

Product manual

IRB 14000

Power and productivity
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**Product manual
IRB 14000-0.5/0.5
IRC5**

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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, service	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 information	Procedures that do not require specific calibration equipment. 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

References

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

Document name	Document ID
<i>Product manual, spare parts - IRB 14000</i>	3HAC052984-001
<i>Product specification - IRB 14000</i>	3HAC052982-001
<i>Product manual - Grippers for IRB 14000</i>	3HAC054949-001
<i>Operating manual - IRB 14000</i>	3HAC052986-001
<i>Circuit diagram - IRB 14000</i>	3HAC050778-003
<i>Operating manual - General safety information</i> ⁱ	3HAC031045-001
<i>Technical reference manual - Lubrication in gearboxes</i>	3HAC042927-001
<i>Product manual - IRC5</i>	3HAC021313-001
<i>Technical reference manual - System parameters</i>	3HAC050948-001

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

Revisions

Revision	Description
-	First edition.
A	The following updates are done in this revision: <ul style="list-style-type: none">• Minor editorial changes.• Changed article number for the ESD warning label and added AbsAcc label, see Inspecting the information labels on page 101.• Added figures for axis-4, axis-5 and axis-6 motors for removal and refitting of the wave generator.• Added reference to absolute accuracy calibration for some repair procedures.

Continues on next page

Revision	Description
B	<p>The following updates are done in this revision:</p> <ul style="list-style-type: none"> • Changed tightening torque of axis-7 motor from 0.2 Nm to 0.8 Nm. • Added a tightening torque for the axis-7 cable bracket (0.8 Nm). • Corrected orientation of removal tool on motor in figure that shows fitting of the removal tool on the axis-1 motor. • Corrected the procedure for replacing the axis-6 motor by adding steps for removal of two more covers/padding added. • Corrected figure of the axis-3 motor to show orientation of motor according to motor connector location. • Corrected the procedure for replacing the battery pack by adding step for removal of two more screws on the body cover. • Added a caution signal to be careful not to hit the arms into something while lifting and transporting the robot. • Changed procedure for replacing the field bus adapter. The computer cover does not need to be removed. • Added a step for moving the battery packs from the old drive board onto the new. • Added information about deviations and fulfilment of certain requirements for ISO10218-1:2011, see Applicable safety standards on page 456. • Added safety information for collaborative robots, see Safety in collaborative operation on page 18. • Changed torque y and torque z for endurance load and maximum load. • Added information about setting the running speed to 100% before running fine calibration procedure.

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 - Introduction to RAPID*
- *Operating manual - IRC5 with FlexPendant*
- *Operating manual - RobotStudio*
- *Operating manual - Trouble shooting IRC5*, for the controller and manipulator.

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 robot 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 robot models, can be illustrated with illustrations that show a different robot 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.

Contents	Examples of content
General information	<ul style="list-style-type: none">• safety, service• limitation of liability• related information
Safety risks 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
Safety actions 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
Safety stops describes different types of stops.	<ul style="list-style-type: none">• stopping functions• description of emergency stop• description of safety stop

1.2.2 Safety in the robot 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 - IRB 14000*
- *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.

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 - IRB 14000</i>	Operating modes

1 Safety

1.2.3 Safety in collaborative operation

1.2.3 Safety in collaborative operation

General

IRB 14000 is intended for collaborative applications where contact between robot and the operator is harmless. The robot is designed to comply with ISO 10218-1, §5.10.5. Power and force limiting by inherent design or control. This is achieved by inherent design measures in the robot arm and control system.

Sensitive body parts must be protected by PPE, and particular care must be taken when designing end effectors and work pieces.

Details are given in the following sections.¹

Mechanical design measures

The power and force of the robot is limited mechanically by:

- Light weight
- Low payload (500 gram)
- Weak drivetrain that can be stopped and overridden by hand
- Soft and round outer shell (Regular inspection of the outer shell is required. See [Inspecting, plastic and padding on page 109](#))
- No sharp edges or pinch points

Certified safety functions

The following safety functions are inherent design measures in the control system, contributing to power and force limiting. They are certified to category B, performance level b, according to EN ISO 13849-1.

Safety function	Description
Cartesian speed supervision	The Cartesian speed of the elbow (arm check point, ACP) and the wrist (wrist center point, WCP) are supervised. If a limit is exceeded, the robot motion is stopped and a message displayed to the user. The default speed limit can be modified based on the risk assessment of the robot installation. The function is active in both manual and automatic mode. The speed limits are set by system parameters. See <i>Operating manual - IRB 14000</i> .
Protective stop (safety stop)	The controller has an electrical input which can be accessed in external devices mode to stop the robot, e.g. from a safety PLC. The protective stop function removes power from the actuators, and is a Category 0 stop, according to ISO 13850. In standalone mode, the FlexPendant emergency stop button is routed to this input, and utilizes the safety function to stop the robot.

Personal protective equipment

There are particularly sensitive body parts, such as the eyes and the larynx, that need personal protective equipment, see ISO/TS15066 (currently under preparation).

¹ See also technote_150918

Continues on next page

Design of work pieces and end effectors

Particular care must be taken to select and design work pieces and end effectors (servo fingers, suction tools) for the application. If the risk assessment of the completed system concludes that there are risks relating to work pieces or end effectors, then the speed limits must be lowered, or the application must be redesigned. See ISO 10218-2.

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.

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.

Continues on next page

1.2.4.1 Safety risks during installation and service work on robots

Continued

- 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.
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 packs are sensitive to mechanical damage!	 CAUTION The cable packs are sensitive to mechanical damage! They must be handled with care, especially the connectors, in order to avoid damaging them!

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!

1 Safety

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 instructions below detail 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.	

1.2.4.3 Safety risks related to tools/work pieces

Safe handling

The IRB 14000 gripper is designed to allow manual release and removal of gripped work pieces. Both servo and vacuum modules can be overridden by manual force.

If end tools (such as fingers and suction tools) and work pieces are not correctly designed and chosen, gravity or robot acceleration may cause a work piece held by the gripper to drop during motion. The work pieces must meet the weight requirements, and the end tools must be suitably designed to grip the work pieces.

Safe design

The IRB 14000 is intended for collaborative applications, where occasional contacts between the robot and operators is safe. End tools (such as fingers and suction tools), as well as work pieces handled by the robot, must be designed and chosen so that such contacts does not introduce safety hazards.

The IRB 14000 gripper is not designed to retain work pieces in case of power loss. Objects held by the servo and vacuum modules may be released, in the event of pneumatic or electric power loss to the gripper. The work pieces handled by the robot, as well as the collaborative work station where the robot operates, should be chosen and designed so that such release does not introduce safety hazards.

All end tools and work pieces must be included in the risk assessment by the system integrator.

1 Safety

1.2.4.4 Safety risks related to pneumatic systems

1.2.4.4 Safety risks related to pneumatic systems

Pneumatic system related risks

The air supply to the robot and the gripper is independent from the rest of the robot system. Air pressure will remain after robot main power has been switched off. Air supply to the robot must therefore be shut off and pressure-released before installing or servicing the gripper.

The air pressure supplied to the robot and gripper must not exceed the rated limit. Use pressure relief valves.

All pipes, hoses and connections have to be inspected regularly for leaks and damage. Damages must be repaired immediately. Wear safety glasses when working with the pneumatic systems.

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 Safety

1.2.4.6 Risks associated with live electric parts

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, 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 power supply (100-240 VAC)
- The drive unit (24 VDC)
- The external voltage connected to the controller remains live even when the robot is disconnected from the mains.
- Additional connections.

Voltage related risks, robot

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

- The power supply for the motors (24 VDC)
- The user connections for tools or other parts of the installation (max. 240 VAC).

See chapter [Installation and commissioning on page 51](#).

Continues on next page

1.2.4.6 Risks associated with live electric parts

Continued

- The IRB 14000 gripper is powered by 24 V DC from the robot tool flange. A risk for short-circuit and sparks exists. All installation and service works should be done with power disconnected from the gripper and the tool flange. This can be done from the robot main switch or from a predefined I/O signal that controls the power to the tool flange. Service works shall, whenever possible, be done with the gripper mechanically removed from the robot arm.

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 Safety

1.2.4.7 Safety risks for collaborative robots

1.2.4.7 Safety risks for collaborative robots

Safety risks in collaborative operation

The arm and gripper must be inspected at frequent intervals to make sure that there are no damages to plastic, padding, or other components.

The arm must not be run without a gripper fitted to the tool flange.

Safe design of the robot cell

Special attention in risk assessment must be given to the following parts:

- end effectors (fingers, suction tools) designed for the application
- work pieces handled by the robot in the application
- any custom gripping solutions that are selected for the application

1.2.5 Safety actions

1.2.5.1 Fire extinguishing



Note

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

1 Safety

1.2.5.2 Manually stopping or overriding the arm

Description

If needed, the robot arm can be stopped or overridden manually. This is possible since the arm is light and the drivetrain power is limited. If the arm is in motion, collision detection will help to stop the motion of the arm. If the arm is at standstill, motors or brakes can be overridden.

To prevent unnecessary damage and wear to the robot arm, it is strongly recommended to use the normal stopping functions of the control system, and push the brake release buttons before manually moving the arm.

1.2.5.3 Brake testing

When to test

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

How to test

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

- 1 Run each 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 Safety

1.2.5.4 Handling of the FlexPendant

1.2.5.4 Handling of the FlexPendant

Handling of the FlexPendant

The FlexPendant is a high-quality handheld terminal equipped with highly sensitive state-of-the-art electronics. To avoid malfunctions or damage through improper handling, follow these instructions during operation.

The FlexPendant may only be used for the purposes mentioned in this manual. The FlexPendant was developed, manufactured, tested and documented in accordance with applicable safety standards. If you follow the instructions regarding safety and use as described in this manual, the product will, in the normal case, neither cause personal injury nor damage to machinery and equipment.

Handling and cleaning

- Handle with care. Do not drop, throw, or give the FlexPendant strong shock. It can cause breakage or failure.
- If the FlexPendant is subjected to shock, always verify that the safety functions (enabling device and emergency stop) work and are not damaged.
- When not using the device, hang it on the wall bracket provided for storage so it does not accidentally fall.
- Always use and store the FlexPendant in such a way that the cable does not become a tripping hazard.
- Never use sharp objects (such as screwdriver or pen) for operating the touch screen. This could damage the touch screen. Instead use your finger or a stylus (located on the back on FlexPendant with USB port).
- Clean the touch screen regularly. Dust and small particles can clog the touch screen and cause it to malfunction.
- Never clean the FlexPendant with solvents, scouring agent, or scrubbing sponges. Use a soft cloth and a bit of water or mild cleaning agent.
See *Product manual - IRC5*, section *Cleaning the FlexPendant*.
- Always close the protective cap on the USB port when no USB device is connected. The port can break or malfunction if exposed to dirt or dust.



CAUTION

A disconnected jogging device should be stored in such a way that it cannot be mistaken for being connected to the controller.

Cabling and power supply

- Turn off the power supply before opening the cable entrance area of the FlexPendant. Otherwise the components could be destroyed or undefined signals could occur.
- Make sure that nobody trips over the cable to prevent the device from falling to the ground.
- Take care not to squeeze and thus damage the cable with any object.

Continues on next page

- Do not lay the cable over sharp edges since this can damage the cable sheath.

Enabling device



Note

The FlexPendant is always equipped with an enabling device, but for the IRB 14000 system the enabling device is not used. Therefore the enabling device is disabled and inactive when the FlexPendant is connected to an IRB 14000 system, but it is enabled and active when connected to another robot.

The 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 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

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.

Waste disposal

Observe the national regulations when disposing of electronic components! When replacing components, please dispose of used components properly.

1 Safety

1.2.6.1 What is an emergency stop?

1.2.6 Safety stops

1.2.6.1 What is an emergency stop?

Definition of emergency stop

An emergency stop is a state that takes precedence over all other robot controls, removes drive power from the robot actuators, remains active until it is reset, and can only be reset by manual action.

An emergency stop state means that all power is disconnected from the robot except for the manual brake release circuits. You must perform a recovery procedure, that is, resetting the emergency stop button and pressing the Motors On button on the FlexPendant, to return to normal operation.

The robot system is configured so that the emergency stop results in a category 0 stop, immediately stopping the robot actions by disconnecting power from the motors.



Note

The emergency stop function may only be used for the purpose and under the conditions for which it is intended.



Note

The emergency stop function is intended for immediately stopping equipment in the event of an emergency.



Note

Emergency stop should not be used for normal program stops as this causes extra, unnecessary wear on the robot.

For how to perform normal program stops, see section *Stopping programs* in *Operating manual - IRC5 with FlexPendant*.

Emergency stop buttons

In a robot system several emergency stop buttons can be installed and operated in order to achieve an emergency stop. By default there is one emergency stop button available on the FlexPendant. There can also be other types of emergency stops on your robot. Consult your plant or cell documentation to see how your robot system is configured.

1.2.6.2 What is a safety stop or protective stop?

1.2.6.2 What is a safety stop or protective stop?

Definition of safety stops

A safety stop is a state that stops all robot motion and removes power to the robot drive actuators. There is no recovery procedure. You need only to restore motor power to recover from a safety stop. Safety stop is also called protective stop.

The robot system is configured so that the safety stop results in a category 0 stop, immediately stopping the robot actions by disconnecting power from the motors.



Note

The safety stop function may only be used for the purpose and under the conditions for which it is intended.



Note

Safety stop should not be used for normal program stops as this causes extra, unnecessary wear on the manipulator.

For how to perform normal program stops, see section *Stopping programs* in *Operating manual - IRC5 with FlexPendant*.

1 Safety

1.2.6.3 What is Cartesian speed supervision?

1.2.6.3 What is Cartesian speed supervision?

Definition of Cartesian speed supervision

The Cartesian speed supervision is a safety function that supervises the Cartesian speed of the elbow (arm check point, ACP) and the wrist (wrist center point, WCP). The default speed limit can be modified if needed, based on the risk assessment for the robot installation. If any of the configured speed limits are exceeded, then the robot motion is stopped and a message is displayed to the user.

The Cartesian speed supervision is active in both manual and automatic mode. The setting is defined by system parameters.

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

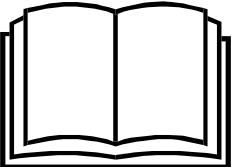
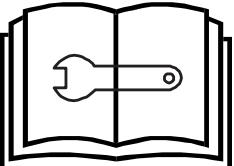
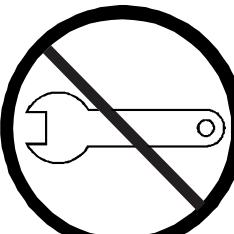
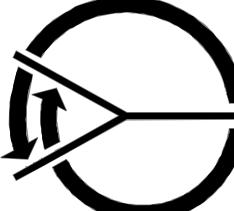
Symbol	Description
	Warning! Warns that an accident <i>may</i> occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion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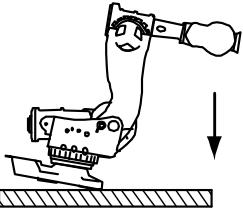
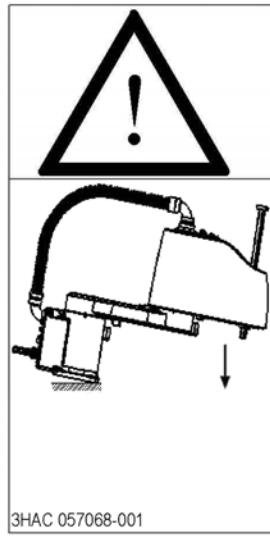
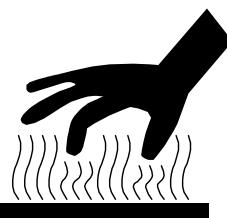
1 Safety

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 dismantling, see product manual
 xx0900000815	Do not dismantle Dismantling 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

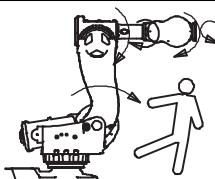
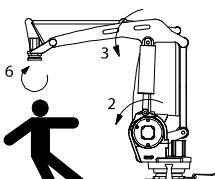
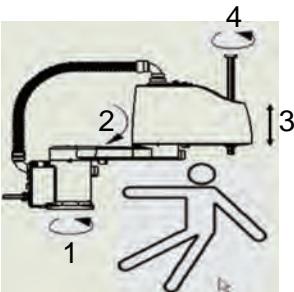
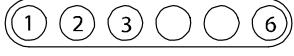
Symbol	Description
 xx0900000810	Tip risk when loosening bolts The robot can tip over if the bolts are not securely fastened.
 3HAC 057068-001 xx1500002402	
 xx0900000817	Crush Risk of crush injuries.
 xx0900000818	Heat Risk of heat that can cause burns.

Continues on next page

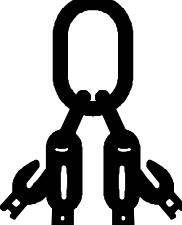
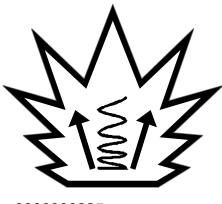
1 Safety

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

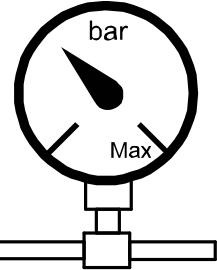
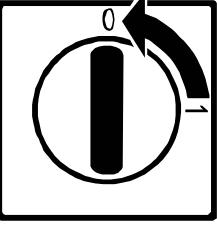
Symbol	Description
 xx1000001242	Chain sling with shortener
 xx0900000822	Lifting of robot
 xx0900000823	Oil Can be used in combination with prohibition if oil is not allowed.
 xx0900000824	Mechanical stop
 xx1000001144	No mechanical stop
 xx0900000825	Stored energy Warns that this part contains stored energy. Used in combination with <i>Do not dismantle</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 - First test run may cause injury or damage!**1.4 Safety related instructions****1.4.1 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.

	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 the fixture and work piece are well secured, if applicable.
4	Verify that all arm covers and paddings are properly secured to the robot.
5	Pay special attention to the function of the part that previously was serviced.

1 Safety

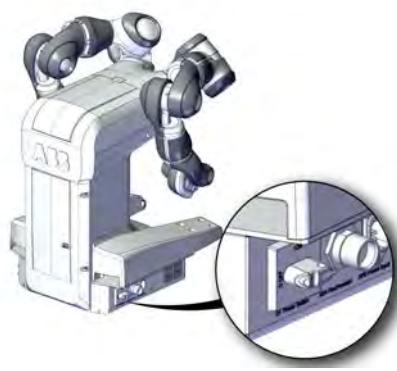
1.4.2 DANGER - Make sure that the main power has been switched off!

1.4.2 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, Controller

	Action	Note/illustration
1	Switch off the main switch on the controller.	 xx1500000503 • A: Main switch

1.4.3 WARNING - The unit is sensitive to ESD!

1.4.3 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.

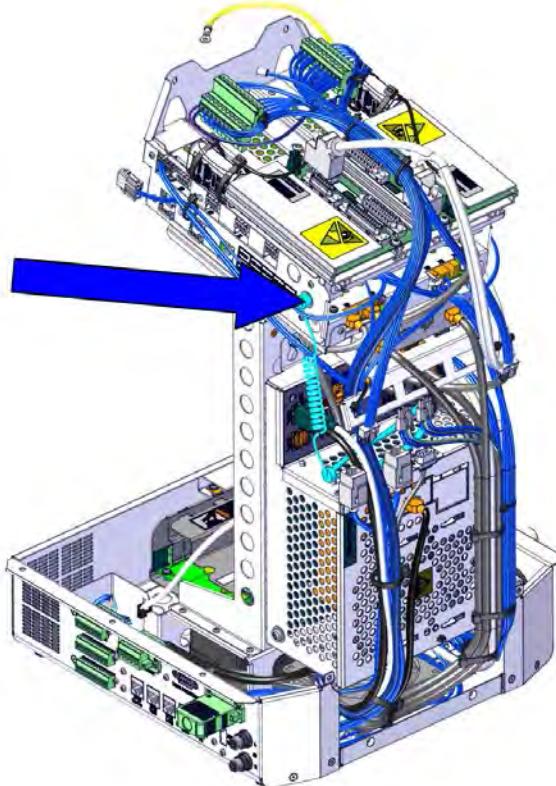
Elimination

	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.

IRB 14000



xx1500000502

1 Safety

1.4.4 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 52 .
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.	

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

1.4.5 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 Safety

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

Continued

Warning	Description	Elimination/Action
 xx010000002 Do not overfill	Overfilling of gearbox lubricant can lead to internal over-pressure inside the gearbox which in turn may: <ul style="list-style-type: none">• damage seals and gaskets• completely press out seals and gaskets• prevent the robot from moving freely.	Make sure not to overfill the gearbox when filling it with oil or grease! After filling, verify that the level is correct.
 xx010000002 Do not mix types of oil	Mixing types of oil may cause severe damage to the gearbox.	When filling gearbox oil, do not mix different types of oil unless specified in the instructions. Always use the type of oil specified by the manufacturer!
 xx010000008 Heat up the oil	Warm oil drains quicker than cold oil.	When changing gearbox oil, first run the robot for a time to heat up the oil.
 xx010000004 Specified amount depends on drained volume	The specified amount of oil or grease is based on the total volume of the gearbox. When changing the lubricant, the amount refilled may differ from the specified amount, depending on how much has previously been drained from the gearbox.	After filling, verify that the level is correct.
 xx010000003 Contaminated oil in gear boxes	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.	

2 Installation and commissioning

2.1 Introduction

General

This chapter contains assembly instructions and information for installing the IRB 14000 at the working site.

More detailed technical data can be found in the *Product specification* for the IRB 14000, 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 14000 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.

Checking the pre-requisites for installation

Installation personnel working with an ABB robot 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.

Action	
1	Visually inspect the robot to make sure that it is not damaged.
2	Make sure that the lifting accessory used is suitable to handle the weight of the robot as specified in: <ul style="list-style-type: none">• <i>Weight, robot on page 52</i>
3	If the robot is not installed directly, it must be stored as described in: <ul style="list-style-type: none">• <i>Storage conditions, robot on page 54</i>
4	Make sure that the expected operating environment of the robot conforms to the specifications as described in: <ul style="list-style-type: none">• <i>Operating conditions, robot on page 54</i>
5	Before taking the robot to its installation site, make sure that the site conforms to: <ul style="list-style-type: none">• <i>Loads on foundation, robot on page 53</i>• <i>Protection classes, robot on page 54</i>• <i>Requirements, foundation on page 54</i>
6	Before moving the robot, please observe the stability of the robot: <ul style="list-style-type: none">• <i>Risk of tipping/stability on page 59</i>
7	When these prerequisites are met, the robot can be taken to its installation site as described in section: <ul style="list-style-type: none">• <i>On-site installation on page 60</i>
8	Install required equipment, if any. <ul style="list-style-type: none">• <i>Installing the signal lamp on page 71</i>

Weight, robot

The table shows the weight of the robot.

Robot model	Weight
IRB 14000	38 kg



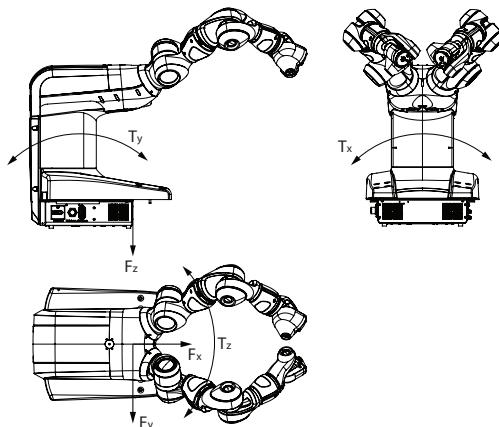
Note

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

Continues on next page

Loads on foundation, robot

The illustration shows the directions of the robots stress forces.



xx1500000104

F_x	Force in the X plane
F_y	Force in the Y plane
F_z	Force in the Z plane
T_y	Bending torque the Y plane
T_x	Bending torque the X 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!

Table mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force x	± 89 N	± 178 N
Force y	± 147 N	± 294 N
Force z	$+380 \pm 140$ N	$+380 \pm 280$ N
Torque x	± 101 Nm	± 202 Nm
Torque y	$+14 \pm 98$ Nm	$+14 \pm 172$ Nm
Torque z	± 61 Nm	± 122 Nm

Continues on next page

2 Installation and commissioning

2.2.1 Pre-installation procedure

Continued

Requirements, foundation

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

Requirement	Value	Note
Maximum deviation from levelness	0.1/500 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°	The limit for the maximum payload on the robot is reduced if the robot is tilted from 0°. Contact ABB for further information about acceptable loads.
Minimum resonance frequency	22Hz	

Storage conditions, robot

The table shows the allowed storage conditions for the robot:

Parameter	Value
Minimum ambient temperature	-10°C
Maximum ambient temperature	+55°C
Maximum ambient temperature (less than 24 hrs)	+55°C
Maximum ambient humidity	85% at constant temperature (gaseous only)

Operating conditions, robot

The table shows the allowed operating conditions for the robot:

Parameter	Value
Minimum ambient temperature	+5°C ⁱ
Maximum ambient temperature	+40°C
Maximum ambient humidity	85% at constant temperature

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

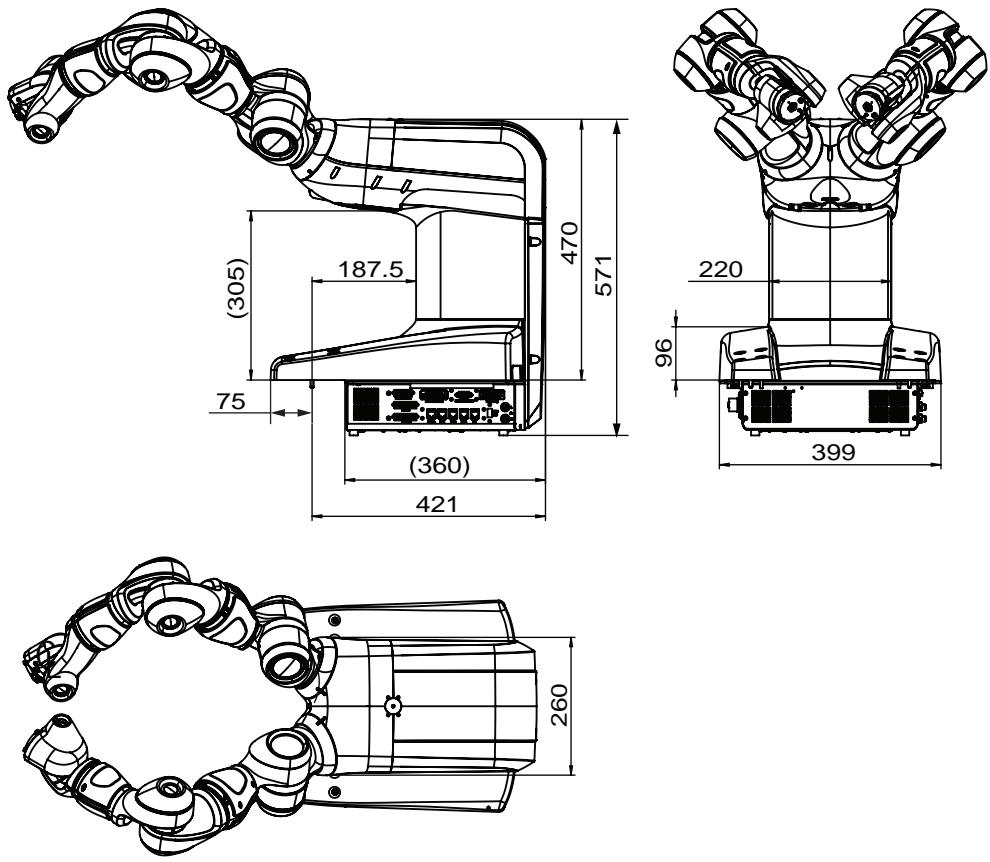
Protection classes, robot

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

Protection type	Protection class
Manipulator, protection type Standard	IP30

2.2.2 Dimensions

Dimensions IRB 14000



2 Installation and commissioning

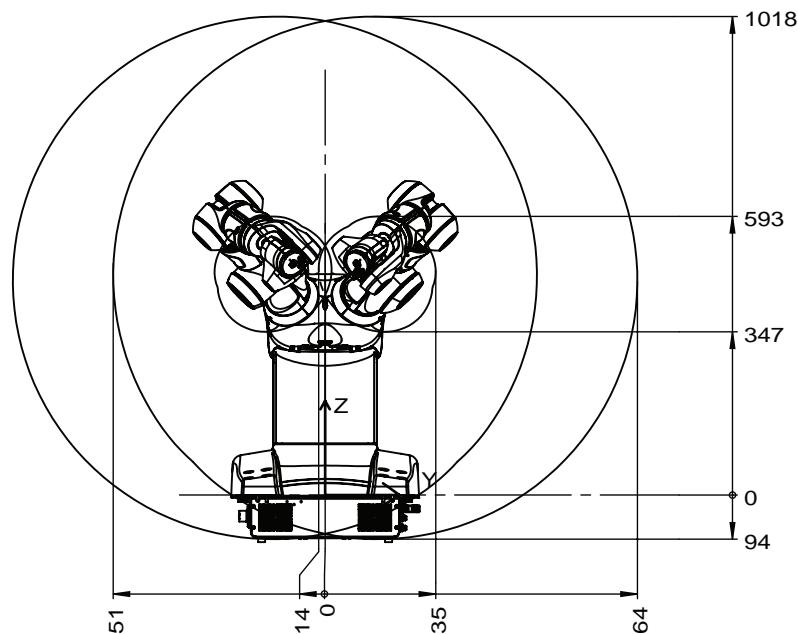
2.2.3 Working range

2.2.3 Working range

Illustration, working range IRB 14000

The illustrations show the unrestricted working range of the robot.

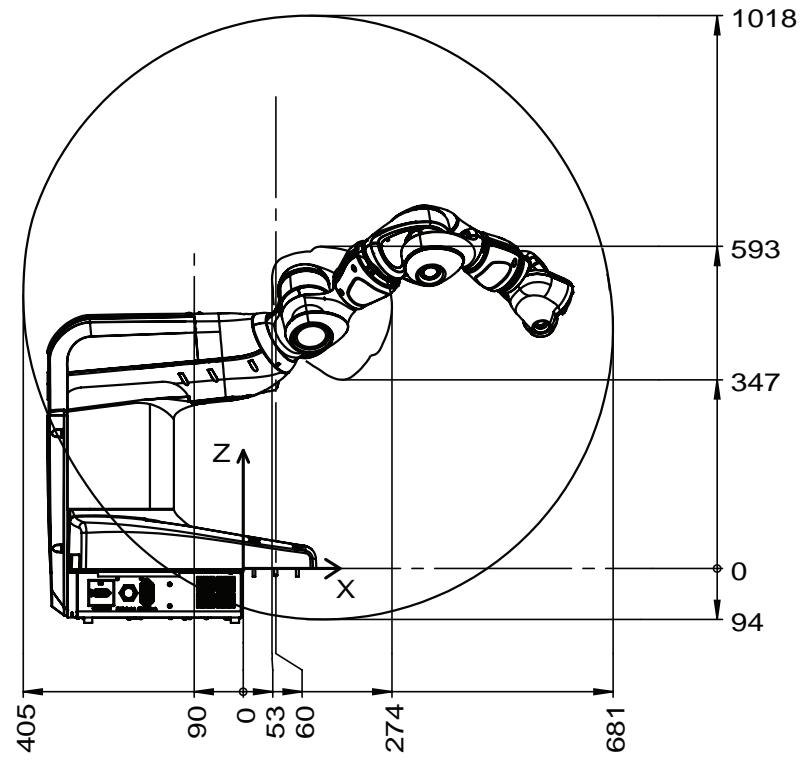
Front view



xx1500000105

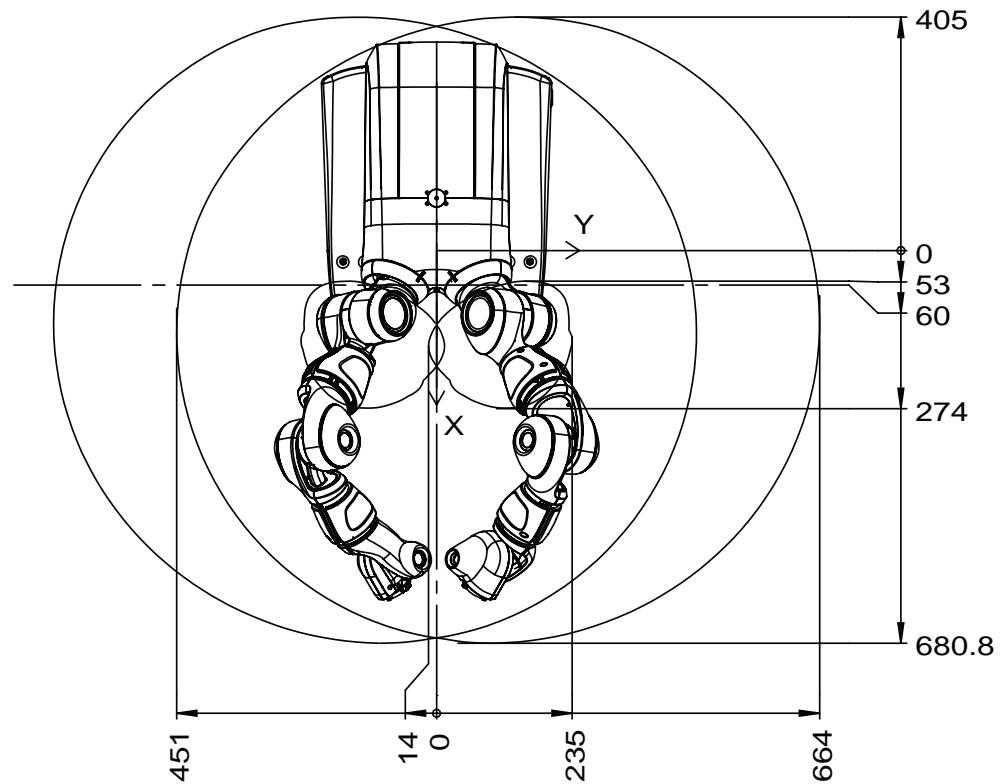
Continues on next page

Side view



xx1500000660

Top view



xx1500000336

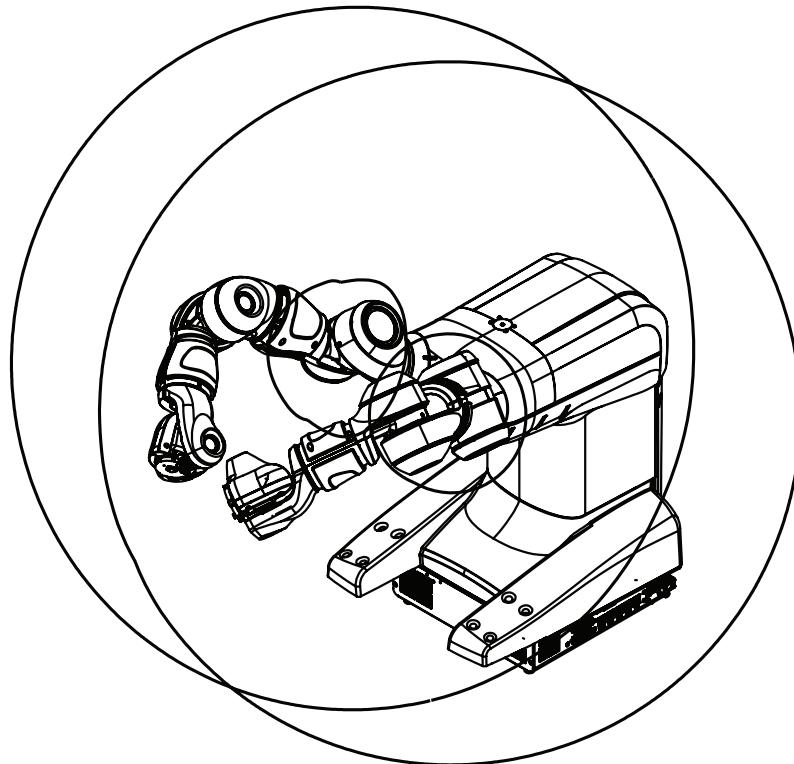
Continues on next page

2 Installation and commissioning

2.2.3 Working range

Continued

Isometric view



xx1500000661

Robot motion

Axis	Type of motion	Degree of motion
Axis 1	Arm - Rotation motion	-168.5° to +168.5°
Axis 2	Arm - Bend motion	-143.5° to +43.5°
Axis 7	Arm - Rotation motion	-168.5° to +168.5°
Axis 3	Arm - Bend motion	-123.5° to +80°
Axis 4	Wrist - Rotation motion	-290° to +290°
Axis 5	Wrist - Bend motion	-88° to +138°
Axis 6	Flange - Rotation motion	-229° to +229°

2.2.4 Risk of tipping/stability

Risk of tipping

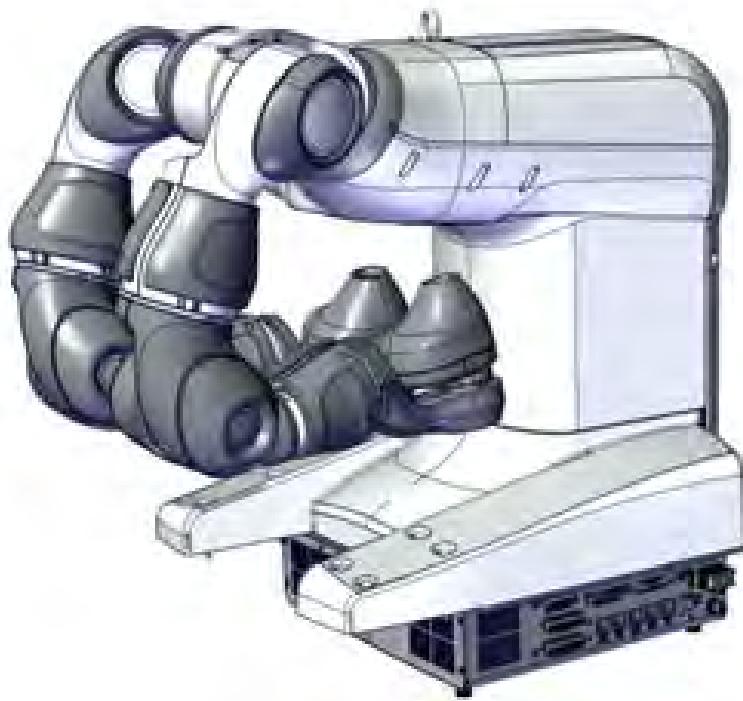
If the robot is not fastened to the foundation and standing still, the robot is not stable in the whole working area. Moving the arms will displace the center of gravity, which may cause the robot to tip over.

The shipping position is the most stable position.

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

Shipping and transport position

This figure shows the robot in its shipping position, which also is a recommended transport position.



xx1500000625



WARNING

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

2 Installation and commissioning

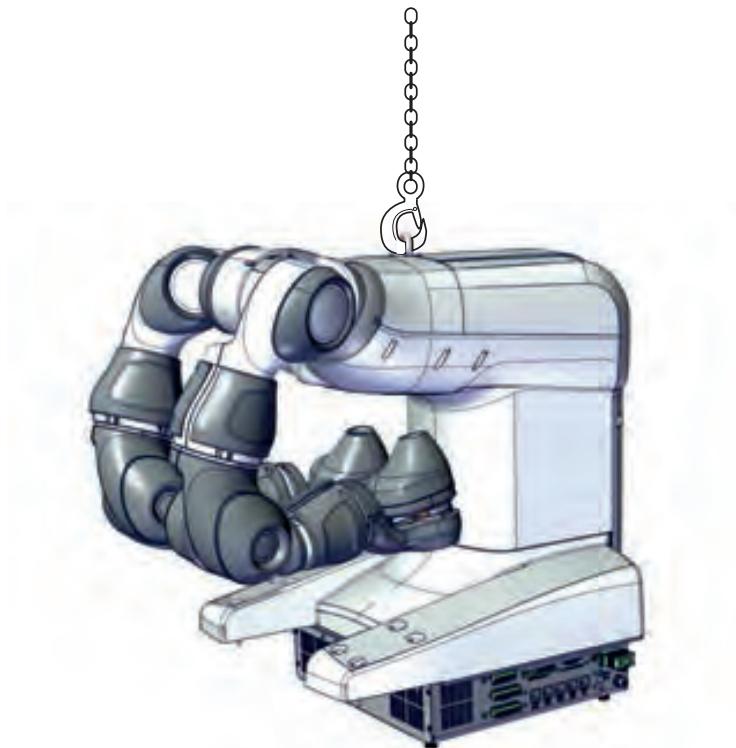
2.3.1 Lifting the robot with lifting accessories

2.3 On-site installation

2.3.1 Lifting the robot with lifting accessories

Introduction

The IRB 14000 is a collaborative robot, the whole robot can be lifted by lifting accessories or lifted by two persons. This section contains a general overview of how to lift the complete robot using lifting accessories.



xx1500000053

Required equipment

Equipment, etc.	Article number	Note
Overhead crane		
Lifting chain	-	>38 kg (capacity of lifting chain)
Lifting eye M8 DIN580	-	

Lifting the robot

Use the following procedure to lift the robot.

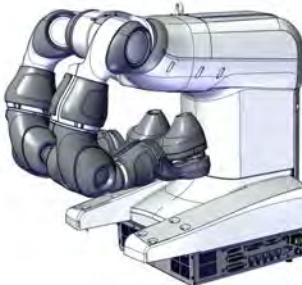
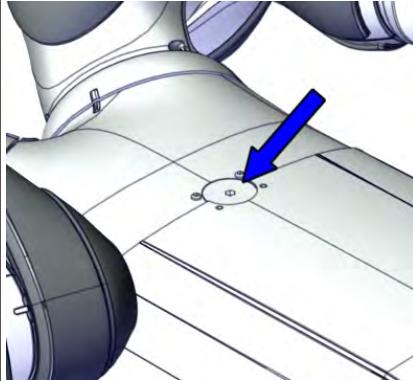
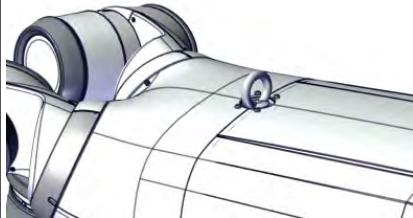
	Action	Note
1	<p>! CAUTION</p> <p>The IRB 14000 robot weighs 38 kg. All lifting accessories used must be sized accordingly!</p>	

Continues on next page

2 Installation and commissioning

2.3.1 Lifting the robot with lifting accessories

Continued

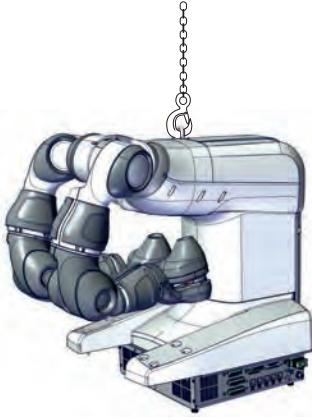
Action	Note
2 Move the robot to the appropriate lifting position. ! CAUTION Be careful not to hit the arms into something while lifting and transporting the robot. This could damage the mechanical structure of the arm.	 xx1500000625
3 Remove the threaded cover.	 xx1500000052
4 Fit the lifting eye to the robot.	Lifting eye M8 DIN580  xx1500000626
5 Attach the lifting chain to the lifting eye and to the overhead crane.	
6 Carefully stretch the chain by lifting the crane slowly.	
7 Remove the robot attachment screws (if the robot is fastened).	Screw (8 pcs) of M5x25

Continues on next page

2 Installation and commissioning

2.3.1 Lifting the robot with lifting accessories

Continued

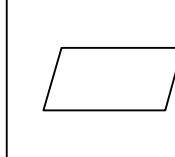
	Action	Note
8	Raise the overhead crane to lift the robot.	 xx1500000053

2.3.2 Lifting the robot by two persons

General

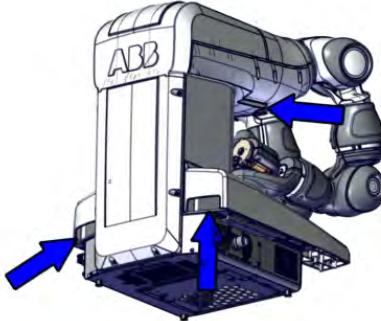
This section describes how to lift the robot and move it by two persons.

Attachment screws and pins

Suitable screws	M5x25
Quantity	8 pcs
Quality	8.8
Washer	8 pcs, 5.3x10x1
Guide pins	2 pcs, article number 3HNP00449-1
Tightening torque	3.8 Nm ± 0.38 Nm
Level surface requirements	 0.1
	xx1500000627

Lifting and transporting the robot

Use this procedure to lift the robot.

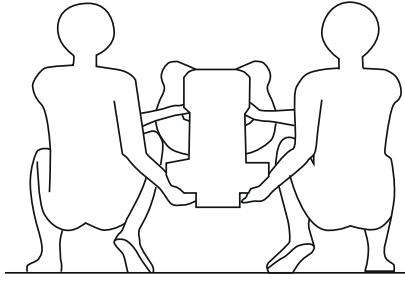
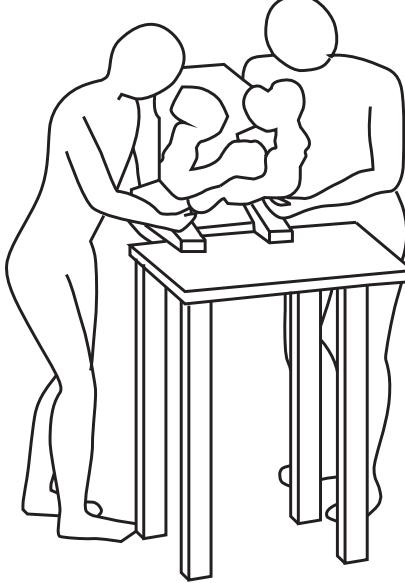
	Action	Note
1	 CAUTION The IRB 14000 robot weighs 38 kg and can be lifted by two persons.	
2	Grasp the hand-holding grooves, one person on each side of the robot.	 xx1400002122

Continues on next page

2 Installation and commissioning

2.3.2 Lifting the robot by two persons

Continued

	Action	Note
3	Lift the robot with one person on each side of the robot.	 xx1400002119
4	Move the robot to desired position.  CAUTION Be careful not to hit the arms into something while lifting and transporting the robot. This could damage the mechanical structure of the arm.	
5	Secure the robot on a workbench according to section <i>Orienting and securing the robot on page 65</i> .	Screws: 8 pcs M5x25 Washers: 8 pcs, 5.3x10x1  xx1400002021

2.3.3 Orienting and securing the robot

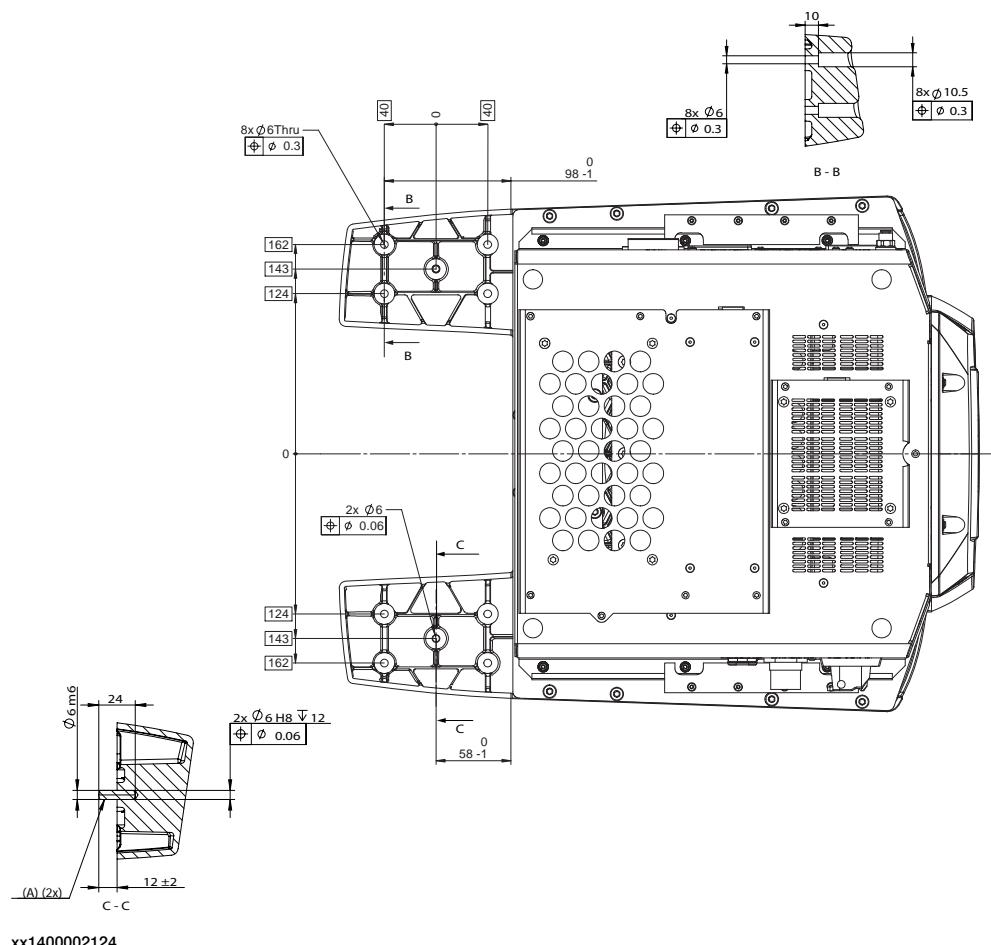
Introduction

This section details how to orient and secure the robot to the working bench in order to run the robot safely. The requirements made on the workbench are shown in sections:

- [Requirements, foundation on page 54](#)
- [Loads on foundation, robot on page 53](#)

Hole configuration, base

There are eight holes on the bottom of the robot body.



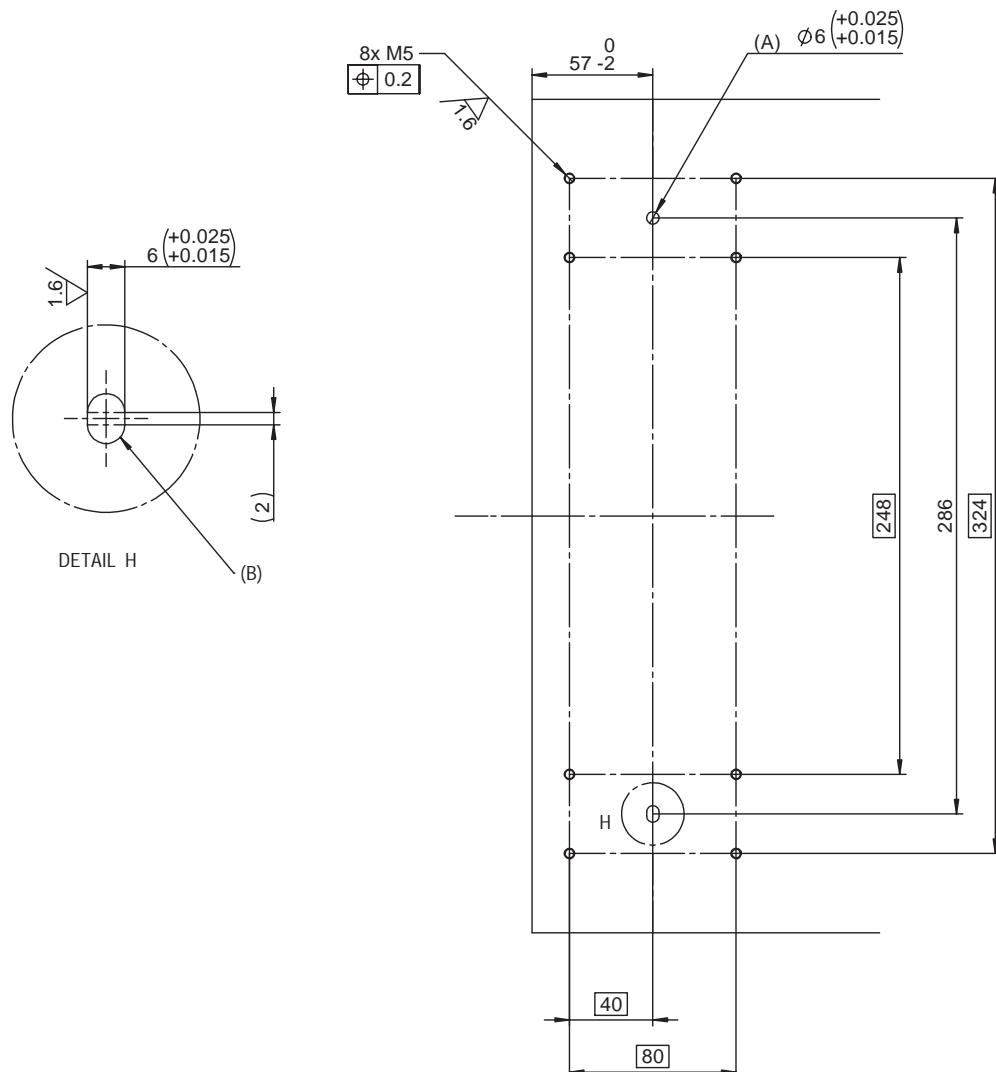
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2 Installation and commissioning

2.3.3 Orienting and securing the robot

Continued

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



xx1400002121

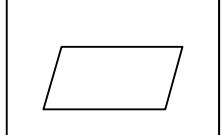
A	Master hole (round)
B	Alignment hole (slot)

Specification, attachment screws and pins

The table specifies the type of securing screws to be used to secure the robot directly to the foundation. It also specifies the type of pins to be used.

Screws	M5x25
Quantity	8 pcs
Quality	8.8
Washer	8 pcs, 5.3x10x1
Guide pins	2 pcs, article number 3HNP00449-1
Tightening torque	3.8 Nm \pm 0.38 Nm

Continues on next page

<p>Level surface requirements</p>	 0.1
xx1500000627	

Orienting and securing the robot

Use this procedure to orient and secure the robot to a table.

Action	Information
1 Make sure the installation site for the robot conforms to the specifications in section: • Pre-installation procedure on page 52	
2 Prepare the installation site with attachment holes.	The hole configuration of the base is shown in the figure in: • Hole configuration, base on page 65
3  CAUTION The robot weighs 38 kg. All lifting equipment must be sized accordingly!	
4  CAUTION When the robot is put down after being lifted or transported, there is a risk of tipping, if not properly secured.	
5 Lift the robot to its installation site.  CAUTION Be careful not to hit the arms into something while lifting and transporting the robot. This could damage the mechanical structure of the arm.	How to lift the robot is described in section: • Lifting the robot by two persons on page 63 • Lifting the robot with lifting accessories on page 60
6 Make sure there are two pins in the holes in the base.	2 pcs, article number 3HNP00449-1
7 Guide the robot using the pins, while lowering it to mounting position.	Make sure the robot base is correctly fitted onto the pins.
8 Fit the securing screws in the attachment holes of the base.	Screws: M5x25, (8 pcs), quality:8.8. Washers: 8 pcs, 5.3x10x1.
9 Tighten the bolts crosswise to ensure that the base is not distorted.	Tightening torque: 3.8 Nm ± 0.38 Nm

2 Installation and commissioning

2.3.4 Manually releasing the brakes

2.3.4 Manually releasing the brakes

Introduction to manually releasing the brakes

This section describes how to release the holding brakes for the motors of axis 1, axis 2, axis 3, and axis 7.

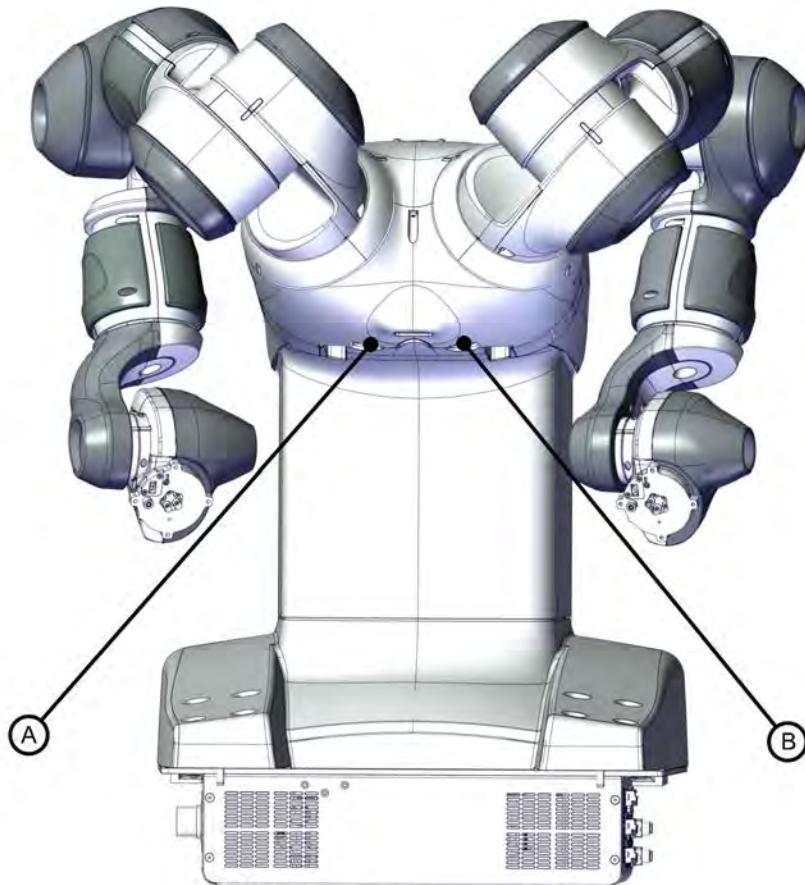


Note

There is no holding brake for axis 4, axis 5, or axis 6.

Location of brake release button

There are two brake release buttons, located as shown in the figure.



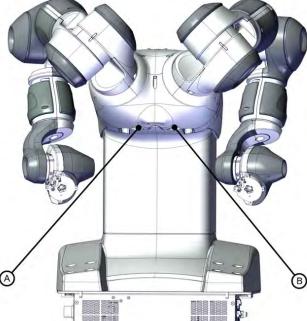
xx1400002126

A	Brake release button for right arm
B	Brake release button for left arm

Continues on next page

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
<p>1 The brake release unit is equipped with two buttons for controlling the axes brakes. Button A for right arm and button B for left arm. Releasing the brakes with the brake release buttons require that power is supplied to the robot, see Connecting power and the FlexPendant on page 81.</p>	 xx1400002126
<p>2  CAUTION When releasing the holding brakes, the robot axes may move very quickly and sometimes in unexpected ways!</p>	
<p>3 Release the holding brake on the right arm axes by pressing the button A. Release the holding brake on the left arm axes by pressing the button B. The brake will function again as soon as the button (A or B) is released.</p>	

2 Installation and commissioning

2.3.5 Loads fitted to the robot

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*

2.3.6 Installing the signal lamp

General



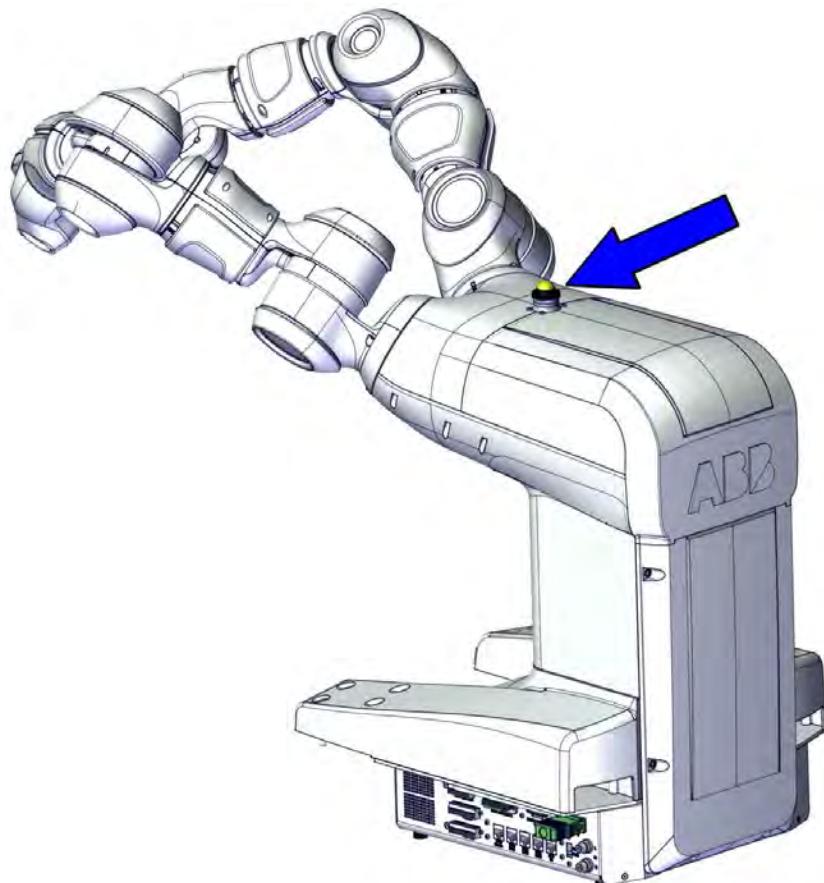
CAUTION

The signal lamp is packed and delivered separately, and should be installed by a system integrator.

A signal lamp with a yellow fixed light can be installed on the robot or to a suitable fixture at the working area. The lamp signals that motors are powered, and it allows the user to meet UL requirements.

Location of signal lamp

The signal lamp is located as shown in the figure.



xx1500000051

Required parts

Spare part	Article number	Note
Signal lamp	3HAC053350-001	Includes attachment screws.

Continues on next page

2 Installation and commissioning

2.3.6 Installing the signal lamp

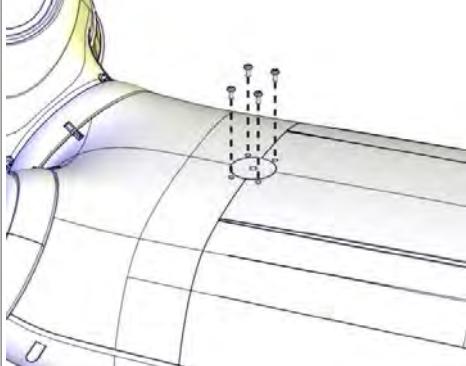
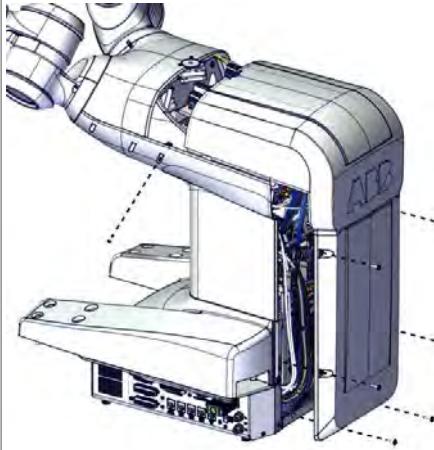
Continued

Required tools and equipment

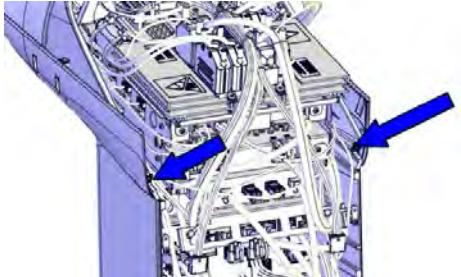
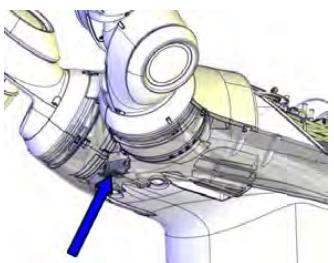
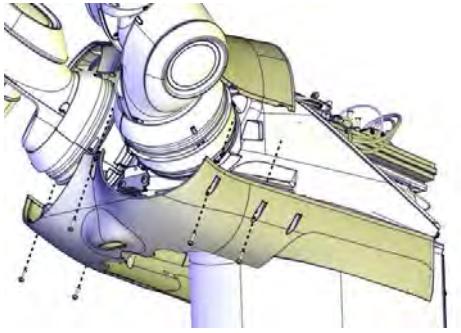
Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

Installing the signal lamp

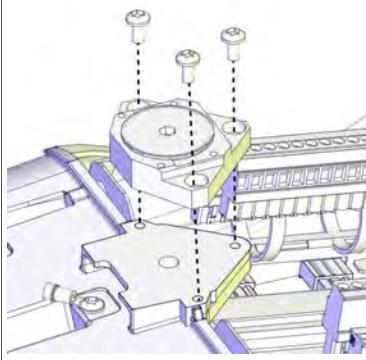
Removing the body covers

	Action	Note
1	 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2	Remove the body cover top screws.	 xx1400002904
3	Remove the body cover.	 xx1500000303

Continues on next page

Action	Note
4 Remove the back screws of the lower body cover.	 xx1500000540
5 Remove the front and lower body cover.  Note Be aware of the tab underneath the cover so it does not get damaged.  xx1500000564	 xx1400002603

Installing the signal lamp

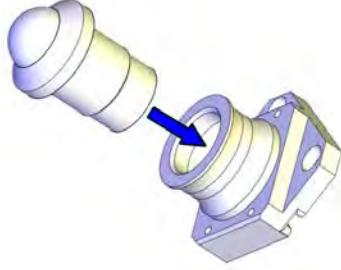
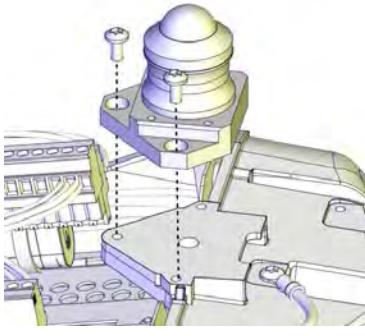
Action	Note
1  DANGER Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Remove the protection cover.	 xx1500000605

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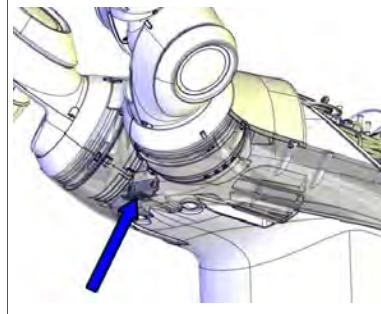
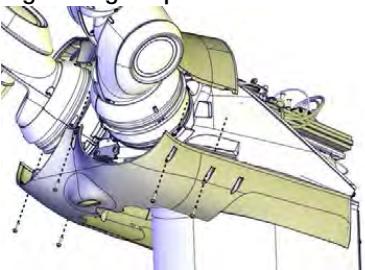
2 Installation and commissioning

2.3.6 Installing the signal lamp

Continued

Action	Note
3 Fit the lamp to the signal lamp base.	 xx1500000615
4 Fit the signal lamp assembly to the robot.	 xx1500000616
5 Connect the lamp cable connector.	
6 The signal lamp is now ready for use and is lit in MOTORS ON mode.	

Refitting the body covers

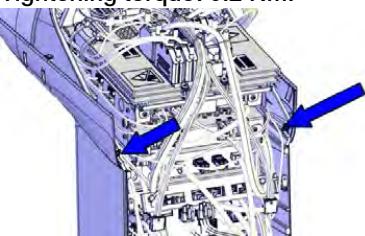
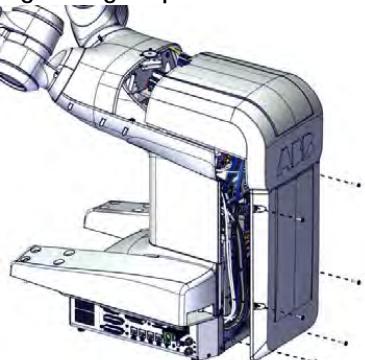
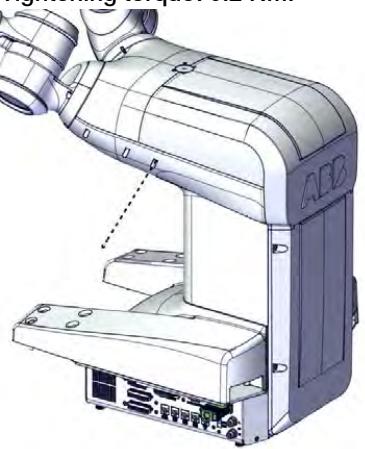
Action	Note
1 Refit the front and lower body cover.  Note Be aware of the tab underneath the cover so it does not get damaged.  xx1500000564	Screws: 3HAC050367-005. (5 pcs) Tightening torque: 0.2 Nm.  xx1400002603

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2 Installation and commissioning

2.3.6 Installing the signal lamp

Continued

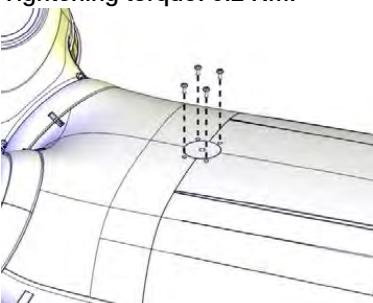
Action	Note
2 Refit the back screws of the lower body cover.	Screws: 2 pcs. Tightening torque: 0.2 Nm.  xx1500000540
3 Refit the body cover.	Screws: 6 pcs. Tightening torque: 0.9 Nm.  xx1500000697
4 Refit the two remaining screws of the body cover.	Screws: 2 pcs. Tightening torque: 0.2 Nm.  xx1500000696

Continues on next page

2 Installation and commissioning

2.3.6 Installing the signal lamp

Continued

	Action	Note
5	Refit the body cover top screws.	Screws: 4 pcs. Tightening torque: 0.2 Nm.  xx1400002904

2.3.7 Electrical connections

2.3.7.1 Robot cabling and connection points

Introduction

Connect the robot after securing it to the working bench. The lists below specify which cables to use for the robot.

Main cable categories

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

Cable category	Description
Main power cable	Supplies power to the robot (provided by customer).
FlexPendant cables	Communicates with FlexPendant to which the robot connects.

2 Installation and commissioning

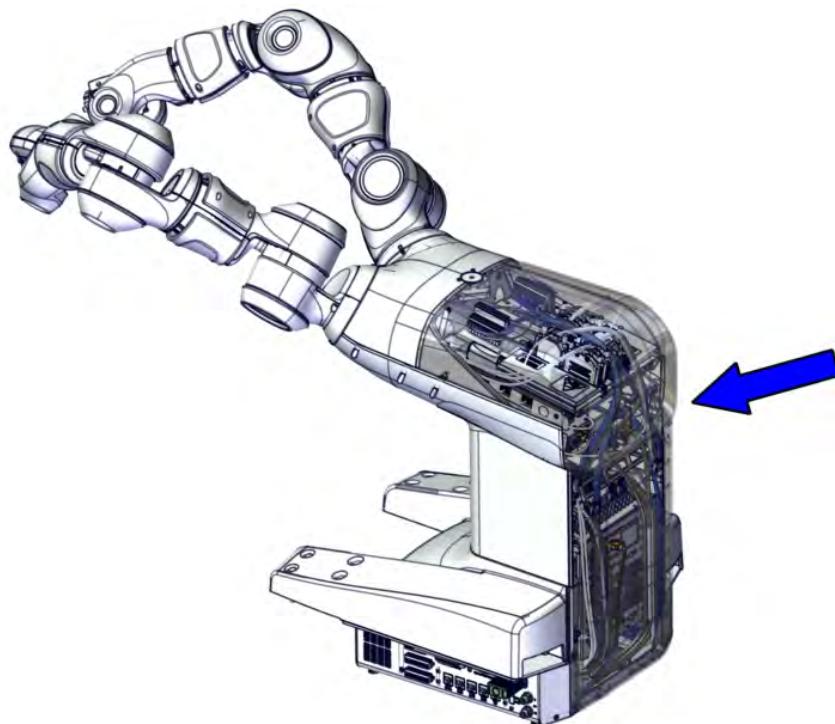
2.4.1 Overview

2.4 Controller

2.4.1 Overview

Overview

The IRB 14000 integrated controller is based on the standard IRC5 controller, and contains all functions needed to move and control the robot.



xx1400002127



Note

When replacing a unit in the controller, report the following data to ABB, for both the replaced unit and the replacement unit:

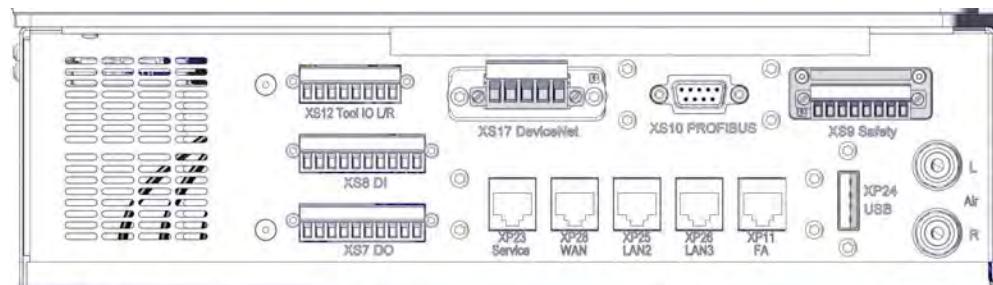
- the serial number
- article number
- revision

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

Continues on next page

Controller interface, left side

The following illustration describes the interface on the left side panel of the controller.



xx1400002129

XS12	Tool I/O, left and right arm 4x4 digital I/O signals to the tool flanges, to be cross connected with XS8 and/or XS9 when not using Ethernet.
XS17	DeviceNet Master/Slave
XS10	Fieldbus adapter PROFIBUS Anybus device (fieldbus adapter option)
XS9	Safety signals
XS8	Digital inputs 8 digital input signals (approx. 5 mA) to the internal I/O board (DSQC 652)
XS7	Digital outputs 8 digital output signals (150 mA/channel) from the internal I/O board (DSQC 652)
XP23	Service
XP28	WAN (connection to factory WAN).
XP25	LAN2 (connection of Ethernet based options).
XP26	LAN3 (connection of Ethernet based options).
XP11	FA = Fieldbus adapter PROFINET or EtherNet/IP (fieldbus adapter option)
XP24	USB port to main computer
Air L	Air supply, left arm O.D. 4 mm air hose, 0.5 MPa air pressure
Air R	Air supply, right arm O.D. 4 mm air hose, 0.5 MPa air pressure

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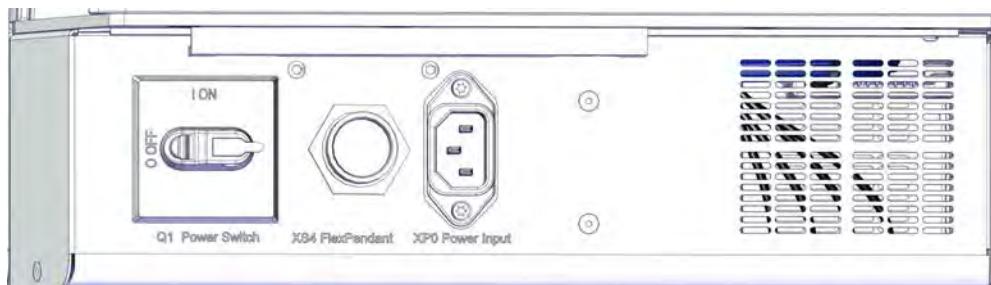
2 Installation and commissioning

2.4.1 Overview

Continued

Controller interface, right side

The following illustration describes the interface on the right side panel of the controller.



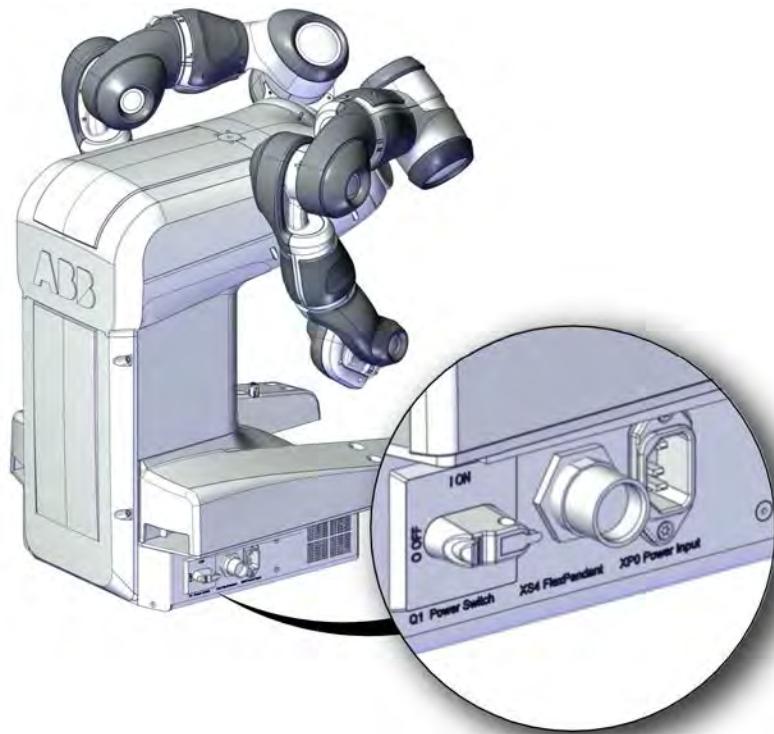
xx1400002125

Q1	Power switch
XS4	FlexPendant
XP0	Power input Main AC power connector, IEC 60320-1 C14, 100-240 VAC, 50-60 Hz

2.4.2 Connecting power and the FlexPendant

Overview

The following illustration shows the connectors on the right side of the controller.



xx1500000503

Q1	Power switch
XS4	FlexPendant
XP0	Power input Main AC power connector, IEC 60320-1 C14, 100-240 VAC, 50-60 Hz

Connecting power to the controller

The following procedure describes how to connect the main power to the controller.



CAUTION

Always inspect the connector for dirt or damage before connecting it to the controller. Clean or replace any damaged parts.



Note

This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

Continues on next page

2 Installation and commissioning

2.4.2 Connecting power and the FlexPendant

Continued

	Action	Information
1	Locate the main AC power connector on the right side of the controller.	The power switch must be turned off.
2	Connect the power cable	

Connecting a FlexPendant

The following procedure describes how to connect a FlexPendant to the controller.



CAUTION

Always inspect the connector for dirt or damage before connecting it to the controller. Clean or replace any damaged parts.

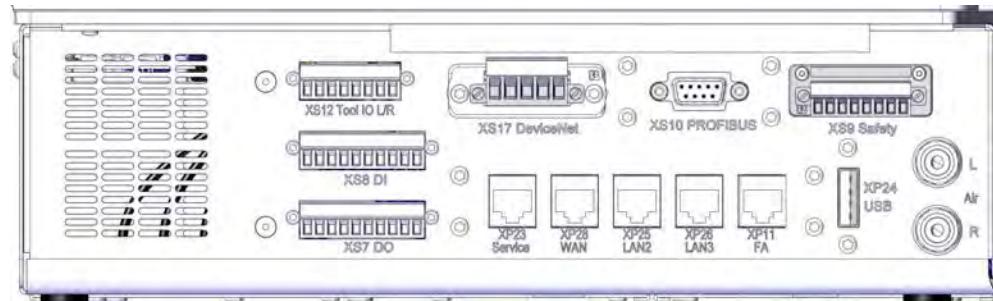
	Action	Information
1	Locate the FlexPendant socket connector on the right side of the controller.	The controller must be in manual mode.
2	Plug in the FlexPendant cable connector.	
3	Screw the connector lock ring firmly by turning it clockwise.	

2.4.3 Connecting a PC and Ethernet based options

Introduction

The following connectors on the interface on the left side panel of the controller are directly connected to the Ethernet ports of the IRC5 main computer.

For more information about the functionality of each connector, see [Connectors on the computer unit on page 84](#).



XP23	Service
XP28	WAN (connection to factory WAN).
XP25	LAN2 (connection of Ethernet based options).
XP26	LAN3 (connection of Ethernet based options).
XP24	USB port to main computer

Multiple Ethernet based options

For IRB 14000 it is possible to use both the options *PROFINET Controller/Device* (888-2) and *EtherNet/IP Scanner/Adapter* (841-1) at the same time.

Continues on next page

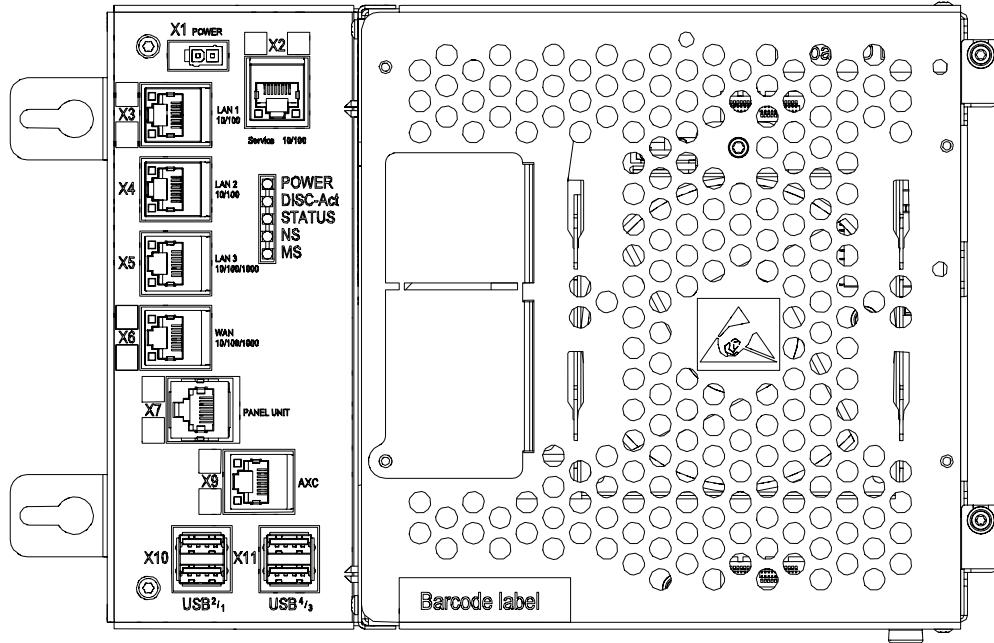
2 Installation and commissioning

2.4.3.1 Connectors on the computer unit

2.4.3.1 Connectors on the computer unit

Overview of the computer unit

The following illustration shows an overview of the computer unit.



xx1300000608

X1	Power supply
X2 (yellow)	Service (connection of PC).
X3 (green)	LAN1 (connection of FlexPendant).
X4	LAN2 (connection of Ethernet based options).
X5	LAN3 (connection of Ethernet based options).
X6	WAN (connection to factory WAN).
X7 (blue)	Panel unit
X9 (red)	Axis computer
X10, X11	USB ports (4 ports)



Note

It is not supported to connect multiple ports of the main computer (X2 - X6) to the same external switch, unless static VLAN isolation is applied on the external switch.

Service port

The service port is intended for service engineers and programmers connecting directly to the controller with a PC.

Continues on next page

The service port is configured with a fixed IP-address, which is the same for all controllers and cannot be changed, and has a DHCP server that automatically assigns an IP-address to the connected PC.



Note

For more information about connecting a PC to the service port, see section *Working online* in *Operating manual - RobotStudio*.

WAN port

The WAN port is a public network interface to the controller, typically connected to the factory network with a public IP address provided by the network administrator.

The WAN port can be configured with fixed IP-address, or DHCP, from the **Boot application** on the FlexPendant. By default the IP-address is blank.

Some network services, like FTP and RobotStudio, are enabled by default. Other services are enabled by the respective RobotWare application.



Note

The WAN port cannot use any of the following IP-addresses which are allocated for other functions on the IRC5 controller:

- 192.168.125.0 - 255
- 192.168.126.0 - 255
- 192.168.127.0 - 255
- 192.168.128.0 - 255
- 192.168.129.0 - 255
- 192.168.130.0 - 255

The WAN port cannot be on a subnet which overlaps with any of the above reserved IP-addresses. If a subnet mask in the class B range has to be used, then a private address of class B must be used to avoid any overlapping. Please contact your local network administrator regarding network overlapping.

See the section about topic *Communication* in *Technical reference manual - System parameters*.



Note

For more information about connecting a PC to the WAN port, see section *Working online* in *Operating manual - RobotStudio*.

LAN ports

The LAN 1 port is dedicated for connecting the FlexPendant.

Continues on next page

2 Installation and commissioning

2.4.3.1 Connectors on the computer unit

Continued

The LAN 2 and LAN 3 ports are intended for connecting network based process equipment to the controller. For example field buses, cameras, and welding equipment.



Note

When using IRB 14000 grippers, the following restrictions apply to the usage of LAN2:

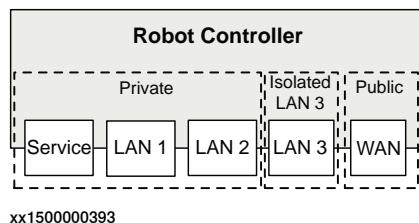
- Any external units connected to LAN2 need to have IP addresses on the same subnet as the grippers, network 192.168.125.0/24.
- If option 841-1 *EtherNet/IP Scanner/Adapter* is used for external units (EtherNet/IP scanners or adapters), these units must be connected to LAN2, network 192.168.125.0/24. These units will share EtherNet/IP network with the IRB 14000 grippers.

Note that option 840-1 *EtherNet/IP Anybus Adapter* can be used without restrictions.

LAN 2 can only be used as private network to the IRC5 controller.

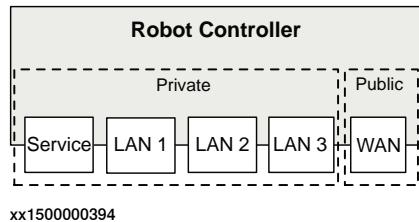
Isolated LAN 3 or LAN 3 as part of the private network (only for RobotWare 6.01 and later)

The default configuration is that LAN 3 is configured as an isolated network. This allows LAN 3 to be connected to an external network, including other robot controllers. The isolated LAN 3 network has the same address limitations as the WAN network.



xx1500000393

An alternative configuration is that LAN 3 is part of the private network. The ports Service, LAN 1, LAN 2, and LAN 3 then belong to the same network and act just as different ports on the same switch. This is configured by changing the system parameter *Interface*, in topic *Communication* and type *Static VLAN*, from "LAN 3" to "LAN". See *Technical reference manual - System parameters*.



xx1500000394

Continues on next page



Note

For more information and examples of connecting to different networks, see *Application manual - EtherNet/IP Scanner/Adapter* or *Application manual - PROFINET Controller/Device*.

USB ports

The USB ports are intended for connecting USB memory devices.



Note

It is recommended to use the USB ports USB¹ and USB² on the X10 connector for connecting USB memory devices.

The USB ports on the X11 connector are intended for internal use.

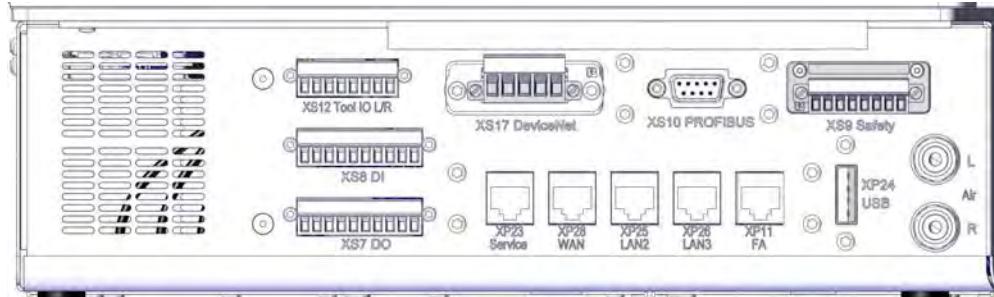
2 Installation and commissioning

2.4.4 Connecting I/O signals

2.4.4 Connecting I/O signals

Introduction

It is possible to connect digital I/O signals to the IRB 14000 through the connectors on the interface on the left side panel of the controller.



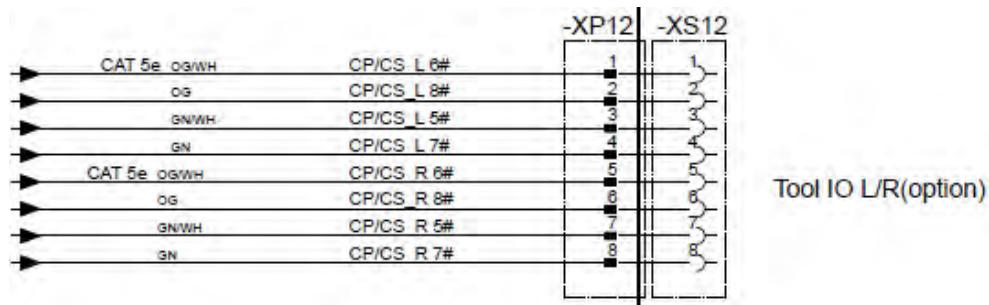
xx1400002129

XS12	Tool I/O, left and right arm 4x4 digital I/O signals to the tool flanges, when not using Ethernet.
XS8	Digital inputs 8 digital input signals to the internal I/O board (DSQC 652)
XS7	Digital outputs 8 digital output signals from the internal I/O board (DSQC 652)

Tool I/O

Tool I/O is a customer option.

When not using Ethernet to the tool flanges it is possible to use the XS12 connector for connecting digital I/O signals instead.



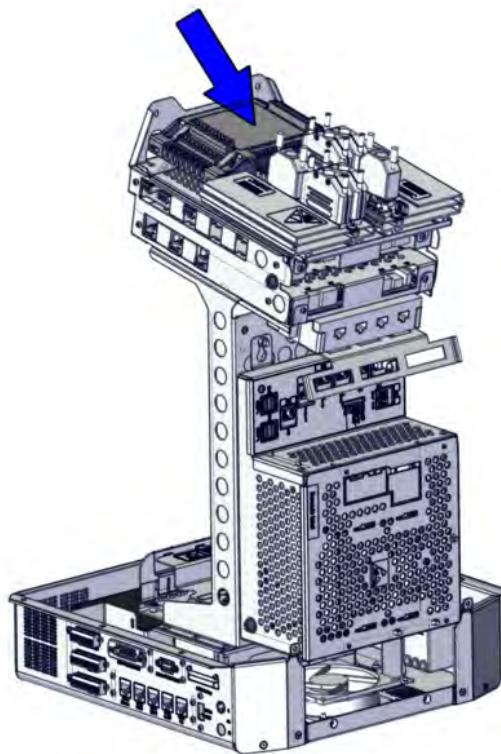
xx1500000012

For more information about connecting the tool I/O, see *Circuit diagram - IRB 14000*.

Continues on next page

Digital inputs and outputs

The connectors for digital inputs and outputs on the controller interface are connected to the internal DeviceNet I/O unit in the controller.



xx1500000429

The signals are predefined in the system parameters in topic *I/O System*, with the names `custom_DI_x` and `custom_DO_x`. The customer should change the names to fit the current application.

For more information about configuring I/O, see *Application manual - DeviceNet Master/Slave* and *Technical reference manual - System parameters*

2 Installation and commissioning

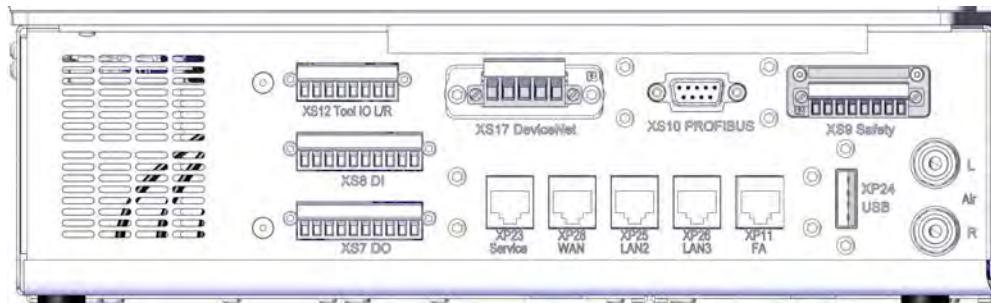
2.4.5 Connecting fieldbuses

2.4.5 Connecting fieldbuses

Introduction

The IRC5 Controller may be fitted with a number of different fieldbus adapters and fieldbus master/slave boards.

The following connectors on the interface on the left side panel of the controller are directly connected to the fieldbus connectors on the integrated IRC5 main computer.



xx1400002129

XS17	DeviceNet
XS10	Fieldbus adapter PROFIBUS (fieldbus adapter option)
XP11	Fieldbus adapter PROFINET or EtherNet/IP (fieldbus adapter option)



Note

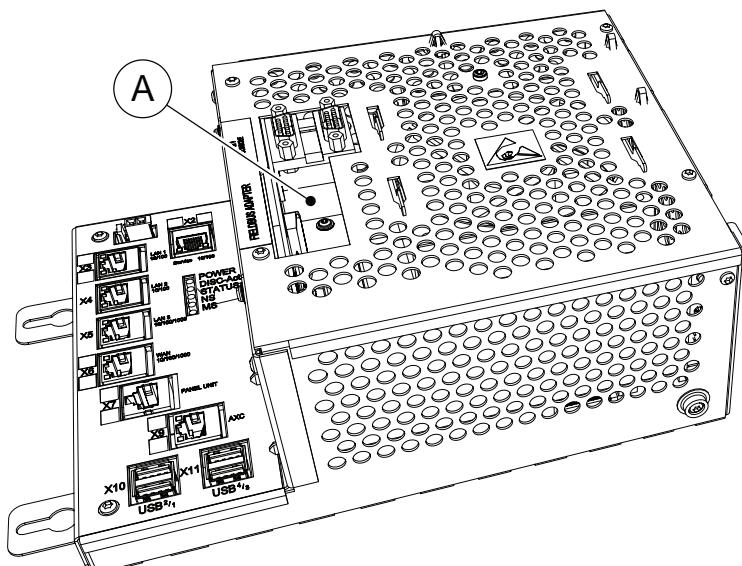
DeviceNet m/s (option 709-1) is provided at XS17 as default.

The DeviceNet fieldbus adapter (option 840-4) is not supported by IRB 14000.

Continues on next page

Expansion board for fieldbus adapters

An expansion board needs to be installed to be able to fit a fieldbus adapter. On top of the main computer unit, there is one slot available for installing the expansion board.

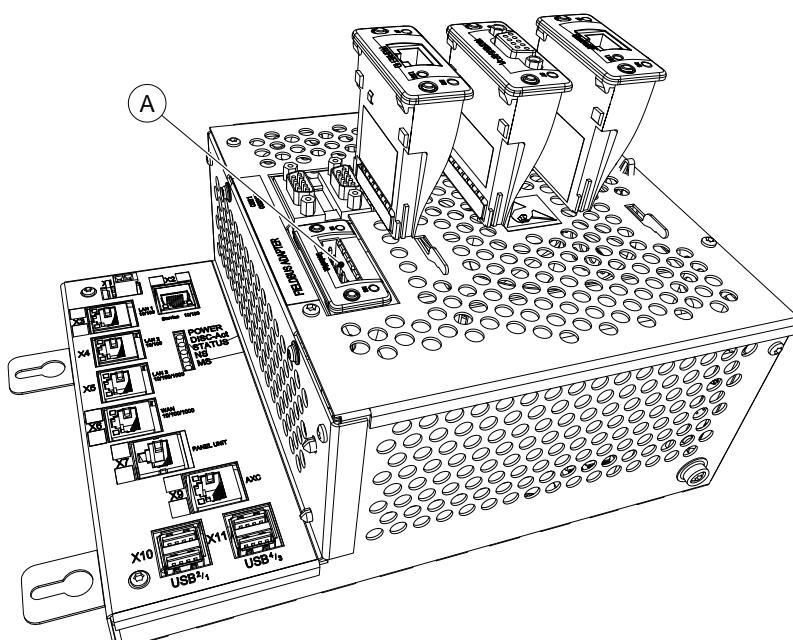


xx1300000605

A	Assembled expansion board for fieldbus adapters, without adapter.
---	---

Fieldbus adapters

The fieldbus adapters are inserted into the expansion board on top of the main computer unit. There is one slot available for installing a fieldbus adapter.



xx1300000604

Continues on next page

2 Installation and commissioning

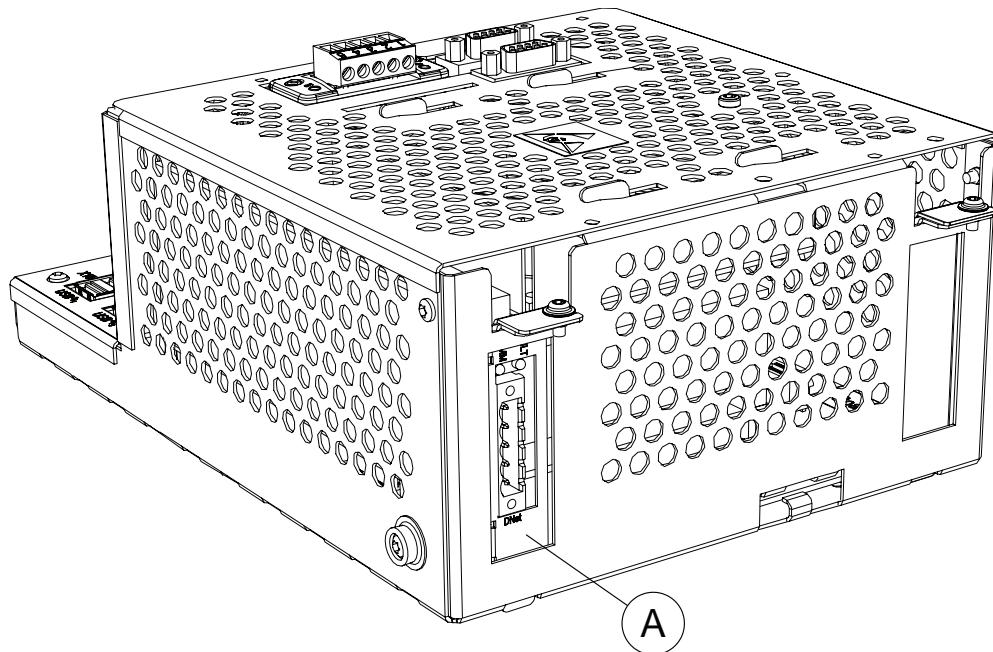
2.4.5 Connecting fieldbuses

Continued

A	Slot for AnybusCC fieldbus adapters
---	-------------------------------------

DeviceNet master/slave board

The DeviceNet m/s board is installed the right side of the main computer.



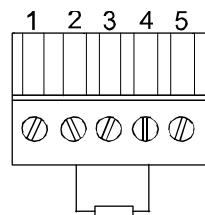
xx1300001968

A	Slot for DeviceNet m/s board
---	------------------------------

Termination resistors in the DeviceNet bus

Each end of the DeviceNet bus must be terminated with a 121 ohm resistor. The two terminating resistors should be as far apart as possible.

The termination resistor is placed in the cable connector. There is no internal termination on the DeviceNet PCI board. The termination resistor is connected between CANL and CANH - that is, between pin 2 and pin 4 according to the illustration below.



xx0400000674

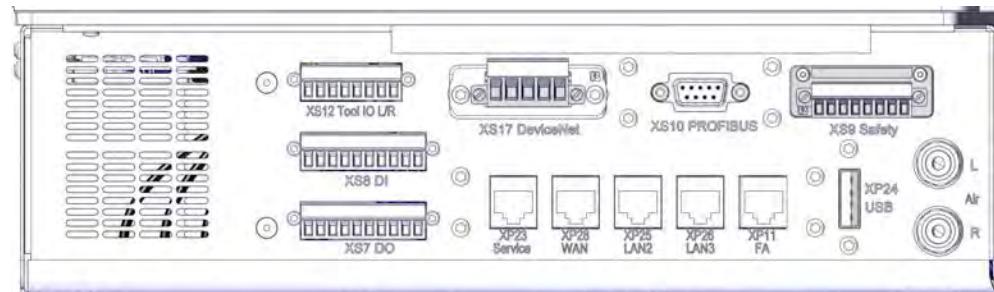
References

For more information on how to install and configure the fieldbuses, see the respective fieldbus application manual.

2.4.6 Connecting safety signals

Introduction

The IRB 14000 safety stop signals (SS) are accessed through the safety connector on the interface on the left side panel of the controller. This is covered by a safety bridge connector by default in standalone mode. If the bridge connector is removed, it is external device mode.

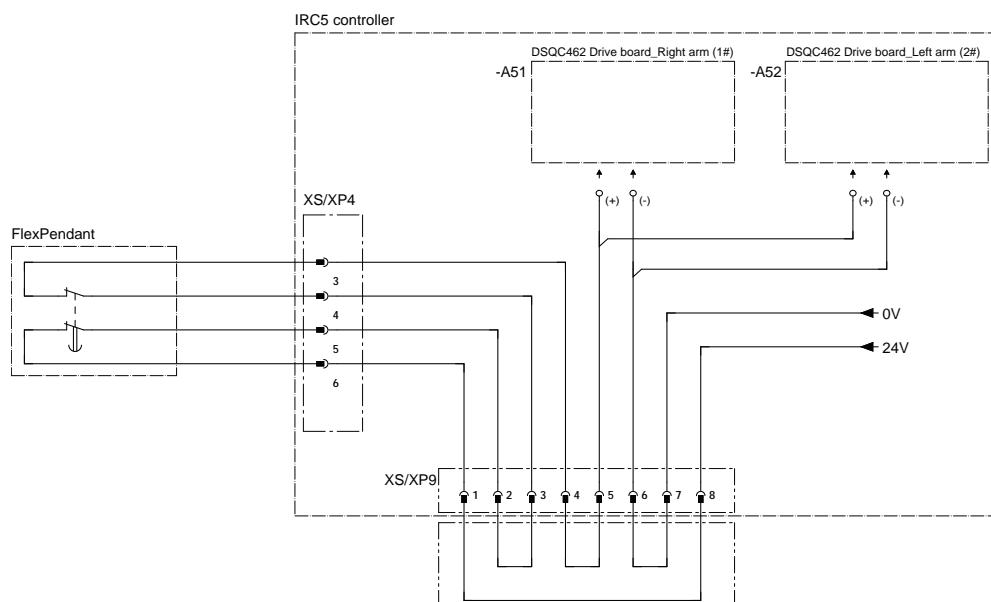


XS9	Safety signals
-----	----------------

Standalone safety

IRB 14000 standalone is not connected to any external safety devices. The safety connector on the foot interface is plugged with a safety bridge connector, that closes both emergency stop channels of the FlexPendant.

The safety stop input on each drive monitors this channel, and triggers a safety stop if the circuit is open or not powered.



xx15000000013

Continues on next page

2 Installation and commissioning

2.4.6 Connecting safety signals

Continued

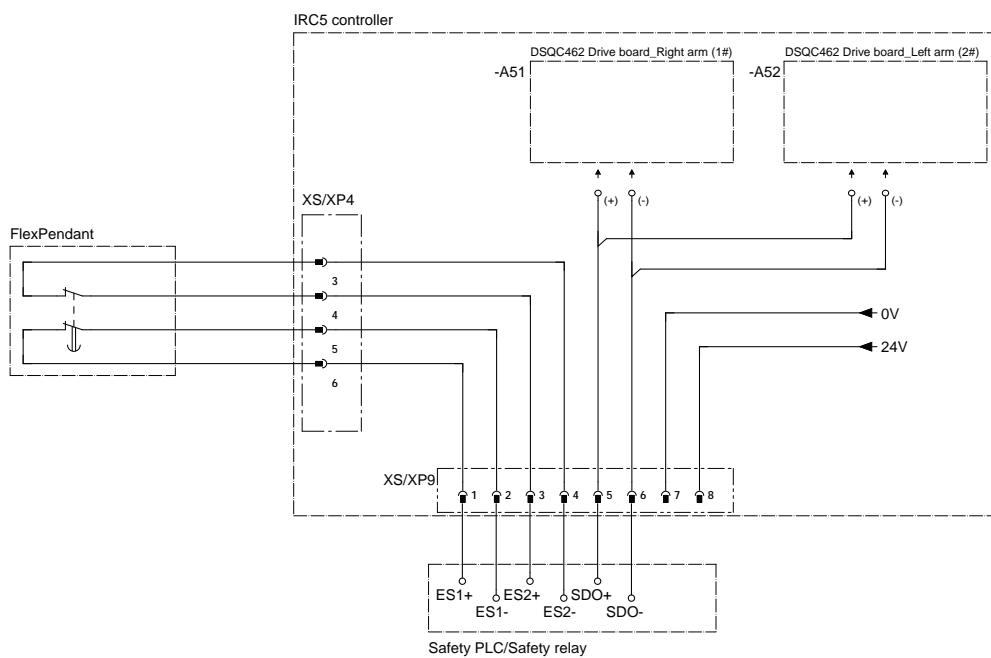
Safety when connected to external devices

To connect to external safety devices, the safety bridge connector must be removed.

The system integrator shall then use a safety PLC or safety relay to feed and monitor the dual channel emergency stop of the IRB 14000 FlexPendant.

The safety PLC shall process the input from the IRB 14000 emergency stop, as well as inputs from other safety devices in the cell, and set the necessary outputs to stop machinery in the cell.

Dual channel safety performance can be maintained where such is required. IRB 14000 can be stopped from the safety PLC by routing back a single channel stop signal to the safety connector XS9.



xx1500000014

For more information about connecting the safety signals, see *Circuit diagram - IRB 14000*.

2.4.7 Memory functions

2.4.7.1 SD-card memory

General

The controller is fitted with an SD-card memory containing ABB Boot Application software. The SD-card memory is located inside the computer unit.



Note

Only use SD-card memory supplied by ABB.

2 Installation and commissioning

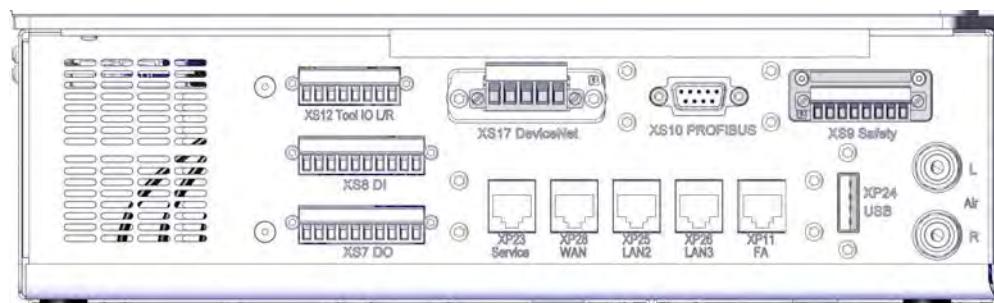
2.4.7.2 Connecting an USB memory

General

Handling of USB memory is described in *Operating manual - IRC5 with FlexPendant*.

Location on the controller

The location of the USB port on the controller is shown by the following illustration:



XP24	USB ¹ port to main computer
------	--

Location on the FlexPendant

The location of the USB port on the FlexPendant is shown by the following illustration:



xx1500000701

3 Maintenance

3.1 Introduction

Structure of this chapter

This chapter describes all the maintenance activities recommended for the IRB 14000.

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 14000 is connected to power, always make sure that the IRB 14000 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

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 14000:

- 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.
- SIS: specified by the robot's SIS (Service Information System). A typical value is given for a typical work cycle, but the value will differ depending on how hard each part is run. The SIS used in M2004 is further described in the *Operating manual - Service Information System*.

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.

Activities and intervals, standard equipment

The table below specifies the required maintenance activities and intervals:

Maintenance activities	Regularly i	Every 1 months	Every 6 months	Every 12 months	Every 36 months	Reference
<i>Cleaning activities</i>						
Cleaning the robot	x					Cleaning the IRB 14000 on page 116
<i>Inspection activities</i>						
Inspecting the robot	x					Look for abnormal wear or contamination.
Inspecting the information labels			x			Inspecting the information labels on page 101
Inspecting cable harness		x				Inspecting, cable harness on page 107
Inspecting plastics and padding	x ii	x				Inspecting, plastic and padding on page 109

i "Regularly" implies that the activity is to be performed regularly, but the actual interval may not be specified by the robot manufacturer. The interval depends on the operation cycle of the robot, its working environment and movement pattern. Generally, the more contaminated environment, the shorter intervals. The more demanding movement pattern (sharper bending cable harness), the shorter intervals.

ii Plastic and padding parts are a safety feature of the robot, that limit impact during collisions. To ensure a maintained safety level of the robot, regular inspections of these parts are necessary.

Continues on next page

3 Maintenance

3.2.2 Maintenance schedule

Continued

Activities and intervals, optional equipment

The table below specifies the required maintenance activities and intervals:

Maintenance activities	Every 12 months	Reference
<i>Inspection activities</i>		
Inspecting the signal lamp	x	<i>Inspecting, signal lamp on page 105</i>

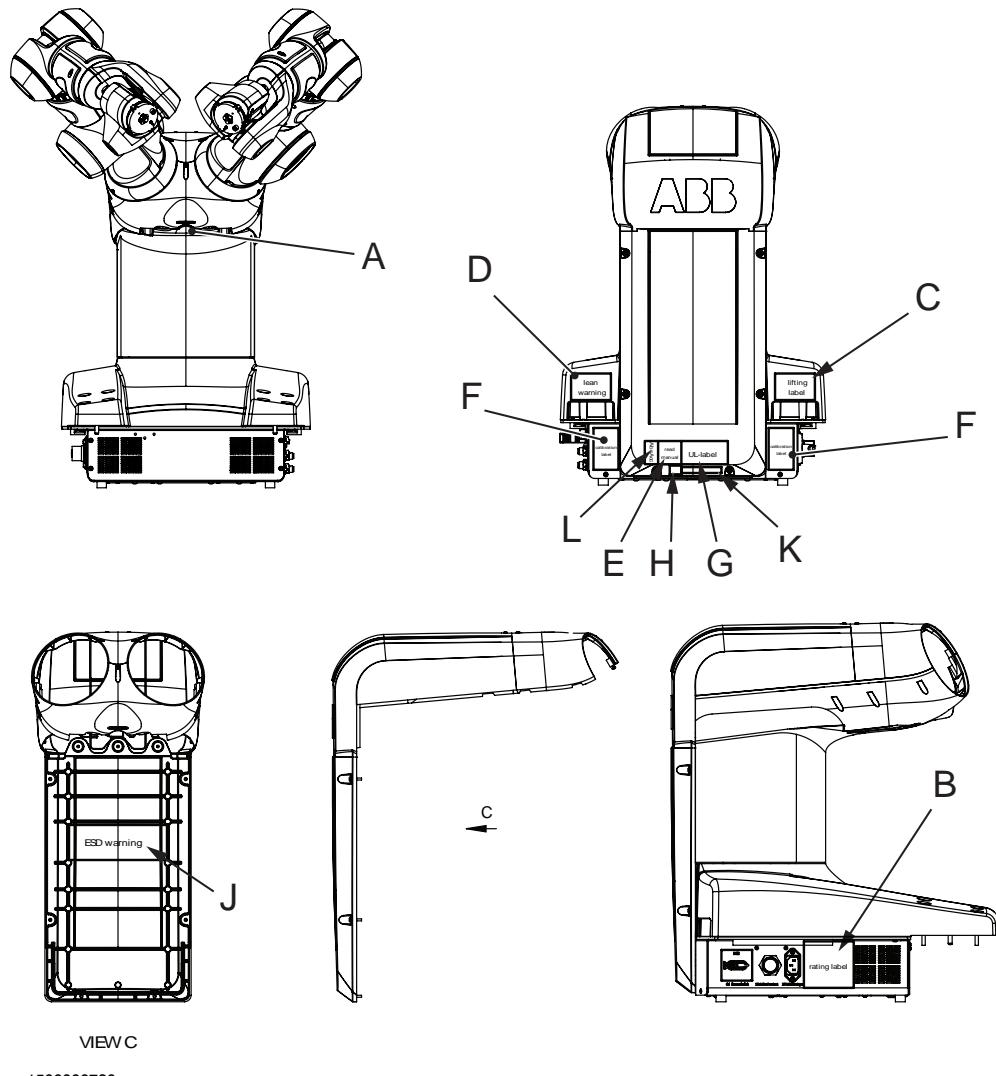
3.3.1 Inspecting the information labels

3.3 Inspection activities

3.3.1 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](#).



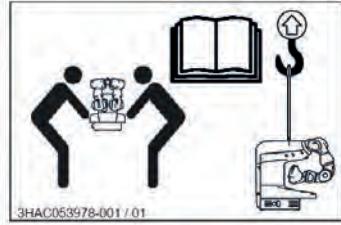
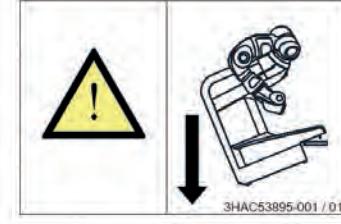
	Description	Illustration
A	Instruction plate, Brake release	 xx1500000723

Continues on next page

3 Maintenance

3.3.1 Inspecting the information labels

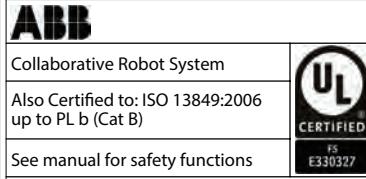
Continued

B	Rating label	<p>14000-500003 14000-500003</p> <p>ABB Engineering(shanghai) Ltd. Made in China</p> <hr/> <p>Type : IRB14000 Robot variant : IRB 14000-0,5/0,5 Power : 100-240VAC, 2,4-1A, 50-60Hz Short circuit current: <7,5 A Protection : IP30 Circuit diagram: See user documentation</p> <p>Serial number: 14000-500003</p> <p>Date of manufacturing: 2015-02-31 Max load: See Load Diagram Net weight: 38 Kg Max air pressure: 0,5 MPa</p> <p>xx1500000724</p>
C	Lifting label	 <p>xx1500000725</p>
D	Caution label, Risk of tipping	 <p>xx1500000726</p>
E	Read manual label	 <p>xx1500000727</p>
F	Calibration label	

Continues on next page

3.3.1 Inspecting the information labels

Continued

G	UL label	 xx1500000791
H	Warning sign, Electrical shock	 xx0200000024
J	ESD Warning (inside of cover)	 xx0200000023
K	Warning label, Disconnect power before servicing controller	WARNING - LOCKOUT/TAGOUT DISCONNECT MAIN POWER BEFORE SERVICING EQUIPMENT xx1500000790
L	AbsAcc label	Absolute Accuracy xx1500001643

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 14000* on ABB Library.

Spare part	Article number	Note
Rating label	3HAB9549-1	
Warning sign	3HAC1589-1	Electrical shock
Caution label	3HAC053895-001	Risk of tipping
Warning label	3HAC055245-001	Disconnect power before servicing controller
Instruction plate	3HAC053898-001	Brake release
Lifting label	3HAC053978-001	
Read manual label	3HAC053979-001	
Calibration label	3HAC13488-1	
ESD Warning	29454254-1	
UL label	3HAC055016-001	

Continues on next page

3 Maintenance

3.3.1 Inspecting the information labels

Continued

Required tools and equipment

Visual inspection, no tools are required.

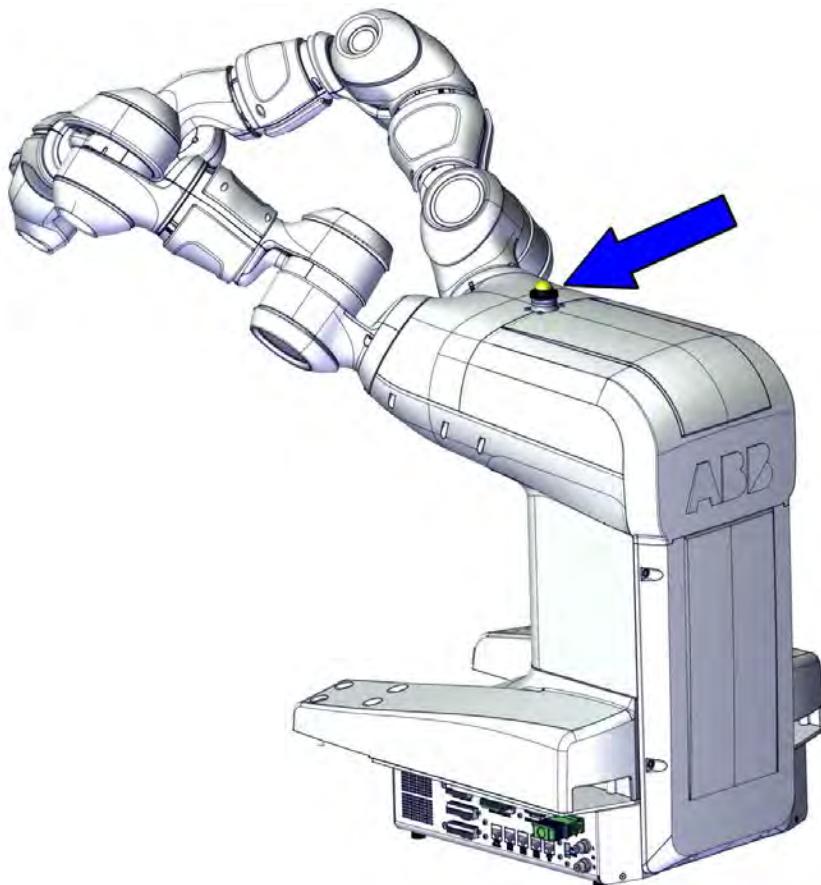
Inspecting, labels

	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• air pressure supply to the robot, before starting maintenance activities.	
2	Inspect the labels, located as shown in the figures.	
3	Replace any missing or damaged labels.	

3.3.2 Inspecting, signal lamp

Location of signal lamp

The signal lamp is located as shown in this figure.



xx1500000051

Required tools and equipment

Equipment, etc.	Art. no.	Note
Signal lamp	3HAC053350-001	To be replaced if damage is detected.
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

Inspecting, signal lamp

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

	Action	Note
1	Verify that the signal lamp is lit when motors are put in operation ("MOTORS ON").	

Continues on next page

3 Maintenance

3.3.2 Inspecting, signal lamp

Continued

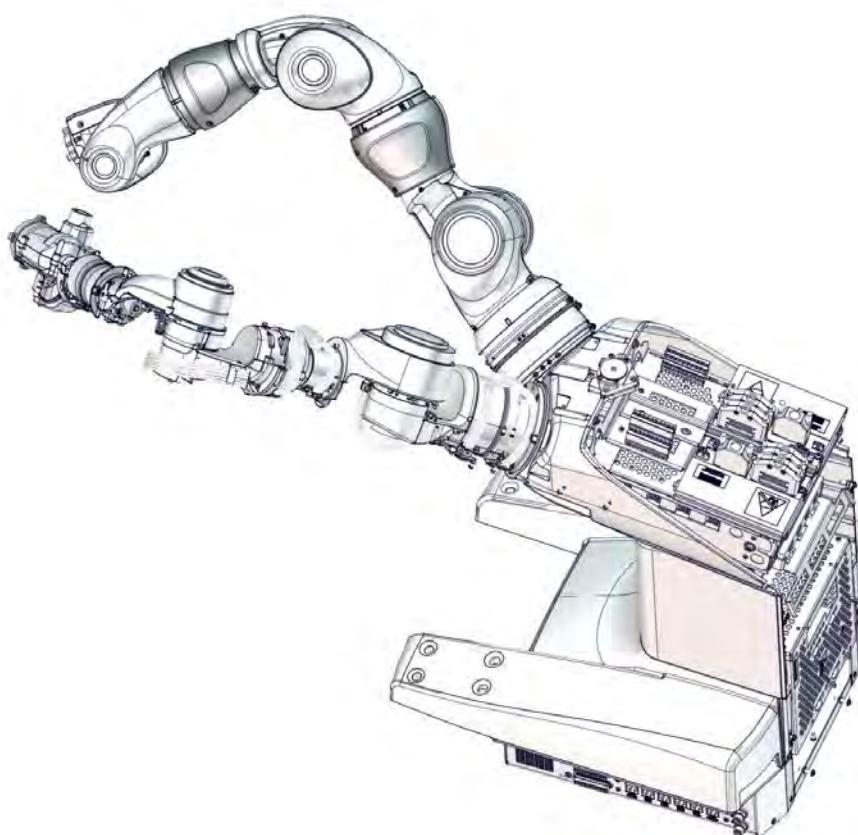
Action	Note
<p>2</p> <p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none">• electric power supply• air pressure supply <p>to the robot, before starting the inspection work on the robot.</p>	
<p>3</p> <p>If the lamp is not lit, trace the fault by:</p> <ul style="list-style-type: none">• Make sure that the <i>signal lamp</i> is not broken. If so, replace it.• Inspect the cable connections.• Inspect the cabling. Replace the cabling if a fault is detected.	<p>Art. no. is specified in section Required tools and equipment on page 105.</p> <p>For details about how to replace the signal lamp, see Installing the signal lamp on page 71.</p>

3.3.3 Inspecting, cable harness

Location of cable harness

The cable harness for the arm runs undivided from its connection point at the drive unit on the controller, out from the body, throughout the arm to the axis motors and ends up at the tool flange.

In the figure below all covers required to be removed for visual access to the cable harness, are removed.



xx1400002908

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

Continues on next page

3 Maintenance

3.3.3 Inspecting, cable harness

Continued

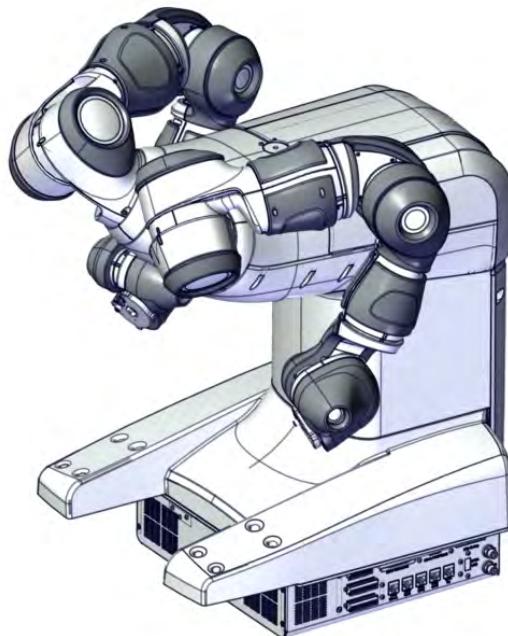
Inspecting the cable harness

Action	Note
1  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• air pressure supply to the robot, before starting the inspection work on the robot.	
2 Remove all covers required to achieve visibility of all cabling.	Information for removal and refitting of covers is found in Replacing the encapsulation and covers on page 135 .
3 Visually inspect all arm cabling. Look for abrasions, cuts or crush damages. If any damage is detected, replace the complete robot arm.	See Replacing the complete arm on page 120 .
4 Inspect that the cabling is lubricated properly. If needed, apply grease evenly on the moving part of the cable harness. It is normal that the grease color turns into black.	Grease: Mobil FM222.
5 Refit all covers. If any cover is damaged, it must be replaced.  CAUTION Be careful not to squeeze any cabling during the refitting procedure.	Replacement information for the covers, such as part numbers and tightening torques for the attachment screws are detailed in section Replacing the encapsulation and covers on page 135 .

3.3.4 Inspecting, plastic and padding

Location of plastic and padding

The plastic and padding are located on the whole arm.



xx1500000507



CAUTION

Plastic and padding parts are a safety feature of the robot, that limit impact during collisions. To ensure a maintained safety level of the robot, regular inspections of these parts are necessary.

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

Inspecting plastic and padding

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

Continues on next page

3 Maintenance

3.3.4 Inspecting, plastic and padding

Continued

	Action	Note
2	Visually inspect all plastics and padding parts for damage. If any cover is damaged or cannot perform its protective function for other reasons, it must be replaced.	Spare part numbers and replacement information is found in <i>Replacing the encapsulation and covers on page 135</i> .
3	Make sure that all plastic and padding covers are fully fastened. Manually check that the parts are not loose. Tighten, if needed.	Tightening torques are specified in <i>Replacing the encapsulation and covers on page 135</i> .

3.4 Replacement/changing activities

3.4.1 Replacing the battery pack

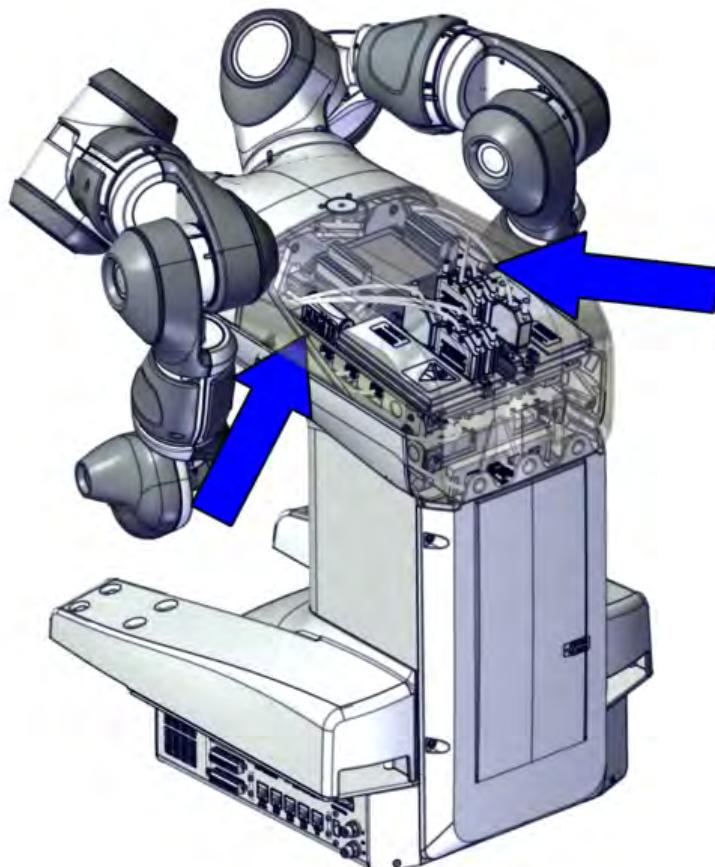


Note

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.

Location of battery pack

The battery pack RMU is located as shown in the figure.



xx1500000504

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. Contact ABB for the latest revision of *Product manual, spare parts - IRB 14000*.

Continues on next page

3 Maintenance

3.4.1 Replacing the battery pack

Continued

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

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

Consumables

Consumable	Article number	Note
Cable ties	-	-

Removing the battery pack

Use this procedure to remove the battery pack.

Preparations before removing the battery pack

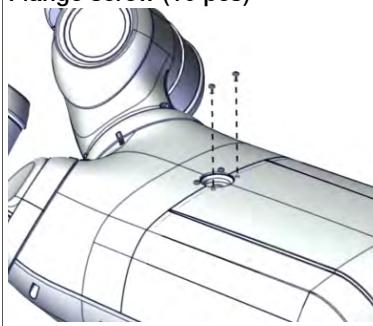
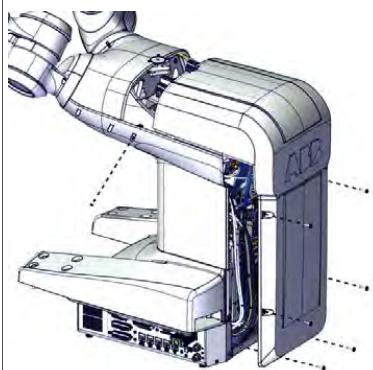
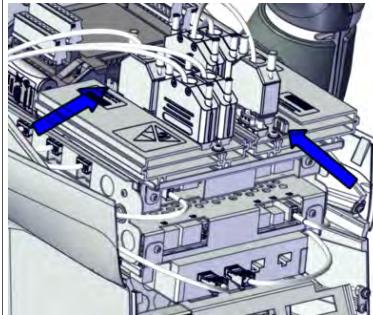
	Action	Note
1	Move the robot to its calibration position.	This is done in order to facilitate updating of the revolution counter.
2	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• air pressure supply to the robot, before starting the repair work on the robot.	

Removing the battery pack

	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 47	

Continues on next page

3.4.1 Replacing the battery pack
Continued

Action	Note
3 Remove the body cover.	<p>Flange screw (10 pcs)</p>  <p>xx1500000525</p>  <p>xx1500000303</p>
4 Disconnect the battery connector(X3).	 <p>xx1500000505</p>
5 Cut the cable tie that secures the battery and remove the battery.	

Continues on next page

3 Maintenance

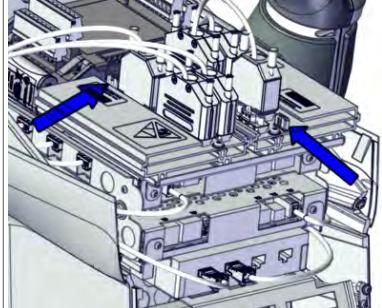
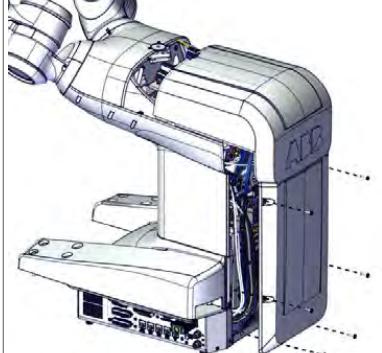
3.4.1 Replacing the battery pack

Continued

Refitting the battery pack

Use these procedures to refit the battery pack.

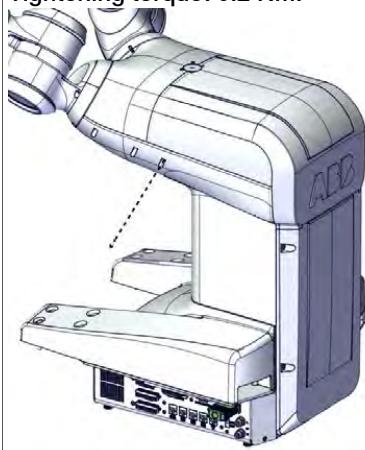
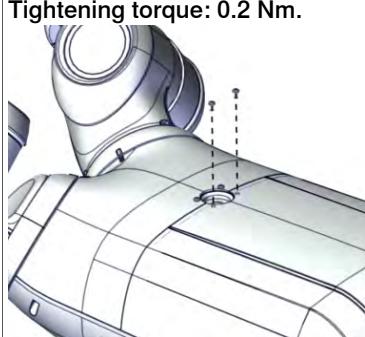
Refitting the battery pack

	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 47	
2	Fit the battery and secure it with a cable tie.  Note Battery includes protection circuits. Only replace with a specified spare part or with an ABB-approved equivalent.	 xx1500000506
3	Connect the battery connector (X3).	 xx1500000505
4	Refit the body cover.	Tightening torque: 0.9 Nm.  xx1500000697

Continues on next page

3.4.1 Replacing the battery pack

Continued

	Action	Note
5	Refit the two remaining screws of the body cover.	Tightening torque: 0.2 Nm.  xx1500000696
6	Refit the attachment screws.	Flange screw (2 pcs) Tightening torque: 0.2 Nm.  xx1500000525

Concluding procedure

	Action	Note
1	Update the revolution counters.	See Updating revolution counters on page 442 .
2	 CAUTION 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 45 .	

3 Maintenance

3.5.1 Cleaning the IRB 14000

3.5 Cleaning activities

3.5.1 Cleaning the IRB 14000



WARNING

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

General

To secure high uptime it is important that the IRB 14000 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 14000.



Note

Always verify the protection type of the robot before cleaning.

Dos and don'ts!

This section specifies some special considerations when cleaning the robot.

Always!

- Always use cleaning equipment as specified above! Any other cleaning equipment may shorten the life of the robot.
- Always check that all protective covers are fitted to the robot before cleaning!

Never!

- Never use compressed air to clean the robot!
- Never use solvents that are not approved by ABB to clean the robot!
- 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
Standard	Yes	Yes. With light cleaning detergent.	No	No

4 Repair

4.1 Introduction

Structure of this chapter

This chapter describes all repair activities recommended for the IRB 14000 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.

The procedures are gathered in sections, divided according to the component location on the IRB 14000.

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 455](#).

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 14000 is connected to power, always make sure that the IRB 14000 is connected to earth before starting any repair work.

For more information see:

- *Product manual - IRC5*

4 Repair

4.2.1 Mounting instructions for seals

4.2 General procedures

4.2.1 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	-	Mobil FM222

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 118 .
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

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 Repair

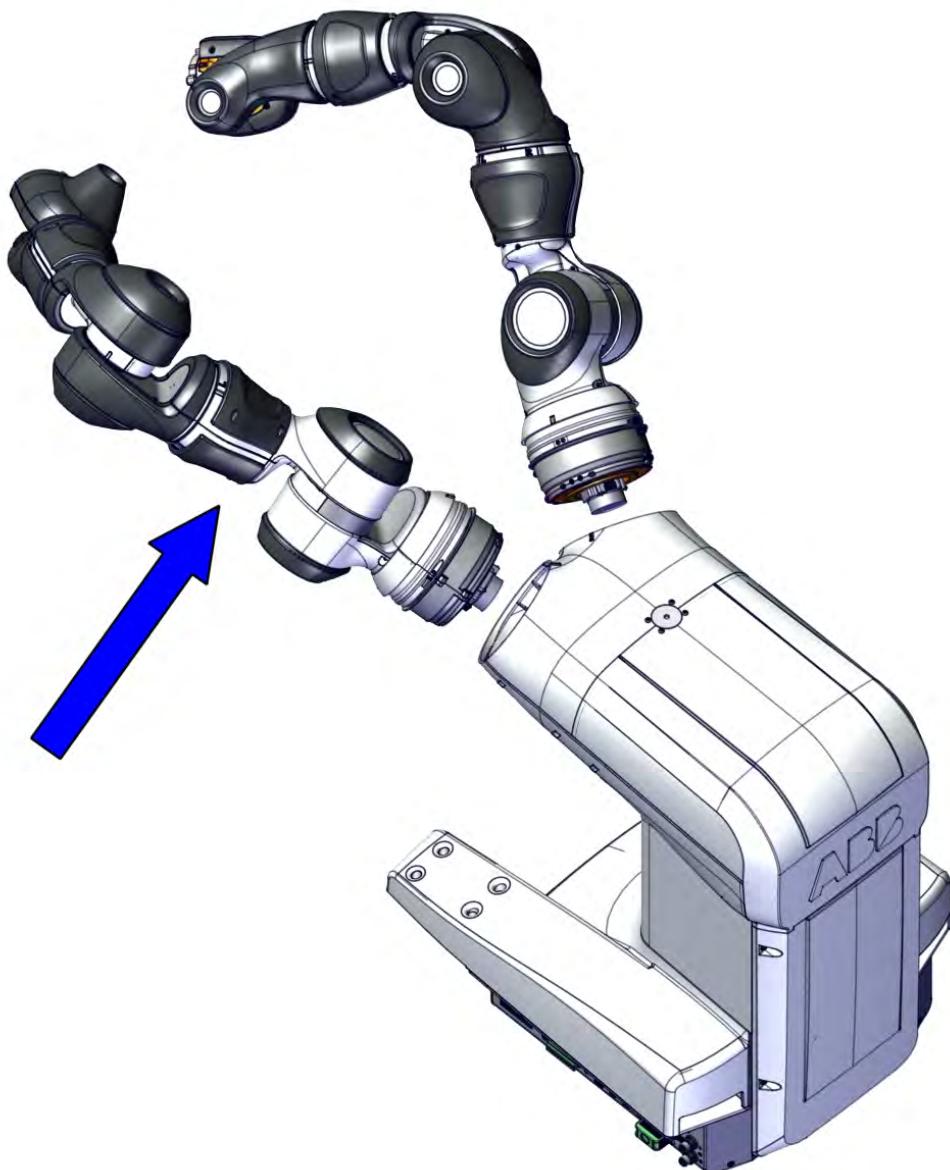
4.3.1 Replacing the complete arm

4.3 Arm and arm covers

4.3.1 Replacing the complete arm

Location of the complete arm

The arm is located as shown in the figure.



xx1500000662

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 14000* on ABB Library.

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4.3.1 Replacing the complete arm

Continued

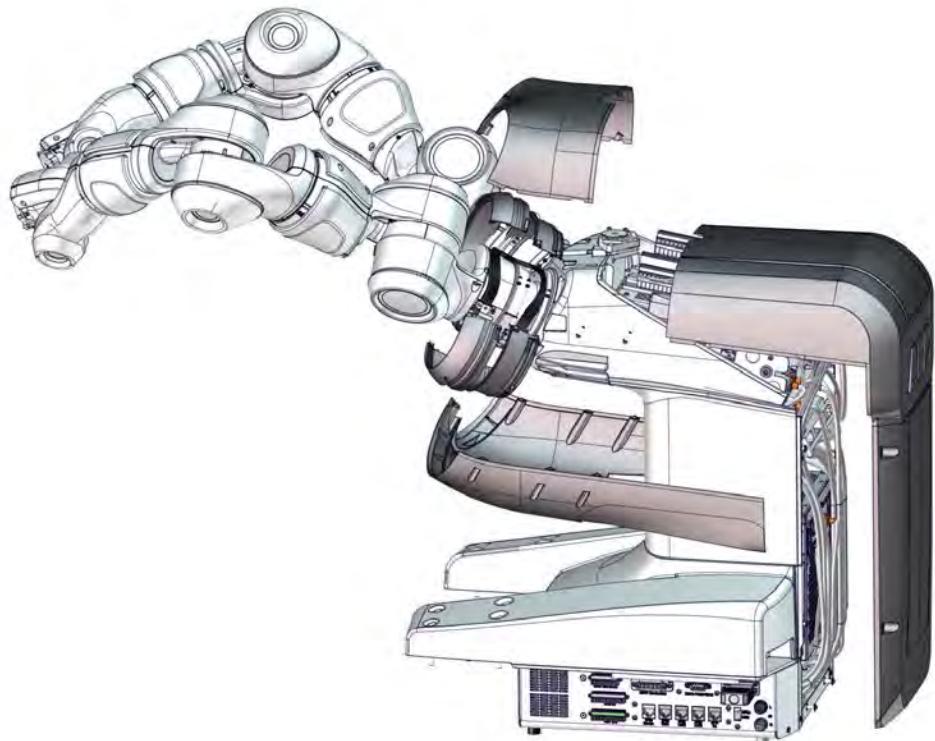
Spare part	Article number	Note
Arm, complete assembly	3HAC047548-001	Complete arm assembly, includes all axes.
Torx pan head screw	3HAC050367-005	M3x12 8.8 Gleitmo 605
Hex socket head cap screw	3HAC050368-005	M2x8 8.8
Hex socket head cap screw	3HAB3409-232	M4x12 12.9 Gleitmo 603+Geomet 500
Hex socket head cap screw	3HAB3409-233	M2.5x6 12.9 Gleitmo 603+Geomet 500

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



xx1500000493

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4 Repair

4.3.1 Replacing the complete arm

Continued

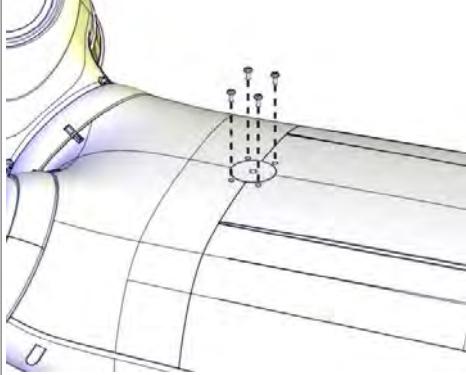
Removing the arm

Use these procedures to remove the arm.

Preparations before removing the arm

	Action	Note
1	Jog the robot so that the covers can be easily accessed and removed.	
2	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• air pressure supply to the robot, before starting the repair work on the robot.	

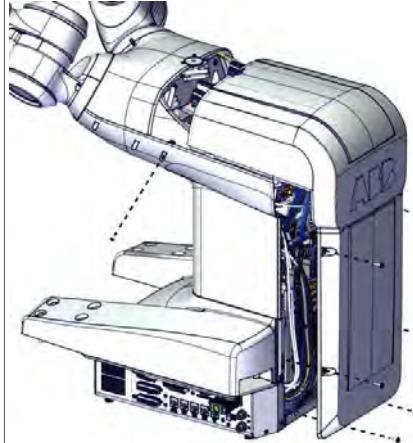
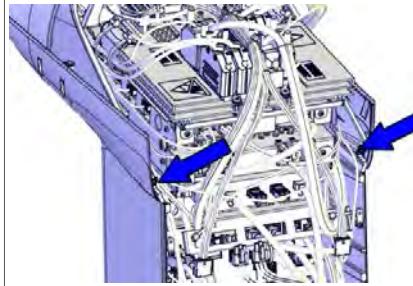
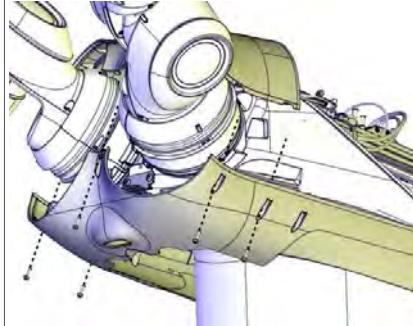
Removing the body covers

	Action	Note
1	 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2	Remove the body cover top screws.	

Continues on next page

4.3.1 Replacing the complete arm

Continued

Action	Note
3 Remove the body cover.	 xx1500000303
4 Remove the back screws of the lower body cover.	 xx1500000540
5 Remove the front and lower body cover. Note Be aware of the tab underneath the cover so it does not get damaged.	 xx1400002603

Removing the axis-1 covers

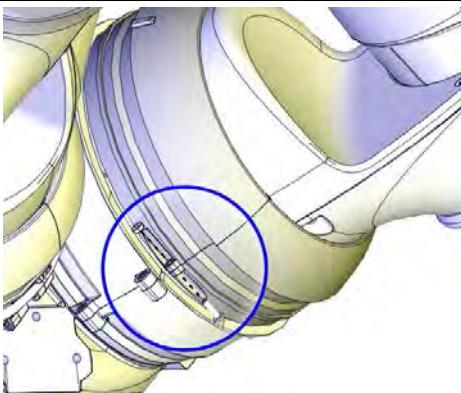
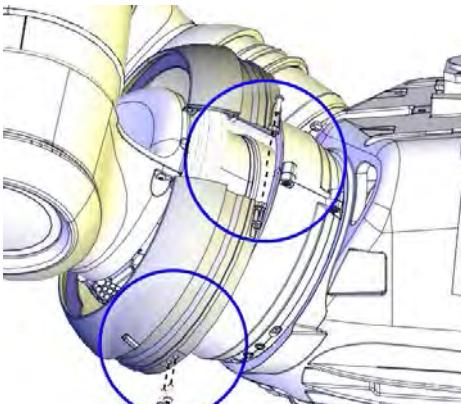
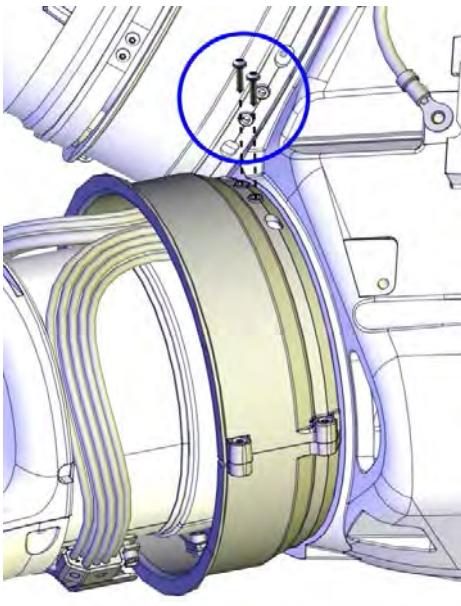
Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	

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4 Repair

4.3.1 Replacing the complete arm

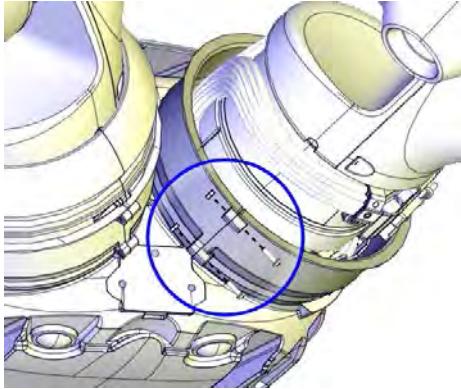
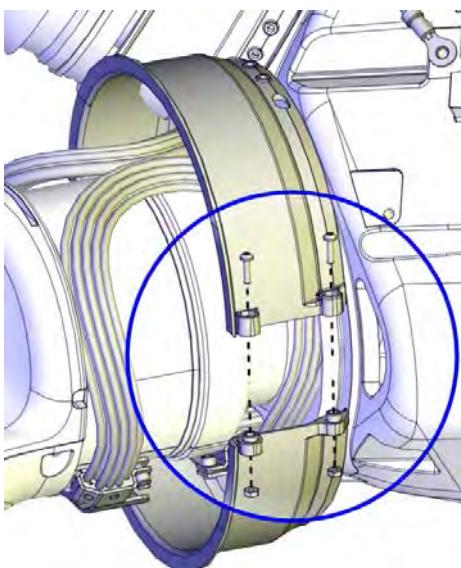
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Action	Note
2 Remove the upper axis-1 cover.	 xx1400002601  xx1400002605
3 Remove the upper screws of the lower axis-1 cover.	 xx1500000565

Continues on next page

4.3.1 Replacing the complete arm

Continued

Action	Note
4 Turn the lower axis-1 cover in order to access all screws properly and remove the lower axis-1 cover.	 xx1400002604  xx1400002606

Removing the arm from the body with cabling still connected



Note

Two persons working together are required to perform this procedure.

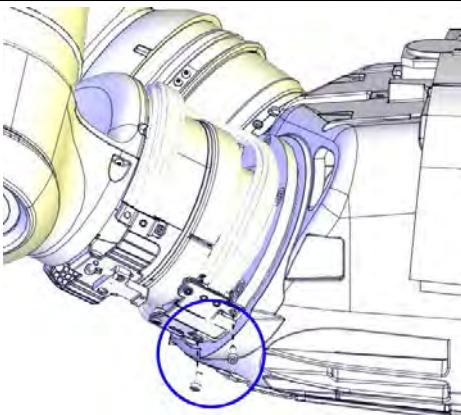
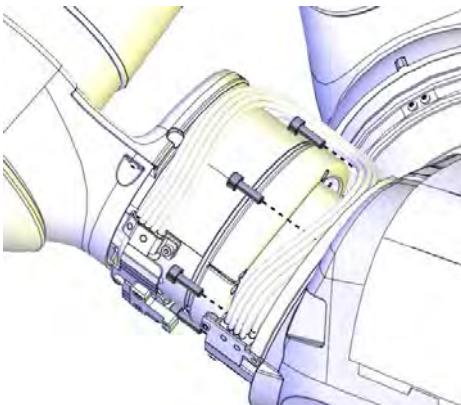
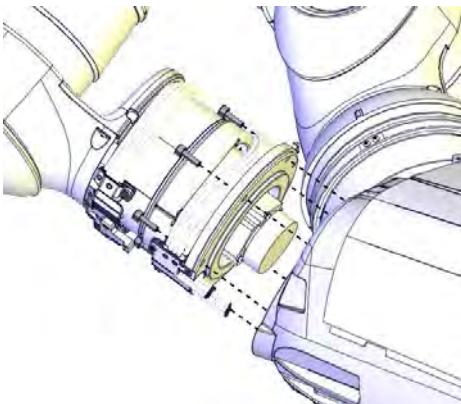
Action	Note
 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	

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4 Repair

4.3.1 Replacing the complete arm

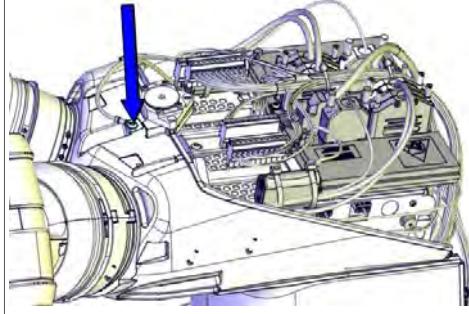
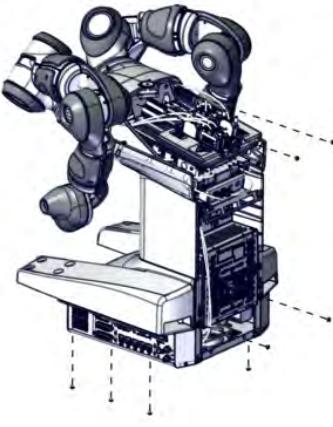
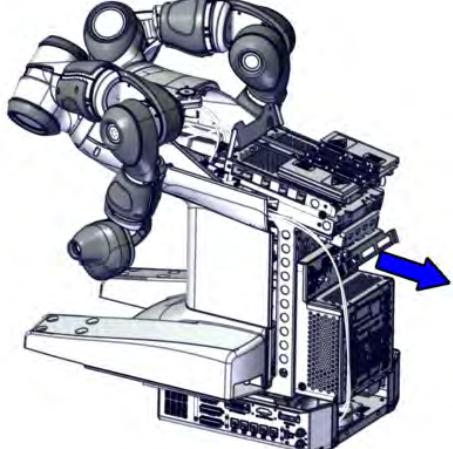
Continued

Action	Note
2 Loosen the cable bracket from the arm by removing the screws.	 xx1400002607
3 Turn on the power to the robot temporarily.	
4  Note Two persons working together are required to perform this step. Person 1: Hold the arm. Person 2: Remove the screws that fasten the arm to the body. Release the brakes and rotate axis 1 in order to access all the screws. Move the axes back into original position when all the screws are removed.	 xx1500000543
5  DANGER Turn off the electric power supply again.	
6  CAUTION The cabling is still connected inside the robot, be careful not to strain the cables!	 xx1400002608

Continues on next page

4.3.1 Replacing the complete arm
Continued

Disconnecting the arm cabling from the controller

	Action	Note
1	 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2	Disconnect the earth cable by removing the screw.	 xx150000601
3	Remove all attachment screws that fasten the controller to the body.	Screws: 10 pcs.  xx150000364
4	CAUTION Carefully pull the controller out partially in the rails so that the power and signal connectors can be accessed.  The controller weighs 13 kg. Support the weight of the controller!	 xx150000365

Continues on next page

4 Repair

4.3.1 Replacing the complete arm

Continued

Action	Note
5 Cut necessary cable ties.	
6 Disconnect the power and signal connectors from the controller. Left side: <ul style="list-style-type: none">• A52.XS11,12,17,13,14,15,16• A52.X3• A52.SMB.X2,X4,X5• A33.X3• A2.XSEN• A2.XPCP Right side: <ul style="list-style-type: none">• A51.XS11,12,17,13,14,15,16• A51.X3• A51.SMB.X2,X4,X5• A33.X2• A1.XSEN• A1.XPCP	
7 Disconnect the air hoses from the controller.	

Refitting the arm

Use these procedures to refit the arm.

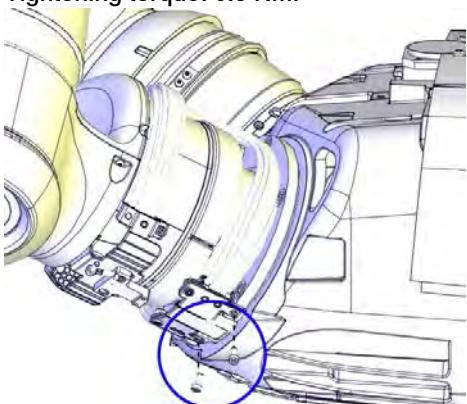
Refitting the arm to the body

Note	
Two persons working together are required to perform this procedure.	
Action	Note
1 Insert the cabling into the body while holding the arm.	
2 Refit the arm and secure with the screws. Some of the screws might not be possible to refit until the cabling is reconnected to the controller and the brakes can be released. Leave these screws for now.	Screw: 3HAB3409-232. (6 pcs) Tightening torque: 3 Nm. xx1400002608

Continues on next page

4.3.1 Replacing the complete arm

Continued

Action	Note
3 Refit the cable bracket to the arm with the screws.	Screw: 3HAB3409-233. (2 pcs) Tightening torque: 0.8 Nm.  xx1400002607

Connecting the arm cabling to the controller

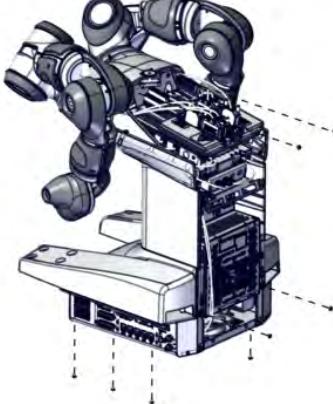
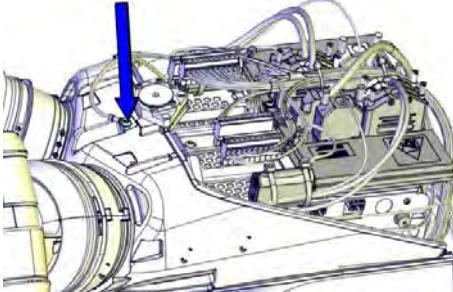
Action	Note
1 Connect the power and signal connectors to the controller. Left side: <ul style="list-style-type: none"> • A52.XS11,12,17,13,14,15,16 • A52.X3 • A52.SMB.X2,X4,X5 • A33.X3 • A2.XSEN • A2.XPCP Right side: <ul style="list-style-type: none"> • A51.XS11,12,17,13,14,15,16 • A51.X3 • A51.SMB.X2,X4,X5 • A33.X2 • A1.XSEN • A1.XPCP 	
2 Connect the air hoses to the controller.	
3 Secure the cabling again with cable ties.	
4 Gently push the controller into the robot body completely.  CAUTION Be careful not to squeeze or damage the cables and air hoses in any way.	

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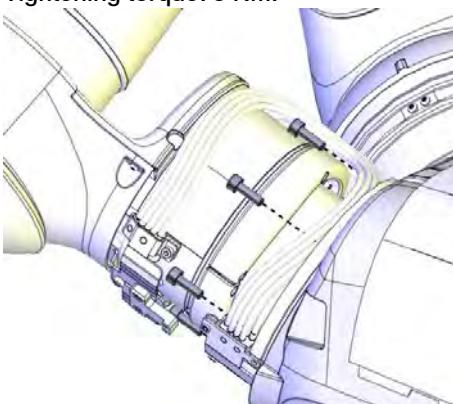
4 Repair

4.3.1 Replacing the complete arm

Continued

Action	Note
5 Refit the attachment screws that fasten the controller to the body.	Screw with flange: M3x6 (10 pcs) Tightening torque: 0.9 Nm.  xx1500000364
6 Connect the earth cable with the screw.	M4x8 8.8-A2F (1 pc)  xx1500000601

Refitting the remaining screws between the arm and the body

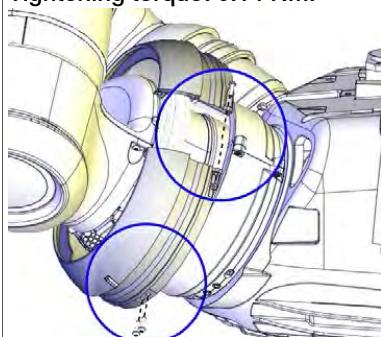
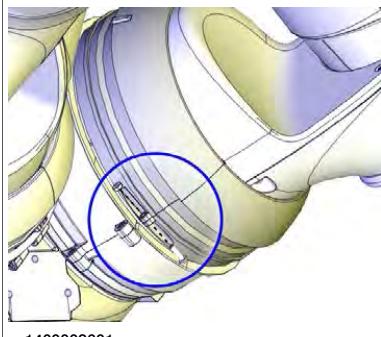
Action	Note
1 Turn on the power to the robot temporarily.	
2 Secure any remaining screws that fasten the arm to the body. Release the brakes and rotate axis 1 in order to access all the screws.	Screw: 3HAB3409-232. Tightening torque: 3 Nm.  xx1500000543
3 Turn off the electric power supply again.	

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4.3.1 Replacing the complete arm

Continued

Refitting the axis-1 covers

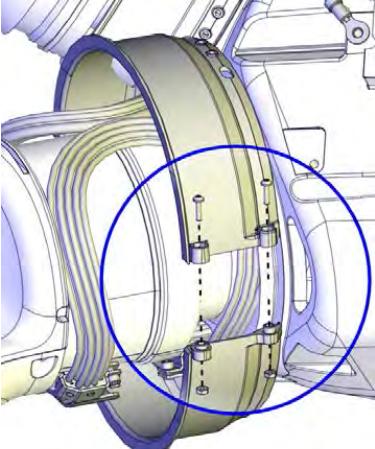
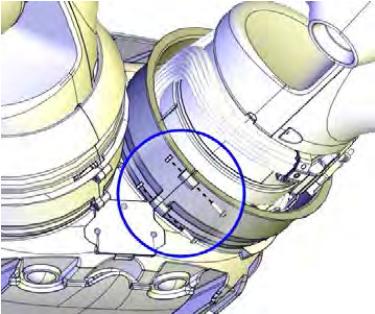
	Action	Note
1	Refit the upper axis-1 cover.	Screws: 3HAC050368-005. (4 pcs) Nuts: M2 DIN934 8 ELZN. (2 pcs) Tightening torque: 0.14 Nm.  xx1400002605  xx1400002601

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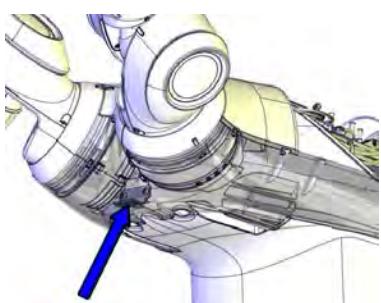
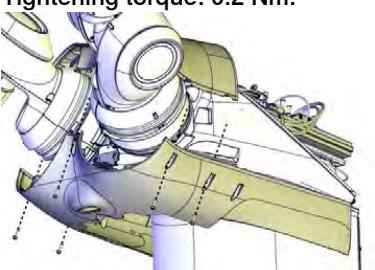
4 Repair

4.3.1 Replacing the complete arm

Continued

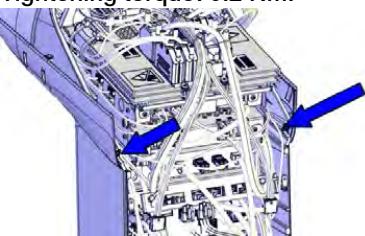
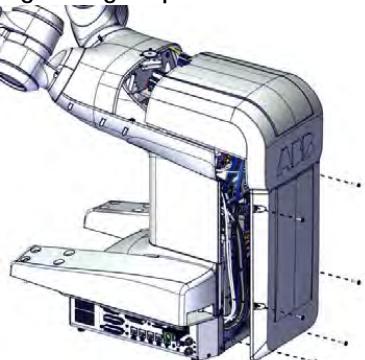
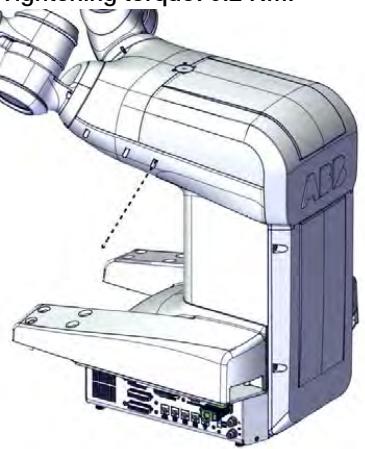
Action	Note
2 Refit the lower axis-1 cover.	<p>Screws: 3HAC050368-005. (4 pcs) Nuts: M2 DIN934 8 ELZN. (4 pcs) Tightening torque: 0.14 Nm.</p>  <p>xx1400002606</p>  <p>xx1400002604</p>

Refitting the body covers

Action	Note
1 Refit the front and lower body cover. i Note Be aware of the tab underneath the cover so it does not get damaged.  <p>xx1500000564</p>	<p>Screws: 3HAC050367-005. (5 pcs) Tightening torque: 0.2 Nm.</p>  <p>xx1400002603</p>

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4.3.1 Replacing the complete arm
Continued

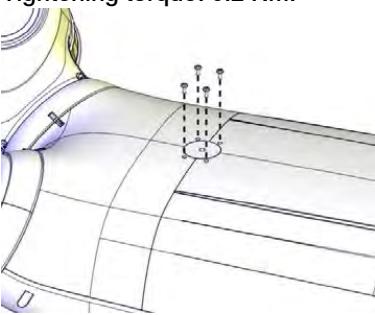
Action	Note
2 Refit the back screws of the lower body cover.	<p>Screws: 2 pcs. Tightening torque: 0.2 Nm.</p>  <p>xx1500000540</p>
3 Refit the body cover.	<p>Screws: 6 pcs. Tightening torque: 0.9 Nm.</p>  <p>xx1500000697</p>
4 Refit the two remaining screws of the body cover.	<p>Screws: 2 pcs. Tightening torque: 0.2 Nm.</p>  <p>xx1500000696</p>

Continues on next page

4 Repair

4.3.1 Replacing the complete arm

Continued

	Action	Note
5	Refit the body cover top screws.	Screws: 4 pcs. Tightening torque: 0.2 Nm.  xx1400002904

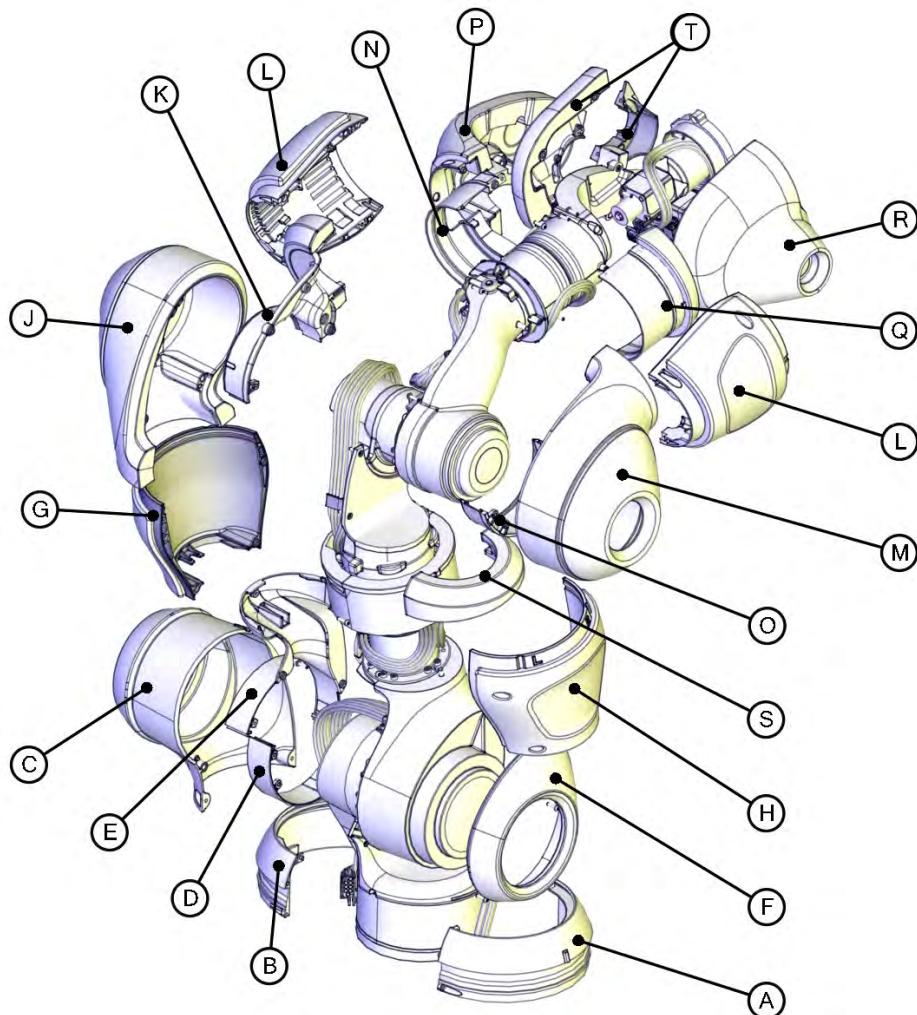
Concluding procedure

	Action	Note
1	Recalibrate the robot.	See Calibration on page 431 .
2	 CAUTION 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 45 .	

4.3.2 Replacing the encapsulation and covers

Replacing the arm covers

Location of arm covers



xx1500000604

Information for replacement

Replace any damaged covers. The table gives input for removal order and shows tightening torques for the cover attachment screws.

	Spare part number	Description	Covers that need to be removed for access	Tightening torque
A	3HAC048783-001	Upper axis-1 cover		0.14 Nm
B	3HAC048783-002	Upper axis-1 cover, brake		0.14 Nm
C	3HAC050559-001	Lower axis-2 cover		0.14 Nm

Continues on next page

4 Repair

4.3.2 Replacing the encapsulation and covers

Continued

	Spare part number	Description	Covers that need to be removed for access	Tightening torque
D	3HAC050560-001	Axis-2 cable collar	Cover C (3HAC050559-001) Cover E (3HAC050561-001)	0.14 Nm
E	3HAC050561-001	Axis-2 cable cover	Cover C (3HAC050559-001) Cover G (3HAC050529-002) Cover H (3HAC050529-001)	0.14 Nm
F	3HAC050558-001	Axis-2 padding Use locking liquid Loc-tite 454 when fitting.		-
G	3HAC050529-002	Axis-7 cover		0.14 Nm
H	3HAC050529-001	Axis-7 cover		0.14 Nm
J	3HAC050532-001	Lower axis-3 cover		0.14 Nm
K	3HAC050538-001	Upper axis-3 cover	Cover J (3HAC050532-001) Cover L (3HAC050542-001) Cover M (3HAC050535-001)	0.14 Nm
L	3HAC050542-001	Lower axis-4 cover		0.14 Nm
M	3HAC050535-001	Axis-3 body cover	Cover J (3HAC050532-001) Cover L (3HAC050542-001)	0.14 Nm
N	3HAC049878-001	Axis-4 cable protection	Cover L (3HAC050542-001) Cover P (3HAC050548-001) Cover Q (3HAC050545-001)	0.14 Nm
O	3HAC050563-001	Axis-3 cable collar	Cover J (3HAC050532-001) Cover K (3HAC050538-001) Cover M (3HAC050535-001)	0.14 Nm
P	3HAC050548-001	Upper axis-4 cover	Cover L (3HAC050542-001)	0.14 Nm

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4.3.2 Replacing the encapsulation and covers

Continued

	Spare part number	Description	Covers that need to be removed for access	Tightening torque
Q	3HAC050545-001	Axis-4 body cover	Cover L (3HAC050542-001) Cover N (3HAC049878-001) Cover P (3HAC050548-001)	0.14 Nm
R	3HAC050553-001	Axis-6 cover		0.2 Nm
S	3HAC050526-001	Axis-7 body padding Use locking liquid Loctite 454 when fitting.		-
T	3HAC041286-001	Cooling flange with padding	Cover P (3HAC050548-001) Cover R (3HAC050553-001)	0.2 Nm

**CAUTION**

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 45*.

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section <i>Standard toolkit on page 461</i> .

Consumables

Consumable	Article number	Note
Locking liquid	-	Loctite 454

4 Repair

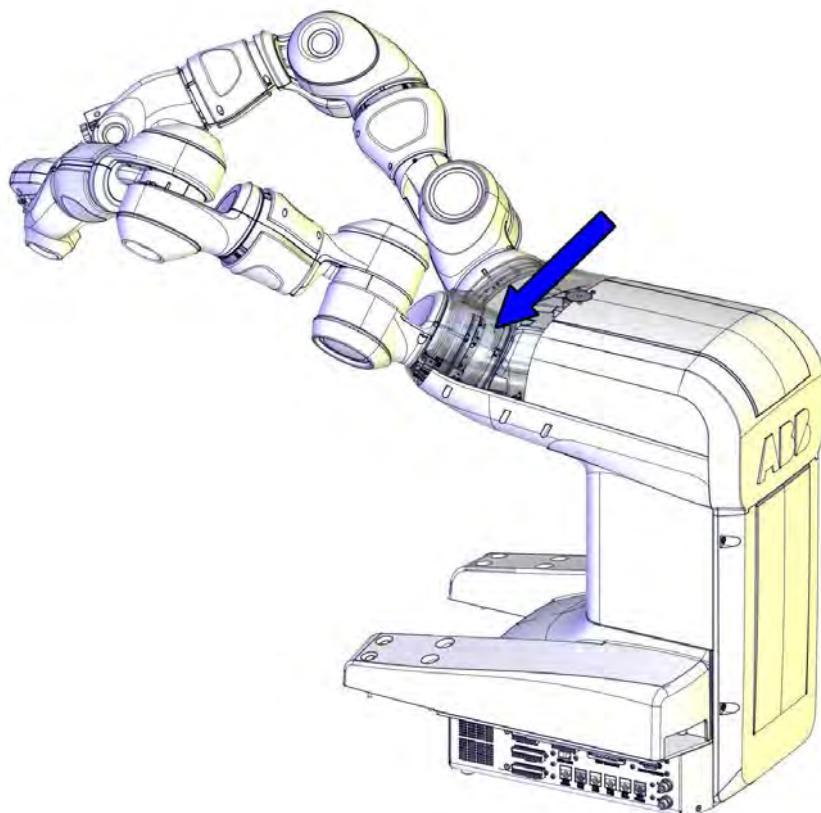
4.4.1 Replacing the axis-1 motor

4.4 Motors

4.4.1 Replacing the axis-1 motor

Location of the axis-1 motor

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



xx1400002791

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 14000* on ABB Library.

Spare part	Article number	Note
Motor M93	3HAC036859-001	Always use a new o-ring 3HAB3772-137. To be ordered separately.
O-ring	3HAB3772-137	Required to be replaced when removing and refitting the motor.

Continues on next page

Required tools and equipment

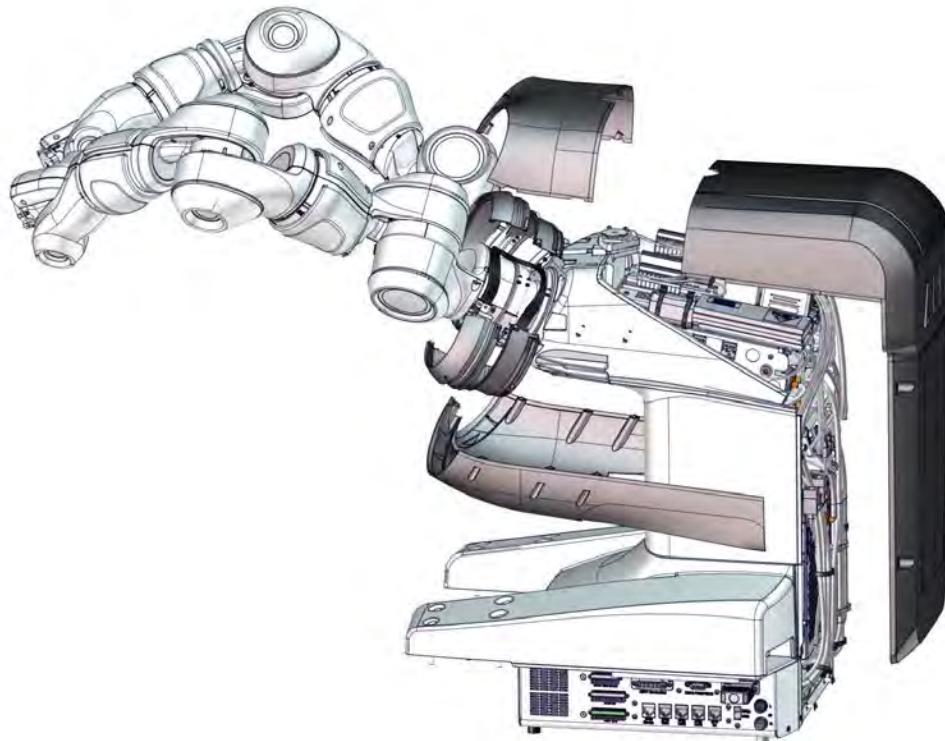
Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Removal tool	3HAC054868-001	Used to pull out the motor.
Fixture tool for wave generator M93	3HAC054870-001	

Consumables

Consumable	Article number	Note
Grease	-	Mobil FM222 Used to lubricate o-rings.
Grease	3HAC038379-001	Used to lubricate the wave generator.
Cleaning agent	-	Isopropanol

Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



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4 Repair

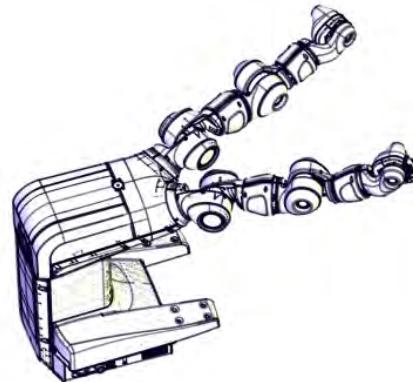
4.4.1 Replacing the axis-1 motor

Continued

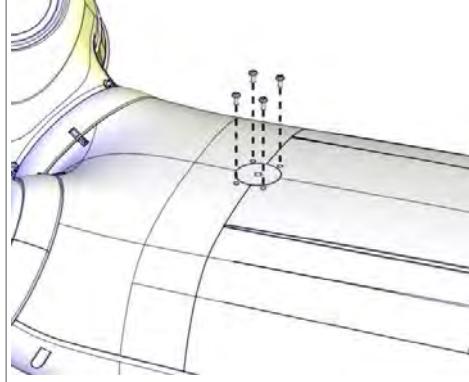
Removing the motor

Use these procedures to remove the axis-1 motor.

Preparations before removing the motor

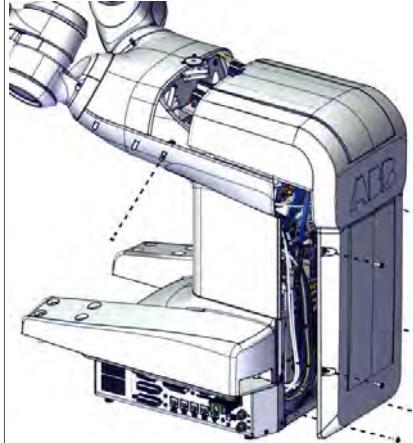
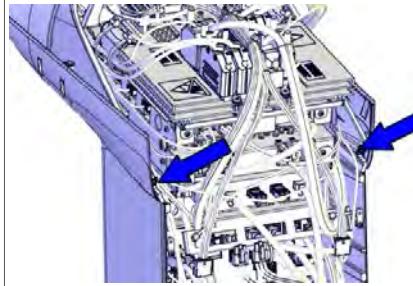
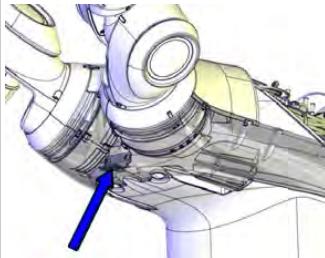
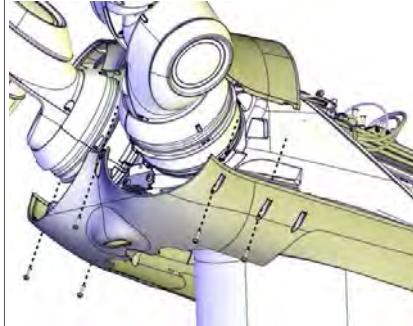
Action	Note
1 Jog the robot to the specified position: <ul style="list-style-type: none">• Axis 1: -53°• Axis 2: -25°• Axis 7: 169°• Axis 3: -109°• Axis 4: No significance.• Axis 5: No significance.• Axis 6: No significance.	The figure shows both arms in the specified position, but only the arm that contains the motor to be replaced needs to be jogged into position.  xx1500000940
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• air pressure supply to the robot, before starting the repair work on the robot.	

Removing the body covers

Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2 Remove the body cover top screws.	 xx1400002904

Continues on next page

4.4.1 Replacing the axis-1 motor Continued

Action	Note
3 Remove the body cover.	 xx1500000303
4 Remove the back screws of the lower body cover.	 xx1500000540
5 Remove the front and lower body cover. i Note Be aware of the tab underneath the cover so it does not get damaged.  xx1500000564	 xx1400002603

Removing the axis-1 covers

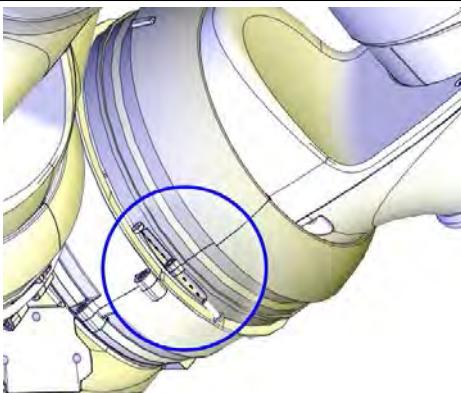
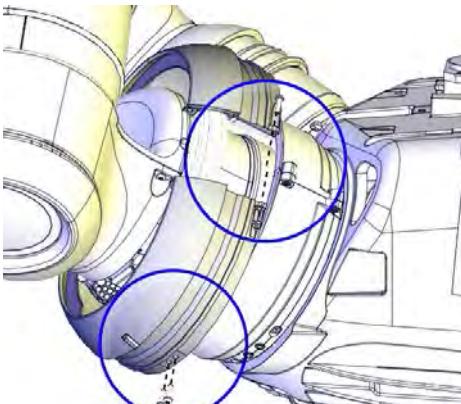
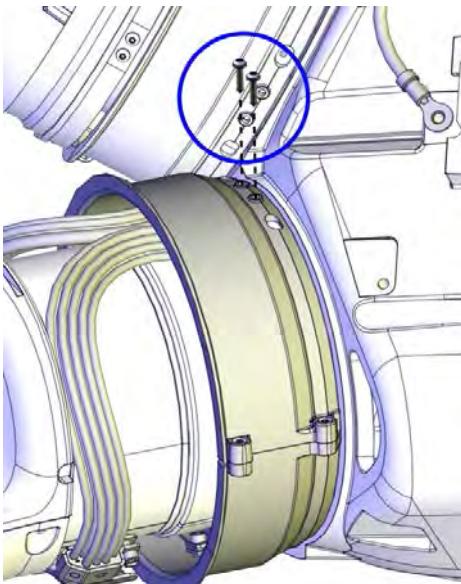
Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	

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4 Repair

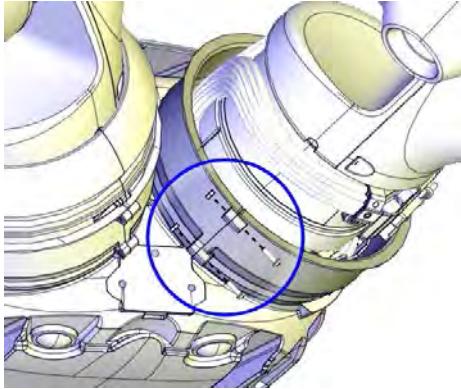
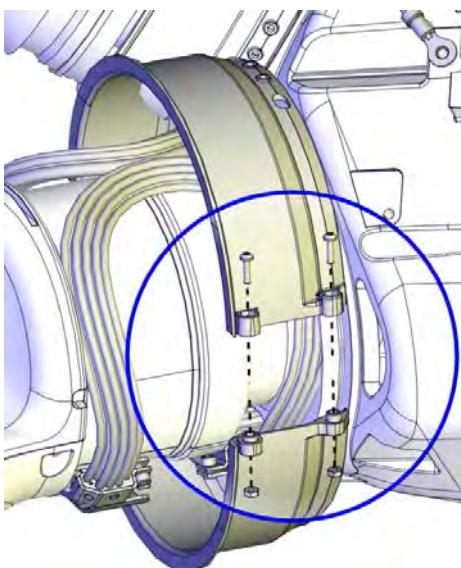
4.4.1 Replacing the axis-1 motor

Continued

Action	Note
2 Remove the upper axis-1 cover.	 xx1400002601  xx1400002605
3 Remove the upper screws of the lower axis-1 cover.	 xx1500000565

Continues on next page

4.4.1 Replacing the axis-1 motor Continued

	Action	Note
4	Turn the lower axis-1 cover in order to access all screws properly and remove the lower axis-1 cover.	 xx1400002604  xx1400002606

Removing the arm from the body with cabling still connected



Note

Two persons working together are required to perform this procedure.

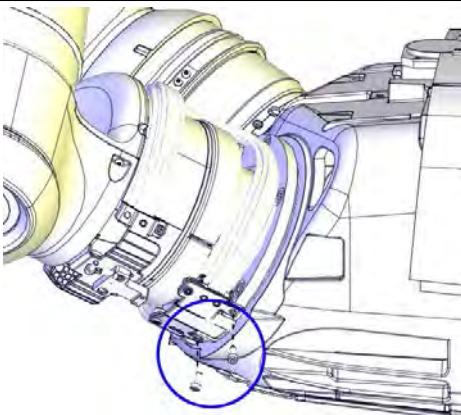
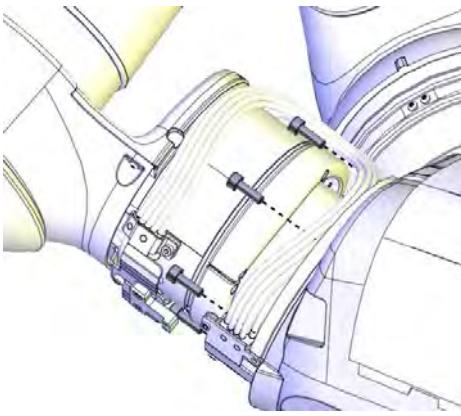
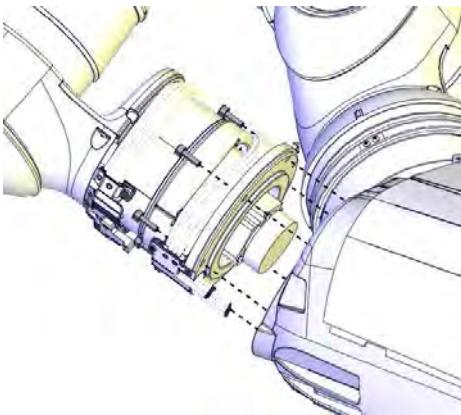
	Action	Note
1	 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	

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4 Repair

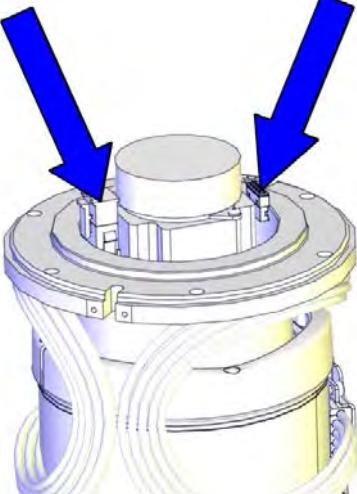
4.4.1 Replacing the axis-1 motor

Continued

Action	Note
2 Loosen the cable bracket from the arm by removing the screws.	 xx1400002607
3 Turn on the power to the robot temporarily.	
4  Note Two persons working together are required to perform this step. Person 1: Hold the arm. Person 2: Remove the screws that fasten the arm to the body. Release the brakes and rotate axis 1 in order to access all the screws. Move the axes back into original position when all the screws are removed.	 xx1500000543
5  DANGER Turn off the electric power supply again.	
6  CAUTION The cabling is still connected inside the robot, be careful not to strain the cables!	 xx1400002608

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Removing the axis-1 motor

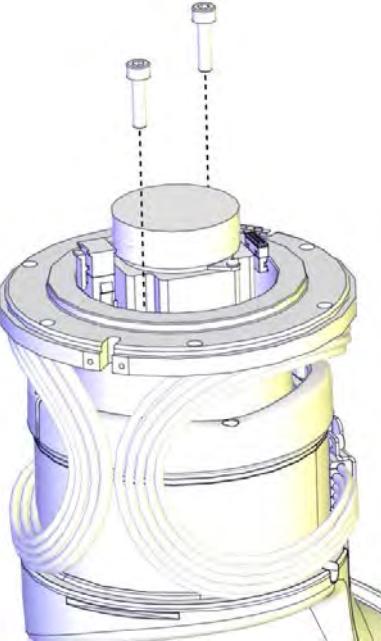
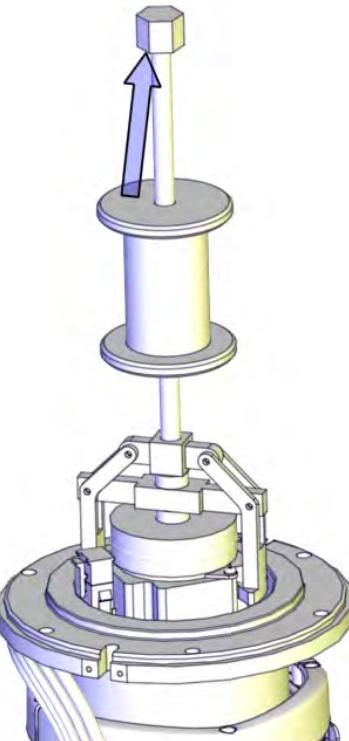
	Action	Note
1	 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2	If possible, place the arm on a workbench. If not possible, two persons are required for the continued procedure on removing the motor, one person holding the arm, the other person working with the motor.  CAUTION The cabling is still connected inside the robot, so be careful not to strain the cables!	
3	Hold the arm so that the motor cover points upwards.  Tip This position makes it possible to change the motor without spilling out any grease from the gearbox.	
4	Disconnect the motor connectors. <ul style="list-style-type: none"> • R1.MP1R / R1.MP1L • R1.FB1R / R1.FB1L 	 xx1500000590
5	 CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	

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4 Repair

4.4.1 Replacing the axis-1 motor

Continued

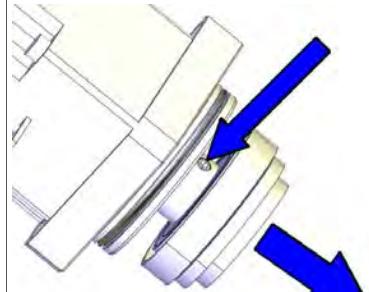
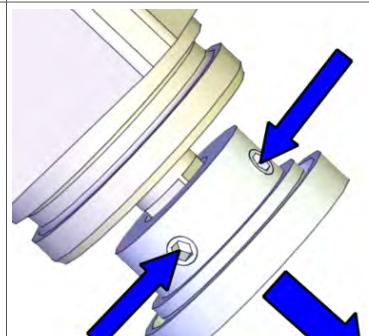
Action	Note
6 Remove the screws.	 xx1500000517
7 Remove the motor by using the removal tool accordingly: <ol style="list-style-type: none">1 Attach the grip arms of the removal tool to the notches on the motor sides.2 Gently knock the block upwards to the end stop of the pin repeatedly until the motor loosens.3 Pull out the motor. <p> CAUTION Lifting the motor out creates a hole into the gear, make sure no dirt falls into the hole.</p>  xx1500000521	Removal tool: 3HAC054868-001.

Continues on next page

4.4.1 Replacing the axis-1 motor

Continued

Removing the wave generator from the motor

	Action	Note
1	<p>Remove the wave generator from the motor shaft by removing the set screw(s) and then pulling it off the shaft.</p> <p>Axis 1, axis 2, axis 7, axis 3.</p> 	xx1500000515
	<p>Axis 4, axis 5 and axis 6.</p> 	xx1500001651
2	<p>Place the wave generator on a clean workbench, if not instantly fitting it to a new motor.</p> <p> CAUTION</p> <p>Keep the wave generator clean.</p>	

Refitting the motor

Use these procedures to refit the axis-1 motor.

Fitting a new o-ring on the motor

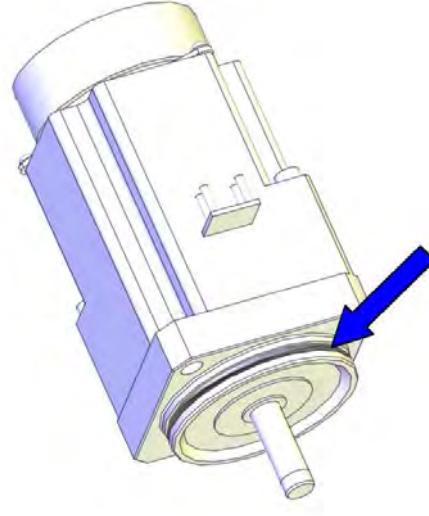
	Action	Note
1	Wipe the o-ring groove of the motor clean.	Motor M93: 3HAC036859-001.

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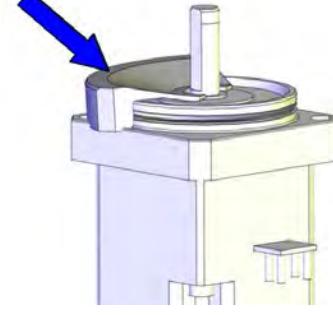
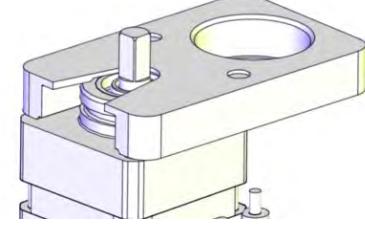
4 Repair

4.4.1 Replacing the axis-1 motor

Continued

Action	Note
<p>2 Fit a new o-ring in the groove.</p> <p> Tip</p> <p>Lubricate the o-ring with some grease for a better fitting in the groove.</p>	<p>O-ring: 3HAB3772-137 Grease: Mobil FM222.</p>  <p>xx1400002611</p>

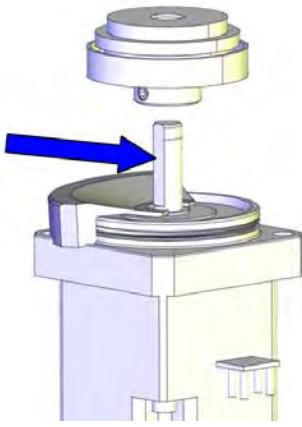
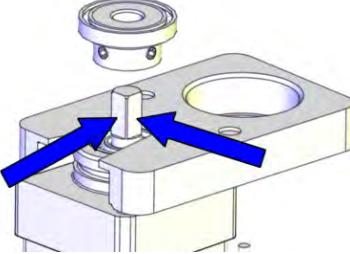
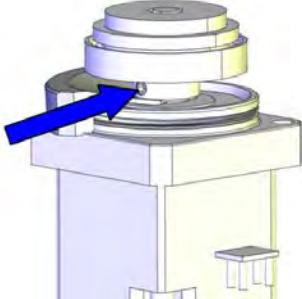
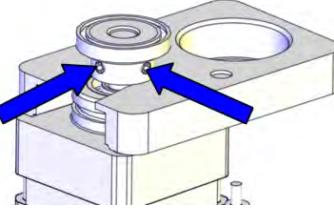
Fitting the wave generator to the motor

Action	Note
1 Wipe the contact surfaces of the motor and wave generator clean from any contamination with cleaning agent applied on a cloth or paper.	
2 Place the fixture tool on the new motor. Axis 1 and axis 2: Fixture tool for wave generator M93, 3HAC054870-001. Axis 7 and axis 3: Fixture tool for wave generator M92, 3HAC054871-001.	 <p>xx1500000527</p>
Axis 4, axis 5 and axis 6: Fixture tool for wave generator M91, 3HAC054904-001.	 <p>xx1500001646</p>

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4.4.1 Replacing the axis-1 motor

Continued

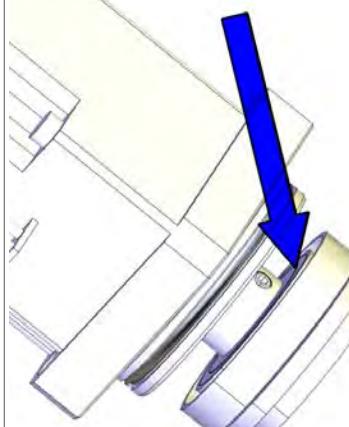
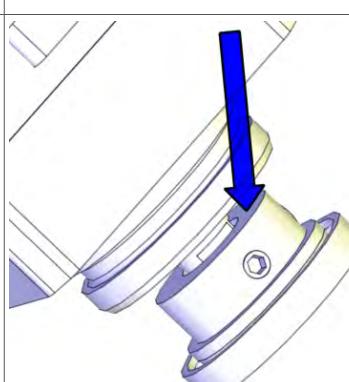
	Action	Note
3	<p>Fit the wave generator to the motor shaft, place it against the distance fixture and secure lightly with the set screw(s). Orient the wave generator so that the set screw will be positioned towards the flat surface on the output axis of the motor. The flat surface is pointed out in the figure.</p>	
	<p>Axis 1, axis 2, axis 7, axis 3.</p>	 <p>xx1500000528</p>
	<p>Axis 4, axis 5 and axis 6.</p>	 <p>xx1500001647</p>
4	<p>Tighten the set screw.</p>	
	<p>Axis 1 and axis 2. Screw, 1 pc. Tightening torque: 0.6 Nm.</p>	 <p>xx1500000518</p>
	<p>Axis 7 and axis 3. Screw, 1 pc. Tightening torque: 0.6 Nm.</p>	
	<p>Axis 4, axis 5 and axis 6. Screws, 2 pcs. Tightening torque: 0.2 Nm.</p>	 <p>xx1500001648</p>

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4 Repair

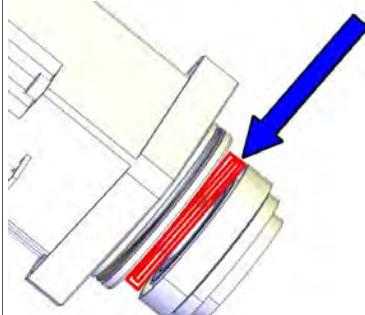
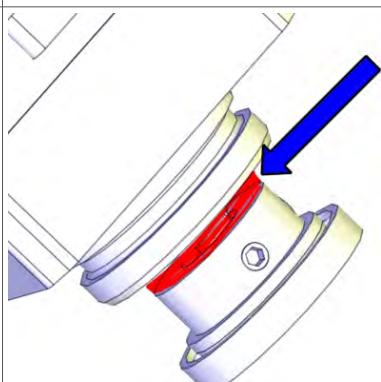
4.4.1 Replacing the axis-1 motor

Continued

	Action	Note
5	Remove the fixture.	
6	Lubricate the wave generator with grease. Axis 1, axis 2, axis 7, axis 3.	Grease: 3HAC038379-001, 1.2 ml.  xx1500000557
	Axis 4, axis 5 and axis 6.	 xx1500001649

Continues on next page

4.4.1 Replacing the axis-1 motor
Continued

	Action	Note
7	<p>Fill the gap between the motor and the wave generator with grease.</p> <p>Axis 1, axis 2, axis 7, axis 3.</p>	<p>Grease: 3HAC038379-001.</p>  <p>xx1500000556</p>
	<p>Axis 4, axis 5 and axis 6.</p>	 <p>xx1500001650</p>

Refitting the axis-1 motor

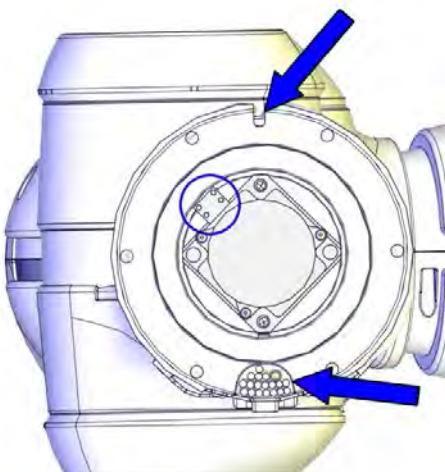
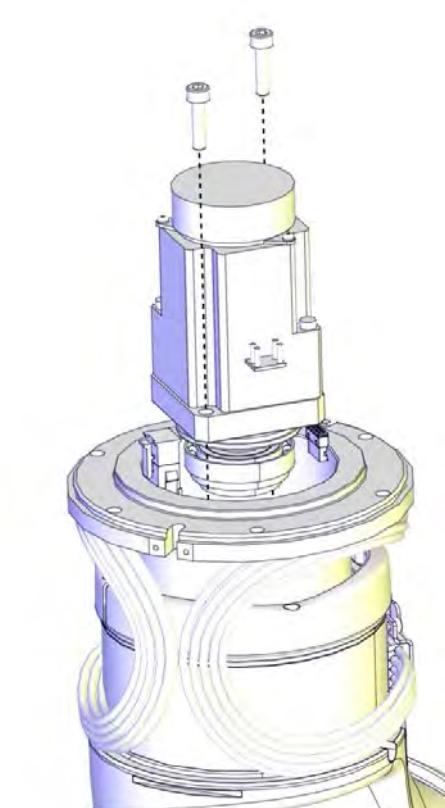
	Action	Note
1	<p> CAUTION</p> <p>Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!</p>	

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4 Repair

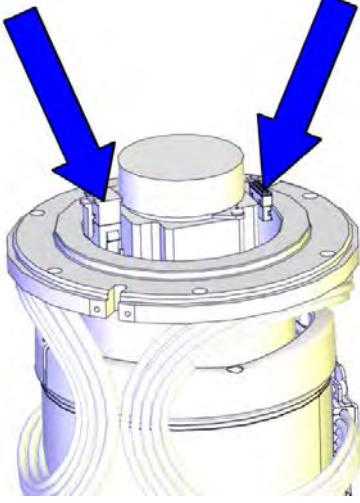
4.4.1 Replacing the axis-1 motor

Continued

Action	Note
<p>2 Orient the motor correctly and fit it into the arm. Secure with the screws.</p> <p>CAUTION</p> <p>The motor must be inserted gently. If the gears do not mate, rotate the axis carefully back and forth until the gears are mated.</p>	<p>Motor orientation: orient the motor according to the figure below, in regard to the encircled motor connector and to the small and the big notch at the arm mounting flange.</p>  <p>xx1500000539</p> <p>Tightening torque: cross-tighten all screws to 1 Nm first, then final cross-tighten to 3 Nm.</p>  <p>xx1400002609</p>

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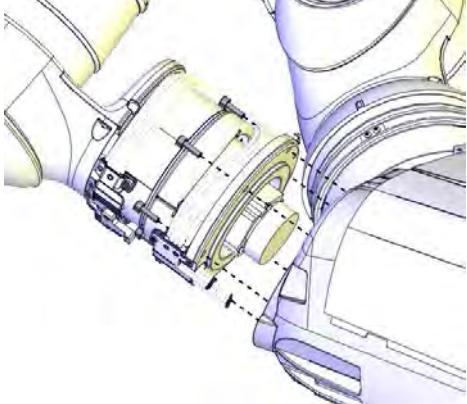
4.4.1 Replacing the axis-1 motor Continued

Action	Note
3 Reconnect the motor connectors. • R1.MP1R / R1.MP1L • R1.FB1R / R1.FB1L	 xx1500000590

Refitting the arm to the body

 Note

Two persons working together are required to perform this procedure.

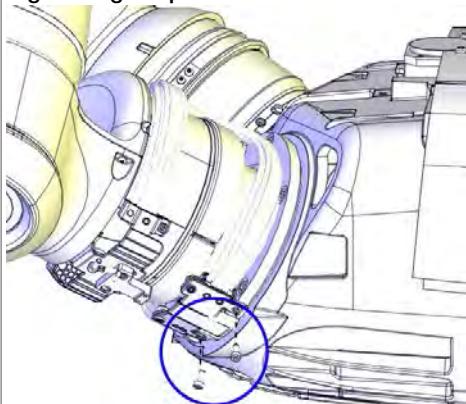
Action	Note
1 Refit the arm to the body. Secure with the screws. Release the brakes and rotate axis 1 in order to access all the screws.  CAUTION Be careful not to squeeze any cabling during the refitting procedure.	Tightening torque: 3 Nm.  xx1400002608

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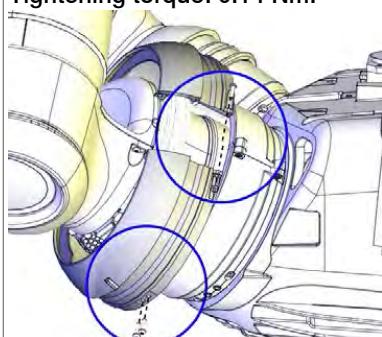
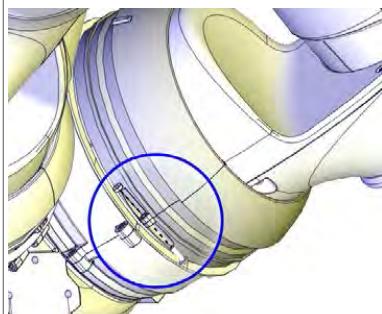
4 Repair

4.4.1 Replacing the axis-1 motor

Continued

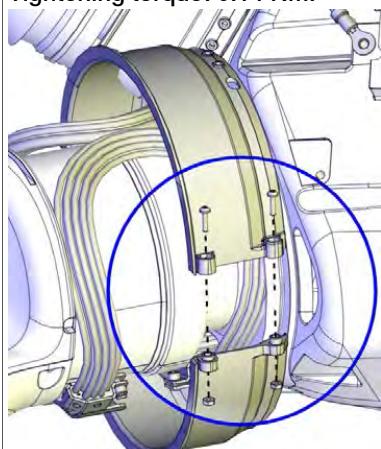
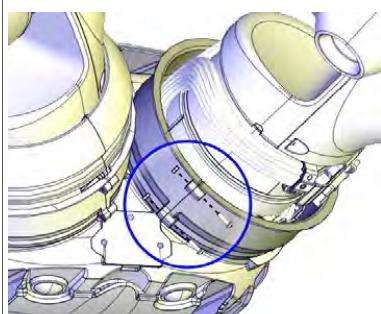
Action	Note
2 Refit the cable bracket to the arm with the screws.	Tightening torque: 0.8 Nm.  xx1400002607

Refitting the axis-1 covers

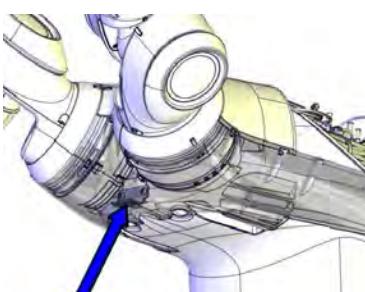
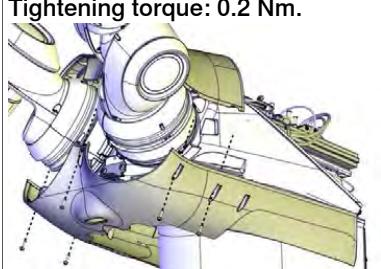
Action	Note
1 Refit the upper axis-1 cover.	Screws: 3HAC050368-005. (4 pcs) Nuts: M2 DIN934 8 ELZN. (2 pcs) Tightening torque: 0.14 Nm.  xx1400002605  xx1400002601

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4.4.1 Replacing the axis-1 motor Continued

Action	Note
2 Refit the lower axis-1 cover.	<p>Screws: 3HAC050368-005. (4 pcs) Nuts: M2 DIN934 8 ELZN. (4 pcs) Tightening torque: 0.14 Nm.</p>  <p>xx1400002606</p>  <p>xx1400002604</p>

Refitting the body covers

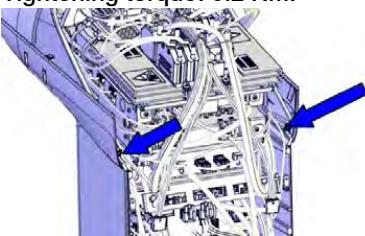
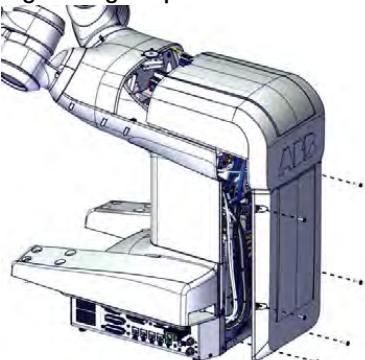
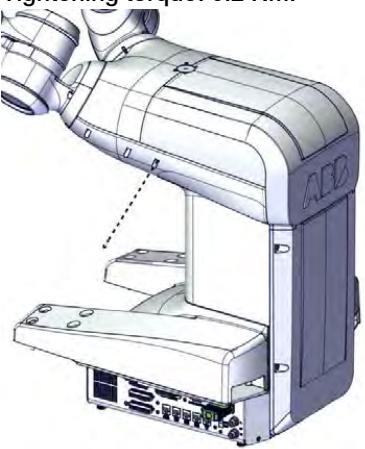
Action	Note
1 Refit the front and lower body cover. Note Be aware of the tab underneath the cover so it does not get damaged.	<p>Screws: 3HAC050367-005. (5 pcs) Tightening torque: 0.2 Nm.</p>  <p>xx1500000564</p>  <p>xx1400002603</p>

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4 Repair

4.4.1 Replacing the axis-1 motor

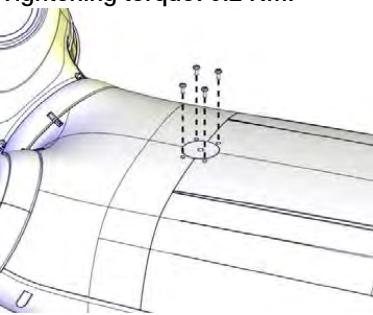
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	Action	Note
2	Refit the back screws of the lower body cover.	Screws: 2 pcs. Tightening torque: 0.2 Nm.  xx1500000540
3	Refit the body cover.	Screws: 6 pcs. Tightening torque: 0.9 Nm.  xx1500000697
4	Refit the two remaining screws of the body cover.	Screws: 2 pcs. Tightening torque: 0.2 Nm.  xx1500000696

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4.4.1 Replacing the axis-1 motor

Continued

Action	Note
5 Refit the body cover top screws.	Screws: 4 pcs. Tightening torque: 0.2 Nm. 

Concluding procedure

Action	Note
1 Recalibrate the robot. If option Absolute Accuracy is valid for the robot, redo absolute accuracy calibration.	See Calibration on page 431 .
2  CAUTION 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 45 .	

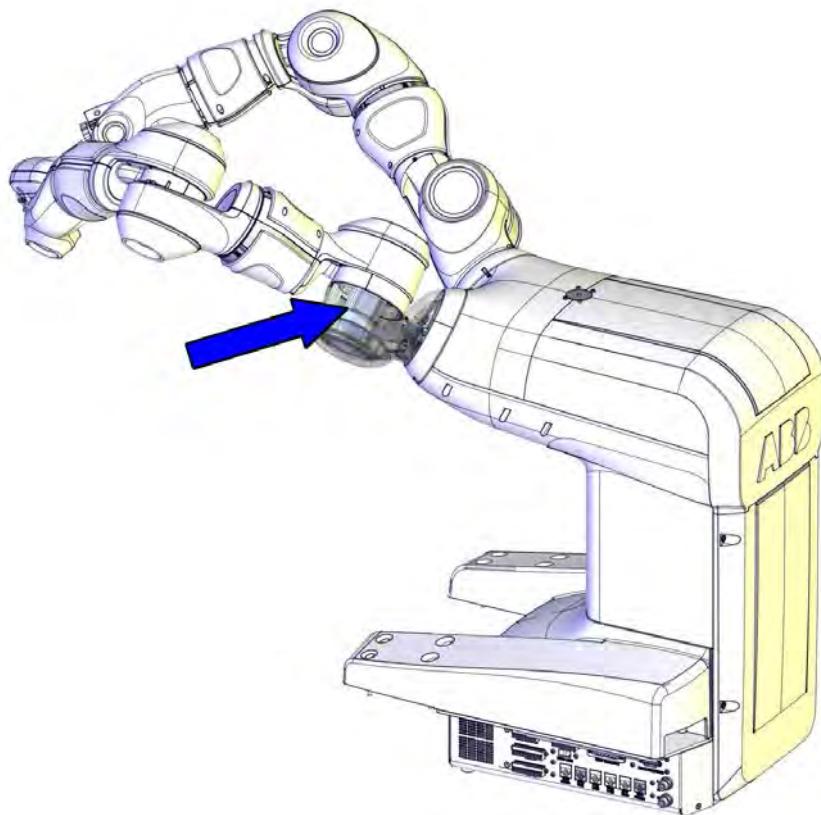
4 Repair

4.4.2 Replacing the axis-2 motor

4.4.2 Replacing the axis-2 motor

Location of the axis-2 motor

The axis-2 motor is located as shown in the figure.



xx1400002792

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 14000* on ABB Library.

Spare part	Article number	Note
Motor M93	3HAC036859-001	Always use a new o-ring 3HAB3772-137. To be ordered separately.
O-ring	3HAB3772-137	Required to be replaced when removing and refitting the motor.

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

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4.4.2 Replacing the axis-2 motor Continued

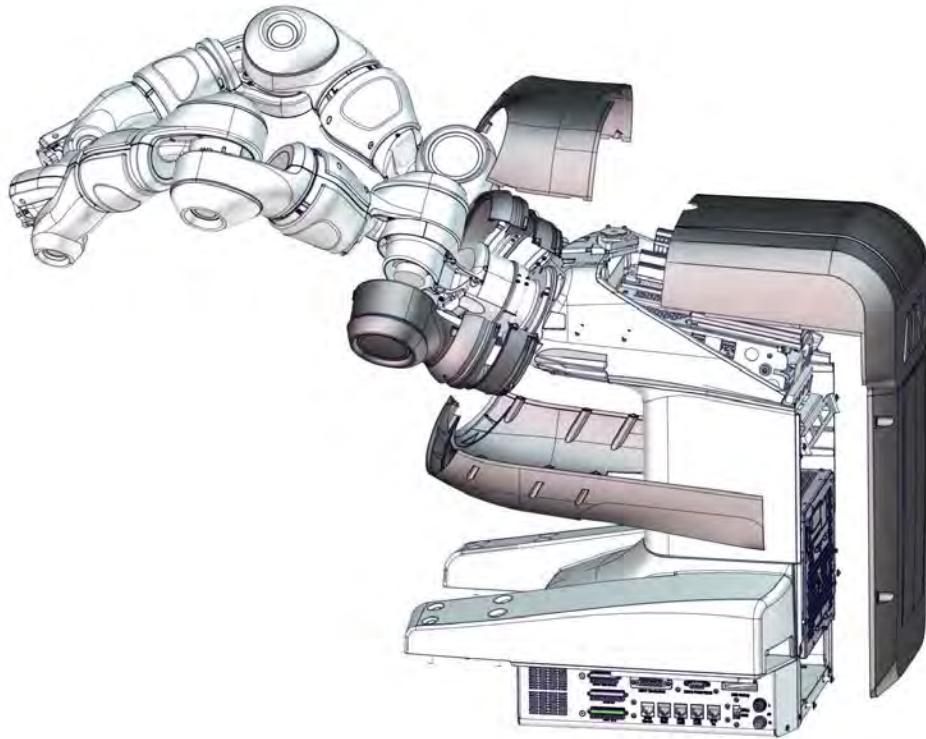
Equipment, etc.	Article number	Note
Removal tool	3HAC054868-001	Used to pull out the motor.
Fixture tool for wave generator M93	3HAC054870-001	

Consumables

Consumable	Article number	Note
Grease	-	Mobil FM222 Used to lubricate o-rings.
Grease	3HAC038379-001	Used to lubricate the wave generator.
Cleaning agent	-	Isopropanol

Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



xx1500000425

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4 Repair

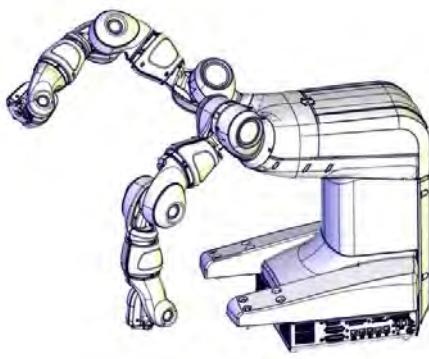
4.4.2 Replacing the axis-2 motor

Continued

Removing the motor

Use these procedures to remove the axis-2 motor.

Preparations before removing the motor

Action	Note
<p>1 Jog the robot to the specified position:</p> <p>Right arm:</p> <ul style="list-style-type: none">• Axis 1: 42°• Axis 2: rotate in positive direction until the axis is secured against the axis-2 mechanical stop.• Axis 7: brake release to position the axis hanging straight down.• Axis 3: brake release to position the axis hanging straight down.• Axis 4: No significance.• Axis 5: No significance.• Axis 6: No significance. <p>Left arm:</p> <ul style="list-style-type: none">• Axis 1: 120°• Axis 2: rotate in positive direction until the axis is secured against the axis-2 mechanical stop.• Axis 7: brake release to position the axis hanging straight down.• Axis 3: brake release to position the axis hanging straight down.• Axis 4: No significance.• Axis 5: No significance.• Axis 6: No significance.	Figure shows position of left arm:  xx1500000585
<p>2</p> <p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none">• electric power supply• air pressure supply <p>to the robot, before starting the repair work on the robot.</p>	

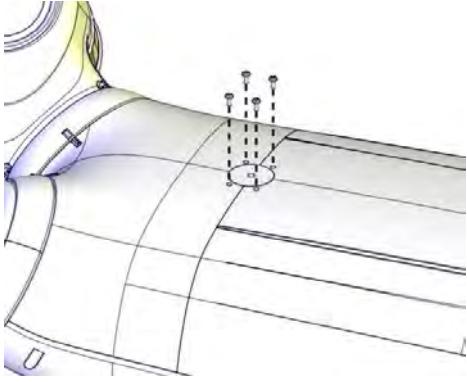
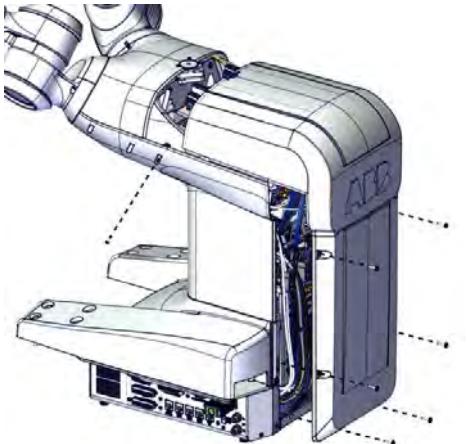
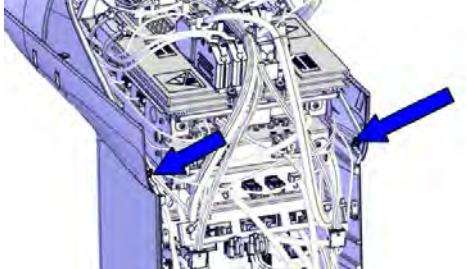
Removing the body covers

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

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4.4.2 Replacing the axis-2 motor

Continued

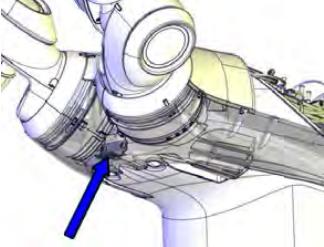
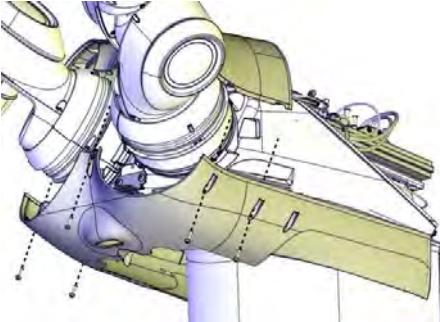
Action	Note
2 Remove the body cover top screws.	 xx1400002904
3 Remove the body cover.	 xx1500000303
4 Remove the back screws of the lower body cover.	 xx1500000540

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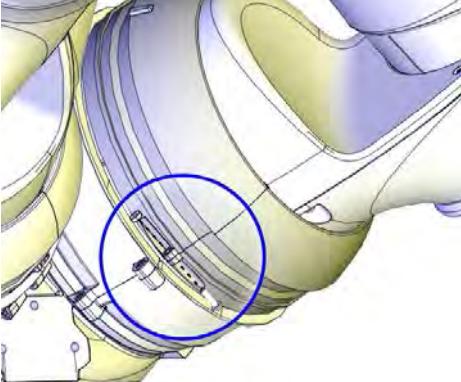
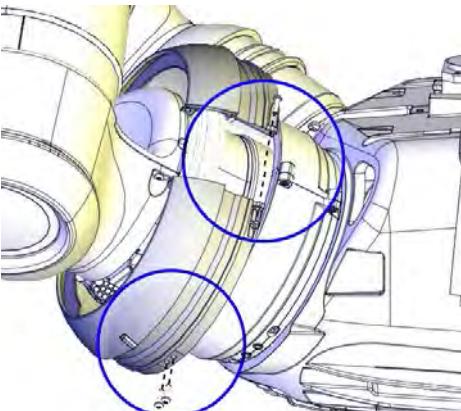
4 Repair

4.4.2 Replacing the axis-2 motor

Continued

Action	Note
5 Remove the front and lower body cover.  Note Be aware of the tab underneath the cover so it does not get damaged.  xx1500000564	 xx1400002603

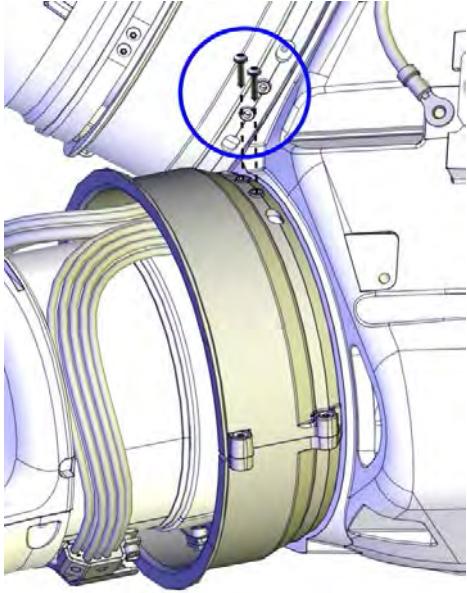
Removing the axis-1 covers

Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2 Remove the upper axis-1 cover.	 xx1400002601  xx1400002605

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4.4.2 Replacing the axis-2 motor

Continued

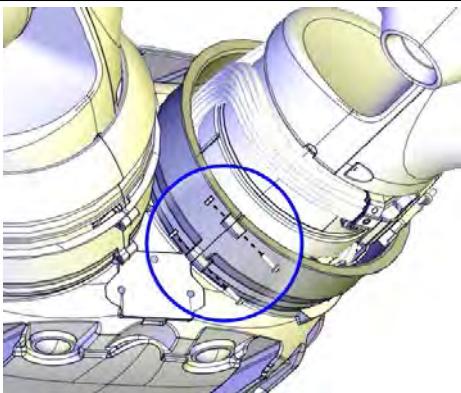
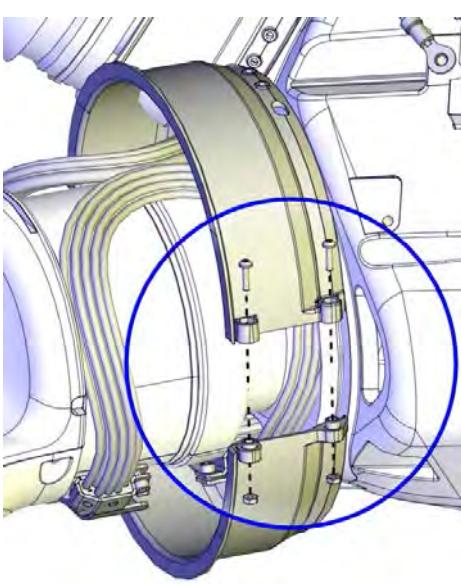
	Action	Note
3	Remove the upper screws of the lower axis-1 cover.	 xx1500000565

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4 Repair

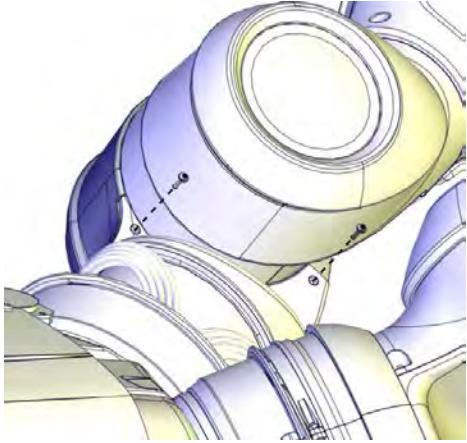
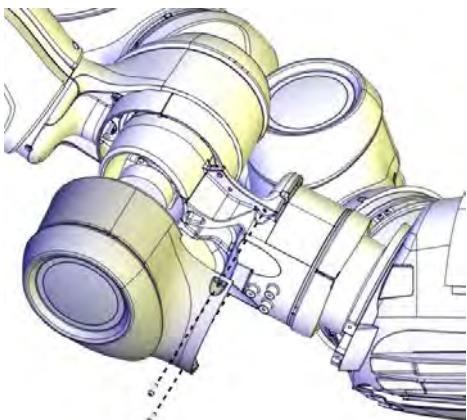
4.4.2 Replacing the axis-2 motor

Continued

Action	Note
4 Turn the lower axis-1 cover in order to access all screws properly and remove the lower axis-1 cover.	 xx1400002604  xx1400002606

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Removing the axis-2 covers

	Action	Note
1	Remove the lower axis-2 cover.	 

Removing the axis-2 motor

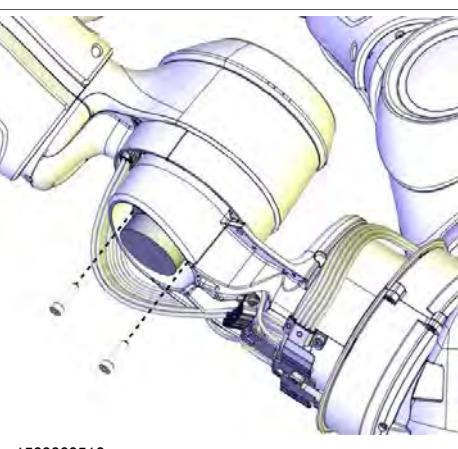
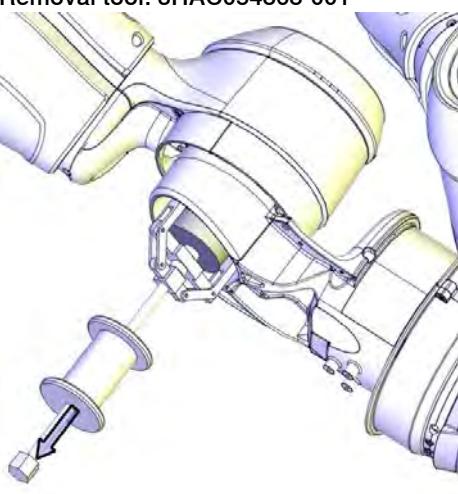
	Action	Note
1	 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2	Disconnect the motor connectors. <ul style="list-style-type: none"> • R1.MP2R / R1.MP2L • R1.FB2R / R1.FB2L 	
3	 CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	

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4 Repair

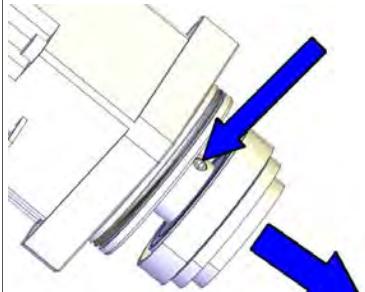
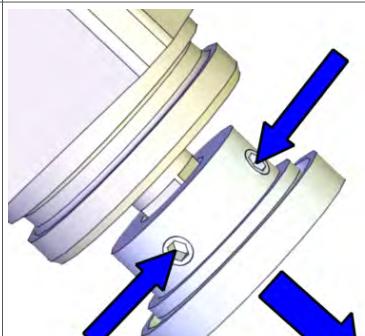
4.4.2 Replacing the axis-2 motor

Continued

	Action	Note
4	 CAUTION The gravity will cause the arm to suddenly fall down when the motor is removed, if the axis is not secured. Make sure the axis is secured against the mechanical stop prior to removing the motor.	
5	Move the cabling in order to access the motor screws. Loosen the cable bracket, if needed. Remove the screws.	 xx1500000516
6	Remove the motor by using the removal tool accordingly: <ol style="list-style-type: none"> 1 Attach the grip arms of the removal tool to the notches on the motor sides. 2 Gently knock the block backwards to the end stop of the pin to carefully knock the motor loose. 3 Pull out the motor.  CAUTION Lifting the motor out creates a hole into the gear, make sure no dirt falls into the hole.	Removal tool: 3HAC054868-001  xx1500000522

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Removing the wave generator from the motor

	Action	Note
1	<p>Remove the wave generator from the motor shaft by removing the set screw(s) and then pulling it off the shaft.</p> <p>Axis 1, axis 2, axis 7, axis 3.</p> 	xx1500000515
	<p>Axis 4, axis 5 and axis 6.</p> 	xx1500001651
2	<p>Place the wave generator on a clean workbench, if not instantly fitting it to a new motor.</p> <p> CAUTION</p> <p>Keep the wave generator clean.</p>	

Refitting the motor

Use these procedures to refit the axis-2 motor.

Fitting a new o-ring on the motor

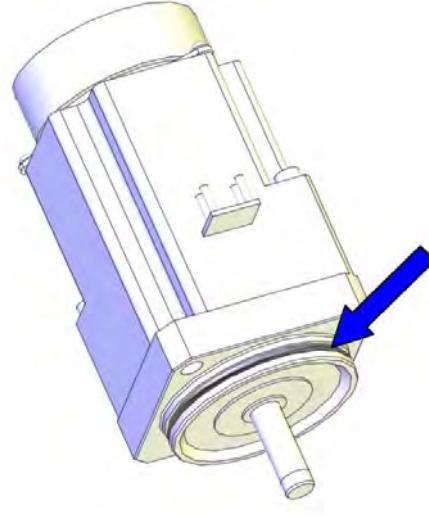
	Action	Note
1	Wipe the o-ring groove of the motor clean.	Motor M93: 3HAC036859-001.

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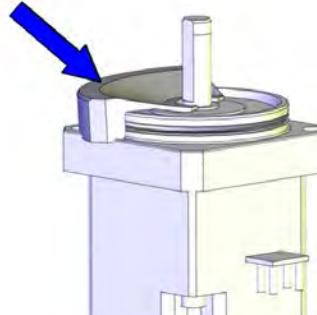
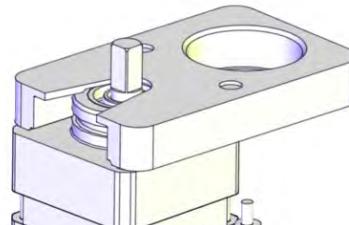
4 Repair

4.4.2 Replacing the axis-2 motor

Continued

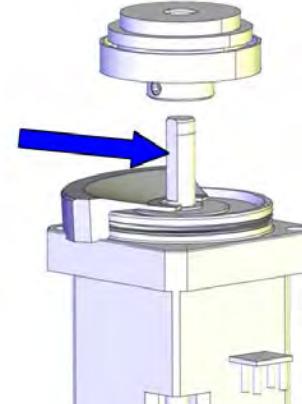
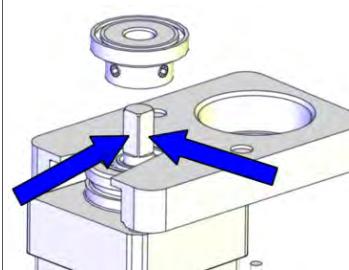
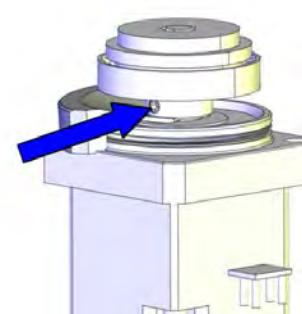
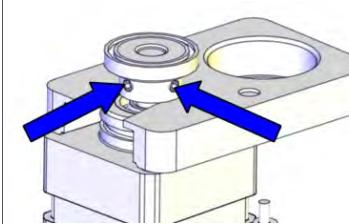
Action	Note
<p>2 Fit a new o-ring in the groove.</p> <p> Tip</p> <p>Lubricate the o-ring with some grease for a better fitting in the groove.</p>	<p>O-ring: 3HAB3772-137 Grease: Mobil FM222.</p>  <p>xx1400002611</p>

Fitting the wave generator to the motor

Action	Note
1 Wipe the contact surfaces of the motor and wave generator clean from any contamination with cleaning agent applied on a cloth or paper.	
2 Place the fixture tool on the new motor. Axis 1 and axis 2: Fixture tool for wave generator M93, 3HAC054870-001. Axis 7 and axis 3: Fixture tool for wave generator M92, 3HAC054871-001.	 <p>xx1500000527</p>
Axis 4, axis 5 and axis 6: Fixture tool for wave generator M91, 3HAC054904-001.	 <p>xx1500001646</p>

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4.4.2 Replacing the axis-2 motor Continued

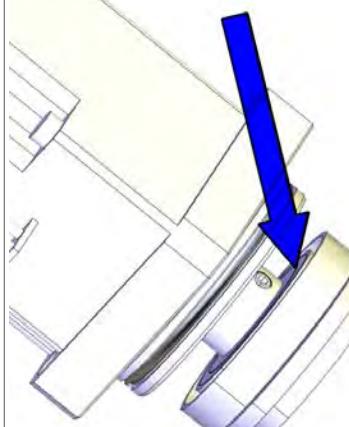
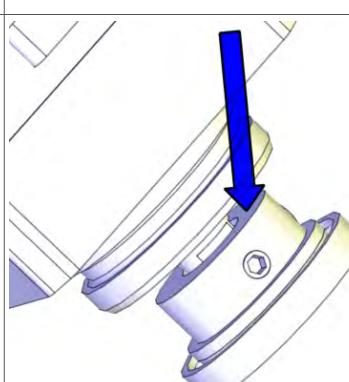
	Action	Note
3	<p>Fit the wave generator to the motor shaft, place it against the distance fixture and secure lightly with the set screw(s). Orient the wave generator so that the set screw will be positioned towards the flat surface on the output axis of the motor. The flat surface is pointed out in the figure.</p> <p>Axis 1, axis 2, axis 7, axis 3.</p>	
	Axis 4, axis 5 and axis 6.	
4	<p>Tighten the set screw.</p> <p>Axis 1 and axis 2. Screw, 1 pc. Tightening torque: 0.6 Nm.</p> <p>Axis 7 and axis 3. Screw, 1 pc. Tightening torque: 0.6 Nm.</p>	
	<p>Axis 4, axis 5 and axis 6. Screws, 2 pcs. Tightening torque: 0.2 Nm.</p>	

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4 Repair

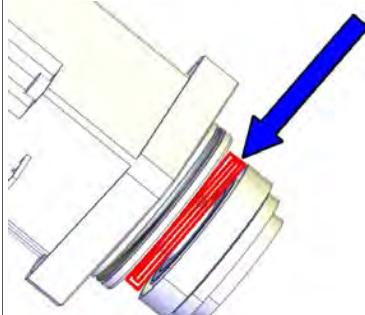
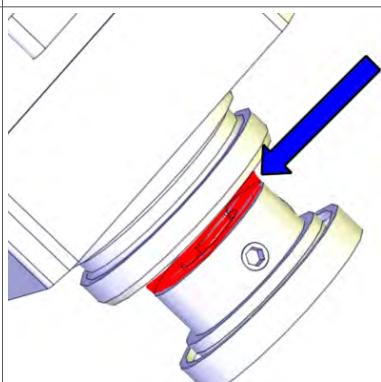
4.4.2 Replacing the axis-2 motor

Continued

	Action	Note
5	Remove the fixture.	
6	Lubricate the wave generator with grease. Axis 1, axis 2, axis 7, axis 3.	Grease: 3HAC038379-001, 1.2 ml.  xx1500000557
	Axis 4, axis 5 and axis 6.	 xx1500001649

Continues on next page

4.4.2 Replacing the axis-2 motor Continued

	Action	Note
7	<p>Fill the gap between the motor and the wave generator with grease.</p> <p>Axis 1, axis 2, axis 7, axis 3.</p>	<p>Grease: 3HAC038379-001.</p>  <p>xx1500000556</p>
	<p>Axis 4, axis 5 and axis 6.</p>	 <p>xx1500001650</p>

Refitting the axis-2 motor

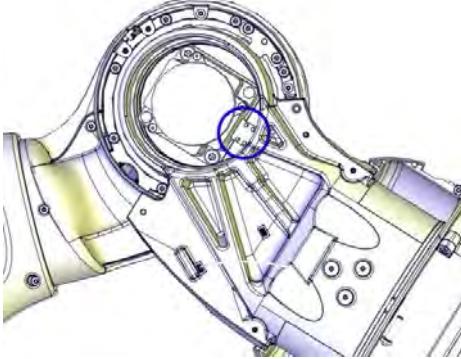
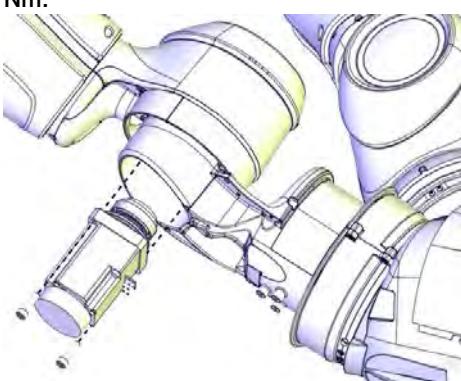
	Action	Note
1	<p> CAUTION</p> <p>Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!</p>	

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4 Repair

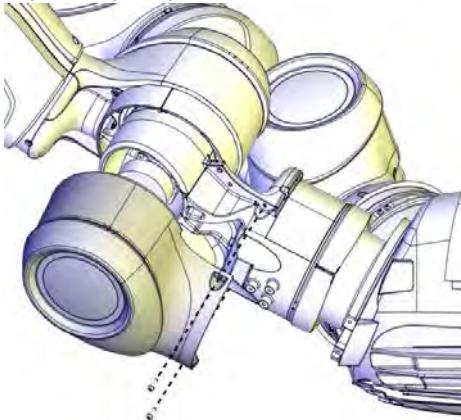
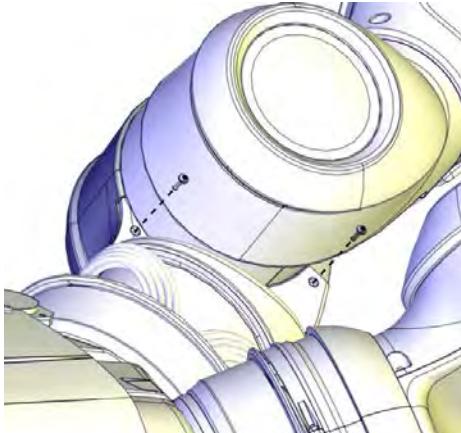
4.4.2 Replacing the axis-2 motor

Continued

Action	Note
2 Orient the motor correctly and fit it into the arm. Secure with the screws.  CAUTION The motor must be inserted gently. If the gears do not mate, rotate the axis carefully back and forth until the gears are mated.	Motor orientation: orient the motor according to the figure below, in regard to the encircled motor connector.  xx1500000566 Tightening torque: cross-tighten all screws to 1 Nm first, then final cross-tighten to 3 Nm.  xx1400002613
3 Reconnect the motor connectors. <ul style="list-style-type: none">• R1.MP2R / R1.MP2L• R1.FB2R / R1.FB2L	

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Refitting the axis-2 covers

	Action	Note
1	Refit the lower axis-2 cover.	<p>Screws: 4 pcs. Tightening torque: 0.14 Nm.</p>  <p>xx150000087</p>  <p>xx1400002612</p>

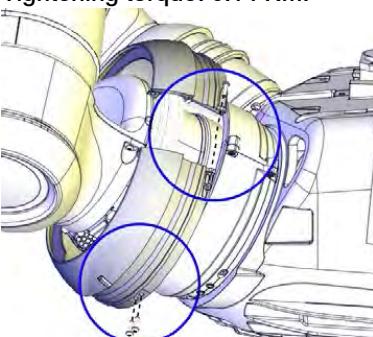
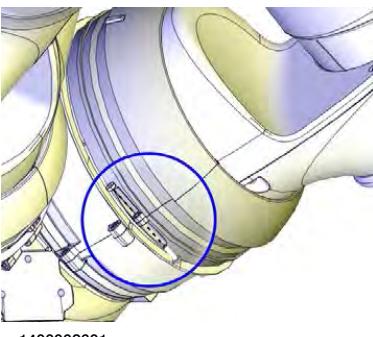
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4 Repair

4.4.2 Replacing the axis-2 motor

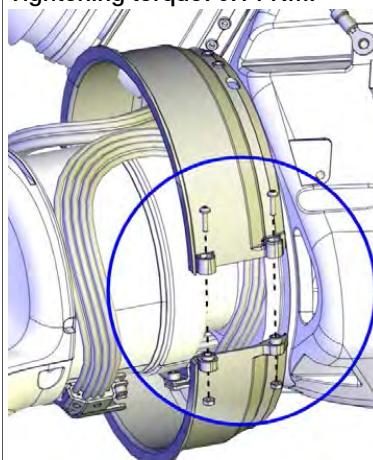
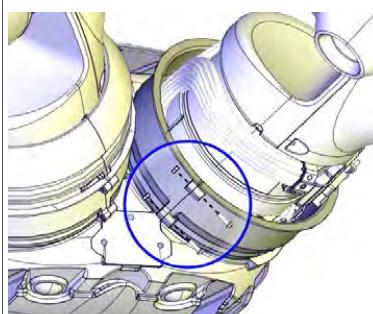
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Refitting the axis-1 covers

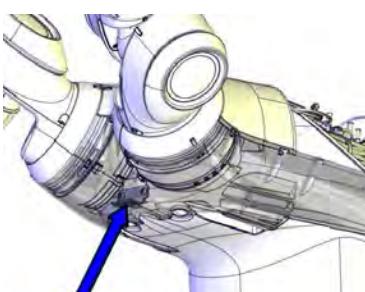
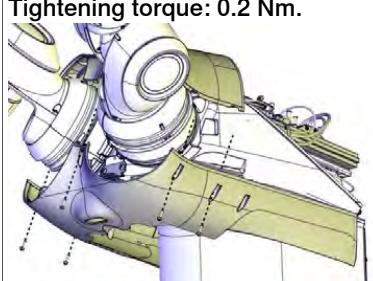
	Action	Note
1	Refit the upper axis-1 cover.	<p>Screws: 3HAC050368-005. (4 pcs) Nuts: M2 DIN934 8 ELZN. (2 pcs) Tightening torque: 0.14 Nm.</p>  <p>xx1400002605</p>  <p>xx1400002601</p>

Continues on next page

4.4.2 Replacing the axis-2 motor Continued

Action	Note
2 Refit the lower axis-1 cover.	<p>Screws: 3HAC050368-005. (4 pcs) Nuts: M2 DIN934 8 ELZN. (4 pcs) Tightening torque: 0.14 Nm.</p>  <p>xx1400002606</p>  <p>xx1400002604</p>

Refitting the body covers

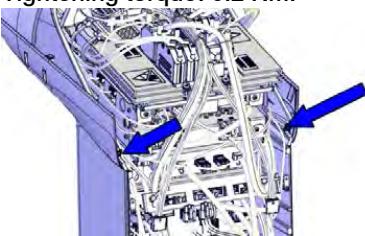
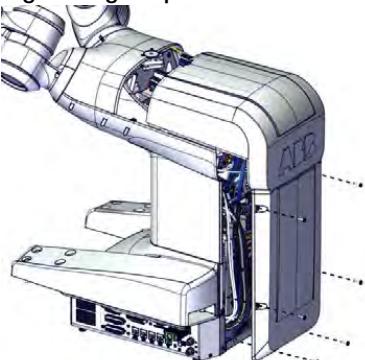
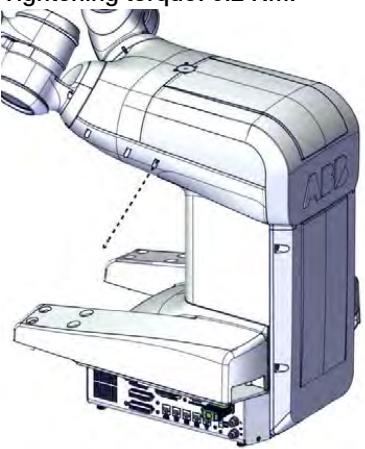
Action	Note
1 Refit the front and lower body cover. Note Be aware of the tab underneath the cover so it does not get damaged.	<p>Screws: 3HAC050367-005. (5 pcs) Tightening torque: 0.2 Nm.</p>  <p>xx1500000564</p>  <p>xx1400002603</p>

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4 Repair

4.4.2 Replacing the axis-2 motor

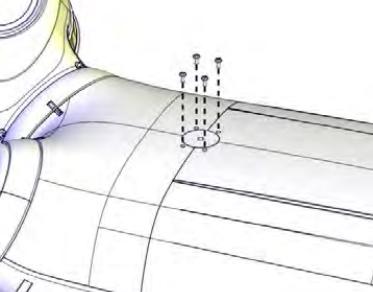
Continued

	Action	Note
2	Refit the back screws of the lower body cover.	Screws: 2 pcs. Tightening torque: 0.2 Nm.  xx1500000540
3	Refit the body cover.	Screws: 6 pcs. Tightening torque: 0.9 Nm.  xx1500000697
4	Refit the two remaining screws of the body cover.	Screws: 2 pcs. Tightening torque: 0.2 Nm.  xx1500000696

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4.4.2 Replacing the axis-2 motor

Continued

Action	Note
5 Refit the body cover top screws.	Screws: 4 pcs. Tightening torque: 0.2 Nm.  xx1400002904

Concluding procedure

Action	Note
1 Recalibrate the robot.	See Calibration on page 431 .
2  CAUTION 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 45 .	

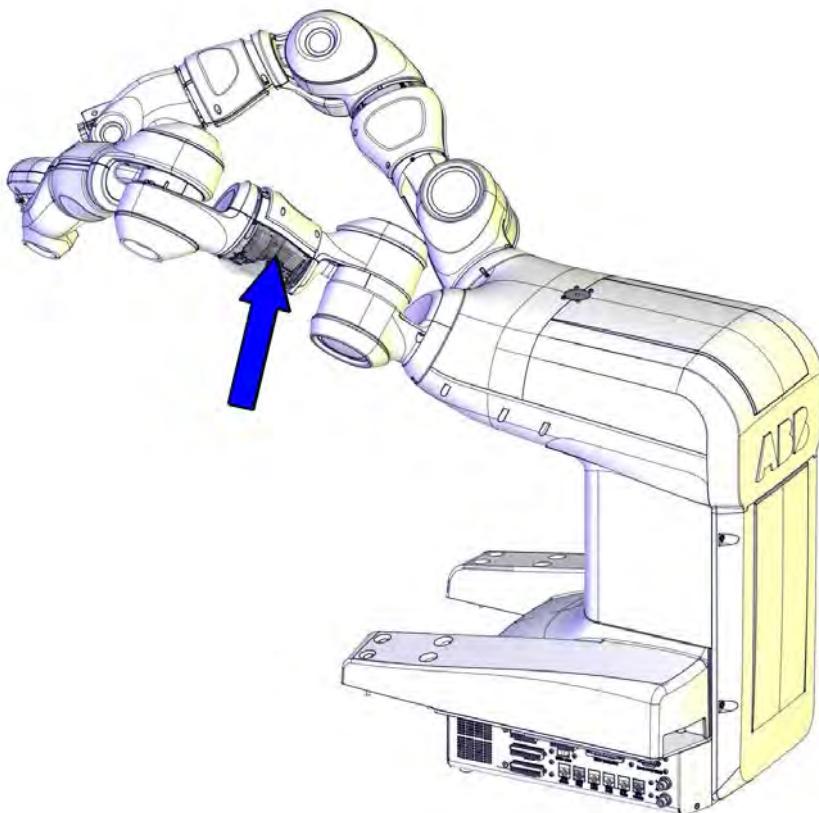
4 Repair

4.4.3 Replacing the axis-7 motor

4.4.3 Replacing the axis-7 motor

Location of the axis-7 motor

The axis-7 motor is located as shown in the figure.



xx1400002793

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 14000* on ABB Library.

Spare part	Article number	Note
Motor M92	3HAC036900-001	Always use a new o-ring 3HAB3772-136. To be ordered separately.
O-ring	3HAB3772-136	Required to be replaced when removing and refitting the motor.

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

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4.4.3 Replacing the axis-7 motor
Continued

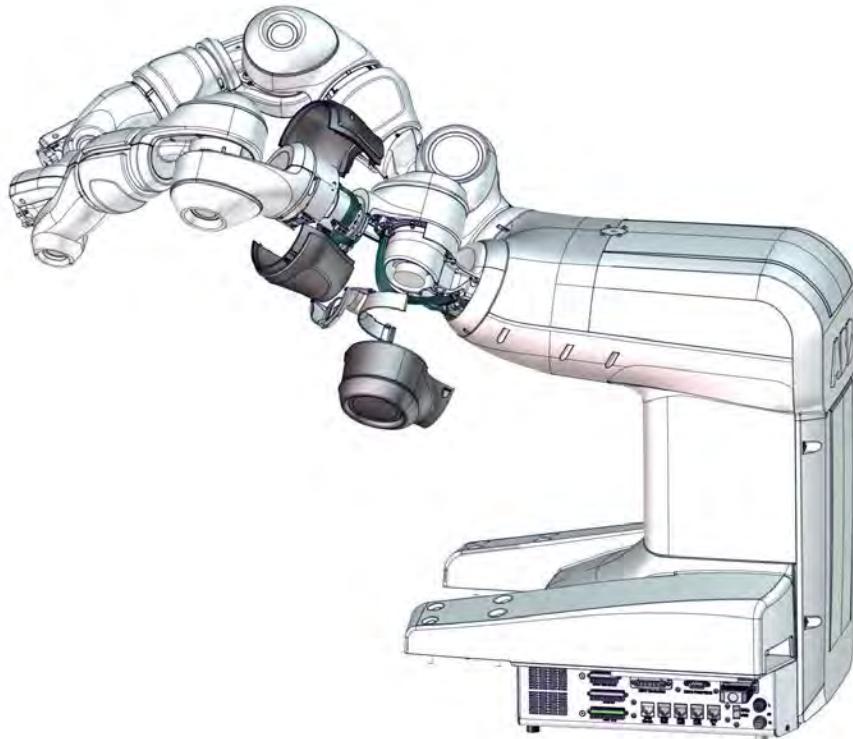
Equipment, etc.	Article number	Note
Removal tool	3HAC054869-001	Used to pull out the motor.
Fixture tool for wave generator M92	3HAC054871-001	

Consumables

Consumable	Article number	Note
Grease	-	Mobil FM222 Used to lubricate o-rings.
Grease	3HAC038379-001	Used to lubricate the wave generator.
Cleaning agent	-	Isopropanol

Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



xx1500000257

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4 Repair

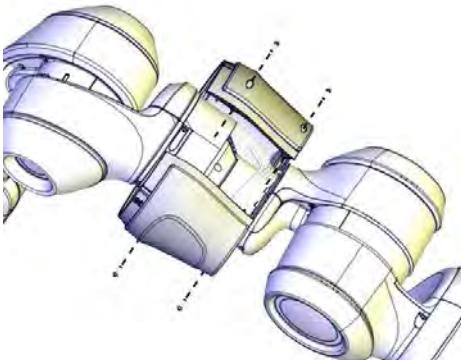
4.4.3 Replacing the axis-7 motor

Continued

Removing the motor

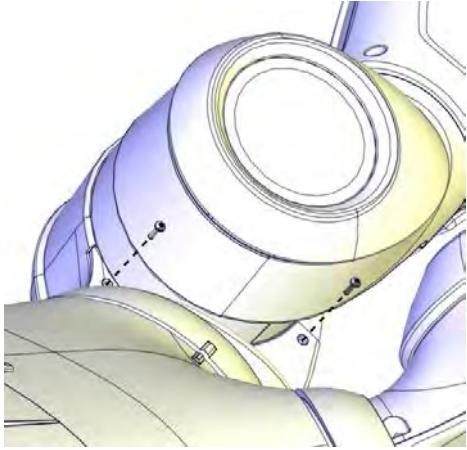
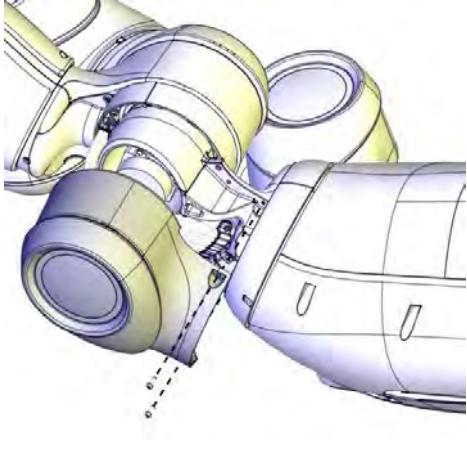
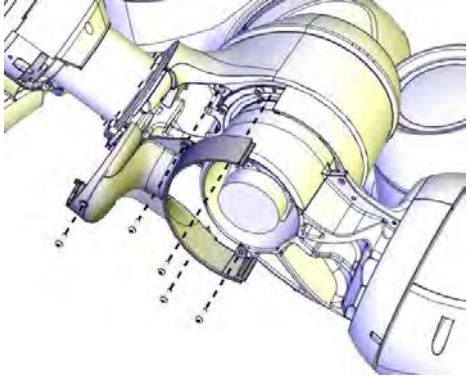
Use these procedures to remove the axis-7 motor.

Preparations before removing the motor

	Action	Note
1	Jog the robot so that the covers can be easily accessed and removed.	
2	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• air pressure supply to the robot, before starting the repair work on the robot.	
3	Remove the axis-7 cover.	 xx1400002691

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4.4.3 Replacing the axis-7 motor
Continued

Action	Note
4 Remove the lower axis-2 cover.	 
5 Remove the axis-2 cable cover.	

Removing the axis-7-3-4 assembly

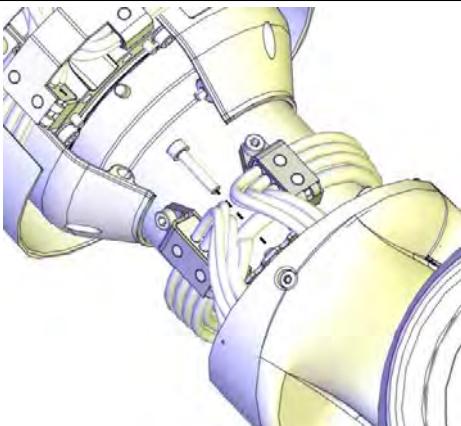
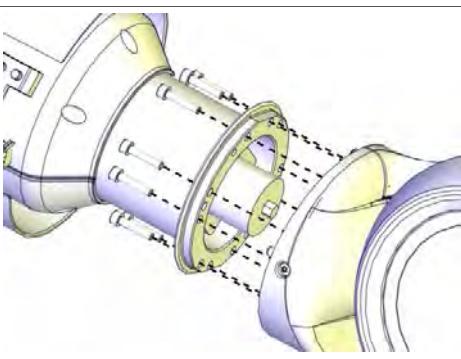
Action	Note
 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	

Continues on next page

4 Repair

4.4.3 Replacing the axis-7 motor

Continued

Action	Note
2 Loosen the cable bracket from the arm by removing the screw.	 xx1400002692
3 Disconnect the motor connectors. <ul style="list-style-type: none"> • R1.MP7R / R1.MP7L • R1.FB7R / R1.FB7L 	
4 Loosen the axis-7-3-4 and wrist assembly from the axis-1-2 assembly by removing the screws. ! CAUTION The cabling is still connected inside the robot, so be careful not to strain the cables! i Note There are 14 attachment screw holes, but only 10 of them are used to secure the axis 7-3-4 and wrist assembly.	 xx1400002693

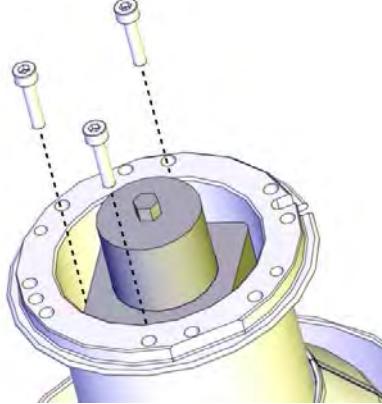
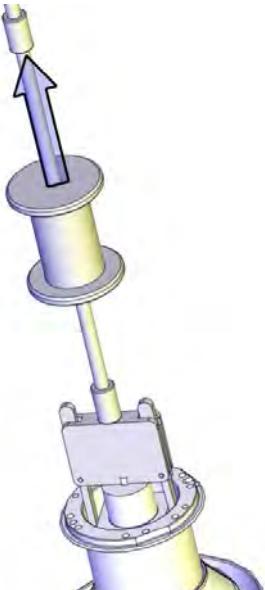
Removing the axis-7 motor

Action	Note
1 ! CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	
2 Hold the arm so that the motor cover points upwards. ! Tip This position makes it possible to change the motor without spilling out any grease from the gearbox.	

Continues on next page

4.4.3 Replacing the axis-7 motor

Continued

Action	Note
3 Remove the screws.	Screws: 3 pcs (no screw underneath the connector).  xx150000520
4 Remove the motor by using the removal tool accordingly: 1 Attach the grip arms of the removal tool to the notches on the motor sides. 2 Gently knock the block backwards to the end stop of the pin to carefully knock the motor loose. 3 Pull out the motor.	Removal tool: 3HAC054869-001  xx150000524

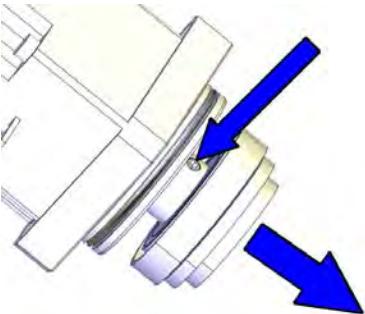
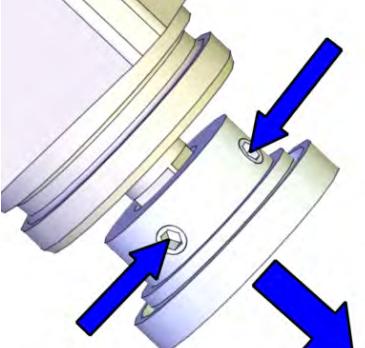
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4 Repair

4.4.3 Replacing the axis-7 motor

Continued

Removing the wave generator from the motor

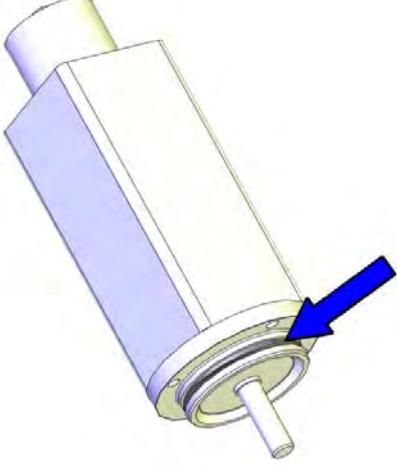
Action	Note
1 Remove the wave generator from the motor shaft by removing the set screw(s) and then pulling it off the shaft. Axis 1, axis 2, axis 7, axis 3.	 xx1500000515
Axis 4, axis 5 and axis 6.	 xx1500001651
2 Place the wave generator on a clean workbench, if not instantly fitting it to a new motor.  CAUTION Keep the wave generator clean.	

Continues on next page

Refitting the motor

Use these procedures to refit the axis-7 motor.

Checking the o-ring on the motor

	Action	Note
1	<p>Check that the o-ring is properly seated in its groove and that it is not damaged. Replace if damaged.</p> <p> Tip</p> <p>If needed, lubricate the o-ring with some grease for a better fitting in the groove.</p>	<p>Motor M92: 3HAC036900-001. O-ring: 3HAB3772-136 Grease: Mobil FM222.</p>  <p>xx1400002700</p>

Fitting the wave generator to the motor

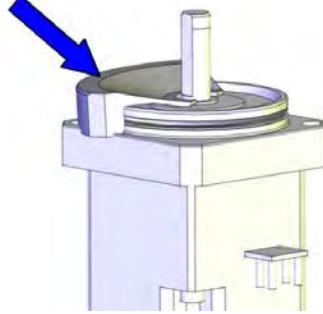
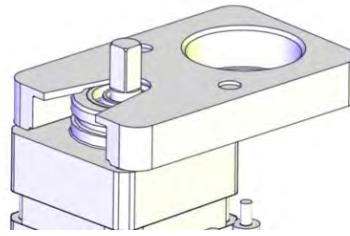
	Action	Note
1	Wipe the contact surfaces of the motor and wave generator clean from any contamination with cleaning agent applied on a cloth or paper.	

Continues on next page

4 Repair

4.4.3 Replacing the axis-7 motor

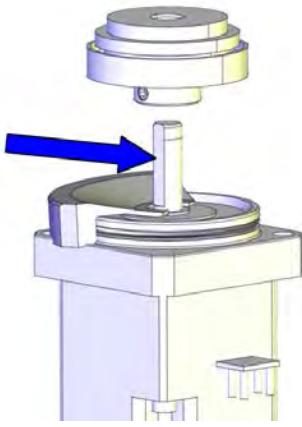
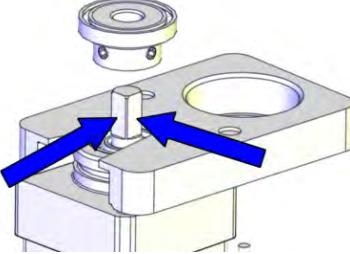
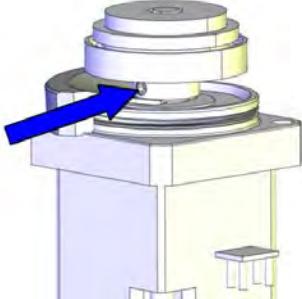
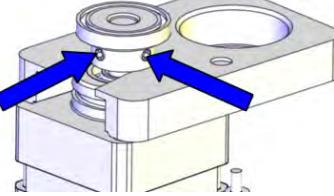
Continued

	Action	Note
2	<p>Place the fixture tool on the new motor.</p> <p>Axis 1 and axis 2: Fixture tool for wave generator M93, 3HAC054870-001.</p> <p>Axis 7 and axis 3: Fixture tool for wave generator M92, 3HAC054871-001.</p>	 xx1500000527
	<p>Axis 4, axis 5 and axis 6: Fixture tool for wave generator M91, 3HAC054904-001.</p>	 xx1500001646

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4.4.3 Replacing the axis-7 motor

Continued

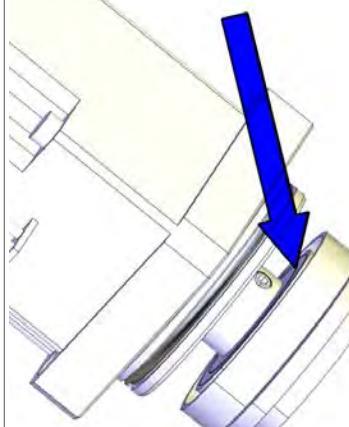
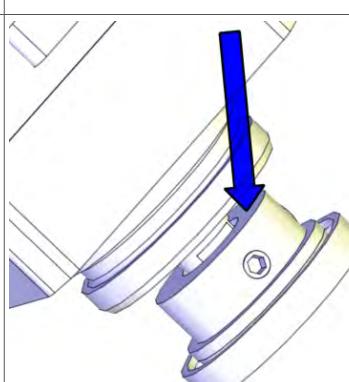
	Action	Note
3	<p>Fit the wave generator to the motor shaft, place it against the distance fixture and secure lightly with the set screw(s). Orient the wave generator so that the set screw will be positioned towards the flat surface on the output axis of the motor. The flat surface is pointed out in the figure.</p>	
	<p>Axis 1, axis 2, axis 7, axis 3.</p>	 xx1500000528
	<p>Axis 4, axis 5 and axis 6.</p>	 xx1500001647
4	<p>Tighten the set screw.</p>	
	<p>Axis 1 and axis 2. Screw, 1 pc. Tightening torque: 0.6 Nm.</p>	 xx1500000518
	<p>Axis 7 and axis 3. Screw, 1 pc. Tightening torque: 0.6 Nm.</p>	
	<p>Axis 4, axis 5 and axis 6. Screws, 2 pcs. Tightening torque: 0.2 Nm.</p>	 xx1500001648

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4 Repair

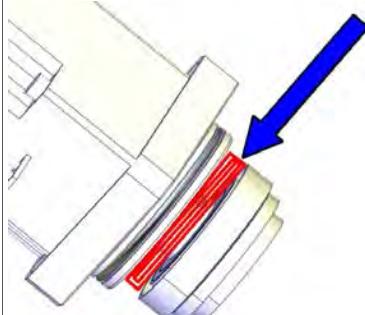
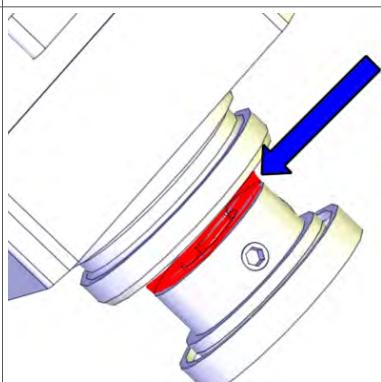
4.4.3 Replacing the axis-7 motor

Continued

	Action	Note
5	Remove the fixture.	
6	Lubricate the wave generator with grease. Axis 1, axis 2, axis 7, axis 3.	Grease: 3HAC038379-001, 1.2 ml.  xx1500000557
	Axis 4, axis 5 and axis 6.	 xx1500001649

Continues on next page

4.4.3 Replacing the axis-7 motor
Continued

	Action	Note
7	<p>Fill the gap between the motor and the wave generator with grease.</p> <p>Axis 1, axis 2, axis 7, axis 3.</p>	<p>Grease: 3HAC038379-001.</p>  <p>xx1500000556</p>
	<p>Axis 4, axis 5 and axis 6.</p>	 <p>xx1500001650</p>

Refitting the axis-7 motor

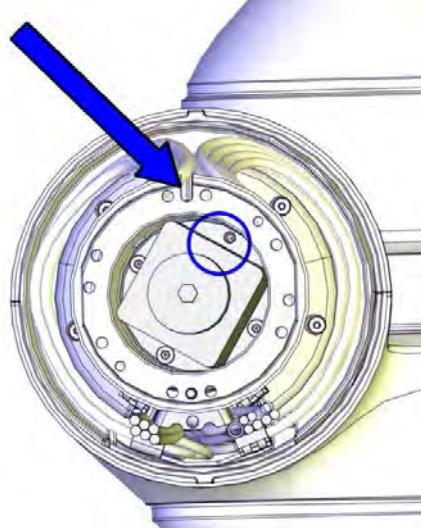
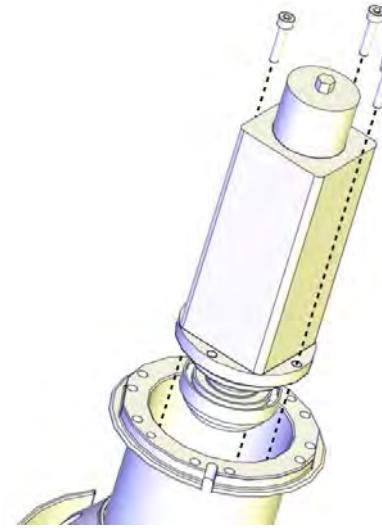
	Action	Note
1	<p> CAUTION</p> <p>Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!</p>	

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4 Repair

4.4.3 Replacing the axis-7 motor

Continued

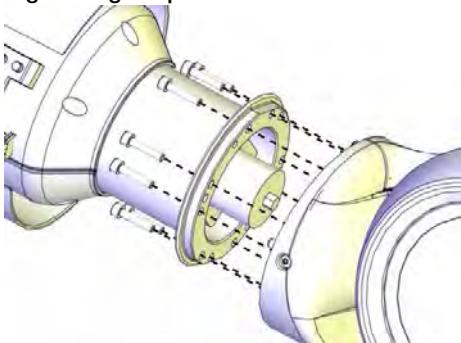
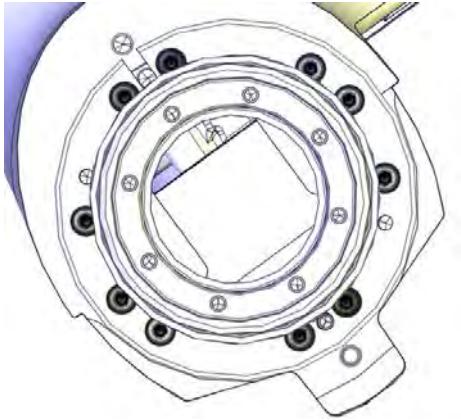
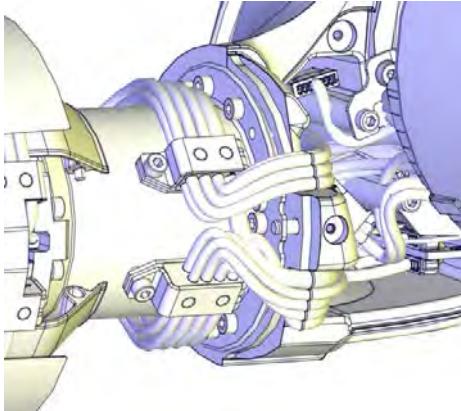
Action	Note
<p>2 Orient the motor correctly and fit it into the arm. Secure with the screws.</p> <p>CAUTION</p> <p>The motor must be inserted gently. If the gears do not mate, rotate the axis carefully back and forth until the gears are mated.</p>	<p>Motor orientation: orient the motor according to the figure below, in regard to the encircled motor connector and to the notch at the arm mounting flange.</p>  <p>xx1500000571</p> <p>Screws: 3 pcs (no screw underneath the connector). Tightening torque: 0.8 Nm.</p>  <p>xx1400002699</p>

Refitting the axis-7-3-4 assembly

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

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4.4.3 Replacing the axis-7 motor Continued

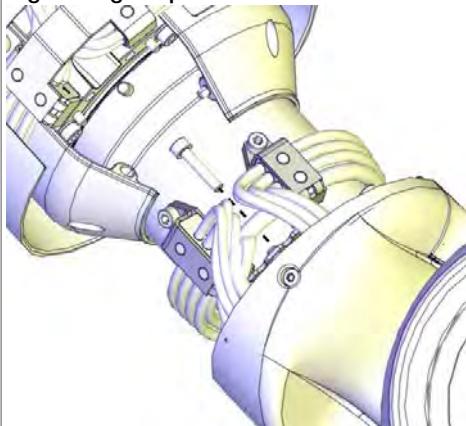
	Action	Note
2	<p>Refit the assembly and secure with screws.</p> <p>CAUTION Be careful not to squeeze any cabling during the refitting procedure.</p> <p>CAUTION There are 14 attachment screw holes, but only 10 of them are used to secure the axis 7-3-4 and wrist assembly.</p>	<p>Tightening torque: 0.8 Nm.</p>  <p>xx1400002693</p> <p>The figure below shows the hole configuration of the assembly. Use the screw holes that are used for screws in the figure.</p>  <p>xx1500000639</p>
3	<p>Reconnect the motor connectors.</p> <ul style="list-style-type: none"> • R1.MP7R / R1.MP7L • R1.FB7R / R1.FB7L 	
4	<p>Route and secure the cabling according to the figure.</p> <p>CAUTION Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	 <p>xx1500000572</p>

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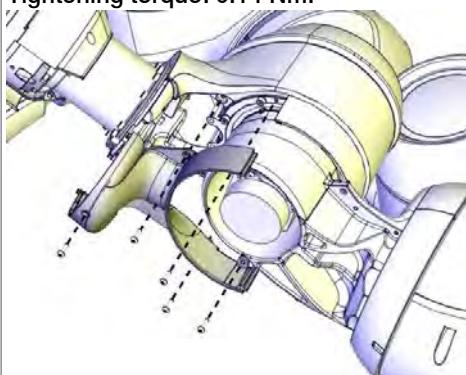
4 Repair

4.4.3 Replacing the axis-7 motor

Continued

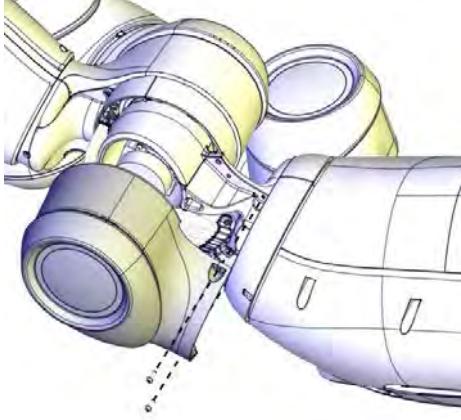
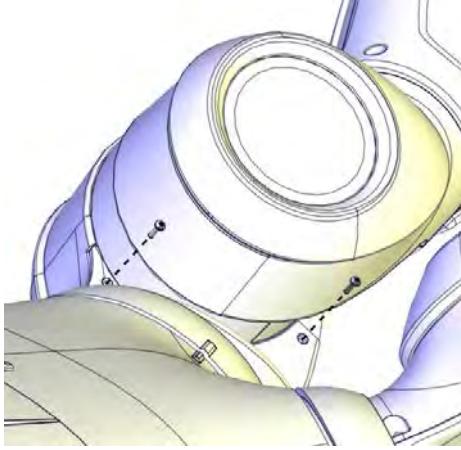
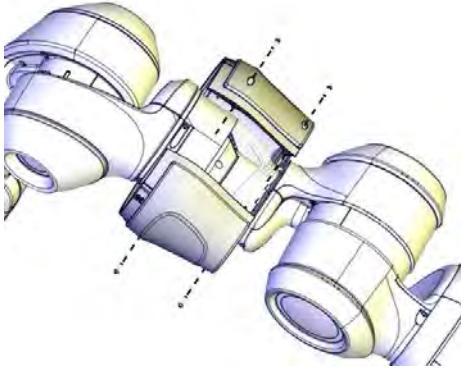
Action	Note
5 Refit the axis-7 cable bracket.	Tightening torque: 0.8 Nm.  xx1400002692

Refitting the covers

Action	Note
1 Refit the axis-2 cable cover. Replace if damaged.	Axis-2 cable cover: 3HAC050561-001. Screws: 5 pcs. Tightening torque: 0.14 Nm.  xx1500000256

Continues on next page

4.4.3 Replacing the axis-7 motor
Continued

	Action	Note
2	Refit the lower axis-2 cover.	<p>Screws: 4 pcs. Tightening torque: 0.14 Nm.</p>  <p>xx1400002615</p>
3	Refit the axis-7 cover.	<p>Screws: 4 pcs. Tightening torque: 0.14 Nm.</p>  <p>xx1400002614</p>
3	Refit the axis-7 cover.	<p>Screws: 4 pcs. Tightening torque: 0.14 Nm.</p>  <p>xx1400002691</p>

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4 Repair

4.4.3 Replacing the axis-7 motor

Continued

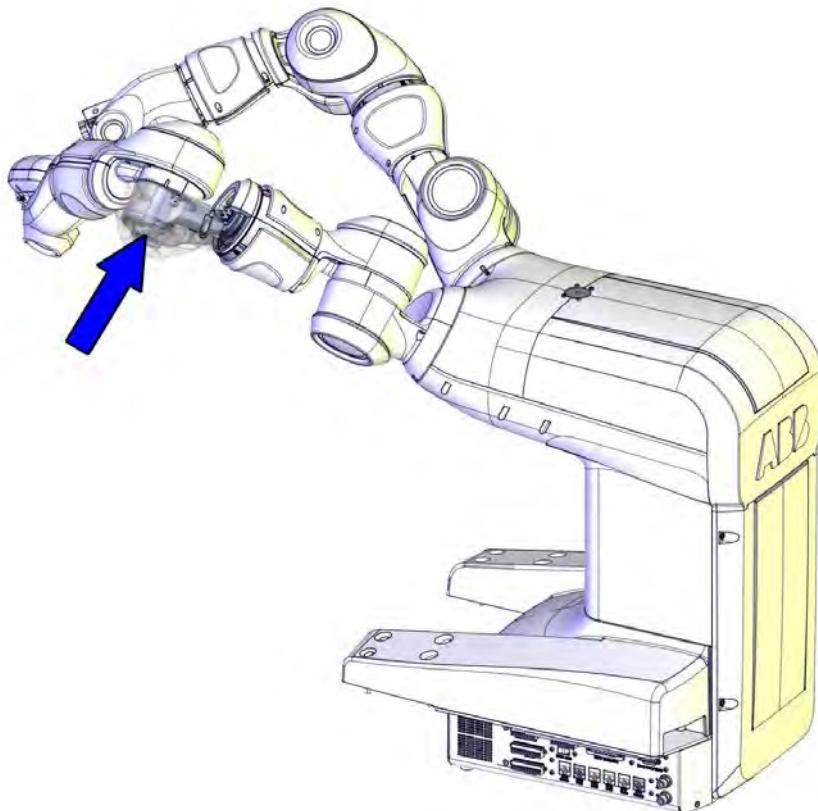
Concluding procedure

Action	Note
1 Recalibrate the robot. If option Absolute Accuracy is valid for the robot, redo absolute accuracy calibration.	See Calibration on page 431 .
2  CAUTION 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 45 .	

4.4.4 Replacing the axis-3 motor

Location of the axis-3 motor

The axis-3 motor is located as shown in the figure.



xx1400002794

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 14000* on ABB Library.

Spare part	Article number	Note
Motor M92	3HAC036900-001	Always use a new o-ring 3HAB3772-136. To be ordered separately.
O-ring	3HAB3772-136	Required to be replaced when removing and refitting the motor.

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

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4 Repair

4.4.4 Replacing the axis-3 motor

Continued

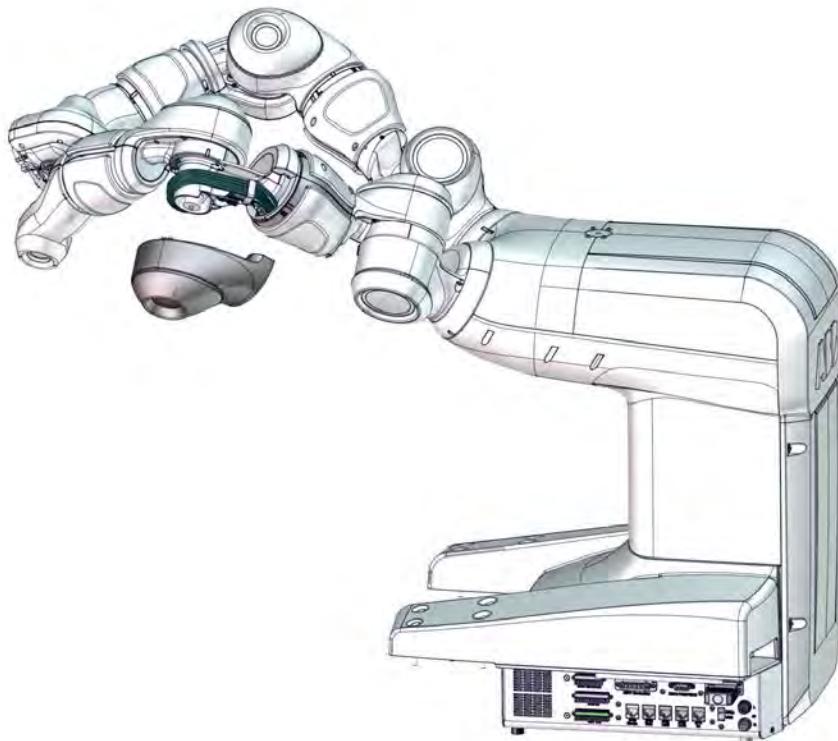
Equipment, etc.	Article number	Note
Removal tool	3HAC054869-001	Used to pull out the motor.
Fixture tool for wave generator or M92	3HAC054871-001	

Consumables

Consumable	Article number	Note
Grease	-	Mobil FM222 Used to lubricate o-rings.
Grease	3HAC038379-001	Used to lubricate the wave generator.
Cleaning agent	-	Isopropanol

Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



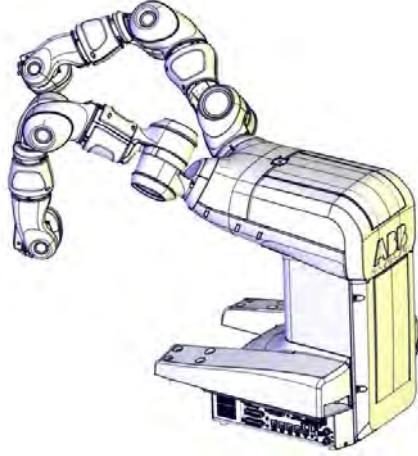
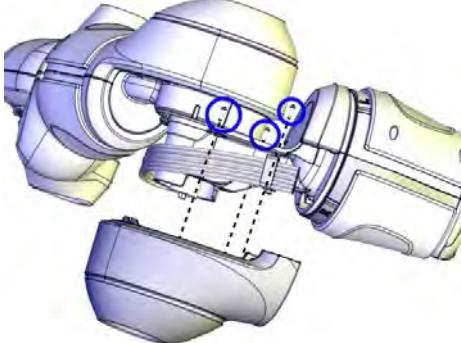
xx1400002862

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Removing the motor

Use these procedures to remove the axis-3 motor.

Preparations before removing the motor

	Action	Note
1	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none"> • Axis 1, axis 7 and axis 2: brake release and rotate so that axis-3 motor shaft is vertical. • Axis 3: rotate in positive direction until the axis is secured against the axis-3 mechanical stop. • Axis 4: No significance. • Axis 5: No significance. • Axis 6: No significance. 	<p>The figure shows the specified position on the left arm:</p>  <p>xx1500000586</p>
2	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • air pressure supply <p>to the robot, before starting the repair work on the robot.</p>	
3	Remove the lower axis-3 cover.	 <p>xx1400002751</p>

Removing the axis-3 motor

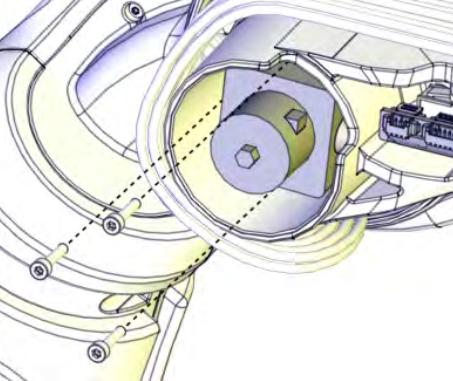
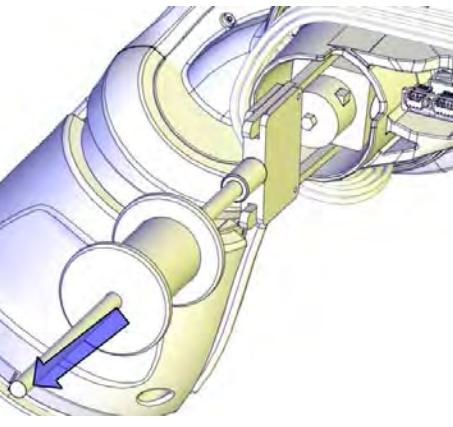
	Action	Note
1	<p> DANGER</p> <p>Make sure that all supplies for electrical power and air pressure are turned off.</p>	

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4 Repair

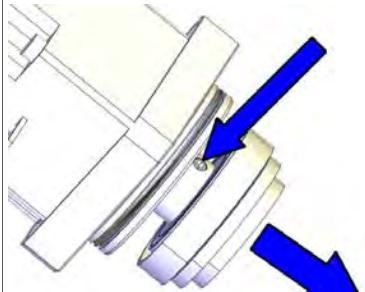
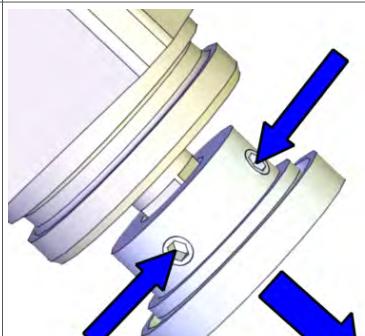
4.4.4 Replacing the axis-3 motor

Continued

Action	Note
2 Disconnect the motor connectors. • R1.MP3R / R1.MP3L • R1.FB3R / R1.FB3L	
3  CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	
4  CAUTION The gravity will cause the arm to suddenly fall down when the motor is removed, if the axis is not secured. Make sure the axis is secured against the mechanical stop prior to removing the motor.	
5 Remove the screws. Screws: 3 pcs (no screw underneath the connector).	
6 Remove the motor by using the removal tool accordingly: 1 Attach the grip arms of the removal tool to the notches on the motor sides. 2 Gently knock the block backwards to the end stop of the pin to carefully knock the motor loose. 3 Pull out the motor.	Removal tool: 3HAC054869-001 

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Removing the wave generator from the motor

	Action	Note
1	<p>Remove the wave generator from the motor shaft by removing the set screw(s) and then pulling it off the shaft.</p> <p>Axis 1, axis 2, axis 7, axis 3.</p> 	xx1500000515
	<p>Axis 4, axis 5 and axis 6.</p> 	xx1500001651
2	<p>Place the wave generator on a clean workbench, if not instantly fitting it to a new motor.</p> <p> CAUTION</p> <p>Keep the wave generator clean.</p>	

Refitting the motor

Use these procedures to refit the axis-3 motor.

Fitting a new o-ring on the motor

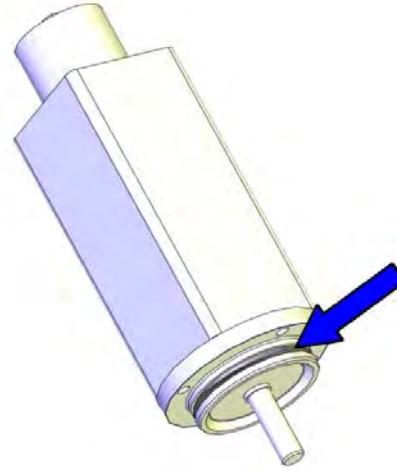
	Action	Note
1	Wipe the o-ring groove of the motor clean.	Motor M92: 3HAC036900-001.

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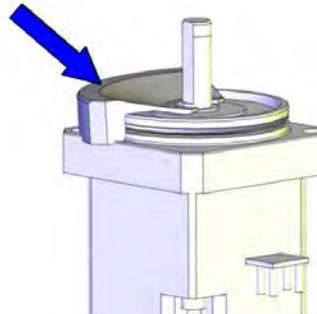
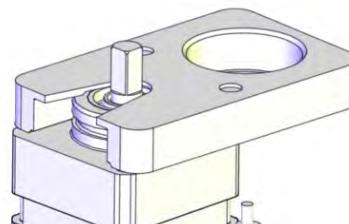
4 Repair

4.4.4 Replacing the axis-3 motor

Continued

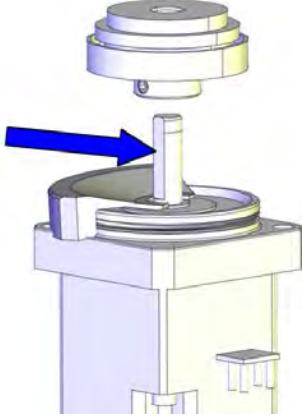
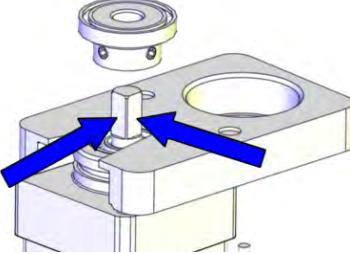
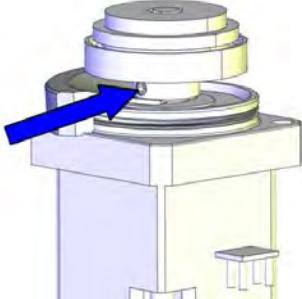
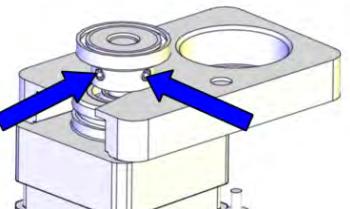
Action	Note
<p>2 Fit a new o-ring in the groove.</p> <p> Tip</p> <p>Lubricate the o-ring with some grease for a better fitting in the groove.</p>	<p>O-ring: 3HAB3772-136 Grease: Mobil FM222.</p>  <p>xx1400002700</p>

Fitting the wave generator to the motor

Action	Note
1 Wipe the contact surfaces of the motor and wave generator clean from any contamination with cleaning agent applied on a cloth or paper.	
2 Place the fixture tool on the new motor. Axis 1 and axis 2: Fixture tool for wave generator M93, 3HAC054870-001. Axis 7 and axis 3: Fixture tool for wave generator M92, 3HAC054871-001.	 <p>xx1500000527</p>
Axis 4, axis 5 and axis 6: Fixture tool for wave generator M91, 3HAC054904-001.	 <p>xx1500001646</p>

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4.4.4 Replacing the axis-3 motor
Continued

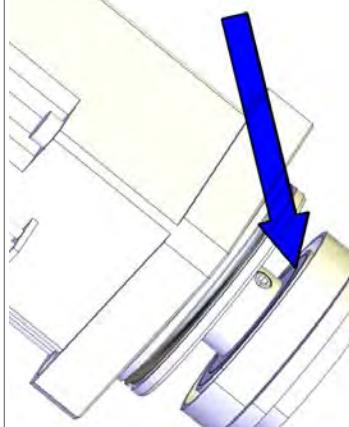
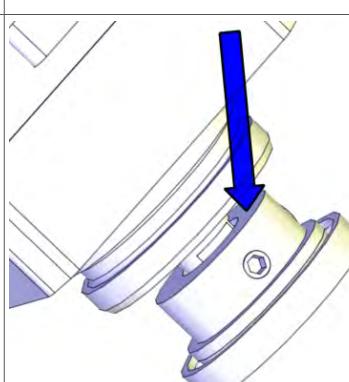
	Action	Note
3	<p>Fit the wave generator to the motor shaft, place it against the distance fixture and secure lightly with the set screw(s). Orient the wave generator so that the set screw will be positioned towards the flat surface on the output axis of the motor. The flat surface is pointed out in the figure.</p>	
	<p>Axis 1, axis 2, axis 7, axis 3.</p>	 xx1500000528
	<p>Axis 4, axis 5 and axis 6.</p>	 xx1500001647
4	<p>Tighten the set screw.</p>	
	<p>Axis 1 and axis 2. Screw, 1 pc. Tightening torque: 0.6 Nm.</p>	 xx1500000518
	<p>Axis 7 and axis 3. Screw, 1 pc. Tightening torque: 0.6 Nm.</p>	
	<p>Axis 4, axis 5 and axis 6. Screws, 2 pcs. Tightening torque: 0.2 Nm.</p>	 xx1500001648

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4 Repair

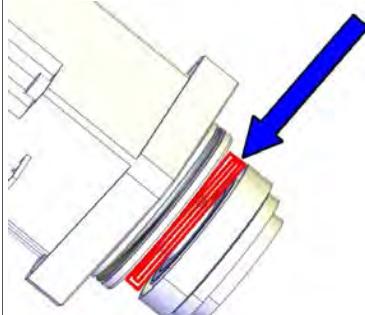
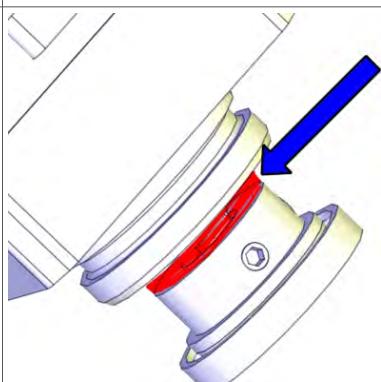
4.4.4 Replacing the axis-3 motor

Continued

	Action	Note
5	Remove the fixture.	
6	Lubricate the wave generator with grease. Axis 1, axis 2, axis 7, axis 3.	Grease: 3HAC038379-001, 1.2 ml.  xx1500000557
	Axis 4, axis 5 and axis 6.	 xx1500001649

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4.4.4 Replacing the axis-3 motor
Continued

	Action	Note
7	<p>Fill the gap between the motor and the wave generator with grease.</p> <p>Axis 1, axis 2, axis 7, axis 3.</p>	<p>Grease: 3HAC038379-001.</p>  <p>xx1500000556</p>
	<p>Axis 4, axis 5 and axis 6.</p>	 <p>xx1500001650</p>

Refitting the axis-3 motor

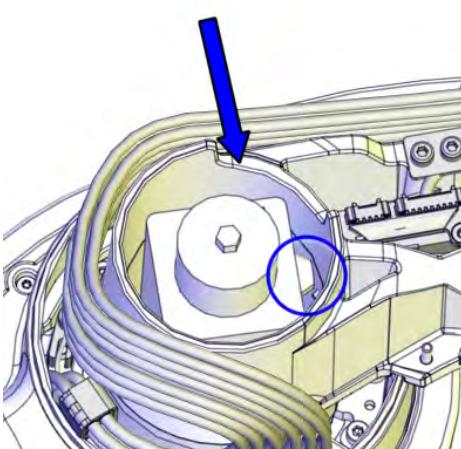
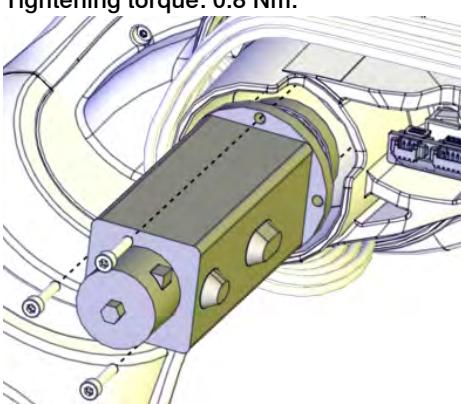
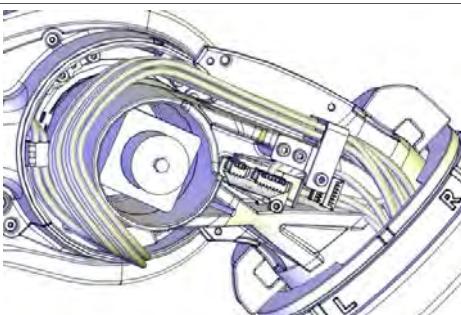
	Action	Note
1	<p> CAUTION</p> <p>Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!</p>	

Continues on next page

4 Repair

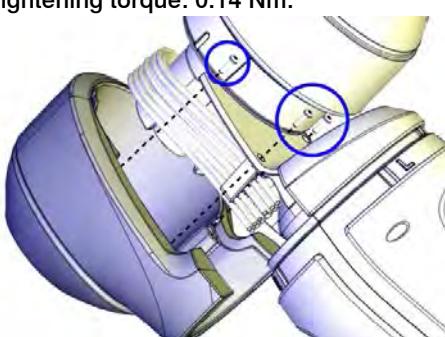
4.4.4 Replacing the axis-3 motor

Continued

Action	Note
<p>2 Orient the motor correctly and fit it into the arm. Secure with the screws.</p> <p>CAUTION</p> <p>The motor must be inserted gently. If the gears do not mate, rotate the axis carefully back and forth until the gears are mated.</p>	<p>Motor orientation: orient the motor so that the motor connector faces the big notch at the arm mounting flange.</p>  <p>xx1500000567</p> <p>Screws: 3 pcs (no screw underneath the connector). Tightening torque: 0.8 Nm.</p>  <p>xx1400002752</p>
<p>3 Reconnect the motor connectors.</p> <ul style="list-style-type: none"> • R1.MP3R / R1.MP3L • R1.FB3R / R1.FB3L 	
<p>4 Route and secure the cabling according to the figure.</p> <p>CAUTION</p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	 <p>xx1500000573</p>

Continues on next page

Refitting the covers

	Action	Note
1	<p>Refit the lower axis-3 cover.</p> <p>CAUTION Be careful not to squeeze any cabling during the refitting procedure.</p>	<p>Lower axis-3 cover: 3HAC050532-001 Screws: 3 pcs. Tightening torque: 0.14 Nm.</p>  <p>xx1400002753</p>

Concluding procedure

	Action	Note
1	Recalibrate the robot.	See Calibration on page 431 .
2	<p>CAUTION</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 45.</p>	

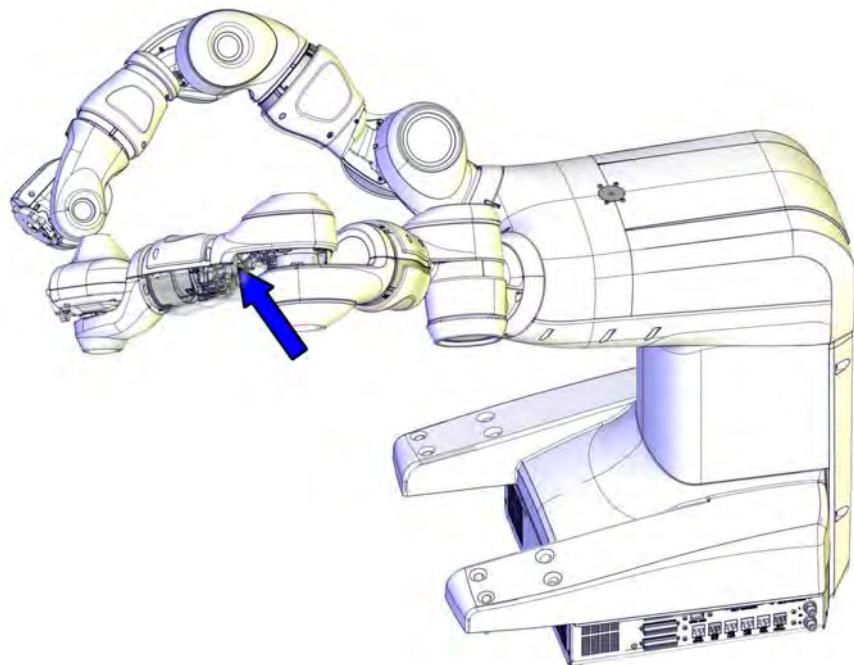
4 Repair

4.4.5 Replacing the axis-4 motor

4.4.5 Replacing the axis-4 motor

Location of the axis-4 motor

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



xx1400002795

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 14000* on ABB Library.

Spare part	Article number	Note
Motor M91	3HAC036950-001	Always use a new o-ring 3HAB3772-138. To be ordered separately.
O-ring	3HAB3772-138	Required to be replaced when removing and refitting the motor.

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Fixture tool for wave generator or M91	3HAC054904-001	

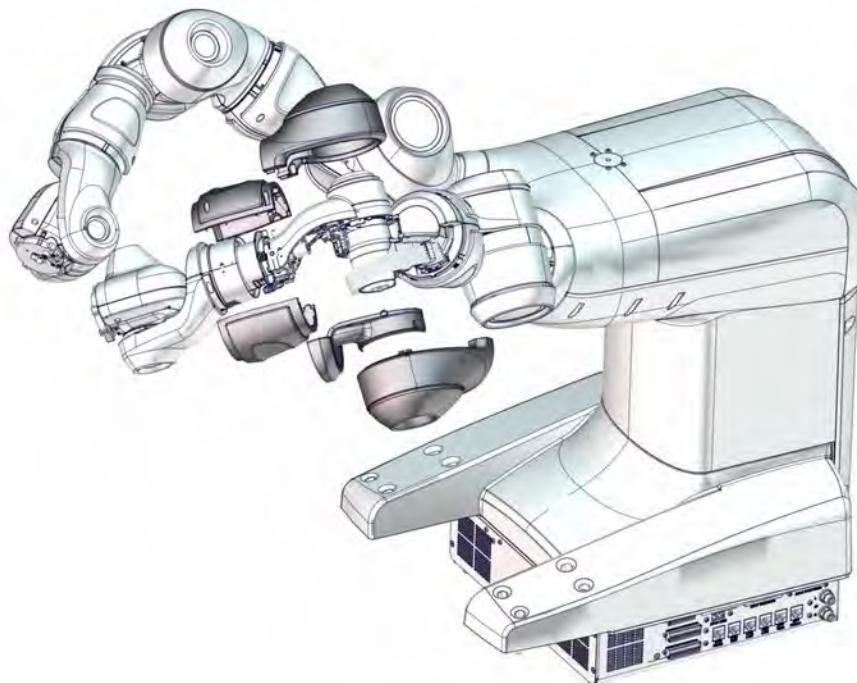
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Consumables

Consumable	Article number	Note
Grease	-	Mobil FM222 Used to lubricate o-rings.
Grease	3HAC038379-001	Used to lubricate the wave generator.
Cleaning agent	-	Isopropanol

Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



xx1400002863

Removing the motor

Use these procedures to remove the axis-4 motor.

Preparations before removing the motor

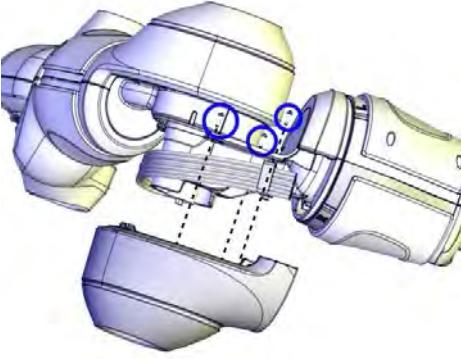
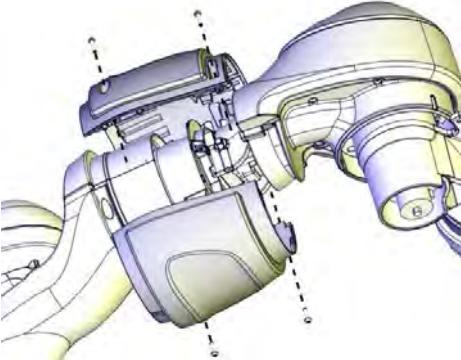
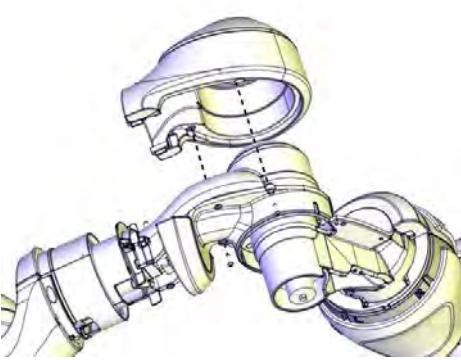
	Action	Note
1	Jog the robot so that the axis-3 and axis-4 covers can be easily accessed and removed.	

Continues on next page

4 Repair

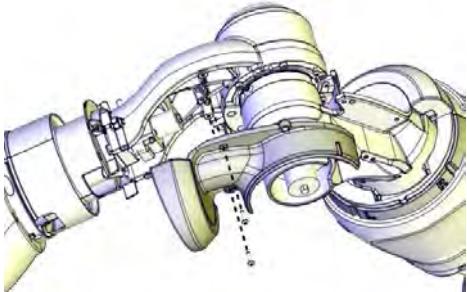
4.4.5 Replacing the axis-4 motor

Continued

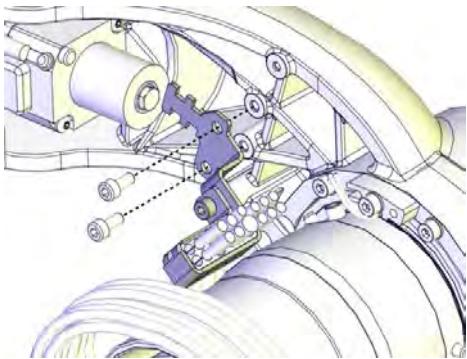
	Action	Note
2	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• air pressure supply to the robot, before starting the repair work on the robot.	
3	Remove the lower axis-3 cover.	 xx1400002751
4	Remove the lower axis-4 cover.	 xx1400002756
5	Remove the axis-3 body cover.	 xx1400002754

Continues on next page

4.4.5 Replacing the axis-4 motor Continued

Action	Note
6 Remove the upper axis-3 cover.	 <p>xx1400002755</p>

Removing the axis-4 motor

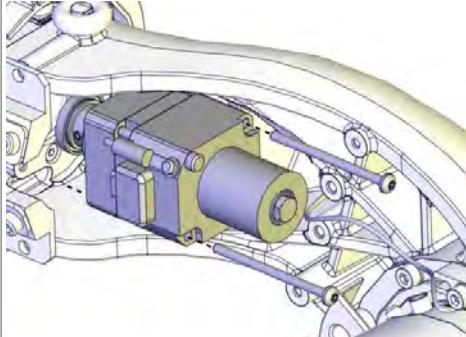
Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2 Remove the upper axis-3 cable bracket.	 <p>xx1400002757</p>
3 Disconnect the motor connectors. <ul style="list-style-type: none">• R1.MP4R / R1.MP4L• R1.FB4R / R1.FB4L	
4  CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	

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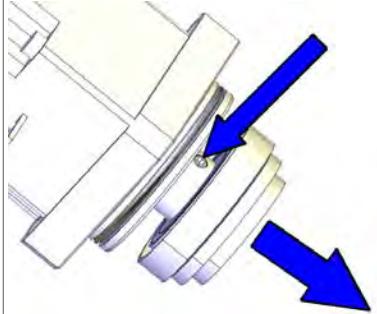
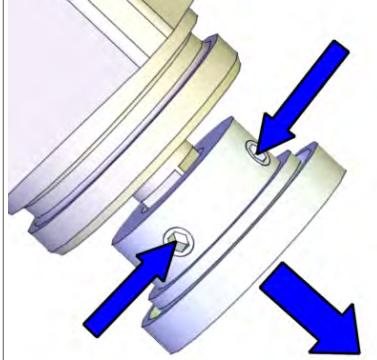
4 Repair

4.4.5 Replacing the axis-4 motor

Continued

Action	Note
5 Remove the screws and lift the motor out carefully.	 xx1400002758

Removing the wave generator from the motor

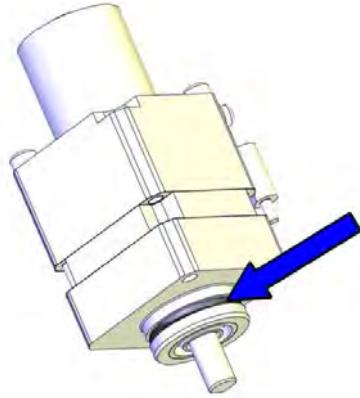
Action	Note
1 Remove the wave generator from the motor shaft by removing the set screw(s) and then pulling it off the shaft. Axis 1, axis 2, axis 7, axis 3.	 xx1500000515
Axis 4, axis 5 and axis 6.	 xx1500001651
2 Place the wave generator on a clean workbench, if not instantly fitting it to a new motor. ! CAUTION Keep the wave generator clean.	

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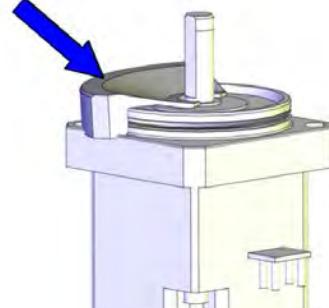
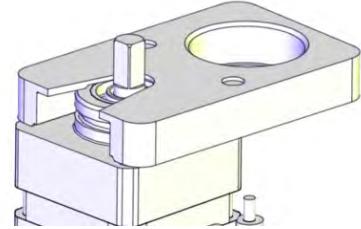
Refitting the motor

Use these procedures to refit the axis-4 motor.

Checking the o-ring on the motor

	Action	Note
1	<p>Check that the o-ring is properly seated in its groove and that it is not damaged. Replace if damaged.</p> <p> Tip</p> <p>If needed, lubricate the o-ring with some grease for a better fitting in the groove.</p>	<p>Motor M91: 3HAC036950-001. O-ring: 3HAB3772-138 Grease: Mobil FM222.</p>  <p>xx1400002759</p>

Fitting the wave generator to the motor

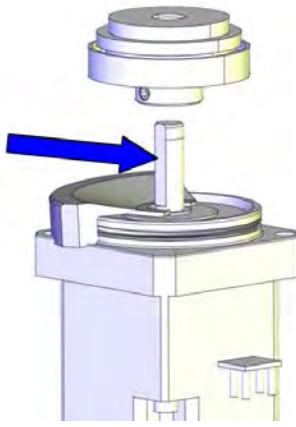
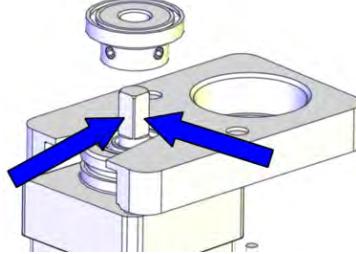
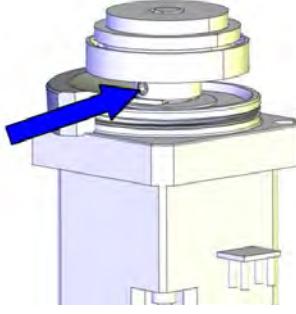
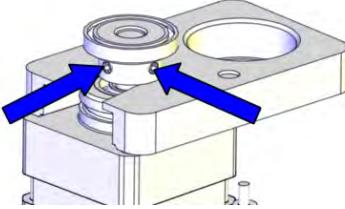
	Action	Note
1	Wipe the contact surfaces of the motor and wave generator clean from any contamination with cleaning agent applied on a cloth or paper.	
2	<p>Place the fixture tool on the new motor.</p> <p>Axis 1 and axis 2: Fixture tool for wave generator M93, 3HAC054870-001.</p> <p>Axis 7 and axis 3: Fixture tool for wave generator M92, 3HAC054871-001.</p>	 <p>xx1500000527</p>
	Axis 4, axis 5 and axis 6: Fixture tool for wave generator M91, 3HAC054904-001.	 <p>xx1500001646</p>

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4 Repair

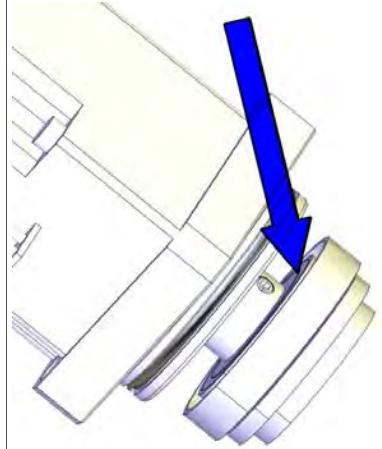
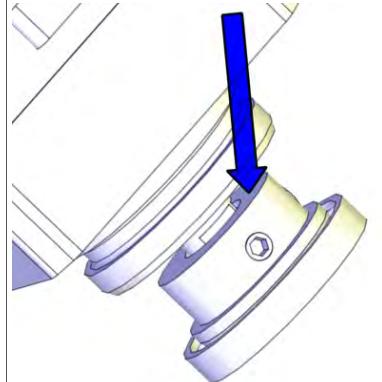
4.4.5 Replacing the axis-4 motor

Continued

	Action	Note
3	<p>Fit the wave generator to the motor shaft, place it against the distance fixture and secure lightly with the set screw(s).</p> <p>Orient the wave generator so that the set screw will be positioned towards the flat surface on the output axis of the motor. The flat surface is pointed out in the figure.</p> <p>Axis 1, axis 2, axis 7, axis 3.</p>	 <p>xx1500000528</p>
	<p>Axis 4, axis 5 and axis 6.</p>	 <p>xx1500001647</p>
4	<p>Tighten the set screw.</p> <p>Axis 1 and axis 2. Screw, 1 pc. Tightening torque: 0.6 Nm.</p> <p>Axis 7 and axis 3. Screw, 1 pc. Tightening torque: 0.6 Nm.</p>	 <p>xx1500000518</p>
	<p>Axis 4, axis 5 and axis 6. Screws, 2 pcs. Tightening torque: 0.2 Nm.</p>	 <p>xx1500001648</p>

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4.4.5 Replacing the axis-4 motor
Continued

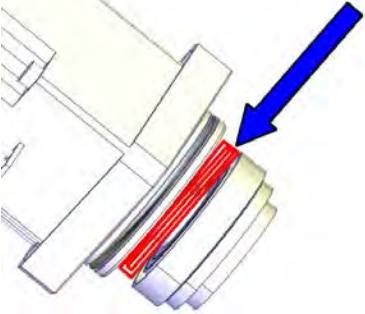
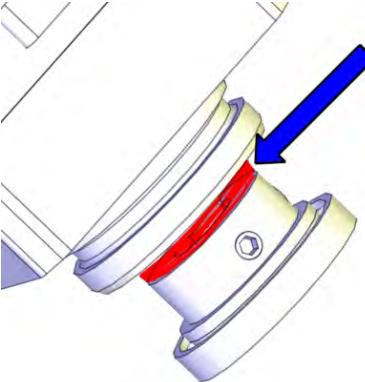
	Action	Note
5	Remove the fixture.	
6	Lubricate the wave generator with grease. Axis 1, axis 2, axis 7, axis 3.	Grease: 3HAC038379-001, 1.2 ml.  xx1500000557
	Axis 4, axis 5 and axis 6.	 xx1500001649

Continues on next page

4 Repair

4.4.5 Replacing the axis-4 motor

Continued

	Action	Note
7	<p>Fill the gap between the motor and the wave generator with grease.</p> <p>Axis 1, axis 2, axis 7, axis 3.</p>	<p>Grease: 3HAC038379-001.</p>  <p>xx1500000556</p>
	<p>Axis 4, axis 5 and axis 6.</p>	 <p>xx1500001650</p>

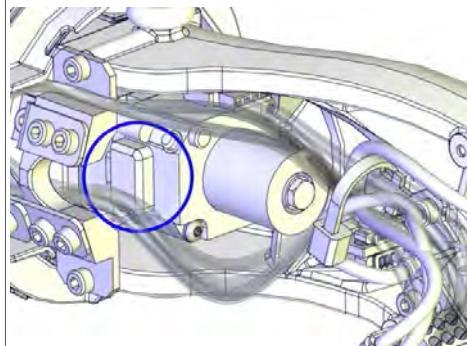
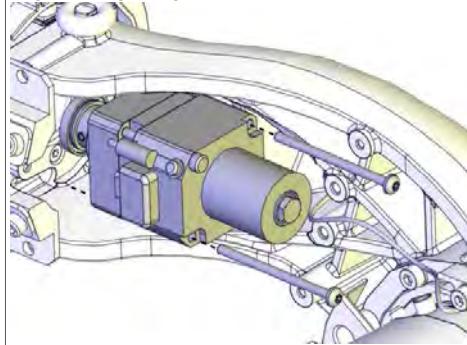
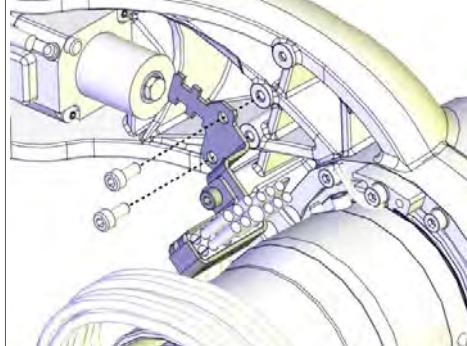
Refitting the axis-4 motor

	Action	Note
1	<p> CAUTION</p> <p>Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!</p>	

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4.4.5 Replacing the axis-4 motor

Continued

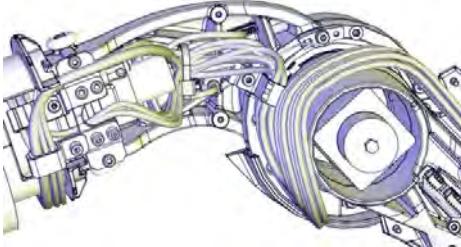
	Action	Note
2	<p>Orient the motor correctly and fit it into the arm. Secure with the screws.</p> <p>CAUTION</p> <p>The motor must be inserted gently. If the gears do not mate, rotate the axis carefully back and forth until the gears are mated.</p>	<p>Motor orientation: orient the motor according to the figure below, in regard to the encircled motor connector.</p>  <p>xx1500000568</p> <p>Tightening torque: 0.2 Nm.</p>  <p>xx1400002758</p>
3	<p>Reconnect the motor connectors.</p> <ul style="list-style-type: none"> • R1.MP4R / R1.MP4L • R1.FB4R / R1.FB4L 	
4	Refit the upper axis-3 cable bracket.	 <p>xx1400002757</p>

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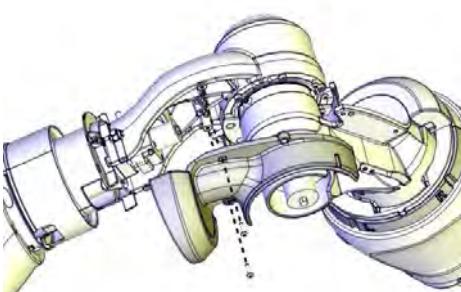
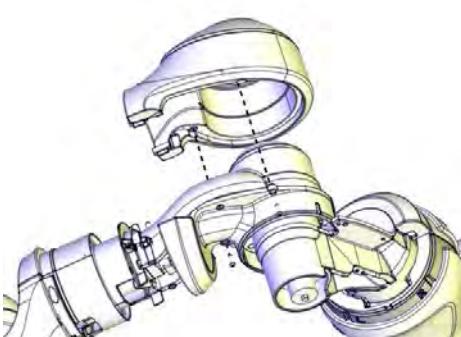
4 Repair

4.4.5 Replacing the axis-4 motor

Continued

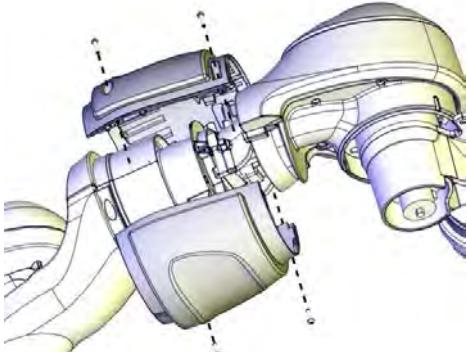
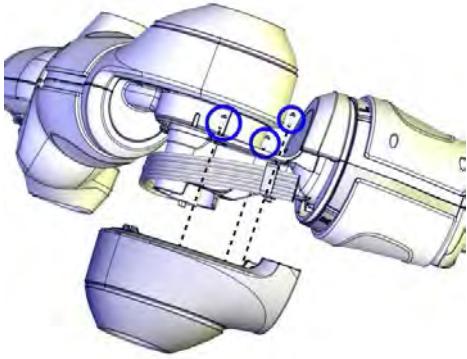
Action	Note
5 Route and secure the cabling according to the figure.  CAUTION Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.	 xx1500000583

Refitting the covers

Action	Note
1 Refit the upper axis-3 cover.	Screws: 2 pcs. Tightening torque: 0.14 Nm.  xx1400002755
2 Refit the axis-3 body cover.	Screws: 2 pcs. Tightening torque: 0.14 Nm.  xx1400002754

Continues on next page

4.4.5 Replacing the axis-4 motor Continued

	Action	Note
3	Refit the lower axis-4 cover.	<p>Screws: 4 pcs. Tightening torque: 0.14 Nm.</p> 
4	Refit the lower axis-3 cover.  CAUTION Be careful not to squeeze any cabling during the refitting procedure.	<p>Screws: 3 pcs. Tightening torque: 0.14 Nm.</p> 

Concluding procedure

	Action	Note
1	Recalibrate the robot.	See Calibration on page 431 .
2	 CAUTION 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 45 .	

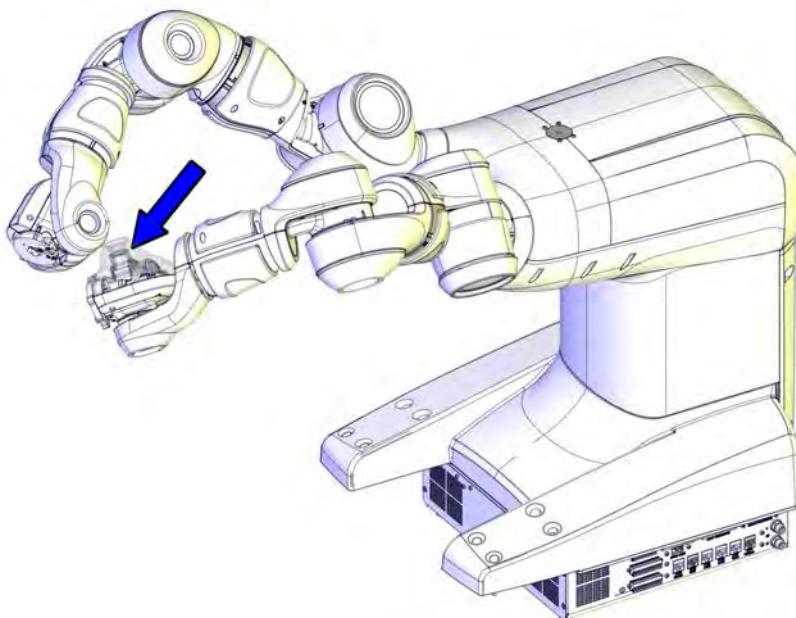
4 Repair

4.4.6 Replacing the axis-5 motor

4.4.6 Replacing the axis-5 motor

Location of the axis-5 motor

The axis-5 motor is located as shown in the figure.



xx1400002796

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 14000* on ABB Library.

Spare part	Article number	Note
Motor M91	3HAC036950-001	Includes o-ring 3HAB3772-138.
O-ring	3HAB3772-138	Required to be replaced when removing and refitting the motor.

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Fixture tool for wave generat- or M91	3HAC054904-001	

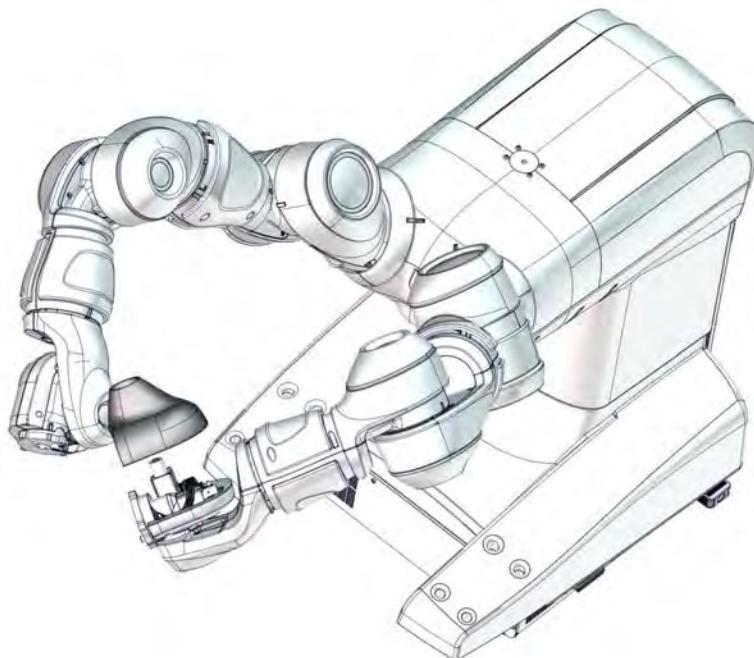
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Consumables

Consumable	Article number	Note
Grease	-	Mobil FM222 Used to lubricate o-rings.
Grease	3HAC038379-001	Used to lubricate the wave generator.
Cleaning agent	-	Isopropanol

Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



xx1400002864

Removing the motor

Use these procedures to remove the axis-5 motor.

Preparations before removing the motor

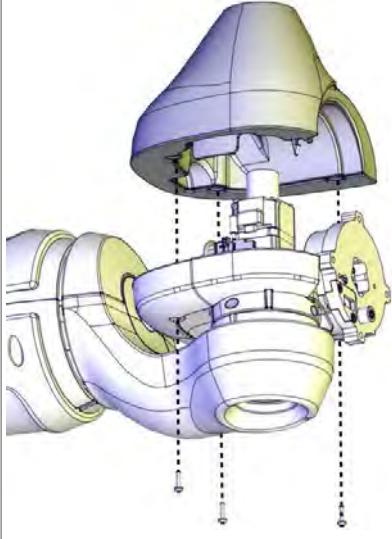
	Action	Note
1	Jog the robot so that the wrist cover points upward.	
2	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • air pressure supply <p>to the robot, before starting the repair work on the robot.</p>	

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4 Repair

4.4.6 Replacing the axis-5 motor

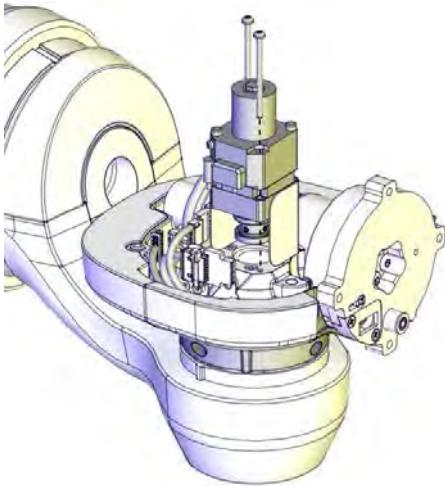
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Action	Note
3 Remove the axis-6 cover. Rotate axis 5 manually so that all screws can be accessed.	 xx1400002760

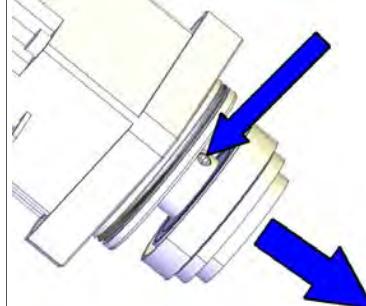
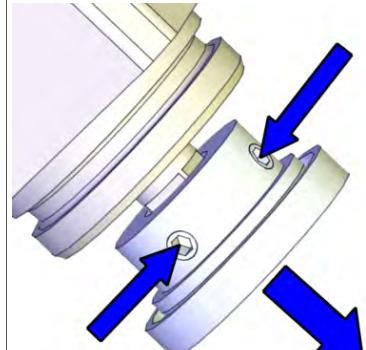
Removing the axis-5 motor

Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2 Disconnect the motor connectors. Cut some cable ties, if needed. <ul style="list-style-type: none">• R1.MP5R / R1.MP5L• R1.FB5R / R1.FB5L	
3  CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	

Continues on next page

	Action	Note
4	Remove the screws and lift the motor out carefully.	 xx1400002790

Removing the wave generator from the motor

	Action	Note
1	Remove the wave generator from the motor shaft by removing the set screw(s) and then pulling it off the shaft. Axis 1, axis 2, axis 7, axis 3.	 xx1500000515
	Axis 4, axis 5 and axis 6.	 xx1500001651

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4 Repair

4.4.6 Replacing the axis-5 motor

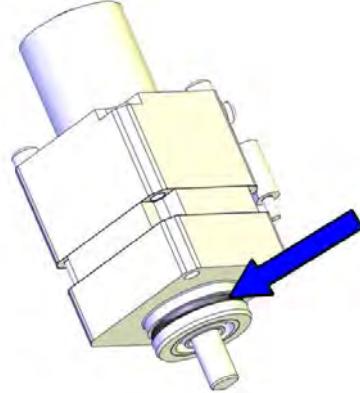
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	Action	Note
2	<p>Place the wave generator on a clean workbench, if not instantly fitting it to a new motor.</p> <p>! CAUTION</p> <p>Keep the wave generator clean.</p>	

Refitting the motor

Use these procedures to refit the axis-5 motor.

Checking the o-ring on the motor

	Action	Note
1	<p>Check that the o-ring is properly seated in its groove and that it is not damaged. Replace if damaged.</p> <p>! Tip</p> <p>If needed, lubricate the o-ring with some grease for a better fitting in the groove.</p>	<p>Motor M91: 3HAC036950-001. O-ring: 3HAB3772-138 Grease: Mobil FM222.</p>  <p>xx1400002759</p>

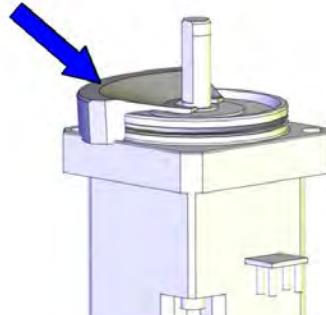
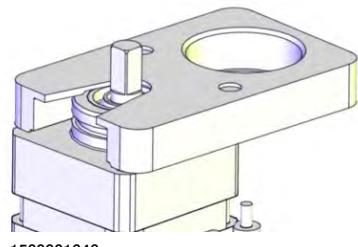
Fitting the wave generator to the motor

	Action	Note
1	Wipe the contact surfaces of the motor and wave generator clean from any contamination with cleaning agent applied on a cloth or paper.	

Continues on next page

4.4.6 Replacing the axis-5 motor

Continued

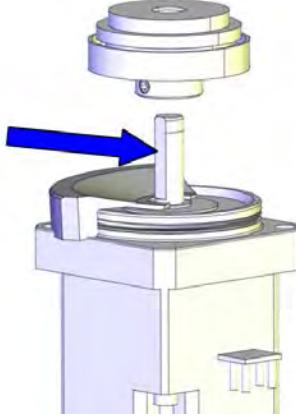
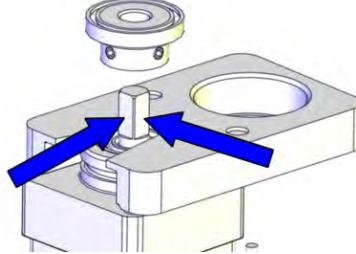
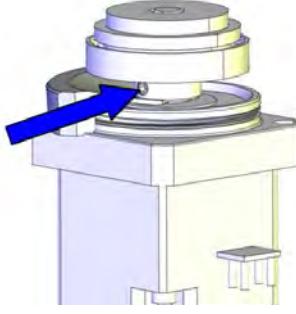
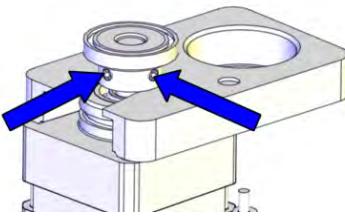
Action	Note
2 Place the fixture tool on the new motor. Axis 1 and axis 2: Fixture tool for wave generator M93, 3HAC054870-001. Axis 7 and axis 3: Fixture tool for wave generator M92, 3HAC054871-001.	 xx1500000527
	 xx1500001646
Axis 4, axis 5 and axis 6: Fixture tool for wave generator M91, 3HAC054904-001.	

Continues on next page

4 Repair

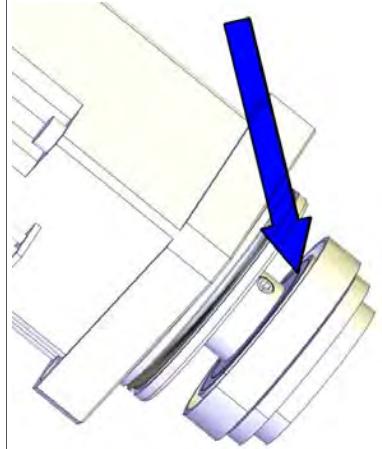
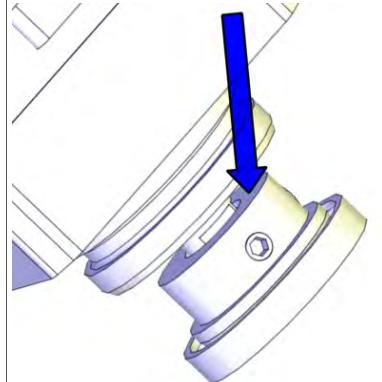
4.4.6 Replacing the axis-5 motor

Continued

	Action	Note
3	<p>Fit the wave generator to the motor shaft, place it against the distance fixture and secure lightly with the set screw(s).</p> <p>Orient the wave generator so that the set screw will be positioned towards the flat surface on the output axis of the motor. The flat surface is pointed out in the figure.</p>	
	<p>Axis 1, axis 2, axis 7, axis 3.</p>	 xx1500000528
	<p>Axis 4, axis 5 and axis 6.</p>	 xx1500001647
4	<p>Tighten the set screw.</p>	
	<p>Axis 1 and axis 2. Screw, 1 pc. Tightening torque: 0.6 Nm.</p>	 xx1500000518
	<p>Axis 7 and axis 3. Screw, 1 pc. Tightening torque: 0.6 Nm.</p>	
	<p>Axis 4, axis 5 and axis 6. Screws, 2 pcs. Tightening torque: 0.2 Nm.</p>	 xx1500001648

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4.4.6 Replacing the axis-5 motor
Continued

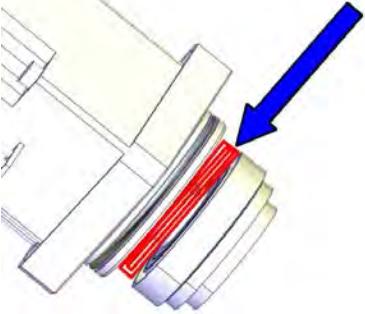
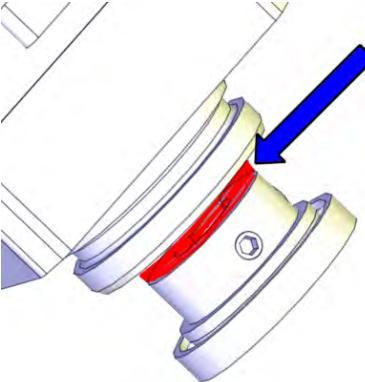
	Action	Note
5	Remove the fixture.	
6	Lubricate the wave generator with grease. Axis 1, axis 2, axis 7, axis 3.	Grease: 3HAC038379-001, 1.2 ml.  xx1500000557
	Axis 4, axis 5 and axis 6.	 xx1500001649

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4 Repair

4.4.6 Replacing the axis-5 motor

Continued

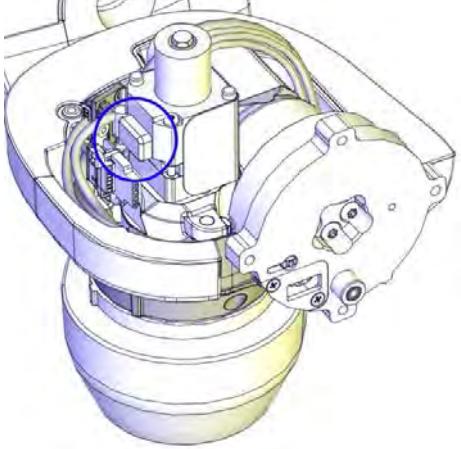
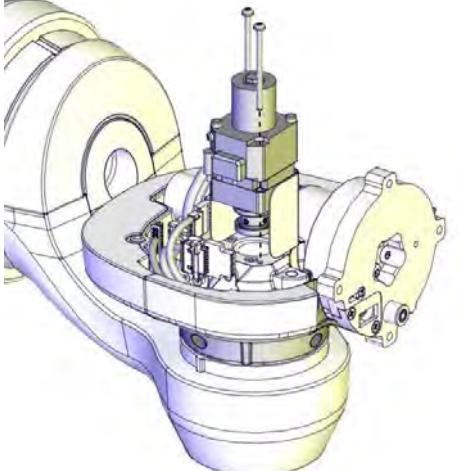
	Action	Note
7	<p>Fill the gap between the motor and the wave generator with grease.</p> <p>Axis 1, axis 2, axis 7, axis 3.</p>	<p>Grease: 3HAC038379-001.</p>  <p>xx1500000556</p>
	<p>Axis 4, axis 5 and axis 6.</p>	 <p>xx1500001650</p>

Refitting the axis-5 motor

	Action	Note
1	<p> CAUTION</p> <p>Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!</p>	

Continues on next page

4.4.6 Replacing the axis-5 motor Continued

Action	Note
<p>2 Orient the motor correctly and fit it into the arm. Secure with the screws.</p> <p>CAUTION</p> <p>The motor must be inserted gently. If the gears do not mate, rotate the axis carefully back and forth until the gears are mated.</p>	<p>Motor orientation: orient the motor according to the figure below, in regard to the encircled motor connector.</p>  <p>xx1500000569</p> <p>Tightening torque: 0.2 Nm.</p>  <p>xx1400002790</p>
<p>3 Reconnect the motor connectors.</p> <ul style="list-style-type: none"> • R1.MP5R / R1.MP5L • R1.FB5R / R1.FB5L 	

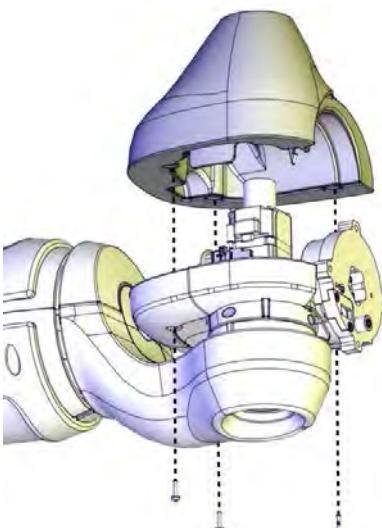
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4 Repair

4.4.6 Replacing the axis-5 motor

Continued

Refitting the covers

	Action	Note
1	Refit the axis-6 cover.	Screws: 3 pcs. Tightening torque: 0.2 Nm.  xx1400002760

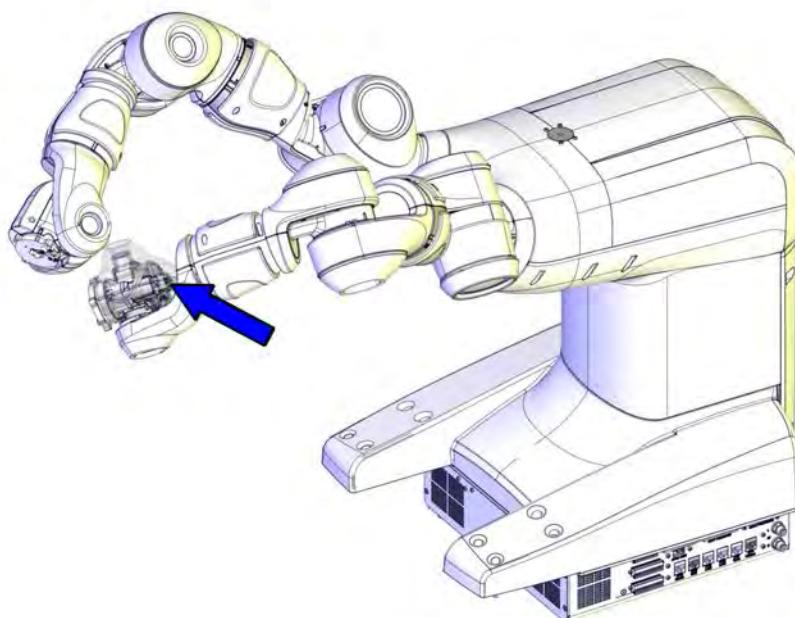
Concluding procedure

	Action	Note
1	Recalibrate the robot.	See Calibration on page 431 .
2	 CAUTION 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 45 .	

4.4.7 Replacing the axis-6 motor

Location of the axis-6 motor

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



xx1400002797

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 14000* on ABB Library.

Spare part	Article number	Note
Motor M91	3HAC036950-001	Includes o-ring 3HAB3772-138.
O-ring	3HAB3772-138	Required to be replaced when removing and refitting the motor.

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Fixture tool for wave generator M91	3HAC054904-001	

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4 Repair

4.4.7 Replacing the axis-6 motor

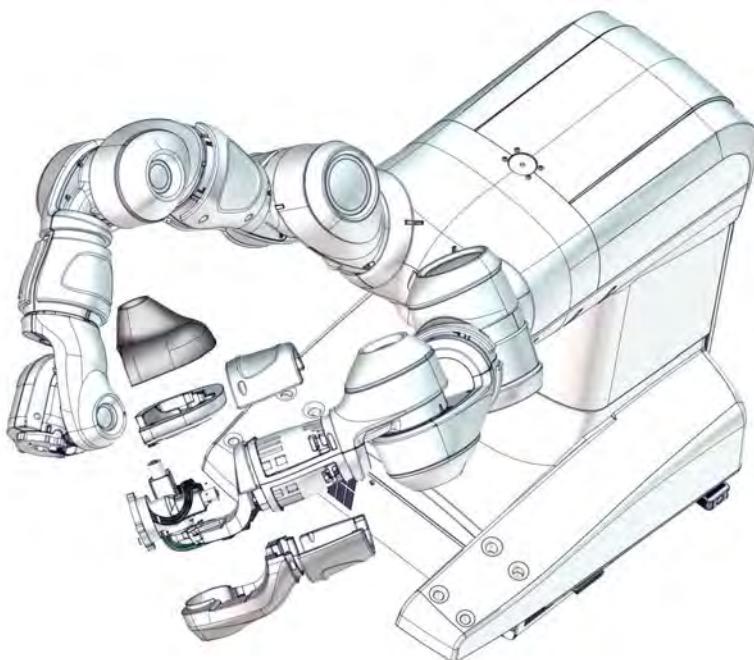
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Consumables

Consumable	Article number	Note
Grease	-	Mobil FM222 Used to lubricate o-rings.
Grease	3HAC038379-001	Used to lubricate the wave generator.
Cleaning agent	-	Isopropanol

Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



xx1400002865

Removing the motor

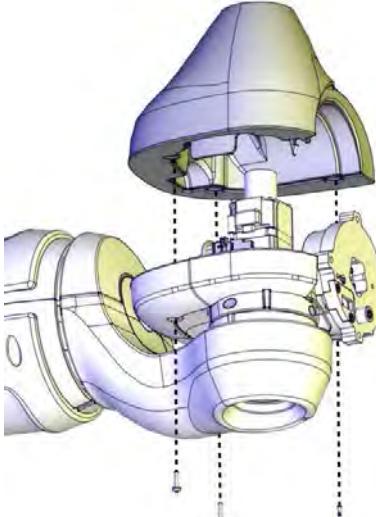
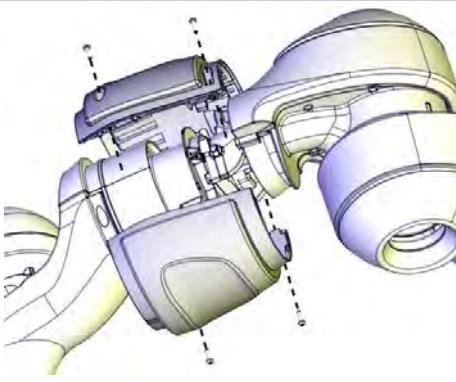
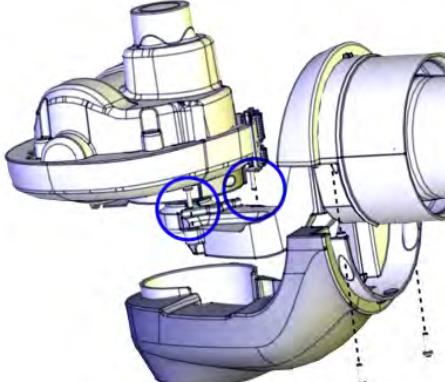
Use these procedures to remove the the axis-6 motor.

Preparations before removing the motor

	Action	Note
1	Jog the robot so that the wrist is easily accessed.	
2	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• air pressure supply to the robot, before starting the repair work on the robot.	

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4.4.7 Replacing the axis-6 motor
Continued

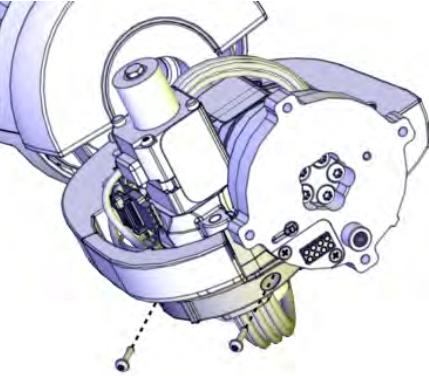
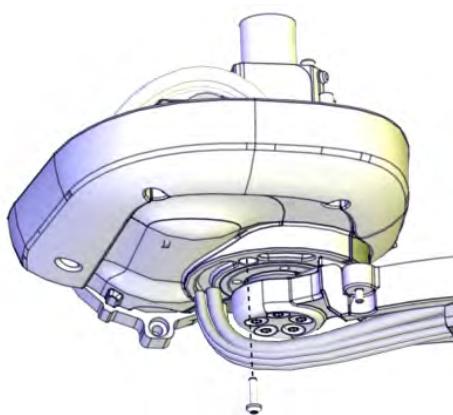
Action	Note
3 Remove the wrist cover. Rotate axis 5 manually so that all screws can be accessed.	 xx1400002760
4 Remove the lower axis-4 cover.	 xx1500000360
5 Remove the upper axis-4 cover.	 xx1500001735

Continues on next page

4 Repair

4.4.7 Replacing the axis-6 motor

Continued

Action	Note
6 Remove the screws for the inner part of the cooling flange.	 xx1400002867
7 Remove the inner part of the cooling flange.	 xx1500000602

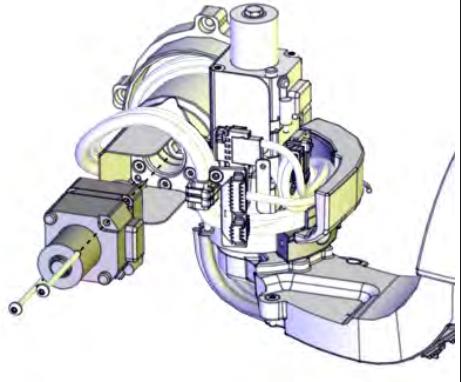
Removing the axis-6 motor

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

Continues on next page

4.4.7 Replacing the axis-6 motor

Continued

	Action	Note
2	Disconnect the motor connectors. Cut some cable ties, if needed. <ul style="list-style-type: none"> • R1.MP6R / R1.MP6L • R1.FB6R / R1.FB6L 	
3	 CAUTION <p>Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!</p>	
4	Remove the screws and lift the motor out carefully.	 xx1500000542

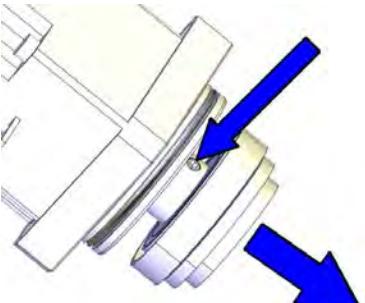
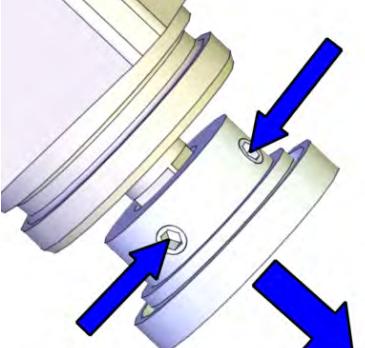
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4 Repair

4.4.7 Replacing the axis-6 motor

Continued

Removing the wave generator from the motor

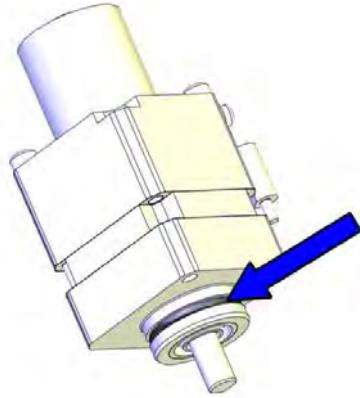
Action	Note
1 Remove the wave generator from the motor shaft by removing the set screw(s) and then pulling it off the shaft. Axis 1, axis 2, axis 7, axis 3.	 xx1500000515
Axis 4, axis 5 and axis 6.	 xx1500001651
2 Place the wave generator on a clean workbench, if not instantly fitting it to a new motor.  CAUTION Keep the wave generator clean.	

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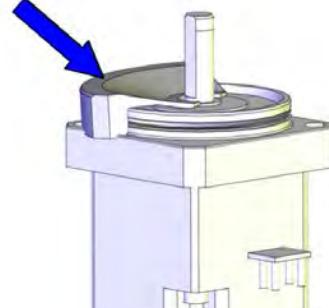
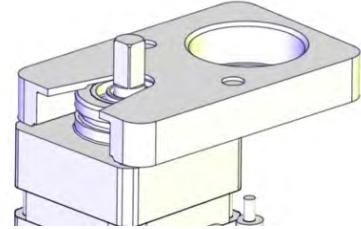
Refitting the motor

Use these procedures to refit the axis-6 motor.

Checking the o-ring on the motor

	Action	Note
1	<p>Check that the o-ring is properly seated in its groove and that it is not damaged. Replace if damaged.</p> <p> Tip</p> <p>If needed, lubricate the o-ring with some grease for a better fitting in the groove.</p>	<p>Motor M91: 3HAC036950-001. O-ring: 3HAB3772-138 Grease: Mobil FM222.</p>  <p>xx1400002759</p>

Fitting the wave generator to the motor

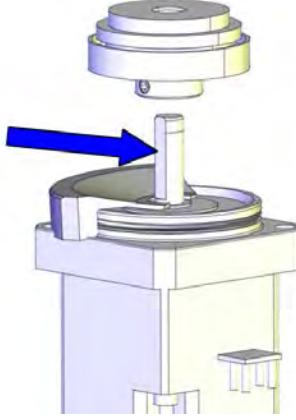
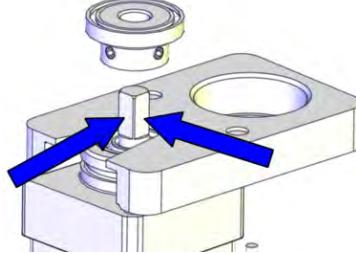
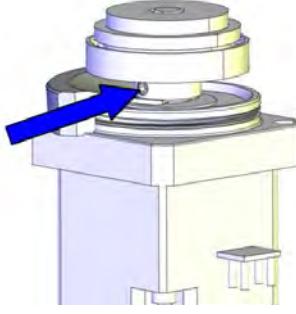
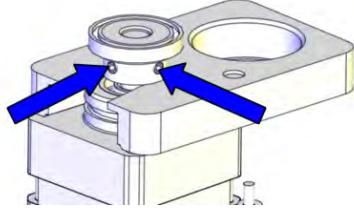
	Action	Note
1	Wipe the contact surfaces of the motor and wave generator clean from any contamination with cleaning agent applied on a cloth or paper.	
2	<p>Place the fixture tool on the new motor.</p> <p>Axis 1 and axis 2: Fixture tool for wave generator M93, 3HAC054870-001.</p> <p>Axis 7 and axis 3: Fixture tool for wave generator M92, 3HAC054871-001.</p>	 <p>xx1500000527</p>
	Axis 4, axis 5 and axis 6: Fixture tool for wave generator M91, 3HAC054904-001.	 <p>xx1500001646</p>

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4 Repair

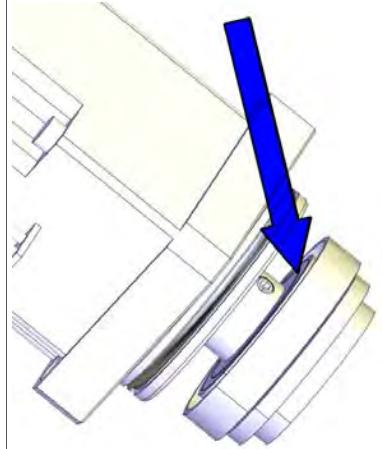
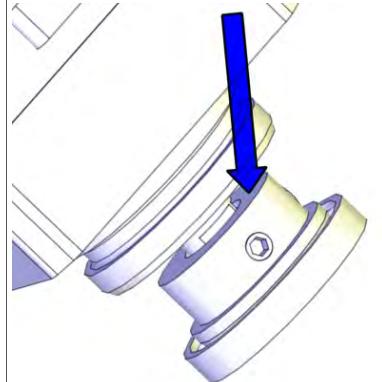
4.4.7 Replacing the axis-6 motor

Continued

	Action	Note
3	<p>Fit the wave generator to the motor shaft, place it against the distance fixture and secure lightly with the set screw(s). Orient the wave generator so that the set screw will be positioned towards the flat surface on the output axis of the motor. The flat surface is pointed out in the figure.</p>	 xx1500000528
	Axis 4, axis 5 and axis 6.	 xx1500001647
4	Tighten the set screw.	 xx1500000518
	Axis 4, axis 5 and axis 6. Screws, 2 pcs. Tightening torque: 0.2 Nm.	 xx1500001648

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4.4.7 Replacing the axis-6 motor
Continued

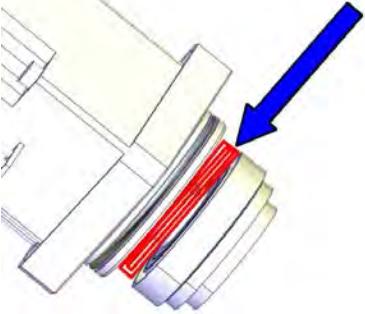
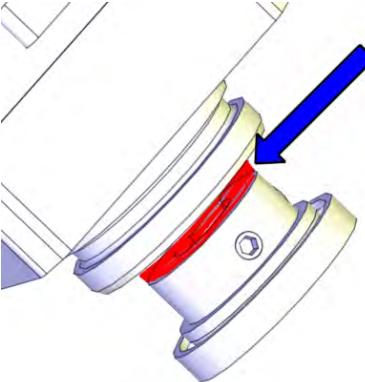
	Action	Note
5	Remove the fixture.	
6	Lubricate the wave generator with grease. Axis 1, axis 2, axis 7, axis 3.	Grease: 3HAC038379-001, 1.2 ml.  xx1500000557
	Axis 4, axis 5 and axis 6.	 xx1500001649

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4 Repair

4.4.7 Replacing the axis-6 motor

Continued

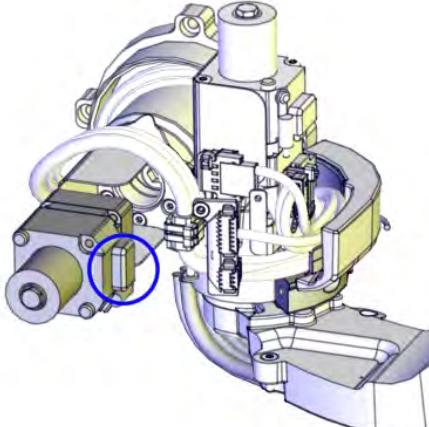
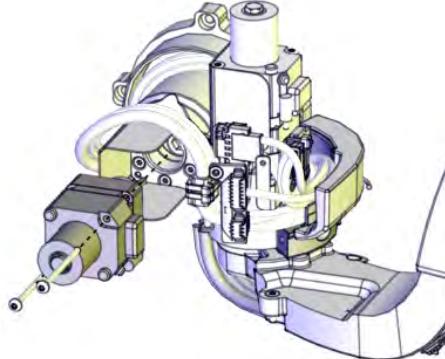
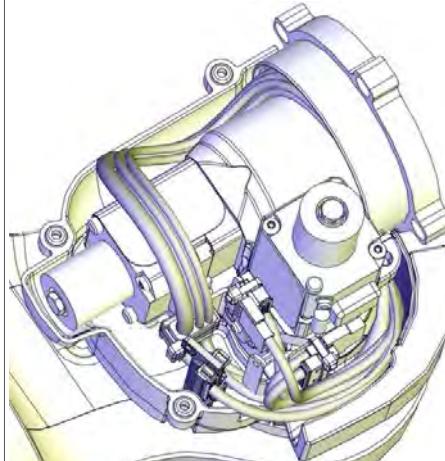
	Action	Note
7	<p>Fill the gap between the motor and the wave generator with grease.</p> <p>Axis 1, axis 2, axis 7, axis 3.</p>	<p>Grease: 3HAC038379-001.</p>  <p>xx1500000556</p>
	<p>Axis 4, axis 5 and axis 6.</p>	 <p>xx1500001650</p>

Refitting the axis-6 motor

	Action	Note
1	<p> CAUTION</p> <p>Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!</p>	

Continues on next page

4.4.7 Replacing the axis-6 motor Continued

	Action	Note
2	<p>Orient the motor correctly and fit it into the arm. Secure with the screws.</p> <p>CAUTION The motor must be inserted gently. If the gears do not mate, rotate the axis carefully back and forth until the gears are mated.</p>	<p>Motor orientation: orient the motor according to the figure below, in regard to the encircled motor connector.</p>  <p>xx1500000570</p> <p>Tightening torque: 0.2 Nm.</p>  <p>xx1500000542</p>
3	<p>Reconnect the motor connectors.</p> <ul style="list-style-type: none"> • R1.MP6R / R1.MP6L • R1.FB6R / R1.FB6L 	
4	<p>Route and secure the cabling according to the figure.</p> <p>CAUTION Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	 <p>xx1500000584</p>

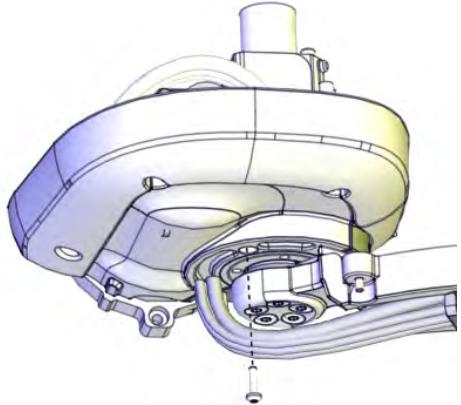
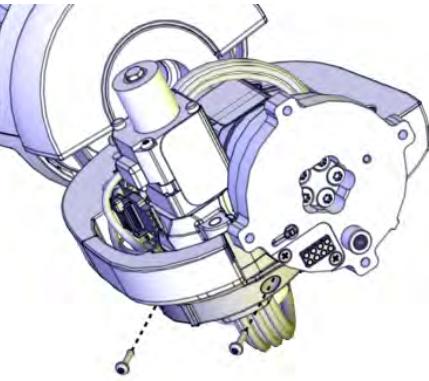
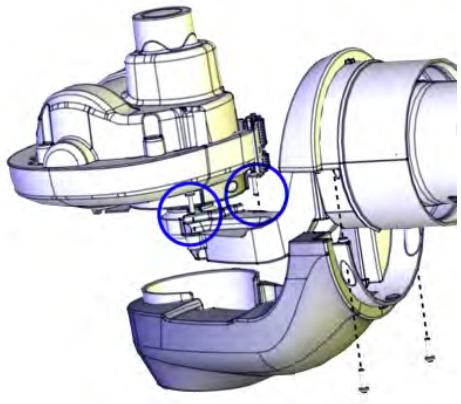
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4 Repair

4.4.7 Replacing the axis-6 motor

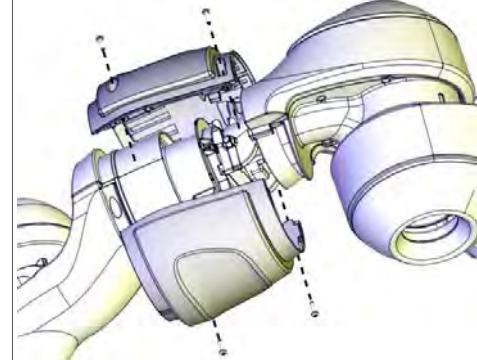
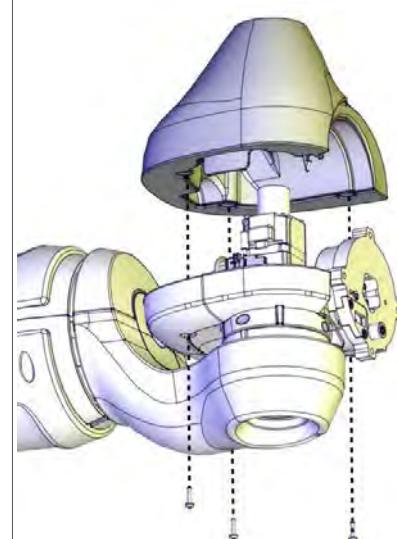
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Refitting the covers

	Action	Note
1	Refit the cooling flange.	<p>Screws: 3 pcs. Tightening torque: 0.2 Nm.</p>  
2	Refit the upper axis-4 cover.	<p>Screws: 4 pcs. Tightening torque: 0.14 Nm.</p> 

Continues on next page

4.4.7 Replacing the axis-6 motor Continued

	Action	Note
3	Refit the lower axis-4 cover.	<p>Screws: 4 pcs. Tightening torque: 0.14 Nm.</p>  <p>xx1500000360</p>
4	Refit the axis-6 cover.	<p>Screws: 3 pcs. Tightening torque: 0.2 Nm.</p>  <p>xx1400002760</p>

Concluding procedure

	Action	Note
1	Recalibrate the robot.	See Calibration on page 431 .
2	<p> CAUTION</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 45.</p>	

4 Repair

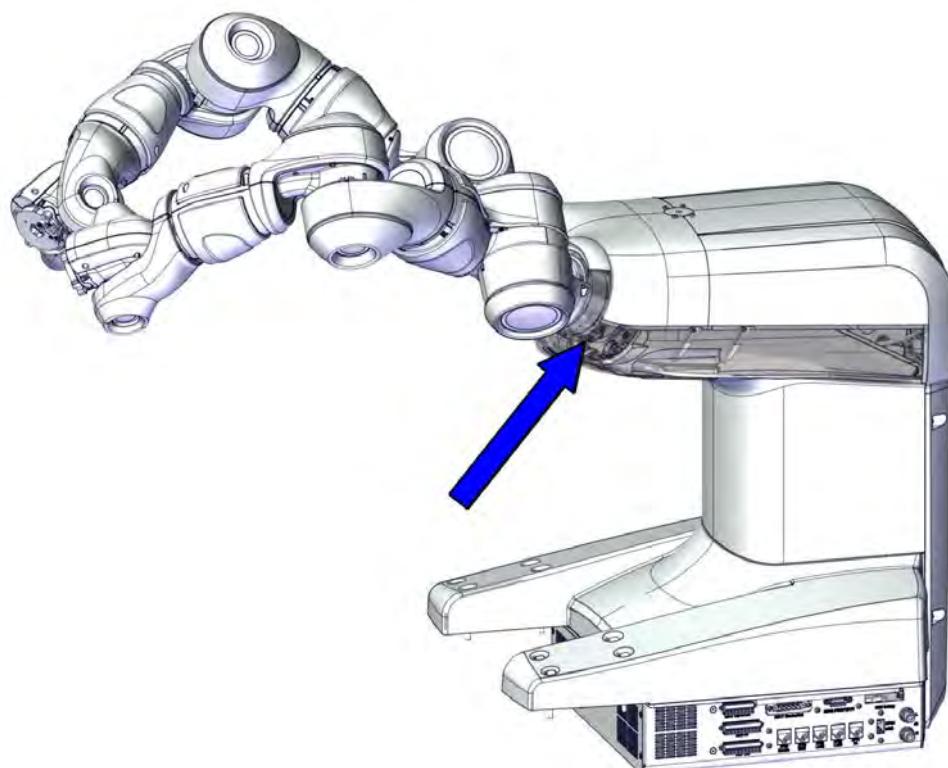
4.5.1 Replacing the axis-1 hall sensor

4.5 Hall sensors

4.5.1 Replacing the axis-1 hall sensor

Location of the hall sensor

The hall sensor is located as shown in the figure.



xx1500000261

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 14000* on ABB Library.

Spare part	Article number	Note
Hall sensor with attachment for axis 1	3HAC052445-001	

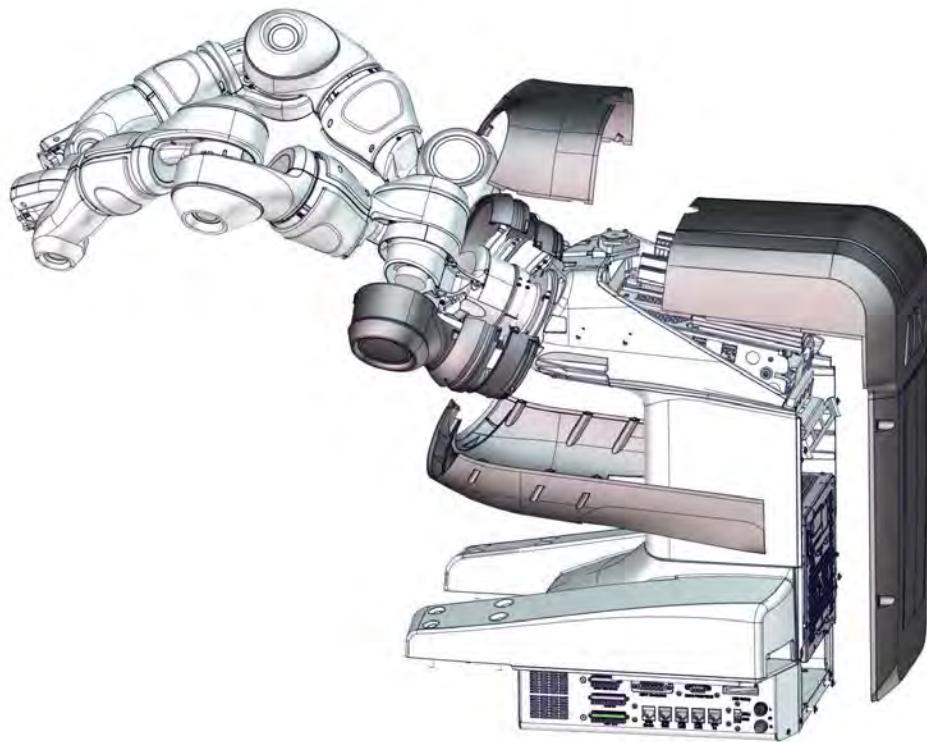
Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

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Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



xx1500000425

Removing the hall sensor

Use these procedures to remove the hall sensor.

Preparations before removing the hall sensor

	Action	Note
1	Jog the robot so that the covers can be easily accessed and removed.	
2	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • air pressure supply <p>to the robot, before starting the repair work on the robot.</p>	

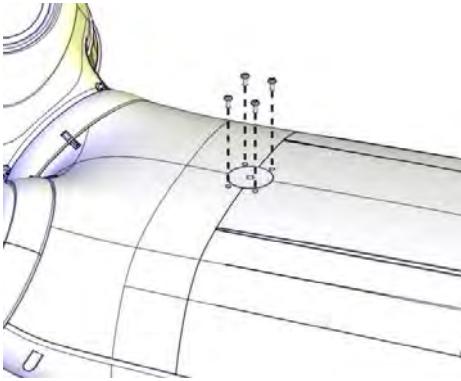
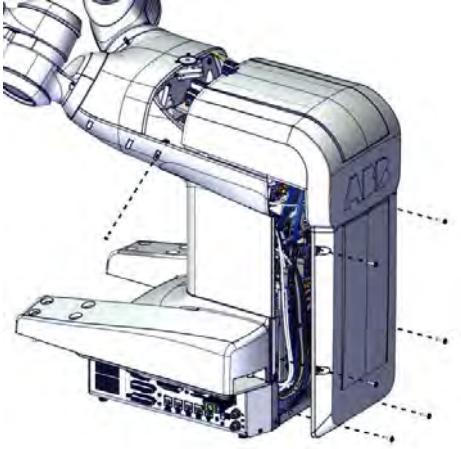
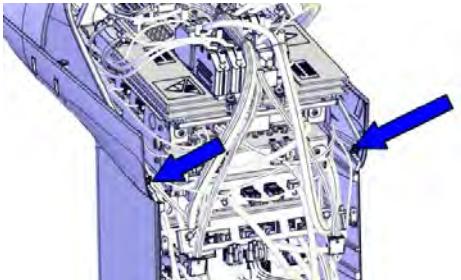
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4 Repair

4.5.1 Replacing the axis-1 hall sensor

Continued

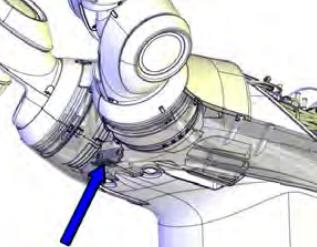
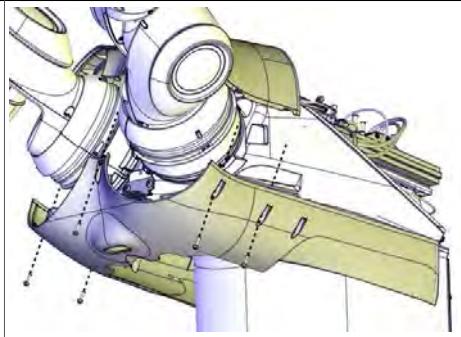
Removing the body covers

Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2 Remove the body cover top screws.	 xx1400002904
3 Remove the body cover.	 xx1500000303
4 Remove the back screws of the lower body cover.	 xx1500000540

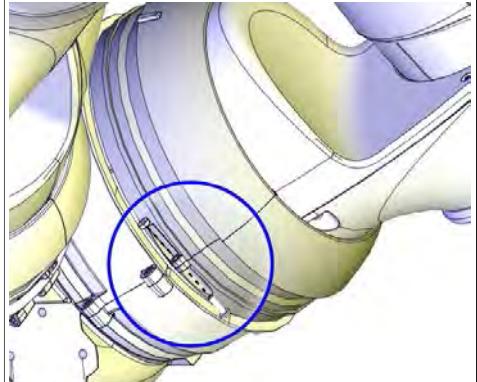
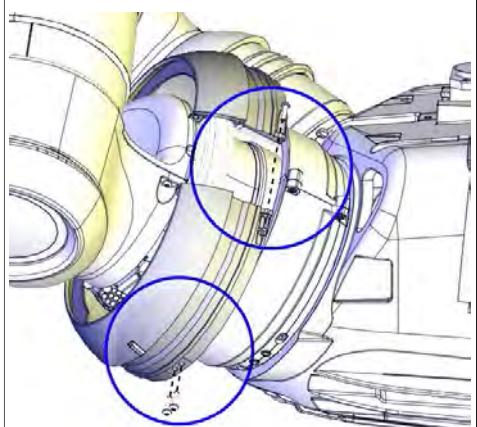
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4.5.1 Replacing the axis-1 hall sensor

Continued

Action	Note
<p>5 Remove the front and lower body cover.</p> <p>Note</p> <p>Be aware of the tab underneath the cover so it does not get damaged.</p>  <p>xx1500000564</p>	 <p>xx1400002603</p>

Removing the axis-1 covers

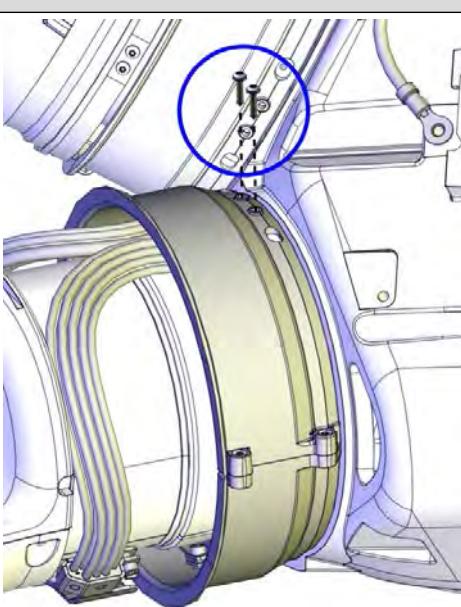
Action	Note
<p>1</p> <p>DANGER</p> <p>Make sure that all supplies for electrical power and air pressure are turned off.</p>	
<p>2 Remove the upper axis-1 cover.</p>	 <p>xx1400002601</p>  <p>xx1400002605</p>

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4 Repair

4.5.1 Replacing the axis-1 hall sensor

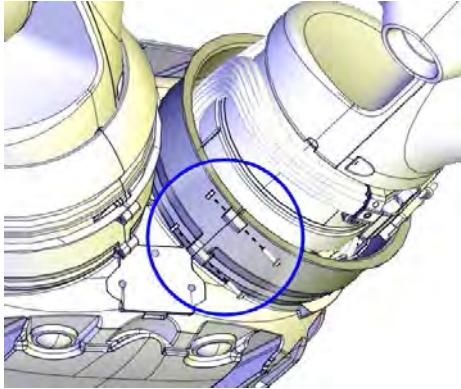
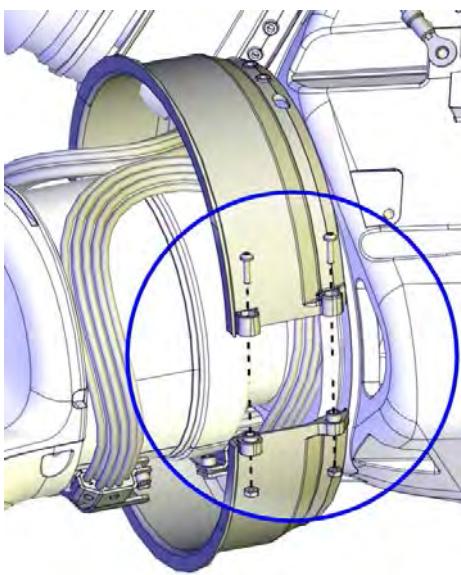
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Action	Note
3 Remove the upper screws of the lower axis-1 cover.	 xx1500000565

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4.5.1 Replacing the axis-1 hall sensor

Continued

Action	Note
4 Turn the lower axis-1 cover in order to access all screws properly and remove the lower axis-1 cover.	 xx1400002604  xx1400002606

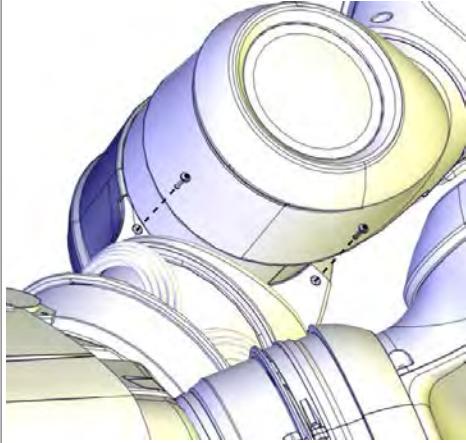
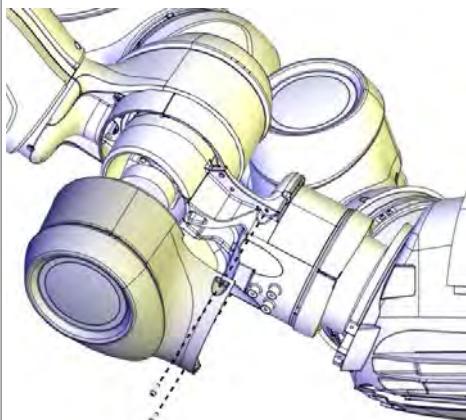
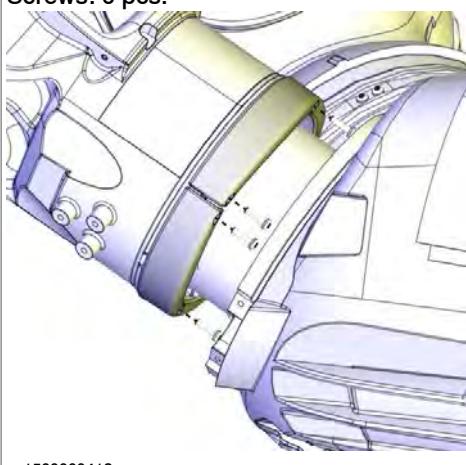
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4 Repair

4.5.1 Replacing the axis-1 hall sensor

Continued

Removing the remaining covers

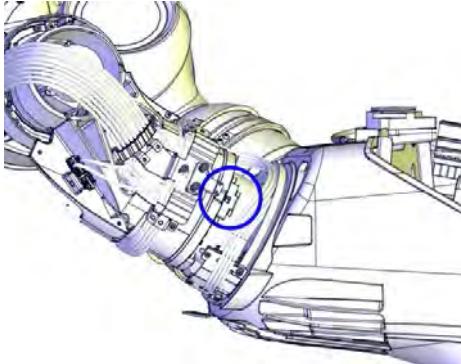
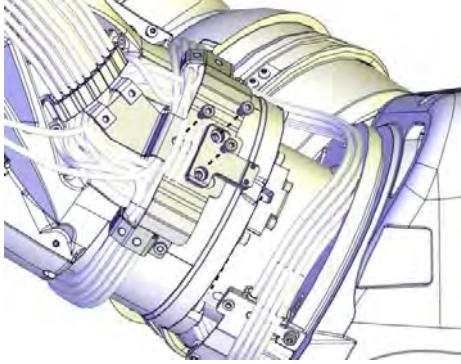
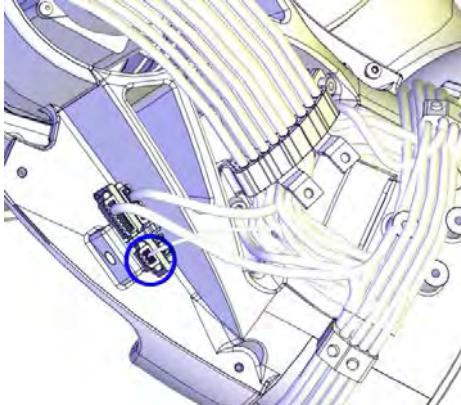
	Action	Note
1	Remove the lower axis-2 cover.	 xx1400002612  xx1500000087
2	Remove the axis-1 cable protection.  Tip In order to access the screws it is helpful to release the brakes and manually move the robot arm. Temporarily turn on the power to the robot and release the brakes.	Screws: 6 pcs.  xx1500000412

Removing the axis-1 hall sensor

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

Continues on next page

4.5.1 Replacing the axis-1 hall sensor
Continued

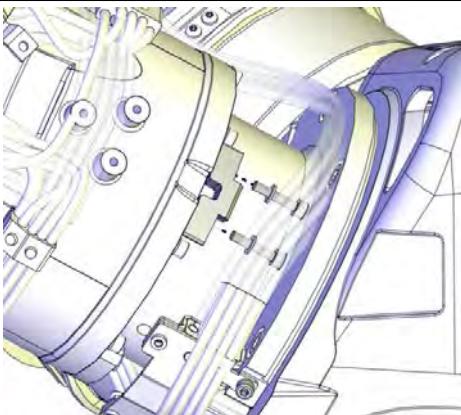
Action	Note
2 Release the brakes and rotate axis 1 in order to access the hall sensor.	 xx150000558
3  DANGER Turn off the electric power supply again.	
4 Remove the cable bracket.	 xx150000510
5 Disconnect the hall sensor connector P3.	 xx150000418

Continues on next page

4 Repair

4.5.1 Replacing the axis-1 hall sensor

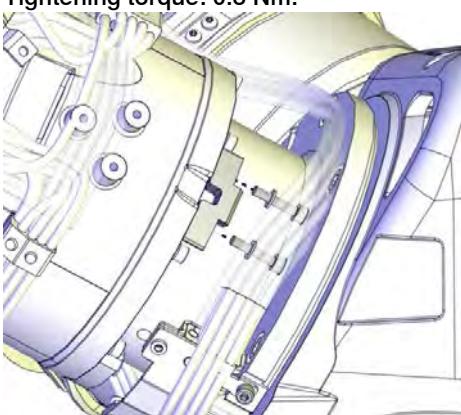
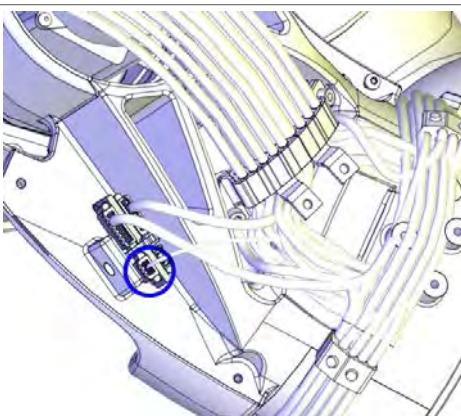
Continued

Action	Note
6 Move the cabling to access the hall sensor attachment screws. Remove the hall sensor by removing the two screws and washers.	 xx1500000419

Refitting the hall sensor

Use these procedures to refit the hall sensor.

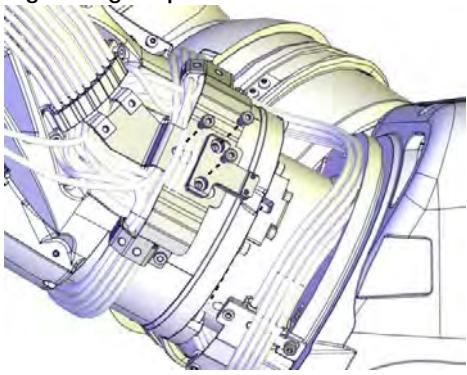
Refitting the axis-1 hall sensor

Action	Note
1 Refit the hall sensor with the screws and washers.	Hall sensor with attachment for axis 1: 3HAC052445-001. Tightening torque: 0.8 Nm.  xx1500000419
2 Connect the hall sensor connector P3.	 xx1500000418

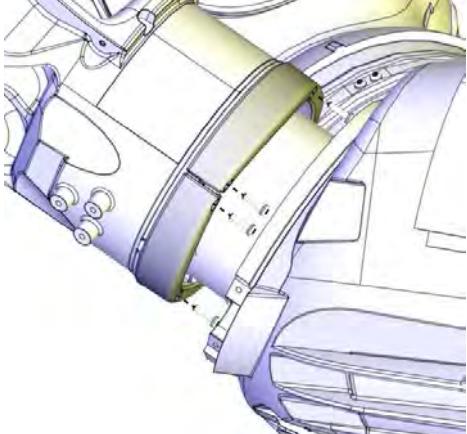
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4.5.1 Replacing the axis-1 hall sensor

Continued

Action	Note
<p>3 Refit the cable bracket with the screws. Tighten all three screws. Then re-tighten the top screw and after that, re-tighten the two other screws. Finally re-tighten all the three screws once more.</p> <p>Note</p> <p>Make sure to orient the bracket correctly and to position it parallel.</p>	<p>Tightening torque: 0.8 Nm.</p>  <p>xx1500000510</p>

Refitting the covers

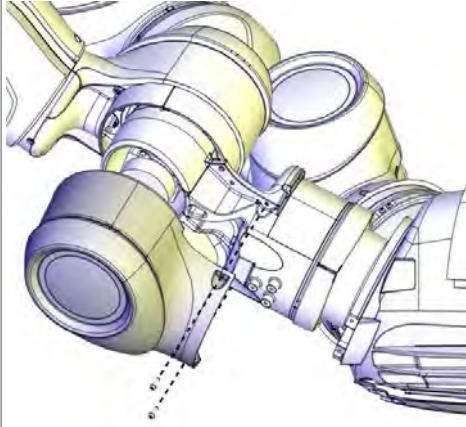
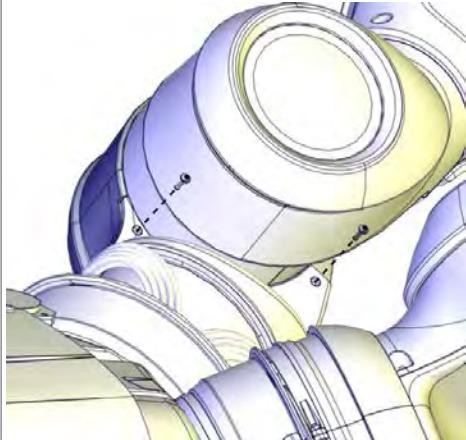
Action	Note
<p>1 Refit the axis-1 cable protection.</p> <p>Tip</p> <p>In order to access the screws it is helpful to release the brakes and manually move the robot arm. Temporarily turn on the power to the robot and release the brakes.</p>	<p>Screws: 6 pcs. Tightening torque: 0.14 Nm.</p>  <p>xx1500000412</p>

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4 Repair

4.5.1 Replacing the axis-1 hall sensor

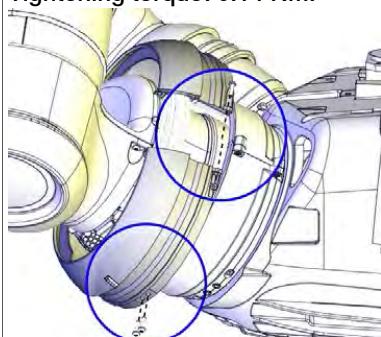
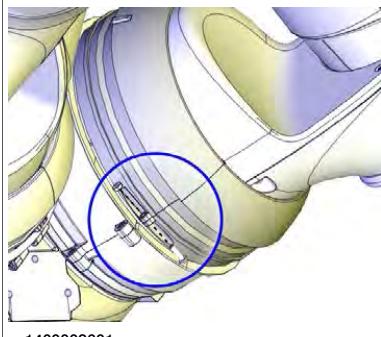
Continued

Action	Note
2 Refit the lower axis-2 cover.	Screws: 4 pcs. Tightening torque: 0.14 Nm.  xx1500000087  xx1400002612

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4.5.1 Replacing the axis-1 hall sensor
Continued

Refitting the axis-1 covers

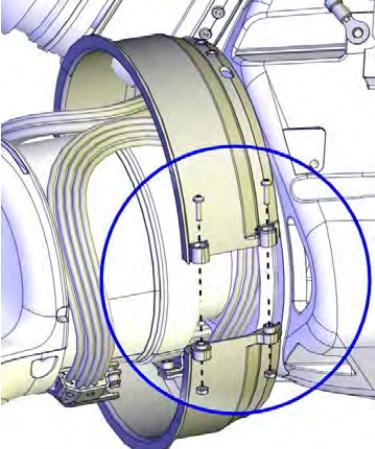
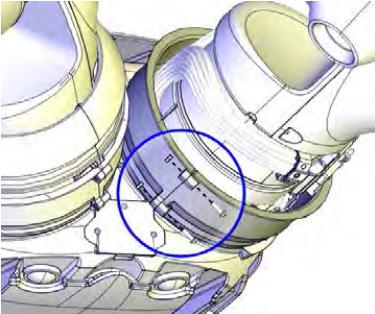
	Action	Note
1	Refit the upper axis-1 cover.	Screws: 3HAC050368-005. (4 pcs) Nuts: M2 DIN934 8 ELZN. (2 pcs) Tightening torque: 0.14 Nm.  xx1400002605  xx1400002601

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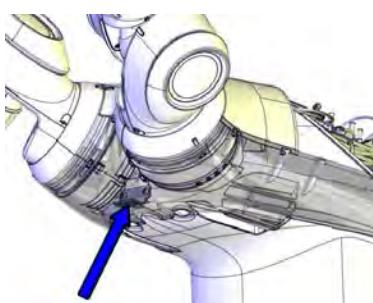
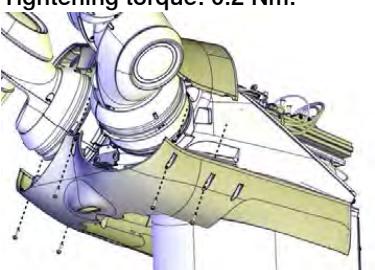
4 Repair

4.5.1 Replacing the axis-1 hall sensor

Continued

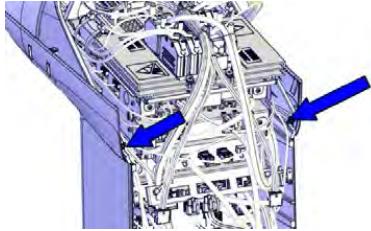
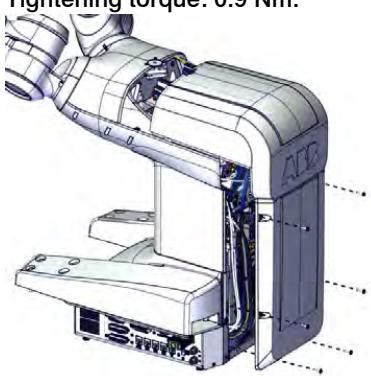
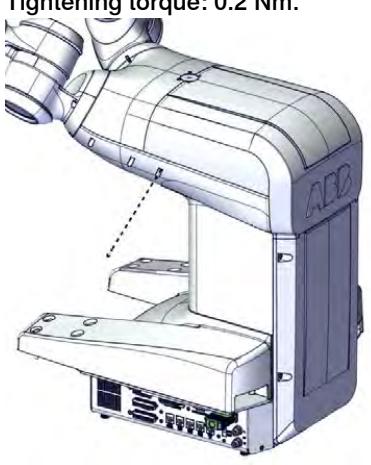
Action	Note
2 Refit the lower axis-1 cover.	<p>Screws: 3HAC050368-005. (4 pcs) Nuts: M2 DIN934 8 ELZN. (4 pcs) Tightening torque: 0.14 Nm.</p>  <p>xx1400002606</p>  <p>xx1400002604</p>

Refitting the body covers

Action	Note
1 Refit the front and lower body cover. i Note Be aware of the tab underneath the cover so it does not get damaged.  <p>xx1500000564</p>	<p>Screws: 3HAC050367-005. (5 pcs) Tightening torque: 0.2 Nm.</p>  <p>xx1400002603</p>

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4.5.1 Replacing the axis-1 hall sensor
Continued

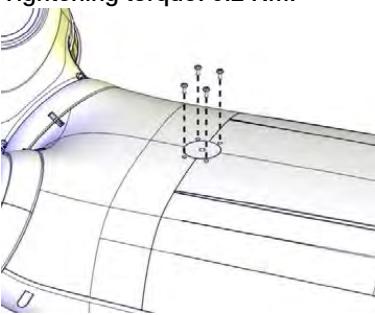
	Action	Note
2	Refit the back screws of the lower body cover.	<p>Screws: 2 pcs. Tightening torque: 0.2 Nm.</p>  <p>xx1500000540</p>
3	Refit the body cover.	<p>Screws: 6 pcs. Tightening torque: 0.9 Nm.</p>  <p>xx1500000697</p>
4	Refit the two remaining screws of the body cover.	<p>Screws: 2 pcs. Tightening torque: 0.2 Nm.</p>  <p>xx1500000696</p>

Continues on next page

4 Repair

4.5.1 Replacing the axis-1 hall sensor

Continued

	Action	Note
5	Refit the body cover top screws.	Screws: 4 pcs. Tightening torque: 0.2 Nm.  xx1400002904

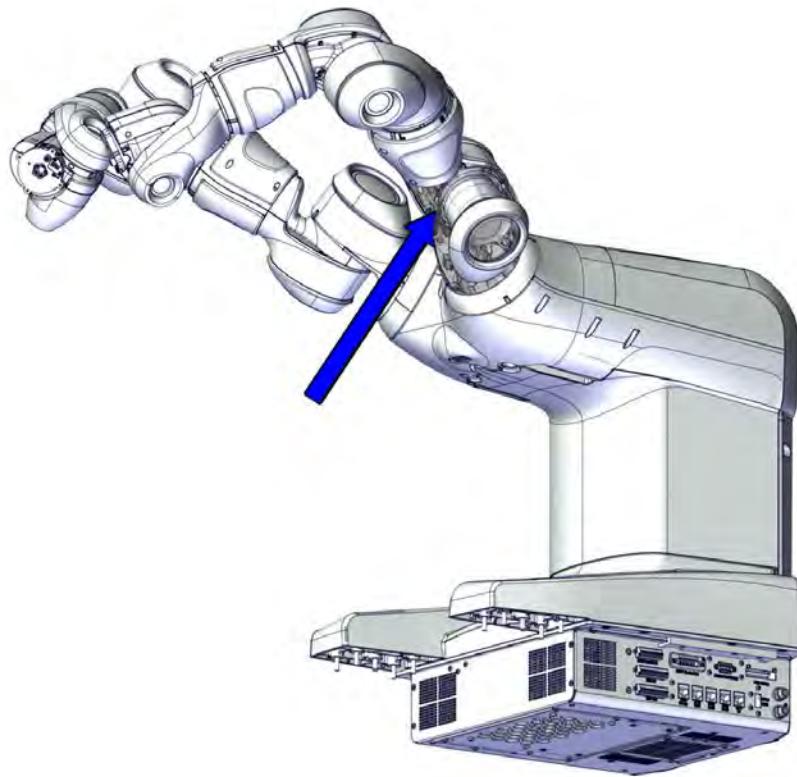
Concluding procedure

	Action	Note
1	Recalibrate the robot. If option Absolute Accuracy is valid for the robot, redo absolute accuracy calibration.	See Calibration on page 431 .
2	 CAUTION 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 45 .	

4.5.2 Replacing the axis-2 hall sensor

Location of the hall sensor

The hall sensor is located as shown in the figure.



xx1500000258

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 14000* on ABB Library.

Spare part	Article number	Note
Hall sensor with attachment for axis 2	3HAC052446-001	

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

Continues on next page

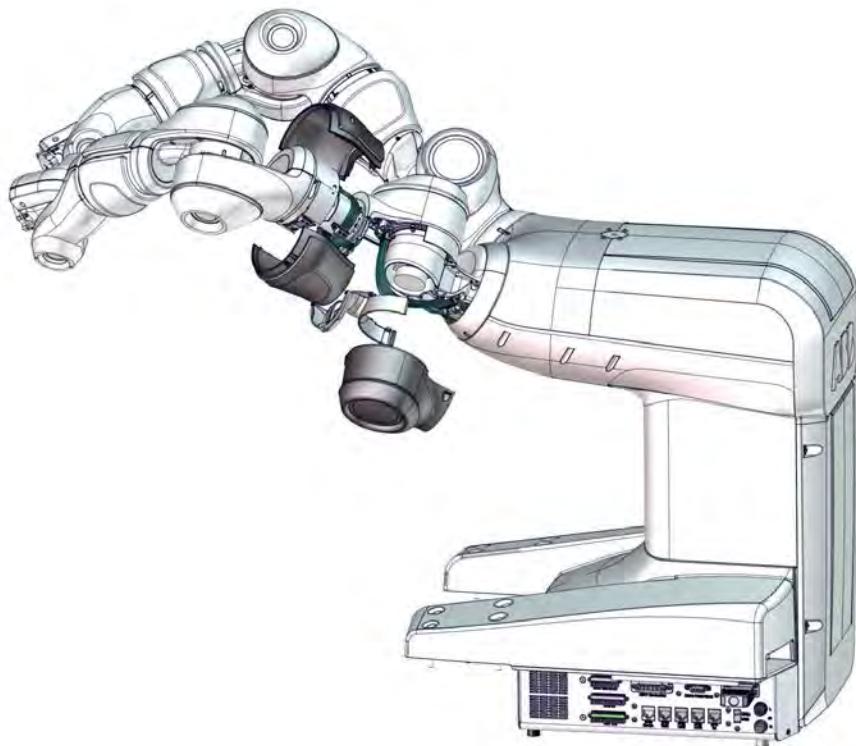
4 Repair

4.5.2 Replacing the axis-2 hall sensor

Continued

Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



xx1500000257

Removing the hall sensor

Use these procedures to remove the hall sensor.

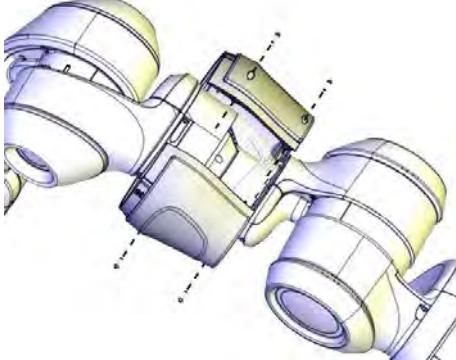
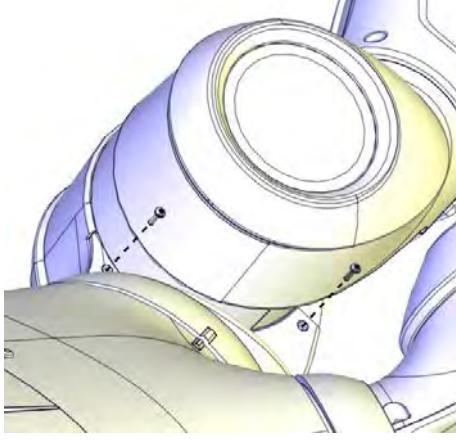
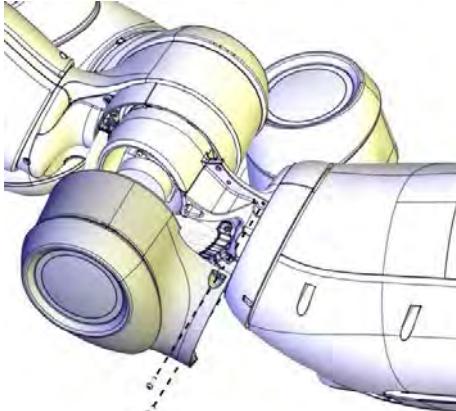
Preparations before removing the hall sensor

	Action	Note
1	Jog the robot so that the covers can be easily accessed and removed.	
2	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none">• electric power supply• air pressure supply <p>to the robot, before starting the repair work on the robot.</p>	

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4.5.2 Replacing the axis-2 hall sensor

Continued

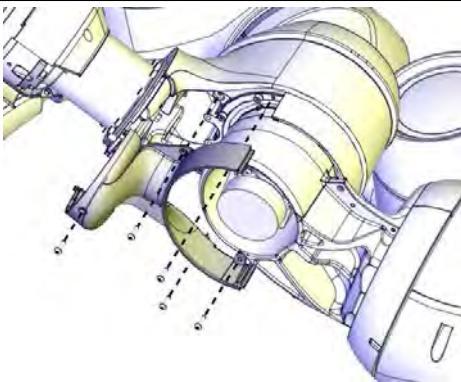
	Action	Note
3	Remove the axis-7 cover.	 xx1400002691
4	Remove the lower axis-2 cover.	 xx1400002614  xx1400002615

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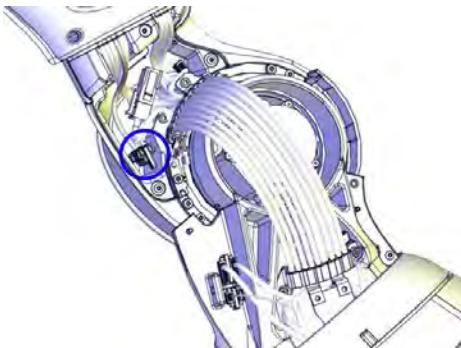
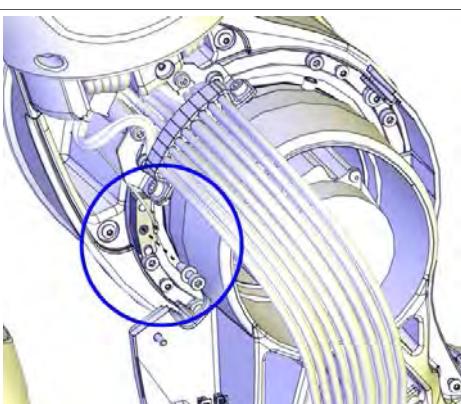
4 Repair

4.5.2 Replacing the axis-2 hall sensor

Continued

Action	Note
5 Remove the axis-2 cable cover.	 xx1500000256

Removing the axis-2 hall sensor

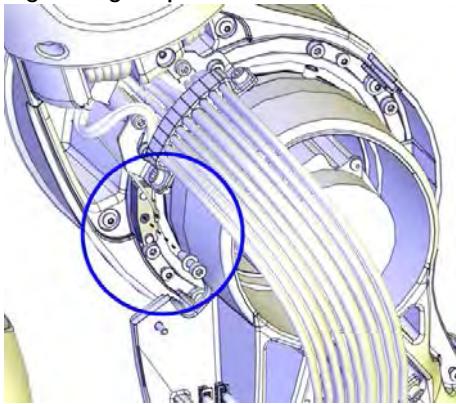
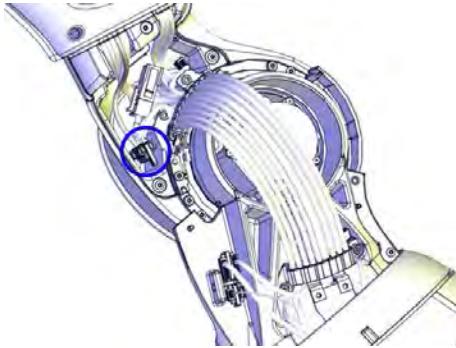
Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2 Gently pull out the hall sensor interface board (HSIB). Disconnect the hall sensor connector P3.	 xx1500000259
3 Remove the hall sensor by removing the screw.	 xx1500000260

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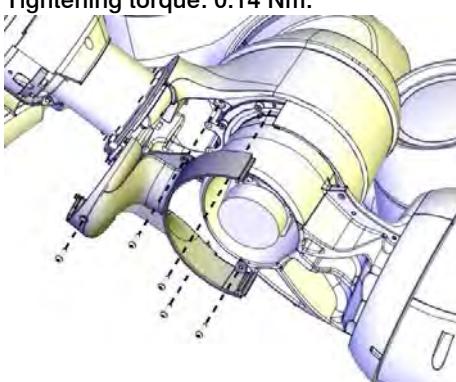
Refitting the hall sensor

Use these procedures to refit the hall sensor.

Refitting the axis-2 hall sensor

	Action	Note
1	Refit the hall sensor with the screw.	Hall sensor with attachment for axis 2: 3HAC052446-001 Tightening torque: 0.8 Nm.  xx1500000260
2	Connect the hall sensor connector P3. Put back the hall sensor interface board (HSIB) in place.	 xx1500000259

Refitting the covers

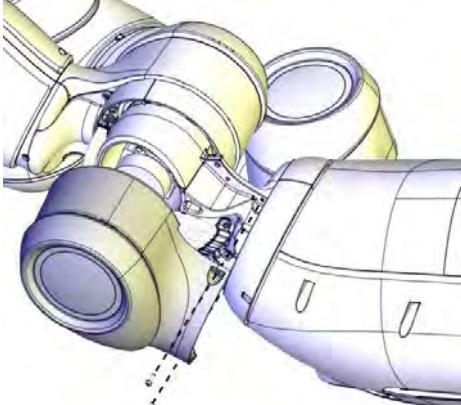
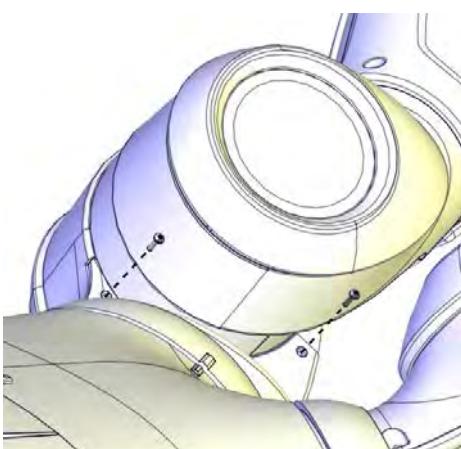
	Action	Note
1	Refit the axis-2 cable cover.	Screws: 5 pcs. Tightening torque: 0.14 Nm.  xx1500000256

Continues on next page

4 Repair

4.5.2 Replacing the axis-2 hall sensor

Continued

Action	Note
2 Refit the lower axis-2 cover.	Screws: 4 pcs. Tightening torque: 0.14 Nm.  xx1400002615
3 Refit the axis-7 cover.	Screws: 4 pcs. Tightening torque: 0.14 Nm.  xx1400002691

Continues on next page

Concluding procedure

	Action	Note
1	Recalibrate the robot. If option Absolute Accuracy is valid for the robot, redo absolute accuracy calibration.	See Calibration on page 431 .
2	 CAUTION 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 45 .	

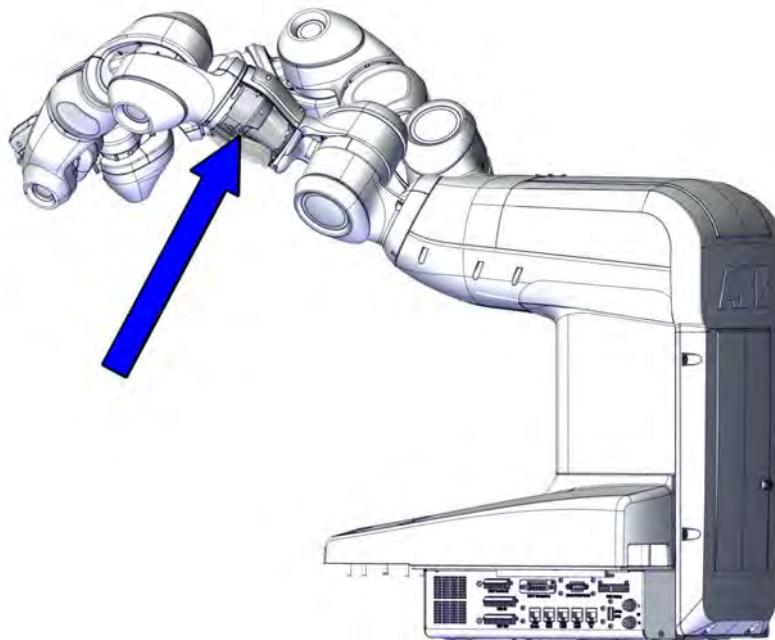
4 Repair

4.5.3 Replacing the axis-7 hall sensor

4.5.3 Replacing the axis-7 hall sensor

Location of the hall sensor

The hall sensor is located as shown in the figure.



xx1500000262

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 14000* on ABB Library.

Spare part	Article number	Note
Hall sensor with attachment for axis 7	3HAC052447-001	

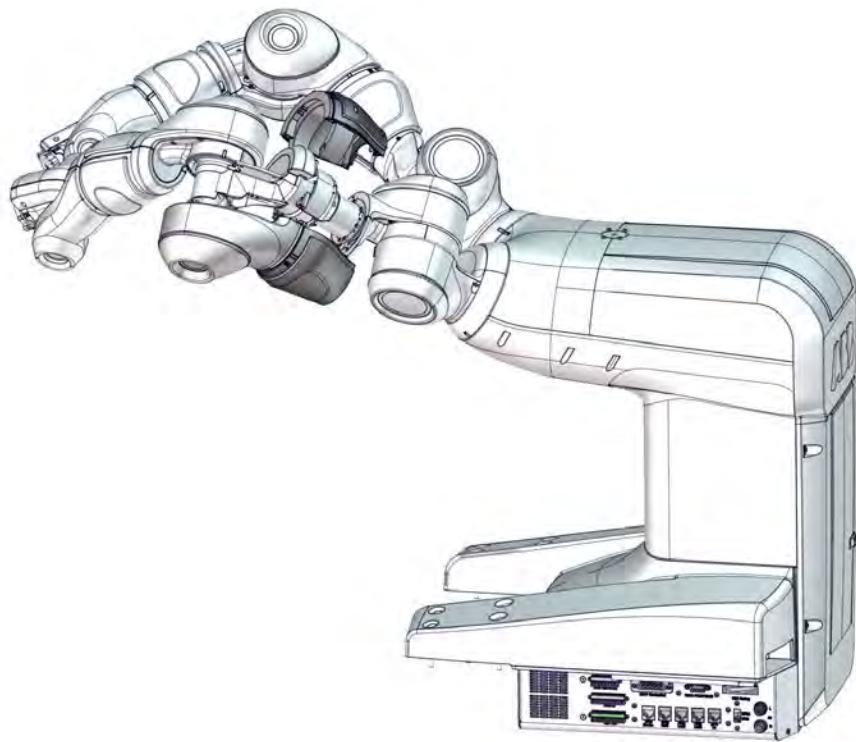
Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

Continues on next page

Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



xx1500000461

Removing the hall sensor

Use these procedures to remove the hall sensor.

Preparations before removing the hall sensor

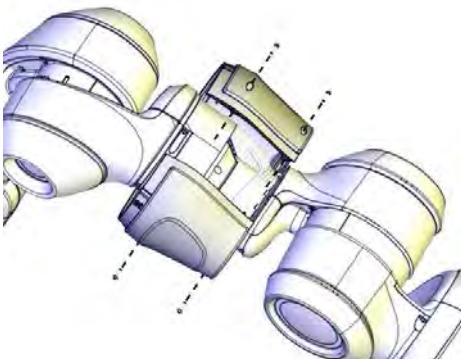
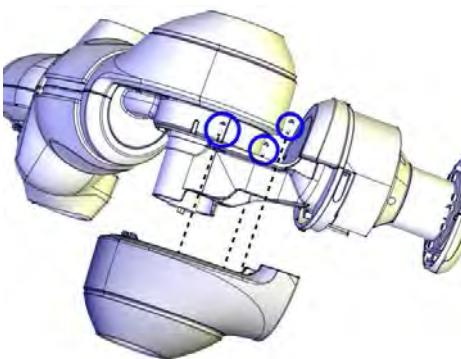
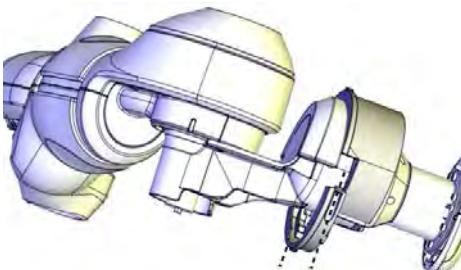
	Action	Note
1	Jog the robot so that the covers can be easily accessed and removed.	
2	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • air pressure supply <p>to the robot, before starting the repair work on the robot.</p>	

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4 Repair

4.5.3 Replacing the axis-7 hall sensor

Continued

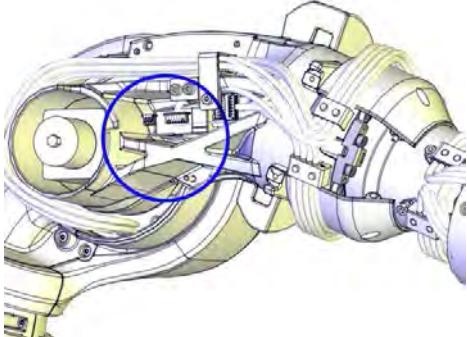
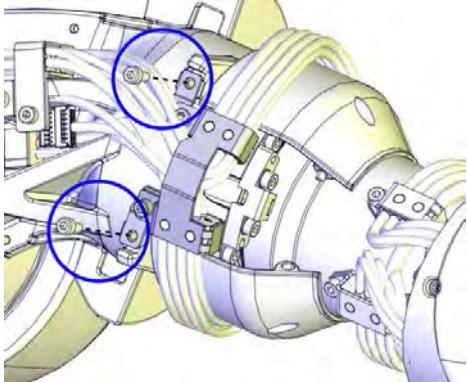
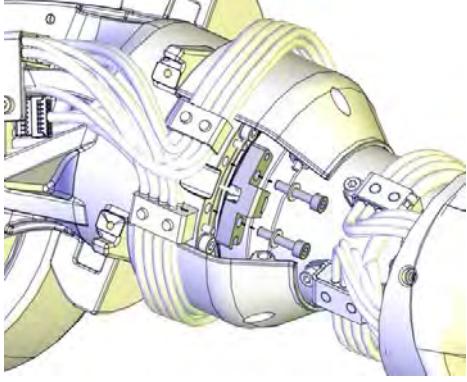
Action	Note
3 Remove the axis-7 cover.	 xx1400002691
4 Remove the axis-3 cover.	 xx1500000458
5 Remove the axis-7 ring (two parts).	 xx1500000460

Removing the axis-7 hall sensor

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

Continues on next page

4.5.3 Replacing the axis-7 hall sensor
Continued

Action	Note
2 Gently pull out the hall sensor interface board (HSIB). Disconnect the hall sensor connector P3.	 xx1500000509
3 Remove the cable bracket by removing the two screws.	 xx1500000508
4 Remove the hall sensor by removing the two screws and washers.	 xx1500000462

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4 Repair

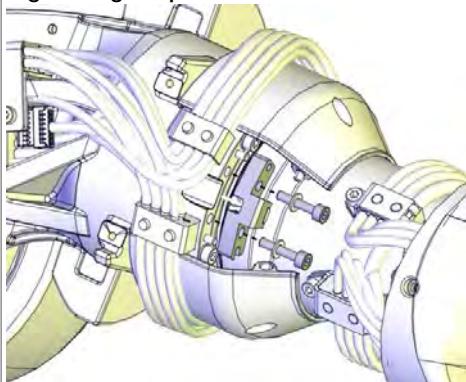
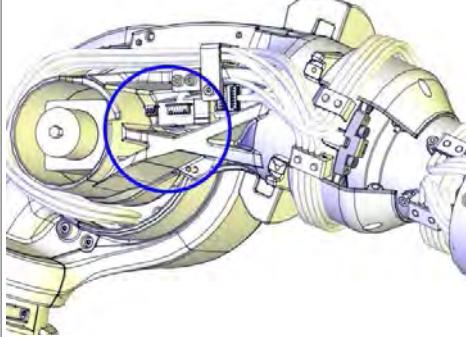
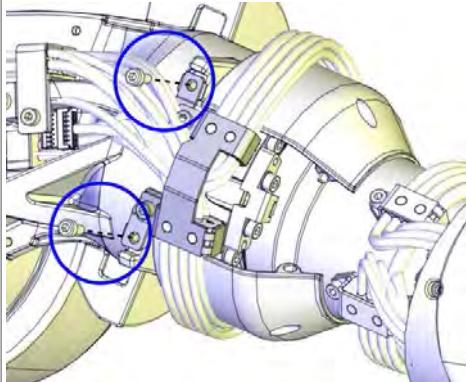
4.5.3 Replacing the axis-7 hall sensor

Continued

Refitting the hall sensor

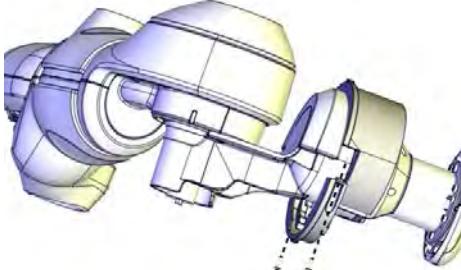
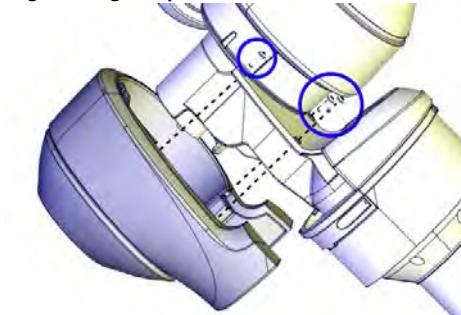
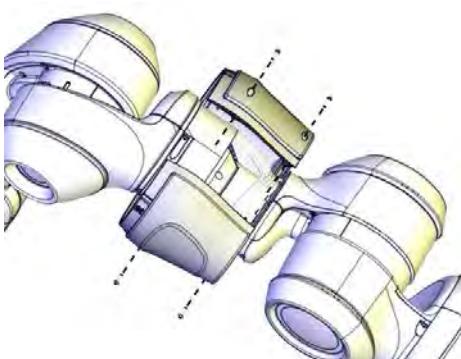
Use these procedures to refit the hall sensor.

Refitting the axis-7 hall sensor

	Action	Note
1	Refit the hall sensor with two screws and washers.	Hall sensor with attachment for axis 7: 3HAC052447-001 Tightening torque: 0.8 Nm.  xx1500000462
2	Connect the hall sensor connector P3. Put back the hall sensor interface board (HSIB) in place.	 xx1500000509
3	Refit the cable bracket with two screws.	 xx1500000508

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Refitting the covers

	Action	Note
1	Refit the axis-7 ring (two parts).	<p>Screws: 2 pcs. Tightening torque: 0.14 Nm.</p>  <p>xx1500000460</p>
2	<p>Refit the axis-3 cover.</p> <p>CAUTION Be careful not to squeeze any cabling during the refitting procedure.</p>	<p>Screws: 3 pcs. Tightening torque: 0.14 Nm.</p>  <p>xx1500000459</p>
3	Refit the axis-7 cover.	<p>Screws: 4 pcs. Tightening torque: 0.14 Nm.</p>  <p>xx1400002691</p>

Concluding procedure

	Action	Note
1	Recalibrate the robot. If option Absolute Accuracy is valid for the robot, redo absolute accuracy calibration.	See Calibration on page 431 .

Continues on next page

4 Repair

4.5.3 Replacing the axis-7 hall sensor

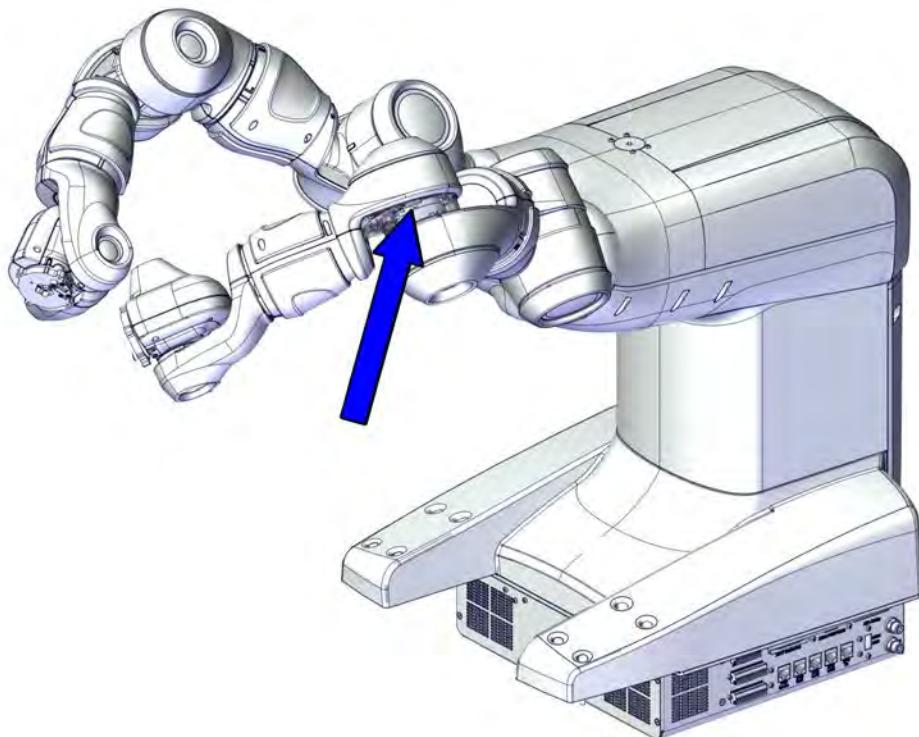
Continued

	Action	Note
2	 CAUTION 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 45.	

4.5.4 Replacing the axis-3 hall sensor

Location of the hall sensor

The hall sensor is located as shown in the figure.



xx1500000263

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 14000* on ABB Library.

Spare part	Article number	Note
Hall sensor with attachment for axis 3	3HAC052448-001	

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

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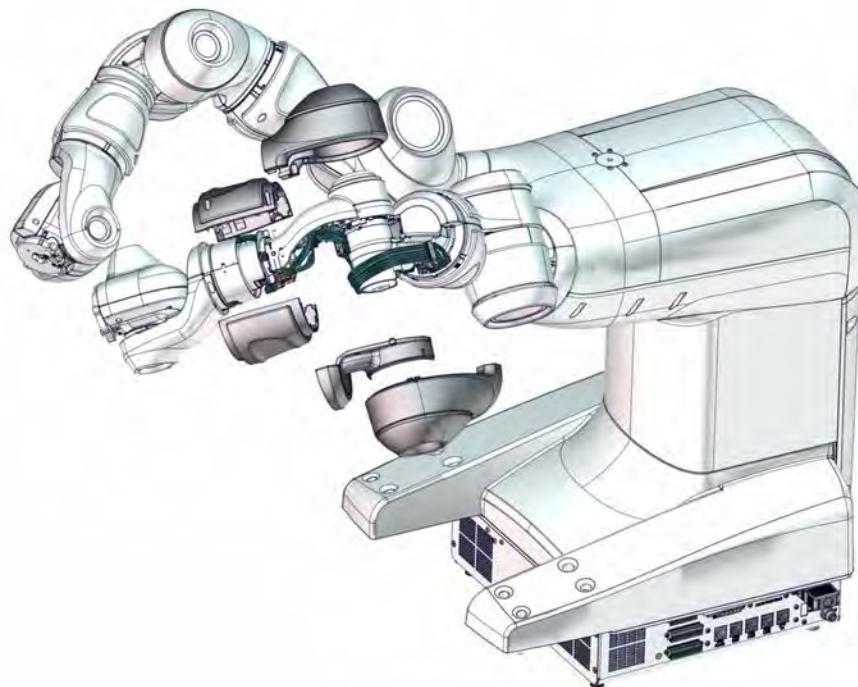
4 Repair

4.5.4 Replacing the axis-3 hall sensor

Continued

Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



xx1500000491

Removing the hall sensor

Use these procedures to remove the hall sensor.

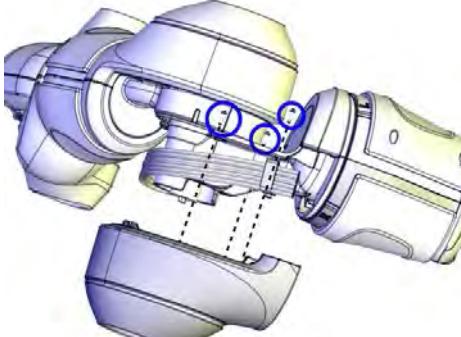
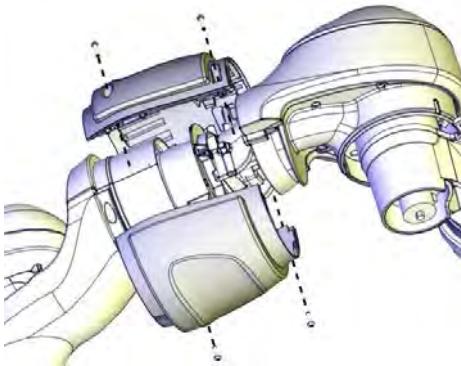
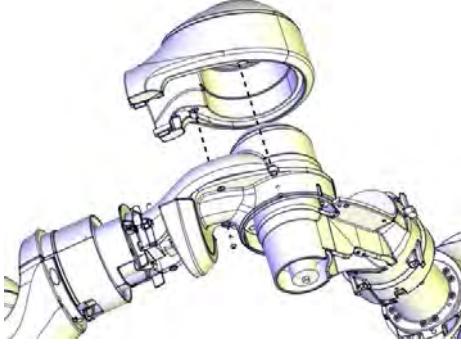
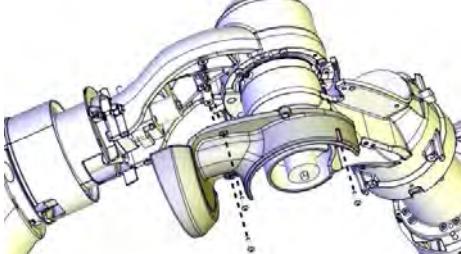
Preparations before removing the hall sensor

	Action	Note
1	Jog the robot so that the covers can be easily accessed and removed.	
2	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none">• electric power supply• air pressure supply <p>to the robot, before starting the repair work on the robot.</p>	

Continues on next page

4.5.4 Replacing the axis-3 hall sensor

Continued

Action	Note
3 Remove the axis-3 cover.	 xx1400002751
4 Remove the lower axis-4 cover.	 xx1400002756
5 Remove the axis-3 body cover.	 xx1500000091
6 Remove the upper axis-3 cover.	 xx1500000093

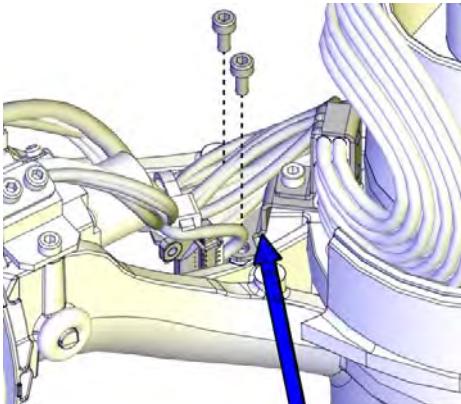
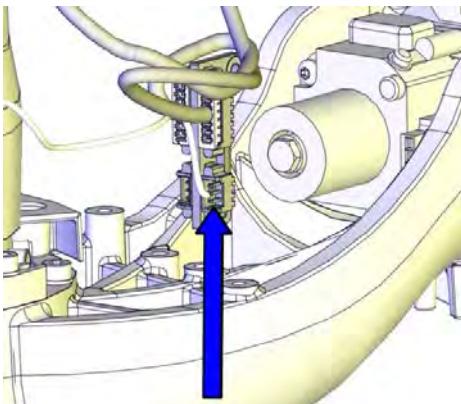
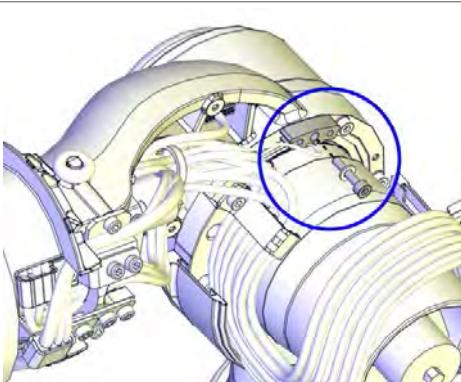
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4 Repair

4.5.4 Replacing the axis-3 hall sensor

Continued

Removing the axis-3 hall sensor

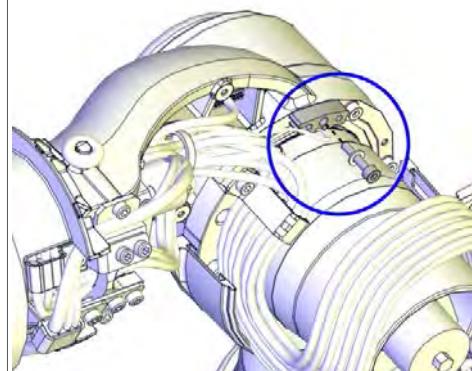
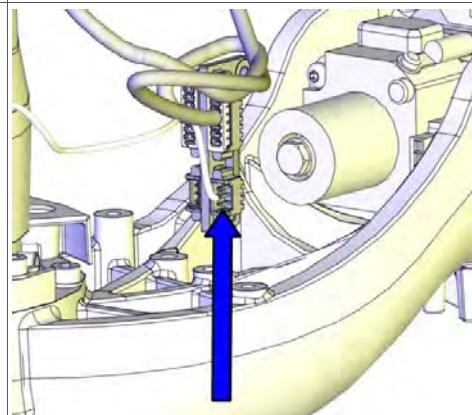
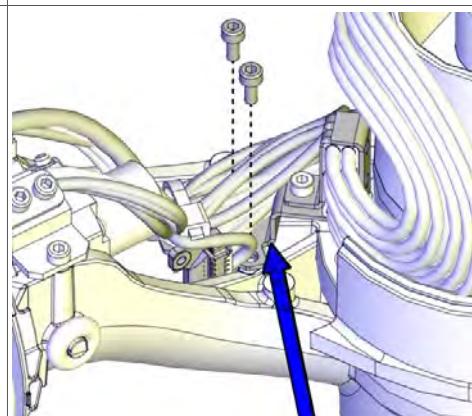
	Action	Note
1	 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2	Loosen the cable bracket by removing the screws. This is done in order to access the hall sensor interface board (HSIB).	 xx1500000559
3	Gently pull out the hall sensor interface board (HSIB). Disconnect the hall sensor connector P3.	 xx1500000512
4	Remove the hall sensor by removing the screw and washer.	 xx1500000513

Continues on next page

Refitting the hall sensor

Use these procedures to refit the hall sensor.

Refitting the axis-3 hall sensor

	Action	Note
1	Refit the hall sensor with the screw and washer.	Hall sensor with attachment for axis 3: 3HAC052448-001 Tightening torque: 0.8 Nm.  xx1500000513
2	Connect the hall sensor connector P3. Put back the HSIB in place.	 xx1500000512
3	Refit the cable bracket with the screws.	 xx1500000559

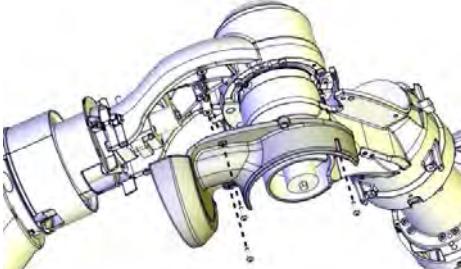
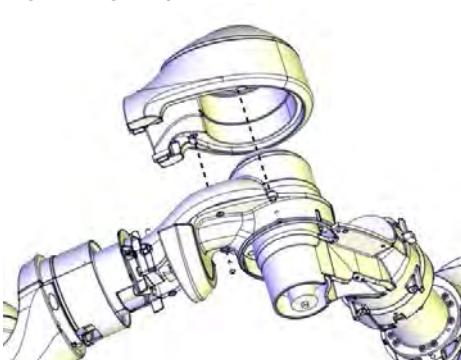
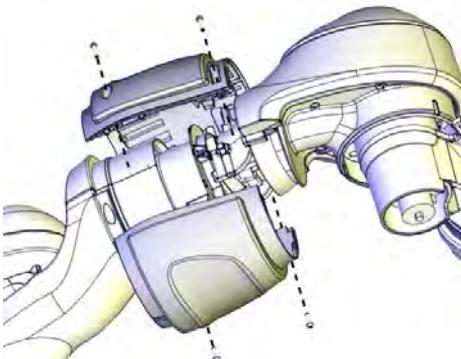
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4 Repair

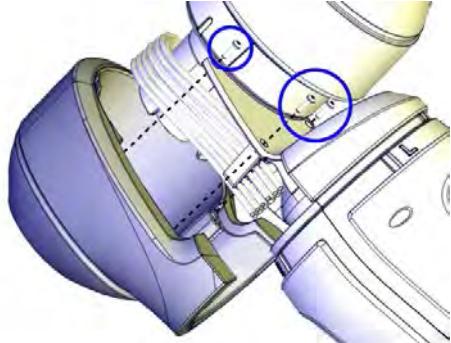
4.5.4 Replacing the axis-3 hall sensor

Continued

Refitting the covers

	Action	Note
1	Refit the upper axis-3 cover.	Screws: 3 pcs. Tightening torque: 0.14 Nm.  xx1500000093
2	Refit the axis-3 body cover.	Screws: 2 pcs. Tightening torque: 0.14 Nm.  xx1500000091
3	Refit the lower axis-4 cover.	Screws: 4 pcs. Tightening torque: 0.14 Nm.  xx1400002756

Continues on next page

	Action	Note
4	<p>Refit the axis-3 cover.</p> <p>CAUTION Be careful not to squeeze any cabling during the refitting procedure.</p>	<p>Screws: 3 pcs. Tightening torque: 0.14 Nm.</p>  <p>xx1400002753</p>

Concluding procedure

	Action	Note
1	<p>Recalibrate the robot.</p> <p>If option Absolute Accuracy is valid for the robot, redo absolute accuracy calibration.</p>	See Calibration on page 431 .
2	<p>CAUTION 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 45.</p>	

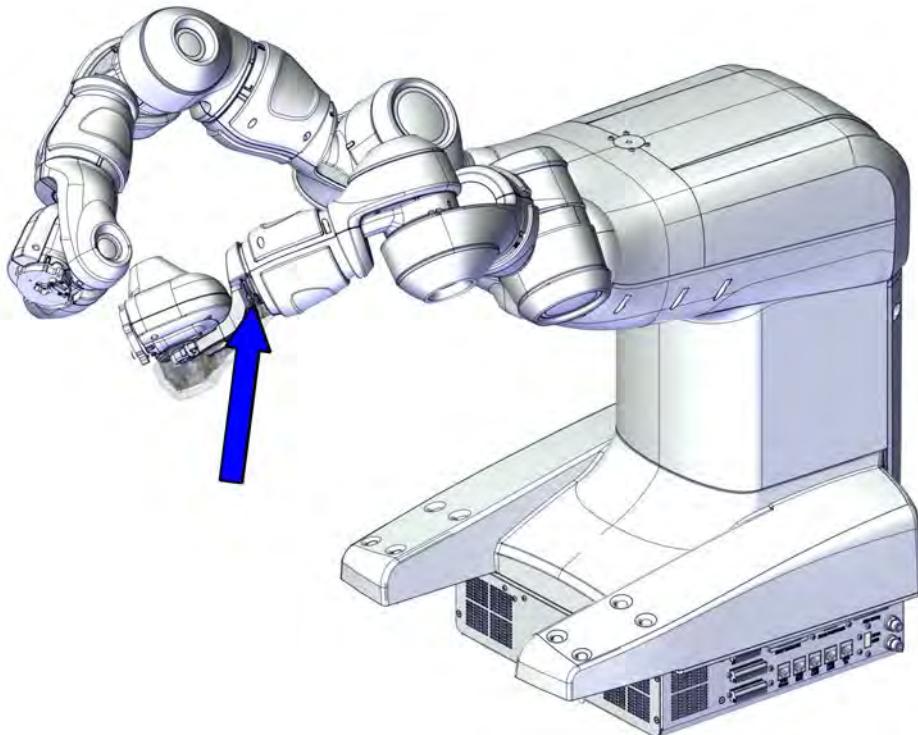
4 Repair

4.5.5 Replacing the axis-4 hall sensor

4.5.5 Replacing the axis-4 hall sensor

Location of the hall sensor

The hall sensor is located as shown in the figure.



xx1500000264

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 14000* on ABB Library.

Spare part	Article number	Note
Hall sensor with attachment for axis 4	3HAC052450-001	

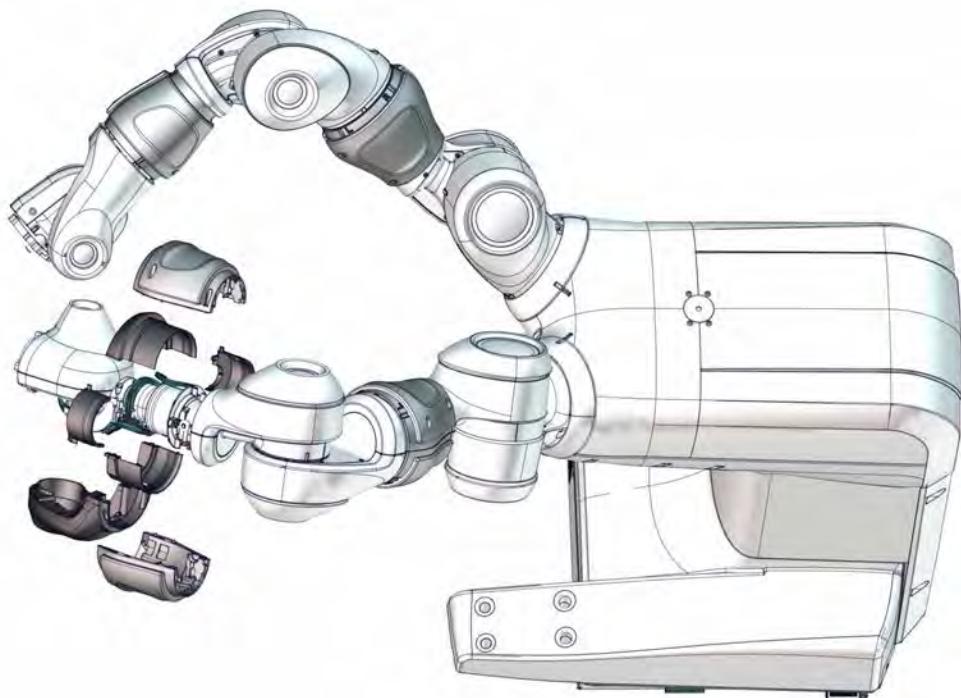
Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

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Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



xx1500000603

Removing the hall sensor

Use these procedures to remove the hall sensor.

Preparations before removing the hall sensor

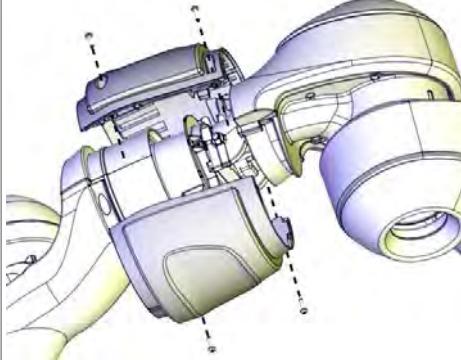
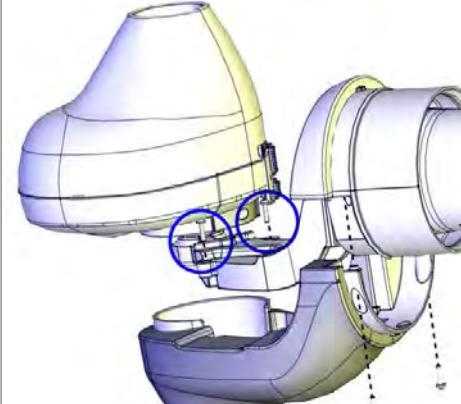
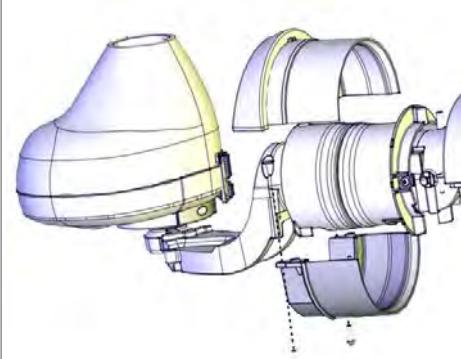
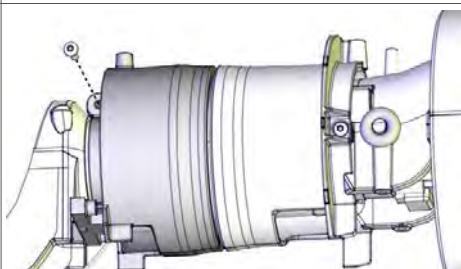
	Action	Note
1	Jog the robot so that the covers can be easily accessed and removed.	
2	DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • air pressure supply to the robot, before starting the repair work on the robot.	

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4 Repair

4.5.5 Replacing the axis-4 hall sensor

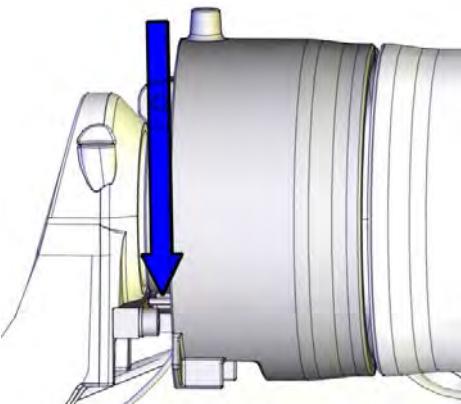
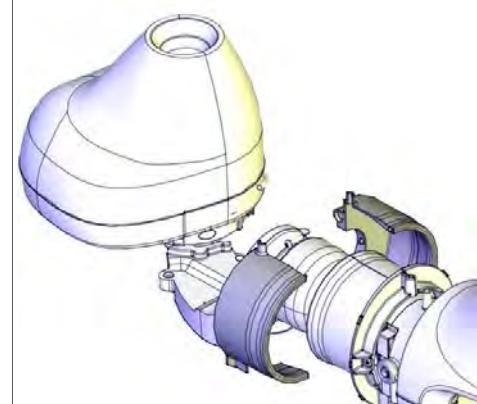
Continued

	Action	Note
3	Remove the lower axis-4 cover.	 xx1500000360
4	Remove the upper axis-4 cover.	 xx1500000095
5	Remove the outer axis-4 cable protection.	 xx1500000496
6	Remove the screw that fastens the halves of the inner axis-4 cable protection together.	 xx1500000560

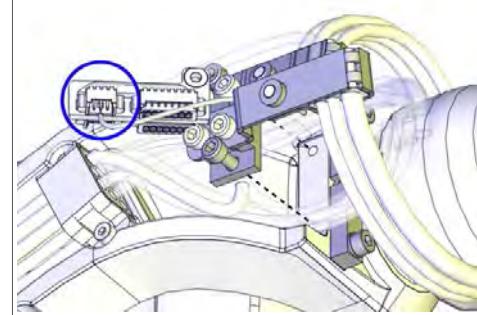
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4.5.5 Replacing the axis-4 hall sensor

Continued

Action	Note
7 Release the latch that holds the two halves together by pressing the latch down with a screwdriver or similar. Remove the protection.	 xx1500000562  xx1500000497

Removing the axis-4 hall sensor

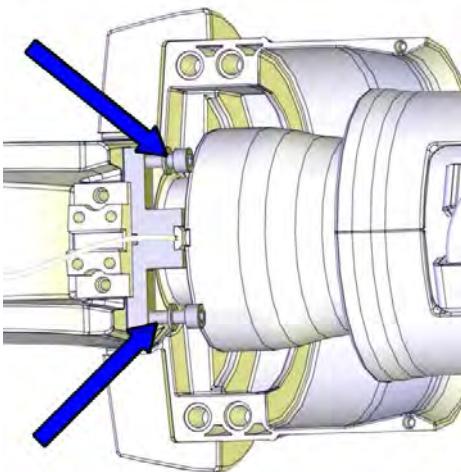
Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2 Gently pull out the hall sensor interface board (HSIB). Disconnect the hall sensor connector P3.	 xx1500000498

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4 Repair

4.5.5 Replacing the axis-4 hall sensor

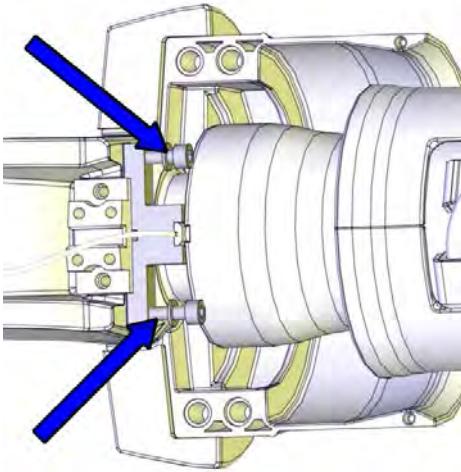
Continued

Action	Note
3 Remove the hall sensor by removing the screws and washers.	 xx1500000499

Refitting the hall sensor

Use these procedures to refit the hall sensor.

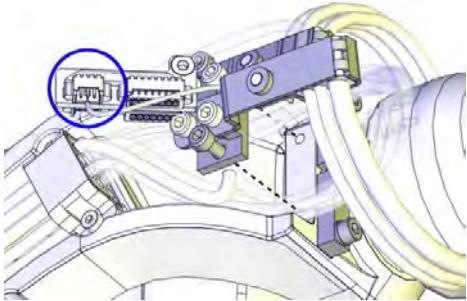
Refitting the axis-4 hall sensor

Action	Note
1 Refit the hall sensor with the screws and washers.	Hall sensor with attachment for axis 4: 3HAC052450-001 Tightening torque: 0.4 Nm.  xx1500000499

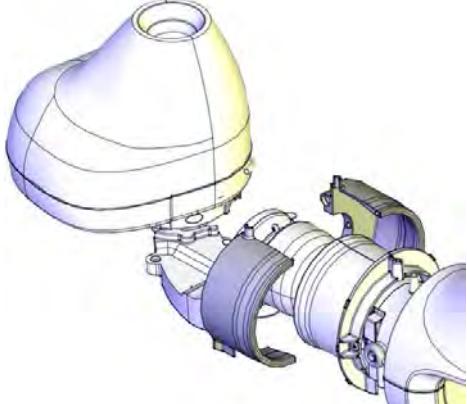
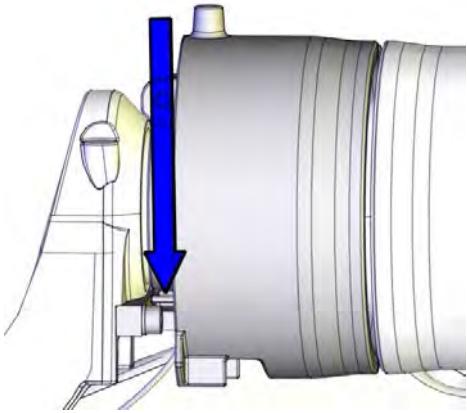
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4.5.5 Replacing the axis-4 hall sensor

Continued

Action	Note
2 Connect the hall sensor connector P3.	 xx1500000498
3 Put back the hall sensor interface board (HSIB) in place.	

Refitting the covers

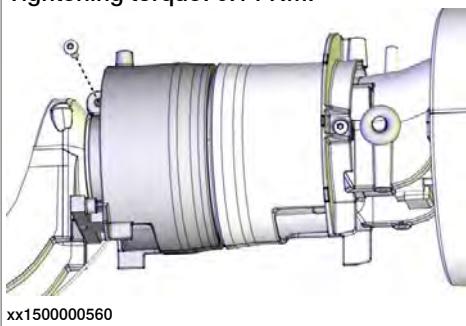
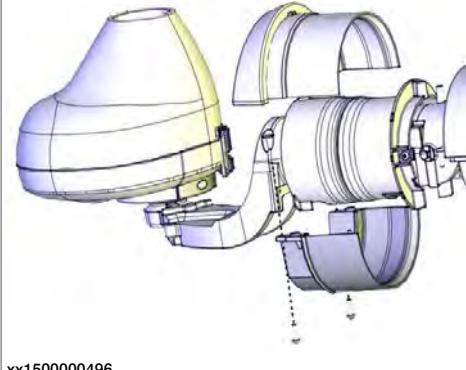
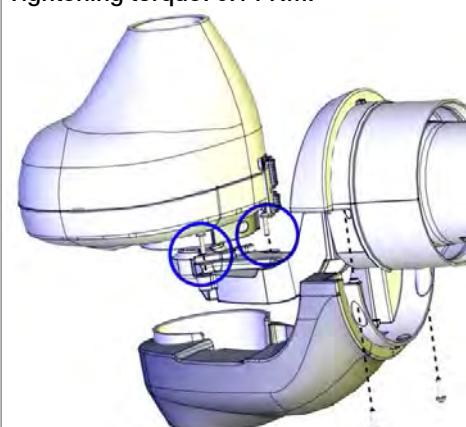
Action	Note
1 Put the two halves of the inner axis-4 cable protection together around the axis and lock them with the latch.	 xx1500000497  xx1500000562

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4 Repair

4.5.5 Replacing the axis-4 hall sensor

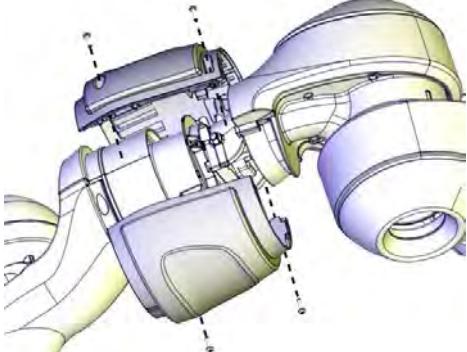
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Action	Note
2 Refit the screw that fastens the halves of the inner axis-4 cable protection together.	Tightening torque: 0.14 Nm.  xx1500000560
3 Refit the outer axis-4 cable protection.	Screws: 2 pcs. Tightening torque: 0.14 Nm.  xx1500000496
4 Refit the upper axis-4 cover.	Screws: 4 pcs. Tightening torque: 0.14 Nm.  xx1500000095

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4.5.5 Replacing the axis-4 hall sensor

Continued

Action	Note
5 Refit the lower axis-4 cover.	Screws: 4 pcs. Tightening torque: 0.14 Nm.  xx1500000360

Concluding procedure

Action	Note
1 Recalibrate the robot. If option Absolute Accuracy is valid for the robot, redo absolute accuracy calibration.	See Calibration on page 431 .
2  CAUTION 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 45 .	

4 Repair

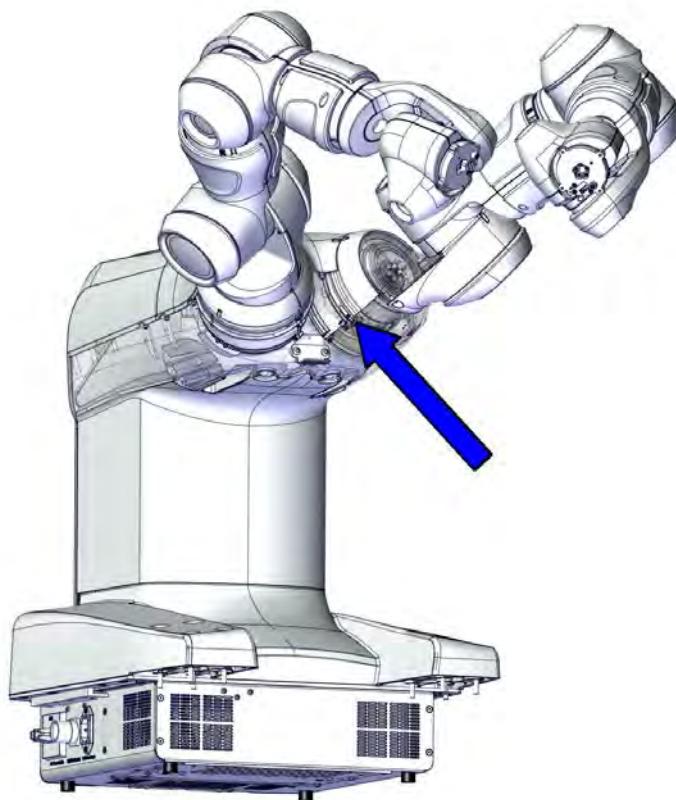
4.6.1 Replacing the axis-1 mechanical stop

4.6 Mechanical stops

4.6.1 Replacing the axis-1 mechanical stop

Location of the mechanical stop

The mechanical stop is located as shown in the figure.



xx1500000739

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 14000* on ABB Library.

Spare part	Article number	Note
Mechanical stop for axis 1	3HAC047602-001	

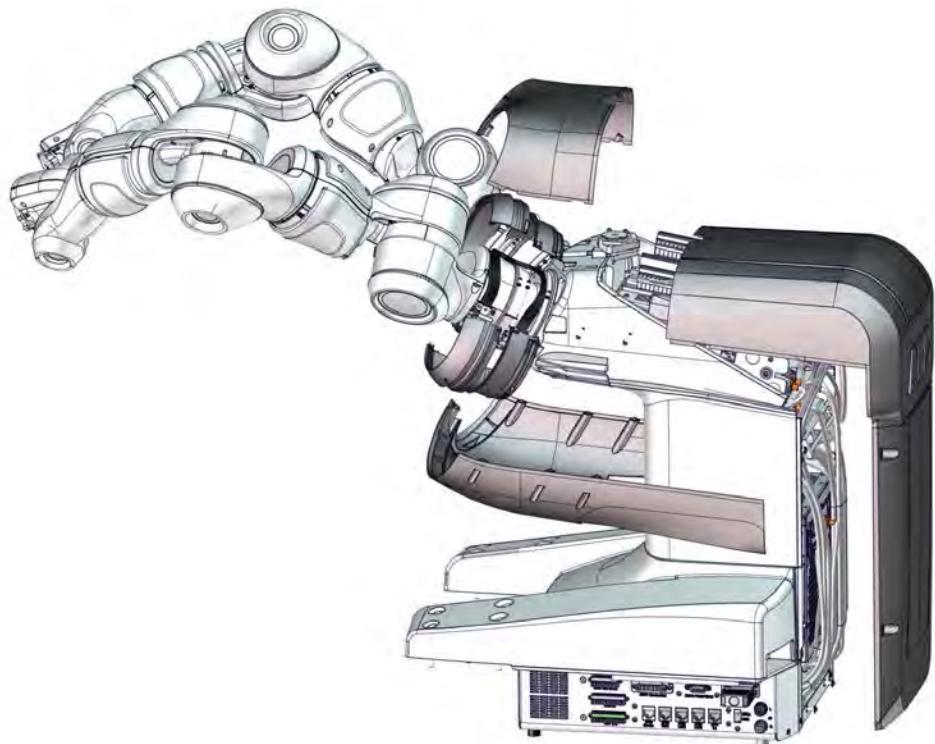
Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

Continues on next page

Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



xx1500000493

Removing the mechanical stop

Use these procedures to remove the mechanical stop.

Preparations before removing the mechanical stop

	Action	Note
1	Jog the robot so that the covers can be easily accessed and removed.	
2	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • air pressure supply <p>to the robot, before starting the repair work on the robot.</p>	

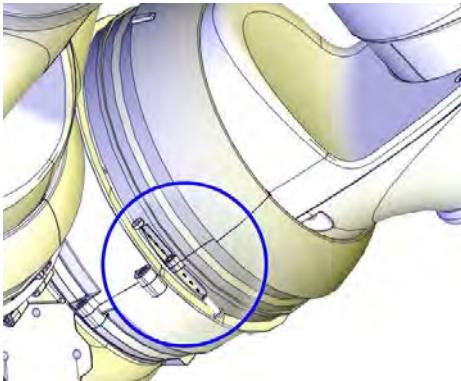
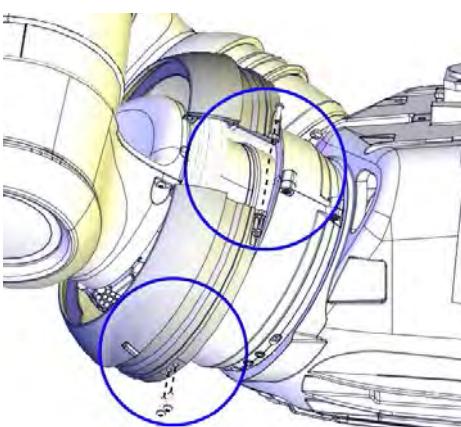
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4 Repair

4.6.1 Replacing the axis-1 mechanical stop

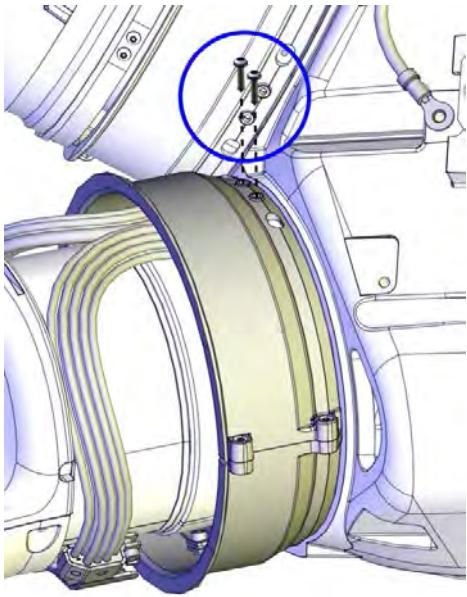
Continued

Removing the axis-1 covers

Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2 Remove the upper axis-1 cover.	 xx1400002601  xx1400002605

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4.6.1 Replacing the axis-1 mechanical stop
Continued

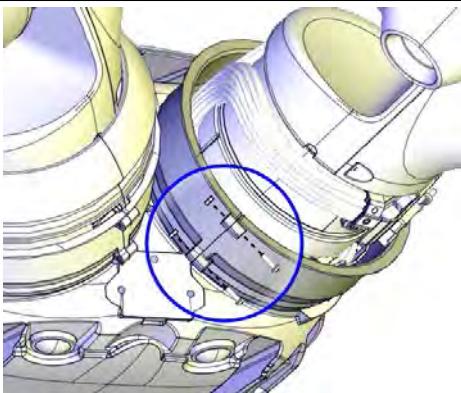
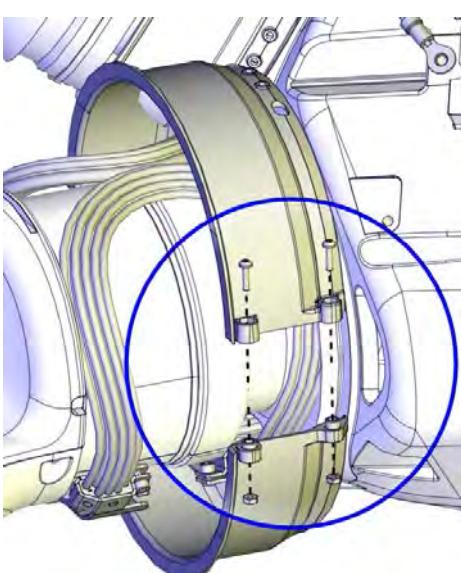
	Action	Note
3	Remove the upper screws of the lower axis-1 cover.	 xx1500000565

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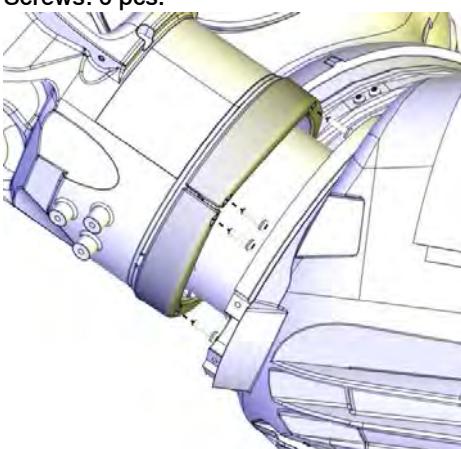
4 Repair

4.6.1 Replacing the axis-1 mechanical stop

Continued

Action	Note
4 Turn the lower axis-1 cover in order to access all screws properly and remove the lower axis-1 cover.	 xx1400002604  xx1400002606

Removing the remaining covers

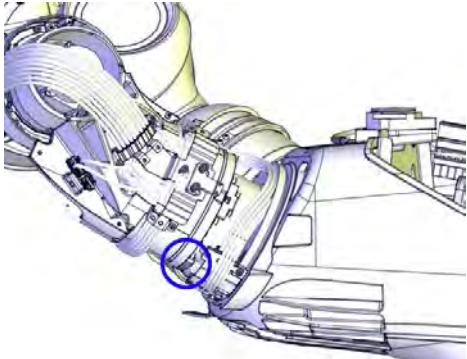
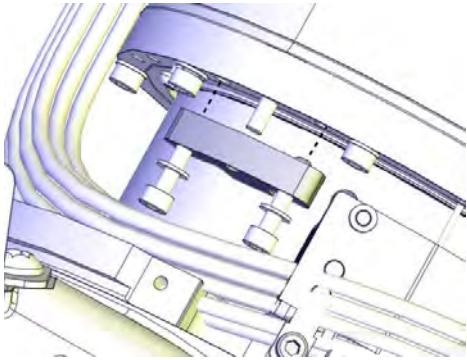
Action	Note
1 Remove the axis-1 cable protection.  Tip In order to access the screws it is helpful to release the brakes and manually move the robot arm. Temporarily turn on the power to the robot and release the brakes.	Screws: 6 pcs.  xx1500000412

Continues on next page

4.6.1 Replacing the axis-1 mechanical stop

Continued

Removing the axis-1 mechanical stop

	Action	Note
1	Turn on the power to the robot temporarily.	
2	Release the brakes and rotate axis 1 in order to access the mechanical stop.	 xx1500000735
3	 DANGER Turn off the electric power supply again.	
4	Remove the mechanical stop by removing the two screws and washers.	 xx1500000738

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4 Repair

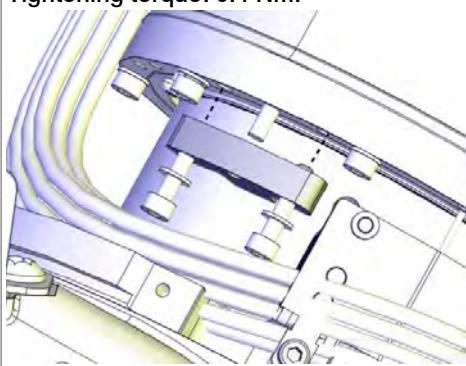
4.6.1 Replacing the axis-1 mechanical stop

Continued

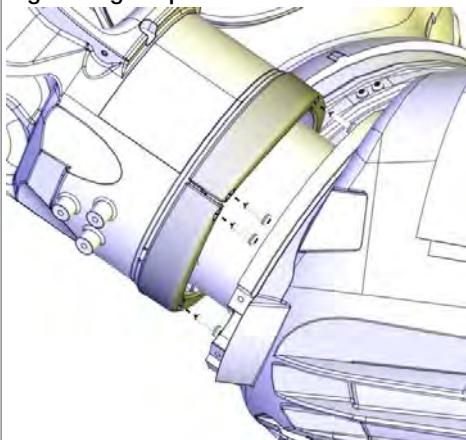
Refitting the mechanical stop

Use these procedures to refit the mechanical stop.

Refitting the axis-1 mechanical stop

Action	Note
1 Refit the mechanical stop with the screws and washers.	Mechanical stop for axis 1: 3HAC047602-001 Screws: 2 pcs. Tightening torque: 0.4 Nm.  xx1500000738

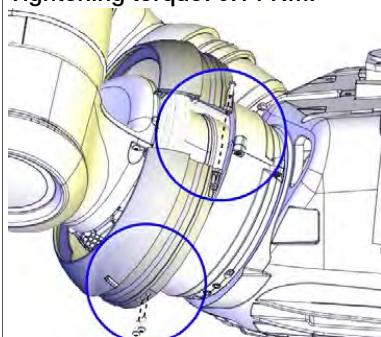
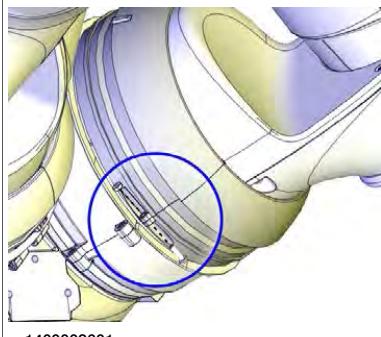
Refitting the covers

Action	Note
1 Refit the axis-1 cable protection.  Tip In order to access the screws it is helpful to release the brakes and manually move the robot arm. Temporarily turn on the power to the robot and release the brakes.	Screws: 6 pcs. Tightening torque: 0.14 Nm.  xx1500000412

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4.6.1 Replacing the axis-1 mechanical stop
Continued

Refitting the axis-1 covers

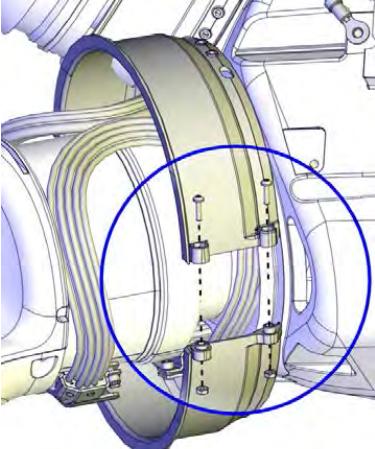
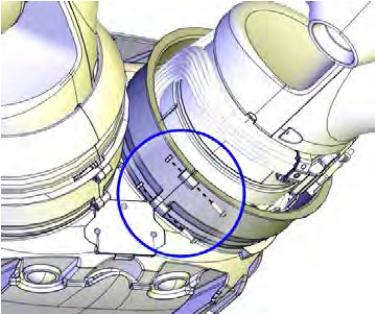
	Action	Note
1	Refit the upper axis-1 cover.	Screws: 3HAC050368-005. (4 pcs) Nuts: M2 DIN934 8 ELZN. (2 pcs) Tightening torque: 0.14 Nm.  xx1400002605  xx1400002601

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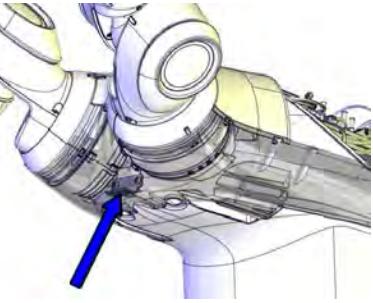
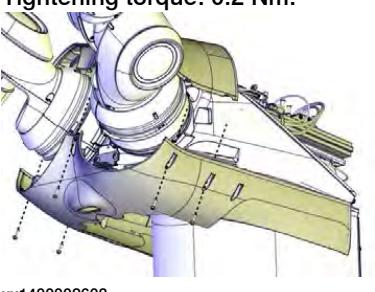
4 Repair

4.6.1 Replacing the axis-1 mechanical stop

Continued

Action	Note
2 Refit the lower axis-1 cover.	<p>Screws: 3HAC050368-005. (4 pcs) Nuts: M2 DIN934 8 ELZN. (4 pcs) Tightening torque: 0.14 Nm.</p>  <p>xx1400002606</p>  <p>xx1400002604</p>

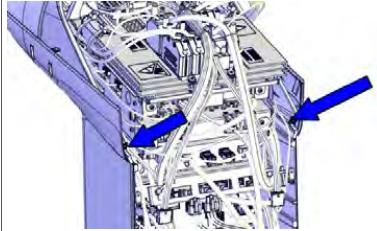
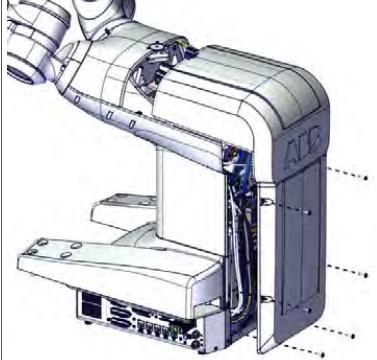
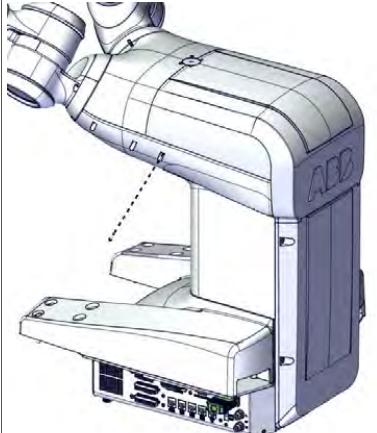
Refitting the body covers

Action	Note
1 Refit the front and lower body cover.  Note Be aware of the tab underneath the cover so it does not get damaged.  <p>xx1500000564</p>	<p>Screws: 3HAC050367-005. (5 pcs) Tightening torque: 0.2 Nm.</p>  <p>xx1400002603</p>

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4.6.1 Replacing the axis-1 mechanical stop

Continued

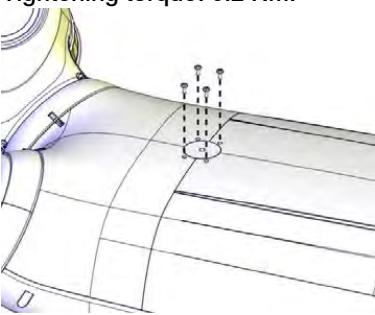
	Action	Note
2	Refit the back screws of the lower body cover.	<p>Screws: 2 pcs. Tightening torque: 0.2 Nm.</p>  <p>xx1500000540</p>
3	Refit the body cover.	<p>Screws: 6 pcs. Tightening torque: 0.9 Nm.</p>  <p>xx1500000697</p>
4	Refit the two remaining screws of the body cover.	<p>Screws: 2 pcs. Tightening torque: 0.2 Nm.</p>  <p>xx1500000696</p>

Continues on next page

4 Repair

4.6.1 Replacing the axis-1 mechanical stop

Continued

Action	Note
5 Refit the body cover top screws.	Screws: 4 pcs. Tightening torque: 0.2 Nm.  xx1400002904

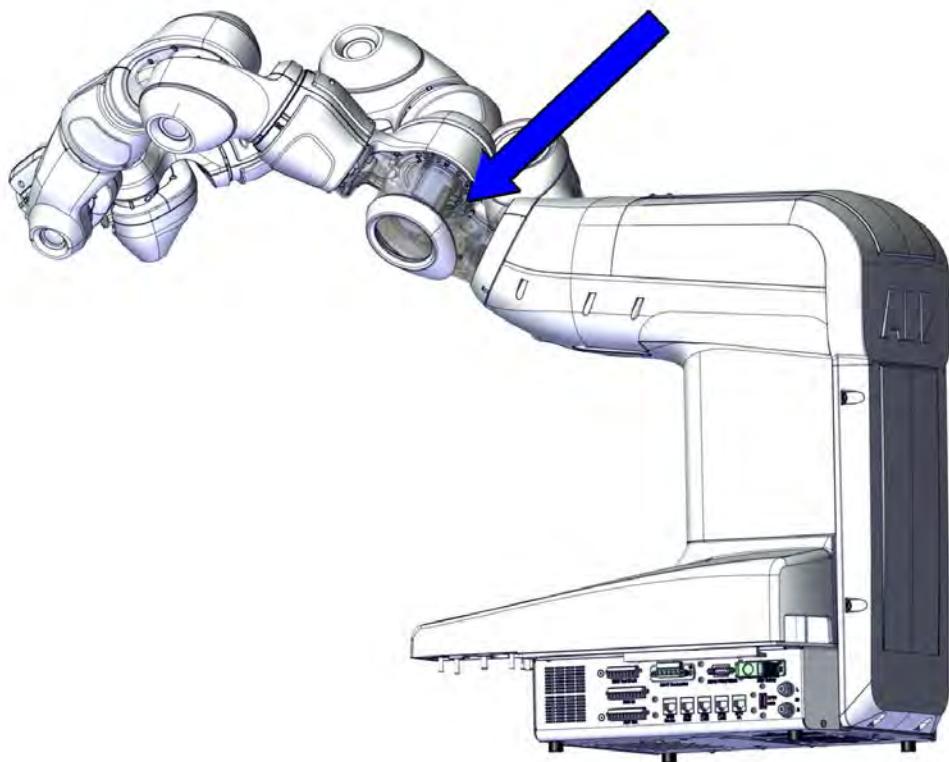
Concluding procedure

Action	Note
1 Recalibrate the robot.	See Calibration on page 431 .
2  CAUTION 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 45 .	

4.6.2 Replacing the axis-2 mechanical stop

Location of the mechanical stop

The mechanical stop is located as shown in the figure.



xx1500000740

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 14000* on ABB Library.

Spare part	Article number	Note
Mechanical stop for axis 2	3HAC047602-001	

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

Continues on next page

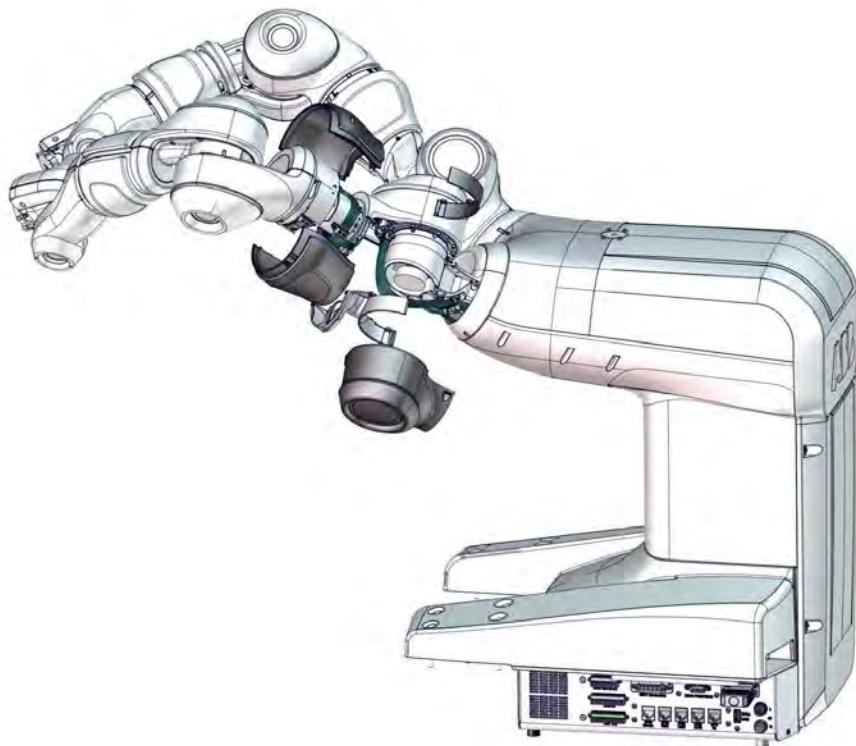
4 Repair

4.6.2 Replacing the axis-2 mechanical stop

Continued

Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



xx1500000741

Removing the mechanical stop

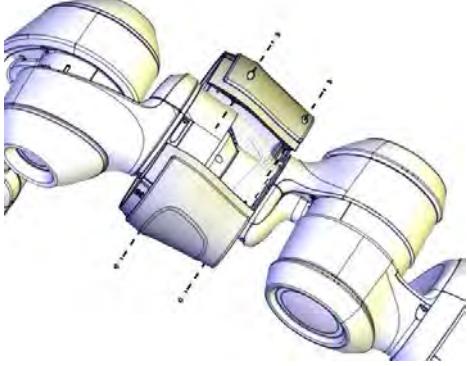
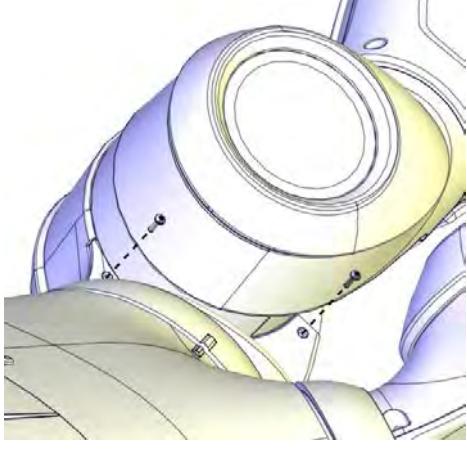
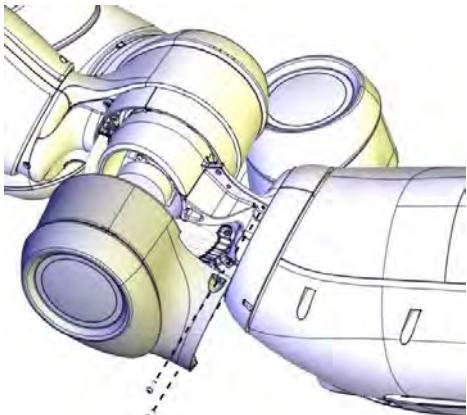
Use these procedures to remove the mechanical stop.

Preparations before removing the mechanical stop

	Action	Note
1	Jog the robot so that the covers can be easily accessed and removed.	
2	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none">• electric power supply• air pressure supply <p>to the robot, before starting the repair work on the robot.</p>	

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4.6.2 Replacing the axis-2 mechanical stop
Continued

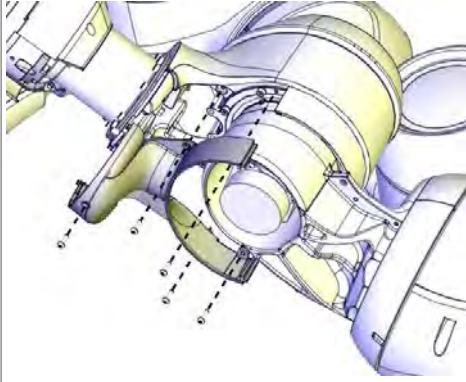
Action	Note
3 Remove the axis-7 cover.	 xx1400002691
4 Remove the lower axis-2 cover.	 xx1400002614  xx1400002615

Continues on next page

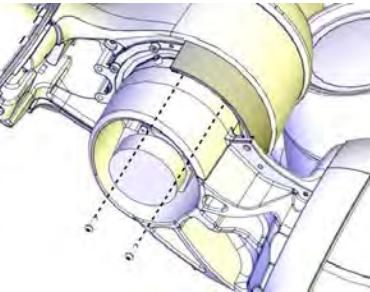
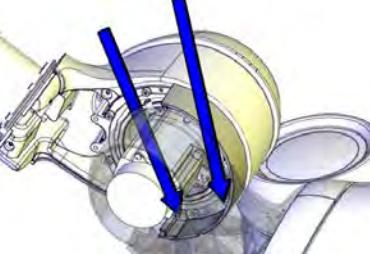
4 Repair

4.6.2 Replacing the axis-2 mechanical stop

Continued

Action	Note
5 Remove the axis-2 cable cover.	 xx1500000256

Removing the axis-2 cable collar

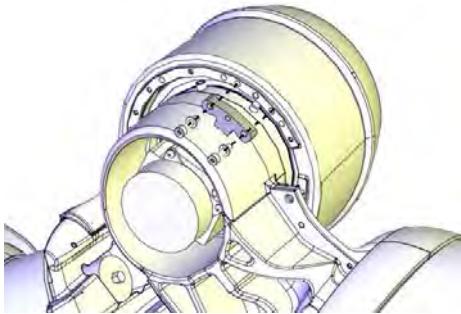
Action	Note
1 Remove the two accessible screws of the axis-2 cable collar.	 xx1500000486
2 Turn on the power to the robot temporarily.	
3 Release the brakes and rotate axis 2 in order to access the two remaining axis-2 cable collar screws.	 xx1500000487
4  DANGER Turn off the electric power supply again.	
5 Remove the two screws and remove the cable collar.	

Continues on next page

4.6.2 Replacing the axis-2 mechanical stop

Continued

Removing the axis-2 mechanical stop

Action	Note
<p>1</p>  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
<p>2</p> Remove the mechanical stop by removing the two screws and washers.	 xx1500000488

Refitting the mechanical stop

Use these procedures to refit the mechanical stop.

Refitting the axis-2 mechanical stop

Action	Note
<p>1</p> Refit the mechanical stop with the screws and washers.	Mechanical stop for axis 2: 3HAC047602-001 Screws: 2 pcs. Tightening torque: 0.4 Nm.

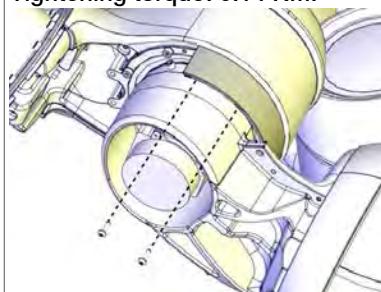
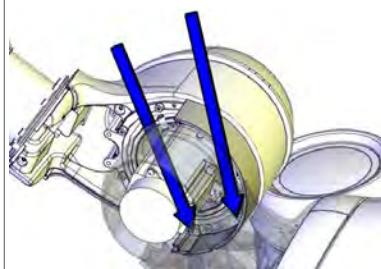
Continues on next page

4 Repair

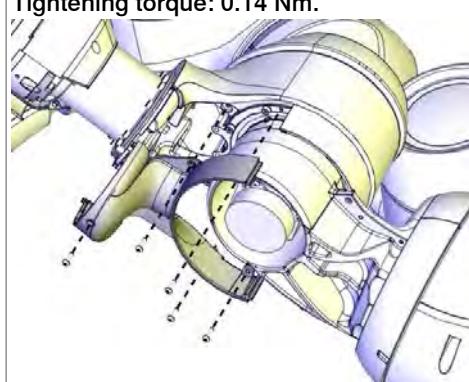
4.6.2 Replacing the axis-2 mechanical stop

Continued

Refitting the axis-2 cable collar

Action	Note
<p>1 Refit the cable collar with the screws.</p> <p> Tip</p> <p>In order to access the screws it is helpful to release the brakes and manually move the robot arm. Temporarily turn on the power to the robot and release the brakes.</p>	<p>Screws: 4 pcs. Tightening torque: 0.14 Nm.</p>  xx1500000486  xx1500000487

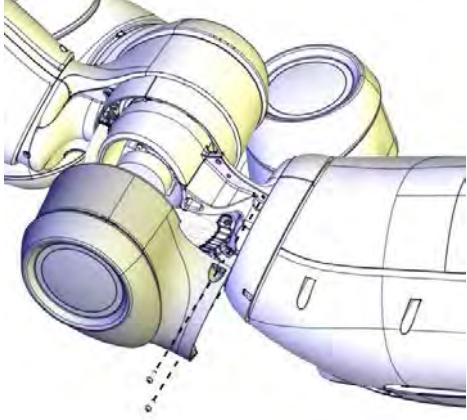
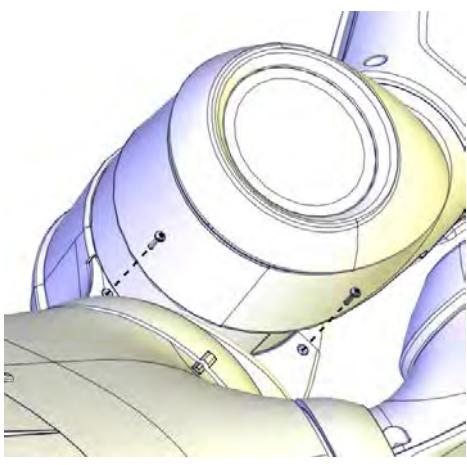
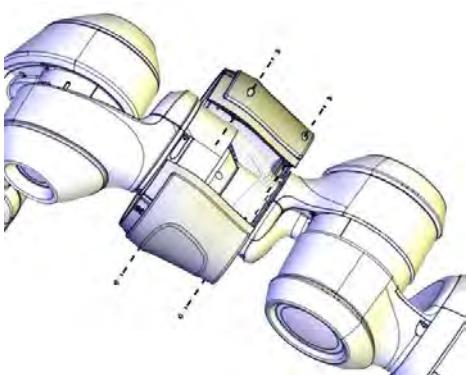
Refitting the covers

Action	Note
<p>1 Refit the axis-2 cable cover.</p>	<p>Screws: 5 pcs. Tightening torque: 0.14 Nm.</p>  xx1500000256

Continues on next page

4.6.2 Replacing the axis-2 mechanical stop

Continued

	Action	Note
2	Refit the lower axis-2 cover.	<p>Screws: 4 pcs. Tightening torque: 0.14 Nm.</p>  <p>xx1400002615</p>  <p>xx1400002614</p>
3	Refit the axis-7 cover.	<p>Screws: 4 pcs. Tightening torque: 0.14 Nm.</p>  <p>xx1400002691</p>

Concluding procedure

	Action	Note
1	Recalibrate the robot.	See Calibration on page 431 .

Continues on next page

4 Repair

4.6.2 Replacing the axis-2 mechanical stop

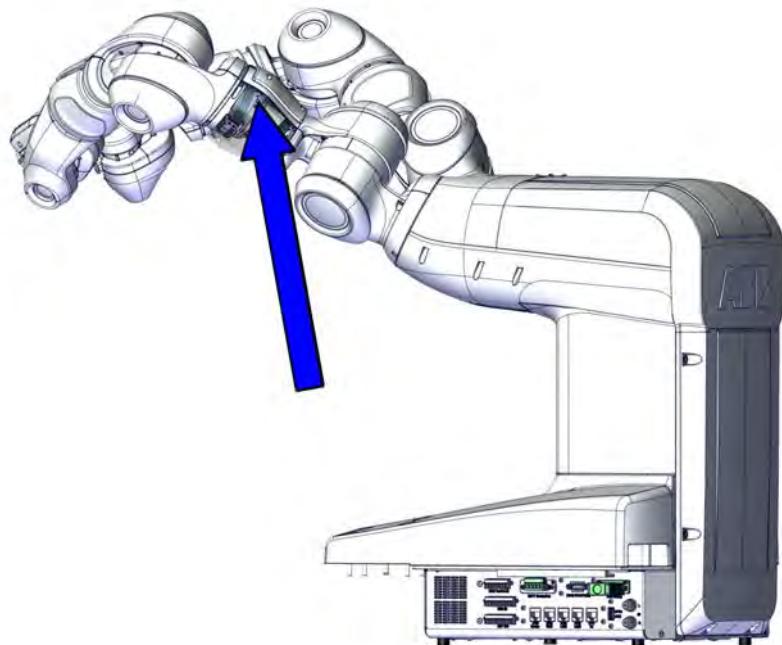
Continued

	Action	Note
2	 CAUTION 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 45.	

4.6.3 Replacing the axis-7 mechanical stop

Location of the mechanical stop

The mechanical stop is located as shown in the figure.



xx1500000748

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 14000* on ABB Library.

Spare part	Article number	Note
Mechanical stop for axis 7	3HAC047603-001	

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

Continues on next page

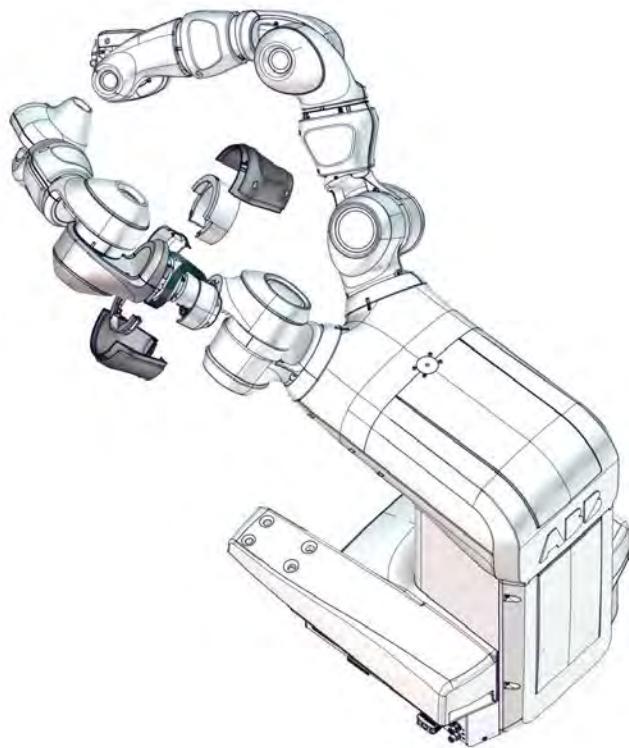
4 Repair

4.6.3 Replacing the axis-7 mechanical stop

Continued

Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



xx1500000749

Removing the mechanical stop

Use these procedures to remove the mechanical stop.

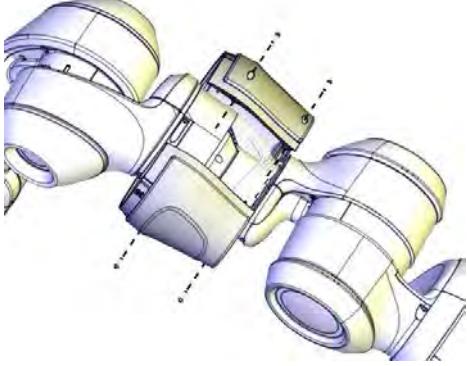
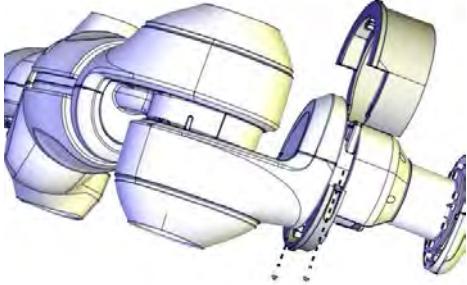
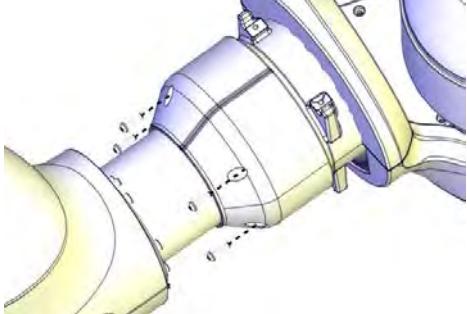
Preparations before removing the mechanical stop

	Action	Note
1	Jog the robot so that the covers can be easily accessed and removed.	
2	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none">• electric power supply• air pressure supply <p>to the robot, before starting the repair work on the robot.</p>	

Continues on next page

4.6.3 Replacing the axis-7 mechanical stop

Continued

Action	Note
3 Remove the axis-7 cover.	 xx1400002691
4 Remove the axis-7 ring (two parts).	 xx1500000742
5 Remove the axis-7 inner cable protection.	 xx1500000743

Removing the axis-7 mechanical stop

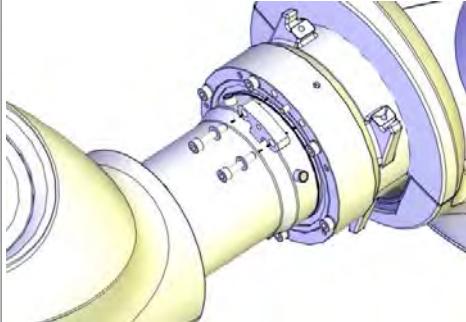
Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	

Continues on next page

4 Repair

4.6.3 Replacing the axis-7 mechanical stop

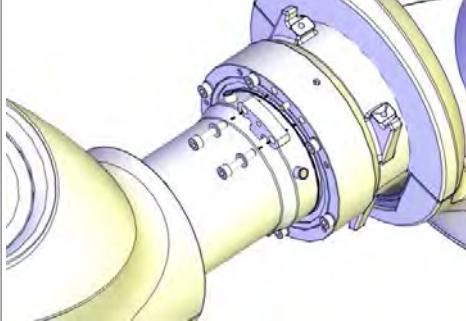
Continued

Action	Note
2 Remove the mechanical stop by removing the two screws and washers.	 xx1500000747

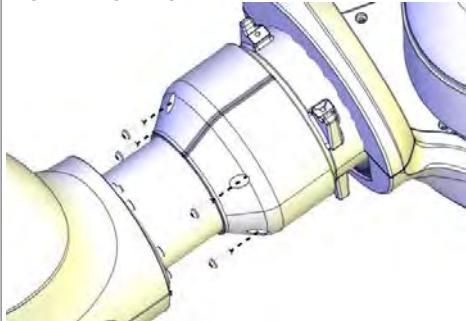
Refitting the mechanical stop

Use these procedures to refit the mechanical stop.

Refitting the axis-7 mechanical stop

Action	Note
1 Refit the mechanical stop with the screws and washers.	Mechanical stop for axis 7: 3HAC047603-001 Screws: 2 pcs. Tightening torque: 0.2 Nm.  xx1500000747

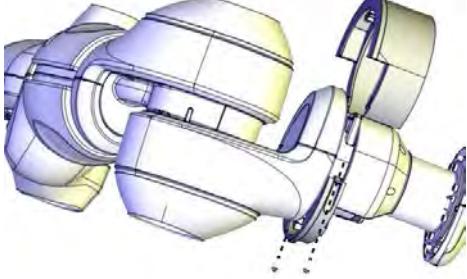
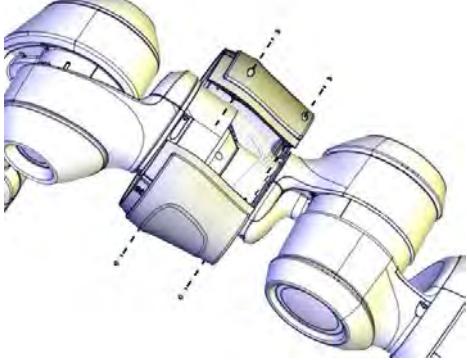
Refitting the covers

Action	Note
1 Refit the axis-7 inner cable protection.	Screws: 4 pcs. Tightening torque: 0.14 Nm.  xx1500000743

Continues on next page

4.6.3 Replacing the axis-7 mechanical stop

Continued

	Action	Note
2	Refit the axis-7 ring (two parts).	<p>Screws: 2 pcs. Tightening torque: 0.14 Nm.</p>  <p>xx1500000742</p>
3	Refit the axis-7 cover.	<p>Screws: 4 pcs. Tightening torque: 0.14 Nm.</p>  <p>xx1400002691</p>

Concluding procedure

	Action	Note
1	Recalibrate the robot.	See Calibration on page 431 .
2	<p> CAUTION</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 45.</p>	

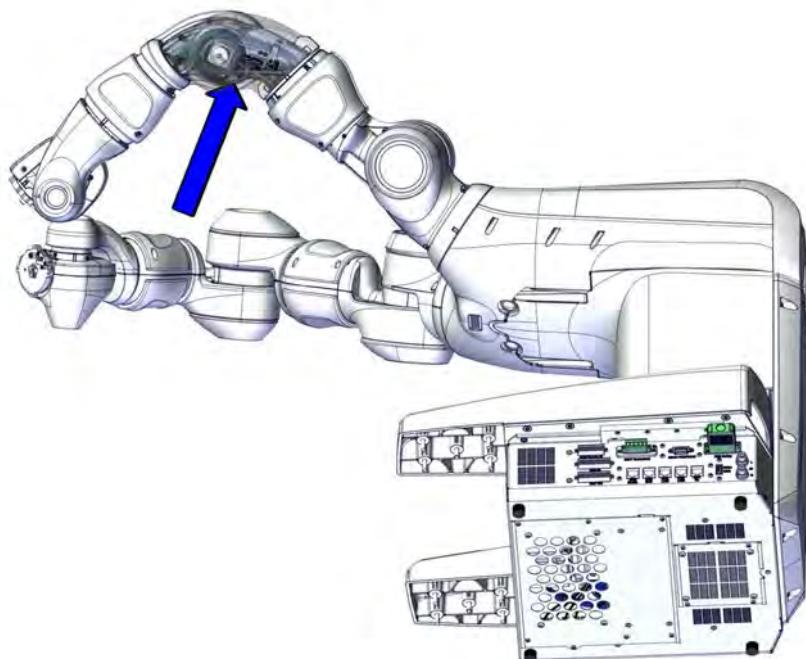
4 Repair

4.6.4 Replacing the axis-3 mechanical stop

4.6.4 Replacing the axis-3 mechanical stop

Location of the mechanical stop

The mechanical stop is located as shown in the figure.



xx1500000750

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 14000* on ABB Library.

Spare part	Article number	Note
Mechanical stop for axis 3	3HAC047603-001	

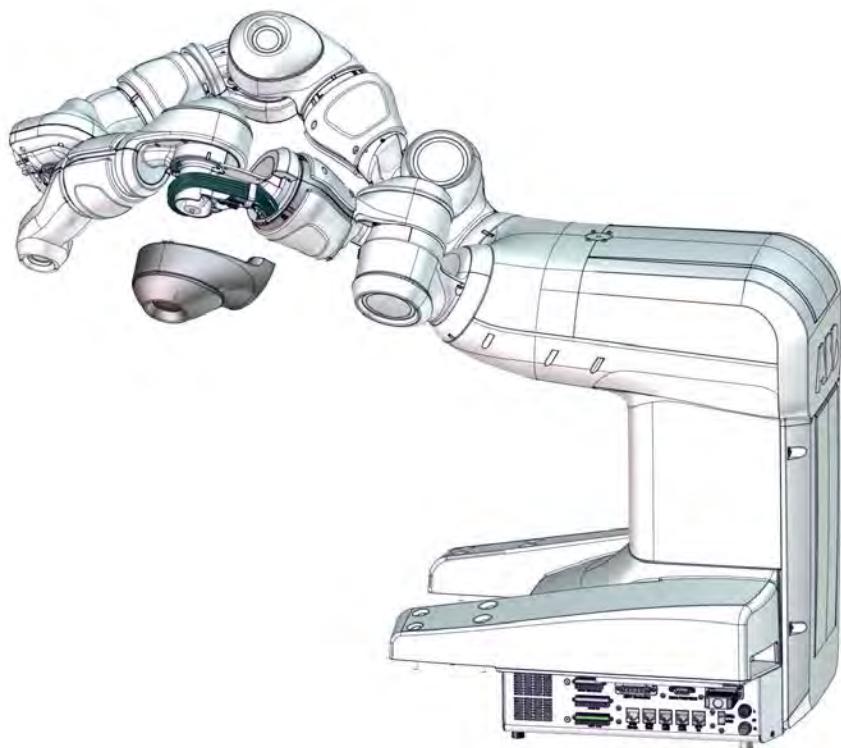
Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

Continues on next page

Covers to be removed for access

This figure shows an overview of which covers to remove to get access to the spare part. Detailed instructions of how to remove the covers are found in the removal procedure.



xx1400002862

Removing the mechanical stop

Use these procedures to remove the mechanical stop.

Preparations before removing the mechanical stop

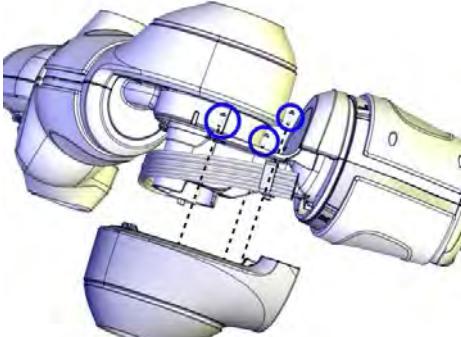
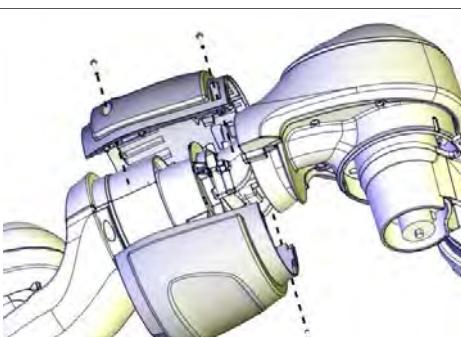
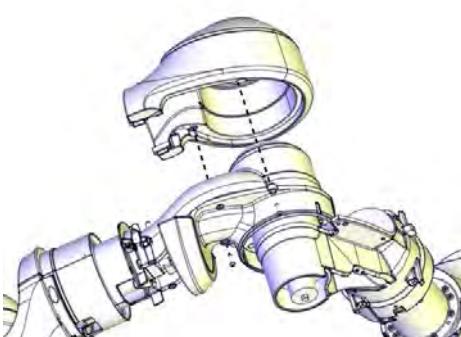
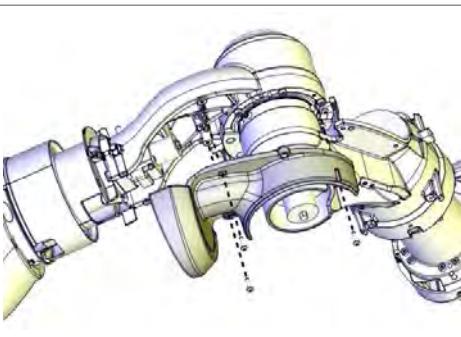
	Action	Note
1	Jog the robot so that the covers can be easily accessed and removed.	
2	<p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • air pressure supply <p>to the robot, before starting the repair work on the robot.</p>	

Continues on next page

4 Repair

4.6.4 Replacing the axis-3 mechanical stop

Continued

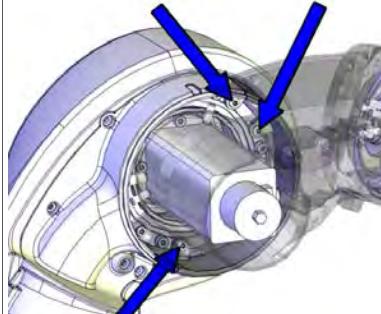
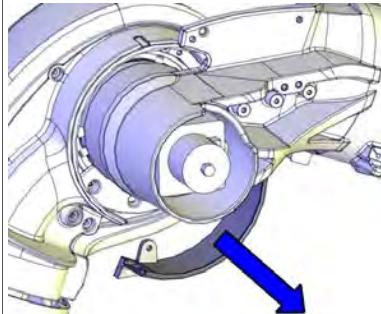
Action	Note
3 Remove the axis-3 cover.	 xx1400002751
4 Remove the lower axis-4 cover.	 xx1400002756
5 Remove the axis-3 body cover.	 xx1500000091
6 Remove the upper axis-3 cover.	 xx1500000093

Continues on next page

4.6.4 Replacing the axis-3 mechanical stop

Continued

Removing the axis-3 cable collar

	Action	Note
1	Turn on the power to the robot temporarily.	
2	Release the brakes and rotate axis 3 in order to access the axis-3 cable collar screws.	 xx1500000489
3	 DANGER Turn off the electric power supply again.	
4	Remove the screws and remove the cable collar.	 xx1500000756

Removing the axis-3 mechanical stop

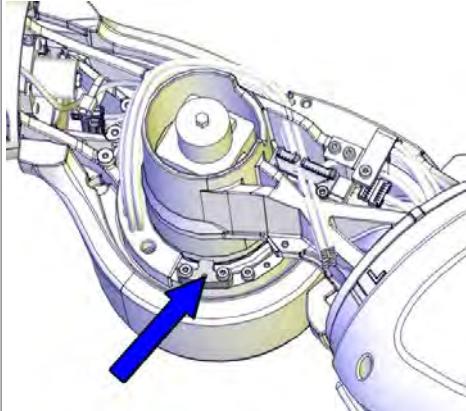
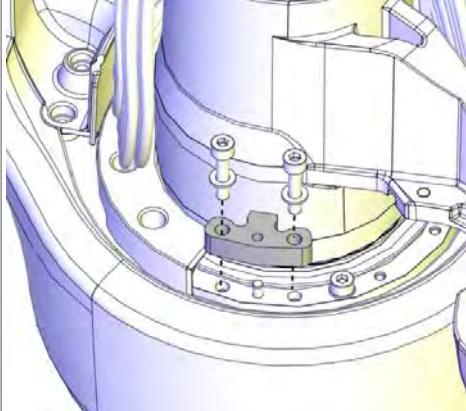
	Action	Note
1	 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2	Turn on the power to the robot temporarily.	

Continues on next page

4 Repair

4.6.4 Replacing the axis-3 mechanical stop

Continued

Action	Note
3 Release the brakes and rotate axis 3 in order to access the axis-3 mechanical stop.	 xx1500000755
4  DANGER Turn off the electric power supply again.	
5 Remove the mechanical stop by removing the two screws and washers.	 xx1500000753

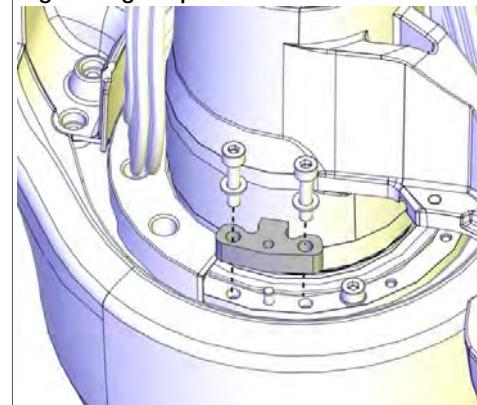
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4.6.4 Replacing the axis-3 mechanical stop

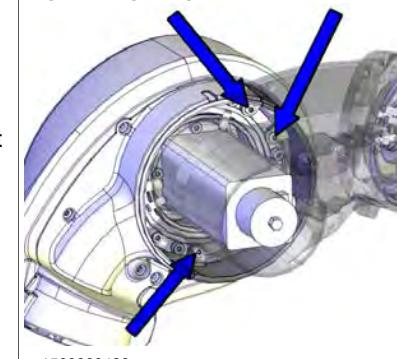
*Continued***Refitting the mechanical stop**

Use these procedures to refit the mechanical stop.

Refitting the axis-3 mechanical stop

	Action	Note
1	Refit the mechanical stop with the screws and washers.	Mechanical stop for axis 3: 3HAC047603-001 Screws: 2 pcs. Tightening torque: 0.2 Nm. 

Refitting the axis-3 cable collar

	Action	Note
1	Refit the cable collar.  Tip In order to access the screws it is helpful to release the brakes and manually move the robot arm. Temporarily turn on the power to the robot and release the brakes.	Screws: 3 pcs. Tightening torque: 0.14 Nm. 

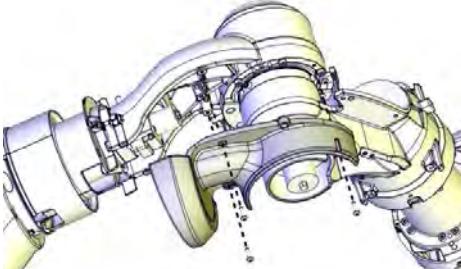
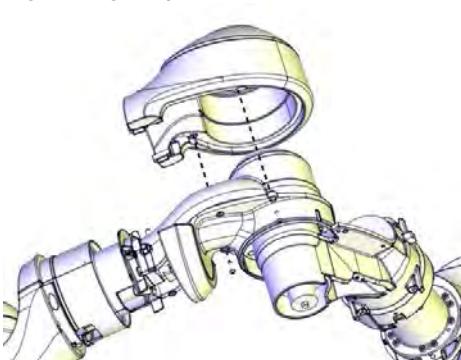
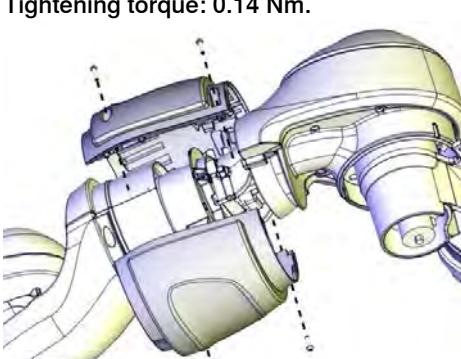
Continues on next page

4 Repair

4.6.4 Replacing the axis-3 mechanical stop

Continued

Refitting the covers

	Action	Note
1	Refit the upper axis-3 cover.	Screws: 3 pcs. Tightening torque: 0.14 Nm.  xx1500000093
2	Refit the axis-3 body cover.	Screws: 2 pcs. Tightening torque: 0.14 Nm.  xx1500000091
3	Remove the lower axis-4 cover.	Screws: 4 pcs. Tightening torque: 0.14 Nm.  xx1400002756

Continues on next page

4.6.4 Replacing the axis-3 mechanical stop

Continued

Action	Note
<p>4 Refit the axis-3 cover.</p> <p>CAUTION</p> <p>Be careful not to squeeze any cabling during the refitting procedure.</p>	<p>Screws: 3 pcs. Tightening torque: 0.14 Nm.</p> <p>xx1400002753</p>

Concluding procedure

Action	Note
1 Recalibrate the robot.	See Calibration on page 431 .
2 CAUTION 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 45 .	

4 Repair

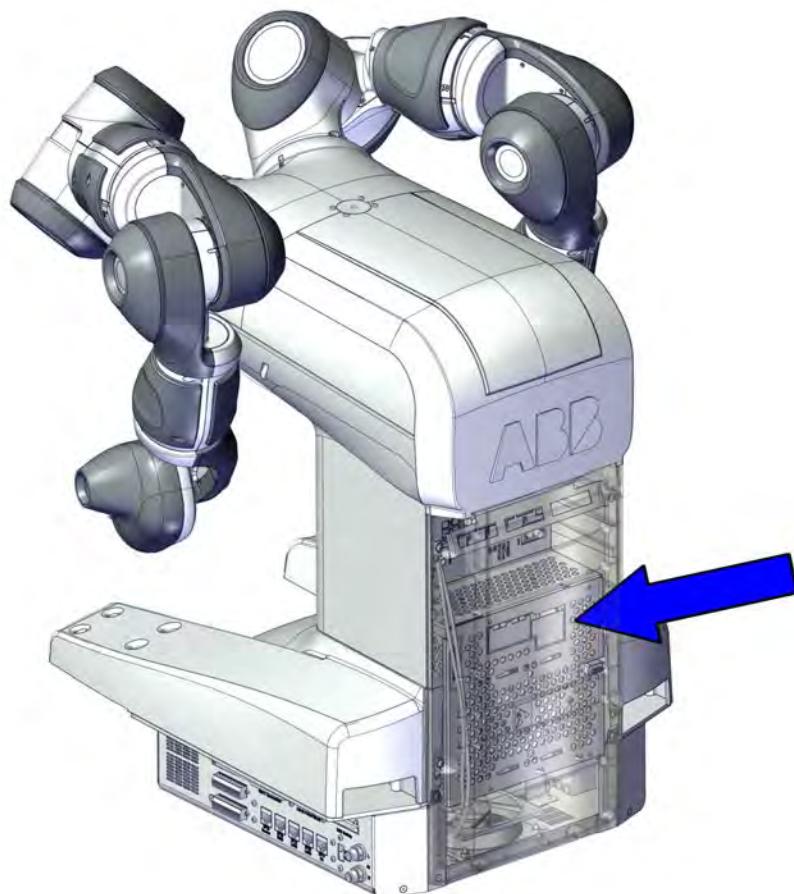
4.7.1 Replacing the computer

4.7 Controller

4.7.1 Replacing the computer

Location of the computer

The computer is located as shown in the figure.



xx1500000369

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 14000* on ABB Library.

Spare part	Article number	Note
DSQC1000 Computer	3HAC042766-001	

Required consumables

Consumable	Article number	Note
Cable ties	-	

Continues on next page

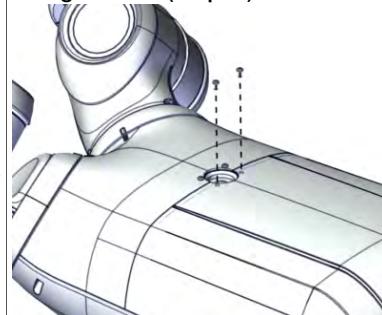
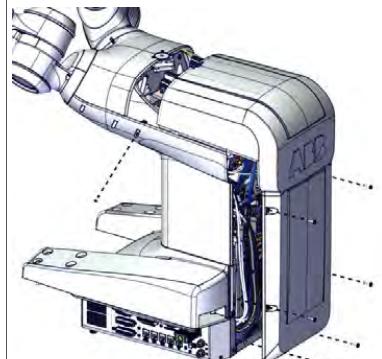
Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Trolley	-	

Removing the computer

Use these procedures to remove the computer.

Pulling the controller out partially

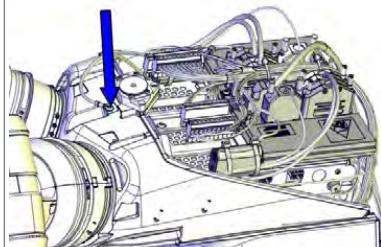
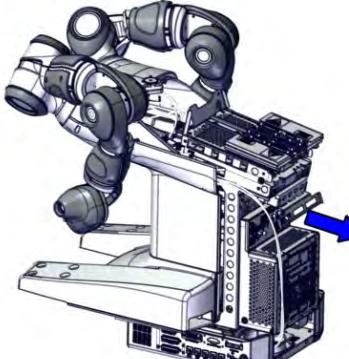
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • air pressure supply to the robot, before starting the repair work on the robot.	
2	 ELECTROSTATIC DISCHARGE (ESD) The equipment is sensitive to ESD. Before handling the equipment please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 47	Flange screw (10 pcs)  xx1500000525  xx1500000303

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4 Repair

4.7.1 Replacing the computer

Continued

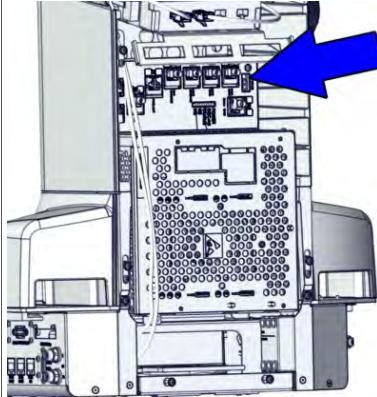
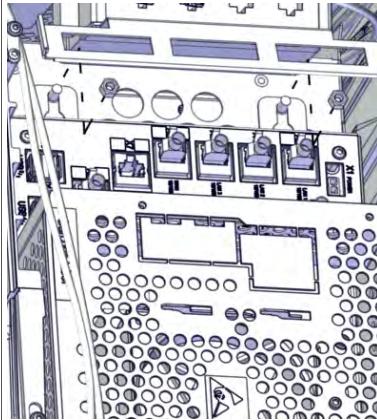
Action	Note
3 Remove the attachment screws that fasten the controller to the body.	 xx1500000364
4 Put a trolley beneath the controller.	
5 Disconnect the grounding cable.	 xx1500000601
6 Carefully pull the controller partially out in the rails.  CAUTION The cabling is still connected inside the robot, so be careful not to strain the cables!	 xx1500000365

Removing the computer

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

Continues on next page

4.7.1 Replacing the computer
Continued

Action	Note
<p>2 Separate the cabling in front of the computer, cut cable ties if necessary.</p> <p>! CAUTION Be careful not to bend or break the cables and air hoses.</p>	
<p>3 Disconnect the connectors:</p> <ul style="list-style-type: none"> • A31.USB (X10) • A31.X9 (X9) • A31.X6 (X6) • A31.X5 (X5) • A31.X4 (X4) • A31.X3 (X3) • A31.XS1 (X1) • A31.SERVICE (X2) 	 xx1500000371
4 Cut cable ties from the disconnected cables if necessary.	
<p>5 (Depending on which connection is installed) Disconnect the connector:</p> <ul style="list-style-type: none"> • Profibus/S: A32.2 • Ethernet/IP/S: A32.1 • Profinet/S: A32.3 	
6 Loosen the nuts holding the computer.	 xx1500000386
7 Gently push the computer upwards a little bit to release the latches from the recesses.	
8 Disconnect the connection (underneath computer): A35.J1 D-NET	
9 Tilt the computer out and remove it from the controller.	

Continues on next page

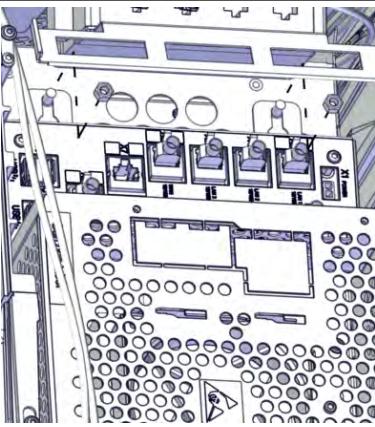
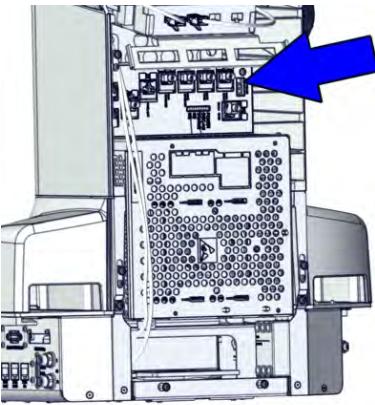
4 Repair

4.7.1 Replacing the computer

Continued

Refitting the computer

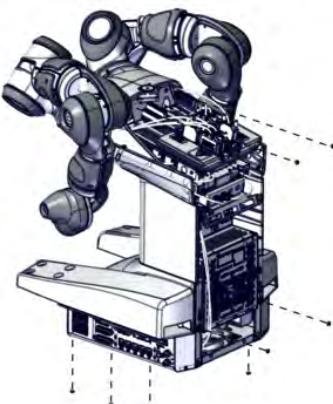
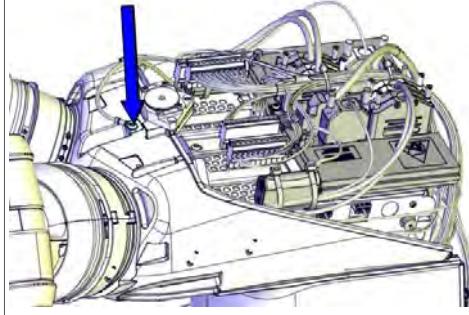
Refitting the computer

	Action	Note
1	Fit the computer.	DSQC1000 Computer: 3HAC042766-001
2	Connect the and tighten the connector (underneath computer) A35.J1 D-NET	
3	Slide the computer downwards to fit the latches in the recesses.	
4	Tighten the nuts, holding the computer.	 xx1500000386
5	(Depending on which connection is installed) Connect the connector: <ul style="list-style-type: none">• Profibus/S: A32.2• Ethernet/IP/S: A32.1• Profinet/S: A32.3	
6	Connect the connectors: <ul style="list-style-type: none">• A31.USB (X10)• A31.X9 (X9)• A31.X6 (X6)• A31.X5 (X5)• A31.X4 (X4)• A31.X3 (X3)• A31.XS1 (X1)• A31.SERVICE (X2)	 xx1500000371
7	Fasten the cabling with cable ties.  CAUTION Be careful not to bend or break the cables and air hoses.	

Continues on next page

4.7.1 Replacing the computer
Continued

Pushing the controller in and fastening it

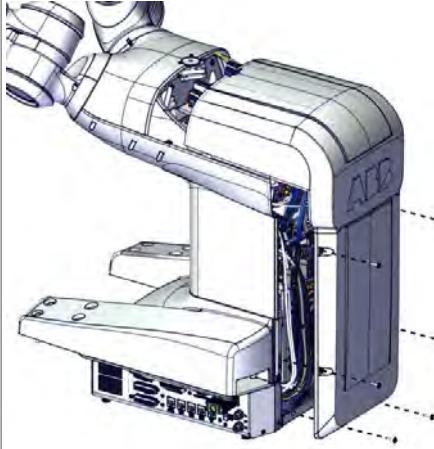
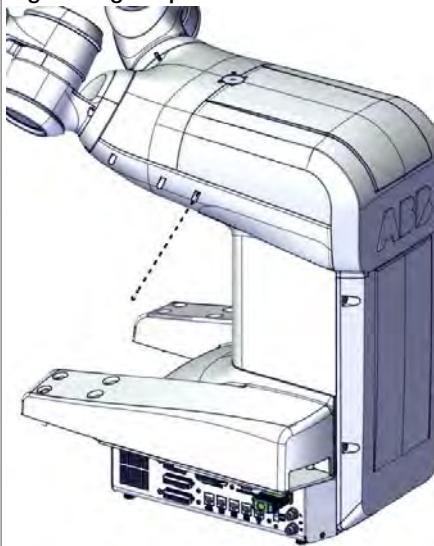
	Action	Note
1	Gently push the controller into the robot body completely. ! CAUTION Be careful not to squeeze or damage the cables and air hoses in any way.	
2	Refit the attachment screws that fasten the controller to the body.	Screws: 10 pcs. Tightening torque: 0.9 Nm.  xx1500000364
3	Connect the grounding cable.	 xx1500000601

Continues on next page

4 Repair

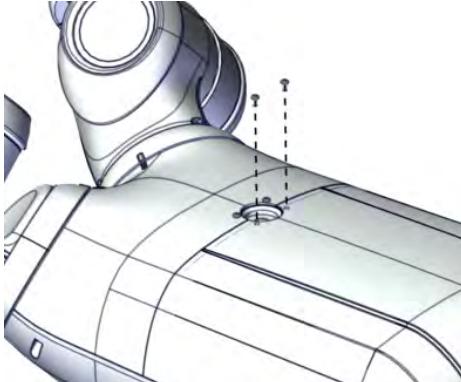
4.7.1 Replacing the computer

Continued

	Action	Note
4	Refit the body cover with the attachment screws.	<p>Flange screw (6 pcs) Tightening torque: 0.9 Nm</p>  <p>xx1500000697</p>
5	Refit the two remaining screws of the body cover.	<p>Flange screw (2 pcs) Tightening torque: 0.2 Nm</p>  <p>xx1500000696</p>

Continues on next page

4.7.1 Replacing the computer
Continued

	Action	Note
6	Refit the attachment screws.	<p>Flange screw (2 pcs) Tightening torque: 0.2 Nm</p>  <p>xx1500000525</p>
7	 CAUTION <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 45.</p>	

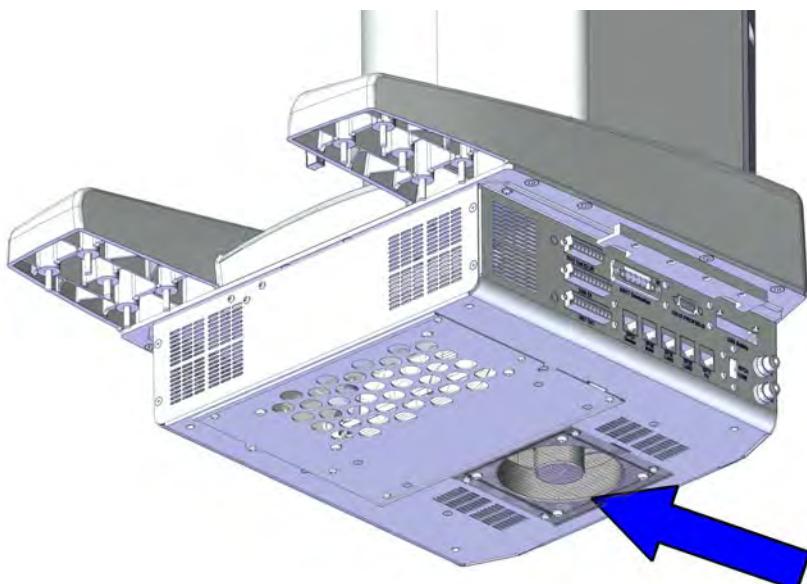
4 Repair

4.7.2 Replacing the controller fan

4.7.2 Replacing the controller fan

Location of the controller fan

The controller fan is located as shown in the figure.



xx1500000309

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 14000* on ABB Library.

Spare part	Article number	Note
Fan with receptacle	3HAC026525-001	

Required tools and equipment

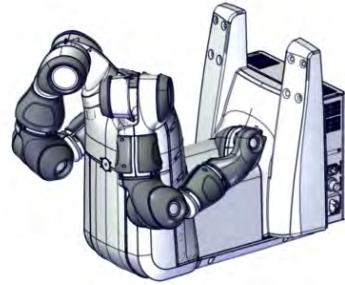
Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Trolley	-	

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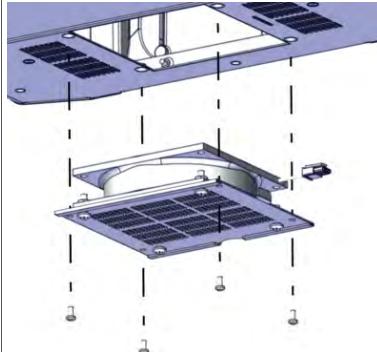
Removing the fan

Use this procedure to remove the fan.

Preparations before removing the fan

	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • air pressure supply to the robot, before starting the repair work on the robot.	
2	Check if there is enough space beneath the robot to remove the bottom cover. If not: <ul style="list-style-type: none"> • Place the robot in its calibration position. • Remove the fastening screws. • Put the robot on a flat and stable surface in the following position: 	 xx1500000370

Removing the fan

	Action	Note
1	 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2	Remove the bottom cover.  CAUTION Be careful not to damage the cables.	 xx1500000310
3	Disconnect the fan connector: <ul style="list-style-type: none"> • E1.XS1 	

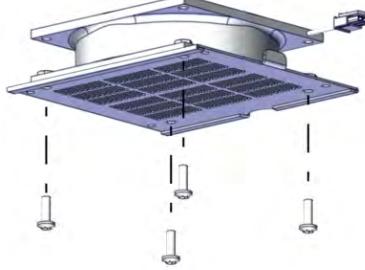
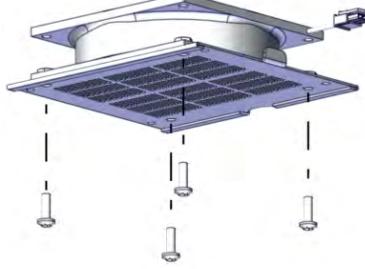
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4 Repair

4.7.2 Replacing the controller fan

Continued

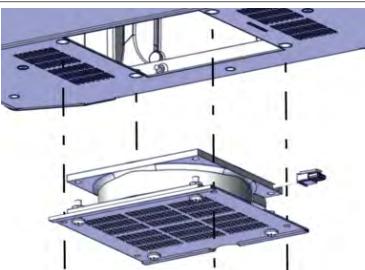
Replacing the fan

Action	Note
1 Remove the attachment screws.	 xx1500000311
2 Remove the fan.	
3 Fit the new fan on the bottom cover and tighten the attachment screws.	Fan with receptacle: 3HAC026525-001  xx1500000311

Refitting the fan

Use this procedure to refit the fan.

Refitting the fan

Action	Note
1 Connect the fan connector. <ul style="list-style-type: none">• E1.XS1	
2 Refit the bottom cover and tighten the screws.  CAUTION Be careful not to damage the cables.	 xx1500000310

Continues on next page

Concluding procedure

	Action	Note
1	 CAUTION 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 45.	

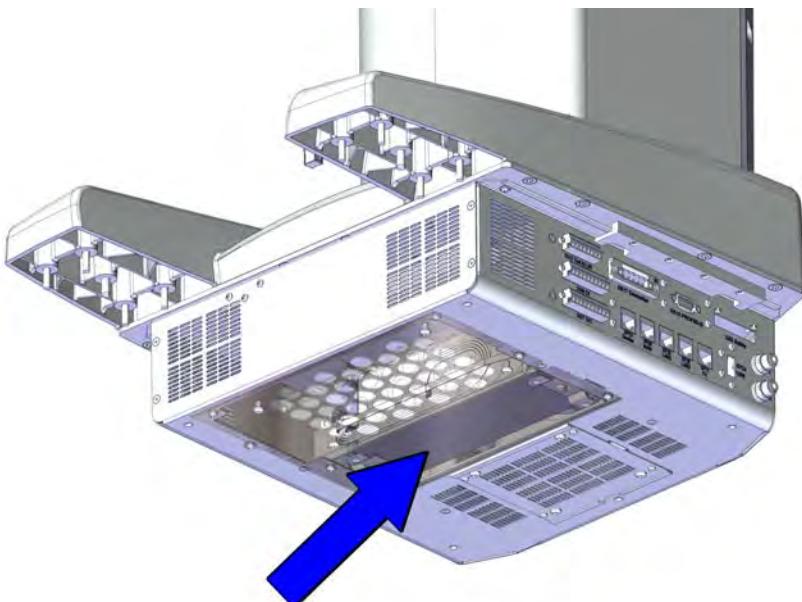
4 Repair

4.7.3 Replacing the capacitor bank

4.7.3 Replacing the capacitor bank

Location of the capacitor bank

The capacitor bank is located as shown in the figure.



xx1500000265

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 14000* on ABB Library.

Spare part	Article number	Note
Capacitor bank	3HAC025562-001	

Required consumables

Consumable	Article number	Note
Cable ties	-	If removed

Required tools and equipment

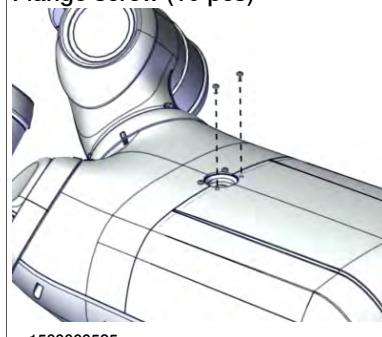
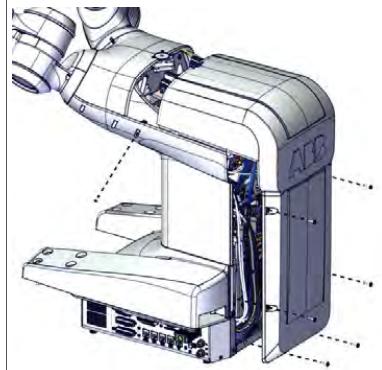
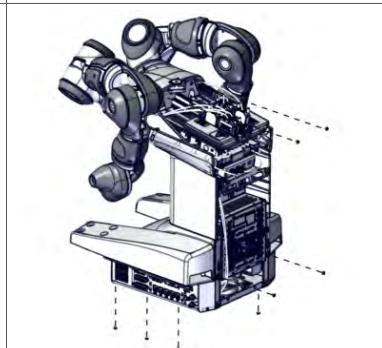
Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Trolley	-	

Continues on next page

Removing the capacitor bank

Use this procedure to remove the capacitor bank.

Pulling the controller out partially

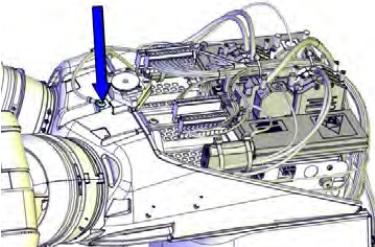
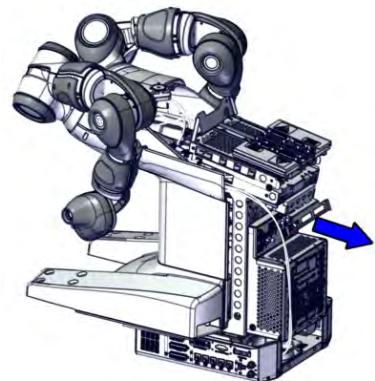
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • air pressure supply to the robot, before starting the repair work on the robot.	
2	 ELECTROSTATIC DISCHARGE (ESD) The equipment is sensitive to ESD. Before handling the equipment please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 47	Flange screw (10 pcs)  xx1500000525  xx1500000303
3	Remove the attachment screws that fasten the controller to the body.	 xx1500000364
4	Put a trolley beneath the controller.	

Continues on next page

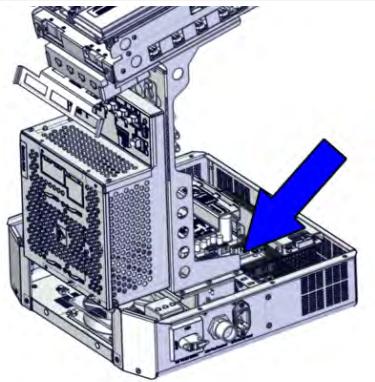
4 Repair

4.7.3 Replacing the capacitor bank

Continued

Action	Note
5 Disconnect the grounding cable.	 xx1500000601
6 Carefully pull the controller partially out in the rails.  CAUTION The cabling is still connected inside the robot, so be careful not to strain the cables!	 xx1500000365

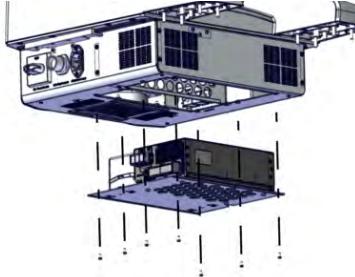
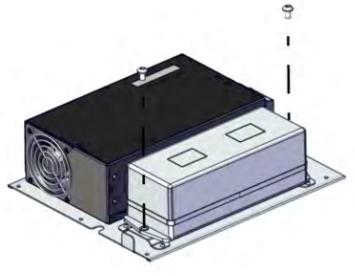
Removing the capacitor bank

Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2 Disconnect the capacitor bank connector, cut cable ties if necessary: • PDB.X7	 xx1500000307

Continues on next page

4.7.3 Replacing the capacitor bank

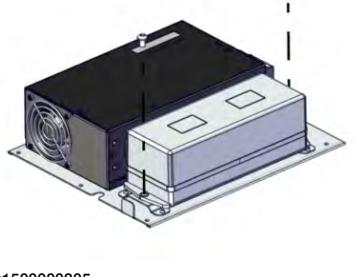
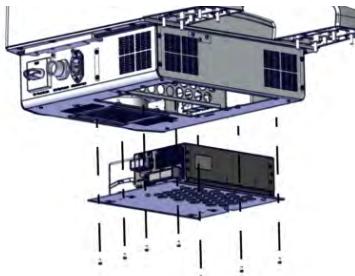
Continued

Action	Note
3 Remove the bottom cover. ! CAUTION Be careful not to damage the cables.	 xx1500000268
4 Remove the attachment screws.	 xx1500000305

Refitting the capacitor bank

Use this procedure to refit the capacitor bank.

Refitting the capacitor bank

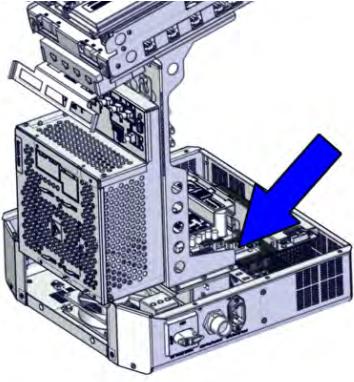
Action	Note
1 Place the new capacitor bank and tighten the attachment screws.	Capacitor bank: 3HAC025562-001  xx1500000305
2 Refit the bottom cover and tighten screws. ! CAUTION Be careful not to damage the cables.	 xx1500000268

Continues on next page

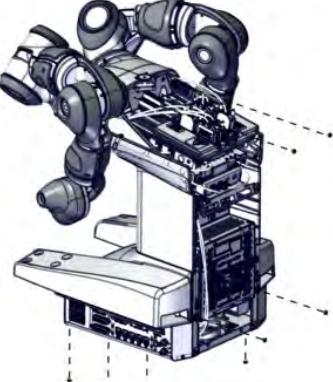
4 Repair

4.7.3 Replacing the capacitor bank

Continued

Action	Note
<p>3 Route cables and connect capacitor bank connector:</p> <ul style="list-style-type: none"> • PDB.X7 	 xx1500000307
<p>4 Fasten cables with cable ties.</p> <p>! CAUTION Be careful not to bend or break the cables.</p>	

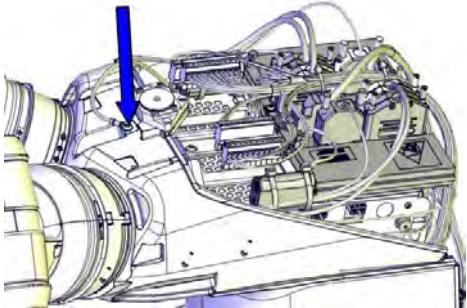
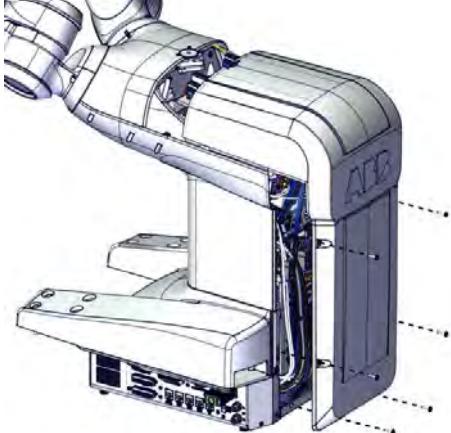
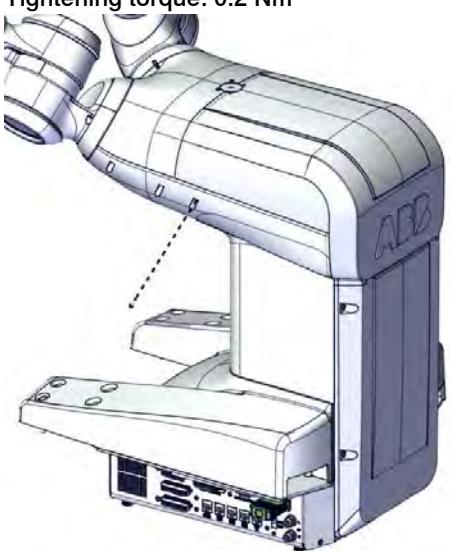
Pushing the controller in and fastening it

Action	Note
<p>1 Gently push the controller into the robot body completely.</p> <p>! CAUTION Be careful not to squeeze or damage the cables and air hoses in any way.</p>	
<p>2 Refit the attachment screws that fasten the controller to the body.</p>	Screws: 10 pcs. Tightening torque: 0.9 Nm.  xx1500000364

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4.7.3 Replacing the capacitor bank

Continued

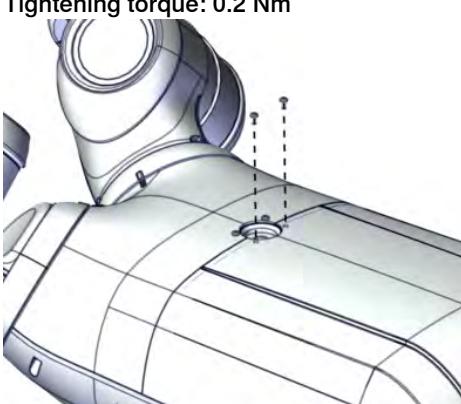
Action	Note
3 Connect the grounding cable.	 xx1500000601
4 Refit the body cover with the attachment screws.	Flange screw (6 pcs) Tightening torque: 0.9 Nm  xx1500000697
5 Refit the two remaining screws of the body cover.	Flange screw (2 pcs) Tightening torque: 0.2 Nm  xx1500000696

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4 Repair

4.7.3 Replacing the capacitor bank

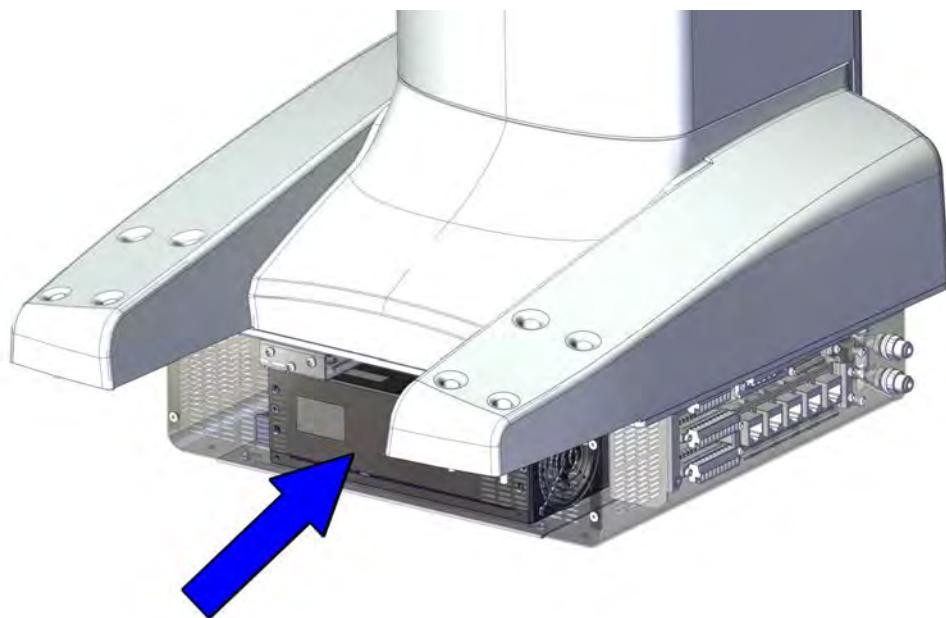
Continued

	Action	Note
6	Refit the attachment screws.	<p>Flange screw (2 pcs) Tightening torque: 0.2 Nm</p>  <p>xx1500000525</p>
7	 CAUTION 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 45.	

4.7.4 Replacing the power supply

Location of the power supply

The power supply is located as shown in the figure.



xx1500000306

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 14000* on ABB Library.

Spare part	Article number	Note
Power supply	3HAC047966-001	

Required consumables

Consumable	Article number	Note
Cable ties		If removed

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Trolley	-	

Continues on next page

4 Repair

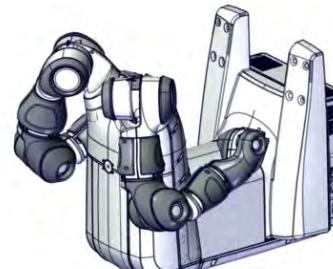
4.7.4 Replacing the power supply

Continued

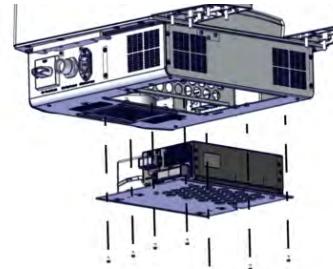
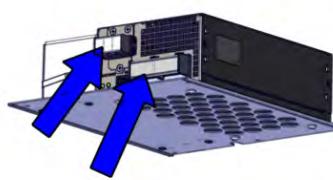
Removing the power supply

Use this procedure to remove the power supply.

Preparations before removing the power supply

	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• air pressure supply to the robot, before starting the repair work on the robot.	
2	Check if there is enough space beneath the robot to remove the bottom cover. If not: <ul style="list-style-type: none">• Place the robot in its calibration position.• Remove the fastening screws.• Put the robot on a flat and stable surface in the following position:	 xx1500000370

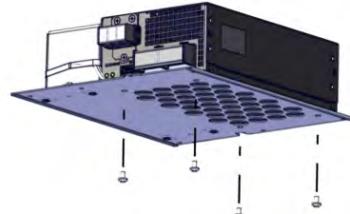
Removing the power supply

	Action	Note
1	 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2	Remove the bottom cover.  CAUTION Be careful not to damage the cables.	 xx1500000268
3	Remove the plastic covers on the connectors on the side of the power supply.	 xx1500000286

Continues on next page

4.7.4 Replacing the power supply

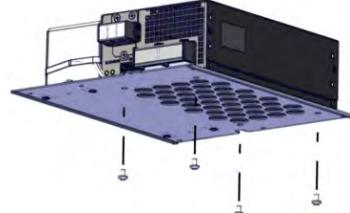
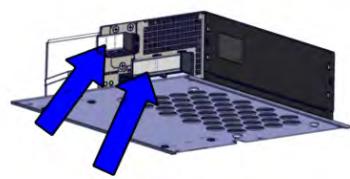
Continued

Action	Note
4 Disconnect the cables, cut cable ties if necessary: <ul style="list-style-type: none"> • G1.SK2 • G1.(-) • G1.(+) • G1.N • G1.L • GND 	
5 Remove the attachment screws that fastens the power supply.	 xx1500000287

Refitting the power supply

Use this procedure to refit the power supply.

Refitting the power supply

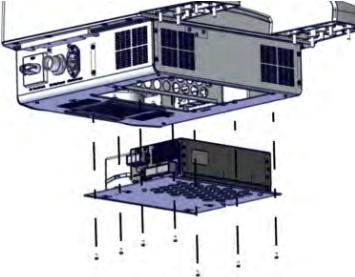
Action	Note
1 Place the new power supply on the bottom cover and tighten the attachment screws.	Power supply: 3HAC047966-001  xx1500000287
2 Connect the cables on the side of the power supply. <ul style="list-style-type: none"> • G1.SK2 • G1.(-) • G1.(+) • G1.N • G1.L • GND 	
3 Fasten the cables with cable ties.	
4 Refit the plastic covers over the connectors on the side of the power supply.	 xx1500000286

Continues on next page

4 Repair

4.7.4 Replacing the power supply

Continued

	Action	Note
5	<p>Refit the bottom cover and tighten screws.</p> <p> CAUTION</p> <p>Be careful not to damage the cables.</p>	 xx1500000268

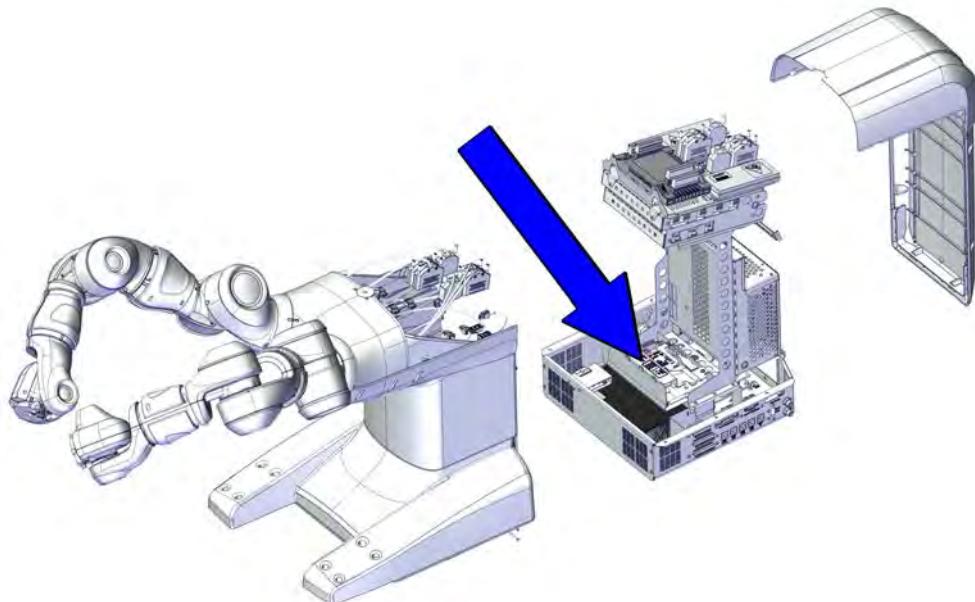
Concluding procedure

	Action	Note
1	If robot was put down for repair: <ul style="list-style-type: none">Fit the robot on the tableFasten the robot with the attachment screws.	Screw M5x25 (8 pcs) Quality: 8.8 Tightening torque: $3.8 \text{ Nm} \pm 0.38 \text{ Nm}$
2	Recalibrate the robot.	See Calibration on page 431 .
3	<p> CAUTION</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 45.</p>	

4.7.5 Replacing the power distribution board

Location of the power distribution board

The power distribution board is located as in the figure.



xx1500000269

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 14000* on ABB Library.

Spare part	Article number	Note
DSQC 662 Power distribution board	3HAC026254-001	

Required consumables

Consumable	Article number	Note
Cable ties	-	If removed

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Trolley	-	

Continues on next page

4 Repair

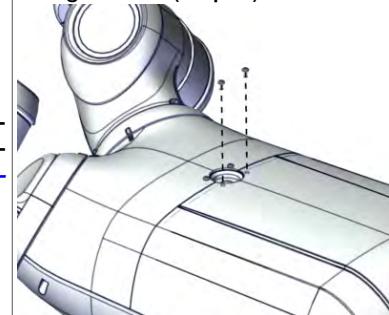
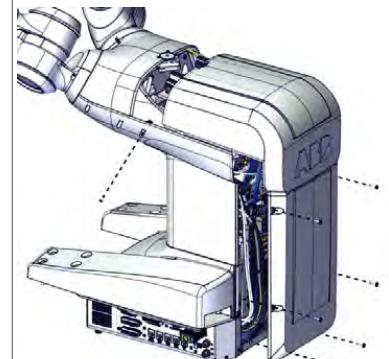
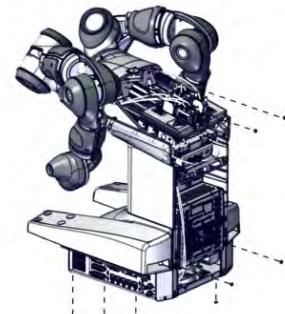
4.7.5 Replacing the power distribution board

Continued

Removing the power distribution board

Use this procedure to remove the power distribution board.

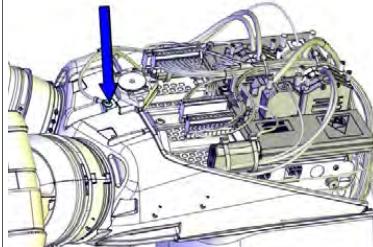
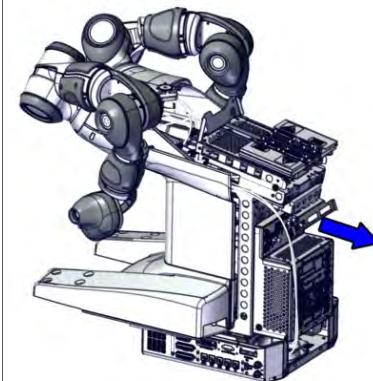
Pulling the controller out partially

	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• air pressure supply to the robot, before starting the repair work on the robot.	
2	 ELECTROSTATIC DISCHARGE (ESD) The equipment is sensitive to ESD. Before handling the equipment please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 47	Flange screw (10 pcs)  xx1500000525  xx1500000303
3	Remove the attachment screws that fasten the controller to the body.	 xx1500000364
4	Put a trolley beneath the controller.	

Continues on next page

4.7.5 Replacing the power distribution board

Continued

Action	Note
5 Disconnect the grounding cable.	 xx1500000601
6 Carefully pull the controller partially out in the rails.  CAUTION The cabling is still connected inside the robot, so be careful not to strain the cables!	 xx1500000365

Removing the power distribution board

Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2 Cut cable tie at (X8).	 Tip Take a photograph of the cable placements to use at refit.
3 Disconnect the connectors: <ul style="list-style-type: none">• G2.X8 (X8)• G2.XS2 (X2)• G2.XS1 (X1)• G2.XS3 (X3)• G2.XS6 (X6)• G2.XS5 (X5)• G2.XS7 (X7)• G2.XS4 (X4)	

Continues on next page

4 Repair

4.7.5 Replacing the power distribution board

Continued

Action	Note
4 Loosen the left attachment screw and remove the right attachment screw.	 xx1500000308
5 Slide the power distribution board to the right.	
6 Lift the power distribution board out.	

Refitting the power distribution board

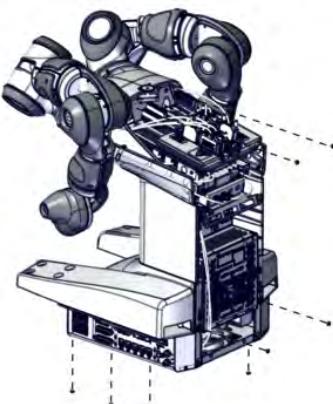
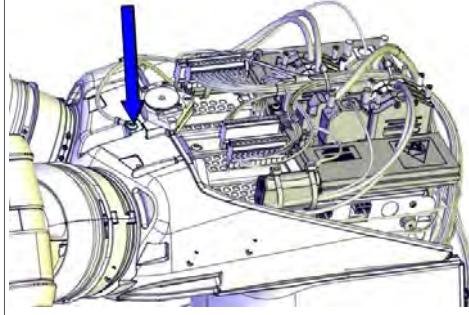
Use this procedure to refit the power distribution board.

Refitting the power distribution board

Action	Note
1 Place the power distribution board and slide it to the left.	DSQC 662 Power distribution board: 3HAC026254-001
2 Tighten the left attachment screw and refit the right attachment screw.	 xx1500000308
3 Connect the connectors: <ul style="list-style-type: none">• G2.X8 (X8)• G2.XS2 (X2)• G2.XS1 (X1)• G2.XS3 (X3)• G2.XS6 (X6)• G2.XS5 (X5)• G2.XS7 (X7)• G2.XS4 (X4)	
4 Put two cable ties around the plate and the G2.X8 connector.	

Continues on next page

Pushing the controller in and fastening it

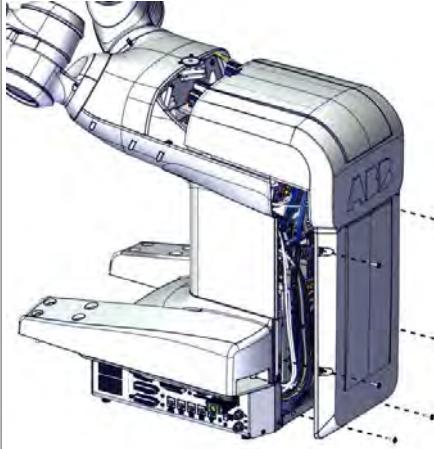
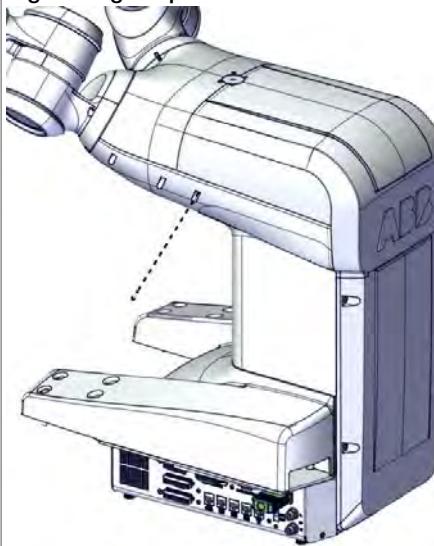
	Action	Note
1	Gently push the controller into the robot body completely. ! CAUTION Be careful not to squeeze or damage the cables and air hoses in any way.	
2	Refit the attachment screws that fasten the controller to the body.	Screws: 10 pcs. Tightening torque: 0.9 Nm.  xx1500000364
3	Connect the grounding cable.	 xx1500000601

Continues on next page

4 Repair

4.7.5 Replacing the power distribution board

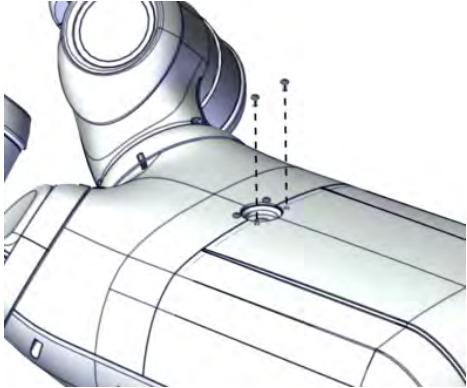
Continued

	Action	Note
4	Refit the body cover with the attachment screws.	<p>Flange screw (6 pcs) Tightening torque: 0.9 Nm</p>  <p>xx1500000697</p>
5	Refit the two remaining screws of the body cover.	<p>Flange screw (2 pcs) Tightening torque: 0.2 Nm</p>  <p>xx1500000696</p>

Continues on next page

4.7.5 Replacing the power distribution board

Continued

	Action	Note
6	Refit the attachment screws.	<p>Flange screw (2 pcs) Tightening torque: 0.2 Nm</p>  <p>xx1500000525</p>
7	 CAUTION 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 45.	

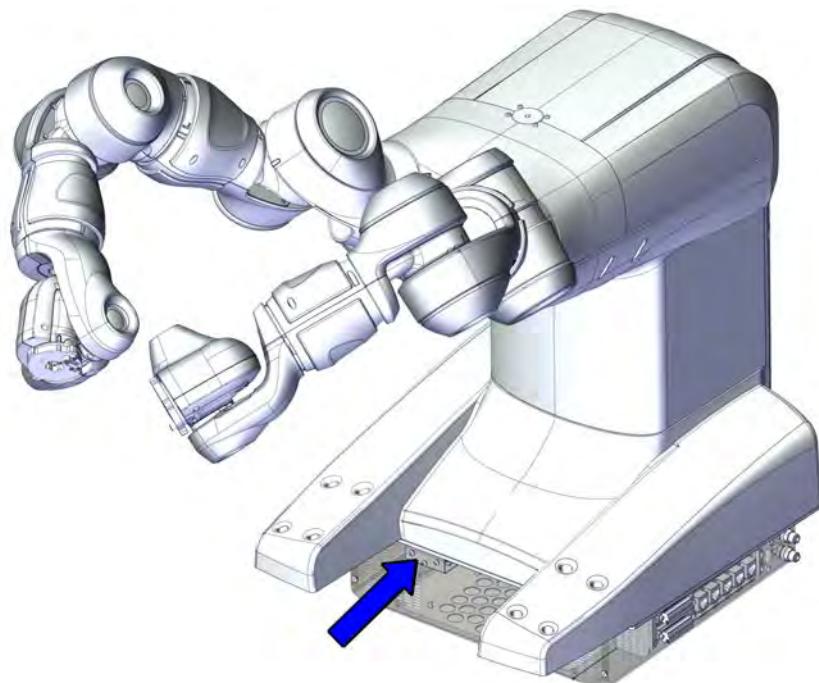
4 Repair

4.7.6 Replacing the external power distribution board

4.7.6 Replacing the external power distribution board

Location of the external power distribution board

The external power distribution board is located as shown in the figure.



xx1500000399

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 14000* on ABB Library.

Spare part	Article number	Note
DSQC 461 PDB ext unit	3HAC049570-001	

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Trolley	-	

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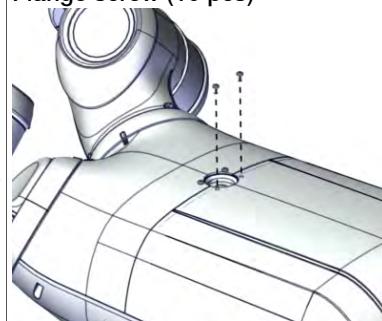
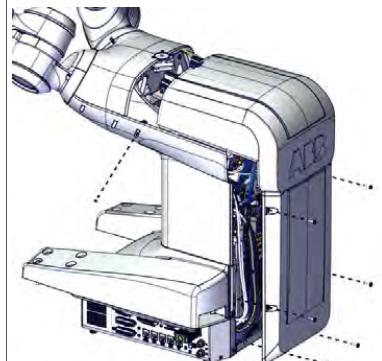
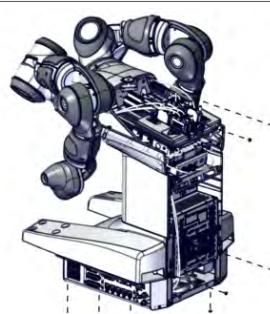
4.7.6 Replacing the external power distribution board

Continued

Removing the external power distribution board

Use this procedure to remove the external power distribution board.

Pulling the controller out partially

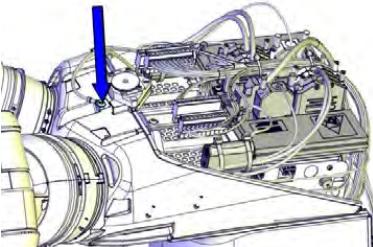
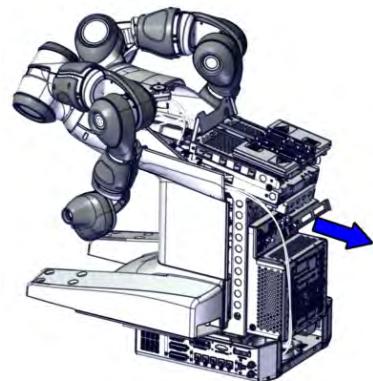
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • air pressure supply to the robot, before starting the repair work on the robot.	
2	 ELECTROSTATIC DISCHARGE (ESD) The equipment is sensitive to ESD. Before handling the equipment please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 47	Flange screw (10 pcs)  xx1500000525  xx1500000303
3	Remove the attachment screws that fasten the controller to the body.	 xx1500000364
4	Put a trolley beneath the controller.	

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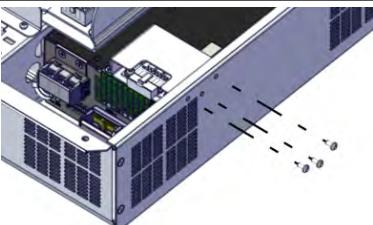
4 Repair

4.7.6 Replacing the external power distribution board

Continued

Action	Note
5 Disconnect the grounding cable.	 xx1500000601
6 Carefully pull the controller partially out in the rails.  CAUTION The cabling is still connected inside the robot, so be careful not to strain the cables!	 xx1500000365

Removing the external power distribution board

Action	Note
1 Disconnect the connector G2.1.X1.	
2 Remove the attachment screws.	 xx1500000400

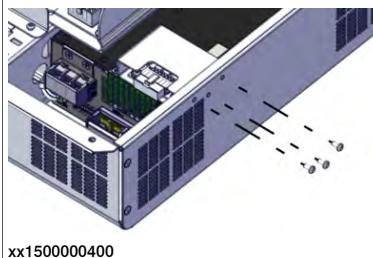
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4.7.6 Replacing the external power distribution board

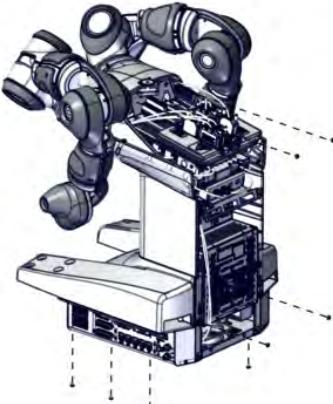
*Continued***Refitting the external power distribution board**

Use this procedure to refit the external power distribution board.

Refitting the external power supply

	Action	Note
1	Fit the external power distribution board and tighten the attachment screws.	DSQC 461 PDB ext unit: 3HAC049570-001 
2	Connect the connector G2.1.X1.	
3	Place the cabling flat to be able to push the controller back into the robot.	

Pushing the controller in and fastening it

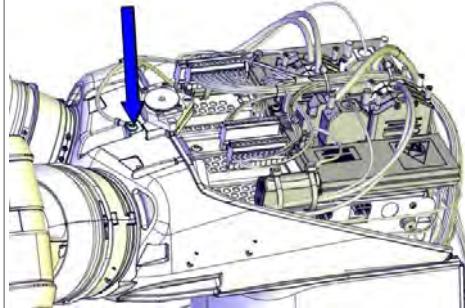
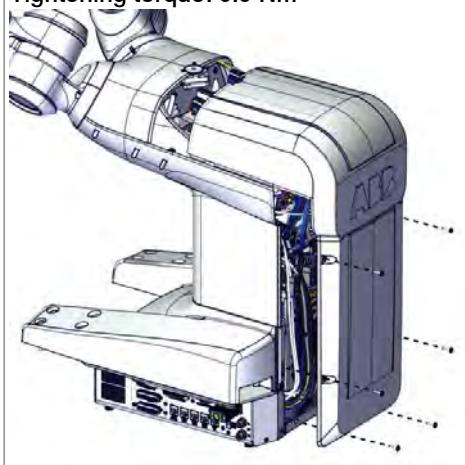
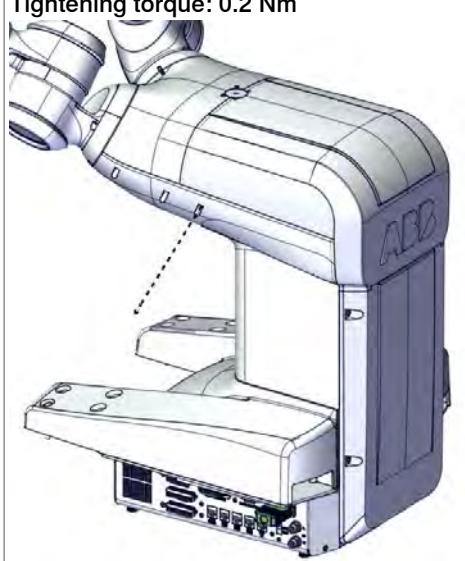
	Action	Note
1	Gently push the controller into the robot body completely.  CAUTION Be careful not to squeeze or damage the cables and air hoses in any way.	
2	Refit the attachment screws that fasten the controller to the body.	Screws: 10 pcs. Tightening torque: 0.9 Nm. 

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4 Repair

4.7.6 Replacing the external power distribution board

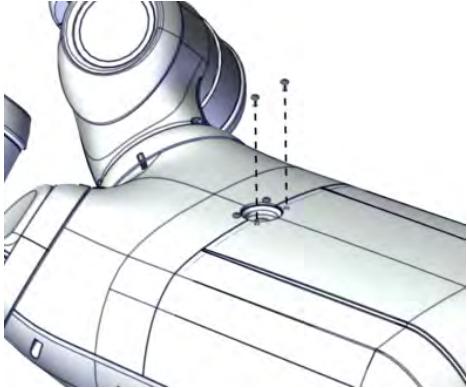
Continued

Action	Note
3 Connect the grounding cable.	 xx1500000601
4 Refit the body cover with the attachment screws.	Flange screw (6 pcs) Tightening torque: 0.9 Nm  xx1500000697
5 Refit the two remaining screws of the body cover.	Flange screw (2 pcs) Tightening torque: 0.2 Nm  xx1500000696

Continues on next page

4.7.6 Replacing the external power distribution board

Continued

	Action	Note
6	Refit the attachment screws.	<p>Flange screw (2 pcs) Tightening torque: 0.2 Nm</p>  <p>xx1500000525</p>
7	 CAUTION <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 45.</p>	

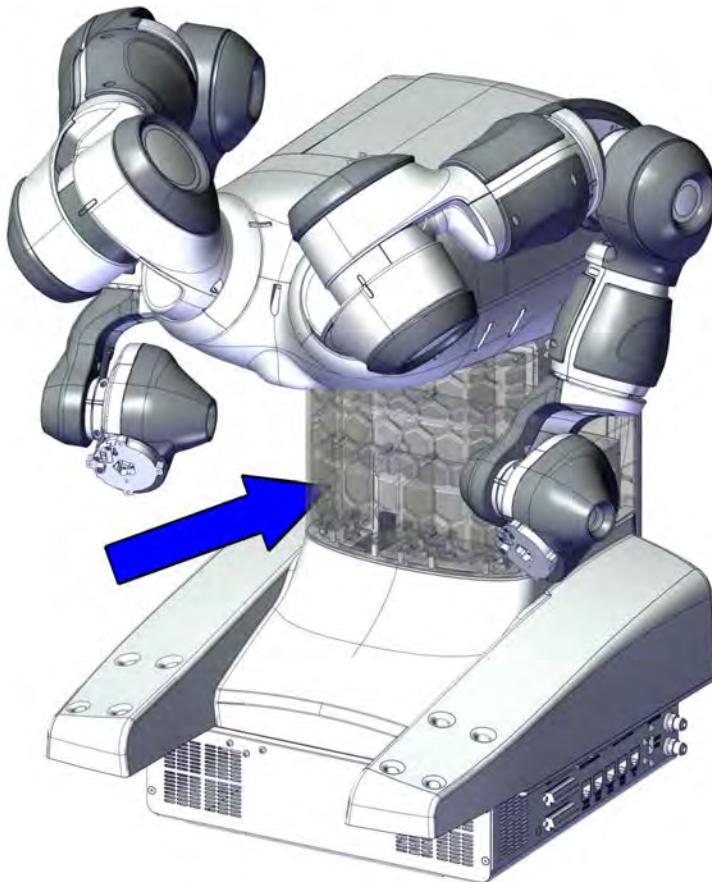
4 Repair

4.7.7 Replacing the axis computer

4.7.7 Replacing the axis computer

Location of the axis computer

The axis computer is located as shown in the figure.



xx1500000351

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 14000* on ABB Library.

Spare part	Article number	Note
DSQC1013 Axis computer	3HAC049969-001	

Required tools and equipment

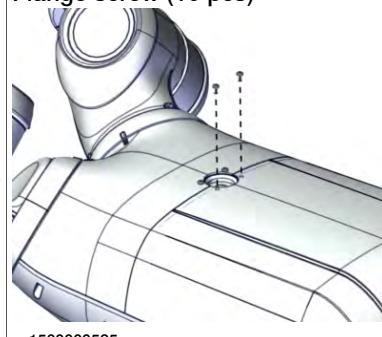
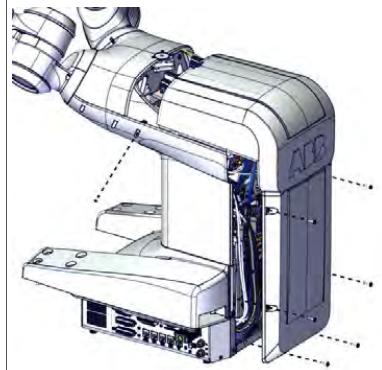
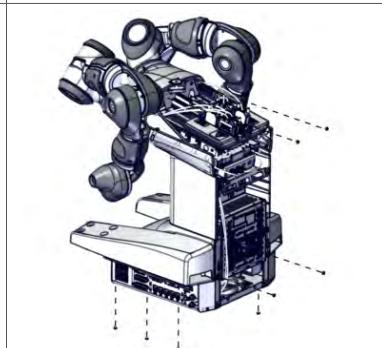
Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Trolley	-	

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Removing the axis computer

Use this procedure to remove the axis computer.

Pulling the controller out partially

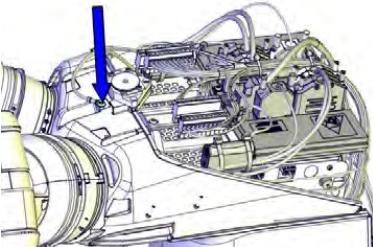
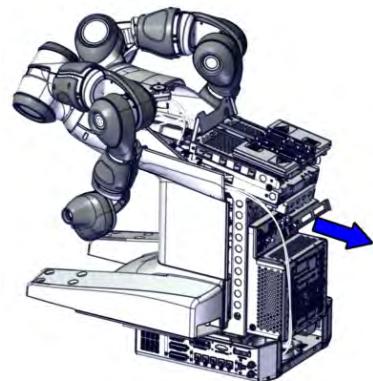
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • air pressure supply to the robot, before starting the repair work on the robot.	
2	 ELECTROSTATIC DISCHARGE (ESD) The equipment is sensitive to ESD. Before handling the equipment please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 47	Flange screw (10 pcs)  xx1500000525  xx1500000303
3	Remove the attachment screws that fasten the controller to the body.	 xx1500000364
4	Put a trolley beneath the controller.	

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4 Repair

4.7.7 Replacing the axis computer

Continued

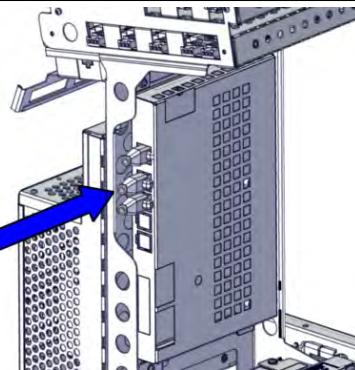
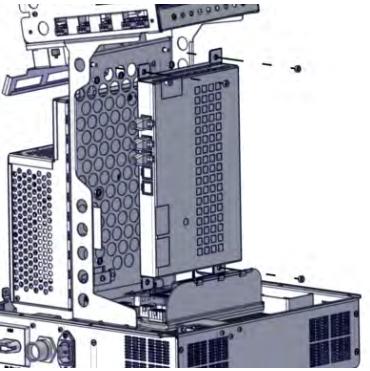
Action	Note
5 Disconnect the grounding cable.	 xx1500000601
6 Carefully pull the controller partially out in the rails.  CAUTION The cabling is still connected inside the robot, so be careful not to strain the cables!	 xx1500000365

Removing the axis computer

Action	Note
1  DANGER Make sure that all supplies for electrical power 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 <i>WARNING - The unit is sensitive to ESD! on page 47</i>	
3 Disconnect the connectors: • A42.X4 (X4 Measurement link 1) • A42.X5 (X5 Measurement link 2)	

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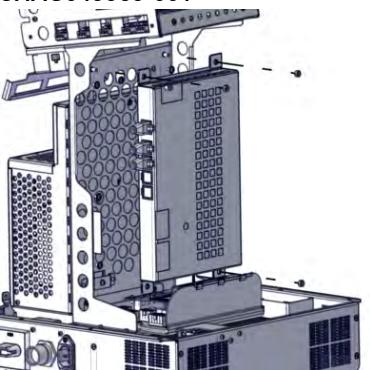
4.7.7 Replacing the axis computer Continued

Action	Note
4 Disconnect the connectors: • A42.X2 (X2) • A42.X11 (X11)	 xx1500000352
5 Remove the attachment nuts.	 xx1500000353
6 Disconnect the connector: • A42.XS1 (X1, underneath)	

Refitting the axis computer

Use this procedure to refit the axis computer.

Refitting the axis computer

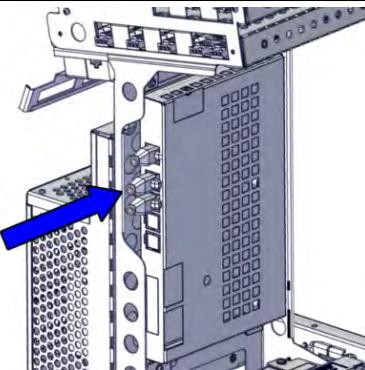
Action	Note
1 Connect the connector: • A42.XS1 (X1, underneath)	
2 Fit the new axis computer and tighten nuts.	DSQC1013 Axis computer: 3HAC049969-001  xx1500000353

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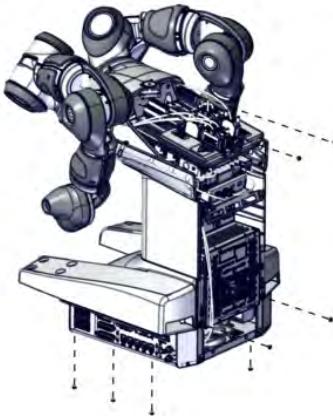
4 Repair

4.7.7 Replacing the axis computer

Continued

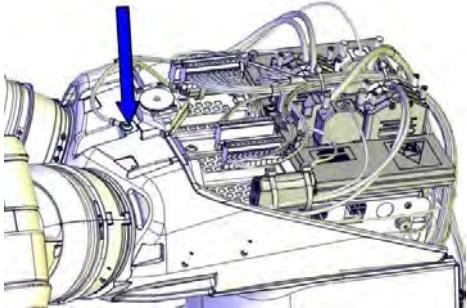
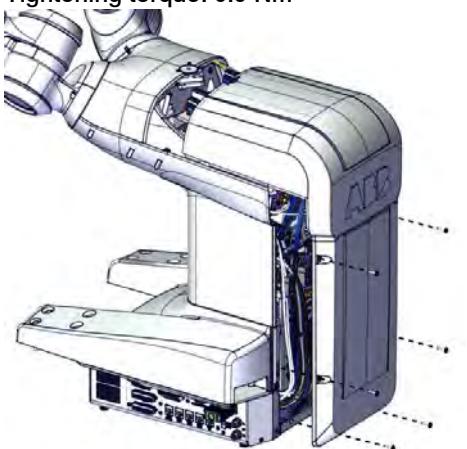
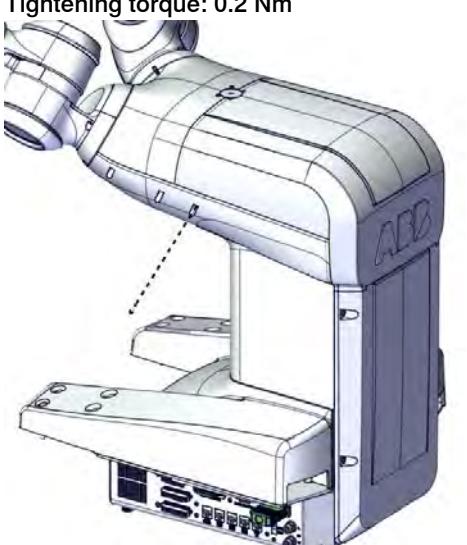
	Action	Note
3	<p>Connect the connectors:</p> <ul style="list-style-type: none">• A42.X11 (X11)• A42.X2 (X2)	 xx1500000352
4	<p>Connect the connectors:</p> <ul style="list-style-type: none">• A42.X4 (X4 Measurement link 1)• A42.X5 (X5 Measurement link 2)	

Pushing the controller in and fastening it

	Action	Note
1	<p>Gently push the controller into the robot body completely.</p> <p> CAUTION</p> <p>Be careful not to squeeze or damage the cables and air hoses in any way.</p>	
2	<p>Refit the attachment screws that fasten the controller to the body.</p>	<p>Screws: 10 pcs. Tightening torque: 0.9 Nm.</p>  xx1500000364

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4.7.7 Replacing the axis computer
Continued

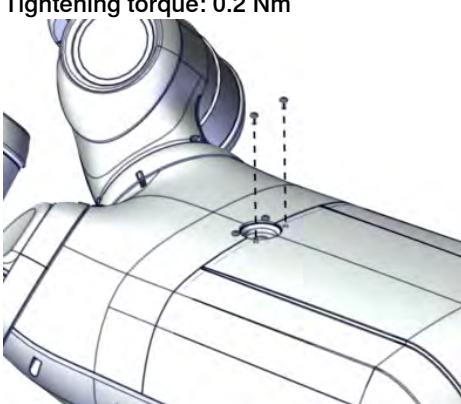
	Action	Note
3	Connect the grounding cable.	 xx1500000601
4	Refit the body cover with the attachment screws.	Flange screw (6 pcs) Tightening torque: 0.9 Nm  xx1500000697
5	Refit the two remaining screws of the body cover.	Flange screw (2 pcs) Tightening torque: 0.2 Nm  xx1500000696

Continues on next page

4 Repair

4.7.7 Replacing the axis computer

Continued

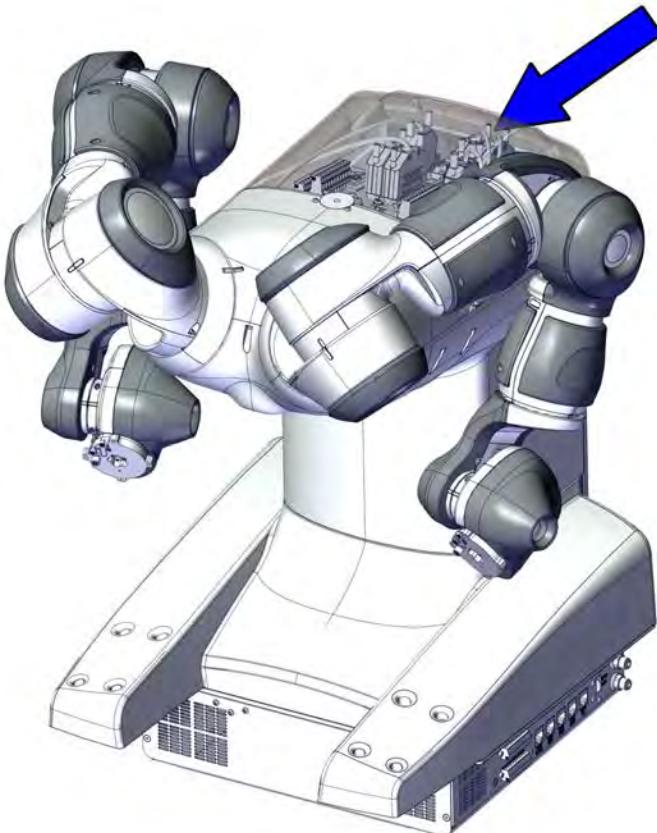
Action	Note
6 Refit the attachment screws.	<p>Flange screw (2 pcs) Tightening torque: 0.2 Nm</p>  <p>xx1500000525</p>
7  CAUTION	<p>Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 45.</p>

4.7.8 Replacing the left arm's drive board

4.7.8 Replacing the left arm's drive board

Location of the drive board

The drive board is located as shown in the figure.



xx1500000413

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 14000* on ABB Library.

Spare part	Article number	Note
DSQC 462 Drive board	3HAC047960-001	

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Trolley	-	

Continues on next page

4 Repair

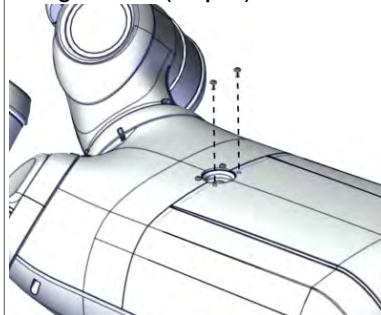
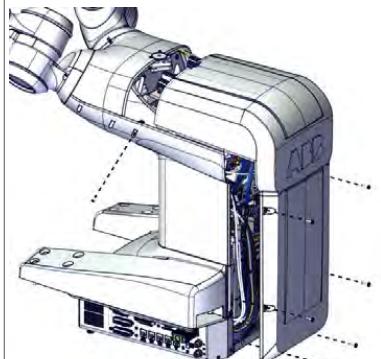
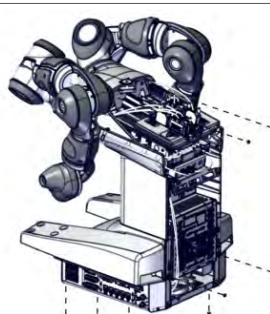
4.7.8 Replacing the left arm's drive board

Continued

Removing the left arm's drive board

Use this procedure to remove the drive board.

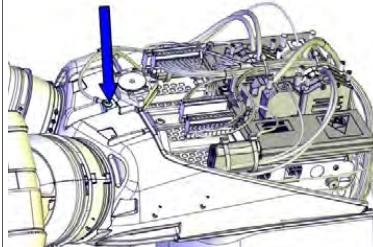
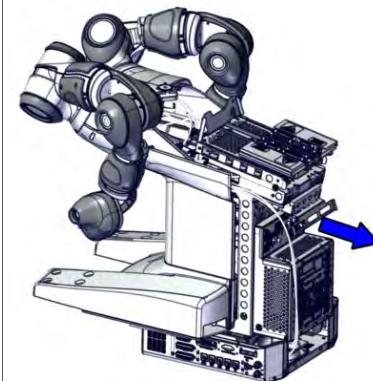
Pulling the controller out partially

	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• air pressure supply to the robot, before starting the repair work on the robot.	
2	 ELECTROSTATIC DISCHARGE (ESD) The equipment is sensitive to ESD. Before handling the equipment please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 47	Flange screw (10 pcs)  xx1500000525  xx1500000303
3	Remove the attachment screws that fasten the controller to the body.	 xx1500000364
4	Put a trolley beneath the controller.	

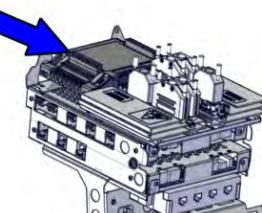
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4.7.8 Replacing the left arm's drive board

Continued

Action	Note
5 Disconnect the grounding cable.	 xx1500000601
6 Carefully pull the controller partially out in the rails.  CAUTION The cabling is still connected inside the robot, so be careful not to strain the cables!	 xx1500000365

Removing the I/O board

Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2 Carefully snap the I/O board loose (it is rail mounted).	 xx1500000415

Removing the SMB board

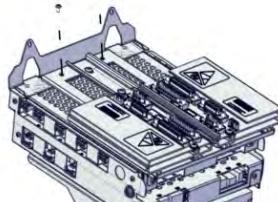
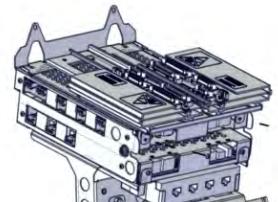
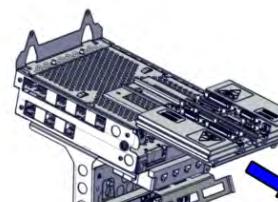
Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2 Disconnect the battery connector (X3)	

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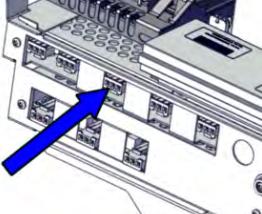
4 Repair

4.7.8 Replacing the left arm's drive board

Continued

Action	Note
3 Remove two attachment screws.	 xx1500000417
4 Remove two attachment screws on the side.	 xx1500000420
5 Gently pull the SMB unit out to loosen the latches from the recesses.	 xx1500000421

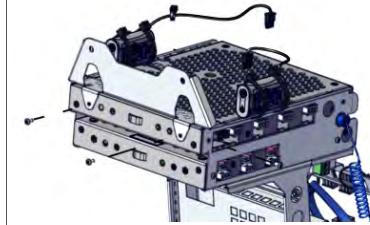
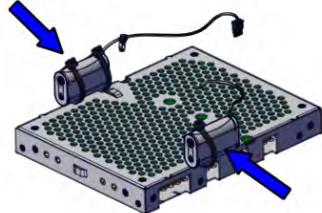
Removing the left arm's drive board

Action	Note
1  DANGER Make sure that all supplies for electrical power 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 <i>WARNING - The unit is sensitive to ESD! on page 47</i>	
3 Disconnect the connectors: Left side: <ul style="list-style-type: none">• A5X.XS11• A5X.XS12• A5X.XS17• A5X.XS13 Right side: <ul style="list-style-type: none">• A5X.XS14• A5X.XS15• A5X.XS16	 xx1500000368

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4.7.8 Replacing the left arm's drive board

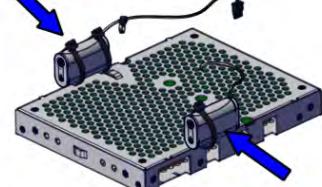
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Action	Note
4 Disconnect the connectors: • A52.X1 • A52.X2 • A52.X3 • A52.X6	
5 Disconnect the connector: • A52.X9	
6 Remove four attachment screws.	 xx1500000426
7 Remove two attachment screws.	 xx1500000427
8 Pull out the left arm's drive board.	
9 Remove the battery packs from the drive board and install them on the new drive board.	 xx1500002101

Refitting the left arm's drive board

Use this procedure to refit the drive board.

Refitting the left arm's drive board

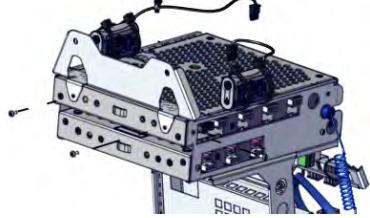
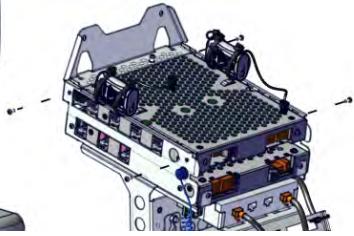
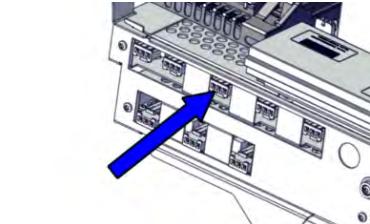
Action	Note
1 Fit the battery packs from the old drive board onto the new drive board.	 xx1500002101

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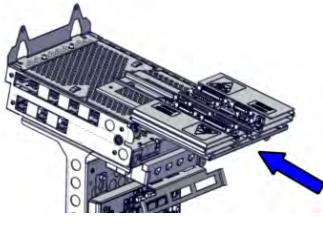
4 Repair

4.7.8 Replacing the left arm's drive board

Continued

	Action	Note
2	Fit the new drive board.	DSQC 462 Drive board: 3HAC047960-001
3	Refit the two attachment screws.	 xx1500000427
4	Refit four attachment screws.	 xx1500000426
5	Connect the connector: • A52.X9	
6	Connect the connectors: • A52.X1 • A52.X2 • A52.X3 • A52.X6	
7	Connect the connectors: Left side: • A5X.XS11 • A5X.XS12 • A5X.XS17 • A5X.XS13 Right side: • A5X.XS14 • A5X.XS15 • A5X.XS16	 xx1500000368

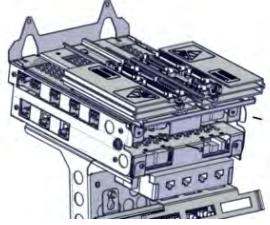
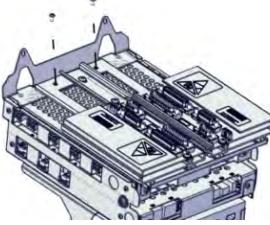
Refitting the SMB board

	Action	Note
1	Gently push the SMB unit to fasten the latches in the recesses.	DSQC633D measurement board: 3HAC048550-001  xx1500000422

Continues on next page

4.7.8 Replacing the left arm's drive board

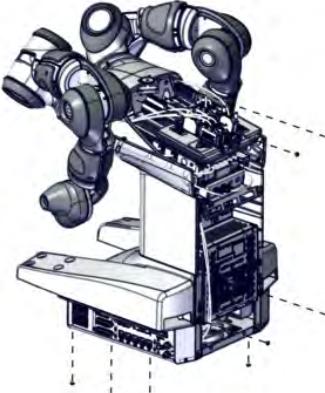
Continued

Action	Note
2 Tighten two attachment screws on the side.	 xx1500000420
3 Tighten two attachment screws.	 xx1500000417
4 Connect the battery connector (X3).	

Refitting the I/O board

Action	Note
1 Snap on the I/O board to the mounting rail.	Digital 24V I/O DSQC 652: 3HAC025917-001

Pushing the controller in and fastening it

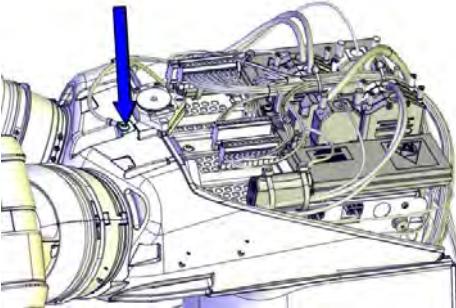
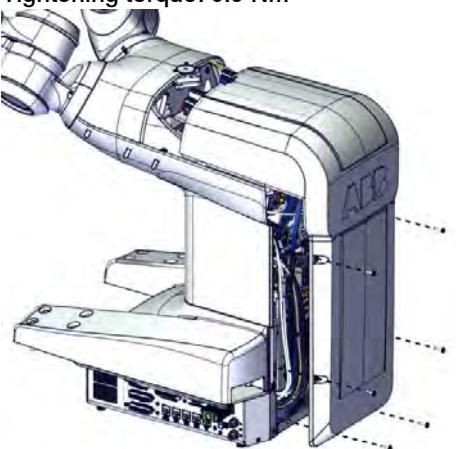
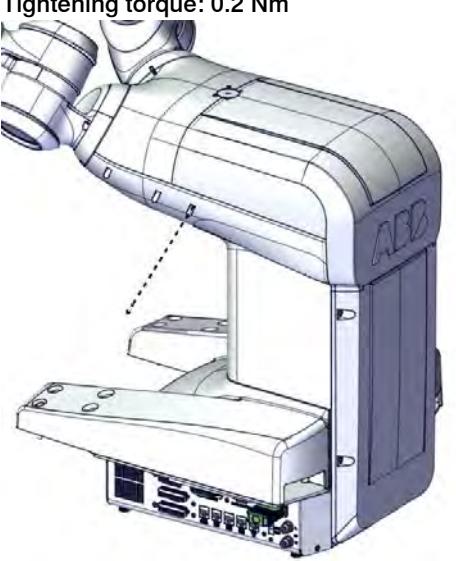
Action	Note
1 Gently push the controller into the robot body completely.  CAUTION Be careful not to squeeze or damage the cables and air hoses in any way.	
2 Refit the attachment screws that fasten the controller to the body.	Screws: 10 pcs. Tightening torque: 0.9 Nm.  xx1500000364

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4 Repair

4.7.8 Replacing the left arm's drive board

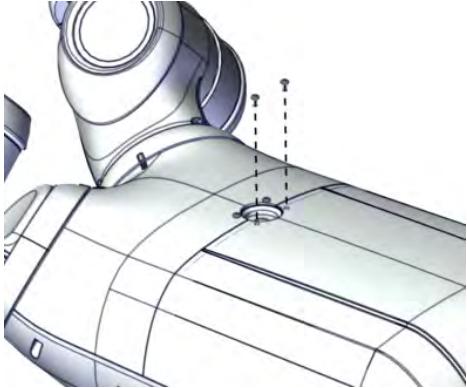
Continued

Action	Note
3 Connect the grounding cable.	 xx1500000601
4 Refit the body cover with the attachment screws.	Flange screw (6 pcs) Tightening torque: 0.9 Nm  xx1500000697
5 Refit the two remaining screws of the body cover.	Flange screw (2 pcs) Tightening torque: 0.2 Nm  xx1500000696

Continues on next page

4.7.8 Replacing the left arm's drive board

Continued

	Action	Note
6	Refit the attachment screws.	<p>Flange screw (2 pcs) Tightening torque: 0.2 Nm</p>  <p>xx1500000525</p>
7	 CAUTION <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 45.</p>	

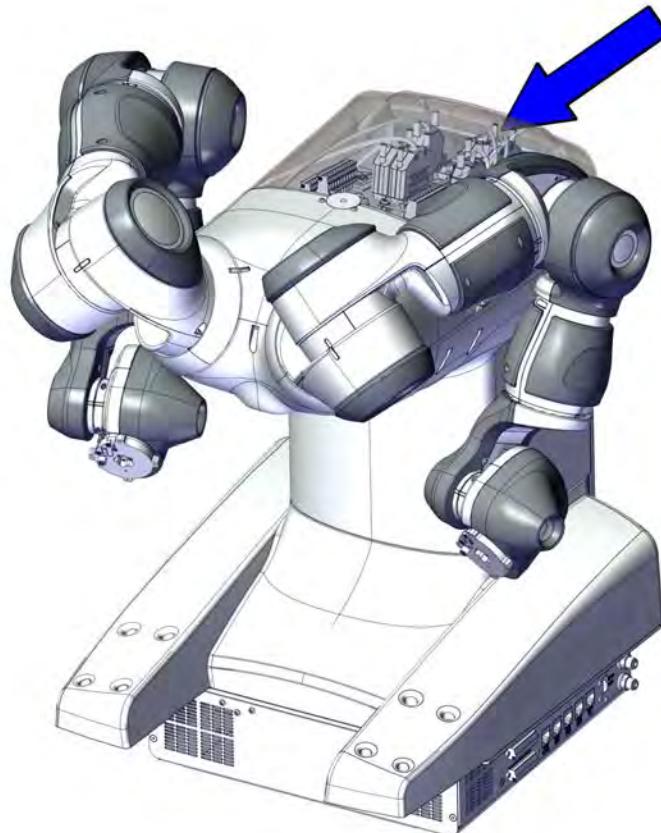
4 Repair

4.7.9 Replacing the right arm's drive board

4.7.9 Replacing the right arm's drive board

Location of the drive board

The drive board is located as shown in the figure.



xx1500000413

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 14000* on ABB Library.

Spare part	Article number	Note
DSQC 462 Drive board	3HAC047960-001	

Required tools and equipment

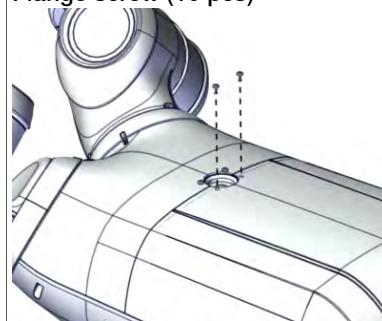
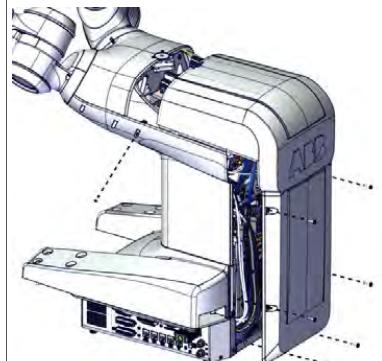
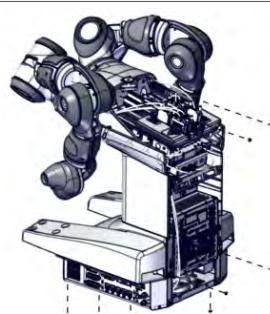
Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Trolley	-	

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Removing the right arm's drive board

Use this procedure to remove the drive board.

Pulling the controller out partially

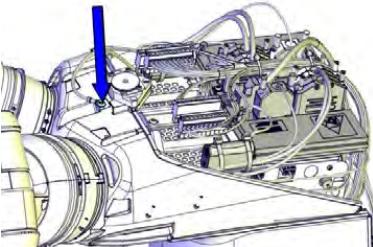
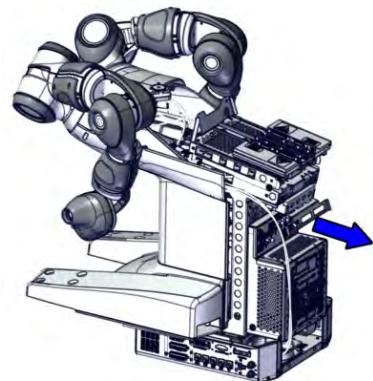
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • air pressure supply to the robot, before starting the repair work on the robot.	
2	 ELECTROSTATIC DISCHARGE (ESD) The equipment is sensitive to ESD. Before handling the equipment please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 47	Flange screw (10 pcs)  xx1500000525  xx1500000303
3	Remove the attachment screws that fasten the controller to the body.	 xx1500000364
4	Put a trolley beneath the controller.	

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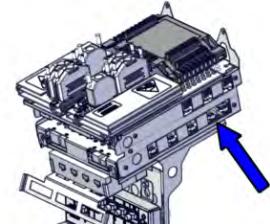
4 Repair

4.7.9 Replacing the right arm's drive board

Continued

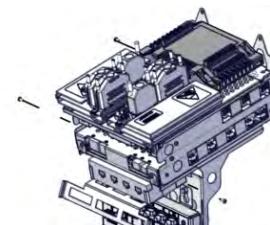
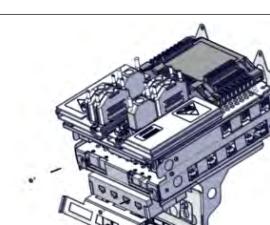
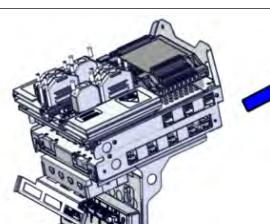
Action	Note
5 Disconnect the grounding cable.	 xx1500000601
6 Carefully pull the controller partially out in the rails.  CAUTION The cabling is still connected inside the robot, so be careful not to strain the cables!	 xx1500000365

Removing the right arm's drive board

Action	Note
1  DANGER Make sure that all supplies for electrical power 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 <i>WARNING - The unit is sensitive to ESD! on page 47</i>	
3 Disconnect the cables from the right arm's drive board: Right side: <ul style="list-style-type: none">• A5X.XS11• A5X.XS12• A5X.XS17• A5X.XS13 Left side: <ul style="list-style-type: none">• A5X.XS14• A5X.XS15• A5X.XS16	 xx1500000428

Continues on next page

4.7.9 Replacing the right arm's drive board
Continued

Action	Note
4 Disconnect the connectors: <ul style="list-style-type: none"> • A51.X8 • A51.X9 	
5 Disconnect the connectors: <ul style="list-style-type: none"> • A51.X1 • A51.X2 • A51.X3 • A51.X6 	
6 Remove four attachment screws.	 xx1500000430
7 Remove two attachment screws.	 xx1500000431
8 Put the EtherNet switch bracket downwards.	
9 Gently pull the drive board out.	 xx1500000432

Refitting the right arm's drive board

Use this procedure to refit the drive board.

Refitting the right arm's drive board

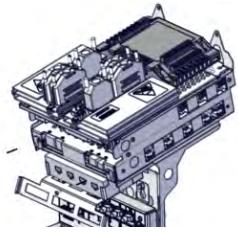
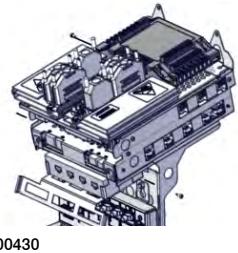
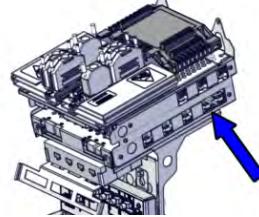
Action	Note
1 Gently push the new drive board into the bracket.	DSQC 462 Drive board: 3HAC047960-001  xx1500000433

Continues on next page

4 Repair

4.7.9 Replacing the right arm's drive board

Continued

Action	Note
2 Refit the ethernet switch bracket.	
3 Refit two attachment screws.	 xx1500000431
4 Refit four attachment screws.	 xx1500000430
5 Connect the connectors: <ul style="list-style-type: none">• A51.X1• A51.X2• A51.X3• A51.X6	
6 Connect the connectors: <ul style="list-style-type: none">• A51.X8• A51.X9	
7 Connect the cables from the right arm's drive board: Right side: <ul style="list-style-type: none">• A5X.XS11• A5X.XS12• A5X.XS17• A5X.XS13 Left side: <ul style="list-style-type: none">• A5X.XS14• A5X.XS15• A5X.XS16	 xx1500000428

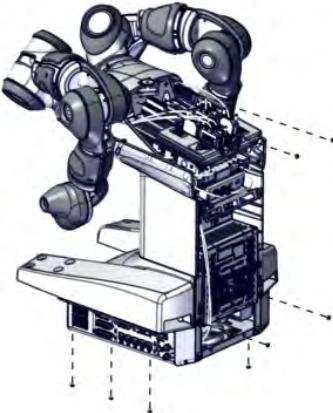
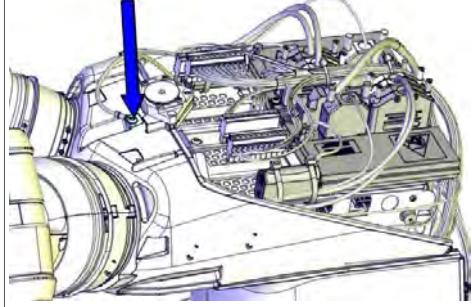
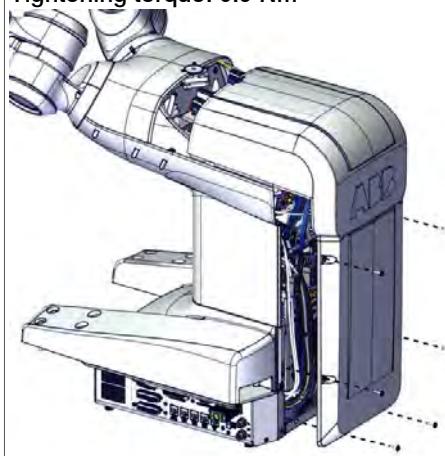
Pushing the controller in and fastening it

Action	Note
1 Gently push the controller into the robot body completely.  CAUTION Be careful not to squeeze or damage the cables and air hoses in any way.	

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4.7.9 Replacing the right arm's drive board

Continued

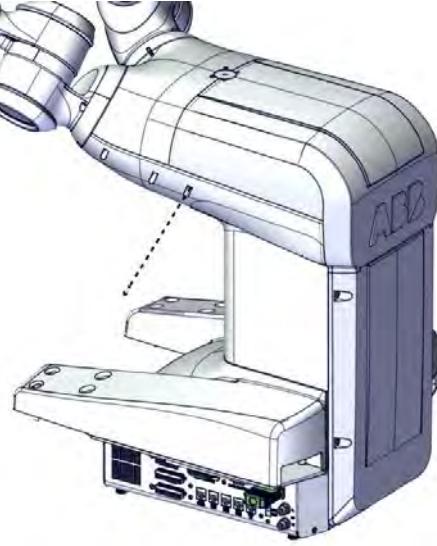
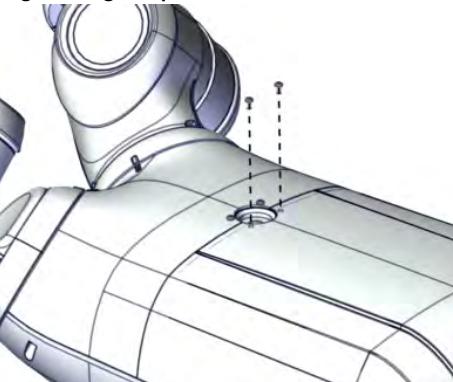
	Action	Note
2	Refit the attachment screws that fasten the controller to the body.	<p>Screws: 10 pcs. Tightening torque: 0.9 Nm.</p>  <p>xx1500000364</p>
3	Connect the grounding cable.	 <p>xx1500000601</p>
4	Refit the body cover with the attachment screws.	<p>Flange screw (6 pcs) Tightening torque: 0.9 Nm</p>  <p>xx1500000697</p>

Continues on next page

4 Repair

4.7.9 Replacing the right arm's drive board

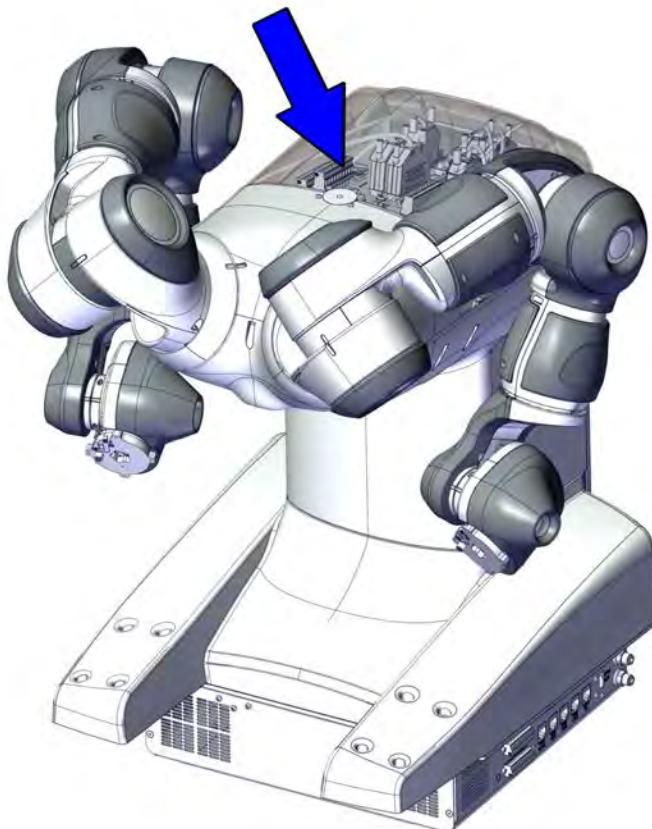
Continued

Action	Note
5 Refit the two remaining screws of the body cover.	<p>Flange screw (2 pcs) Tightening torque: 0.2 Nm</p>  <p>xx1500000696</p>
6 Refit the attachment screws.	<p>Flange screw (2 pcs) Tightening torque: 0.2 Nm</p>  <p>xx1500000525</p>
7	<p> CAUTION</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 45.</p>

4.7.10 Replacing the I/O board

Location of the I/O board

The I/O board is located as shown in the figure.



xx1500000401

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 14000* on ABB Library.

Spare part	Article number	Note
Digital 24V I/O DSQC 652	3HAC025917-001	

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Trolley	-	

Continues on next page

4 Repair

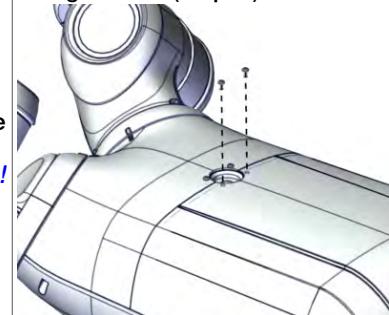
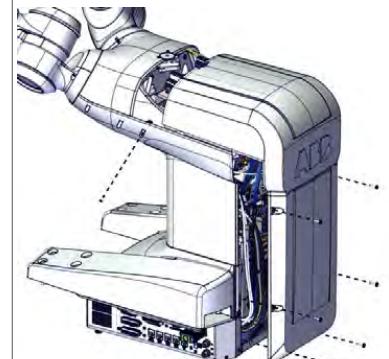
4.7.10 Replacing the I/O board

Continued

Removing the I/O board

Use this procedure to remove the I/O board.

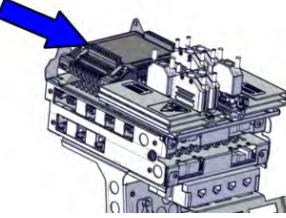
Remove the body cover

	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• air pressure supply to the robot, before starting the repair work on the robot.	
2	Remove the body cover.  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! <i>on page 47</i>	Flange screw (10 pcs)  xx1500000525  xx1500000303

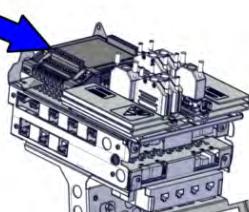
Removing the I/O connectors

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

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	Action	Note
2	 ELECTROSTATIC DISCHARGE (ESD) <p>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 47</p>	
3	Disconnect connectors: <ul style="list-style-type: none"> • IO.X1 (X1) • IO.X2 (X2) • IO.X3 (X3) • IO.X4 (X4) • IO.X5 (X5) 	 xx1500000415

Removing the I/O board

	Action	Note
1	 DANGER <p>Make sure that all supplies for electrical power and air pressure are turned off.</p>	
2	Carefully snap the I/O board loose (it is rail mounted).	 xx1500000415

Refitting the I/O board

Use this procedure to refit the I/O board.

Refitting the I/O board

	Action	Note
1	Snap on the I/O board to the mounting rail.	Digital 24V I/O DSQC 652: 3HAC025917-001

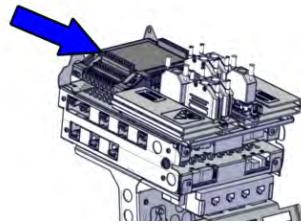
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4 Repair

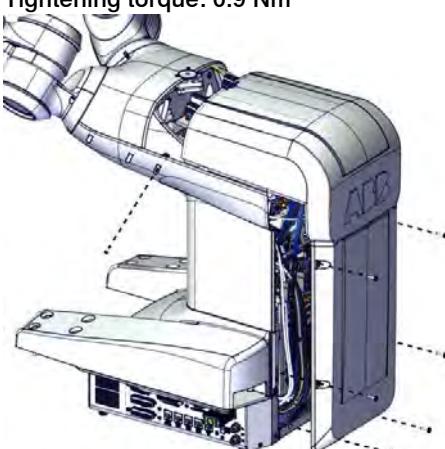
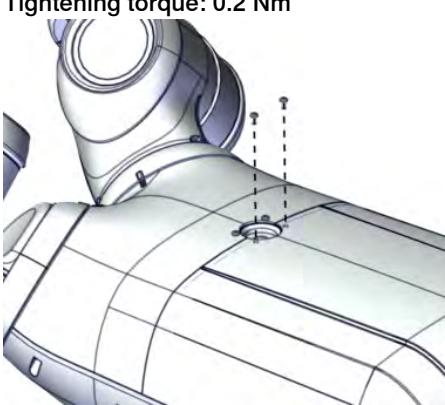
4.7.10 Replacing the I/O board

Continued

Refitting the I/O connectors

	Action	Note
1	Connect the connectors: <ul style="list-style-type: none">• IO.X5 (X5)• IO.X1 (X1)• IO.X2 (X2)• IO.X3 (X3)• IO.X4 (X4)	 xx1500000415

Refitting the body cover

	Action	Note
1	Refit the body cover with the attachment screws.	Flange screw (8 pcs) Tightening torque: 0.9 Nm  xx1500000303
2	Refit the attachment screws.	Flange screw (2 pcs) Tightening torque: 0.2 Nm  xx1500000525

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	Action	Note
3	 CAUTION 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 45.	

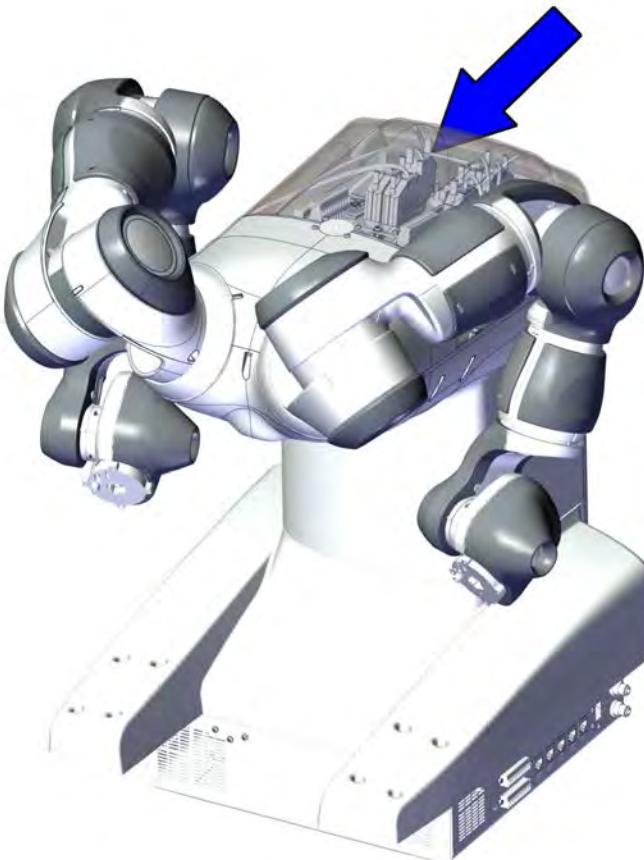
4 Repair

4.7.11 Replacing the SMB boards

4.7.11 Replacing the SMB boards

Location of the SMB board

The SMB board is located as shown in the figure.



xx1500000414

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 14000* on ABB Library.

Spare part	Article number	Note
DSQC633D measurement board	3HAC048550-001	

Required tools and equipment

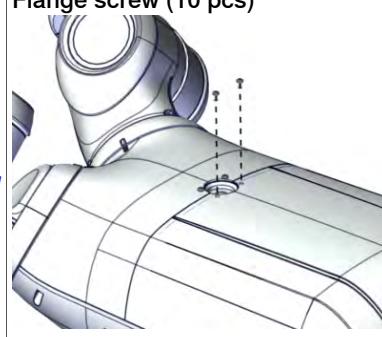
Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Trolley	-	

Continues on next page

Removing the SMB board

Use this procedure to remove the SMB board.

Remove the body cover

	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • air pressure supply to the robot, before starting the repair work on the robot.	
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 47</i>	 Flange screw (10 pcs) xx1500000525

Removing the I/O board

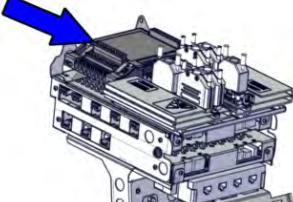
	Action	Note
1	 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	

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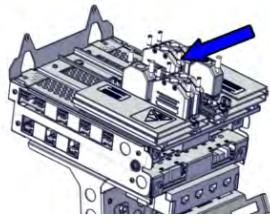
4 Repair

4.7.11 Replacing the SMB boards

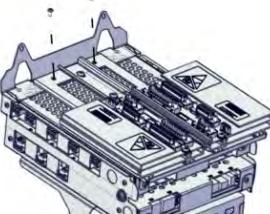
Continued

Action	Note
2 Carefully snap the I/O board loose (it is rail mounted).	 xx1500000415

Removing the SMB connectors

Action	Note
1  DANGER Make sure that all supplies for electrical power 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 <i>WARNING - The unit is sensitive to ESD! on page 47</i>	
3 Disconnect the connectors (left and/or right side): <ul style="list-style-type: none"> • A5X.SMB.X4 • A5X.SMB.X5 • A5X.SMB.X2 • A52.SMB.X1 	 xx1500000416

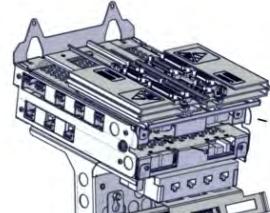
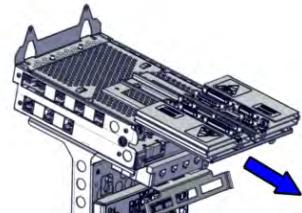
Removing the SMB board

Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2 Disconnect the battery connector (X3)	
3 Remove two attachment screws.	 xx1500000417

Continues on next page

4.7.11 Replacing the SMB boards

Continued

Action	Note
4 Remove two attachment screws on the side.	 xx1500000420
5 Gently pull the SMB unit out to loosen the latches from the recesses.	 xx1500000421

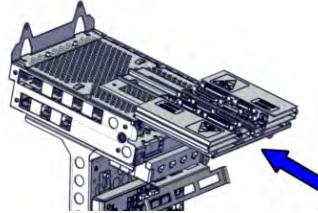
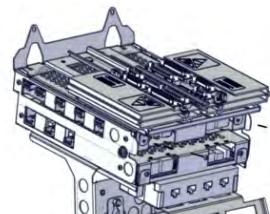
Replacing the SMB board

Action	Note
1 Remove the screws to remove left or right SMB board from bracket.	
2 Refit the new SMB board to the bracket and fasten with four screws.	

Refitting the SMB board

Use this procedure to refit the SMB board.

Refitting the SMB board

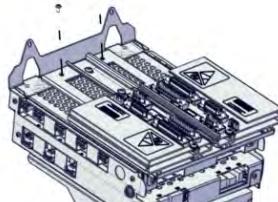
Action	Note
1 Gently push the SMB unit to fasten the latches in the recesses.	DSQC633D measurement board: 3HAC048550-001  xx1500000422
2 Tighten two attachment screws on the side.	 xx1500000420

Continues on next page

4 Repair

4.7.11 Replacing the SMB boards

Continued

	Action	Note
3	Tighten two attachment screws.	 xx1500000417
4	Connect the battery connector (X3).	

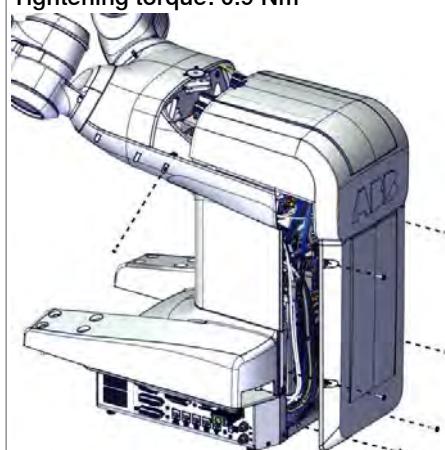
Refitting SMB connectors

	Action	Note
1	Connect the connectors (left and/or right side): <ul style="list-style-type: none">• A5X.SMB.X4• A5X.SMB.X5• A5X.SMB.X2• A52.SMB.X1	

Refitting the I/O board

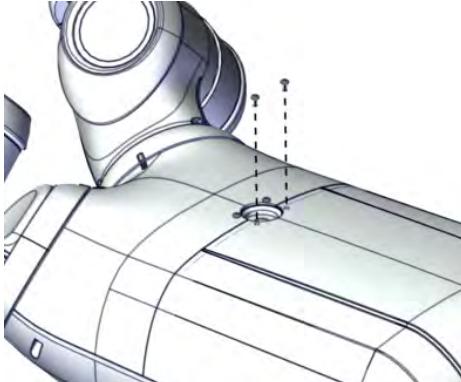
	Action	Note
1	Snap on the I/O board to the mounting rail.	Digital 24V I/O DSQC 652: 3HAC025917-001

Refitting the body cover

	Action	Note
1	Refit the body cover with the attachment screws.	Flange screw (8 pcs) Tightening torque: 0.9 Nm  xx1500000303

Continues on next page

4.7.11 Replacing the SMB boards
Continued

	Action	Note
2	Refit the attachment screws.	<p>Flange screw (2 pcs) Tightening torque: 0.2 Nm</p> 
3	 CAUTION <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 45.</p>	

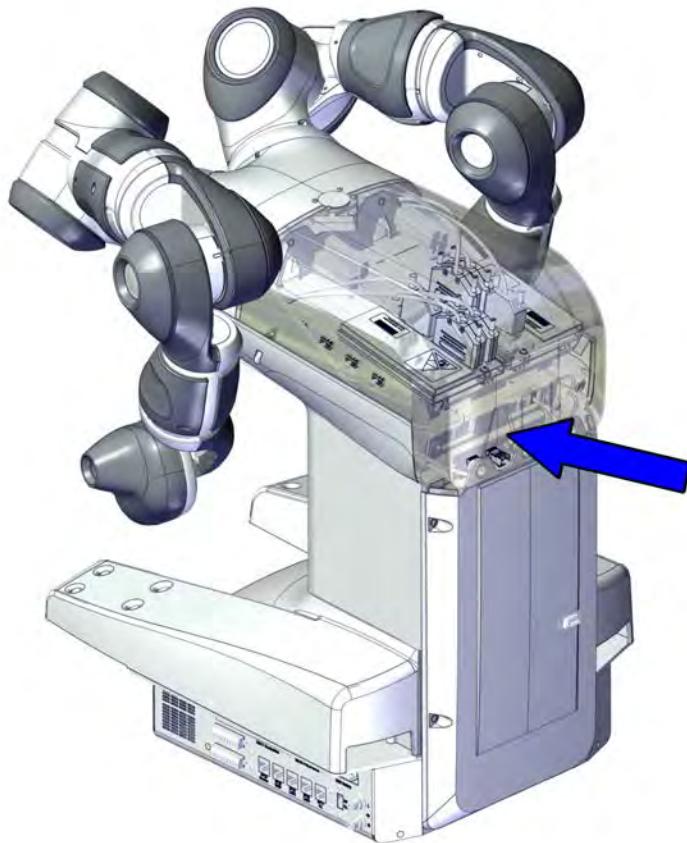
4 Repair

4.7.12 Replacing the EtherNet switch

4.7.12 Replacing the EtherNet switch

Location of the EtherNet switch

The EtherNet switch is located as shown in the figure.



xx1500000423

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 14000* on ABB Library.

Spare part	Article number	Note
Ethernet switch 5p	3HAC034884-001	

Required tools and equipment

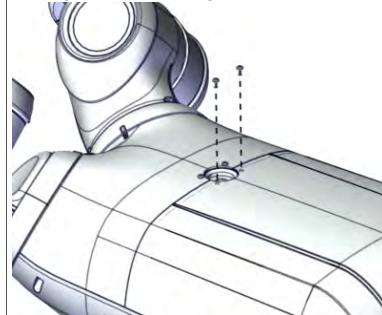
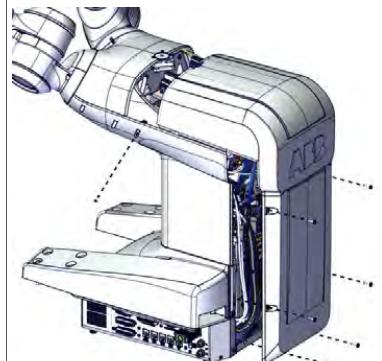
Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

Continues on next page

Removing the EtherNet switch

Use this procedure to remove the EtherNet switch.

Removing the body cover

	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • air pressure supply to the robot, before starting the repair work on the robot.	
2	Remove the body cover.	 Flange screw (10 pcs) xx1500000525  xx1500000303

Removing the EtherNet switch

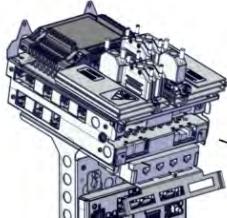
	Action	Note
1	 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2	Disconnect the connectors (cut cable ties if necessary): <ul style="list-style-type: none"> • A33.X2 (X2) • A33.X3 (X3) 	

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4 Repair

4.7.12 Replacing the EtherNet switch

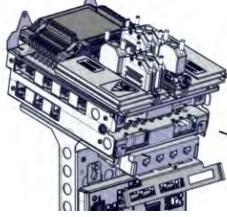
Continued

Action	Note
3 Remove two attachment screws.	 xx1500000424
4 Gently pull out the EtherNet switch and the holder to remove the latches from the recesses.	
5 Disconnect the connector: <ul style="list-style-type: none">• A33.X1• A33.X6• A33.X5	
6 Pull out the EtherNet switch from the holder.	

Refitting the EtherNet switch

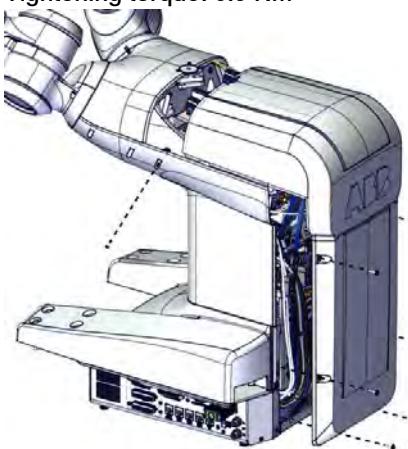
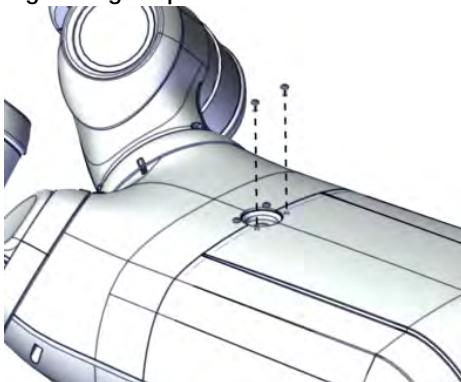
Use this procedure to refit the EtherNet switch.

Refitting the EtherNet switch

Action	Note
1 Fit the new ethernet switch in the holder.	Ethernet switch 5p: 3HAC034884-001
2 Connect the connectors: <ul style="list-style-type: none">• A33.X1• A33.X5• A33.X6	
3 Gently push the holder latches into the recesses.	
4 Tighten two attachment screws.	 xx1500000424
5 Connect the connectors: <ul style="list-style-type: none">• A33.X2 (X2)• A33.X3 (X3)	

Continues on next page

Refitting the body cover

	Action	Note
1	Refit the body cover with the attachment screws.	<p>Flange screw (8 pcs) Tightening torque: 0.9 Nm</p>  <p>xx1500000303</p>
2	Refit the attachment screws.	<p>Flange screw (2 pcs) Tightening torque: 0.2 Nm</p>  <p>xx1500000525</p>
3	<p> CAUTION</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 45.</p>	

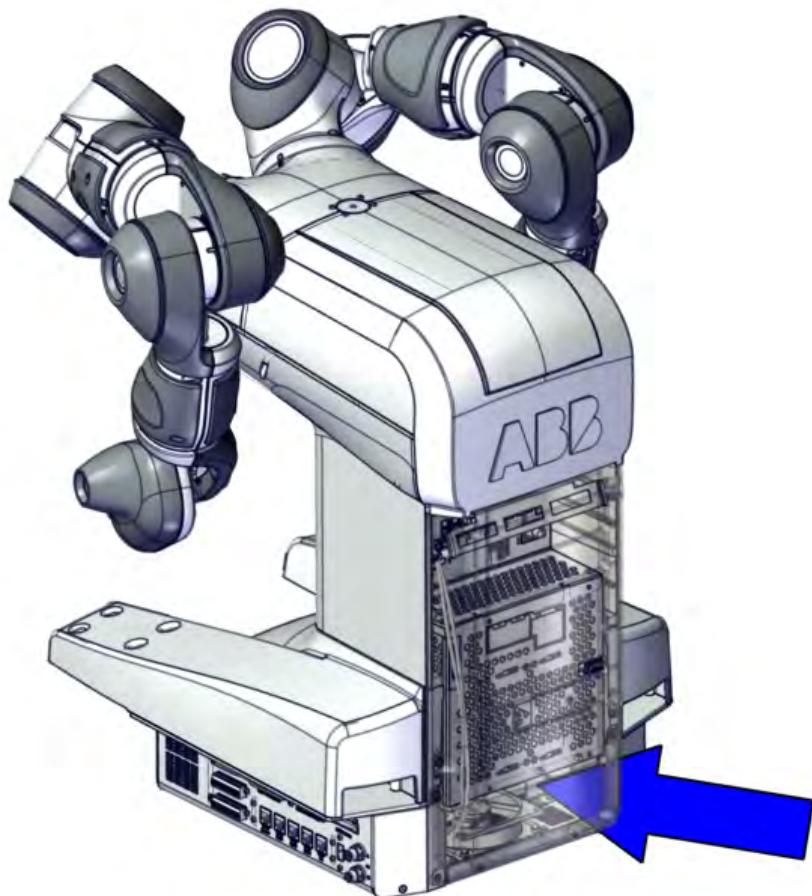
4 Repair

4.7.13 Replacing the mass memory card

4.7.13 Replacing the mass memory card

Location of the mass memory card

The mass memory card is located as shown in the figure.



xx1500000561

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 14000* on ABB Library.

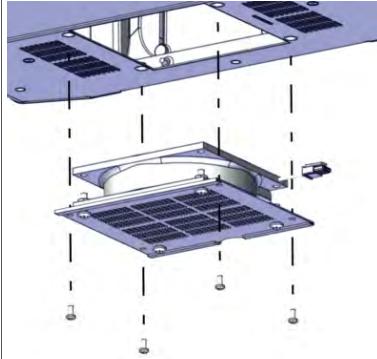
Spare part	Article number	Note
Mass memory with boot loader	3HAC047184-003	

Required tools and equipment

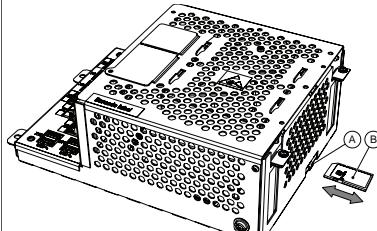
Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

Continues on next page

Removing the mass memory card**Removing the fan**

Action	Note
<p>1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.</p>	
<p>2 Remove the bottom cover.  CAUTION Be careful not to damage the cables.</p>	 <p>xx1500000310</p>
<p>3 Disconnect the fan connector: • E1.XS1</p>	

Removing the mass memory card

Action	Note				
<p>1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.</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 47</p>					
<p>3 Gently push the memory card until it clicks and then pull the card straight out.</p>	 <p>xx1300000807</p> <table border="1"> <tr> <td>A</td> <td>Slot for memory card</td> </tr> <tr> <td>B</td> <td>Mass memory card</td> </tr> </table>	A	Slot for memory card	B	Mass memory card
A	Slot for memory card				
B	Mass memory card				

Continues on next page

4 Repair

4.7.13 Replacing the mass memory card

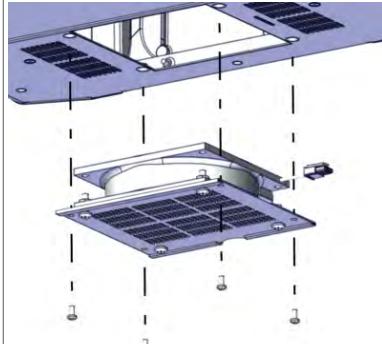
Continued

Refitting the mass memory card

Refitting the mass memory card

	Action	Note
1	 DANGER Make sure that all supplies for electrical power 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 47	
3	 CAUTION Make sure that the memory card is oriented correctly before inserting it. Otherwise the memory card or the memory slot may be damaged.	
4	Gently push the memory card with the finger until it clicks into place.	Mass memory with boot loader: 3HAC047184-003

Refitting the fan

	Action	Note
1	Connect the fan connector. • E1.XS1	
2	Refit the bottom cover and tighten the screws.  CAUTION Be careful not to damage the cables.	 xx1500000310

4.7.14 Replacing the expansion board complete

4.7.14 Replacing the expansion board complete**Location of the expansion board complete**

The expansion board complete is located as shown in the figure.



xx1500000369

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 14000* on ABB Library.

Spare part	Article number	Note
DSQC1003 Expansion board complete	3HAC046408-001	

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

Continues on next page

4 Repair

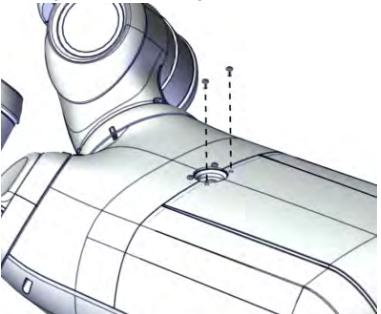
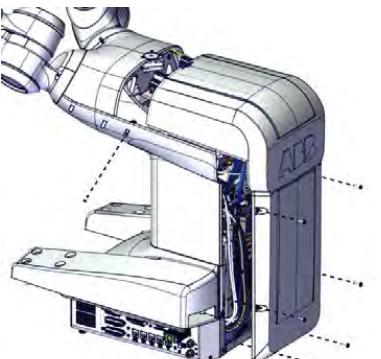
4.7.14 Replacing the expansion board complete

Continued

Equipment, etc.	Article number	Note
Trolley	-	

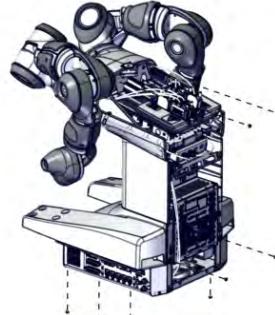
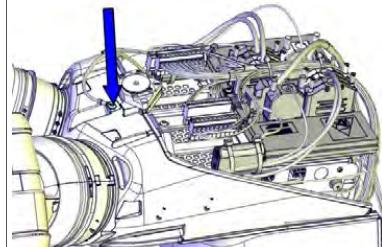
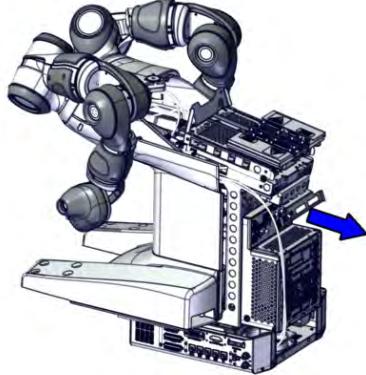
Removing the computer

Pulling the controller out partially

	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• air pressure supply to the robot, before starting the repair work on the robot.	
2	 ELECTROSTATIC DISCHARGE (ESD) The equipment is sensitive to ESD. Before handling the equipment please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 47	Flange screw (10 pcs)  xx1500000525  xx1500000303

Continues on next page

4.7.14 Replacing the expansion board complete
Continued

Action	Note
3 Remove the attachment screws that fasten the controller to the body.	 xx1500000364
4 Put a trolley beneath the controller.	
5 Disconnect the grounding cable.	 xx1500000601
6 Carefully pull the controller partially out in the rails.  CAUTION The cabling is still connected inside the robot, so be careful not to strain the cables!	 xx1500000365

Removing the computer

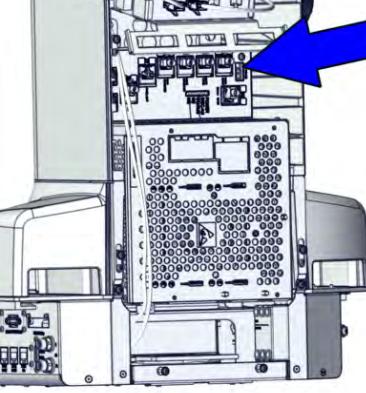
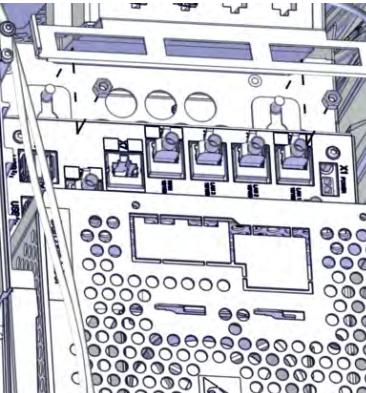
Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	

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4 Repair

4.7.14 Replacing the expansion board complete

Continued

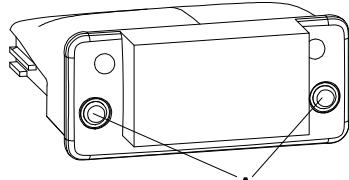
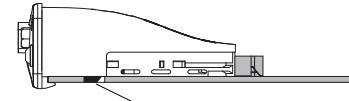
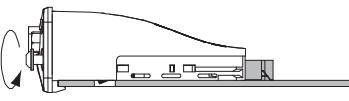
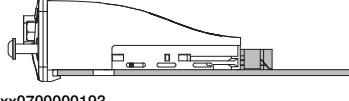
Action	Note
<p>2 Separate the cabling in front of the computer, cut cable ties if necessary.</p> <p>! CAUTION</p> <p>Be careful not to bend or break the cables and air hoses.</p>	
<p>3 Disconnect the connectors:</p> <ul style="list-style-type: none"> • A31.USB (X10) • A31.X9 (X9) • A31.X6 (X6) • A31.X5 (X5) • A31.X4 (X4) • A31.X3 (X3) • A31.XS1 (X1) • A31.SERVICE (X2) 	 xx1500000371
<p>4 Cut cable ties from the disconnected cables if necessary.</p>	
<p>5 (Depending on which connection is installed) Disconnect the connector:</p> <ul style="list-style-type: none"> • Profibus/S: A32.2 • Ethernet/IP/S: A32.1 • Profinet/S: A32.3 	
<p>6 Loosen the nuts holding the computer.</p>	 xx1500000386
<p>7 Gently push the computer upwards a little bit to release the latches from the recesses.</p>	
<p>8 Disconnect the connection (underneath computer): A35.J1 D-NET</p>	
<p>9 Tilt the computer out and remove it from the controller.</p>	

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Removing the expansion board complete

Use this procedure to remove the expansion board complete.

Removing the fieldbus adapter

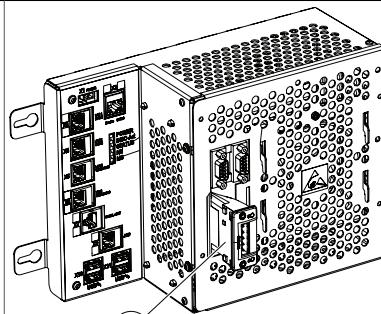
	Action	Note
1	 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <i>WARNING - The unit is sensitive to ESD! on page 47</i>	
3	(Depending on which connection is installed) Disconnect the connector: <ul style="list-style-type: none"> • Profibus/S: A32.2 • Ethernet/IP/S: A32.1 • Profinet/S: A32.3 	
4	Loosen the attachment screws (2 pcs) on front of the fieldbus adapter to release the fastening mechanism.  Note Do not remove the attachment screws, only loosen them.	    xx0700000193 A Attachment screw (2 pcs) B Fastening mechanism

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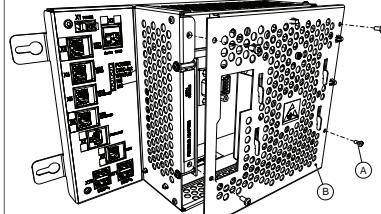
4 Repair

4.7.14 Replacing the expansion board complete

Continued

Action	Note
5 Grip the loosened attachment screws and gently pull the fieldbus adapter straight out.	 xx1500001755

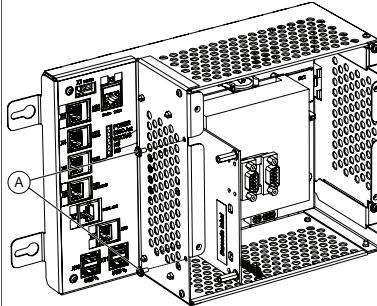
Opening the computer

Action	Note				
1  DANGER Make sure that all supplies for electrical power 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 <i>WARNING - The unit is sensitive to ESD!</i> <i>on page 47</i>					
3 (Depending on which connection is installed) Disconnect the connector: <ul style="list-style-type: none">• Profibus/S: A32.2• Ethernet/IP/S: A32.1• Profinet/S: A32.3					
4 Open the computer unit by removing the attachment screws and lift the cover off.  CAUTION Be careful not to stretch the fan cable.	 xx1300000684				
	<table border="1"> <tr> <td>A</td> <td>Attachment screw (4 pcs)</td> </tr> <tr> <td>B</td> <td>Cover</td> </tr> </table>	A	Attachment screw (4 pcs)	B	Cover
A	Attachment screw (4 pcs)				
B	Cover				
5 Disconnect the fan connector.					

Continues on next page

4.7.14 Replacing the expansion board complete
Continued

Removing the expansion board complete

	Action	Note		
1	 DANGER Make sure that all supplies for electrical power 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 <i>WARNING - The unit is sensitive to ESD! on page 47</i>			
3	Remove the attachment screws on the computer unit.	 xx1300000859 <table border="1"> <tr> <td>A</td> <td>Attachment screw (2 pcs)</td> </tr> </table>	A	Attachment screw (2 pcs)
A	Attachment screw (2 pcs)			
4	Grip the expansion board and gently pull it straight out.  CAUTION Always grip the expansion board around the edges to avoid damage to the board or its components.			

Refitting the expansion board complete

Use this procedure to refit the expansion board complete.

Refitting the expansion board complete

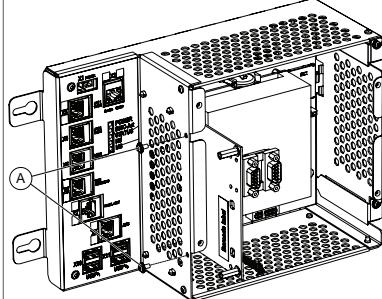
	Action	Note
1	 DANGER Make sure that all supplies for electrical power and air pressure are turned off.	

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4 Repair

4.7.14 Replacing the expansion board complete

Continued

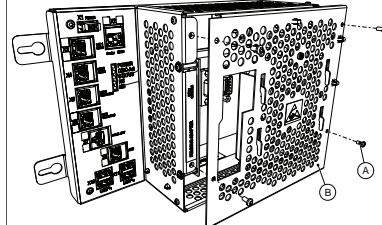
Action	Note		
<p>2  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 47</p>			
<p>3 Fit the expansion board complete by pushing it into the connector on the motherboard.</p> <p> CAUTION Always grip the expansion board around the edges to avoid damage to the board or its components.</p> <p> CAUTION Push carefully so no pins are damaged. Make sure that the expansion board is pushed straight into the connector.</p>	DSQC1003 Expansion board complete: 3HAC046408-001		
4 Fasten the expansion board complete with the attachment screws.	 xx1300000859 <table border="1"> <tr> <td>A</td> <td>Attachment screw (2 pcs)</td> </tr> </table>	A	Attachment screw (2 pcs)
A	Attachment screw (2 pcs)		

Closing the computer

Action	Note
<p>1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.</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 47</p>	

Continues on next page

4.7.14 Replacing the expansion board complete
Continued

Action	Note				
3 Connect the fan connector. ! CAUTION Be careful not to stretch or squeeze the fan cable.					
4 Fasten the computer cover with its attachment screws.	 xx1300000684 <table border="1"> <tr> <td>A</td> <td>Attachment screw (4 pcs)</td> </tr> <tr> <td>B</td> <td>Cover</td> </tr> </table>	A	Attachment screw (4 pcs)	B	Cover
A	Attachment screw (4 pcs)				
B	Cover				
5 (Depending on which connection is installed) Connect the connector: <ul style="list-style-type: none"> • Profibus/S: A32.2 • Ethernet/IP/S: A32.1 • Profinet/S: A32.3 					
6 Make sure the robot system is configured to reflect the installed parts.					

Refitting the fieldbus adapter

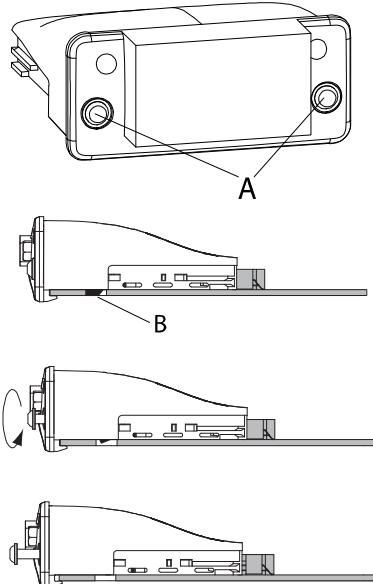
Action	Note
1 ! DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 47	

Continues on next page

4 Repair

4.7.14 Replacing the expansion board complete

Continued

Action	Note				
<p>3 Fit the fieldbus adapter by pushing it along the rails on the motherboard.</p> <p>! CAUTION Always grip the fieldbus adapter around the edges to avoid damage to the adapter or its components.</p> <p>! CAUTION Make sure that the adapter is pushed straight onto the rails. Push carefully so no pins are damaged.</p>					
<p>4 Fasten the fieldbus adapter with its attachment screws.</p>	 <p>xx0700000193</p> <table border="1"> <tr> <td>A</td> <td>Attachment screw (2 pcs)</td> </tr> <tr> <td>B</td> <td>Fastening mechanism</td> </tr> </table>	A	Attachment screw (2 pcs)	B	Fastening mechanism
A	Attachment screw (2 pcs)				
B	Fastening mechanism				
<p>5 (Depending on which connection is installed) Connect the connector:</p> <ul style="list-style-type: none"> • Profibus/S: A32.2 • Ethernet/IP/S: A32.1 • Profinet/S: A32.3 					
6 Make sure the robot system is configured to reflect the installed parts.					

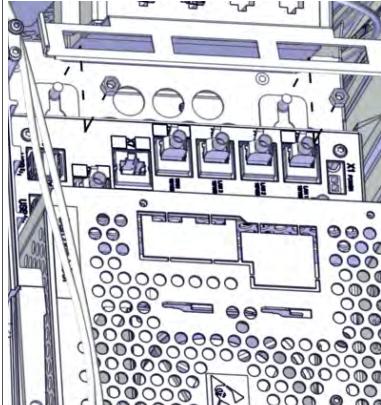
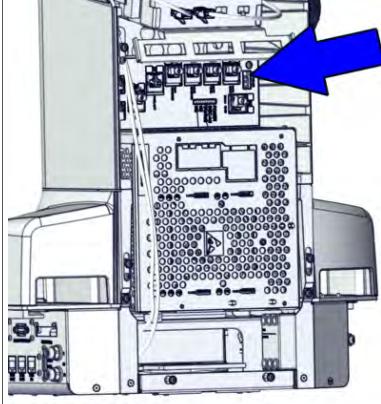
Refitting the computer

Refitting the computer

Action	Note
1 Fit the computer.	DSQC1000 Computer: 3HAC042766-001
2 Connect the and tighten the connector (underneath computer) A35.J1 D-NET	

Continues on next page

4.7.14 Replacing the expansion board complete
Continued

	Action	Note
3	Slide the computer downwards to fit the latches in the recesses.	
4	Tighten the nuts, holding the computer.	 xx1500000386
5	(Depending on which connection is installed) Connect the connector: <ul style="list-style-type: none">• Profibus/S: A32.2• Ethernet/IP/S: A32.1• Profinet/S: A32.3	
6	Connect the connectors: <ul style="list-style-type: none">• A31.USB (X10)• A31.X9 (X9)• A31.X6 (X6)• A31.X5 (X5)• A31.X4 (X4)• A31.X3 (X3)• A31.XS1 (X1)• A31.SERVICE (X2)	 xx1500000371
7	Fasten the cabling with cable ties.  CAUTION Be careful not to bend or break the cables and air hoses.	

Pushing the controller in and fastening it

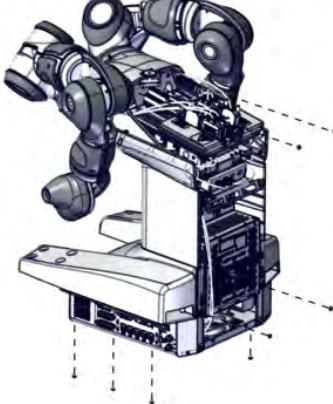
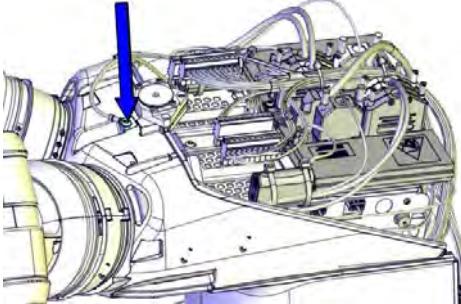
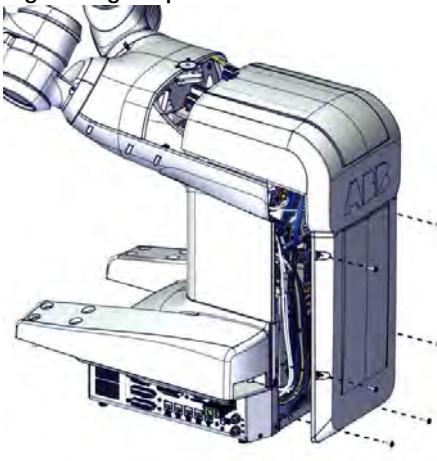
	Action	Note
1	Gently push the controller into the robot body completely.  CAUTION Be careful not to squeeze or damage the cables and air hoses in any way.	

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4 Repair

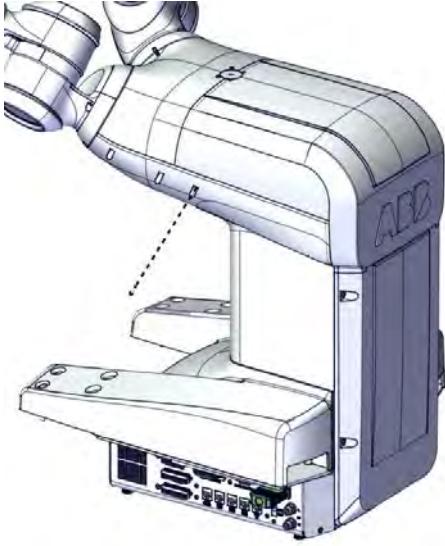
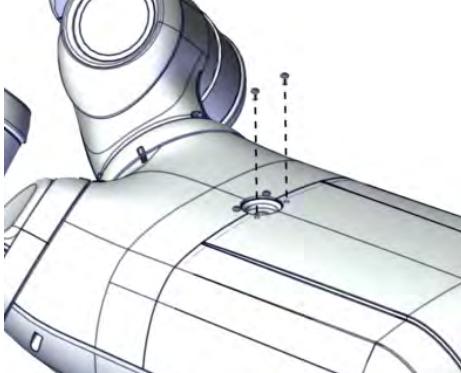
4.7.14 Replacing the expansion board complete

Continued

	Action	Note
2	Refit the attachment screws that fasten the controller to the body.	Screws: 10 pcs. Tightening torque: 0.9 Nm.  xx1500000364
3	Connect the grounding cable.	 xx1500000601
4	Refit the body cover with the attachment screws.	Flange screw (6 pcs) Tightening torque: 0.9 Nm  xx1500000697

Continues on next page

4.7.14 Replacing the expansion board complete
Continued

	Action	Note
5	Refit the two remaining screws of the body cover.	<p>Flange screw (2 pcs) Tightening torque: 0.2 Nm</p>  <p>xx1500000696</p>
6	Refit the attachment screws.	<p>Flange screw (2 pcs) Tightening torque: 0.2 Nm</p>  <p>xx1500000525</p>
7	<p> CAUTION</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 45.</p>	

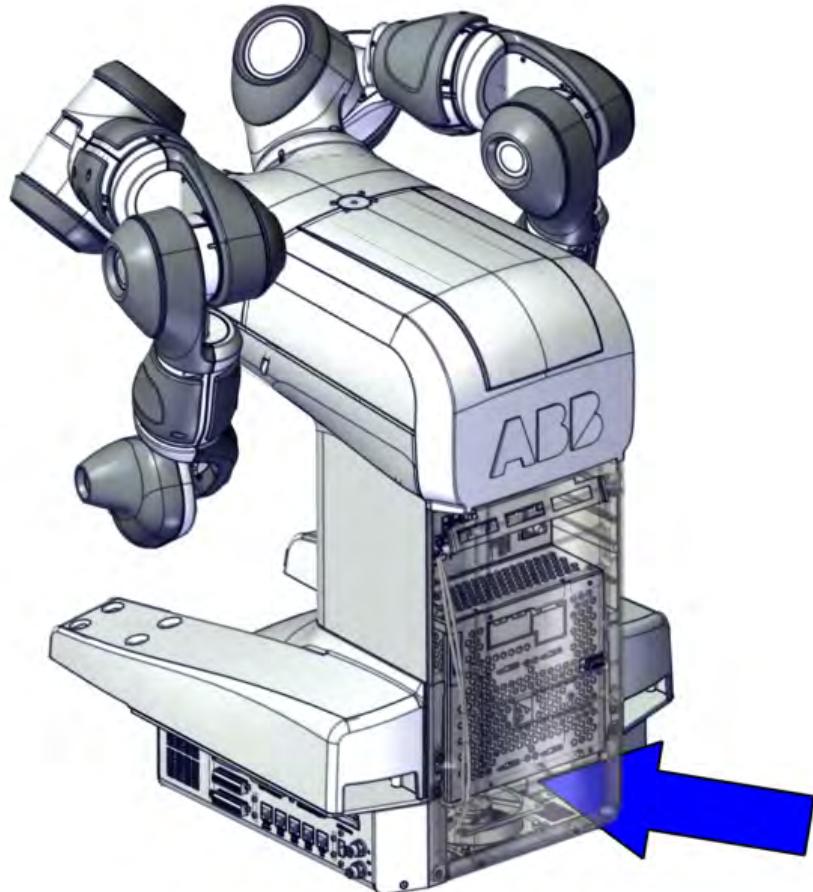
4 Repair

4.7.15 Replacing the DeviceNet master

4.7.15 Replacing the DeviceNet master

Location of the DeviceNet master

The DeviceNet master is located as shown in the figure.



xx1500000561

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 14000* on ABB Library.

Spare part	Article number	Note
DSQC1006 DeviceNet Master PCI-E	3HAC043383-001	

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .

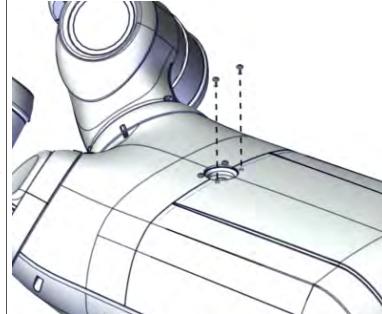
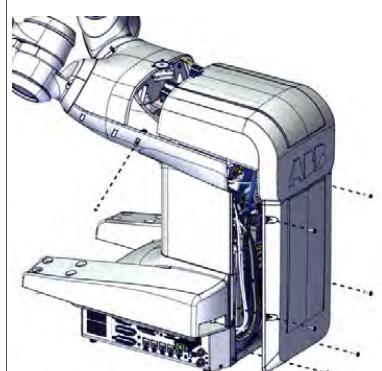
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4.7.15 Replacing the DeviceNet master
Continued

Equipment, etc.	Article number	Note
Trolley	-	

Removing the computer

Pulling the controller out partially

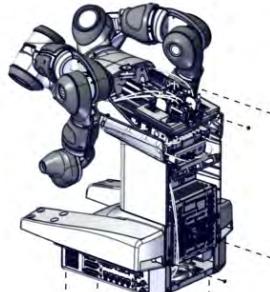
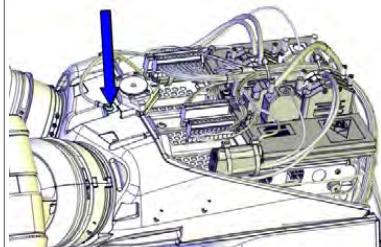
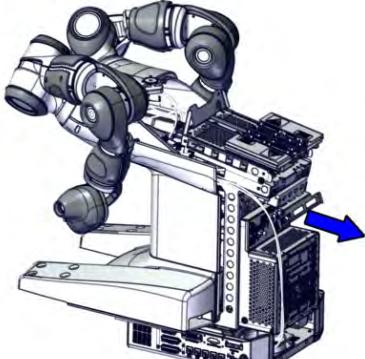
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • air pressure supply to the robot, before starting the repair work on the robot.	
2	Remove the body cover.  ELECTROSTATIC DISCHARGE (ESD) The equipment is sensitive to ESD. Before handling the equipment please read the safety information in the section <i>WARNING - The unit is sensitive to ESD! on page 47</i>	Flange screw (10 pcs)  xx1500000525  xx1500000303

Continues on next page

4 Repair

4.7.15 Replacing the DeviceNet master

Continued

Action	Note
3 Remove the attachment screws that fasten the controller to the body.	 xx1500000364
4 Put a trolley beneath the controller.	
5 Disconnect the grounding cable.	 xx1500000601
6 Carefully pull the controller partially out in the rails.  CAUTION The cabling is still connected inside the robot, so be careful not to strain the cables!	 xx1500000365

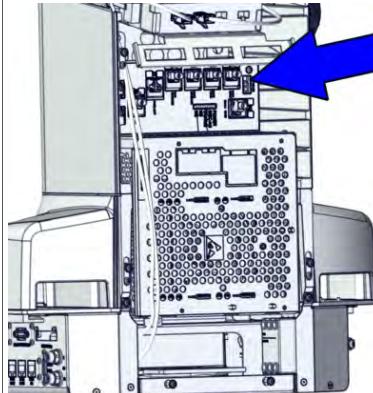
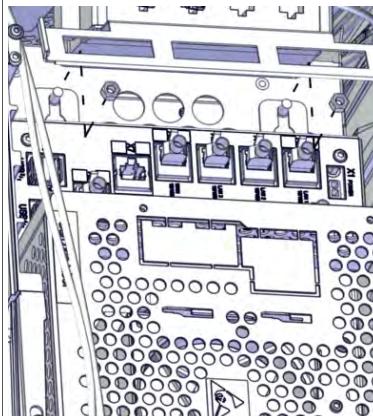
Removing the computer

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

Continues on next page

4.7.15 Replacing the DeviceNet master

Continued

Action	Note
2 Separate the cabling in front of the computer, cut cable ties if necessary. ! CAUTION Be careful not to bend or break the cables and air hoses.	
3 Disconnect the connectors: <ul style="list-style-type: none">• A31.USB (X10)• A31.X9 (X9)• A31.X6 (X6)• A31.X5 (X5)• A31.X4 (X4)• A31.X3 (X3)• A31.XS1 (X1)• A31.SERVICE (X2)	 xx1500000371
4 Cut cable ties from the disconnected cables if necessary.	
5 (Depending on which connection is installed) Disconnect the connector: <ul style="list-style-type: none">• Profibus/S: A32.2• Ethernet/IP/S: A32.1• Profinet/S: A32.3	
6 Loosen the nuts holding the computer.	 xx1500000386
7 Gently push the computer upwards a little bit to release the latches from the recesses.	
8 Disconnect the connection (underneath computer): A35.J1 D-NET	
9 Tilt the computer out and remove it from the controller.	

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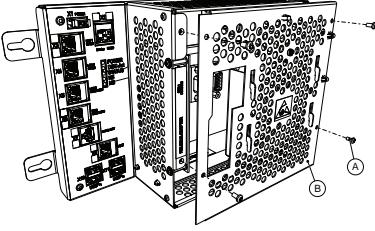
4 Repair

4.7.15 Replacing the DeviceNet master

Continued

Removing the DeviceNet master

Opening the computer

	Action	Note				
1	 DANGER Make sure that all supplies for electrical power 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 <i>WARNING - The unit is sensitive to ESD! on page 47</i>					
3	(Depending on which connection is installed) Disconnect the connector: <ul style="list-style-type: none">• Profibus/S: A32.2• Ethernet/IP/S: A32.1• Profinet/S: A32.3					
4	Open the computer unit by removing the attachment screws and lift the cover off.  CAUTION Be careful not to stretch the fan cable.	 xx1300000684 <table border="1"><tr><td>A</td><td>Attachment screw (4 pcs)</td></tr><tr><td>B</td><td>Cover</td></tr></table>	A	Attachment screw (4 pcs)	B	Cover
A	Attachment screw (4 pcs)					
B	Cover					
5	Disconnect the fan connector.					

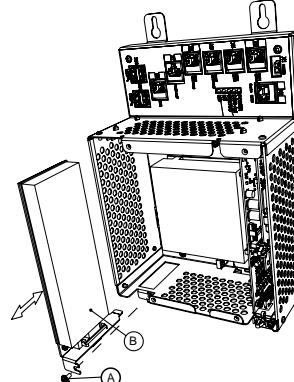
Removing the DeviceNet master

	Action	Note
1	 DANGER Make sure that all supplies for electrical power 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 <i>WARNING - The unit is sensitive to ESD! on page 47</i>	

Continues on next page

4.7.15 Replacing the DeviceNet master

Continued

Action	Note				
3 Remove the attachment screw on the DeviceNet master bracket.	 xx1500000728 <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>A</td> <td>Attachment screw</td> </tr> <tr> <td>B</td> <td>DeviceNet master board</td> </tr> </table>	A	Attachment screw	B	DeviceNet master board
A	Attachment screw				
B	DeviceNet master board				
4 Gently pull the board straight out. CAUTION Always grip the board around the edges to avoid damage to the board or its components. ELECTROSTATIC DISCHARGE (ESD) Immediately put the board in an ESD safe bag or similar.					

Refitting the DeviceNet master**Refitting the DeviceNet master**

Action	Note
1 DANGER Make sure that all supplies for electrical power 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 <i>WARNING - The unit is sensitive to ESD! on page 47</i>	

Continues on next page

4 Repair

4.7.15 Replacing the DeviceNet master

Continued

Action	Note				
<p>3 Fit the DeviceNet master board by pushing it into the socket on the motherboard.</p> <p>CAUTION Always grip the board around the edges to avoid damage to the board or its components.</p>	<p>xx1500000728</p> <table border="1"> <tr> <td>A</td> <td>Attachment screw</td> </tr> <tr> <td>B</td> <td>DeviceNet master board</td> </tr> </table>	A	Attachment screw	B	DeviceNet master board
A	Attachment screw				
B	DeviceNet master board				
4 Refit the attachment screw on the DeviceNet master bracket.					

Closing the computer

Action	Note				
<p>1 DANGER Make sure that all supplies for electrical power and air pressure are turned off.</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 47</p>					
<p>3 Connect the fan connector.</p> <p>CAUTION Be careful not to stretch or squeeze the fan cable.</p>					
4 Fasten the computer cover with its attachment screws.	<p>xx1300000684</p> <table border="1"> <tr> <td>A</td> <td>Attachment screw (4 pcs)</td> </tr> <tr> <td>B</td> <td>Cover</td> </tr> </table>	A	Attachment screw (4 pcs)	B	Cover
A	Attachment screw (4 pcs)				
B	Cover				

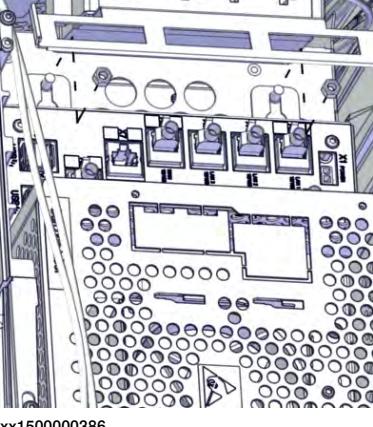
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4.7.15 Replacing the DeviceNet master

Continued

Action	Note
5 (Depending on which connection is installed) Connect the connector: <ul style="list-style-type: none">• Profibus/S: A32.2• Ethernet/IP/S: A32.1• Profinet/S: A32.3	
6 Make sure the robot system is configured to reflect the installed parts.	

Refitting the computer**Refitting the computer**

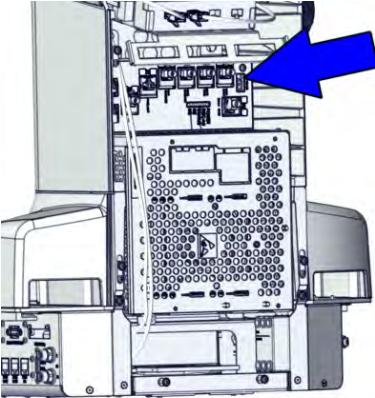
Action	Note
1 Fit the computer.	DSQC1000 Computer: 3HAC042766-001
2 Connect the and tighten the connector (underneath computer) A35.J1 D-NET	
3 Slide the computer downwards to fit the latches in the recesses.	
4 Tighten the nuts, holding the computer.	
5 (Depending on which connection is installed) Connect the connector: <ul style="list-style-type: none">• Profibus/S: A32.2• Ethernet/IP/S: A32.1• Profinet/S: A32.3	

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4 Repair

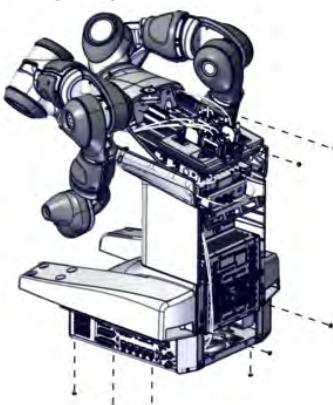
4.7.15 Replacing the DeviceNet master

Continued

Action	Note
6 Connect the connectors: <ul style="list-style-type: none"> • A31.USB (X10) • A31.X9 (X9) • A31.X6 (X6) • A31.X5 (X5) • A31.X4 (X4) • A31.X3 (X3) • A31.XS1 (X1) • A31.SERVICE (X2) 	 xx1500000371
7 Fasten the cabling with cable ties. ! CAUTION Be careful not to bend or break the cables and air hoses.	

Pushing the controller in and fastening it

Action	Note
1 Gently push the controller into the robot body completely. ! CAUTION Be careful not to squeeze or damage the cables and air hoses in any way.	
2 Refit the attachment screws that fasten the controller to the body.	Screws: 10 pcs. Tightening torque: 0.9 Nm.

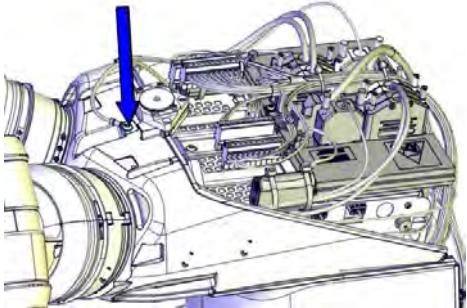
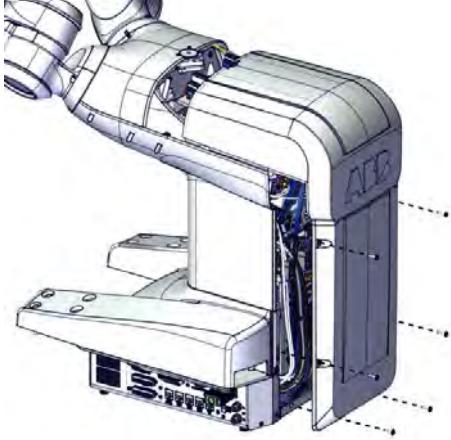
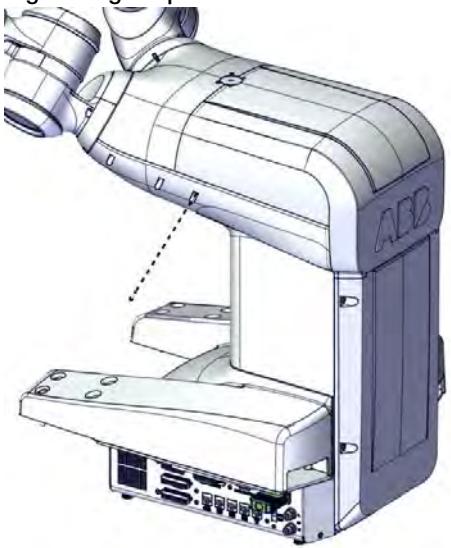


xx1500000364

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4.7.15 Replacing the DeviceNet master

Continued

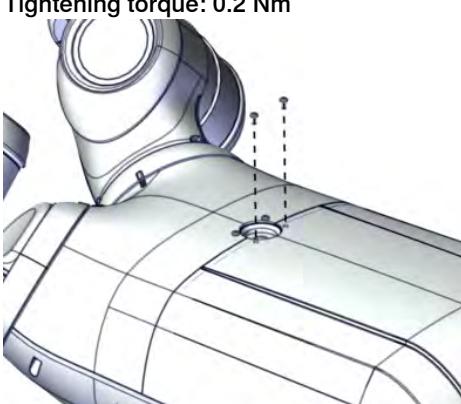
Action	Note
3 Connect the grounding cable.	 xx1500000601
4 Refit the body cover with the attachment screws.	Flange screw (6 pcs) Tightening torque: 0.9 Nm  xx1500000697
5 Refit the two remaining screws of the body cover.	Flange screw (2 pcs) Tightening torque: 0.2 Nm  xx1500000696

Continues on next page

4 Repair

4.7.15 Replacing the DeviceNet master

Continued

Action	Note
6 Refit the attachment screws.	Flange screw (2 pcs) Tightening torque: 0.2 Nm  xx1500000525
7  CAUTION	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 45.

4.7.16 Replacing the fieldbus adapter

Location of the fieldbus adapter

The fieldbus adapter is located as shown in the figure.



xx1500000369

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 14000* on ABB Library.

Spare part	Article number	Note
DSQC667 Profibus Fieldbus adapter	3HAC026840-001	
DSQC688 PROFINET FA	3HAC031670-001	
DSQC669 Ethernet Slave AnyBus adapter	3HAC027652-001	

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4 Repair

4.7.16 Replacing the fieldbus adapter

Continued

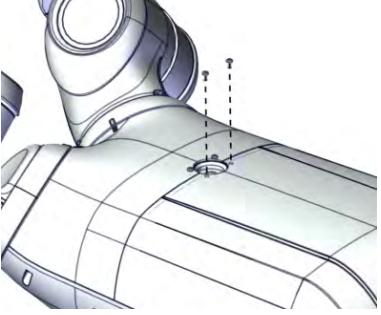
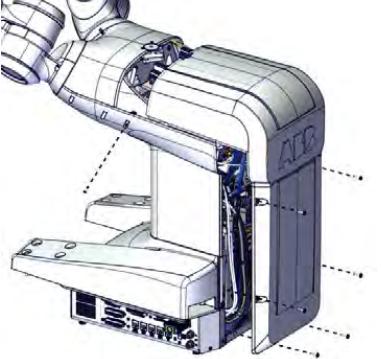
Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Trolley	-	

Removing the fieldbus adapter

Use this procedure to remove the fieldbus adapter.

Remove the body cover

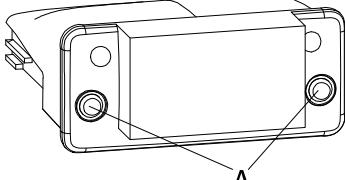
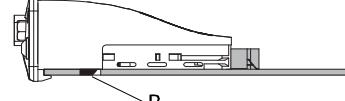
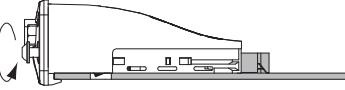
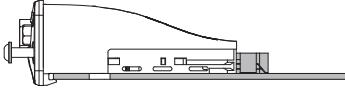
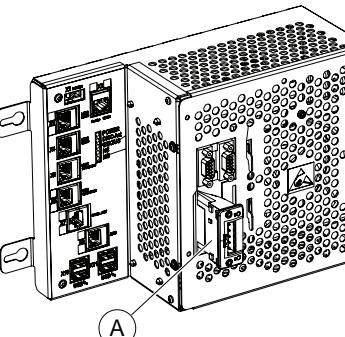
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• air pressure supply to the robot, before starting the repair work on the robot.	
2	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit please read the safety information in the section WARNING - The unit is sensitive to ESD on page 47	Flange screw (10 pcs)  xx1500000525  xx1500000303

Continues on next page

4.7.16 Replacing the fieldbus adapter

Continued

Removing the fieldbus adapter

	Action	Note
1	 DANGER Make sure that all supplies for electrical power 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 <i>WARNING - The unit is sensitive to ESD! on page 47</i>	
3	(Depending on which connection is installed) Disconnect the connector: <ul style="list-style-type: none"> • Profibus/S: A32.2 • Ethernet/IP/S: A32.1 • Profinet/S: A32.3 	
4	Loosen the attachment screws (2 pcs) on front of the fieldbus adapter to release the fastening mechanism.  Note Do not remove the attachment screws, only loosen them.	    xx0700000193 A Attachment screw (2 pcs) B Fastening mechanism
5	Grip the loosened attachment screws and gently pull the fieldbus adapter straight out.	 xx1500001755

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4 Repair

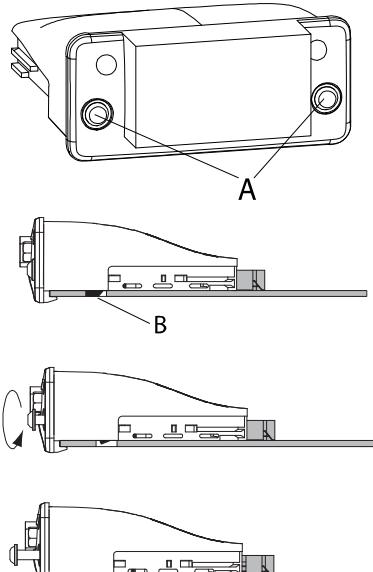
4.7.16 Replacing the fieldbus adapter

Continued

Refitting the fieldbus adapter

Use this procedure to refit the fieldbus adapter.

Refitting the fieldbus adapter

	Action	Note				
1	 DANGER Make sure that all supplies for electrical power 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 <i>WARNING - The unit is sensitive to ESD! on page 47</i>					
3	 CAUTION Always grip the fieldbus adapter around the edges to avoid damage to the adapter or its components.  CAUTION Make sure that the adapter is pushed straight onto the rails. Push carefully so no pins are damaged.					
4	Fasten the fieldbus adapter with its attachment screws.	 xx0700000193 <table border="1"><tr><td>A</td><td>Attachment screw (2 pcs)</td></tr><tr><td>B</td><td>Fastening mechanism</td></tr></table>	A	Attachment screw (2 pcs)	B	Fastening mechanism
A	Attachment screw (2 pcs)					
B	Fastening mechanism					

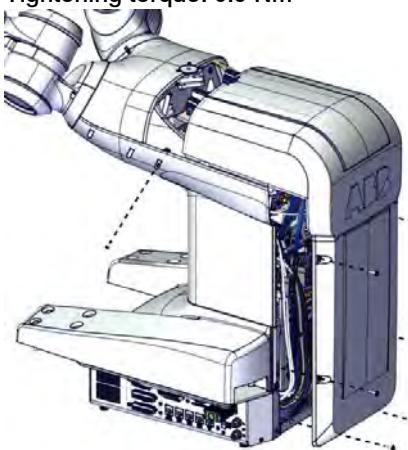
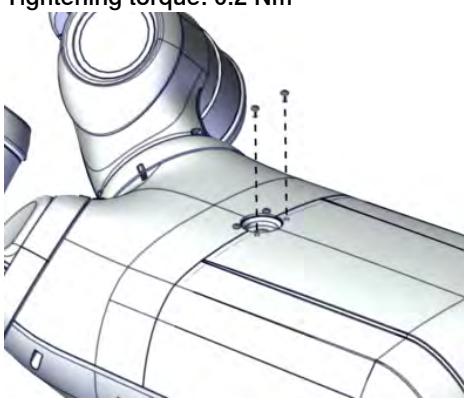
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4.7.16 Replacing the fieldbus adapter

Continued

Action	Note
5 (Depending on which connection is installed) Connect the connector: <ul style="list-style-type: none">• Profibus/S: A32.2• Ethernet/IP/S: A32.1• Profinet/S: A32.3	
6 Make sure the robot system is configured to reflect the installed parts.	

Refitting the body cover

Action	Note
1 Refit the body cover with the attachment screws.	Flange screw (8 pcs) Tightening torque: 0.9 Nm  xx1500000303
2 Refit the attachment screws.	Flange screw (2 pcs) Tightening torque: 0.2 Nm  xx1500000525
3  CAUTION 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 45.	

4 Repair

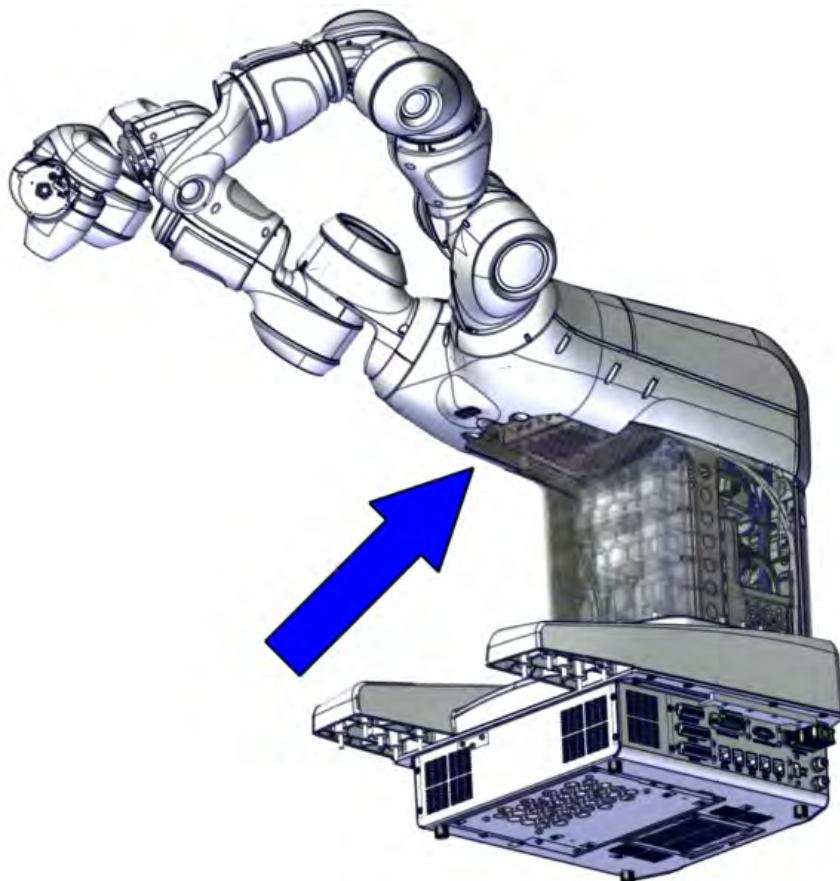
4.8.1 Replacing the brake release harness

4.8 Brake release harness

4.8.1 Replacing the brake release harness

Location of the brake release harness

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



xx1500000737

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 14000* on ABB Library.

Spare part	Article number	Note
Brake release harness	3HAC038361-001	Includes brake release button and harness.

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4.8.1 Replacing the brake release harness

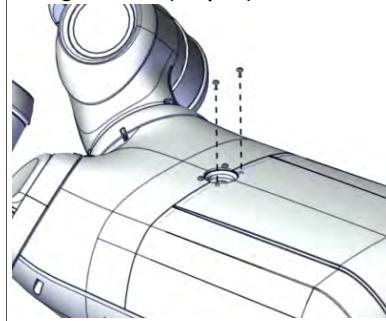
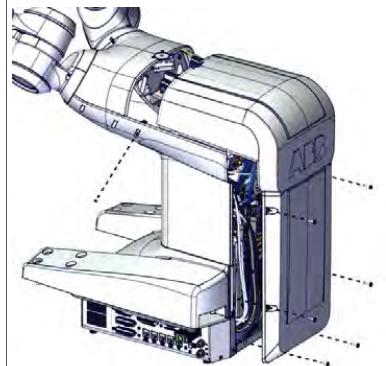
Continued

Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 461 .
Trolley	-	

Removing the brake release harness

Pulling the controller out partially

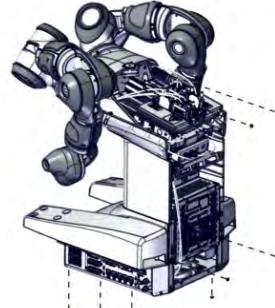
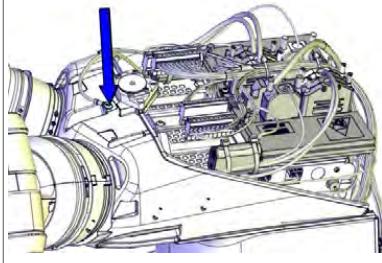
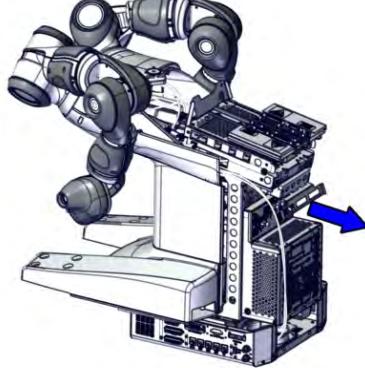
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • air pressure supply to the robot, before starting the repair work on the robot.	
2	 ELECTROSTATIC DISCHARGE (ESD) The equipment is sensitive to ESD. Before handling the equipment please read the safety information in the section WARNING - The unit is sensitive to ESD! on page 47	Flange screw (10 pcs)  xx1500000525  xx1500000303

Continues on next page

4 Repair

4.8.1 Replacing the brake release harness

Continued

Action	Note
3 Remove the attachment screws that fasten the controller to the body.	 xx1500000364
4 Put a trolley beneath the controller.	
5 Disconnect the grounding cable.	 xx1500000601
6 Carefully pull the controller partially out in the rails.  CAUTION The cabling is still connected inside the robot, so be careful not to strain the cables!	 xx1500000365

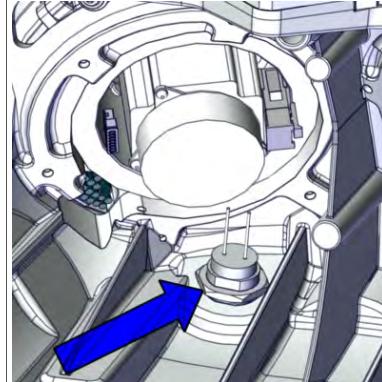
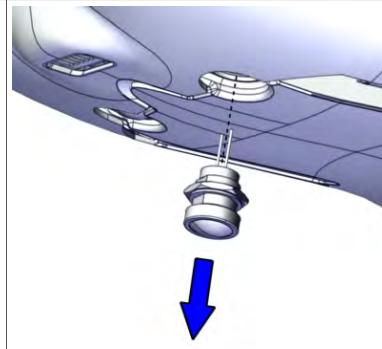
Removing the brake release harness

Action	Note
1  DANGER Make sure that all supplies for electrical power and air pressure are turned off.	
2 Disconnect the brake release harness connector.	

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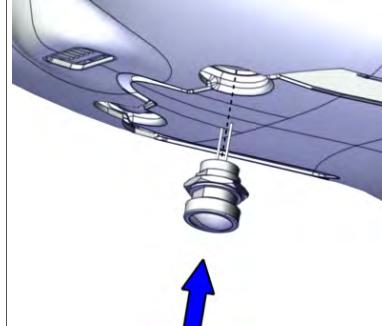
4.8.1 Replacing the brake release harness

Continued

	Action	Note
3	Remove the nut.	 xx1500000744
4	Carefully pull the brake release button out downwards.	 xx1500000745

Refitting the brake release harness

Refitting the brake release harness

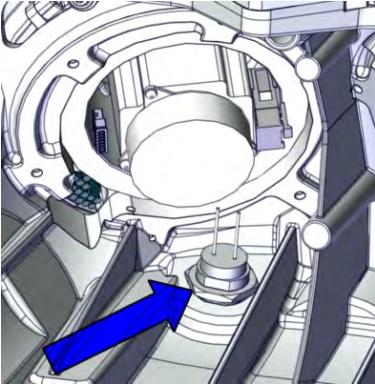
	Action	Note
1	Gently push and pull the brake release harness through the mounting hole.  CAUTION Be careful not to bend or break the cables.	Brake release harness, 3HAC038361-001  xx1500000746

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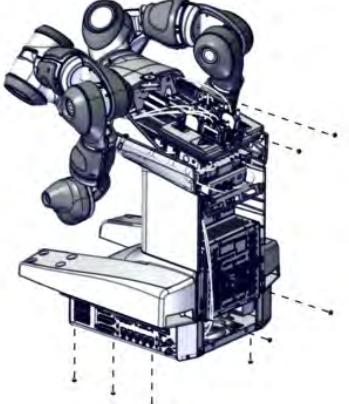
4 Repair

4.8.1 Replacing the brake release harness

Continued

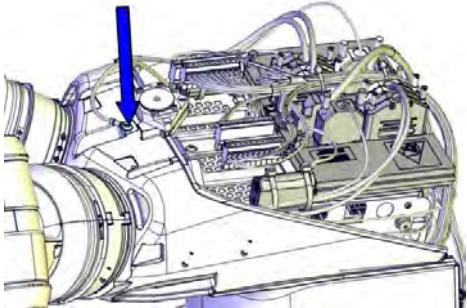
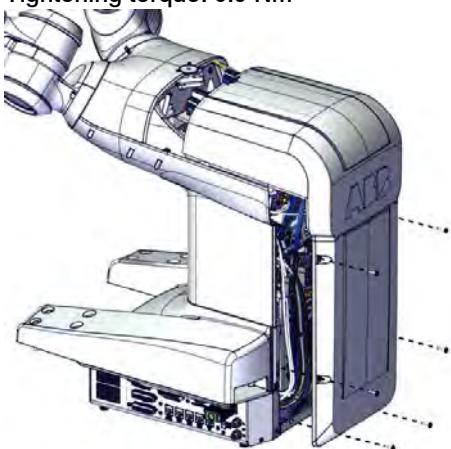
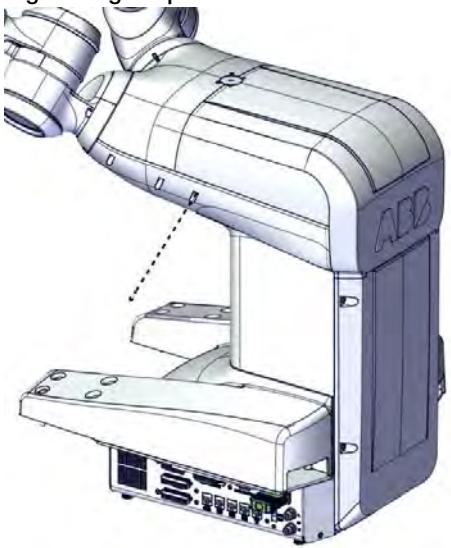
	Action	Note
2	Refit the nut.	 xx1500000744
3	Connect the brake release harness connector.	

Pushing the controller in and fastening it

	Action	Note
1	Gently push the controller into the robot body completely.  CAUTION Be careful not to squeeze or damage the cables and air hoses in any way.	
2	Refit the attachment screws that fasten the controller to the body.	Screws: 10 pcs. Tightening torque: 0.9 Nm.  xx1500000364

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4.8.1 Replacing the brake release harness
Continued

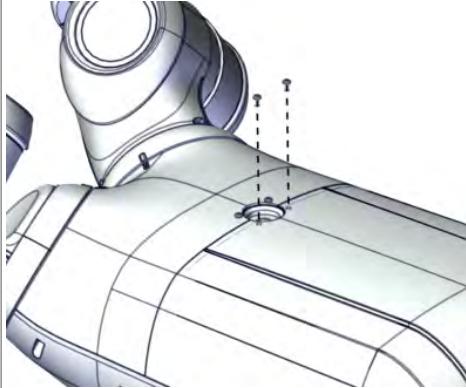
Action	Note
3 Connect the grounding cable.	 xx1500000601
4 Refit the body cover with the attachment screws.	Flange screw (6 pcs) Tightening torque: 0.9 Nm  xx1500000697
5 Refit the two remaining screws of the body cover.	Flange screw (2 pcs) Tightening torque: 0.2 Nm  xx1500000696

Continues on next page

4 Repair

4.8.1 Replacing the brake release harness

Continued

	Action	Note
6	Refit the attachment screws.	<p>Flange screw (2 pcs) Tightening torque: 0.2 Nm</p>  <p>xx1500000525</p>
7	 CAUTION 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 45.	

5 Calibration

5.1 Introduction

General

This chapter includes information about the calibration method.

When the robot system must be recalibrated, it is done with special calibration tools and according to this section.

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 method described in section [Calibrating the robot on page 434](#).

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 442](#). 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 Calibration

5.2 Calibration method

5.2 Calibration method

Overview

This section specifies the different types of calibration and the calibration methods that are supplied by ABB.

Type of calibration

Type of calibration	Description	Calibration method
Standard calibration	The calibrated robot is positioned with the TCP linked to the calibration surface at the robot base, with hall sensor technology.	Fine calibration
Absolute accuracy calibration	<p>Based on standard calibration, and besides positioning the robot at home position, the Absolute accuracy calibration also compensates for:</p> <ul style="list-style-type: none">• Mechanical tolerances in the robot structure• Deflection 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 in the robot.</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>3HAC 14257-1</p> <p>xx0400001197</p>	CalibWare

Calibration method

With the fine calibration method, the robot's TCP is linked to the robot base with hall sensor. Under this condition, all the seven joints' positions are pre-determined, and all of the axes can be calibrated at the same time.

The fine calibration method is used for all IRB 14000 robots and is the recommended method in order to achieve proper performance.

Calibration order of axes: axis 1-2-3-4-5-6-7.

5.3 Calibration scale and correct axis position

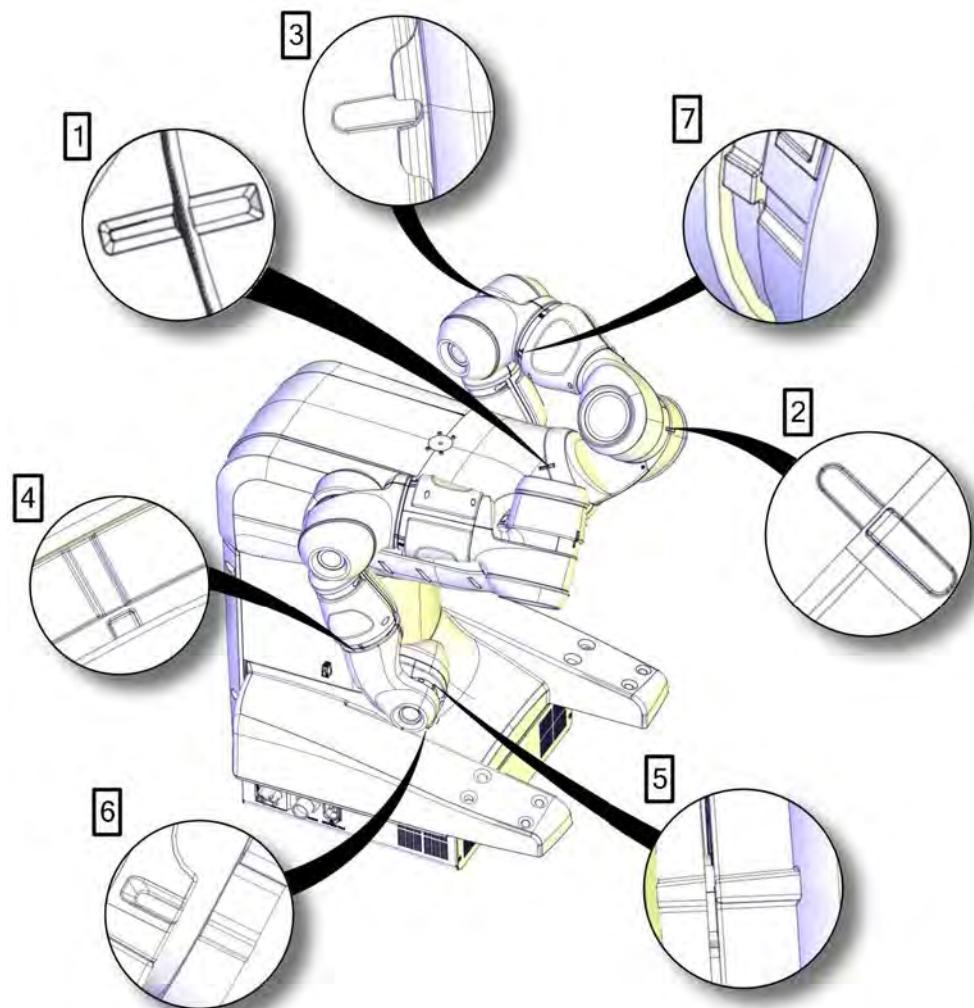
Introduction

This section specifies the calibration scale positions and/or correct axis positions.

Calibration scales/marks

This illustration shows the positions of the calibration scales and marks on the robot.

The number aside of the enlargement corresponds to the axis number.



xx1500000526

5 Calibration

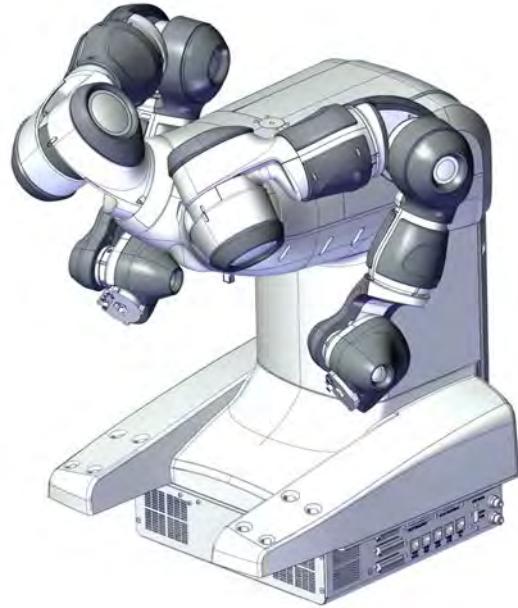
5.4 Calibrating the robot

5.4 Calibrating the robot

Synchronization position

Illustration of robot in synchronization position

The figure shows the robot in its synchronization position, that is when the synchronization marks are aligned with each other on each axis.



xx1500000363

Exact axis positions in degrees

The table below specifies the exact axis positions in degrees.

Axis	IRB 14000 ROB_R	IRB 14000 ROB_L
1	0°	0°
2	-130°	-130°
3	30°	30°
4	0°	0°
5	40°	40°
6	0°	0°
7	-135°	135°

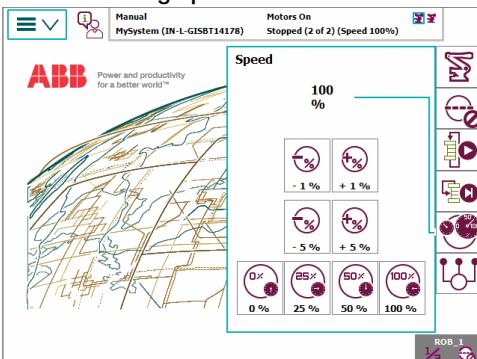
Continues on next page

Calibrating the robot with fine calibration procedure

Moving the robot to its calibration position

Action	Note
1  CAUTION When releasing the holding brakes, the robot axes may move very quickly and sometimes in unexpected ways!	
2 Release the brakes of the robot arm to be calibrated and move the arm manually so that the synchronization mark of each joint is aligned. The robot now stands in its calibration position.	The synchronization marks are shown in Calibration scale and correct axis position on page 433 . There is a tolerance for the joint position. The edge of a mark should be at least within the area of the opposite mark.

Setting the running speed to 100%

Action	Note
1 Set the running speed to 100%. 	

Selecting the Calibration with hall sensors (CalHall) routine

Action	Note
1 Open the Program Editor on the FlexPendant.	
2 Select the task that corresponds to the robot arm to be calibrated. Tap Open.	
3 If necessary, create a new program. This needs to be done if no existing program is available.	
4 Select Debug and tap PP to Main.	
5 Select Debug and tap Call Routine...	
6 Select CalHall.	
7 Go to Motor On and press the Start button.	

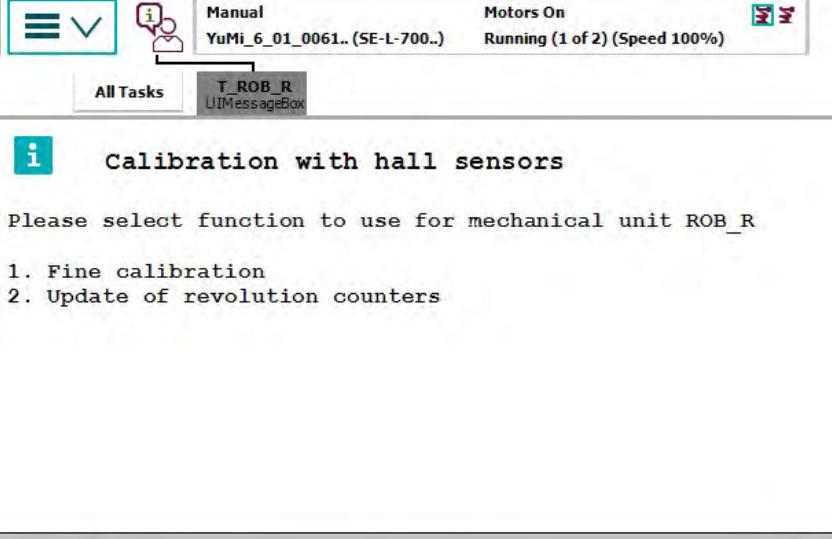
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5 Calibration

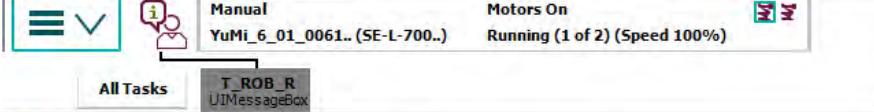
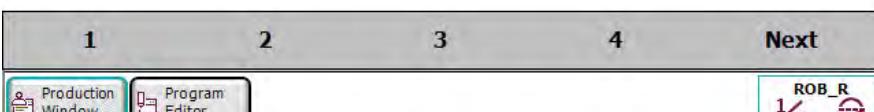
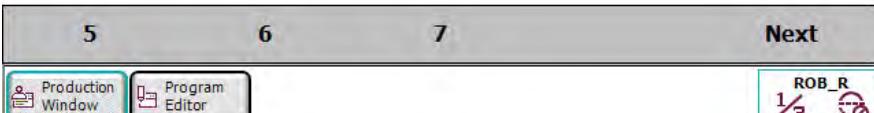
5.4 Calibrating the robot

Continued

Selecting the function Fine calibration

	Action
1	<p>In the calibration with hall sensors routine (CalHall), tap 1 to select the function of fine calibration.</p>  <p>The screenshot shows the YuMi software interface with the following details:</p> <ul style="list-style-type: none">Top bar: Manual mode, YuMi_6_01_0061.. (SE-L-700..), Motors On, Running (1 of 2) (Speed 100%).Bottom bar: All Tasks, T_ROB_R (highlighted in blue), UIMessageBox.Message box: i Calibration with hall sensors Please select function to use for mechanical unit ROB_R 1. Fine calibration 2. Update of revolution countersBottom row: Buttons for T_ROB_R CAL_HAL..., Production Window, I/O, Jogging, and a status indicator showing ROB_R 1/3.Text at the bottom: xx1400002694

Continues on next page

	Action
2	<p>Tap to select which joint(s) to fine calibrate. Joints 1, 2, 3 and 4 are selectable in the first window. Tap Next to open the second window where joints 5, 6 and 7 are selectable.</p>  <p>i Selection of joint(s) to update</p> <p>Choose joint(s) to fine calibrate for ROB_R</p> <p>1. [X] 2. [X] 3. [X] 4. [X] 5. [X] 6. [X] 7. [X]</p>  <p>1 2 3 4 Next</p> <p>Production Window Program Editor</p> <p>xx1500000658</p> <p>i Selection of joint(s) to update</p> <p>Choose joint(s) to fine calibrate for ROB_R</p> <p>1. [X] 2. [X] 3. [X] 4. [X] 5. [X] 6. [X] 7. [X]</p>  <p>5 6 7 Next</p> <p>Production Window Program Editor</p> <p>xx1500000659</p>

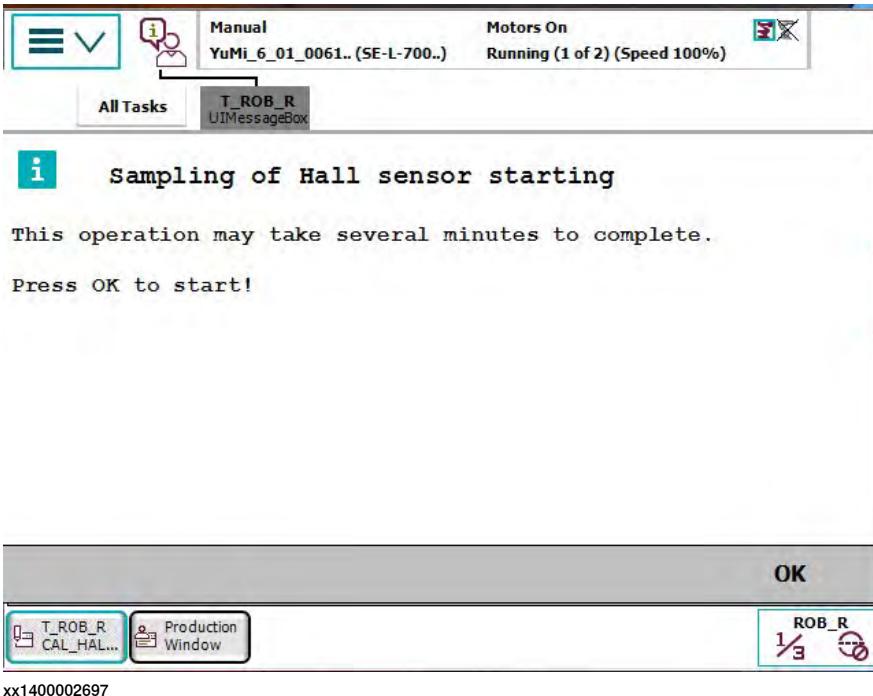
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5 Calibration

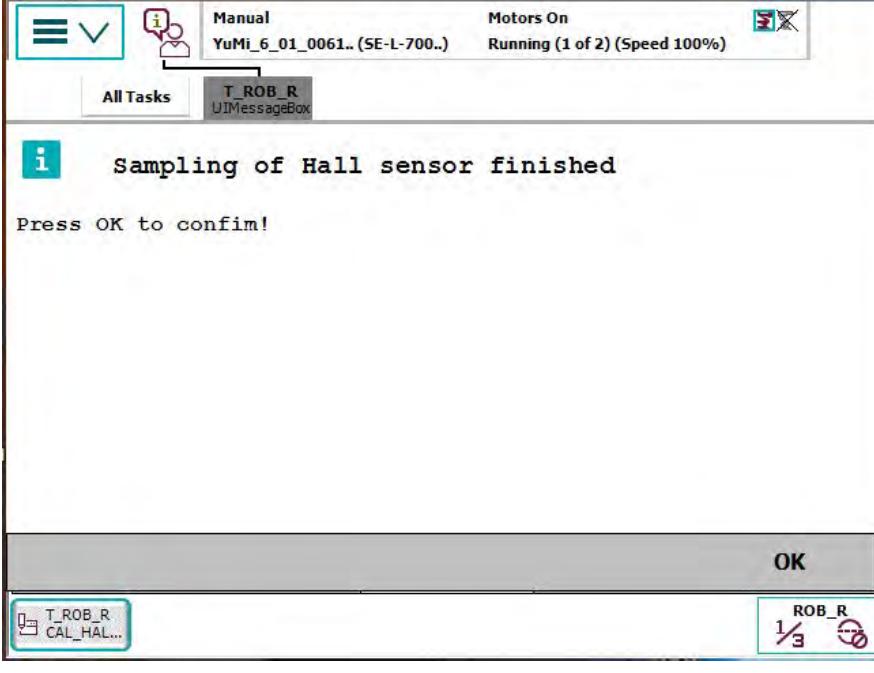
5.4 Calibrating the robot

Continued

Running the fine calibration procedure

	Action
1	<p>Tap OK to start the sampling procedure of the hall sensor. One at a time, each selected joint now rotates back and forth several times to calculate and find the exact position where the hall sensor is aligned with the magnet. Calibration order: axis 1-2-3-4-5-6-7.</p> <p>Note</p> <p>This procedure may take several minutes.</p>  <p>The screenshot shows the software interface with the following details:</p> <ul style="list-style-type: none">Top bar: Manual mode, YuMi_6_01_0061.. (SE-L-700..), Motors On, Running (1 of 2) (Speed 100%).Bottom bar: T_ROB_R, CAL_HAL..., Production Window, ROB_R, 1/3.Message box content:<ul style="list-style-type: none">Sampling of Hall sensor startingThis operation may take several minutes to complete.Press OK to start!Bottom status bar: xx1400002697.

Continues on next page

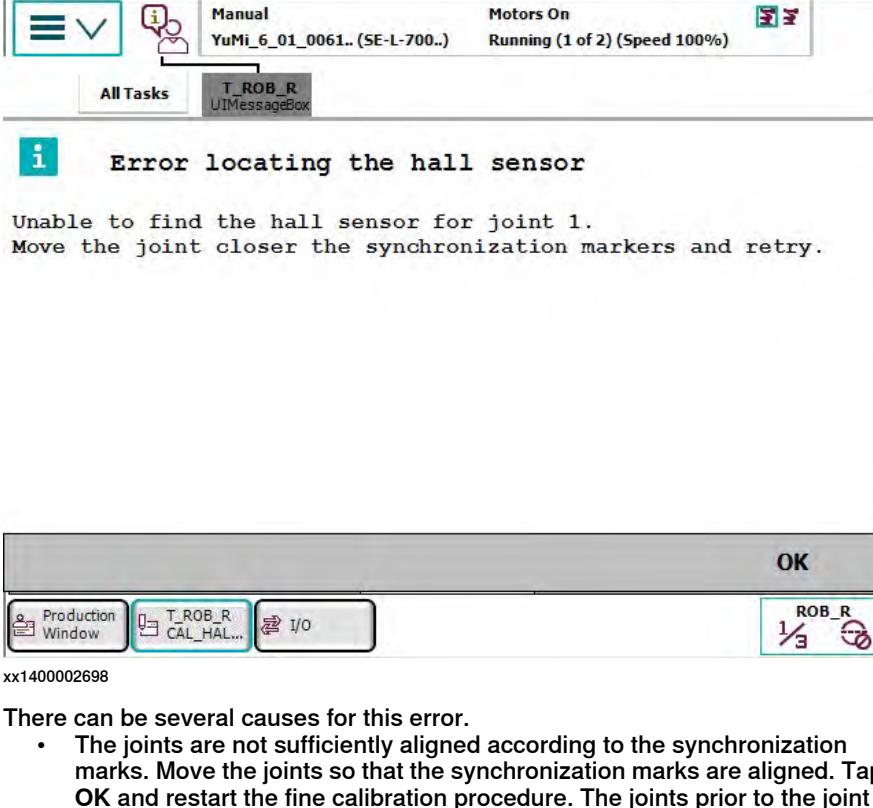
	Action
2	When the sampling of hall sensors is finished, tap OK to confirm.  <p>The screenshot shows the YuMi software interface with a message box. The message box contains the text "Sampling of Hall sensor finished" and "Press OK to confirm!". At the bottom right of the message box is an "OK" button. Below the message box, the task bar shows "T_ROB_R CAL_HAL..." and the status bar shows "xx1400002898". The top of the screen displays "Manual", "YuMi_6_01_0061.. (SE-L-700..)", "Motors On", and "Running (1 of 2) (Speed 100%)".</p>

Continues on next page

5 Calibration

5.4 Calibrating the robot

Continued

Action
<p>3 If the hall sensor can not be found, following error message is displayed.</p>  <p>There can be several causes for this error.</p> <ul style="list-style-type: none"> The joints are not sufficiently aligned according to the synchronization marks. Move the joints so that the synchronization marks are aligned. Tap OK and restart the fine calibration procedure. The joints prior to the joint that stopped the calibration procedure are calibrated and do not need to be calibrated again. Joints coming after the joint that stopped the calibration procedure has not been calibrated. (Calibration order: axis 1-2-3-4-5-6-7.) The hall sensor is defect. Perform troubleshooting of I/O signals. Possible replacement of hall sensor may be required.

Checking the synchronization position of all axes

Action	Note
1 Jog each axis to its exact synchronization position in degrees using the FlexPendant.	Degrees are specified in Exact axis positions in degrees on page 434 .
2 Check that the synchronization marks on each axis are aligned with each other. Are they aligned within the tolerances? The edge of a mark should be at least within the area of the opposite mark. <ul style="list-style-type: none"> If yes, the calibration is verified and the robot is correctly calibrated. No more action needed. If no, then move the robot to calibration position again and repeat the fine calibration procedure. Moving the robot to its calibration position on page 435 Running the fine calibration procedure on page 438 	

Continues on next page

After calibration

	Action	Note
1	Refit any tools or customer cables previously removed from the arm.	

5 Calibration

5.5 Updating revolution counters

5.5 Updating revolution counters

Introduction

This section describes how to do a rough calibration of each robot axis, which updates the revolution counter value for each axis using the FlexPendant.

The procedure can be summarized accordingly:

- 1 Manually move the manipulator to the calibration position.
- 2 Select the Calibration with hall sensors (CalHall) routine.
- 3 Select the function Update of revolution counters.
- 4 Store the revolution counter setting.

Each step is described in detail in following sections.

Step 1 - Manually moving the manipulator to the calibration position

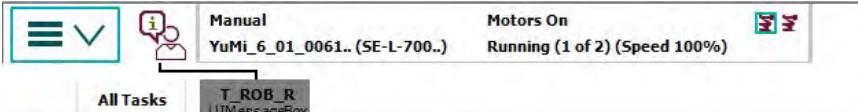
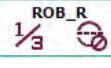
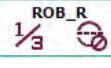
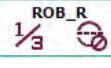
	Action	Note
1	 CAUTION When releasing the holding brakes, the robot axes may move very quickly and sometimes in unexpected ways!	
2	Release the brakes of the robot arm to be calibrated and move the arm manually so that the synchronization mark of each joint is aligned. The robot now stands in its calibration position.	The synchronization marks are shown in Calibration scale and correct axis position on page 433 . There is a tolerance for the joint position. The edge of a mark should be at least within the area of the opposite mark.

Step 2 - Selecting the Calibration with hall sensors (CalHall) routine

	Action	Note
1	Open the Program Editor on the FlexPendant.	
2	Select the task that corresponds to the robot arm to be calibrated. Tap Open.	
3	If necessary, create a new program. This needs to be done if no existing program is available.	
4	Select Debug and tap PP to Main.	
5	Select Debug and tap Call Routine...	
6	Select CalHall.	
7	Go to Motor On and press the Start button.	

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Step 3 - Selecting the function Update of revolution counters

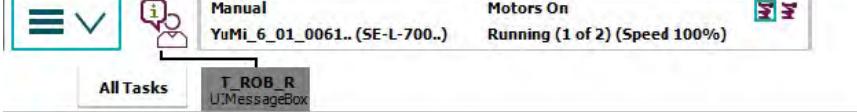
	Action										
1	<p>In the calibration with hall sensors routine (CalHall), tap 2 to select the function of updating the revolution counters.</p>  <p>i Calibration with hall sensors</p> <p>Please select function to use for mechanical unit ROB_R</p> <p>1. Fine calibration 2. Update of revolution counters</p> <table border="1" style="margin-top: 20px; width: 100%;"> <tr> <td style="text-align: center; padding: 5px;">1</td> <td style="text-align: center; padding: 5px;">2</td> </tr> <tr> <td style="padding: 5px;"> <input checked="" type="button"/> T_ROB_R CAL_HAL... </td> <td style="padding: 5px;"> <input type="button"/> Production Window </td> </tr> <tr> <td style="padding: 5px;"> <input type="button"/> I/O </td> <td style="padding: 5px;"> <input type="button"/> Jogging </td> </tr> <tr> <td colspan="2" style="text-align: right; padding: 5px;"> xx1400002694 </td> </tr> <tr> <td colspan="2" style="text-align: right; padding: 5px;">  </td> </tr> </table>	1	2	<input checked="" type="button"/> T_ROB_R CAL_HAL...	<input type="button"/> Production Window	<input type="button"/> I/O	<input type="button"/> Jogging	xx1400002694			
1	2										
<input checked="" type="button"/> T_ROB_R CAL_HAL...	<input type="button"/> Production Window										
<input type="button"/> I/O	<input type="button"/> Jogging										
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5 Calibration

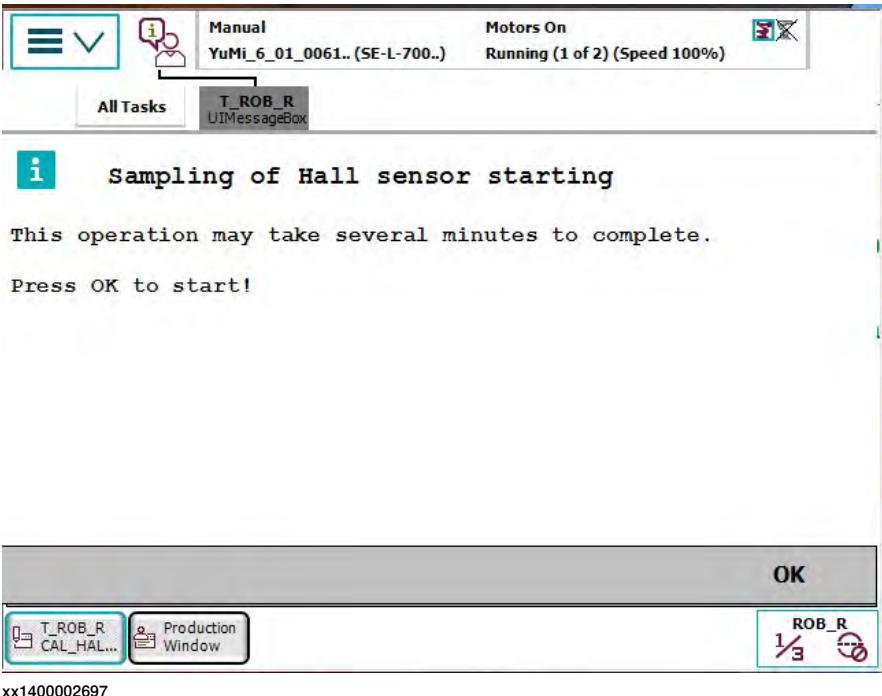
5.5 Updating revolution counters

Continued

	Action
2	<p>Tap to select which joint(s) to update revolution counters for. Joints 1, 2, 3 and 4 are selectable in the first window. Tap Next to open the second window where joints 5, 6 and 7 are selectable.</p>  <p>i Selection of joint(s) to update</p> <p>Choose joint(s) to update revolution counters for ROB_R</p> <ul style="list-style-type: none">1. [X]2. [X]3. [X]4. [X]5. [X]6. [X]7. [X] <p>1 2 3 4 Next</p> <p>Production Window T_ROB_R CAL_HAL... ROB_R 1/3</p> <p>xx1400002695</p>  <p>i Selection of joint(s) to update</p> <p>Choose joint(s) to update revolution counters for ROB_R</p> <ul style="list-style-type: none">1. [X]2. [X]3. [X]4. [X]5. [X]6. [X]7. [X] <p>5 6 7 Next</p> <p>Production Window T_ROB_R CAL_HAL... ROB_R 1/3</p> <p>xx1400002696</p>

Continues on next page

Step 4 - Storing the revolution counter setting

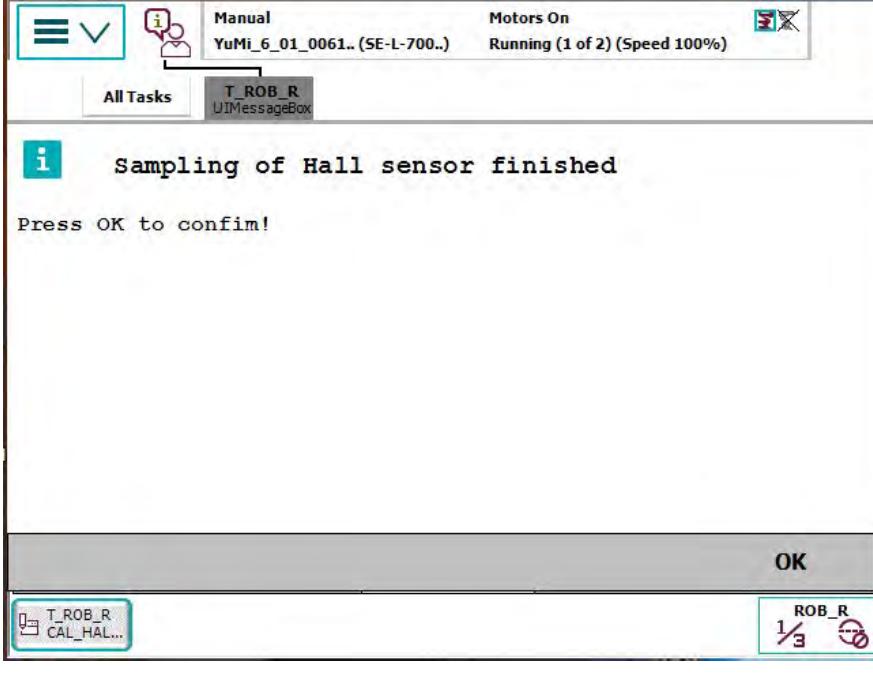
	Action
1	<p>Tap OK to start the sampling procedure of the hall sensor. One at a time, each selected joint now rotates back and forth several times to calculate and find the exact position where the hall sensor is aligned with the magnet. Calibration order: axis 1-2-3-4-5-6-7.</p> <p>Note</p> <p>This procedure may take several minutes.</p>  <p>The screenshot shows the YuMi software interface with the following details: - Top bar: Manual mode, YuMi_6_01_0061.. (SE-L-700..), Motors On, Running (1 of 2) (Speed 100%). - Bottom bar: T_ROB_R, CAL_HAL... (highlighted in blue), Production Window, ROB_R status (1/3, red circle).</p>

Continues on next page

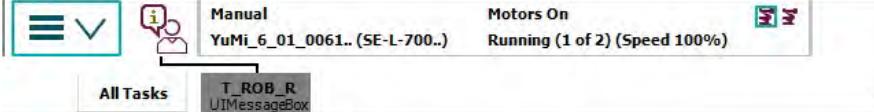
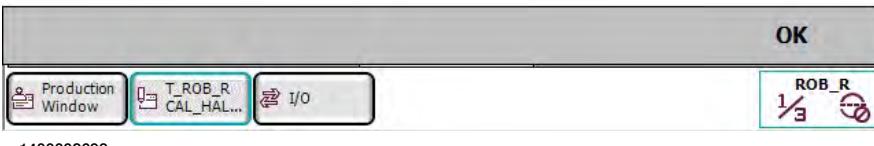
5 Calibration

5.5 Updating revolution counters

Continued

	Action
2	<p>When the sampling of hall sensors is finished, tap OK to confirm.</p>  <p>The screenshot shows a robotic control interface with a message box. The message box contains the text "Sampling of Hall sensor finished" and "Press OK to confirm!". At the bottom right of the message box is a large "OK" button. Below the message box, there is a task bar with icons for "T_ROB_R" and "CAL_HAL..." on the left, and "ROB_R" with a progress indicator "1/3" and a circular icon on the right. The background of the interface shows "Manual" mode, "YuMi_6_01_0061.. (SE-L-700..)", and "Motors On Running (1 of 2) (Speed 100%)".</p>

Continues on next page

Action
<p>3 If the hall sensor can not be found, following error message is displayed.</p>  <p>i Error locating the hall sensor</p> <p>Unable to find the hall sensor for joint 1. Move the joint closer the synchronization markers and retry.</p>  <p>OK</p> <p>Production Window T_ROB_R CAL_HAL... I/O</p> <p>xx1400002698</p> <p>ROB_R 1/3</p> <p>There can be several causes for this error.</p> <ul style="list-style-type: none"> The joints are not sufficiently aligned according to the synchronization marks. Move the joints so that the synchronization marks are aligned. Tap OK and restart the fine calibration procedure. The joints prior to the joint that stopped the calibration procedure are calibrated and do not need to be calibrated again. Joints coming after the joint that stopped the calibration procedure has not been calibrated. (Calibration order: axis 1-2-3-4-5-6-7.) The hall sensor is defect. Perform troubleshooting of I/O signals. Possible replacement of hall sensor may be required.

5 Calibration

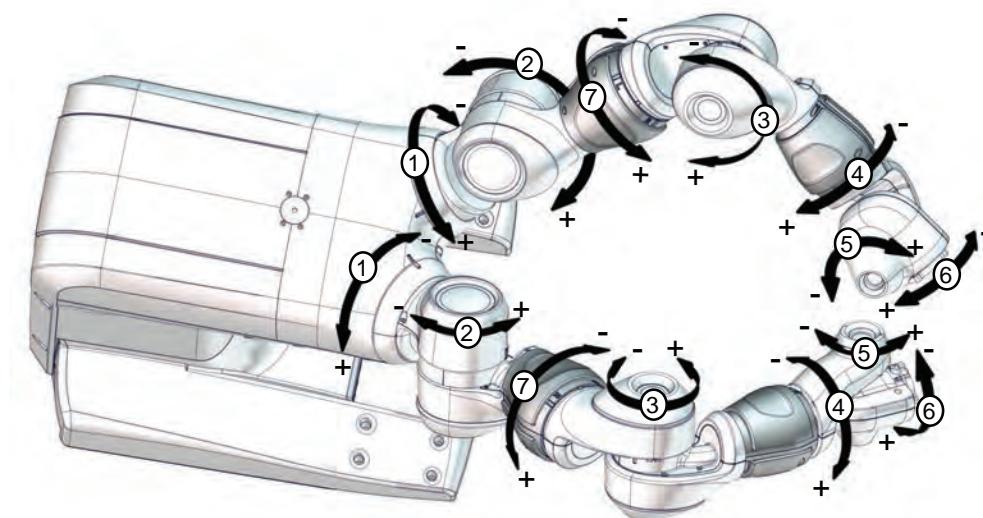
5.6 Calibration movement directions for all axes

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.

This is normally handled by the robot calibration software.

Calibration movement directions, 7 axes



xx1500000254

5.7 Verifying the calibration position

Introduction

Verify the calibration position of the robot before beginning any programming of the robot system. This may be done:

- Using a **MoveAbsJ** instruction with argument according to calibration position degrees 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 calibration 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 for the right arm: <pre>MoveAbsJ [[0,-130,30,0,40,0], [-135,9E9,9E9,9E9,9E9,9E9]]\NoEOffs, v1000, fine, tool0;</pre> Create the following program for the left arm: <pre>MoveAbsJ [[0,-130,30,0,40,0], [135,9E9,9E9,9E9,9E9,9E9]]\NoEOffs, v1000, fine, tool0;</pre>	
5	Run the program in manual mode.	
6	Verify that the calibration marks for the axes align correctly. If they do not, then update the revolution counters.	See Calibration scale and correct axis position on page 433 and Updating revolution counters on page 442 .

Using the jogging window

Use this procedure to jog the robot to the calibration position for 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 the calibration position degrees.	Degrees are specified in Exact axis positions in degrees on page 434 .
5	Verify that the calibration marks for the axes align correctly. If they do not, then update the revolution counters!	See Calibration scale and correct axis position on page 433 and Updating revolution counters on page 442 .

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6 Decommissioning

6.1 Introduction

Introduction

This section contains information to consider when taking a product, robot or controller, out of operation.

It deals with how to handle potentially dangerous components and potentially hazardous materials.

General

All used grease/oils and dead batteries **must** be disposed of in accordance with the current legislation of the country in which the robot and the control unit are installed.

If the robot or the control unit is partially or completely disposed of, the various parts **must** be grouped together according to their nature (which is all iron together and all plastic together), and disposed of accordingly. These parts **must** also be disposed of in accordance with the current legislation of the country in which the robot and control unit are installed.

6 Decommissioning

6.2 Environmental information

6.2 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
Steel	Gears, screws, washers, brackets
Neodymium	Brakes, motors
Plastic/rubber	Cables, connectors, covers, etc
Foam	Covers
Oil, grease	Gears, cables, etc
Aluminium	Base, body, arm, etc
Magnesium	Wrist casting, upper arm, back cover, tool flange, etc
Magnalium	

Oil and grease

Where possible, arrange for oil and grease to be recycled. Dispose of via an authorized person/contractor in accordance with local regulations. Do not dispose of oil and grease near lakes, ponds, ditches, down drains, or onto soil. Incineration must be carried out under controlled conditions in accordance with local regulations.

Also note that:

- Spills can form a film on water surfaces causing damage to organisms.
Oxygen transfer could also be impaired.
- Spillage can penetrate the soil causing ground water contamination.

6.3 Scrapping of robot

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.

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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 safety standards

7.2 Applicable safety standards

Standards, EN ISO

The robot system is designed in accordance with the requirements of:

Standard	Description
EN ISO 12100	Safety of machinery - Basic concepts, general principles for design
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 ⁱ	Robots for industrial environments - Safety requirements - Part 1 Robot
EN ISO 9787	Manipulating industrial robots, coordinate systems, and motion nomenclatures
EN ISO 9283	Manipulating industrial robots, performance criteria, and related test methods
EN ISO 14644-1 ⁱⁱ	Classification of air cleanliness
EN IEC 61000-6-4	EMC, Generic emission
EN IEC 61000-6-2	EMC, Generic immunity
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 See [Deviations from ISO 10218-1:2011 on page 456](#).

ⁱⁱ Only robots with protection Clean Room.

Deviations from ISO 10218-1:2011

ISO 10218-1:2011 was developed with conventional industrial robots in mind.

Deviations from the standard are motivated for IRB 14000 in the table below. More information about ISO 10218-1 compliance is given in [technote_150918](#).

Requirement	IRB 14000 deviation	Motivation
§5.7.1 Mode selector which can be locked in each position.	The mode selector is implemented in software on FlexPendant.	Automatic and manual mode are usability features for IRB 14000, but not safety features. Locking the operating mode does not contribute to a necessary risk reduction. ⁱ
§5.12.1 Limiting the range of motion by adjustable stops (§5.12.2) or by safety functions (§5.12.3).	IRB 14000 does not have adjustable mechanical stops or provisions to install non-mechanical limiting devices.	The IRB 14000 robot is intended for collaborative applications where contact between robot and the operator is harmless. Limiting the working range is then not necessary for risk reduction. Note that PPE (Personal Protective Equipment) may be required. See Personal protective equipment on page 18

ⁱ The selector is replaced by a selection through software and user authorities can be set to restrict the use of certain functions of the robot (e.g. access codes).

Continues on next page

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
EN 953	Safety of machinery - General requirements for the design and construction of fixed and movable guards

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 434-03	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 14000.

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 Tighten to the torque as described in the procedures.

Lubricant	Art. no.
Molycote 1000 (molybdenum disulphide grease)	11712016-618

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 38 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	Note
1	Torque screwdriver JOFAST 70-ICP range 0.07-0.70 Nm i	
1	Torque screwdriver JOFAST 170-ICP range 0.17-1.70 Nm i	
1	Torque screwdriver JOFAST 450-ICP range 0.45-4.50 Nm i	
1	Torque screwdriver TLS1360 range 2.5-13.6 Nm i	
1	Screw bit (3mm--1/4")	
1	Screw bit (3mm--1/4"(BALL HEAD))	
1	Screw bit (2mm--1/4")	
1	Screw bit (2mm--1/4"(BALL HEAD))	
1	Screw bit (TX6--1/4")	
1	Screw bit (1.5mm--1/4")	
1	Screw bit (1.5mm--1/4"(BALL HEAD))	
1	Screw bit (1.0mm--1/4")	
1	Screw bit (TX10--1/4")	
1	Screw bit (TX20--1/4")	
1	Screw bit (4mm--1/4")	
1	Screw bit (4mm--1/4"(BALL HEAD))	
1	Wrench 7mm	
1	Wrench 8mm	

i The standard torque screwdriver should be calibrated to the torque value specified in the repair procedures, in advance.

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 461*](#), and of special tools, listed directly in the instructions and also gathered in this section.

Special tools



Note

If the replacing procedure is not listed in the table below, only standard tools are needed for the procedure.

Continues on next page

Tools and equipment with spare part number: (These tools can be ordered from ABB)		Axis-1 motor	Axis-2 motor	Axis-7 motor	Axis-3 motor	Axis-4 motor	Axis-5 motor	Axis-6 motor
Removal tools								
3HAC054868-001	Removal tool		1	1				
3HAC054869-001	Removal tool				1	1		
Lifting accessories								
-	Lifting eye M8 DIN580							
Fixtures								
3HAC054870-001	Fixture tool for wave generator M93		1	1				
3HAC054871-001	Fixture tool for wave generator M92				1	1		
3HAC054904-001	Fixture tool for wave generator M91						1	1

Continues on next page

7 Reference information

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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