

ROBOTICS

# Product manual

## IRB 1010



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**Product manual**  
**IRB 1010-1.5/0.370**

OmniCore

Document ID: 3HAC081964-001

Revision: E

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Original instructions.

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# Overview of this manual

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## About this manual

This manual contains instructions for:

- mechanical and electrical installation of the IRB 1010
- maintenance of the IRB 1010
- mechanical and electrical repair of the IRB 1010

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

- *Standard*
- 

## Usage

This manual should be used during:

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



### Note

It is the responsibility of the integrator to conduct a risk assessment of the final application.

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

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## 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.
- 

## Product manual scope

The manual covers all variants and designs of the IRB 1010. Some variants and designs may have been removed from the business offer and are no longer available for purchase.

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## References

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

Document name	Document ID
<i>Product manual, spare parts - IRB 1010</i>	3HAC081965-001
<i>Product specification - IRB 1010</i>	3HAC081966-001
<i>Circuit diagram - IRB 1010</i>	3HAC080051-003
<i>Safety manual for robot - Manipulator and IRC5 or OmniCore controller<sup>i</sup></i>	3HAC031045-001
<i>Product manual - OmniCore E10</i>	3HAC079399-001
<i>Operating manual - OmniCore</i>	3HAC065036-001
<i>Application manual - Controller software OmniCore</i>	3HAC066554-001
<i>Technical reference manual - Event logs for RobotWare 7</i>	3HAC066553-001
<i>Technical reference manual - Lubrication in gearboxes</i>	3HAC042927-001
<i>Technical reference manual - System parameters</i>	3HAC065041-001

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

## Revisions

Revision	Description
A	First edition.
B	Published in release 22D. The following updates are done in this revision: <ul style="list-style-type: none"> <li>• Added information about Wrist Optimization in calibration chapter.</li> <li>• Updated the description about calibration tool used for axis calibration.</li> <li>• Updated the procedure of securing the cable package in axis 4 during spare part replacement.</li> <li>• Minor editorial changes.</li> </ul>
C	Published in release 23A. The following updates are done in this revision: <ul style="list-style-type: none"> <li>• Added table with specified values for axes angles of most stable transportation position.</li> <li>• Added information about first test run.</li> </ul>
D	Published in release 23C. The following updates are done in this revision: <ul style="list-style-type: none"> <li>• Updated article number of robot signal cable from 3HAC067446-00X to 3HAC084767-00X.</li> <li>• Updated maintenance interval for robot overhaul.</li> </ul>
E	Published in release 24A. The following updates are done in this revision: <ul style="list-style-type: none"> <li>• Added troubleshooting about robot vibration.</li> </ul>

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# Product documentation

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## 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](http://www.abb.com/myABB).

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## Product manuals

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

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

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## Technical reference manuals

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

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## Application manuals

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

An application manual generally contains information about:

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

*Continues on next page*

- Examples of how to use the application.

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### 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

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## 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

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#### Limitation of liability

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

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

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

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

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#### Spare parts and equipment

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

# 1 Safety

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## 1.1.2 Requirements on personnel

### 1.1.2 Requirements on personnel

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#### General

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

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

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

---

#### Personal protective equipment

Use personal protective equipment, as stated in the instructions.



## 1.2 Safety signals and symbols

### 1.2.1 Safety signals in the manual







#### Introduction to safety signals

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

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

#### Hazard levels

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

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


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# 1 Safety

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## 1.2.1 Safety signals in the manual

*Continued*

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

## 1.2.2 Safety symbols on manipulator labels

### Introduction to symbols

This section describes safety symbols used on labels (stickers) on the manipulator. Symbols are used in combinations on the labels, describing each specific warning. The descriptions in this section are generic, the labels can contain additional information such as values.



#### Note

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




### Types of symbols

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

The safety labels are language independent, they only use graphics. See [Symbols on safety labels on page 19](#).

The information labels can contain information in text.

### Symbols on safety labels

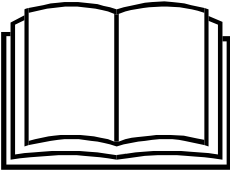
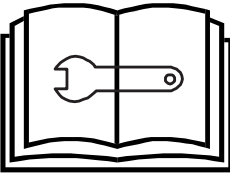
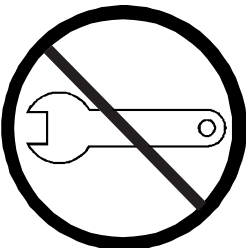
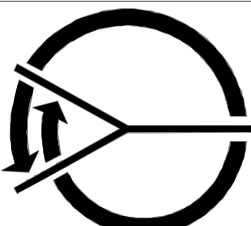

Symbol	Description
 xx0900000812	<p><b>Warning!</b></p> <p>Warns that an accident <i>may</i> occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high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

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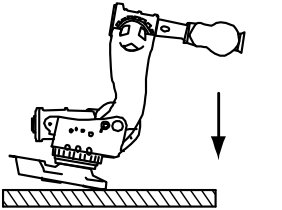

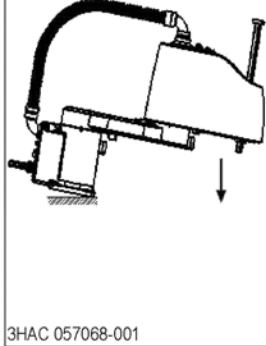
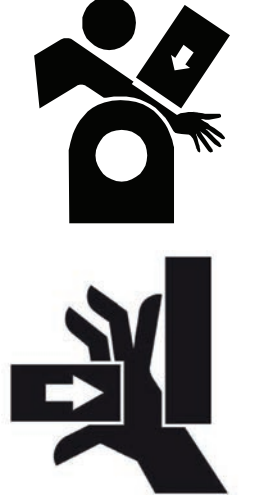

# 1 Safety

## 1.2.2 Safety symbols on manipulator labels

Continued

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



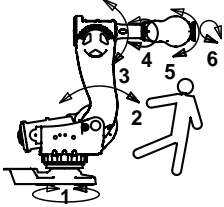
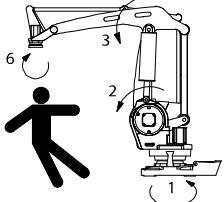
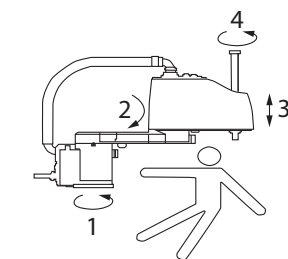
Continues on next page

Symbol	Description
 <p>xx0900000810</p>   <p>3HAC 057068-001</p> <p>xx1500002402</p>	<p><b>Tip risk when loosening bolts</b> The robot can tip over if the bolts are not securely fastened.</p>
  <p>xx0900000817</p>	<p><b>Crush</b> Risk of crush injuries.</p>

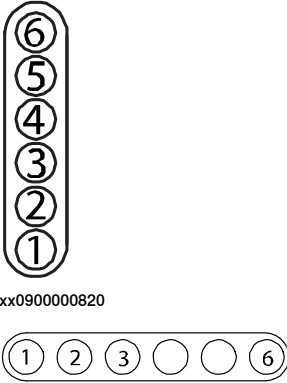

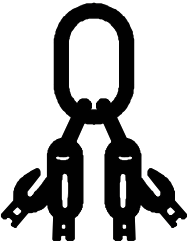



# 1 Safety

## 1.2.2 Safety symbols on manipulator labels

Continued

Symbol	Description
 <p>xx0900000818</p>  <p>xx1300001087</p>	<b>Heat</b> Risk of heat that can cause burns. (Both signs are used)
 <p>xx0900000819</p>  <p>xx1000001141</p>  <p>xx1500002616</p>	<b>Moving robot</b> The robot can move unexpectedly.

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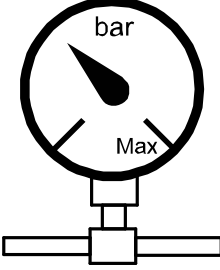
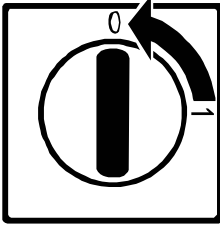

Symbol	Description
 <p>xx0900000820</p> <p>xx1000001140</p>	<p><b>Brake release buttons</b></p>
 <p>xx0900000821</p>	<p><b>Lifting bolt</b></p>
 <p>xx1000001242</p>	<p><b>Adjustable chain sling with shortener</b></p>
 <p>xx0900000822</p>	<p><b>Lifting of robot</b></p>
 <p>xx0900000823</p>	<p><b>Oil</b> Can be used in combination with prohibition if oil is not allowed.</p>
 <p>xx0900000824</p>	<p><b>Mechanical stop</b></p>

Continues on next page

# 1 Safety

## 1.2.2 Safety symbols on manipulator labels

Continued

Symbol	Description
 xx1000001144	<b>No mechanical stop</b>
 xx0900000825	<b>Stored energy</b> Warns that this part contains stored energy. Used in combination with <i>Do not disassemble</i> symbol.
 xx0900000826	<b>Pressure</b> Warns that this part is pressurized. Usually contains additional text with the pressure level.
 xx0900000827	<b>Shut off with handle</b> Use the power switch on the controller.
 xx1400002648	<b>Do not step</b> Warns that stepping on these parts can cause damage to the parts.



### 1.3 Robot stopping functions

---

#### Protective stop and emergency stop

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

For more information see:

- *Product manual - OmniCore C30*
- *Product manual - OmniCore E10*

# 1 Safety

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## 1.4 Safety during installation and commissioning

### 1.4 Safety during installation and commissioning

---

#### National or regional regulations

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

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

The integrator of the robot system is required to perform a risk assessment.

---

#### Layout

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

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

If the manipulator is delivered with mechanical stops, these can be used for reducing the working space.

A perimeter safeguarding, for example a fence, shall be dimensioned to withstand the following:

- The force of the manipulator.
- The force of the load handled by the robot if dropped or released at maximum speed.
- The maximum possible impact caused by a breaking or malfunctioning rotating tool or other device fitted to the robot.

The maximum TCP speed and the maximum velocity of the robot axes are detailed in the section *Robot motion* in the product specification for the respective manipulator.

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

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

Hazards due to noise emission from the robot needs to be considered.

Consider hazards from other equipment in the robot system, for example, that guards remain active until identified hazards are reduced to an acceptable level.

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#### Allergenic material

See [Environmental information on page 320](#) for specification of allergenic materials in the product, if any.

---

#### Securing the robot to the foundation

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

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

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### Using lifting accessories and other external equipment

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

### Electrical safety

Incoming mains must be installed to fulfill national regulations.

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

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

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

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



#### Note

Use a CARBON DIOXIDE (CO<sub>2</sub>) extinguisher in the event of a fire in the robot.

### Safety devices

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

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

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

### Other hazards

A robot may perform unexpected limited movement.



#### WARNING

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

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

- Water
- Compressed air
- Hydraulics

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

*Continues on next page*

# 1 Safety

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## 1.4 Safety during installation and commissioning

*Continued*

---

### **Verify the safety functions**

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

### 1.5 Safety during operation

#### Automatic operation

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

#### Unexpected movement of robot arm



#### WARNING

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

A robot may perform unexpected limited movement.



#### WARNING

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

# 1 Safety

## 1.6.1 Safety during maintenance and repair

## 1.6 Safety during maintenance and repair

### 1.6.1 Safety during maintenance and repair

#### General

Corrective maintenance must only be carried out by personnel trained on the robot. Maintenance or repair must be done with all electrical, pneumatic, and hydraulic power switched off, that is, no remaining hazards.

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

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


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

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

#### Hot surfaces

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

#### Allergic reaction

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


#### Gearbox lubricants (oil or grease)

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







#### Note

Take special care when handling hot lubricants.

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

Continues on next page

Warning	Description	Elimination/Action
 <b>Allergic reaction</b>	When working with lubricants there is a risk of an allergic reaction.	Make sure that protective gear like goggles and gloves are always worn.
 <b>Possible pressure build-up in gearbox</b>	When opening the oil or grease plug, there may be pressure present in the gearbox, causing lubricant to spray from the opening.	Open the plug carefully and keep away from the opening. Do not overfill the gearbox when filling.
 <b>Do not overfill</b>	Overfilling of gearbox lubricant can lead to internal over-pressure inside the gearbox which in turn may: <ul style="list-style-type: none"> <li>• damage seals and gaskets</li> <li>• completely press out seals and gaskets</li> <li>• prevent the robot from moving freely.</li> </ul>	Make sure not to overfill the gearbox when filling it with oil or grease. After filling, verify that the level is correct.
 <b>Specified amount depends on drained volume</b>	The specified amount of oil or grease is based on the total volume of the gearbox. When changing the lubricant, the amount refilled may differ from the specified amount, depending on how much has previously been drained from the gearbox.	After filling, verify that the level is correct.

### Hazards related to batteries

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


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

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

Operating temperatures are listed in [Operating conditions, robot on page 41](#).

See safety instructions for the batteries in *Material/product safety data sheet - Battery pack (3HAC043118-001)*.

### Unexpected movement of robot arm



**WARNING**

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

*Continues on next page*

# 1 Safety

---

## 1.6.1 Safety during maintenance and repair

*Continued*

A robot may perform unexpected limited movement.



### **WARNING**

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

---

### **Related information**

See also the safety information related to installation and operation.



### 1.6.2 Emergency release of the robot axes

#### Description

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

How to release the brakes is described in the section:

- [Manually releasing the brakes on page 56](#).

The robot may be moved manually on smaller robot models, but larger models may require using an overhead crane or similar equipment.

#### Increased injury

Before releasing the brakes, make sure that the weight of the manipulator does not result in additional hazards, for example, even more severe injuries on a trapped person.



#### **DANGER**

When releasing the holding brakes, the robot axes may move very quickly and sometimes in unexpected ways.

Make sure no personnel is near or beneath the robot.

# 1 Safety

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## 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

It is recommended to run the service routine *BrakeCheck* as part of the regular maintenance, see the operating manual for the robot controller.

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

### 1.7 Safety during troubleshooting

#### General

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

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



#### **DANGER**

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

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



#### **WARNING**

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

A robot may perform unexpected limited movement.



#### **WARNING**

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

#### Related information

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

# 1 Safety

---

## 1.8 Safety during decommissioning

### 1.8 Safety during decommissioning

---

#### General

See section [Decommissioning on page 319](#).

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

---

#### Unexpected movement of robot arm



#### WARNING

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

A robot may perform unexpected limited movement.



#### WARNING

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

## 2 Manipulator description

### 2.1 About IRB 1010

---

#### Introduction

The IRB 1010 is one of ABB Robotics latest generation of 6-axis robot, with a payload of 1.5 kg, designed specifically for manufacturing industries that use flexible robot-based automation, e.g. 3C industry. The robot has an open structure that is especially adapted for flexible use, and can communicate extensively with external systems. Benefit from its smaller size and lighter weight, the IRB 1010 is easy for deployment and suitable for manufacturing processes in limited spaces, e.g. film peeling.

The robot can be equipped with OmniCore E10 or OmniCore C30 controllers and with robot control software, RobotWare 7.

## 2 Manipulator description

---

### 2.2 Technical data

### 2.2 Technical data

---

#### Weight, robot

The table shows the weight of the robot.

Robot model	Nominal weight
IRB 1010	13.5 kg



#### Note

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

#### Mounting positions

The table shows valid mounting positions and the installation (mounting) angle for the manipulator.

Mounting position	Installation angle
Floor mounted	0° <sup>i</sup>
Suspended	180°

<sup>i</sup> A tilt of up to 5° does not affect the payload or reach, but it can have a negative impact on performance and lifetime. The actual value must be set in the system parameters.



#### Note

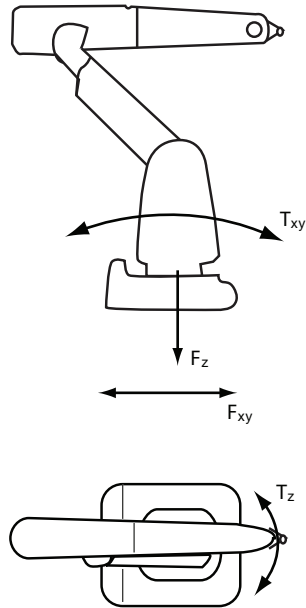
The actual mounting angle must always be configured in the system parameters, otherwise the performance and lifetime is affected. See [Setting the system parameters for an inverted or a tilted robot on page 58](#).

#### Loads on foundation, robot

The illustration shows the directions of the robots stress forces.

*Continues on next page*

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



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

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



#### Note

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



#### WARNING

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

#### Floor mounted

Force	Endurance load (in operation)	Maximum load (emergency stop)
Force xy	150 N	264 N
Force z	200 N	353 N
Torque xy	70 Nm	121 Nm
Torque z	30 Nm	51 Nm

*Continues on next page*

## 2 Manipulator description

### 2.2 Technical data


Continued

Suspended

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	150 N	340 N
Force z	340 N	493 N
Torque xy	70 Nm	121 Nm
Torque z	30 Nm	51 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	Flat foundations give better repeatability of the resolver calibration compared to original settings on delivery from ABB. The value for levelness aims at the circumstance of the anchoring points in the robot base. In order to compensate for an uneven surface, the robot can be recalibrated during installation. If resolver/encoder calibration is changed this will influence the absolute accuracy.
Minimum resonance frequency	22 Hz  <b>Note</b> It may affect the manipulator lifetime to have a lower resonance frequency than recommended.	The value is recommended for optimal performance. Due to foundation stiffness, consider robot mass including equipment. <sup>i</sup> For information about compensating for foundation flexibility, see the description of <i>Motion Process Mode</i> in the manual that describes the controller software option, see <a href="#">References on page 10</a> .
Minimum foundation material yield strength	150 MPa	

<sup>i</sup> 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 possible to the floor.

Disturbances from other machinery will affect the robot and the tool accuracy. The robot has resonance frequencies in the region 10 – 20 Hz and disturbances in this region will be amplified, although somewhat damped by the servo control. This might be a problem, depending on the requirements from the applications. If this is a problem, the robot needs to be isolated from the environment.

### Storage conditions, robot

The table shows the allowed storage conditions for the robot:

Parameter	Value
Minimum ambient temperature	-25 °C (-13 °F)
Maximum ambient temperature	+55 °C (+131 °F)
Maximum ambient temperature (less than 24 hrs)	+70 °C (+158 °F)

Continues on next page



Parameter	Value
Maximum ambient humidity	95% at constant temperature (gaseous only)

#### Operating conditions, robot

The table shows the allowed operating conditions for the robot:

Parameter	Value
Minimum ambient temperature	0 °C <sup>i</sup> (32 °F)
Maximum ambient temperature	+45 °C (113 °F)
Maximum ambient humidity	95% at constant temperature

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

#### Protection classes, robot

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

Protection type	Protection class <sup>i</sup>
Manipulator, protection type Standard	IP40 <sup>ii</sup>

<sup>i</sup> According to IEC 60529.

<sup>ii</sup> The IRB 1010 has IP40 as default. And the IRB 1010 fulfill clean room class 5 standard according to DIN EN ISO14644-1, -14.

#### Environmental information

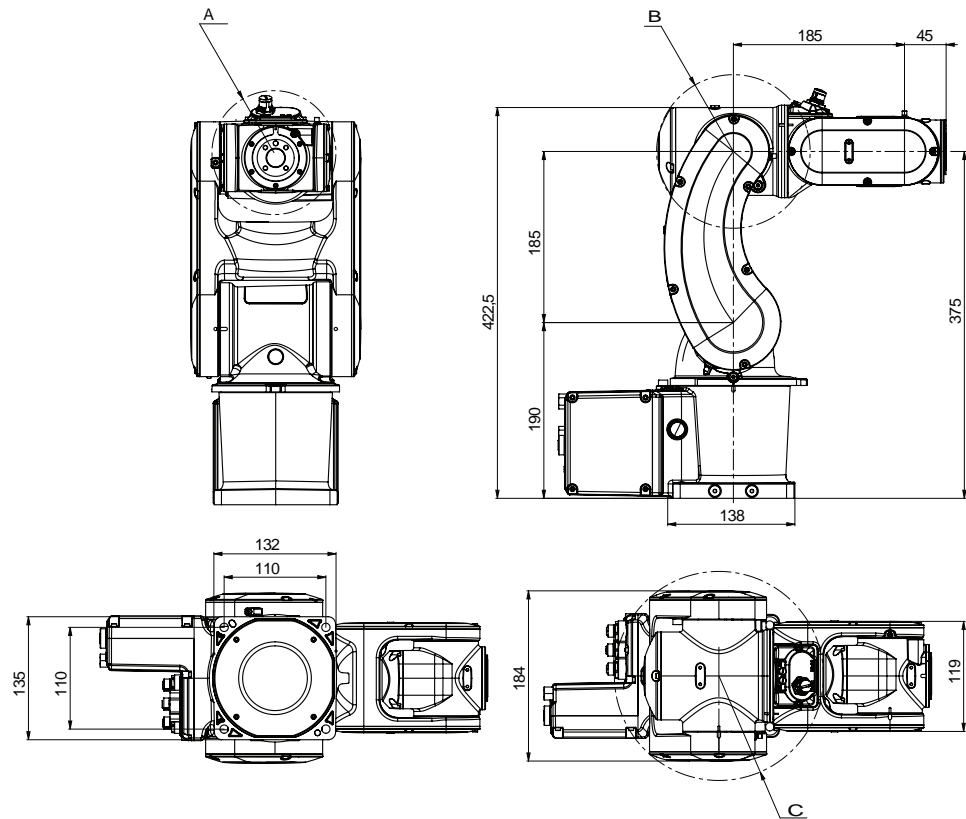
The product complies with IEC 63000. *Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.*

## 2 Manipulator description

### 2.3 Dimensions

### 2.3 Dimensions

#### Main dimensions of IRB 1010-1.5/0.370



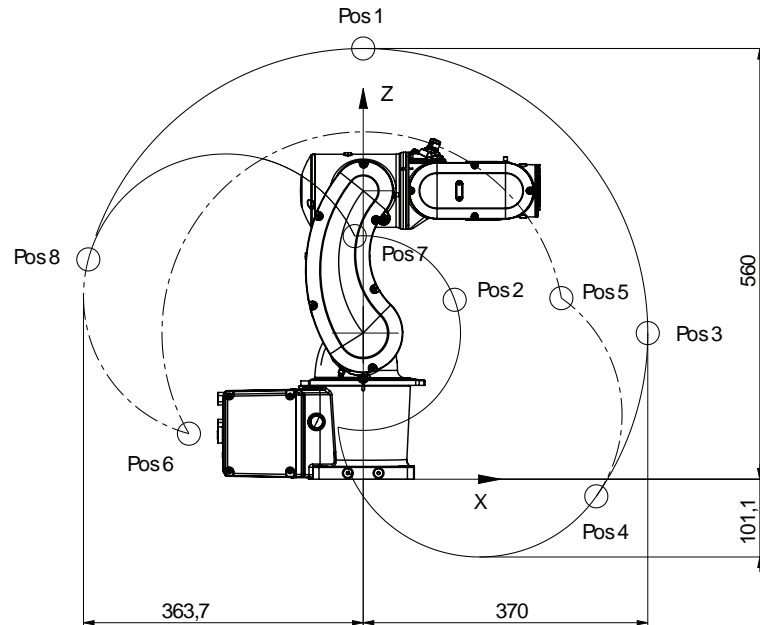
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Pos	Description
A	Turning radius: R67
B	Turning radius: R83
C	Turning radius: R113

## 2.4 Working range

### Illustration, working range IRB 1010-1.5/0.370

This illustration shows the unrestricted working range of the robot.



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### Positions at wrist center 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	+185	+375	0°	0°
pos1	0	+560	0°	-90°
pos2	+118.9	+233.3	0°	+50°
pos3	+370	+190	+90°	-90°
pos4	+303.1	-22.2	+125°	-90°
pos5	+270.5	+225.6	+125°	-180°
pos6	-226.6	+59.2	-75°	-180°
pos7	-11.0	+316.1	-75°	+50°
pos8	-357.4	+285.8	-75°	-90°

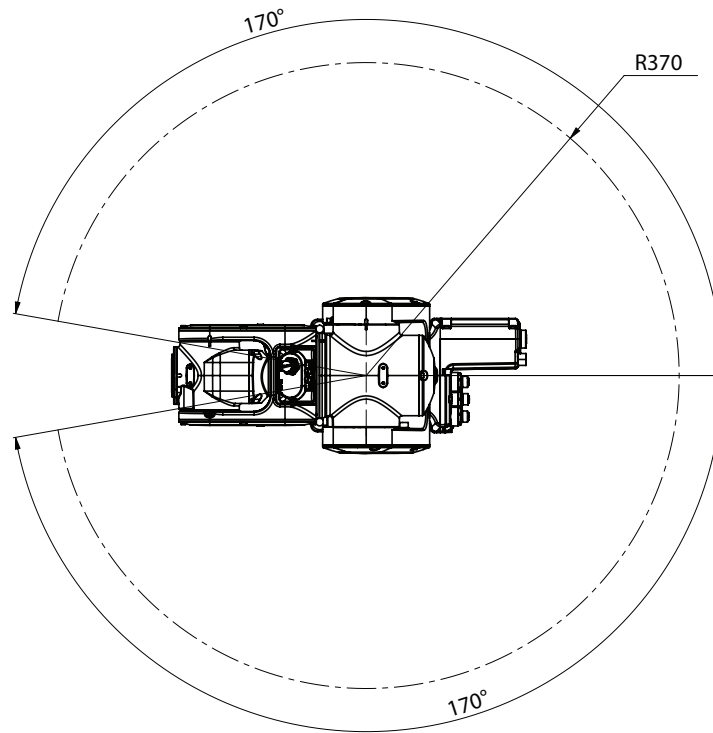
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## 2 Manipulator description

### 2.4 Working range

Continued

#### Top view of working range



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#### Working range

Axis	Working range	Note
Axis 1	$\pm 170^\circ$	
Axis 2	$-75^\circ / +125^\circ$	
Axis 3	$-180^\circ / +50^\circ$	
Axis 4	$\pm 170^\circ$	
Axis 5	$\pm 125^\circ$	
Axis 6	$\pm 360^\circ$	Default value.
	$\pm 242^\circ$	Maximum revolution value. The default working range for axis 6 can be extended by changing parameter values in the software.

### 2.5 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.

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## 3 Installation and commissioning

### 3.1 Introduction to installation and commissioning

#### General

This chapter contains assembly instructions and information for installing the IRB 1010 at the working site.

See also the product manual for the robot controller.

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

The technical data is detailed in section [Technical data on page 38](#).

#### Safety information

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



#### Note

Always connect the IRB 1010 and the robot to protective earth and residual current device (RCD) before connecting to power and starting any installation work.

For more information see:

- *Product manual - OmniCore C30*
- *Product manual - OmniCore E10*

## 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.  <b>Note</b> 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: <a href="#">Weight, robot on page 38</a>
6	If the robot is not installed directly, it must be stored as described in: <a href="#">Storage conditions, robot on page 40</a>
7	Make sure that the expected operating environment of the robot conforms to the specifications as described in: <a href="#">Operating conditions, robot on page 41</a>
8	Before taking the robot to its installation site, make sure that the site conforms to: <ul style="list-style-type: none"><li>• <a href="#">Loads on foundation, robot on page 38</a></li><li>• <a href="#">Protection classes, robot on page 41</a></li><li>• <a href="#">Requirements, foundation on page 40</a></li></ul>
9	Before moving the robot, please observe the stability of the robot: <a href="#">Risk of tipping/stability on page 49</a>
10	When these prerequisites are met, the robot can be taken to its installation site as described in section: <a href="#">On-site installation on page 51</a>
11	Install required equipment, if any.



### 3.2.2 Risk of tipping/stability

#### Risk of tipping

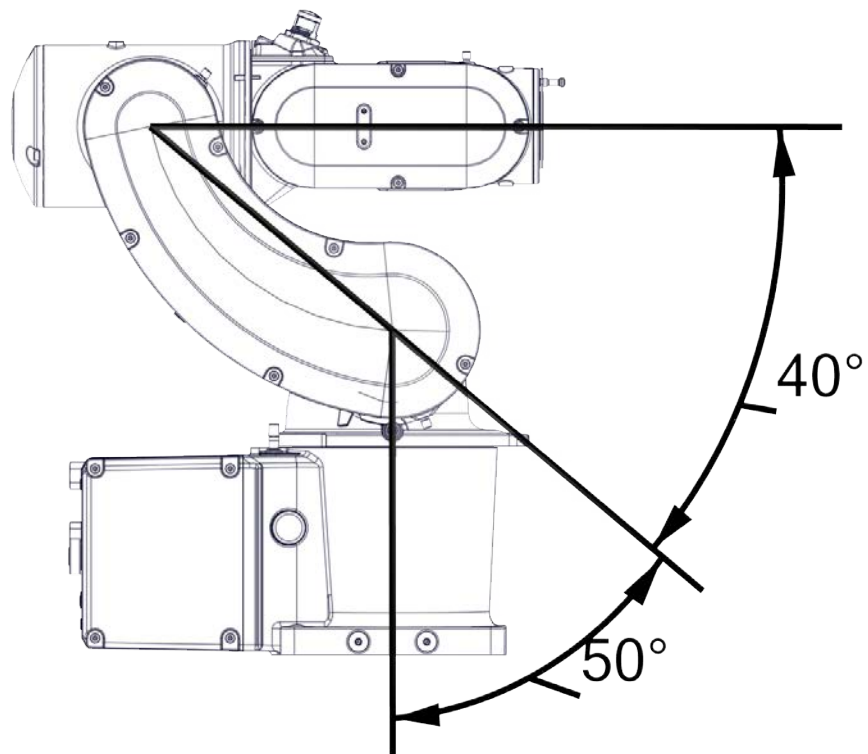
If the robot is not fastened to the foundation while moving the arm, the robot is not stable in the whole working area. Moving the arm will displace the center of gravity, which may cause the robot to tip over.

The transportation position is the most stable position.

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

#### Transportation position

This figure shows the robot in its transportation position.



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#### Note

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

Axis number	Angle of axis
Axis 1	0°
Axis 2	-50°
Axis 3	+50°
Axis 4	0°
Axis 5	0°
Axis 6	0°

*Continues on next page*

### 3 Installation and commissioning

---

#### 3.2.2 Risk of tipping/stability

*Continued*



#### **WARNING**

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

## 3.3 On-site installation

### 3.3.1 Lifting the robot

#### 3.3.1.1 Lifting the robot by one person

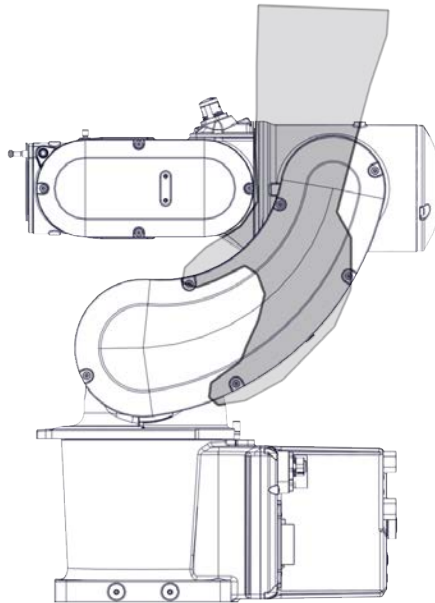
##### General

This section describes how to lift the robot and move it by one person.

##### Grasping location


When moving the IRB 1010, stand behind the robot (base rear side) and holds the lower part of the arm.

The following figure illustrates the recommended grasping location of the robot.



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##### Lifting and transporting the robot

	Action
1	 <b>CAUTION</b> The IRB 1010 weighs, 13.5 kg and can be lifted by one person.
2	Grasp the robot as instructed in <a href="#">Grasping location on page 51</a> .
3	Lift the robot.


*Continues on next page*

### 3 Installation and commissioning

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#### 3.3.1.1 Lifting the robot by one person

*Continued*

	Action
4	<p>Move the robot to desired position.</p> <p> <b>CAUTION</b></p> <p>Be careful so that the robot does not bump into something while lifting and transporting. It could damage the robot.</p>
5	<p>Secure the robot on a workbench according to section <a href="#">Orienting and securing the robot on page 54</a>.</p>

#### 3.3.1.2 Lifting and rotating a suspended mounted robot

---

##### Introduction

How to lift and turn the robot to a **suspended** position: Contact ABB for more information.

## 3 Installation and commissioning

### 3.3.2 Orienting and securing the robot

### 3.3.2 Orienting and securing the robot

#### General

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

#### Attachment screws


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

Suitable screws	M8x30 (robot installation directly on foundation)
Quantity	4 pcs
Quality	8.8
Suitable washer	8.4 x 16 x 1.6
Guide pins	2 pcs, D6x20, ISO 2338 - 6m6x20 - A1
Tightening torque	20 Nm±2 Nm
Length of thread engagement	Minimum 14 mm for ground with material yield strength 150 MPa
Level surface requirements	0.1/500 mm <sup>i</sup>

<sup>i</sup> See [Requirements, foundation on page 40](#).

#### Securing a floor mounted robot

Use this procedure to orient and secure the robot floor mounted.

	Action	Note
1	Make sure the installation site for the robot conforms to the specifications in section <a href="#">Technical data on page 38</a> .	
2	Prepare the installation site with attachment holes. The foundation surface must be clean and unpainted.	The hole configuration of the base is shown in the figure in <a href="#">Hole configuration, base on page 55</a> .
3		
4	 <b>CAUTION</b> When the robot is put down after being lifted or transported, there is a risk of it tipping, if not properly secured.	
5	Lift the robot.	See <a href="#">Lifting the robot on page 51</a> .
6	Fit two pins to the holes in the base.	2 pcs, D6x20, ISO 2338 - 6m6x20 - A1
7	Guide the robot gently, using the attachment screws while lowering it into its mounting position.	Make sure the robot base is correctly fitted onto the pins.
8	Fit the securing screws and washers in the attachment holes of the base.	Screws: M8x30 (robot installation directly on foundation), 4 pcs, quality 8.8 Washers: 8.4 x 16 x 1.6

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### 3 Installation and commissioning

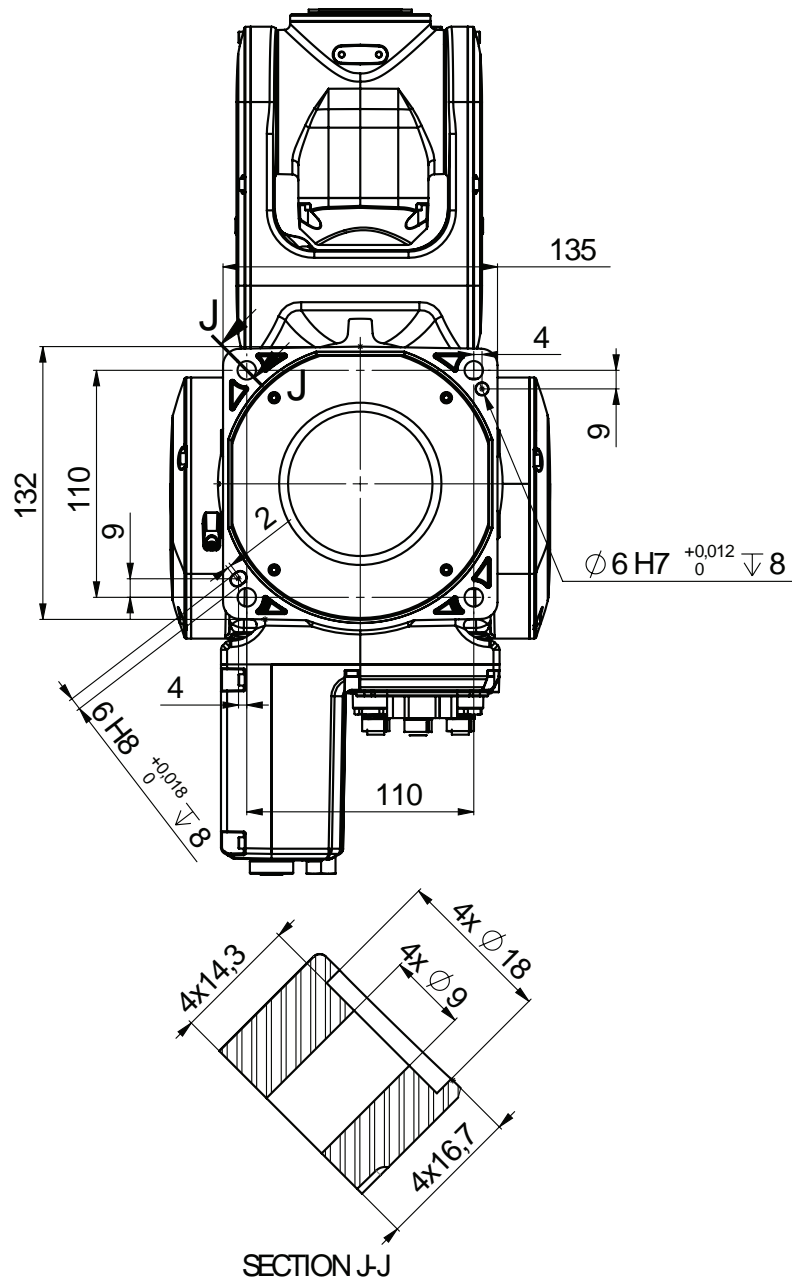
#### 3.3.2 Orienting and securing the robot

*Continued*

	Action	Note
9	Tighten the bolts in a crosswise pattern to ensure that the base is not distorted.	Tightening torque: 20 Nm $\pm$ 2 Nm

#### Hole configuration, base

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



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## 3 Installation and commissioning

### 3.3.3 Manually releasing the brakes

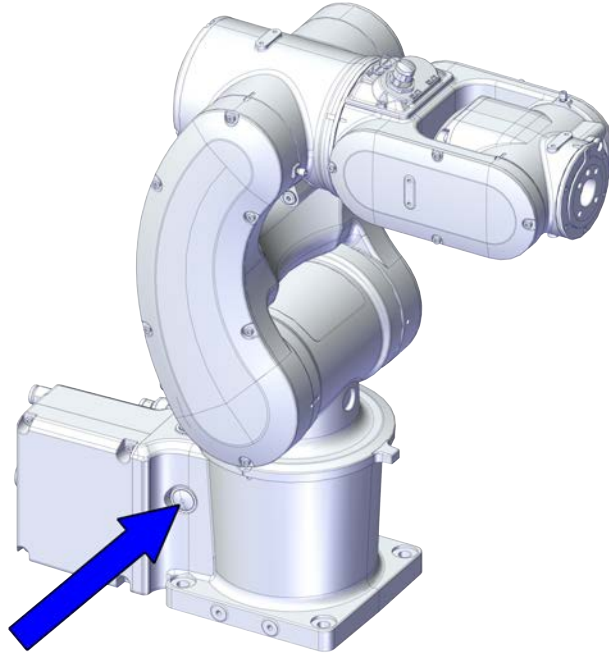
### 3.3.3 Manually releasing the brakes

#### Introduction to manually releasing the brakes

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

#### Location of the brake release unit



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



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#### Releasing the brakes

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

	Action	Note
1	 <b>Note</b> If the robot is not connected to the controller, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a> .	
2	 <b>DANGER</b> 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.	


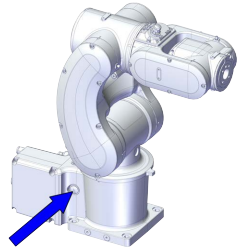
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### 3 Installation and commissioning



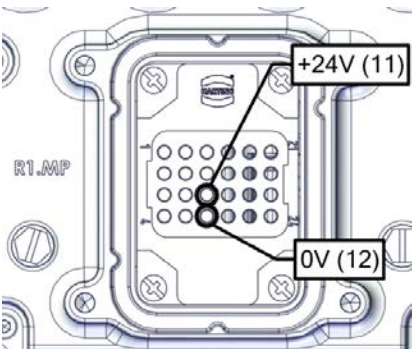
#### 3.3.3 Manually releasing the brakes

*Continued*

	Action	Note
3	<p>Release the holding brake of all axes by pressing the brake release button.</p> <p>The brake will be enable as soon as the button is released.</p> <p> <b>WARNING</b></p> <p>Pressing the brake release button will release the holding brakes on all axes simultaneously.</p>	 <p>xx220000020</p>

#### Supplying power to connector R1.MP

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

	Action	Note
1	<p> <b>DANGER</b></p> <p>Incorrect connections, such as supplying power to the wrong pin, may cause all brakes to be released simultaneously and instantly!</p>	
2	<p>Supply</p> <ul style="list-style-type: none"> <li>• 0V on pin 12.</li> <li>• 24V on pin 11.</li> </ul> <p> <b>Note</b></p> <p>Do not interchange the 24V and 0V pins. If they are mixed up, damage can be caused to internal electrical components.</p>	 <p>xx1800002443</p>
3	<p>Use the brake releasing button as described in <a href="#">Releasing the brakes on page 56</a>.</p>	

## 3 Installation and commissioning

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### 3.3.4 Setting the system parameters for an inverted or a tilted robot

#### 3.3.4 Setting the system parameters for an inverted or a tilted robot

---

##### General

The robot is configured for mounting parallel to the floor, without tilting, on delivery. If the robot is mounted in any other angle than  $0^\circ$ , then the system parameters that describe the mounting angle (how the robot is oriented relative to the gravity) must be re-defined.



##### Note

With inverted 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 mounting positions are described in [Mounting positions on page 38](#), and the requirements on the foundation are described in [Requirements, foundation on page 40](#).

---

##### 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. If the robot is mounted upside down (inverted), then *Gravity Beta* should be  $\pi$  (+3.141593).

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

*Continues on next page*

#### Gravity Alpha

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.

$\text{Gravity Beta} = A^\circ \times 3.141593/180 = B \text{ radians}$ , 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)
Inverted mounting	180°	3.141593

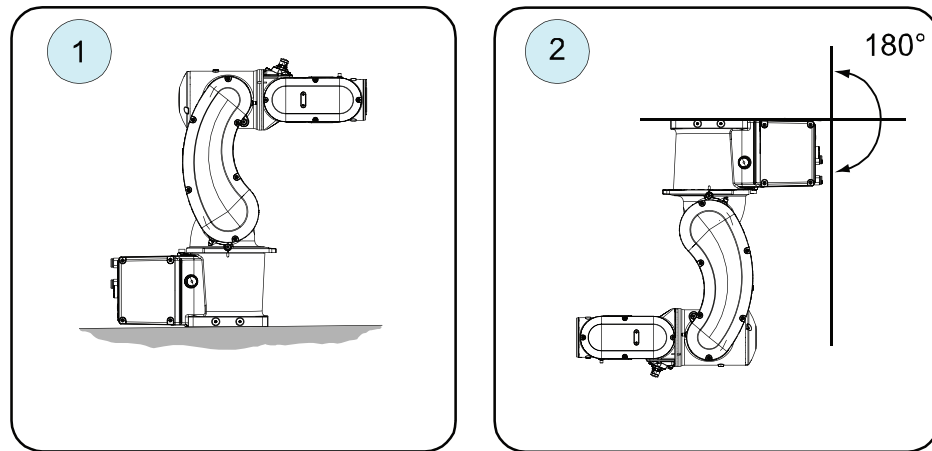
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### 3 Installation and commissioning

#### 3.3.4 Setting the system parameters for an inverted or a tilted robot

Continued

Examples of mounting angles tilted around the Y axis (*Gravity Beta*)

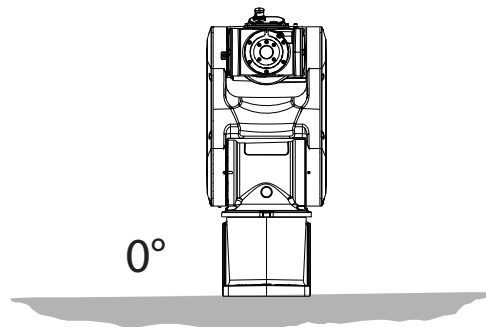


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Pos 1	Floor mounted
Pos 2	Mounting angle 180° (Suspended)

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.



xx220000535

Mounting angle	Gravity Alpha
0° (Floor mounted)	0



#### Note

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

#### 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*.

Continues on next page

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

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### 3.3.5 Loads fitted to the robot, stopping time and braking distances

### 3.3.5 Loads fitted to the robot, stopping time and braking distances

---

#### Define loads carefully

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



#### CAUTION

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

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

---

#### Stopping time and braking distances

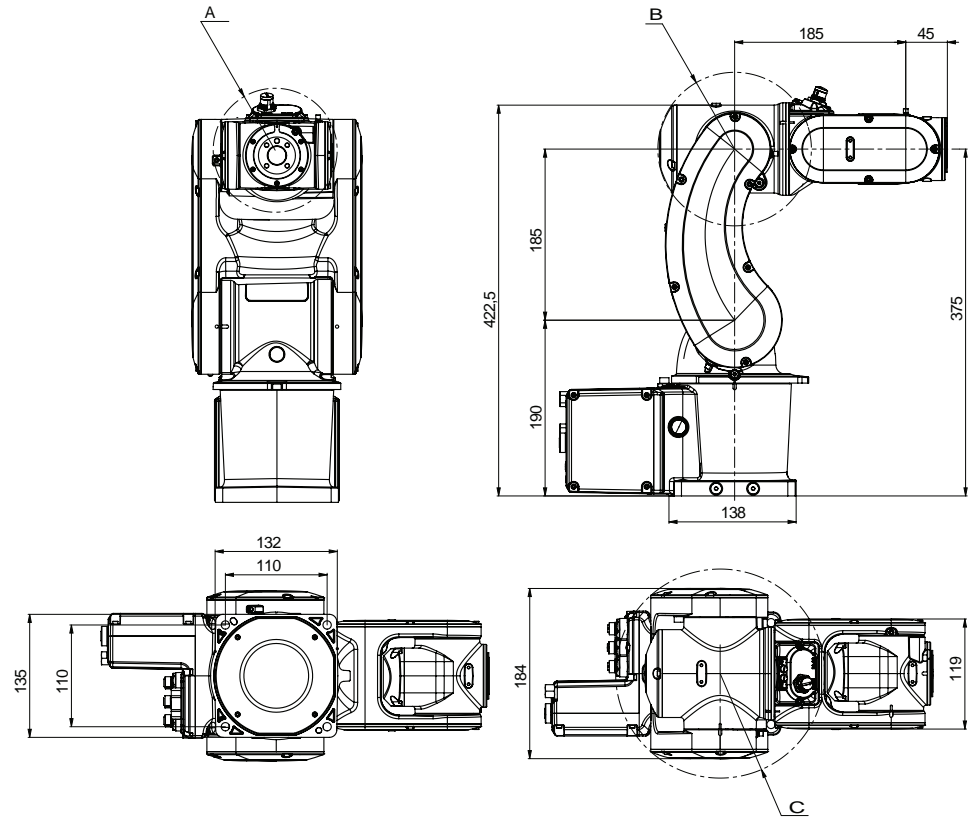
The performance of the motor brake depends on if there are any loads attached to the robot.

See the product specification for the robot, listed in [References on page 10](#).

#### 3.3.6 Fitting equipment on the robot (robot dimensions)

##### Robot dimensions

The figure shows the dimension of the IRB 1010-1.5/0.370.



xx2200000188

Pos	Description
A	Turning radius: R67
B	Turning radius: R83
C	Turning radius: R113

##### Attachment holes and dimensions

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

*Continues on next page*

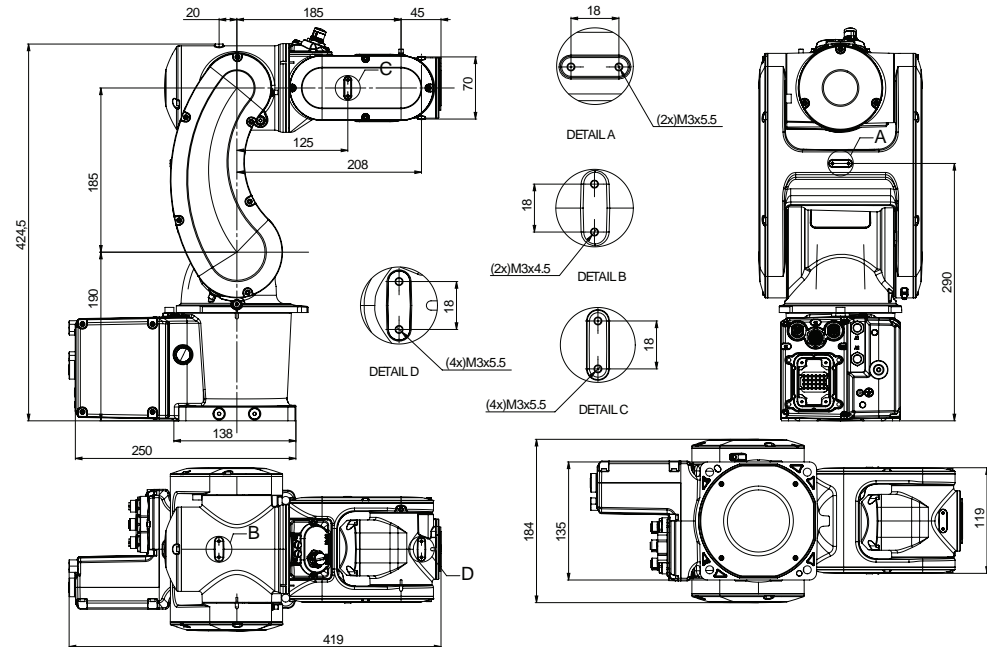
### 3 Installation and commissioning

#### 3.3.6 Fitting equipment on the robot (robot dimensions)

Continued

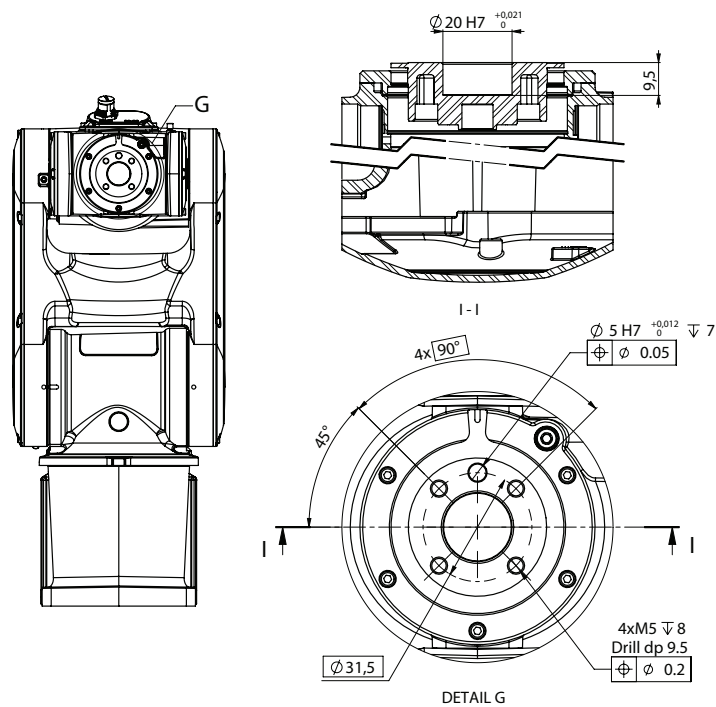
Maximum allowed arm load depends on center of gravity of arm load and robot payload.

#### Holes for fitting extra equipment



xx220000189

#### Tool flange standard



xx220000190

Continues on next page





#### CAUTION

To calibrate the axis 6, the notch on the wrist must be aligned with the marked pin hole on the tool flange. Before installing a tool on the tool flange, make sure a visible mark has been made to the tool at the corresponding position.

For details about the synchronization mark, see [Synchronization marks and synchronization position for axes on page 287](#).

---

#### Fastener quality

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

## 3 Installation and commissioning

### 3.3.7 Installation of signal lamp (option)

#### 3.3.7 Installation of signal lamp (option)




##### Description

A signal lamp with a yellow fixed light can be mounted in the cell or any other visible location, and driven by I/O signal or MON\_LAMP signal from the controller.



##### Function

The lamp is active in MOTORS ON mode.


##### Installation of signal lamp from I/O signal

	Action
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.
2	<b>For robots with OmniCore C line</b> Connect the lamp cable connector to the local I/O connector on the controller.  <b>Note</b> The local I/O connectors provides 16 digital output signals for use.
3	<b>For robots with OmniCore E line</b> Connect the lamp cable connector to the I/O connector on the controller.  <b>Note</b> The I/O connector provides 8 digital output signals for use.
4	Configure the lamp by adding a <i>System Output</i> type signal with status set to <i>Motors On State</i> .
5	The lamp is now ready for use and is lit in MOTORS ON mode.

##### Installation of signal lamp from MON\_LAMP signal

	Action
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.
2	<b>For robots with OmniCore C line</b> Connect the lamp cable connector to the X15 connector on the controller.  <b>Note</b> The X15 connector provides MON_LAMP output signals for use. For more details, see chapter <i>Descriptions for connectors</i> in OmniCore product manuals.

*Continues on next page*

	Action
3	<p><b>For robots with OmniCore E line</b> Connect the lamp cable connector to the MON connector on the controller.</p> <p> <b>Note</b> The MON connector provides MON_LAMP output signals for use. For more details, see chapter <i>Descriptions for connectors</i> in OmniCore product manuals.</p>
4	The lamp is now ready for use and is lit in MOTORS ON mode.

#### Further information

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

Further information about how to set up I/O system may be found in *Technical reference manual - System parameters*.

## 3 Installation and commissioning

### 3.4.1 Adjusting the working range

## 3.4 Working range alterations

### 3.4.1 Adjusting the working range

#### Reasons for adjusting the manipulator working range

The working range of each manipulator axis is configured in the software. If there is a risk that the manipulator may collide with other objects at installation site, its working space should be limited. The manipulator must always be able to move freely within its entire working space.

#### Working range configurations

The parameter values for the axes working range can be altered within the allowed working range and according to available options for the robot, either to limit or to extend a default working range. Allowed working ranges and available options for each manipulator axis are specified in [Working range on page 44](#).

#### Mechanical stops on the manipulator

Mechanical stops are and can be installed on the manipulator as limiting devices to ensure that the manipulator axis does not exceed the working range values set in the software parameters.



#### Note

The mechanical stops are only installed as safety precaution to physically stop the robot from exceeding the working range set. A collision with a mechanical stop always requires actions for repair and troubleshooting.

Axis	Fixed mechanical stop <sup>i</sup>	Movable mechanical stop <sup>ii</sup>
Axis 1	yes	yes The working range can be reduced by altering the parameter values. Installation of additional mechanical stops is recommended as a safety measure. Addition mechanical stops are not delivered with the robot and shall be designed according to actual applications and site requirements. See <a href="#">Installing movable mechanical stops on axis 1 on page 74</a> for hole dimensions when designing and preparing the stops. Contact ABB for more information.
Axis 2	yes	no
Axis 3	yes	no
Axis 4	yes	no
Axis 5	yes	no
Axis 6	no	no

<sup>i</sup> Part of the casting or fixed on the casting and can not /should not be removed.

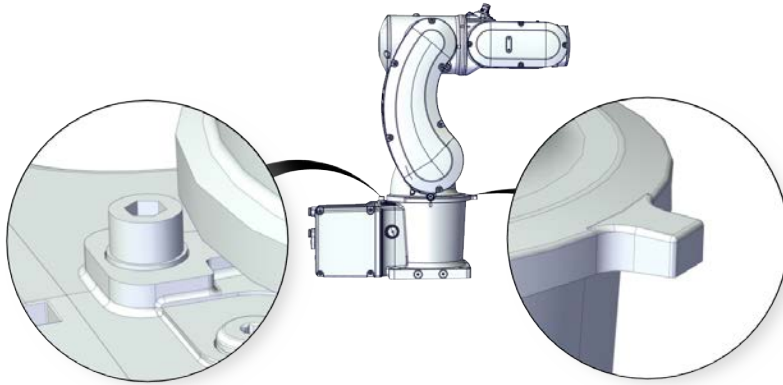
<sup>ii</sup> Can be installed in one or more than one position, to ensure a reduced working range, or be removed to allow extended working range.

#### 3.4.2 Mechanically restricting the working range

##### Location of mechanical stops

Axis 1 and axis 3 have fixed stops that must be installed during operation of robot. Axis 2, axis 4 and axis 5 have castings as mechanical stops to restrict working range, which could not be replaced.

##### Axis 1



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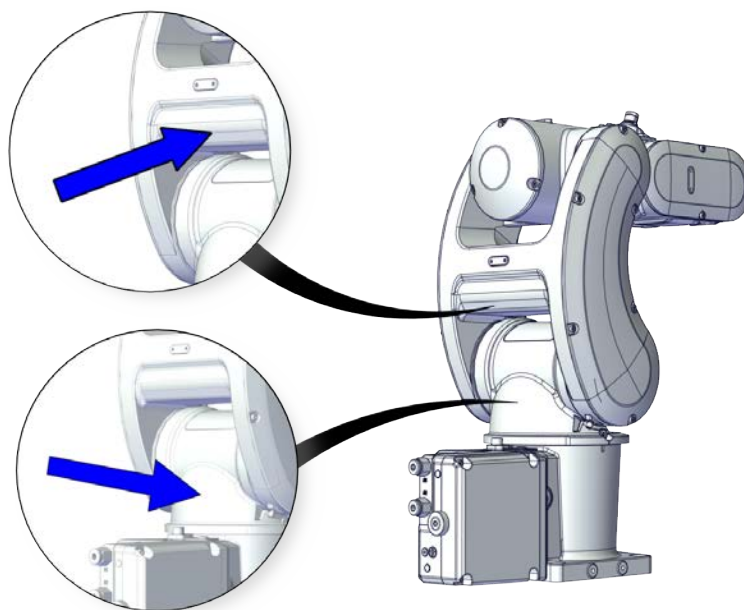
### 3 Installation and commissioning

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#### 3.4.2 Mechanically restricting the working range

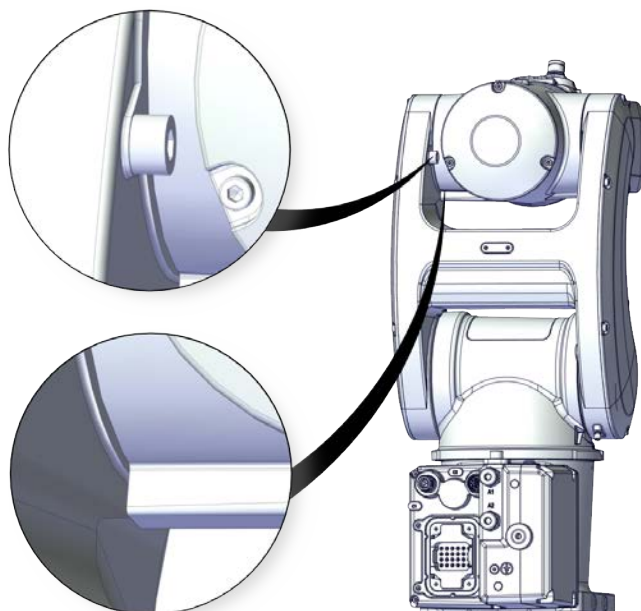
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##### Axis 2



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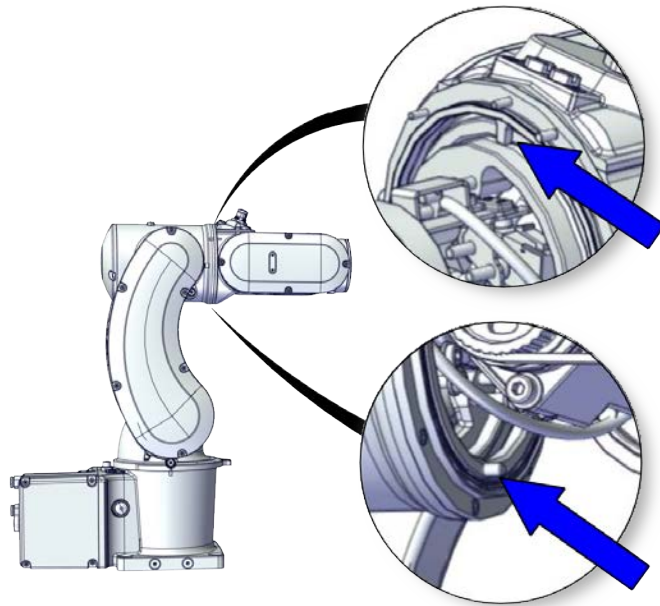
##### Axis 3



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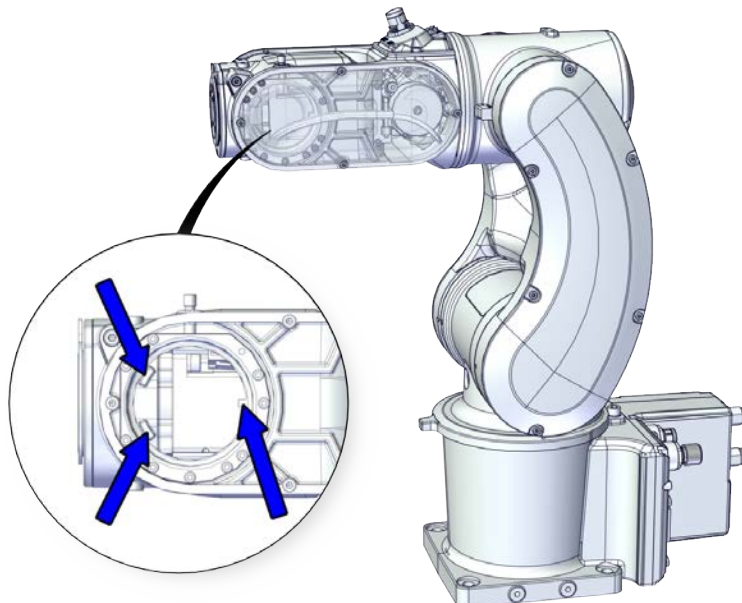
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#### Axis 4



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#### Axis 5



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### 3 Installation and commissioning

#### 3.4.2 Mechanically restricting the working range

Continued

#### Installation of mechanical stop, axis 1 and axis 3

##### Required spare parts


 <b>Note</b> The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 1010 via myABB Business Portal, <a href="http://www.abb.com/myABB">www.abb.com/myABB</a> .
---

Spare part	Article number	Note
Mechanical stop, screw	9ADA186-23	Used to mechanically restrict the motion of axis 1 and axis 3.
Mechanical stop, washer	9ADA762-6	Used with Mechanical stop, screw to mechanically restrict the motion of axis 1.

##### Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 330</a> .

##### Replacing the axis-1 and axis-3 mechanical stops

	Action	Note
1	Jog the robot to a position where the mechanical stops are most easily accessed.	
2	 <b>DANGER</b> Turn off all: <ul style="list-style-type: none"><li>• electric power supply</li><li>• hydraulic pressure supply</li><li>• air pressure supply</li></ul> to the robot, before entering the safeguarded space.	

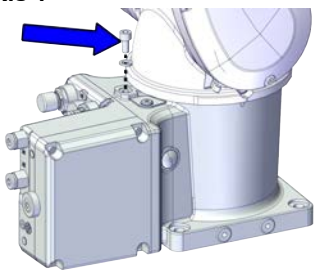
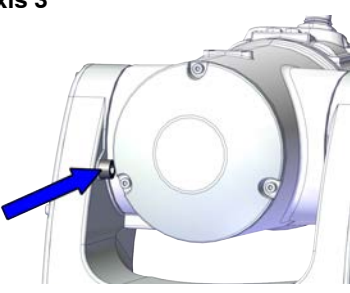
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### 3 Installation and commissioning

#### 3.4.2 Mechanically restricting the working range

*Continued*

	Action	Note
3	Remove the mechanical stops.	<p><b>Axis 1</b></p>  <p>xx2200000203</p> <p><b>Axis 3</b></p>  <p>xx2200000204</p>
4	Discard the old stops and refit with new ones.	<p><b>Axis1</b> Mechanical stop, screw: 9ADA186-23 Mechanical stop, washer: 9ADA762-6</p> <p><b>Axis 3</b> Mechanical stop, screw: 9ADA186-23</p>
5	Secure the mechanical stops.	Tightening torque: 5 Nm

## 3 Installation and commissioning

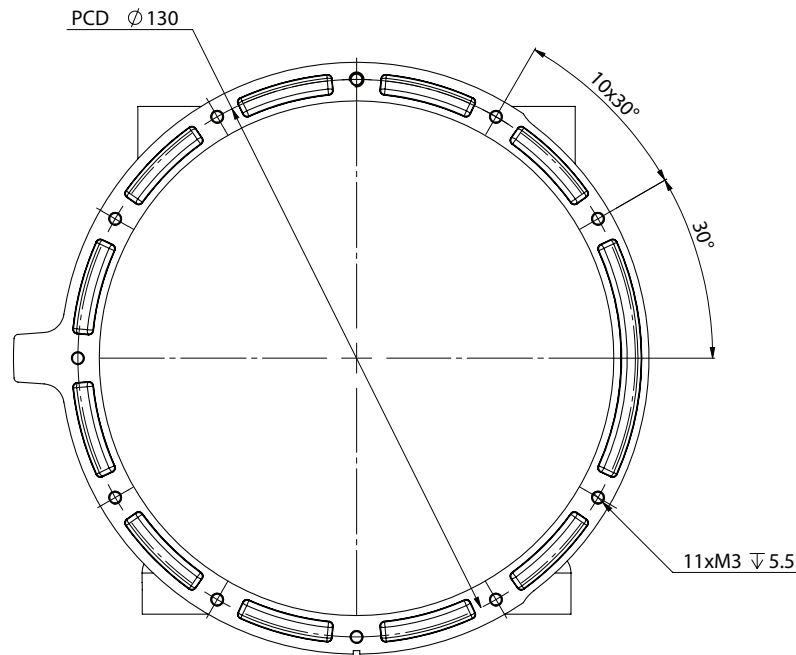
### 3.4.3 Installing movable mechanical stops on axis 1

### 3.4.3 Installing movable mechanical stops on axis 1

#### Reduction of the axis-1 working range

The working range of axis 1 is limited by system parameter configuration. To reduce the working range from default range, first adjust the parameter values and then install additional mechanical stops as a safety measure.

Additional mechanical stops shall be designed according to actual application and site requirements. Refer to the following hole dimension on swing bottom to prepare the stops.



xx2200001082



#### Note

Additional mechanical stops are not delivered with the robot. Contact ABB for more information.

## 3.5 Electrical connection

### 3.5.1 Robot cabling and connection points

#### Introduction

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



#### DANGER

Turn off the main power before connecting any cables.



#### CAUTION

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

#### Main cable categories

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

Cable category	Description
Robot cables	Handles power supply to and control of the robot's motors as well as feedback from the serial measurement board. Specified in the table <a href="#">Robot cables on page 75</a> .
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. The customer cables also include the air hose. See the product manual for the controller, see document number in <a href="#">References on page 10</a> .
Air hoses	The hose for compressed air is integrated with the manipulator cable harness.

#### Robot cables

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

Cable sub-category	Description	Connection point, cabinet	Connection point, robot
Robot cables, power	Transfers drive power from the drive units in the control cabinet to the robot motors.	X1	R1.MP
Robot cable, signals	Transfers resolver data from and power supply to the serial measurement board.	X2	R1.SMB

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### 3 Installation and commissioning

#### 3.5.1 Robot cabling and connection points

*Continued*

##### Robot cable, power

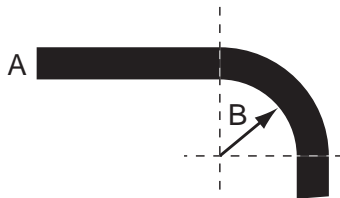
Power cable length	Article number
Power cable 3 m	3HAC061139-001
Power cable 7 m	3HAC061139-002
Power cable 15 m	3HAC061139-003

##### Robot cable, signals

Signal cable length	Article number
Signal cable, shielded: 3 m	3HAC084767-001
Signal cable, shielded: 7 m	3HAC084767-002
Signal cable, shielded: 15 m	3HAC084767-003

##### Bending radius for static floor cables

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



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A	Diameter
B	Diameter x10

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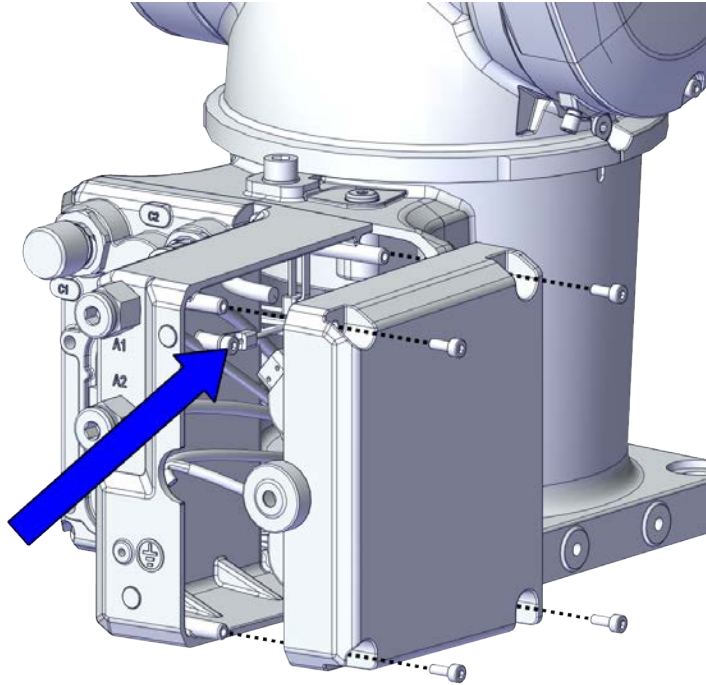
### 3 Installation and commissioning

#### 3.5.1 Robot cabling and connection points

*Continued*

#### Grounding and bonding point on manipulator

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



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#### Customer cables - CP/CS cable

CP/CS cable length	Article number
3 m	3HAC067449-001
7 m	3HAC067449-002

### 3 Installation and commissioning

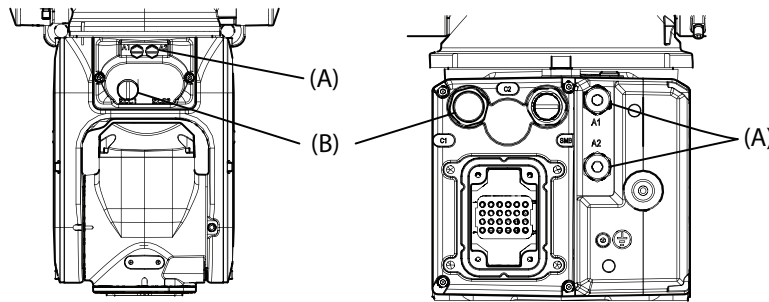
#### 3.5.2 Customer connections

#### 3.5.2 Customer connections

##### Introduction to customer connections

The cables for customer connection are integrated in the robot and the connectors are placed on the wrist and at the base. There is one connector R2.C1 at the wrist. Corresponding connector R1.C1 is located at the base.

Hose for compressed air is also integrated into the manipulator. There are 2 inlets at the base (R1/8") and 2 outlets (M5) on the wrist.



xx220000194

Position	Connection	Description	Number	Value
A	Air	Max. 5 bar	2	Outer diameter of air hose: 4 mm
B	(R1)R2.C1	Customer power/signal	12 wires	30 V, 1.54 A

##### Connector kits (optional)

###### Connector kits, base

R1.C1 connector on the base is part of the CP/CS cable. For details about the robot cabling, see [Robot cabling and connection points on page 75](#).

###### Connector kits, wrist

The table describes the CP/CS connector kits for wrist.

Position	Description	Art. no.	
Connector kits	CP/CS	M12 CPCS Male straight connector kits	3HAC066098-001
		M12 CPCS Male angled connector kits	3HAC066099-001

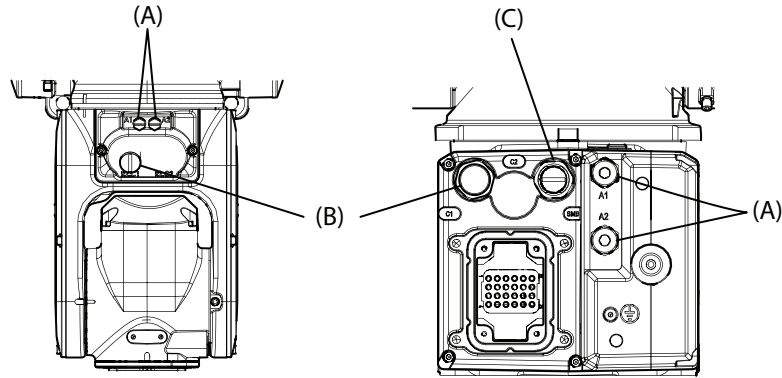
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#### Protection covers

##### Protection covers for water and dust proofing

Protection covers are delivered together with the robot and must be well fitted to the connectors in any application requiring water and dust proofing.

Always remember to refit the protection covers after removing them.



xx220000195

A	Air hose connector protection covers
B	CP/CS connector protection covers
C	SMB connector protection cover

## 3 Installation and commissioning

### 3.6 Start of robot in cold environments

### 3.6 Start of robot in cold environments

#### Introduction

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

#### Problems with starting the robot

##### Event message from Motion Supervision

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

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

##### Robot stopping with other event message

Use this procedure if the robot is not starting.

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

#### Adjusting the speed and acceleration during warm-up

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

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

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



#### 3.7 Test run after installation, maintenance, or repair

##### Safe handling

Use the following procedure after installation, maintenance, or repair, before initiating motion.



#### DANGER

Initiating motion without fulfilling the following aspects, may increase the risk for injury or cause damage to the robot.

	Action
1	Remove all tools and foreign objects from the robot and its working area.
2	Verify that the robot is properly secured to its position by all screws, before it is powered up.
3	Verify that any safety equipment installed to secure the position or restrict the robot motion during service activity is removed.
4	Verify that the fixture and work piece are well secured, if applicable.
5	Verify that all safety equipment is installed, as designed for the application.
6	Verify that no personnel are inside the safeguarded space.
7	If maintenance or repair has been done, verify the function of the part that was maintained.
8	Verify the application in the operating mode manual reduced speed.

##### Collision risks



#### CAUTION

When programming the movements of the robot, always identify potential collision risks before initiating motion.

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# 4 Maintenance

## 4.1 Introduction

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### Structure of this chapter

This chapter describes all the maintenance activities recommended for the IRB 1010.

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.

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### 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 IRB 1010 is connected to power, always make sure that the IRB 1010 is connected to protective earth and a residual current device (RCD) before starting any maintenance work.

For more information see:

- *Product manual - OmniCore C30*
- *Product manual - OmniCore E10*
- [Robot cabling and connection points on page 75.](#)

## 4 Maintenance

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### 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 IRB 1010:

- Calendar time: specified in months regardless of whether the system is running or not.
- Operating time: specified in operating hours. More frequent running means more frequent maintenance activities.

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

## 4.2.2 Maintenance schedule

### Scheduled and non-predictable maintenance

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

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

### Life of each component

The inspection intervals *do not* specify the life of each component. Values for these are specified in the section [Expected component life on page 87](#)

### Maintenance schedule

Maintenance activities	Regularly <sup>i</sup>	Every 12 months	Every 36 months	Every 20,000 hours <sup>ii</sup>	Reference
Cleaning the robot	x				<a href="#">Cleaning the IRB 1010 on page 88</a>
Inspecting the robot	x				Check for abnormal wear or contamination.
Inspecting the information labels		x			<a href="#">Inspecting the information labels on page 89</a>
Inspecting the robot harness		x <sup>iii</sup>			<a href="#">Inspecting the robot cabling on page 91</a>
Inspecting the timing belt			x		<a href="#">Inspecting timing belts on page 92</a>
Inspecting the mechanical stop		x			<a href="#">Inspecting mechanical stops on page 93</a>
Lubricating the robot harness		x <sup>iv</sup>			<a href="#">Lubricating the cable package on page 96</a>
Replacing the SMB battery pack			x <sup>v</sup>		<a href="#">Replacing the battery pack on page 98</a>
Running the <i>Brake Check</i> routine <sup>vi</sup>	x <sup>vii</sup>				Recommended to robots without the SafeMove option. See <i>Operating manual - OmniCore</i> .
Overhaul of complete robot				x	

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

<sup>ii</sup> Operating hours counted by the DTC = Duty time counter.

<sup>iii</sup> Replace when damage or cracks is detected or life limit is approaching.

<sup>iv</sup> Replace when damage or cracks is detected or life limit is approaching.

<sup>v</sup> The battery is to be replaced at given maintenance interval or at battery low alert.

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## 4 Maintenance

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### 4.2.2 Maintenance schedule

*Continued*

- vi Not needed separately if already included in the application.
- vii Recommended test interval is within the range 8-48 hours.

### 4.2.3 Expected component life

#### Expected life depends on usage

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

#### Expected component life

Component	Expected life	Note
Cable harness, normal usage <sup>i</sup>	20000 hours <sup>ii</sup>	
Cable harness, extreme usage <sup>iii</sup>	20000 hours <sup>ii</sup>	

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

<sup>ii</sup> Severe chemical or thermal environments, or similar environments, can result in shortened life expectancy.

<sup>iii</sup> Examples of "extreme usage" in regard to movement: press tending, very severe palletizing applications, major use of axis 1 movement and major use of bending backwards of axis 3.

## 4 Maintenance

### 4.3.1 Cleaning the IRB 1010

## 4.3 Cleaning activities

### 4.3.1 Cleaning the IRB 1010

#### General

To secure high uptime it is important that the IRB 1010 is cleaned regularly. The frequency of cleaning depends on the environment in which the manipulator works. Different cleaning methods are allowed depending on the type of protection of the IRB 1010.



#### 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 remove any covers or other protective devices before cleaning the robot.

#### Cleaning methods

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

Protection type	Cleaning method			
	Vacuum cleaner	Wipe with cloth	Rinse with water	High pressure water, steam or spray
Standard IP40	Yes	Yes. With light cleaning detergent.	No	No

#### Cables

Movable cables need to be able to move freely:

- Remove waste material, such as sand, dust and chips, if it prevents cable movement.
- Clean the cables if they have a crusty surface, for example from dry release agents.

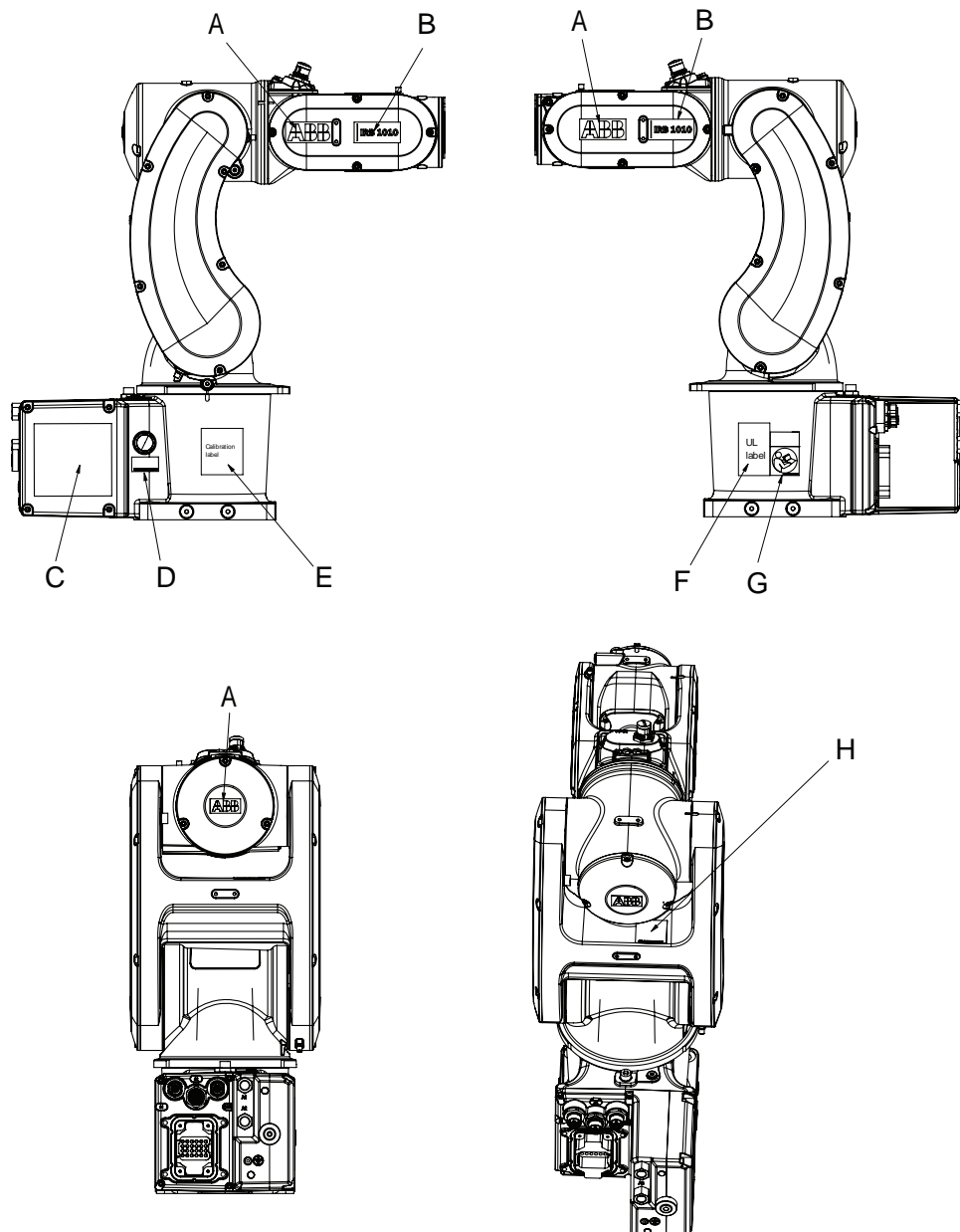


4.4 Inspection activities

4.4.1 Inspecting the information labels

Location of labels

These figures show the location of the information labels to be inspected. The symbols are described in section [Safety symbols on manipulator labels on page 19](#).



xx220000197

A	ABB logo
B	Robot model

Continues on next page

## 4 Maintenance

### 4.4.1 Inspecting the information labels


*Continued*

C	Rating label, CE label and AbsAcc label
D	Instruction label Brake release
E	Calibration label
F	UL label
G	Read manual label, also specifying warning labels
H	Warning label Crush

#### Required tools and equipment

Visual inspection, no tools are required.

#### Inspecting, labels

	Action	Note
1	 <b>DANGER</b> Turn off all: <ul style="list-style-type: none"><li>• electric power supply</li><li>• hydraulic pressure supply</li><li>• air pressure supply</li></ul> to the robot, before entering the safeguarded space.	
2	Inspect the labels, located as shown in the figures.	
3	Replace any missing or damaged labels.	Article numbers for the labels and plate set is specified in <a href="#">Spare parts on page 333</a> .

## 4.4.2 Inspecting the robot cabling

### Location of robot cabling

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


### Required tools and equipment

Visual inspection, no tools are required.

Other tools and procedures may be required if the spare part needs to be replaced. These are specified in the replacement procedure.

### Inspection, robot cabling

Use this procedure to inspect the robot cabling.

	Action	Note
1	 <b>DANGER</b> Turn off all: <ul style="list-style-type: none"> <li>• electric power supply to the robot</li> <li>• hydraulic pressure supply to the robot</li> <li>• air pressure supply to the robot</li> </ul> Before entering the robot working area.	
2	Visually inspect: <ul style="list-style-type: none"> <li>• the control cabling between the robot and control cabinet</li> </ul> Look for abrasions, cuts or crush damage.	
3	Replace the cabling if wear or damage is detected.	

## 4 Maintenance

### 4.4.3 Inspecting timing belts

### 4.4.3 Inspecting timing belts

#### Location of timing belts

The timing belts are located as shown in the figures.

#### Required tools and equipment

Equipment	Note
Standard toolkit	The content is defined in the section <a href="#">Standard toolkit on page 330</a> .
Other tools and procedures may be required if the spare part needs to be replaced. These are specified in the replacement procedure.	

#### Timing belt tension

The table describes the timing belt tension.

Axis	Force		Frequency	
	Used timing belt <sup>i</sup>	New timing belt	Used timing belt <sup>i</sup>	New timing belt
Axis 3	14.1±1 N <sup>ii</sup>	20.2±1 N	86-93 Hz	93-118 Hz
Axis 5	13.7±1 N <sup>ii</sup>	19.6±1 N	123-131 Hz	132-169 Hz


<sup>i</sup> Used belt is the one having been installed and used for more than 12 hours.

Compared with the new timing belt, the force value decreases 15% and the frequency value decreases 28% when the timing belt has been installed and used for more than 12 hours but less than 150 hours. When the timing belt has been installed and used for more than 150 hours, both the force and frequency values decrease 30%.

<sup>ii</sup> The value range is only for reference.

#### Inspecting timing belts

Use this procedure to inspect timing belts.

Action	Information
1  <b>DANGER</b> Turn off all: <ul style="list-style-type: none"><li>• electric power supply</li><li>• hydraulic pressure supply</li><li>• air pressure supply</li></ul> to the robot, before entering the robot working area.	
2	Gain access to each <i>timing belt</i> by removing the cover.
3	Check the timing belts for damage or wear.
4	Check the <i>timing belt pulleys</i> for damage.
5	If any damage or wear is detected, the part must be replaced!
6	Use a sonic tension meter to measure the timing belt tension. If the belt has no tension, adjust it!

#### 4.4.4 Inspecting mechanical stops

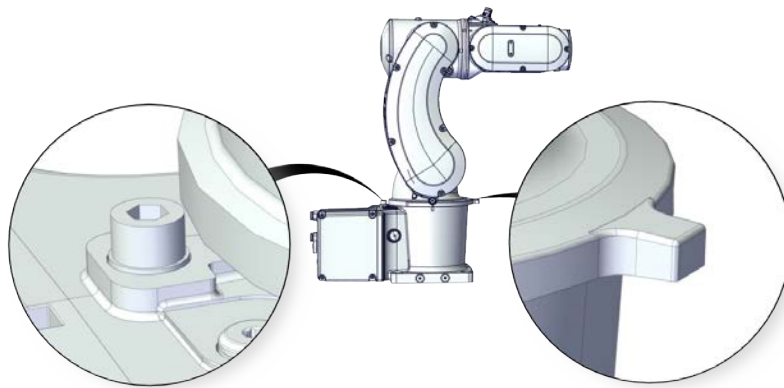
##### Location of mechanical stops



##### Note

Only axis-1 and axis-3 are visible for inspection and available for replacement.

##### Axis 1



xx220000198

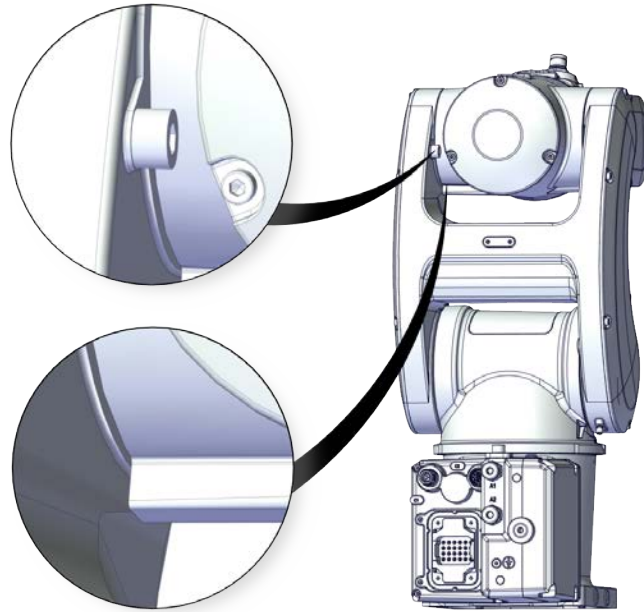
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## 4 Maintenance

### 4.4.4 Inspecting mechanical stops

*Continued*

#### Axis 3



xx2200000200

#### Required spare parts



#### Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 1010 via myABB Business Portal, [www.abb.com/myABB](http://www.abb.com/myABB).

Spare part	Article number	Note
Mechanical stop, screw	9ADA186-23	Used to mechanically restrict the motion of axis 1 and axis 3.
Mechanical stop, washer	9ADA762-6	Used with Mechanical stop, screw to mechanically restrict the motion of axis 1.

#### Required tools and equipment



Visual inspection, no tools are required.

Other tools and procedures may be required if the spare part needs to be replaced. These are specified in the replacement procedure.

*Continues on next page*

#### Inspecting mechanical stops

Use this procedure to inspect mechanical stops on axes 1 and 3.

	Action	Information
1	 <b>DANGER</b> Turn off all: <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> to the robot, before entering the robot working area.	
2	Inspect the mechanical stops.	See figures in <a href="#">Location of mechanical stops on page 93</a> .
3	Replace if the mechanical stop is: <ul style="list-style-type: none"> <li>• bent</li> <li>• loose</li> <li>• damaged.</li> </ul>  <b>Note</b> The expected life of gearboxes can be reduced as a result of collisions with the mechanical stop.	

## 4 Maintenance

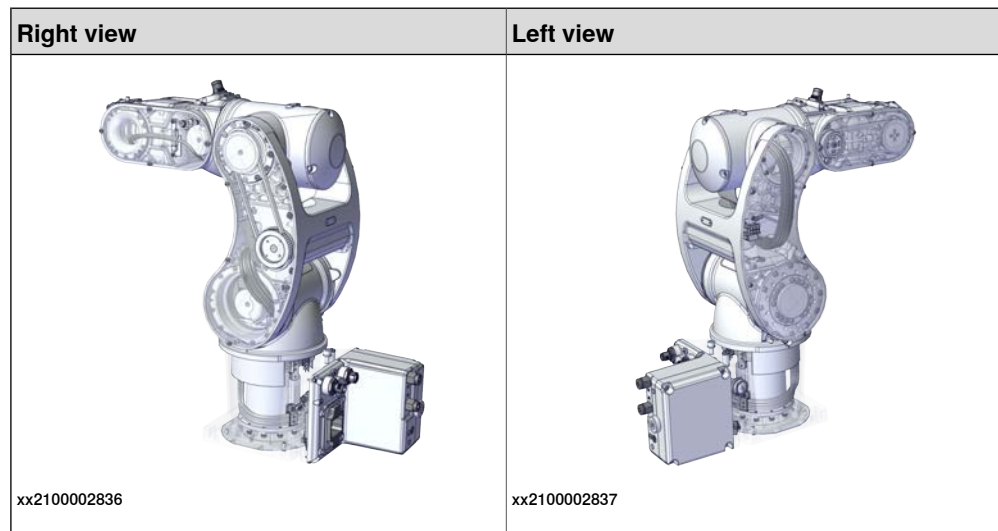
### 4.5.1 Lubricating the cable package

## 4.5 Lubricating activities

### 4.5.1 Lubricating the cable package

#### Location of the cable package

The cable packages are located as shown in the figure.



#### Required tools and equipment


Equipment	Note
Standard toolkit	The content is defined in the section <a href="#">Standard toolkit on page 330</a> .
Other tools and procedures may be required if the spare part needs to be replaced. These are specified in the replacement procedure.	

#### Required consumables

Consumable	Article number	Note
Grease	3HAC029132-001	FM 222

#### Lubricating the cable package

Use this procedure to lubricate the cable package.

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

*Continues on next page*



	Action	Information
2	Gain access to the cable package by removing the covers.	
3	Check the cable package for damage or wear.	
4	If any damage or wear is detected, the part must be replaced!	See <a href="#">Replacing the cable package on page 111</a> .
5	Apply grease to the cable package, cover all moving area of the package.	
6	Apply grease to the covers that have contacting area with the cable package.	

## 4 Maintenance

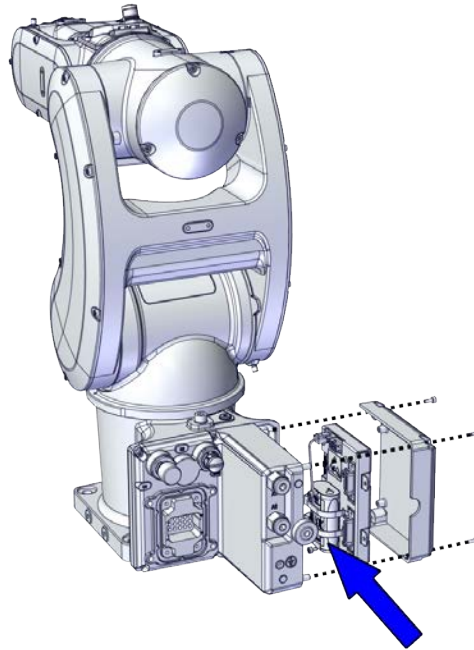
### 4.6.1 Replacing the battery pack

## 4.6 Replacing/changing activities

### 4.6.1 Replacing the battery pack

#### Location of the battery pack

The battery pack is located as shown in the figure.



xx220000019

#### Required spare parts



#### Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 1010 via myABB Business Portal, [www.abb.com/myABB](http://www.abb.com/myABB).

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

#### Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 330</a> .

Continues on next page

Equipment	Article number	Note
Calibration tool box, Axis Calibration	3HAC074119-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
24 VDC power supply	-	Used to release the motor brakes.

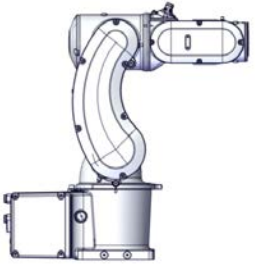

#### Required consumables

Consumable	Article number	Note
Cable straps	-	
Grease	3HAC029132-001	FM 222


#### Removing the battery pack

Use these procedures to remove the battery pack.

#### Preparations before removing the battery pack

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Jog the robot to the synchronization position.	 <p>xx2200000173</p>
3	 <p><b>DANGER</b></p> <p>Turn off all:</p> <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> <p>to the robot, before entering the safeguarded space.</p>	

#### Disconnecting the SMB connectors




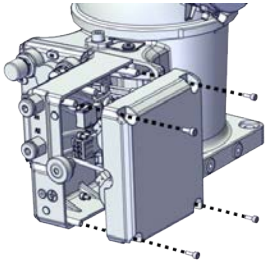

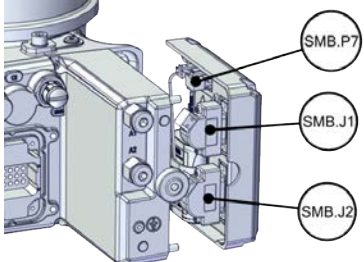
	Action	Note
1	 <p><b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	

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## 4 Maintenance

### 4.6.1 Replacing the battery pack

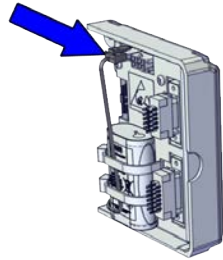
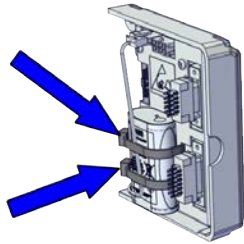
Continued

	Action	Note
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	
3	Remove the SMB cover attachment screws and carefully open the cover.   <b>CAUTION</b> Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.   <b>CAUTION</b> There are cabling attached to the cover. The cover cannot be removed completely until the connectors are removed.	 xx220000012
4	Disconnect the connectors. <ul style="list-style-type: none"> <li>• SMB.P7</li> <li>• SMB.J1</li> <li>• SMB.J2</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 xx220000013
5	Remove the SMB cover completely from the base.	

### Removing the battery pack

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	


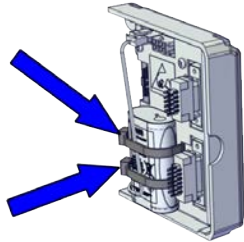
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	Action	Note
3	Disconnect the battery cable.	 xx2200000014
4	Remove the battery pack by cutting the cable strap.	 xx2200000015

#### Refitting the battery pack

Use these procedures to refit the battery pack.

#### Refitting the battery pack

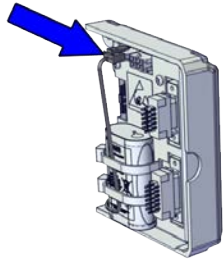
	Action	Note
1	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	
2	Secure the battery pack using the cable strap.	 xx2200000015

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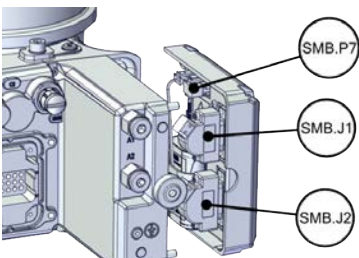

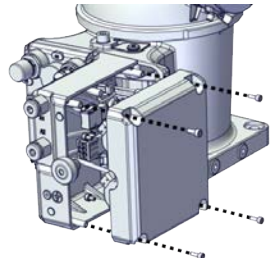
## 4 Maintenance

### 4.6.1 Replacing the battery pack

Continued


	Action	Note
3	Reconnect the battery cable.	 xx2200000014

### Reconnecting the SMB connectors

	Action	Note
1	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	
2	Reconnect the connectors. <ul style="list-style-type: none"> <li>• SMB.P7</li> <li>• SMB.J1</li> <li>• SMB.J2</li> </ul>  <b>Tip</b> See the number markings on the connectors for help to find the corresponding connector.	Tightening torque: 0.4 Nm  xx2200000013
3	Route and secure the cabling with cable straps.  <b>CAUTION</b> Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.	
4	Refit the SMB cover to the base.	Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (4 pcs) Tightening torque: 1.2 Nm  xx2200000012

Continues on next page

#### Concluding procedure

	Action	Note
1	Recalibrate the robot.	Calibration is detailed in section <a href="#">Calibration on page 283</a> .
2	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. See <a href="#">Test run after installation, maintenance, or repair on page 81</a> .	

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# 5 Repair

## 5.1 Introduction

### Structure of this chapter

This chapter describes repair activities for the IRB 1010. Each procedure contains the information required to perform the activity, for example spare parts numbers, required special tools, and materials.



#### WARNING

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

### Report replaced units



#### Note

When replacing a part on the IRB 1010, 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 IRB 1010 is connected to power, always make sure that the IRB 1010 is connected to protective earth and a residual current device (RCD) before starting any repair work.

For more information see:

- *Product manual - OmniCore C30*
- *Product manual - OmniCore E10*

## 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	3HAC038379-001	Harmonic Grease Flexolub-1A Used to lubricate the seals.

#### Rotating sealings

The following procedures describe how to fit rotating sealings.



#### CAUTION

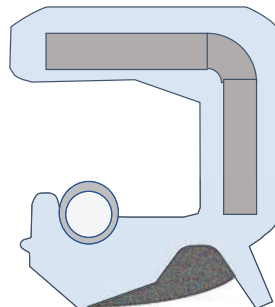
Please observe the following before commencing any assembly of sealings:

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

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

#### Radial sealings

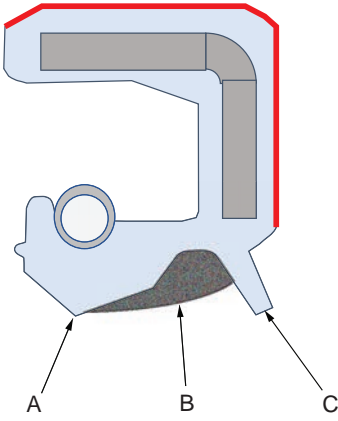

A radial sealing consists of a flexible rubber lip bonded to a rigid metal case. Only one side of the sealing is static with a metal insert.



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5.2.1 Mounting instructions for sealings  
Continued

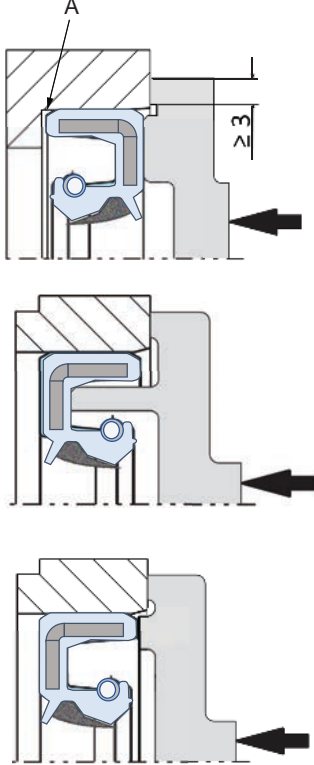
	Action	Note
1	Check the sealing to ensure that: <ul style="list-style-type: none"> <li>The sealing is of the correct type.</li> <li>There is no damage on the main lip.</li> </ul>	
2	Inspect the shaft surface before mounting. If scratches or damage are found, the shaft must be replaced since it may result in future leakage. Do not try to grind or polish the shaft surface to get rid of the defect.	
3	Lubricate the sealing with grease just before fitting. (Not too early - there is a risk of dirt and foreign particles adhering to the sealing.) Fill 2/3 of the space between the dust lip and the main lip with grease. If the sealing is without dust lip, just lubricate the main lip with a thin layer of grease.	<p>Article number is specified in <a href="#">Equipment on page 106</a>.</p>  <p>xx200000071</p> <p>A Main lip B Grease C Dust lip</p> <p> <b>Note</b></p> <p>Ensure that no grease is applied to the red marked surface.</p>

Continues on next page

## 5 Repair

### 5.2.1 Mounting instructions for sealings

Continued

	Action	Note
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>

### Flange sealings and static sealings

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

	Action
1	<p>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.</p>
2	<p>Clean the surfaces properly in accordance with the recommendations of ABB.</p>
3	<p>Distribute the sealing compound evenly over the surface.</p>
4	<p>Tighten the screws evenly when fastening the flange joint.</p>

### O-rings

The following procedure describes how to fit o-rings.

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

Continues on next page

	Action	Note
3	Check the o-ring grooves and mating surfaces. They should be free of pores, contamination and obvious scratches/damage.	
4	Lubricate the o-ring with grease.	
5	Tighten the screws evenly while assembling.	
6	Check that the o-ring is not squashed outside the o-ring groove.	

## 5 Repair

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### 5.2.2 The brake release buttons may be jammed after service work

### 5.2.2 The brake release buttons may be jammed after service work

---

#### Description

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



#### **DANGER**

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

#### Elimination

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

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

5.3 Cable harness

5.3.1 Replacing the cable package

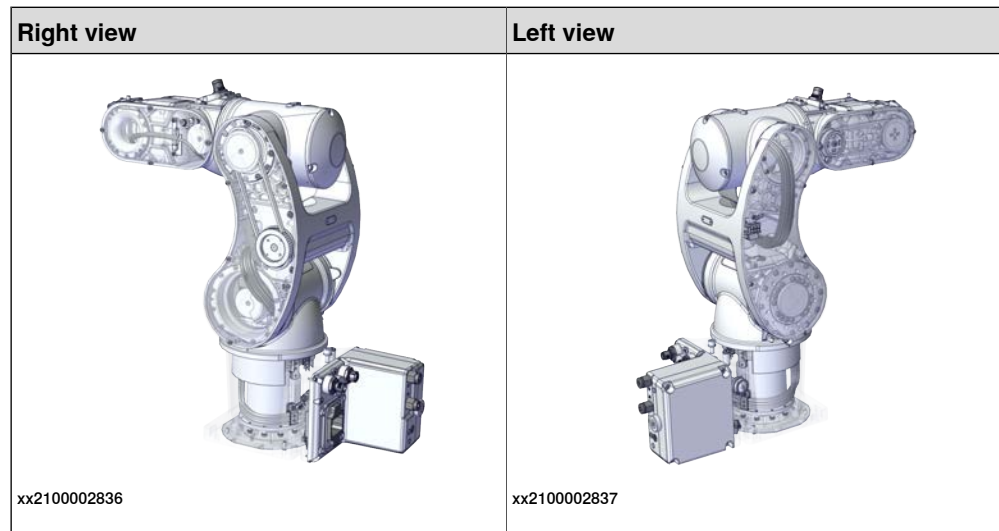
Location of the cable package

The main cable package runs from the base, up through the axis-1 unit, axis 3-4 unit, and into the wrist unit.

The main cable package includes the cabling for all the six motors. Options CP/CS cabling and air hoses can also be included.

The connector interface is located at the rear of the base. As standard feature, straight connector kit is used for cabling from base rear. The angled connector kit is used for cabling from base bottom, as an option.

The cable package is located as shown in the figures.



Required spare parts



Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 1010 via myABB Business Portal, [www.abb.com/myABB](http://www.abb.com/myABB).

Spare part	Article number	Note
Cable harness (basic)	3HAC076884-001	
Cable harness (CP/CS and air hose)	3HAC079810-001	
Process hub (basic)	3HAC082449-001	
Process hub (CP/CS and air hose)	3HAC082450-001	

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## 5 Repair

### 5.3.1 Replacing the cable package

*Continued*

#### Required service parts

Spare part	Article number	Note
Cable bracket, axis 2	3HAC080837-001	
Cable bracket, axis 4	3HAC076867-001	
Cable bracket, axis 5	3HAC079126-001	
Cable bracket, axis 6	3HAC079127-001	
Cable protector, axis 1	3HAC078560-001	
Cable protector, axis 2	3HAC078561-001	
Cable protector, axis 3	3HAC078562-001	
Cable protector, axis 4	3HAC075565-001	
Cable protector, axis 5	3HAC076870-001	
SMB cable	3HAC068830-005	
Axis-2 sleeve	3HAC074872-001	
Axis-2 radial sealing	3HAC076888-001	
Axis-4 radial sealing	3HAC076795-001	
Base interface panel (basic)	3HAC082455-001	
Base interface panel (CP/CS and air hose)	3HAC082456-001	
Base bottom cover	3HAC074903-001	
Swing top cover	3HAC082452-001	
Lower arm cover, left	3HAC082446-001	
Lower arm cover, right	3HAC082447-001	
Housing cover	3HAC082445-001	
Wrist cover	3HAC082443-001	
Tilt cover	3HAC082442-001	
Mechanical stop, screw	9ADA186-23	Used to mechanically restrict the motion of axis 1 and axis 3.
Mechanical stop, washer	9ADA762-6	Used with Mechanical stop, screw to mechanically restrict the motion of axis 1.
Flange socket head screw	3HAB3412-308	M3x8 12.9 Lafre 2C2B/FC6.9+PrO-COat111
Flange socket head screw	3HAB3412-310	M3x10 12.9 Lafre 2C2B/FC6.9+PrO-COat111
Flange socket head screw	3HAB3412-312	M3x12 12.9 Lafre 2C2B/FC6.9+PrO-COat111
Flange socket head screw	3HAB3412-316	M3x16 12.9 Lafre 2C2B/FC6.9+PrO-COat111

*Continues on next page*



## Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 330</a> .
Calibration tool box, Axis Calibration	3HAC074119-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
24 VDC power supply	-	Used to release the motor brakes.
Sonic tension meter	-	Used for measuring the timing belt tension.
Dynamometer	-	Used for measuring the timing belt tension.
Special toolkit	3HAC071022-001	Includes M12 connector assembly tool and Brake release button assembly tool.
Axis-2 radial sealing assembly tool	3HAC082535-001	
Axis-4 radial sealing assembly tool	3HAC082535-003	
Radial sealing pressfit tool	3HAC082535-002	

## Required consumables and wear parts

Consumable	Article number	Note
Cable straps	-	
Grease	3HAC029132-001	FM 222
Grease	3HAC038379-001	Harmonic Grease Flexolub-1A Used to lubricate the seals.
Cooling pad for axis-2 motor	3HAC071021-001	Cooling pads are wear parts. One cooling pad sheet contains 6 pieces of small pad. Replace if damaged with one piece each time.

## Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

	Action	Note
1	Decide which calibration routine to use for calibrating the robot. <ul style="list-style-type: none"> <li>Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot.</li> <li>Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.</li> </ul>	

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## 5 Repair

### 5.3.1 Replacing the cable package

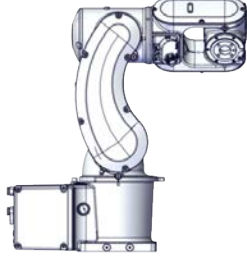

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Action	Note
<p><b>If the robot is to be calibrated with reference calibration:</b> Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.</p>	<p>Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 291</a>.</p>
<p><b>If the robot is to be calibrated with fine calibration:</b> Remove all external cable packages (DressPack) and tools from the robot.</p>	


#### Removing the cable package

Use these procedures to remove the cable package.

#### Preparations before removing the cable package

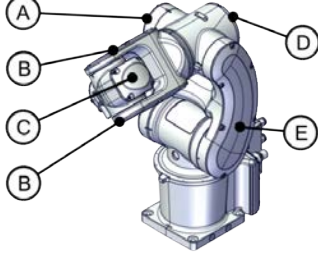
	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none"> <li>• Axis 1: 0°</li> <li>• Axis 2: 0°</li> <li>• Axis 3: 0°</li> <li>• Axis 4: +130°</li> <li>• Axis 5: -90°</li> <li>• Axis6: No significance</li> </ul>	 <p>xx2200000175</p>
3	<p> <b>DANGER</b></p> <p>Turn off all:</p> <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> <p>to the robot, before entering the safeguarded space.</p>	

#### Removing the covers



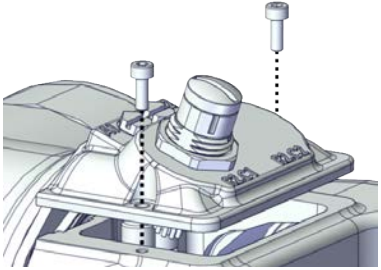
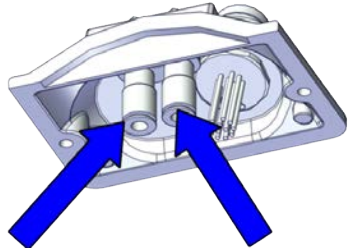

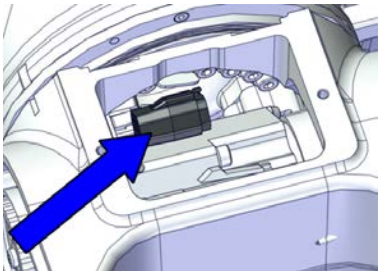
	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	

Continues on next page

5.3.1 Replacing the cable package  
Continued

	Action	Note
2	Remove the covers. <ul style="list-style-type: none"> <li>• Lower arm cover, left (A)</li> <li>• Wrist covers (B)</li> <li>• Tilt cover (C)</li> <li>• Housing cover (D)</li> <li>• Lower arm cover, right (E)</li> </ul>	 <p>xx2200000029</p>

Removing the process hub

	Action	Note
1	 <p><b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	 <p><b>CAUTION</b></p> <p>There is cabling attached to the cover. The cover cannot be removed completely until the connectors are removed.</p>	 <p>xx2200000030</p>
3	<p><b>For robots with air hoses</b></p> <p>Disconnect the air hoses.</p>	 <p>xx2200000031</p>
4	<p><b>For robots with CP/CS cabling</b></p> <p>Disconnect the connector.</p> <ul style="list-style-type: none"> <li>• R2.C1</li> </ul>  <p><b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000032</p>




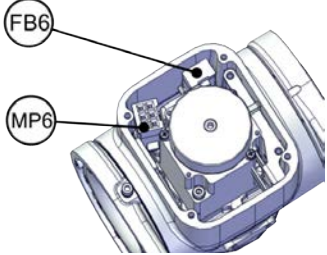

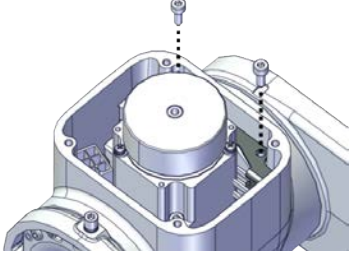
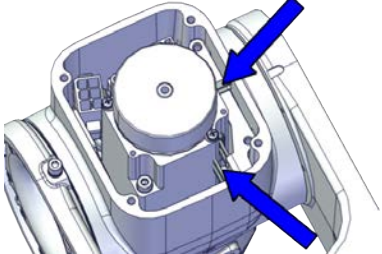
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## 5 Repair


### 5.3.1 Replacing the cable package

*Continued*

#### Disconnecting the axis-6 motor connectors


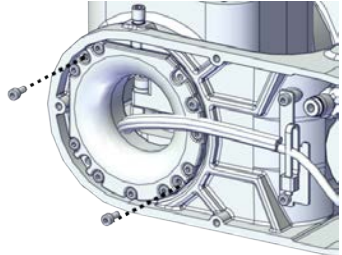
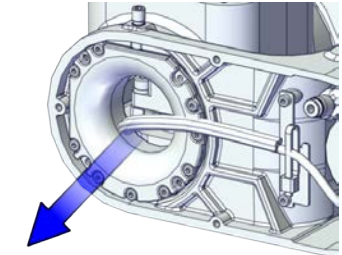
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Disconnect the connectors. <ul style="list-style-type: none"> <li>• MP6</li> <li>• FB6</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.   <b>Tip</b> The MP6 connector is fitted in particular position. Handle with cautions to not get it stuck.	 xx2200000035
3	Remove the axis-6 cable bracket.   <b>CAUTION</b> Be aware of the cablings that are attached to the cable bracket! The bracket cannot be removed completely until the cablings are removed from the plate.	 xx2200000033
4	Cut the cable straps.	 xx2200000034

#### Pulling out the cable package from axis 5



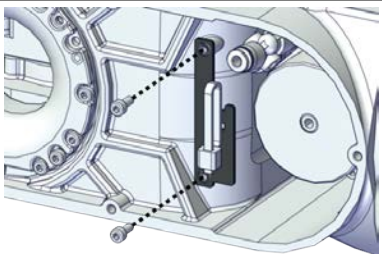
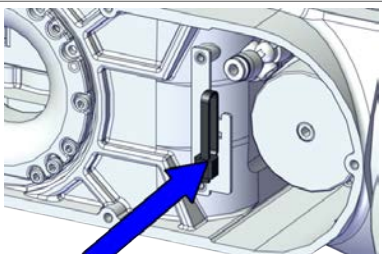
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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5.3.1 Replacing the cable package  
Continued

	Action	Note
2	Wrap the connectors with the masking tape.	
3	Remove the axis-5 cable protector.  <b>Note</b> The screws to be removed are a little protruding than others. Do not mix the screws.	 xx2200000036
4	Pull out the cable package in the direction as shown in the figure.	 xx2200000037
5	Slip out the cable protector.	

Separating the cable package from axis 5

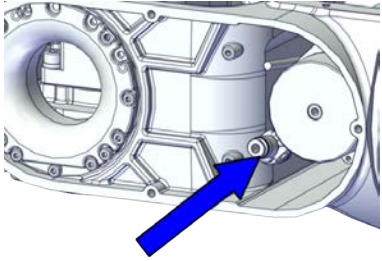
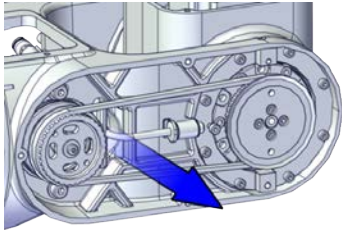
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the axis-5 cable bracket.  <b>CAUTION</b> Be aware of the cablings that are attached to the cable bracket! The bracket cannot be removed completely until the cablings are removed from the plate.	 xx2200000038
3	Cut the cable strap.	 xx2200000039

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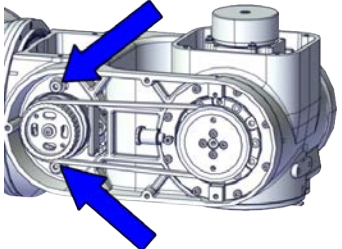
## 5 Repair

### 5.3.1 Replacing the cable package

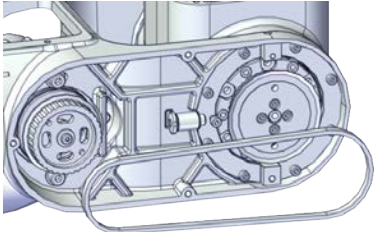
Continued

	Action	Note
4	Disconnect the pressure relief pipe connector.	 xx220000041
5	Pull out the pressure relief pipe carefully from the other side of the wrist unit.	 xx2200000537




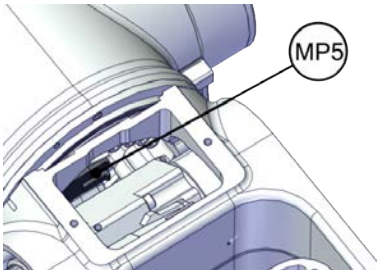
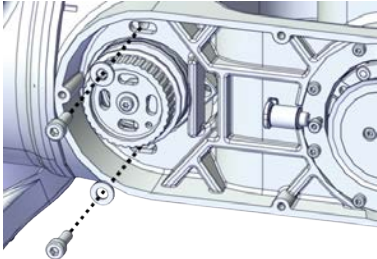
### Removing the axis-5 timing belt

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>CAUTION</b> Loosening timing belts will release axes. This means the axes can fall down. Make sure axes are well supported before loosening timing belts.	
3	Loosen the screws and move the motor slightly to slacken the timing belt.	 xx220000042

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	Action	Note
4	Remove the timing belt from its groove on the motor.	 <p>xx2200000043</p>

#### Removing the axis-5 motor

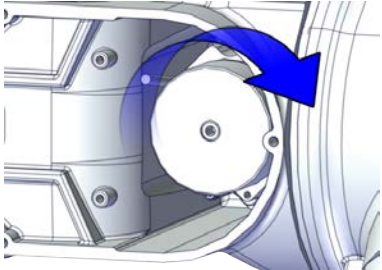

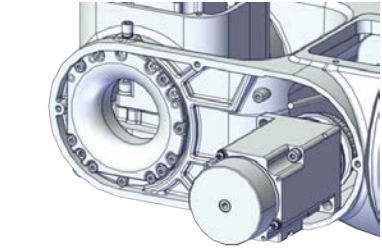

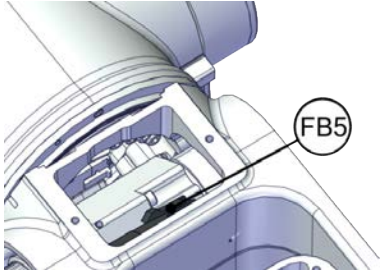
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>CAUTION</b> Removing motors will release axes. This means the axes can fall down. Make sure axes are well supported before removing motors.	
3	Disconnect the connector. <ul style="list-style-type: none"> <li>• MP5</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 <p>xx2200000040</p>
4	Remove the screws and washers.	 <p>xx2200000044</p>

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## 5 Repair

### 5.3.1 Replacing the cable package

Continued

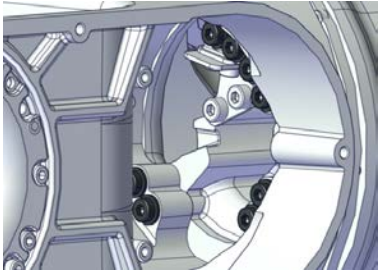
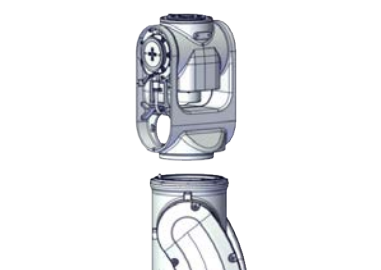

	Action	Note
5	Carefully rotate the motor to make its motor connector to a levelled position.	 xx220000045
6	Carefully lift out the motor.  <b>CAUTION</b> Be aware of the connector that is still connected! The motor cannot be removed completely until the connector is disconnected.	 xx220000046
7	Disconnect the connector. <ul style="list-style-type: none"> <li>• FB5</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 xx2200000538

### Separating the wrist unit from the axis 3-4 assembly unit


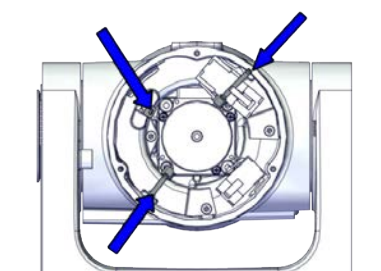
	Action	Note
1	Connect the power supply to axis-3 motor and release the axis-3 brake to move the axis 3 to -90°. Then, disconnect the power supply.  <b>Note</b> The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a> .	
2	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page



	Action	Note
3	Remove the screws (dark-colored in the figure).	 <p>xx220000047</p>
4	Separate the wrist unit.	 <p>xx2200000539</p>
5	<p>Connect the power supply to axis-3 motor and release the axis-3 brake to move the axis 3 to zero position. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	

Disconnecting the axis-4 motor connectors


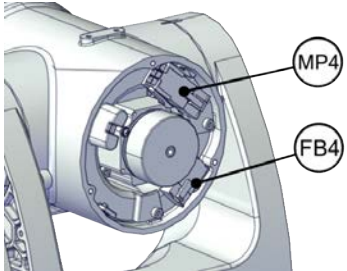
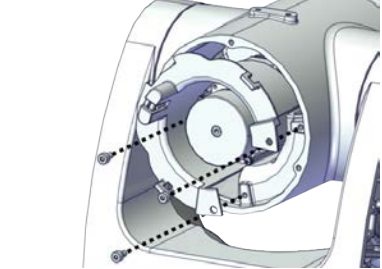
	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	Cut the cable straps.	 <p>xx2200000050</p>

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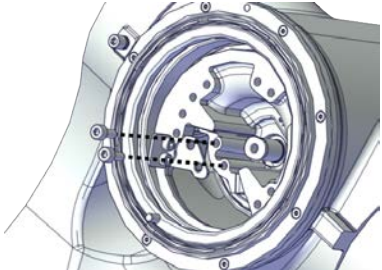
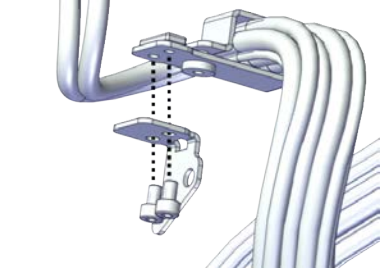
## 5 Repair

### 5.3.1 Replacing the cable package

Continued


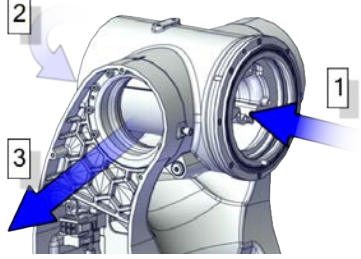
	Action	Note
3	Disconnect the connectors. <ul style="list-style-type: none"> <li>• MP4</li> <li>• FB4</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 xx2200000049
4	Remove the axis-4 cable protector.	 xx2200000051

#### Pulling out the cable package from axis 4


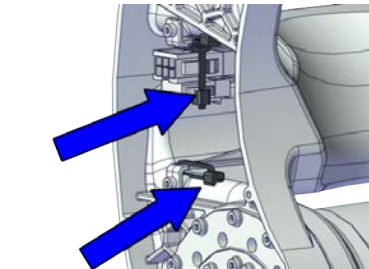

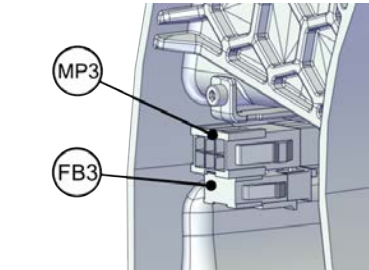
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Wrap the connectors with the masking tape.	
3	Remove the axis-4 cable bracket to separate the cable from the housing.	 xx2200000052
4	Remove the axis-4 cable bracket from the cable.	 xx2200000058

Continues on next page


5.3.1 Replacing the cable package  
Continued

	Action	Note
5	<p>Pull out the cable package in the direction as shown in the figure.</p> <p> <b>Note</b></p> <p>Pay attention to the axis-4 motor cablings which locate in different direction from the main cable package. Do not pull them out with force!</p>	 <p>xx2200000053</p>

Disconnecting the axis-3 motor connectors

	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	<p>Cut the cable straps.</p>	 <p>xx2200000054</p>
3	<p>Disconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB3</li> <li>• MP3</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000055</p>

Removing the axis-3 timing belt


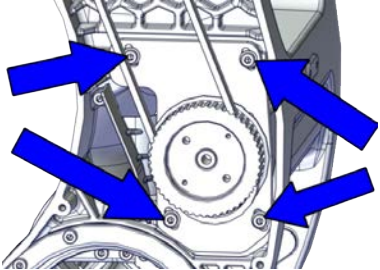
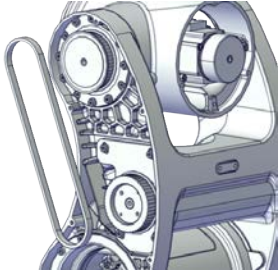
	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	

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## 5 Repair

### 5.3.1 Replacing the cable package

*Continued*

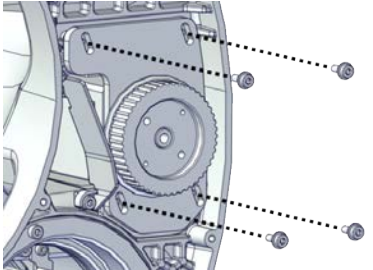
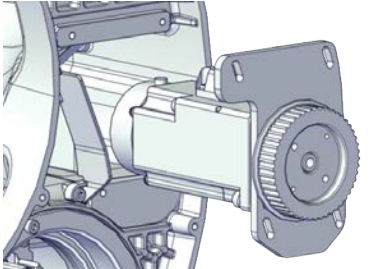
	Action	Note
2	 <b>CAUTION</b> Loosening timing belts will release axes. This means the axes can fall down. Make sure axes are well supported before loosening timing belts.	
3	Loosen the screws and move the motor slightly to slacken the timing belt.	 xx2200000056
4	Remove the timing belt from its groove on the motor.	 xx2200000057

### Removing the axis-3 motor


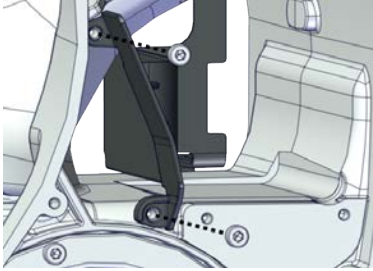
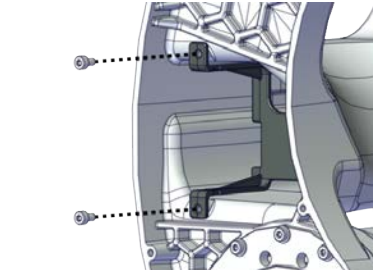
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>CAUTION</b> Removing motors will release axes. This means the axes can fall down. Make sure axes are well supported before removing motors.	

*Continues on next page*

5.3.1 Replacing the cable package  
Continued

	Action	Note
3	Remove the screws.	 <p>xx2200000058</p>
4	Carefully lift out the motor.	 <p>xx2200000059</p>

Pulling out the cable package from axis 3

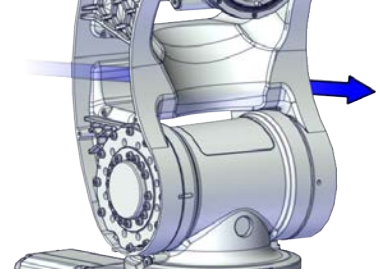
	Action	Note
1	 <p><b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	Wrap the connectors with the masking tape.	
3	Remove the axis-3 cable protector.	 <p>xx2200000060</p>  <p>xx2200000061</p>

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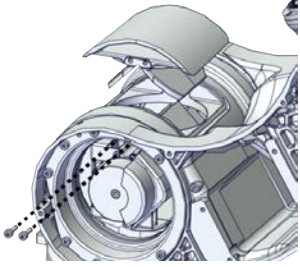
## 5 Repair

### 5.3.1 Replacing the cable package


Continued

	Action	Note
4	Pull out the cable package through out the cavity of the axis 3-4 assembly unit.	 xx220000062



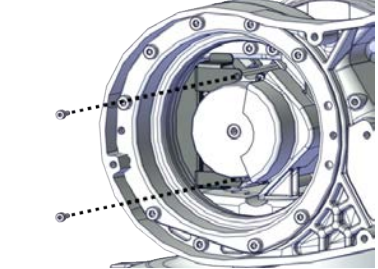
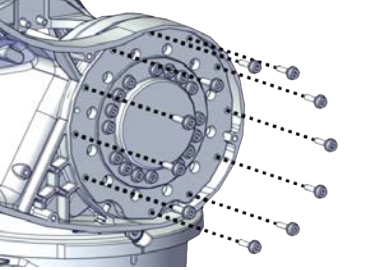

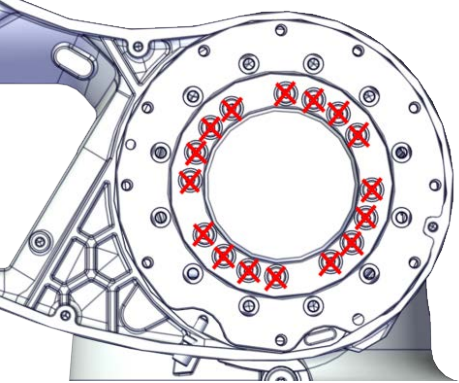
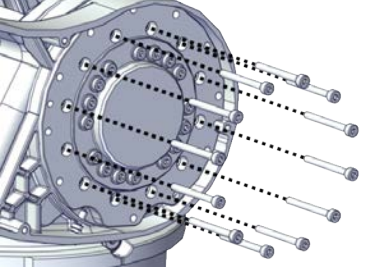
### Removing the swing top cover

	Action	Note
1	Connect the power supply to axis-2 motor and release the axis-2 brake to move the axis 2 to -60°. Then, disconnect the power supply.   <b>Note</b> The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a> .	
2	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
3	Remove the swing top cover.	 xx2200000540

### Removing the axis-2 drive unit

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

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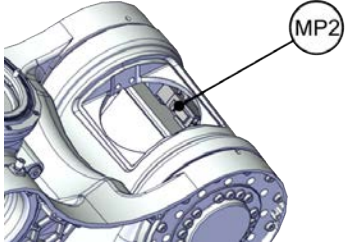

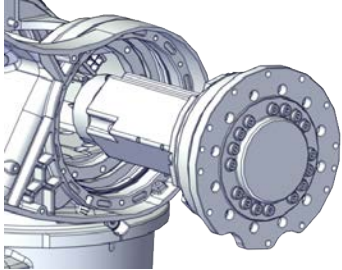

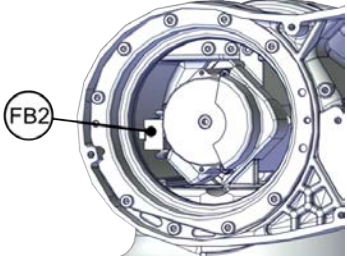
	Action	Note
2	<p> <b>CAUTION</b></p> <p>Removing drive units will release axes. This means the axes can fall down. Make sure axes are well supported before removing drive units.</p>	
3	<p> <b>Note</b></p> <p>Make sure axis 2 remains positioning in <math>-60^\circ</math>; otherwise, the screws securing the axis-2 drive unit cannot be accessible during drive unit replacement.</p>	
4	Remove the axis-2 cable bracket.	 <p>xx2200000063</p>
5	Remove the outermost screws (flange screws, 11 pcs) securing the axis-2 drive unit to the axis 3-4 assembly unit.	 <p>xx2200000065</p>
6	<p>Remove the screws (12 pcs) securing the axis-2 drive unit to the axis-1 assembly unit.</p> <p> <b>CAUTION</b></p> <p>Do not remove the innermost screws (16 pcs).</p>  <p>xx2200000068</p>	 <p>xx2200000066</p>

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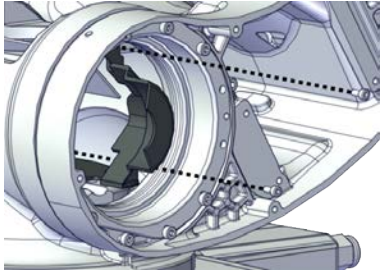
## 5 Repair

### 5.3.1 Replacing the cable package

Continued

	Action	Note
7	<p>Access and disconnect the connector from the swing top.</p> <ul style="list-style-type: none"> <li>MP2</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000541</p>
8	<p>Carefully lift out the drive unit.</p> <p> <b>CAUTION</b></p> <p>Be aware of the connector that is still connected! The drive unit cannot be removed completely until the connector is disconnected.</p>	 <p>xx2200000067</p>
9	<p>Disconnect the connector.</p> <ul style="list-style-type: none"> <li>FB2</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000064</p>





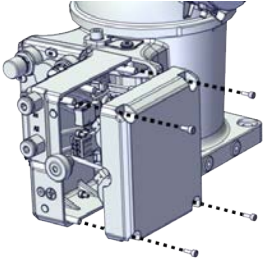

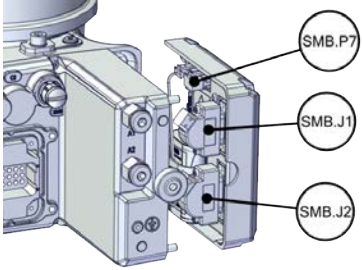
### Separating the cable package from axis 2

	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	<p>Remove the axis-2 cable protector.</p>	 <p>xx2200000069</p>


Continues on next page



Disconnecting the SMB connectors

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	
3	Remove the SMB cover attachment screws and carefully open the cover.   <b>CAUTION</b> Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.   <b>CAUTION</b> There are cabling attached to the cover. The cover cannot be removed completely until the connectors are removed.	 xx2200000012
4	Disconnect the connectors. <ul style="list-style-type: none"> <li>• SMB.P7</li> <li>• SMB.J1</li> <li>• SMB.J2</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 xx2200000013
5	Remove the SMB cover completely from the base.	

Removing the base interface plate


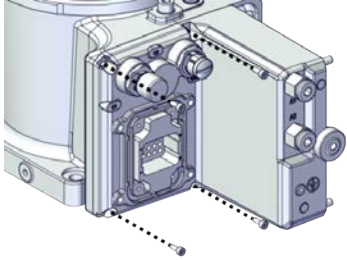
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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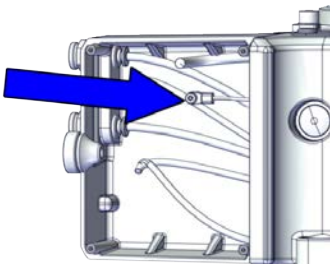
## 5 Repair

### 5.3.1 Replacing the cable package



Continued

	Action	Note
2	Remove the base interface plate.   <b>Note</b>  Be aware of the cabling that is attached to the interface plate! The interface plate can not be removed completely until the connectors are disconnected, as shown in following steps.	  xx220000074

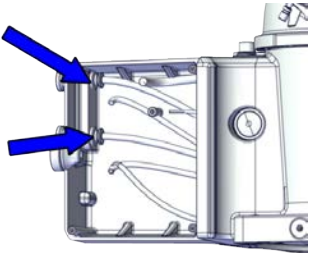

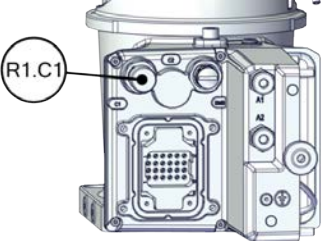
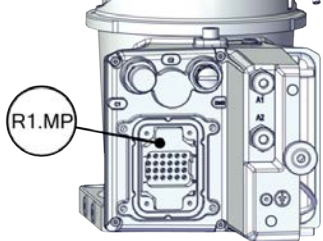
#### Disconnecting the earth cable

	Action	Note
1	 <b>DANGER</b>  Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b>  The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	
3	Disconnect the earth cable.	  xx220000072


#### Disconnecting the connectors from the base interface panel

	Action	Note
1	 <b>DANGER</b>  Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b>  The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	

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	Action	Note
3	Cut the cable straps.	
4	<p>For robots with air hoses Disconnect the air hoses.</p>	 <p>xx220000073</p>
5	<p>For robots with CP/CS cabling Disconnect the connector using the tool.</p> <ul style="list-style-type: none"> <li>R1.C1</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	<p>M12 connector assembly tool, included in the special toolkit 3HAC071022-001</p>  <p>xx220000075</p>
6	Remove the main power connector R1.MP.	 <p>xx220000076</p>

Disconnecting the axis-1 motor connectors


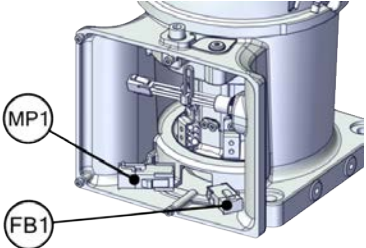
	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	

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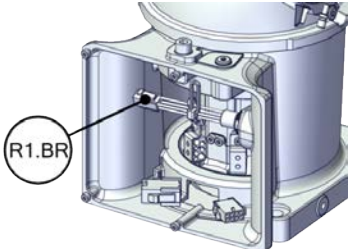
## 5 Repair

### 5.3.1 Replacing the cable package




Continued

	Action	Note
2	<p>Disconnect the motor connectors.</p> <ul style="list-style-type: none"> <li>• FB1</li> <li>• MP1</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000077</p>

#### Disconnecting the break release connector

	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	<p>Disconnect the connector R1.BR.</p> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000078</p>


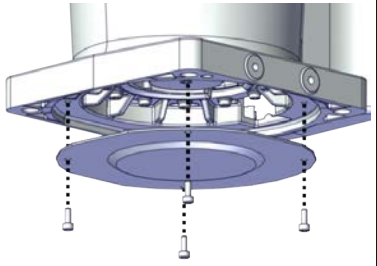

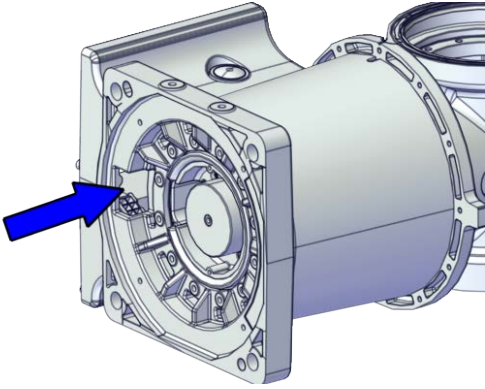
#### Putting the robot on its side

	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	<p> <b>CAUTION</b></p> <p>The base and axis-1 assembly unit weigh 3.4 kg and can be lifted by one person.</p>	
3	<p> <b>WARNING</b></p> <p>The robot is likely to be mechanically unstable if not secured to the foundation.</p>	


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	Action	Note
4	Loosen the robot from the foundation by removing the foundation attachment screws and put the robot on its side.	

Separating the base from the axis-1 assembly unit

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the base cover.	 xx220000079
3	Remove the base.  <b>Note</b> Pay attention to the axis-1 motor cablings which should be carefully pulled out from the pointed hole first before removing the base.	 xx220000081

Separating the cable package from the axis-1 assembly unit

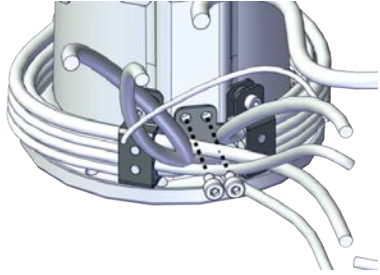
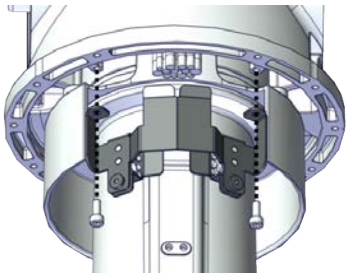
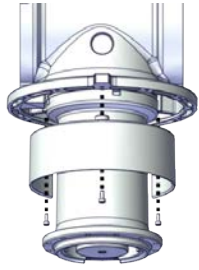
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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## 5 Repair

### 5.3.1 Replacing the cable package

*Continued*

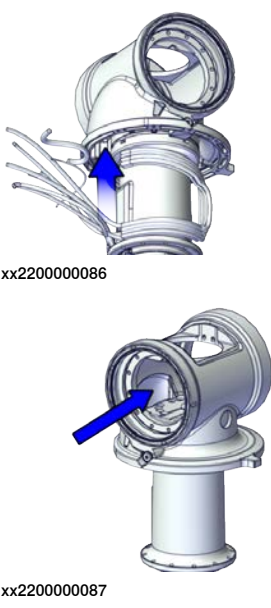
	Action	Note
2	Separate the cable package by removing the screws.	 <p>xx220000082</p>  <p>xx220000083</p>
3	Remove the axis-1 cable protector.	 <p>xx220000084</p>

#### Pulling out the cable package

	Action	Note
1	 <p><b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	Wrap the connectors with the masking tape.	

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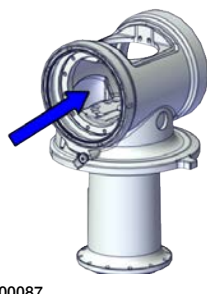
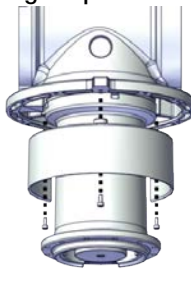
5.3.1 Replacing the cable package  
Continued

	Action	Note
3	<p>Pull out the cable package up through the pointed hole in the axis-1 assembly unit and then pull it out completely.</p>	 <p>xx220000086</p> <p>xx220000087</p>

**Refitting the cable package**

Use these procedures to refit the cable package.

**Securing the cable package to the axis-1 assembly unit**




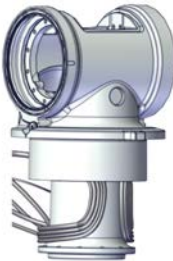

	Action	Note
1	<p>Wrap the connectors with the masking tape.</p>	
2	<p>Insert the cable package into the axis-1 assembly unit through the pointed hole.</p> <p> <b>CAUTION</b></p> <p>Note the correct direction of the cable package. Make sure that no cables or hoses are twisted or strained. Reroute if necessary.</p>	 <p>xx220000087</p>
3	<p>Refit the axis-1 cable protector.</p>	<p>Cable protector, axis 1: 3HAC078560-001 Screw: M2.5x6 12.9 Lafre 2C2B/FC6.9 (3 pcs) Tightening torque: 0.4 Nm</p>  <p>xx220000084</p>

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## 5 Repair

### 5.3.1 Replacing the cable package

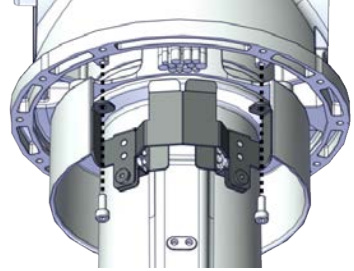
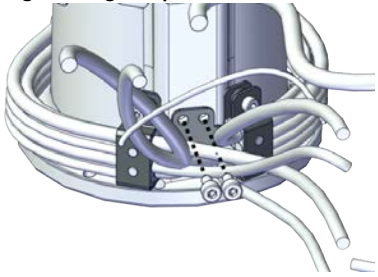
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	Action	Note
4	<p>Separate the two bunches of the cable package. Carefully bend them backwards (opposite direction to the hole where the cable package inserted) in the cable protector, and then bend back after a half-turn.</p> <p> <b>CAUTION</b></p> <p>Make sure that no cables or hoses are twisted or strained. Reroute if necessary.</p>	<p>Take the following figures as reference for cable package bending</p> <p>Front view</p>  <p>xx220000088</p> <p>Right view</p>  <p>xx220000089</p> <p>Left view</p>  <p>xx220000059</p> <p>Back view</p>  <p>xx220000090</p>

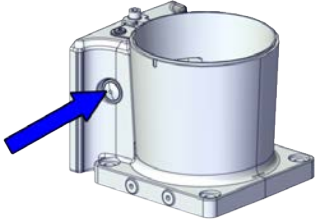
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5.3.1 Replacing the cable package  
Continued

	Action	Note
5	Secure the cable package to the axis-1 assembly unit.	<p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (2 pcs) Tightening torque: 1.2 Nm</p>  <p>xx220000083</p> <hr/> <p>Screw: M3x6 12.9 Lafre 2C2B/FC6.9 (2 pcs) Tightening torque: 0.8 Nm</p>  <p>xx220000082</p>

Refitting the base

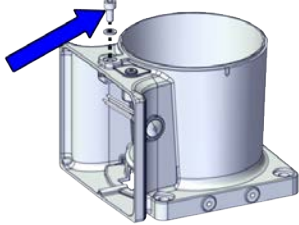
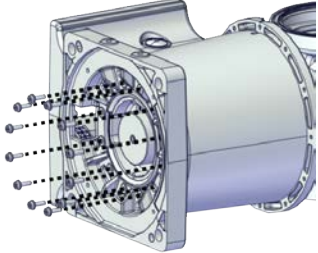
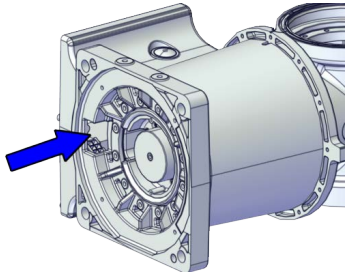
	Action	Note
1	Check the brake release button. Replace if damaged.	<p>Brake release button: 3HAC068448-001 Brake release button assembly tool, included in the special toolkit 3HAC071022-001</p>  <p>xx220000091</p>

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## 5 Repair

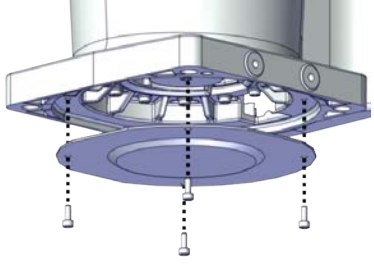
### 5.3.1 Replacing the cable package

Continued


	Action	Note
2	Check the fixed mechanical stop screw and washer. Replace if damaged.	<p>Mechanical stop, screw: 9ADA186-23 Mechanical stop, washer: 9ADA762-6 Tightening torque: 5 Nm</p>  <p>xx2200000092</p>
3	Apply grease to the cable package, cover all moving area of the package.	Grease: 3HAC029132-001
4	Apply grease to the inner base that have contact- ing area with the cable package.	Grease: 3HAC029132-001
5	Refit the base.	<p>Flange socket head screw, M3x10 12.9 Lafre 2C2B/FC6.9+PrO- COat111, 3HAB3412-310(12 pcs) Tightening torque: 1.5 Nm</p>  <p>xx2200000080</p>
6	Insert the axis-1 drive unit connectors through the hole to the robot rear.	 <p>xx2200000081</p>

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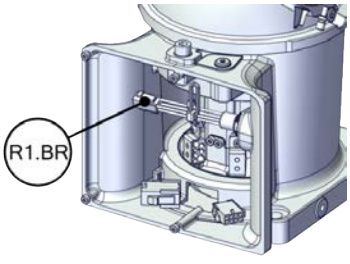
5.3.1 Replacing the cable package  
Continued

	Action	Note
7	Refit the base cover.	<p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (4 pcs) Tightening torque: 1.2 Nm</p>  <p>xx2200000079</p>

Securing the robot to the foundation

	Action	Note
1	 <b>CAUTION</b> The base and axis-1 assembly unit weigh 3.4 kg and can be lifted by one person.	
2	Raise the robot to standing and secure to the foundation with the attachment screws and washers.	<p>Attachment screws: M8x30 (robot installation directly on foundation), quality: 8.8. Washers: 8.4 x 16 x 1.6. Tightening Torque: 20 Nm±2 Nm.</p>

Reconnecting the brake release connector

	Action	Note
1	<p>Reconnect the connector R1.BR.</p>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 <p>xx2200000078</p>


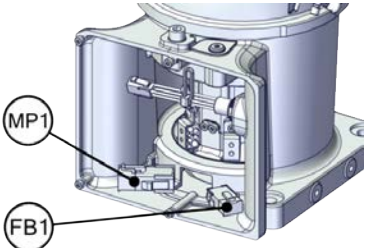
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## 5 Repair

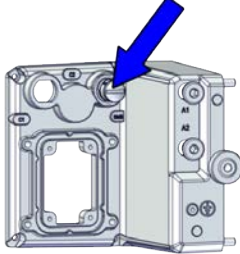
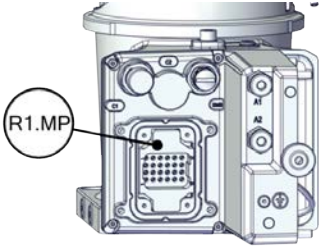
### 5.3.1 Replacing the cable package

*Continued*

#### Reconnecting the axis-1 motor connectors


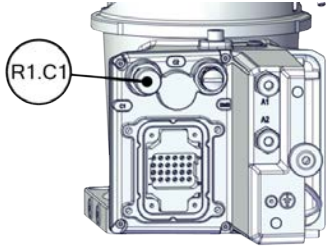
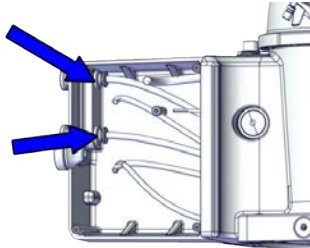
	Action	Note
1	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB1</li> <li>• MP1</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000077</p>

#### Reconnecting the connectors to the base interface panel

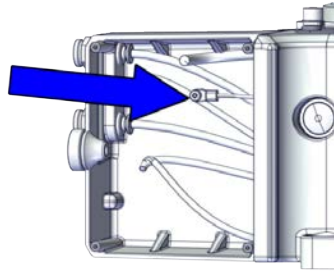
	Action	Note
1	<p>Check the SMB cabling on the base interface panel. Replace if damaged.</p>	<p>SMB cable: 3HAC068830-005 M12 connector assembly tool, included in the special toolkit 3HAC071022-001</p>  <p>xx2200000093</p>
2	<p>Refit the main power connector R1.MP.</p>	<p>Screw: M3x10 12.9 Lafre 2C2B/FC6.9 (4 pcs) Tightening torque: 0.6 Nm</p>  <p>xx2200000076</p>

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5.3.1 Replacing the cable package  
Continued

	Action	Note
3	<p>For robots with CP/CS cabling</p> <p>Reconnect the connector using the tool.</p> <ul style="list-style-type: none"> <li>R1.C1</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	<p>M12 connector assembly tool, included in the special toolkit 3HAC071022-001</p>  <p>xx2200000075</p>
4	<p>For robots with air hoses</p> <p>Reconnect the air hoses.</p>	 <p>xx2200000073</p>

Reconnecting the earth cable

	Action	Note
1	Reconnect the earth cable.	 <p>xx2200000072</p>

Refitting the base interface panel

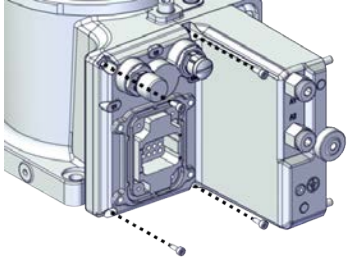
	Action	Note
1	Check the grommet. Replace if damaged.	Grommet M16: 3HAC024817-001
2	<p>Route and secure the cabling with cable straps.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	
3	Apply grease to the cable package, cover all moving area of the package.	

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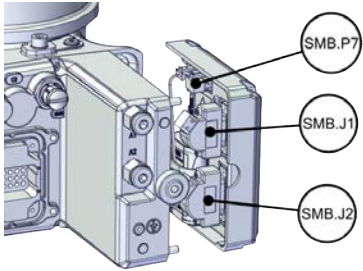

## 5 Repair

### 5.3.1 Replacing the cable package

Continued

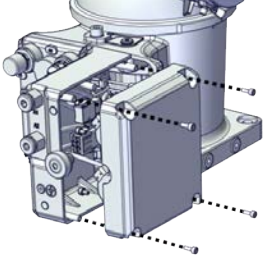
	Action	Note
4	Refit the base interface panel.	<p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (4 pcs) Tightening torque: 1.2 Nm</p>  <p>xx2200000074</p>

### Reconnecting the SMB connectors


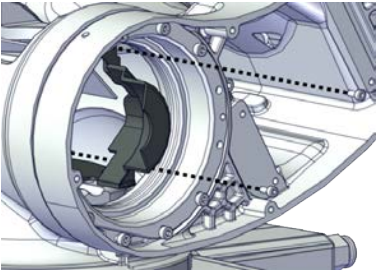
	Action	Note
1	 <p><b>ELECTROSTATIC DISCHARGE (ESD)</b></p> <p>The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a>.</p>	
2	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• SMB.P7</li> <li>• SMB.J1</li> <li>• SMB.J2</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	<p>Tightening torque: 0.4 Nm</p>  <p>xx2200000013</p>
3	<p>Route and secure the cabling with cable straps.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	

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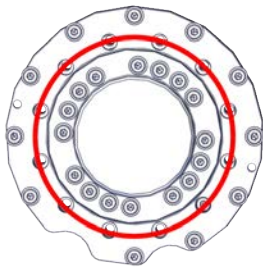
5.3.1 Replacing the cable package  
Continued

	Action	Note
4	Refit the SMB cover to the base.	<p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (4 pcs) Tightening torque: 1.2 Nm</p>  <p>xx220000012</p>

Securing the cable package in axis 2

	Action	Note
1	<p>Secure the the cable package with the axis-2 cable protector.</p> <p> <b>Note</b> Pay attention to leave axis-2 drive unit connectors free.</p>	<p>Cable protector, axis 2: 3HAC078561-001 Screw: M2.5x6 12.9 Lafre 2C2B/FC6.9 (2 pcs) Tightening torque: 0.4 Nm</p>  <p>xx220000069</p>

Refit the axis-2 drive unit


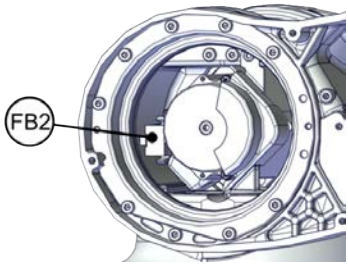
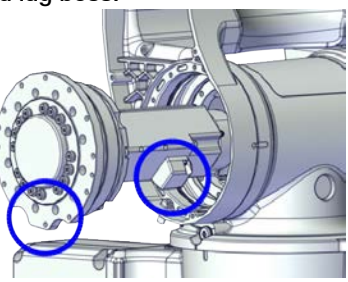
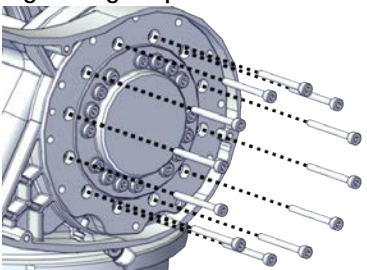
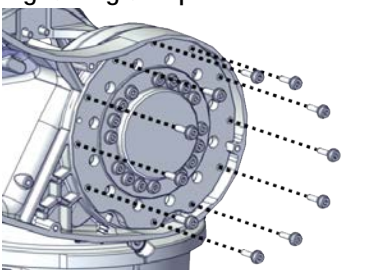
	Action	Note
1	<p>Check that:</p> <ul style="list-style-type: none"> <li>• all assembly surfaces are clean and without damages</li> <li>• the drive unit is clean and undamaged.</li> </ul>	
2	<p>Make sure:</p> <ul style="list-style-type: none"> <li>• the axis-2 synchronization marks are aligned.</li> <li>• the axis-2 drive unit is in zero position.</li> <li>• the screw holes (marked on the red circle) on the drive unit are through-holes.</li> </ul>	 <p>xx2200000543</p>

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## 5 Repair

### 5.3.1 Replacing the cable package


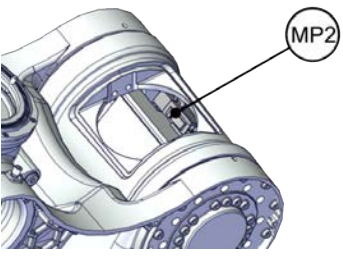
Continued

	Action	Note
3	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB2</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000064</p>
4	<p>Orient the drive unit correctly and insert it into the axis-1 assembly unit.</p> <p>Make sure the drive unit is properly fit and its cabling are not twisted or strained.</p>	<p>Orientation: orient the drive unit according to the figure below, in regard to the encircled connector and lug boss.</p>  <p>xx2200000096</p>
5	<p>Refit the drive unit to the axis-1 assembly unit.</p>	<p>Screw: M3x30 12.9 Lafre 2C2B/FC6.9 (12 pcs) Tightening torque: 1.5 Nm</p>  <p>xx2200000066</p>
6	<p>Refit the drive unit to the axis 3-4 assembly unit.</p>	<p>Flange socket head screw, M3x12 12.9 Lafre 2C2B/FC6.9+PrO-COat111, 3HAB3412-312 (11 pcs) Tightening torque: 1.5 Nm</p>  <p>xx2200000065</p>


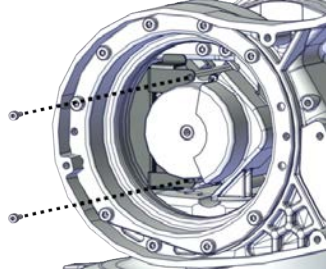
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5.3.1 Replacing the cable package  
Continued

	Action	Note
7	<p>Access and reconnect the connector from the swing top.</p> <ul style="list-style-type: none"> <li>• MP2</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000541</p>

Routing the cable package in axis 2

	Action	Note
1	<p>Route and secure the cabling with cable straps.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	
2	<p>Apply grease to the cable package, cover all moving area of the package.</p>	<p>Grease: 3HAC029132-001</p>
3	<p>Refit the axis-2 cable bracket.</p>	<p>Cable bracket, axis 2: 3HAC080837-001</p> <p>Screw: M2x6 12.9 (2 pcs)</p> <p>Tightening torque: 0.4 Nm</p>  <p>xx2200000063</p>

Refitting the swing top cover

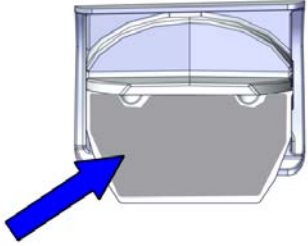
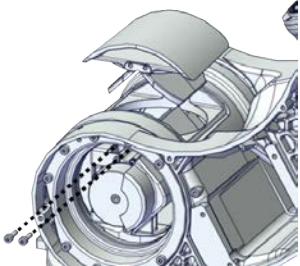

	Action	Note
1	<p>Make sure the axis 2 is in -60° position; otherwise, connect the power supply to axis-2 motor and release the axis-2 brake to move the axis 2 to -60°. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	

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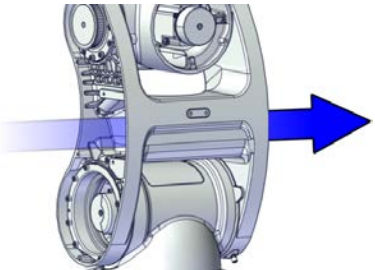
## 5 Repair

### 5.3.1 Replacing the cable package

Continued

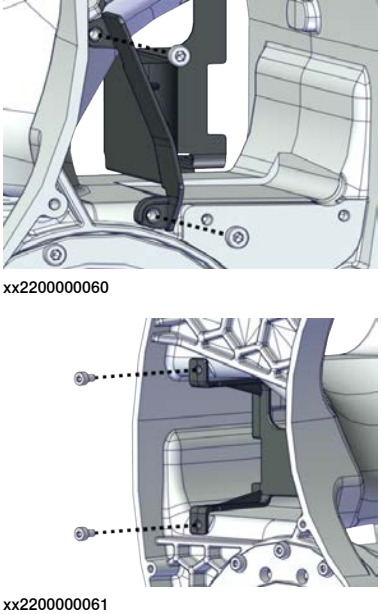
	Action	Note
2	Check the cooling pad. Replace if damaged.	<p>Cooling pad for axis-2 motor: 3HAC071021-001</p>  <p>xx2200000122</p>
3	Refit the swing top cover.	<p>Screw: M3x10 12.9 Lafre 2C2B/FC6.9 (2 pcs) Tightening torque: 1.2 Nm</p>  <p>xx2200000540</p>
4	<p>Connect the power supply to axis-2 motor and release the axis-2 brake to move the axis 2 to zero position. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	

### Securing the cable package in axis 3

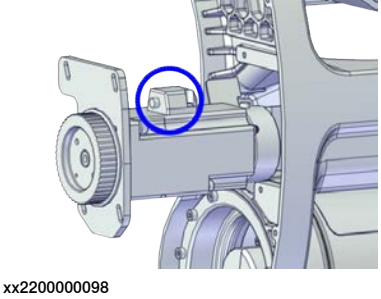
	Action	Note
1	Route the cable package through the axis 3-4 assembly unit.	 <p>xx2200000097</p>

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5.3.1 Replacing the cable package  
Continued

	Action	Note
2	Secure the the cable package with the axis-3 cable protector.	<p>Cable protector, axis 3: 3HAC078562-001 Screw: M3x6 12.9 Lafre 2C2B/FC6.9 (4 pcs) Tightening torque: 0.4 Nm</p> 

Refitting the axis-3 motor


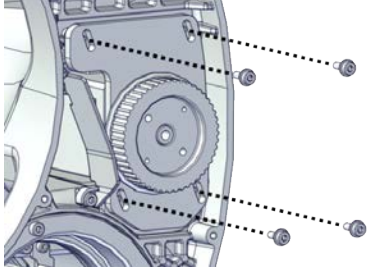
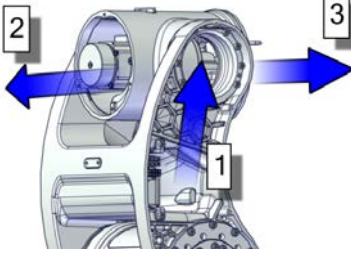
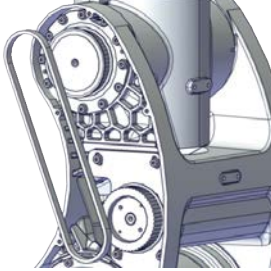

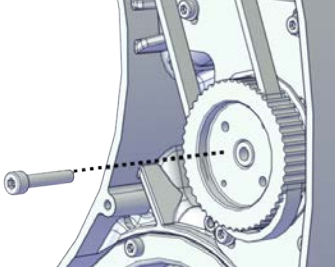
	Action	Note
1	<p>Check that:</p> <ul style="list-style-type: none"> <li>• all assembly surfaces are clean and without damages</li> <li>• the motor is clean and undamaged.</li> </ul>	
2	Orient the motor correctly and fit it into the axis 3-4 assembly unit.	<p>Motor orientation: orient the motor according to the figure below, in regard to the encircled motor connector.</p> 

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## 5 Repair

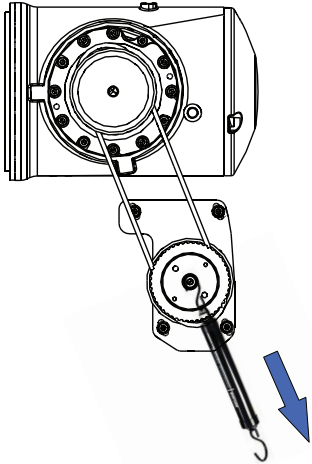
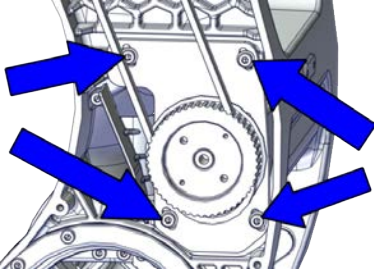

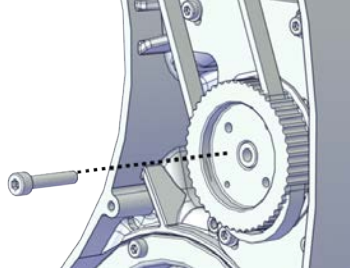
### 5.3.1 Replacing the cable package

Continued

	Action	Note
3	<p>Refit the screws and washers.</p> <p> <b>Note</b></p> <p>Do not tighten the screws yet.</p>	<p>Flange socket head screw, M3x8 12.9 Lafre 2C2B/FC6.9+PrO- COat111, 3HAB3412-308 (4 pcs)</p>  <p>xx220000058</p>
4	<p>Route the cable package.</p> <ul style="list-style-type: none"><li>Route the cable package up into the axis 4 (direction 1).</li><li>Pull the axis-4 motor connectors out from the robot rear (direction 2).</li><li>Pull the main cable harness out from the axis 3-4 assembly unit and to the wrist unit direction (direction 3).</li></ul>	 <p>xx2200000100</p>
5	<p>Install the timing belt to the pulleys and verify that the belt runs correctly in the grooves of the pulleys.</p>	 <p>xx2200000099</p>
6	<p>Install an M4x20 or longer adjustment screw to the motor.</p> <p> <b>Note</b></p> <p>Do not insert the entire screw to the hole. The screw shall be installed with proper force to avoid shaft rotation.</p>	 <p>xx2200000544</p>

Continues on next page

5.3.1 Replacing the cable package  
Continued

	Action	Note
7	Use a handheld dynamometer hooking to the screw and pull the dynamometer to reach the initial referenced force.	<p>Initial referenced force for used belt: 14.1±1 N (for reference only) Initial referenced force for new belt: 20.2±1 N</p>  <p>xx2200000545</p>
8	Secure the motor with the screws.	<p>Tightening torque: 0.8 Nm</p>  <p>xx220000056</p>
9	Use a sonic tension meter to measure the timing belt tension.	<p>Used belt: 86-93 Hz New belt: 93-118 Hz (for reference only)</p>
10	If the timing belt tension does not meet the requirement, loosen the motor screws and readjust.	
11	<p>Remove the adjustment screw from the motor.</p> <p> <b>Note</b></p> <p>Pay attention to the screw turning direction. Incorrect direction may weaken the brake capacity of the motor.</p>	 <p>xx2200000544</p>


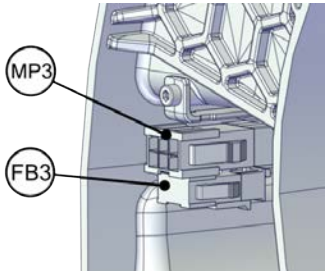

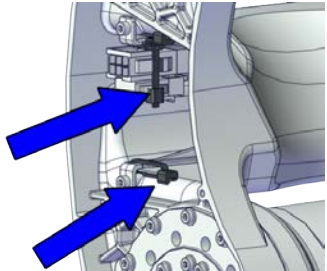
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## 5 Repair

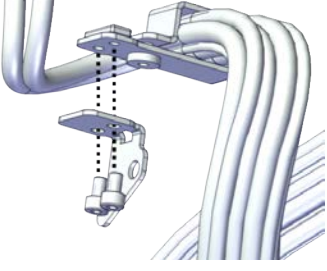
### 5.3.1 Replacing the cable package

*Continued*

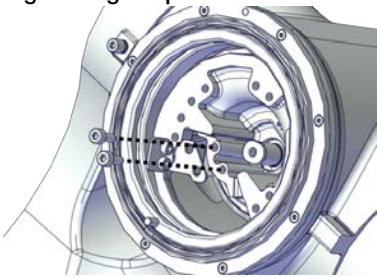

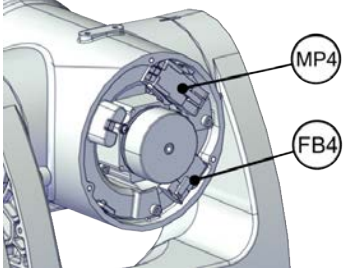


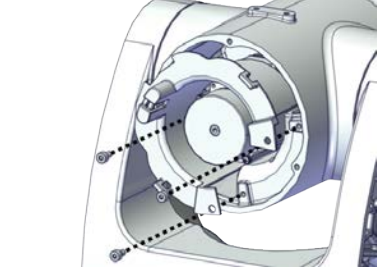
#### Reconnecting the axis-3 motor connectors

	Action	Note
1	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB3</li> <li>• MP3</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000055</p>
2	<p>Route and secure the cabling with cable straps.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	 <p>xx2200000054</p>
3	<p>Apply grease to the cable package, cover all moving area of the package.</p>	<p>Grease: 3HAC029132-001</p>

#### Securing the cable package in axis 4

	Action	Note
1	<p>Refit the axis-4 cable bracket to the cable.</p>	<p>Cable bracket, axis 4: 3HAC076867-001</p> <p>Screw: M2.5x4 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 0.6 Nm</p>  <p>xx2200000058</p>

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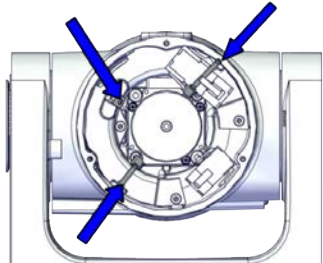
	Action	Note
2	Refit the axis-4 cable bracket to the housing.	Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (2 pcs) Tightening torque: 1.2 Nm  xx2200000052
3	Reconnect the connectors. <ul style="list-style-type: none"> <li>• FB4</li> <li>• MP4</li> </ul>  <b>Tip</b> See the number markings on the connectors for help to find the corresponding connector.	 xx2200000049
4	Make sure the axis 4 is in 130° position; otherwise, connect the power supply to axis-4 motor and release the axis-4 brake to move the axis 4 to 130°. Then, disconnect the power supply.   <b>Note</b> The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a> .	
5	Apply grease to the cable package, cover all moving area of the package.	Grease: 3HAC029132-001
6	Refit the axis-4 cable protector.   <b>Tip</b> If required, disconnect the axis-4 connectors before the refitting. This facilitates the cable routing.	Cable protector, axis 4: 3HAC075565-001 Screw: M3x6 12.9 Lafre 2C2B/FC6.9 (3 pcs) Tightening torque: 0.4 Nm  xx2200000051

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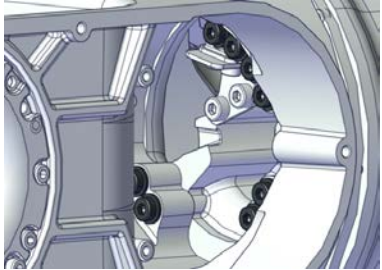
## 5 Repair

### 5.3.1 Replacing the cable package

Continued


	Action	Note
7	<p>Route and secure the cabling with cable straps.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	 <p>xx2200000050</p>

### Refitting the wrist unit


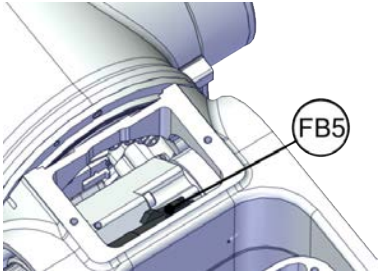
	Action	Note
1	<p>Connect the power supply to axis-3 motor and release the axis-3 brake to move the axis 3 to -90°. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	
2	Route the cable package into the wrist unit.	
3	Carefully align the wrist unit to the axis 3-4 assembly unit by the screw holes.	 <p>xx2200000539</p>
4	Refit the wrist unit.	<p>Flange socket head screw, M3x16 12.9 Lafre 2C2B/FC6.9+PrO-COat111, 3HAB3412-316 (8 pcs) Tightening torque: 1.2 Nm</p>  <p>xx2200000047</p>

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	Action	Note
5	<p>Connect the power supply to axis-3 motor and release the axis-3 brake to move the axis 3 to zero position. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	

Refitting the axis-5 motor

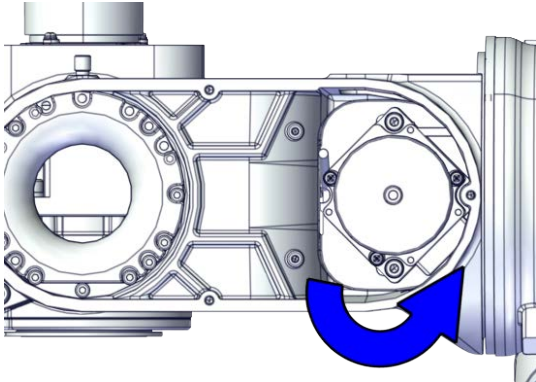

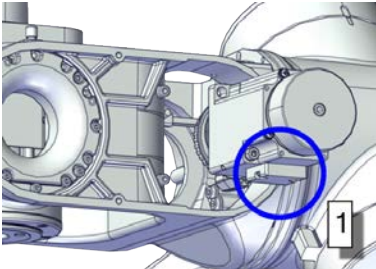
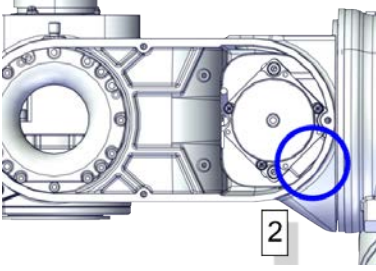

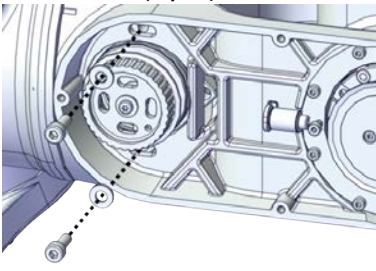

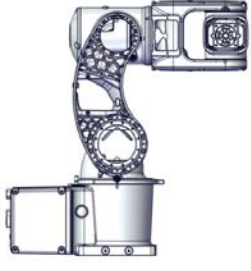
	Action	Note
1	<p>Arrange the cable package as follows:</p> <ul style="list-style-type: none"> <li>• Cablings out from the process hub                             <ul style="list-style-type: none"> <li>- air hoses</li> <li>- CP/CS cabling (connector R2.C1)</li> <li>- axis-5 motor cablings (connectors MP5 and FB5)</li> </ul> </li> <li>• Cablings out from the right side of wrist unit (facing the tool flange)                             <ul style="list-style-type: none"> <li>- axis-6 motor cablings (connectors MP6 and FB6)</li> <li>- pressure relief pipe connector</li> </ul> </li> </ul>	
2	<p>Check that:</p> <ul style="list-style-type: none"> <li>• all assembly surfaces are clean and without damages</li> <li>• the motor is clean and undamaged.</li> </ul>	
3	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB5</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000538</p>

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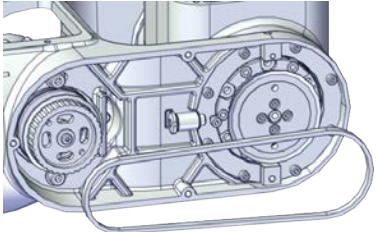
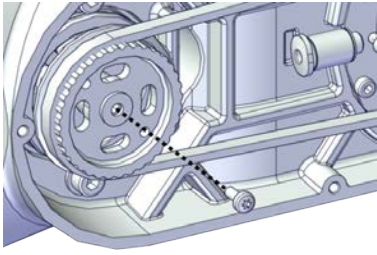

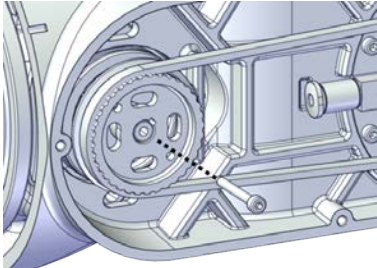
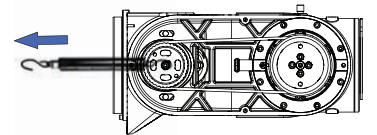
## 5 Repair

### 5.3.1 Replacing the cable package

Continued

	Action	Note
<p>4</p>  <p>xx220000103</p> <p> <b>Note</b></p> <p>Carefully handle the connectors. Leave the MP5 connector visible and accessible from the process hub.</p>	<p>Motor orientation: orient the motor according to the figures below, in regard to the encircled motor connector.</p>  <p>xx220000104</p>  <p>xx220000105</p>	
<p>5</p> <p>Refit the screws and washers.</p> <p> <b>Note</b></p> <p>Do not tighten the screws yet.</p>	<p>Screw: M4x12 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p>  <p>xx220000044</p>	
<p>6</p> <p>Connect the power supply to axis-4 motor and release the axis-4 brake to move the axis 4 to -90°. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	 <p>xx2200000120</p>	

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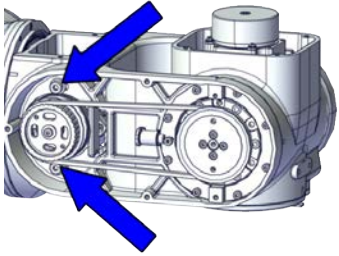

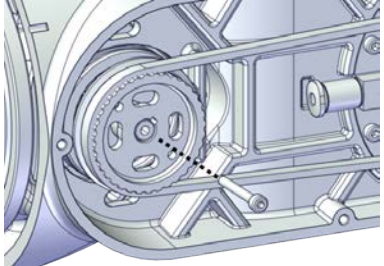


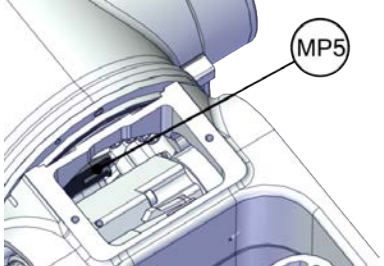
	Action	Note
7	Install the timing belt to the pulleys and verify that the belt runs correctly in the grooves of the pulleys.	 <p>xx2200000043</p>
8	Remove the pulley screw from the motor.	 <p>xx2200000546</p>
9	Install an M2.5x20 or longer adjustment screw to the motor.  <b>Note</b> Do not insert the entire screw to the hole. The screw shall be installed with proper force to avoid shaft rotation.	 <p>xx2200000547</p>
10	Use a handheld dynamometer hooking to the screw and pull the dynamometer to reach the initial referenced force.	Initial referenced force for used belt: $13.7 \pm 1$ N (for reference only) Initial referenced force for new belt: $19.6 \pm 1$ N  <p>xx2200000548</p>

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## 5 Repair

### 5.3.1 Replacing the cable package

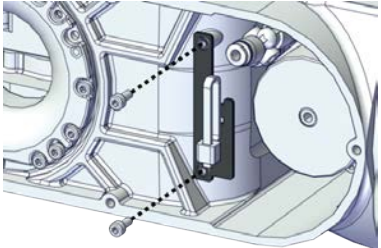

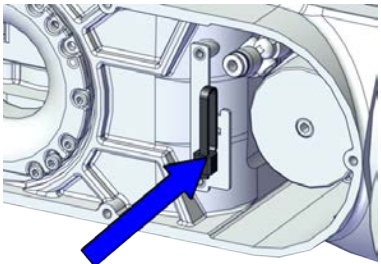
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	Action	Note
11	Secure the motor with the screws.	<p>Tightening torque: 2.8 Nm</p>  <p>xx2200000042</p>
12	Use a sonic tension meter to measure the timing belt tension.	<p>Used belt: 123-131 Hz New belt: 132-169 Hz (for reference only)</p>
13	If the timing belt tension does not meet the requirement, loosen the motor screws and readjust.	
14	<p>Remove the adjustment screw from the motor.</p> <p> <b>Note</b></p> <p>Pay attention to the screw turning direction. Incorrect direction may weaken the brake capacity of the motor.</p>	 <p>xx2200000047</p>
15	Refit the pulley screw.	Tightening torque: 0.8 Nm
16	<p>Connect the power supply to axis-4 motor and release the axis-4 brake to move the axis 4 to zero position. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	
17	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>MP5</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000040</p>

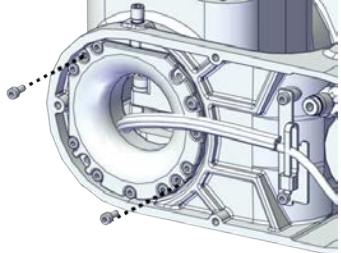
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5.3.1 Replacing the cable package  
Continued

Securing the cable package in axis 5

	Action	Note
1	Refit the axis-5 cable bracket.	<p>Cable bracket, axis 5: 3HAC079126-001</p> <p>Screw: M2.5x6 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 0.6 Nm</p>  <p>xx2200000038</p>
2	<p>Route and secure the cabling with cable straps. Make sure the white mark on the cabling facing outside.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	 <p>xx2200000039</p>

Reconnecting the axis-6 motor connectors


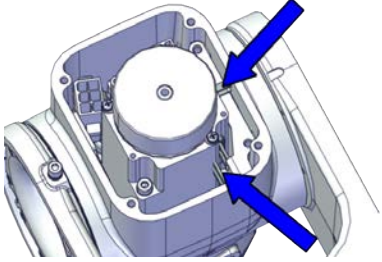
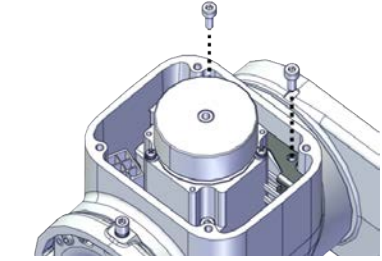

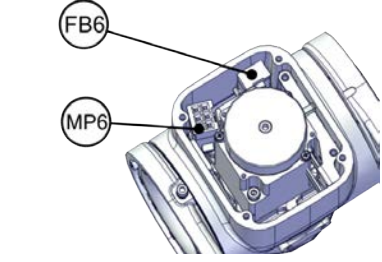
	Action	Note
1	Apply grease to the cable package, cover all moving area of the package.	Grease: 3HAC029132-001
2	Slip the axis-5 cable protector over the cable package and refit the protector.	<p>Cable protector, axis 5: 3HAC076870-001</p> <p>Screw: M2.5x6 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 0.3 Nm</p>  <p>xx2200000036</p>
3	Arrange the cable package in axis 6.	

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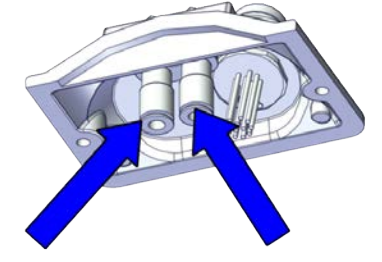
## 5 Repair

### 5.3.1 Replacing the cable package

Continued


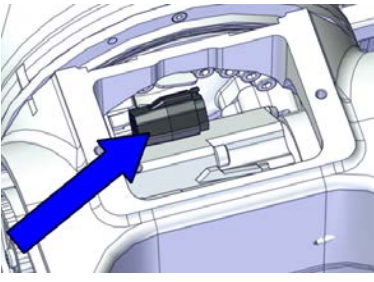

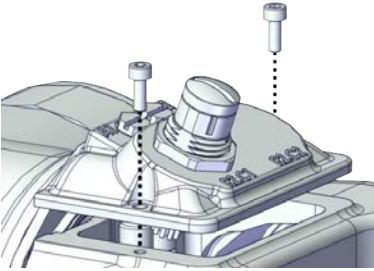
	Action	Note
4	<p>Secure the cabling with cable straps. Make sure the white mark on the cabling facing outside.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	 <p>xx2200000034</p>
5	<p>Refit the axis-6 cable bracket.</p>	<p>Cable bracket, axis 6: 3HAC079127-001</p> <p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 1.2 Nm</p>  <p>xx2200000033</p>
6	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB6</li> <li>• MP6</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000035</p>

### Refitting the process hub

	Action	Note
1	<p>For robots with air hoses</p> <p>Reconnect the air hoses.</p>	 <p>xx2200000031</p>

Continues on next page

5.3.1 Replacing the cable package  
Continued

	Action	Note
2	<p>For robots with CP/CS cabling</p> <p>Reconnect the connector.</p> <ul style="list-style-type: none"> <li>R2.C1</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000032</p>
3	<p>Route and secure the cabling with cable straps.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	
4	<p>Apply grease to the cable package, cover all moving area of the package.</p>	<p>Grease: 3HAC029132-001</p>
5	<p>Refit the process hub.</p>	<p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 1.2 Nm</p>  <p>xx2200000030</p>

Refitting the covers

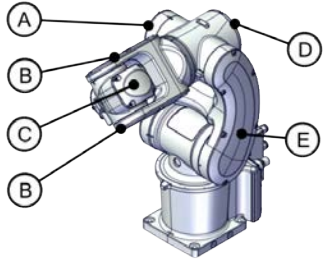
	Action	Note
1	<p>Apply grease to the cable package, cover all moving area of the package.</p>	<p>Grease: 3HAC029132-001</p>
2	<p>Apply grease to the covers that have contacting area with the cable package.</p>	<p>Grease: 3HAC029132-001</p>

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## 5 Repair

### 5.3.1 Replacing the cable package

*Continued*

	Action	Note
3	Refit the covers. <ul style="list-style-type: none"> <li>• Lower arm cover, left (A)</li> <li>• Wrist covers (B)</li> <li>• Tilt cover (C)</li> <li>• Housing cover (D)</li> <li>• Lower arm cover, right (E)</li> </ul>	Screw: M3x8 12.9 Lafre 2C2B/FC6.9 Tightening torque: 1.2 Nm  <small>xx2200000029</small>

#### Concluding procedure

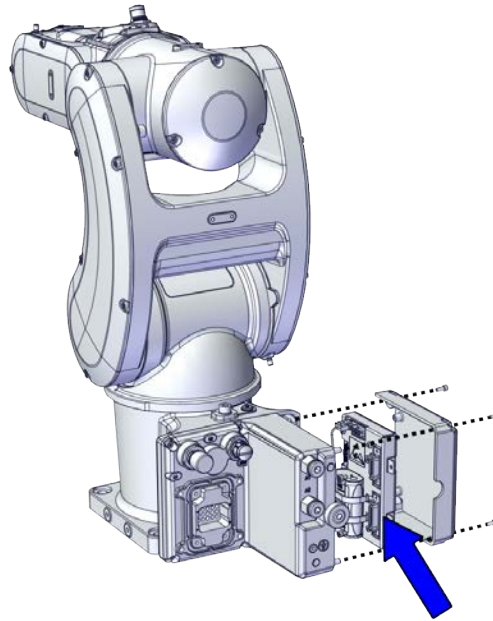
	Action	Note
1	Recalibrate the robot.	Calibration is detailed in section <a href="#">Calibration on page 283</a> .
2	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. See <a href="#">Test run after installation, maintenance, or repair on page 81</a> .	



## 5.3.2 Replacing the SMB unit

### Location of the SMB unit

The SMB unit is located as shown in the figure.



xx220000002

### Required spare parts



#### Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 1010 via myABB Business Portal, [www.abb.com/myABB](http://www.abb.com/myABB).

Spare part	Article number	Note
Serial measurement unit	3HAC063968-001	

### Required service parts

Spare part	Article number	Note
SMB cover	3HAC082448-001	
SMB cable	3HAC068830-005	

*Continues on next page*

## 5 Repair

### 5.3.2 Replacing the SMB unit

*Continued*

#### Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 330</a> .
Calibration tool box, Axis Calibration	3HAC074119-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
24 VDC power supply	-	Used to release the motor brakes.
Special toolkit	3HAC071022-001	Includes M12 connector assembly tool and Brake release button assembly tool.

#### Required consumables and wear parts

Consumable	Article number	Note
Cable straps	-	
Grease	3HAC029132-001	FM 222
Battery pack	3HAC044075-001	Battery includes protection circuits. Only replace with the specified spare part or an ABB-approved equivalent.

#### Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

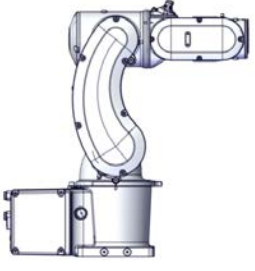

	Action	Note
1	Decide which calibration routine to use for calibrating the robot. <ul style="list-style-type: none"><li>Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot.</li><li>Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.</li></ul>	
	<b>If the robot is to be calibrated with reference calibration:</b> Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 291</a> .
	<b>If the robot is to be calibrated with fine calibration:</b> Remove all external cable packages (DressPack) and tools from the robot.	

*Continues on next page*



Removing the SMB unit

Use these procedures to remove the SMB unit.

Preparations before removing the SMB unit

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Jog the robot to the synchronization position.	 xx2200000173
3	 <b>DANGER</b> Turn off all: <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> to the robot, before entering the safeguarded space.	

Disconnecting the SMB connectors



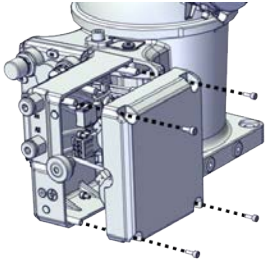

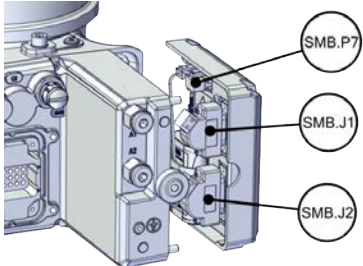
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	

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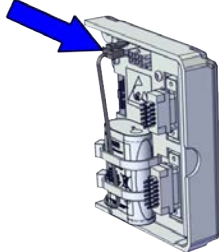
## 5 Repair

### 5.3.2 Replacing the SMB unit

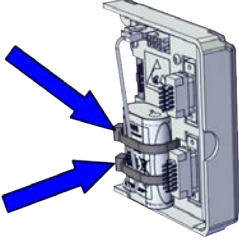
Continued

	Action	Note
3	<p>Remove the SMB cover attachment screws and carefully open the cover.</p> <p> <b>CAUTION</b></p> <p>Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.</p> <p> <b>CAUTION</b></p> <p>There are cabling attached to the cover. The cover cannot be removed completely until the connectors are removed.</p>	 <p>xx2200000012</p>
4	<p>Disconnect the connectors.</p> <ul style="list-style-type: none"> <li>• SMB.P7</li> <li>• SMB.J1</li> <li>• SMB.J2</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000013</p>
5	Remove the SMB cover completely from the base.	



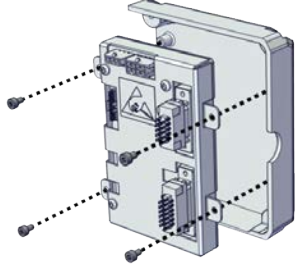
### Removing the battery pack

	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	<p> <b>ELECTROSTATIC DISCHARGE (ESD)</b></p> <p>The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a>.</p>	
3	Disconnect the battery cable.	 <p>xx2200000014</p>

Continues on next page

	Action	Note
4	Remove the battery pack by cutting the cable strap.	 xx2200000015


Removing the SMB unit

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	
3	Remove the screws.	 xx2200000016

Refitting the SMB unit

Use these procedures to refit the SMB unit.

Checking the SMB cable

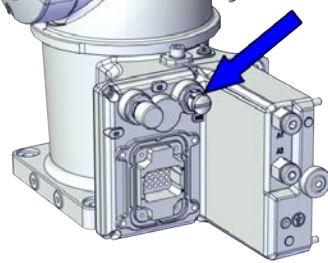
	Action	Note
1	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	
2	Check the SMB cable.	

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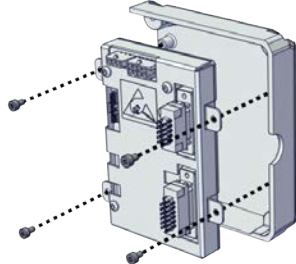
## 5 Repair

### 5.3.2 Replacing the SMB unit


Continued

	Action	Note
3	If damaged, remove the SMB cable from the base interface panel using the tool.	M12 connector assembly tool, included in the special toolkit 3HAC071022-001  xx2200000018
4	Replace with a new one.	

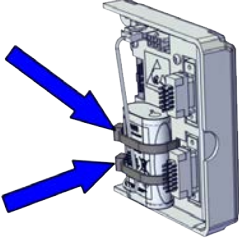
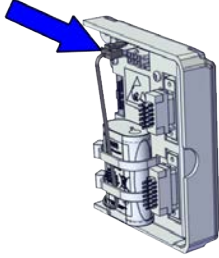
#### Refitting the SMB unit

	Action	Note
1	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	
2	Refit the screws.	Screw: M3x5 12.9 Lafre 2C2B/FC6.9 (4 pcs) Tightening torque: 0.8 Nm  xx2200000016



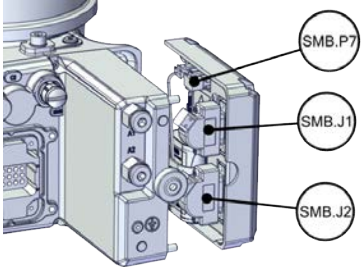

#### Refitting the battery pack

	Action	Note
1	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	

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	Action	Note
2	Secure the battery pack using the cable strap.	 xx2200000015
3	Reconnect the battery cable.	 xx2200000014

Reconnecting the SMB connectors

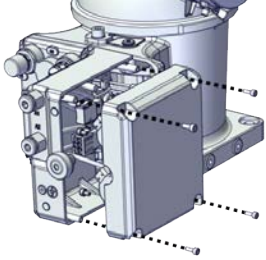
	Action	Note
1	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	
2	Reconnect the connectors. <ul style="list-style-type: none"> <li>• SMB.P7</li> <li>• SMB.J1</li> <li>• SMB.J2</li> </ul>  <b>Tip</b> See the number markings on the connectors for help to find the corresponding connector.	Tightening torque: 0.4 Nm  xx2200000013
3	Route and secure the cabling with cable straps.  <b>CAUTION</b> Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.	

Continues on next page


## 5 Repair

### 5.3.2 Replacing the SMB unit

*Continued*

	Action	Note
4	Refit the SMB cover to the base.	<p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (4 pcs) Tightening torque: 1.2 Nm</p>  <p>xx2200000012</p>

#### Concluding procedure

	Action	Note
1	Recalibrate the robot.	Calibration is detailed in section <a href="#">Calibration on page 283</a> .
2	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. See <a href="#">Test run after installation, maintenance, or repair on page 81</a> .	

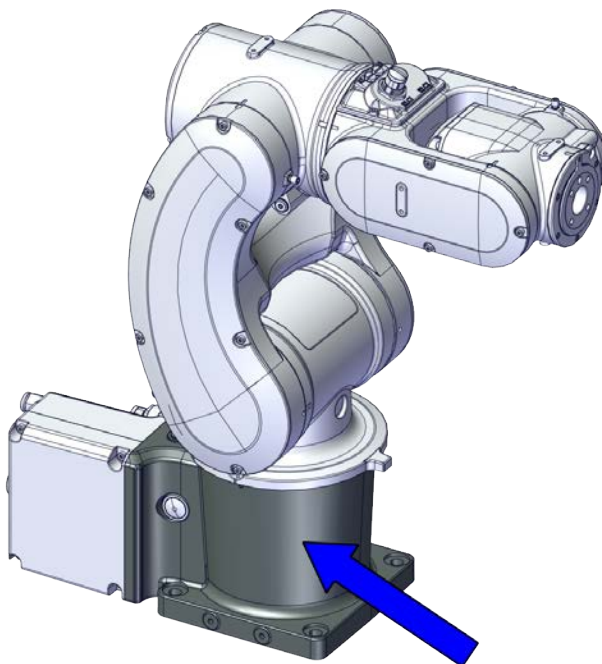


## 5.4 Base and arm system

### 5.4.1 Replacing the base

#### Location of the base

The base is located as shown in the figure.



xx220000003

#### Required spare parts



#### Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 1010 via myABB Business Portal, [www.abb.com/myABB](http://www.abb.com/myABB).

Spare part	Article number	Note
Base	3HAC082454-001	

#### Required service parts

Spare part	Article number	Note
SMB cable	3HAC068830-005	
Brake release button	3HAC068448-001	
Base interface panel (basic)	3HAC082455-001	

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## 5 Repair

### 5.4.1 Replacing the base

Continued

Spare part	Article number	Note
Base interface panel (CP/CS and air hose)	3HAC082456-001	
Base bottom cover	3HAC074903-001	
Mechanical stop, screw	9ADA186-23	Used to mechanically restrict the motion of axis 1 and axis 3.
Mechanical stop, washer	9ADA762-6	Used with Mechanical stop, screw to mechanically restrict the motion of axis 1.
Flange socket head screw	3HAB3412-310	M3x10 12.9 Lafre 2C2B/FC6.9+PrO-COat111

#### Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 330</a> .
Calibration tool box, Axis Calibration	3HAC074119-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
24 VDC power supply	-	Used to release the motor brakes.
Special toolkit	3HAC071022-001	Includes M12 connector assembly tool and Brake release button assembly tool.

#### Required consumables and wear parts

Consumable	Article number	Note
Cable straps	-	
Grease	3HAC029132-001	FM 222
Grease	3HAC038379-001	Harmonic Grease Flexolub-1A Used to lubricate the seals.

#### Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

	Action	Note
1	Decide which calibration routine to use for calibrating the robot. <ul style="list-style-type: none"><li>Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot.</li><li>Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.</li></ul>	

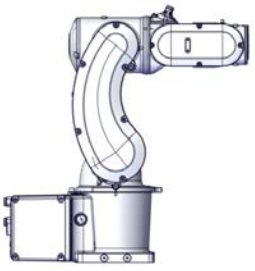

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Action	Note
<p><b>If the robot is to be calibrated with reference calibration:</b> Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot.</p> <p>If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.</p>	<p>Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values.</p> <p>Creating new values requires possibility to move the robot.</p> <p>Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 291</a>.</p>
<p><b>If the robot is to be calibrated with fine calibration:</b> Remove all external cable packages (DressPack) and tools from the robot.</p>	


**Removing the base**

Use these procedures to remove the base.

**Preparations before removing the base**

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Jog the robot to the synchronization position.	 <p>xx2200000173</p>
3	<p> <b>DANGER</b></p> <p>Turn off all:</p> <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> <p>to the robot, before entering the safeguarded space.</p>	

**Disconnecting the SMB connectors**




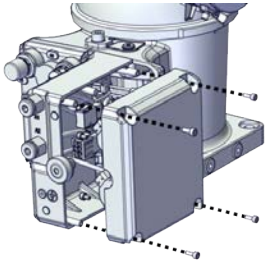

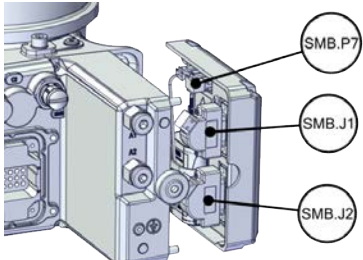
	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	

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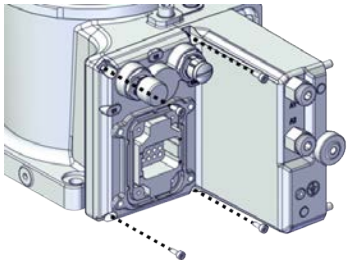
## 5 Repair

### 5.4.1 Replacing the base

Continued



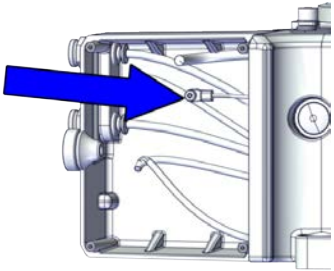
	Action	Note
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	
3	Remove the SMB cover attachment screws and carefully open the cover.  <b>CAUTION</b> Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.  <b>CAUTION</b> There are cabling attached to the cover. The cover cannot be removed completely until the connectors are removed.	 xx2200000012
4	Disconnect the connectors. <ul style="list-style-type: none"> <li>• SMB.P7</li> <li>• SMB.J1</li> <li>• SMB.J2</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 xx2200000013
5	Remove the SMB cover completely from the base.	

### Removing the base interface plate



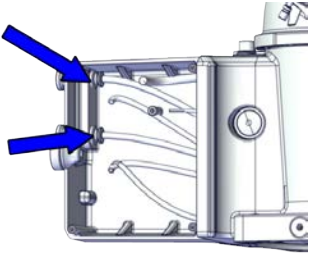
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the base interface plate.  <b>Note</b> Be aware of the cabling that is attached to the interface plate! The interface plate can not be removed completely until the connectors are disconnected, as shown in following steps.	 xx2200000074

Continues on next page

Disconnecting the earth cable

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	
3	Disconnect the earth cable.	 xx2200000072

Disconnecting the connectors from the base interface panel


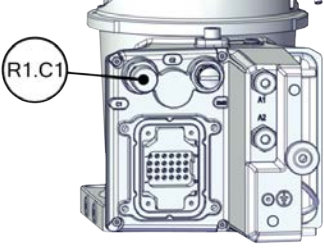
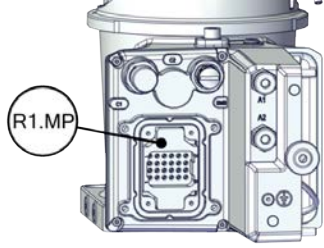
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a> .	
3	Cut the cable straps.	
4	<b>For robots with air hoses</b> Disconnect the air hoses.	 xx2200000073

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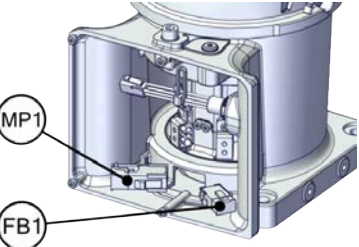
## 5 Repair

### 5.4.1 Replacing the base


Continued

	Action	Note
5	<p><b>For robots with CP/CS cabling</b> Disconnect the connector using the tool.</p> <ul style="list-style-type: none"> <li>R1.C1</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	<p>M12 connector assembly tool, included in the special toolkit 3HAC071022-001</p>  <p>xx2200000075</p>
6	<p>Remove the main power connector R1.MP.</p>	 <p>xx2200000076</p>


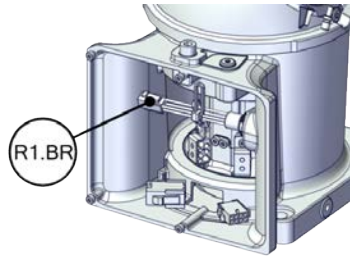
#### Disconnecting the axis-1 motor connectors

	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	<p>Disconnect the motor connectors.</p> <ul style="list-style-type: none"> <li>FB1</li> <li>MP1</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000077</p>




#### Disconnecting the break release connector

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


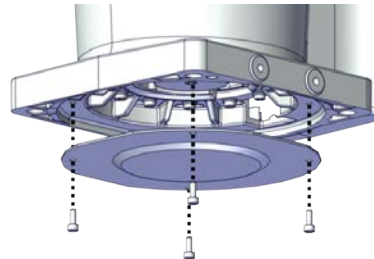
Continues on next page

	Action	Note
2	<p>Disconnect the connector R1.BR.</p> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000078</p>

Putting the robot on its side

	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	<p> <b>CAUTION</b></p> <p>The IRB 1010 robot weighs 13.5 kg and can be lifted by one person.</p>	
3	<p> <b>WARNING</b></p> <p>The robot is likely to be mechanically unstable if not secured to the foundation.</p>	
4	<p>Loosen the robot from the foundation by removing the foundation attachment screws and put the robot on its side.</p>	

Separating the base from the axis-1 assembly unit


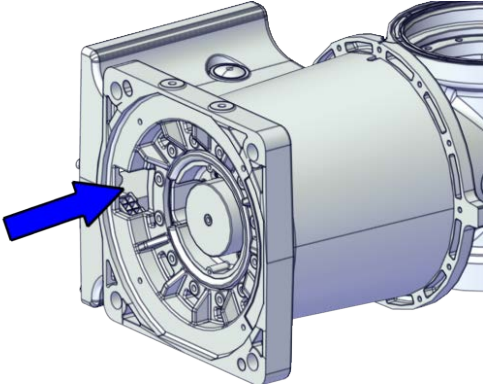
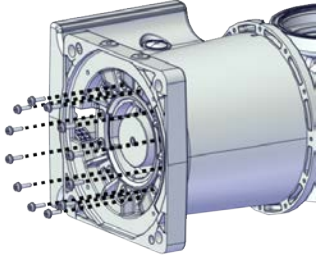
	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	<p>Remove the base cover.</p>	 <p>xx2200000079</p>

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## 5 Repair

### 5.4.1 Replacing the base

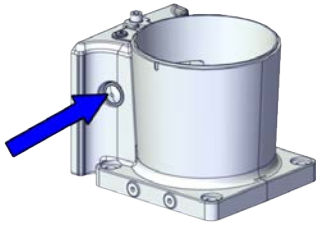
Continued

	Action	Note
3	<p>Remove the base.</p> <p> <b>Note</b></p> <p>Pay attention to the axis-1 motor cablings which should be carefully pulled out from the pointed hole first before removing the base.</p>  <p>xx220000081</p>	 <p>xx220000080</p>

### Refitting the base

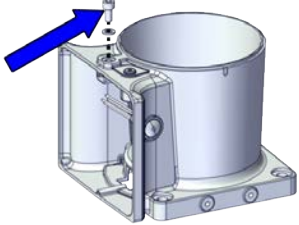
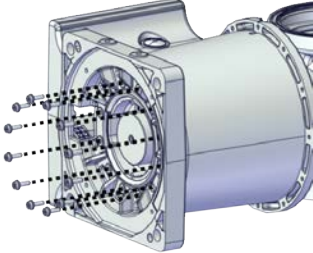
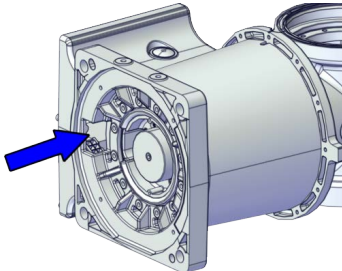
Use these procedures to refit the base.

### Refitting the base

	Action	Note
1	<p>Check the brake release button. Replace if damaged.</p>	<p>Brake release button: 3HAC068448-001</p> <p>Brake release button assembly tool, included in the special toolkit 3HAC071022-001</p>  <p>xx220000091</p>

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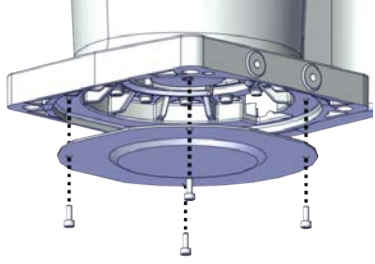
	Action	Note
2	<p>Check the fixed mechanical stop screw and washer. Replace if damaged.</p>	<p>Mechanical stop, screw: 9ADA186-23 Mechanical stop, washer: 9ADA762-6 Tightening torque: 5 Nm</p>  <p>xx220000092</p>
3	<p>Apply grease to the cable package, cover all moving area of the package.</p>	<p>Grease: 3HAC029132-001</p>
4	<p>Apply grease to the inner base that have contacting area with the cable package.</p>	<p>Grease: 3HAC029132-001</p>
5	<p>Refit the base.</p>	<p>Flange socket head screw, M3x10 12.9 Lafre 2C2B/FC6.9+PrO-COat111, 3HAB3412-310(12 pcs) Tightening torque: 1.5 Nm</p>  <p>xx220000080</p>
6	<p>Insert the axis-1 drive unit connectors through the hole to the robot rear.</p>	 <p>xx220000081</p>

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## 5 Repair

### 5.4.1 Replacing the base


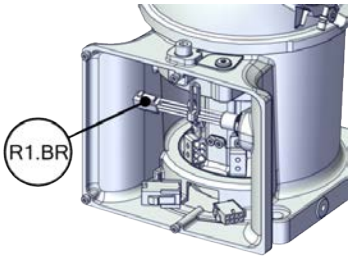
*Continued*

	Action	Note
7	Refit the base cover.	<p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (4 pcs) Tightening torque: 1.2 Nm</p>  <p>xx220000079</p>

### Securing the robot to the foundation


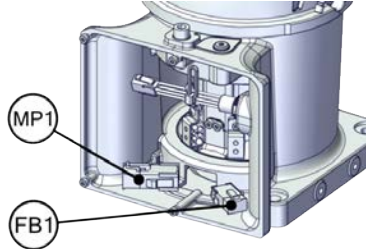
	Action	Note
1	 <b>CAUTION</b> The IRB 1010 robot weighs 13.5 kg and can be lifted by one person.	
2	Raise the robot to standing and secure to the foundation with the attachment screws and washers.	<p>Attachment screws: M8x30 (robot installation directly on foundation), quality: 8.8. Washers: 8.4 x 16 x 1.6. Tightening Torque: 20 Nm±2 Nm.</p>

### Reconnecting the brake release connector

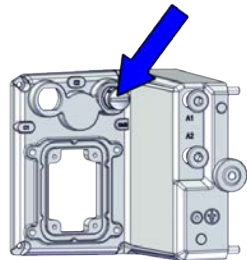
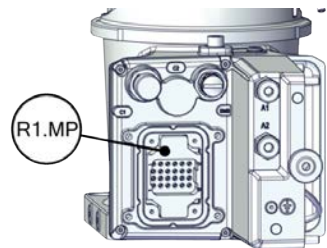
	Action	Note
1	<p>Reconnect the connector R1.BR.</p>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 <p>xx220000078</p>

*Continues on next page*

Reconnecting the axis-1 motor connectors

	Action	Note
1	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB1</li> <li>• MP1</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000077</p>

Reconnecting the connectors to the base interface panel


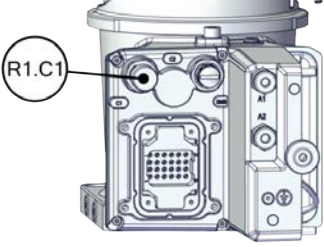
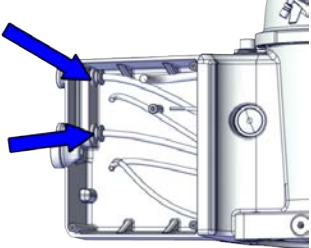
	Action	Note
1	<p>Check the SMB cabling on the base interface panel. Replace if damaged.</p>	<p>SMB cable: 3HAC068830-005 M12 connector assembly tool, included in the special toolkit 3HAC071022-001</p>  <p>xx2200000093</p>
2	<p>Refit the main power connector R1.MP.</p>	<p>Screw: M3x10 12.9 Lafre 2C2B/FC6.9 (4 pcs) Tightening torque: 0.6 Nm</p>  <p>xx2200000076</p>

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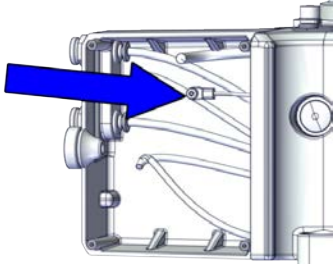
## 5 Repair

### 5.4.1 Replacing the base


Continued

	Action	Note
3	<p>For robots with CP/CS cabling Reconnect the connector using the tool.</p> <ul style="list-style-type: none"> <li>R1.C1</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	<p>M12 connector assembly tool, included in the special toolkit 3HAC071022-001</p>  <p>xx220000075</p>
4	<p>For robots with air hoses Reconnect the air hoses.</p>	 <p>xx220000073</p>

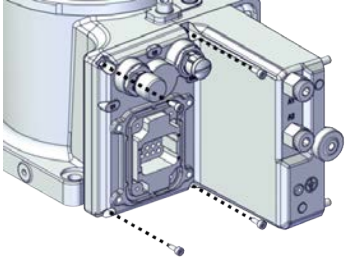
#### Reconnecting the earth cable

	Action	Note
1	Reconnect the earth cable.	 <p>xx220000072</p>



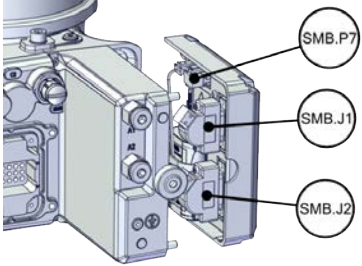

#### Refitting the base interface panel

	Action	Note
1	Check the grommet. Replace if damaged.	Grommet M16: 3HAC024817-001
2	<p>Route and secure the cabling with cable straps.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	
3	Apply grease to the cable package, cover all moving area of the package.	

Continues on next page

	Action	Note
4	Refit the base interface panel.	<p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (4 pcs) Tightening torque: 1.2 Nm</p>  <p>xx2200000074</p>

Reconnecting the SMB connectors

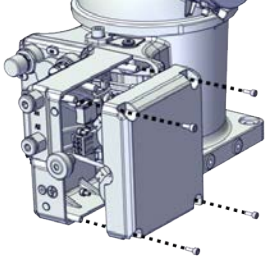
	Action	Note
1	 <p><b>ELECTROSTATIC DISCHARGE (ESD)</b></p> <p>The unit is sensitive to ESD. Before handling the unit read the safety information in section <a href="#">The unit is sensitive to ESD on page 45</a>.</p>	
2	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• SMB.P7</li> <li>• SMB.J1</li> <li>• SMB.J2</li> </ul>  <p><b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	<p>Tightening torque: 0.4 Nm</p>  <p>xx2200000013</p>
3	 <p><b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	

Continues on next page


## 5 Repair

### 5.4.1 Replacing the base

*Continued*

	Action	Note
4	Refit the SMB cover to the base.	<p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (4 pcs) Tightening torque: 1.2 Nm</p>  <p>xx2200000012</p>

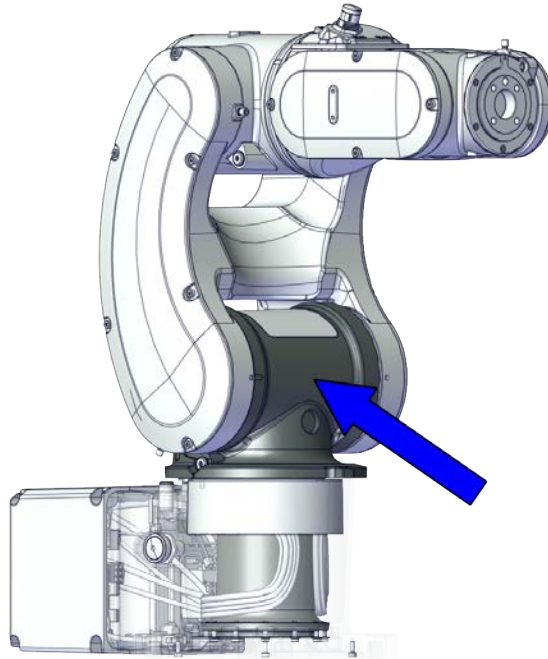
### Concluding procedure

	Action	Note
1	Recalibrate the robot.	Calibration is detailed in section <a href="#">Calibration on page 283</a> .
2	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. See <a href="#">Test run after installation, maintenance, or repair on page 81</a> .	

## 5.4.2 Replacing the axis-1 assembly unit

### Location of the axis-1 assembly unit

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



xx220000004

### Required spare parts



#### Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 1010 via myABB Business Portal, [www.abb.com/myABB](http://www.abb.com/myABB).

Spare part	Article number	Note
Axis-1 assembly unit	3HAC082643-001	Includes swing and axis-1 drive unit.

### Required service parts

Spare part	Article number	Note
Cable bracket, axis 2	3HAC080837-001	
Cable bracket, axis 4	3HAC076867-001	
Cable bracket, axis 5	3HAC079126-001	
Cable bracket, axis 6	3HAC079127-001	
Cable protector, axis 1	3HAC078560-001	

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## 5 Repair

### 5.4.2 Replacing the axis-1 assembly unit

Continued

Spare part	Article number	Note
Cable protector, axis 2	3HAC078561-001	
Cable protector, axis 3	3HAC078562-001	
Cable protector, axis 4	3HAC075565-001	
Cable protector, axis 5	3HAC076870-001	
SMB cable	3HAC068830-005	
Axis-2 sleeve	3HAC074872-001	
Axis-2 radial sealing	3HAC076888-001	
Axis-4 radial sealing	3HAC076795-001	
Base interface panel (basic)	3HAC082455-001	
Base interface panel (CP/CS and air hose)	3HAC082456-001	
Base bottom cover	3HAC074903-001	
Swing top cover	3HAC082452-001	
Lower arm cover, left	3HAC082446-001	
Lower arm cover, right	3HAC082447-001	
Housing cover	3HAC082445-001	
Wrist cover	3HAC082443-001	
Tilt cover	3HAC082442-001	
Mechanical stop, screw	9ADA186-23	Used to mechanically restrict the motion of axis 1 and axis 3.
Mechanical stop, washer	9ADA762-6	Used with Mechanical stop, screw to mechanically restrict the motion of axis 1.
Flange socket head screw	3HAB3412-308	M3x8 12.9 Lafre 2C2B/FC6.9+PrO-COat111
Flange socket head screw	3HAB3412-310	M3x10 12.9 Lafre 2C2B/FC6.9+PrO-COat111
Flange socket head screw	3HAB3412-312	M3x12 12.9 Lafre 2C2B/FC6.9+PrO-COat111
Flange socket head screw	3HAB3412-316	M3x16 12.9 Lafre 2C2B/FC6.9+PrO-COat111

#### Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 330</a> .
Calibration tool box, Axis Calibration	3HAC074119-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
24 VDC power supply	-	Used to release the motor brakes.

Continues on next page



Equipment	Article number	Note
Sonic tension meter	-	Used for measuring the timing belt tension.
Dynamometer	-	Used for measuring the timing belt tension.
Special toolkit	3HAC071022-001	Includes M12 connector assembly tool and Brake release button assembly tool.
Axis-2 radial sealing assembly tool	3HAC082535-001	
Axis-4 radial sealing assembly tool	3HAC082535-003	
Radial sealing pressfit tool	3HAC082535-002	

#### Required consumables and wear parts

Consumable	Article number	Note
Cable straps	-	
Grease	3HAC029132-001	FM 222
Grease	3HAC038379-001	Harmonic Grease Flexolub-1A Used to lubricate the seals.
Cooling pad for axis-2 motor	3HAC071021-001	Cooling pads are wear parts. One cooling pad sheet contains 6 pieces of small pad. Replace if damaged with one piece each time.

#### Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

	Action	Note
1	<p>Decide which calibration routine to use for calibrating the robot.</p> <ul style="list-style-type: none"> <li>Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot.</li> <li>Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.</li> </ul>	
	<p><b>If the robot is to be calibrated with reference calibration:</b></p> <p>Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot.</p> <p>If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.</p>	<p>Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values.</p> <p>Creating new values requires possibility to move the robot.</p> <p>Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 291</a>.</p>

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## 5 Repair

### 5.4.2 Replacing the axis-1 assembly unit


*Continued*

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

#### Replacement of the axis-1 assembly unit


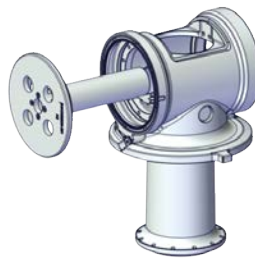
The axis-1 assembly unit is available for replacement after removing the cable package and separating from the axis 3-4 assembly unit. Main procedures are provided as follows.

#### Removing the axis-1 assembly unit

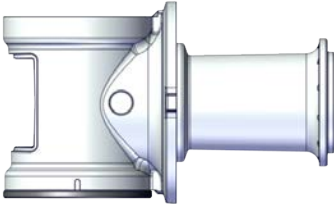
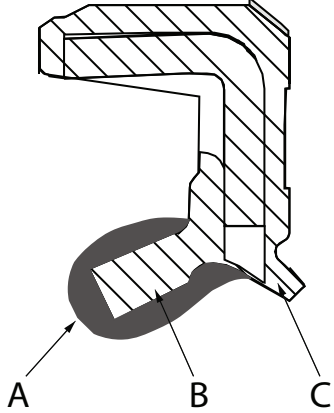
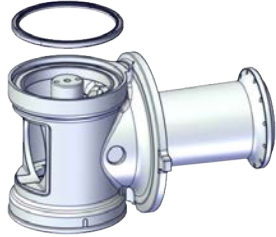
Action	Note
<p>1</p>  <p><b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
<p>2</p> <p>Remove the cable package.</p>	<p>See detailed procedures in <a href="#">Removing the cable package on page 114</a>.</p>
<p>3</p> <p>Separate the axis 3-4 assembly unit. Axis-1 assembly unit is now accessible.</p>	<p>See detailed procedure in <a href="#">Separating the axis 3-4 assembly unit from the axis-1 assembly unit on page 207t</a>.</p>

#### Check the radial sealing on the axis-1 assembly unit

Check the radial sealing on the axis-1 assembly unit before assembly unit replacement.

Action	Note
<p>1</p> <p>Check the radial sealing on the right side of the axis-1 assembly unit (facing the lug boss on the assembly unit). Replace if damaged, as described below.</p>	 <p>xx2200000106</p>
<p>2</p> <p>Place the axis-2 sealing assembly tool to the left side of the assembly unit.</p>	<p>Axis-2 radial sealing assembly tool: 3HAC082535-001</p>  <p>xx2200000107</p>

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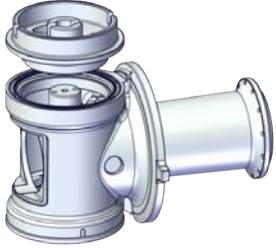

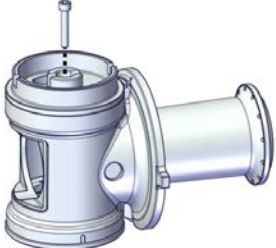
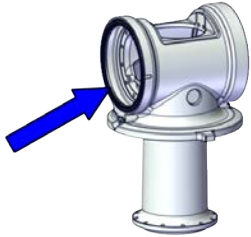
	Action	Note						
3	<p>Lay the assembly unit on the workbench with the axis-2 sealing assembly tool at the bottom. Make sure the assembly unit and the assembly tool are placed evenly and stable.</p>	 <p>xx2200000108</p>						
4	<p>Apply sufficient grease around the sealing lip when replacing the radial sealing. Make sure no area around the lips is exposed without grease. Wipe clean after replacement if any redundant grease.</p>	<p>Grease: 3HAC038379-001</p>  <p>xx2200000596</p> <table border="1"> <tr> <td>A</td> <td>Grease</td> </tr> <tr> <td>B</td> <td>Main lip</td> </tr> <tr> <td>C</td> <td>Dust lip</td> </tr> </table>	A	Grease	B	Main lip	C	Dust lip
A	Grease							
B	Main lip							
C	Dust lip							
5	<p>Fit the new sealing into the assembly unit.</p>	 <p>xx2200000109</p>						

Continues on next page

## 5 Repair

### 5.4.2 Replacing the axis-1 assembly unit

Continued

	Action	Note
6	<p>Place the radial sealing pressfit tool and secure it to the axis-2 sealing assembly tool with two M4x20 screws.</p> <p> <b>Note</b></p> <p>The screws are just for securing. Do not tighten them with extreme forces. Recommended tightening torque is 2.5 Nm.</p>	<p>Radial sealing pressfit tool: 3HAC082535-002</p>  <p>xx2200000110</p>  <p>xx2200000111</p>
7	Fix the pressfit tool with a M6x25 screw.	 <p>xx2200000112</p>
8	Screw the screws, little by little and evenly, to press the sealing into place.	
9	Remove the assembly tool.	
10	Check that the sealing is undamaged and properly fitted.	
11	Check the radial sealing on the left side of the axis-1 assembly unit. Replace if damaged, repeat steps 2 to 10.	 <p>xx2200000113</p>

Continues on next page

#### Refitting the axis-1 assembly unit

	Action	Note
1	Refit the axis 3-4 assembly unit.	See detailed procedure in <a href="#">Placing the axis 3-4 assembly unit on page 210</a> .
2	Refit the cable package	See detailed procedure in <a href="#">Refitting the cable package on page 135</a> .

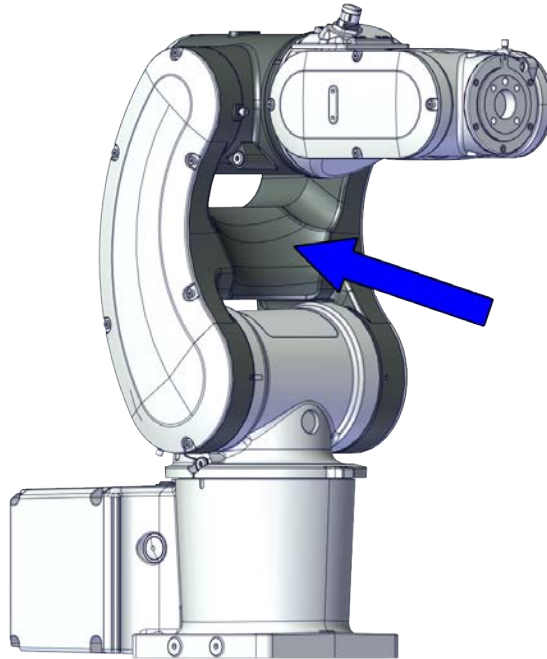
## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit

### 5.4.3 Replacing the axis 3-4 assembly unit

#### Location of the axis 3-4 assembly unit

The axis 3-4 assembly unit is located as shown in the figure.



xx220000005

#### Required spare parts



#### Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 1010 via myABB Business Portal, [www.abb.com/myABB](http://www.abb.com/myABB).

Spare part	Article number	Note
Axis 3-4 assembly unit	3HAC082453-001	Includes lower arm, housing, axis-3 gearbox and axis-4 drive unit.

#### Required service parts

Spare part	Article number	Note
Cable bracket, axis 2	3HAC080837-001	
Cable bracket, axis 4	3HAC076867-001	
Cable bracket, axis 5	3HAC079126-001	
Cable bracket, axis 6	3HAC079127-001	
Cable protector, axis 2	3HAC078561-001	

Continues on next page

Spare part	Article number	Note
Cable protector, axis 3	3HAC078562-001	
Cable protector, axis 4	3HAC075565-001	
Cable protector, axis 5	3HAC076870-001	
Axis-2 sleeve	3HAC074872-001	
Axis-4 radial sealing	3HAC076795-001	
Lower arm cover, left	3HAC082446-001	
Lower arm cover, right	3HAC082447-001	
Housing cover	3HAC082445-001	
Wrist cover	3HAC082443-001	
Tilt cover	3HAC082442-001	
Mechanical stop, screw	9ADA186-23	Used to mechanically restrict the motion of axis 1 and axis 3.
Mechanical stop, washer	9ADA762-6	Used with Mechanical stop, screw to mechanically restrict the motion of axis 1.
Flange socket head screw	3HAB3412-308	M3x8 12.9 Lafre 2C2B/FC6.9+PrO-COat111

#### Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 330</a> .
Calibration tool box, Axis Calibration	3HAC074119-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
24 VDC power supply	-	Used to release the motor brakes.
Sonic tension meter	-	Used for measuring the timing belt tension.
Dynamometer	-	Used for measuring the timing belt tension.

#### Required consumables and wear parts

Consumable	Article number	Note
Cable straps	-	
Grease	3HAC029132-001	FM 222
Grease	3HAC038379-001	Harmonic Grease Flexolub-1A Used to lubricate the seals.

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## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit

*Continued*

#### Deciding calibration routine

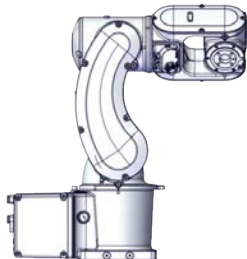
Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

	Action	Note
1	<p>Decide which calibration routine to use for calibrating the robot.</p> <ul style="list-style-type: none"> <li>Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot.</li> <li>Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.</li> </ul>	
	<p><b>If the robot is to be calibrated with reference calibration:</b></p> <p>Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot.</p> <p>If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.</p>	<p>Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values.</p> <p>Creating new values requires possibility to move the robot.</p> <p>Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 291</a>.</p>
	<p><b>If the robot is to be calibrated with fine calibration:</b></p> <p>Remove all external cable packages (DressPack) and tools from the robot.</p>	

#### Removing the axis 3-4 assembly unit


Use these procedures to remove the axis 3-4 assembly unit.

#### Preparations before removing the axis 3-4 assembly unit


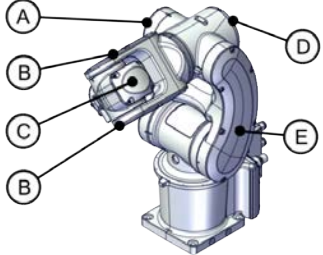
	Action	Note
1	<p>Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.</p>	
2	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none"> <li>Axis 1: 0°</li> <li>Axis 2: 0°</li> <li>Axis 3: 0°</li> <li>Axis 4: +130°</li> <li>Axis 5: -90°</li> <li>Axis6: No significance</li> </ul>	 <p>xx2200000175</p>

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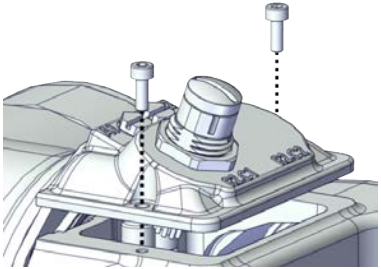


	Action	Note
3	 <b>DANGER</b> Turn off all: <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> to the robot, before entering the safeguarded space.	

Removing the covers

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the covers. <ul style="list-style-type: none"> <li>• Lower arm cover, left (A)</li> <li>• Wrist covers (B)</li> <li>• Tilt cover (C)</li> <li>• Housing cover (D)</li> <li>• Lower arm cover, right (E)</li> </ul>	 <p>xx2200000029</p>

Removing the process hub

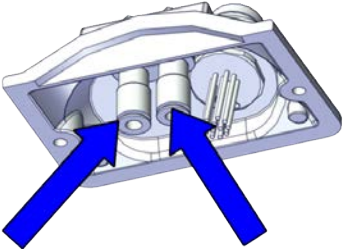

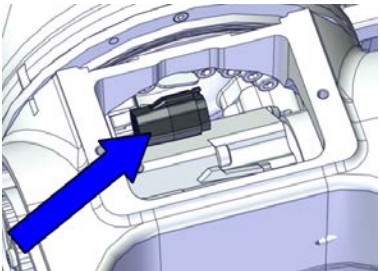
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the screws and carefully open the cover.  <b>CAUTION</b> There is cabling attached to the cover. The cover cannot be removed completely until the connectors are removed.	 <p>xx2200000030</p>

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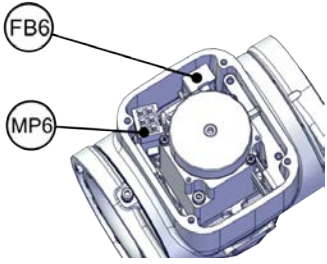
## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit


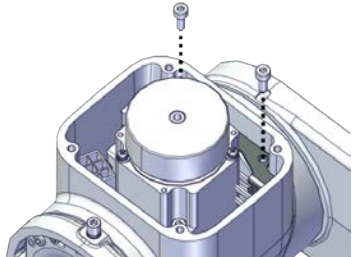
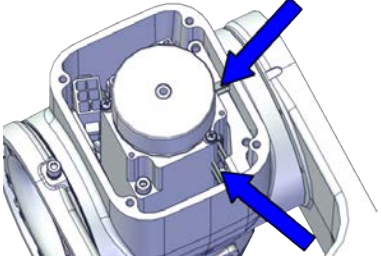
Continued

	Action	Note
3	<p>For robots with air hoses Disconnect the air hoses.</p>	 <p>xx2200000031</p>
4	<p>For robots with CP/CS cabling Disconnect the connector.</p> <ul style="list-style-type: none"> <li>R2.C1</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000032</p>



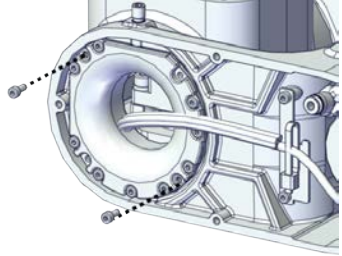
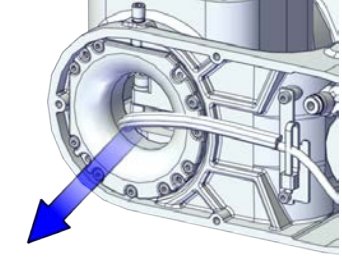
### Disconnecting the axis-6 motor connectors

	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	<p>Disconnect the connectors.</p> <ul style="list-style-type: none"> <li>MP6</li> <li>FB6</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p> <p> <b>Tip</b></p> <p>The MP6 connector is fitted in particular position. Handle with cautions to not get it stuck.</p>	 <p>xx2200000035</p>

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	Action	Note
3	Remove the axis-6 cable bracket.   <b>CAUTION</b>  Be aware of the cablings that are attached to the cable bracket! The bracket cannot be removed completely until the cablings are removed from the plate.	 xx2200000033
4	Cut the cable straps.	 xx2200000034

Pulling out the cable package from axis 5

	Action	Note
1	 <b>DANGER</b>  Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Wrap the connectors with the masking tape.	
3	Remove the axis-5 cable protector.   <b>Note</b>  The screws to be removed are a little protruding than others. Do not mix the screws.	 xx2200000036
4	Pull out the cable package in the direction as shown in the figure.	 xx2200000037
5	Slip out the cable protector.	



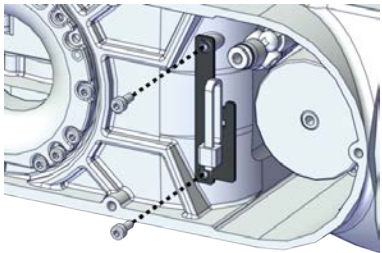
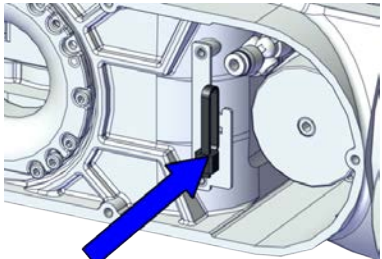
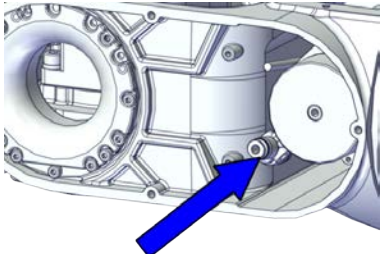
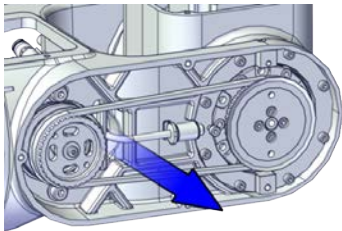
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## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit



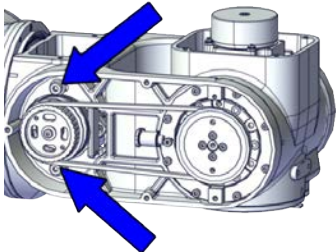
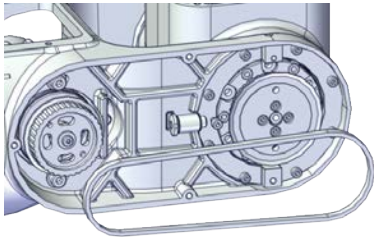
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#### Separating the cable package from axis 5



	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the axis-5 cable bracket.  <b>CAUTION</b> Be aware of the cablings that are attached to the cable bracket! The bracket cannot be removed completely until the cablings are removed from the plate.	 xx2200000038
3	Cut the cable strap.	 xx2200000039
4	Disconnect the pressure relief pipe connector.	 xx2200000041
5	Pull out the pressure relief pipe carefully from the other side of the wrist unit.	 xx2200000537

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Removing the axis-5 timing belt

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>CAUTION</b> Loosening timing belts will release axes. This means the axes can fall down. Make sure axes are well supported before loosening timing belts.	
3	Loosen the screws and move the motor slightly to slacken the timing belt.	 xx2200000042
4	Remove the timing belt from its groove on the motor.	 xx2200000043

Removing the axis-5 motor


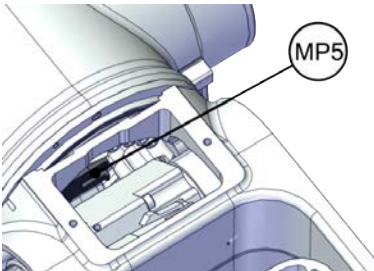
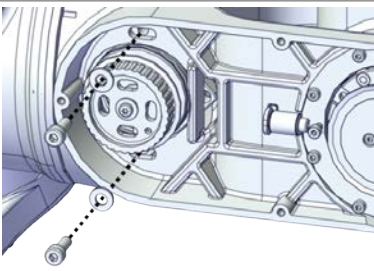
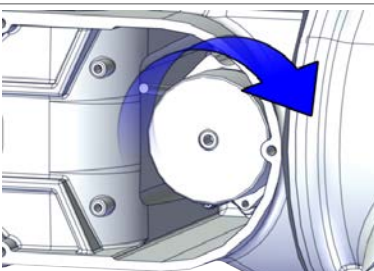

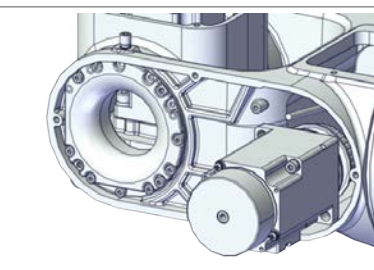

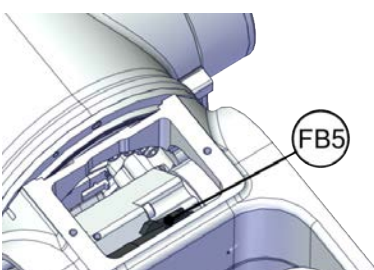
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>CAUTION</b> Removing motors will release axes. This means the axes can fall down. Make sure axes are well supported before removing motors.	

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## 5 Repair



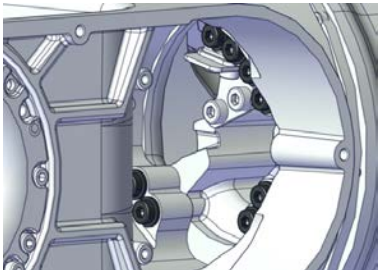


### 5.4.3 Replacing the axis 3-4 assembly unit

Continued

	Action	Note
3	<p>Disconnect the connector.</p> <ul style="list-style-type: none"><li>• MP5</li></ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000040</p>
4	<p>Remove the screws and washers.</p>	 <p>xx2200000044</p>
5	<p>Carefully rotate the motor to make its motor connector to a levelled position.</p>	 <p>xx2200000045</p>
6	<p>Carefully lift out the motor.</p> <p> <b>CAUTION</b></p> <p>Be aware of the connector that is still connected! The motor cannot be removed completely until the connector is disconnected.</p>	 <p>xx2200000046</p>
7	<p>Disconnect the connector.</p> <ul style="list-style-type: none"><li>• FB5</li></ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000538</p>

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Separating the wrist unit from the axis 3-4 assembly unit

	Action	Note
1	<p>Connect the power supply to axis-3 motor and release the axis-3 brake to move the axis 3 to -90°. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	
2	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
3	<p>Remove the screws (dark-colored in the figure).</p>	 <p>xx2200000047</p>
4	<p>Separate the wrist unit.</p>	 <p>xx2200000539</p>
5	<p>Connect the power supply to axis-3 motor and release the axis-3 brake to move the axis 3 to zero position. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	


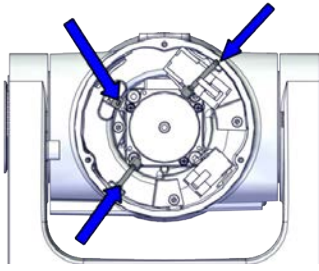

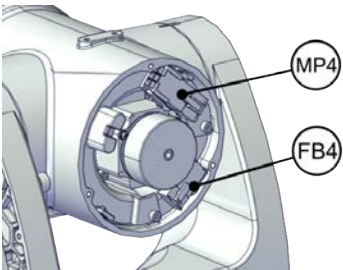
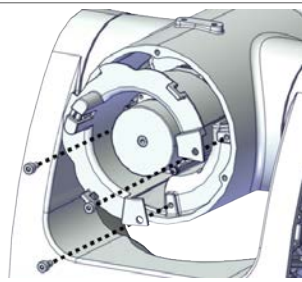
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## 5 Repair


### 5.4.3 Replacing the axis 3-4 assembly unit

Continued

#### Disconnecting the axis-4 motor connectors

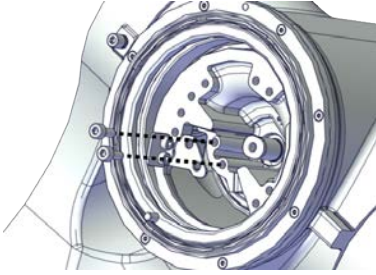
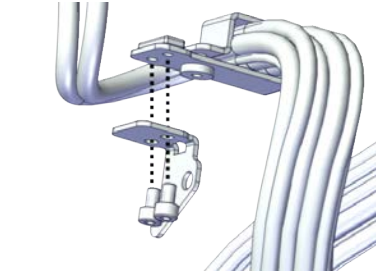

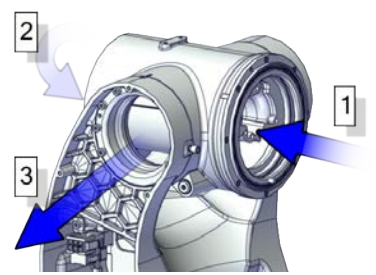
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Cut the cable straps.	 xx2200000050
3	Disconnect the connectors. <ul style="list-style-type: none"> <li>• MP4</li> <li>• FB4</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 xx2200000049
4	Remove the axis-4 cable protector.	 xx2200000051

#### Pulling out the cable package from axis 4


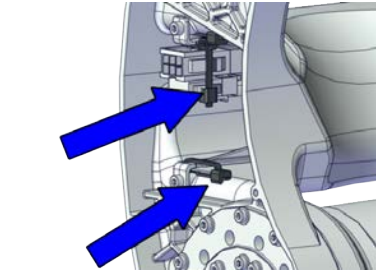
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Wrap the connectors with the masking tape.	

Continues on next page



	Action	Note
3	Remove the axis-4 cable bracket to separate the cable from the housing.	 <p>xx220000052</p>
4	Remove the axis-4 cable bracket from the cable.	 <p>xx220000058</p>
5	<p>Pull out the cable package in the direction as shown in the figure.</p> <p> <b>Note</b></p> <p>Pay attention to the axis-4 motor cablings which locate in different direction from the main cable package. Do not pull them out with force!</p>	 <p>xx220000053</p>

Disconnecting the axis-3 motor connectors


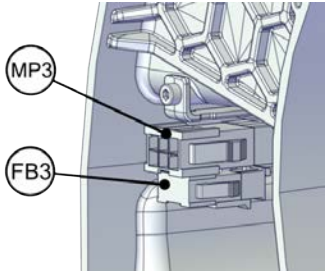
	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	Cut the cable straps.	 <p>xx220000054</p>

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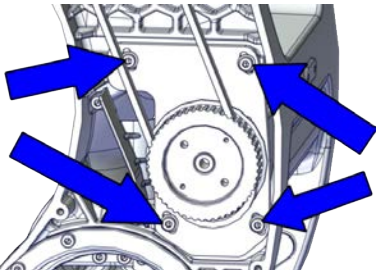
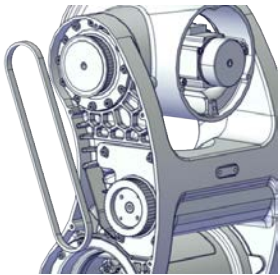
## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit

Continued



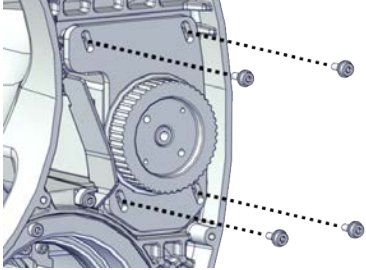
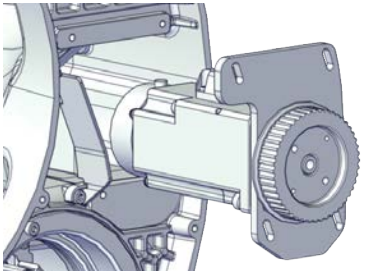
	Action	Note
3	<p>Disconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB3</li> <li>• MP3</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000055</p>

### Removing the axis-3 timing belt


	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	<p> <b>CAUTION</b></p> <p>Loosening timing belts will release axes. This means the axes can fall down. Make sure axes are well supported before loosening timing belts.</p>	
3	<p>Loosen the screws and move the motor slightly to slacken the timing belt.</p>	 <p>xx2200000056</p>
4	<p>Remove the timing belt from its groove on the motor.</p>	 <p>xx2200000057</p>

Continues on next page

Removing the axis-3 motor

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>CAUTION</b> Removing motors will release axes. This means the axes can fall down. Make sure axes are well supported before removing motors.	
3	Remove the screws.	 xx2200000058
4	Carefully lift out the motor.	 xx2200000059

Pulling out the cable package from axis 3

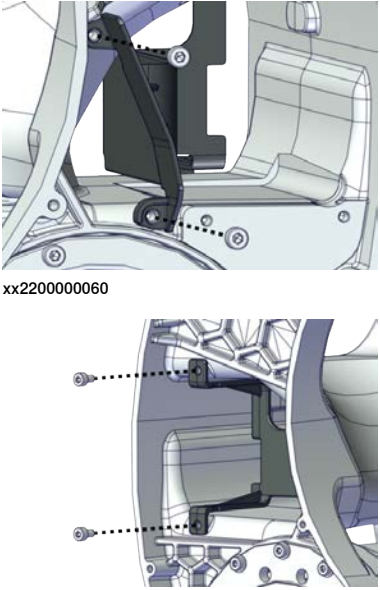
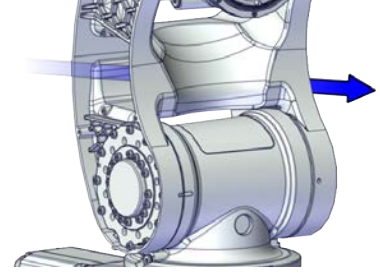
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Wrap the connectors with the masking tape.	

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## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit

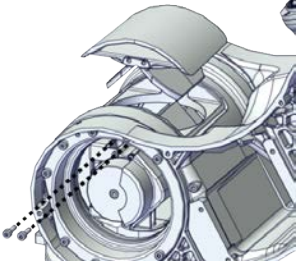
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	Action	Note
3	Remove the axis-3 cable protector.	 <p>xx220000060</p> <p>xx220000061</p>
4	Pull out the cable package through out the cavity of the axis 3-4 assembly unit.	 <p>xx220000062</p>




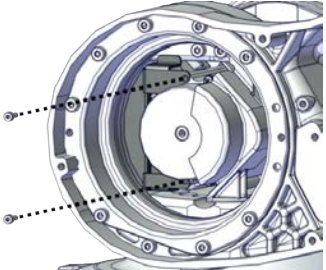
### Removing the swing top cover

	Action	Note
1	Connect the power supply to axis-2 motor and release the axis-2 brake to move the axis 2 to -60°. Then, disconnect the power supply.   <b>Note</b>  The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a> .	
2	 <b>DANGER</b>  Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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	Action	Note
3	Remove the swing top cover.	 <p>xx2200000540</p>

Removing the axis-2 drive unit

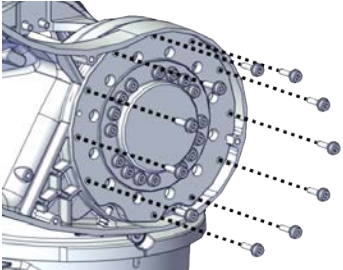

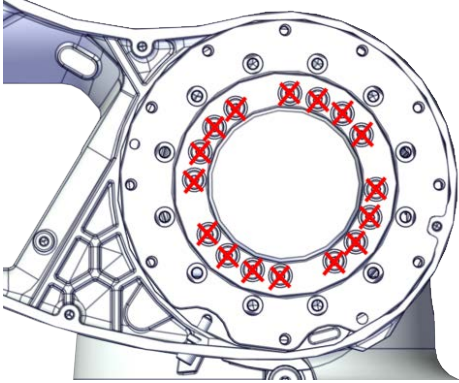
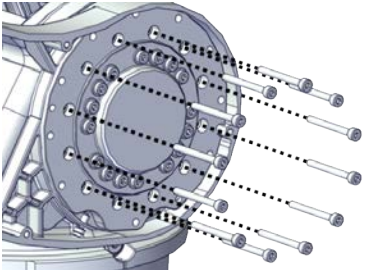

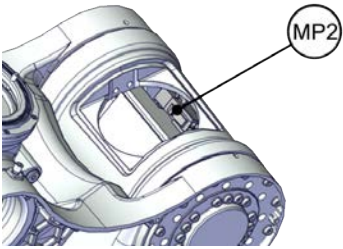

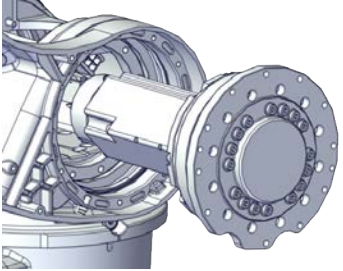
	Action	Note
1	 <p><b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	 <p><b>CAUTION</b></p> <p>Removing drive units will release axes. This means the axes can fall down. Make sure axes are well supported before removing drive units.</p>	
3	 <p><b>Note</b></p> <p>Make sure axis 2 remains positioning in <math>-60^\circ</math>; otherwise, the screws securing the axis-2 drive unit cannot be accessible during drive unit replacement.</p>	
4	Remove the axis-2 cable bracket.	 <p>xx2200000063</p>

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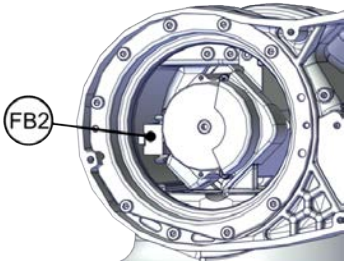
## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit


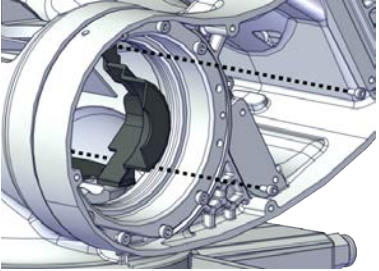
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	Action	Note
5	Remove the outermost screws (flange screws, 11 pcs) securing the axis-2 drive unit to the axis 3-4 assembly unit.	 <p>xx2200000065</p>
6	Remove the screws (12 pcs) securing the axis-2 drive unit to the axis-1 assembly unit.  <b>CAUTION</b> Do not remove the innermost screws (16 pcs).  <p>xx2200000068</p>	 <p>xx2200000066</p>
7	Access and disconnect the connector from the swing top. <ul style="list-style-type: none"> <li>• MP2</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 <p>xx2200000541</p>
8	Carefully lift out the drive unit.  <b>CAUTION</b> Be aware of the connector that is still connected! The drive unit cannot be removed completely until the connector is disconnected.	 <p>xx2200000067</p>



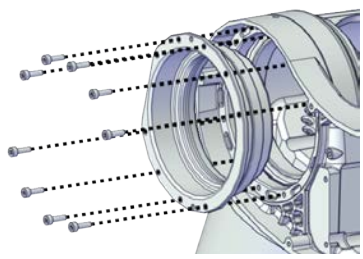
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	Action	Note
9	Disconnect the connector. <ul style="list-style-type: none"> <li>• FB2</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 <p>xx220000064</p>

Separating the cable package from axis 2

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the axis-2 cable protector.	 <p>xx220000069</p>

Separating the axis 3-4 assembly unit from the axis-1 assembly unit


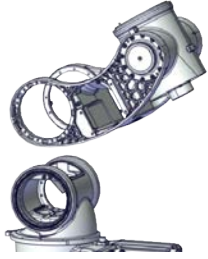
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the axis-2 sleeve.   <b>Tip</b> Use two M3x12 screws to help press out the sleeve.	 <p>xx220000070</p>

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## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit



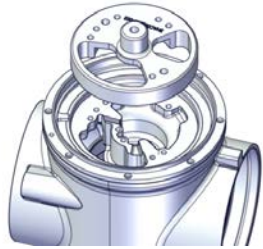
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	Action	Note
3	<p>Separate the axis 3-4 assembly unit.</p> <p> <b>Tip</b></p> <p>If the axis 3-4 assembly unit is hard to loosen from the axis-1 assembly unit, use a plastic hammer to knock on the axis 3-4 assembly unit lightly.</p>	 <p>xx220000071</p>

### Refitting the axis 3-4 assembly unit

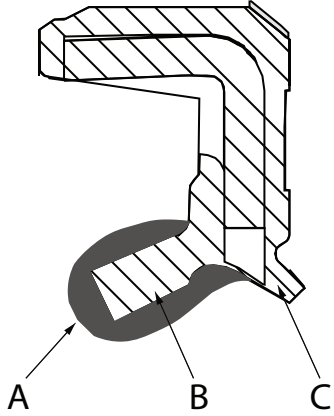

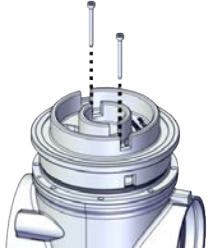
Use these procedures to refit the axis 3-4 assembly unit.

Check the radial sealing on the axis- 3-4 assembly unit

	Action	Note
1	<p>Check the radial sealing on the axis 3-4 assembly unit.</p> <p>Replace if damaged, as described below.</p>	 <p>xx2200000114</p>
2	<p>Lay the assembly unit on the workbench with the axis 3 in -90° position.</p> <p>Make sure the assembly unit is placed evenly and stable.</p>	 <p>xx2200000028</p>
3	<p>Place the axis-4 sealing assembly tool to the assembly unit and secure it with at least three M3x16 screws in different directions.</p> <p>Make sure that screw holes and openings on the assembly tool are aligned with those on the assembly unit.</p>	<p>Axis-4 radial sealing assembly tool: 3HAC082535-003</p>  <p>xx2200000115</p>

*Continues on next page*



	Action	Note						
4	<p>Apply sufficient grease around the sealing lip when replacing the radial sealing. Make sure no area around the lips is exposed without grease. Wipe clean after replacement if any redundant grease.</p>	<p>Grease: 3HAC038379-001</p>  <p>xx2200000596</p> <table border="1"> <tr> <td>A</td> <td>Grease</td> </tr> <tr> <td>B</td> <td>Main lip</td> </tr> <tr> <td>C</td> <td>Dust lip</td> </tr> </table>	A	Grease	B	Main lip	C	Dust lip
A	Grease							
B	Main lip							
C	Dust lip							
5	<p>Fit the new sealing into the assembly unit.</p>	 <p>xx2200000116</p>						
6	<p>Place the radial sealing pressfit tool and fix with two M3x30 screws.</p>	<p>Radial sealing pressfit tool: 3HAC082535-002</p>  <p>xx2200000117</p>						
7	<p>Screw the screws, little by little and evenly, to press the sealing into place.</p>							
8	<p>Remove the assembly tool.</p>							
9	<p>Check that the sealing is undamaged and properly fitted.</p>							

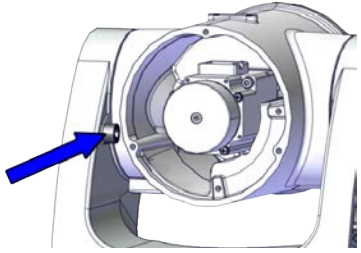

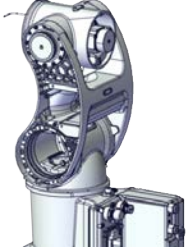

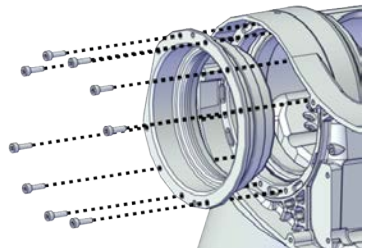

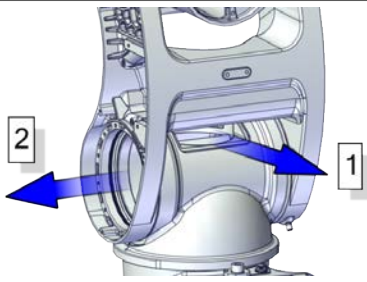
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## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit


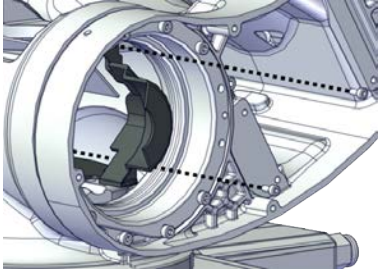
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#### Placing the axis 3-4 assembly unit

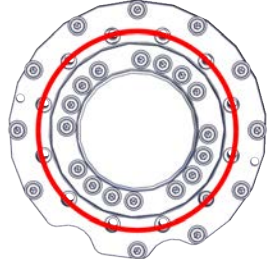

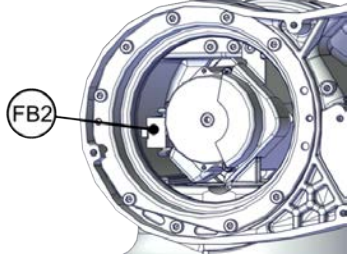
	Action	Note
1	Check the fixed mechanical axis limiting screw. Replace if damaged.	Mechanical stop, screw: 9ADA186-23   <small>xx2200000094</small>
2	Place the axis 3-4 assembly unit in place with the axis-1 assembly unit.   <b>Note</b> The axis 3-4 assembly unit is not secured with the axis-1 assembly unit until the axis-2 drive unit is refitted. Support the axis 3-4 assembly unit to make sure it will not fall down.	 <small>xx2200000542</small>
3	Lay the assembly units on the workbench with the axis-2 sleeve facing upwards.	
4	Refit the axis-2 sleeve.   <b>Note</b> Make sure the screw holes are aligned and the sleeve is evenly refitted.	Axis-2 sleeve: 3HAC074872-001 Screw: M3x10 12.9 Lafre 2C2B/FC6.9 (9 pcs) Tightening torque: 1.5 Nm   <small>xx2200000070</small>
5	Turn the assembly units to stand position.	
6	Route the cable package out from the swing top first (direction 1) and then out from the axis 1 assembly unit (directions 2).   <b>Note</b> Note the cable routing direction, that is, out from the right side of the robot (the side where the axis-2 sleeve will be fixed).	 <small>xx2200000095</small>

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Securing the cable package in axis 2

	Action	Note
1	<p>Secure the the cable package with the axis-2 cable protector.</p>  <p><b>Note</b></p> <p>Pay attention to leave axis-2 drive unit connectors free.</p>	<p>Cable protector, axis 2: 3HAC078561-001</p> <p>Screw: M2.5x6 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 0.4 Nm</p>  <p>xx2200000069</p>

Refit the axis-2 drive unit

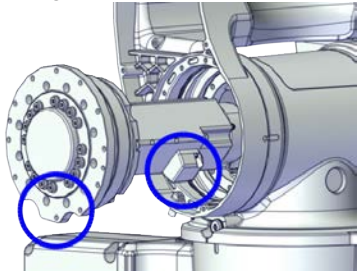
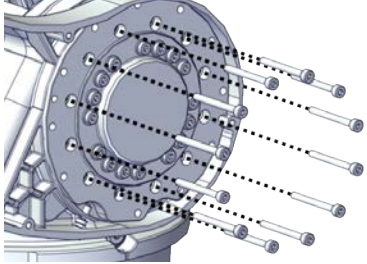
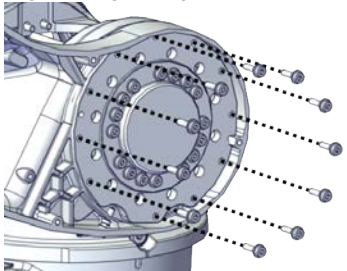

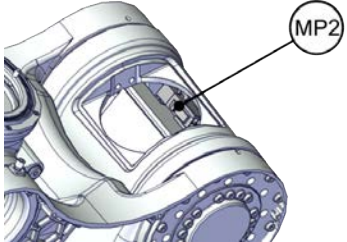
	Action	Note
1	<p>Check that:</p> <ul style="list-style-type: none"> <li>all assembly surfaces are clean and without damages</li> <li>the drive unit is clean and undamaged.</li> </ul>	
2	<p>Make sure:</p> <ul style="list-style-type: none"> <li>the axis-2 synchronization marks are aligned.</li> <li>the axis-2 drive unit is in zero position.</li> <li>the screw holes (marked on the red circle) on the drive unit are through-holes.</li> </ul>	 <p>xx2200000543</p>
3	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>FB2</li> </ul>  <p><b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000064</p>

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## 5 Repair


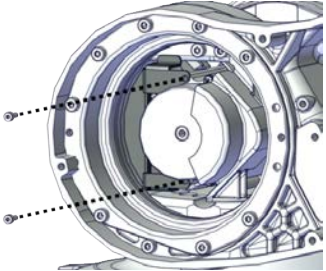
### 5.4.3 Replacing the axis 3-4 assembly unit

Continued


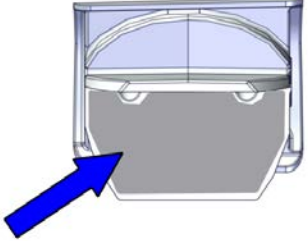
	Action	Note
4	<p>Orient the drive unit correctly and insert it into the axis-1 assembly unit.            Make sure the drive unit is properly fit and its cabling are not twisted or strained.</p>	<p>Orientation: orient the drive unit according to the figure below, in regard to the encircled connector and lug boss.</p>  <p>xx2200000096</p>
5	<p>Refit the drive unit to the axis-1 assembly unit.</p>	<p>Screw: M3x30 12.9 Lafre 2C2B/FC6.9 (12 pcs)            Tightening torque: 1.5 Nm</p>  <p>xx2200000066</p>
6	<p>Refit the drive unit to the axis 3-4 assembly unit.</p>	<p>Flange socket head screw, M3x12 12.9 Lafre 2C2B/FC6.9+PrO-COat111, 3HAB3412-312 (11 pcs)            Tightening torque: 1.5 Nm</p>  <p>xx2200000065</p>
7	<p>Access and reconnect the connector from the swing top.</p> <ul style="list-style-type: none"> <li>• MP2</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000541</p>

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Routing the cable package in axis 2

	Action	Note
1	Route and secure the cabling with cable straps.   <b>CAUTION</b>  Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.	
2	Apply grease to the cable package, cover all moving area of the package.	Grease: 3HAC029132-001
3	Refit the axis-2 cable bracket.	Cable bracket, axis 2: 3HAC080837-001 Screw: M2x6 12.9 (2 pcs) Tightening torque: 0.4 Nm    xx220000063

Refitting the swing top cover

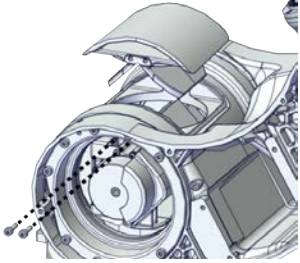

	Action	Note
1	Make sure the axis 2 is in -60° position; otherwise, connect the power supply to axis-2 motor and release the axis-2 brake to move the axis 2 to -60°. Then, disconnect the power supply.   <b>Note</b>  The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a> .	
2	Check the cooling pad. Replace if damaged.	Cooling pad for axis-2 motor: 3HAC071021-001    xx2200000122

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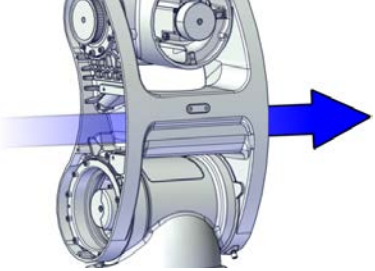
## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit

Continued

	Action	Note
3	Refit the swing top cover.	<p>Screw: M3x10 12.9 Lafre 2C2B/FC6.9 (2 pcs) Tightening torque: 1.2 Nm</p>  <p>xx2200000540</p>
4	<p>Connect the power supply to axis-2 motor and release the axis-2 brake to move the axis 2 to zero position. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	

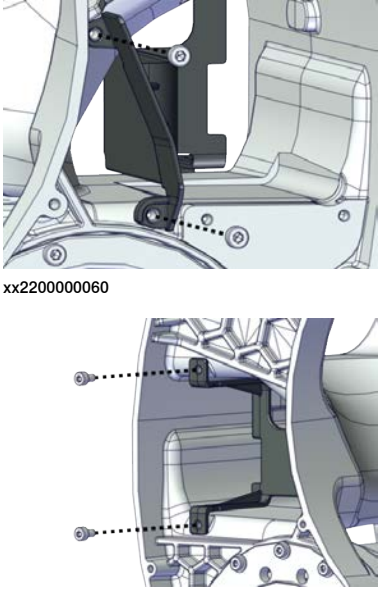
#### Securing the cable package in axis 3

	Action	Note
1	Route the cable package through the axis 3-4 assembly unit.	 <p>xx2200000097</p>

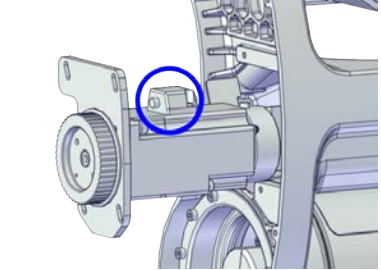
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5.4.3 Replacing the axis 3-4 assembly unit

Continued

	Action	Note
2	Secure the the cable package with the axis-3 cable protector.	<p>Cable protector, axis 3: 3HAC078562-001 Screw: M3x6 12.9 Lafre 2C2B/FC6.9 (4 pcs) Tightening torque: 0.4 Nm</p>  <p>xx2200000060</p> <p>xx2200000061</p>

Refitting the axis-3 motor


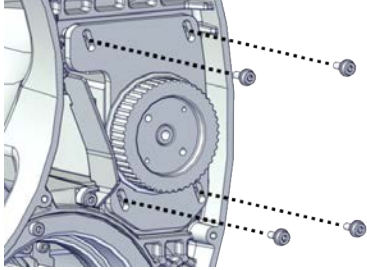
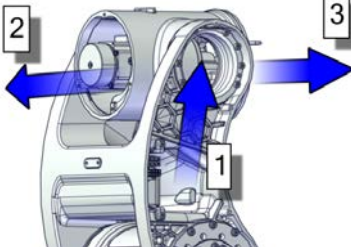
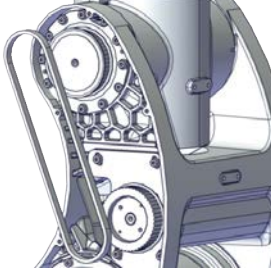

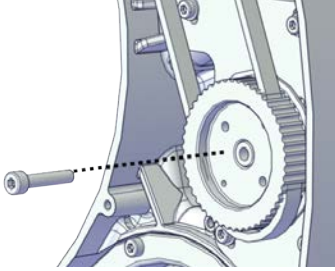
	Action	Note
1	<p>Check that:</p> <ul style="list-style-type: none"> <li>• all assembly surfaces are clean and without damages</li> <li>• the motor is clean and undamaged.</li> </ul>	
2	Orient the motor correctly and fit it into the axis 3-4 assembly unit.	<p>Motor orientation: orient the motor according to the figure below, in regard to the encircled motor connector.</p>  <p>xx2200000098</p>

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## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit

Continued

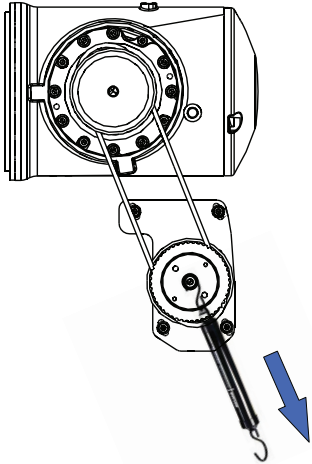
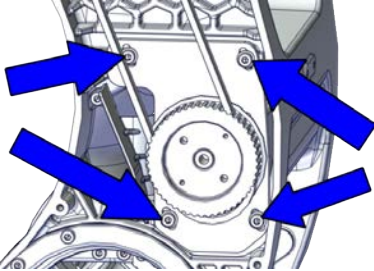

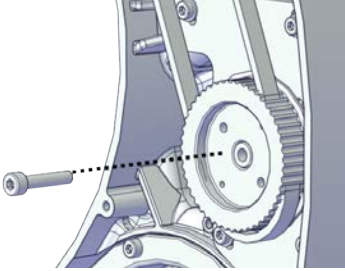
	Action	Note
3	<p>Refit the screws and washers.</p> <p> <b>Note</b></p> <p>Do not tighten the screws yet.</p>	<p>Flange socket head screw, M3x8 12.9 Lafre 2C2B/FC6.9+PrO-COat111, 3HAB3412-308 (4 pcs)</p>  <p>xx220000058</p>
4	<p>Route the cable package.</p> <ul style="list-style-type: none"> <li>Route the cable package up into the axis 4 (direction 1).</li> <li>Pull the axis-4 motor connectors out from the robot rear (direction 2).</li> <li>Pull the main cable harness out from the axis 3-4 assembly unit and to the wrist unit direction (direction 3).</li> </ul>	 <p>xx2200000100</p>
5	<p>Install the timing belt to the pulleys and verify that the belt runs correctly in the grooves of the pulleys.</p>	 <p>xx2200000099</p>
6	<p>Install an M4x20 or longer adjustment screw to the motor.</p> <p> <b>Note</b></p> <p>Do not insert the entire screw to the hole. The screw shall be installed with proper force to avoid shaft rotation.</p>	 <p>xx2200000544</p>

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5.4.3 Replacing the axis 3-4 assembly unit

Continued

	Action	Note
7	Use a handheld dynamometer hooking to the screw and pull the dynamometer to reach the initial referenced force.	<p>Initial referenced force for used belt: 14.1±1 N (for reference only)                      Initial referenced force for new belt: 20.2±1 N</p>  <p>xx2200000545</p>
8	Secure the motor with the screws.	<p>Tightening torque: 0.8 Nm</p>  <p>xx220000056</p>
9	Use a sonic tension meter to measure the timing belt tension.	<p>Used belt: 86-93 Hz                      New belt: 93-118 Hz (for reference only)</p>
10	If the timing belt tension does not meet the requirement, loosen the motor screws and readjust.	
11	<p>Remove the adjustment screw from the motor.</p> <p> <b>Note</b></p> <p>Pay attention to the screw turning direction. Incorrect direction may weaken the brake capacity of the motor.</p>	 <p>xx2200000544</p>


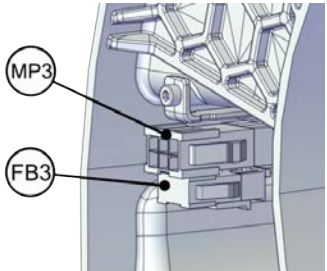

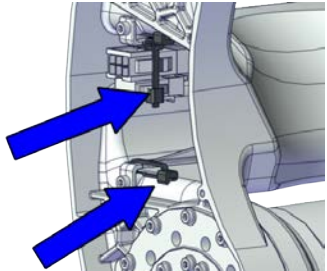
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## 5 Repair

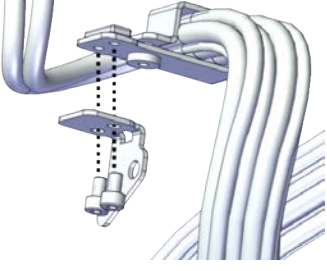
### 5.4.3 Replacing the axis 3-4 assembly unit

*Continued*

#### Reconnecting the axis-3 motor connectors

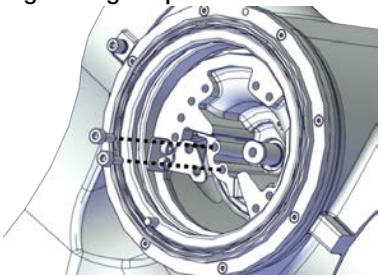

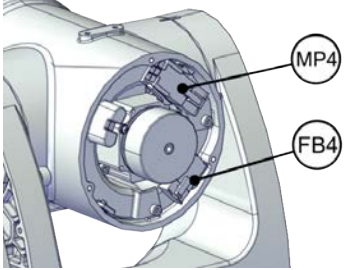


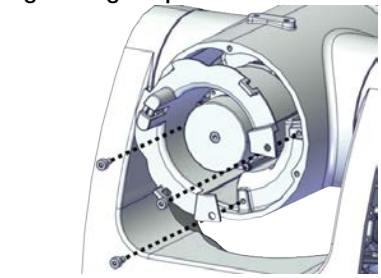
	Action	Note
1	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB3</li> <li>• MP3</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000055</p>
2	<p>Route and secure the cabling with cable straps.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	 <p>xx2200000054</p>
3	<p>Apply grease to the cable package, cover all moving area of the package.</p>	<p>Grease: 3HAC029132-001</p>

#### Securing the cable package in axis 4

	Action	Note
1	<p>Refit the axis-4 cable bracket to the cable.</p>	<p>Cable bracket, axis 4: 3HAC076867-001</p> <p>Screw: M2.5x4 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 0.6 Nm</p>  <p>xx2200000058</p>

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5.4.3 Replacing the axis 3-4 assembly unit  
Continued


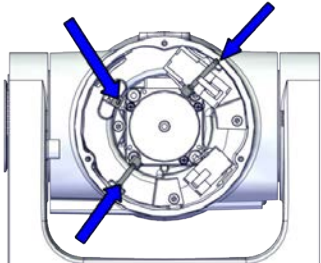
	Action	Note
2	Refit the axis-4 cable bracket to the housing.	Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (2 pcs) Tightening torque: 1.2 Nm  xx220000052
3	Reconnect the connectors. <ul style="list-style-type: none"> <li>• FB4</li> <li>• MP4</li> </ul>  <b>Tip</b> See the number markings on the connectors for help to find the corresponding connector.	 xx220000049
4	Make sure the axis 4 is in 130° position; otherwise, connect the power supply to axis-4 motor and release the axis-4 brake to move the axis 4 to 130°. Then, disconnect the power supply.  <b>Note</b> The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a> .	
5	Apply grease to the cable package, cover all moving area of the package.	Grease: 3HAC029132-001
6	Refit the axis-4 cable protector.  <b>Tip</b> If required, disconnect the axis-4 connectors before the refitting. This facilitates the cable routing.	Cable protector, axis 4: 3HAC075565-001 Screw: M3x6 12.9 Lafre 2C2B/FC6.9 (3 pcs) Tightening torque: 0.4 Nm  xx220000051

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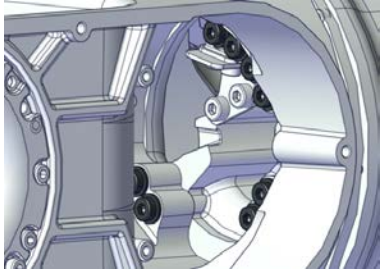
## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit


Continued

	Action	Note
7	<p>Route and secure the cabling with cable straps.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	 <p>xx2200000050</p>


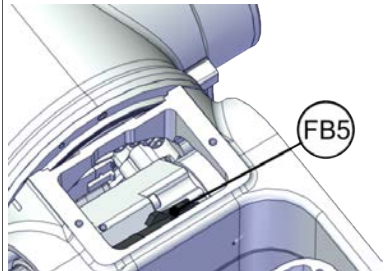
### Refitting the wrist unit

	Action	Note
1	<p>Connect the power supply to axis-3 motor and release the axis-3 brake to move the axis 3 to -90°. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	
2	Route the cable package into the wrist unit.	
3	Carefully align the wrist unit to the axis 3-4 assembly unit by the screw holes.	 <p>xx2200000539</p>
4	Refit the wrist unit.	<p>Flange socket head screw, M3x16 12.9 Lafre 2C2B/FC6.9+PrO-COat111, 3HAB3412-316 (8 pcs) Tightening torque: 1.2 Nm</p>  <p>xx2200000047</p>

Continues on next page

	Action	Note
5	<p>Connect the power supply to axis-3 motor and release the axis-3 brake to move the axis 3 to zero position. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	

Refitting the axis-5 motor

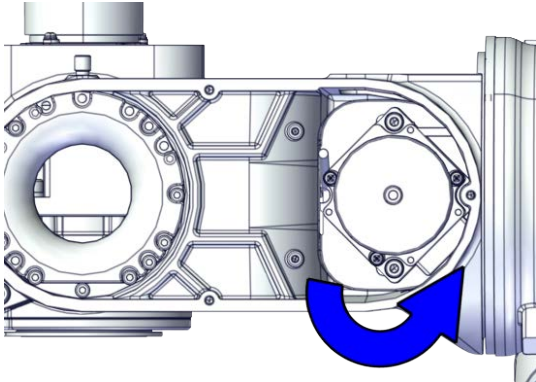

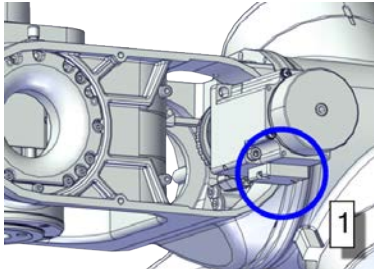
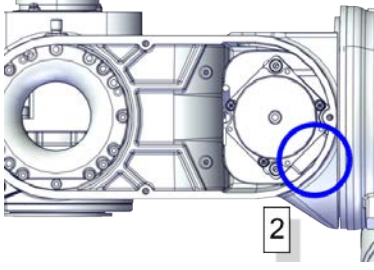

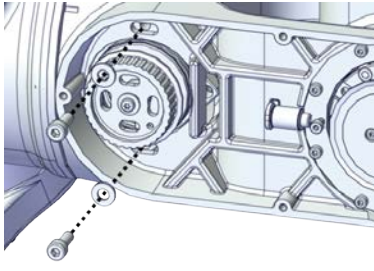

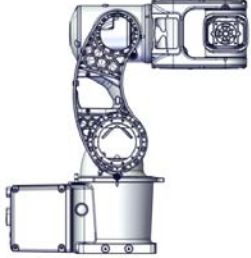
	Action	Note
1	<p>Arrange the cable package as follows:</p> <ul style="list-style-type: none"> <li>• Cablings out from the process hub                             <ul style="list-style-type: none"> <li>- air hoses</li> <li>- CP/CS cabling (connector R2.C1)</li> <li>- axis-5 motor cablings (connectors MP5 and FB5)</li> </ul> </li> <li>• Cablings out from the right side of wrist unit (facing the tool flange)                             <ul style="list-style-type: none"> <li>- axis-6 motor cablings (connectors MP6 and FB6)</li> <li>- pressure relief pipe connector</li> </ul> </li> </ul>	
2	<p>Check that:</p> <ul style="list-style-type: none"> <li>• all assembly surfaces are clean and without damages</li> <li>• the motor is clean and undamaged.</li> </ul>	
3	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB5</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000538</p>

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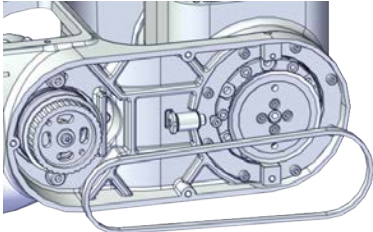
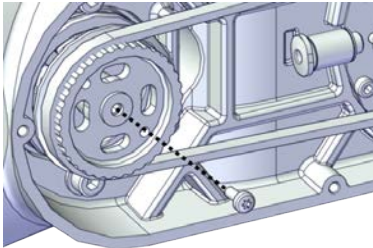

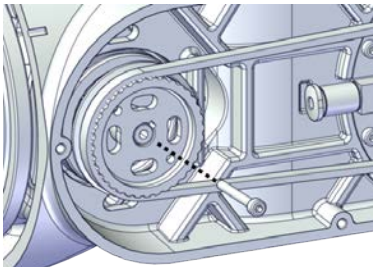
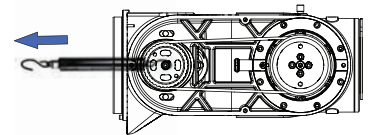
## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit

Continued

	Action	Note
<p>4</p>  <p>xx2200000103</p> <p> <b>Note</b></p> <p>Carefully handle the connectors. Leave the MP5 connector visible and accessible from the process hub.</p>	<p>Motor orientation: orient the motor according to the figures below, in regard to the encircled motor connector.</p>  <p>xx2200000104</p>  <p>xx2200000105</p>	
<p>5</p> <p>Refit the screws and washers.</p> <p> <b>Note</b></p> <p>Do not tighten the screws yet.</p>	<p>Screw: M4x12 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p>  <p>xx2200000044</p>	
<p>6</p> <p>Connect the power supply to axis-4 motor and release the axis-4 brake to move the axis 4 to -90°. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	 <p>xx2200000120</p>	

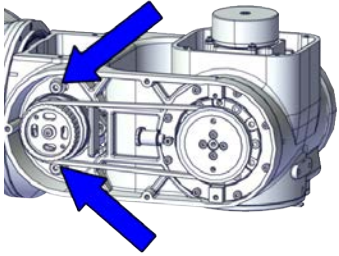

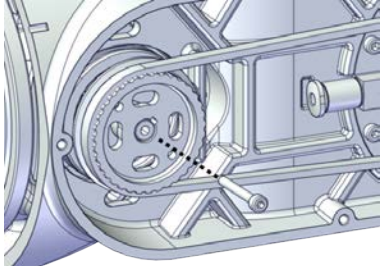


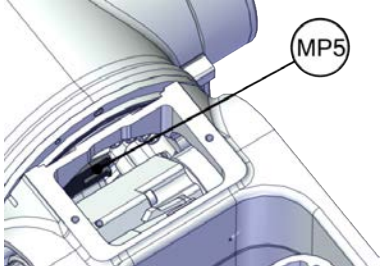
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	Action	Note
7	Install the timing belt to the pulleys and verify that the belt runs correctly in the grooves of the pulleys.	 <p>xx2200000043</p>
8	Remove the pulley screw from the motor.	 <p>xx2200000546</p>
9	Install an M2.5x20 or longer adjustment screw to the motor.  <b>Note</b> Do not insert the entire screw to the hole. The screw shall be installed with proper force to avoid shaft rotation.	 <p>xx2200000547</p>
10	Use a handheld dynamometer hooking to the screw and pull the dynamometer to reach the initial referenced force.	Initial referenced force for used belt: $13.7 \pm 1$ N (for reference only) Initial referenced force for new belt: $19.6 \pm 1$ N  <p>xx2200000548</p>

## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit

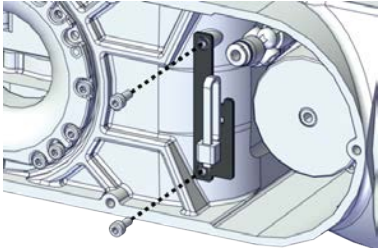

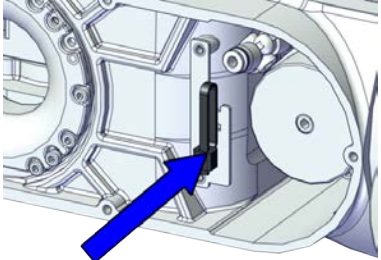
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	Action	Note
11	Secure the motor with the screws.	<p>Tightening torque: 2.8 Nm</p>  <p>xx2200000042</p>
12	Use a sonic tension meter to measure the timing belt tension.	<p>Used belt: 123-131 Hz New belt: 132-169 Hz (for reference only)</p>
13	If the timing belt tension does not meet the requirement, loosen the motor screws and readjust.	
14	<p>Remove the adjustment screw from the motor.</p> <p> <b>Note</b></p> <p>Pay attention to the screw turning direction. Incorrect direction may weaken the brake capacity of the motor.</p>	 <p>xx2200000047</p>
15	Refit the pulley screw.	Tightening torque: 0.8 Nm
16	<p>Connect the power supply to axis-4 motor and release the axis-4 brake to move the axis 4 to zero position. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	
17	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>MP5</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000040</p>

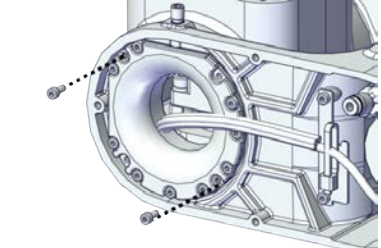
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Securing the cable package in axis 5

	Action	Note
1	Refit the axis-5 cable bracket.	<p>Cable bracket, axis 5: 3HAC079126-001</p> <p>Screw: M2.5x6 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 0.6 Nm</p>  <p>xx2200000038</p>
2	<p>Route and secure the cabling with cable straps. Make sure the white mark on the cabling facing outside.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	 <p>xx2200000039</p>

Reconnecting the axis-6 motor connectors


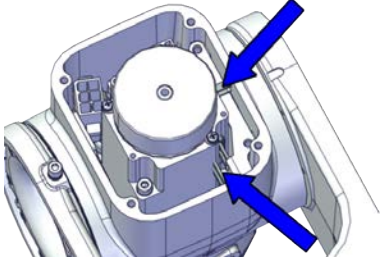
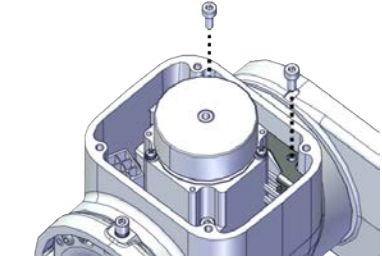

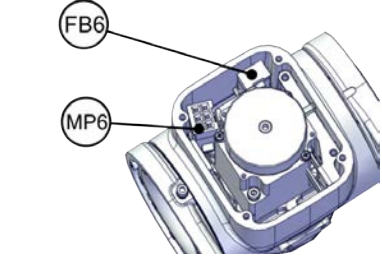
	Action	Note
1	Apply grease to the cable package, cover all moving area of the package.	Grease: 3HAC029132-001
2	Slip the axis-5 cable protector over the cable package and refit the protector.	<p>Cable protector, axis 5: 3HAC076870-001</p> <p>Screw: M2.5x6 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 0.3 Nm</p>  <p>xx2200000036</p>
3	Arrange the cable package in axis 6.	

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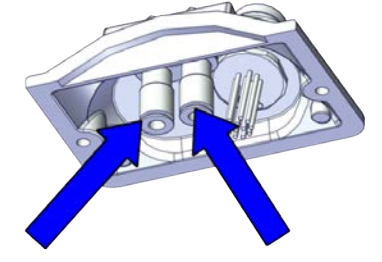
## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit

Continued


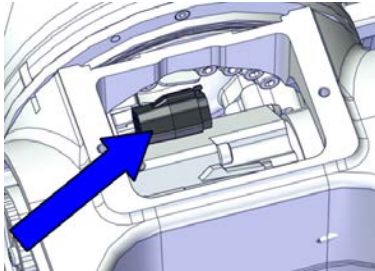

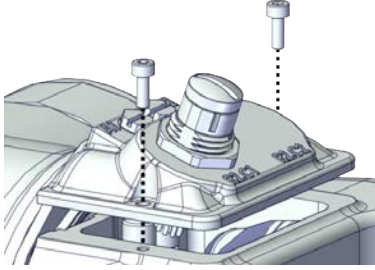
	Action	Note
4	<p>Secure the cabling with cable straps. Make sure the white mark on the cabling facing outside.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	 <p>xx2200000034</p>
5	<p>Refit the axis-6 cable bracket.</p>	<p>Cable bracket, axis 6: 3HAC079127-001</p> <p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 1.2 Nm</p>  <p>xx2200000033</p>
6	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB6</li> <li>• MP6</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000035</p>

### Refitting the process hub

	Action	Note
1	<p>For robots with air hoses</p> <p>Reconnect the air hoses.</p>	 <p>xx2200000031</p>

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5.4.3 Replacing the axis 3-4 assembly unit  
Continued

	Action	Note
2	<p>For robots with CP/CS cabling</p> <p>Reconnect the connector.</p> <ul style="list-style-type: none"> <li>R2.C1</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000032</p>
3	<p>Route and secure the cabling with cable straps.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	
4	<p>Apply grease to the cable package, cover all moving area of the package.</p>	<p>Grease: 3HAC029132-001</p>
5	<p>Refit the process hub.</p>	<p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 1.2 Nm</p>  <p>xx2200000030</p>

Refitting the covers

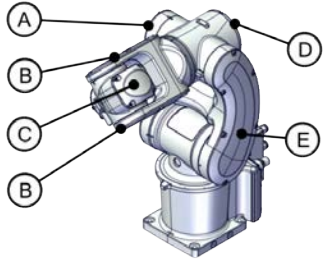
	Action	Note
1	<p>Apply grease to the cable package, cover all moving area of the package.</p>	<p>Grease: 3HAC029132-001</p>
2	<p>Apply grease to the covers that have contacting area with the cable package.</p>	<p>Grease: 3HAC029132-001</p>

Continues on next page


## 5 Repair

### 5.4.3 Replacing the axis 3-4 assembly unit

Continued

	Action	Note
3	Refit the covers. <ul style="list-style-type: none"> <li>• Lower arm cover, left (A)</li> <li>• Wrist covers (B)</li> <li>• Tilt cover (C)</li> <li>• Housing cover (D)</li> <li>• Lower arm cover, right (E)</li> </ul>	Screw: M3x8 12.9 Lafre 2C2B/FC6.9 Tightening torque: 1.2 Nm  xx2200000029

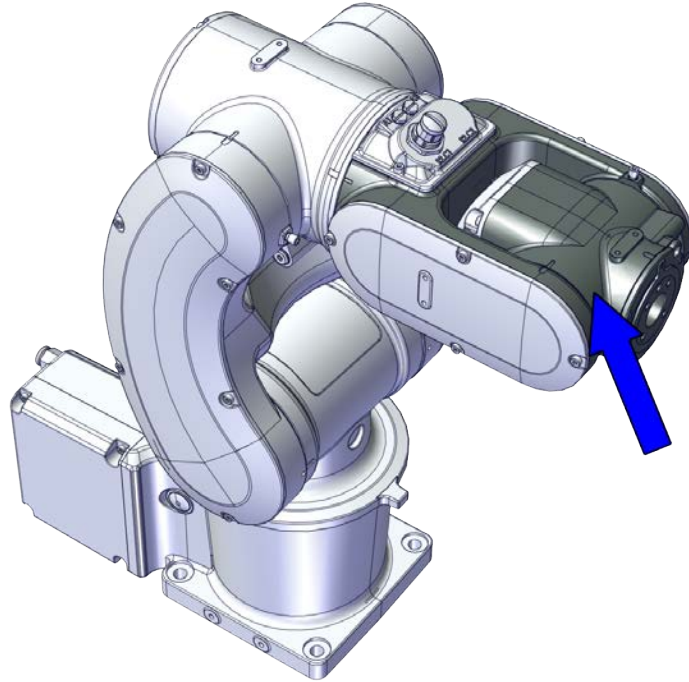
#### Concluding procedure

	Action	Note
1	Recalibrate the robot.	Calibration is detailed in section <a href="#">Calibration on page 283</a> .
2	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. See <a href="#">Test run after installation, maintenance, or repair on page 81</a> .	

## 5.4.4 Replacing the wrist unit

### Location of the wrist unit

The wrist unit is located as shown in the figure.



xx220000006

### Required spare parts



#### Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 1010 via myABB Business Portal, [www.abb.com/myABB](http://www.abb.com/myABB).

Spare part	Article number	Note
Wrist unit	3HAC082451-001	Includes tubular, wrist, axis-5 gearbox and axis-6 drive unit.

### Required service parts

Spare part	Article number	Note
Cable bracket, axis 5	3HAC079126-001	
Cable bracket, axis 6	3HAC079127-001	
Cable protector, axis 5	3HAC076870-001	
Wrist cover	3HAC082443-001	
Tilt cover	3HAC082442-001	

*Continues on next page*

## 5 Repair

### 5.4.4 Replacing the wrist unit

Continued

Spare part	Article number	Note
Flange socket head screw	3HAB3412-316	M3x16 12.9 Lafre 2C2B/FC6.9+PrO-COat111

#### Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 330</a> .
Calibration tool box, Axis Calibration	3HAC074119-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
24 VDC power supply	-	Used to release the motor brakes.
Sonic tension meter	-	Used for measuring the timing belt tension.
Dynamometer	-	Used for measuring the timing belt tension.

#### Required consumables and wear parts

Consumable	Article number	Note
Cable straps	-	
Grease	3HAC029132-001	FM 222

#### Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

	Action	Note
1	Decide which calibration routine to use for calibrating the robot. <ul style="list-style-type: none"><li>Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot.</li><li>Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.</li></ul>	
	<b>If the robot is to be calibrated with reference calibration:</b> Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 291</a> .

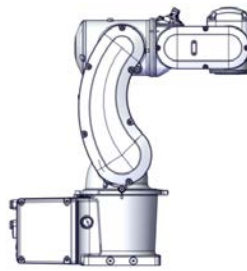

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Action	Note
<p><b>If the robot is to be calibrated with fine calibration:</b> Remove all external cable packages (DressPack) and tools from the robot.</p>	


#### Removing the wrist unit

Use these procedures to remove the wrist unit.

#### Preparations before removing the wrist unit

Action	Note	
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none"> <li>• Axis 1: 0°</li> <li>• Axis 2: 0°</li> <li>• Axis 3: 0°</li> <li>• Axis 4: 0°</li> <li>• Axis 5: +90°</li> <li>• Axis 6: No significance</li> </ul>	 <p>xx2200000174</p>
3	<p> <b>DANGER</b></p> <p>Turn off all:</p> <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> <p>to the robot, before entering the safeguarded space.</p>	

#### Removing the covers

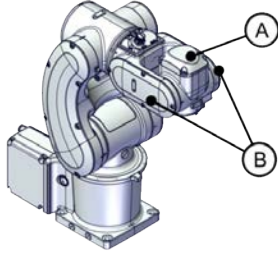
Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>

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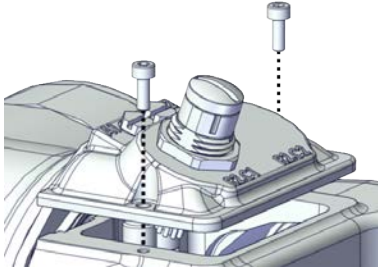
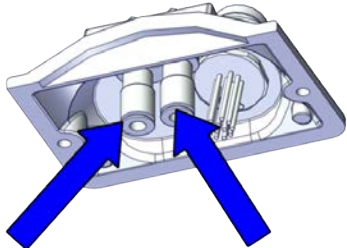

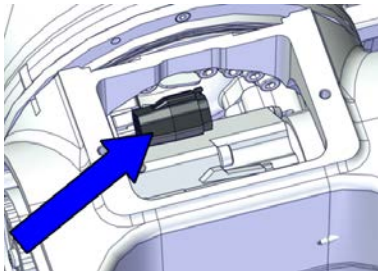
## 5 Repair

### 5.4.4 Replacing the wrist unit

*Continued*

	Action	Note
2	Remove the covers. <ul style="list-style-type: none"> <li>• Wrist covers (A)</li> <li>• Tilt cover (B)</li> </ul>	 <p>xx2200000553</p>




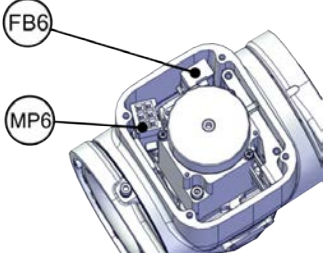

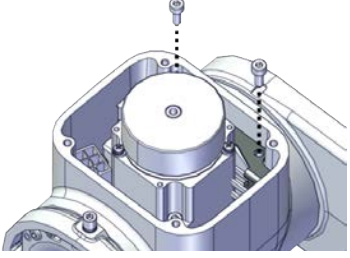
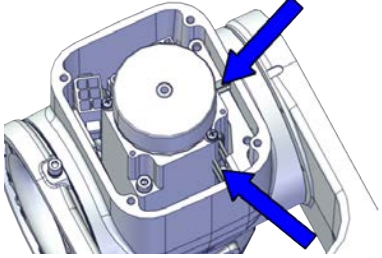
### Removing the process hub

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the screws and carefully open the cover.  <b>CAUTION</b> There is cabling attached to the cover. The cover cannot be removed completely until the connectors are removed.	 <p>xx2200000030</p>
3	<b>For robots with air hoses</b> Disconnect the air hoses.	 <p>xx2200000031</p>
4	<b>For robots with CP/CS cabling</b> Disconnect the connector. <ul style="list-style-type: none"> <li>• R2.C1</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 <p>xx2200000032</p>


*Continues on next page*



Disconnecting the axis-6 motor connectors

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Disconnect the connectors. <ul style="list-style-type: none"> <li>• MP6</li> <li>• FB6</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.   <b>Tip</b> The MP6 connector is fitted in particular position. Handle with cautions to not get it stuck.	 xx2200000035
3	Remove the axis-6 cable bracket.   <b>CAUTION</b> Be aware of the cablings that are attached to the cable bracket! The bracket cannot be removed completely until the cablings are removed from the plate.	 xx2200000033
4	Cut the cable straps.	 xx2200000034

Pulling out the cable package from axis 5


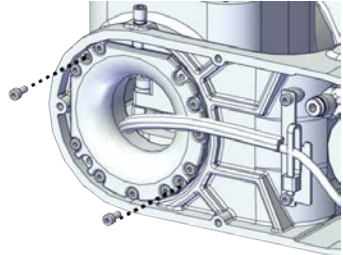
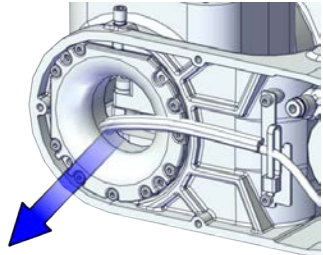
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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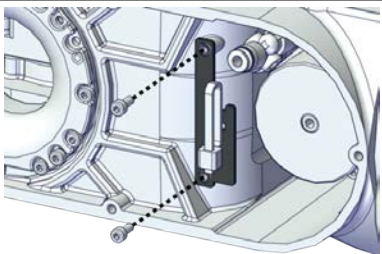
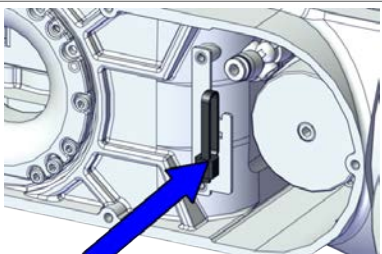
## 5 Repair

### 5.4.4 Replacing the wrist unit

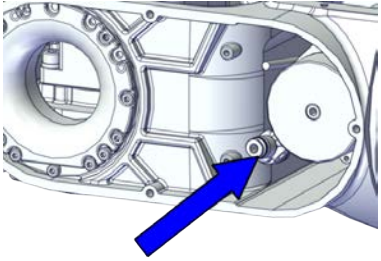
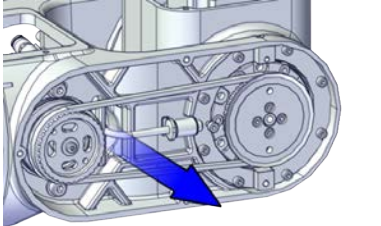
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	Action	Note
2	Wrap the connectors with the masking tape.	
3	Remove the axis-5 cable protector.  <b>Note</b> The screws to be removed are a little protruding than others. Do not mix the screws.	 xx2200000036
4	Pull out the cable package in the direction as shown in the figure.	 xx2200000037
5	Slip out the cable protector.	



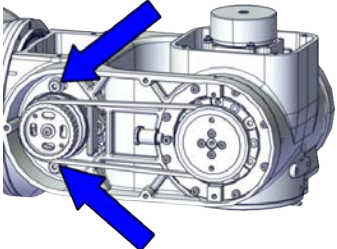
#### Separating the cable package from axis 5

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the axis-5 cable bracket.  <b>CAUTION</b> Be aware of the cablings that are attached to the cable bracket! The bracket cannot be removed completely until the cablings are removed from the plate.	 xx2200000038
3	Cut the cable strap.	 xx2200000039

Continues on next page

	Action	Note
4	Disconnect the pressure relief pipe connector.	 <p>xx220000041</p>
5	Pull out the pressure relief pipe carefully from the other side of the wrist unit.	 <p>xx2200000537</p>

Removing the axis-5 timing belt

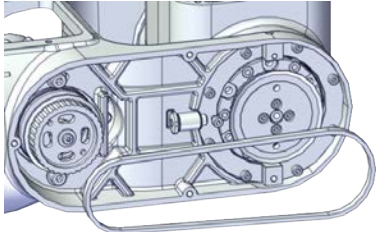
	Action	Note
1	 <p><b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	 <p><b>CAUTION</b></p> <p>Loosening timing belts will release axes. This means the axes can fall down. Make sure axes are well supported before loosening timing belts.</p>	
3	Loosen the screws and move the motor slightly to slacken the timing belt.	 <p>xx220000042</p>

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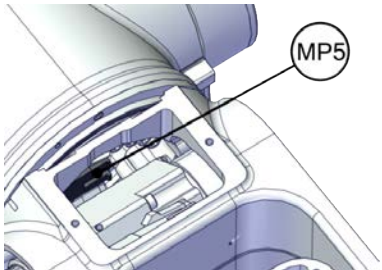
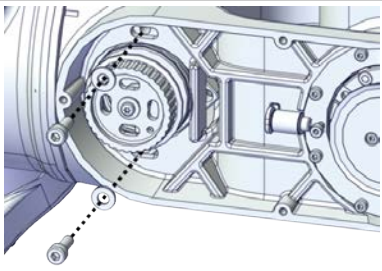
## 5 Repair

### 5.4.4 Replacing the wrist unit

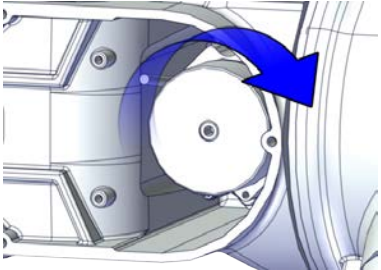

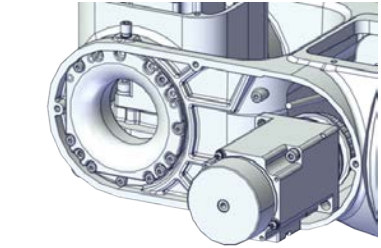

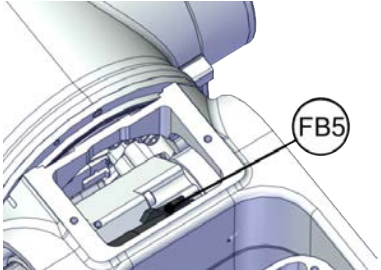
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	Action	Note
4	Remove the timing belt from its groove on the motor.	 xx2200000043



### Removing the axis-5 motor

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>CAUTION</b> Removing motors will release axes. This means the axes can fall down. Make sure axes are well supported before removing motors.	
3	Disconnect the connector. <ul style="list-style-type: none"> <li>MP5</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 xx2200000040
4	Remove the screws and washers.	 xx2200000044

Continues on next page

	Action	Note
5	Carefully rotate the motor to make its motor connector to a levelled position.	 xx2200000045
6	Carefully lift out the motor.  <b>CAUTION</b> Be aware of the connector that is still connected! The motor cannot be removed completely until the connector is disconnected.	 xx2200000046
7	Disconnect the connector. <ul style="list-style-type: none"> <li>• FB5</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 xx2200000538

Separating the wrist unit from the axis 3-4 assembly unit

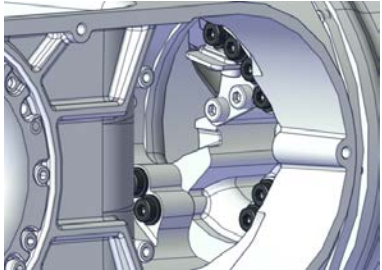


	Action	Note
1	Connect the power supply to axis-3 motor and release the axis-3 brake to move the axis 3 to -90°. Then, disconnect the power supply.  <b>Note</b> The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a> .	
2	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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## 5 Repair

### 5.4.4 Replacing the wrist unit


Continued

	Action	Note
3	Remove the screws (dark-colored in the figure).	 xx2200000047
4	Separate the wrist unit.	 xx2200000539
5	Connect the power supply to axis-3 motor and release the axis-3 brake to move the axis 3 to zero position. Then, disconnect the power supply.   <b>Note</b> The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a> .	


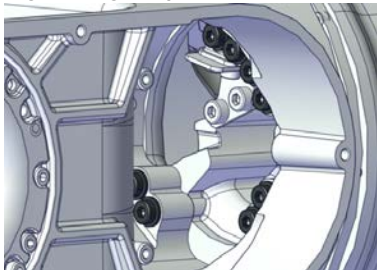

#### Refitting the wrist unit

Use these procedures to refit the wrist unit.

#### Refitting the wrist unit

	Action	Note
1	Connect the power supply to axis-3 motor and release the axis-3 brake to move the axis 3 to -90°. Then, disconnect the power supply.   <b>Note</b> The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a> .	
2	Route the cable package into the wrist unit.	

Continues on next page

	Action	Note
3	Carefully align the wrist unit to the axis 3-4 assembly unit by the screw holes.	 <p>xx2200000539</p>
4	Refit the wrist unit.	<p>Flange socket head screw, M3x16 12.9 Lafre 2C2B/FC6.9+PrO-COat111, 3HAB3412-316 (8 pcs) Tightening torque: 1.2 Nm</p>  <p>xx2200000047</p>
5	<p>Connect the power supply to axis-3 motor and release the axis-3 brake to move the axis 3 to zero position. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	

#### Refitting the axis-5 motor


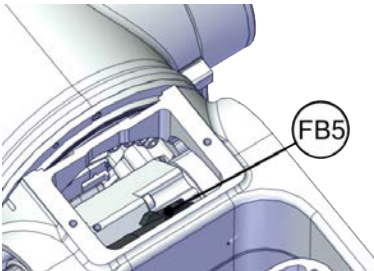
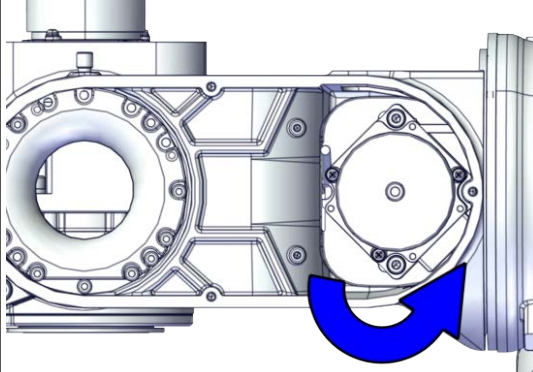

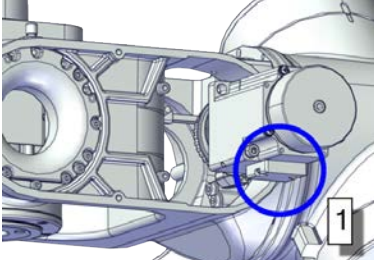
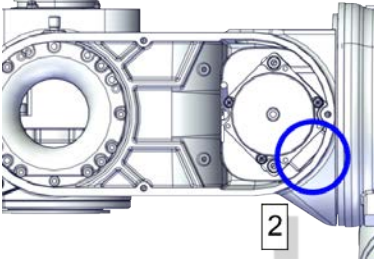

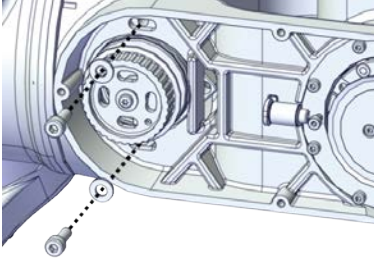
	Action	Note
1	<p>Arrange the cable package as follows:</p> <ul style="list-style-type: none"> <li>• Cablings out from the process hub <ul style="list-style-type: none"> <li>- air hoses</li> <li>- CP/CS cabling (connector R2.C1)</li> <li>- axis-5 motor cablings (connectors MP5 and FB5)</li> </ul> </li> <li>• Cablings out from the right side of wrist unit (facing the tool flange) <ul style="list-style-type: none"> <li>- axis-6 motor cablings (connectors MP6 and FB6)</li> <li>- pressure relief pipe connector</li> </ul> </li> </ul>	
2	<p>Check that:</p> <ul style="list-style-type: none"> <li>• all assembly surfaces are clean and without damages</li> <li>• the motor is clean and undamaged.</li> </ul>	

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## 5 Repair


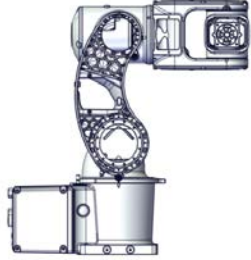
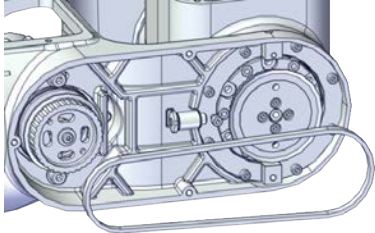
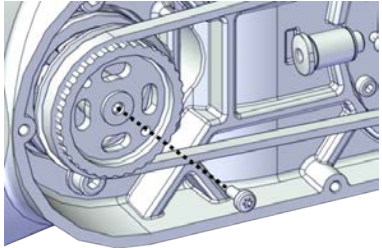

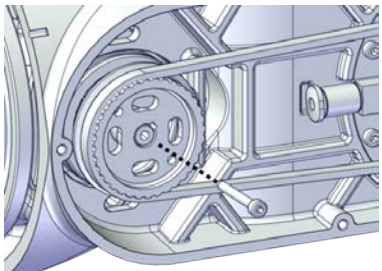
### 5.4.4 Replacing the wrist unit

Continued

	Action	Note
3	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB5</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000538</p>
4	<p>Orient the motor into the wrist unit in a leveled position first (connector reference 1), and then rotate it 45° when it is in the wrist unit (connector reference 2).</p>  <p>xx2200000103</p> <p> <b>Note</b></p> <p>Carefully handle the connectors. Leave the MP5 connector visible and accessible from the process hub.</p>	<p>Motor orientation: orient the motor according to the figures below, in regard to the encircled motor connector.</p>  <p>xx2200000104</p>  <p>xx2200000105</p>
5	<p>Refit the screws and washers.</p> <p> <b>Note</b></p> <p>Do not tighten the screws yet.</p>	<p>Screw: M4x12 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p>  <p>xx2200000044</p>

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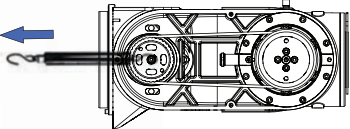
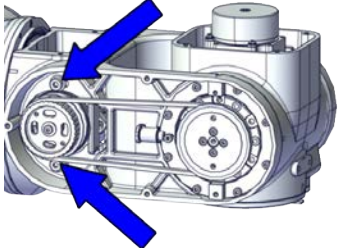

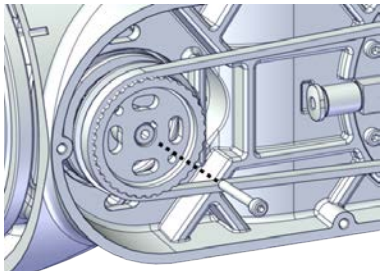



	Action	Note
6	<p>Connect the power supply to axis-4 motor and release the axis-4 brake to move the axis 4 to -90°. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	 <p>xx2200000120</p>
7	<p>Install the timing belt to the pulleys and verify that the belt runs correctly in the grooves of the pulleys.</p>	 <p>xx2200000043</p>
8	<p>Remove the pulley screw from the motor.</p>	 <p>xx2200000546</p>
9	<p>Install an M2.5x20 or longer adjustment screw to the motor.</p> <p> <b>Note</b></p> <p>Do not insert the entire screw to the hole. The screw shall be installed with proper force to avoid shaft rotation.</p>	 <p>xx2200000547</p>

## 5 Repair


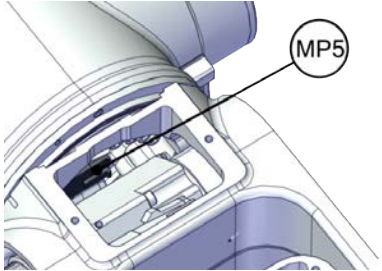
### 5.4.4 Replacing the wrist unit

Continued

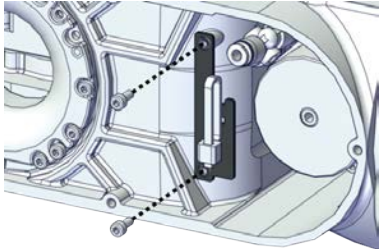

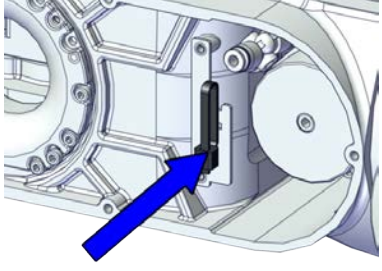
	Action	Note
10	Use a handheld dynamometer hooking to the screw and pull the dynamometer to reach the initial referenced force.	<p>Initial referenced force for used belt: 13.7±1 N (for reference only) Initial referenced force for new belt: 19.6±1 N</p>  <p>xx2200000548</p>
11	Secure the motor with the screws.	<p>Tightening torque: 2.8 Nm</p>  <p>xx2200000042</p>
12	Use a sonic tension meter to measure the timing belt tension.	<p>Used belt: 123-131 Hz New belt: 132-169 Hz (for reference only)</p>
13	If the timing belt tension does not meet the requirement, loosen the motor screws and readjust.	
14	<p>Remove the adjustment screw from the motor.</p> <p> <b>Note</b></p> <p>Pay attention to the screw turning direction. Incorrect direction may weaken the brake capacity of the motor.</p>	 <p>xx2200000547</p>
15	Refit the pulley screw.	Tightening torque: 0.8 Nm
16	<p>Connect the power supply to axis-4 motor and release the axis-4 brake to move the axis 4 to zero position. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	

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5.4.4 Replacing the wrist unit  
Continued

	Action	Note
17	Reconnect the connectors. <ul style="list-style-type: none"> <li>• MP5</li> </ul>  <b>Tip</b> See the number markings on the connectors for help to find the corresponding connector.	 <p>xx2200000040</p>

Securing the cable package in axis 5

	Action	Note
1	Refit the axis-5 cable bracket.	Cable bracket, axis 5: 3HAC079126-001 Screw: M2.5x6 12.9 Lafre 2C2B/FC6.9 (2 pcs) Tightening torque: 0.6 Nm  <p>xx2200000038</p>
2	Route and secure the cabling with cable straps. Make sure the white mark on the cabling facing outside.  <b>CAUTION</b> Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.	 <p>xx2200000039</p>

Reconnecting the axis-6 motor connectors

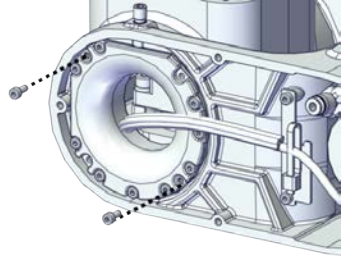

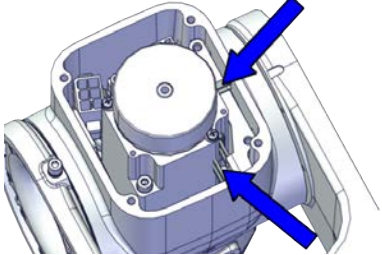
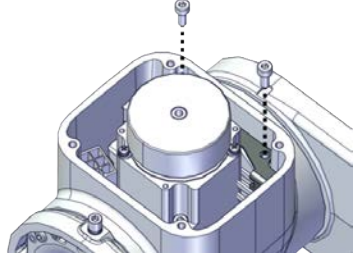

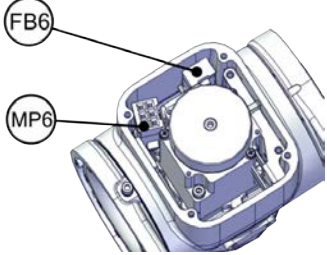
	Action	Note
1	Apply grease to the cable package, cover all moving area of the package.	Grease: 3HAC029132-001

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## 5 Repair

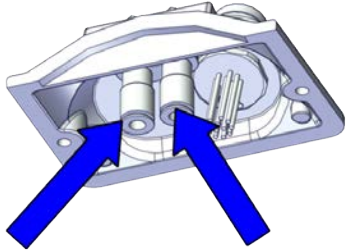

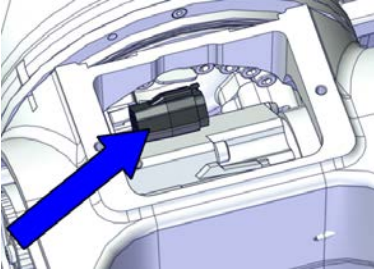

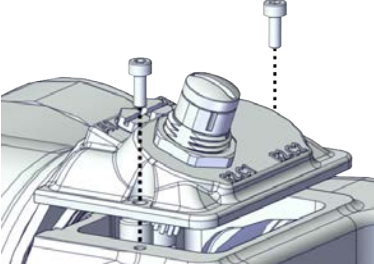
### 5.4.4 Replacing the wrist unit

Continued

	Action	Note
2	Slip the axis-5 cable protector over the cable package and refit the protector.	<p>Cable protector, axis 5: 3HAC076870-001</p> <p>Screw: M2.5x6 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 0.3 Nm</p>  <p>xx2200000036</p>
3	Arrange the cable package in axis 6.	
4	<p>Secure the cabling with cable straps. Make sure the white mark on the cabling facing outside.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	 <p>xx2200000034</p>
5	Refit the axis-6 cable bracket.	<p>Cable bracket, axis 6: 3HAC079127-001</p> <p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 1.2 Nm</p>  <p>xx2200000033</p>
6	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB6</li> <li>• MP6</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000035</p>

Continues on next page

Refitting the process hub

	Action	Note
1	<p>For robots with air hoses</p> <p>Reconnect the air hoses.</p>	 <p>xx2200000031</p>
2	<p>For robots with CP/CS cabling</p> <p>Reconnect the connector.</p> <ul style="list-style-type: none"> <li>R2.C1</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000032</p>
3	<p>Route and secure the cabling with cable straps.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	
4	<p>Apply grease to the cable package, cover all moving area of the package.</p>	<p>Grease: 3HAC029132-001</p>
5	<p>Refit the process hub.</p>	<p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 1.2 Nm</p>  <p>xx2200000030</p>

Refitting the covers

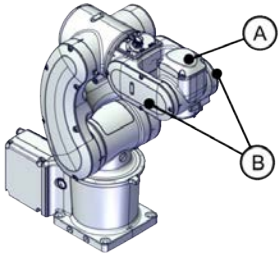
	Action	Note
1	<p>Apply grease to the cable package, cover all moving area of the package.</p>	<p>Grease: 3HAC029132-001</p>
2	<p>Apply grease to the covers that have contacting area with the cable package.</p>	<p>Grease: 3HAC029132-001</p>

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## 5 Repair

### 5.4.4 Replacing the wrist unit

Continued

	Action	Note
3	Refit the covers. <ul style="list-style-type: none"><li>• Wrist covers (B)</li><li>• Tilt cover (C)</li></ul>	Screw: M3x8 12.9 Lafre 2C2B/FC6.9 Tightening torque: 1.2 Nm  xx2200000553

### Concluding procedure

	Action	Note
1	Recalibrate the robot.	Calibration is detailed in section <a href="#">Calibration on page 283</a> .
2	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. See <a href="#">Test run after installation, maintenance, or repair on page 81</a> .	

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## 5.5 Motors and drive units

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### Introduction

Only axis-2 drive unit, axis-3 motor and axis-5 motor of IRB 1010 are available to replace as spare parts. For details about the replacement procedure, see,

- [Replacing the axis-2 drive unit on page 248](#)
- [Replacing the axis-3 motor on page 257](#)
- [Replacing the axis-5 motor on page 266](#)

Axis-1 drive unit is part of the axis-1 assembly unit, see [Replacing the axis-1 assembly unit on page 183](#).

Axis-3 gearbox and axis-4 drive unit are part of the axis 3-4 assembly unit, see [Replacing the axis 3-4 assembly unit on page 190](#).

Axis-5 gearbox and axis-6 drive unit are part of the wrist unit, see [Replacing the wrist unit on page 229](#).

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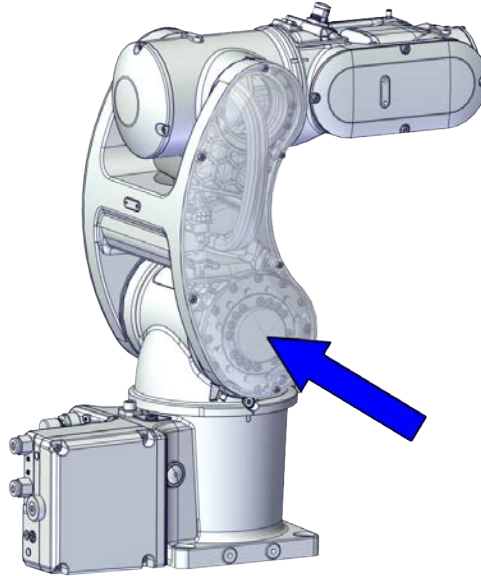
## 5 Repair

### 5.5.1 Replacing the axis-2 drive unit

#### 5.5.1 Replacing the axis-2 drive unit

##### Location of the axis-2 drive unit

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



xx220000007

##### Required spare parts



##### Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 1010 via myABB Business Portal, [www.abb.com/myABB](http://www.abb.com/myABB).

Spare part	Article number	Note
Drive unit, axis 2	3HAC082580-001	

##### Required service parts

Spare part	Article number	Note
Cable bracket, axis 2	3HAC080837-001	
Cable protector, axis 2	3HAC078561-001	
Swing top cover	3HAC082452-001	
Lower arm cover, left	3HAC082446-001	
Lower arm cover, right	3HAC082447-001	

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Spare part	Article number	Note
Flange socket head screw	3HAB3412-312	M3x12 12.9 Lafre 2C2B/FC6.9+PrO-COat111

#### Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 330</a> .
Calibration tool box, Axis Calibration	3HAC074119-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
24 VDC power supply	-	Used to release the motor brakes.

#### Required consumables and wear parts

Consumable	Article number	Note
Cable straps	-	
Grease	3HAC029132-001	FM 222
Cooling pad for axis-2 motor	3HAC071021-001	Cooling pads are wear parts. One cooling pad sheet contains 6 pieces of small pad. Replace if damaged with one piece each time.

#### Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

	Action	Note
1	Decide which calibration routine to use for calibrating the robot. <ul style="list-style-type: none"> <li>Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot.</li> <li>Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.</li> </ul>	
	<p><b>If the robot is to be calibrated with reference calibration:</b></p> <p>Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot.</p> <p>If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.</p>	<p>Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values.</p> <p>Creating new values requires possibility to move the robot.</p> <p>Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 291</a>.</p>

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## 5 Repair

### 5.5.1 Replacing the axis-2 drive unit



*Continued*

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


#### Removing the axis-2 drive unit

Use these procedures to remove the axis-2 drive unit.

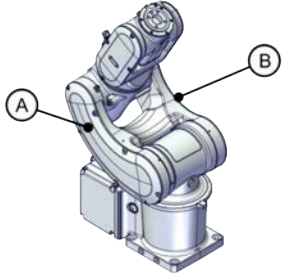
#### Preparations before removing the axis-2 drive unit

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none"> <li>• Axis 1: 0°</li> <li>• Axis 2: -60°</li> <li>• Axis 3: 0°</li> <li>• Axis 4: 0°</li> <li>• Axis 5: 0°</li> <li>• Axis6: No significance</li> </ul>	 <p>xx2200000550</p>
3	<p> <b>DANGER</b></p> <p>Turn off all:</p> <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> <p>to the robot, before entering the safeguarded space.</p>	


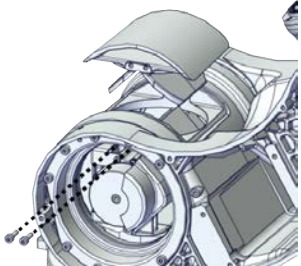
#### Removing the covers

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



*Continues on next page*

	Action	Note
2	Remove the covers. <ul style="list-style-type: none"> <li>• Lower arm cover, left (A)</li> <li>• Lower arm cover, right (B)</li> </ul>	 <p>xx220000552</p>

Removing the swing top cover

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the swing top cover.	 <p>xx220000540</p>

Removing the axis-2 drive unit


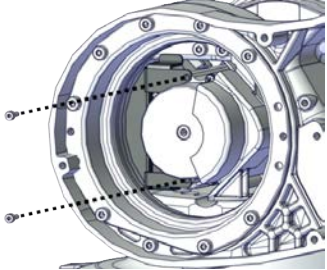
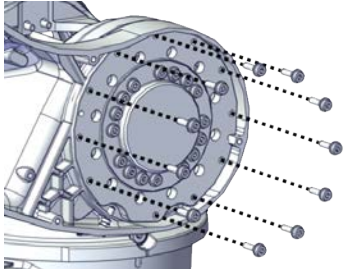

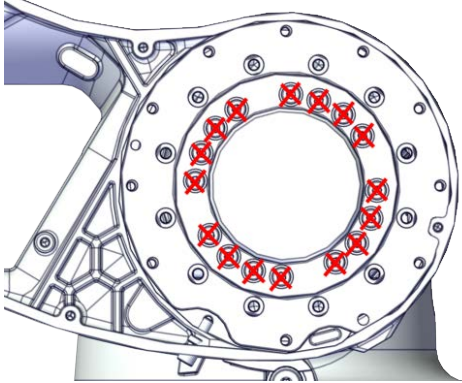
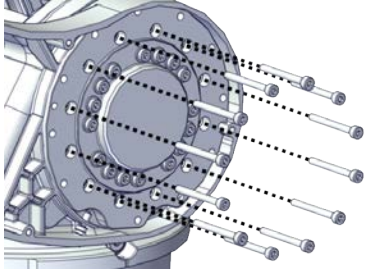
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>CAUTION</b> Removing drive units will release axes. This means the axes can fall down. Make sure axes are well supported before removing drive units.	

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## 5 Repair


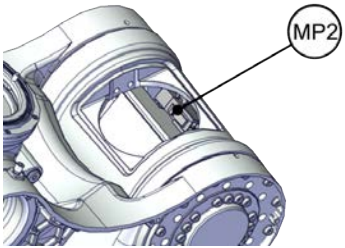

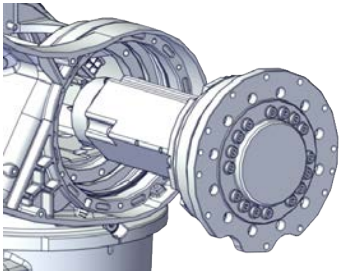

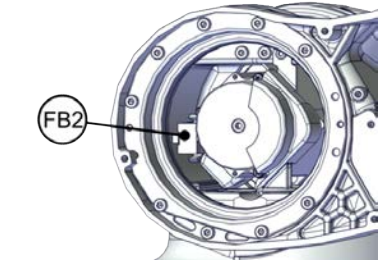
### 5.5.1 Replacing the axis-2 drive unit

Continued

	Action	Note
3	 <b>Note</b> Make sure axis 2 remains positioning in $-60^\circ$ ; otherwise, the screws securing the axis-2 drive unit cannot be accessible during drive unit replacement.	
4	Remove the axis-2 cable bracket.	 xx2200000063
5	Remove the outermost screws (flange screws, 11 pcs) securing the axis-2 drive unit to the axis 3-4 assembly unit.	 xx2200000065
6	Remove the screws (12 pcs) securing the axis-2 drive unit to the axis-1 assembly unit.  <b>CAUTION</b> Do not remove the innermost screws (16 pcs).  xx2200000068	 xx2200000066

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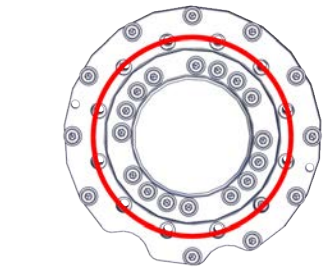
5.5.1 Replacing the axis-2 drive unit  
Continued

	Action	Note
7	<p>Access and disconnect the connector from the swing top.</p> <ul style="list-style-type: none"> <li>MP2</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000541</p>
8	<p>Carefully lift out the drive unit.</p> <p> <b>CAUTION</b></p> <p>Be aware of the connector that is still connected! The drive unit cannot be removed completely until the connector is disconnected.</p>	 <p>xx2200000067</p>
9	<p>Disconnect the connector.</p> <ul style="list-style-type: none"> <li>FB2</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000064</p>

**Refitting the axis-2 drive unit**

Use these procedures to refit the axis-2 drive unit.

Refit the axis-2 drive unit


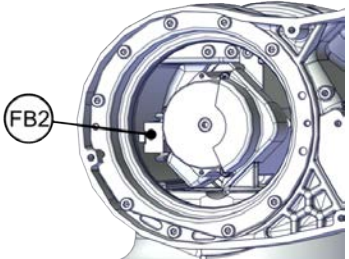
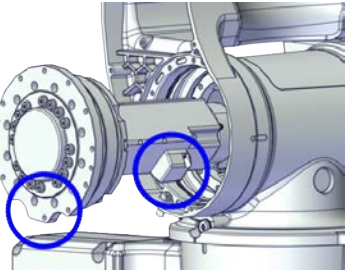
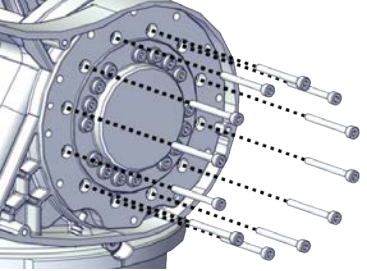
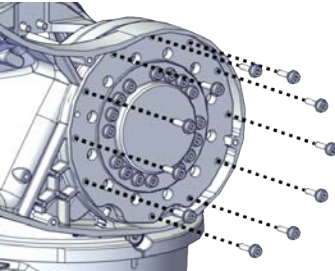
	Action	Note
1	<p>Check that:</p> <ul style="list-style-type: none"> <li>all assembly surfaces are clean and without damages</li> <li>the drive unit is clean and undamaged.</li> </ul>	
2	<p>Make sure:</p> <ul style="list-style-type: none"> <li>the axis-2 synchronization marks are aligned.</li> <li>the axis-2 drive unit is in zero position.</li> <li>the screw holes (marked on the red circle) on the drive unit are through-holes.</li> </ul>	 <p>xx2200000543</p>

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## 5 Repair

### 5.5.1 Replacing the axis-2 drive unit


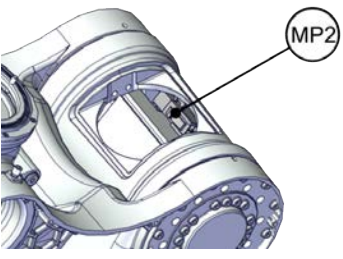
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	Action	Note
3	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB2</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000064</p>
4	<p>Orient the drive unit correctly and insert it into the axis-1 assembly unit.</p> <p>Make sure the drive unit is properly fit and its cabling are not twisted or strained.</p>	<p>Orientation: orient the drive unit according to the figure below, in regard to the encircled connector and lug boss.</p>  <p>xx2200000096</p>
5	<p>Refit the drive unit to the axis-1 assembly unit.</p>	<p>Screw: M3x30 12.9 Lafre 2C2B/FC6.9 (12 pcs) Tightening torque: 1.5 Nm</p>  <p>xx2200000066</p>
6	<p>Refit the drive unit to the axis 3-4 assembly unit.</p>	<p>Flange socket head screw, M3x12 12.9 Lafre 2C2B/FC6.9+PrO-COat111, 3HAB3412-312 (11 pcs) Tightening torque: 1.5 Nm</p>  <p>xx2200000065</p>


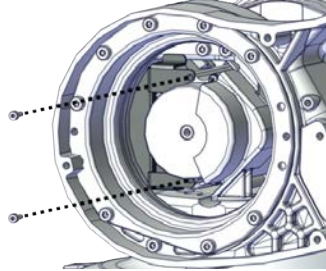
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5.5.1 Replacing the axis-2 drive unit

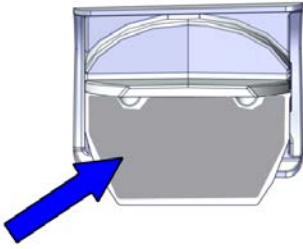
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	Action	Note
7	<p>Access and reconnect the connector from the swing top.</p> <ul style="list-style-type: none"> <li>• MP2</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000541</p>

Routing the cable package in axis 2

	Action	Note
1	<p>Route and secure the cabling with cable straps.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	
2	<p>Apply grease to the cable package, cover all moving area of the package.</p>	<p>Grease: 3HAC029132-001</p>
3	<p>Refit the axis-2 cable bracket.</p>	<p>Cable bracket, axis 2: 3HAC080837-001</p> <p>Screw: M2x6 12.9 (2 pcs)</p> <p>Tightening torque: 0.4 Nm</p>  <p>xx2200000063</p>

Refitting the swing top cover

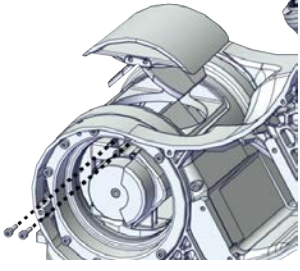
	Action	Note
1	<p>Check the cooling pad. Replace if damaged.</p>	<p>Cooling pad for axis-2 motor: 3HAC071021-001</p>  <p>xx2200000122</p>

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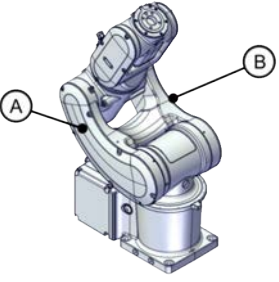
## 5 Repair

### 5.5.1 Replacing the axis-2 drive unit


*Continued*

	Action	Note
2	Refit the swing top cover.	<p>Screw: M3x10 12.9 Lafre 2C2B/FC6.9 (2 pcs) Tightening torque: 1.2 Nm</p>  <p>xx2200000540</p>

#### Refitting the covers

	Action	Note
1	Apply grease to the cable package, cover all moving area of the package.	Grease: 3HAC029132-001
2	Apply grease to the covers that have contacting area with the cable package.	Grease: 3HAC029132-001
3	Refit the covers. <ul style="list-style-type: none"> <li>• Lower arm cover, left (A)</li> <li>• Lower arm cover, right (B)</li> </ul>	<p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 Tightening torque: 1.2 Nm</p>  <p>xx2200000552</p>

#### Concluding procedure

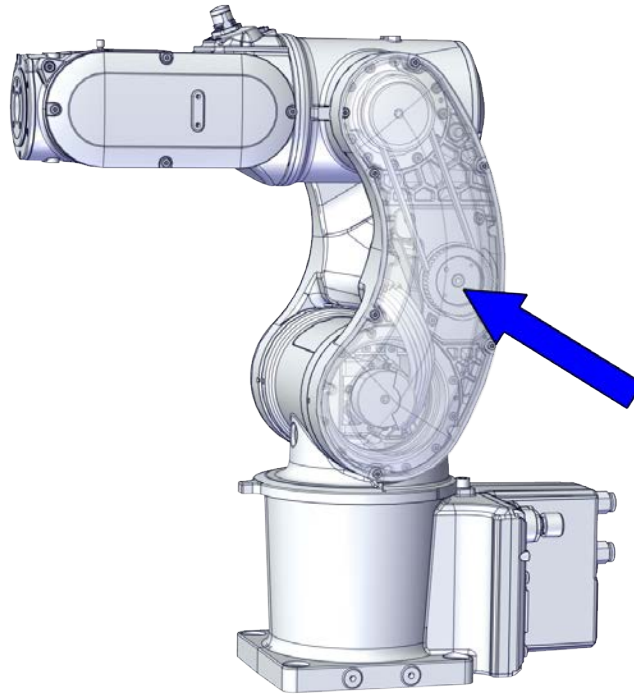
	Action	Note
1	Recalibrate the robot.	Calibration is detailed in section <a href="#">Calibration on page 283</a> .
2	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. See <a href="#">Test run after installation, maintenance, or repair on page 81</a> .	



## 5.5.2 Replacing the axis-3 motor

### Location of the axis-3 motor

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



xx220000008

### Required spare parts



#### Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 1010 via myABB Business Portal, [www.abb.com/myABB](http://www.abb.com/myABB).

Spare part	Article number	Note
Motor, axis 3	3HAC082579-001	

### Required service parts

Spare part	Article number	Note
Flange socket head screw	3HAB3412-308	M3x8 12.9 Lafre 2C2B/FC6.9+PrO-COat111

### Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 330</a> .

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## 5 Repair

### 5.5.2 Replacing the axis-3 motor

Continued

Equipment	Article number	Note
Calibration tool box, Axis Calibration	3HAC074119-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
24 VDC power supply	-	Used to release the motor brakes.
Sonic tension meter	-	Used for measuring the timing belt tension.
Dynamometer	-	Used for measuring the timing belt tension.

#### Required consumables and wear parts

Consumable	Article number	Note
Cable straps	-	
Grease	3HAC029132-001	FM 222

#### Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

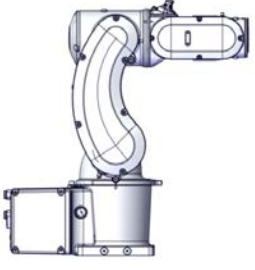

	Action	Note
1	Decide which calibration routine to use for calibrating the robot. <ul style="list-style-type: none"><li>Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot.</li><li>Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.</li></ul>	
	<b>If the robot is to be calibrated with reference calibration:</b> Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 291</a> .
	<b>If the robot is to be calibrated with fine calibration:</b> Remove all external cable packages (DressPack) and tools from the robot.	

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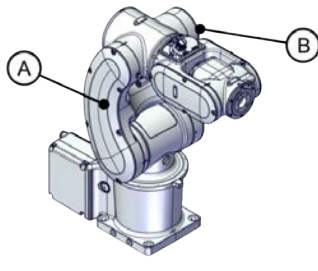
**Removing the axis-3 motor**

Use these procedures to remove the axis-3 motor.

**Preparations before removing the axis-3 motor**

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Jog the robot to the synchronization position.	 xx220000173
3	 <b>DANGER</b> Turn off all: <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> to the robot, before entering the safeguarded space.	

**Removing the covers**

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the covers. <ul style="list-style-type: none"> <li>• Lower arm cover, left (A)</li> <li>• Lower arm cover, right (B)</li> </ul>	 xx220000551


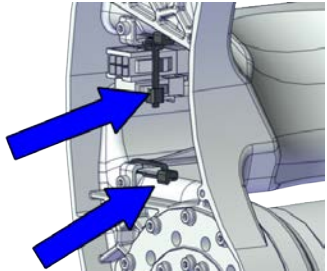

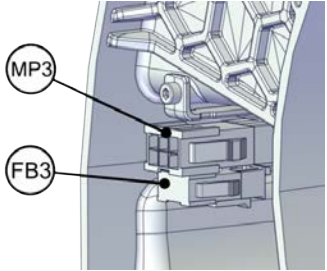
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## 5 Repair



### 5.5.2 Replacing the axis-3 motor

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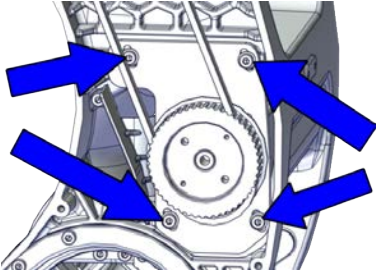
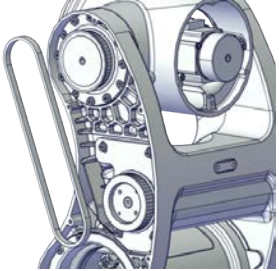
#### Disconnecting the axis-3 motor connectors

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Cut the cable straps.	 <small>xx220000054</small>
3	Disconnect the connectors. <ul style="list-style-type: none"> <li>• FB3</li> <li>• MP3</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 <small>xx220000055</small>



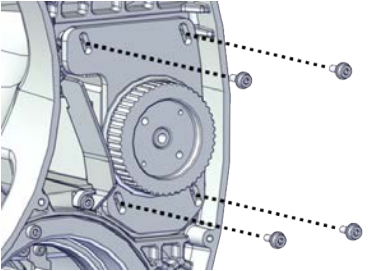
#### Removing the axis-3 timing belt

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>CAUTION</b> Loosening timing belts will release axes. This means the axes can fall down. Make sure axes are well supported before loosening timing belts.	

*Continues on next page*

	Action	Note
3	Loosen the screws and move the motor slightly to slacken the timing belt.	 <p>xx2200000056</p>
4	Remove the timing belt from its groove on the motor.	 <p>xx2200000057</p>

Removing the axis-3 motor

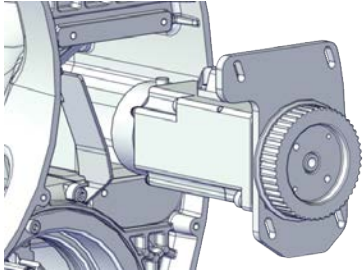
	Action	Note
1	 <p><b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	 <p><b>CAUTION</b></p> <p>Removing motors will release axes. This means the axes can fall down. Make sure axes are well supported before removing motors.</p>	
3	Remove the screws.	 <p>xx2200000058</p>

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## 5 Repair

### 5.5.2 Replacing the axis-3 motor

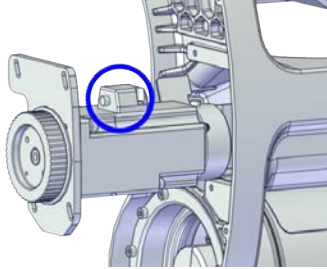

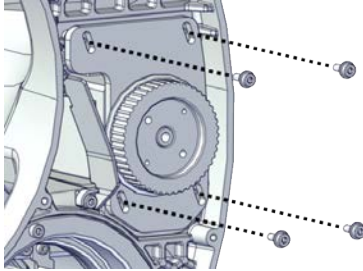
Continued

	Action	Note
4	Carefully lift out the motor.	 <p>xx2200000059</p>

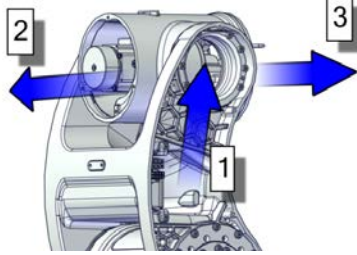
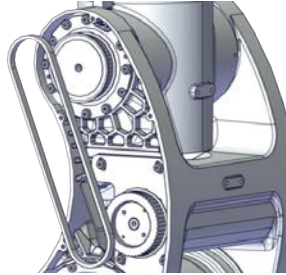

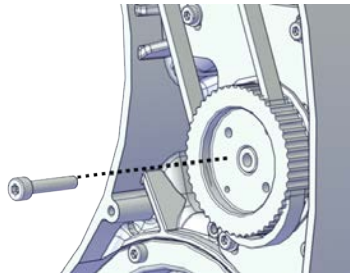
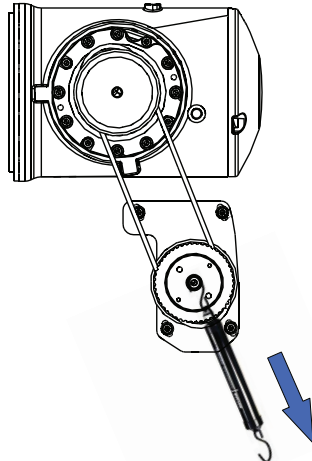
### Refitting the axis-3 motor

Use these procedures to refit the axis-3 motor.

### Refitting the axis-3 motor

	Action	Note
1	Check that: <ul style="list-style-type: none"> <li>all assembly surfaces are clean and without damages</li> <li>the motor is clean and undamaged.</li> </ul>	
2	Orient the motor correctly and fit it into the axis 3-4 assembly unit.	<p>Motor orientation: orient the motor according to the figure below, in regard to the encircled motor connector.</p>  <p>xx2200000098</p>
3	Refit the screws and washers.  <b>Note</b> Do not tighten the screws yet.	<p>Flange socket head screw, M3x8 12.9 Lafre 2C2B/FC6.9+PrO-COat111, 3HAB3412-308 (4 pcs)</p>  <p>xx2200000058</p>

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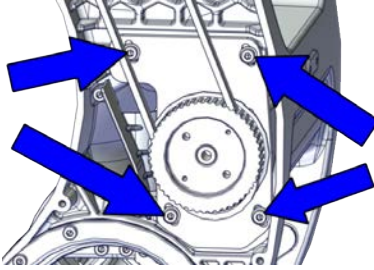

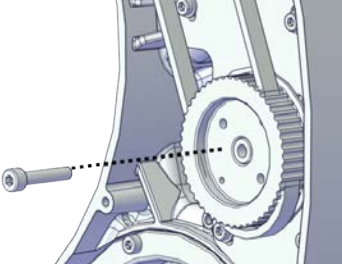
	Action	Note
4	<p>Route the cable package.</p> <ul style="list-style-type: none"> <li>Route the cable package up into the axis 4 (direction 1).</li> <li>Pull the axis-4 motor connectors out from the robot rear (direction 2).</li> <li>Pull the main cable harness out from the axis 3-4 assembly unit and to the wrist unit direction (direction 3).</li> </ul>	 <p>xx2200000100</p>
5	<p>Install the timing belt to the pulleys and verify that the belt runs correctly in the grooves of the pulleys.</p>	 <p>xx2200000099</p>
6	<p>Install an M4x20 or longer adjustment screw to the motor.</p> <p> <b>Note</b></p> <p>Do not insert the entire screw to the hole. The screw shall be installed with proper force to avoid shaft rotation.</p>	 <p>xx2200000544</p>
7	<p>Use a handheld dynamometer hooking to the screw and pull the dynamometer to reach the initial referenced force.</p>	<p>Initial referenced force for used belt: <math>14.1 \pm 1</math> N (for reference only) Initial referenced force for new belt: <math>20.2 \pm 1</math> N</p>  <p>xx2200000545</p>

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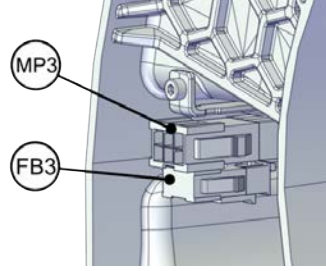

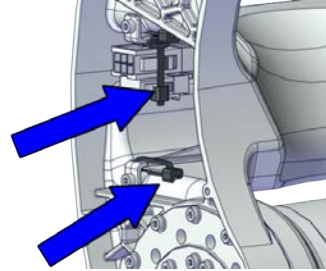
## 5 Repair

### 5.5.2 Replacing the axis-3 motor

Continued

	Action	Note
8	Secure the motor with the screws.	<p>Tightening torque: 0.8 Nm</p>  <p>xx220000056</p>
9	Use a sonic tension meter to measure the timing belt tension.	<p>Used belt: 86-93 Hz New belt: 93-118 Hz (for reference only)</p>
10	If the timing belt tension does not meet the requirement, loosen the motor screws and readjust.	
11	<p>Remove the adjustment screw from the motor.</p> <p> <b>Note</b></p> <p>Pay attention to the screw turning direction. Incorrect direction may weaken the brake capacity of the motor.</p>	 <p>xx220000054</p>

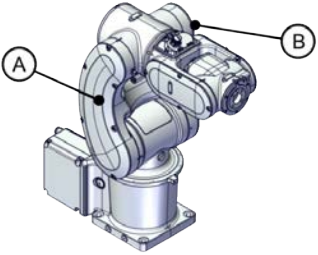
### Reconnecting the axis-3 motor connectors

	Action	Note
1	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB3</li> <li>• MP3</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx220000055</p>
2	<p>Route and secure the cabling with cable straps.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	 <p>xx220000054</p>
3	Apply grease to the cable package, cover all moving area of the package.	Grease: 3HAC029132-001


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## Refitting the covers

	Action	Note
1	Apply grease to the cable package, cover all moving area of the package.	Grease: 3HAC029132-001
2	Apply grease to the covers that have contacting area with the cable package.	Grease: 3HAC029132-001
3	Refit the covers. <ul style="list-style-type: none"> <li>• Lower arm cover, left (A)</li> <li>• Lower arm cover, right (B)</li> </ul>	Screw: M3x8 12.9 Lafre 2C2B/FC6.9 Tightening torque: 1.2 Nm  xx2200000551

## Concluding procedure

	Action	Note
1	Recalibrate the robot.	Calibration is detailed in section <a href="#">Calibration on page 283</a> .
2	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. See <a href="#">Test run after installation, maintenance, or repair on page 81</a> .	

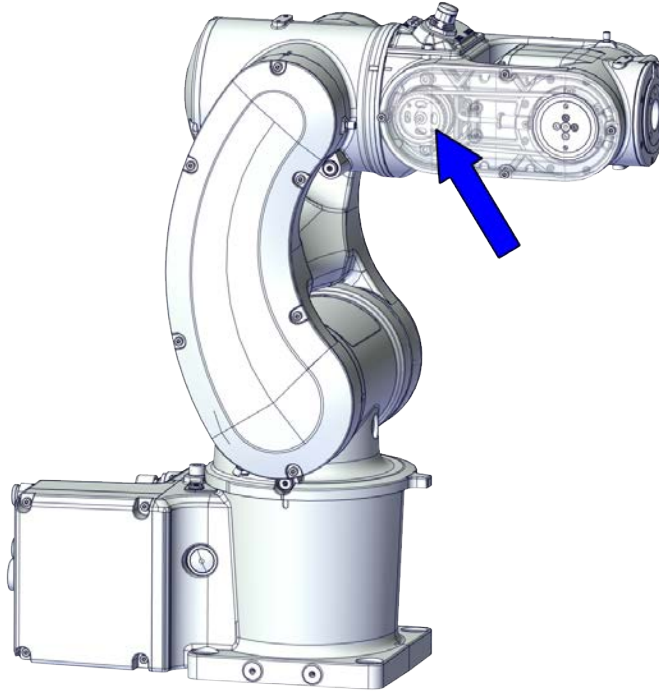
## 5 Repair

### 5.5.3 Replacing the axis-5 motor

### 5.5.3 Replacing the axis-5 motor

#### Location of the axis-5 motor

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



xx220000010

#### Required spare parts



#### Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 1010 via myABB Business Portal, [www.abb.com/myABB](http://www.abb.com/myABB).

Spare part	Article number	Note
Motor, axis 5	3HAC082444-001	

#### Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 330</a> .
Calibration tool box, Axis Calibration	3HAC074119-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
24 VDC power supply	-	Used to release the motor brakes.

*Continues on next page*

Equipment	Article number	Note
Sonic tension meter	-	Used for measuring the timing belt tension.
Dynamometer	-	Used for measuring the timing belt tension.

#### Required consumables and wear parts

Consumable	Article number	Note
Cable straps	-	
Grease	3HAC029132-001	FM 222

#### Deciding calibration routine

Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

	Action	Note
1	<p>Decide which calibration routine to use for calibrating the robot.</p> <ul style="list-style-type: none"> <li>Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot.</li> <li>Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.</li> </ul>	
	<p><b>If the robot is to be calibrated with reference calibration:</b></p> <p>Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot.</p> <p>If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.</p>	<p>Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values.</p> <p>Creating new values requires possibility to move the robot.</p> <p>Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 291</a>.</p>
	<p><b>If the robot is to be calibrated with fine calibration:</b></p> <p>Remove all external cable packages (DressPack) and tools from the robot.</p>	

#### Removing the axis-5 motor

Use these procedures to remove the axis-5 motor.

#### Preparations before removing the axis-5 motor

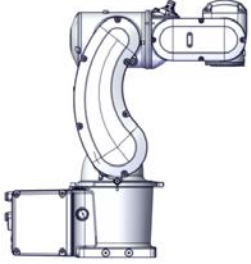

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	

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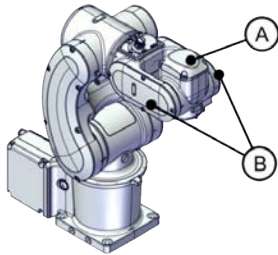
## 5 Repair

### 5.5.3 Replacing the axis-5 motor


Continued

	Action	Note
2	<p>Jog the robot to the specified position:</p> <ul style="list-style-type: none"> <li>• Axis 1: 0°</li> <li>• Axis 2: 0°</li> <li>• Axis 3: 0°</li> <li>• Axis 4: 0°</li> <li>• Axis 5: +90°</li> <li>• Axis6: No significance</li> </ul>	 <p>xx2200000174</p>
3	<p> <b>DANGER</b></p> <p>Turn off all:</p> <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> <p>to the robot, before entering the safeguarded space.</p>	


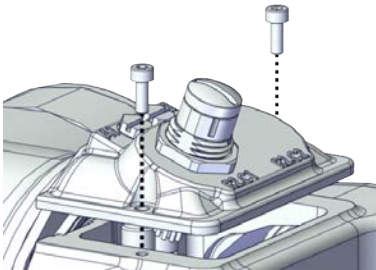
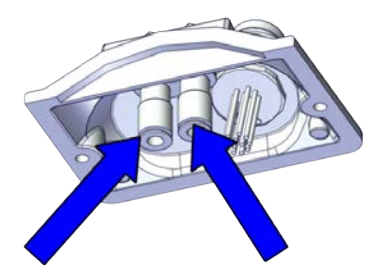

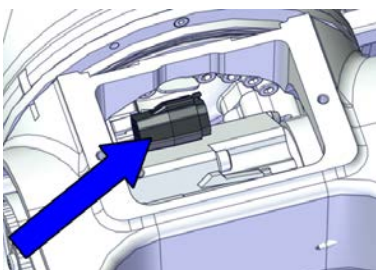
#### Removing the covers

	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	<p>Remove the covers.</p> <ul style="list-style-type: none"> <li>• Wrist covers (A)</li> <li>• Tilt cover (B)</li> </ul>	 <p>xx2200000553</p>


#### Removing the process hub

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

Continues on next page

	Action	Note
2	<p>Remove the screws and carefully open the cover.</p> <p> <b>CAUTION</b></p> <p>There is cabling attached to the cover. The cover cannot be removed completely until the connectors are removed.</p>	 <p>xx2200000030</p>
3	<p>For robots with air hoses Disconnect the air hoses.</p>	 <p>xx2200000031</p>
4	<p>For robots with CP/CS cabling Disconnect the connector.</p> <ul style="list-style-type: none"> <li>• R2.C1</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000032</p>



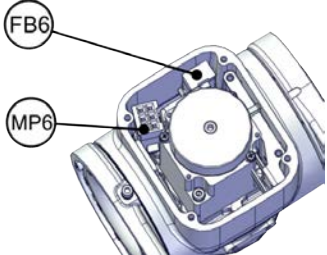

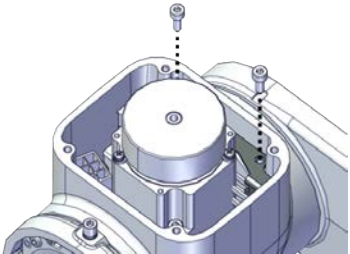
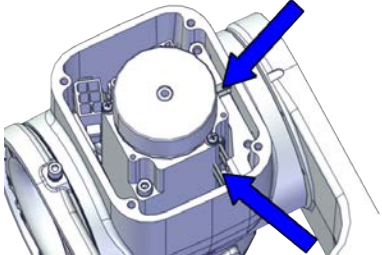
Disconnecting the axis-6 motor connectors

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


## 5 Repair

### 5.5.3 Replacing the axis-5 motor


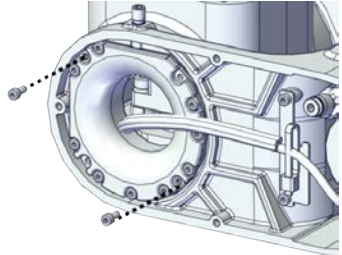
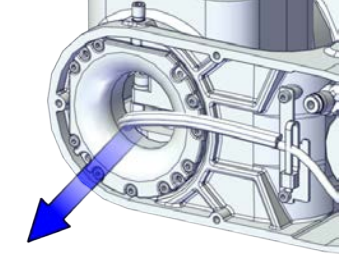
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	Action	Note
2	<p>Disconnect the connectors.</p> <ul style="list-style-type: none"> <li>• MP6</li> <li>• FB6</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p> <p> <b>Tip</b></p> <p>The MP6 connector is fitted in particular position. Handle with cautions to not get it stuck.</p>	 <p>xx2200000035</p>
3	<p>Remove the axis-6 cable bracket.</p> <p> <b>CAUTION</b></p> <p>Be aware of the cablings that are attached to the cable bracket! The bracket cannot be removed completely until the cablings are removed from the plate.</p>	 <p>xx2200000033</p>
4	<p>Cut the cable straps.</p>	 <p>xx2200000034</p>



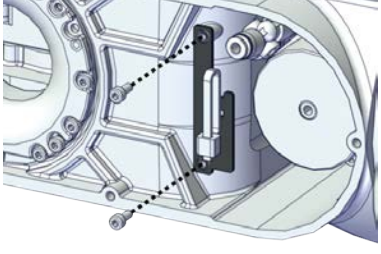
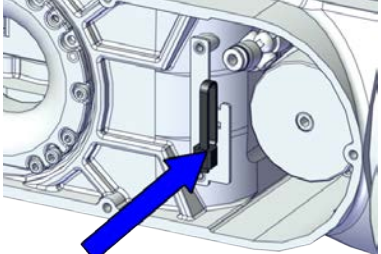
#### Pulling out the cable package from axis 5

	Action	Note
1	<p> <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2	<p>Wrap the connectors with the masking tape.</p>	

Continues on next page

	Action	Note
3	Remove the axis-5 cable protector.   <b>Note</b> The screws to be removed are a little protruding than others. Do not mix the screws.	 xx2200000036
4	Pull out the cable package in the direction as shown in the figure.	 xx2200000037
5	Slip out the cable protector.	

Separating the cable package from axis 5

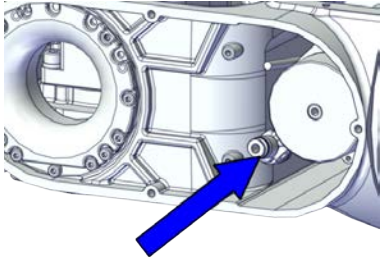
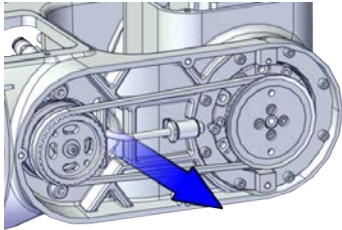
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the axis-5 cable bracket.   <b>CAUTION</b> Be aware of the cablings that are attached to the cable bracket! The bracket cannot be removed completely until the cablings are removed from the plate.	 xx2200000038
3	Cut the cable strap.	 xx2200000039

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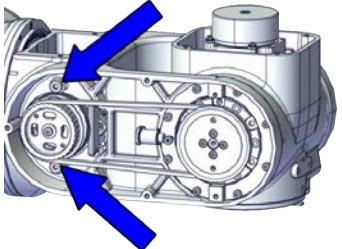
## 5 Repair

### 5.5.3 Replacing the axis-5 motor

Continued

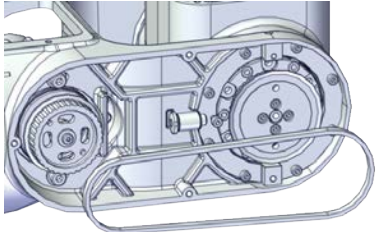
	Action	Note
4	Disconnect the pressure relief pipe connector.	 xx220000041
5	Pull out the pressure relief pipe carefully from the other side of the wrist unit.	 xx2200000537

### Removing the axis-5 timing belt




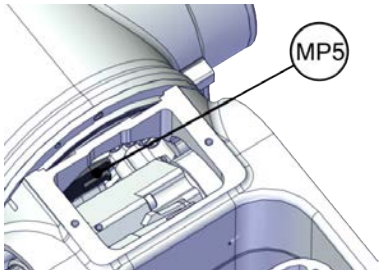
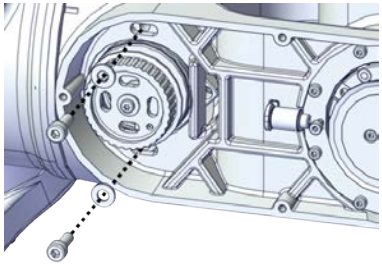
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>CAUTION</b> Loosening timing belts will release axes. This means the axes can fall down. Make sure axes are well supported before loosening timing belts.	
3	Loosen the screws and move the motor slightly to slacken the timing belt.	 xx220000042

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	Action	Note
4	Remove the timing belt from its groove on the motor.	 <p>xx2200000043</p>

Removing the axis-5 motor

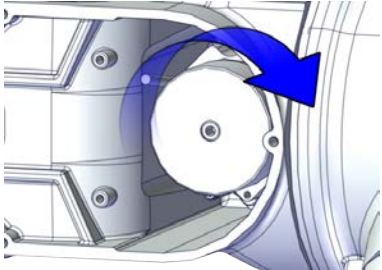

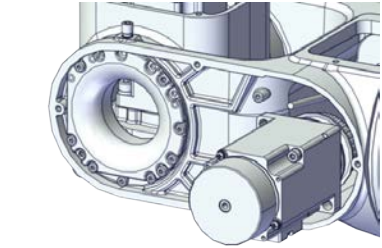

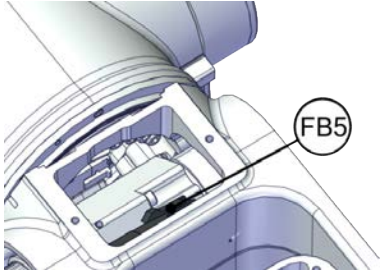
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>CAUTION</b> Removing motors will release axes. This means the axes can fall down. Make sure axes are well supported before removing motors.	
3	Disconnect the connector. <ul style="list-style-type: none"> <li>• MP5</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 <p>xx2200000040</p>
4	Remove the screws and washers.	 <p>xx2200000044</p>

Continues on next page

## 5 Repair

### 5.5.3 Replacing the axis-5 motor

Continued

	Action	Note
5	Carefully rotate the motor to make its motor connector to a levelled position.	 xx2200000045
6	Carefully lift out the motor.  <b>CAUTION</b> Be aware of the connector that is still connected! The motor cannot be removed completely until the connector is disconnected.	 xx2200000046
7	Disconnect the connector. <ul style="list-style-type: none"> <li>• FB5</li> </ul>  <b>Tip</b> Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.	 xx2200000538


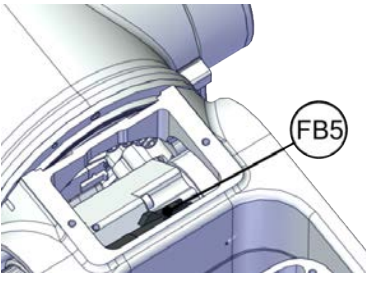
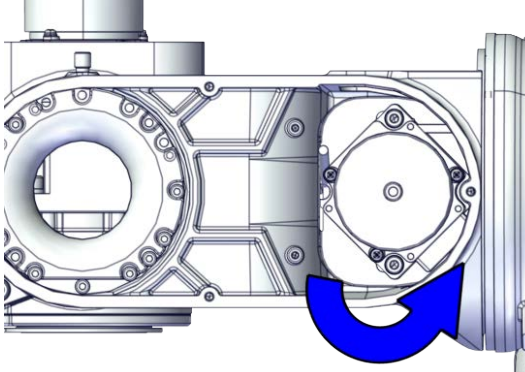

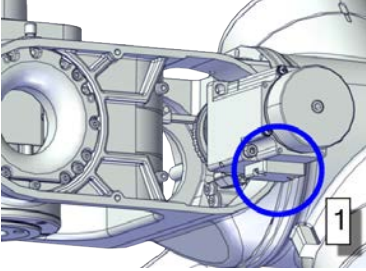
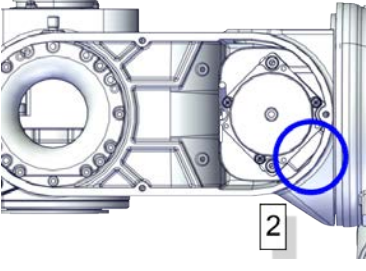

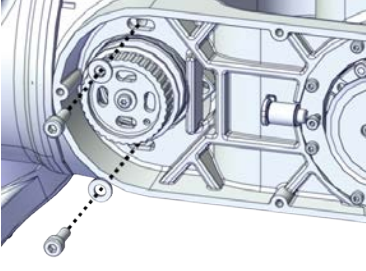
### Refitting the axis-5 motor

Use these procedures to refit the axis-5 motor.

### Refitting the axis-5 motor

	Action	Note
1	Arrange the cable package as follows: <ul style="list-style-type: none"> <li>• Cablings out from the process hub               <ul style="list-style-type: none"> <li>- air hoses</li> <li>- CP/CS cabling (connector R2.C1)</li> <li>- axis-5 motor cablings (connectors MP5 and FB5)</li> </ul> </li> <li>• Cablings out from the right side of wrist unit (facing the tool flange)               <ul style="list-style-type: none"> <li>- axis-6 motor cablings (connectors MP6 and FB6)</li> <li>- pressure relief pipe connector</li> </ul> </li> </ul>	
2	Check that: <ul style="list-style-type: none"> <li>• all assembly surfaces are clean and without damages</li> <li>• the motor is clean and undamaged.</li> </ul>	

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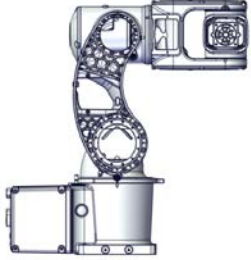
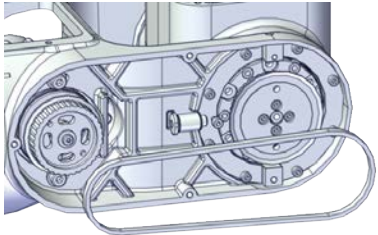
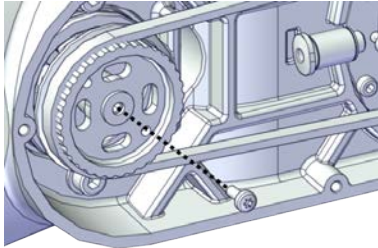

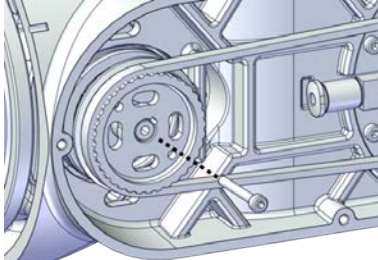
	Action	Note
3	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB5</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000538</p>
4	<p>Orient the motor into the wrist unit in a leveled position first (connector reference 1), and then rotate it 45° when it is in the wrist unit (connector reference 2).</p>  <p>xx2200000103</p> <p> <b>Note</b></p> <p>Carefully handle the connectors. Leave the MP5 connector visible and accessible from the process hub.</p>	<p>Motor orientation: orient the motor according to the figures below, in regard to the encircled motor connector.</p>  <p>xx2200000104</p>  <p>xx2200000105</p>
5	<p>Refit the screws and washers.</p> <p> <b>Note</b></p> <p>Do not tighten the screws yet.</p>	<p>Screw: M4x12 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p>  <p>xx2200000044</p>

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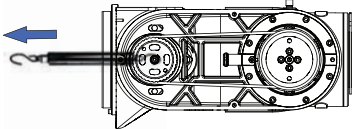
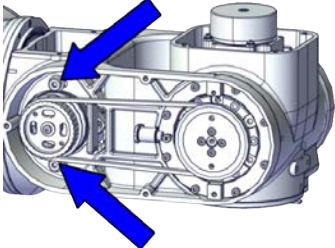

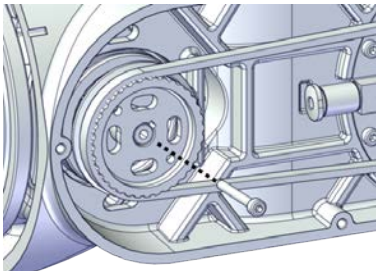

## 5 Repair

### 5.5.3 Replacing the axis-5 motor

Continued

	Action	Note
6	<p>Connect the power supply to axis-4 motor and release the axis-4 brake to move the axis 4 to -90°. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	 <p>xx2200000120</p>
7	<p>Install the timing belt to the pulleys and verify that the belt runs correctly in the grooves of the pulleys.</p>	 <p>xx2200000043</p>
8	<p>Remove the pulley screw from the motor.</p>	 <p>xx2200000546</p>
9	<p>Install an M2.5x20 or longer adjustment screw to the motor.</p> <p> <b>Note</b></p> <p>Do not insert the entire screw to the hole. The screw shall be installed with proper force to avoid shaft rotation.</p>	 <p>xx2200000547</p>

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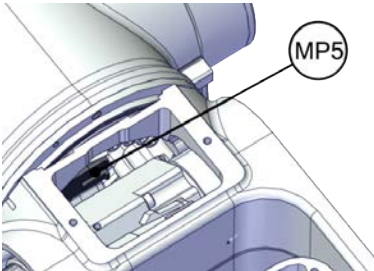
	Action	Note
10	Use a handheld dynamometer hooking to the screw and pull the dynamometer to reach the initial referenced force.	<p>Initial referenced force for used belt: 13.7±1 N (for reference only) Initial referenced force for new belt: 19.6±1 N</p>  <p>xx2200000548</p>
11	Secure the motor with the screws.	<p>Tightening torque: 2.8 Nm</p>  <p>xx2200000042</p>
12	Use a sonic tension meter to measure the timing belt tension.	<p>Used belt: 123-131 Hz New belt: 132-169 Hz (for reference only)</p>
13	If the timing belt tension does not meet the requirement, loosen the motor screws and readjust.	
14	<p>Remove the adjustment screw from the motor.</p> <p> <b>Note</b></p> <p>Pay attention to the screw turning direction. Incorrect direction may weaken the brake capacity of the motor.</p>	 <p>xx2200000547</p>
15	Refit the pulley screw.	Tightening torque: 0.8 Nm
16	<p>Connect the power supply to axis-4 motor and release the axis-4 brake to move the axis 4 to zero position. Then, disconnect the power supply.</p> <p> <b>Note</b></p> <p>The robot is not connected to the controller during replacement, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 57</a>.</p>	

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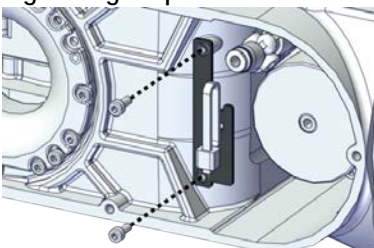

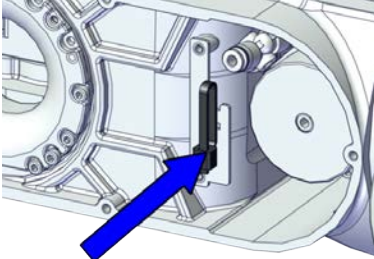
## 5 Repair

### 5.5.3 Replacing the axis-5 motor

Continued

	Action	Note
17	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>MP5</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000040</p>

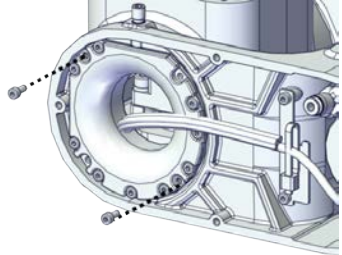

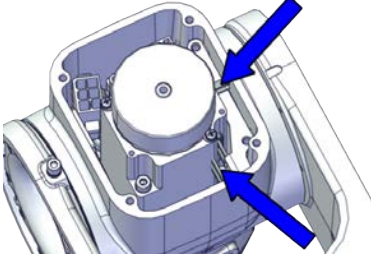
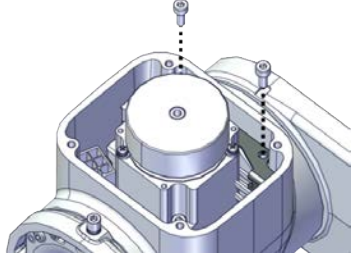

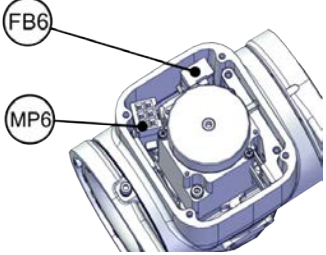
### Securing the cable package in axis 5

	Action	Note
1	<p>Refit the axis-5 cable bracket.</p>	<p>Cable bracket, axis 5: 3HAC079126-001</p> <p>Screw: M2.5x6 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 0.6 Nm</p>  <p>xx2200000038</p>
2	<p>Route and secure the cabling with cable straps. Make sure the white mark on the cabling facing outside.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	 <p>xx2200000039</p>

### Reconnecting the axis-6 motor connectors

	Action	Note
1	<p>Apply grease to the cable package, cover all moving area of the package.</p>	<p>Grease: 3HAC029132-001</p>

Continues on next page

	Action	Note
2	Slip the axis-5 cable protector over the cable package and refit the protector.	<p>Cable protector, axis 5: 3HAC076870-001</p> <p>Screw: M2.5x6 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 0.3 Nm</p>  <p>xx2200000036</p>
3	Arrange the cable package in axis 6.	
4	<p>Secure the cabling with cable straps. Make sure the white mark on the cabling facing outside.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	 <p>xx2200000034</p>
5	Refit the axis-6 cable bracket.	<p>Cable bracket, axis 6: 3HAC079127-001</p> <p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 1.2 Nm</p>  <p>xx2200000033</p>
6	<p>Reconnect the connectors.</p> <ul style="list-style-type: none"> <li>• FB6</li> <li>• MP6</li> </ul> <p> <b>Tip</b></p> <p>See the number markings on the connectors for help to find the corresponding connector.</p>	 <p>xx2200000035</p>

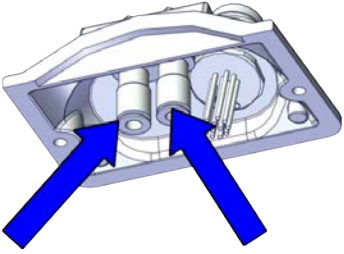

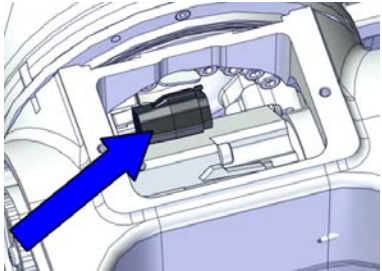

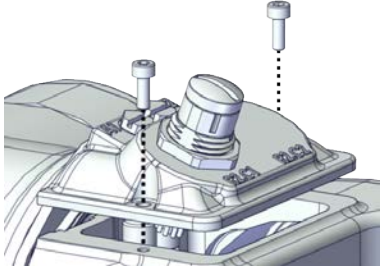
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## 5 Repair

### 5.5.3 Replacing the axis-5 motor

Continued

#### Refitting the process hub

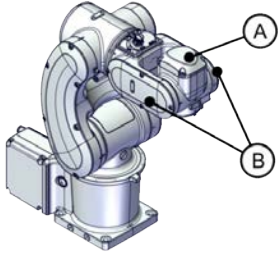
	Action	Note
1	<p>For robots with air hoses</p> <p>Reconnect the air hoses.</p>	 <p>xx2200000031</p>
2	<p>For robots with CP/CS cabling</p> <p>Reconnect the connector.</p> <ul style="list-style-type: none"> <li>R2.C1</li> </ul> <p> <b>Tip</b></p> <p>Take photos of the connector and cable position before disconnecting them, to have as a reference when reconnecting.</p>	 <p>xx2200000032</p>
3	<p>Route and secure the cabling with cable straps.</p> <p> <b>CAUTION</b></p> <p>Correct cable routing is highly important. If the cables are routed and secured incorrectly the cables can be damaged.</p>	
4	<p>Apply grease to the cable package, cover all moving area of the package.</p>	<p>Grease: 3HAC029132-001</p>
5	<p>Refit the process hub.</p>	<p>Screw: M3x8 12.9 Lafre 2C2B/FC6.9 (2 pcs)</p> <p>Tightening torque: 1.2 Nm</p>  <p>xx2200000030</p>

#### Refitting the covers


	Action	Note
1	<p>Apply grease to the cable package, cover all moving area of the package.</p>	<p>Grease: 3HAC029132-001</p>
2	<p>Apply grease to the covers that have contacting area with the cable package.</p>	<p>Grease: 3HAC029132-001</p>

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	Action	Note
3	Refit the covers. <ul style="list-style-type: none"> <li>• Wrist covers (B)</li> <li>• Tilt cover (C)</li> </ul>	Screw: M3x8 12.9 Lafre 2C2B/FC6.9 Tightening torque: 1.2 Nm  xx2200000553

## Concluding procedure

	Action	Note
1	Recalibrate the robot.	Calibration is detailed in section <a href="#">Calibration on page 283</a> .
2	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. See <a href="#">Test run after installation, maintenance, or repair on page 81</a> .	

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## 6 Calibration

### 6.1 Introduction to calibration

#### 6.1.1 Introduction and calibration terminology

##### Calibration information

This chapter includes general information about the recommended calibration methods and also the detailed procedures for updating the revolution counters, checking the calibration position etc.

Detailed instructions of how to perform Axis Calibration are given on the FlexPendant during the calibration procedure. To prepare calibration with Axis Calibration method, see [Calibrating with Axis Calibration method on page 290](#).

##### Calibration terminology

Term	Definition
Calibration method	A collective term for several methods that might be available for calibrating the ABB robot. Each method contains calibration routines.
Synchronization position	Known position of the complete robot where the angle of each axis can be checked against visual synchronization marks.
Calibration position	Known position of the complete robot that is used for calibration of the robot.
Standard calibration	A generic term for all calibration methods that aim to move the robot to calibration position.
Fine calibration	A calibration routine that generates a new zero position of the robot.
Reference calibration	<p>A calibration routine that in the first step generates a reference to current zero position of the robot. The same calibration routine can later on be used to recalibrate the robot back to the same position as when the reference was stored.</p> <p>This routine is more flexible compared to fine calibration and is used when tools and process equipment are installed.</p> <p>Requires that a reference is created before being used for recalibrating the robot.</p> <p>Requires that the robot is dressed with the same tools and process equipment during calibration as during creation of the reference values.</p>
Update revolution counter	A calibration routine to make a rough calibration of each manipulator axis.
Synchronization mark	Visual marks on the robot axes. When marks are aligned, the robot is in synchronization position.

## 6 Calibration


### 6.1.2 Calibration methods

### 6.1.2 Calibration methods

#### Overview

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

#### Types of calibration

Type of calibration	Description	Calibration method
Standard calibration	The calibrated robot is positioned at calibration position. Standard calibration data is found on the SMB (serial measurement board) or EIB in the robot.	Axis Calibration
Absolute accuracy calibration (optional)	Based on standard calibration, and besides positioning the robot at synchronization position, the Absolute accuracy calibration also compensates for: <ul style="list-style-type: none"><li>Mechanical tolerances in the robot structure</li><li>Deflection due to load</li></ul> Absolute accuracy calibration focuses on positioning accuracy in the Cartesian coordinate system for the robot. Absolute accuracy calibration data is found on the serial measurement board (SMB) or other robot memory. A robot calibrated with Absolute accuracy has the option information printed on its name plate (OmniCore). To regain 100% Absolute accuracy performance, the robot must be recalibrated for absolute accuracy after repair or maintenance that affects the mechanical structure.	CalibWare
Optimization	Optimization of TCP reorientation performance. The purpose is to improve reorientation accuracy for continuous processes like welding and gluing. Wrist optimization will update standard calibration data for axes 4 and 5.  <b>Note</b> For advanced users, it is also possible to use the do the wrist optimization using the RAPID instruction <code>WristOpt</code> , see <i>Technical reference manual - RAPID Instructions, Functions and Data types</i> . This instruction is only available for OmniCore robots.	Wrist Optimization

#### Brief description of calibration methods

##### Axis Calibration method

Axis Calibration is a standard calibration method for calibration of IRB 1010. It is the recommended method in order to achieve proper performance.

*Continues on next page*

The following routines are available for the Axis Calibration method:

- Fine calibration
- Update revolution counters
- Reference calibration

The calibration equipment for Axis Calibration is delivered as a toolkit.

An introduction to the calibration method is given in this manual, see [Calibrating with Axis Calibration method on page 290](#).

The actual instructions of how to perform the calibration procedure and what to do at each step is given on the FlexPendant. You will be guided through the calibration procedure, step by step.

#### Wrist Optimization method

Wrist Optimization is a method for improving reorientation accuracy for continuous processes like welding and gluing and is a complement to the standard calibration method.

The actual instructions of how to perform the wrist optimization procedure is given on the FlexPendant.

#### CalibWare - Absolute Accuracy calibration

The CalibWare tool guides through the calibration process and calculates new compensation parameters. This is further detailed in the *Application manual - CalibWare Field*.

If a service operation is done to a robot with the option Absolute Accuracy, a new absolute accuracy calibration is required in order to establish full performance. For most cases after replacements that do not include taking apart the robot structure, standard calibration is sufficient.

The Absolute Accuracy option varies according to the robot mounting position. This is printed on the robot name plate for each robot. The robot must be in the correct mounting position when it is recalibrated for absolute accuracy.

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#### References

Article numbers for the calibration tools are listed in the section [Special tools on page 331](#).

## 6 Calibration

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### 6.1.3 When to calibrate

#### 6.1.3 When to calibrate

---

##### When to calibrate

The system must be calibrated if any of the following situations occur.

##### The resolver values are changed

If resolver values are changed, the robot must be re-calibrated using the calibration methods supplied by ABB. Calibrate the robot carefully with standard calibration, according to information in this manual.

If the robot has *absolute accuracy* calibration, it is also recommended, but not always necessary to calibrate for new absolute accuracy.

The resolver values will change when parts affecting the calibration position are replaced on the robot, for example motors or parts of the transmission.

##### The revolution counter memory is lost

If the revolution counter memory is lost, the counters must be updated. See [Updating revolution counters on page 289](#). This will occur when:

- The battery is discharged
- A resolver error occurs
- The signal between a resolver and measurement board is interrupted
- A robot axis is moved with the control system disconnected

The revolution counters must also be updated after the robot and controller are connected at the first installation.

##### The robot is rebuilt

If the robot is rebuilt, for example, after a crash or when the reachability of a robot is changed, it needs to be re-calibrated for new resolver values.

If the robot has *absolute accuracy* calibration, it needs to be calibrated for new absolute accuracy.

##### Robot is not floor mounted

The original calibration data delivered with the robot is generated when the robot is floor mounted. If the robot is not floor mounted, then the robot accuracy could be affected. The robot needs to be calibrated after it is mounted.

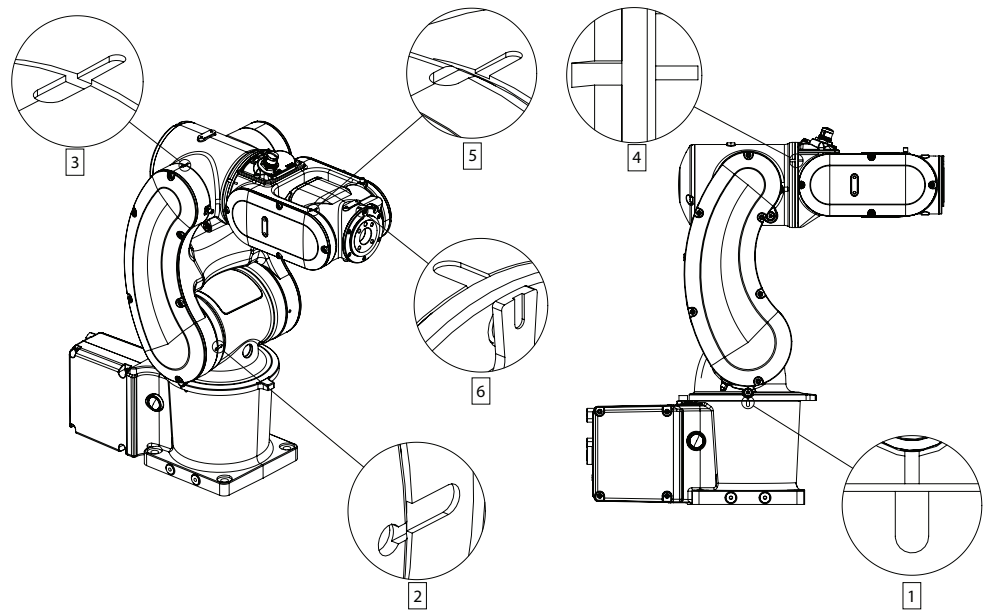
## 6.2 Synchronization marks and axis movement directions

### 6.2.1 Synchronization marks and synchronization position for axes

#### Introduction

This section shows the position of the synchronization marks and the synchronization position for each axis.

#### Synchronization marks, IRB 1010



xx220000179

## 6 Calibration

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### 6.2.2 Calibration movement directions for all axes

### 6.2.2 Calibration movement directions for all axes

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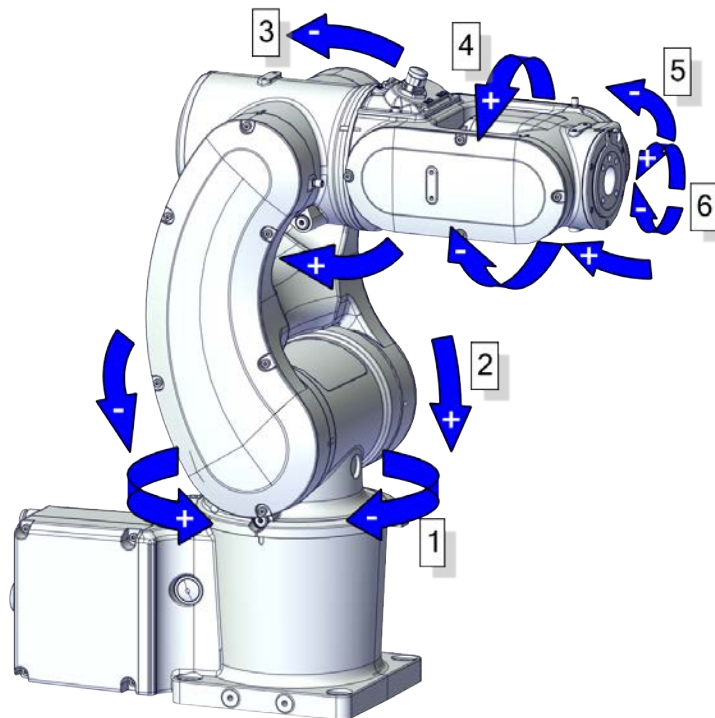
#### Overview

When calibrating, the axis must consistently be run towards the calibration position in the same direction in order to avoid position errors caused by backlash in gears and so on. Positive directions are shown in the graphic below.

Calibration service routines will handle the calibration movements automatically and these might be different from the positive directions shown below.

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#### Manual movement directions



xx220000178



## 6.3 Updating revolution counters

### 6.3.1 Updating revolution counters on OmniCore robots

#### Introduction

This section describes how to do a rough calibration of each manipulator axis by updating the revolution counter for each axis, using the FlexPendant.


#### Step 1 - Manually running the manipulator to the synchronization position

Use this procedure to manually run the manipulator to the synchronization position.

	Action	Note
1	Select axis-by-axis motion mode.	
2	Jog the manipulator to align the synchronization marks.	See <a href="#">Synchronization marks and synchronization position for axes on page 287</a> .
3	When all axes are positioned, update the revolution counter.	<a href="#">Step 2 - Updating the revolution counter with the FlexPendant on page 289</a> .

#### Step 2 - Updating the revolution counter with the FlexPendant

Use this procedure to update the revolution counter with the FlexPendant (OmniCore).

	Action
1	On the start screen, tap <b>Calibrate</b> . The calibration summary page for the mechanical unit is displayed.
2	In the <b>Calibration Methods</b> menu, select <b>Revolution Counters</b> .
3	In the <b>Selection</b> column select the axes for which revolution counters need to be updated.
4	Tap <b>Update</b> . A dialog box is displayed warning that the updating operation cannot be undone.
5	Tap <b>OK</b> to update the revolution counter.
6	 <b>CAUTION</b> If a revolution counter is incorrectly updated, it will cause incorrect manipulator positioning, which in turn may cause damage or injury! Check the synchronization position very carefully after each update. See <a href="#">Checking the synchronization position on page 308</a> .

## 6 Calibration

---

### 6.4.1 Description of Axis Calibration

## 6.4 Calibrating with Axis Calibration method

### 6.4.1 Description of Axis Calibration

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#### Instructions for Axis Calibration procedure given on the FlexPendant

The actual instructions of how to perform the calibration procedure and what to do at each step is given on the FlexPendant. You will be guided through the calibration procedure, step by step.

This manual contains a brief description of the method, additional information to the information given on the FlexPendant, article number for the tools and images of where to fit the calibration tools on the robot.

---

#### Overview of the Axis Calibration procedure

The Axis Calibration procedure applies to all axes, and is performed on one axis at the time. The robot axes are both manually and automatically moved into position, as instructed on the FlexPendant.

A fixed calibration pin/bushing is installed on each robot axis at delivery.

The Axis Calibration procedure described roughly:

- 1 A removable calibration tool is inserted by the operator into a calibration bushing on the axis chosen for calibration, according to instructions on the FlexPendant.



#### WARNING

Calibrating the robot with Axis Calibration requires special calibration tools from ABB. Using other pins in the calibration bushings may cause severe damage to the robot and/or personnel.



#### WARNING

The calibration tool must be fully inserted into the calibration bushing, until the steel spring ring snaps into place.

- 2 During the calibration procedure, RobotWare moves the robot axis chosen for calibration so that the calibration tools get into contact. RobotWare records values of the axis position and repeats the coming-in-contact procedure several times to get an exact value of the axis position.



#### WARNING

Risk of pinching! The contact force for large robots can be up to 150 kg. Keep a safe distance to the robot.

- 3 The axis position is stored in RobotWare with an active choice from the operator.

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#### Routines in the calibration procedure

The following routines are available in the Axis Calibration procedure, given at the beginning of the procedure on the FlexPendant.

##### Fine calibration routine

Choose this routine to calibrate the robot when there are no tools, process cabling or equipment fitted to the robot.

##### Reference calibration routine

Choose this routine to create reference values and to calibrate the robot when the robot is dressed with tools, process cabling or other equipment.

Also choose this routine if the robot is suspended.



#### Note

When calibrating the robot with the reference calibration routine, the robot must be dressed with the same tools, process cabling and any other equipment as when the reference values were created.



#### Note

When using reference calibration with some tools, typically large or flexible tools, oscillations in the robot can cause issues leading to failure of the calibration.

If calibrating the robot with reference calibration there must be reference values created before repair is made to the robot, if values are not already available. Creating new values requires possibility to move the robot. The reference values contain positions of all axes, torque of axes and technical data about the tool installed. A benefit with reference calibration is that the current state of the robot is stored and not the state when the robot left the ABB factory. The reference value will be named according to tool name, date etc.

Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values.

When reference calibration is performed, the robot is restored to the status given by the reference values.

##### Update revolution counters

Choose this routine to make a rough calibration of each manipulator axis by updating the revolution counter for each axis, using the FlexPendant.

##### Validation

In the mentioned routines, it is also possible to validate the calibration data.

---

#### Position of robot axes

The robot axes should be positioned close to 0 degrees before commencing the calibration program. The axis chosen for calibration is then automatically run by the calibration program to its exact calibration position during the calibration procedure.

*Continues on next page*

## 6 Calibration

### 6.4.1 Description of Axis Calibration

*Continued*

It is possible to position some of the other axes in positions different from 0 degrees. Information about which axes are allowed to be jogged is given on the FlexPendant. These axes are marked with **Unrestricted** in the FlexPendant window. Also the following table shows the dependencies between the axes.

Requirements for axis positioning during calibration

Required position of axis	Axis to calibrate					
	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
Axis 1	-	*	*	*	*	*
Axis 2	X	-	*	*	*	*
Axis 3	*	*	-	*	*	*
Axis 4	*	*	*	-	*	*
Axis 5	*	*	*	*	-	*
Axis 6	*	*	*	*	*	-

-	Axis to be calibrated
*	Unrestricted. Axis is allowed to be jogged to other position than 0 degrees.
0	Axis must be put in position 0 degrees.
X	Special requirement

#### How to calibrate a suspended robot

The IRB 1010 is fine calibrated floor standing in factory, prior to shipping.

To calibrate a suspended robot, reference calibration must be used. Reference values for a suspended robot must be created with the robot mounted at its working position, not standing on a floor.

To calibrate a suspended robot with the fine calibration routine, the robot must first be taken down and then be mounted standing on the floor.

## 6.4.2 Calibration tools for Axis Calibration

### Calibration tool set

The calibration tools used for Axis Calibration are designed to meet requirements for calibration performance, durability and safety in case of accidental damage.

The calibration tool will eventually break from fatigue after longer period of use and then needs to be replaced. There is no risk for bad calibrations as long as the calibration tool is in one piece.



#### WARNING

Calibrating the robot with Axis Calibration requires special calibration tools from ABB. Using other pins in the calibration bushings may cause severe damage to the robot and/or personnel.

Equipment, etc.	Article number	Note
Calibration tool box, Axis Calibration	3HAC074119-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.

### Examining the calibration tool

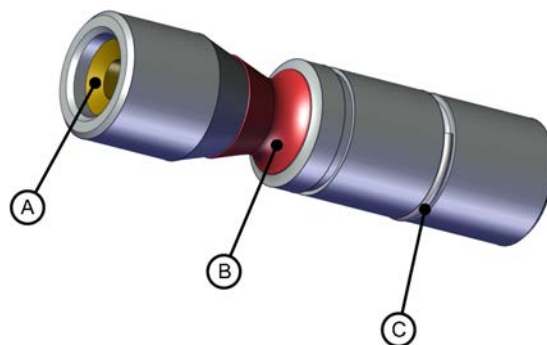
#### Check prior to usage

Before using the calibration tool, make sure that the tube insert, the plastic protection and the steel spring ring are present.



#### WARNING

If any part is missing or damaged, the tool must be replaced immediately.



xx1500001914

A	Tube insert
B	Plastic protection
C	Steel spring ring

*Continues on next page*

## 6 Calibration

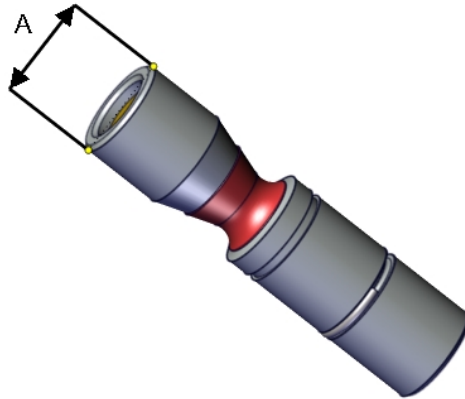
### 6.4.2 Calibration tools for Axis Calibration

*Continued*

#### Periodic check of the calibration tool

If including the calibration tool in a local periodic check system, the following measures should be checked.

- Outer diameter within  $\varnothing 12g4$  mm,  $\varnothing 8g4$  mm or  $\varnothing 6g5$  mm (depending on calibration tool size).
- Straightness within 0.005 mm.



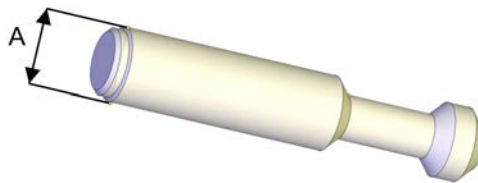
xx150000951

A	Outer diameter
---	----------------

#### Periodic check of the calibration tool with smaller outer diameter (3HAC058238-001)

If including the calibration tool with smaller outer diameter in a local periodic check system, the following measures should be checked.

- Outer diameter within  $\varnothing 5g5$  mm.
- Straightness within 0.005 mm.



xx1600001142

A	Outer diameter
---	----------------

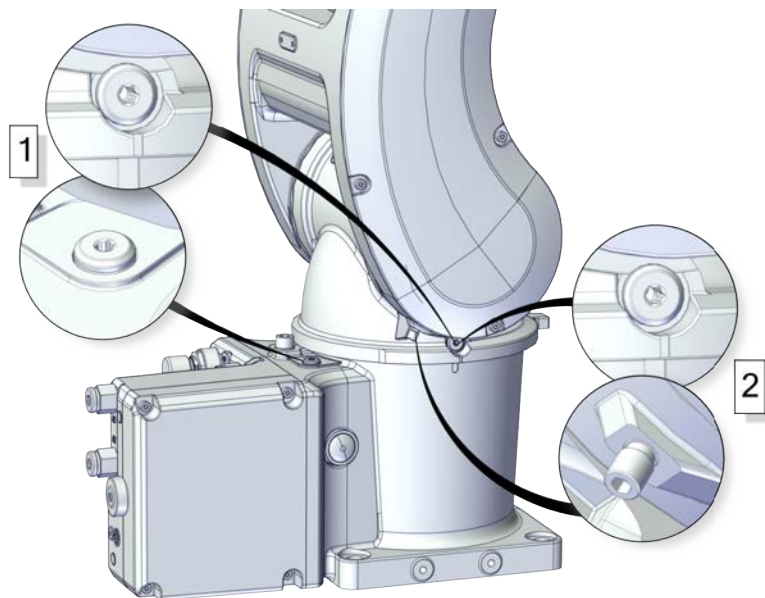
### 6.4.3 Installation locations for the calibration tools

#### Location of fixed calibration items

This section shows how the robot is equipped with items for installation of calibration tools for Axis Calibration (fixed calibration pins and/or bushings). Installed calibration tools are not shown.

A fixed calibration pin and a bushing for the movable calibration tool are located on each axis as follows.

If there is not enough space on an axis to install a fixed calibration pin, the axis is equipped with two bushings instead, for installation of two calibration tools when calibration is carried out. This is shown in the figure.



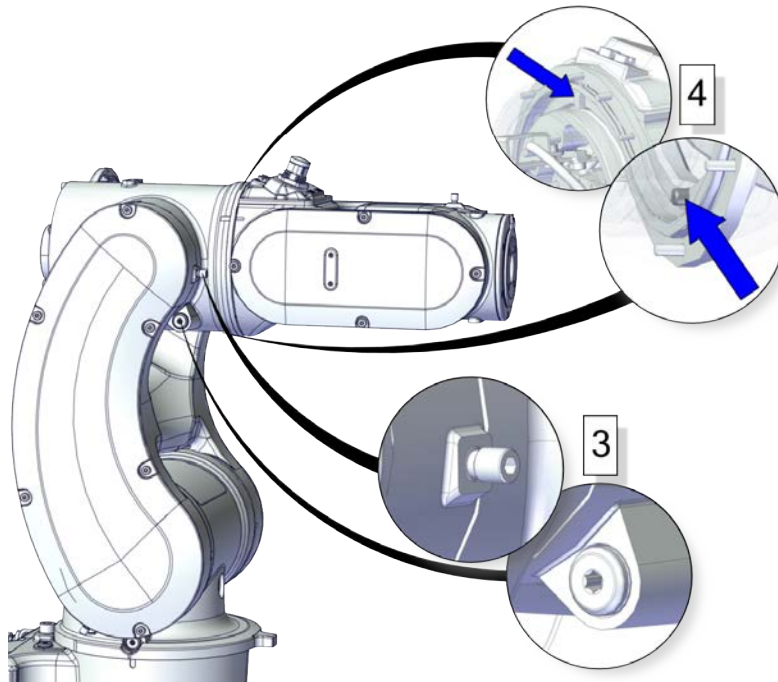
xx2100002855

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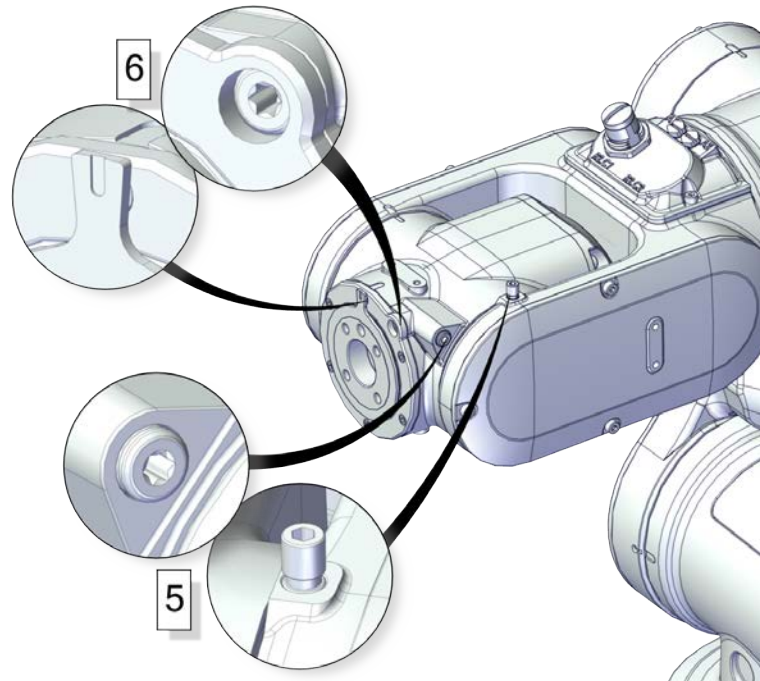
## 6 Calibration

### 6.4.3 Installation locations for the calibration tools

Continued



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xx2100002857

Continues on next page



**Spare parts**

When calibration is not being performed, a protective cover and an o-ring should always be installed on the fixed calibration pin as well as a protective plug, included a sealing, in the bushing. Replace damaged parts with new.

Spare part	Article number	Note
Fixed calibration pin	3HAC076792-001	Replace if damaged or missing. Used on axis 2, axis 3 and axis 5.
Protective plug for bushing (OD $\phi$ 6)	3HAC053237-003	Replace if damaged or missing. Used on axis 1 to axis 3.
Protective plug for bushing (OD $\phi$ 5)	3HAC076804-001	Replace if damaged or missing. Used on axis 5 and axis 6.

## 6 Calibration

### 6.4.4 Axis Calibration - Running the calibration procedure

#### 6.4.4 Axis Calibration - Running the calibration procedure

##### Required tools

The calibration tools used for Axis Calibration are designed to meet requirements for calibration performance, durability and safety in case of accidental damage.



##### WARNING

Calibrating the robot with Axis Calibration requires special calibration tools from ABB. Using other pins in the calibration holes may cause severe damage to the robot and/or personnel.

Equipment, etc.	Article number	Note
Calibration tool box, Axis Calibration	3HAC074119-001	Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.

##### Required consumables

Consumable	Article number	Note
Clean cloth	-	

##### Spare parts

Spare part	Article number	Note
Fixed calibration pin	3HAC076792-001	Replace if damaged or missing. Used on axis 2, axis 3 and axis 5.
Protective plug for bushing (OD $\phi$ 6)	3HAC053237-003	Replace if damaged or missing. Used on axis 1 to axis 3.
Protective plug for bushing (OD $\phi$ 5)	3HAC076804-001	Replace if damaged or missing. Used on axis 5 and axis 6.

##### Overview of the calibration procedure on the FlexPendant

The actual instructions of how to perform the calibration procedure and what to do at each step is given on the FlexPendant. You will be guided through the calibration procedure, step by step.

Use the following list to learn about the calibration procedure before running the RobotWare program on the FlexPendant. It gives you a brief overview of the calibration procedure.

After the calibration method has been started on the FlexPendant, the following sequence will be run.

- 1 Choose calibration routine. The routines are described in [Routines in the calibration procedure on page 291](#).
- 2 Choose which axis/axes to calibrate.
- 3 The robot moves to synchronization position.
- 4 Validate the synchronization marks.
- 5 The robot moves to preparation position.

*Continues on next page*

### 6.4.4 Axis Calibration - Running the calibration procedure



*Continued*

- 6 Remove the protective cover from the fixed pin and the protection plug from the bushing, if any, and install the calibration tool.
- 7 The robot performs a measurement sequence by rotating the axis back and forth.
- 8 Remove the calibration tool and reinstall the protective cover on the fixed pin and the protection plug in the bushing, if any.
- 9 The robot moves to verify that the calibration tool is removed.
- 10 Choose whether to save the calibration data or not.

Calibration of the robot is not finished until the calibration data is saved, as last step of the calibration procedure.


#### Preparation prior to calibration

The calibration procedure is described in the FlexPendant while conducting it.

	Action	Note
1	 <b>DANGER</b> While conducting the calibration, the robot needs to be connected to power. Make sure that the robot's working area is empty, as the robot can make unpredictable movements.	
2	Wipe the calibration tool clean.  <b>Note</b> The calibration method is exact. Dust, dirt or color flakes will affect the calibration value.	Use a clean cloth.
3	Check if the standard calibration data for axes 4 or 5 are updated with wrist optimization. This is shown in the calibration overview/summary window on the FlexPendant.	If the data is optimized, the calibration routine <b>Wrist Optimization</b> must be re-run after standard calibration. See <a href="#">Calibrating with Wrist Optimization method on page 305</a> .

#### Starting the calibration procedure

Use this procedure to start the Axis Calibration routine on the FlexPendant.

	Action	Note
1	Tap the calibration icon and enter the calibration main page.	
2	All mechanical units connected to the system are shown with their calibration status. Tap the mechanical unit in question.  <b>Note</b> For RobotWare 7, the mechanical unit page is displayed only if there is more than one mechanical unit available.	

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## 6 Calibration

### 6.4.4 Axis Calibration - Running the calibration procedure

*Continued*

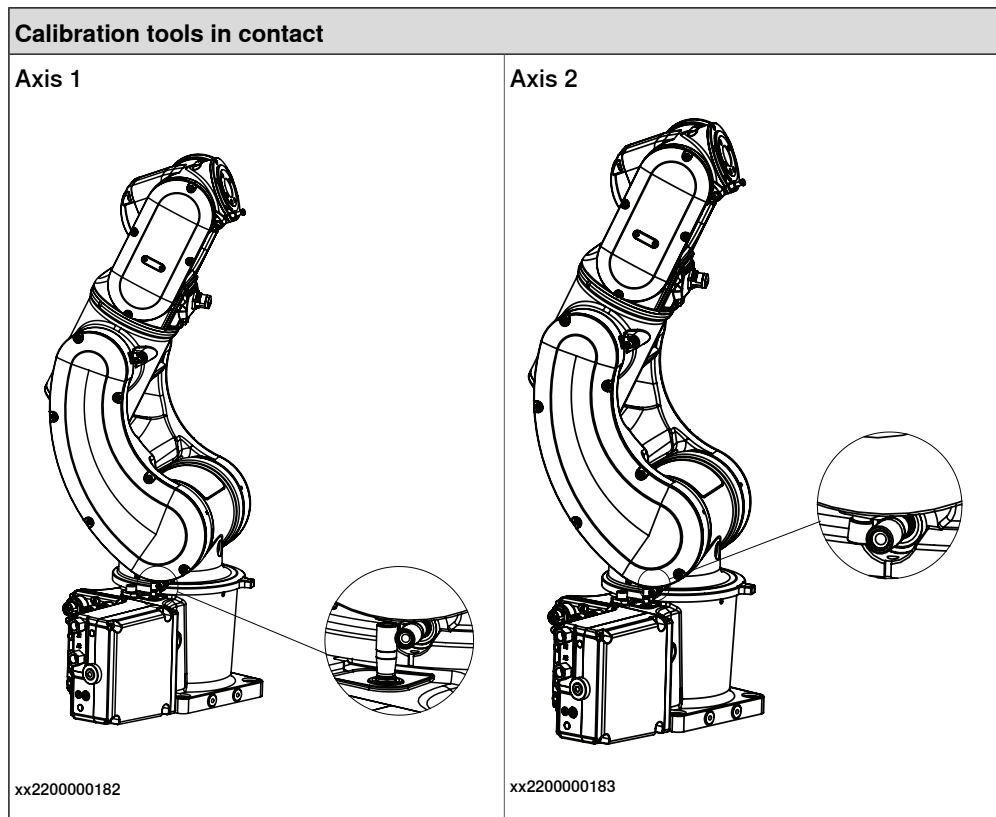
	Action	Note
3	The calibration method used at ABB factory for each axis is shown, as well as calibration method used for the robot during last field calibration.	The FlexPendant will give all information needed to proceed with Axis Calibration.
4	<b>Valid for RobotWare 7</b> Tap <b>Calibration Methods</b> on the right pane and then tap <b>Calibration</b> . The software will automatically call for the procedure for the valid calibration method.	
5	Follow the instructions given on the FlexPendant.	A brief overview of the sequence that will be run on the FlexPendant is given in <a href="#">Overview of the calibration procedure on the FlexPendant on page 298</a> .

#### Fitting of calibration tools

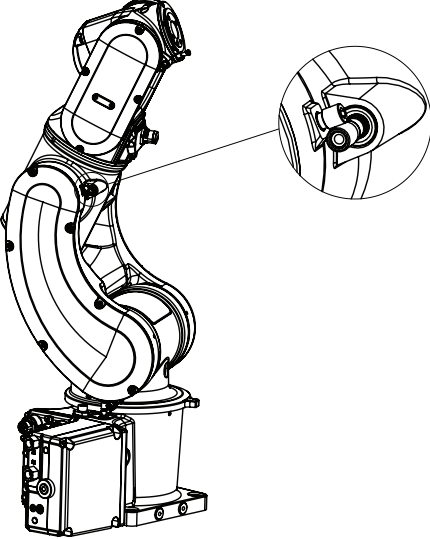
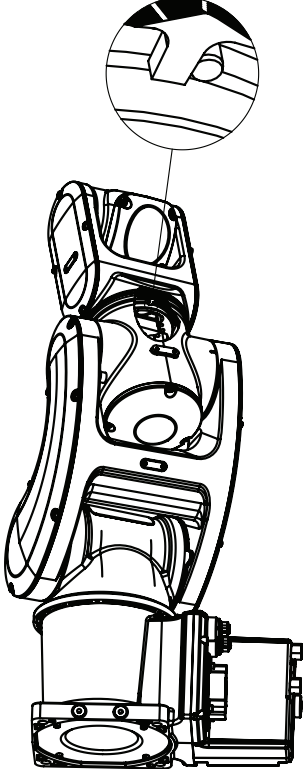
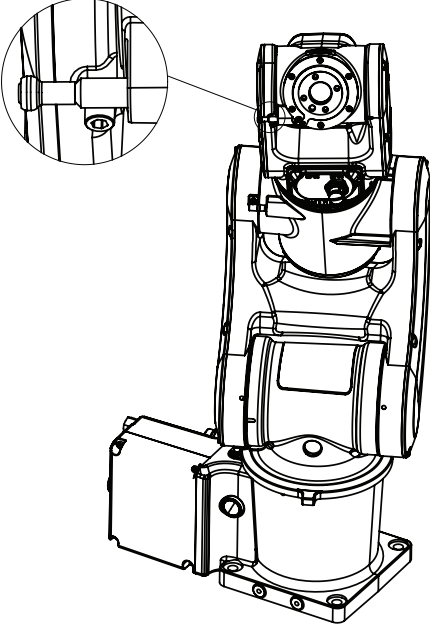
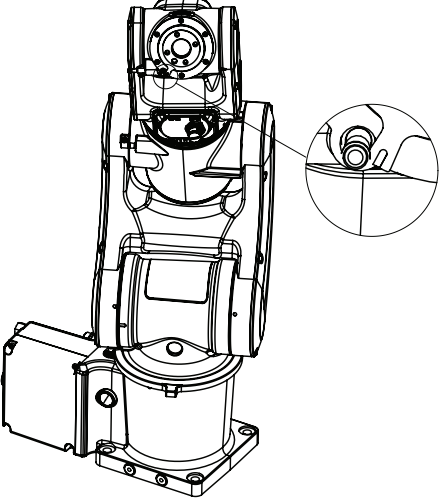
The figures show the calibration tool in contact with the fixed pin on each axis.

The position of the complete robot shown for each axis is only an example.

In order for the axis to be able to be moved to calibration position, or in order for getting proper access to the calibration bushing, other axes might need to be jogged to positions different from 0 degrees. Information about which axes are allowed to be jogged will be given on the FlexPendant. These axes are marked with **Unrestricted** in the FlexPendant window.



*Continues on next page*

Calibration tools in contact	
<p>Axis 3</p>  <p>xx2200000184</p>	<p>Axis 4</p>  <p>xx2200000185</p>
<p>Axis 5</p>  <p>xx2200000186</p>	<p>Axis 6</p>  <p>xx2200000187</p>

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## 6 Calibration

### 6.4.4 Axis Calibration - Running the calibration procedure

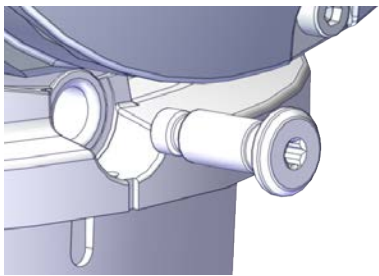
*Continued*

#### Restarting an interrupted calibration procedure

If the Axis Calibration procedure is interrupted before the calibration is finished, the RobotWare program needs to be started again. Use this procedure to take required action.

Situation	Action
The three-position enabling device on the FlexPendant has been released during robot movement.	Press and hold the three-position enabling device and press <b>Play</b> .
The RobotWare program is terminated with <b>PP to Main</b> .	Remove the calibration tool, if it is installed, and restart the calibration procedure from the beginning. See <i>Starting the calibration procedure</i> .  If the calibration tool is in contact the robot axis needs to be jogged in order to release the calibration tool. Jogging the axis in wrong direction will cause the calibration tool to break. Directions of axis movement is shown in <a href="#">Calibration movement directions for all axes on page 288</a>

#### After calibration

	Action	Note
1	Reinstall the protective plug in the bushing on each axis, directly after the axis has been calibrated.  Replace the plug with new spare part, if missing or damaged.	 <p>xx2200000536</p> <p>Protective plug for bushing (OD <math>\phi 6</math>): 3HAC053237-003. Protective plug for bushing (OD <math>\phi 5</math>): 3HAC076804-001.</p>
2	If the standard calibration data for axes 4, 5 or 6 should be updated with wrist optimization, run the calibration routine <b>Wrist Optimization</b> .	See <a href="#">Calibrating with Wrist Optimization method on page 305</a> .

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## 6.4.5 Reference calibration

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### Brief introduction to Reference Calibration

Reference calibration is a faster method compared to Fine calibration, as it refers to a previously made calibration.

- 1 Create a backup of the current robot system.
- 2 Check that the active calibration offset values corresponds to the values on the calibration label (located on the lower arm or the base).
- 3 Jog the manipulator so that all axes are in zero position (ex use `MoveAbsJ` instruction). Check that all axis scales are aligned with calibration marks.
- 4 If the scales differ from calibration marks it might depend on wrong turns of the revolution counters. Make a marker line on the corresponding axis to be able to validate the result of the calibration. If more than one motor revolutions are wrong, the calibration will fail.
- 5 Use a verification position. This is especially recommended if all axes were not aligned with the synchronization marks (step 3). Reuse an existing position that is suitable and accurate so it can be used to validate the repair. Use a position where a deviation in axis calibration gives a big deviation in positioning. Note! Check the position after each repair in one axis.
- 6 Use Reference calibration to save reference values for all axes that is to be replaced. Make sure that the values are saved in RobotStudio or FTP program. The files are located in "Active system folder name/HOME/RefCalibFiles".
- 7 Perform the repair.
- 8 Make sure that the tooling and process equipment are the same as when creating the reference. Use Reference calibration to update the system with new calibration offset value for the repaired axis.
- 9 Check the position against the verification position (step 5).
- 10 Proceed with the repair of the next axis, if necessary, and repeat (step 8-9) for every axis.
- 11 Perform test run.
- 12 Update the calibration label with new resolver values (calibration values).

### Manual tuning of calibration offset

Manual tuning of calibration offset is normally not needed, but can be useful in some situations. The requirement to do manual tuning is that there is a known accurate position, that worked accurately before the repair (step 5, see [Brief introduction to Reference Calibration on page 303](#)).

Example "Adjust axis 4":

- 1 Create a backup.
- 2 Run the manipulator to the verification position. (The manipulator position is now deviating from the verification position.)
- 3 Read and note current axis 4 value in degrees (example: 96.3 degrees).
- 4 Manually jog, only axis 4, so that the manipulator is correctly positioned to the verification position.

*Continues on next page*

## 6 Calibration

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### 6.4.5 Reference calibration

*Continued*

- 5 Read and note current axis 4 value in degrees (example: 94.2 degrees).
- 6 Move the manipulator to its calibration position.
- 7 Calculate the angle difference (ie  $96.3-94.2=2.1$  degrees).
- 8 Manually jog axis 4 the calculated angle difference (-2.1). NOTE! The direction +/- shall be the same direction as the direction used when axis 4 was manually jogged to coincide with the verification process. In the example -2.1 degrees.
- 9 Make a new manual fine calibration of axis 4 with axis in -2.1 degrees position.
- 10 Check again against the verification position.
- 11 Repeat the manual tuning if needed.
- 12 Create a new reference if the intention is to use the reference in the future.



## 6.5 Calibrating with Wrist Optimization method

### When to run Wrist Optimization

Wrist Optimization routine is run to improve TCP reorientation performance.

Calibrating the robot with standard calibration method overwrites the optimized positions of axes 4, 5. Re-run the Wrist Optimization routine after standard calibration to re-achieve the optimized positions of the wrist axes.

### Overview of the calibration procedure on the FlexPendant

The actual instructions of how to perform the calibration procedure and what to do at each step is given on the FlexPendant. You will be guided through the calibration procedure, step by step.

Use the following list to learn about the calibration procedure before running the RobotWare program on the FlexPendant. It gives you a brief overview of the calibration procedure sequence.

After the calibration method has been called for on the FlexPendant, the following sequence will be run.

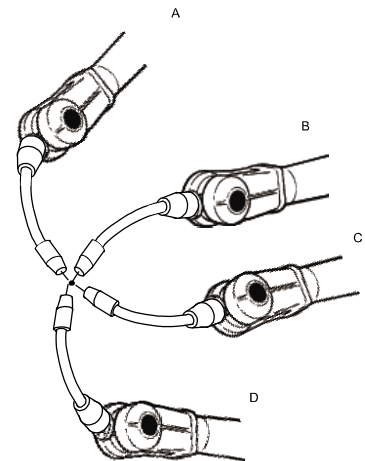
- 1 Choose calibration routine Wrist Optimization.
- 2 Modify targets for 4-point tool frame definition, in Wrist Optimization routine.



#### Tip

Select positions with large reorientations around the TCP. For best results, make sure that axis 4 and 5 have large movements.

- a Jog the robot to an appropriate position, A, for the first approach point.  
Use small increments to accurately position the tool tip as close to the reference point as possible.
- b Tap **Modify Position** to define the point.
- c Repeat for each approach point to be defined, positions B, C, and D.  
Jog away from the fixed world point to achieve the best result. Just changing the tool orientation will not give as good a result.



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- 3 Improved calibration data to the wrist axes is identified and presented.
- 4 Optimized positions for the wrist axes are presented.

*Continues on next page*

## 6 Calibration

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### 6.5 Calibrating with Wrist Optimization method

*Continued*

- 5 The robot moves to the optimized positions for the wrist axes and automatically overwrites previous calibration data.



#### **WARNING**

Robot moves automatically when pressing **Calibrate**.

- 6 Wrist optimization is finished.
- 7 Redefine / verify TCP for all tools.

---

## 6.6 Verifying the calibration

---

### Introduction

Always verify the results after calibrating *any* robot axis to verify that all calibration positions are correct.

---

### Verifying the calibration

Use this procedure to verify the calibration result.

	Action	Note
1	Run the calibration home position program twice. Do not change the position of the robot axes after running the program!	See <a href="#">Checking the synchronization position on page 308</a> .
2	Adjust the <i>synchronization marks</i> when the calibration is done, if necessary.	This is detailed in section <a href="#">Synchronization marks and synchronization position for axes on page 287</a> .
3	Write down the values on a new label and stick it on top of the calibration label. The label is located on one side of the base.	

## 6 Calibration

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### 6.7 Checking the synchronization position

### 6.7 Checking the synchronization position

---

#### Introduction

Check the synchronization position of the robot before beginning any programming of the robot system. This may be done:

- Using a `MoveAbsJ` instruction with argument zero on all axes.
- Using the **Jog** window on the FlexPendant.

*Continues on next page*

## 6.7.1 Checking the synchronization position on OmniCore robots

### Using a MoveAbsJ instruction

Use this procedure to create a program that runs all the robot axes to their synchronization position.

	Action	Note
1	Tap Code.	
2	Create a new program.	
3	Use <b>MoveAbsJ</b> in the <b>Add Instruction</b> menu.	
4	Create the following program: <pre>MoveAbsJ [[0,0,0,0,0,0],           [9E9,9E9,9E9,9E9,9E9,9E9]] \NoEOffs, v1000, fine, tool0</pre>	
5	Run the program in manual mode.	
6	Check that the synchronization marks for the axes align correctly. If they do not, update the revolution counters.	See <a href="#">Synchronization marks and synchronization position for axes on page 287</a> and <a href="#">Updating revolution counters on page 289</a> .

### Using the jogging window

Use this procedure to jog the robot to the synchronization position of all axes.

	Action	Note
1	Tap Jog.	
2	From the <b>Mechanical unit</b> list select a mechanical unit.	
3	From the <b>Motion mode</b> section, select an axis-set that need to be jogged. For example, to jog axis 2, select the axis set <b>Axis 1-3</b> .	
4	Follow the screen instruction on joystick movements to understand the direction of the axis that you want to move and move the joystick.	
5	Manually run the robots axes to a position where the axis position value read on the FlexPendant, is equal to zero.	
6	Check that the synchronization marks for the axes align correctly. If they do not, update the revolution counters.	See <a href="#">Synchronization marks and synchronization position for axes on page 287</a> and <a href="#">Updating revolution counters on page 289</a> .

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# 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"> <li>• the configuration files</li> <li>• connectors</li> <li>• options and their configuration</li> <li>• changes in the robot working space/movements.</li> </ul>
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*Continues on next page*

## 7 Troubleshooting

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### 7.1 Introduction to troubleshooting

*Continued*

The robot has recently been repaired	Check: <ul style="list-style-type: none"><li>• all connections to the replaced part</li><li>• power supplies</li><li>• that the correct part has been fitted</li><li>• the last repair documents.</li></ul>
The robot recently had a software upgrade	Check: <ul style="list-style-type: none"><li>• software versions</li><li>• compatibilities between hardware and software</li><li>• options and their configuration</li></ul>
The robot has recently been moved from one site to another (an already working robot)	Check: <ul style="list-style-type: none"><li>• connections</li><li>• software versions</li></ul>



## 7.2 Oil and grease stains on motors and gearboxes

### Description

The area surrounding the motor or gearbox shows signs of oil leaks. This can be at the base, closest to the mating surface, or at the furthest end of the motor at the resolver.

### Consequences

Besides the dirty appearance, in most cases there are no serious consequences if the leaked amount of oil is very small.


### Possible causes

The symptom can be caused by:

- Leakage of rust preventives or mounting grease. This should be wiped off.
- Leaking sealing between gearbox and motor.
- Gearbox overfilled with oil.
- Gearbox oil too hot.

### Recommended actions

The following actions are recommended:

	Action	Information
1	 <b>CAUTION</b> Allow hot parts to cool down.	
2	Wipe off the oil or grease, see <a href="#">Cleaning the IRB 1010 on page 88</a> . Monitor the robot over time to see if new oil or grease occurs.	If the oil spill is small, this step is sufficient.
3	Check the gearbox oil level.	
4	Too hot gearbox oil may be caused by: <ul style="list-style-type: none"> <li>• Incorrect oil quality or level.</li> <li>• The robot work cycle runs a specific axis too hard. Investigate whether it is possible to program small "cooling periods" into the application.</li> <li>• Overpressure created inside gearbox.</li> </ul>	Robots performing certain, extremely heavy duty work cycles may be fitted with vented oil plugs. These are not fitted to normal duty robots, but can be purchased from your local ABB representative.
5	Inspect all sealings and gaskets between motor and gearbox. Replace broken parts.	

## 7 Troubleshooting

### 7.3 Mechanical noise or dissonance

### 7.3 Mechanical noise or dissonance

#### Description

Mechanical noise or dissonance that has not been observed before can indicate problems in bearings, motors, gearboxes, or similar. Be observant of changes over time.

A faulty bearing often emits scraping, grinding, or clicking noises shortly before failing.

A humming resonance sound can occur without being an error. Mechanical resonance sound is a physical phenomenon in mechanical structures. It has no impact on product performance or lifetime. Adjusting the robot movement speed out of the range that causes the resonance will eliminate the sound.

#### 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	 <b>CAUTION</b> Allow hot parts to cool down.	
2	Verify that the service is done according to the maintenance schedule.	
3	If a bearing is emitting the noise, determine which one and make sure that it has sufficient lubrication.	
4	If possible, disassemble the joint and measure the clearance.	
5	Bearings inside motors are not to be replaced individually, but the complete motor is replaced.	
6	Make sure the bearings are fitted correctly.	
7	Tighten the screws if a heat sink, fan, or metal sheet is loose.	

## 7.4 Manipulator collapses on power down

### Description

The manipulator is able to work correctly while Motors ON is active, but when Motors OFF is active, one or more axes drops or collapses under its own weight. The holding brakes (normally one in each motor), is not able to hold the weight of the manipulator arm.

### Consequences

For a heavy robot, the collapse can cause severe injury to personnel working in the area or severe damage to the robot and/or surrounding equipment.  
For a small robot, the collapse can cause injury to personnel working close to the robot or damage to the robot and/or surrounding equipment.

### Possible causes

The symptom can be caused by:

- Faulty brake.
- Faulty power supply to the brake.

### Recommended actions

The following actions are recommended:

	Action	Information
1	Determine which motor(s) causes the robot to collapse.	
2	Check the brake power supply to the collapsing motor during the Motors OFF state.	See the circuit diagram.
3	Remove the resolver or resolver cover of the motor to see if there are any signs of oil leaks.	If found faulty, the motor must be replaced as a complete unit.
4	Remove the motor from the gearbox to inspect it from the drive side.	If found faulty, the motor must be replaced as a complete unit.

## 7 Troubleshooting

### 7.5 Robot vibration during low speed movement

### 7.5 Robot vibration during low speed movement

#### Description

Robot vibration, especially at the wrist, can be observed when the robot moves at a low speed.

#### Consequences

Slight vibration that is invisible will not affect the use of the robot. However, a clear robot vibration will decrease path accuracy and affect user applications.

#### Possible causes

Vibration might be caused by external factors:

- Incorrect robot installation
- Insufficient stiffness of robot pedestal
- Resonance with nearby moving machines
- Incorrect definition of payloads and tools
- Part malfunction, such as motor, gearbox, timing belt or main cable harness

Vibration might also happen when the robot moves at a low speed or in some specific poses. This is generally caused by mechanical resonance between servo system, gearbox and robot body, which is considered as an internal factor. Such vibration is a normal physical phenomenon, which is not a quality-related issue.

#### Recommended actions

The following actions are recommended:

	Action	Information
1	Verify that the robot is firmly secured to the foundation.	The attachment screws used for securing the robot to the foundation must be tightened with correct tightening torque. See <a href="#">Orienting and securing the robot on page 54</a> .
2	Verify that the stiffness of robot pedestal meets the requirement.	
3	Turn off all the moving machines near to the robot and then check robot vibration again. If no vibration can be observed any more, move either the machines or the robot to another place to remove the external resonance source.	
4	Verify the payload and tools are correctly defined. If not correctly defined, redefine them.	
5	Jog the robot joint by joint to verify the functionality of each joint. If anything abnormal is found on a joint, locate the possible malfunction part with other measurements such as noise, warnings on the FlexPendant, and then replace it.	

*Continues on next page*

	Action	Information
6	Make sure all the external factors have been checked and excluded. If vibration remains, it might be caused by the internal factor. Contact ABB for further assistance.	

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# 8 Decommissioning

## 8.1 Introduction to decommissioning

### Introduction

This section contains information to consider when taking a product, robot or controller, out of operation.

It deals with how to handle potentially dangerous components and potentially hazardous materials.



#### Note

The decommissioning process shall be preceded by a risk assessment.

### Disposal of materials used in the robot

All used grease/oils and dead batteries **must** be disposed of in accordance with the current legislation of the country in which the robot and the control unit are installed.

If the robot or the control unit is partially or completely disposed of, the various parts **must** be grouped together according to their nature (which is all iron together and all plastic together), and disposed of accordingly. These parts **must** also be disposed of in accordance with the current legislation of the country in which the robot and control unit are installed.

See also [Environmental information on page 320](#).

### Transportation

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

## 8 Decommissioning

---

### 8.2 Environmental information

## 8.2 Environmental information

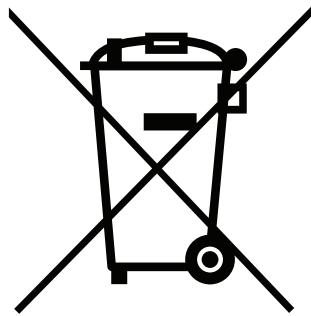
---

### Introduction

ABB robots contain components in different materials. During decommissioning, all materials should be dismantled, recycled, or reused responsibly, according to the relevant laws and industrial standards. Robots or parts that can be reused or upcycled helps to reduce the usage of natural resources.

### Symbol

The following symbol indicates that the product must not be disposed of as common garbage. Handle each product according to local regulations for the respective content (see table below).



xx1800000058

### Materials used in the product

The table specifies some of the materials in the product and their respective use throughout the product.

Dispose components properly according to local regulations to prevent health or environmental hazards.

Material	Example application
Aluminium	Manipulator body castings, etc.
Batteries, Lithium	Serial measurement board
Copper	Calibration pins, cables, etc.
Lead	Serial measurement board
Oil, grease	Gearboxes, process hub, cable harness, etc.
Plastic/rubber	Cable protectors, etc.
Stainless steel	Mechanical stop screws, etc.
Steel	Mechanical stop screws, etc.

*Continues on next page*



#### Oil and grease

Where possible, arrange for oil and grease to be recycled. Dispose of via an authorized person/contractor in accordance with local regulations. Do not dispose of oil and grease near lakes, ponds, ditches, down drains, or onto soil. Incineration must be carried out under controlled conditions in accordance with local regulations.

Also note that:

- Spills can form a film on water surfaces causing damage to organisms. Oxygen transfer could also be impaired.
- Spillage can penetrate the soil causing ground water contamination.

## 8 Decommissioning

---

### 8.3 Scrapping of robot

### 8.3 Scrapping of robot



#### Note

The decommissioning process shall be preceded by a risk assessment.

---

#### Important when scrapping the robot



#### DANGER

The risk assessment should consider hazards arising in the decommissioning, such as, but not limited to:

- Always remove all batteries. If a battery is exposed to heat, for example from a blow torch, it will explode.
- Always remove all oil/grease in gearboxes. If exposed to heat, for example from a blow torch, the oil/grease will catch fire.
- When motors are removed from the robot, the robot will collapse if it is not properly supported before the motor is removed.
- A used robot does not have the same performance as on delivery. Springs, brakes, bearings, and other parts might be worn or broken.

## **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

### 9.2 Applicable standards

#### General

The product is compliant with ISO 10218-1:2011, *Robots for industrial environments - Safety requirements - Part 1 Robots*, and applicable parts in the normative references, as referred to from ISO 10218-1:2011. In case of deviation from ISO 10218-1:2011, these are listed in the declaration of incorporation. The declaration of incorporation is part of the delivery.

#### Robot standards

Standard	Description
ISO 9283	Manipulating industrial robots – Performance criteria and related test methods
ISO 9787	Robots and robotic devices – Coordinate systems and motion nomenclatures
ISO 9946	Manipulating industrial robots – Presentation of characteristics

#### Other standards used in design

Standard	Description
IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements, normative reference from ISO 10218-1
IEC 61000-6-2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
IEC 61000-6-4	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
ISO 13849-1:2006	Safety of machinery - Safety related parts of control systems - Part 1: General principles for design, normative reference from ISO 10218-1
IEC 61340-5-1	Protection of electronic devices from electrostatic phenomena - General requirements

#### 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 434-03	Industrial robots and robot Systems - General safety requirements
ANSI/ESD S20.20	Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)
EN ISO 10218-1	Robots and robotic devices — Safety requirements for industrial robots — Part 1: Robots

## 9.3 Unit conversion

### Converter table

Use the following table to convert units used in this manual.

Quantity	Units		
Length	1 m	3.28 ft.	39.37 in
Weight	1 kg	2.21 lb.	
Weight	1 g	0.035 ounces	
Pressure	1 bar	100 kPa	14.5 psi
Force	1 N	0.225 lbf	
Moment	1 Nm	0.738 lbf-ft	
Volume	1 L	0.264 US gal	

## 9 Reference information

---

### 9.4 Screw joints

### 9.4 Screw joints

---

#### General

This section describes how to tighten the various types of screw joints on ABB robots.

The instructions and torque values are valid for screw joints comprised of metallic materials and do *not* apply to soft or brittle materials.

---

#### UNBRAKO screws

UNBRAKO is a special type of screw recommended by ABB for certain screw joints. It features special surface treatment (Gleitmo as described below) and is extremely resistant to fatigue.

Whenever used, this is specified in the instructions, and in such cases, *no other type of replacement screw* is allowed. Using other types of screws will void any warranty and may potentially cause serious damage or injury.

---

#### Gleitmo treated screws

Gleitmo is a special surface treatment to reduce the friction when tightening the screw joint. It is recommended by ABB for M6-M20 screw joints. Screws treated with Gleitmo may be reused 3-4 times before the coating disappears. After this the screw must be discarded and replaced with a new one.

When handling screws treated with Gleitmo, protective gloves of nitrile rubber type should be used.

Generally, screws are lubricated with *Gleitmo 603* mixed with *Geomet 500* or *Geomet 702* in proportion 1:3. *Geomet* thickness varies according to screw dimensions, refer to the following.

Dimension	Lubricant	Geomet thickness
M6-M20 (any length except M20x60)	<i>Gleitmo 603 + Geomet 500</i>	3-5 µm
M6-M20 (any length except M20x60)	<i>Gleitmo 603 + Geomet 720</i>	3-5 µm
M20x60	<i>Gleitmo 603 + Geomet 500</i>	8-12 µm
M20x60	<i>Gleitmo 603 + Geomet 720</i>	6-10 µm

---

#### Screws lubricated in other ways

Screws lubricated with Molykote 1000 or Molykote P1900 should *only* be used when specified in the repair, maintenance or installation procedure descriptions.

In such cases, proceed as follows:

- 1 Apply lubricant to the screw thread.
- 2 Apply lubricant between the plain washer and screw head.
- 3 Screw dimensions of M8 or larger must be tightened with a torque wrench. Screw dimensions of M6 or smaller may be tightened without a torque wrench *if* this is done by trained and qualified personnel.

*Continues on next page*

Lubricant	Article number
Molykote 1000 (molybdenum disulphide grease)	3HAC042472-001
Molykote P1900 (molybdenum disulphide grease)	3HAC070875-001

**Tightening torque**

Before tightening any screw, note the following:

- Determine whether a **standard** tightening torque or **special** torque is to be applied. The **standard torques** are specified in the following tables. Any **special torques** are specified in the repair, maintenance or installation procedure descriptions. **Any special torque specified overrides the standard torque!**
- Use the *correct tightening torque* for each type of screw joint.
- Only use *correctly calibrated* torque keys.
- *Always tighten the joint by hand*, and never use pneumatic tools.
- Use the *correct tightening technique*, that is *do not* jerk. Tighten the screw in a slow, flowing motion.
- Maximum allowed total deviation from the specified value is **10%!**

**Tightening torque for oil-lubricated screws with slotted or cross-recess head screws**

The following table specifies the recommended standard tightening torque for *oil-lubricated screws with slotted or cross-recess head screws*.



**Note**

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

**Tightening torque for oil-lubricated screws with allen head screws**

The following table specifies the recommended standard tightening torque for *oil-lubricated screws with allen head screws*.



**Note**

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque (Nm)	Tightening torque (Nm)	Tightening torque (Nm)
	Class 8.8, oil-lubricated	Class 10.9, oil-lubricated	Class 12.9, oil-lubricated
M5	6	-	-
M6	10	-	-
M8	24	34	40
M10	47	67	80
M12	82	115	140
M16	200	290	340
M20	400	560	670

Continues on next page

## 9 Reference information

### 9.4 Screw joints

Continued

Dimension	Tightening torque (Nm) Class 8.8, oil-lubricated	Tightening torque (Nm) Class 10.9, oil-lubricated	Tightening torque (Nm) Class 12.9, oil-lubricated
M24	680	960	1150

Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws  
The following table specifies the recommended standard tightening torque for *screws lubricated with Molykote 1000, Gleitmo 603 or equivalent with allen head screws.*



#### Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque (Nm) Class 10.9, lubricated <sup>i</sup>	Tightening torque (Nm) Class 12.9, lubricated <sup>i</sup>
M5		8
M6		14
M8	28	35
M10	55	70
M12	96	120
M16	235	300
M20	460	550
M24	790	950

<sup>i</sup> Lubricated with Molykote 1000, Gleitmo 603 or equivalent



## 9.5 Weight specifications


### Definition

In installation, repair, and maintenance procedures, weights of the components handled are sometimes specified. All components exceeding 22 kg (50 lbs) are highlighted in this way.

To avoid injury, ABB recommends the use of a lifting accessory when handling components with a weight exceeding 22 kg. A wide range of lifting accessories and devices are available for each manipulator model.

### Example

Following is an example of a weight specification in a procedure:

	Action	Note
	 <b>CAUTION</b> The arm weighs 25 kg. All lifting accessories used must be sized accordingly.	

## 9 Reference information

---

### 9.6 Standard toolkit

### 9.6 Standard toolkit

---

#### General

All service (repairs, maintenance, and installation) procedures contains lists of tools required to perform the specified activity.

All special tools required are listed directly in the procedures while all the tools that are considered standard are gathered in the standard toolkit and defined in the following table.

This way, the tools required are the sum of the standard toolkit and any tools listed in the instruction.

---

#### Contents, standard toolkit

Qty	Tool	Rem.
1	Socket head cap 2-17 mm	
1	Torque wrench 0.3-45 Nm	
1	Torque wrench 20 Nm $\pm$ 2 Nm	For securing robot to foundation.
1	Ratchet head for torque wrench 1/2	
1	Hex socket head cap no. 2.5 socket 1/2" bit L=110 mm	
1	Small screwdriver	
1	T-handle with ball head	
1	Small cutting plier	
1	Plastic mallet	
1	Needle-nose plier	

## 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 330](#), 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.

Tools and equipment with spare part number: (These tools can be ordered from ABB)	
-	24 VDC power supply
3HAC074119-001	Calibration tool box, Axis Calibration Delivered as a set of calibration tools. Required if Axis Calibration is the valid calibration method for the robot.
-	Sonic tension meter Used for measuring the timing belt tension.
-	Dynamometer Used for measuring the timing belt tension.
3HAC082535-001	Axis-2 radial sealing assembly tool
3HAC082535-003	Axis-4 radial sealing assembly tool
3HAC082535-002	Radial sealing pressfit tool
3HAC071022-001	Special toolkit Includes M12 connector assembly tool and Brake release button assembly tool.

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## 10 Spare parts

### 10.1 Spare part lists and illustrations

---

#### Location

Spare parts and exploded views are not included in the manual but delivered as a separate document for registered users on myABB Business Portal, [www.abb.com/myABB](http://www.abb.com/myABB).

**Tip**

All documents can be found via myABB Business Portal, [www.abb.com/myABB](http://www.abb.com/myABB).

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