200</i>	<i>3HAC046307-003</i>
<i>Circuit diagram - IRB 1410</i>	<i>3HAC2800-3</i>
<i>Circuit diagram - IRB 1600/1660</i>	<i>3HAC021351-003</i>
<i>Circuit diagram - IRB 1520</i>	<i>3HAC039498-007</i>
<i>Circuit diagram - IRB 2400</i>	<i>3HAC6670-3</i>
<i>Circuit diagram - IRB 2600</i>	<i>3HAC029570-007</i>
<i>Circuit diagram - IRB 4400/4450S</i>	<i>3HAC9821-1</i>
<i>Circuit diagram - IRB 4600</i>	<i>3HAC029038-003</i>
<i>Circuit diagram - IRB 6400RF</i>	<i>3HAC8935-1</i>
<i>Circuit diagram - IRB 6600 type A</i>	<i>3HAC13347-1 3HAC025744-001</i>
<i>Circuit diagram - IRB 6600 type B</i>	<i>3HAC13347-1 3HAC025744-001</i>
<i>Circuit diagram - IRB 6620</i>	<i>3HAC025090-001</i>

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9 Circuit diagrams

9.1 Circuit diagrams

Continued

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRB 6620 / IRB 6620LX</i>	<i>3HAC025090-001</i>
<i>Circuit diagram - IRB 6640</i>	<i>3HAC025744-001</i>
<i>Circuit diagram - IRB 6650S</i>	<i>3HAC13347-1</i> <i>3HAC025744-001</i>
<i>Circuit diagram - IRB 6660</i>	<i>3HAC025744-001</i> <i>3HAC029940-001</i>
<i>Circuit diagram - IRB 6700</i>	<i>3HAC043446-005</i>
<i>Circuit diagram - IRB 7600</i>	<i>3HAC13347-1</i> <i>3HAC025744-001</i>
<i>Circuit diagram - IRB 14000</i>	<i>3HAC050778-003</i>
<i>Circuit diagram - IRB 910SC</i>	<i>3HAC056159-002</i>

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