

ROBOTICS

Product manual

CRB 15000



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**Product manual
CRB 15000
OmniCore**

**Document ID: 3HAC077389-001
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Overview of this manual

About this manual

This manual contains instructions for:

- mechanical and electrical installation of the CRB 15000
- maintenance of the CRB 15000
- mechanical and electrical repair of the CRB 15000

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

- *Standard*

Product manual scope

The manual covers all variants and designs of the CRB 15000. Some variants and designs may have been removed from the business offer and are no longer available for purchase.

Usage

This manual should be used during:

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



Note

It is the responsibility of the integrator to conduct a hazard and risk analysis of the final application and to ensure its safety.

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

Who should read this manual?

This manual is intended for:

- installation personnel
- maintenance personnel
- repair personnel.

Prerequisites

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

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

Continues on next page

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 - CRB 15000</i>	3HAC079469-001
<i>Product specification - CRB 15000</i>	3HAC077390-001
<i>Product manual - OmniCore C30</i>	3HAC060860-001
<i>Circuit diagram - CRB 15000</i>	3HAC074304-003
<i>Operating manual - Integrator's guide OmniCore</i>	3HAC065037-001
<i>Technical reference manual - System parameters</i>	3HAC065041-001

Revisions

Revision	Description
A	First edition.

Product documentation

Categories for user documentation from ABB Robotics

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



Tip

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

Product manuals

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

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

Technical reference manuals

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

Application manuals

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

An application manual generally contains information about:

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

Continues on next page

Operating manuals

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

How to read the product manual

Reading the procedures

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

Safety information

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

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

Illustrations

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

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

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1 Safety

1.1 Safety information

1.1.1 Limitation of liability

Limitation of liability

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

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

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

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

Intended use

The ABB robot is intended for automation of different tasks including moving/handling parts and production equipment or carrying sensors etc. Application ranges from traditional manufacturing to services.

The integrator of the robot system is required to perform an assessment of the hazards and risks.

Spare parts and equipment

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

1 Safety

1.1.2 Safety data

1.1.2 Safety data

Prevailing standards and directives

For the use of industrial robots, regulations must be fulfilled as described in the following standards and directives:

- EN ISO 10218-1:2011
- Machinery Directive 2006/42/EC

Performance level and category

EN ISO 10218-1 requires structure category 3 and performance level *PL d* on the robot, see EN ISO 13849-1.

Risk assessment

The results of a risk assessment performed on the robot and its intended application may determine that a safety-related control system performance other than that stated in ISO 10218 is warranted for the application.

The SISTEMA/ABB FSDT libraries contains details for the safety functions.

Performance level for OmniCore C30 for CRB 15000

The OmniCore C30 for CRB 15000 controller safety system has a safety *category 3* with performance level *PL d* according to EN ISO 13849-1 and thus fulfils the safety performance requirement of the robot safety standard EN ISO 10218-1.



Note

It is not possible to provide an average MTTFd and DC for each channel of the CRB 15000 system. This is because some internal components do not follow the designated architecture shown in the standard. The system nevertheless complies with all the requirements of a Category 3 architecture.

Safety function	Category	PFH _D [1/hour]	Performance level
Emergency Stop	3	3.6E-07	d
External Emergency Stop (Discrete input)	3	3.6E-07	d
External Emergency Stop (Safe bus)	3	3.8E-07	d
Automatic Stop (Discrete input)	3	3.6E-07	d
Automatic Stop (Safe bus)	3	3.8E-07	d
Three-position Enabling Device	3	3.5E-07	d
ESTOP_STATUS Output	3	1.01E-07	d

1.1.3 Requirements on personnel

General

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

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

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

Personal protective equipment

Use personal protective equipment, as stated in the product manual.

1 Safety

1.2.1 Safety signals in the manual

1.2 Safety signals and symbols

1.2.1 Safety signals in the manual

Introduction to safety signals

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

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

Hazard levels

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

For more information, see standard ISO 13849.

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

Continues on next page

1.2.1 Safety signals in the manual

Continued

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

1 Safety

1.2.2 Safety symbols on manipulator labels

1.2.2 Safety symbols on manipulator labels

Introduction to symbols

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

Symbols are used in combinations on the labels, describing each specific warning.

The descriptions in this section are generic, the labels can contain additional information such as values.



Note

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

Types of symbols

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

The safety labels are language independent, they only use graphics. See [Symbols on safety labels on page 20](#).

The information labels can contain information in text.

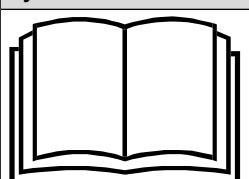
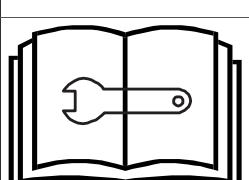
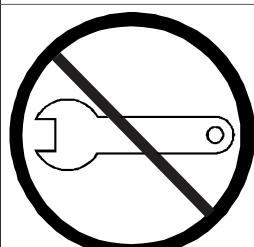
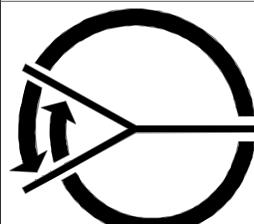
Symbols on safety labels

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

Continues on next page

1.2.2 Safety symbols on manipulator labels

Continued

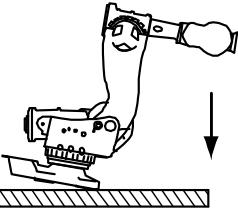
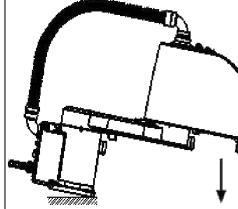
Symbol	Description
 xx0900000813	See user documentation Read user documentation for details. Which manual to read is defined by the symbol: <ul style="list-style-type: none"> • No text: <i>Product manual</i>.
 xx0900000816	Before disassembly, see product manual
 xx0900000815	Do not disassemble Disassembling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

Continues on next page

1 Safety

1.2.2 Safety symbols on manipulator labels

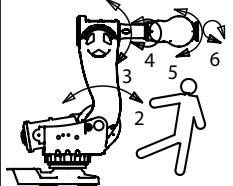
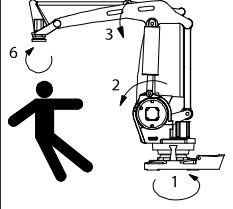
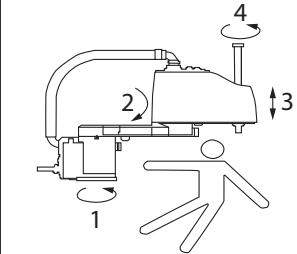
Continued

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.

Continues on next page

1.2.2 Safety symbols on manipulator labels

Continued

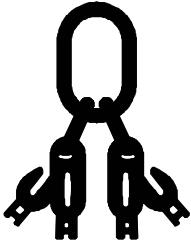
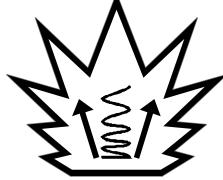
Symbol	Description
 xx0900000818	Heat Risk of heat that can cause burns. (Both signs are used)
 xx1300001087	
 xx0900000819	Moving robot The robot can move unexpectedly.
 xx1000001141	
 xx1500002616	
 xx0900000821	Lifting bolt

Continues on next page

1 Safety

1.2.2 Safety symbols on manipulator labels

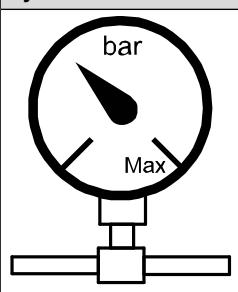
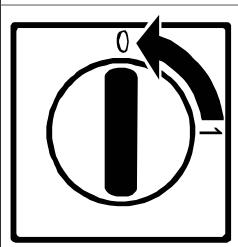
Continued

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

Continues on next page

1.2.2 Safety symbols on manipulator labels

Continued

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

1 Safety

1.3 Robot stopping functions

1.3 Robot stopping functions

Protective stop and emergency stop

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

For more information see:

- *Product manual - OmniCore C30*

1.4 Installation and commissioning

National or regional regulations

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

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

The integrator of the robot system is required to perform an assessment of the hazards and risks.

Layout

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

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

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

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

Allergenic material

See [Environmental information on page 615](#) for specification of allergenic materials in the product, if any.

Securing the robot to the foundation

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

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

Electrical safety

The mains power must be installed to fulfill national regulations.

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

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

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

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



Note

Use a CARBON DIOXIDE (CO₂) extinguisher in the event of a fire in the robot.

Continues on next page

1 Safety

1.4 Installation and commissioning

Continued

Safety devices

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

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

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

Other hazards



WARNING

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

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

- Water
- Compressed air
- Hydraulics

Verify the safety functions

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

1.5.1 Unexpected movement of robot arm

1.5 Operation

1.5.1 Unexpected movement of robot arm

Unexpected movement of robot arm



WARNING

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

A robot may perform unexpected limited movement.

1 Safety

1.6.1 Maintenance and repair

1.6 Maintenance and repair

1.6.1 Maintenance and repair

General

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

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

Make sure that there are no loose screws, turnings, or other unexpected parts remaining after work on the robot has been performed.

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

Hot surfaces

Surfaces can be hot after running the robot. Touching the surfaces may result in burns.

Allow the parts to cool down before maintenance or repair.

Allergic reaction

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

Gearbox lubricants (oil or grease)

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



Note

Take special care when handling hot lubricants.

Risk of exceeding design life

Regular inspections, maintenance, and exchange of worn components are essential to ensure the safe operation of this robot. Follow the instructions in section [Maintenance on page 77](#).

Related information

See also the safety information related to installation and operation.

1.6.2 Emergency release of the robot axes

1.6.2 Emergency release of the robot axes

Description

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

How to release the brakes is described in the section:

- [*Manually releasing the brakes on page 50.*](#)

1 Safety

1.6.3 Brake testing

1.6.3 Brake testing

When to test

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

How to test

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

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

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



Note

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

1.7 Troubleshooting

General

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

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



DANGER

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

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

Related information

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

1 Safety

1.8 Decommissioning

1.8 Decommissioning

General

See section *Decommissioning on page 615*.

2 Manipulator description

2.1 About CRB 15000

Introduction

The CRB 15000 robot is a lightweight, flexible, agile 6-axis articulated, industrial robot, with a payload of 5 kg, designed specifically for manufacturing industries that use flexible robot-based automation, for example, the 3C industry. The robot has an open structure that is especially adapted for flexible use, and can communicate extensively with external systems.

2 Manipulator description

2.2 Technical data

2.2 Technical data

Weight, robot

The table shows the weight of the robot.

Robot model	Weight
CRB 15000	28 kg



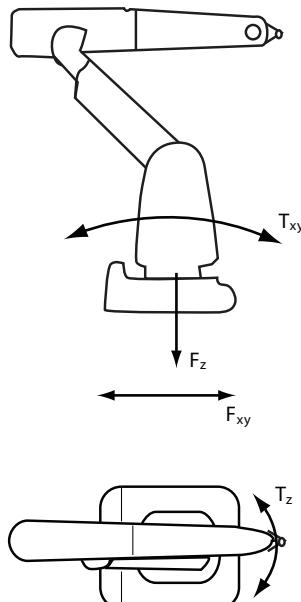
Note

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

Loads on foundation, robot

The illustration shows the directions of the robots stress forces.

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



xx1100000521

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

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



Note

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

Continues on next page



WARNING

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

Floor mounted

Force	Endurance load (in operation)	Maximum load (emergency stop)
Force xy	±303 N	±1113 N
Force z	+280 ±147 N	+280 ±857 N
Torque xy	±246 Nm	±711 Nm
Torque z	±145 Nm	±334 Nm

Wall mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	+280 ±130 N	+280 ±1000 N
Force z	±289 N	±944 N
Torque xy	±275 Nm	±768 Nm
Torque z	±162 Nm	±338 Nm

Suspended

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	±303 N	±1113 N
Force z	-280 ±147 N	-280 ±857 N
Torque xy	±246 Nm	±711 Nm
Torque z	±145 Nm	±334 Nm

Requirements, foundation

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

Requirement	Value	Note
Flatness of foundation surface	0.1/500 mm	The value for levelness aims at the circumstance of the anchoring points in the robot base.
Maximum tilt	No restriction	Wall mounted robot has a work area for axis 1 that depends on payload and the positions of other axes. Simulation in RobotStudio is recommended.

Continues on next page

2 Manipulator description

2.2 Technical data

Continued

Requirement	Value	Note
Minimum resonance frequency	22Hz  Note	The value is recommended for optimal performance. Due to foundation stiffness, consider robot mass including equipment. It may affect the manipulator lifetime to have a lower resonance frequency than recommended. For information about compensating for foundation flexibility, see <i>Application manual - Controller software OmniCore</i> , section <i>Motion Process Mode</i> .

- i The minimum resonance frequency given should be interpreted as the frequency of the robot mass/inertia, robot assumed stiff, when a foundation translational/torsional elasticity is added, i.e., the stiffness of the pedestal where the robot is mounted. The minimum resonance frequency should not be interpreted as the resonance frequency of the building, floor etc. For example, if the equivalent mass of the floor is very high, it will not affect robot movement, even if the frequency is well below the stated frequency. The robot should be mounted as rigid as possibly to the floor.
Disturbances from other machinery will affect the robot and the tool accuracy. The robot has resonance frequencies in the region 10 – 20 Hz and disturbances in this region will be amplified, although somewhat damped by the servo control. This might be a problem, depending on the requirements from the applications. If this is a problem, the robot needs to be isolated from the environment.

Storage conditions, robot

The table shows the allowed storage conditions for the robot:

Parameter	Value
Minimum ambient temperature	-40 °C
Maximum ambient temperature	70 °C
Maximum ambient temperature (less than 24 hrs)	70 °C
Maximum ambient humidity	95% at constant temperature (not intended to operate with condensation)
Maximum ambient altitude	0-3,000 m (100-74 kPa)

Operating conditions, robot

The table shows the allowed operating conditions for the robot:

Parameter	Value
Minimum ambient temperature	5 °C ⁱ
Maximum ambient temperature	35 °C ⁱⁱ
Maximum ambient humidity	95% at constant temperature
Maximum ambient altitude	0-2,000 m (100-84 kPa)

- 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 run with lower performance due to temperature dependent oil and grease viscosity.
ii Higher ambient temperature may be possible, if duty cycle is reduced.

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	IP54

Continues on next page

Joint torques

In collaborative applications, the joint torque must be considered in the risk analysis. The following table shows the maximum torque for each joint. The maximum value can be achieved on one axis at a time.

Axis	Maximum joint torque
1	175.44 Nm
2	175.44 Nm
3	90.6 Nm
4	18.72 Nm
5	21.44 Nm
6	9.2 Nm

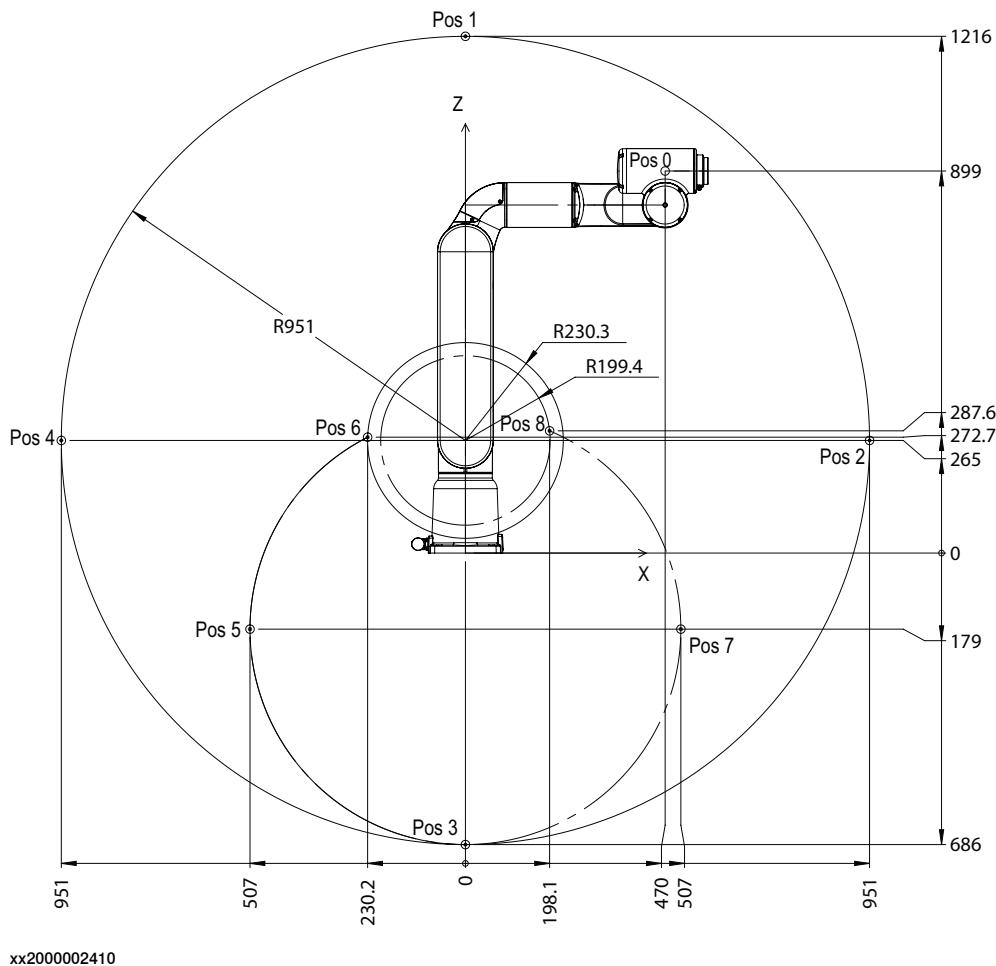
2 Manipulator description

2.3 Working range

2.3 Working range

Illustration, working range CRB 15000

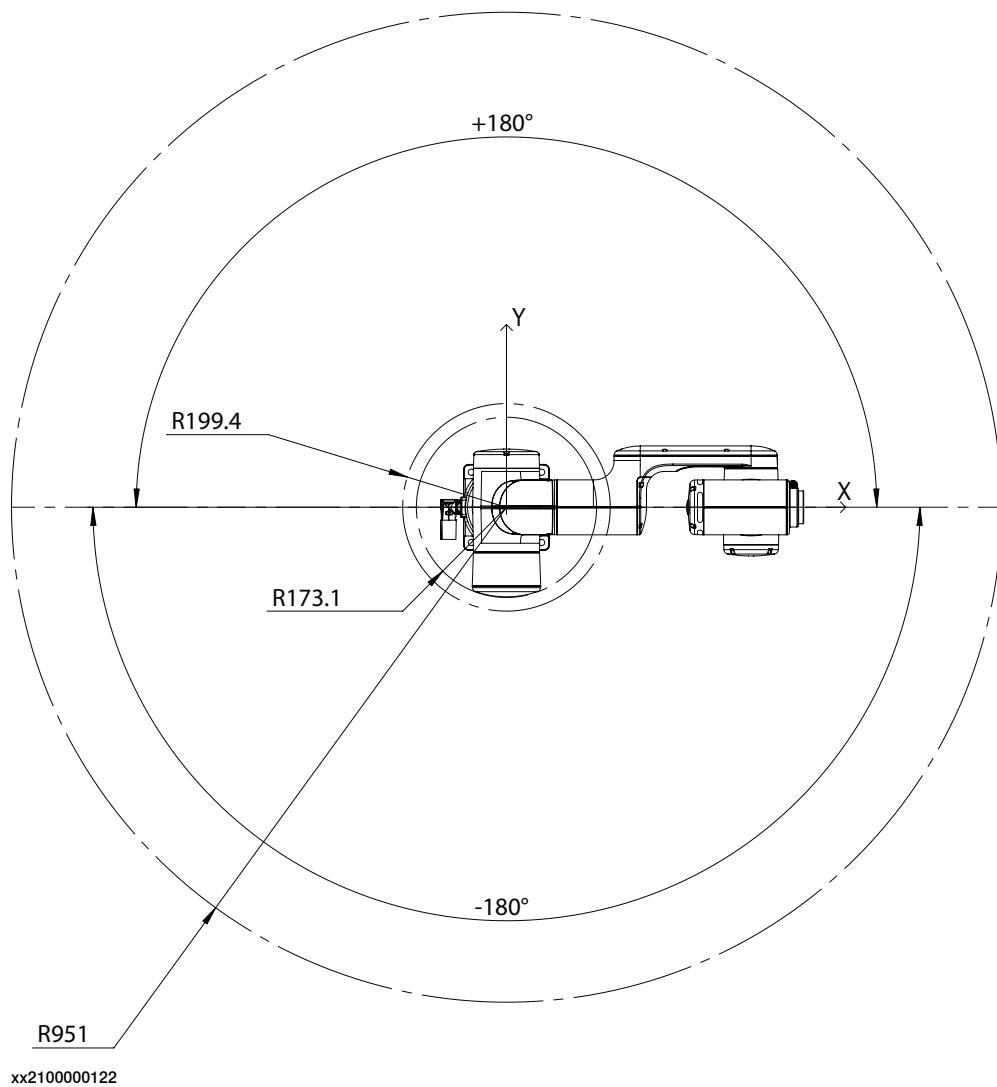
This illustration shows the unrestricted working range of the robot.



Positions at intersection point of axes 4-5-6 and angle of axes 2 and 3

Position in the figure	Positions at wrist center (mm)		Angle (degrees)	
	X	Z	axis 2	axis 3
pos0	470	899	0°	0°
pos1	0	1216	0°	-68°
pos2	951	265	90°	-68°
pos3	0	-686	180°	-68°
pos4	-951	265	-90°	-68°
pos5	-507	-179	180°	22°
pos6	-230.2	272.7	180°	85°
pos7	507	-179	180°	-158°
pos8	198.1	287.6	180°	-225°

Continues on next page

Turning radius**Working range**

Axis	Working range	Note
Axis 1	$\pm 180^\circ$	Wall mounted robot has a work area for axis 1 that depends on payload and the positions of other axes. Simulation in RobotStudio is recommended.
Axis 2	$\pm 180^\circ$	
Axis 3	$-225^\circ/+85^\circ$	
Axis 4	$\pm 180^\circ$	
Axis 5	$\pm 180^\circ$	
Axis 6	$\pm 180^\circ$	

2 Manipulator description

2.4 The unit is sensitive to ESD

Description

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

Safe handling

Use one of the following alternatives:

- Use a wrist strap.

Wrist straps must be tested frequently to ensure that they are not damaged and are operating correctly.

- Use an ESD protective floor mat.

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

- Use a dissipative table mat.

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

3 Installation and commissioning

3.1 Introduction to installation and commissioning

General

This chapter contains assembly instructions and information for installing the CRB 15000 at the working site.

See also the product manual for the robot controller.

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

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 CRB 15000 is connected to power, always make sure that the robot is connected to protective earth and a residual current device (RCD) before starting any installation work.

For more information see:

- *Product manual - OmniCore C30*

3 Installation and commissioning

3.2.1 Pre-installation procedure

3.2 Unpacking

3.2.1 Pre-installation procedure

Introduction

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

Prerequisites for installation personnel

Installation personnel working with an ABB product must:

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

Checking the pre-requisites for installation

	Action
1	Make a visual inspection of the packaging and make sure that nothing is damaged.
2	Remove the packaging.
3	Check for any visible transport damage.  Note Stop unpacking and contact ABB if transport damages are found.
4	Clean the unit with a lint-free cloth, if necessary.
5	Make sure that the lifting accessory used (if required) is suitable to handle the weight of the robot as specified in: <i>Weight, robot on page 36</i>
6	If the robot is not installed directly, it must be stored as described in: <i>Storage conditions, robot on page 38</i>
7	Make sure that the expected operating environment of the robot conforms to the specifications as described in: <i>Operating conditions, robot on page 38</i>
8	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 36</i>• <i>Protection classes, robot on page 38</i>• <i>Requirements, foundation on page 37</i>
S9	Before moving the robot, please observe the stability of the robot: <i>Risk of tipping/stability on page 45</i>
10	When these prerequisites are met, the robot can be taken to its installation site as described in section: <i>On-site installation on page 46</i>
11	Install required equipment, if any.

3.2.2 Risk of tipping/stability

Risk of tipping

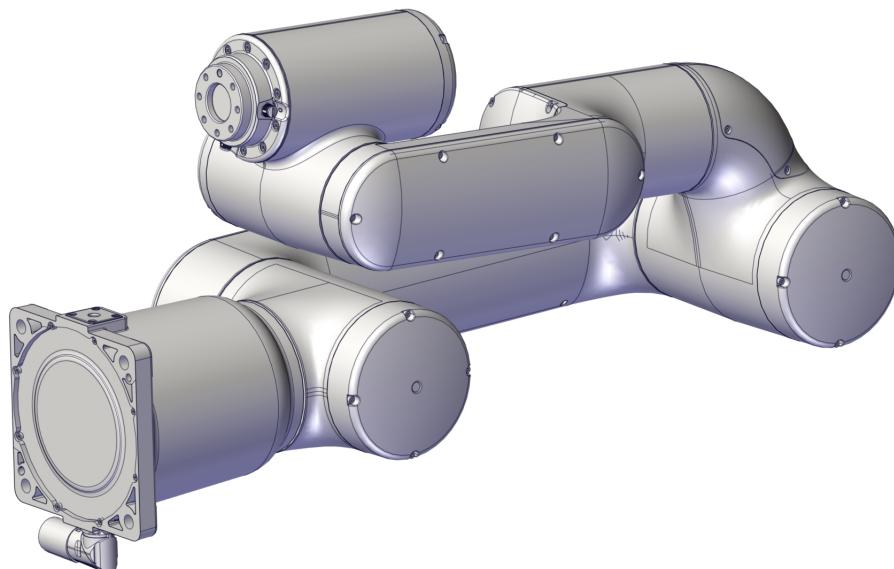
The robot is delivered lying flat in the delivery package and cannot stand on its own without being secured to the foundation.

If the robot can not be fastened to the foundation directly, store it in the delivery package.

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

Transportation and shipping position

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



xx2100000115

Axis 1	0°
Axis 2	0°
Axis 3	+85°
Axis 4	0°
Axis 5	0°
Axis 6	0°



WARNING

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

3 Installation and commissioning

3.3.1 Brief installation procedure

3.3 On-site installation

3.3.1 Brief installation procedure

Introduction

This procedure is a brief guide when installing the robot for the first time. Also see [Pre-installation procedure on page 44](#).

First installation

Use these procedures to install the CRB 15000.

	Action	Note
1	Transport the manipulator to its intended location.	
2	Install the valid platform or prepare the foundation for the manipulator.	
3	Lift and secure the manipulator to the platform/foundation.	See Lifting the robot on page 47 . See Orienting and securing the robot on page 47 .
4	Connect the manipulator to the controller.	See <ul style="list-style-type: none">Product manual - OmniCore C30
5	Configure the safety settings.	See <ul style="list-style-type: none">Product manual - OmniCore C30
6	How to start and run the robot is described in the product manual for the controller.	See <ul style="list-style-type: none">Product manual - OmniCore C30
7	Install required equipment, if any. <ul style="list-style-type: none">Installation of brake release tool on page 53	
8	 DANGER Make sure all safety requirements are met when performing the first test run.	



Note

Wait till the robot has reached room temperature before switching on the mains power. Otherwise there might be a risk of condensation on internal components such as electronics.

3.3.2 Lifting the robot

3.3.2.1 Orienting and securing the robot

Introduction

This section describes how to lift the robot and transport it to the installation site. Two persons are always required when lifting and securing the robot.

Do not leave the robot standing unfastened to the foundation, it is not stable on its own.



CAUTION

The manipulator must not be connected to power during lifting and securing it to the foundation.

Attachment screws

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

All hardware is enclosed in the robot delivery.

Suitable screws	M10x35
Quantity	4 pcs
Quality	8.8
Suitable washer	23/10.5/2.5 mm Steel
Guide pins	DIN6325, hardened steel Ø6x24 mm, 2 pcs
Tightening torque	30 Nm ±10%
Level surface requirements	0.1/500 mm

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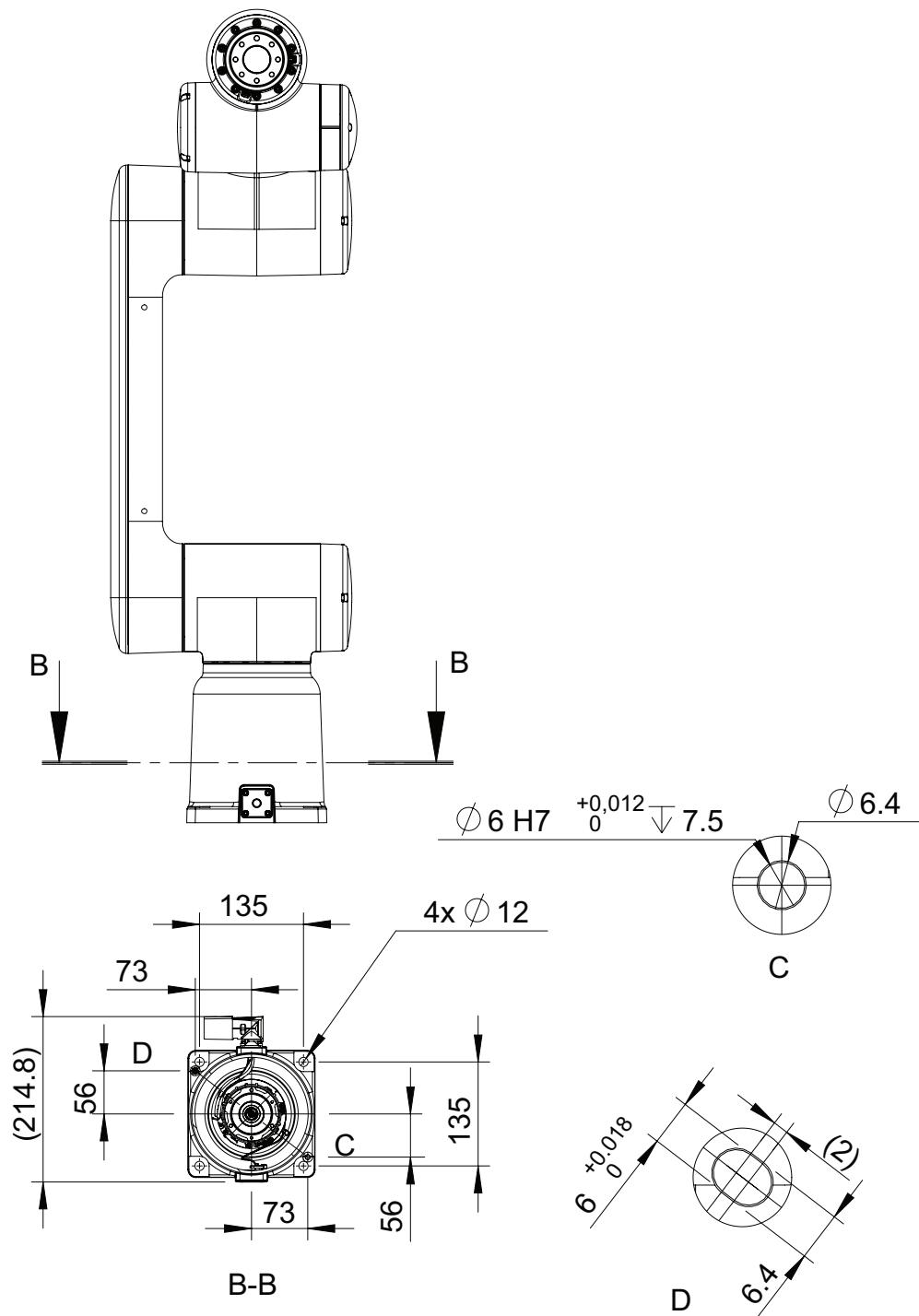
3 Installation and commissioning

3.3.2.1 Orienting and securing the robot

Continued

Hole configuration, base

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



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C	Circular hole for locating pin
D	Elongated hole for locating pin

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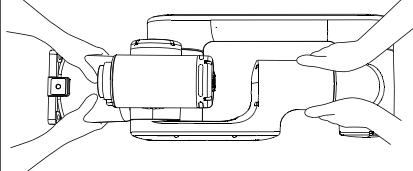
Lifting and securing the robot

Use this procedure to lift and secure the robot to its foundation.

Preparations of the installation site

	Action	Note
1	Make sure the installation site for the robot conforms to the specifications in section Technical data on page 36 .	
2	Prepare the installation site with attachment holes.	The hole configuration of the base is shown in Hole configuration, base on page 48 .

Lifting and securing the robot

	Action	Note
1	 CAUTION The CRB 15000 robot weighs 28 kg. A minimum of two persons are required for lifting as well as securing the robot in order to avoid any damage, instability, and injury. Special consideration is necessary when mounting the robot in an elevated, suspended or wall mounted position.	
2	Grasp the robot at the foot and elbow, as shown in the figure, and lift it up from the transportation package.	 xx2100000118
3	 CAUTION Do not leave the robot standing unfastened to the foundation, it is not stable on its own.	
4	Fit two pins to the holes in the base.	Centering pins: DIN6325, hardened steel Ø6x24 mm, 2 pcs .
5	Raise the robot to standing and secure to foundation, paying attention to the centering holes at the bottom of the robot base. <ul style="list-style-type: none"> • Person 1: keep holding the robot stable. • Person 2: secure the robot base to the foundation with the securing screws and washers. 	Screws: M10x35, 4 pcs, quality 8.8 Washers: 23/10.5/2.5 mm Steel
6	Tighten the bolts in a crosswise pattern to ensure that the base is not distorted.	Tightening torque: 30 Nm ±10%

3 Installation and commissioning

3.3.3 Manually releasing the brakes

3.3.3 Manually releasing the brakes

Introduction to manually releasing the brakes

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

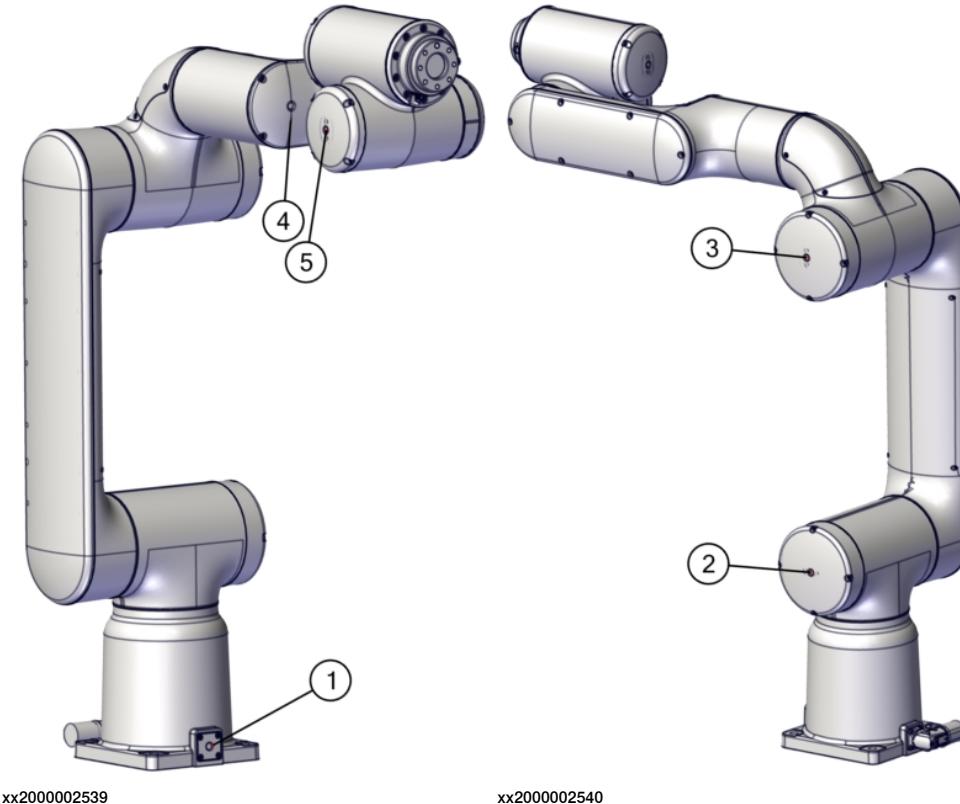
Required equipment

Equipment	Article number	Note
Brake release tool	3HAC077146-001	For releasing the holding brakes of a joint unit motor.

Location of the brake release points

The brake release points are located on each axis as shown in the figure. The numbers correspond to the axis number.

The holding brake on axis 6 can not be released manually. If axis 6 needs to be moved, release the holding brake on another proper axis instead.



Releasing the brakes

This procedure describes how to release the holding brakes using the brake release tool.



Note

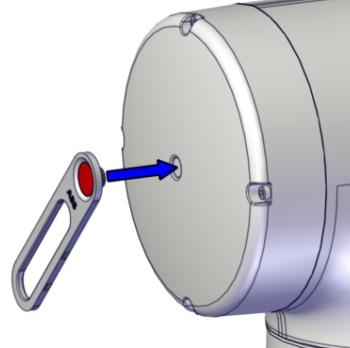
The manipulator needs to be powered and motors in state Motors OFF.

Continues on next page

3 Installation and commissioning

3.3.3 Manually releasing the brakes

Continued

Action	Note
1 Take out the tool from its holder.	<p>Brake release tool: 3HAC077146-001</p>  <p>xx2000002542</p>
2  DANGER When releasing the holding brakes, the robot axes may move very quickly and sometimes in unexpected ways. Make sure no personnel is near or beneath the robot.	
3 Release the holding brake on a particular robot axis by holding the brake release tool against the small round recess at the axis. The brake will function again as soon as the tool is removed.	 <p>xx2000002538</p> <p>The sensor behind the cover is triggered by the tool magnet and the corresponding motor holding brake will be released. If any faulty functionality is discovered, see Brake release tool does not work on page 614.</p>
4 Put back the tool in its holder and store on specified location close to the robot.	

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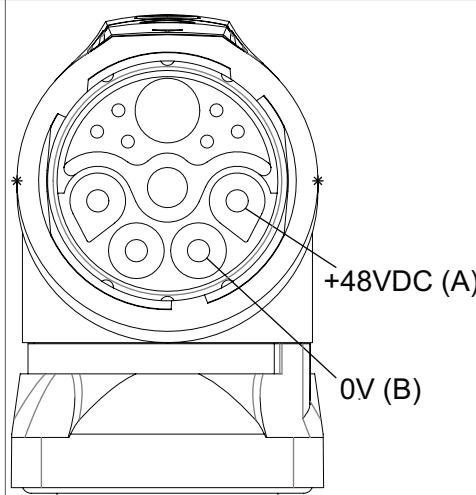
3 Installation and commissioning

3.3.3 Manually releasing the brakes

Continued

Supplying power to connector R1.MP

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

Action	Note
<p>1</p> <p>CAUTION</p> <p>Incorrect connections, such as supplying power to the wrong pin, may cause damage to the electrical components.</p>	
<p>2 Supply 0V on pin B and +48VDC on pin A.</p>	

3.3.4 Installation of brake release tool

Brake release tool included in robot delivery

A brake release tool is included in the robot package box. The tool is used for releasing the holding brakes of the axes motors.



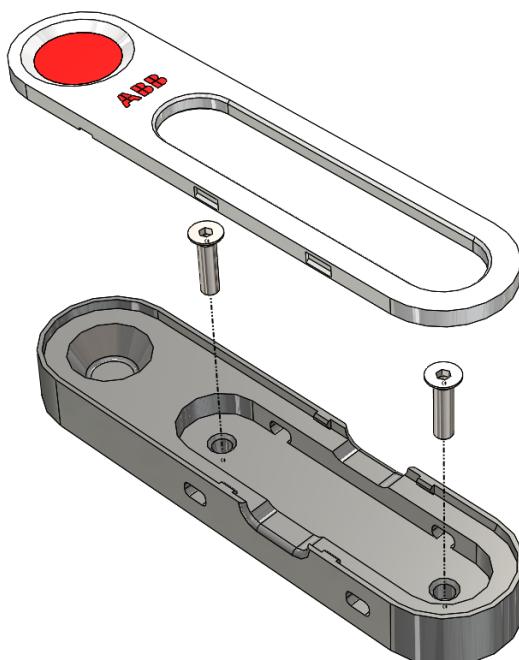
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Specify storage location

The brake release tool must be mounted or permanently stored close to the robot, for easy and quick access in case of emergency. The storage location must be well known for all personnel working with or nearby the robot.

Securing the brake release tool holder

Securing with screws



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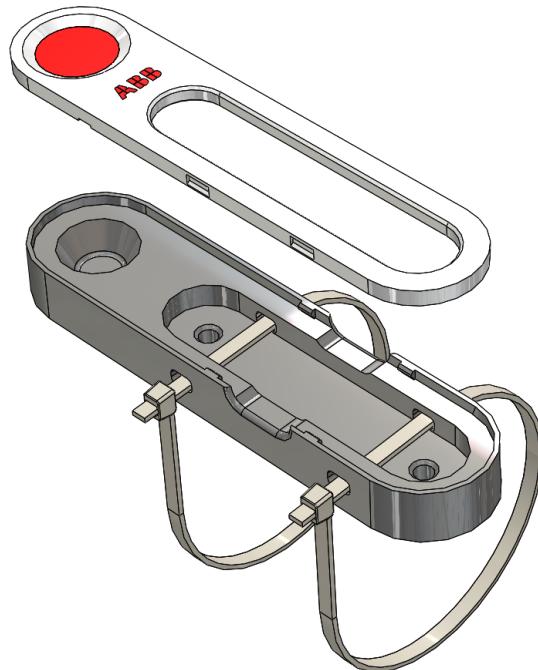
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3 Installation and commissioning

3.3.4 Installation of brake release tool

Continued

Securing with cable ties



xx2100000404

3.3.5 Setting the system parameters for a suspended or a tilted robot

3.3.5 Setting the system parameters for a suspended or a tilted robot

General

The robot is configured for mounting parallel to the floor, without tilting, on delivery. The method for mounting the robot in a suspended (upside down) or tilted position is basically the same as for floor mounting, but the system parameters that describe the mounting angle (how the robot is oriented relative to the gravity) must be re-defined.



Note

With suspended installation, make sure that the gantry or corresponding structure is rigid enough to prevent unacceptable vibrations and deflections, so that optimum performance can be achieved.



Note

The allowed mounting positions are described in the product specification for the robot. The requirements on the foundation are described in [Requirements, foundation on page 37](#).

System parameters



Note

The mounting angle must be configured correctly in the system parameters so that the robot system can control the movements in the best possible way. An incorrect definition of the mounting angle will result in:

- Overloading the mechanical structure.
- Lower path performance and path accuracy.
- Some functions will not work properly, for example *Load Identification* and *Collision detection*.

Gravity Beta

When the robot is mounted other than floor-standing (rotated around the y-axis), the robot base frame and the system parameter *Gravity Beta* must be redefined. *Gravity Beta* should then be π (+3.141593) if the robot is mounted upside down (suspended), or $\pm\pi/2$ (±1.570796) if mounted on a wall.

The *Gravity Beta* is a positive rotation direction around the y-axis in the base coordinate system. The value is set in radians.

Gravity Alpha

If the robot is mounted on a wall (rotated around the x-axis), then the robot base frame and the system parameter *Gravity Alpha* must be redefined. The value of *Gravity Alpha* should then be $\pm\pi/2$ (±1.570796).

Continues on next page

3 Installation and commissioning

3.3.5 Setting the system parameters for a suspended or a tilted robot

Continued

The *Gravity Alpha* is a positive rotation direction around the x-axis in the base coordinate system. The value is set in radians.



Note

The system parameter *Gravity Alpha* is not supported for all robot types.

If the robot does not support *Gravity Alpha*, then use *Gravity Beta* along with the re-calibration of axis 1 to define the rotation of the robot around the x-axis.



Note

The parameter is supported for all robots on track when the system parameter *7 axes high performance motion* is set, see *Technical reference manual - System parameters*.

Gamma Rotation

Gamma Rotation defines the orientation of the robot foot on the travel carriage (track motion).

Mounting angles and values

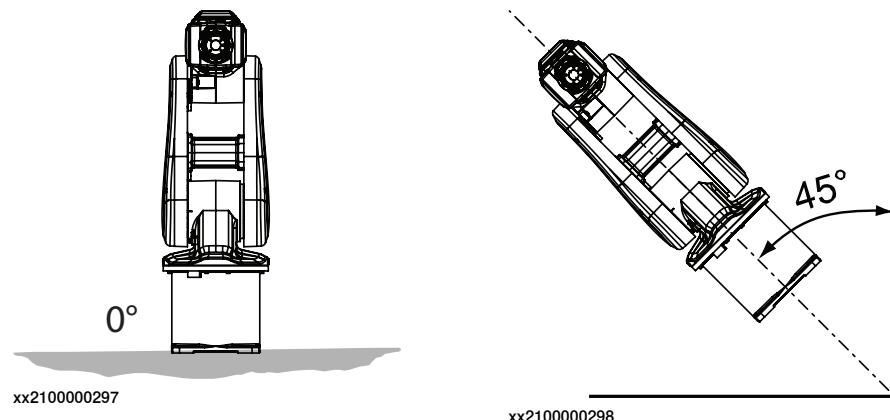
The parameter *Gravity Beta* (or *Gravity Alpha*) specifies the mounting angle of the robot in radians. It is calculated in the following way.

$\text{Gravity Beta} = A^\circ \times \frac{3.141593}{180} = B \text{ radians}$, where A is the mounting angle in degrees and B is the mounting angle in radians.

Example of position	Mounting angle (A°)	Gravity Beta
Floor mounted	0°	0.000000 (Default)
Tilted mounting	Example: 15°	Corresponds to: 0.261799 rad
Wall mounted	90°	1.570796
Suspended mounting	180°	3.141593

Examples of mounting angles tilted around the X axis (*Gravity Alpha*)

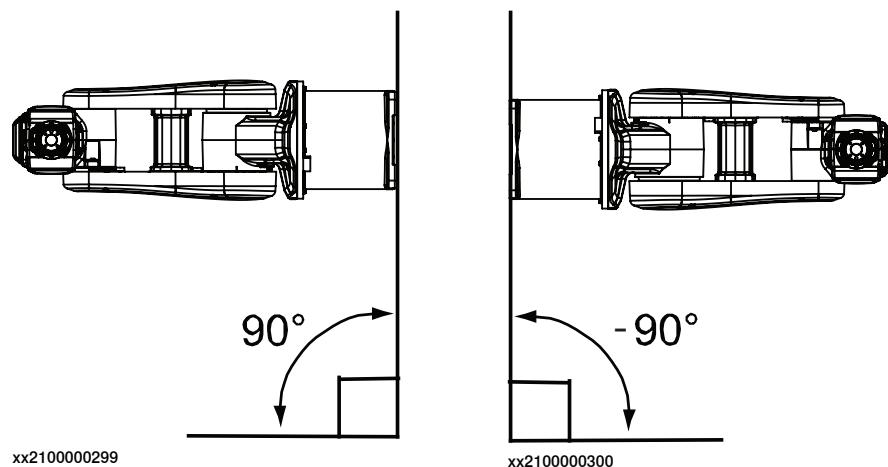
The following illustration shows the IRB 120, but the same principle applies for all robots.



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3.3.5 Setting the system parameters for a suspended or a tilted robot

Continued



Mounting angle	Gravity Alpha
0° (Floor mounted)	0
45° (Tilted)	0.785398
90° (Wall)	1.570796
-90° (Wall)	-1.570796



Note

For suspended robots (180°), it is recommended to use *Gravity Beta* instead of *Gravity Alpha*.

Limitations in working area

If tilting a floor mounted robot, the working range of axis 1 is limited. These limitations are specified in the table [Working range on page 41](#).

If mounting the robot on a wall, the working range of axis 1 is limited. These limitations are specified in the table [Working range on page 41](#).

Defining the system parameters in RobotWare

The value of the system parameters that define the mounting angle must be redefined when changing the mounting angle of the robot. The parameters belong to the type *Robot*, in the topic *Motion*.

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

The system parameters are configured in RobotStudio or on the FlexPendant.

3 Installation and commissioning

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

Define loads carefully

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



CAUTION

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

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

Stopping time and braking distances

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

See *Product specification - Robot stopping distances according to ISO 10218-1*.

3.3.7 Fitting equipment on the robot (robot dimensions)

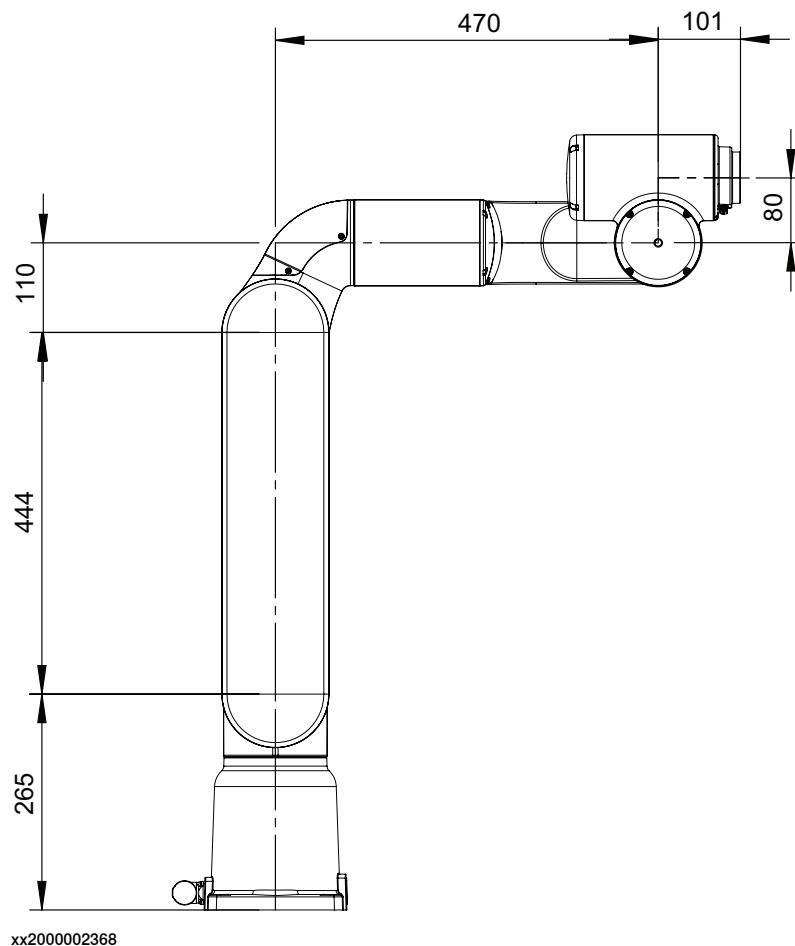


Note

Even after the robot is secured to the foundation, do not lean on it or place loads on it, except what is permitted on the tool flange.

Robot dimensions

The figure shows the dimension of the robot.



Fitting equipment on the robot

Load from equipment on robot arms

The robot arm is not designed with attachment holes for any arm load. However, for light loads such as cables, it is possible to mount them directly on the arm.

Considerations:

- Any external cable routing along the robot arm shall be done in a flexible way allowing for robot motion and taking hazards associated with entanglement into account.
- The brake release points on each axis must be accessible in the end application.

Continues on next page

3 Installation and commissioning

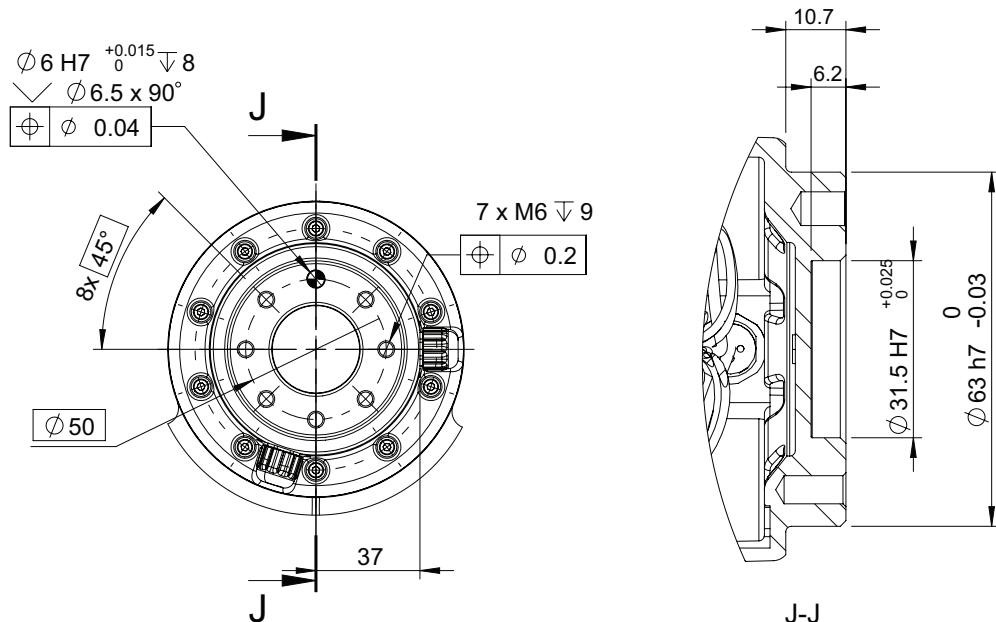
3.3.7 Fitting equipment on the robot (robot dimensions)

Continued

Brake release points are shown in [Manually releasing the brakes on page 50](#).

- The upper arm can handle a load of 5 kg. This includes the weight of the cabling, tools, and workpiece (if lifted).

Tool flange



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Fastener quality on tool flange

Use screws with suitable length and tightening torque for your application.

Screws with quality class 12.9 are recommended.

3.3.8 First test run may cause injury or damage

3.3.8 First test run may cause injury or damage

Description

After installation and performing service activities, there are several safety risks to take into consideration before the first test run.

Safe handling

Use this procedure when performing the first test run after installation, maintenance, or repair.



DANGER

Running the robot without fulfilling the following aspects, may involve a risk of injury and cause severe damage to the robot.

	Action
1	Remove all tools and foreign objects from the robot and its working area.
2	Verify that the robot is properly secured to its position by all screws, before it is powered up.
3	Verify that any safety equipment installed to secure the position or restrict the robot motion during service activity is removed.
4	Verify that the fixture and work piece are well secured, if applicable.
5	Verify that the brake release tool is in its intended place.
6	Make sure that no one is leaning on, or have their head or neck close to the robot.
7	Verify that all arm covers and paddings, if any, are properly secured to the robot.
8	If maintenance or repair has been done, pay special attention to the function of the part that was maintained.

3 Installation and commissioning

3.4.1 Robot cabling and connection points

3.4 Electrical connections

3.4.1 Robot cabling and connection points

Introduction

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



DANGER

Turn off the main power before connecting any cables.

Main cable categories

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

Cable category	Description
Robot cables	Handles power supply to and control of the robot's motors. Specified in the table Robot cables on page 62 .
Customer cables	Handles communication with equipment fitted on the robot by the customer, low voltage signals and high voltage power supply + protective ground. The customer cables also handle databus communication. See the product manual for the controller, see document number in References on page 10 .

Robot cables

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

Cable sub-category	Description	Connection point, cabinet	Connection point, robot
Robot cable (combined power and control cable + CP/CS)	Transfers DC bus power from power supply in the control cabinet to the drive units in the robot.	X2	R1.MP

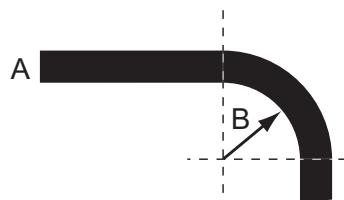
Robot cable

Signal cable length	Article number
Hybrid floor cable 7 m	3HAC073212-002

Continues on next page

Bending radius for static floor cables

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



xx1600002016

A	Diameter
B	Diameter x10

3 Installation and commissioning

3.4.2 Customer connections on the manipulator

3.4.2 Customer connections on the manipulator

Introduction

The customer cables are routed internally with the manipulator cable harness.

Customer cabling

Customer connection	Cable specification	Article number	Rating in each wire ⁱ	Note
Customer power (CP)	Raw cable is twisted pair 1x2xAWG24	See <i>Product manual, spare parts - CRB 15000</i>	24V ⁱⁱ 2A	Routed internally with the manipulator cable harness.
Customer signal (CS)	2x2xAWG26 in 4x2XAWG26 cable	See <i>Product manual, spare parts - CRB 15000</i>	24V ⁱⁱⁱ 500mA	Routed internally with the manipulator cable harness.

ⁱ Stresses above the limitation may cause permanent damage to the manipulator.

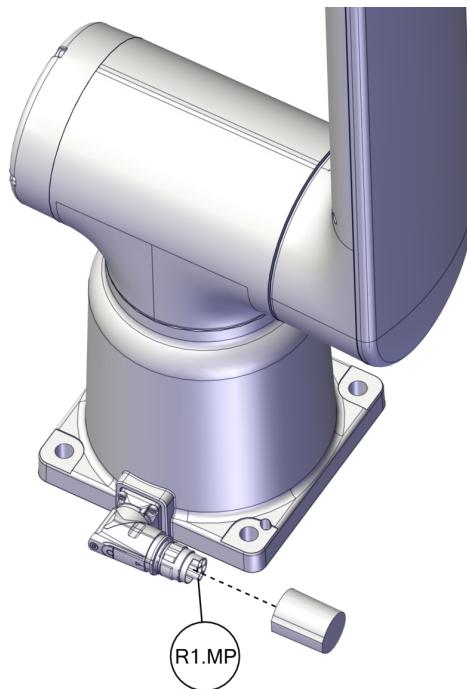
ⁱⁱ Rated 24V, max 30V

ⁱⁱⁱ Rated 24V, max 30V

Customer connectors on the manipulator

Connectors at the base

The R1.MP on the base is used for transferring DC bus, EtherCat and customer signals (CP/CS).



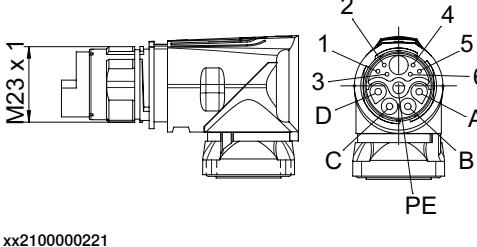
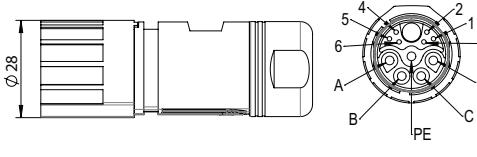
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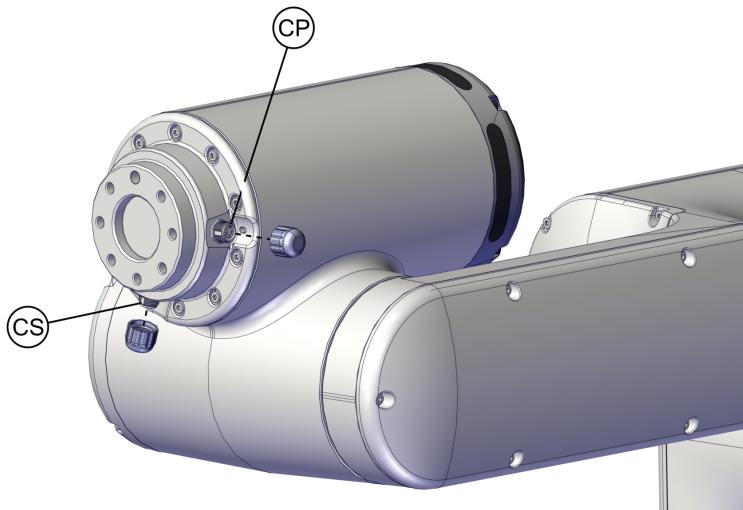
3 Installation and commissioning

3.4.2 Customer connections on the manipulator

Continued

Pos	Connector type	Layout
R1.MP	Receptacle angled rotatable male connector with housing and insert.	 xx2100000221
-	Plug with female connector includes housing and insert.	 xx2100000229

Connectors at the tool flange



xx2100000125



CAUTION

Always use protective caps on unused customer connectors to protect the connector and to cover sharp connector edges.



Note

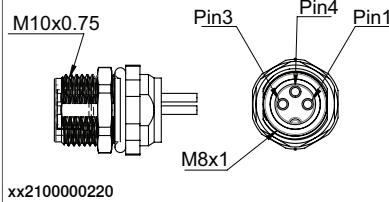
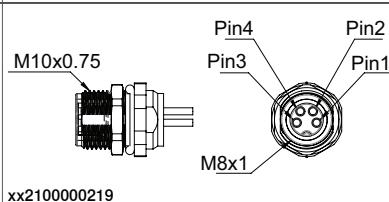
Always inspect the connector for dirt or damage before connecting it. Clean or replace any damaged parts.

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3 Installation and commissioning

3.4.2 Customer connections on the manipulator

Continued

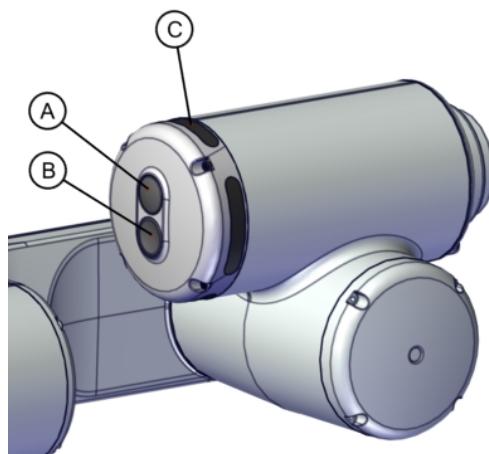
Pos	Connector type	Torque for mating/unmating	Layout
CP	M8 3 pin female, 200 mm wire, straight (two pins for use, one pin is spare)	0.4 Nm	
CS	M8 4 pin female, 200 mm wire, straight	0.4 Nm	

3.5 Arm-side interface

3.5.1 Configuring the arm-side interface

Introduction

The arm-side interface is located on axis 5, opposite to the tool flange. The configuration of the arm-side interface is done using the application **ASI Setting** on the FlexPendant.



xx2000002420

A	Up button (convex button)
B	Down button (concave button)
C	Light ring

Prerequisites

A validated safety configuration must be set up before using the arm-side interface. See *Application manual - SafeMove*.

The payload must be configured before configuring the arm-side interface. See *Operating manual - OmniCore*.

The application **ASI Setting** on the FlexPendant must be open when using the buttons.

Continues on next page

3 Installation and commissioning

3.5.1 Configuring the arm-side interface

Continued



WARNING

When using the lead-through function from the arm-side interface, make sure that no one else can take control of the robot.

- In manual mode, by having a FlexPendant connected to the controller.
- In automatic mode, by setting up the system with caution regarding who has the user grant UAS_REMOTE_START_STOP_IN_AUTO. This grant is required to start or stop program execution in automatic mode. Any user with this grant should be located within eyesight of the robot. The FlexPendant can always be used to start or stop program execution.

See also *Operating manual - Integrator's guide OmniCore*.



CAUTION

The robot is delivered with the buttons and LED lights pre-configured. During installation this configuration must be verified before commissioning the application.



CAUTION

When using the arm-side interface, make sure to use zone limits or physical barriers to prevent contact between the manipulator and the human head. This applies both to commissioning and automatic operation.



CAUTION

During fine tuning of positions, make sure not to place your head too close to the manipulator.

Default configuration of the arm-side interface

On delivery, the up button is configured to enable lead-through. The down button is configured to add a move block in the *Wizard* software. The configuration is shown on the FlexPendant.

On delivery, the light ring shows the states according to the following table:

Color of the light ring	State of the robot
White	Stand by
Green	Program running
Yellow	Programming in progress
Red	Error

Continues on next page

Configuring the buttons



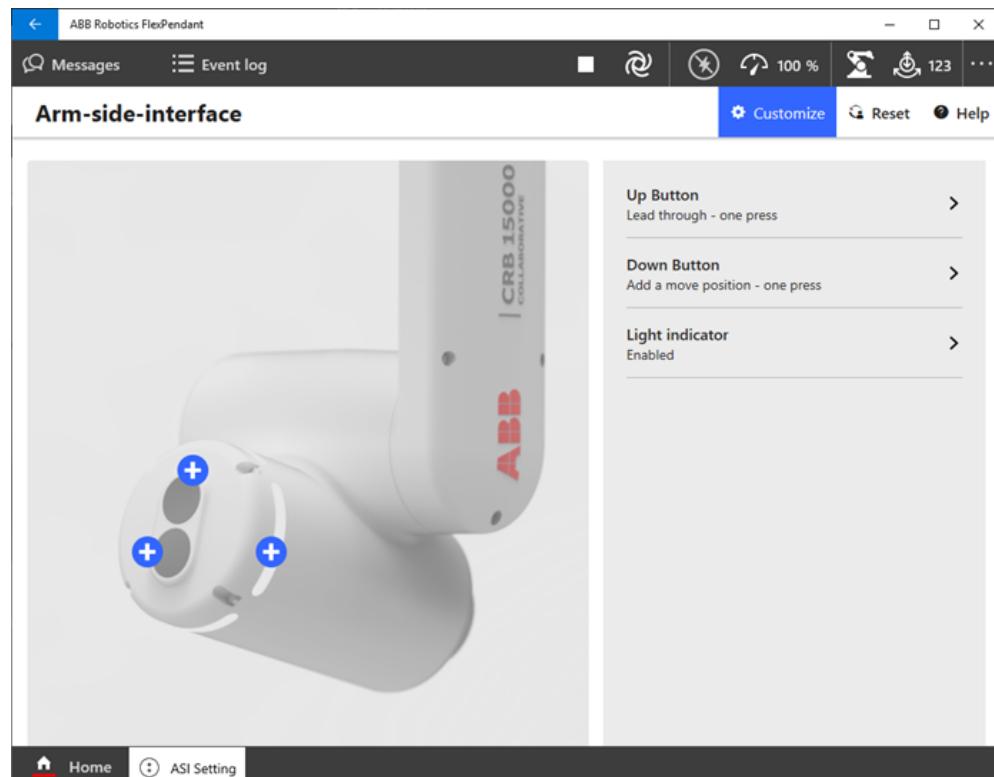
Note

The buttons are deactivated until there is a valid safety configuration in the robot controller.

The buttons on the arm-side interface are configured with RAPID routines in the module `GOFA_ASI_Procedures`, located in the task `T_ROB1`.

On delivery, a number of pre-configured routines are available. These can be customized as needed, and more routines can be added. All routine names must start with `ASI_`.

To change what routine to run when pressing a button, use the FlexPendant app **ASI Setting**.



xx2100000080

For more information on RAPID, see *Technical reference manual - RAPID Instructions, Functions and Data types* and *Technical reference manual - RAPID Overview*.

For more information about Wizard, see *Application manual - Wizard*.

Example of RAPID routine with MoveJ

Example of customized routine with the instruction MoveJ.

```
PROC ASI_MoveRobot()
    TPWrite "The robot will move along path";
    MoveJ Target_10,v1000,z100,tool0\WObj:=wobj0;
    MoveJ Target_20,v1000,z100,tool0\WObj:=wobj0;
```

Continues on next page

3 Installation and commissioning

3.5.1 Configuring the arm-side interface

Continued

```
MoveJ Target_30,v1000,z100,tool0\WObj:=wobj0;
MoveJ Target_20,v1000,z100,tool0\WObj:=wobj0;
MoveJ Target_30,v1000,z100,tool0\WObj:=wobj0;
ENDPROC
```

Example of RAPID routine with TPWrite

Example of customized routine with the instruction TPWrite.

```
PROC ASI_Routine1()
    MoveJ
        [[0,0,0],[1,0,0,0],[0,0,0,0],[9E9,9E9,9E9,9E9,9E9,9E9]],v100,z0,tool0;
    TPWrite "Example 1";
ENDPROC
```

Configuring the light ring

The arm-side interface has a light ring with LED lights that indicate status. The configuration is shown on the FlexPendant.

The light will blink when a button is pressed on the arm-side interface.



Note

In RobotWare 7.2, the light ring configuration cannot be changed, only disabled.

3.5.2 Using the arm-side interface



WARNING

When using the lead-through function from the arm-side interface, make sure that no one else can take control of the robot. See recommendations in [Configuring the arm-side interface on page 67](#).

Prerequisites

A validated safety configuration must be set up before using the arm-side interface. See *Application manual - SafeMove*.

The payload must be configured before configuring the arm-side interface. See *Operating manual - OmniCore*.

The application **ASI Setting** on the FlexPendant must be open when using the buttons.

Using the buttons on the arm-side interface

To use the function that is configured for a button, press the button. The light ring will start blinking and the defined routine will start.

If the button configured for lead-through is pressed but the arm is not moved, then the lead-through functionality is switched off after 10 seconds. For more information about lead-through, see [Lead-through on page 73](#).

The buttons on the arm-side interface can be used in both manual mode and automatic mode.



Note

The application **ASI Setting** on the FlexPendant must be open when using the buttons.

3 Installation and commissioning

3.6.1 Information about RobotWare and CRB 15000

3.6 Configuring the software

3.6.1 Information about RobotWare and CRB 15000

Overview

CRB 15000 is designed to simplify collaborative applications. Therefore some software features work somewhat different compared with standard industrial robots. Some of them are listed in this section.

How to configure RobotWare is described in *Operating manual - Integrator's guide OmniCore*.

Emergency stops

The configuration of emergency stops is stop category 1 and cannot be changed.

Collision detection

As default CRB 15000 will have collision detection active at stand still. It also has another stop ramp compared to other robots to be able to release clamping forces.



Note

If the tool data is wrong, false collisions might be triggered and the robot arm might drop a short distance during the stop ramp.

SafeMove

See [CRB 15000 with SafeMove on page 75](#).

3.6.2 Lead-through

What is lead-through?

The lead-through functionality is available for robots designed for collaborative applications. If lead-through is available, this is shown on the FlexPendant.

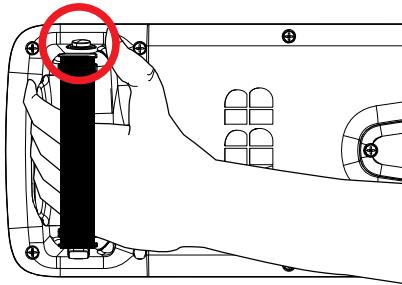
Using lead-through, you can grab the robot arm and move it manually to a desired position, as an alternative to jogging.

Using lead-through

Use the following procedure to jog the robot using the lead-through functionality:

- 1 Enable lead-through in one of the following ways:

- Press the thumb button on the FlexPendant.



xx2100000331

- On the start screen, tap **Jog** and in the **Jog** app, select the **Lead-through** menu.
- In **Quick settings**, select the **Jog** tab.



Note

If the robot is in motors off state, it will automatically go to the motors on state when the lead-through is enabled.

- 2 Gently pull the robot arm to the desired position.



Note

You can feel if an axis reaches its end position. Do not try to force the axis beyond this position.

- 3 If desired, save the position.

Lead-through can also be enabled using the RAPID instruction `SetLeadThrough`, or a button on the arm side interface, see [Arm-side interface on page 67](#). If the

Continues on next page

3 Installation and commissioning

3.6.2 Lead-through

Continued

lead-through button is pressed but the arm is not moved, then the lead-through functionality is switched off after 10 seconds.



Note

If lead-through is enabled, it will be temporarily disabled during program execution and jogging. This means that it is possible to combine lead-through, jogging, and testing the RAPID program without having to disable the lead-through.



Note

When using lead-through, it is important that the load is correctly defined. If the load is heavier than defined, the effect will be the same as if you are pulling the robot arm downwards. If the load is lighter than the defined load, the effect will be the same as if you are pulling the robot arm upwards.



Note

For CRB 15000 with SafeMove, some different behaviors apply, see [CRB 15000 with SafeMove on page 75](#).

3.6.3 CRB 15000 with SafeMove

General

For CRB 15000 with SafeMove, some different behaviors apply.

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

Limitations

Lead-through	<p>It is only possible to use lead-through if a <i>Contact Application Tolerance (CAP)</i> is configured in SafeMove. When using lead-through the servo lag increases which in normal case triggers a stop from SafeMove. By configuring a Contact Application Tolerance the servo lag can be decreased. For more information, see <i>Application manual - SafeMove</i>.</p> <p>The recommendation is to add speed supervision in the safeguarded space.</p> <p>In manual mode, more effort is required to move the robot arm in lead-through mode. This is to avoid getting speed violations from SafeMove.</p>
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4 Maintenance

4.1 Introduction

Structure of this chapter

This chapter describes all the maintenance activities recommended for the CRB 15000.

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

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

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

Safety information

Observe all safety information before conducting any service work.

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

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



Note

If the CRB 15000 is connected to power, always make sure that the CRB 15000 is connected to protective earth and a residual current device (RCD) before starting any maintenance work.

For more information see:

- [Product manual - OmniCore C30](#)
- [Robot cabling and connection points on page 62.](#)

4 Maintenance

4.2.1 Specification of maintenance intervals

4.2 Maintenance schedule and expected component life

4.2.1 Specification of maintenance intervals

Introduction

The intervals are specified in different ways depending on the type of maintenance activity to be carried out and the working conditions of the CRB 15000:

- 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 OmniCore is further described in the *Operating manual - OmniCore*.

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

4.2.2 Maintenance schedule

Scheduled and non-predictable maintenance

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

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

Life of each component

The inspection intervals *do not* specify the life of each component.

Maintenance schedule

Maintenance activities	Regularly	Every 6 months	Every 12 months	Reference
Cleaning the robot	x			Cleaning the CRB 15000 on page 86
Inspecting the robot	x			Inspecting the robot on page 80
Inspecting the robot harness		x ⁱ		Inspecting the cable harness on page 83
Testing the brake release functionality		x		Testing the brake release functionality on page 87
Testing the brake release tool		x		Testing the brake release functionality on page 87
Running the <i>Cyclic Brake Check</i> routine ⁱⁱ	x ^{iv}			Application manual - SafeMove
Testing the functionality of the joint electronics ^v		x		Testing the functionality of the joint electronics on page 88

ⁱ Replace if damage or cracks are detected.

ⁱⁱ Not needed separately if already included in the application.

Recommended test interval is within the range 8-48 hours.

^{iv} Recommended test interval is within the range 8-48 hours.

^v Not necessary if the *Cyclic Brake Check* routine is used.

4 Maintenance

4.3.1 Inspecting the robot

4.3 Inspection activities

4.3.1 Inspecting the robot

Required equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Inspecting the robot

Use these procedures to inspect the robot.

Inspecting the light indicators of the manipulator

	Action	Note
1	Turn on the power supply on the controller.	
2	Check the lights of the arm-side interface. If the lights do not work as configured, contact your local ABB office.	A description of the LED output indicators is found in Arm-side interface on page 67 .

Checking the overall condition of the manipulator

	Action	Note
1	Look for abnormal wear or contamination.	Clean as necessary. See Cleaning the CRB 15000 on page 86 .
2	Check for loose hardware at robot arms, base (foundation screws), and tool flange.	Tighten loose hardware at base (foundation screws tightening torque: 30 Nm $\pm 10\%$) and tool flange, if any.
3	Check for seepage of lubricants.	If any seepage is found, contact ABB.

Inspecting the covers

	Action	Note
1	Visually inspect all outer covers for damage. If any cover is damaged or cannot perform its protective function for other reasons, it must be replaced.	Spare part numbers are found in Product manual, spare parts - CRB 15000 .
2	Make sure that all covers are fully fastened. Manually check that the parts are not loose. Tighten, if needed.	Tightening torques specified in Tightening torques to be inspected on page 81 .

Inspecting the floor cable

The floor cable comprises the cabling between the robot and the controller cabinet.

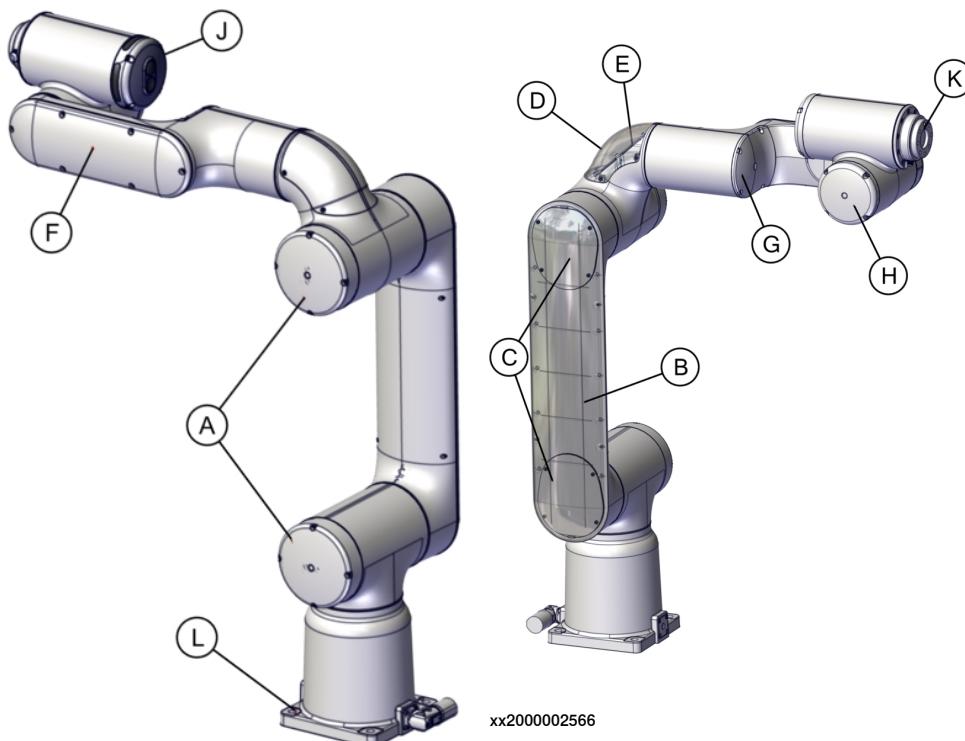
	Action	Note
1	Make an overall visual inspection of the cable in order to detect wear or damage.	Replace the cable if wear, cracks or damage is detected. See article numbers in Robot cabling and connection points on page 62 .

Continues on next page

Checking the presence of the brake release tool

	Action	Note
1	Check that the brake release tool is available at its storage location close to the robot.	Brake release tool: 3HAC077146-001. See Installation of brake release tool on page 53 .

Tightening torques to be inspected



Position	Cover	Screws	Tightening torque
A	Cover for axis 2/3	Hex socket head cap screw M3x30 12.9 Gleitmo 603+Geomet 500	0.45 Nm
B	Lower arm cover	Hex socket head cap screw M3x16 12.9 Gleitmo 603+Geomet 500 (Black Oxide)	0.45 Nm
C	Lower arm inner cover	Hex socket head cap screw M3x8 12.9 Gleitmo 603+Geomet 500	1.4 Nm
D	Housing top cover	Hex socket head cap screw M3x8 12.9 Gleitmo 603+Geomet 500	0.45 Nm
E	Housing inner plate	Hex socket head cap screw M3x8 12.9 Gleitmo 603+Geomet 500	1.4 Nm

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4 Maintenance

4.3.1 Inspecting the robot

Continued

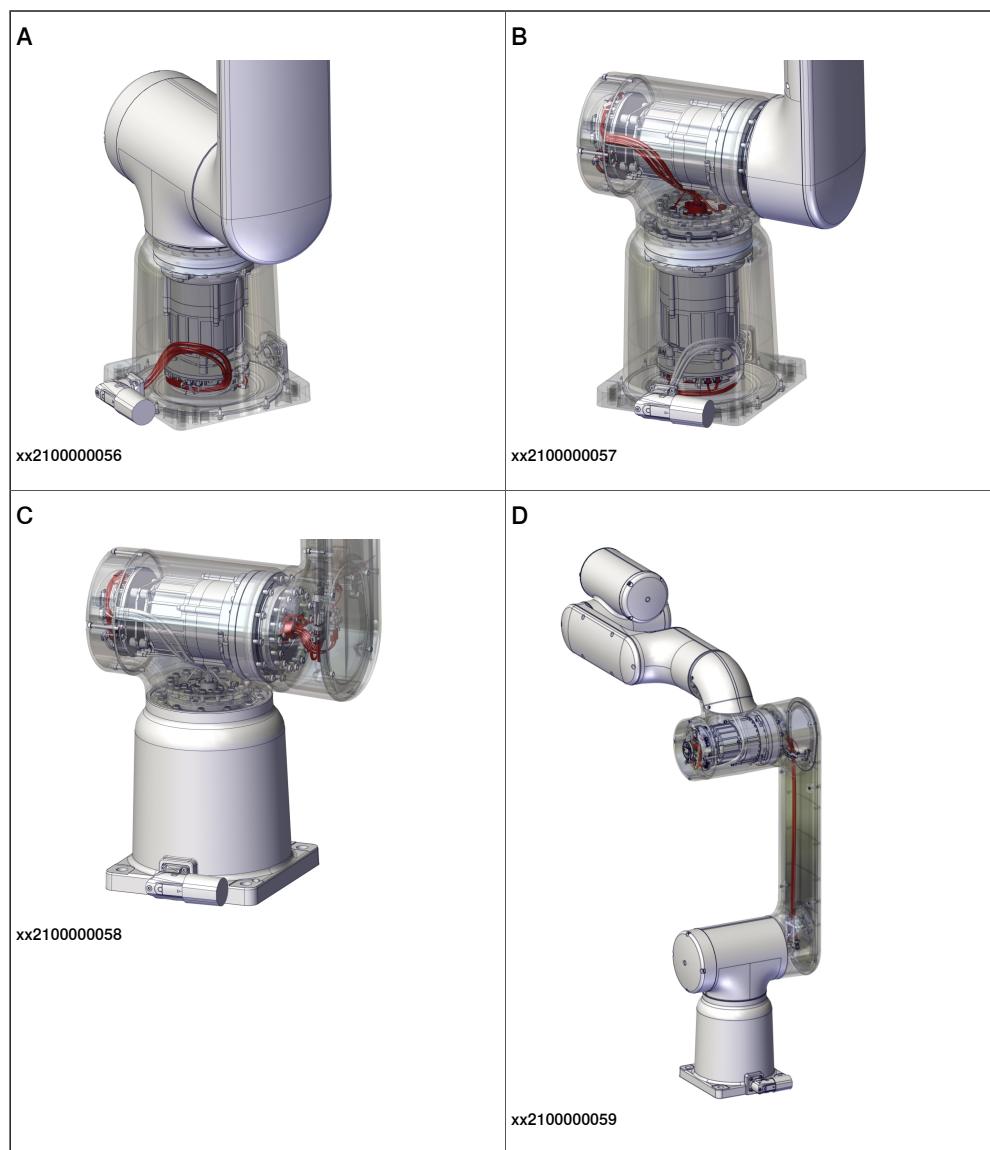
Position	Cover	Screws	Tightening torque
F	Tubular cover	Hex socket head cap flange screw with glue 3HAB3413-312 M3x12 For tubular cover. Always use new screws. If ordering a new axis-4 or axis-5 joint unit spare part, new screws for the tubular cover are included.	1.6 Nm
G	Axis-4 cover	Hex socket head cap screw M3x8 12.9 Gleitmo 603+Geomet 500	0.45 Nm
H	Axis-5 cover	Hex socket head cap screw M3x8 12.9 Gleitmo 603+Geomet 500	0.45 Nm
J	Arm side interface	Hex socket head cap screw M3x12 12.9 Gleitmo 603+Geomet 500	0.45 Nm
K	Tool flange	Hex socket head cap screw M3x12 12.9 Gleitmo 603+Geomet 500	0.45 Nm
L	Base	M10x35 8.8	30 Nm ±10%

4.3.2 Inspecting the cable harness

4.3.2 Inspecting the cable harness

Location of cable harness

The figures show the location for the cable harness.



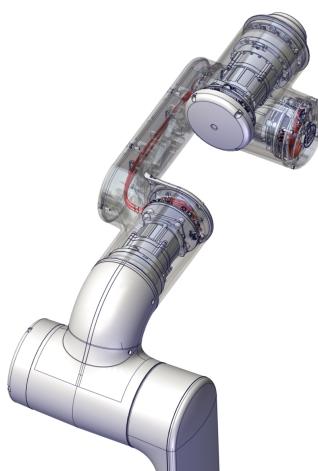
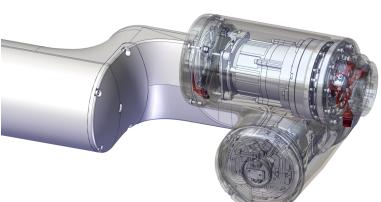
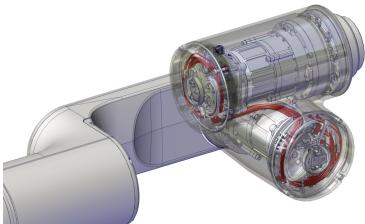
	Spare part	Spare part number
A	Cable harness, base socket	3HAC073202-001
B	Cable harness, joint 1	3HAC073204-001
C	Cable harness, joint 2	3HAC073205-001
D	Cable harness, joint 3	3HAC073207-001

Continues on next page

4 Maintenance

4.3.2 Inspecting the cable harness

Continued

A		B																
C		D																
<table border="1"><thead><tr><th></th><th>Spare part</th><th>Spare part number</th></tr></thead><tbody><tr><td>A</td><td>Cable harness, joint 4</td><td>3HAC073206-001</td></tr><tr><td>B</td><td>Cable harness, joint 5</td><td>3HAC073206-001</td></tr><tr><td>C</td><td>Cable harness, joint 6</td><td>3HAC073208-001</td></tr><tr><td>D</td><td>Cable harness, transition joint-5 and joint-6</td><td>3HAC073209-001</td></tr></tbody></table>				Spare part	Spare part number	A	Cable harness, joint 4	3HAC073206-001	B	Cable harness, joint 5	3HAC073206-001	C	Cable harness, joint 6	3HAC073208-001	D	Cable harness, transition joint-5 and joint-6	3HAC073209-001	
	Spare part	Spare part number																
A	Cable harness, joint 4	3HAC073206-001																
B	Cable harness, joint 5	3HAC073206-001																
C	Cable harness, joint 6	3HAC073208-001																
D	Cable harness, transition joint-5 and joint-6	3HAC073209-001																

Required equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Inspecting the cable harness

	Action	Note
1	 CAUTION Turn off all supplies for electrical power to the robot, before starting the repair work.	

Continues on next page

4.3.2 Inspecting the cable harness
Continued

Action	Note
2  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section <i>The unit is sensitive to ESD on page 42.</i>	
3 Remove all covers required to achieve visibility of all cabling.	
4 Visually inspect all arm cabling. Look for abrasions, cuts or crush damages. If any damage is detected, replace the cabling.	
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 <i>Tightening torques to be inspected on page 81.</i>

4 Maintenance

4.4.1 Cleaning the CRB 15000

4.4 Cleaning activities

4.4.1 Cleaning the CRB 15000

General

To secure high uptime it is important that the CRB 15000 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 CRB 15000.



Note

Always verify the protection type of the robot before cleaning.



WARNING

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

Special cleaning considerations

This section specifies some special considerations when cleaning the robot.

- Always use cleaning equipment as specified. Any other cleaning equipment may shorten the life of the robot.
- Always check that all protective covers are fitted to the robot before cleaning.
- Do not point the water jet at connectors, joints, sealings or gaskets.
- Do not use compressed air to clean the robot.
- Do not use solvents that are not approved by ABB to clean the robot.
- Do not spray from a distance closer than 0.4 m.
- Do not remove any covers or other protective devices before cleaning the robot.

Cleaning methods

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

Protection type	Cleaning method			
	Vacuum cleaner	Wipe with cloth	Rinse with water	High pressure water or steam
Standard	Yes	Yes. With light cleaning detergent.	No	No

4.5 Testing activities

4.5.1 Testing the brake release functionality

When to test the brake release functionality

Test the brake release functionality regularly as a maintenance activity. If possible, include the *Cyclic Brake Check* routine in the application, to be run according to the recommended interval in the maintenance schedule (see [Maintenance schedule on page 79](#)). See *Application manual - SafeMove*.

The brake release functionality shall be tested after heavy collisions. This does not apply to collisions which may routinely be experienced as part of a power and force limiting application.

Required equipment

Equipment	Article number	Note
Brake release tool	3HAC077146-001	For releasing the holding brakes of a joint unit motor.

Testing the brake release functionality

	Action	Note
1	Test the brake release functionality on each axis, by using the brake release tool.	See Manually releasing the brakes on page 50 .
2	If the holding brake does not release, check following: <ul style="list-style-type: none"> • Check for event log messages on the FlexPendant. • Look for damage to the magnet. Replace the tool if damaged. • See troubleshooting section Brake release tool does not work on page 614. 	For OmniCore, all event logs from the software can be seen on the FlexPendant, or in <i>Technical reference manual - Event logs for RobotWare 7</i> .

4 Maintenance

4.5.2 Testing the functionality of the joint electronics

4.5.2 Testing the functionality of the joint electronics

When to test the joint electronics

Test the functionality regularly as a maintenance activity.

Testing the joint electronics is not necessary if the *Cyclic Brake Check* routine is used.

Required equipment

Equipment	Article number	Note
Brake release tool	3HAC077146-001	For releasing the holding brakes of a joint unit motor.

Testing the joint electronics

	Action	Note
1	Turn off power to the controller and then turn the power on again.	
2	Verify that the robot starts as expected.	

5 Repair

5.1 Introduction

Structure of this chapter

This chapter describes repair activities for the CRB 15000. Each procedure contains the information required to perform the activity, for example spare parts numbers, required special tools, and materials.



WARNING

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

Report replaced units



Note

When replacing a part on the CRB 15000, report to your local ABB the serial number, the article number, and the revision of both the replaced unit and the replacement unit.

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

Safety information

Make sure to read through the chapter [Safety on page 15](#) before commencing any service work.



Note

If the CRB 15000 is connected to power, always make sure that the CRB 15000 is connected to protective earth and a residual current device (RCD) before starting any repair work.

For more information see:

- *Product manual - OmniCore C30*

5 Repair

5.2.1 Mounting instructions for sealings

5.2 General procedures

5.2.1 Mounting instructions for sealings

General

This section describes how to mount different types of sealings.

Equipment

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

Rotating sealings

The procedure below describes how to fit rotating sealings.



CAUTION

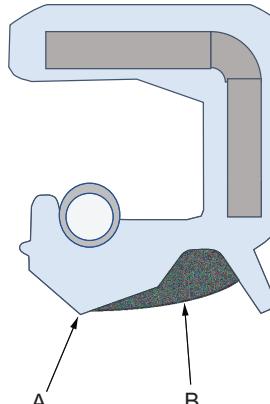
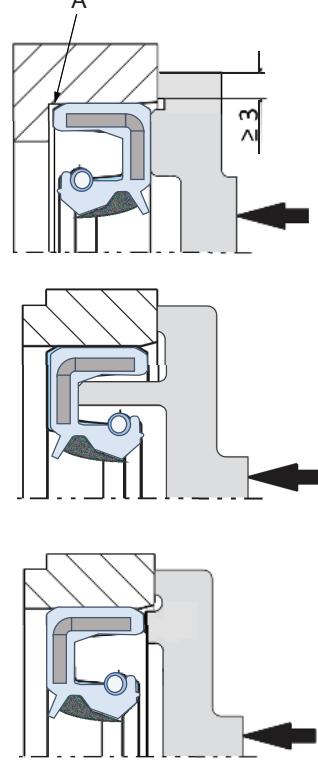
Please observe the following before commencing any assembly of sealings:

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

	Action	Note
1	Check the sealing to ensure that: <ul style="list-style-type: none">• The sealing is of the correct type.• There is no damage on the main lip.	
2	Inspect the shaft surface before mounting. If scratches or damage are found, the shaft must be replaced since it may result in future leakage. Do not try to grind or polish the shaft surface to get rid of the defect.	

Continues on next page

5.2.1 Mounting instructions for sealings
Continued

	Action	Note
3	<p>Lubricate the sealing with grease just before fitting. (Not too early - there is a risk of dirt and foreign particles adhering to the sealing.)</p> <p>Fill 2/3 of the space between the dust lip and the main lip with grease. If the sealing is without dust lip, just lubricate the main lip with a thin layer of grease.</p>	<p>Article number is specified in Equipment on page 90.</p>  <p>xx2000000071</p> <p>A Main lip B Grease C Dust lip</p>
4	<p>Mount the sealing correctly with a mounting tool. Never hammer directly on the sealing as this may result in leakage.</p>	 <p>xx2000000072</p> <p>A Gap</p>

Continues on next page

5 Repair

5.2.1 Mounting instructions for sealings

Continued

Flange sealings and static sealings

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

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

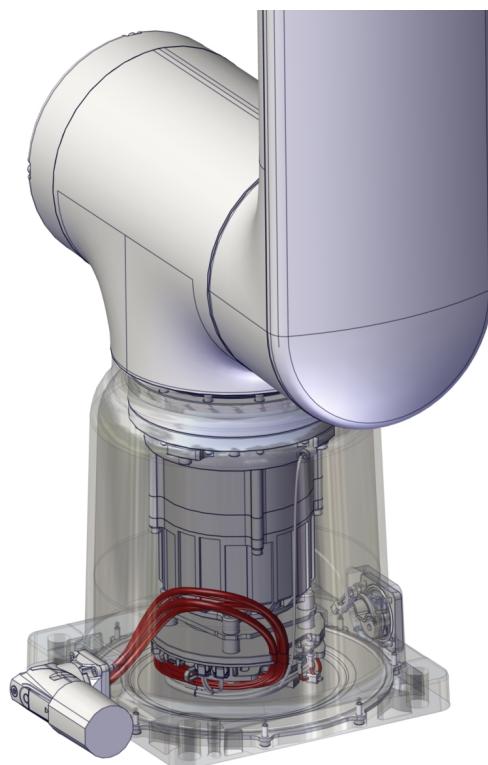
Action	Note
1 Ensure that the correct o-ring size is used.	
2 Check the o-ring for surface defects, burrs, shape accuracy, or deformation.	Defective o-rings, including damaged or deformed o-rings, may not be used.
3 Check the o-ring grooves. The grooves must be geometrically correct and should be free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

5.3 Cable harness

5.3.1 Replacing the base cabling

Location of the cable harness

The cable harness is located as shown in the figure.



xx2100000056

Summary of the replacement procedure

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

- 1 Jog the robot to transportation position.
- 2 Loosen the robot from the foundation and lay it down on its back.
This step requires two persons.
- 3 Remove the base cover.
- 4 Replace the cabling.

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Continues on next page

5 Repair

5.3.1 Replacing the base cabling

Continued

Spare part	Article number	Note
Cable harness, base socket	3HAC073202-001	

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

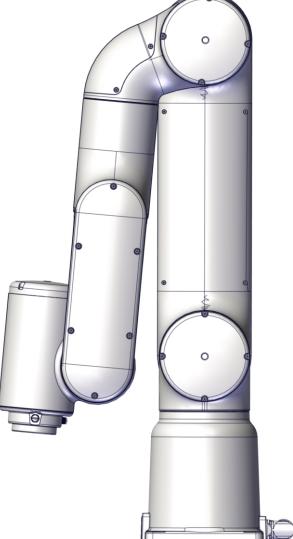
Required consumables

Consumable	Article number	Note
Cable ties	-	
O-ring, nitrile rubber	3HAB3772-64	Base cover
Grease	3HAC042536-001	Shell Gadus S2

Removing the base cabling

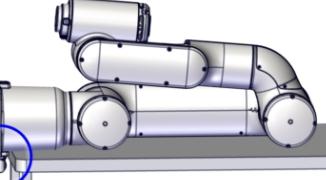
Use these procedures to remove the base cabling.

Preparations before removing the cabling

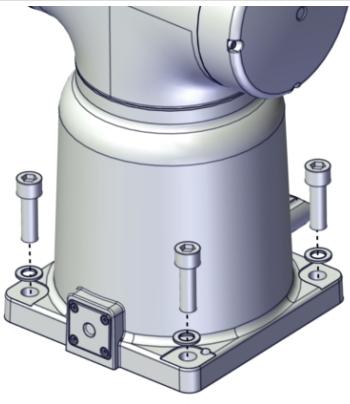
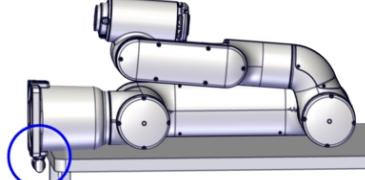
	Action	Note
1	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none">• Axis 1: 0°• Axis 2: 0°• Axis 3: +85°• Axis 4: 0°• Axis 5: 0°• Axis 6: 0°	 xx2100000113
2	<p> CAUTION</p> <p>Turn off all supplies for electrical power to the robot, before starting the repair work.</p>	

Continues on next page

5.3.1 Replacing the base cabling
Continued

Action	Note
3 Prepare a working bench where the robot can be laid down on its back with the base socket outside the table edge.	 xx2100000414

Laying down the robot

Action	Note
1  CAUTION The CRB 15000 robot weighs 28 kg. A minimum of two persons are required for lifting as well as securing the robot in order to avoid any damage, instability, and injury.	
2 Loosen the robot from the foundation. <ul style="list-style-type: none"> • Person 1: keep holding the robot stable. • Person 2: loosen the robot base from the foundation by removing the attachment screws and washers. • Both persons: grasp the robot at appropriate locations and lay it down on its back on a working bench. Do not damage the base socket.  xx2100000415	 xx2100000414

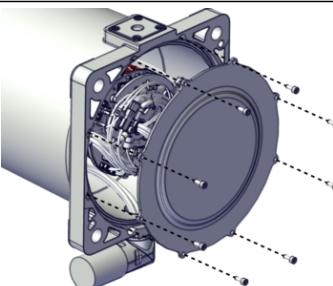
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5 Repair

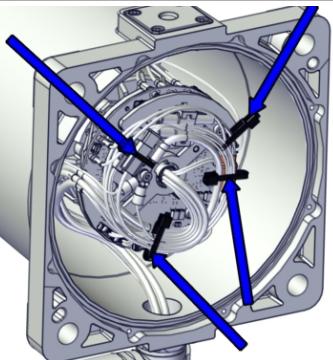
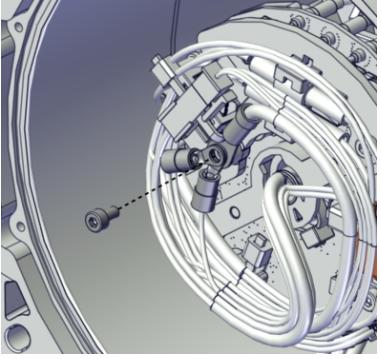
5.3.1 Replacing the base cabling

Continued

Removing the base cover

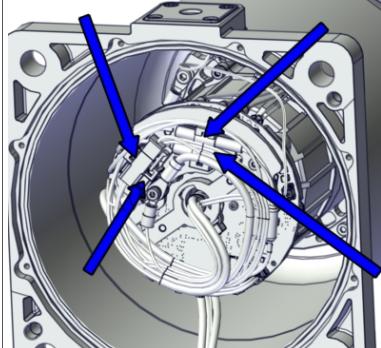
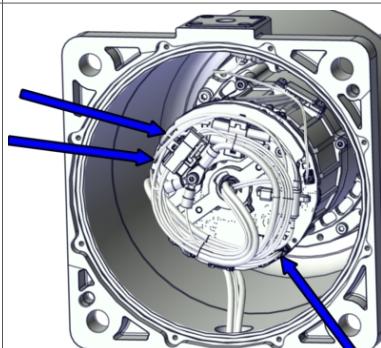
	Action	Note
1	Remove the bottom cover by removing the attachment screws.	 xx2000002007

Disconnecting the base cabling

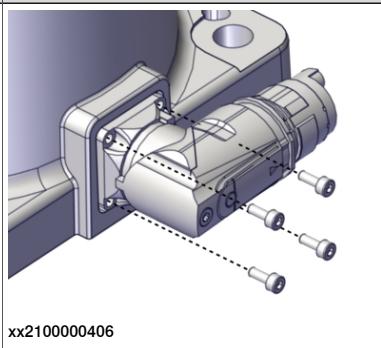
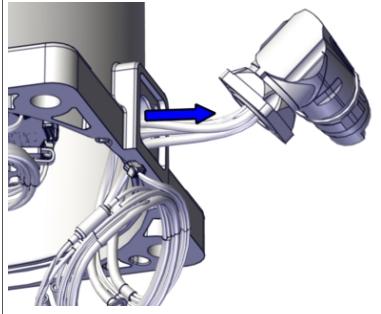
	Action	Note
1	Cut the cable ties.	 xx2100000424
2	Remove the functional and protective earth cables by removing the screw.	 xx2100000425

Continues on next page

5.3.1 Replacing the base cabling
Continued

Action	Note
3 Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J1.DC+ • J1.DC- • J1.CS • J1.CP 	 xx2100000426
4 Disconnect the connectors from the drive board. <ul style="list-style-type: none"> • D1.X1 from X1 • D1.DC+ from DC+ • D1.DC- from ground 	 xx2100000405

Removing the base cabling

Action	Note
1 Remove the attachment screws.	 xx2100000406
2 Pull out the cabling from the base.	 xx2100000407

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5 Repair

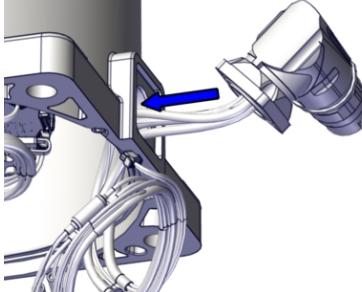
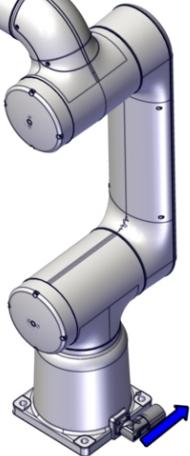
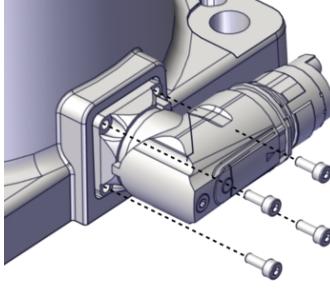
5.3.1 Replacing the base cabling

Continued

Refitting the base cabling

Use these procedures to refit the base cabling.

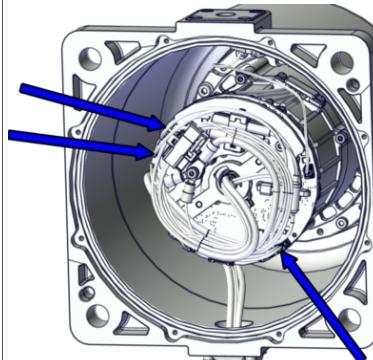
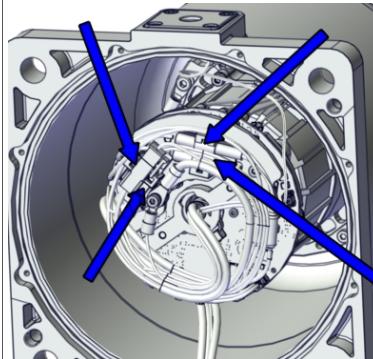
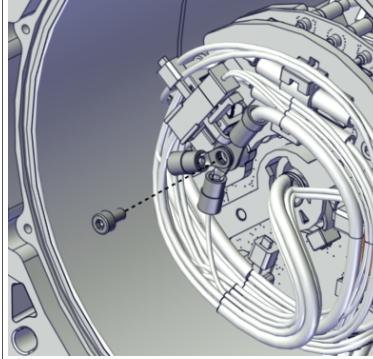
Refitting the base cabling

Action	Note
1 Insert the cabling into the base.	 xx2100000408
2 Orient the base connector so that it points to the right, seen from back of the robot.	 xx2100000409
3 Secure the base connector with the attachment screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.8 Nm.</p>  xx2100000406

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5.3.1 Replacing the base cabling
Continued

Connecting the base cabling

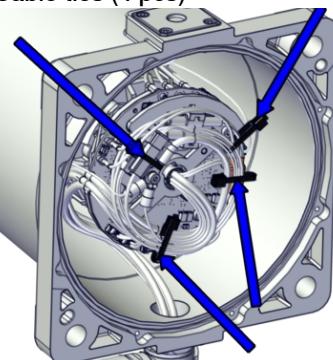
	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section <i>The unit is sensitive to ESD on page 42.</i>	
2	Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D1.X1 to X1 • D1.DC+ to DC+ • D1.DC- to Ground 	 xx2100000405
3	Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J1.DC+ to J1.DC+ • J1.DC- to J1.DC- • J1.CS to J1.CS • J1.CP to J1.CP 	 xx2100000426
4	Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2100000425

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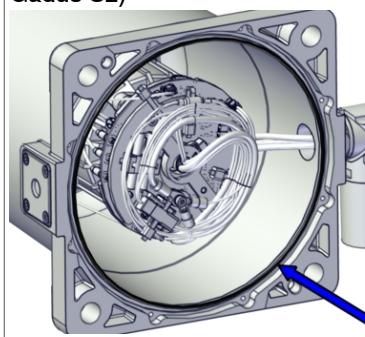
5 Repair

5.3.1 Replacing the base cabling

Continued

	Action	Note
5	Secure the cabling with cable ties.	<p>Cable ties (4 pcs)</p>  <p>xx2100000424</p>

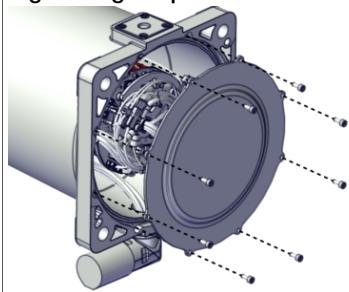
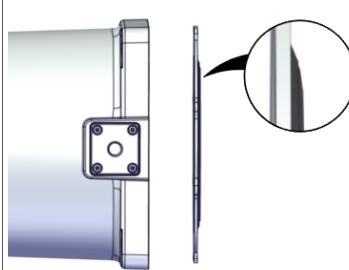
Refitting the base cover

	Action	Note
1	Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	<p>O-ring, nitrile rubber: 3HAB3772-64 Grease: 3HAC042536-001 (Shell Gadus S2)</p>  <p>xx2000002016</p>

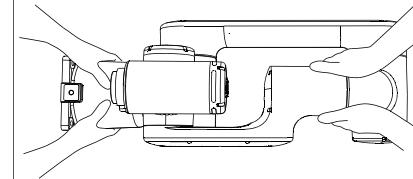
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5.3.1 Replacing the base cabling

Continued

Action	Note
<p>2 Refit the bottom cover with the attachment screws.</p> <p>Note</p> <p>Fit the cover in correct direction, the protrusion of the cover must face outwards.</p>	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (8 pcs) Tightening torque: 1.2 Nm.</p>  <p>xx2000002007</p>  <p>xx2100000268</p>

Lifting and securing the robot

Action	Note
<p>1 CAUTION</p> <p>The CRB 15000 robot weighs 28 kg. A minimum of two persons are required for lifting as well as securing the robot in order to avoid any damage, instability, and injury.</p> <p>Special consideration is necessary when mounting the robot in an elevated, suspended or wall mounted position.</p>	
<p>2 Grasp the robot at the foot and elbow, as shown in the figure, and lift it up from the transportation package.</p>	 <p>xx2100000118</p>
<p>3 CAUTION</p> <p>Do not leave the robot standing unfastened to the foundation, it is not stable on its own.</p>	
<p>4 Fit two pins to the holes in the base.</p>	<p>Centering pins: DIN6325, hardened steel Ø6x24 mm, 2 pcs .</p>

Continues on next page

5 Repair

5.3.1 Replacing the base cabling

Continued

	Action	Note
5	Raise the robot to standing and secure to foundation, paying attention to the centering holes at the bottom of the robot base. <ul style="list-style-type: none">• Person 1: keep holding the robot stable.• Person 2: secure the robot base to the foundation with the securing screws and washers.	Screws: M10x35, 4 pcs, quality 8.8 Washers: 23/10.5/2.5 mm Steel
6	Tighten the bolts in a crosswise pattern to ensure that the base is not distorted.	Tightening torque: 30 Nm ±10%

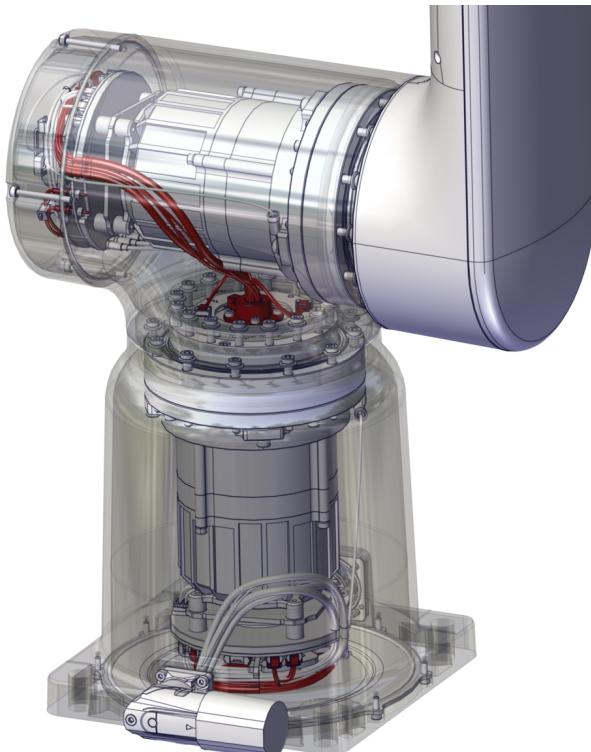
Concluding procedure

	Action	Note
1	 DANGER Make sure all safety requirements are met when performing the first test run.	

5.3.2 Replacing the axis-1 cabling

Location of the cable harness

The cable harness is located as shown in the figure.



xx2100000057

Summary of the replacement procedure

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

- 1 Separate the cabling between the swing and the lower arm.
- 2 Remove the lower and upper arm undivided.
- 3 Remove the axis-2 joint unit.
- 4 Remove the swing.
- 5 Loosen the base from the foundation and lay it down on its side.
- 6 Replace the cabling.

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Continues on next page

5 Repair

5.3.2 Replacing the axis-1 cabling

Continued

Spare part	Article number	Note
Cable harness, joint 1	3HAC073204-001	Also order new Cable tie: 3HAC075545-001.
Hex socket head cap flange screw with glue	3HAB3413-435	M4x35, 12 pcs Always use new screws when re-fitting a joint unit. If ordering a new joint unit spare part, new screws are included.
Cable tie	3HAC075545-001	For securing joint unit cable.

Required tools and equipment

Equipment	Article number	Note
Guide pin, M4x120	3HAC077786-001	Always use guide pins in pairs. For joint units on axes 1, 2 and 3.
Lifting aid	3HAC077788-001	For joint units on axes 1, 2 and 3. Attachment screws M4x35 (4 pcs) are enclosed.
Protection plate	3HAC077790-001	For protection of drive board during cabling installation on joint unit.
Cable tie gun EVO7	-	HellermannTyton 110-70084 or similar
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

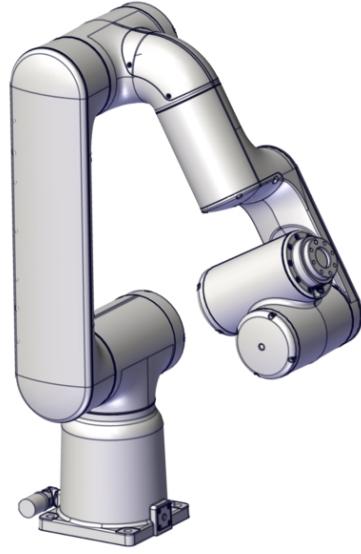
Consumable	Article number	Note
Cable ties	-	
O-ring, nitrile rubber	3HAB3772-64	Base cover
Grease	3HAC042536-001	Shell Gadus S2
Cleaning agent	-	Isopropanol
Flange sealant	-	Loctite 574
O-ring	3HAC061327-044	Lower arm, inner cover. 1 pcs / cover. Replace if damaged.
O-ring	3HAC061327-047	Cover for axis 2/3 Replace if damaged.

Continues on next page

Removing the joint cabling

Use these procedures to remove the joint-1 cabling.

Preparations before removing the cabling

	Action	Note
1	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none"> • Axis 1: 0° • Axis 2: 0° • Axis 3: +60° • Axis 4: 0° • Axis 5: -90° • Axis 6: No significance. 	 xx2100000044
2	<p>! CAUTION</p> <p>Turn off all supplies for electrical power to the robot, before starting the repair work.</p>	

Removing the lower arm covers

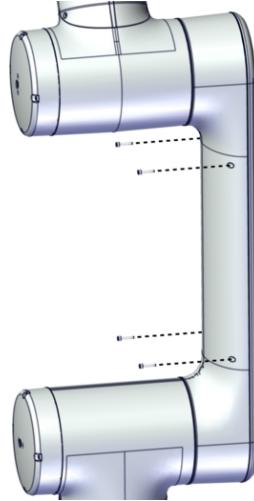
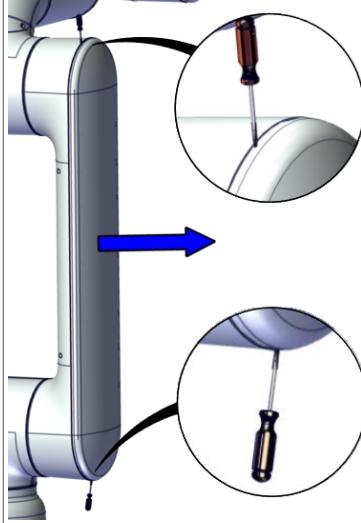
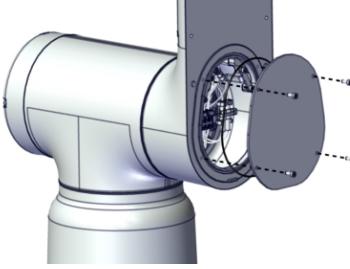
	Action	Note
1	<p>! CAUTION</p> <p>Make sure that all supplies for electrical power are turned off.</p>	

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5 Repair

5.3.2 Replacing the axis-1 cabling

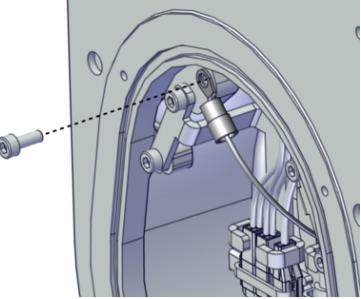
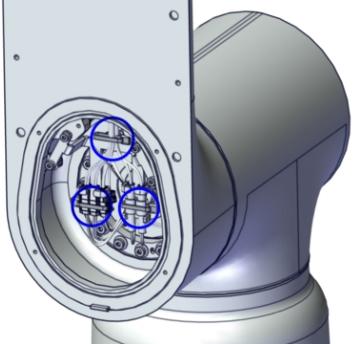
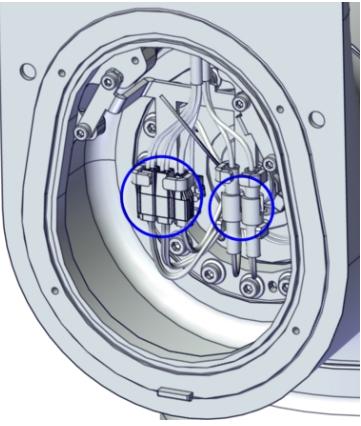
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	Action	Note
2	Remove the four lower arm cover screws.	 xx2000001929
3	Remove the cover by inserting a small flat screwdriver to snap open the locks at each end of the cover.	 xx2100000267
4	Remove the inner cover by removing the four screws.	 xx2000001930

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5.3.2 Replacing the axis-1 cabling
Continued

Disconnecting the cabling between the lower arm and the swing

Action	Note
1 Remove the functional earth cable by removing the screw.	 xx2000001936
2 Cut the cable ties.	 xx2000001937
3 Snap loose and disconnect all connectors.	 xx2000001938

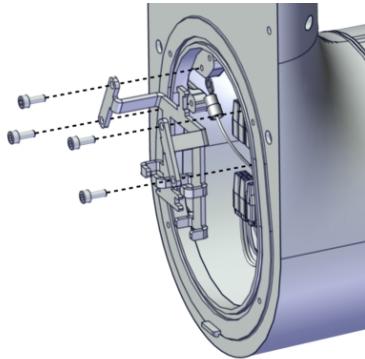
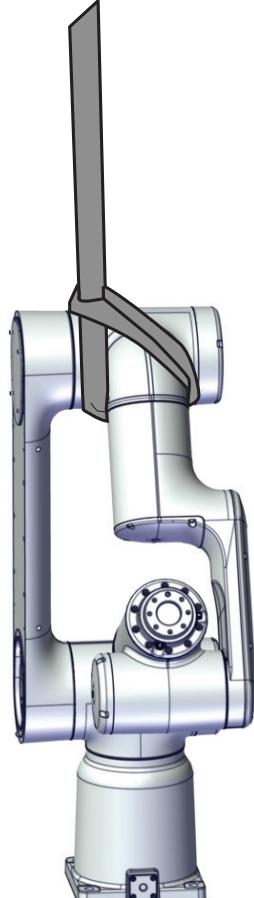
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5 Repair

5.3.2 Replacing the axis-1 cabling

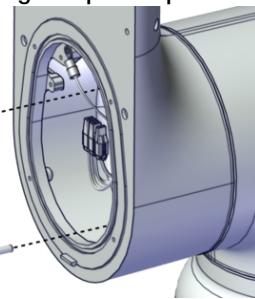
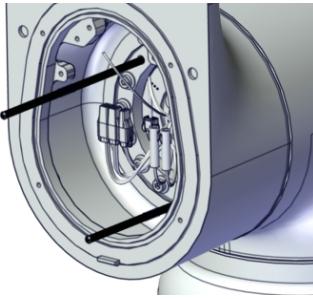
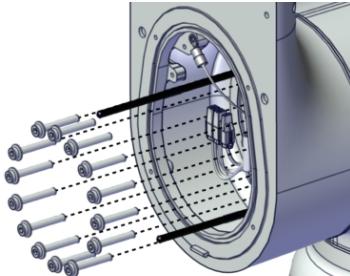
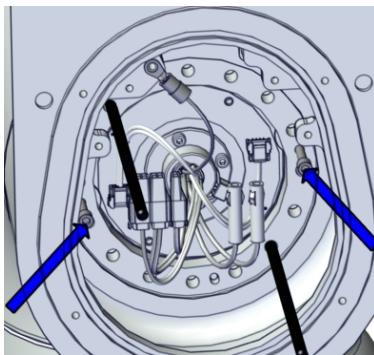
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Removing the lower and upper arm assembled

	Action	Note
1	Remove the cable bracket by removing the four screws.	 xx2000001939
2	Secure the weight of the upper and lower arm.  CAUTION The weight of the complete upper and lower arm together is 18 kg	Suggestion with lifting sling and an overhead crane:  xx2100000294

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5.3.2 Replacing the axis-1 cabling
Continued

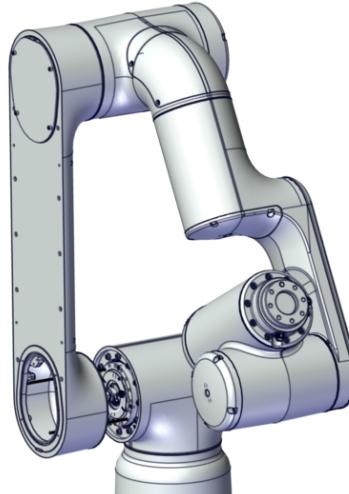
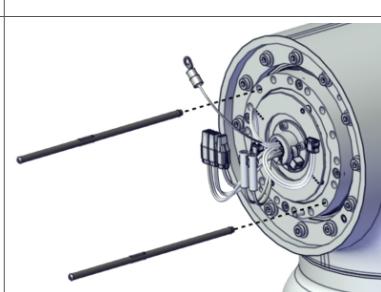
	Action	Note
3	Remove two attachment screws and fit two guide pins to the axis-2 joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs.</p>  <p>xx2000001951</p>  <p>xx2000001960</p>
4	Remove the lower arm attachment screws.	 <p>xx2000001940</p>
5	Use two fully threaded attachment screws as removal tools to press the lower arm out of position.	 <p>xx2000002151</p>

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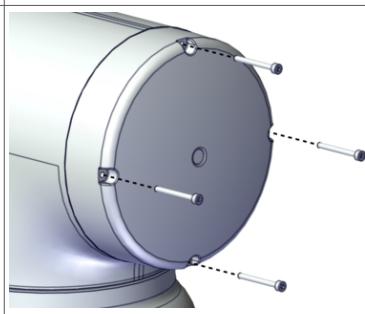
5 Repair

5.3.2 Replacing the axis-1 cabling

Continued

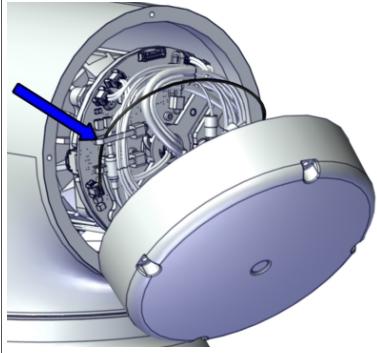
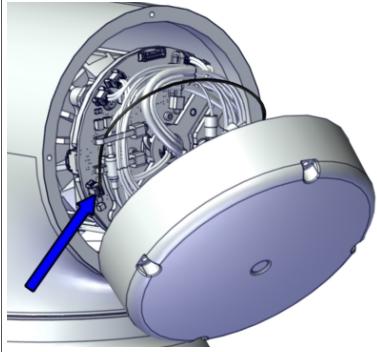
Action	Note
6 Remove the complete arm system from the swing.	 xx2000001941
7 Remove the guide pins.	 xx2000002432

Removing the swing cover

Action	Note
1  CAUTION Make sure that all supplies for electrical power are turned off.	
2 Remove the cover screws.	 xx2000001935

Continues on next page

5.3.2 Replacing the axis-1 cabling
Continued

Action	Note
<p>3</p> <p> CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.</p>	
<p>4</p> <p>Open the cover and cut the cable tie that holds the brake release cable.</p>	 xx2000001931
<p>5</p> <p>Disconnect the brake release connector from the drive board. Remove the cover.</p>	 xx2000001932

Disconnecting the axis-2 joint unit cabling

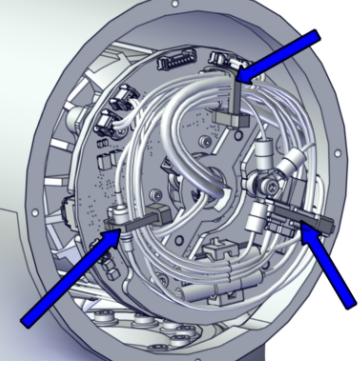
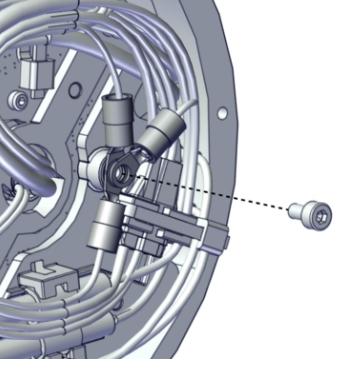
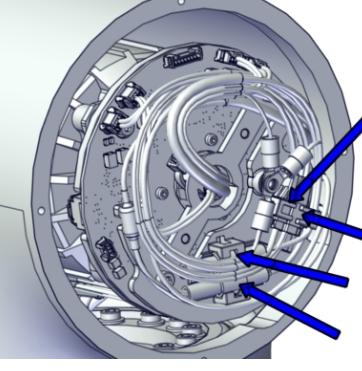
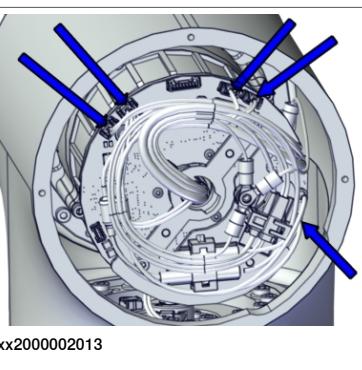
Action	Note
<p>1</p> <p> ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42.</p>	

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5 Repair

5.3.2 Replacing the axis-1 cabling

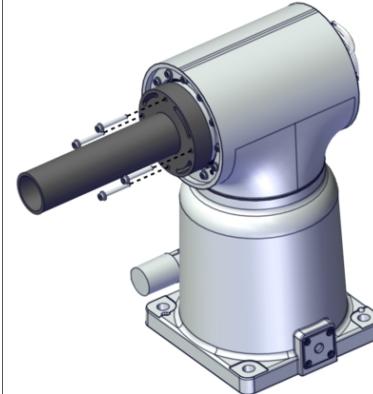
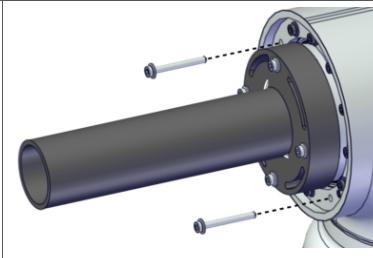
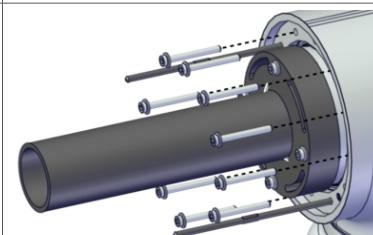
Continued

Action	Note
2 Cut the cable ties.	 xx2000001946
3 Remove the functional and protective earth cables by removing the screw.	 xx2000001945
4 Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J2.DC+ • J2.DC- • J2.CS • J2.CP 	 xx2000001944
5 Disconnect the connectors from the drive board. <ul style="list-style-type: none"> • D2.X1 from X1 • D2.DC+ from DC+ • D2.DC- from ground • D2.X4 from X4 • D2.X2 from X2 • D2.X5 from X5 	 xx2000002013

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5.3.2 Replacing the axis-1 cabling
Continued

Removing the axis-2 joint unit

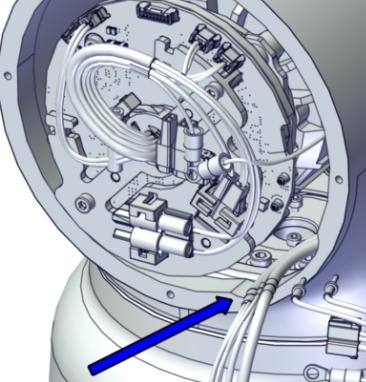
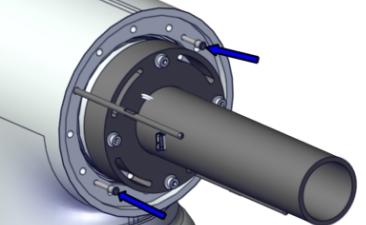
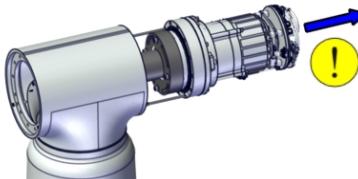
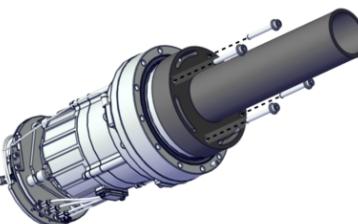
	Action	Note
1	<p>Fit the lifting aid to the joint unit, on the torque sensor side.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	<p>Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)</p>  <p>xx2000001956</p>
2	<p>Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.</p>	 <p>xx2100000295</p>
3	<p>Fit two guide pins to the axis-2 joint unit.</p>	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.</p>  <p>xx2000002433</p>
4	<p>Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.</p>	 <p>xx2000001943</p>

Continues on next page

5 Repair

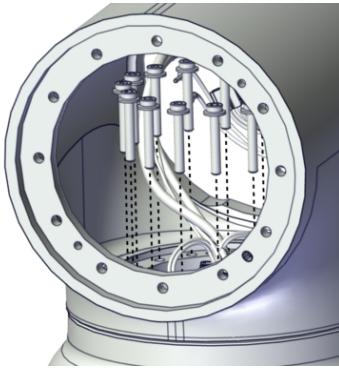
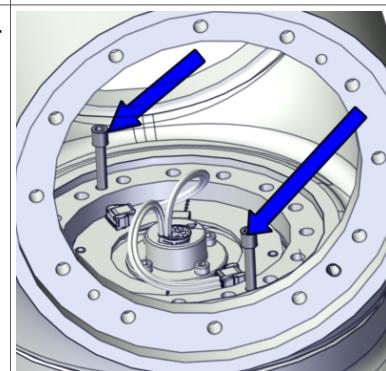
5.3.2 Replacing the axis-1 cabling

Continued

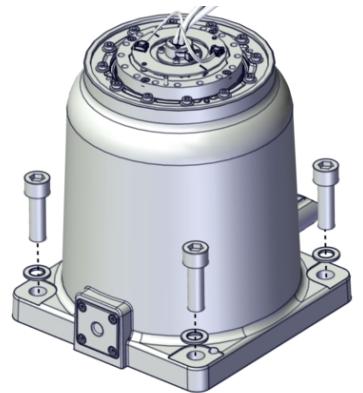
Action	Note
5 Put the cabling at the slot in order not to squeeze it during removal of joint unit.	 xx2100000045
6 Press the joint unit out of position using two of the previous attachment screws as removal tools.	 xx2000002434
7 Remove the joint unit from the swing. CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000001958
8 Remove the lifting aid and guide pins.	 xx2000001957

Continues on next page

Removing the swing

	Action	Note
1	Remove the swing attachment screws.	 xx2000001987
2	Use two fully threaded attachment screws as removal tools to press the swing out of position.	 xx2000002152
3	Lift away the swing.  CAUTION The torque sensor (on the exposed PCBA) is sensitive to mechanical damage. Handle the assembly with care.	

Loosening the base and removing the base cover

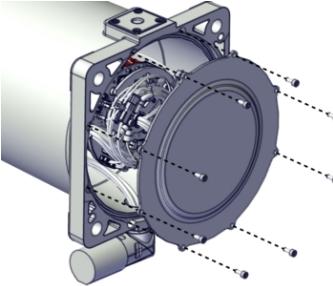
	Action	Note
1	Loosen the base from the foundation by removing the attachment screws and washers.	 xx2000002006

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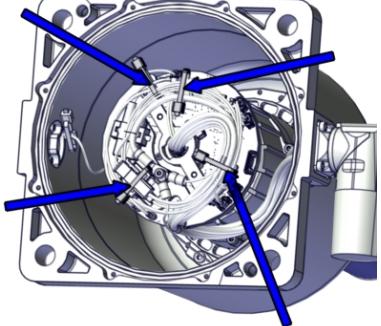
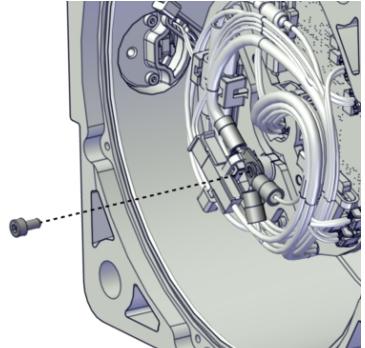
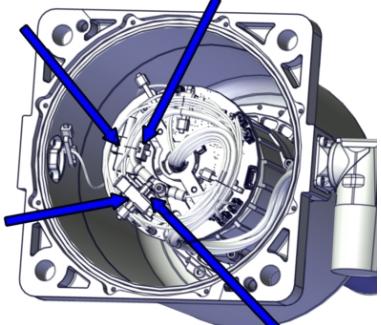
5 Repair

5.3.2 Replacing the axis-1 cabling

Continued

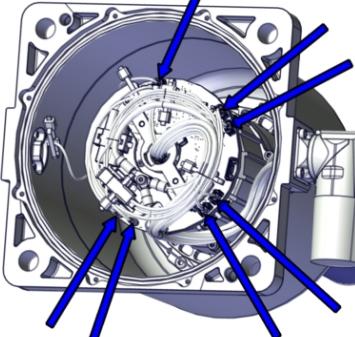
Action	Note
2 Tilt the base on to its side and remove the bottom cover by removing the attachment screws.	 xx2000002007

Disconnecting the axis-1 joint unit cabling

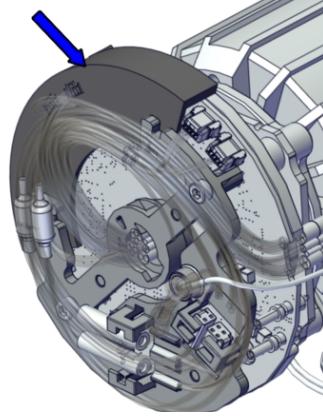
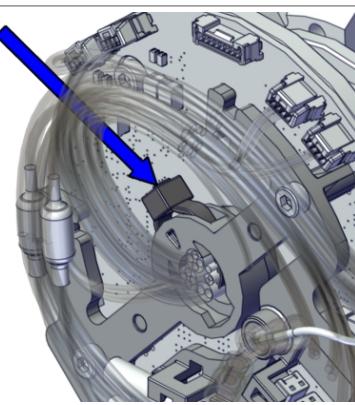
Action	Note
1 Cut the cable ties.	 xx2000002012
2 Remove the functional and protective earth cables by removing the screw.	 xx2000002011
3 Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J1.DC+ • J1.DC- • J1.CS • J1.CP 	 xx2000002010

Continues on next page

5.3.2 Replacing the axis-1 cabling
Continued

Action	Note
<p>4 Disconnect the connectors from the drive board.</p> <ul style="list-style-type: none"> • D1.X1 from X1 • D1.DC+ from DC+ • D1.DC- from ground • D1.X4 from X4 • D1.X2 from X2 • D1.X5 from X5 • DR.X8 from X8 	 <p>xx2000002009</p>

Removing the joint cable

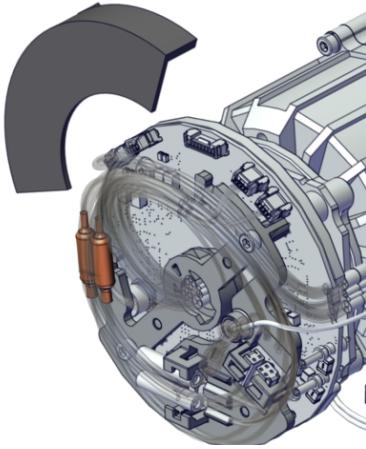
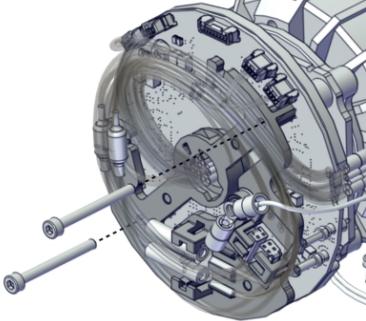
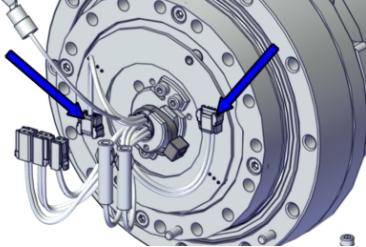
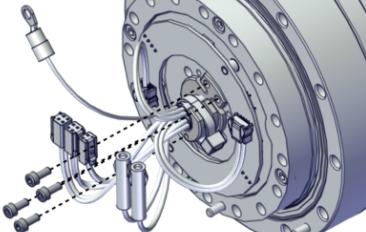
Action	Note
<p>1  ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42.</p>	
<p>2 Fit the protection plate to the drive board unit.</p> <p> Tip</p> <p>Using the protection plate is important for protecting the drive board unit. If complete joint unit is to be replaced, the protection plate is not needed.</p>	<p>Protection plate: 3HAC077790-001</p>  <p>xx2000002057</p>
<p>3 Cut the cable tie at the drive board.</p>	 <p>xx2000002058</p>

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5 Repair

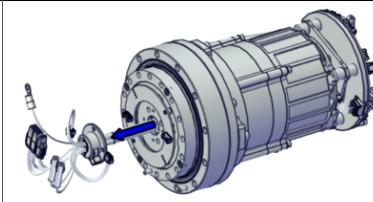
5.3.2 Replacing the axis-1 cabling

Continued

	Action	Note
4	Remove the protection plate.	 xx2100000301
5	Remove the cable support from the drive board by removing the attachment screws.	 xx2000002055
6	Disconnect the two connectors from the torque sensor board. <ul style="list-style-type: none"> • TQ.A • TQ.B 	 xx2000002053
7	Remove the cable plate by removing the attachment screws.	 xx2000002049

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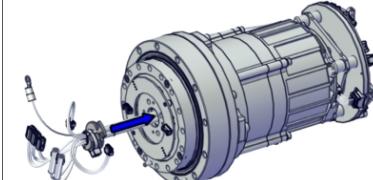
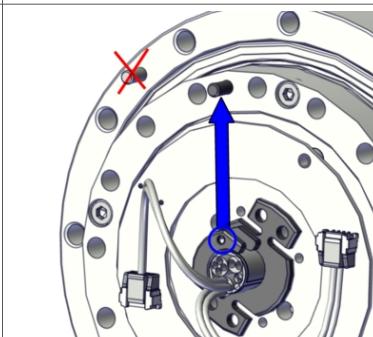
5.3.2 Replacing the axis-1 cabling
Continued

Action	Note
<p>8 Remove the joint cable from the hollow shaft from the torque sensor side.</p> <p>! CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	

Refitting the joint cabling

Use these procedures to refit the joint-1 cabling.

Refitting the joint cable

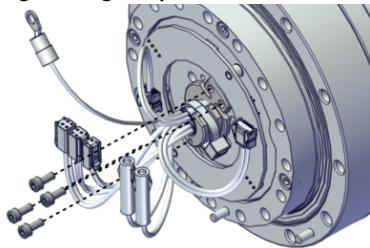
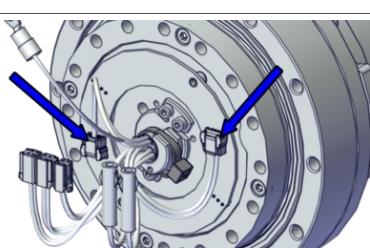
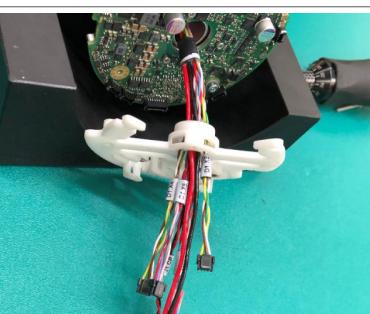
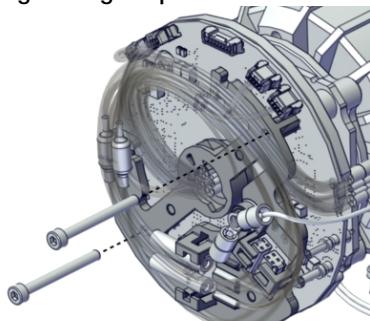
Action	Note
<p>1 ! ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42.</p>	
<p>2 Place the joint cable through the hollow shaft from the torque sensor side.</p> <p>! CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	
<p>3 Orient the cable plate according to the figure. The circle on the cable plate should point towards the guide pin on the torque sensor.</p>	

Continues on next page

5 Repair

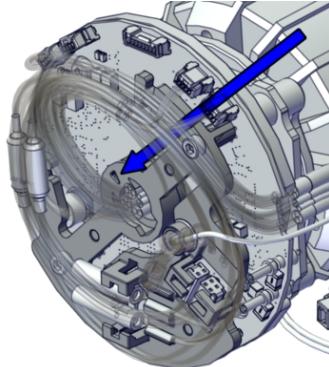
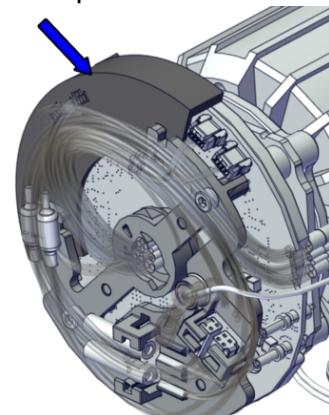
5.3.2 Replacing the axis-1 cabling

Continued

	Action	Note
4	Secure the cable plate to the joint unit with the attachment screws.	<p>Hex socket head cap screw: M2.5x6 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000002049</p>
5	<p>Connect the two connectors to the torque sensor board.</p> <ul style="list-style-type: none"> • TQ.A to CH1/A • TQ.B to CH2/B 	 <p>xx2000002053</p>
6	Insert the cabling through the cable support and fit the support to the drive board with the attachment screws.	 <p>xx2000002056</p> <p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (2 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000002055</p>

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5.3.2 Replacing the axis-1 cabling
Continued

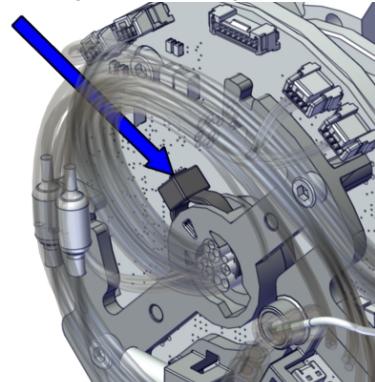
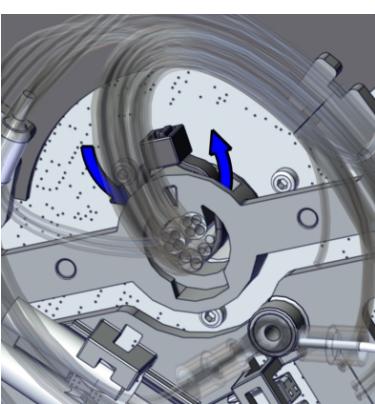
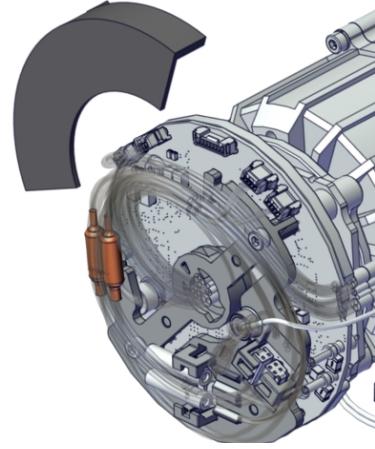
	Action	Note
7	Align the triangle direction mark on the cable support and the white mark on the cable harness. Use the cable tie to pre-fix the cable by hand.	 xx2100000507
		 xx2100000508
8	Fit the protection plate to the drive board unit.	Protection plate: 3HAC077790-001  xx2000002057

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5 Repair

5.3.2 Replacing the axis-1 cabling

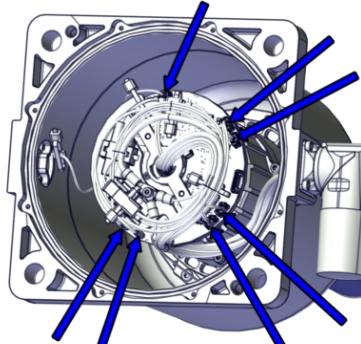
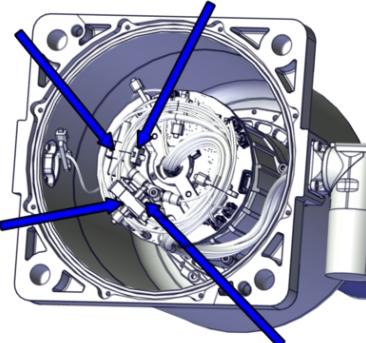
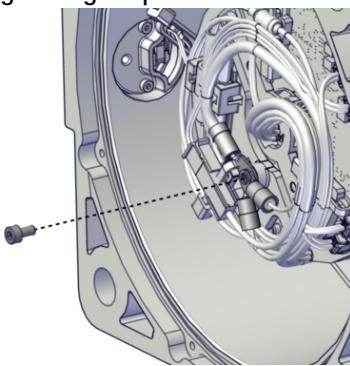
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	Action	Note
9	<p>Secure the cables to the cable support with a cable tie, using a cable tie gun.</p> <p>Assembly direction for the cable tie is shown in the figure.</p>	<p>Cable tie: 3HAC075545-001. For securing joint unit cable.</p> <p>Cable tie gun EVO7</p> <p>Setting for cable tie gun: 6.75.</p>  <p>xx2000002058</p>  <p>xx2000002059</p>
10	Remove the protection plate.	 <p>xx2100000301</p>

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5.3.2 Replacing the axis-1 cabling
Continued

Connecting the axis-1 joint unit cabling

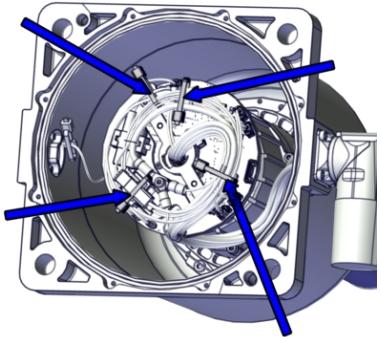
	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section <i>The unit is sensitive to ESD on page 42.</i>	
2	Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D1.X1 to X1 • D1.DC+ to DC+ • D1.DC- to Ground • D1.X4 to X4 • D1.X2 to X2 • D1.X5 to X5 • DR.X8 to X8 	 xx2000002009
3	Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J1.DC+ to J1.DC+ • J1.DC- to J1.DC- • J1.CS to J1.CS • J1.CP to J1.CP 	 xx2000002010
4	Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000002011

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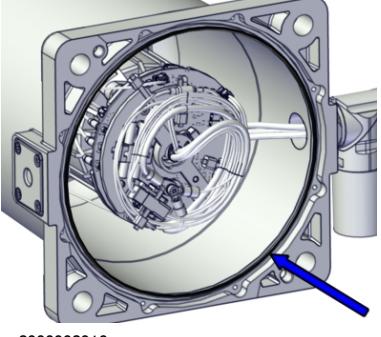
5 Repair

5.3.2 Replacing the axis-1 cabling

Continued

	Action	Note
5	Secure the cabling with cable ties.	Cable ties (4 pcs)  xx2000002012

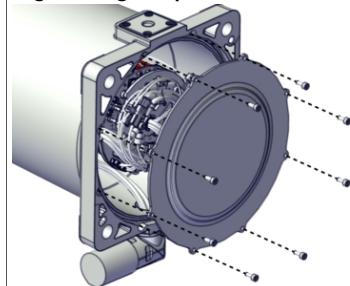
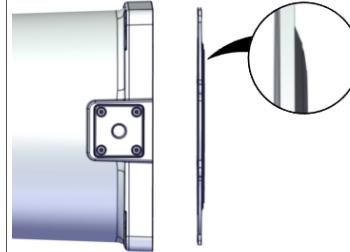
Refitting the base cover

	Action	Note
1	Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring, nitrile rubber: 3HAB3772-64 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000002016

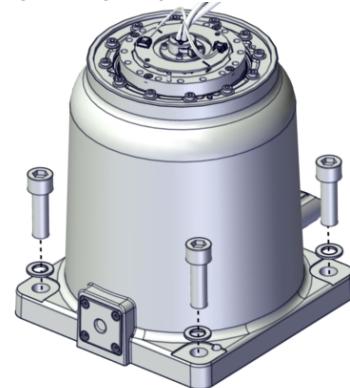
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5.3.2 Replacing the axis-1 cabling

Continued

Action	Note
<p>2 Refit the bottom cover with the attachment screws.</p> <p>Note</p> <p>Fit the cover in correct direction, the protrusion of the cover must face outwards.</p>	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (8 pcs) Tightening torque: 1.2 Nm.</p>  <p>xx2000002007</p>  <p>xx2100000268</p>

Securing the base

Action	Note
<p>1 Lift the base to standing and secure it to the foundation with the attachment screws and washers.</p>	<p>Attachment screws: M10x35 8.8 (4 pcs). Washers: 23/10.5/2.5 mm Steel (4 pcs). Tightening torque: 30 Nm ±10%.</p>  <p>xx2000002006</p>

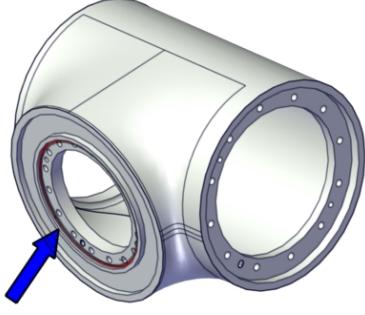
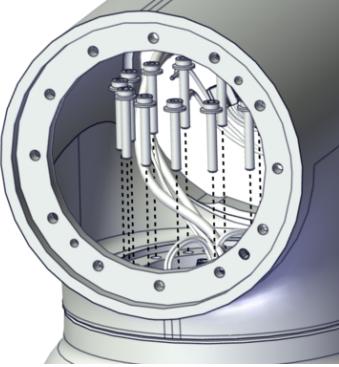
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5 Repair

5.3.2 Replacing the axis-1 cabling

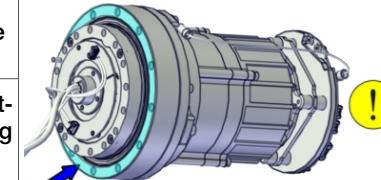
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Refitting the swing

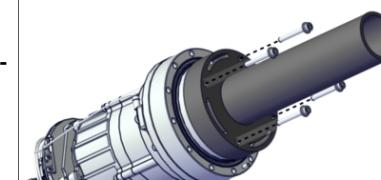
	Action	Note
1	<p>Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the base mounting surface, as pointed out in the figure.</p>	<p>Cleaning agent: Isopropanol Flange sealant: Loctite 574</p>  <p>xx2000001990</p>
2	<p>Refit the swing to the base unit, aligning the pin with the pin hole.</p> <p>CAUTION</p> <p>The torque sensor (on the exposed PCBA) is sensitive to mechanical damage. Handle the assembly with care.</p>	 <p>xx2000001989</p>
3	<p>Secure the swing with the attachment screws. Pre-tighten the screws crosswise firstly.</p>	<p>Hex socket head cap flange screw: M4x25 (16 pcs)</p>  <p>xx2000001987</p>
4	Torque tighten all screws crosswise.	Tightening torque: 4.6 Nm.

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Preparations before fitting the joint unit

	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section <i>The unit is sensitive to ESD on page 42.</i>	
2	Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol. Joint unit mounting surface is pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001860
3	 CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section <i>The unit is sensitive to ESD on page 42.</i>	

Refitting the axis-2 joint unit

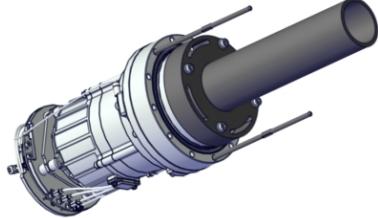
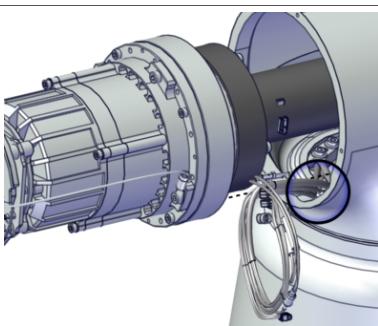
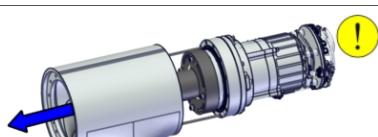
	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section <i>The unit is sensitive to ESD on page 42.</i>	
2	Fit the lifting aid to the joint unit.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Joint unit: 3HAC079141-001 Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)  xx2000001957

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5 Repair

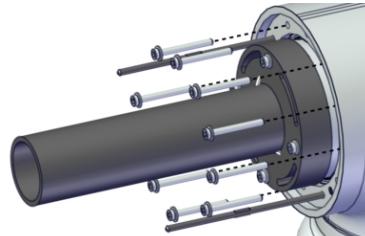
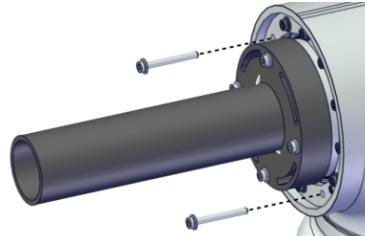
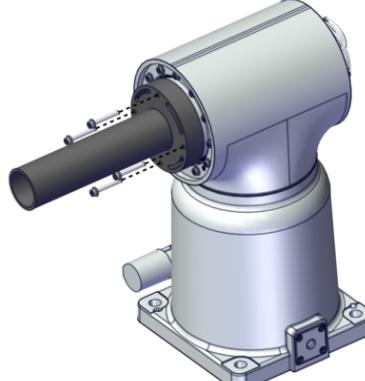
5.3.2 Replacing the axis-1 cabling

Continued

	Action	Note
3	Fit two guide pins to the joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.</p>  <p>xx2000002438</p>
4	<p>Place the axis-1 cabling at the notch in the swing.</p> <p> CAUTION The cabling is sensitive to mechanical damage. Handle it with care to avoid damage to the cabling or the connector.</p>	 <p>xx2000002153</p>
5	<p>Fit the joint unit to the swing, aligning the pin with the pin hole.</p> <p> CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	 <p>xx2000001959</p>  <p>xx2000001961</p>

Continues on next page

5.3.2 Replacing the axis-1 cabling
Continued

Action	Note
6 Secure the joint unit with new attachment screws.	<p>Hex socket head cap flange screw with glue: 3HAB3413-435 M4x35, 12 pcs</p> <p>Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.</p>  <p>xx2000001943</p>
7 Remove the guide pins and secure the remaining two attachment screws.	 <p>xx2100000295</p>
8 Pre-tighten the screws crosswise.	
9 Torque tighten all screws crosswise.	Tightening torque: 4.3 Nm.
10 Remove the lifting aid by removing the screws.	 <p>xx2000001956</p>
11 Clean pushed-out flange sealant, if any.	

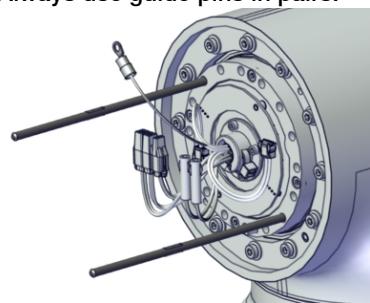
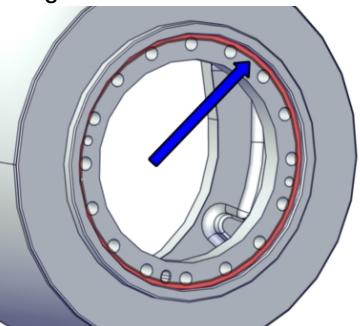
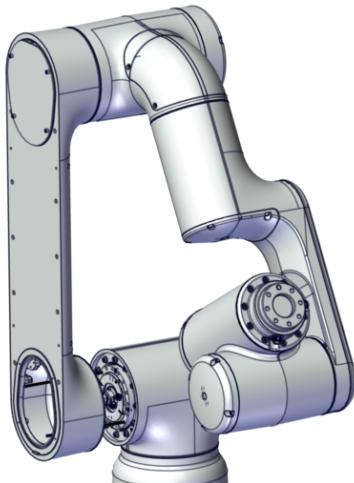
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5 Repair

5.3.2 Replacing the axis-1 cabling

Continued

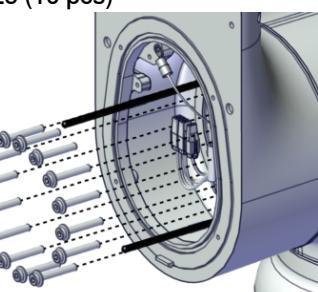
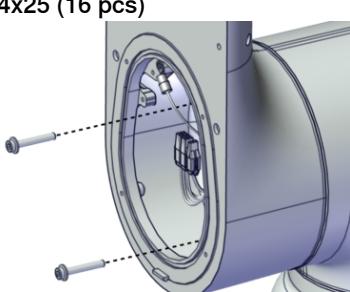
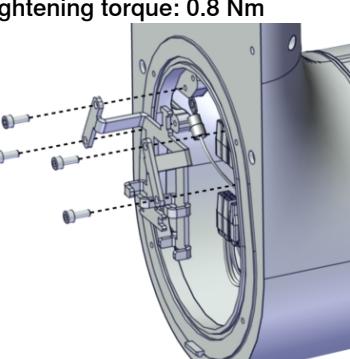
Refitting the lower and upper arm assembled

	Action	Note
1	Fit two guide pins to the axis-2 joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs.</p>  <p>xx2000001949</p>
2	<p>Remove any old residuals of flange sealant from the lower arm mounting surface and clean with isopropanol.</p> <p>Apply new flange sealant to the corner of the lower arm mounting surface, as pointed out in the figure.</p>	<p>Cleaning agent: Isopropanol Flange sealant: Loctite 574</p>  <p>xx2000001963</p>
3	<p> CAUTION</p> <p>The weight of the complete upper and lower arm together is 18 kg</p>	
4	Lift the upper and lower arm assembly to mounting position and slide it onto the guide pins.	 <p>xx2000001941</p>

Continues on next page

5.3.2 Replacing the axis-1 cabling

Continued

Action	Note
5 Secure the lower arm to the swing with all attachment screws but two. Pre-tighten the screws crosswise firstly.	Hex socket head cap flange screw: M4x25 (16 pcs)  xx2000001940
6 Remove the guide pins and fasten the remaining two screws.	Hex socket head cap flange screw: M4x25 (16 pcs)  xx2000001951
7 Torque tighten all screws crosswise.	Tightening torque: 4.6 Nm.
8 Refit the cable bracket with four screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.8 Nm  xx2000001939

Connecting the axis-2 joint unit cabling

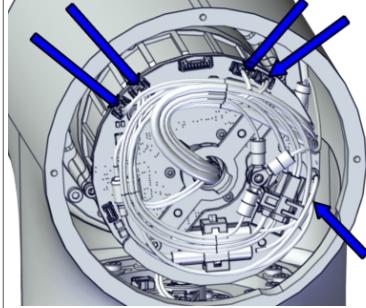
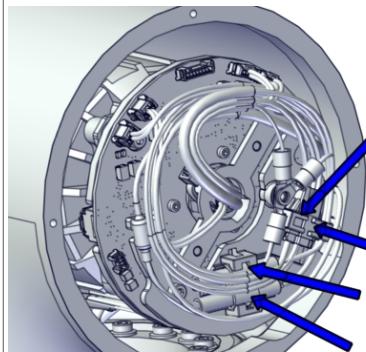
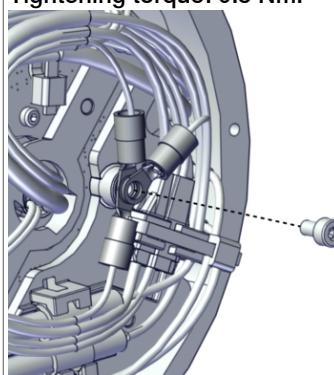
Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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5 Repair

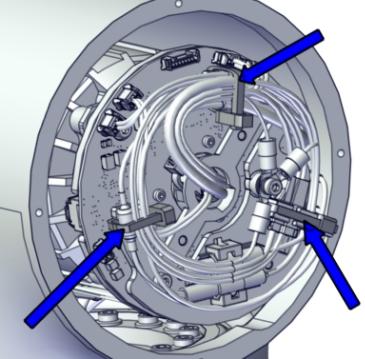
5.3.2 Replacing the axis-1 cabling

Continued

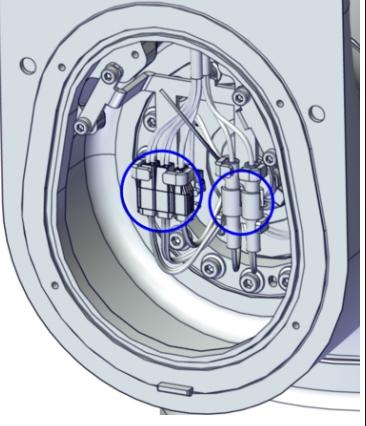
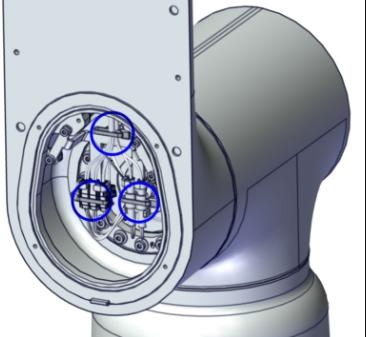
	Action	Note
2	<p>Reconnect the connectors to the drive board.</p> <ul style="list-style-type: none"> • D2.X1 to X1 • D2.DC+ to DC+ • D2.DC- to Ground • D2.X4 to X4 • D2.X2 to X2 • D2.X5 to X5 	 xx2000002013
3	<p>Connect the connectors to each other and snap them to the cable holders.</p> <ul style="list-style-type: none"> • J2.DC+ to J2.DC+ • J2.DC- to J2.DC- • J2.CS to J2.CS • J2.CP to J2.CP 	 xx2000001944
4	<p>Secure the cables for functional earth and protective earth with a screw.</p>	<p>Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.</p>  xx2000001945

Continues on next page

5.3.2 Replacing the axis-1 cabling
Continued

Action	Note
5 Secure the cabling with cable ties.	<p>Cable ties (3 pcs)</p>  <p>xx2000001946</p>

Connecting the cabling between the lower arm and swing

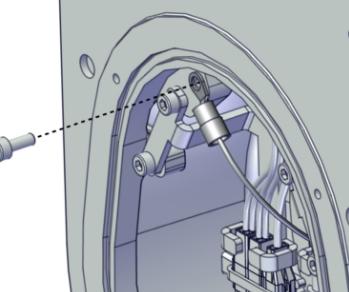
Action	Note
1 Connect the connectors to each other and snap them to the cable holders.	 <p>xx2000001938</p>
2 Secure the cabling with cable ties.	<p>Cable ties (3 pcs)</p>  <p>xx2000001937</p>

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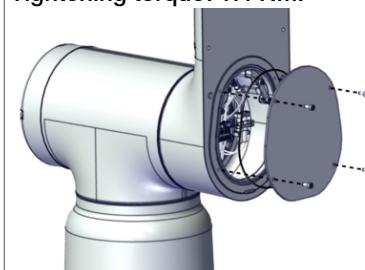
5 Repair

5.3.2 Replacing the axis-1 cabling

Continued

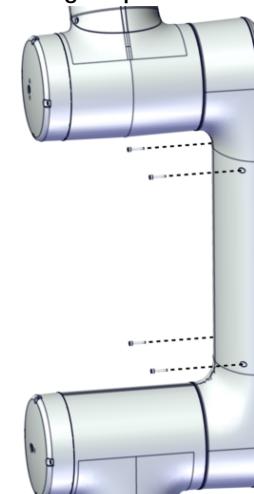
Action	Note
3 Connect the functional earth cable with the screw.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (1 pcs). Tightening torque: 0.8 Nm</p>  <p>xx2000001936</p>

Refitting the lower arm covers

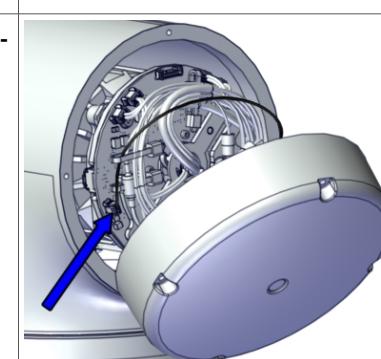
Action	Note
1 Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	<p>O-ring: 3HAC061327-044 Grease: 3HAC042536-001 (Shell Gadus S2)</p>  <p>xx2000001954</p>
2 Refit the inner cover with four screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 1.4 Nm.</p>  <p>xx2000001930</p>

Continues on next page

5.3.2 Replacing the axis-1 cabling
Continued

	Action	Note
3	Snap the lower arm cover into place.	
4	Secure the cover with four screws.	<p>Hex socket head cap screw: M3x16 12.9 Gleitmo 603+Geomet 500 (Black Oxide) (4 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000001929</p>

Refitting the swing cover

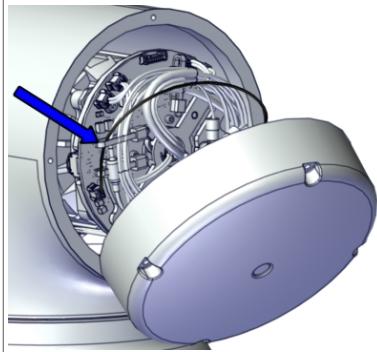
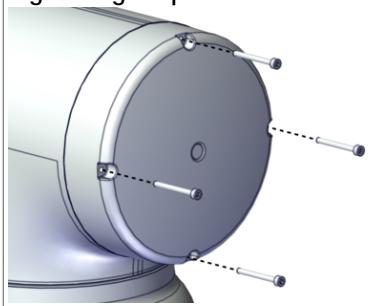
	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	<p>O-ring: 3HAC061327-047</p>  <p>xx2000001962</p>
2	Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board. Orient the cover for proper arrangement of the brake release cable.	 <p>xx2000001932</p>

Continues on next page

5 Repair

5.3.2 Replacing the axis-1 cabling

Continued

	Action	Note
3	Secure the brake release cable with a cable tie.	<p>Cable ties</p>  <p>xx2000001931</p>
4	Refit the cover with the four screws.	<p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs)</p> <p>Tightening torque: 0.45 Nm</p>  <p>xx2000001935</p>

Concluding procedure

	Action	Note
1	Calibrate the joint unit torque sensor.	See Calibration on page 607
2	 DANGER Make sure all safety requirements are met when performing the first test run.	

5.3.3 Replacing the axis-2 cabling

Location of the cable harness

The cable harness is located as shown in the figure.



xx2100000058

Summary of the replacement procedure

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

- 1 Remove the swing cover.
- 2 Remove the lower arm cover and inner lower arm cover.
- 3 Disconnect the joint-2 cabling.
- 4 Replace the cabling.

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Spare part	Article number	Note
Cable harness, joint 2	3HAC073205-001	Also order new Cable tie: 3HAC075545-001.

Continues on next page

5 Repair

5.3.3 Replacing the axis-2 cabling

Continued

Spare part	Article number	Note
Cable tie	3HAC075545-001	For securing joint unit cable.

Required tools and equipment

Equipment	Article number	Note
Protection plate	3HAC077790-001	For protection of drive board during cabling installation on joint unit.
Cable tie gun EVO7	-	HellermannTyton 110-70084 or similar
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cable ties	-	
O-ring	3HAC061327-044	Lower arm, inner cover. 1 pcs / cover. Replace if damaged.
Grease	3HAC042536-001	Shell Gadus S2
O-ring	3HAC061327-047	Cover for axis 2/3 Replace if damaged.

Removing the joint cabling

Use these procedures to remove the joint-2 cabling.

Preparations before removing the cabling

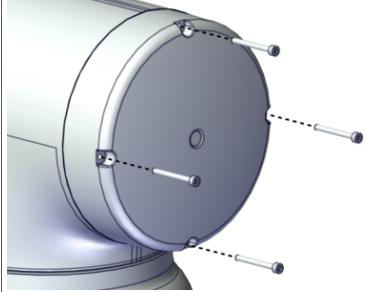
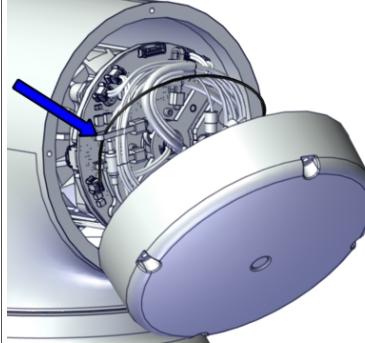
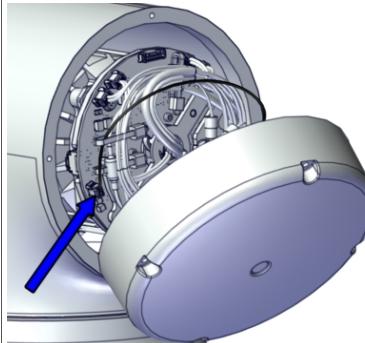
	Action	Note
1	Jog the robot to the home position: <ul style="list-style-type: none">• Axis 1: 0°• Axis 2: 0°• Axis 3: -80°• Axis 4: 0°• Axis 5: 0°• Axis 6: 0°	
2	 CAUTION Turn off all supplies for electrical power to the robot, before starting the repair work.	

Removing the swing cover

	Action	Note
1	 CAUTION Make sure that all supplies for electrical power are turned off.	

Continues on next page

5.3.3 Replacing the axis-2 cabling
Continued

Action	Note
2 Remove the cover screws.	 xx2000001935
3  CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	
4 Open the cover and cut the cable tie that holds the brake release cable.	 xx2000001931
5 Disconnect the brake release connector from the drive board. Remove the cover.	 xx2000001932

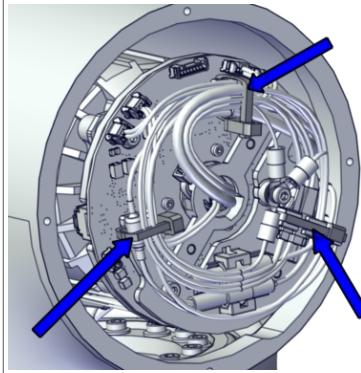
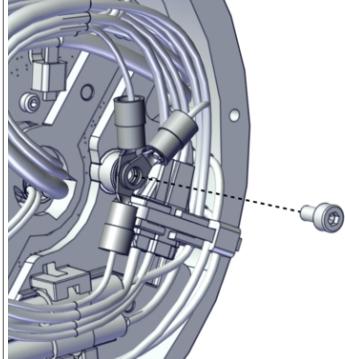
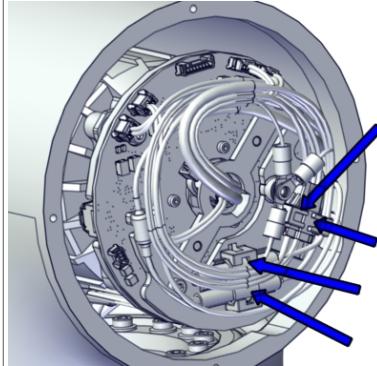
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5 Repair

5.3.3 Replacing the axis-2 cabling

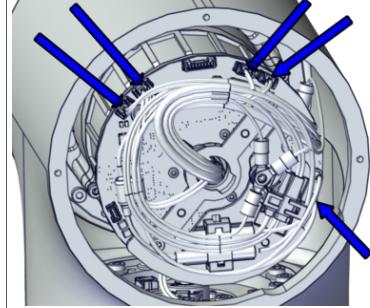
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Disconnecting the axis-2 joint unit cabling

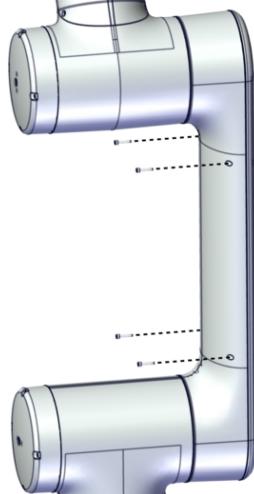
	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2	Cut the cable ties.	 xx2000001946
3	Remove the functional and protective earth cables by removing the screw.	 xx2000001945
4	Snap loose and disconnect the connectors: <ul style="list-style-type: none">• J2.DC+• J2.DC-• J2.CS• J2.CP	 xx2000001944

Continues on next page

5.3.3 Replacing the axis-2 cabling
Continued

Action	Note
5 Disconnect the connectors from the drive board. <ul style="list-style-type: none"> • D2.X1 from X1 • D2.DC+ from DC+ • D2.DC- from ground • D2.X4 from X4 • D2.X2 from X2 • D2.X5 from X5 	 xx2000002013

Removing the lower arm covers

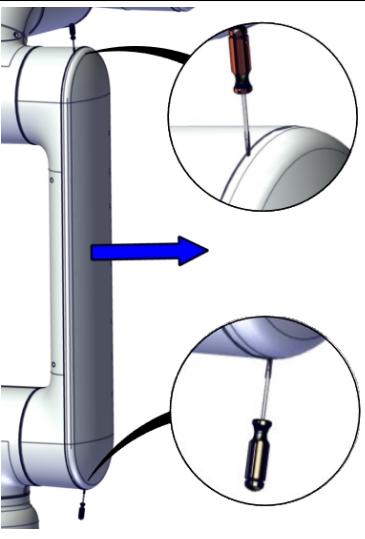
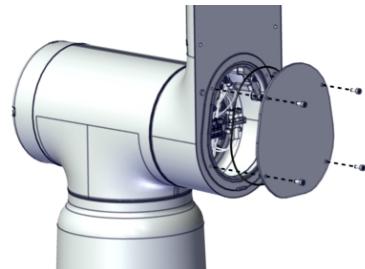
Action	Note
1  CAUTION Make sure that all supplies for electrical power are turned off.	
2 Remove the four lower arm cover screws.	 xx2000001929

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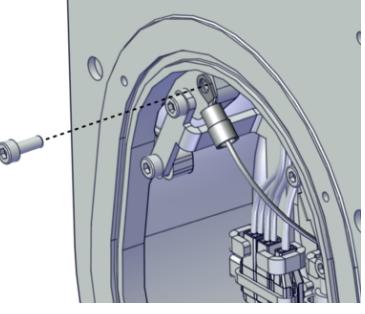
5 Repair

5.3.3 Replacing the axis-2 cabling

Continued

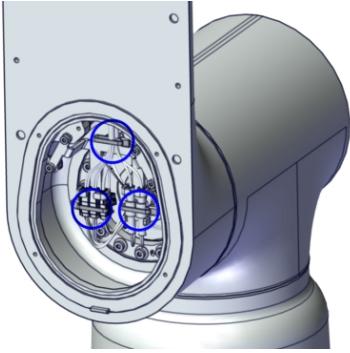
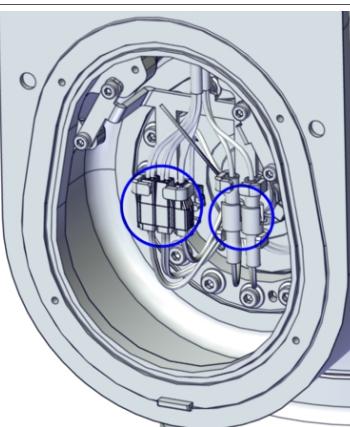
Action	Note
3 Remove the cover by inserting a small flat screwdriver to snap open the locks at each end of the cover.	 xx2100000267
4 Remove the inner cover by removing the four screws.	 xx2000001930

Disconnecting the cabling between the lower arm and the swing

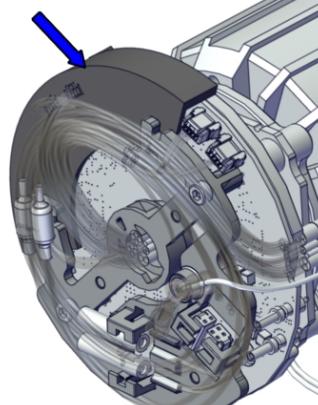
Action	Note
1 Remove the functional earth cable by removing the screw.	 xx2000001936

Continues on next page

5.3.3 Replacing the axis-2 cabling
Continued

Action	Note
2 Cut the cable ties.	 xx2000001937
3 Snap loose and disconnect all connectors.	 xx2000001938

Removing the joint cable

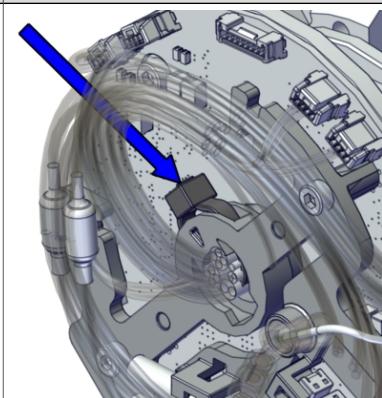
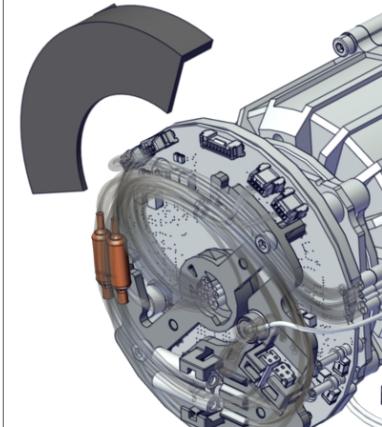
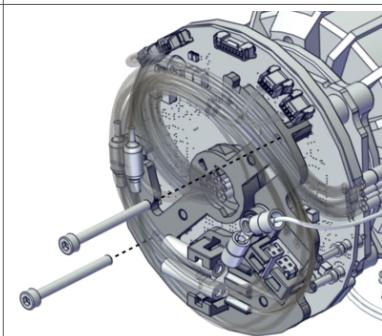
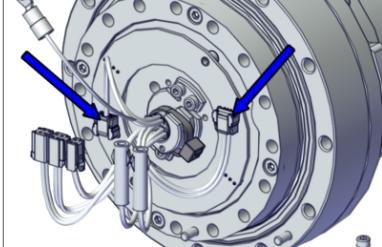
Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2 Fit the protection plate to the drive board unit.  Tip Using the protection plate is important for protecting the drive board unit. If complete joint unit is to be replaced, the protection plate is not needed.	Protection plate: 3HAC077790-001  xx2000002057

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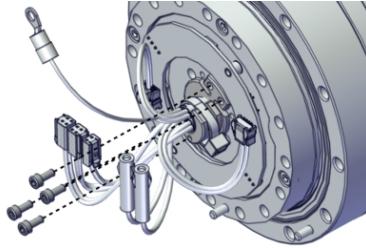
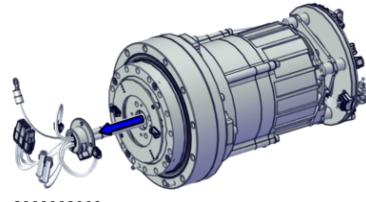
5 Repair

5.3.3 Replacing the axis-2 cabling

Continued

Action	Note
3 Cut the cable tie at the drive board.	 xx2000002058
4 Remove the protection plate.	 xx2100000301
5 Remove the cable support from the drive board by removing the attachment screws.	 xx2000002055
6 Disconnect the two connectors from the torque sensor board. • TQ.A • TQ.B	 xx2000002053

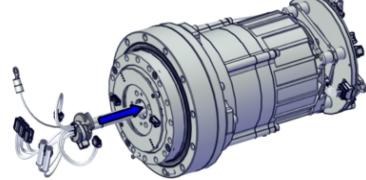
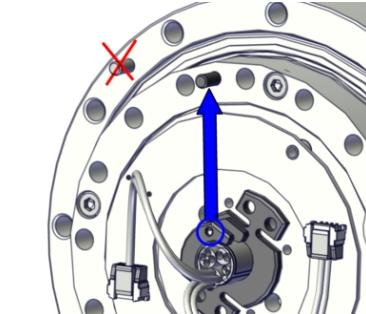
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	Action	Note
7	Remove the cable plate by removing the attachment screws.	 xx2000002049
8	Remove the joint cable from the hollow shaft from the torque sensor side.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002060

Refitting the joint cabling

Use these procedures to refit the joint-2 cabling.

Refitting the joint cable

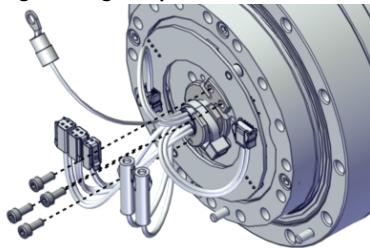
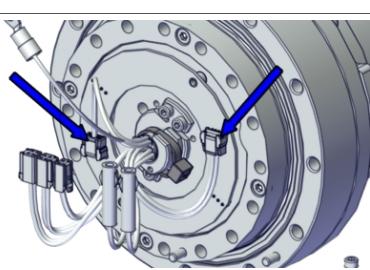
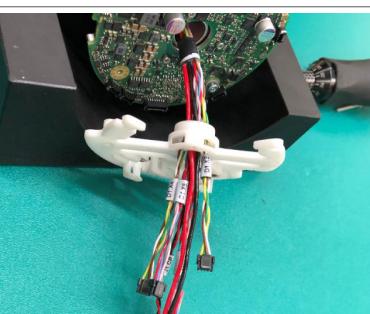
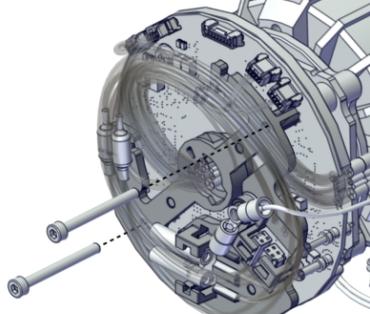
	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2	Place the joint cable through the hollow shaft from the torque sensor side.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002048
3	Orient the cable plate according to the figure. The circle on the cable plate should point towards the guide pin on the torque sensor.	 xx2000002051

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5 Repair

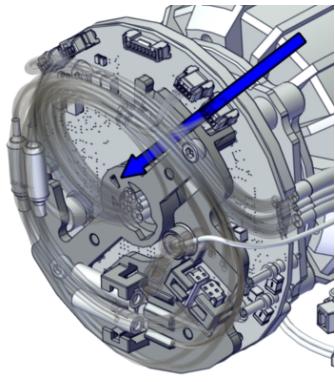
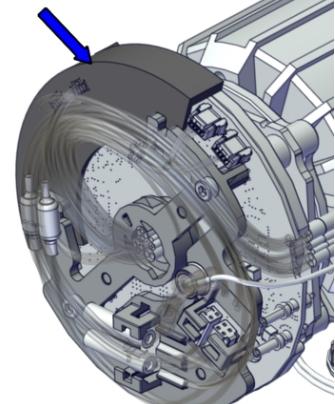
5.3.3 Replacing the axis-2 cabling

Continued

	Action	Note
4	Secure the cable plate to the joint unit with the attachment screws.	<p>Hex socket head cap screw: M2.5x6 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000002049</p>
5	<p>Connect the two connectors to the torque sensor board.</p> <ul style="list-style-type: none"> • TQ.A to CH1/A • TQ.B to CH2/B 	 <p>xx2000002053</p>
6	Insert the cabling through the cable support and fit the support to the drive board with the attachment screws.	 <p>xx2000002056</p> <p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (2 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000002055</p>

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5.3.3 Replacing the axis-2 cabling
Continued

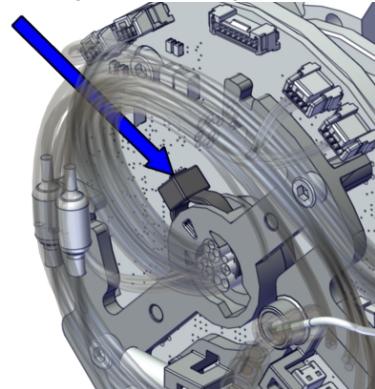
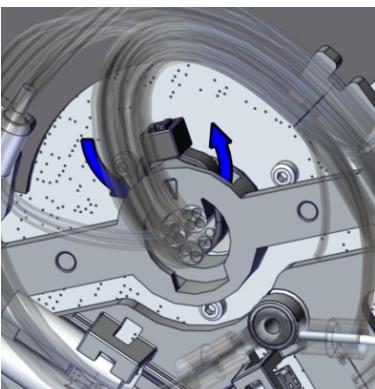
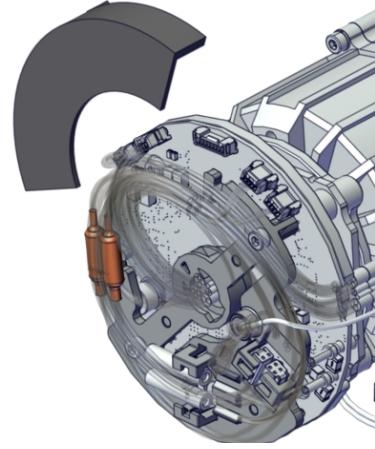
	Action	Note
7	Align the triangle direction mark on the cable support and the white mark on the cable harness. Use the cable tie to pre-fix the cable by hand.	 xx2100000507
		 xx2100000508
8	Fit the protection plate to the drive board unit.	Protection plate: 3HAC077790-001  xx2000002057

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5 Repair

5.3.3 Replacing the axis-2 cabling

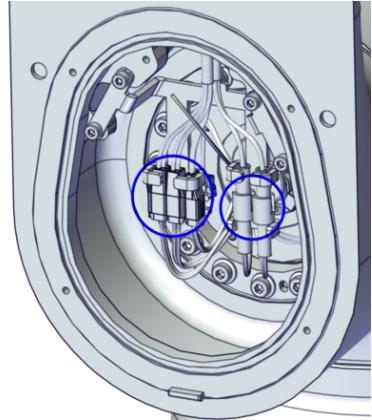
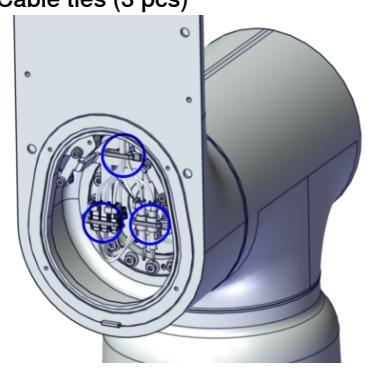
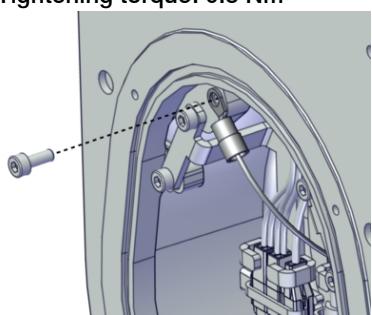
Continued

	Action	Note
9	Secure the cables to the cable support with a cable tie, using a cable tie gun. Assembly direction for the cable tie is shown in the figure.	<p>Cable tie: 3HAC075545-001. For securing joint unit cable. Cable tie gun EVO7 Setting for cable tie gun: 6.75.</p>  <p>xx2000002058</p>  <p>xx2000002059</p>
10	Remove the protection plate.	 <p>xx2100000301</p>

Continues on next page

5.3.3 Replacing the axis-2 cabling
Continued

Connecting the cabling between the lower arm and swing

	Action	Note
1	Connect the connectors to each other and snap them to the cable holders.	 xx2000001938
2	Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000001937
3	Connect the functional earth cable with the screw.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (1 pcs). Tightening torque: 0.8 Nm  xx2000001936

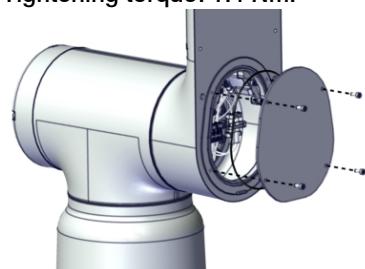
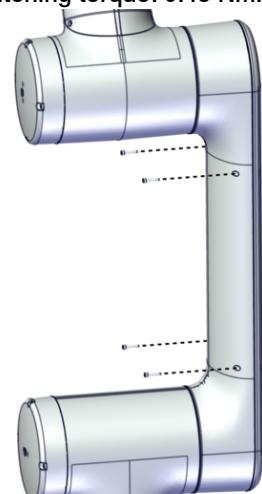
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5 Repair

5.3.3 Replacing the axis-2 cabling

Continued

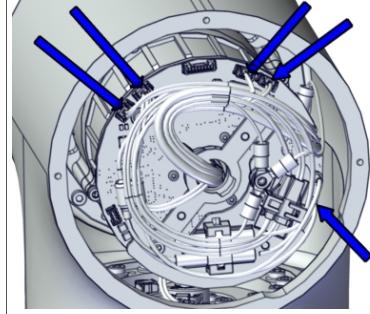
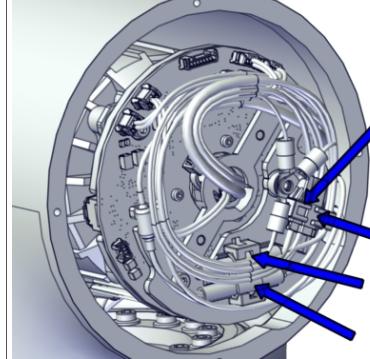
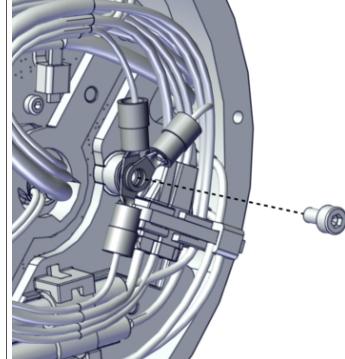
Refitting the lower arm covers

	Action	Note
1	Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-044 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000001954
2	Refit the inner cover with four screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 1.4 Nm.  xx2000001930
3	Snap the lower arm cover into place.	Hex socket head cap screw: M3x16 12.9 Gleitmo 603+Geomet 500 (Black Oxide) (4 pcs)
4	Secure the cover with four screws.	Tightening torque: 0.45 Nm.  xx2000001929

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5.3.3 Replacing the axis-2 cabling
Continued

Connecting the axis-2 joint unit cabling

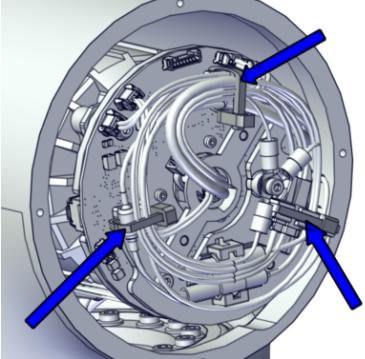
	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2	Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D2.X1 to X1 • D2.DC+ to DC+ • D2.DC- to Ground • D2.X4 to X4 • D2.X2 to X2 • D2.X5 to X5 	 xx2000002013
3	Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J2.DC+ to J2.DC+ • J2.DC- to J2.DC- • J2.CS to J2.CS • J2.CP to J2.CP 	 xx2000001944
4	Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000001945

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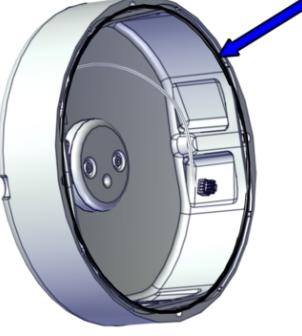
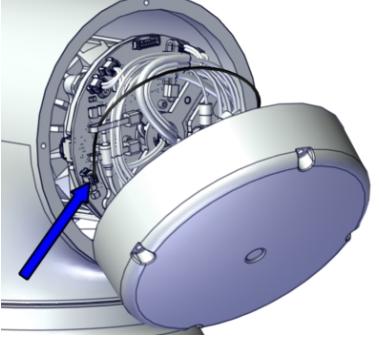
5 Repair

5.3.3 Replacing the axis-2 cabling

Continued

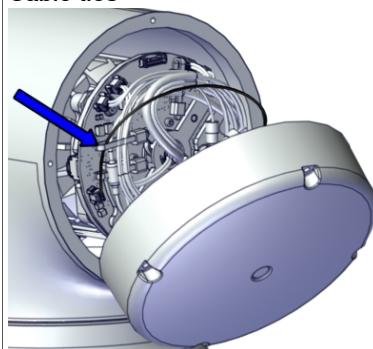
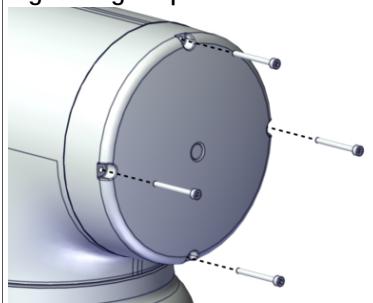
	Action	Note
5	Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000001946

Refitting the swing cover

	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-047  xx2000001962
2	Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board. Orient the cover for proper arrangement of the brake release cable.	 xx2000001932

Continues on next page

5.3.3 Replacing the axis-2 cabling
Continued

Action	Note
3 Secure the brake release cable with a cable tie.	Cable ties  xx2000001931
4 Refit the cover with the four screws.	Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm  xx2000001935

Concluding procedure

Action	Note
1  DANGER Make sure all safety requirements are met when performing the first test run.	

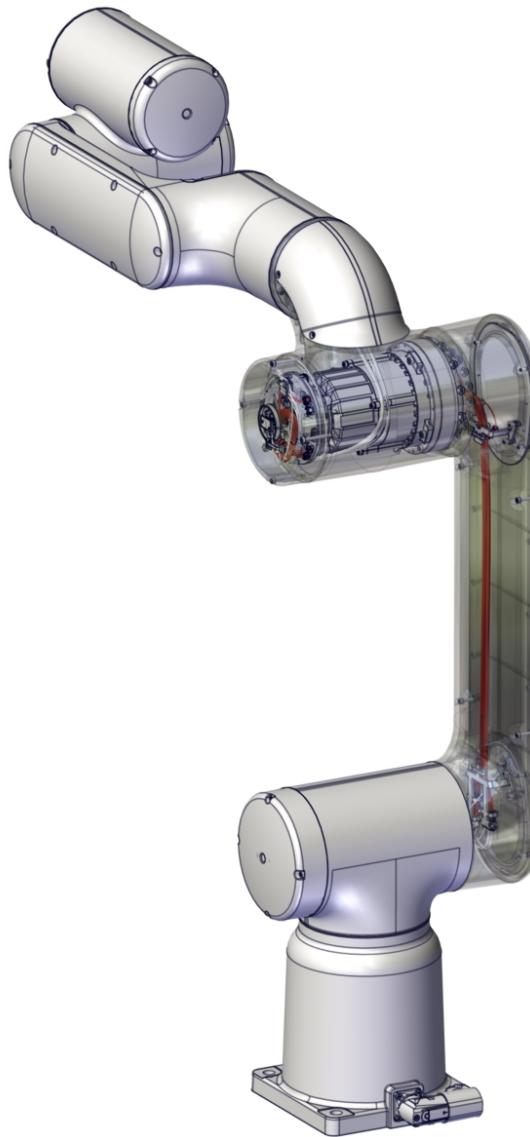
5 Repair

5.3.4 Replacing the axis-3 cabling

5.3.4 Replacing the axis-3 cabling

Location of the cable harness

The cable harness is located as shown in the figure.



xx2100000059

Summary of the replacement procedure

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

- 1 Remove the lower arm covers.
- 2 Remove the housing cover.
- 3 Disconnect the joint-3 cabling.
- 4 Replace the cabling.

Continues on next page

Required spare parts**Note**

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Spare part	Article number	Note
Cable harness, joint 3	3HAC073207-001	Also order new Cable tie: 3HAC075545-001.
Cable tie	3HAC075545-001	For securing joint unit cable.

Required tools and equipment

Equipment	Article number	Note
Protection plate	3HAC077790-001	For protection of drive board during cabling installation on joint unit.
Cable tie gun EVO7	-	HellermannTyton 110-70084 or similar
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cable ties	-	
O-ring	3HAC061327-047	Cover for axis 2/3 Replace if damaged.
O-ring	3HAC061327-044	Lower arm, inner cover. 1 pcs / cover. Replace if damaged.
Grease	3HAC042536-001	Shell Gadus S2

Removing the joint cabling

Use these procedures to remove the joint-3 cabling.

Preparations before removing the cabling

	Action	Note
1	Jog the robot to the home position: <ul style="list-style-type: none"> • Axis 1: 0° • Axis 2: 0° • Axis 3: -80° • Axis 4: 0° • Axis 5: 0° • Axis 6: 0° 	

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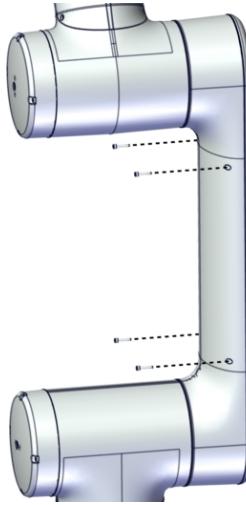
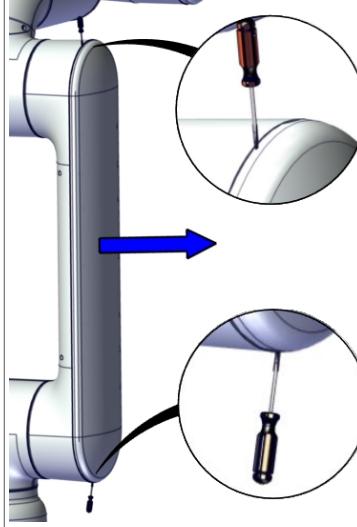
5 Repair

5.3.4 Replacing the axis-3 cabling

Continued

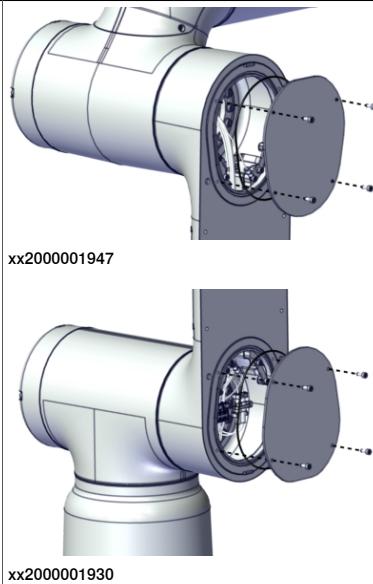
	Action	Note
2	 CAUTION Turn off all supplies for electrical power to the robot, before starting the repair work.	

Removing the lower arm covers

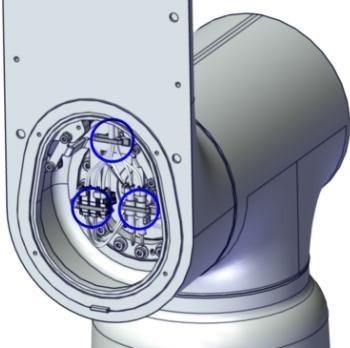
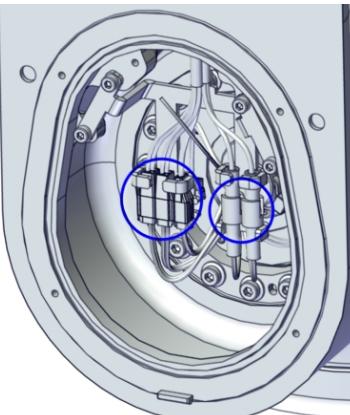
	Action	Note
1	 CAUTION Make sure that all supplies for electrical power are turned off.	
2	Remove the four lower arm cover screws.	 xx2000001929
3	Remove the cover by inserting a small flat screwdriver to snap open the locks at each end of the cover.	 xx2100000267

Continues on next page

5.3.4 Replacing the axis-3 cabling
Continued

Action	Note
4 Remove the inner covers by removing the screws.	

Disconnecting the upper arm cabling

Action	Note
1 Cut the cable ties.	
2 Snap loose and disconnect all connectors.	

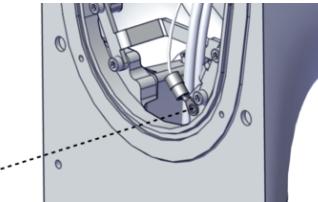
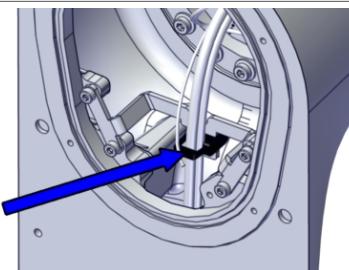
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5 Repair

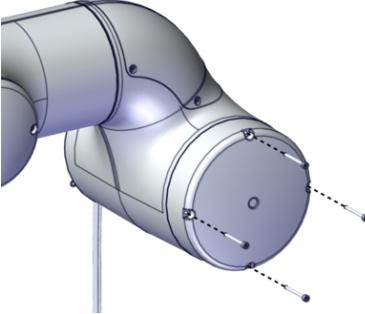
5.3.4 Replacing the axis-3 cabling

Continued

Loosening the cabling between the lower and upper arm

	Action	Note
1	Remove the functional earth cable by removing the screw.	 xx2000001964
2	Cut the cable tie.	 xx2000001965

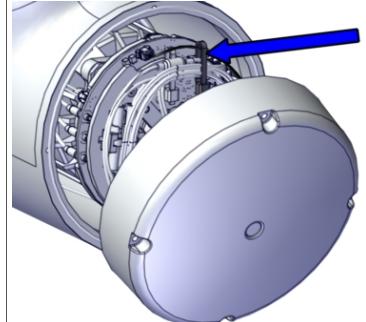
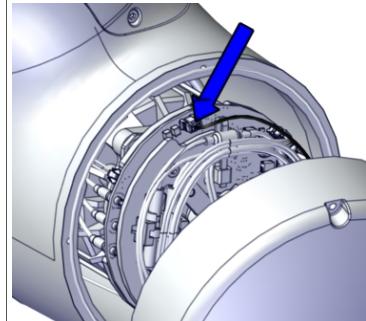
Removing the housing cover

	Action	Note
1	 CAUTION Make sure that all supplies for electrical power are turned off.	
2	Remove the cover screws.	 xx2000002021
3	 CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	

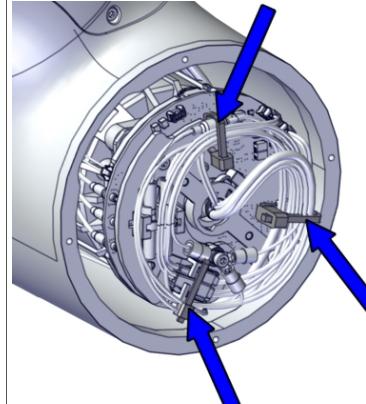
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5.3.4 Replacing the axis-3 cabling

Continued

Action	Note
4 Open the cover and cut the cable tie that holds the brake release cable.	 xx2000002022
5 Disconnect the brake release connector from the drive board. Remove the cover.	 xx2000002023

Disconnecting the axis-3 joint unit cabling

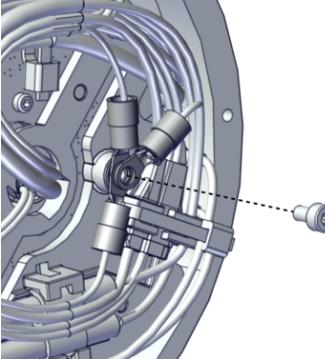
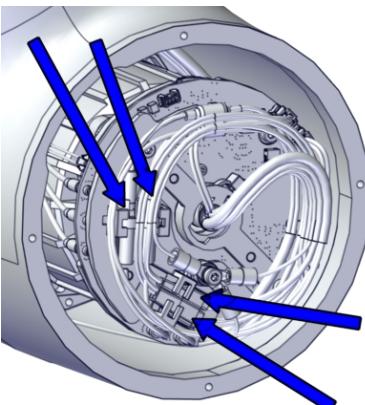
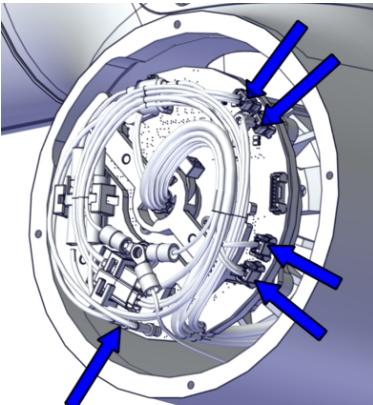
Action	Note
1 Cut the cable ties.	 xx2000002066

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5 Repair

5.3.4 Replacing the axis-3 cabling

Continued

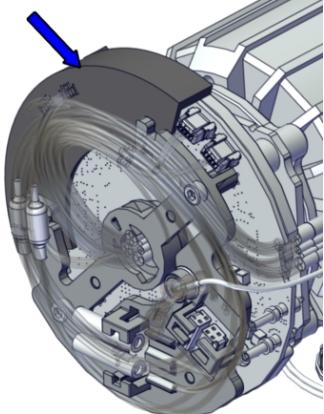
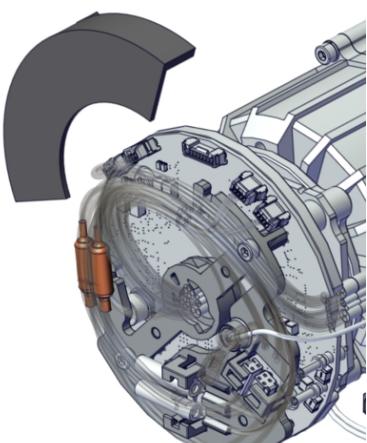
Action	Note
2 Remove the functional and protective earth cables by removing the screw.	 xx2000001945
3 Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J4.DC+ • J4.DC- • J4.CS • J4.CP 	 xx2000002067
4 Disconnect the connectors from the drive board. <ul style="list-style-type: none"> • D3.X1 • D3/4.DC+ • D3/4.DC- • D3.X4 • D3/4.X2 • D3.X5 	 xx2000002068

Removing the joint cable

Action	Note
 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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5.3.4 Replacing the axis-3 cabling
Continued

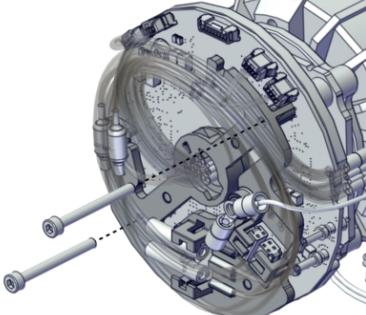
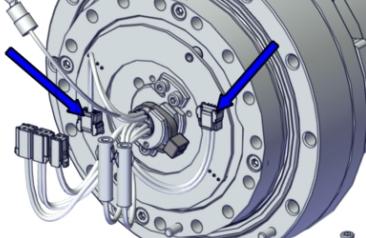
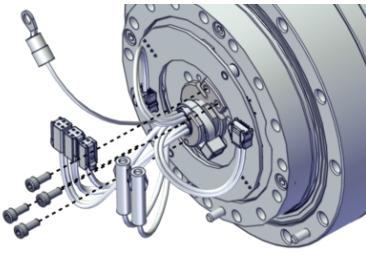
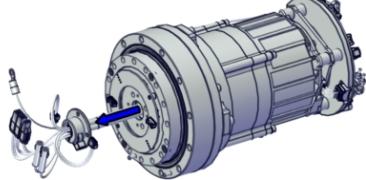
	Action	Note
2	<p>Fit the protection plate to the drive board unit.</p> <p> Tip</p> <p>Using the protection plate is important for protecting the drive board unit. If complete joint unit is to be replaced, the protection plate is not needed.</p>	<p>Protection plate: 3HAC077790-001</p>  <p>xx2000002057</p>
3	Cut the cable tie at the drive board.	 <p>xx2000002058</p>
4	Remove the protection plate.	 <p>xx2100000301</p>

Continues on next page

5 Repair

5.3.4 Replacing the axis-3 cabling

Continued

Action	Note
5 Remove the cable support from the drive board by removing the attachment screws.	 xx2000002055
6 Disconnect the two connectors from the torque sensor board. <ul style="list-style-type: none"> • TQ.A • TQ.B 	 xx2000002053
7 Remove the cable plate by removing the attachment screws.	 xx2000002049
8 Remove the joint cable from the hollow shaft from the torque sensor side. CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002060

Refitting the joint cabling

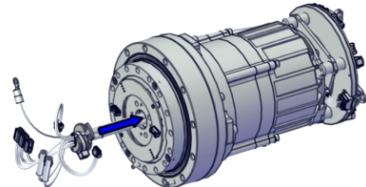
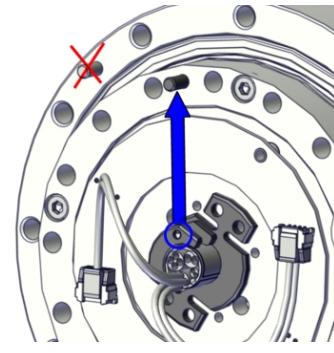
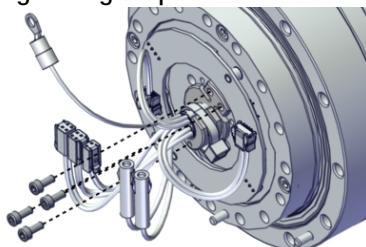
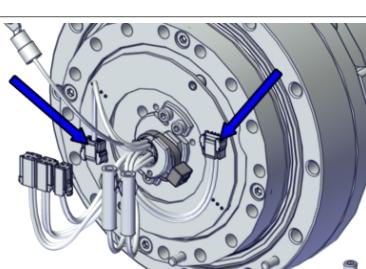
Use these procedures to refit the joint-3 cabling.

Refitting the joint cable

Action	Note
 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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5.3.4 Replacing the axis-3 cabling
Continued

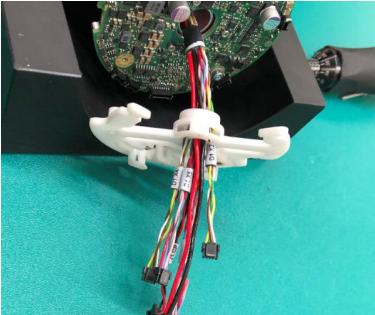
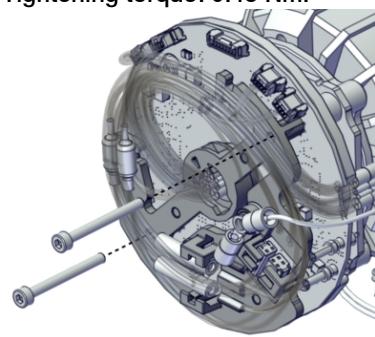
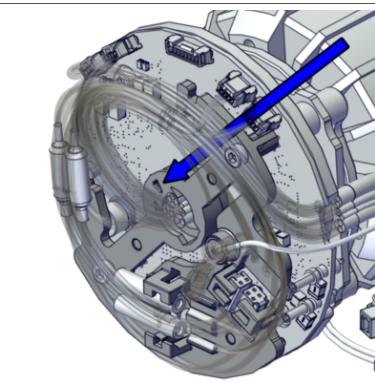
	Action	Note
2	<p>Place the joint cable through the hollow shaft from the torque sensor side.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	 xx2000002048
3	<p>Orient the cable plate according to the figure. The circle on the cable plate should point towards the guide pin on the torque sensor.</p>	 xx2000002051
4	<p>Secure the cable plate to the joint unit with the attachment screws.</p>	<p>Hex socket head cap screw: M2.5x6 12.9 Gleitmo 603+Geomet 500 (4 pcs)</p> <p>Tightening torque: 0.45 Nm.</p>  xx2000002049
5	<p>Connect the two connectors to the torque sensor board.</p> <ul style="list-style-type: none"> • TQ.A to CH1/A • TQ.B to CH2/B 	 xx2000002053

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5 Repair

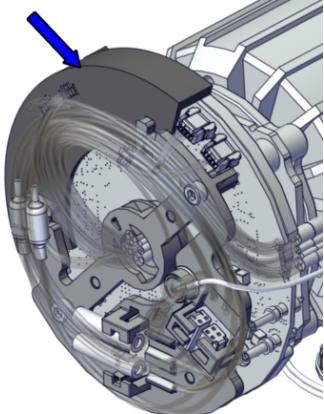
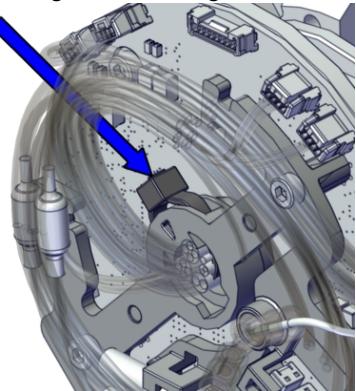
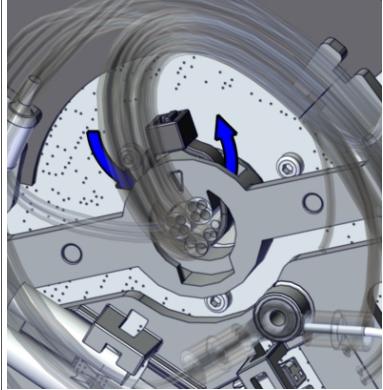
5.3.4 Replacing the axis-3 cabling

Continued

Action	Note
<p>6 Insert the cabling through the cable support and fit the support to the drive board with the attachment screws.</p>	 <p>xx2000002056</p> <p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (2 pcs)</p> <p>Tightening torque: 0.45 Nm.</p>  <p>xx2000002055</p>
<p>7 Align the triangle direction mark on the cable support and the white mark on the cable harness. Use the cable tie to pre-fix the cable by hand.</p>	 <p>xx2100000507</p>  <p>xx2100000508</p>

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5.3.4 Replacing the axis-3 cabling
Continued

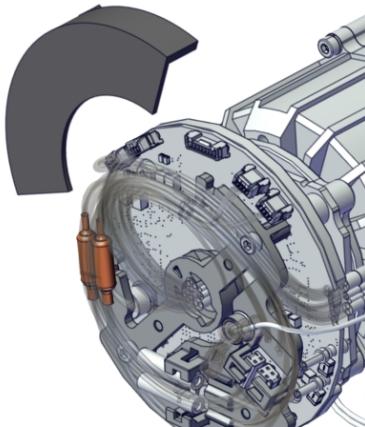
	Action	Note
8	Fit the protection plate to the drive board unit.	<p>Protection plate: 3HAC077790-001</p>  <p>xx2000002057</p>
9	<p>Secure the cables to the cable support with a cable tie, using a cable tie gun. Assembly direction for the cable tie is shown in the figure.</p>	<p>Cable tie: 3HAC075545-001. For securing joint unit cable. Cable tie gun EVO7 Setting for cable tie gun: 6.75.</p>  <p>xx2000002058</p>  <p>xx2000002059</p>

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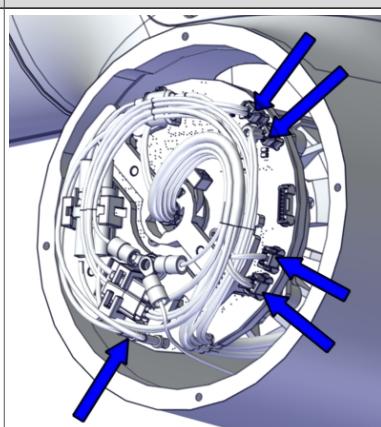
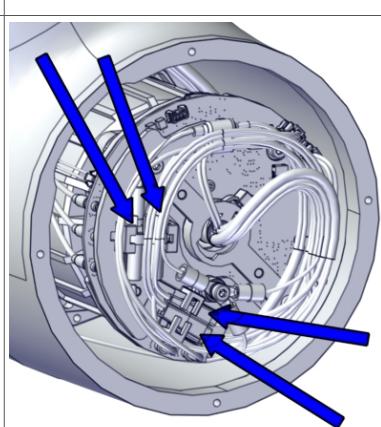
5 Repair

5.3.4 Replacing the axis-3 cabling

Continued

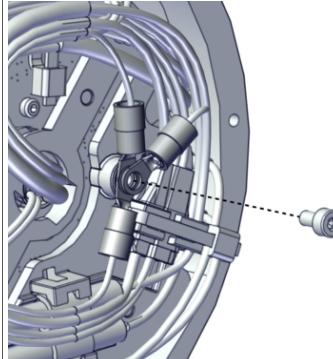
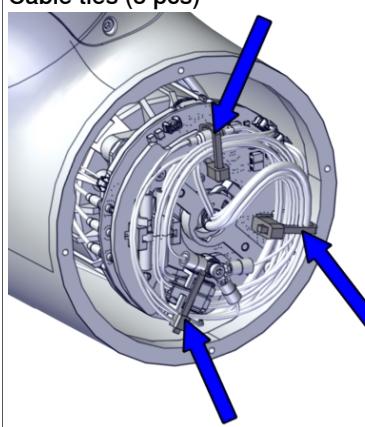
Action	Note
10 Remove the protection plate.	 xx2100000301

Connecting the axis-3 joint unit cabling

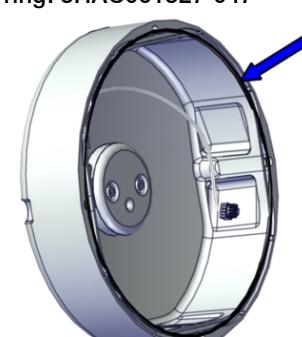
Action	Note
1 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D3.X1 to X1 • D3/4.DC+ to DC+ • D3/4.DC- to Ground • D3.X4 to X4 • D3/4.X2 to X2 • D3.X5 to X5 	 xx2000002068
2 Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J4.DC+ to J4/5.DC+ • J4.DC- to J4/5.DC- • J4.CS to J4/5.CS • J4.CP to J4/5.CP 	 xx2000002067

Continues on next page

5.3.4 Replacing the axis-3 cabling
Continued

	Action	Note
3	Secure the cables for functional earth and protective earth with a screw.	<p>Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.</p>  <p>xx2000001945</p>
4	Secure the cabling with cable ties.	<p>Cable ties (3 pcs)</p>  <p>xx2000002066</p>

Refitting the housing cover

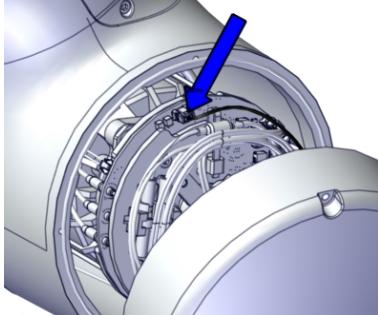
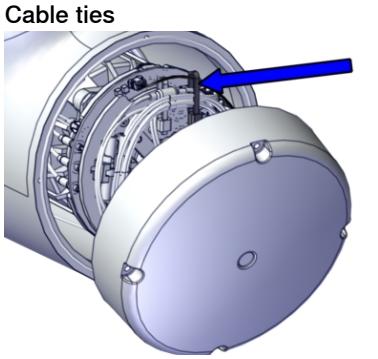
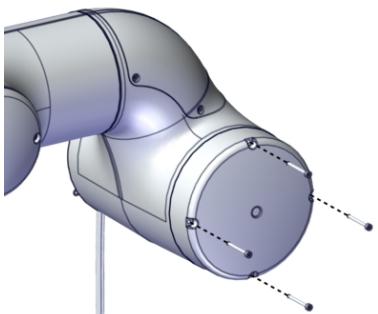
	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	<p>O-ring: 3HAC061327-047</p>  <p>xx2000001962</p>

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5 Repair

5.3.4 Replacing the axis-3 cabling

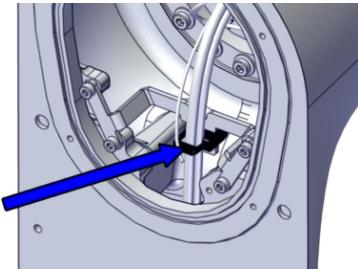
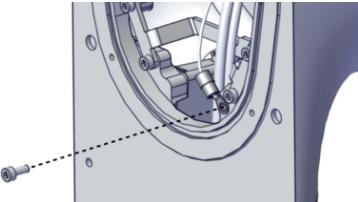
Continued

	Action	Note
2	<p>Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board.</p> <p>Orient the cover for proper arrangement of the brake release cable.</p>	 xx2000002023
3	Secure the brake release cable with a cable tie.	 Cable ties xx2000002022
4	Refit the cover with the four screws.	<p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs)</p> <p>Tightening torque: 0.45 Nm</p>  xx2000002021

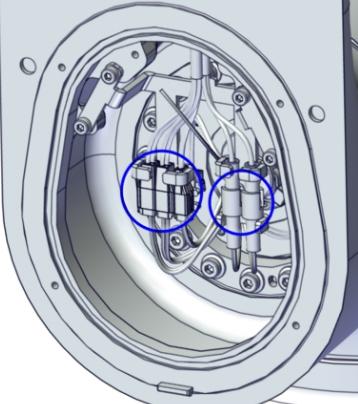
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5.3.4 Replacing the axis-3 cabling
Continued

Fastening the cabling between the lower and upper arm

	Action	Note
1	Secure the cabling with the cable tie.	<p>Cable ties</p>  <p>xx2000001965</p>
2	Connect the functional earth cable with the screw.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (1 pcs). Tightening torque: 0.8 Nm</p>  <p>xx2000001964</p>

Connecting the upper arm cabling

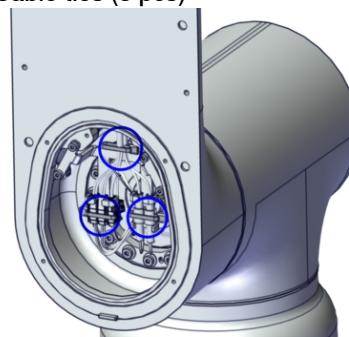
	Action	Note
1	Connect the connectors to each other and snap them to the cable holders.	 <p>xx2000001938</p>

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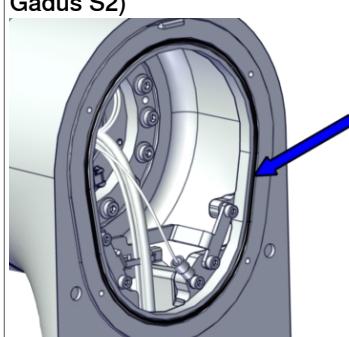
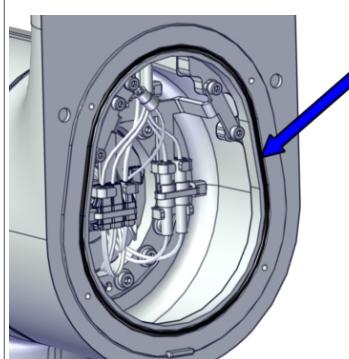
5 Repair

5.3.4 Replacing the axis-3 cabling

Continued

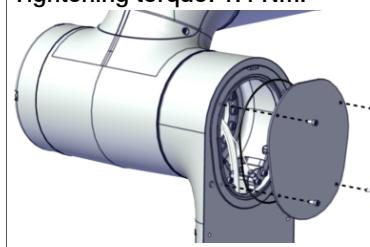
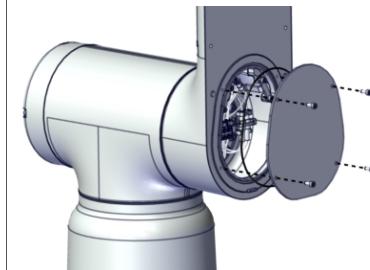
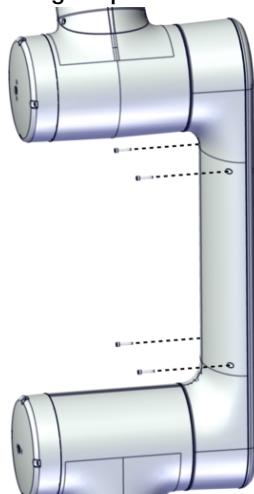
	Action	Note
2	Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000001937

Refitting the lower arm covers

	Action	Note
1	Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-044 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000001955  xx2000001954

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5.3.4 Replacing the axis-3 cabling
Continued

Action	Note
2 Refit the inner covers with four screws each.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (8 pcs) Tightening torque: 1.4 Nm.</p>  <p>xx2000001947</p>  <p>xx2000001930</p>
3 Snap the lower arm cover into place.	
4 Secure the cover with four screws.	<p>Hex socket head cap screw: M3x16 12.9 Gleitmo 603+Geomet 500 (Black Oxide) (4 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000001929</p>

Concluding procedure

Action	Note
<p> DANGER</p> <p>Make sure all safety requirements are met when performing the first test run.</p>	

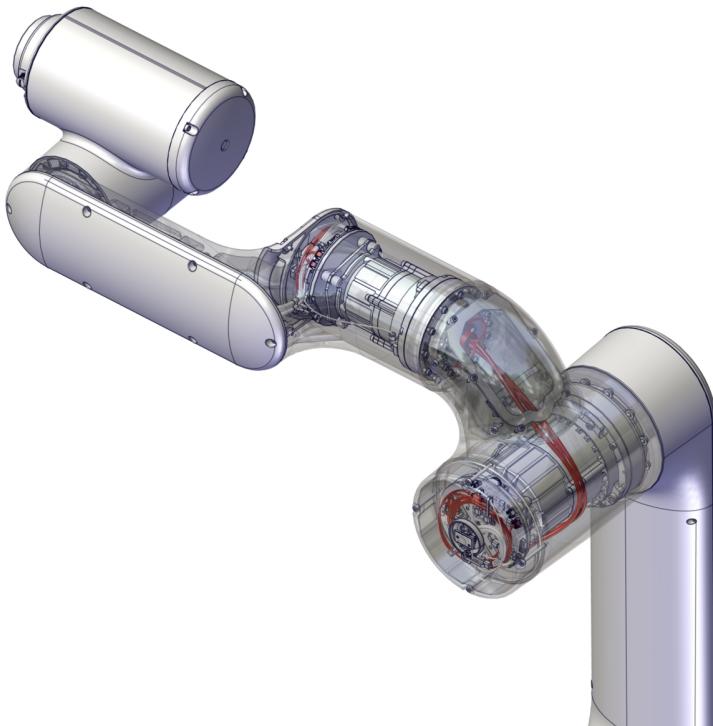
5 Repair

5.3.5 Replacing the axis-4 cabling

5.3.5 Replacing the axis-4 cabling

Location of the cable harness

The cable harness is located as shown in the figure.



xx2100000060

Summary of the replacement procedure

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

- 1 Remove the housing cover.
- 2 Remove the housing top cover.
- 3 Pull out the joint-4 cabling from the housing.
- 4 Remove the axis-4 cover.
- 5 Disconnect the joint-4 cabling.
- 6 Replace the cabling.

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Continues on next page

Spare part	Article number	Note
Cable harness, joint 4	3HAC073206-001	Also order new Cable tie: 3HAC075545-001.
Cable tie	3HAC075545-001	For securing joint unit cable.

Required tools and equipment

Equipment	Article number	Note
Tweezers	-	Used to handle drive board connectors.
Protection plate	3HAC077790-001	For protection of drive board during cabling installation on joint unit.
Cable tie gun EVO7	-	HellermannTyton 110-70084 or similar
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cable ties	-	
O-ring	3HAC061327-051	Axis-4 cover Replace if damaged.
Gasket	3HAC075056-001	Cover inside housing Replace if damaged.
O-ring	3HAC061327-047	Cover for axis 2/3 Replace if damaged.

Removing the joint cabling

Use these procedures to remove the joint-4 cabling.

Preparations before removing the cabling

	Action	Note
1	Jog the robot to the home position: <ul style="list-style-type: none"> • Axis 1: 0° • Axis 2: 0° • Axis 3: -80° • Axis 4: 0° • Axis 5: 0° • Axis 6: 0° 	
2	 CAUTION Turn off all supplies for electrical power to the robot, before starting the repair work.	

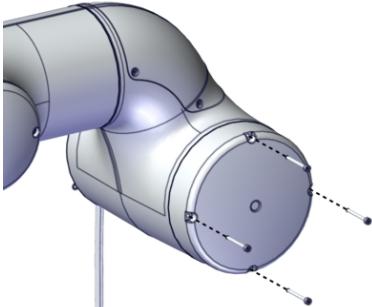
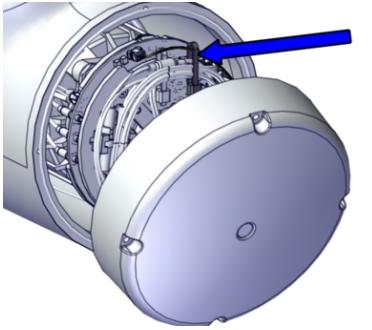
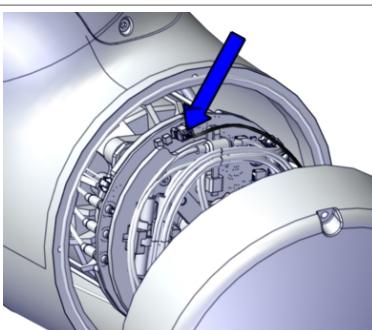
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5 Repair

5.3.5 Replacing the axis-4 cabling

Continued

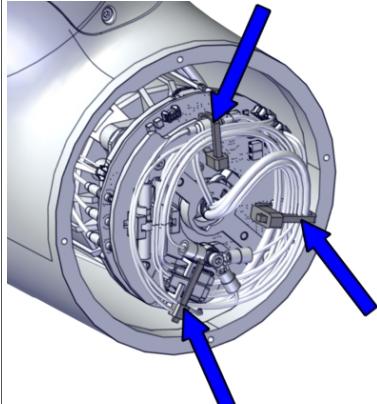
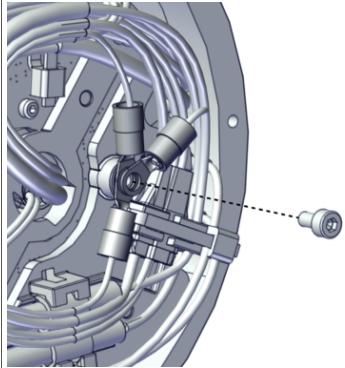
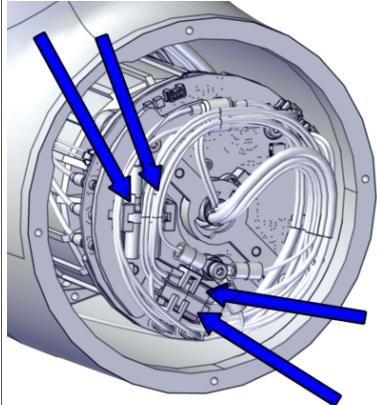
Removing the housing cover

	Action	Note
1	 CAUTION Make sure that all supplies for electrical power are turned off.	
2	Remove the cover screws.	 xx2000002021
3	 CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	
4	Open the cover and cut the cable tie that holds the brake release cable.	 xx2000002022
5	Disconnect the brake release connector from the drive board. Remove the cover.	 xx2000002023

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5.3.5 Replacing the axis-4 cabling
Continued

Separating the cabling between the housing and the tubular

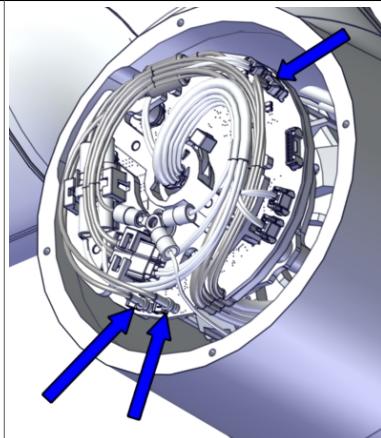
	Action	Note
1	Cut the cable ties.	 xx2000002066
2	Remove the functional and protective earth cables by removing the screw.	 xx2000001945
3	Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J4/5.DC+ • J4/5.DC- • J4/5.CS • J4/5.CP 	 xx2000002067

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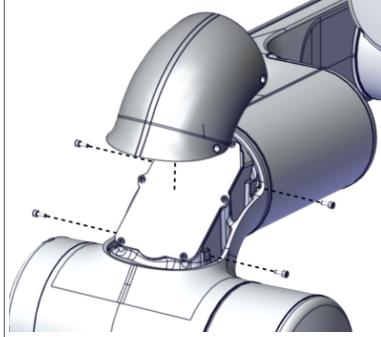
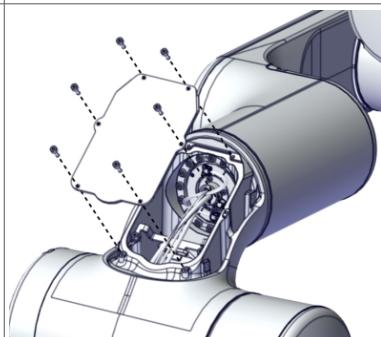
5 Repair

5.3.5 Replacing the axis-4 cabling

Continued

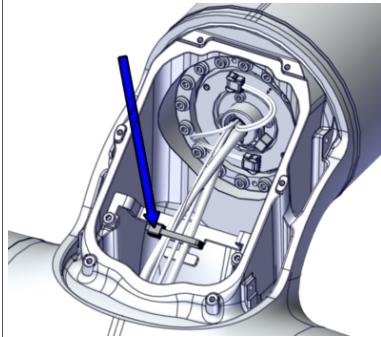
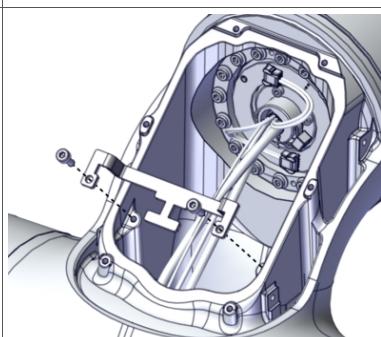
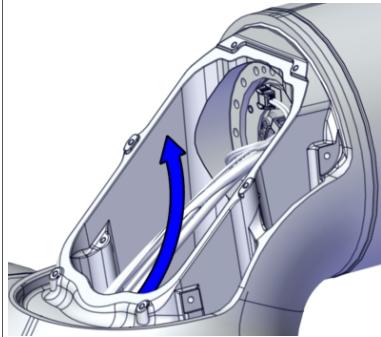
Action	Note
4 Disconnect the connectors from the drive board. <ul style="list-style-type: none">• D3/4.X2• D3/4.DC+• D3/4.DC-	 xx2000002120

Opening the housing top cover

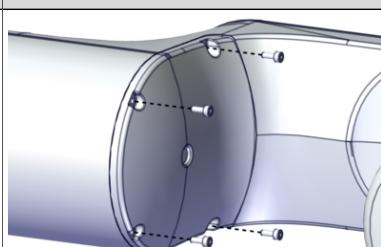
Action	Note
1 Remove the cover by removing the four screws.	 xx2000002075
2 Remove the inner plate by removing the screws.	 xx2000002076

Continues on next page

Pulling out the cabling from the housing

	Action	Note
1	Cut the cable tie.	 xx2000002077
2	Remove the cable bracket by removing the two screws.	 xx2000002078
3	Pull out the cabling carefully from the housing.	 xx2100000344

Removing the axis-4 cover

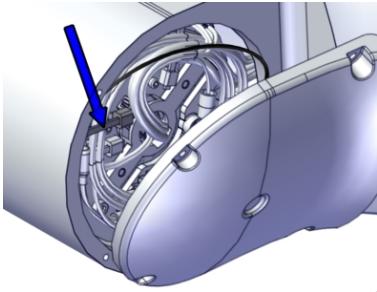
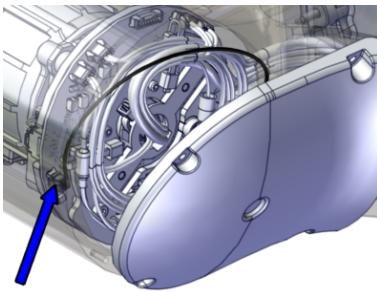
	Action	Note
1	Remove the cover screws.	 xx2000002083

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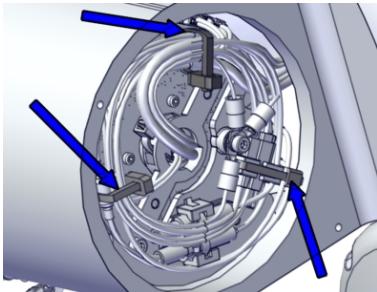
5 Repair

5.3.5 Replacing the axis-4 cabling

Continued

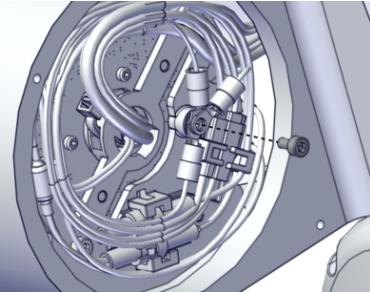
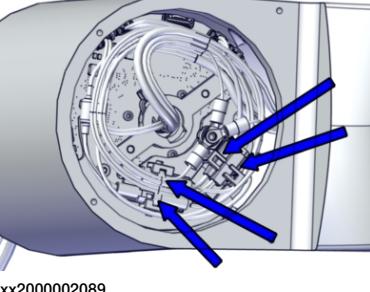
	Action	Note
2	 CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	
3	Open the cover and cut the cable tie that holds the brake release cable.	 xx2000002084
4	Disconnect the brake release connector from the drive board. Remove the cover.	Tweezers  xx2000002085

Disconnecting the axis-5 connectors

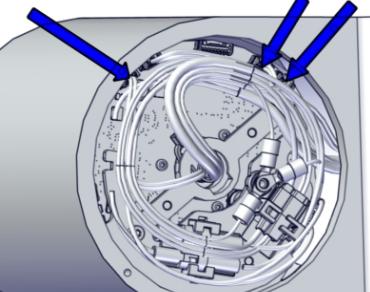
	Action	Note
1	Cut the cable ties.	 xx2000002086

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5.3.5 Replacing the axis-4 cabling
Continued

Action	Note
2 Remove the functional and protective earth cables by removing the screw.	 xx2000002087
3 Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J4/5.DC+ • J4/5.DC- • J4/5.CS • J4/5.CP 	 xx2000002089

Disconnecting the axis-4 joint unit cabling

Action	Note
1 Disconnect the connectors from the drive board. Use tweezers. <ul style="list-style-type: none"> • D4/5.X1 • D4/5.X4 • D4/5.X5 	Tweezers  xx2000002088

Removing the joint cable

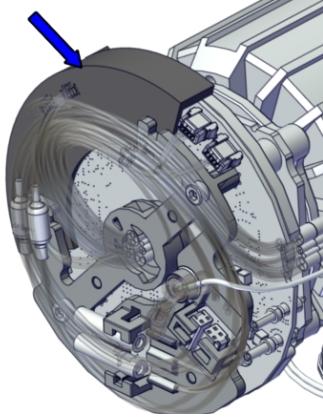
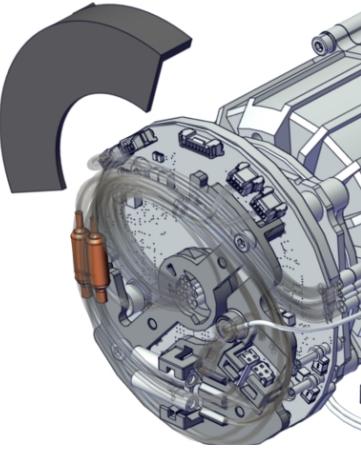
Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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5 Repair

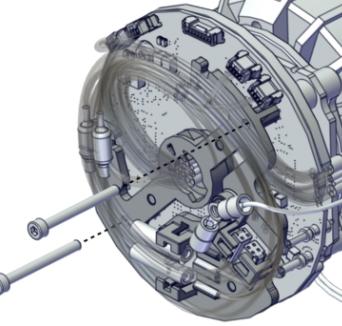
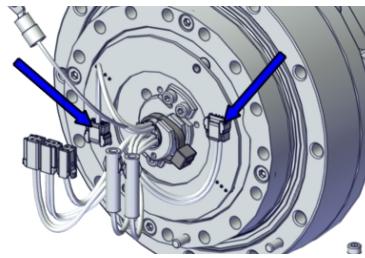
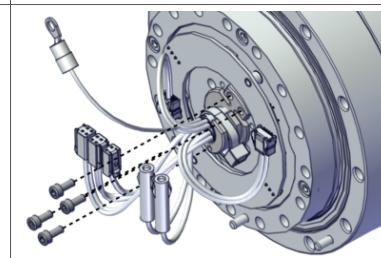
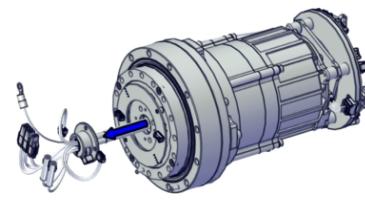
5.3.5 Replacing the axis-4 cabling

Continued

	Action	Note
2	<p>Fit the protection plate to the drive board unit.</p> <p> Tip</p> <p>Using the protection plate is important for protecting the drive board unit. If complete joint unit is to be replaced, the protection plate is not needed.</p>	<p>Protection plate: 3HAC077790-001</p>  <p>xx2000002057</p>
3	Cut the cable tie at the drive board.	 <p>xx2000002058</p>
4	Remove the protection plate.	 <p>xx2100000301</p>

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5.3.5 Replacing the axis-4 cabling
Continued

Action	Note
5 Remove the cable support from the drive board by removing the attachment screws.	 xx2000002055
6 Disconnect the two connectors from the torque sensor board. <ul style="list-style-type: none"> • TQ.A • TQ.B 	 xx2000002053
7 Remove the cable plate by removing the attachment screws.	 xx2000002049
8 Remove the joint cable from the hollow shaft from the torque sensor side.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002060

Refitting the joint cabling

Use these procedures to refit the joint-4 cabling.

Refitting the joint cable

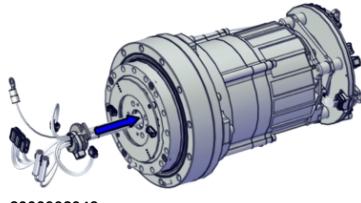
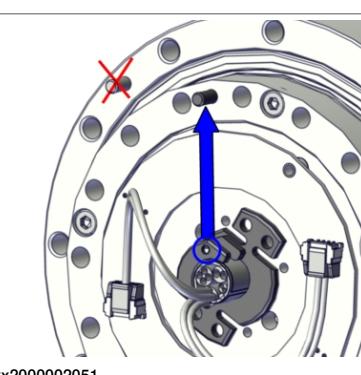
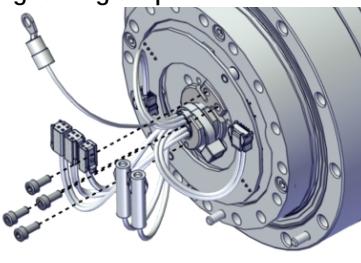
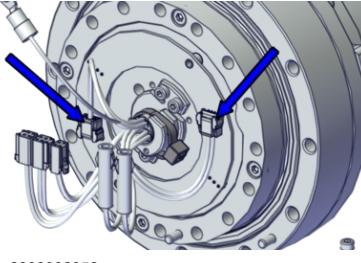
Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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5 Repair

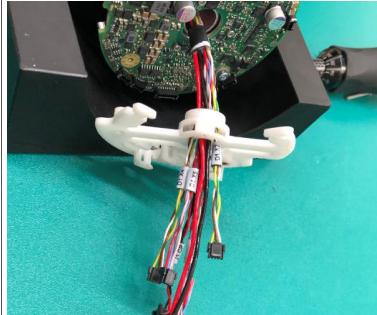
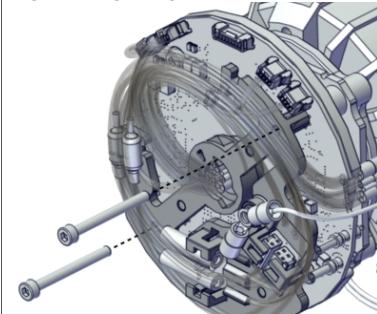
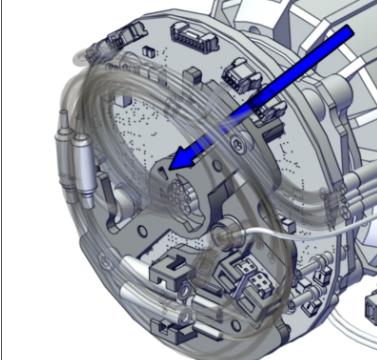
5.3.5 Replacing the axis-4 cabling

Continued

Action	Note
<p>2 Place the joint cable through the hollow shaft from the torque sensor side.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	 xx2000002048
<p>3 Orient the cable plate according to the figure. The circle on the cable plate should point towards the guide pin on the torque sensor.</p>	 xx2000002051
<p>4 Secure the cable plate to the joint unit with the attachment screws.</p>	<p>Hex socket head cap screw: M2.5x6 12.9 Gleitmo 603+Geomet 500 (4 pcs)</p> <p>Tightening torque: 0.45 Nm.</p>  xx2000002049
<p>5 Connect the two connectors to the torque sensor board.</p> <ul style="list-style-type: none"> • TQ.A to CH1/A • TQ.B to CH2/B 	 xx2000002053

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5.3.5 Replacing the axis-4 cabling
Continued

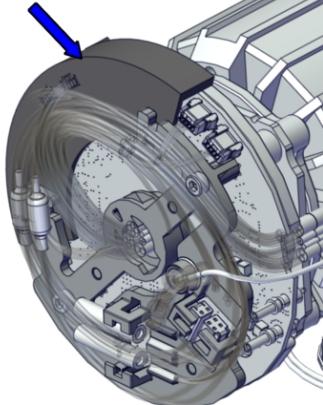
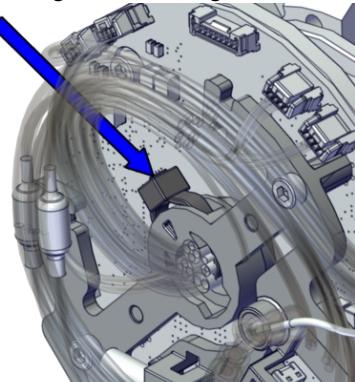
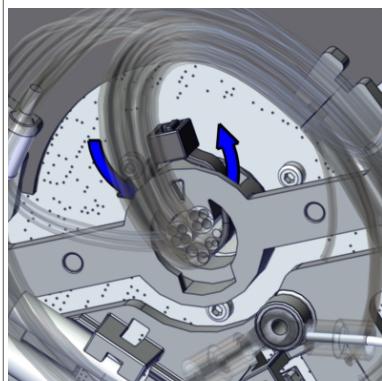
Action	Note
6 Insert the cabling through the cable support and fit the support to the drive board with the attachment screws.	 <p>xx2000002056</p> <p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (2 pcs)</p> <p>Tightening torque: 0.45 Nm.</p>  <p>xx2000002055</p>
7 Align the triangle direction mark on the cable support and the white mark on the cable harness. Use the cable tie to pre-fix the cable by hand.	 <p>xx2100000507</p>  <p>xx2100000508</p>

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5 Repair

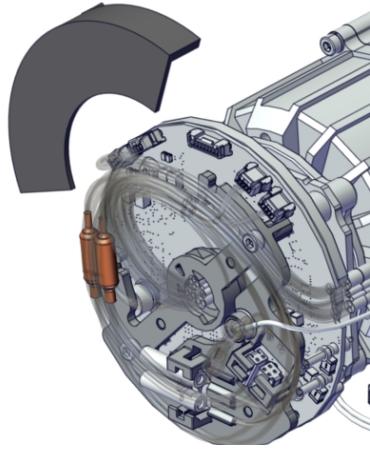
5.3.5 Replacing the axis-4 cabling

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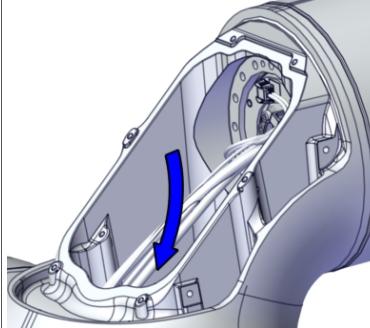
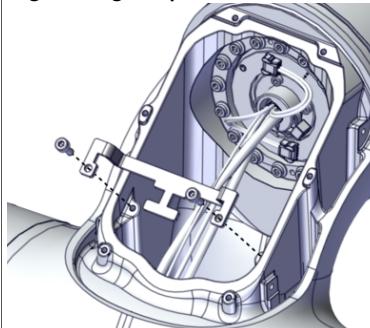
Action	Note
8 Fit the protection plate to the drive board unit.	<p>Protection plate: 3HAC077790-001</p>  <p>xx2000002057</p>
9 Secure the cables to the cable support with a cable tie, using a cable tie gun. Assembly direction for the cable tie is shown in the figure.	<p>Cable tie: 3HAC075545-001. For securing joint unit cable. Cable tie gun EVO7 Setting for cable tie gun: 6.75.</p>  <p>xx2000002058</p>  <p>xx2000002059</p>

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5.3.5 Replacing the axis-4 cabling
Continued

	Action	Note
10	Remove the protection plate.	 xx2100000301

Refitting the cabling into the housing

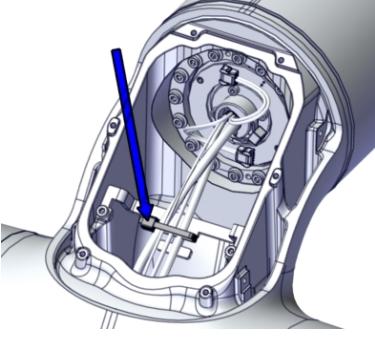
	Action	Note
1	Insert the cabling carefully into the housing and out at the axis-3 joint.	 xx2100000345
2	Refit the cable bracket with the two screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.8 Nm  xx2000002078

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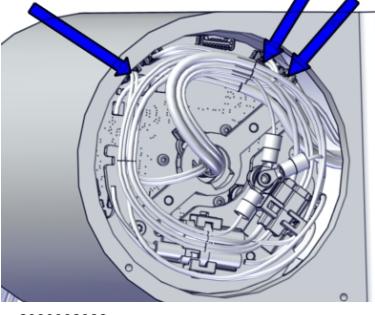
5 Repair

5.3.5 Replacing the axis-4 cabling

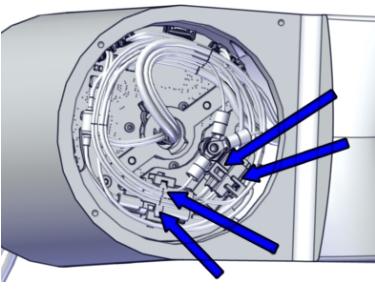
Continued

Action	Note
3 Secure the cabling with a cable tie.	Cable ties (1 pcs)  xx2000002077

Connecting the axis-4 joint unit cabling

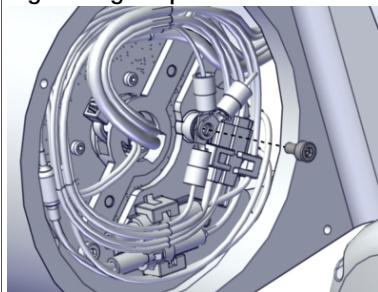
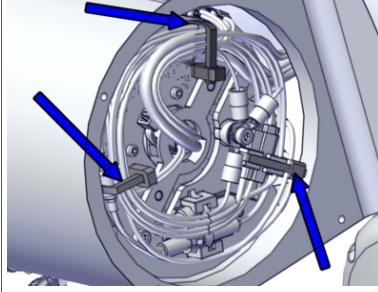
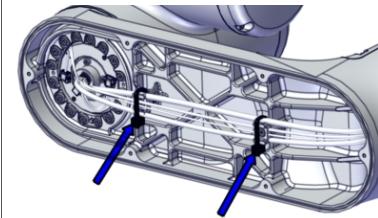
Action	Note
1 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D4/5.X1 to X1 • D4/5.X4 to X4 • D4/5.X5 to X5 	 xx2000002088

Connecting the axis-5 connectors

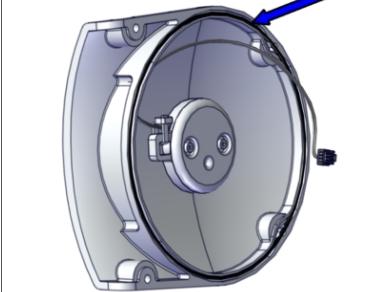
Action	Note
1 Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J4/5.DC+ to J5/6.DC+ • J4/5.DC- to J5/6.DC- • J4/5.CS to J5/6.CS • J4/5.CP to J5/6.CP 	 xx2000002089

Continues on next page

5.3.5 Replacing the axis-4 cabling
Continued

	Action	Note
2	Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000002087
3	Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000002086  xx2000002124

Refitting the axis-4 cover

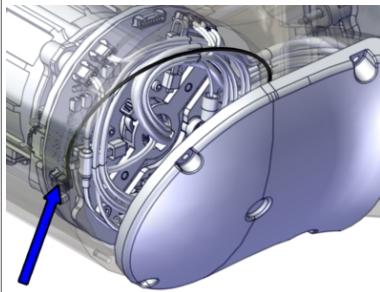
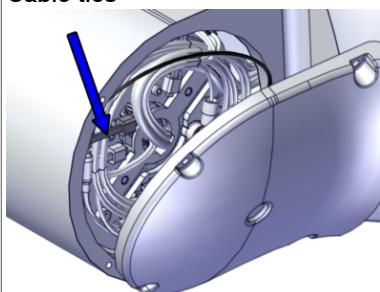
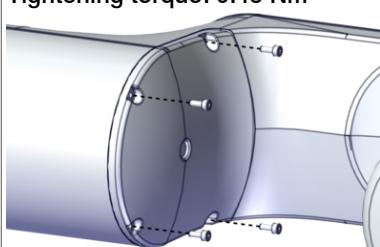
	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-051  xx2000002092

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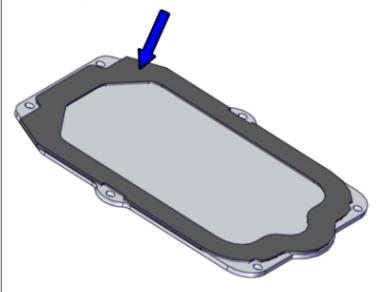
5 Repair

5.3.5 Replacing the axis-4 cabling

Continued

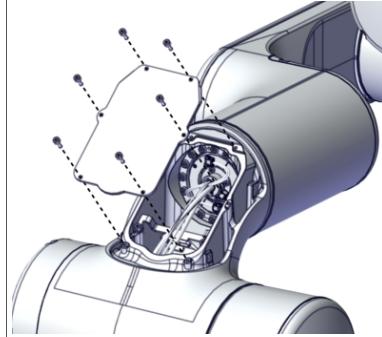
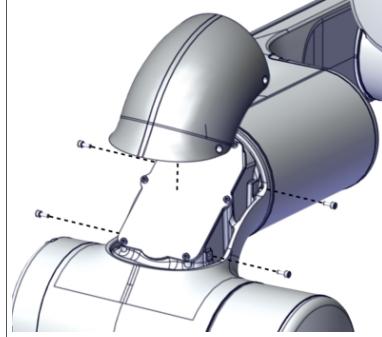
	Action	Note
2	Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board.	<p>Tweezers</p>  <p>xx2000002085</p>
3	Secure the brake release cable with a cable tie.	<p>Cable ties</p>  <p>xx2000002084</p>
4	Refit the cover with the four screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm</p>  <p>xx2000002083</p>

Closing the housing top cover

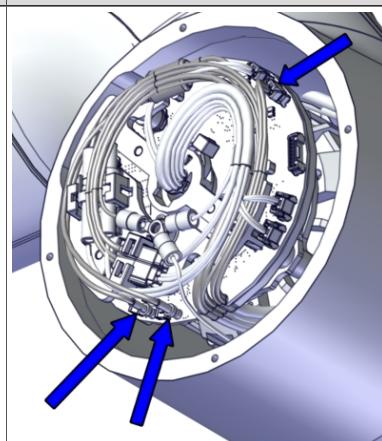
	Action	Note
1	Check the inner plate gasket. Replace if damaged.	<p>Gasket: 3HAC075056-001</p>  <p>xx2000002095</p>

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5.3.5 Replacing the axis-4 cabling
Continued

Action	Note
2 Refit the inner plate with the screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 1.4 Nm</p>  <p>xx2000002076</p>
3 Refit the cover with the four screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.45 Nm</p>  <p>xx2000002075</p>

Connecting the tubular cabling

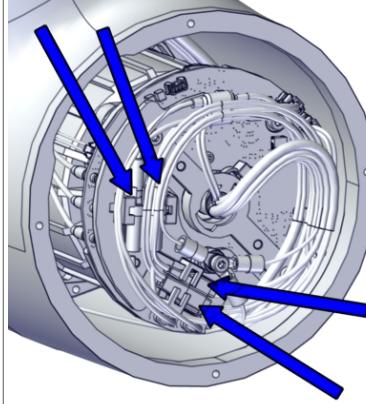
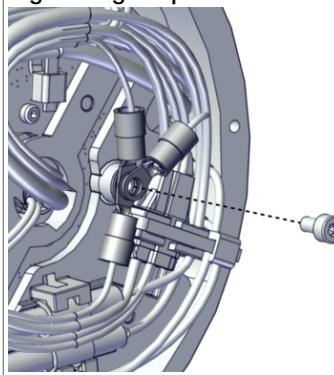
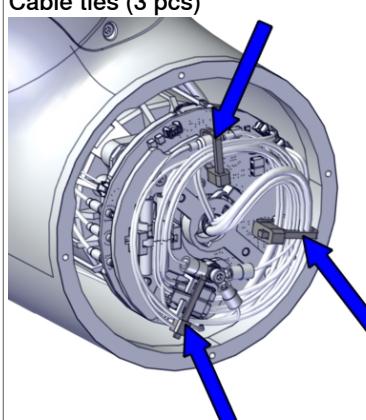
Action	Note
1 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D3/4.DC+ to DC+ • D3/4.DC- to Ground • D3/4.X2 to X2 	 <p>xx2000002120</p>

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5 Repair

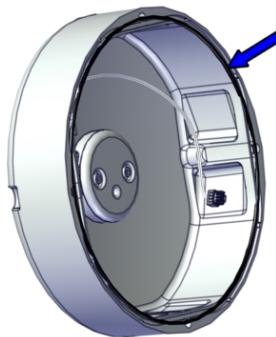
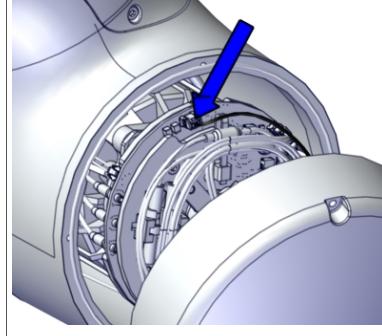
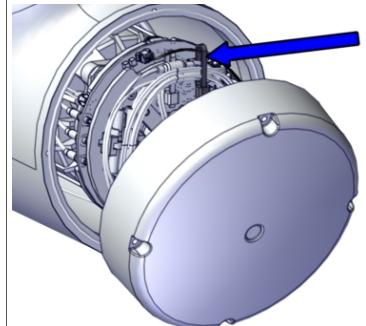
5.3.5 Replacing the axis-4 cabling

Continued

	Action	Note
2	<p>Connect the connectors to each other and snap them to the cable holders.</p> <ul style="list-style-type: none"> • J3.DC+ to J3.DC+ • J3.DC- to J3.DC- • J3.CS to J3.CS • J3.CP to J3.CP 	 xx2000002067
3	<p>Secure the cables for functional earth and protective earth with a screw.</p>	<p>Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.</p>  xx2000001945
4	<p>Secure the cabling with cable ties.</p>	<p>Cable ties (3 pcs)</p>  xx2000002066

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Refitting the housing cover

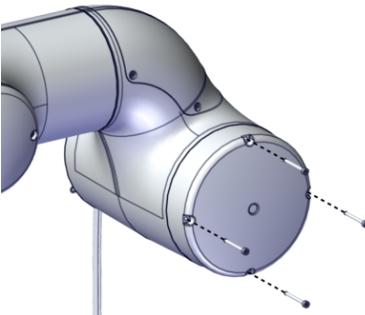
	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-047  xx2000001962
2	Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board. Orient the cover for proper arrangement of the brake release cable.	 xx2000002023
3	Secure the brake release cable with a cable tie.	Cable ties  xx2000002022

Continues on next page

5 Repair

5.3.5 Replacing the axis-4 cabling

Continued

	Action	Note
4	Refit the cover with the four screws.	<p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm</p>  <p>xx2000002021</p>

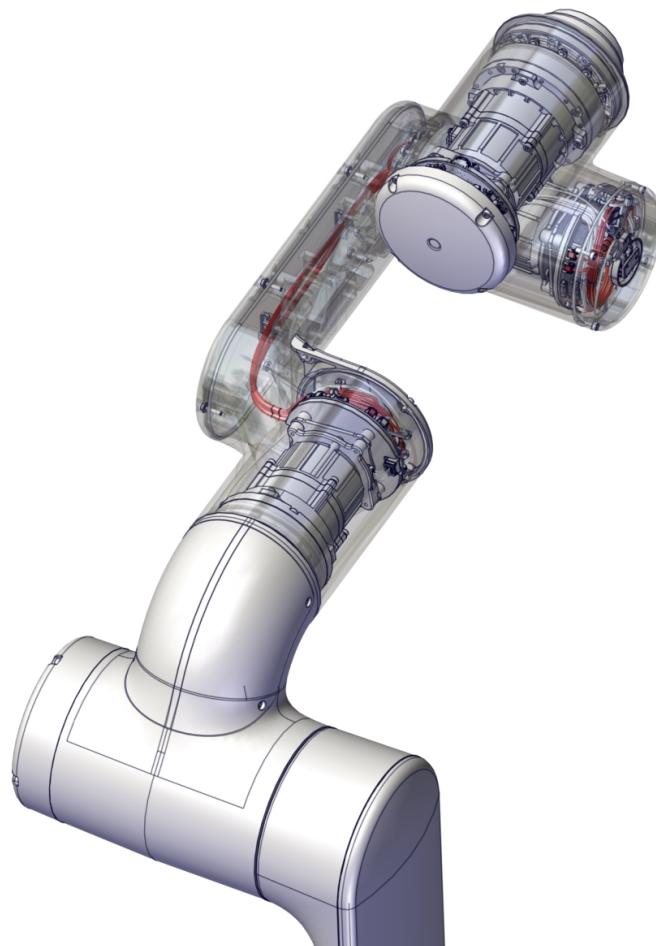
Concluding procedure

	Action	Note
1	 DANGER Make sure all safety requirements are met when performing the first test run.	

5.3.6 Replacing the axis-5 cabling

Location of the cable harness

The cable harness is located as shown in the figure.



xx2100000061

Summary of the replacement procedure

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

- 1 Remove the tubular cover.
- 2 Remove the axis-4 cover.
- 3 Pull out the joint-5 cabling from the tubular.
- 4 Remove the axis-5 cover.
- 5 Disconnect the joint-5 cabling.
- 6 Replace the cabling.

Continues on next page

5 Repair

5.3.6 Replacing the axis-5 cabling

Continued

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Spare part	Article number	Note
Cable harness, joint 5	3HAC073206-001	Also order new Cable tie: 3HAC075545-001.
Cable tie	3HAC075545-001	For securing joint unit cable.

Required tools and equipment

Equipment	Article number	Note
Tweezers	-	Used to handle drive board connectors.
Protection plate	3HAC077790-001	For protection of drive board during cabling installation on joint unit.
Cable tie gun EVO7	-	HellermannTyton 110-70084 or similar
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cable ties	-	
O-ring	3HAC061327-051	Axis-5 cover Replace if damaged.
O-ring	3HAC061327-051	Axis-4 cover Replace if damaged.
O-ring	3HAC061327-043	Tubular cover Replace if damaged.
Grease	3HAC042536-001	Shell Gadus S2
Hex socket head cap flange screw with glue	3HAB3413-312	M3x12 For tubular cover. Always use new screws. If ordering a new axis-4 or axis-5 joint unit spare part, new screws for the tubular cover are included.

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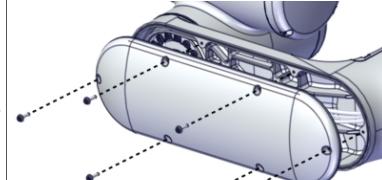
Removing the joint cabling

Use these procedures to remove the joint-5 cabling.

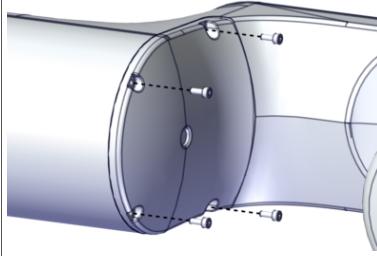
Preparations before removing the cabling

	Action	Note
1	Jog the robot to the home position: <ul style="list-style-type: none"> • Axis 1: 0° • Axis 2: 0° • Axis 3: -80° • Axis 4: 0° • Axis 5: 0° • Axis 6: 0° 	
2	 CAUTION Turn off all supplies for electrical power to the robot, before starting the repair work.	

Removing the tubular cover

	Action	Note
1	Remove the cover by removing the six screws. Dispose the screws. New screws must be used when refitting the cover. New screws are included in the spare part delivery of the joint unit.	 xx2000002123

Removing the axis-4 cover

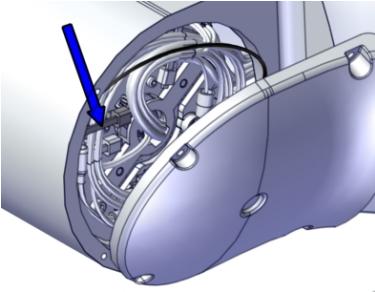
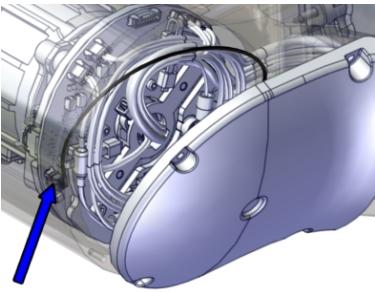
	Action	Note
1	Remove the cover screws.	 xx2000002083
2	 CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	

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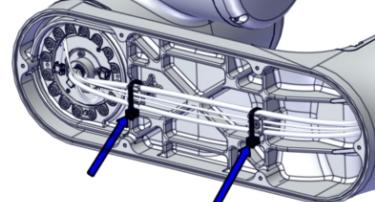
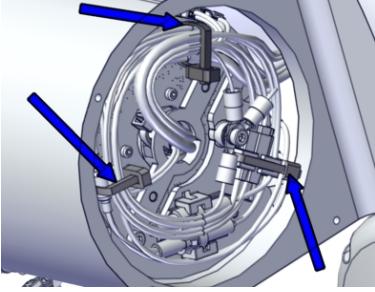
5 Repair

5.3.6 Replacing the axis-5 cabling

Continued

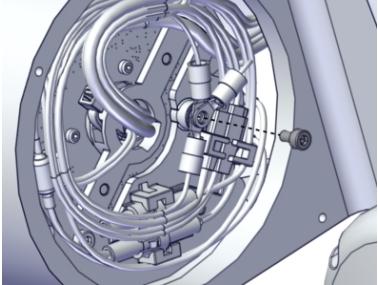
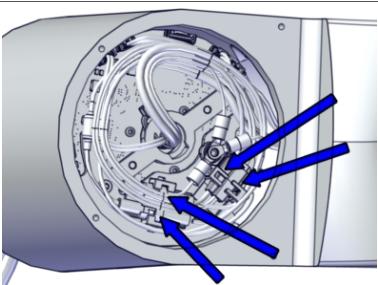
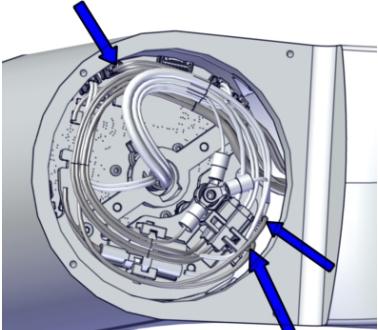
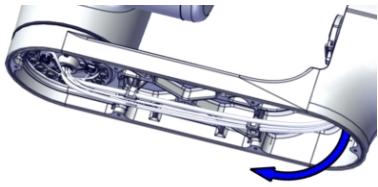
Action	Note
3 Open the cover and cut the cable tie that holds the brake release cable.	 xx2000002084
4 Disconnect the brake release connector from the drive board. Remove the cover.	Tweezers  xx2000002085

Separating the cabling between the tubular and the tilt

Action	Note
1 Cut the cable ties, if needed.	 xx2000002124  xx2000002086

Continues on next page

5.3.6 Replacing the axis-5 cabling
Continued

	Action	Note
2	Remove the functional and protective earth cables by removing the screw.	 xx2000002087
3	Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J4/5.DC+ • J4/5.DC- • J4/5.CS • J4/5.CP 	 xx2000002089
4	Disconnect the connectors that belongs to the axis-5 cabling, from the axis-4 drive board: <ul style="list-style-type: none"> • D3/4.X2 • D3/4.DC- • D3/4.DC+ <p>Use tweezers, if needed.</p>	Tweezers  xx2000002125
5	Pull out the cabling carefully from the tubular.	 xx2000002126

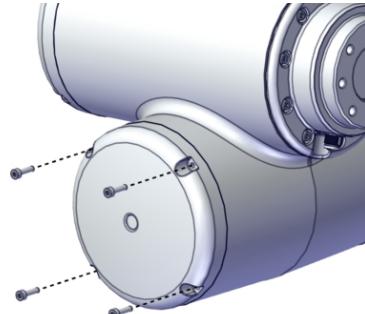
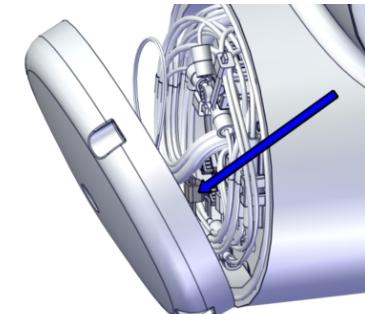
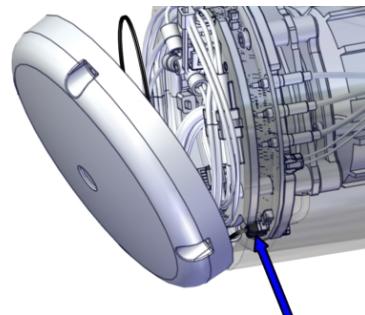
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5 Repair

5.3.6 Replacing the axis-5 cabling

Continued

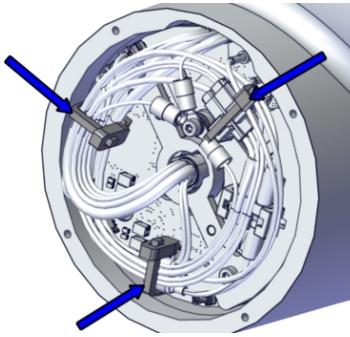
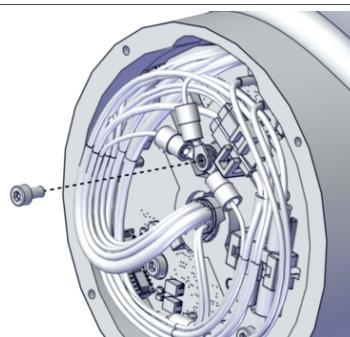
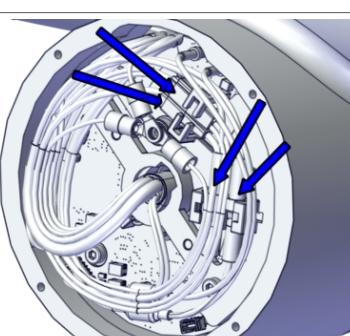
Removing the axis-5 cover

	Action	Note
1	Remove the cover by removing the four screws.	 xx2000002132
2	CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	
3	Open the cover and cut the cable tie that holds the brake release cable.	 xx2000002133
4	Disconnect the brake release connector from the drive board. Remove the cover.	 xx2000002134

Continues on next page

5.3.6 Replacing the axis-5 cabling
Continued

Disconnecting the axis-5 joint unit cabling

	Action	Note
1	Cut the cable ties.	 xx2000002135
2	Remove the functional and protective earth cables by removing the screw.	 xx2000002136
3	Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J5/6.DC+ • J5/6.DC- • J5/6.CS • J5/6.CP 	 xx2000002137
4	Disconnect the connectors from the drive board. <ul style="list-style-type: none"> • D4/5.X1 • D5.DC+ • D5.DC- • D4/5.X4 • D5.X2 • D4/5.X5 <p>Use tweezers, if needed.</p>	Tweezers  xx2000002138

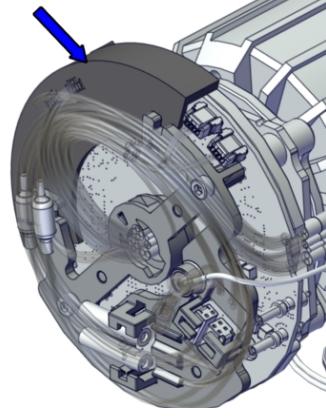
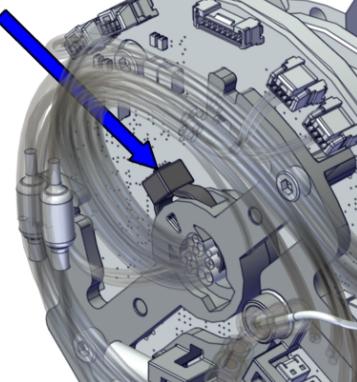
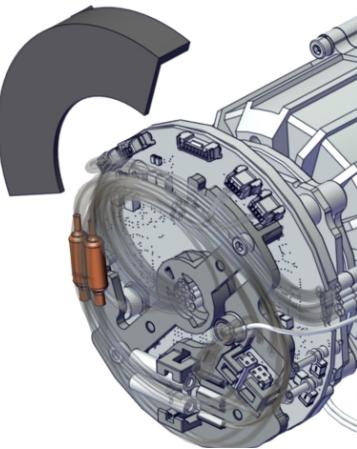
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5 Repair

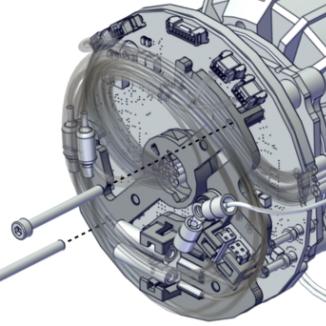
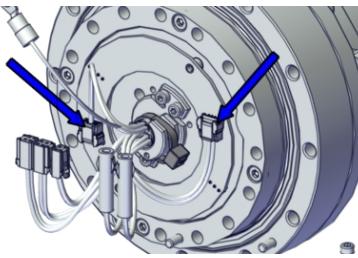
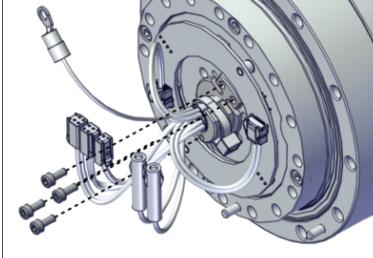
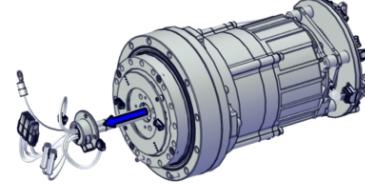
5.3.6 Replacing the axis-5 cabling

Continued

Removing the joint cable

	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2	 Tip Using the protection plate is important for protecting the drive board unit. If complete joint unit is to be replaced, the protection plate is not needed.	Protection plate: 3HAC077790-001  xx2000002057
3	Cut the cable tie at the drive board.	 xx2000002058
4	Remove the protection plate.	 xx2100000301

Continues on next page

	Action	Note
5	Remove the cable support from the drive board by removing the attachment screws.	 xx2000002055
6	Disconnect the two connectors from the torque sensor board. <ul style="list-style-type: none">• TQ.A• TQ.B	 xx2000002053
7	Remove the cable plate by removing the attachment screws.	 xx2000002049
8	Remove the joint cable from the hollow shaft from the torque sensor side.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002060

Refitting the joint cabling

Use these procedures to refit the joint-5 cabling.

Refitting the joint cable

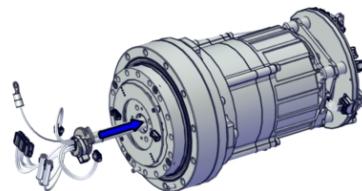
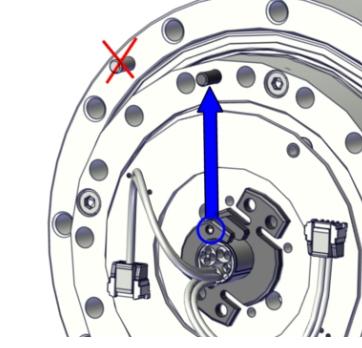
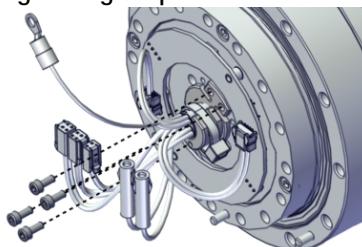
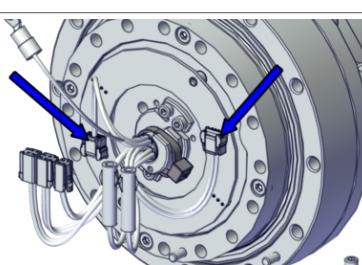
	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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5 Repair

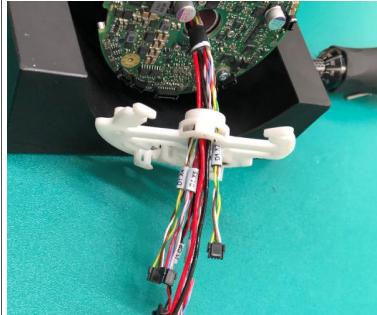
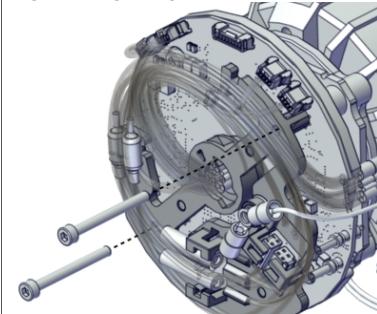
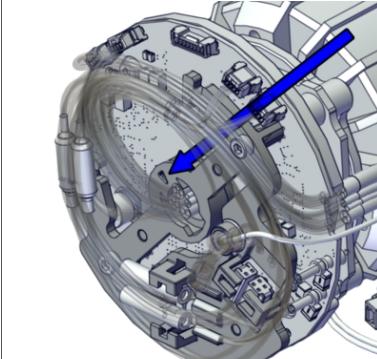
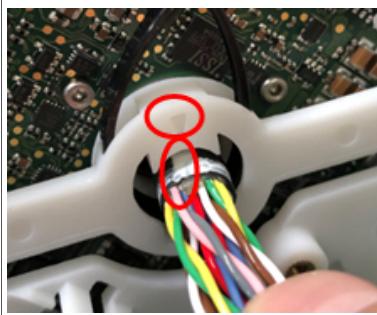
5.3.6 Replacing the axis-5 cabling

Continued

	Action	Note
2	<p>Place the joint cable through the hollow shaft from the torque sensor side.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	 xx2000002048
3	<p>Orient the cable plate according to the figure. The circle on the cable plate should point towards the guide pin on the torque sensor.</p>	 xx2000002051
4	<p>Secure the cable plate to the joint unit with the attachment screws.</p>	<p>Hex socket head cap screw: M2.5x6 12.9 Gleitmo 603+Geomet 500 (4 pcs)</p> <p>Tightening torque: 0.45 Nm.</p>  xx2000002049
5	<p>Connect the two connectors to the torque sensor board.</p> <ul style="list-style-type: none"> • TQ.A to CH1/A • TQ.B to CH2/B 	 xx2000002053

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5.3.6 Replacing the axis-5 cabling
Continued

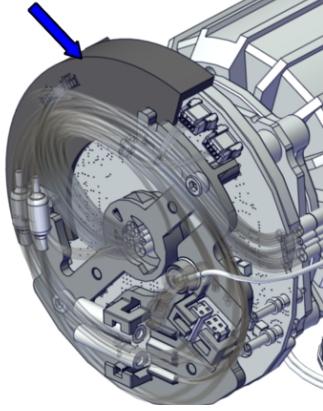
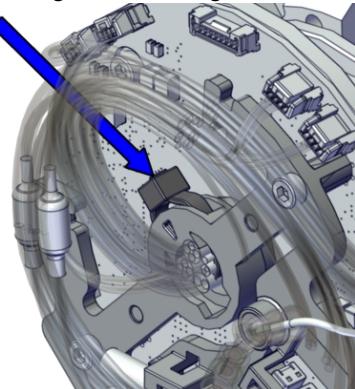
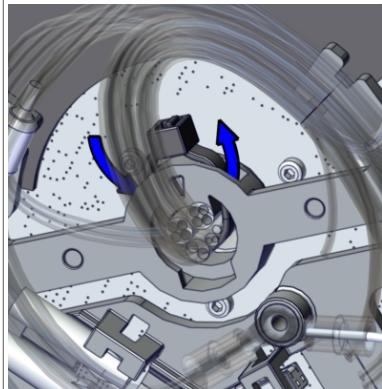
Action	Note
6 Insert the cabling through the cable support and fit the support to the drive board with the attachment screws.	 xx2000002056 <p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (2 pcs) Tightening torque: 0.45 Nm.</p>  xx2000002055
7 Align the triangle direction mark on the cable support and the white mark on the cable harness. Use the cable tie to pre-fix the cable by hand.	 xx2100000507  xx2100000508

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5 Repair

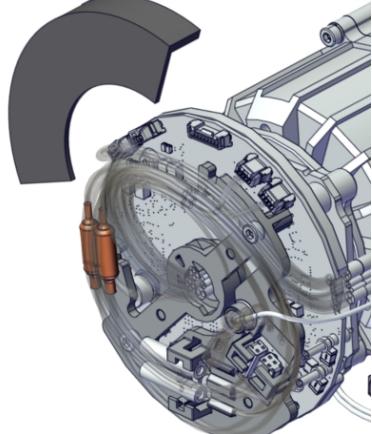
5.3.6 Replacing the axis-5 cabling

Continued

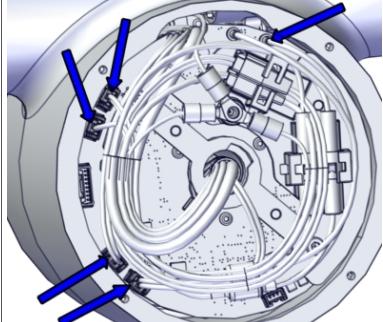
Action	Note
8 Fit the protection plate to the drive board unit.	<p>Protection plate: 3HAC077790-001</p>  <p>xx2000002057</p>
9 Secure the cables to the cable support with a cable tie, using a cable tie gun. Assembly direction for the cable tie is shown in the figure.	<p>Cable tie: 3HAC075545-001. For securing joint unit cable. Cable tie gun EVO7 Setting for cable tie gun: 6.75.</p>  <p>xx2000002058</p>  <p>xx2000002059</p>

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5.3.6 Replacing the axis-5 cabling
Continued

Action	Note
10 Remove the protection plate.	 xx2100000301

Connecting the axis-5 joint unit cabling

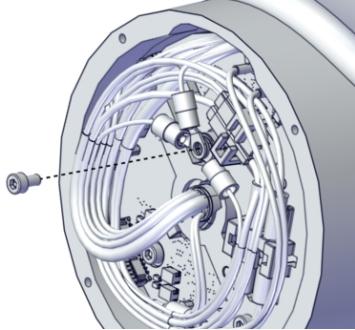
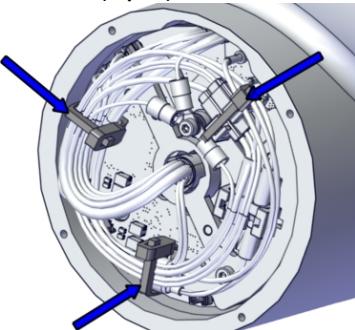
Action	Note
1 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D4/5.X1 to X1 • D5.DC+ to +DC • D5.DC- to Ground • D4/5.X4 to X4 • D5/4.X2 to X2 • D4/5.X5 to X5 	 xx2000002138
2 Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J5/6.DC+ to J6.DC+ • J5/6.DC- to J6.DC- • J5/6.CS to J6.CS • J5/6.CP to J6.CP 	 xx2000002137

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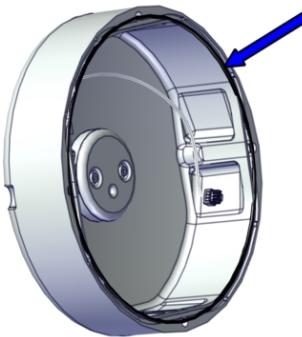
5 Repair

5.3.6 Replacing the axis-5 cabling

Continued

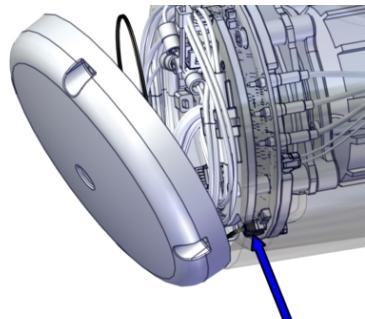
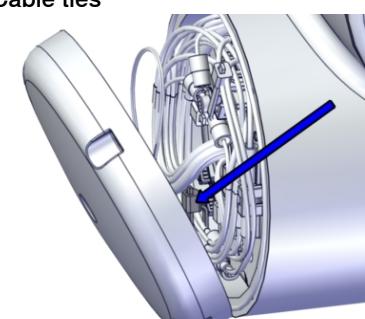
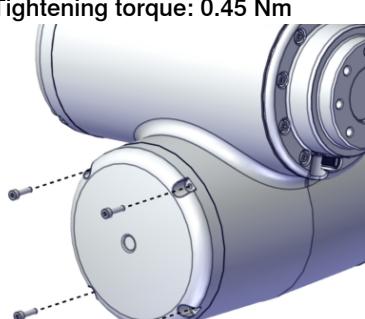
	Action	Note
3	Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000002136
4	Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000002135

Refitting the axis-5 cover

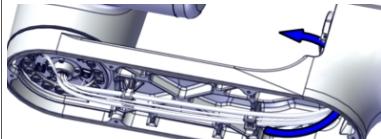
	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-051  xx2000001962

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5.3.6 Replacing the axis-5 cabling
Continued

	Action	Note
2	Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board.	 xx2000002134
3	Secure the brake release cable with a cable tie.	Cable ties  xx2000002133
4	Refit the cover with the four screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm  xx2000002132

Connecting the tilt cabling

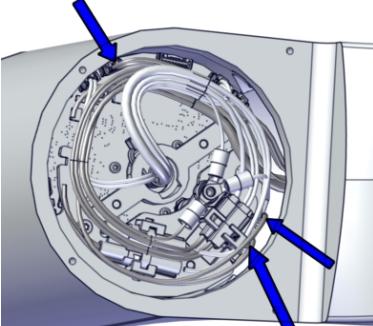
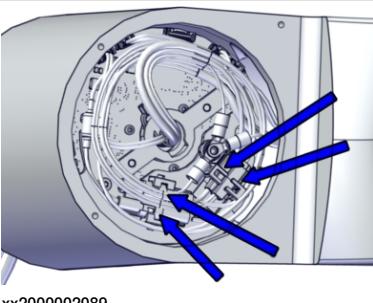
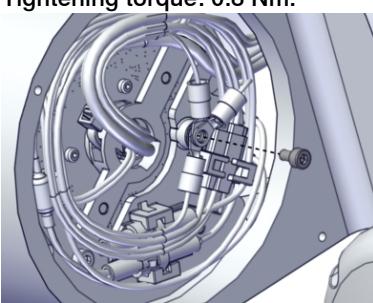
	Action	Note
1	Insert the cabling into the tubular.	 xx2000002148

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5 Repair

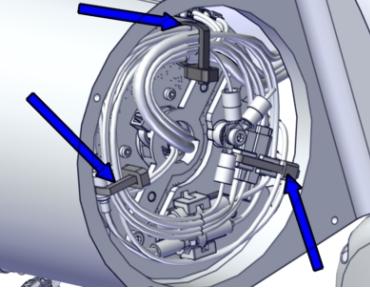
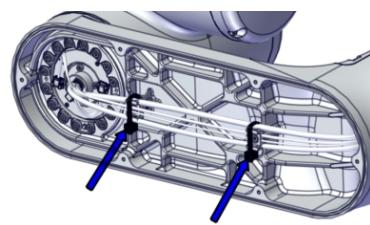
5.3.6 Replacing the axis-5 cabling

Continued

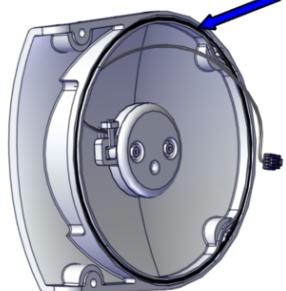
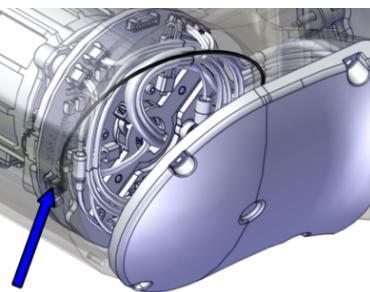
Action	Note
2 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D3/4.X2 to X2 • D3/4.DC- to Ground • D3/4.DC+ to +DC 	 xx2000002125
3 Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J4/5.DC+ to J5/6.DC+ • J4/5.DC- to J5/6.DC- • J4/5.CS to J5/6.CS • J4/5.CP to J5/6.CP 	 xx2000002089
4 Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000002087

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5.3.6 Replacing the axis-5 cabling
Continued

Action	Note
5 Secure the cabling with cable ties.	<p>Cable ties (3 pcs)</p>  <p>xx2000002086</p>  <p>xx2000002124</p>

Refitting the axis-4 cover

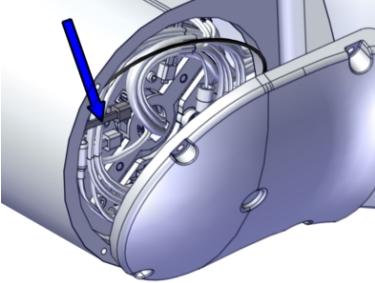
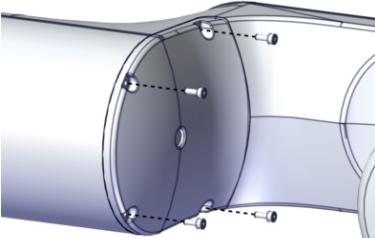
Action	Note
1 Fit the o-ring to its groove. Replace if damaged.	<p>O-ring: 3HAC061327-051</p>  <p>xx2000002092</p>
2 Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board.	<p>Tweezers</p>  <p>xx2000002085</p>

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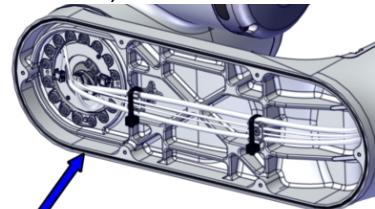
5 Repair

5.3.6 Replacing the axis-5 cabling

Continued

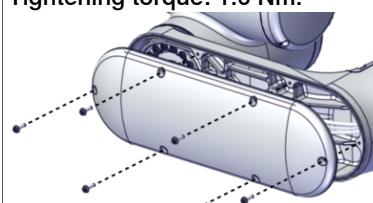
Action	Note
3 Secure the brake release cable with a cable tie.	Cable ties  xx2000002084
4 Refit the cover with the four screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm  xx2000002083

Refitting the tubular cover

Action	Note
1 Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-043 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000002149

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5.3.6 Replacing the axis-5 cabling
Continued

Action	Note
2 Refit the cover with new attachment screws.	<p>Hex socket head cap flange screw with glue: 3HAB3413-312 M3x12</p> <p>For tubular cover.</p> <p>Always use new screws.</p> <p>If ordering a new axis-4 or axis-5 joint unit spare part, new screws for the tubular cover are included.</p> <p>Tightening torque: 1.6 Nm.</p>  <p>xx2000002123</p>

Concluding procedure

Action	Note
1  DANGER Make sure all safety requirements are met when performing the first test run.	

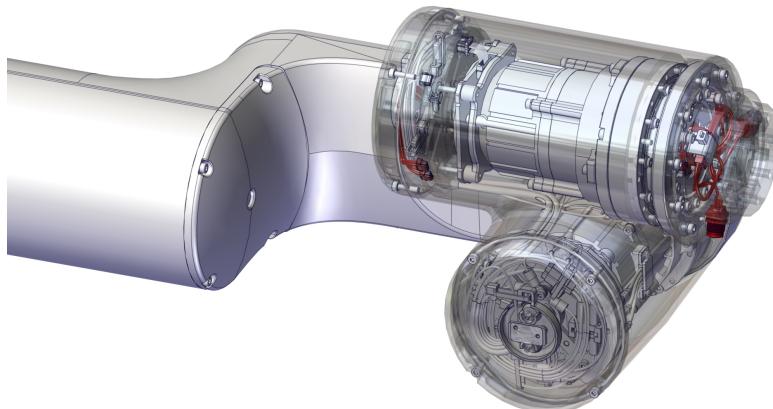
5 Repair

5.3.7 Replacing the axis-6 cabling

5.3.7 Replacing the axis-6 cabling

Location of the cable harness

The cable harness is located as shown in the figure.



xx2100000062

Summary of the replacement procedure

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

- 1 Remove the arm-side interface.
- 2 Remove the tool flange.
- 3 Disconnect the joint-6 cabling.
- 4 Replace the cabling.

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Spare part	Article number	Note
Cable harness, joint 6	3HAC073208-001	Also order new Cable tie: 3HAC075545-001.
Cable tie	3HAC075545-001	For securing joint unit cable.

Required tools and equipment

Equipment	Article number	Note
Tweezers	-	Used to handle drive board connectors.

Continues on next page

Equipment	Article number	Note
Protection plate	3HAC077790-001	For protection of drive board during cabling installation on joint unit.
Cable tie gun EVO7	-	HellermannTyton 110-70084 or similar
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cable ties	-	
O-ring	3HAC061327-051	Arm-side interface Replace if damaged.
O-ring	3HAB3772-182	Tool flange
Grease	3HAC042536-001	Shell Gadus S2

Removing the joint cabling

Use these procedures to remove the joint-6 cabling.

Preparations before removing the cabling

	Action	Note
1	Jog the robot to the home position: <ul style="list-style-type: none"> • Axis 1: 0° • Axis 2: 0° • Axis 3: -80° • Axis 4: 0° • Axis 5: 0° • Axis 6: 0° 	
2	 CAUTION Turn off all supplies for electrical power to the robot, before starting the repair work.	

Removing the arm-side interface

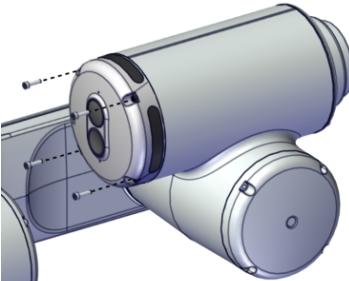
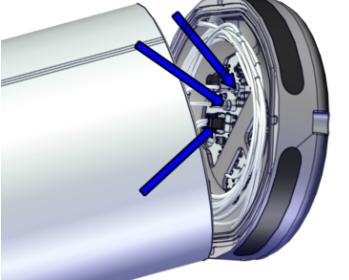
	Action	Note
1	 CAUTION Make sure that all supplies for electrical power are turned off.	

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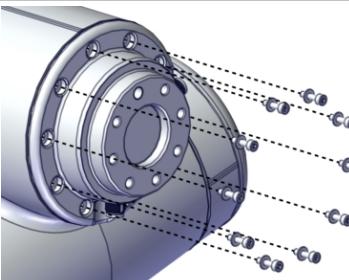
5 Repair

5.3.7 Replacing the axis-6 cabling

Continued

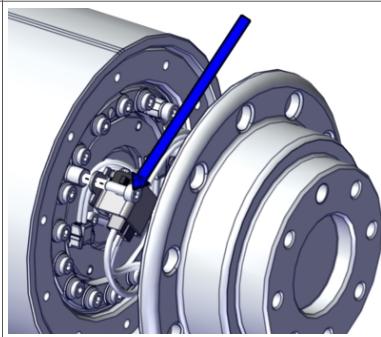
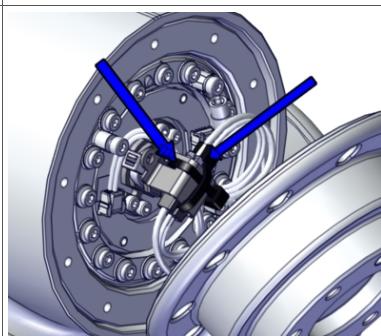
Action	Note
2  CAUTION There is cabling connected between the arm-side interface and the joint unit drive board. Open the arm-side interface with care to avoid damage to the cabling or the connector(s). Do not leave the arm-side interface in location without being secured with the attachment screws.	
3 Remove the attachment screws.	 xx2000002550
4 Loosen the arm-side interface carefully and disconnect the connectors from it. <ul style="list-style-type: none"> • ASI.DC+ • ASI.DC- • ASI.X1 	 xx2100000335

Removing the tool flange

Action	Note
1 Remove the tool flange screws and washers.	 xx2000002155

Continues on next page

5.3.7 Replacing the axis-6 cabling
Continued

Action	Note
2  CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	
3 Loosen the tool flange and remove the cable bracket by removing the screw.	 xx2000002156
4 Cut the cable ties.	 xx2000002157
5 Disconnect the CP/CS connectors from the drive board and remove the tool flange.	 xx2000002158

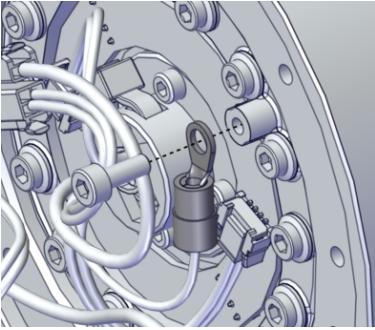
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5 Repair

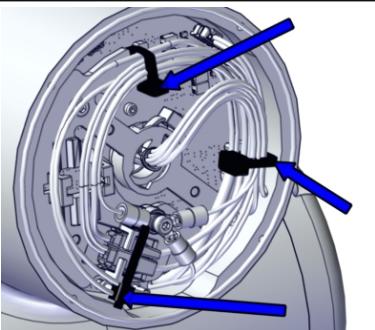
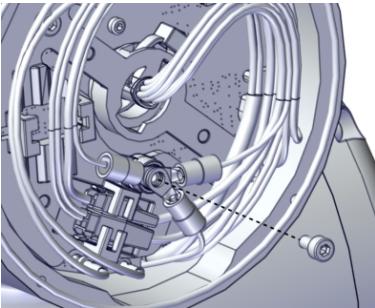
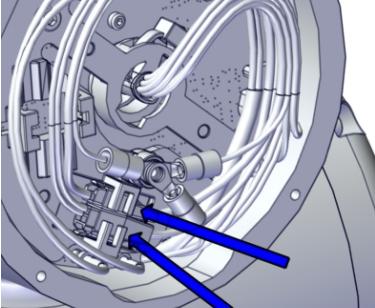
5.3.7 Replacing the axis-6 cabling

Continued

Disconnecting the tool flange functional earth cable

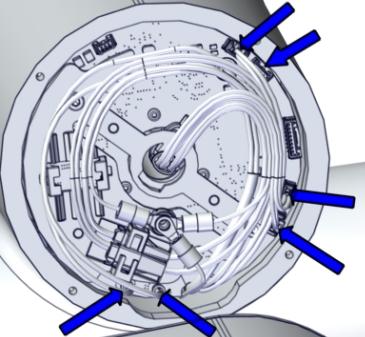
	Action	Note
1	Remove the functional earth cable by removing the screw.	 xx2000002159

Disconnecting the axis-6 joint unit cabling

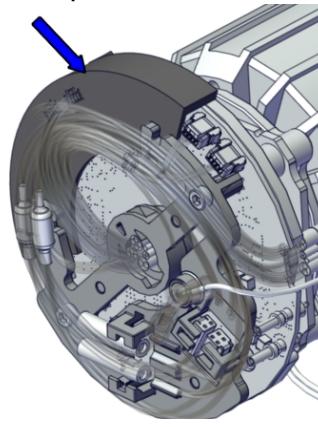
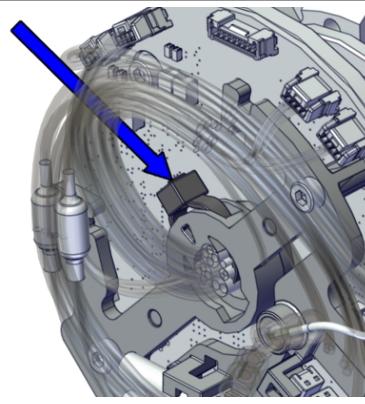
	Action	Note
1	Cut the cable ties.	 xx2000002161
2	Remove the functional and protective earth cables by removing the screw.	 xx2000002162
3	Snap loose and disconnect the connectors: <ul style="list-style-type: none">• J7.CS• J7.CP	 xx2000002163

Continues on next page

5.3.7 Replacing the axis-6 cabling Continued

Action	Note
<p>4 Disconnect the connectors from the drive board.</p> <ul style="list-style-type: none"> • D6.X1 • D6.DC+ • D6.DC- • D6.X4 • D6.X2 • D6.X5 <p>Use tweezers, if needed.</p>	<p>Tweezers</p>  <p>xx2000002164</p>

Removing the joint cable

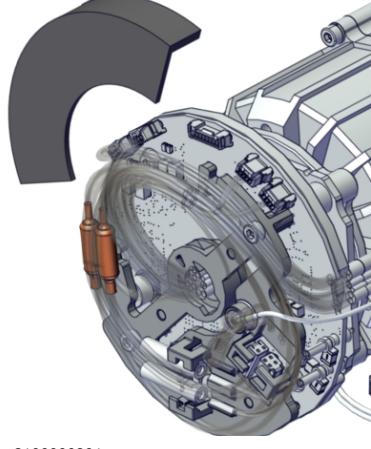
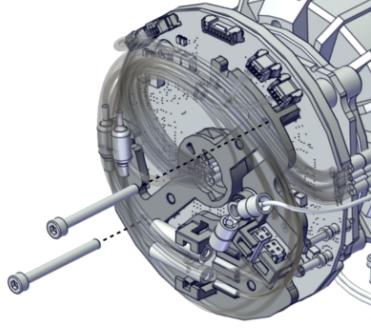
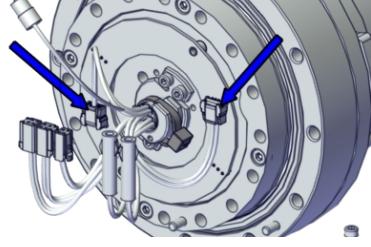
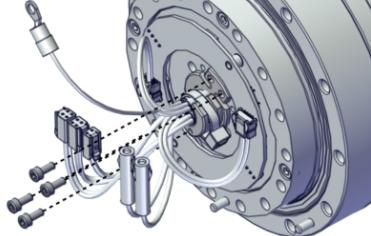
Action	Note
<p>1  ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42.</p>	
<p>2 Fit the protection plate to the drive board unit.</p> <p> Tip</p> <p>Using the protection plate is important for protecting the drive board unit. If complete joint unit is to be replaced, the protection plate is not needed.</p>	<p>Protection plate: 3HAC077790-001</p>  <p>xx2000002057</p>
<p>3 Cut the cable tie at the drive board.</p>	 <p>xx2000002058</p>

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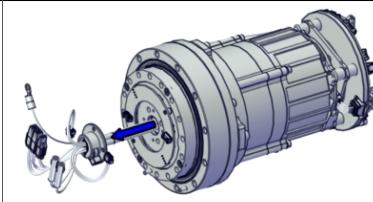
5 Repair

5.3.7 Replacing the axis-6 cabling

Continued

Action	Note
4 Remove the protection plate.	 xx2100000301
5 Remove the cable support from the drive board by removing the attachment screws.	 xx2000002055
6 Disconnect the two connectors from the torque sensor board. <ul style="list-style-type: none"> • TQ.A • TQ.B 	 xx2000002053
7 Remove the cable plate by removing the attachment screws.	 xx2000002049

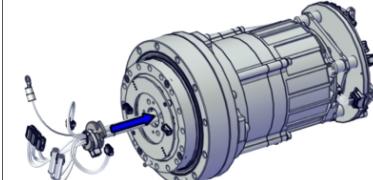
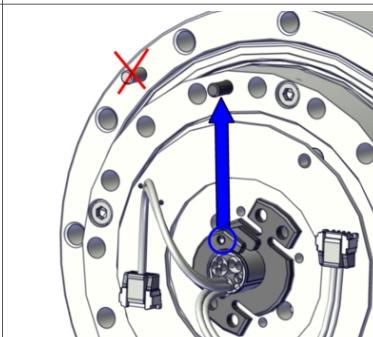
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	Action	Note
8	<p>Remove the joint cable from the hollow shaft from the torque sensor side.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	

Refitting the joint cabling

Use these procedures to refit the joint-6 cabling.

Refitting the joint cable

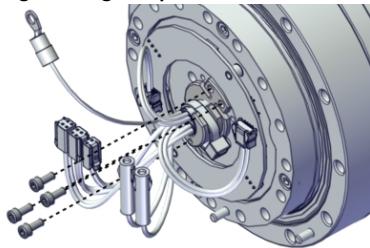
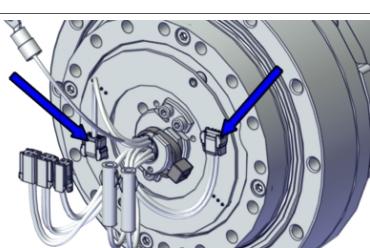
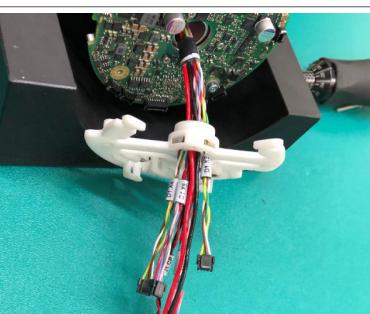
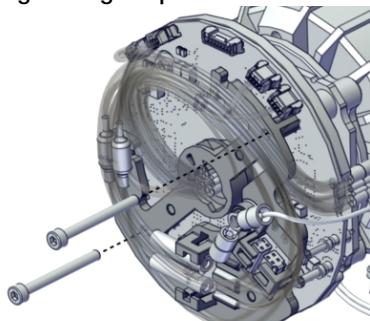
	Action	Note
1	<p>ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42.</p>	
2	<p>Place the joint cable through the hollow shaft from the torque sensor side.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	
3	<p>Orient the cable plate according to the figure. The circle on the cable plate should point towards the guide pin on the torque sensor.</p>	

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5 Repair

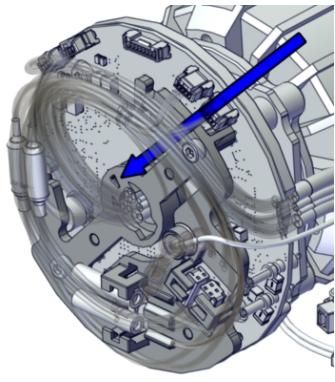
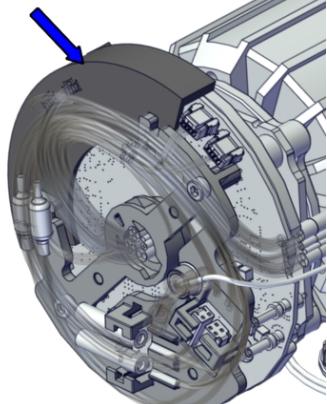
5.3.7 Replacing the axis-6 cabling

Continued

	Action	Note
4	Secure the cable plate to the joint unit with the attachment screws.	<p>Hex socket head cap screw: M2.5x6 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000002049</p>
5	<p>Connect the two connectors to the torque sensor board.</p> <ul style="list-style-type: none"> • TQ.A to CH1/A • TQ.B to CH2/B 	 <p>xx2000002053</p>
6	Insert the cabling through the cable support and fit the support to the drive board with the attachment screws.	 <p>xx2000002056</p> <p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (2 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000002055</p>

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5.3.7 Replacing the axis-6 cabling
Continued

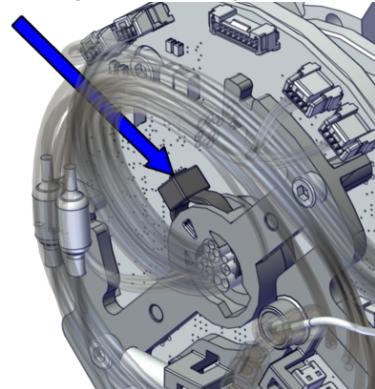
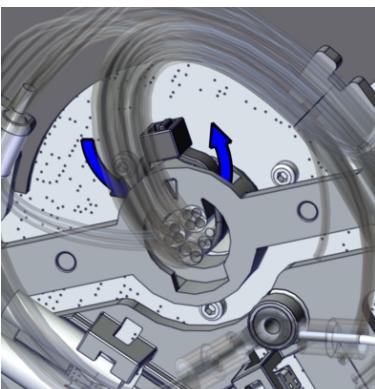
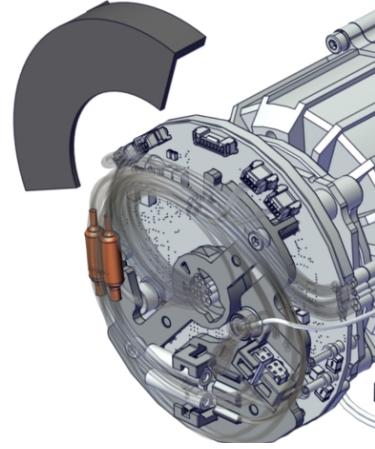
	Action	Note
7	Align the triangle direction mark on the cable support and the white mark on the cable harness. Use the cable tie to pre-fix the cable by hand.	 xx2100000507
		 xx2100000508
8	Fit the protection plate to the drive board unit.	Protection plate: 3HAC077790-001  xx2000002057

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5 Repair

5.3.7 Replacing the axis-6 cabling

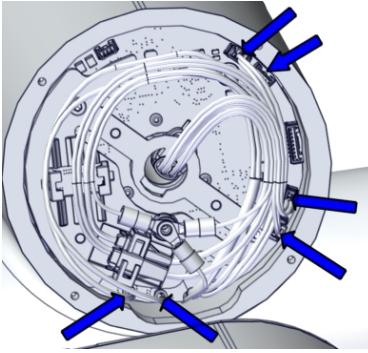
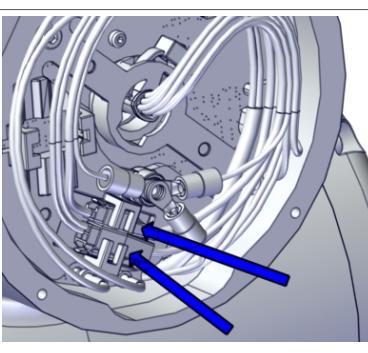
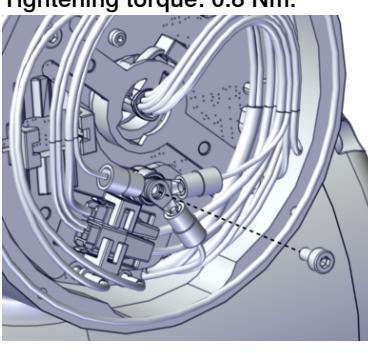
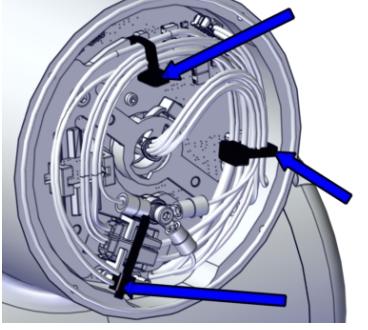
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	Action	Note
9	Secure the cables to the cable support with a cable tie, using a cable tie gun. Assembly direction for the cable tie is shown in the figure.	<p>Cable tie: 3HAC075545-001. For securing joint unit cable. Cable tie gun EVO7 Setting for cable tie gun: 6.75.</p>  <p>xx2000002058</p>  <p>xx2000002059</p>
10	Remove the protection plate.	 <p>xx2100000301</p>

Continues on next page

5.3.7 Replacing the axis-6 cabling
Continued

Connecting the axis-6 joint unit cabling

	Action	Note
1	Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D6.X1 to X1 • D6.DC+ to +DC • D6.DC- to Ground • D6.X4 to X4 • D6.X2 to X2 • D6.X5 to X5 	 xx2000002164
2	Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J7.CS to J7.CS • J7.CP to J7.CP 	 xx2000002163
3	Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000002162
4	Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000002161

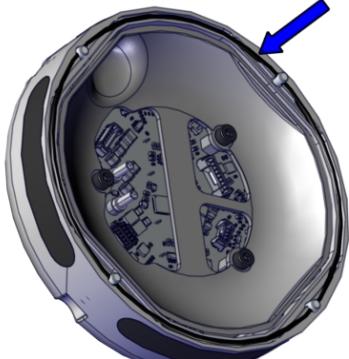
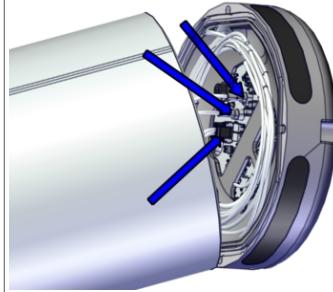
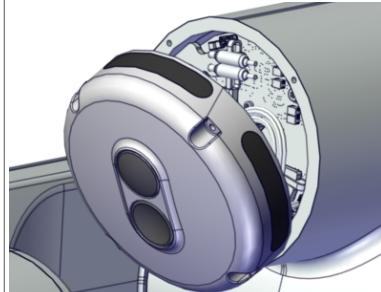
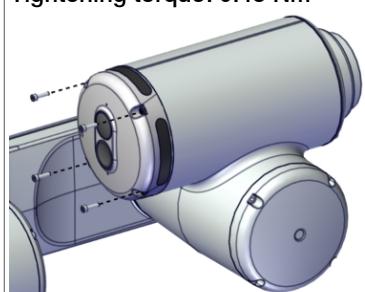
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5 Repair

5.3.7 Replacing the axis-6 cabling

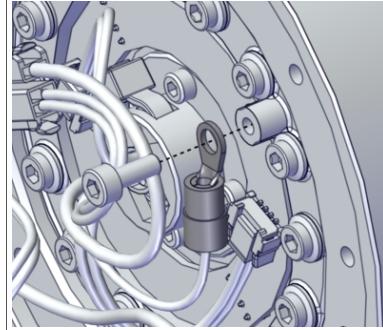
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Refitting the arm-side interface

	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-051  xx2000002551
2	Place the arm-side interface at mounting position and reconnect the connectors. <ul style="list-style-type: none"> • ASI.DC+ • ASI.DC- • ASI.X1 The correct orientation of the arm-side interface is with the convex button in upper position.  Note Do not leave the arm-side interface in location without being secured with the attachment screws.	 xx2100000335  xx2100000336
3	Refit the arm-side interface with four screws.	Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm  xx2000002550

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Connecting the tool flange functional earth cable

	Action	Note
1	Secure the cable for functional earth to the tool flange adapter with a screw.	 xx2000002159

Refitting the tool flange

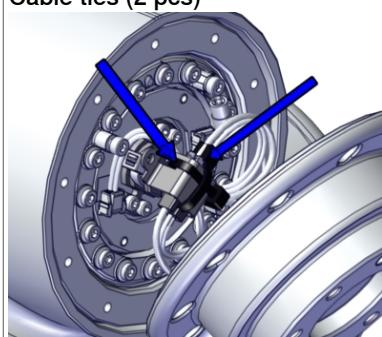
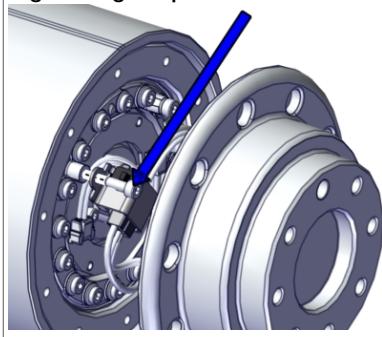
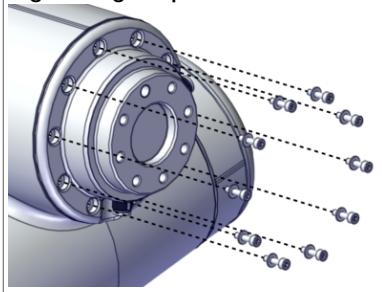
	Action	Note
1	Check the o-ring on the tool flange and lubricate with grease. Replace if damaged.	Axis-6 flange: 3HAC073953-001 O-ring: 3HAB3772-182 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000002197
2	Place the tool flange at mounting position and reconnect the CP/CS connectors.	 xx2000002158

Continues on next page

5 Repair

5.3.7 Replacing the axis-6 cabling

Continued

	Action	Note
3	Fit the connectors to the cable bracket and secure the connectors with two cable ties.	<p>Cable ties (2 pcs)</p>  <p>xx2000002157</p>
4	Refit the cable bracket with the screw.	<p>Hex socket head cap screw: M3x20 12.9 Gleitmo 603+Geomet 500 (1 pcs) Tightening torque: 0.8 Nm.</p>  <p>xx2000002156</p>
5	Refit and secure the tool flange with screws and washers.	<p>Hex socket head cap screw: M3x12 12.9 Gleitmo 603+Geomet 500 (10 pcs) Spring washer: 7x3.2x0.6 Steel (10 pcs) Tightening torque: 1.8 Nm.</p>  <p>xx2000002155</p>

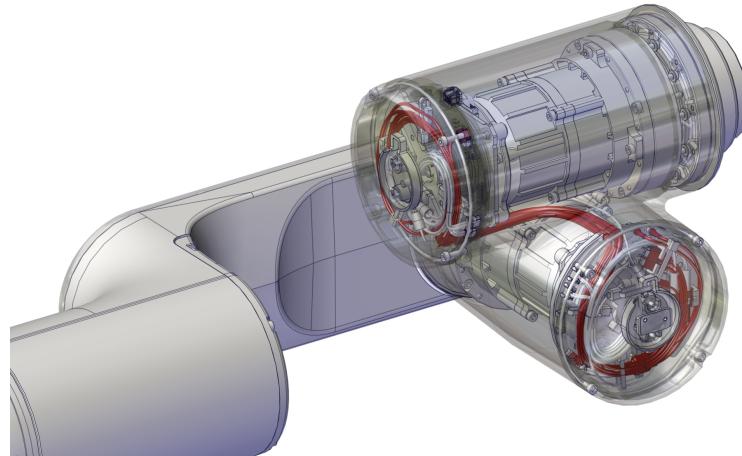
Concluding procedure

	Action	Note
1	 DANGER Make sure all safety requirements are met when performing the first test run.	

5.3.8 Replacing the axis-5 to axis-6 transition cabling

Location of the cable harness

The cable harness is located as shown in the figure.



xx2100000091

Summary of the replacement procedure

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

- 1 Remove the tubular cover.
- 2 Separate the cabling between the tubular and the tilt (at the axis-4 joint unit).
- 3 Remove the tilt and place on a workbench.
- 4 Remove the axis-6 joint unit.
- 5 Remove the axis-5 cover.
- 6 Remove the axis-5 joint unit. Move the cabling from old to new joint unit.
- 7 Replace the axis-5 to axis-6 transition cabling.

Replacing the axis-5 to axis-6 transition cabling

The replacement procedure is identical to replacing the axis-5 joint unit.

Follow procedure [Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling on page 542](#).

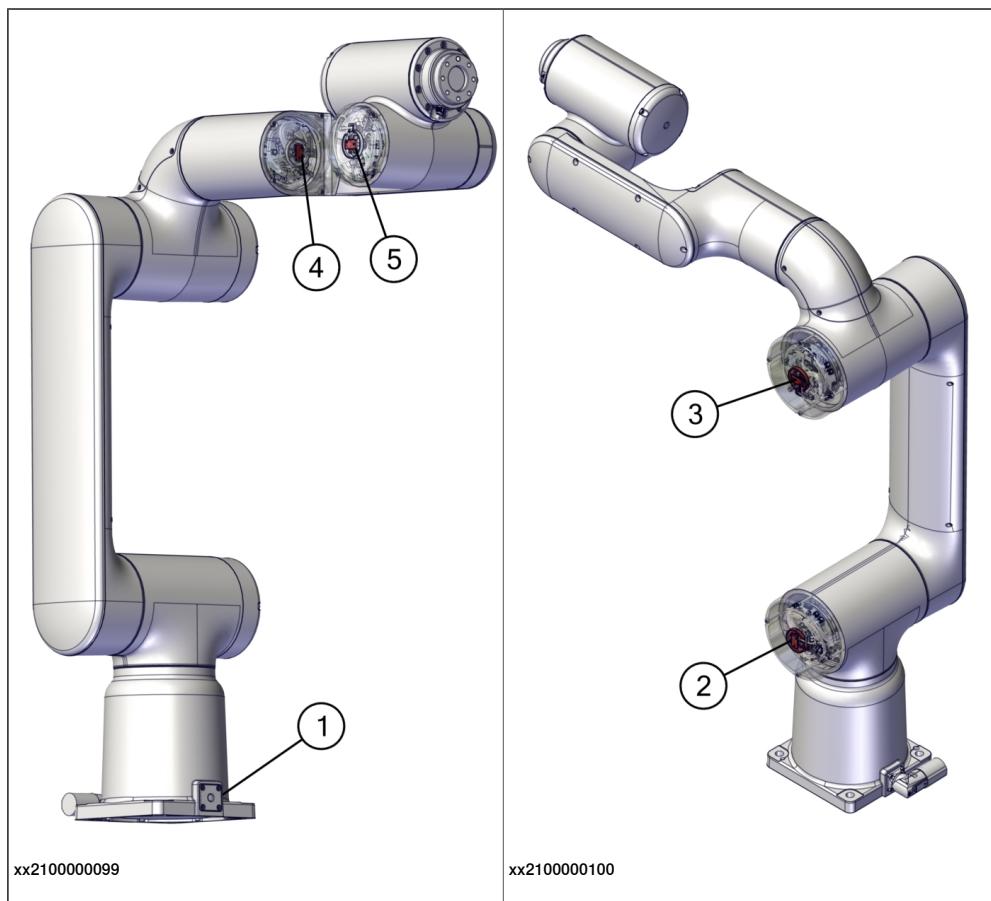
5 Repair

5.3.9 Replacing the brake release unit

5.3.9 Replacing the brake release unit

Location of the brake release unit

The brake release units are located as shown in the figure.



Summary of the replacement procedure

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

Axis-1 brake release unit

- 1 Jog the robot to transportation position.
- 2 Loosen the robot from the foundation and lay it down on its back.
This step requires two persons.
- 3 Remove the base cover.
- 4 Replace the brake release unit.

Axis-2/-3/-4/-5 brake release unit

- 1 Open the joint unit cover.
- 2 Replace the brake release unit.

Continues on next page

Required spare parts**Note**

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Spare part	Article number	Note
Brake release unit	3HAC079144-001	Axis 1
Brake release unit	3HAC079145-001	Axes 2, 3, 4 and 5

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cable ties	-	
O-ring, nitrile rubber	3HAB3772-119	Axis-1 brake release unit Replace if damaged.
O-ring, nitrile rubber	3HAB3772-64	Base cover
O-ring	3HAC061327-047	Cover for axis 2/3 Replace if damaged.
O-ring	3HAC061327-051	Axis-4 cover Replace if damaged.
O-ring	3HAC061327-051	Axis-5 cover Replace if damaged.
Grease	3HAC031695-001	Harmonic Grease 4B No.2 Used to lubricate the seals.
Grease	3HAC042536-001	Shell Gadus S2

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5 Repair

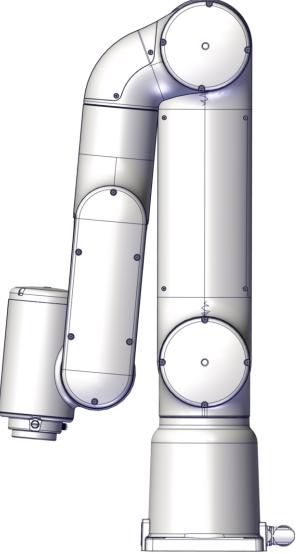
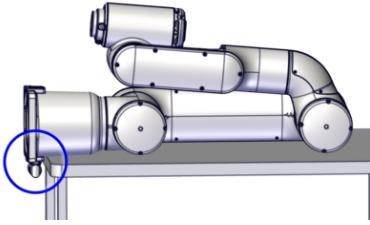
5.3.9 Replacing the brake release unit

Continued

Replacing the brake release unit for axis 1

Use these procedures to replace the brake release unit.

Preparations before removing the brake release unit

	Action	Note
1	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none">• Axis 1: 0°• Axis 2: 0°• Axis 3: +85°• Axis 4: 0°• Axis 5: 0°• Axis 6: 0°	 xx2100000113
2	<p> CAUTION</p> <p>Turn off all supplies for electrical power to the robot, before starting the repair work.</p>	
3	<p>Prepare a working bench where the robot can be laid down on its back with the base socket outside the table edge.</p>	 xx2100000414

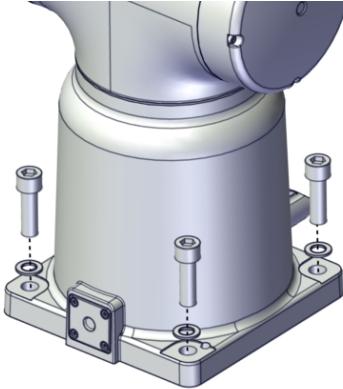
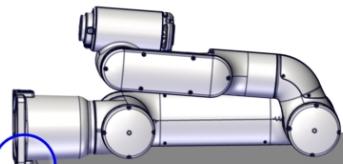
Laying down the robot

	Action	Note
1	<p> CAUTION</p> <p>The CRB 15000 robot weighs 28 kg. A minimum of two persons are required for lifting as well as securing the robot in order to avoid any damage, instability, and injury.</p>	

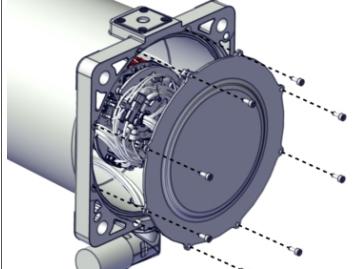
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5.3.9 Replacing the brake release unit

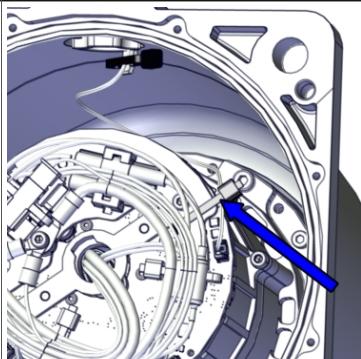
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Action	Note
<p>2 Loosen the robot from the foundation.</p> <ul style="list-style-type: none"> Person 1: keep holding the robot stable. Person 2: loosen the robot base from the foundation by removing the attachment screws and washers. Both persons: grasp the robot at appropriate locations and lay it down on its back on a working bench. Do not damage the base socket. <p>CAUTION</p> <p>Do not leave the robot standing unfastened to the foundation, it is not stable on its own.</p>	 <p>xx2100000415</p>  <p>xx2100000414</p>

Removing the base cover

Action	Note
1 Remove the bottom cover by removing the attachment screws.	 <p>xx2000002007</p>

Removing the brake release unit

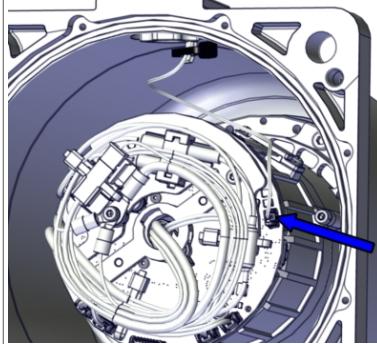
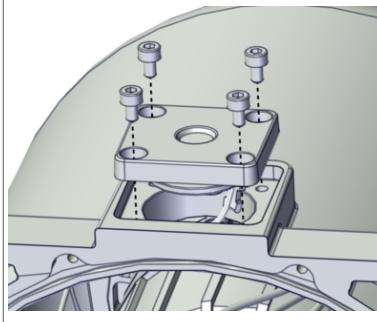
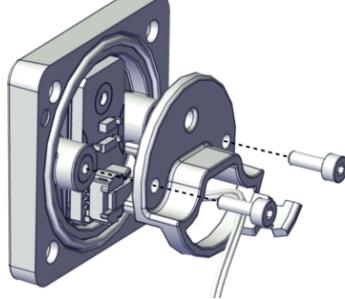
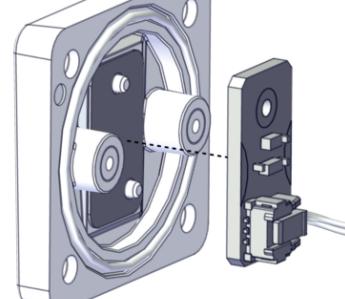
Action	Note
1 Cut the cable tie.	 <p>xx2100000410</p>

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5 Repair

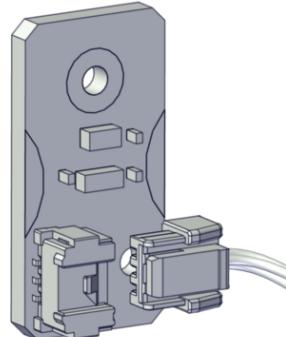
5.3.9 Replacing the brake release unit

Continued

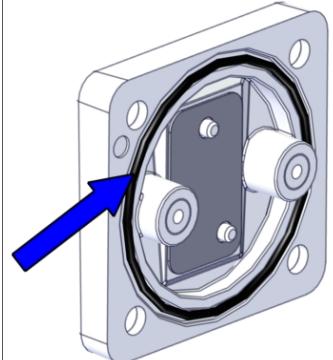
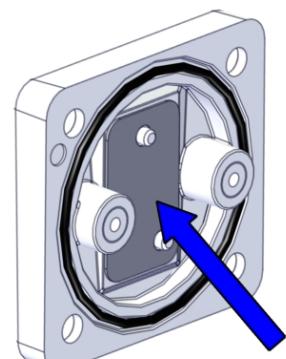
	Action	Note
2	Disconnect the brake release cable from the board.	 xx2100000411
3	Remove the brake release unit by removing the screws.	 xx2100000413
4	Remove the brake release cover by removing the two screws.	 xx2100000416
5	Remove the brake release board.	 xx2100000418

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5.3.9 Replacing the brake release unit
Continued

Action	Note
6 Disconnect the brake release cable from the board.	 xx2100000417

Refitting the brake release unit

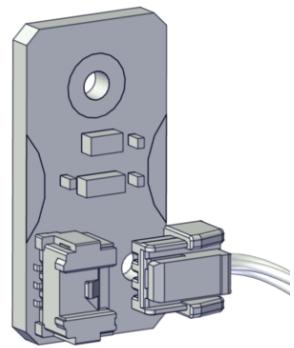
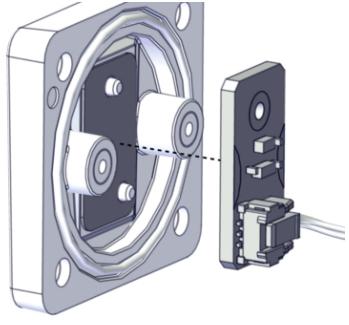
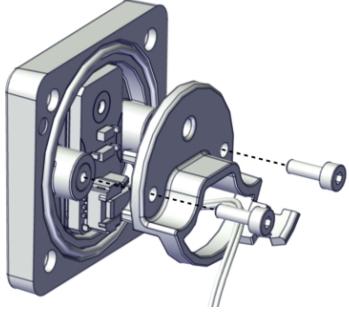
Action	Note
1 Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring, nitrile rubber: 3HAB3772-119 Grease: 3HAC031695-001 Harmonic Grease 4B No.2 Used to lubricate the seals.  xx2100000419
2 If not already fitted, place the sheet metal inside the cover.	 xx2100000420

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5 Repair

5.3.9 Replacing the brake release unit

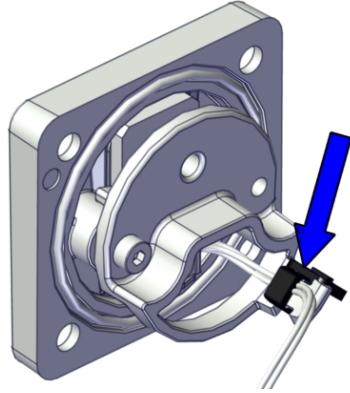
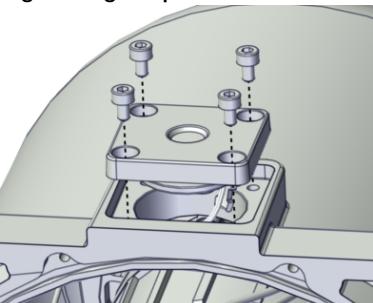
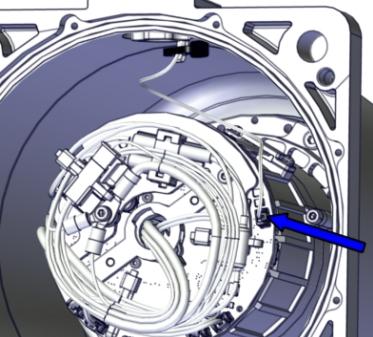
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	Action	Note
3	Connect the brake release cable to the board.	<p>Brake release unit: 3HAC079144-001</p>  <p>xx2100000417</p>
4	Fit the brake release board to the sheet metal.	 <p>xx2100000418</p>
5	Fit the brake release cover and secure with two screws.	<p>Screws: M2x6 12.9 Gleitmo 605 (2 pcs) Tightening torque: 0.2 Nm.</p>  <p>xx2100000416</p>

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5.3.9 Replacing the brake release unit

Continued

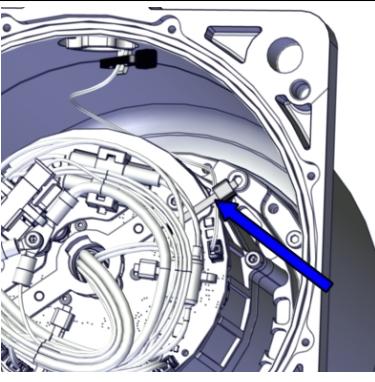
Action	Note
6 Secure the brake release cable with a cable tie.	 xx2100000421
7 Refit the brake release unit with the screws. Screws: M3x5 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm.	 xx2100000413
8 Reconnect the brake release connector DR.X8 to the drive board.	 xx2100000411

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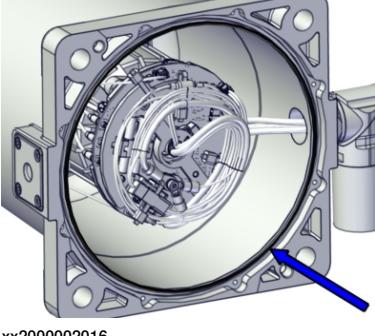
5 Repair

5.3.9 Replacing the brake release unit

Continued

Action	Note
9 Secure the brake release cable with a cable tie.	 xx2100000410

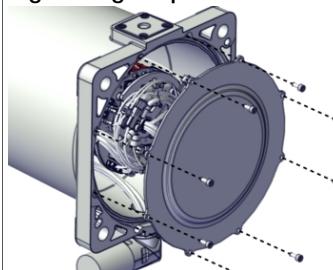
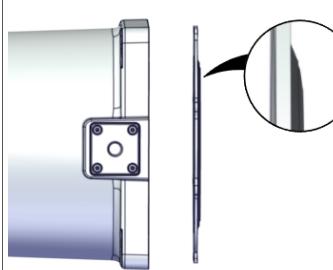
Refitting the base cover

Action	Note
1 Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring, nitrile rubber: 3HAB3772-64 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000002016

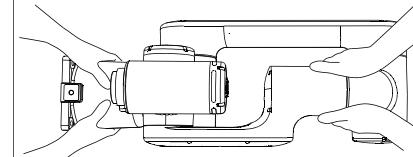
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5.3.9 Replacing the brake release unit

Continued

Action	Note
<p>2 Refit the bottom cover with the attachment screws.</p> <p>Note</p> <p>Fit the cover in correct direction, the protrusion of the cover must face outwards.</p>	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (8 pcs) Tightening torque: 1.2 Nm.</p>  <p>xx2000002007</p>  <p>xx2100000268</p>

Lifting and securing the robot

Action	Note
<p>1 CAUTION</p> <p>The CRB 15000 robot weighs 28 kg. A minimum of two persons are required for lifting as well as securing the robot in order to avoid any damage, instability, and injury.</p> <p>Special consideration is necessary when mounting the robot in an elevated, suspended or wall mounted position.</p>	
<p>2 Grasp the robot at the foot and elbow, as shown in the figure, and lift it up from the transportation package.</p>	 <p>xx2100000118</p>
<p>3 CAUTION</p> <p>Do not leave the robot standing unfastened to the foundation, it is not stable on its own.</p>	
<p>4 Fit two pins to the holes in the base.</p>	<p>Centering pins: DIN6325, hardened steel Ø6x24 mm, 2 pcs .</p>

Continues on next page

5 Repair

5.3.9 Replacing the brake release unit

Continued

Action	Note
5 Raise the robot to standing and secure to foundation, paying attention to the centering holes at the bottom of the robot base. <ul style="list-style-type: none">• Person 1: keep holding the robot stable.• Person 2: secure the robot base to the foundation with the securing screws and washers.	Screws: M10x35, 4 pcs, quality 8.8 Washers: 23/10.5/2.5 mm Steel
6 Tighten the bolts in a crosswise pattern to ensure that the base is not distorted.	Tightening torque: 30 Nm ±10%

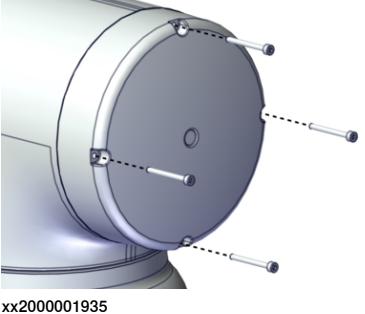
Concluding procedure

Action	Note
1  DANGER Make sure all safety requirements are met when performing the first test run.	

Replacing the brake release unit for axes 2, 3, 4 and 5

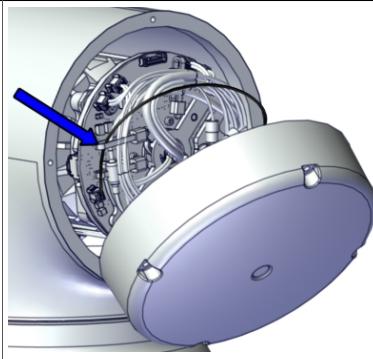
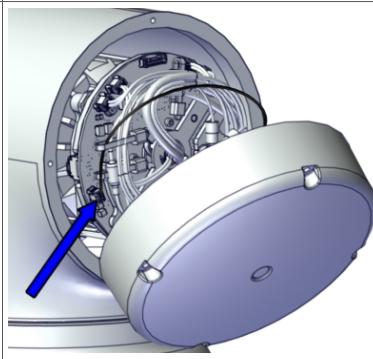
Use these procedures to replace the brake release unit.

Opening the joint unit cover

Action	Note
1  CAUTION Make sure that all supplies for electrical power are turned off.	
2 Remove the cover screws.	
3  CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	

Continues on next page

5.3.9 Replacing the brake release unit
Continued

	Action	Note
4	Open the cover and cut the cable tie that holds the brake release cable.	 xx2000001931
5	Disconnect the brake release connector from the drive board. Remove the cover.	 xx2000001932

Removing the brake release unit

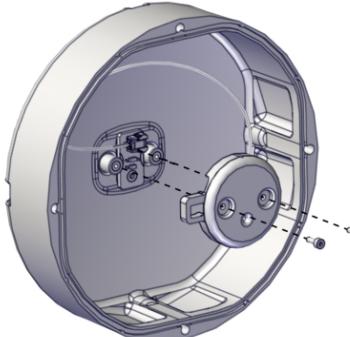
	Action	Note
1	Cut the cable tie.	 xx2100000096

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5 Repair

5.3.9 Replacing the brake release unit

Continued

Action	Note
2 Remove the brake release cover by removing the two screws.	 xx2100000095
3 Disconnect the brake release cable from the board.	 xx2100000094
4 Remove the brake release board.	 xx2100000093

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Refitting the brake release unit

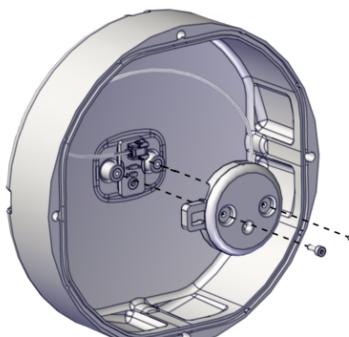
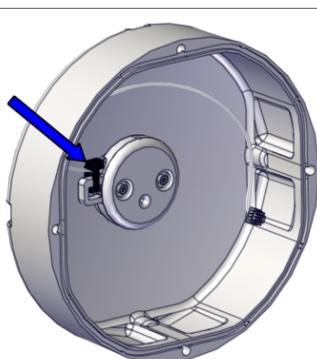
	Action	Note
1	If not already fitted, place the sheet metal inside the cover.	 xx2100000092
2	Fit the brake release board to the sheet metal.	 xx2100000093
3	Connect the brake release cable to the board.	 xx2100000094

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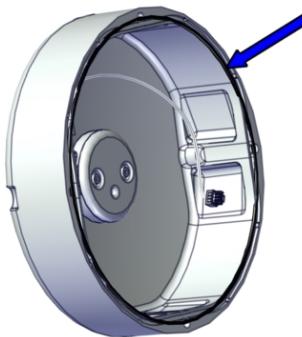
5 Repair

5.3.9 Replacing the brake release unit

Continued

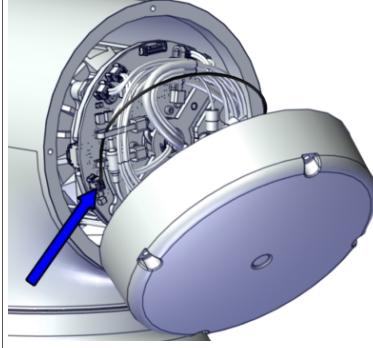
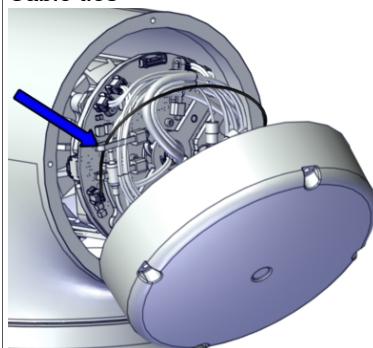
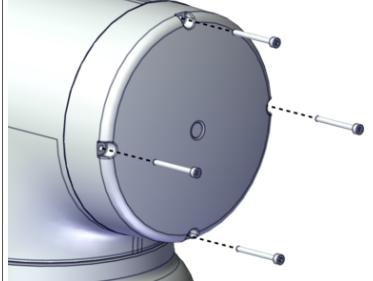
	Action	Note
4	Fit the brake release cover and secure with two screws.	Screws: M2x6 12.9 Gleitmo 605 (2 pcs) Tightening torque: 0.2 Nm.  xx2100000095
5	Secure the cable with a cable tie.	 xx2100000096

Closing the joint unit cover

	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-047  xx2000001962

Continues on next page

5.3.9 Replacing the brake release unit
Continued

	Action	Note
2	Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board. Orient the cover for proper arrangement of the brake release cable.	 xx2000001932
3	Secure the brake release cable with a cable tie.	Cable ties  xx2000001931
4	Refit the cover with the four screws.	Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm  xx2000001935

Concluding procedure

	Action	Note
1	 DANGER Make sure all safety requirements are met when performing the first test run.	

5 Repair

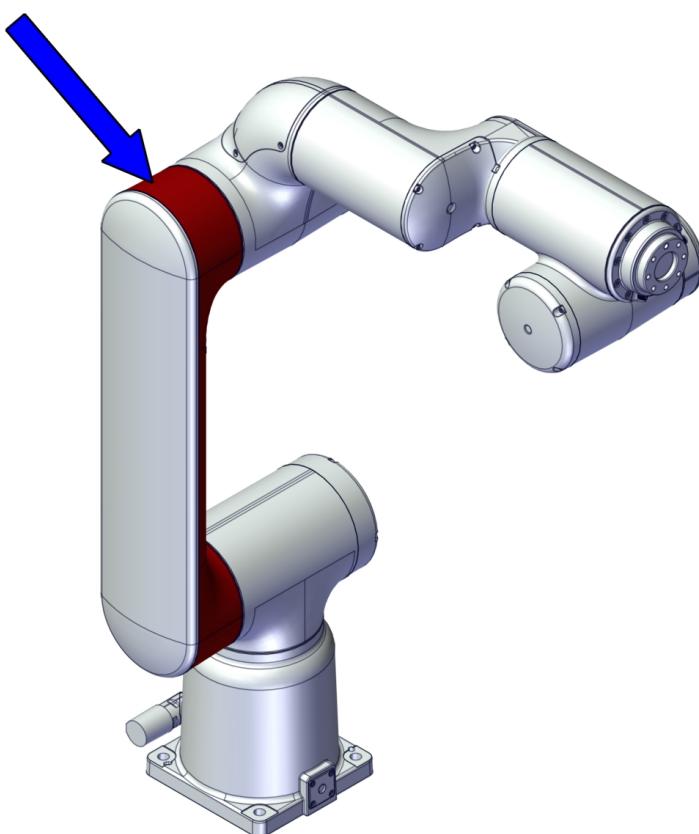
5.4.1 Replacing the lower arm

5.4 Upper and lower arms

5.4.1 Replacing the lower arm

Location of the lower arm

The lower arm is located as shown in the figure.



xx2000001928

Summary of the replacement procedure

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

- 1 Separate the cabling between the swing and the lower arm.
- 2 Remove the upper arm.
- 3 Replace the lower arm.

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

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Spare part	Article number	Note
Lower arm	3HAC073948-001	

Required tools and equipment

Equipment	Article number	Note
Guide pin, M4x120	3HAC077786-001	Always use guide pins in pairs.
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Grease	3HAC042536-001	Shell Gadus S2
Cleaning agent	-	Isopropanol
Flange sealant	-	Loctite 574
Cable ties	-	
O-ring	3HAC061327-047	Cover for axis 2/3 Replace if damaged.
O-ring	3HAC061327-044	Lower arm, inner cover. 1 pcs / cover. Replace if damaged.

Removing the lower arm

Use these procedures to remove the lower arm.

Preparations before removing the lower arm

	Action	Note
1	Jog the robot to the synchronization position.	
2	 CAUTION Turn off all supplies for electrical power to the robot, before starting the repair work.	

Removing the lower arm covers

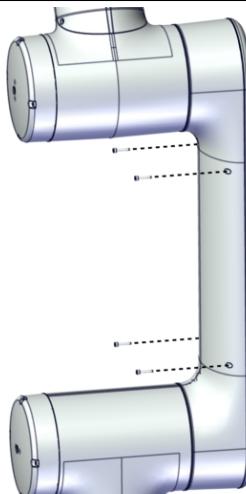
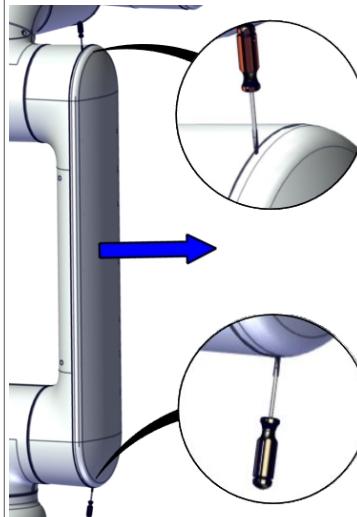
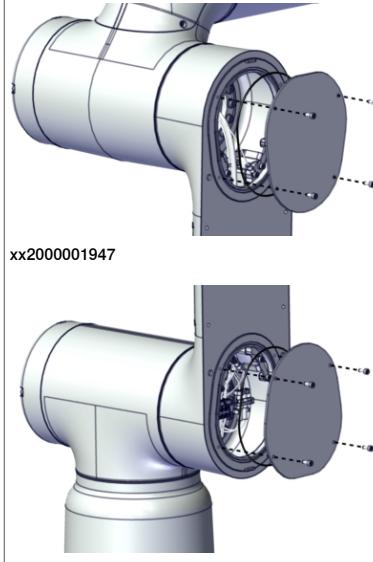
	Action	Note
1	 CAUTION Make sure that all supplies for electrical power are turned off.	

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5 Repair

5.4.1 Replacing the lower arm

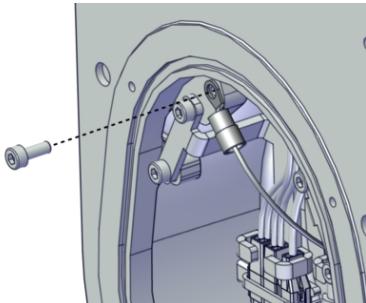
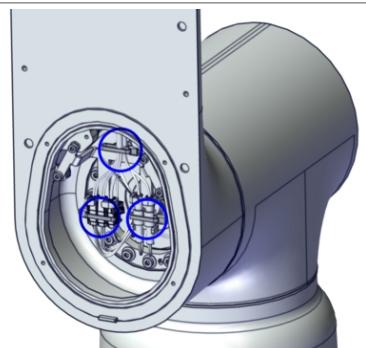
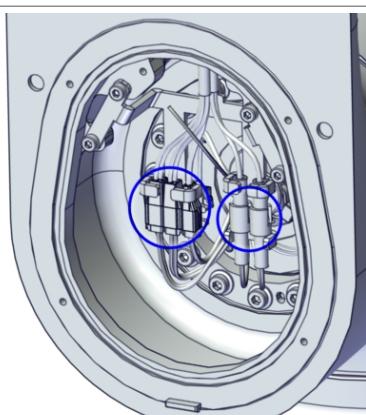
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Action	Note
2 Remove the four lower arm cover screws.	 xx2000001929
3 Remove the cover by inserting a small flat screwdriver to snap open the locks at each end of the cover.	 xx2100000267
4 Remove the inner covers by removing the screws.	 xx2000001947 xx2000001930

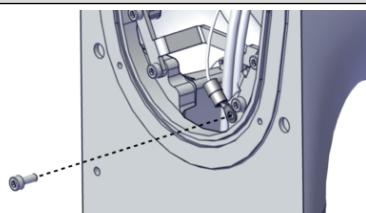
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5.4.1 Replacing the lower arm
Continued

Disconnecting the cabling between the lower arm and the swing

Action	Note
1 Remove the functional earth cable by removing the screw.	 xx2000001936
2 Cut the cable ties.	 xx2000001937
3 Snap loose and disconnect all connectors.	 xx2000001938

Loosening the cabling between the lower and upper arm

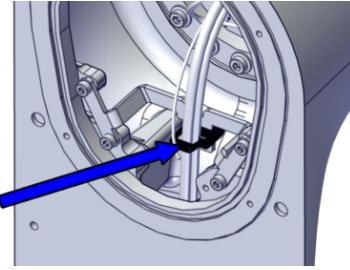
Action	Note
1 Remove the functional earth cable by removing the screw.	 xx2000001964

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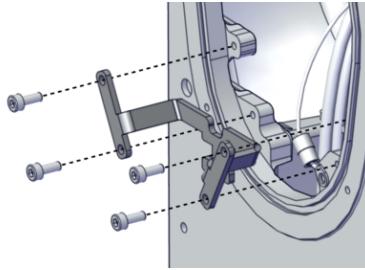
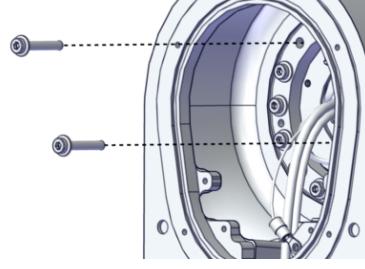
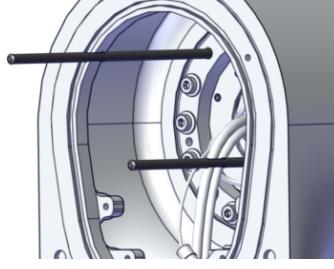
5 Repair

5.4.1 Replacing the lower arm

Continued

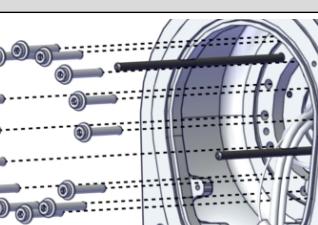
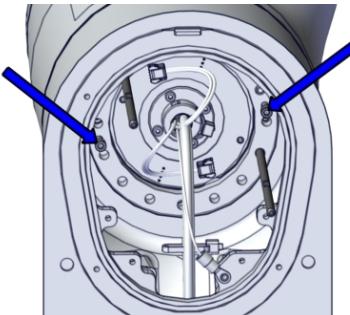
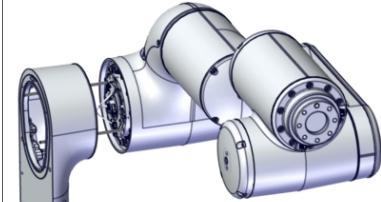
	Action	Note
2	Cut the cable tie.	 xx2000001965

Removing the upper arm

	Action	Note
1	Remove the cable bracket by removing the four screws.	 xx2000001966
2	Secure the weight of the upper arm.  CAUTION The weight of the complete upper arm is 14 kg.	
3	Remove two attachment screws.	 xx2000001967
4	Fit two guide pins to the axis-3 joint unit.	Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs.  xx2000001968

Continues on next page

5.4.1 Replacing the lower arm
Continued

Action	Note
5 Remove the remaining attachment screws.	 xx2000001969
6 Press the upper arm out of position by using two fully threaded attachment screws as removal tools.	 xx2100000001
7 Remove the upper arm from the lower arm. Assist the cabling to be removed from the lower arm while lifting away the complete upper arm. Place the upper arm on a workbench.	 xx2000001970

Removing the lower arm

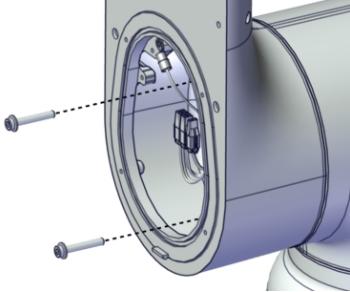
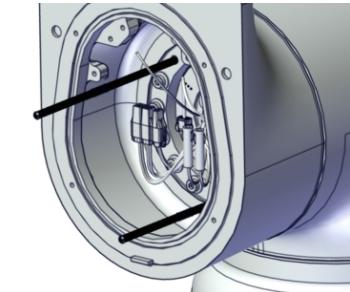
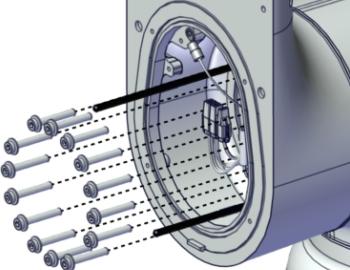
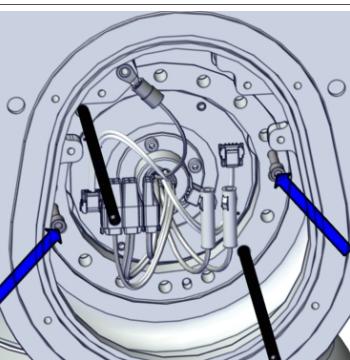
Action	Note
1 Secure the weight of the lower arm.	

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5 Repair

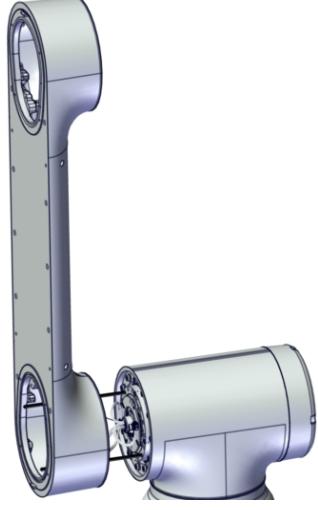
5.4.1 Replacing the lower arm

Continued

Action	Note
2 Remove two attachment screws and fit two guide pins to the axis-2 joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs.</p>  <p>xx2000001951</p>  <p>xx2000001960</p>
3 Remove the lower arm attachment screws.	 <p>xx2000001940</p>
4 Use two fully threaded attachment screws as removal tools to press the lower arm out of position.	 <p>xx2000002151</p>

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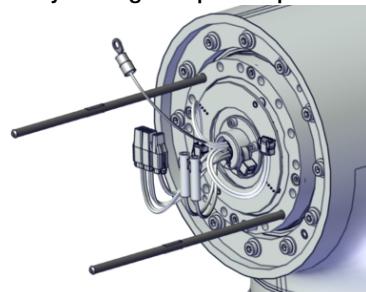
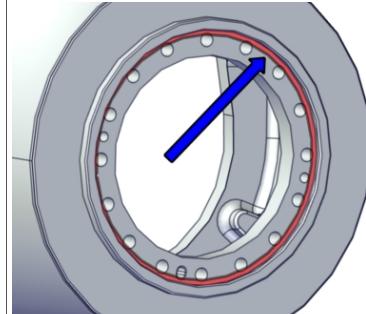
5.4.1 Replacing the lower arm
Continued

Action	Note
5 Remove the lower arm from the swing.	 xx2000001952

Refitting the lower arm

Use these procedures to refit the lower arm.

Refitting the lower arm

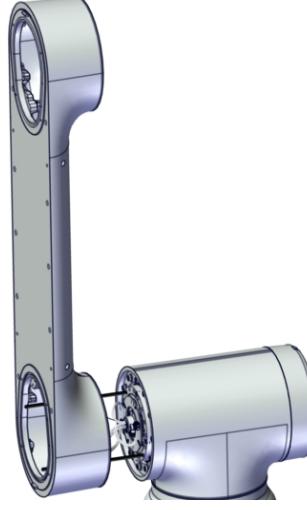
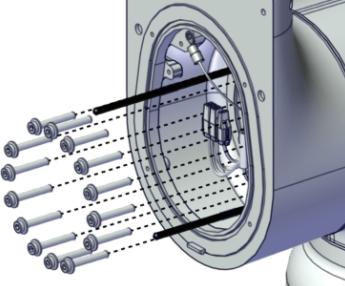
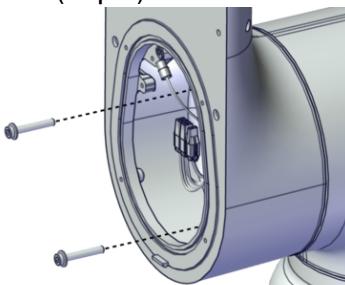
Action	Note
1 Fit two guide pins to the axis-2 joint unit.	Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs.  xx2000001949
2 Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the lower arm mounting surface, as pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001963

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5 Repair

5.4.1 Replacing the lower arm

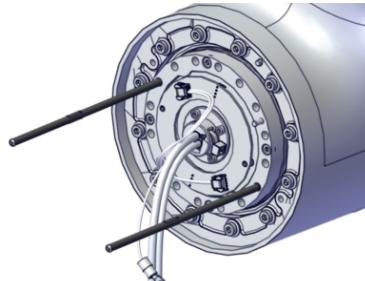
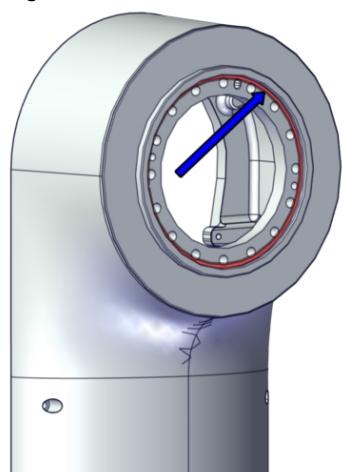
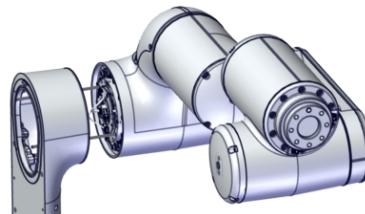
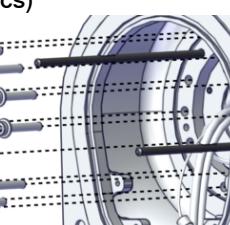
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Action	Note
3 Lift the lower arm to mounting position and slide it onto the guide pins.	 xx2000001952
4 Secure the lower arm to the swing with all attachment screws but two. Pre-tighten the screws crosswise firstly.	Hex socket head cap flange screw: M4x25 (16 pcs)  xx2000001940
5 Remove the guide pins and fasten the remaining two screws.	Hex socket head cap flange screw: M4x25 (16 pcs)  xx2000001951
6 Torque tighten all screws crosswise.	Tightening torque: 4.6 Nm.

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5.4.1 Replacing the lower arm
Continued

Refitting the upper arm

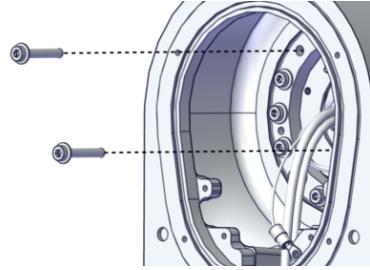
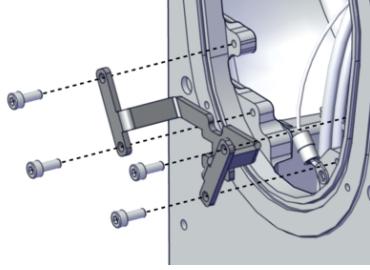
	Action	Note
1	Fit two guide pins to the axis-3 joint.	 xx2000001971
2	Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the lower arm mounting surface, as pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001973
3	Lift the upper arm into mounting position while inserting the cabling into the lower arm.	
4	Slide the upper arm into place on the guide pins.	 xx2000001970
5	Secure the upper arm to the lower arm with all attachment screws but two. Pre-tighten the screws crosswise firstly.	Hex socket head cap flange screw: M4x25 (16 pcs)  xx2000001969

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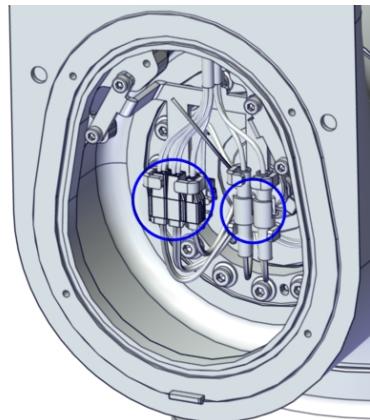
5 Repair

5.4.1 Replacing the lower arm

Continued

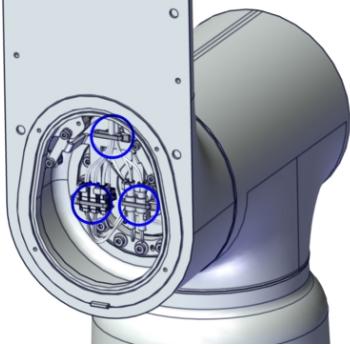
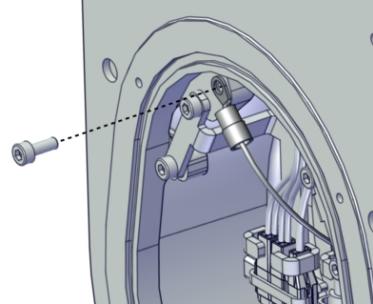
Action	Note
6 Remove the guide pins and fasten the remaining two screws.	Hex socket head cap flange screw: M4x25 (16 pcs)  xx2000001967
7 Torque tighten all screws crosswise.	Tightening torque: 4.6 Nm.
8 Refit the cable bracket with the four screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.8 Nm  xx2000001966

Connecting the cabling between the lower arm and swing

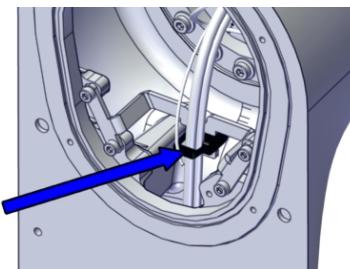
Action	Note
1 Connect the connectors to each other and snap them to the cable holders.	 xx2000001938

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5.4.1 Replacing the lower arm
Continued

	Action	Note
2	Secure the cabling with cable ties.	<p>Cable ties (3 pcs)</p>  <p>xx2000001937</p>
3	Connect the functional earth cable with the screw.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (1 pcs). Tightening torque: 0.8 Nm</p>  <p>xx2000001936</p>

Fastening the cabling between the lower and upper arm

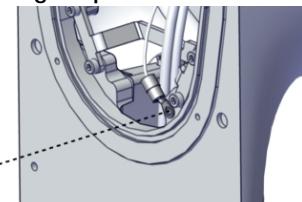
	Action	Note
1	Secure the cabling with the cable tie.	<p>Cable ties</p>  <p>xx2000001965</p>

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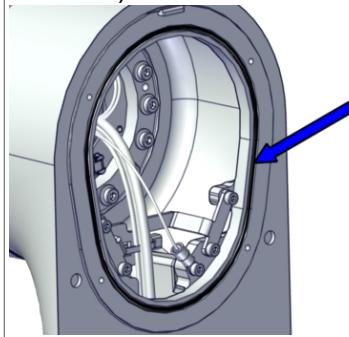
5 Repair

5.4.1 Replacing the lower arm

Continued

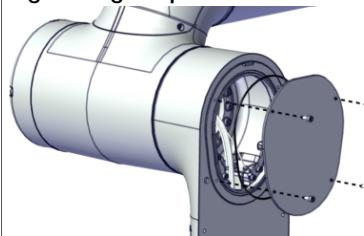
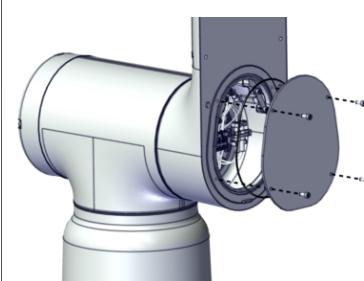
	Action	Note
2	Connect the functional earth cable with the screw.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (1 pcs). Tightening torque: 0.8 Nm</p>  <p>xx2000001964</p>

Refitting the lower arm covers

	Action	Note
1	Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	<p>O-ring: 3HAC061327-044 Grease: 3HAC042536-001 (Shell Gadus S2)</p>  <p>xx2000001955</p>  <p>xx2000001954</p>

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5.4.1 Replacing the lower arm
Continued

Action	Note
2 Refit the inner covers with four screws each.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (8 pcs) Tightening torque: 1.4 Nm.</p>  <p>xx2000001947</p>
3 Snap the lower arm cover into place.	
4 Secure the cover with four screws.	<p>Hex socket head cap screw: M3x16 12.9 Gleitmo 603+Geomet 500 (Black Oxide) (4 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000001930</p>

Concluding procedure

Action	Note
<p>DANGER</p>  <p>Make sure all safety requirements are met when performing the first test run.</p>	

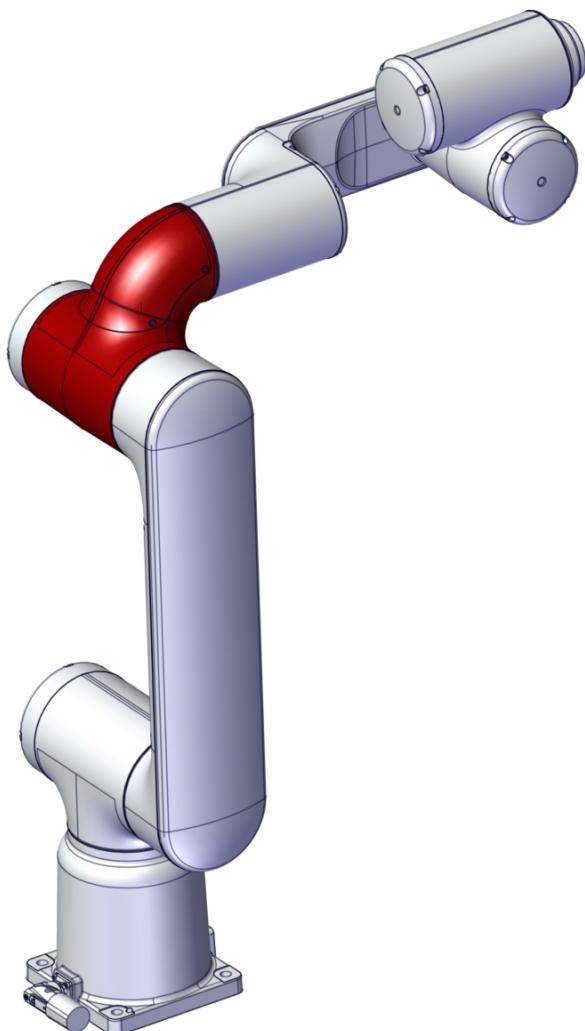
5 Repair

5.4.2 Replacing the housing

5.4.2 Replacing the housing

Location of the housing

The housing is located as shown in the figure.



xx2000002019

Summary of the replacement procedure

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

- 1 Disconnect the cabling between the lower arm and the upper arm.
- 2 Remove the upper arm and place on a workbench.
- 3 Remove the axis-3 joint unit.
- 4 Remove the tubular.
- 5 Replace the housing.

Continues on next page

Required spare parts**Note**

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Spare part	Article number	Note
Housing	3HAC073949-001	Also order new attachment screws for the axis-3 joint unit: 3HAB3413-435 (12 pcs).
Hex socket head cap flange screw with glue	3HAB3413-435	M4x35, 12 pcs Always use new screws when re-fitting a joint unit. If ordering a new joint unit spare part, new screws are included.
Cable tie	3HAC075545-001	For securing joint unit cable.

Required tools and equipment

Equipment	Article number	Note
Lifting aid	3HAC077788-001	For joint units on axes 1, 2 and 3. Attachment screws M4x35 (4 pcs) are enclosed.
Guide pin, M4x120	3HAC077786-001	Always use guide pins in pairs. For joint units on axes 1, 2 and 3.
Guide pin, M3x110	3HAC077787-001	Always use guide pins in pairs.
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cleaning agent	-	Isopropanol
Flange sealant	-	Loctite 574
Cable ties	-	
Gasket	3HAC075056-001	Cover inside housing Replace if damaged.
Hex socket head cap flange screw with glue	3HAB3413-435	M4x35, 12 pcs Always use new screws when re-fitting a joint unit. If ordering a new joint unit spare part, new screws are included.
O-ring	3HAC061327-047	Cover for axis 2/3 Replace if damaged.
O-ring	3HAC061327-044	Lower arm, inner cover. 1 pcs / cover. Replace if damaged.

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5 Repair

5.4.2 Replacing the housing

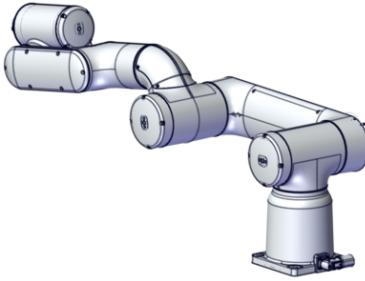
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Consumable	Article number	Note
Grease	3HAC042536-001	Shell Gadus S2

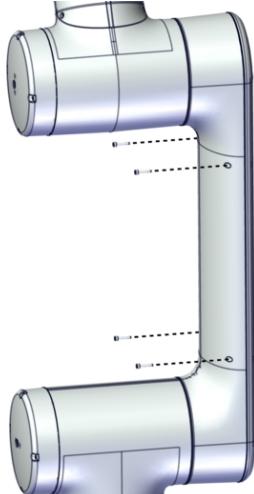
Removing the housing

Use these procedures to remove the housing.

Preparations before removing the housing

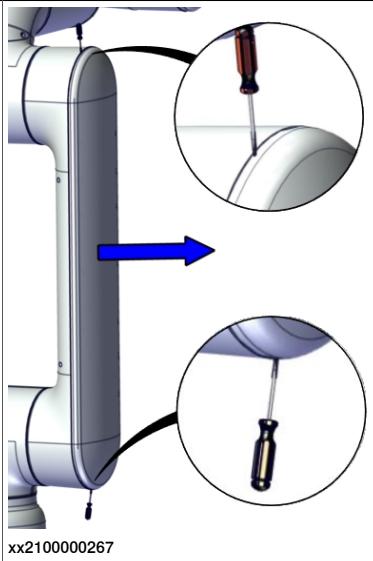
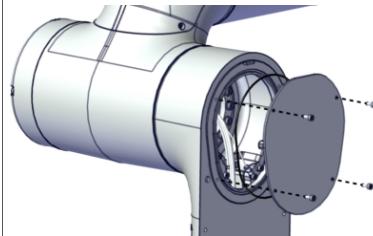
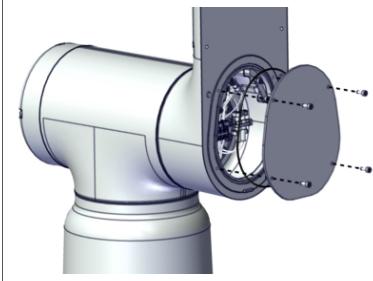
	Action	Note
1	Jog the robot to the specified position: <ul style="list-style-type: none">• Axis 1: 0°• Axis 2: +90° (suggested position for convenient working position)• Axis 3: -80°• Axis 4: 0°• Axis 5: 0°• Axis 6: 0°	 xx2100000002
2	 CAUTION Turn off all supplies for electrical power to the robot, before starting the repair work.	

Removing the lower arm covers

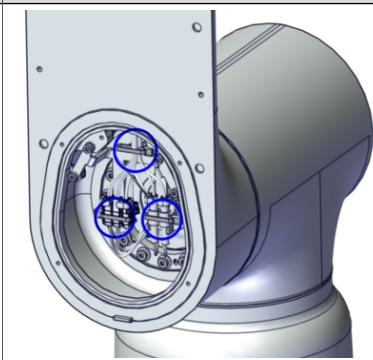
	Action	Note
1	 CAUTION Make sure that all supplies for electrical power are turned off.	
2	Remove the four lower arm cover screws.	 xx2000001929

Continues on next page

**5.4.2 Replacing the housing
Continued**

Action	Note
3 Remove the cover by inserting a small flat screwdriver to snap open the locks at each end of the cover.	 xx2100000267
4 Remove the inner covers by removing the screws.	 xx2000001947  xx2000001930

Disconnecting the upper arm cabling

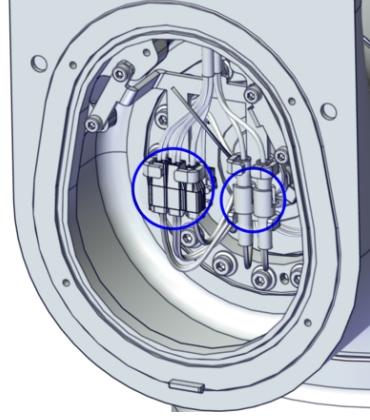
Action	Note
1 Cut the cable ties.	 xx2000001937

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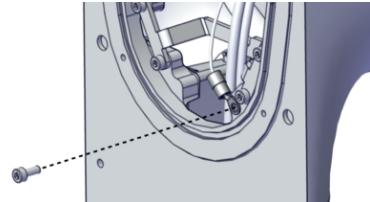
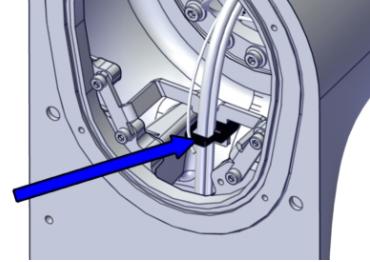
5 Repair

5.4.2 Replacing the housing

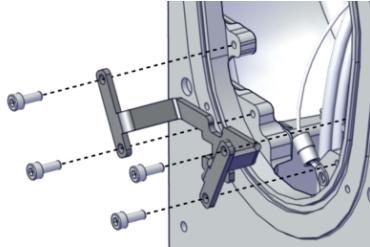
Continued

Action	Note
2 Snap loose and disconnect all connectors.	 xx2000001938

Loosening the cabling between the lower and upper arm

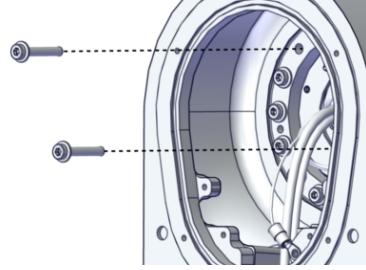
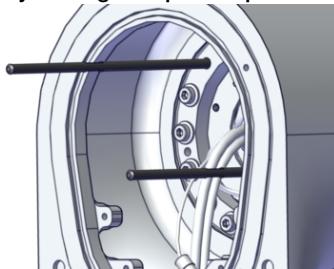
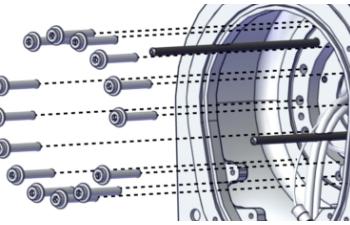
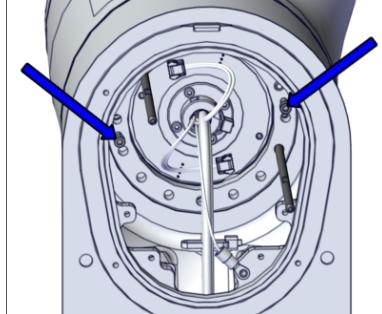
Action	Note
1 Remove the functional earth cable by removing the screw.	 xx2000001964
2 Cut the cable tie.	 xx2000001965

Removing the upper arm

Action	Note
1 Remove the cable bracket by removing the four screws.	 xx2000001966

Continues on next page

**5.4.2 Replacing the housing
Continued**

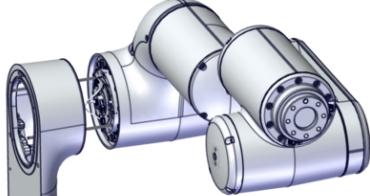
Action	Note
2 Secure the weight of the upper arm.  CAUTION The weight of the complete upper arm is 14 kg.	
3 Remove two attachment screws.	 xx2000001967
4 Fit two guide pins to the axis-3 joint unit.	Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs.  xx2000001968
5 Remove the remaining attachment screws.	 xx2000001969
6 Press the upper arm out of position by using two fully threaded attachment screws as removal tools.	 xx2100000001

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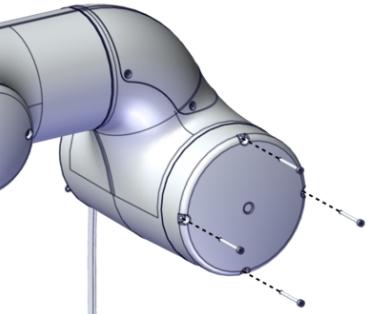
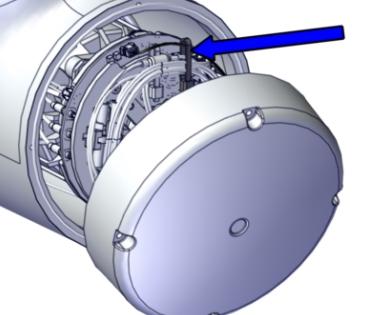
5 Repair

5.4.2 Replacing the housing

Continued

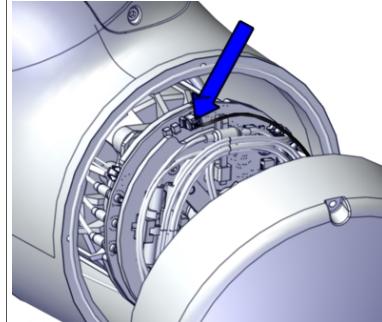
	Action	Note
7	<p>Remove the upper arm from the lower arm. Assist the cabling to be removed from the lower arm while lifting away the complete upper arm. Place the upper arm on a workbench.</p>	 xx2000001970

Removing the housing cover

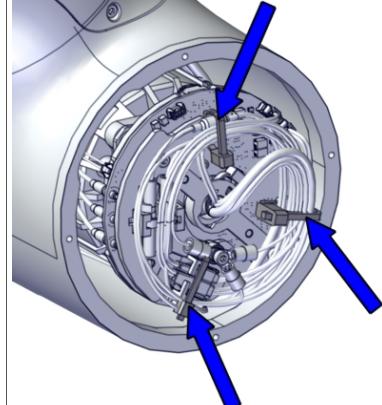
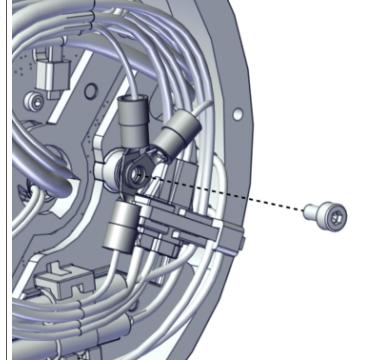
	Action	Note
1	 CAUTION Make sure that all supplies for electrical power are turned off.	
2	Remove the cover screws.	 xx2000002021
3	 CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	
4	Open the cover and cut the cable tie that holds the brake release cable.	 xx2000002022

Continues on next page

**5.4.2 Replacing the housing
Continued**

Action	Note
5 Disconnect the brake release connector from the drive board. Remove the cover.	 xx2000002023

Disconnecting the axis-3 joint unit cabling

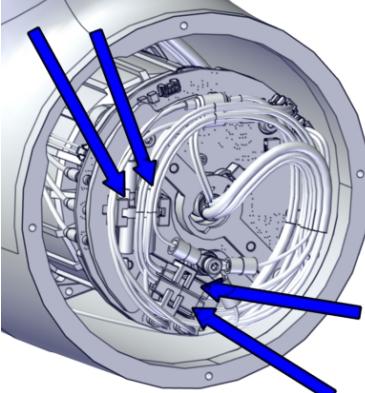
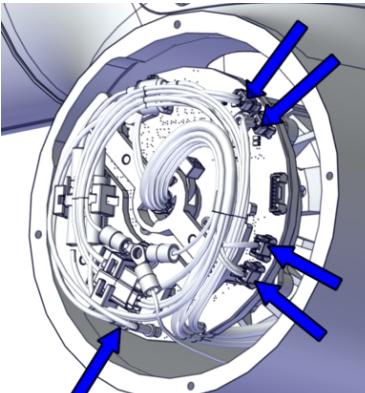
Action	Note
1 Cut the cable ties.	 xx2000002066
2 Remove the functional and protective earth cables by removing the screw.	 xx2000001945

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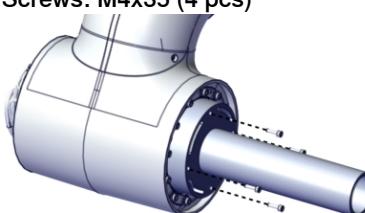
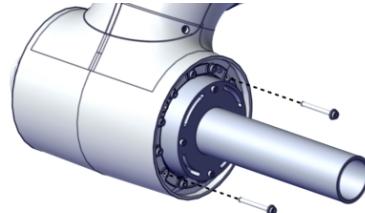
5 Repair

5.4.2 Replacing the housing

Continued

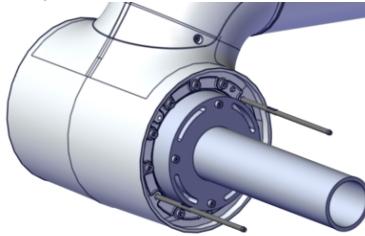
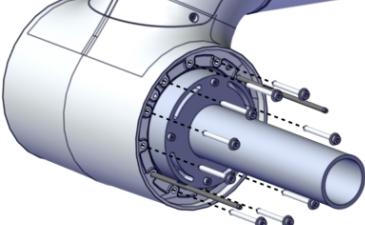
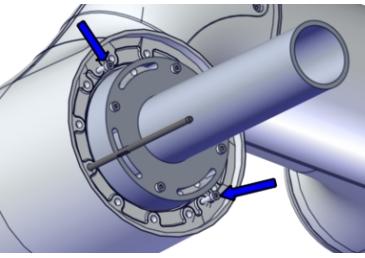
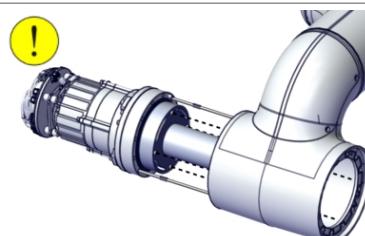
Action	Note
3 Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J4.DC+ • J4.DC- • J4.CS • J4.CP 	 xx2000002067
4 Disconnect the connectors from the drive board. <ul style="list-style-type: none"> • D3.X1 • D3/4.DC+ • D3/4.DC- • D3.X4 • D3/4.X2 • D3.X5 	 xx2000002068

Removing the axis-3 joint unit

Action	Note
1 Fit the lifting aid to the joint unit, on the torque sensor side. ! CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)  xx2000002069
2 Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.	 xx2000002070

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5.4.2 Replacing the housing Continued

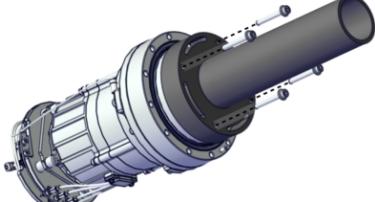
Action	Note
3 Fit two guide pins to the axis-3 joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.</p>  <p>xx2000002576</p>
4 Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.	 <p>xx2100000320</p>
5 Put the cabling at the slot in order not to squeeze it during removal of joint unit.	 <p>xx2100000003</p>
6 Press the joint unit out of position using two of the previous attachment screws as removal tools.	 <p>xx2000002577</p>
7 Remove the joint unit from the housing. CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 <p>xx2000002071</p>

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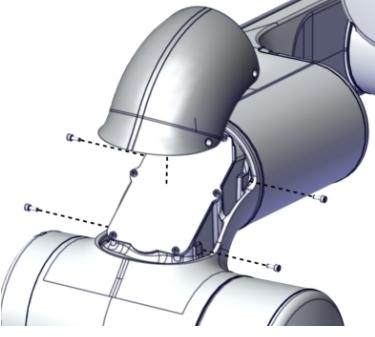
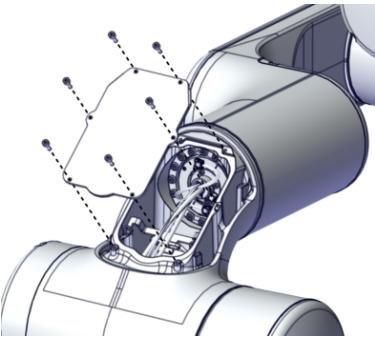
5 Repair

5.4.2 Replacing the housing

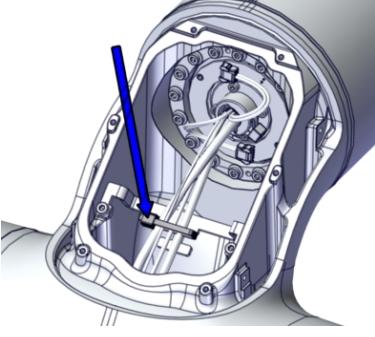
Continued

Action	Note
8 Remove the lifting aid and guide pins.	 xx2000001957

Opening the housing top cover

Action	Note
1 Remove the cover by removing the four screws.	 xx2000002075
2 Remove the inner plate by removing the screws.	 xx2000002076

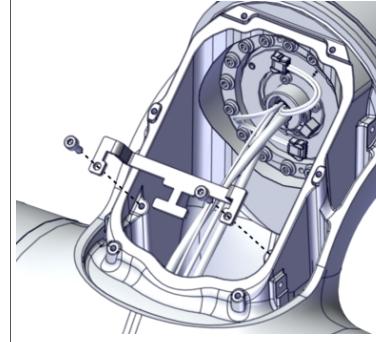
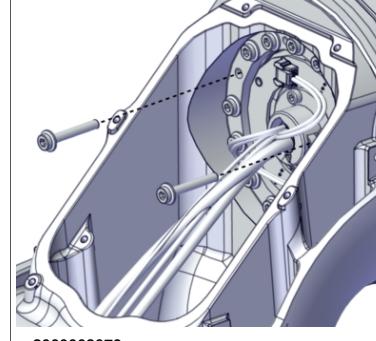
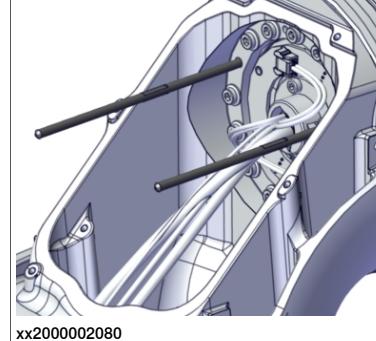
Removing the tubular

Action	Note
1 Cut the cable tie.	 xx2000002077

Continues on next page

5.4.2 Replacing the housing

Continued

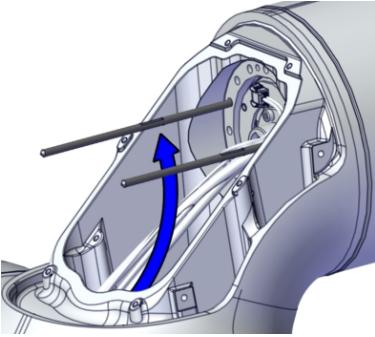
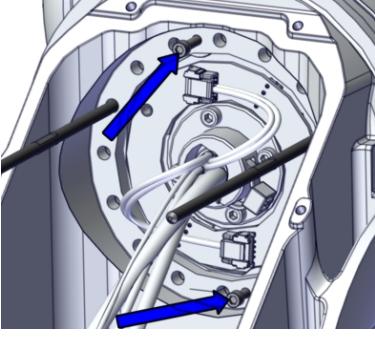
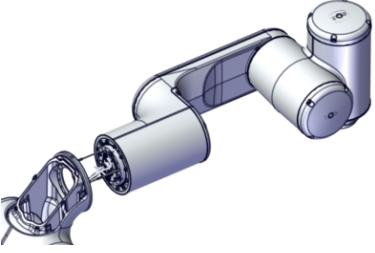
Action	Note
2 Remove the cable bracket by removing the two screws.	 xx2000002078
3 Remove two attachment screws and fit two guide pins to the axis-4 joint unit.	Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs.  xx2000002079
4 Remove the remaining attachment screws.	 xx2000002080

Continues on next page

5 Repair

5.4.2 Replacing the housing

Continued

	Action	Note
5	Pull out the cabling carefully from the housing.	 xx2000002127
6	Use two fully threaded attachment screws as removal tools to press the housing out of position.	 xx2100000006
7	Remove the tubular from the housing. Assist the cabling to be removed from the housing while lifting away the complete tubular. Place the tubular on a workbench.	 xx2000002082

Replace the housing

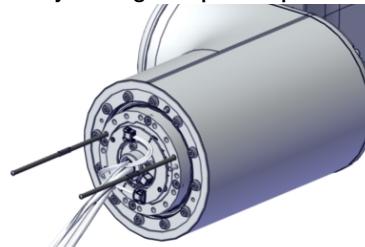
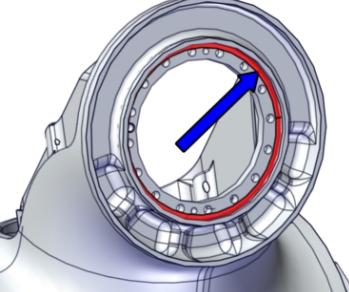
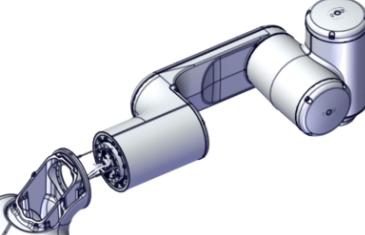
	Action	Note
1	Replace the housing.	Housing: 3HAC073949-001

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Refitting the housing

Use these procedures to refit the housing.

Refitting the tubular

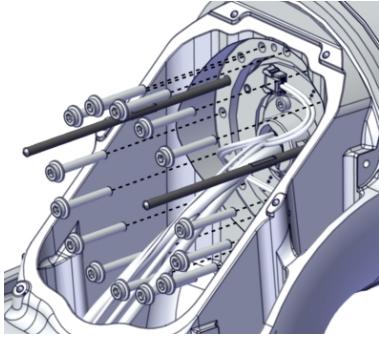
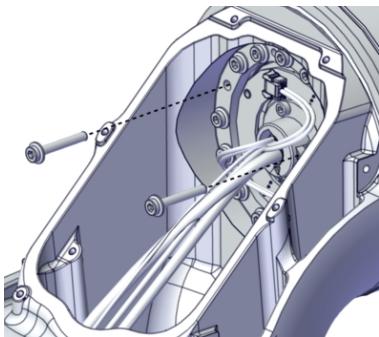
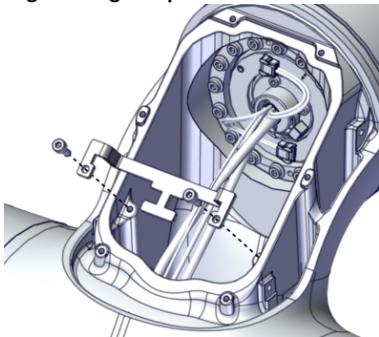
	Action	Note
1	Fit two guide pins to the axis-4 joint.	Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs.  xx2000002093
2	Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the housing mounting surface, as pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000002094
3	Lift the tubular into mounting position while inserting the cabling into the housing.	
4	Slide the tubular into place on the guide pins.	 xx2000002082

Continues on next page

5 Repair

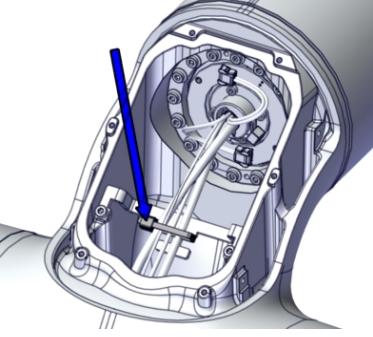
5.4.2 Replacing the housing

Continued

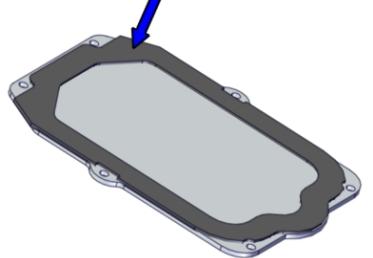
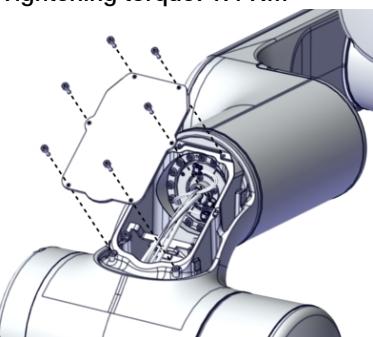
	Action	Note
5	<p>Secure the tubular to the housing with all attachment screws but two.</p> <p>Pre-tighten the screws crosswise firstly.</p>	<p>Hex socket head cap flange screw: M3x20</p>  <p>xx2000002081</p>
6	<p>Remove the guide pins and fasten the remaining two screws.</p>	<p>Hex socket head cap flange screw: M3x20</p>  <p>xx2000002079</p>
7	<p>Torque tighten all screws crosswise.</p>	<p>Tightening torque: 1.8 Nm.</p>
8	<p>Refit the cable bracket with the two screws.</p>	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs).</p> <p>Tightening torque: 0.8 Nm</p>  <p>xx2000002078</p>

Continues on next page

**5.4.2 Replacing the housing
Continued**

Action	Note
9 Secure the cabling with a cable tie.	Cable ties (1 pcs)  xx2000002077

Closing the housing top cover

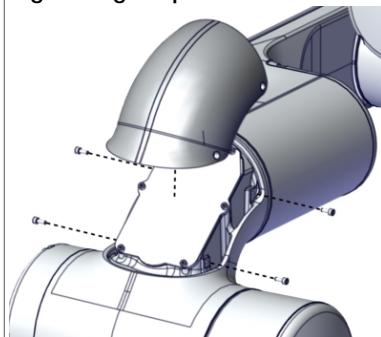
Action	Note
1 Check the inner plate gasket. Replace if damaged.	Gasket: 3HAC075056-001  xx2000002095
2 Refit the inner plate with the screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 1.4 Nm  xx2000002076

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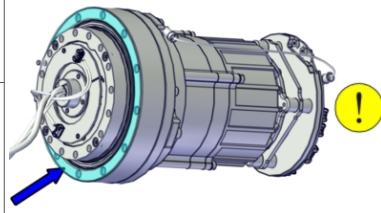
5 Repair

5.4.2 Replacing the housing

Continued

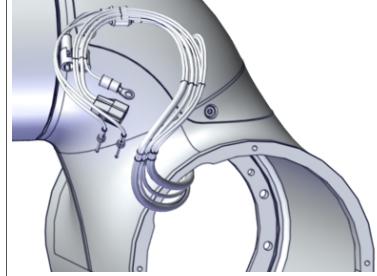
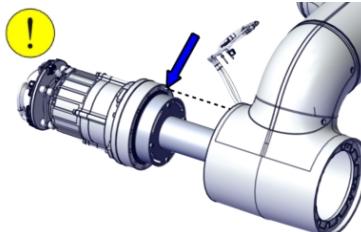
Action	Note
3 Refit the cover with the four screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.45 Nm</p> 

Preparations before fitting the joint unit

Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2 Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol. Joint unit mounting surface is pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574
3 Apply a thin layer of flange sealant to the mounting surface. Do not contaminate the radial sealing with sealant.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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Refitting the axis-3 joint unit

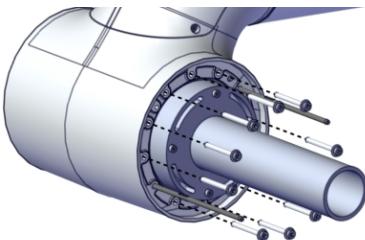
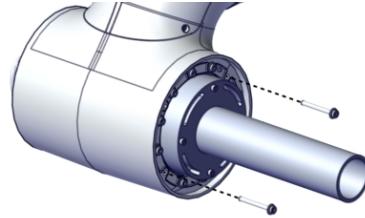
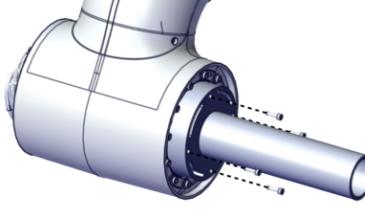
	Action	Note
1	<p>Fit the lifting aid to the joint unit.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	Joint unit: 3HAC079141-001 Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)
2	Fit two guide pins to the joint unit.	Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.
3	Place the cabling at the slot before refitting the joint unit.	 xx2100000004
4	<p>Fit the joint unit to the housing, aligning the pin with the pin hole.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	 xx2000002072

Continues on next page

5 Repair

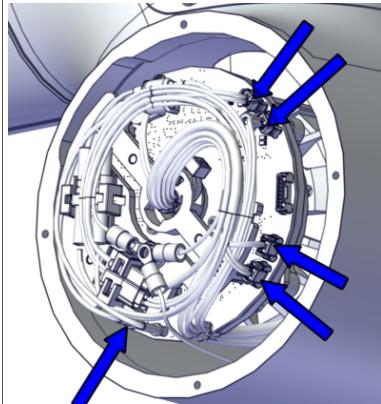
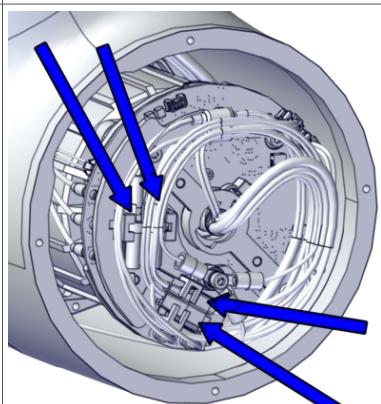
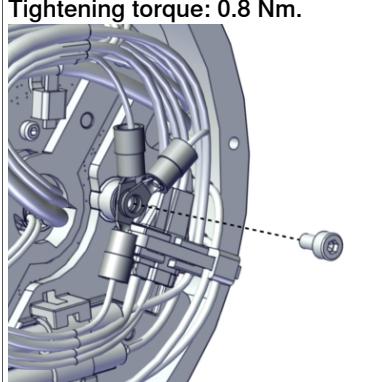
5.4.2 Replacing the housing

Continued

	Action	Note
5	Secure the joint unit with new attachment screws.	<p>Hex socket head cap flange screw with glue: 3HAB3413-435 M4x35, 12 pcs</p> <p>Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.</p>  <p>xx2100000320</p>
6	Remove the guide pins and secure the remaining two attachment screws.	 <p>xx2000002070</p>
7	Pre-tighten the screws crosswise.	
8	Torque tighten all screws crosswise.	Tightening torque: 4.3 Nm.
9	Remove the lifting aid by removing the screws.	 <p>xx2000002069</p>
10	Clean pushed-out flange sealant, if any.	

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Connecting the axis-3 joint unit cabling

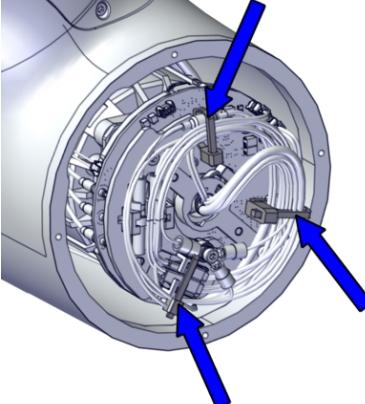
	Action	Note
1	<p>Reconnect the connectors to the drive board.</p> <ul style="list-style-type: none"> • D3.X1 to X1 • D3/4.DC+ to DC+ • D3/4.DC- to Ground • D3.X4 to X4 • D3/4.X2 to X2 • D3.X5 to X5 	 xx2000002068
2	<p>Connect the connectors to each other and snap them to the cable holders.</p> <ul style="list-style-type: none"> • J4.DC+ to J4/5.DC+ • J4.DC- to J4/5.DC- • J4.CS to J4/5.CS • J4.CP to J4/5.CP 	 xx2000002067
3	<p>Secure the cables for functional earth and protective earth with a screw.</p>	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000001945

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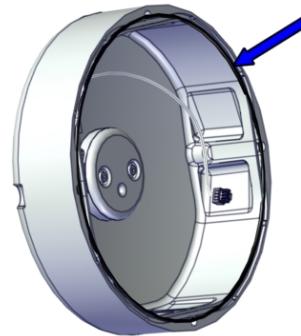
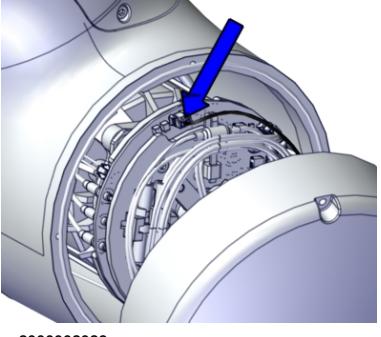
5 Repair

5.4.2 Replacing the housing

Continued

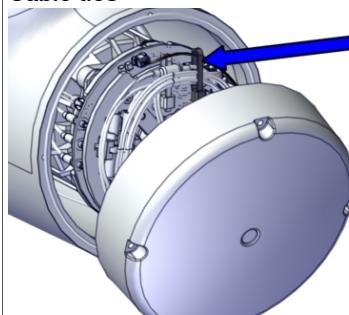
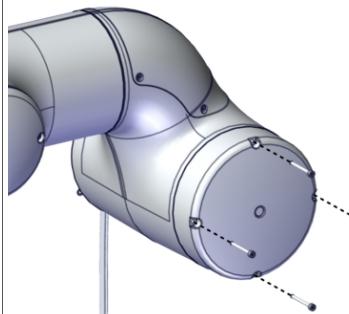
	Action	Note
4	Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000002066

Refitting the housing cover

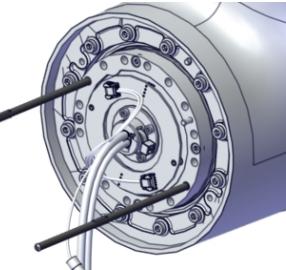
	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-047  xx2000001962
2	Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board. Orient the cover for proper arrangement of the brake release cable.	 xx2000002023

Continues on next page

5.4.2 Replacing the housing
Continued

Action	Note
3 Secure the brake release cable with a cable tie.	 xx2000002022
4 Refit the cover with the four screws.	Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm  xx2000002021

Refitting the upper arm

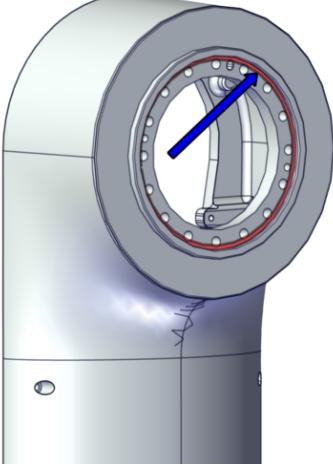
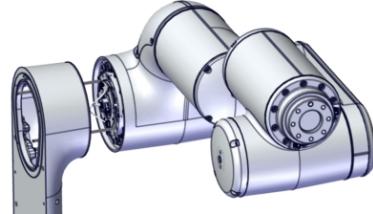
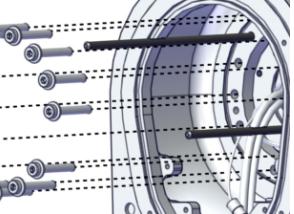
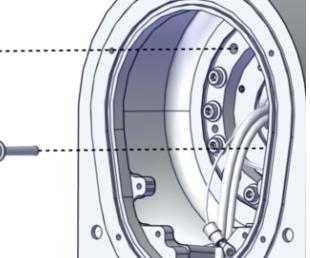
Action	Note
1 Fit two guide pins to the axis-3 joint.	 xx2000001971

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5 Repair

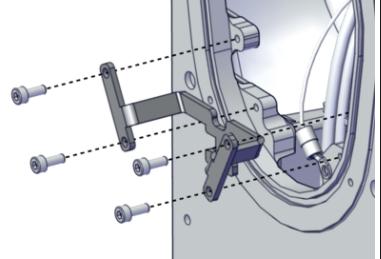
5.4.2 Replacing the housing

Continued

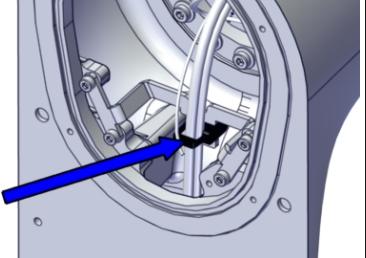
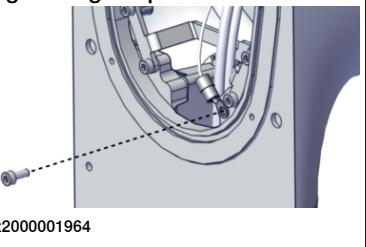
Action	Note
2 Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the lower arm mounting surface, as pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001973
3 Lift the upper arm into mounting position while inserting the cabling into the lower arm. 4 Slide the upper arm into place on the guide pins.	 xx2000001970
5 Secure the upper arm to the lower arm with all attachment screws but two. Pre-tighten the screws crosswise firstly.	Hex socket head cap flange screw: M4x25 (16 pcs)  xx2000001969
6 Remove the guide pins and fasten the remaining two screws.	Hex socket head cap flange screw: M4x25 (16 pcs)  xx2000001967
7 Torque tighten all screws crosswise.	Tightening torque: 4.6 Nm.

Continues on next page

5.4.2 Replacing the housing
Continued

Action	Note
8 Refit the cable bracket with the four screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.8 Nm</p>  <p>xx2000001966</p>

Fastening the cabling between the lower and upper arm

Action	Note
1 Secure the cabling with the cable tie.	<p>Cable ties</p>  <p>xx2000001965</p>
2 Connect the functional earth cable with the screw.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (1 pcs). Tightening torque: 0.8 Nm</p>  <p>xx2000001964</p>

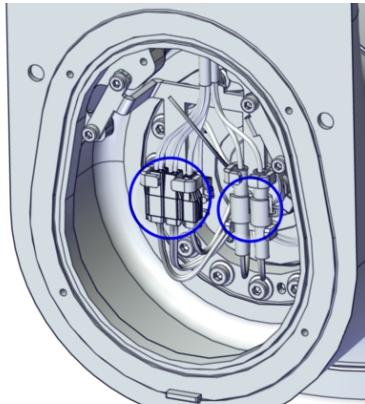
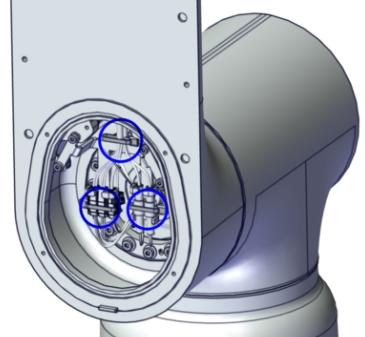
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5 Repair

5.4.2 Replacing the housing

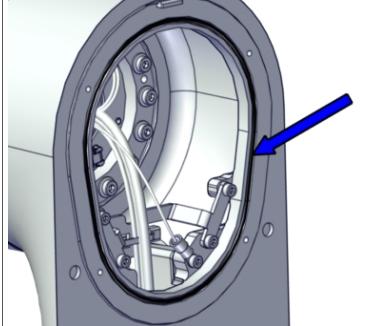
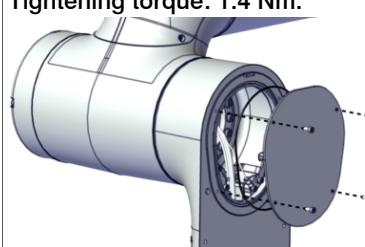
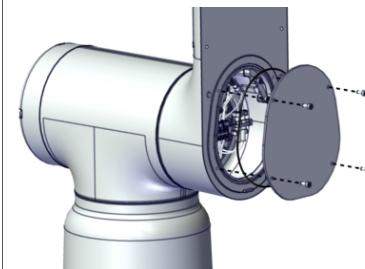
Continued

Connecting the upper arm cabling

	Action	Note
1	Connect the connectors to each other and snap them to the cable holders.	 xx2000001938
2	Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000001937

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Refitting the lower arm covers

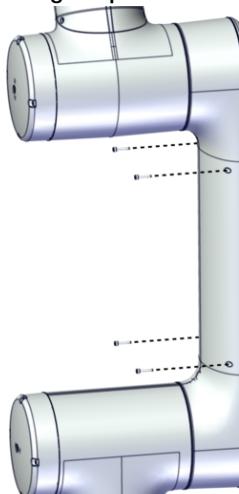
	Action	Note
1	Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-044 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000001955  xx2000001954
2	Refit the inner covers with four screws each.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (8 pcs) Tightening torque: 1.4 Nm.  xx2000001947  xx2000001930

Continues on next page

5 Repair

5.4.2 Replacing the housing

Continued

Action	Note
3 Snap the lower arm cover into place.	
4 Secure the cover with four screws.	<p>Hex socket head cap screw: M3x16 12.9 Gleitmo 603+Geomet 500 (Black Oxide) (4 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000001929</p>

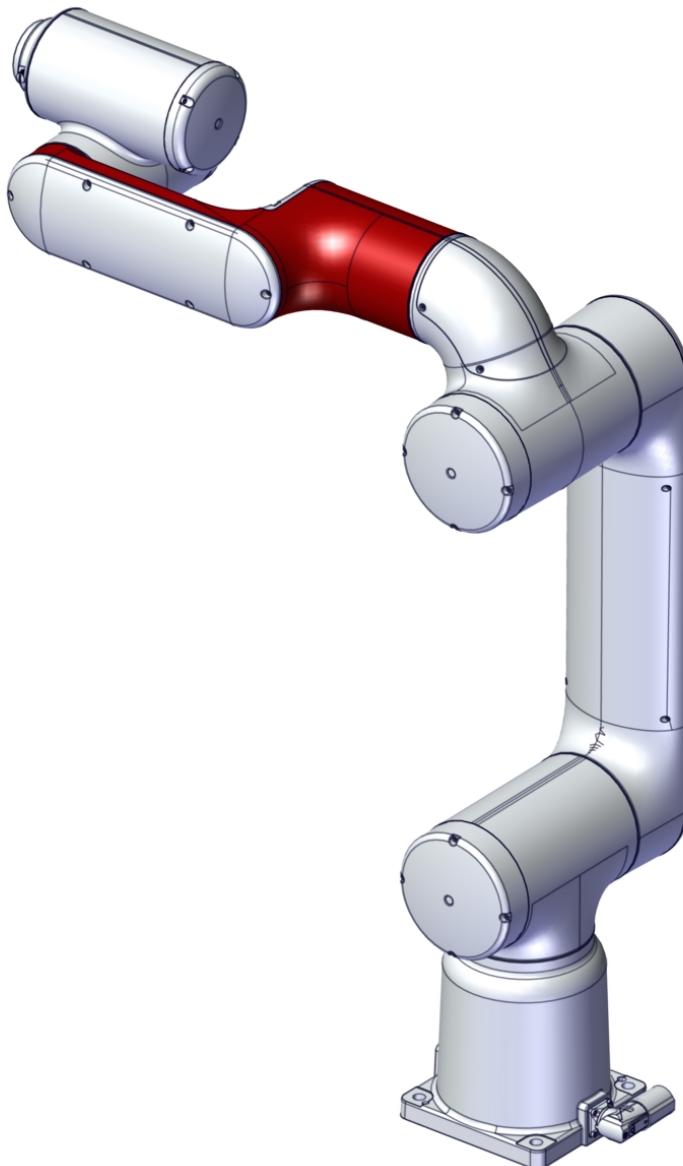
Concluding procedure

Action	Note
1 Calibrate the axis-3 joint unit torque sensor.	See Calibration on page 607
2  DANGER Make sure all safety requirements are met when performing the first test run.	

5.4.3 Replacing the tubular

Location of the tubular

The tubular is located as shown in the figure.



xx2100000052

Summary of the replacement procedure

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

- 1 Separate the cabling between the housing and the tubular (at the axis-3 joint unit).
- 2 Remove the complete tubular.
- 3 Remove the axis-4 joint unit.

Continues on next page

5 Repair

5.4.3 Replacing the tubular

Continued

- 4 Remove the tilt.
- 5 Replace the tubular.

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Spare part	Article number	Note
Tubular	3HAC074509-001	Also order new attachment screws for the axis-4 joint unit: 3HAB3413-330 (12 pcs).
Hex socket head cap flange screw with glue	3HAB3413-312	M3x12 For tubular cover. Always use new screws. If ordering a new axis-4 or axis-5 joint unit spare part, new screws for the tubular cover are included.
Hex socket head cap flange screw with glue	3HAB3413-330	M3x30, 12 pcs Always use new screws when re-fitting a joint unit. If ordering a new joint unit spare part, new screws are included.
Cable tie	3HAC075545-001	For securing joint unit cable.

Required tools and equipment

Equipment	Article number	Note
Tweezers	-	Used to handle drive board connectors.
Lifting aid	3HAC077789-001	For joint units on axes 4, 5 and 6. Attachment screws M3x12 (4 pcs) are enclosed.
Guide pin, M3x110	3HAC077787-001	Always use guide pins in pairs. For joint units on axes 4, 5 and 6.
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cleaning agent	-	Isopropanol
Flange sealant	-	Loctite 574
Cable ties	-	
O-ring	3HAC061327-043	Tubular cover Replace if damaged.

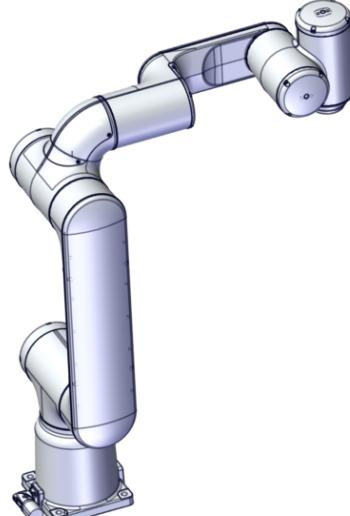
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Consumable	Article number	Note
Grease	3HAC042536-001	Shell Gadus S2
O-ring	3HAC061327-051	Axis-4 cover Replace if damaged.
Gasket	3HAC075056-001	Cover inside housing Replace if damaged.
O-ring	3HAC061327-047	Cover for axis 2/3 Replace if damaged.

Removing the tubular

Use these procedures to remove the tubular.

Preparations before removing the tubular

	Action	Note
1	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none"> • Axis 1: No significance. • Axis 2: 0° • Axis 3: 0° • Axis 4: 0° • Axis 5: +90° • Axis 6: No significance. 	 xx2100000005
2	<p>! CAUTION</p> <p>Turn off all supplies for electrical power to the robot, before starting the repair work.</p>	

Removing the housing cover

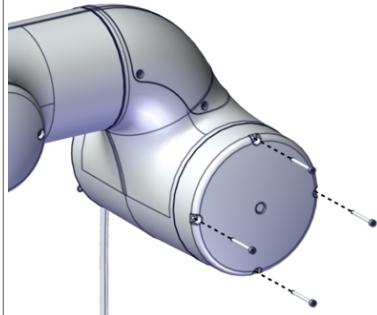
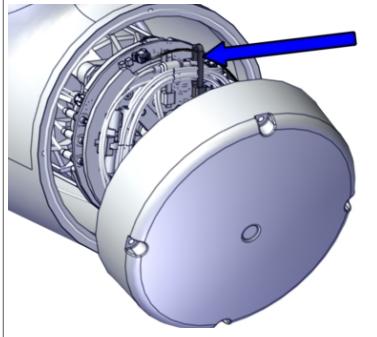
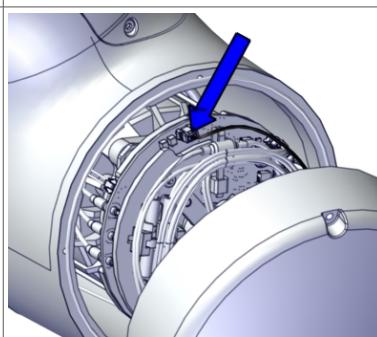
	Action	Note
1	<p>! CAUTION</p> <p>Make sure that all supplies for electrical power are turned off.</p>	

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5 Repair

5.4.3 Replacing the tubular

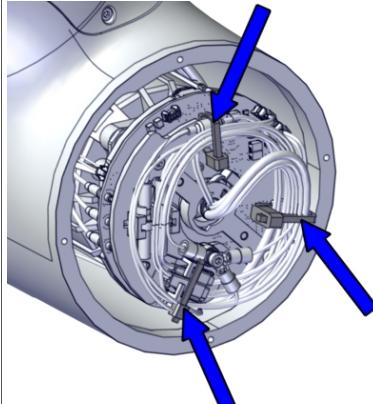
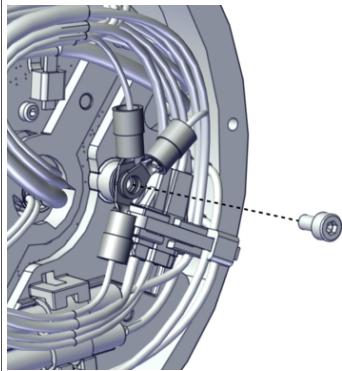
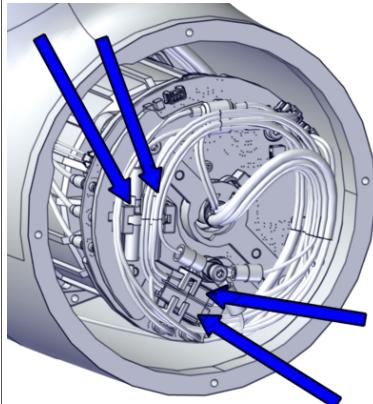
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	Action	Note
2	Remove the cover screws.	 xx2000002021
3	! CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	
4	Open the cover and cut the cable tie that holds the brake release cable.	 xx2000002022
5	Disconnect the brake release connector from the drive board. Remove the cover.	 xx2000002023

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5.4.3 Replacing the tubular
Continued

Separating the cabling between the housing and the tubular

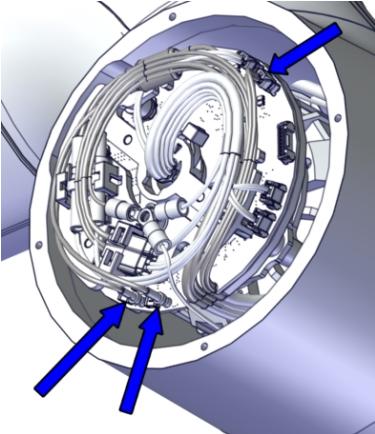
	Action	Note
1	Cut the cable ties.	 xx2000002066
2	Remove the functional and protective earth cables by removing the screw.	 xx2000001945
3	Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J4/5.DC+ • J4/5.DC- • J4/5.CS • J4/5.CP 	 xx2000002067

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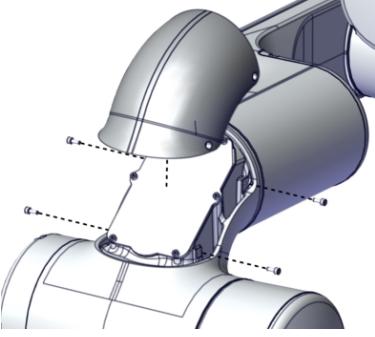
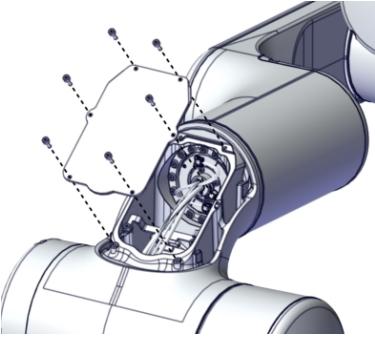
5 Repair

5.4.3 Replacing the tubular

Continued

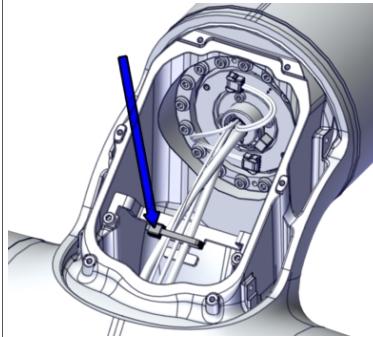
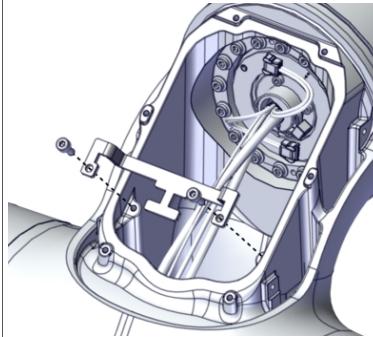
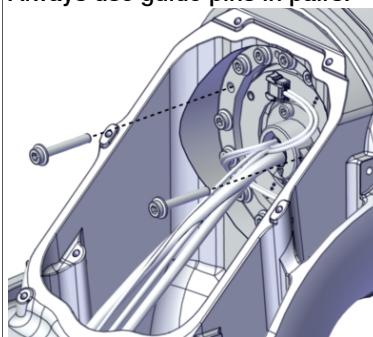
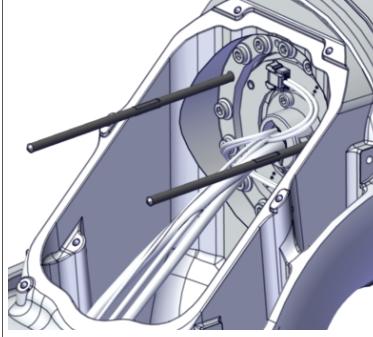
Action	Note
4 Disconnect the connectors from the drive board. <ul style="list-style-type: none">• D3/4.X2• D3/4.DC+• D3/4.DC-	 xx2000002120

Opening the housing top cover

Action	Note
1 Remove the cover by removing the four screws.	 xx2000002075
2 Remove the inner plate by removing the screws.	 xx2000002076

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Removing the tubular

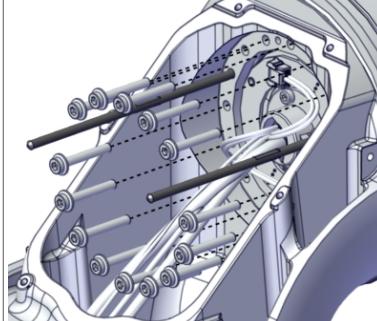
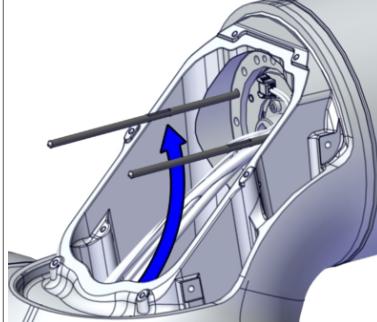
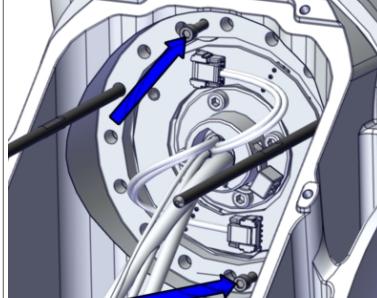
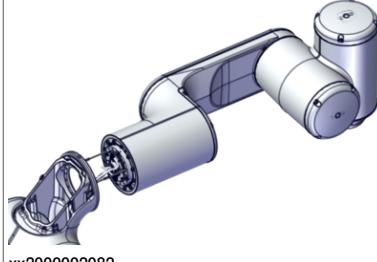
	Action	Note
1	Cut the cable tie.	 xx2000002077
2	Remove the cable bracket by removing the two screws.	 xx2000002078
3	Remove two attachment screws and fit two guide pins to the axis-4 joint unit.	<p>Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs.</p>  xx2000002079
		 xx2000002080

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5 Repair

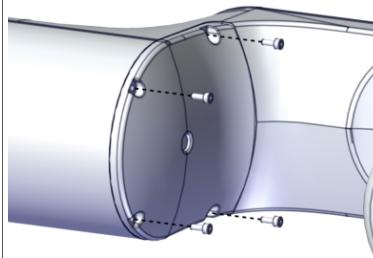
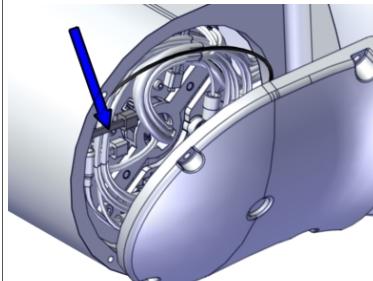
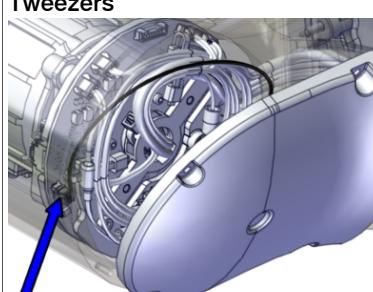
5.4.3 Replacing the tubular

Continued

Action	Note
4 Remove the remaining attachment screws.	 xx2000002081
5 Pull out the cabling carefully from the housing.	 xx2000002127
6 Use two fully threaded attachment screws as removal tools to press the housing out of position.	 xx2100000006
7 Remove the tubular from the housing. Assist the cabling to be removed from the housing while lifting away the complete tubular. Place the tubular on a workbench.	 xx2000002082

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Removing the axis-4 cover

	Action	Note
1	Remove the cover screws.	 xx2000002083
2	<p>! CAUTION</p> <p>There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.</p>	
3	Open the cover and cut the cable tie that holds the brake release cable.	 xx2000002084
4	<p>Disconnect the brake release connector from the drive board. Remove the cover.</p>	 Tweezers xx2000002085

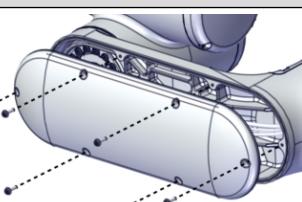
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5 Repair

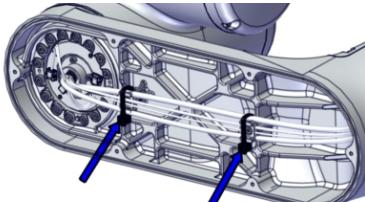
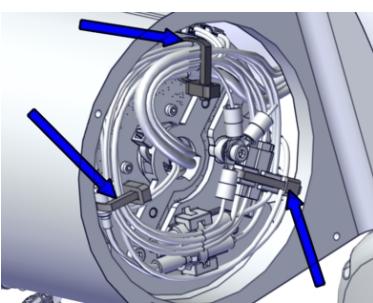
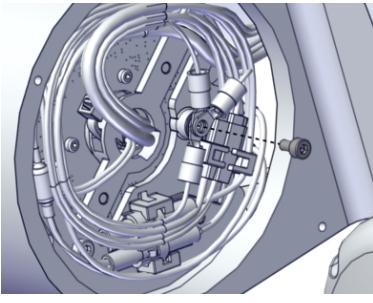
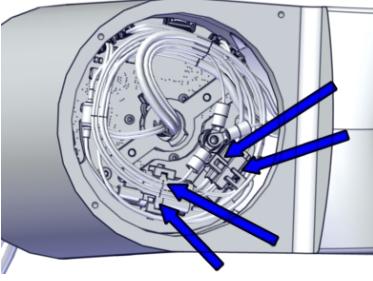
5.4.3 Replacing the tubular

Continued

Removing the tubular cover

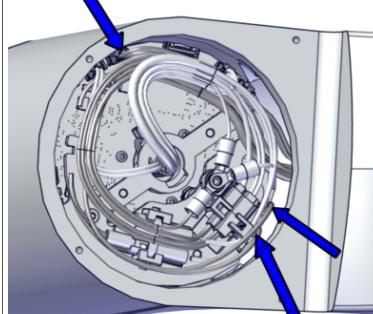
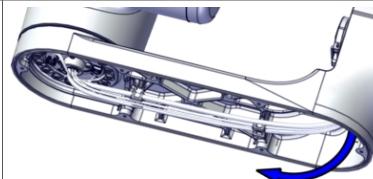
	Action	Note
1	Remove the cover by removing the six screws. Dispose the screws. New screws must be used when refitting the cover. New screws are included in the spare part delivery of the joint unit.	 xx2000002123

Separating the cabling between the tubular and the tilt

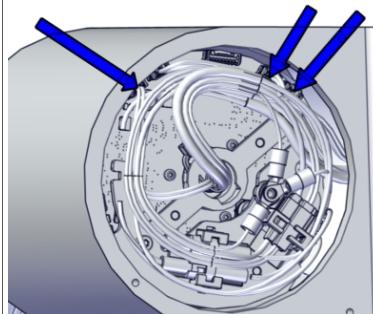
	Action	Note
1	Cut the cable ties, if needed.	 xx2000002124  xx2000002086
2	Remove the functional and protective earth cables by removing the screw.	 xx2000002087
3	Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J4/5.DC+ • J4/5.DC- • J4/5.CS • J4/5.CP 	 xx2000002089

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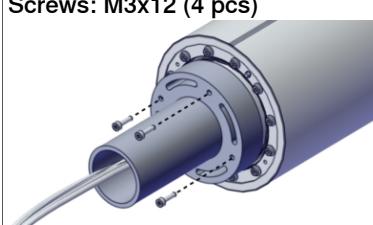
5.4.3 Replacing the tubular Continued

	Action	Note
4	<p>Disconnect the connectors that belongs to the axis-5 cabling, from the axis-4 drive board:</p> <ul style="list-style-type: none"> • D3/4.X2 • D3/4.DC- • D3/4.DC+ <p>Use tweezers, if needed.</p>	<p>Tweezers</p>  <p>xx2000002125</p>
5	Pull out the cabling carefully from the tubular.	 <p>xx2000002126</p>

Disconnecting the axis-4 joint unit cabling

	Action	Note
1	<p>Disconnect the connectors from the drive board.</p> <p>Use tweezers.</p> <ul style="list-style-type: none"> • D4/5.X1 • D4/5.X4 • D4/5.X5 	<p>Tweezers</p>  <p>xx2000002088</p>

Removing the axis-4 joint unit

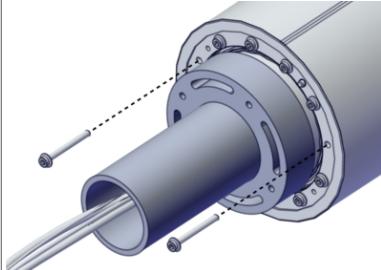
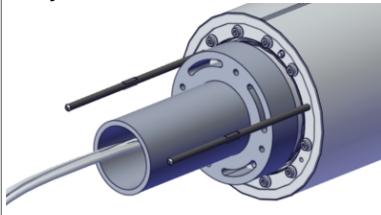
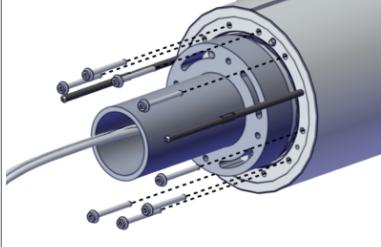
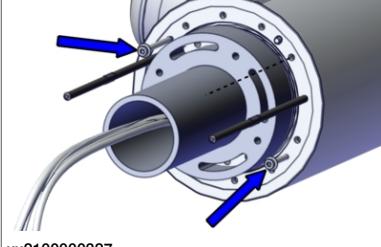
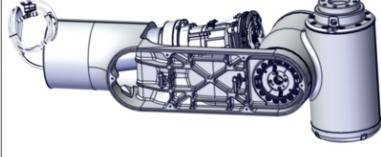
	Action	Note
1	<p>Fit the lifting aid to the joint unit, on the torque sensor side.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	<p>Lifting aid: 3HAC077789-001 Screws: M3x12 (4 pcs)</p>  <p>xx2000002090</p>

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5 Repair

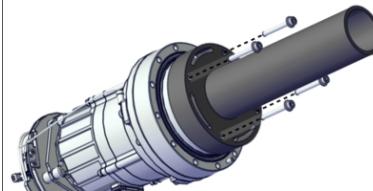
5.4.3 Replacing the tubular

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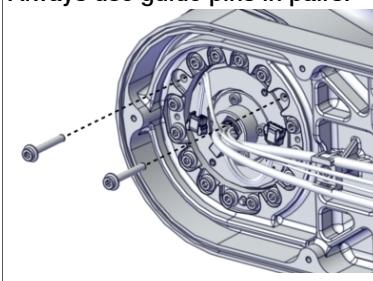
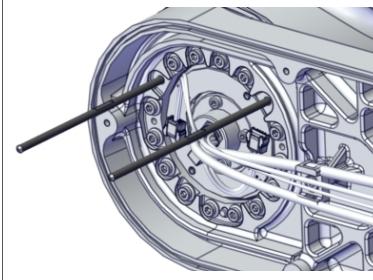
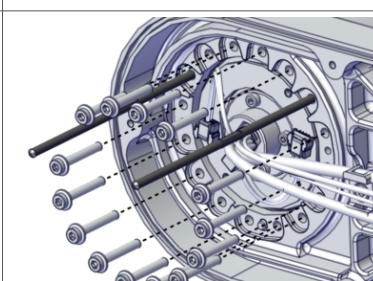
Action	Note
<p>2 Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.</p>	 xx2000002091
<p>3 Fit two guide pins to the axis-4 joint unit.</p>	<p>Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs. For joint units on axes 4, 5 and 6.</p>  xx2000002578
<p>4 Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.</p>	 xx2100000326
<p>5 Press the joint unit out of position using two of the previous attachment screws as removal tools.</p>	 xx2100000327
<p>6 Remove the joint unit from the tubular.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	 xx2000002116

Continues on next page

**5.4.3 Replacing the tubular
Continued**

	Action	Note
7	Remove the lifting aid and guide pins.	 xx2000001957

Removing the tilt

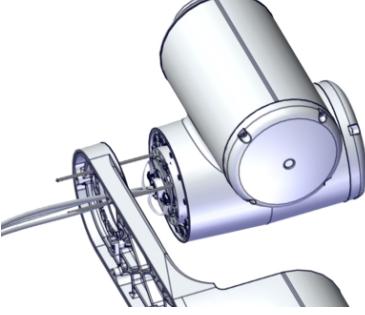
	Action	Note
1	Remove two attachment screws and fit two guide pins to the axis-5 joint unit.	Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs.  xx2000002128
2	Remove the remaining attachment screws.	 xx2000002129
3	Press the tilt out of position using two of the previous attachment screws as removal tools.	 xx2000002130

Continues on next page

5 Repair

5.4.3 Replacing the tubular

Continued

	Action	Note
4	Remove the tilt from the tubular. Assist the cabling to be removed while lifting away the complete tilt. Place the tilt on a workbench.	 xx2000002131

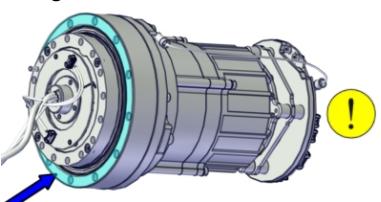
Replacing the tubular

	Action	Note
1	Replace the tubular.	Tubular: 3HAC074509-001

Refitting the tubular

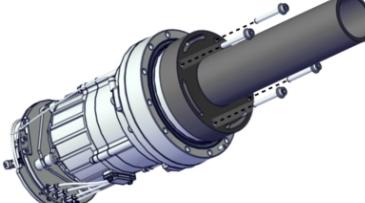
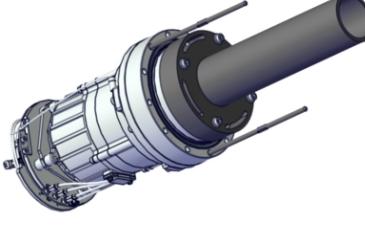
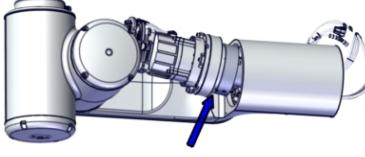
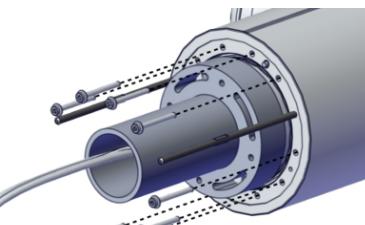
Use these procedures to refit the tubular.

Preparations before fitting the joint unit

	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2	Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol. Joint unit mounting surface is pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001860
3	Apply a thin layer of flange sealant to the mounting surface. Do not contaminate the radial sealing with sealant.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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Refitting the axis-4 joint unit

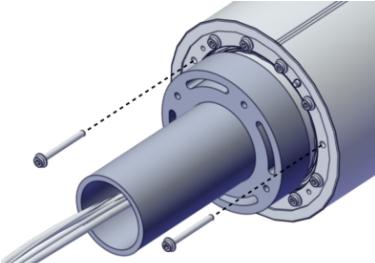
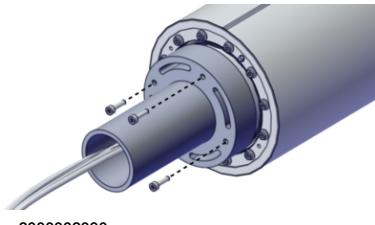
	Action	Note
1	<p>Fit the lifting aid to the joint unit.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	<p>Joint unit: 3HAC079143-001 Lifting aid: 3HAC077789-001 Screws: M3x12 (4 pcs)</p>  <p>xx2000001957</p>
2	Fit two guide pins to the joint unit.	<p>Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs. For joint units on axes 4, 5 and 6.</p>  <p>xx2000002438</p>
3	<p>Fit the joint unit to the tubular, aligning the pin with the pin hole.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	 <p>xx2000002117</p>
4	Secure the joint unit with new attachment screws.	<p>Hex socket head cap flange screw with glue: 3HAB3413-330 M3x30, 12 pcs Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.</p>  <p>xx2100000326</p>

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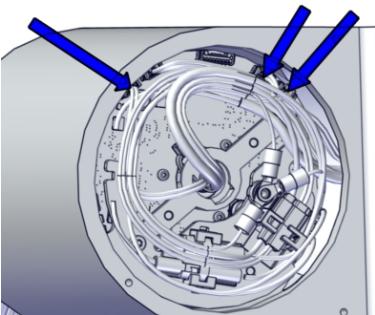
5 Repair

5.4.3 Replacing the tubular

Continued

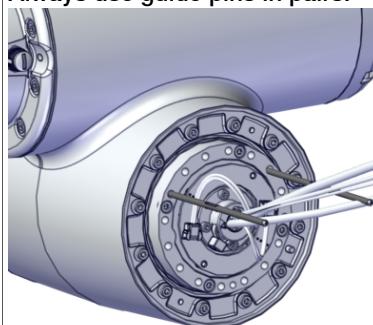
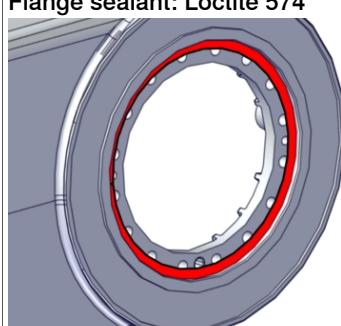
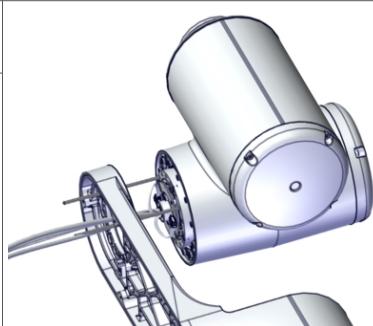
Action	Note
5 Remove the guide pins and secure the remaining two attachment screws.	 xx2000002091
6 Pre-tighten the screws crosswise.	
7 Torque tighten all screws crosswise.	Tightening torque: 1.4 Nm.
8 Remove the lifting aid by removing the screws.	 xx2000002090
9 Clean pushed-out flange sealant, if any.	

Connecting the axis-4 joint unit cabling

Action	Note
1 Reconnect the connectors to the drive board. <ul style="list-style-type: none">• D4/5.X1 to X1• D4/5.X4 to X4• D4/5.X5 to X5	 xx2000002088

Continues on next page

Refitting the tilt

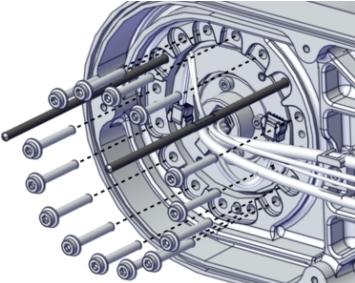
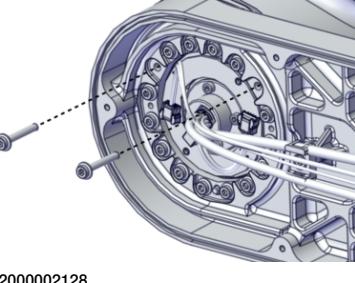
	Action	Note
1	Fit two guide pins to the axis-5 joint.	Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs.  xx2000002146
2	Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the tubular mounting surface, as pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000002147
3	Lift the tilt into mounting position while inserting the cabling into the tubular.	
4	Slide the tilt into place on the guide pins.	 xx2000002131

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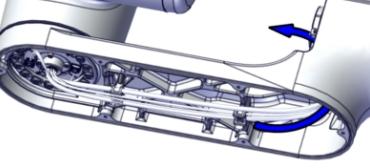
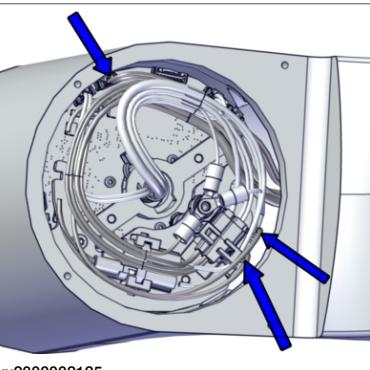
5 Repair

5.4.3 Replacing the tubular

Continued

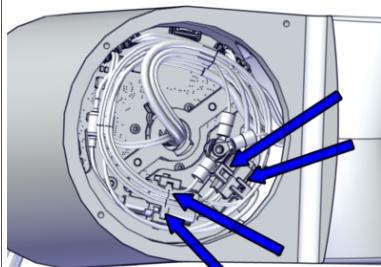
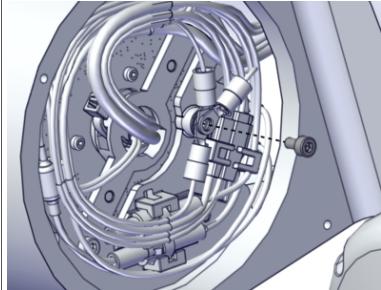
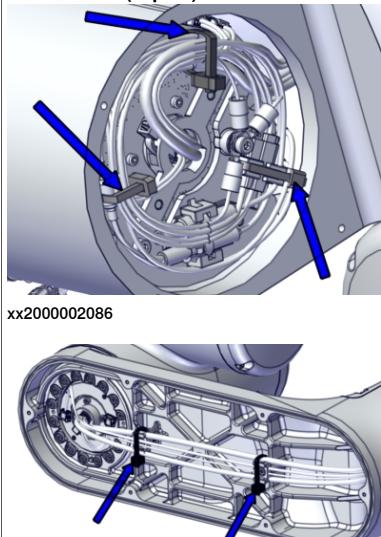
Action	Note
5 Secure the tilt to the tubular with all attachment screws but two. Pre-tighten the screws crosswise firstly.	Hex socket head cap flange screw: M3x20 (14 pcs)  xx2000002130
6 Remove the guide pins and fasten the remaining two screws.	Hex socket head cap flange screw: M3x20 (2 pcs)  xx2000002128
7 Torque tighten all screws crosswise.	Tightening torque: 1.8 Nm.

Connecting the tilt cabling

Action	Note
1 Insert the cabling into the tubular.	 xx2000002148
2 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D3/4.X2 to X2 • D3/4.DC- to Ground • D3/4.DC+ to +DC 	 xx2000002125

Continues on next page

5.4.3 Replacing the tubular
Continued

	Action	Note
3	<p>Connect the connectors to each other and snap them to the cable holders.</p> <ul style="list-style-type: none"> • J4/5.DC+ to J5/6.DC+ • J4/5.DC- to J5/6.DC- • J4/5.CS to J5/6.CS • J4/5.CP to J5/6.CP 	 xx2000002089
4	<p>Secure the cables for functional earth and protective earth with a screw.</p>	<p>Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.</p>  xx2000002087
5	<p>Secure the cabling with cable ties.</p>	<p>Cable ties (3 pcs)</p>  xx2000002086 xx2000002124

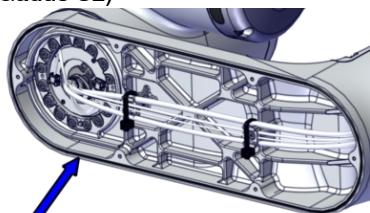
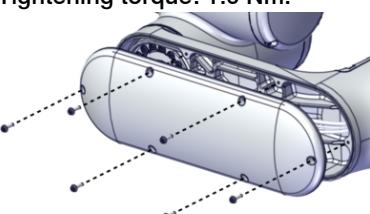
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5 Repair

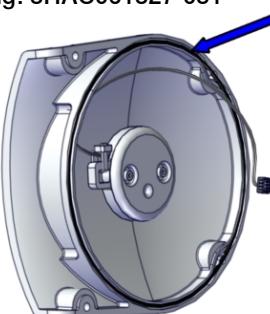
5.4.3 Replacing the tubular

Continued

Refitting the tubular cover

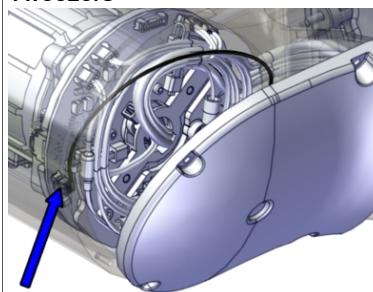
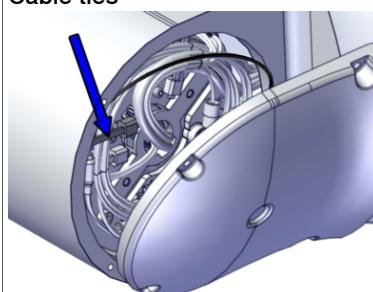
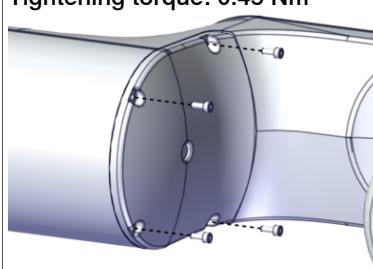
	Action	Note
1	Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-043 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000002149
2	Refit the cover with new attachment screws.	Hex socket head cap flange screw with glue: 3HAB3413-312 M3x12 For tubular cover. Always use new screws. If ordering a new axis-4 or axis-5 joint unit spare part, new screws for the tubular cover are included. Tightening torque: 1.6 Nm.  xx2000002123

Refitting the axis-4 cover

	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-051  xx2000002092

Continues on next page

5.4.3 Replacing the tubular
Continued

	Action	Note
2	Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board.	Tweezers  xx2000002085
3	Secure the brake release cable with a cable tie.	Cable ties  xx2000002084
4	Refit the cover with the four screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm  xx2000002083

Refitting the tubular

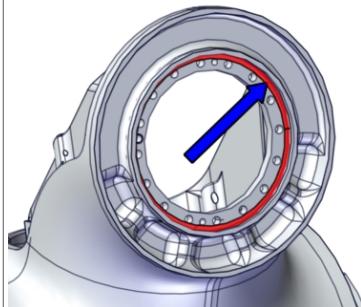
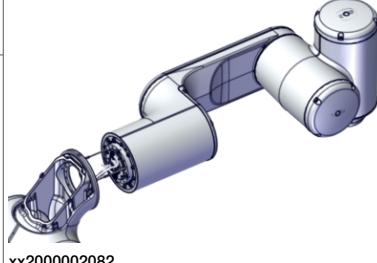
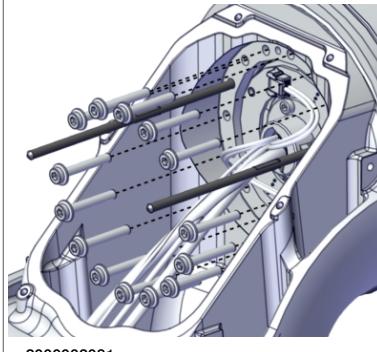
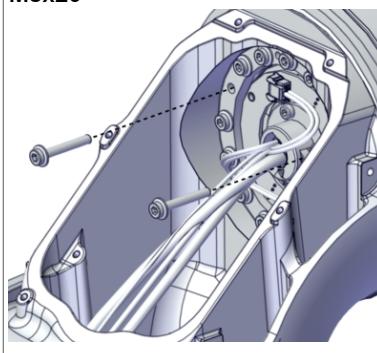
	Action	Note
1	Fit two guide pins to the axis-4 joint.	Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs.  xx2000002093

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5 Repair

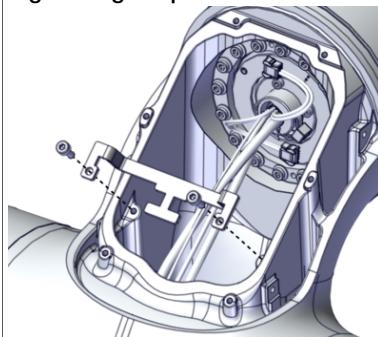
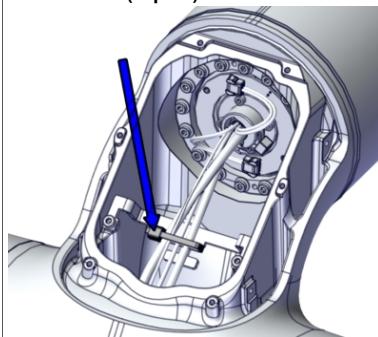
5.4.3 Replacing the tubular

Continued

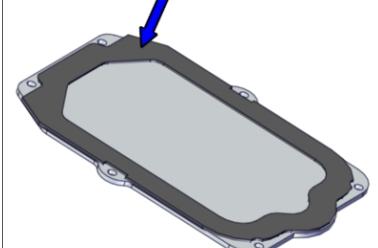
	Action	Note
2	<p>Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the housing mounting surface, as pointed out in the figure.</p>	<p>Cleaning agent: Isopropanol Flange sealant: Loctite 574</p>  <p>xx2000002094</p>
3	Lift the tubular into mounting position while inserting the cabling into the housing.	
4	Slide the tubular into place on the guide pins.	 <p>xx2000002082</p>
5	<p>Secure the tubular to the housing with all attachment screws but two. Pre-tighten the screws crosswise firstly.</p>	<p>Hex socket head cap flange screw: M3x20</p>  <p>xx2000002081</p>
6	Remove the guide pins and fasten the remaining two screws.	<p>Hex socket head cap flange screw: M3x20</p>  <p>xx2000002079</p>
7	Torque tighten all screws crosswise.	Tightening torque: 1.8 Nm.

Continues on next page

5.4.3 Replacing the tubular
Continued

	Action	Note
8	Refit the cable bracket with the two screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.8 Nm</p>  <p>xx2000002078</p>
9	Secure the cabling with a cable tie.	<p>Cable ties (1 pcs)</p>  <p>xx2000002077</p>

Closing the housing top cover

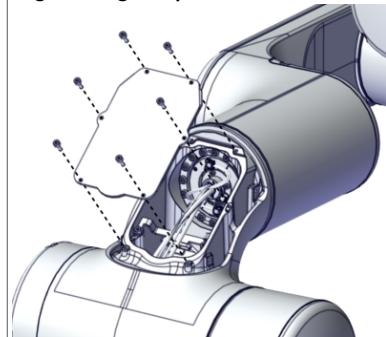
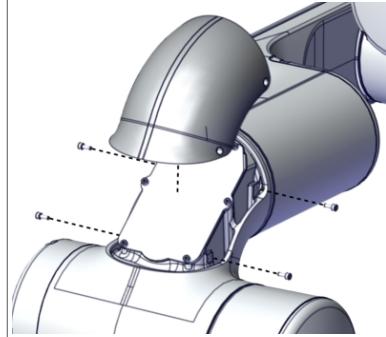
	Action	Note
1	Check the inner plate gasket. Replace if damaged.	<p>Gasket: 3HAC075056-001</p>  <p>xx2000002095</p>

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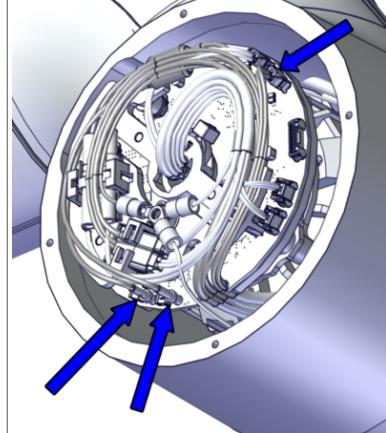
5 Repair

5.4.3 Replacing the tubular

Continued

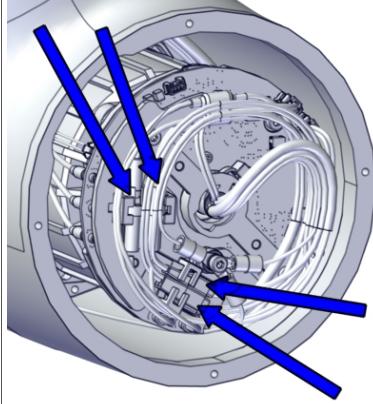
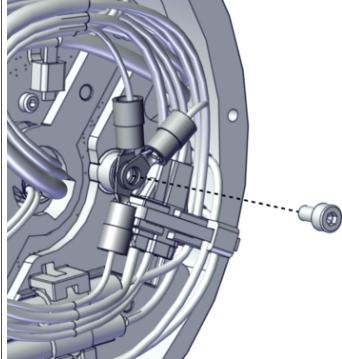
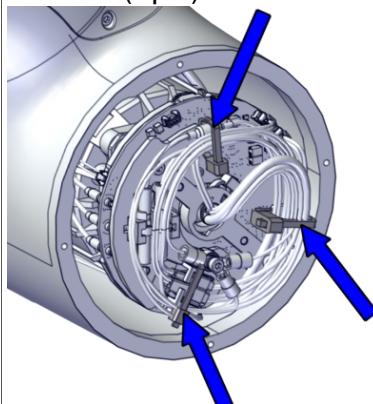
	Action	Note
2	Refit the inner plate with the screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 1.4 Nm</p>  <p>xx2000002076</p>
3	Refit the cover with the four screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.45 Nm</p>  <p>xx2000002075</p>

Connecting the tubular cabling

	Action	Note
1	<p>Reconnect the connectors to the drive board.</p> <ul style="list-style-type: none"> • D3/4.DC+ to DC+ • D3/4.DC- to Ground • D3/4.X2 to X2 	 <p>xx2000002120</p>

Continues on next page

5.4.3 Replacing the tubular
Continued

	Action	Note
2	<p>Connect the connectors to each other and snap them to the cable holders.</p> <ul style="list-style-type: none"> • J3.DC+ to J3.DC+ • J3.DC- to J3.DC- • J3.CS to J3.CS • J3.CP to J3.CP 	 xx2000002067
3	<p>Secure the cables for functional earth and protective earth with a screw.</p>	<p>Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.</p>  xx2000001945
4	<p>Secure the cabling with cable ties.</p>	<p>Cable ties (3 pcs)</p>  xx2000002066

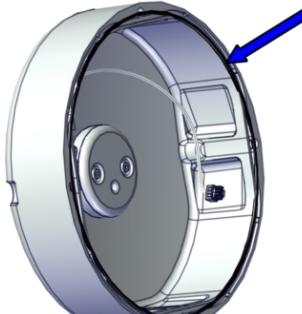
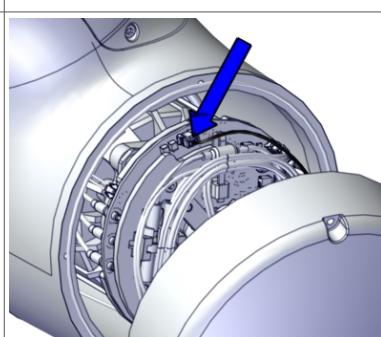
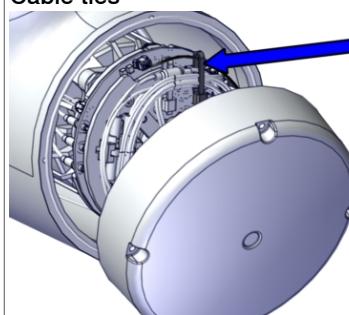
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5 Repair

5.4.3 Replacing the tubular

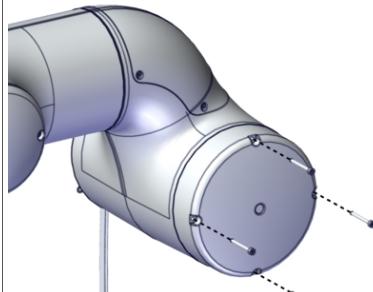
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Refitting the housing cover

	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-047  xx2000001962
2	Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board. Orient the cover for proper arrangement of the brake release cable.	 xx2000002023
3	Secure the brake release cable with a cable tie.	Cable ties  xx2000002022

Continues on next page

5.4.3 Replacing the tubular
Continued

	Action	Note
4	Refit the cover with the four screws.	<p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm</p>  <p>xx2000002021</p>

Concluding procedure

	Action	Note
1	Calibrate the axis-4 joint unit torque sensor.	See Calibration on page 607
2	 DANGER Make sure all safety requirements are met when performing the first test run.	

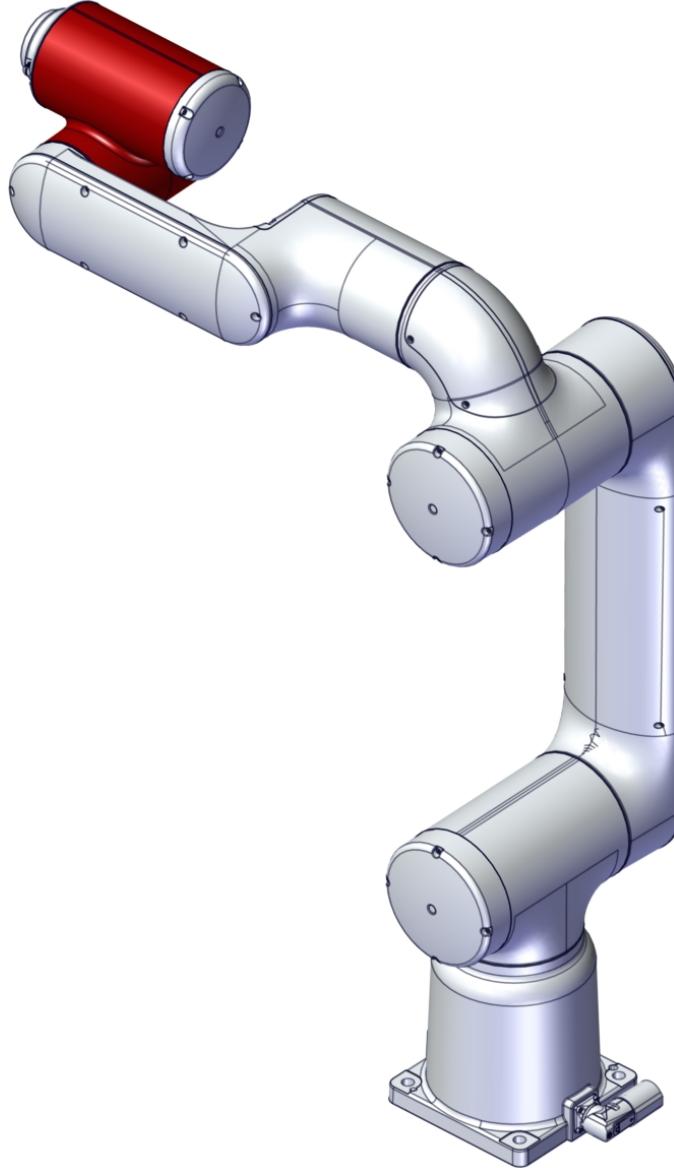
5 Repair

5.4.4 Replacing the wrist housing

5.4.4 Replacing the wrist housing

Location of the wrist

The wrist is located as shown in the figure.



xx2100000053

Summary of the replacement procedure

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

- 1 Remove the tubular cover.
- 2 Separate the cabling between the tubular and the tilt (at the axis-4 joint unit).
- 3 Remove the tilt and place on a workbench.
- 4 Remove the axis-6 joint unit.

Continues on next page

- 5 Remove the axis-5 joint unit.
- 6 Replace the wrist housing.

Required spare parts

 Note		
The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB .		

Spare part	Article number	Note
Wrist housing	3HAC073951-001	Also order new attachment screws for the axis-5 and axis-6 joint unit: 3HAB3413-330 (24 pcs).
Hex socket head cap flange screw with glue	3HAB3413-330	M3x30, 12 pcs Always use new screws when re-fitting a joint unit. If ordering a new joint unit spare part, new screws are included.
Hex socket head cap flange screw with glue	3HAB3413-330	M3x30, 12 pcs Always use new screws when re-fitting a joint unit. If ordering a new joint unit spare part, new screws are included.
Hex socket head cap flange screw with glue	3HAB3413-312	M3x12 For tubular cover. Always use new screws. If ordering a new axis-4 or axis-5 joint unit spare part, new screws for the tubular cover are included.
Cable tie	3HAC075545-001	For securing joint unit cable.
Cable tie	3HAC075545-001	For securing joint unit cable.

Required tools and equipment

Equipment	Article number	Note
Lifting aid	3HAC077789-001	For joint units on axes 4, 5 and 6. Attachment screws M3x12 (4 pcs) are enclosed.
Guide pin, M3x110	3HAC077787-001	Always use guide pins in pairs. For joint units on axes 4, 5 and 6.
Protection plate	3HAC077790-001	For protection of drive board during cabling installation on joint unit.
Cable tie gun EVO7	-	HellermannTyton 110-70084 or similar
Tweezers	-	Used to handle drive board connectors.

Continues on next page

5 Repair

5.4.4 Replacing the wrist housing

Continued

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cleaning agent	-	Isopropanol
Flange sealant	-	Loctite 574
Grease	3HAC042536-001	Shell Gadus S2
Cable ties	-	
O-ring	3HAC061327-051	Axis-5 cover Replace if damaged.
O-ring	3HAC061327-051	Arm-side interface Replace if damaged.
O-ring	3HAC061327-043	Tubular cover Replace if damaged.

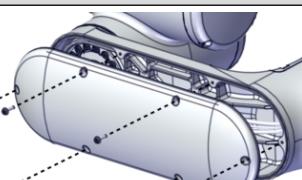
Removing the wrist housing

Use these procedures to remove the wrist.

Preparations before removing the wrist

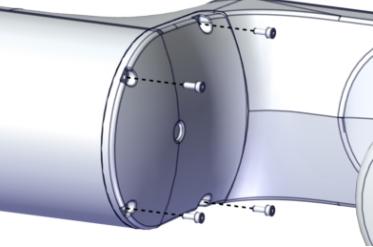
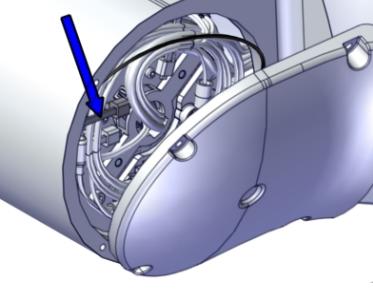
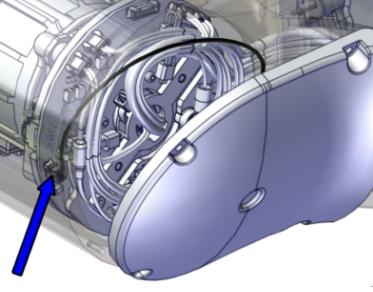
	Action	Note
1	Jog the robot to the synchronization position.	
2	 CAUTION Turn off all supplies for electrical power to the robot, before starting the repair work.	

Removing the tubular cover

	Action	Note
1	Remove the cover by removing the six screws. Dispose the screws. New screws must be used when refitting the cover. New screws are included in the spare part delivery of the joint unit.	 xx2000002123

Continues on next page

Removing the axis-4 cover

	Action	Note
1	Remove the cover screws.	 xx2000002083
2	<p>! CAUTION</p> <p>There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.</p>	
3	Open the cover and cut the cable tie that holds the brake release cable.	 xx2000002084
4	<p>Disconnect the brake release connector from the drive board. Remove the cover.</p>	 Tweezers xx2000002085

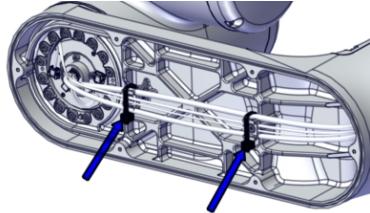
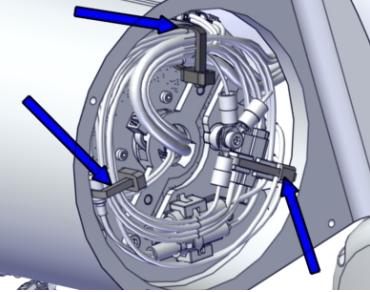
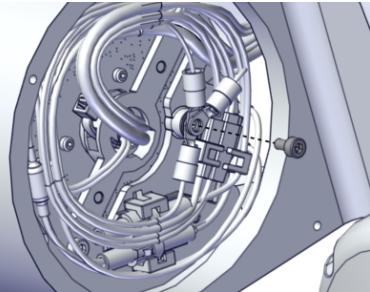
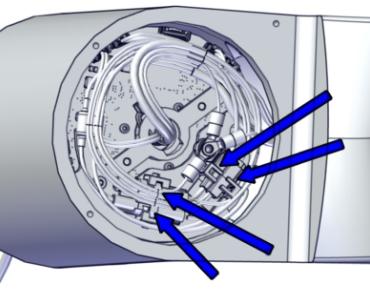
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5 Repair

5.4.4 Replacing the wrist housing

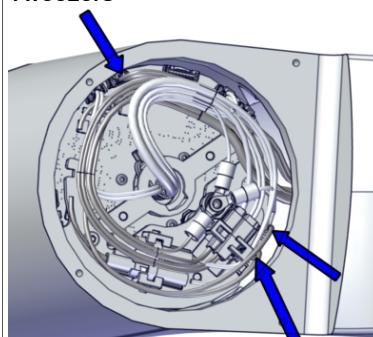
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Separating the cabling between the tubular and the tilt

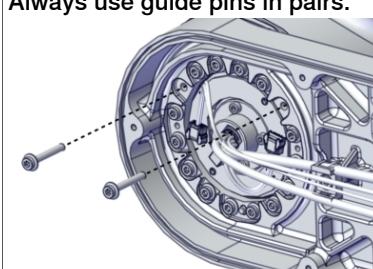
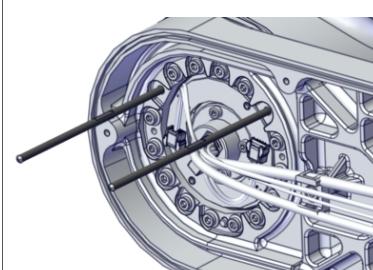
	Action	Note
1	Cut the cable ties, if needed.	 xx2000002124  xx2000002086
2	Remove the functional and protective earth cables by removing the screw.	 xx2000002087
3	Snap loose and disconnect the connectors: <ul style="list-style-type: none">• J4/5.DC+• J4/5.DC-• J4/5.CS• J4/5.CP	 xx2000002089

Continues on next page

5.4.4 Replacing the wrist housing Continued

	Action	Note
4	<p>Disconnect the connectors that belongs to the axis-5 cabling, from the axis-4 drive board:</p> <ul style="list-style-type: none"> • D3/4.X2 • D3/4.DC- • D3/4.DC+ <p>Use tweezers, if needed.</p>	<p>Tweezers</p>  <p>xx2000002125</p>
5	Pull out the cabling carefully from the tubular.	 <p>xx2000002126</p>

Removing the tilt

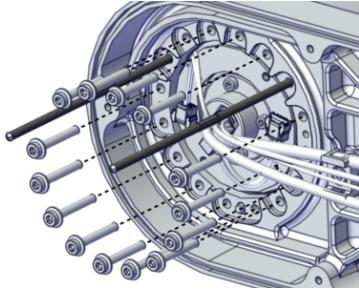
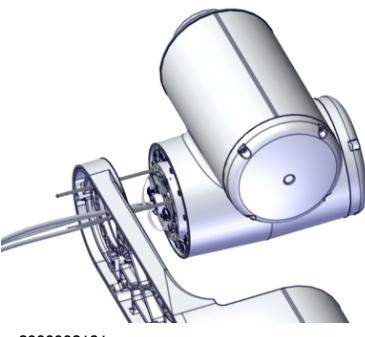
	Action	Note
1	Remove two attachment screws and fit two guide pins to the axis-5 joint unit.	<p>Guide pin, M3x110: 3HAC077787-001</p> <p>Always use guide pins in pairs.</p>  <p>xx2000002128</p>  <p>xx2000002129</p>

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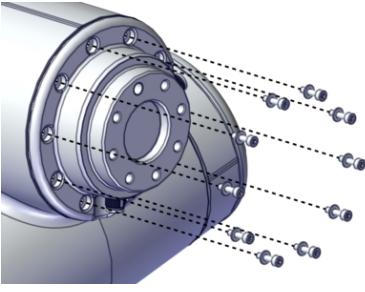
5 Repair

5.4.4 Replacing the wrist housing

Continued

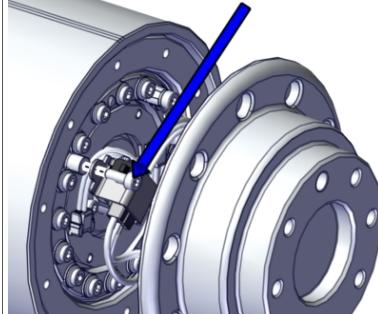
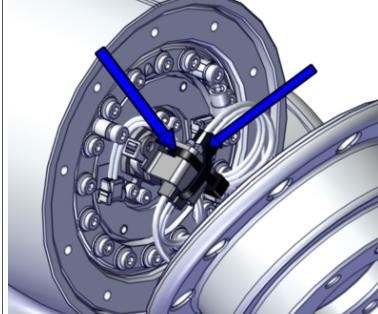
Action	Note
2 Remove the remaining attachment screws.	 xx2000002130
3 Press the tilt out of position using two of the previous attachment screws as removal tools.	
4 Remove the tilt from the tubular. Assist the cabling to be removed while lifting away the complete tilt. Place the tilt on a workbench.	 xx2000002131

Removing the tool flange

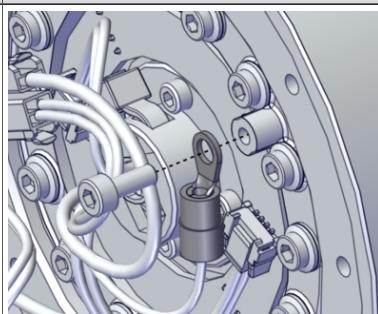
Action	Note
1 Remove the tool flange screws and washers.	 xx2000002155
2  CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	

Continues on next page

5.4.4 Replacing the wrist housing
Continued

Action	Note
3 Loosen the tool flange and remove the cable bracket by removing the screw.	 xx2000002156
4 Cut the cable ties.	 xx2000002157
5 Disconnect the CP/CS connectors from the drive board and remove the tool flange.	 xx2000002158

Disconnecting the tool flange functional earth cable

Action	Note
1 Remove the functional earth cable by removing the screw.	 xx2000002159

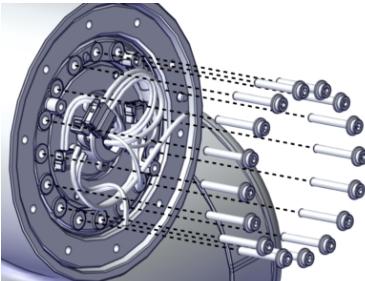
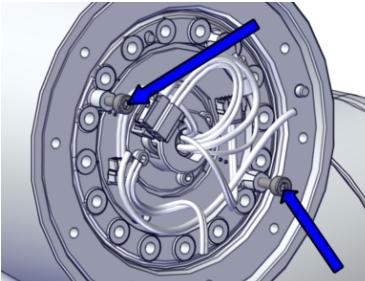
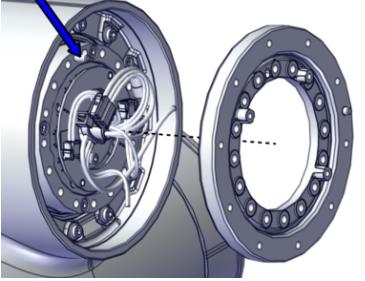
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5 Repair

5.4.4 Replacing the wrist housing

Continued

Removing the tool flange adapter

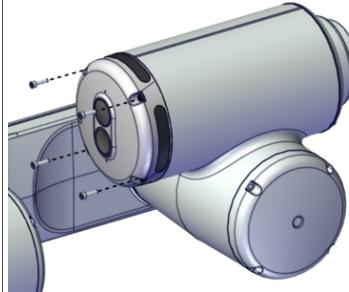
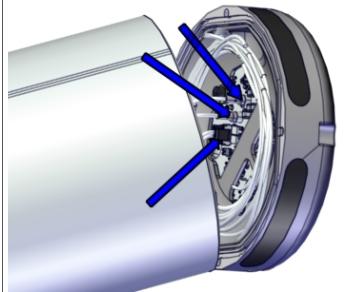
	Action	Note
1	Remove the tool flange adapter screws.	 xx2000002165
2	Press the adapter out of position by using two of the attachment screws as removal tools.	 xx2000002166
3	Remove the tool flange adapter.	 xx2000002167

Removing the arm-side interface

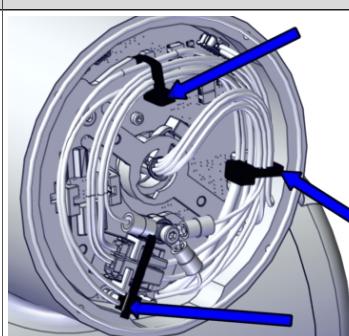
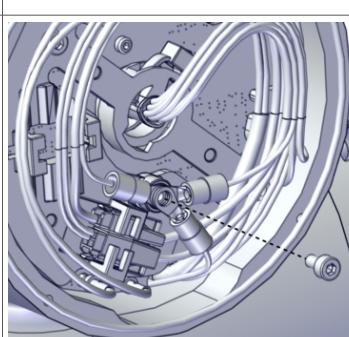
	Action	Note
1	 CAUTION Make sure that all supplies for electrical power are turned off.	
2	 CAUTION There is cabling connected between the arm-side interface and the joint unit drive board. Open the arm-side interface with care to avoid damage to the cabling or the connector(s). Do not leave the arm-side interface in location without being secured with the attachment screws.	

Continues on next page

5.4.4 Replacing the wrist housing
Continued

Action	Note
3 Remove the attachment screws.	 xx2000002550
4 Loosen the arm-side interface carefully and disconnect the connectors from it. <ul style="list-style-type: none"> • ASI.DC+ • ASI.DC- • ASI.X1 	 xx2100000335

Disconnecting the axis-6 joint unit cabling

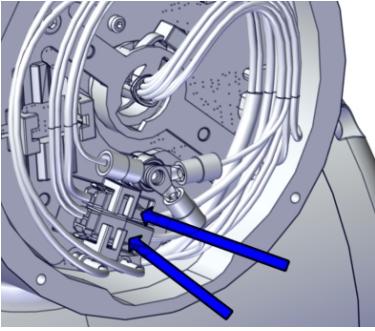
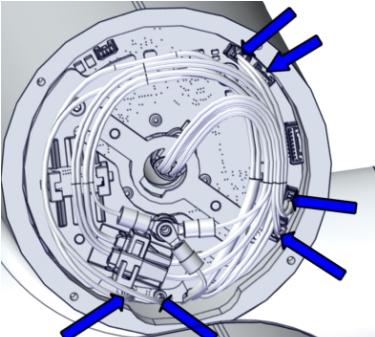
Action	Note
1 Cut the cable ties.	 xx2000002161
2 Remove the functional and protective earth cables by removing the screw.	 xx2000002162

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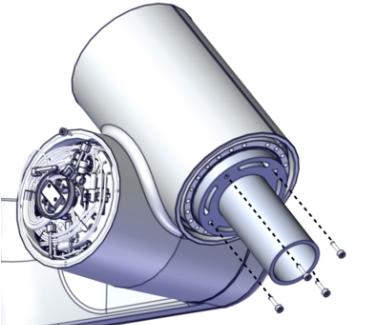
5 Repair

5.4.4 Replacing the wrist housing

Continued

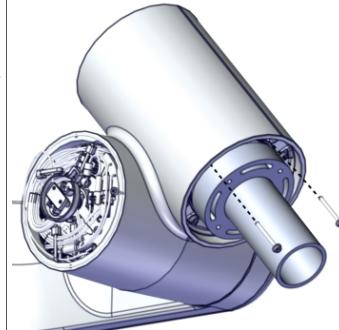
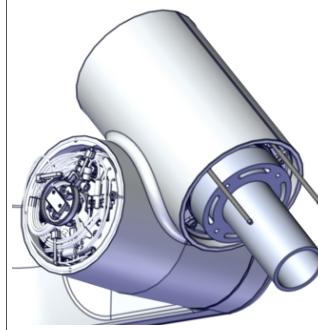
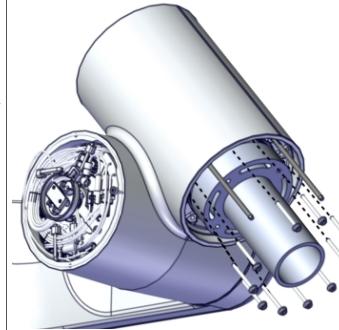
Action	Note
3 Snap loose and disconnect the connectors: • J7.CS • J7.CP	 xx2000002163
4 Disconnect the connectors from the drive board. • D6.X1 • D6.DC+ • D6.DC- • D6.X4 • D6.X2 • D6.X5 Use tweezers, if needed.	Tweezers  xx2000002164

Removing the axis-6 joint unit

Action	Note
1 Fit the lifting aid to the joint unit, on the torque sensor side.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Lifting aid: 3HAC077789-001 Screws: M3x12 (4 pcs)  xx2000002168 Position shown in the figure shows axis 5 jogged to +20°, which is a more convenient position when replacing only the axis-6 joint unit.

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5.4.4 Replacing the wrist housing
Continued

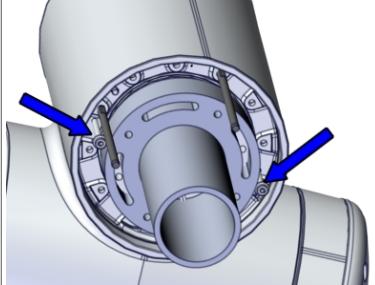
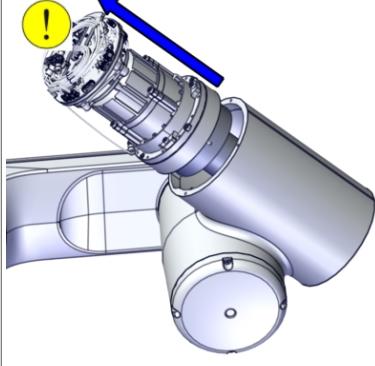
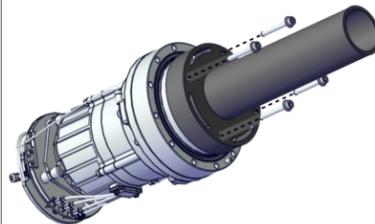
Action	Note
2 Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.	 <p>xx2000002170</p> <p>Position shown in the figure shows axis 5 jogged to +20°, which is a more convenient position when replacing only the axis-6 joint unit.</p>
3 Fit two guide pins to the axis-6 joint unit.	<p>Guide pin, M3x110: 3HAC077787-001</p> <p>Always use guide pins in pairs.</p> <p>For joint units on axes 4, 5 and 6.</p>  <p>xx2100000328</p>
4 Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.	 <p>xx2100000329</p>

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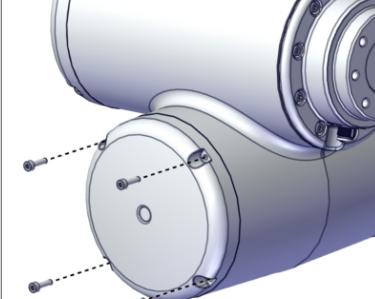
5 Repair

5.4.4 Replacing the wrist housing

Continued

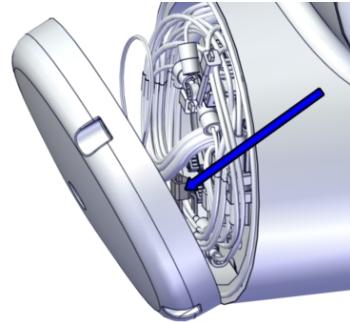
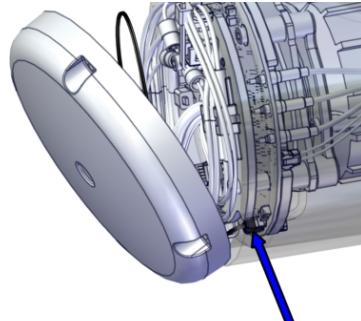
Action	Note
5 Press the joint unit out of position using two of the previous attachment screws as removal tools.	 xx2100000330
6 Remove the joint unit from the tubular. CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002169 <p>Position shown in the figure shows axis 5 jogged to +20°, which is a more convenient position when replacing only the axis-6 joint unit.</p>
7 Remove the lifting aid and guide pins.	 xx2000001957

Removing the axis-5 cover

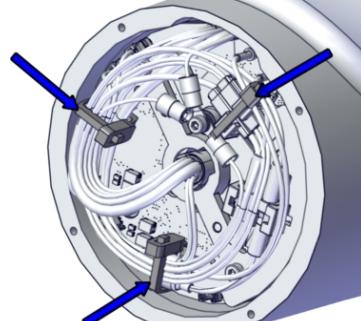
Action	Note
1 Remove the cover by removing the four screws.	 xx2000002132

Continues on next page

5.4.4 Replacing the wrist housing
Continued

Action	Note
2  CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	
3 Open the cover and cut the cable tie that holds the brake release cable.	 xx2000002133
4 Disconnect the brake release connector from the drive board. Remove the cover.	 xx2000002134

Disconnecting the axis-5 joint unit cabling

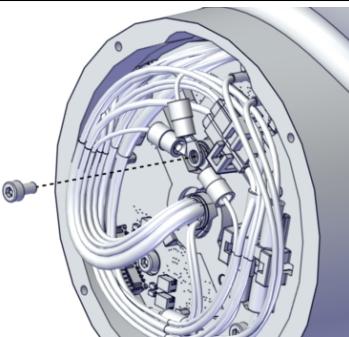
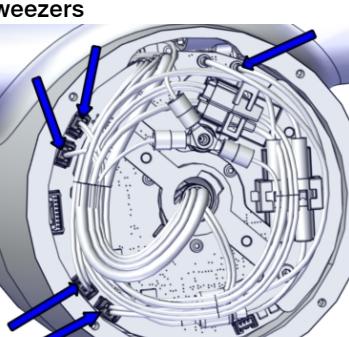
Action	Note
1 Cut the cable ties.	 xx2000002135

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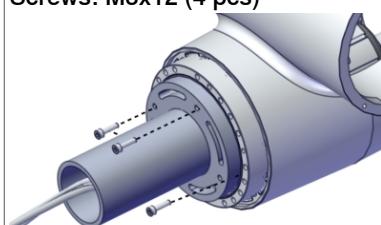
5 Repair

5.4.4 Replacing the wrist housing

Continued

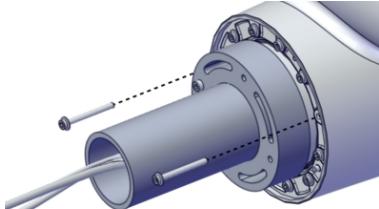
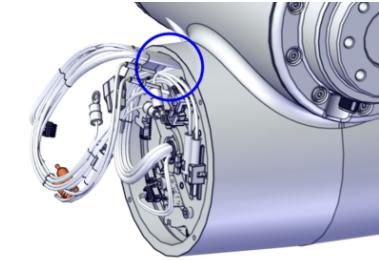
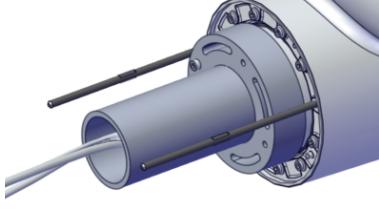
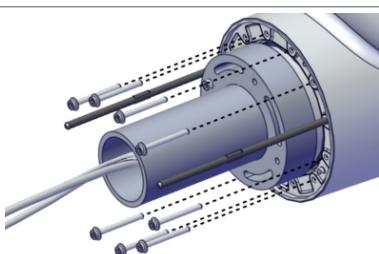
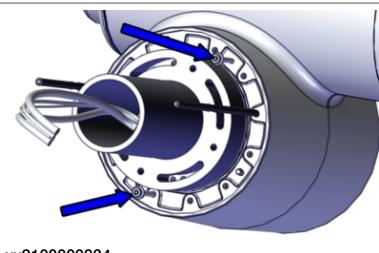
Action	Note
2 Remove the functional and protective earth cables by removing the screw.	 xx2000002136
3 Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J5/6.DC+ • J5/6.DC- • J5/6.CS • J5/6.CP 	 xx2000002137
4 Disconnect the connectors from the drive board. <ul style="list-style-type: none"> • D4/5.X1 • D5.DC+ • D5.DC- • D4/5.X4 • D5.X2 • D4/5.X5 <p>Use tweezers, if needed.</p>	Tweezers  xx2000002138

Removing the axis-5 joint unit

Action	Note
1 Fit the lifting aid to the joint unit, on the torque sensor side.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Lifting aid: 3HAC077789-001 Screws: M3x12 (4 pcs)  xx2000002139

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5.4.4 Replacing the wrist housing
Continued

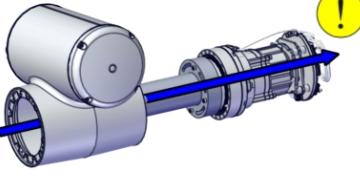
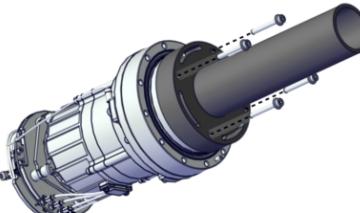
	Action	Note
2	<p>Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.</p>	 xx2000002140
3	<p>Put the cabling at the slot in order not to squeeze it during removal of joint unit.</p>	 xx2100000284
4	<p>Fit two guide pins to the axis-5 joint unit.</p>	<p>Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs. For joint units on axes 4, 5 and 6.</p>  xx2100000332
5	<p>Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.</p>	 xx2100000333
6	<p>Press the joint unit out of position using two of the previous attachment screws as removal tools.</p>	 xx2100000334

Continues on next page

5 Repair

5.4.4 Replacing the wrist housing

Continued

Action	Note
7 Remove the joint unit from the tubular. ! CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002141
8 Remove the lifting aid and guide pins.	 xx2000001957

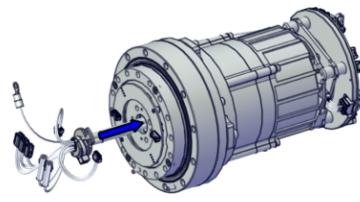
Replacing the wrist

Action	Note
1 Replace the wrist unit.	Wrist housing: 3HAC073951-001

Refitting the wrist housing

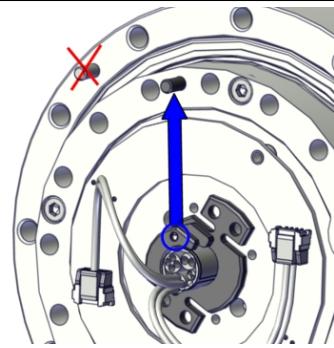
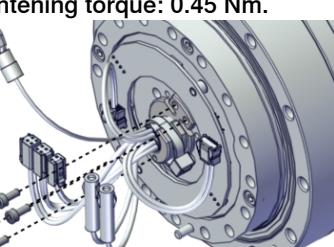
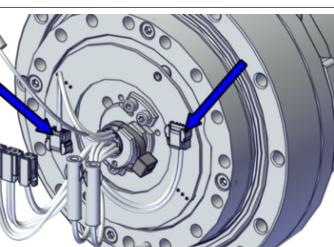
Use these procedures to refit the wrist.

Refitting the axis-5 joint unit cable

Action	Note
1 ! ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2 Place the joint cable through the hollow shaft from the torque sensor side. ! CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002048

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5.4.4 Replacing the wrist housing
Continued

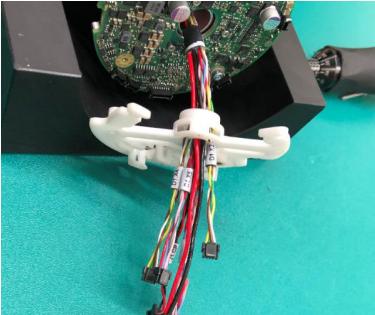
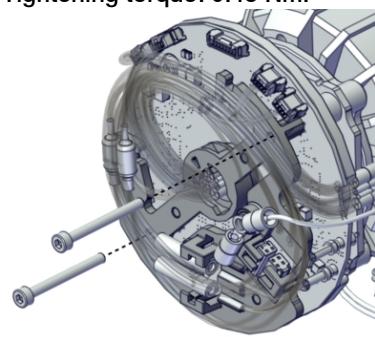
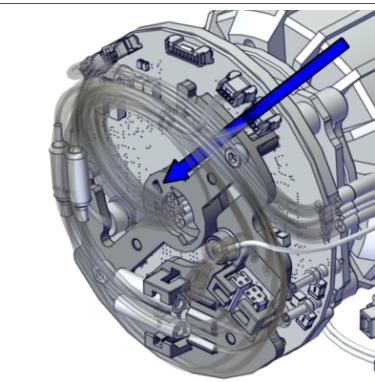
Action	Note
3 Orient the cable plate according to the figure. The circle on the cable plate should point towards the guide pin on the torque sensor.	 xx2000002051
4 Secure the cable plate to the joint unit with the attachment screws.	Hex socket head cap screw: M2.5x6 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm.  xx2000002049
5 Connect the two connectors to the torque sensor board. <ul style="list-style-type: none"> • TQ.A to CH1/A • TQ.B to CH2/B 	 xx2000002053

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5 Repair

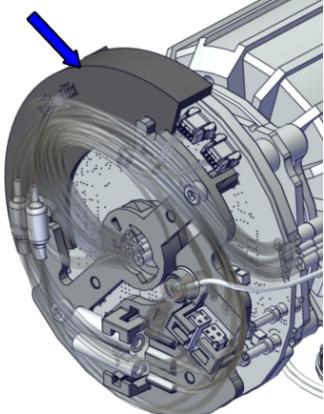
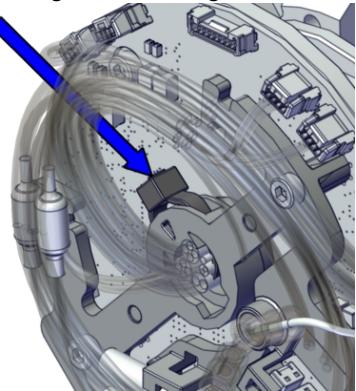
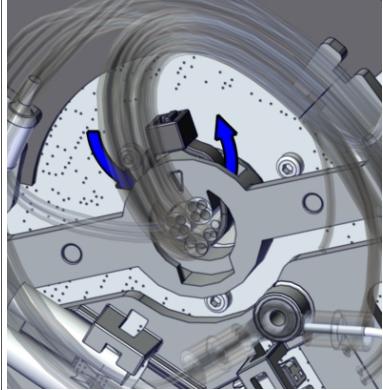
5.4.4 Replacing the wrist housing

Continued

Action	Note
<p>6 Insert the cabling through the cable support and fit the support to the drive board with the attachment screws.</p>	 <p>xx2000002056</p> <p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (2 pcs)</p> <p>Tightening torque: 0.45 Nm.</p>  <p>xx2000002055</p>
<p>7 Align the triangle direction mark on the cable support and the white mark on the cable harness. Use the cable tie to pre-fix the cable by hand.</p>	 <p>xx2100000507</p>  <p>xx2100000508</p>

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5.4.4 Replacing the wrist housing
Continued

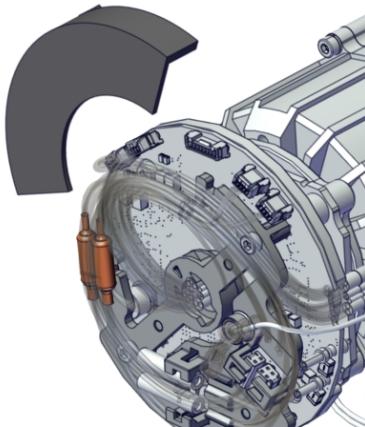
	Action	Note
8	Fit the protection plate to the drive board unit.	<p>Protection plate: 3HAC077790-001</p>  <p>xx2000002057</p>
9	<p>Secure the cables to the cable support with a cable tie, using a cable tie gun. Assembly direction for the cable tie is shown in the figure.</p>	<p>Cable tie: 3HAC075545-001. For securing joint unit cable. Cable tie gun EVO7 Setting for cable tie gun: 6.75.</p>  <p>xx2000002058</p>  <p>xx2000002059</p>

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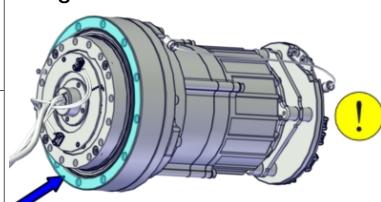
5 Repair

5.4.4 Replacing the wrist housing

Continued

Action	Note
10 Remove the protection plate.	 xx2100000301

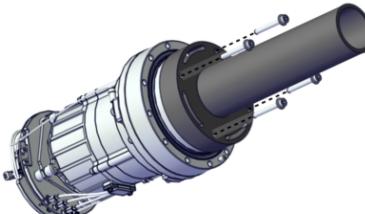
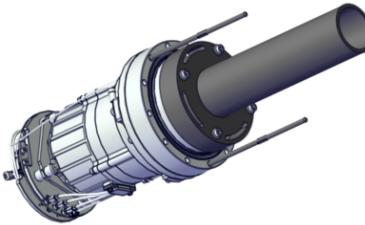
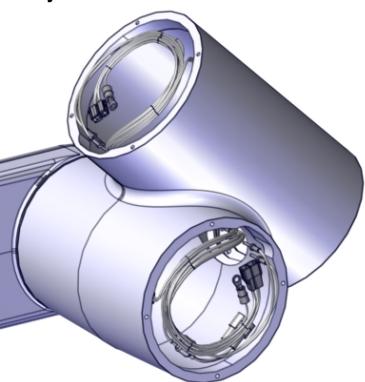
Preparations before fitting the joint unit

Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2 Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol. Joint unit mounting surface is pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574
3  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	 xx2000001860

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5.4.4 Replacing the wrist housing
Continued

Refitting the axis-5 joint unit and transition cabling

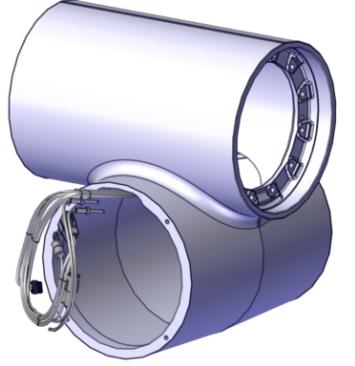
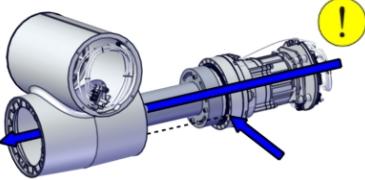
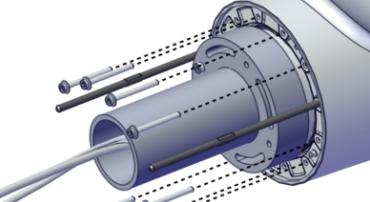
	Action	Note
1	<p>Fit the lifting aid to the joint unit.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	<p>Joint unit: 3HAC079143-001 Lifting aid: 3HAC077789-001 Screws: M3x12 (4 pcs)</p>  <p>xx2000001957</p>
2	Fit two guide pins to the joint unit.	<p>Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs. For joint units on axes 4, 5 and 6.</p>  <p>xx2000002438</p>
3	Fit the transition cable between axis-5 and axis-6 joint units into the tilt.	<p>Cable harness, transition joint-5 and joint-6: 3HAC073209-001</p>  <p>xx2100000040</p>

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5 Repair

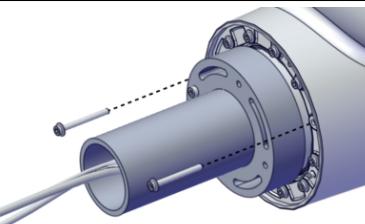
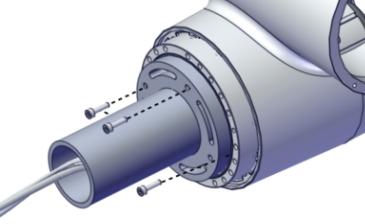
5.4.4 Replacing the wrist housing

Continued

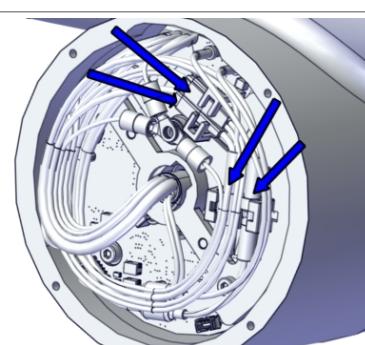
Action	Note
4 Place the cabling at the slot before refitting the joint unit.	 xx2100000041  xx2100000285
5 Fit the joint unit to the tilt, aligning the pin with the pin hole. ! CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002142
6 Secure the joint unit with new attachment screws.	Hex socket head cap flange screw with glue: 3HAB3413-330 M3x30, 12 pcs Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.  xx2100000333

Continues on next page

5.4.4 Replacing the wrist housing
Continued

	Action	Note
7	Remove the guide pins and secure the remaining two attachment screws.	 xx2000002140
8	Pre-tighten the screws crosswise.	
9	Torque tighten all screws crosswise.	Tightening torque: 1.4 Nm.
10	Remove the lifting aid by removing the screws.	 xx2000002139
11	Clean pushed-out flange sealant, if any.	

Connecting the axis-5 joint unit cabling

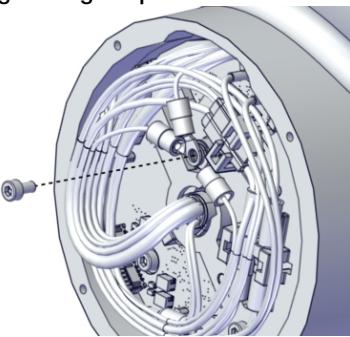
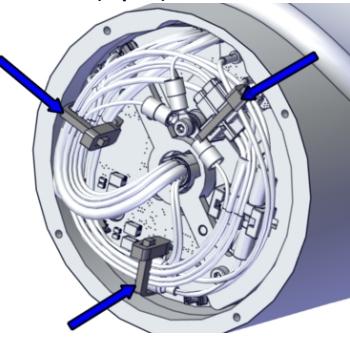
	Action	Note
1	Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D4/5.X1 to X1 • D5.DC+ to +DC • D5.DC- to Ground • D4/5.X4 to X4 • D5/4.X2 to X2 • D4/5.X5 to X5 	 xx2000002138
2	Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J5/6.DC+ to J6.DC+ • J5/6.DC- to J6.DC- • J5/6.CS to J6.CS • J5/6.CP to J6.CP 	 xx2000002137

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5 Repair

5.4.4 Replacing the wrist housing

Continued

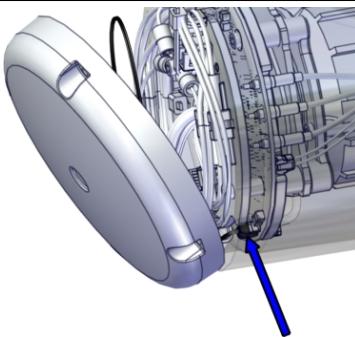
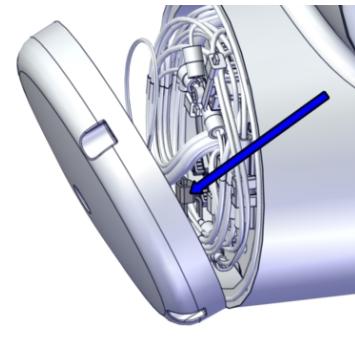
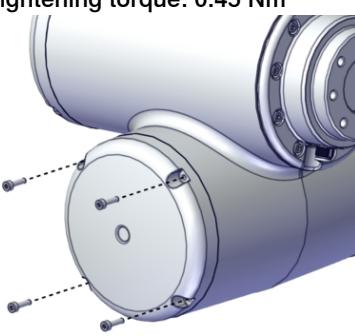
Action	Note
3 Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000002136
4 Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000002135

Refitting the axis-5 cover

Action	Note
1 Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-051  xx2000001962

Continues on next page

5.4.4 Replacing the wrist housing
Continued

	Action	Note
2	Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board.	 xx2000002134
3	Secure the brake release cable with a cable tie.	Cable ties  xx2000002133
4	Refit the cover with the four screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm  xx2000002132

Preparations before fitting the joint unit

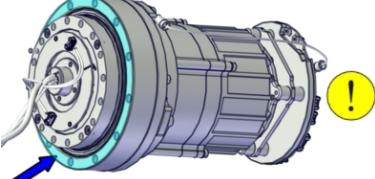
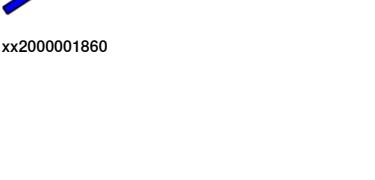
	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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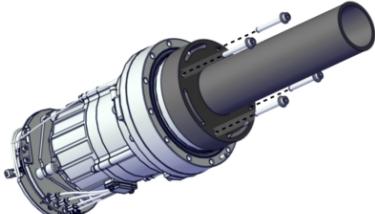
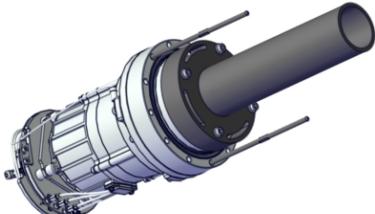
5 Repair

5.4.4 Replacing the wrist housing

Continued

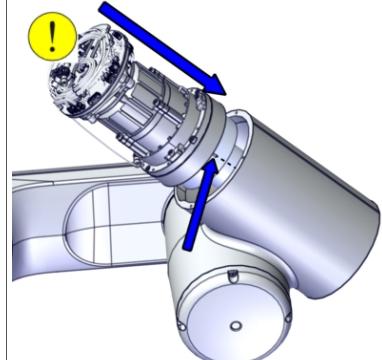
Action	Note
<p>2 Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol.</p> <p>Joint unit mounting surface is pointed out in the figure.</p>	<p>Cleaning agent: Isopropanol Flange sealant: Loctite 574</p> 
<p>3 Apply a thin layer of flange sealant to the mounting surface. Do not contaminate the radial sealing with sealant.</p> <p>CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p> <p>ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section <i>The unit is sensitive to ESD on page 42</i>.</p>	 <p>xx2000001860</p>

Refitting the axis-6 joint unit

Action	Note
<p>1 Fit the lifting aid to the joint unit.</p> <p>CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	<p>Joint unit: 3HAC079143-001 Lifting aid: 3HAC077789-001 Screws: M3x12 (4 pcs)</p> 
<p>2 Fit two guide pins to the joint unit.</p>	<p>Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs. For joint units on axes 4, 5 and 6.</p> 

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5.4.4 Replacing the wrist housing
Continued

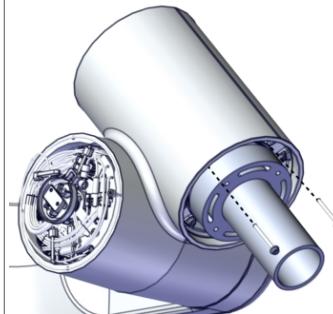
Action	Note
3 Place the cabling at the slot before refitting the joint unit.	 xx210000041
4 Fit the joint unit to the tilt, aligning the pin with the pin hole. CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002195
5 Secure the joint unit with new attachment screws.	Hex socket head cap flange screw with glue: 3HAB3413-330 M3x30, 12 pcs Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.  xx2100000329

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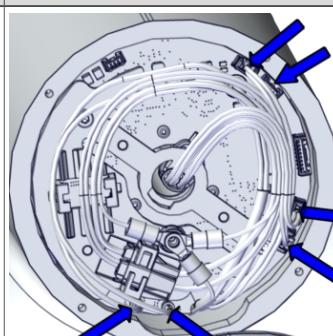
5 Repair

5.4.4 Replacing the wrist housing

Continued

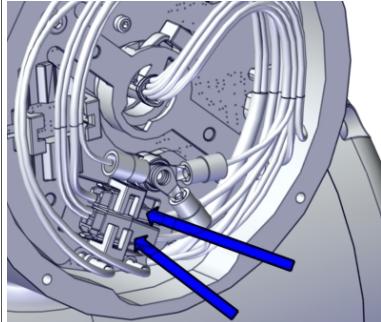
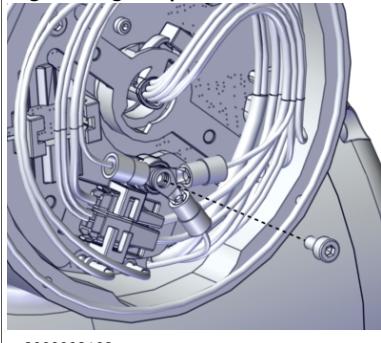
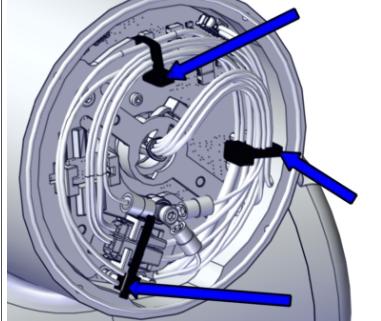
Action	Note
6 Remove the guide pins and secure the remaining two attachment screws.	 xx2000002170
7 Pre-tighten the screws crosswise.	
8 Torque tighten all screws crosswise. Tightening torque: 1.4 Nm.	
9 Remove the lifting aid by removing the screws.	 xx2000002168
10 Clean pushed-out flange sealant, if any.	

Connecting the axis-6 joint unit cabling

Action	Note
1 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D6.X1 to X1 • D6.DC+ to +DC • D6.DC- to Ground • D6.X4 to X4 • D6.X2 to X2 • D6.X5 to X5 	 xx2000002164

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5.4.4 Replacing the wrist housing
Continued

Action	Note
2 Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J7.CS to J7.CS • J7.CP to J7.CP 	 xx2000002163
3 Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000002162
4 Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000002161

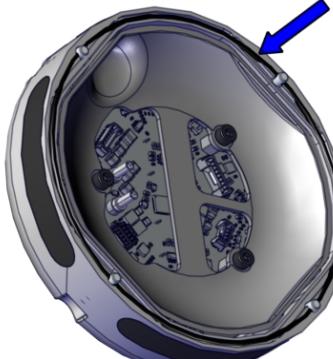
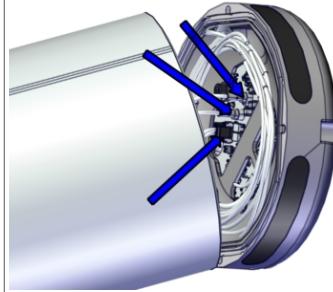
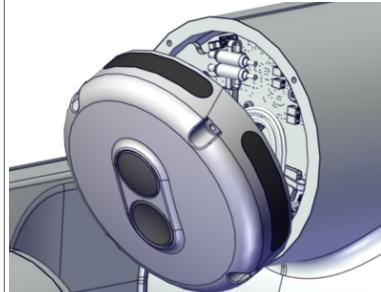
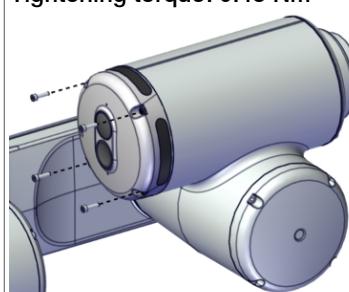
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5 Repair

5.4.4 Replacing the wrist housing

Continued

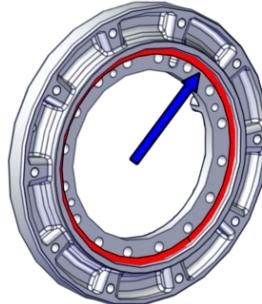
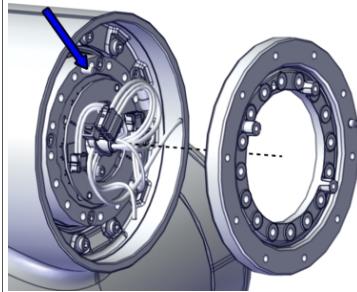
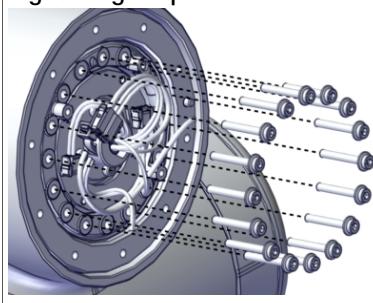
Refitting the arm-side interface

	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-051  xx2000002551
2	Place the arm-side interface at mounting position and reconnect the connectors. <ul style="list-style-type: none">• ASI.DC+• ASI.DC-• ASI.X1 The correct orientation of the arm-side interface is with the convex button in upper position.  Note Do not leave the arm-side interface in location without being secured with the attachment screws.	 xx2100000335  xx2100000336
3	Refit the arm-side interface with four screws.	Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm  xx2000002550

Continues on next page

5.4.4 Replacing the wrist housing
Continued

Refitting the tool flange adapter

	Action	Note
1	Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the adapter mounting surface, as pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000002196
2	Refit the tool flange adapter, aligning the pin with the pin hole.	Axis-6 inner flange: 3HAC073952-001  xx2000002167
3	Secure with screws.	Hex socket head cap flange screw: M3x20 (16 pcs) Tightening torque: 1.8 Nm.  xx2000002165

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5 Repair

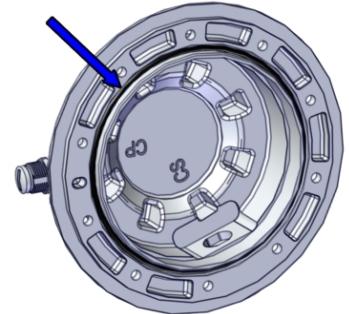
5.4.4 Replacing the wrist housing

Continued

Connecting the tool flange functional earth cable

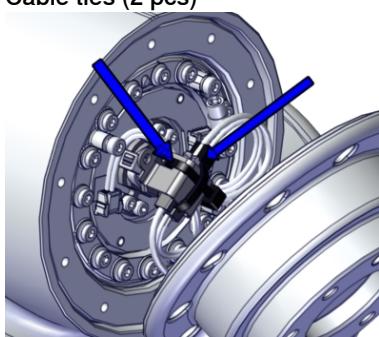
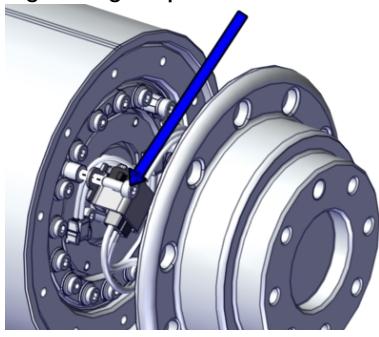
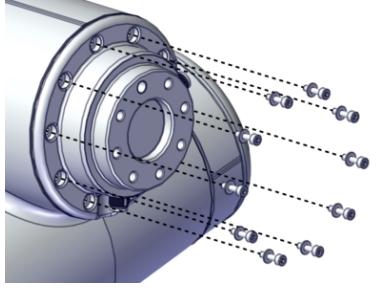
	Action	Note
1	Secure the cable for functional earth to the tool flange adapter with a screw.	 xx2000002159

Refitting the tool flange

	Action	Note
1	Check the o-ring on the tool flange and lubricate with grease. Replace if damaged.	Axis-6 flange: 3HAC073953-001 O-ring: 3HAB3772-182 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000002197
2	Place the tool flange at mounting position and reconnect the CP/CS connectors.	 xx2000002158

Continues on next page

5.4.4 Replacing the wrist housing
Continued

	Action	Note
3	Fit the connectors to the cable bracket and secure the connectors with two cable ties.	<p>Cable ties (2 pcs)</p>  <p>xx2000002157</p>
4	Refit the cable bracket with the screw.	<p>Hex socket head cap screw: M3x20 12.9 Gleitmo 603+Geomet 500 (1 pcs) Tightening torque: 0.8 Nm.</p>  <p>xx2000002156</p>
5	Refit and secure the tool flange with screws and washers.	<p>Hex socket head cap screw: M3x12 12.9 Gleitmo 603+Geomet 500 (10 pcs) Spring washer: 7x3.2x0.6 Steel (10 pcs) Tightening torque: 1.8 Nm.</p>  <p>xx2000002155</p>

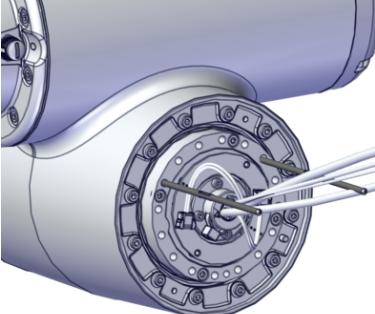
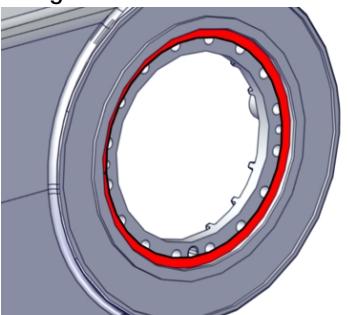
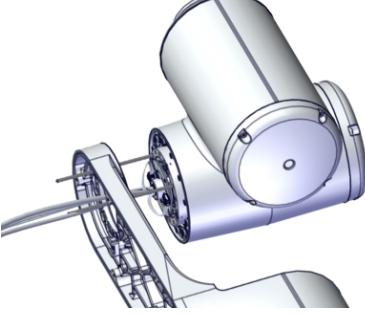
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5 Repair

5.4.4 Replacing the wrist housing

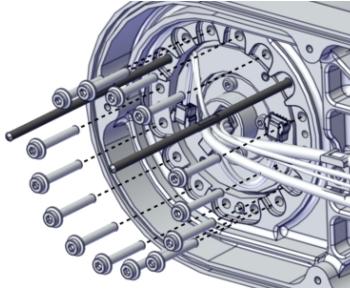
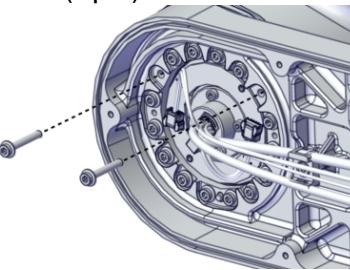
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Refitting the tilt

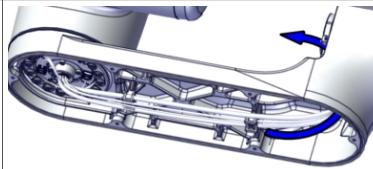
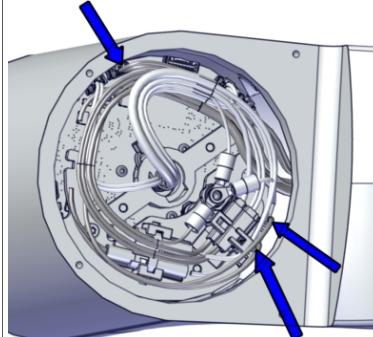
	Action	Note
1	Fit two guide pins to the axis-5 joint.	Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs.  xx2000002146
2	Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the tubular mounting surface, as pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000002147
3	Lift the tilt into mounting position while inserting the cabling into the tubular.	
4	Slide the tilt into place on the guide pins.	 xx2000002131

Continues on next page

5.4.4 Replacing the wrist housing
Continued

Action	Note
5 Secure the tilt to the tubular with all attachment screws but two. Pre-tighten the screws crosswise firstly.	Hex socket head cap flange screw: M3x20 (14 pcs)  xx2000002130
6 Remove the guide pins and fasten the remaining two screws.	Hex socket head cap flange screw: M3x20 (2 pcs)  xx2000002128
7 Torque tighten all screws crosswise.	Tightening torque: 1.8 Nm.

Connecting the tilt cabling

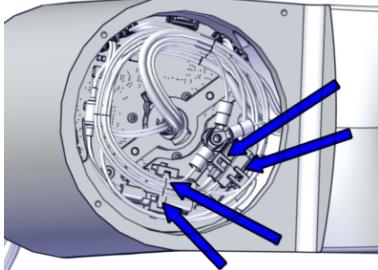
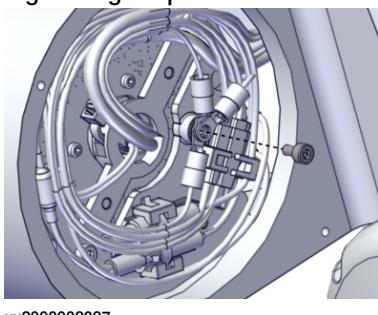
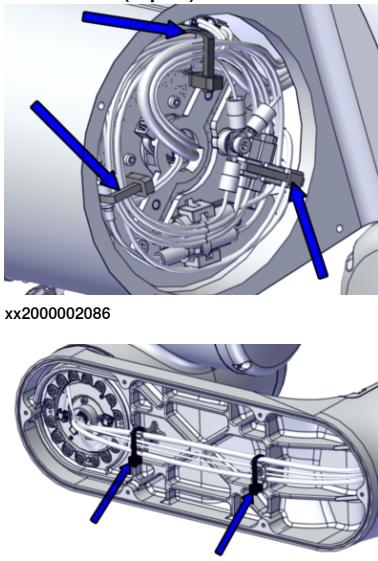
Action	Note
1 Insert the cabling into the tubular.	 xx2000002148
2 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D3/4.X2 to X2 • D3/4.DC- to Ground • D3/4.DC+ to +DC 	 xx2000002125

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5 Repair

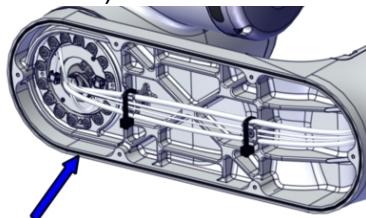
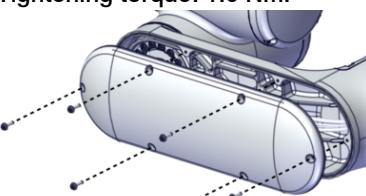
5.4.4 Replacing the wrist housing

Continued

	Action	Note
3	<p>Connect the connectors to each other and snap them to the cable holders.</p> <ul style="list-style-type: none"> • J4/5.DC+ to J5/6.DC+ • J4/5.DC- to J5/6.DC- • J4/5.CS to J5/6.CS • J4/5.CP to J5/6.CP 	 xx2000002089
4	<p>Secure the cables for functional earth and protective earth with a screw.</p>	<p>Hex socket head cap screw: M3x6 (1 pcs).</p> <p>Tightening torque: 0.8 Nm.</p>  xx2000002087
5	<p>Secure the cabling with cable ties.</p>	<p>Cable ties (3 pcs)</p>  xx2000002086 xx2000002124

Continues on next page

Refitting the tubular cover

	Action	Note
1	Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-043 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000002149
2	Refit the cover with new attachment screws.	Hex socket head cap flange screw with glue: 3HAB3413-312 M3x12 For tubular cover. Always use new screws. If ordering a new axis-4 or axis-5 joint unit spare part, new screws for the tubular cover are included. Tightening torque: 1.6 Nm.  xx2000002123

Concluding procedure

	Action	Note
1	Calibrate the axis-5 and axis-6 joint unit torque sensor.	See Calibration on page 607
2	 DANGER Make sure all safety requirements are met when performing the first test run.	

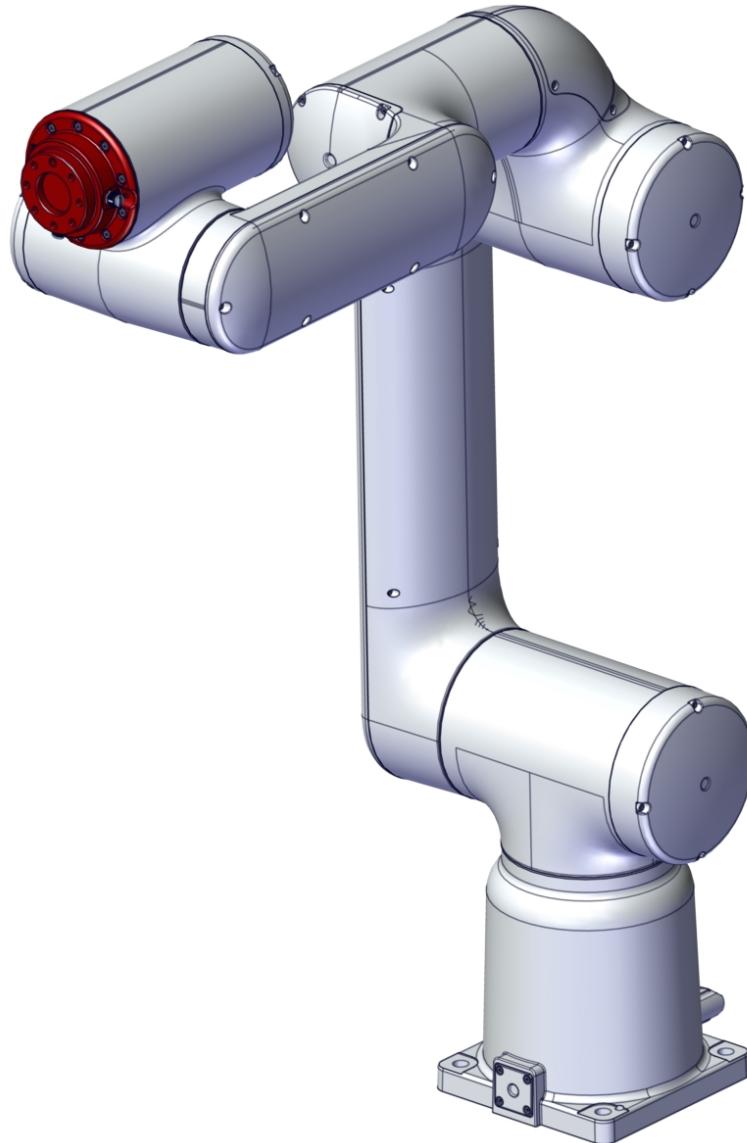
5 Repair

5.4.5 Replacing the tool flange and axis-6 inner flange

5.4.5 Replacing the tool flange and axis-6 inner flange

Location of the tool flange and axis-6 inner flange

The tool flange is located as shown in the figure. The axis-6 inner flange is located beneath the tool flange.



xx2100000054

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

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5.4.5 Replacing the tool flange and axis-6 inner flange
Continued

Spare part	Article number	Note
Axis-6 flange	3HAC073953-001	
Axis-6 inner flange	3HAC073952-001	

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 625.

Required consumables

Consumable	Article number	Note
Cleaning agent	-	Isopropanol
Flange sealant	-	Loctite 574
Grease	3HAC042536-001	Shell Gadus S2
O-ring	3HAB3772-182	Tool flange
Cable ties	-	

Removing the tool flange and axis-6 inner flange

Use these procedures to remove the tool flange and axis-6 inner flange.

Preparations before removing the flanges

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Jog the robot to the specified position: <ul style="list-style-type: none"> • Axis 1: No significance. • Axis 2: No significance. • Axis 3: No significance. • Axis 4: No significance. • Axis 5: No significance. • Axis 6: 0° 	
3	 CAUTION Turn off all supplies for electrical power to the robot, before starting the repair work.	

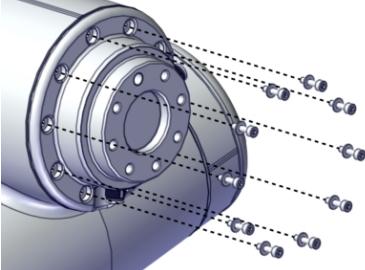
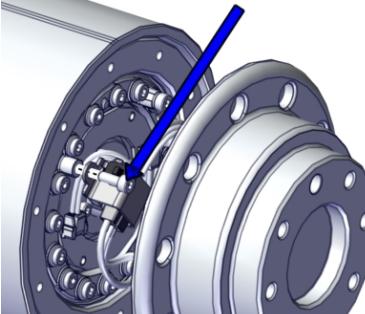
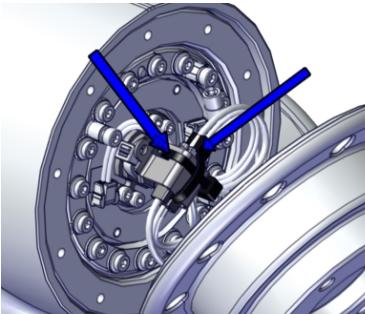
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5 Repair

5.4.5 Replacing the tool flange and axis-6 inner flange

Continued

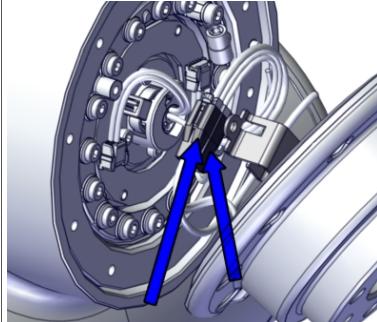
Removing the tool flange

	Action	Note
1	Remove the tool flange screws and washers.	 xx2000002155
2	! CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	
3	Loosen the tool flange and remove the cable bracket by removing the screw.	 xx2000002156
4	Cut the cable ties.	 xx2000002157

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5.4.5 Replacing the tool flange and axis-6 inner flange

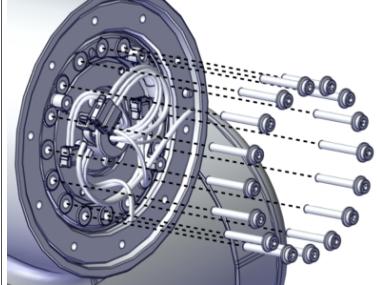
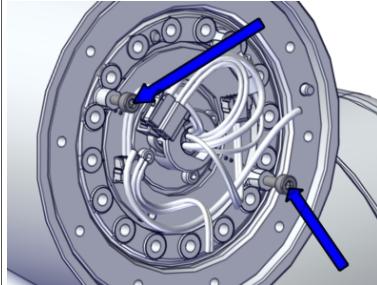
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Action	Note
5 Disconnect the CP/CS connectors from the drive board and remove the tool flange.	 xx2000002158

Disconnecting the tool flange functional earth cable

Action	Note
1 Remove the functional earth cable by removing the screw.	 xx2000002159

Removing the tool flange adapter

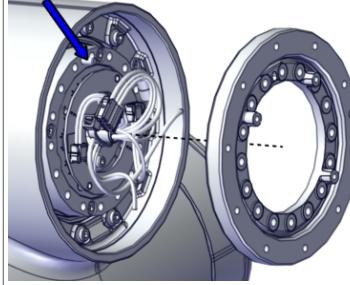
Action	Note
1 Remove the tool flange adapter screws.	 xx2000002165
2 Press the adapter out of position by using two of the attachment screws as removal tools.	 xx2000002166

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5 Repair

5.4.5 Replacing the tool flange and axis-6 inner flange

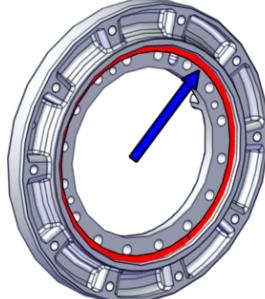
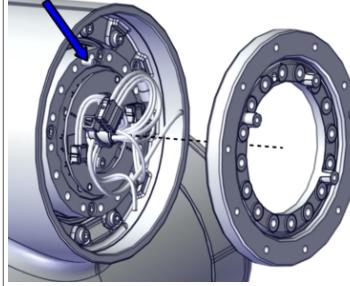
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Action	Note
3 Remove the tool flange adapter.	 xx2000002167

Refitting the flanges

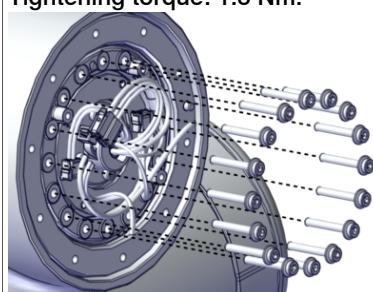
Use these procedures to refit the tool flange and axis-6 inner flange.

Refitting the tool flange adapter

Action	Note
1 Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the adapter mounting surface, as pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000002196
2 Refit the tool flange adapter, aligning the pin with the pin hole.	Axis-6 inner flange: 3HAC073952-001  xx2000002167

Continues on next page

5.4.5 Replacing the tool flange and axis-6 inner flange
Continued

Action	Note
3 Secure with screws.	<p>Hex socket head cap flange screw: M3x20 (16 pcs) Tightening torque: 1.8 Nm.</p>  <p>xx2000002165</p>

Connecting the tool flange functional earth cable

Action	Note
1 Secure the cable for functional earth to the tool flange adapter with a screw.	 <p>xx2000002159</p>

Refitting the tool flange

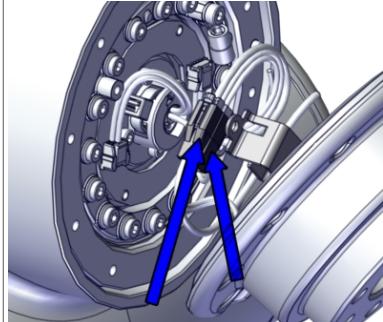
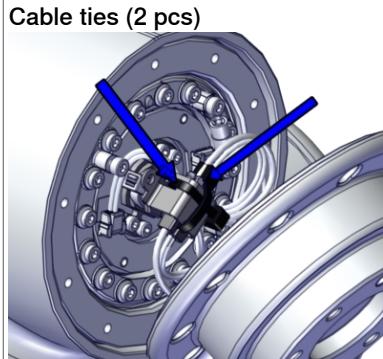
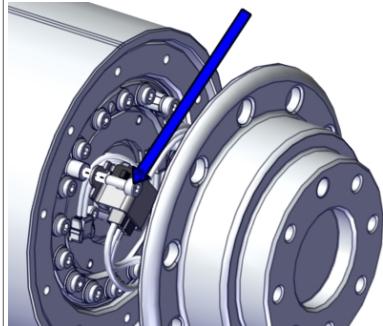
Action	Note
1 Check the o-ring on the tool flange and lubricate with grease. Replace if damaged.	<p>Axis-6 flange: 3HAC073953-001 O-ring: 3HAB3772-182 Grease: 3HAC042536-001 (Shell Gadus S2)</p>  <p>xx2000002197</p>

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5 Repair

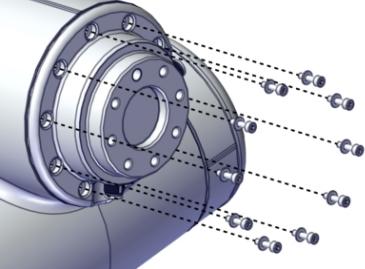
5.4.5 Replacing the tool flange and axis-6 inner flange

Continued

	Action	Note
2	Place the tool flange at mounting position and reconnect the CP/CS connectors.	 xx2000002158
3	Fit the connectors to the cable bracket and secure the connectors with two cable ties.	 xx2000002157
4	Refit the cable bracket with the screw.	<p>Hex socket head cap screw: M3x20 12.9 Gleitmo 603+Geomet 500 (1 pcs) Tightening torque: 0.8 Nm.</p>  xx2000002156

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5.4.5 Replacing the tool flange and axis-6 inner flange
Continued

Action	Note
5 Refit and secure the tool flange with screws and washers.	<p>Hex socket head cap screw: M3x12 12.9 Gleitmo 603+Geomet 500 (10 pcs) Spring washer: 7x3.2x0.6 Steel (10 pcs) Tightening torque: 1.8 Nm.</p>  <p>xx2000002155</p>

Concluding procedure

Action	Note
1  DANGER Make sure all safety requirements are met when performing the first test run.	

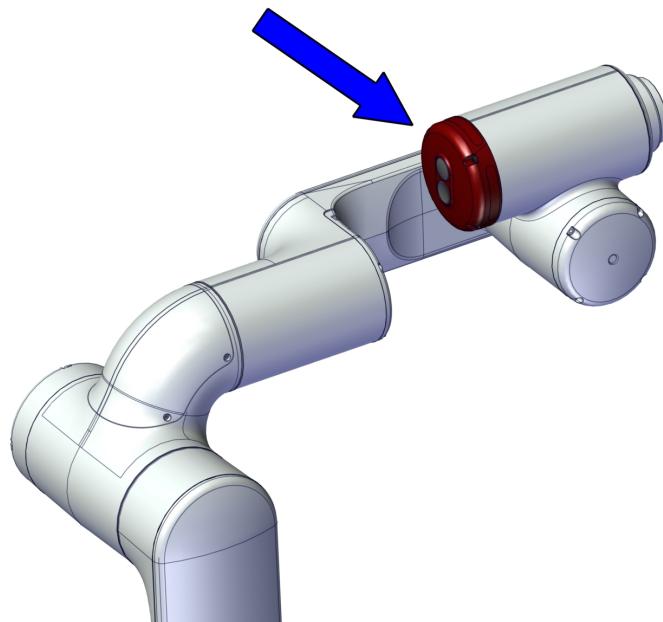
5 Repair

5.4.6 Replacing the arm-side interface

5.4.6 Replacing the arm-side interface

Location of the arm-side interface

The arm-side interface is located as shown in the figure.



xx2000002549

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Spare part	Article number	Note
Arm side interface	3HAC076855-001	

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
O-ring	3HAC061327-051	Arm-side interface Replace if damaged.
Cable ties	-	

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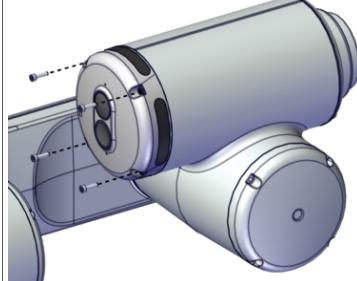
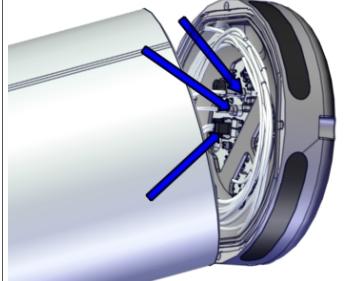
Removing the arm-side interface

Use these procedures to remove the arm side interface.

Preparations before removing the arm-side interface

	Action	Note
1	Jog the robot to a position where the arm side interface is easily accessed.	
2	 CAUTION Turn off all supplies for electrical power to the robot, before starting the repair work.	

Removing the arm-side interface

	Action	Note
1	 CAUTION Make sure that all supplies for electrical power are turned off.	
2	 CAUTION There is cabling connected between the arm-side interface and the joint unit drive board. Open the arm-side interface with care to avoid damage to the cabling or the connector(s). Do not leave the arm-side interface in location without being secured with the attachment screws.	
3	Remove the attachment screws.	 xx2000002550
4	Loosen the arm-side interface carefully and disconnect the connectors from it. <ul style="list-style-type: none"> • ASI.DC+ • ASI.DC- • ASI.X1 	 xx2100000335

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5 Repair

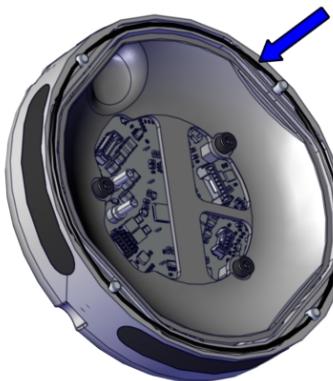
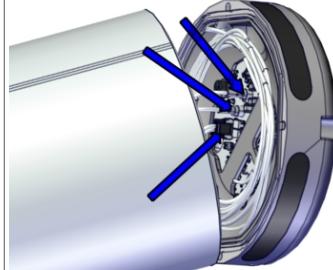
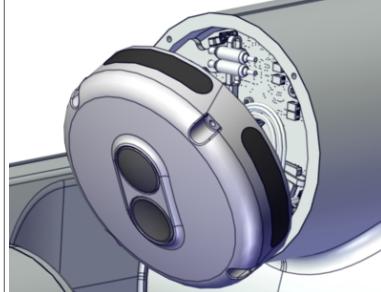
5.4.6 Replacing the arm-side interface

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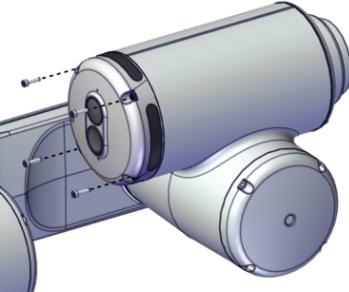
Refitting the arm-side interface

Use these procedures to refit the arm-side interface.

Refitting the arm-side interface

	Action	Note
1	<p>Fit the o-ring to its groove. Replace if damaged.</p>	<p>O-ring: 3HAC061327-051</p>  <p>xx2000002551</p>
2	<p>Place the arm-side interface at mounting position and reconnect the connectors.</p> <ul style="list-style-type: none">• ASI.DC+• ASI.DC-• ASI.X1 <p>The correct orientation of the arm-side interface is with the convex button in upper position.</p> <p> Note</p> <p>Do not leave the arm-side interface in location without being secured with the attachment screws.</p>	 <p>xx2100000335</p>  <p>xx2100000336</p>

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Action	Note
3 Refit the arm-side interface with four screws.	<p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm</p> 

Concluding procedure

Action	Note
<p>1  DANGER Make sure all safety requirements are met when performing the first test run.</p>	

5 Repair

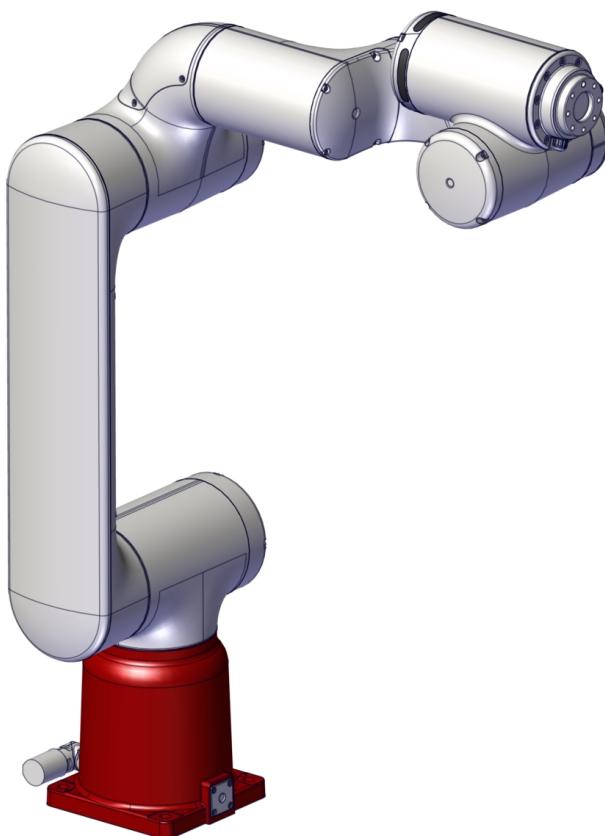
5.5.1 Replacing the base

5.5 Swing and base

5.5.1 Replacing the base

Location of the base

The base is located as shown in the figure.



xx2100000422

Figure 5.1:

Summary of the replacement procedure

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

- 1 Separate the cabling between the swing and the lower arm.
- 2 Remove the lower and upper arm undivided.
- 3 Remove the axis-2 joint unit.
- 4 Remove the swing.
- 5 Loosen the base from the foundation and lay it down on its side.
- 6 Remove the axis-1 joint unit.
- 7 Replace the base. Move the base cabling and axis-1 brake release unit from old to new base.

Continues on next page

Required spare parts**Note**

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Spare part	Article number	Note
Base	3HAC073922-001	Also order new attachment screws for the axis-1 and axis-2 joint unit: 3HAB3413-435 (24 pcs).
Hex socket head cap flange screw with glue	3HAB3413-435	M4x35, 12 pcs Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.
Hex socket head cap flange screw with glue	3HAB3413-435	M4x35, 12 pcs Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.
Cable tie	3HAC075545-001	For securing joint unit cable.
Cable tie	3HAC075545-001	For securing joint unit cable.

Required tools and equipment

Equipment	Article number	Note
Lifting aid	3HAC077788-001	For joint units on axes 1, 2 and 3. Attachment screws M4x35 (4 pcs) are enclosed.
Guide pin, M4x120	3HAC077786-001	Always use guide pins in pairs. For joint units on axes 1, 2 and 3.
Protection plate	3HAC077790-001	For protection of drive board during cabling installation on joint unit.
Cable tie gun EVO7	-	HellermannTyton 110-70084 or similar
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cable tie	3HAC075545-001	For securing joint unit cable.
O-ring, nitrile rubber	3HAB3772-119	Axis-1 brake release unit Replace if damaged.
O-ring, nitrile rubber	3HAB3772-64	Base cover

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5 Repair

5.5.1 Replacing the base

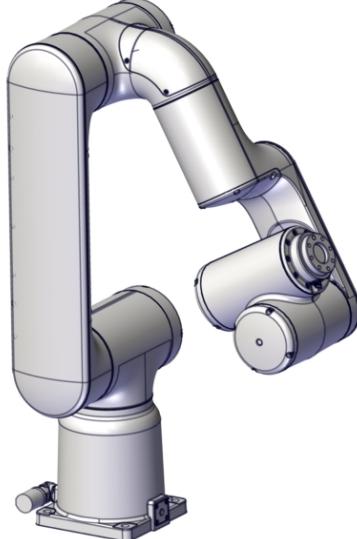
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Consumable	Article number	Note
O-ring	3HAC061327-044	Lower arm, inner cover. 1 pcs / cover. Replace if damaged.
O-ring	3HAC061327-047	Cover for axis 2/3 Replace if damaged.
Grease	3HAC031695-001	Harmonic Grease 4B No.2 Used to lubricate the seals.
Grease	3HAC042536-001	Shell Gadus S2
Cleaning agent	-	Isopropanol
Flange sealant	-	Loctite 574
Cable ties	-	

Removing the base

Use these procedures to remove the base.

Preparations before removing the base

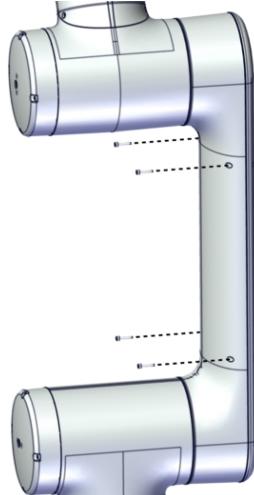
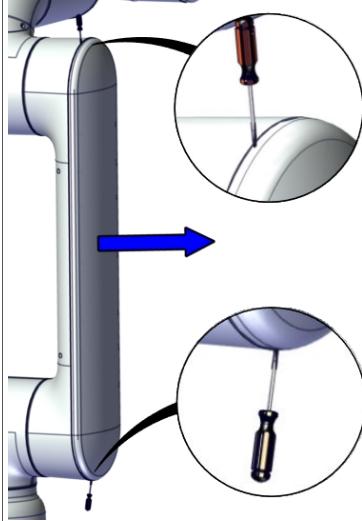
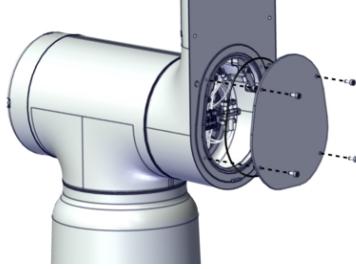
	Action	Note
1	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none">• Axis 1: 0°• Axis 2: 0°• Axis 3: +60°• Axis 4: 0°• Axis 5: -90°• Axis 6: No significance. <p>! CAUTION Jog the axis on which the joint unit is to be replaced to home position, to achieve correct cable routing during replacement of the joint unit.</p>	 xx210000044
2	<p>! CAUTION</p> <p>Turn off all supplies for electrical power to the robot, before starting the repair work.</p>	

Removing the lower arm covers

	Action	Note
1	<p>! CAUTION</p> <p>Make sure that all supplies for electrical power are turned off.</p>	

Continues on next page

5.5.1 Replacing the base
Continued

Action	Note
2 Remove the four lower arm cover screws.	 xx2000001929
3 Remove the cover by inserting a small flat screwdriver to snap open the locks at each end of the cover.	 xx2100000267
4 Remove the inner cover by removing the four screws.	 xx2000001930

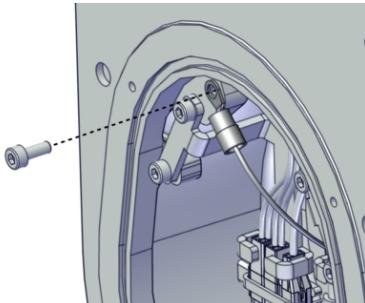
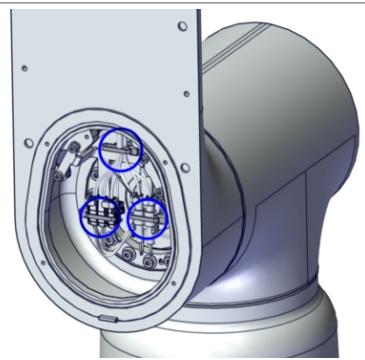
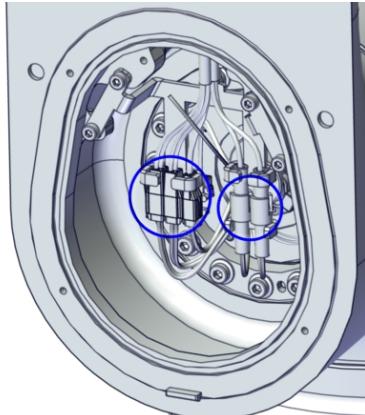
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5 Repair

5.5.1 Replacing the base

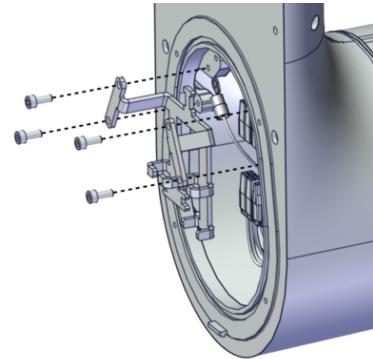
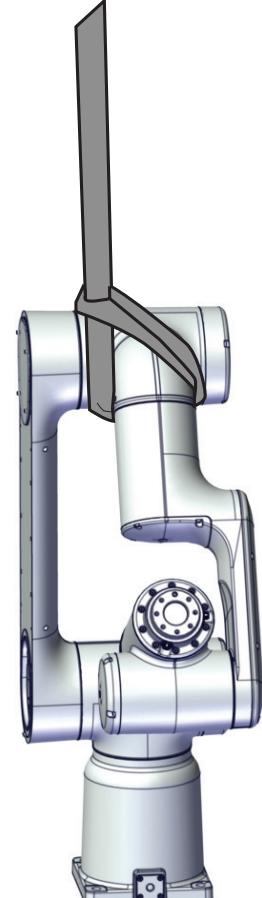
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Disconnecting the cabling between the lower arm and the swing

	Action	Note
1	Remove the functional earth cable by removing the screw.	 xx2000001936
2	Cut the cable ties.	 xx2000001937
3	Snap loose and disconnect all connectors.	 xx2000001938

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Removing the lower and upper arm assembled

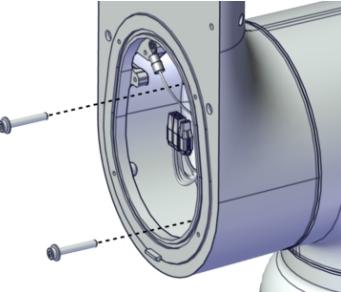
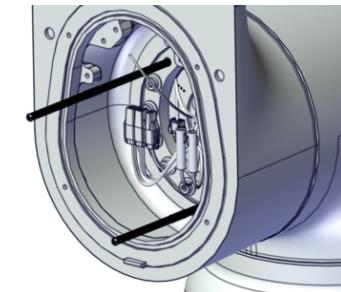
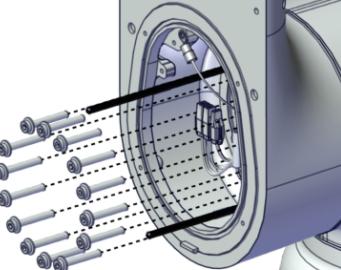
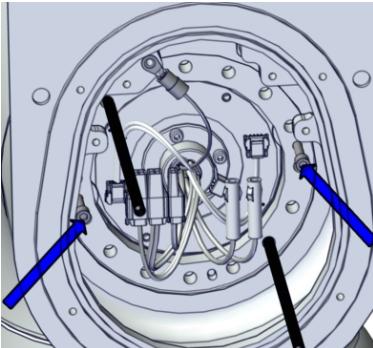
	Action	Note
1	Remove the cable bracket by removing the four screws.	 xx2000001939
2	Secure the weight of the upper and lower arm. CAUTION The weight of the complete upper and lower arm together is 18 kg	Suggestion with lifting sling and an overhead crane:  xx2100000294

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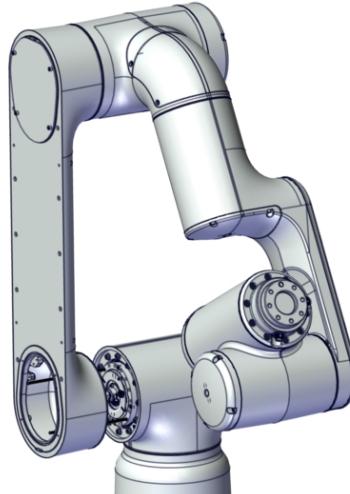
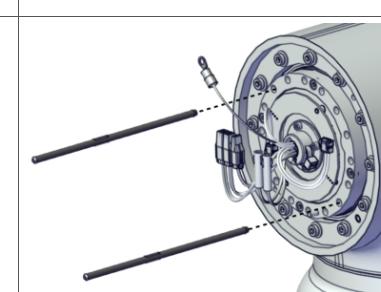
5 Repair

5.5.1 Replacing the base

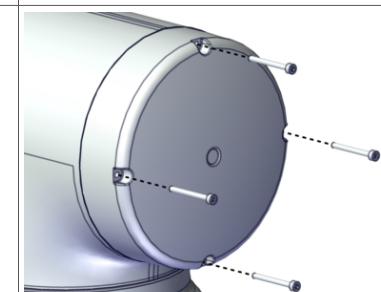
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	Action	Note
3	Remove two attachment screws and fit two guide pins to the axis-2 joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs.</p>  <p>xx2000001951</p>  <p>xx2000001960</p>
4	Remove the lower arm attachment screws.	 <p>xx2000001940</p>
5	Use two fully threaded attachment screws as removal tools to press the lower arm out of position.	 <p>xx2000002151</p>

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Action	Note
6 Remove the complete arm system from the swing.	 xx2000001941
7 Remove the guide pins.	 xx2000002432

Removing the swing cover

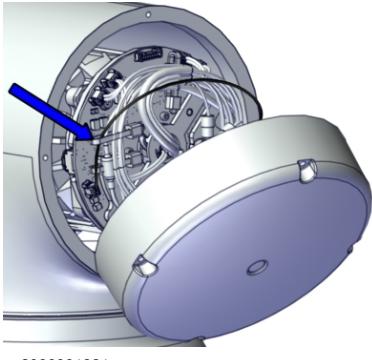
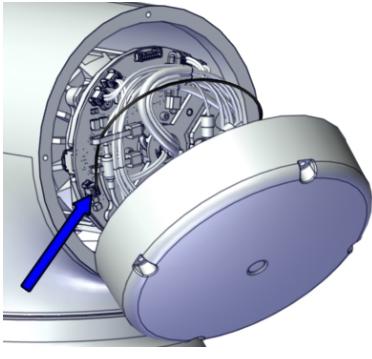
Action	Note
1  CAUTION Make sure that all supplies for electrical power are turned off.	
2 Remove the cover screws.	 xx2000001935

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5 Repair

5.5.1 Replacing the base

Continued

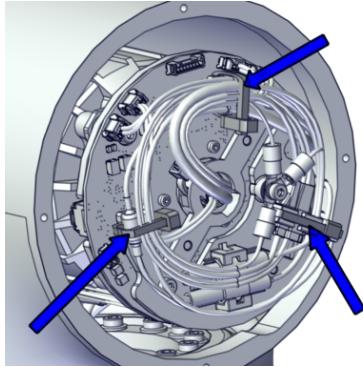
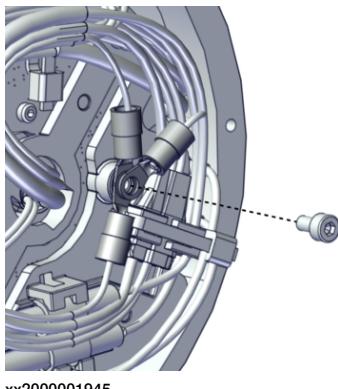
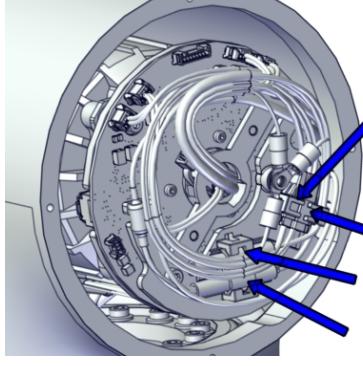
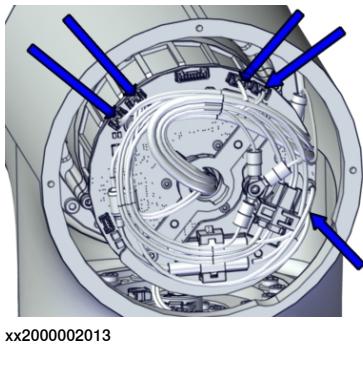
	Action	Note
3	 CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	
4	Open the cover and cut the cable tie that holds the brake release cable.	 xx2000001931
5	Disconnect the brake release connector from the drive board. Remove the cover.	 xx2000001932

Disconnecting the axis-2 joint unit cabling

	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

Continues on next page

5.5.1 Replacing the base
Continued

	Action	Note
2	Cut the cable ties.	 xx2000001946
3	Remove the functional and protective earth cables by removing the screw.	 xx2000001945
4	Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J2.DC+ • J2.DC- • J2.CS • J2.CP 	 xx2000001944
5	Disconnect the connectors from the drive board. <ul style="list-style-type: none"> • D2.X1 from X1 • D2.DC+ from DC+ • D2.DC- from ground • D2.X4 from X4 • D2.X2 from X2 • D2.X5 from X5 	 xx2000002013

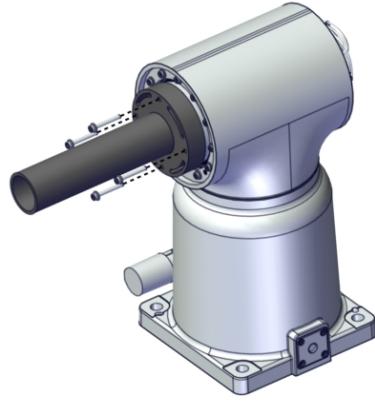
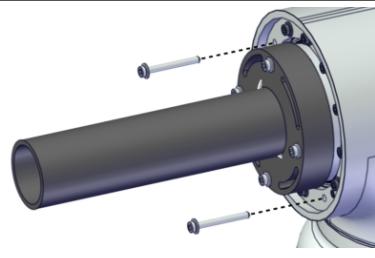
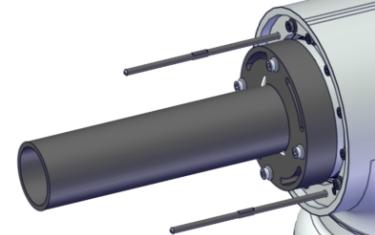
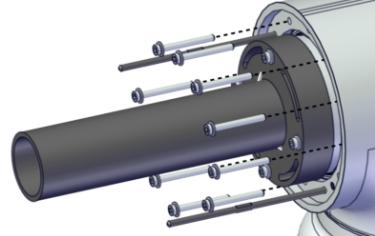
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5 Repair

5.5.1 Replacing the base

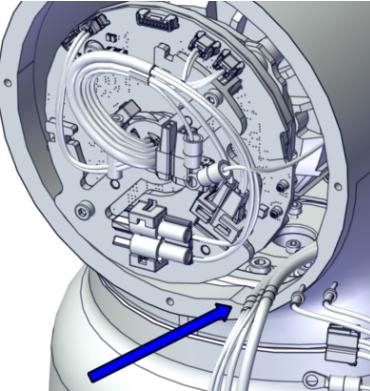
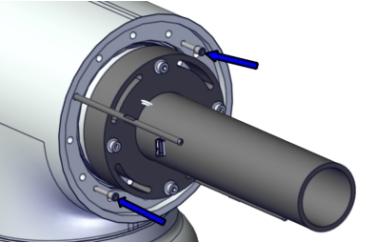
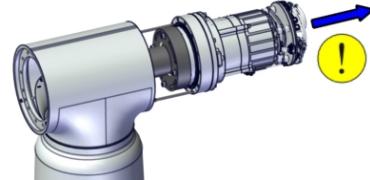
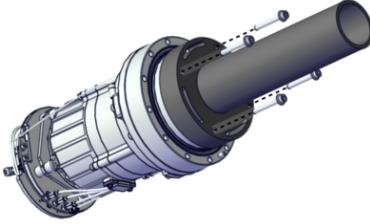
Continued

Removing the axis-2 joint unit

	Action	Note
1	<p>Fit the lifting aid to the joint unit, on the torque sensor side.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	<p>Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)</p>  <p>xx2000001956</p>
2	<p>Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.</p>	 <p>xx2100000295</p>
3	Fit two guide pins to the axis-2 joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.</p>  <p>xx2000002433</p>
4	<p>Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.</p>	 <p>xx2000001943</p>

Continues on next page

5.5.1 Replacing the base
Continued

Action	Note
5 Put the cabling at the slot in order not to squeeze it during removal of joint unit.	 xx2100000045
6 Press the joint unit out of position using two of the previous attachment screws as removal tools.	 xx2000002434
7 Remove the joint unit from the swing. CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000001958
8 Remove the lifting aid and guide pins.	 xx2000001957

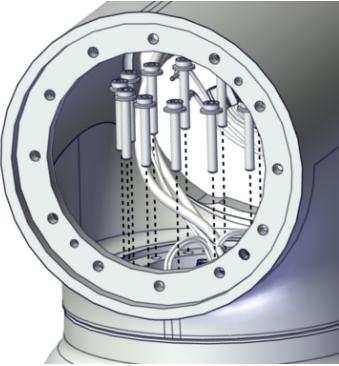
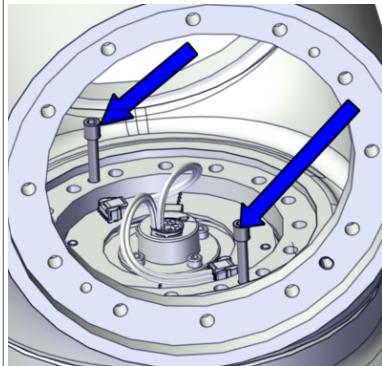
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5 Repair

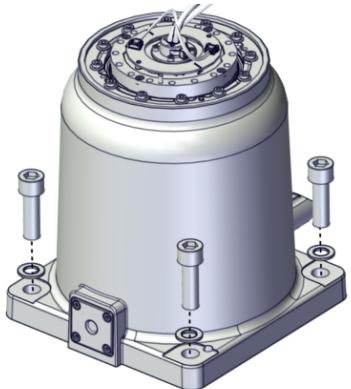
5.5.1 Replacing the base

Continued

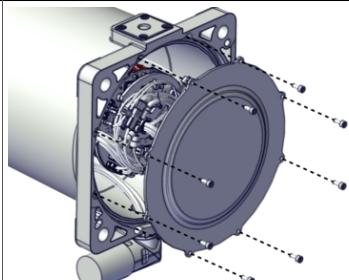
Removing the swing

	Action	Note
1	Remove the swing attachment screws.	 xx2000001987
2	Use two fully threaded attachment screws as removal tools to press the swing out of position.	 xx2000002152
3	Lift away the swing.  CAUTION The torque sensor (on the exposed PCBA) is sensitive to mechanical damage. Handle the assembly with care.	

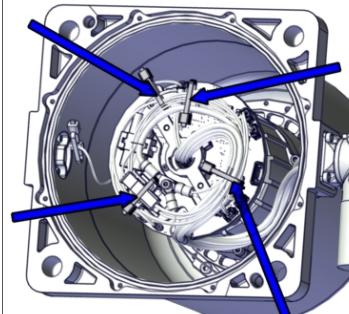
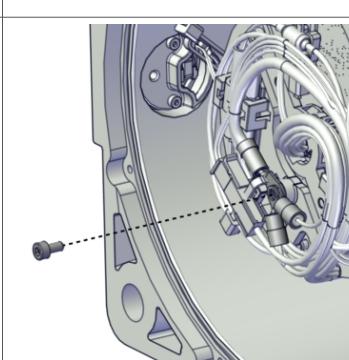
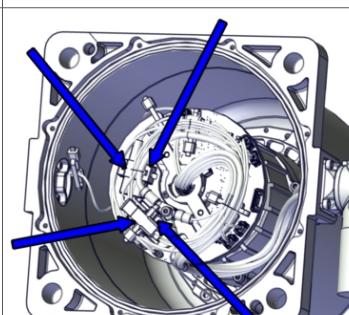
Loosening the base and removing the base cover

	Action	Note
1	Loosen the base from the foundation by removing the attachment screws and washers.	 xx2000002006

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	Action	Note
2	Tilt the base on to its side and remove the bottom cover by removing the attachment screws.	 xx2000002007

Disconnecting the axis-1 joint unit cabling

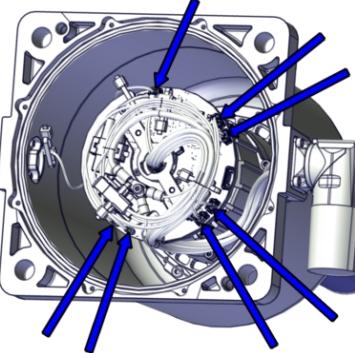
	Action	Note
1	Cut the cable ties.	 xx2000002012
2	Remove the functional and protective earth cables by removing the screw.	 xx2000002011
3	Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J1.DC+ • J1.DC- • J1.CS • J1.CP 	 xx2000002010

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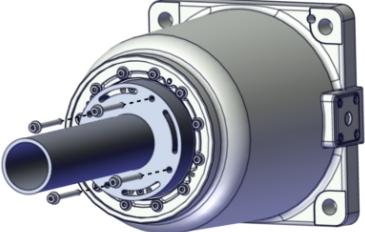
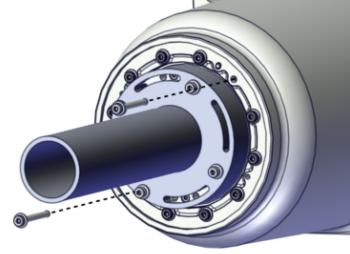
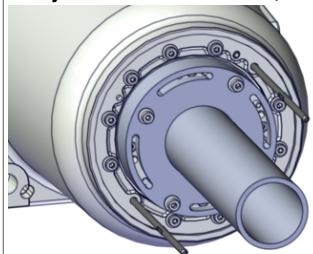
5 Repair

5.5.1 Replacing the base

Continued

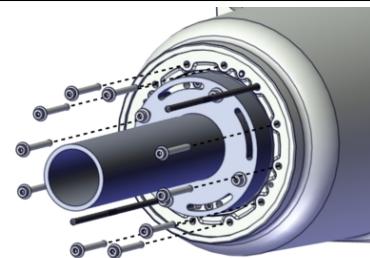
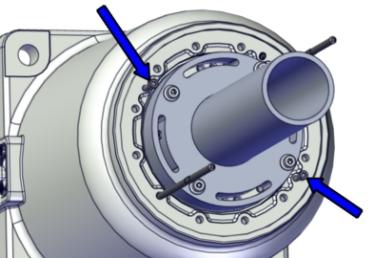
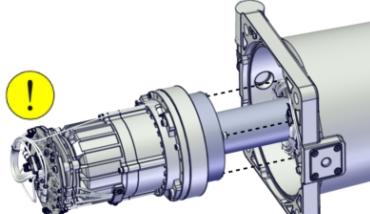
Action	Note
<p>4 Disconnect the connectors from the drive board.</p> <ul style="list-style-type: none"> • D1.X1 from X1 • D1.DC+ from DC+ • D1.DC- from ground • D1.X4 from X4 • D1.X2 from X2 • D1.X5 from X5 • DR.X8 from X8 	 xx2000002009

Removing the axis-1 joint unit

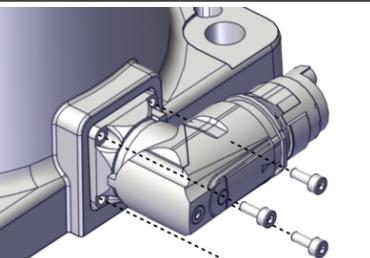
Action	Note
<p>1 Fit the lifting aid to the joint unit.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)  xx2000001994
<p>2 Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.</p>	 xx2100000296
<p>3 Fit two guide pins to the axis-1 joint unit.</p>	Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.  xx2000002435

Continues on next page

5.5.1 Replacing the base
Continued

Action	Note
4 Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.	 xx2000002008
5 Press the joint unit out of position using two of the previous attachment screws as removal tools.	 xx2000002436
6 Remove the joint unit from the base.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002014
7 Remove the lifting aid and guide pins.	 xx2000001957

Removing the base cabling

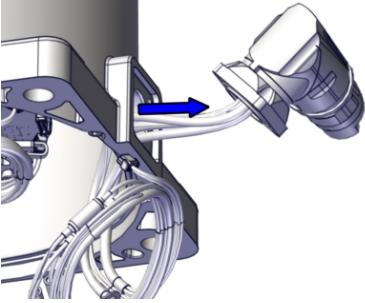
Action	Note
1 Remove the attachment screws.	 xx2100000406

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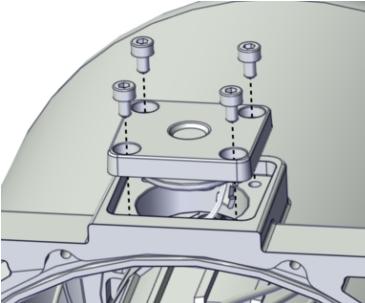
5 Repair

5.5.1 Replacing the base

Continued

	Action	Note
2	Pull out the cabling from the base.	 xx2100000407

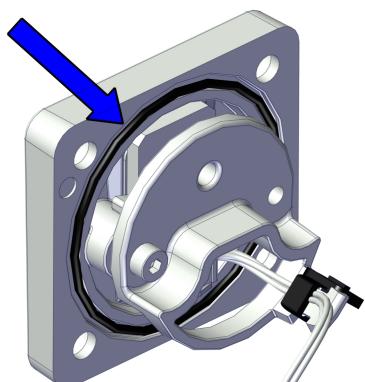
Removing the brake release unit

	Action	Note
1	Remove the brake release unit by removing the screws.	 xx2100000413

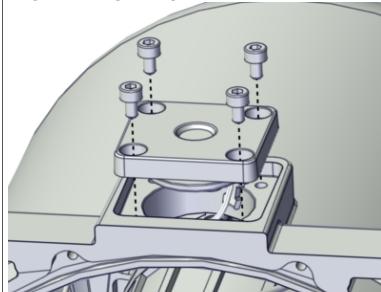
Refitting the base

Use these procedures to refit the base.

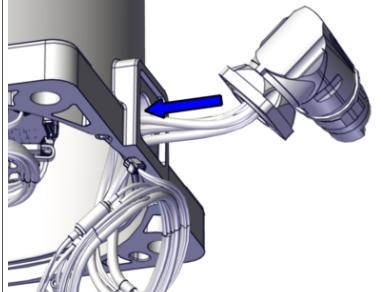
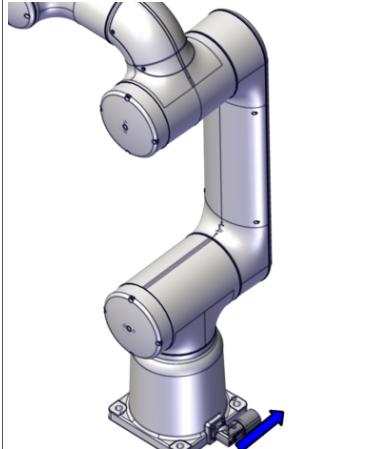
Refitting the brake release unit

	Action	Note
1	Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring, nitrile rubber: 3HAB3772-119 Grease: 3HAC031695-001 Harmonic Grease 4B No.2 Used to lubricate the seals.  xx2100000423

Continues on next page

	Action	Note
2	Refit the brake release unit to the new base with the screws.	<p>Base: 3HAC073922-001 Screws: M3x5 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2100000413</p>

Refitting the base cabling

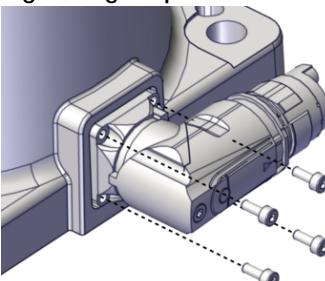
	Action	Note
1	Insert the cabling into the base.	 <p>xx2100000408</p>
2	Orient the base connector so that it points to the right, seen from back of the robot.	 <p>xx2100000409</p>

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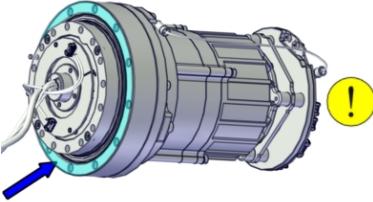
5 Repair

5.5.1 Replacing the base

Continued

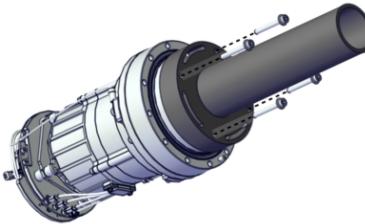
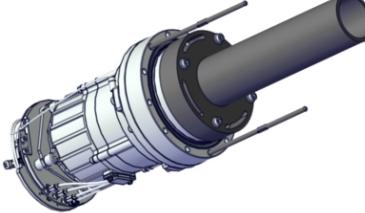
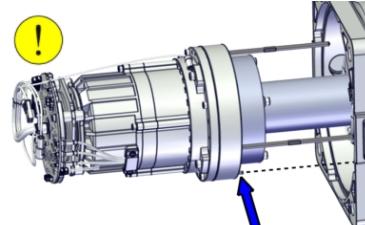
Action	Note
3 Secure the base connector with the attachment screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.8 Nm.</p>  <p>xx2100000406</p>

Preparations before fitting the joint unit

Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2 Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol. Joint unit mounting surface is pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574
3 Apply a thin layer of flange sealant to the mounting surface. Do not contaminate the radial sealing with sealant.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	 xx2000001860

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Refitting the axis-1 joint unit

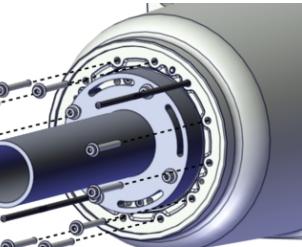
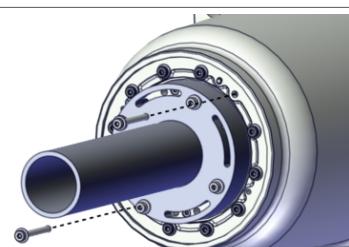
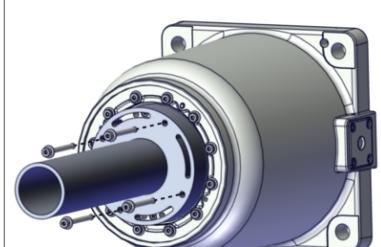
	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section <i>The unit is sensitive to ESD on page 42.</i>	
2	 CAUTION Fit the lifting aid to the joint unit. The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Joint unit: 3HAC079141-001 Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)  xx2000001957
3	Fit two guide pins to the joint unit.	Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.  xx2000002438
4	 CAUTION Fit the joint unit to the base, aligning the pin with the pin hole. The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002015

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5 Repair

5.5.1 Replacing the base

Continued

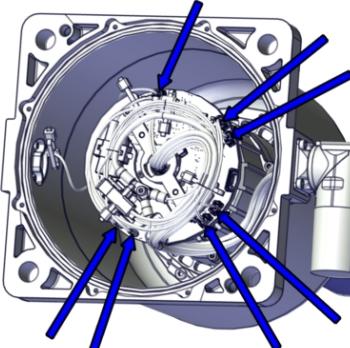
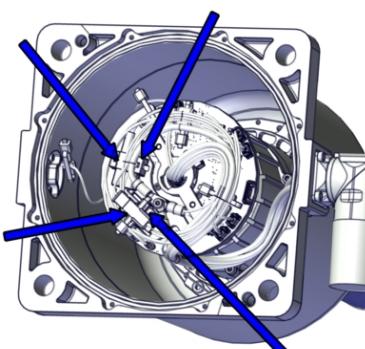
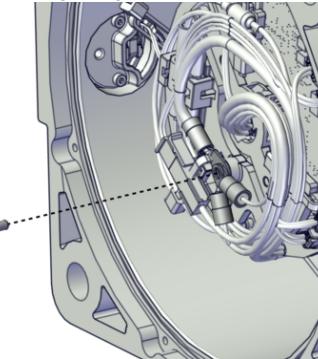
Action	Note
5 Secure the joint unit with new attachment screws.	<p>Hex socket head cap flange screw with glue: 3HAB3413-435 M4x35, 12 pcs</p> <p>Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.</p>  <p>xx2000002008</p>
6 Remove the guide pins and secure the remaining two attachment screws.	 <p>xx2100000296</p>
7 Pre-tighten the screws crosswise.	
8 Torque tighten all screws crosswise.	Tightening torque: 4.3 Nm.
9 Remove the lifting aid by removing the screws.	 <p>xx2000001994</p>
10 Clean pushed-out flange sealant, if any.	

Connecting the axis-1 joint unit cabling

Action	Note
<p>1  ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42.</p>	

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5.5.1 Replacing the base
Continued

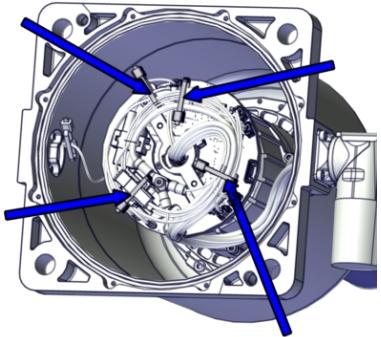
Action	Note
2 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D1.X1 to X1 • D1.DC+ to DC+ • D1.DC- to Ground • D1.X4 to X4 • D1.X2 to X2 • D1.X5 to X5 • DR.X8 to X8 	 xx2000002009
3 Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J1.DC+ to J1.DC+ • J1.DC- to J1.DC- • J1.CS to J1.CS • J1.CP to J1.CP 	 xx2000002010
4 Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000002011

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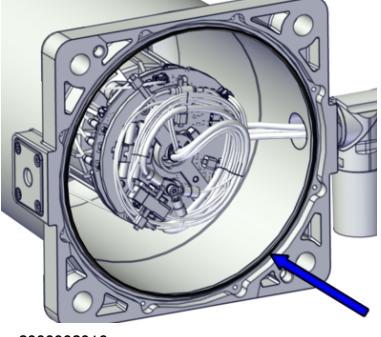
5 Repair

5.5.1 Replacing the base

Continued

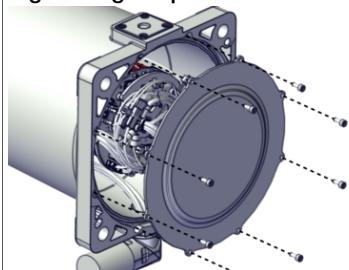
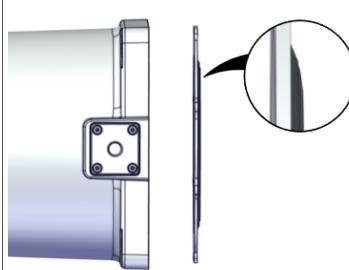
	Action	Note
5	Secure the cabling with cable ties.	Cable ties (4 pcs)  xx2000002012

Refitting the base cover

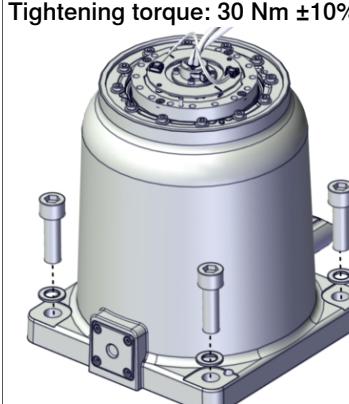
	Action	Note
1	Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring, nitrile rubber: 3HAB3772-64 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000002016

Continues on next page

5.5.1 Replacing the base Continued

	Action	Note
2	<p>Refit the bottom cover with the attachment screws.</p> <p>Note</p> <p>Fit the cover in correct direction, the protrusion of the cover must face outwards.</p>	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (8 pcs) Tightening torque: 1.2 Nm.</p>  <p>xx2000002007</p>  <p>xx2100000268</p>

Securing the base

	Action	Note
1	Lift the base to standing and secure it to the foundation with the attachment screws and washers.	<p>Attachment screws: M10x35 8.8 (4 pcs). Washers: 23/10.5/2.5 mm Steel (4 pcs). Tightening torque: 30 Nm ±10%.</p>  <p>xx2000002006</p>

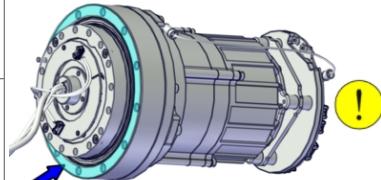
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5 Repair

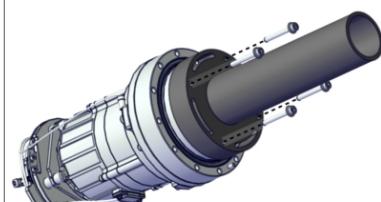
5.5.1 Replacing the base

Continued

Preparations before fitting the joint unit

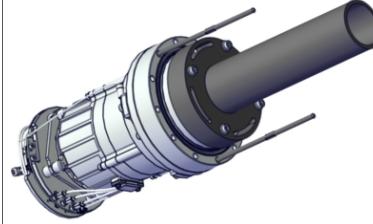
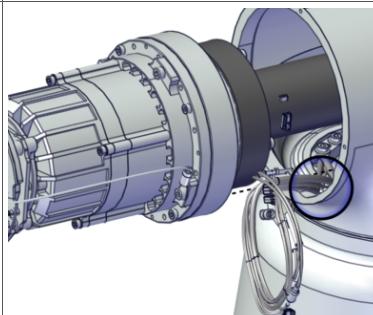
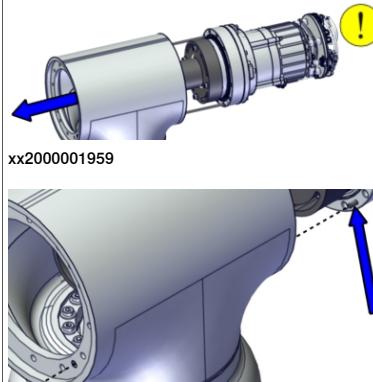
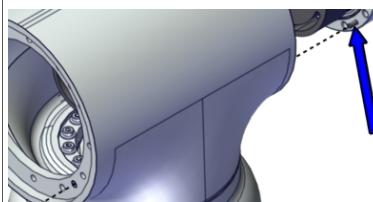
Action	Note
<p>1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42.</p>	
<p>2 Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol. Joint unit mounting surface is pointed out in the figure.</p>	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001860
<p>3 Apply a thin layer of flange sealant to the mounting surface. Do not contaminate the radial sealing with sealant.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42.</p>	

Refitting the axis-2 joint unit

Action	Note
<p>1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42.</p>	
<p>2 Fit the lifting aid to the joint unit.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	Joint unit: 3HAC079141-001 Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)  xx2000001957

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5.5.1 Replacing the base
Continued

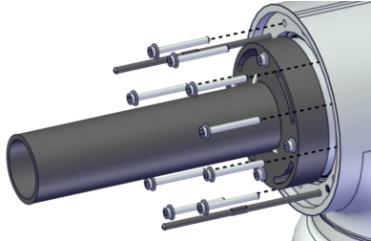
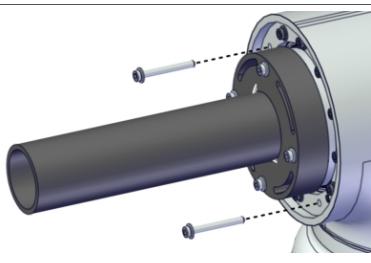
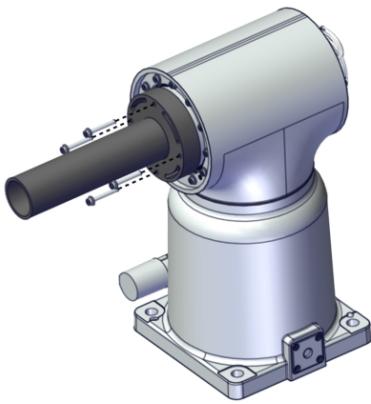
Action	Note
3 Fit two guide pins to the joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.</p>  <p>xx2000002438</p>
4 Place the axis-1 cabling at the notch in the swing.	<p>! CAUTION The cabling is sensitive to mechanical damage. Handle it with care to avoid damage to the cabling or the connector.</p>  <p>xx2000002153</p>
5 Fit the joint unit to the swing, aligning the pin with the pin hole.	<p>! CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>  <p>xx2000001959</p>  <p>xx2000001961</p>

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5 Repair

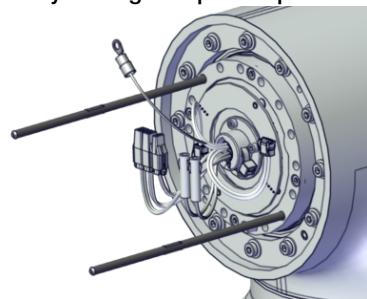
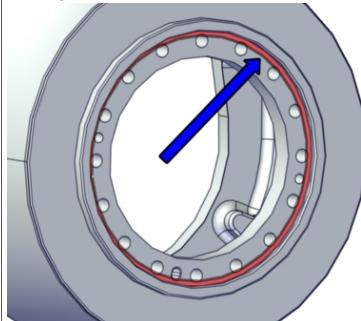
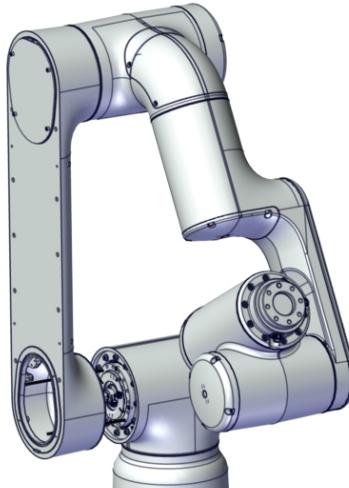
5.5.1 Replacing the base

Continued

Action	Note
6 Secure the joint unit with new attachment screws.	<p>Hex socket head cap flange screw with glue: 3HAB3413-435 M4x35, 12 pcs</p> <p>Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.</p>  <p>xx2000001943</p>
7 Remove the guide pins and secure the remaining two attachment screws.	 <p>xx2100000295</p>
8 Pre-tighten the screws crosswise.	
9 Torque tighten all screws crosswise.	Tightening torque: 4.3 Nm.
10 Remove the lifting aid by removing the screws.	 <p>xx2000001956</p>
11 Clean pushed-out flange sealant, if any.	

Continues on next page

Refitting the lower and upper arm assembled

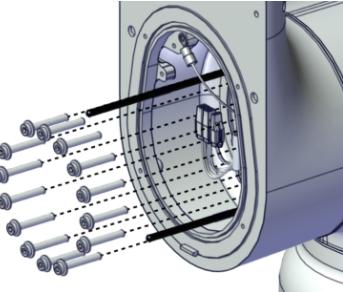
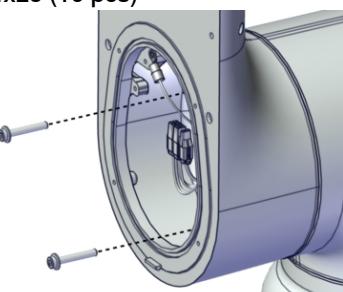
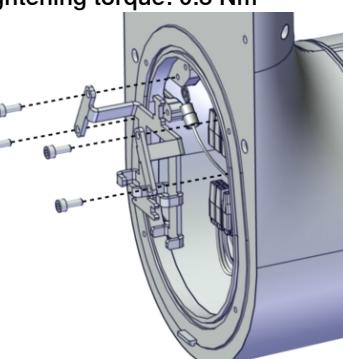
	Action	Note
1	Fit two guide pins to the axis-2 joint unit.	Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs.  xx2000001949
2	Remove any old residuals of flange sealant from the lower arm mounting surface and clean with isopropanol. Apply new flange sealant to the corner of the lower arm mounting surface, as pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001963
3	 CAUTION The weight of the complete upper and lower arm together is 18 kg	
4	Lift the upper and lower arm assembly to mounting position and slide it onto the guide pins.	 xx2000001941

Continues on next page

5 Repair

5.5.1 Replacing the base

Continued

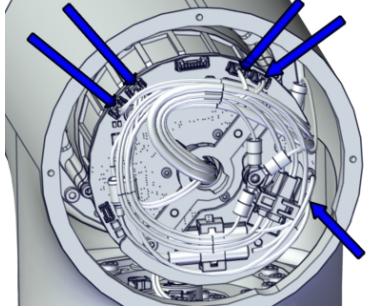
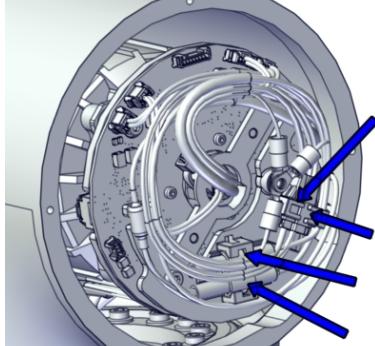
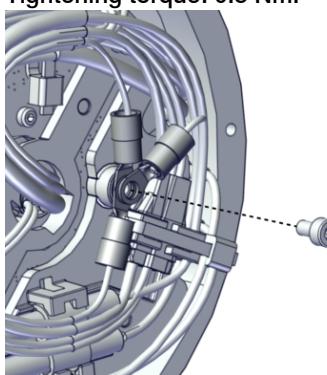
Action	Note
5 Secure the lower arm to the swing with all attachment screws but two. Pre-tighten the screws crosswise firstly.	Hex socket head cap flange screw: M4x25 (16 pcs)  xx2000001940
6 Remove the guide pins and fasten the remaining two screws.	Hex socket head cap flange screw: M4x25 (16 pcs)  xx2000001951
7 Torque tighten all screws crosswise.	Tightening torque: 4.6 Nm.
8 Refit the cable bracket with four screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.8 Nm  xx2000001939

Connecting the axis-2 joint unit cabling

Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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5.5.1 Replacing the base
Continued

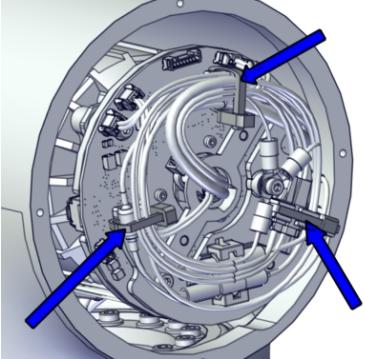
	Action	Note
2	Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D2.X1 to X1 • D2.DC+ to DC+ • D2.DC- to Ground • D2.X4 to X4 • D2.X2 to X2 • D2.X5 to X5 	 xx2000002013
3	Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J2.DC+ to J2.DC+ • J2.DC- to J2.DC- • J2.CS to J2.CS • J2.CP to J2.CP 	 xx2000001944
4	Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000001945

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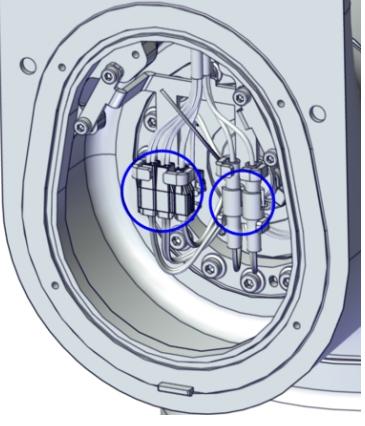
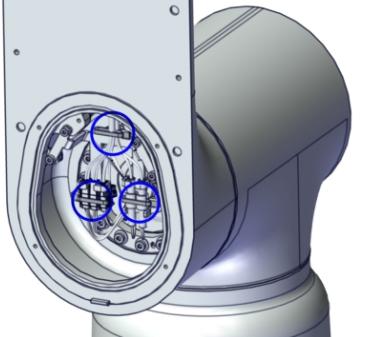
5 Repair

5.5.1 Replacing the base

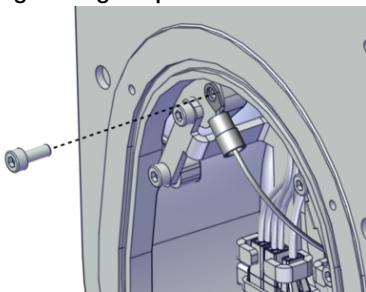
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Action	Note
5 Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000001946

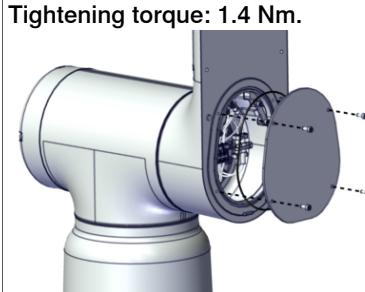
Connecting the cabling between the lower arm and swing

Action	Note
1 Connect the connectors to each other and snap them to the cable holders.	 xx2000001938
2 Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000001937

Continues on next page

	Action	Note
3	Connect the functional earth cable with the screw.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (1 pcs). Tightening torque: 0.8 Nm</p>  <p>xx2000001936</p>

Refitting the lower arm covers

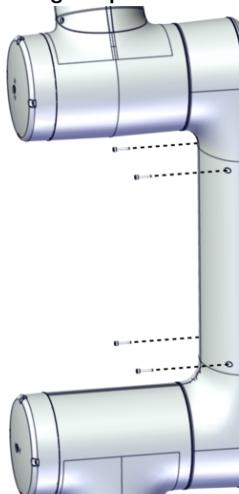
	Action	Note
1	Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	<p>O-ring: 3HAC061327-044 Grease: 3HAC042536-001 (Shell Gadus S2)</p>  <p>xx2000001954</p>
2	Refit the inner cover with four screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 1.4 Nm.</p>  <p>xx2000001930</p>

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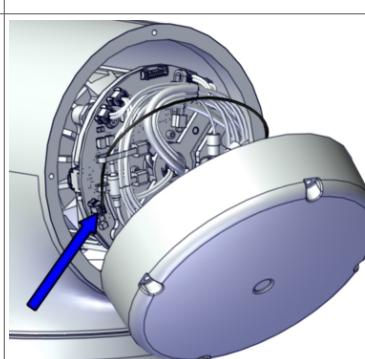
5 Repair

5.5.1 Replacing the base

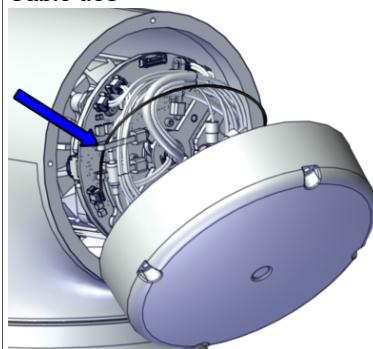
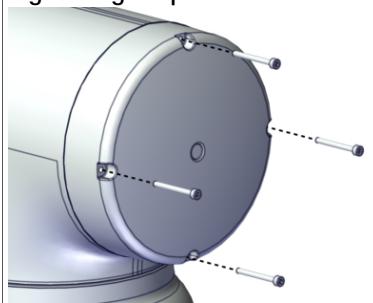
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Action	Note
3 Snap the lower arm cover into place.	
4 Secure the cover with four screws.	Hex socket head cap screw: M3x16 12.9 Gleitmo 603+Geomet 500 (Black Oxide) (4 pcs) Tightening torque: 0.45 Nm.  xx2000001929

Refitting the swing cover

Action	Note
1 Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-047  xx2000001962
2 Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board. Orient the cover for proper arrangement of the brake release cable.	 xx2000001932

Continues on next page

	Action	Note
3	Secure the brake release cable with a cable tie.	<p>Cable ties</p>  <p>xx2000001931</p>
4	Refit the cover with the four screws.	<p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm</p>  <p>xx2000001935</p>

Concluding procedure

	Action	Note
1	Calibrate the joint unit torque sensor for the axis-1 and axis-2 joint units.	See Calibration on page 607
2	 DANGER Make sure all safety requirements are met when performing the first test run.	

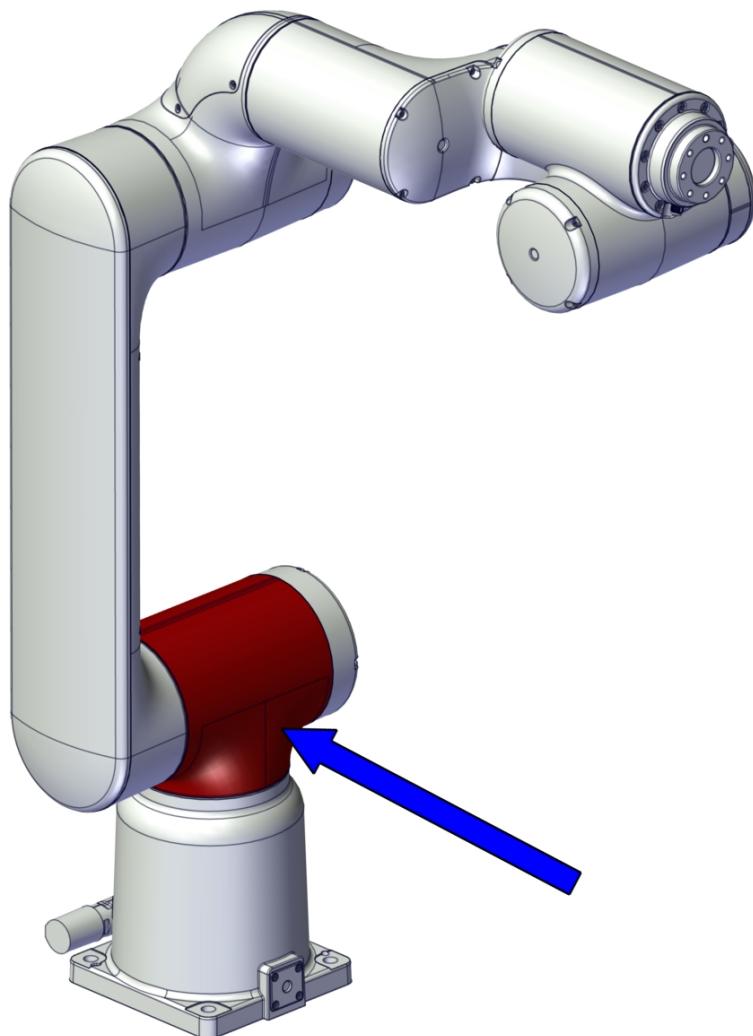
5 Repair

5.5.2 Replacing the swing

5.5.2 Replacing the swing

Location of the swing

The swing is located as shown in the figure.



xx2000001986

Summary of the replacement procedure

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

- 1 Separate the cabling between the swing and the lower arm.
- 2 Remove the lower and upper arm undivided.
- 3 Remove the swing cover.
- 4 Remove the axis-2 joint unit.
- 5 Replace the swing.

Continues on next page

Required spare parts**Note**

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Spare part	Article number	Note
Swing	3HAC073933-001	Also order new attachment screws for the axis-2 joint unit: 3HAB3413-435 (12 pcs).
Hex socket head cap flange screw with glue	3HAB3413-435	M4x35, 12 pcs Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.
Cable tie	3HAC075545-001	For securing joint unit cable.

Required tools and equipment

Equipment	Article number	Note
Lifting aid	3HAC077788-001	For joint units on axes 1, 2 and 3. Attachment screws M4x35 (4 pcs) are enclosed.
Guide pin, M4x120	3HAC077786-001	Always use guide pins in pairs. For joint units on axes 1, 2 and 3.
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cleaning agent	-	Isopropanol
Flange sealant	-	Loctite 574
Grease	3HAC042536-001	Shell Gadus S2
Cable ties	-	
O-ring	3HAC061327-047	Cover for axis 2/3 Replace if damaged.
O-ring	3HAC061327-044	Lower arm, inner cover. 1 pcs / cover. Replace if damaged.

Continues on next page

5 Repair

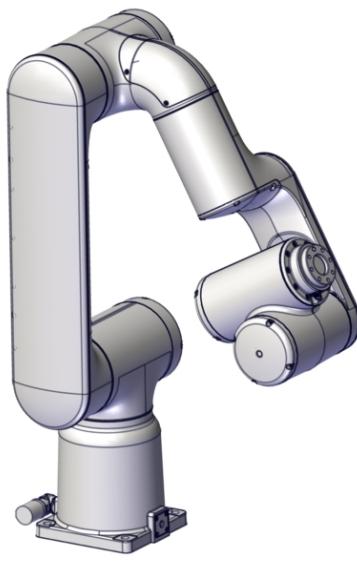
5.5.2 Replacing the swing

Continued

Removing the swing

Use these procedures to remove the swing.

Preparations before removing the swing

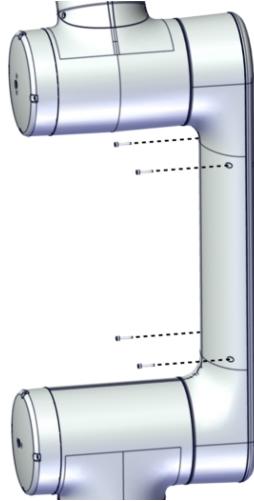
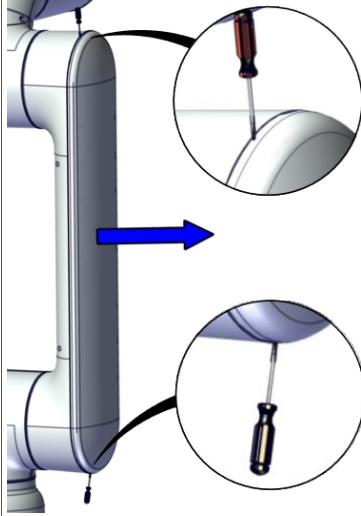
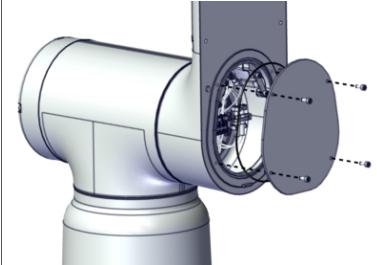
Action	Note
<p>1 Jog the robot to the specified position:</p> <ul style="list-style-type: none">• Axis 1: 0°• Axis 2: 0° (home position)• Axis 3: +60°• Axis 4: 0°• Axis 5: -90°• Axis 6: No significance. <p>! CAUTION</p> <p>Jog the axis on which the joint unit is to be replaced to home position, to achieve correct cable routing during replacement of the joint unit.</p>	 xx2100000044
<p>2 ! DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply <p>to the robot, before entering the safeguarded space.</p>	

Removing the lower arm covers

Action	Note
<p>1 ! CAUTION</p> <p>Make sure that all supplies for electrical power are turned off.</p>	

Continues on next page

**5.5.2 Replacing the swing
Continued**

Action	Note
2 Remove the four lower arm cover screws.	 xx2000001929
3 Remove the cover by inserting a small flat screwdriver to snap open the locks at each end of the cover.	 xx2100000267
4 Remove the inner cover by removing the four screws.	 xx2000001930

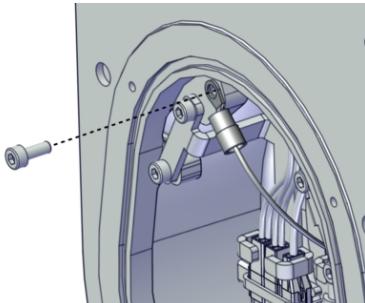
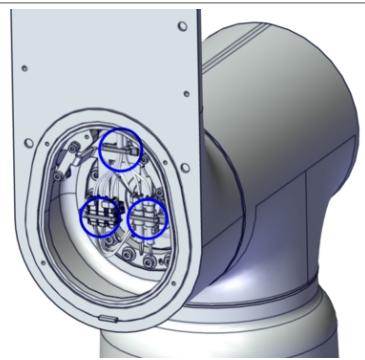
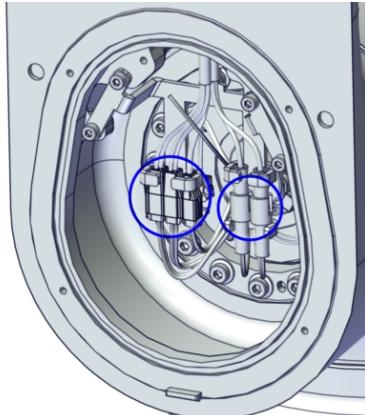
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5 Repair

5.5.2 Replacing the swing

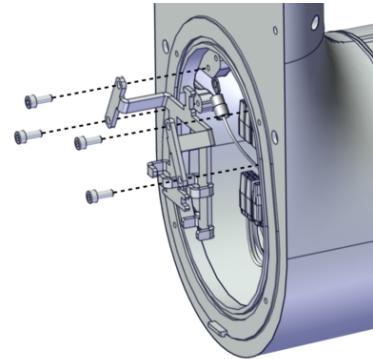
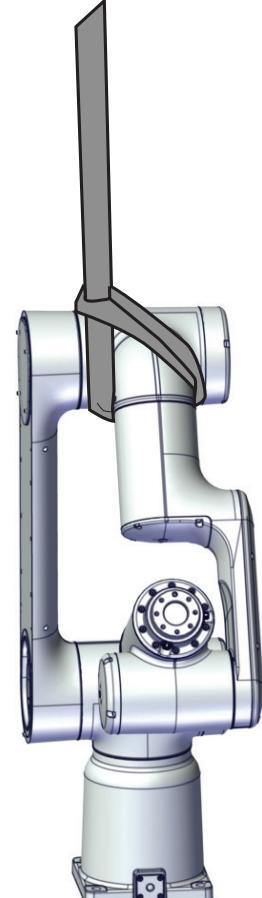
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Disconnecting the cabling between the lower arm and the swing

	Action	Note
1	Remove the functional earth cable by removing the screw.	 xx2000001936
2	Cut the cable ties.	 xx2000001937
3	Snap loose and disconnect all connectors.	 xx2000001938

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Removing the lower and upper arm assembled

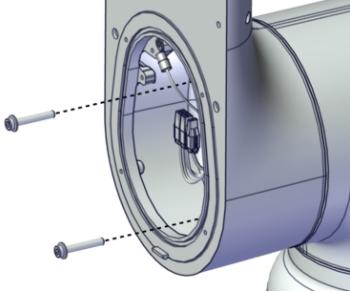
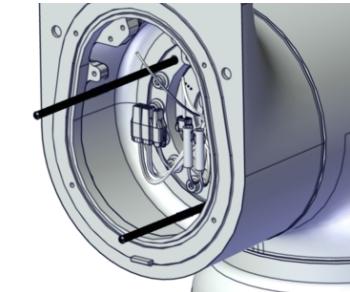
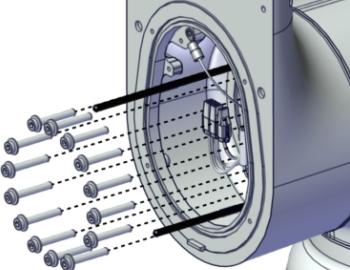
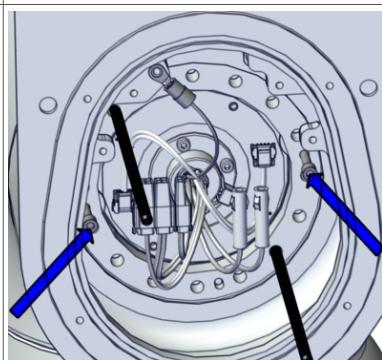
	Action	Note
1	Remove the cable bracket by removing the four screws.	 xx2000001939
2	Secure the weight of the upper and lower arm. CAUTION The weight of the complete upper and lower arm together is 18 kg	Suggestion with lifting sling and an overhead crane:  xx2100000294

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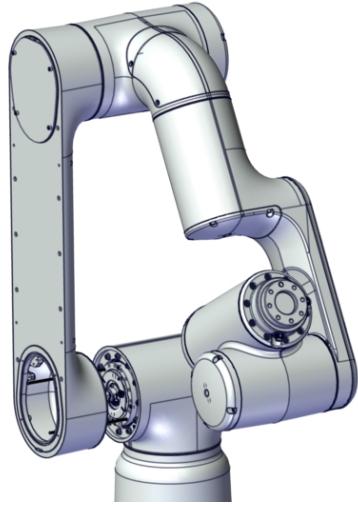
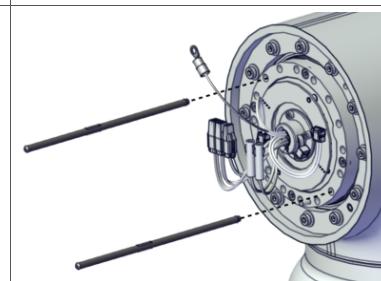
5 Repair

5.5.2 Replacing the swing

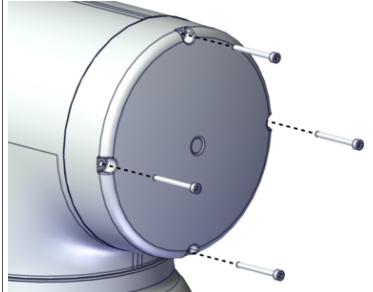
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Action	Note
3 Remove two attachment screws and fit two guide pins to the axis-2 joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs.</p>  <p>xx2000001951</p>  <p>xx2000001960</p>
4 Remove the lower arm attachment screws.	 <p>xx2000001940</p>
5 Use two fully threaded attachment screws as removal tools to press the lower arm out of position.	 <p>xx2000002151</p>

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Action	Note
6 Remove the complete arm system from the swing.	 xx2000001941
7 Remove the guide pins.	 xx2000002432

Removing the swing cover

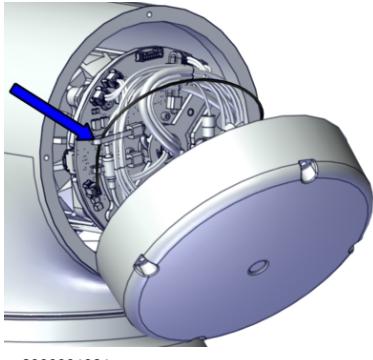
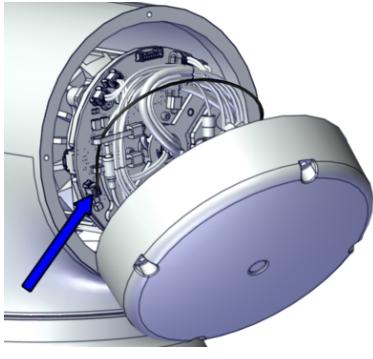
Action	Note
1  CAUTION Make sure that all supplies for electrical power are turned off.	
2 Remove the cover screws.	 xx2000001935

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5 Repair

5.5.2 Replacing the swing

Continued

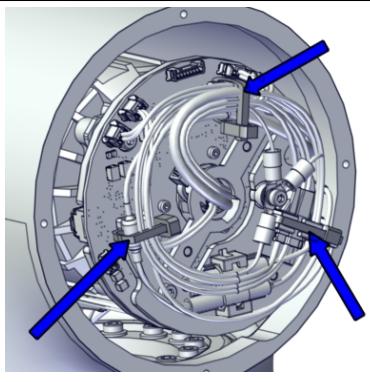
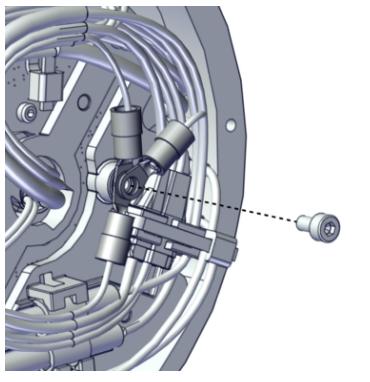
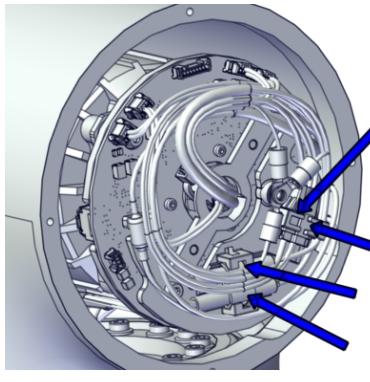
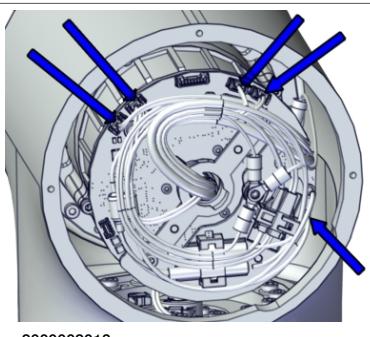
	Action	Note
3	 CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	
4	Open the cover and cut the cable tie that holds the brake release cable.	 xx2000001931
5	Disconnect the brake release connector from the drive board. Remove the cover.	 xx2000001932

Disconnecting the axis-2 joint unit cabling

	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

Continues on next page

**5.5.2 Replacing the swing
Continued**

	Action	Note
2	Cut the cable ties.	 xx2000001946
3	Remove the functional and protective earth cables by removing the screw.	 xx2000001945
4	Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J2.DC+ • J2.DC- • J2.CS • J2.CP 	 xx2000001944
5	Disconnect the connectors from the drive board. <ul style="list-style-type: none"> • D2.X1 from X1 • D2.DC+ from DC+ • D2.DC- from ground • D2.X4 from X4 • D2.X2 from X2 • D2.X5 from X5 	 xx2000002013

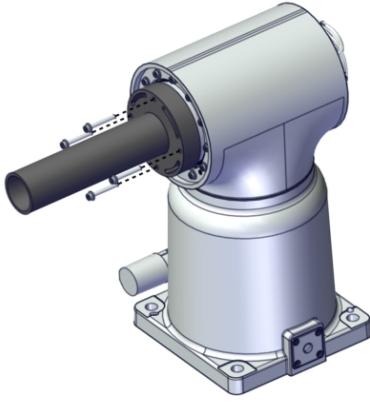
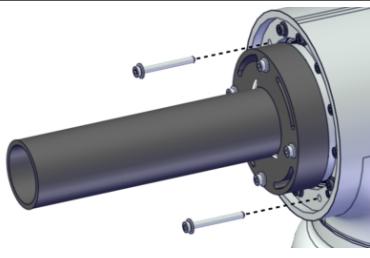
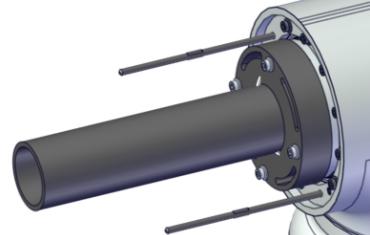
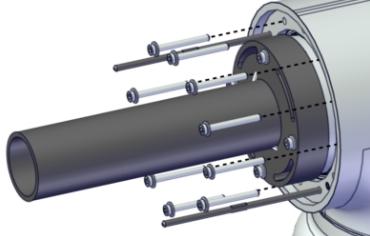
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5 Repair

5.5.2 Replacing the swing

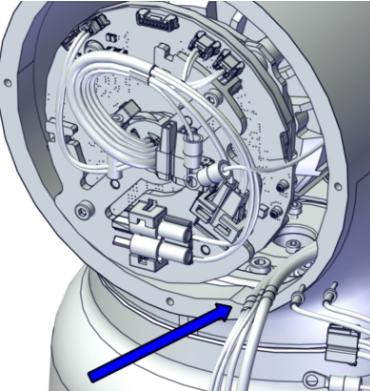
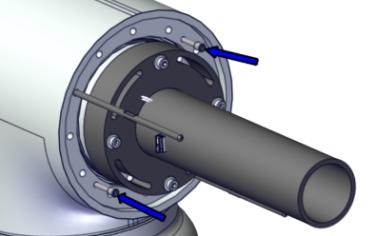
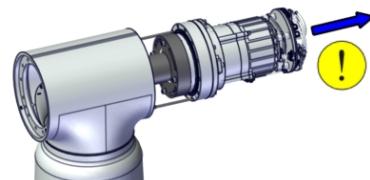
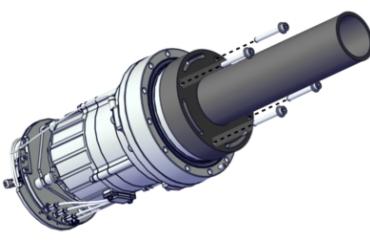
Continued

Removing the axis-2 joint unit

	Action	Note
1	<p>Fit the lifting aid to the joint unit, on the torque sensor side.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	<p>Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)</p>  <p>xx2000001956</p>
2	<p>Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.</p>	 <p>xx2100000295</p>
3	Fit two guide pins to the axis-2 joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.</p>  <p>xx2000002433</p>
4	<p>Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.</p>	 <p>xx200001943</p>

Continues on next page

**5.5.2 Replacing the swing
Continued**

Action	Note
5 Put the cabling at the slot in order not to squeeze it during removal of joint unit.	 xx210000045
6 Press the joint unit out of position using two of the previous attachment screws as removal tools.	 xx2000002434
7 Remove the joint unit from the swing. CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000001958
8 Remove the lifting aid and guide pins.	 xx2000001957

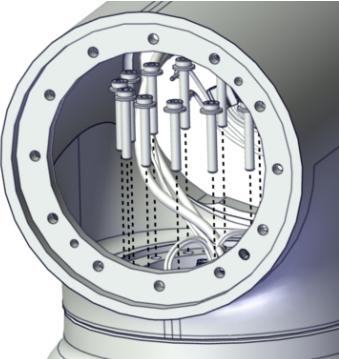
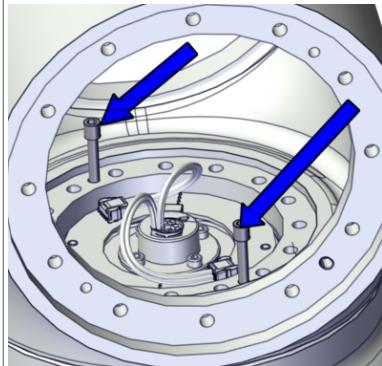
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5 Repair

5.5.2 Replacing the swing

Continued

Removing the swing

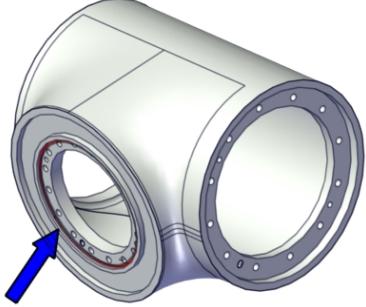
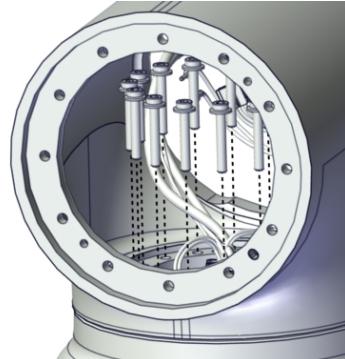
	Action	Note
1	Remove the swing attachment screws.	 xx2000001987
2	Use two fully threaded attachment screws as removal tools to press the swing out of position.	 xx2000002152
3	Lift away the swing.  CAUTION The torque sensor (on the exposed PCBA) is sensitive to mechanical damage. Handle the assembly with care.	

Continues on next page

Refitting the swing

Use these procedures to refit the swing.

Refitting the swing

	Action	Note
1	Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the base mounting surface, as pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001990
2	Refit the swing to the base unit, aligning the pin with the pin hole.  CAUTION The torque sensor (on the exposed PCBA) is sensitive to mechanical damage. Handle the assembly with care.	 xx2000001989
3	Secure the swing with the attachment screws. Pre-tighten the screws crosswise firstly.	Hex socket head cap flange screw: M4x25 (16 pcs)  xx2000001987
4	Torque tighten all screws crosswise.	Tightening torque: 4.6 Nm.

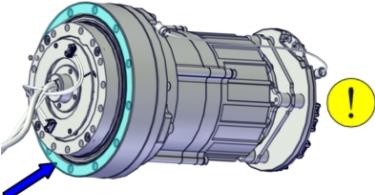
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5 Repair

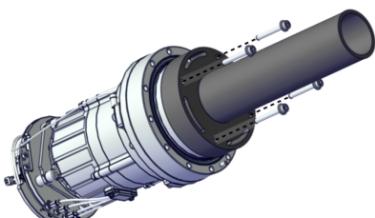
5.5.2 Replacing the swing

Continued

Preparations before fitting the joint unit

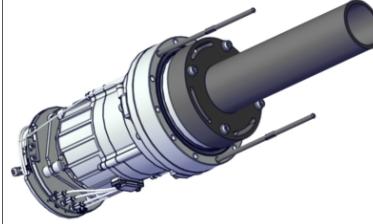
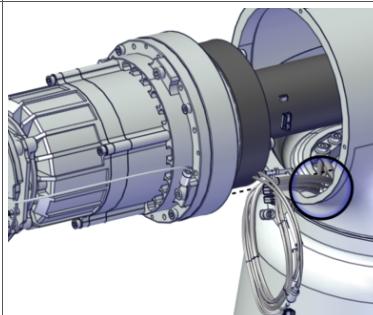
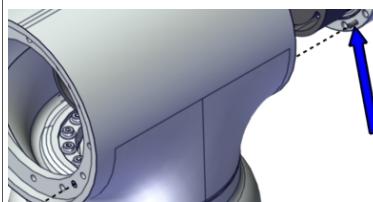
Action	Note
<p>1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42.</p>	
<p>2 Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol. Joint unit mounting surface is pointed out in the figure.</p>	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001860
<p>3 Apply a thin layer of flange sealant to the mounting surface. Do not contaminate the radial sealing with sealant.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42.</p>	

Refitting the axis-2 joint unit

Action	Note
<p>1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42.</p>	
<p>2 Fit the lifting aid to the joint unit.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	Joint unit: 3HAC079141-001 Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)  xx2000001957

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5.5.2 Replacing the swing Continued

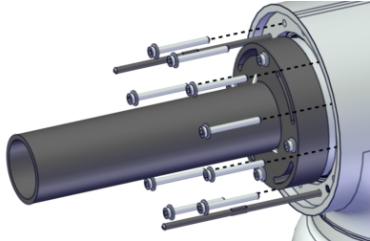
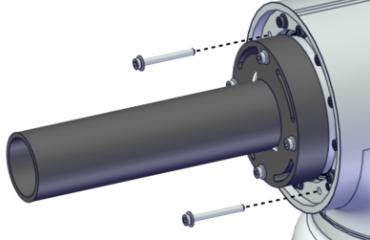
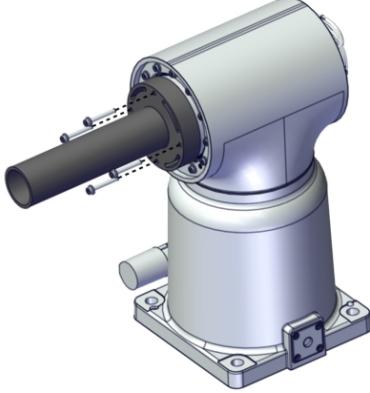
	Action	Note
3	Fit two guide pins to the joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.</p>  <p>xx2000002438</p>
4	<p>Place the axis-1 cabling at the notch in the swing.</p> <p>CAUTION The cabling is sensitive to mechanical damage. Handle it with care to avoid damage to the cabling or the connector.</p>	 <p>xx2000002153</p>
5	<p>Fit the joint unit to the swing, aligning the pin with the pin hole.</p> <p>CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	 <p>xx2000001959</p>  <p>xx2000001961</p>

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5 Repair

5.5.2 Replacing the swing

Continued

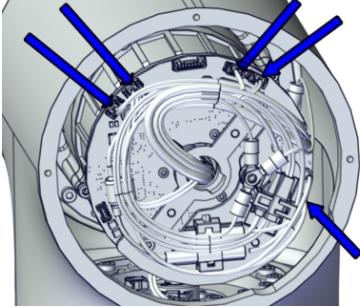
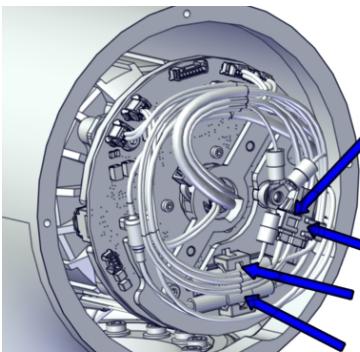
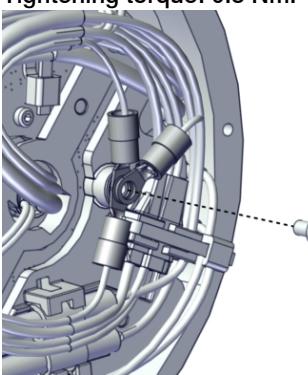
Action	Note
6 Secure the joint unit with new attachment screws.	<p>Hex socket head cap flange screw with glue: 3HAB3413-435 M4x35, 12 pcs</p> <p>Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.</p> 
7 Remove the guide pins and secure the remaining two attachment screws.	
8 Pre-tighten the screws crosswise.	
9 Torque tighten all screws crosswise.	Tightening torque: 4.3 Nm.
10 Remove the lifting aid by removing the screws.	
11 Clean pushed-out flange sealant, if any.	

Connecting the axis-2 joint unit cabling

Action	Note
 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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**5.5.2 Replacing the swing
Continued**

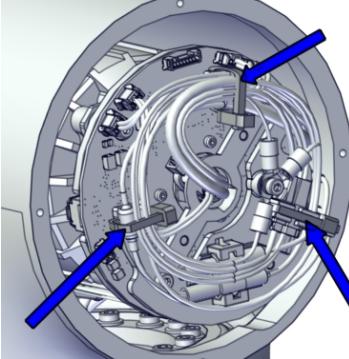
	Action	Note
2	Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D2.X1 to X1 • D2.DC+ to DC+ • D2.DC- to Ground • D2.X4 to X4 • D2.X2 to X2 • D2.X5 to X5 	 xx2000002013
3	Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J2.DC+ to J2.DC+ • J2.DC- to J2.DC- • J2.CS to J2.CS • J2.CP to J2.CP 	 xx2000001944
4	Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000001945

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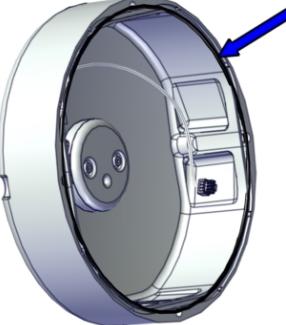
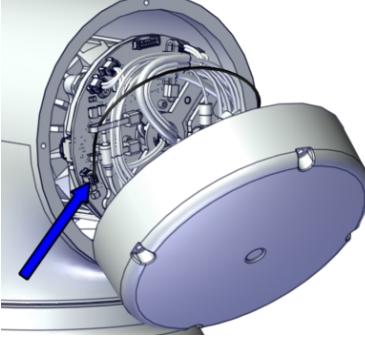
5 Repair

5.5.2 Replacing the swing

Continued

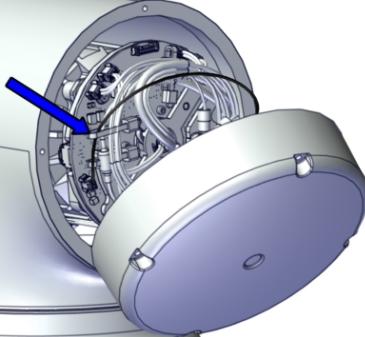
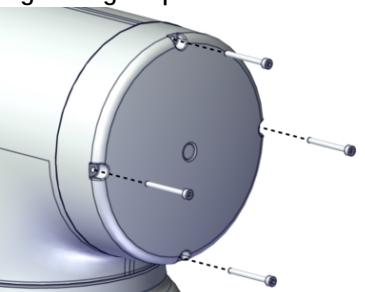
	Action	Note
5	Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000001946

Refitting the swing cover

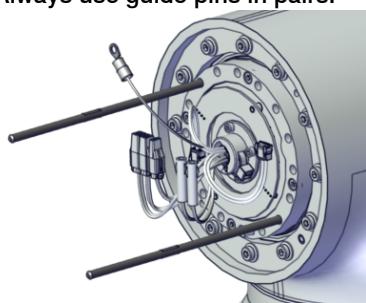
	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-047  xx2000001962
2	Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board. Orient the cover for proper arrangement of the brake release cable.	 xx2000001932

Continues on next page

**5.5.2 Replacing the swing
Continued**

Action	Note
3 Secure the brake release cable with a cable tie.	Cable ties  xx2000001931
4 Refit the cover with the four screws.	Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm  xx2000001935

Refitting the lower and upper arm assembled

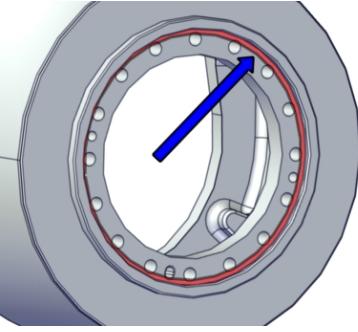
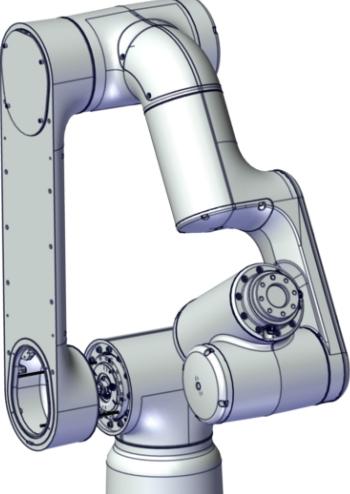
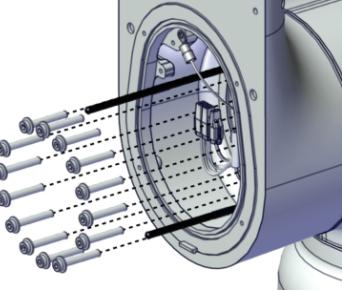
Action	Note
1 Fit two guide pins to the axis-2 joint unit.	Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs.  xx2000001949

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5 Repair

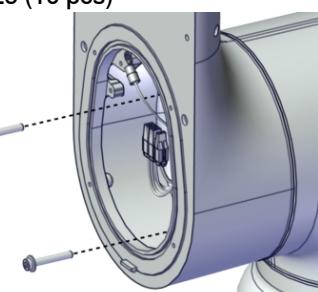
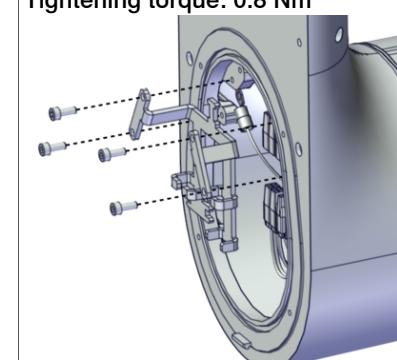
5.5.2 Replacing the swing

Continued

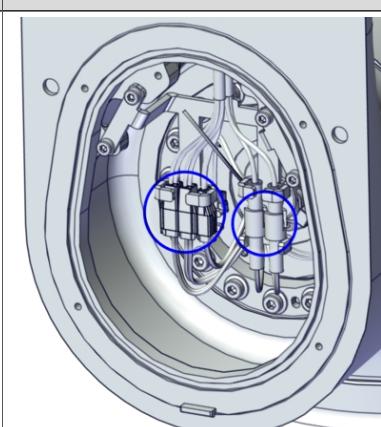
	Action	Note
2	<p>Remove any old residuals of flange sealant from the lower arm mounting surface and clean with isopropanol.</p> <p>Apply new flange sealant to the corner of the lower arm mounting surface, as pointed out in the figure.</p>	<p>Cleaning agent: Isopropanol Flange sealant: Loctite 574</p>  <p>xx2000001963</p>
3	<p> CAUTION</p> <p>The weight of the complete upper and lower arm together is 18 kg</p>	
4	Lift the upper and lower arm assembly to mounting position and slide it onto the guide pins.	 <p>xx2000001941</p>
5	<p>Secure the lower arm to the swing with all attachment screws but two.</p> <p>Pre-tighten the screws crosswise firstly.</p>	<p>Hex socket head cap flange screw: M4x25 (16 pcs)</p>  <p>xx2000001940</p>

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**5.5.2 Replacing the swing
Continued**

	Action	Note
6	Remove the guide pins and fasten the remaining two screws.	Hex socket head cap flange screw: M4x25 (16 pcs)  xx2000001951
7	Torque tighten all screws crosswise.	Tightening torque: 4.6 Nm.
8	Refit the cable bracket with four screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.8 Nm  xx2000001939

Connecting the cabling between the lower arm and swing

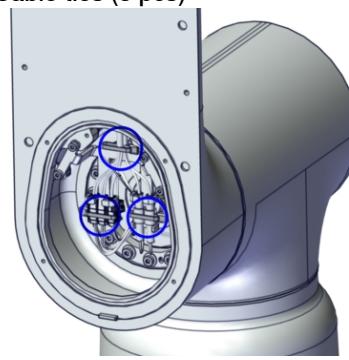
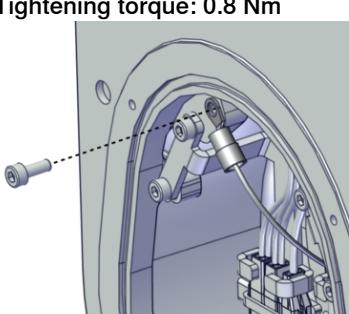
	Action	Note
1	Connect the connectors to each other and snap them to the cable holders.	 xx2000001938

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5 Repair

5.5.2 Replacing the swing

Continued

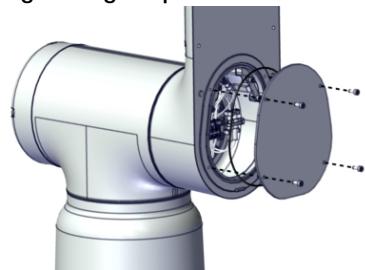
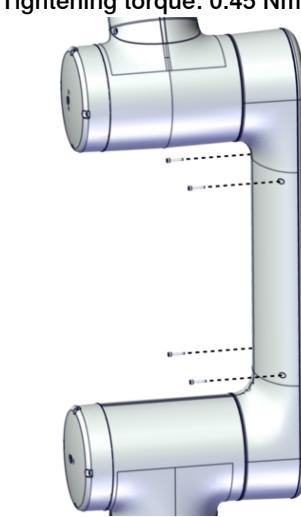
Action	Note
2 Secure the cabling with cable ties.	<p>Cable ties (3 pcs)</p>  <p>xx2000001937</p>
3 Connect the functional earth cable with the screw.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (1 pcs).</p> <p>Tightening torque: 0.8 Nm</p>  <p>xx2000001936</p>

Refitting the lower arm covers

Action	Note
1 Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	<p>O-ring: 3HAC061327-044 Grease: 3HAC042536-001 (Shell Gadus S2)</p>  <p>xx2000001954</p>

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5.5.2 Replacing the swing Continued

	Action	Note
2	Refit the inner cover with four screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 1.4 Nm.</p>  <p>xx2000001930</p>
3	Snap the lower arm cover into place.	
4	Secure the cover with four screws.	<p>Hex socket head cap screw: M3x16 12.9 Gleitmo 603+Geomet 500 (Black Oxide) (4 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000001929</p>

Concluding procedure

	Action	Note
1	Calibrate the joint unit torque sensor for the axis-2 joint unit.	See Calibration on page 607
2	 DANGER Make sure all safety requirements are met when performing the first test run.	

5 Repair

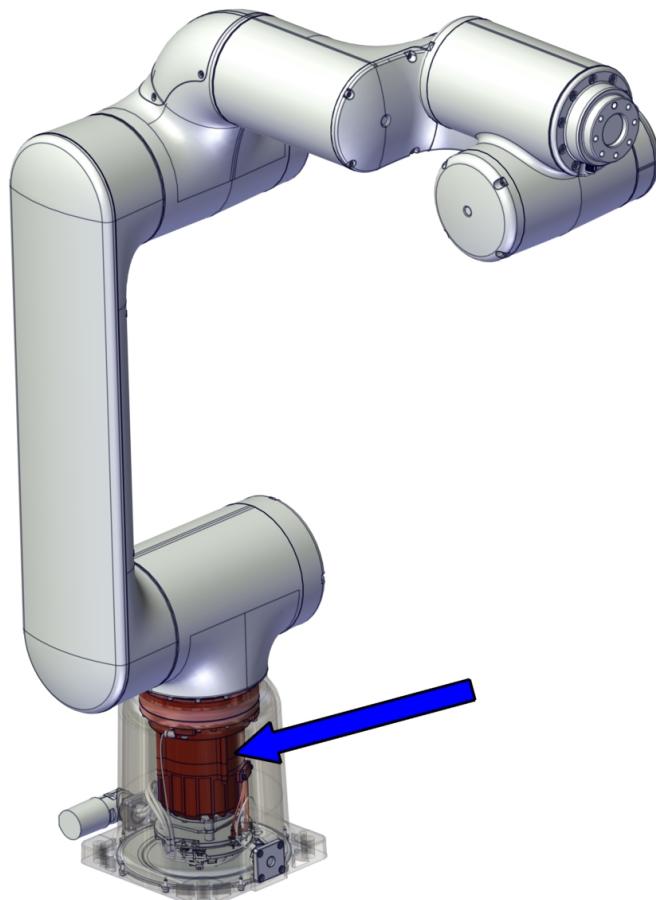
5.6.1 Replacing the axis-1 joint unit

5.6 Joint units

5.6.1 Replacing the axis-1 joint unit

Location of the axis-1 joint unit

The joint unit is located as shown in the figure.



xx2000002018

Summary of the replacement procedure

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

- 1 Separate the cabling between the swing and the lower arm.
- 2 Remove the lower and upper arm undivided.
- 3 Remove the axis-2 joint unit.
- 4 Remove the swing.
- 5 Loosen the base from the foundation and lay it down on its side.
- 6 Replace the axis-1 joint unit. Move the cabling from old to new joint unit.

Continues on next page

Required spare parts

	Note
The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB .	

Spare part	Article number	Note
Joint unit	3HAC079141-001	New attachment screws and cable tie 3HAC075545-001 are included in the delivery.

Required tools and equipment

Equipment	Article number	Note
Lifting aid	3HAC077788-001	For joint units on axes 1, 2 and 3. Attachment screws M4x35 (4 pcs) are enclosed.
Guide pin, M4x120	3HAC077786-001	Always use guide pins in pairs. For joint units on axes 1, 2 and 3.
Protection plate	3HAC077790-001	For protection of drive board during cabling installation on joint unit.
Cable tie gun EVO7	-	HellermannTyton 110-70084 or similar
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cleaning agent	-	Isopropanol
Flange sealant	-	Loctite 574
Cable ties	-	

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5 Repair

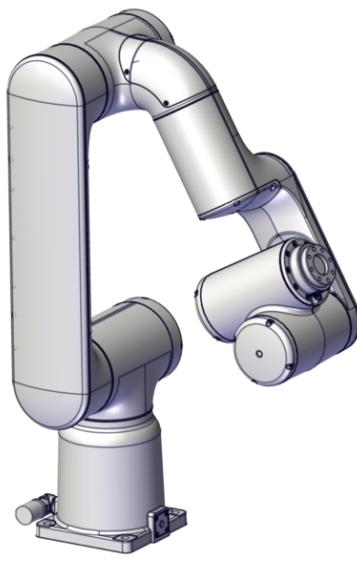
5.6.1 Replacing the axis-1 joint unit

Continued

Removing the joint unit

Use these procedures to remove the joint unit.

Preparations before removing the joint unit

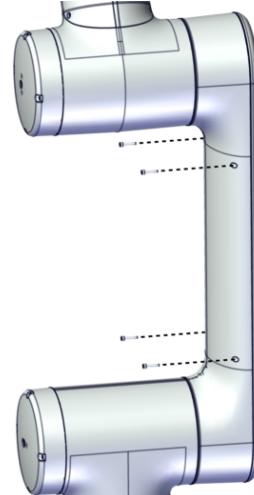
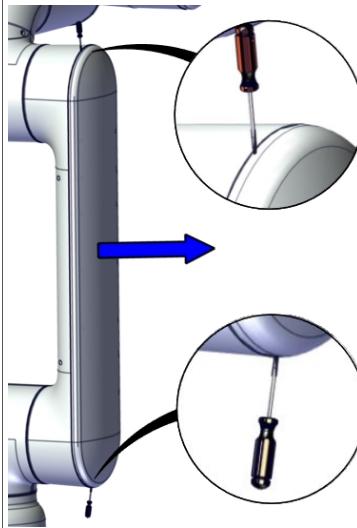
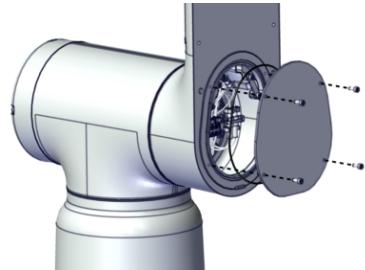
	Action	Note
1	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none">• Axis 1: 0° (home position)• Axis 2: 0°• Axis 3: +60°• Axis 4: 0°• Axis 5: -90°• Axis 6: No significance. <p>! CAUTION</p> <p>Jog the axis on which the joint unit is to be replaced to home position, to achieve correct cable routing during replacement of the joint unit.</p>	 xx2100000044
2	<p>! CAUTION</p> <p>Turn off all supplies for electrical power to the robot, before starting the repair work.</p>	

Removing the lower arm covers

	Action	Note
1	<p>! CAUTION</p> <p>Make sure that all supplies for electrical power are turned off.</p>	

Continues on next page

5.6.1 Replacing the axis-1 joint unit
Continued

Action	Note
2 Remove the four lower arm cover screws.	 xx2000001929
3 Remove the cover by inserting a small flat screwdriver to snap open the locks at each end of the cover.	 xx2100000267
4 Remove the inner cover by removing the four screws.	 xx2000001930

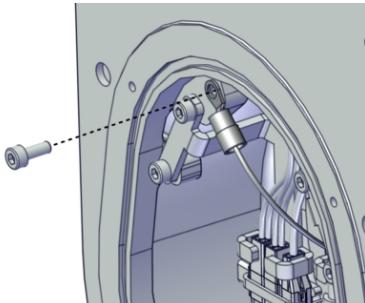
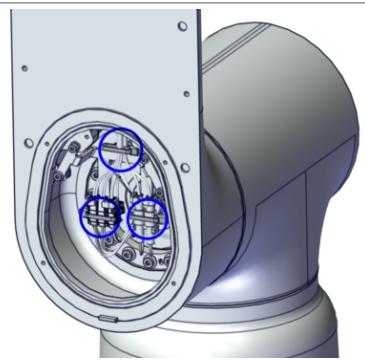
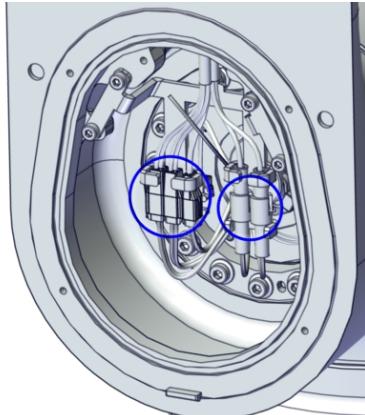
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5 Repair

5.6.1 Replacing the axis-1 joint unit

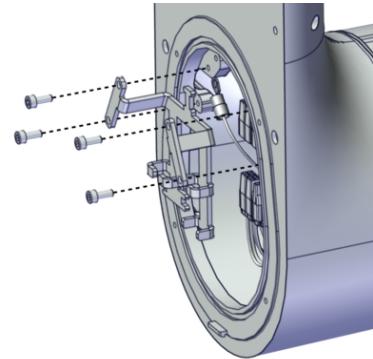
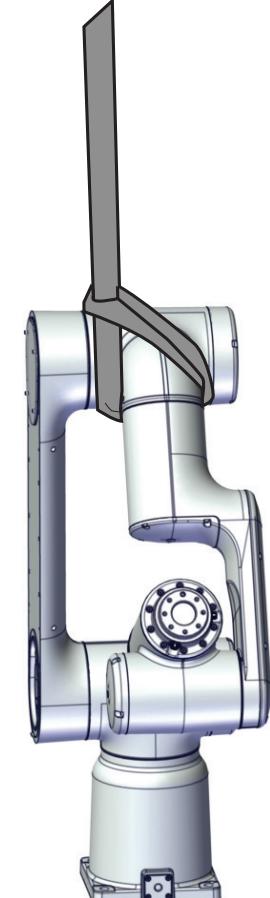
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Disconnecting the cabling between the lower arm and the swing

	Action	Note
1	Remove the functional earth cable by removing the screw.	 xx2000001936
2	Cut the cable ties.	 xx2000001937
3	Snap loose and disconnect all connectors.	 xx2000001938

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Removing the lower and upper arm assembled

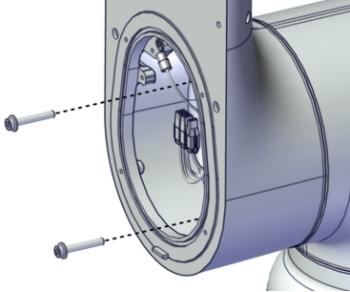
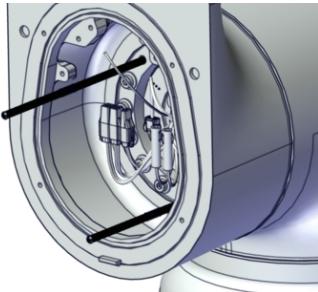
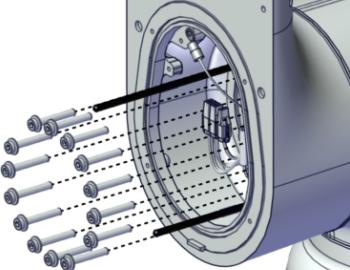
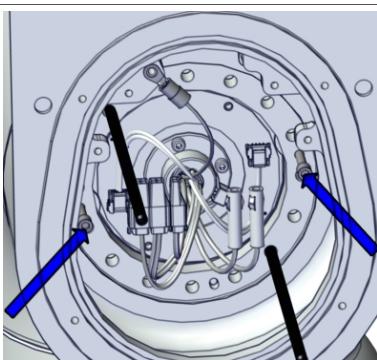
	Action	Note
1	Remove the cable bracket by removing the four screws.	 xx2000001939
2	Secure the weight of the upper and lower arm. CAUTION The weight of the complete upper and lower arm together is 18 kg	Suggestion with lifting sling and an overhead crane:  xx2100000294

Continues on next page

5 Repair

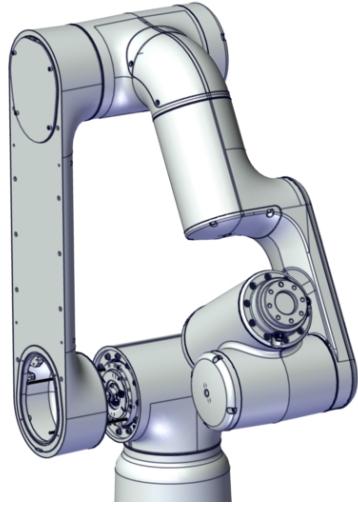
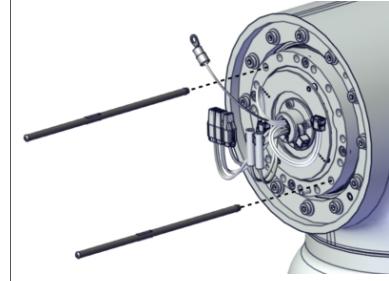
5.6.1 Replacing the axis-1 joint unit

Continued

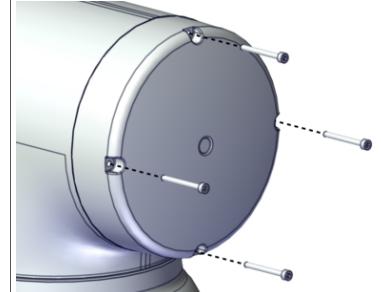
	Action	Note
3	Remove two attachment screws and fit two guide pins to the axis-2 joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs.</p>  <p>xx2000001951</p>  <p>xx2000001960</p>
4	Remove the lower arm attachment screws.	 <p>xx2000001940</p>
5	Use two fully threaded attachment screws as removal tools to press the lower arm out of position.	 <p>xx2000002151</p>

Continues on next page

5.6.1 Replacing the axis-1 joint unit
Continued

Action	Note
6 Remove the complete arm system from the swing.	 xx2000001941
7 Remove the guide pins.	 xx2000002432

Removing the swing cover

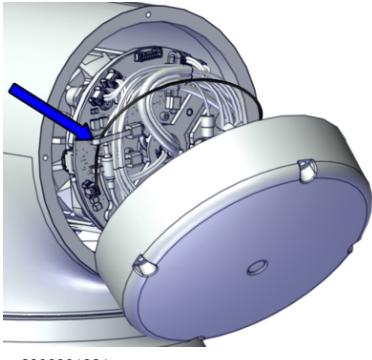
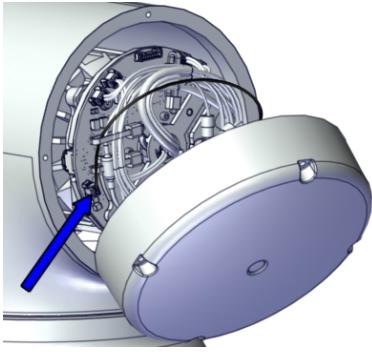
Action	Note
1  CAUTION Make sure that all supplies for electrical power are turned off.	
2 Remove the cover screws.	 xx2000001935

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5 Repair

5.6.1 Replacing the axis-1 joint unit

Continued

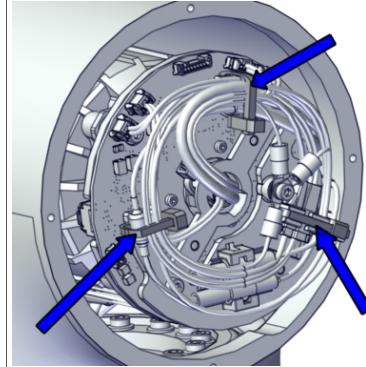
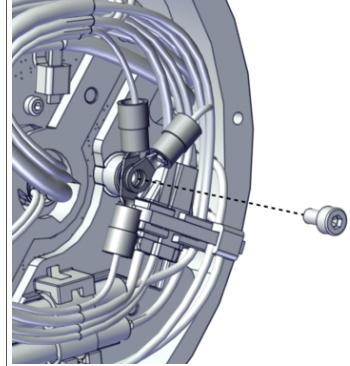
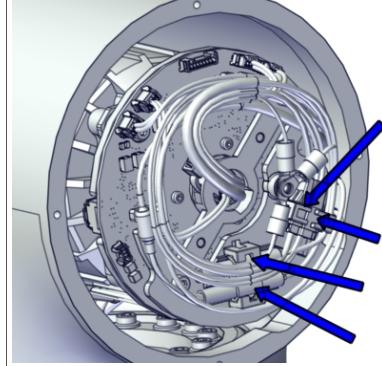
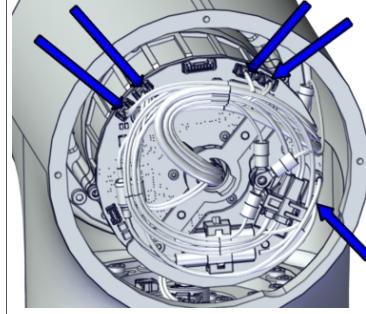
	Action	Note
3	 CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	
4	Open the cover and cut the cable tie that holds the brake release cable.	 xx2000001931
5	Disconnect the brake release connector from the drive board. Remove the cover.	 xx2000001932

Disconnecting the axis-2 joint unit cabling

	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

Continues on next page

5.6.1 Replacing the axis-1 joint unit
Continued

Action	Note
2 Cut the cable ties.	 xx2000001946
3 Remove the functional and protective earth cables by removing the screw.	 xx2000001945
4 Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J2.DC+ • J2.DC- • J2.CS • J2.CP 	 xx2000001944
5 Disconnect the connectors from the drive board. <ul style="list-style-type: none"> • D2.X1 from X1 • D2.DC+ from DC+ • D2.DC- from ground • D2.X4 from X4 • D2.X2 from X2 • D2.X5 from X5 	 xx2000002013

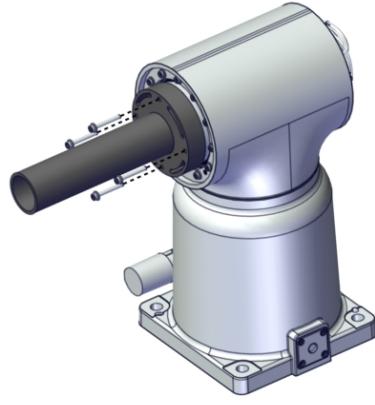
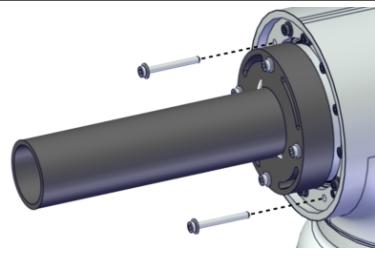
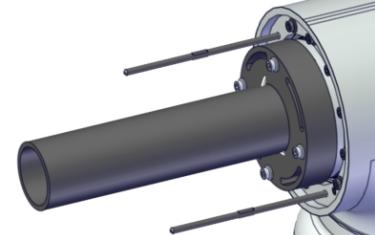
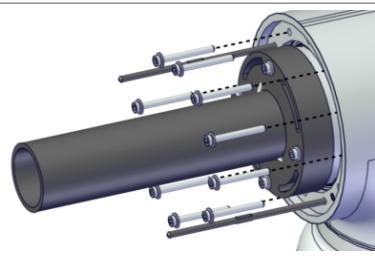
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5 Repair

5.6.1 Replacing the axis-1 joint unit

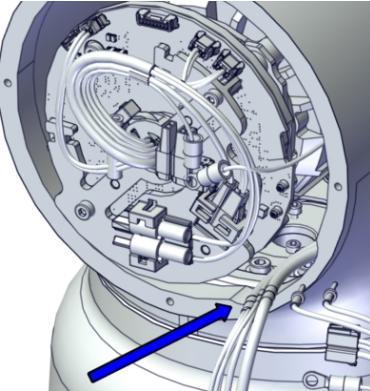
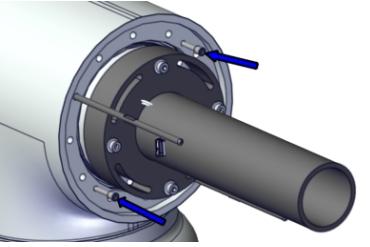
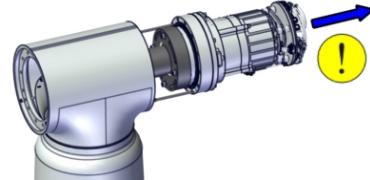
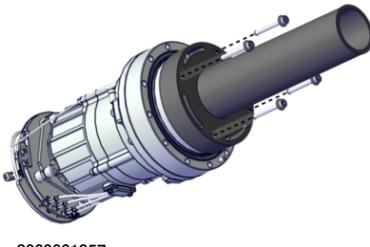
Continued

Removing the axis-2 joint unit

	Action	Note
1	<p>Fit the lifting aid to the joint unit, on the torque sensor side.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	<p>Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)</p>  <p>xx2000001956</p>
2	<p>Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.</p>	 <p>xx2100000295</p>
3	Fit two guide pins to the axis-2 joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.</p>  <p>xx2000002433</p>
4	<p>Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.</p>	 <p>xx200001943</p>

Continues on next page

5.6.1 Replacing the axis-1 joint unit
Continued

Action	Note
5 Put the cabling at the slot in order not to squeeze it during removal of joint unit.	 xx210000045
6 Press the joint unit out of position using two of the previous attachment screws as removal tools.	 xx2000002434
7 Remove the joint unit from the swing. CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000001958
8 Remove the lifting aid and guide pins.	 xx2000001957

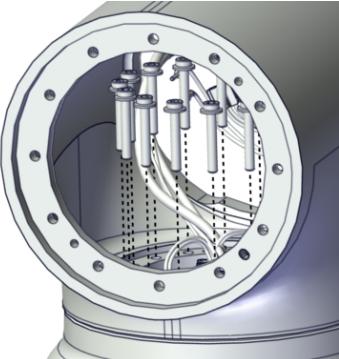
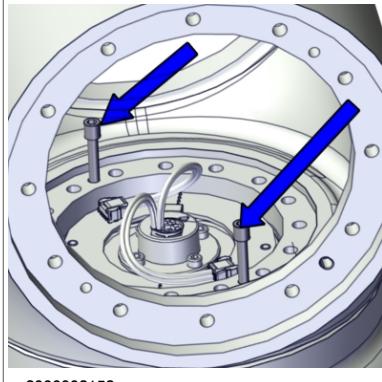
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5 Repair

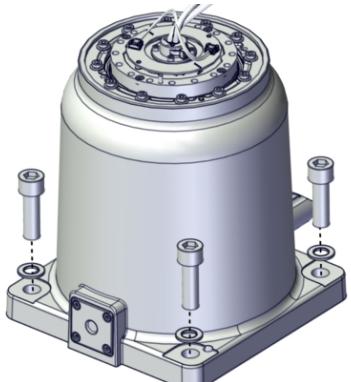
5.6.1 Replacing the axis-1 joint unit

Continued

Removing the swing

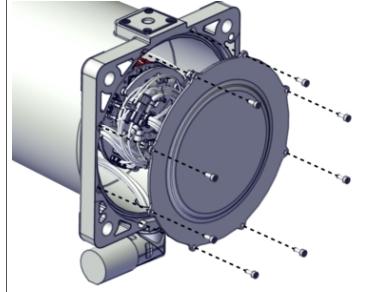
	Action	Note
1	Remove the swing attachment screws.	 xx2000001987
2	Use two fully threaded attachment screws as removal tools to press the swing out of position.	 xx2000002152
3	Lift away the swing.  CAUTION The torque sensor (on the exposed PCBA) is sensitive to mechanical damage. Handle the assembly with care.	

Loosening the base and removing the base cover

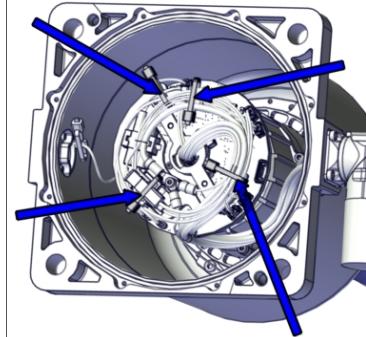
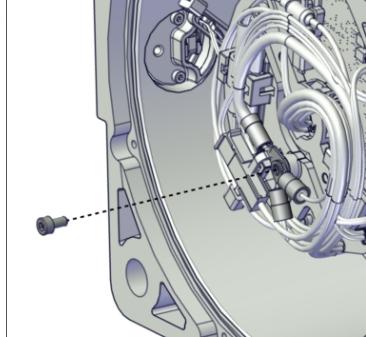
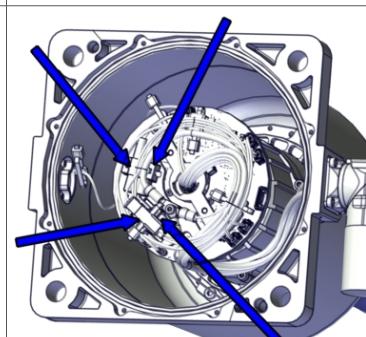
	Action	Note
1	Loosen the base from the foundation by removing the attachment screws and washers.	 xx2000002006

Continues on next page

5.6.1 Replacing the axis-1 joint unit
Continued

Action	Note
2 Tilt the base on to its side and remove the bottom cover by removing the attachment screws.	 xx2000002007

Disconnecting the axis-1 joint unit cabling

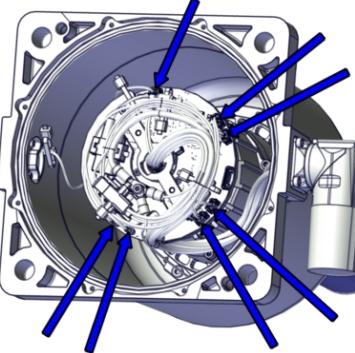
Action	Note
1 Cut the cable ties.	 xx2000002012
2 Remove the functional and protective earth cables by removing the screw.	 xx2000002011
3 Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J1.DC+ • J1.DC- • J1.CS • J1.CP 	 xx2000002010

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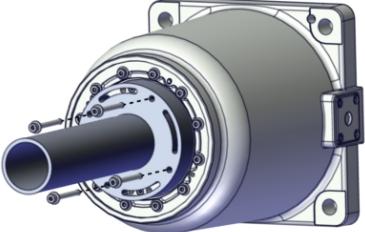
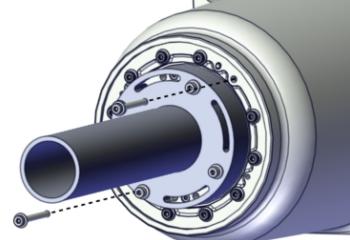
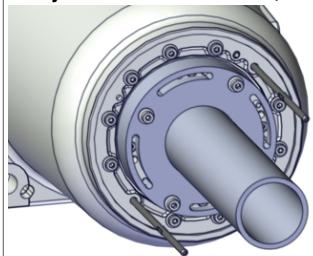
5 Repair

5.6.1 Replacing the axis-1 joint unit

Continued

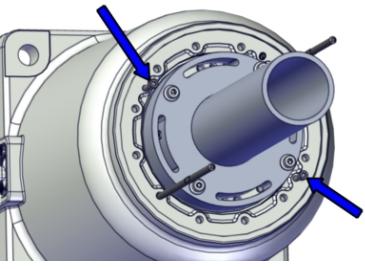
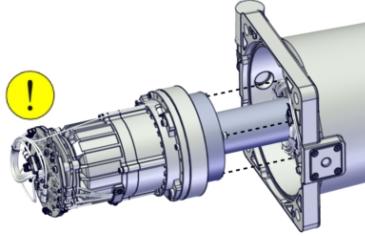
Action	Note
<p>4 Disconnect the connectors from the drive board.</p> <ul style="list-style-type: none"> • D1.X1 from X1 • D1.DC+ from DC+ • D1.DC- from ground • D1.X4 from X4 • D1.X2 from X2 • D1.X5 from X5 • DR.X8 from X8 	 xx2000002009

Removing the axis-1 joint unit

Action	Note
<p>1 Fit the lifting aid to the joint unit.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)  xx2000001994
<p>2 Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.</p>	 xx2100000296
<p>3 Fit two guide pins to the axis-1 joint unit.</p>	Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.  xx2000002435

Continues on next page

5.6.1 Replacing the axis-1 joint unit
Continued

Action	Note
4 Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.	 xx2000002008
5 Press the joint unit out of position using two of the previous attachment screws as removal tools.	 xx2000002436
6 Remove the joint unit from the base.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002014
7 Remove the lifting aid and guide pins.	 xx2000001957

Removing the joint cable

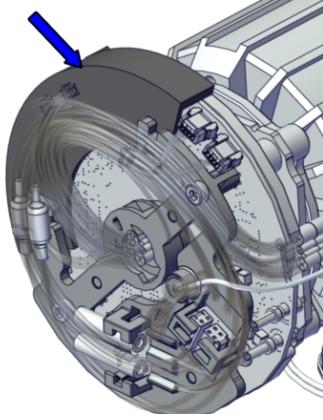
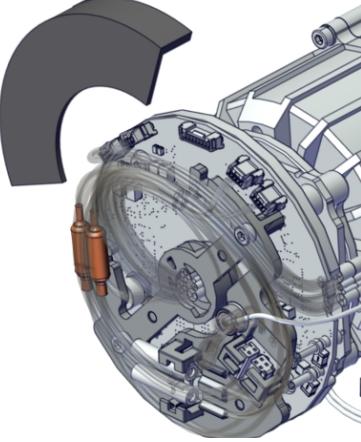
Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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5 Repair

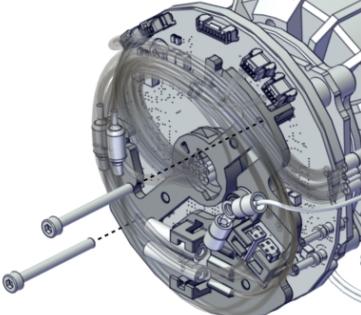
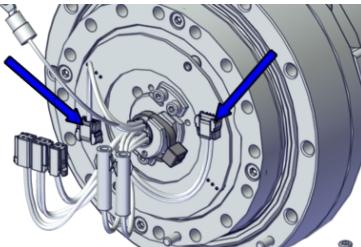
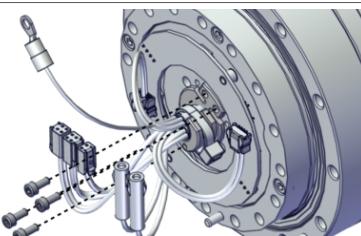
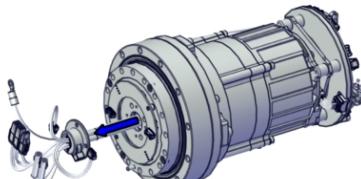
5.6.1 Replacing the axis-1 joint unit

Continued

	Action	Note
2	<p>Fit the protection plate to the drive board unit.</p> <p> Tip</p> <p>Using the protection plate is important for protecting the drive board unit. If complete joint unit is to be replaced, the protection plate is not needed.</p>	<p>Protection plate: 3HAC077790-001</p>  <p>xx2000002057</p>
3	Cut the cable tie at the drive board.	 <p>xx2000002058</p>
4	Remove the protection plate.	 <p>xx2100000301</p>

Continues on next page

5.6.1 Replacing the axis-1 joint unit
Continued

	Action	Note
5	Remove the cable support from the drive board by removing the attachment screws.	 xx2000002055
6	Disconnect the two connectors from the torque sensor board. <ul style="list-style-type: none"> • TQ.A • TQ.B 	 xx2000002053
7	Remove the cable plate by removing the attachment screws.	 xx2000002049
8	Remove the joint cable from the hollow shaft from the torque sensor side.	 xx2000002060

Refitting the joint unit

Use these procedures to refit the joint unit.

Refitting the joint cable

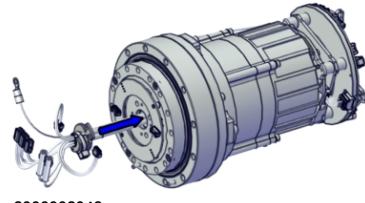
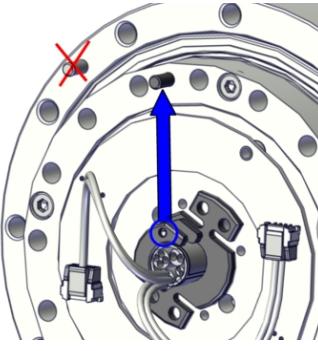
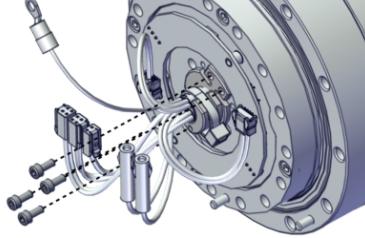
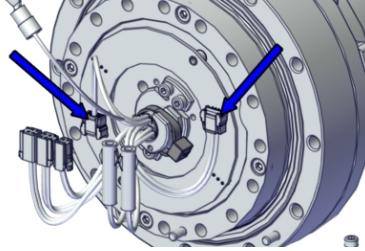
	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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5 Repair

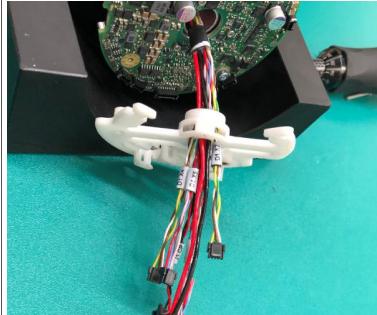
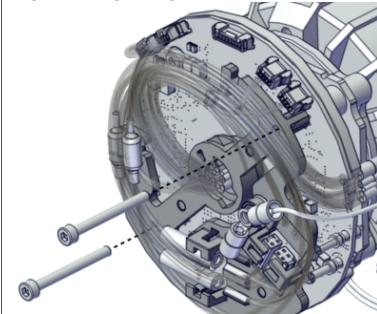
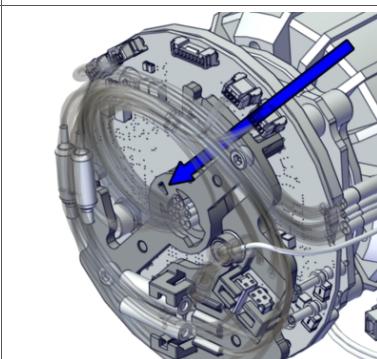
5.6.1 Replacing the axis-1 joint unit

Continued

	Action	Note
2	<p>Place the joint cable through the hollow shaft from the torque sensor side.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	 xx2000002048
3	<p>Orient the cable plate according to the figure. The circle on the cable plate should point towards the guide pin on the torque sensor.</p>	 xx2000002051
4	<p>Secure the cable plate to the joint unit with the attachment screws.</p>	<p>Hex socket head cap screw: M2.5x6 12.9 Gleitmo 603+Geomet 500 (4 pcs)</p> <p>Tightening torque: 0.45 Nm.</p>  xx2000002049
5	<p>Connect the two connectors to the torque sensor board.</p> <ul style="list-style-type: none"> • TQ.A to CH1/A • TQ.B to CH2/B 	 xx2000002053

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5.6.1 Replacing the axis-1 joint unit
Continued

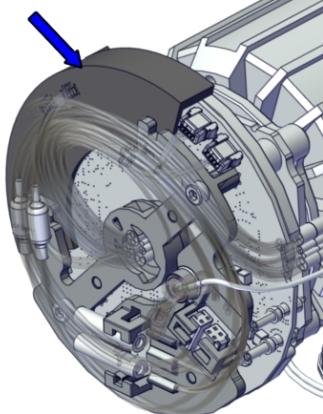
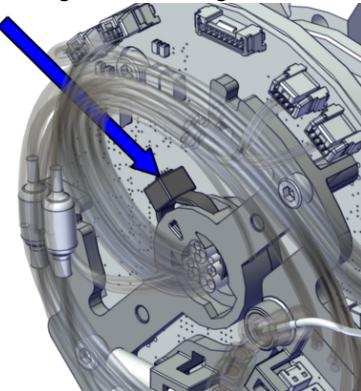
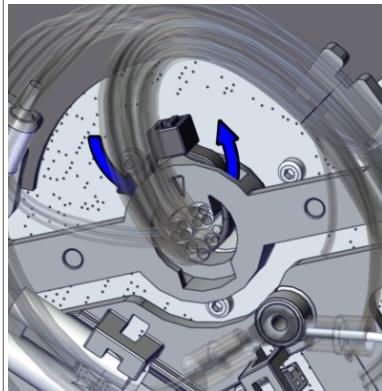
Action	Note
6 Insert the cabling through the cable support and fit the support to the drive board with the attachment screws.	 <p>xx2000002056</p> <p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (2 pcs)</p> <p>Tightening torque: 0.45 Nm.</p>  <p>xx2000002055</p>
7 Align the triangle direction mark on the cable support and the white mark on the cable harness. Use the cable tie to pre-fix the cable by hand.	 <p>xx2100000507</p>  <p>xx2100000508</p>

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5 Repair

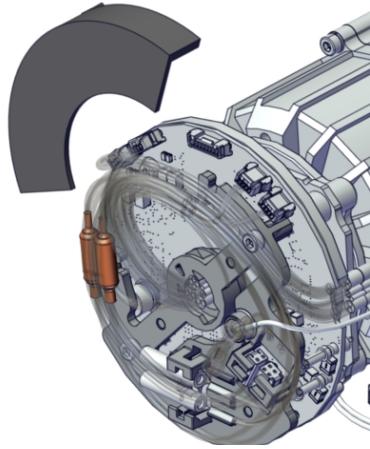
5.6.1 Replacing the axis-1 joint unit

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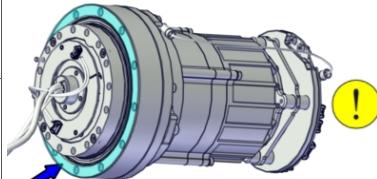
	Action	Note
8	Fit the protection plate to the drive board unit.	<p>Protection plate: 3HAC077790-001</p>  <p>xx2000002057</p>
9	<p>Secure the cables to the cable support with a cable tie, using a cable tie gun. Assembly direction for the cable tie is shown in the figure.</p>	<p>Cable tie: 3HAC075545-001. For securing joint unit cable. Cable tie gun EVO7 Setting for cable tie gun: 6.75.</p>  <p>xx2000002058</p>  <p>xx2000002059</p>

Continues on next page

5.6.1 Replacing the axis-1 joint unit
Continued

Action	Note
10 Remove the protection plate.	 xx2100000301

Preparations before fitting the joint unit

Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2 Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol. Joint unit mounting surface is pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574
3  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	 xx2000001860

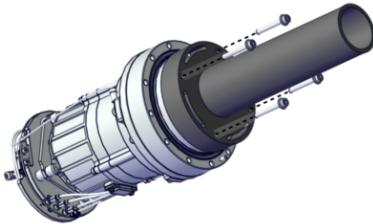
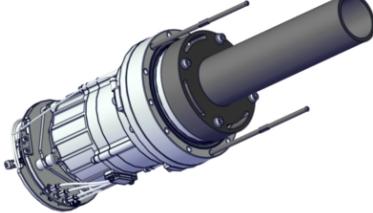
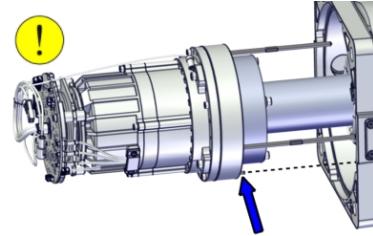
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5 Repair

5.6.1 Replacing the axis-1 joint unit

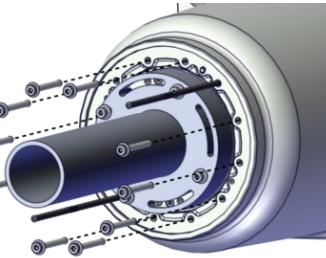
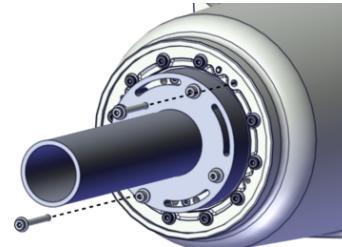
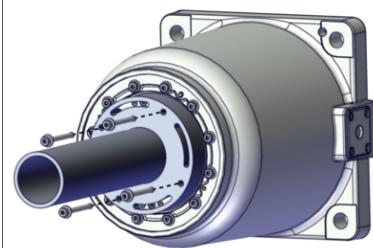
Continued

Refitting the axis-1 joint unit

	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section <i>The unit is sensitive to ESD on page 42</i> .	
2	Fit the lifting aid to the joint unit.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Joint unit: 3HAC079141-001 Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)  xx2000001957
3	Fit two guide pins to the joint unit.	Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.  xx2000002438
4	Fit the joint unit to the base, aligning the pin with the pin hole.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002015

Continues on next page

5.6.1 Replacing the axis-1 joint unit
Continued

Action	Note
5 Secure the joint unit with new attachment screws.	<p>Hex socket head cap flange screw with glue: 3HAB3413-435 M4x35, 12 pcs</p> <p>Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.</p>  <p>xx2000002008</p>
6 Remove the guide pins and secure the remaining two attachment screws.	 <p>xx2100000296</p>
7 Pre-tighten the screws crosswise.	
8 Torque tighten all screws crosswise.	Tightening torque: 4.3 Nm.
9 Remove the lifting aid by removing the screws.	 <p>xx2000001994</p>
10 Clean pushed-out flange sealant, if any.	

Connecting the axis-1 joint unit cabling

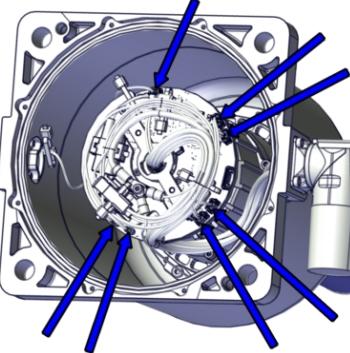
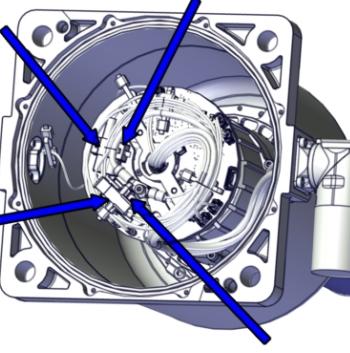
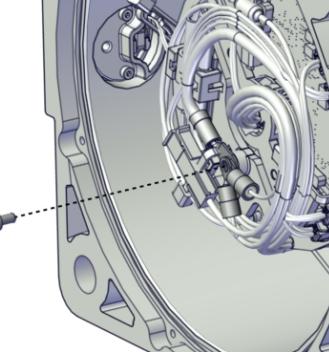
Action	Note
<p>1  ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42.</p>	

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5 Repair

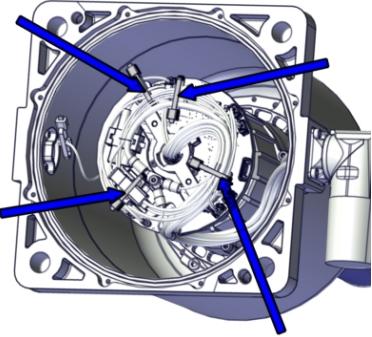
5.6.1 Replacing the axis-1 joint unit

Continued

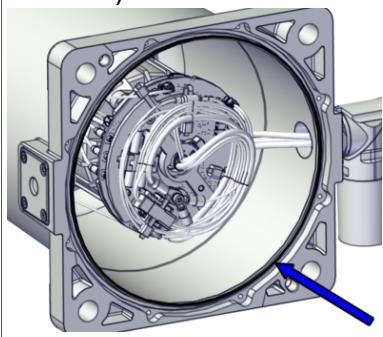
	Action	Note
2	<p>Reconnect the connectors to the drive board.</p> <ul style="list-style-type: none"> • D1.X1 to X1 • D1.DC+ to DC+ • D1.DC- to Ground • D1.X4 to X4 • D1.X2 to X2 • D1.X5 to X5 • DR.X8 to X8 	 xx2000002009
3	<p>Connect the connectors to each other and snap them to the cable holders.</p> <ul style="list-style-type: none"> • J1.DC+ to J1.DC+ • J1.DC- to J1.DC- • J1.CS to J1.CS • J1.CP to J1.CP 	 xx2000002010
4	<p>Secure the cables for functional earth and protective earth with a screw.</p>	<p>Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.</p>  xx2000002011

Continues on next page

5.6.1 Replacing the axis-1 joint unit
Continued

Action	Note
5 Secure the cabling with cable ties.	Cable ties (4 pcs)  xx2000002012

Refitting the base cover

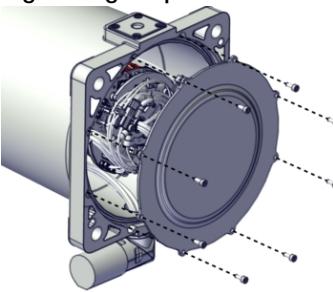
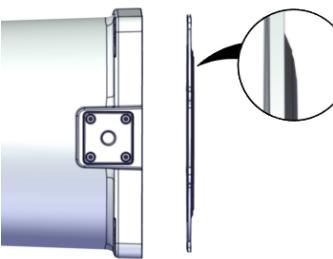
Action	Note
1 Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring, nitrile rubber: 3HAB3772-64 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000002016

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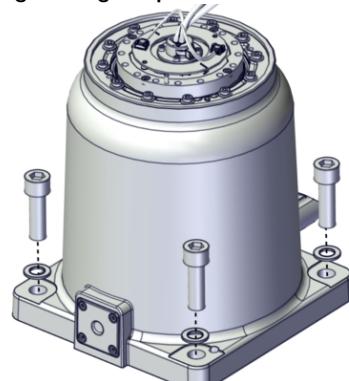
5 Repair

5.6.1 Replacing the axis-1 joint unit

Continued

	Action	Note
2	<p>Refit the bottom cover with the attachment screws.</p> <p> Note</p> <p>Fit the cover in correct direction, the protrusion of the cover must face outwards.</p>	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (8 pcs)</p> <p>Tightening torque: 1.2 Nm.</p>  <p>xx2000002007</p>  <p>xx2100000268</p>

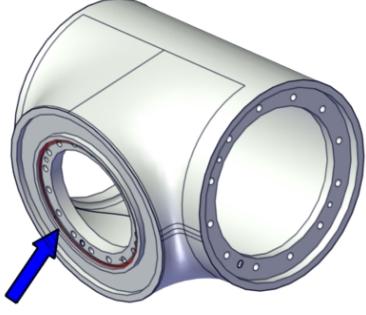
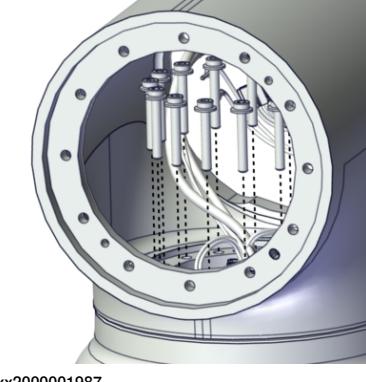
Securing the base

	Action	Note
1	Lift the base to standing and secure it to the foundation with the attachment screws and washers.	<p>Attachment screws: M10x35 8.8 (4 pcs).</p> <p>Washers: 23/10.5/2.5 mm Steel (4 pcs).</p> <p>Tightening torque: 30 Nm ±10%.</p>  <p>xx2000002006</p>

Continues on next page

5.6.1 Replacing the axis-1 joint unit
Continued

Refitting the swing

	Action	Note
1	<p>Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the base mounting surface, as pointed out in the figure.</p>	<p>Cleaning agent: Isopropanol Flange sealant: Loctite 574</p>  <p>xx2000001990</p>
2	<p>Refit the swing to the base unit, aligning the pin with the pin hole.</p> <p>CAUTION</p> <p>The torque sensor (on the exposed PCBA) is sensitive to mechanical damage. Handle the assembly with care.</p>	 <p>xx2000001989</p>
3	<p>Secure the swing with the attachment screws. Pre-tighten the screws crosswise firstly.</p>	<p>Hex socket head cap flange screw: M4x25 (16 pcs)</p>  <p>xx2000001987</p>
4	Torque tighten all screws crosswise.	Tightening torque: 4.6 Nm.

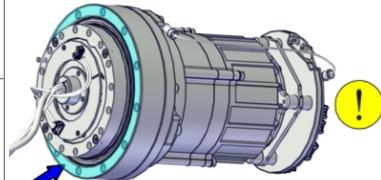
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5 Repair

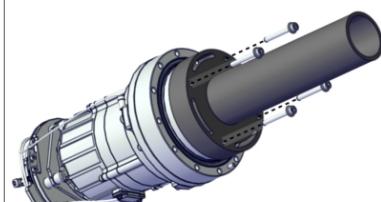
5.6.1 Replacing the axis-1 joint unit

Continued

Preparations before fitting the joint unit

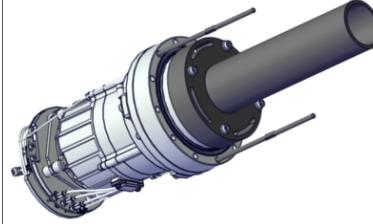
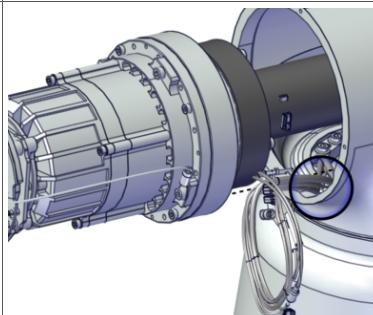
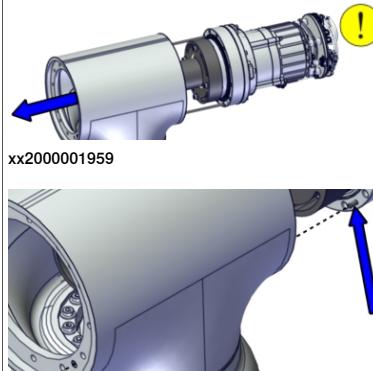
	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2	Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol. Joint unit mounting surface is pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001860
3	Apply a thin layer of flange sealant to the mounting surface. Do not contaminate the radial sealing with sealant.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

Refitting the axis-2 joint unit

	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2	Fit the lifting aid to the joint unit.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Joint unit: 3HAC079141-001 Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)  xx2000001957

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5.6.1 Replacing the axis-1 joint unit
Continued

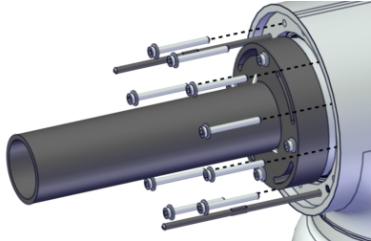
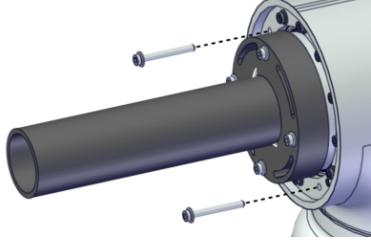
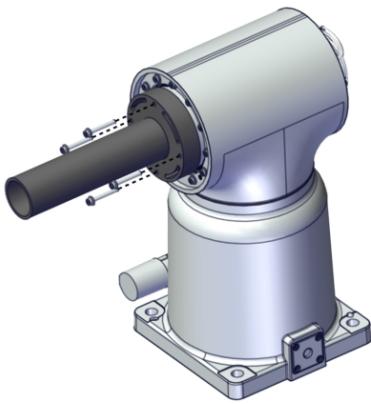
Action	Note
3 Fit two guide pins to the joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.</p>  <p>xx2000002438</p>
4 Place the axis-1 cabling at the notch in the swing.	<p>! CAUTION The cabling is sensitive to mechanical damage. Handle it with care to avoid damage to the cabling or the connector.</p>  <p>xx2000002153</p>
5 Fit the joint unit to the swing, aligning the pin with the pin hole.	<p>! CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>  <p>xx2000001959 xx2000001961</p>

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5 Repair

5.6.1 Replacing the axis-1 joint unit

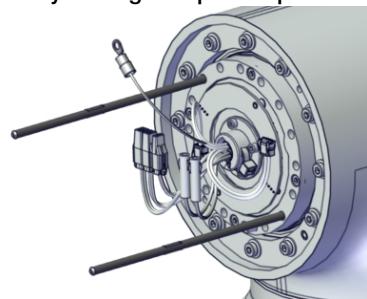
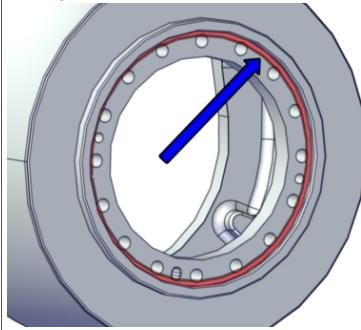
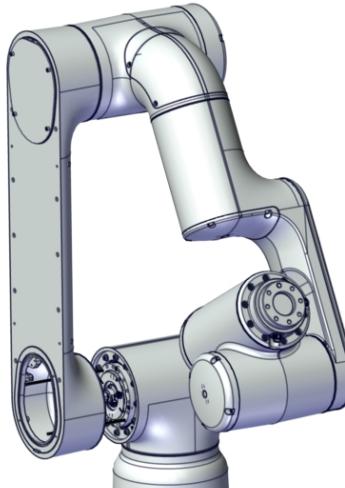
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Action	Note
6 Secure the joint unit with new attachment screws.	<p>Hex socket head cap flange screw with glue: 3HAB3413-435 M4x35, 12 pcs</p> <p>Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.</p>  <p>xx2000001943</p>
7 Remove the guide pins and secure the remaining two attachment screws.	 <p>xx2100000295</p>
8 Pre-tighten the screws crosswise.	
9 Torque tighten all screws crosswise.	Tightening torque: 4.3 Nm.
10 Remove the lifting aid by removing the screws.	 <p>xx2000001956</p>
11 Clean pushed-out flange sealant, if any.	

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5.6.1 Replacing the axis-1 joint unit
Continued

Refitting the lower and upper arm assembled

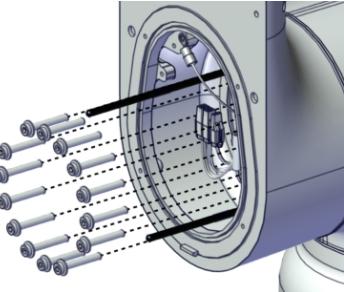
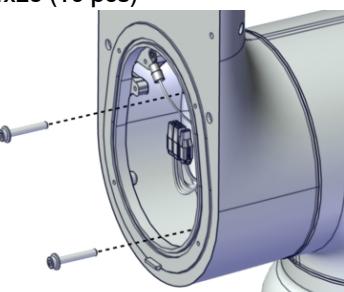
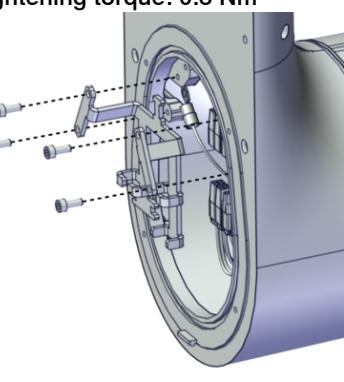
	Action	Note
1	Fit two guide pins to the axis-2 joint unit.	Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs.  xx2000001949
2	Remove any old residuals of flange sealant from the lower arm mounting surface and clean with isopropanol. Apply new flange sealant to the corner of the lower arm mounting surface, as pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001963
3	 CAUTION The weight of the complete upper and lower arm together is 18 kg	
4	Lift the upper and lower arm assembly to mounting position and slide it onto the guide pins.	 xx2000001941

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5 Repair

5.6.1 Replacing the axis-1 joint unit

Continued

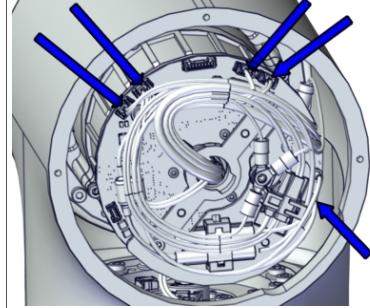
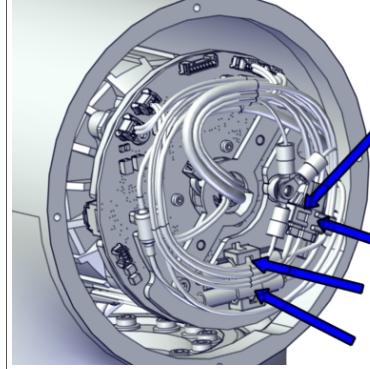
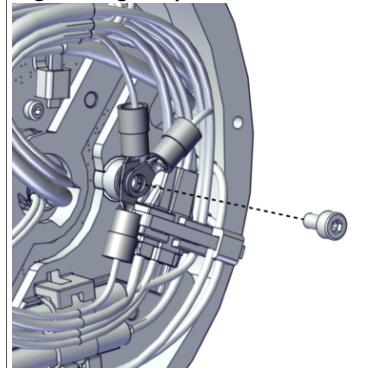
	Action	Note
5	<p>Secure the lower arm to the swing with all attachment screws but two. Pre-tighten the screws crosswise firstly.</p>	<p>Hex socket head cap flange screw: M4x25 (16 pcs)</p>  <p>xx2000001940</p>
6	Remove the guide pins and fasten the remaining two screws.	<p>Hex socket head cap flange screw: M4x25 (16 pcs)</p>  <p>xx2000001951</p>
7	Torque tighten all screws crosswise.	Tightening torque: 4.6 Nm.
8	Refit the cable bracket with four screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs).</p> <p>Tightening torque: 0.8 Nm</p>  <p>xx2000001939</p>

Connecting the axis-2 joint unit cabling

	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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5.6.1 Replacing the axis-1 joint unit
Continued

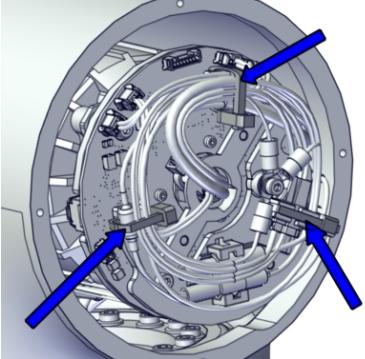
Action	Note
2 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D2.X1 to X1 • D2.DC+ to DC+ • D2.DC- to Ground • D2.X4 to X4 • D2.X2 to X2 • D2.X5 to X5 	 xx2000002013
3 Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J2.DC+ to J2.DC+ • J2.DC- to J2.DC- • J2.CS to J2.CS • J2.CP to J2.CP 	 xx2000001944
4 Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000001945

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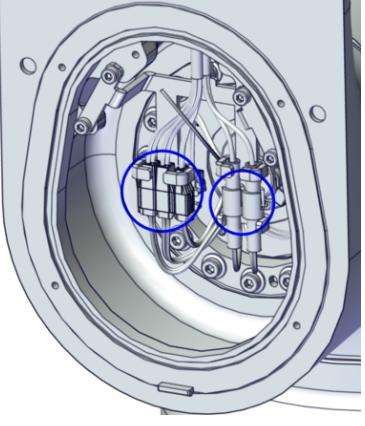
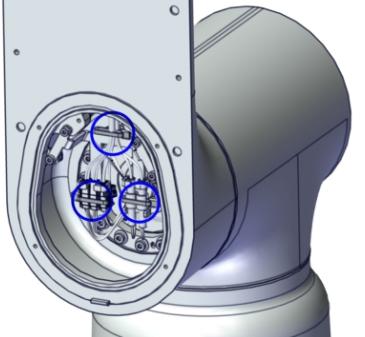
5 Repair

5.6.1 Replacing the axis-1 joint unit

Continued

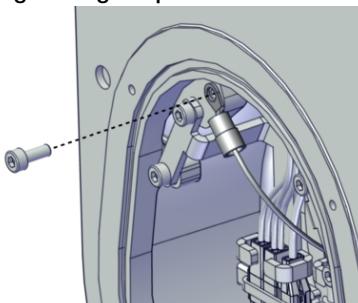
Action	Note
5 Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000001946

Connecting the cabling between the lower arm and swing

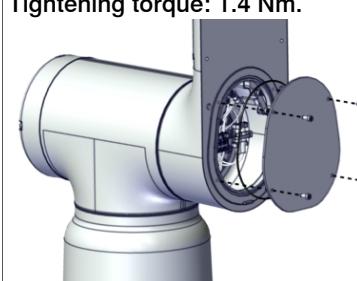
Action	Note
1 Connect the connectors to each other and snap them to the cable holders.	 xx2000001938
2 Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000001937

Continues on next page

5.6.1 Replacing the axis-1 joint unit
Continued

Action	Note
3 Connect the functional earth cable with the screw.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (1 pcs). Tightening torque: 0.8 Nm</p>  <p>xx2000001936</p>

Refitting the lower arm covers

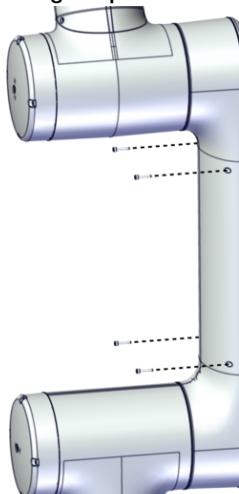
Action	Note
1 Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	<p>O-ring: 3HAC061327-044 Grease: 3HAC042536-001 (Shell Gadus S2)</p>  <p>xx2000001954</p>
2 Refit the inner cover with four screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 1.4 Nm.</p>  <p>xx2000001930</p>

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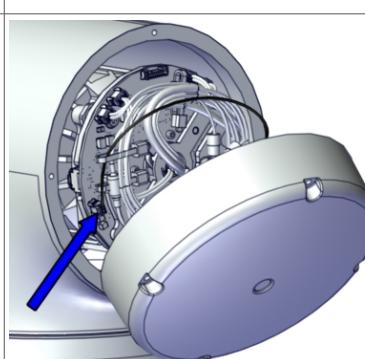
5 Repair

5.6.1 Replacing the axis-1 joint unit

Continued

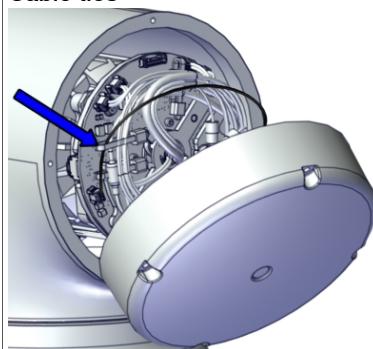
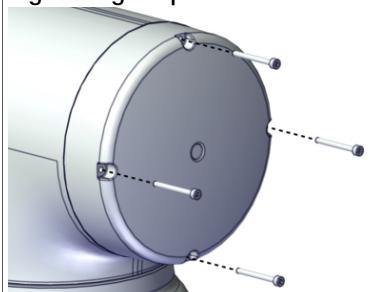
Action	Note
3 Snap the lower arm cover into place.	
4 Secure the cover with four screws.	Hex socket head cap screw: M3x16 12.9 Gleitmo 603+Geomet 500 (Black Oxide) (4 pcs) Tightening torque: 0.45 Nm.  xx2000001929

Refitting the swing cover

Action	Note
1 Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-047  xx2000001962
2 Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board. Orient the cover for proper arrangement of the brake release cable.	 xx2000001932

Continues on next page

5.6.1 Replacing the axis-1 joint unit
Continued

Action	Note
3 Secure the brake release cable with a cable tie.	 <p>Cable ties xx2000001931</p>
4 Refit the cover with the four screws.	<p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm</p>  <p>xx2000001935</p>

Concluding procedure

Action	Note
1 Calibrate the joint unit torque sensor.	See Calibration on page 607
2  DANGER Make sure all safety requirements are met when performing the first test run.	

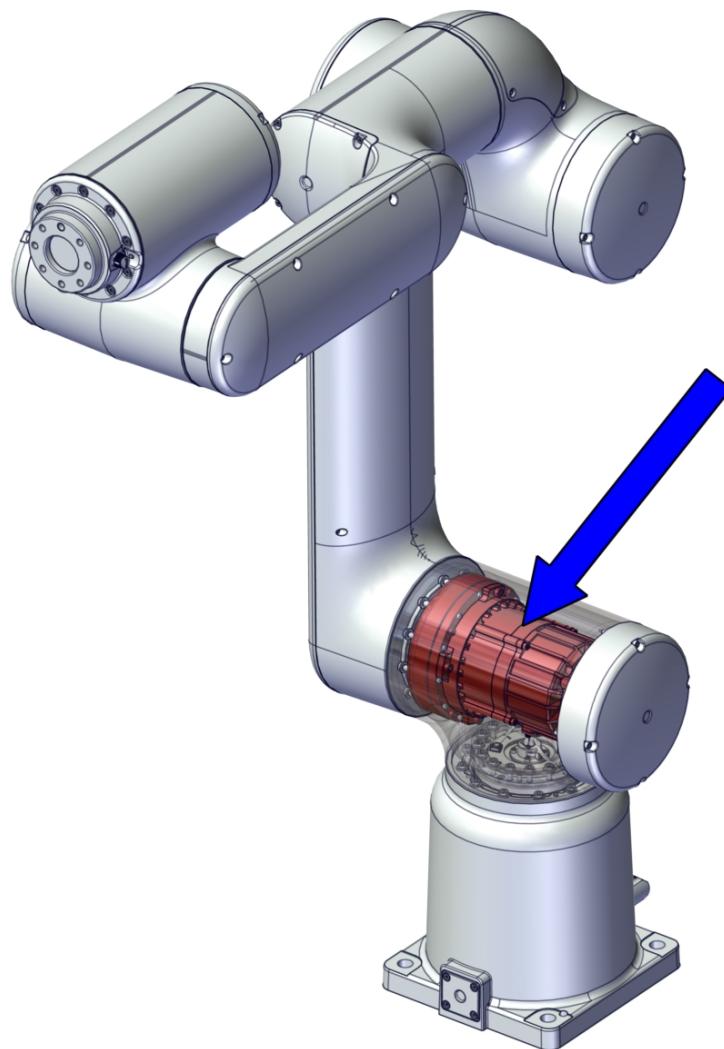
5 Repair

5.6.2 Replacing the axis-2 joint unit

5.6.2 Replacing the axis-2 joint unit

Location of the axis-2 joint unit

The joint unit is located as shown in the figure.



xx2000001948

Summary of the replacement procedure

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

- 1 Separate the cabling between the swing and the lower arm.
- 2 Remove the lower and upper arm undivided.
- 3 Remove the swing cover.
- 4 Replace the joint unit. Move the cabling from old to new joint unit.

Continues on next page

Required spare parts**Note**

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal,
www.abb.com/myABB.

Spare part	Article number	Note
Joint unit	3HAC079141-001	New attachment screws and cable tie 3HAC075545-001 are included in the delivery.

Required tools and equipment

Equipment	Article number	Note
Lifting aid	3HAC077788-001	For joint units on axes 1, 2 and 3. Attachment screws M4x35 (4 pcs) are enclosed.
Guide pin, M4x120	3HAC077786-001	Always use guide pins in pairs. For joint units on axes 1, 2 and 3.
Protection plate	3HAC077790-001	For protection of drive board during cabling installation on joint unit.
Cable tie gun EVO7	-	HellermannTyton 110-70084 or similar
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cleaning agent	-	Isopropanol
Flange sealant	-	Loctite 574
Cable ties	-	
O-ring, nitrile rubber	3HAB3772-64	Base cover
O-ring	3HAC061327-047	Cover for axis 2/3 Replace if damaged.
O-ring	3HAC061327-044	Lower arm, inner cover. 1 pcs / cover. Replace if damaged.

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5 Repair

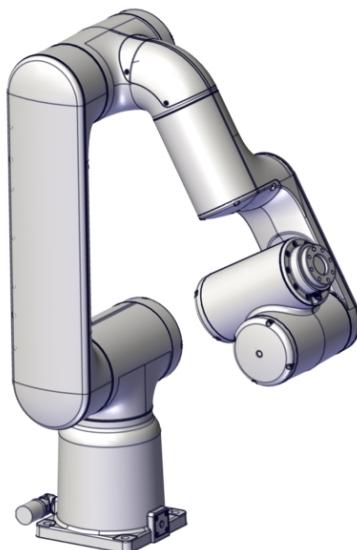
5.6.2 Replacing the axis-2 joint unit

Continued

Removing the joint unit

Use these procedures to remove the joint unit.

Preparations before removing the joint unit

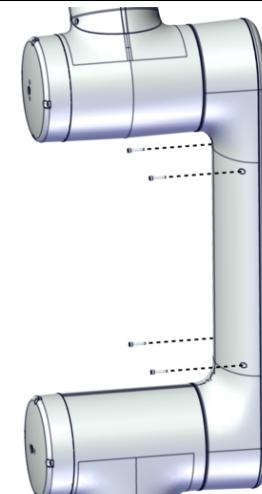
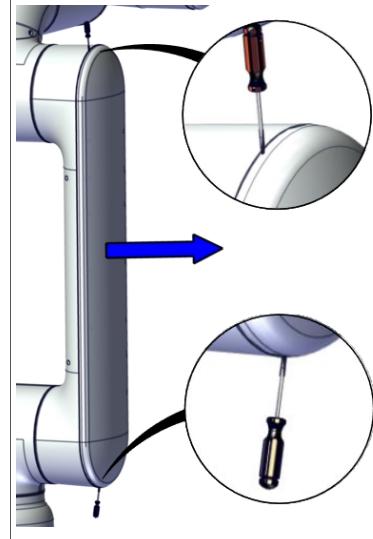
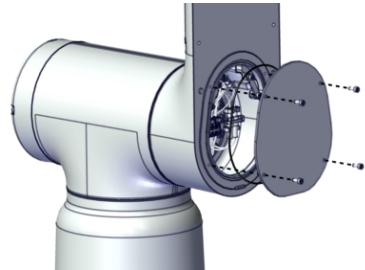
	Action	Note
1	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none">• Axis 1: 0°• Axis 2: 0° (home position)• Axis 3: +60°• Axis 4: 0°• Axis 5: -90°• Axis 6: No significance. <p>! CAUTION</p> <p>Jog the axis on which the joint unit is to be replaced to home position, to achieve correct cable routing during replacement of the joint unit.</p>	 xx2100000044
2	<p>! CAUTION</p> <p>Turn off all supplies for electrical power to the robot, before starting the repair work.</p>	

Removing the lower arm covers

	Action	Note
1	<p>! CAUTION</p> <p>Make sure that all supplies for electrical power are turned off.</p>	

Continues on next page

5.6.2 Replacing the axis-2 joint unit
Continued

Action	Note
2 Remove the four lower arm cover screws.	 xx2000001929
3 Remove the cover by inserting a small flat screwdriver to snap open the locks at each end of the cover.	 xx2100000267
4 Remove the inner cover by removing the four screws.	 xx2000001930

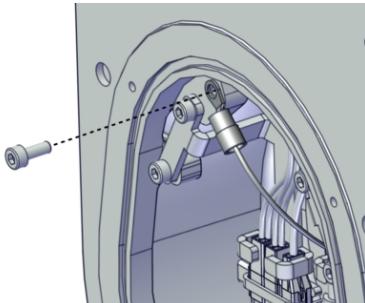
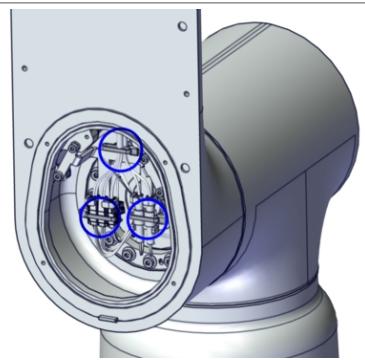
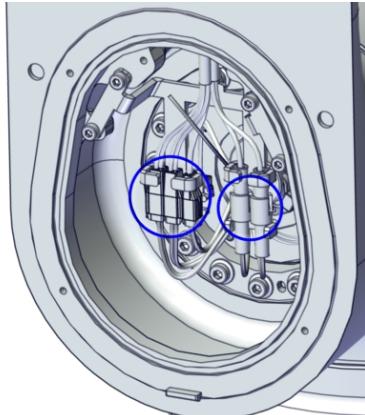
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5 Repair

5.6.2 Replacing the axis-2 joint unit

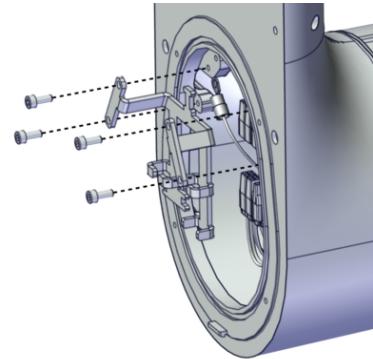
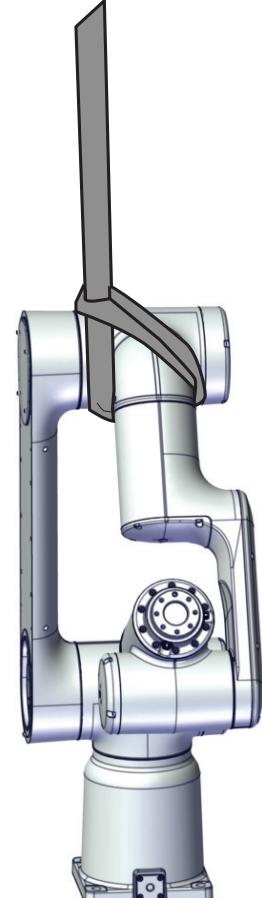
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Disconnecting the cabling between the lower arm and the swing

	Action	Note
1	Remove the functional earth cable by removing the screw.	 xx2000001936
2	Cut the cable ties.	 xx2000001937
3	Snap loose and disconnect all connectors.	 xx2000001938

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Removing the lower and upper arm assembled

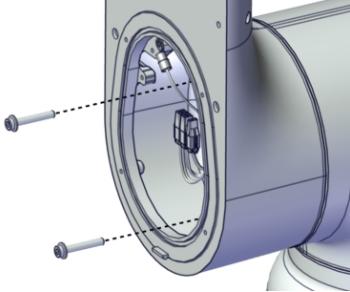
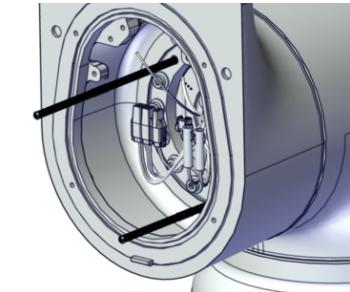
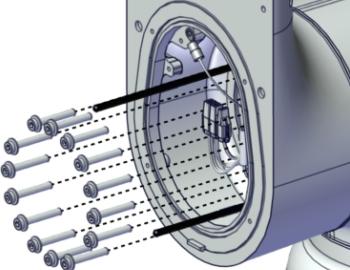
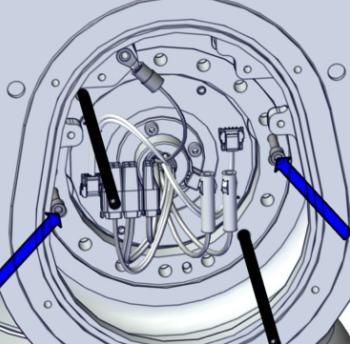
	Action	Note
1	Remove the cable bracket by removing the four screws.	 xx2000001939
2	Secure the weight of the upper and lower arm. CAUTION The weight of the complete upper and lower arm together is 18 kg	Suggestion with lifting sling and an overhead crane:  xx2100000294

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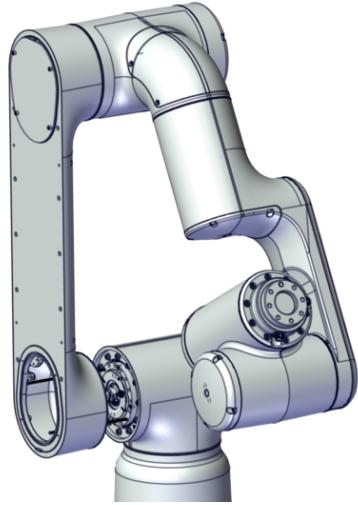
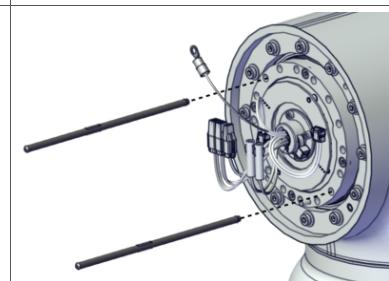
5 Repair

5.6.2 Replacing the axis-2 joint unit

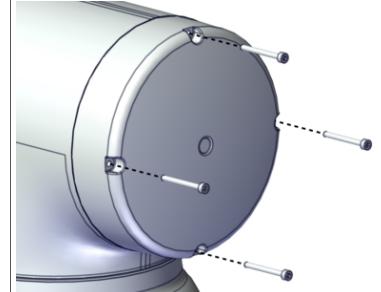
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Action	Note
3 Remove two attachment screws and fit two guide pins to the axis-2 joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs.</p>  <p>xx2000001951</p>  <p>xx2000001960</p>
4 Remove the lower arm attachment screws.	 <p>xx2000001940</p>
5 Use two fully threaded attachment screws as removal tools to press the lower arm out of position.	 <p>xx2000002151</p>

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	Action	Note
6	Remove the complete arm system from the swing.	 xx2000001941
7	Remove the guide pins.	 xx2000002432

Removing the swing cover

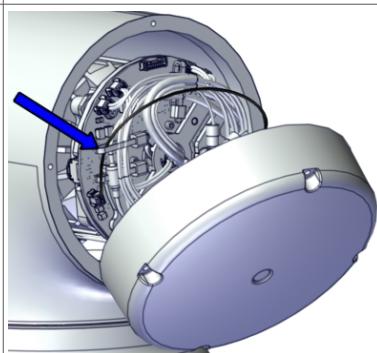
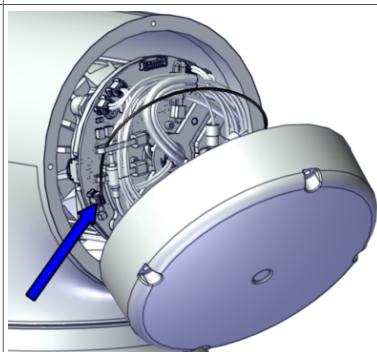
	Action	Note
1	 CAUTION Make sure that all supplies for electrical power are turned off.	
2	Remove the cover screws.	 xx2000001935

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5 Repair

5.6.2 Replacing the axis-2 joint unit

Continued

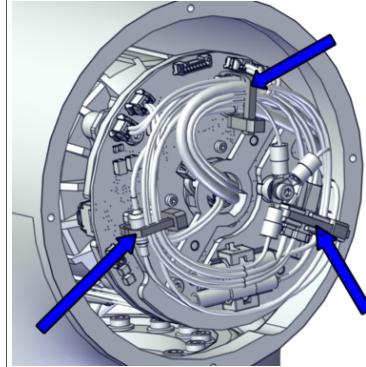
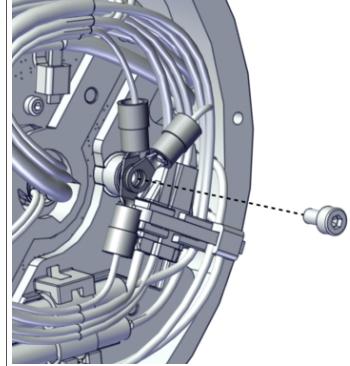
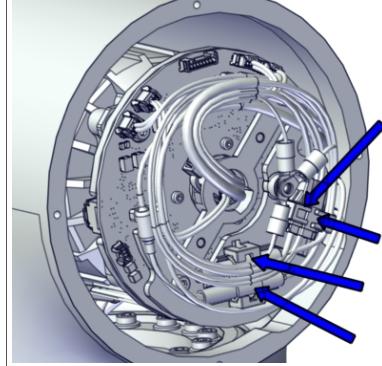
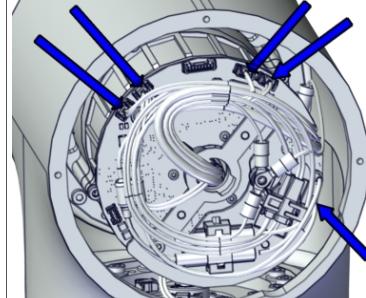
	Action	Note
3	 CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	
4	Open the cover and cut the cable tie that holds the brake release cable.	 xx2000001931
5	Disconnect the brake release connector from the drive board. Remove the cover.	 xx2000001932

Disconnecting the axis-2 joint unit cabling

	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

Continues on next page

5.6.2 Replacing the axis-2 joint unit
Continued

Action	Note
2 Cut the cable ties.	 xx2000001946
3 Remove the functional and protective earth cables by removing the screw.	 xx2000001945
4 Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J2.DC+ • J2.DC- • J2.CS • J2.CP 	 xx2000001944
5 Disconnect the connectors from the drive board. <ul style="list-style-type: none"> • D2.X1 from X1 • D2.DC+ from DC+ • D2.DC- from ground • D2.X4 from X4 • D2.X2 from X2 • D2.X5 from X5 	 xx2000002013

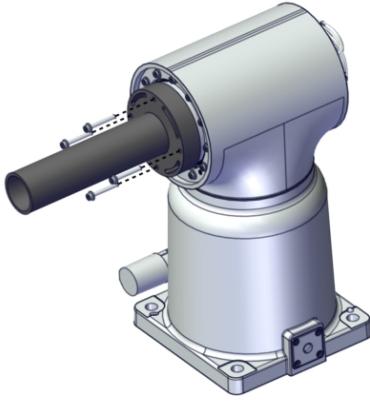
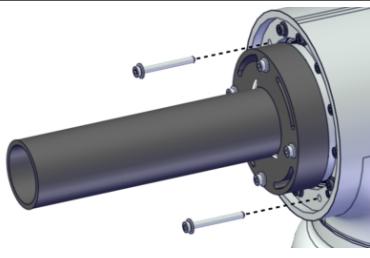
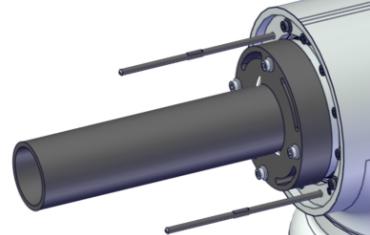
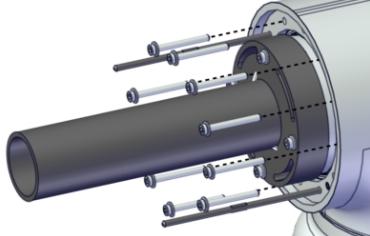
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5 Repair

5.6.2 Replacing the axis-2 joint unit

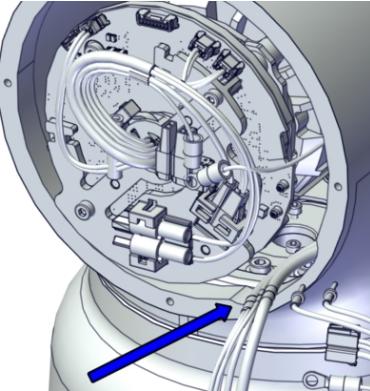
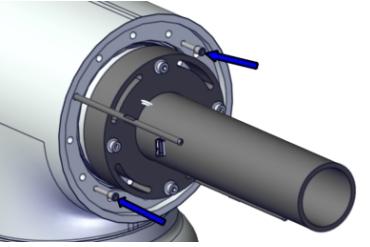
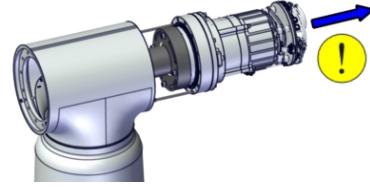
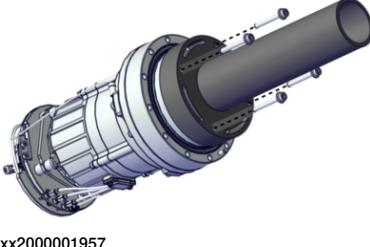
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Removing the axis-2 joint unit

	Action	Note
1	<p>Fit the lifting aid to the joint unit, on the torque sensor side.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	<p>Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)</p>  <p>xx2000001956</p>
2	<p>Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.</p>	 <p>xx2100000295</p>
3	Fit two guide pins to the axis-2 joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.</p>  <p>xx2000002433</p>
4	<p>Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.</p>	 <p>xx200001943</p>

Continues on next page

5.6.2 Replacing the axis-2 joint unit
Continued

Action	Note
5 Put the cabling at the slot in order not to squeeze it during removal of joint unit.	 xx2100000045
6 Press the joint unit out of position using two of the previous attachment screws as removal tools.	 xx2000002434
7 Remove the joint unit from the swing.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000001958
8 Remove the lifting aid and guide pins.	 xx2000001957

Removing the joint cable

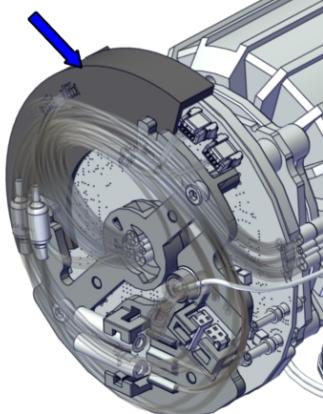
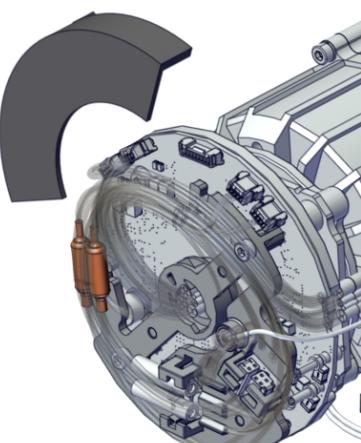
Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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5 Repair

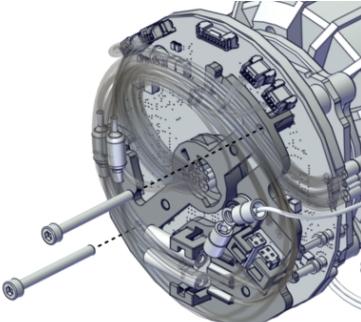
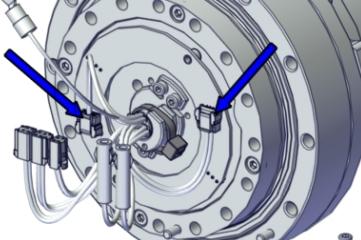
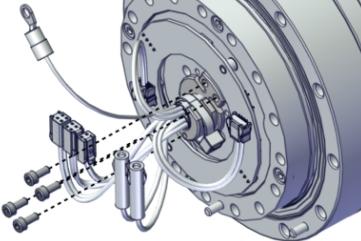
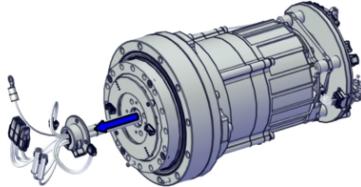
5.6.2 Replacing the axis-2 joint unit

Continued

	Action	Note
2	<p>Fit the protection plate to the drive board unit.</p> <p> Tip</p> <p>Using the protection plate is important for protecting the drive board unit. If complete joint unit is to be replaced, the protection plate is not needed.</p>	<p>Protection plate: 3HAC077790-001</p>  <p>xx2000002057</p>
3	Cut the cable tie at the drive board.	 <p>xx2000002058</p>
4	Remove the protection plate.	 <p>xx2100000301</p>

Continues on next page

5.6.2 Replacing the axis-2 joint unit
Continued

	Action	Note
5	Remove the cable support from the drive board by removing the attachment screws.	 xx2000002055
6	Disconnect the two connectors from the torque sensor board. <ul style="list-style-type: none"> • TQ.A • TQ.B 	 xx2000002053
7	Remove the cable plate by removing the attachment screws.	 xx2000002049
8	Remove the joint cable from the hollow shaft from the torque sensor side.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002060

Refitting the joint unit

Use these procedures to refit the joint unit.

Refitting the joint cable

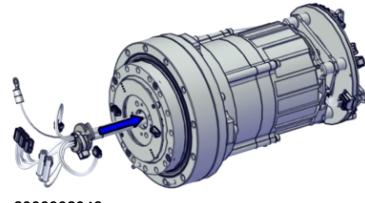
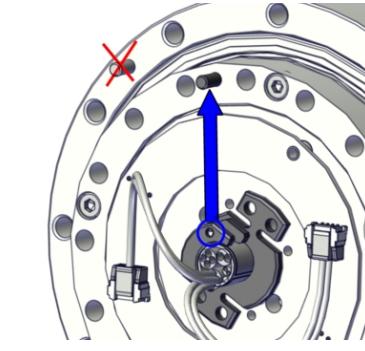
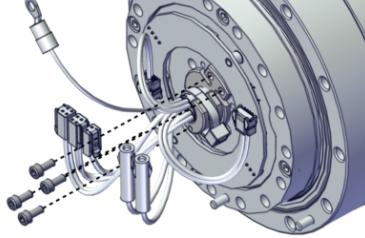
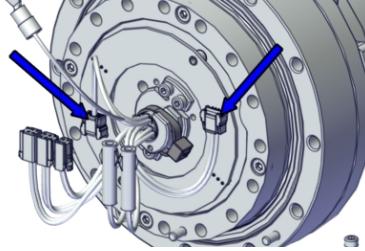
	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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5 Repair

5.6.2 Replacing the axis-2 joint unit

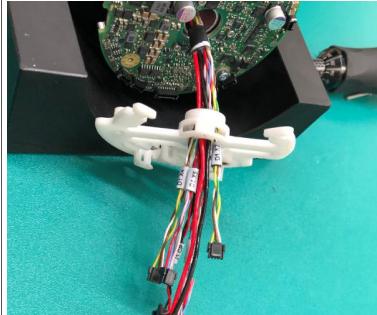
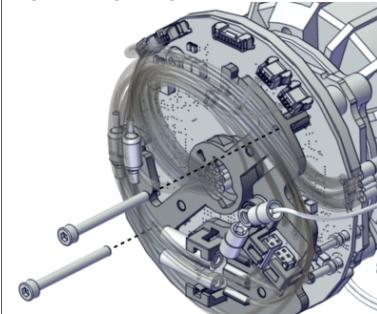
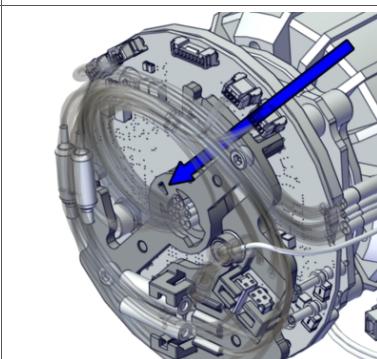
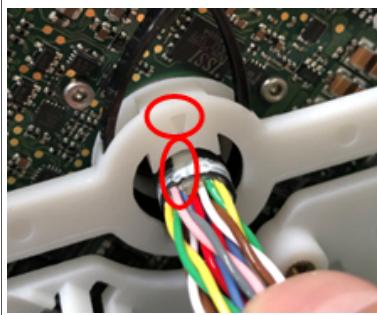
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	Action	Note
2	<p>Place the joint cable through the hollow shaft from the torque sensor side.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	 xx2000002048
3	<p>Orient the cable plate according to the figure. The circle on the cable plate should point towards the guide pin on the torque sensor.</p>	 xx2000002051
4	<p>Secure the cable plate to the joint unit with the attachment screws.</p>	<p>Hex socket head cap screw: M2.5x6 12.9 Gleitmo 603+Geomet 500 (4 pcs)</p> <p>Tightening torque: 0.45 Nm.</p>  xx2000002049
5	<p>Connect the two connectors to the torque sensor board.</p> <ul style="list-style-type: none"> • TQ.A to CH1/A • TQ.B to CH2/B 	 xx2000002053

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5.6.2 Replacing the axis-2 joint unit

Continued

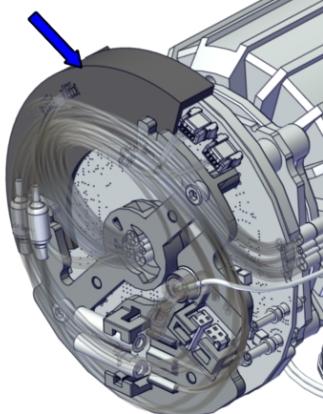
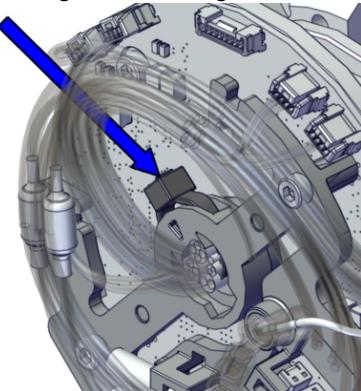
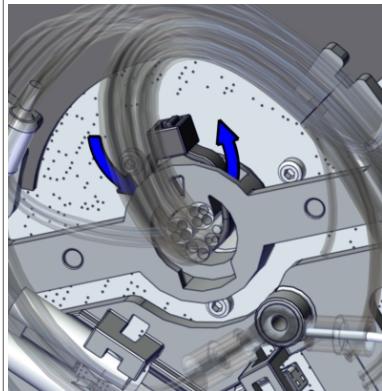
Action	Note
6 Insert the cabling through the cable support and fit the support to the drive board with the attachment screws.	 <p>xx2000002056</p> <p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (2 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000002055</p>
7 Align the triangle direction mark on the cable support and the white mark on the cable harness. Use the cable tie to pre-fix the cable by hand.	 <p>xx2100000507</p>  <p>xx2100000508</p>

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5 Repair

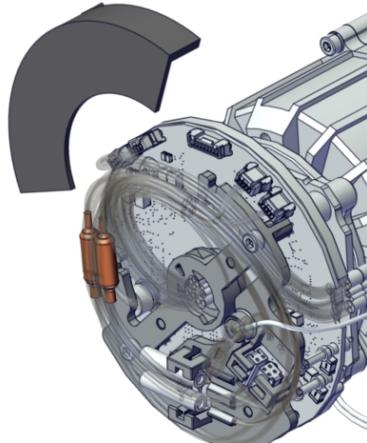
5.6.2 Replacing the axis-2 joint unit

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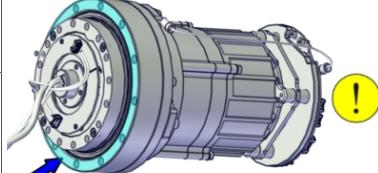
	Action	Note
8	Fit the protection plate to the drive board unit.	<p>Protection plate: 3HAC077790-001</p>  <p>xx2000002057</p>
9	<p>Secure the cables to the cable support with a cable tie, using a cable tie gun. Assembly direction for the cable tie is shown in the figure.</p>	<p>Cable tie: 3HAC075545-001. For securing joint unit cable. Cable tie gun EVO7 Setting for cable tie gun: 6.75.</p>  <p>xx2000002058</p>  <p>xx2000002059</p>

Continues on next page

5.6.2 Replacing the axis-2 joint unit
Continued

Action	Note
10 Remove the protection plate.	 xx2100000301

Preparations before fitting the joint unit

Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2 Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol. Joint unit mounting surface is pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574
3  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	 xx2000001860

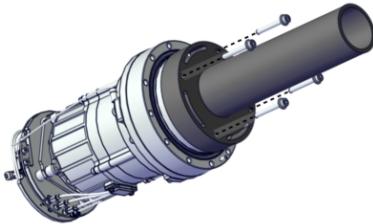
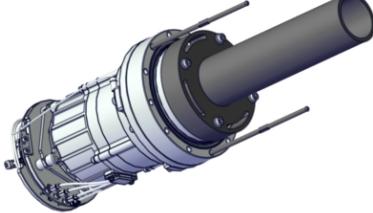
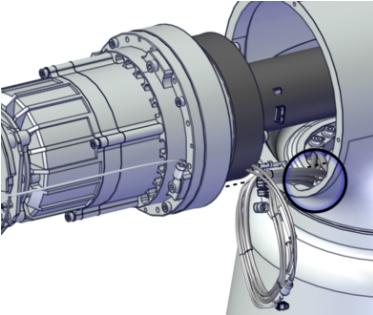
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5 Repair

5.6.2 Replacing the axis-2 joint unit

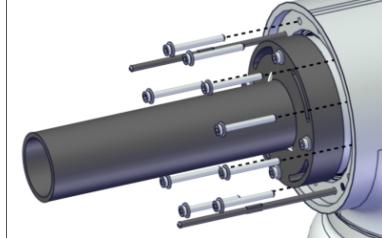
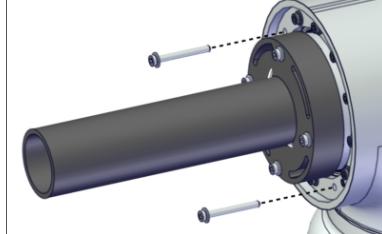
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Refitting the axis-2 joint unit

	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section <i>The unit is sensitive to ESD on page 42.</i>	
2	Fit the lifting aid to the joint unit.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Joint unit: 3HAC079141-001 Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)  xx2000001957
3	Fit two guide pins to the joint unit.	Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.  xx2000002438
4	Place the axis-1 cabling at the notch in the swing.  CAUTION The cabling is sensitive to mechanical damage. Handle it with care to avoid damage to the cabling or the connector.	  xx2000002153

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5.6.2 Replacing the axis-2 joint unit
Continued

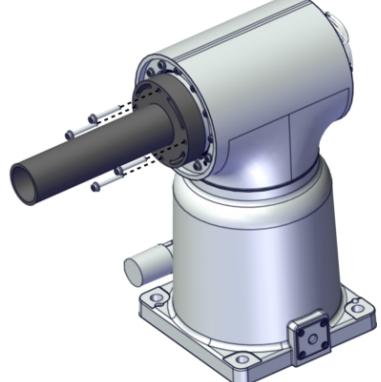
Action	Note
5 Fit the joint unit to the swing, aligning the pin with the pin hole.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000001959  xx2000001961
6 Secure the joint unit with new attachment screws.	Hex socket head cap flange screw with glue: 3HAB3413-435 M4x35, 12 pcs Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.  xx2000001943
7 Remove the guide pins and secure the remaining two attachment screws.	 xx2100000295
8 Pre-tighten the screws crosswise.	
9 Torque tighten all screws crosswise.	Tightening torque: 4.3 Nm.

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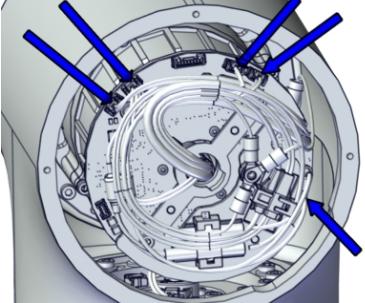
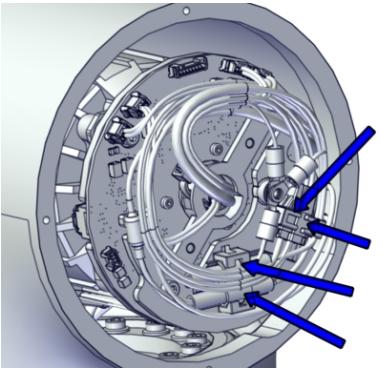
5 Repair

5.6.2 Replacing the axis-2 joint unit

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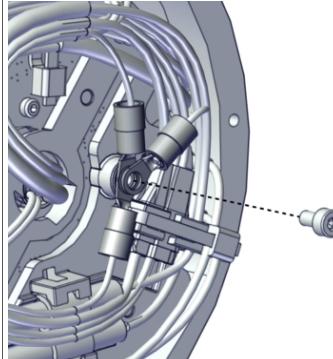
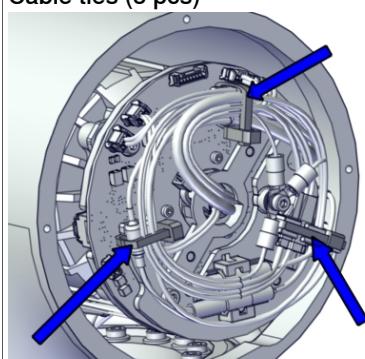
Action	Note
10 Remove the lifting aid by removing the screws.	 xx2000001956
11 Clean pushed-out flange sealant, if any.	

Connecting the axis-2 joint unit cabling

Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2 Reconnect the connectors to the drive board. <ul style="list-style-type: none">• D2.X1 to X1• D2.DC+ to DC+• D2.DC- to Ground• D2.X4 to X4• D2.X2 to X2• D2.X5 to X5	 xx2000002013
3 Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none">• J2.DC+ to J2.DC+• J2.DC- to J2.DC-• J2.CS to J2.CS• J2.CP to J2.CP	 xx2000001944

Continues on next page

5.6.2 Replacing the axis-2 joint unit
Continued

Action	Note
4 Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000001945
5 Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000001946

Refitting the swing cover

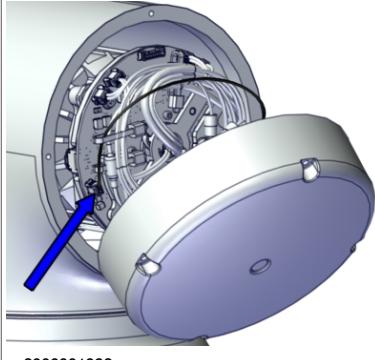
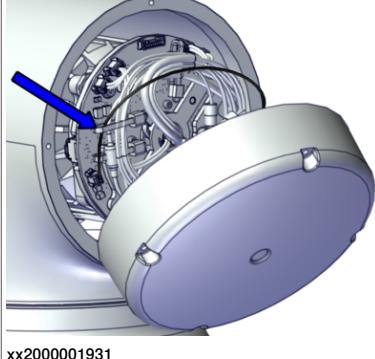
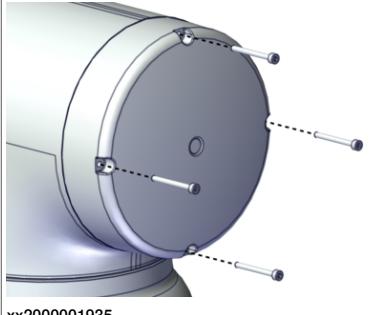
Action	Note
1 Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-047  xx2000001962

Continues on next page

5 Repair

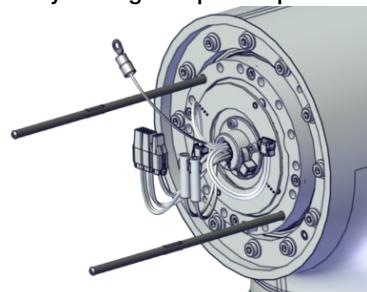
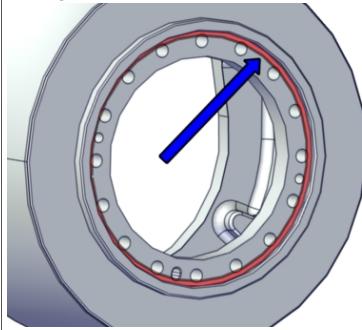
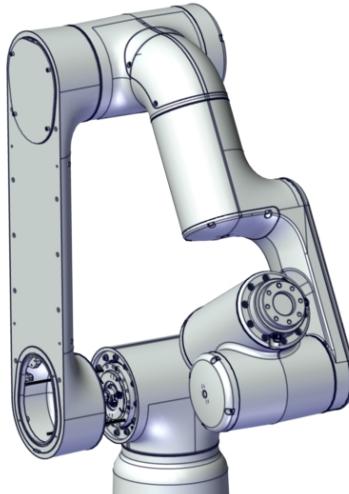
5.6.2 Replacing the axis-2 joint unit

Continued

	Action	Note
2	<p>Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board.</p> <p>Orient the cover for proper arrangement of the brake release cable.</p>	 xx2000001932
3	Secure the brake release cable with a cable tie.	<p>Cable ties</p>  xx2000001931
4	Refit the cover with the four screws.	<p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs)</p> <p>Tightening torque: 0.45 Nm</p>  xx2000001935

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Refitting the lower and upper arm assembled

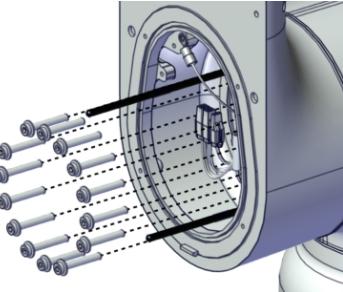
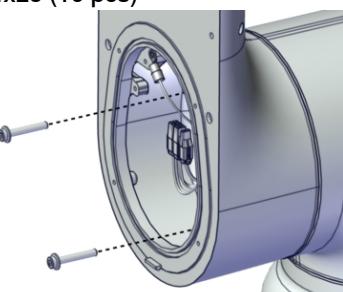
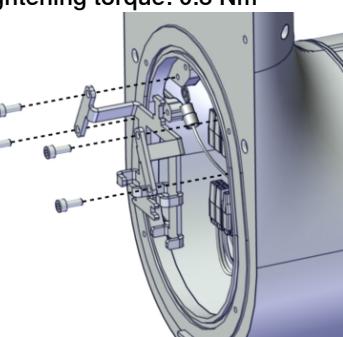
	Action	Note
1	Fit two guide pins to the axis-2 joint unit.	Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs.  xx2000001949
2	Remove any old residuals of flange sealant from the lower arm mounting surface and clean with isopropanol. Apply new flange sealant to the corner of the lower arm mounting surface, as pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001963
3	 CAUTION The weight of the complete upper and lower arm together is 18 kg	
4	Lift the upper and lower arm assembly to mounting position and slide it onto the guide pins.	 xx2000001941

Continues on next page

5 Repair

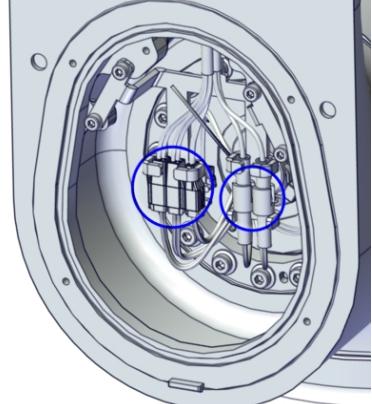
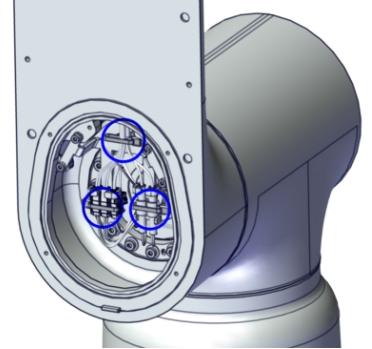
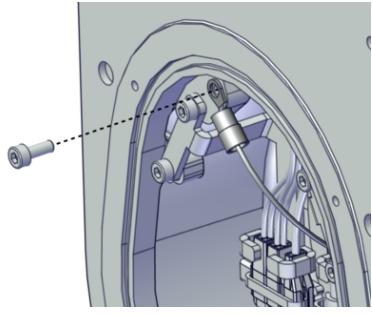
5.6.2 Replacing the axis-2 joint unit

Continued

	Action	Note
5	<p>Secure the lower arm to the swing with all attachment screws but two. Pre-tighten the screws crosswise firstly.</p>	<p>Hex socket head cap flange screw: M4x25 (16 pcs)</p>  <p>xx2000001940</p>
6	<p>Remove the guide pins and fasten the remaining two screws.</p>	<p>Hex socket head cap flange screw: M4x25 (16 pcs)</p>  <p>xx2000001951</p>
7	<p>Torque tighten all screws crosswise.</p>	<p>Tightening torque: 4.6 Nm.</p>
8	<p>Refit the cable bracket with four screws.</p>	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.8 Nm</p>  <p>xx2000001939</p>

Continues on next page

Connecting the cabling between the lower arm and swing

	Action	Note
1	Connect the connectors to each other and snap them to the cable holders.	 xx2000001938
2	Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000001937
3	Connect the functional earth cable with the screw.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (1 pcs). Tightening torque: 0.8 Nm  xx2000001936

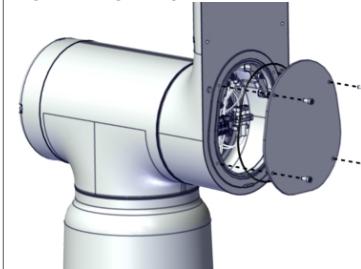
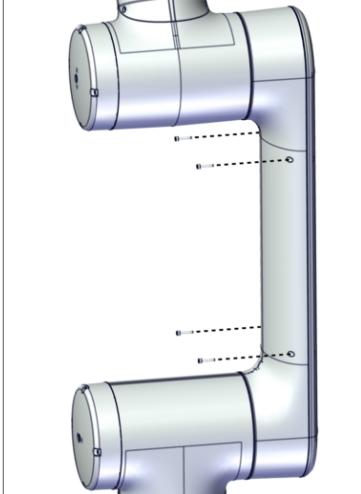
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5 Repair

5.6.2 Replacing the axis-2 joint unit

Continued

Refitting the lower arm covers

	Action	Note
1	Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-044 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000001954
2	Refit the inner cover with four screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 1.4 Nm.  xx2000001930
3	Snap the lower arm cover into place.	Hex socket head cap screw: M3x16 12.9 Gleitmo 603+Geomet 500 (Black Oxide) (4 pcs)
4	Secure the cover with four screws.	Tightening torque: 0.45 Nm.  xx2000001929

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Concluding procedure

	Action	Note
1	Calibrate the joint unit torque sensor.	See Calibration on page 607
2	 DANGER Make sure all safety requirements are met when performing the first test run.	

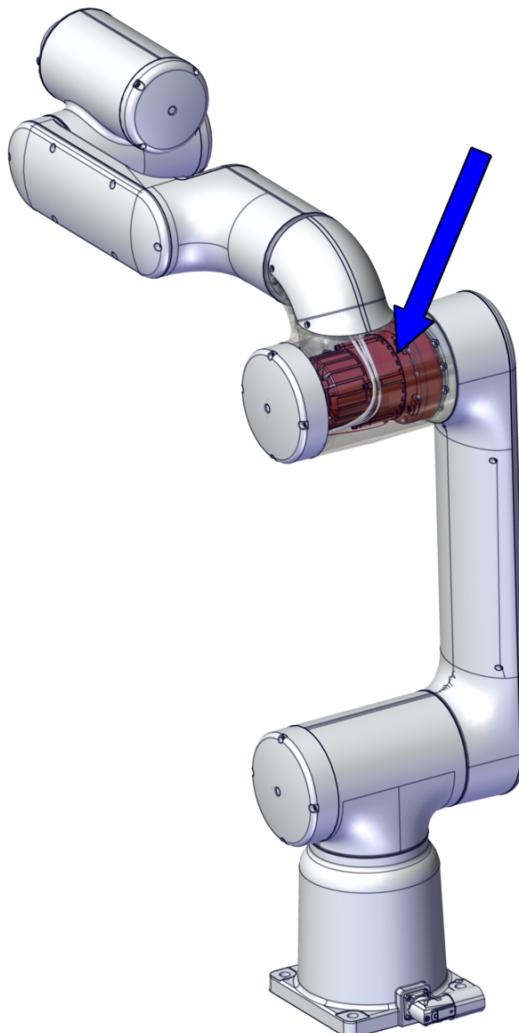
5 Repair

5.6.3 Replacing the axis-3 joint unit

5.6.3 Replacing the axis-3 joint unit

Location of the axis-3 joint unit

The joint unit is located as shown in the figure.



xx2000002020

Summary of the replacement procedure

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

- 1 Disconnect the cabling between the lower arm and the upper arm.
- 2 Remove the upper arm and place on a workbench.
- 3 Remove the housing cover.
- 4 Replace the joint unit. Move the cabling from old to new joint unit.

Continues on next page

Required spare parts
**Note**

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal,
www.abb.com/myABB.

Spare part	Article number	Note
Joint unit	3HAC079142-001	New attachment screws and cable tie 3HAC075545-001 are included in the delivery.

Required tools and equipment

Equipment	Article number	Note
Lifting aid	3HAC077788-001	For joint units on axes 1, 2 and 3. Attachment screws M4x35 (4 pcs) are enclosed.
Guide pin, M4x120	3HAC077786-001	Always use guide pins in pairs. For joint units on axes 1, 2 and 3.
Protection plate	3HAC077790-001	For protection of drive board during cabling installation on joint unit.
Cable tie gun EVO7	-	HellermannTyton 110-70084 or similar
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cleaning agent	-	Isopropanol
Flange sealant	-	Loctite 574
Cable ties	-	
O-ring	3HAC061327-047	Cover for axis 2/3 Replace if damaged.
O-ring	3HAC061327-044	Lower arm, inner cover. 1 pcs / cover. Replace if damaged.

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5 Repair

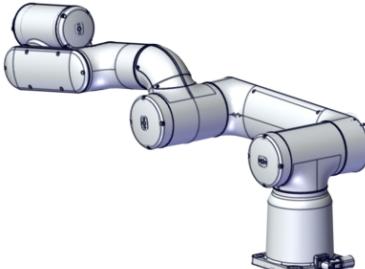
5.6.3 Replacing the axis-3 joint unit

Continued

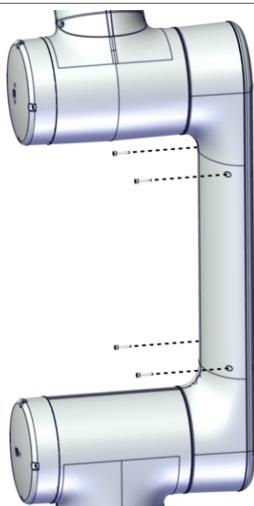
Removing the joint unit

Use these procedures to remove the joint unit.

Preparations before removing the joint unit

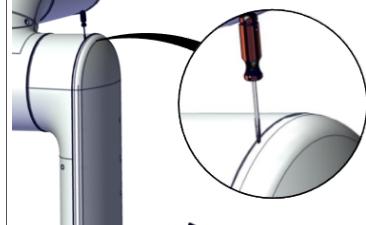
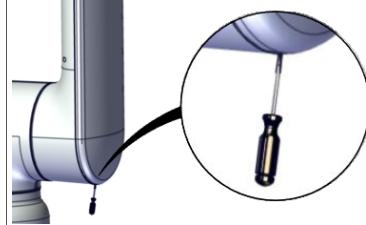
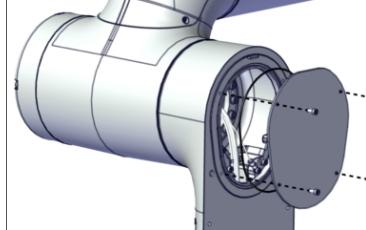
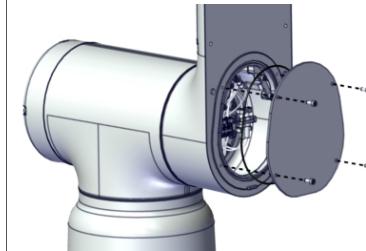
	Action	Note
1	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none">• Axis 1: 0°• Axis 2: +90° (suggested position for convenient working position)• Axis 3: -80° (home position)• Axis 4: 0°• Axis 5: 0°• Axis 6: 0° <p>! CAUTION</p> <p>Jog the axis on which the joint unit is to be replaced to home position, to achieve correct cable routing during replacement of the joint unit.</p>	 xx2100000002
2	<p>! CAUTION</p> <p>Turn off all supplies for electrical power to the robot, before starting the repair work.</p>	

Removing the lower arm covers

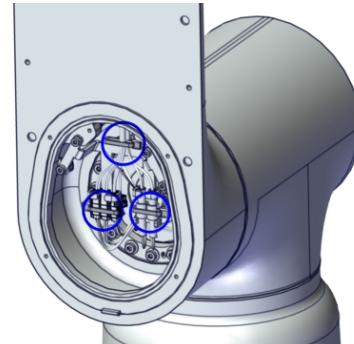
	Action	Note
1	<p>! CAUTION</p> <p>Make sure that all supplies for electrical power are turned off.</p>	
2	Remove the four lower arm cover screws.	 xx2000001929

Continues on next page

5.6.3 Replacing the axis-3 joint unit
Continued

Action	Note
3 Remove the cover by inserting a small flat screwdriver to snap open the locks at each end of the cover.	  xx2100000267
4 Remove the inner covers by removing the screws.	 xx2000001947  xx2000001930

Disconnecting the upper arm cabling

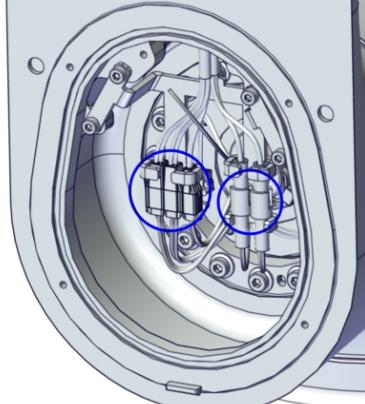
Action	Note
1 Cut the cable ties.	 xx2000001937

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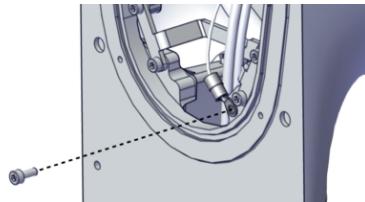
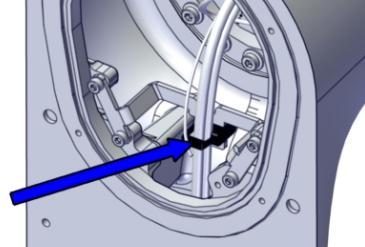
5 Repair

5.6.3 Replacing the axis-3 joint unit

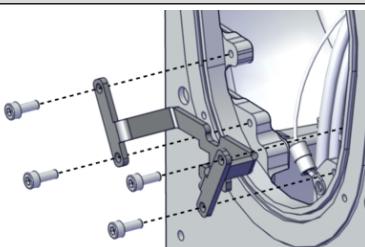
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Action	Note
2 Snap loose and disconnect all connectors.	 xx2000001938

Loosening the cabling between the lower and upper arm

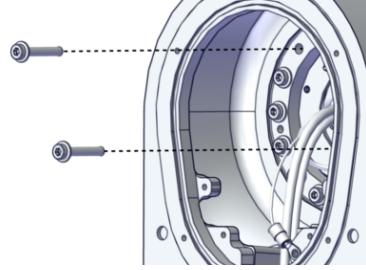
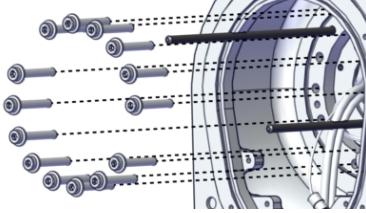
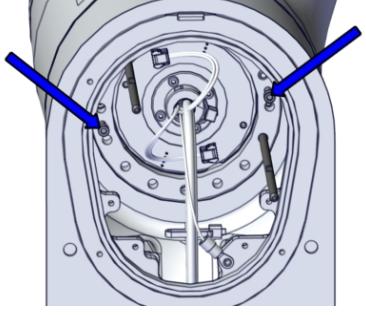
Action	Note
1 Remove the functional earth cable by removing the screw.	 xx2000001964
2 Cut the cable tie.	 xx2000001965

Removing the upper arm

Action	Note
1 Remove the cable bracket by removing the four screws.	 xx2000001966

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5.6.3 Replacing the axis-3 joint unit
Continued

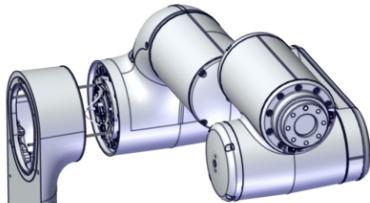
Action	Note
2 Secure the weight of the upper arm. ! CAUTION The weight of the complete upper arm is 14 kg.	
3 Remove two attachment screws.	 xx2000001967
4 Fit two guide pins to the axis-3 joint unit.	Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs.  xx2000001968
5 Remove the remaining attachment screws.	 xx2000001969
6 Press the upper arm out of position by using two fully threaded attachment screws as removal tools.	 xx2100000001

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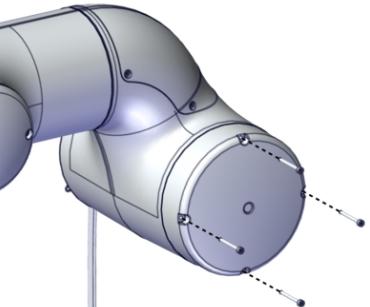
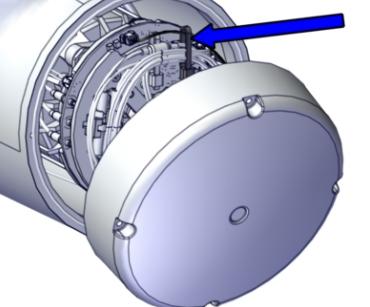
5 Repair

5.6.3 Replacing the axis-3 joint unit

Continued

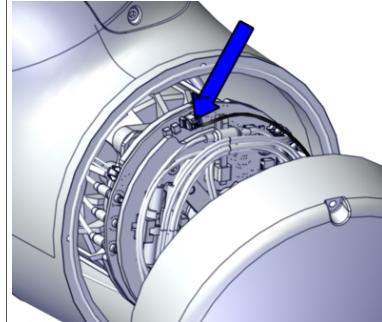
	Action	Note
7	<p>Remove the upper arm from the lower arm. Assist the cabling to be removed from the lower arm while lifting away the complete upper arm. Place the upper arm on a workbench.</p>	 xx2000001970

Removing the housing cover

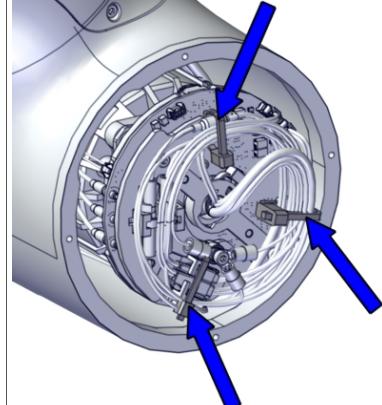
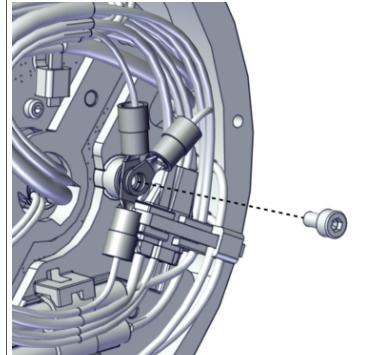
	Action	Note
1	 CAUTION Make sure that all supplies for electrical power are turned off.	
2	Remove the cover screws.	 xx2000002021
3	 CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	
4	Open the cover and cut the cable tie that holds the brake release cable.	 xx2000002022

Continues on next page

5.6.3 Replacing the axis-3 joint unit
Continued

Action	Note
5 Disconnect the brake release connector from the drive board. Remove the cover.	 xx2000002023

Disconnecting the axis-3 joint unit cabling

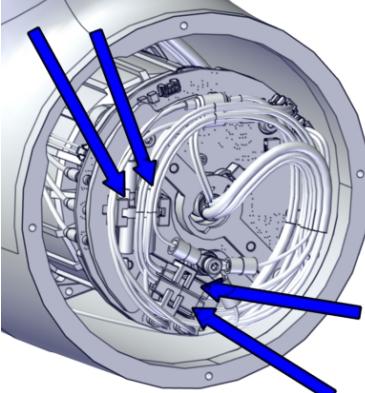
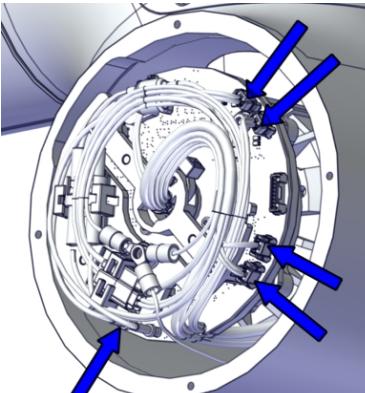
Action	Note
1 Cut the cable ties.	 xx2000002066
2 Remove the functional and protective earth cables by removing the screw.	 xx2000001945

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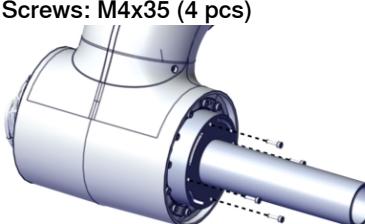
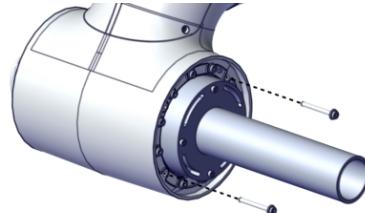
5 Repair

5.6.3 Replacing the axis-3 joint unit

Continued

Action	Note
3 Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J4.DC+ • J4.DC- • J4.CS • J4.CP 	 xx2000002067
4 Disconnect the connectors from the drive board. <ul style="list-style-type: none"> • D3.X1 • D3/4.DC+ • D3/4.DC- • D3.X4 • D3/4.X2 • D3.X5 	 xx2000002068

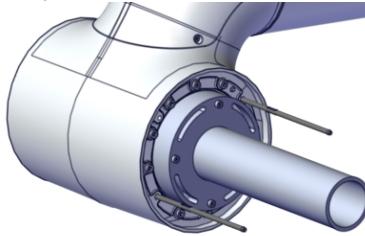
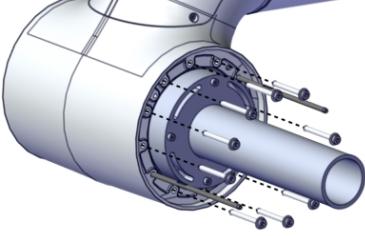
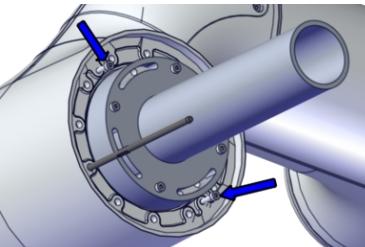
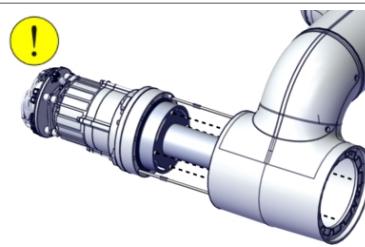
Removing the axis-3 joint unit

Action	Note
1 Fit the lifting aid to the joint unit, on the torque sensor side. ! CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)  xx2000002069
2 Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.	 xx2000002070

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5.6.3 Replacing the axis-3 joint unit

Continued

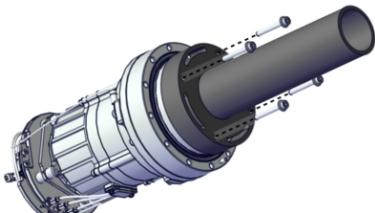
Action	Note
3 Fit two guide pins to the axis-3 joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.</p>  <p>xx2000002576</p>
4 Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.	 <p>xx2100000320</p>
5 Put the cabling at the slot in order not to squeeze it during removal of joint unit.	 <p>xx2100000003</p>
6 Press the joint unit out of position using two of the previous attachment screws as removal tools.	 <p>xx2000002577</p>
7 Remove the joint unit from the housing.	<p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>  <p>xx2000002071</p>

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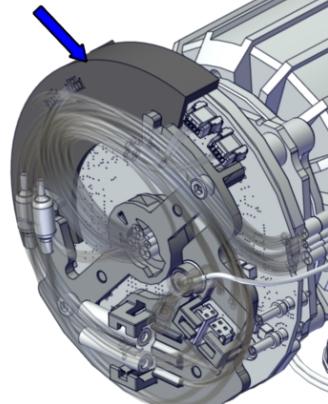
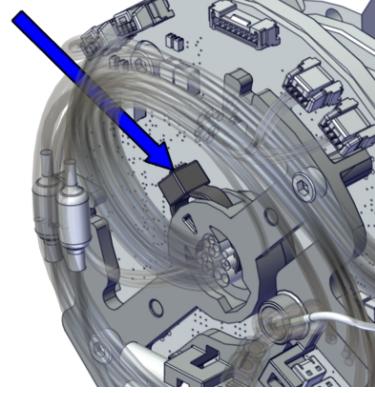
5 Repair

5.6.3 Replacing the axis-3 joint unit

Continued

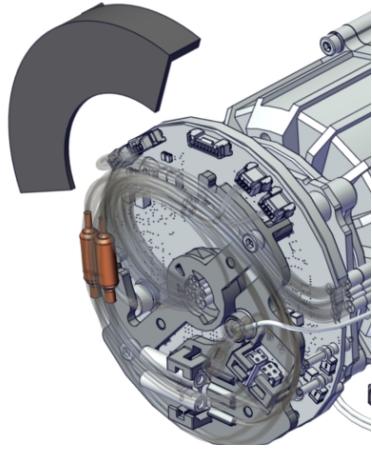
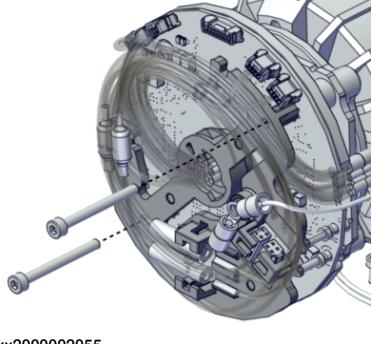
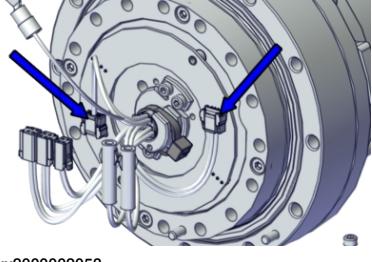
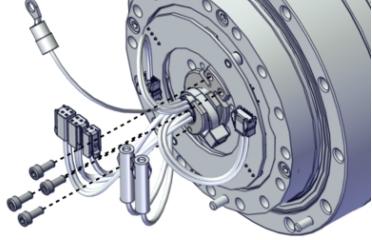
Action	Note
8 Remove the lifting aid and guide pins.	 xx2000001957

Removing the joint cable

Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2 Fit the protection plate to the drive board unit.  Tip Using the protection plate is important for protecting the drive board unit. If complete joint unit is to be replaced, the protection plate is not needed.	Protection plate: 3HAC077790-001  xx2000002057
3 Cut the cable tie at the drive board.	 xx2000002058

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5.6.3 Replacing the axis-3 joint unit
Continued

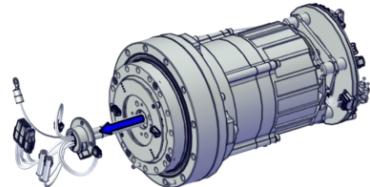
	Action	Note
4	Remove the protection plate.	 xx2100000301
5	Remove the cable support from the drive board by removing the attachment screws.	 xx2000002055
6	Disconnect the two connectors from the torque sensor board. <ul style="list-style-type: none"> • TQ.A • TQ.B 	 xx2000002053
7	Remove the cable plate by removing the attachment screws.	 xx2000002049

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5 Repair

5.6.3 Replacing the axis-3 joint unit

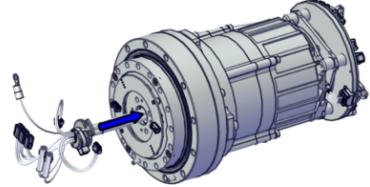
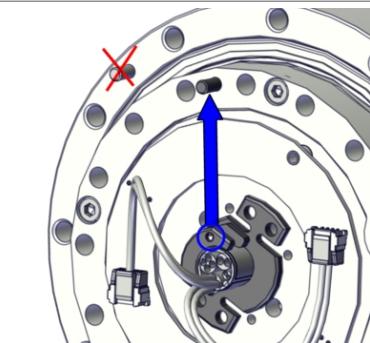
Continued

	Action	Note
8	<p>Remove the joint cable from the hollow shaft from the torque sensor side.</p> <p>! CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	 xx2000002060

Refitting the joint unit

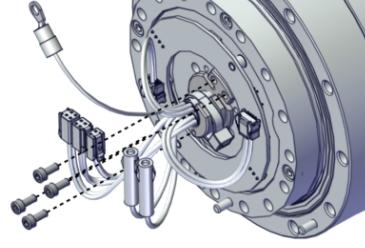
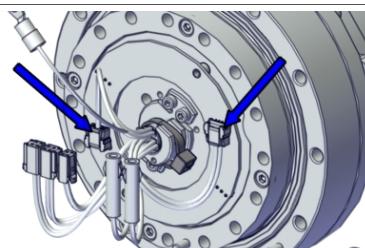
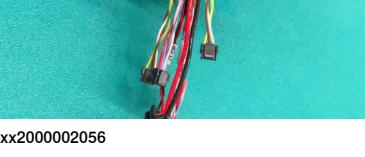
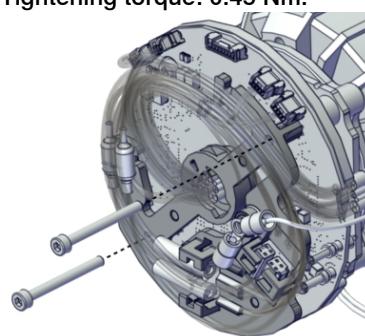
Use these procedures to refit the joint unit.

Refitting the joint cable

	Action	Note
1	<p>! ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42.</p>	
2	<p>Place the joint cable through the hollow shaft from the torque sensor side.</p> <p>! CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	 xx2000002048
3	Orient the cable plate according to the figure. The circle on the cable plate should point towards the guide pin on the torque sensor.	 xx2000002051

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5.6.3 Replacing the axis-3 joint unit
Continued

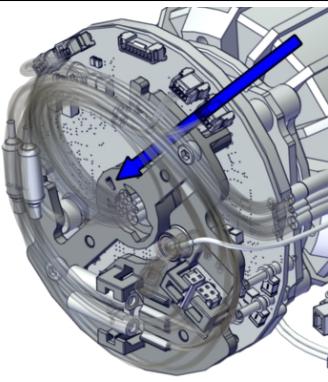
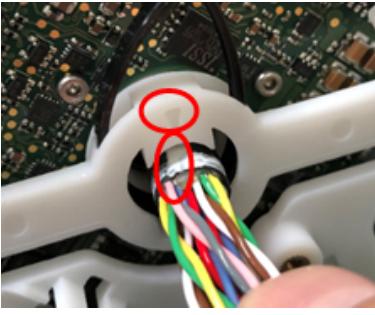
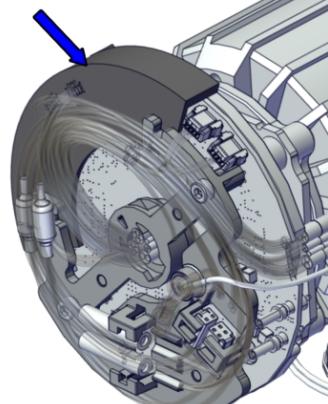
Action	Note
4 Secure the cable plate to the joint unit with the attachment screws.	<p>Hex socket head cap screw: M2.5x6 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000002049</p>
5 Connect the two connectors to the torque sensor board. <ul style="list-style-type: none"> • TQ.A to CH1/A • TQ.B to CH2/B 	 <p>xx2000002053</p>
6 Insert the cabling through the cable support and fit the support to the drive board with the attachment screws.	<p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (2 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000002056</p>  <p>xx2000002055</p>

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5 Repair

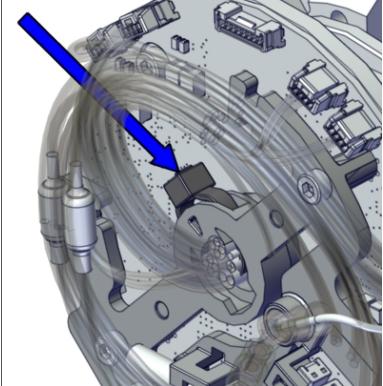
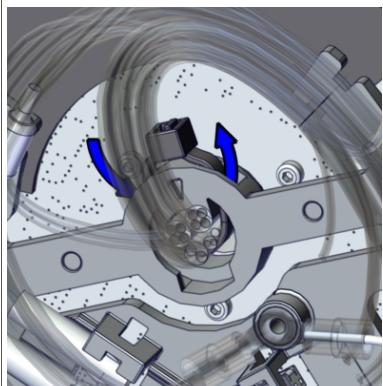
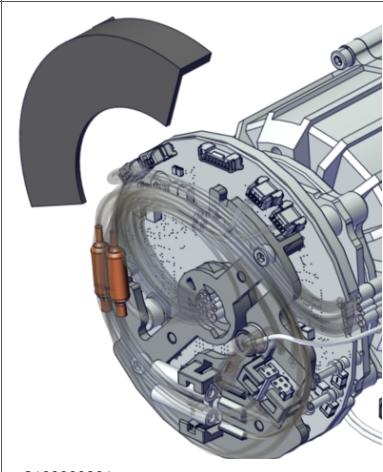
5.6.3 Replacing the axis-3 joint unit

Continued

	Action	Note
7	Align the triangle direction mark on the cable support and the white mark on the cable harness. Use the cable tie to pre-fix the cable by hand.	 xx2100000507  xx2100000508
8	Fit the protection plate to the drive board unit.	Protection plate: 3HAC077790-001  xx2000002057

Continues on next page

5.6.3 Replacing the axis-3 joint unit
Continued

	Action	Note
9	<p>Secure the cables to the cable support with a cable tie, using a cable tie gun. Assembly direction for the cable tie is shown in the figure.</p>	<p>Cable tie: 3HAC075545-001. For securing joint unit cable. Cable tie gun EVO7 Setting for cable tie gun: 6.75.</p>  <p>xx2000002058</p>
10	Remove the protection plate.	 <p>xx2000002059</p>
		 <p>xx2100000301</p>

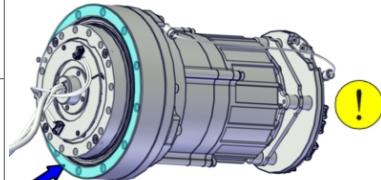
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5 Repair

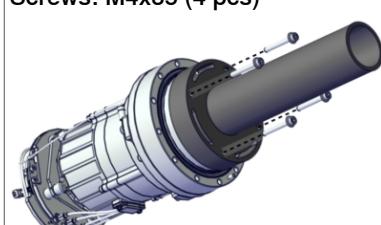
5.6.3 Replacing the axis-3 joint unit

Continued

Preparations before fitting the joint unit

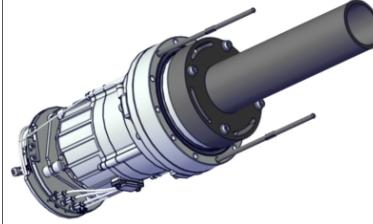
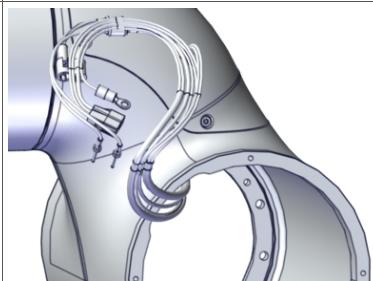
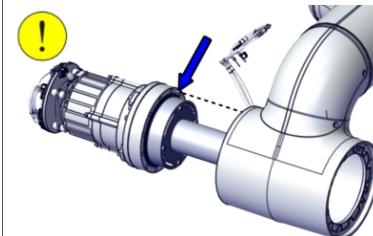
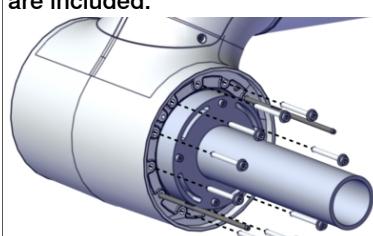
Action	Note
 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2 Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol. Joint unit mounting surface is pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001860
3 Apply a thin layer of flange sealant to the mounting surface. Do not contaminate the radial sealing with sealant.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

Refitting the axis-3 joint unit

Action	Note
1 Fit the lifting aid to the joint unit.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Joint unit: 3HAC079141-001 Lifting aid: 3HAC077788-001 Screws: M4x35 (4 pcs)  xx2000001957

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5.6.3 Replacing the axis-3 joint unit
Continued

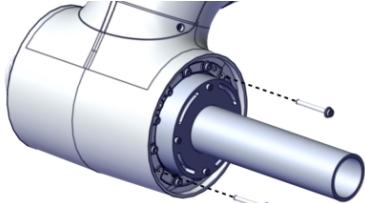
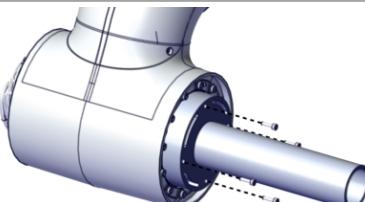
Action	Note
2 Fit two guide pins to the joint unit.	<p>Guide pin, M4x120: 3HAC077786-001 Always use guide pins in pairs. For joint units on axes 1, 2 and 3.</p>  <p>xx2000002438</p>
3 Place the cabling at the slot before refitting the joint unit.	 <p>xx2100000004</p>
4 Fit the joint unit to the housing, aligning the pin with the pin hole.	<p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>  <p>xx2000002072</p>
5 Secure the joint unit with new attachment screws.	<p>Hex socket head cap flange screw with glue: 3HAB3413-435 M4x35, 12 pcs Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.</p>  <p>xx2100000320</p>

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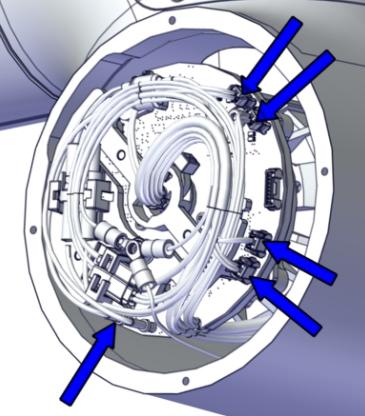
5 Repair

5.6.3 Replacing the axis-3 joint unit

Continued

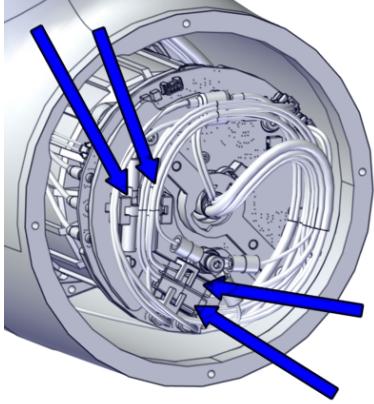
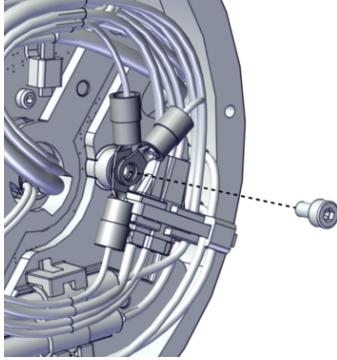
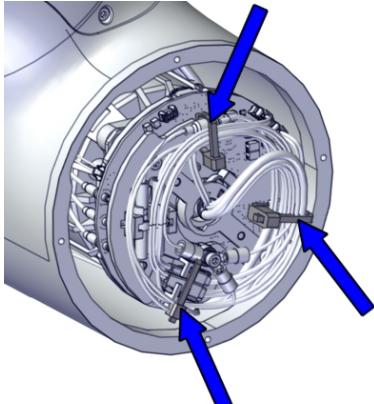
Action	Note
6 Remove the guide pins and secure the remaining two attachment screws.	 xx2000002070
7 Pre-tighten the screws crosswise.	
8 Torque tighten all screws crosswise. Tightening torque: 4.3 Nm.	
9 Remove the lifting aid by removing the screws.	 xx2000002069
10 Clean pushed-out flange sealant, if any.	

Connecting the axis-3 joint unit cabling

Action	Note
1 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D3.X1 to X1 • D3/4.DC+ to DC+ • D3/4.DC- to Ground • D3.X4 to X4 • D3/4.X2 to X2 • D3.X5 to X5 	 xx2000002068

Continues on next page

5.6.3 Replacing the axis-3 joint unit
Continued

	Action	Note
2	<p>Connect the connectors to each other and snap them to the cable holders.</p> <ul style="list-style-type: none"> • J4.DC+ to J4/5.DC+ • J4.DC- to J4/5.DC- • J4.CS to J4/5.CS • J4.CP to J4/5.CP 	 <p>xx2000002067</p>
3	<p>Secure the cables for functional earth and protective earth with a screw.</p>	<p>Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.</p>  <p>xx2000001945</p>
4	<p>Secure the cabling with cable ties.</p>	<p>Cable ties (3 pcs)</p>  <p>xx2000002066</p>

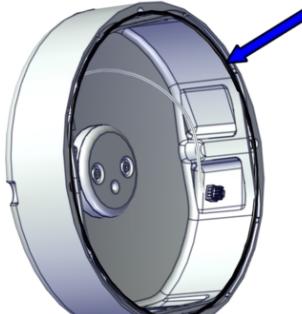
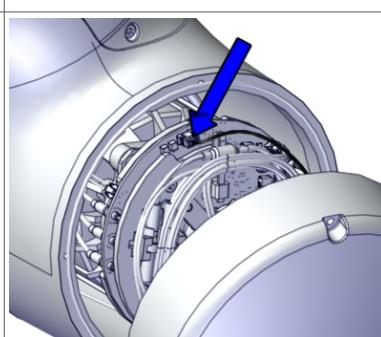
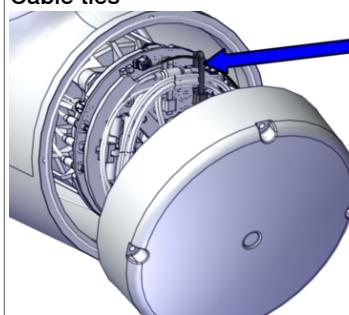
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5 Repair

5.6.3 Replacing the axis-3 joint unit

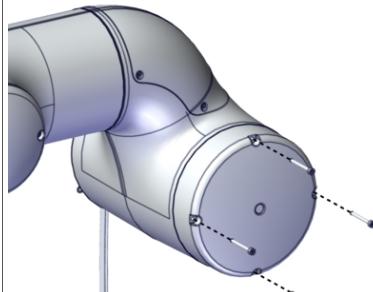
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Refitting the housing cover

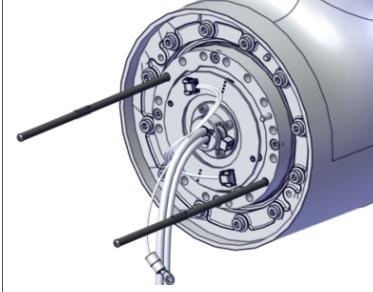
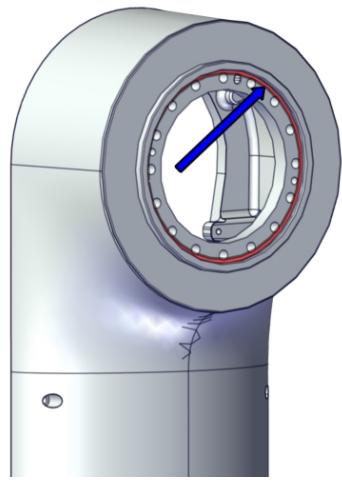
	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-047  xx2000001962
2	Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board. Orient the cover for proper arrangement of the brake release cable.	 xx2000002023
3	Secure the brake release cable with a cable tie.	Cable ties  xx2000002022

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5.6.3 Replacing the axis-3 joint unit
Continued

Action	Note
4 Refit the cover with the four screws.	<p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm</p>  <p>xx2000002021</p>

Refitting the upper arm

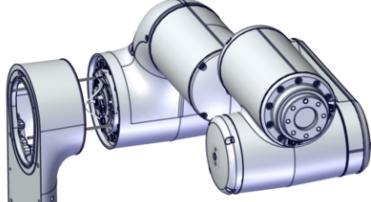
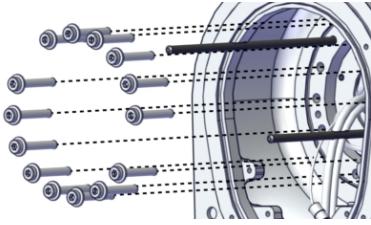
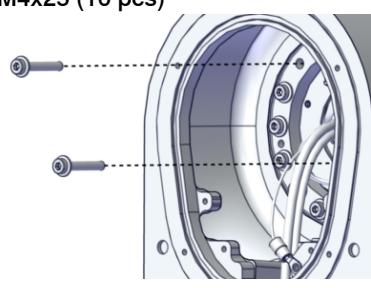
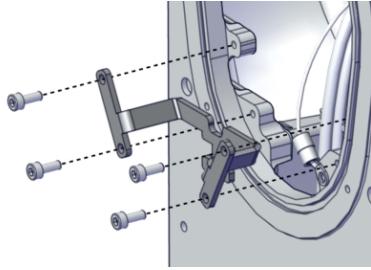
Action	Note
1 Fit two guide pins to the axis-3 joint.	 <p>xx2000001971</p>
2 Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the lower arm mounting surface, as pointed out in the figure.	<p>Cleaning agent: Isopropanol Flange sealant: Loctite 574</p>  <p>xx2000001973</p>

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5 Repair

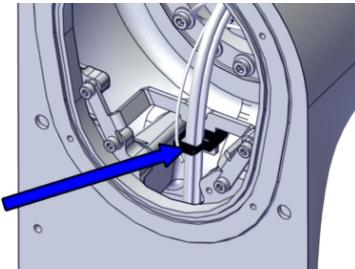
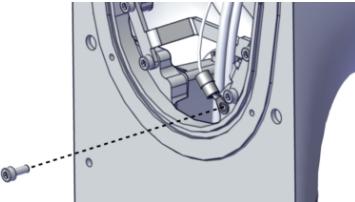
5.6.3 Replacing the axis-3 joint unit

Continued

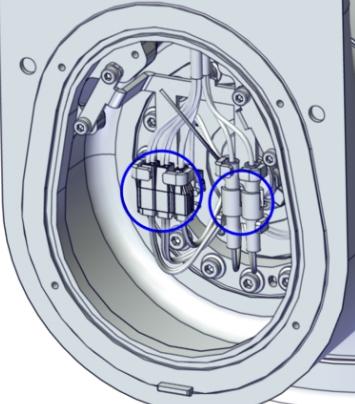
	Action	Note
3	Lift the upper arm into mounting position while inserting the cabling into the lower arm.	 xx2000001970
4	Slide the upper arm into place on the guide pins.	
5	Secure the upper arm to the lower arm with all attachment screws but two. Pre-tighten the screws crosswise firstly.	Hex socket head cap flange screw: M4x25 (16 pcs)  xx2000001969
6	Remove the guide pins and fasten the remaining two screws.	Hex socket head cap flange screw: M4x25 (16 pcs)  xx2000001967
7	Torque tighten all screws crosswise.	Tightening torque: 4.6 Nm.
8	Refit the cable bracket with the four screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.8 Nm  xx2000001966

Continues on next page

Fastening the cabling between the lower and upper arm

	Action	Note
1	Secure the cabling with the cable tie.	<p>Cable ties</p>  <p>xx2000001965</p>
2	Connect the functional earth cable with the screw.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (1 pcs). Tightening torque: 0.8 Nm</p>  <p>xx2000001964</p>

Connecting the upper arm cabling

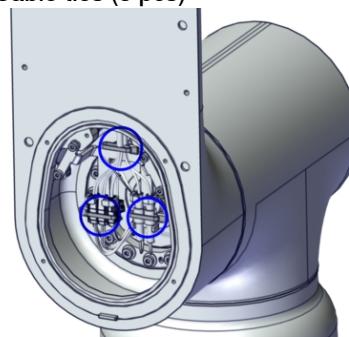
	Action	Note
1	Connect the connectors to each other and snap them to the cable holders.	 <p>xx2000001938</p>

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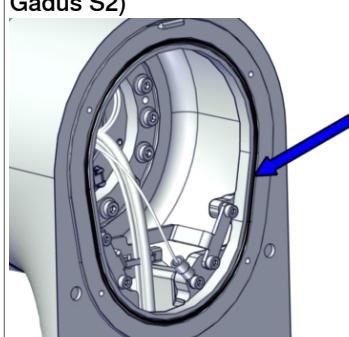
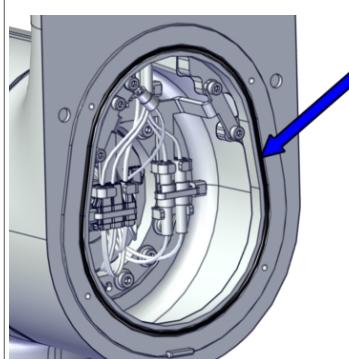
5 Repair

5.6.3 Replacing the axis-3 joint unit

Continued

	Action	Note
2	Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000001937

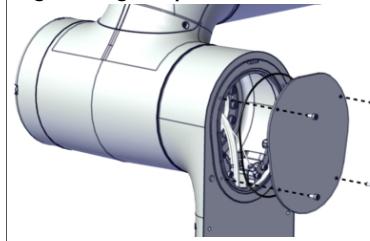
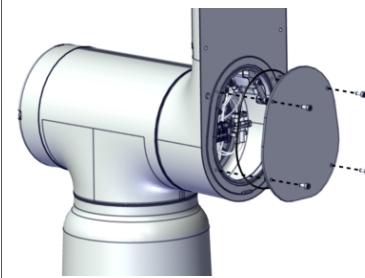
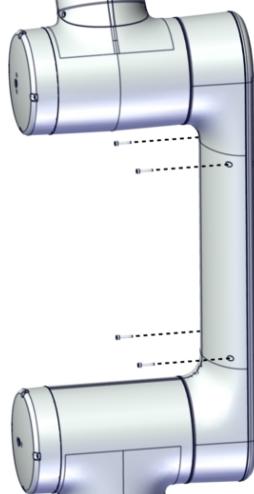
Refitting the lower arm covers

	Action	Note
1	Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-044 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000001955  xx2000001954

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5.6.3 Replacing the axis-3 joint unit

Continued

Action	Note
2 Refit the inner covers with four screws each.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (8 pcs) Tightening torque: 1.4 Nm.</p>  <p>xx2000001947</p>  <p>xx2000001930</p>
3 Snap the lower arm cover into place.	
4 Secure the cover with four screws.	<p>Hex socket head cap screw: M3x16 12.9 Gleitmo 603+Geomet 500 (Black Oxide) (4 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000001929</p>

Concluding procedure

Action	Note
1 Calibrate the joint unit torque sensor.	See Calibration on page 607
2  DANGER Make sure all safety requirements are met when performing the first test run.	

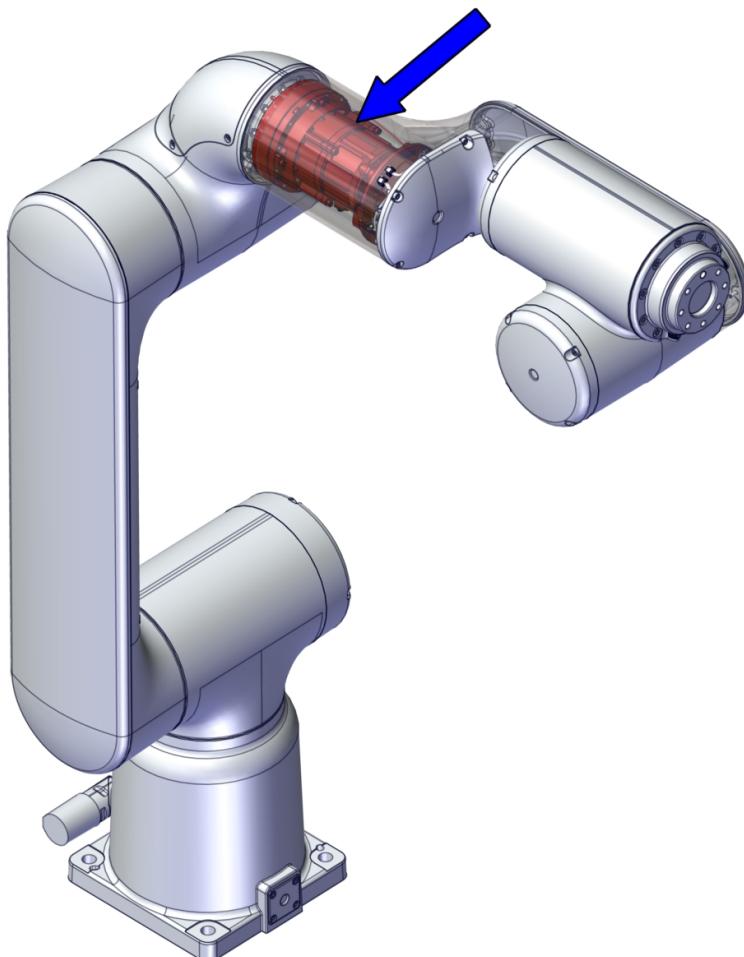
5 Repair

5.6.4 Replacing the axis-4 joint unit

5.6.4 Replacing the axis-4 joint unit

Location of the axis-4 joint unit

The joint unit is located as shown in the figure.



xx2000002119

Summary of the replacement procedure

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

- 1 Separate the cabling between the housing and the tubular (at the axis-3 joint unit).
- 2 Remove the tubular and place on a workbench.
- 3 Remove the axis-4 cover.
- 4 Replace the joint unit. Move the cabling from old to new joint unit.

Continues on next page

Required spare parts**Note**

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Spare part	Article number	Note
Joint unit	3HAC079143-001	New attachment screws and cable tie 3HAC075545-001 are included in the delivery.

Required tools and equipment

Equipment	Article number	Note
Lifting aid	3HAC077789-001	For joint units on axes 4, 5 and 6. Attachment screws M3x12 (4 pcs) are enclosed.
Guide pin, M3x110	3HAC077787-001	Always use guide pins in pairs. For joint units on axes 4, 5 and 6.
Protection plate	3HAC077790-001	For protection of drive board during cabling installation on joint unit.
Cable tie gun EVO7	-	HellermannTyton 110-70084 or similar
Tweezers	-	Used to handle drive board connectors.
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cleaning agent	-	Isopropanol
Flange sealant	-	Loctite 574
Cable ties	-	
O-ring	3HAC061327-043	Tubular cover Replace if damaged.
Hex socket head cap flange screw with glue	3HAB3413-312	M3x12 For tubular cover. Always use new screws. If ordering a new axis-4 or axis-5 joint unit spare part, new screws for the tubular cover are included.
O-ring	3HAC061327-051	Axis-4 cover Replace if damaged.
Gasket	3HAC075056-001	Cover inside housing Replace if damaged.

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5 Repair

5.6.4 Replacing the axis-4 joint unit

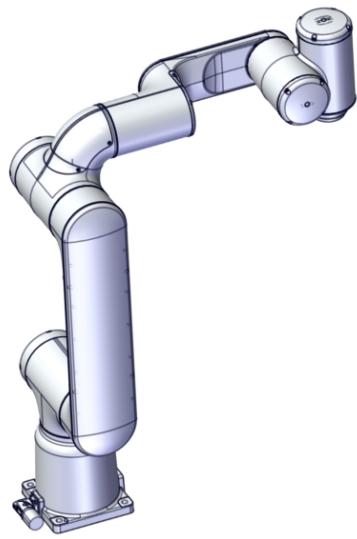
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Consumable	Article number	Note
O-ring	3HAC061327-047	Cover for axis 2/3 Replace if damaged.

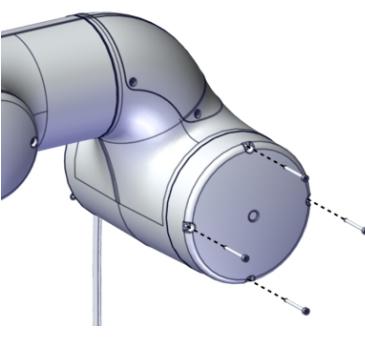
Removing the joint unit

Use these procedures to remove the joint unit.

Preparations before removing the joint unit

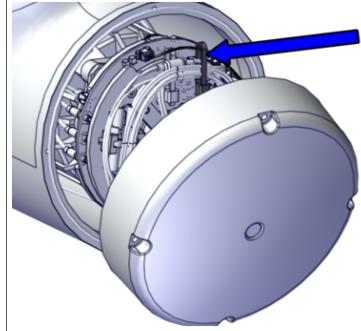
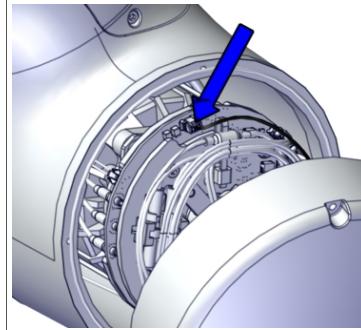
	Action	Note
1	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none">• Axis 1: No significance.• Axis 2: 0°• Axis 3: 0°• Axis 4: 0° (home position)• Axis 5: +90°• Axis 6: No significance. <p> CAUTION</p> <p>Jog the axis on which the joint unit is to be replaced to home position, to achieve correct cable routing during replacement of the joint unit.</p>	 xx2100000005
2	<p> CAUTION</p> <p>Turn off all supplies for electrical power to the robot, before starting the repair work.</p>	

Removing the housing cover

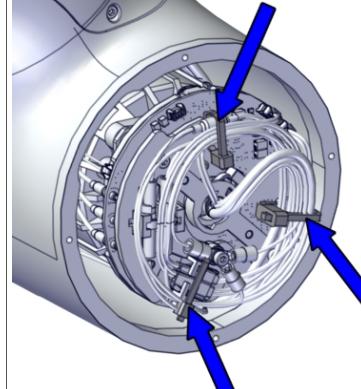
	Action	Note
1	<p> CAUTION</p> <p>Make sure that all supplies for electrical power are turned off.</p>	
2	Remove the cover screws.	 xx2000002021

Continues on next page

5.6.4 Replacing the axis-4 joint unit
Continued

Action	Note
<p>3</p> <p>CAUTION</p> <p>There is cabling connected between the cover and the joint unit drive board.</p> <p>Open the cover with care to avoid damage to the cabling or the connector(s).</p> <p>Do not leave the cover in location without being secured with the attachment screws.</p>	
<p>4</p> <p>Open the cover and cut the cable tie that holds the brake release cable.</p>	 <p>xx2000002022</p>
<p>5</p> <p>Disconnect the brake release connector from the drive board.</p> <p>Remove the cover.</p>	 <p>xx2000002023</p>

Separating the cabling between the housing and the tubular

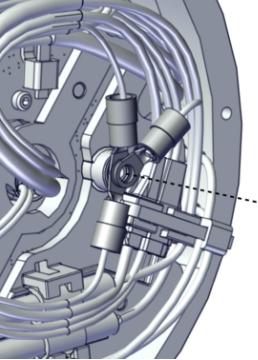
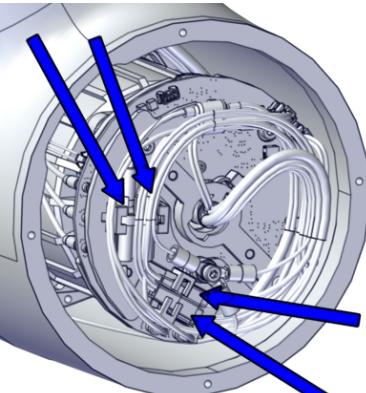
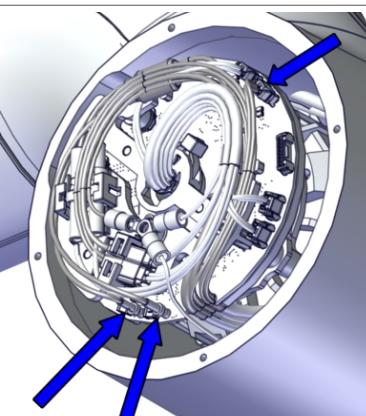
Action	Note
<p>1</p> <p>Cut the cable ties.</p>	 <p>xx2000002066</p>

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5 Repair

5.6.4 Replacing the axis-4 joint unit

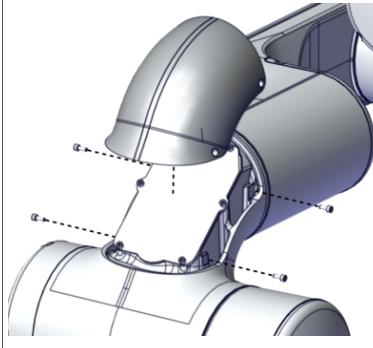
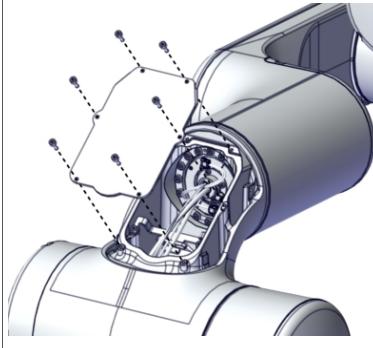
Continued

Action	Note
2 Remove the functional and protective earth cables by removing the screw.	 xx2000001945
3 Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J4/5.DC+ • J4/5.DC- • J4/5.CS • J4/5.CP 	 xx2000002067
4 Disconnect the connectors from the drive board. <ul style="list-style-type: none"> • D3/4.X2 • D3/4.DC+ • D3/4.DC- 	 xx2000002120

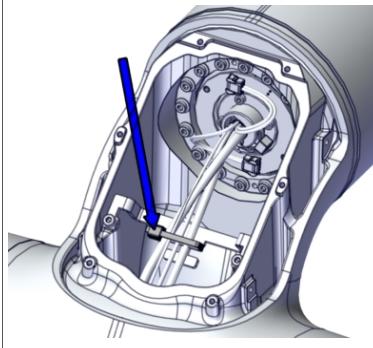
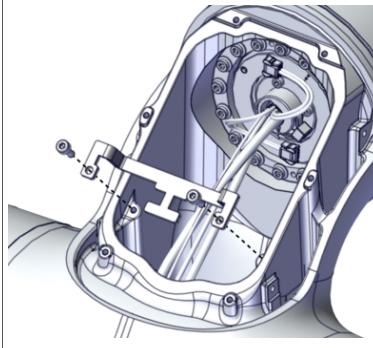
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5.6.4 Replacing the axis-4 joint unit
Continued

Opening the housing top cover

	Action	Note
1	Remove the cover by removing the four screws.	 xx2000002075
2	Remove the inner plate by removing the screws.	 xx2000002076

Removing the tubular

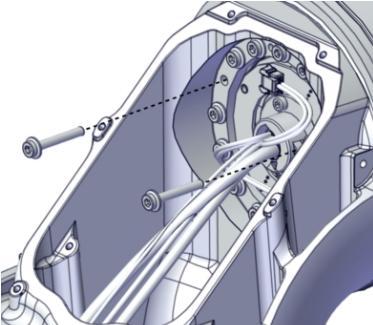
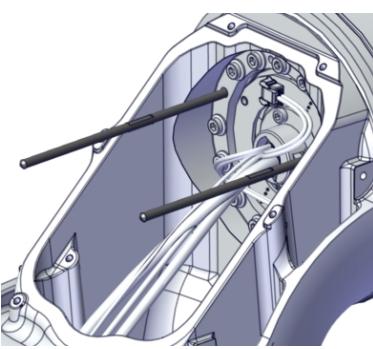
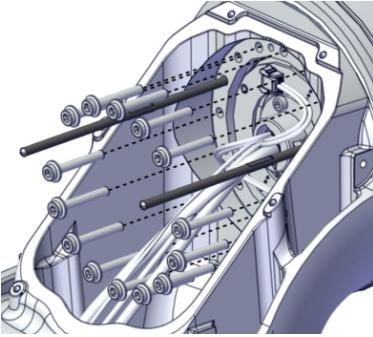
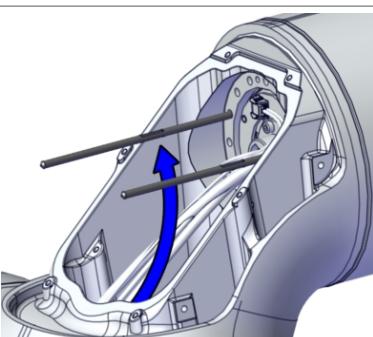
	Action	Note
1	Cut the cable tie.	 xx2000002077
2	Remove the cable bracket by removing the two screws.	 xx2000002078

Continues on next page

5 Repair

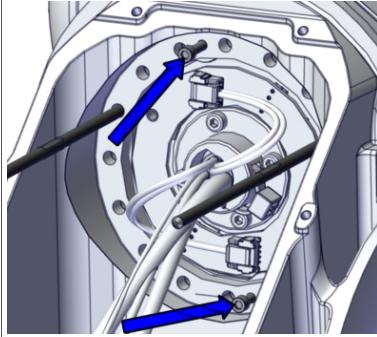
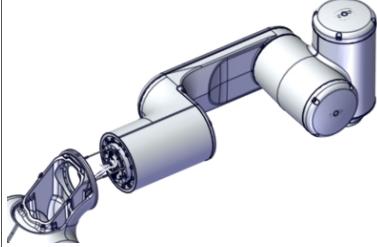
5.6.4 Replacing the axis-4 joint unit

Continued

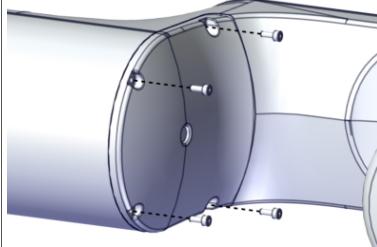
Action	Note
3 Remove two attachment screws and fit two guide pins to the axis-4 joint unit.	<p>Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs.</p>  <p>xx2000002079</p>  <p>xx2000002080</p>
4 Remove the remaining attachment screws.	 <p>xx2000002081</p>
5 Pull out the cabling carefully from the housing.	 <p>xx2000002127</p>

Continues on next page

5.6.4 Replacing the axis-4 joint unit
Continued

Action	Note
6 Use two fully threaded attachment screws as removal tools to press the housing out of position.	 xx2100000006
7 Remove the tubular from the housing. Assist the cabling to be removed from the housing while lifting away the complete tubular. Place the tubular on a workbench.	 xx2000002082

Removing the axis-4 cover

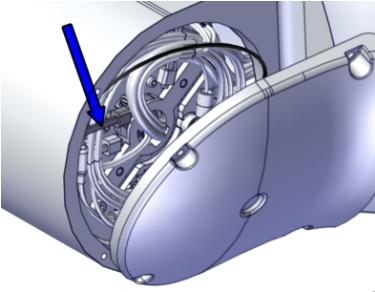
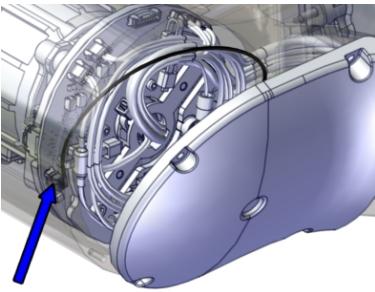
Action	Note
1 Remove the cover screws.	 xx2000002083
2  CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	

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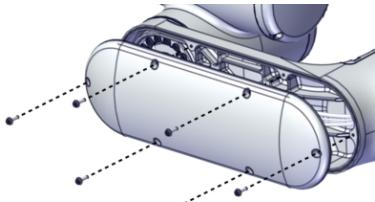
5 Repair

5.6.4 Replacing the axis-4 joint unit

Continued

Action	Note
3 Open the cover and cut the cable tie that holds the brake release cable.	 xx2000002084
4 Disconnect the brake release connector from the drive board. Remove the cover.	Tweezers  xx2000002085

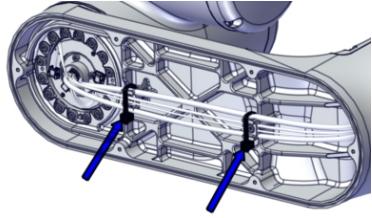
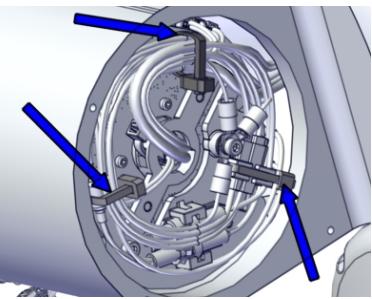
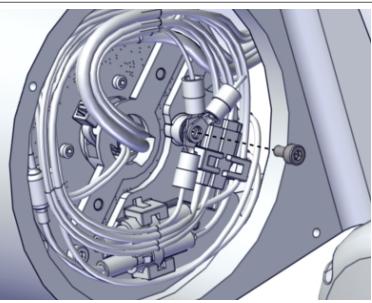
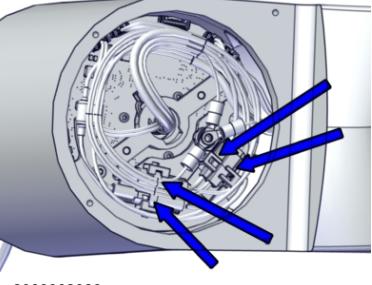
Removing the tubular cover

Action	Note
1 Remove the cover by removing the six screws. Dispose the screws. New screws must be used when refitting the cover. New screws are included in the spare part delivery of the joint unit.	 xx2000002123

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5.6.4 Replacing the axis-4 joint unit
Continued

Separating the cabling between the tubular and the tilt

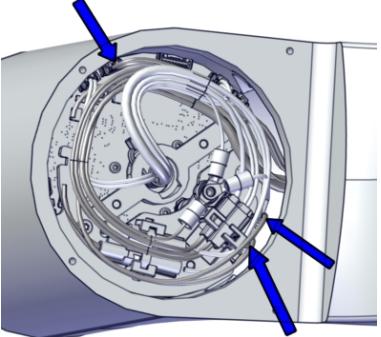
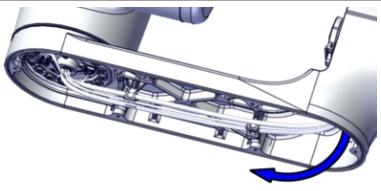
	Action	Note
1	Cut the cable ties, if needed.	 xx2000002124  xx2000002086
2	Remove the functional and protective earth cables by removing the screw.	 xx2000002087
3	Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J4/5.DC+ • J4/5.DC- • J4/5.CS • J4/5.CP 	 xx2000002089

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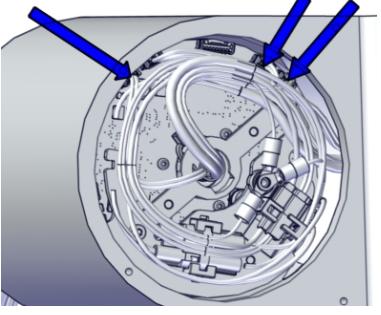
5 Repair

5.6.4 Replacing the axis-4 joint unit

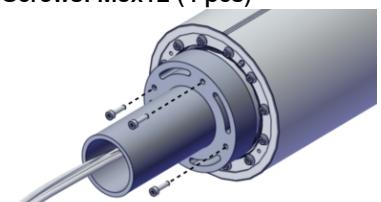
Continued

Action	Note
<p>4 Disconnect the connectors that belongs to the axis-5 cabling, from the axis-4 drive board:</p> <ul style="list-style-type: none"> • D3/4.X2 • D3/4.DC- • D3/4.DC+ <p>Use tweezers, if needed.</p>	<p>Tweezers</p>  <p>xx2000002125</p>
5 Pull out the cabling carefully from the tubular.	 <p>xx2000002126</p>

Disconnecting the axis-4 joint unit cabling

Action	Note
<p>1 Disconnect the connectors from the drive board.</p> <p>Use tweezers.</p> <ul style="list-style-type: none"> • D4/5.X1 • D4/5.X4 • D4/5.X5 	<p>Tweezers</p>  <p>xx2000002088</p>

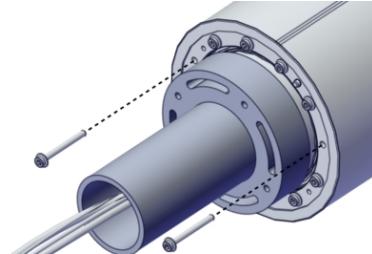
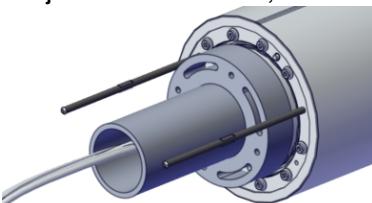
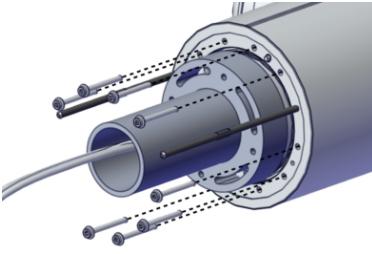
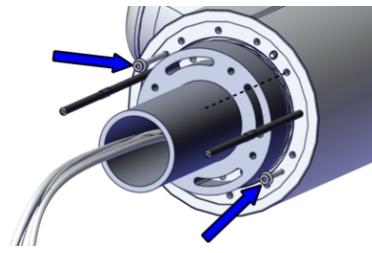
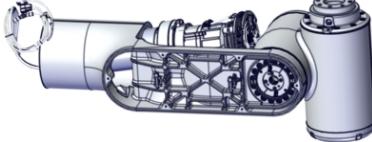
Removing the axis-4 joint unit

Action	Note
<p>1 Fit the lifting aid to the joint unit, on the torque sensor side.</p> <p>! CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	<p>Lifting aid: 3HAC077789-001 Screws: M3x12 (4 pcs)</p>  <p>xx2000002090</p>

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5.6.4 Replacing the axis-4 joint unit

Continued

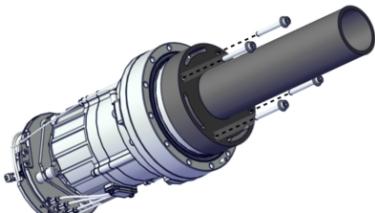
	Action	Note
2	<p>Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.</p>	 xx2000002091
3	<p>Fit two guide pins to the axis-4 joint unit.</p>	<p>Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs. For joint units on axes 4, 5 and 6.</p>  xx2000002578
4	<p>Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.</p>	 xx2100000326
5	<p>Press the joint unit out of position using two of the previous attachment screws as removal tools.</p>	 xx2100000327
6	<p>Remove the joint unit from the tubular.</p> <p>CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	 xx2000002116

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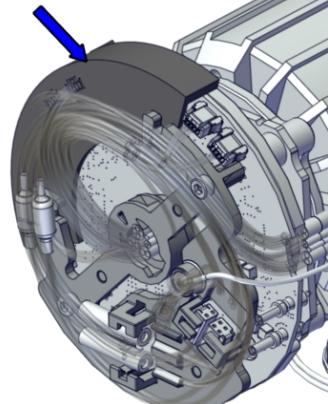
5 Repair

5.6.4 Replacing the axis-4 joint unit

Continued

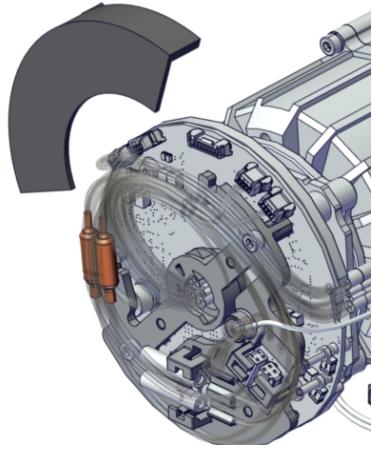
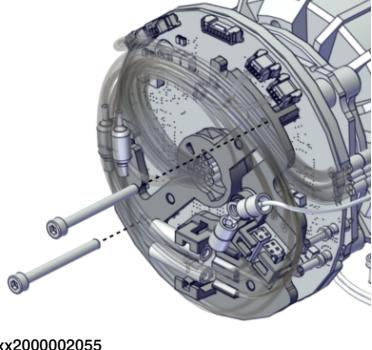
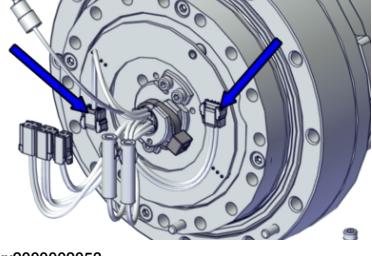
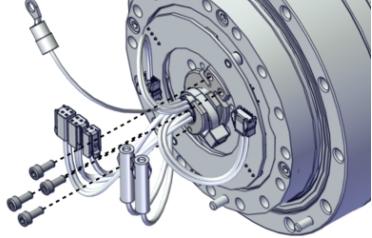
Action	Note
7 Remove the lifting aid and guide pins.	 xx2000001957

Removing the joint cable

Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2 Fit the protection plate to the drive board unit.  Tip Using the protection plate is important for protecting the drive board unit. If complete joint unit is to be replaced, the protection plate is not needed.	Protection plate: 3HAC077790-001  xx2000002057
3 Cut the cable tie at the drive board.	 xx2000002058

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5.6.4 Replacing the axis-4 joint unit
Continued

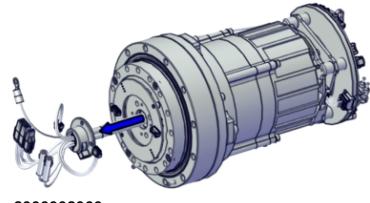
	Action	Note
4	Remove the protection plate.	 xx2100000301
5	Remove the cable support from the drive board by removing the attachment screws.	 xx2000002055
6	Disconnect the two connectors from the torque sensor board. • TQ.A • TQ.B	 xx2000002053
7	Remove the cable plate by removing the attachment screws.	 xx2000002049

Continues on next page

5 Repair

5.6.4 Replacing the axis-4 joint unit

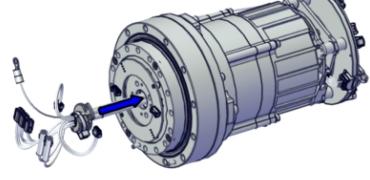
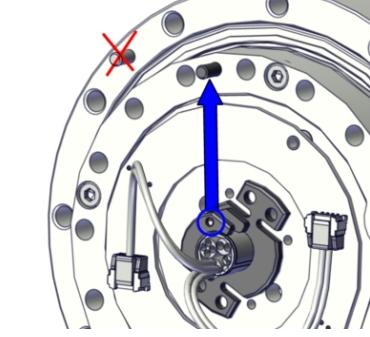
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Action	Note
<p>8 Remove the joint cable from the hollow shaft from the torque sensor side.</p> <p>! CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	

Refitting the joint unit

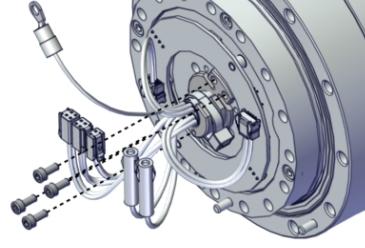
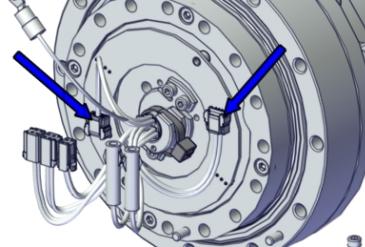
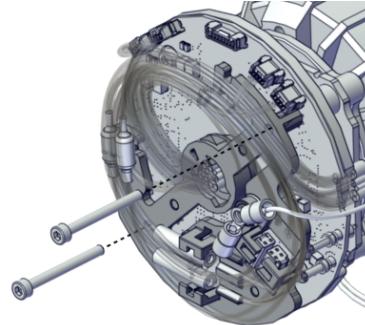
Use these procedures to refit the joint unit.

Refitting the joint cable

Action	Note
<p>1 ELECTROSTATIC DISCHARGE (ESD)</p> <p>The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42.</p>	
<p>2 Place the joint cable through the hollow shaft from the torque sensor side.</p> <p>! CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	
<p>3 Orient the cable plate according to the figure. The circle on the cable plate should point towards the guide pin on the torque sensor.</p>	

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5.6.4 Replacing the axis-4 joint unit
Continued

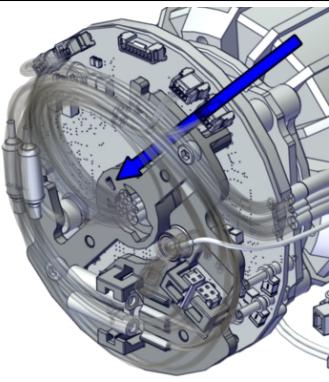
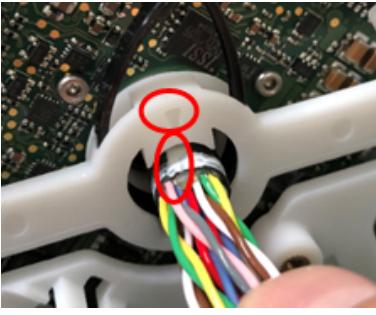
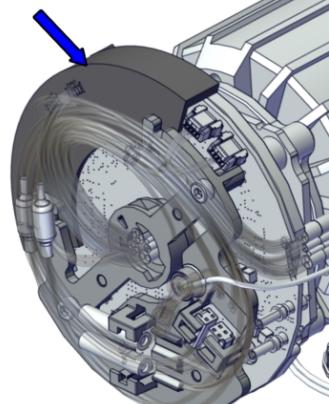
Action	Note
4 Secure the cable plate to the joint unit with the attachment screws.	<p>Hex socket head cap screw: M2.5x6 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000002049</p>
5 Connect the two connectors to the torque sensor board. <ul style="list-style-type: none"> • TQ.A to CH1/A • TQ.B to CH2/B 	 <p>xx2000002053</p>
6 Insert the cabling through the cable support and fit the support to the drive board with the attachment screws.	<p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (2 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000002056</p>

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5 Repair

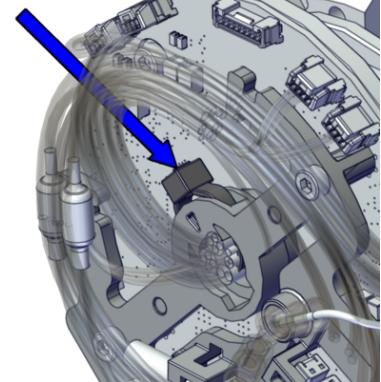
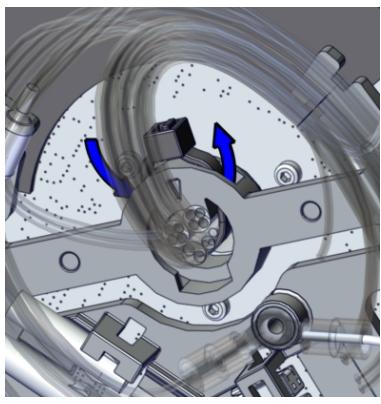
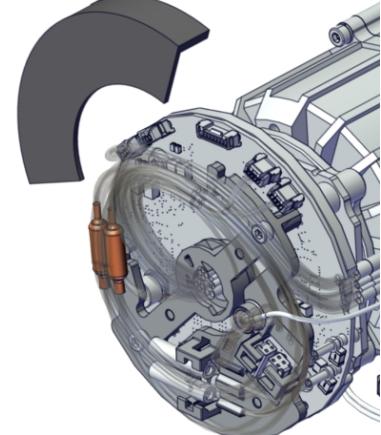
5.6.4 Replacing the axis-4 joint unit

Continued

	Action	Note
7	Align the triangle direction mark on the cable support and the white mark on the cable harness. Use the cable tie to pre-fix the cable by hand.	 xx2100000507  xx2100000508
8	Fit the protection plate to the drive board unit.	Protection plate: 3HAC077790-001  xx2000002057

Continues on next page

5.6.4 Replacing the axis-4 joint unit
Continued

	Action	Note
9	<p>Secure the cables to the cable support with a cable tie, using a cable tie gun. Assembly direction for the cable tie is shown in the figure.</p>	<p>Cable tie: 3HAC075545-001. For securing joint unit cable. Cable tie gun EVO7 Setting for cable tie gun: 6.75.</p>  <p>xx2000002058</p>  <p>xx2000002059</p>
10	Remove the protection plate.	 <p>xx2100000301</p>

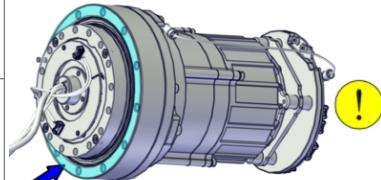
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5 Repair

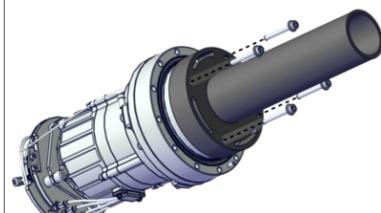
5.6.4 Replacing the axis-4 joint unit

Continued

Preparations before fitting the joint unit

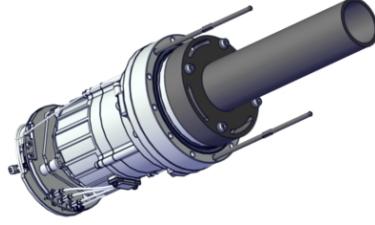
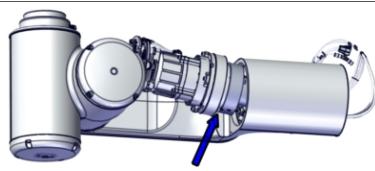
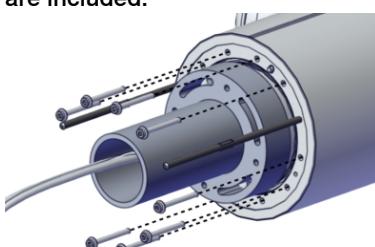
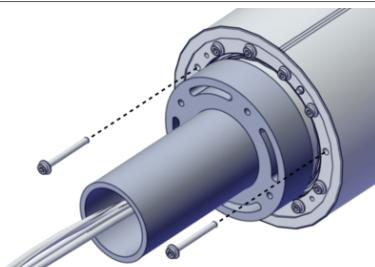
Action	Note
 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2 Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol. Joint unit mounting surface is pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001860
3 Apply a thin layer of flange sealant to the mounting surface. Do not contaminate the radial sealing with sealant.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

Refitting the axis-4 joint unit

Action	Note
1 Fit the lifting aid to the joint unit.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Joint unit: 3HAC079143-001 Lifting aid: 3HAC077789-001 Screws: M3x12 (4 pcs)  xx2000001957

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5.6.4 Replacing the axis-4 joint unit
Continued

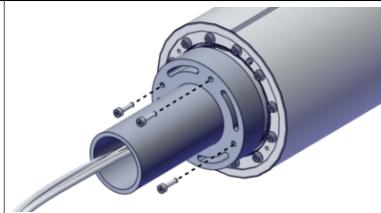
	Action	Note
2	Fit two guide pins to the joint unit.	<p>Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs. For joint units on axes 4, 5 and 6.</p>  <p>xx2000002438</p>
3	<p>Fit the joint unit to the tubular, aligning the pin with the pin hole.</p> <p> CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	 <p>xx2000002117</p>
4	Secure the joint unit with new attachment screws.	<p>Hex socket head cap flange screw with glue: 3HAB3413-330 M3x30, 12 pcs Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.</p>  <p>xx2100000326</p>
5	Remove the guide pins and secure the remaining two attachment screws.	 <p>xx2000002091</p>
6	Pre-tighten the screws crosswise.	
7	Torque tighten all screws crosswise.	Tightening torque: 1.4 Nm.

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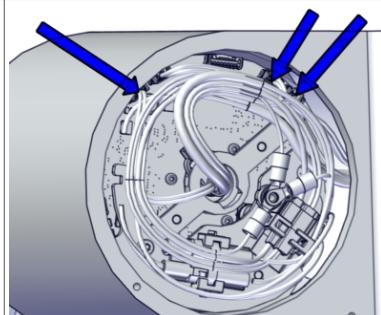
5 Repair

5.6.4 Replacing the axis-4 joint unit

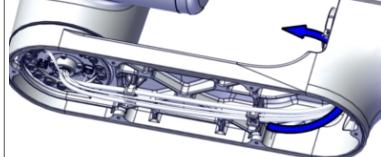
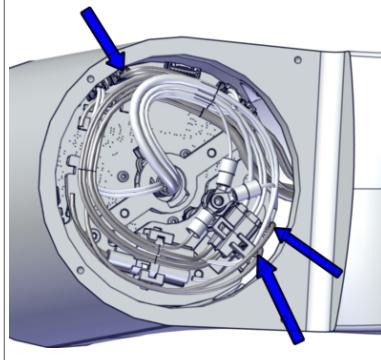
Continued

Action	Note
8 Remove the lifting aid by removing the screws.	 xx2000002090
9 Clean pushed-out flange sealant, if any.	

Connecting the axis-4 joint unit cabling

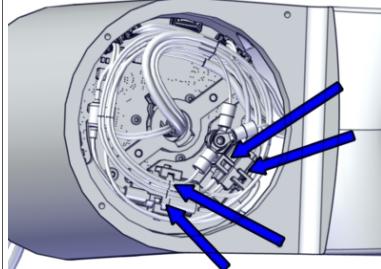
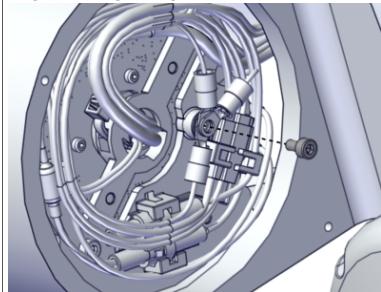
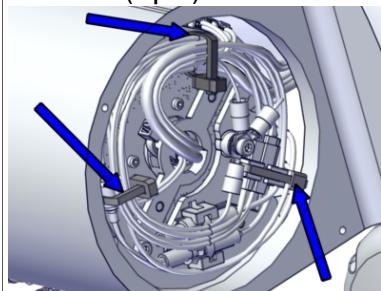
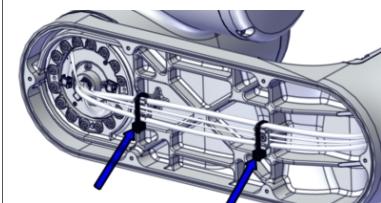
Action	Note
1 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D4/5.X1 to X1 • D4/5.X4 to X4 • D4/5.X5 to X5 	 xx2000002088

Connecting the tilt cabling

Action	Note
1 Insert the cabling into the tubular.	 xx2000002148
2 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D3/4.X2 to X2 • D3/4.DC- to Ground • D3/4.DC+ to +DC 	 xx2000002125

Continues on next page

5.6.4 Replacing the axis-4 joint unit
Continued

Action	Note
3 Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J4/5.DC+ to J5/6.DC+ • J4/5.DC- to J5/6.DC- • J4/5.CS to J5/6.CS • J4/5.CP to J5/6.CP 	 xx2000002089
4 Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000002087
5 Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000002086  xx2000002124

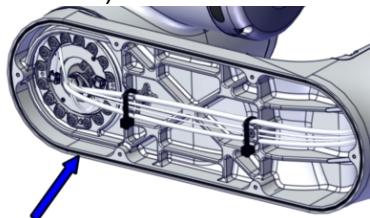
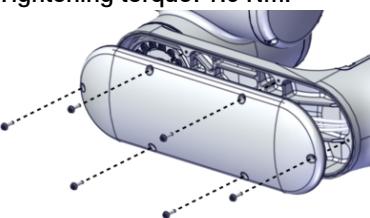
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5 Repair

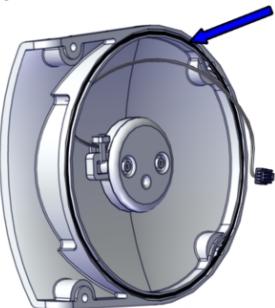
5.6.4 Replacing the axis-4 joint unit

Continued

Refitting the tubular cover

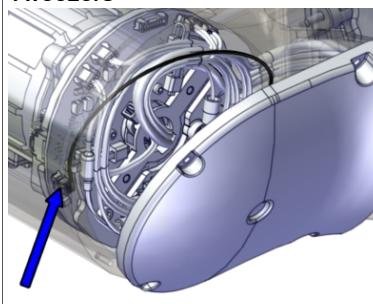
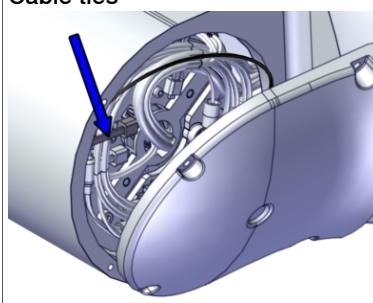
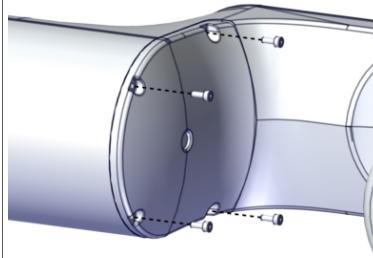
	Action	Note
1	Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-043 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000002149
2	Refit the cover with new attachment screws.	Hex socket head cap flange screw with glue: 3HAB3413-312 M3x12 For tubular cover. Always use new screws. If ordering a new axis-4 or axis-5 joint unit spare part, new screws for the tubular cover are included. Tightening torque: 1.6 Nm.  xx2000002123

Refitting the axis-4 cover

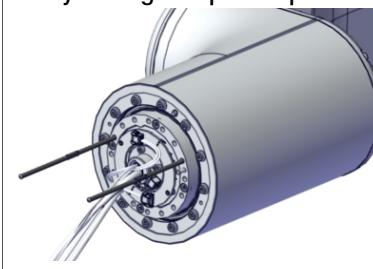
	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-051  xx2000002092

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5.6.4 Replacing the axis-4 joint unit
Continued

	Action	Note
2	Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board.	Tweezers  xx2000002085
3	Secure the brake release cable with a cable tie.	Cable ties  xx2000002084
4	Refit the cover with the four screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm  xx2000002083

Refitting the tubular

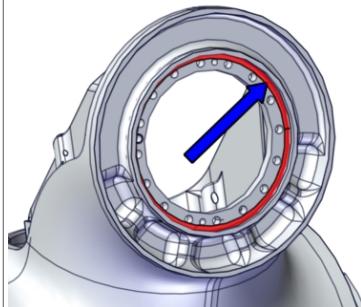
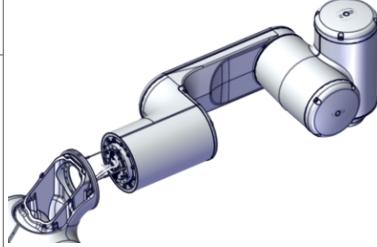
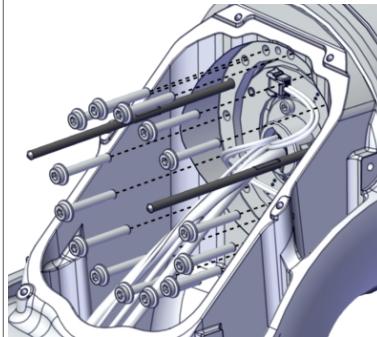
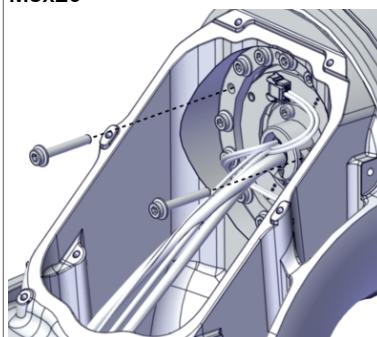
	Action	Note
1	Fit two guide pins to the axis-4 joint.	Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs.  xx2000002093

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5 Repair

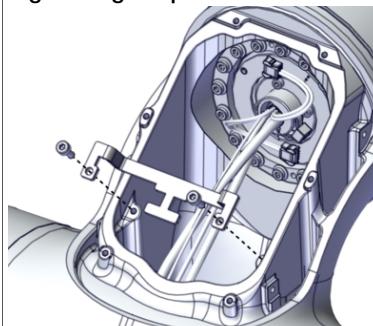
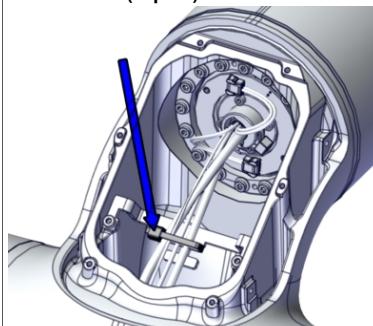
5.6.4 Replacing the axis-4 joint unit

Continued

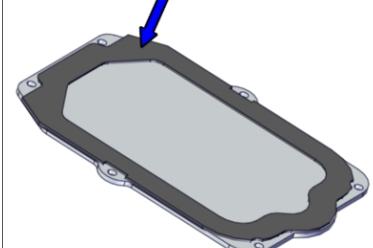
	Action	Note
2	<p>Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the housing mounting surface, as pointed out in the figure.</p>	<p>Cleaning agent: Isopropanol Flange sealant: Loctite 574</p>  <p>xx2000002094</p>
3	Lift the tubular into mounting position while inserting the cabling into the housing.	
4	Slide the tubular into place on the guide pins.	 <p>xx2000002082</p>
5	<p>Secure the tubular to the housing with all attachment screws but two. Pre-tighten the screws crosswise firstly.</p>	<p>Hex socket head cap flange screw: M3x20</p>  <p>xx2000002081</p>
6	Remove the guide pins and fasten the remaining two screws.	<p>Hex socket head cap flange screw: M3x20</p>  <p>xx2000002079</p>
7	Torque tighten all screws crosswise.	Tightening torque: 1.8 Nm.

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5.6.4 Replacing the axis-4 joint unit
Continued

	Action	Note
8	Refit the cable bracket with the two screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.8 Nm  xx2000002078
9	Secure the cabling with a cable tie.	Cable ties (1 pcs)  xx2000002077

Closing the housing top cover

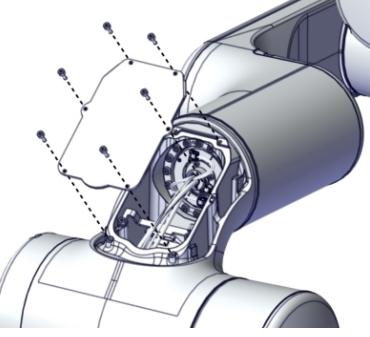
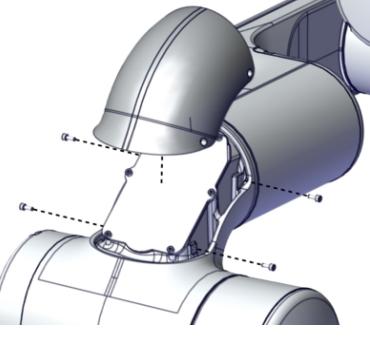
	Action	Note
1	Check the inner plate gasket. Replace if damaged.	Gasket: 3HAC075056-001  xx2000002095

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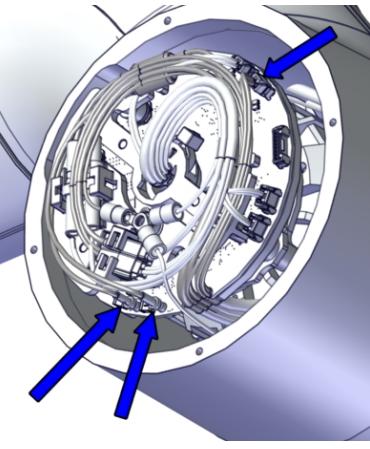
5 Repair

5.6.4 Replacing the axis-4 joint unit

Continued

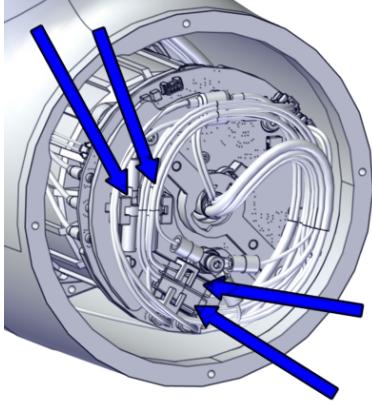
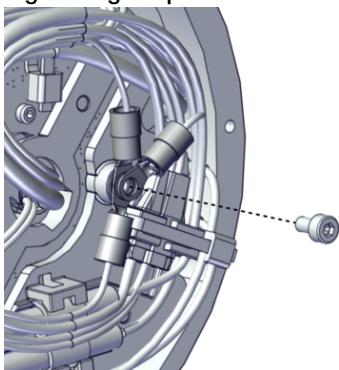
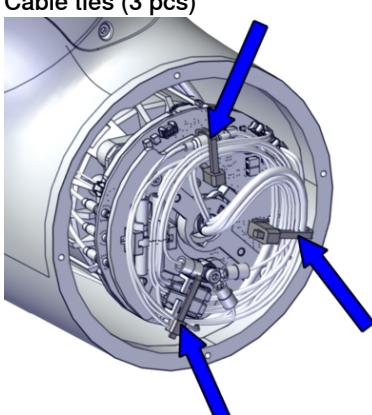
Action	Note
2 Refit the inner plate with the screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 1.4 Nm</p>  <p>xx2000002076</p>
3 Refit the cover with the four screws.	<p>Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs). Tightening torque: 0.45 Nm</p>  <p>xx2000002075</p>

Connecting the tubular cabling

Action	Note
1 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D3/4.DC+ to DC+ • D3/4.DC- to Ground • D3/4.X2 to X2 	 <p>xx2000002120</p>

Continues on next page

5.6.4 Replacing the axis-4 joint unit
Continued

	Action	Note
2	<p>Connect the connectors to each other and snap them to the cable holders.</p> <ul style="list-style-type: none"> • J3.DC+ to J3.DC+ • J3.DC- to J3.DC- • J3.CS to J3.CS • J3.CP to J3.CP 	 xx2000002067
3	<p>Secure the cables for functional earth and protective earth with a screw.</p>	<p>Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.</p>  xx2000001945
4	<p>Secure the cabling with cable ties.</p>	<p>Cable ties (3 pcs)</p>  xx2000002066

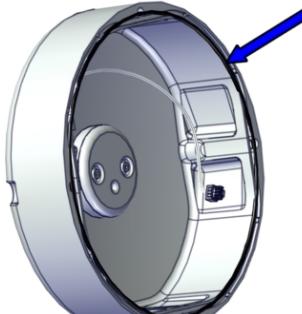
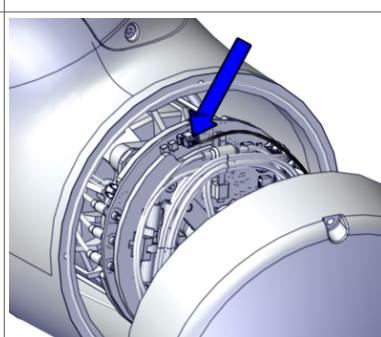
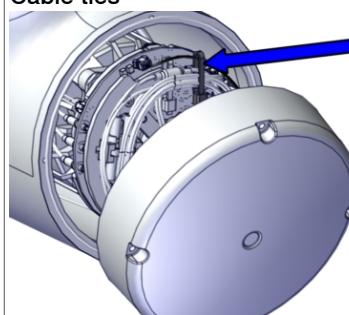
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5 Repair

5.6.4 Replacing the axis-4 joint unit

Continued

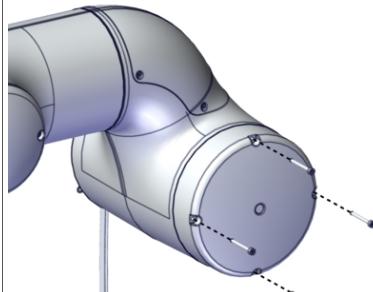
Refitting the housing cover

	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-047  xx2000001962
2	Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board. Orient the cover for proper arrangement of the brake release cable.	 xx2000002023
3	Secure the brake release cable with a cable tie.	Cable ties  xx2000002022

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5.6.4 Replacing the axis-4 joint unit

Continued

Action	Note
4 Refit the cover with the four screws.	<p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm</p> 

Concluding procedure

Action	Note
1 Calibrate the joint unit torque sensor.	See Calibration on page 607
2  DANGER Make sure all safety requirements are met when performing the first test run.	

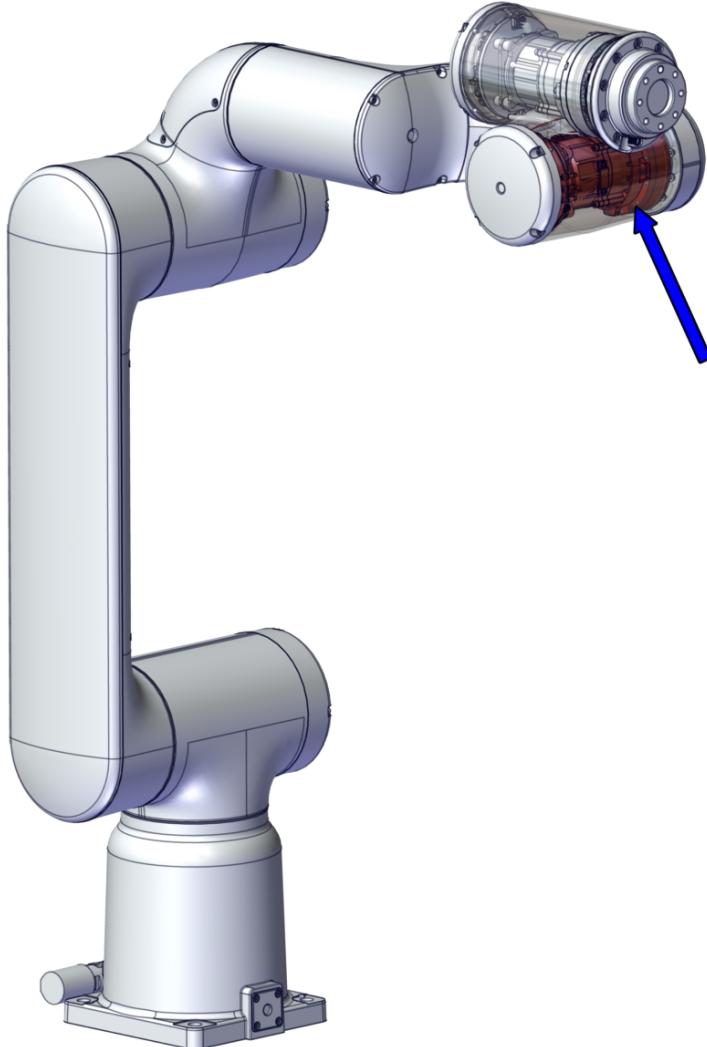
5 Repair

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Location of the axis-5 joint unit

The joint unit is located as shown in the figure.



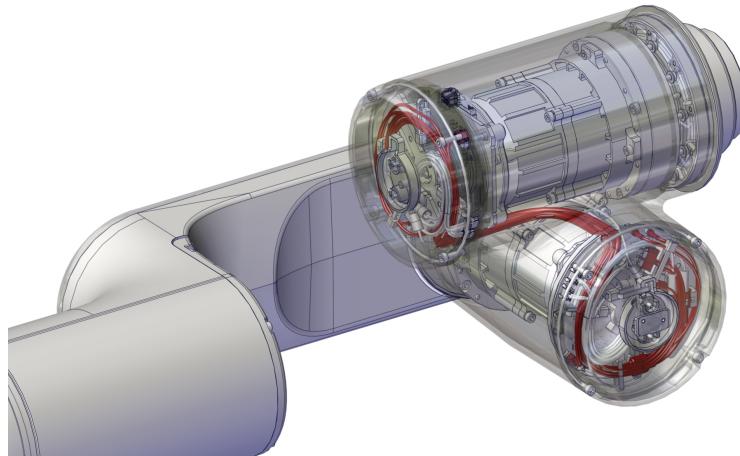
xx2000002121

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5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

*Continued***Location of the axis-5 to axis-6 transition cabling**

The cable harness is located as shown in the figure.



xx210000091

Summary of the replacement procedure

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

- 1 Remove the tubular cover.
- 2 Separate the cabling between the tubular and the tilt (at the axis-4 joint unit).
- 3 Remove the tilt and place on a workbench.
- 4 Remove the axis-6 joint unit.
- 5 Remove the axis-5 cover.
- 6 Replace the joint unit. Move the cabling from old to new joint unit.
- 7 Replace the axis-5 to axis-6 transition cabling.

Required spare parts**Note**

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Spare part	Article number	Note
Joint unit	3HAC079143-001	New attachment screws and cable tie 3HAC075545-001 are included in the delivery.
Cable harness, transition joint-5 and joint-6	3HAC073209-001	

Continues on next page

5 Repair

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

Required tools and equipment

Equipment	Article number	Note
Lifting aid	3HAC077789-001	For joint units on axes 4, 5 and 6. Attachment screws M3x12 (4 pcs) are enclosed.
Guide pin, M3x110	3HAC077787-001	Always use guide pins in pairs. For joint units on axes 4, 5 and 6.
Protection plate	3HAC077790-001	For protection of drive board during cabling installation on joint unit.
Cable tie gun EVO7	-	HellermannTyton 110-70084 or similar
Tweezers	-	Used to handle drive board connectors.
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

Consumable	Article number	Note
Cleaning agent	-	Isopropanol
Flange sealant	-	Loctite 574
Grease	3HAC042536-001	Shell Gadus S2
Cable ties	-	
O-ring	3HAC061327-051	Axis-5 cover Replace if damaged.
O-ring	3HAC061327-051	Arm-side interface Replace if damaged.
Hex socket head cap flange screw with glue	3HAB3413-312	M3x12 For tubular cover. Always use new screws. If ordering a new axis-4 or axis-5 joint unit spare part, new screws for the tubular cover are included.
O-ring	3HAC061327-043	Tubular cover Replace if damaged.

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5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

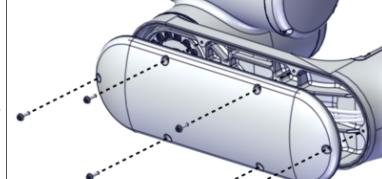
Removing the joint unit and transition cabling

Use these procedures to remove the joint unit and transition cabling.

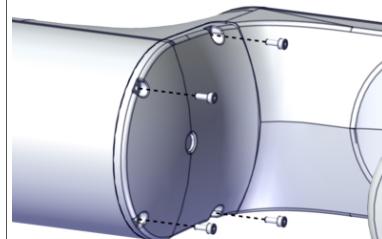
Preparations before removing the joint unit and transition cabling

	Action	Note
1	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none"> • Axis 1: No significance. • Axis 2: No significance. • Axis 3: No significance. • Axis 4: No significance. • Axis 5: 0° (home position) • Axis 6: No significance. <p>! CAUTION Jog the axis on which the joint unit is to be replaced to home position, to achieve correct cable routing during replacement of the joint unit.</p>	
2	<p>! CAUTION Turn off all supplies for electrical power to the robot, before starting the repair work.</p>	

Removing the tubular cover

	Action	Note
1	<p>Remove the cover by removing the six screws. Dispose the screws. New screws must be used when refitting the cover. New screws are included in the spare part delivery of the joint unit.</p>	 xx2000002123

Removing the axis-4 cover

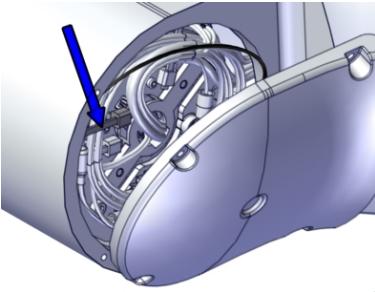
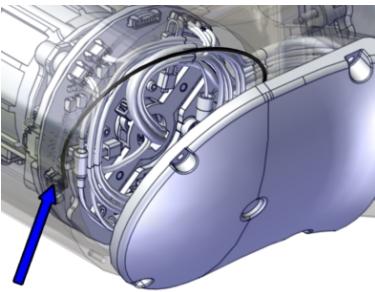
	Action	Note
1	Remove the cover screws.	 xx2000002083

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5 Repair

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

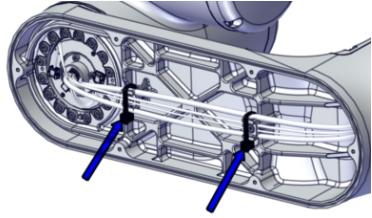
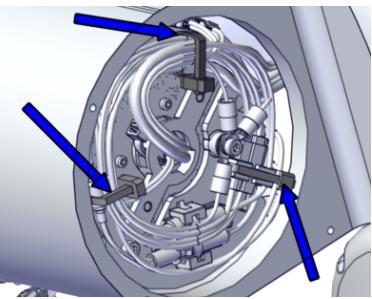
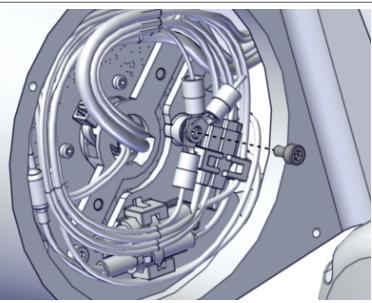
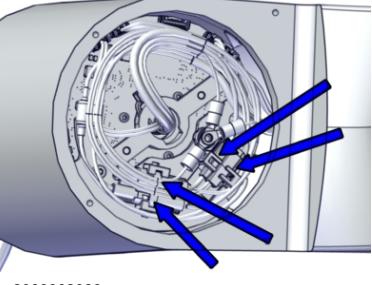
Continued

	Action	Note
2	<p>! CAUTION</p> <p>There is cabling connected between the cover and the joint unit drive board.</p> <p>Open the cover with care to avoid damage to the cabling or the connector(s).</p> <p>Do not leave the cover in location without being secured with the attachment screws.</p>	
3	Open the cover and cut the cable tie that holds the brake release cable.	 xx2000002084
4	Disconnect the brake release connector from the drive board. Remove the cover.	Tweezers  xx2000002085

Continues on next page

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling
Continued

Separating the cabling between the tubular and the tilt

	Action	Note
1	Cut the cable ties, if needed.	 xx2000002124  xx2000002086
2	Remove the functional and protective earth cables by removing the screw.	 xx2000002087
3	Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J4/5.DC+ • J4/5.DC- • J4/5.CS • J4/5.CP 	 xx2000002089

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5 Repair

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

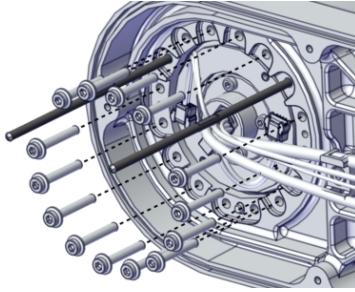
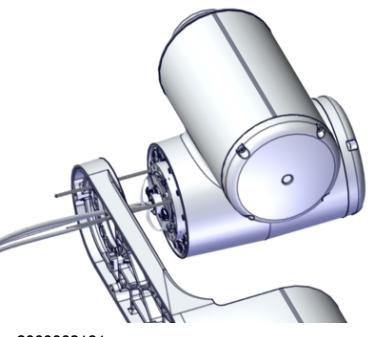
Action	Note
<p>4 Disconnect the connectors that belongs to the axis-5 cabling, from the axis-4 drive board:</p> <ul style="list-style-type: none"> • D3/4.X2 • D3/4.DC- • D3/4.DC+ <p>Use tweezers, if needed.</p>	<p>Tweezers</p> <p>xx2000002125</p>
5 Pull out the cabling carefully from the tubular.	<p>xx2000002126</p>

Removing the tilt

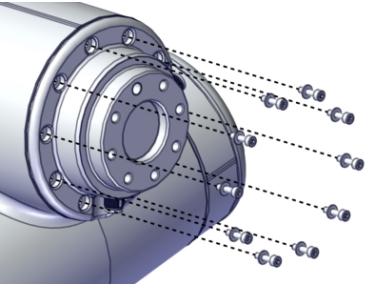
Action	Note
1 Remove two attachment screws and fit two guide pins to the axis-5 joint unit.	<p>Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs.</p> <p>xx2000002128</p> <p>xx2000002129</p>

Continues on next page

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling
Continued

Action	Note
2 Remove the remaining attachment screws.	 xx2000002130
3 Press the tilt out of position using two of the previous attachment screws as removal tools.	
4 Remove the tilt from the tubular. Assist the cabling to be removed while lifting away the complete tilt. Place the tilt on a workbench.	 xx2000002131

Removing the tool flange

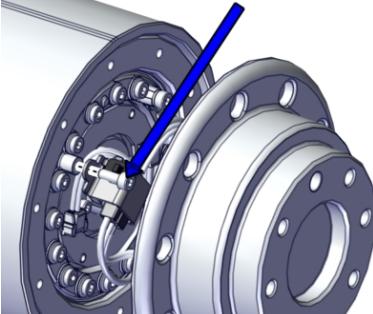
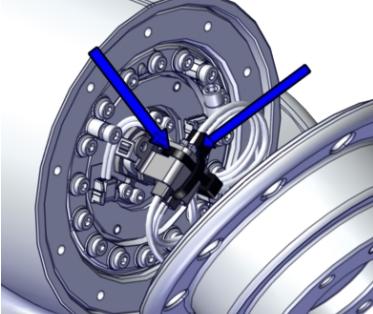
Action	Note
1 Remove the tool flange screws and washers.	 xx2000002155
2  CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	

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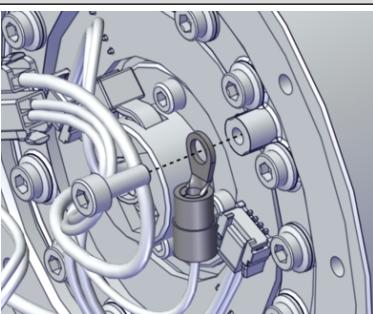
5 Repair

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

Action	Note
3 Loosen the tool flange and remove the cable bracket by removing the screw.	 xx2000002156
4 Cut the cable ties.	 xx2000002157
5 Disconnect the CP/CS connectors from the drive board and remove the tool flange.	 xx2000002158

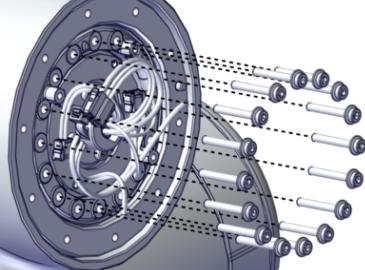
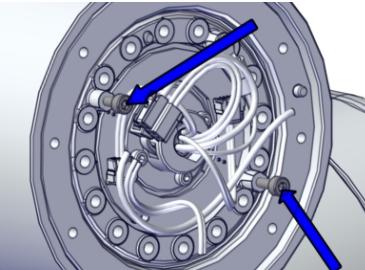
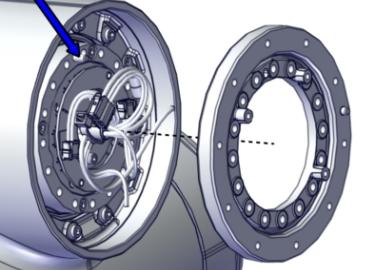
Disconnecting the tool flange functional earth cable

Action	Note
1 Remove the functional earth cable by removing the screw.	 xx2000002159

Continues on next page

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling
Continued

Removing the tool flange adapter

	Action	Note
1	Remove the tool flange adapter screws.	 xx2000002165
2	Press the adapter out of position by using two of the attachment screws as removal tools.	 xx2000002166
3	Remove the tool flange adapter.	 xx2000002167

Removing the arm-side interface

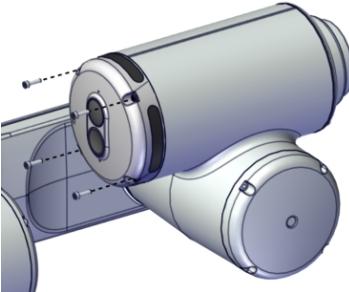
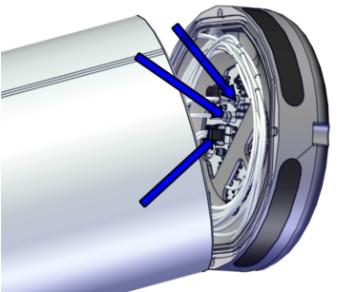
	Action	Note
1	 CAUTION Make sure that all supplies for electrical power are turned off.	
2	 CAUTION There is cabling connected between the arm-side interface and the joint unit drive board. Open the arm-side interface with care to avoid damage to the cabling or the connector(s). Do not leave the arm-side interface in location without being secured with the attachment screws.	

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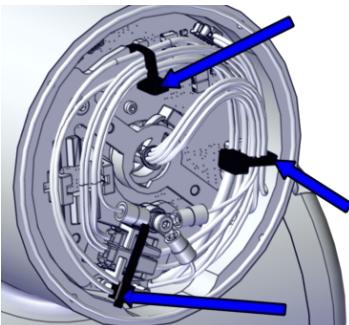
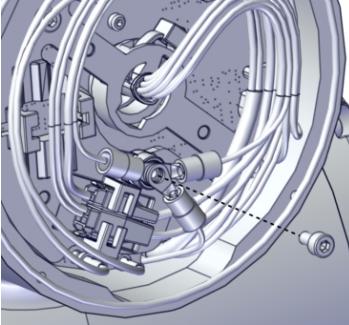
5 Repair

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

Action	Note
3 Remove the attachment screws.	 xx2000002550
4 Loosen the arm-side interface carefully and disconnect the connectors from it. <ul style="list-style-type: none"> • ASI.DC+ • ASI.DC- • ASI.X1 	 xx2100000335

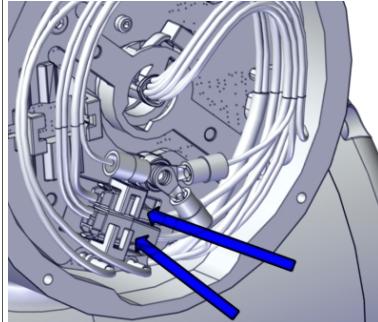
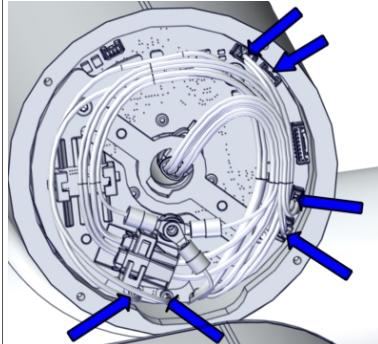
Disconnecting the axis-6 joint unit cabling

Action	Note
1 Cut the cable ties.	 xx2000002161
2 Remove the functional and protective earth cables by removing the screw.	 xx2000002162

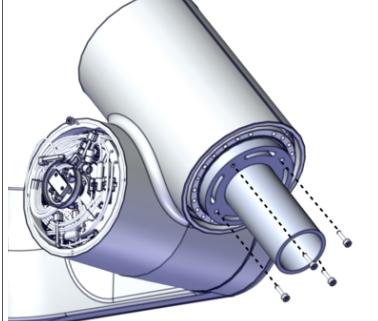
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5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

	Action	Note
3	Snap loose and disconnect the connectors: • J7.CS • J7.CP	 xx2000002163
4	Disconnect the connectors from the drive board. • D6.X1 • D6.DC+ • D6.DC- • D6.X4 • D6.X2 • D6.X5 Use tweezers, if needed.	Tweezers  xx2000002164

Removing the axis-6 joint unit

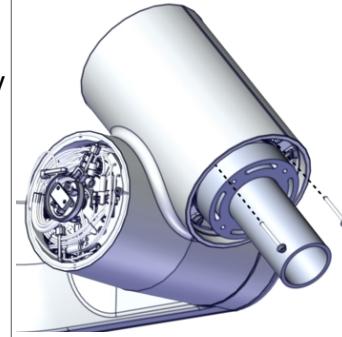
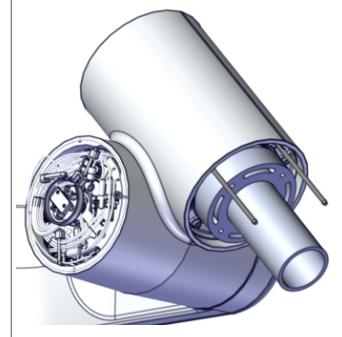
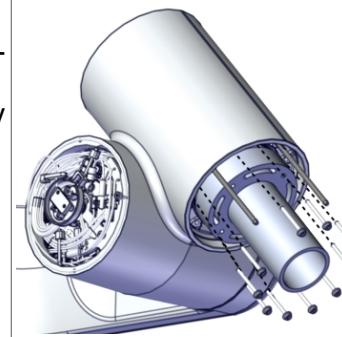
	Action	Note
1	Fit the lifting aid to the joint unit, on the torque sensor side.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Lifting aid: 3HAC077789-001 Screws: M3x12 (4 pcs)  xx2000002168 Position shown in the figure shows axis 5 jogged to +20°, which is a more convenient position when replacing only the axis-6 joint unit.

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5 Repair

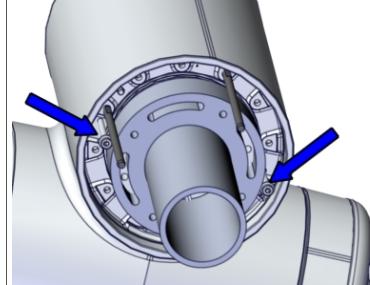
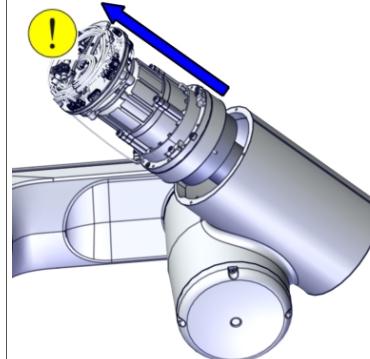
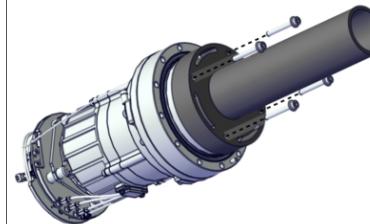
5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

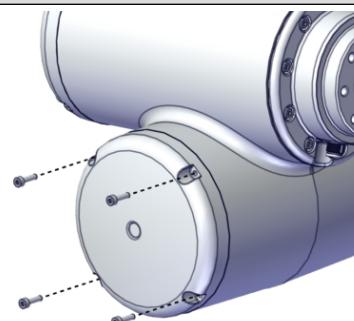
	Action	Note
2	<p>Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.</p>	 xx2000002170 Position shown in the figure shows axis 5 jogged to +20°, which is a more convenient position when replacing only the axis-6 joint unit.
3	<p>Fit two guide pins to the axis-6 joint unit.</p>	Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs. For joint units on axes 4, 5 and 6.  xx2100000328
4	<p>Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.</p>	 xx2100000329

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5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling
Continued

Action	Note
5 Press the joint unit out of position using two of the previous attachment screws as removal tools.	 xx2100000330
6 Remove the joint unit from the tubular. CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002169 Position shown in the figure shows axis 5 jogged to +20°, which is a more convenient position when replacing only the axis-6 joint unit.
7 Remove the lifting aid and guide pins.	 xx2000001957

Removing the axis-5 cover

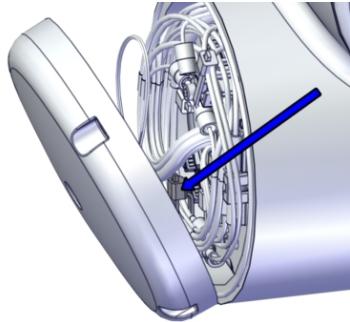
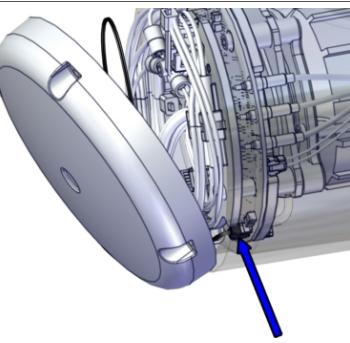
Action	Note
1 Remove the cover by removing the four screws.	 xx2000002132

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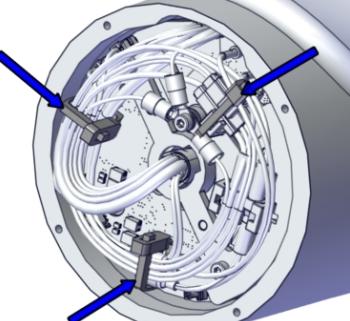
5 Repair

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

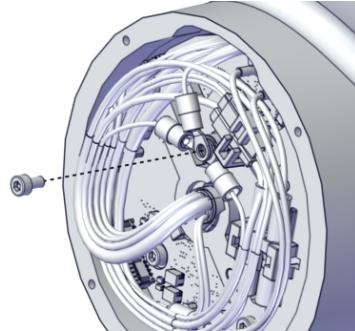
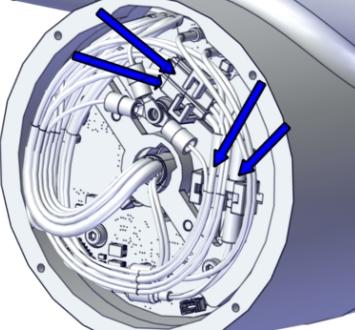
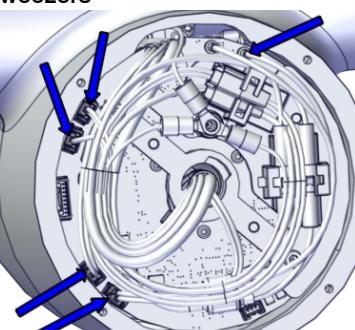
	Action	Note
2	 CAUTION There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.	
3	Open the cover and cut the cable tie that holds the brake release cable.	 xx2000002133
4	Disconnect the brake release connector from the drive board. Remove the cover.	 xx2000002134

Disconnecting the axis-5 joint unit cabling

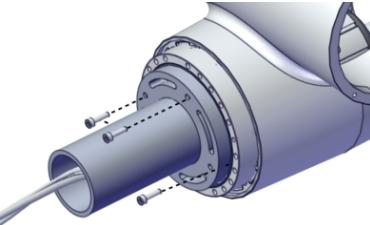
	Action	Note
1	Cut the cable ties.	 xx2000002135

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5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling
Continued

Action	Note
2 Remove the functional and protective earth cables by removing the screw.	 xx2000002136
3 Snap loose and disconnect the connectors: <ul style="list-style-type: none"> • J5/6.DC+ • J5/6.DC- • J5/6.CS • J5/6.CP 	 xx2000002137
4 Disconnect the connectors from the drive board. <ul style="list-style-type: none"> • D4/5.X1 • D5.DC+ • D5.DC- • D4/5.X4 • D5.X2 • D4/5.X5 <p>Use tweezers, if needed.</p>	Tweezers  xx2000002138

Removing the axis-5 joint unit

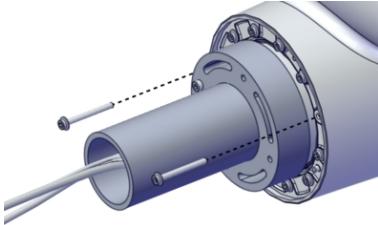
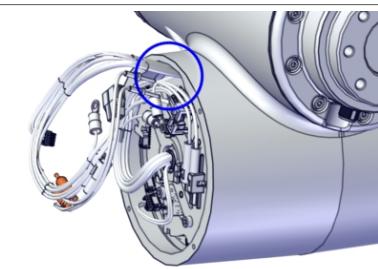
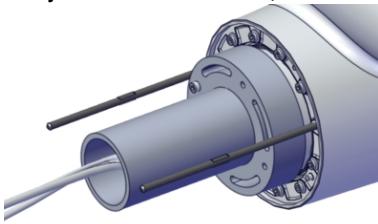
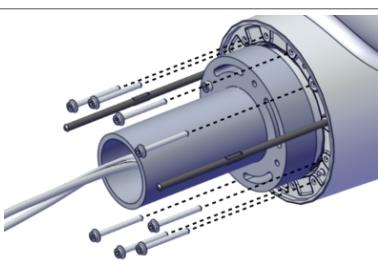
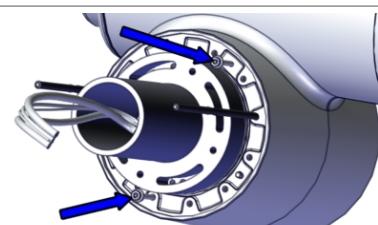
Action	Note
1 Fit the lifting aid to the joint unit, on the torque sensor side.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Lifting aid: 3HAC077789-001 Screws: M3x12 (4 pcs)  xx2000002139

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5 Repair

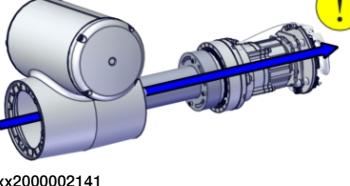
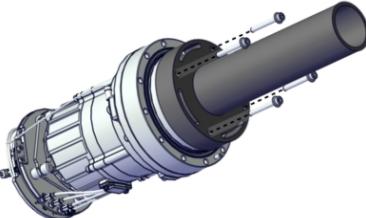
5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

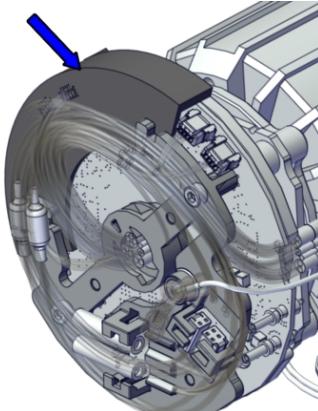
Action	Note
<p>2 Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.</p>	 xx2000002140
<p>3 Put the cabling at the slot in order not to squeeze it during removal of joint unit.</p>	 xx2100000284
<p>4 Fit two guide pins to the axis-5 joint unit.</p>	Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs. For joint units on axes 4, 5 and 6.  xx2100000332
<p>5 Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.</p>	 xx2100000333
<p>6 Press the joint unit out of position using two of the previous attachment screws as removal tools.</p>	 xx2100000334

Continues on next page

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling
Continued

Action	Note
7 Remove the joint unit from the tubular. ! CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002141
8 Remove the lifting aid and guide pins.	 xx2000001957

Removing the joint cable

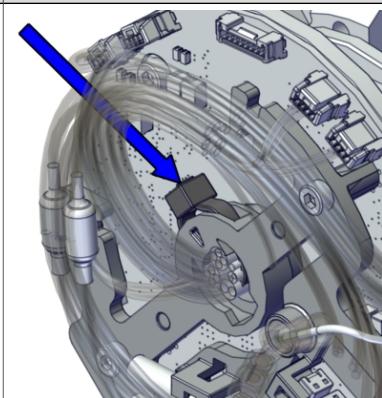
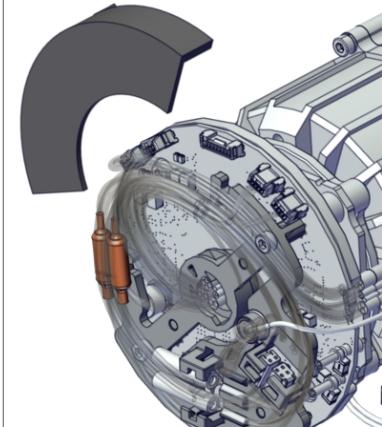
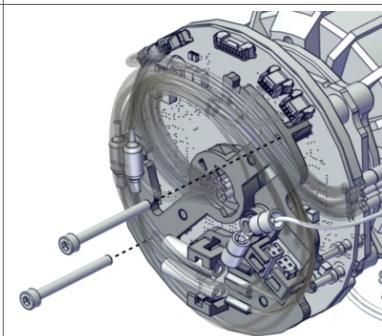
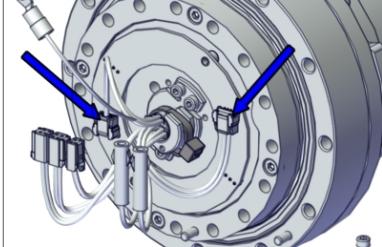
Action	Note
1 ! ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2 Fit the protection plate to the drive board unit. ! Tip Using the protection plate is important for protecting the drive board unit. If complete joint unit is to be replaced, the protection plate is not needed.	Protection plate: 3HAC077790-001  xx2000002057

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5 Repair

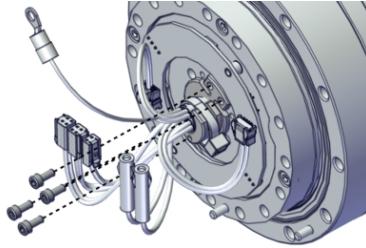
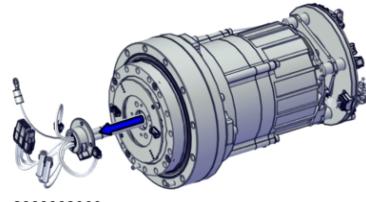
5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

Action	Note
3 Cut the cable tie at the drive board.	 xx2000002058
4 Remove the protection plate.	 xx2100000301
5 Remove the cable support from the drive board by removing the attachment screws.	 xx2000002055
6 Disconnect the two connectors from the torque sensor board. • TQ.A • TQ.B	 xx2000002053

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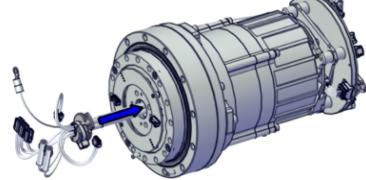
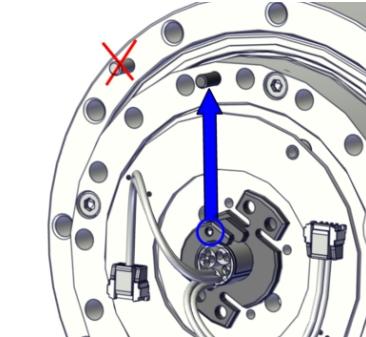
5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling
Continued

Action	Note
7 Remove the cable plate by removing the attachment screws.	
8 Remove the joint cable from the hollow shaft from the torque sensor side.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	

Refitting the joint unit and transition cabling

Use these procedures to refit the joint unit and transition cabling.

Refitting the axis-5 joint unit cable

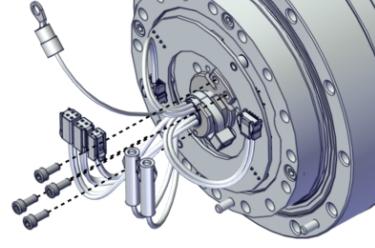
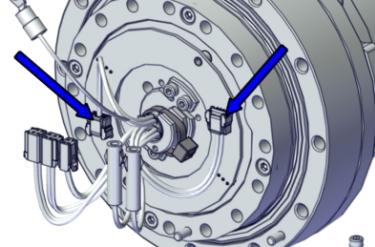
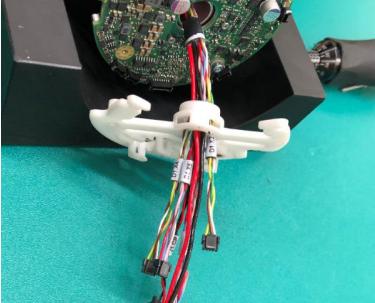
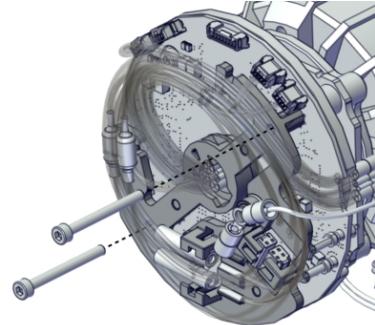
Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2 Place the joint cable through the hollow shaft from the torque sensor side.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	
3 Orient the cable plate according to the figure. The circle on the cable plate should point towards the guide pin on the torque sensor.	

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5 Repair

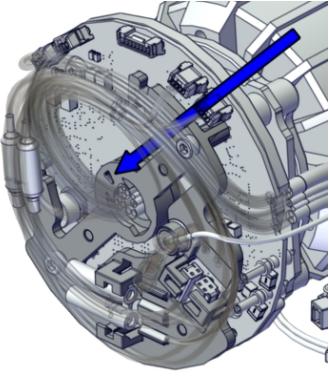
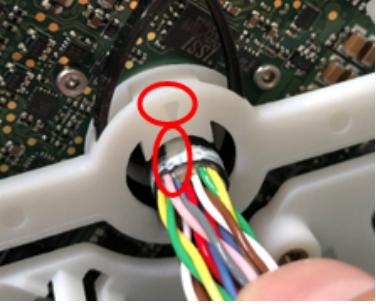
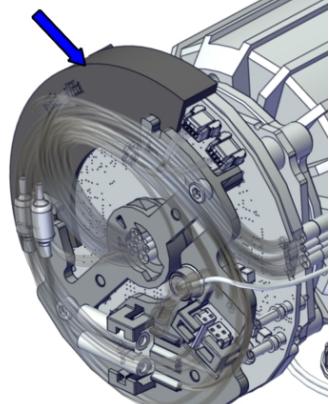
5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

	Action	Note
4	Secure the cable plate to the joint unit with the attachment screws.	<p>Hex socket head cap screw: M2.5x6 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000002049</p>
5	<p>Connect the two connectors to the torque sensor board.</p> <ul style="list-style-type: none"> • TQ.A to CH1/A • TQ.B to CH2/B 	 <p>xx2000002053</p>
6	Insert the cabling through the cable support and fit the support to the drive board with the attachment screws.	 <p>xx2000002056</p> <p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (2 pcs) Tightening torque: 0.45 Nm.</p>  <p>xx2000002055</p>

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5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling
Continued

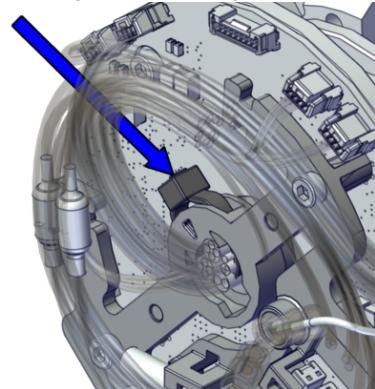
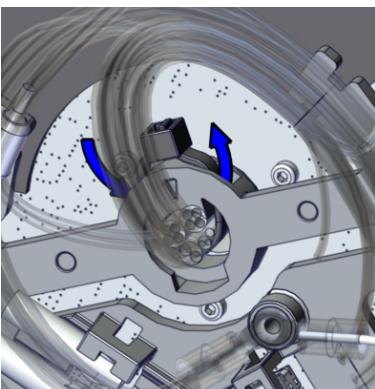
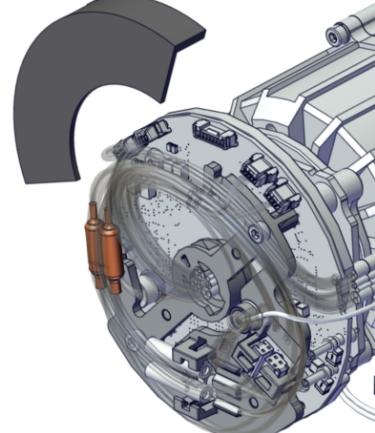
	Action	Note
7	Align the triangle direction mark on the cable support and the white mark on the cable harness. Use the cable tie to pre-fix the cable by hand.	 xx2100000507
8	Fit the protection plate to the drive board unit.	 xx2100000508
8	Fit the protection plate to the drive board unit.	Protection plate: 3HAC077790-001  xx2000002057

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5 Repair

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

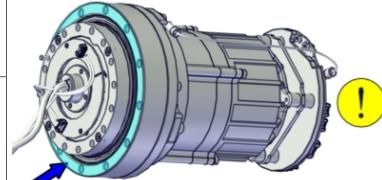
	Action	Note
9	Secure the cables to the cable support with a cable tie, using a cable tie gun. Assembly direction for the cable tie is shown in the figure.	<p>Cable tie: 3HAC075545-001. For securing joint unit cable. Cable tie gun EVO7 Setting for cable tie gun: 6.75.</p>  <p>xx2000002058</p>  <p>xx2000002059</p>
10	Remove the protection plate.	 <p>xx2100000301</p>

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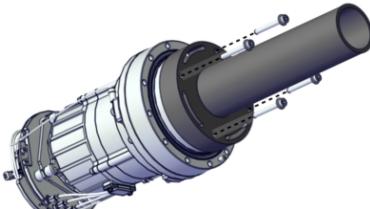
5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

Preparations before fitting the joint unit

	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2	Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol. Joint unit mounting surface is pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001860
3	 CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

Refitting the axis-5 joint unit and transition cabling

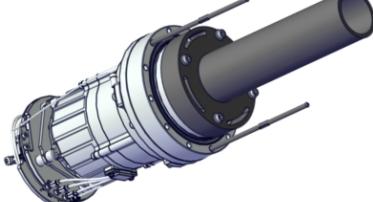
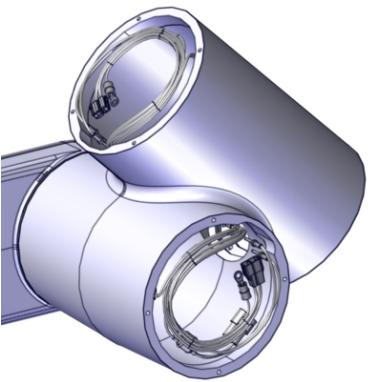
	Action	Note
1	 CAUTION Fit the lifting aid to the joint unit. The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Joint unit: 3HAC079143-001 Lifting aid: 3HAC077789-001 Screws: M3x12 (4 pcs)  xx2000001957

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5 Repair

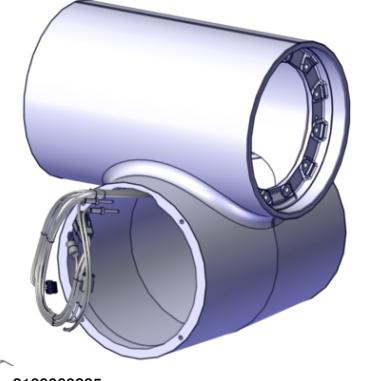
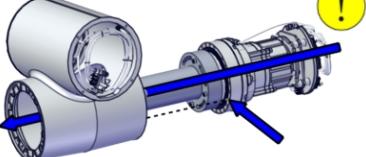
5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

	Action	Note
2	Fit two guide pins to the joint unit.	<p>Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs. For joint units on axes 4, 5 and 6.</p>  <p>xx2000002438</p>
3	Fit the transition cable between axis-5 and axis-6 joint units into the tilt.	<p>Cable harness, transition joint-5 and joint-6: 3HAC073209-001</p>  <p>xx2100000040</p>

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5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling
Continued

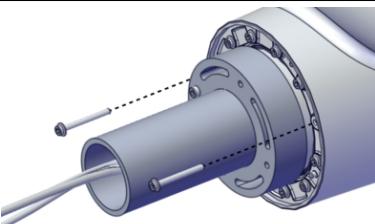
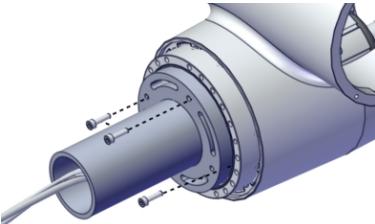
Action	Note
4 Place the cabling at the slot before refitting the joint unit.	 xx210000041
5 Fit the joint unit to the tilt, aligning the pin with the pin hole.	 xx2100000285
6 Secure the joint unit with new attachment screws.	CAUTION <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>  xx2000002142 <p>Hex socket head cap flange screw with glue: 3HAB3413-330 M3x30, 12 pcs Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.</p>  xx210000333

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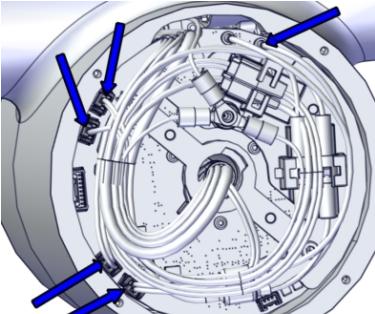
5 Repair

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

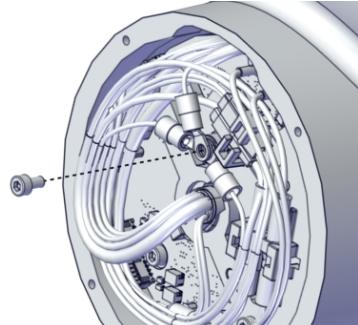
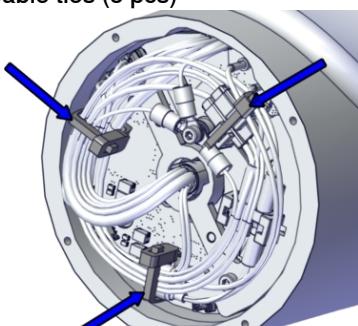
Action	Note
7 Remove the guide pins and secure the remaining two attachment screws.	 xx2000002140
8 Pre-tighten the screws crosswise.	
9 Torque tighten all screws crosswise.	Tightening torque: 1.4 Nm.
10 Remove the lifting aid by removing the screws.	 xx2000002139
11 Clean pushed-out flange sealant, if any.	

Connecting the axis-5 joint unit cabling

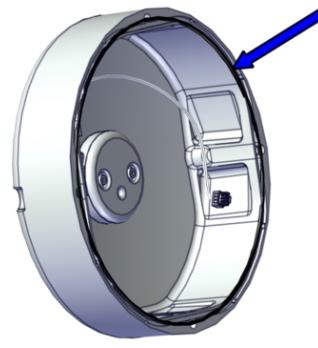
Action	Note
1 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D4/5.X1 to X1 • D5.DC+ to +DC • D5.DC- to Ground • D4/5.X4 to X4 • D5/4.X2 to X2 • D4/5.X5 to X5 	 xx2000002138
2 Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none"> • J5/6.DC+ to J6.DC+ • J5/6.DC- to J6.DC- • J5/6.CS to J6.CS • J5/6.CP to J6.CP 	 xx2000002137

Continues on next page

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling
Continued

Action	Note
3 Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000002136
4 Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000002135

Refitting the axis-5 cover

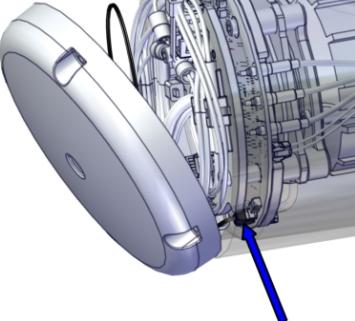
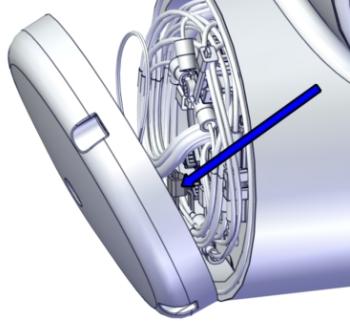
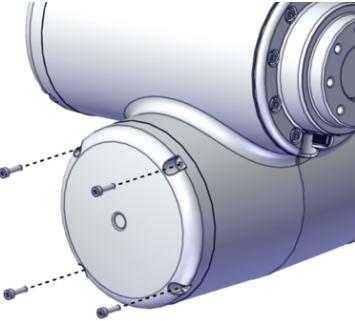
Action	Note
1 Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-051  xx2000001962

Continues on next page

5 Repair

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

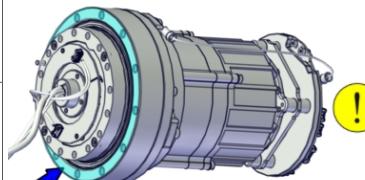
Action	Note
2 Place the cover at mounting position and reconnect the brake release connector DR.X8 to the drive board.	 xx2000002134
3 Secure the brake release cable with a cable tie.	Cable ties  xx2000002133
4 Refit the cover with the four screws.	Hex socket head cap screw: M3x8 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm  xx2000002132

Preparations before fitting the joint unit

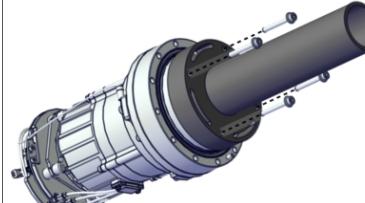
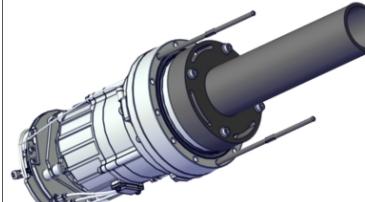
Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

Continues on next page

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling
Continued

Action	Note
2 Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol. Joint unit mounting surface is pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000001860
3 Apply a thin layer of flange sealant to the mounting surface. Do not contaminate the radial sealing with sealant.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section <i>The unit is sensitive to ESD on page 42</i> .	

Refitting the axis-6 joint unit

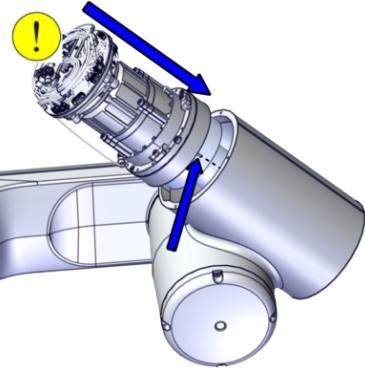
Action	Note
1 Fit the lifting aid to the joint unit.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Joint unit: 3HAC079143-001 Lifting aid: 3HAC077789-001 Screws: M3x12 (4 pcs)  xx2000001957
2 Fit two guide pins to the joint unit.	Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs. For joint units on axes 4, 5 and 6.  xx2000002438

Continues on next page

5 Repair

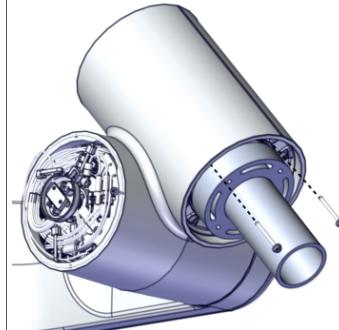
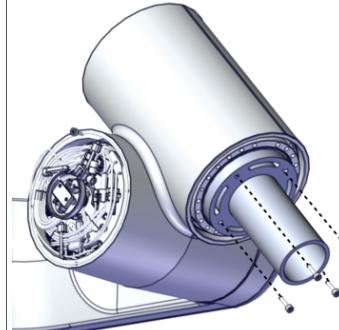
5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

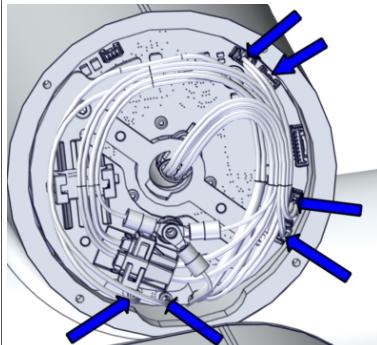
Action	Note
3 Place the cabling at the slot before refitting the joint unit.	 xx2100000041
4 Fit the joint unit to the tilt, aligning the pin with the pin hole. CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002195
5 Secure the joint unit with new attachment screws.	Hex socket head cap flange screw with glue: 3HAB3413-330 M3x30, 12 pcs Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.  xx2100000329

Continues on next page

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling
Continued

Action	Note
6 Remove the guide pins and secure the remaining two attachment screws.	 xx2000002170
7 Pre-tighten the screws crosswise.	
8 Torque tighten all screws crosswise.	Tightening torque: 1.4 Nm.
9 Remove the lifting aid by removing the screws.	 xx2000002168
10 Clean pushed-out flange sealant, if any.	

Connecting the axis-6 joint unit cabling

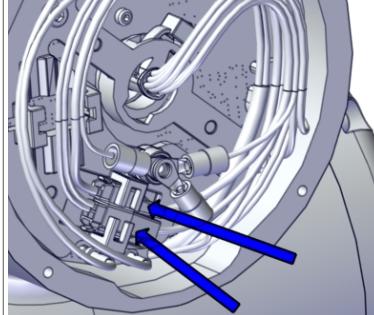
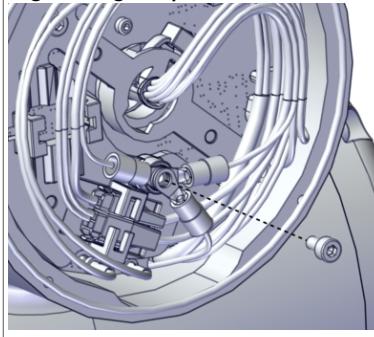
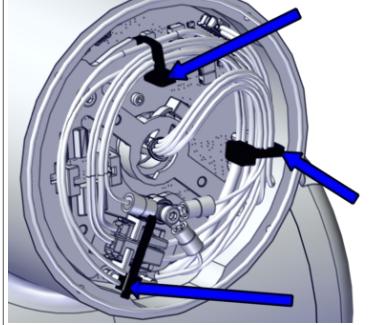
Action	Note
1 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D6.X1 to X1 • D6.DC+ to +DC • D6.DC- to Ground • D6.X4 to X4 • D6.X2 to X2 • D6.X5 to X5 	 xx2000002164

Continues on next page

5 Repair

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

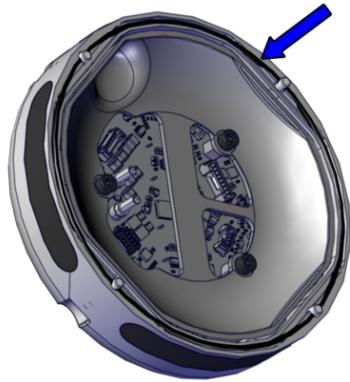
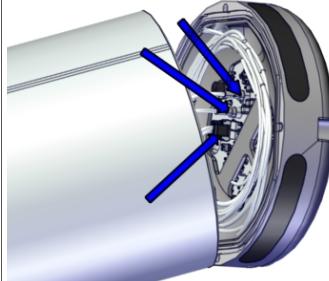
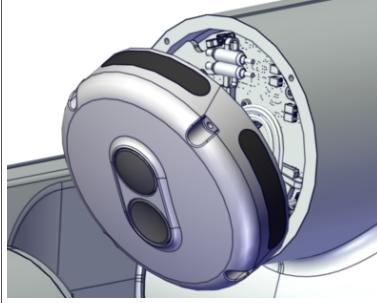
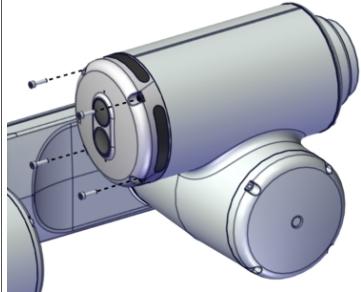
Continued

	Action	Note
2	<p>Connect the connectors to each other and snap them to the cable holders.</p> <ul style="list-style-type: none"> • J7.CS to J7.CS • J7.CP to J7.CP 	 xx2000002163
3	<p>Secure the cables for functional earth and protective earth with a screw.</p>	<p>Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.</p>  xx2000002162
4	<p>Secure the cabling with cable ties.</p>	<p>Cable ties (3 pcs)</p>  xx2000002161

Continues on next page

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling
Continued

Refitting the arm-side interface

	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-051  xx2000002551
2	Place the arm-side interface at mounting position and reconnect the connectors. <ul style="list-style-type: none"> • ASI.DC+ • ASI.DC- • ASI.X1 The correct orientation of the arm-side interface is with the convex button in upper position.  Note Do not leave the arm-side interface in location without being secured with the attachment screws.	 xx2100000335  xx2100000336
3	Refit the arm-side interface with four screws.	Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm  xx2000002550

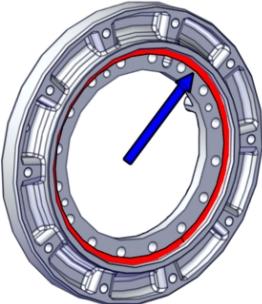
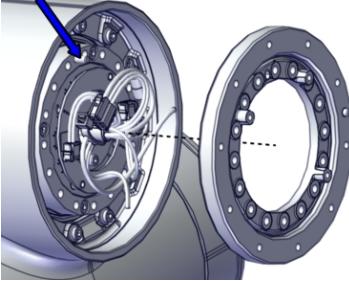
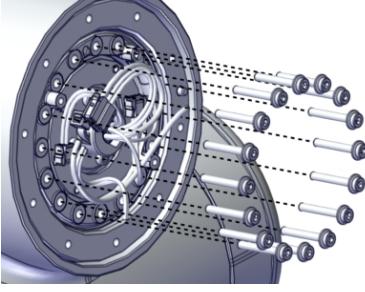
Continues on next page

5 Repair

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

Refitting the tool flange adapter

	Action	Note
1	Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the adapter mounting surface, as pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574  xx2000002196
2	Refit the tool flange adapter, aligning the pin with the pin hole.	Axis-6 inner flange: 3HAC073952-001  xx2000002167
3	Secure with screws.	Hex socket head cap flange screw: M3x20 (16 pcs) Tightening torque: 1.8 Nm.  xx2000002165

Continues on next page

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling
Continued

Connecting the tool flange functional earth cable

	Action	Note
1	Secure the cable for functional earth to the tool flange adapter with a screw.	 xx2000002159

Refitting the tool flange

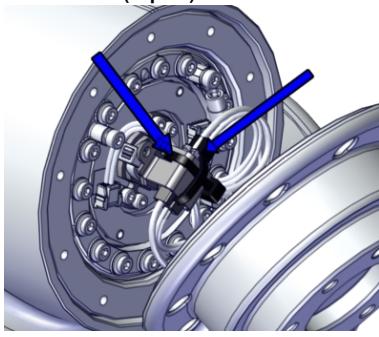
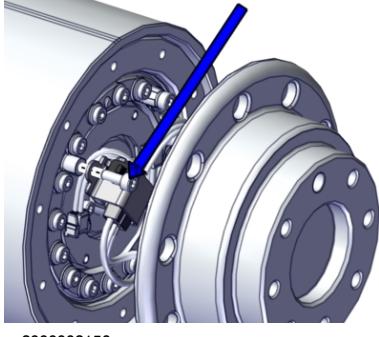
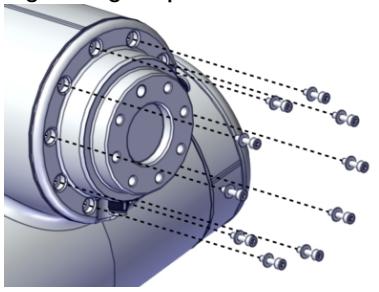
	Action	Note
1	Check the o-ring on the tool flange and lubricate with grease. Replace if damaged.	Axis-6 flange: 3HAC073953-001 O-ring: 3HAB3772-182 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000002197
2	Place the tool flange at mounting position and reconnect the CP/CS connectors.	 xx2000002158

Continues on next page

5 Repair

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

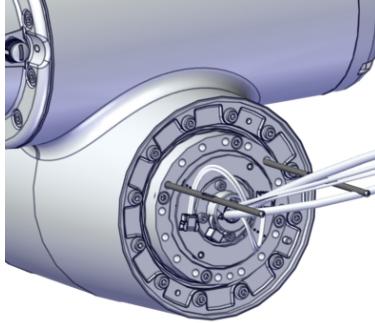
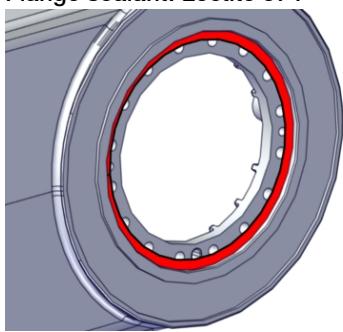
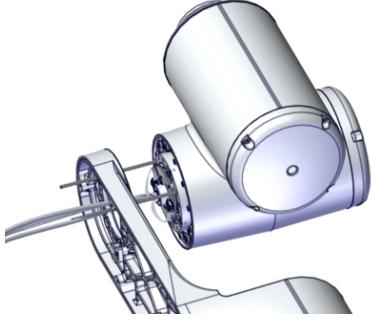
Continued

	Action	Note
3	Fit the connectors to the cable bracket and secure the connectors with two cable ties.	<p>Cable ties (2 pcs)</p>  <p>xx2000002157</p>
4	Refit the cable bracket with the screw.	<p>Hex socket head cap screw: M3x20 12.9 Gleitmo 603+Geomet 500 (1 pcs) Tightening torque: 0.8 Nm.</p>  <p>xx2000002156</p>
5	Refit and secure the tool flange with screws and washers.	<p>Hex socket head cap screw: M3x12 12.9 Gleitmo 603+Geomet 500 (10 pcs) Spring washer: 7x3.2x0.6 Steel (10 pcs) Tightening torque: 1.8 Nm.</p>  <p>xx2000002155</p>

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5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling
Continued

Refitting the tilt

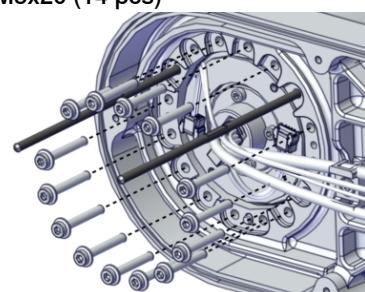
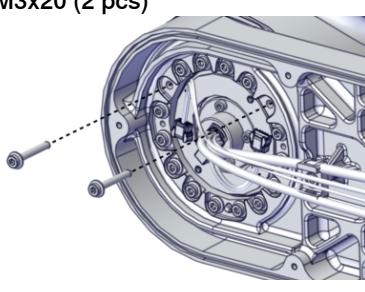
	Action	Note
1	Fit two guide pins to the axis-5 joint.	<p>Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs.</p>  <p>xx2000002146</p>
2	Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the tubular mounting surface, as pointed out in the figure.	<p>Cleaning agent: Isopropanol Flange sealant: Loctite 574</p>  <p>xx2000002147</p>
3	Lift the tilt into mounting position while inserting the cabling into the tubular.	
4	Slide the tilt into place on the guide pins.	 <p>xx2000002131</p>

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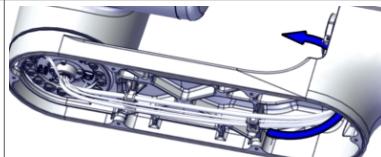
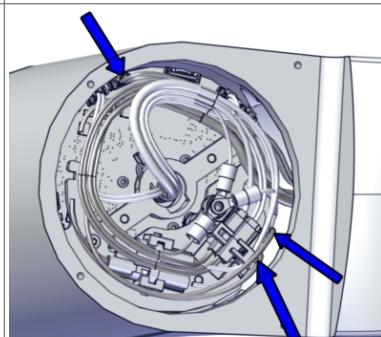
5 Repair

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

Action	Note
5 Secure the tilt to the tubular with all attachment screws but two. Pre-tighten the screws crosswise firstly.	Hex socket head cap flange screw: M3x20 (14 pcs)  xx2000002130
6 Remove the guide pins and fasten the remaining two screws.	Hex socket head cap flange screw: M3x20 (2 pcs)  xx2000002128
7 Torque tighten all screws crosswise.	Tightening torque: 1.8 Nm.

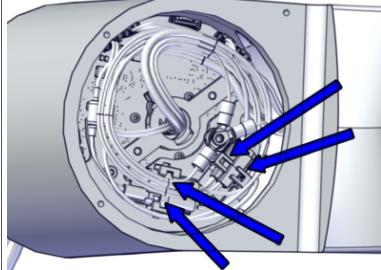
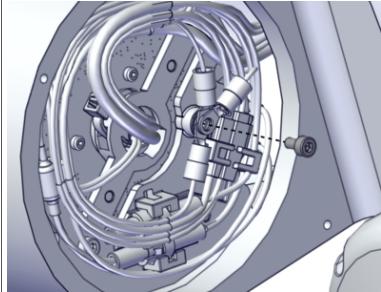
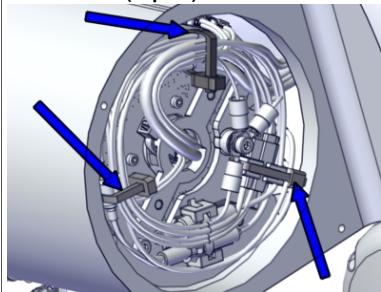
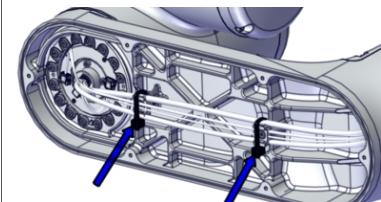
Connecting the tilt cabling

Action	Note
1 Insert the cabling into the tubular.	 xx2000002148
2 Reconnect the connectors to the drive board. <ul style="list-style-type: none"> • D3/4.X2 to X2 • D3/4.DC- to Ground • D3/4.DC+ to +DC 	 xx2000002125

Continues on next page

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

	Action	Note
3	<p>Connect the connectors to each other and snap them to the cable holders.</p> <ul style="list-style-type: none"> • J4/5.DC+ to J5/6.DC+ • J4/5.DC- to J5/6.DC- • J4/5.CS to J5/6.CS • J4/5.CP to J5/6.CP 	 xx2000002089
4	Secure the cables for functional earth and protective earth with a screw.	<p>Hex socket head cap screw: M3x6 (1 pcs).</p> <p>Tightening torque: 0.8 Nm.</p>  xx2000002087
5	Secure the cabling with cable ties.	<p>Cable ties (3 pcs)</p>  xx2000002086  xx2000002124

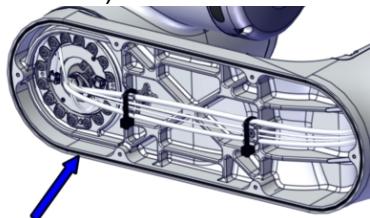
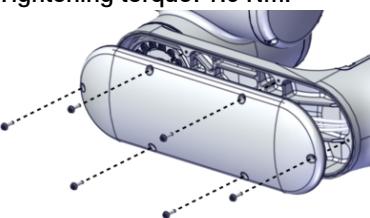
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5 Repair

5.6.5 Replacing the axis-5 joint unit and the axis-5 to axis-6 transition cabling

Continued

Refitting the tubular cover

	Action	Note
1	Wipe, lubricate and fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-043 Grease: 3HAC042536-001 (Shell Gadus S2)  xx2000002149
2	Refit the cover with new attachment screws.	Hex socket head cap flange screw with glue: 3HAB3413-312 M3x12 For tubular cover. Always use new screws. If ordering a new axis-4 or axis-5 joint unit spare part, new screws for the tubular cover are included. Tightening torque: 1.6 Nm.  xx2000002123

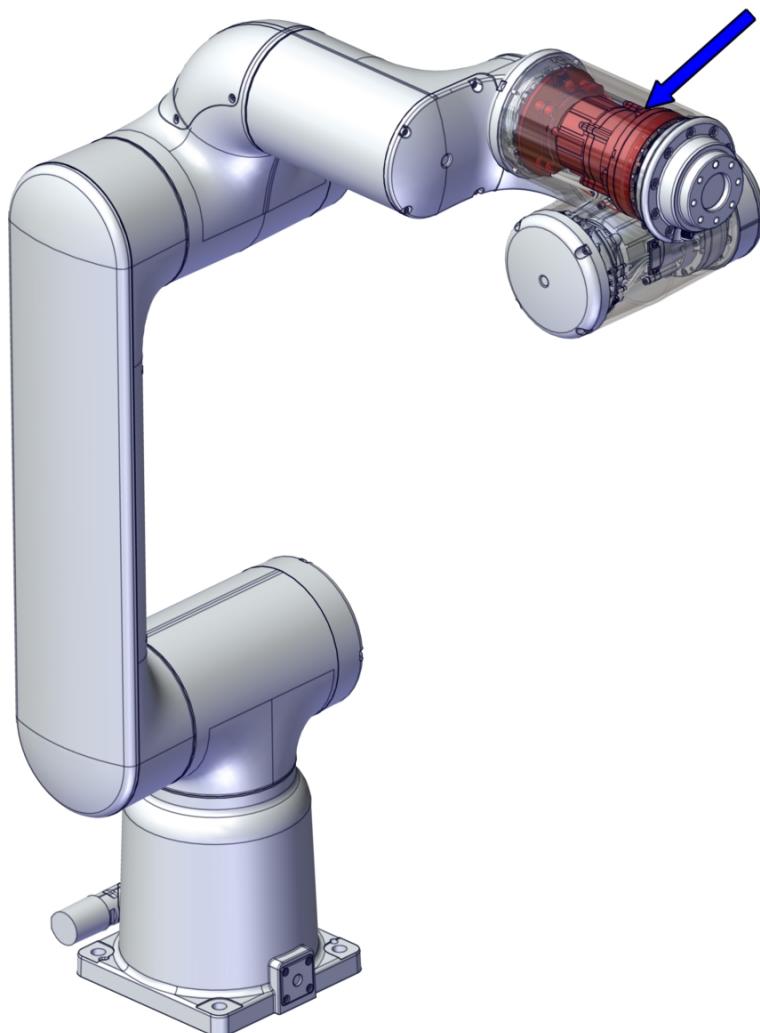
Concluding procedure

	Action	Note
1	Calibrate the joint unit torque sensor.	See Calibration on page 607
2	 DANGER Make sure all safety requirements are met when performing the first test run.	

5.6.6 Replacing the axis-6 joint unit

Location of the axis-6 joint unit

The joint unit is located as shown in the figure.



xx2000002122

Summary of the replacement procedure

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

- 1 Remove the tool flange.
- 2 Remove the tool flange adapter.
- 3 Remove the axis-6 cover.
- 4 Replace the joint unit. Move the cabling from old to new joint unit.

Continues on next page

5 Repair

5.6.6 Replacing the axis-6 joint unit

Continued

Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the CRB 15000 via myABB Business Portal, www.abb.com/myABB.

Spare part	Article number	Note
Joint unit	3HAC079143-001	New attachment screws and cable tie 3HAC075545-001 are included in the delivery.

Required tools and equipment

Equipment	Article number	Note
Lifting aid	3HAC077789-001	For joint units on axes 4, 5 and 6. Attachment screws M3x12 (4 pcs) are enclosed.
Guide pin, M3x110	3HAC077787-001	Always use guide pins in pairs. For joint units on axes 4, 5 and 6.
Protection plate	3HAC077790-001	For protection of drive board during cabling installation on joint unit.
Cable tie gun EVO7	-	HellermannTyton 110-70084 or similar
Tweezers	-	Used to handle drive board connectors.
Standard toolkit	-	Content is defined in section Standard toolkit on page 625 .

Required consumables

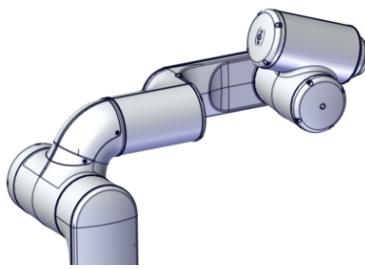
Consumable	Article number	Note
Cleaning agent	-	Isopropanol
Flange sealant	-	Loctite 574
Grease	3HAC042536-001	Shell Gadus S2
O-ring	3HAB3772-182	Tool flange
O-ring	3HAC061327-051	Arm-side interface Replace if damaged.
Cable ties	-	

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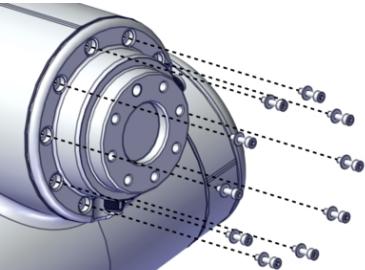
Removing the joint unit

Use these procedures to remove the joint unit.

Preparations before removing the joint unit

	Action	Note
1	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none"> • Axis 1: No significance. • Axis 2: No significance. • Axis 3: No significance. • Axis 4: No significance. • Axis 5: approximately +20° • Axis 6: 0° (home position) <p> CAUTION</p> <p>Jog the axis on which the joint unit is to be replaced to home position, to achieve correct cable routing during replacement of the joint unit.</p>	 xx2100000043
2	<p> CAUTION</p> <p>Turn off all supplies for electrical power to the robot, before starting the repair work.</p>	

Removing the tool flange

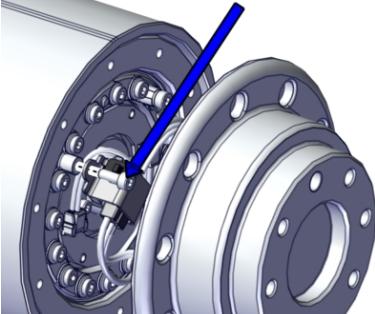
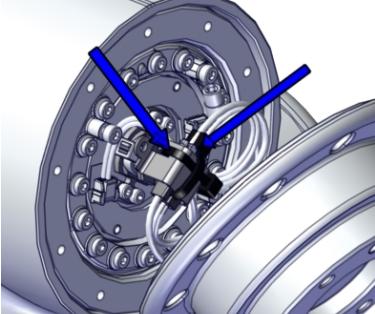
	Action	Note
1	Remove the tool flange screws and washers.	 xx2000002155
2	<p> CAUTION</p> <p>There is cabling connected between the cover and the joint unit drive board. Open the cover with care to avoid damage to the cabling or the connector(s). Do not leave the cover in location without being secured with the attachment screws.</p>	

Continues on next page

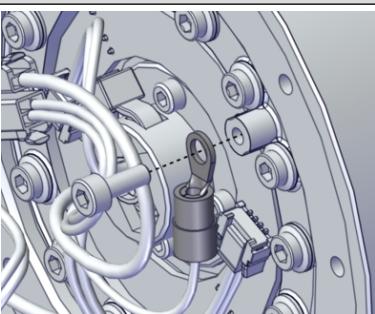
5 Repair

5.6.6 Replacing the axis-6 joint unit

Continued

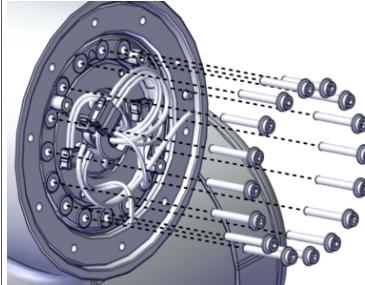
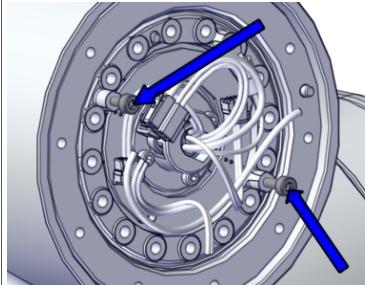
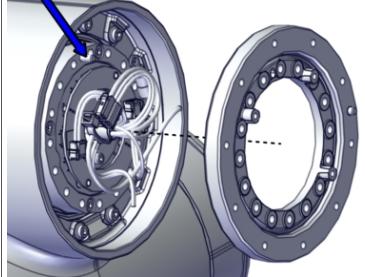
Action	Note
3 Loosen the tool flange and remove the cable bracket by removing the screw.	 xx2000002156
4 Cut the cable ties.	 xx2000002157
5 Disconnect the CP/CS connectors from the drive board and remove the tool flange.	 xx2000002158

Disconnecting the tool flange functional earth cable

Action	Note
1 Remove the functional earth cable by removing the screw.	 xx2000002159

Continues on next page

Removing the tool flange adapter

	Action	Note
1	Remove the tool flange adapter screws.	 xx2000002165
2	Press the adapter out of position by using two of the attachment screws as removal tools.	 xx2000002166
3	Remove the tool flange adapter.	 xx2000002167

Removing the arm-side interface

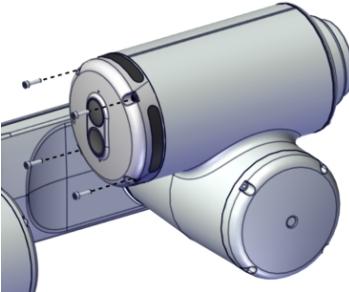
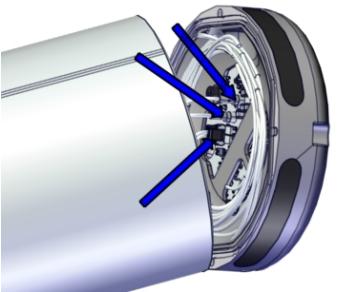
	Action	Note
1	 CAUTION Make sure that all supplies for electrical power are turned off.	
2	 CAUTION There is cabling connected between the arm-side interface and the joint unit drive board. Open the arm-side interface with care to avoid damage to the cabling or the connector(s). Do not leave the arm-side interface in location without being secured with the attachment screws.	

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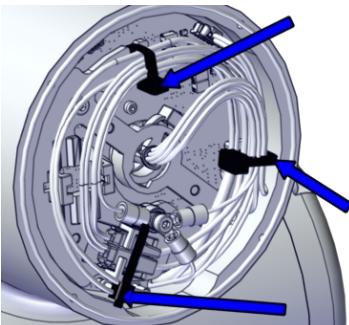
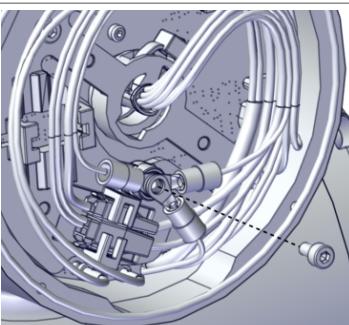
5 Repair

5.6.6 Replacing the axis-6 joint unit

Continued

Action	Note
3 Remove the attachment screws.	 xx2000002550
4 Loosen the arm-side interface carefully and disconnect the connectors from it. <ul style="list-style-type: none"> • ASI.DC+ • ASI.DC- • ASI.X1 	 xx2100000335

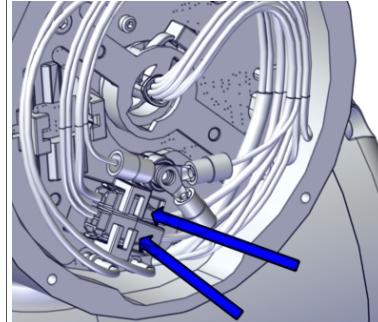
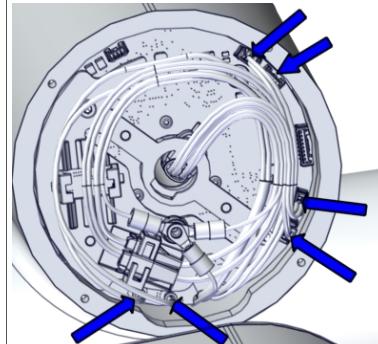
Disconnecting the axis-6 joint unit cabling

Action	Note
1 Cut the cable ties.	 xx2000002161
2 Remove the functional and protective earth cables by removing the screw.	 xx2000002162

Continues on next page

5.6.6 Replacing the axis-6 joint unit

Continued

Action	Note
3 Snap loose and disconnect the connectors: • J7.CS • J7.CP	 xx2000002163
4 Disconnect the connectors from the drive board. • D6.X1 • D6.DC+ • D6.DC- • D6.X4 • D6.X2 • D6.X5 Use tweezers, if needed.	Tweezers  xx2000002164

Removing the axis-6 joint unit

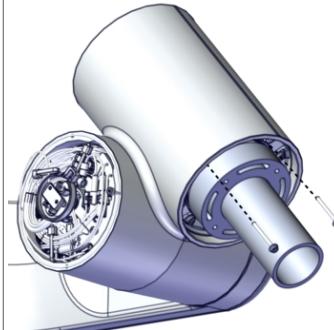
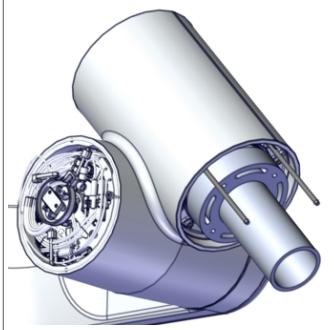
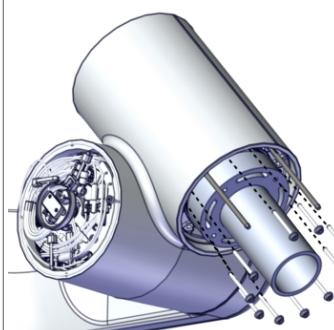
Action	Note
1 Fit the lifting aid to the joint unit, on the torque sensor side.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	Lifting aid: 3HAC077789-001 Screws: M3x12 (4 pcs)  xx2000002168 Position shown in the figure shows axis 5 jogged to +20°, which is a more convenient position when replacing only the axis-6 joint unit.

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5 Repair

5.6.6 Replacing the axis-6 joint unit

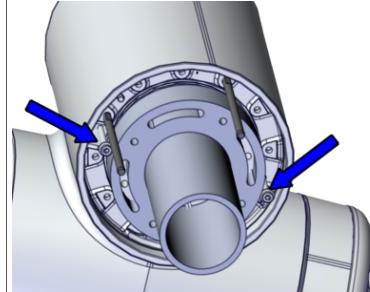
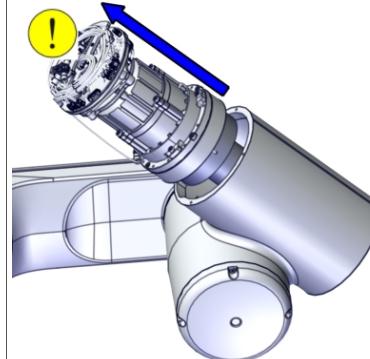
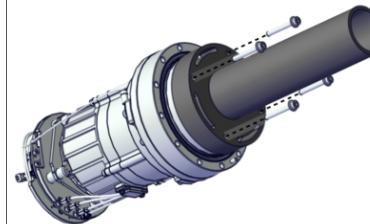
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	Action	Note
2	<p>Remove two attachment screws. Dispose the screws. New screws are included in the spare part delivery of the joint unit.</p>	 xx2000002170 Position shown in the figure shows axis 5 jogged to +20°, which is a more convenient position when replacing only the axis-6 joint unit.
3	<p>Fit two guide pins to the axis-6 joint unit.</p>	Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs. For joint units on axes 4, 5 and 6.  xx2100000328
4	<p>Remove the remaining attachment screws. Use two screws as press out screws in the upcoming step, then dispose all screws. New screws are included in the spare part delivery of the joint unit.</p>	 xx2100000329

Continues on next page

5.6.6 Replacing the axis-6 joint unit

Continued

Action	Note
5 Press the joint unit out of position using two of the previous attachment screws as removal tools.	 xx2100000330
6 Remove the joint unit from the tubular.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002169 Position shown in the figure shows axis 5 jogged to +20°, which is a more convenient position when replacing only the axis-6 joint unit.
7 Remove the lifting aid and guide pins.	 xx2000001957

Removing the joint cable

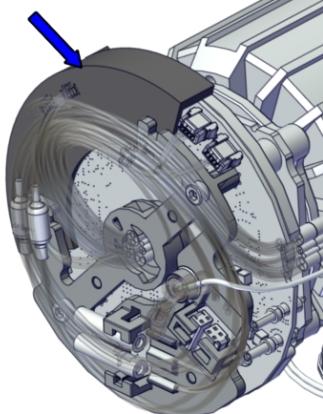
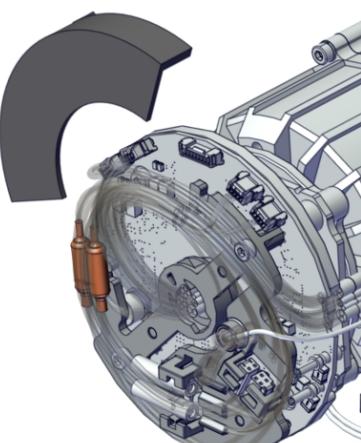
Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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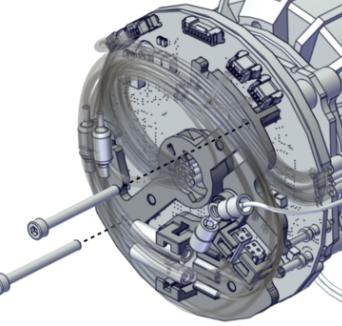
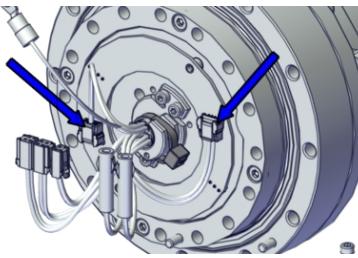
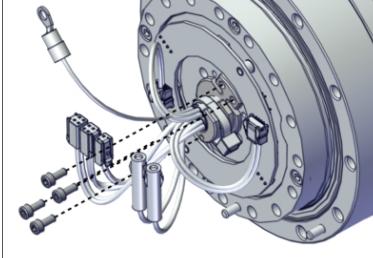
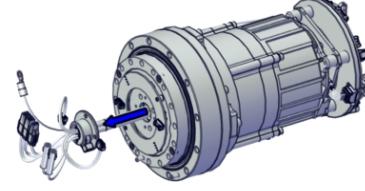
5 Repair

5.6.6 Replacing the axis-6 joint unit

Continued

	Action	Note
2	<p>Fit the protection plate to the drive board unit.</p> <p> Tip</p> <p>Using the protection plate is important for protecting the drive board unit. If complete joint unit is to be replaced, the protection plate is not needed.</p>	<p>Protection plate: 3HAC077790-001</p>  <p>xx2000002057</p>
3	Cut the cable tie at the drive board.	 <p>xx2000002058</p>
4	Remove the protection plate.	 <p>xx2100000301</p>

Continues on next page

	Action	Note
5	Remove the cable support from the drive board by removing the attachment screws.	 xx2000002055
6	Disconnect the two connectors from the torque sensor board. <ul style="list-style-type: none">• TQ.A• TQ.B	 xx2000002053
7	Remove the cable plate by removing the attachment screws.	 xx2000002049
8	Remove the joint cable from the hollow shaft from the torque sensor side.  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002060

Refitting the joint unit

Use these procedures to refit the joint unit.

Refitting the joint cable

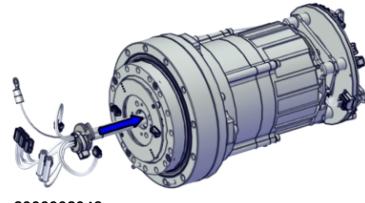
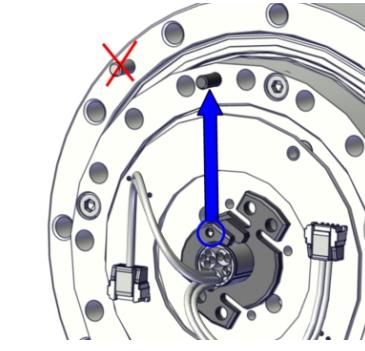
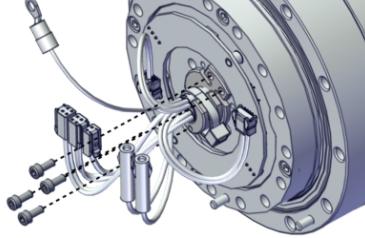
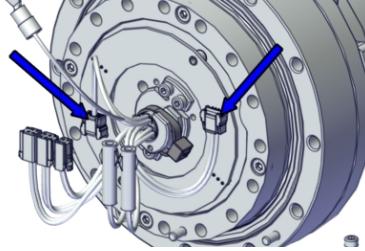
	Action	Note
1	 ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	

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5 Repair

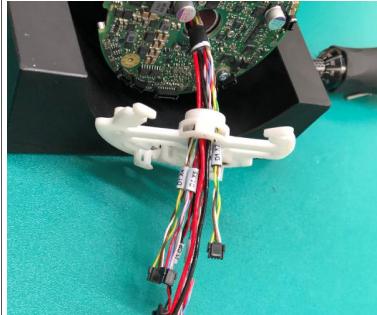
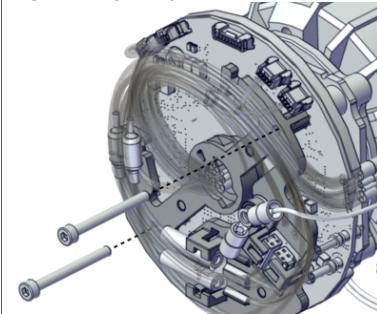
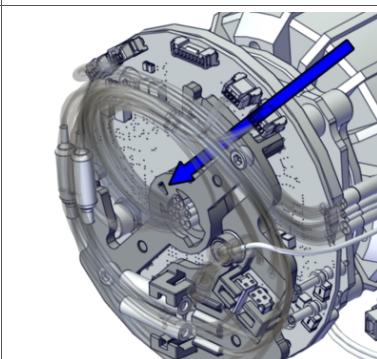
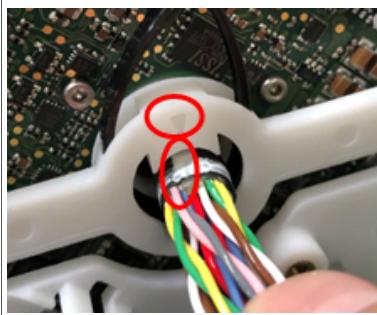
5.6.6 Replacing the axis-6 joint unit

Continued

	Action	Note
2	<p>Place the joint cable through the hollow shaft from the torque sensor side.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	 xx2000002048
3	<p>Orient the cable plate according to the figure. The circle on the cable plate should point towards the guide pin on the torque sensor.</p>	 xx2000002051
4	<p>Secure the cable plate to the joint unit with the attachment screws.</p>	<p>Hex socket head cap screw: M2.5x6 12.9 Gleitmo 603+Geomet 500 (4 pcs)</p> <p>Tightening torque: 0.45 Nm.</p>  xx2000002049
5	<p>Connect the two connectors to the torque sensor board.</p> <ul style="list-style-type: none"> • TQ.A to CH1/A • TQ.B to CH2/B 	 xx2000002053

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5.6.6 Replacing the axis-6 joint unit
Continued

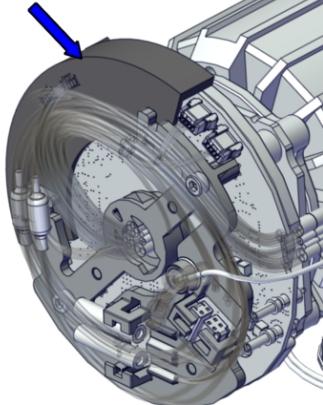
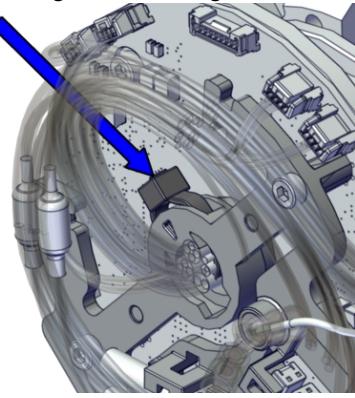
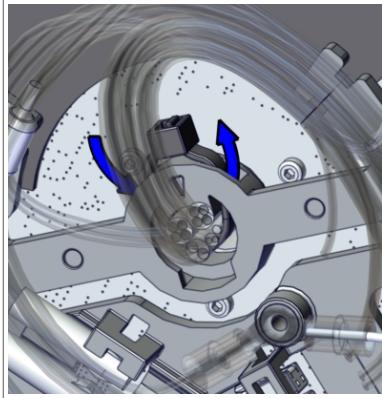
Action	Note
6 Insert the cabling through the cable support and fit the support to the drive board with the attachment screws.	 <p>xx2000002056</p> <p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (2 pcs)</p> <p>Tightening torque: 0.45 Nm.</p>  <p>xx2000002055</p>
7 Align the triangle direction mark on the cable support and the white mark on the cable harness. Use the cable tie to pre-fix the cable by hand.	 <p>xx2100000507</p>  <p>xx2100000508</p>

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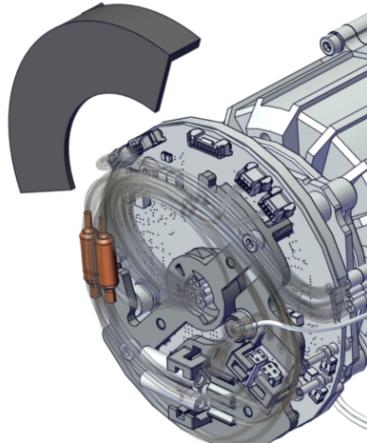
5 Repair

5.6.6 Replacing the axis-6 joint unit

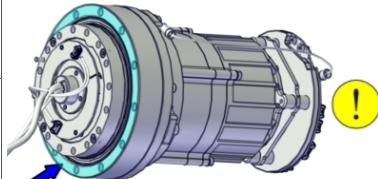
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	Action	Note
8	Fit the protection plate to the drive board unit.	<p>Protection plate: 3HAC077790-001</p>  <p>xx2000002057</p>
9	Secure the cables to the cable support with a cable tie, using a cable tie gun. Assembly direction for the cable tie is shown in the figure.	<p>Cable tie: 3HAC075545-001. For securing joint unit cable. Cable tie gun EVO7 Setting for cable tie gun: 6.75.</p>  <p>xx2000002058</p>  <p>xx2000002059</p>

Continues on next page

Action	Note
10 Remove the protection plate.	 xx2100000301

Preparations before fitting the joint unit

Action	Note
1  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	
2 Clean the mounting surface of the joint unit and the mating surface on the casting with isopropanol. Joint unit mounting surface is pointed out in the figure.	Cleaning agent: Isopropanol Flange sealant: Loctite 574
3  CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.  ELECTROSTATIC DISCHARGE (ESD) The unit is sensitive to ESD. Before handling the unit read the safety information in section The unit is sensitive to ESD on page 42 .	 xx2000001860

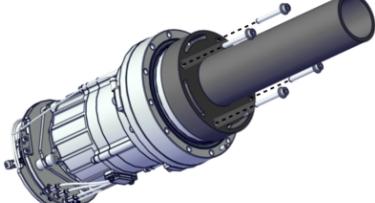
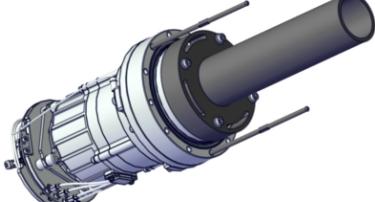
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5 Repair

5.6.6 Replacing the axis-6 joint unit

Continued

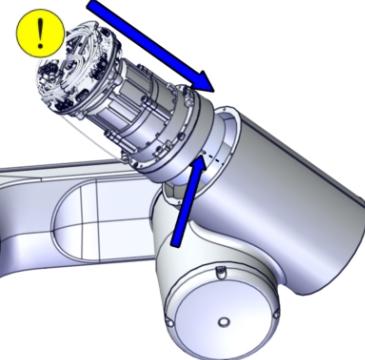
Refitting the axis-6 joint unit

	Action	Note
1	<p>Fit the lifting aid to the joint unit.</p> <p>CAUTION</p> <p>The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.</p>	<p>Joint unit: 3HAC079143-001 Lifting aid: 3HAC077789-001 Screws: M3x12 (4 pcs)</p>  <p>xx2000001957</p>
2	Fit two guide pins to the joint unit.	<p>Guide pin, M3x110: 3HAC077787-001 Always use guide pins in pairs. For joint units on axes 4, 5 and 6.</p>  <p>xx2000002438</p>
3	Place the cabling at the slot before refitting the joint unit.	 <p>xx2100000041</p>

Continues on next page

5.6.6 Replacing the axis-6 joint unit

Continued

Action	Note
4 Fit the joint unit to the tilt, aligning the pin with the pin hole. ! CAUTION The connectors and the joint unit cables are sensitive to mechanical damage. Handle the assembly with care.	 xx2000002195
5 Secure the joint unit with new attachment screws.	Hex socket head cap flange screw with glue: 3HAB3413-330 M3x30, 12 pcs Always use new screws when refitting a joint unit. If ordering a new joint unit spare part, new screws are included.  xx2100000329
6 Remove the guide pins and secure the remaining two attachment screws.	  xx2000002170
7 Pre-tighten the screws crosswise.	
8 Torque tighten all screws crosswise.	Tightening torque: 1.4 Nm.

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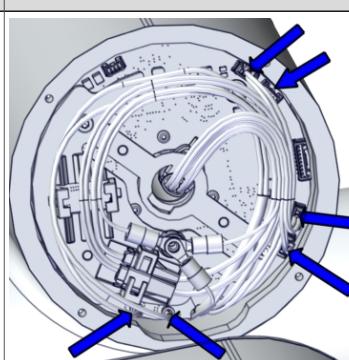
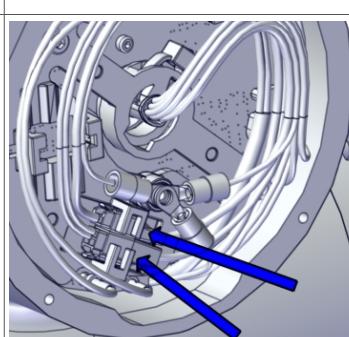
5 Repair

5.6.6 Replacing the axis-6 joint unit

Continued

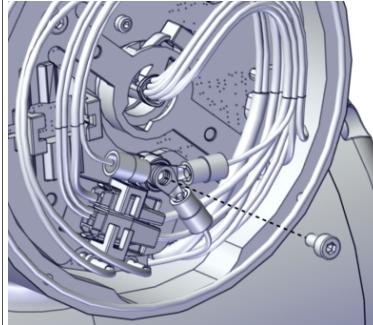
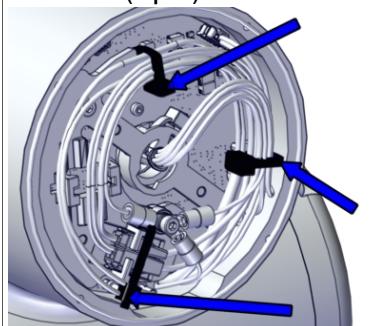
Action	Note
9 Remove the lifting aid by removing the screws.	 xx2000002168
10 Clean pushed-out flange sealant, if any.	

Connecting the axis-6 joint unit cabling

Action	Note
1 Reconnect the connectors to the drive board. <ul style="list-style-type: none">• D6.X1 to X1• D6.DC+ to +DC• D6.DC- to Ground• D6.X4 to X4• D6.X2 to X2• D6.X5 to X5	 xx2000002164
2 Connect the connectors to each other and snap them to the cable holders. <ul style="list-style-type: none">• J7.CS to J7.CS• J7.CP to J7.CP	 xx2000002163

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5.6.6 Replacing the axis-6 joint unit
Continued

	Action	Note
3	Secure the cables for functional earth and protective earth with a screw.	Hex socket head cap screw: M3x6 (1 pcs). Tightening torque: 0.8 Nm.  xx2000002162
4	Secure the cabling with cable ties.	Cable ties (3 pcs)  xx2000002161

Refitting the arm-side interface

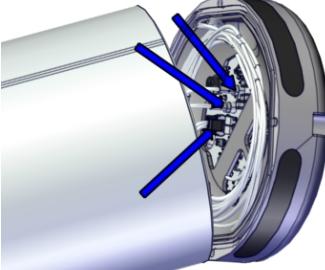
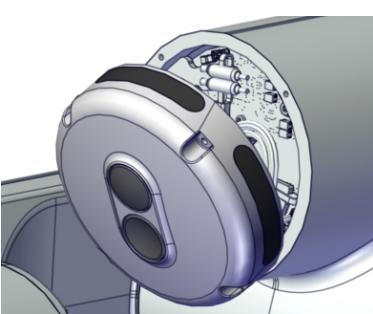
	Action	Note
1	Fit the o-ring to its groove. Replace if damaged.	O-ring: 3HAC061327-051  xx2000002551

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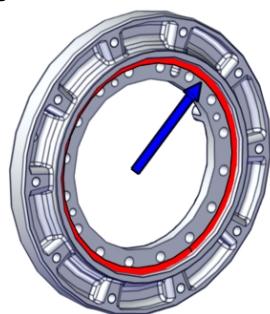
5 Repair

5.6.6 Replacing the axis-6 joint unit

Continued

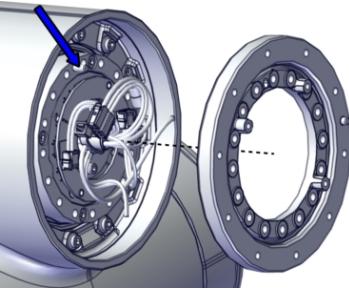
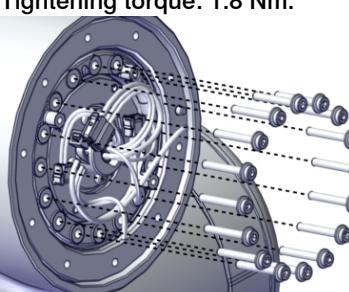
Action	Note
<p>2 Place the arm-side interface at mounting position and reconnect the connectors.</p> <ul style="list-style-type: none"> • ASI.DC+ • ASI.DC- • ASI.X1 <p>The correct orientation of the arm-side interface is with the convex button in upper position.</p> <p> Note</p> <p>Do not leave the arm-side interface in location without being secured with the attachment screws.</p>	 xx2100000335
<p>3 Refit the arm-side interface with four screws.</p>	<p>Hex socket head cap screw: M3x30 12.9 Gleitmo 603+Geomet 500 (4 pcs) Tightening torque: 0.45 Nm</p>  xx2000002550

Refitting the tool flange adapter

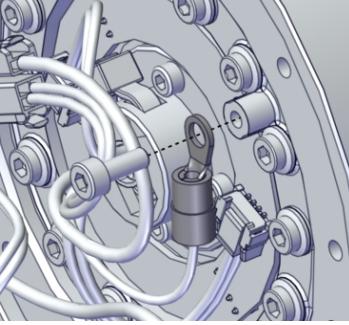
Action	Note
<p>1 Clean the mounting surface with isopropanol. Apply flange sealant to the corner of the adapter mounting surface, as pointed out in the figure.</p>	<p>Cleaning agent: Isopropanol Flange sealant: Loctite 574</p>  xx2000002196

Continues on next page

5.6.6 Replacing the axis-6 joint unit
Continued

	Action	Note
2	Refit the tool flange adapter, aligning the pin with the pin hole.	Axis-6 inner flange: 3HAC073952-001  xx2000002167
3	Secure with screws.	Hex socket head cap flange screw: M3x20 (16 pcs) Tightening torque: 1.8 Nm.  xx2000002165

Connecting the tool flange functional earth cable

	Action	Note
1	Secure the cable for functional earth to the tool flange adapter with a screw.	 xx2000002159

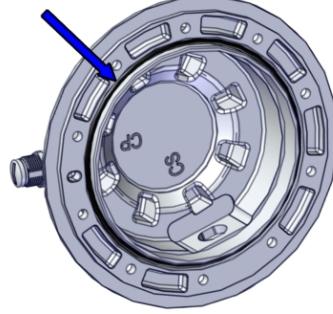
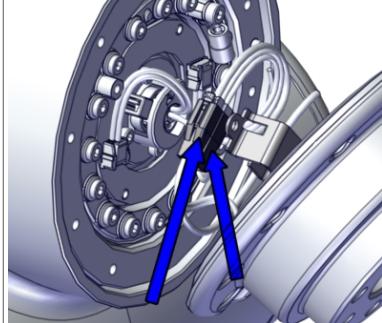
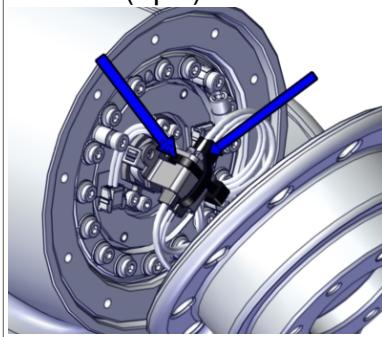
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5 Repair

5.6.6 Replacing the axis-6 joint unit

Continued

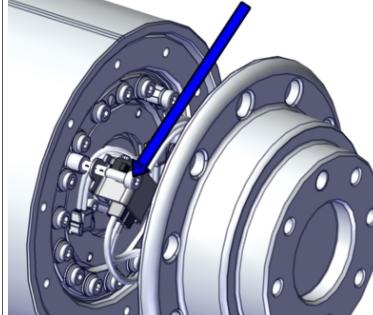
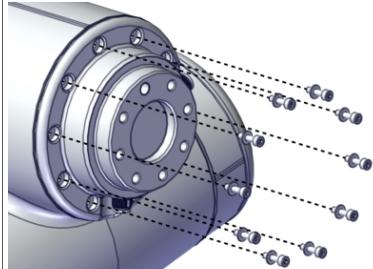
Refitting the tool flange

	Action	Note
1	<p>Check the o-ring on the tool flange and lubricate with grease.</p> <p>Replace if damaged.</p>	<p>Axis-6 flange: 3HAC073953-001 O-ring: 3HAB3772-182 Grease: 3HAC042536-001 (Shell Gadus S2)</p>  <p>xx2000002197</p>
2	Place the tool flange at mounting position and reconnect the CP/CS connectors.	 <p>xx2000002158</p>
3	Fit the connectors to the cable bracket and secure the connectors with two cable ties.	Cable ties (2 pcs)  <p>xx2000002157</p>

Continues on next page

5.6.6 Replacing the axis-6 joint unit

Continued

Action	Note
4 Refit the cable bracket with the screw.	Hex socket head cap screw: M3x20 12.9 Gleitmo 603+Geomet 500 (1 pcs) Tightening torque: 0.8 Nm.  xx2000002156
5 Refit and secure the tool flange with screws and washers.	Hex socket head cap screw: M3x12 12.9 Gleitmo 603+Geomet 500 (10 pcs) Spring washer: 7x3.2x0.6 Steel (10 pcs) Tightening torque: 1.8 Nm.  xx2000002155

Concluding procedure

Action	Note
1 Calibrate the joint unit torque sensor.	See Calibration on page 607
2  DANGER Make sure all safety requirements are met when performing the first test run.	

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6 Calibration

6.1 Calibrating the robot

Calibration after installation of robot

No calibration is needed at site at installation.

Calibration after repair of robot

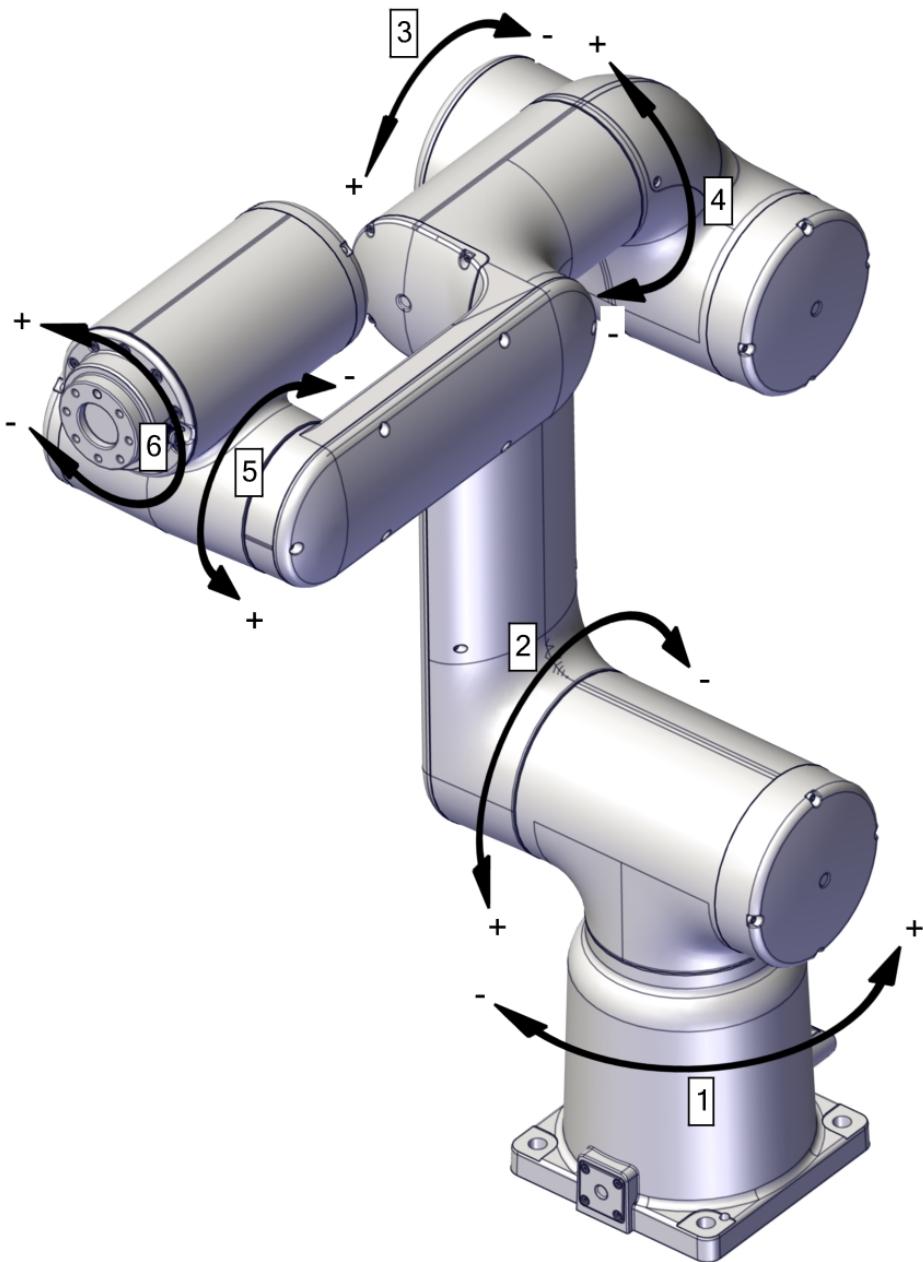
Replacement of mechanical parts that involve removal and refitting of the joint units, require torque sensor offset calibration. Contact ABB for more information.

6.2 Jogging directions

6.2 Jogging directions

Illustration of axis jogging directions

The figure shows the positive and negative directions for each axis when jogging the robot in the base coordinate system.



xx2000002400

7 Troubleshooting

7.1 Introduction to troubleshooting

Introduction

The product manual and the circuit diagram contains information that can be good when troubleshooting.

For OmniCore, all event logs from the software can be seen on the FlexPendant, or in *Technical reference manual - Event logs for RobotWare 7*.

Make sure to read through the section [Safety on page 15](#) before starting.

Troubleshooting strategies

- 1 Isolate the fault to pinpoint the cause of the problem from consequential problems.
- 2 Divide the fault chain in two.
- 3 Check communication parameters and cables.
- 4 Check that the software version is compatible with the hardware.

Work systematically

- 1 Take a look around to make sure that all screws, connectors, and cables are secured, and that the robot and other parts are clean, not damaged, and correctly fitted.
- 2 Replace one thing at a time.
- 3 Do not replace units randomly.
- 4 Make sure that there are no loose screws, turnings, or other unexpected parts remaining after work has been performed.
- 5 When the work is completed, verify that the safety functions are working as intended.

Keep a track of history

- Make a historical fault log to keep track of problems over time.
- Consult those working with the robot when the problem occurred.

Basic scenarios

What to look for during troubleshooting depends on when the fault occurred. Was the robot recently installed or was it recently repaired? The following table gives hints on what to look for in specific situations.

The robot has recently been installed	Check: <ul style="list-style-type: none">• the configuration files• connectors• options and their configuration• changes in the robot working area/movements.
---------------------------------------	--

Continues on next page

7 Troubleshooting

7.1 Introduction to troubleshooting

Continued

The robot has recently been repaired	Check: <ul style="list-style-type: none">• all connections to the replaced part• power supplies• that the correct part has been fitted• the last repair documents.
The robot recently had a software upgrade	Check: <ul style="list-style-type: none">• software versions• compatibilities between hardware and software• options and their configuration
The robot has recently been moved from one site to another (an already working robot)	Check: <ul style="list-style-type: none">• connections• software versions

7.2 Mechanical noise or dissonance

Description

Mechanical noise or dissonance that has not been observed before can indicate problems in bearings, motors, gearboxes, or similar. Be observant of changes over time.

A faulty bearing often emits scraping, grinding, or clicking noises shortly before failing.

Consequences

Failing bearings cause the path accuracy to become inconsistent, and in severe cases, the joint can seize completely.

Possible causes

The symptom can be caused by:

- Worn bearings.
- Contaminations have entered the bearing grooves.
- Loss of lubrication in bearings.
- Loose heat sinks, fans, or metal parts.

If the noise is emitted from a gearbox, the following can also apply:

- Overheating.

Recommended actions

The following actions are recommended:

	Action	Information
1	 CAUTION Allow hot parts to cool down.	
2	Verify that the service is done according to the maintenance schedule.	
3	If a bearing is emitting the noise, determine which one and make sure that it has sufficient lubrication.	
4	If possible, disassemble the joint and measure the clearance.	
5	Bearings inside motors are not to be replaced individually, but the complete motor is replaced.	
6	Make sure the bearings are fitted correctly.	
7	Tighten the screws if a heat sink, fan, or metal sheet is loose.	

Continues on next page

7 Troubleshooting

7.2 Mechanical noise or dissonance

Continued

	Action	Information
8	Too hot gearbox oil may be caused by: <ul style="list-style-type: none">• Incorrect oil quality or level.• The robot work cycle runs a specific axis too hard. Investigate whether it is possible to program small "cooling periods" into the application.• Overpressure created inside gearbox.	Robots performing certain, extremely heavy duty work cycles may be fitted with vented oil plugs. These are not fitted to normal duty robots, but can be purchased from your local ABB representative.

7.3 Manipulator collapses on power down

Description

The manipulator is able to work correctly while Motors ON is active, but when Motors OFF is active, one or more axes drops or collapses under its own weight.

The holding brakes (normally one in each motor), is not able to hold the weight of the manipulator arm.

Consequences

For a heavy robot, the collapse can cause severe injury to personnel working in the area or severe damage to the robot and/or surrounding equipment.

For a small robot, the collapse can cause injury to personnel working close to the robot or damage to the robot and/or surrounding equipment.

Possible causes

The symptom can be caused by:

- Faulty brake.
- Faulty power supply to the brake.

Recommended actions

The following actions are recommended:

	Action	Information
1	Determine which motor(s) causes the robot to collapse.	
2	Check the brake power supply to the collapsing motor during the Motors OFF state.	See the circuit diagram. Check for any recorded fault status.

7 Troubleshooting

7.4 Brake release tool does not work

7.4 Brake release tool does not work

Description

The holding brake of a motor is not released using the brake release tool.

Consequences

The robot axis can not be manually moved.

Possible causes

The symptom can be caused by:

- Damaged magnet on the brake release tool.
- Faulty power supply to the brake.
- Incorrect usage of the brake release tool:
 - There has been an attempt to use the brake release mechanism while the robot is in mode MOTORS ON
 - There has been an attempt to use the brake release mechanism while the manipulator is moving.
 - There has been a very brief application of the magnet to the brake release points (e.g. by accident).
- Faulty joint electronic hardware.

Recommended actions

The following actions are recommended:

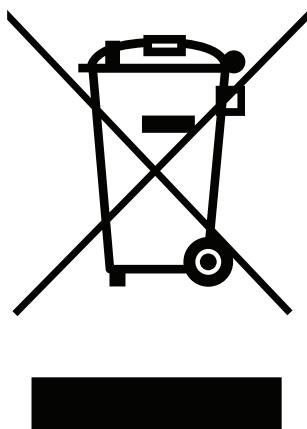
	Action	Information
1	Look for damage to the magnet. Replace the tool if damaged.	Brake release tool: 3HAC077146-001
2	Verify that the brake release tool is used correctly.	See Manually releasing the brakes on page 50 .
3	Check the brake power supply to the motor during the Motors OFF state.	See the circuit diagram. Check for any recorded fault status.
4	Reset the brake release software as follows: <ol style="list-style-type: none">1 Turn off electrical power supply to the robot.2 Turn on electrical power supply to the robot, without enabling the motors, and perform following step within 30 minutes.3 Wait for at least 5 seconds after power has been turned on, then put the brake release tool against the brake release point on the joint and hold for 2-4 seconds. Remove the brake release tool and wait for at least 2 seconds. Software is reset. Any error code is removed from the FlexPendant.4 Test the brake release function using the brake release tool against the brake release point on the joint. If the brake still does not release, repeat the reset cycle steps 3 and 4. Five (5) attempts are allowed in total to reset the brake release. If desired, the process can be repeated from step 1. If the brake still does not release, replace the hardware.	

8 Decommissioning

8.1 Environmental information

Symbol

The following symbol indicates that the product must not be disposed of as common garbage. Handle each product according to local regulations for the respective content (see table below).



xx1800000058

Hazardous material

The table specifies some of the materials in the product and their respective use throughout the product.

Dispose components properly according to local regulations to prevent health or environmental hazards.

Material	Example application
Aluminium	Base, lower arm, upper arm
Copper	Cables, motors, brakes
Electronics	PCBAs, sensors, brake release unit
Neodymium	Motors, brake release tool
Nickel	Tool flange, protection cap
Oil, grease	Gearboxes
Plastic/rubber	Cables, connectors, holder, covers, and so on
Steel	Gears, screws, sheet metals, brackets

Continues on next page

8 Decommissioning

8.1 Environmental information

Continued

China RoHS symbol

The following symbol shows the information to hazardous substances and the environmental protection use period of CRB 15000 according to "Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products (SJ/T 11364-2014) ".



xx1900000803

Green symbol with "e" in it: The product does not contain any hazardous substances exceeding concentration limits and is a green environmentally friendly product which can be recycled.

Oil and grease

Where possible, arrange for oil and grease to be recycled. Dispose of via an authorized person/contractor in accordance with local regulations. Do not dispose of oil and grease near lakes, ponds, ditches, down drains, or onto soil. Incineration must be carried out under controlled conditions in accordance with local regulations.

Also note that:

- Spills can form a film on water surfaces causing damage to organisms.
Oxygen transfer could also be impaired.
- Spillage can penetrate the soil causing ground water contamination.

8.2 Scrapping of robot

Important when scrapping the robot



DANGER

When a robot is disassembled while being scrapped, it is very important to remember the following before disassembling starts, in order to prevent injuries:

- Always remove all 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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9 Reference information

9.1 Introduction

General

This chapter includes general information, complementing the more specific information in the different procedures in the manual.

9 Reference information

9.2 Applicable standards



Note

The listed standards are valid at the time of the release of this document. Phased out or replaced standards are removed from the list when needed.

General

The product is designed in accordance with ISO 10218-1:2011, Robots for industrial environments - Safety requirements -Part 1 Robots, and applicable parts in the normative references, as referred to from ISO 10218-1:2011. In case of deviations from ISO 10218-1:2011, these are listed in the declaration of incorporation which is part of the product delivery.

Normative standards, ISO

Standard	Description
ISO 9283:1998	Manipulating industrial robots - Performance criteria and related test methods
ISO 10218-2	Robots and robotic devices - Safety requirements for industrial robots - Part 2: Robot systems and integration
ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
ISO 13849-1:2006	Safety of machinery - Safety related parts of control systems - Part 1: General principles for design
ISO 13850	Safety of machinery - Emergency stop - Principles for design
IEC 60204-1:2005	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
IEC 62061:2005	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems

Region specific standards and regulations

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
ANSI/UL 1740	Safety standard for robots and robotic equipment
CAN/CSA Z 434-14	Industrial robots and robot Systems - General safety requirements

Other standards used in design

Standard	Description
ISO 9787:2013	Robots and robotic devices -- Coordinate systems and motion nomenclatures
IEC 61000-6-2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
IEC 61000-6-4 (option 129-1)	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments

Continues on next page

Standard	Description
ISO 13732-1:2008	Ergonomics of the thermal environment - Part 1
ISO 14644-1:2015 ⁱ	Classification of air cleanliness
IEC 60529:1989 + A2:2013	Degrees of protection provided by enclosures (IP code)
ISO/TS 15066	Robots and robotic devices - Safety requirements - Industrial collaborative workspace

ⁱ Only robots with protection Clean Room.

9 Reference information

9.3 Unit conversion

9.3 Unit conversion

Converter table

Use the following table to convert units used in this manual.

Quantity	Units		
Length	1 m	3.28 ft.	39.37 in
Weight	1 kg	2.21 lb.	
Weight	1 g	0.035 ounces	
Pressure	1 bar	100 kPa	14.5 psi
Force	1 N	0.225 lbf	
Moment	1 Nm	0.738 lbf-ft	
Volume	1 L	0.264 US gal	

9.4 Screw joints

General

This section describes how to tighten the various types of screw joints on ABB robots.

The instructions and torque values are valid for screw joints comprised of metallic materials and do *not* apply to soft or brittle materials.

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.

Tightening torque

Before tightening any screw, note the following:

- **Special torques** are specified in the repair, maintenance or installation procedure descriptions. **Any special torque specified overrides a standard torque!**
- Use the *correct tightening torque* for each type of screw joint.
- Only use *correctly calibrated* torque keys.
- Always *tighten the joint by hand*, and never use pneumatic tools.
- Use the *correct tightening technique*, that is *do not jerk*. Tighten the screw in a slow, flowing motion.
- Maximum allowed total deviation from the specified value is **10%**!

9 Reference information

9.5 Weight specifications

9.5 Weight specifications

Definition

In installation, repair, and maintenance procedures, weights of the components handled are sometimes specified. All components exceeding 22 kg (50 lbs) are highlighted in this way.

To avoid injury, ABB recommends the use of a lifting accessory when handling components with a weight exceeding 22 kg. A wide range of lifting accessories and devices are available for each manipulator model.

Example

Following is an example of a weight specification in a procedure:

	Action	Note
	 CAUTION The arm weighs 25 kg. All lifting accessories used must be sized accordingly.	

9.6 Standard toolkit

General

All service (repairs, maintenance, and installation) procedures contains lists of tools required to perform the specified activity.

All special tools required are listed directly in the procedures while all the tools that are considered standard are gathered in the standard toolkit and defined in the following table.

This way, the tools required are the sum of the standard toolkit and any tools listed in the instruction.

Contents, standard toolkit

Qty	Tool	Note
1	Torque wrench, 0.2-4.6 Nm	
1	Hexagon bit socket head cap, size 1.5 mm	
1	Hexagon bit socket head cap, size 2 mm	
1	Hexagon bit socket head cap, size 2.5 mm	
1	Hexagon bit socket head cap, size 3 mm	
1	Tweezer	
1	Cable ties	

9 Reference information

9.7 Special tools

9.7 Special tools

General

All service instructions contain lists of tools required to perform the specified activity. The required tools are a sum of standard tools, defined in the section [*Standard toolkit on page 625*](#), and of special tools, listed directly in the instructions and also gathered in this section.

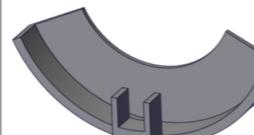
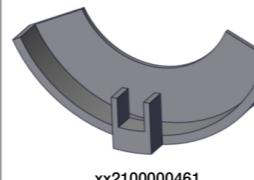
Special tools



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 cabling	Axis-2 cabling	Axis-3 cabling	Axis-4 cabling	Axis-5 cabling	Axis-6 cabling	Axis-5 to axis-6 transition cabling	Lower arm	Housing	Tubular	Wrist housing	Base	Swing	Axis-1 joint unit	Axis-2 joint unit	Axis-3 joint unit	Axis-4 joint unit	Axis-5 joint unit	Axis-6 joint unit
Lifting accessories																					
Lifting aid	3HAC077788-001	 xx2100000465	1							1			1	1	1	1	1	1	1	1	
Lifting aid	3HAC077789-001	 xx2100000464							1		1	1					1	1	1		
Guiding tools																					
Guide pin, M4x120	3HAC077786-001	 xx2100000463	2							2	2		2	2	2	2	2	2	2	2	
Guide pin, M3x110	3HAC077787-001	 xx2100000462							2		2	2					2	2	2	2	
Other tools																					
Cable tie gun EVO7	-		1	1	1	1	1	1	1				1	1		1	1	1	1	1	1
Protection plate	3HAC077790-001	 xx2100000461	1	1	1	1	1	1	1				1	1		1	1	1	1	1	1

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ABB AB
Robotics & Discrete Automation
S-721 68 VÄSTERÅS, Sweden
Telephone +46 (0) 21 344 400

ABB AS
Robotics & Discrete Automation
Nordlysvegen 7, N-4340 BRYNE, Norway
Box 265, N-4349 BRYNE, Norway
Telephone: +47 22 87 2000

ABB Engineering (Shanghai) Ltd.
Robotics & Discrete Automation
No. 4528 Kangxin Highway
PuDong District
SHANGHAI 201319, China
Telephone: +86 21 6105 6666

ABB Inc.
Robotics & Discrete Automation
1250 Brown Road
Auburn Hills, MI 48326
USA
Telephone: +1 248 391 9000

abb.com/robotics