



# Product manual

## IRB 6700Inv

**Trace back information:**

**Workspace R17-1 version a7**

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**Product manual**

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**IRC5**

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

## Usage

This manual should be used during:

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

## Who should read this manual?

This manual is intended for:

- installation personnel
  - maintenance personnel
  - repair personnel.
- 

## Prerequisites

Maintenance/repair/installation personnel working with an ABB Robot must:

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

## Organization of chapters

The manual is organized in the following chapters:

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

*Continues on next page*

## Overview of this manual

*Continued*

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

## References

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

Document name	Document ID
<i>Product manual, spare parts - IRB 6700</i>	3HAC044268-001
<i>Product manual - IRB 6700</i>	3HAC044266-001
<i>Product specification - IRB 6700</i>	3HAC044265-001
<i>Directions for use - Fork lift accessory for IRB 6700Inv</i>	3HAC060303-001
<i>Circuit diagram - IRB 6700</i>	3HAC043446-005
<i>Product manual - DressPack/SpotPack IRB 6700</i>	3HAC044270-001
<i>Operating manual - General safety information</i> <sup>i</sup>	3HAC031045-001
<i>Product manual - IRC5</i> IRC5 with main computer DSQC1000.	3HAC047136-001
<i>Product manual - IRC5</i> IRC5 with main computer DSQC 639.	3HAC021313-001
<i>Operating manual - IRC5 with FlexPendant</i>	3HAC050941-001
<i>Operating manual - Calibration Pendulum</i>	3HAC16578-1
<i>Technical reference manual - Lubrication in gearboxes</i>	3HAC042927-001
<i>Technical reference manual - System parameters</i>	3HAC050948-001

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

## Revisions

Revision	Description
-	First edition.

# Product documentation, IRC5

## Categories for user documentation from ABB Robotics

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

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

## Product manuals

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

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

## Technical reference manuals

The technical reference manuals describe reference information for robotics products.

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

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

The group of manuals includes (among others):

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

# How to read the product manual

### Reading the procedures

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

### Safety information

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

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

### Illustrations

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

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

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# 1 Safety

## 1.1 Introduction to safety information

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### Overview

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

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

# 1 Safety

---

## 1.2.1 Introduction to general safety information

## 1.2 General safety information

### 1.2.1 Introduction to general safety information

---

#### Definitions

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

---

#### Sections

The general safety information is divided into the following sections.

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

## 1.2.2 Safety in the manipulator system

### Validity and responsibility

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

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

- *Operating manual - IRC5 with FlexPendant*
- *Operating manual - General safety information*<sup>1</sup>
- *Product manual*

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

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

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

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

### Connection of external safety devices

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

### Limitation of liability

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

### Related information

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

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## 1 Safety

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### 1.2.2 Safety in the manipulator system

*Continued*

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

### **1.2.3 Protective stop and emergency stop**

---

#### **Overview**

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

# 1 Safety

---

## 1.2.4.1 Safety risks during installation and service work on robots

### 1.2.4 Safety risks

#### 1.2.4.1 Safety risks during installation and service work on robots

---

##### Overview

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

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

---

##### General risks during installation and service

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

---

##### Spare parts and special equipment

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

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##### Personal protective equipment

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

---

##### Nation/region specific regulations

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

---

##### Non-voltage related risks

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

*Continues on next page*

## 1.2.4.1 Safety risks during installation and service work on robots

*Continued*

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

**To be observed by the supplier of the complete system**

When integrating the robot with external devices and machines:

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

**Complete robot**

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

*Continues on next page*

# 1 Safety

## 1.2.4.1 Safety risks during installation and service work on robots

*Continued*

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

## Cabling

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

## Gearboxes and motors

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

## Balancing device

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

## 1.2.4.2 CAUTION - Hot parts may cause burns!

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

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

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

**Elimination**

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

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

# 1 Safety

---

## 1.2.4.3 Safety risks related to tools/work pieces

### 1.2.4.3 Safety risks related to tools/work pieces

#### Safe handling

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

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

#### Safe design

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

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



#### CAUTION

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

#### 1.2.4.4 Safety risks related to pneumatic/hydraulic systems

---

##### General

Special safety regulations apply to pneumatic and hydraulic systems.



##### Note

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

---

##### Residual energy

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

---

##### Safe design

- Gravity may cause any parts or objects held by these systems to drop.
- Dump valves should be used in case of emergency.
- Shot bolts should be used to prevent tools, etc., from falling due to gravity.

# **1 Safety**

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## **1.2.4.5 Safety risks during operational disturbances**

---

### **General**

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

---

### **Qualified personnel**

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

---

### **Extraordinary risks**

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

## 1.2.4.6 Risks associated with live electric parts

### Voltage related risks, general

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

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

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

All work must be performed:

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

### Voltage related risks, IRC5 controller

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

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

*Continues on next page*

# **1 Safety**

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## **1.2.4.6 Risks associated with live electric parts**

*Continued*

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### **Voltage related risks, robot**

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

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

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

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

### 1.2.5 Safety actions

#### 1.2.5.1 Safety fence dimensions

---

##### General

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

---

##### Dimensioning

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

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

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

## **1 Safety**

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### **1.2.5.2 Fire extinguishing**



#### **Note**

**Use a CARBON DIOXIDE (CO<sub>2</sub>) extinguisher in the event of a fire in the robot or controller!**

### 1.2.5.3 Emergency release of the robot arm

#### Description

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

How to release the brakes is detailed in the section:

- [Manually releasing the brakes on page 78.](#)

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

#### Increased injury

Before releasing the brakes, make sure that the weight of the arms does not increase the pressure on the trapped person, further increasing any injury!

Also, make sure that the pushing force from the balancing device does not increase the pressure on the trapped person.



#### DANGER

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

Release of the axis-2 motor holding brakes can cause the axis 2 to move in opposite direction in regard to gravity, due to the pushing force from the balancing device. Current arm load and position of the lower and upper arm determines the occurring movement when releasing the holding brakes of the axis-2 motor.

Make sure no personnel is near or beneath the robot arm.

# 1 Safety

---

## 1.2.5.4 Brake testing

### 1.2.5.4 Brake testing

---

#### When to test

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

---

#### How to test

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

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

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

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



### Note

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

# 1 Safety

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## 1.2.5.6 Safe use of the jogging device

### 1.2.5.6 Safe use of the jogging device

#### Three-position enabling device

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

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



#### Note

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

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

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

---

#### Hold-to-run function

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

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

### 1.2.5.7 Work inside the working range of the robot



#### WARNING

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

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



#### WARNING

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

## **1 Safety**

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### **1.2.5.8 Signal lamp (optional)**

#### **1.2.5.8 Signal lamp (optional)**

---

##### **Description**

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

---

##### **Function**

The lamp is active in MOTORS ON mode.

---

##### **Further information**

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

## 1.3 Safety signals and symbols

### 1.3.1 Safety signals in the manual

#### Introduction to safety signals

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

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

#### Danger levels

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

Symbol	Designation	Significance
 xx0200000022	DANGER	Warns that an accident <i>will</i> occur if the instructions are not followed, resulting in a serious or fatal injury and/or severe damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, and so on.
 xx0100000002	WARNING	Warns that an accident <i>may</i> occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, etc.
 xx0200000024	ELECTRICAL SHOCK	Warns for electrical hazards which could result in severe personal injury or death.
 xx0100000003	CAUTION	Warns that an accident <i>may</i> occur if the instructions are not followed that can result in injury and/or damage to the product. It also applies to warnings of risks that include burns, eye injury, skin injury, hearing damage, crushing or slipping, tripping, impact, fall from height, etc. Furthermore, it applies to warnings that include function requirements when fitting and removing equipment where there is a risk of damaging the product or causing a breakdown.
 xx0200000023	ELECTROSTATIC DISCHARGE (ESD)	Warns for electrostatic hazards which could result in severe damage to the product.

*Continues on next page*

# 1 Safety

## 1.3.1 Safety signals in the manual

*Continued*

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

## 1.3.2 Safety symbols on product labels

### Introduction to labels

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

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

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



#### Note

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

### Types of labels

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

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

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

### Symbols on safety labels

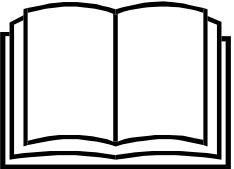
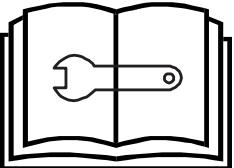
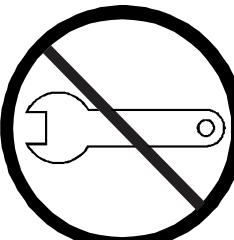
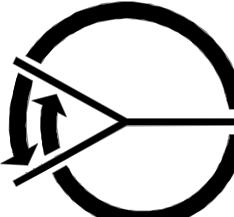
Symbol	Description
	<b>Warning!</b> Warns that an accident <i>may</i> occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units,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

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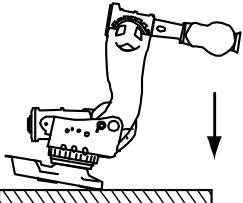
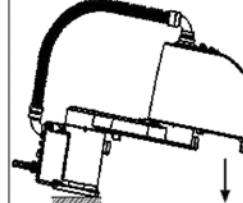
# 1 Safety

## 1.3.2 Safety symbols on product labels

*Continued*

Symbol	Description
 xx0900000813	<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><li>• EPS: <i>Application manual - Electronic Position Switches</i>.</li></ul>
 xx0900000816	<b>Before disassemble, 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*

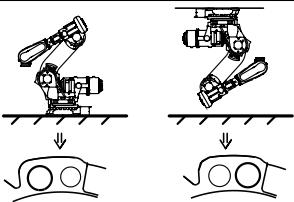
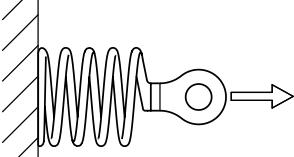
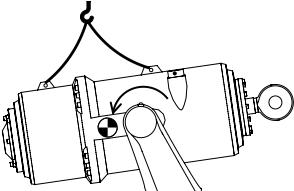
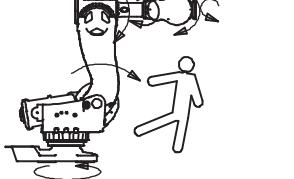
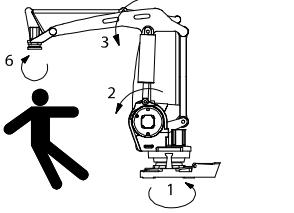
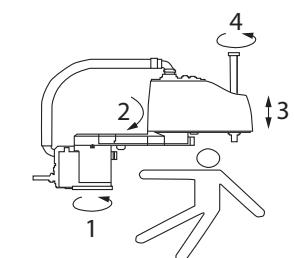
Symbol	Description
 xx0900000810	<b>Tip risk when loosening bolts</b> The robot can tip over if the bolts are not securely fastened.
  3HAC 057068-001	
  xx0900000817	<b>Crush</b> Risk of crush injuries.
 xx0900000818	<b>Heat</b> Risk of heat that can cause burns.

*Continues on next page*

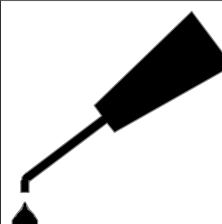
# 1 Safety

## 1.3.2 Safety symbols on product labels

*Continued*

Symbol	Description
 xx1700000518	<b>Risk of lower arm movement when robot is floor mounted</b> Use transportation lock screw when moving, transporting or rotating robot.
 xx1700000519	<b>Pressurized balancing device</b> Release of the axis-2 motor holding brakes can cause the axis 2 to move in opposite direction in regard to gravity, due to the pushing force from the balancing device. Current arm load and position of the lower and upper arm determines the occurring movement when releasing the holding brakes of the axis-2 motor.
 xx1700000520	<b>Lifting of balancing device</b> Center of gravity will cause the balancing device to tip over when released in the front ear.
 xx0900000819  xx1000001141	<b>Moving robot</b> The robot can move unexpectedly.
 xx1500002616	

*Continues on next page*

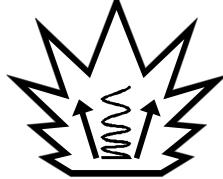
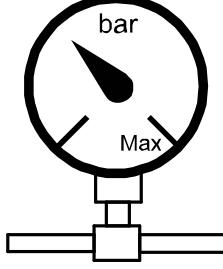
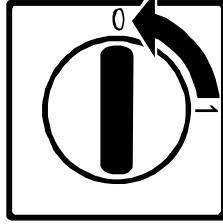
Symbol	Description
 xx0900000820	Brake release buttons
 xx1000001140	
 xx0900000821	Lifting bolt
 xx1000001242	Chain sling with shortener
 xx0900000822	Lifting of robot
 xx0900000823	Oil Can be used in combination with prohibition if oil is not allowed.
 xx0900000824	Mechanical stop

*Continues on next page*

# 1 Safety

## 1.3.2 Safety symbols on product 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.

## 1.4.1 DANGER - Moving robots are potentially lethal!

## 1.4 Safety related instructions

### 1.4.1 DANGER - Moving robots are potentially lethal!

#### Description

Any moving robot is a potentially lethal machine.

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

#### Elimination

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

## 1 Safety

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

#### Description

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

#### Elimination

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



#### DANGER

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

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

#### Collision risks



#### CAUTION

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

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

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

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

**DANGER**

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

**Elimination**

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

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

# 1 Safety

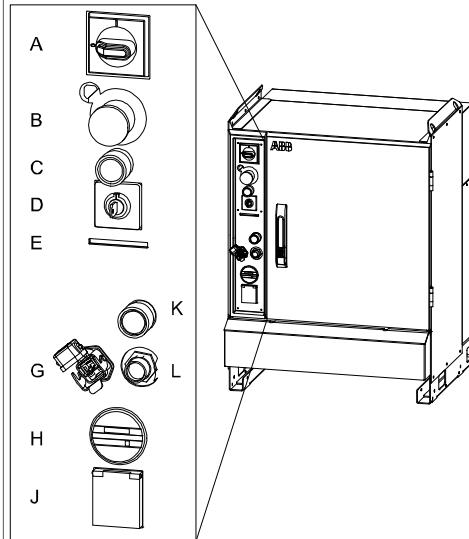
1.4.4 DANGER - Make sure that the main power has been switched off!

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

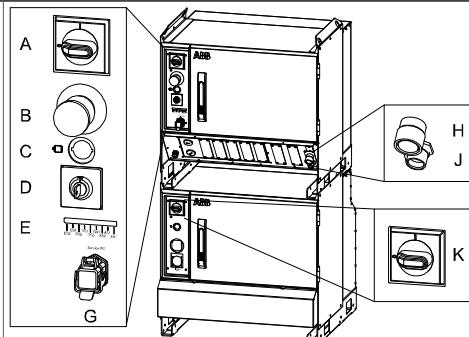
### Description

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

### Elimination, IRC5 Single Cabinet Controller

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

### Elimination, IRC5 Dual Cabinet Controller

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

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

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

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

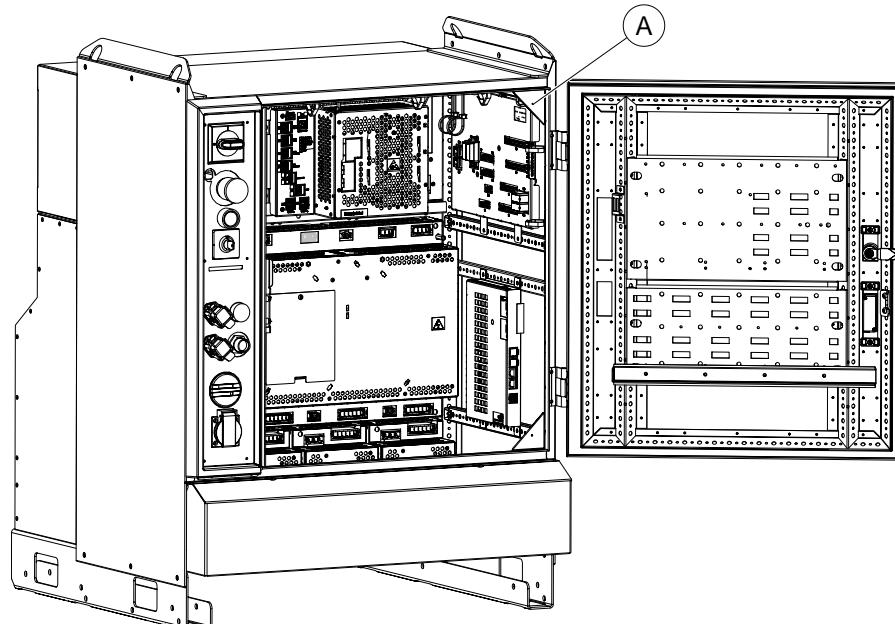
**Elimination**

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

**Location of wrist strap button**

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

IRC5



A	Wrist strap button
---	--------------------

# 1 Safety

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## 1.4.6 WARNING - Safety risks during handling of batteries

### Description

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

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



#### Note

Appropriate disposal regulations must be observed.

### Elimination

	Action	Note
1	Do not short circuit, recharge, puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of the product. Risk of fire or explosion.	Operating temperatures are listed in <a href="#">Pre-installation procedure on page 54</a> .
2	Use safety glasses when handling the batteries.	
3	In the event of leakage, wear gloves and chemical apron.	
4	In the event of fire, use self-contained breathing apparatus.	

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

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

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

**Note**

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

**Note**

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

**Note**

Appropriate disposal regulations must be observed.

**Note**

Take special care when handling hot lubricants.

**Warnings and elimination**

Warning	Description	Elimination/Action
 xx0100000002 <b>Hot oil or grease</b>	Changing and draining gearbox oil or grease may require handling hot lubricant heated up to 90 °C.	Make sure that protective gear like goggles and gloves are always worn during this activity.
 xx0100000002 <b>Allergic reaction</b>	When working with gearbox lubricant there is a risk of an allergic reaction.	Make sure that protective gear like goggles and gloves are always worn.
 xx0100000002 <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.

*Continues on next page*

# 1 Safety

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

*Continued*

Warning	Description	Elimination/Action
 xx010000002 <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.
 xx010000002 <b>Do not mix types of oil</b>	Mixing types of oil may cause severe damage to the gearbox.	When filling gearbox oil, do not mix different types of oil unless specified in the instructions. Always use the type of oil specified by the manufacturer!
 xx0100000098 <b>Heat up the oil</b>	Warm oil drains quicker than cold oil.	When changing gearbox oil, first run the robot for a time to heat up the oil.
 xx010000004 <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.
 xx010000003 <b>Contaminated oil in gear boxes</b>	When draining the oil make sure that as much oil as possible is drained from the gearbox. The reason for this is to drain as much oil sludge and metal chips as possible from the gearbox. The magnetic oil plugs will take care of any remaining metal chips.	

# 2 Installation and commissioning

## 2.1 Introduction

### General

This chapter contains assembly instructions and information for installing the IRB 6700Inv at the working site.

More detailed technical data can be found in the *Product specification* for the IRB 6700Inv, such as:

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

### Safety information

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

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



#### Note

If the IRB 6700Inv is connected to power, always make sure that the robot is connected to *protective earth* before starting any installation work!

For more information see:

- *Product manual - IRC5*

## 2 Installation and commissioning

### 2.2.1 Pre-installation procedure

## 2.2 Unpacking

### 2.2.1 Pre-installation procedure

#### Introduction

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

#### Prerequisites for installation personnel

Installation personnel working with an ABB product must:

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

#### Checking the pre-requisites for installation

	Action
1	Make a visual inspection of the packaging and make sure that nothing is damaged.
2	Remove the packaging.
3	Check for any visible transport damage.   <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 is suitable to handle the weight of the robot as specified in: <a href="#">Weight, robot on page 55</a>
6	If the robot is not installed directly, it must be stored as described in: <a href="#">Storage conditions, robot on page 56</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 56</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 55</a></li><li>• <a href="#">Protection classes, robot on page 57</a></li><li>• <a href="#">Requirements, foundation on page 56</a></li></ul>
9	Before moving the robot, please observe the stability of the robot: <a href="#">Risk of tipping/stability on page 62</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 69</a>
11	Install required equipment, if any. <ul style="list-style-type: none"><li>• <a href="#">Installing the signal lamp (option) on page 94</a></li></ul>

Continues on next page

**Weight, robot**

The table shows the weight of the robot.

The weight does not include the weight of the DressPack.

Robot model	Weight
IRB 6700Inv	1,750 kg

**Note**

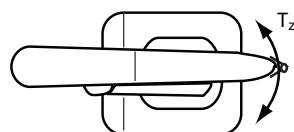
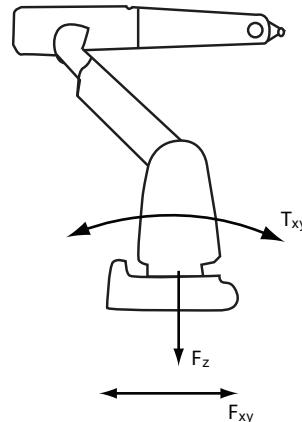
The weight does not include tools and other equipment fitted on the robot!

The weight does not include the weight of the DressPack.

**Loads on foundation, robot**

The illustration shows the directions of the robots stress forces.

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



xx1100000521

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

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

**Note**

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

*Continues on next page*

## 2 Installation and commissioning

### 2.2.1 Pre-installation procedure

*Continued*

Inverted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	$\pm 8.9$ kN	$\pm 23.7$ kN
Force z	$-22.1 \pm 6.6$ kN	$-22.1 \pm 18.1$ kN
Torque xy	$\pm 22.5$ kNm	$\pm 45.4$ kNm
Torque z	$\pm 6.5$ kNm	$\pm 15.7$ kNm

### Requirements, foundation

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

Requirement	Value	Note
Flatness of foundation surface	0.3 mm	Flat foundations give better repeatability of the resolver calibration compared to original settings on delivery from ABB. The value for levelness aims at the circumstance of the anchoring points in the robot base.
Maximum tilt	$0^\circ$	
Minimum resonance frequency	22 Hz	

### Storage conditions, robot

The table shows the allowed storage conditions for the robot:

Parameter	Value
Minimum ambient temperature	-25°C (-13°F)
Maximum ambient temperature	+55°C (+131°F)
Maximum ambient temperature (less than 24 hrs)	+70°C (+158°F)
Maximum ambient humidity	Maximum 95% at constant temperature.

### Operating conditions, robot

The table shows the allowed operating conditions for the robot:

Parameter	Value
Minimum ambient temperature	+5°C <sup>i</sup> (41°F)
Maximum ambient temperature	+50°C (122°F)
Maximum ambient humidity	Maximum 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.

*Continues on next page*

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#### **Protection classes, robot**

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

<b>Protection type</b>	<b>Protection class</b>
Manipulator, protection type Standard	IP67
Manipulator, protection type Foundry Plus	IP67

## 2 Installation and commissioning

### 2.2.2 Working range

#### 2.2.2 Working range

##### Working range

Axis	Type of motion	Working range	Note
Axis 1	Rotation motion	$\pm 170^\circ$	
Axis 2	Arm motion	$\pm 65^\circ$ <sup>i</sup>	
Axis 3	Arm motion	$-180^\circ$ <sup>i</sup> / $+70^\circ$ <sup>i</sup>	
Axis 4	Wrist motion	$\pm 300^\circ$	Default value.
Axis 5	Bend motion	$\pm 130^\circ$ <sup>ii</sup>	
Axis 6	Turn motion	$\pm 360^\circ$ <sup>iii</sup>	Default value.
		$\pm 93.7$ revolutions	Maximum value. The default working range for axis 6 can be extended by changing parameter values in the software.

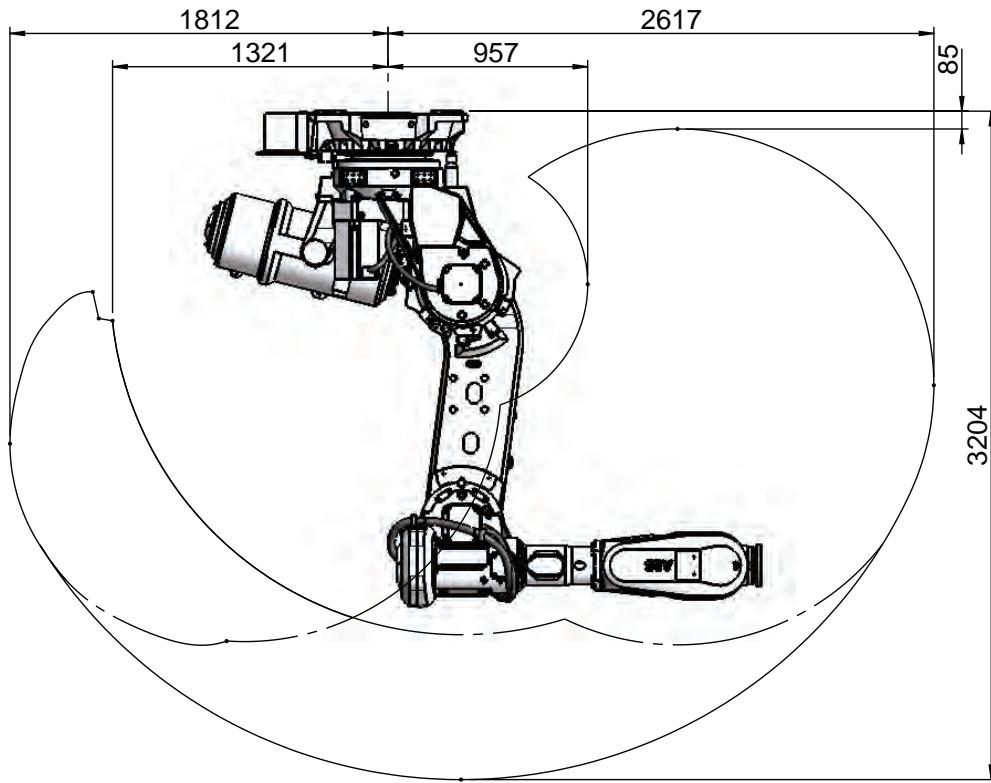
<sup>i</sup> Working ranges of axis 2 and axis 3 are limited in some areas to avoid collision with balancing. See [Working range axis 2 and axis 3 for IRB 6700Inv-300/2.60 and -245/2.90 on page 60](#).

<sup>ii</sup> Working range  $+120^\circ$  to  $-120^\circ$  for robots with LeanID, option 780-4.

<sup>iii</sup> Working range  $+220^\circ$  to  $-220^\circ$  for robots with LeanID, option 780-4.

##### Illustration, working range IRB 6700Inv - 300/2.60

This illustration shows the unrestricted working range of the robot.



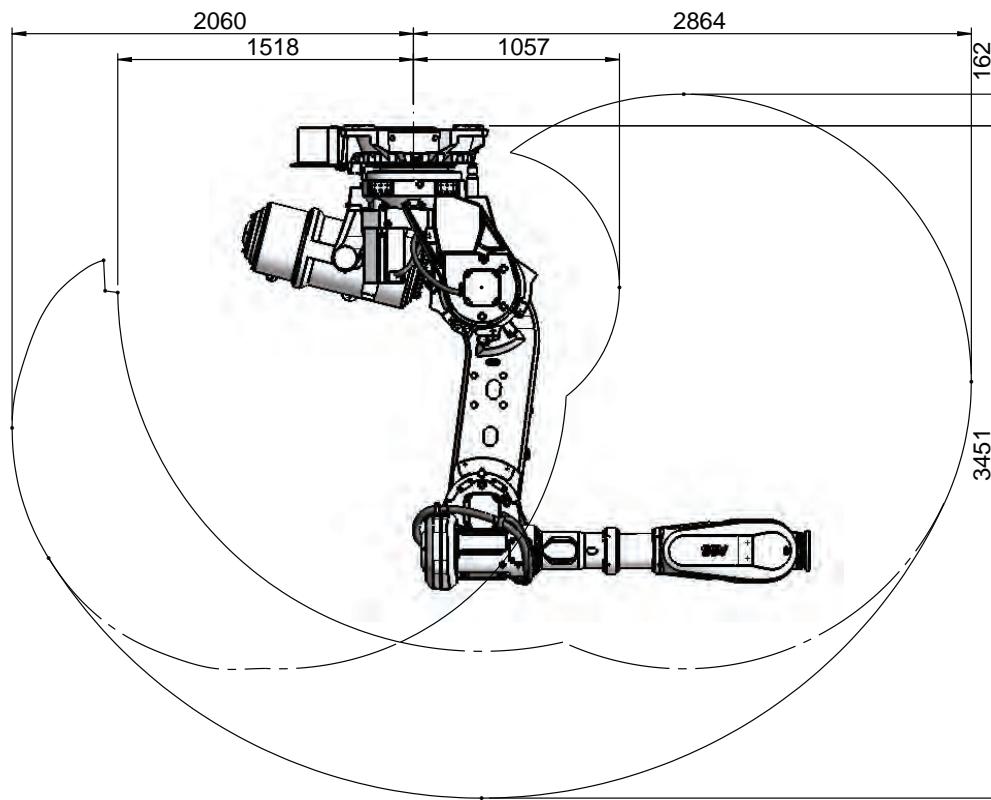
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Robot type	Handling capacity	Reach
IRB 6700Inv	300 kg	2.60 m

#### Illustration, working range IRB 6700Inv - 245/2.90

This illustration shows the unrestricted working range of the robot.



Robot type	Handling capacity	Reach
IRB 6700Inv	245 kg	2.90 m

*Continues on next page*

## 2 Installation and commissioning

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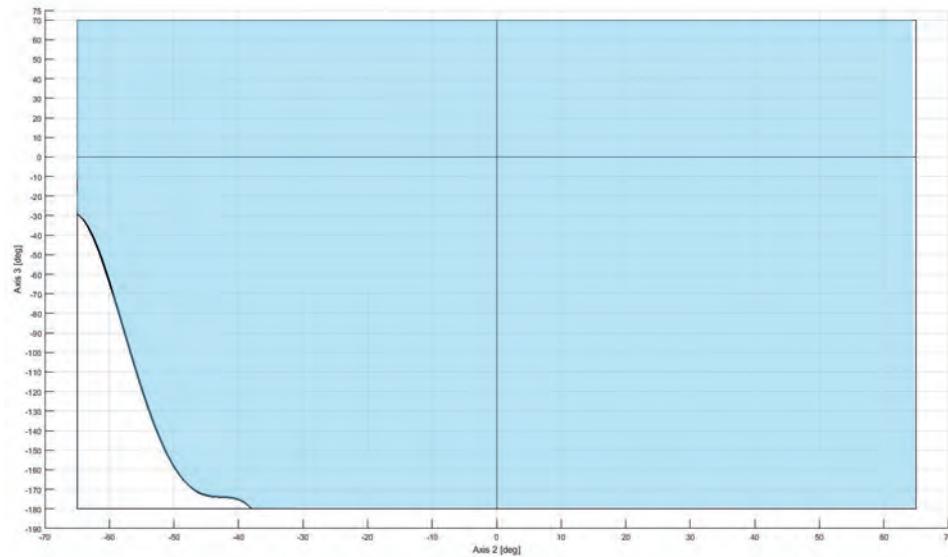
### 2.2.2 Working range

*Continued*

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#### Working range axis 2 and axis 3 for IRB 6700Inv-300/2.60 and -245/2.90

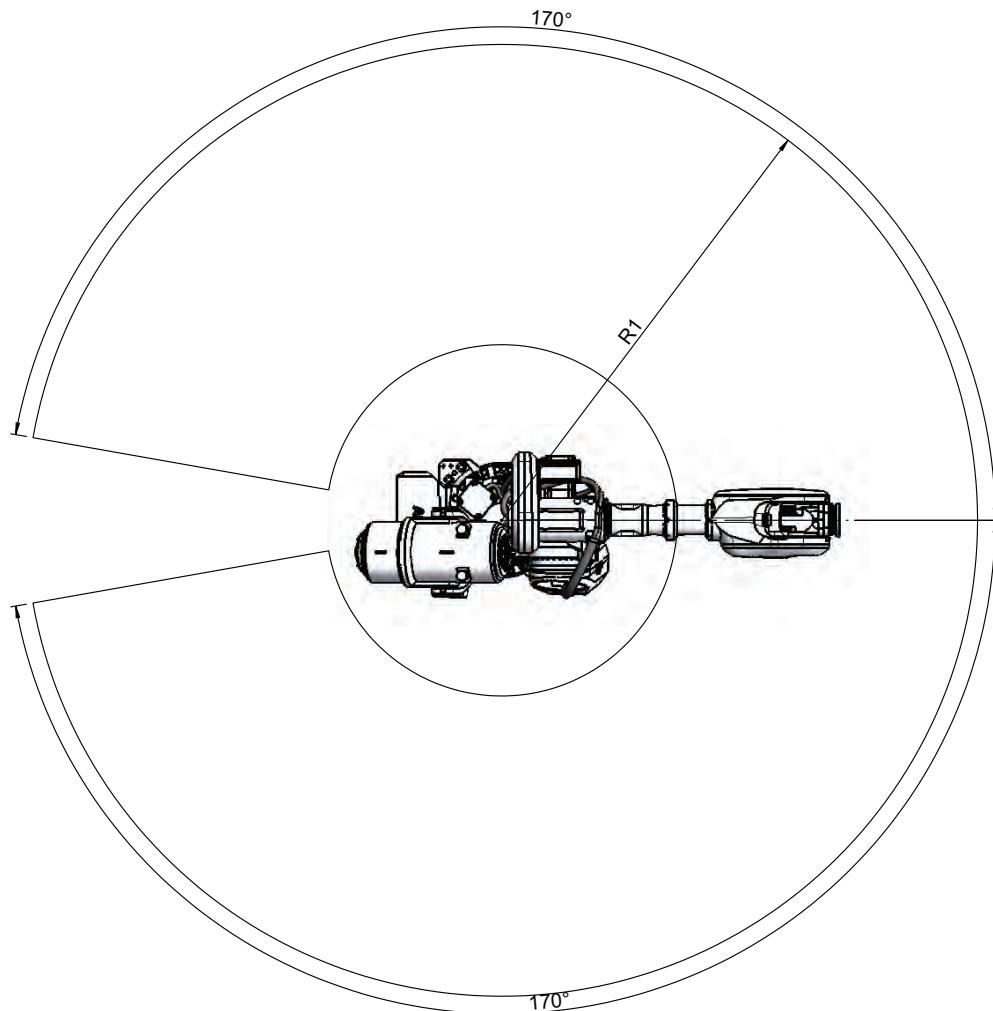
Limited in some areas to avoid collision with balancing.



xx1700000510

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#### Turning radius axis 1



xx1700000575

Robot variant	R1 (mm)
IRB 6700Inv - 300/2.60	2617
IRB 6700Inv - 245/2.90	2864

## 2 Installation and commissioning

### 2.2.3 Risk of tipping/stability

#### 2.2.3 Risk of tipping/stability

##### Risk of tipping

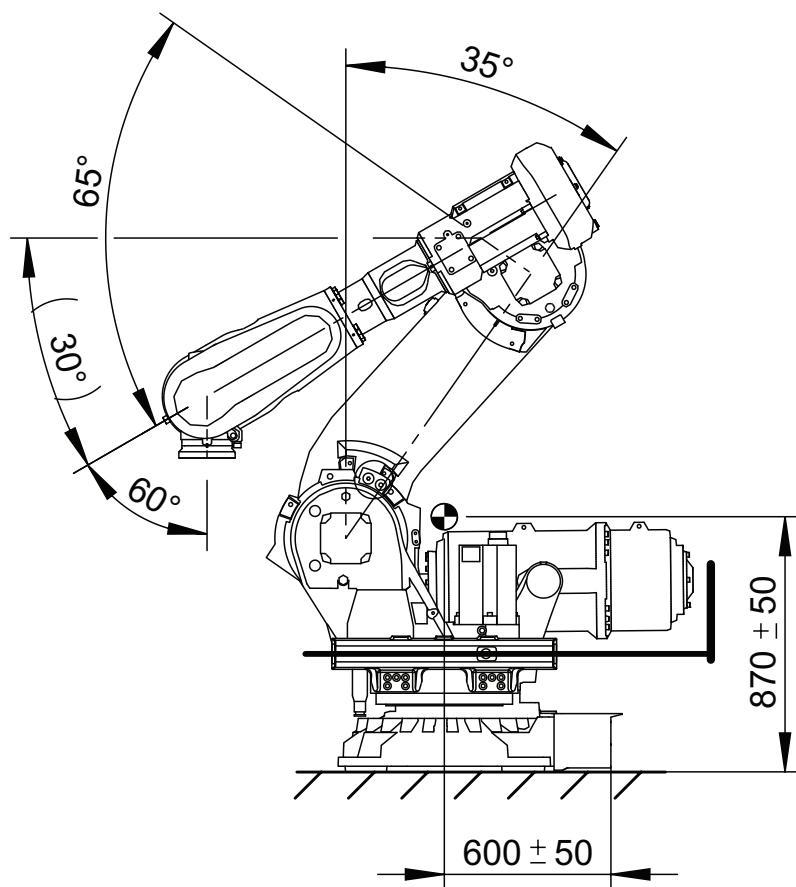
If the robot is not fastened to the foundation while moving the arm, the robot is not stable in the whole working area. Moving the arm will displace the center of gravity, which may cause the robot to tip over.

The shipping position is the most stable position.

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

##### Shipping and transportation position

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



xx1600001371

##### Transportation lock screw

The robot arm system must always be locked in a secure position during lift, transport or rotation to inverted or standing position. This is done by locking the lower arm in position with a transportation lock screw.

At delivery, the robot and the lower arm is already locked in the correct position with the transportation lock screw.

*Continues on next page*

How to use the transportation lock screw is described further in [\*Securing the robot arm position for lift, rotation and transportation on page 66.\*](#)



#### DANGER

Always use the transportation lock screw and sleeve to lock the lower arm at transportation, turning and floor standing.



#### WARNING

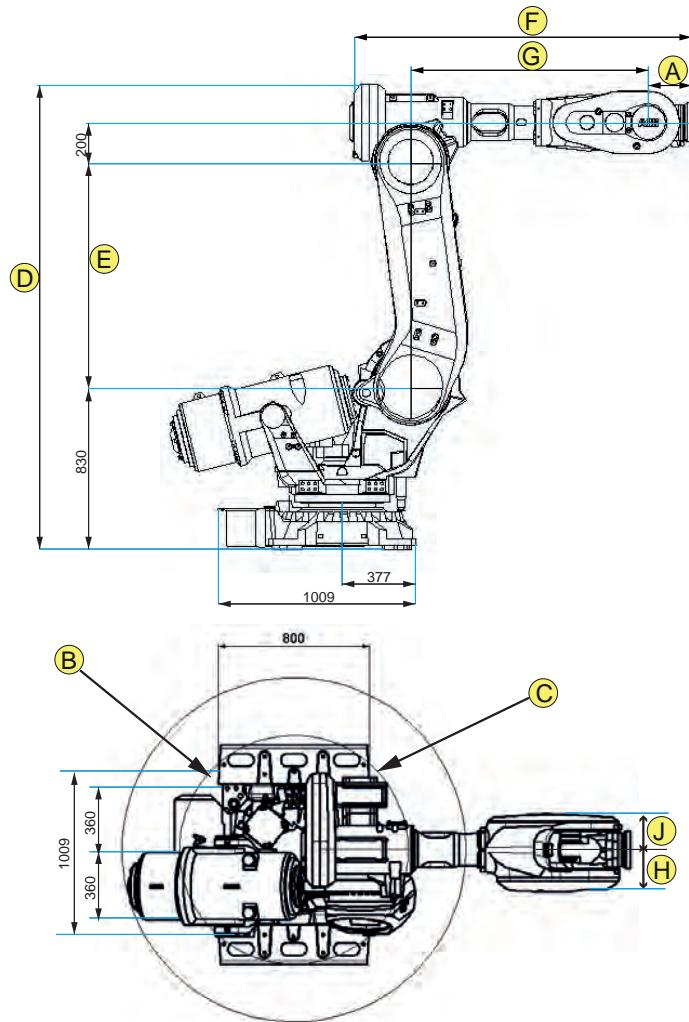
The robot is likely to be mechanically unstable if not secured to the foundation.

## 2 Installation and commissioning

### 2.2.4 Main dimensions

#### 2.2.4 Main dimensions

##### Illustration



xx1700000559

##### Dimensions for different robot variants

Pos	Description
B	Radius ax1, front = 626 mm
C	Radius ax1, back = 910 mm

Robot variant	A	A LeanID	D	E	F	F LeanID	G	H	J
IRB 6700Inv - 300/2.60	220	380	2372	1145	1718.5	1878.5	1212.5	222.5	187
IRB 6700Inv - 245/2.90	220	380	2372	1145	1968.5	2128.5	1468.5	222.5	186

## 2.3 On-site transportation

### 2.3.1 Robot transportation precautions

#### General

This section describes ABB approved transportation precautions for ABB robots.



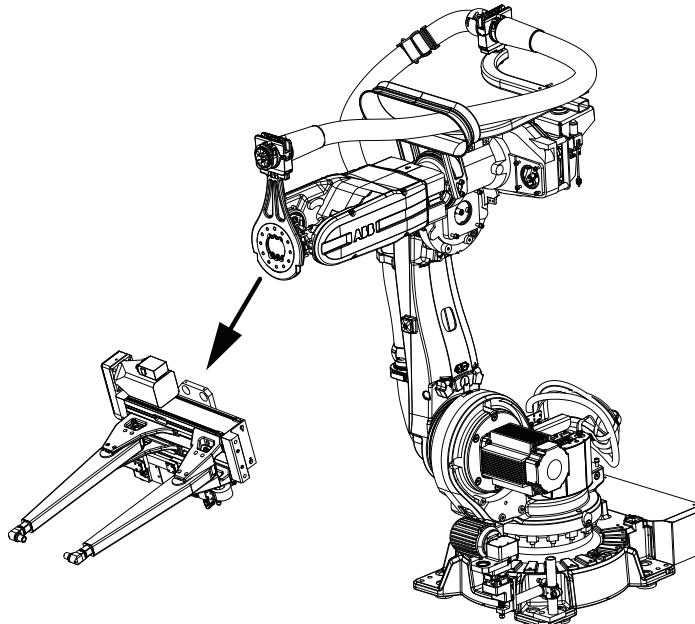
#### CAUTION

All transportation in or outside the plant, must be carried out according to the method described in this section.

Transportation in any other way can seriously damage the robot. If the robot is incorrectly transported and the instructions are not followed, the robot is not covered by the warranty and ABB will not accept any compensation claim.

#### Method 1 - recommended method

Transportation according to method 1 is strongly recommended by ABB.



xx0800000030

Always follow these instructions when transporting an ABB robot according to method 1:

- Always remove the tool before transportation of the robot.
- Always place the robot in the ABB recommended transport position, described in section [Risk of tipping/stability on page 62](#).
- Always read and follow the instructions in section [Pre-installation procedure on page 54](#)
- Always use the transportation lock screw during lifting, turning and transporting of the robot, see [Securing the robot arm position for lift, rotation and transportation on page 66](#).

## 2 Installation and commissioning

### 2.3.2 Securing the robot arm position for lift, rotation and transportation

#### 2.3.2 Securing the robot arm position for lift, rotation and transportation

##### Position of the lower arm must be secured

###### Lift, transport and rotation of the robot

The robot arm system must always be locked in a secure position during lift, transport or rotation to inverted or standing position. This is done by locking the lower arm in position with a transportation lock screw. The transportation lock screw is stored at a parking position in the robot frame, when not used. This section describes how to move the screw to the locking position in order to secure the lower arm.

At delivery, the robot and the lower arm is already locked in the correct position with the transportation lock screw.



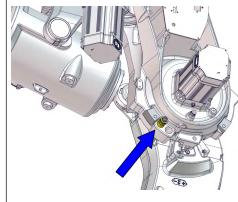
##### CAUTION

No tool is permitted to be fitted on the robot when it is lifted, transported or rotated.

###### Temporarily floor standing of the robot

Always keep the the transportation lock screw and sleeve in locked position when the robot is floor standing. During some repair activities, the transportation lock screw and sleeve is replaced with service stops. These situations are clearly stated in the current repair activities in this manual. The service stops are detailed further in [Service stops on page 195](#).

##### Required equipment

Equipment	Article number	Note	Figure
Transportation lock screw Sleeve 3HAB3409-93 Screw, M16x120 (class 12.9 or 8.8)	3HAC059728-001 xx1600002008	Used to secure the lower arm. Stored at the parking position on the robot frame.	 xx1600002009

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### 2.3.2 Securing the robot arm position for lift, rotation and transportation

*Continued*

#### Securing the lower arm

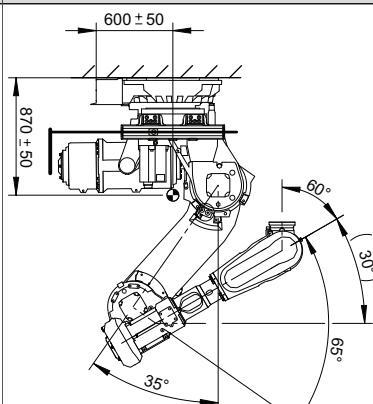
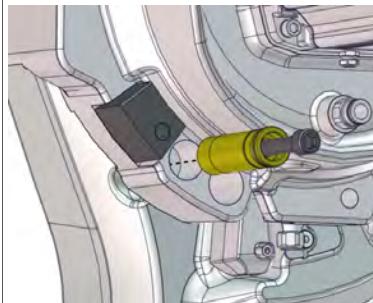
Use this procedure to secure the lower arm in order to prevent it from moving if the point of gravity is shifted in the mechanical structure of the robot during lifting, transporting or rotation of the robot.

#### Preparations before securing the lower arm

	Action	Note
1	<p>Remove any tools fitted on the axis-6 turning disc of the robot.</p> <p><b>!</b> <b>CAUTION</b></p> <p>No tool is permitted to be fitted on the robot when it is lifted, transported or rotated.</p>	

#### Securing the lower arm

Use this procedure to secure the lower arm before lifting down the robot from inverted position.

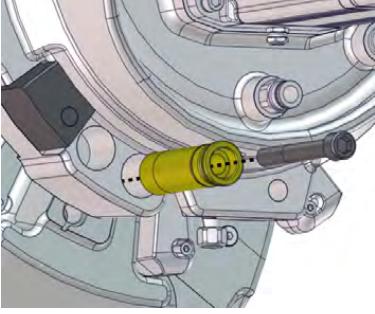
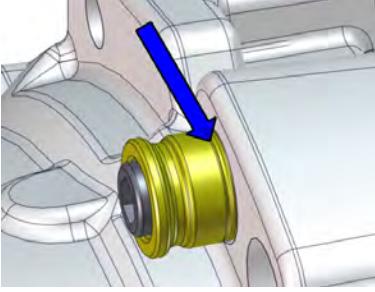
	Action	Note
1	<p>Jog the robot into position:</p> <ul style="list-style-type: none"> <li>• Axis 1: 0°</li> <li>• Axis 2: -35°</li> <li>• Axis 3: +65°</li> <li>• Axis 4: 0°</li> <li>• Axis 5: +60°</li> <li>• Axis 6: no significance</li> </ul>	 xx1700000555
2	Remove the transportation lock screw and the yellow sleeve from the parking position.	 xx1700000270

*Continues on next page*

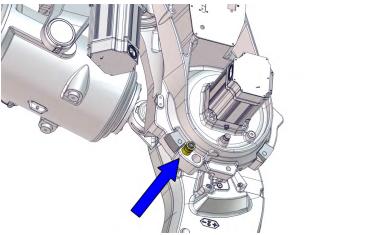
## 2 Installation and commissioning

### 2.3.2 Securing the robot arm position for lift, rotation and transportation

*Continued*

Action	Note
<p>3 Insert the yellow sleeve and the transportation lock screw in the hole at the locking position. Insert the sleeve all the way so that the marking in the sleeve is aligned with the casting, see figure. Tighten the screw.</p> <p> <b>DANGER</b></p> <p>Always use the transportation lock screw and sleeve to lock the lower arm at transportation, turning and floor standing.</p>	<p>Tightening torque: 70 Nm ±15 Nm.</p>  <p>xx1700000269</p>  <p>xx1600002114</p>

#### Storing the transportation lock screw when not in use

Action	Note
1 Keep the transportation lock screw stored in the parking position when not in use.	 <p>xx1600002008</p>

## 2.4 On-site installation

### 2.4.1 Lifting the robot with fork lift

#### Lifting methods

The robot may be lifted and transported using a fork lift, provided that available special aids are used. Also follow the recommendations given in [Robot transportation precautions on page 65](#).

For rotation of the robot to an inverted position, the fork lift accessory must be used together with a special turning tool or a fork lift truck with a rotator attachment.

This section specifies available special aids and references to valid user documentation for the lifting accessories.

#### Required tools and equipment

Equipment	Article number	Note
Fork lift accessory set	3HAC058825-001	Contains fork lift pockets and all required hardware for installation. User instructions are enclosed with the tool, see Directions for use - Fork lift accessory for IRB 6700Inv. In order to rotate the robot, either use the turning tool or a fork lift truck with a rotator attachment.
Turning tool	3HAC061162-001	User instructions are enclosed.

#### Required documents

Document	Document number
Directions for use - Fork lift accessory for IRB 6700Inv	3HAC060303
User instructions for turning tool (enclosed with the turning tool)	-

#### Lifting the robot

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

## 2 Installation and commissioning

### 2.4.2 Lifting the robot with roundslings

#### 2.4.2 Lifting the robot with roundslings

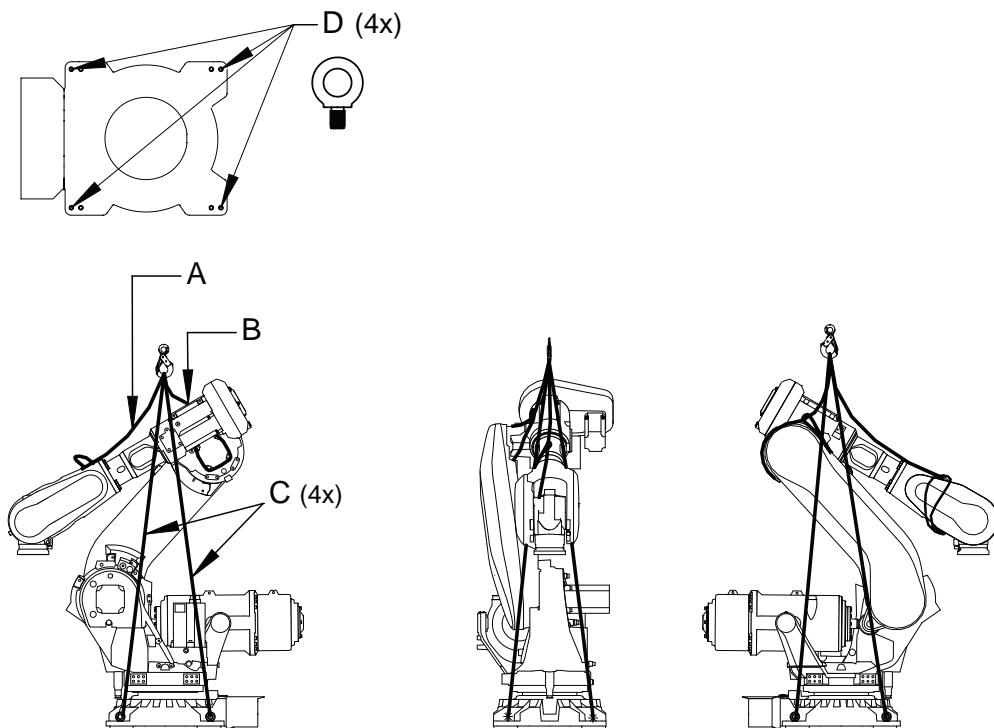
##### Roundslings used for lifting and transporting

The robot can be lifted and transported using roundslings according to this section.

For rotation of the robot to an inverted position, a fork lift accessory must be used together with a special turning tool or a fork lift truck with a rotator attachment.

See [Lifting the robot with fork lift on page 69](#).

##### Attaching the roundslings



Variant	Length A (1 pc) Do not strain!	Length B (1 pc) Do not strain!
IRB 6700Inv - 300/2.60	Roundsling, 2.5 m	Roundsling, 2.5 m
IRB 6700Inv - 245/2.90	Roundsling, 2.5 m	Roundsling, 2.5 m
C	Roundsling, 2.5 m (4 pcs)	
D	Lifting eye, M20 (4 pcs)	

##### Required equipment

See quantity of roundslings in figure [Attaching the roundslings on page 70](#).

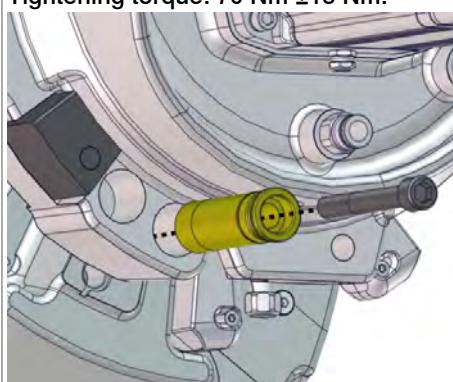
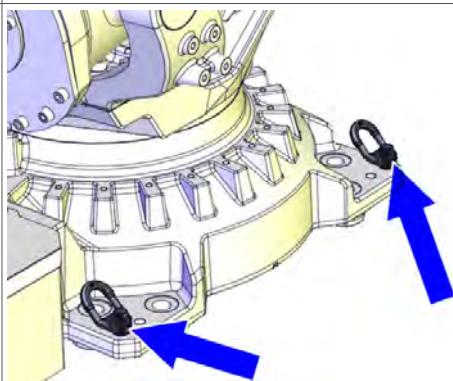
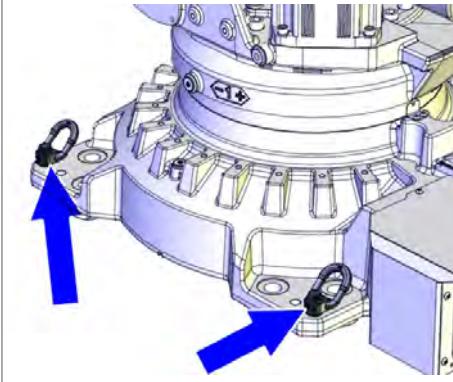
Equipment, etc.	Article number	Note
Overhead crane	-	
Lifting eye, M20	-	Working load limit: 2,000 kg.
Roundsling, 2.5 m	-	Lifting capacity: 2,000 kg.

Continues on next page

#### Lifting the robot with roundslings

Use this procedure to lift the robot with roundslings.

#### Lifting the robot with roundslings

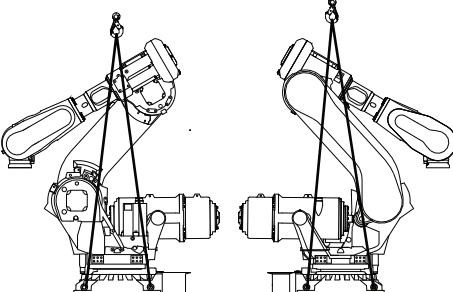
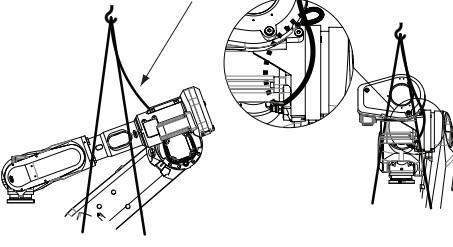
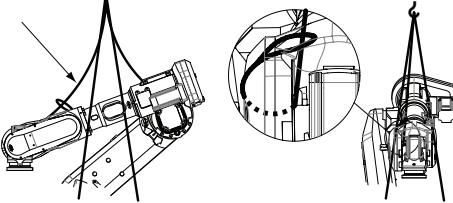
	Action	Note
1	Verify that the lower arm is secured with the transportation lock screw in the locking position.	 xx1700000269 <p><i>See Securing the robot arm position for lift, rotation and transportation on page 66.</i></p>
2	Fit lifting eyes to the outer holes on each corner of the base.	 xx1200001301  xx1200001302

*Continues on next page*

## 2 Installation and commissioning

### 2.4.2 Lifting the robot with roundslings

*Continued*

Action	Note
<p>3 Run roundslings through the lifting eyes and fasten them in an overhead crane.</p> <p><b>CAUTION</b> If the lifting eyes have sharp edges that might damage the roundslings, lifting shackles must be used to attach the roundslings to the lifting eyes.</p>	<p>Make sure the roundslings do not rub against any sharp edges. Roundsling, 2.5 m (4 pcs)</p>  <p>xx1600001374</p>
<p>4 Attach a securing roundsling at the rear according to figure.</p> <p><b>Note</b> The securing sling must not be strained at lifting. It only secures for tipping.</p>	<p>Length for the roundsling is given in the table <a href="#">Attaching the roundslings on page 70</a>.</p>  <p>xx1300001573</p>
<p>5 Attach a securing roundsling at the front according to figure.</p> <p><b>Note</b> The securing sling must not be strained at lifting. It only secures for tipping.</p>	<p>Length for the roundsling is given in the table <a href="#">Attaching the roundslings on page 70</a>.</p>  <p>xx1300001574</p>
<p>6 <b>CAUTION</b> The IRB 6700Inv robot weighs 1,750 kg. All lifting accessories used must be sized accordingly!</p>	
<p>7 <b>WARNING</b> Personnel must not, under any circumstances, be present under the suspended load!</p>	

*Continues on next page*

	Action	Note
8	<p>Raise the overhead crane to lift the robot.</p> <p> <b>CAUTION</b></p> <p>Make sure that the roundsling running from the front, left corner is positioned on the correct side of the brake release unit plate when stretching the roundslings with the crane.</p>	

## 2 Installation and commissioning

### 2.4.3 Orienting, rotating and securing the robot

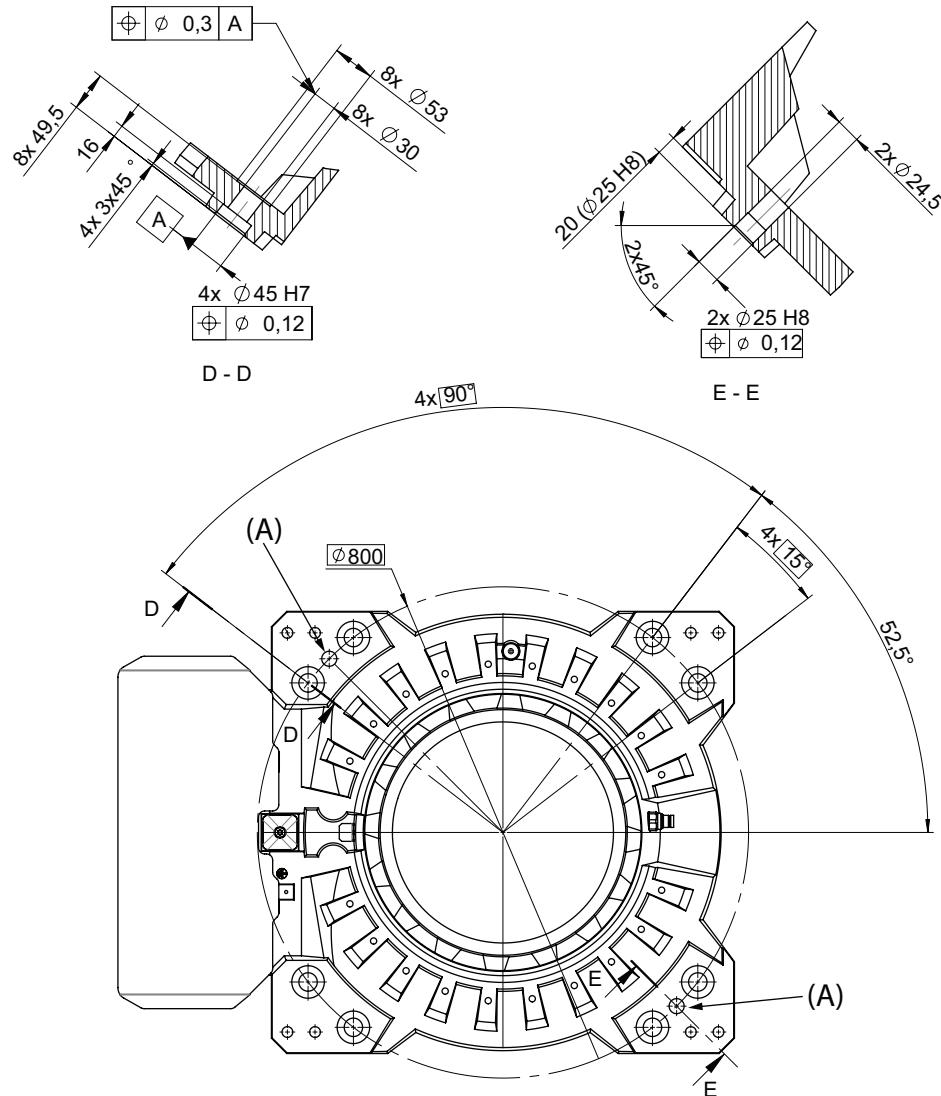
#### 2.4.3 Orienting, rotating and securing the robot

##### General

This section details how to orient and secure the robot to the installation site in order to run the robot safely.

##### Hole configuration, base

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



xx1300000243

Pos	Description
A	Holes for guide pins (x2)

Continues on next page

#### Attachment screws

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

Suitable screws, lightly lubricated	M24x100
Quantity	8 pcs
Quality	8.8
Screw tightening yield point utilization factor (v) (according to VDI2230)	90% (v=0.9)
Suitable washer	4 mm flat washer
Tightening torque	550 Nm (screws lubricated with Molykote 1000) 600-725 Nm, typical 650 Nm (screws none or lightly lubricated)

#### Required tools and equipment

Equipment	Article number	Note
Fork lift accessory set	3HAC058825-001	Contains fork lift pockets and all required hardware for installation. User instructions are enclosed with the tool, see Directions for use - Fork lift accessory for IRB 6700Inv. In order to rotate the robot, either use the turning tool or a fork lift truck with a rotator attachment.
Turning tool	3HAC061162-001	User instructions are enclosed.

#### Required documents

Document	Document number
Directions for use - Fork lift accessory for IRB 6700Inv	3HAC060303
User instructions for turning tool (enclosed with the turning tool)	-

#### Securing the robot

Use this procedure to secure the robot to the foundation.

#### Preparations of the installation site

	Action	Note
1	Make sure the foundation conforms to all requirements stated in <a href="#">Pre-installation procedure on page 54</a> .	
2	Prepare the installation site. The foundation surface must be clean and unpainted.	See <a href="#">Hole configuration, base on page 74</a> and <a href="#">Attachment screws on page 75</a> .

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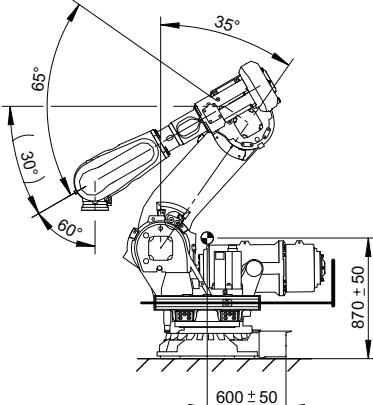
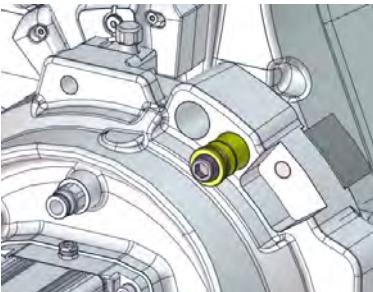
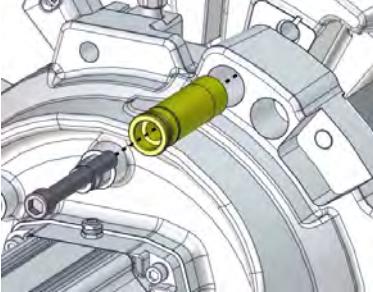
## 2 Installation and commissioning

### 2.4.3 Orienting, rotating and securing the robot

*Continued*

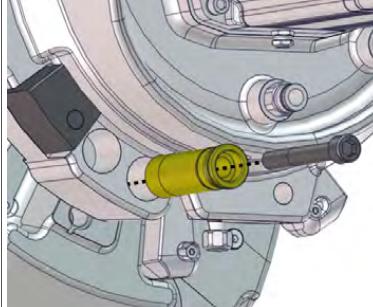
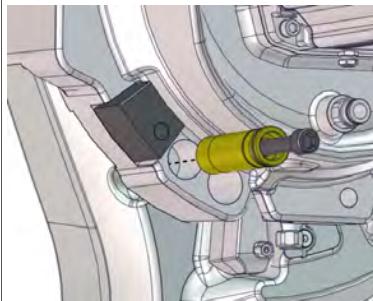
#### Securing the lower arm

Use this procedure to secure the lower arm before lifting the robot to inverted position.

Action	Note
1 Verify that the robot stands in position: <ul style="list-style-type: none"> <li>• 0°</li> <li>• -35°</li> <li>• +65°</li> <li>• 0°</li> <li>• +60°</li> <li>• no significance</li> </ul>	 xx1600001371
2 Remove the transportation lock screw and the yellow sleeve from the parking position.	 xx1700000348
3 Insert the yellow sleeve and the transportation lock screw in the hole at the locking position. Insert the sleeve all the way so that the marking in the sleeve is aligned with the casting, see figure. Tighten the screw. <div style="text-align: center;">  <b>DANGER</b> </div> <p>Always use the transportation lock screw and sleeve to lock the lower arm at transportation, turning and floor standing.</p>	<b>Tightening torque: 70 Nm ±15 Nm</b>  xx1700000347

*Continues on next page*

#### Orienting and securing the robot

	Action	Note
1	Lift the robot using the fork lift accessory.	See user instructions enclosed with the fork lift accessory.
2	Move the robot close to its installation location.	
3	Rotate the robot into inverted position using the turning tool or using a fork lift truck with a rotator attachment.   <b>DANGER</b>  Make sure that there is enough space underneath the robot. See user instructions for the turning tool.	See user instructions enclosed with the turning tool.
4	Guide the robot using two M24 screws while lifting it into its mounting position.	
5	Fit the bolts and washers in the base attachment holes.   <b>Note</b>  Lightly lubricate screws before assembly.	Specified in <a href="#">Attachment screws on page 75</a>
6	Tighten bolts in a crosswise pattern to ensure that the base is not distorted.	
7	Remove the yellow sleeve and transportation lock screw from the transportation and turning position.	 xx1700000269
8	Fasten the yellow sleeve and transportation lock screw in its parking position.	 xx1700000270

## 2 Installation and commissioning

### 2.4.4 Manually releasing the brakes

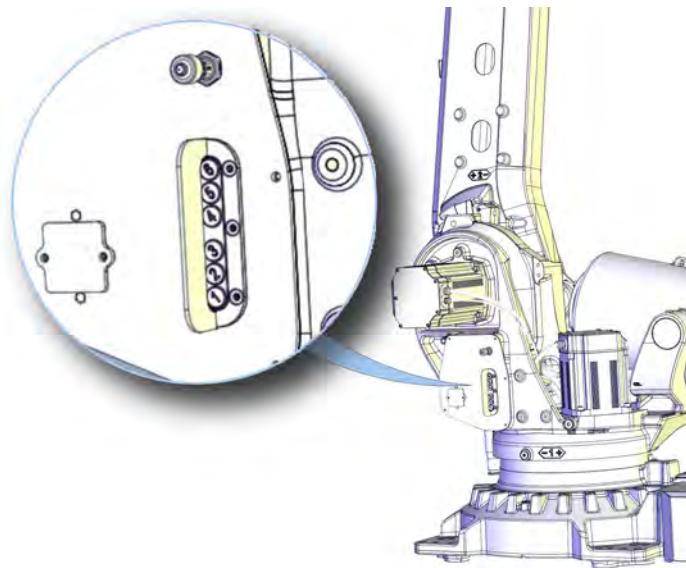
#### 2.4.4 Manually releasing the brakes

##### Introduction to manually releasing the brakes

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

##### Location of brake release unit

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



xx1200000964

##### Releasing the brakes

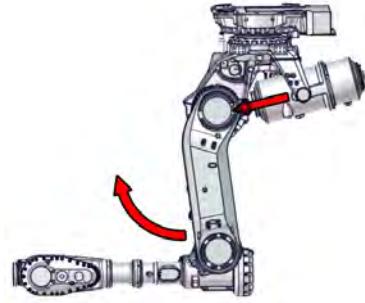
This procedure details how to release the holding brakes when the robot is equipped with an internal brake release unit.

Action	Note
1 The internal brake release unit is equipped with buttons for controlling the axes brakes. The buttons are numbered according to the numbers of the axes. If the robot is not connected to the controller, power must be supplied to the connector R1.MP according to the section <a href="#">Supplying power to connector R1.MP on page 79</a> .	Buttons are shown in figure <a href="#">Location of brake release unit on page 78</a> .

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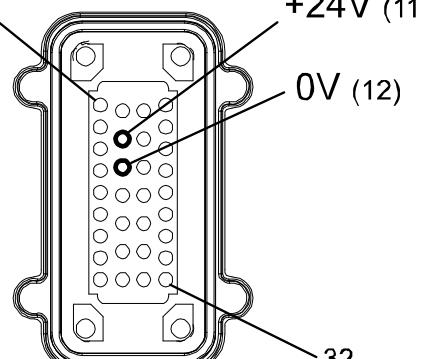
### 2.4.4 Manually releasing the brakes

*Continued*

Action	Note
<p>2</p> <p> <b>DANGER</b></p> <p>When releasing the holding brakes, the robot axes may move very quickly and sometimes in unexpected ways.</p> <p>Release of the axis-2 motor holding brakes can cause the axis 2 to move in opposite direction in regard to gravity, due to the pushing force from the balancing device. Current arm load and position of the lower and upper arm determines the occurring movement when releasing the holding brakes of the axis-2 motor.</p> <p>Make sure no personnel is near or beneath the robot arm.</p>	<p>In the example below, with no arm load and in synchronization position, the pushing force from the balancing device will cause the lower and upper arm to move forwards/upwards, when the brakes of the axis-2 motor are released.</p>  <p>xx1700000522</p>
<p>3</p> <p>Release the holding brake on a particular robot axis by pressing the corresponding button on the internal brake release unit.</p> <p>The brake will function again as soon as the button is released.</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
<p>1</p> <p> <b>DANGER</b></p> <p>Incorrect connections, such as supplying power to the wrong pin, may cause all brakes to be released simultaneously!</p>	
<p>2</p> <p>Supply 0V on pin 12 and 24V on pin 11.</p>	 <p>xx0600002937</p>

## **2 Installation and commissioning**

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

---

#### **General**

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



#### **CAUTION**

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

---

#### **References**

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

- *Operating manual - IRC5 with FlexPendant*

---

#### **Stopping time and braking distances**

The performance of the motor brake depends on if there are any loads attached to the robot. For more information, see product specification for the robot.

## 2.4.6 Fitting equipment to the robot

### General

Extra loads can be fitted on the upper arm housing, the lower arm, and on the frame. Definitions of distances and masses are shown in the following figures. The robot is supplied with holes for fitting extra equipment (see figure in [Holes for fitting extra equipment on page 84](#)). Maximum allowed arm load depends on center of gravity of arm load and robot payload.



#### Note

All equipment and cables used on the robot, must be designed and fitted not to damage the robot and/or its parts.

### Frame (hip load)

Extra load can be fitted on the frame.

	Description
Permitted extra load on frame	$J_H = 100 \text{ kgm}^2$
Recommended position (see the following figure)	$J_H = J_{H0} + M_4 \times R^2$ where: <ul style="list-style-type: none"><li>• <math>J_{H0}</math> is the moment of inertia of the equipment</li><li>• <math>R</math> is the radius (m) from the center of axis 1</li><li>• <math>M_4</math> is the total mass (kg) of the equipment including bracket and harness (<math>\leq 250 \text{ kg}</math>)</li></ul>

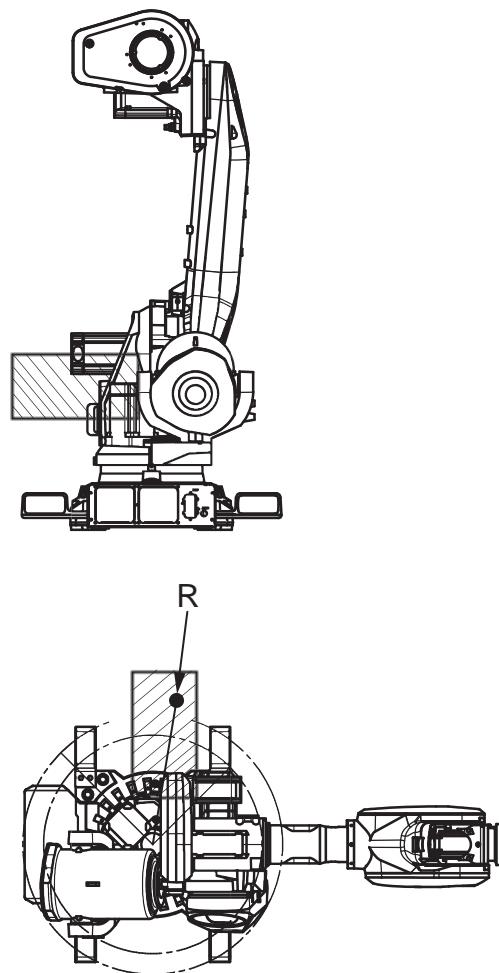
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## 2 Installation and commissioning

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### 2.4.6 Fitting equipment to the robot

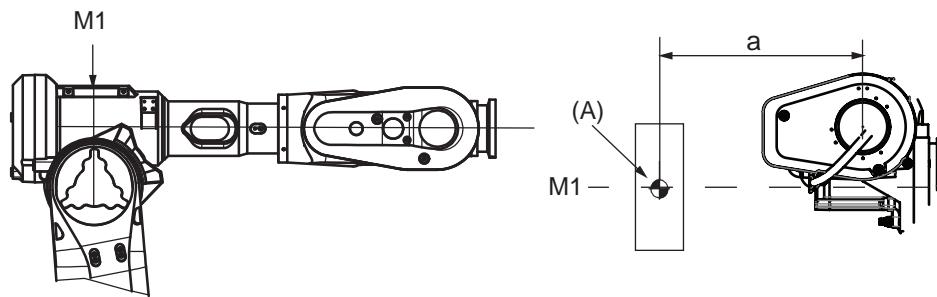
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#### Upper arm

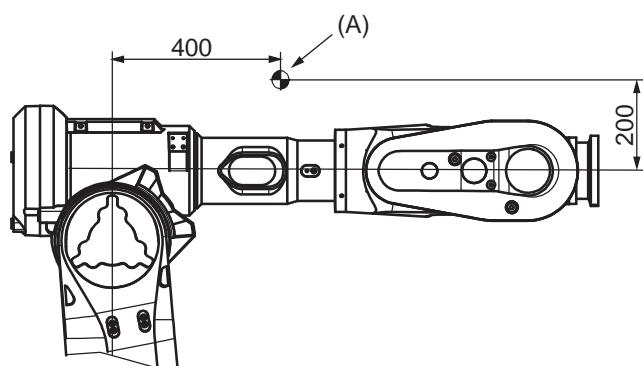
Allowed extra load on the upper arm housing, in addition to the maximum handling weight, is  $M_1 \leq 50$  kg with a distance  $(a) \leq 500$  mm from the center of gravity in the axis-3 extension.



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A	Mass center
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xx1300000866

A	Center of gravity 50 kg
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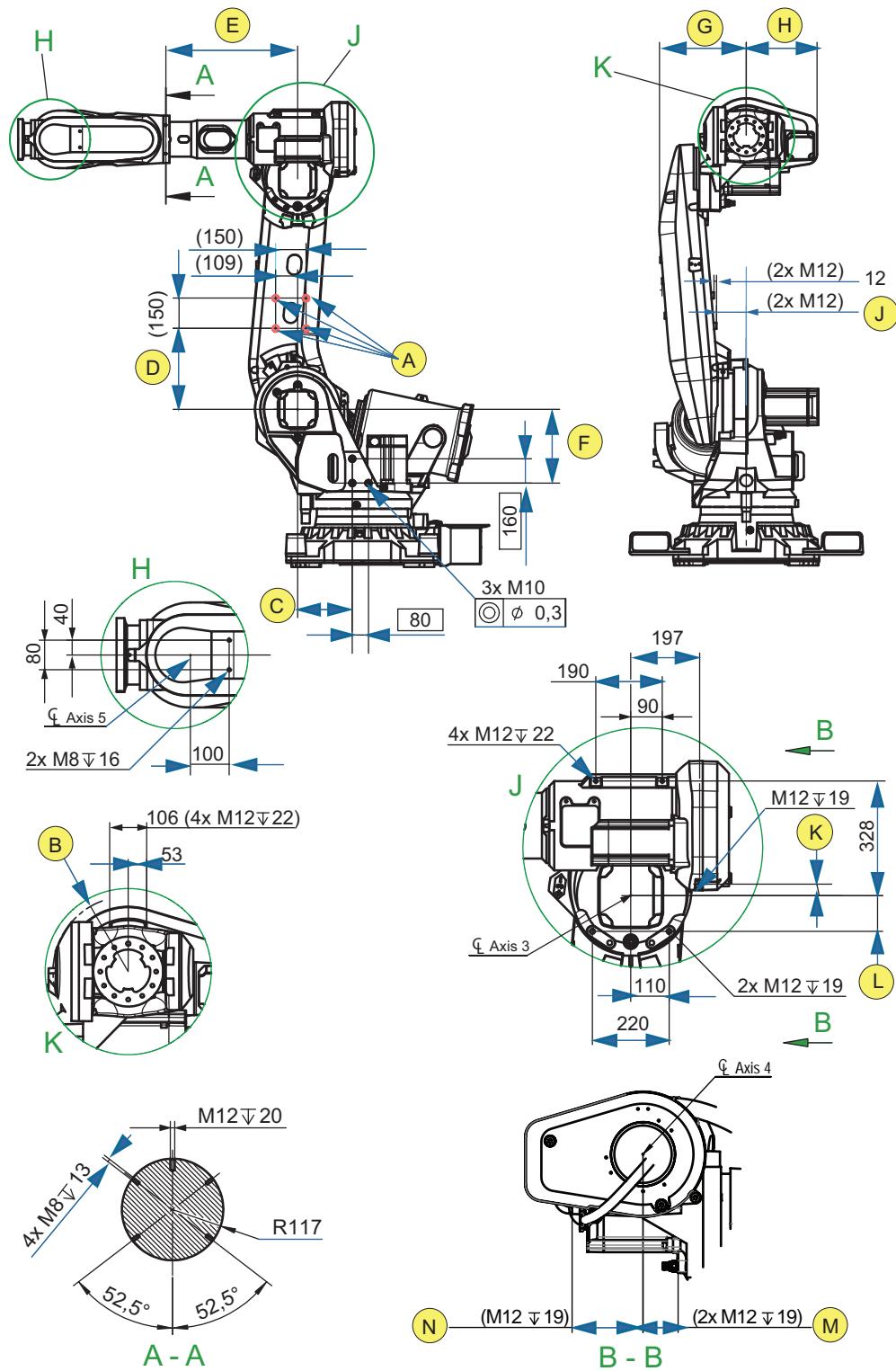
## **2 Installation and commissioning**

#### 2.4.6 Fitting equipment to the robot

*Continued*

#### **Holes for fitting extra equipment**

## Position of attachment holes - drawing 1



xx1300000263

**A** Allowed position for attachment holes, M12 through. Be careful not to touch the cables when drilling.

*Continues on next page*

## **2 Installation and commissioning**

### **2.4.6 Fitting equipment to the robot**

*Continued*

<b>Variant</b>	<b>B<sup>i</sup></b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>	<b>J</b>	<b>K</b>	<b>L</b>	<b>M</b>	<b>N</b>
IRB 6700Inv - 300/2.60	R=230	310	450	652.5	376	467	405	152	12	117	98.5	215.5
IRB 6700Inv - 245/2.90	R=230	310	450	652.5	376	467	405	152	12	117	98.5	215.5

<sup>i</sup> Smallest circumscribed radius axis-4.

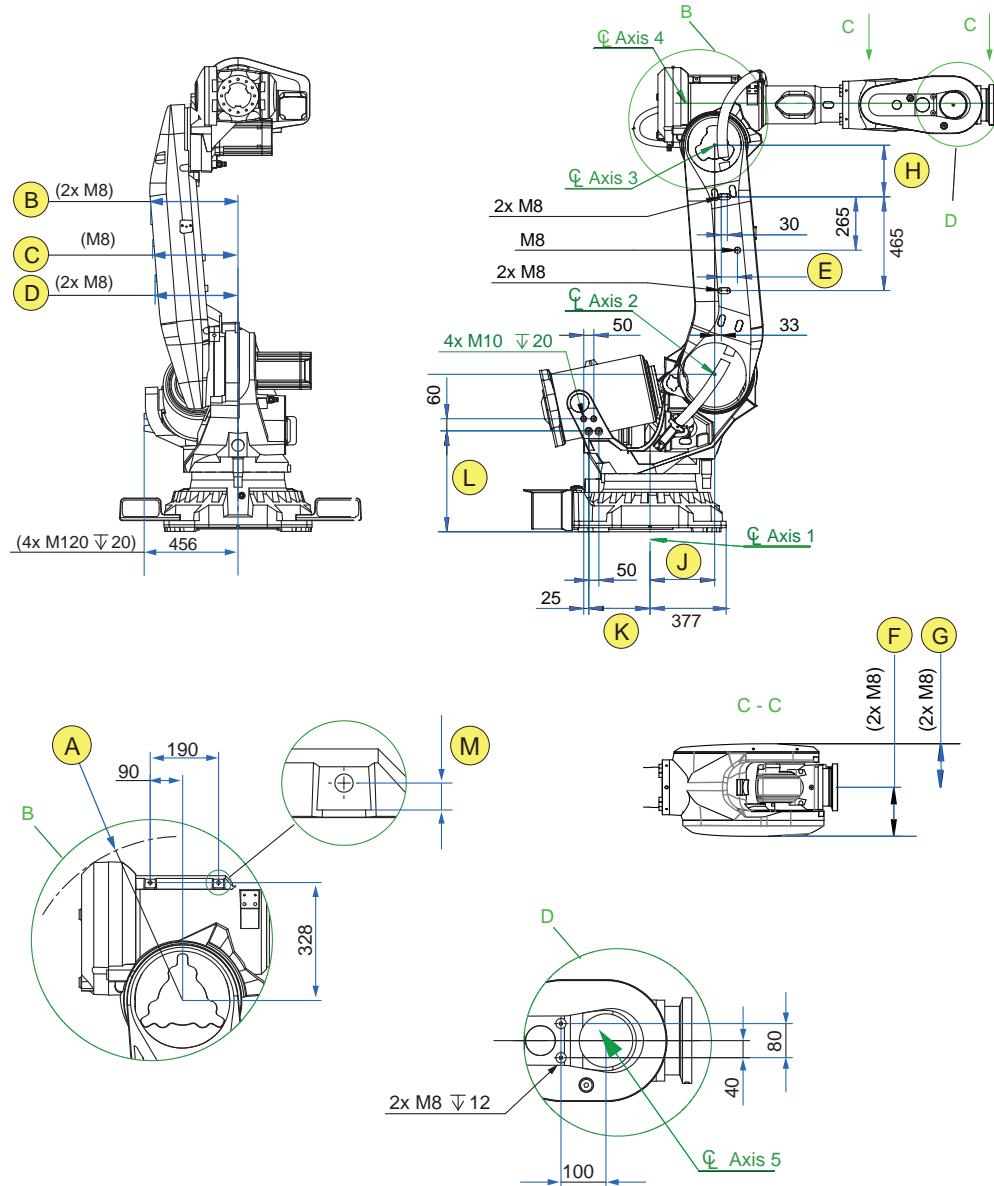
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## 2 Installation and commissioning

### 2.4.6 Fitting equipment to the robot

*Continued*

Position of attachment holes - drawing 2



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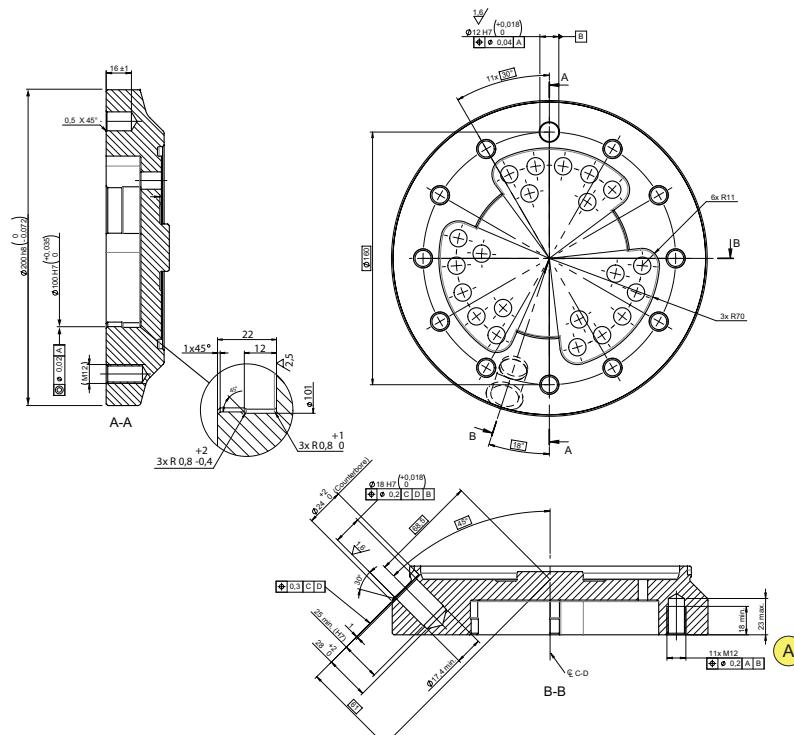
Variant	A <sup>i</sup>	B	C	D	E	F	G	H	J	K	L	M
IRB 6700Inv - 300/2.60	R=468	453	438	423	80	222.5	187	265	350	273.5	523.5	15
IRB 6700Inv - 245/2.90	R=468	453	438	423	80	222.5	187	265	350	273.5	523.5	15

<sup>i</sup> Smallest circumscribed radius axis-3.

*Continues on next page*

#### Tool flange, standard

Below is the standard tool flange. The guide pin hole is, in calibration position, pointing upwards in Z-direction.



xx1300000280

A	Thread length: 18 mm.
---	-----------------------

#### Fastener quality

Use suitable screws and tightening torque for your application, screws with quality class 12.9 are recommended.

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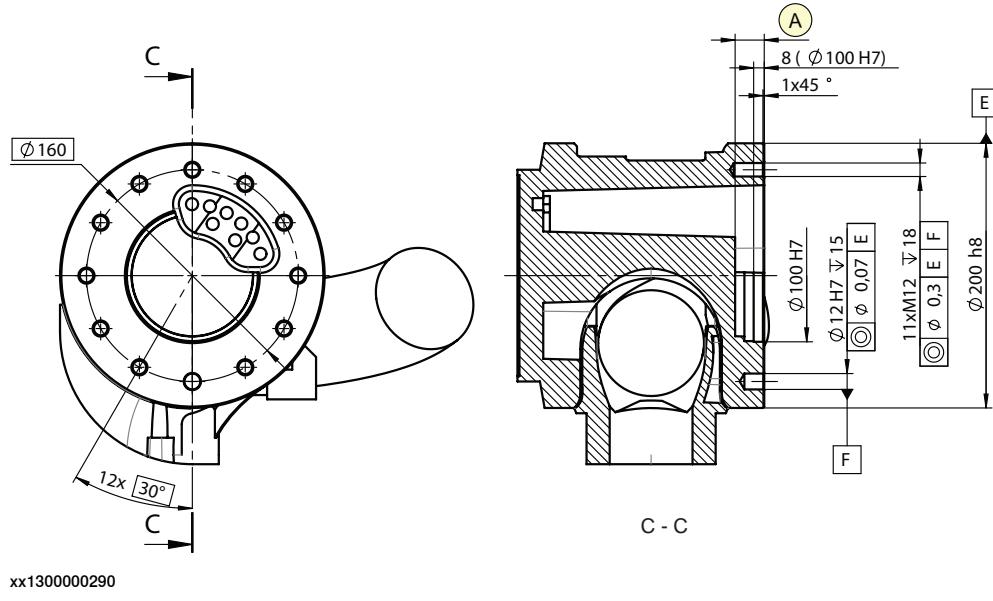
## 2 Installation and commissioning

### 2.4.6 Fitting equipment to the robot

*Continued*

#### Tool flange, LeanID

Below is the tool flange for option 780-4, LeanID. The guide pin hole is, in calibration position, pointing upwards in Z-direction.



A	Thread length: 18 mm.
---	-----------------------

#### Fastener quality

Use suitable screws and tightening torque for your application, screws with quality class 12.9 are recommended.

## 2.5 Restricting the working range

### 2.5.1 Axes with restricted working range

#### General

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

The working range of the following axes may be restricted:

- Axis 1, hardware (mechanical stop) and software.
- Axis 2, software.
- Axis 3, software.

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



#### Note

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

#### Service stops for axis 2

There are service stops available for restricting the movement of axis 2 during floor standing service activities. Never use these service stops as mechanical stops for restriction of the working range during operation. See [Service stops on page 195](#).

## 2 Installation and commissioning

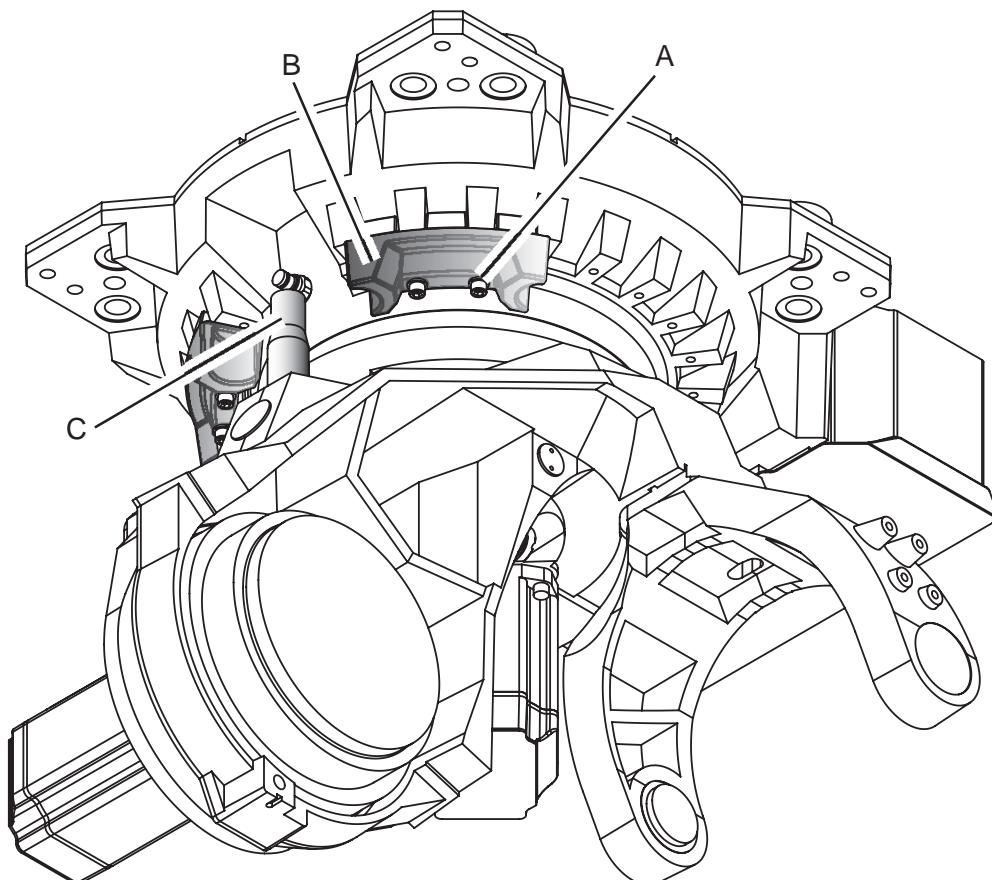
### 2.5.2 Mechanically restricting the working range of axis 1

#### General

The working range of axis 1 is limited by fixed mechanical stops and adjustment of the system parameter configuration. The working range can be reduced by adding additional mechanical stops giving 15° graduation, between ±5° and ±125° in both directions.

#### Mechanical stops, axis 1

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



xx1600002066

A	Attachment screws M12x70 quality 12.9 Gleitmo 603 (2 pcs per additional mechanical stop)
B	Movable mechanical stop
C	Mechanical stop pin axis-1

#### Required equipment

Equipment, etc.	Article number	Note
Movable mechanical stop set, axis 1 (15°).	3HAC048533-003	Includes attachment screws and an assembly drawing.

*Continues on next page*

### 2.5.2 Mechanically restricting the working range of axis 1

*Continued*

Equipment, etc.	Article number	Note
Standard toolkit	-	
<i>Technical reference manual - System parameters</i>	-	Article number is specified in section <a href="#">References on page 10</a> .

#### Installation, mechanical stops axis 1

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

	Action	Note
1	 <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	Fit the additional mechanical stop to the frame according to the figure <a href="#">Mechanical stops, axis 1 on page 90</a> .	Tightening torque: 120 Nm.
3	Adjust the software working range limitations (system parameter configuration) to correspond to the mechanical limitations.	The system parameters that must be changed ( <i>Upper joint bound</i> and <i>Lower joint bound</i> ) are described in <i>Technical reference manual - System parameters</i> .
4	 <b>WARNING</b> If the mechanical stop pin is deformed after a hard collision, it must be replaced! <i>Deformed movable stops and/or additional stops as well as deformed attachment screws</i> must also be replaced after a hard collision.	

## 2 Installation and commissioning

### 2.6.1 Robot cabling and connection points

## 2.6 Electrical connections

### 2.6.1 Robot cabling and connection points

#### Introduction

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

#### Main cable categories

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

Cable category	Description
Robot cables	Handles power supply to and control of the robot's motors as well as feedback from the serial measurement board.
Customer cables (option)	Handles communication with equipment fitted on the robot by the customer, low voltage signals and high voltage power supply + protective ground. The customer cables also handle databus communication. See the product manual for the controller, see document number in <a href="#">References on page 10</a> .

#### Robot cables

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

Cable sub-category	Description	Connection point, cabinet	Connection point, robot
Robot cable, power	Transfers drive power from the drive units in the control cabinet to the robot motors.	XS1	R1.MP
Robot cable, signals	Transfers resolver data from and power supply to the serial measurement board.	XS2	R1.SMB

#### Robot cable, power

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

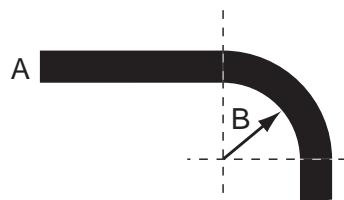
#### Robot cable, signals

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

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#### Bending radius for static floor cables

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

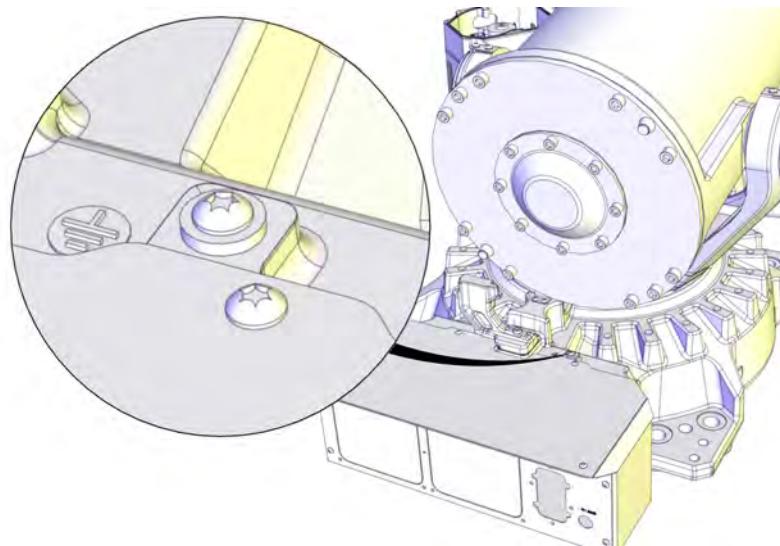


xx1600002016

A	Diameter
B	Diameter x10

#### 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.



xx1500001600

## **2 Installation and commissioning**

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### **2.7.1 Installing the signal lamp (option)**

## **2.7 Installation of options**

### **2.7.1 Installing the signal lamp (option)**

---

#### **Signal lamp**

See the assembly instruction delivered with the signal lamp.

# 3 Maintenance

## 3.1 Introduction

### Structure of this chapter

This chapter describes all the maintenance activities recommended for the IRB 6700Inv.

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

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

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

### Safety information

Observe all safety information before conducting any service work!

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



#### Note

If the IRB 6700Inv is connected to power, always make sure that the IRB 6700Inv is connected to protective earth before starting any maintenance work!

For more information see:

- *Product manual - IRC5*

## **3 Maintenance**

---

### **3.2.1 Specification of maintenance intervals**

## **3.2 Maintenance schedule and expected component life**

### **3.2.1 Specification of maintenance intervals**

---

#### **Introduction**

The intervals are specified in different ways depending on the type of maintenance activity to be carried out and the working conditions of the IRB 6700Inv:

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

## 3.2.2 Maintenance schedule

### Scheduled and non-predictable maintenance

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

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

### Life of each component

The inspection intervals *do not* specify the life of each component. Values for these are specified in the section [Expected component life on page 99](#)

### Activities and intervals, standard equipment

The table below specifies the required maintenance activities and intervals:

Maintenance activities	Regularly	Every 12 months	Every 36 months	Every 12,000 hours <sup>i</sup>	Every 20,000 hours <sup>i</sup>	Every 40,000 hours <sup>i</sup>	Reference
<b>Cleaning activities</b>							
Cleaning the robot	x						<a href="#">Cleaning the IRB 6700Inv on page 186</a>
<b>Inspection activities</b>							
Inspecting the motor seal		x					<a href="#">Inspecting the motor seal on page 100</a>
Inspecting the oil level in gearboxes							Inspect the oil level in the actual gearbox if there is a suspected leakage, after an oil change or a maintenance or repair activity where draining and filling oil is required.
Inspecting the balancing device		x					<a href="#">Inspecting the balancing device on page 123</a>
Inspecting the robot harness		x <sup>ii</sup>					<a href="#">Inspecting the cable harness on page 127</a>
Inspecting the information labels		x					<a href="#">Inspecting the information labels on page 130</a>
Inspecting the transportation lock screw	x						
Inspecting the dampers		x					<a href="#">Inspecting the axis-1 mechanical stop pin on page 136</a>
Inspecting the mechanical stop		x					<a href="#">Inspecting the dampers on page 143</a>
<b>Replacement/changing activities</b>							

*Continues on next page*

### 3 Maintenance

#### 3.2.2 Maintenance schedule

*Continued*

Maintenance activities	Regularly	Every 12 months	Every 36 months	Every 12,000 hours <sup>i</sup>	Every 20,000 hours <sup>i</sup>	Every 40,000 hours <sup>i</sup>	Reference
Changing the oil in axis-1 gearbox				x			<a href="#">Changing oil, axis-1 gearbox on page 149</a>
Changing the oil in axis-2 gearbox				x			<a href="#">Changing oil, axis-2 gearbox on page 158</a>
Changing the oil in axis-3 gearbox				x			<a href="#">Changing oil, axis-3 gearbox on page 164</a>
Changing the oil in axis-4 gearbox				x			<a href="#">Changing oil, axis-4 gearbox on page 169</a>
Changing the oil in axis-5 gearbox				x			<a href="#">Changing oil, axis-5 gearbox on page 173</a>
Changing the oil in axis-6 gearbox				x			<a href="#">Changing oil, axis-6 gearbox on page 177</a>
Replacing the SMB battery pack		x <sup>iii</sup>					<a href="#">Replacing the SMB battery pack on page 181</a>
<b>Lubrication activities</b>							
Lubricating the balancing device bearings			x <sup>iv</sup>				<a href="#">Lubricating the spherical roller bearing, balancing device on page 184</a>
<b>Overhaul</b>							
Overhaul of complete robot					x		

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

<sup>ii</sup> Replace when damage or cracks is detected or life limit is approaching that specified in section [Expected component life on page 99](#).

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

<sup>iv</sup> Always lubricate the front eye bearing after refitting the shaft of the balancing device.

### 3.2.3 Expected component life

#### General

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

#### Expected component life - protection type Standard

Component	Expected life	Note
Cable harness Normal usage <sup>i</sup>	40,000 hours <sup>ii</sup>	Not including: • Possible SpotPack harnesses • Optional upper arm harnesses
Cable harness Extreme usage <sup>iii</sup>	20,000 hours <sup>ii</sup>	Not including: • Possible SpotPack harnesses • Optional upper arm harnesses
Cable harness installed with lower arm DressPack	10,000 hours	
Balancing device	40,000 hours <sup>iv</sup>	
Gearboxes <sup>v</sup>	40,000 hours	

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

<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.

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

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

## 3 Maintenance

### 3.3.1 Inspecting the motor seal

## 3.3 Inspection activities

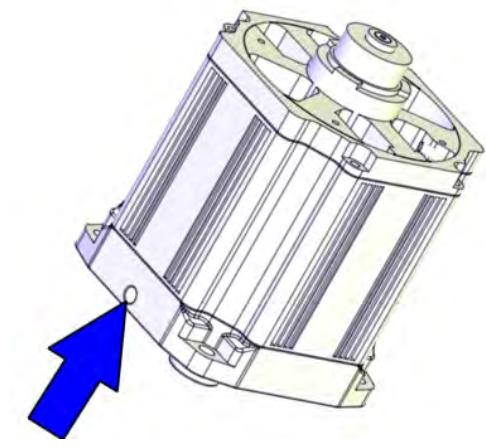
### 3.3.1 Inspecting the motor seal

#### Purpose of evacuation holes

The motors include evacuation on the motor flange to indicate failure of primary sealing between the gearbox and the motor. Robots with protection type Foundry Plus have a sight glass installed in the evacuation holes. Robots with protection type Standard have a protection filter installed in the evacuation hole.

#### Location of evacuation holes/sight glasses on motor

The evacuation hole/sight glass is located on each motor flange. The figure shows axis-1 motor as an example.



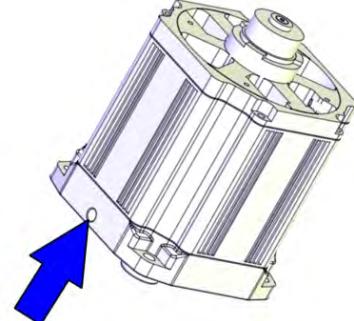
#### Inspecting the evacuation hole/sight glass

Action	Note
<p>1</p> <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>	
<p>2</p> <p> <b>WARNING</b></p> <p>Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <a href="#">WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51.</a></p>	

Continues on next page

#### 3.3.1 Inspecting the motor seal

*Continued*

Action	Note
3 Do a leakage check of the sight glass/evacuation hole of each motor. If any oil is available on the sight glass or if any oil has been spilled out from the evacuation hole, replacement of the motor is recommended.	 xx1500001057 Replacing of motors is described in the repair chapter <a href="#">Motors on page 447</a> .

### 3 Maintenance

#### 3.3.2 Inspecting the oil level in axis-1 gearbox

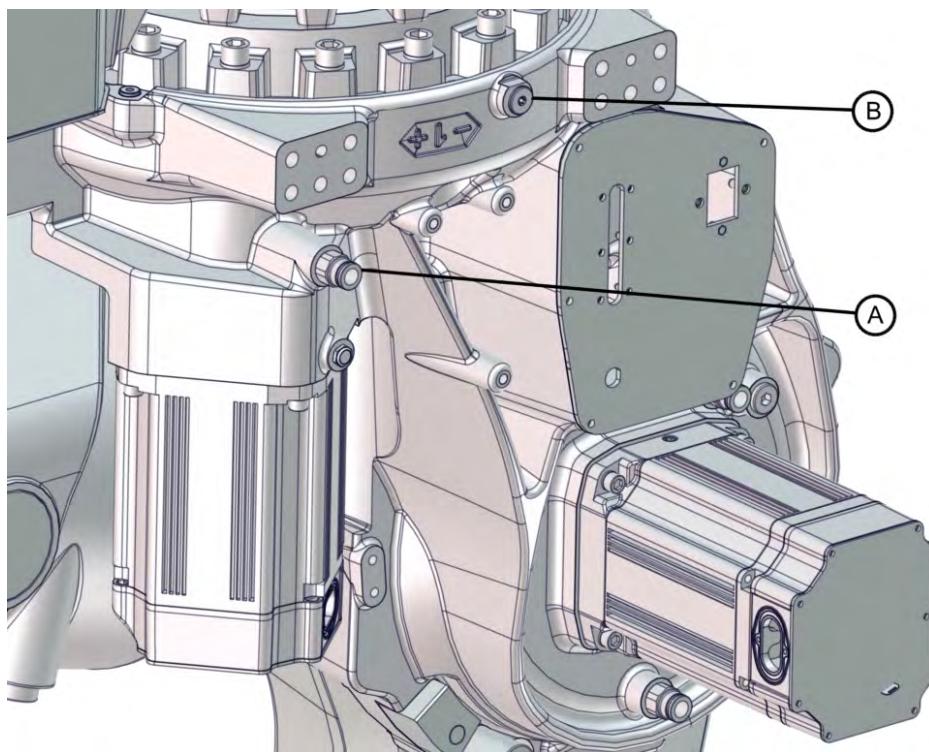
#### 3.3.2 Inspecting the oil level in axis-1 gearbox

##### Two alternative ways of checking the oil level

There are two alternatives for checking the oil level on an IRB 6700Inv, inverted or floor standing. The first section below describes inverted measuring of oil level and the second floor standing measuring of oil.

##### Location of oil plug

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



xx1600002030

A	Oil plug Tightening torque: 24 Nm
B	Venting hole

##### Required tools

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .
oil level gauge	3HAC061881-001	Assemble the extender to be able to use the oil level gauge when the fork lift accessories are mounted. The tool also includes an air vent.

Continues on next page

**Required consumables**

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

**Required documents**

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

**Inspecting the oil level in axis-1 gearbox**

Use this procedure to inspect the oil level in the gearbox, when the robot is inverted.

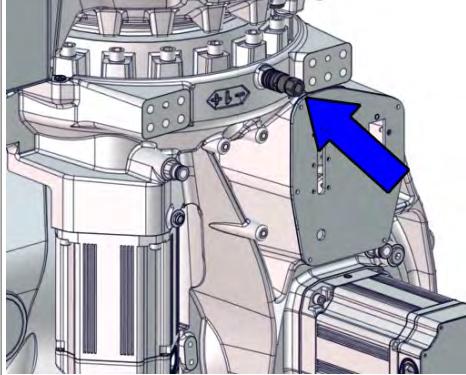
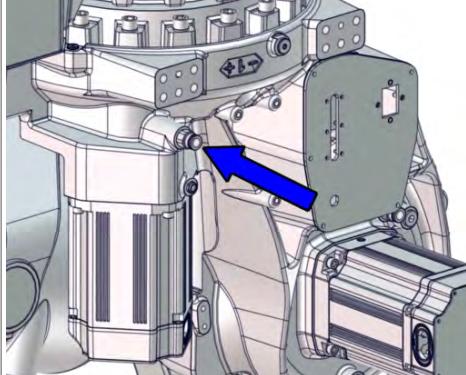
	Action	Note
1	 <b>DANGER</b> Turn off all: <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> to the robot, before entering the robot working area.	
2	 <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, read the safety information in the section <a href="#">WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51</a> .	
3	 <b>CAUTION</b> Make sure that the oil temperature is +25°C ± 10°C.  The gearbox can contain an <i>excess pressure</i> that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.	

*Continues on next page*

### 3 Maintenance

#### 3.3.2 Inspecting the oil level in axis-1 gearbox

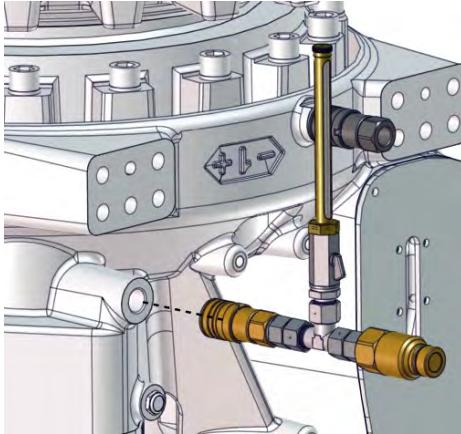
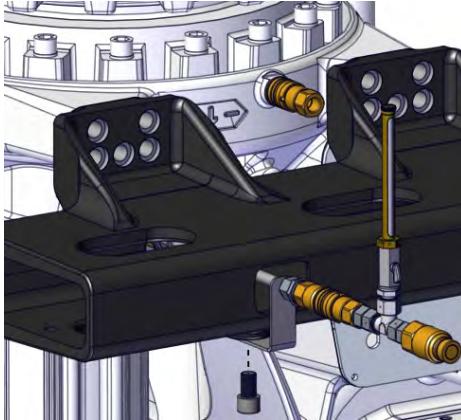
*Continued*

Action	Note
4 Install the ventilating valve.	 xx1700000349
5 Remove the protective cap and open the oil plug.	 xx1600002042
6 Make sure that the valve is closed (horizontal) and mount the oil level gauge	

*Continues on next page*

## 3.3.2 Inspecting the oil level in axis-1 gearbox

Continued

Action	Note
7 Open the valve slowly to avoid air bubbles in the oil. Check the oil level using the oil level gauge. Required oil level is: According to level measurement on tool $\pm 5$ mm	 xx1600002097  If the Fork lift accessory set is assembled, fasten the extender screw in the fork lift pocket.  xx1700000314
8 Add or drain oil, if required.	Type of oil and total amount is detailed in <i>Technical reference manual - Lubrication in gearboxes</i> . Further information about how to drain or fill with oil is found in section <a href="#">Changing oil, axis-1 gearbox on page 149</a> .
9 Refit the oil plug.	Tightening torque: 24 Nm.
10  <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <a href="#"><b>DANGER - First test run may cause injury or damage! on page 46</b></a> .	

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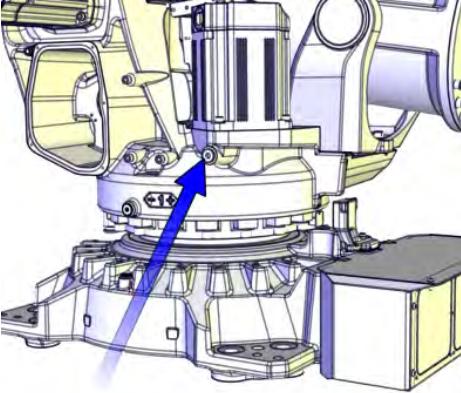
### 3 Maintenance

#### 3.3.2 Inspecting the oil level in axis-1 gearbox

Continued

##### Inspecting the oil level in axis-1 gearbox

Use this procedure to inspect the oil level in the gearbox.

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 robot working area.	
2  <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <a href="#">WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51</a> .	
3 Make sure that the oil temperature is +25 °C ± 10 °C.	
4 Open the oil plug.	 xx1500001655
5 Check the oil level. Required oil level is: 0 - 10 mm below the oil plug hole.	
6 Add or drain oil, if required.	Type of oil and total amount is detailed in <a href="#">Technical reference manual - Lubrication in gearboxes</a> . Further information about how to drain or fill with oil is found in section <a href="#">Changing oil, axis-1 gearbox on page 149</a> .
7 Refit the oil plug.	Tightening torque: 24 Nm.

Continues on next page

#### 3.3.2 Inspecting the oil level in axis-1 gearbox

*Continued*

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

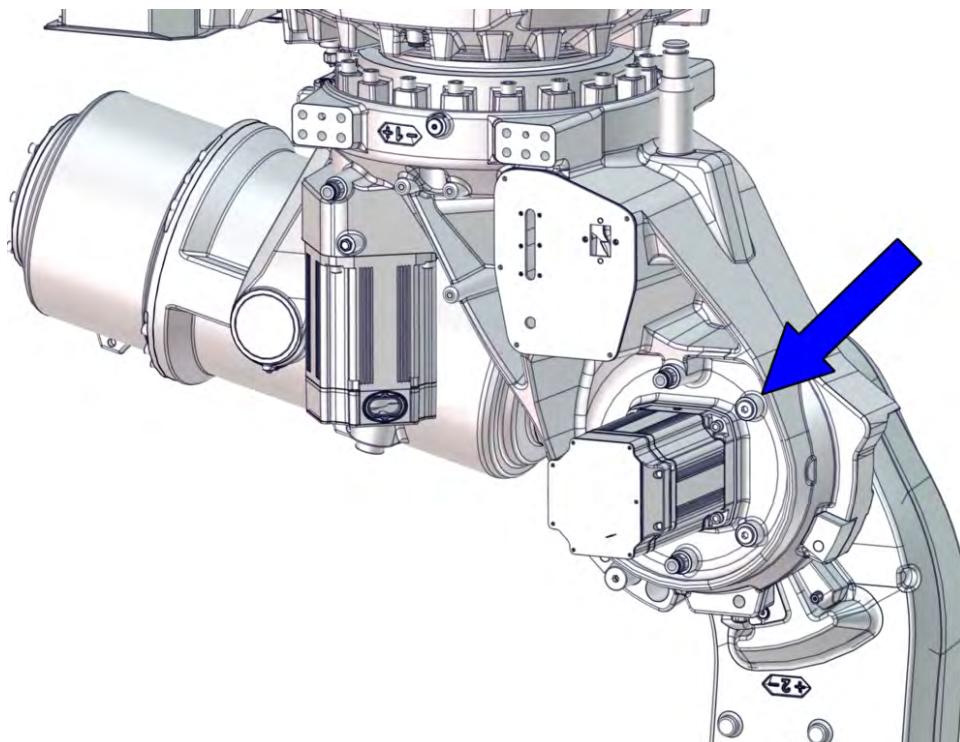
### 3 Maintenance

#### 3.3.3 Inspecting the oil level in axis-2 gearbox

##### 3.3.3 Inspecting the oil level in axis-2 gearbox

###### Location of oil plug

The gearbox has a level plug that is located as shown in the figure.



xx1600002043

Tightening torque: 24 Nm

###### Required tools

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

###### Required consumables

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

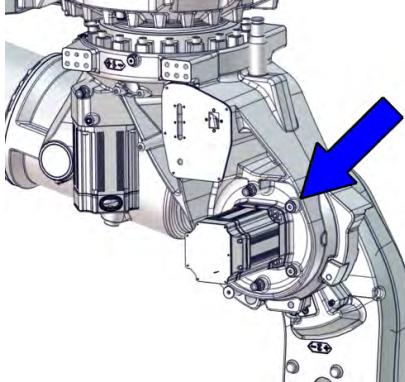
###### Required documents

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

Continues on next page

**Inspecting the oil level in axis-2 gearbox**

Use this procedure to inspect the oil level in the gearbox.

Action	Note
<b>1</b>  <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.	
<b>2</b>  <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <a href="#">WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51</a> .	
<b>3</b> Make sure that the oil temperature is $+25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ .	
<b>4</b> Open the oil plug.	 xx1600002044
<b>5</b> Check the oil level. Required oil level is: 0-15 mm below the oil plug hole.	
<b>6</b> Add or drain oil, if required.	Type of oil and total amount is detailed in <a href="#">Technical reference manual - Lubrication in gearboxes</a> . Further information about how to drain or fill with oil is found in section <a href="#">Changing oil, axis-2 gearbox on page 158</a> .
<b>7</b> Refit the oil plug.	Tightening torque: 24 Nm.

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### 3 Maintenance

#### 3.3.3 Inspecting the oil level in axis-2 gearbox

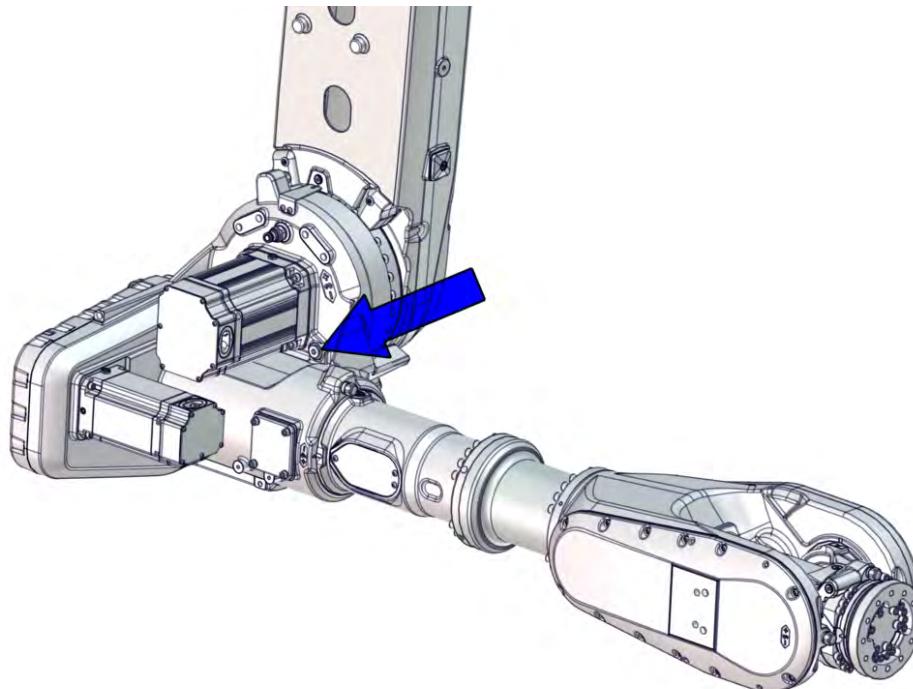
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	Action	Note
8	 <b>DANGER</b>  Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <i>DANGER - First test run may cause injury or damage! on page 46.</i>	

### 3.3.4 Inspecting the oil level in axis-3 gearbox

#### Location of oil plug

The gearbox has a level plug that is located as shown in the figure.



xx1600002045

Tightening torque: 24 Nm

#### Required tools

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

#### Required consumables

Consumables	Article number	Note
Lubricating oil	-	Information about the oil is found in <a href="#">Technical reference manual - Lubrication in gearboxes</a> .

#### Required documents

Document name	Document number
<a href="#">Technical reference manual - Lubrication in gearboxes</a>	3HAC042927-001

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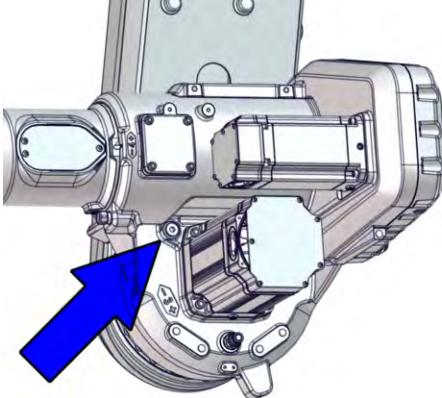
### 3 Maintenance

#### 3.3.4 Inspecting the oil level in axis-3 gearbox

*Continued*

##### Inspecting the oil level in axis-3 gearbox

Use this procedure to inspect the oil level in the gearbox.

Action	Note
1 Jog the robot into position: <ul style="list-style-type: none"><li>• Axis 1:</li><li>• Axis 2: 0°</li><li>• Axis 3: 180° (horizontal)</li><li>• Axis 4:</li><li>• Axis 5:</li><li>• Axis 6: no significance</li></ul>	
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 robot working area.	
3 Make sure that the oil temperature is +25°C ± 10°C.	
4  <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <b><i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51.</i></b>	
5 Open the oil plug.	 xx1600002046
6 Check the oil level. Required oil level is: 0 - 20 mm below the oil plug hole.	

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#### 3.3.4 Inspecting the oil level in axis-3 gearbox

*Continued*

	Action	Note
7	Add or drain oil, if required.	Type of oil and total amount is detailed in <i>Technical reference manual - Lubrication in gearboxes</i> . Further information about how to drain or fill with oil is found in section <a href="#">Changing oil, axis-3 gearbox on page 164</a> .
8	Refit the oil plug.	Tightening torque: 24 Nm.
9	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

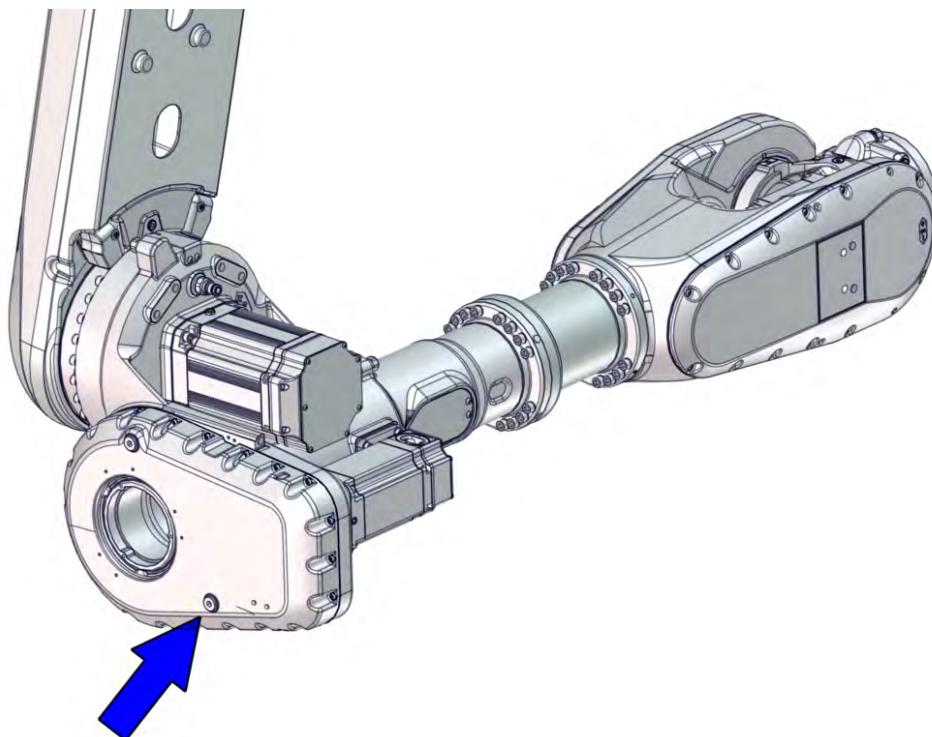
### 3 Maintenance

#### 3.3.5 Inspecting the oil level in axis-4 gearbox

##### 3.3.5 Inspecting the oil level in axis-4 gearbox

###### Location of oil plug

The gearbox has a level plug that is located as shown in the figure.



xx1600002047

Tightening torque: 24 Nm

###### Required tools

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

###### Required consumables

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

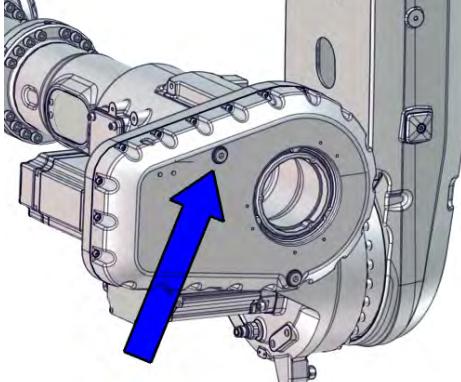
###### Required documents

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

Continues on next page

### Inspecting the oil level in axis-4 gearbox

Use this procedure to inspect the oil level in the gearbox.

	Action	Note
1	Jog the robot into position: <ul style="list-style-type: none"><li>• Axis 1:</li><li>• Axis 2: 0°</li><li>• Axis 3: 180°</li><li>• Axis 4:</li><li>• Axis 5:</li><li>• Axis 6: no significance</li></ul>	
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 robot working area.	
3	Make sure that the oil temperature is +25°C ± 10°C.	
4	 <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <b><i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51.</i></b>	
5	Open the oil plug.	 xx1600002048
6	Check the oil level. Required oil level is: 0 - 10 mm below the oil plug hole.	

Continues on next page

### 3 Maintenance

#### 3.3.5 Inspecting the oil level in axis-4 gearbox

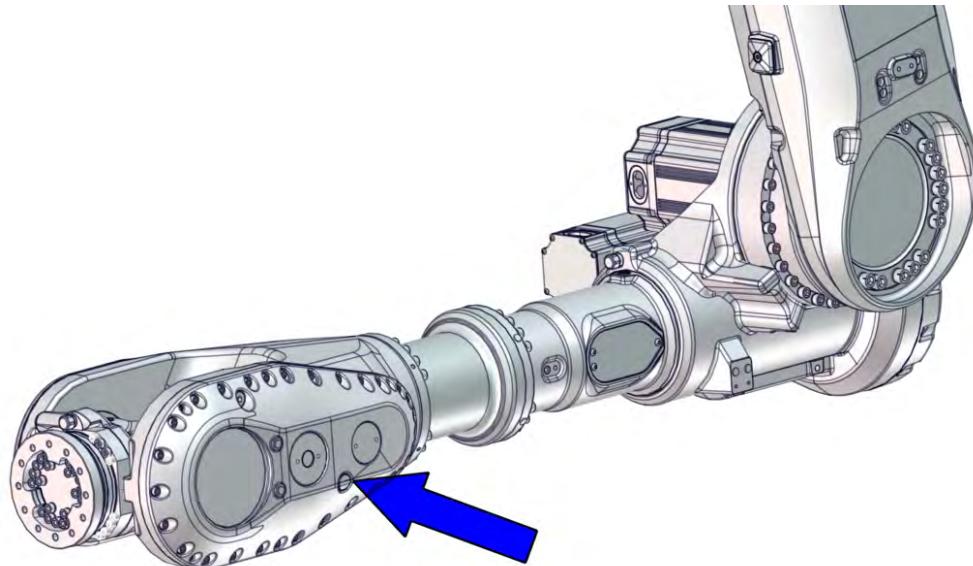
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	Action	Note
7	Add or drain oil, if required.	Type of oil and total amount is detailed in <i>Technical reference manual - Lubrication in gearboxes</i> . Further information about how to drain or fill with oil is found in section <a href="#">Changing oil, axis-4 gearbox on page 169</a> .
8	Refit the oil plug.	Tightening torque: 24 Nm.
9	 <b>DANGER</b>  Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

### 3.3.6 Inspecting the oil level in axis-5 gearbox

#### Location of oil plug

The gearbox has a level plug that is located as shown in the figure.



xx1700000315

Tightening torque: 24 Nm
--------------------------

#### Required tools

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

#### Required consumables

Consumables	Article number	Note
Lubricating oil	-	Information about the oil is found in <a href="#">Technical reference manual - Lubrication in gearboxes</a> .

#### Required documents

Document name	Document number
<a href="#">Technical reference manual - Lubrication in gearboxes</a>	3HAC042927-001

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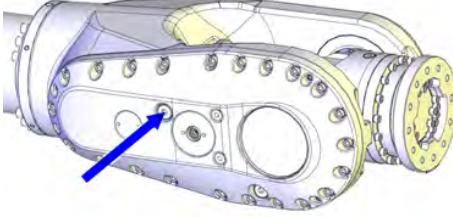
### 3 Maintenance

#### 3.3.6 Inspecting the oil level in axis-5 gearbox

Continued

##### Inspecting the oil level in axis-5 gearbox

Use this procedure to inspect the oil level in the gearbox.

Action	Note
1 Jog the robot into position: <ul style="list-style-type: none"><li>• Axis 1:</li><li>• Axis 2: 0°</li><li>• Axis 3:</li><li>• Axis 4: 180°</li><li>• Axis 5:</li><li>• Axis 6: no significance</li></ul>	
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 robot working area.	
3 Make sure that the oil temperature is +25°C ± 10°C.	
4  <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <b><i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51.</i></b>	
5 Open the oil plug.	 xx1200000959
6 Check the oil level. Required oil level is: 0 - 10 mm below the oil plug hole.	
7 Add or drain oil, if required.	Type of oil and total amount is detailed in <i>Technical reference manual - Lubrication in gearboxes</i> . Further information about how to drain or fill with oil is found in section <b><i>Changing oil, axis-5 gearbox on page 173.</i></b>
8 Refit the oil plug.	Tightening torque: 24 Nm.

Continues on next page

#### 3.3.6 Inspecting the oil level in axis-5 gearbox

*Continued*

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

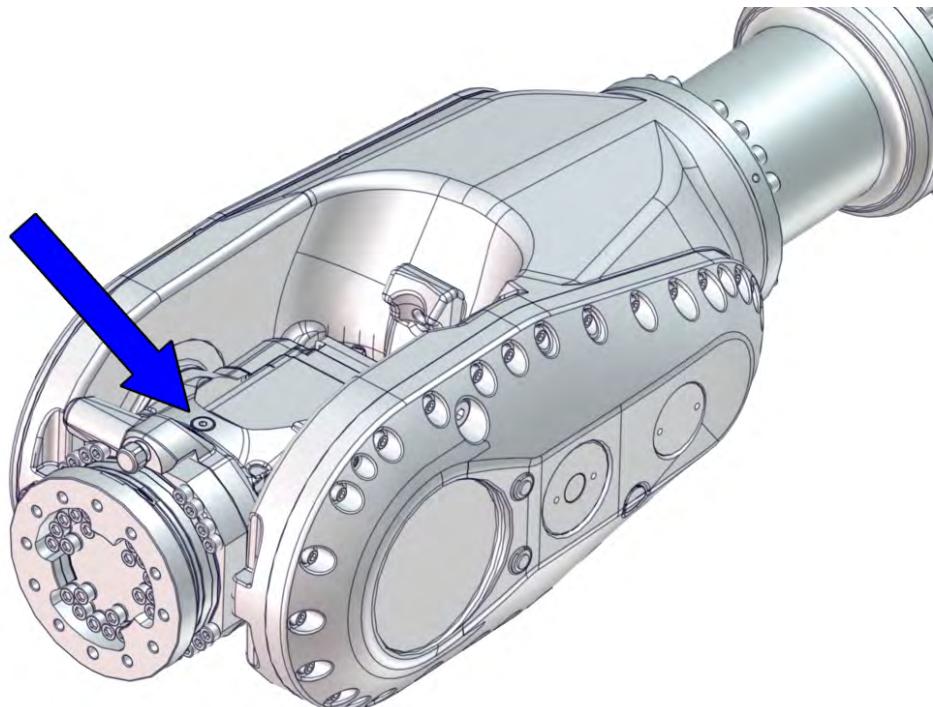
### 3 Maintenance

#### 3.3.7 Inspecting the oil level in axis-6 gearbox

#### 3.3.7 Inspecting the oil level in axis-6 gearbox

##### Location of oil plug

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



xx1600002049

Tightening torque: 24 Nm

##### Required tools

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

##### Required consumables

Consumable	Article number	Note
Lubricating oil	-	Information about the oil is found in <a href="#">Technical reference manual - Lubrication in gearboxes</a> .

##### Required documents

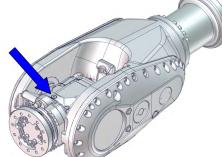
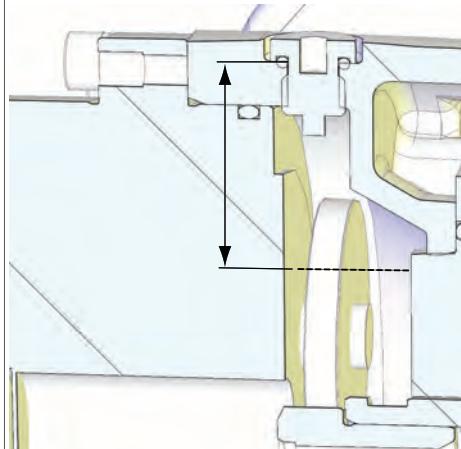
Document name	Document number
<a href="#">Technical reference manual - Lubrication in gearboxes</a>	3HAC042927-001

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### Inspecting the oil level in axis-6 gearbox

Use this procedure to inspect the oil level in the gearbox.

The procedure includes two alternative positions for axis 5, where one of the positions makes it possible to use the filling plug as a level plug.

	Action	Note
1	Run the robot to calibration position.	
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 robot working area.	
3	Make sure that the oil temperature is +25°C ± 10°C.	
4	 <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <b><i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51.</i></b>	
5	Open the oil plug.	 xx1600002049
6	<b>Method 1</b> Check the oil level. <ul style="list-style-type: none"> <li>• Required oil level is: 50 mm ± 5 mm below the sealing surface of the oil plug.</li> </ul>	 xx1300000693

Continues on next page

### 3 Maintenance

#### 3.3.7 Inspecting the oil level in axis-6 gearbox

*Continued*

	Action	Note
7	<b>Method 2</b> Rotate axis 5 -77°. Required oil level is: 0 - 10 mm below the oil plug hole.	
8	Add or drain oil, if required.	Type of oil and total amount is detailed in <i>Technical reference manual - Lubrication in gearboxes</i> . Further information about how to drain or fill with oil is found in section <a href="#">Changing oil, axis-6 gearbox on page 177</a> .
9	Refit the oil plug.	Tightening torque: 24 Nm.
10	 <b>DANGER</b>  Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <a href="#"><b>DANGER - First test run may cause injury or damage! on page 46</b></a> .	

### 3.3.8 Inspecting the balancing device

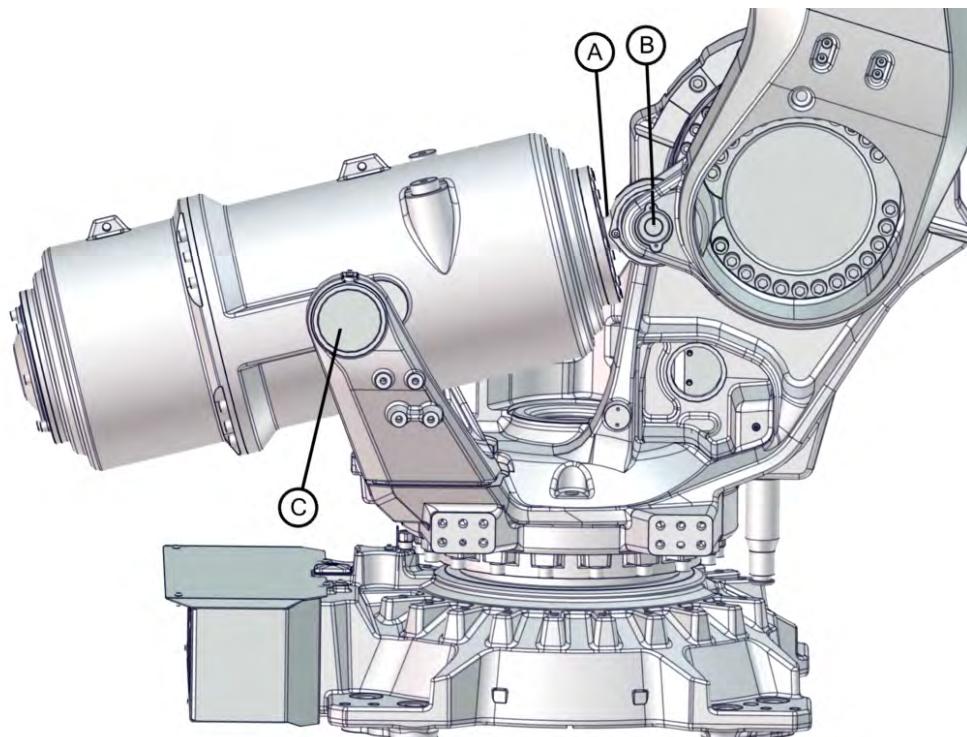
#### General

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

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

#### Inspection points, balancing device

The balancing device is located at the top rear of the frame as shown in the figure. The figure also shows the inspection points, further described in the instructions.



xx1600002052

A	Piston rod (inside balancing device)
B	Link ear
C	Rear attachments of the balancing device (rear bearing)

#### Required tools

Visual inspection, no tools are required.

*Continues on next page*

### 3 Maintenance

#### 3.3.8 Inspecting the balancing device

*Continued*

##### Required material

Equipment	Article number	Note
Maintenance kit, link ear	3HAC062076-001	The maintenance kit contains: <ul style="list-style-type: none"><li>• End cover</li><li>• Radial sealing with dust lip, 50x68x8 (2 pcs)</li><li>• O-ring 104.5</li><li>• Spherical roller bearing</li><li>• Washer</li></ul>
Maintenance kit, rear attachment	3HAC045822-001	Includes: <ul style="list-style-type: none"><li>• bearings and seals</li><li>• VK cover.</li></ul>

##### Check for dissonance

The check points are shown in the figure [Inspection points, balancing device on page 123](#).

	Check points	Action
1	Check for dissonance from the bearing at the link ear and the bearings at the rear attachments.	If dissonance is detected, perform maintenance according to maintenance kits and instructions in section <a href="#">Replacing the spherical roller bearing on page 389</a> and <a href="#">on page ?</a> .
2	Check for dissonance from the balancing device (a tapping sound, caused by the springs inside the cylinder).	If dissonance is detected, replace the balancing device or consult ABB Robotics. How to replace the device is detailed in section <a href="#">Replacing the balancing device on page 408</a> . This section also specifies the spare part number!
3	Check for dissonance from the piston rod (squeaking may indicate worn plain bearings, internal contamination or insufficient lubrication).	If dissonance is detected, perform maintenance according to given instructions in Maintenance kit, complete.

##### Check for damage

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

The check points are shown in the figure [Inspection points, balancing device on page 123](#).

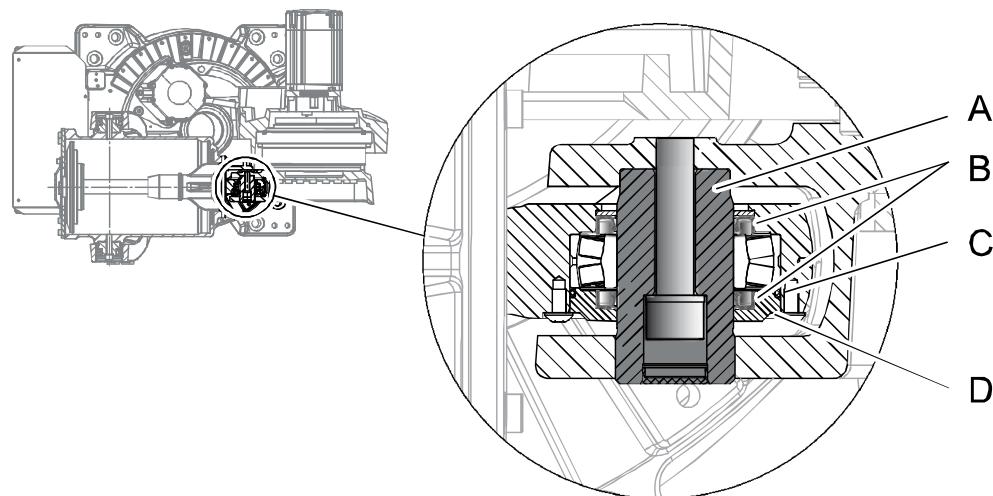
	Check points	Action
1	Check for damage on the part of the piston rod that is visible at the front of the balancing device.	If damage is detected, perform maintenance according to given instructions in Maintenance kit, complete.

*Continues on next page*

**Check for leakage**

The front ear of the balancing device is lubricated with grease.

Leaks at o-rings, radial sealings etc. are not acceptable and must be attended to immediately to avoid damage to the bearing.



xx1000000207

A	Shaft
B	Radial sealing with dust lip, 50x68x8 (2 pcs)
C	O-ring, 85x3
D	End cover

	Action	Note
1	Clean the area at the front ear from contamination.	
2	Run the robot for some minutes, in order to move the balancing device piston.	
3	<p> <b>DANGER</b></p> <p>Turn off all:</p> <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> <p>Before entering the robot working area.</p>	
4	Check the area around the o-ring and radial sealings at the front ear, for leakage.	
5	Replace o-ring and radial sealings if leaks are detected.	<p>The o-ring and radial sealings are included in the Maintenance kit, bearings and seals already assembled with sealing spacers and sealing rings. Article number for the kit is specified in <a href="#">Required material on page 124</a>.</p> <p>Replacement of the complete bearing is also described in section <a href="#">Replacing the balancing device on page 408</a>.</p>

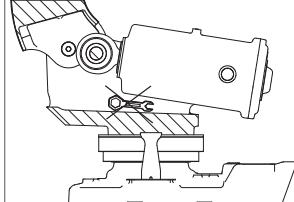
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### 3 Maintenance

#### 3.3.8 Inspecting the balancing device

*Continued*

##### Check for contamination / lack of free space

Action	Note
<p>1</p> <p> <b>DANGER</b></p> <p>Turn off all:</p> <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> <p>Before entering the robot working area.</p>	
<p>2</p> <p>Check that there are no obstacles inside the frame, that could prevent the balancing device from moving freely.</p> <p>Keep the areas around the balancing device clean and free from objects, such as service tools.</p>	 xx1300000423

#### 3.3.9 Inspecting the cable harness

##### Location of cable harness

The cable harness is located as shown in the figure.



xx1600002063

##### Required tools

Visual inspection, no tools are needed.

*Continues on next page*

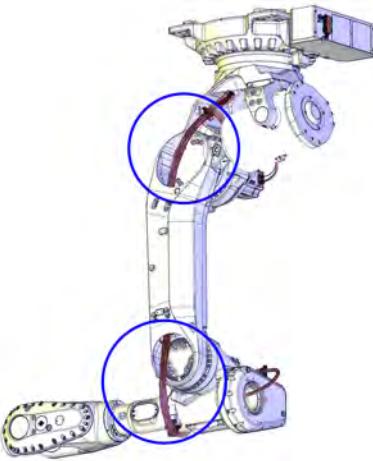
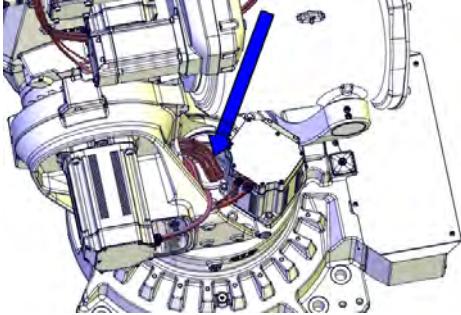
### 3 Maintenance

#### 3.3.9 Inspecting the cable harness

*Continued*

##### Inspecting the cable harness

Use this procedure to inspect cable harness of axes 1-6.

Action	Note
<p>1</p> <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>	
<p>2</p> <p>Make an overall inspection of the cable harness in order to detect wear and damage.</p> <p>Pay special attention to the areas of axis-2 and axis-3 movement, shown in the figure. Make sure the cabling is not damaged between the cable brackets in these areas.</p>	 xx1600002064
<p>3</p> <p>Check that all visible cable brackets, velcro straps and attachments are properly secured, by following the cable harness from the base to the wrist.</p>	
<p>4</p> <p>Check the motor cables visually for any damage.</p>	
<p>5</p> <p>Check the connectors at the base visually for any damage.</p>	
<p>6</p> <p>Check the cabling going through the protection tube, to detect possible cable chafing, by using your hands inside the tube to feel the cables. Ensure that the cables are undamaged.</p> <p>Remove any objects that may cause possible cable chafing.</p> <p>Replace damaged cabling, if any.</p>	 xx1300001094

*Continues on next page*

#### 3.3.9 Inspecting the cable harness

*Continued*

	Action	Note
7	Replace the cable harness if wear, cracks or damage is detected.	See <a href="#">Removing the cable harness on page 213</a> .

### 3 Maintenance

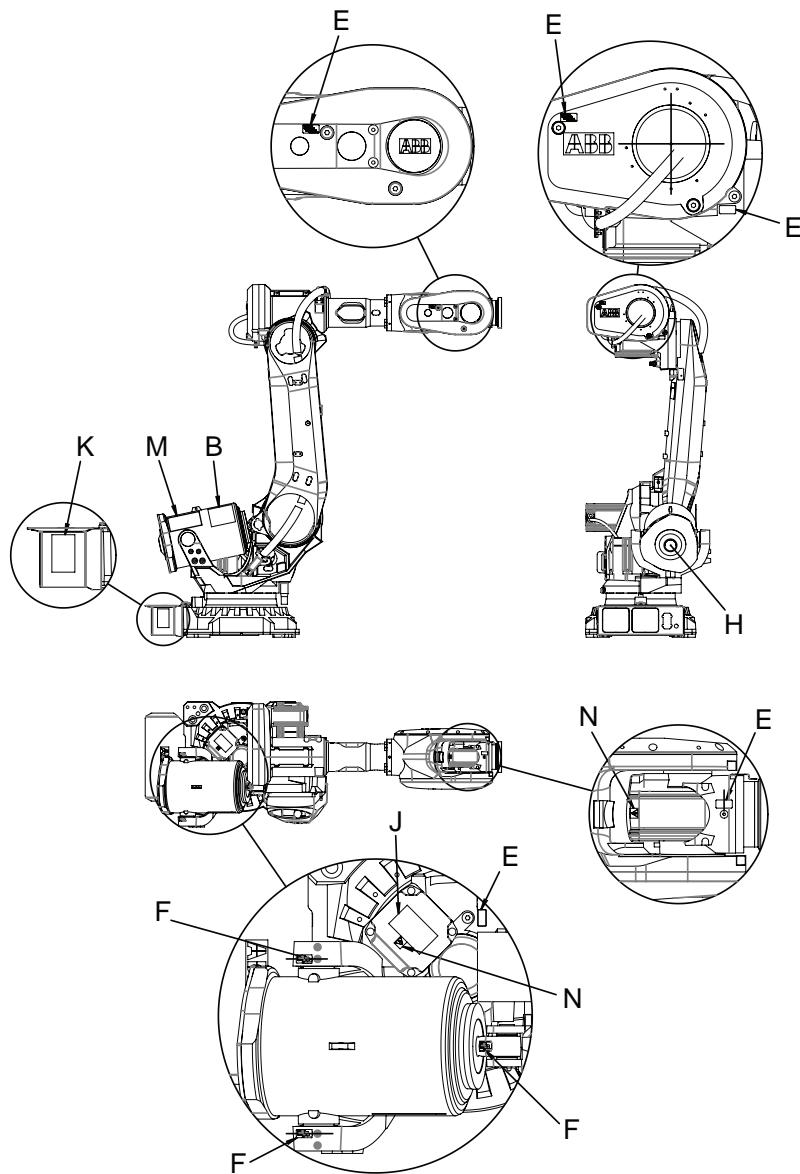
#### 3.3.10 Inspecting the information labels

#### 3.3.10 Inspecting the information labels

##### Location of labels

These figures show the location of the information labels to be inspected. The symbols are described in section [Safety symbols on product labels on page 39](#).

Illustration 1



*Continues on next page*

#### 3.3.10 Inspecting the information labels

*Continued*

Illustration 2

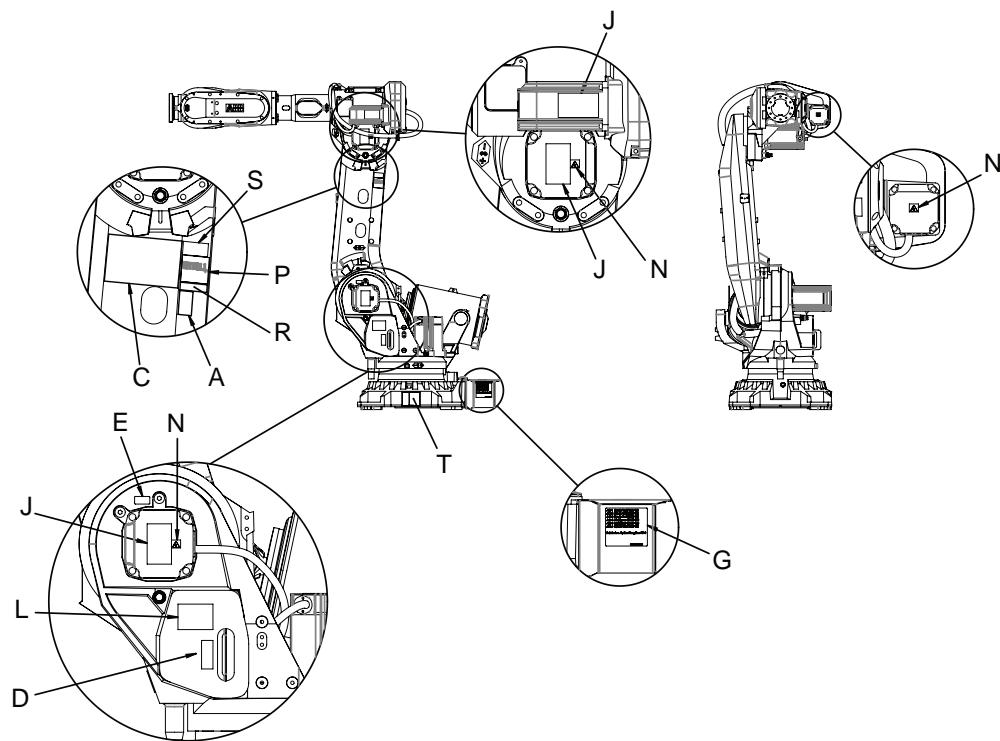
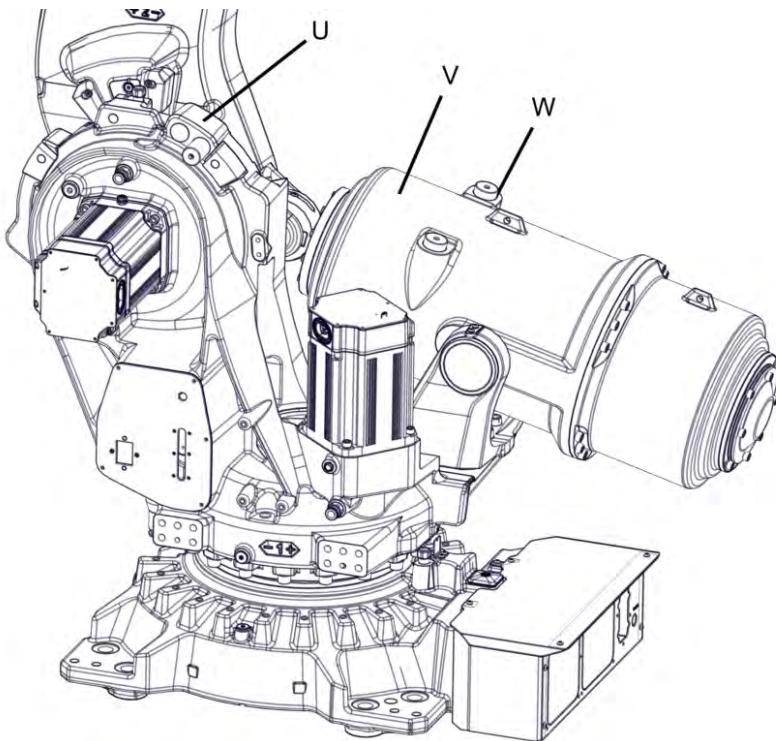


Illustration 3



xx1600002059

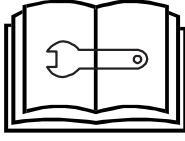
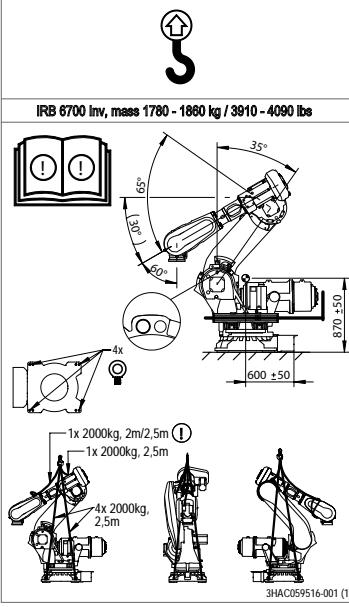
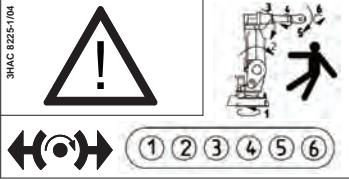
	Description	Illustration
<b>A</b>	Calibration label	

*Continues on next page*

### 3 Maintenance

#### 3.3.10 Inspecting the information labels

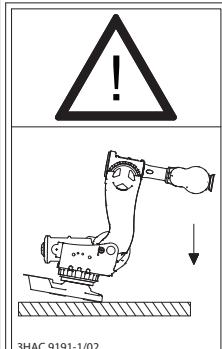
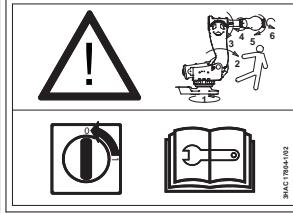
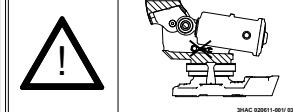
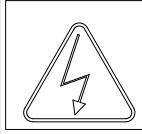
*Continued*

B	Instruction label <b>Before dismantling see product manual</b>	 xx0900000816
C	Instruction label <b>Lifting of robot</b>	 xx1600002055
D	Instruction label <b>Brake release</b> <b>Moving robot</b> <b>Brake release buttons</b>	 xx1300001083
E	Oil specification label	
F	Grease specification label	
G	Complete oil specification	
H	Warning label <b>Do not dismantle</b> <b>Stored energy</b>	 xx1300001086

*Continues on next page*

## 3.3.10 Inspecting the information labels

*Continued*

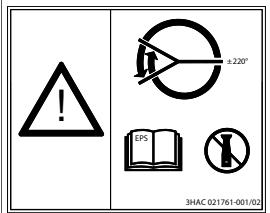
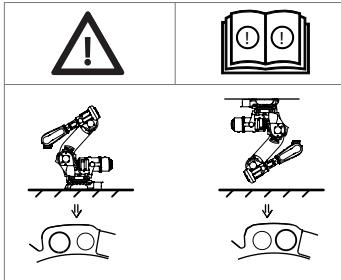
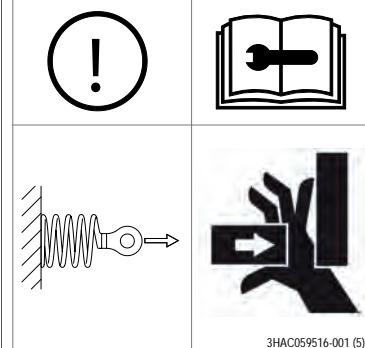
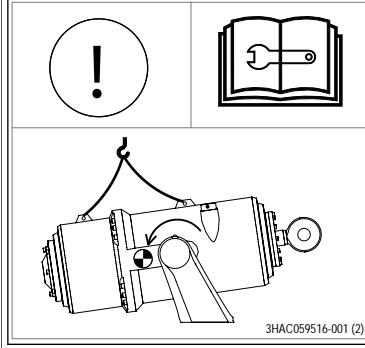
J	Warning label <b>Heat</b>	 xx1300001087
K	Warning label <b>Tip risk when loosening bolts</b>	 xx1300001088
L	Warning label <b>Moving robot</b> <b>Shut off with handle</b> <b>Before dismantling see product manual</b>	 xx1300001089
M	Warning label <b>Keep areas around the balancing device free from objects</b>	 xx1300001090
N	Warning label <b>Flash</b>	 xx1300001091
P	Rating label	
S	UL label	

*Continues on next page*

### 3 Maintenance

#### 3.3.10 Inspecting the information labels

*Continued*

T	<b>Label</b> <b>Extended rotation</b> <b>No mechanical stop</b> <b>See user documentation</b>	 xx1300001092
U	<b>Warning label</b> <b>Use transportation lock screw when moving, transporting or rotating robot.</b> <b>See user documentation</b>	 xx1600002053
V	<b>Caution label</b> <b>Balancing device pressurized</b> <b>See user documentation</b>	 xx1600002056 3HAC059516-001 (5)
W	<b>Caution label</b> <b>Center of gravity and lifting of balancing device</b> <b>Risk of squeezing</b> <b>See user documentation</b>	 xx1600002060 3HAC059516-001 (2)

#### Required tools and equipment

Visual inspection, no tools are required.

*Continues on next page*

##### 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 robot working area.	
2	Inspect the labels, located as shown in the figures.	
3	Replace any missing or damaged labels.	Article numbers for the labels and plate set is specified in <a href="#">Spare parts on page 723</a> .

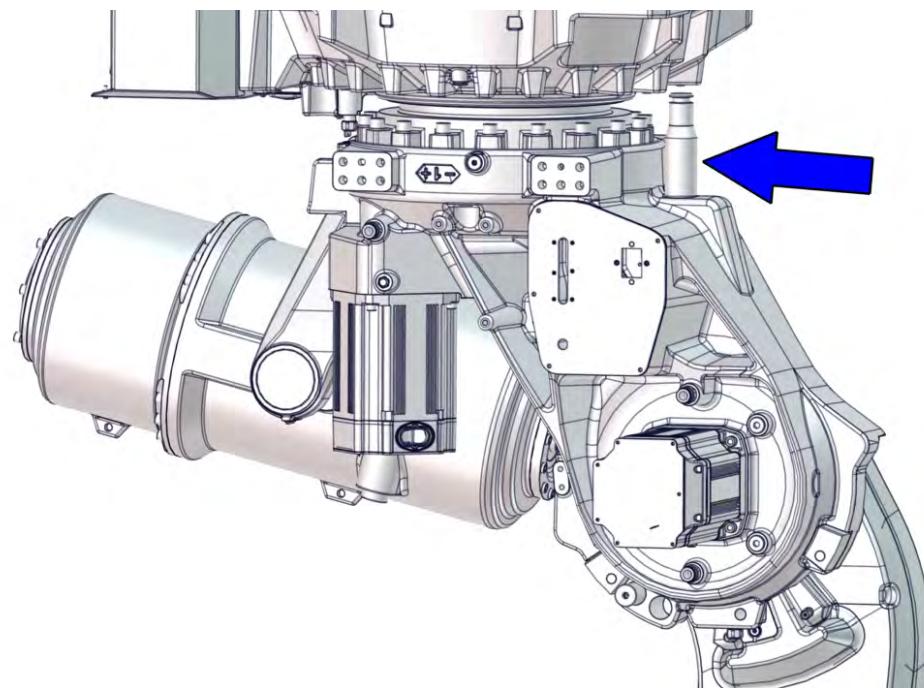
### 3 Maintenance

#### 3.3.11 Inspecting the axis-1 mechanical stop pin

#### 3.3.11 Inspecting the axis-1 mechanical stop pin

##### Location of mechanical stop pin

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



xx1600002065

##### Required equipment

Visual inspection, no tools are required.

##### Inspecting, mechanical stop pin

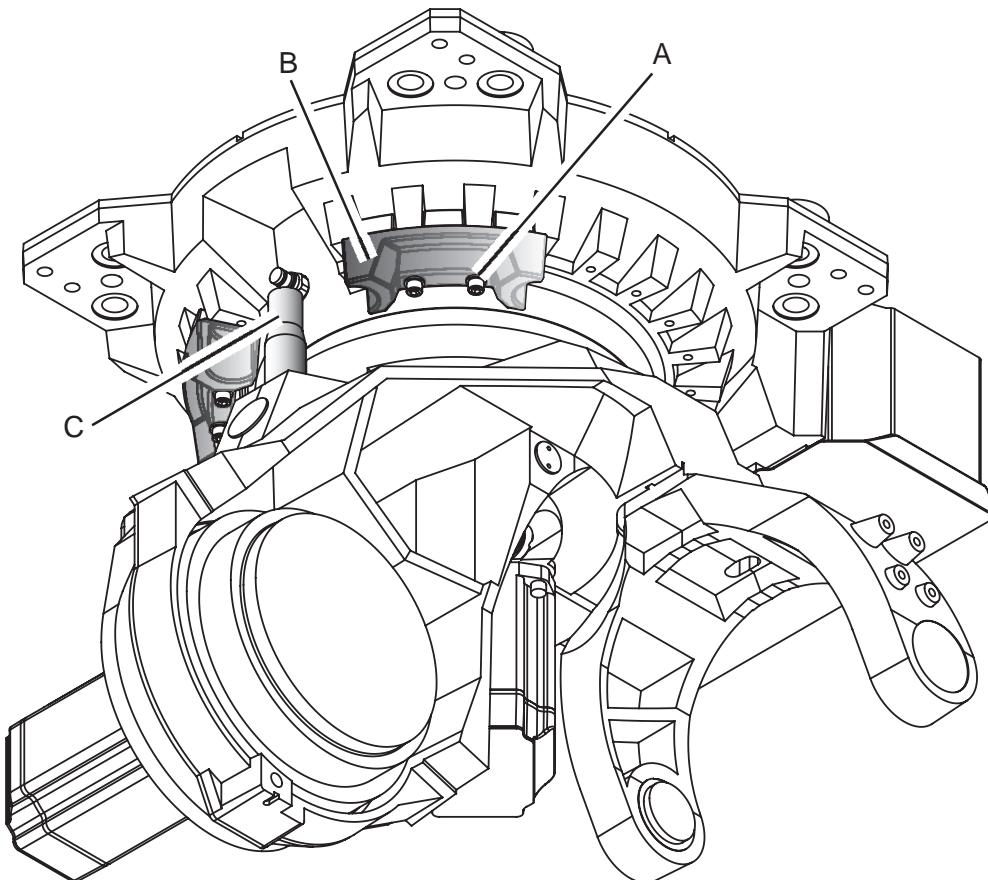
Use this procedure to inspect the axis-1 mechanical stop pin.

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

## 3.3.12 Inspecting the additional mechanical stops

## 3.3.12 Inspecting the additional mechanical stops

## Location of mechanical stops



xx1600002066

A	Attachment screws M12x70 quality 12.9 Gleitmo 603 (2 pcs per additional mechanical stop)
B	Movable mechanical stop
C	Mechanical stop pin axis-1

## Required equipment

Equipment etc.	Article number	Note
Movable mechanical stop axis 1	3HAC048533-003	300/2.70, 245/3.00 Limits the robot working range by 15°. Includes attachment screws and an assembly drawing. <ul style="list-style-type: none"><li>• Mechanical stop</li><li>• Attachment screws M12x70 quality 12.9 Gleitmo 603 and washers</li><li>• Document for mechanical stop</li></ul>
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

Continues on next page

### 3 Maintenance

#### 3.3.12 Inspecting the additional mechanical stops

*Continued*

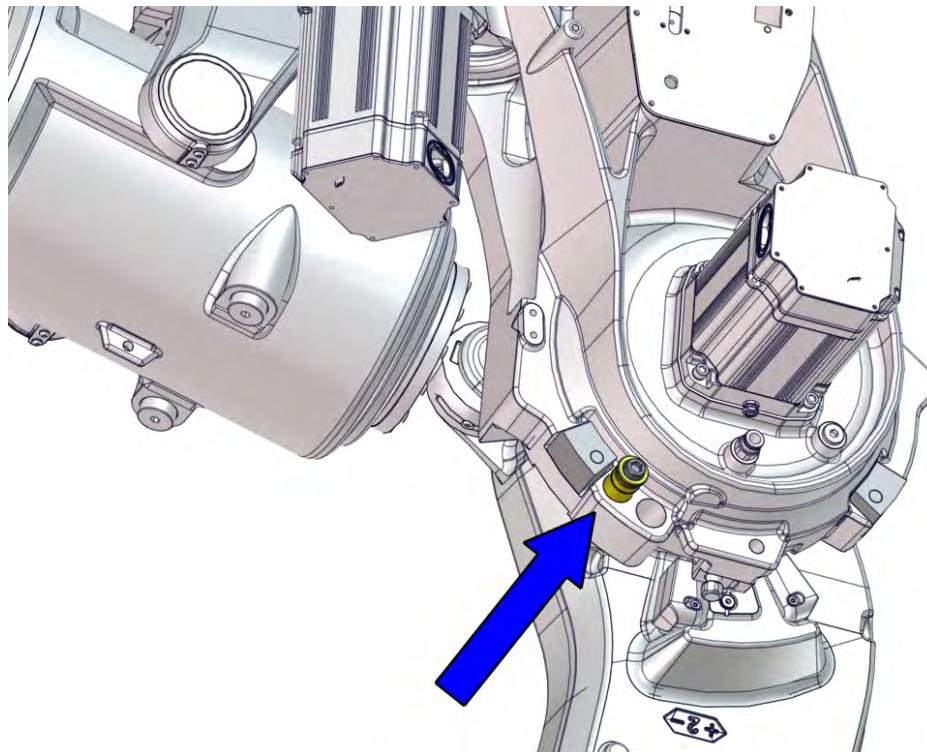
##### Inspecting, mechanical stops

Use this procedure to inspect the additional mechanical stops.

Action	Note
1  <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 Make sure no additional stops are damaged.	Shown in figure <a href="#">Location of mechanical stops on page 137</a> .
3 Make sure the stops are properly attached. Correct tightening torque, additional mechanical stops: <ul style="list-style-type: none"><li>• Axis 1 = 115 Nm</li></ul>	
4 If any damage is detected, the mechanical stops must be replaced! Correct attachment screws: <ul style="list-style-type: none"><li>• M12x70 quality 12.9 Gleitmo 603 (2 pcs per additional mechanical stop)</li></ul>	Article number is specified in <a href="#">Required equipment on page 137</a> .

### 3.3.13 Inspecting the transportation lock screw

#### Location of the transportation lock screw



xx1600002008

#### Lift, transport and rotation of the robot

The robot arm system must always be locked in a secure position during lift, transport or rotation to inverted or standing position. This is done by locking the lower arm in position with a transportation lock screw. The transportation lock screw is stored at a parking position in the robot frame, when not used. This section describes how to move the screw to the locking position in order to secure the lower arm.

At delivery, the robot and the lower arm is already locked in the correct position with the transportation lock screw.



#### CAUTION

No tool is permitted to be fitted on the robot when it is lifted, transported or rotated.

#### Required tools

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

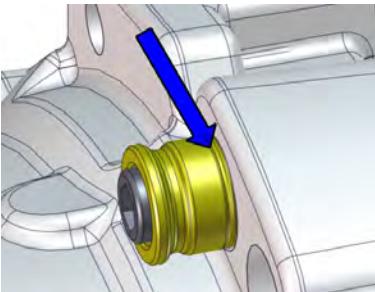
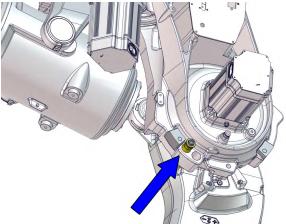
Continues on next page

### 3 Maintenance

#### 3.3.13 Inspecting the transportation lock screw

*Continued*

##### Inspecting the transportation lock screw for transport and rotation

	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	Remove any dirt from the hole in axis 2. The groove on the sleeve is supposed to be aligned with the frame in lifting, rotating and transportation position.	 xx1600002114
3	Make sure that there are no deformations or damages to the sleeve or the screw.	
4	Make sure that the screw and sleeve are in their correct position when lifting, rotating or transporting the robot.	
5	Check the tightening torque.	Tightening torque: $75 \text{ Nm} \pm 15 \text{ Nm}$
6	Always keep the transportation lock screw and sleeve in the parking position when not in use.	 xx1600002008

### 3.3.14 Inspecting the fork lift accessory

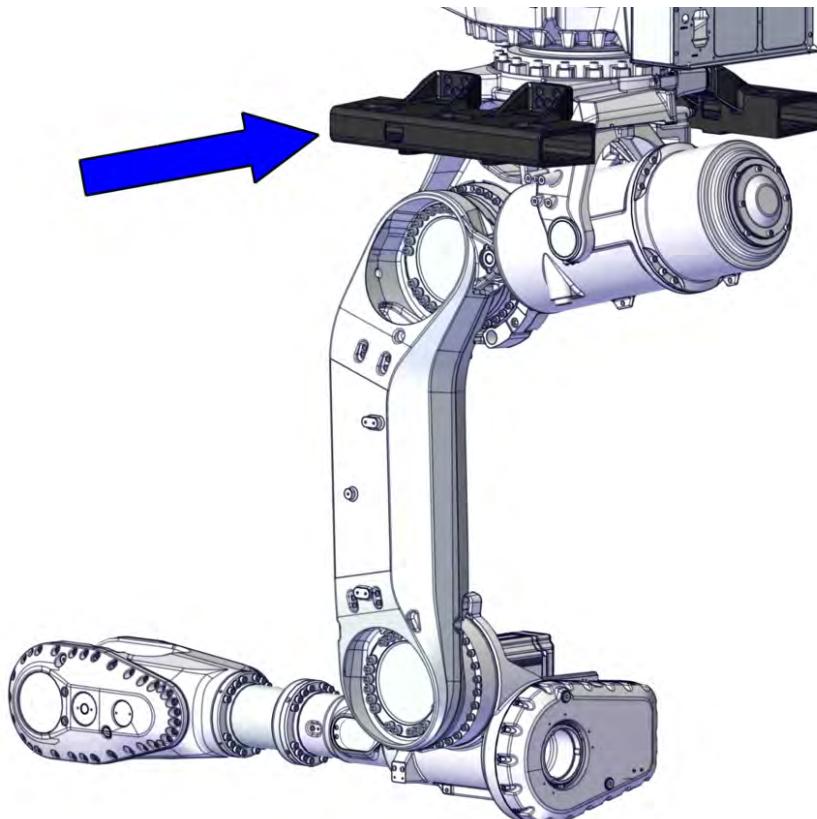
#### Introduction

The installation and use of the Fork lift accessories is described in:

- *Directions for use - Fork lift accessory for IRB 6700Inv*

#### Location of fork lift accessory

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



xx1600002094

#### Required equipment

Equipment	Article number	Note
Fork lift accessory set	3HAC058825-001	
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

#### Inspection

The fork lift accessory shall be inspected regularly according to Standard SS 7685006 Periodical Inspection.

*Continues on next page*

### 3 Maintenance

#### 3.3.14 Inspecting the fork lift accessory

*Continued*

Use this procedure to inspect the fork lift accessory set.



##### Note

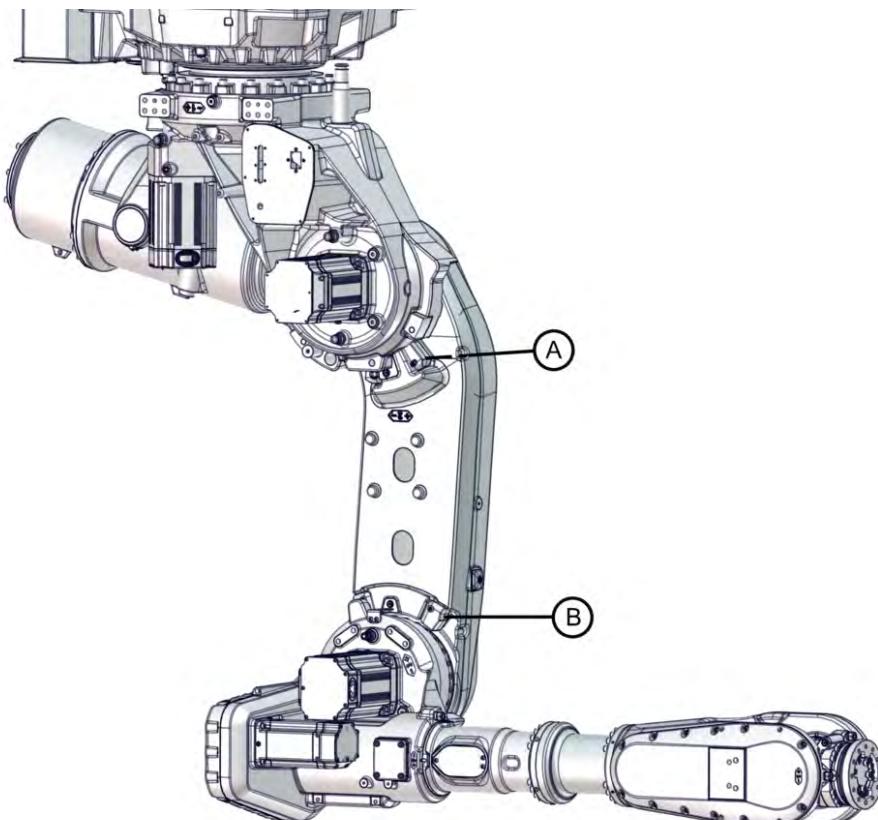
Damaged parts (as pockets or attachment screws) of the fork lift accessory, must be replaced with new ones before use.

	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 robot working area.	
2	Check the fork lift pockets for damage.	
3	Check attachment screws for deformation and/or other types of damage.	
4	Make sure that the fork lift pockets are properly attached.	
5	If any damage is detected on the fork lift pockets or attachment screws, they must be replaced.  Correct attachments: <ul style="list-style-type: none"><li>• Screw M16x50 12.9 Gleitmo 603 (2x10 pcs)</li><li>• Washer 17x25, 3 mm thick (2x10 pcs)</li></ul>	

### 3.3.15 Inspecting the dampers

#### Location of dampers

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



xx1600002067

A	Axis-2 damper, 2 pcs
B	Axis-3 damper, 2 pcs

#### Required equipment

Visual inspection, no tools are required.

#### Inspecting, dampers

The procedure below details how to inspect the dampers.



##### Note

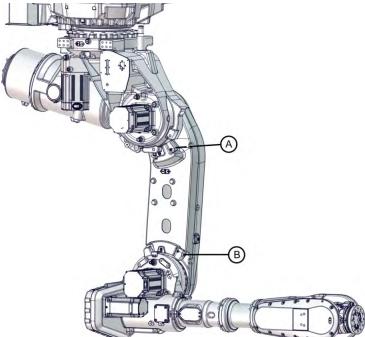
A damaged damper must be replaced.

*Continues on next page*

### 3 Maintenance

#### 3.3.15 Inspecting the dampers

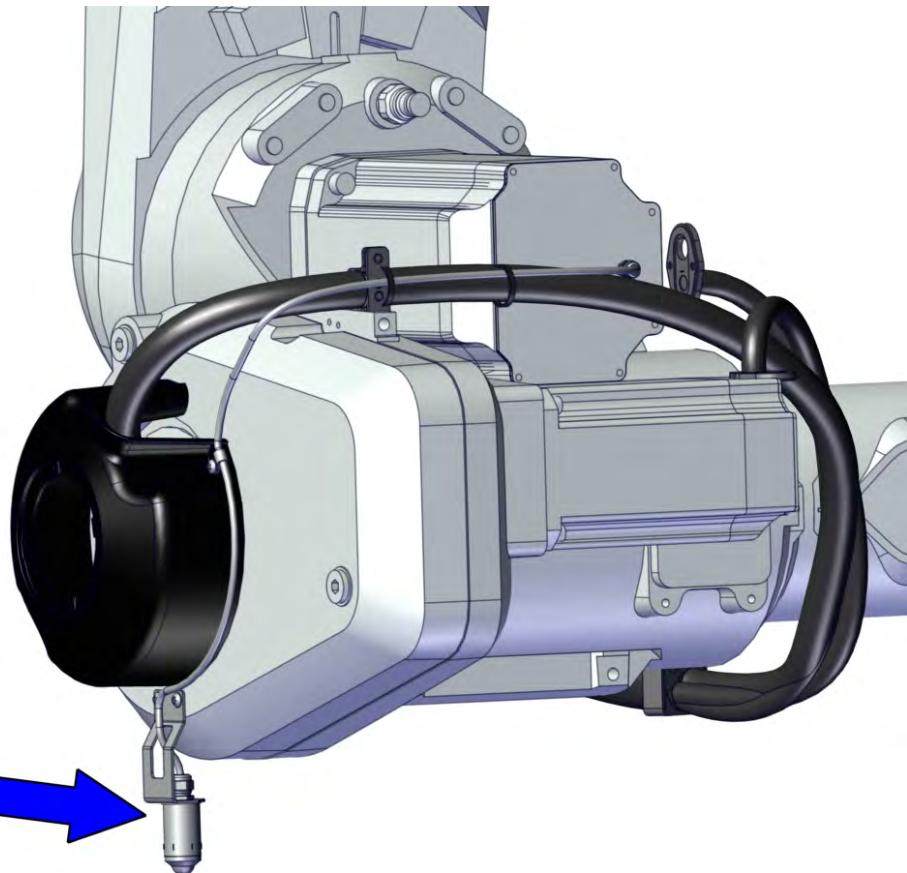
*Continued*

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 Check all dampers for damage, cracks or existing impressions larger than 1 mm.	 xx1600002067				
3 Check attachment screws for deformation.	<table border="1"><tr><td>A</td><td>Axis-2 damper, 2 pcs</td></tr><tr><td>B</td><td>Axis-3 damper, 2 pcs</td></tr></table>	A	Axis-2 damper, 2 pcs	B	Axis-3 damper, 2 pcs
A	Axis-2 damper, 2 pcs				
B	Axis-3 damper, 2 pcs				
4 If any damage is detected, the damper must be replaced with a new one. Attachment screws: M6x60. Locking liquid: Loctite 243.	Spare part number is found in <i>Product manual, spare parts - IRB 6700</i> .				

### 3.3.16 Inspecting the signal lamp (option)

#### Location of signal lamp

The signal lamp is located as shown in this figure.



xx1600002090

#### Required tools and equipment

Equipment	Article number	Note
Signal lamp kit	See <a href="#">Spare parts on page 723</a> .	To be replaced if damage is detected.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

#### Inspecting, signal lamp

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

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

*Continues on next page*

### 3 Maintenance

#### 3.3.16 Inspecting the signal lamp (option)

*Continued*

Action	Note
<p>2</p> <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>	
<p>3</p> <p>If the lamp is not lit, trace the fault by:</p> <ul style="list-style-type: none"><li>• inspecting whether the signal lamp is broken. If so, replace it.</li><li>• inspecting cable connections.</li><li>• measuring the voltage in the connectors of motor axis 3 (=24V).</li><li>• inspecting the cabling. Replace the cabling if a fault is detected.</li></ul>	Article number is specified in <a href="#">Required tools and equipment on page 145</a> .

## 3.4 Replacement/changing activities

### 3.4.1 Type of lubrication in gearboxes

---

#### Introduction

This section describes where to find information about the *type of lubrication*, *article number* and the *amount of lubrication* in the specific gearbox. It also describes the equipment needed when working with lubrication.

---

#### Type and amount of oil in gearboxes

Information about the *type of lubrication*, *article number* as well as the *amount* in the specific gearbox can be found in *Technical reference manual - Lubrication in gearboxes* on the Documentation DVD (released twice a year). The revision of the manual published on the Documentation DVD, will contain the latest updates when the Documentation DVD is released.

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

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

*Continues on next page*

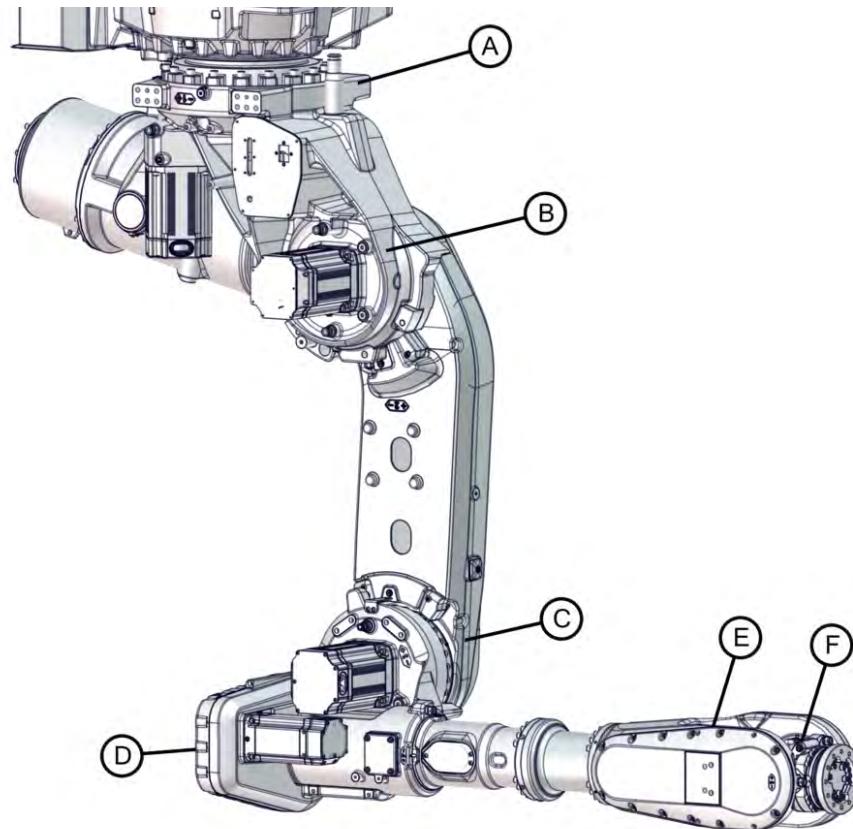
### 3 Maintenance

#### 3.4.1 Type of lubrication in gearboxes

*Continued*

#### Location of gearboxes

The figure shows the location of the gearboxes.



xx1600002100

A	Gearbox, axis 1
B	Gearbox, axis 2
C	Gearbox, axis 3
D	Gearbox, axis 4
E	Gearbox, axis 5
F	Gearbox, axis 6

#### Equipment

Equipment	Note
Oil dispenser	Includes pump with outlet pipe. Use the suggested dispenser or a similar one: <ul style="list-style-type: none"><li>Orion OriCan article number 22590 (pneumatic)</li></ul>
Nipple for quick connect fitting, with o-ring	
oil level gauge	Used to check the oil level in axis-1 gearbox. Assemble the extender to be able to use the oil level gauge when the fork lift accessories are mounted. The tool also includes an air vent.

### 3.4.2 Changing oil, axis-1 gearbox

#### Two alternative ways of draining the oil

There are two alternatives for draining the oil on an IRB 6700Inv, inverted or floor standing. The first section below describes inverted oil drainage and the second floor standing oil drainage.

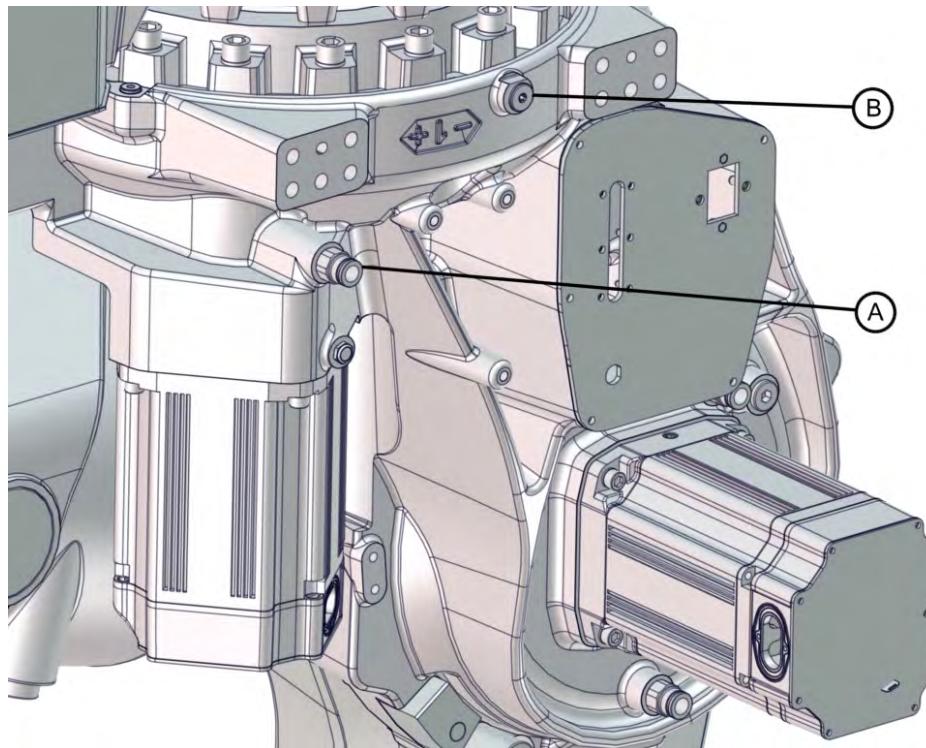
The gearbox is usually always filled in inverted position.

#### Usage of oil dispenser

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

#### Location of oil plugs

The oil plug of the gearbox is located as shown in the figure.



xx1600002030

	Oil plug, Tightening torque: 24 Nm Used for both ventilation and level measurement.
--	--

#### Required tools and equipment

Equipment, etc.	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section <a href="#">Type of lubrication in gearboxes on page 147</a> .

*Continues on next page*

### 3 Maintenance

#### 3.4.2 Changing oil, axis-1 gearbox

Continued

Equipment, etc.	Article number	Note
oil level gauge	3HAC061881-001	Assemble the extender to be able to use the oil level gauge when the fork lift accessories are mounted. The tool also includes an air vent.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

#### Required consumables

Material	Note
Lubricating oil	Information about the oil is found in <i>Technical reference manual - Lubrication in gearboxes</i> . See <a href="#">Type and amount of oil in gearboxes on page 147</a> .

#### Required documents

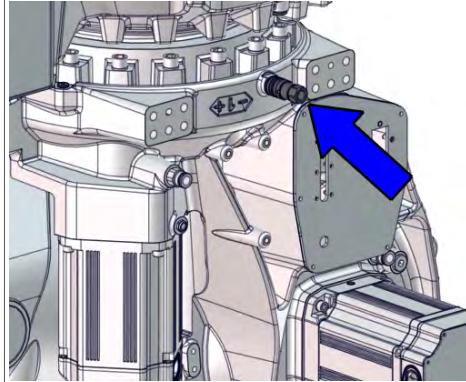
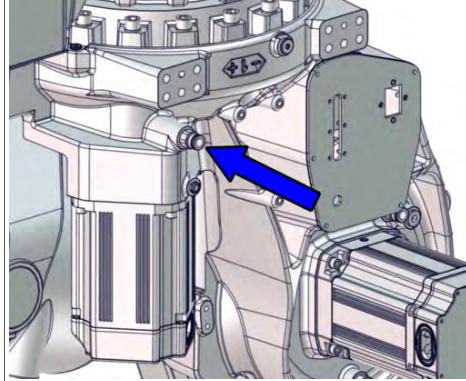
Document name	Document number	Note
<i>Technical reference manual - Lubrication in gearboxes</i>	3HAC042927-001	

#### Draining the axis-1 gearbox

##### Draining the axis-1 gearbox of an inverted robot

	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 robot working area.	
2	 <b>WARNING</b>  Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <a href="#">WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51</a> .	
3	 <b>CAUTION</b>  The gearbox can contain an excess pressure that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.	

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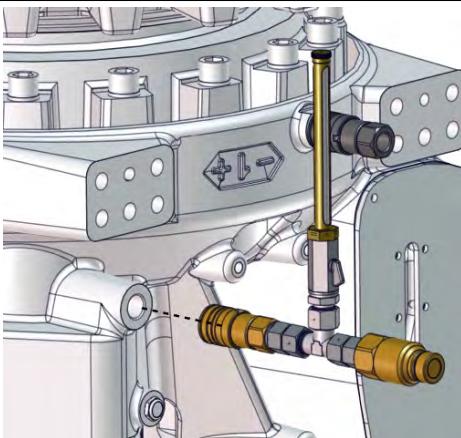
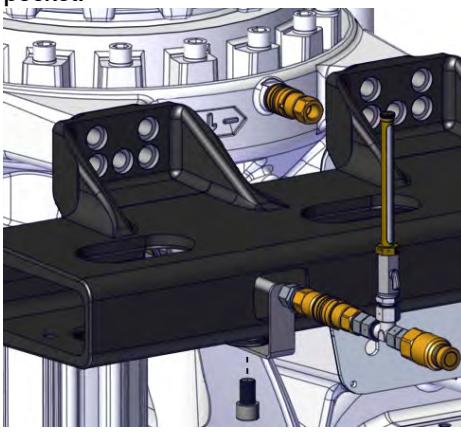
	Action	Note
4	Install the ventilating valve.	 xx1700000349
5	Remove the protective cap and open the oil plug.	 xx1600002042
6	Make sure that the valve is closed (horizontal) and mount the oil level gauge	

*Continues on next page*

### 3 Maintenance

#### 3.4.2 Changing oil, axis-1 gearbox

*Continued*

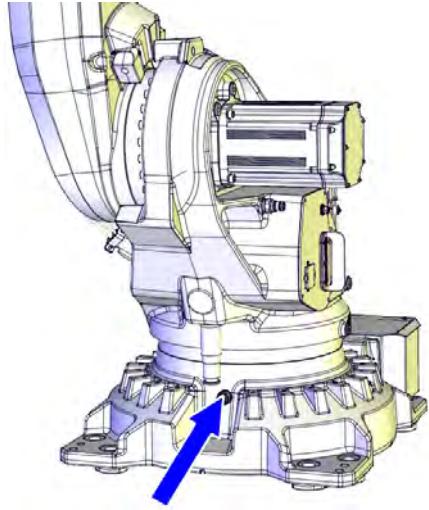
Action	Note
7 Open the valve slowly to avoid air bubbles in the oil. Check the oil level using the oil level gauge. Required oil level is: According to level measurement on tool ± 5 mm	 xx1600002097  If the Fork lift accessory set is assembled, fasten the extender screw in the fork lift pocket.  xx170000314
8 Connect the oil dispenser to the oil level gauge.	
9 Suck out the oil with the oil dispenser.   <b>Note</b> There will be some oil left in the gear after draining.	
10  <b>WARNING</b> Used oil is hazardous material and must be disposed of in a safe way. See section <a href="#">Decommissioning on page 705</a> for more information.	
11 Refill oil or: 1 Remove the oil dispenser and the oil level gauge. 2 Refit the oil plug.	Tightening torque: 24 Nm

*Continues on next page*

## Draining the axis-1 gearbox of a floor-standing robot

If the robot has been taken down to floor standing, for example due to axis-1 gearbox replacement, the gearbox is drained when the robot is floor standing.

Use this procedure to drain the gearbox.

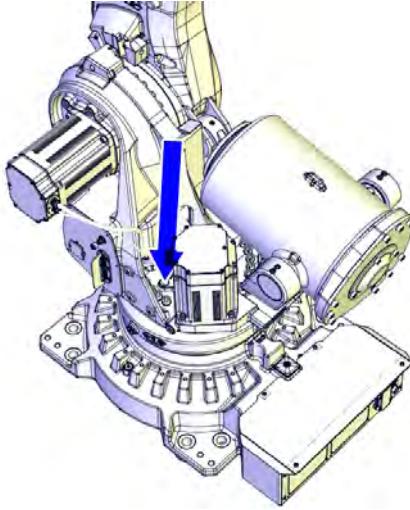
	Action	Note
1	 <b>DANGER</b> Turn off all: <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> to the robot, before entering the robot working area.	
2	 <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <b><i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51.</i></b>	
3	 <b>CAUTION</b> The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.	
4	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx1200000948

Continues on next page

### 3 Maintenance

#### 3.4.2 Changing oil, axis-1 gearbox

*Continued*

Action	Note
5 Remove the plug from the vent hole.   <b>WARNING</b> Open the vent hole while using the dispenser, to avoid damaging vital parts in the gear.	 xx1200000950
6 Suck out the oil with the oil dispenser.   <b>Note</b> There will be some oil left in the gear after draining.	
7   <b>WARNING</b> Used oil is hazardous material and must be disposed of in a safe way. See section <a href="#">Decommissioning on page 705</a> for more information.	
8 Remove the oil dispenser and refit the protective cap on the nipple.	
9 Refit the vent hole plug.	Tightening torque: 24 Nm.

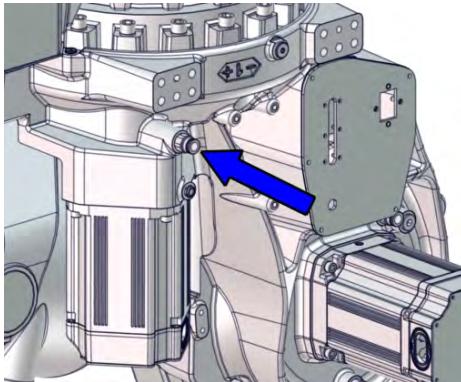
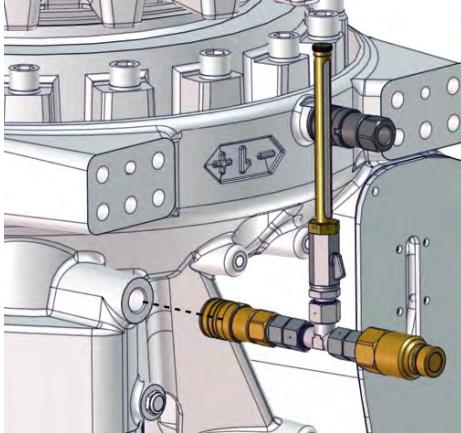
#### Filling oil into the axis-1 gearbox

Use this procedure to refill the gearbox with oil.

#### Filling oil into axis-1 gearbox

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 robot working area.	

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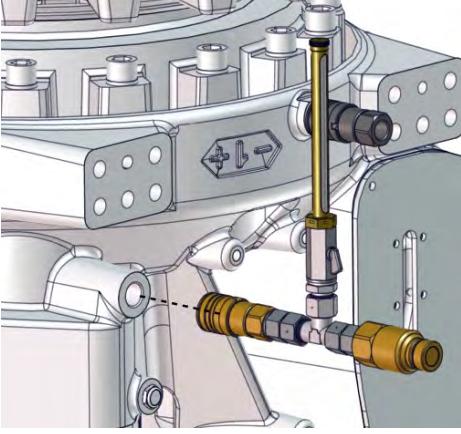
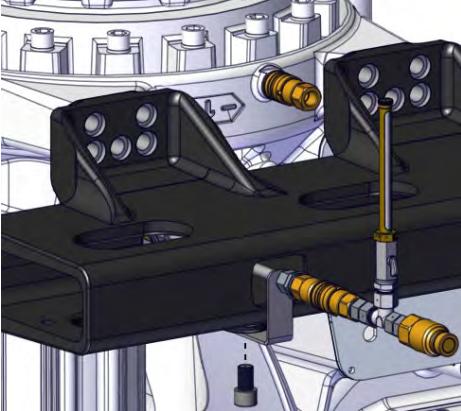
Action	Note
2  <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <b>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51.</b>	
3 Open the oil plug.	 xx1600002042
4 Fit the oil level gauge.	 xx1600002097  If the Fork lift accessory set is assembled, fasten the extender screw in the fork lift pocket.   xx1600002092
5 Connect the oil dispenser to the oil level gauge.	

Continues on next page

### 3 Maintenance

#### 3.4.2 Changing oil, axis-1 gearbox

*Continued*

Action	Note
6 Refill the gearbox with oil with the oil dispenser.	Type of oil and total amount is detailed in <i>Technical reference manual - Lubrication in gearboxes</i> .   <b>Note</b>  The amount of oil to be filled depends on the amount previously being drained.
7 Inspect the oil level using the oil level gauge.	Required oil level: According to level measurement on tool ± 5 mm   xx1600002097  If the Fork lift accessory set is assembled, fasten the extender screw in the fork lift pocket.   xx1700000314
8 Remove the oil dispenser and the oil level gauge.	
9 Refit the oil plug.	Tightening torque: 24 Nm
10  <b>Note</b>  After all repair and maintenance work involving oil, always wipe the robot clean from all surplus oil. The oil can effect the robot color.	

*Continues on next page*

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

### 3 Maintenance

#### 3.4.3 Changing oil, axis-2 gearbox

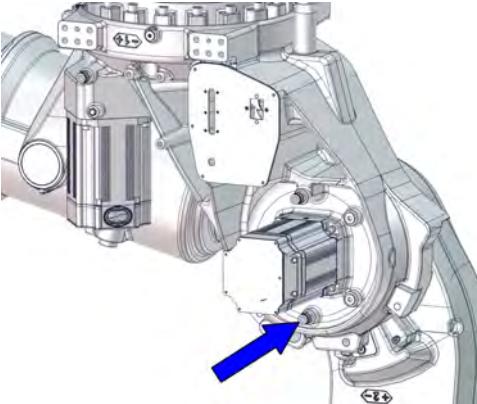
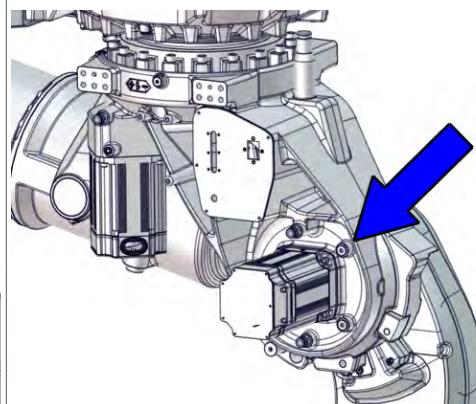
#### 3.4.3 Changing oil, axis-2 gearbox

##### Usage of oil dispenser

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

##### Location of oil plugs

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

 xx1600002141	 xx1600002044
Oil hole with nipple Used for both draining and filling with an oil dispenser.	Vent hole plug/level plug
Tightening torque: N/A.	Tightening torque: 24 Nm.

##### Required tools and equipment

Equipment, etc.	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section <a href="#">Type of lubrication in gearboxes on page 147</a> .
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

##### Required consumable

Material	Note
Lubricating oil	Information about the oil is found in <a href="#">Technical reference manual - Lubrication in gearboxes</a> . See <a href="#">Type and amount of oil in gearboxes on page 147</a> .

Continues on next page

**Required documents**

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

**Draining the axis-2 gearbox**

Use this procedure to drain the gearbox.

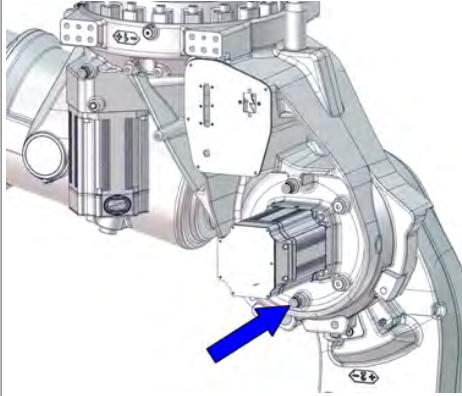
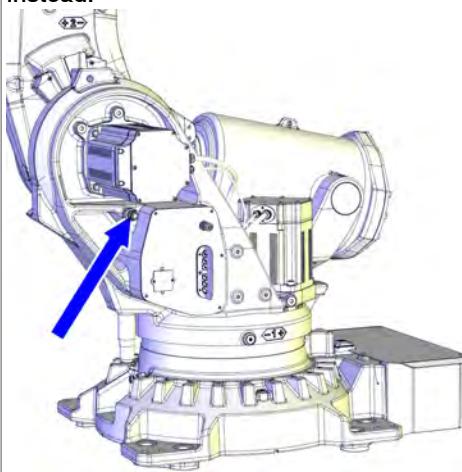
	Action	Note
1	 <b>DANGER</b> Turn off all: <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> to the robot, before entering the robot working area.	
2	 <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <b><i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51.</i></b>	
3	 <b>CAUTION</b> The gearbox can contain an excess pressure that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.	

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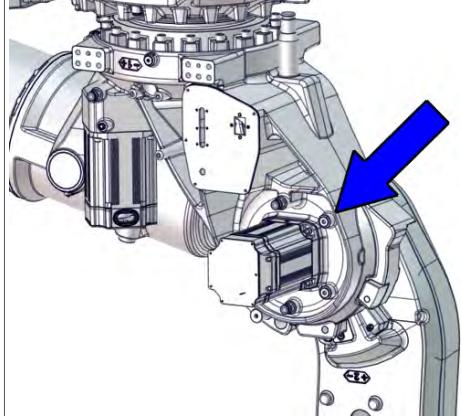
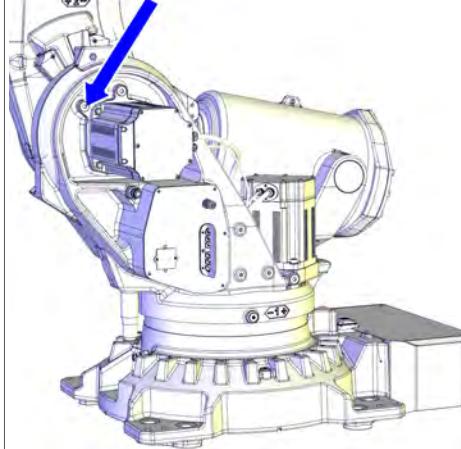
### 3 Maintenance

#### 3.4.3 Changing oil, axis-2 gearbox

*Continued*

Action	Note
4 Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx1600002141 <p>If the robot has been taken down to floor standing, for example due to axis-2 gearbox replacement, refer to the below figure instead.</p>  xx1200000951

*Continues on next page*

Action	Note
5 Remove the plug from the vent hole.   <b>WARNING</b> Open the vent hole while using the dispenser, to avoid damaging vital parts in the gear.	 xx1600002044  If the robot has been taken down to floor standing, for example due to axis-2 gearbox replacement, refer to the below figure instead.   xx1200000952
6 Suck out the oil with the oil dispenser.   <b>Note</b> There will be some oil left in the gear after draining.	
7  <b>WARNING</b> Used oil is hazardous material and must be disposed of in a safe way. See section <a href="#">Decommissioning on page 705</a> for more information.	
8 Refill oil or: 1 Remove the oil dispenser and refit the protective cap on the nipple. 2 Refit the vent hole plug.	Vent hole plug, tightening torque: 24 Nm.

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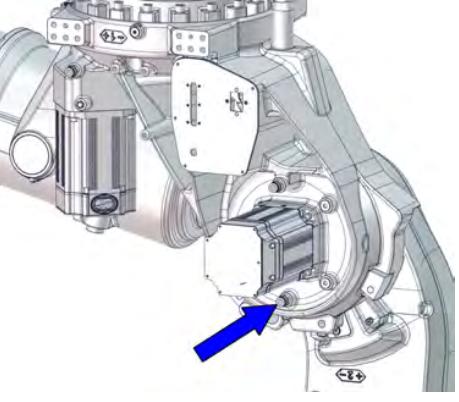
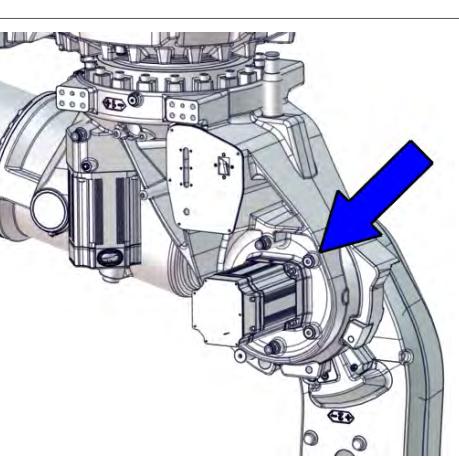
### 3 Maintenance

#### 3.4.3 Changing oil, axis-2 gearbox

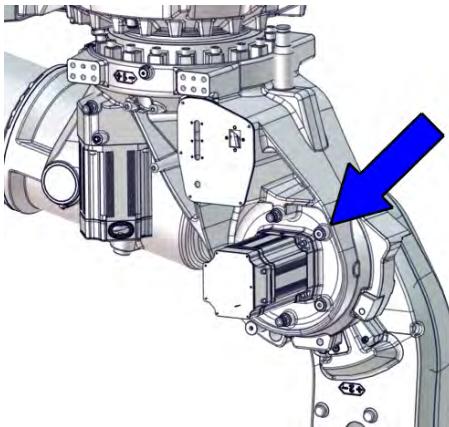
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##### Filling oil into the axis-2 gearbox

Use this procedure to refill the gearbox with oil.

	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 robot working area.	
2	 <b>WARNING</b>  Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <b><i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51.</i></b>	
3	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx1600002141
4	Remove the plug from the vent hole.   <b>Note</b>  The vent hole is opened to let air out during the filling process.	 xx1600002044

*Continues on next page*

	Action	Note
5	Refill the gearbox with oil.   <b>Note</b>  The amount of oil to be filled depends on the amount previously being drained.	Type of oil and total amount is detailed in <i>Technical reference manual - Lubrication in gearboxes</i> .
6	Inspect the oil level at the vent hole (level plug).	 xx1600002044  Required oil level is: 0-15 mm below the oil plug hole. More information is found in <a href="#">Inspecting the oil level in axis-2 gearbox on page 109</a> .
7	Remove the oil dispenser and refit the protective cap to the nipple.	
8	Refit the level plug.	Tightening torque: 24 Nm
9	 <b>DANGER</b>  Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

### 3 Maintenance

#### 3.4.4 Changing oil, axis-3 gearbox

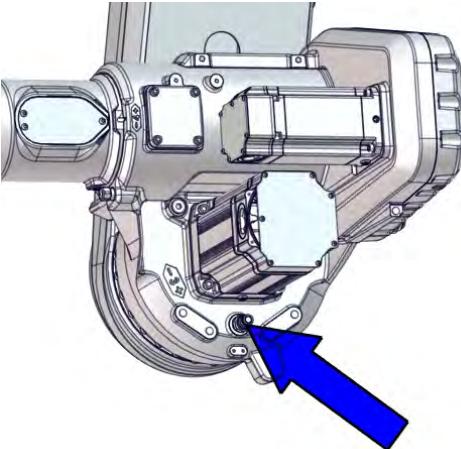
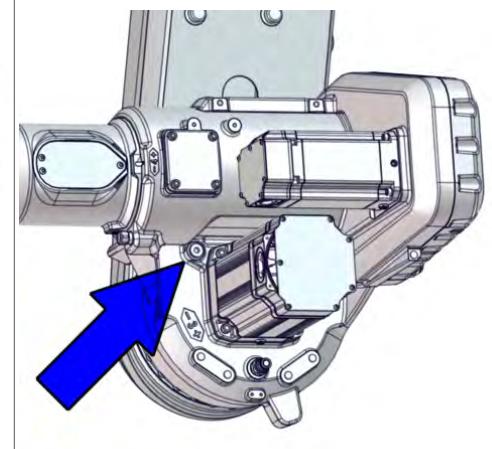
#### 3.4.4 Changing oil, axis-3 gearbox

##### Usage of oil dispenser

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

##### Location of oil plugs

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

	xx1600002145		xx1600002046
Oil hole with nipple Used for both draining and filling with an oil dispenser.			Level/vent plug
Tightening torque: 24 Nm.			Tightening torque: 24 Nm.

##### Required tools and equipment

Equipment, etc.	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section <a href="#">Type of lubrication in gearboxes on page 147</a> .
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

##### Consumable

Material	Note
Lubricating oil	Information about the oil is found in <a href="#">Technical reference manual - Lubrication in gearboxes</a> . See <a href="#">Type and amount of oil in gearboxes on page 147</a> .

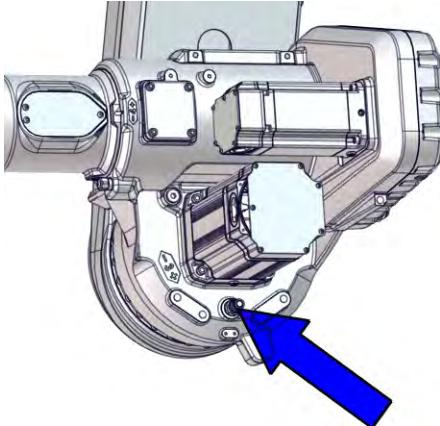
Continues on next page

**Required documents**

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

**Draining the axis-3 gearbox**

Use this procedure to drain the gearbox.

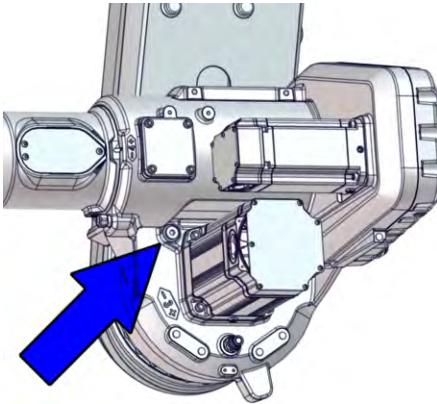
	Action	Note
1	Jog axis-3 to position: -180° (horizontal).	
2	 <b>DANGER</b> Turn off all: <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> to the robot, before entering the robot working area.	
3	 <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <b>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51.</b>	
4	 <b>CAUTION</b> The gearbox can contain an <i>excess pressure</i> that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.	
5	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx1600002145

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### 3 Maintenance

#### 3.4.4 Changing oil, axis-3 gearbox

*Continued*

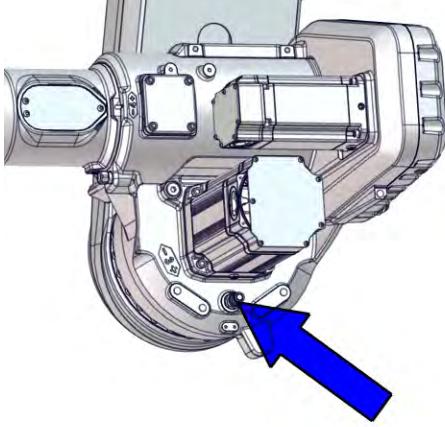
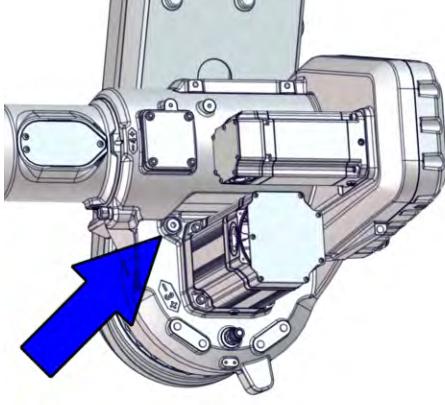
Action	Note
6 Remove the plug from the vent hole.   <b>WARNING</b> Open the vent hole while using the dispenser, to avoid damaging vital parts in the gear.	 xx1600002046
7 Suck out the oil with the oil dispenser.   <b>Note</b> There will be some oil left in the gear after draining.	
8   <b>WARNING</b> Used oil is hazardous material and must be disposed of in a safe way. See <a href="#">Decommissioning on page 705</a> for more information.	
9 Remove the oil dispenser and refit the protective cap on the nipple.	
10 Refit the vent hole plug.	Tightening torque: 24 Nm.

#### Filling oil into the axis-3 gearbox

Use this procedure to refill the gearbox with oil.

Action	Note
1 Jog the robot into position: <ul style="list-style-type: none"> <li>• Axis 1:</li> <li>• Axis 2: 0°</li> <li>• Axis 3: 180° (horizontal)</li> <li>• Axis 4:</li> <li>• Axis 5:</li> <li>• Axis 6: no significance</li> </ul>	

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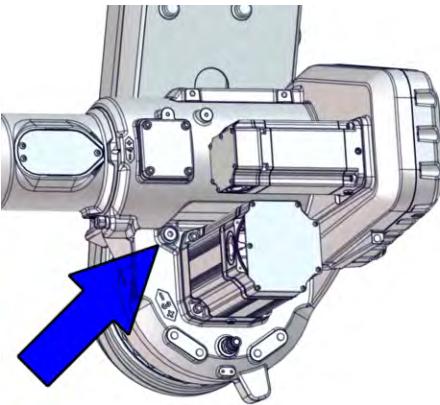
	Action	Note
2	 <b>DANGER</b> Turn off all: <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> to the robot, before entering the robot working area.	
3	 <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <b>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51.</b>	
4	Remove the protective cap from the nipple of the oil hole and connect the oil dispenser.	 xx1600002145
5	<b>Remove the plug from the vent hole.</b>  <b>Note</b> The vent hole is opened to let air out during the filling process.	 xx1600002046

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### 3 Maintenance

#### 3.4.4 Changing oil, axis-3 gearbox

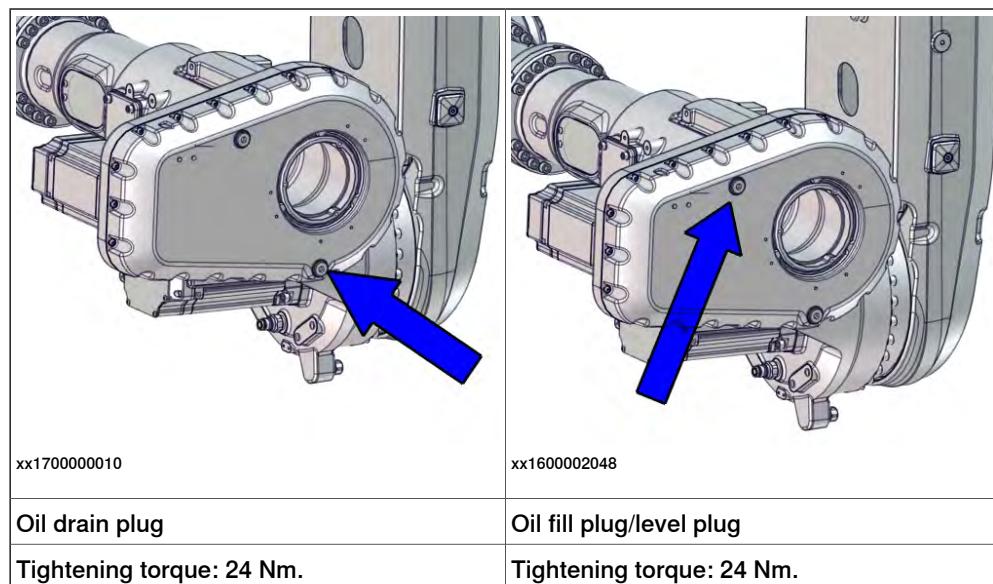
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Action	Note
6 Refill the gearbox with oil.  <b>Note</b> The amount of oil to be filled depends on the amount previously being drained.	Type of oil and total amount is detailed in <i>Technical reference manual - Lubrication in gearboxes</i> .
7 Inspect the oil level at the vent hole (level plug).	 xx1600002046 Required oil level is: 0 - 20 mm below the oil plug hole. More information is found in <a href="#">Inspecting the oil level in axis-3 gearbox on page 112</a> .
8 Remove the oil dispenser and refit the protective cap on the nipple.	
9 Refit the level plug.	Tightening torque: 24 Nm
10  <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

### 3.4.5 Changing oil, axis-4 gearbox

#### Location of oil plugs

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



#### Required tools and equipment

Equipment, etc.	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section <a href="#">Type of lubrication in gearboxes on page 147</a> .
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

#### Consumable

Material	Note
Lubricating oil	Information about the oil is found in <a href="#">Technical reference manual - Lubrication in gearboxes</a> . See <a href="#">Type and amount of oil in gearboxes on page 147</a> .

#### Required documents

Document name	Document number	Note
<a href="#">Technical reference manual - Lubrication in gearboxes</a>	3HAC042927-001	

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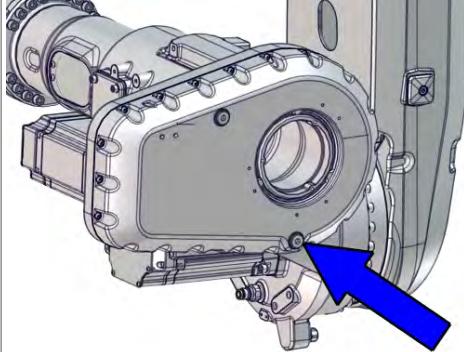
### 3 Maintenance

#### 3.4.5 Changing oil, axis-4 gearbox

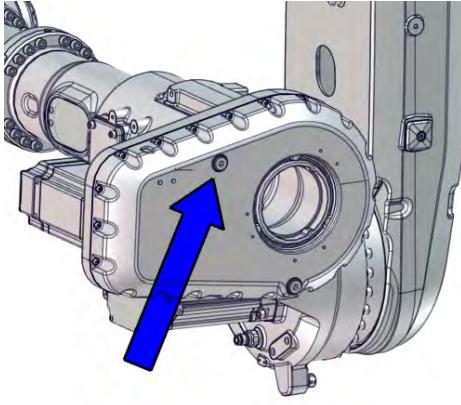
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##### Draining the axis-4 gearbox

Use this procedure to drain the gearbox.

	Action	Note
1	Jog axis-3 to position -180°.	
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 robot working area.	
3	 <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <b><i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51.</i></b>	
4	 <b>CAUTION</b> The gearbox can contain an <i>excess pressure</i> that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.	
5	Place the oil collecting vessel underneath the oil drain plug.	
6	Remove the oil plug from the drain hole and let the oil run into the vessel.	 xx1700000010

*Continues on next page*

Action	Note
7 Remove the oil plug from the fill/level hole.   <b>Note</b>  The level hole is opened to speed up the drainage.	 xx1600002048
8  <b>WARNING</b>  Used oil is hazardous material and must be disposed of in a safe way. See <a href="#">Decommissioning on page 705</a> for more information.	
9 Refill oil or refit the oil plugs.	Tightening torque: 24 Nm.

### Filling oil into the axis-4 gearbox

Use this procedure to refill the gearbox with oil.

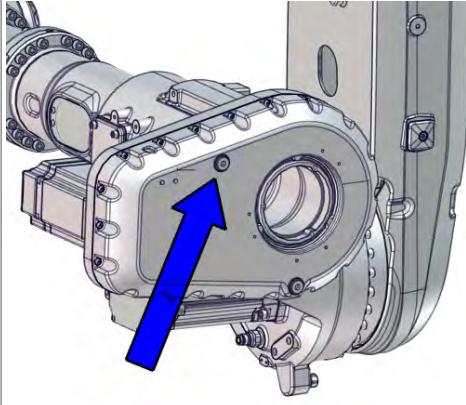
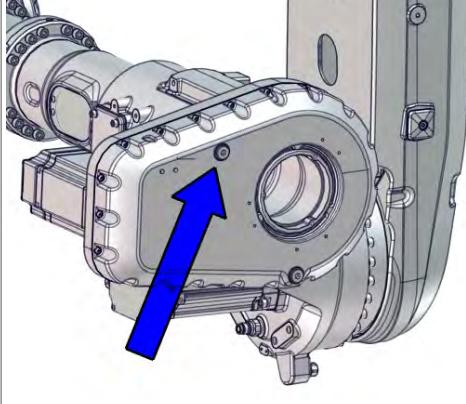
Action	Note
1 Jog axis-3 to position:-180°.	
2  <b>DANGER</b>  Turn off all: <ul style="list-style-type: none"><li>• electric power supply</li><li>• hydraulic pressure supply</li><li>• air pressure supply</li></ul> to the robot, before entering the robot working area.	
3  <b>WARNING</b>  Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <a href="#">WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51</a> .	

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### 3 Maintenance

#### 3.4.5 Changing oil, axis-4 gearbox

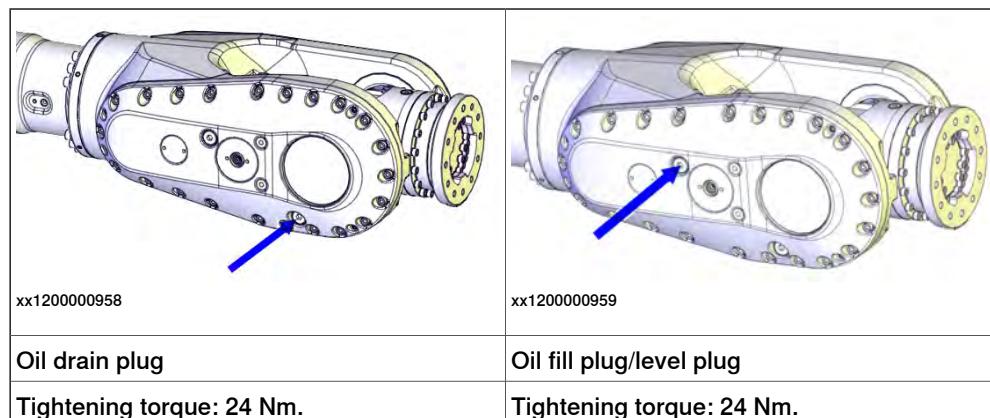
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Action	Note
4 Open the fill/level plug.	 xx1600002048
5 Refill the gearbox with oil. <b>Note</b> The amount of oil to be filled depends on the amount previously being drained.	Type of oil and total amount is detailed in <i>Technical reference manual - Lubrication in gearboxes</i> .
6 Inspect the oil level.	The level is measured at the fill hole.  xx1600002048
7 Refit the oil plug.	Required oil level is: 0 - 10 mm below the oil plug hole. See <i>Inspecting the oil level in axis-4 gearbox on page 115</i> .
8  <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <i>DANGER - First test run may cause injury or damage! on page 46</i> .	

### 3.4.6 Changing oil, axis-5 gearbox

#### Location of oil plugs

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



#### Required tools and equipment

Equipment, etc.	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section <a href="#">Type of lubrication in gearboxes on page 147</a> .
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

#### Consumable

Material	Note
Lubricating oil	Information about the oil is found in <i>Technical reference manual - Lubrication in gearboxes</i> . See <a href="#">Type and amount of oil in gearboxes on page 147</a> .

#### Required documents

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

#### Draining the axis-5 gearbox

Use this procedure to drain the gearbox.

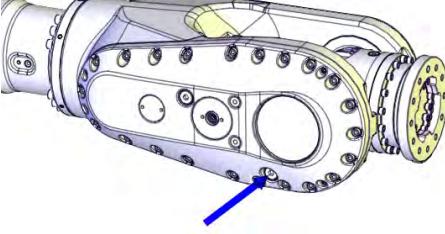
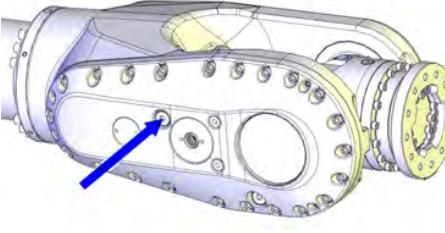
Action	Note
1 Jog axis-2 to 0°, and axis-4 to 180°.	

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### 3 Maintenance

#### 3.4.6 Changing oil, axis-5 gearbox

*Continued*

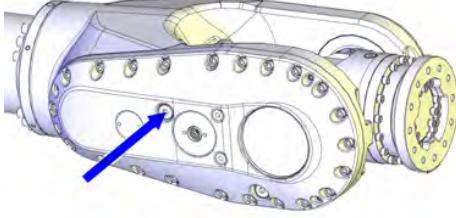
Action	Note
<p>2  <b>DANGER</b></p> <p>Turn off all:</p> <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> <p>to the robot, before entering the robot working area.</p>	
<p>3  <b>WARNING</b></p> <p>Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <b><i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51.</i></b></p>	
<p>4  <b>CAUTION</b></p> <p>The gearbox can contain an <i>excess pressure</i> that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.</p>	
<p>5 Remove the oil plug from the drain hole and let the oil run into the vessel.</p>	 xx1200000958
<p>6 Place the oil collecting vessel underneath the oil drain plug.</p>	
<p>7 Remove the oil plug from the fill/level hole.</p> <p> <b>Note</b></p> <p>The fill hole is opened to speed up the drainage.</p>	 xx1200000959

*Continues on next page*

Action	Note
8  <b>WARNING</b> Used oil is hazardous material and must be disposed of in a safe way. See section <a href="#">Decommissioning on page 705</a> for more information.	
9 Refill oil or refit the oil plug.	Tightening torque: 24 Nm.

**Filling oil into the axis-5 gearbox**

Use this procedure to refill the gearbox with oil.

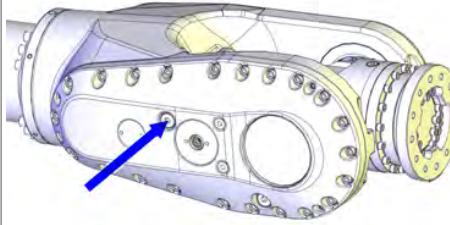
Action	Note
1 Jog axis-2 to 0°, and axis-4 to 180°.	
2  <b>DANGER</b> Turn off all: <ul style="list-style-type: none"><li>• electric power supply</li><li>• hydraulic pressure supply</li><li>• air pressure supply</li></ul> to the robot, before entering the robot working area.	
3  <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <a href="#">WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51</a> .	
4 Open the fill/level plug.	 xx1200000959
5 Refill the gearbox with oil.  <b>Note</b> The amount of oil to be filled depends on the amount previously being drained.	Type of oil and total amount is detailed in <a href="#">Technical reference manual - Lubrication in gearboxes</a> .

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### 3 Maintenance

#### 3.4.6 Changing oil, axis-5 gearbox

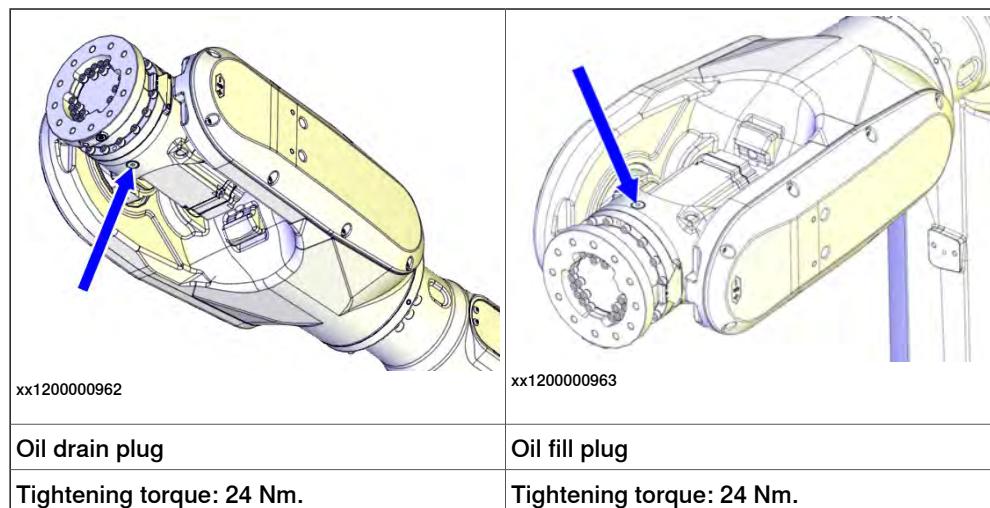
*Continued*

Action	Note
6 Inspect the oil level at the oil fill/level hole (level plug).	 xx1200000959 Required oil level is: 0 - 10 mm below the oil plug hole. More information is found in <a href="#">Inspecting the oil level in axis-5 gearbox on page 118</a> .
7 Refit the oil plug.	Tightening torque: 24 Nm
8  <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

### 3.4.7 Changing oil, axis-6 gearbox

#### Location of oil plugs

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



#### Required tools and equipment

Equipment, etc.	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section <a href="#">Type of lubrication in gearboxes on page 147</a> .
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

#### Consumable

Material	Note
Lubricating oil	Information about the oil is found in <i>Technical reference manual - Lubrication in gearboxes</i> . See <a href="#">Type and amount of oil in gearboxes on page 147</a> .

#### Required documents

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

#### Draining the axis-6 gearbox

Use this procedure to drain the gearbox.

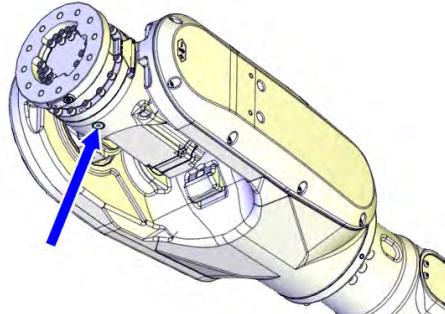
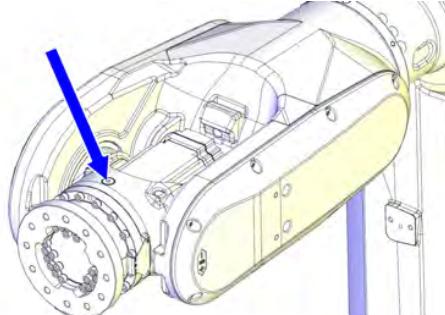
	Action	Note
1	Jog axis-4 to 180°.	

*Continues on next page*

### 3 Maintenance

#### 3.4.7 Changing oil, axis-6 gearbox

*Continued*

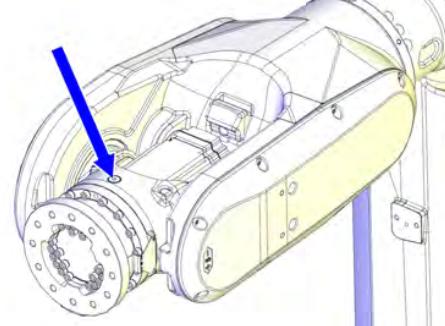
Action	Note
<p>2  <b>DANGER</b></p> <p>Turn off all:</p> <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> <p>to the robot, before entering the robot working area.</p>	
<p>3  <b>WARNING</b></p> <p>Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <b><i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51.</i></b></p>	
<p>4  <b>CAUTION</b></p> <p>The gearbox can contain an <i>excess pressure</i> that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.</p>	
<p>5 Place the oil collecting vessel underneath the oil drain plug.</p> <p>6 Remove the oil plug from the drain hole and let the oil run into the vessel.</p>	 <p>xx1200000962</p>
<p>7 Remove the oil plug from the fill hole.</p> <p> <b>Note</b></p> <p>The fill hole is opened to speed up the drainage.</p>	 <p>xx1200000963</p>

*Continues on next page*

Action	Note
8  <b>WARNING</b> Used oil is hazardous material and must be disposed of in a safe way. See section <a href="#">Decommissioning on page 705</a> for more information.	
9 Refill oil or refit the oil plugs.	Tightening torque: 24 Nm.

**Filling oil into the axis-6 gearbox**

Use this procedure to refill the gearbox with oil.

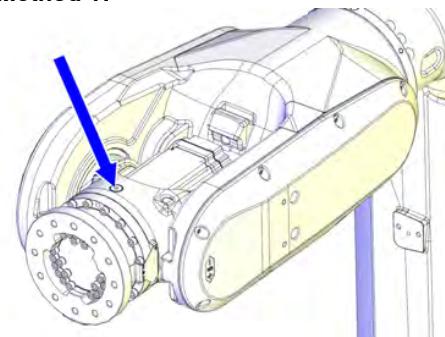
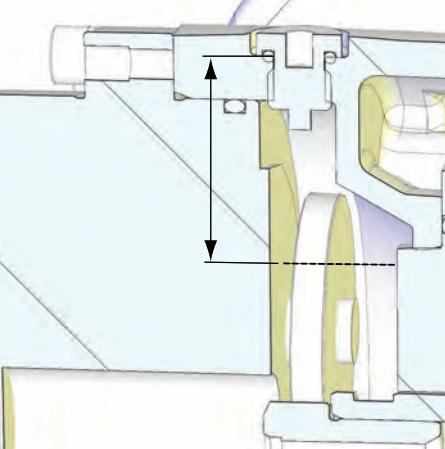
Action	Note
1 Jog axis 5 to horizontal position.	
2  <b>DANGER</b> Turn off all: <ul style="list-style-type: none"><li>• electric power supply</li><li>• hydraulic pressure supply</li><li>• air pressure supply</li></ul> to the robot, before entering the robot working area.	
3  <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <a href="#">WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51</a> .	
4 Open the fill plug.	 xx1200000963
5 Refill the gearbox with oil.  <b>Note</b> The amount of oil to be filled depends on the amount previously being drained.	Type of oil and total amount is detailed in <a href="#">Technical reference manual - Lubrication in gearboxes</a> .

Continues on next page

### 3 Maintenance

#### 3.4.7 Changing oil, axis-6 gearbox

*Continued*

Action	Note
6 Check the oil level.	<p><b>Method 1:</b></p>  <p>The level is measured at the fill hole.</p> <p>Required oil level is: 45 mm ± 5 mm below the sealing surface of the oil plug.</p>  <p>More information is found in <a href="#">Inspecting the oil level in axis-6 gearbox on page 121</a>.</p> <p><b>Method 2:</b></p> <p>Rotate axis 5 +77°.</p> <p>Required oil level is: 0 - 10 mm below the oil plug hole.</p>
7 Refit the oil plug.	Tightening torque: 24 Nm
8 	<p><b>DANGER</b></p> <p>Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <a href="#">DANGER - First test run may cause injury or damage! on page 46</a>.</p>

### 3.4.8 Replacing the SMB battery



#### Note

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

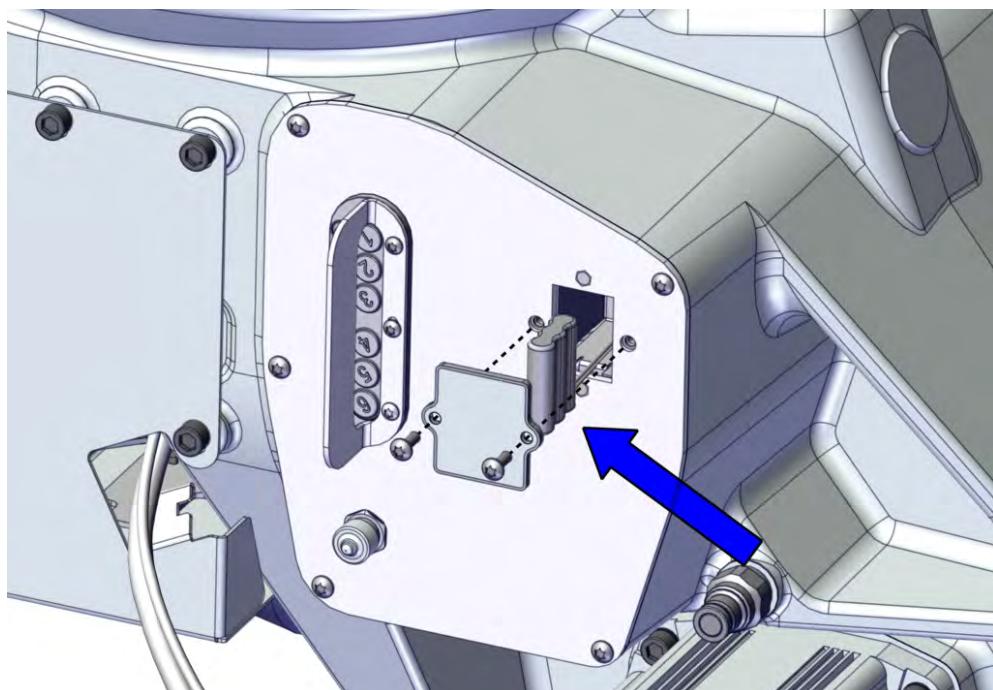


#### WARNING

See instructions for batteries, [WARNING - Safety risks during handling of batteries on page 50](#).

#### Location of SMB battery

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



xx1700000045

#### Required tools

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

*Continues on next page*

### 3 Maintenance

#### 3.4.8 Replacing the SMB battery

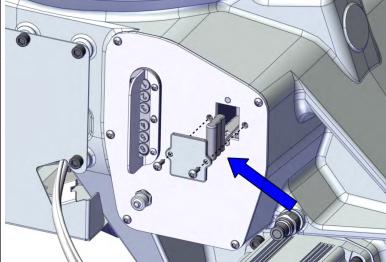
*Continued*

##### Required spare parts

Spare part	Article number	Note
Battery unit	For spare part number, see: • <a href="#">Spare parts on page 723</a>	Battery includes protection circuits. Only replace with the specified spare part or an ABB-approved equivalent.

##### Removing the battery

Use this procedure to remove the SMB battery.

	Action	Note
1	Move the robot to its calibration position.	This is done in order to facilitate updating of the revolution counter.
2	 <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.	
3	 <b>ELECTROSTATIC DISCHARGE (ESD)</b>  The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <a href="#">WARNING - The unit is sensitive to ESD! on page 49</a>	
4	Remove the SMB battery cover by unscrewing the attachment screws.	
5	Pull out the battery and disconnect the battery cable.	
6	Remove the SMB battery. Battery includes protection circuits. Only replace with a specified spare part or with an ABB-approved equivalent.	 xx1700000045

##### Refitting the battery

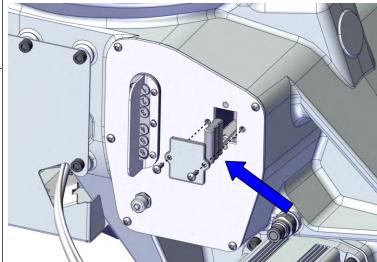
Use this procedure to refit the SMB battery.

	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 robot working area.	

*Continues on next page*

### 3.4.8 Replacing the SMB battery

*Continued*

Action	Note
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <a href="#">WARNING - The unit is sensitive to ESD! on page 49</a>	
3 Connect the battery cable and install the battery pack into the SMB/battery recess.	 xx1700000045
4 Secure the SMB battery cover with its attachment screws.	
5 Update the revolution counters.	See <a href="#">Updating revolution counters on page 688</a> .
6  <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further described in the section <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

### 3 Maintenance

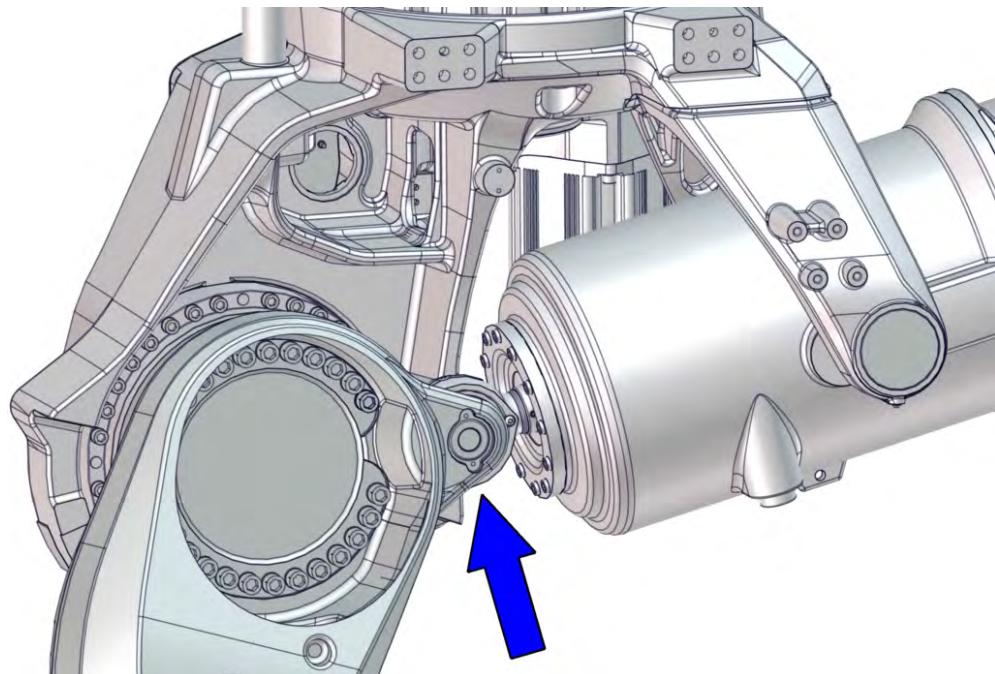
#### 3.5.1 Lubricating the spherical roller bearing, balancing device

### 3.5 Lubrication activities

#### 3.5.1 Lubricating the spherical roller bearing, balancing device

##### Location of spherical roller bearing

The spherical roller bearing is located in the link ear of the balancing device.



##### Consumables

Equipment, etc.	Article number	Note
Bearing grease	3HAB3537-1	Shell Gadus S2V220 AC Used for lubrication of the spherical roller bearing.

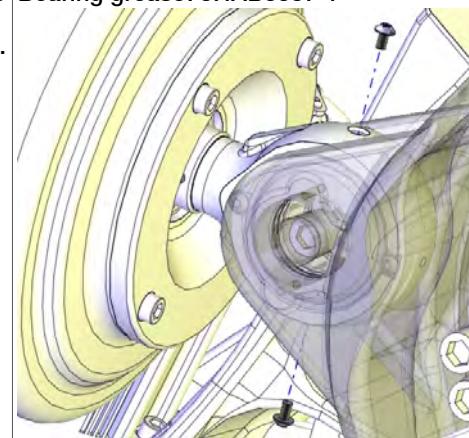
##### Lubricating the spherical roller bearing

Use this procedure to lubricate the spherical roller bearing.

	Action	Note
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

#### 3.5.1 Lubricating the spherical roller bearing, balancing device *Continued*

Action	Note
2 Unscrew both screws in link ear and fill the bearing with grease from the upper hole until the grease appears in the lower hole.	Bearing grease: 3HAB3537-1  xx1300000783
3 Refit the two screws and wipe clean from residual grease.	

## 3 Maintenance

### 3.6.1 Cleaning the IRB 6700Inv

## 3.6 Cleaning activities

### 3.6.1 Cleaning the IRB 6700Inv



#### WARNING

Turn off all electrical power supplies to the manipulator before entering its work space.

#### General

To secure high uptime it is important that the IRB 6700Inv 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 6700Inv.



#### Note

Always verify the protection type of the robot before cleaning.

#### Oil spills

##### Oil spills from gearboxes

Use the following procedure if any oil spills are detected that can be suspected to originate from a gearbox.

- 1 Inspect that the oil level in the suspected gearbox is according to the recommendations, see [Inspection activities on page 100](#).
- 2 Write down the oil level.
- 3 Inspect the oil level again after, for example, 6 months.
- 4 If the oil level is decreased then replace the gearbox.

##### Oil spills discolors painted surfaces

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



#### Note

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

#### Dos and don'ts!

This section specifies some special considerations when cleaning the robot.

##### Always!

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

*Continues on next page*

**Never!**

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

**Cleaning methods**

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

Protection type	Cleaning method			
	Vacuum cleaner	Wipe with cloth	Rinse with water	High pressure water or steam
Standard	Yes	Yes. With light cleaning detergent.	Yes. It is highly recommended that the water contains a rust-prevention solution and that the manipulator is dried afterwards.	No
Foundry Plus	Yes	Yes. With light cleaning detergent or spirit.	Yes. It is highly recommended that the water contains a rust-prevention solution.	Yes <sup>i</sup> . It is highly recommended that the water and steam contains rust preventive, without cleaning detergents.

<sup>i</sup> Perform according to section [Cleaning with water and steam on page 187](#).

**Cleaning with water and steam****Instructions for rinsing with water**

ABB robots with protection types *Standard*, *Foundry Plus*, *Wash*, or *Foundry Prime* can be cleaned by rinsing with water (water cleaner).<sup>1</sup>

The following list defines the prerequisites:

- Maximum water pressure at the nozzle: 700 kN/m<sup>2</sup> (7 bar)<sup>1</sup>
- Fan jet nozzle should be used, min. 45° spread
- Minimum distance from nozzle to encapsulation: 0.4 meters
- Maximum flow: 20 liters/min<sup>1</sup>

<sup>1</sup> Typical tap water pressure and flow

**Instructions for steam or high pressure water cleaning**

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

<sup>1</sup> See [Cleaning methods on page 187](#) for exceptions.

<sup>2</sup> See [Cleaning methods on page 187](#) for exceptions.

*Continues on next page*

### **3 Maintenance**

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#### **3.6.1 Cleaning the IRB 6700Inv**

*Continued*

The following list defines the prerequisites:

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

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#### **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 Repair

## 4.1 Introduction

### Structure of this chapter

This chapter describes all repair activities recommended for the IRB 6700Inv and any external unit.

It is made up of separate procedures, each describing a specific repair activity. Each procedure contains all the information required to perform the activity, for example spare parts numbers, required special tools, and materials.



### WARNING

Repair activities not described in this chapter must only be carried out by ABB. Otherwise damage to the mechanics and electronics may occur.

### Required equipment

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

The details of equipment are also available in different lists in the chapter [Reference information on page 709](#).

### Safety information

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



### Note

If the IRB 6700Inv is connected to power, always make sure that the IRB 6700Inv is connected to earth before starting any repair work.

For more information see:

- *Product manual - IRC5*

## 4 Repair

### 4.2.1 Performing a leak-down test

## 4.2 General procedures

### 4.2.1 Performing a leak-down test

#### When to perform a leak-down test

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

#### Required equipment

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

#### Performing a leak-down test

Action	Note
1 Finish the refitting procedure of the motor or gear in question.	
2 Remove the topmost oil plug on the gear and replace it with the <i>leak-down tester</i> . Regulators, which are included in the leak-down test, may be required.	
3 Use caution, apply compressed air and raise the pressure with the knob until the correct value is shown on the manometer.  <b>CAUTION</b> The pressure must under no circumstance be higher than 0.25 bar (20-25 kPa). Also during the time when the pressure is raised.	Correct value: 0.2-0.25 bar (20-25 kPa)
4 Disconnect the compressed air supply.	
5 Wait for approximately 8-10 minutes and make sure that no pressure loss occurs.	If the compressed air is significantly colder or warmer than the gearbox to be tested, a slight pressure increase or decrease may occur. This is quite normal.
6 If any pressure drop occurred, then localize the leak as described in step 7. If no pressure drop occurred, then remove the leak-down tester and refit the oil plug. The test is complete.	
7 Spray any suspected leak areas with the leak detection spray. Bubbles indicate a leak.	
8 When the leak has been localized, take the necessary measures to correct the leak.	

## 4.2.2 Mounting instructions for bearings

### General

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

### Equipment

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

### Assembly of all bearings

Follow the following instructions while mounting a bearing on the robot.

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

### Assembly of tapered bearings

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

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

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

### Greasing of bearings

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

- The bearings must not be completely filled with grease. However, if space is available beside the bearing fitting, the bearing may be totally filled with grease when mounted, as excessive grease will be pressed out from the bearing when the robot is started.

*Continues on next page*

## **4 Repair**

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### **4.2.2 Mounting instructions for bearings**

*Continued*

- During operation, the bearing should be filled to 70-80% of the available volume.
- Ensure that grease is handled and stored properly to avoid contamination.

Grease the different types of bearings as following description:

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

## 4.2.3 Mounting instructions for seals

### General

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

### Equipment

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

### Rotating seals

The procedure below describes how to fit rotating seals.



#### CAUTION

Please observe the following before commencing any assembly of seals:

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

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

*Continues on next page*

## 4 Repair

### 4.2.3 Mounting instructions for seals

*Continued*

#### Flange seals and static seals

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

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

#### O-rings

The following procedure describes how to fit o-rings.

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

## 4.2.4 Service stops

### Description

Some repair activities require the robot to be taken down to floor standing. The transportation lock screw must always be used when the robot is floor standing, but during some specific repair actions, the lock screw needs to be removed. In those cases, the movement of the lower arm is instead restricted with special service stops.

When to use the service stops is clearly stated in current repair procedures.

The service stops are stored at a parking position at the robot frame, when not used. Always return the service stops to their parking position after the repair activity is completed, according to the repair procedure.



#### WARNING

Never use the service stops as additional mechanical stops for restriction of the robot working range during operation.



#### DANGER

Only use the service stops when the robot is floor standing. Always follow the information given in the repair activities.

*Continues on next page*

## 4 Repair

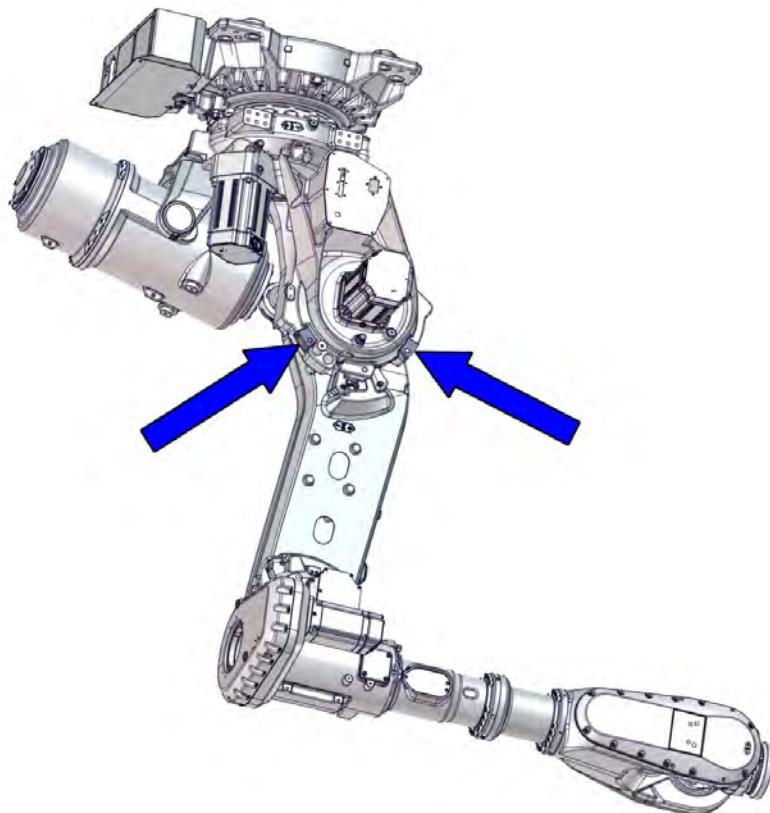
### 4.2.4 Service stops

*Continued*

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#### Location of the service stops

The service stops shown in the figure are located in their parking positions.



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#### Required tools

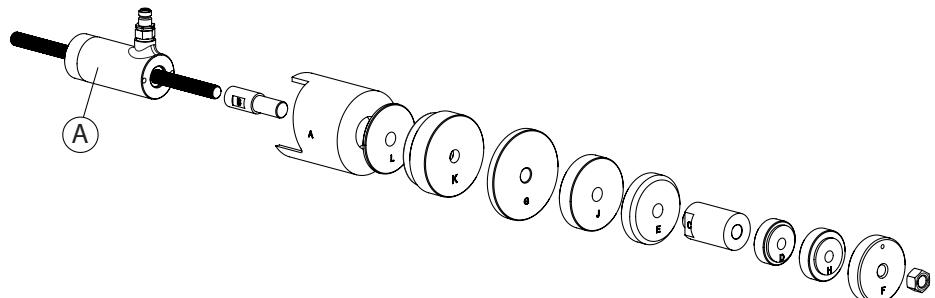
Spare part	Article number	Note
Service stop	3HAC058167-001	Screws: 3HAB3409-88. Tightening torque: 70 Nm $\pm 15$ Nm.

## 4.2.5 Dismantle and mounting tool, 3HAC028920-001

### Dismantle and mounting tool

The dismantle and mounting tool is used to replace shafts and replace bearings and sealings in several of the following instructions. Only some of the tool parts are needed in each procedure. The procedure specifies which tool to be used.

The complete tool set (3HAC028920-001), as follows.



xx1700000383

Part A can be ordered separately, 3HAC028920-002.

## 4 Repair

### 4.3.1 Attaching lifting accessories to complete arm system

## 4.3 Lifting associated procedures

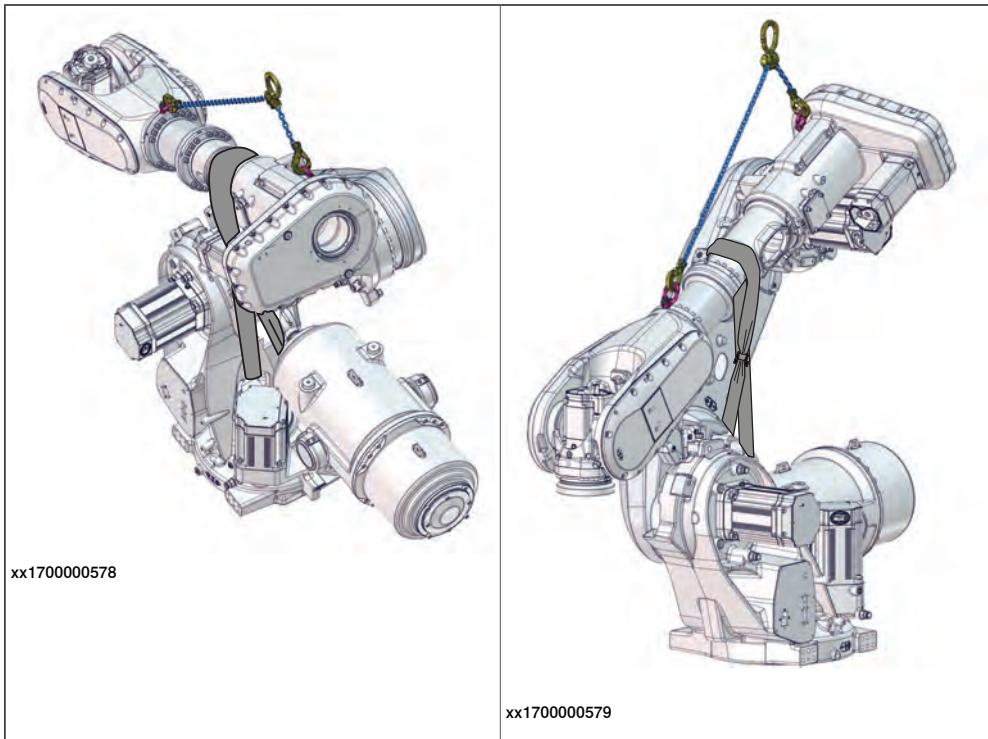
### 4.3.1 Attaching lifting accessories to complete arm system

#### Definition of the complete arm system

The complete arm system consists of the following parts of the robot:

- upper arm
- wrist
- lower arm
- frame, including the balancing device.

#### Attachment points of lifting accessory



#### Note

The robot must be taken down and secured floor standing in order for the lifting accessories to be installed.

How to do that, is described in this section.



#### DANGER

Always lock the position of the lower arm, using the yellow sleeve and transportation lock screw, before attempting to lift the robot.

*Continues on next page*

## 4.3.1 Attaching lifting accessories to complete arm system

*Continued***Required tools**

Equipment, etc.	Article number	Note
Fork lift accessory set	3HAC058825-001	Contains fork lift pockets and all required hardware for installation. User instructions are enclosed with the tool, see Directions for use - Fork lift accessory for IRB 6700Inv. In order to rotate the robot, either use the turning tool or a fork lift truck with a rotator attachment.
Turning tool	3HAC061162-001	User instructions are enclosed.
Lifting eye, M12	3HAC16131-1	
Lifting eye, M12	3HAC16131-1	
Fender washer	-	Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.
Lifting shackle, 2 pcs	-	SA-10-8-NA1
Roundsling, 2 m	-	Lifting capacity: 2,000 kg.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

**Attaching the lifting accessories****Preparations**

	Action	Note
1	Take down and secure the robot floor standing in order to attach the lifting accessories for lift of the arm system.	See <a href="#">Lifting down the robot from inverted position on page 209</a> .

**Attaching the lifting accessories to the arm system**

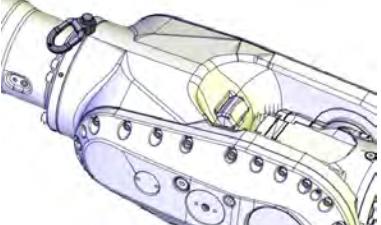
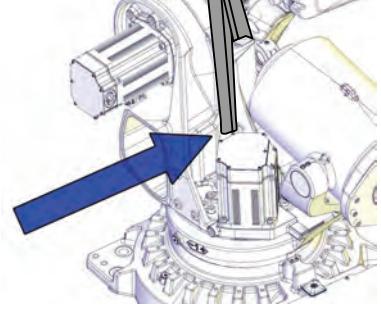
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	 <b>CAUTION</b> The complete arm system weighs 1300 Kg. All lifting accessories used must be sized accordingly!	

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## 4 Repair

### 4.3.1 Attaching lifting accessories to complete arm system

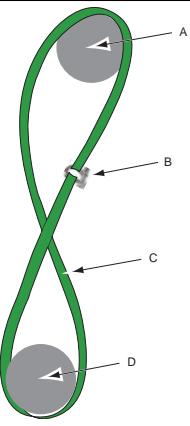
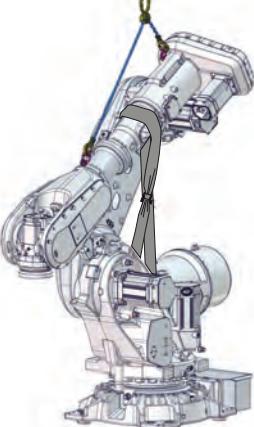
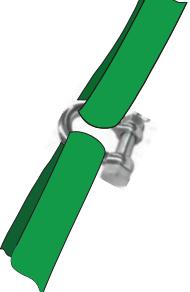
*Continued*

	Action	Note
3	Fit a lifting eye to the wrist.	Lifting eye, M12: 3HAC16131-1  xx1200001133
4	Run a roundsling through the hole in the frame.	Roundsling, 2 m: Lifting capacity: 2,000 kg.  xx1400002107

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## 4.3.1 Attaching lifting accessories to complete arm system

*Continued*

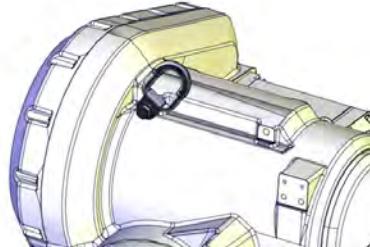
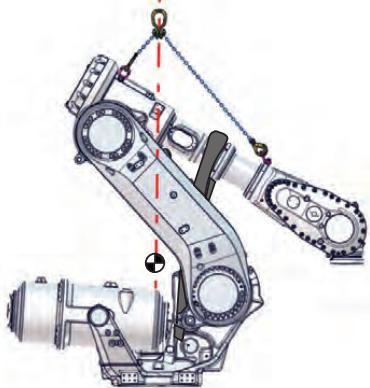
Action	Note
5 Continue to run the roundsling up and over the upper arm.   <b>Tip</b>  When attaching the roundsling, make sure to cross it over, creating a figure 8 of the roundsling. This will prevent the roundsling from gliding.	 xx1400000728 A Upper arm B Shackle C Roundsling D Hole in frame  xx1700000317
6 Connect the roundsling with a shackle.	Lifting shackle, 2 pcs SA-10-8-NA1  xx1400000729

*Continues on next page*

## 4 Repair

### 4.3.1 Attaching lifting accessories to complete arm system

*Continued*

	Action	Note
7	<p>Use caution and jog axis-3 slowly to stretch the roundsling.</p> <p> <b>Note</b></p> <p>Make sure the roundsling is stretched, so it can carry the weight of the frame. The position of axis 3 will be approximately -45°.</p>	
8	<p>Fit a lifting eye to the arm house, with a fender washer underneath.</p>  <p>xx1400002196</p>	<p>Lifting eye, M12: 3HAC16131-1 Fender washer. Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.</p>  <p>xx1200001134</p>
9	<p>Attach the Lifting accessory (chain) to an overhead crane (or similar) and then to the lifting eye in the arm house and to the lifting eye in the wrist. Adjust the lengths of the chains so that the lifting hook is located in line with the center of gravity when the robot arm system is lifted, as shown in the figure.</p>	<p>Lifting accessory (chain): 3HAC15556-1</p>  <p>xx1700000313</p>
10	<p> <b>WARNING</b> The angle between the two chains may not exceed 90°.</p>	 <p>xx1700000319</p>

## 4.3.2 Attaching lifting accessories to an unseparated lower and upper arm

**4.3.2 Attaching lifting accessories to an unseparated lower and upper arm****Attachment points of lifting accessory**

xx1700000577

**Note**

The robot must be taken down and secured floor standing in order to perform this lift.

**Required tools**

Equipment, etc.	Article number	Note
Fork lift accessory set	3HAC058825-001	Contains fork lift pockets and all required hardware for installation. User instructions are enclosed with the tool, see Directions for use - Fork lift accessory for IRB 6700Inv. In order to rotate the robot, either use the turning tool or a fork lift truck with a rotator attachment.
Turning tool	3HAC061162-001	User instructions are enclosed.
Lifting eye, M12	3HAC16131-1	

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## 4 Repair

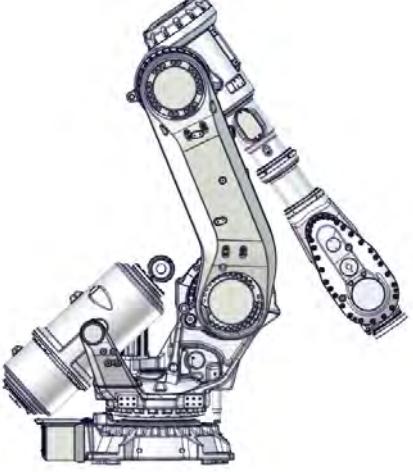
### 4.3.2 Attaching lifting accessories to an unseparated lower and upper arm

*Continued*

Equipment, etc.	Article number	Note
Lifting eye, M12	3HAC16131-1	
Fender washer	-	Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.
Lifting shackle, 2 pcs	-	SA-10-8-NA1
Roundsling, 2 m	-	Lifting capacity: 2,000 kg.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

#### Attaching lifting accessories to the lower and upper arm

##### Robot position

	Action	Note
1	Follow the procedure of replacing the axis-2 gearbox to get the robot prepared for attachment of the lifting accessories for lift of the unseparated lower and upper arm.	See <a href="#">Replacing the axis-2 gearbox on page 594</a> .
2	Jog the robot into position: <ul style="list-style-type: none"><li>• Axis-1: no significance.</li><li>• Axis-2: -15°</li><li>• Axis-3: +70° (approximately)</li><li>• Axis-4: 0°</li><li>• Axis-5: 0°</li><li>• Axis-6: 0°.</li></ul>	 xx1700000374
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 robot working area.	

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## 4.3.2 Attaching lifting accessories to an unseparated lower and upper arm

*Continued*

## Attaching lifting accessories to the lower and upper arm

Use this procedure to attach the lifting accessories.

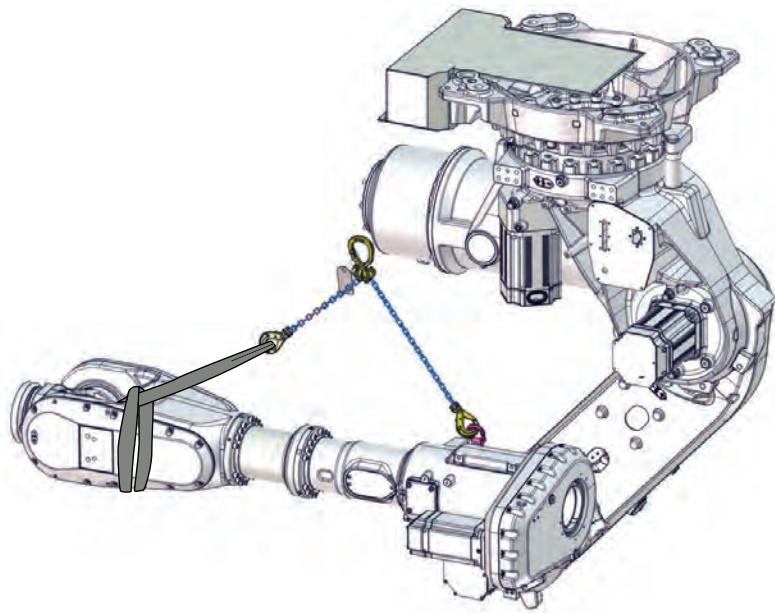
	Action	Note
1	 <b>CAUTION</b> The lower and upper arms together weigh (according to variants) 650 kg. All lifting accessories used must be sized accordingly.	
2	Fit a lifting eye in the arm house, with a fender washer underneath.  xx1400002196	Lifting eye, M12: 3HAC16131-1 Fender washer: Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.  xx1700000376
3	Attach the Lifting accessory (chain) to an overhead crane (or similar), then to the lifting eye in the arm house.	Lifting accessory (chain): 3HAC15556-1   xx1700000377
4	Raise the overhead crane to stretch the chain.	
5	To release the brake, connect the 24 VDC power supply. Connect to connector R2.MP2, axis-2 motor: • + = pin 2 • - = pin 5	

## 4 Repair

### 4.3.3 Attaching lifting accessories to the upper arm

#### 4.3.3 Attaching lifting accessories to the upper arm

##### Attachment points of lifting accessory

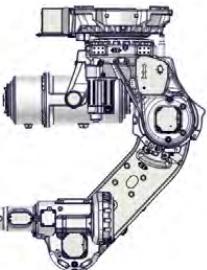


xx1700000453

##### Required equipment

Equipment, etc.	Article number	Note
Lifting eye, M12	3HAC16131-1	
Fender washer	-	Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Roundsling, 1 m	-	Lifting capacity: 1,000 kg.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

##### Robot position

	Action	Note
1	<p>Jog the robot to the position:</p> <ul style="list-style-type: none"><li>• Axis-1: a position that allows best possible access to fit the lifting accessories to the upper arm.</li><li>• Axis-2: -35 (so that the lower arm rests against the service stop).</li><li>• Axis-3: -143 (so that the upper arm is horizontal)</li><li>• Axis-4: 0°</li><li>• Axis-5: +90°</li><li>• Axis-6: 0°</li></ul>	 xx1700000450

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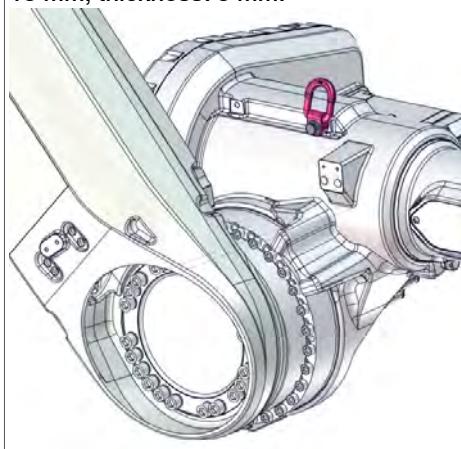
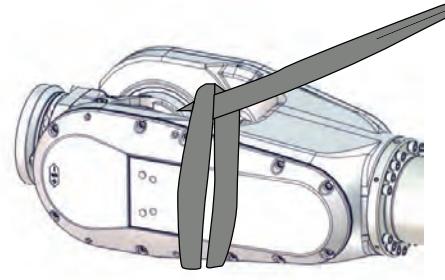
### 4.3.3 Attaching lifting accessories to the upper arm

*Continued*

#### Attaching lifting accessories

##### Attaching the lifting accessories to the upper arm

Use this procedure to attach the lifting accessories to the upper arm.

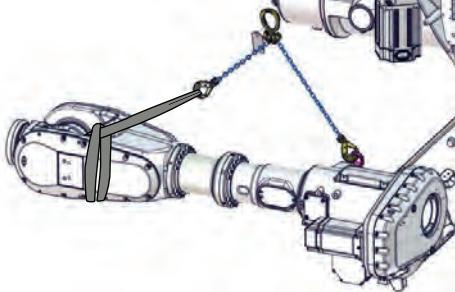
	Action	Note
1	 <b>CAUTION</b> The weight of the complete upper arm (including the wrist) is 465 kg All lifting accessories used must be sized accordingly.	
2	Fit a lifting eye in the arm house, with a fender washer underneath.  xx1400002196	Lifting eye, M12: 3HAC16131-1 Fender washer: Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.  xx1700000454
3	Run a lifting sling around the wrist.	Roundsling, 1 m: Lifting capacity: 1,000 kg.  xx1700000455

*Continues on next page*

## 4 Repair

### 4.3.3 Attaching lifting accessories to the upper arm

*Continued*

Action	Note
4 Attach the upper arm lifting accessory (chain) to an overhead crane (or similar) and then to the lifting eye in the arm house and the lifting sling around the wrist.	Lifting accessory (chain): 3HAC15556-1  xx1700000456
5 Raise the lifting accessories to take the weight of the upper arm.	
6 In case of necessary adjustments, use the shortening loops on the lifting accessory (chain) to find the level position. See figure!	 xx1400002197
7 Release the brakes in order to find the most level lifting position of the upper arm as possible, before lifting. To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP3: <ul style="list-style-type: none"><li>• + = pin 2</li><li>• - = pin 5</li></ul>	24 VDC power supply

## 4.3.4 Lifting down the robot from inverted position

**4.3.4 Lifting down the robot from inverted position****General**

This section details how to lift down the robot from its inverted position, rotate it and secure it floor mounted in order to perform service procedures that require the robot to be standing on the floor.

**DANGER**

Always lock the position of the lower arm, using the yellow sleeve and transportation lock screw, before attempting to lift the robot.

**DANGER**

Always keep the the transportation lock screw and sleeve in locked position when the robot is floor standing. During some repair activities, the transportation lock screw and sleeve is replaced with service stops. These situations are clearly stated in the current repair activities in this manual.

**Required tools and equipment**

Equipment	Article number	Note
Fork lift accessory set	3HAC058825-001	Contains fork lift pockets and all required hardware for installation. User instructions are enclosed with the tool, see Directions for use - Fork lift accessory for IRB 6700Inv. In order to rotate the robot, either use the turning tool or a fork lift truck with a rotator attachment.
Turning tool	3HAC061162-001	User instructions are enclosed.

**Required documents**

Document	Document number
Directions for use - Fork lift accessory for IRB 6700Inv	3HAC060303
User instructions for turning tool (enclosed with the turning tool)	-

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## 4 Repair

### 4.3.4 Lifting down the robot from inverted position

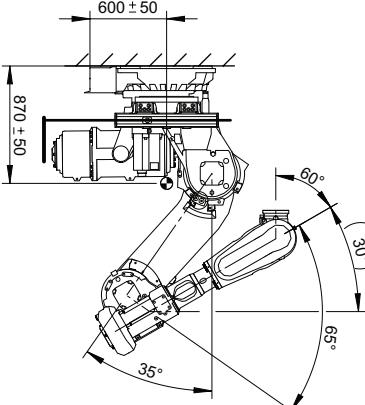
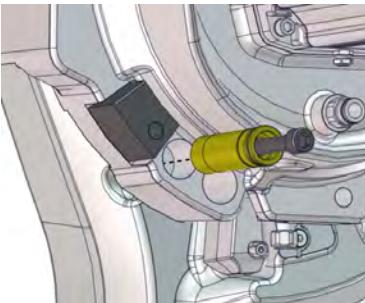
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#### Removing the robot from inverted position

Use these procedures to lift down the robot from inverted position and rotate it to floor standing.

#### Securing the lower arm

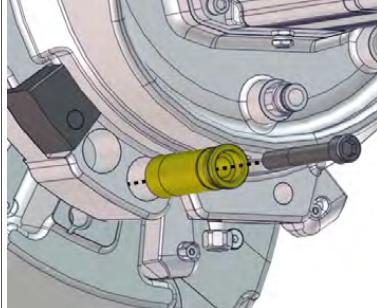
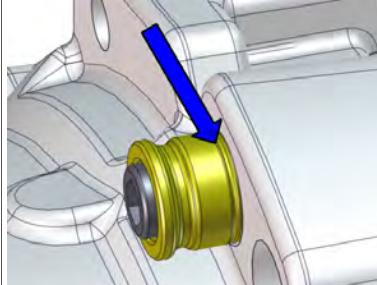
Use this procedure to secure the lower arm before lifting down the robot from inverted position.

	Action	Note
1	Jog the robot into position: <ul style="list-style-type: none"><li>• Axis 1: 0°</li><li>• Axis 2: -35°</li><li>• Axis 3: +65°</li><li>• Axis 4: 0°</li><li>• Axis 5: +60°</li><li>• Axis 6: no significance</li></ul>	 <p>xx1700000555</p>
2	Remove the transportation lock screw and the yellow sleeve from the parking position.	 <p>xx1700000270</p>

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#### 4.3.4 Lifting down the robot from inverted position

*Continued*

Action	Note
<p>3 Insert the yellow sleeve and the transportation lock screw in the hole at the locking position. Insert the sleeve all the way so that the marking in the sleeve is aligned with the casting, see figure. Tighten the screw.</p> <p> <b>DANGER</b></p> <p>Always use the transportation lock screw and sleeve to lock the lower arm at transportation, turning and floor standing.</p>	<p>Tightening torque: 70 Nm <math>\pm</math>15 Nm.</p>  <p>xx1700000269</p>  <p>xx1600002114</p>

#### Lifting down the robot from inverted position

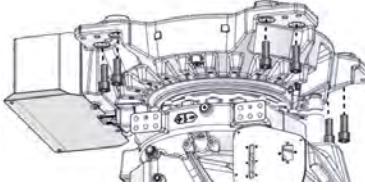
Action	Note
<p>1 If the robot is to be secured to the floor, prepare an area where the robot can be secured with the attachment bolts. The robot must always be secured to the floor if any kind of repair or maintenance work is to be performed.</p>	<p>Suitable screws, lightly lubricated: M24x100 (8 pcs) For hole configuration, see <a href="#">Hole configuration, base on page 74</a>.</p>
2 Verify that the lower arm is secured with the transportation lock screw.	
3 Remove any payload from the robot.	DressPack can stay fitted.
<p>4  <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>	
5 Disconnect the robot cables at the base.	
<p>6  <b>CAUTION</b></p> <p>The IRB 6700Inv robot weighs 1,750 kg. All lifting accessories used must be sized accordingly.</p>	

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## 4 Repair

### 4.3.4 Lifting down the robot from inverted position

*Continued*

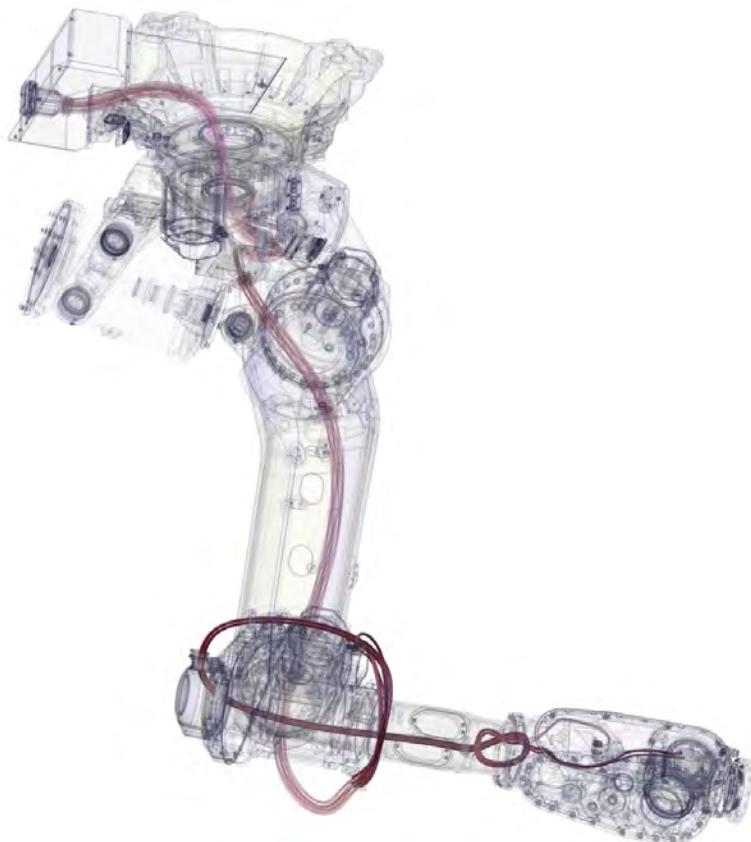
	Action	Note
7	Install the fork lift pockets on the robot, if not already installed.	See user instructions enclosed with the fork lift accessory set. Fork lift accessory set: 3HAC058825-001.
8	Insert the forks of the fork lift truck into the fork lift pockets, as far as possible.	
9	Raise the forks of the fork lift truck to make sure that the weight of the robot rests on the forks.   <b>Tip</b>  Two M16 screws can be fitted to the fork lift pockets, to press the forks against the pockets and make the lift more stable.	
10	Remove the bolts that secure the robot to the foundation.	Quantity: 8 pcs.   xx1600002098
11	Rotate the robot to floor standing position, using the turning tool or using a fork lift truck with a rotator attachment.	Only one direction for rotation is allowed with the turning tool. Follow the user instructions enclosed with the turning tool.
12	Lower and secure the robot to the floor.	Attachment screws: M24x100 (8 pcs).

## 4.4 Complete robot

### 4.4.1 Removing the cable harness

#### Location of the cable harness

The cable harness is located as shown in the figure.



xx1700000341

#### Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

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## 4 Repair

### 4.4.1 Removing the cable harness

*Continued*

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#### Deciding calibration routine

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

	Action	Note
1	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 692</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 cable harness - upper arm and wrist

These procedures describe how to remove the cable harness in the upper arm and wrist.

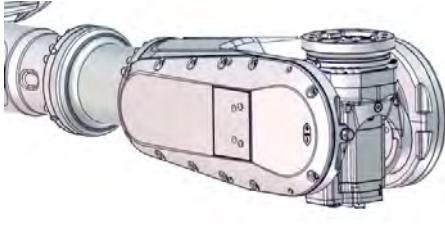
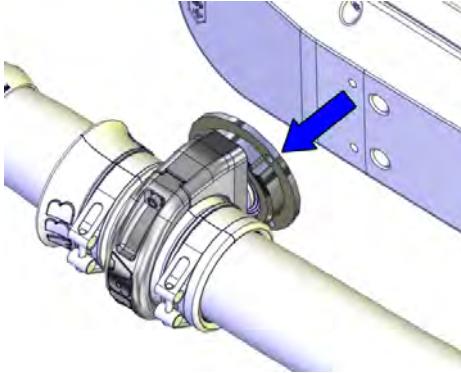
#### Preparations on the robot

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

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## 4.4.1 Removing the cable harness

*Continued*

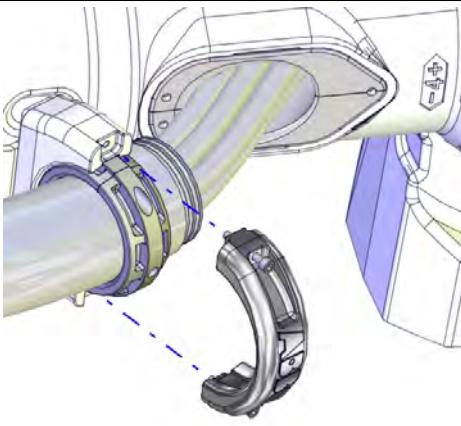
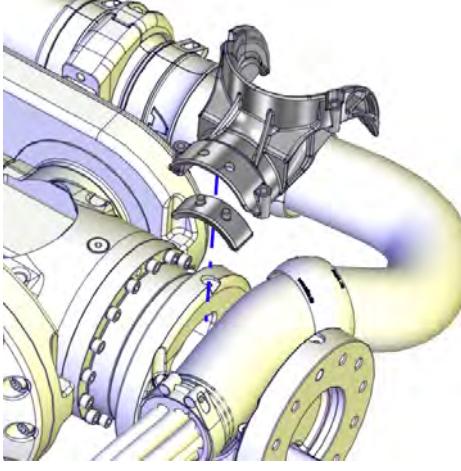
Action	Note
<p>2 Jog the robot to the specified position:</p> <ul style="list-style-type: none"> <li>• Axis 1: 0°</li> <li>• Axis 2: -60°</li> <li>• Axis 3: +60°</li> <li>• Axis 4: 0°</li> <li>• Axis 5: +90°</li> <li>• Axis 6: No significance.</li> </ul> <p> <b>Note</b></p> <p>The specified position is a recommended position for an inverted robot. If the robot has been taken down to floor standing, the robot arm positions given are inaccurate for replacement of the cable harness. Axis-5 must be oriented as close as possible to +90° to be able to open the axis-6 motor cover and to remove the axis-6 motor cables, and in order to avoid the spiral of the cable harness in the carrier, being unwound or placed in the wrong position. Depending on what tool is used, the other axes may need to be jogged to another position.</p>	 xx1600002054
<p>3  <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>	
<p>4 If DressPack is installed:</p> <ul style="list-style-type: none"> <li>• Remove the bracket with the complete ball joint housing still fitted, as shown in the figure.</li> </ul> <p>This is done to be able to reach the two hidden screws that secure the wrist cover.</p>	 xx1400000355

*Continues on next page*

## 4 Repair

### 4.4.1 Removing the cable harness

*Continued*

Action	Note
5 If used, open the ball joint housing on the arm tube and remove the DressPack cable package.	 xx1400000206
6  Note If only the manipulator harness shall be removed, the DressPack cable package can stay fitted on the process turning disk.	 xx1400000208

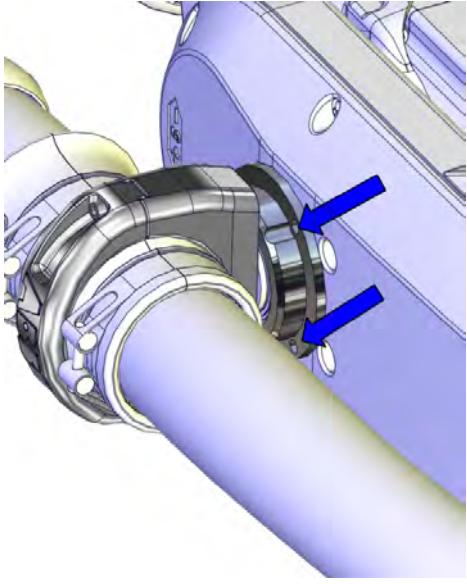
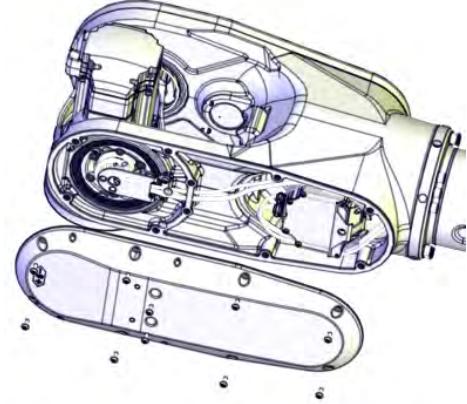
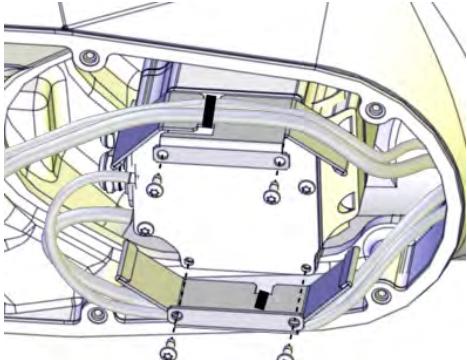
#### Retrieving access to the wrist cabling

Use this procedure to remove the wrist cover to retrieve access to the axis-5 and axis-6 motor cables.

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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**4.4.1 Removing the cable harness**  
*Continued*

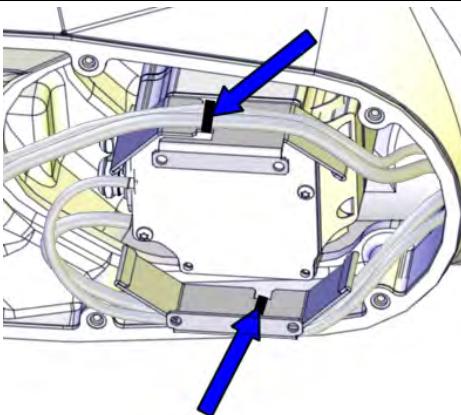
Action	Note
2 If DressPack is not already removed, the complete ball joint housing (including the bracket) must be removed at this point, in order to reach the two hidden screws that secures the wrist cover.	 xx1400000355
3 Remove the wrist cover.	 xx1300002247
4 Remove the heat protection plates from the motor with the cabling still attached to the plate.	 xx1500001030

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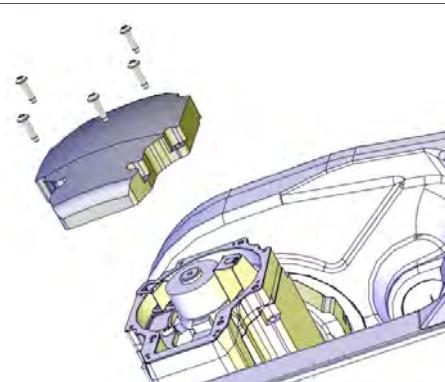
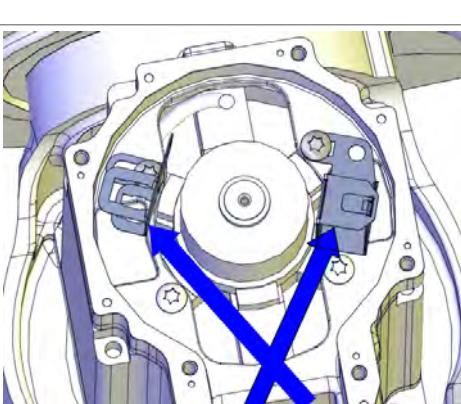
## 4 Repair

### 4.4.1 Removing the cable harness

*Continued*

Action	Note
<p>5 Cut the cable ties that hold the cable harness to the plate.</p> <p><b>Note</b> Keep the heat protection plate until refitting.</p> <p><b>Tip</b> If removing the plate only for replacing the motor, the cabling does not need to be loosened from the plate.</p>	 <p>xx1500001029</p>

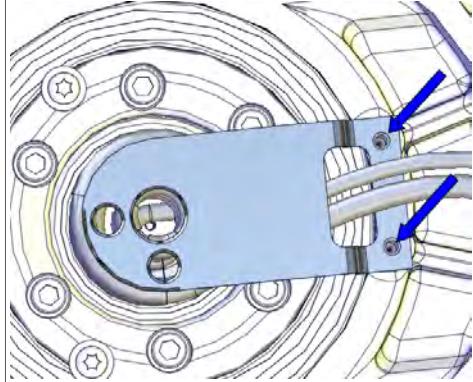
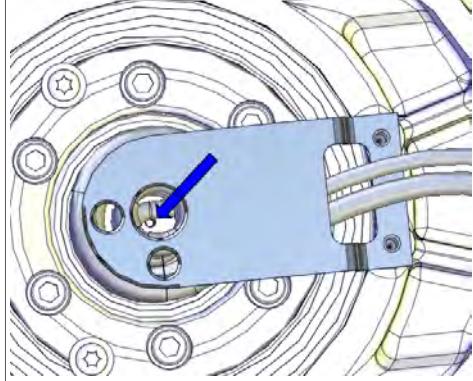
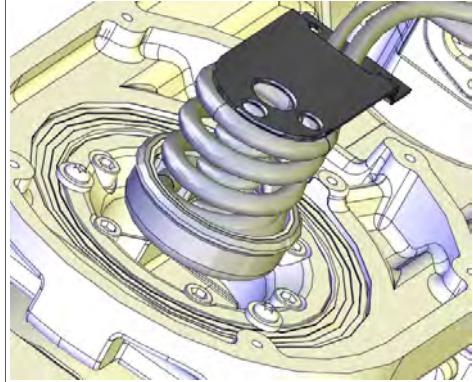
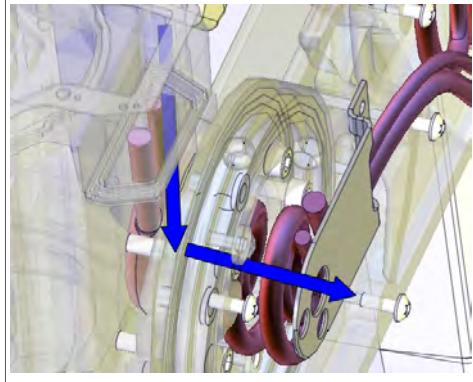
#### Disconnecting the axis-6 motor cables

Action	Note
<p>1 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
<p>2 Unscrew the attachment screws and remove the motor cover.</p>	 <p>xx1200001080</p>
<p>3 Disconnect the motor cables.</p>	 <p>xx1300000488</p>

*Continues on next page*

#### 4.4.1 Removing the cable harness

*Continued*

	Action	Note
4	Unscrew the attachment screws that hold the cable bracket.	 xx1300000484
5	Unscrew the M4 screw that holds the carrier. <b>Note</b> The screw is located at the bottom of the carrier.	 xx1300000485
6	Pull out the carrier from its position.	 xx1300001113
7	Pull out the axis-6 motor cables by holding the cables with one hand at the motor and the other at the carrier.	 xx130000666

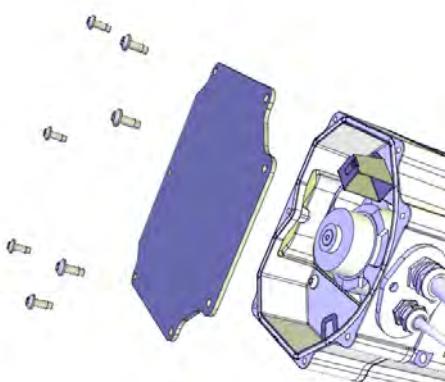
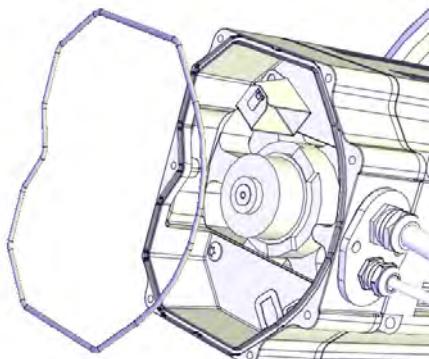
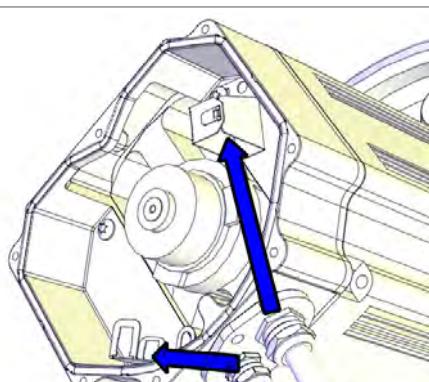
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## 4 Repair

### 4.4.1 Removing the cable harness

*Continued*

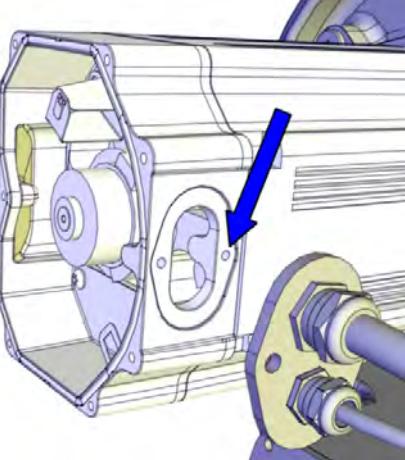
Disconnecting the axis-5 motor cables

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

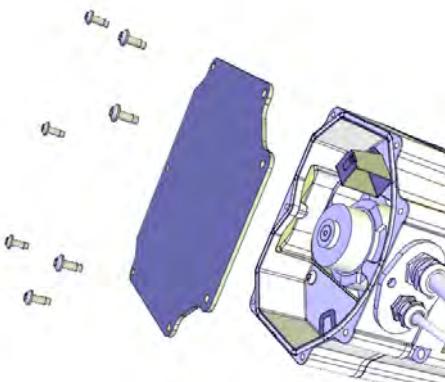
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#### 4.4.1 Removing the cable harness

*Continued*

Action	Note
<p>5 Remove the cable gland cover by performing the following steps:</p> <ol style="list-style-type: none"> <li>1 Open the inner screw a little (the one the arrow is pointing at). No need to remove this screw from the motor.</li> <li>2 Remove the outer screw.</li> <li>3 Slide the cable gland cover away from the inner screw. Make sure the gasket is not damaged.</li> </ol> <p> <b>Tip</b></p> <p>Make a note in which direction the cable exit hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.</p>	 xx1300000656
6 Use caution and pull out the motor cables.	

Disconnecting the axis-3 and axis-4 motor cables

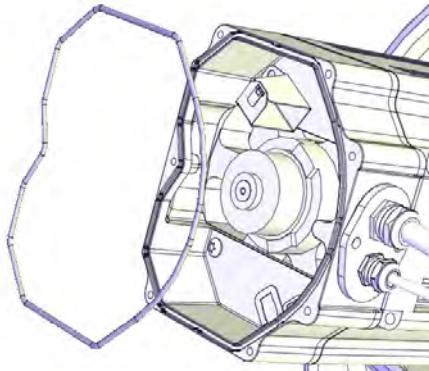
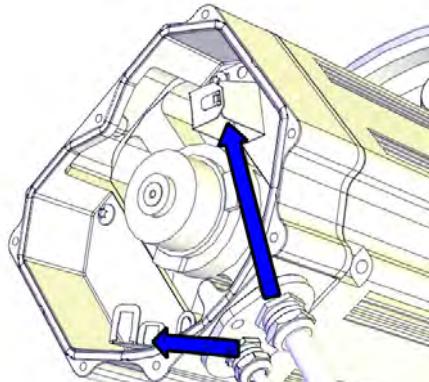
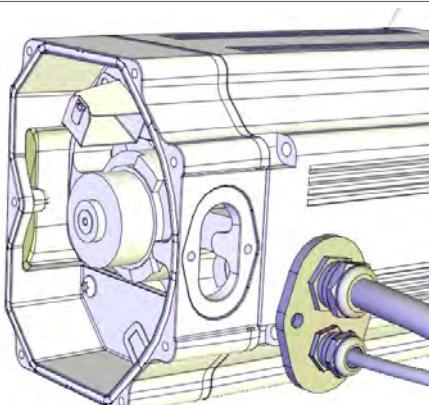
Action	Note
<p>1  <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2 Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135

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## 4 Repair

### 4.4.1 Removing the cable harness

*Continued*

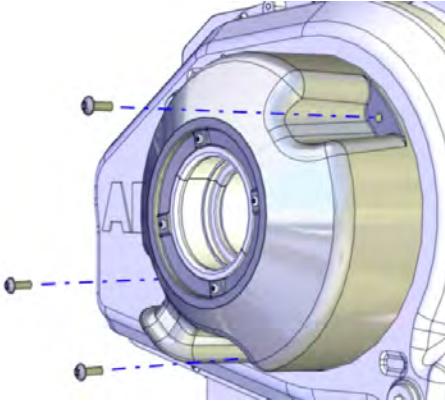
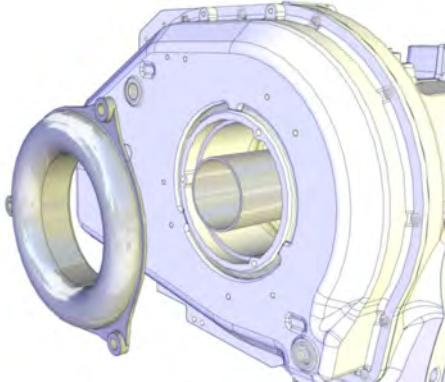
Action	Note
3 Make sure the o-ring is present.	 xx1200001070
4 Disconnect the motor cables.	 xx1200001066
5 Remove the cable gland cover. Make sure the gasket is not damaged.	 <b>Tip</b> <p>Make a note in which direction the <i>cable exit hole</i> is facing, if the motor will be removed too. The motor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

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#### 4.4.1 Removing the cable harness

*Continued*

##### Removing the cable harness - wrist and upper arm

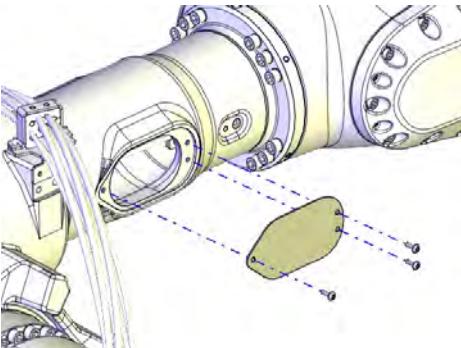
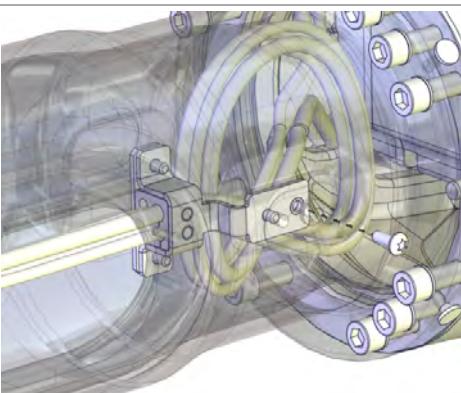
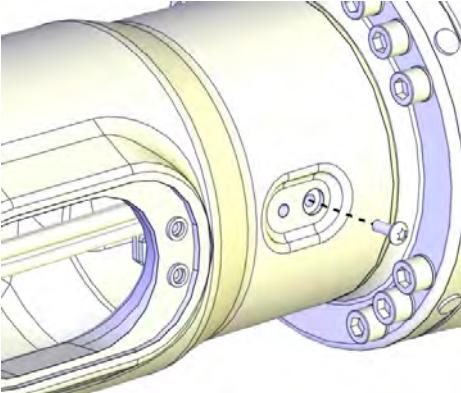
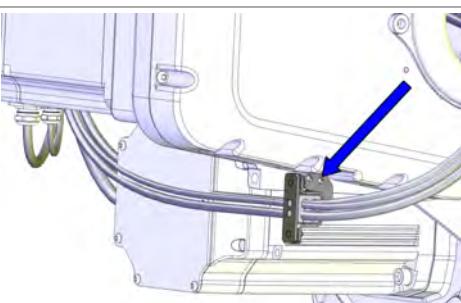
Action	Note
1 Remove the cover.   <b>Note</b>  <b>Foundry Plus:</b> Use caution not to damage the gasket, to loose the washers on the cover sealing or to loose the inserts fitted on the cover.	
2 Remove the cable guide, slide it out a little and let it rest on the cables.	
3  <b>Tip</b>  Use tape and tie the axis-5 and axis-6 connectors and carrier into a bundle (if not already done). This is done to facilitate the procedure and to avoid damaging the parts during the procedure.  This will also make it easier to run the cable harness through the inside of the upper arm.	

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## 4 Repair

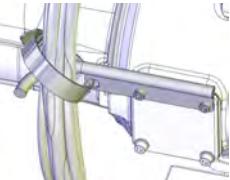
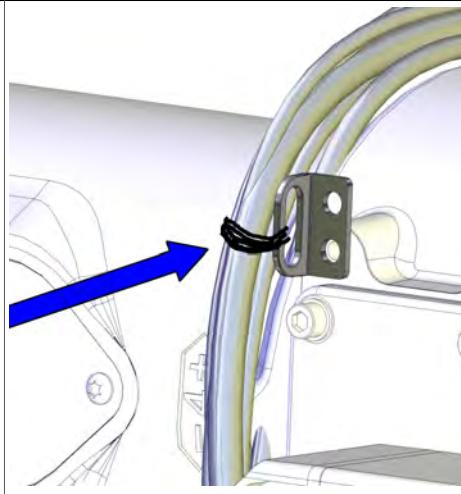
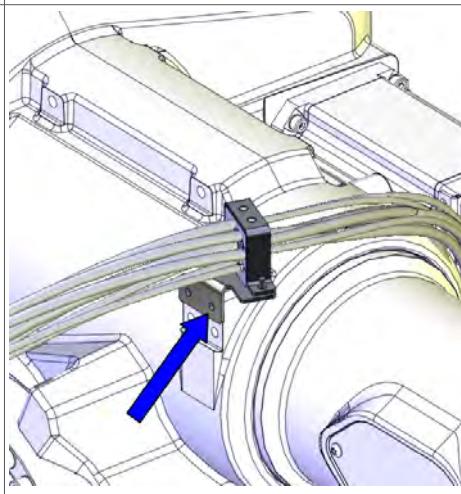
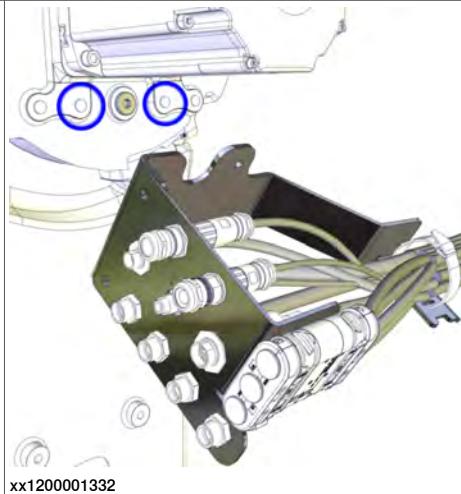
### 4.4.1 Removing the cable harness

*Continued*

Action	Note
4 Remove the side cover on the arm tube.	 xx1300000557
5 Unscrew the attachment screw that secures the axis-4 metal clamp inside the arm tube.   <b>Note</b>  The screw is reached from outside the upper arm!	 xx1700000340   xx1700000339
6 Remove the armhouse metal clamp.	 xx1300000543

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#### 4.4.1 Removing the cable harness Continued

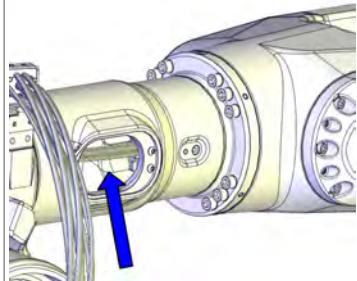
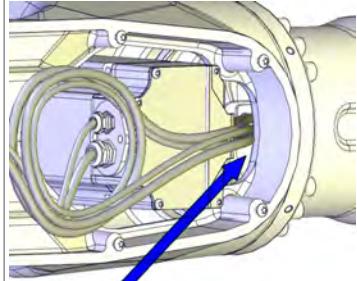
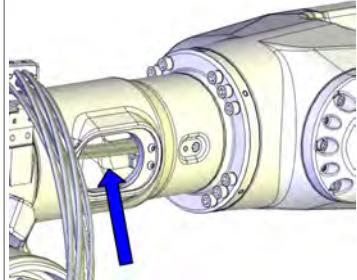
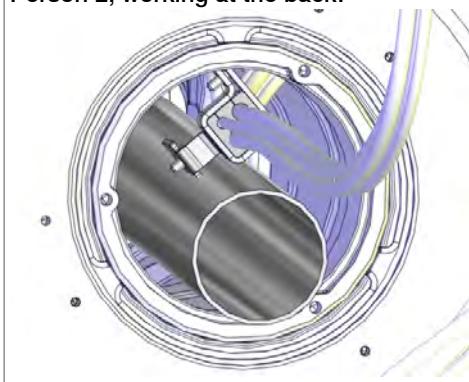
Action	Note
7 Open the velcro strap at the cable fixing bracket.   <b>Note</b>  If DressPack is fitted, the cable fixing bracket is replaced by the cable guide.   xx1300001973 <b>Cable guide.</b>	 xx1300000544 <b>Cable fixing bracket.</b>
8 Remove the metal clamp on top of the armhouse.	 xx1300000541
9 If used (and if not already done), unscrew the screws that hold the connection plate and let it hang free with the rest of the DressPack cable package.	 xx1200001332

*Continues on next page*

## 4 Repair

### 4.4.1 Removing the cable harness

*Continued*

	Action	Note
10	 <b>Tip</b> <p>This step is best performed by two persons working together.</p> <p>Use caution and remove the cable harness out of the wrist like this:</p> <ul style="list-style-type: none"> <li>• Person 1: Put one hand inside the side hole and take a hold of the cable harness.</li> <li>• Person 2: Take a hold on the cable harness inside the wrist.</li> <li>• Together: Move the cable harness past the axis-5 motor and into the arm tube.</li> </ul>	<p>Person 1, working at the side hole:</p>  xx1300000745 <p>Person 2, working at the wrist:</p>  xx1300000746
11	 <b>Tip</b> <p>This step is best performed by two persons working together.</p> <p>Use caution and remove the cable harness out of the arm tube like this:</p> <ul style="list-style-type: none"> <li>• Person 1: Put one hand inside the side hole and take a hold of the cable harness.</li> <li>• Person 2: Take a hold on the cable harness at the back of the robot.</li> <li>• Together: Move the cable harness out of the arm tube.</li> </ul> <p>Remove the cable harness from the upper arm.</p>	<p>Person 1, working at side hole:</p>  xx1300000745 <p>Person 2, working at the back:</p>  xx1400002561

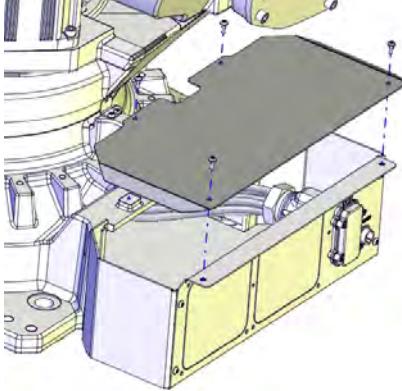
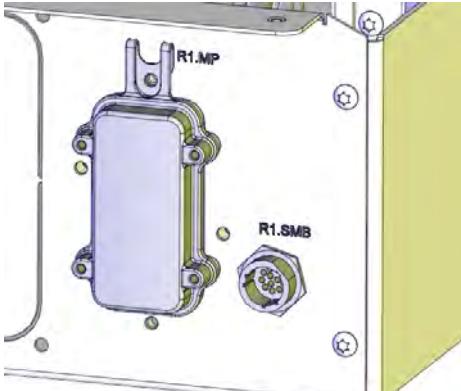
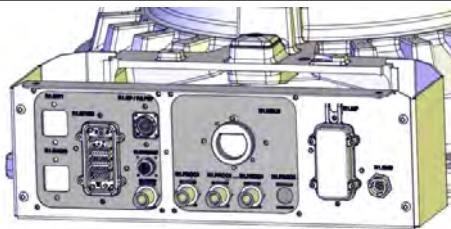
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#### 4.4.1 Removing the cable harness Continued

##### Removing the cable harness - base, frame and lower arm

These procedures describes how to remove the cable harness from base, frame and lower arm.

##### Preparations before removing the cable harness in the base

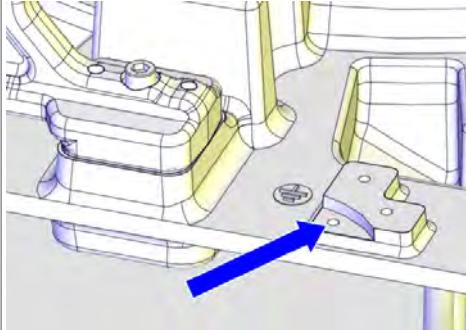
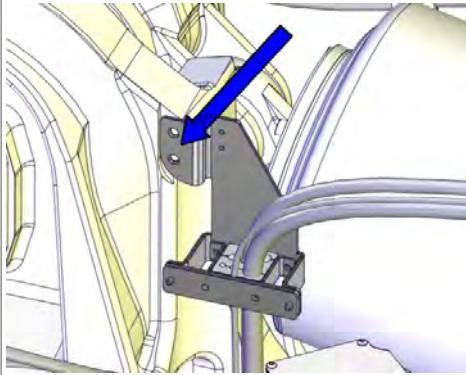
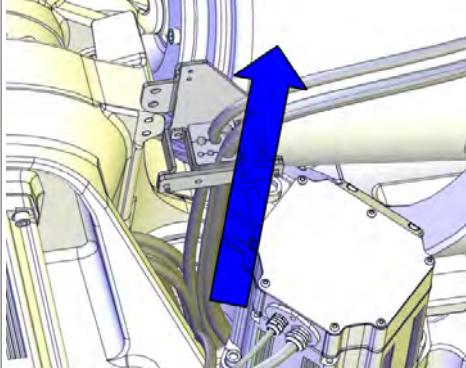
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the base cover.	 xx1300000561
3	Remove connectors in the base: • R1.MP • R1.SMB	 xx1300000591
4	If used, disconnect the DressPack hoses in the base.	 xx1400000366

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## 4 Repair

### 4.4.1 Removing the cable harness

*Continued*

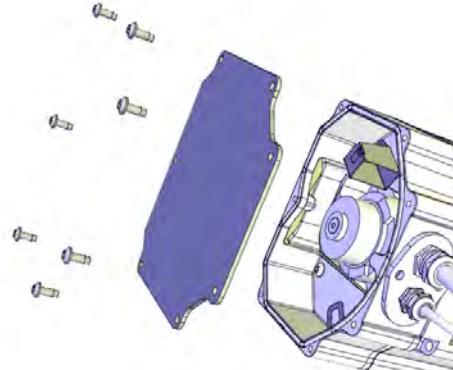
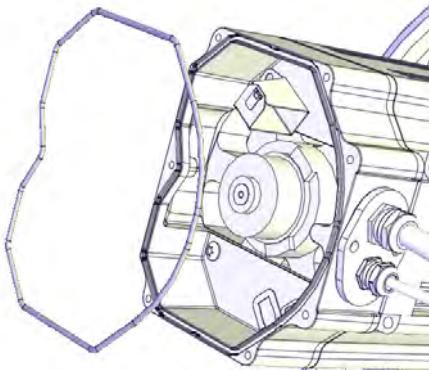
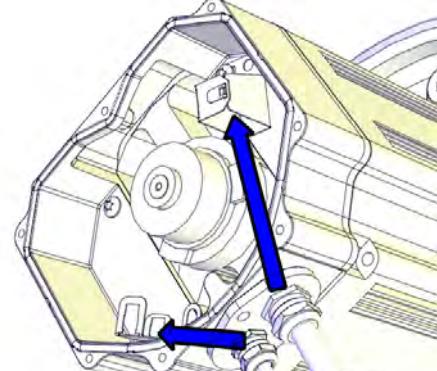
Action	Note
5 Disconnect the earth cable.	<p>Screw dimension : M6x16 Washer dimension : 6.4x17x3</p>  <p>xx1400000354</p>
6 If used, remove the attachment screws that secure the bracket. This is done to facilitate removal of the DressPack hoses.	 <p>xx1400000078</p>
7 If used, use caution and pull out the DressPack hoses through the protection tube in the base.  <b>Note</b> There is no need to pull out the DressPack cables at this point!	 <p>xx1400000088</p>

Disconnecting the axis-1 and axis-2 motor cables

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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**4.4.1 Removing the cable harness**  
*Continued*

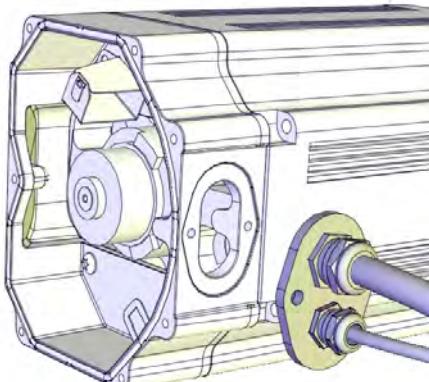
Action	Note
2 Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135
3 Make sure the o-ring is present.	 xx1200001070
4 Disconnect the motor cables.	 xx1200001066

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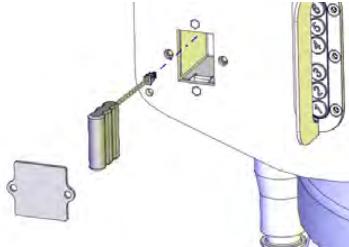
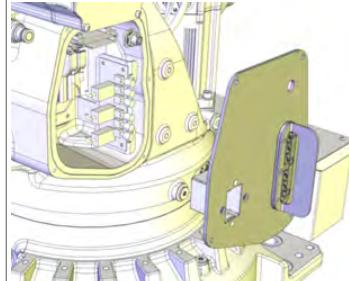
## 4 Repair

### 4.4.1 Removing the cable harness

*Continued*

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

Preparations before disconnecting the SMB unit

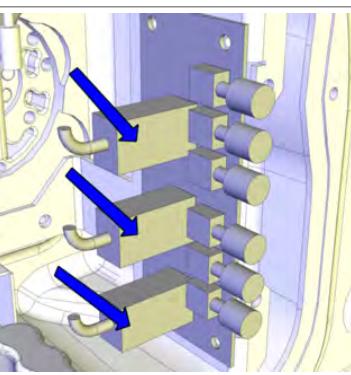
Action	Note
<p>1  <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
<p>2  <b>ELECTROSTATIC DISCHARGE (ESD)</b></p> <p>The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <b>WARNING - The unit is sensitive to ESD! on page 49</b></p>	
3 Open the small cover on the SMB cover, disconnect the battery cable and remove the battery.	 xx1300000829
4 Remove the SMB cover.	 xx1300000669

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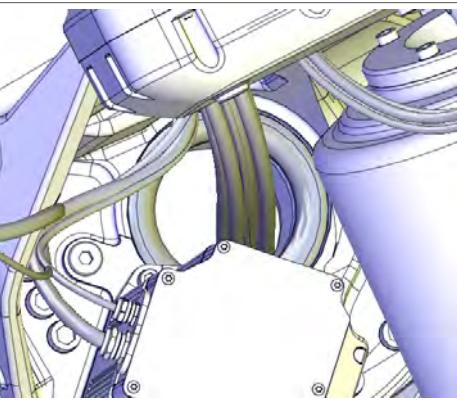
#### 4.4.1 Removing the cable harness

*Continued*

##### Disconnecting the brake release 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 please read the safety information in the section <b><i>WARNING - The unit is sensitive to ESD! on page 49</i></b>	
3	Remove the connectors X8, X9 and X10 from the brake release board.	 xx1300000670

##### Removing the cable harness in the base

	Action	Note
1	If used, use caution and pull out the DressPack cables through the protection tube and place it safely over the balancing device.	
2	Use caution and pull out the robot cable harness through the protection tube.  <b>CAUTION</b> Be careful when pulling out the cabling, there is risk that the white protection ring loosens from the frame.	 xx1300000732
3	Place the cable harness over the balancing device.	

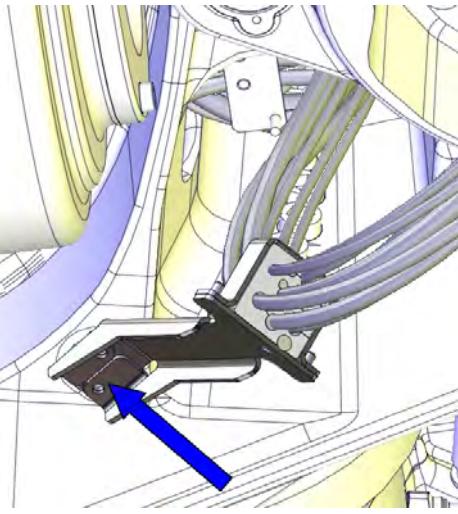
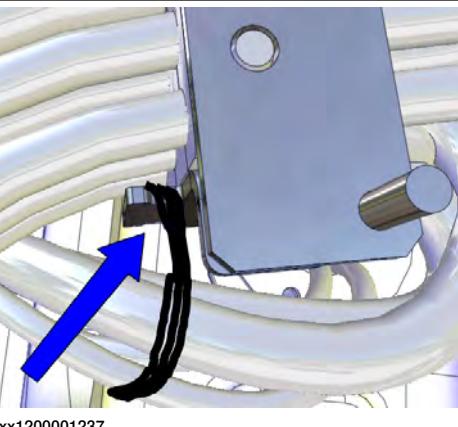
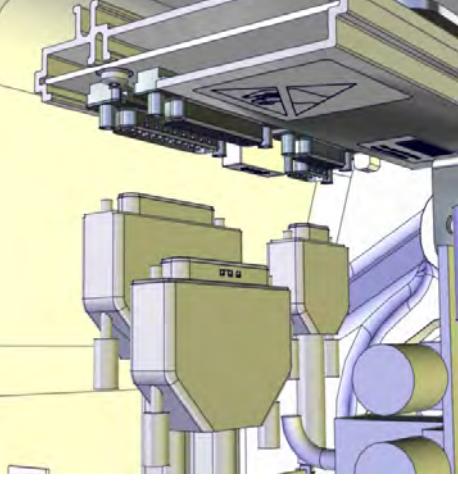
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## 4 Repair

### 4.4.1 Removing the cable harness

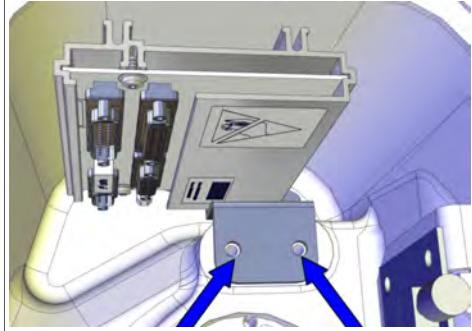
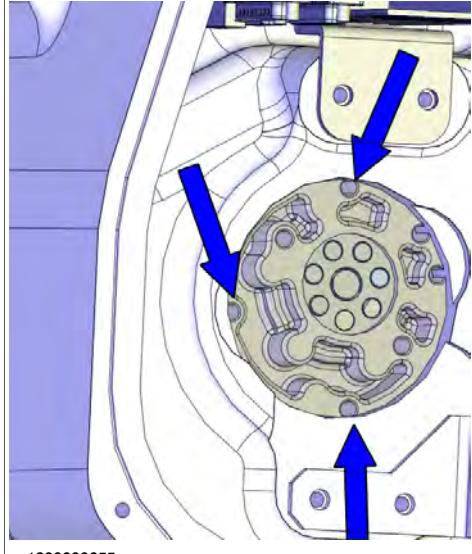
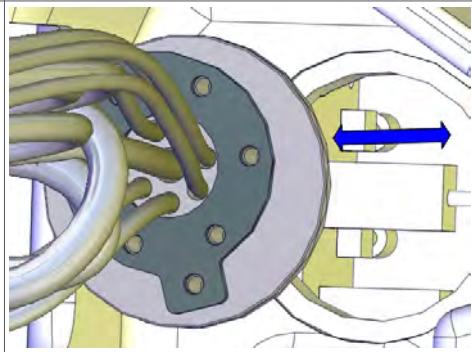
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Removing the cable harness in the frame

Action	Note
1 Unscrew the attachment screws that hold the metal clamp frame.	 xx1300000542
2 Cut the cable tie inside the hole in the frame.	 xx1200001237
3 Disconnect connectors on the SMB unit.	 xx1300001114

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4.4.1 Removing the cable harness  
*Continued*

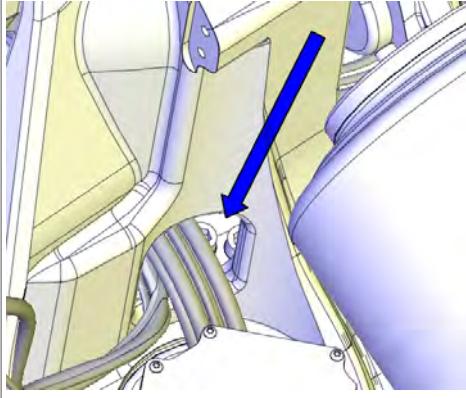
Action	Note
4 Unscrew the screws and washers that holds the bracket with the SMB unit, and remove the SMB unit.	 xx1300000730
5 Put the SMB unit in an ESD bag until it shall be refitted.	
6 Unscrew the three attachment screws that hold the SMB/BU cover from inside the SMB recess.	 xx1300000655
7 Use caution and pull out the cable harness from the SMB recess.	 xx1300000560

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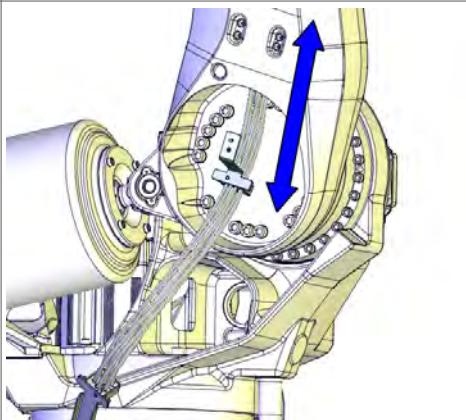
## 4 Repair

### 4.4.1 Removing the cable harness

*Continued*

Action	Note
8 Use caution and pull out the cable harness through the hole in the frame.	 xx1300000593

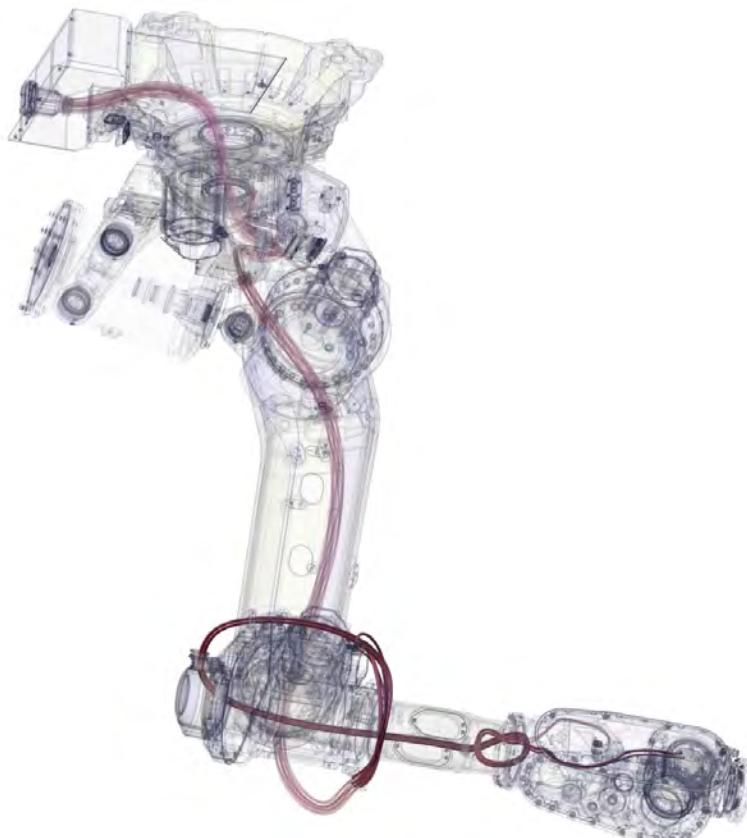
#### Removing the cable harness in the lower arm

Action	Note
1 Loosen the axis-2 lower arm metal clamp and the axis-3 lower arm metal clamp located on the inside of the lower arm by removing the attachment screws.	 xx1300000540
2 Use caution and pull the cable harness out of the lower arm.	 xx1300000733

## 4.4.2 Refitting the cable harness

### Location of the cable harness

The cable harness is located as shown in the figure.



xx1700000341

### Spare part

Spare part	Spare part number	Note
Cable harness	See <i>Product manual, spare parts - IRB 6700</i> .	

### Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

### Consumables

Consumable	Article number	Note
Grease	3HAB3537-1	Used to lubricate o-rings.
O-ring	21522012-429	D=84.5x3 Used on the SMB/BU cover.

*Continues on next page*

## 4 Repair

### 4.4.2 Refitting the cable harness

*Continued*

Consumable	Article number	Note
O-ring	3HAC054692-002	D=169.5x3 Used on axis-1 motor cover.
	3HAC054692-002	D=169.5x3 Used on axis-2 motor cover.
	3HAC054692-002	D=169.5x3 Used on axis-3 motor cover
	3HAC054692-001	D=119x3 Used on axis-4 motor cover.
	3HAC054692-001	D=119x3 Used on axis-5 motor cover.
Gasket	3HAC033489-001	Used on axis-6 motor cover.
Cable ties	-	
Elastic glue and sealant	3HAC042559-001	Sikaflex 521FC

#### Refitting the cable harness - base, frame and lower arm

These procedures describes how to refit the cable harness in base, frame and lower arm.

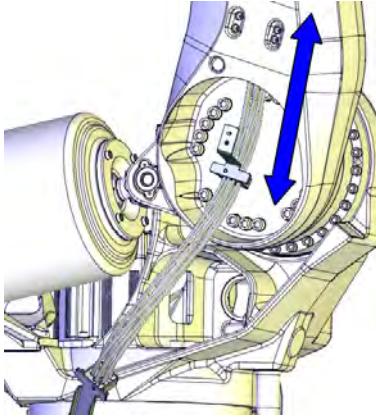
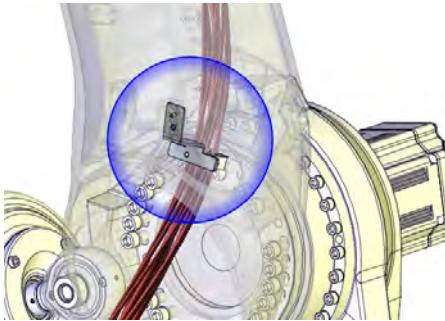
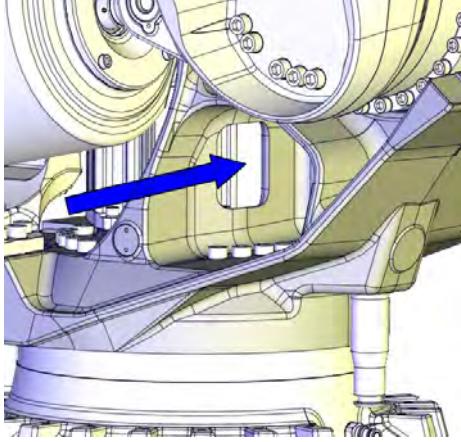
#### Preparations before refitting the cable harness in the base, frame and lower arm

Action	Note
<p>1</p> <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>	
<p>2</p> <p>Tie the axis-5 and axis-6 connectors and carrier into a bundle with tape. This is done to facilitate the procedure and to avoid damaging the parts during the procedure. This will also make it easier to run the cable harness through the inside of the robot.</p>	 xx1300000668

*Continues on next page*

#### 4.4.2 Refitting the cable harness

*Continued*

Action	Note
3 Run the cable harness through the lower arm.	 xx1300000733
4 Secure the axis-2 lower arm cable bracket. <p><b>Note</b> Do not secure the axis-3 lower arm cable bracket at this point.</p> <p><b>Note</b> Screws are reached from the outside of the lower arm.</p>	 xx1300000734
5 Run the cable harness into the hole in the frame in this order: <ul style="list-style-type: none"> <li>• R1.MP</li> <li>• R1.SMB</li> <li>• R2.MP2</li> <li>• R2.MP1</li> </ul>	 xx1300000735

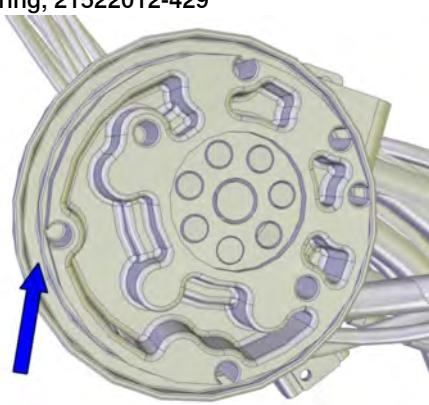
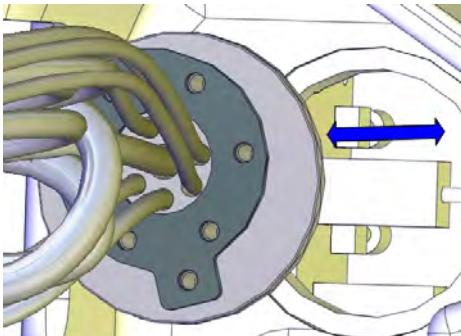
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## 4 Repair

### 4.4.2 Refitting the cable harness

*Continued*

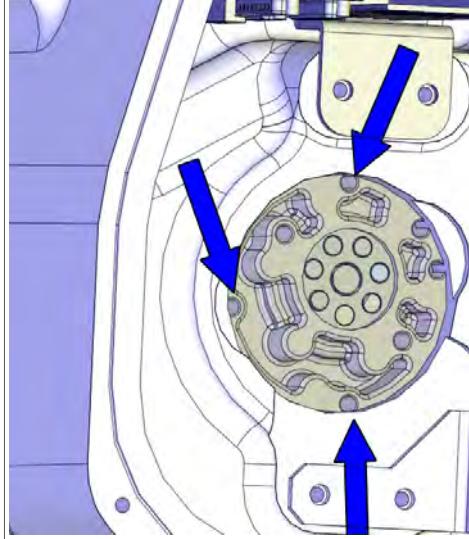
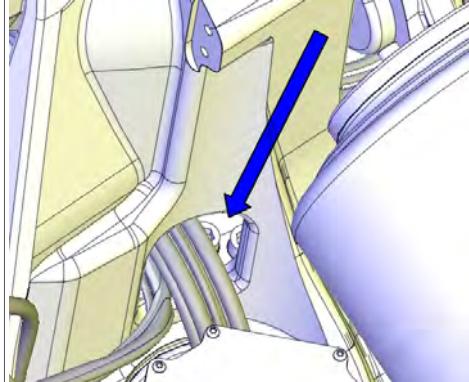
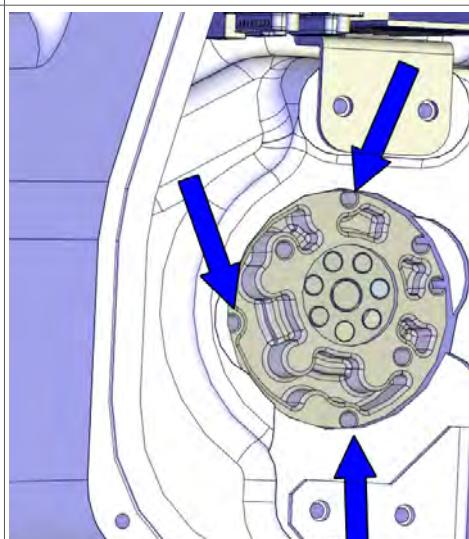
#### Refitting the cable harness in the frame

Action	Note
1 Check the o-ring located on the SMB/BU cover. Replace if damaged.	 O-ring, 21522012-429 xx1300000737 The figure shows the position of the o-ring.
2 Wipe clean the contact surfaces of the cover as well as the hole it shall fit in.	
3 Fit the o-ring.	
4 Apply Sikaflex on the o-ring before assembly.	
5 Run the SMB/BU cables into the SMB recess.	 xx1300000560

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## 4.4.2 Refitting the cable harness

*Continued*

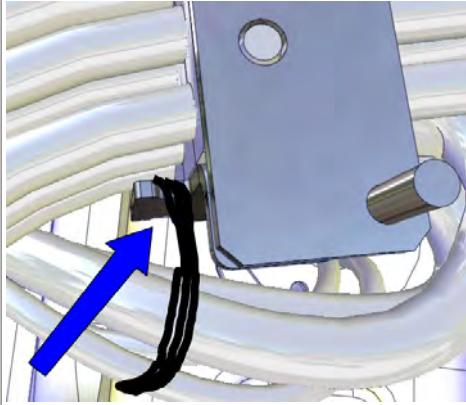
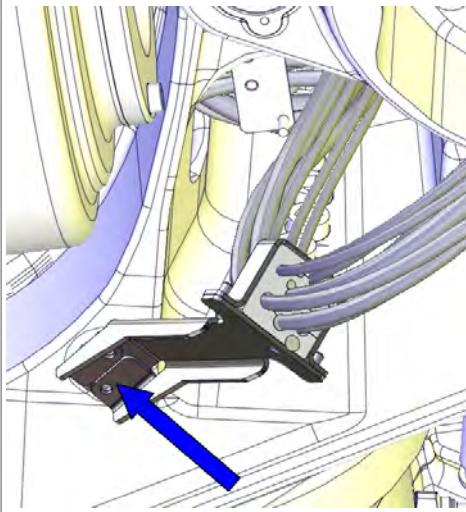
	Action	Note
6	<p>Fit the SMB/BU cover in its hole with three attachment screws from inside the SMB recess without damaging the o-ring.</p> <p><b>Note</b></p> <p>Do not tighten the screws fully! It must still be possible to adjust the position of the cable harness by rotating the SMB/BU cover in its hole a little.</p>	 xx1300000655
7	<p>Adjust the cables running through the hole in the frame by carefully moving the SMB/BU cover on its screws, while at the same time checking the position of the cable harness through the hole.</p> <p><b>Note</b></p> <p>The cables must be placed so that they don't rub against any part of the robot.</p>	 xx1300000593
8	<p>Secure the SMB/BU cover with its attachment screws from inside the SMB/BU recess.</p>	 xx1300000655

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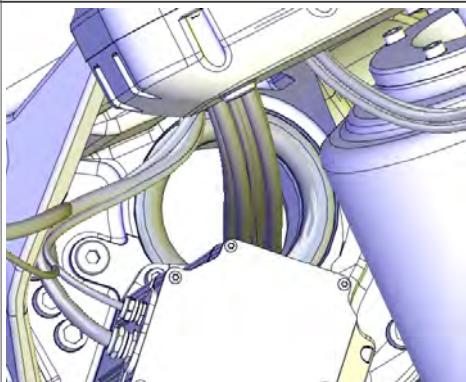
## 4 Repair

### 4.4.2 Refitting the cable harness

*Continued*

Action	Note
9 Secure the cable harness to the bracket inside the frame hole, with a cable tie.	 xx1200001237
10 Refit the frame metal clamp.	 xx1300000542

### Refitting the cable harness in the base

Action	Note
1 Run the cables through the protection tube in this order: <ul style="list-style-type: none"> <li>• R1.MP</li> <li>• R1.SMB</li> </ul> If necessary, lubricate the cables with grease in order to make them run more smoothly.	 xx1300000732

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## 4.4.2 Refitting the cable harness

Continued

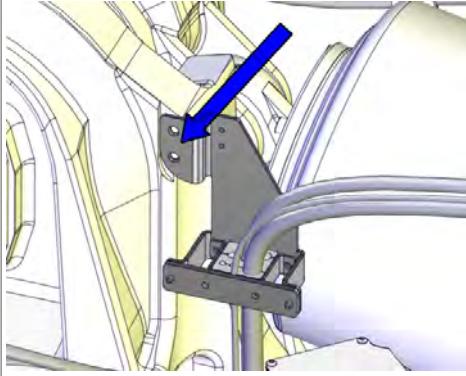
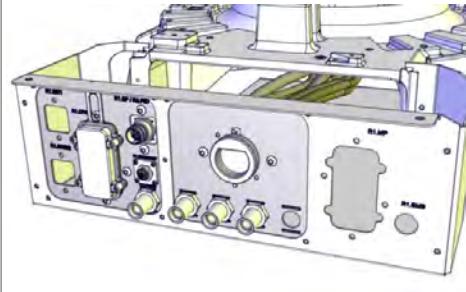
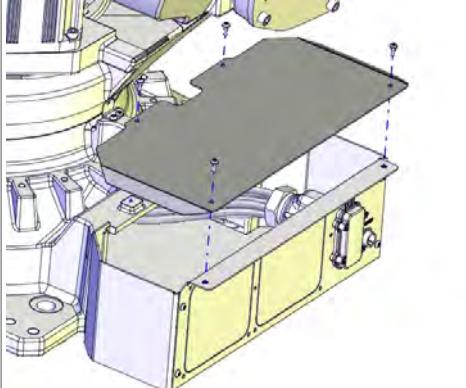
Action	Note
2 • Make sure that the cables are not twisted. Each cable must be in line with its position on the base plate. • Make sure that the R1.SMB cable will run on the correct side of the R1.MP1, see the figure.	
3 Make sure that the markings on the cables are facing the base cover, when connected.	
4 Connect R1.MP and R1.SMB.	Tightening torque for R1.SMB: 10 Nm. 
5 Connect the earth cable.	Screw dimension: M6x16 Washer dimension: 6.4x17x3 
6 If used, run the DressPack cables through the protection tube in the base.	
7 If used, run the DressPack hoses through the protection tube in the base. Make sure that the hoses are running correctly and are not twisted!	

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## 4 Repair

### 4.4.2 Refitting the cable harness

*Continued*

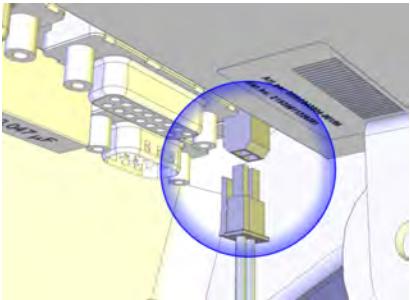
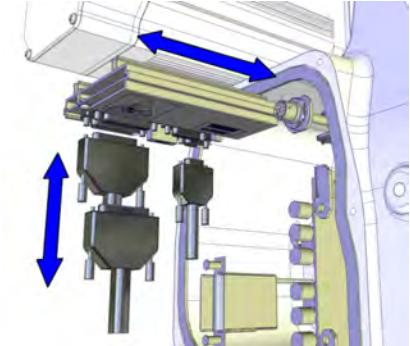
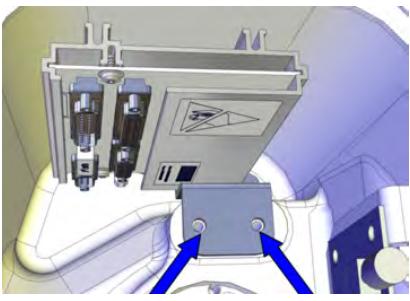
Action	Note
8 If used, fit the bracket that hold the DressPack to the frame.	 xx1400000078
9 If used, connect the DressPack cable package on the base plate.	 xx1200000052
10 Refit the base cover.	 xx1300000561

Refitting and reconnecting the SMB and BU units

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

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#### 4.4.2 Refitting the cable harness Continued

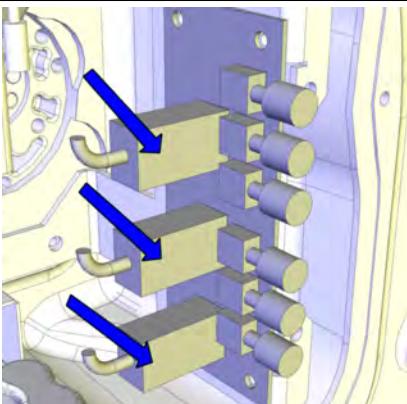
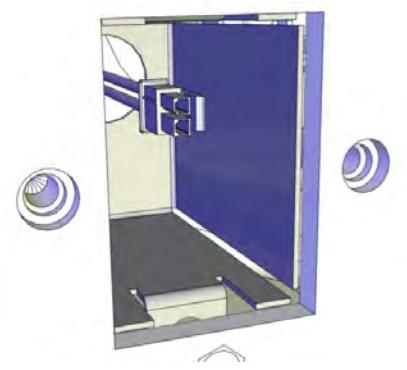
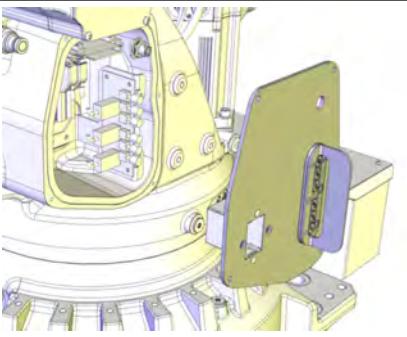
Action	Note
2  ELECTROSTATIC DISCHARGE (ESD)  The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <i>WARNING - The unit is sensitive to ESD!</i> on page 49	
3 Connect the battery cable to the SMB unit.	 xx1300000729
4 Connect all connectors to the SMB board: R1.SMB1-3, R1.SMB4-6 and R2.SMB	 xx1300000728
5 Push in the SMB unit carefully into position and fit the bracket that secures the SMB unit.	 xx1300000730

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## 4 Repair

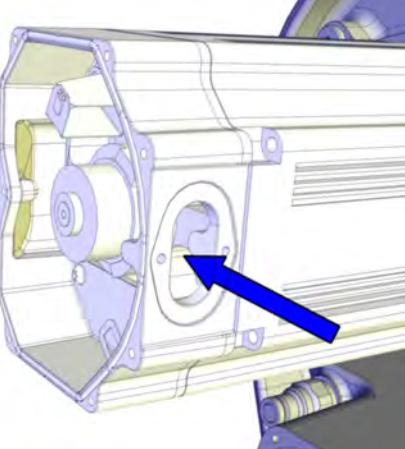
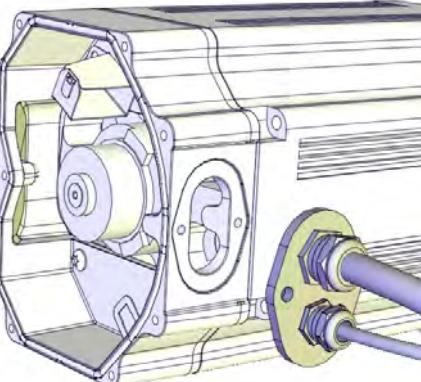
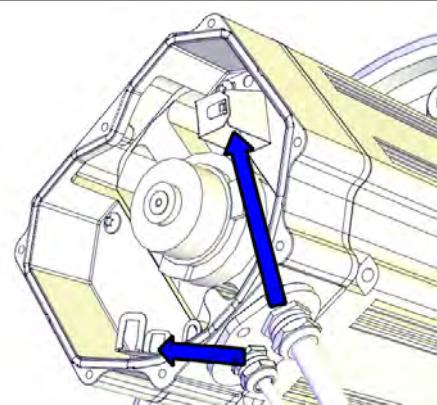
### 4.4.2 Refitting the cable harness

*Continued*

Action	Note
6 If disconnected, reconnect the connectors X8, X9 and X10 to the brake release board.	 xx1300000670
7 Pull out the battery cable through the recess for the battery.	 xx1300000834
8 Secure the SMB cover with its attachment screws. If cabling is used for 7th axis (option), refit the connector R2.FB7 to the SMB cover and tighten with 6 Nm.	 xx1300000669

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## Reconnecting the axis-1 and axis-2 motor cables

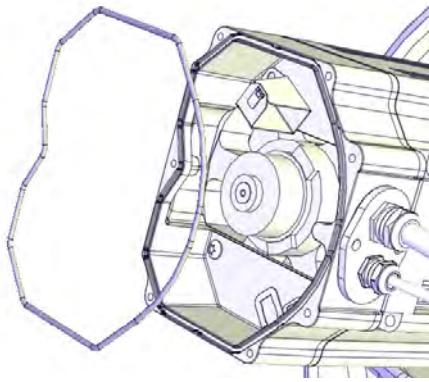
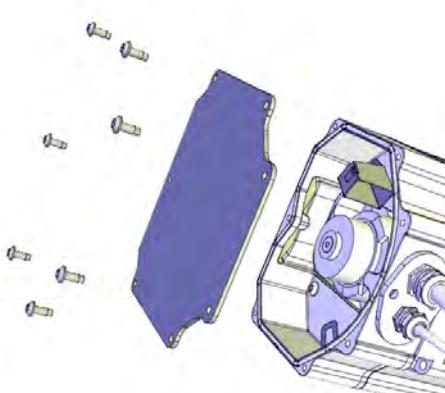
	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1300000738
2	Refit the cable gland cover.  <b>Note</b> Replace the gasket if damaged.	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066

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## 4 Repair

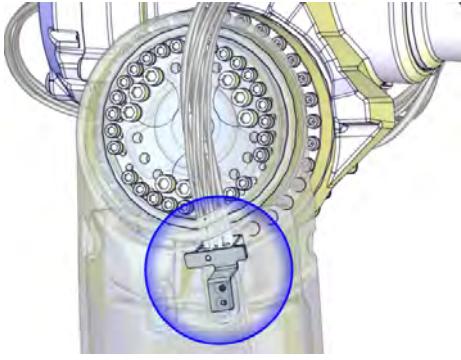
### 4.4.2 Refitting the cable harness

*Continued*

Action	Note
4 Inspect the o-ring.  Note Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-001   xx1200001070
5 Wipe clean o-ring and o-ring groove.	
6 Refit the o-ring.  Tip Lubricate the o-ring with some grease for a better fitting in the groove.	
7 CAUTION When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8 Refit the motor cover with its attachment screws.  Note Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged.  Note Make sure the o-ring is undamaged and properly fitted.	 xx1200001135
9 Make sure that the covers are tightly sealed.	

*Continues on next page*

## Refitting the cable harness - lower arm

	Action	Note
1	Before fitting the remaining axis-3 lower arm cable bracket inside the lower arm, make sure that it will stay twisted between the metal clamps, after fitting, as shown in the figure.	 xx1300000595
2	Refit the axis-3 lower arm metal clamp located on the inside of the lower arm.  <b>Note</b> The screws are reached from the outside of the lower arm.	 xx1300000558

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## 4 Repair

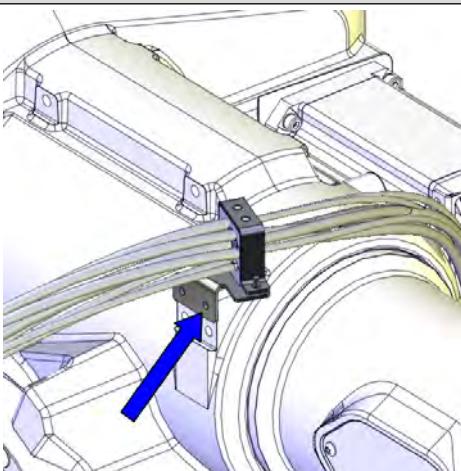
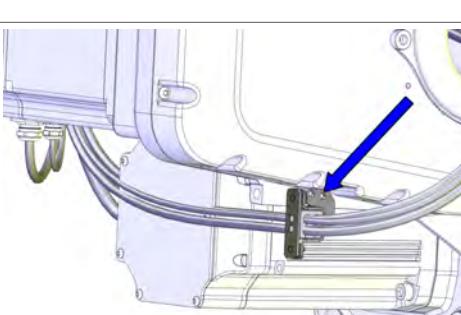
### 4.4.2 Refitting the cable harness

*Continued*

#### Refitting the cable harness - upper arm and wrist

These procedures describes how to refit the cable harness in upper arm and wrist.

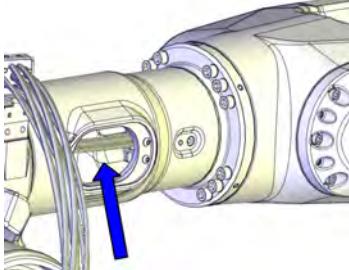
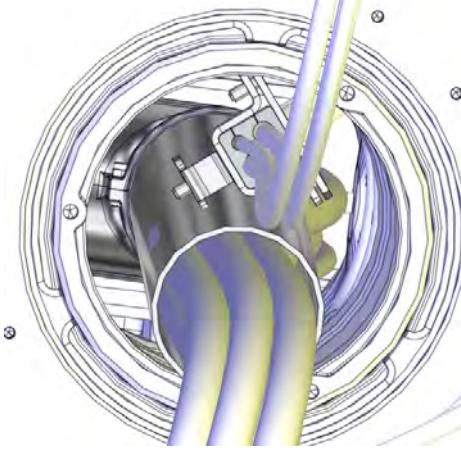
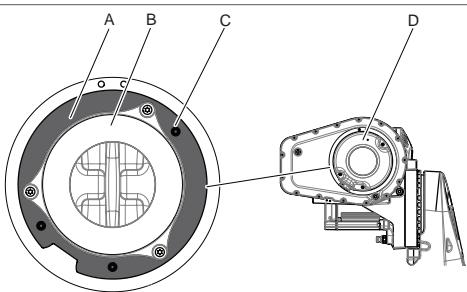
#### Refitting the cable harness - upper arm

Action	Note
1 Refit the metal clamp on top of the arm house.	 xx1300000541
2 Refit the arm house metal clamp.	 xx1300000543
3 Arrange the cables between the cable clamps in the upper arm.	
4  <b>Tip</b>  Use tape and tie the axis-5 and axis-6 connectors and carrier into a bundle (if not already done). This is done to facilitate the procedure and to avoid damaging the parts during the procedure.  This will also make it easier to run the cable harness through the inside of the upper arm.	 xx1300000668

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#### 4.4.2 Refitting the cable harness

*Continued*

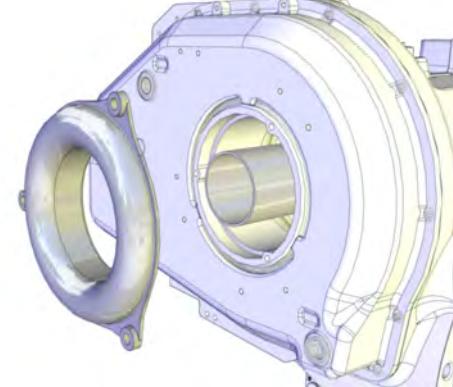
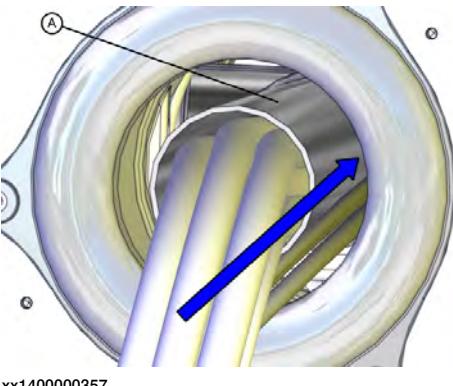
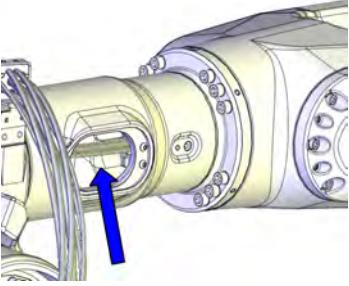
Action	Note
<p>5</p>  <b>Tip</b> <p>This step is best performed by two persons working together:</p> <ul style="list-style-type: none"> <li>• Person 1: Put one hand inside the side hole of the arm tube and take a hold of the cable harness.</li> <li>• Person 2: Take a hold on the cable harness at the back of the robot.</li> <li>• Together: Use caution and move the cable harness into the arm tube.</li> </ul>	<p>Person 1, working at the side hole:</p>  xx1300000745 <p>Person 2, working at the back:</p>  xx1400000356
<p>6</p> <b>Foundry Plus:</b> <p>Make sure that the gasket between the robot and cover is correctly fitted. Replace if damaged!</p> <p>The gasket is covered with adhesive on the side facing the upper arm cover. The three washers are pressed into the holes in the gasket. Make sure all three washers are fitted.</p>	 xx1400000382 <ul style="list-style-type: none"> <li>A Gasket</li> <li>B Cable guide</li> <li>C Washer</li> <li>D Cover</li> </ul>

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## 4 Repair

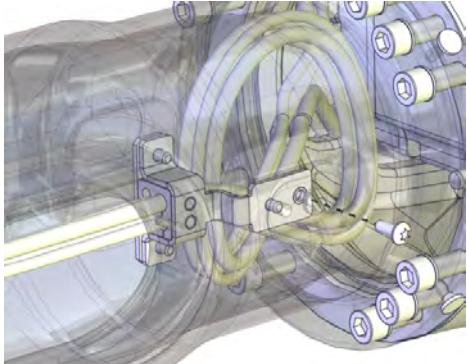
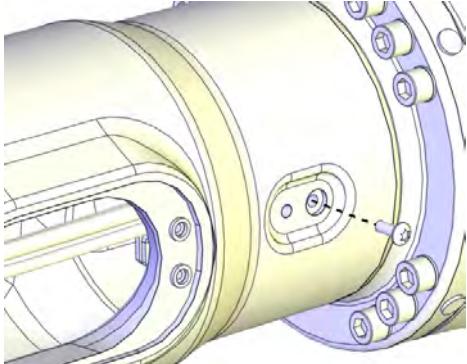
### 4.4.2 Refitting the cable harness

*Continued*

Action	Note
7 Fit the cable guide.	 xx1300000657
8 Run the cable harness through the cable guide and then into the upper arm tube.  <b>Note</b>  The cable harness is best placed at the upper right hand side of the DressPack tube, if used, through the arm tube. Do not run the cable harness into the DressPack tube!	 xx1400000357
9 Use caution and push the cable harness into the upper arm tube.	
10 <b>Tip</b>  This step is best performed by two persons working together. Use caution and push the cable harness into the wrist like this: <ul style="list-style-type: none"> <li>• Person 1: Put one hand inside the side cover hole and take a hold of the cable harness.</li> <li>• Person 2: Take a hold of the cable harness from inside the wrist.</li> <li>• Together: Move the cable harness past the axis-5 motor and into the wrist.</li> </ul>	Person 1, working at the side hole:  xx1300000745

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#### 4.4.2 Refitting the cable harness Continued

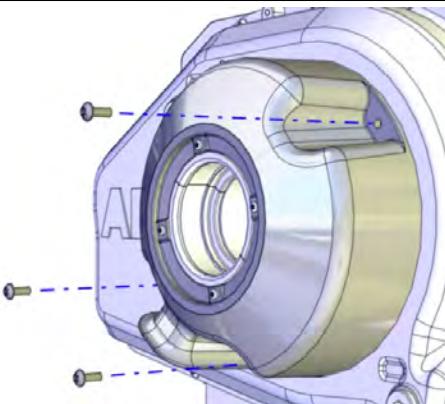
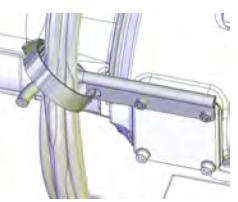
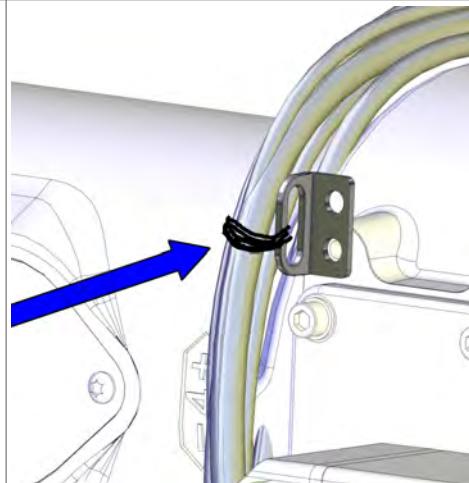
Action	Note
11 Refit the metal clamp axis-4 inside the arm tube.   <b>Note</b>  The screws are reached from outside the upper arm!	 xx1700000340
12 Refit the side cover.   <b>Note</b>  <b>Foundry Plus:</b> <ul style="list-style-type: none"> <li>• Make sure the gasket is fitted correctly on the side cover</li> <li>• Use attachment screws made of stainless steel to fit the side cover.</li> </ul>	 xx1700000339

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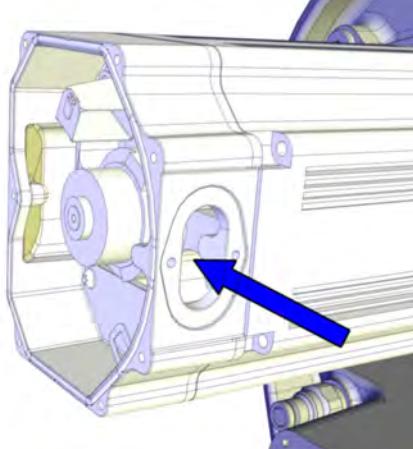
## 4 Repair

### 4.4.2 Refitting the cable harness

*Continued*

Action	Note
13 If used ( <i>DressPack or Foundry Plus</i> ), refit the cover with the tube guiding ring fitted.   <b>Note</b>  <b>Foundry Plus:</b> <ul style="list-style-type: none"> <li>• Make sure the gasket is fitted correctly</li> <li>• Use attachment screws made of stainless steel to fit the cover.</li> </ul>	 xx1200000045
14 Secure the cable harness to the cable fixing bracket with the velcro strap.   <b>Note</b>  If DressPack is fitted, the cable fixing bracket is replaced by the cable guide.   xx1300001973	 xx1300000544

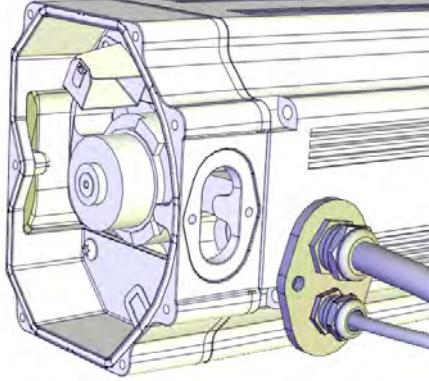
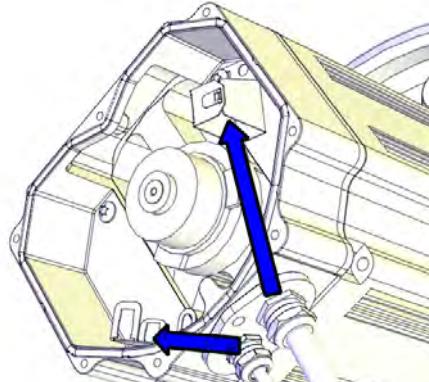
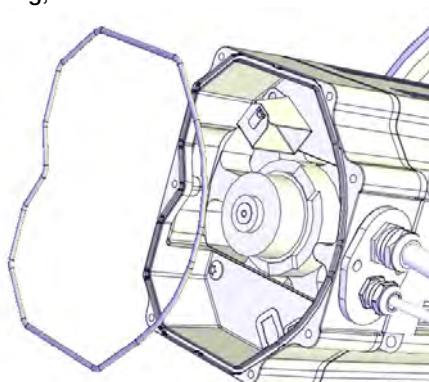
### Connecting the axis-3 and axis-4 motor cables

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

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#### 4.4.2 Refitting the cable harness

*Continued*

	Action	Note
2	<p>Refit the cable gland cover.</p> <p><b>Note</b></p> <p>Replace the gasket if damaged.</p>	 xx1200001067
3	<p>Connect the motor cables.</p> <p>Connect in accordance with the markings on the connectors.</p>	 xx1200001066
4	<p>Inspect the o-ring.</p> <p><b>Note</b></p> <p>Replace if damaged.</p>	<p>O-ring, axis-1: 3HAC054692-002        O-ring, axis-2: 3HAC054692-002        O-ring, axis-3: 3HAC054692-002        O-ring, axis-4: 3HAC054692-001</p>  xx1200001070
5	Wipe clean o-ring and o-ring groove.	

*Continues on next page*

## 4 Repair

### 4.4.2 Refitting the cable harness

*Continued*

Action	Note
6 Refit the o-ring.  Tip  Lubricate the o-ring with some grease for a better fitting in the groove.	
7 <b>CAUTION</b>  When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8 Refit the motor cover with its attachment screws.  Note  Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged.  Note  Make sure the o-ring is undamaged and properly fitted.	 xx1200001135
9 Make sure that the covers are tightly sealed.	

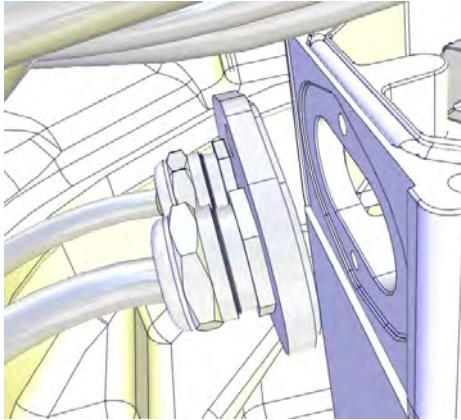
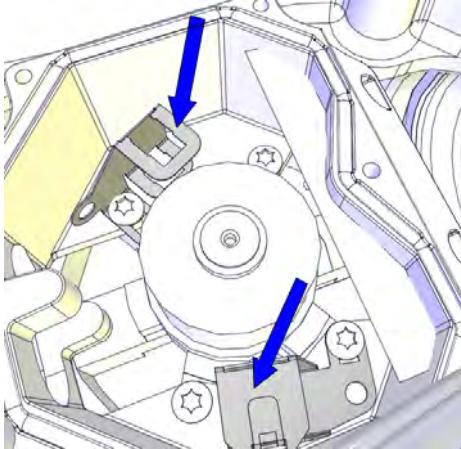
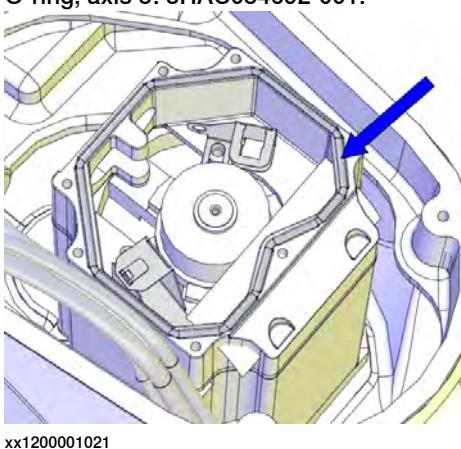
### Connecting the axis-5 motor cables

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

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#### 4.4.2 Refitting the cable harness

*Continued*

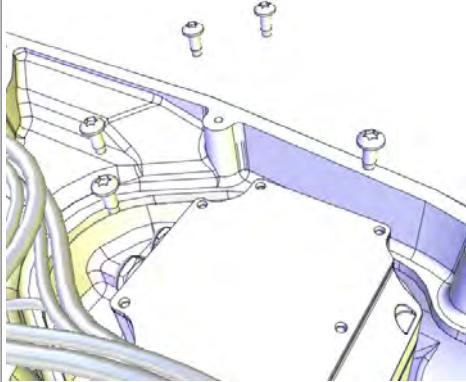
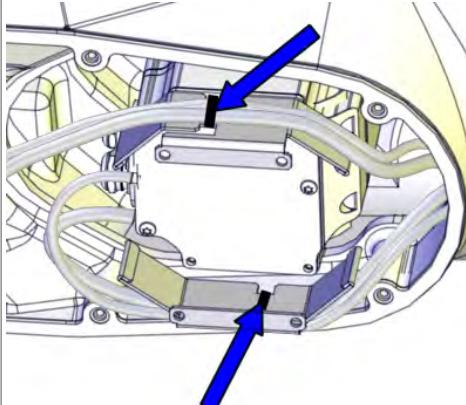
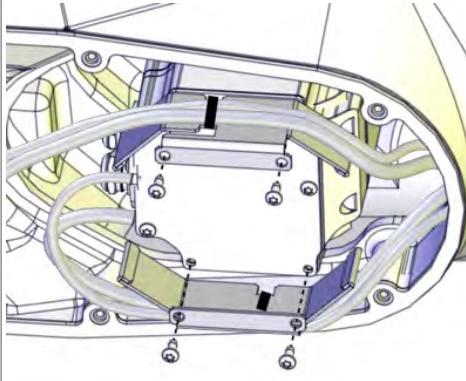
Action	Note
<p>2 Refit the cable gland cover by performing the following steps:</p> <ul style="list-style-type: none"> <li>• Slide the cable gland cover onto the inner screw.</li> <li>• Refit and tighten the outer screw.</li> <li>• Tighten the inner screw. Make sure that the gasket is not damaged.</li> </ul> <p> <b>Note</b></p> <p>Replace the gasket if damaged.</p>	 xx1200001016
<p>3 Connect the connectors.</p> <p>Connect in accordance with the markings on the connectors.</p>	 xx1200001015
<p>4 Make sure the o-ring on the motor is undamaged.</p> <p>Replace if damaged.</p>	<p>O-ring, axis 5: 3HAC054692-001.</p>  xx1200001021
<p>5  <b>CAUTION</b></p> <p>When fitting the motor cover, make sure that none of the cables inside will be damaged.</p>	

*Continues on next page*

## 4 Repair

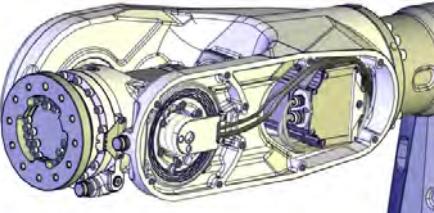
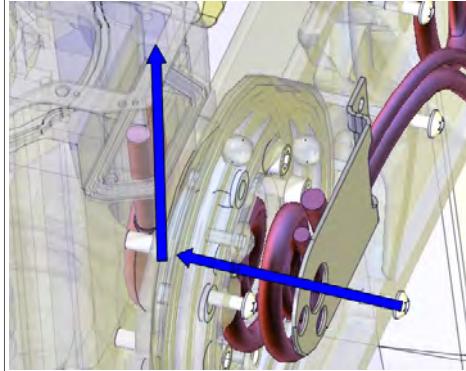
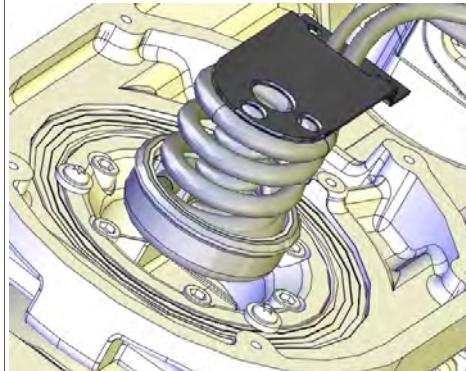
### 4.4.2 Refitting the cable harness

*Continued*

Action	Note
6 Refit the motor cover with its attachment screws.	<p><b>Note</b> Do not refit the screws that will hold the heat protection plate at this point.</p> <p><b>Note</b> Do not reuse the self-threading attachment screws, it will damage the threads. Replace with standard attachment screws.</p> <p><b>Note</b> Make sure the o-ring is undamaged and properly fitted.</p>  <p>xx1200001013</p>
7 Secure the cable harness with cable straps to the heat protection plate.	 <p>xx1500001029</p>
8 Fit the heat protection plate with the screws.	 <p>xx1500001030</p>
9 Make sure that the cover is tightly sealed.	

*Continues on next page*

## Connecting the axis-6 motor cables

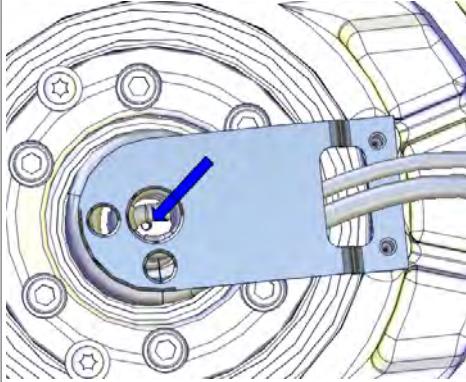
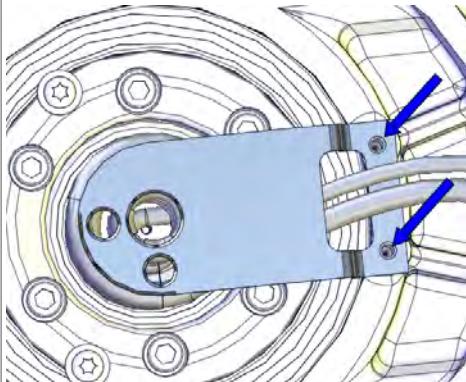
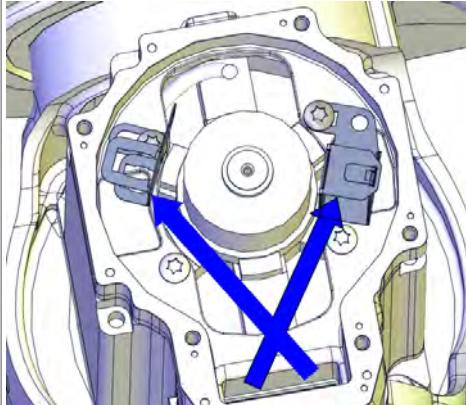
	Action	Note
1	Make sure that the cable harness is placed in a way that it will not be damaged when the cover is fitted.	 xx1600002061
2	<p> Note</p> <p>Axis 5 must be in position +90° (or as close as possible) for a correct installation of the cable harness in the wrist. If not, connect the 24 VDC power supply, release the brakes and move axis 5 manually to +90°.</p>	Position +90° of axis 5 makes the turning disc face the floor, if the robot is floor standing.
3	Push the cable harness into the wrist recess and up into the axis-6 motor.	 xx1300000667
4	Push the carrier carefully into position.	 xx1300001113

Continues on next page

## 4 Repair

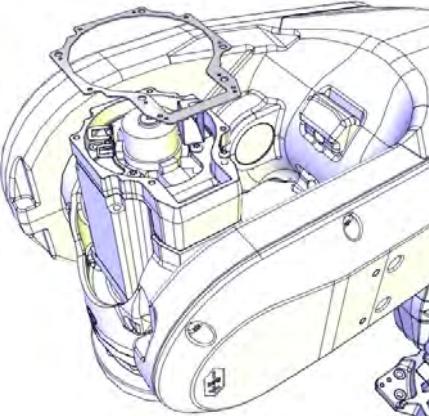
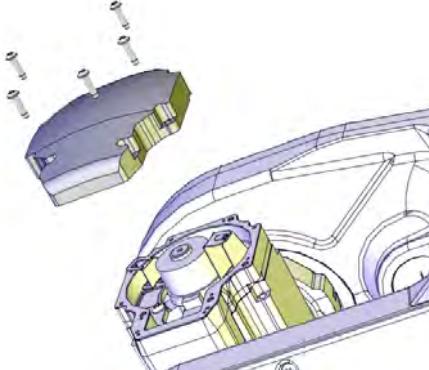
### 4.4.2 Refitting the cable harness

*Continued*

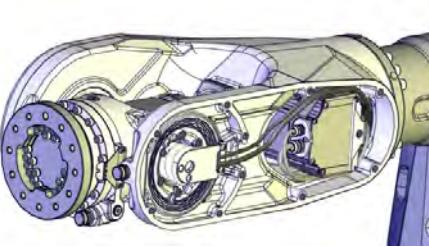
Action	Note
5 Secure the carrier with the M4 screw.	<p> <b>Note</b> The screw is located at the bottom of the carrier.</p> <p> <b>Tip</b> The attachment screw securing the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.</p>  <p>xx1300000485</p>
6 Secure the cable bracket with its attachment screws.	 <p>xx1300000484</p>
7 Reconnect the connectors to the axis-6 motor.	<p> <b>Note</b> Place the resolver cable under the motor cable.</p>  <p>xx1300000488</p>

*Continues on next page*

4.4.2 Refitting the cable harness  
*Continued*

Action	Note
8 Make sure the gasket is undamaged. Replace if damaged.	Gasket, 3HAC033489-001  xx1200001095
9  <b>CAUTION</b> When fitting the motor cover, make sure that none of the cables inside will be damaged.	
10 Refit the motor cover.	 xx1200001080

## Concluding procedure

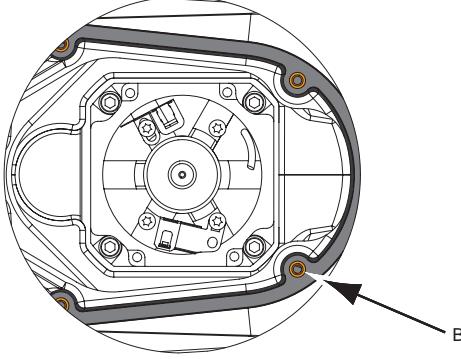
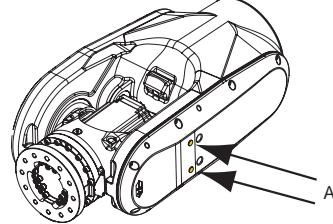
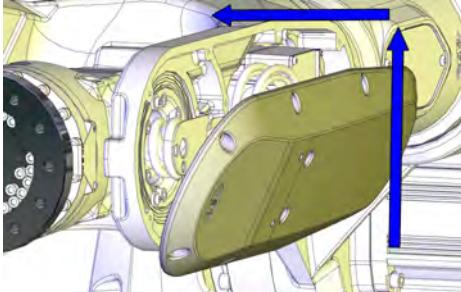
Action	Note
1 Make sure that the cable harness is placed in a way that it will not be damaged when the wrist cover is fitted.	 xx1600002061
2 Inspect the gasket. Replace if damaged.	

*Continues on next page*

## 4 Repair

### 4.4.2 Refitting the cable harness

*Continued*

Action	Note
3 <b>Foundry Plus:</b> <ul style="list-style-type: none"> <li>Make sure that the gasket is undamaged on the cover. Replace if damaged!</li> <li>Put washers in the holes of the gasket.</li> <li>Use attachment screws made of stainless steel to fit the wrist cover.</li> </ul>	  xx1400000383 <p>A Protection plugs (2 on wrist cover and 2 on cover axis-5 gearbox) B Washers (10 pcs) in gasket holes</p>
4 Refit the wrist cover. In order not to damage the cable harness when the wrist cover is refitted, use this method: <ol style="list-style-type: none"> <li>Hold the cover in an angle. See figure!</li> <li>Catch any part of the cable harness hanging down.</li> <li>Lift the cover, still held in an angle.</li> <li>Move the upper part of the cover into position.</li> <li>Secure the cover with its attachment screws.</li> </ol>	Tightening torque: 10 Nm.  xx1300000772
5 <b>Foundry Plus:</b> Refit protection plugs.	See figure above!
6 If used, refit the DressPack cable package on the wrist.	
7 Recalibrate the robot.	Axis Calibration is described in <a href="#">Calibrating with Axis Calibration method on page 691</a> . General calibration information is included in section <a href="#">Calibration on page 683</a> .
8  <b>DANGER</b>  Make sure all safety requirements are met when performing the first test run. These are further described in <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

### 4.4.3 Replacing the SMB

#### About the figures

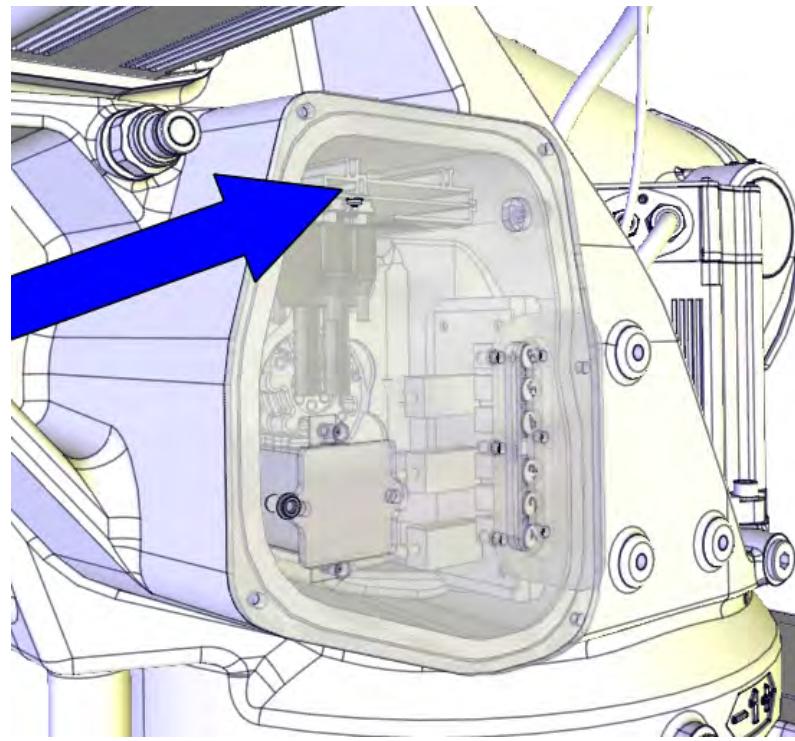


##### Note

When visual differences between variants, is of no importance, only one is shown in the figures.

#### Location of SMB unit

The SMB (serial measurement board) unit is located inside the SMB/BU recess, as shown in the figure.



xx1300000740

#### Spare part

Equipment, etc.	Article number	Note
SMB unit (DSQC633C)	See <i>Product manual, spare parts - IRB 6700</i> .	
Battery pack	See <i>Product manual, spare parts - IRB 6700</i> .	

#### Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

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## 4 Repair

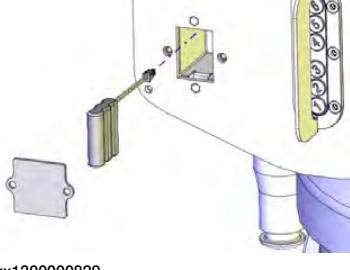
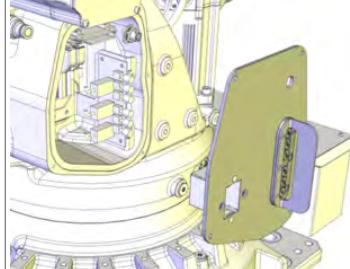
### 4.4.3 Replacing the SMB

*Continued*

#### Removing the SMB unit

Use these procedures to disconnect and remove the SMB unit.

Preparations before disconnecting the SMB unit

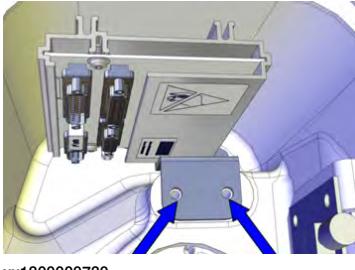
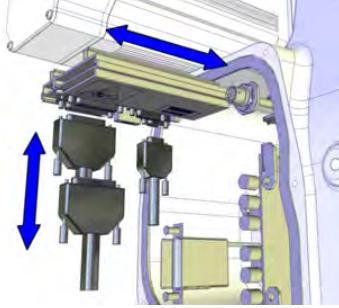
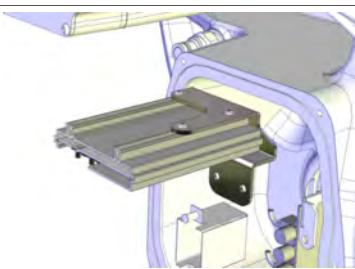
Action	Note
1  <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <a href="#">WARNING - The unit is sensitive to ESD! on page 49</a>	
3 Open the small cover on the SMB cover, disconnect the battery cable and remove the battery.	
4 Remove the SMB cover.	

Disconnecting and 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 please read the safety information in the section <a href="#">WARNING - The unit is sensitive to ESD! on page 49</a>	

*Continues on next page*

#### 4.4.3 Replacing the SMB Continued

Action	Note
3 Remove the screws and washers that secure the SMB unit bracket.	 xx1300000730
4 Pull out the SMB unit a little and disconnect the connectors from the SMB board: R1.SMB1-3, R1.SMB4-6 and R2.SMB	 xx1300000728
5 Pull out the SMB unit and put it in an ESD bag.	 xx1300000731

#### Refitting the SMB unit

##### Refitting the SMB unit

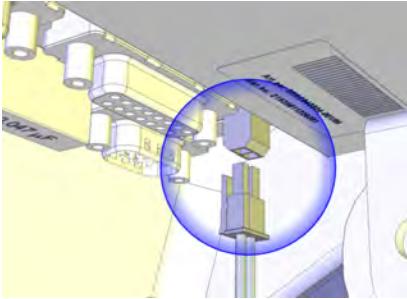
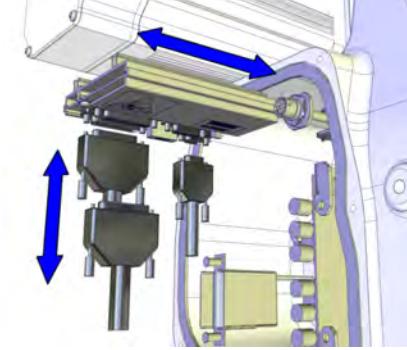
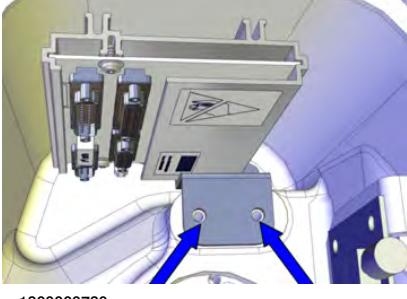
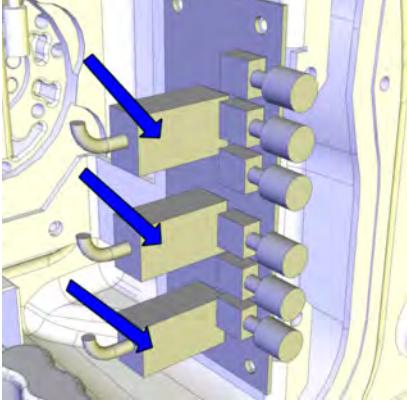
Action	Note
1  <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2  <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <b>WARNING - The unit is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

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## 4 Repair

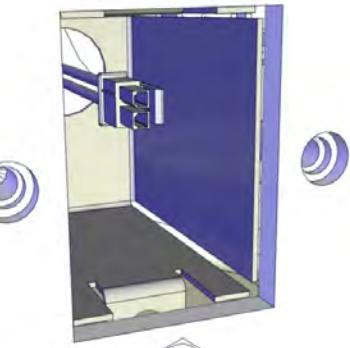
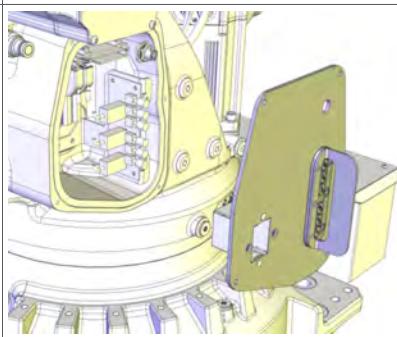
### 4.4.3 Replacing the SMB

*Continued*

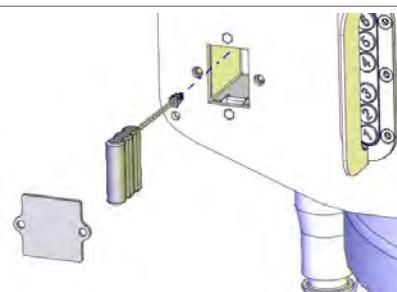
Action	Note
3 Connect the battery cable to the SMB unit.	 xx1300000729
4 Connect all connectors to the SMB board: R1.SMB1-3, R1.SMB4-6 and R2.SMB	 xx1300000728
5 Push in the SMB unit carefully into position and fit the bracket that secures the SMB unit.	 xx1300000730
6 If disconnected, reconnect the connectors X8, X9 and X10 to the brake release board.	 xx1300000670

*Continues on next page*

#### 4.4.3 Replacing the SMB Continued

Action	Note
7 Pull out the battery cable through the recess for the battery.	 xx1300000834
8 Secure the SMB cover with its attachment screws. If cabling is used for 7th axis (option), refit the connector R2.FB7 to the SMB cover and tighten with 6 Nm.	 xx1300000669

#### Refitting the SMB battery

Action	Note
1  ELECTROSTATIC DISCHARGE (ESD)  The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <a href="#">WARNING - The unit is sensitive to ESD! on page 49</a>	
2 Get a hold of the battery cable in the recess for the battery and reconnect.	
3 Place the battery in the recess.	 xx1300000829
4 Refit the battery cover.	

*Continues on next page*

## 4 Repair

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### 4.4.3 Replacing the SMB

*Continued*

#### Concluding procedures

Action	Note
1 Update the revolution counters.	See <a href="#">Updating revolution counters on page 688</a> .
2  <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further described in <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

#### 4.4.4 Replacing the brake release unit

##### About the figures

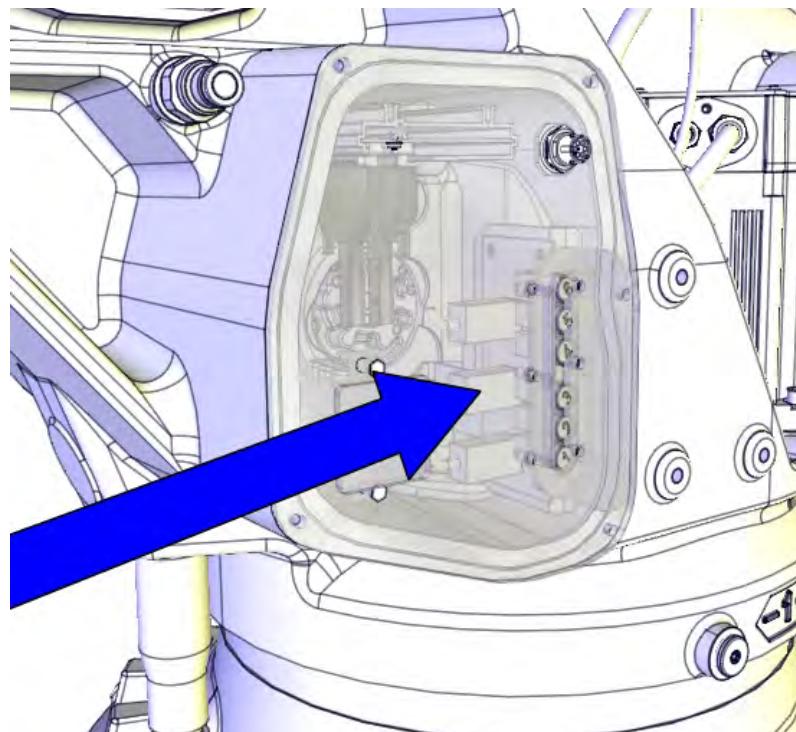


##### Note

When visual differences between variants, is of no importance, only one is shown in the figures.

##### Location of BU unit

The brake release unit (BU) is located inside SMB/BU recess, as shown in the figure.



xx1300000741

##### Spare part

Equipment, etc.	Article number	Note
Brake release unit	See <i>Product manual, spare parts - IRB 6700</i> .	
Battery pack	See <i>Product manual, spare parts - IRB 6700</i> .	

##### Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

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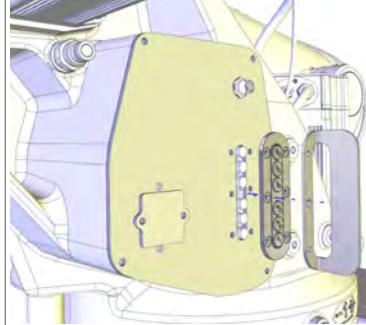
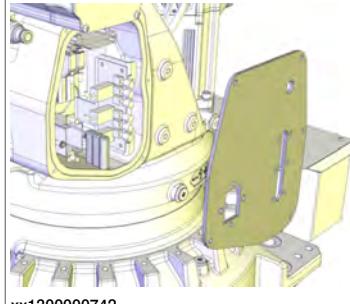
## 4 Repair

### 4.4.4 Replacing the brake release unit

*Continued*

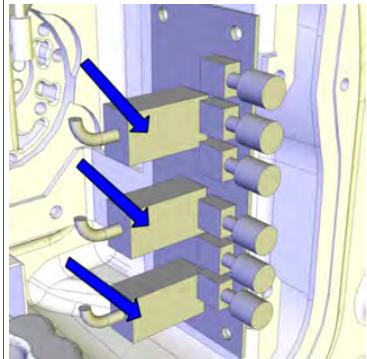
#### Removing the brake release unit

Preparations before removing the brake release unit

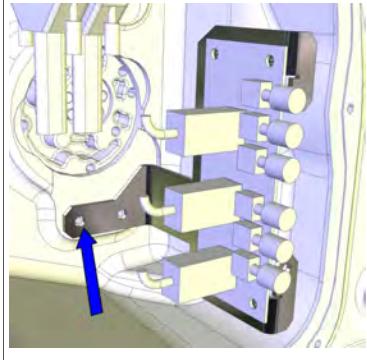
Action	Note
<p>1  <b>DANGER</b> Turn off all:<ul style="list-style-type: none"><li>• electric power supply</li><li>• hydraulic pressure supply</li><li>• air pressure supply</li></ul>to the robot, before entering the robot working area.</p>	
<p>2  <b>ELECTROSTATIC DISCHARGE (ESD)</b> The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <b>WARNING - The unit is sensitive to ESD! on page 49</b></p>	
<p>3 Remove the push button guard from the SMB cover. The push button guard must be removed to ensure a correct refitting of the brake release unit.</p>	 xx1300000743
<p>4 Remove the SMB cover.</p>	 xx1300000742
<p>5 The battery can stay connected, to avoid the need of synchronizing the robot.</p> <p> <b>CAUTION</b> If the battery stays connected, put (or hold) the SMB cover in a safe position. The battery cable connectors can otherwise be damaged.</p>	

*Continues on next page*

## Disconnecting the brake release 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 please read the safety information in the section <b>WARNING - The unit is sensitive to ESD! on page 49</b>	
3	Remove the connectors X8, X9 and X10 from the brake release board.	 xx1300000670

## Removing the brake release unit

	Action	Note
1	Unscrew the attachment screws that secure the brake release unit bracket.	
2	Remove the bracket with the brake release unit fitted.	 xx1300000744

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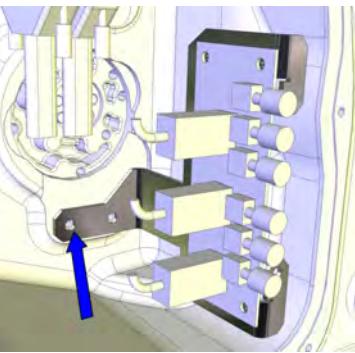
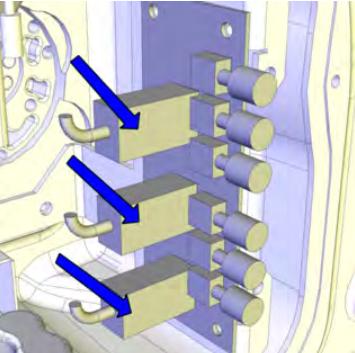
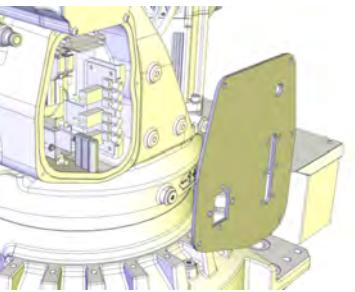
## 4 Repair

### 4.4.4 Replacing the brake release unit

Continued

#### Refitting the brake release unit

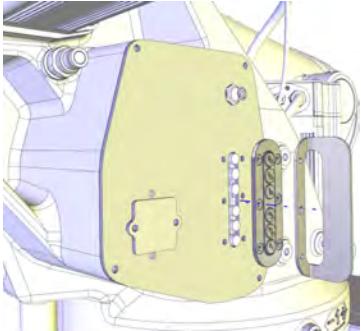
Use this procedure to refit the brake release unit.

Action	Note
1  <b>ELECTROSTATIC DISCHARGE (ESD)</b>  The unit is sensitive to ESD. Before handling the unit please read the safety information in the section <a href="#">WARNING - The unit is sensitive to ESD! on page 49</a>	
2 Refit the bracket with the brake release unit fitted. Make sure the unit is placed as straight as possible on the bracket! The push buttons can otherwise get jammed when the SMB cover is refitted.	 xx1300000744
3 Reconnect the connectors X8, X9 and X10 to the brake release unit.	 xx1300000670
4 Refit the SMB cover with its attachment screws.   <b>Note</b>  Do not refit the push button guard at this point!	 xx1300000742
5  <b>WARNING</b>  Before continuing any service work, please observe the safety information in section <a href="#">WARNING - The brake release buttons may be jammed after service work on page 47!</a>	

Continues on next page

## 4.4.4 Replacing the brake release unit

Continued

Action	Note
6 Refit the push button guard to the SMB cover.	 xx1300000743
7 Reconnect the battery, if it has been disconnected. Update the revolution counters if the battery has been disconnected.	See <a href="#">Updating revolution counters on page 688</a> .
8  <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further described in <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

## 4 Repair

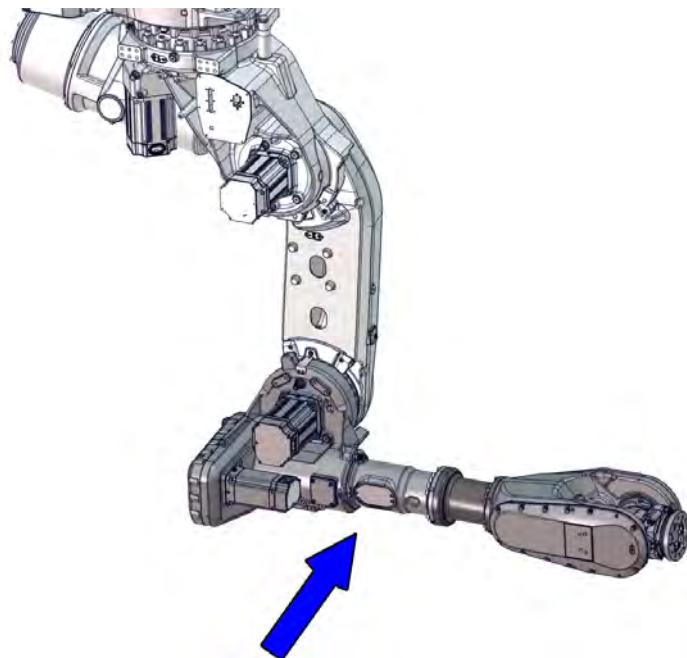
### 4.5.1 Replacing the upper arm

## 4.5 Upper and lower arms

### 4.5.1 Replacing the upper arm

#### Location of the upper arm

The upper arm is located as shown in the figure. These sections describe how to replace the complete upper arm, which includes the wrist unit.



xx1600002096

#### Spare part

Spare part	Spare part number	Note
Upper arm	See <i>Product manual, spare parts - IRB 6700</i> .	

#### Required tools and equipment

Equipment, etc.	Article number	Note
Roundsling, 1 m	-	Lifting capacity: 1,000 kg.
Lifting eye, M12	3HAC16131-1	
Fender washer	-	Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Pallet		Used for putting down removed parts from robot.
Guide pin, M16x150	3HAC13120-2	Always use guide pins in pairs.
Guide pin, M16x200	3HAC13120-3	Always use guide pins in pairs.

Continues on next page

4.5.1 Replacing the upper arm  
*Continued*

Equipment, etc.	Article number	Note
24 VDC power supply	-	Used to release the motor brakes.
Rotation tool	3HAB7887-1	Used to rotate the motor pinion.
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

**Consumables**

Parts needed to be replaced after removal.

Equipment, etc.	Art. no.	Note
Grease	3HAB3537-1	Used to lubricate o-rings.
O-ring	3HAC054692-002	D=169.5x3 Used on axis-3 motor cover.
	3HAC054692-001	D=119x3 Used on axis-4 motor cover.
	3HAC054692-001	D=119x3 Used on axis-5 motor cover.
	3HAC033489-001	Used on axis-6 motor cover.
Rust preventive	-	Mercasol, used to Foundry Plus

**Required documents**

Document	Document number
Directions for use - Fork lift accessory for IRB 6700Inv	3HAC060303
User instructions for turning tool (enclosed with the turning tool)	-

**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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## 4 Repair

### 4.5.1 Replacing the upper arm

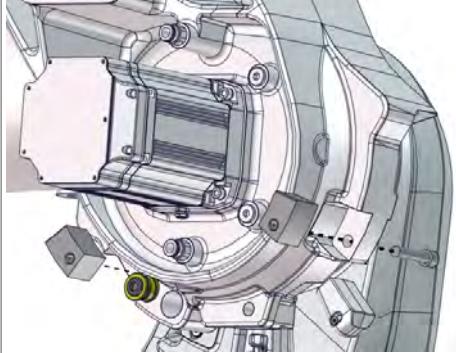
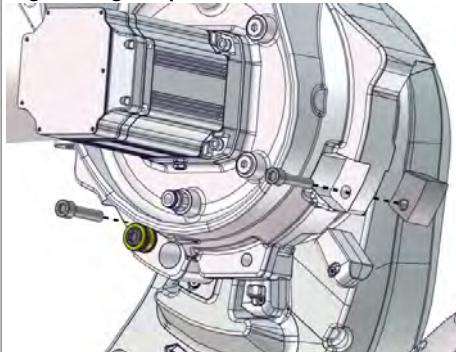
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Action	Note
<p><b>If the robot is to be calibrated with reference calibration:</b> Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the 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 692</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 upper arm

Use these procedures to remove the upper arm.

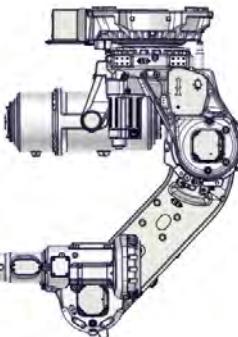
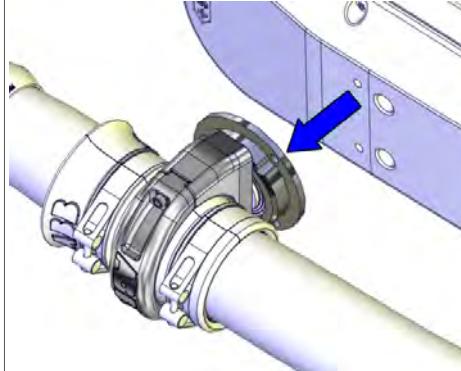
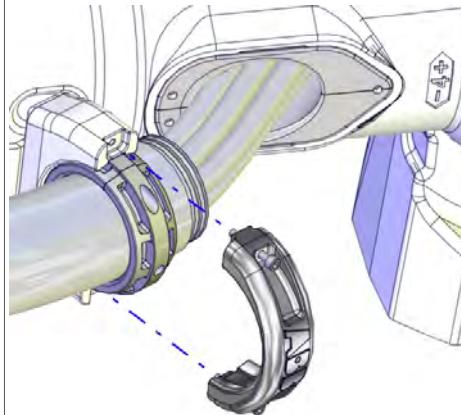
#### Preparations before removing the upper arm

Action	Note
1 Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2 Remove the service stops from their parking position.	 xx1700000448
3 Fit the service stops in maintenance position.	Tightening torque: 70 Nm ±15 Nm.  xx1700000449

*Continues on next page*

#### 4.5.1 Replacing the upper arm

*Continued*

Action	Note
4 Jog the robot to the position: <ul style="list-style-type: none"> <li>• Axis-1: a position that allows best possible access to fit the lifting accessories to the upper arm.</li> <li>• Axis-2: -35 (so that the lower arm rests against the service stop).</li> <li>• Axis-3: -143 (so that the upper arm is horizontal)</li> <li>• Axis-4: 0°</li> <li>• Axis-5: +90°</li> <li>• Axis-6: 0°</li> </ul>	 xx1700000450
5  <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.	
6 If DressPack is installed: <ul style="list-style-type: none"> <li>• Remove the bracket with the complete ball joint housing still fitted, as shown in the figure. This is done to be able to reach the two hidden screws that secure the wrist cover.</li> </ul>	 xx1400000355
7 If used, open the ball joint housing on the arm tube and remove the DressPack cable package.	 xx1400000206
8 Remove tools and other equipment fitted to wrist and upper arm.	

*Continues on next page*

## 4 Repair

### 4.5.1 Replacing the upper arm

*Continued*

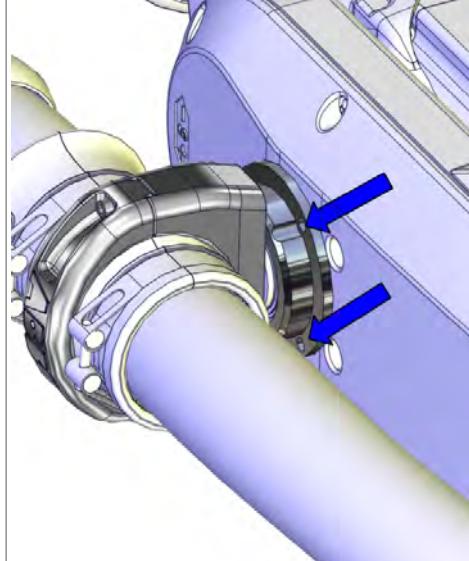
Action	Note
9 Prepare an area where to put the upper arm, after removed. On pallets, as a suggestion.	

#### Removing the DressPack cable package

Remove the DressPack cable package, if used. How to remove the DressPack cable package is described in more detail in the product manual "IRB 6700 DressPack". For article number see [References on page 10](#).

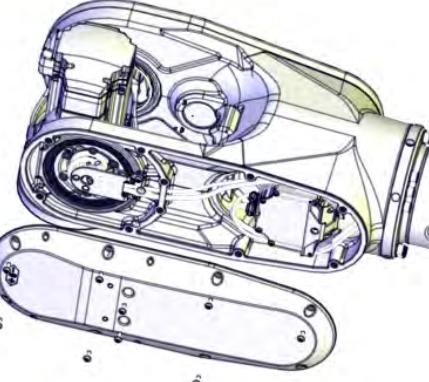
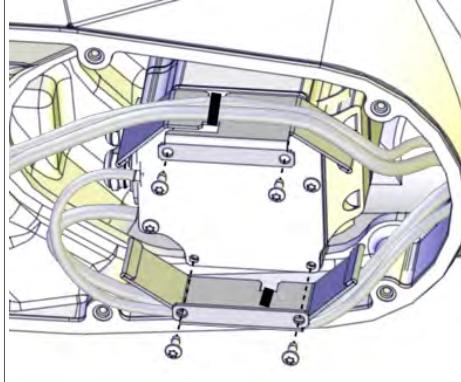
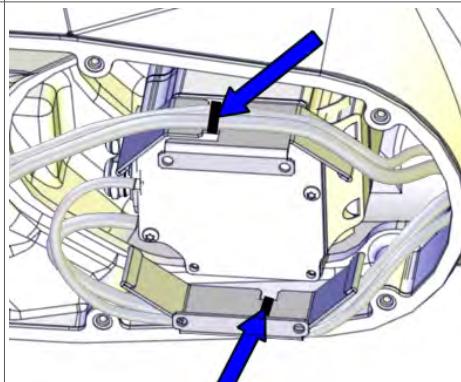
#### Retrieving access to the wrist cabling

Use this procedure to remove the wrist cover to retrieve access to the axis-5 and axis-6 motor cables.

Action	Note
1  <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 If DressPack is not already removed, the complete ball joint housing (including the bracket) must be removed at this point, in order to reach the two hidden screws that secures the wrist cover.	 xx1400000355

*Continues on next page*

#### 4.5.1 Replacing the upper arm Continued

Action	Note
3 Remove the wrist cover.	 xx1300002247
4 Remove the heat protection plates from the motor with the cabling still attached to the plate.	 xx1500001030
5 Cut the cable ties that hold the cable harness to the plate.  <b>Note</b> Keep the heat protection plate until refitting.  <b>Tip</b> If removing the plate only for replacing the motor, the cabling does not need to be loosened from the plate.	 xx1500001029

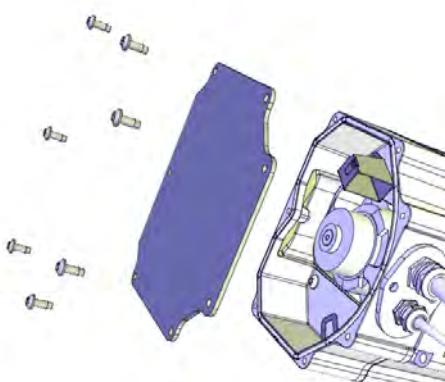
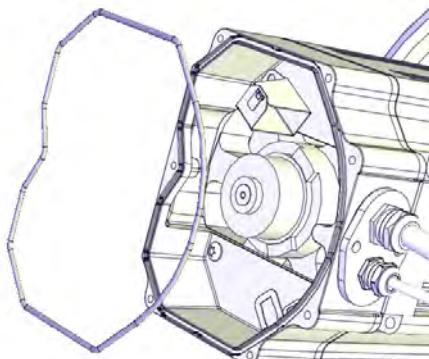
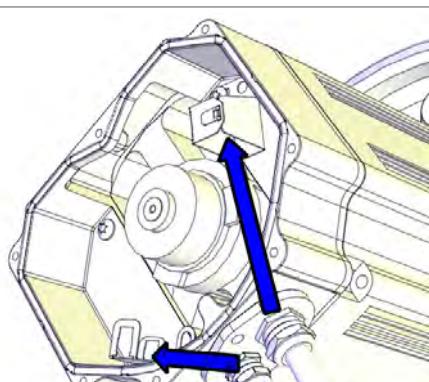
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## 4 Repair

### 4.5.1 Replacing the upper arm

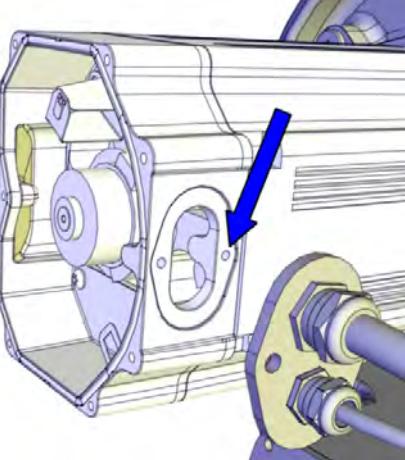
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Disconnecting the axis-5 motor cables

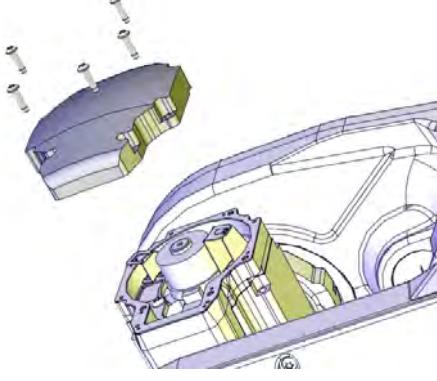
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135
3	Make sure the o-ring is present.	 xx1200001070
4	Disconnect the motor cables.	 xx1200001066

*Continues on next page*

4.5.1 Replacing the upper arm  
*Continued*

Action	Note
<p>5 Remove the cable gland cover by performing the following steps:</p> <ol style="list-style-type: none"> <li>1 Open the inner screw a little (the one the arrow is pointing at). No need to remove this screw from the motor.</li> <li>2 Remove the outer screw.</li> <li>3 Slide the cable gland cover away from the inner screw. Make sure the gasket is not damaged.</li> </ol> <p> <b>Tip</b></p> <p>Make a note in which direction the cable exit hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.</p>	 <p>xx1300000656</p>
6 Use caution and pull out the motor cables.	

Disconnecting the axis-6 motor cables

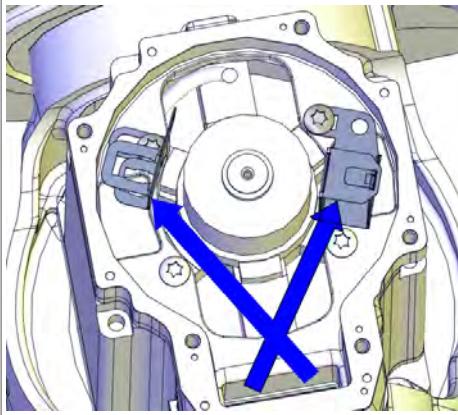
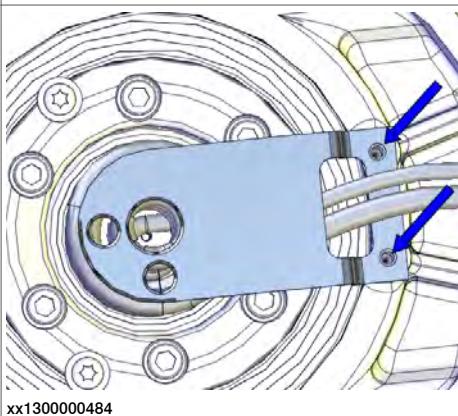
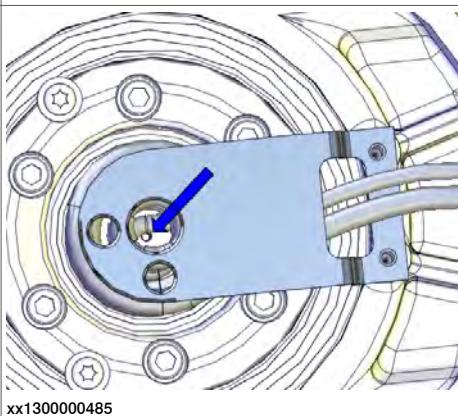
Action	Note
<p>1  <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2 Unscrew the attachment screws and remove the motor cover.	 <p>xx1200001080</p>

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## 4 Repair

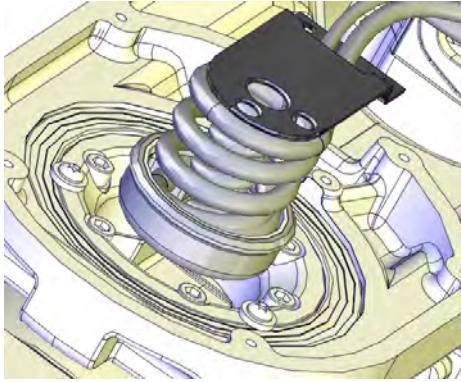
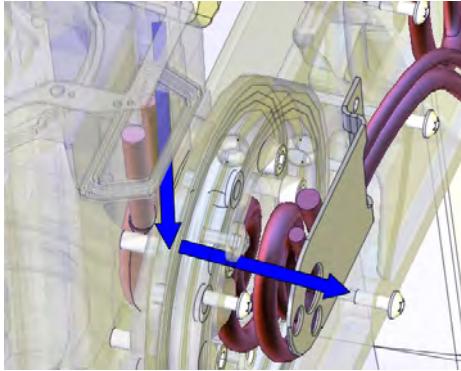
### 4.5.1 Replacing the upper arm

*Continued*

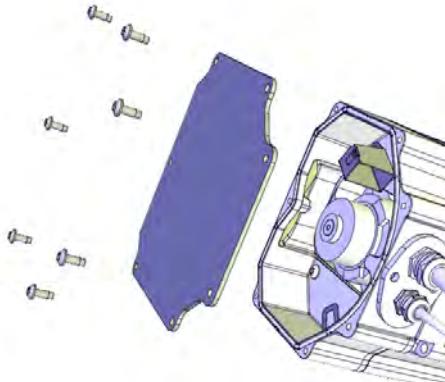
	Action	Note
3	Disconnect the motor cables.	 xx1300000488
4	Unscrew the attachment screws that hold the cable bracket.	 xx1300000484
5	Unscrew the M4 screw that holds the carrier.   <b>Note</b> The screw is located at the bottom of the carrier.	 xx1300000485

*Continues on next page*

4.5.1 Replacing the upper arm  
*Continued*

Action	Note
6 Pull out the carrier from its position.	 xx1300001113
7 Pull out the axis-6 motor cables by holding the cables with one hand at the motor and the other at the carrier.	 xx1300000666

Disconnecting the axis-3 and axis-4 motor cables

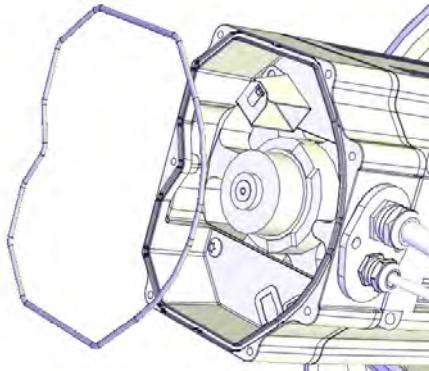
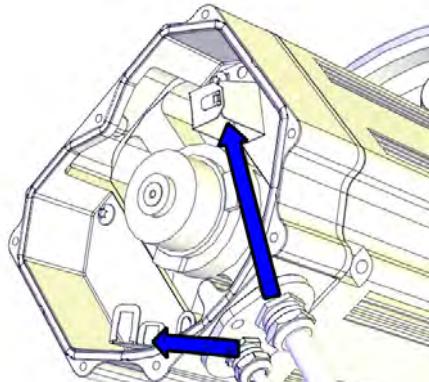
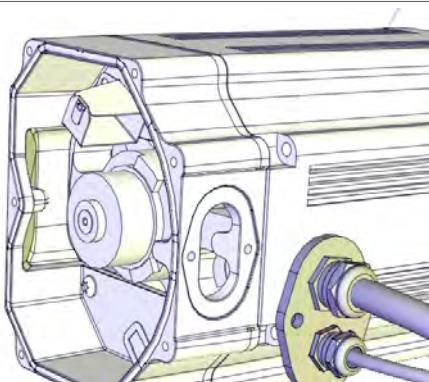
Action	Note
1  <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135

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## 4 Repair

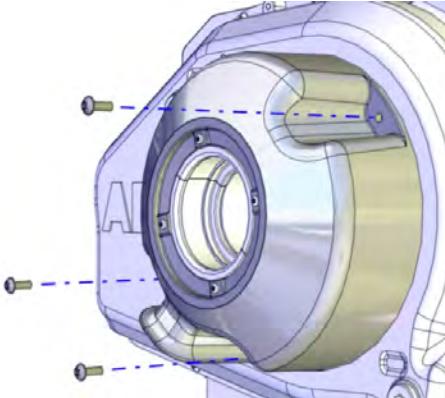
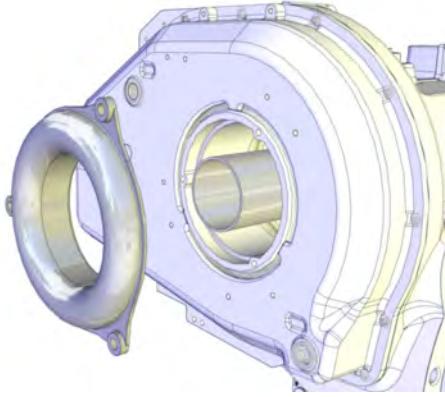
### 4.5.1 Replacing the upper arm

*Continued*

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

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## Removing the cable harness - wrist and upper arm

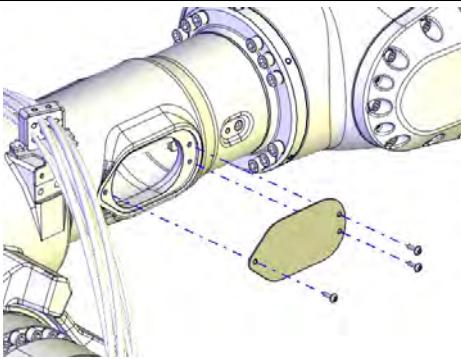
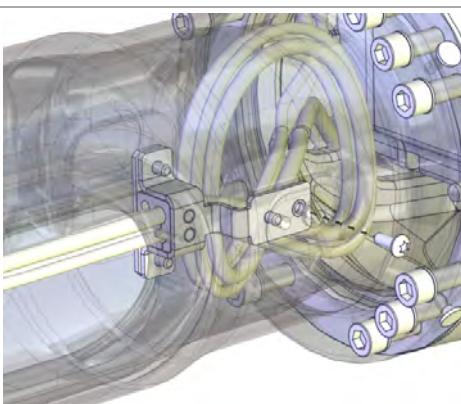
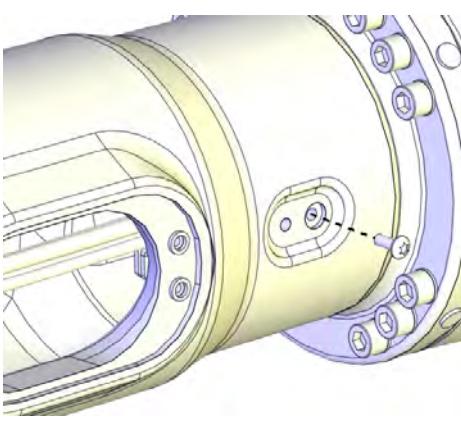
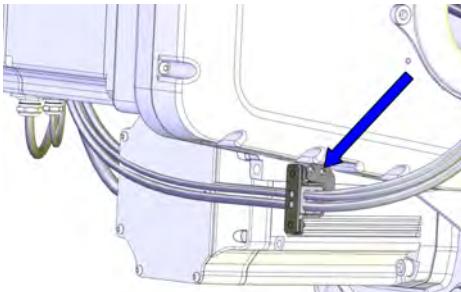
	Action	Note
1	<p>Remove the cover.</p> <p> <b>Note</b></p> <p><b>Foundry Plus:</b> Use caution not to damage the gasket, to loose the washers on the cover sealing or to loose the inserts fitted on the cover.</p>	 <p>xx1200000045</p>
2	<p>Remove the cable guide, slide it out a little and let it rest on the cables.</p>	 <p>xx1300000657</p>
3	<p> <b>Tip</b></p> <p>Use tape and tie the axis-5 and axis-6 connectors and carrier into a bundle (if not already done). This is done to facilitate the procedure and to avoid damaging the parts during the procedure. This will also make it easier to run the cable harness through the inside of the upper arm.</p>	 <p>xx1300000668</p>

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## 4 Repair

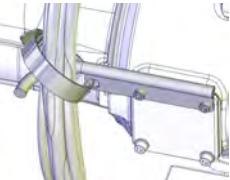
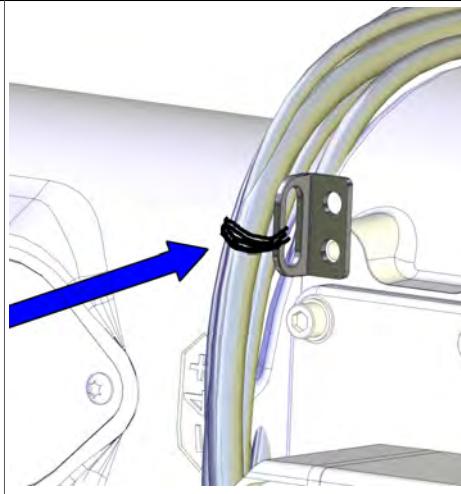
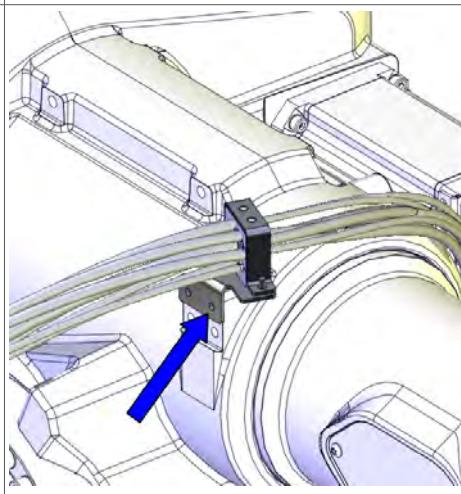
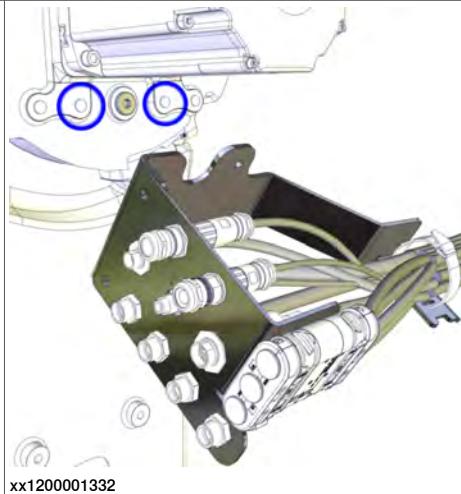
### 4.5.1 Replacing the upper arm

*Continued*

Action	Note
4 Remove the side cover on the arm tube.	 xx1300000557
5 Unscrew the attachment screw that secures the axis-4 metal clamp inside the arm tube.  <b>Note</b> The screw is reached from outside the upper arm!	 xx1700000340  xx1700000339
6 Remove the armhouse metal clamp.	 xx1300000543

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4.5.1 Replacing the upper arm  
*Continued*

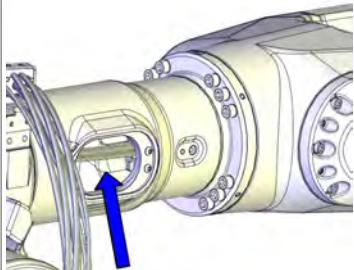
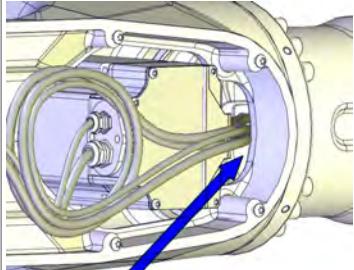
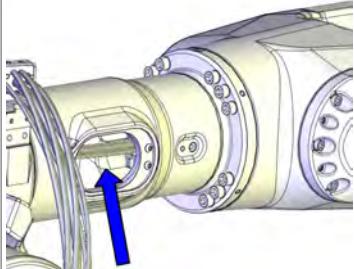
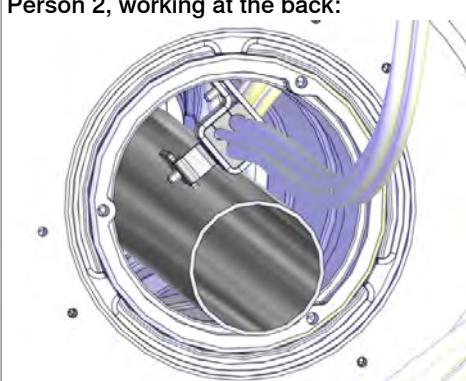
Action	Note
7 Open the velcro strap at the cable fixing bracket.   <b>Note</b>  If DressPack is fitted, the cable fixing bracket is replaced by the cable guide.   xx1300001973 <b>Cable guide.</b>	 xx1300000544 <b>Cable fixing bracket.</b>
8 Remove the metal clamp on top of the armhouse.	 xx1300000541
9 If used (and if not already done), unscrew the screws that hold the connection plate and let it hang free with the rest of the DressPack cable package.	 xx1200001332

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## 4 Repair

### 4.5.1 Replacing the upper arm

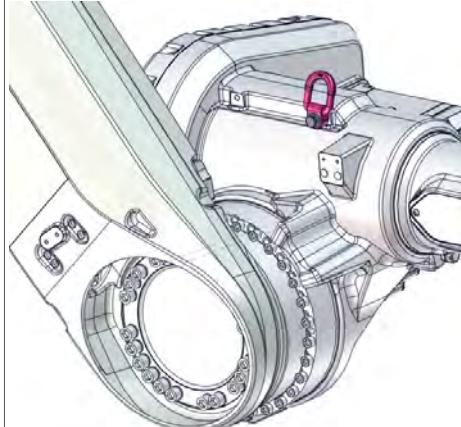
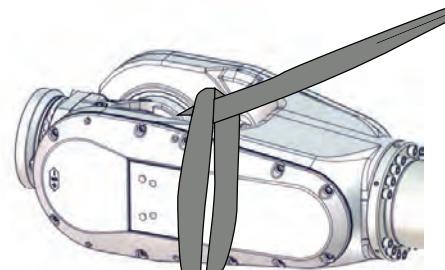
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	Action	Note
10	 <b>Tip</b> <p>This step is best performed by two persons working together.</p> <p>Use caution and remove the cable harness out of the wrist like this:</p> <ul style="list-style-type: none"> <li>• Person 1: Put one hand inside the side hole and take a hold of the cable harness.</li> <li>• Person 2: Take a hold on the cable harness inside the wrist.</li> <li>• Together: Move the cable harness past the axis-5 motor and into the arm tube.</li> </ul>	<p>Person 1, working at the side hole:</p>  xx1300000745 <p>Person 2, working at the wrist:</p>  xx1300000746
11	 <b>Tip</b> <p>This step is best performed by two persons working together.</p> <p>Use caution and remove the cable harness out of the arm tube like this:</p> <ul style="list-style-type: none"> <li>• Person 1: Put one hand inside the side hole and take a hold of the cable harness.</li> <li>• Person 2: Take a hold on the cable harness at the back of the robot.</li> <li>• Together: Move the cable harness out of the arm tube.</li> </ul> <p>Remove the cable harness from the upper arm.</p>	<p>Person 1, working at side hole:</p>  xx1300000745 <p>Person 2, working at the back:</p>  xx1400002561

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## Attaching the lifting accessories

Use this procedure to attach the lifting accessories to the upper arm.

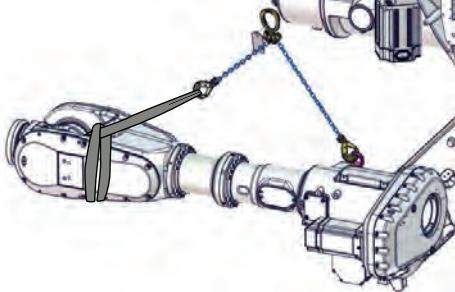
	Action	Note
1	 <b>CAUTION</b> The weight of the complete upper arm (including the wrist) is 465 kg All lifting accessories used must be sized accordingly.	
2	Fit a lifting eye in the arm house, with a fender washer underneath.  xx1400002196	Lifting eye, M12: 3HAC16131-1 Fender washer: Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.  xx1700000454
3	Run a lifting sling around the wrist.	Roundsling, 1 m: Lifting capacity: 1,000 kg.  xx1700000455

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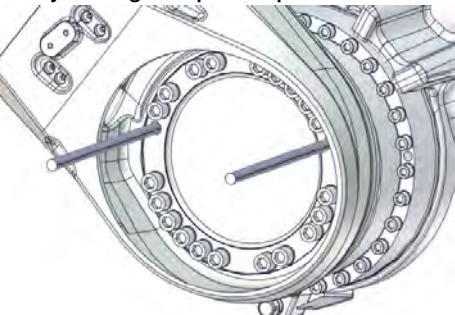
## 4 Repair

### 4.5.1 Replacing the upper arm

*Continued*

Action	Note
4 Attach the upper arm lifting accessory (chain) to an overhead crane (or similar) and then to the lifting eye in the arm house and the lifting sling around the wrist.	Lifting accessory (chain): 3HAC15556-1  xx1700000456
5 Raise the lifting accessories to take the weight of the upper arm.	
6 In case of necessary adjustments, use the shortening loops on the lifting accessory (chain) to find the level position. See figure!	 xx1400002197
7 Release the brakes in order to find the most level lifting position of the upper arm as possible, before lifting. To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP3: <ul style="list-style-type: none"><li>• + = pin 2</li><li>• - = pin 5</li></ul>	24 VDC power supply

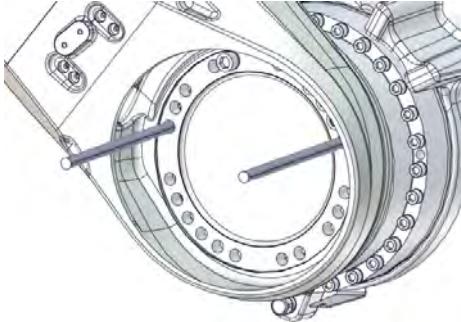
#### Preparations before removing the upper arm

Action	Note
1 Remove two attachment screws in opposite holes and replace them with guide pins.   <b>Note</b> Make sure that it is the screws that hold the lower arm to the axis-3 gearbox that are removed! See figure!   <b>Tip</b> Lubricate the guide pins with some grease to make the upper arm slide better.	Guide pin, M16x150: 3HAC13120-2 Guide pin, M16x200: 3HAC13120-3 Always use guide pins in pairs.  xx1700000457

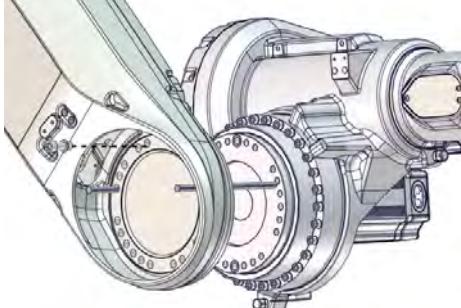
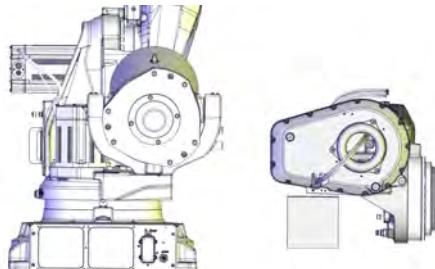
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#### 4.5.1 Replacing the upper arm

*Continued*

Action	Note
2 Leave one of the remaining attachment screws fitted, remove the other screws.	 xx1700000458

#### Removing the upper arm

Action	Note
1  Note  Make sure the lift is done completely leveled! In case of necessary adjustments, use the shortening loops on the lifting accessory (chain), and make sure to place the chain the right way through the loops.	 xx1400002197
2 Remove the remaining attachment screw and let the upper arm slide out from the lower arm with support from the guide pins.	 xx1700000459
3 Lift the upper arm and place it on the prepared area.	
4 <i>This step is only valid when the upper arm is removed due to replacement of the axis-3 gearbox:</i>  Place pieces of wood (or similar) under arm house and wrist. Lower the upper arm, and let the upper arm rest as shown in the figure.  This is done in order to keep the axis-3 gearbox in a vertical position and to get the best position to replace the axis-3 gearbox, if applicable.	 xx1300000553

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## 4 Repair

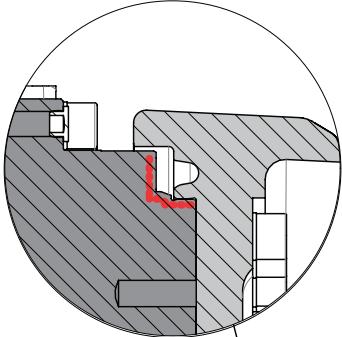
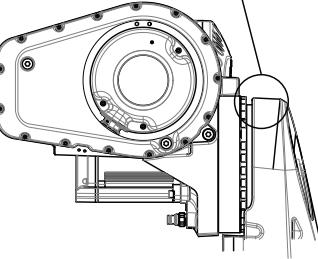
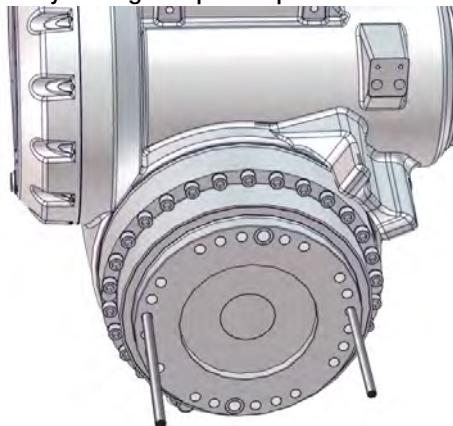
### 4.5.1 Replacing the upper arm

*Continued*

#### Refitting the upper arm

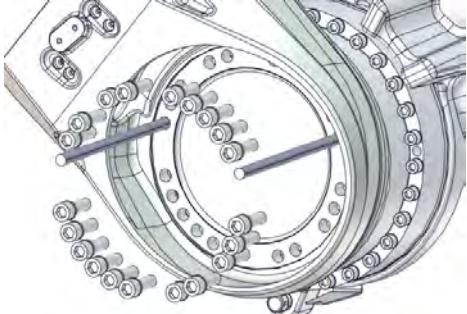
Use these procedures to refit the upper arm.

#### Preparations before refitting the upper arm

Action	Note
1 Wipe clean all contact surfaces.	
2 <b>Foundry Plus:</b> Apply Mercasol on the surface shown in the figure.	  xx1400000375
3 Fit two guide pins in opposite M16 holes in the axis-3 gearbox.   <b>Tip</b>  Lubricate the guide pins with some grease to make the upper arm slide better.	Guide pin, M16x150: 3HAC13120-2 Guide pin, M16x200: 3HAC13120-3 Always use guide pins in pairs.  xx1700000056

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## Securing the upper arm

	Action	Note
1	 <b>CAUTION</b> The weight of the complete upper arm (including the wrist) is 465 kg All lifting accessories used must be sized accordingly.	
2	Attach the lifting accessories, if not already fitted.	See <a href="#">Attaching lifting accessories to the upper arm on page 206</a> .
3	Lift the upper arm and bring it towards the lower arm.	
4	In order to release the brakes, connect the 24 VDC power supply  Connect to R2.MP3-connector: • + = pin 2 • - = pin 5	24 VDC power supply
5	Use the rotation tool and rotate the axis-3 motor to find the correct position for the guide pins in the lower arm.	Rotation tool
6	Insert and tighten 20 of the 22 M16 screws.	 xx1700000460
7	Remove the guide pins and fit the two remaining screws.	
8	Secure the upper arm by tightening the attachment screws.	M16, tightening torque: 300 Nm

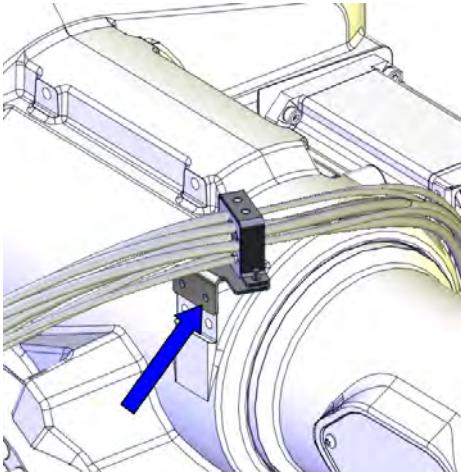
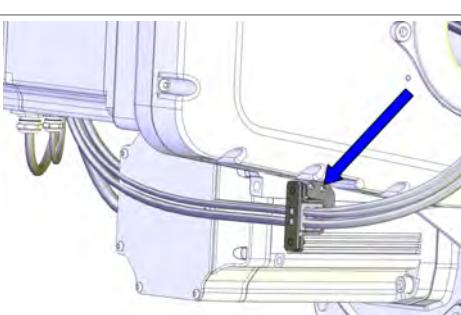
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## 4 Repair

### 4.5.1 Replacing the upper arm

*Continued*

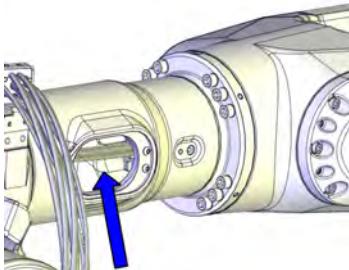
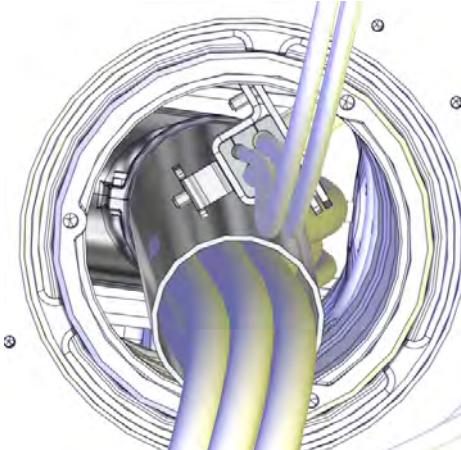
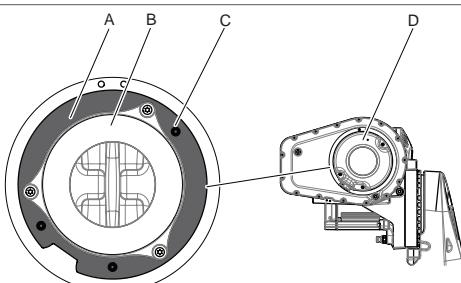
#### Refitting the cable harness - upper arm

Action	Note
1 Refit the metal clamp on top of the arm house.	 xx1300000541
2 Refit the arm house metal clamp.	 xx1300000543
3 Arrange the cables between the cable clamps in the upper arm.	
4  <b>Tip</b> <p>Use tape and tie the axis-5 and axis-6 connectors and carrier into a bundle (if not already done). This is done to facilitate the procedure and to avoid damaging the parts during the procedure. This will also make it easier to run the cable harness through the inside of the upper arm.</p>	 xx1300000668

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## 4.5.1 Replacing the upper arm

*Continued*

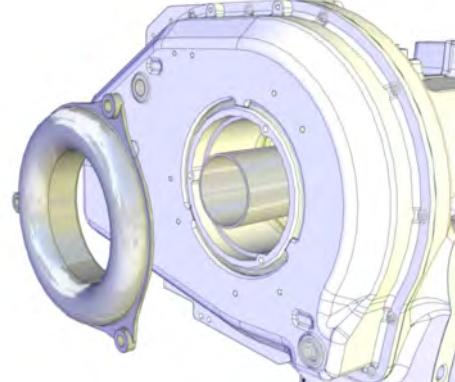
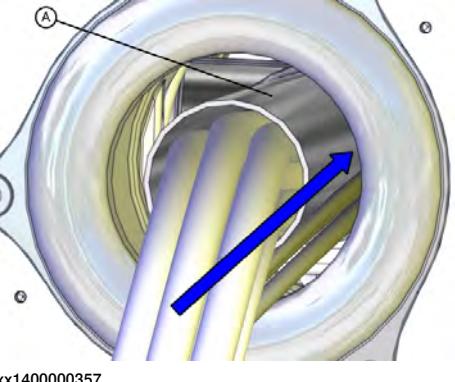
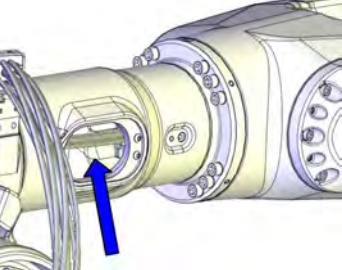
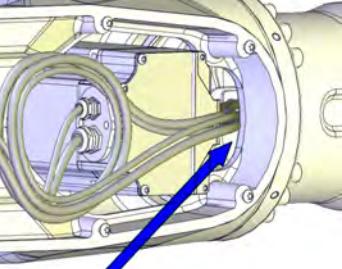
	Action	Note
5	 <b>Tip</b> <p>This step is best performed by two persons working together:</p> <ul style="list-style-type: none"> <li>• Person 1: Put one hand inside the side hole of the arm tube and take a hold of the cable harness.</li> <li>• Person 2: Take a hold on the cable harness at the back of the robot.</li> <li>• Together: Use caution and move the cable harness into the arm tube.</li> </ul>	<p>Person 1, working at the side hole:</p>  xx1300000745 <p>Person 2, working at the back:</p>  xx1400000356
6	<p><b>Foundry Plus:</b>  Make sure that the gasket between the robot and cover is correctly fitted. Replace if damaged!</p> <p>The gasket is covered with adhesive on the side facing the upper arm cover. The three washers are pressed into the holes in the gasket. Make sure all three washers are fitted.</p>	 xx1400000382 <ul style="list-style-type: none"> <li>A Gasket</li> <li>B Cable guide</li> <li>C Washer</li> <li>D Cover</li> </ul>

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## 4 Repair

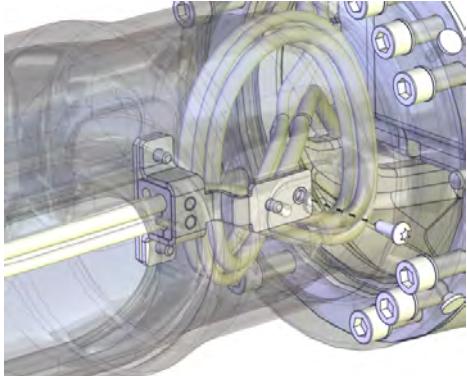
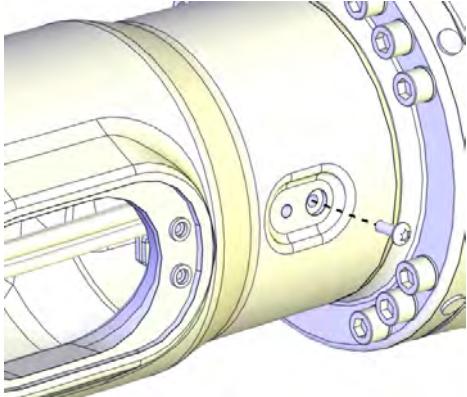
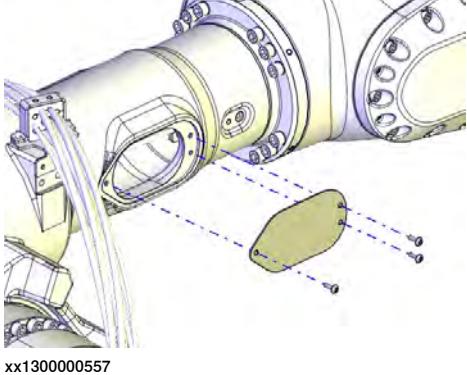
### 4.5.1 Replacing the upper arm

*Continued*

Action	Note
7 Fit the cable guide.	 xx1300000657
8 Run the cable harness through the cable guide and then into the upper arm tube.   <b>Note</b>  The cable harness is best placed at the upper right hand side of the DressPack tube, if used, through the arm tube. Do not run the cable harness into the DressPack tube!	 xx1400000357  <b>A Tube for DressPack</b>
9 Use caution and push the cable harness into the upper arm tube.	
10  <b>Tip</b>  This step is best performed by two persons working together. Use caution and push the cable harness into the wrist like this: <ul style="list-style-type: none"> <li>Person 1: Put one hand inside the side cover hole and take a hold of the cable harness.</li> <li>Person 2: Take a hold of the cable harness from inside the wrist.</li> <li>Together: Move the cable harness past the axis-5 motor and into the wrist.</li> </ul>	Person 1, working at the side hole:  xx1300000745 Person 2, working at the wrist:  xx1300000746

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4.5.1 Replacing the upper arm  
*Continued*

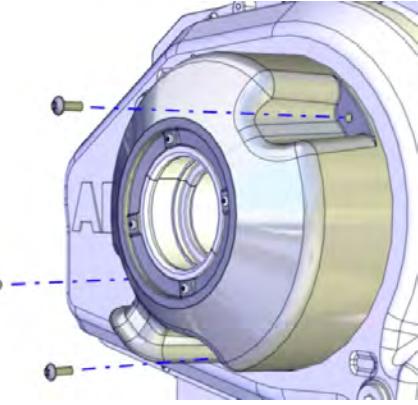
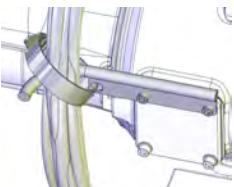
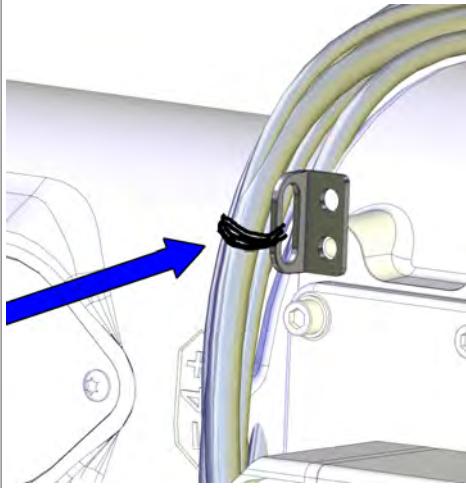
Action	Note
11 Refit the metal clamp axis-4 inside the arm tube.   <b>Note</b>  The screws are reached from outside the upper arm!	 xx1700000340   xx1700000339
12 Refit the side cover.   <b>Note</b>  <b>Foundry Plus:</b> <ul style="list-style-type: none"> <li>• Make sure the gasket is fitted correctly on the side cover</li> <li>• Use attachment screws made of stainless steel to fit the side cover.</li> </ul>	 xx1300000557

*Continues on next page*

## 4 Repair

### 4.5.1 Replacing the upper arm

*Continued*

Action	Note
13 If used ( <i>DressPack or Foundry Plus</i> ), refit the cover with the tube guiding ring fitted.   <b>Note</b>  <b>Foundry Plus:</b> <ul style="list-style-type: none"> <li>• Make sure the gasket is fitted correctly</li> <li>• Use attachment screws made of stainless steel to fit the cover.</li> </ul>	 xx1200000045
14 Secure the cable harness to the cable fixing bracket with the velcro strap.   <b>Note</b>  If DressPack is fitted, the cable fixing bracket is replaced by the cable guide.   xx1300001973	 xx1300000544

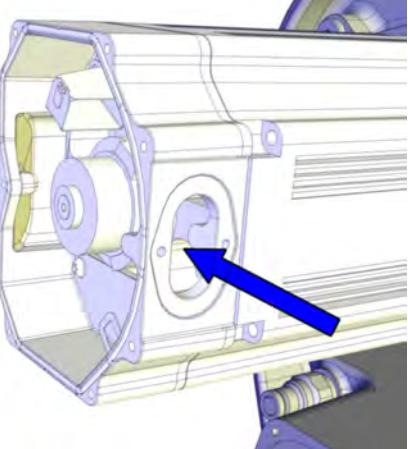
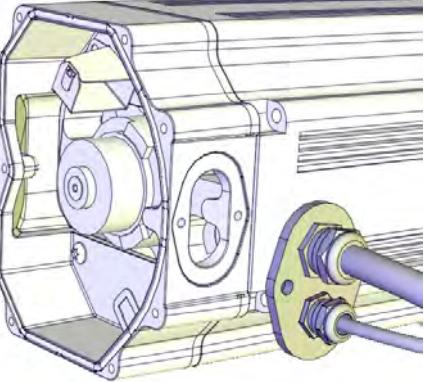
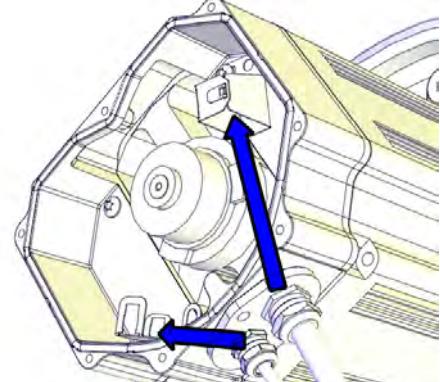
#### Refitting the DressPack cable package

If used, refit the DressPack cable package. How to refit the DressPack cable package is described in more detail in the product manual "IRB 6700 DressPack". For article number see [References on page 10](#).

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4.5.1 Replacing the upper arm  
*Continued*

Connecting the axis-3 and axis-4 motor cables

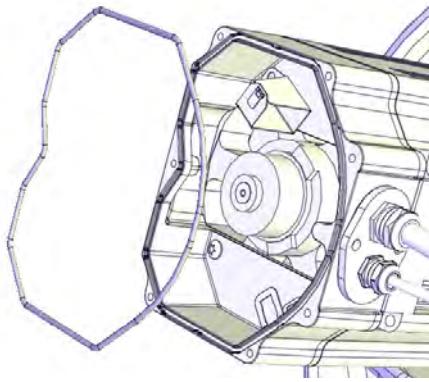
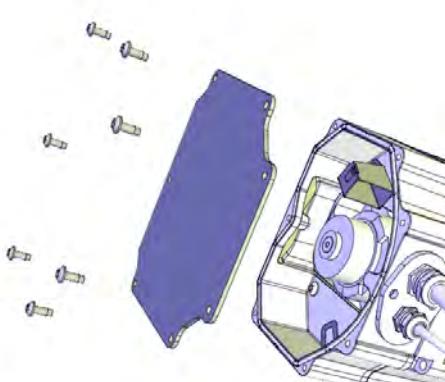
	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1300000738
2	Refit the cable gland cover. <b>Note</b> Replace the gasket if damaged.	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066

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## 4 Repair

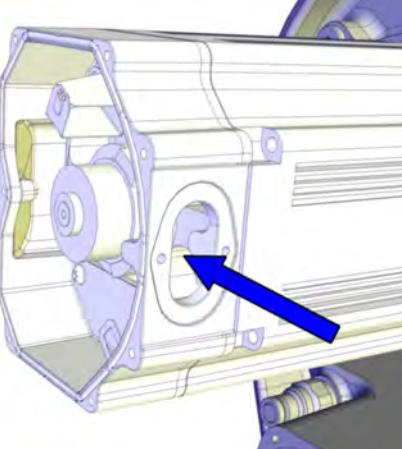
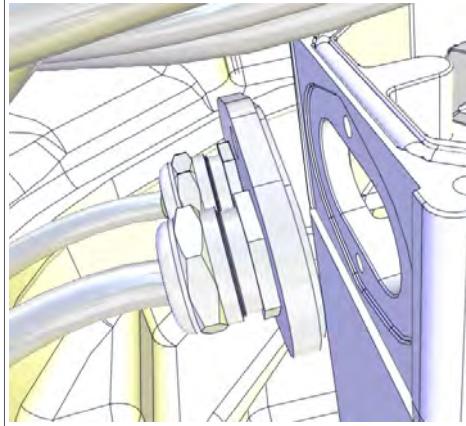
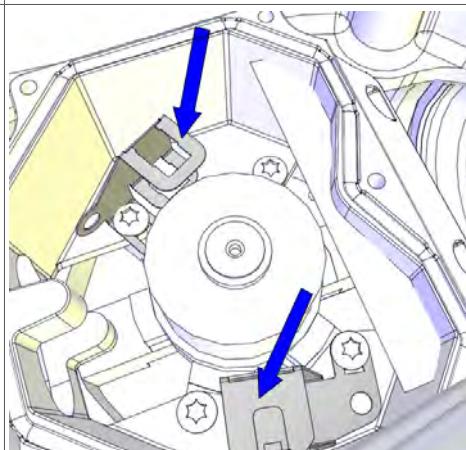
### 4.5.1 Replacing the upper arm

*Continued*

Action	Note
4 Inspect the o-ring.  Note Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-001
	 xx1200001070
5 Wipe clean o-ring and o-ring groove.	
6 Refit the o-ring.  Tip Lubricate the o-ring with some grease for a better fitting in the groove.	
7 CAUTION When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8 Refit the motor cover with its attachment screws.  Note Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged.  Note Make sure the o-ring is undamaged and properly fitted.	 xx1200001135
9 Make sure that the covers are tightly sealed.	

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## Connecting the axis-5 motor cables

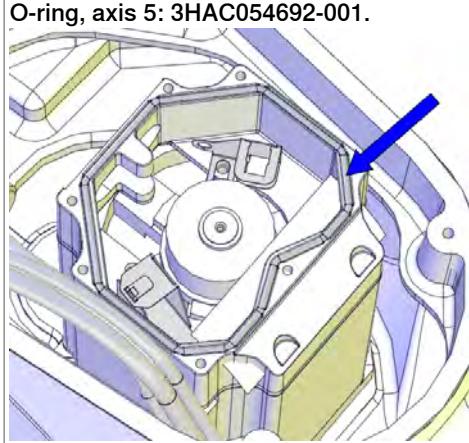
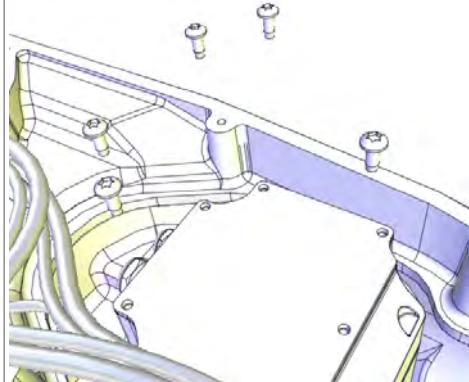
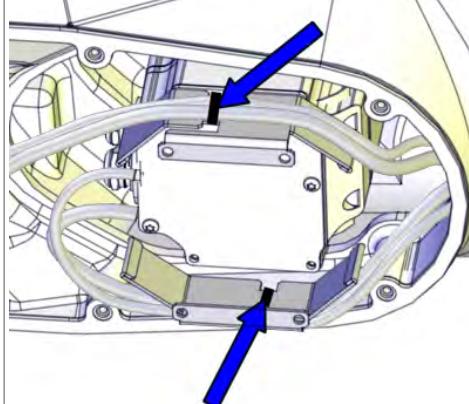
	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1300000738
2	Refit the cable gland cover by performing the following steps: <ul style="list-style-type: none"> <li>Slide the cable gland cover onto the inner screw.</li> <li>Refit and tighten the outer screw.</li> <li>Tighten the inner screw. Make sure that the gasket is not damaged.</li> </ul> <p><b>Note</b> Replace the gasket if damaged.</p>	 xx1200001016
3	Connect the connectors. Connect in accordance with the markings on the connectors.	 xx1200001015

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## 4 Repair

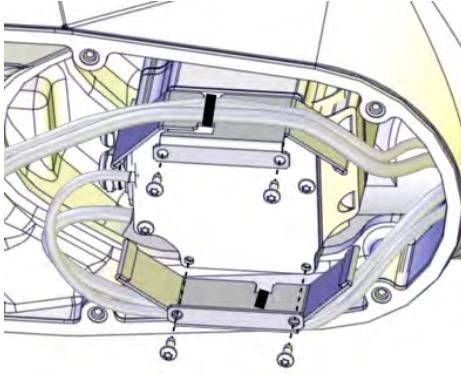
### 4.5.1 Replacing the upper arm

*Continued*

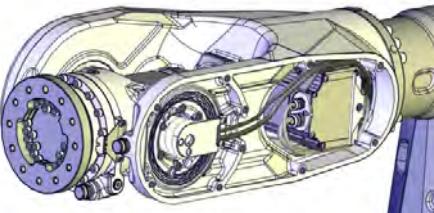
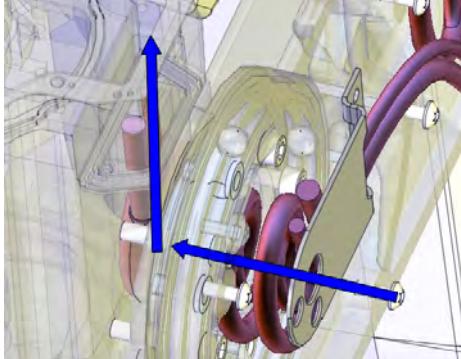
	Action	Note
4	<p>Make sure the o-ring on the motor is undamaged. Replace if damaged.</p>	 O-ring, axis 5: 3HAC054692-001. <small>xx1200001021</small>
5	<p><b>!</b> <b>CAUTION</b>             When fitting the motor cover, make sure that none of the cables inside will be damaged.</p>	
6	<p>Refit the motor cover with its attachment screws.</p> <p><b>Note</b>             Do not refit the screws that will hold the heat protection plate at this point.</p> <p><b>Note</b>             Do not reuse the self-threading attachment screws, it will damage the threads. Replace with standard attachment screws.</p> <p><b>Note</b>             Make sure the o-ring is undamaged and properly fitted.</p>	 <small>xx1200001013</small>
7	<p>Secure the cable harness with cable straps to the heat protection plate.</p>	 <small>xx1500001029</small>

*Continues on next page*

### 4.5.1 Replacing the upper arm Continued

	Action	Note
8	Fit the heat protection plate with the screws.	 xx1500001030
9	Make sure that the cover is tightly sealed.	

#### Connecting the axis-6 motor cables

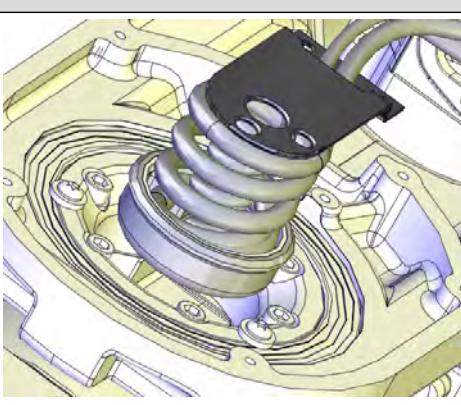
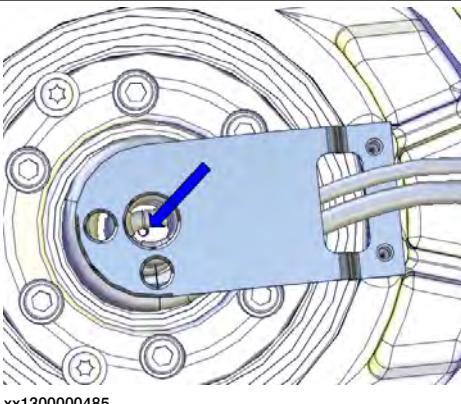
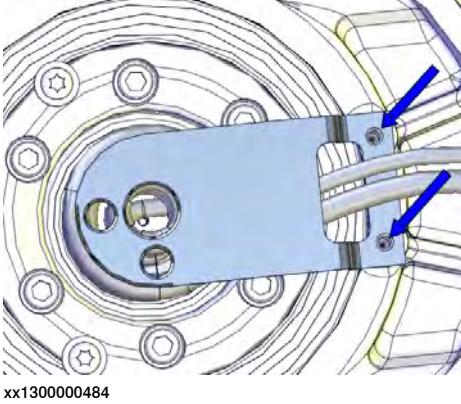
	Action	Note
1	Make sure that the cable harness is placed in a way that it will not be damaged when the cover is fitted.	 xx1600002061
2	<p> Note</p> <p>Axis 5 must be in position +90° (or as close as possible) for a correct installation of the cable harness in the wrist. If not, connect the 24 VDC power supply, release the brakes and move axis 5 manually to +90°.</p>	Position +90° of axis 5 makes the turning disc face the floor, if the robot is floor standing.
3	Push the cable harness into the wrist recess and up into the axis-6 motor.	 xx1300000667

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## 4 Repair

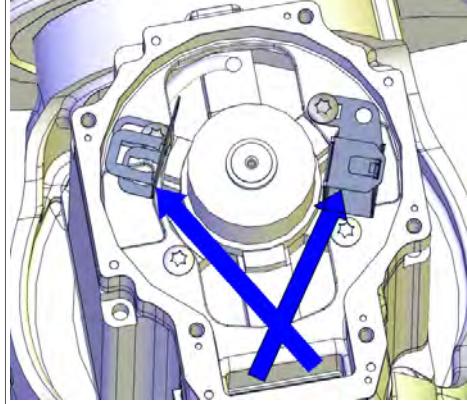
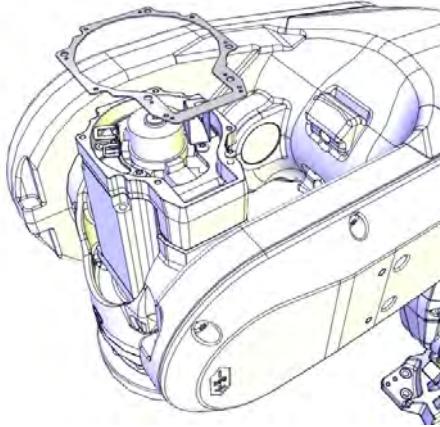
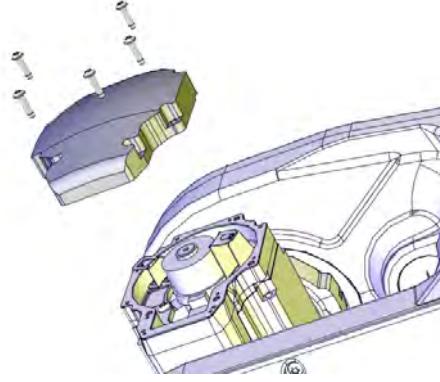
### 4.5.1 Replacing the upper arm

*Continued*

Action	Note
4 Push the carrier carefully into position.	 xx1300001113
5 Secure the carrier with the M4 screw.   <b>Note</b> The screw is located at the bottom of the carrier.   <b>Tip</b> The attachment screw securing the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.	 xx1300000485
6 Secure the cable bracket with its attachment screws.	 xx1300000484

*Continues on next page*

#### 4.5.1 Replacing the upper arm Continued

	Action	Note
7	<p>Reconnect the connectors to the axis-6 motor.</p> <p><b>Note</b></p> <p>Place the resolver cable under the motor cable.</p>	 xx1300000488
8	<p>Make sure the gasket is undamaged. Replace if damaged.</p>	Gasket, 3HAC033489-001  xx1200001095
9	<p><b>CAUTION</b></p> <p>When fitting the motor cover, make sure that none of the cables inside will be damaged.</p>	
10	Refit the motor cover.	 xx1200001080

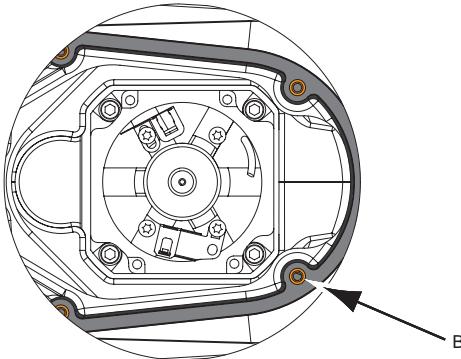
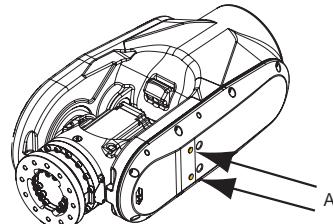
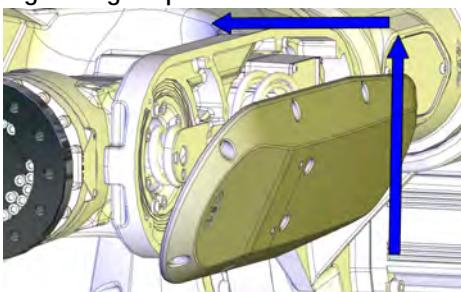
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## 4 Repair

### 4.5.1 Replacing the upper arm

*Continued*

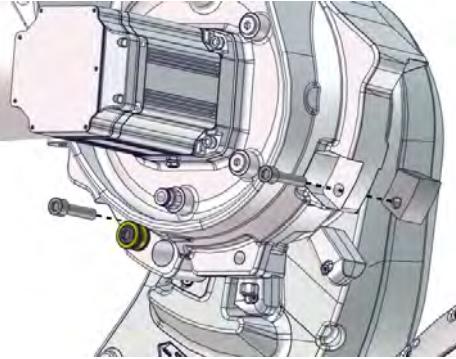
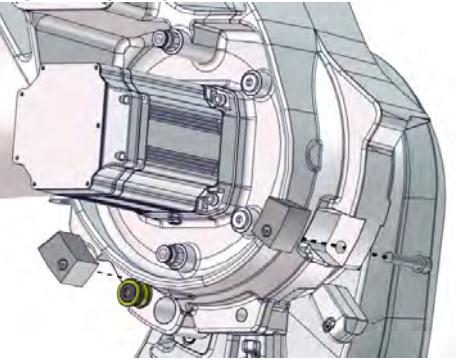
#### Refitting the wrist cover

Action	Note
<p><b>1 Foundry Plus:</b></p> <ul style="list-style-type: none"> <li>• Make sure that the gasket is undamaged on the cover. Replace if damaged!</li> <li>• Put washers (10 pcs) in the holes of the gasket.</li> <li>• Use attachment screws made of stainless steel to fit the wrist cover.</li> </ul>	  xx1400000383 <p>A Protection plugs (2 on wrist cover and 2 on cover axis-5 gearbox) B Washers (10 pcs) in gasket holes</p>
<p><b>2</b> Refit the wrist cover. In order not to damage the cable harness when the wrist cover is refitted, use this method:</p> <ol style="list-style-type: none"> <li>1 Hold the cover in an angle. See figure!</li> <li>2 Catch any part of the cable harness hanging down.</li> <li>3 Lift the cover, still held in an angle.</li> <li>4 Move the upper part of the cover into position.</li> <li>5 Secure the cover with its attachment screws.</li> </ol>	Tightening torque: 10 Nm.  xx1300000772
<b>3</b> Remove the lifting accessories.	

*Continues on next page*

4.5.1 Replacing the upper arm  
*Continued*

## Concluding procedure

	Action	Note
1	Remove the service stops from maintenance position.	 xx1700000449
2	Fit the service stops in their parking position.	Tightening torque: 70 Nm ±15 Nm.  xx1700000448
3	Recalibrate the robot.	Axis Calibration is described in <a href="#">Calibrating with Axis Calibration method on page 691</a> . General calibration information is included in section <a href="#">Calibration on page 683</a> .
4	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further described in <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

## 4 Repair

### 4.5.2 Replacing the wrist

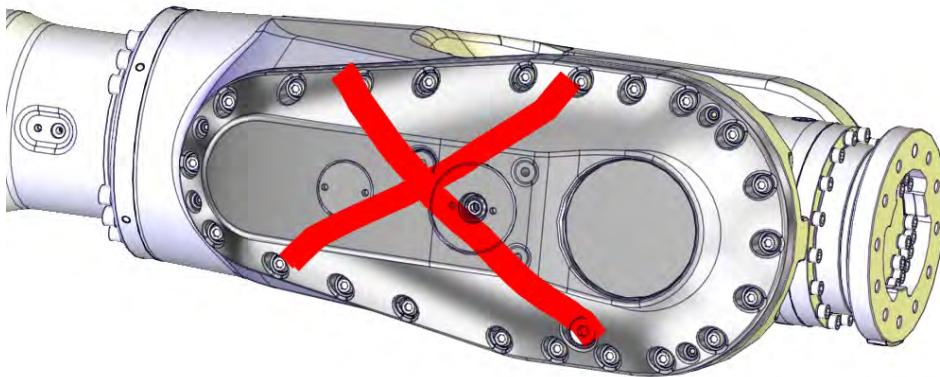
#### 4.5.2 Replacing the wrist

**Strictly forbidden to open the cover on the axis-5 gearbox**



##### Note

Do not, under any circumstances, open the cover on the axis-5 gearbox! It is strictly forbidden to do any repair work on the axis-5 gearbox.

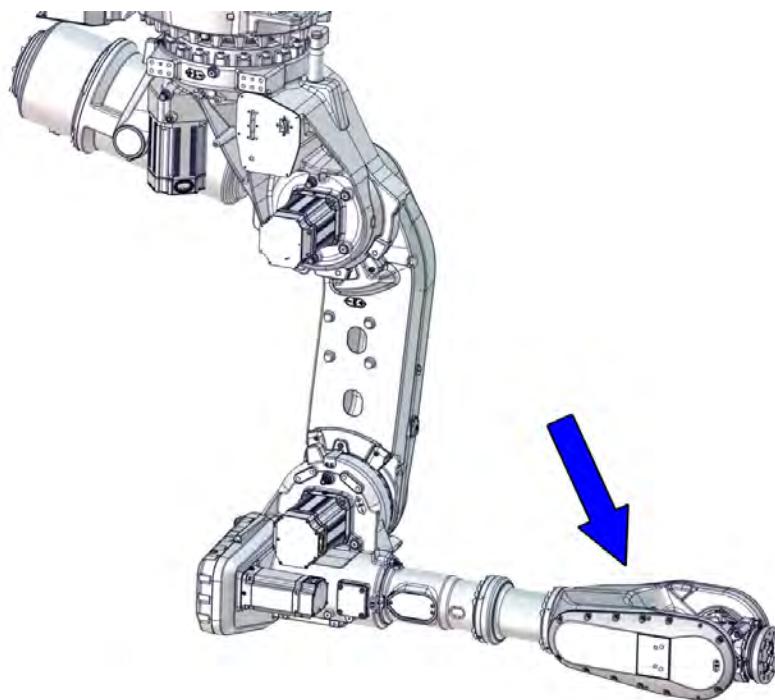


xx1300002248

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**Location of the wrist**

The wrist is located as shown in the figure.



xx1700000052

**Spare part**

Spare part	Spare part number	Note
Wrist	See <i>Product manual, spare parts - IRB 6700</i> .	

**Required tools and equipment**

Equipment, etc.	Article number	Note
Roundsling, 1 m	-	Lifting capacity: 1,000 kg.
Pallet		Used for putting down removed parts from robot.
Cardboard		Used for protection.
Guide pin, M12x150	3HAC13056-2	Always use guide pins in pairs.
24 VDC power supply	-	Used to release the motor brakes.
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

**Consumables**

Equipment, etc.	Art. no.	Note
Cable tie	-	

*Continues on next page*

## 4 Repair

### 4.5.2 Replacing the wrist

*Continued*

Equipment, etc.	Art. no.	Note
Grease	3HAB3537-1	Used to lubricate o-rings.
O-ring	3HAC054692-001	D=119x3 Used on axis-5 motor cover.
Gasket	3HAC033489-001	Used on axis-6 motor cover.
Mercasol	-	Foundry Plus

#### 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>If the robot is to be calibrated with reference calibration:</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 692</a>.</p>
	<p>If the robot is to be calibrated with fine calibration:</p> <p>Remove all external cable packages (DressPack) and tools from the robot.</p>	

#### Removing the wrist

These procedures describes how to remove the wrist.

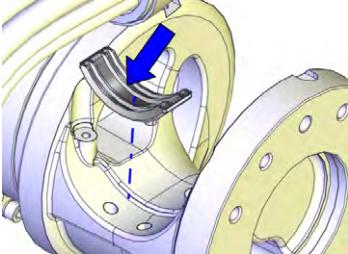
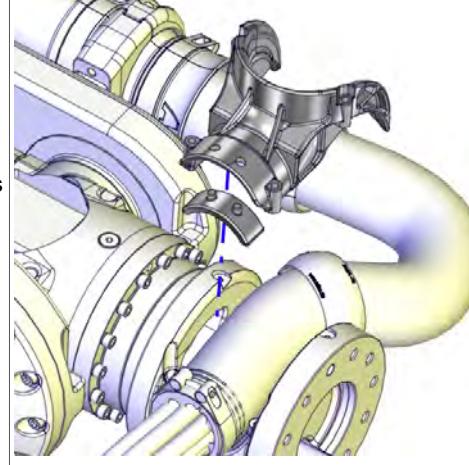
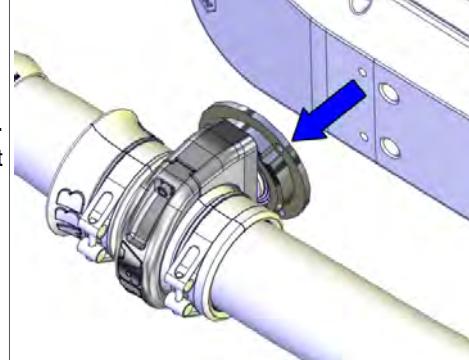
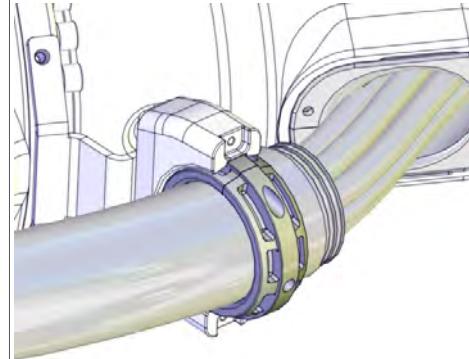
#### Preparations before removing the wrist

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

*Continues on next page*

#### 4.5.2 Replacing the wrist

*Continued*

	Action	Note
3	<p>If used, open the DressPack axis-6 cable support and remove the DressPack cable package from the process turning disk.</p> <p><b>Note</b></p> <p>Use caution not to lose the two clamp jaws on either side of the DressPack cable package.</p>  <p>xx1400000223</p> <p>Clamp jaw</p>	 <p>xx1400000208</p>
4	<p>If used, remove the complete ball joint housing (including the bracket), from the wrist cover.</p> <p>This is done to be able to reach the two hidden screws that secure the wrist cover. Leave the DressPack fitted in the ball joint housing.</p>	 <p>xx1400000355</p> <p>How to remove the DressPack is described in more detail in the product manual "IRB 6700 DressPack". For article number see <a href="#">References on page 10</a>.</p>
5	<p>If used, open the ball joint housing on the arm tube, use caution and lift down the DressPack cable package on the floor.</p>	 <p>xx1400000352</p>
6	<p>If used, remove the bracket with the part of the ball joint housing still fitted.</p>	

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## 4 Repair

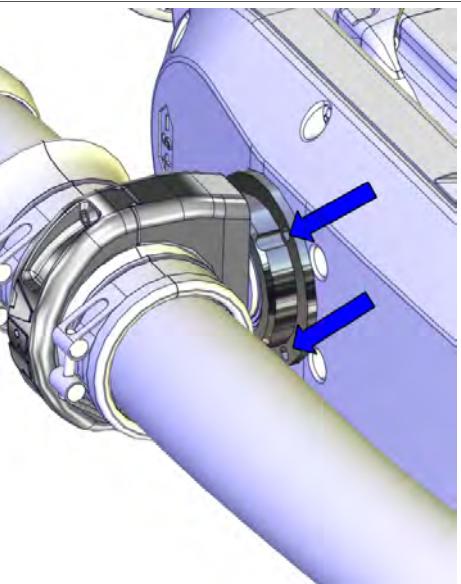
### 4.5.2 Replacing the wrist

*Continued*

Action	Note
7 Jog the robot into position: <ul style="list-style-type: none"> <li>• Axis 1: no significance (as long as the robot is secured to the foundation)</li> <li>• Axis 2: 0°</li> <li>• Axis 3: 0°</li> <li>• Axis 4: -90°</li> <li>• Axis 5: +90°</li> <li>• Axis 6: no significance</li> </ul>	
8  <b>DANGER</b> <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>	
9 Prepare a pallet with cardboard in front of the robot or where it is possible, to be used for putting down the wrist unit on.	

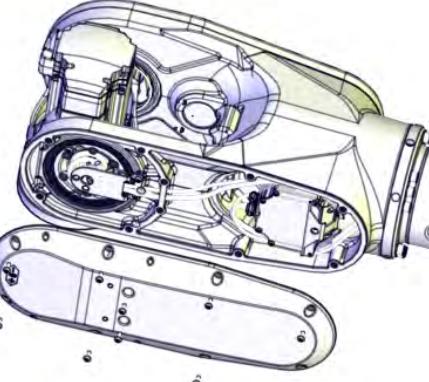
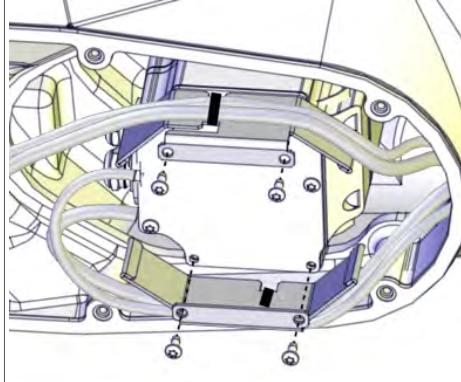
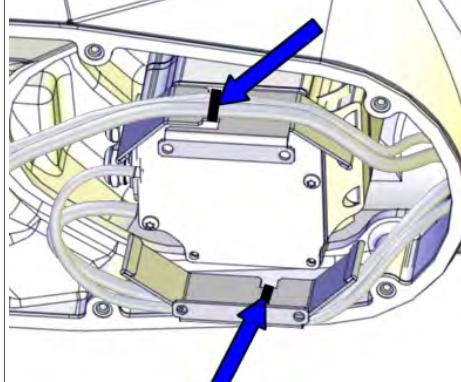
#### Retrieving access to the wrist cabling

Use this procedure to remove the wrist cover to retrieve access to the axis-5 and axis-6 motor cables.

Action	Note
1  <b>DANGER</b> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2 If DressPack is not already removed, the complete ball joint housing (including the bracket) must be removed at this point, in order to reach the two hidden screws that secures the wrist cover.	 xx1400000355

*Continues on next page*

#### 4.5.2 Replacing the wrist Continued

Action	Note
3 Remove the wrist cover.	 xx1300002247
4 Remove the heat protection plates from the motor with the cabling still attached to the plate.	 xx1500001030
5 Cut the cable ties that hold the cable harness to the plate.  <b>Note</b> Keep the heat protection plate until refitting.  <b>Tip</b> If removing the plate only for replacing the motor, the cabling does not need to be loosened from the plate.	 xx1500001029

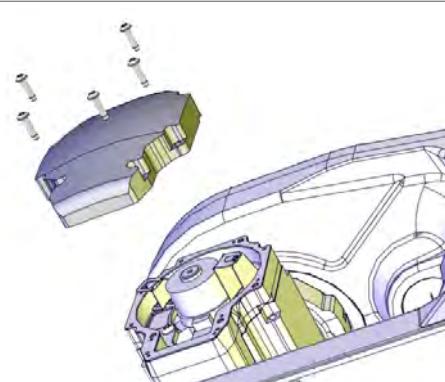
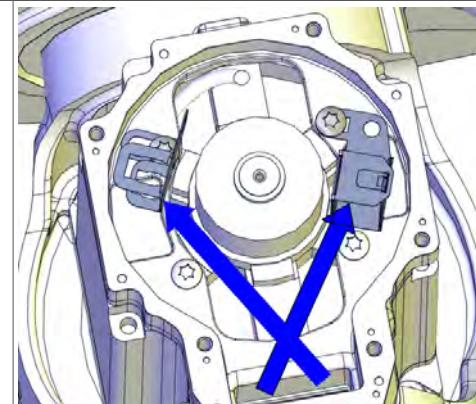
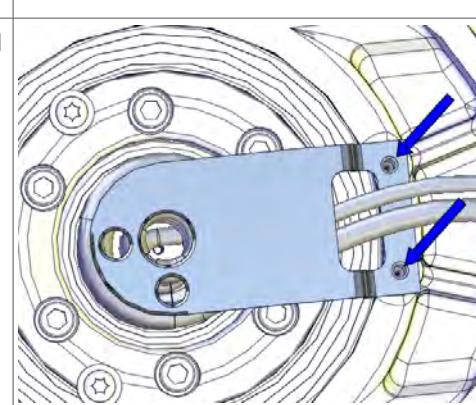
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## 4 Repair

### 4.5.2 Replacing the wrist

*Continued*

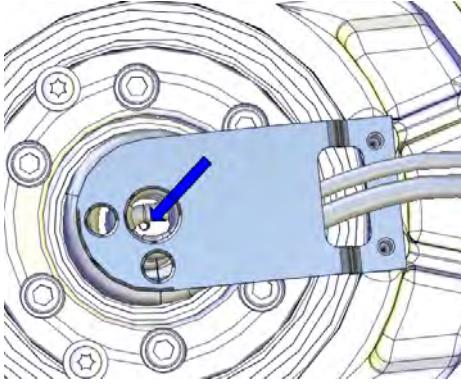
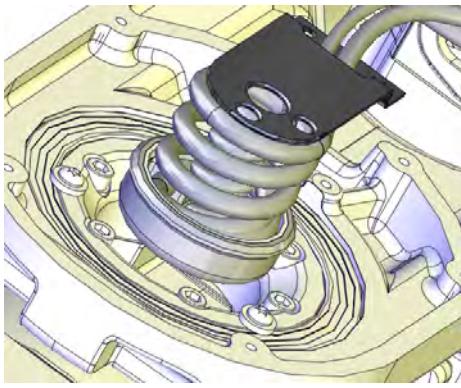
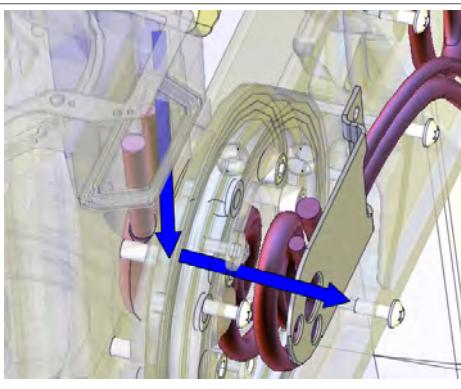
#### Disconnecting the axis-6 motor cables

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws and remove the motor cover.	 xx1200001080
3	Disconnect the motor cables.	 xx1300000488
4	Unscrew the attachment screws that hold the cable bracket.	 xx1300000484

*Continues on next page*

#### 4.5.2 Replacing the wrist

*Continued*

Action	Note
5 Unscrew the M4 screw that holds the carrier.	 <b>Note</b> The screw is located at the bottom of the carrier.  xx1300000485
6 Pull out the carrier from its position.	 xx1300001113
7 Pull out the axis-6 motor cables by holding the cables with one hand at the motor and the other at the carrier.	 xx1300000666

#### Disconnecting the axis-5 motor cables

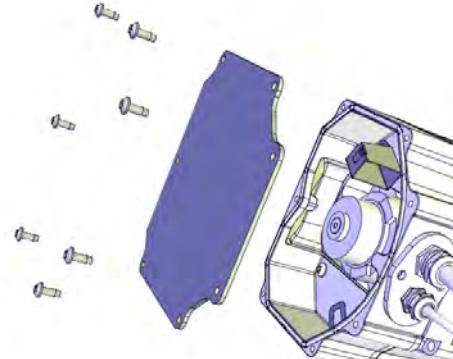
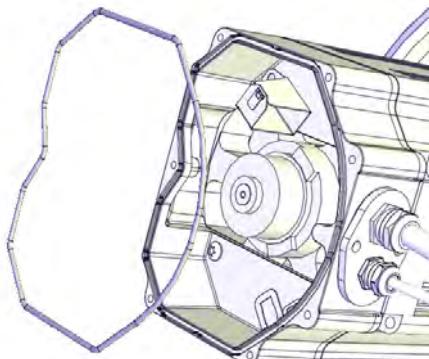
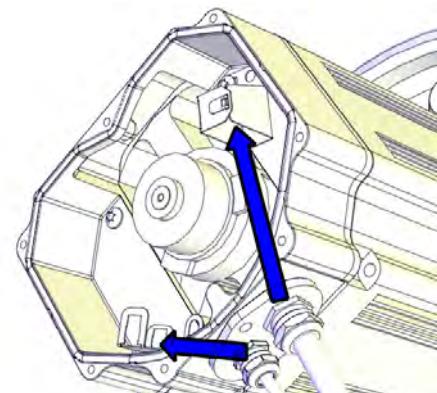
Action	Note
1  <b>DANGER</b>  Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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## 4 Repair

### 4.5.2 Replacing the wrist

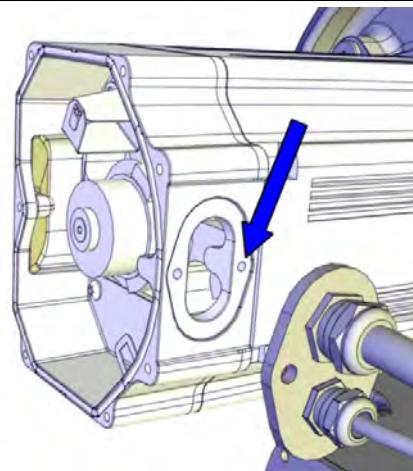
*Continued*

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

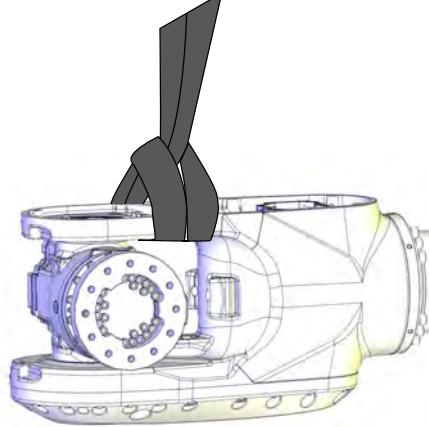
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#### 4.5.2 Replacing the wrist

*Continued*

Action	Note
<p>5 Remove the cable gland cover by performing the following steps:</p> <ol style="list-style-type: none"> <li>1 Open the inner screw a little (the one the arrow is pointing at). No need to remove this screw from the motor.</li> <li>2 Remove the outer screw.</li> <li>3 Slide the cable gland cover away from the inner screw. Make sure the gasket is not damaged.</li> </ol> <p> <b>Tip</b></p> <p>Make a note in which direction the cable exit hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.</p>	 xx1300000656
6 Use caution and pull out the motor cables.	

#### Attaching the lifting accessories to the wrist

Action	Note
<p>1  <b>CAUTION</b></p> <p>The weight of the complete wrist is 140 kg All lifting accessories used must be sized accordingly.</p>	
<p>2 Attach a roundsling to the wrist as shown in the figure.</p> <p> <b>CAUTION</b></p> <p>It is very important that the roundsling is placed as shown in the figure, to keep the wrist balanced when it is removed. Placed at a different position, there is a risk of sudden change in the balance, which can cause damage or injury. Do not attach the roundsling around the axis-5 gearbox!</p>	Roundsling, 1 m: Lifting capacity: 1,000 kg.  xx1300000673
<p>3  <b>Note</b></p> <p>Make sure the roundsling is stretched, so it can carry the weight of the wrist.</p>	

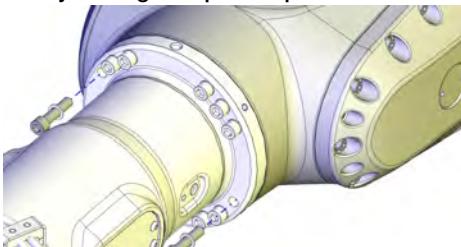
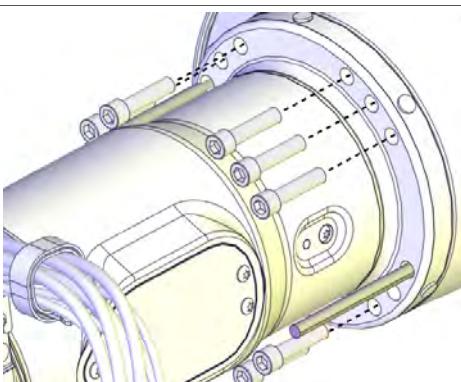
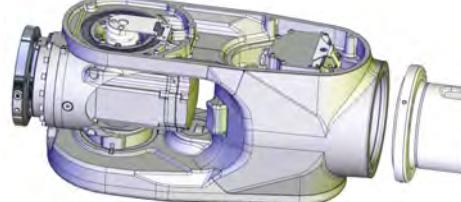
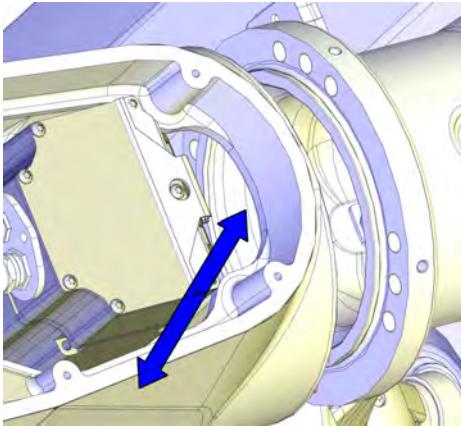
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## 4 Repair

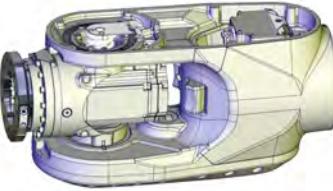
### 4.5.2 Replacing the wrist

*Continued*

#### Removing the wrist

Action	Note
<p>1 Remove two attachment screws in opposite holes and replace them with guide pins.</p> <p> <b>Tip</b></p> <p>Lubricate the guide pins with some grease to make the wrist slide better.</p>	<p>Guide pin, M12x150: 3HAC13056-2 Always use guide pins in pairs.</p>  <p>xx1300000748</p>
2 Remove the remaining attachment screws.	 <p>xx1300000749</p>
<p>3 Pull out the wrist a bit, onto the guide pins. This is done to be able to remove the cable harness from the wrist in a safe way.</p> <p> <b>CAUTION</b></p> <p>Make sure that the cabling does not get damaged.</p>	 <p>xx1300000750</p>
4 Use caution and pull out the cabling from the wrist unit.	 <p>xx1300000769</p>

*Continues on next page*

Action	Note
5 Slide the wrist off the guide pins and put it on a pallet or similar.	  xx1300000770

**Refitting the wrist**

These procedures describes how to refit the wrist.

**Preparations before refitting the wrist**

Action	Note
1  <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Wipe clean all contact surfaces.	
3 Fit two guide pins in opposite holes in the wrist.   <b>Tip</b> Lubricate the guide pins with some grease to make the wrist slide better.	Guide pin, M12x150: 3HAC13056-2 Always use guide pins in pairs.
4 If axis-5 is not already in position +90°, connect the 24 VDC power supply, release the brakes and move the axis manually into that position. Connect to R2.MP5-connector: • + = pin 2 • - = pin 5	24 VDC power supply

**Attaching the lifting accessories to the wrist**

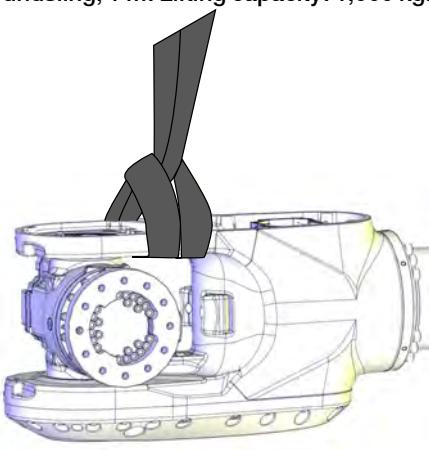
Action	Note
1  <b>CAUTION</b> The weight of the complete wrist is 140 kg All lifting accessories used must be sized accordingly.	

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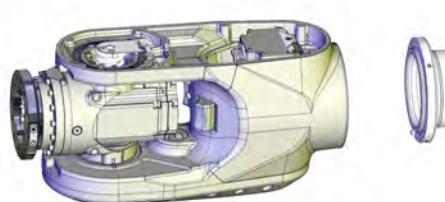
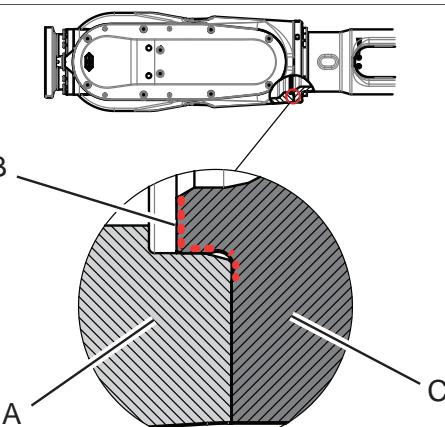
## 4 Repair

### 4.5.2 Replacing the wrist

*Continued*

Action	Note
<p>2 Attach a roundsling to the wrist as shown in the figure.</p> <p><b>CAUTION</b></p> <p>It is very important that the roundsling is placed as shown in the figure, to keep the wrist balanced when it is removed. Placed at a different position, there is a risk of sudden change in the balance, which can cause damage or injury.</p> <p>Do not attach the roundsling around the axis-5 gearbox!</p>	<p>Roundsling, 1 m: Lifting capacity: 1,000 kg.</p>  <p>xx1300000673</p>
<p>3 <b>Note</b></p> <p>Make sure the roundsling is stretched, so it can carry the weight of the wrist.</p>	

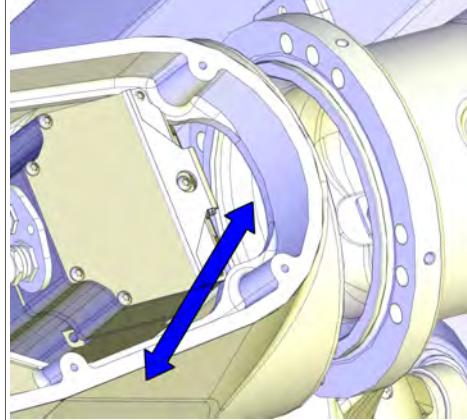
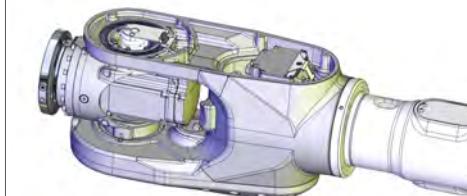
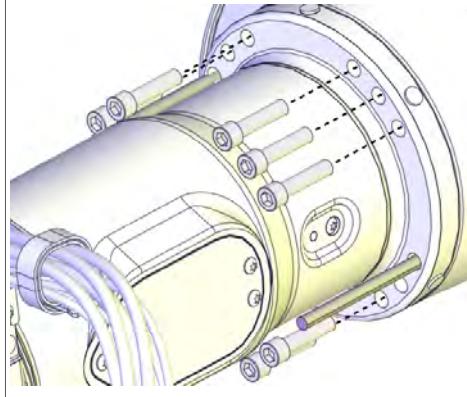
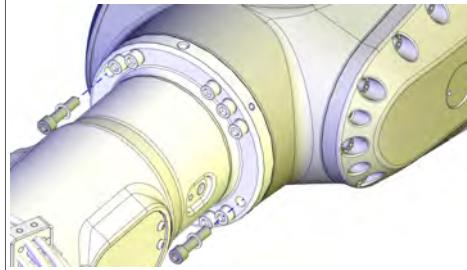
#### Refitting the wrist

Action	Note
<p>1 Lift the wrist and insert the guide pins into the holes of the arm tube.</p> <p><b>Tip</b></p> <p>Leave a small opening between wrist and arm tube. This will make it easier to run the cable harness back into the wrist.</p>	 <p>xx1300000770</p>
<p>2 <b>Foundry Plus:</b> Apply Mercasol on the surfaces shown in the figure.</p>	 <p>xx1400000371</p>

*Continues on next page*

#### 4.5.2 Replacing the wrist

*Continued*

	Action	Note
3	<p>Run the cabling into the wrist unit. Be careful not to damage any part of the cable harness.</p>	 xx1300000769
4	Slide the wrist into fitting position.	 xx1300000771
5	Fit 10 of the 12 attachment screws.	 xx1300000749
6	Remove the guide pins and replace them with the remaining attachment screws.	 xx1300000748
7	Tighten the attachment screws.	M12x50, tightening torque: 120 Nm.

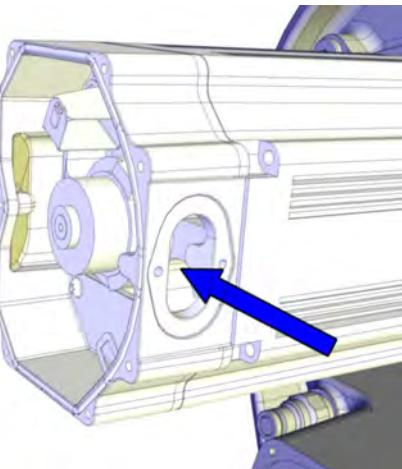
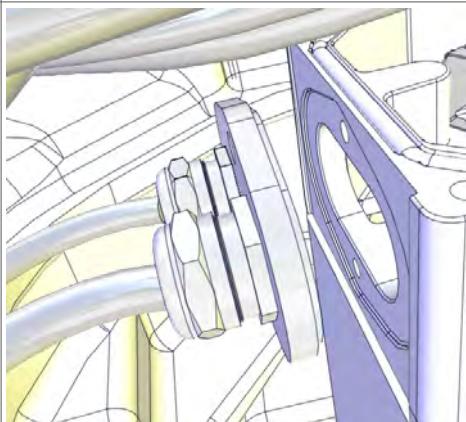
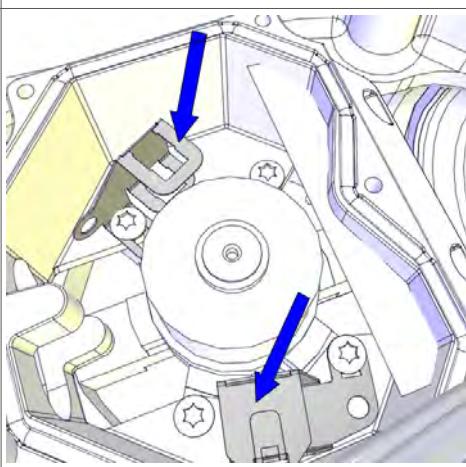
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## 4 Repair

### 4.5.2 Replacing the wrist

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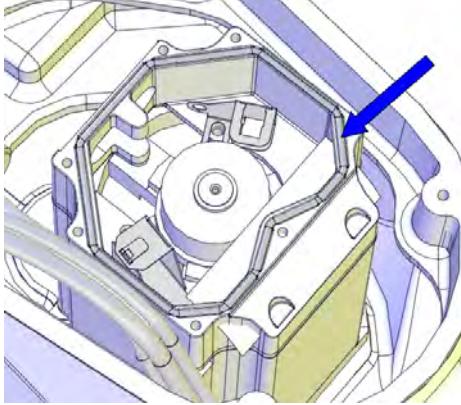
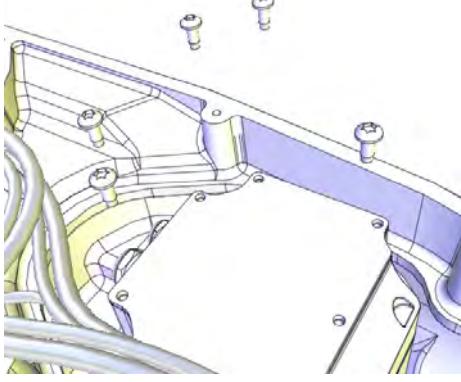
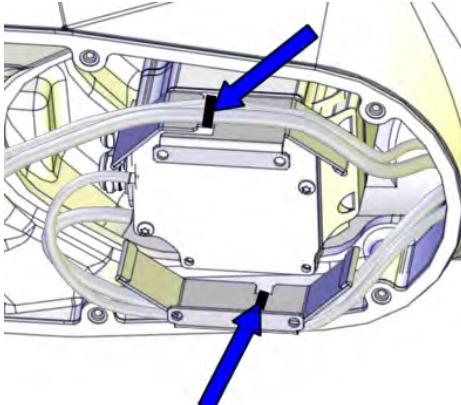
#### Connecting the axis-5 motor cables

Action	Note
1	Push the motor cables in through the cable gland opening.  xx1300000738
2	Refit the cable gland cover by performing the following steps: <ul style="list-style-type: none"><li>Slide the cable gland cover onto the inner screw.</li><li>Refit and tighten the outer screw.</li><li>Tighten the inner screw. Make sure that the gasket is not damaged.</li></ul>  xx1200001016
3	Connect the connectors. Connect in accordance with the markings on the connectors.  xx1200001015

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#### 4.5.2 Replacing the wrist

*Continued*

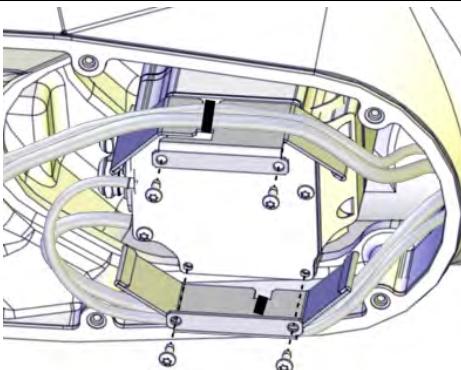
Action	Note
4 Make sure the o-ring on the motor is undamaged. Replace if damaged.	 O-ring, axis 5: 3HAC054692-001. xx1200001021
5  <b>CAUTION</b>  When fitting the motor cover, make sure that none of the cables inside will be damaged.	
6 Refit the motor cover with its attachment screws.   <b>Note</b>  Do not refit the screws that will hold the heat protection plate at this point.   <b>Note</b>  Do not reuse the self-threading attachment screws, it will damage the threads. Replace with standard attachment screws.   <b>Note</b>  Make sure the o-ring is undamaged and properly fitted.	 xx1200001013
7 Secure the cable harness with cable straps to the heat protection plate.	 xx1500001029

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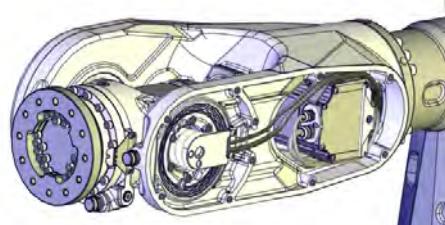
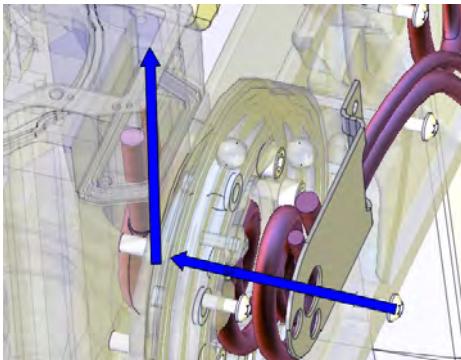
## 4 Repair

### 4.5.2 Replacing the wrist

*Continued*

Action	Note
8 Fit the heat protection plate with the screws.	 xx1500001030
9 Make sure that the cover is tightly sealed.	

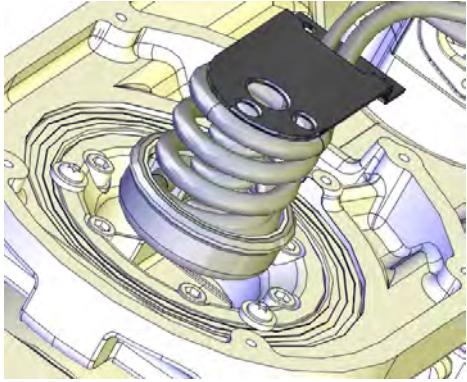
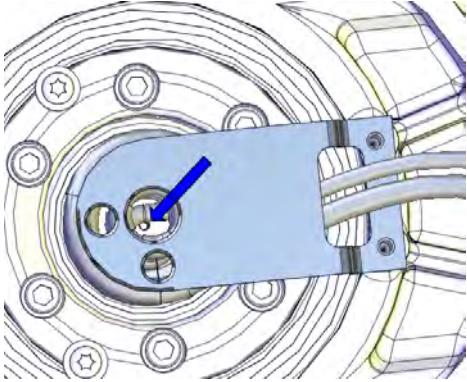
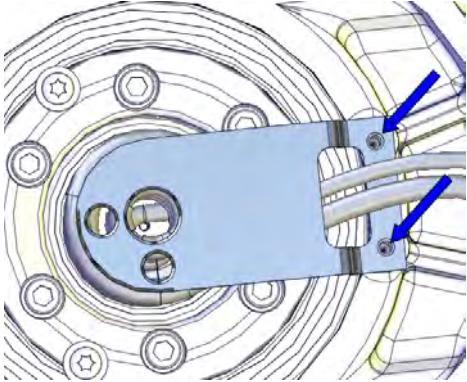
#### Connecting the axis-6 motor cables

Action	Note
1 Make sure that the cable harness is placed in a way that it will not be damaged when the cover is fitted.	 xx1600002061
2  <b>Note</b> Axis 5 must be in position +90° (or as close as possible) for a correct installation of the cable harness in the wrist. If not, connect the 24 VDC power supply, release the brakes and move axis 5 manually to +90°.	Position +90° of axis 5 makes the turning disc face the floor, if the robot is floor standing.
3 Push the cable harness into the wrist recess and up into the axis-6 motor.	 xx1300000667

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#### 4.5.2 Replacing the wrist

*Continued*

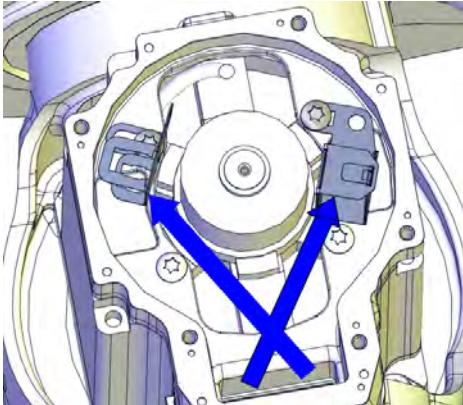
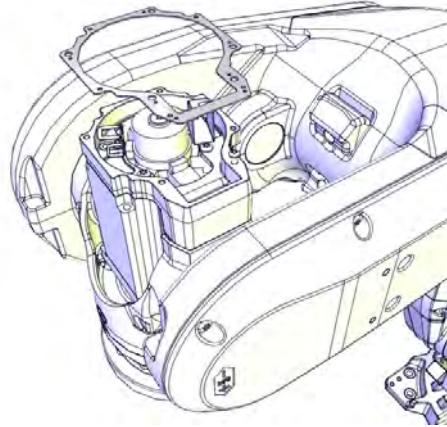
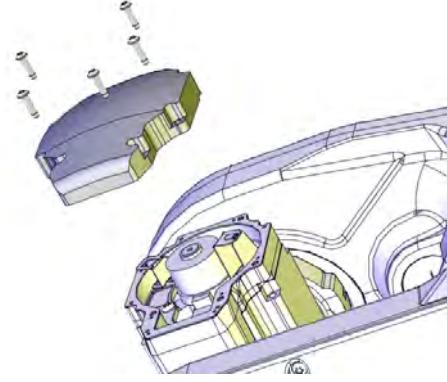
Action	Note
4 Push the carrier carefully into position.	
5 Secure the carrier with the M4 screw. <b>Note</b> The screw is located at the bottom of the carrier. <b>Tip</b> The attachment screw securing the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.	
6 Secure the cable bracket with its attachment screws.	

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## 4 Repair

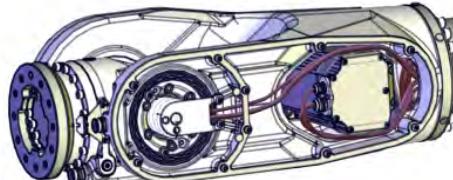
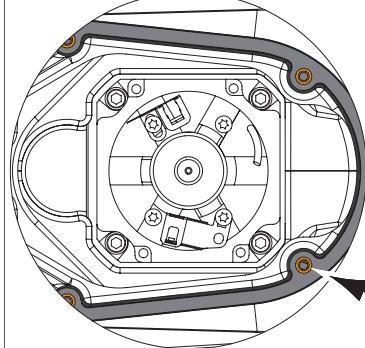
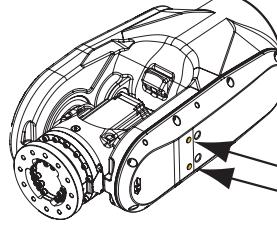
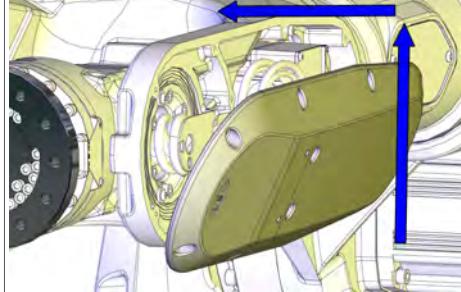
### 4.5.2 Replacing the wrist

*Continued*

Action	Note
7 Reconnect the connectors to the axis-6 motor.   <b>Note</b> Place the resolver cable under the motor cable.	 xx1300000488
8 Make sure the gasket is undamaged. Replace if damaged.	Gasket, 3HAC033489-001   xx1200001095
9  <b>CAUTION</b> When fitting the motor cover, make sure that none of the cables inside will be damaged.	
10 Refit the motor cover.	 xx1200001080

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## Concluding procedure

	Action	Note
1	Make sure that the cable harness is placed in a way so it will not be damaged when the wrist cover is fitted.	 xx1500001672
2	Inspect the gasket. Replace if damaged.	
3	<b>Foundry Plus:</b> <ul style="list-style-type: none"> <li>• Make sure that the gasket is undamaged on the cover. Replace if damaged.</li> <li>• Put washers in the holes of the gasket.</li> <li>• Use attachment screws made of stainless steel to fit the wrist cover.</li> </ul>	  xx1400000383 <p style="text-align: center;">A Protection plugs (2 on wrist cover and 2 on cover axis-5 gearbox) B Washers (10 pcs) in gasket holes</p>
4	Refit the wrist cover. Use this method not to damage the cable harness: <ol style="list-style-type: none"> <li>1 Hold the cover tilted. See figure!</li> <li>2 Catch any part of the cable harness hanging down.</li> <li>3 Lift the cover, still held tilted.</li> <li>4 Move the upper part of the cover into position.</li> <li>5 Secure the cover with its attachment screws.</li> </ol>	Tightening torque: 10 Nm.  xx1300000772
5	<b>Foundry Plus:</b> Refit protection plugs.	
6	If used, refit the DressPack cable package on the wrist.	

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## 4 Repair

### 4.5.2 Replacing the wrist

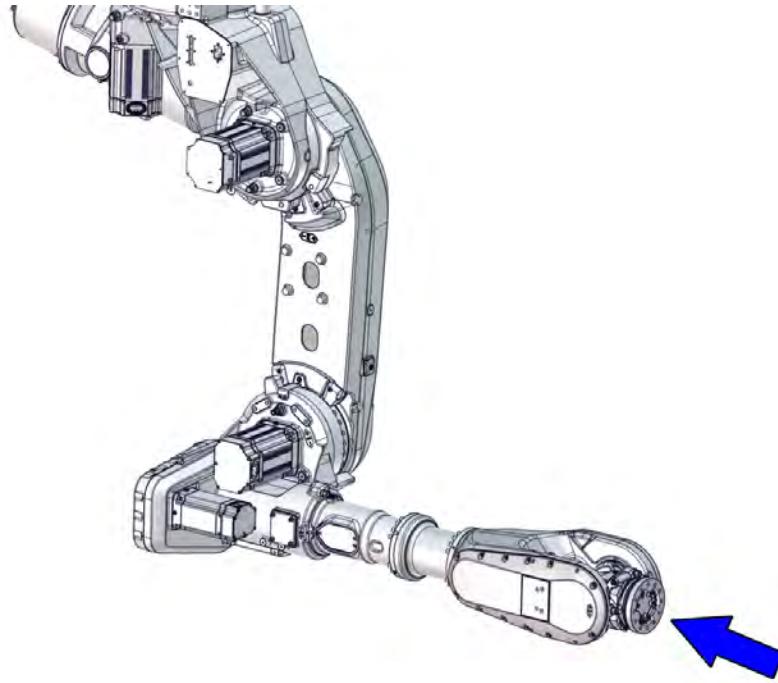
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Action	Note
7 Re-calibrate the robot.	Axis Calibration is described in <a href="#">Calibrating with Axis Calibration method on page 691</a> . General calibration information is included in section <a href="#">Calibration on page 683</a> .
8  <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further described in <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

### 4.5.3 Replacing the turning disc

#### Location of the turning disc

The turning disc is located in the front of the wrist housing as shown in the figure.



xx1700000053

#### Spare part

Spare part	Spare part number	Note
Turning disc	See <i>Product manual, spare parts - IRB 6700</i> .	

#### Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

#### Consumables

Equipment, etc.	Article number	Note
Rust preventive	-	Mercasol, used on Foundry Plus

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## 4 Repair

### 4.5.3 Replacing the turning disc

*Continued*

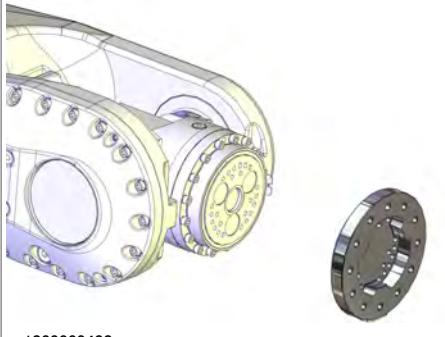
#### Removing the turning disc

Use these procedures to remove the turning disc.

#### Preparations before removing the turning disc

Action	Note
1 Run the robot to a position most comfortable for the removal of the turning disc.	
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 robot working area.	
3 Remove any equipment fitted to the turning disc.	

#### Removing the turning disc

Action	Note
1 Remove the 21 M10 screws and washers, that secure the turning disc.	 xx1400002195
2 Remove the turning disc.	 xx1300000493

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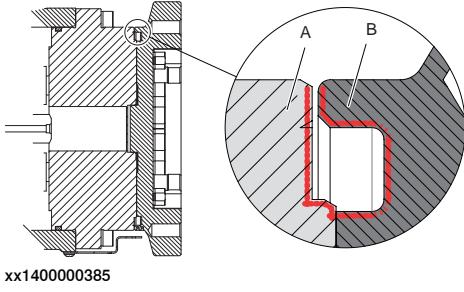
**Refitting the turning disc**

Use this procedure to refit the turning disc.

**Screw joint for refitting turning disc**

Variant	Screw dimension	Number of screws	Number of washers	Tightening torque
IRB 6700Inv - 300/2.60	M10x25	21 pcs	21 pcs	70 Nm
IRB 6700Inv - 245/2.90	M10x25	21 pcs	21 pcs	70 Nm

**Refitting the turning disc**

	Action	Note
1	Wipe clean the contact surfaces.	
2	<b>Foundry Plus:</b> Apply Mercasol on the surfaces on turning disc and axis-6 gearbox as shown in the figure.	
3	Secure the turning disc with its attachment screws and washers.	Tightening torque: 70 Nm Attachment screws: M10x25, Steel 12.9 Gleitmo 603, (21 pcs) Washers: Steel (21 pcs) 

**Concluding procedure**

	Action	Note
1	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further described in <b>DANGER - First test run may cause injury or damage!</b> on page 46.	

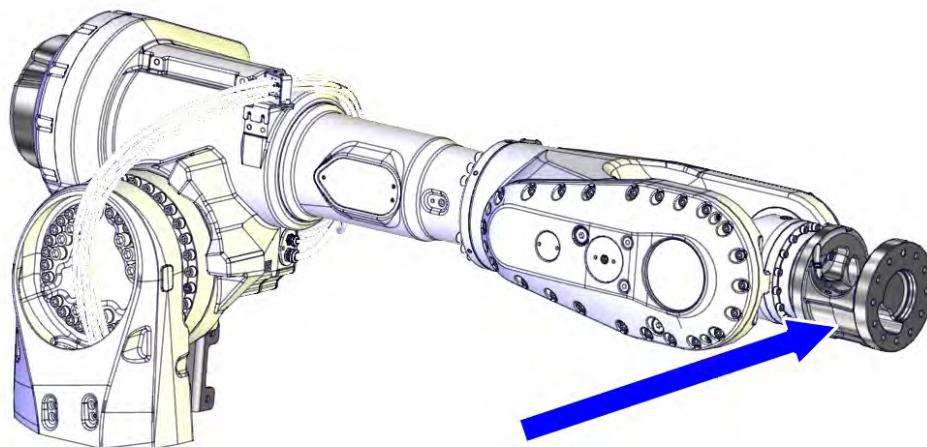
## 4 Repair

### 4.5.4 Replacing the process turning disc

#### 4.5.4 Replacing the process turning disc

##### Location of the process turning disc

The process turning disc is located in the front of the wrist housing as shown in the figure.



xx1400001391

##### Required tools and equipment

Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

##### Consumables

Equipment, etc.	Article number	Note
Rust preventive	-	Mercasol, used on Foundry Plus

##### Removing the process turning disc

Use these procedures to remove the process turning disc.

##### Preparations before removing the process turning disc

	Action	Note
1	Run the robot to a position most comfortable for the removal of the process turning disc.	

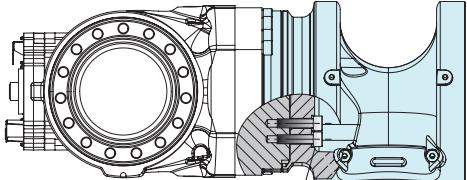
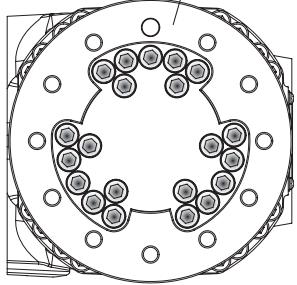
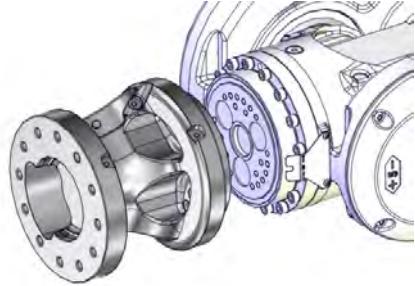
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## 4.5.4 Replacing the process turning disc

*Continued*

Action	Note
<p>2</p>  <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.	
3 Remove any equipment fitted to the process turning disc.	

## Removing the process turning disc

Action	Note
1 Remove the 21 M10 screws and washers, that secure the process turning disc.	  xx1400001395
2 Remove the process turning disc.	 xx1400001393

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## 4 Repair

### 4.5.4 Replacing the process turning disc

*Continued*

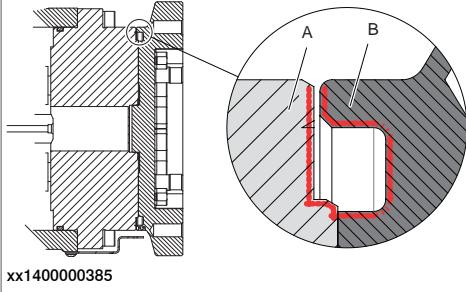
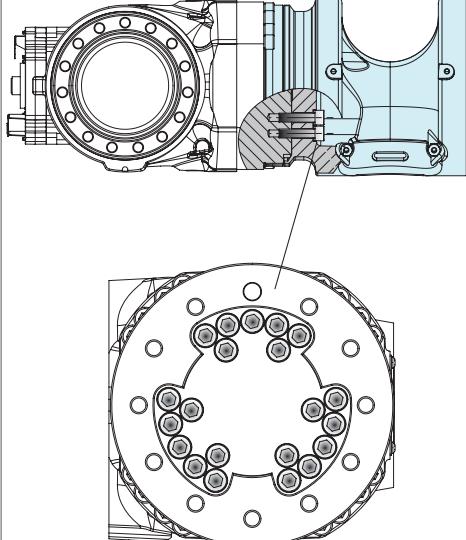
#### Refitting the process turning disc

Use this procedure to refit the process turning disc.

Screw joint for refitting process turning disc

Variant	Screw dimension	Number of screws	Number of washers	Tightening torque
IRB 6700Inv - 300/2.60	M10x25	21 pcs	21 pcs	70 Nm
IRB 6700Inv - 245/2.90	M10x25	21 pcs	21 pcs	70 Nm

#### Refitting the process turning disc

Action	Note
1 Wipe clean the contacts surfaces.	
2 <b>Foundry Plus:</b> Apply Mercasol on the surfaces on the process turning disc and axis-6 gearbox as shown in the figure.	 <p>The figure show standard turning disc. Surfaces to apply Mercasol on are the same with process turning disc.</p>
3 Secure the process turning disc with its attachment screws and washers.	<p>Tightening torque: 70 Nm Attachment screws: M10x25, Steel 12.9 Gleitmo 603, (21 pcs) Washers: Steel (21 pcs)</p>  <p>xx1400001395</p>

*Continues on next page*

## Concluding procedure

	Action	Note
1	 <b>DANGER</b>  Make sure all safety requirements are met when performing the first test run. These are further described in <i>DANGER - First test run may cause injury or damage! on page 46.</i>	

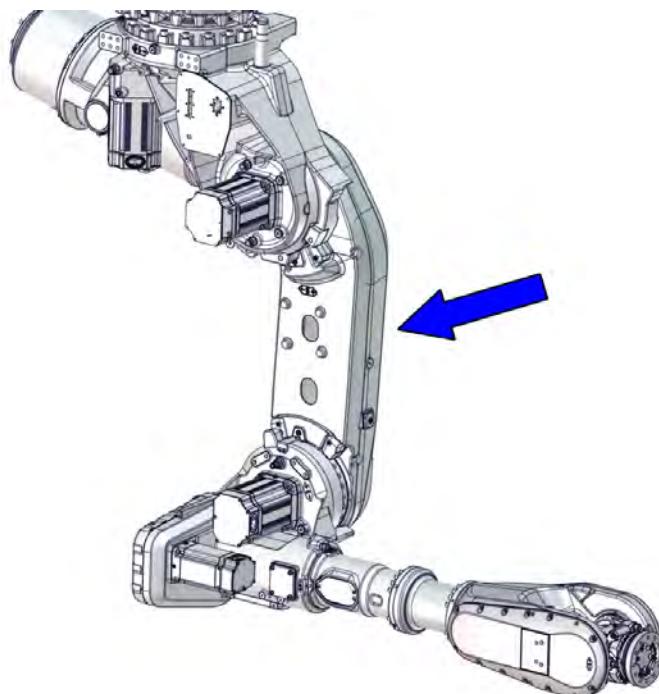
## 4 Repair

### 4.5.5 Replacing the lower arm

#### 4.5.5 Replacing the lower arm

##### Location of the lower arm

The lower arm is located as shown in the figure.



xx1700000054



##### Note

The robot must be taken down and secured floor standing to perform this replacement procedure.

How to do this is described in the removal procedure in this section.



##### DANGER

Always lock the position of the lower arm, using the yellow sleeve and transportation lock screw, before attempting to lift the robot.

##### Summary of the replacement procedure

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

- 1 Lift down the robot to floor standing.
- 2 Unload the balancing device.
- 3 Remove the shaft in the balancing device front link ear
- 4 Remove the cabling from the upper and lower arm.
- 5 Remove the upper arm.
- 6 Replace the lower arm.

*Continues on next page*

**Spare part**

Spare part	Spare part number	Note
Lower arm	See <i>Product manual, spare parts - IRB 6700</i> .	
VK cover, 28x7	3HAA2166-12	Located at the front link ear of the balancing device.

**Required tools and equipment**

Equipment	Article number	Note
Fork lift accessory set	3HAC058825-001	Contains fork lift pockets and all required hardware for installation. User instructions are enclosed with the tool, see <i>Directions for use - Fork lift accessory for IRB 6700Inv</i> . In order to rotate the robot, either use the turning tool or a fork lift truck with a rotator attachment.
Turning tool	3HAC061162-001	User instructions are enclosed.
Lifting shackle, 2 pcs	-	SA-10-8-NA1
Roundsling, 1 m	-	Lifting capacity: 1,000 kg.
Dismantle and mounting tool	3HAC028920-001	Used for removing and fitting shaft and bearings.
Lifting eye, M12	3HAC16131-1	
Lifting eye, M12	3HAC16131-1	
Fender washer	-	Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Pallet		Used for putting down removed parts from robot.
Guide pin, M16x150	3HAC13120-2	Always use guide pins in pairs.
Guide pin, M16x200	3HAC13120-3	Always use guide pins in pairs.
Rotation tool	3HAB7887-1	Used to rotate the motor pinion.
24 VDC power supply	-	Used to release the motor brakes.
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

**Consumables**

Equipment	Article number	Note
Bearing grease	3HAB3537-1	Shell Gadus S2V220 AC For lubrication of the front bearing of the balancing device.

*Continues on next page*

## 4 Repair

### 4.5.5 Replacing the lower arm

*Continued*

Equipment	Article number	Note
Grease	3HAB3537-1	Used to lubricate o-rings.
O-ring	3HAC054692-002	D=169.5x3 Used on axis-3 motor cover.
	3HAC054692-001	D=119x3 Used on axis-4 motor cover.
	3HAC054692-001	D=119x3 Used on axis-5 motor cover.
Gasket	3HAC033489-001	Used on axis-6 motor cover.

#### Required documents

Document	Document number
Directions for use - Fork lift accessory for IRB 6700Inv	3HAC060303
User instructions for turning tool (enclosed with the turning tool)	-

#### 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.

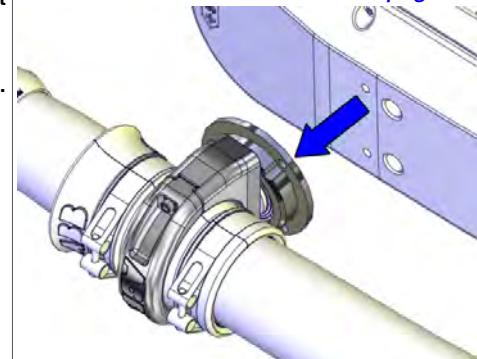
	Action	Note
1	Decide which calibration routine to use for calibrating the robot. <ul style="list-style-type: none"><li>• Reference calibration. External cable packages (DressPack) and tools can stay fitted on the robot.</li><li>• Fine calibration. All external cable packages (DressPack) and tools must be removed from the robot.</li></ul>	
	If the robot is to be calibrated with reference calibration:  Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot.  If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values.  Creating new values requires possibility to move the robot.  Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 692</a> .
	If the robot is to be calibrated with fine calibration:  Remove all external cable packages (DressPack) and tools from the robot.	

*Continues on next page*

**Removing the lower arm**

Use these procedures to remove the lower arm.

**Preparations before removing the lower arm**

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
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 robot working area.	
3	Remove all equipment fitted to upper and lower arms.	
4	If used, remove the complete ball joint housing (including the bracket), from the wrist cover. Leave the DressPack fitted in the ball joint housing. This is done to be able to reach the two hidden screws that secure the wrist cover.	How to remove the DressPack cable package is described in more detail in the product manual "IRB 6700 DressPack". For article number see <a href="#">References on page 10</a> .  xx1400000355

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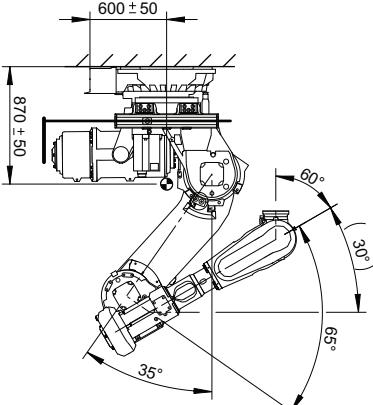
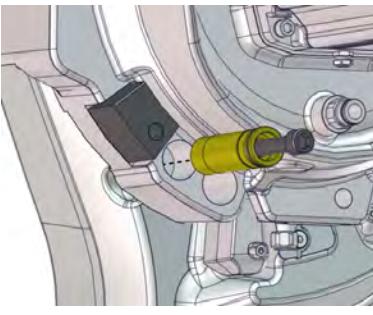
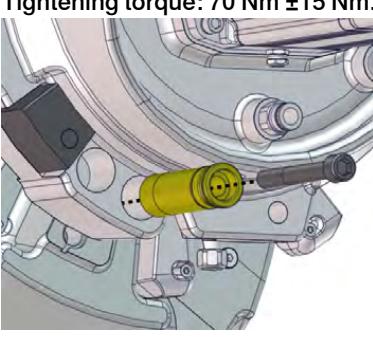
## 4 Repair

### 4.5.5 Replacing the lower arm

*Continued*

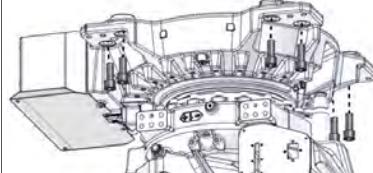
#### Securing the lower arm

Use this procedure to secure the lower arm before lifting down the robot from inverted position.

Action	Note
<p>1 Jog the robot into position:</p> <ul style="list-style-type: none"> <li>• Axis 1: 0°</li> <li>• Axis 2: -35°</li> <li>• Axis 3: +65°</li> <li>• Axis 4: 0°</li> <li>• Axis 5: +60°</li> <li>• Axis 6: no significance</li> </ul>	 xx1700000555
<p>2 Remove the transportation lock screw and the yellow sleeve from the parking position.</p>	 xx1700000270
<p>3 Insert the yellow sleeve and the transportation lock screw in the hole at the locking position. Insert the sleeve all the way so that the marking in the sleeve is aligned with the casting, see figure. Tighten the screw.</p> <p><b>DANGER</b></p> <p>Always use the transportation lock screw and sleeve to lock the lower arm at transportation, turning and floor standing.</p>	<p>Tightening torque: 70 Nm ±15 Nm.</p>  xx1700000269

*Continues on next page*

## Lifting down the robot from inverted position

	Action	Note
1	If the robot is to be secured to the floor, prepare an area where the robot can be secured with the attachment bolts.  The robot must always be secured to the floor if any kind of repair or maintenance work is to be performed.	Suitable screws, lightly lubricated: M24x100 (8 pcs) For hole configuration, see <a href="#">Hole configuration, base on page 74</a> .
2	Verify that the lower arm is secured with the transportation lock screw.	
3	Remove any payload from the robot.	DressPack can stay fitted.
4	 <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.	
5	Disconnect the robot cables at the base.	
6	 <b>CAUTION</b>  The IRB 6700Inv robot weighs 1,750 kg. All lifting accessories used must be sized accordingly.	
7	Install the fork lift pockets on the robot, if not already installed.	See user instructions enclosed with the fork lift accessory set. Fork lift accessory set: 3HAC058825-001.
8	Insert the forks of the fork lift truck into the fork lift pockets, as far as possible.	
9	Raise the forks of the fork lift truck to make sure that the weight of the robot rests on the forks.   <b>Tip</b>  Two M16 screws can be fitted to the fork lift pockets, to press the forks against the pockets and make the lift more stable.	
10	Remove the bolts that secure the robot to the foundation.	Quantity: 8 pcs.   xx1600002098

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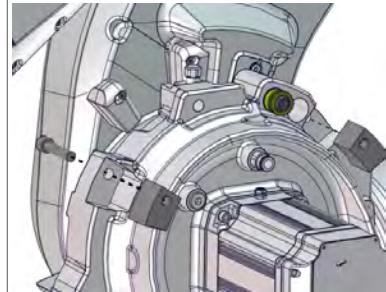
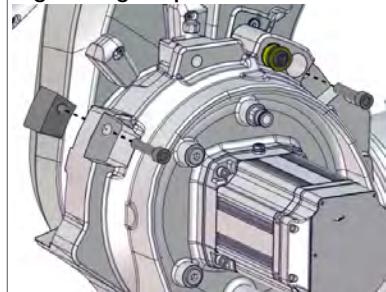
## 4 Repair

### 4.5.5 Replacing the lower arm

*Continued*

	Action	Note
11	Rotate the robot to floor standing position, using the turning tool or using a fork lift truck with a rotator attachment.	Only one direction for rotation is allowed with the turning tool. Follow the user instructions enclosed with the turning tool.
12	Lower and secure the robot to the floor.	Attachment screws: M24x100 (8 pcs).

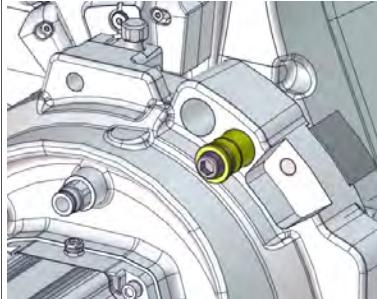
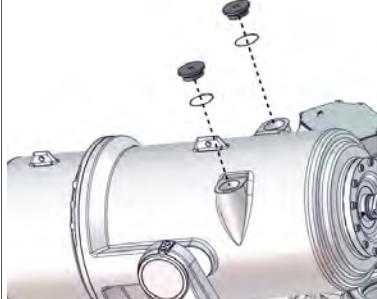
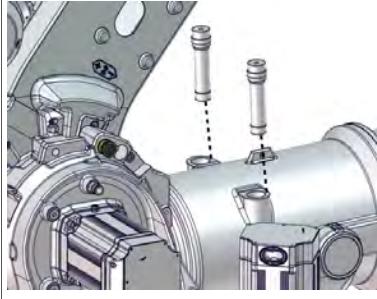
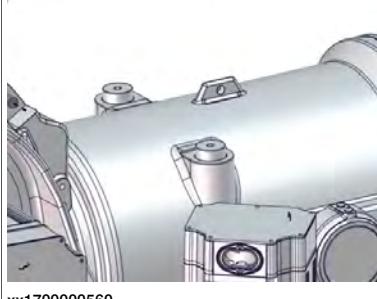
#### Unloading the balancing device

	Action	Note
1	Verify that the robot is secured to the foundation.	Attachment screws: M24x100 (8 pcs).
2	Remove the two service stops from their parking position.	 xx1700000067
3	Fit the service stops in maintenance position.	Tightening torque: 70 Nm ±15 Nm.  xx1700000068
4	Remove the transportation lock screw and yellow sleeve from locking position.  <b>Note</b>  It is only allowed to remove the transportation lock screw and sleeve, if the service stops are in maintenance position, when the robot is floor standing.	 xx1700000347

*Continues on next page*

## 4.5.5 Replacing the lower arm

*Continued*

Action	Note
5 Fit the transportation lock screw and the yellow sleeve in their parking position.	 xx1700000348
6 Jog axis 2 to -4° to be able to insert the relief screws.	
7 Remove the covers on the balancing device.   <b>Note</b>  The covers have to be refitted after repair or maintenance.	 xx1700000451
8 Fit the relief screws to unload the balancing device.   <b>DANGER</b>  Do not remove the relief screws when the balancing device is removed from the robot.	Tightening torque: 70 Nm±15 Nm Relief screws, 3HAC058129-001   xx1700000070   xx1700000560
9 Jog axis 2 to +15°.	

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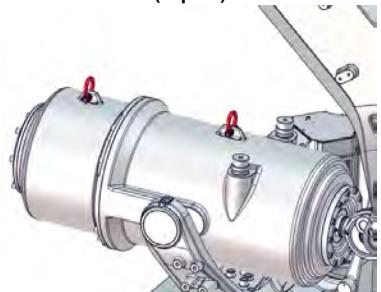
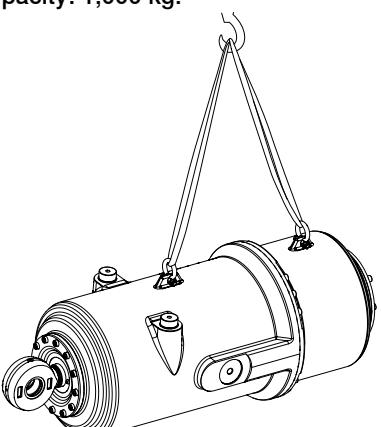
## 4 Repair

### 4.5.5 Replacing the lower arm

*Continued*

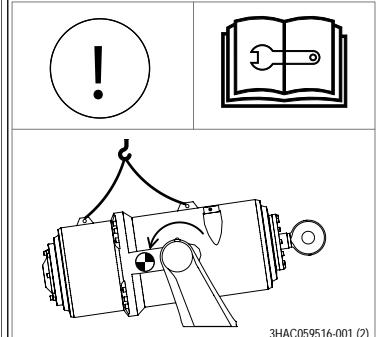
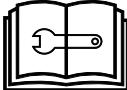
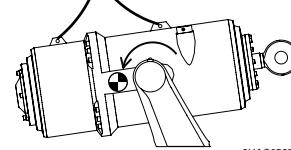
Action	Note
<p>10  <b>DANGER</b></p> <p>Turn off all:</p> <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> <p>to the robot, before entering the robot working area.</p>	

#### Attaching lifting accessories to the balancing device

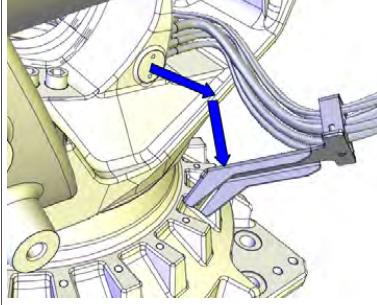
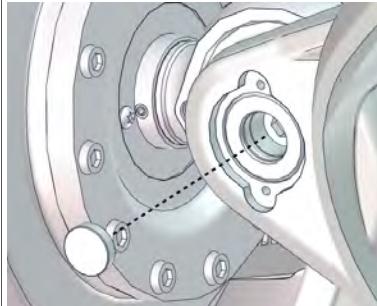
Action	Note
<p>1  <b>CAUTION</b></p> <p>The weight of the balancing device (excluding cradle) is 305 kg</p> <p>All lifting accessories used must be sized accordingly.</p>	
<p>2 Fasten lifting shackles on the balancing device.</p>	<p>SA-10-8-NA1 (2 pcs)</p>  <p>xx1700000086</p>
<p>3 Fasten the lifting slings.</p>	<p>Roundsling, 1 m (2 pcs) Lifting capacity: 1,000 kg.</p>  <p>xx1700000087</p>

*Continues on next page*

#### 4.5.5 Replacing the lower arm Continued

Action	Note
<p>4 Raise the lifting slings to take the weight of the balancing device.</p> <p><b>CAUTION</b></p> <p>The balancing device is heavy at the back, and will tip over when the link ear is loosened.</p>	 <p>! </p> <p></p> <p>3HAC059516-001 (2)</p> <p>xx1600002060</p>

##### Removing the shaft in the front (link ear)

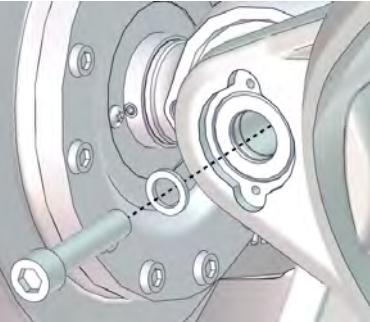
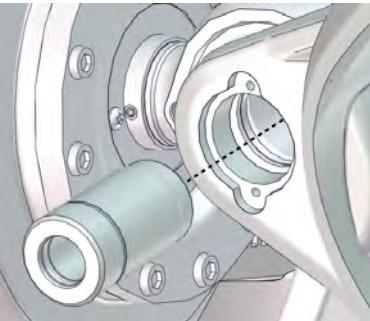
Action	Note
<p>1 Unscrew the attachment screws of the bracket, use caution and move it a little to the side, to give room for the Dismantle and mounting tool.</p>	 <p>xx1200001184</p>
<p>2 Remove the VK cover at the link ear.</p> <p><b>Note</b></p> <p>Make sure that the lifting accessories hold the weight of the balancing device.</p> <p><b>Tip</b></p> <p>Use high pressure air to remove the VK covers.</p>	<p>It is possible to drive a screwdriver (or similar) through the VK cover, as close as possible to the center of the VK cover and pull it out.</p>  <p>xx1700000088</p>

*Continues on next page*

## 4 Repair

### 4.5.5 Replacing the lower arm

*Continued*

	Action	Note
3	<p>Remove the attachment screw and washer at the link ear.</p> <p><b>CAUTION</b></p> <p>The balancing device is heavy at the back, and will tip over when the link ear is loosened.</p>	 xx1700000089
4	<p>Use the dismantle and mounting tool and pull the shaft out.</p> <p><b>Press tool M</b></p>	<p>Dismantle and mounting tool: 3HAC028920-001 Press Tool M</p>  xx1700000090
5	<p>Carefully lower the lifting device to let the balancing device rest on the frame.</p>	

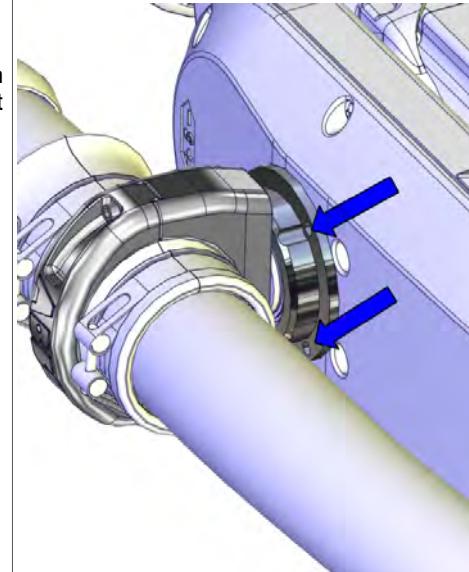
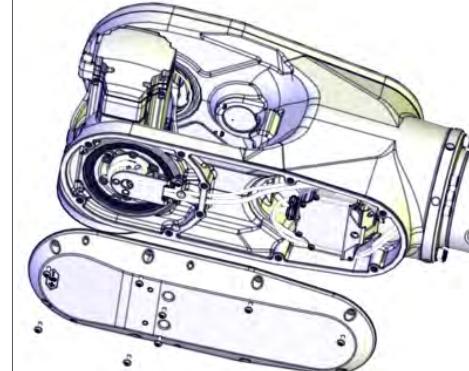
#### Positioning the robot

	Action	Note
1	<p>Turn the power on temporarily and jog axis 3 so that the upper arm is horizontal. Jog axis 5 to +90°.</p>	<p>The upper arm needs to be in a horizontal position later on, when the arm is lifted away from the robot.</p>
2	<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>	

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## Retrieving access to the wrist cabling

Use this procedure to remove the wrist cover to retrieve access to the axis-5 and axis-6 motor cables.

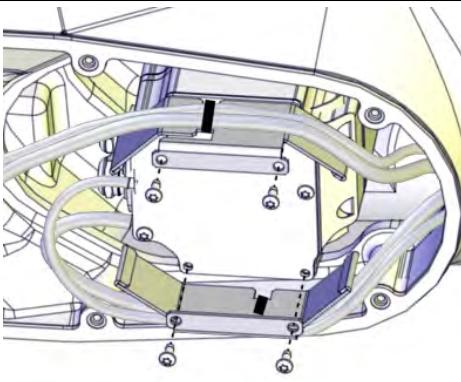
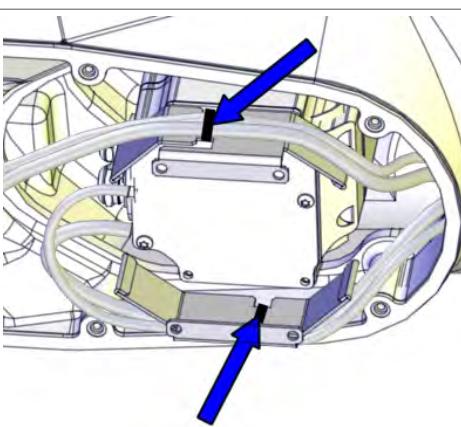
Action	Note
<b>1</b>  <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
<b>2</b> If DressPack is not already removed, the complete ball joint housing (including the bracket) must be removed at this point, in order to reach the two hidden screws that secures the wrist cover.	 xx1400000355
<b>3</b> Remove the wrist cover.	 xx1300002247

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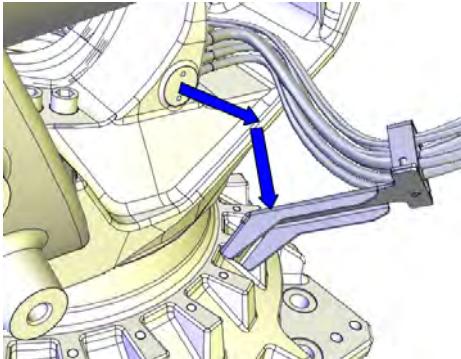
## 4 Repair

### 4.5.5 Replacing the lower arm

*Continued*

Action	Note
4 Remove the heat protection plates from the motor with the cabling still attached to the plate.	 xx1500001030
5 Cut the cable ties that hold the cable harness to the plate.  <b>Note</b> Keep the heat protection plate until refitting.  <b>Tip</b> If removing the plate only for replacing the motor, the cabling does not need to be loosened from the plate.	 xx1500001029

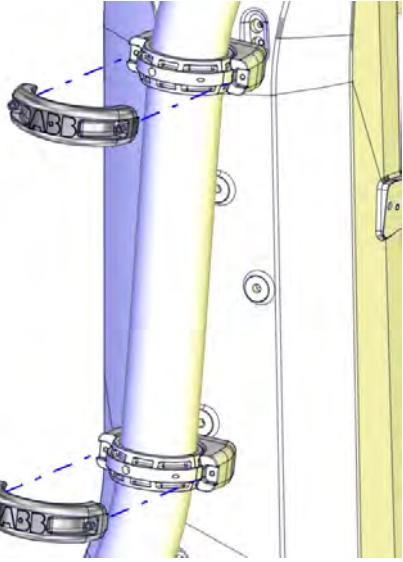
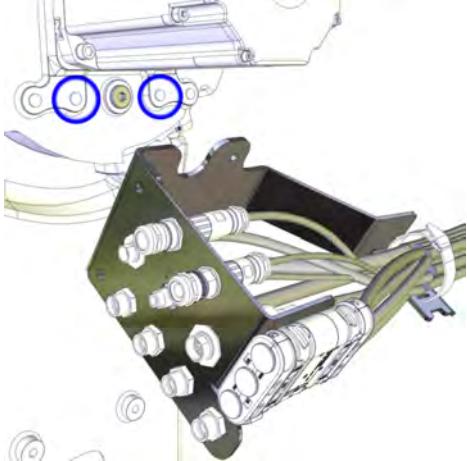
#### Removing cable brackets

Action	Note
1 Unscrew the screws that hold the bracket and let it hang free.	 xx1200001184

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## 4.5.5 Replacing the lower arm

*Continued*

Action	Note
2 If used, open the ball joint housings on the lower arm and remove the DressPack.	 xx1400000195
3 If used, unscrew the screws that hold the connection plate and let the DressPack hang free.	 xx1200001332

## Disconnecting the axis-3 and axis-4 motor cables

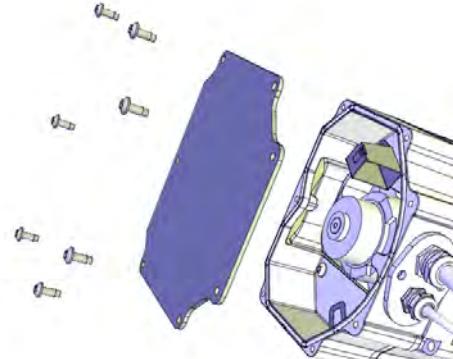
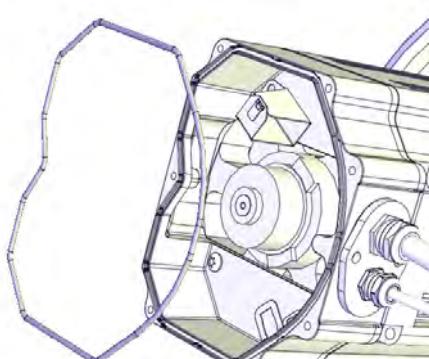
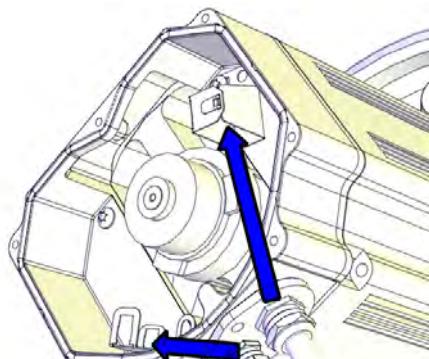
Action	Note
<p>1  <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	

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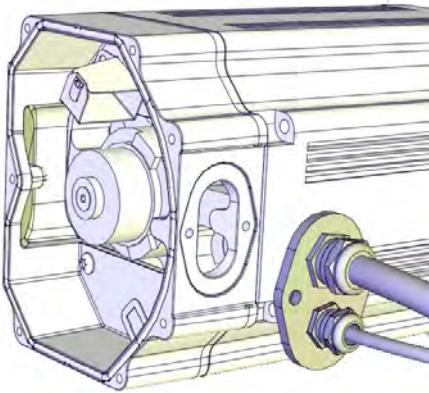
## 4 Repair

### 4.5.5 Replacing the lower arm

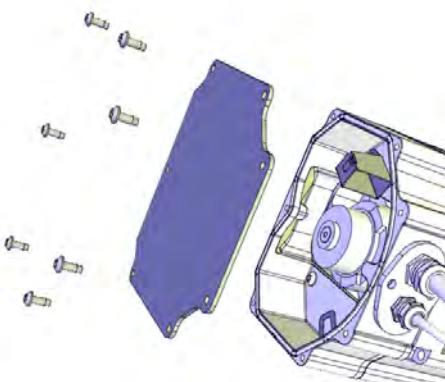
*Continued*

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

*Continues on next page*

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

## Disconnecting the axis-5 motor cables

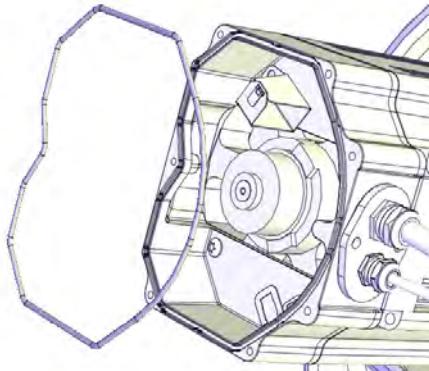
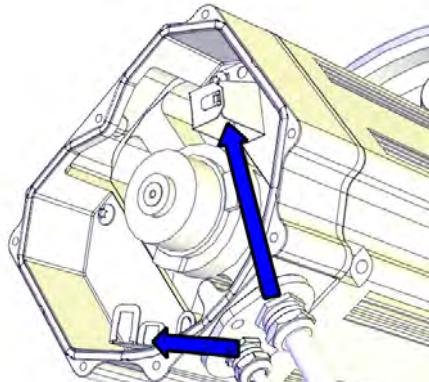
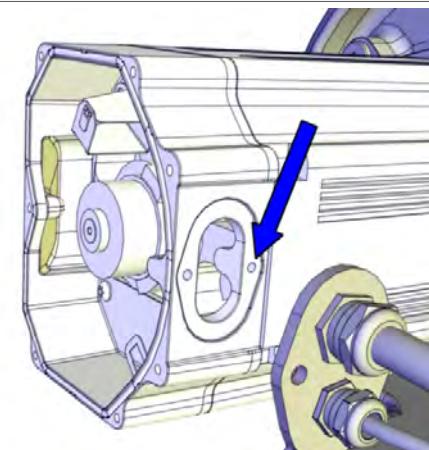
Action	Note
<p>1  <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2 Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135

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## 4 Repair

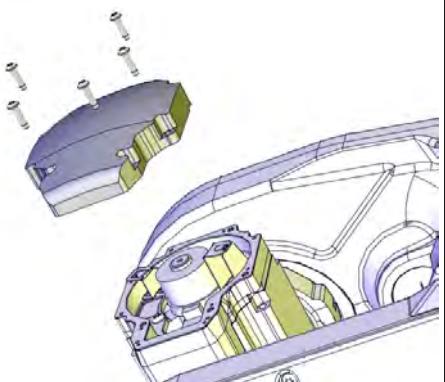
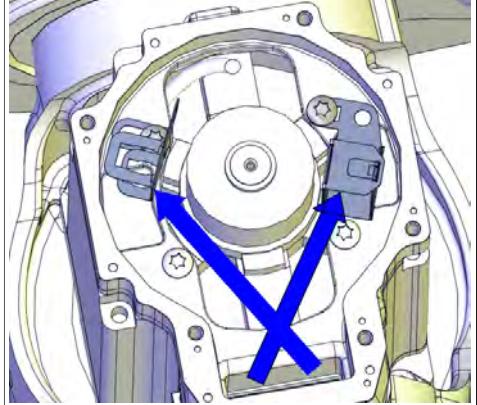
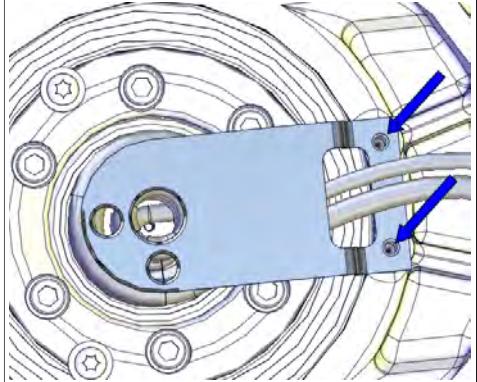
### 4.5.5 Replacing the lower arm

*Continued*

Action	Note
3 Make sure the o-ring is present.	 xx1200001070
4 Disconnect the motor cables.	 xx1200001066
5 Remove the cable gland cover by performing the following steps: 1 Open the inner screw a little (the one the arrow is pointing at). No need to remove this screw from the motor. 2 Remove the outer screw. 3 Slide the cable gland cover away from the inner screw. Make sure the gasket is not damaged.  <b>Tip</b>  Make a note in which direction the cable exit hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.	 xx1300000656
6 Use caution and pull out the motor cables.	

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## Disconnecting the axis-6 motor cables

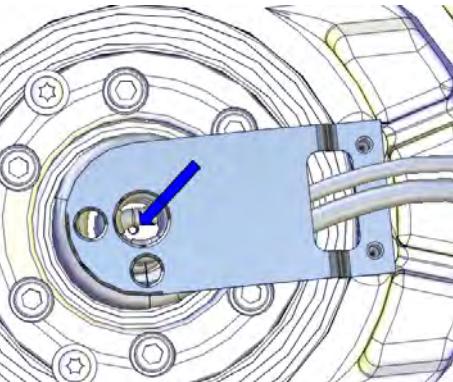
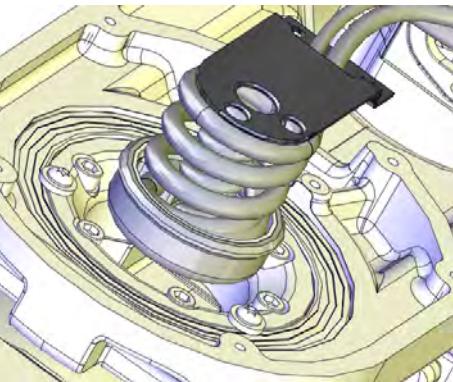
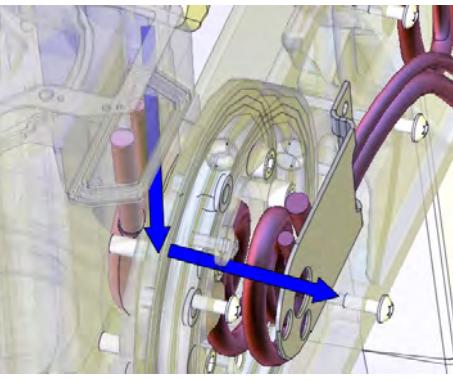
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws and remove the motor cover.	 xx1200001080
3	Disconnect the motor cables.	 xx1300000488
4	Unscrew the attachment screws that hold the cable bracket.	 xx1300000484

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## 4 Repair

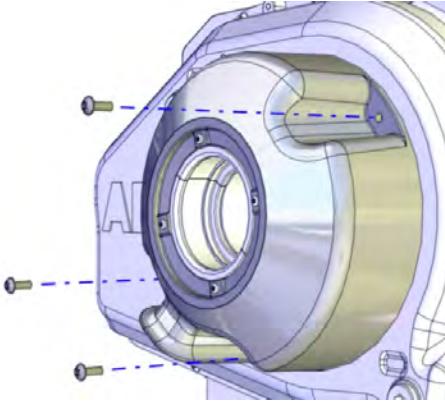
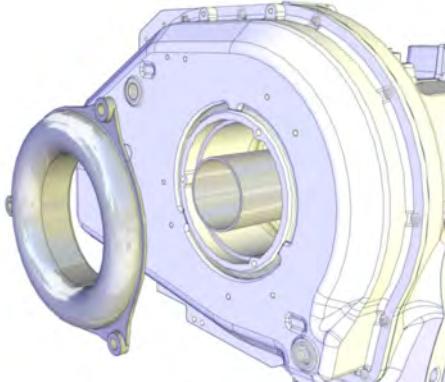
### 4.5.5 Replacing the lower arm

*Continued*

Action	Note	Note
5 Unscrew the M4 screw that holds the carrier.	<p> Note The screw is located at the bottom of the carrier.</p>	 xx1300000485
6 Pull out the carrier from its position.		 xx1300001113
7 Pull out the axis-6 motor cables by holding the cables with one hand at the motor and the other at the carrier.		 xx1300000666

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## Removing the cable harness - wrist and upper arm

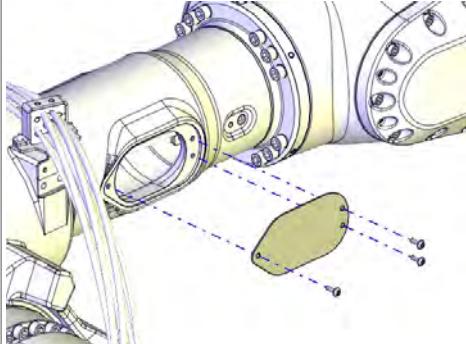
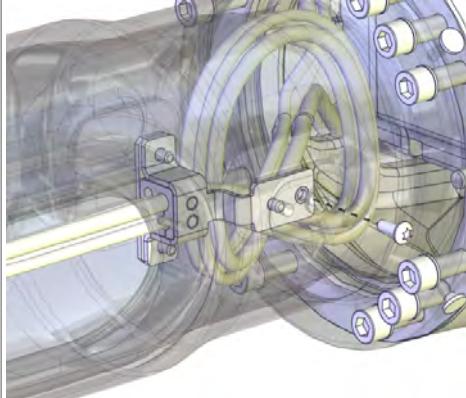
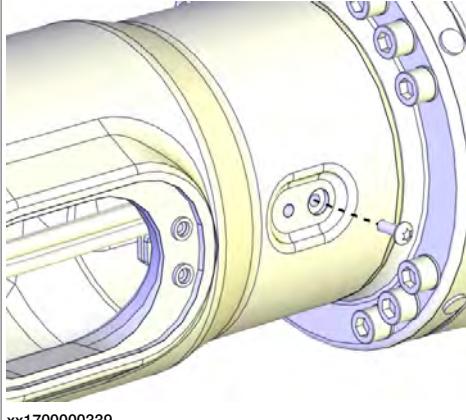
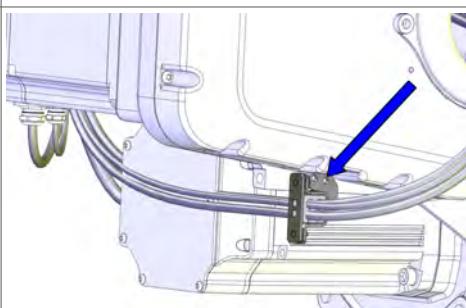
	Action	Note
1	<p>Remove the cover.</p> <p> <b>Note</b></p> <p><b>Foundry Plus:</b> Use caution not to damage the gasket, to loose the washers on the cover sealing or to loose the inserts fitted on the cover.</p>	 <p>xx1200000045</p>
2	<p>Remove the cable guide, slide it out a little and let it rest on the cables.</p>	 <p>xx1300000657</p>
3	<p> <b>Tip</b></p> <p>Use tape and tie the axis-5 and axis-6 connectors and carrier into a bundle (if not already done). This is done to facilitate the procedure and to avoid damaging the parts during the procedure. This will also make it easier to run the cable harness through the inside of the upper arm.</p>	 <p>xx1300000668</p>

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## 4 Repair

### 4.5.5 Replacing the lower arm

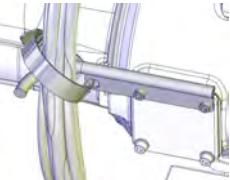
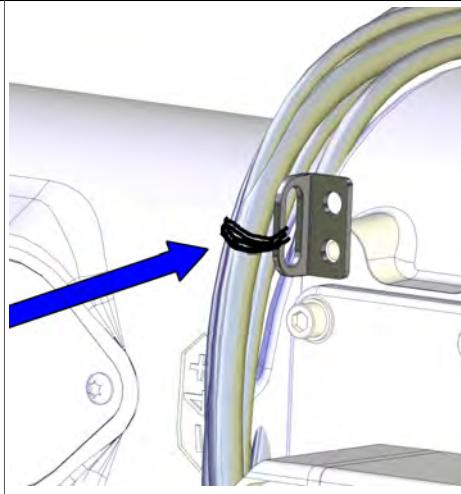
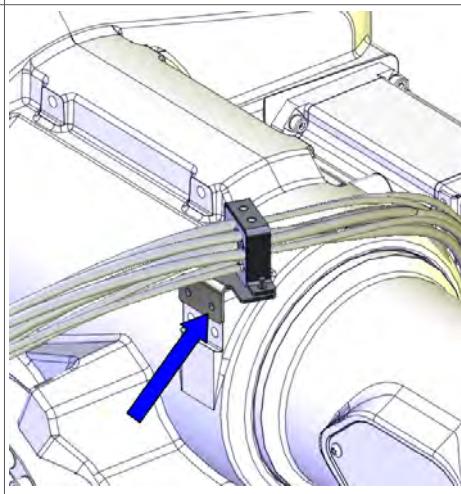
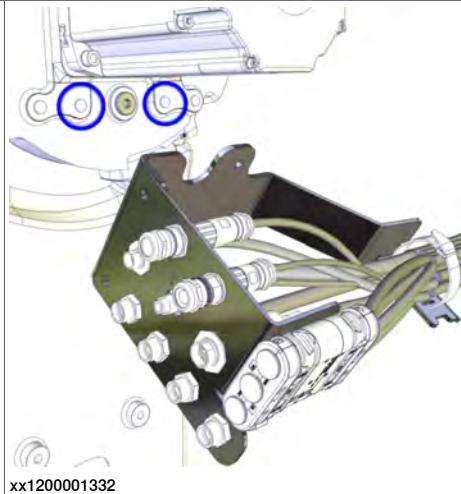
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Action	Note
4 Remove the side cover on the arm tube.	 xx1300000557
5 Unscrew the attachment screw that secures the axis-4 metal clamp inside the arm tube.  <b>Note</b> The screw is reached from outside the upper arm!	 xx1700000340  xx1700000339
6 Remove the armhouse metal clamp.	 xx1300000543

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## 4.5.5 Replacing the lower arm

*Continued*

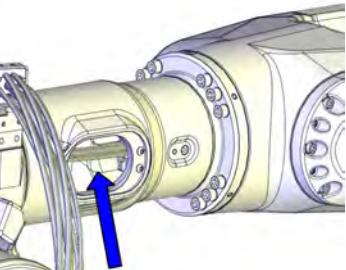
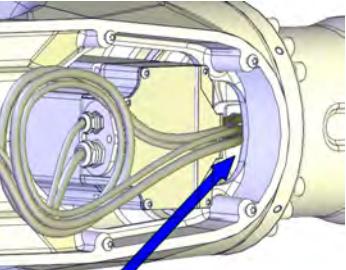
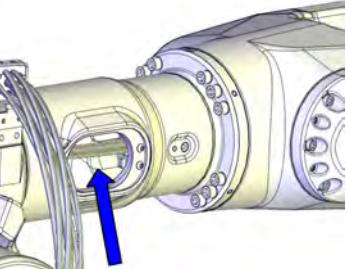
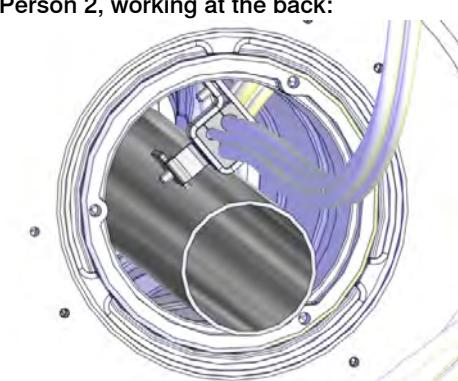
Action	Note
7 Open the velcro strap at the cable fixing bracket.   <b>Note</b>  If DressPack is fitted, the cable fixing bracket is replaced by the cable guide.   xx1300001973  <b>Cable guide.</b>	 xx1300000544  <b>Cable fixing bracket.</b>
8 Remove the metal clamp on top of the armhouse.	 xx1300000541
9 If used (and if not already done), unscrew the screws that hold the connection plate and let it hang free with the rest of the DressPack cable package.	 xx1200001332

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## 4 Repair

### 4.5.5 Replacing the lower arm

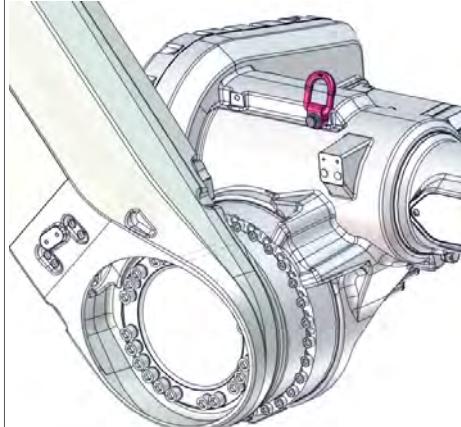
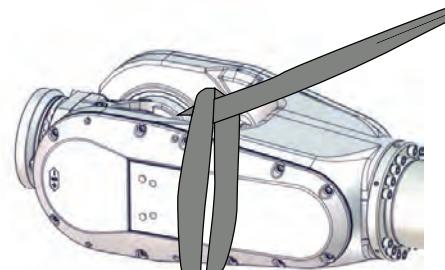
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Action	Note
<p>10</p>  <b>Tip</b> <p>This step is best performed by two persons working together.</p> <p>Use caution and remove the cable harness out of the wrist like this:</p> <ul style="list-style-type: none"> <li>• Person 1: Put one hand inside the side hole and take a hold of the cable harness.</li> <li>• Person 2: Take a hold on the cable harness inside the wrist.</li> <li>• Together: Move the cable harness past the axis-5 motor and into the arm tube.</li> </ul>	<p>Person 1, working at the side hole:</p>  xx1300000745 <p>Person 2, working at the wrist:</p>  xx1300000746
<p>11</p>  <b>Tip</b> <p>This step is best performed by two persons working together.</p> <p>Use caution and remove the cable harness out of the arm tube like this:</p> <ul style="list-style-type: none"> <li>• Person 1: Put one hand inside the side hole and take a hold of the cable harness.</li> <li>• Person 2: Take a hold on the cable harness at the back of the robot.</li> <li>• Together: Move the cable harness out of the arm tube.</li> </ul> <p>Remove the cable harness from the upper arm.</p>	<p>Person 1, working at side hole:</p>  xx1300000745 <p>Person 2, working at the back:</p>  xx1400002561

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## Attaching the lifting accessories to the upper arm

Use this procedure to attach the lifting accessories to the upper arm.

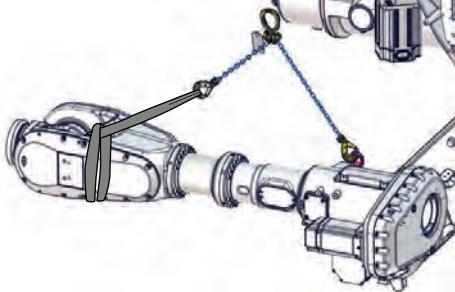
	Action	Note
1	 <b>CAUTION</b> The weight of the complete upper arm (including the wrist) is 465 kg All lifting accessories used must be sized accordingly.	
2	Fit a lifting eye in the arm house, with a fender washer underneath.  xx1400002196	Lifting eye, M12: 3HAC16131-1 Fender washer: Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.  xx1700000454
3	Run a lifting sling around the wrist.	Roundsling, 1 m: Lifting capacity: 1,000 kg.  xx1700000455

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## 4 Repair

### 4.5.5 Replacing the lower arm

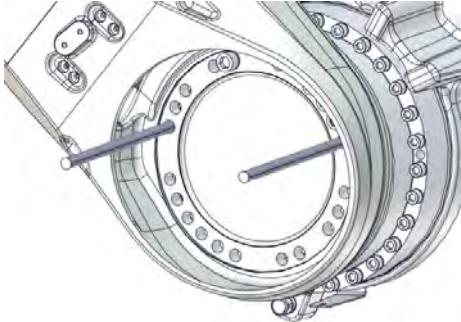
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Action	Note
4 Attach the upper arm lifting accessory (chain) to an overhead crane (or similar) and then to the lifting eye in the arm house and the lifting sling around the wrist.	Lifting accessory (chain): 3HAC15556-1  xx1700000456
5 Raise the lifting accessories to take the weight of the upper arm.	
6 In case of necessary adjustments, use the shortening loops on the lifting accessory (chain) to find the level position. See figure!	 xx1400002197
7 Release the brakes in order to find the most level lifting position of the upper arm as possible, before lifting. To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP3: <ul style="list-style-type: none"><li>• + = pin 2</li><li>• - = pin 5</li></ul>	24 VDC power supply

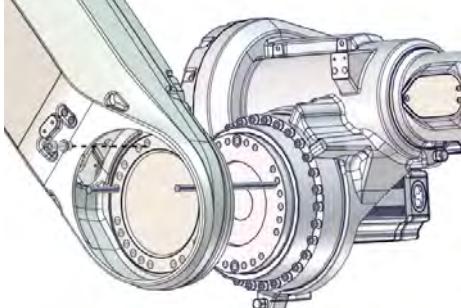
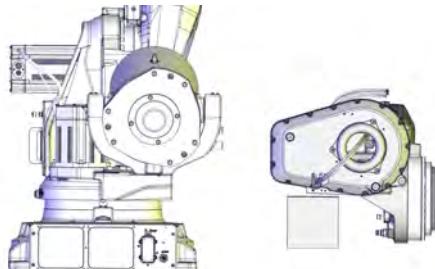
#### Preparations before removing the upper arm

Action	Note
1 Remove two attachment screws in opposite holes and replace them with guide pins.   <b>Note</b> Make sure that it is the screws that hold the lower arm to the axis-3 gearbox that are removed! See figure!   <b>Tip</b> Lubricate the guide pins with some grease to make the upper arm slide better.	Guide pin, M16x150: 3HAC13120-2 Guide pin, M16x200: 3HAC13120-3 Always use guide pins in pairs.  xx1700000457

*Continues on next page*

Action	Note
2 Leave one of the remaining attachment screws fitted, remove the other screws.	 xx1700000458

## Removing the upper arm

Action	Note
1  Note  Make sure the lift is done completely leveled! In case of necessary adjustments, use the shortening loops on the lifting accessory (chain), and make sure to place the chain the right way through the loops.	 xx1400002197
2 Remove the remaining attachment screw and let the upper arm slide out from the lower arm with support from the guide pins.	 xx1700000459
3 Lift the upper arm and place it on the prepared area.	
4 <i>This step is only valid when the upper arm is removed due to replacement of the axis-3 gearbox:</i>  Place pieces of wood (or similar) under arm house and wrist. Lower the upper arm, and let the upper arm rest as shown in the figure.  This is done in order to keep the axis-3 gearbox in a vertical position and to get the best position to replace the axis-3 gearbox, if applicable.	 xx1300000553

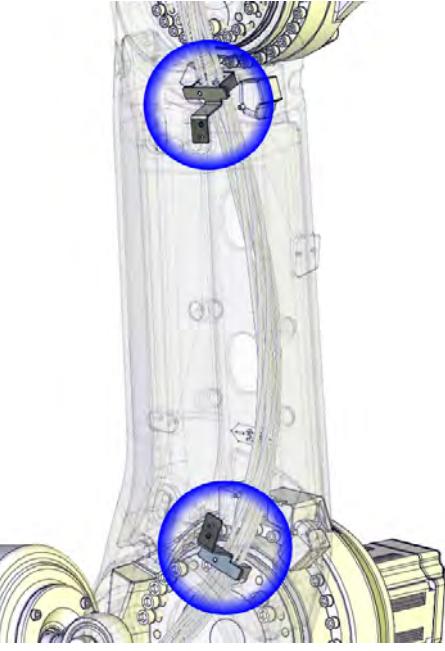
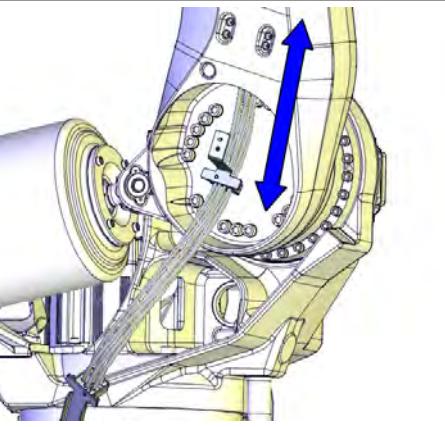
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## 4 Repair

### 4.5.5 Replacing the lower arm

*Continued*

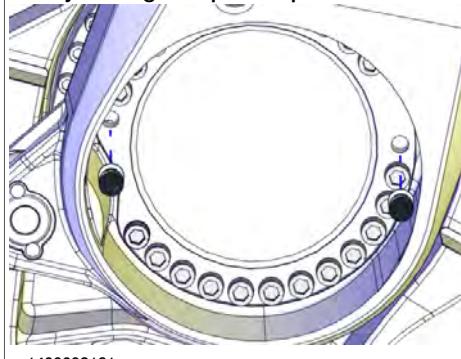
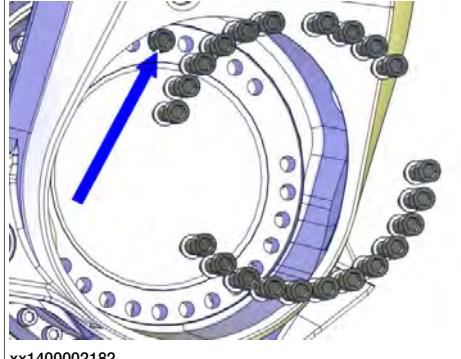
Preparations before removing the lower arm

Action	Note
<p>1  <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
<p>2 Open the ball joint housings on the lower arm and remove the DressPack.</p>	
<p>3 Loosen the axis-2 lower arm metal clamp and the axis-3 lower arm metal clamp located on the inside of the lower arm by removing the attachment screws.</p> <p> Note The screws are reached from outside the lower arm!</p>	 xx1300000540
<p>4 Remove the cable harness from inside the lower arm.</p>	 xx1300000733
<p>5  <b>CAUTION</b> The lower arm weighs 160 kg All lifting accessories used must be sized accordingly!</p>	

*Continues on next page*

	Action	Note
6	Apply the lifting accessory to the lower arm.	

**Removing the lower arm**

	Action	Note
1	Raise the lifting accessory to unload the lower arm.	
2	Remove two attachment screws in opposite holes and replace them with guide pins.   <b>Tip</b> Lubricate the guide pins with some grease to make the lower arm slide better.	Guide pin, M16x150: 3HAC13120-2 Guide pin, M16x200: 3HAC13120-3 Always use guide pins in pairs.  xx1400002181
3	Remove all but one of the remaining attachment screws that secure the lower arm to the axis-2 gearbox.	 xx1400002182
4	Make sure the lifting accessory is holding the weight of the arm system.	
5	Remove the remaining screw and slide the lower arm out on the guide pins and remove the lower arm.	

**Refitting the lower arm**

Use these procedures to refit the lower arm.

**Preparations before refitting the lower arm**

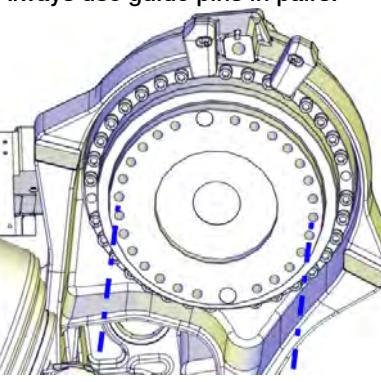
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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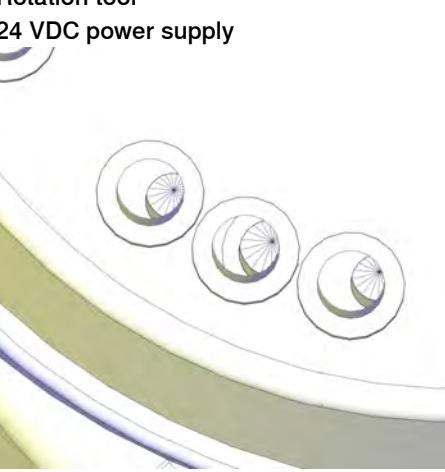
## 4 Repair

### 4.5.5 Replacing the lower arm

*Continued*

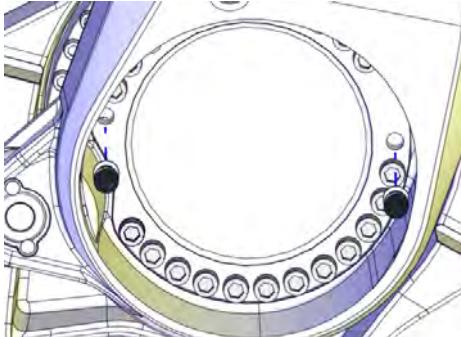
Action	Note
2 Fit two guide pins in opposite holes in the axis-2 gearbox.	Guide pin, M16x150: 3HAC13120-2 Always use guide pins in pairs.   <b>Tip</b> Lubricate the guide pins with some grease to make the lower arm slide better.   xx1400002189
3  <b>CAUTION</b> The lower arm weighs 160 kg. All lifting accessories used must be sized accordingly.	
4 Attach the lifting accessory to the lower arm.	
5 Wipe clean all contact surfaces.	

#### Securing the lower arm to the axis-2 gearbox

Action	Note
1 Lift the lower arm onto the guide pins and slide it into position.	
2 In case the hole pattern of the lower arm and gearbox does not match: <ul style="list-style-type: none"><li>• Remove the motor cover.</li><li>• Apply the rotation tool on the motor shaft.</li><li>• Connect the 24 VDC power supply.</li><li>• Release the brakes.</li><li>• Rotate pinion and gear with the rotational tool until the holes matches.</li></ul> Connect 24 VDC the power supply to connector R2.MP2: <ul style="list-style-type: none"><li>• + = pin 2</li><li>• - = pin 5</li></ul>	Rotation tool 24 VDC power supply  xx1300000819
3 Fit one attachment screw in one of the upper holes using it for security and lower the lifting accessory a little.	

*Continues on next page*

**4.5.5 Replacing the lower arm**  
*Continued*

	Action	Note
4	Secure the lower arm by fitting and tightening the accessible screws.	Tightening torque M16: 300 Nm Attachment screws: M16x50 quality steel 12.9 Gleitmo (21 pcs) Washers: steel 17x25x3 (21 pcs)  xx1400002190
5	Disconnect the 24 VDC power supply (if used).	
6	Remove the guide pins and replace them with the remaining attachment screws.	 xx1400002181
7	Secure the remaining attachment screws.	Tightening torque M16: 300 Nm
8	Remove the lifting accessory from the lower arm.	

Preparations before refitting the upper arm

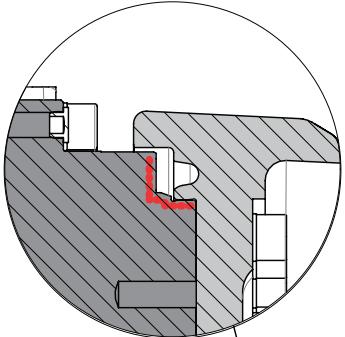
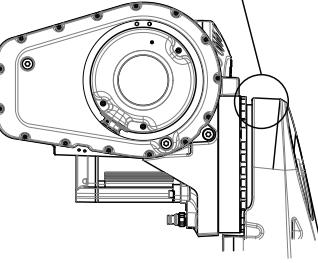
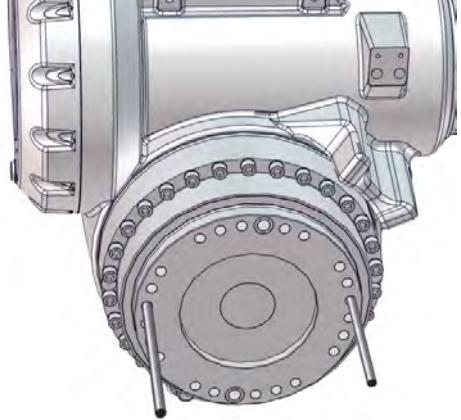
	Action	Note
1	Wipe clean all contact surfaces.	

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## 4 Repair

### 4.5.5 Replacing the lower arm

*Continued*

Action	Note
2 <b>Foundry Plus:</b> Apply Mercasol on the surface shown in the figure.	  xx1400000375
3 Fit two guide pins in opposite M16 holes in the axis-3 gearbox.   <b>Tip</b>  Lubricate the guide pins with some grease to make the upper arm slide better.	Guide pin, M16x150: 3HAC13120-2 Guide pin, M16x200: 3HAC13120-3 Always use guide pins in pairs.  xx1700000056

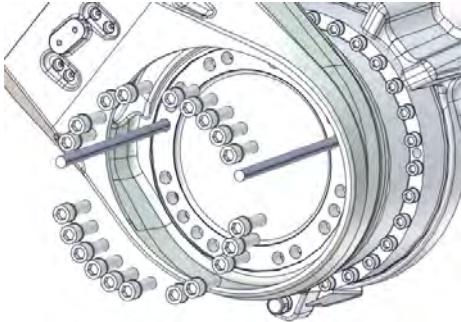
### Securing the upper arm

Action	Note
1  <b>CAUTION</b>  The weight of the complete upper arm (including the wrist) is 465 kg All lifting accessories used must be sized accordingly.	
2 Attach the lifting accessories, if not already fitted.	See <a href="#">Attaching lifting accessories to the upper arm on page 206</a> .

*Continues on next page*

### 4.5.5 Replacing the lower arm

*Continued*

Action	Note
3 Lift the upper arm and bring it towards the lower arm.	
4 In order to release the brakes, connect the 24 VDC power supply. Connect to R2.MP3-connector: <ul style="list-style-type: none"><li>• + = pin 2</li><li>• - = pin 5</li></ul>	24 VDC power supply
5 Use the rotation tool and rotate the axis-3 motor to find the correct position for the guide pins in the lower arm.	Rotation tool
6 Insert and tighten 20 of the 22 M16 screws.	 xx1700000460
7 Remove the guide pins and fit the two remaining screws.	
8 Secure the upper arm by tightening the attachment screws.	M16, tightening torque: 300 Nm

#### Refitting the cable harness - lower arm

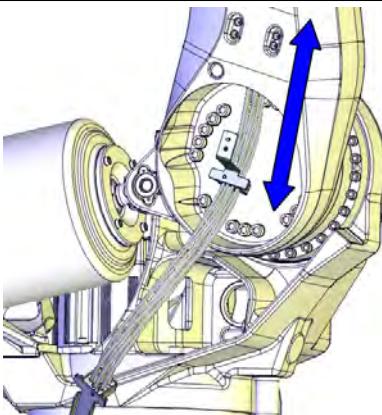
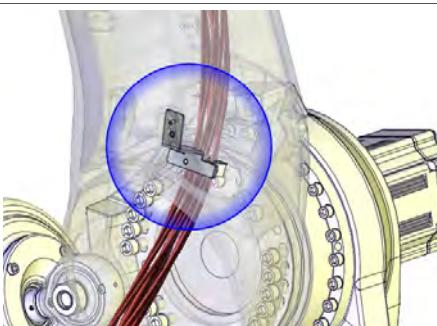
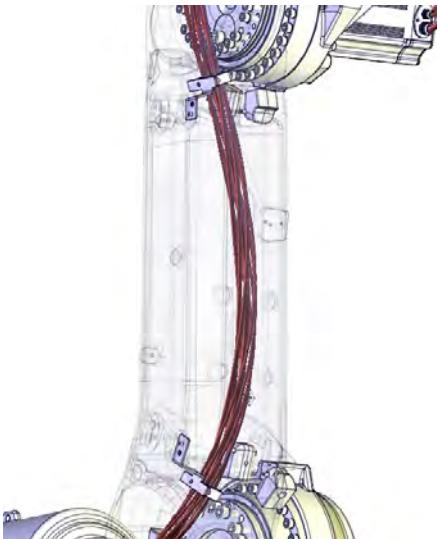
Action	Note
1  <b>DANGER</b> Turn off all: <ul style="list-style-type: none"><li>• electric power supply</li><li>• hydraulic pressure supply</li><li>• air pressure supply</li></ul> to the robot, before entering the robot working area.	
2 Tie the axis-5 and axis-6 motor cables into bundles (if not already done), to avoid damaging them during the continued procedure. This will also make it easier to run the cables through the inside of the robot.	 xx1300000668

*Continues on next page*

## 4 Repair

### 4.5.5 Replacing the lower arm

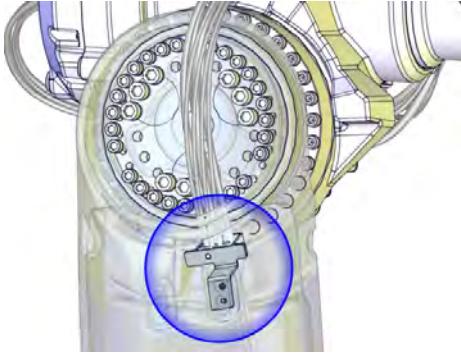
*Continued*

Action	Note
3 Run the upper end of the cable harness up through the lower arm.	 xx1300000733
4 Refit the axis-2 lower arm metal clamp located on the inside of the lower arm.  <b>Note</b> The screws are reached from the outside of the lower arm.	 xx1300000734
5 Before fitting the remaining axis-3 lower arm cable bracket inside the lower arm, check that it will stay twisted a little between the metal clamps, after fitting, as shown in the figure. Do not change the position of the brackets!	 xx1300000595

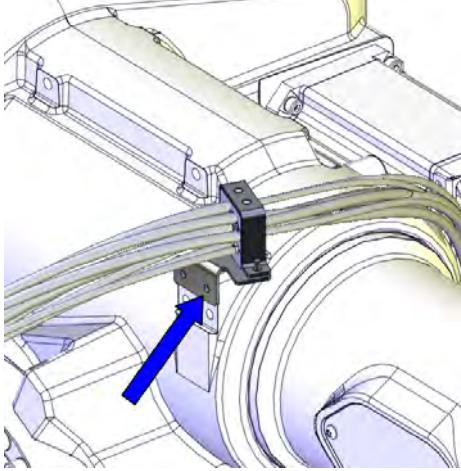
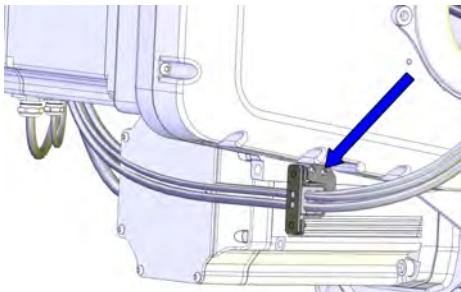
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## 4.5.5 Replacing the lower arm

*Continued*

Action	Note
<p>6 Refit the axis-3 lower arm metal clamp located on the inside of the lower arm.</p> <p><b>Note</b> The screws are reached from the outside of the lower arm.</p>	 xx1300000558

## Refitting the cable harness - upper arm

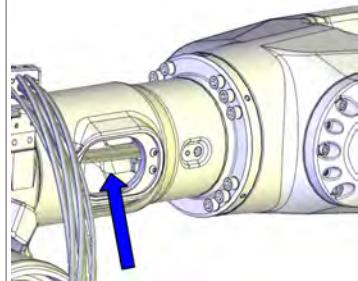
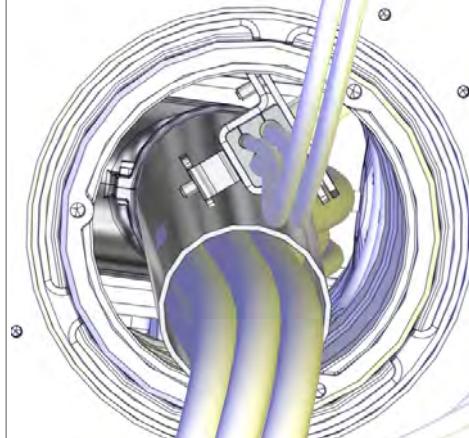
Action	Note
1 Refit the metal clamp on top of the arm house.	 xx1300000541
2 Refit the arm house metal clamp.	 xx1300000543

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## 4 Repair

### 4.5.5 Replacing the lower arm

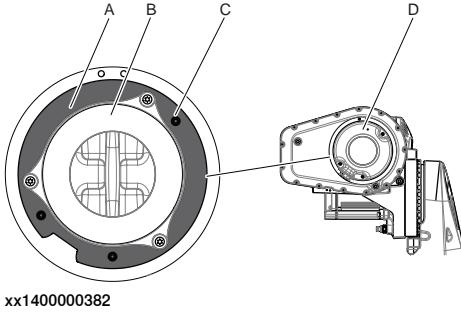
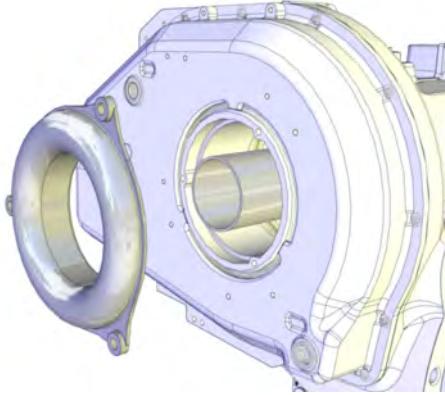
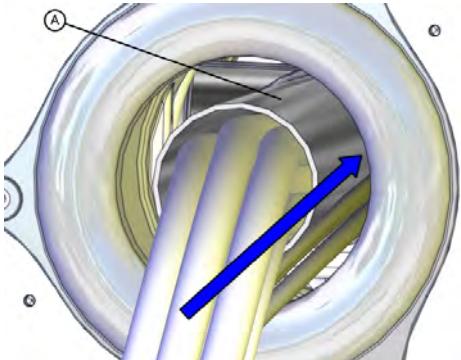
*Continued*

Action	Note
3 Tie the axis-5 and axis-6 motor cables into bundles (if not already done), to avoid damaging them during the continued procedure. This will also make it easier to run the cables through the inside of the robot.	 xx1300000668
4  <b>Tip</b> The next step is best performed by two persons working together: <ul style="list-style-type: none"> <li>• Person 1: Put one hand inside the side hole of the arm tube and take a hold of the cable harness.</li> <li>• Person 2: Take a hold on the cable harness at the back of the robot.</li> <li>• Together: Use caution and move the cable harness into the arm tube.</li> </ul> If DressPack is fitted it is needed to pull out the DressPack tube a little and then place it on the lower left side in the arm tube and then place the bracket of the cable harness on the upper right hand side, to be able to remove the cable harness. See figure!	Person 1, working at the side hole:  xx1300000745 Person 2, working at the back:  xx1400000356

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## 4.5.5 Replacing the lower arm

*Continued*

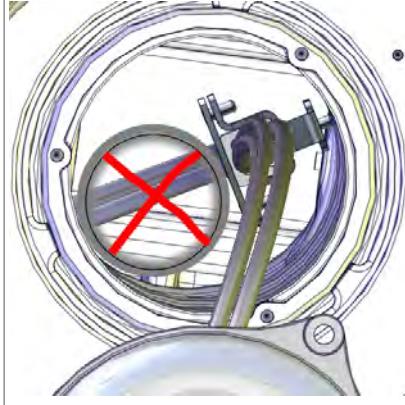
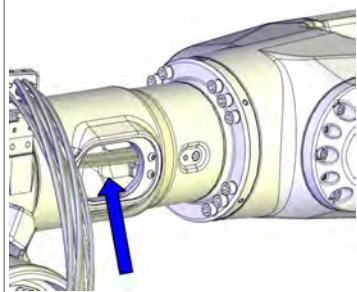
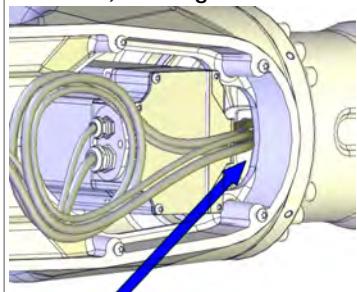
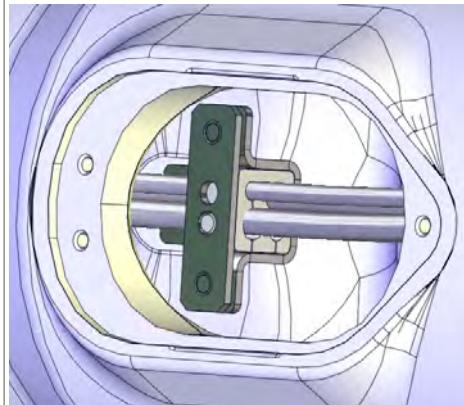
	Action	Note
5	<p><b>Foundry Plus:</b> Make sure that the gasket between the robot and cover is correctly fitted. Replace if damaged!</p>	 <p>A Gasket B Cable guide C Washer D Cover</p> <p>xx1400000382</p>
6	Fit the cable guide.	 <p>xx1300000657</p>
7	<p>Run the cabling through the cable guide and then into the arm upper arm tube.</p> <p><b>Note</b></p> <p>The cable harness is best placed at the upper right hand side of the DressPack tube through the arm tube. Do not run the cable harness into the DressPack tube!</p>	 <p>xx1400000357</p>

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## 4 Repair

### 4.5.5 Replacing the lower arm

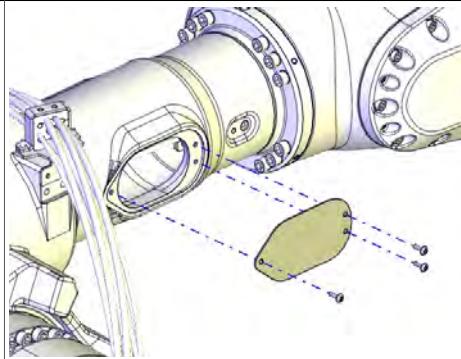
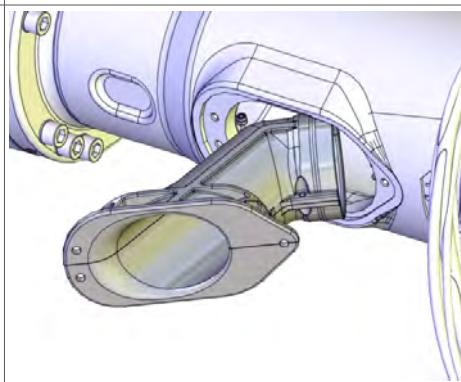
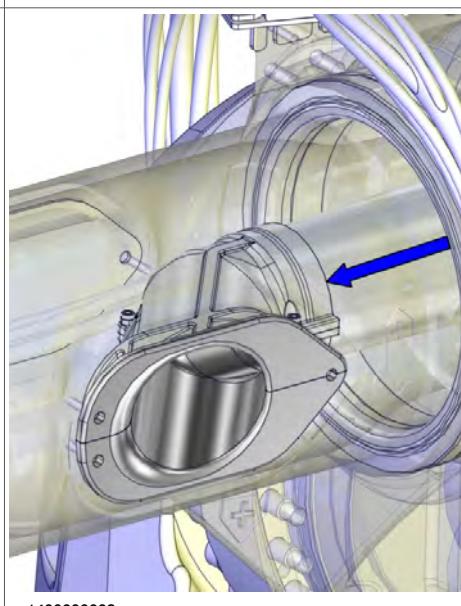
*Continued*

Action	Note	Note
8	<p>Use caution and push the cable harness into the upper arm tube.</p> <p><b>Note</b></p> <p>Do not run the cable harness into the DressPack tube, if one is fitted!</p>	 xx1300000820
9	<p><b>Tip</b></p> <p>This step is best performed by two persons working together.</p> <p>Use caution and push the cable harness into the wrist like this:</p> <ul style="list-style-type: none"> <li>Person 1: Put one hand inside the side cover hole and take a hold of the cable harness.</li> <li>Person 2: Take a hold of the cable harness from inside the wrist.</li> <li>Together: Use caution and move the cable harness past the axis-5 motor and into the wrist.</li> </ul>	<p>Person 1, working at the side hole:</p>  xx1300000745 <p>Person 2, working at the wrist:</p>  xx1300000746
10	<p>Refit the metal clamp axis-4 inside the arm tube.</p> <p><b>Note</b></p> <p>The screws are reached from outside the upper arm!</p>	 xx1300000592

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## 4.5.5 Replacing the lower arm

*Continued*

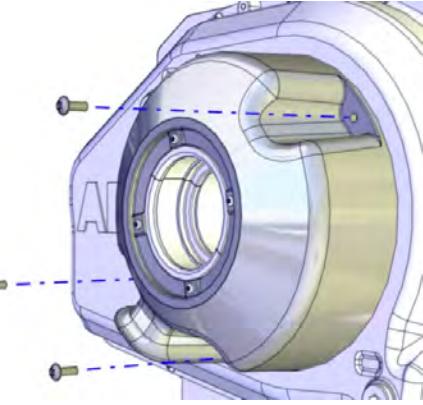
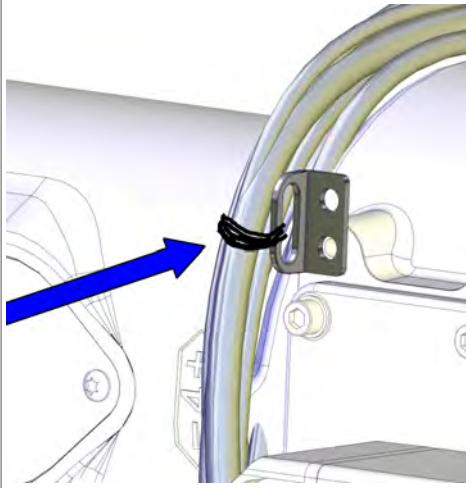
	Action	Note
11	<p>Refit the side cover.</p> <p><b>Note</b></p> <p><b>Foundry Plus:</b></p> <ul style="list-style-type: none"> <li>• Make sure the gasket is fitted correctly on the side cover</li> <li>• Use attachment screws made of stainless steel to fit the side cover.</li> </ul>	
12	<p>If used, refit the insert that guides the DressPack cable package through the hole in the upper arm.</p>	
13	<p>If used, refit the tube containing the DressPack into the insert.</p>	

*Continues on next page*

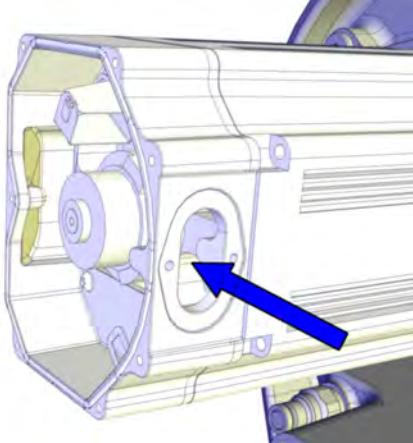
## 4 Repair

### 4.5.5 Replacing the lower arm

*Continued*

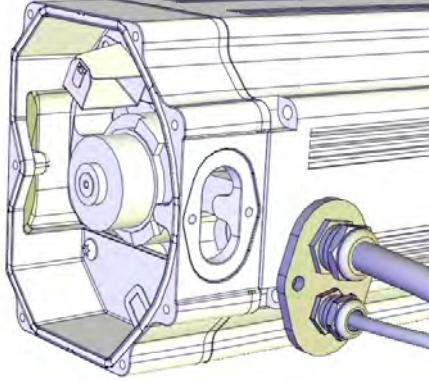
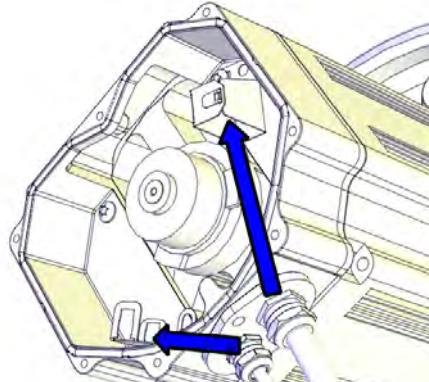
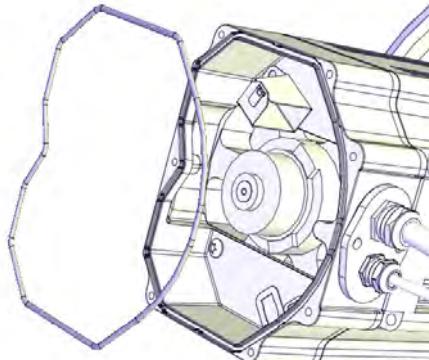
Action	Note
14 If used ( <i>DressPack or Foundry Plus</i> ), refit the cover with the tube guiding ring fitted.   <b>Note</b>  <b>Foundry Plus:</b> <ul style="list-style-type: none"> <li>• Make sure the gasket is fitted correctly</li> <li>• Use attachment screws made of stainless steel to fit the cover.</li> </ul>	 xx1200000045
15 Secure the cable harness to the cable fixing bracket with the velcro strap.  If DressPack is fitted, the cable fixing bracket is replaced by the cable guide.	 xx1300000544

#### Connecting the axis-3 and axis-4 motor cables

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

*Continues on next page*

#### 4.5.5 Replacing the lower arm Continued

	Action	Note
2	Refit the cable gland cover.   <b>Note</b>  Replace the gasket if damaged.	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066
4	Inspect the o-ring.   <b>Note</b>  Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-001   xx1200001070
5	Wipe clean o-ring and o-ring groove.	

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## 4 Repair

### 4.5.5 Replacing the lower arm

*Continued*

Action	Note
6 Refit the o-ring.  Tip Lubricate the o-ring with some grease for a better fitting in the groove.	
7 <b>CAUTION</b> When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8 Refit the motor cover with its attachment screws.  Note Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged.  Note Make sure the o-ring is undamaged and properly fitted.	 xx1200001135
9 Make sure that the covers are tightly sealed.	

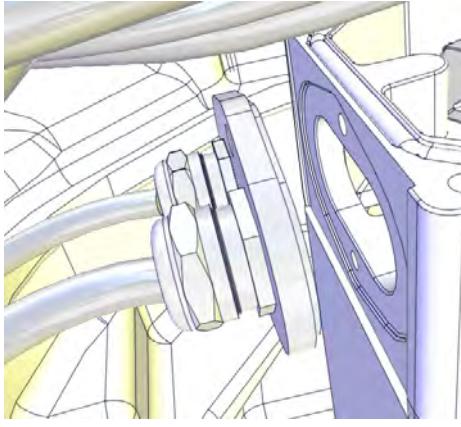
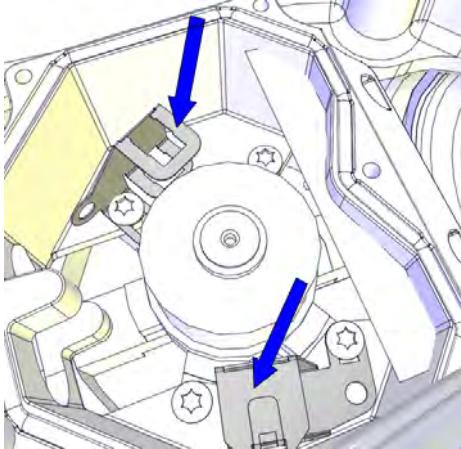
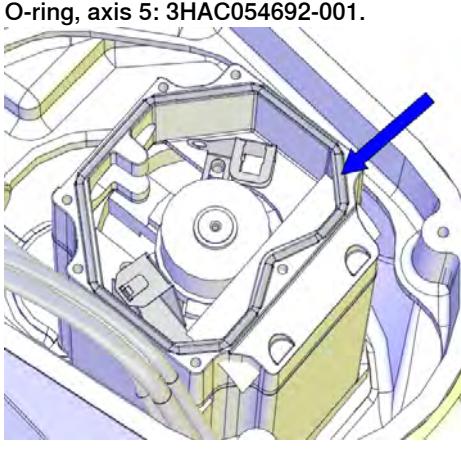
#### Connecting the axis-5 motor cables

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

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## 4.5.5 Replacing the lower arm

*Continued*

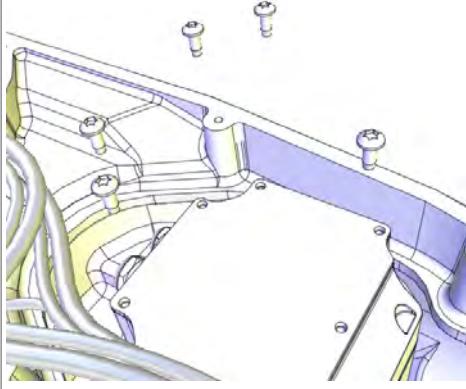
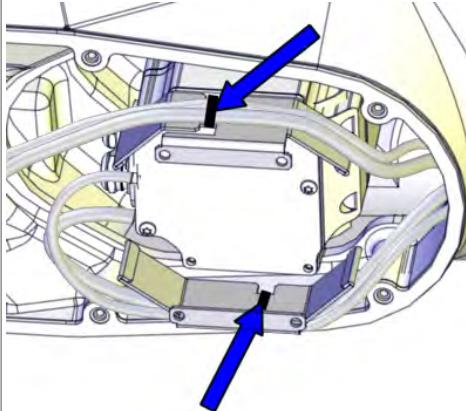
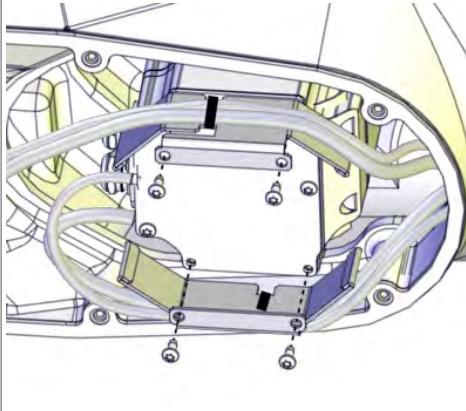
	Action	Note
2	<p>Refit the cable gland cover by performing the following steps:</p> <ul style="list-style-type: none"> <li>• Slide the cable gland cover onto the inner screw.</li> <li>• Refit and tighten the outer screw.</li> <li>• Tighten the inner screw. Make sure that the gasket is not damaged.</li> </ul> <p> <b>Note</b></p> <p>Replace the gasket if damaged.</p>	 xx1200001016
3	<p>Connect the connectors.</p> <p>Connect in accordance with the markings on the connectors.</p>	 xx1200001015
4	<p>Make sure the o-ring on the motor is undamaged.</p> <p>Replace if damaged.</p>	<p>O-ring, axis 5: 3HAC054692-001.</p>  xx1200001021
5	<p> <b>CAUTION</b></p> <p>When fitting the motor cover, make sure that none of the cables inside will be damaged.</p>	

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## 4 Repair

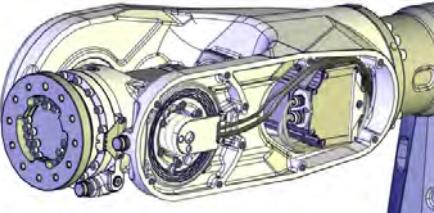
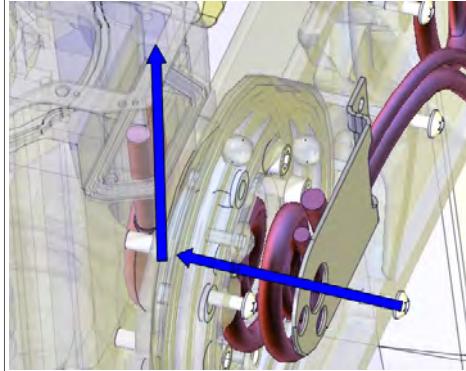
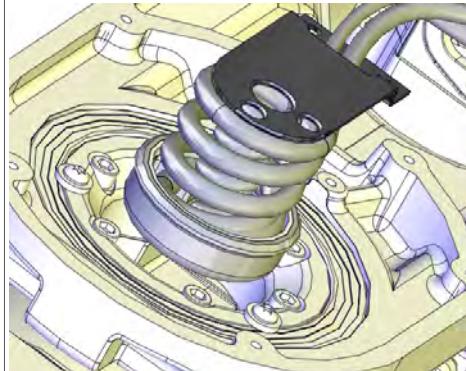
### 4.5.5 Replacing the lower arm

*Continued*

Action	Note
6 Refit the motor cover with its attachment screws.	 <b>Note</b> Do not refit the screws that will hold the heat protection plate at this point.  <b>Note</b> Do not reuse the self-threading attachment screws, it will damage the threads. Replace with standard attachment screws.  <b>Note</b> Make sure the o-ring is undamaged and properly fitted.
7 Secure the cable harness with cable straps to the heat protection plate.	 xx1200001013
8 Fit the heat protection plate with the screws.	 xx1500001029
9 Make sure that the cover is tightly sealed.	 xx1500001030

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## Connecting the axis-6 motor cables

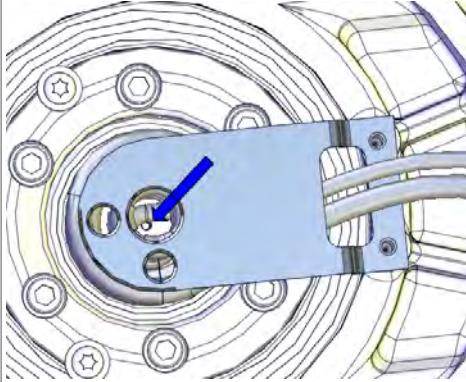
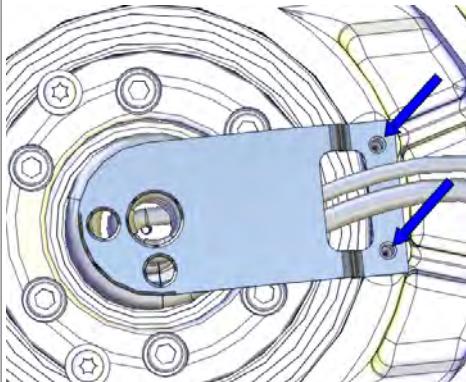
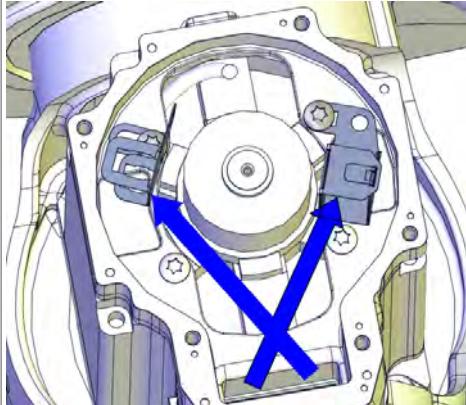
	Action	Note
1	Make sure that the cable harness is placed in a way that it will not be damaged when the cover is fitted.	 xx1600002061
2	<p> Note</p> <p>Axis 5 must be in position +90° (or as close as possible) for a correct installation of the cable harness in the wrist. If not, connect the 24 VDC power supply, release the brakes and move axis 5 manually to +90°.</p>	Position +90° of axis 5 makes the turning disc face the floor, if the robot is floor standing.
3	Push the cable harness into the wrist recess and up into the axis-6 motor.	 xx1300000667
4	Push the carrier carefully into position.	 xx1300001113

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## 4 Repair

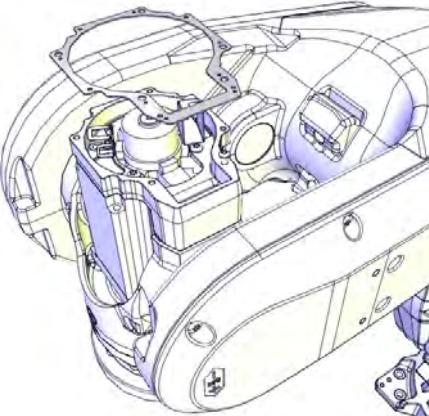
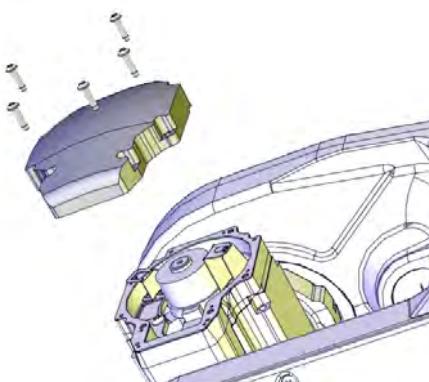
### 4.5.5 Replacing the lower arm

*Continued*

Action	Note
5 Secure the carrier with the M4 screw.	<p> <b>Note</b> The screw is located at the bottom of the carrier.</p> <p> <b>Tip</b> The attachment screw securing the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.</p>  <p>xx1300000485</p>
6 Secure the cable bracket with its attachment screws.	 <p>xx1300000484</p>
7 Reconnect the connectors to the axis-6 motor.	<p> <b>Note</b> Place the resolver cable under the motor cable.</p>  <p>xx1300000488</p>

*Continues on next page*

**4.5.5 Replacing the lower arm**  
*Continued*

Action	Note
8 Make sure the gasket is undamaged. Replace if damaged.	Gasket, 3HAC033489-001  xx1200001095
9  <b>CAUTION</b> When fitting the motor cover, make sure that none of the cables inside will be damaged.	
10 Refit the motor cover.	 xx1200001080

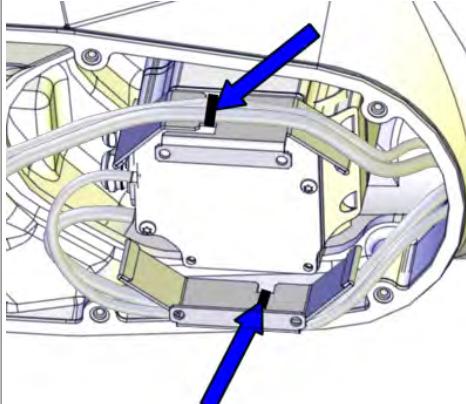
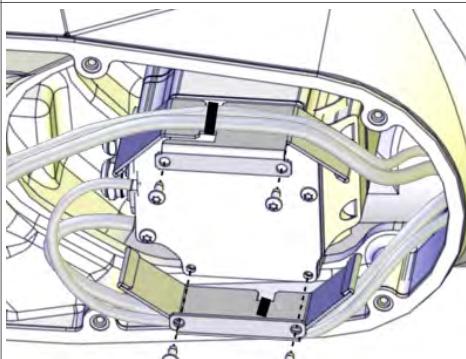
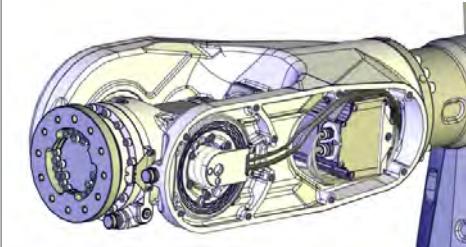
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## 4 Repair

### 4.5.5 Replacing the lower arm

*Continued*

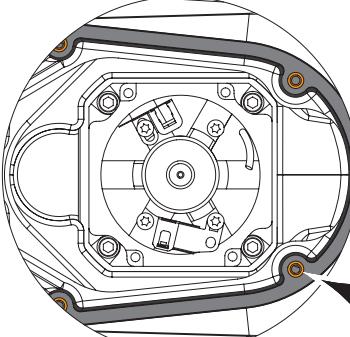
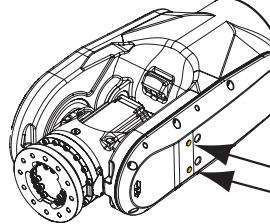
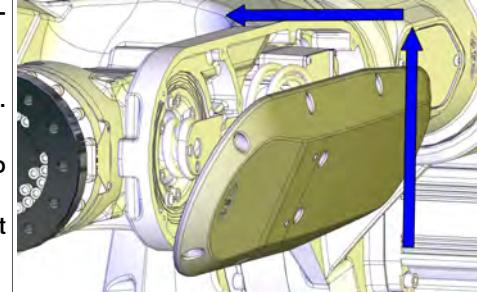
Concluded refitting of the cable harness

Action	Note
1 Secure the cable harness with cable straps to the heat protection plate.	 xx1500001029
2 Fit the heat protection plate with the screws.	 xx1500001030
3 Make sure that the cable harness is placed so it will not be damaged when the wrist cover is fitted.	 xx1600002061

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## 4.5.5 Replacing the lower arm

*Continued*

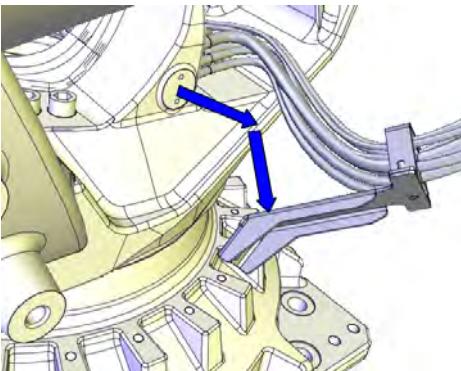
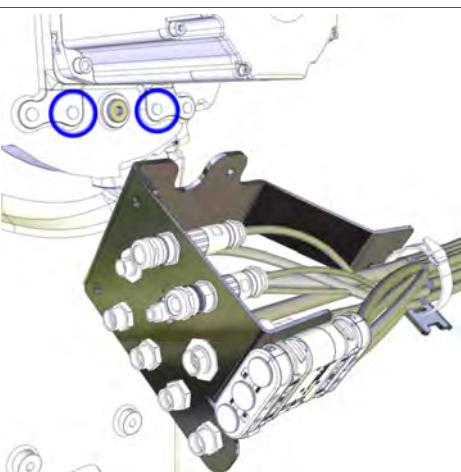
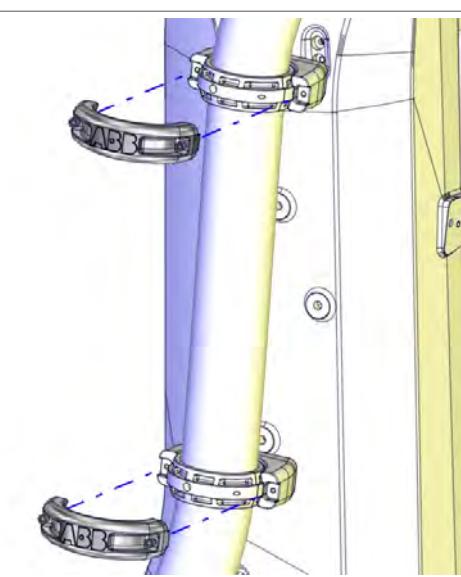
Action	Note
4 <b>Foundry Plus:</b> <ul style="list-style-type: none"> <li>Make sure that the gasket is undamaged on the cover. Replace if damaged.</li> <li>Put washers (10 pcs) in the holes of the gasket.</li> <li>Use attachment screws made of stainless steel to fit the wrist cover.</li> </ul>	  <p>xx1400000383</p> <p>A Protection plugs (2 on wrist cover and 2 on cover axis-5 gearbox) B Washers (10 pcs) in gasket holes</p>
5 Use caution in order not to damage the cable harness when the wrist cover is refitted, by following this method: <ol style="list-style-type: none"> <li>Hold the cover tilted. See figure!</li> <li>Put the cable harness on the cover.</li> <li>Lift the cover, still tilted.</li> <li>Move the upper part of the cover into position.</li> <li>Secure the cover with its attachment screws.</li> </ol>	<p>Tightening torque: 10 Nm.</p>  <p>xx1300000772</p>
6 If the robot is equipped with DressPack cable package: <ul style="list-style-type: none"> <li>Refit the distance to the wrist cover.</li> <li>Refit the ball joint housing to the distance.</li> <li>Refit the bracket with the ball joint housing to the upper arm tube.</li> <li>Refit the process turning disk.</li> </ul>	How to refit the DressPack cable package is described in the product manual "IRB 6700 DressPack". For article number see <a href="#">References on page 10</a> .

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## 4 Repair

### 4.5.5 Replacing the lower arm

*Continued*

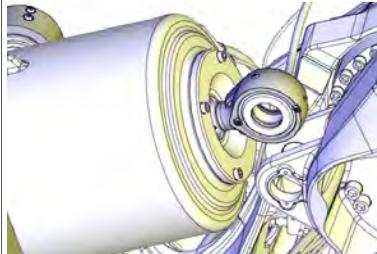
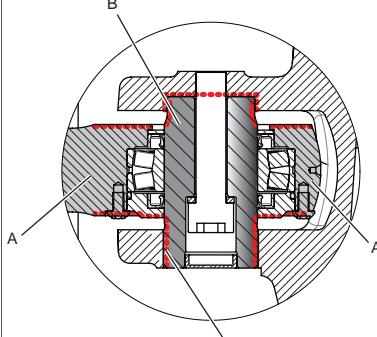
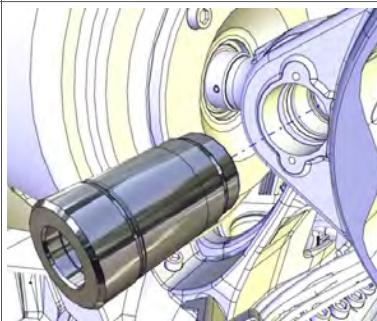
Action	Note
7 Refit the bracket to the frame.	 xx1200001184
8 Refit the connection plate.	 xx1200001332
9 If used, refit the DressPack in the ball joint housings on the lower arm.	 xx1400000195

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## 4.5.5 Replacing the lower arm

*Continued*

## Refitting the front shaft

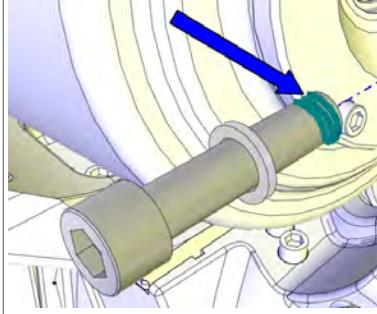
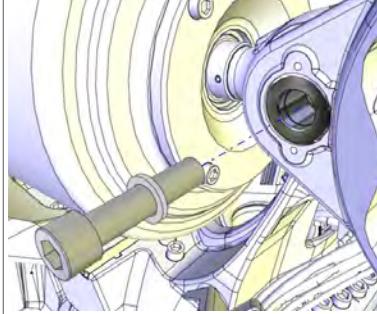
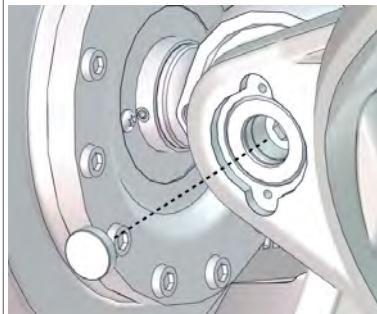
	Action	Note
1	 <b>DANGER</b> Turn off all: <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> to the robot, before entering the robot working area.	
2	Remove all residues of Loctite in the screw hole of the shaft.	
3	Wipe all contact surfaces inside the recess clean from residual grease or other contamination.	
4	<b>Align the balancing device link ear with the hole in the lower arm.</b>  <b>Note</b> Verify that the link ear is correctly turned.	 xx1300000784
5	<b>Foundry Plus:</b> Apply Mercasol on the surfaces on the shaft and front ear.	 xx1400000368 A Front link ear B Shaft C Mercasol (red dotted lines)
6	<b>Lubricate the shaft and place it to the front ear.</b>  <b>Note</b> <b>Foundry Plus:</b> Do not lubricate surfaces where Mercasol is applied!	 xx1200001280

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## 4 Repair

### 4.5.5 Replacing the lower arm

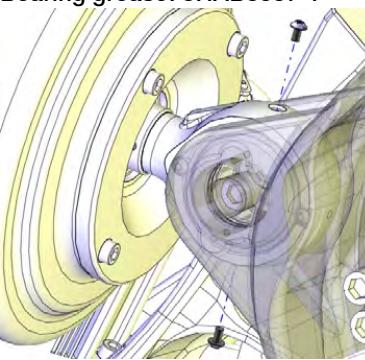
*Continued*

	Action	Note
7	Press the shaft in with the hydraulic press tool. <b>Tool figure missing</b> <small>xx1700000380</small>	Hydraulic pump 80 MPa: 3HAC13086-1 Hydraulic cylinder: 3HAC11731-1 Dismantle and mounting tool: 3HAC028920-001 Press tool M
8	Apply locking liquid on the first threads of the screw.	Loctite 2701  <small>xx1300000782</small>
9	Secure the shaft with screw and washer.	Tightening torque: 180 Nm  <small>xx1200001279</small>
10	Fit a new VK-cover.	 <small>xx1700000088</small>

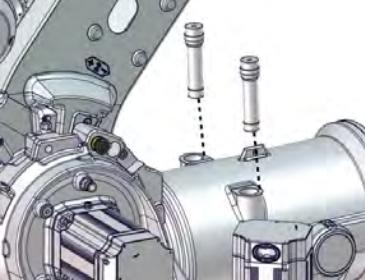
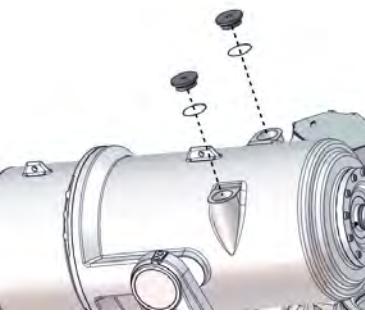
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## 4.5.5 Replacing the lower arm

*Continued*

Action	Note
11 Unscrew both screws in link ear. Fill the bearing with grease from the upper hole, until the grease appears in the lower hole.	Bearing grease: 3HAB3537-1  xx1300000783
12 Refit the two screws and wipe clean from residual grease.	
13 Refit the DressPack bracket, if used.	

## Restoring the balancing device

Action	Note
1 Remove the lifting equipment from the balancing device.	
2 Jog axis 2 to -4° in order to be able to remove the relief screws.	
3 Remove the relief screws to activate the balancing device.   <b>Note</b> Axis 2 must be in -4°.	 xx1700000070
4 Refit the covers. Make sure that the o-rings are still fitted.	 xx1700000451

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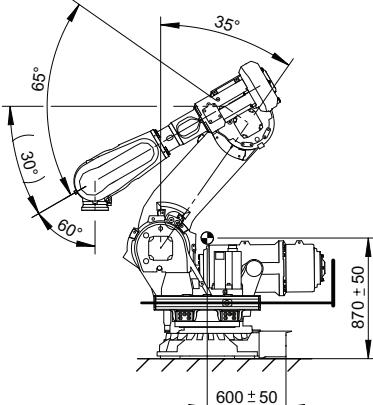
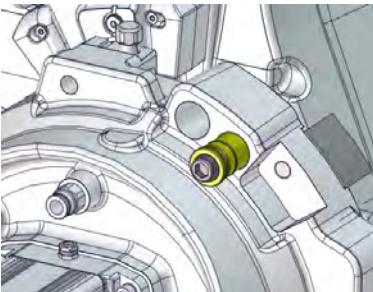
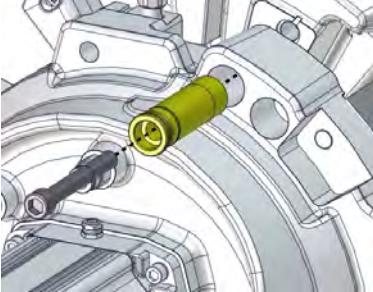
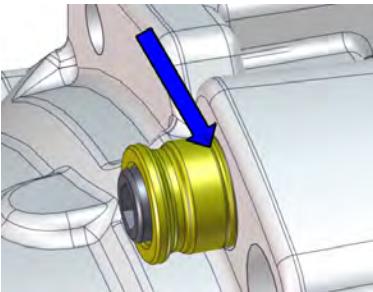
## 4 Repair

### 4.5.5 Replacing the lower arm

*Continued*

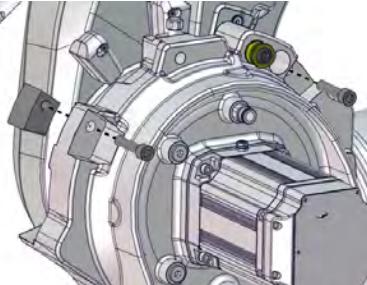
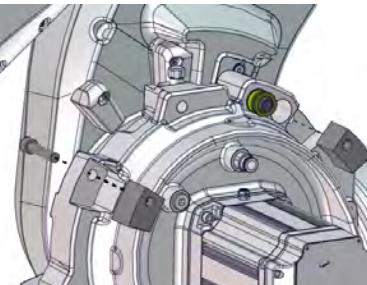
#### Securing the lower arm

Use this procedure to secure the lower arm before lifting the robot to inverted position.

Action	Note
1 Verify that the robot stands in position: <ul style="list-style-type: none"><li>• 0°</li><li>• -35°</li><li>• +65°</li><li>• 0°</li><li>• +60°</li><li>• no significance</li></ul>	 xx1600001371
2 Remove the transportation lock screw and the yellow sleeve from the parking position.	 xx1700000348
3 Insert the yellow sleeve and the transportation lock screw in the hole at the locking position. Insert the sleeve all the way so that the marking in the sleeve is aligned with the casting, see figure. Tighten the screw.   <b>DANGER</b>  Always use the transportation lock screw and sleeve to lock the lower arm at transportation, turning and floor standing.	Tightening torque: 70 Nm ±15 Nm  xx1700000347   xx1600002114

*Continues on next page*

Preparations before lifting up the robot to inverted position

	Action	Note
1	Remove the two service stops from maintenance position, if previously moved there.	 xx1700000068
2	Fit the service stops in their parking position.	 xx1700000067
3	Fasten the fork lift accessory.	See user instructions enclosed with the fork lift accessory. Fork lift accessory set: 3HAC058825-001.
4	Remove the bolts securing the robot to the foundation.	

Orienting and securing the robot

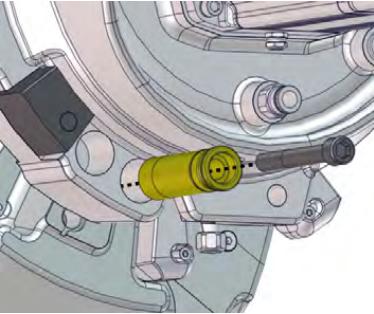
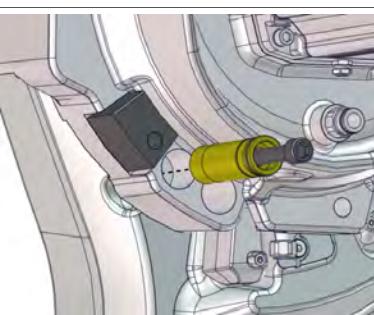
	Action	Note
1	Lift the robot using the fork lift accessory.	See user instructions enclosed with the fork lift accessory.
2	Move the robot close to its installation location.	
3	Rotate the robot into inverted position using the turning tool or using a fork lift truck with a rotator attachment.	See user instructions enclosed with the turning tool.
	 <b>DANGER</b> Make sure that there is enough space underneath the robot. See user instructions for the turning tool.	
4	Guide the robot using two M24 screws while lifting it into its mounting position.	

Continues on next page

## 4 Repair

### 4.5.5 Replacing the lower arm

*Continued*

	Action	Note
5	Fit the bolts and washers in the base attachment holes.	Specified in <a href="#">Attachment screws on page 75</a>
	 <b>Note</b> Lightly lubricate screws before assembly.	
6	Tighten bolts in a crosswise pattern to ensure that the base is not distorted.	
7	Remove the yellow sleeve and transportation lock screw from the transportation and turning position.	 xx1700000269
8	Fasten the yellow sleeve and transportation lock screw in its parking position.	 xx1700000270

#### Concluding procedure

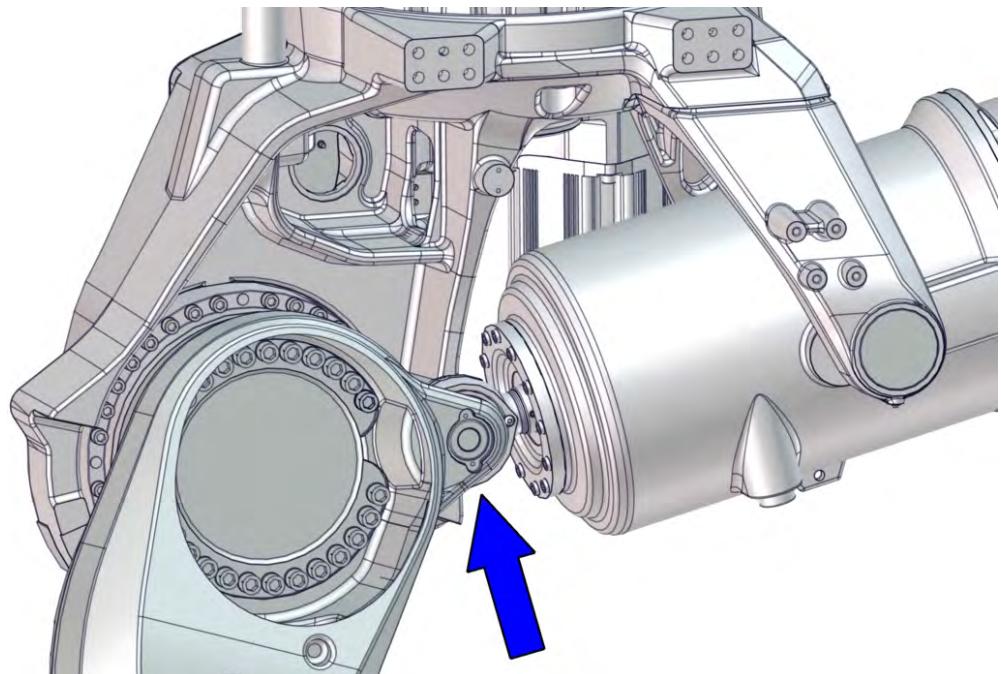
	Action	Note
1	Remove the lifting accessory.	
2	Re-calibrate the robot.	Axis Calibration is described in <a href="#">Calibrating with Axis Calibration method on page 691</a> . General calibration information is included in section <a href="#">Calibration on page 683</a> .
3	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further described in <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

## 4.6 Frame and base

### 4.6.1 Replacing the spherical roller bearing

#### Location of the spherical roller bearing

The spherical roller bearing is located in the link ear of the balancing device.



xx1700000318

#### Summary of the replacement procedure

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

- 1 Lift down the robot to floor standing.
- 2 Unload the balancing device.
- 3 Replace the spherical roller bearing.
- 4 Restore the balancing device.
- 5 Lift up and rotate the robot to inverted position.

#### Spare parts



##### Note

The spare part numbers that are listed in the table can be out of date. See the latest revision of *Product manual, spare parts - IRB 6700* on ABB Library.

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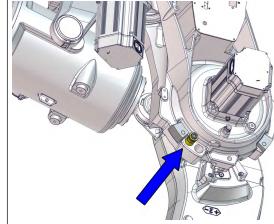
## 4 Repair

### 4.6.1 Replacing the spherical roller bearing

*Continued*

Spare part	Article number	Note
Spherical roller bearing kit	3HAC062076-001	The maintenance kit contains: <ul style="list-style-type: none"> <li>• End cover</li> <li>• Radial sealing with dust lip, 50x68x8 (2 pcs)</li> <li>• O-ring 104.5</li> <li>• Spherical roller bearing</li> <li>• Washer</li> </ul>

### Required tools and equipment

Equipment	Article number	Note
Transportation lock screw	3HAC059728-001 Sleeve 3HAB3409-93 Screw, M16x120 (class 12.9 or 8.8)	Used to secure the lower arm. Stored at the parking position on the robot frame.   xx1600002008
Relief screws	3HAC058129-001	Used for unloading the balancing device. Included in spare part balancing device.
Dismantle and mounting tool	3HAC028920-001	Used for removing and fitting shaft and bearings.
Hydraulic cylinder	3HAC11731-1	To be used with the press tool.
Hydraulic pump 80 MPa	3HAC13086-1	To be used with the hydraulic cylinder.
Press tool A	3HAC028920-003	
Press tool J	3HAC034037-001	
Lifting shackle, 2 pcs	-	SA-10-8-NA1
Roundsling, 1 m	-	Lifting capacity: 1,000 kg.
Fork lift accessory set	3HAC058825-001	Contains fork lift pockets and all required hardware for installation. User instructions are enclosed with the tool, see Directions for use - Fork lift accessory for IRB 6700Inv.  In order to rotate the robot, either use the turning tool or a fork lift truck with a rotator attachment.
Turning tool	3HAC061162-001	User instructions are enclosed.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

*Continues on next page*

#### 4.6.1 Replacing the spherical roller bearing Continued

##### Consumables

Consumable	Article number	Note
VK cover, 28x7	3HAA2166-12	
Bearing grease	3HAB3537-1	Shell Gadus S2V220 AC Used for lubrication of the spherical roller bearing.
Locking liquid	3HAB7116-1	Loctite 243

##### Required documents

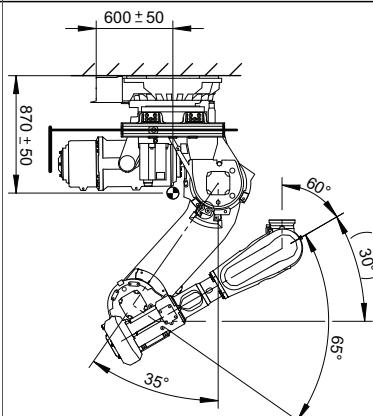
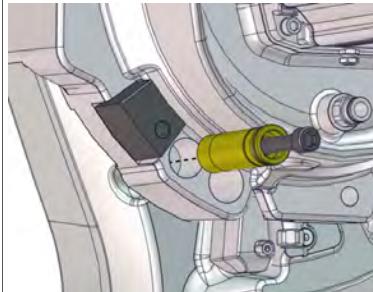
Document	Document number
Directions for use - Fork lift accessory for IRB 6700Inv	3HAC060303
User instructions for turning tool (enclosed with the turning tool)	-

##### Removing the spherical roller bearing

Use these procedures to remove the spherical roller bearing.

##### Securing the lower arm

Use this procedure to secure the lower arm before lifting down the robot from inverted position.

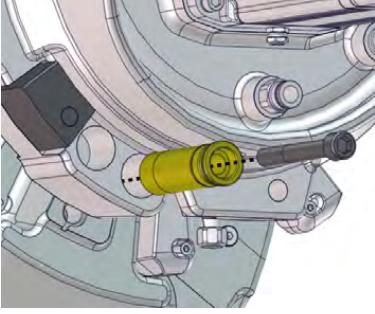
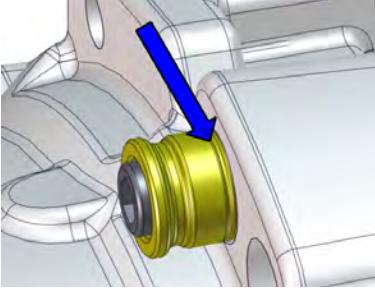
	Action	Note
1	Jog the robot into position: <ul style="list-style-type: none"> <li>• Axis 1: 0°</li> <li>• Axis 2: -35°</li> <li>• Axis 3: +65°</li> <li>• Axis 4: 0°</li> <li>• Axis 5: +60°</li> <li>• Axis 6: no significance</li> </ul>	 xx1700000555
2	Remove the transportation lock screw and the yellow sleeve from the parking position.	 xx1700000270

Continues on next page

## 4 Repair

### 4.6.1 Replacing the spherical roller bearing

*Continued*

Action	Note
<p>3 Insert the yellow sleeve and the transportation lock screw in the hole at the locking position. Insert the sleeve all the way so that the marking in the sleeve is aligned with the casting, see figure. Tighten the screw.</p> <p> <b>DANGER</b></p> <p>Always use the transportation lock screw and sleeve to lock the lower arm at transportation, turning and floor standing.</p>	<p>Tightening torque: 70 Nm ±15 Nm.</p>  <p>xx1700000269</p>  <p>xx1600002114</p>

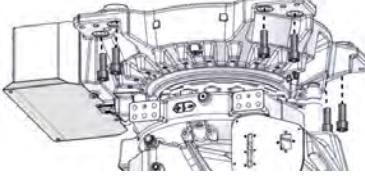
Lifting down the robot from inverted position

Action	Note
<p>1 If the robot is to be secured to the floor, prepare an area where the robot can be secured with the attachment bolts. The robot must always be secured to the floor if any kind of repair or maintenance work is to be performed.</p>	<p>Suitable screws, lightly lubricated: M24x100 (8 pcs) For hole configuration, see <a href="#">Hole configuration, base on page 74</a>.</p>
2 Verify that the lower arm is secured with the transportation lock screw.	
3 Remove any payload from the robot.	DressPack can stay fitted.
<p>4  <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.</p>	
5 Disconnect the robot cables at the base.	
<p>6  <b>CAUTION</b> The IRB 6700Inv robot weighs 1,750 kg. All lifting accessories used must be sized accordingly.</p>	

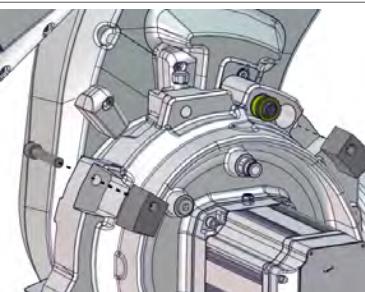
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#### 4.6.1 Replacing the spherical roller bearing

*Continued*

	Action	Note
7	Install the fork lift pockets on the robot, if not already installed.	See user instructions enclosed with the fork lift accessory set. Fork lift accessory set: 3HAC058825-001.
8	Insert the forks of the fork lift truck into the fork lift pockets, as far as possible.	
9	Raise the forks of the fork lift truck to make sure that the weight of the robot rests on the forks.   <b>Tip</b>  Two M16 screws can be fitted to the fork lift pockets, to press the forks against the pockets and make the lift more stable.	
10	Remove the bolts that secure the robot to the foundation.	Quantity: 8 pcs.   xx1600002098
11	Rotate the robot to floor standing position, using the turning tool or using a fork lift truck with a rotator attachment.	Only one direction for rotation is allowed with the turning tool. Follow the user instructions enclosed with the turning tool.
12	Lower and secure the robot to the floor.	Attachment screws: M24x100 (8 pcs).

#### Unloading the balancing device

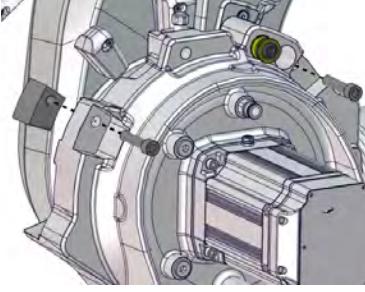
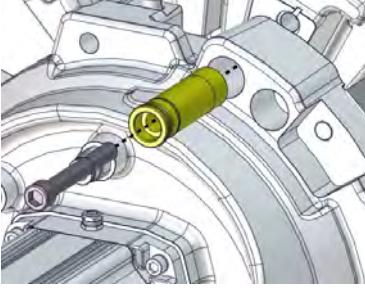
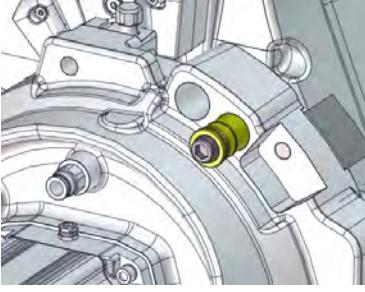
	Action	Note
1	Verify that the robot is secured to the foundation.	Attachment screws: M24x100 (8 pcs).
2	Remove the two service stops from their parking position.	  xx1700000067

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## 4 Repair

### 4.6.1 Replacing the spherical roller bearing

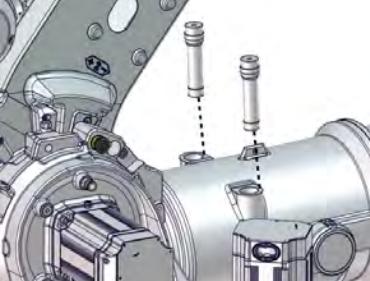
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	Action	Note
3	Fit the service stops in maintenance position.	<p>Tightening torque: 70 Nm ±15 Nm.</p>  <p>xx1700000068</p>
4	<p>Remove the transportation lock screw and yellow sleeve from locking position.</p> <p><b>Note</b> It is only allowed to remove the transportation lock screw and sleeve, if the service stops are in maintenance position, when the robot is floor standing.</p>	 <p>xx1700000347</p>
5	Fit the transportation lock screw and the yellow sleeve in their parking position.	 <p>xx1700000348</p>
6	Jog axis 2 to -4° to be able to insert the relief screws.	
7	<p>Remove the covers on the balancing device.</p> <p><b>Note</b> The covers have to be refitted after repair or maintenance.</p>	 <p>xx1700000451</p>

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#### 4.6.1 Replacing the spherical roller bearing

*Continued*

Action	Note
8 Fit the relief screws to unload the balancing device.  ! <b>DANGER</b>  Do not remove the relief screws when the balancing device is removed from the robot.	Tightening torque: 70 Nm±15 Nm Relief screws, 3HAC058129-001  xx1700000070
9 Jog axis 2 to +15°.	
10 ! <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.	

#### Attaching lifting accessories to the balancing device

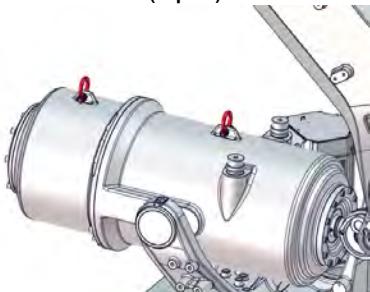
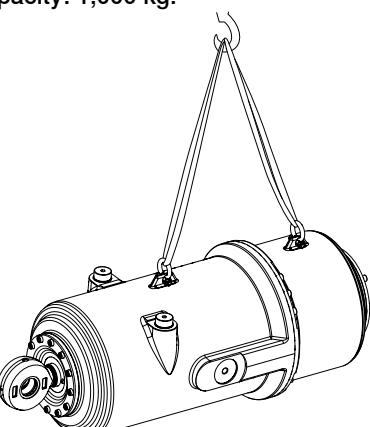
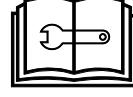
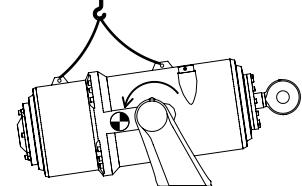
Action	Note
1 ! <b>CAUTION</b>  The weight of the balancing device (excluding cradle) is 305 kg All lifting accessories used must be sized accordingly.	

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## 4 Repair

### 4.6.1 Replacing the spherical roller bearing

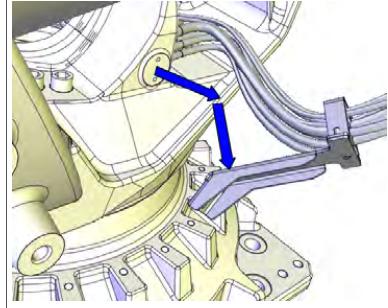
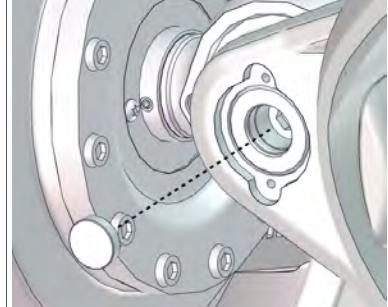
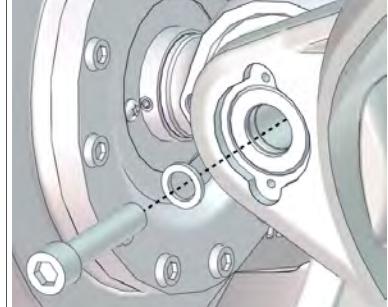
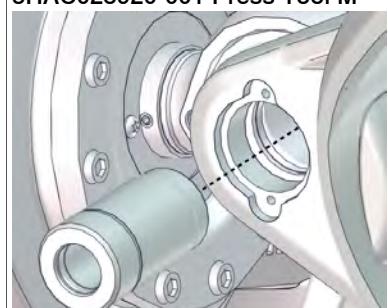
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Action	Note
2 Fasten lifting shackles on the balancing device.	SA-10-8-NA1 (2 pcs)  xx1700000086
3 Fasten the lifting slings.	Roundsling, 1 m (2 pcs) Lifting capacity: 1,000 kg.  xx1700000087
4 Raise the lifting slings to take the weight of the balancing device.   <b>CAUTION</b>  The balancing device is heavy at the back, and will tip over when the link ear is loosened.	   3HAC059516-001 (2) xx1600002060

*Continues on next page*

#### 4.6.1 Replacing the spherical roller bearing Continued

Removing the shaft in the front (link ear)

	Action	Note
1	Unscrew the attachment screws of the bracket, use caution and move it a little to the side, to give room for the Dismantle and mounting tool.	 xx1200001184
2	<p>Remove the VK cover at the link ear.</p> <p><b>Note</b> Make sure that the lifting accessories hold the weight of the balancing device.</p> <p><b>Tip</b> Use high pressure air to remove the VK covers.</p>	<p>It is possible to drive a screwdriver (or similar) through the VK cover, as close as possible to the center of the VK cover and pull it out.</p>  xx1700000088
3	<p>Remove the attachment screw and washer at the link ear.</p> <p><b>CAUTION</b> The balancing device is heavy at the back, and will tip over when the link ear is loosened.</p>	 xx1700000089
4	Use the dismantle and mounting tool and pull the shaft out.	<p>Dismantle and mounting tool: 3HAC028920-001 Press Tool M</p>  xx1700000409 xx1700000090

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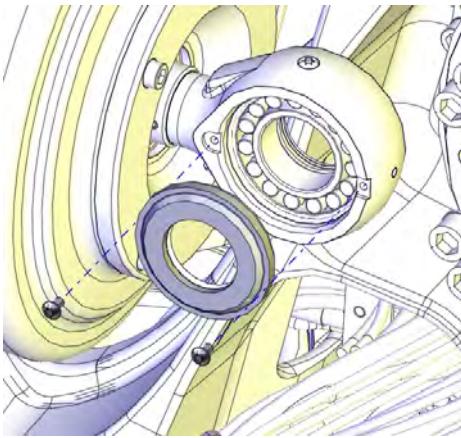
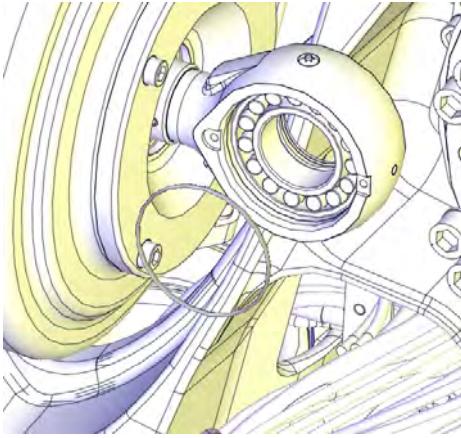
## 4 Repair

### 4.6.1 Replacing the spherical roller bearing

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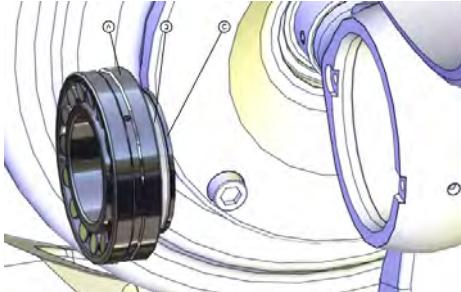
	Action	Note
5	Carefully lower the lifting device to let the balancing device rest on the frame.	

#### Removing the spherical roller bearing, link ear

	Action	Note
1	Check that the link ear is in a position where it is possible to apply the dismantle and mounting tool. If not, adjust with the lifting accessory.	
2	Unscrew the attachment screws securing the end cover, remove end cover and radial sealing with a screwdriver.	 xx1300000774
3	Remove the o-ring.	 xx1300000775

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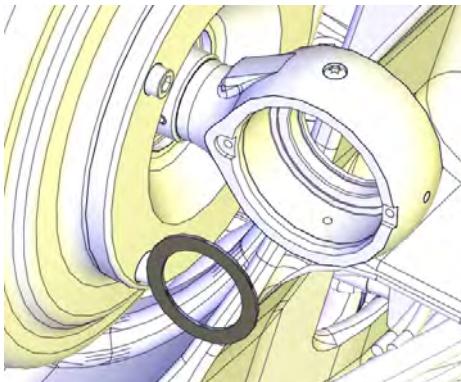
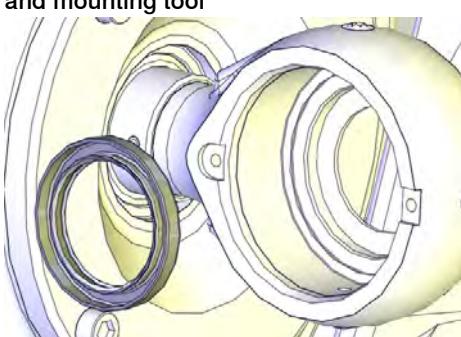
#### 4.6.1 Replacing the spherical roller bearing Continued

Action	Note
<p>4 Apply the dismantle and mounting tool and pull out the spherical roller bearing together with the radial sealing and washer.</p> <p><b>Tool figure missing</b></p> <p>xx1700000412</p>	<p>Dismantle and mounting tool: 3HAC028920-001</p>  <p>xx1300000840</p> <p>A Spherical roller bearing B Radial sealing C Washer</p>

#### Refitting the spherical roller bearing

Use these procedures to refit the spherical roller bearing.

#### Refitting the spherical roller bearing, link ear

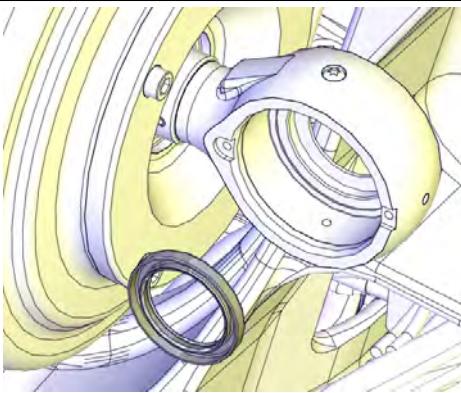
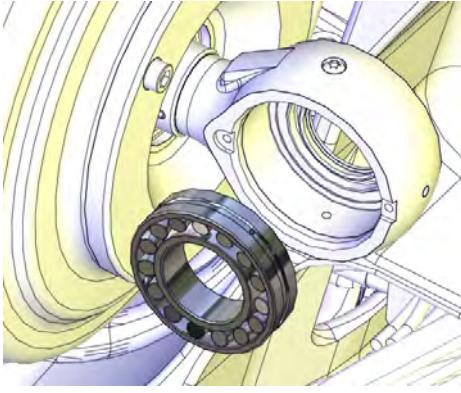
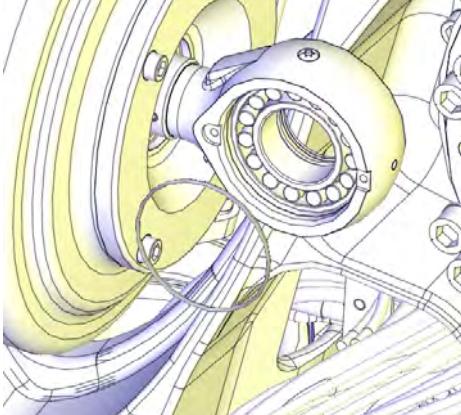
Action	Note
1 Wipe clean all contact surfaces from residual grease.	
2 Refit the washer.	 <p>xx1300000778</p>
3 Put the radial sealing on the Press tool J.  <span style="color: blue; font-weight: bold;">Note</span> Make sure that the sealing is turned the according to figure.	<p>Press tool J included in tool set Dismantle and mounting tool</p>  <p>xx1300000839</p>

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## 4 Repair

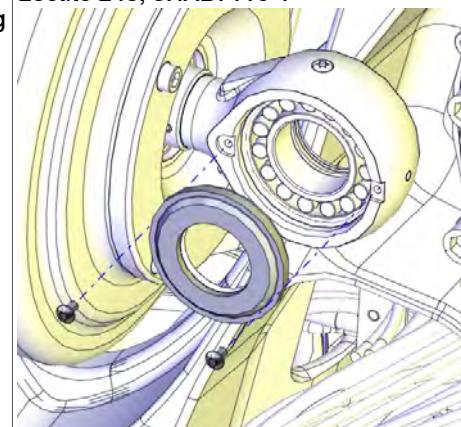
### 4.6.1 Replacing the spherical roller bearing

*Continued*

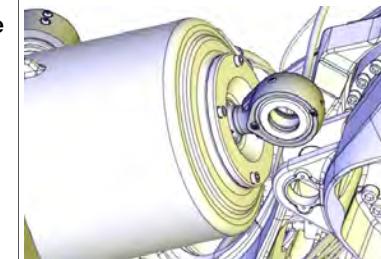
Action	Note
4 Use a plastic mallet or similar on the Press tool J and refit the radial sealing.	 xx1300000777
5 Apply some grease on the surface for the bearing.	
6 Apply the dismantle and mounting tool and press in the spherical roller bearing. <b>Tool figure missing</b> xx1700000413	Dismantle and mounting tool: 3HAC028920-001  xx1300000776
7 Refit the o-ring.	 xx1300000775

*Continues on next page*

#### 4.6.1 Replacing the spherical roller bearing Continued

Action	Note
8 Apply Locking liquid on the screws and secure the end cover with the radial sealing ring.	<p>Loctite 243, 3HAB7116-1</p>  <p>xx1300000774</p>

#### Refitting the front shaft

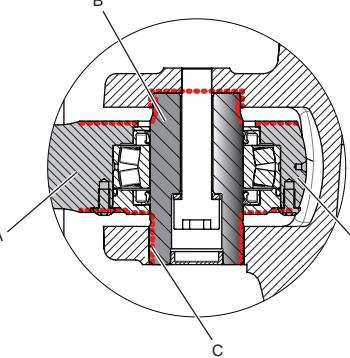
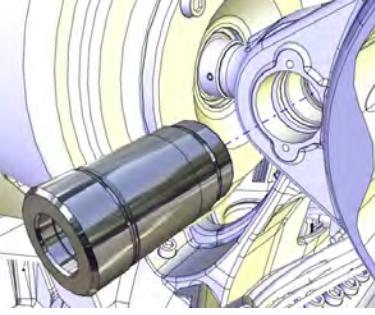
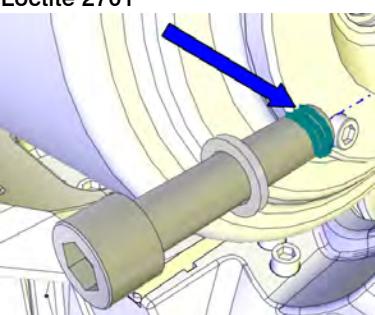
Action	Note
1  <b>DANGER</b> Turn off all: <ul style="list-style-type: none"><li>• electric power supply</li><li>• hydraulic pressure supply</li><li>• air pressure supply</li></ul> to the robot, before entering the robot working area.	
2 Remove all residues of Loctite in the screw hole of the shaft.	
3 Wipe all contact surfaces inside the recess clean from residual grease or other contamination.	
4 Align the balancing device link ear with the hole in the lower arm.   <b>Note</b> Verify that the link ear is correctly turned.	 <p>xx1300000784</p>

*Continues on next page*

## 4 Repair

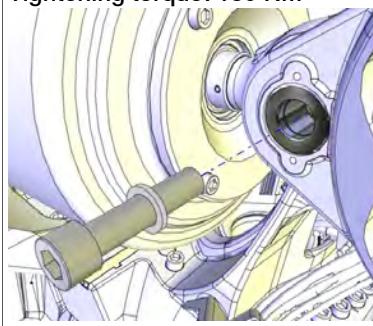
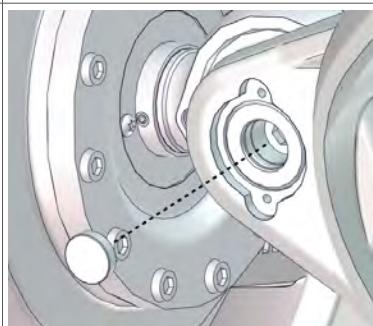
### 4.6.1 Replacing the spherical roller bearing

*Continued*

Action	Note
<p>5 <b>Foundry Plus:</b> Apply Mercasol on the surfaces on the shaft and front ear.</p>	 <p>xx1400000368</p> <p>A Front link ear B Shaft C Mercasol (red dotted lines)</p>
<p>6 Lubricate the shaft and place it to the front ear.</p> <p> <b>Note</b></p> <p><b>Foundry Plus:</b> Do not lubricate surfaces where Mercasol is applied!</p>	 <p>xx1200001280</p>
<p>7 Press the shaft in with the hydraulic press tool. <b>Tool figure missing</b></p> <p>xx1700000380</p>	<p>Hydraulic pump 80 MPa: 3HAC13086-1 Hydraulic cylinder: 3HAC11731-1 Dismantle and mounting tool: 3HAC028920-001 Press tool M</p>
<p>8 Apply locking liquid on the first threads of the screw.</p>	<p>Loctite 2701</p>  <p>xx1300000782</p>

*Continues on next page*

#### 4.6.1 Replacing the spherical roller bearing Continued

	Action	Note
9	Secure the shaft with screw and washer.	Tightening torque: 180 Nm  xx1200001279
10	Fit a new VK-cover.	 xx1700000088
11	Unscrew both screws in link ear. Fill the bearing with grease from the upper hole, until the grease appears in the lower hole.	Bearing grease: 3HAB3537-1  xx1300000783
12	Refit the two screws and wipe clean from residual grease.	
13	Refit the DressPack bracket, if used.	

#### Restoring the balancing device

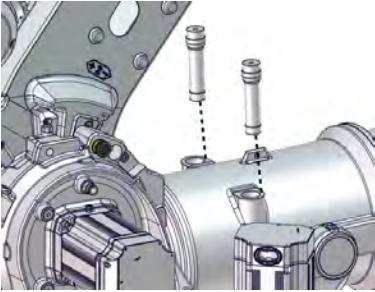
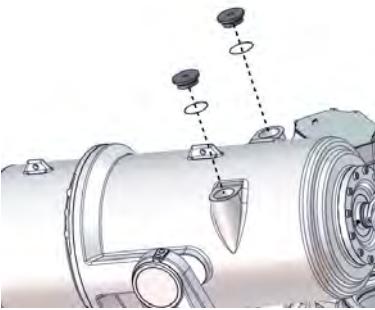
	Action	Note
1	Remove the lifting equipment from the balancing device.	
2	Jog axis 2 to -4° in order to be able to remove the relief screws.	

*Continues on next page*

## 4 Repair

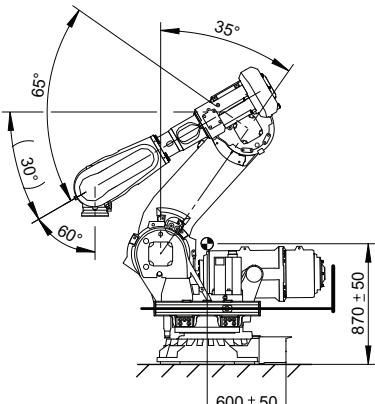
### 4.6.1 Replacing the spherical roller bearing

*Continued*

Action	Note
3 Remove the relief screws to activate the balancing device.  Note Axis 2 must be in -4°.	 xx1700000070
4 Refit the covers. Make sure that the o-rings are still fitted.	 xx1700000451

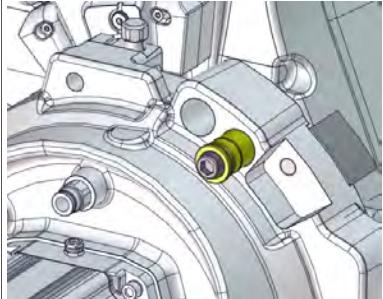
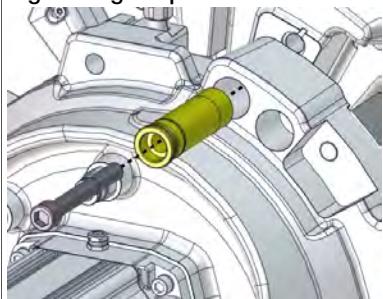
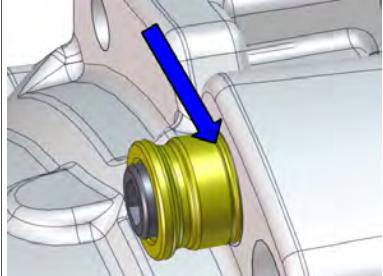
#### Securing the lower arm

Use this procedure to secure the lower arm before lifting the robot to inverted position.

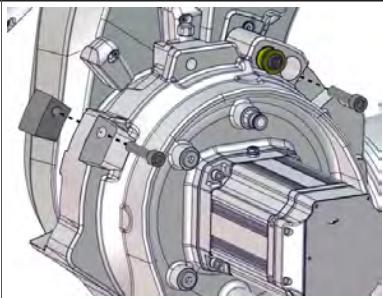
Action	Note
1 Verify that the robot stands in position: <ul style="list-style-type: none"><li>• 0°</li><li>• -35°</li><li>• +65°</li><li>• 0°</li><li>• +60°</li><li>• no significance</li></ul>	 xx1600001371

*Continues on next page*

#### 4.6.1 Replacing the spherical roller bearing Continued

	Action	Note
2	Remove the transportation lock screw and the yellow sleeve from the parking position.	 xx1700000348
3	Insert the yellow sleeve and the transportation lock screw in the hole at the locking position. Insert the sleeve all the way so that the marking in the sleeve is aligned with the casting, see figure. Tighten the screw. <p style="text-align: center;"> <b>DANGER</b></p> <p>Always use the transportation lock screw and sleeve to lock the lower arm at transportation, turning and floor standing.</p>	Tightening torque: 70 Nm ±15 Nm  xx1700000347  xx1600002114

Preparations before lifting up the robot to inverted position

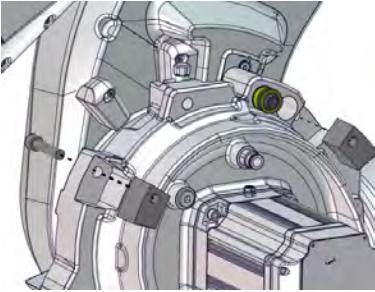
	Action	Note
1	Remove the two service stops from maintenance position, if previously moved there.	 xx1700000068

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## 4 Repair

### 4.6.1 Replacing the spherical roller bearing

*Continued*

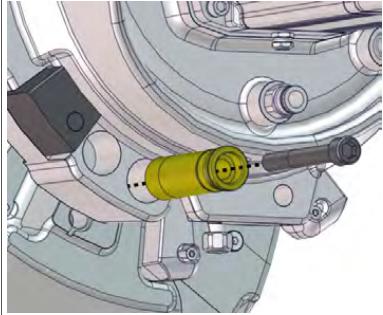
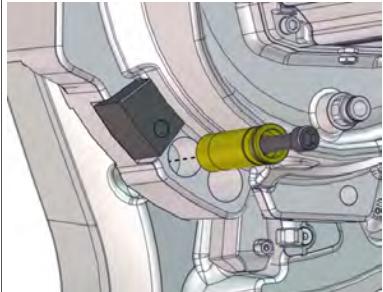
Action	Note
2 Fit the service stops in their parking position.	 xx1700000067
3 Fasten the fork lift accessory.	See user instructions enclosed with the fork lift accessory. Fork lift accessory set: 3HAC058825-001.
4 Remove the bolts securing the robot to the foundation.	

#### Orienting and securing the robot

Action	Note
1 Lift the robot using the fork lift accessory.	See user instructions enclosed with the fork lift accessory.
2 Move the robot close to its installation location.	
3 Rotate the robot into inverted position using the turning tool or using a fork lift truck with a rotator attachment.	See user instructions enclosed with the turning tool.
<p> <b>DANGER</b></p> <p>Make sure that there is enough space underneath the robot. See user instructions for the turning tool.</p>	
4 Guide the robot using two M24 screws while lifting it into its mounting position.	
5 Fit the bolts and washers in the base attachment holes.	Specified in <a href="#">Attachment screws on page 75</a>
<p> <b>Note</b></p> <p>Lightly lubricate screws before assembly.</p>	
6 Tighten bolts in a crosswise pattern to ensure that the base is not distorted.	

*Continues on next page*

4.6.1 Replacing the spherical roller bearing  
*Continued*

	Action	Note
7	Remove the yellow sleeve and transportation lock screw from the transportation and turning position.	 xx1700000269
8	Fasten the yellow sleeve and transportation lock screw in its parking position.	 xx1700000270

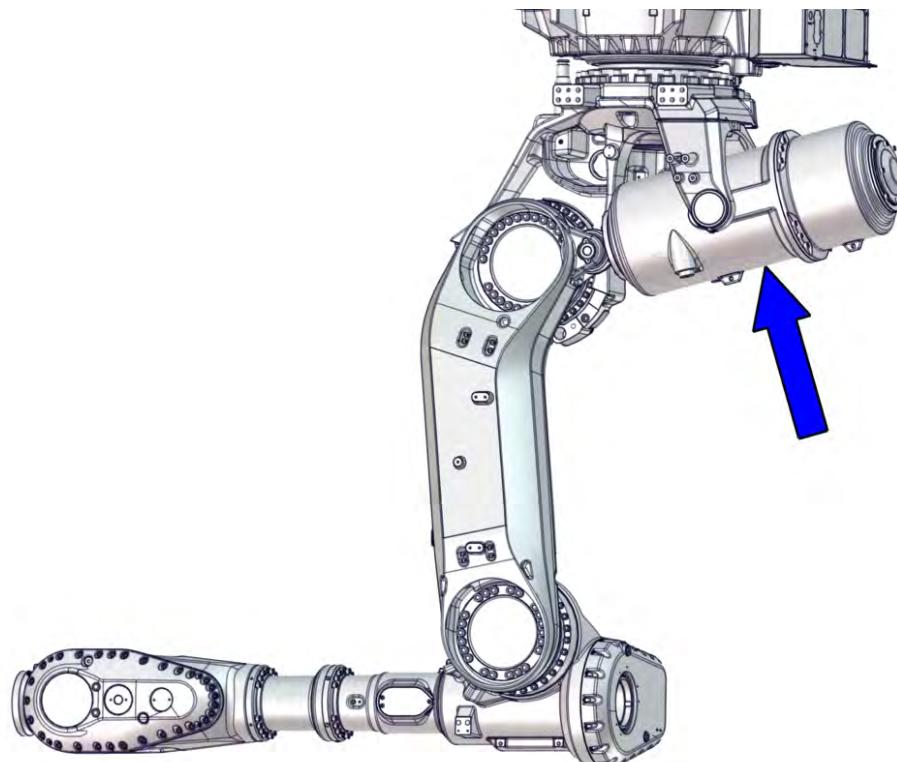
## 4 Repair

### 4.6.2 Replacing the balancing device

#### 4.6.2 Replacing the balancing device

##### Location of the balancing device

The balancing device is located as shown in the figure.



xx170000060



##### Note

The robot must be taken down and secured floor standing to perform this replacement procedure.

How to do this is described in the removal procedure in this section.



##### DANGER

Always lock the position of the lower arm, using the yellow sleeve and transportation lock screw, before attempting to lift the robot.

##### Summary of the replacement procedure

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

- 1 Lift down the robot to floor standing.
- 2 Unload the balancing device.
- 3 Replace the balancing device.
- 4 Lift up and rotate the robot to inverted position.

*Continues on next page*

**Required spare parts****Note**

The spare part numbers that are listed in the table can be out of date. See the latest revision of *Product manual, spare parts - IRB 6700* on ABB Library.

Spare part	Article number	Note
Balancing device	3HAC058121-005 Graphite White 3HAC058121-006 ABB Orange	

**Required tools and equipment**

Equipment, etc.	Article number	Note
Relief screws	3HAC058129-001	Used for unloading the balancing device. Included in spare part balancing device.
Dismantle and mounting tool	3HAC028920-001	Used for removing and fitting shaft and bearings.
Roundsling, 1 m	-	Lifting capacity: 1,000 kg.
Lifting shackle, 2 pcs	-	SA-10-8-NA1
Fork lift accessory set	3HAC058825-001	Contains fork lift pockets and all required hardware for installation. User instructions are enclosed with the tool, see Directions for use - Fork lift accessory for IRB 6700Inv. In order to rotate the robot, either use the turning tool or a fork lift truck with a rotator attachment.
Turning tool	3HAC061162-001	User instructions are enclosed.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

**Required consumables**

Equipment, etc.	Article number	Note
Bearing grease	3HAB3537-1	Shell Gadus S2V220 AC Used for lubrication of the bearings at the cradle.
Bearing grease	3HAB3537-1	Shell Gadus S2V220 AC Used for lubrication of the spherical roller bearing.
VK cover, 28x7 (2 pcs)	3HAA2166-12	Located at the front link ear of the balancing device.
VK cover, 100x10 (2 pcs)	3HAA2166-13	Located at the cradle of the balancing device.
Locking liquid		Loctite 2701
Locking liquid	3HAB7116-1	Loctite 243

*Continues on next page*

## 4 Repair

### 4.6.2 Replacing the balancing device

*Continued*

#### Required documents

Document	Document number
Directions for use - Fork lift accessory for IRB 6700Inv	3HAC060303
User instructions for turning tool (enclosed with the turning tool)	-

#### Removing the balancing device

Use these procedures to remove the balancing device.

#### Securing the lower arm

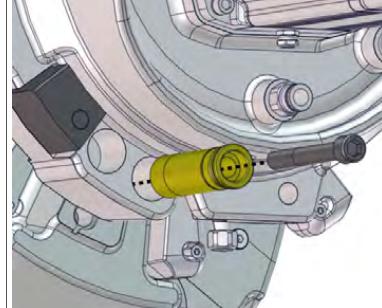
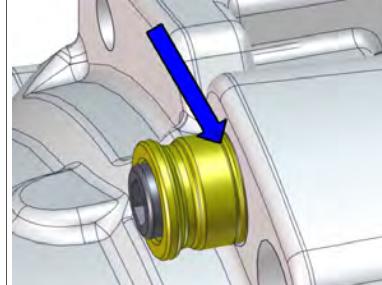
Use this procedure to secure the lower arm before lifting down the robot from inverted position.

Action	Note
1 Jog the robot into position: <ul style="list-style-type: none"><li>• Axis 1: 0°</li><li>• Axis 2: -35°</li><li>• Axis 3: +65°</li><li>• Axis 4: 0°</li><li>• Axis 5: +60°</li><li>• Axis 6: no significance</li></ul>	 xx1700000555
2 Remove the transportation lock screw and the yellow sleeve from the parking position.	 xx1700000270

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#### 4.6.2 Replacing the balancing device

*Continued*

Action	Note
<p>3 Insert the yellow sleeve and the transportation lock screw in the hole at the locking position. Insert the sleeve all the way so that the marking in the sleeve is aligned with the casting, see figure. Tighten the screw.</p> <p> <b>DANGER</b></p> <p>Always use the transportation lock screw and sleeve to lock the lower arm at transportation, turning and floor standing.</p>	<p>Tightening torque: 70 Nm <math>\pm</math>15 Nm.</p>  <p>xx1700000269</p>  <p>xx1600002114</p>

#### Lifting down the robot from inverted position

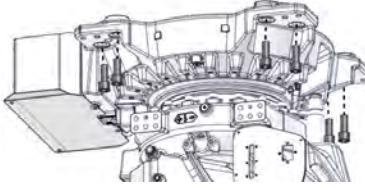
Action	Note
<p>1 If the robot is to be secured to the floor, prepare an area where the robot can be secured with the attachment bolts. The robot must always be secured to the floor if any kind of repair or maintenance work is to be performed.</p>	<p>Suitable screws, lightly lubricated: M24x100 (8 pcs) For hole configuration, see <a href="#">Hole configuration, base on page 74</a>.</p>
2 Verify that the lower arm is secured with the transportation lock screw.	
3 Remove any payload from the robot.	DressPack can stay fitted.
<p>4</p> <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>	
5 Disconnect the robot cables at the base.	
<p>6</p> <p> <b>CAUTION</b></p> <p>The IRB 6700Inv robot weighs 1,750 kg. All lifting accessories used must be sized accordingly.</p>	

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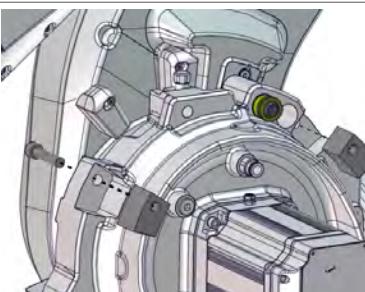
## 4 Repair

### 4.6.2 Replacing the balancing device

*Continued*

	Action	Note
7	Install the fork lift pockets on the robot, if not already installed.	See user instructions enclosed with the fork lift accessory set. Fork lift accessory set: 3HAC058825-001.
8	Insert the forks of the fork lift truck into the fork lift pockets, as far as possible.	
9	Raise the forks of the fork lift truck to make sure that the weight of the robot rests on the forks.   <b>Tip</b>  Two M16 screws can be fitted to the fork lift pockets, to press the forks against the pockets and make the lift more stable.	
10	Remove the bolts that secure the robot to the foundation.	Quantity: 8 pcs.   xx1600002098
11	Rotate the robot to floor standing position, using the turning tool or using a fork lift truck with a rotator attachment.	Only one direction for rotation is allowed with the turning tool. Follow the user instructions enclosed with the turning tool.
12	Lower and secure the robot to the floor.	Attachment screws: M24x100 (8 pcs).

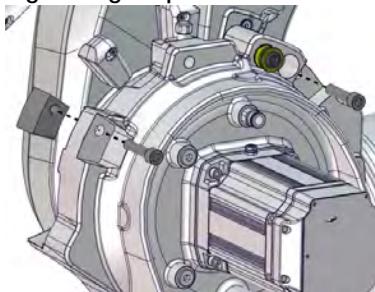
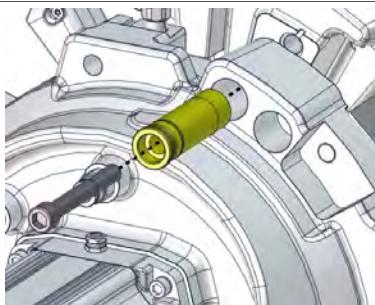
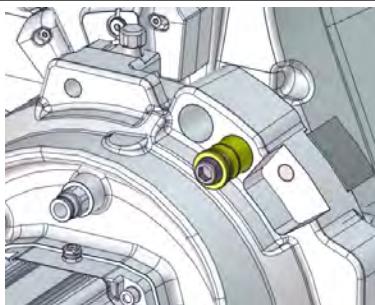
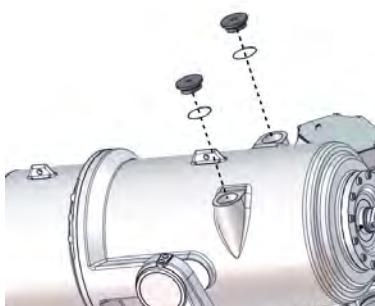
### Unloading the balancing device

	Action	Note
1	Verify that the robot is secured to the foundation.	Attachment screws: M24x100 (8 pcs).
2	Remove the two service stops from their parking position.	 xx1700000067

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#### 4.6.2 Replacing the balancing device

*Continued*

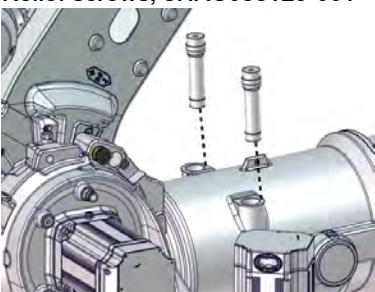
	Action	Note
3	Fit the service stops in maintenance position.	Tightening torque: 70 Nm $\pm 15$ Nm.  xx1700000068
4	Remove the transportation lock screw and yellow sleeve from locking position. <b>Note</b> It is only allowed to remove the transportation lock screw and sleeve, if the service stops are in maintenance position, when the robot is floor standing.	 xx1700000347
5	Fit the transportation lock screw and the yellow sleeve in their parking position.	 xx1700000348
6	Jog axis 2 to -4° to be able to insert the relief screws.	
7	Remove the covers on the balancing device. <b>Note</b> The covers have to be refitted after repair or maintenance.	 xx1700000451

*Continues on next page*

## 4 Repair

### 4.6.2 Replacing the balancing device

*Continued*

	Action	Note
8	Fit the relief screws to unload the balancing device.	<p>Tightening torque: <math>70 \text{ Nm} \pm 15 \text{ Nm}</math>          Relief screws, 3HAC058129-001</p>  <p>xx1700000070</p>
9	Jog axis 2 to $+15^\circ$ .	
10	 <b>DANGER</b>	
	<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>	

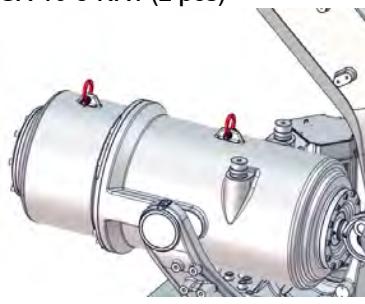
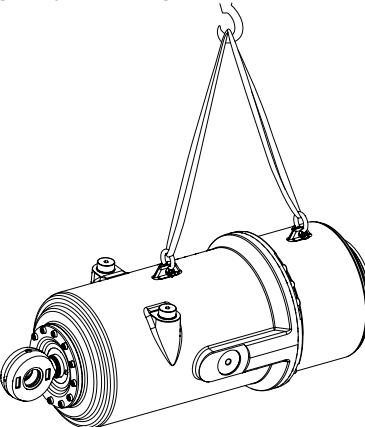
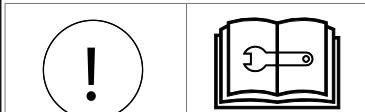
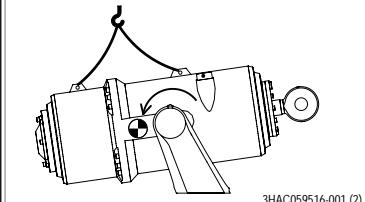
### Attaching lifting accessories to the balancing device

	Action	Note
1	 <b>CAUTION</b>	

*Continues on next page*

## 4.6.2 Replacing the balancing device

Continued

	Action	Note
2	Fasten lifting shackles on the balancing device.	<p>SA-10-8-NA1 (2 pcs)</p>  <p>xx1700000086</p>
3	Fasten the lifting slings.	<p>Roundsling, 1 m (2 pcs) Lifting capacity: 1,000 kg.</p>  <p>xx1700000087</p>
4	<p>Raise the lifting slings to take the weight of the balancing device.</p> <p><b>CAUTION</b></p> <p>The balancing device is heavy at the back, and will tip over when the link ear is loosened.</p>	  <p>3HAC059516-001 (2)</p> <p>xx1600002060</p>

## Removing the balancing device

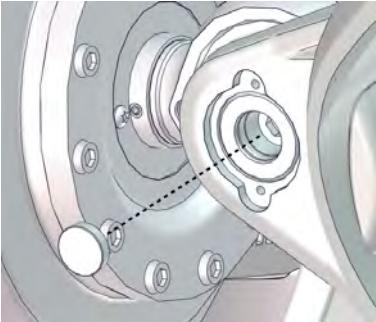
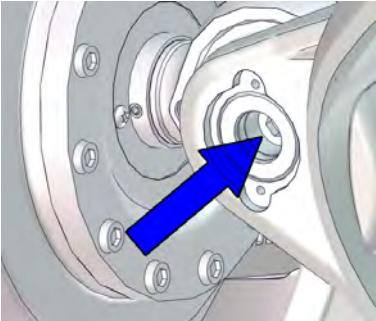
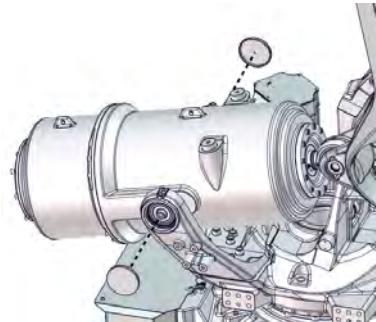
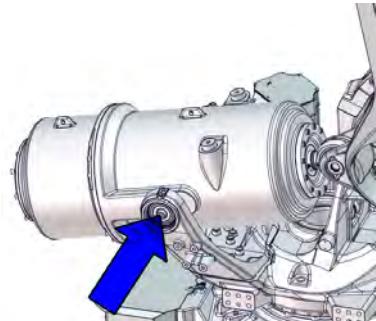
	Action	Note
1	Loosen the DressPack bracket, if mounted.	

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## 4 Repair

### 4.6.2 Replacing the balancing device

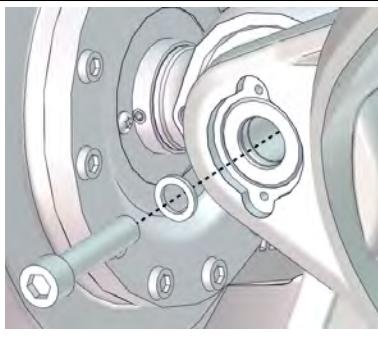
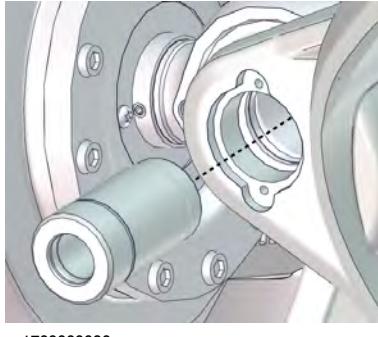
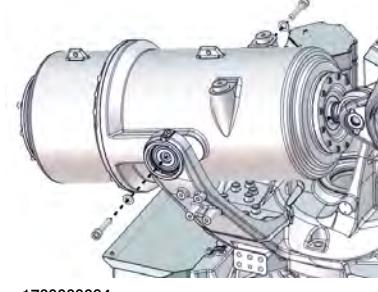
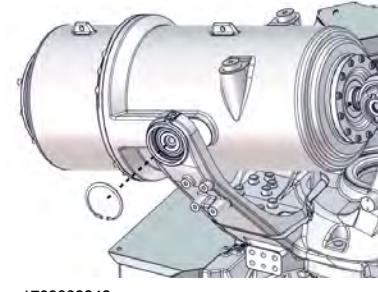
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Action	Note
2 Remove the VK cover at the link ear.	 xx1700000088
3 Loosen the attachment screw.   <b>Note</b>  Make sure that the lifting accessories hold the weight of the balancing device.	 xx1700000092
4 Remove the VK covers at the cradle.   <b>Tip</b>  Use high pressure air to remove the VK covers.	 It is possible to drive a screwdriver (or similar) through the VK cover, as close as possible to the center of the VK cover.   xx1700000091
5 Wipe off all residual grease inside the recess.	
6 Loosen the attachment screws.	 xx1700000093

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#### 4.6.2 Replacing the balancing device

*Continued*

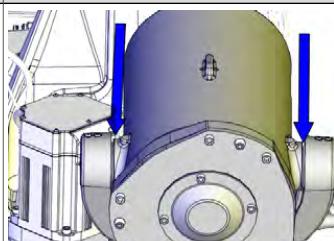
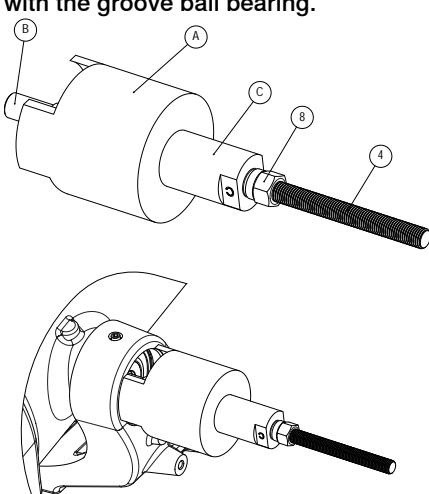
	Action	Note
7	<p>Remove the attachment screw and washer at the link ear.</p> <p><b>CAUTION</b></p> <p>The balancing device is heavy at the back, and will tip over when the link ear is loosened.</p>	 xx1700000089
8	<p>Use the dismantle and mounting tool and pull the shaft out.</p> <p><b>Press tool M</b></p>	<p>Dismantle and mounting tool: 3HAC028920-001</p>  xx1700000090
9	Remove attachment screws and washers at the cradle.	 xx1700000094
10	Remove the retaining ring bore.	 xx1700000343

*Continues on next page*

## 4 Repair

### 4.6.2 Replacing the balancing device

*Continued*

	Action	Note
11	Put a big screw driver between the cradle and balancing device and use it as a distance tool.	 xx1300000838
12	Apply the press tool and pull out the shaft end with the groove ball bearing.  xx1700000384	Dismantle and mounting tool: 3HAC028920-001

### Refitting the balancing device

Use these procedures to refit the balancing device.

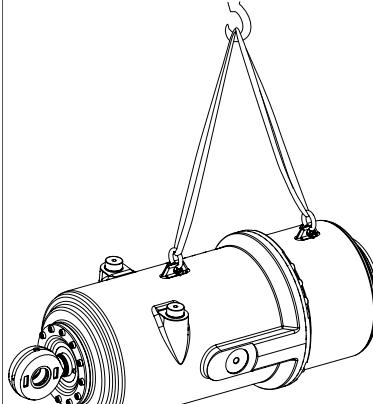
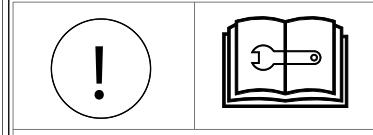
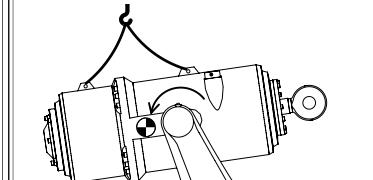
### Attaching lifting accessories to the balancing device

	Action	Note
1	 <b>CAUTION</b> The weight of the balancing device (excluding cradle) is 305 kg All lifting accessories used must be sized accordingly.	
2	Fasten lifting shackles on the balancing device.	SA-10-8-NA1 (2 pcs)  xx1700000086

*Continues on next page*

#### 4.6.2 Replacing the balancing device

*Continued*

Action	Note
3 Fasten the lifting slings.	<p>Roundsling, 1 m (2 pcs) Lifting capacity: 1,000 kg.</p>  <p>xx1700000087</p>
4 Raise the lifting slings to take the weight of the balancing device.   <b>CAUTION</b>  The balancing device is heavy at the back, and will tip over when the link ear is loosened.	  <p>3HAC059516-001 (2)</p> <p>xx1600002060</p>

#### Refitting the rear shafts

Perform this procedure on both sides of the balancing device.

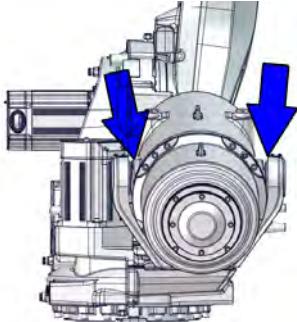
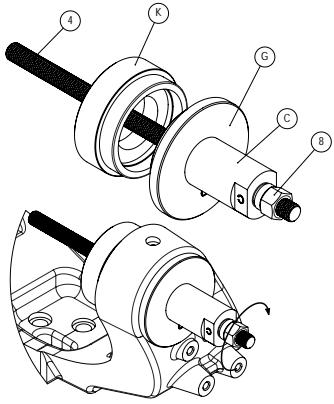
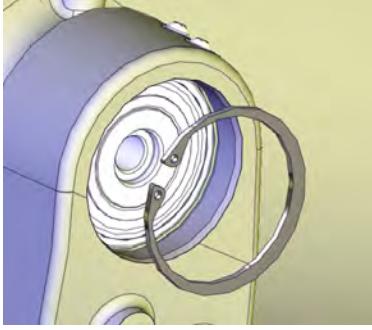
Action	Note
1  <b>DANGER</b>  Turn off all: <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> to the robot, before entering the robot working area.	
2 Lift the balancing device into position in the cradle.	

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## 4 Repair

### 4.6.2 Replacing the balancing device

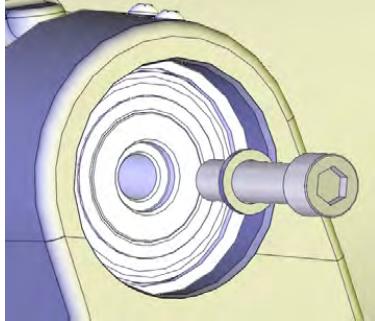
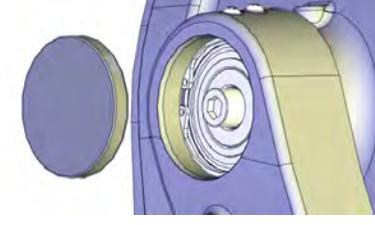
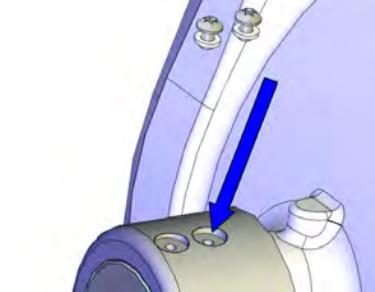
*Continued*

	Action	Note
3	Apply a big screwdriver between the cradle and the balancing device, when the shafts are refitted.	 xx1700000096
4	Press the shafts into position one at a time.  xx1700000406	Dismantle and mounting tool 3HAC028920-001
5	Fit the retaining ring.	 xx1300000664

*Continues on next page*

#### 4.6.2 Replacing the balancing device

*Continued*

	Action	Note
6	Apply locking liquid on the screws and secure the shafts.	Loctite 243 M16x70 12.9 Gleitmo 603+Geomet 500 (2 pcs) Tightening torque: 180 Nm  xx1300000663
7	Fit new VK covers.	VK cover, 100x10, 3HAA2166-13 (2 pcs)  xx1300000837
8	Unscrew both screws in the cradle and fill the bearing with grease from the inner hole until grease appears in the outer hole.	Shell Gadus S2V220 AC: 3HAB3537-1  xx1300000832
9	Refit the screws.	
10	Wipe clean from residual grease.	

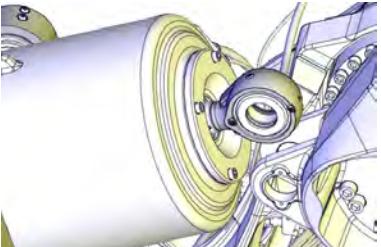
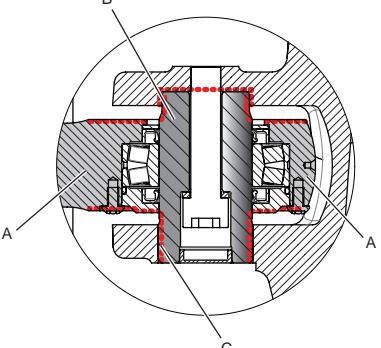
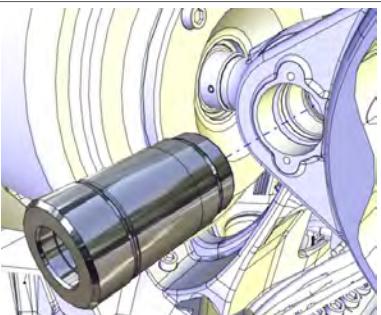
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## 4 Repair

### 4.6.2 Replacing the balancing device

*Continued*

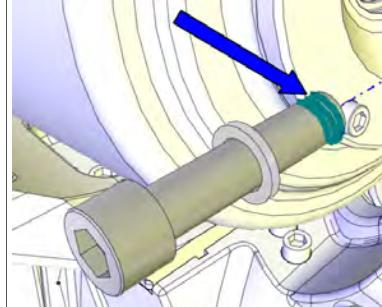
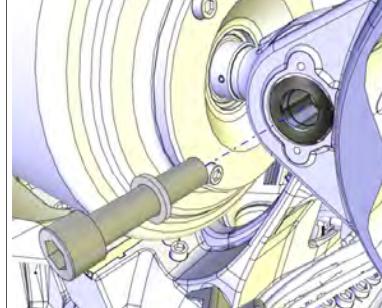
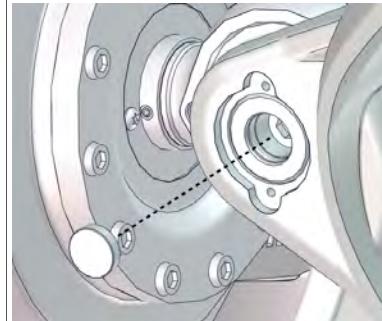
#### Refitting the front shaft

Action	Note
<p>1</p> <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>	
2 Remove all residues of Loctite in the screw hole of the shaft.	
3 Wipe all contact surfaces inside the recess clean from residual grease or other contamination.	
<p>4 Align the balancing device link ear with the hole in the lower arm.</p> <p> <b>Note</b></p> <p>Verify that the link ear is correctly turned.</p>	 xx1300000784
<p>5 <b>Foundry Plus:</b> Apply Mercasol on the surfaces on the shaft and front ear.</p>	 xx1400000368 <p>A Front link ear B Shaft C Mercasol (red dotted lines)</p>
<p>6 Lubricate the shaft and place it to the front ear.</p> <p> <b>Note</b></p> <p><b>Foundry Plus:</b> Do not lubricate surfaces where Mercasol is applied!</p>	 xx1200001280

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#### 4.6.2 Replacing the balancing device

*Continued*

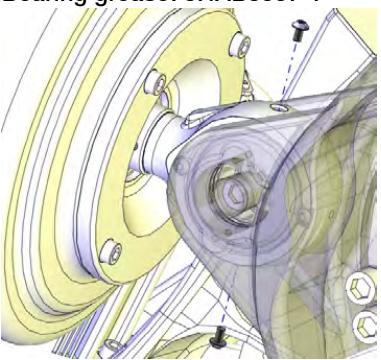
Action	Note
7 Press the shaft in with the hydraulic press tool. <b>Tool figure missing</b> xx1700000380	Hydraulic pump 80 MPa: 3HAC13086-1 Hydraulic cylinder: 3HAC11731-1 Dismantle and mounting tool: 3HAC028920-001 Press tool M
8 Apply locking liquid on the first threads of the screw.	Loctite 2701  xx1300000782
9 Secure the shaft with screw and washer.	Tightening torque: 180 Nm  xx1200001279
10 Fit a new VK-cover.	 xx1700000088

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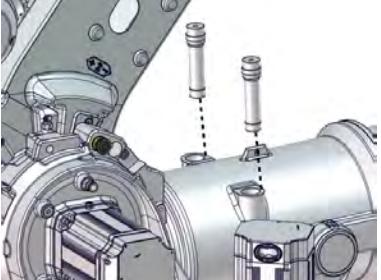
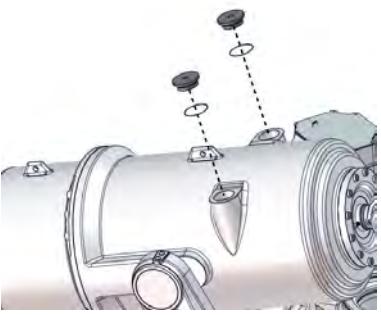
## 4 Repair

### 4.6.2 Replacing the balancing device

*Continued*

Action	Note
11 Unscrew both screws in link ear. Fill the bearing with grease from the upper hole, until the grease appears in the lower hole.	Bearing grease: 3HAB3537-1  xx1300000783
12 Refit the two screws and wipe clean from residual grease.	
13 Refit the DressPack bracket, if used.	

#### Restoring the balancing device

Action	Note
1 Remove the lifting equipment from the balancing device.	
2 Jog axis 2 to -4° in order to be able to remove the relief screws.	
3 Remove the relief screws to activate the balancing device.   Note Axis 2 must be in -4°.	 xx1700000070
4 Refit the covers. Make sure that the o-rings are still fitted.	 xx1700000451

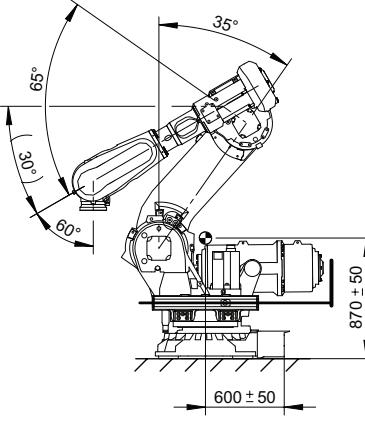
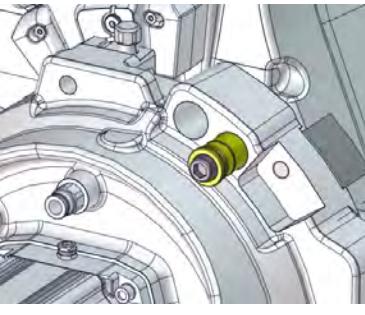
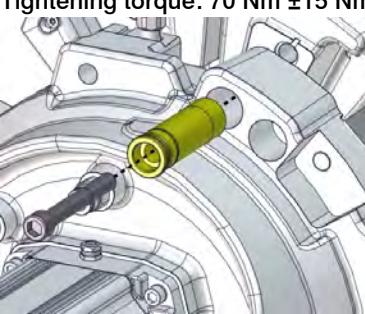
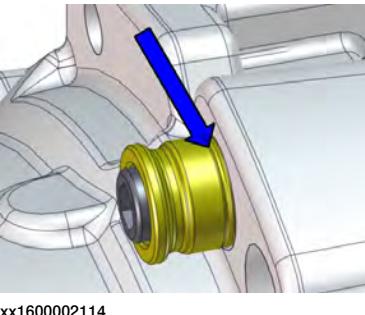
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#### 4.6.2 Replacing the balancing device

*Continued*

##### Securing the lower arm

Use this procedure to secure the lower arm before lifting the robot to inverted position.

Action	Note
1 Verify that the robot stands in position: <ul style="list-style-type: none"> <li>• 0°</li> <li>• -35°</li> <li>• +65°</li> <li>• 0°</li> <li>• +60°</li> <li>• no significance</li> </ul>	
2 Remove the transportation lock screw and the yellow sleeve from the parking position.	
3 Insert the yellow sleeve and the transportation lock screw in the hole at the locking position. Insert the sleeve all the way so that the marking in the sleeve is aligned with the casting, see figure. Tighten the screw.  <b>DANGER</b> Always use the transportation lock screw and sleeve to lock the lower arm at transportation, turning and floor standing.	<p>Tightening torque: 70 Nm ±15 Nm</p>  <p>xx1700000348</p>  <p>xx1600002114</p>

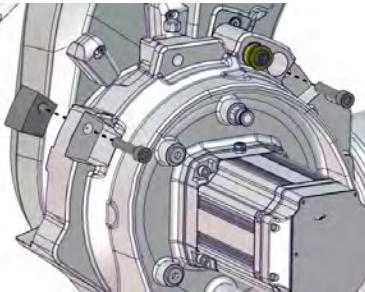
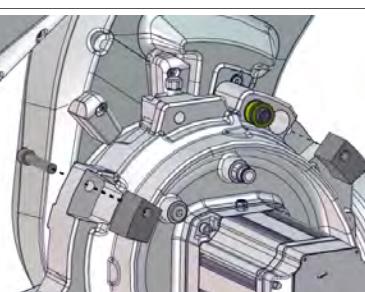
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## 4 Repair

### 4.6.2 Replacing the balancing device

*Continued*

Preparations before lifting up the robot to inverted position

Action	Note
1 Remove the two service stops from maintenance position, if previously moved there.	 xx1700000068
2 Fit the service stops in their parking position.	 xx1700000067
3 Fasten the fork lift accessory.	See user instructions enclosed with the fork lift accessory. Fork lift accessory set: 3HAC058825-001.
4 Remove the bolts securing the robot to the foundation.	

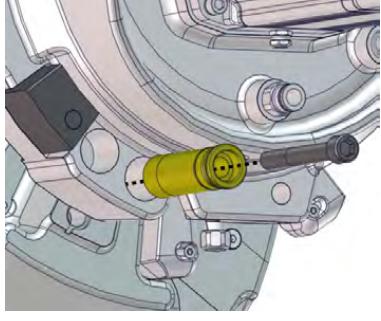
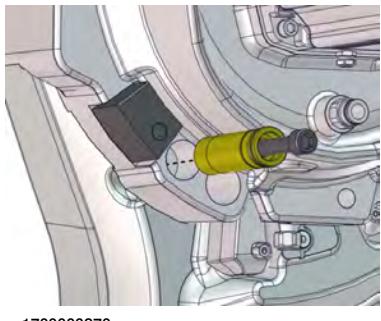
Orienting and securing the robot

Action	Note
1 Lift the robot using the fork lift accessory.	See user instructions enclosed with the fork lift accessory.
2 Move the robot close to its installation location.	
3 Rotate the robot into inverted position using the turning tool or using a fork lift truck with a rotator attachment.	See user instructions enclosed with the turning tool.
<p> <b>DANGER</b></p> <p>Make sure that there is enough space underneath the robot. See user instructions for the turning tool.</p>	
4 Guide the robot using two M24 screws while lifting it into its mounting position.	

*Continues on next page*

## 4.6.2 Replacing the balancing device

*Continued*

	Action	Note
5	Fit the bolts and washers in the base attachment holes.	Specified in <a href="#">Attachment screws on page 75</a>
	 <b>Note</b> Lightly lubricate screws before assembly.	
6	Tighten bolts in a crosswise pattern to ensure that the base is not distorted.	
7	Remove the yellow sleeve and transportation lock screw from the transportation and turning position.	 xx1700000269
8	Fasten the yellow sleeve and transportation lock screw in its parking position.	 xx1700000270

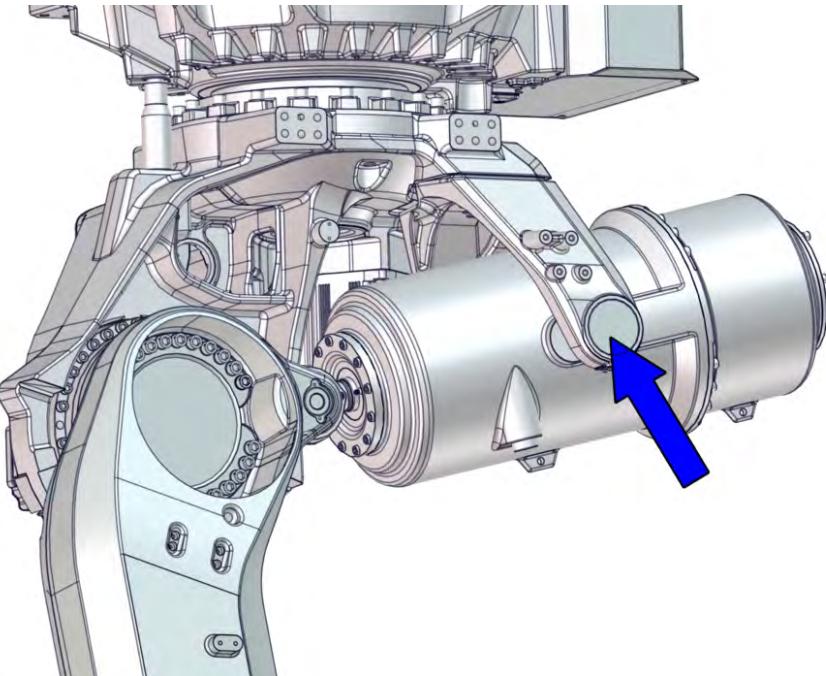
## 4 Repair

### 4.6.3 Replacing the rear bearings on the balancing device

#### 4.6.3 Replacing the rear bearings on the balancing device

##### Location of the rear bearings

The rear bearings are located on each side of the balancing device.



xx1700000342

##### Summary of the replacement procedure

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

- 1 Lift down the robot to floor standing.
- 2 Unload the balancing device.
- 3 Replace the rear bearings.
- 4 Restore the balancing device.
- 5 Lift up and rotate the robot to inverted position.

##### Required spare parts



###### Note

The spare part numbers that are listed in the table can be out of date. See the latest revision of *Product manual, spare parts - IRB 6700* on ABB Library.

Spare part	Article number	Note
Maintenance kit, cradle	3HAC048834-001	The maintenance kit contains bearings, radial sealings, retaining rings, and VK covers.

Continues on next page

### 4.6.3 Replacing the rear bearings on the balancing device

*Continued*

#### Required tools and equipment

Equipment	Article number	Note
Relief screws	3HAC058129-001	Used for unloading the balancing device. Included in spare part balancing device.
Dismantle and mounting tool	3HAC028920-001	Used for removing and fitting shaft and bearings.
Lifting shackle, 2 pcs	-	SA-10-8-NA1
Roundsling, 1 m	-	Lifting capacity: 1,000 kg.
Threaded bar, M16x340	-	
Press tool G	3HAC027146-001	
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

#### Required consumables

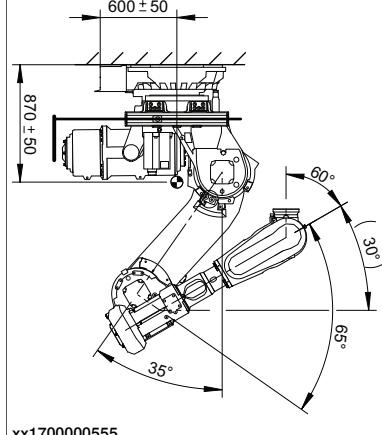
Consumable	Article number	Note
VK cover, 100x10 (2 pcs)	3HAA2166-13	Also included in the maintenance kit.
Bearing grease	3HAB3537-1	Shell Gadus S2V220 AC
Locking liquid	3HAB7116-1	Loctite 243

#### Removing the rear bearings on the balancing device

Use these procedures to remove the rear bearings.

#### Securing the lower arm

Use this procedure to secure the lower arm before lifting down the robot from inverted position.

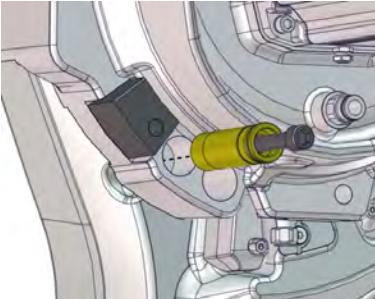
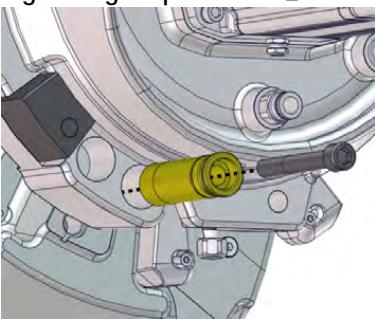
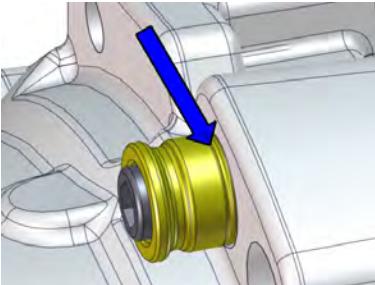
	Action	Note
1	<p>Jog the robot into position:</p> <ul style="list-style-type: none"> <li>• Axis 1: 0°</li> <li>• Axis 2: -35°</li> <li>• Axis 3: +65°</li> <li>• Axis 4: 0°</li> <li>• Axis 5: +60°</li> <li>• Axis 6: no significance</li> </ul>	

*Continues on next page*

## 4 Repair

### 4.6.3 Replacing the rear bearings on the balancing device

*Continued*

Action	Note
2 Remove the transportation lock screw and the yellow sleeve from the parking position.	 xx1700000270
3 Insert the yellow sleeve and the transportation lock screw in the hole at the locking position.  Insert the sleeve all the way so that the marking in the sleeve is aligned with the casting, see figure.  Tighten the screw.  <b>DANGER</b> Always use the transportation lock screw and sleeve to lock the lower arm at transportation, turning and floor standing.	Tightening torque: 70 Nm ±15 Nm.  xx1700000269  xx1600002114

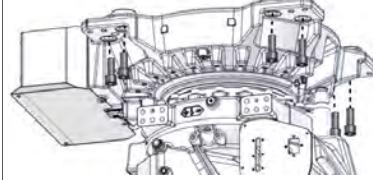
#### Lifting down the robot from inverted position

Action	Note
1 If the robot is to be secured to the floor, prepare an area where the robot can be secured with the attachment bolts.  The robot must always be secured to the floor if any kind of repair or maintenance work is to be performed.	Suitable screws, lightly lubricated: M24x100 (8 pcs) For hole configuration, see <a href="#">Hole configuration, base on page 74</a> .
2 Verify that the lower arm is secured with the transportation lock screw.	
3 Remove any payload from the robot.	DressPack can stay fitted.

*Continues on next page*

## 4.6.3 Replacing the rear bearings on the balancing device

*Continued*

Action	Note
4  <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.	
5 Disconnect the robot cables at the base.	
6  <b>CAUTION</b> The IRB 6700Inv robot weighs 1,750 kg. All lifting accessories used must be sized accordingly.	
7 Install the fork lift pockets on the robot, if not already installed.	See user instructions enclosed with the fork lift accessory set. Fork lift accessory set: 3HAC058825-001.
8 Insert the forks of the fork lift truck into the fork lift pockets, as far as possible.	
9  <b>Tip</b> Two M16 screws can be fitted to the fork lift pockets, to press the forks against the pockets and make the lift more stable.	
10 Remove the bolts that secure the robot to the foundation.	Quantity: 8 pcs.  xx1600002098
11 Rotate the robot to floor standing position, using the turning tool or using a fork lift truck with a rotator attachment.	Only one direction for rotation is allowed with the turning tool. Follow the user instructions enclosed with the turning tool.
12 Lower and secure the robot to the floor.	Attachment screws: M24x100 (8 pcs).

## Unloading the balancing device

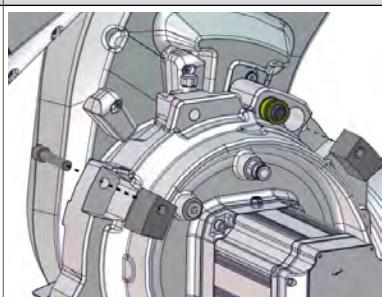
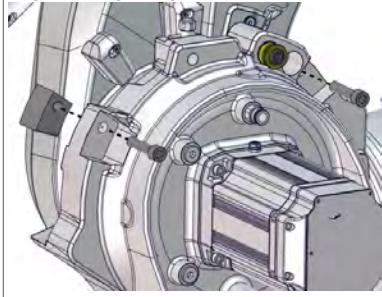
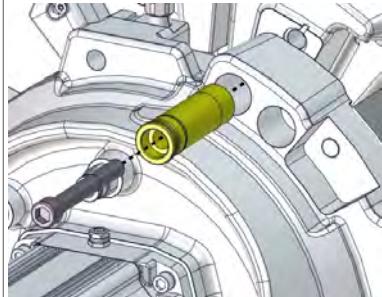
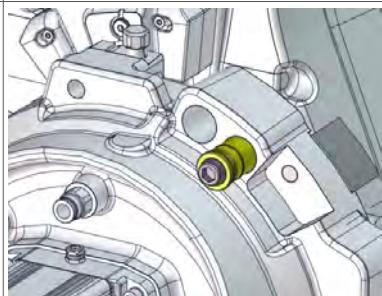
Action	Note
1 Verify that the robot is secured to the foundation.	Attachment screws: M24x100 (8 pcs).

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## 4 Repair

### 4.6.3 Replacing the rear bearings on the balancing device

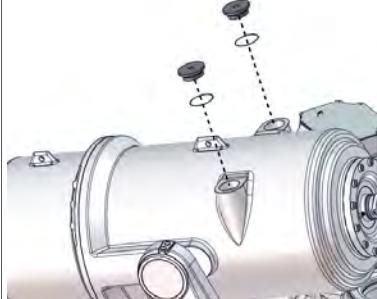
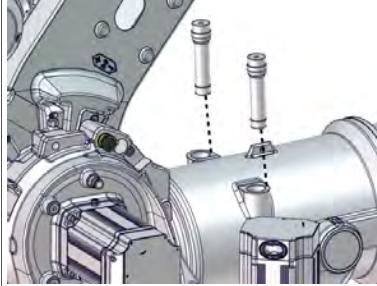
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Action	Note
2 Remove the two service stops from their parking position.	 xx1700000067
3 Fit the service stops in maintenance position.	<b>Tightening torque: 70 Nm ±15 Nm.</b>  xx1700000068
4 Remove the transportation lock screw and yellow sleeve from locking position.   <b>Note</b>  It is only allowed to remove the transportation lock screw and sleeve, if the service stops are in maintenance position, when the robot is floor standing.	 xx1700000347
5 Fit the transportation lock screw and the yellow sleeve in their parking position.	 xx1700000348
6 Jog axis 2 to -4° to be able to insert the relief screws.	

*Continues on next page*

## 4.6.3 Replacing the rear bearings on the balancing device

*Continued*

	Action	Note
7	<p>Remove the covers on the balancing device.</p> <p> <b>Note</b></p> <p>The covers have to be refitted after repair or maintenance.</p>	 xx1700000451
8	<p>Fit the relief screws to unload the balancing device.</p> <p> <b>DANGER</b></p> <p>Do not remove the relief screws when the balancing device is removed from the robot.</p>	<p>Tightening torque: <math>70 \text{ Nm} \pm 15 \text{ Nm}</math></p> <p>Relief screws, 3HAC058129-001</p>  xx1700000070
9	Jog axis 2 to $+15^\circ$ .	
10	<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>	

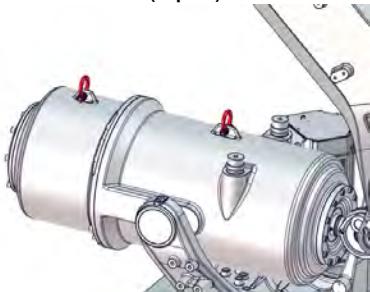
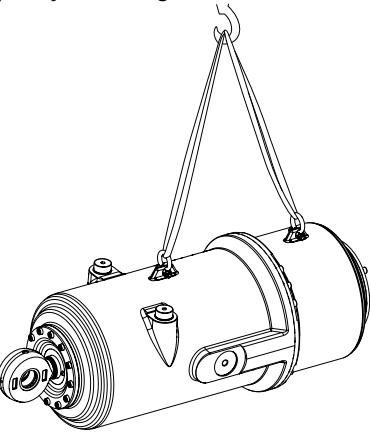
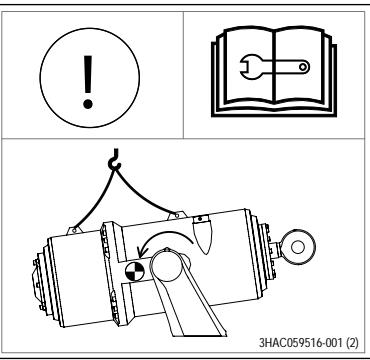
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## 4 Repair

### 4.6.3 Replacing the rear bearings on the balancing device

*Continued*

#### Attaching lifting accessories to the balancing device

	Action	Note
1	 <b>CAUTION</b> The weight of the balancing device (excluding cradle) is 305 kg All lifting accessories used must be sized accordingly.	
2	Fasten lifting shackles on the balancing device.	SA-10-8-NA1 (2 pcs)  xx1700000086
3	Fasten the lifting slings.	Roundsling, 1 m (2 pcs) Lifting capacity: 1,000 kg.  xx1700000087
4	Raise the lifting slings to take the weight of the balancing device.  <b>CAUTION</b> The balancing device is heavy at the back, and will tip over when the link ear is loosened.	 3HAC059516-001 (2) xx1600002060

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## 4.6.3 Replacing the rear bearings on the balancing device

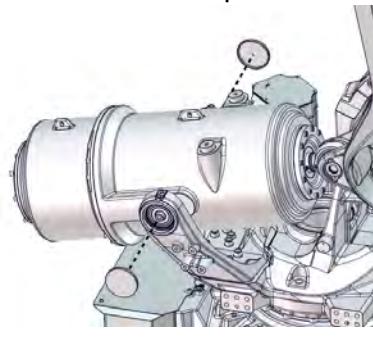
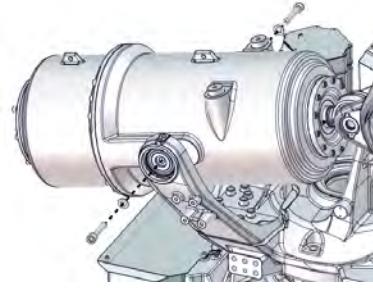
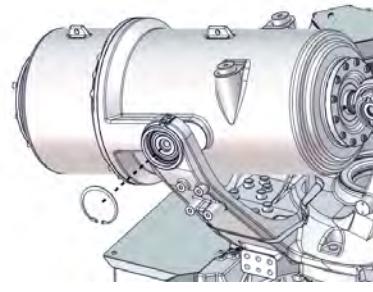
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## Removing the shaft end and rear bearings



## Note

Remove one shaft end and one bearing at a time.

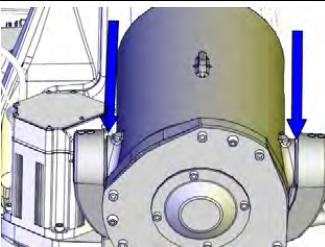
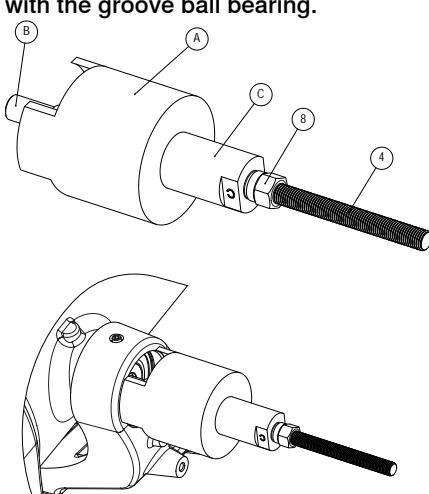
	Action	Note
1	<p>Remove the VK covers at the cradle.</p> <p> <b>Tip</b></p> <p>Use high pressure air to remove the VK covers.</p>	<p>It is possible to drive a screwdriver (or similar) through the VK cover, as close as possible to the center of the VK cover and pull it out.</p>  <p>xx1700000091</p>
2	Wipe off all residual grease inside the recess.	
3	Remove attachment screws and washers.	 <p>xx1700000094</p>
4	Remove the retaining ring bore.	 <p>xx1700000343</p>

*Continues on next page*

## 4 Repair

### 4.6.3 Replacing the rear bearings on the balancing device

*Continued*

Action	Note
5 Put a big screw driver between the cradle and balancing device and use it as a distance tool.	 xx1300000838
6 Apply the press tool and pull out the shaft end with the groove ball bearing.	Dismantle and mounting tool: 3HAC028920-001  xx1700000384

#### Refitting the rear bearings

Use these procedures to refit the bearings in the cradle.

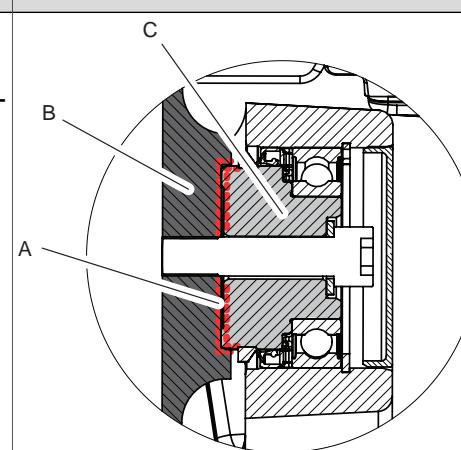
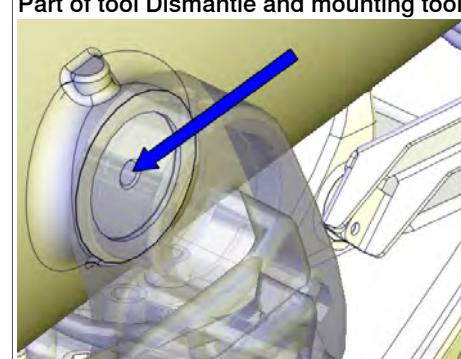
#### Refitting the shaft end and rear bearings

Action	Note
1 Wipe clean all contact surfaces from residual grease and other contamination inside the recess.	

*Continues on next page*

### 4.6.3 Replacing the rear bearings on the balancing device

*Continued*

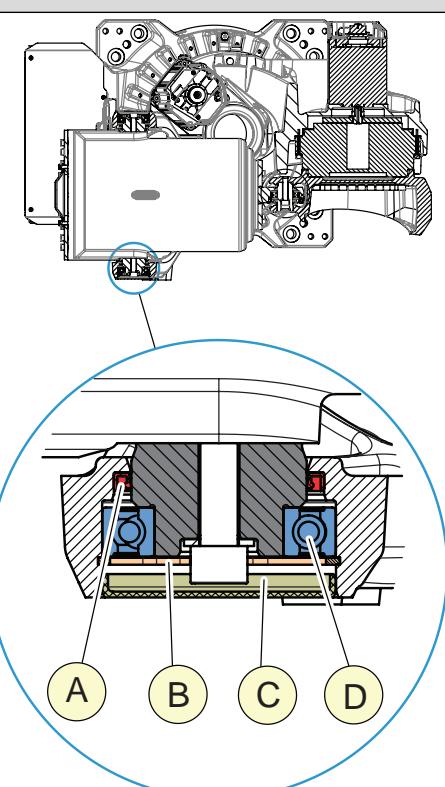
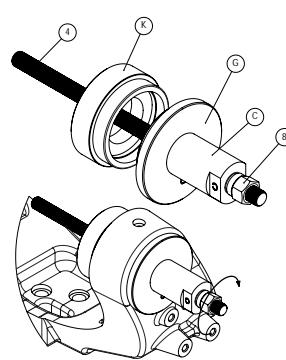
Action	Note
<p><b>2</b> <i>Foundry Plus:</i> Apply Mercasol on matching surfaces on the axis and balancing device. See the figure!</p>	 <p>xx1400000367</p> <p>A Mercasol (red dotted lines) B Balancing device C Shaft</p>
<p><b>3</b> Apply some grease in the hole for the bearing in the cradle.</p> <p><b>Note</b> Do not apply grease on surfaces with Mercasol.</p>	
<p><b>4</b> Apply a threaded bar into the hole in the balancing device.</p>	 <p>Part of tool Dismantle and mounting tool</p> <p>xx1300000831</p>

*Continues on next page*

## 4 Repair

### 4.6.3 Replacing the rear bearings on the balancing device

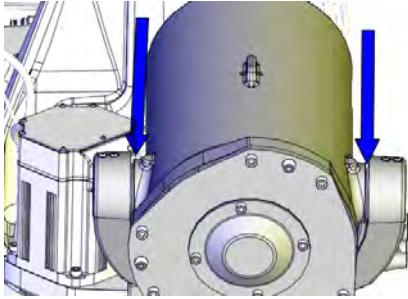
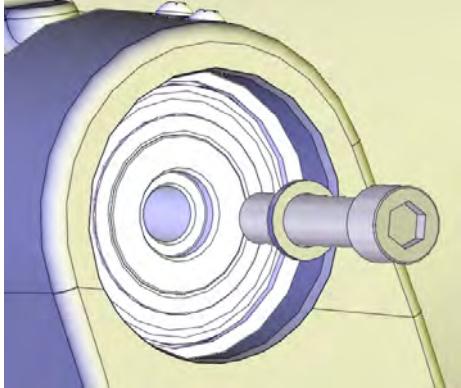
*Continued*

Action	Note								
5 Use caution and put radial sealing and groove ball bearing onto the shaft end manually.	 <p>xx1400001996</p> <table border="1"> <tr> <td>A</td><td>Radial sealing with dustlip(2 pcs)</td></tr> <tr> <td>B</td><td>Retaining ring bore (2 pcs)</td></tr> <tr> <td>C</td><td>VK-cover (2 pcs)</td></tr> <tr> <td>D</td><td>Groove ball bearing (2 pcs)</td></tr> </table>	A	Radial sealing with dustlip(2 pcs)	B	Retaining ring bore (2 pcs)	C	VK-cover (2 pcs)	D	Groove ball bearing (2 pcs)
A	Radial sealing with dustlip(2 pcs)								
B	Retaining ring bore (2 pcs)								
C	VK-cover (2 pcs)								
D	Groove ball bearing (2 pcs)								
6 Put the shaft end with the fitted parts, on the threaded bar.									
7 Manually press the shaft end into the cradle a little.									
8 Apply the press tool, hydraulic pump and nut on the threaded bar. Do not press yet!	<p>Hydraulic pump 80 MPa, 3HAC13086-1 To be used with the hydraulic cylinder.. Hydraulic cylinder, 3HAC11731-1</p>  <p>xx1700000406</p>								

*Continues on next page*

## 4.6.3 Replacing the rear bearings on the balancing device

*Continued*

	Action	Note
9	Put a big screw driver between the cradle and balancing device and use it as a distance tool.	 xx1300000838
10	Use caution and press the shaft end in position.	
11	Remove the press tool and the threaded bar.	
12	Apply locking liquid on the attachment screw.	Loctite 243, 3HAB7116-1
13	While using the screw driver between the cradle and balancing device as a distance tool, tighten the attachment screw completely.	
14	Secure the balancing device.	Tightening torque: 280 Nm.  xx1300000663

## Restoring the balancing device

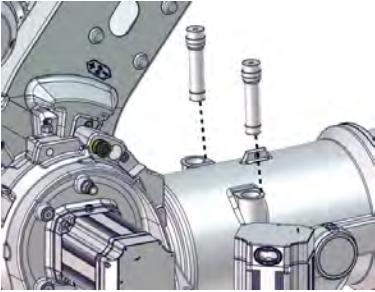
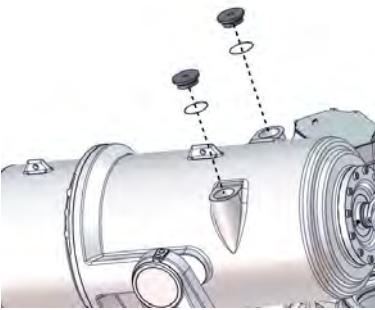
	Action	Note
1	Remove the lifting equipment from the balancing device.	
2	Jog axis 2 to -4° in order to be able to remove the relief screws.	

*Continues on next page*

## 4 Repair

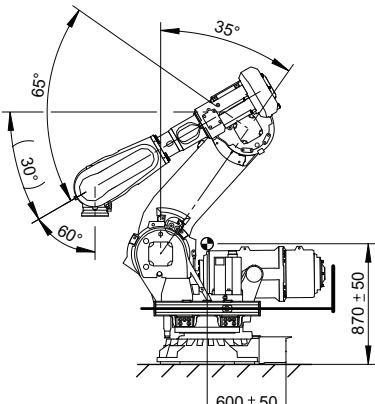
### 4.6.3 Replacing the rear bearings on the balancing device

*Continued*

Action	Note
3 Remove the relief screws to activate the balancing device.  Note Axis 2 must be in -4°.	 xx1700000070
4 Refit the covers. Make sure that the o-rings are still fitted.	 xx1700000451

#### Securing the lower arm

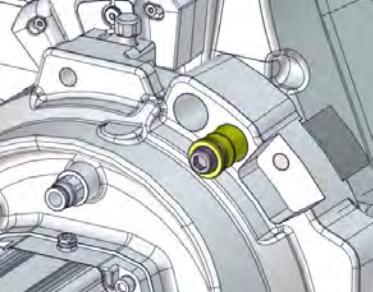
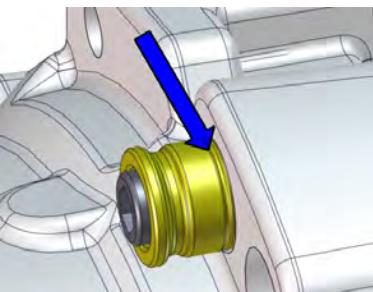
Use this procedure to secure the lower arm before lifting the robot to inverted position.

Action	Note
1 Verify that the robot stands in position: <ul style="list-style-type: none"><li>• 0°</li><li>• -35°</li><li>• +65°</li><li>• 0°</li><li>• +60°</li><li>• no significance</li></ul>	 xx1600001371

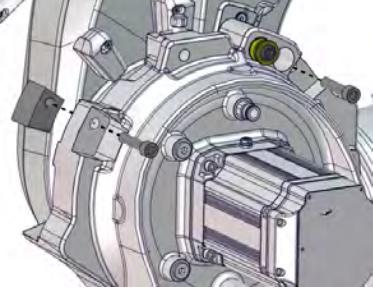
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## 4.6.3 Replacing the rear bearings on the balancing device

*Continued*

	Action	Note
2	Remove the transportation lock screw and the yellow sleeve from the parking position.	 xx1700000348
3	Insert the yellow sleeve and the transportation lock screw in the hole at the locking position. Insert the sleeve all the way so that the marking in the sleeve is aligned with the casting, see figure. Tighten the screw. <p style="text-align: center;"> <b>DANGER</b></p> <p>Always use the transportation lock screw and sleeve to lock the lower arm at transportation, turning and floor standing.</p>	Tightening torque: 70 Nm ±15 Nm  xx1700000347  xx1600002114

Preparations before lifting up the robot to inverted position

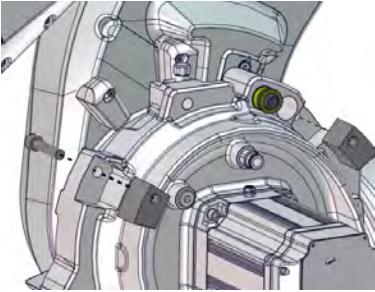
	Action	Note
1	Remove the two service stops from maintenance position, if previously moved there.	 xx1700000068

*Continues on next page*

## 4 Repair

### 4.6.3 Replacing the rear bearings on the balancing device

*Continued*

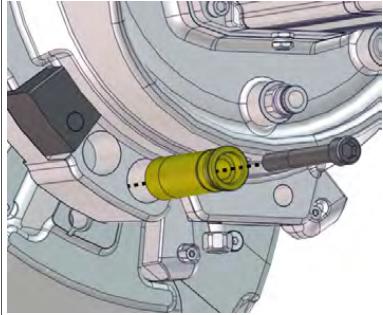
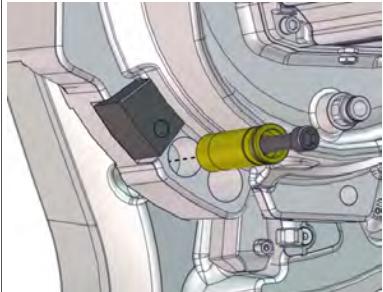
Action	Note
2 Fit the service stops in their parking position.	 xx1700000067
3 Fasten the fork lift accessory.	See user instructions enclosed with the fork lift accessory. Fork lift accessory set: 3HAC058825-001.
4 Remove the bolts securing the robot to the foundation.	

#### Orienting and securing the robot

Action	Note
1 Lift the robot using the fork lift accessory.	See user instructions enclosed with the fork lift accessory.
2 Move the robot close to its installation location.	
3 Rotate the robot into inverted position using the turning tool or using a fork lift truck with a rotator attachment.	See user instructions enclosed with the turning tool.
<p> <b>DANGER</b></p> <p>Make sure that there is enough space underneath the robot. See user instructions for the turning tool.</p>	
4 Guide the robot using two M24 screws while lifting it into its mounting position.	
5 Fit the bolts and washers in the base attachment holes.	Specified in <a href="#">Attachment screws on page 75</a>
<p> <b>Note</b></p> <p>Lightly lubricate screws before assembly.</p>	
6 Tighten bolts in a crosswise pattern to ensure that the base is not distorted.	

*Continues on next page*

#### 4.6.3 Replacing the rear bearings on the balancing device *Continued*

	Action	Note
7	Remove the yellow sleeve and transportation lock screw from the transportation and turning position.	 xx1700000269
8	Fasten the yellow sleeve and transportation lock screw in its parking position.	 xx1700000270

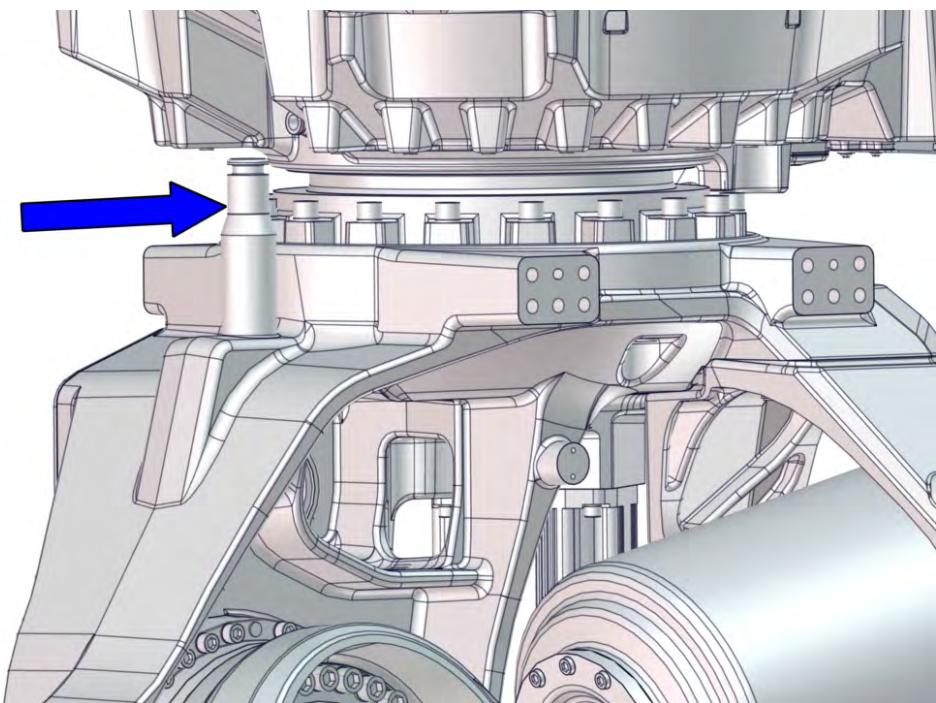
## 4 Repair

### 4.6.4 Replacing the stop pin

#### 4.6.4 Replacing the stop pin

##### Location of the stop pin

The stop pin is located as shown in the figure.



xx1700000351

##### Spare part

Equipment	Article number	Note
Stop pin	See <i>Product manual, spare parts - IRB 6700</i> .	

##### Required tools and equipment

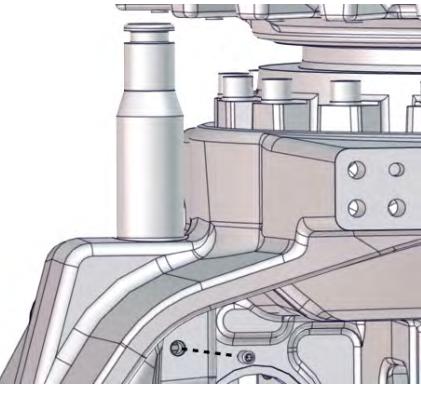
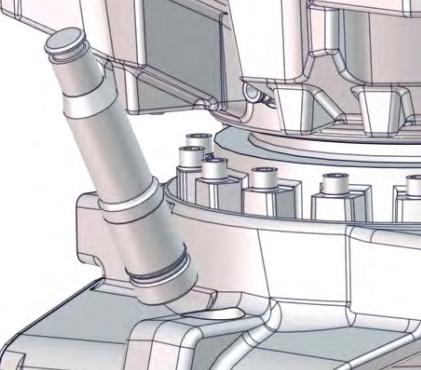
Equipment, etc.	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

##### Required consumables

Consumable	Article number	Note
Locking liquid	3HAB7116-1	Loctite 243
Foundry plus: Rust preventive		Mercasol

Continues on next page

**Removing the stop pin**

	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 robot working area.	
2	Hold the mechanical stop pin in a firm grip. Remove the set screw, cup point.	 xx1700000356
3	Remove the stop pin.	 xx1700000358

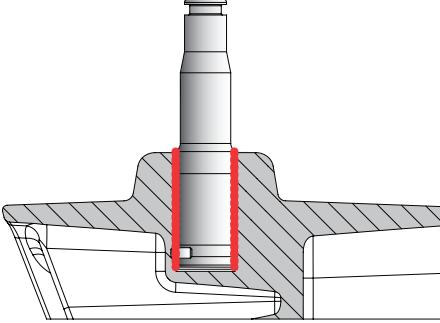
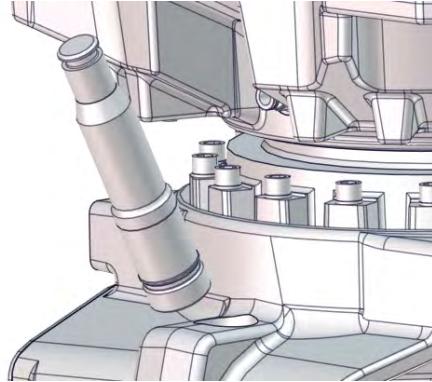
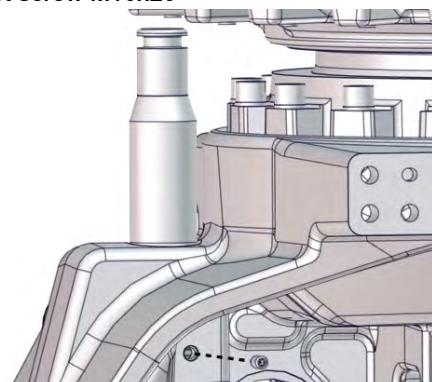
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## 4 Repair

### 4.6.4 Replacing the stop pin

Continued

#### Refitting the stop pin

Action	Note
1 <b>Foundry Plus:</b> Apply Mercasol on the surfaces shown in the figure, on stop pin and in the hole as shown in the figure.	 xx1700000414
2 Fit the stop pin.	 xx1700000358
3 Apply locking liquid on the set screw, and secure the stop pin.	Loctite 243 Set screw M10x20  xx1700000356

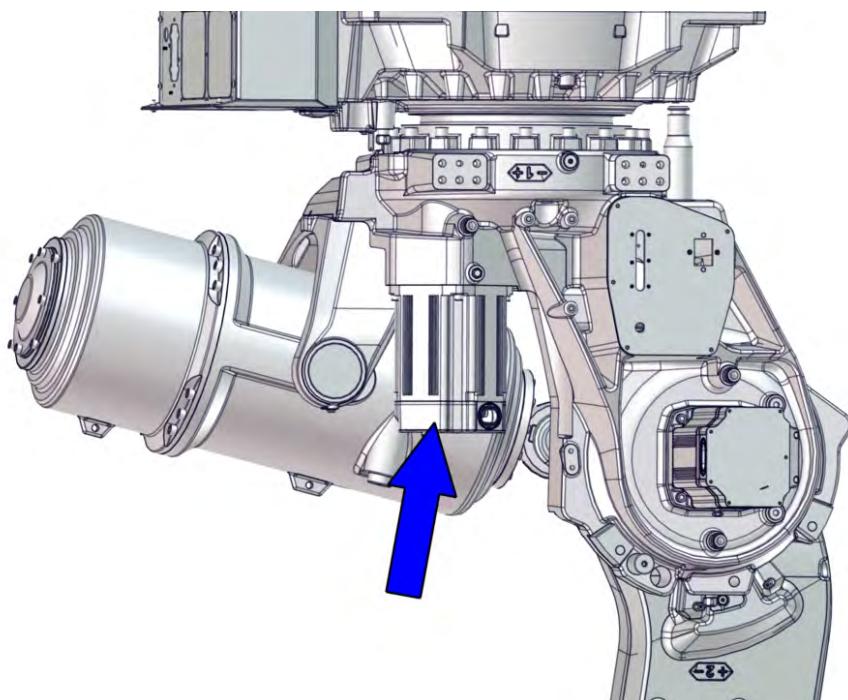
## 4.7.1 Replacing the axis-1 motor

## 4.7 Motors

## 4.7.1 Replacing the axis-1 motor

## Location of the axis-1 motor

The motor is located as shown in the figure.



xx1700000359

## Summary of the replacement procedure

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

- 1 Attach the lifting tools
- 2 Remove the motor
- 3 Refit the motor
- 4 Remove the lifting tools.

## Spare parts

Spare part	Spare part number	Note
Axis-1 motor	See <i>Product manual, spare parts - IRB 6700</i> .	

## Required tools and equipment

Equipment, etc.	Article number	Note
Removal tool axis-1 motor	3HAC055444-001	Used to lower and raise the motor axis-1 (inverted position).

*Continues on next page*

## 4 Repair

### 4.7.1 Replacing the axis-1 motor

*Continued*

Equipment, etc.	Article number	Note
Removal tool M12	3HAC057339-003	Used to push out the motor, if necessary. Always use removal tools in pairs.
Roundsling, 1 m	-	Lifting capacity: 1,000 kg.
Lifting eye, M12	3HAC16131-1	
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Rotation tool	3HAB7887-1	Used to rotate the motor pinion.
24 VDC power supply	-	Used to release the motor brakes.
Leak-down tester	-	
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

### Consumables

Equipment, etc.	Article number	Note
Grease	3HAB3537-1	Used to lubricate o-rings, Shell Gadus S2V220 AC.
Grease	-	Castrol Molub. Alloy 777-1 NG Used on hub splines to prevent from fretting corrosion.
O-ring	3HAC054692-002	D=169.5x3 Used on motor cover.
O-ring	3HAB3772-107	D=102x3 Used on motor flange.

### 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>	

*Continues on next page*

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>	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 692</a> .
<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-1 motor

These procedures describe how to remove the motor.

#### Preparations before removing the axis-1 motor

Action	Note
1 Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2 Jog the robot to the synchronization position.	
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 robot working area.	

#### Disconnecting the motor cables

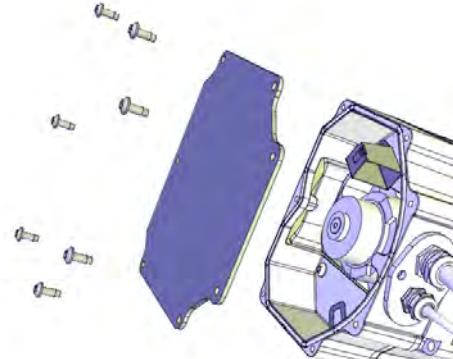
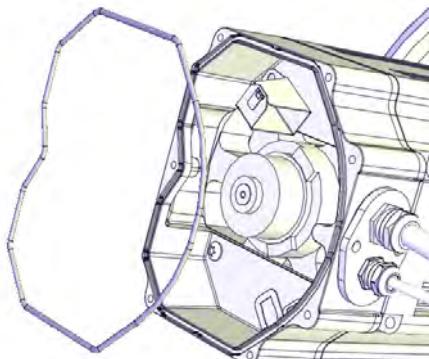
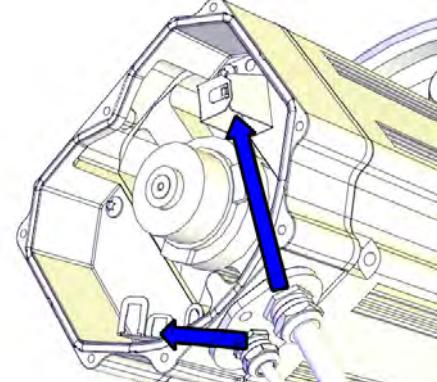
Action	Note
1  <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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## 4 Repair

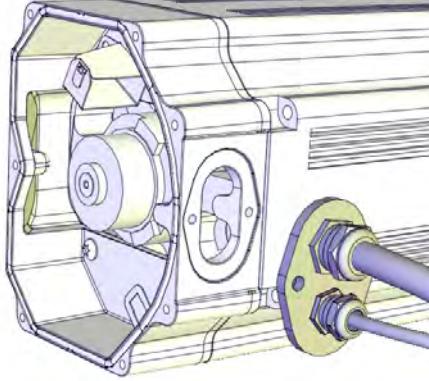
### 4.7.1 Replacing the axis-1 motor

*Continued*

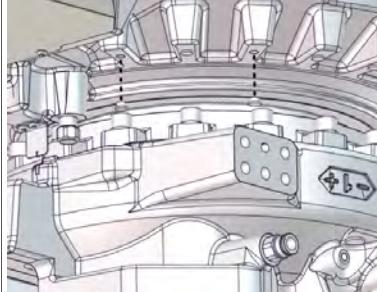
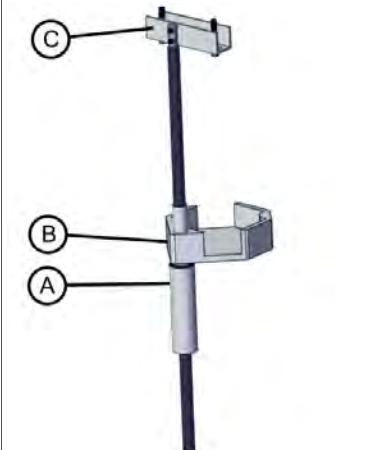
Action	Note
2 Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135
3 Make sure the o-ring is present.	 xx1200001070
4 Disconnect the motor cables.	 xx1200001066

*Continues on next page*

#### 4.7.1 Replacing the axis-1 motor Continued

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

##### Attaching the removal tool

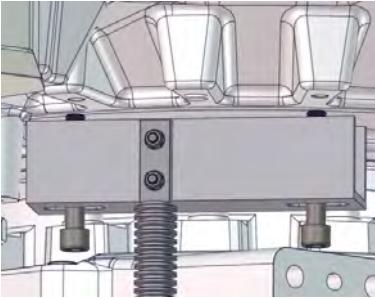
Action	Note						
<p>1 <i>Foundry plus:</i> Remove the plastic plugs.</p>	 <p>xx1700000364</p>						
<p>2 Lower the revolving handle on the removal tool, to be able to fit the shelf beneath the motor while fastening the tool.</p>	 <p>xx1700000365</p> <table border="1"> <tr> <td>A</td> <td>Revolving handle</td> </tr> <tr> <td>B</td> <td>Shelf</td> </tr> <tr> <td>C</td> <td>Bracket</td> </tr> </table>	A	Revolving handle	B	Shelf	C	Bracket
A	Revolving handle						
B	Shelf						
C	Bracket						

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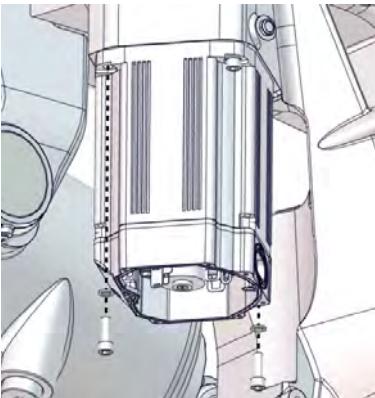
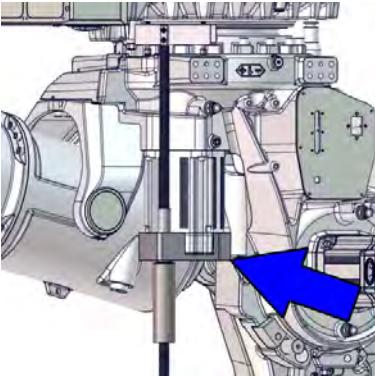
## 4 Repair

### 4.7.1 Replacing the axis-1 motor

*Continued*

	Action	Note
3	Attach the tools bracket screws to the robot frame.	 xx1700000366

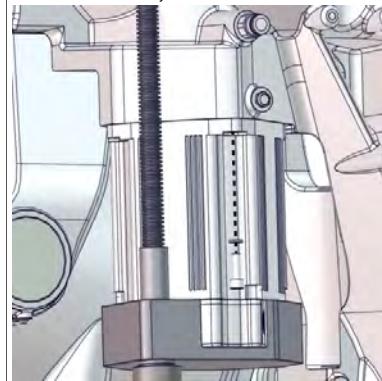
#### Removing the axis-1 motor

	Action	Note
1	Remove the two shown motor screws and washers.	 xx1700000368
2	Raise the revolving handle to fit the motor on the tool shelf.	 xx1700000367

*Continues on next page*

### 4.7.1 Replacing the axis-1 motor

*Continued*

Action	Note
3 Remove the two remaining screws holding the motor. (One screw is placed on the opposite side of the motor.)  ! <b>CAUTION</b> Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.	Bits extender, 3HAC12342-1  xx1700000369
4 To release the brakes, connect the 24 VDC power supply. Connect to R2.MP1-connector: <ul style="list-style-type: none"><li>• + = pin 2</li><li>• - = pin 5</li></ul>	24 VDC power supply
5 Lower the revolving handle.	If the motor is stuck, use Removal tool M12: 3HAC057339-003
6 Rotate the shelf to remove the motor.  ! <b>CAUTION</b> The weight of the motor is 27 kg All lifting accessories used must be sized accordingly.	
7 Disconnect the 24 VDC power supply.	
8 Fasten lifting eyes in two of the fastening holes on the motor.	Lifting eye, M12, 3HAC16131-1
9 Use a roundsling to lift the motor off.	

#### Refitting the axis-1 motor

These procedures describes how to refit the motor.

#### Preparations prior to refitting motor

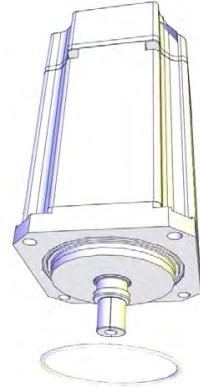
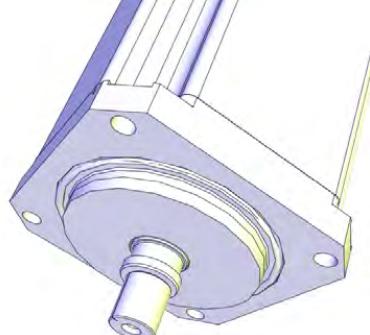
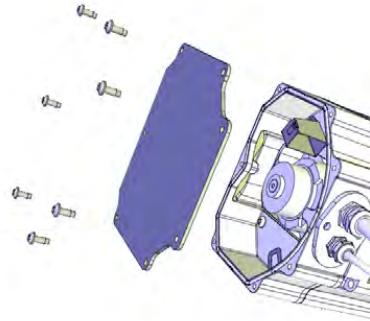
Action	Note
1 ! <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Remove old paint residues and other contamination from the contact surfaces on both the motor and the mating parts.	

*Continues on next page*

## 4 Repair

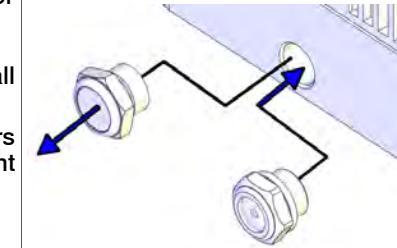
### 4.7.1 Replacing the axis-1 motor

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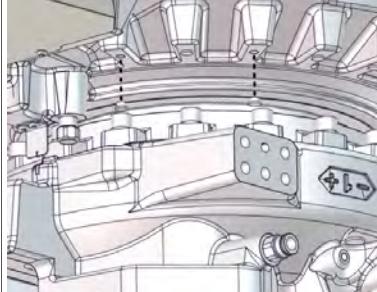
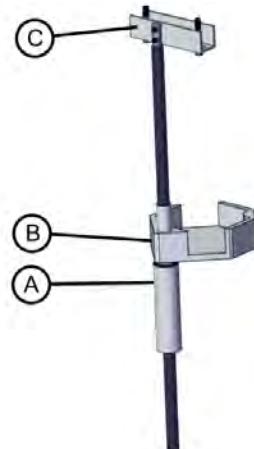
Action	Note
3 Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4 Check the o-ring. Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
5 Make sure the o-ring is seated in the groove.   <b>Tip</b> Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020
6 If the motor is a new spare part, remove the cover.	 xx1200001135

*Continues on next page*

#### 4.7.1 Replacing the axis-1 motor Continued

	Action	Note
7	<p><b>Foundry Plus:</b>            Valid for axis-2, axis-3, axis-4 and axis-6 motors.            If the motor is a new spare part, the protection filter located in the evacuation hole on the motor flange must be replaced with a transparent plug/sight glass (enclosed with the spare part delivery). Remove the protection filter and install the transparent plug/sight glass.            On the axis-6 motor there are two protection filters that must be replaced with transparent plugs/sight glasses.</p>	<p>Tightening torque, transparent plug: 25 Nm <math>\pm 10\%</math>.            Tightening torque, protection filter: 10 Nm <math>\pm 10\%</math>.</p>  <p>xx1600000576</p>

##### Attaching the removal tool

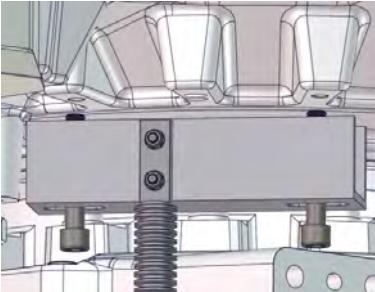
	Action	Note						
1	<p><b>Foundry plus:</b>            Remove the plastic plugs.</p>	 <p>xx1700000364</p>						
2	<p>Lower the revolving handle on the removal tool, to be able to fit the shelf beneath the motor while fastening the tool.</p>	 <p>xx1700000365</p> <table border="1"> <tr> <td>A</td> <td>Revolving handle</td> </tr> <tr> <td>B</td> <td>Shelf</td> </tr> <tr> <td>C</td> <td>Bracket</td> </tr> </table>	A	Revolving handle	B	Shelf	C	Bracket
A	Revolving handle							
B	Shelf							
C	Bracket							

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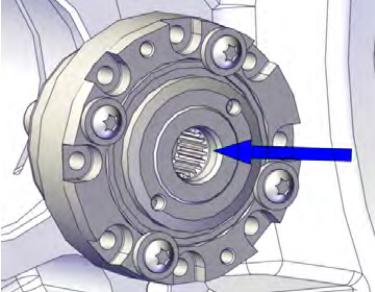
## 4 Repair

### 4.7.1 Replacing the axis-1 motor

*Continued*

Action	Note
3 Attach the tools bracket screws to the robot frame.	 xx1700000366

#### Securing the axis-1 motor

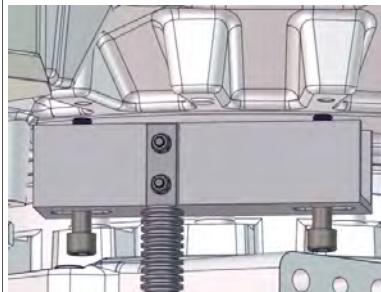
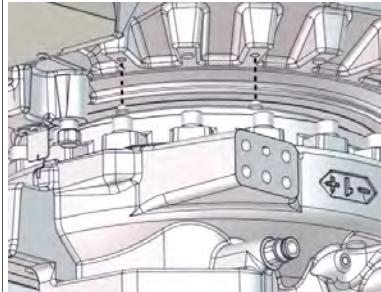
Action	Note
1  <b>CAUTION</b>  The weight of the motor is 27 kg All lifting accessories used must be sized accordingly.	
2 Fasten lifting eyes in two of the fastening holes on the motor.	Lifting eye, M12, 3HAC16131-1
3 Use a roundsling to lift the motor.	
4 Put the motor on the tool shelf and rotate it into position.	
5 Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
6 Apply 3 gram grease on the splines before fitting.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346
7 In order to release the brakes, connect the 24 VDC power supply. Connect to R2.MP1-connector: • + = pin 2 • - = pin 5	
8  <b>CAUTION</b>  Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.	

*Continues on next page*

#### 4.7.1 Replacing the axis-1 motor Continued

	Action	Note
9	Raise the revolving handle to assemble motor. <ul style="list-style-type: none"> <li>• Make sure that the motor pinion is properly mated into the hub.</li> <li>• Make sure that the motor pinion does not get damaged.</li> <li>• Make sure that the direction of the cable exit is facing the correct way.</li> </ul>	
10	Secure the motor with its attachment screws and washers. Use a bits extender to reach the screws.	Bits extender: 3HAC12342-1 Tightening torque: 50 Nm. Screw dimension : M10x40 quality 12.9 Gleitmo (4 pcs)
11	Perform a leak-down test (if not already done).	See <a href="#">Performing a leak-down test on page 190</a> .
12	Disconnect the 24 VDC power supply.	

#### Removing the removal tool

	Action	Note
1	Remove screws holding the tool bracket.	
2	<i>Foundry plus:</i> Refit the plastic plugs.	

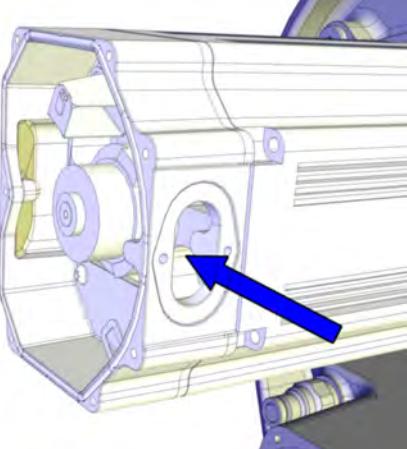
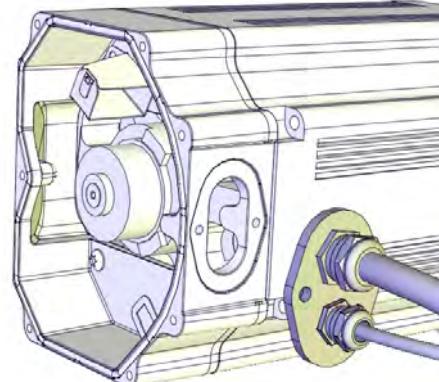
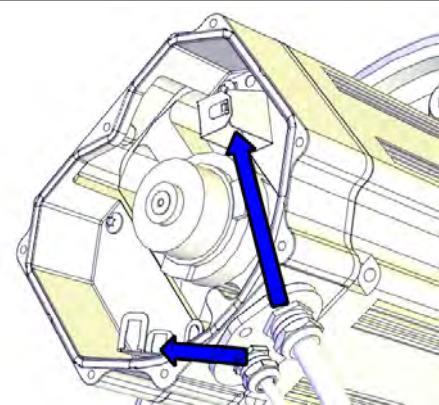
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## 4 Repair

### 4.7.1 Replacing the axis-1 motor

*Continued*

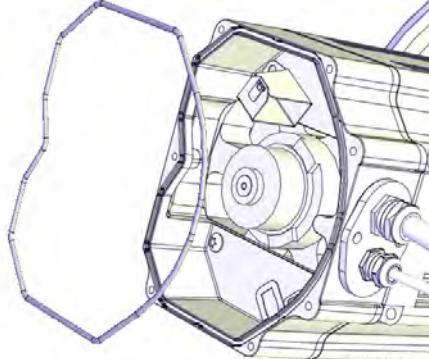
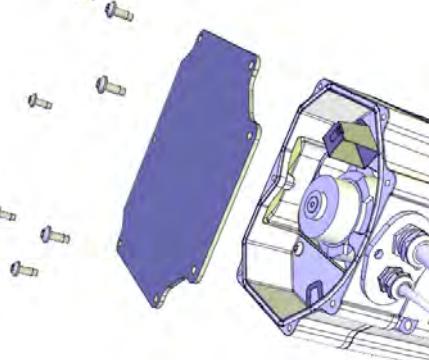
#### Connecting the motor cables

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

*Continues on next page*

## 4.7.1 Replacing the axis-1 motor

*Continued*

Action	Note
4 Inspect the o-ring.  Note Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-001   xx1200001070
5 Wipe clean o-ring and o-ring groove.	
6 Refit the o-ring.  Tip Lubricate the o-ring with some grease for a better fitting in the groove.	
7 CAUTION When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8 Refit the motor cover with its attachment screws.  Note Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged.  Note Make sure the o-ring is undamaged and properly fitted.	 xx1200001135
9 Make sure that the covers are tightly sealed.	

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## 4 Repair

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### 4.7.1 Replacing the axis-1 motor

*Continued*

#### Concluding procedure

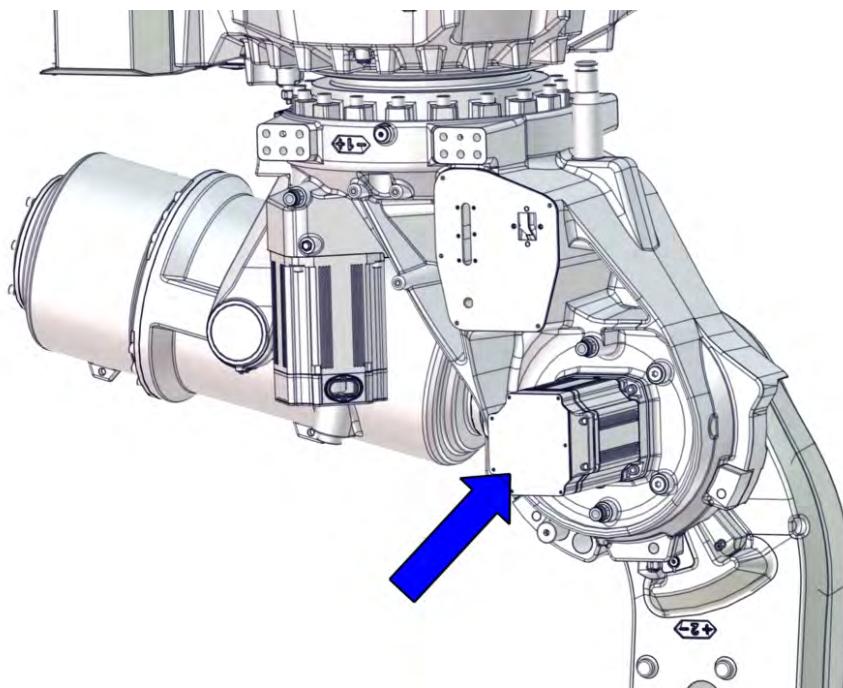
Use this procedure for the concluding refitting.

	Action	Note
1	Re-calibrate the robot.	Axis Calibration is described in <a href="#">Calibrating with Axis Calibration method on page 691</a> . General calibration information is included in section <a href="#">Calibration on page 683</a> .
2	 <b>DANGER</b>  Make sure all safety requirements are met when performing the first test run. These are further described in <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

## 4.7.2 Replacing the axis-2 motor

### Location of the motor

The motor is located as shown in the figure.



xx1700000511

### Summary of the replacement procedure

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

- 1 Attach the lifting tools
- 2 Remove the motor
- 3 Refit the motor
- 4 Remove the lifting tools.

### Spare parts

Spare part	Spare part number	Note
Axis-2 motor	See <i>Product manual, spare parts - IRB 6700</i> .	

### Required tools and equipment

Equipment, etc.	Article number	Note
Lifting accessory, motor	3HAC15534-1	Lifting instruction 3HAC15640-2 enclosed.
Roundsling, 1 m	-	Lifting capacity: 1,000 kg.

*Continues on next page*

## 4 Repair

### 4.7.2 Replacing the axis-2 motor

*Continued*

Equipment, etc.	Article number	Note
Removal tool M12	3HAC057339-003	Used to push out the motor, if necessary. Always use removal tools in pairs.
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Rotation tool	3HAB7887-1	Used to rotate the motor pinion.
24 VDC power supply	-	Used to release the motor brakes.
Lock screw, M16x120	-	Used to secure lower arm.
Leak-down tester	-	
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

### Consumables

Equipment, etc.	Article number	Note
Grease	3HAB3537-1	Shell Gadus S2V220 AC Used to lubricate o-rings.
Rust preventive	3HAC034903-001	Mercasol. Recommended drying time is 24h.
O-ring	3HAC054692-002	D=169.5x3 Used on motor cover.
O-ring	3HAB3772-107	D=102x3 Used on motor flange.

### 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>	

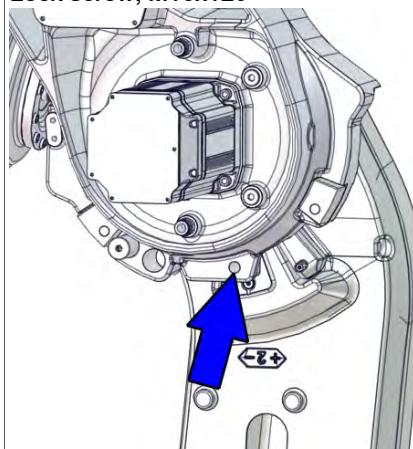
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Action	Note
<p>If the robot is to be calibrated with reference calibration:</p> <p>Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the 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 692</a>.</p>
<p>If the robot is to be calibrated with fine calibration:</p> <p>Remove all external cable packages (DressPack) and tools from the robot.</p>	

## Removing the motor

These procedures describes how to remove the motor.

### Preparations before removing the axis-2 motor

Action	Note
1 Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2 Drain the oil from the gearbox.	See <a href="#">Draining the axis-2 gearbox on page 159</a> .
3 Jog the robot to the calibration position.	
4  <b>DANGER</b> Secure the weight of the lower arm with a lock screw, before releasing the brakes on the axis-2 motor as well as before removing the axis-2 motor or the axis-2 gearbox.	
5 Insert the lock screw into the frame. If needed, adjust the position of axis-2 to make it possible to insert the lock screw. The lock screw is used to secure the weight of the lower arm, in order to avoid accidents or damage.	<p>Lock screw, M16x120</p> 
<p> <b>Note</b></p> <p>Tighten the lock screw manually, no tools needed.</p>	

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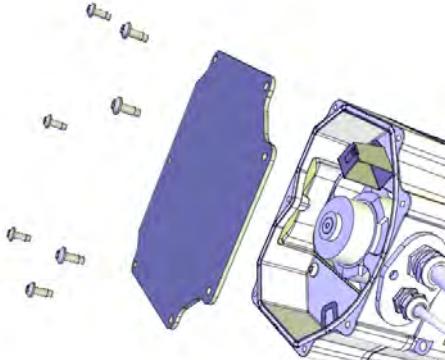
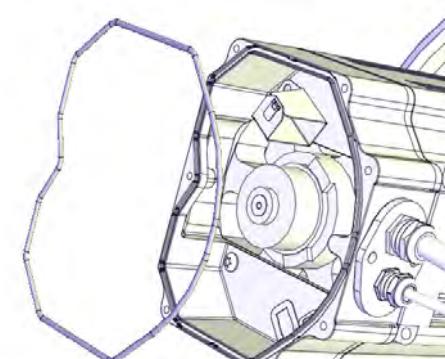
## 4 Repair

### 4.7.2 Replacing the axis-2 motor

*Continued*

Action	Note
6  <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.	
7 Remove any equipment hindering access to the motor.	

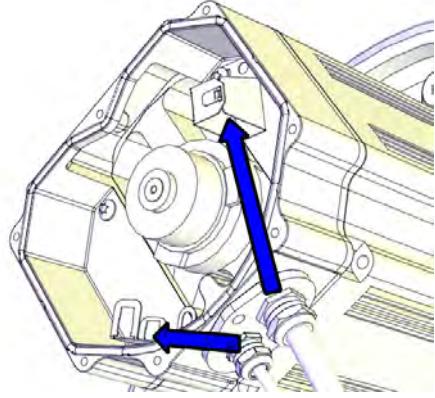
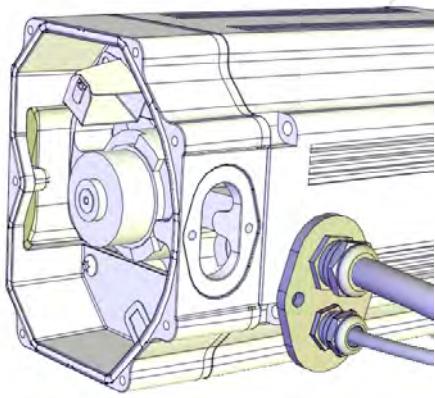
Disconnecting the motor cables

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

*Continues on next page*

#### 4.7.2 Replacing the axis-2 motor

*Continued*

Action	Note
4 Disconnect the motor cables.	 xx1200001066
5 Remove the cable gland cover. Make sure the gasket is not damaged.   <b>Tip</b>  Make a note in which direction the <i>cable exit hole</i> is facing, if the motor will be removed too. The motor shall be refitted in the same position.	 xx1200001067
6 Use caution and pull out the motor cables.	

#### Removing the axis-2 motor

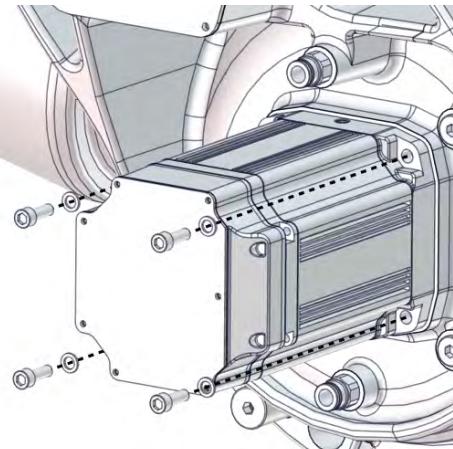
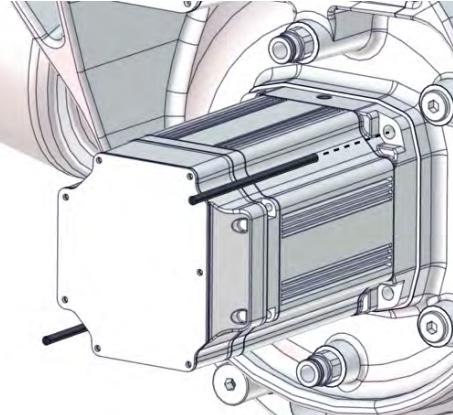
Action	Note
1 Before removing the motor, make sure that the axis-2 gearbox is completely drained.	
2 To release the brake, connect the 24 VDC power supply. Connect to connector R2.MP2, axis-2 motor: <ul style="list-style-type: none"> <li>• + = pin 2</li> <li>• - = pin 5</li> </ul>	

*Continues on next page*

## 4 Repair

### 4.7.2 Replacing the axis-2 motor

*Continued*

Action	Note
3 Remove the attachment screws securing the motor. Use a bits extender in order to reach the screws.	<p>Bits extender: 3HAC12342-1</p>  <p>xx1700000515</p>
4 Fit guide pins in opposite holes.	<p> <b>Tip</b> Lubricate the guide pins with some grease to make the motor slide better.</p>
	 <p>xx1700000516</p>
5	<p> <b>CAUTION</b></p>
	<p>Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.</p>
6	<p>If required, press the motor out of its position by using the removal tool in opposite holes of the motor.</p>
7	<p>Disconnect the 24 VDC power supply.</p>
8	<p> <b>CAUTION</b></p>
	<p>The motor weighs 28 kg. All lifting accessories used must be sized accordingly.</p>
9	<p>Carefully lift the motor out on the guide pins, in order to get the pinion away from the gear and let it rest on the guide pins.</p>

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## 4.7.2 Replacing the axis-2 motor

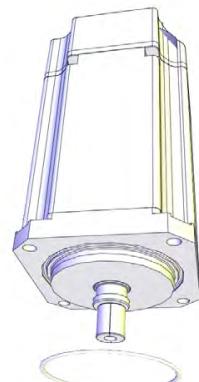
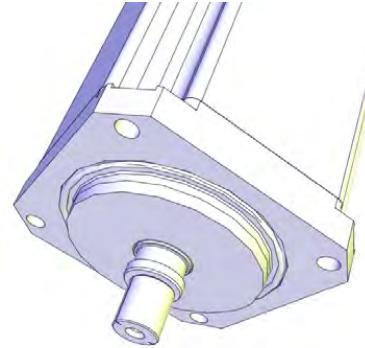
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Action	Note
10 Fasten the lifting accessory. Attach the lifting chain to the accessory and an overhead crane.	Lifting accessory, motor: 3HAC15534-1 Lifting accessory (chain): 3HAC15556-1
11 Remove the motor by sliding it out on the guide pins and lift it off.	Make sure the pinion is not damaged.

### Refitting the motor

These procedures describes how to refit the motor.

#### Preparations prior to refitting motor

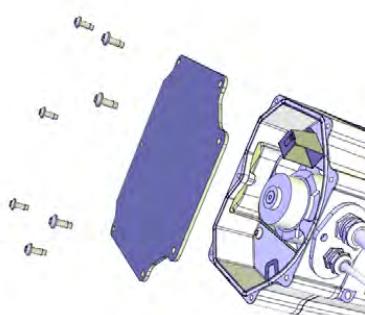
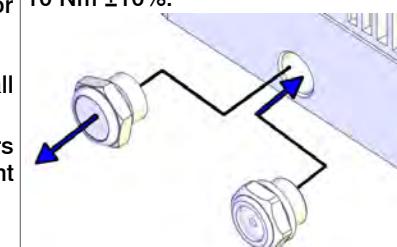
Action	Note
1  <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Remove old paint residues and other contamination from the contact surfaces on both the motor and the mating parts.	
3 Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4 Check the o-ring. Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
5 Make sure the o-ring is seated in the groove.  <b>Tip</b> Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020

*Continues on next page*

## 4 Repair

### 4.7.2 Replacing the axis-2 motor

*Continued*

Action	Note
6 If the motor is a new spare part, remove the cover.	 xx1200001135
7 <b>Foundry Plus:</b> Valid for axis-2, axis-3, axis-4 and axis-6 motors. If the motor is a new spare part, the protection filter located in the evacuation hole on the motor flange must be replaced with a transparent plug/sight glass (enclosed with the spare part delivery). Remove the protection filter and install the transparent plug/sight glass. On the axis-6 motor there are two protection filters that must be replaced with transparent plugs/sight glasses.	Tightening torque, transparent plug: 25 Nm $\pm 10\%$ . Tightening torque, protection filter: 10 Nm $\pm 10\%$ .  xx1600000576

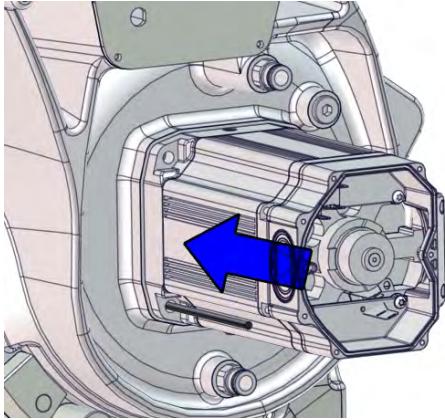
#### Securing the axis-2 motor

Action	Note
1 Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
2  <b>CAUTION</b> The motor weighs 28 kg. All lifting accessories used must be sized accordingly.	
3 Apply the lifting accessory.	Lifting accessory, motor: 3HAC15534-1

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## 4.7.2 Replacing the axis-2 motor

Continued

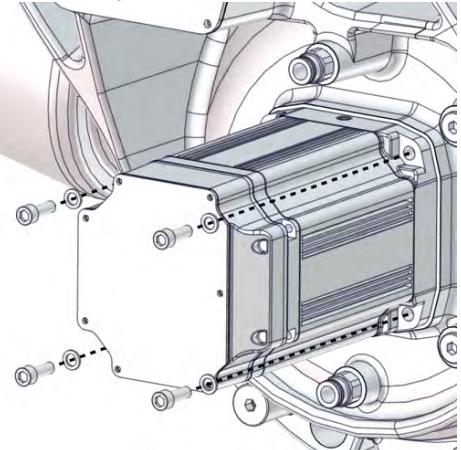
Action	Note
4  <b>Note</b> Make sure the cable exit hole is turned the correct way.	 xx1700000517
5 Lift the motor and put it on the guide pins as close as possible to its final position without pushing the motor pinion into the gear.	
6 Remove the lifting accessory and allow the motor to rest on the guide pins.	
7 Apply the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool: 3HAB7887-1
8 To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP2, axis-2 motor: <ul style="list-style-type: none"><li>• + = pin 2</li><li>• - = pin 5</li></ul>	
9  <b>CAUTION</b> Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
10 Use caution and fit the motor in its final position while at the same time rotating the motor pinion slightly using the rotation tool. <ul style="list-style-type: none"><li>• Make sure that the motor pinion is properly mated to the gear of the gearbox.</li><li>• Make sure that the motor pinion does not get damaged.</li><li>• Make sure that the direction of the cable exit is facing the correct way.</li></ul>	
11 Fit two of the attachment screws.	Screw dimension: M10x40 quality 12.9 Gleitmo (4 pcs)
12 Remove the guide pins and replace with the remaining attachment screws.	

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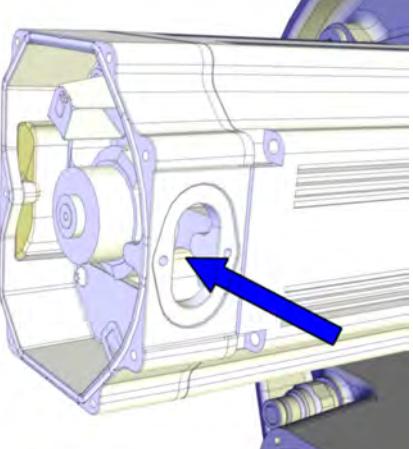
## 4 Repair

### 4.7.2 Replacing the axis-2 motor

*Continued*

Action	Note
13 Secure the motor with its attachment screws and washers. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1 Tightening torque: 50 Nm. Screw dimension: M10x40 quality 12.9 Gleitmo (4 pcs)  xx1700000515
14 Perform a leak-down test.	See <a href="#">Performing a leak-down test on page 190</a> .

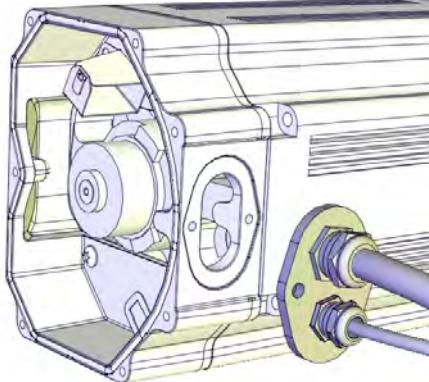
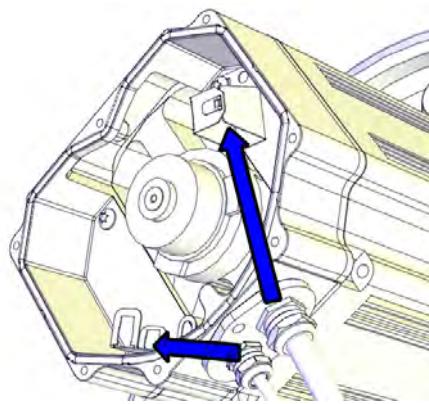
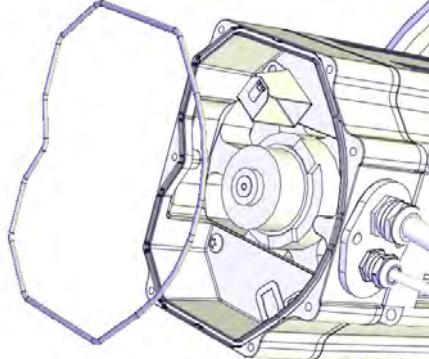
#### Connecting the motor cables

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

*Continues on next page*

## 4.7.2 Replacing the axis-2 motor

Continued

	Action	Note
2	Refit the cable gland cover.   <b>Note</b>  Replace the gasket if damaged.	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066
4	Inspect the o-ring.   <b>Note</b>  Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-001   xx1200001070
5	Wipe clean o-ring and o-ring groove.	

Continues on next page

## 4 Repair

### 4.7.2 Replacing the axis-2 motor

*Continued*

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

#### Concluding procedure

Action	Note
1 Use caution and jog axis-2 a little to facilitate the removal of the lock screw.	
2 Remove the lock screw securing the lower arm.	Lock screw, M16x120  xx1700000513

*Continues on next page*

#### 4.7.2 Replacing the axis-2 motor

*Continued*

	Action	Note
3	<b>Foundry Plus:</b> Apply Mercasol in the hole for the lock screw.	
4	Refill the gearbox with oil.	See <a href="#">Filling oil into the axis-2 gearbox on page 162</a> .
5	Re-calibrate the robot.	Axis Calibration is described in <a href="#">Calibrating with Axis Calibration method on page 691</a> . General calibration information is included in section <a href="#">Calibration on page 683</a> .
6	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further described in the section <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

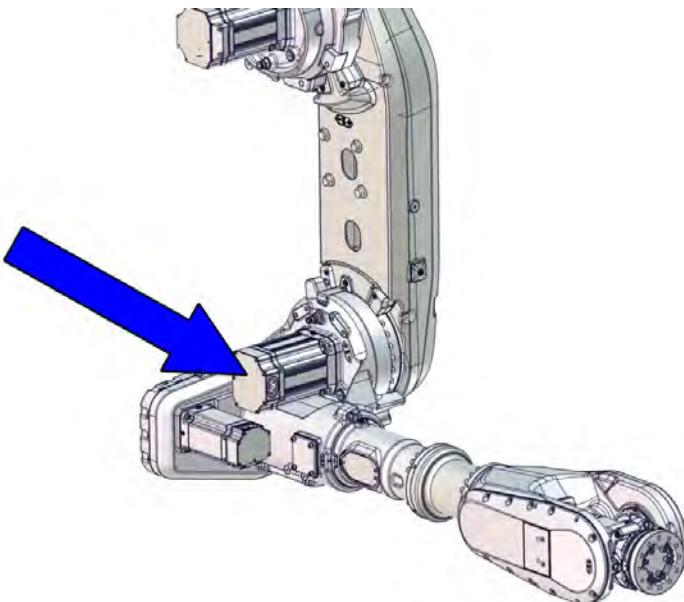
## 4 Repair

### 4.7.3 Replacing the axis-3 motor

#### 4.7.3 Replacing the axis-3 motor

##### Location of the axis-3 motor

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



xx1700000123

##### Spare part

Spare part	Spare part number	Note
Axis-3 motor	See <i>Product manual, spare parts - IRB 6700</i> .	

##### Required tools and equipment

Equipment, etc.	Article number	Note
Chain block	-	Used together with a lifting sling and a lifting eye as one of the methods for securing the weight of the upper arm. The chain block included in the turning tool for the robot can be used (Turning tool: 3HAC061162-001).
Lifting eye, M12	3HAC16131-1	
Roundsling, 1 m	-	Lifting capacity: 1,000 kg.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Lifting accessory, motor	3HAC15534-1	Lifting instruction 3HAC15640-2 enclosed.
Removal tool M12	3HAC057339-003	Used to push out the motor, if necessary. Always use removal tools in pairs.
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.

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### 4.7.3 Replacing the axis-3 motor

*Continued*

Equipment, etc.	Article number	Note
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Rotation tool	3HAB7887-1	Used to rotate the motor pinion.
24 VDC power supply	-	Used to release the motor brakes.
Leak-down tester	-	
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

**Consumables**

Equipment, etc.	Article number	Note
Grease	3HAB3537-1	Shell Gadus S2V220 AC Used to lubricate o-rings.
O-ring	3HAC054692-002	D=169.5x3 Used on motor cover.
O-ring	3HAB3772-107	D=102x3 Used on motor flange.

**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>	
	If the robot is to be calibrated with reference calibration: Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 692</a> .
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

*Continues on next page*

## 4 Repair

### 4.7.3 Replacing the axis-3 motor

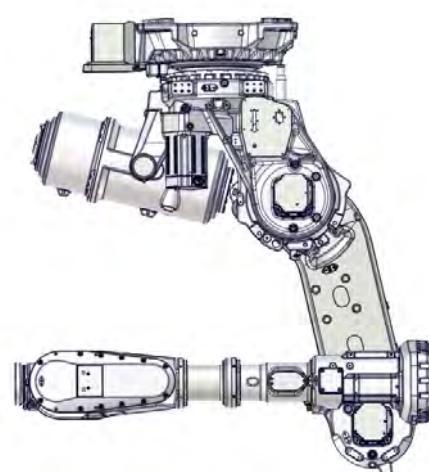
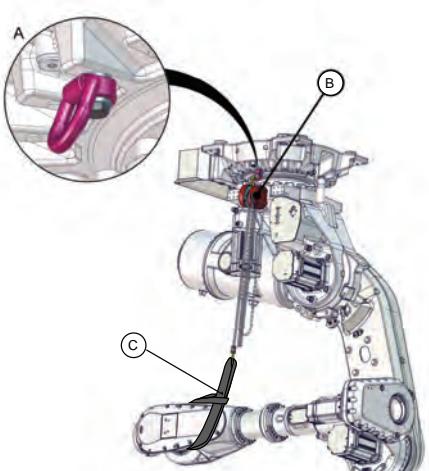
Continued

#### Removing the motor

These procedures describes how to remove the motor.

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

Use this procedure to do the necessary preparations before removing the motor.

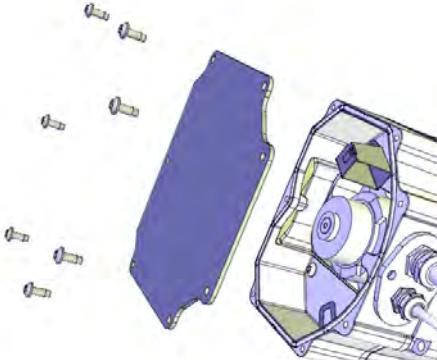
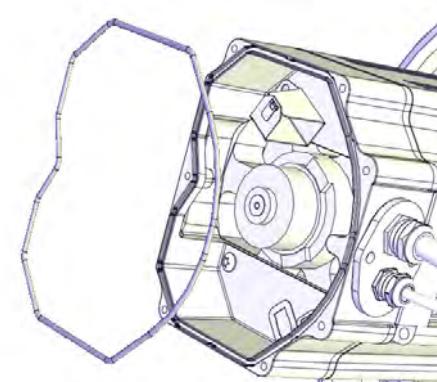
Action	Note
1 Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2 Drain the axis-3 gearbox.  3 Jog axis 2 +20° and axis 3 -200°. The upper arm should be horizontal.  Unload the weight of the upper arm using one of these methods: <ul style="list-style-type: none"><li>• Use a fork lift to rest the upper arm onto.</li><li>• Use lifting slings and an overhead crane to rest the upper arm onto.</li><li>• Secure the upper arm with a lifting eye, a lifting sling and a chain block. Fit the lifting eye at the base of the robot, the lifting sling around the wrist and the chain block in between. Strain the lifting sling with the chain block until the weight of the upper arm is unloaded.</li></ul>	<p>See <a href="#">Draining the axis-3 gearbox on page 165</a>.</p>  <p>xx1700000258</p> <p>The figure shows the third method of securing the upper arm weight.</p>  <p>xx1700000360</p> <p>A Lifting eye, M12 B Chain block C Roundsling, 1 m</p>

Continues on next page

### 4.7.3 Replacing the axis-3 motor Continued

	Action	Note
4	 <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.	
5	Remove any equipment hindering access to the motor.	

#### Disconnecting the motor cables

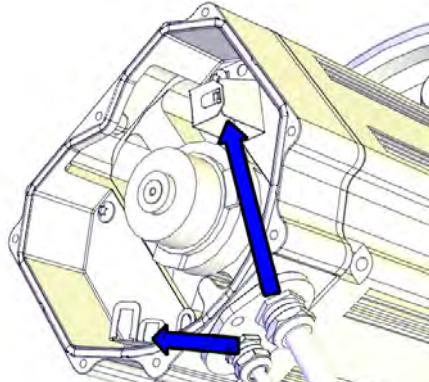
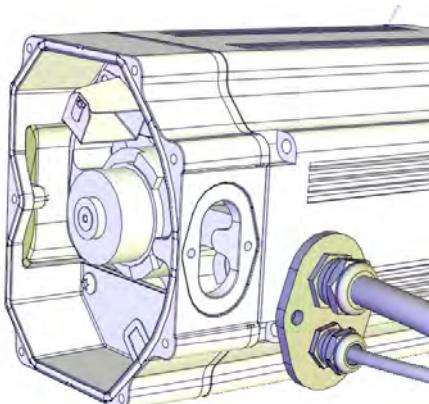
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135
3	Make sure the o-ring is present.	 xx1200001070

*Continues on next page*

## 4 Repair

### 4.7.3 Replacing the axis-3 motor

*Continued*

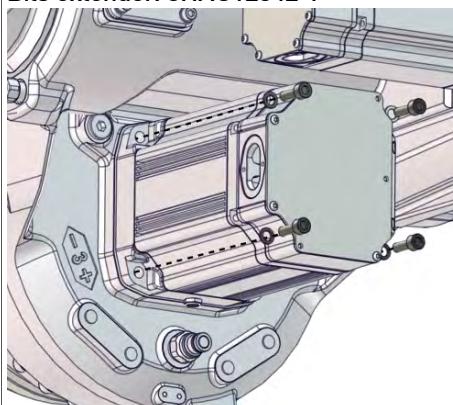
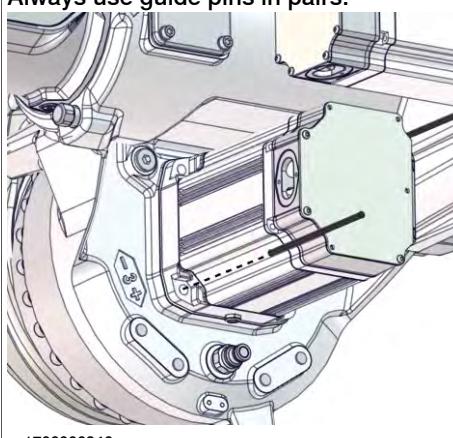
Action	Note
4 Disconnect the motor cables.	 xx1200001066
5 Remove the cable gland cover. Make sure the gasket is not damaged.   <b>Tip</b>  Make a note in which direction the <i>cable exit hole</i> is facing, if the motor will be removed too. The motor shall be refitted in the same position.	 xx1200001067
6 Use caution and pull out the motor cables.	

#### Removing the axis-3 motor

Action	Note
1 Before removing the motor, make sure that the axis-3 gearbox is completely drained.	
2  <b>DANGER</b>  When releasing the holding brakes of the motor, the upper arm will be movable and may fall down! Before continuing the weight of the upper arm must be secured!	
3 To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP3: <ul style="list-style-type: none"> <li>• + = pin 2</li> <li>• - = pin 5</li> </ul>	

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### 4.7.3 Replacing the axis-3 motor Continued

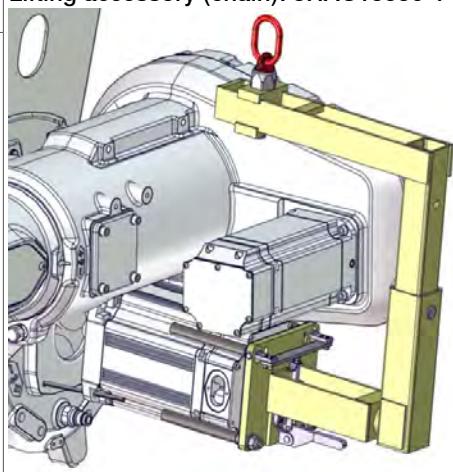
	Action	Note
4	Unscrew the attachment screws that hold the motor. Use a bits extender to reach the screws.	<p>Bits extender: 3HAC12342-1</p>  <p>xx1700000285</p>
5	Fit guide pins in opposite holes.   <b>Tip</b>  Lubricate the guide pins with some grease to make the motor slide better.	<p>Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.</p>  <p>xx1700000346</p>
6	 <b>CAUTION</b>  Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
7	If required, press the motor out of position by using the removal tool in the remaining holes for the motor.	Removal tool M12: 3HAC057339-003 Always use removal tools in pairs.
8	Use caution and lift the motor out on the guide pins, in order to get the pinion away from the gear, and let the motor rest on the guide pins.	
9	 <b>CAUTION</b>  The motor weighs 26 kg. All lifting accessories used must be sized accordingly.	

*Continues on next page*

## 4 Repair

### 4.7.3 Replacing the axis-3 motor

Continued

Action	Note
10 Fasten the lifting accessory to the motor. Attach the lifting chain to the accessory and an overhead crane.	Lifting accessory, motor: 3HAC15534-1 Lifting accessory (chain): 3HAC15556-1
11 When the motor is hanging in the lifting accessory, and the pinion no longer is mated to the gear, let the outer end of the motor hang lower so that it will hang in an angle. This position makes it easier to remove the axis-3 motor with the axis-4 motor still fitted.   <b>CAUTION</b>  The pinion must have been parted from the gear before the motor is angled. If not there is a risk of damaging the pinion and gear.	 xx1700000271
12 Disconnect the 24 VDC power supply.	
13 Remove the motor by lifting it straight out. Make sure the pinion is not damaged.	

### Refitting the motor

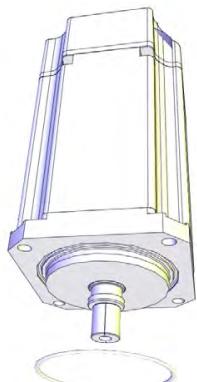
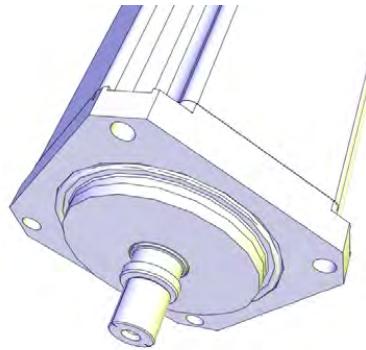
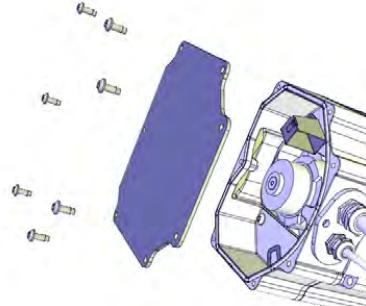
These procedures describes how to refit the motor.

#### Preparations prior to refitting motor

Action	Note
1  <b>DANGER</b>  Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Remove old paint residues and other contamination from the contact surfaces on both the motor and the mating parts.	
3 Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	

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### 4.7.3 Replacing the axis-3 motor Continued

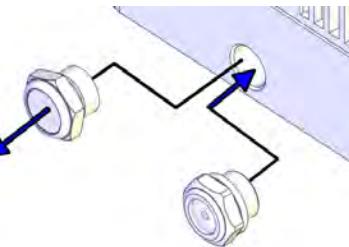
	Action	Note
4	Check the o-ring. Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
5	Make sure the o-ring is seated in the groove.   <b>Tip</b>  Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020
6	If the motor is a new spare part, remove the cover.	 xx1200001135

Continues on next page

## 4 Repair

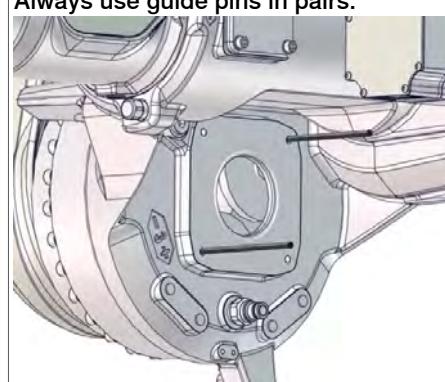
### 4.7.3 Replacing the axis-3 motor

*Continued*

	Action	Note
7	<p><b>Foundry Plus:</b> Valid for axis-2, axis-3, axis-4 and axis-6 motors. If the motor is a new spare part, the protection filter located in the evacuation hole on the motor flange must be replaced with a transparent plug/sight glass (enclosed with the spare part delivery). Remove the protection filter and install the transparent plug/sight glass. On the axis-6 motor there are two protection filters that must be replaced with transparent plugs/sight glasses.</p>	<p>Tightening torque, transparent plug: 25 Nm <math>\pm 10\%</math>. Tightening torque, protection filter: 10 Nm <math>\pm 10\%</math>.</p>  <p>xx1600000576</p>

#### Securing the axis-3 motor

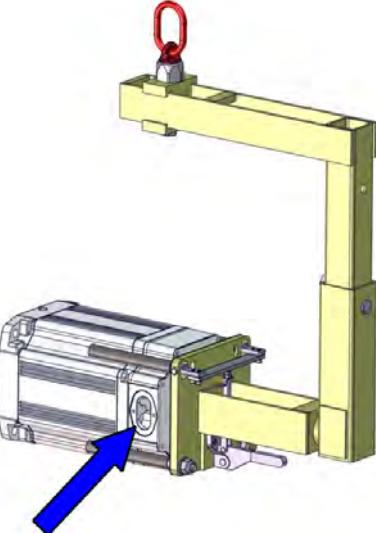
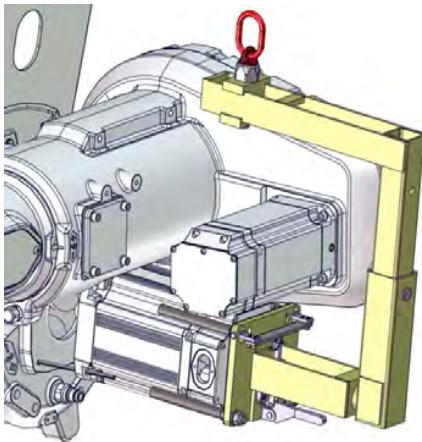
Use this procedure to secure the motor.

	Action	Note
1	Fit guide pins in opposite holes.	<p>Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.</p>  <p>xx1700000272</p>
2	<p><b>!</b> <b>CAUTION</b> The motor weighs 26 kg. All lifting accessories used must be sized accordingly.</p>	

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### 4.7.3 Replacing the axis-3 motor

*Continued*

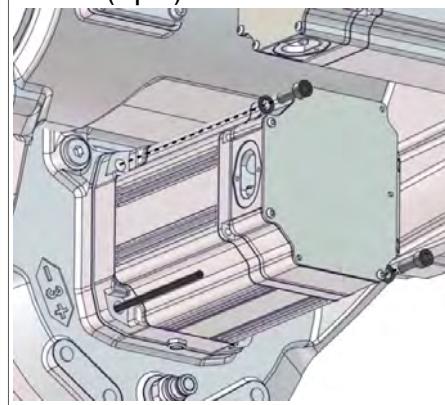
Action	Note
3 Apply the lifting accessories to the motor.   <b>Note</b>  Make sure the cable exit hole is turned according to figure.	Lifting accessory, motor: 3HAC15534-1   xx1700000273
4 Lift the motor on to the guide pins and let it hang with the outer end a little lower when resting on the guide pins. Do not push the motor pinion into the gear yet!  This is done in order to fit the motor with the axis-4 motor still fitted.	 xx1700000271
5 Remove the lifting accessory and allow the motor to rest on the guide pins.	
6 Apply the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool: 3HAB7887-1
7 To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP3: <ul style="list-style-type: none"> <li>• + = pin 2</li> <li>• - = pin 5</li> </ul>	
8  <b>CAUTION</b>  Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

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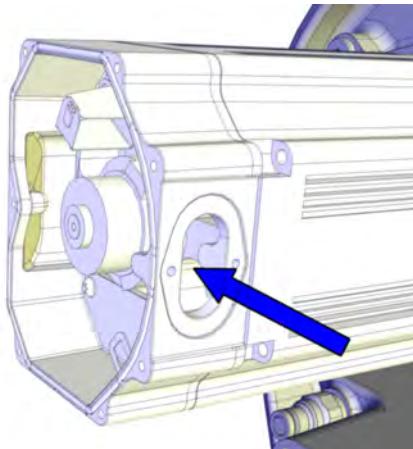
## 4 Repair

### 4.7.3 Replacing the axis-3 motor

*Continued*

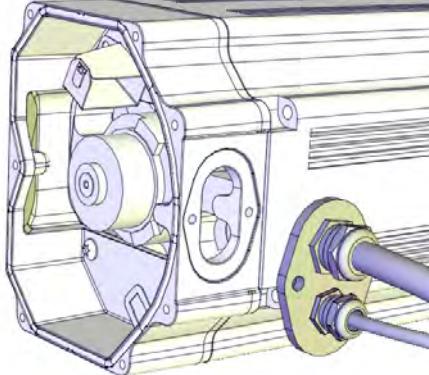
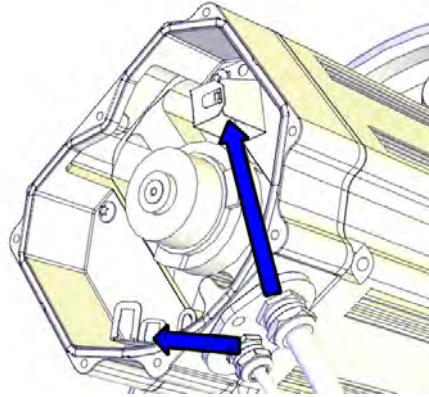
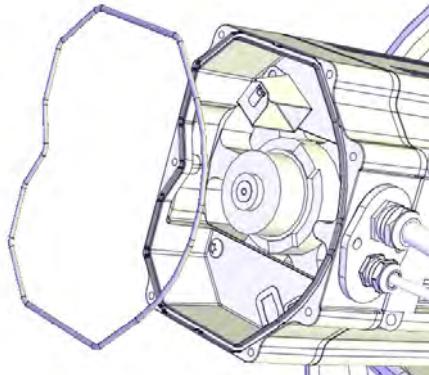
Action	Note
9 Use caution and push the motor in position while at the same time the motor pinion is slightly rotated. Pay attention to following points: <ul style="list-style-type: none"><li>• Mate the motor pinion properly to the gear of the gearbox.</li><li>• Do not damage the motor pinion!</li></ul>	
10 Fit two of the attachment screws.	Screw dimension: M10x30 quality 12.9 Gleitmo (2 pcs)  xx1700000259
11 Remove the guide pins.	
12 Fit the remaining attachment screws.	Screw dimension: M10x30 quality 12.9 Gleitmo (2 pcs)
13 Tighten the screws.	Tightening torque: 50 Nm
14 Remove the rotation tool.	
15 Perform a leak-down test.	See <a href="#">Performing a leak-down test on page 190</a> .
16 Disconnect the 24 VDC power supply.	

#### Connecting the motor cables

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

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### 4.7.3 Replacing the axis-3 motor Continued

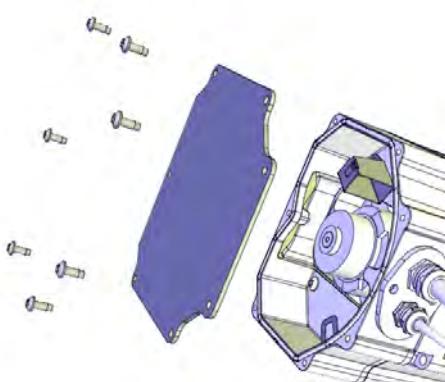
	Action	Note
2	Refit the cable gland cover.   <b>Note</b>  Replace the gasket if damaged.	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066
4	Inspect the o-ring.   <b>Note</b>  Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-001   xx1200001070
5	Wipe clean o-ring and o-ring groove.	

Continues on next page

## 4 Repair

### 4.7.3 Replacing the axis-3 motor

*Continued*

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

#### Concluding procedure

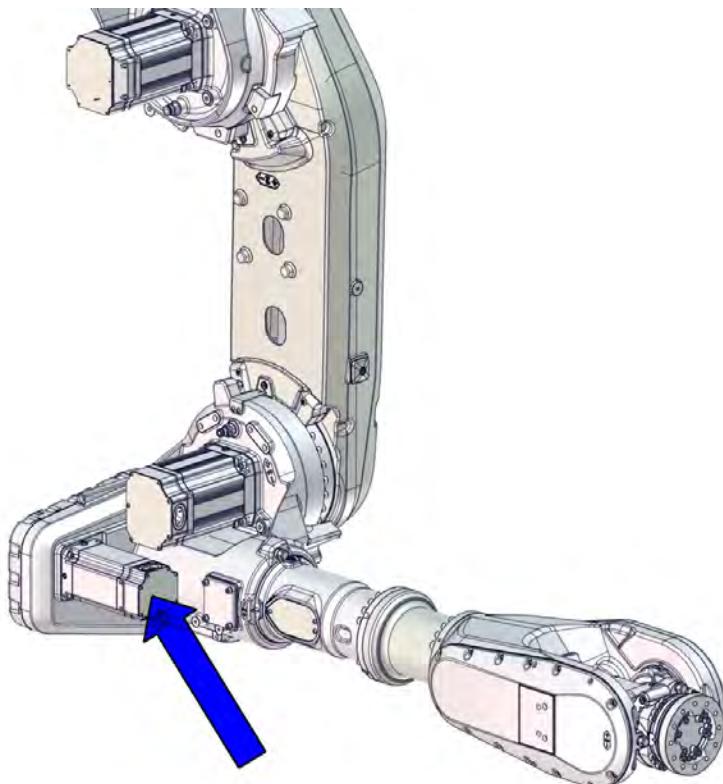
Use this procedure for the concluding refitting.

Action	Note
1 Remove the equipment used to unload the upper arm.	
2 Refill the gearbox with oil.	See <a href="#">Filling oil into the axis-3 gearbox on page 166</a> .
3 Re-calibrate the robot.	Axis Calibration is described in <a href="#">Calibrating with Axis Calibration method on page 691</a> . General calibration information is included in section <a href="#">Calibration on page 683</a> .
4 DANGER  Make sure all safety requirements are met when performing the first test run. These are further described in <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

## 4.7.4 Replacing the axis-4 motor

### Location of the axis-4 motor

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



xx1700000289

### Spare parts

Spare part	Spare part number	Note
Axis-4 motor	See <i>Product manual, spare parts - IRB 6700</i> .	

### Required tools and equipment

Equipment, etc.	Article number	Note
Removal tool M12	3HAC057339-003	Used to push out the motor, if necessary. Always use removal tools in pairs.
Guide pin, M8x150	3HAC15520-2	Always use guide pins in pairs.
Long AllenKeySocketIN19L 6-140	-	Length: 140 mm.
Rotation tool	3HAB7887-1	Used to rotate the motor pinion.
24 VDC power supply	-	Used to release the motor brakes.
Leak-down tester	-	

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## 4 Repair

### 4.7.4 Replacing the axis-4 motor

Continued

Equipment, etc.	Article number	Note
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

### Consumables

Equipment, etc.	Article number	Note
Grease	3HAB3537-1	Shell Gadus S2V220 AC Used to lubricate o-rings.
O-ring	3HAC054692-001	D=119x3 Used on motor cover.
O-ring	3HAB3772-107	D=102x3 Used on motor flange.

### 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>	
	If the robot is to be calibrated with reference calibration: Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 692</a> .
	If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

Continues on next page

**Removing the motor**

These procedures describes how to remove the motor.

**Preparations before removing the axis-4 motor**

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Jog the robot into position: <ul style="list-style-type: none"> <li>• axis 1 = no significance.</li> <li>• axis 2 = +20°</li> <li>• axis 3 = +70° (upper arm pointing straight up, if possible).</li> </ul> With the robot in this position, there is no need to drain oil from the axis-4 gearbox when the motor is replaced.	
3	If there is no space to position the upper arm pointed straight up, drain the axis-4 gearbox.	
4	 <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.	

**Disconnecting the motor cables**

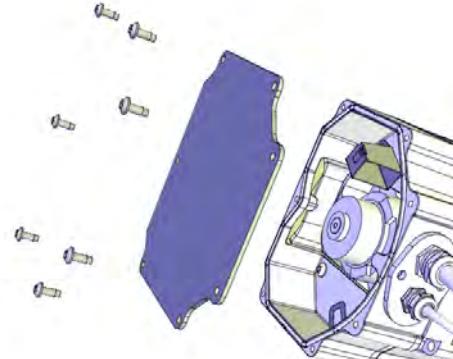
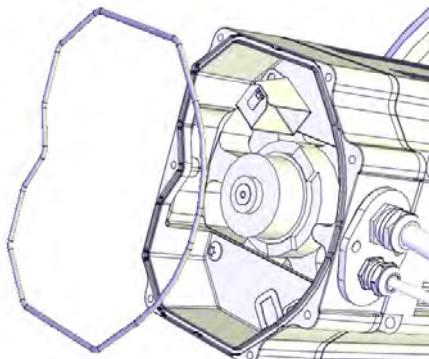
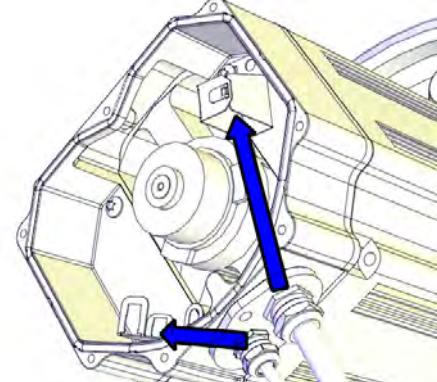
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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## 4 Repair

### 4.7.4 Replacing the axis-4 motor

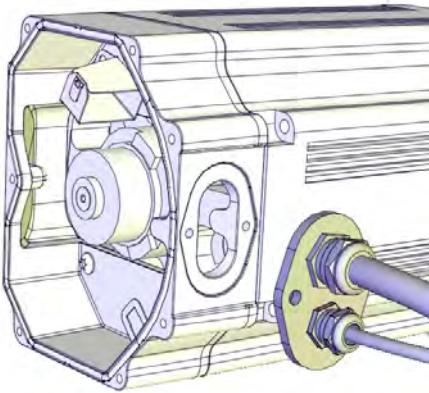
*Continued*

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

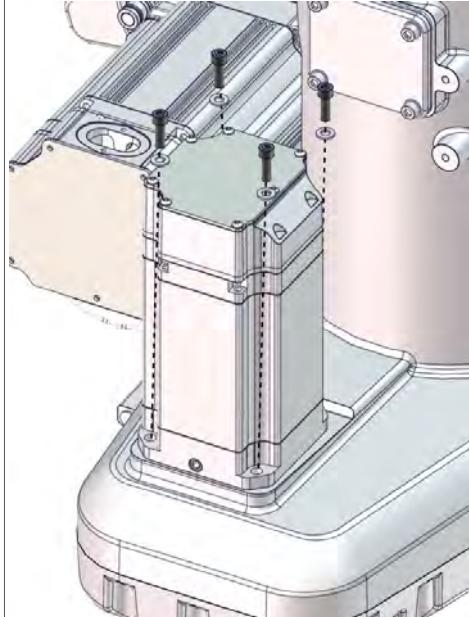
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#### 4.7.4 Replacing the axis-4 motor

*Continued*

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

#### Removing the axis-4 motor

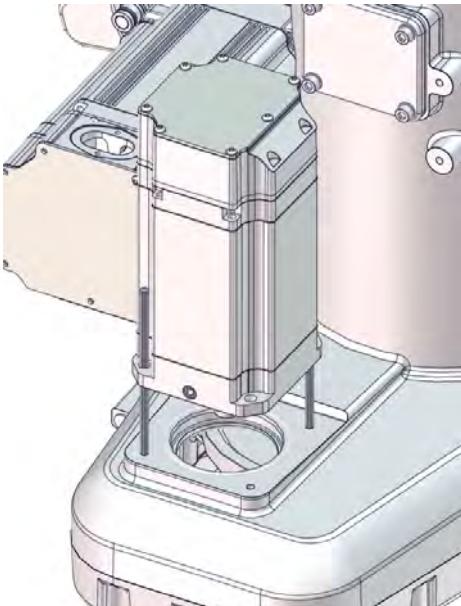
Action	Note
<p>1  <b>CAUTION</b></p> <p>Use caution when releasing the brakes! Axis-4 can move unexpectedly!</p>	
<p>2 To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP4:</p> <ul style="list-style-type: none"> <li>• + = pin 2</li> <li>• - = pin 5</li> </ul>	
3 Unscrew the attachment screws that secure the motor.	 xx1700000290
4 Apply two guide pins in opposite holes.	Guide pin, M8x150: 3HAC15520-2 Always use guide pins in pairs.

*Continues on next page*

## 4 Repair

### 4.7.4 Replacing the axis-4 motor

Continued

Action	Note
5  <b>CAUTION</b> Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
6 Press the motor out of position by fitting the removal tool in the remaining attachment holes for the motor.	Removal tool M12: 3HAC057339-003 Always use removal tools in pairs.
7  <b>CAUTION</b> The motor weighs 13 kg. All lifting accessories used must be sized accordingly.	
8 Disconnect the 24 VDC power supply.	
9 Remove the motor by carefully lifting it straight out/straight up (if the upper arm points upwards). Make sure the pinion is not damaged.	 xx1700000291

#### Refitting the motor

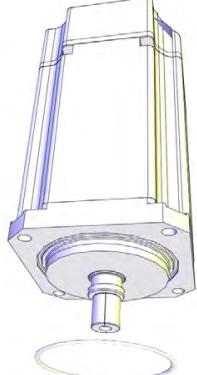
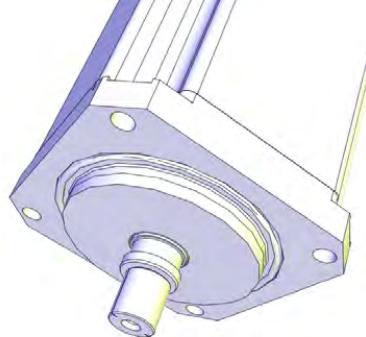
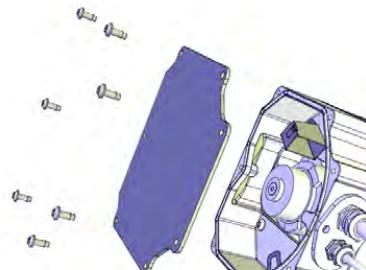
These procedures describes how to refit the motor.

#### Preparations prior to refitting motor

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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4.7.4 Replacing the axis-4 motor  
*Continued*

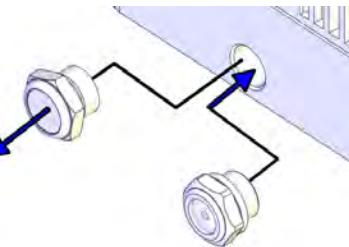
Action	Note
2 Remove old paint residues and other contamination from the contact surfaces on both the motor and the mating parts.	
3 Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4 Check the o-ring. Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019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

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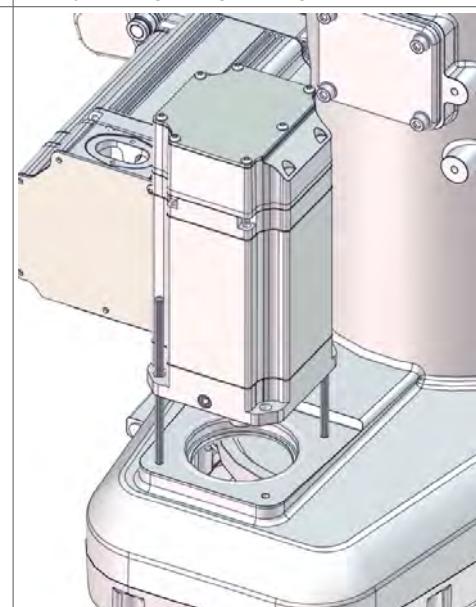
## 4 Repair

### 4.7.4 Replacing the axis-4 motor

*Continued*

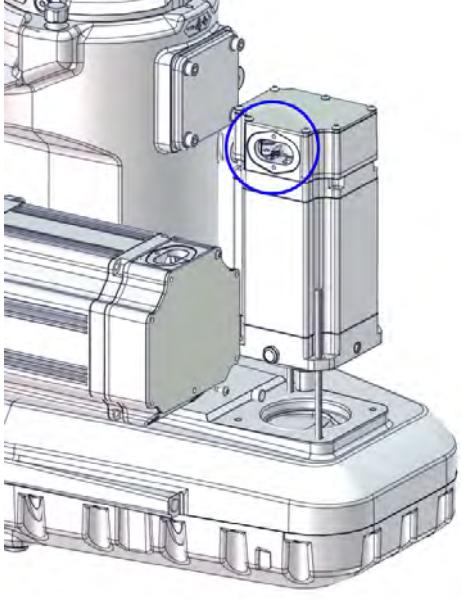
	Action	Note
7	<p><b>Foundry Plus:</b> Valid for axis-2, axis-3, axis-4 and axis-6 motors. If the motor is a new spare part, the protection filter located in the evacuation hole on the motor flange must be replaced with a transparent plug/sight glass (enclosed with the spare part delivery). Remove the protection filter and install the transparent plug/sight glass. On the axis-6 motor there are two protection filters that must be replaced with transparent plugs/sight glasses.</p>	<p>Tightening torque, transparent plug: 25 Nm <math>\pm 10\%</math>. Tightening torque, protection filter: 10 Nm <math>\pm 10\%</math>.</p> 

#### Securing the axis-4 motor

	Action	Note
1	Apply two guide pins in opposite holes.	Guide pin, M8x150: 3HAC15520-2 Always use guide pins in pairs.
2	Put the motor onto the guide pins.	

*Continues on next page*

#### 4.7.4 Replacing the axis-4 motor Continued

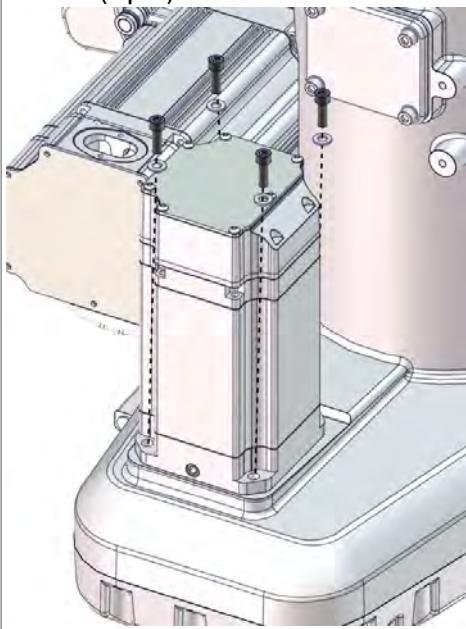
	Action	Note
3	<p><b>i</b> Note</p> <p>Make sure the cable gland opening is turned the correct way.</p>	 xx1700000292
4	<p><b>!</b> CAUTION</p> <p>The motor weighs 13 kg. All lifting accessories used must be sized accordingly.</p>	
5	<p>Apply the <i>rotation tool</i> and use it to rotate the pinion when mating it into the gear. This requires two persons co-operating, if the motor is installed from above (if the upper arm is pointing upwards).</p>	Rotation tool: 3HAB7887-1
6	<p>To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP2:</p> <ul style="list-style-type: none"> <li>• + = pin 2</li> <li>• - = pin 5</li> </ul>	
7	<p><b>!</b> CAUTION</p> <p>Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.</p>	
8	<p>Push the motor carefully in position while at the same time rotating the motor pinion slightly.</p> <ul style="list-style-type: none"> <li>• Make sure that the motor pinion is properly mated to the gear of the gearbox.</li> <li>• Make sure that the motor pinion does not get damaged.</li> <li>• Make sure that the direction of the cable gland is facing the correct way.</li> </ul>	

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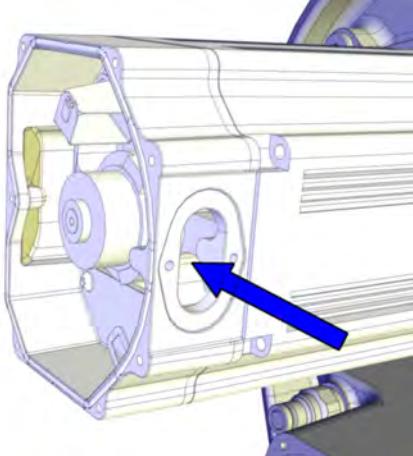
## 4 Repair

### 4.7.4 Replacing the axis-4 motor

*Continued*

Action	Note
9 Remove the guide pins.	
10 Secure the motor with its attachment screws and washers.	Tightening torque: 35 Nm. Screw dimension: M8x30 quality 12.9 Gleitmo (4 pcs)
	 xx1700000290
11 Perform a leak-down test.	See <a href="#">Performing a leak-down test on page 190</a> .
12 Disconnect the 24 VDC power supply.	

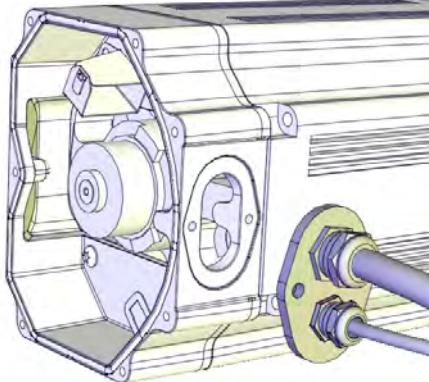
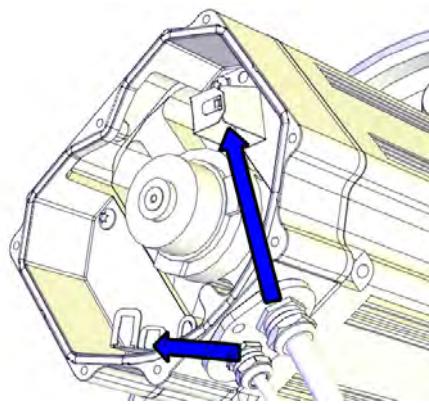
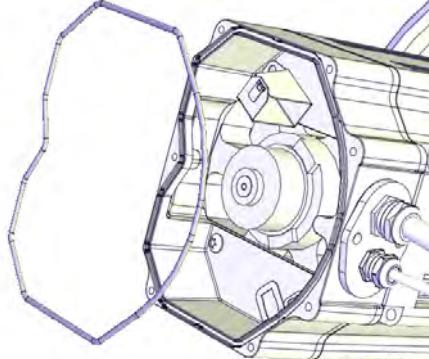
Connecting the motor cables

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

*Continues on next page*

## 4.7.4 Replacing the axis-4 motor

Continued

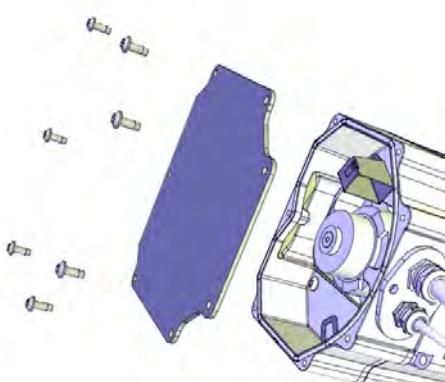
	Action	Note
2	Refit the cable gland cover.   <b>Note</b>  Replace the gasket if damaged.	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066
4	Inspect the o-ring.   <b>Note</b>  Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-001   xx1200001070
5	Wipe clean o-ring and o-ring groove.	

Continues on next page

## 4 Repair

### 4.7.4 Replacing the axis-4 motor

*Continued*

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

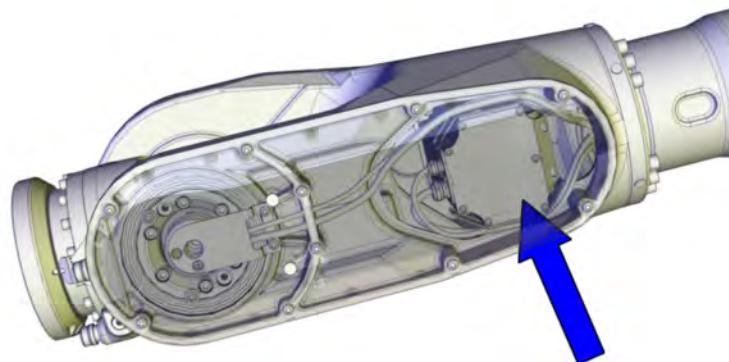
#### Concluding procedure

Action	Note
1 Refill the gearbox with oil, if gearbox has been drained.	See <a href="#">Filling oil into the axis-4 gearbox on page 171</a> .
2 Re-calibrate the robot.	Axis Calibration is described in <a href="#">Calibrating with Axis Calibration method on page 691</a> . General calibration information is included in section <a href="#">Calibration on page 683</a> .
3 DANGER  Make sure all safety requirements are met when performing the first test run. These are further described in <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

## 4.7.5 Replacing the axis-5 motor

### Location of the axis-5 motor

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



xx1500001899

### Spare part

Spare part	Spare part number	Note
Axis-5 motor	See <i>Product manual, spare parts - IRB 6700</i> .	
Heat protection plate (2 pcs required)	See <i>Product manual, spare parts - IRB 6700</i> .	

### Required tools

Equipment, etc.	Article number	Note
Removal tool M12	3HAC057339-003	Used to push out the motor, if necessary. Always use removal tools in pairs.
Long AllenKeySocketIN19L 6-140	-	Length: 140 mm.
Guide pin, M8x100	3HAC15520-1	Always use guide pins in pairs.
Rotation tool	3HAB7887-1	Used to rotate the motor pinion.
24 VDC power supply	-	Used to release the motor brakes.
Leak-down tester	-	
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

### Consumables

Equipment, etc.	Article number	Note
Grease	3HAB3537-1	Shell Gadus S2V220 AC Used to lubricate o-rings.

*Continues on next page*

## 4 Repair

### 4.7.5 Replacing the axis-5 motor

*Continued*

Equipment, etc.	Article number	Note
O-ring	3HAC054692-001	D=119x3 Used on motor cover.
O-ring	3HAB3772-107	D=102x3 Used on motor flange.

#### 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>	
If the robot is to be calibrated with reference calibration: Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 692</a> .
If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

#### Removing the axis-5 motor

Use these procedures to remove the motor.

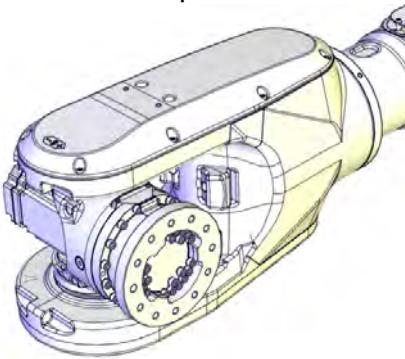
#### Preparations before removing the axis-5 motor

Action	Note
1 Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2 Jog the robot to this position: <ul style="list-style-type: none"><li>• Axis 2: 0°</li><li>• Axis 3: To a suitable working position for the operator to remove axis-5 motor.</li></ul>	

*Continues on next page*

### 4.7.5 Replacing the axis-5 motor

*Continued*

Action	Note
3 Jog axis 4 to this position: • Axis 4: +90°	With the robot in this position, there is no need to drain oil from the axis-5 gearbox when the motor is replaced.   xx1400000719
4  <b>DANGER</b> Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
5 If DressPack is used: Remove the complete ball joint housing, with DressPack still fitted, from the bracket on the wrist cover. This is done in order to reach the two hidden attachment screws that hold the cover.	
6 Remove the bracket from the wrist cover.	

#### Retrieving access to the wrist cabling

Use this procedure to remove the wrist cover to retrieve access to the axis-5 and axis-6 motor cables.

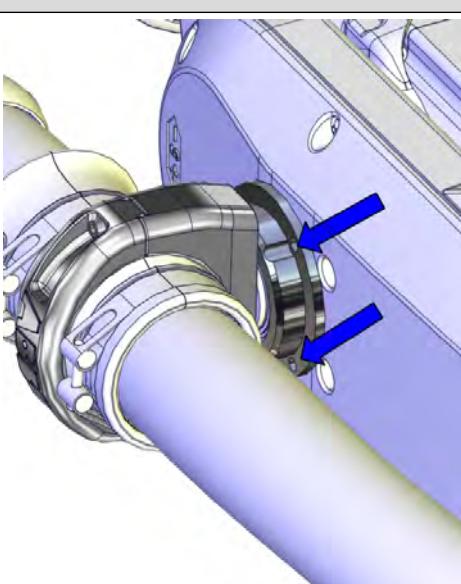
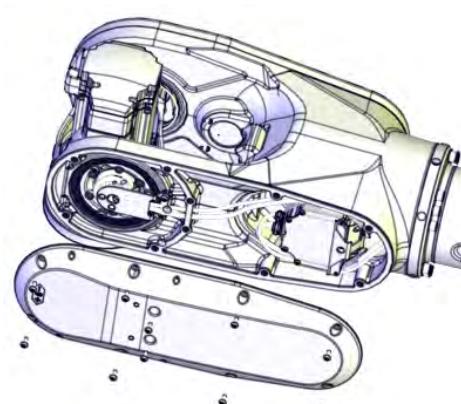
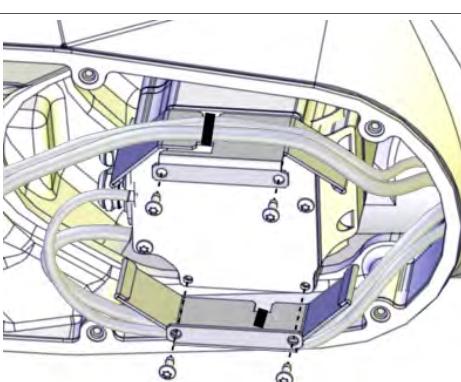
Action	Note
1  <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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## 4 Repair

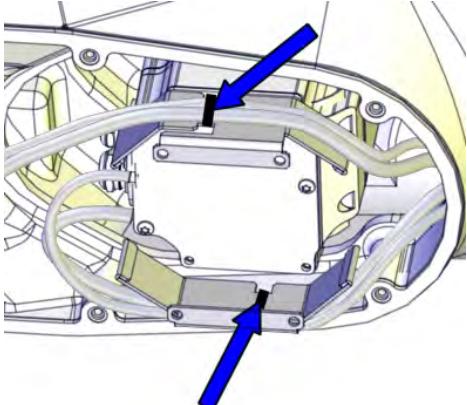
### 4.7.5 Replacing the axis-5 motor

*Continued*

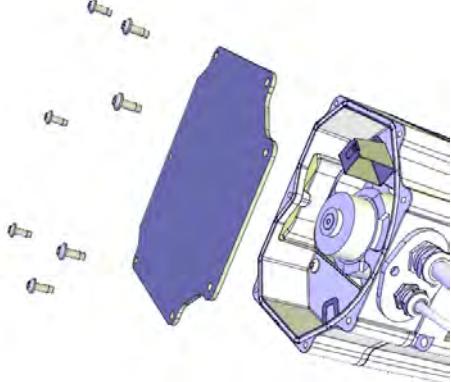
Action	Note
2 If DressPack is not already removed, the complete ball joint housing (including the bracket) must be removed at this point, in order to reach the two hidden screws that secures the wrist cover.	 xx1400000355
3 Remove the wrist cover.	 xx1300002247
4 Remove the heat protection plates from the motor with the cabling still attached to the plate.	 xx1500001030

*Continues on next page*

#### 4.7.5 Replacing the axis-5 motor Continued

Action	Note
<p>5 Cut the cable ties that hold the cable harness to the plate.</p> <p><b>Note</b> Keep the heat protection plate until refitting.</p> <p><b>Tip</b> If removing the plate only for replacing the motor, the cabling does not need to be loosened from the plate.</p>	 <p>xx1500001029</p>

##### Disconnecting the motor cables

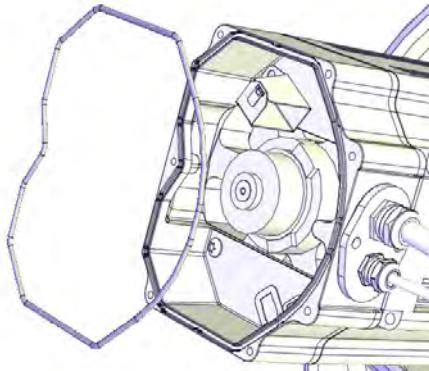
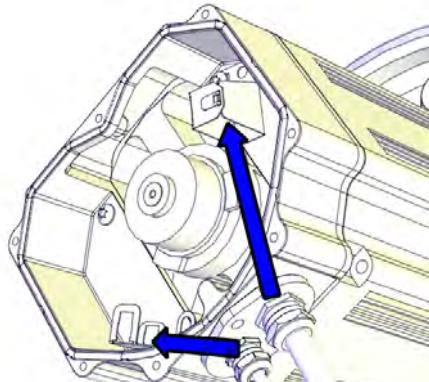
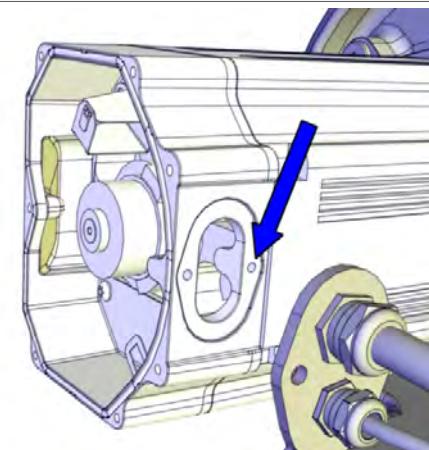
Action	Note
<p>1  <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
<p>2 Unscrew the attachment screws and washers and remove the motor cover.</p>	 <p>xx1200001135</p>

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## 4 Repair

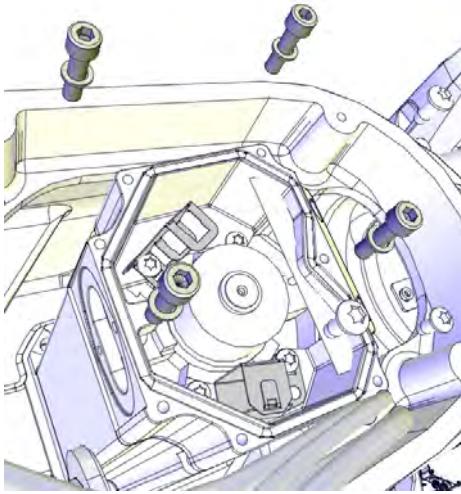
### 4.7.5 Replacing the axis-5 motor

*Continued*

Action	Note
3 Make sure the o-ring is present.	 xx1200001070
4 Disconnect the motor cables.	 xx1200001066
5 Remove the cable gland cover by performing the following steps: 1 Open the inner screw a little (the one the arrow is pointing at). No need to remove this screw from the motor. 2 Remove the outer screw. 3 Slide the cable gland cover away from the inner screw. Make sure the gasket is not damaged.  <b>Tip</b>  Make a note in which direction the cable exit hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.	 xx1300000656
6 Use caution and pull out the motor cables.	

*Continues on next page*

## Removing the axis-5 motor

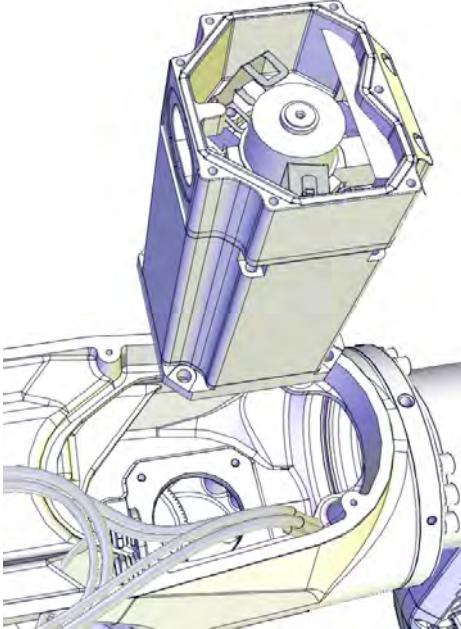
	Action	Note
1	Unscrew the attachment screws that secure the motor, using a bits extender.	Bits extender: 3HAC12342-1  xx1200001017
2	 <b>CAUTION</b> Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
3	If needed, fit removal tools in opposite holes.	Removal tool M12: 3HAC057339-003 Always use removal tools in pairs.
4	 <b>CAUTION</b> The motor weighs 12 kg. All lifting accessories used must be sized accordingly.	

Continues on next page

## 4 Repair

### 4.7.5 Replacing the axis-5 motor

*Continued*

Action	Note
5 Use caution and lift the motor out. Be careful not to damage the pinion.	 xx1200001018

#### Refitting the axis-5 motor

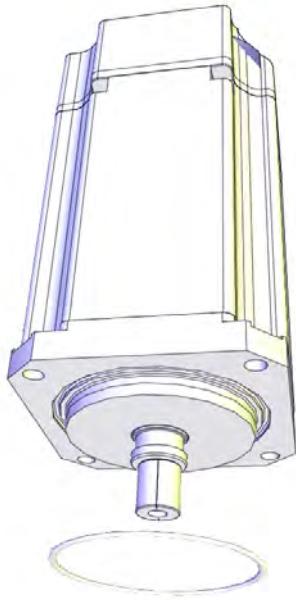
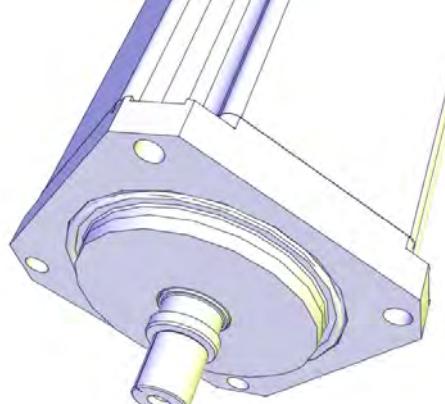
The procedures describe how to refit the motor.

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

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 robot working area.	

*Continues on next page*

#### 4.7.5 Replacing the axis-5 motor Continued

	Action	Note
2	Wipe clean the contact surfaces from any contamination. Also wipe clean the o-ring groove.	 xx1200001019
3	Check the o-ring. Replace if damaged.	O-ring, 3HAB3772-107
4	Lubricate the o-ring with some grease.	
5	Make sure the o-ring is seated in the groove.	 xx1200001020
6	Apply two guide pins in opposite holes.	Guide pin, M8x100: 3HAC15520-1

#### Securing the axis-5 motor

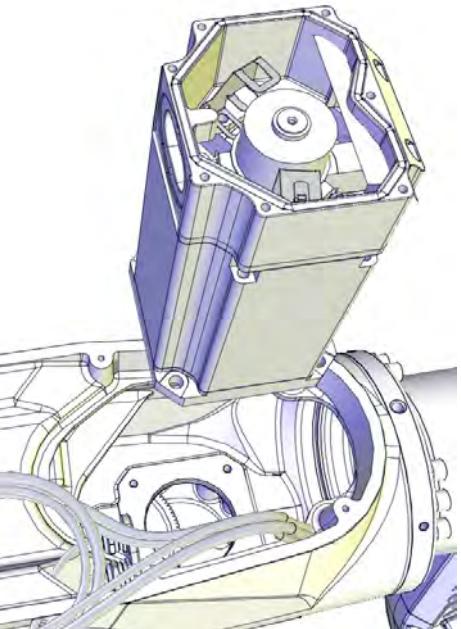
	Action	Note
1	 <b>CAUTION</b> Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

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## 4 Repair

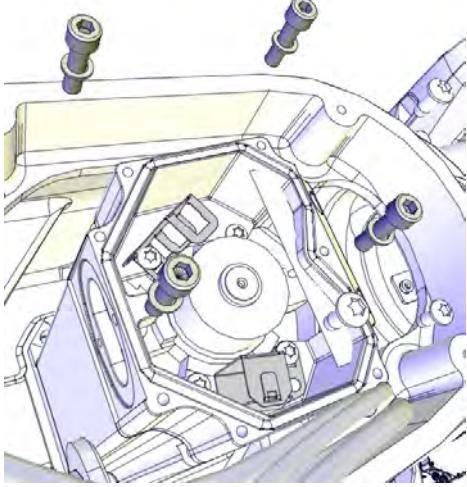
### 4.7.5 Replacing the axis-5 motor

*Continued*

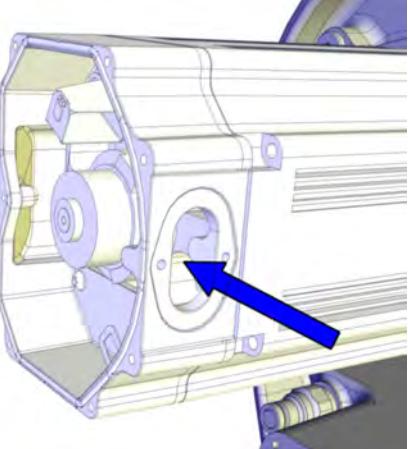
	Action	Note
2	Apply the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool: 3HAB7887-1
3	To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP5: <ul style="list-style-type: none"><li>• + = pin 2</li><li>• - = pin 5</li></ul>	24 VDC power supply
4	 <b>CAUTION</b>  The motor weighs 12 kg. All lifting accessories used must be sized accordingly.	
5	Use caution and lower the motor into position on the guide pins, while at the same time rotating the motor pinion slightly.  Make sure that: <ul style="list-style-type: none"><li>• the motor pinion is properly mated to the gear of the gearbox.</li><li>• the motor pinion does not get damaged.</li><li>• the direction of the cable exit is facing the same way as before removal.</li></ul>	Rotation tool, 3HAB7887-1  xx1200001018
6	Remove the guide pins.	

*Continues on next page*

#### 4.7.5 Replacing the axis-5 motor Continued

	Action	Note
7	Secure the motor with its attachment screws and washers.	Tightening torque: 24 Nm. Screw dimension: M8x30 quality 12.9 Gleitmo(4 pcs)
		 xx1200001017
8	Perform a leak-down test.	See <a href="#">Performing a leak-down test on page 190</a> .
9	Disconnect the 24 VDC power supply.	

#### Connecting the motor cables

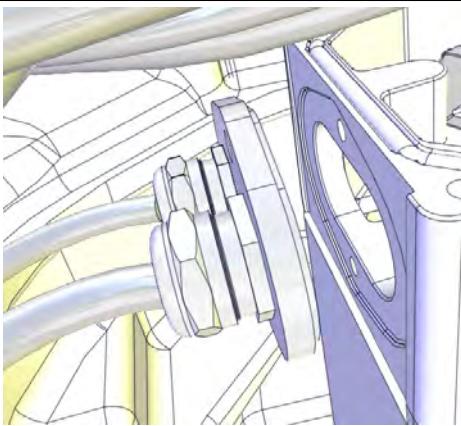
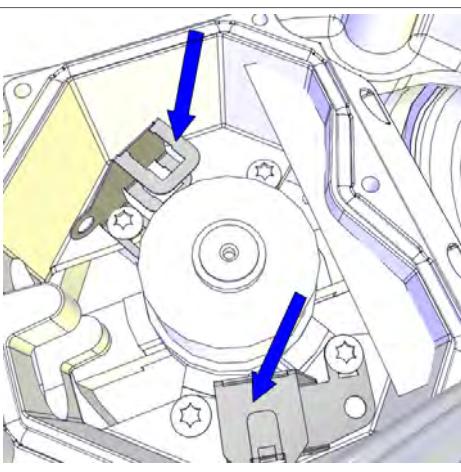
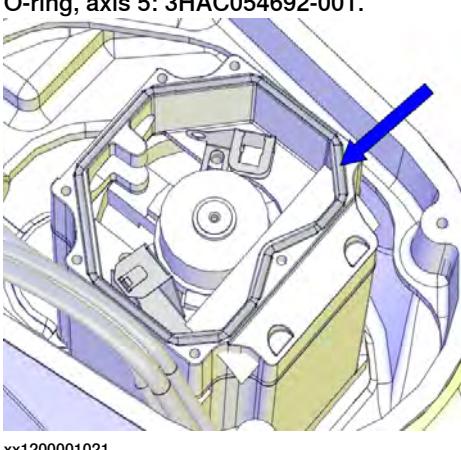
	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1300000738

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## 4 Repair

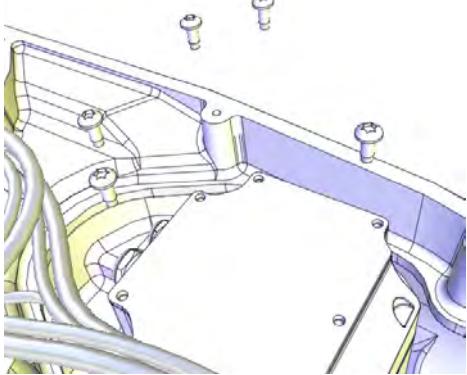
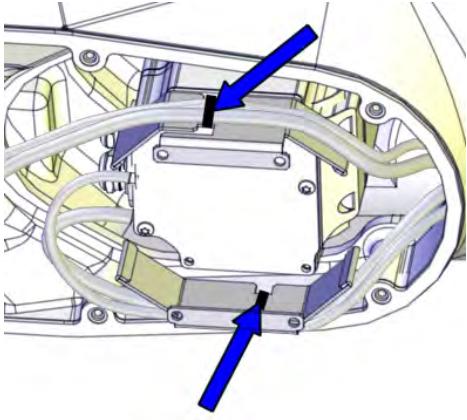
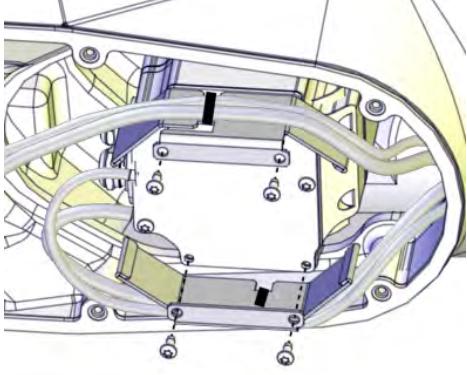
### 4.7.5 Replacing the axis-5 motor

*Continued*

Action	Note
<p>2 Refit the cable gland cover by performing the following steps:</p> <ul style="list-style-type: none"> <li>• Slide the cable gland cover onto the inner screw.</li> <li>• Refit and tighten the outer screw.</li> <li>• Tighten the inner screw. Make sure that the gasket is not damaged.</li> </ul> <p><b>Note</b> Replace the gasket if damaged.</p>	 xx1200001016
<p>3 Connect the connectors. Connect in accordance with the markings on the connectors.</p>	 xx1200001015
<p>4 Make sure the o-ring on the motor is undamaged. Replace if damaged.</p>	O-ring, axis 5: 3HAC054692-001.  xx1200001021
<p>5</p> <p><b>CAUTION</b></p> <p>When fitting the motor cover, make sure that none of the cables inside will be damaged.</p>	

*Continues on next page*

#### 4.7.5 Replacing the axis-5 motor Continued

	Action	Note
6	<p>Refit the motor cover with its attachment screws.</p> <p><b>Note</b> Do not refit the screws that will hold the heat protection plate at this point.</p> <p><b>Note</b> Do not reuse the self-threading attachment screws, it will damage the threads. Replace with standard attachment screws.</p> <p><b>Note</b> Make sure the o-ring is undamaged and properly fitted.</p>	 xx1200001013
7	Secure the cable harness with cable straps to the heat protection plate.	 xx1500001029
8	Fit the heat protection plate with the screws.	 xx1500001030
9	Make sure that the cover is tightly sealed.	

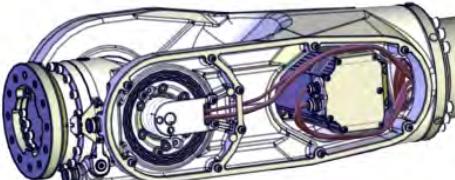
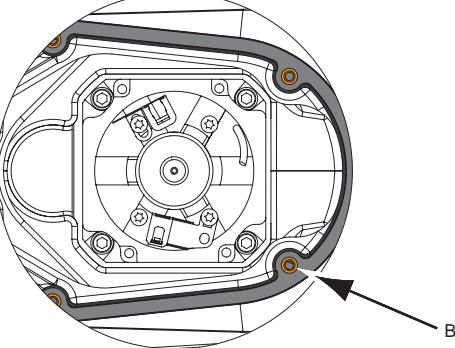
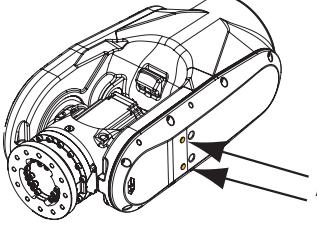
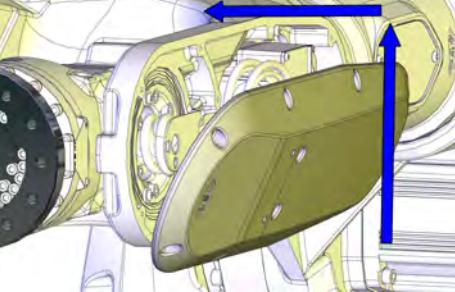
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## 4 Repair

### 4.7.5 Replacing the axis-5 motor

*Continued*

#### Concluding procedure

Action	Note
1 Make sure that the cable harness is placed in a way that it will not be damaged when the wrist cover is fitted.	 xx1500001672
2 Inspect the gasket. Replace if damaged.	
3 <b>Foundry Plus:</b> <ul style="list-style-type: none"> <li>Make sure that the gasket is undamaged on the cover. Replace if damaged.</li> <li>Put washers in the holes of the gasket.</li> <li>Use attachment screws made of stainless steel to fit the wrist cover.</li> </ul>	  xx1400000383 <p>A Protection plugs (2 on wrist cover and 2 on cover axis-5 gearbox)  B Washers (10 pcs) in gasket holes</p>
4 Carefully refit the wrist cover. Use the following method not to damage the cables: <ol style="list-style-type: none"> <li>Hold the cover slightly tilted below the wrist.</li> <li>Put the cable harness inside the cover.</li> <li>Lift the cover, still tilted.</li> <li>Move the upper part of the cover into position.</li> <li>Secure the cover with its attachment screws.</li> </ol>	Tightening torque: 10 Nm  xx1300000772
5 <b>Foundry Plus:</b> Refit protection plugs.	
6 If used, refit the DressPack cable package on the wrist.	

*Continues on next page*

	Action	Note
7	Recalibrate the robot.	Axis Calibration is described in <a href="#">Calibrating with Axis Calibration method on page 691</a> . General calibration information is included in section <a href="#">Calibration on page 683</a> .
8	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

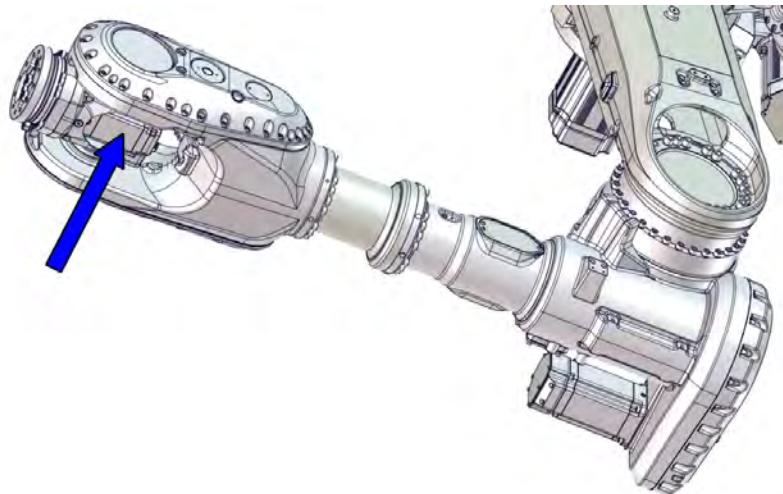
## 4 Repair

### 4.7.6 Replacing the axis-6 motor

#### 4.7.6 Replacing the axis-6 motor

##### Location of axis-6 motor

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



xx1700000463

##### Spare part

Spare part	Spare part number	Note
Axis-6 motor	See <i>Product manual, spare parts - IRB 6700</i> .	

##### Required tools and equipment

Equipment, etc.	Article number	Note
Removal tool M12	3HAC057339-003	Used to push out the motor, if necessary. Always use removal tools in pairs.
Rotation tool	3HAB7887-1	Used to rotate the motor pinion.
24 VDC power supply	-	Used to release the motor brakes.
Leak-down tester	-	
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

##### Consumables

Equipment, etc.	Article number	Note
Grease	3HAB3537-1	Shell Gadus S2V220 AC Used to lubricate o-rings.
Gasket	3HAC033489-001	Used on motor cover.

*Continues on next page*

Equipment, etc.	Article number	Note
O-ring	3HAB3772-107	D=102x3 Used on motor flange.

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

### Removing the axis-6 motor

Use these procedures to remove the motor.

#### Preparations before removing the axis-6 motor

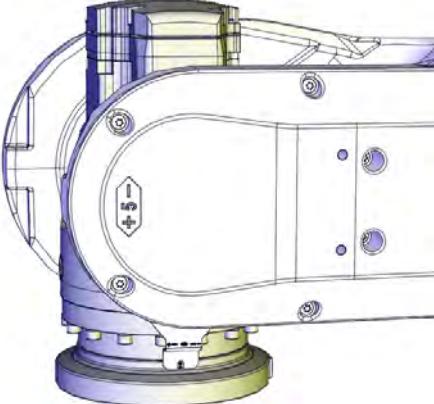
	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	

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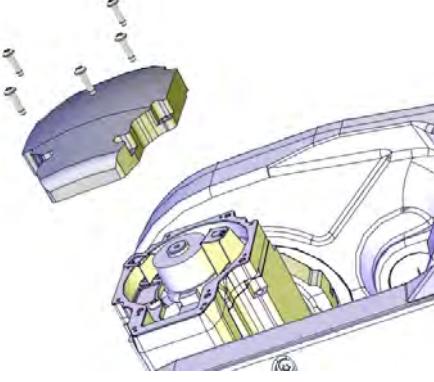
## 4 Repair

### 4.7.6 Replacing the axis-6 motor

*Continued*

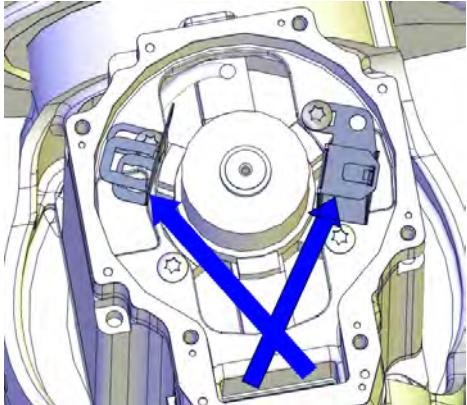
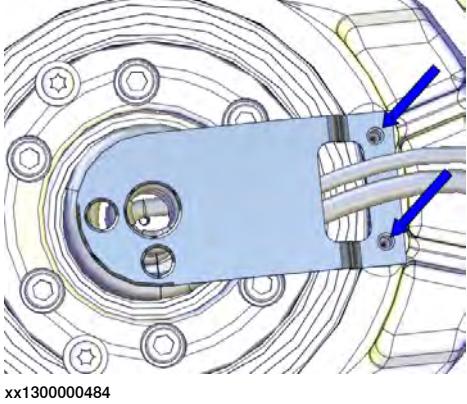
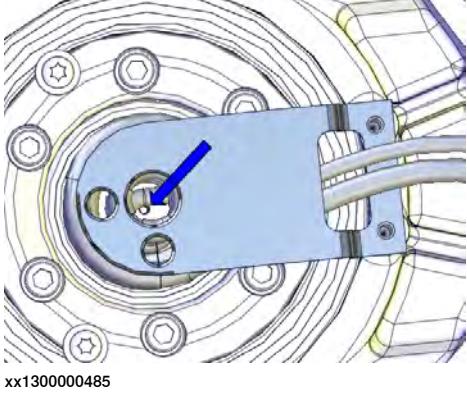
Action	Note
<p>2 Jog the robot to a position where axis 5 can be positioned with the motor pointing straight up at an acceptable working position.</p> <p>With axis 5 in this position it is possible to replace the motor without draining the oil from the axis-6 gearbox.</p>	 xx1200001081
<p>3</p> <p> <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>	

#### Disconnecting the axis-6 motor cables

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>Unscrew the attachment screws and remove the motor cover.</p>	 xx1200001080

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#### 4.7.6 Replacing the axis-6 motor Continued

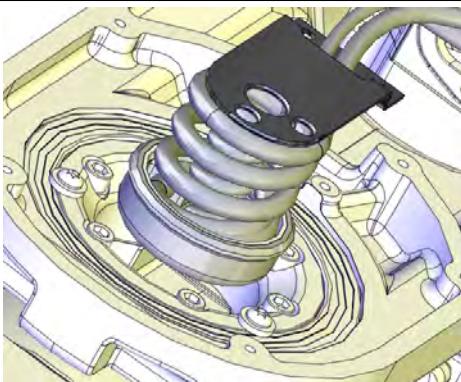
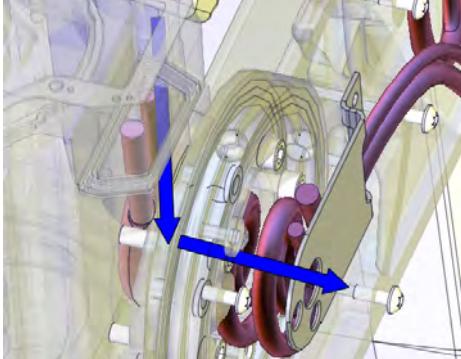
Action	Note
3 Disconnect the motor cables.	 xx1300000488
4 Unscrew the attachment screws that hold the cable bracket.	 xx1300000484
5 Unscrew the M4 screw that holds the carrier.  <span style="background-color: #4f81bd; color: white; padding: 2px 10px; border-radius: 5px;">Note</span> The screw is located at the bottom of the carrier.	 xx1300000485

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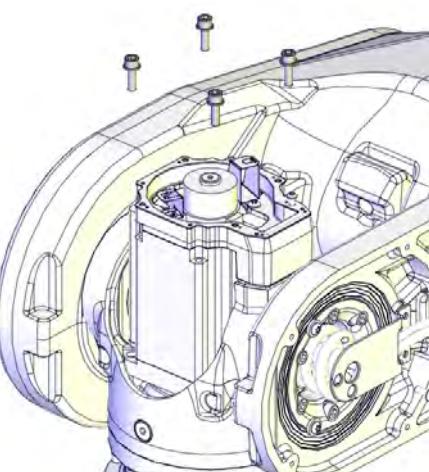
## 4 Repair

### 4.7.6 Replacing the axis-6 motor

*Continued*

Action	Note
6 Pull out the carrier from its position.	 xx1300001113
7 Pull out the axis-6 motor cables by holding the cables with one hand at the motor and the other at the carrier.	 xx1300000666

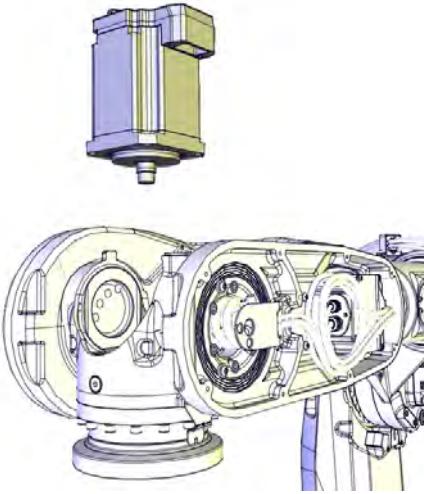
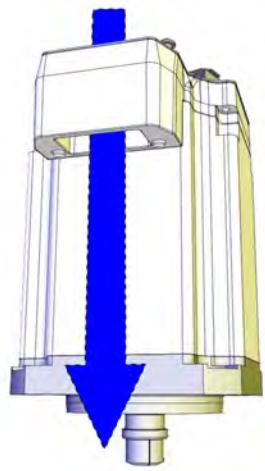
#### Removing the axis-6 motor

Action	Note
1 To release the brakes, connect the 24 VDC power supply. Connect to R2.MP6-connector: <ul style="list-style-type: none"><li>• + = pin 2</li><li>• - = pin 5</li></ul>	24 VDC power supply
2 Unscrew the motor attachment screws.	 xx1200001090

*Continues on next page*

## 4.7.6 Replacing the axis-6 motor

*Continued*

	Action	Note
3	 <b>CAUTION</b> Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
4	If required, press the motor out of position by fitting the removal tool, motor to the attachment holes of the motor.	Removal tool M12: 3HAC057339-003 Always use removal tools in pairs.
5	 <b>CAUTION</b> The motor weighs 9 kg. All lifting accessories used must be sized accordingly.	
6	Remove the motor by lifting it straight up from the gear while at the same time picking out the motor cables from the motor. Make sure the motor pinion is not damaged!	 xx1200001091
7	Disconnect the 24 VDC power supply.	 xx1200001096

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## 4 Repair

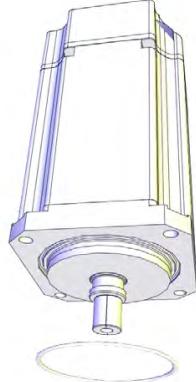
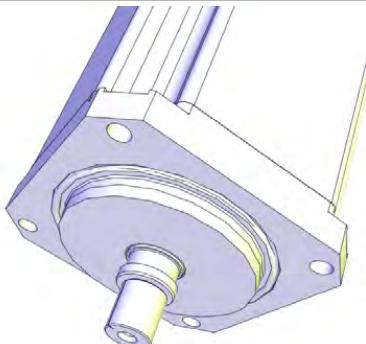
### 4.7.6 Replacing the axis-6 motor

*Continued*

#### Refitting the axis-6 motor

Use this procedure to refit the motor.

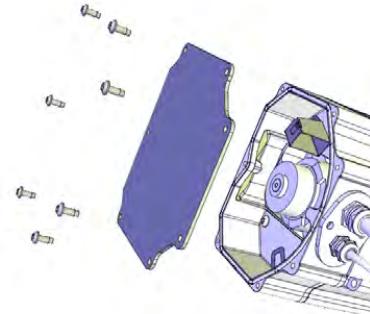
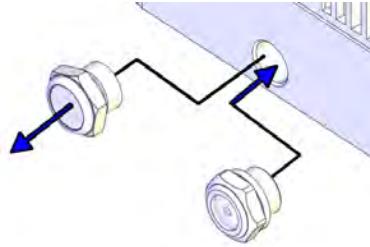
##### Preparations prior to refitting motor

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove old paint residues and other contamination from the contact surfaces on both the motor and the mating parts.	
3	Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4	Check the o-ring. Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
5	 <b>Tip</b> Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020

*Continues on next page*

## 4.7.6 Replacing the axis-6 motor

Continued

Action	Note
6 If the motor is a new spare part, remove the cover.	 xx1200001135
7 <b>Foundry Plus:</b> Valid for axis-2, axis-3, axis-4 and axis-6 motors. If the motor is a new spare part, the protection filter located in the evacuation hole on the motor flange must be replaced with a transparent plug/sight glass (enclosed with the spare part delivery). Remove the protection filter and install the transparent plug/sight glass. On the axis-6 motor there are two protection filters that must be replaced with transparent plugs/sight glasses.	Tightening torque, transparent plug: 25 Nm $\pm 10\%$ . Tightening torque, protection filter: 10 Nm $\pm 10\%$ .  xx1600000576

## Securing the axis-6 motor

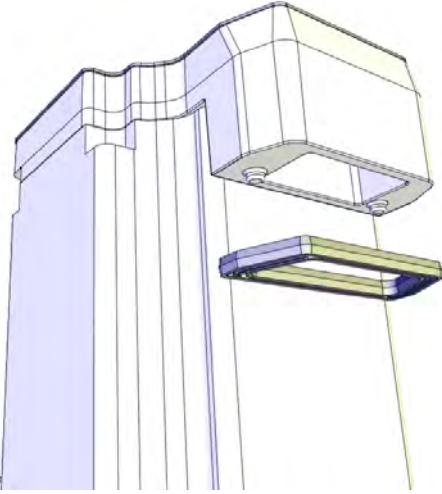
Action	Note
1  <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP6: <ul style="list-style-type: none"><li>• + = pin 2</li><li>• - = pin 5</li></ul>	
3  <b>CAUTION</b> Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

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## 4 Repair

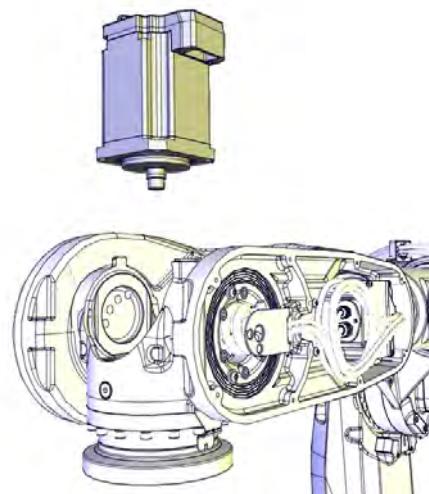
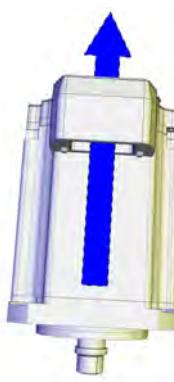
### 4.7.6 Replacing the axis-6 motor

*Continued*

	Action	Note
4	Check the gasket. Replace if damaged.	 xx1200001094
5	 <b>CAUTION</b> The motor weighs 9 kg. All lifting accessories used must be sized accordingly.	

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#### 4.7.6 Replacing the axis-6 motor Continued

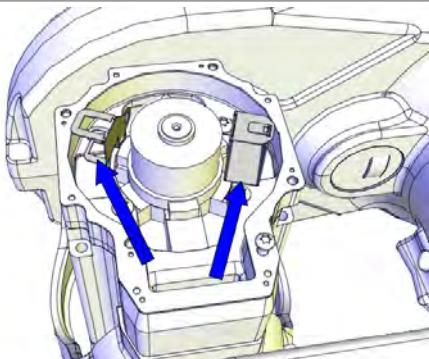
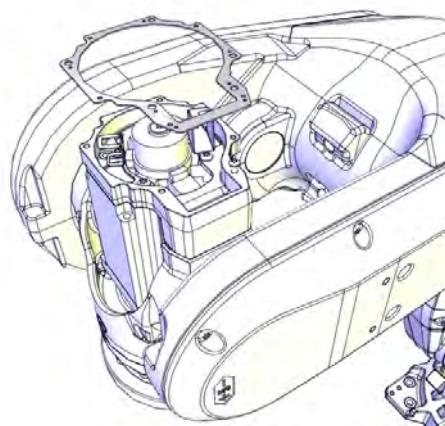
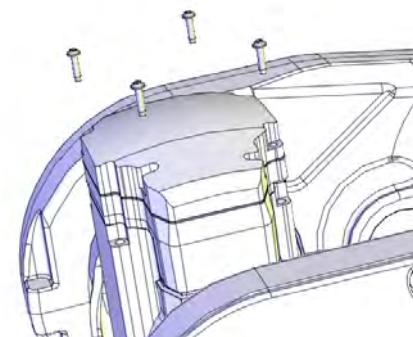
Action	Note
6 Fit the motor while, at the same, time pushing the motor cables in through the cable gland.  Make sure the motor pinion is properly mated with the gear of the axis-6 gearbox.  Make sure the motor pinion is not damaged!	 xx1200001091
	 xx1200001097
7 Check that the gasket is fitted correctly. Secure the motor with its attachment screws.	Tightening torque: 24 Nm Screw dimension: M8x25 Steel 8.8-A2F (4 pcs)
8 Perform a leak-down test.	See <a href="#">Performing a leak-down test on page 190</a> .

Continues on next page

## 4 Repair

### 4.7.6 Replacing the axis-6 motor

*Continued*

Action	Note
9 Disconnect the 24 V DC power supply.	
10 Reconnect the connectors.	 xx1200001084
11 Check the gasket. Replace if damaged.	Gasket: 3HAC033489-001  xx1200001095
12 Refit the motor cover.	 xx1200001082
13 Re-calibrate the robot.	Axis Calibration is described in <a href="#">Calibrating with Axis Calibration method on page 691</a> . General calibration information is included in section <a href="#">Calibration on page 683</a> .

*Continues on next page*

	Action	Note
14	 <b>DANGER</b>  Make sure all safety requirements are met when performing the first test run. These are further described in <i>DANGER - First test run may cause injury or damage! on page 46.</i>	

## 4 Repair

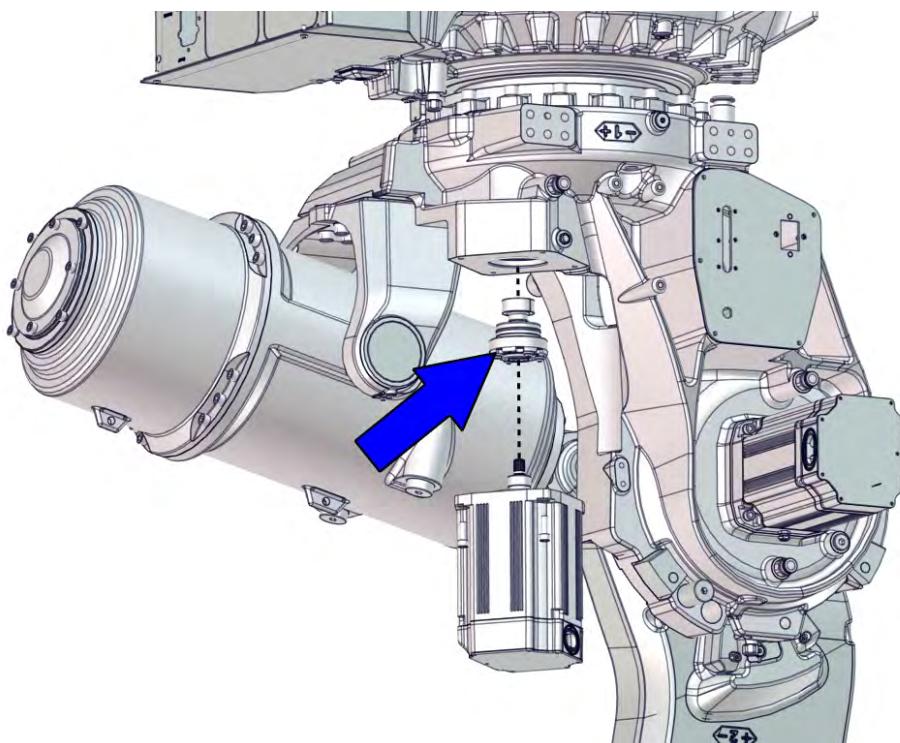
### 4.8.1 Replacing the hub

## 4.8 Gearboxes

### 4.8.1 Replacing the hub

#### Location of the hub

The hub is located as shown in the figure.



xx1700000462

#### Summary of the replacement procedure

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

- 1 Drain the oil in axis 1.
- 2 Remove the axis-1 motor.
- 3 Replace the hub.
- 4 Refit the axis-1 motor.
- 5 Fill oil in axis 1.

#### Required spare parts

Spare part	Article number	Note
Hub with pinion	3HAC058203-003	

*Continues on next page*

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Required tools and equipment

Equipment	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section <a href="#">Type of lubrication in gearboxes on page 147</a> .
oil level gauge	3HAC061881-001	Assemble the extender to be able to use the oil level gauge when the fork lift accessories are mounted. The tool also includes an air vent.
Removal tool axis-1 motor	3HAC055444-001	Used to lower and raise the motor axis-1 (inverted position).
Roundsling, 1 m	-	Lifting capacity: 1,000 kg.
Lifting eye, M12	3HAC16131-1	
Guide pin, M12x150	3HAC13056-2	Always use guide pins in pairs.
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Rotation tool	3HAB7887-1	Used to rotate the motor pinion.
24 VDC power supply	-	Used to release the motor brakes.
Leak-down tester	-	
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

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Required consumables

Consumable	Article number	Note
Grease		

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Deciding calibration routine

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

	Action	Note
1	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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## 4 Repair

### 4.8.1 Replacing the hub

*Continued*

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 692</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 hub

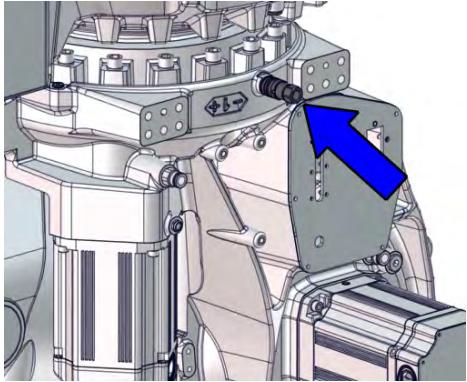
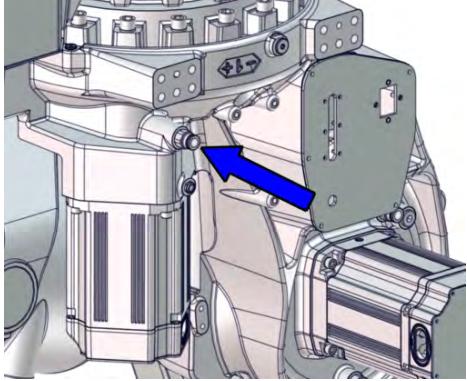
Use these procedures to remove the hub.

#### Draining the axis-1 gearbox of an inverted robot

Action	Note
<p>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.</p>	
<p>2  <b>WARNING</b> Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <a href="#">WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51</a>.</p>	
<p>3 Make sure that the oil temperature is +25°C ± 10°C.  <b>CAUTION</b> The gearbox can contain an excess pressure that can be hazardous. Open the oil plug carefully in order to let the excess pressure out.</p>	

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4.8.1 Replacing the hub  
*Continued*

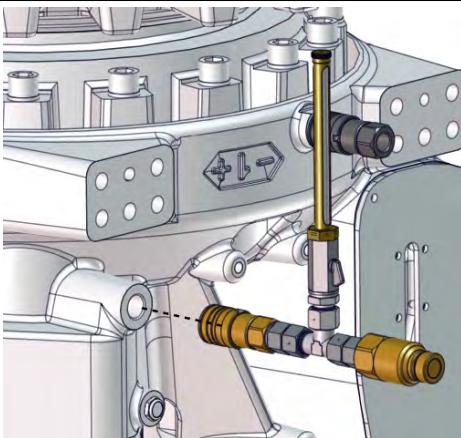
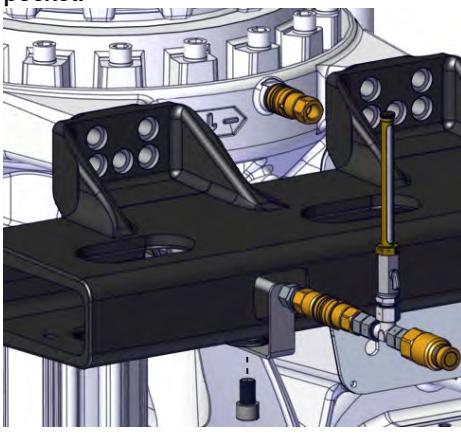
Action	Note
4 Install the ventilating valve.	 xx1700000349
5 Remove the protective cap and open the oil plug.	 xx1600002042
6 Make sure that the valve is closed (horizontal) and mount the oil level gauge	

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## 4 Repair

### 4.8.1 Replacing the hub

*Continued*

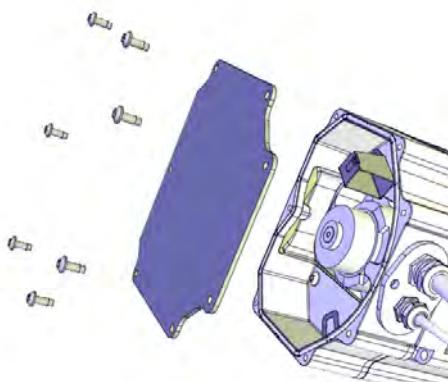
Action	Note
7 Open the valve slowly to avoid air bubbles in the oil. Check the oil level using the oil level gauge. Required oil level is: According to level measurement on tool ± 5 mm	 xx1600002097  If the Fork lift accessory set is assembled, fasten the extender screw in the fork lift pocket.  xx170000314
8 Connect the oil dispenser to the oil level gauge.	
9 Suck out the oil with the oil dispenser.   <b>Note</b> There will be some oil left in the gear after draining.	
10  <b>WARNING</b> Used oil is hazardous material and must be disposed of in a safe way. See section <a href="#">Decommissioning on page 705</a> for more information.	
11 Refill oil or: 1 Remove the oil dispenser and the oil level gauge. 2 Refit the oil plug.	Tightening torque: 24 Nm

*Continues on next page*

## Preparations before removing the axis-1 motor

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	Jog the robot to the synchronization position.	
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 robot working area.	

## Disconnecting the motor cables

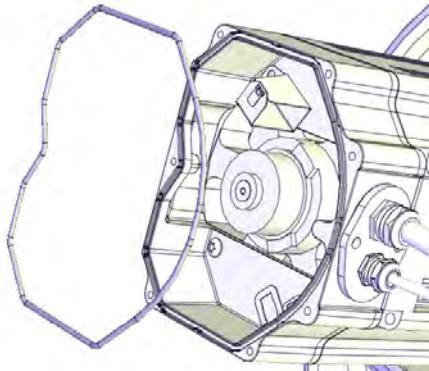
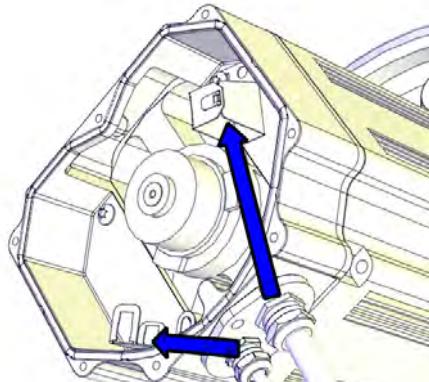
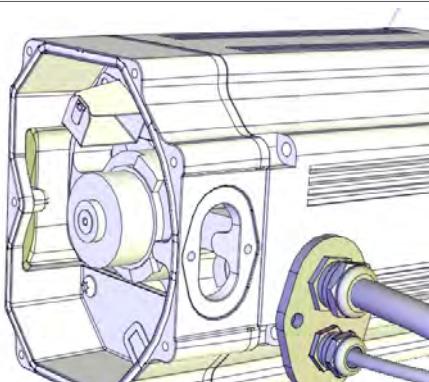
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135

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## 4 Repair

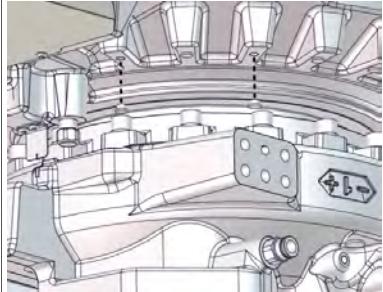
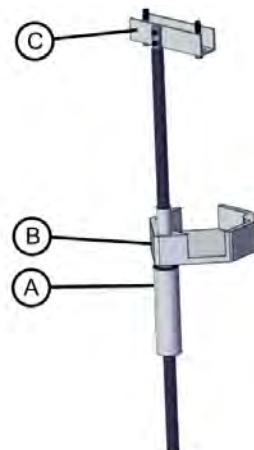
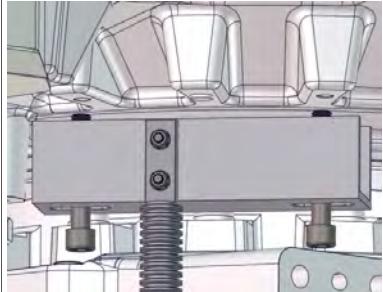
### 4.8.1 Replacing the hub

*Continued*

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

*Continues on next page*

## Attaching the removal tool

	Action	Note						
1	<p><i>Foundry plus:</i> Remove the plastic plugs.</p>	 <p>xx1700000364</p>						
2	<p>Lower the revolving handle on the removal tool, to be able to fit the shelf beneath the motor while fastening the tool.</p>	 <p>xx1700000365</p> <table border="1"> <tr> <td>A</td> <td>Revolving handle</td> </tr> <tr> <td>B</td> <td>Shelf</td> </tr> <tr> <td>C</td> <td>Bracket</td> </tr> </table>	A	Revolving handle	B	Shelf	C	Bracket
A	Revolving handle							
B	Shelf							
C	Bracket							
3	Attach the tools bracket screws to the robot frame.	 <p>xx1700000366</p>						

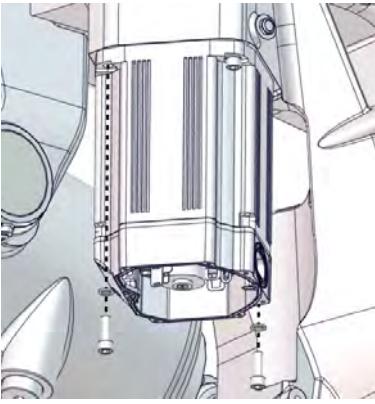
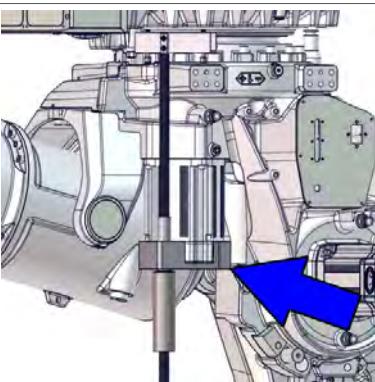
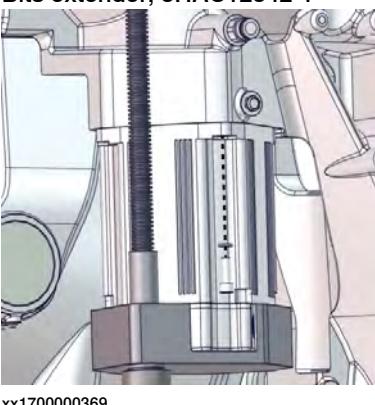
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## 4 Repair

### 4.8.1 Replacing the hub

*Continued*

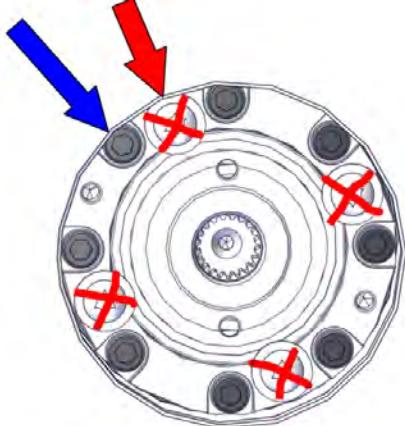
#### Removing the axis-1 motor

	Action	Note
1	Remove the two shown motor screws and washers.	Bits extender, 3HAC12342-1  xx1700000368
2	Raise the revolving handle to fit the motor on the tool shelf.	 xx1700000367
3	Remove the two remaining screws holding the motor. (One screw is placed on the opposite side of the motor.)   <b>CAUTION</b> Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.	Bits extender, 3HAC12342-1  xx1700000369
4	To release the brakes, connect the 24 VDC power supply. Connect to R2.MP1-connector: • + = pin 2 • - = pin 5	24 VDC power supply
5	Lower the revolving handle.	If the motor is stuck, use Removal tool M12: 3HAC057339-003

*Continues on next page*

Action	Note
6 Rotate the shelf to remove the motor.  ! <b>CAUTION</b>  The weight of the motor is 27 kg All lifting accessories used must be sized accordingly.	
7 Disconnect the 24 VDC power supply.	
8 Fasten lifting eyes in two of the fastening holes on the motor.	Lifting eye, M12, 3HAC16131-1
9 Use a roundsling to lift the motor off.	

## Removing the hub

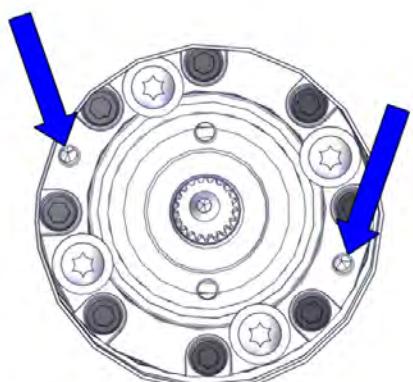
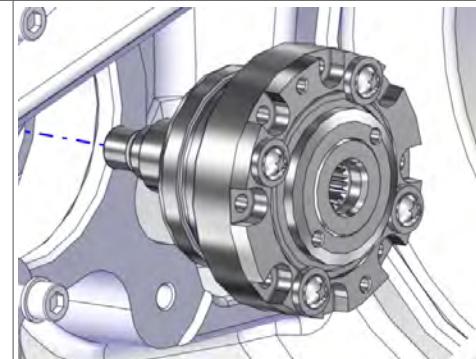
Action	Note
1 ! <b>DANGER</b>  Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Unscrew the M6x30 hex socket head cap screws that secure the hub.  ! <b>Note</b>  Do not remove the M6x16 torx pan head screws.	 xx1500002038
3 ! <b>CAUTION</b>  Whenever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

Continues on next page

## 4 Repair

### 4.8.1 Replacing the hub

*Continued*

	Action	Note
4	Fit two screws in opposite holes of the hub and use them as removal tools.	Attachment screws: M6x110 (2 pcs)  xx1500002081
5	Lift out the hub carefully.	 xx1500002326

### Refitting the hub

Use these procedures to refit the hub.

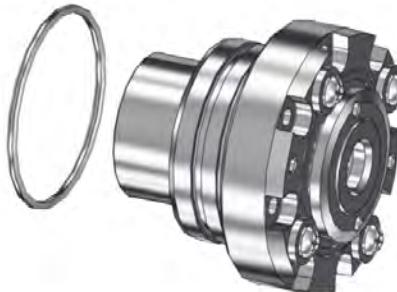
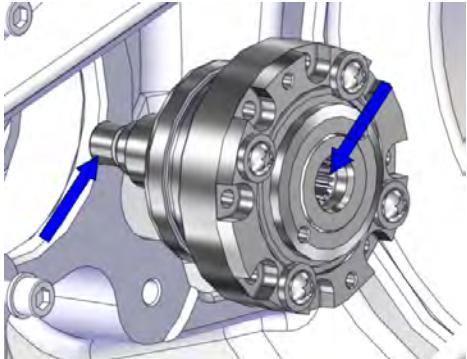
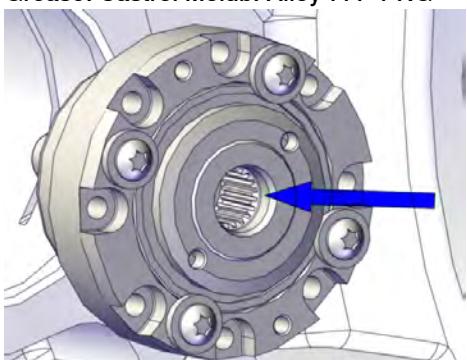
#### Preparations before refitting the hub

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

*Continues on next page*

#### 4.8.1 Replacing the hub

*Continued*

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

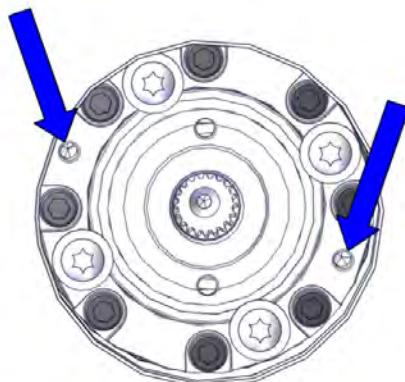
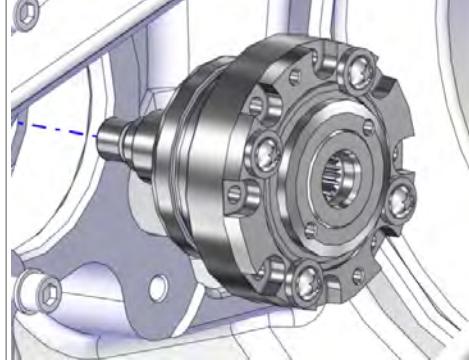
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## 4 Repair

### 4.8.1 Replacing the hub

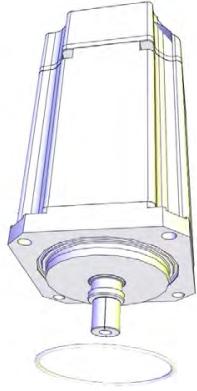
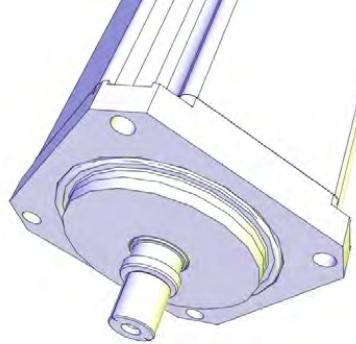
*Continued*

#### Refitting the hub

Action	Note
1 Attach two screws in opposite holes of the hub and use them as tools to fit the hub.	Attachment screws: M6x110 (2 pcs)  xx1500002081
2  <b>CAUTION</b> Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	
3 Refit the hub.	 xx1500002326
4 Remove the two M6x110 and fit the attachment screws for the hub. Apply locking liquid (Loctite 243) on the screws.	Attachment screws: M6x30 12.9. Loctite 243 Quantity: 6 pcs
 <b>Note</b> The number of attachment screws differ depending on gearbox.	
5 Secure the hub.	Tightening torque: 14 Nm.

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## Preparations prior to refitting motor

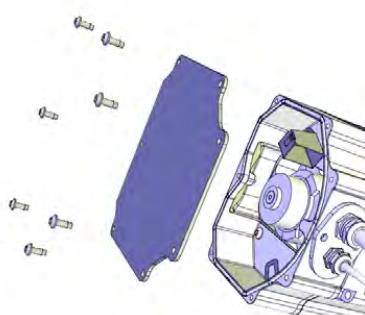
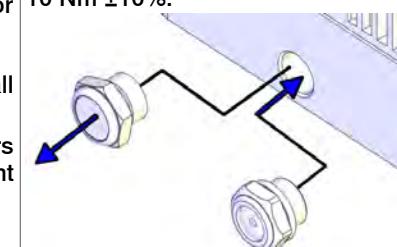
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove old paint residues and other contamination from the contact surfaces on both the motor and the mating parts.	
3	Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4	Check the o-ring. Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
5	 <b>Tip</b> Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020

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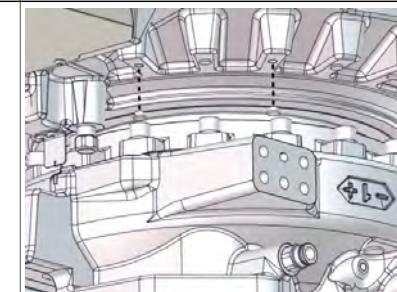
## 4 Repair

### 4.8.1 Replacing the hub

*Continued*

Action	Note
6 If the motor is a new spare part, remove the cover.	 xx1200001135
7 <b>Foundry Plus:</b> Valid for axis-2, axis-3, axis-4 and axis-6 motors. If the motor is a new spare part, the protection filter located in the evacuation hole on the motor flange must be replaced with a transparent plug/sight glass (enclosed with the spare part delivery). Remove the protection filter and install the transparent plug/sight glass. On the axis-6 motor there are two protection filters that must be replaced with transparent plugs/sight glasses.	Tightening torque, transparent plug: 25 Nm $\pm 10\%$ . Tightening torque, protection filter: 10 Nm $\pm 10\%$ .  xx1600000576

#### Attaching the removal tool

Action	Note
1 <b>Foundry plus:</b> Remove the plastic plugs.	 xx1700000364

*Continues on next page*

#### 4.8.1 Replacing the hub

*Continued*

Action	Note						
2 Lower the revolving handle on the removal tool, to be able to fit the shelf beneath the motor while fastening the tool.	 xx1700000365 <table border="1" style="margin-left: 20px;"> <tr> <td>A</td> <td>Revolving handle</td> </tr> <tr> <td>B</td> <td>Shelf</td> </tr> <tr> <td>C</td> <td>Bracket</td> </tr> </table>	A	Revolving handle	B	Shelf	C	Bracket
A	Revolving handle						
B	Shelf						
C	Bracket						
3 Attach the tools bracket screws to the robot frame.	 xx1700000366						

#### Securing the axis-1 motor

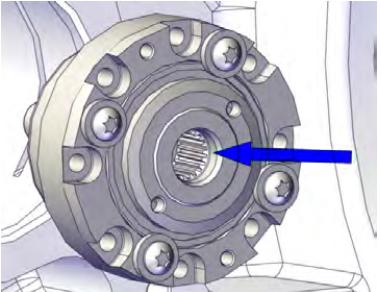
Action	Note
1 <b>CAUTION</b> The weight of the motor is 27 kg All lifting accessories used must be sized accordingly.	
2 Fasten lifting eyes in two of the fastening holes on the motor.	Lifting eye, M12, 3HAC16131-1
3 Use a roundsling to lift the motor.	
4 Put the motor on the tool shelf and rotate it into position.	
5 Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.

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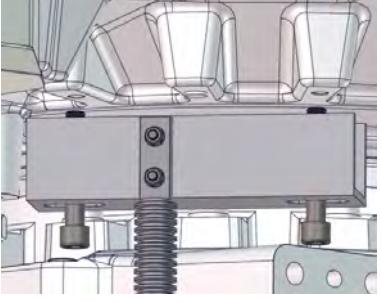
## 4 Repair

### 4.8.1 Replacing the hub

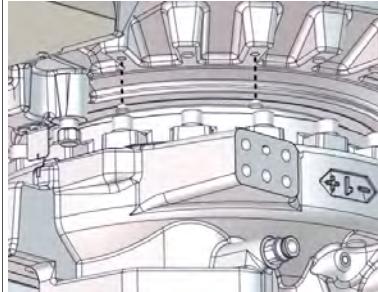
*Continued*

	Action	Note
6	Apply 3 gram grease on the splines before fitting.	<p>Grease: Castrol Molub. Alloy 777-1 NG</p>  <p>xx1500002346</p>
7	<p>In order to release the brakes, connect the 24 VDC power supply.</p> <p>Connect to R2.MP1-connector:</p> <ul style="list-style-type: none"> <li>• + = pin 2</li> <li>• - = pin 5</li> </ul>	
8	<p> <b>CAUTION</b></p> <p>Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.</p>	
9	<p>Raise the revolving handle to assemble motor.</p> <ul style="list-style-type: none"> <li>• Make sure that the motor pinion is properly mated into the hub.</li> <li>• Make sure that the motor pinion does not get damaged.</li> <li>• Make sure that the direction of the cable exit is facing the correct way.</li> </ul>	
10	<p>Secure the motor with its attachment screws and washers.</p> <p>Use a bits extender to reach the screws.</p>	<p>Bits extender: 3HAC12342-1 Tightening torque: 50 Nm. Screw dimension : M10x40 quality 12.9 Gleitmo (4 pcs)</p>
11	Perform a leak-down test (if not already done).	See <a href="#">Performing a leak-down test on page 190</a> .
12	Disconnect the 24 VDC power supply.	

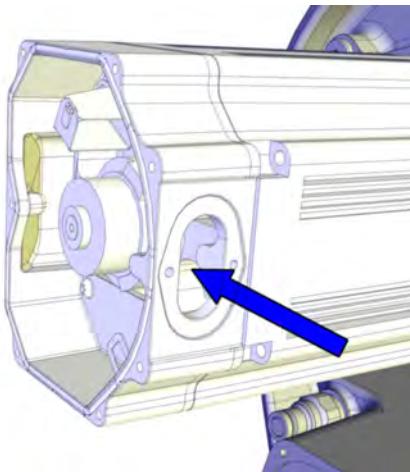
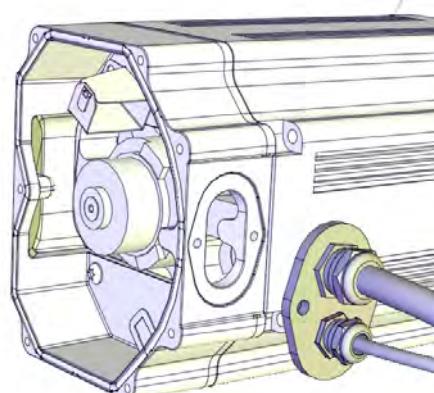
Removing the removal tool

	Action	Note
1	Remove screws holding the tool bracket.	 <p>xx1700000366</p>

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	Action	Note
2	<i>Foundry plus:</i> Refit the plastic plugs.	 xx1700000364

## Connecting the motor cables

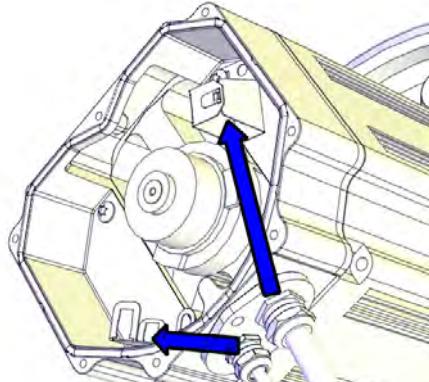
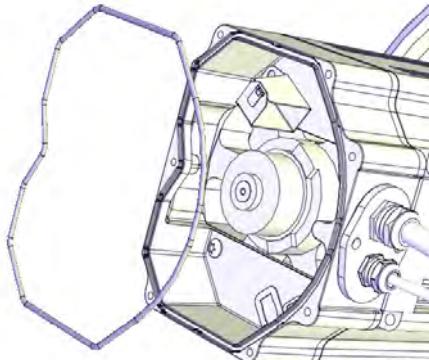
	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1300000738
2	Refit the cable gland cover.  <span style="color: #0070C0; font-size: 1.5em;">i</span> <b>Note</b> Replace the gasket if damaged.	 xx1200001067

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## 4 Repair

### 4.8.1 Replacing the hub

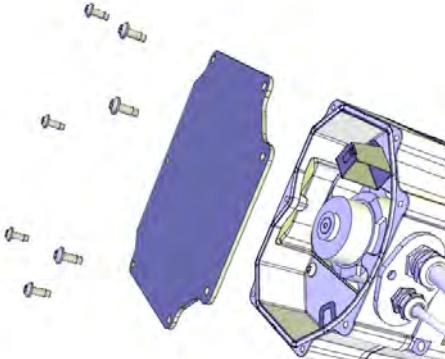
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Action	Note
3 Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066
4 Inspect the o-ring.   <b>Note</b>  Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-001   xx1200001070
5 Wipe clean o-ring and o-ring groove.	
6 Refit the o-ring.   <b>Tip</b>  Lubricate the o-ring with some grease for a better fitting in the groove.	
7  <b>CAUTION</b>  When fitting the motor cover, make sure that none of the cables inside will be damaged.	

*Continues on next page*

## 4.8.1 Replacing the hub

Continued

	Action	Note
8	<p>Refit the motor cover with its attachment screws.</p> <p><b>Note</b> Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged.</p> <p><b>Note</b> Make sure the o-ring is undamaged and properly fitted.</p>	 xx1200001135
9	Make sure that the covers are tightly sealed.	

## Filling oil into axis-1 gearbox

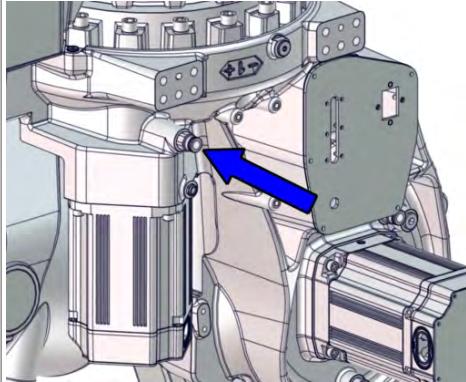
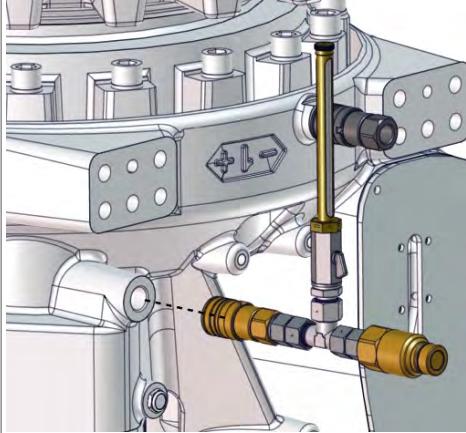
	Action	Note
1	<p><b>DANGER</b></p> <p>Turn off all:</p> <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> <p>to the robot, before entering the robot working area.</p>	
2	<p><b>WARNING</b></p> <p>Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section <b><i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 51.</i></b></p>	

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## 4 Repair

### 4.8.1 Replacing the hub

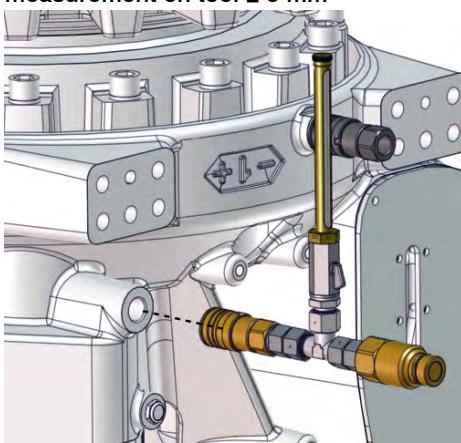
*Continued*

Action	Note
3 Open the oil plug.	 xx1600002042
4 Fit the oil level gauge.	 xx1600002097 <p>If the Fork lift accessory set is assembled, fasten the extender screw in the fork lift pocket.</p>  xx1600002092
5 Connect the oil dispenser to the oil level gauge.	
6 Refill the gearbox with oil with the oil dispenser.	<p> <b>Note</b></p> <p>The amount of oil to be filled depends on the amount previously being drained.</p> <p>Type of oil and total amount is detailed in <i>Technical reference manual - Lubrication in gearboxes</i>.</p>

*Continues on next page*

## 4.8.1 Replacing the hub

Continued

	Action	Note
7	Inspect the oil level using the oil level gauge.	Required oil level: According to level measurement on tool $\pm 5 \text{ mm}$
		 xx1600002097
		If the Fork lift accessory set is assembled, fasten the extender screw in the fork lift pocket.
		
8	Remove the oil dispenser and the oil level gauge.	
9	Refit the oil plug.	Tightening torque: 24 Nm
10	 Note	
		After all repair and maintenance work involving oil, always wipe the robot clean from all surplus oil. The oil can effect the robot color.
11	 DANGER	
	<b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <b>DANGER - First test run may cause injury or damage! on page 46.</b>	

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## 4 Repair

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### 4.8.1 Replacing the hub

*Continued*

#### Concluding procedure

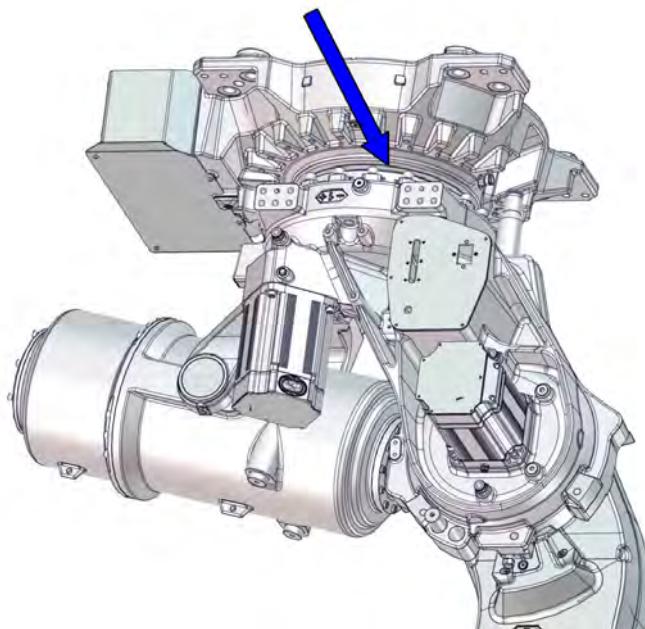
Use this procedure for the concluding refitting.

	Action	Note
1	Re-calibrate the robot.	Axis Calibration is described in <a href="#">Calibrating with Axis Calibration method on page 691</a> . General calibration information is included in section <a href="#">Calibration on page 683</a> .
2	 <b>DANGER</b>  Make sure all safety requirements are met when performing the first test run. These are further described in <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

## 4.8.2 Replacing the axis-1 gearbox

### Location of the axis-1 gearbox

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



xx1700000095



#### Note

The robot must be taken down and secured floor standing to perform this replacement procedure.

How to do this is described in the removal procedure in this section.



#### DANGER

Always lock the position of the lower arm, using the yellow sleeve and transportation lock screw, before attempting to lift the robot.

### Summary of the replacement procedure

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

- 1 Lift down the robot to floor standing.
- 2 Remove the cabling from the base.
- 3 Remove the complete arm system (including frame and balancing device) as a package.
- 4 Replace the axis-1 gearbox.

*Continues on next page*

## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

*Continued*

#### Spare parts

Spare parts	Article number	Note
Axis-1 gearbox	See <i>Product manual, spare parts - IRB 6700</i> .	

#### Required tools and equipment

Equipment, etc.	Article number	Note
Fork lift accessory set	3HAC058825-001	Contains fork lift pockets and all required hardware for installation. User instructions are enclosed with the tool, see <i>Directions for use - Fork lift accessory for IRB 6700Inv</i> . In order to rotate the robot, either use the turning tool or a fork lift truck with a rotator attachment.
Turning tool	3HAC061162-001	User instructions are enclosed.
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section <i>Type of lubrication in gearboxes on page 147</i> .
Removal tool M12	3HAC057339-003	Used to push out the motor, if necessary. Always use removal tools in pairs.
Bits extender	3HAC12342-1	300 mm, bits 1/2"
Lifting eye, M12	3HAC16131-1	
Lifting eye, M12	3HAC16131-1	
Fender washer	-	Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.
Lifting shackle, 2 pcs	-	SA-10-8-NA1
Roundsling, 2 m	-	Lifting capacity: 2,000 kg.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Lifting eye, M16	3HAC14457-4	
Lifting eye, M16	3HAC14457-4	
Lifting accessory, motor	3HAC14459-1	
Rotation tool	3HAB7887-1	Used to rotate the motor pinion.
Aligning tool	3HAC046645-003	Used for aligning the gearbox against the frame, so that the play in the motor does not need to be adjusted.
24 VDC power supply	-	Used to release the motor brakes.
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Guide pin, M16x120	3HAC062397-001	Always use guide pins in pairs.

*Continues on next page*

## 4.8.2 Replacing the axis-1 gearbox

Continued

Equipment, etc.	Article number	Note
Guide pin, M16x120	3HAC062397-001	Always use guide pins in pairs.
Guide pin, M20x180	3HAC048814-002	Always use guide pins in pairs.
Support legs	3HAC15535-1	
Bit holder	3HAC029090-001	
Leak-down tester	-	
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

**Consumables**

Equipment, etc	Article number	Note
Locking liquid (Loctite 243)	-	
Flange sealant	12340011-116	Loctite 574
Grease	3HAB3537-1	Used to lubricate o-rings.
Grease	-	Castrol Molub. Alloy 777-1 NG Used on hub splines to prevent from fretting corrosion.
Locking liquid	3HAB7116-1	Loctite 243
O-ring	3HAB3772-160	414.3x5.7. Located between the gearbox and the frame.
O-ring	3HAB3772-97	Located at the oil inlet underneath of gearbox.
O-ring	3HAC054692-002	D=169.5x3 Used on motor cover.
O-ring	3HAB3772-107	D=102x3 Used on motor flange.
Sealing ring	3HAC047474-001	Located in the frame, on top of the protection tube.
O-ring	3HAB3772-57	Located on the sealing ring.
Radial sealing with dust lip	3HAB3701-51	Located in the frame, underneath the sealing ring.
Cable straps	-	

**Required documents**

Document name	Document number	Note
Technical reference manual - Lubrication in gearboxes	3HAC042927-001	
Directions for use - Fork lift accessory for IRB 6700Inv	3HAC060303	
User instructions for turning tool (enclosed with the turning tool)	-	

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## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

*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 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>	
If the robot is to be calibrated with reference calibration: Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 692</a> .
If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

#### Removing the axis-1 gearbox

These procedures describe how to remove the gearbox.

#### Securing the lower arm

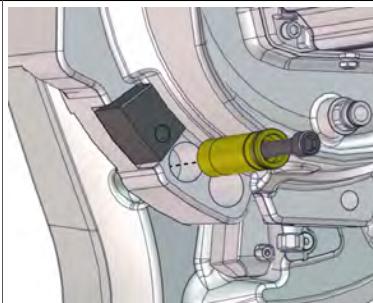
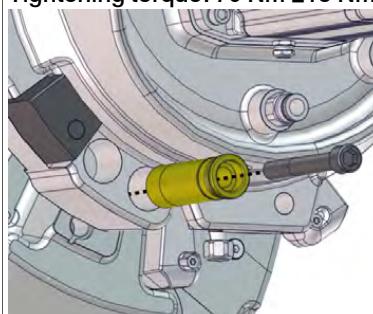
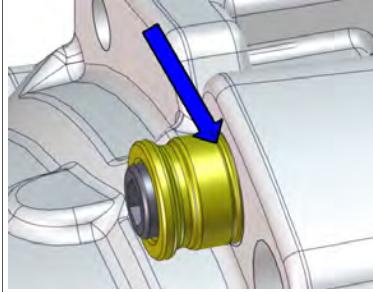
Use this procedure to secure the lower arm before lifting down the robot from inverted position.

Action	Note
1 Jog the robot into position: <ul style="list-style-type: none"><li>• Axis 1: 0°</li><li>• Axis 2: -35°</li><li>• Axis 3: +65°</li><li>• Axis 4: 0°</li><li>• Axis 5: +60°</li><li>• Axis 6: no significance</li></ul>	<p>xx1700000555</p>

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## 4.8.2 Replacing the axis-1 gearbox

*Continued*

Action	Note
2 Remove the transportation lock screw and the yellow sleeve from the parking position.	 xx1700000270
3 Insert the yellow sleeve and the transportation lock screw in the hole at the locking position. Insert the sleeve all the way so that the marking in the sleeve is aligned with the casting, see figure. Tighten the screw.   <b>DANGER</b>  Always use the transportation lock screw and sleeve to lock the lower arm at transportation, turning and floor standing.	Tightening torque: 70 Nm ±15 Nm.  xx1700000269   xx1600002114

## Lifting down the robot from inverted position

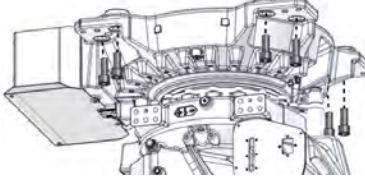
Action	Note
1 If the robot is to be secured to the floor, prepare an area where the robot can be secured with the attachment bolts. The robot must always be secured to the floor if any kind of repair or maintenance work is to be performed.	Suitable screws, lightly lubricated: M24x100 (8 pcs) For hole configuration, see <a href="#">Hole configuration, base on page 74</a> .
2 Verify that the lower arm is secured with the transportation lock screw.	
3 Remove any payload from the robot.	DressPack can stay fitted.

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## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

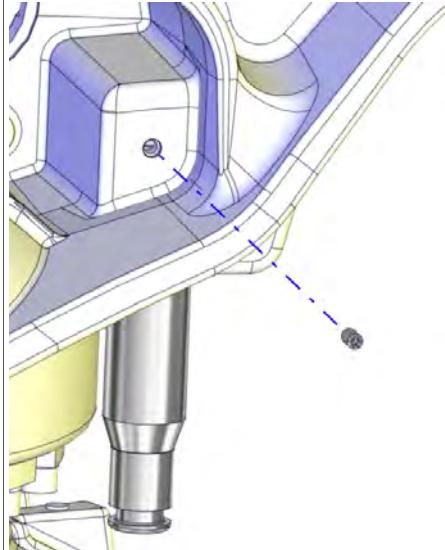
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Action	Note
<p>4  <b>DANGER</b> Turn off all:  <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul>           to the robot, before entering the robot working area.</p>	
5 Disconnect the robot cables at the base.	
<p>6  <b>CAUTION</b> The IRB 6700Inv robot weighs 1,750 kg. All lifting accessories used must be sized accordingly.</p>	
7 Install the fork lift pockets on the robot, if not already installed.	See user instructions enclosed with the fork lift accessory set. <b>Fork lift accessory set:</b> 3HAC058825-001.
8 Insert the forks of the fork lift truck into the fork lift pockets, as far as possible.	
<p>9 Raise the forks of the fork lift truck to make sure that the weight of the robot rests on the forks.</p> <p> <b>Tip</b> Two M16 screws can be fitted to the fork lift pockets, to press the forks against the pockets and make the lift more stable.</p>	
10 Remove the bolts that secure the robot to the foundation.	Quantity: 8 pcs.  xx1600002098
11 Rotate the robot to floor standing position, using the turning tool or using a fork lift truck with a rotator attachment.	Only one direction for rotation is allowed with the turning tool. Follow the user instructions enclosed with the turning tool.
12 Lower and secure the robot to the floor.	Attachment screws: M24x100 (8 pcs).

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## Preparations before removing the axis-1 gearbox

Use this procedure to do the necessary preparations, before removing the gearbox.

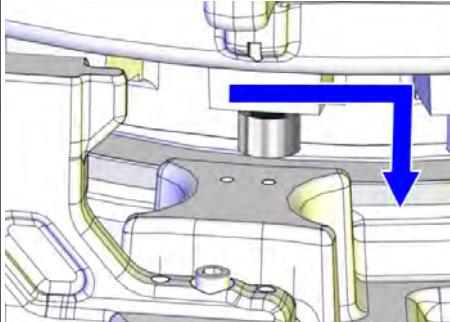
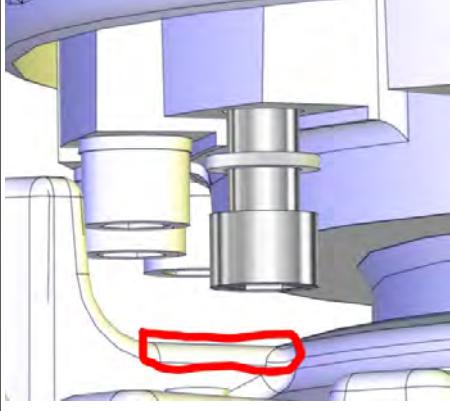
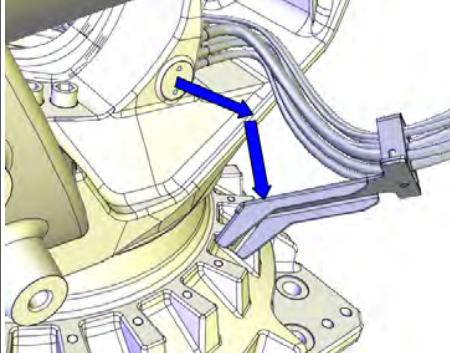
	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	 <b>DANGER</b> Turn off all: <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> to the robot, before entering the robot working area.	
3	Remove tools and other equipment fitted on the turning disc. DressPack can stay fitted for the time being.	This is done to achieve the best stability of the complete arm system, when it is resting by itself, after it has been removed.
4	Begin draining the axis-1 gearbox.	See <a href="#">Draining the axis-1 gearbox on page 150</a> .
5	 <b>CAUTION</b> The mechanical stop weighs 5 kg.	 xx1400002179

Continues on next page

## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

*Continued*

Action	Note
<p>6 Move axis 1 to a position where it is possible to remove the most backward attachment screw, placed behind the axis-1 synchronization plate.</p> <p><b>Tip</b></p> <p>Either turn on the power temporarily, jog the robot and then turn off power supply again. Or release the brakes manually on the axis-1 motor by connecting the 24 VDC power supply to the R2.MP1-connector:</p> <ul style="list-style-type: none"> <li>• + = pin 2</li> <li>• - = pin 5</li> </ul>	 xx1400002167
<p>7 Unscrew the screw but only so far that it will be possible to remove manually later.</p> <p><b>Note</b></p> <p>It must still be possible to change position of axis-1 without the attachment screw colliding with something.</p>	 xx1400002168
<p>8 Unscrew the attachment screws that secure the cable bracket.</p>	 xx1200001184

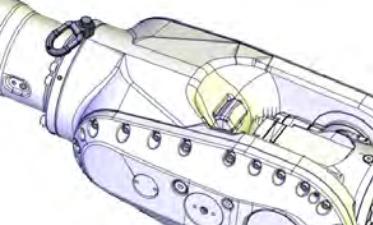
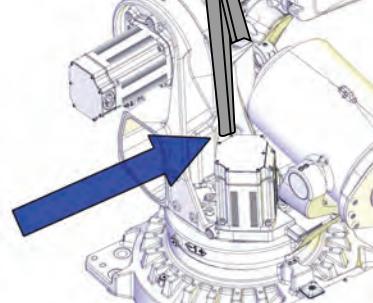
### Attaching the lifting accessories to the arm system

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>	

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#### 4.8.2 Replacing the axis-1 gearbox

*Continued*

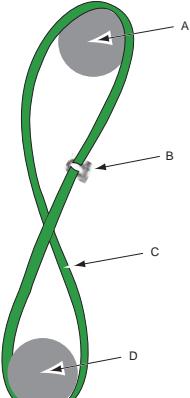
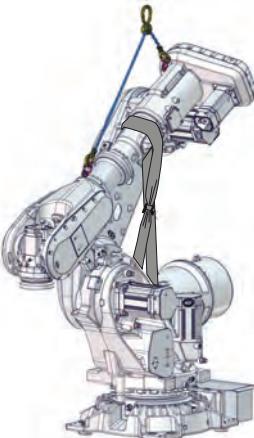
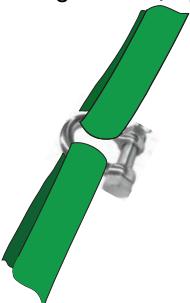
Action	Note
<b>2</b>  <b>CAUTION</b> The complete arm system weighs 1300 Kg. All lifting accessories used must be sized accordingly!	
<b>3</b> Fit a lifting eye to the wrist.	Lifting eye, M12: 3HAC16131-1  xx1200001133
<b>4</b> Run a roundsling through the hole in the frame.	Roundsling, 2 m: Lifting capacity: 2,000 kg.  xx1400002107

*Continues on next page*

## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

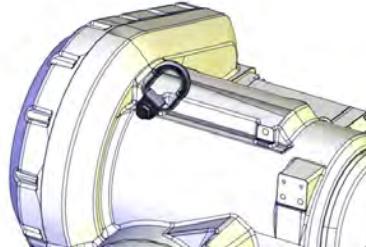
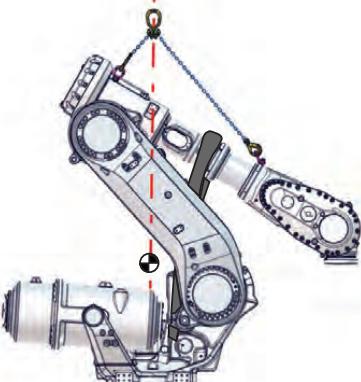
*Continued*

	Action	Note
5	<p>Continue to run the roundsling up and over the upper arm.</p> <p> <b>Tip</b></p> <p>When attaching the roundsling, make sure to cross it over, creating a figure 8 of the roundsling. This will prevent the roundsling from gliding.</p>	 <p>xx1400000728</p> <p>A Upper arm B Shackle C Roundsling D Hole in frame</p>  <p>xx1700000317</p>
6	Connect the roundsling with a shackle.	<p>Lifting shackle, 2 pcs SA-10-8-NA1</p>  <p>xx1400000729</p>

*Continues on next page*

#### 4.8.2 Replacing the axis-1 gearbox

*Continued*

	Action	Note
7	<p>Use caution and jog axis-3 slowly to stretch the roundsling.</p> <p><b>Note</b></p> <p>Make sure the roundsling is stretched, so it can carry the weight of the frame. The position of axis 3 will be approximately -45°.</p>	
8	<p>Fit a lifting eye to the arm house, with a fender washer underneath.</p>  <p>xx1400002196</p>	<p>Lifting eye, M12: 3HAC16131-1 Fender washer. Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.</p>  <p>xx1200001134</p>
9	<p>Attach the Lifting accessory (chain) to an overhead crane (or similar) and then to the lifting eye in the arm house and to the lifting eye in the wrist. Adjust the lengths of the chains so that the lifting hook is located in line with the center of gravity when the robot arm system is lifted, as shown in the figure.</p>	<p>Lifting accessory (chain): 3HAC15556-1</p>  <p>xx1700000313</p>
10	<p><b>WARNING</b></p> <p>The angle between the two chains may not exceed 90°.</p>	 <p>xx1700000319</p>

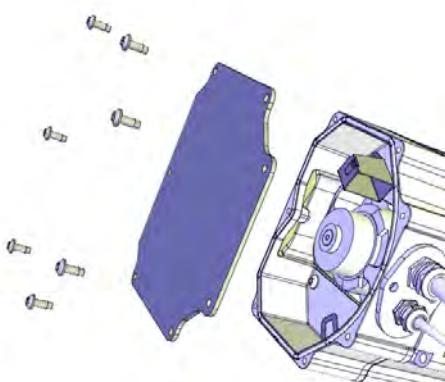
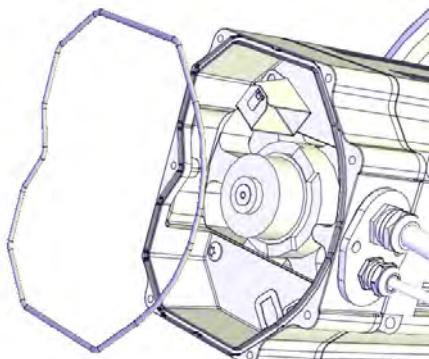
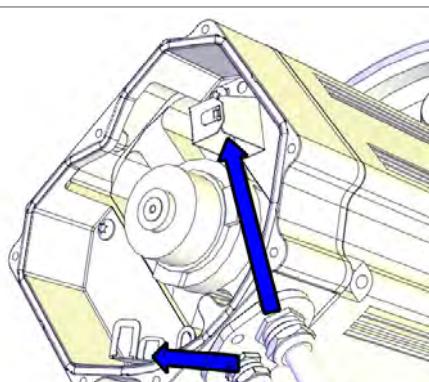
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## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

*Continued*

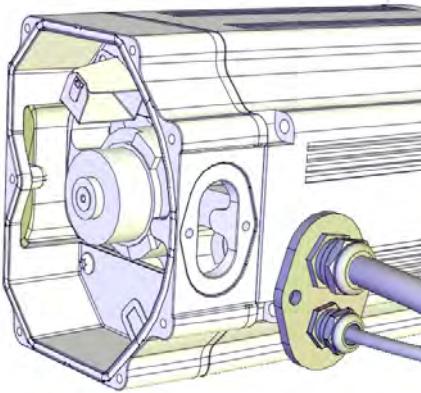
#### Disconnecting the axis-1 motor cables

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

*Continues on next page*

#### 4.8.2 Replacing the axis-1 gearbox

*Continued*

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

#### Removing the axis-1 motor

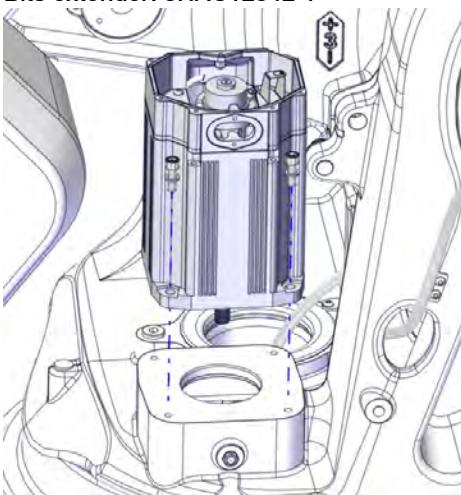
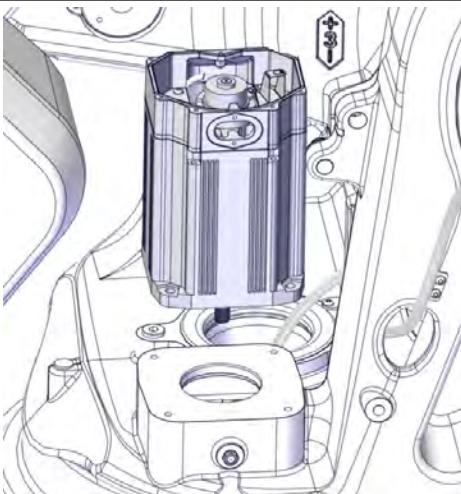
Action	Note
<p>1  <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2 Attach the lifting accessories.	Lifting accessory (chain): 3HAC15556-1 Lifting accessory, motor: 3HAC14459-1.
<p>3 To release the brakes, connect the 24 VDC power supply</p> <p>Connect to R2.MP1-connector:</p> <ul style="list-style-type: none"> <li>• + = pin 2</li> <li>• - = pin 5</li> </ul>	24 VDC power supply
<p>4  <b>CAUTION</b></p> <p>The weight of the motor is 27 kg All lifting accessories used must be sized accordingly.</p>	

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## 4 Repair

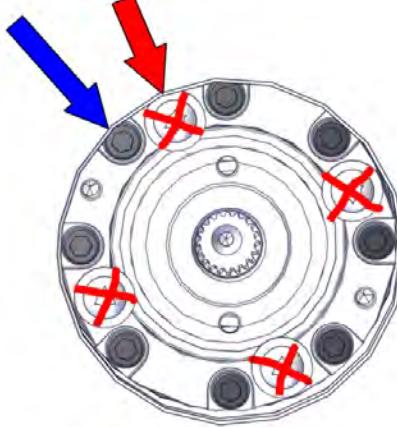
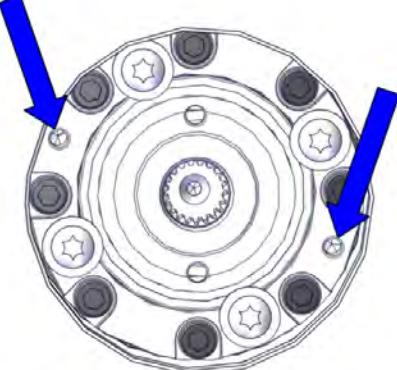
### 4.8.2 Replacing the axis-1 gearbox

*Continued*

Action	Note
5 Unscrew the attachment screws and washers. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1  xx1500002083
6 Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
7  <b>CAUTION</b> Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.	
8 If needed, use removal tools to help remove the motor.	Removal tool M12: 3HAC057339-003
9 Use caution and lift the motor straight up to get the pinion parted from the gear.	 xx1500002084
10 Disconnect the 24 VDC power supply.	

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## Removing the hub

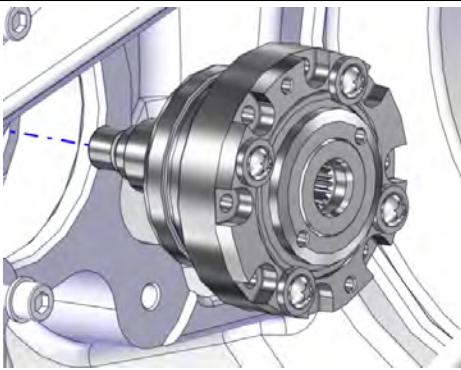
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the M6x30 hex socket head cap screws that secure the hub.  <b>Note</b> Do not remove the M6x16 torx pan head screws.	 xx1500002038
3	 <b>CAUTION</b> Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	
4	Fit two screws in opposite holes of the hub and use them as removal tools.	Attachment screws: M6x110 (2 pcs)  xx1500002081

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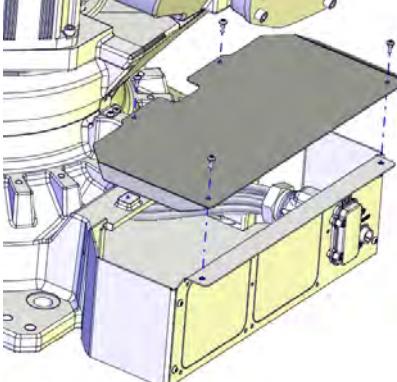
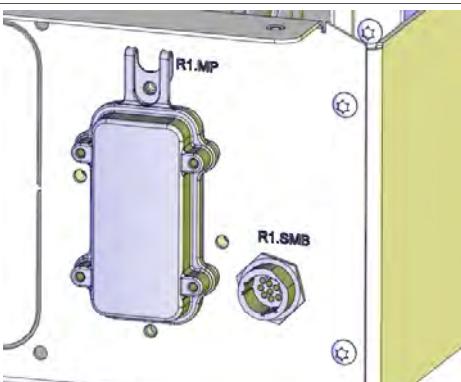
## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

*Continued*

Action	Note
5 Lift out the hub carefully.	 xx1500002326

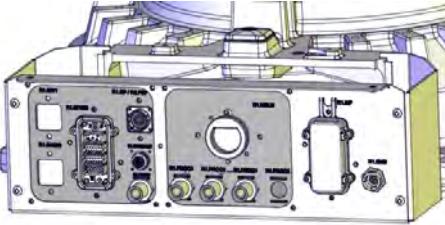
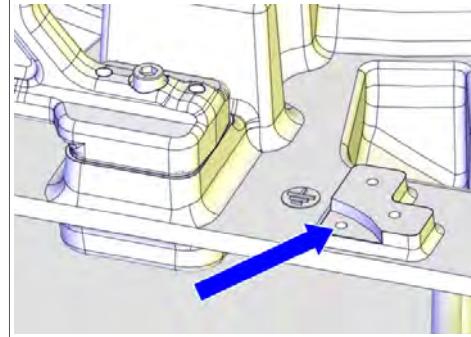
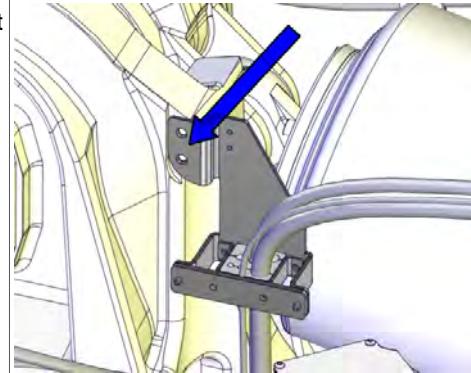
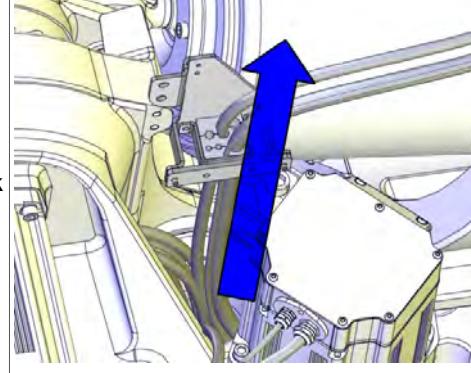
Preparations before removing the cable harness in the base

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.	 xx1300000561
3 Remove connectors in the base: <ul style="list-style-type: none"> <li>• R1.MP</li> <li>• R1.SMB</li> </ul>	 xx1300000591

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#### 4.8.2 Replacing the axis-1 gearbox

*Continued*

	Action	Note
4	If used, disconnect the DressPack hoses in the base.	 xx1400000366
5	Disconnect the earth cable.	<p>Screw dimension : M6x16 Washer dimension : 6.4x17x3</p>  xx1400000354
6	<p>If used, remove the attachment screws that secure the bracket. This is done to facilitate removal of the DressPack hoses.</p>	 xx1400000078
7	<p>If used, use caution and pull out the DressPack hoses through the protection tube in the base.</p> <p><b>Note</b> There is no need to pull out the DressPack cables at this point!</p>	 xx1400000088

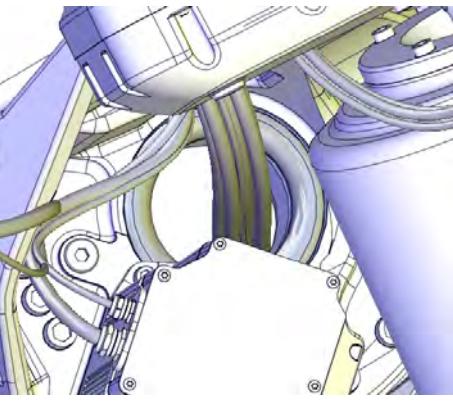
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## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

*Continued*

#### Removing the cable harness in the base

Action	Note
1 If used, use caution and pull out the DressPack cables through the protection tube and place it safely over the balancing device.	
2 Use caution and pull out the robot cable harness through the protection tube.  <b>CAUTION</b> Be careful when pulling out the cabling, there is risk that the white protection ring loosens from the frame.	 xx1300000732
3 Place the cable harness over the balancing device.	

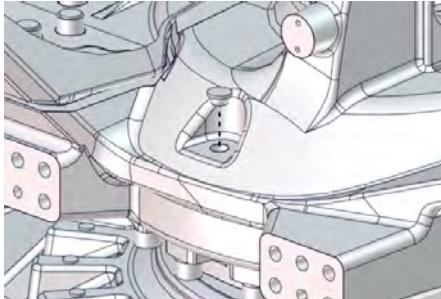
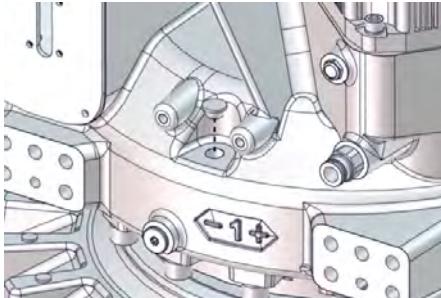
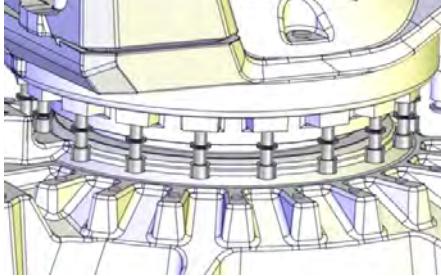
#### Lifting away the complete arm system

Action	Note
1 Check that the axis-1 gearbox is drained and then remove the draining equipment.	
2 Raise the overhead crane to stretch the chains and roundslings. Make sure that the roundsling between the upper arm and the frame is stretched.	

*Continues on next page*

#### 4.8.2 Replacing the axis-1 gearbox

*Continued*

	Action	Note
3	<p>Remove the two protection plugs on the left and right hand side of the frame and install guide pins in the holes.</p> <p> <b>Tip</b></p> <p>Lubricate the guide pins with some grease to make the frame slide better.</p>	 xx1700000320
4	<p>Unscrew all attachment screws as far as it is possible at this point.</p>	 xx1700000321 <p>Guide pin, M16x120: 3HAC062397-001 Always use guide pins in pairs.</p>
5	<p> <b>CAUTION</b></p> <p>The complete arm system weighs: 1300 Kg. All lifting accessories used must be sized accordingly!</p>	 xx1400002169 <p> <b>Note</b></p> <p>It will not be possible to remove the screws completely at this point.</p>

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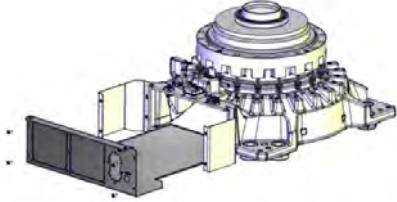
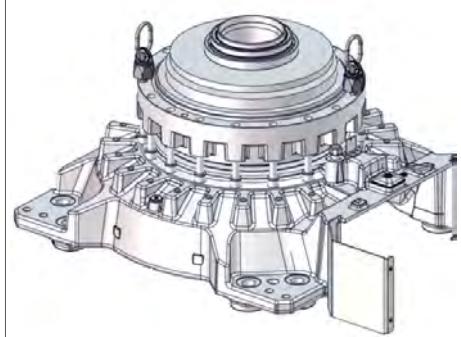
## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

*Continued*

Action	Note
<p>6 Lift away the complete arm system.</p> <p><b>!</b> <b>CAUTION</b></p> <p>When the arm system has left the guide pins it can move. Use caution in order to avoid injury or damage!</p> <p><b>i</b> <b>Note</b></p> <p>There will be some oil spill!</p>	
7 Put down the arm system on the floor.	
<p>8 <b>!</b> <b>DANGER</b></p> <p>When the complete arm system is removed and resting by itself on the floor, make sure it is resting completely stable before removing the lifting accessories. Do not change the position of the axes from the position described earlier.</p>	

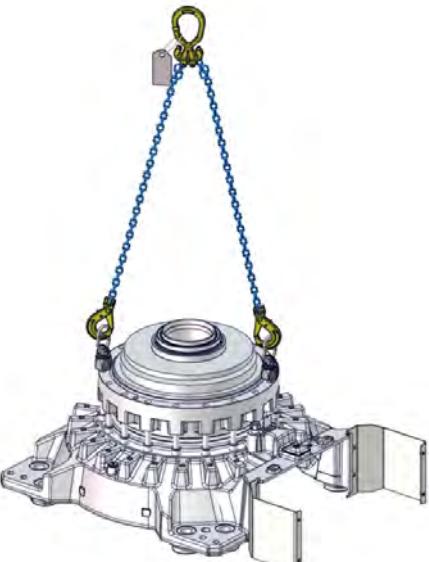
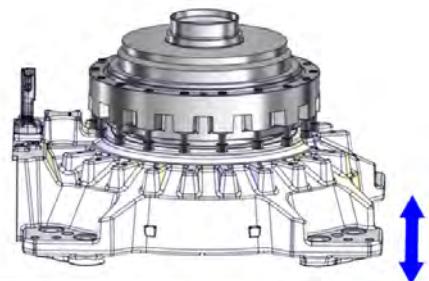
#### Removing the gearbox

Action	Note
1 Remove the back plate.	 xx1400002171
<p>2 Fit two lifting eyes in opposite holes in the gearbox.</p> <p><b>!</b> <b>CAUTION</b></p> <p>Leave a couple of millimeters of space between the lug and the surface of the gearbox. This is done in order not to damage the surface of the gearbox which is a sealing surface.</p>	Lifting eye, M16: 3HAC14457-4  xx1700000323

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## 4.8.2 Replacing the axis-1 gearbox

*Continued*

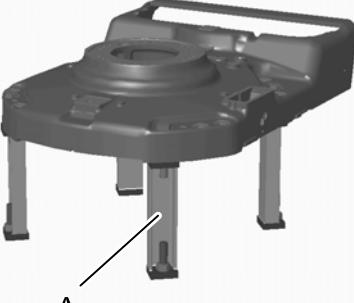
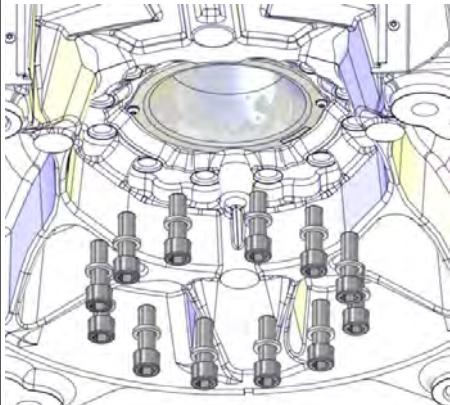
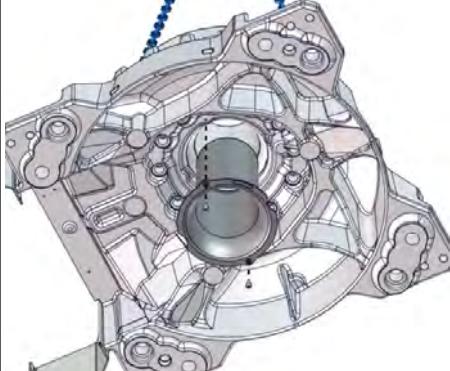
Action	Note
3 ! <b>CAUTION</b> The gearbox and base together weighs: 305 kg All lifting accessories used must be sized accordingly.	
4 Attach the lifting accessory.	Lifting accessory (chain): 3HAC15556-1  xx1700000324
5 Unscrew the attachment screws that hold the base to the foundation and lift base and gearbox up high enough to be able to fit the four support legs.	 xx1400002180

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## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

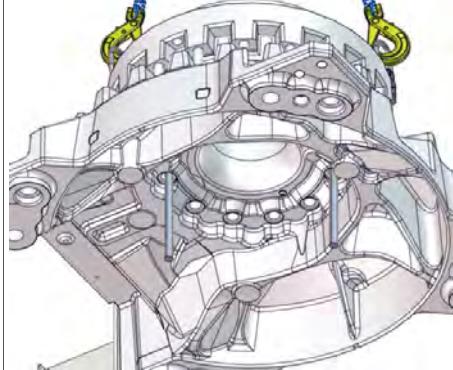
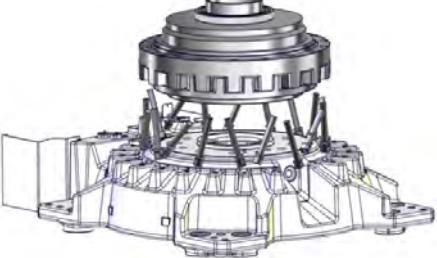
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Action	Note
6 Secure the support legs to the foundation using the same holes as to secure the base.	 xx1000000364 <b>A Support legs: 3HAC15535-1.</b>
7 Lower the base and gearbox to the support legs and secure.	
8 With base and gearbox safely resting on the support legs, unscrew the attachment screws that secure the gearbox to the base, from underneath the base.   <b>Tip</b>  This procedure is best performed by two persons working together: <ul style="list-style-type: none"><li>• one underneath the robot base making sure that the bit is being fitted into the screw head holes, all the way until they reach the bottom</li><li>• one using the torque wrench, tightening the screws from beside the base.</li></ul>	 xx1400002172
9 Remove the protection tube from the base by removing the two attachment screws and pulling the tube downwards.	 xx1700000561

*Continues on next page*

#### 4.8.2 Replacing the axis-1 gearbox

*Continued*

Action	Note
10 Fit two guide pins in opposite holes.  Tip  Lubricate the guide pins with some grease to make the gearbox slide better.	Guide pin, M20x180: 3HAC048814-002 Always use guide pins in pairs.   xx1700000337
11 <b>CAUTION</b>  The gearbox weighs: 140 kg All lifting accessories used must be sized accordingly.	
12 Lift away the gearbox.	   xx1700000566
13 Make sure that the o-ring between base and gearbox is not lost.	

#### Refitting the axis-1 gearbox

These procedures describe how to refit the axis-1 gearbox.

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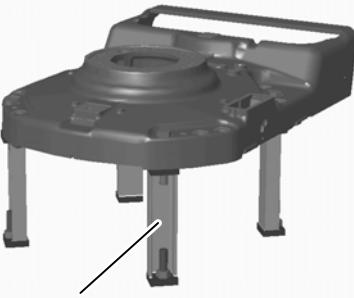
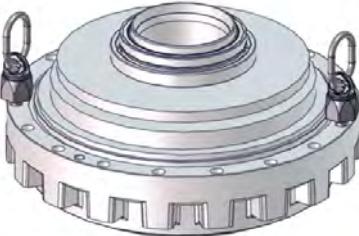
## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

*Continued*

Follow the order of the procedures according to the order they are presented.

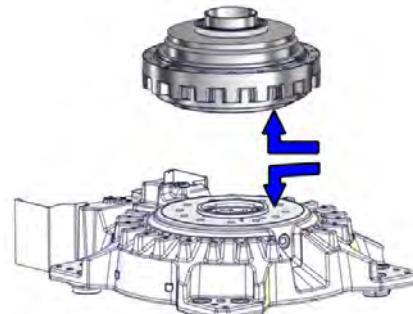
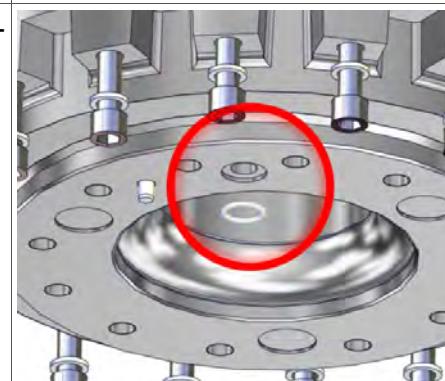
Preparations before refitting the axis-1 gearbox

Action	Note
1 If not already done, fit and secure the four support legs to the foundation. Then lift up and secure the base on top of the legs.	 xx1000000364 <b>A</b> Support legs: 3HAC15535-1.
2 Fit two lifting eyes in opposite holes in the gearbox.   <b>CAUTION</b>  Leave a couple of millimeters of space between the lug and the surface of the gearbox. This is done in order not to damage the surface of the gearbox which is a sealing surface.	Lifting eye, M16: 3HAC14457-4   xx1700000325
3  <b>CAUTION</b>  The gearbox weighs: 140 kg All lifting accessories used must be sized accordingly.	

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#### 4.8.2 Replacing the axis-1 gearbox

*Continued*

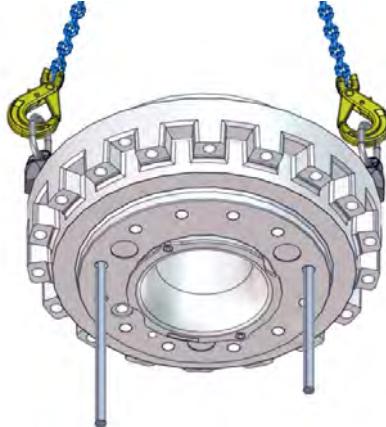
Action	Note
4 Attach the lifting accessory and lift the gearbox.	Lifting accessory (chain): 3HAC15556-1  xx1700000326
5 Wipe the contact surfaces between gearbox and base clean from any contamination.	 xx1700000567
6 Wipe clean the o-ring groove for the small o-ring beneath the gearbox.	 xx1400002175
7 Replace the small o-ring between base and gearbox with a new. Clean the new o-ring, put some grease on it and place it in the groove.	O-ring: 3HAB3772-97.

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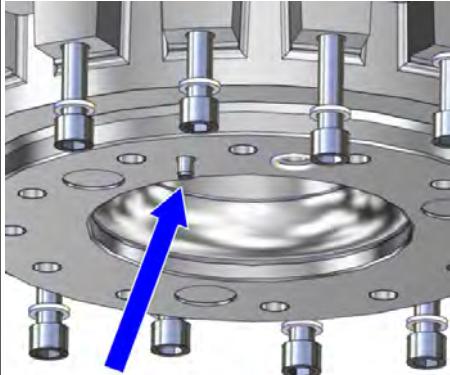
## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

*Continued*

Action	Note
<p>8 Fit guide pins in opposite holes in the gearbox.</p> <p> <b>Tip</b></p> <p>Lubricate the guide pins with some grease to make the gearbox slide better.</p>	<p>Guide pin, M20x180: 3HAC048814-002 Always use guide pins in pairs.</p>  <p>xx1700000327</p>

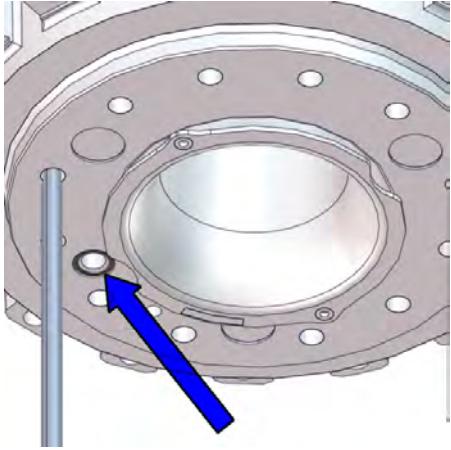
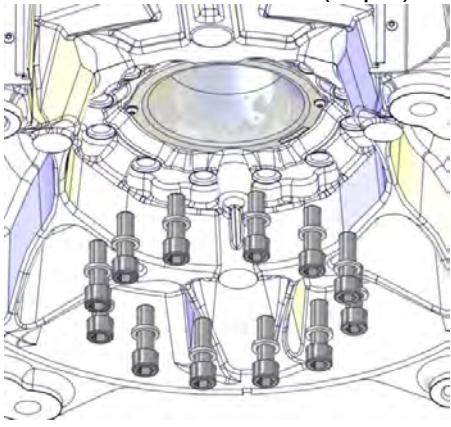
#### Refitting the gearbox to the base

Action	Note
<p>1 Before the gearbox is being fitted, place the attachment screws that will secure the gearbox to the frame, temporarily in their holes and lock screws with the old o-ring. This is done to prevent the screws from falling out.</p> <p> <b>Note</b></p> <p>Do not use the new o-ring!</p>	<p>If the attachment screws are not fitted like this at this point, it will be almost impossible to fit the screws later when the gearbox is resting on the base.</p>  <p>xx1400002176</p>
<p>2 Make sure that the locating pin in the base will match its hole in the gearbox.</p>	 <p>xx1400002177</p>

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## 4.8.2 Replacing the axis-1 gearbox

*Continued*

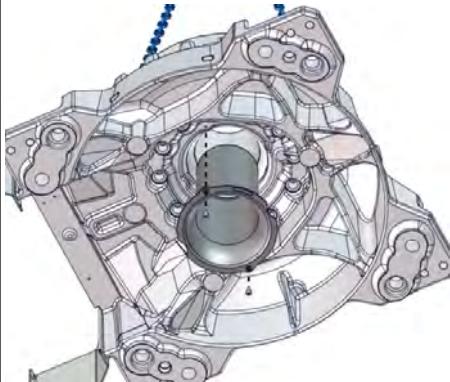
Action	Note
3 With all screws in position, lower the gearbox carefully down against the base with guidance from the guide pins.	 <b>Note</b> Make sure that the small o-ring underneath the gearbox, stays fitted correctly when the gearbox is being fitted.  xx1700000328 O-ring: 3HAB3772-97.
4 Remove the big o-ring that holds the attachment screws in the temporary position and let them drop down on the base.	 <b>Note</b> Make sure that none of the screws are missing or in the wrong position. If so, redo the procedure!
5 Lower the lifting accessory so that the chain is no longer stretched.	
6 Fit the attachment screws that secure the gearbox to the base, from underneath.	Attachment screws: M20x60 (12 pcs)  xx1400002172
7 Remove the guide pins and fit the two remaining screws.	

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## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

*Continued*

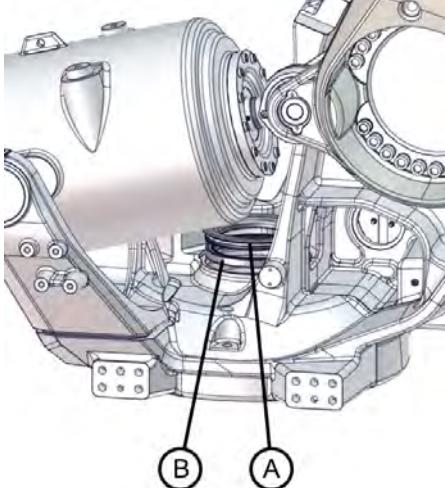
Action	Note
<p>8 Secure the attachment screws.</p> <p> <b>Tip</b></p> <p>This procedure is best performed by two persons working together:</p> <ul style="list-style-type: none"> <li>• one underneath the robot base making sure that the bit is being fitted into the screw head holes, all the way until they reach the bottom</li> <li>• one using the torque wrench, tightening the screws from beside the base.</li> </ul>	Tightening torque: 500 Nm.
<p>9 Check the protection tube for damages. Especially inspect the surface for the sealing ring. Replace if damaged.</p>	 xx1700000568
<p>10 Wipe the surfaces of the protection tube and the hole in axis-1 gearbox clean from any contamination.</p>	
<p>11 Put some grease on the protection tube.</p>	
<p>12 Refit the protection tube to the base. Secure with the two attachment screws.</p>	 xx1700000561

*Continues on next page*

## Refitting the base to the foundation

	Action	Note
1	 <b>CAUTION</b> The gearbox and base together weighs: 305 kg All lifting accessories used must be sized accordingly.	
2	Stretch the lifting accessories to take the weight of base and gearbox.	
3	Unscrew the screws that secure the base to the support legs and lift up base and gearbox.	
4	Remove the support legs.	
5	Lower the base and gearbox down to the foundation.	
6	Secure the base to the foundation.	M24x100 (8 pcs) 550 Nm (screws lubricated with Molykote 1000) 600-725 Nm, typical 650 Nm (screws none or lightly lubricated)

## Preparations before refitting the arm system

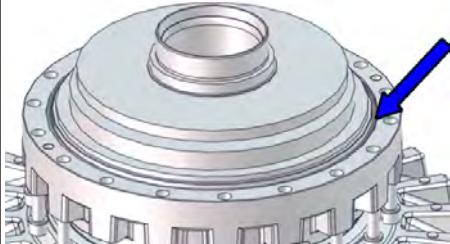
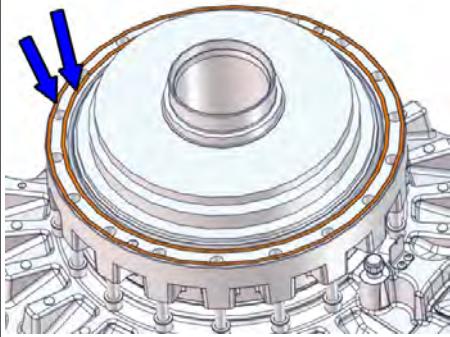
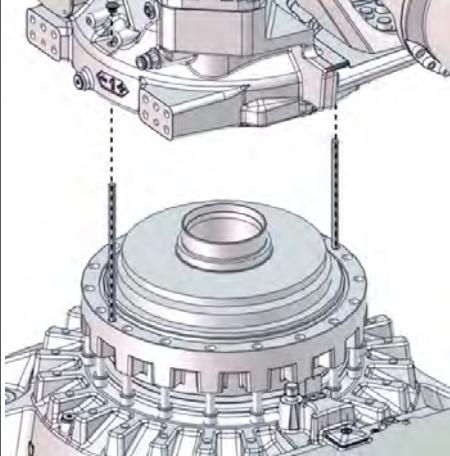
	Action	Note
1	Remove the sealing ring and the radial sealing from the frame.	 xx1700000569 A Sealing ring B Radial sealing with dust lip
2	Remove old residues of flange sealant and other contamination from the contact surfaces on the gearbox.	
3	Wipe clean the contact surfaces from any remaining contamination.	
4	Wipe clean the o-ring groove in the gearbox and apply some grease to the groove.	Grease, Shell Gadus S2V220 AC: 3HAB3537-1.

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## 4 Repair

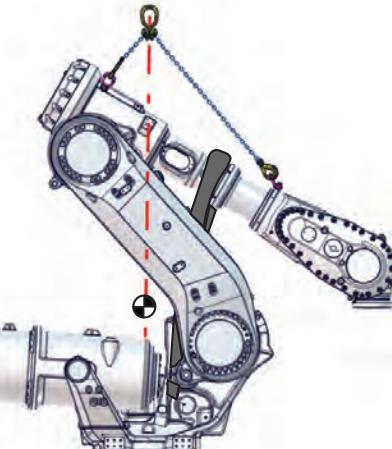
### 4.8.2 Replacing the axis-1 gearbox

*Continued*

Action	Note
5 Wipe a new o-ring clean, apply some grease to it and replace the old one between base and frame with a new. Install the new o-ring in the groove.	O-ring: 3HAB3772-160. Grease, Shell Gadus S2V220 AC: 3HAB3537-1.   <b>Note</b> A new o-ring also needs to be cleaned!   xx1700000336
6 Apply flange sealant in two strings according to the figure.	Flange sealant, Loctite 574: 12340011-116.   xx1700000415
7 Apply some grease on: <ul style="list-style-type: none"><li>• the outside of the bearing</li><li>• the guiding part of the bearing</li><li>• the edge of the protection tube</li><li>• the edge around the gearbox.</li></ul>	
8 Apply guide pins in the guide pin holes in the gearbox.	Guide pin, M16x120: 3HAC062397-001 (2 pcs). Always use guide pins in pairs.   xx1700000329

*Continues on next page*

## Refitting the armsystem

	Action	Note
1	 <b>CAUTION</b> The arm system weighs 1300 Kg. All lifting accessories used must be sized accordingly!	
2	Make sure that all lifting accessories still is fitted correctly on the arm system.	See <a href="#">Attachment points of lifting accessory on page 198</a> .
3	Attach the upper arm lifting accessory (chain) to an overhead crane (or similar) and then to the lifting eye in the arm house and to the lifting eye in the wrist. Adjust the lengths of the chains so that the lifting hook is located in line with the center of gravity when the robot arm system is lifted, as shown in the figure.	Lifting accessory (chain): 3HAC15556-1  xx1700000313
4	 <b>WARNING</b> The angle between the two chains may not exceed 90°.	 xx1700000319
5	Lift the arm system up, in order to reach the contact surfaces underneath the frame.	
6	Wipe clean the contact surfaces from any remaining contamination.	
7	Before putting the complete arm system on to the guide pins, make sure that the hole pattern will match and that the guide pins will enter the correct holes in the frame.	

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## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

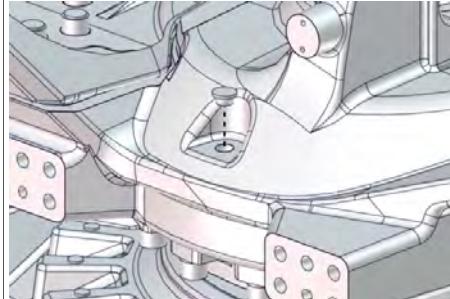
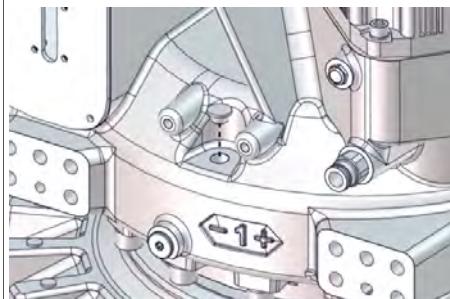
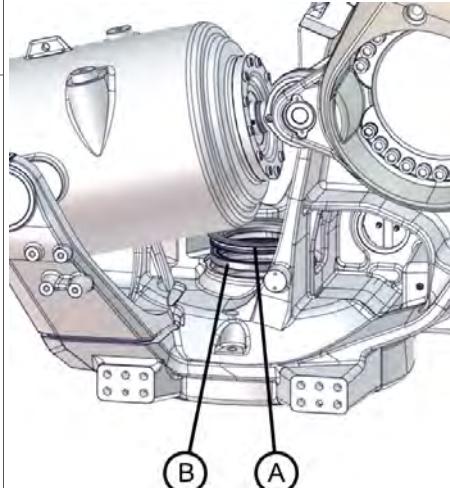
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Action	Note
8 Lift the complete arm system and lower it slowly down over the guide pins, until it is possible to insert the attachment screws manually.   <b>CAUTION</b>  Do not lower the arm system completely at this stage! The attachment screws must be fitted in two steps. If not, the complete arm system will risk resting on the attachment screws in the wrong position!	
9 Fit the attachment screws manually as far as possible. Then lower the complete arm system slowly in steps until all attachment screws no longer can reach the base when the arm system is completely lowered all the way down.	Attachment screws: M16x110
10 Make sure that the complete arm system is completely lowered all the way.	
11  <b>Note</b>  The attachment screw at the axis-1 synchronization plate can not be reached to be secured at this stage. Make sure it is still in its place and will not be damaged in the continued procedure.	
12 Secure all screws now possible to reach.   <b>Note</b>  In order to be able to reach the attachment screws, a holder for bits is needed.	Bit holder: 3HAC029090-001. Tightening torque: 300 Nm
13 Manually rotate axis-1 to a position where the remaining attachment screw can be secured.	

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#### 4.8.2 Replacing the axis-1 gearbox

*Continued*

Action	Note
14 Remove the guide pins and refit the plastic protection plugs.	 xx1700000320
	 xx1700000321
15 Refit the radial sealing. Replace if damaged.	
16 Refit the sealing ring. Make sure the o-ring is placed in its groove on the sealing ring. Replace if damaged.	 xx1700000569
	A Sealing ring B Radial sealing with dust lip
17 Refit the base plate.	

#### Preparations before refitting the hub

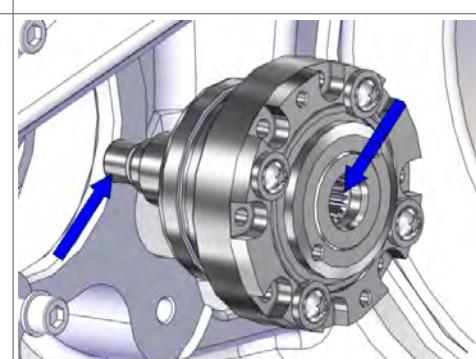
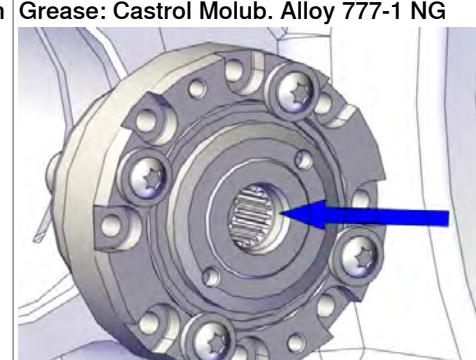
Action	Note
1 Wipe the hub clean.	
2 Inspect the hole where the hub shall be refitted. Wipe clean if needed.	

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## 4 Repair

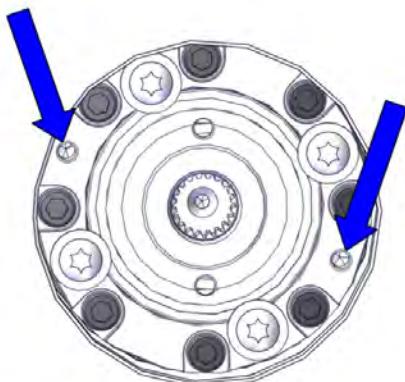
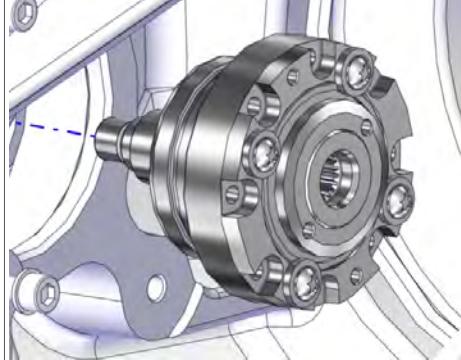
### 4.8.2 Replacing the axis-1 gearbox

*Continued*

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

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## Refitting the hub

	Action	Note
1	Attach two screws in opposite holes of the hub and use them as tools to fit the hub.	Attachment screws: M6x110 (2 pcs)  xx1500002081
2	<b>!</b> CAUTION Whenever parting/mating the hub pinion and gearbox, the gears may be damaged if excessive force is used.	
3	Refit the hub.	 xx1500002326
4	Remove the two M6x110 and fit the attachment screws for the hub. Apply locking liquid (Loctite 243) on the screws.  <b>i Note</b> The number of attachment screws differ depending on gearbox.	Attachment screws: M6x30 12.9. Loctite 243 Quantity: 6 pcs
5	Secure the hub.	Tightening torque: 14 Nm.

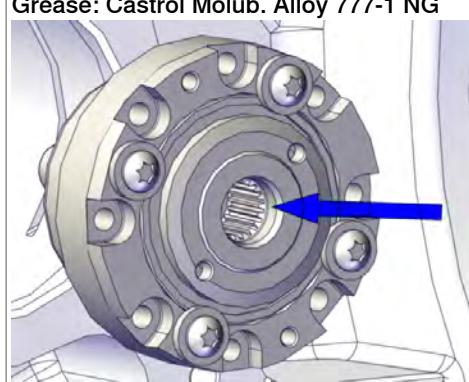
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## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

*Continued*

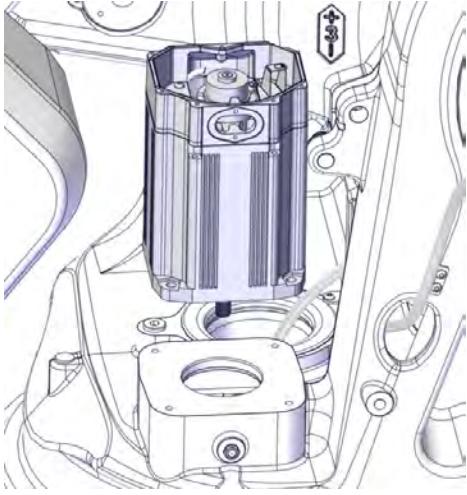
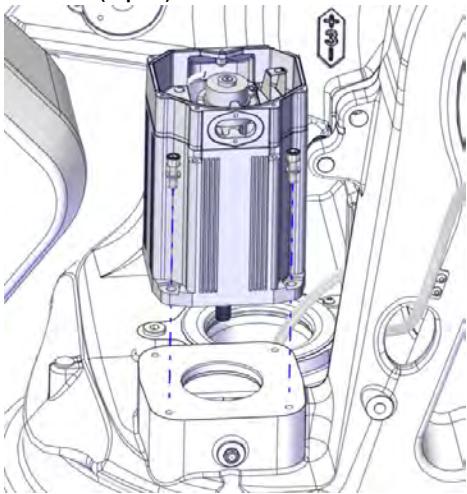
#### Securing the axis-1 motor

	Action	Note
1	Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
2	 <b>CAUTION</b> The motor weighs 27 kg. All lifting accessories used must be sized accordingly.	
3	Apply the lifting accessory.	Lifting accessory, motor: 3HAC14459-1.
4	Fit the rotation tool.	Rotation tool: 3HAB7887-1
5	Make sure that there is enough grease on the splines, before fitting. If not, apply 1 gram of grease.	Grease: Castrol Molub. Alloy 777-1 NG  xx1500002346
6	In order to release the brakes, connect the 24 VDC power supply. To release the brakes, connect the 24 VDC power supply as described in the list. Connect to R2.MP1-connector: • + = pin 2 • - = pin 5	
7	 <b>CAUTION</b> Whenever parting/mating motor pinion and hub, the splines may be damaged if excessive force is used.	

*Continues on next page*

#### 4.8.2 Replacing the axis-1 gearbox

*Continued*

Action	Note
8 Lower the motor into position. <ul style="list-style-type: none"> <li>• Make sure that the motor pinion is properly mated into the hub.</li> <li>• Make sure that the motor pinion does not get damaged.</li> <li>• Make sure that the direction of the cable exit is facing the correct way.</li> </ul>	 xx1500002084
9 Secure the motor with its attachment screws and washers. Use a bits extender to reach the screws.	Bits extender: 3HAC12342-1 Tightening torque: 50 Nm. Screw dimension : M10x40 quality 12.9 Gleitmo (4 pcs)  xx1500002083
10 Perform a leak-down test (if not already done).	See <a href="#">Performing a leak-down test on page 190</a> .
11 Disconnect the 24 VDC power supply.	

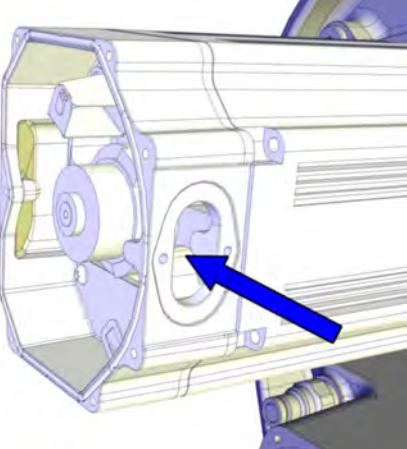
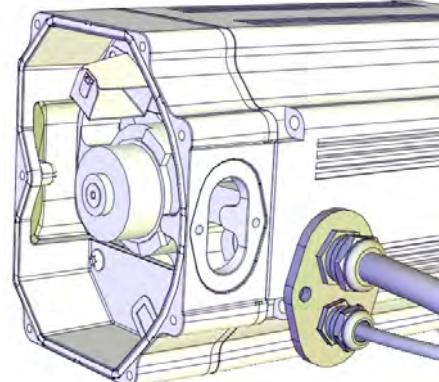
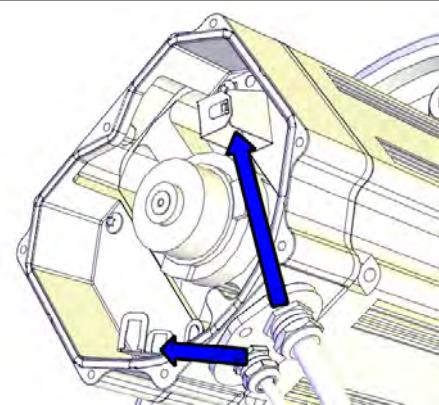
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## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

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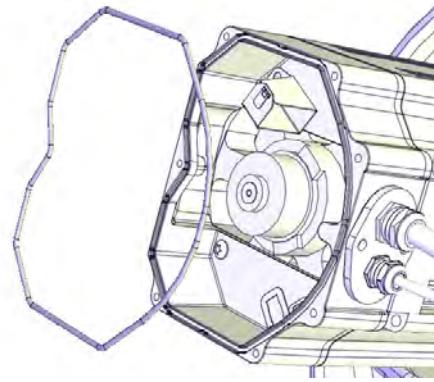
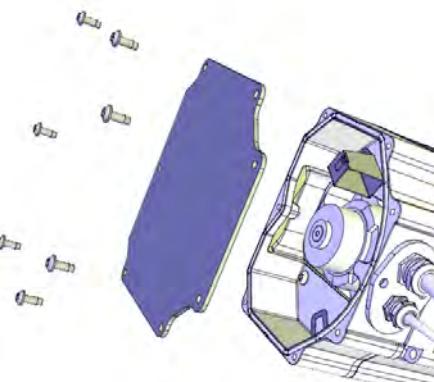
#### Connecting the axis-1 motor cables

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

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## 4.8.2 Replacing the axis-1 gearbox

*Continued*

Action	Note
4 Inspect the o-ring.  Note Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-001   xx1200001070
5 Wipe clean o-ring and o-ring groove.	
6 Refit the o-ring.  Tip Lubricate the o-ring with some grease for a better fitting in the groove.	
7 CAUTION When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8 Refit the motor cover with its attachment screws.  Note Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged.  Note Make sure the o-ring is undamaged and properly fitted.	 xx1200001135
9 Make sure that the covers are tightly sealed.	

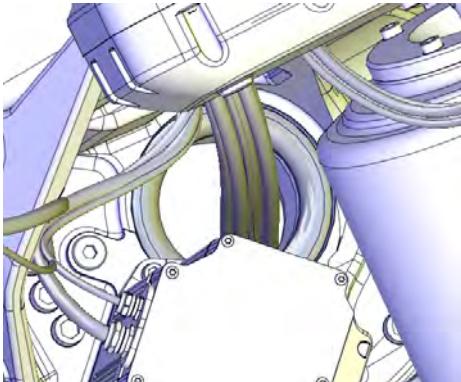
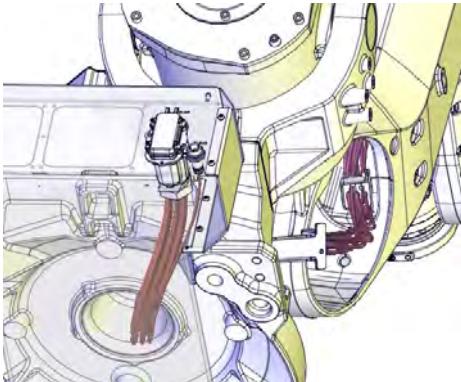
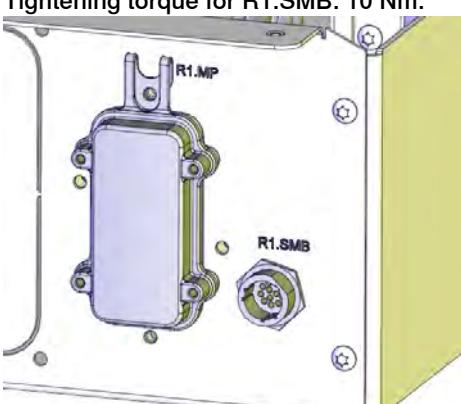
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## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

*Continued*

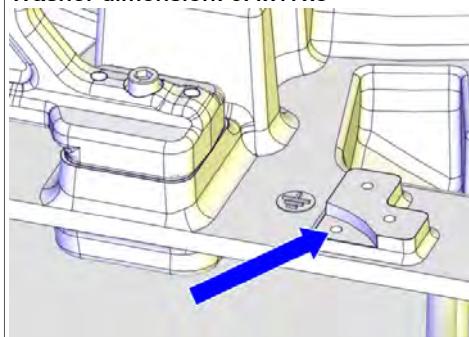
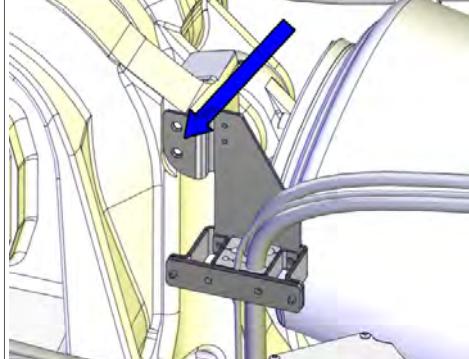
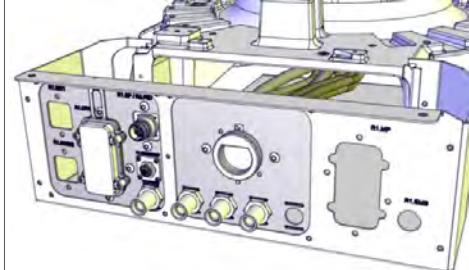
#### Refitting the cable harness in the base

Action	Note
<p>1 Run the cables through the protection tube in this order:</p> <ul style="list-style-type: none"> <li>• R1.MP</li> <li>• R1.SMB</li> </ul> <p>If necessary, lubricate the cables with grease in order to make them run more smoothly.</p>	 xx1300000732
<p>2</p> <ul style="list-style-type: none"> <li>• Make sure that the cables are not twisted. Each cable must be in line with its position on the base plate.</li> <li>• Make sure that the R1.SMB cable will run on the correct side of the R1.MP1, see the figure.</li> </ul>	 xx1300000736
<p>3 Make sure that the markings on the cables are facing the base cover, when connected.</p>	
<p>4 Connect R1.MP and R1.SMB.</p>	<p>Tightening torque for R1.SMB: 10 Nm.</p>  xx1300000591

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#### 4.8.2 Replacing the axis-1 gearbox

*Continued*

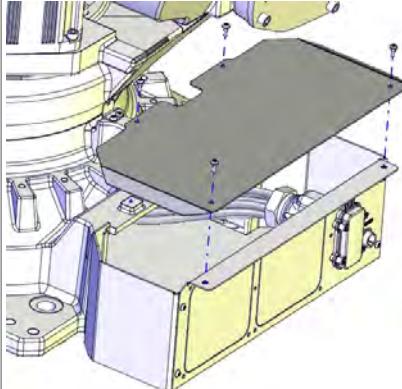
	Action	Note
5	Connect the earth cable.	<p>Screw dimension: M6x16 Washer dimension: 6.4x17x3</p>  <p>xx1400000354</p>
6	If used, run the DressPack <i>cables</i> through the protection tube in the base.	
7	If used, run the DressPack <i>hoses</i> through the protection tube in the base. Make sure that the hoses are running correctly and are not twisted!	
8	If used, fit the bracket that hold the DressPack to the frame.	 <p>xx1400000078</p>
9	If used, connect the DressPack cable package on the base plate.	 <p>xx1200000052</p>

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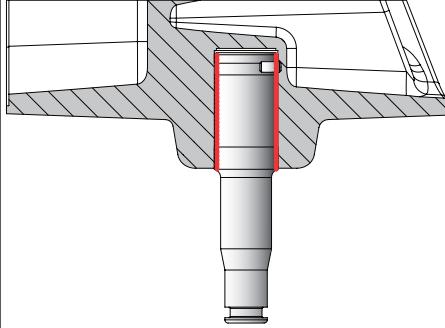
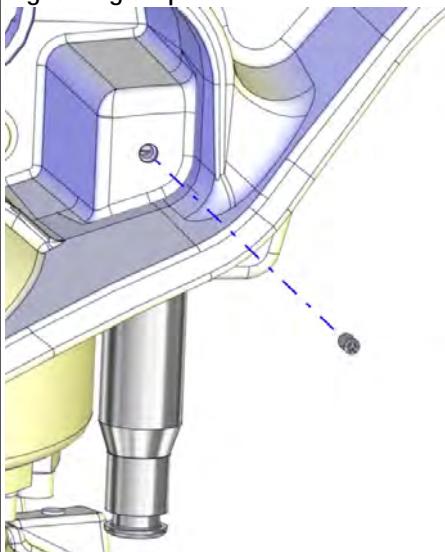
## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

*Continued*

Action	Note
10 Refit the base cover.	 xx1300000561

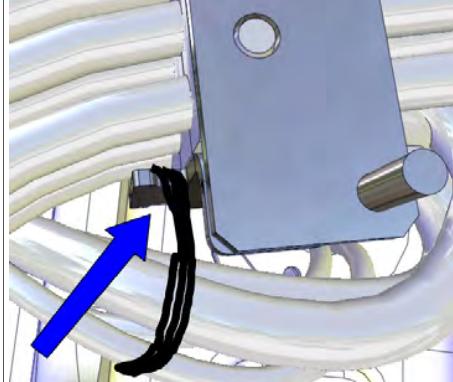
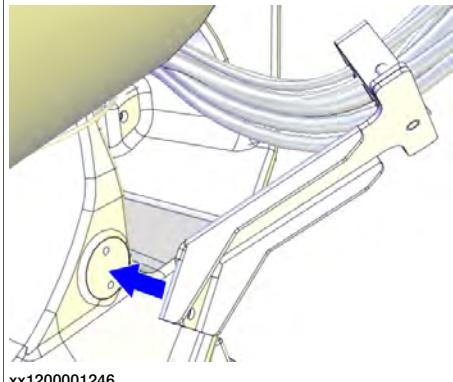
Refitting the mechanical stop and remaining cable brackets

Action	Note
1 <i>Foundry Plus:</i> Apply Mercasol on the surfaces shown in the figure, on stop pin and in the hole as shown in the figure.	 xx1400000378
2 Refit the mechanical stop pin and secure it with the attachment screw. Locking liquid (Loctite 243) on screw.	Tightening torque: 24 Nm  xx1400002179

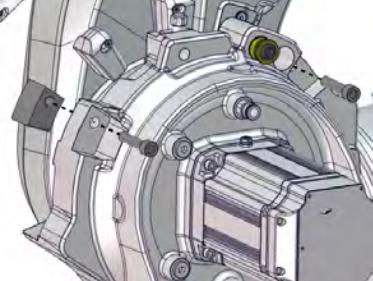
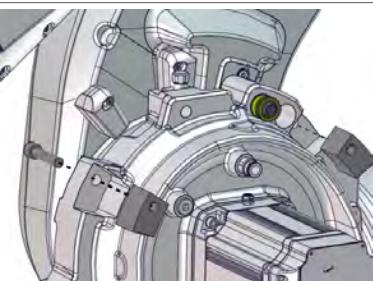
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#### 4.8.2 Replacing the axis-1 gearbox

*Continued*

Action	Note
3 Secure the cable harness inside the frame hole with a cable strap.	 xx1200001237
4 Refit the cable bracket on the frame.	 xx1200001246

Preparations before lifting up the robot to inverted position

Action	Note
1 Remove the two service stops from maintenance position, if previously moved there.	 xx1700000068
2 Fit the service stops in their parking position.	 xx1700000067

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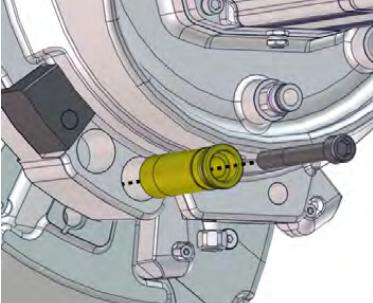
## 4 Repair

### 4.8.2 Replacing the axis-1 gearbox

*Continued*

	Action	Note
3	Fasten the fork lift accessory.	See user instructions enclosed with the fork lift accessory. Fork lift accessory set: 3HAC058825-001.
4	Remove the bolts securing the robot to the foundation.	

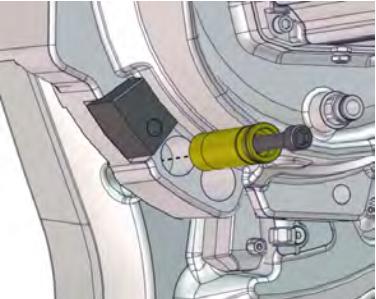
#### Orienting and securing the robot

	Action	Note
1	Lift the robot using the fork lift accessory.	See user instructions enclosed with the fork lift accessory.
2	Move the robot close to its installation location.	
3	Rotate the robot into inverted position using the turning tool or using a fork lift truck with a rotator attachment.	See user instructions enclosed with the turning tool.
	 <b>DANGER</b>  Make sure that there is enough space underneath the robot. See user instructions for the turning tool.	
4	Guide the robot using two M24 screws while lifting it into its mounting position.	
5	Fit the bolts and washers in the base attachment holes.	Specified in <a href="#">Attachment screws on page 75</a>
	 <b>Note</b>  Lightly lubricate screws before assembly.	
6	Tighten bolts in a crosswise pattern to ensure that the base is not distorted.	
7	Remove the yellow sleeve and transportation lock screw from the transportation and turning position.	 xx1700000269

*Continues on next page*

## 4.8.2 Replacing the axis-1 gearbox

*Continued*

Action	Note
8 Fasten the yellow sleeve and transportation lock screw in its parking position.	 xx1700000270

## Concluding procedure

Action	Note
1 Refill oil in the gearbox.	See <a href="#">Changing oil, axis-1 gearbox on page 149</a> .
2 Recalibrate the robot.	Axis Calibration is described in <a href="#">Calibrating with Axis Calibration method on page 691</a> . General calibration information is included in section <a href="#">Calibration on page 683</a> .
3  <b>DANGER</b>  Make sure all safety requirements are met when performing the first test run. These are further described in <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

## 4 Repair

### 4.8.3 Replacing the axis-2 gearbox

#### 4.8.3 Replacing the axis-2 gearbox

##### Space required beside

This section describes how to replace the gearbox without needing to remove the cable harness and DressPack cable package (if installed) from the robot.

The described procedure requires free space on the floor, in front of the lower arm, so that the upper and lower arm can be laid down with the cabling still attached to the robot. There should be enough space to place two pallets on the floor. If needed, run axis-1 into a position that gives the required space.



##### DANGER

The base shall be fitted to the foundation when performing this procedure! Valid in both examples described below!

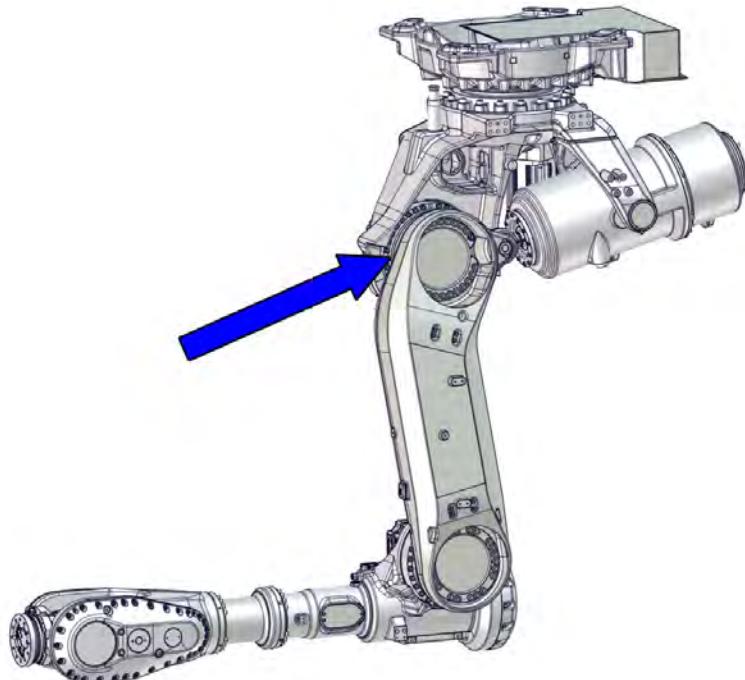


##### Note

Using this method to replace the gearbox with cable harness and DressPack fitted, is only a recommendation. If it is not possible to put the arm system close enough to the robot and keep the cable harness partly fitted, it is necessary to remove the cable harness and DressPack in base and frame first.

##### Location of the axis-2 gearbox

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



xx1700000373

*Continues on next page*

**Note**

The robot must be taken down and secured floor standing to perform this replacement procedure.

How to do this is described in the removal procedure in this section.

**DANGER**

Always lock the position of the lower arm, using the yellow sleeve and transportation lock screw, before attempting to lift the robot.

**Summary of the replacement procedure**

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

- 1 Lift down the robot to floor standing.
- 2 Remove the upper and lower arm together, as a package.
- 3 Replace the axis-2 gearbox.

**Spare parts**

Spare parts	Article number	Note
Axis-2 gearbox	See <i>Product manual, spare parts - IRB 6700</i> .	

**Required tools and equipment**

Equipment, etc.	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section <a href="#">Type of lubrication in gearboxes on page 147</a> .
Lifting eye, M12	3HAC16131-1	
Lifting eye, M16	3HAC14457-4	
Fender washer	-	Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.
Lifting shackle, 2 pcs	-	SA-10-8-NA1
Roundsling, 1.5 m	-	Lifting capacity: 2,000 kg.
Roundsling, 1 m	-	Lifting capacity: 1,000 kg.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Rotation tool	3HAB7887-1	Used to rotate the motor pinion.
24 VDC power supply	-	Used to release the motor brakes.

*Continues on next page*

## 4 Repair

### 4.8.3 Replacing the axis-2 gearbox

*Continued*

Equipment, etc.	Article number	Note
Removal tool M14	3HAC057339-004	Used to push out the motor, if necessary. Always use removal tools in pairs.
Pallet		Used for putting down removed parts from robot.
Guide pin, M16x150	3HAC13120-2	Always use guide pins in pairs.
Guide pin, M16x200	3HAC13120-3	Always use guide pins in pairs.
Guide pin, M12x150	3HAC13056-2	Always use guide pins in pairs.
Guide pin, M12x200	3HAC13056-3	Always use guide pins in pairs.
Aligning tool	3HAC046645-003	Used for aligning the gearbox against the frame, so that the play in the motor does not need to be adjusted.
Guide pin, M10x150	3HAC15521-2	Always use guide pins in pairs.
Lifting accessory, gearbox	3HAC046128-001	
Hydraulic cylinder	3HAC11731-1	To be used with the press tool.
Hydraulic pump 80 MPa	3HAC13086-1	To be used with the hydraulic cylinder.
Leak-down tester	-	
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

### Consumables

Equipment, etc	Article number	Note
Grease	3HAB3537-1	Used to lubricate o-rings.
O-ring	3HAB3772-107	D=102x3 Used on motor flange.
O-ring	3HAC054692-002	D=169.5x3 Used on motor cover.
O-ring	3HAB3772-144	D=309.3x3.1 Used on gearbox.
VK cover	3HAA2166-28	VK 28x7
Locking liquid (Loctite 2701)	-	

### Required documents

Document name	Document number	Note
Technical reference manual - Lubrication in gearboxes	3HAC042927-001	
Directions for use - Fork lift accessory for IRB 6700Inv	3HAC060303	
User instructions for turning tool (enclosed with the turning tool)	-	

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### Deciding calibration routine

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

	Action	Note
1	<p>Decide which calibration routine to use for calibrating the robot.</p> <ul style="list-style-type: none"> <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> Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.</p>	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 692</a> .
	<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 gearbox

Use these procedures to remove the gearbox.

Follow the order of the separate procedures according to the order they are presented.



#### CAUTION

When performing these procedures, the cable harness will still be fitted or partly fitted to the robot. Use extreme caution not to cause any damage to the cable harness!

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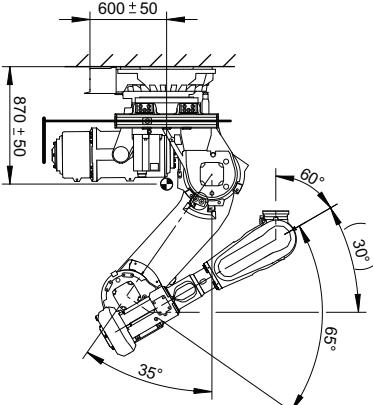
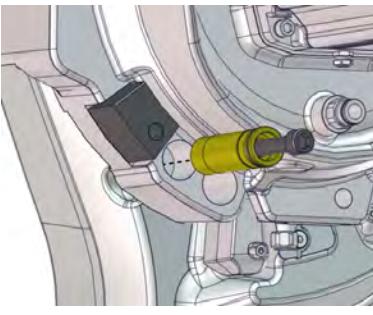
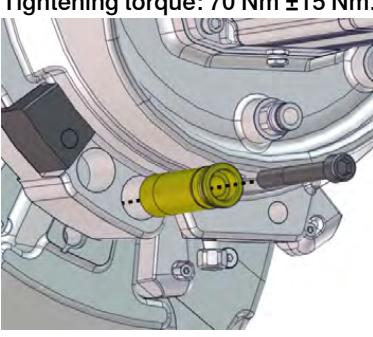
## 4 Repair

### 4.8.3 Replacing the axis-2 gearbox

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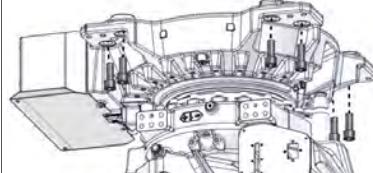
#### Securing the lower arm

Use this procedure to secure the lower arm before lifting down the robot from inverted position.

Action	Note
<p>1 Jog the robot into position:</p> <ul style="list-style-type: none"> <li>• Axis 1: 0°</li> <li>• Axis 2: -35°</li> <li>• Axis 3: +65°</li> <li>• Axis 4: 0°</li> <li>• Axis 5: +60°</li> <li>• Axis 6: no significance</li> </ul>	 xx1700000555
<p>2 Remove the transportation lock screw and the yellow sleeve from the parking position.</p>	 xx1700000270
<p>3 Insert the yellow sleeve and the transportation lock screw in the hole at the locking position. Insert the sleeve all the way so that the marking in the sleeve is aligned with the casting, see figure. Tighten the screw.</p> <p><b>DANGER</b></p> <p>Always use the transportation lock screw and sleeve to lock the lower arm at transportation, turning and floor standing.</p>	<p>Tightening torque: 70 Nm ±15 Nm.</p>  xx1700000269

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## Lifting down the robot from inverted position

	Action	Note
1	If the robot is to be secured to the floor, prepare an area where the robot can be secured with the attachment bolts.  The robot must always be secured to the floor if any kind of repair or maintenance work is to be performed.	Suitable screws, lightly lubricated: M24x100 (8 pcs) For hole configuration, see <a href="#">Hole configuration, base on page 74</a> .
2	Verify that the lower arm is secured with the transportation lock screw.	
3	Remove any payload from the robot.	DressPack can stay fitted.
4	 <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.	
5	Disconnect the robot cables at the base.	
6	 <b>CAUTION</b>  The IRB 6700Inv robot weighs 1,750 kg. All lifting accessories used must be sized accordingly.	
7	Install the fork lift pockets on the robot, if not already installed.	See user instructions enclosed with the fork lift accessory set. Fork lift accessory set: 3HAC058825-001.
8	Insert the forks of the fork lift truck into the fork lift pockets, as far as possible.	
9	Raise the forks of the fork lift truck to make sure that the weight of the robot rests on the forks.   <b>Tip</b>  Two M16 screws can be fitted to the fork lift pockets, to press the forks against the pockets and make the lift more stable.	
10	Remove the bolts that secure the robot to the foundation.	Quantity: 8 pcs.   xx1600002098

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## 4 Repair

### 4.8.3 Replacing the axis-2 gearbox

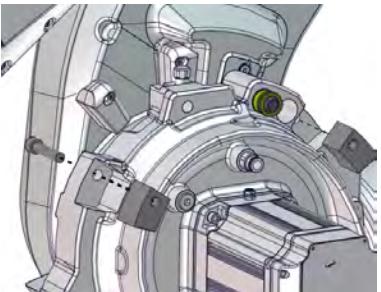
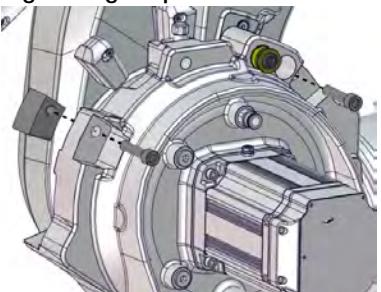
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	Action	Note
11	Rotate the robot to floor standing position, using the turning tool or using a fork lift truck with a rotator attachment.	Only one direction for rotation is allowed with the turning tool. Follow the user instructions enclosed with the turning tool.
12	Lower and secure the robot to the floor.	Attachment screws: M24x100 (8 pcs).

Preparations before replacing the axis-2 gearbox

	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
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 robot working area.	
3	Begin draining the gearbox.	See <a href="#">Draining the axis-2 gearbox on page 159</a> .

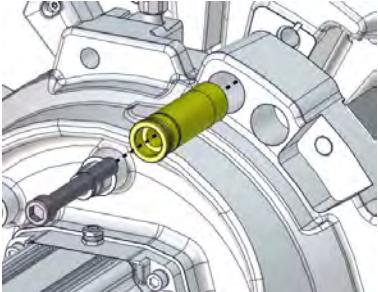
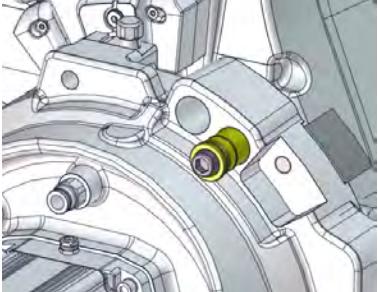
Unloading the balancing device

	Action	Note
1	Verify that the robot is secured to the foundation.	Attachment screws: M24x100 (8 pcs).
2	Remove the two service stops from their parking position.	 xx1700000067
3	Fit the service stops in maintenance position.	Tightening torque: 70 Nm ±15 Nm.  xx1700000068

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#### 4.8.3 Replacing the axis-2 gearbox

*Continued*

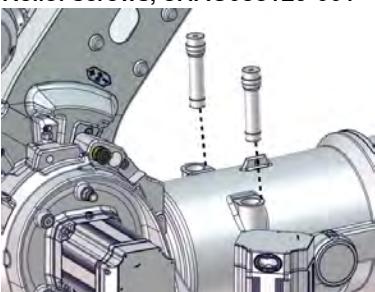
	Action	Note
4	Remove the transportation lock screw and yellow sleeve from locking position.	 <b>Note</b> It is only allowed to remove the transportation lock screw and sleeve, if the service stops are in maintenance position, when the robot is floor standing.  xx1700000347
5	Fit the transportation lock screw and the yellow sleeve in their parking position.	 xx1700000348
6	Jog axis 2 to -4° to be able to insert the relief screws.	
7	Remove the covers on the balancing device.	 <b>Note</b> The covers have to be refitted after repair or maintenance.  xx1700000451

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## 4 Repair

### 4.8.3 Replacing the axis-2 gearbox

*Continued*

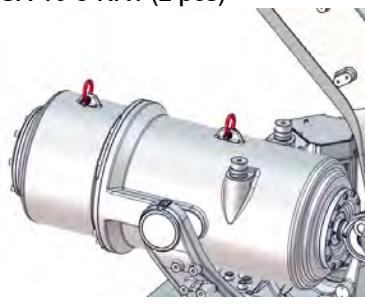
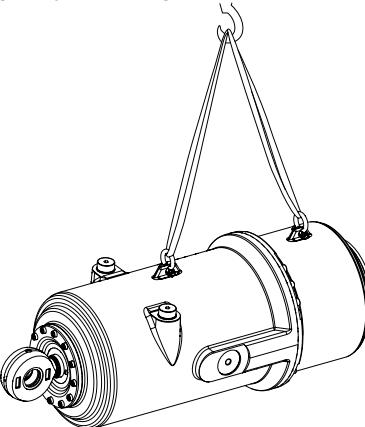
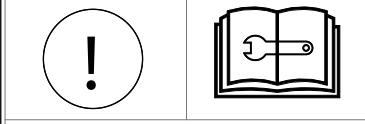
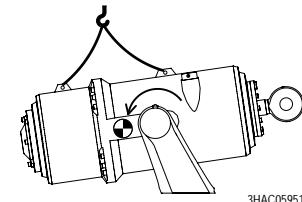
	Action	Note
8	Fit the relief screws to unload the balancing device.	<p>Tightening torque: 70 Nm±15 Nm Relief screws, 3HAC058129-001</p>  <p>xx1700000070</p>
9	Jog axis 2 to +15°.	
10	<p> <b>DANGER</b></p> <p>Turn off all:</p> <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> <p>to the robot, before entering the robot working area.</p>	

#### Attaching lifting accessories to the balancing device

	Action	Note
1	<p> <b>CAUTION</b></p> <p>The weight of the balancing device (excluding cradle) is 305 kg</p> <p>All lifting accessories used must be sized accordingly.</p>	

*Continues on next page*

**4.8.3 Replacing the axis-2 gearbox**  
*Continued*

Action	Note
2 Fasten lifting shackles on the balancing device.	SA-10-8-NA1 (2 pcs)   xx1700000086
3 Fasten the lifting slings.	Roundsling, 1 m (2 pcs) Lifting capacity: 1,000 kg.   xx1700000087
4 Raise the lifting slings to take the weight of the balancing device.   <b>CAUTION</b>  The balancing device is heavy at the back, and will tip over when the link ear is loosened.	   3HAC059516-001 (2) xx1600002060

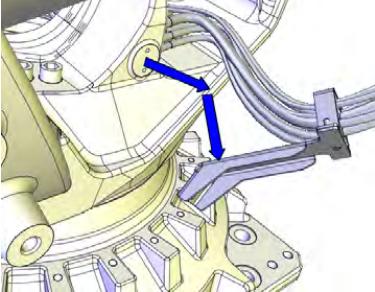
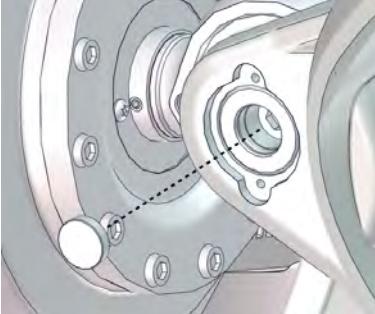
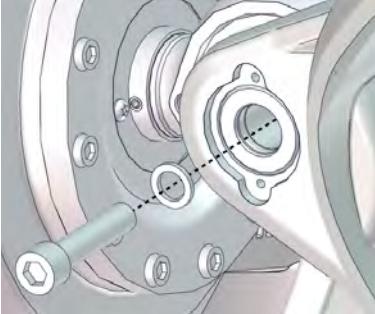
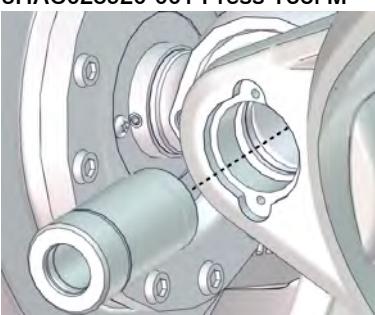
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## 4 Repair

### 4.8.3 Replacing the axis-2 gearbox

*Continued*

#### Removing the shaft in the front (link ear)

	Action	Note
1	Unscrew the attachment screws of the bracket, use caution and move it a little to the side, to give room for the Dismantle and mounting tool.	 xx1200001184
2	Remove the VK cover at the link ear. <b>Note</b> Make sure that the lifting accessories hold the weight of the balancing device. <b>Tip</b> Use high pressure air to remove the VK covers.	It is possible to drive a screwdriver (or similar) through the VK cover, as close as possible to the center of the VK cover and pull it out.
		 xx1700000088
3	Remove the attachment screw and washer at the link ear. <b>CAUTION</b> The balancing device is heavy at the back, and will tip over when the link ear is loosened.	 xx1700000089
4	Use the dismantle and mounting tool and pull the shaft out.	Dismantle and mounting tool: 3HAC028920-001 Press Tool M  xx1700000409  xx1700000090

*Continues on next page*

	Action	Note
5	Carefully lower the lifting device to let the balancing device rest on the frame.	

## Robot position

	Action	Note
1	Follow the procedure of replacing the axis-2 gearbox to get the robot prepared for attachment of the lifting accessories for lift of the unseparated lower and upper arm.	See <a href="#">Replacing the axis-2 gearbox on page 594</a> .
2	Jog the robot into position: <ul style="list-style-type: none"><li>• Axis-1: no significance.</li><li>• Axis-2: -15°</li><li>• Axis-3: +70° (approximately)</li><li>• Axis-4: 0°</li><li>• Axis-5: 0°</li><li>• Axis-6: 0°.</li></ul>	 xx1700000374
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 robot working area.	

## Attaching lifting accessories to the lower and upper arm

Use this procedure to attach the lifting accessories.

	Action	Note
1	 <b>CAUTION</b> The lower and upper arms together weigh (according to variants) 650 kg. All lifting accessories used must be sized accordingly.	

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## 4 Repair

### 4.8.3 Replacing the axis-2 gearbox

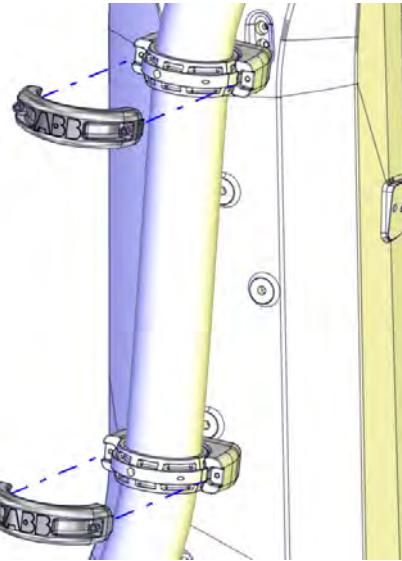
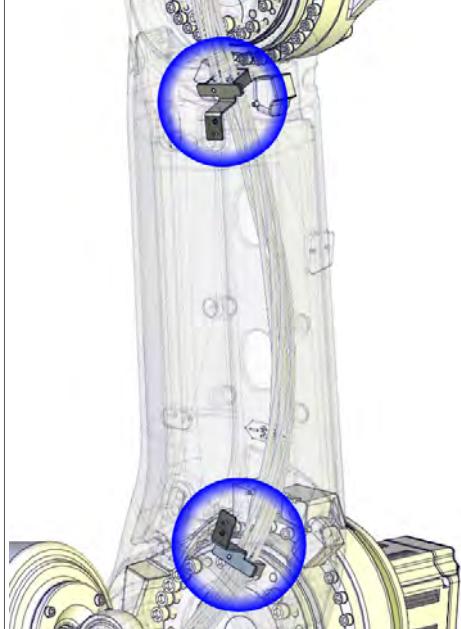
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Action	Note
<p>2 Fit a lifting eye in the arm house, with a fender washer underneath.</p>  <p>xx1400002196</p>	<p>Lifting eye, M12: 3HAC16131-1 Fender washer: Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.</p>  <p>xx1700000376</p>
<p>3 Attach the Lifting accessory (chain) to an overhead crane (or similar), then to the lifting eye in the arm house.</p>	<p>Lifting accessory (chain): 3HAC15556-1</p>  <p>xx1700000377</p>
<p>4 Raise the overhead crane to stretch the chain.</p>	
<p>5 To release the brake, connect the 24 VDC power supply. Connect to connector R2.MP2, axis-2 motor:</p> <ul style="list-style-type: none"> <li>• + = pin 2</li> <li>• - = pin 5</li> </ul>	

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## Loosening the cable brackets

Use this procedure to loosen required cable brackets.

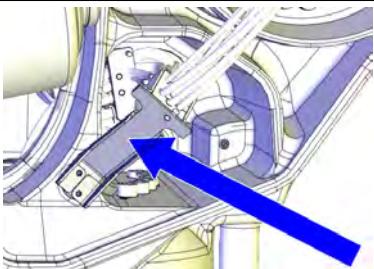
	Action	Note
1	If robot is equipped with DressPack: • Open the two ball joint housings from the lower arm and lift away the cabling from the ball joint housings.	How to remove the DressPack cable package is described in more detail in the product manual "IRB 6700 DressPack". For article number see <a href="#">References on page 10</a> .   xx1400000195
2	Unscrew the attachment screws that secure the <i>axis-2 lower arm metal clamp</i> and the <i>axis-3 lower arm metal clamp</i> located on the inside of the lower arm by removing the attachment screws.   The screws are reached from outside the lower arm!	   xx1300000540

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## 4 Repair

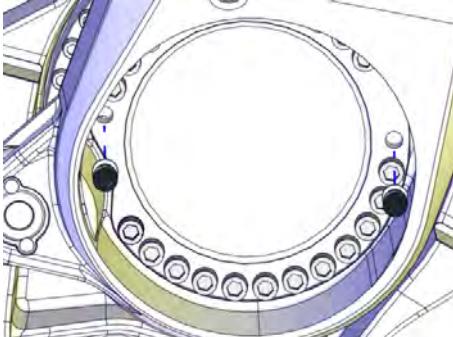
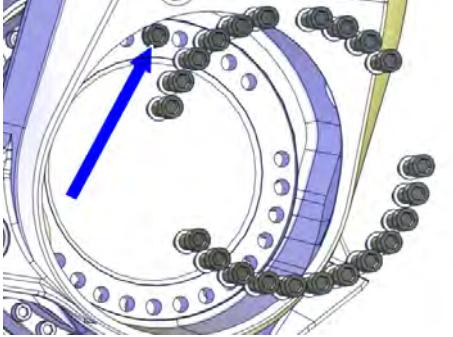
### 4.8.3 Replacing the axis-2 gearbox

*Continued*

Action	Note
3 Unscrew the attachment screws of the cable bracket on the frame and let it hang loose.	 xx1200001283

#### Fitting guide pins to the lower arm

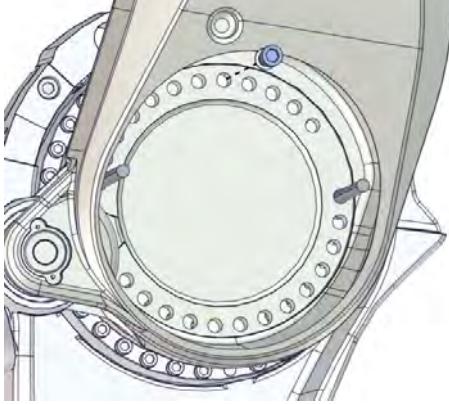
Use this procedure to prepare the removal of the lower arm.

Action	Note
1 Remove two attachment screws in opposite holes and replace them with guide pins.   <b>Tip</b> Lubricate the guide pins with some grease to make the lower arm slide better.	Guide pin, M16x150: 3HAC13120-2 Guide pin, M16x200: 3HAC13120-3 Always use guide pins in pairs.  xx1400002181
2 Remove all but one of the remaining attachment screws that secure the lower arm to the axis-2 gearbox.	 xx1400002182

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## Removing and lifting away the lower and upper arms un-separated

Use this procedure to remove and lift away the lower and upper arm unseparated.

	Action	Note
1	<p>Put two pallets on the floor, in front of the position of the mechanical stop.</p> <p><b>Note</b></p> <p>Using the method to replace the gearbox with cable harness and DressPack fitted, is only a recommendation. If it is not possible to put the arm system close enough to the robot and keep the cable harness partly fitted, it is necessary to remove the cable harness and DressPack in base and frame first.</p>	
2	<p><b>CAUTION</b></p> <p>The lower and upper arms together weigh 650 kg. All lifting accessories used must be sized accordingly!</p>	
3	<p>Remove the remaining screw and slowly lift away the lower and upper arm together. Let the cabling run in the lower arm. Make sure not to stretch any cabling!</p> <p><b>CAUTION</b></p> <p>Use extreme caution when lifting the lower and upper arm. The cable harness is still partly connected.</p>	 <p>xx1700000442</p>
4	<p>Use a piece of wood or similar as a support under the arm house when the arm system is put down on the pallets. This is done in order not to damage any parts of the cable harness and DressPack.</p>	
5	<p>Use caution and lift the arm system and lay it down safely on the pallets.</p>	

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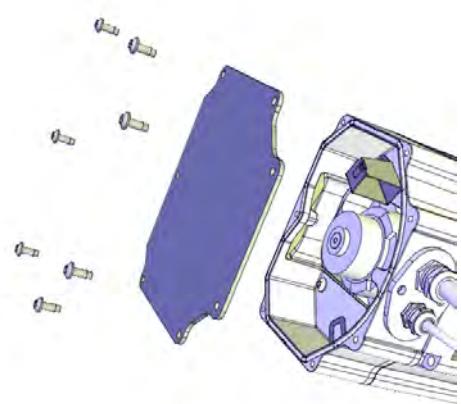
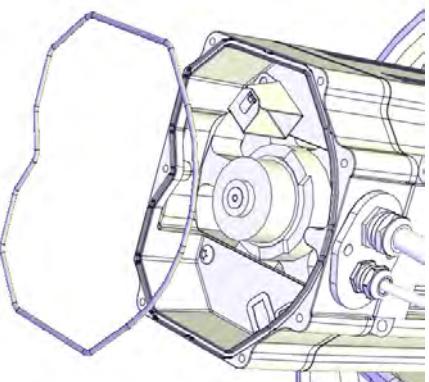
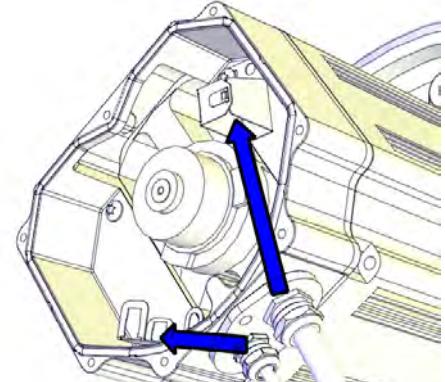
## 4 Repair

### 4.8.3 Replacing the axis-2 gearbox

*Continued*

#### Disconnecting the axis-2 motor cables

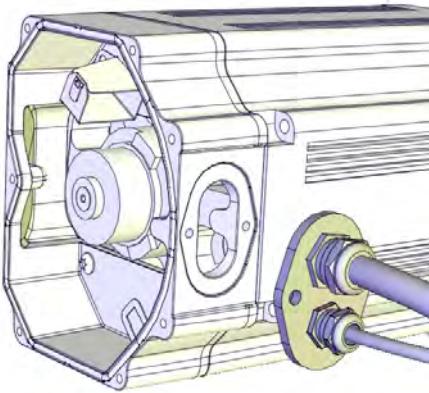
Use this procedure to disconnect the motor cables.

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

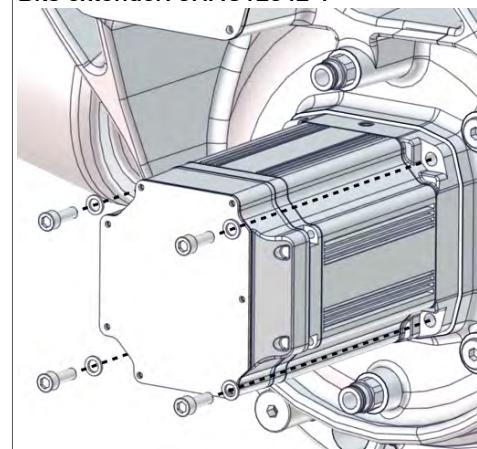
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#### 4.8.3 Replacing the axis-2 gearbox

*Continued*

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

#### Removing the axis-2 motor

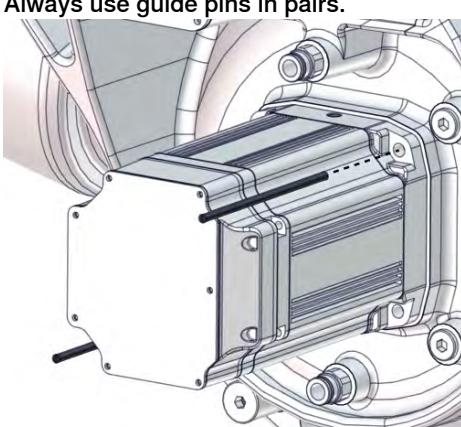
Action	Note
1 Before removing the motor, make sure that the axis-2 gearbox is completely drained.	
<p>2 To release the brake, connect the 24 VDC power supply. Connect to connector R2.MP2, axis-2 motor:</p> <ul style="list-style-type: none"> <li>• + = pin 2</li> <li>• - = pin 5</li> </ul>	
<p>3 Remove the attachment screws securing the motor. Use a bits extender in order to reach the screws.</p>	Bits extender: 3HAC12342-1  xx1700000515

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## 4 Repair

### 4.8.3 Replacing the axis-2 gearbox

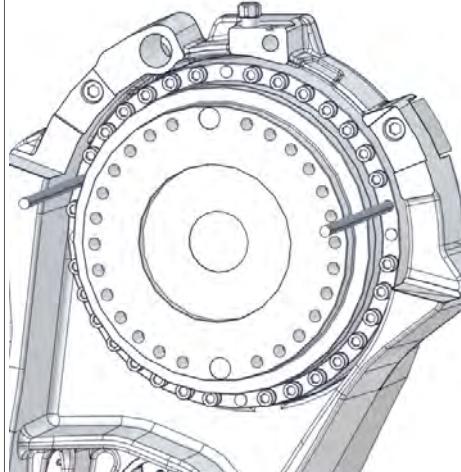
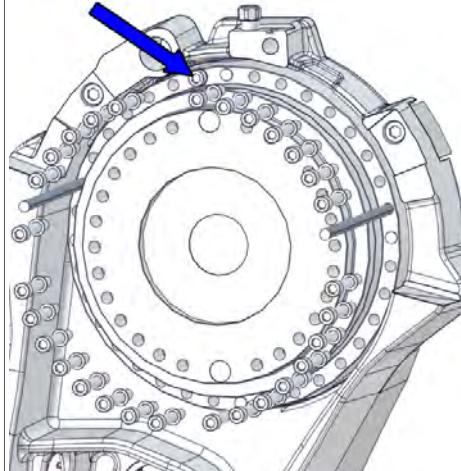
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Action	Note
4 Fit guide pins in opposite holes.  Tip  Lubricate the guide pins with some grease to make the motor slide better.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.   xx1700000516
5 <b>CAUTION</b>  Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
6 If required, press the motor out of its position by using the removal tool in opposite holes of the motor.	Removal tool M12: 3HAC057339-003 Always use removal tools in pairs.
7 Disconnect the 24 VDC power supply.	
8 <b>CAUTION</b>  The motor weighs 28 kg. All lifting accessories used must be sized accordingly.	
9 Carefully lift the motor out on the guide pins, in order to get the pinion away from the gear and let it rest on the guide pins.	
10 Fasten the lifting accessory. Attach the lifting chain to the accessory and an overhead crane.	Lifting accessory, motor: 3HAC15534-1 Lifting accessory (chain): 3HAC15556-1
11 Remove the motor by sliding it out on the guide pins and lift it off.	Make sure the pinion is not damaged.

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## Removing the axis-2 gearbox

Use the procedure to remove gearbox.

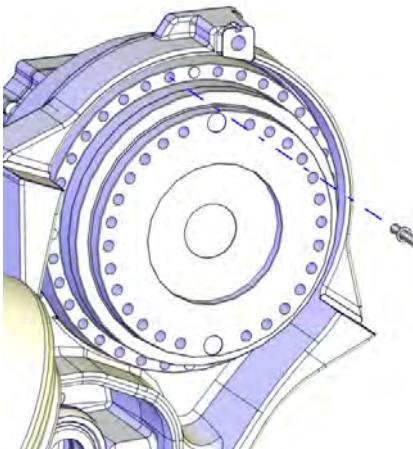
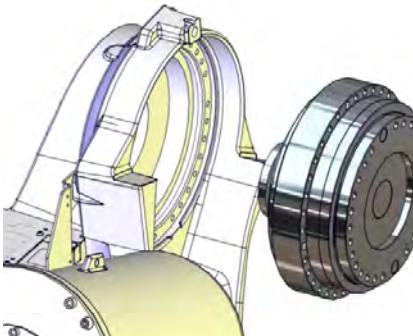
	Action	Note
1	<p>Remove two attachment screws in opposite holes and replace them with guide pins.</p> <p> <b>Tip</b></p> <p>Lubricate the guide pins with some grease to make the gearbox slide better.</p>	<p>Guide pin, M12x150: 3HAC13056-2 Guide pin, M12x200: 3HAC13056-3 Always use guide pins in pairs.</p>  <p>xx1700000443</p>
2	Leave one of the upper attachment screws and remove the rest. The remaining screw is used to prevent the gearbox from falling down.	 <p>xx1700000444</p>
3	<p> <b>CAUTION</b></p> <p>The gearbox weighs 110 kg. All lifting accessories used must be sized accordingly!</p>	

Continues on next page

## 4 Repair

### 4.8.3 Replacing the axis-2 gearbox

*Continued*

Action	Note
4 Remove the remaining screw left in the gearbox.	 xx1400002185
5 Use two fully threaded attachment screws (M12) as removal tools to press the gearbox out of position.	
6 Attach the lifting accessory to the gearbox.	Lifting accessory, gearbox: 3HAC046128-001
7 Let the gearbox slide out on the guide pins.	
8 Remove the gearbox.	 xx1400002186

### Refitting the axis-2 gearbox

Use these procedures to refit the gearbox.

Follow the order of the separate procedures according to the order they are presented.



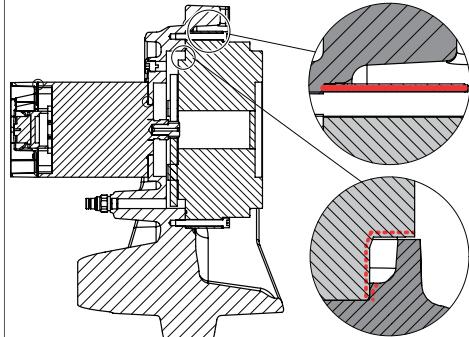
#### CAUTION

When performing these procedures, the cable harness will still be fitted or partly fitted to the robot. Use the utmost caution not to cause any damage to the cable harness!

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## Refitting the gearbox

Use this procedure to refit the gearbox.

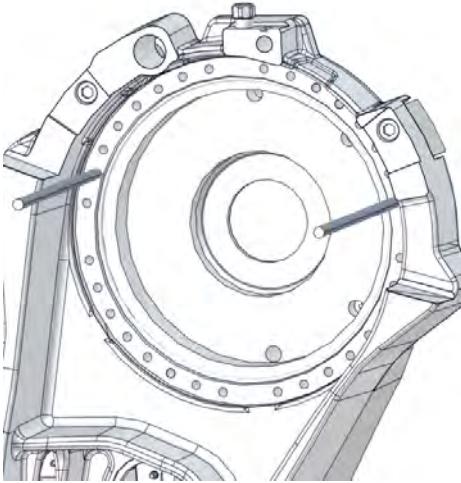
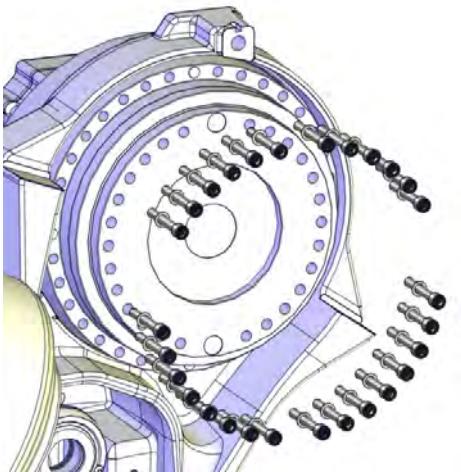
	Action	Note
1	 <b>CAUTION</b> The gearbox weighs according to variant 110 kg. All lifting accessories used must be sized accordingly!	
2	Apply the lifting accessory to the gearbox.	Lifting accessory, gearbox: 3HAC046128-001
3	Use caution and lift the gearbox so that it rests on its side.	
4	<b>Remove the o-ring and wipe it clean.</b>  <b>Note</b> This must also be done on a new spare part!	
5	<b>Wipe clean the contact surfaces from any contamination.</b>  <b>Note</b> Also wipe clean the o-ring groove.	
6	Check the condition of the o-ring. Replace if damaged!	
7	Lubricate the o-ring with some grease, for a better fitting in the groove.	
8	Fit the o-ring in the groove.	
9	<b>Foundry Plus:</b> Apply Mercasol on the surfaces shown in the figure.	 xx1400000374

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## 4 Repair

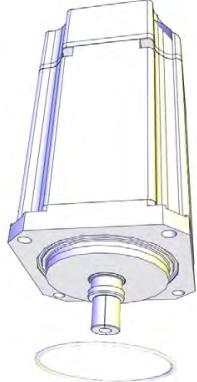
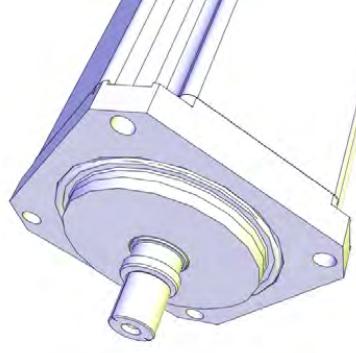
### 4.8.3 Replacing the axis-2 gearbox

*Continued*

Action	Note
10 Fit two guide pins in opposite holes (M12).   <b>Tip</b>  Lubricate the guide pins with some grease to make the gearbox slide better.	Guide pin, M12x150: 3HAC13056-2 Guide pin, M12x200: 3HAC13056-3 Always use guide pins in pairs.   xx170000445
11 Lift the gearbox and let it rest on the guide pins.	
12 Slide the gearbox into position.	
13 Fit the attachment screws now accessible.	   xx1400002188  Screw dimension: M12x90. Screw quality: 12.9 Gleitmo (totally 32 pcs)
14 Remove the lifting accessory.	
15 Remove the guide pins and fit the remaining attachment screws.	
16 Secure the gearbox with its attachment screws.	Tightening torque: 120 Nm.

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## Preparations prior to refitting motor

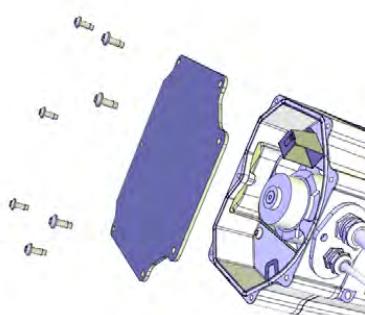
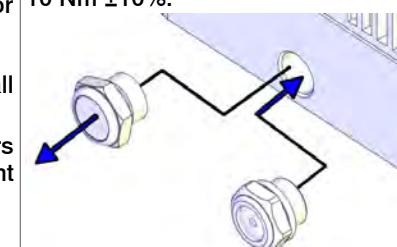
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove old paint residues and other contamination from the contact surfaces on both the motor and the mating parts.	
3	Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4	Check the o-ring. Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
5	 <b>Tip</b> Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020

Continues on next page

## 4 Repair

### 4.8.3 Replacing the axis-2 gearbox

*Continued*

Action	Note
6 If the motor is a new spare part, remove the cover.	 xx1200001135
7 <b>Foundry Plus:</b> Valid for axis-2, axis-3, axis-4 and axis-6 motors. If the motor is a new spare part, the protection filter located in the evacuation hole on the motor flange must be replaced with a transparent plug/sight glass (enclosed with the spare part delivery). Remove the protection filter and install the transparent plug/sight glass. On the axis-6 motor there are two protection filters that must be replaced with transparent plugs/sight glasses.	Tightening torque, transparent plug: 25 Nm $\pm 10\%$ . Tightening torque, protection filter: 10 Nm $\pm 10\%$ .  xx1600000576

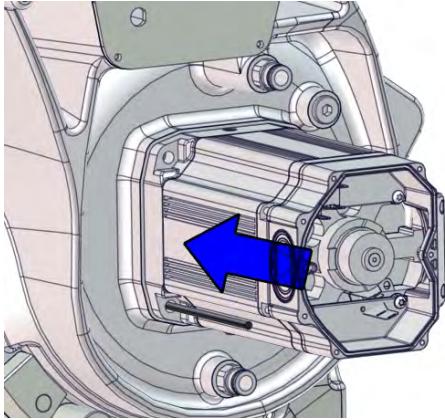
#### Securing the axis-2 motor

Action	Note
1 Fit guide pins in opposite holes.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.
2  <b>CAUTION</b> The motor weighs 28 kg. All lifting accessories used must be sized accordingly.	
3 Apply the lifting accessory.	Lifting accessory, motor: 3HAC15534-1

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#### 4.8.3 Replacing the axis-2 gearbox

*Continued*

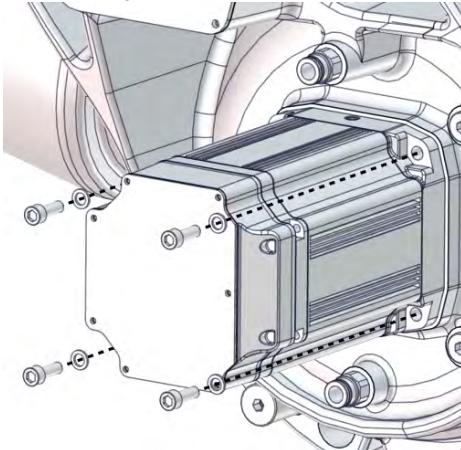
Action	Note
4  <b>Note</b> Make sure the cable exit hole is turned the correct way.	 xx1700000517
5 Lift the motor and put it on the guide pins as close as possible to its final position without pushing the motor pinion into the gear.	
6 Remove the lifting accessory and allow the motor to rest on the guide pins.	
7 Apply the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool: 3HAB7887-1
8 To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP2, axis-2 motor: <ul style="list-style-type: none"> <li>• + = pin 2</li> <li>• - = pin 5</li> </ul>	
9  <b>CAUTION</b> Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
10 Use caution and fit the motor in its final position while at the same time rotating the motor pinion slightly using the rotation tool. <ul style="list-style-type: none"> <li>• Make sure that the motor pinion is properly mated to the gear of the gearbox.</li> <li>• Make sure that the motor pinion does not get damaged.</li> <li>• Make sure that the direction of the cable exit is facing the correct way.</li> </ul>	
11 Fit two of the attachment screws.	Screw dimension: M10x40 quality 12.9 Gleitmo (4 pcs)
12 Remove the guide pins and replace with the remaining attachment screws.	

*Continues on next page*

## 4 Repair

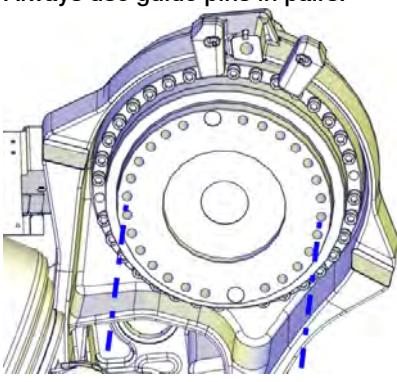
### 4.8.3 Replacing the axis-2 gearbox

*Continued*

Action	Note
13 Secure the motor with its attachment screws and washers. Use a bits extender in order to reach the screws.	Bits extender: 3HAC12342-1 Tightening torque: 50 Nm. Screw dimension: M10x40 quality 12.9 Gleitmo (4 pcs)  xx1700000515
14 Perform a leak-down test.	See <a href="#">Performing a leak-down test on page 190</a> .

#### Lifting back and refitting the lower and upper arm

Use this procedure to lift back and refit the lower and upper arm unseparated.

Action	Note
1 Connect the 24 VDC power supply to the axis-2 motor to release the brakes of the motor.	
2 Fit the rotation tool, if not already fitted.	Rotation tool: 3HAB7887-1
3 Fit two guide pins in opposite holes in the axis-2 gearbox.   <b>Tip</b> Lubricate the guide pins with some grease to make the lower arm slide better.	Guide pin, M16x150: 3HAC13120-2 Always use guide pins in pairs.  xx1400002189
4  <b>CAUTION</b> The lower and upper arms together weigh 650 kg. All lifting accessories used must be sized accordingly!	

*Continues on next page*

### 4.8.3 Replacing the axis-2 gearbox

*Continued*

Action	Note
5 Apply the lifting accessories, if not already fitted.	
6 Use caution and slowly lift the lower and upper arm together. Make sure: <ul style="list-style-type: none"><li>• not to stretch any of the cables</li><li>• that the arm package is level when lifted.</li></ul>	
7 Before putting the upper and lower arm on the guide pins, make sure that the hole pattern is matched and in the correct position for all screws.	
8 If the hole pattern is not matching, use the rotation tool and adjust.	 xx1300000819
9 Slide the lower arm on to the guide pins.	
10 Use caution and move the arms into position at the axis-2 gearbox on the guide pins. Rotate the axis-2 gearbox until the hole pattern is matching the holes in the lower arm.	
11 Fit one attachment screw in one of the upper holes using it for security and lower the lifting accessory a little.	
12 Fit all now accessible attachment screws.	 xx1400002190
13 Remove the two guide pins and fit the remaining attachment screws.	

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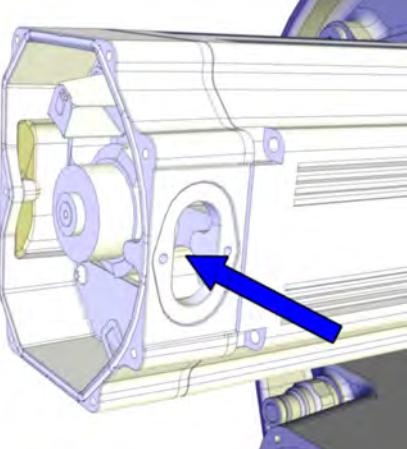
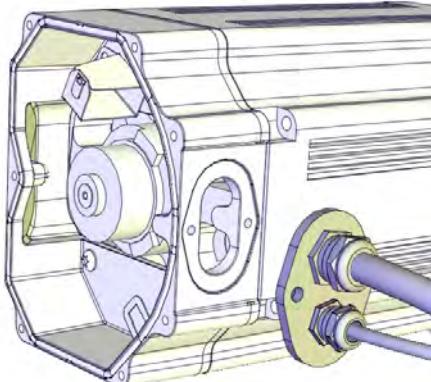
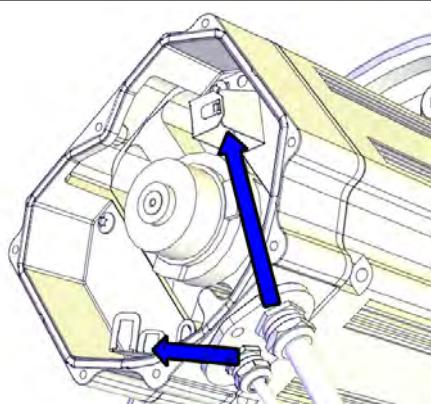
## 4 Repair

### 4.8.3 Replacing the axis-2 gearbox

*Continued*

Action	Note
14 Secure the lower arm to the axis-2 gearbox with its attachment screws.	Tightening torque M16: 300 Nm.
15 Disconnect the 24 VDC power supply.	
16 Remove the lifting accessories.	

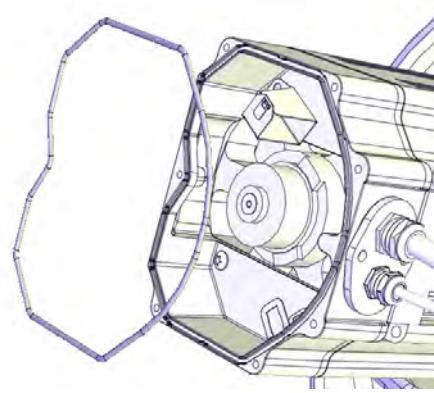
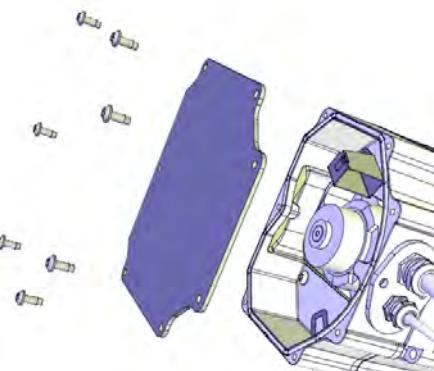
Connecting the axis-2 motor cables

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

*Continues on next page*

## 4.8.3 Replacing the axis-2 gearbox

*Continued*

Action	Note
4 Inspect the o-ring.  Note Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-001   xx1200001070
5 Wipe clean o-ring and o-ring groove.	
6 Refit the o-ring.  Tip Lubricate the o-ring with some grease for a better fitting in the groove.	
7 CAUTION When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8 Refit the motor cover with its attachment screws.  Note Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged.  Note Make sure the o-ring is undamaged and properly fitted.	 xx1200001135
9 Make sure that the covers are tightly sealed.	

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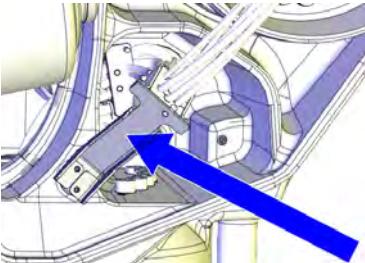
## 4 Repair

### 4.8.3 Replacing the axis-2 gearbox

*Continued*

#### Refitting the cabling

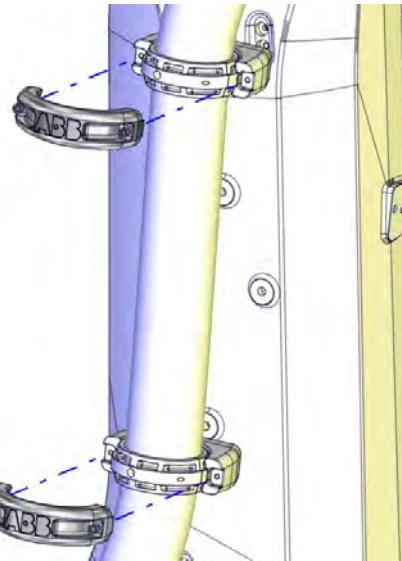
Use this procedure to refit the cabling.

Action	Note
1 Use caution and push the cable harness into the lower arm.	
2 Refit the <i>axis-2 lower arm metal clamp</i> and the <i>axis-3 lower arm metal clamp</i> located on the inside of the lower arm.   <b>Note</b> The screws are reached from the outside of the lower arm!	 xx1200001282
3 Refit the cable bracket on the frame.	 xx1200001283

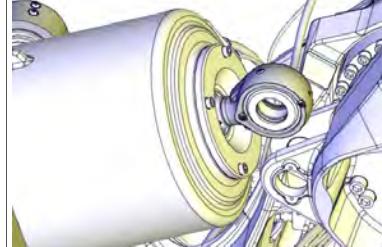
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## 4.8.3 Replacing the axis-2 gearbox

Continued

Action	Note
<p>4 If robot is equipped with DressPack.</p> <ul style="list-style-type: none"> <li>Place the cabling in the two ball joint housings on the lower arm and close the ball joint housings.</li> </ul>	<p>How to refit the DressPack is described in the product manual "IRB 6700 DressPack". For article number see <a href="#">References on page 10</a>.</p>  <p>xx1400000195</p>

## Refitting the front shaft

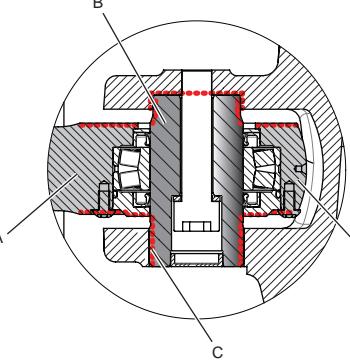
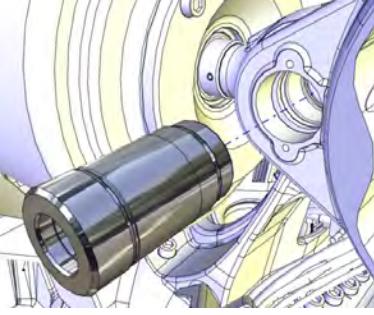
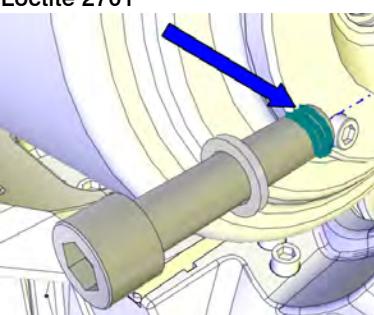
Action	Note
<p>1  <b>DANGER</b></p> <p>Turn off all:</p> <ul style="list-style-type: none"> <li>electric power supply</li> <li>hydraulic pressure supply</li> <li>air pressure supply</li> </ul> <p>to the robot, before entering the robot working area.</p>	
2 Remove all residues of Loctite in the screw hole of the shaft.	
3 Wipe all contact surfaces inside the recess clean from residual grease or other contamination.	
<p>4 Align the balancing device link ear with the hole in the lower arm.</p> <p> <b>Note</b></p> <p>Verify that the link ear is correctly turned.</p>	 <p>xx1300000784</p>

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## 4 Repair

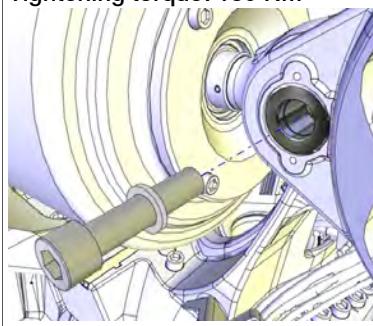
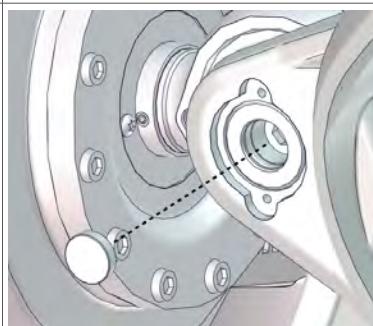
### 4.8.3 Replacing the axis-2 gearbox

*Continued*

Action	Note
<p>5 <b>Foundry Plus:</b> Apply Mercasol on the surfaces on the shaft and front ear.</p>	 <p>xx1400000368</p> <p>A Front link ear B Shaft C Mercasol (red dotted lines)</p>
<p>6 Lubricate the shaft and place it to the front ear.</p> <p> <b>Note</b></p> <p><b>Foundry Plus:</b> Do not lubricate surfaces where Mercasol is applied!</p>	 <p>xx1200001280</p>
<p>7 Press the shaft in with the hydraulic press tool. <b>Tool figure missing</b></p> <p>xx1700000380</p>	<p>Hydraulic pump 80 MPa: 3HAC13086-1 Hydraulic cylinder: 3HAC11731-1 Dismantle and mounting tool: 3HAC028920-001 Press tool M</p>
<p>8 Apply locking liquid on the first threads of the screw.</p>	<p>Loctite 2701</p>  <p>xx1300000782</p>

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#### 4.8.3 Replacing the axis-2 gearbox Continued

	Action	Note
9	Secure the shaft with screw and washer.	Tightening torque: 180 Nm  xx1200001279
10	Fit a new VK-cover.	 xx1700000088
11	Unscrew both screws in link ear. Fill the bearing with grease from the upper hole, until the grease appears in the lower hole.	Bearing grease: 3HAB3537-1  xx1300000783
12	Refit the two screws and wipe clean from residual grease.	
13	Refit the DressPack bracket, if used.	

#### Restoring the balancing device

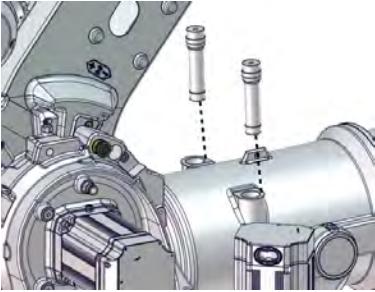
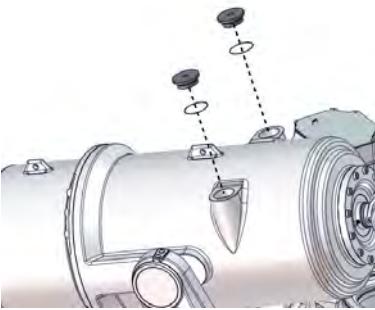
	Action	Note
1	Remove the lifting equipment from the balancing device.	
2	Jog axis 2 to -4° in order to be able to remove the relief screws.	

*Continues on next page*

## 4 Repair

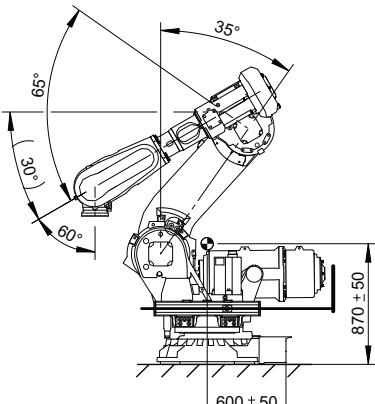
### 4.8.3 Replacing the axis-2 gearbox

*Continued*

Action	Note
3 Remove the relief screws to activate the balancing device.  Note Axis 2 must be in -4°.	 xx1700000070
4 Refit the covers. Make sure that the o-rings are still fitted.	 xx1700000451

#### Securing the lower arm

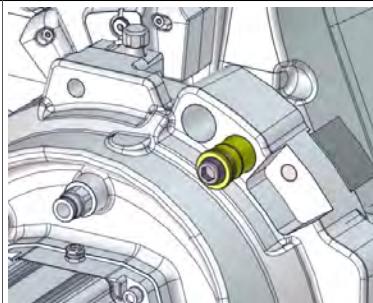
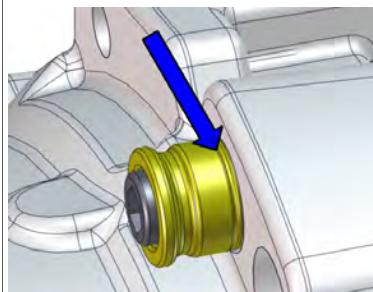
Use this procedure to secure the lower arm before lifting the robot to inverted position.

Action	Note
1 Verify that the robot stands in position: <ul style="list-style-type: none"><li>• 0°</li><li>• -35°</li><li>• +65°</li><li>• 0°</li><li>• +60°</li><li>• no significance</li></ul>	 xx1600001371

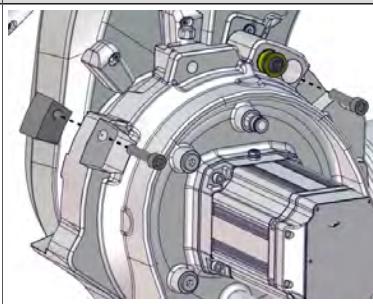
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#### 4.8.3 Replacing the axis-2 gearbox

*Continued*

Action	Note
2 Remove the transportation lock screw and the yellow sleeve from the parking position.	 xx1700000348
3 Insert the yellow sleeve and the transportation lock screw in the hole at the locking position. Insert the sleeve all the way so that the marking in the sleeve is aligned with the casting, see figure. Tighten the screw.  <b>DANGER</b> Always use the transportation lock screw and sleeve to lock the lower arm at transportation, turning and floor standing.	Tightening torque: 70 Nm ±15 Nm  xx1700000347  xx1600002114

Preparations before lifting up the robot to inverted position

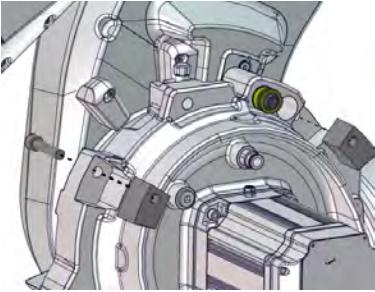
Action	Note
1 Remove the two service stops from maintenance position, if previously moved there.	 xx1700000068

*Continues on next page*

## 4 Repair

### 4.8.3 Replacing the axis-2 gearbox

*Continued*

Action	Note
2 Fit the service stops in their parking position.	 xx1700000067
3 Fasten the fork lift accessory.	See user instructions enclosed with the fork lift accessory. Fork lift accessory set: 3HAC058825-001.
4 Remove the bolts securing the robot to the foundation.	

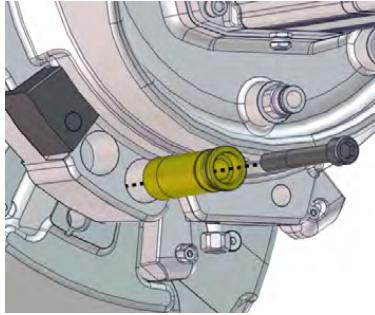
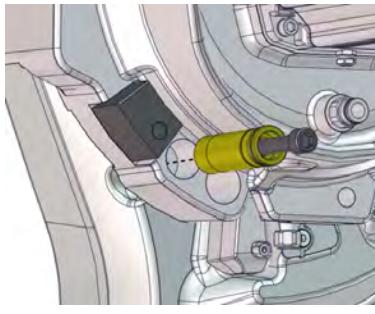
#### Orienting and securing the robot

Action	Note
1 Lift the robot using the fork lift accessory.	See user instructions enclosed with the fork lift accessory.
2 Move the robot close to its installation location.	
3 Rotate the robot into inverted position using the turning tool or using a fork lift truck with a rotator attachment.	See user instructions enclosed with the turning tool.
<p> <b>DANGER</b></p> <p>Make sure that there is enough space underneath the robot. See user instructions for the turning tool.</p>	
4 Guide the robot using two M24 screws while lifting it into its mounting position.	
5 Fit the bolts and washers in the base attachment holes.	Specified in <a href="#">Attachment screws on page 75</a>
<p> <b>Note</b></p> <p>Lightly lubricate screws before assembly.</p>	
6 Tighten bolts in a crosswise pattern to ensure that the base is not distorted.	

*Continues on next page*

### 4.8.3 Replacing the axis-2 gearbox

*Continued*

	Action	Note
7	Remove the yellow sleeve and transportation lock screw from the transportation and turning position.	 xx1700000269
8	Fasten the yellow sleeve and transportation lock screw in its parking position.	 xx1700000270

#### Concluding procedure

	Action	Note
1	If the robot is equipped with DressPack, refit the brackets of the ball joint housings on the wrist.	
2	Refill oil to the axis-2 gearbox.	See <a href="#">Filling oil into the axis-2 gearbox on page 162</a> .
3	Recalibrate the robot.	Axis Calibration is described in <a href="#">Calibrating with Axis Calibration method on page 691</a> . General calibration information is included in section <a href="#">Calibration on page 683</a> .
4	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

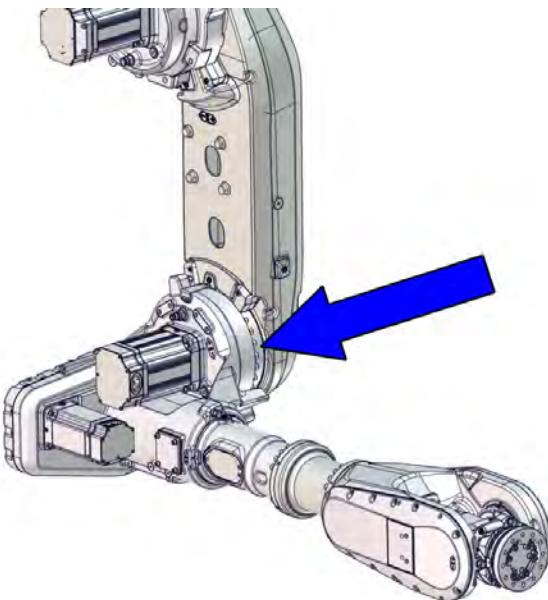
## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

#### 4.8.4 Replacing the axis-3 gearbox

##### Location of the axis-3 gearbox

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



xx1700000372

##### Summary of the replacement procedure

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

- 1 Remove the upper arm from the robot.
- 2 Replace the axis-3 gearbox.

##### Spare parts

Spare parts	Spare part number	Note
Axis-3 gearbox	See <i>Product manual, spare parts - IRB 6700</i> .	

##### Required tools and equipment

Equipment, etc.	Article number	Note
Oil collecting vessel	-	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	-	One example of oil dispenser can be found in section <a href="#">Type of lubrication in gearboxes on page 147</a> .
Lifting eye, M12	3HAC16131-1	
Lifting eye, M16	3HAC14457-4	

Continues on next page

## 4.8.4 Replacing the axis-3 gearbox

*Continued*

Equipment, etc.	Article number	Note
Fender washer	-	Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.
Roundsling, 1 m	-	Lifting capacity: 1,000 kg.
Lifting accessory (chain)	3HAC15556-1	Lifting instruction 3HAC15880-2 enclosed.
Pallet		Used for putting down removed parts from robot.
Lifting accessory, gearbox	3HAC046128-001	
Removal tool M14	3HAC057339-004	Used to push out the motor, if necessary. Always use removal tools in pairs.
ScrewsM8x75, fully threaded	-	Used to push out the gearbox, if necessary.
Guide pin, M12x150	3HAC13056-2	Always use guide pins in pairs.
Guide pin, M16x200	3HAC13120-3	Always use guide pins in pairs.
Rotation tool	3HAB7887-1	Used to rotate the motor pinion.
24 VDC power supply	-	Used to release the motor brakes.
Leak-down tester	-	
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

**Consumables**

Equipment, etc	Article number	Note
Grease	3HAB3537-1	Used to lubricate o-rings.
O-ring	3HAB3772-107	D=102x3 Used on motor flange.
O-ring	3HAC054692-002	D=169.5x3 Used on motor cover.
O-ring	3HAB3772-145	D=266.29x3.53 Used on gearbox.

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## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

*Continued*

#### Deciding calibration routine

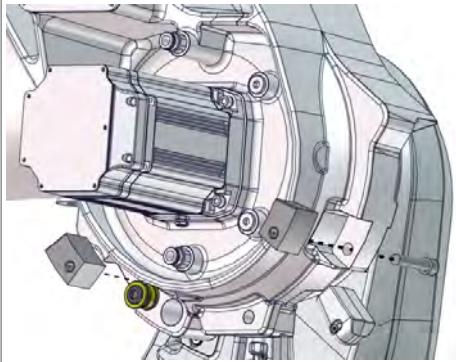
Decide which calibration routine to be used, based on the information in the table. Depending on which routine is chosen, action might be required prior to beginning the repair work of the robot, see the table.

Action	Note
1 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>	
If the robot is to be calibrated with reference calibration: Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 692</a> .
If the robot is to be calibrated with fine calibration: Remove all external cable packages (DressPack) and tools from the robot.	

#### Removing the axis-3 gearbox

Use these procedures to remove the axis-3 gearbox.

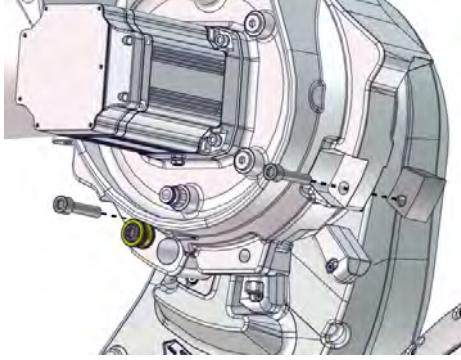
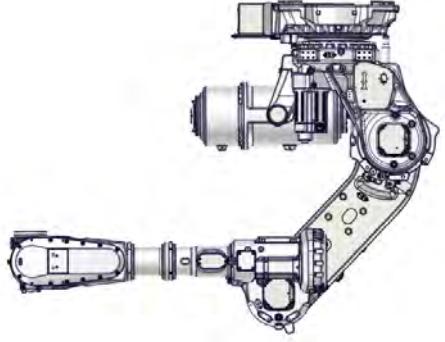
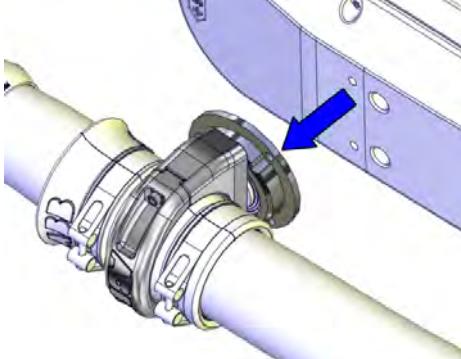
##### Preparations before removing the axis-3 gearbox

Action	Note
1 Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2 Remove the service stops from their parking position.	 xx1700000448

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#### 4.8.4 Replacing the axis-3 gearbox

*Continued*

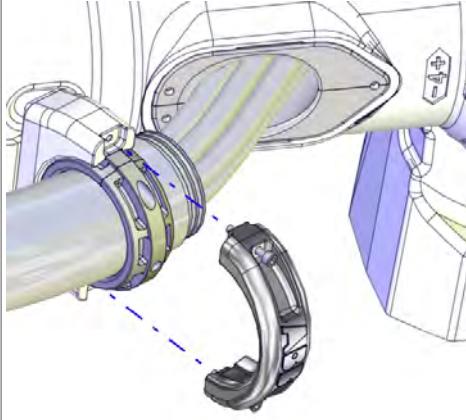
Action	Note
3 Fit the service stops in maintenance position.	Tightening torque: 70 Nm ±15 Nm.  xx1700000449
4 Jog the robot to the position: <ul style="list-style-type: none"> <li>• Axis-1: a position that allows best possible access to fit the lifting accessories to the upper arm.</li> <li>• Axis-2: -35 (so that the lower arm rests against the service stop).</li> <li>• Axis-3: -143 (so that the upper arm is horizontal)</li> <li>• Axis-4: 0°</li> <li>• Axis-5: +90°</li> <li>• Axis-6: 0°</li> </ul>	 xx1700000450
5  <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.	
6 If DressPack is installed: <ul style="list-style-type: none"> <li>• Remove the bracket with the complete ball joint housing still fitted, as shown in the figure.</li> </ul> This is done to be able to reach the two hidden screws that secure the wrist cover.	 xx1400000355

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## 4 Repair

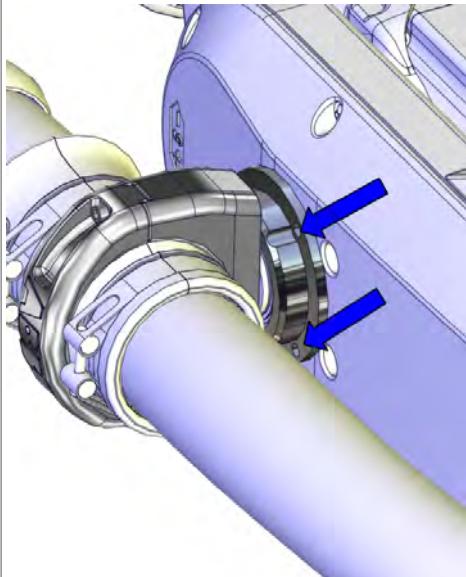
### 4.8.4 Replacing the axis-3 gearbox

*Continued*

Action	Note
7 If used, open the ball joint housing on the arm tube and remove the DressPack cable package.	 xx1400000206
8 Begin draining the gearbox.	See <a href="#">Draining the axis-3 gearbox on page 165</a> .

#### Retrieving access to the wrist cabling

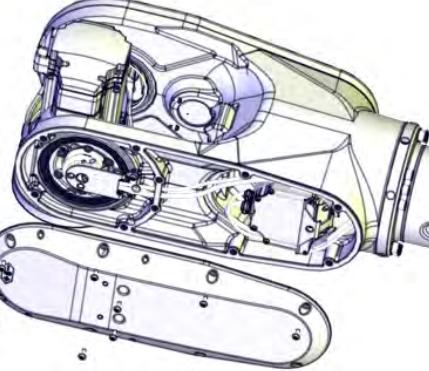
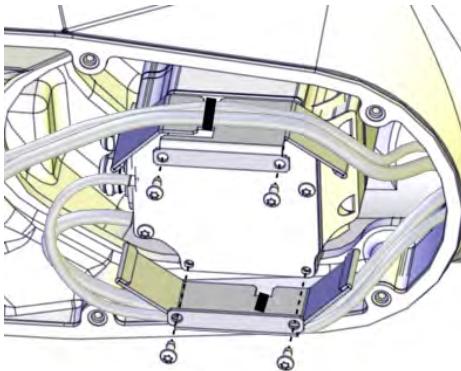
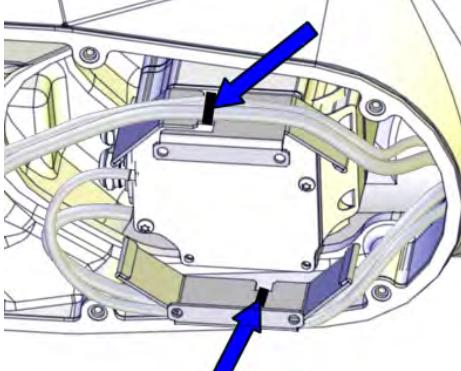
Use this procedure to remove the wrist cover to retrieve access to the axis-5 and axis-6 motor cables.

Action	Note
1  <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 If DressPack is not already removed, the complete ball joint housing (including the bracket) must be removed at this point, in order to reach the two hidden screws that secures the wrist cover.	 xx1400000355

*Continues on next page*

#### 4.8.4 Replacing the axis-3 gearbox

*Continued*

	Action	Note
3	Remove the wrist cover.	 xx1300002247
4	Remove the heat protection plates from the motor with the cabling still attached to the plate.	 xx1500001030
5	Cut the cable ties that hold the cable harness to the plate. <b>Note</b> Keep the heat protection plate until refitting. <b>Tip</b> If removing the plate only for replacing the motor, the cabling does not need to be loosened from the plate.	 xx1500001029

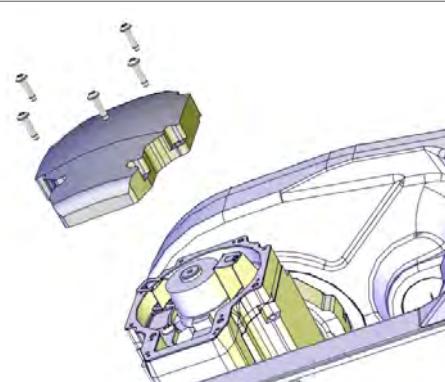
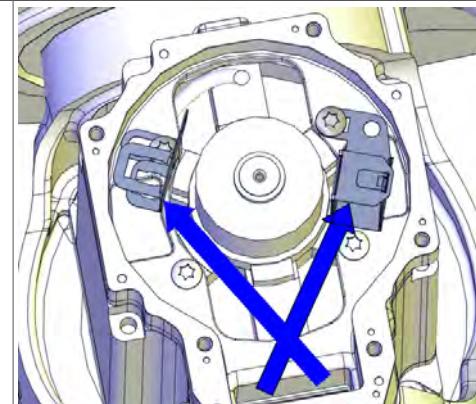
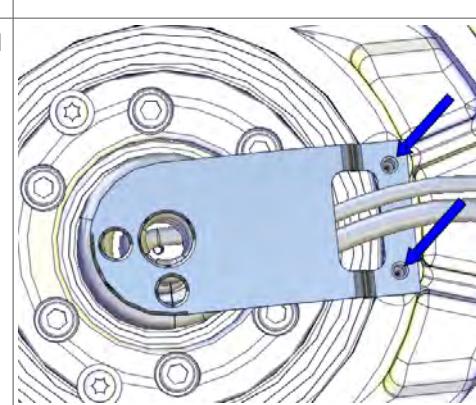
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## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

*Continued*

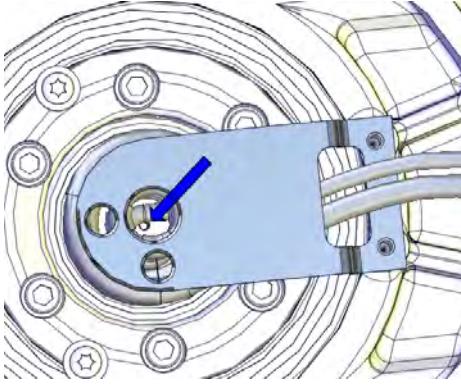
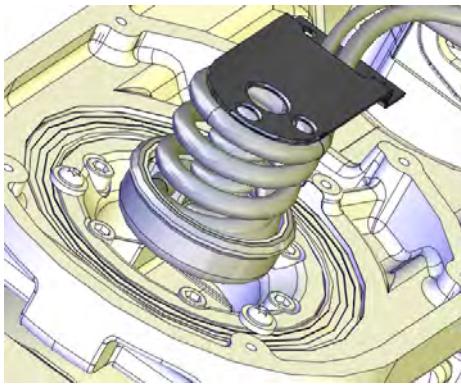
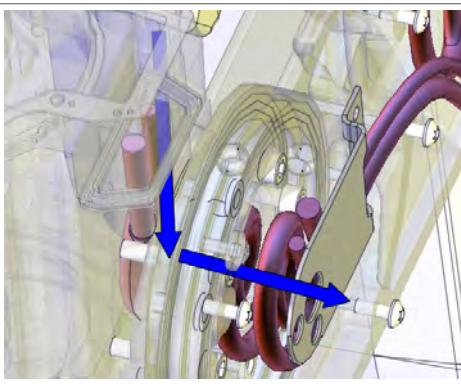
#### Disconnecting the axis-6 motor cables

	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Unscrew the attachment screws and remove the motor cover.	 xx1200001080
3	Disconnect the motor cables.	 xx1300000488
4	Unscrew the attachment screws that hold the cable bracket.	 xx1300000484

*Continues on next page*

## 4.8.4 Replacing the axis-3 gearbox

Continued

	Action	Note
5	Unscrew the M4 screw that holds the carrier.   <b>Note</b> The screw is located at the bottom of the carrier.	 xx1300000485
6	Pull out the carrier from its position.	 xx1300001113
7	Pull out the axis-6 motor cables by holding the cables with one hand at the motor and the other at the carrier.	 xx1300000666

## Disconnecting the axis-5 motor cables

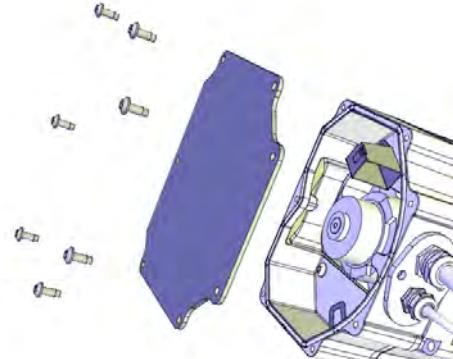
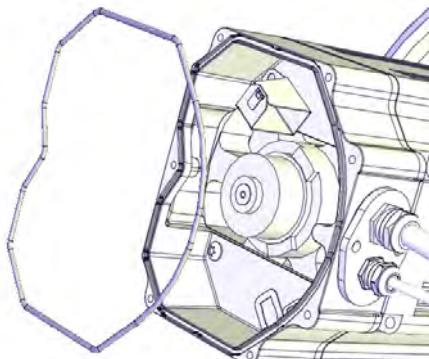
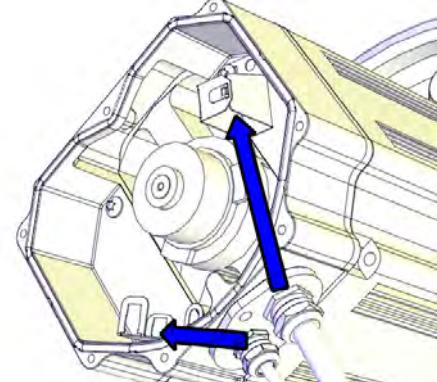
	Action	Note
1	 <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

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## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

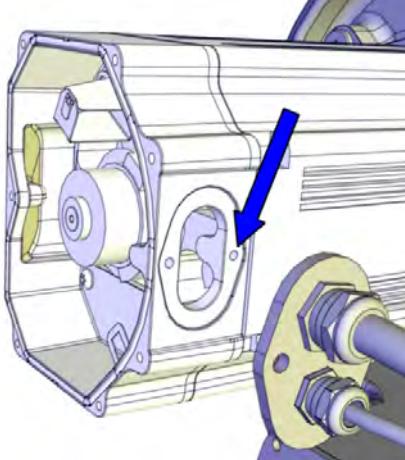
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Action	Note
2 Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135
3 Make sure the o-ring is present.	 xx1200001070
4 Disconnect the motor cables.	 xx1200001066

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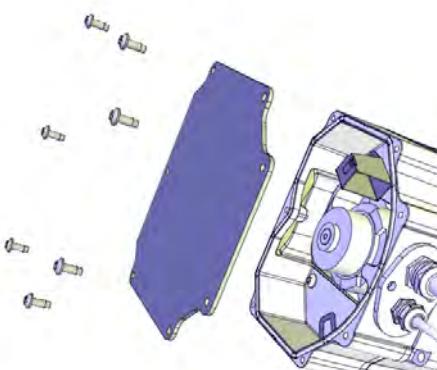
#### 4.8.4 Replacing the axis-3 gearbox

*Continued*

Action	Note
<p>5 Remove the cable gland cover by performing the following steps:</p> <ol style="list-style-type: none"> <li>1 Open the inner screw a little (the one the arrow is pointing at). No need to remove this screw from the motor.</li> <li>2 Remove the outer screw.</li> <li>3 Slide the cable gland cover away from the inner screw. Make sure the gasket is not damaged.</li> </ol> <p> <b>Tip</b></p> <p>Make a note in which direction the cable exit hole is facing, if the motor will be removed too. The motor shall be refitted in the same position.</p>	 xx1300000656
6 Use caution and pull out the motor cables.	

#### Disconnecting the axis-3 and axis-4 motor cables

Use this procedure to disconnect the motor cables on the axis-3 and axis-4 motors.

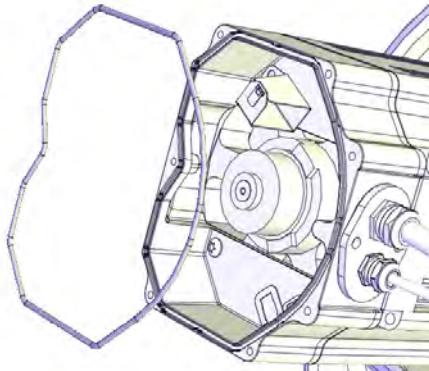
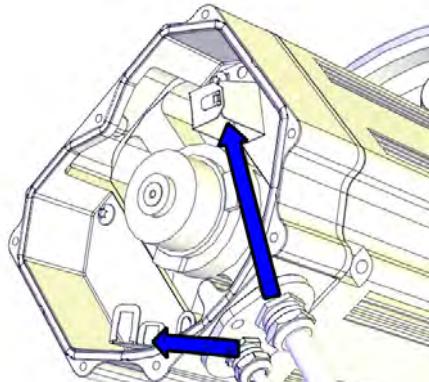
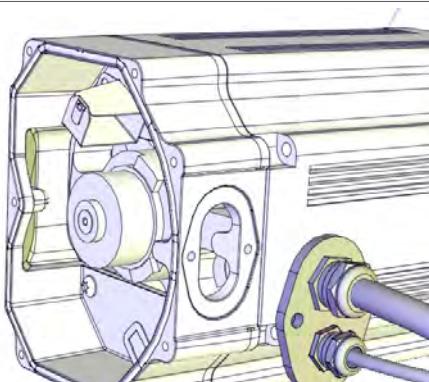
Action	Note
<p>1  <b>DANGER</b></p> <p>Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.</p>	
2 Unscrew the attachment screws and washers and remove the motor cover.	 xx1200001135

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## 4 Repair

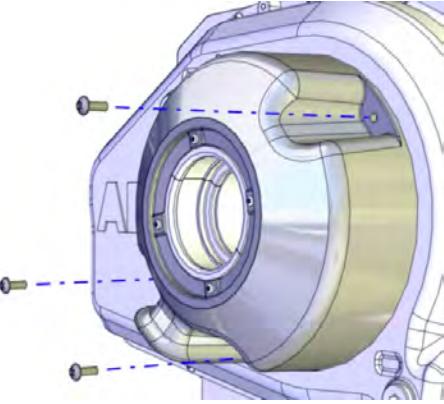
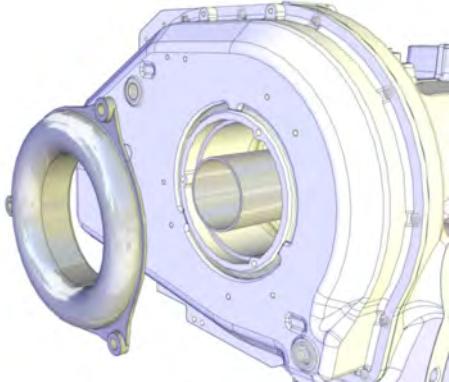
### 4.8.4 Replacing the axis-3 gearbox

*Continued*

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

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## Removing the cable harness - wrist and upper arm

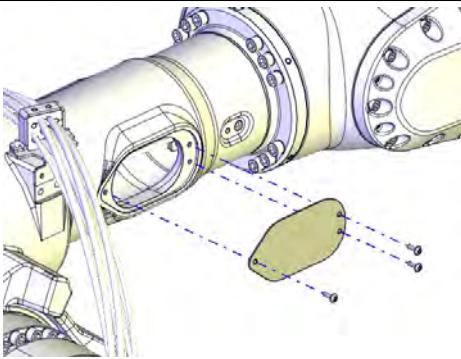
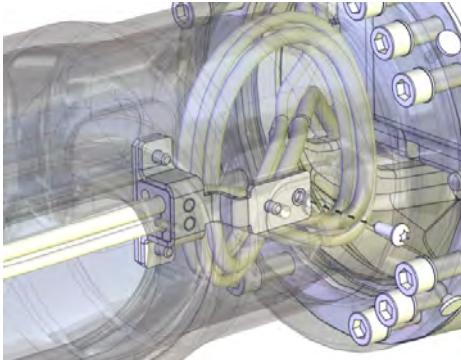
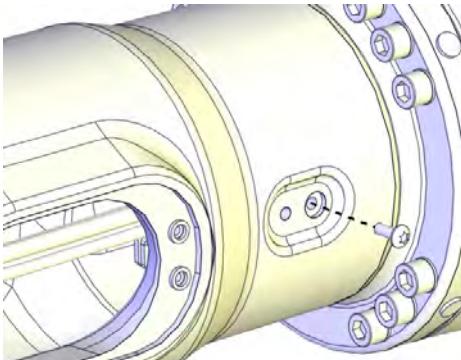
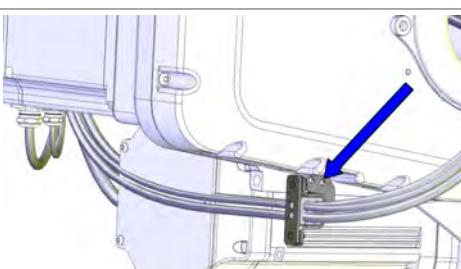
	Action	Note
1	<p>Remove the cover.</p> <p> <b>Note</b></p> <p><b>Foundry Plus:</b> Use caution not to damage the gasket, to loose the washers on the cover sealing or to loose the inserts fitted on the cover.</p>	 <p>xx1200000045</p>
2	<p>Remove the cable guide, slide it out a little and let it rest on the cables.</p>	 <p>xx1300000657</p>
3	<p> <b>Tip</b></p> <p>Use tape and tie the axis-5 and axis-6 connectors and carrier into a bundle (if not already done). This is done to facilitate the procedure and to avoid damaging the parts during the procedure. This will also make it easier to run the cable harness through the inside of the upper arm.</p>	 <p>xx1300000668</p>

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## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

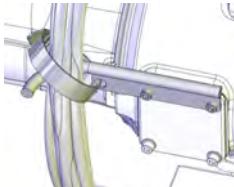
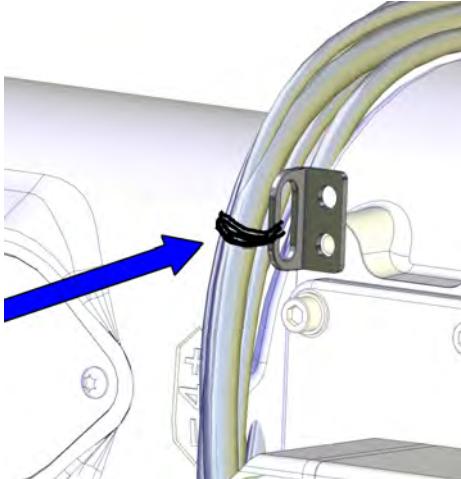
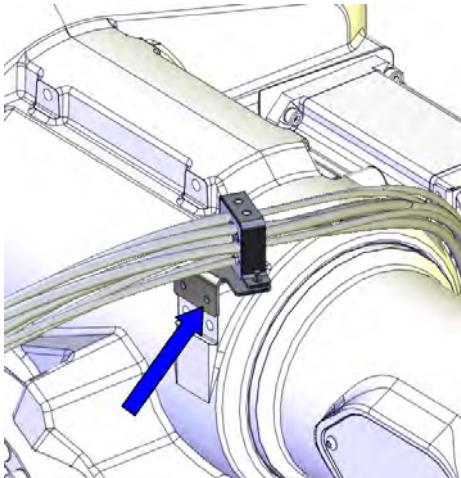
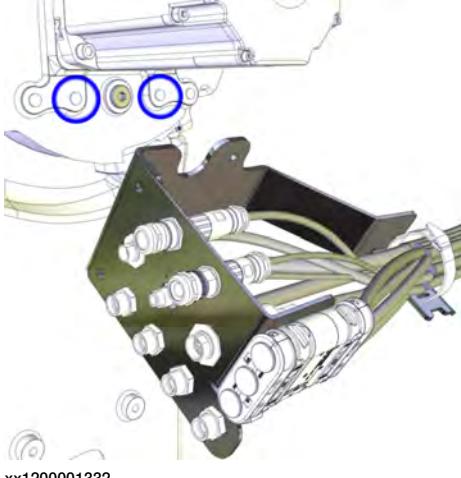
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Action	Note
4 Remove the side cover on the arm tube.	 xx1300000557
5 Unscrew the attachment screw that secures the axis-4 metal clamp inside the arm tube.  <b>Note</b> The screw is reached from outside the upper arm!	 xx1700000340  xx1700000339
6 Remove the armhouse metal clamp.	 xx1300000543

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## 4.8.4 Replacing the axis-3 gearbox

Continued

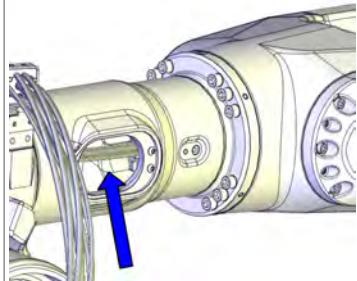
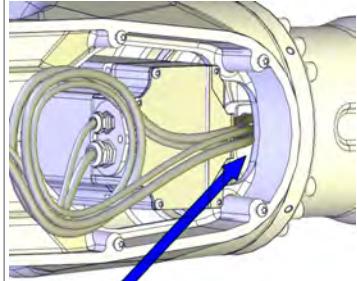
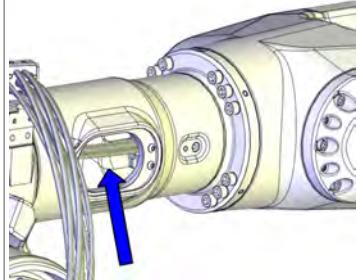
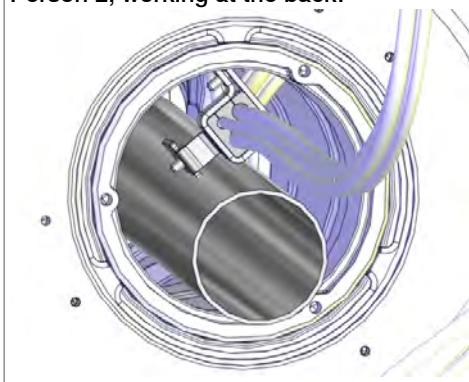
Action	Note
7 Open the velcro strap at the cable fixing bracket.   <b>Note</b>  If DressPack is fitted, the cable fixing bracket is replaced by the cable guide.   xx1300001973  <b>Cable guide.</b>	 xx1300000544  <b>Cable fixing bracket.</b>
8 Remove the metal clamp on top of the armhouse.	 xx1300000541
9 If used (and if not already done), unscrew the screws that hold the connection plate and let it hang free with the rest of the DressPack cable package.	 xx1200001332

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## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

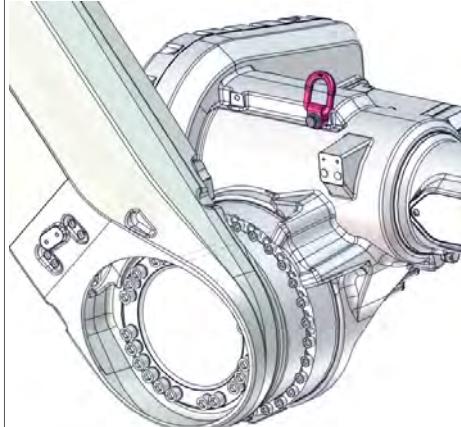
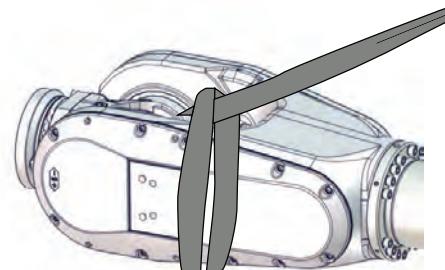
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	Action	Note
10	 <b>Tip</b> <p>This step is best performed by two persons working together.</p> <p>Use caution and remove the cable harness out of the wrist like this:</p> <ul style="list-style-type: none"> <li>• Person 1: Put one hand inside the side hole and take a hold of the cable harness.</li> <li>• Person 2: Take a hold on the cable harness inside the wrist.</li> <li>• Together: Move the cable harness past the axis-5 motor and into the arm tube.</li> </ul>	<p>Person 1, working at the side hole:</p>  xx1300000745 <p>Person 2, working at the wrist:</p>  xx1300000746
11	 <b>Tip</b> <p>This step is best performed by two persons working together.</p> <p>Use caution and remove the cable harness out of the arm tube like this:</p> <ul style="list-style-type: none"> <li>• Person 1: Put one hand inside the side hole and take a hold of the cable harness.</li> <li>• Person 2: Take a hold on the cable harness at the back of the robot.</li> <li>• Together: Move the cable harness out of the arm tube.</li> </ul> <p>Remove the cable harness from the upper arm.</p>	<p>Person 1, working at side hole:</p>  xx1300000745 <p>Person 2, working at the back:</p>  xx1400002561

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## Attaching the lifting accessories to the upper arm

Use this procedure to attach the lifting accessories to the upper arm.

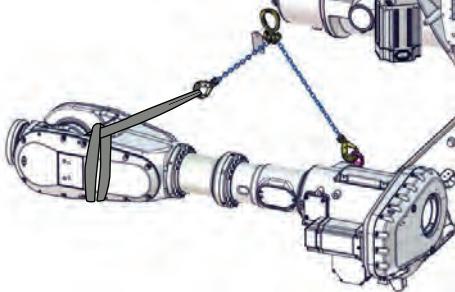
	Action	Note
1	 <b>CAUTION</b> The weight of the complete upper arm (including the wrist) is 465 kg All lifting accessories used must be sized accordingly.	
2	Fit a lifting eye in the arm house, with a fender washer underneath.  xx1400002196	Lifting eye, M12: 3HAC16131-1 Fender washer: Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.  xx1700000454
3	Run a lifting sling around the wrist.	Roundsling, 1 m: Lifting capacity: 1,000 kg.  xx1700000455

Continues on next page

## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

*Continued*

Action	Note
4 Attach the upper arm lifting accessory (chain) to an overhead crane (or similar) and then to the lifting eye in the arm house and the lifting sling around the wrist.	Lifting accessory (chain): 3HAC15556-1  xx1700000456
5 Raise the lifting accessories to take the weight of the upper arm.	
6 In case of necessary adjustments, use the shortening loops on the lifting accessory (chain) to find the level position. See figure!	 xx1400002197
7 Release the brakes in order to find the most level lifting position of the upper arm as possible, before lifting. To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP3: <ul style="list-style-type: none"><li>• + = pin 2</li><li>• - = pin 5</li></ul>	24 VDC power supply

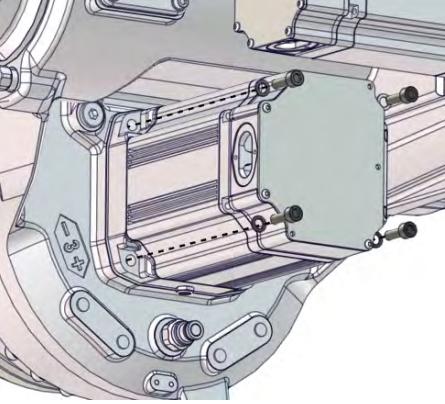
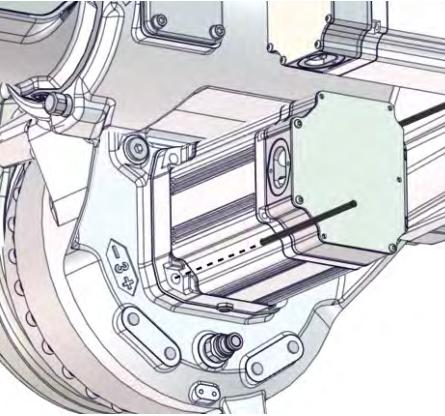
#### Removing the axis-3 motor

Action	Note
1 Before removing the motor, make sure that the axis-3 gearbox is completely drained.	
2  <b>DANGER</b> When releasing the holding brakes of the motor, the upper arm will be movable and may fall down! Before continuing the weight of the upper arm must be secured!	
3 To release the brakes, connect the 24 VDC power supply. Connect to connector R2.MP3: <ul style="list-style-type: none"><li>• + = pin 2</li><li>• - = pin 5</li></ul>	

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#### 4.8.4 Replacing the axis-3 gearbox

*Continued*

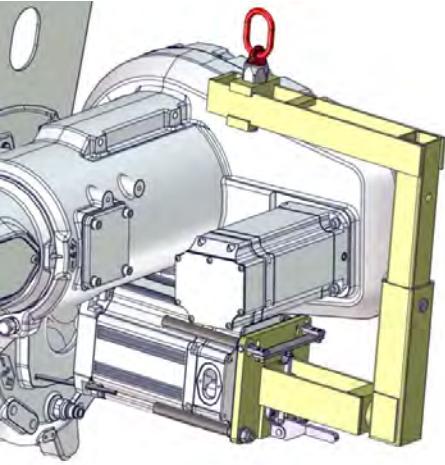
Action	Note
4 Unscrew the attachment screws that hold the motor. Use a bits extender to reach the screws.	Bits extender: 3HAC12342-1  xx1700000285
5 Fit guide pins in opposite holes.   <b>Tip</b>  Lubricate the guide pins with some grease to make the motor slide better.	Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.  xx1700000346
6  <b>CAUTION</b>  Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
7 If required, press the motor out of position by using the removal tool in the remaining holes for the motor.	Removal tool M12: 3HAC057339-003 Always use removal tools in pairs.
8 Use caution and lift the motor out on the guide pins, in order to get the pinion away from the gear, and let the motor rest on the guide pins.	
9  <b>CAUTION</b>  The motor weighs 26 kg. All lifting accessories used must be sized accordingly.	

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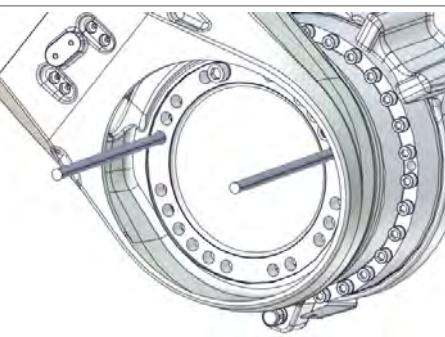
## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

*Continued*

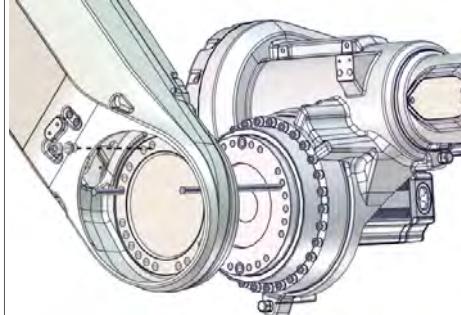
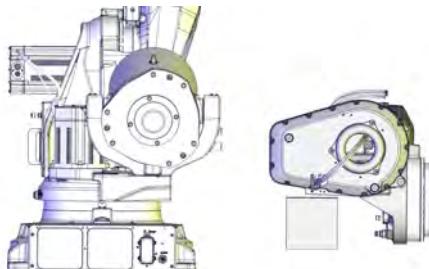
Action	Note
10 Fasten the lifting accessory to the motor. Attach the lifting chain to the accessory and an overhead crane.	Lifting accessory, motor: 3HAC15534-1 Lifting accessory (chain): 3HAC15556-1  xx1700000271
11 When the motor is hanging in the lifting accessory, and the pinion no longer is mated to the gear, let the outer end of the motor hang lower so that it will hang in an angle. This position makes it easier to remove the axis-3 motor with the axis-4 motor still fitted.	<b>CAUTION</b> The pinion must have been parted from the gear before the motor is angled. If not there is a risk of damaging the pinion and gear.
12 Disconnect the 24 VDC power supply.	
13 Remove the motor by lifting it straight out.	Make sure the pinion is not damaged.

Preparations before removing the upper arm

Action	Note
1 Remove two attachment screws in opposite holes and replace them with guide pins.  <b>Note</b> Make sure that it is the screws that hold the lower arm to the axis-3 gearbox that are removed! See figure!  <b>Tip</b> Lubricate the guide pins with some grease to make the upper arm slide better.	Guide pin, M16x150: 3HAC13120-2 Guide pin, M16x200: 3HAC13120-3 Always use guide pins in pairs.  xx1700000457
2 Leave one of the remaining attachment screws fitted, remove the other screws.	 xx1700000458

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## Removing the upper arm

	Action	Note
1	<p> Note</p> <p>Make sure the lift is done completely leveled! In case of necessary adjustments, use the shortening loops on the lifting accessory (chain), and make sure to place the chain the right way through the loops.</p>	 xx1400002197
2	Remove the remaining attachment screw and let the upper arm slide out from the lower arm with support from the guide pins.	 xx1700000459
3	Lift the upper arm and place it on the prepared area.	
4	<p><i>This step is only valid when the upper arm is removed due to replacement of the axis-3 gearbox:</i></p> <p>Place pieces of wood (or similar) under arm house and wrist. Lower the upper arm, and let the upper arm rest as shown in the figure.</p> <p>This is done in order to keep the axis-3 gearbox in a vertical position and to get the best position to replace the axis-3 gearbox, if applicable.</p>	 xx1300000553

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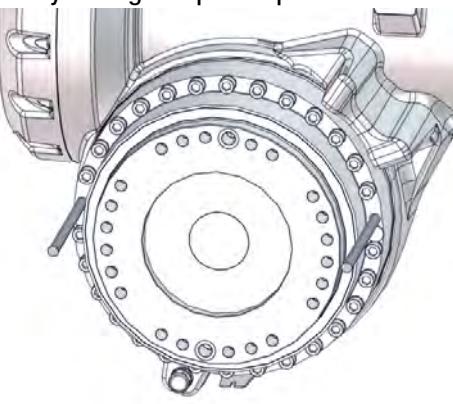
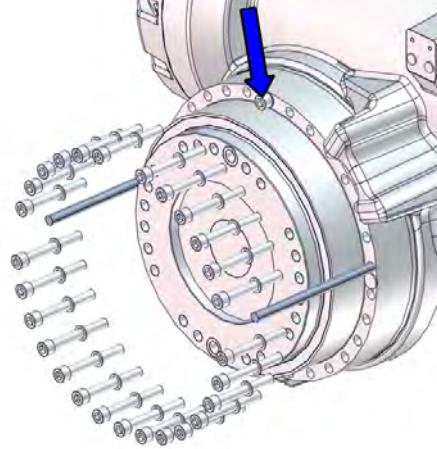
## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

*Continued*

#### Removing the axis-3 gearbox

Use this procedure to remove the gearbox.

Action	Note
<p>1 Remove two attachment screws in opposite holes and replace them with guide pins.</p> <p> <b>Tip</b></p> <p>Lubricate the guide pins with some grease to make the gearbox slide better.</p>	<p>Guide pin, M12x150: 3HAC13056-2 Always use guide pins in pairs.</p>  <p>xx1700000370</p>
2 Remove all but one of the remaining attachment screws.	 <p>xx1700000371</p>
3 Fit three fully threaded screws and use them as removal tools.	ScrewsM8x75, fully threaded: Used to push out the gearbox, if necessary.
4 Remove the remaining attachment screw.	
5 Loosen the gearbox from its fitting position with the help of the removal tools, but only pull it out on the guide pins a little.	
<p> <b>DANGER</b></p> <p>If pulled out to far on the guide pins before the lifting accessory is applied, there is a risk the gearbox may start to glide on the guide pins with a risk of falling down!</p>	

*Continues on next page*

	Action	Note
6	 <b>CAUTION</b>  The axis-3 gearbox weighs 85 kg. All lifting accessories used must be sized accordingly!	
7	Apply the lifting accessory to the gearbox.	Lifting accessory, gearbox: 3HAC046128-001
8	 <b>Note</b>  There will be some oil spill when the gearbox is removed! Put some oil absorbant cloth or paper below the gearbox.	
9	With the gearbox attached to the lifting accessory, remove the gearbox by letting it slide out on the guide pins.	
10	Remove the gearbox.	

**Refitting the axis-3 gearbox**

Use these procedures to refit the axis-3 gearbox.

Follow the order of the separate procedures according to the order they are presented.

**Refitting the axis-3 gearbox**

	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>  The axis-3 gearbox weighs 85 kg. All lifting accessories used must be sized accordingly!	
3	Apply the lifting accessory to the gearbox.	Lifting accessory, gearbox: 3HAC046128-001
4	Lift the gearbox so that it rests on the side.	
5	Remove the o-ring and wipe it clean.   <b>Note</b>  This shall also be done on a new spare part!	

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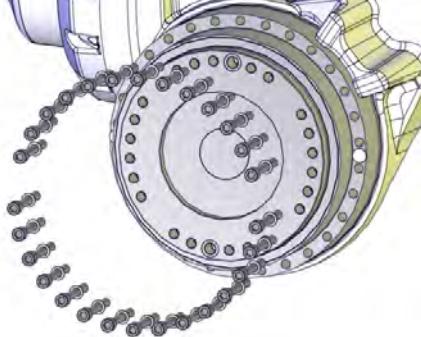
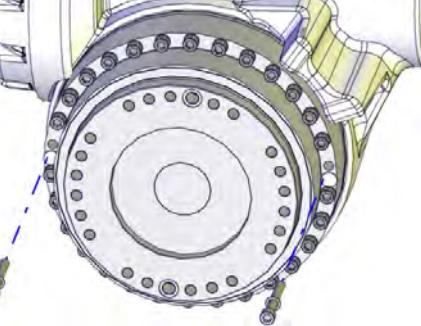
## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

*Continued*

Action	Note
6 Check the condition of the o-ring. Replace if damaged!	
7 Wipe clean the contact surfaces. Also wipe clean the o-ring groove!	
8 Lubricate the o-ring with some grease.	
9 Fit the o-ring in the groove.	
10 Fit two guide pins in opposite holes.   <b>Tip</b>  Lubricate the guide pins with some grease to make the gearbox slide better.	Guide pin, M12x150: 3HAC13056-2 Always use guide pins in pairs.
11 Lift the gearbox to the upper arm and let it rest on the guide pins.	

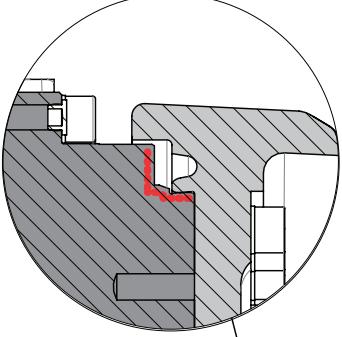
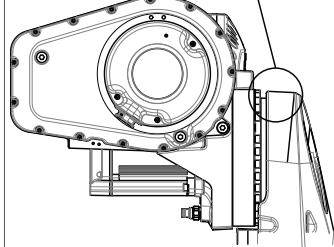
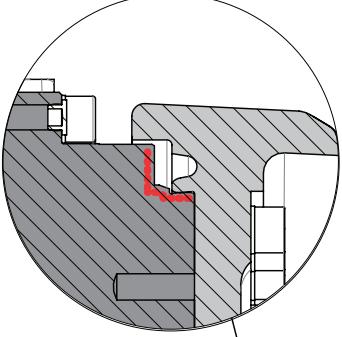
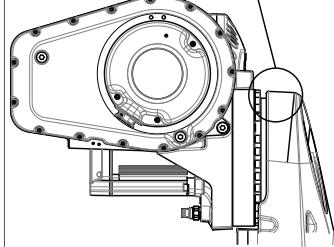
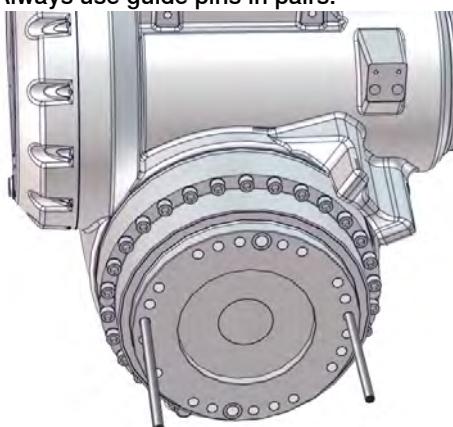
#### Securing the axis-3 gearbox

Action	Note
1 Secure the gearbox with 28 of the 30 attachment screws.	Tightening torque: 120 Nm M12x70.   xx1400002193
2 Remove the guide pins and replace with the remaining attachment screws.	   xx1400002194
3 Secure the remaining attachment screws.	Tightening torque: 120 Nm. M12x70.
4 Remove the lifting accessory.	

*Continues on next page*

	Action	Note
5	Perform a leak-down test.	See <i>Performing a leak-down test on page 190</i> .

Preparations before refitting the upper arm

	Action	Note
1	Wipe clean all contact surfaces.	
2	<p><b>Foundry Plus:</b> Apply Mercasol on the surface shown in the figure.</p>  	 
3	<p>Fit two guide pins in opposite M16 holes in the axis-3 gearbox.</p> <p> <b>Tip</b></p> <p>Lubricate the guide pins with some grease to make the upper arm slide better.</p>	<p>Guide pin, M16x150: 3HAC13120-2 Guide pin, M16x200: 3HAC13120-3 Always use guide pins in pairs.</p> 

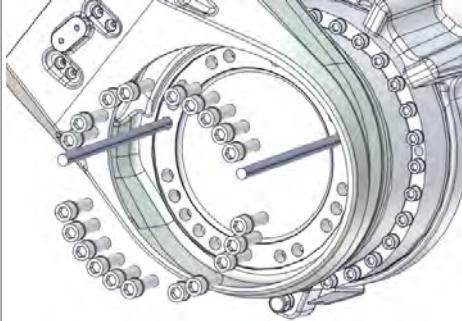
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## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

*Continued*

#### Securing the upper arm

Action	Note
1  <b>CAUTION</b> The weight of the complete upper arm (including the wrist) is 465 kg All lifting accessories used must be sized accordingly.	
2 Attach the lifting accessories, if not already fitted.	See <a href="#">Attaching lifting accessories to the upper arm on page 206</a> .
3 Lift the upper arm and bring it towards the lower arm.	
4 In order to release the brakes, connect the 24 VDC power supply. Connect to R2.MP3-connector: <ul style="list-style-type: none"><li>• + = pin 2</li><li>• - = pin 5</li></ul>	24 VDC power supply
5 Use the rotation tool and rotate the axis-3 motor to find the correct position for the guide pins in the lower arm.	Rotation tool
6 Insert and tighten 20 of the 22 M16 screws.	 xx1700000460
7 Remove the guide pins and fit the two remaining screws.	
8 Secure the upper arm by tightening the attachment screws.	M16, tightening torque: 300 Nm

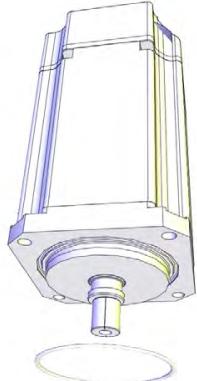
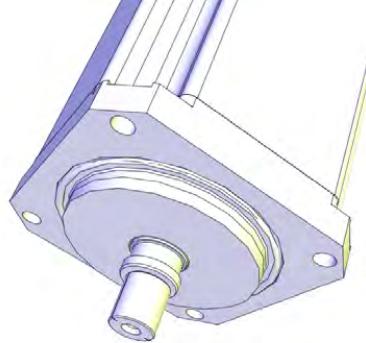
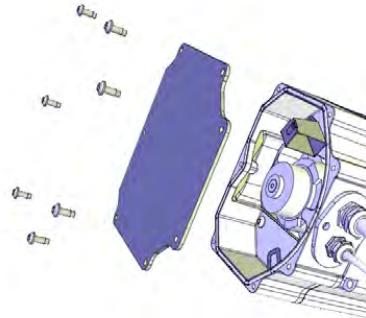
#### Preparations prior to refitting motor

Action	Note
1  <b>DANGER</b> Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2 Remove old paint residues and other contamination from the contact surfaces on both the motor and the mating parts.	

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#### 4.8.4 Replacing the axis-3 gearbox

*Continued*

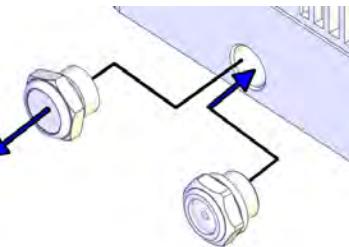
Action	Note
3 Wipe clean the contact surfaces from any remaining contamination. Also wipe clean the o-ring groove.	
4 Check the o-ring. Replace if damaged.	O-ring, 3HAB3772-107  xx1200001019
5 Make sure the o-ring is seated in the groove.   <b>Tip</b> Lubricate the o-ring with some grease for a better fitting in the groove.	 xx1200001020
6 If the motor is a new spare part, remove the cover.	 xx1200001135

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## 4 Repair

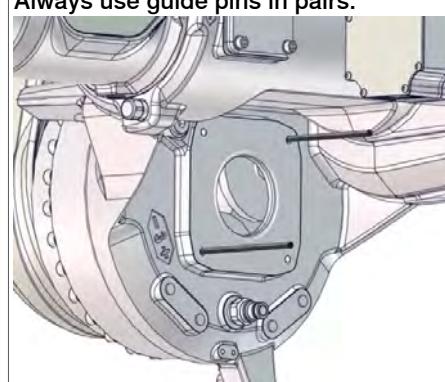
### 4.8.4 Replacing the axis-3 gearbox

*Continued*

Action	Note
<p>7 <b>Foundry Plus:</b> Valid for axis-2, axis-3, axis-4 and axis-6 motors. If the motor is a new spare part, the protection filter located in the evacuation hole on the motor flange must be replaced with a transparent plug/sight glass (enclosed with the spare part delivery). Remove the protection filter and install the transparent plug/sight glass. On the axis-6 motor there are two protection filters that must be replaced with transparent plugs/sight glasses.</p>	<p>Tightening torque, transparent plug: 25 Nm <math>\pm 10\%</math>. Tightening torque, protection filter: 10 Nm <math>\pm 10\%</math>.</p>  <p>xx1600000576</p>

#### Securing the axis-3 motor

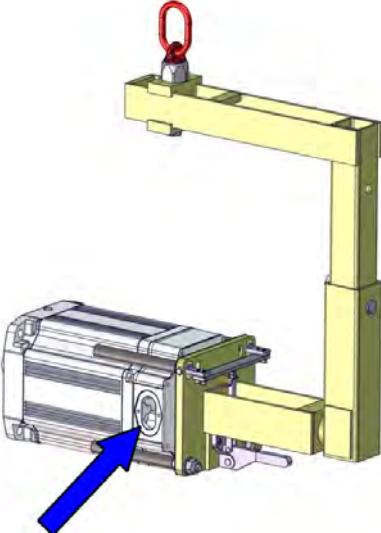
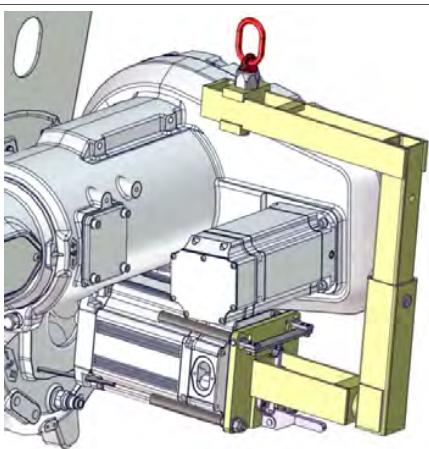
Use this procedure to secure the motor.

Action	Note
1 Fit guide pins in opposite holes.	<p>Guide pin, M10x150: 3HAC15521-2 Always use guide pins in pairs.</p>  <p>xx1700000272</p>
2  <b>CAUTION</b> The motor weighs 26 kg. All lifting accessories used must be sized accordingly.	

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#### 4.8.4 Replacing the axis-3 gearbox

*Continued*

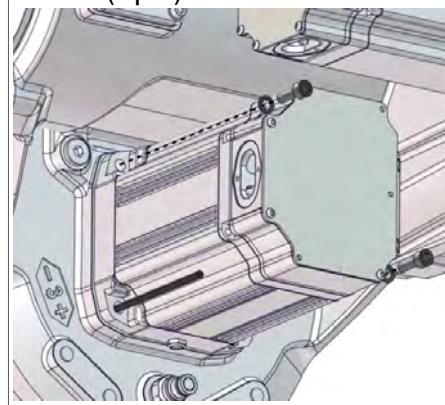
Action	Note
<p>3 Apply the lifting accessories to the motor.</p> <p><b>Note</b></p> <p>Make sure the cable exit hole is turned according to figure.</p>	 <p>Lifting accessory, motor: 3HAC15534-1</p> <p>xx1700000273</p>
<p>4 Lift the motor on to the guide pins and let it hang with the outer end a little lower when resting on the guide pins. Do not push the motor pinion into the gear yet!</p> <p>This is done in order to fit the motor with the axis-4 motor still fitted.</p>	 <p>xx1700000271</p>
5 Remove the lifting accessory and allow the motor to rest on the guide pins.	
6 Apply the rotation tool and use it to rotate the pinion when mating it into the gear.	Rotation tool: 3HAB7887-1
<p>7 To release the brakes, connect the 24 VDC power supply.</p> <p>Connect to connector R2.MP3:</p> <ul style="list-style-type: none"> <li>• + = pin 2</li> <li>• - = pin 5</li> </ul>	
<p>8</p> <p><b>CAUTION</b></p> <p>Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.</p>	

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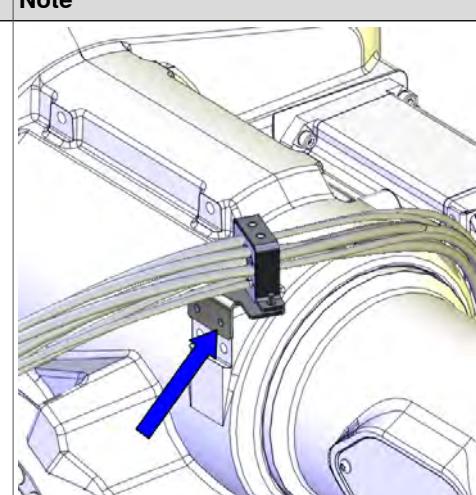
## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

*Continued*

Action	Note
9 Use caution and push the motor in position while at the same time the motor pinion is slightly rotated. Pay attention to following points: <ul style="list-style-type: none"><li>• Mate the motor pinion properly to the gear of the gearbox.</li><li>• Do not damage the motor pinion!</li></ul>	
10 Fit two of the attachment screws.	Screw dimension: M10x30 quality 12.9 Gleitmo (2 pcs)  xx1700000259
11 Remove the guide pins.	
12 Fit the remaining attachment screws.	Screw dimension: M10x30 quality 12.9 Gleitmo (2 pcs)
13 Tighten the screws.	Tightening torque: 50 Nm
14 Remove the rotation tool.	
15 Perform a leak-down test.	See <a href="#">Performing a leak-down test on page 190</a> .
16 Disconnect the 24 VDC power supply.	

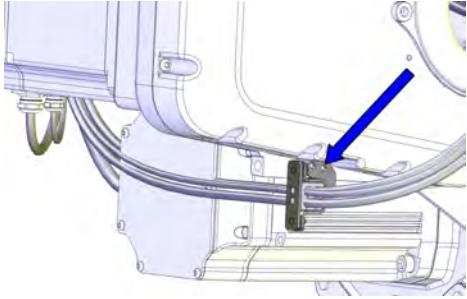
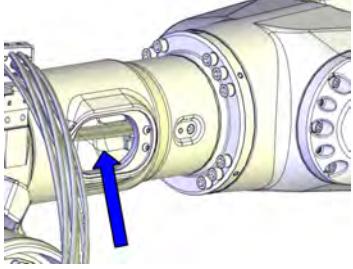
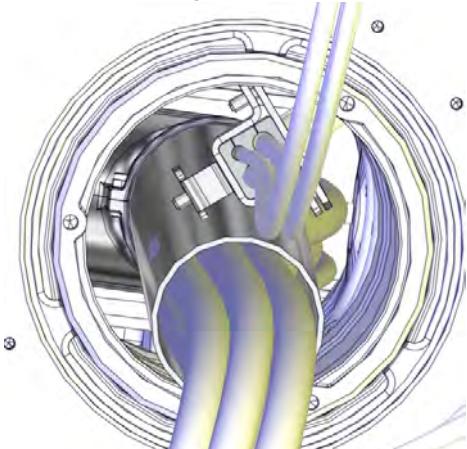
#### Refitting the cable harness - upper arm

Action	Note
1 Refit the metal clamp on top of the arm house.	 xx1300000541

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## 4.8.4 Replacing the axis-3 gearbox

Continued

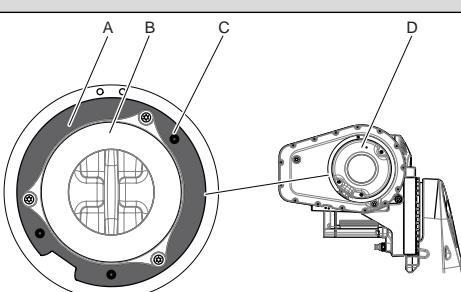
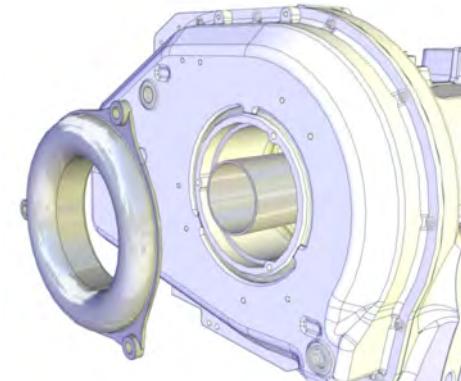
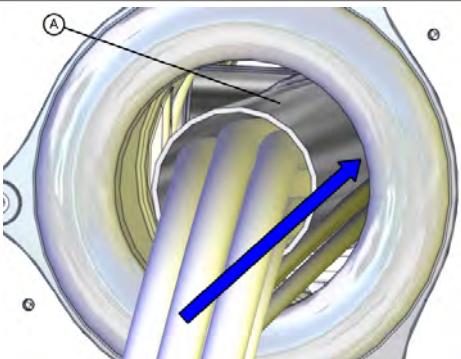
Action	Note
2 Refit the arm house metal clamp.	 xx1300000543
3 Arrange the cables between the cable clamps in the upper arm.	
4  <b>Tip</b>  Use tape and tie the axis-5 and axis-6 connectors and carrier into a bundle (if not already done). This is done to facilitate the procedure and to avoid damaging the parts during the procedure.  This will also make it easier to run the cable harness through the inside of the upper arm.	 xx1300000668
5  <b>Tip</b>  This step is best performed by two persons working together: <ul style="list-style-type: none"> <li>• Person 1: Put one hand inside the side hole of the arm tube and take a hold of the cable harness.</li> <li>• Person 2: Take a hold on the cable harness at the back of the robot.</li> <li>• Together: Use caution and move the cable harness into the arm tube.</li> </ul>	Person 1, working at the side hole:   xx1300000745  Person 2, working at the back:   xx1400000356

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## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

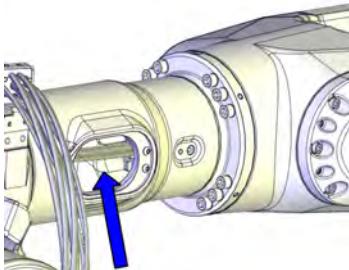
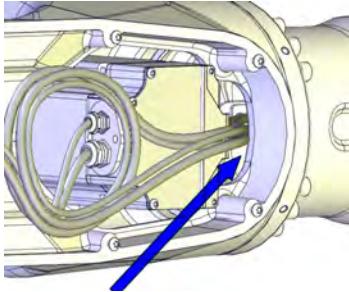
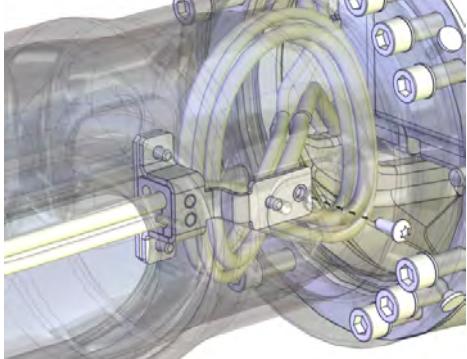
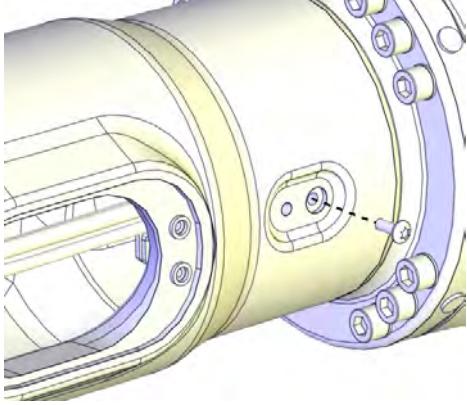
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Action	Note
6 <b>Foundry Plus:</b> Make sure that the gasket between the robot and cover is correctly fitted. Replace if damaged!  The gasket is covered with adhesive on the side facing the upper arm cover. The three washers are pressed into the holes in the gasket. Make sure all three washers are fitted.	 xx1400000382 <ul style="list-style-type: none"> <li>A Gasket</li> <li>B Cable guide</li> <li>C Washer</li> <li>D Cover</li> </ul>
7 Fit the cable guide.	 xx1300000657
8 Run the cable harness through the cable guide and then into the upper arm tube.  <span style="color: blue; font-size: 1.5em;">i</span> <b>Note</b>  The cable harness is best placed at the upper right hand side of the DressPack tube, if used, through the arm tube. Do not run the cable harness into the DressPack tube!	 xx1400000357 <ul style="list-style-type: none"> <li>A Tube for DressPack</li> </ul>
9 Use caution and push the cable harness into the upper arm tube.	

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## 4.8.4 Replacing the axis-3 gearbox

Continued

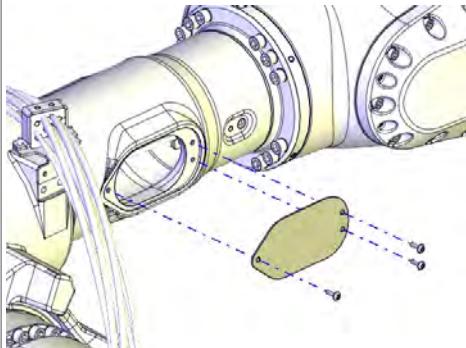
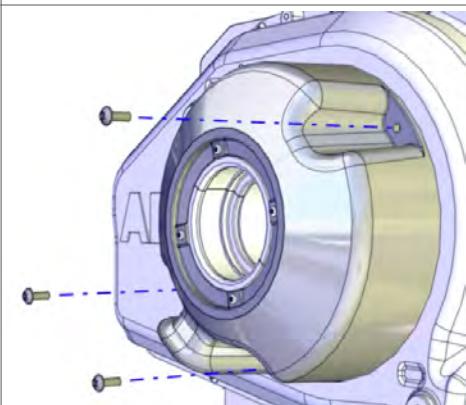
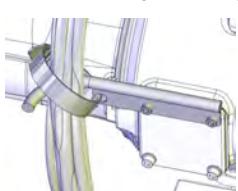
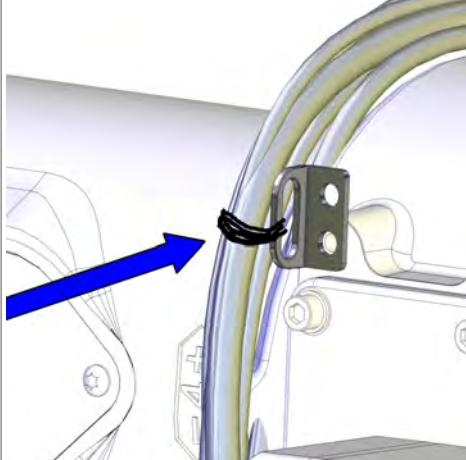
	Action	Note
10	 <b>Tip</b> <p>This step is best performed by two persons working together.</p> <p>Use caution and push the cable harness into the wrist like this:</p> <ul style="list-style-type: none"> <li>• Person 1: Put one hand inside the side cover hole and take a hold of the cable harness.</li> <li>• Person 2: Take a hold of the cable harness from inside the wrist.</li> <li>• Together: Move the cable harness past the axis-5 motor and into the wrist.</li> </ul>	<p>Person 1, working at the side hole:</p>  xx1300000745 <p>Person 2, working at the wrist:</p>  xx1300000746
11	 <b>Note</b> <p>The screws are reached from outside the upper arm!</p>	 xx1700000340  xx1700000339

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## 4 Repair

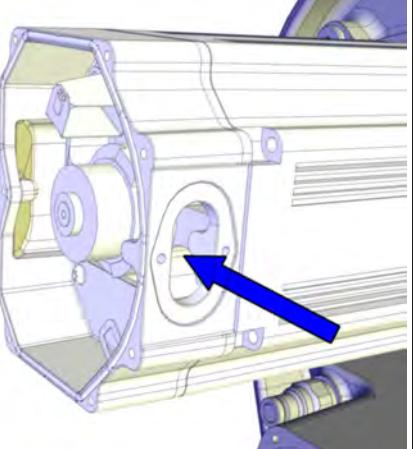
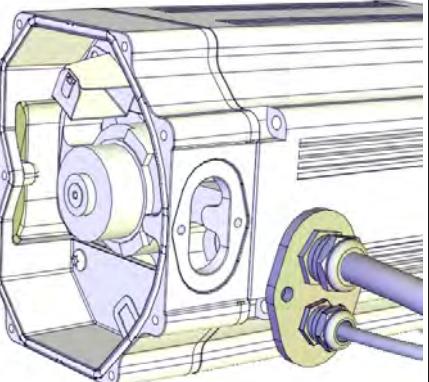
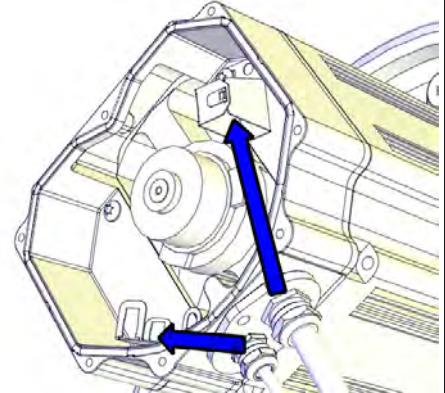
### 4.8.4 Replacing the axis-3 gearbox

*Continued*

	Action	Note
12	<p>Refit the side cover.</p> <p><b>Note</b></p> <p><b>Foundry Plus:</b></p> <ul style="list-style-type: none"> <li>• Make sure the gasket is fitted correctly on the side cover</li> <li>• Use attachment screws made of stainless steel to fit the side cover.</li> </ul>	 xx1300000557
13	<p>If used (<i>DressPack</i> or <i>Foundry Plus</i>), refit the cover with the tube guiding ring fitted.</p> <p><b>Note</b></p> <p><b>Foundry Plus:</b></p> <ul style="list-style-type: none"> <li>• Make sure the gasket is fitted correctly</li> <li>• Use attachment screws made of stainless steel to fit the cover.</li> </ul>	 xx1200000045
14	<p>Secure the cable harness to the cable fixing bracket with the velcro strap.</p> <p><b>Note</b></p> <p>If <i>DressPack</i> is fitted, the cable fixing bracket is replaced by the cable guide.</p>  xx1300001973	 xx1300000544

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## Connecting the axis-3 and axis-4 motor cables

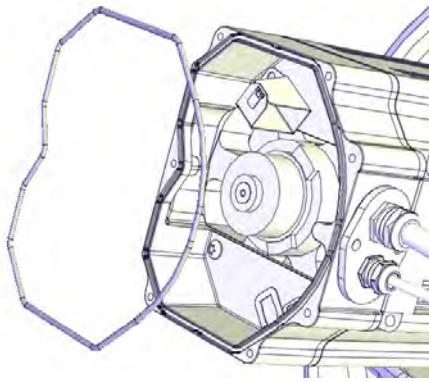
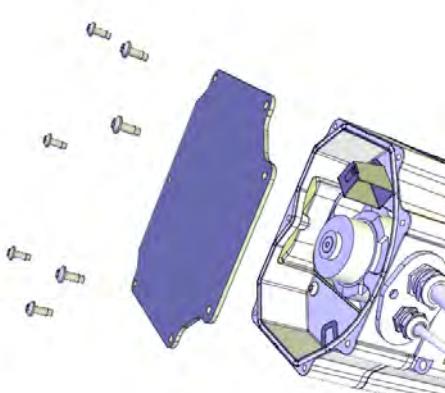
	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1300000738
2	Refit the cable gland cover.  <b>Note</b> Replace the gasket if damaged.	 xx1200001067
3	Connect the motor cables. Connect in accordance with the markings on the connectors.	 xx1200001066

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## 4 Repair

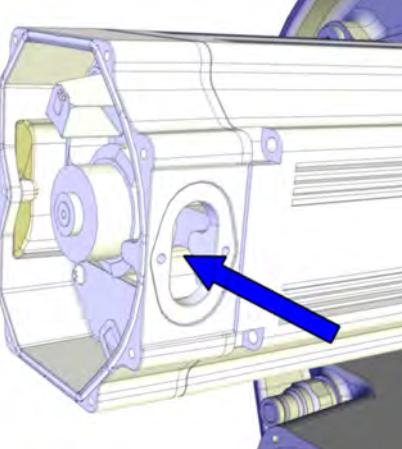
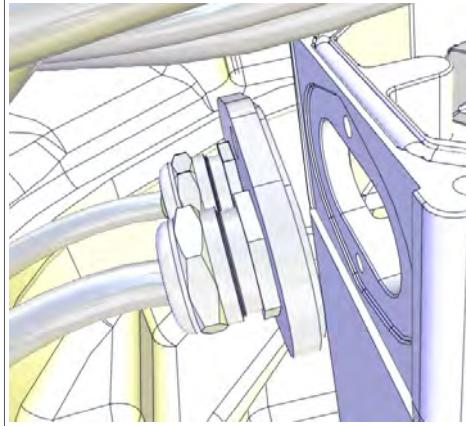
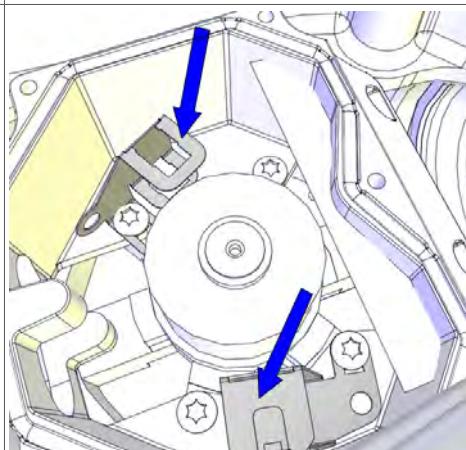
### 4.8.4 Replacing the axis-3 gearbox

*Continued*

Action	Note
4 Inspect the o-ring.  Note Replace if damaged.	O-ring, axis-1: 3HAC054692-002 O-ring, axis-2: 3HAC054692-002 O-ring, axis-3: 3HAC054692-002 O-ring, axis-4: 3HAC054692-001   xx1200001070
5 Wipe clean o-ring and o-ring groove.	
6 Refit the o-ring.  Tip Lubricate the o-ring with some grease for a better fitting in the groove.	
7 CAUTION When fitting the motor cover, make sure that none of the cables inside will be damaged.	
8 Refit the motor cover with its attachment screws.  Note Do not reuse the self-threading attachment screws. Replace with standard attachment screws or the threads will be damaged.  Note Make sure the o-ring is undamaged and properly fitted.	 xx1200001135
9 Make sure that the covers are tightly sealed.	

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## Connecting the axis-5 motor cables

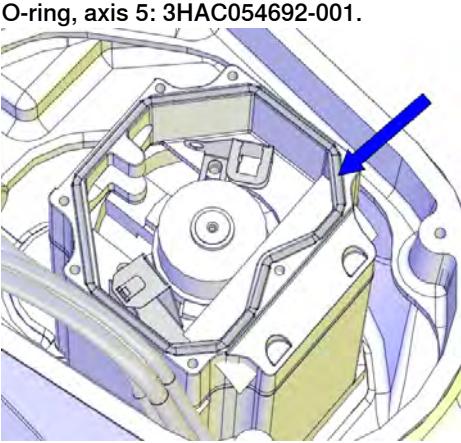
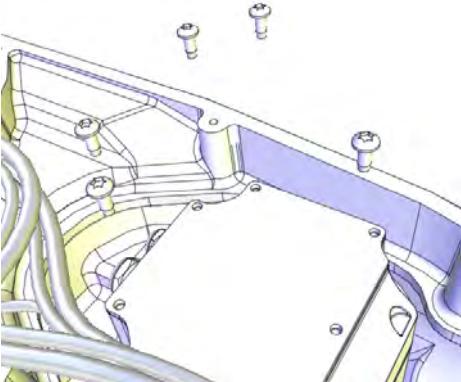
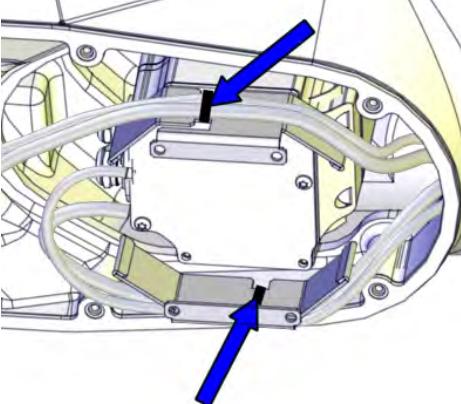
	Action	Note
1	Push the motor cables in through the cable gland opening.	 xx1300000738
2	Refit the cable gland cover by performing the following steps: <ul style="list-style-type: none"> <li>• Slide the cable gland cover onto the inner screw.</li> <li>• Refit and tighten the outer screw.</li> <li>• Tighten the inner screw. Make sure that the gasket is not damaged.             </li></ul> <p><b>Note</b> Replace the gasket if damaged.</p>	 xx1200001016
3	Connect the connectors. Connect in accordance with the markings on the connectors.	 xx1200001015

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## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

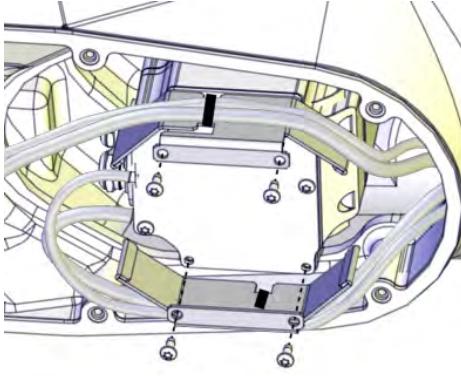
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Action	Note
4 Make sure the o-ring on the motor is undamaged. Replace if damaged.	 O-ring, axis 5: 3HAC054692-001. <small>xx1200001021</small>
5  <b>CAUTION</b>  When fitting the motor cover, make sure that none of the cables inside will be damaged.	
6 Refit the motor cover with its attachment screws.   <b>Note</b>  Do not refit the screws that will hold the heat protection plate at this point.   <b>Note</b>  Do not reuse the self-threading attachment screws, it will damage the threads. Replace with standard attachment screws.   <b>Note</b>  Make sure the o-ring is undamaged and properly fitted.	 <small>xx1200001013</small>
7 Secure the cable harness with cable straps to the heat protection plate.	 <small>xx1500001029</small>

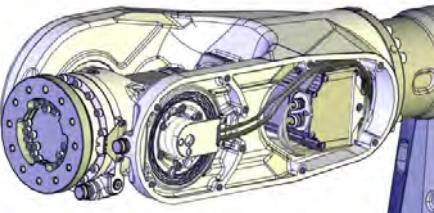
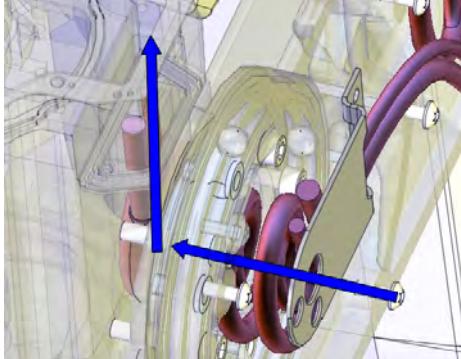
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#### 4.8.4 Replacing the axis-3 gearbox

*Continued*

Action	Note
8 Fit the heat protection plate with the screws.	 xx1500001030
9 Make sure that the cover is tightly sealed.	

#### Connecting the axis-6 motor cables

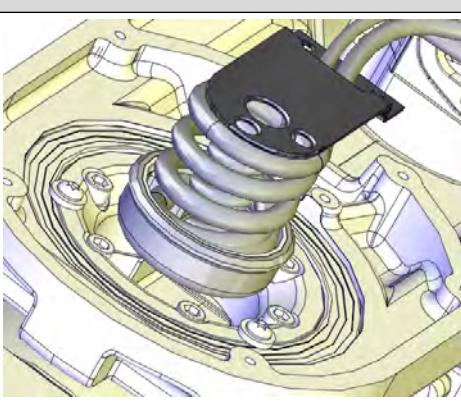
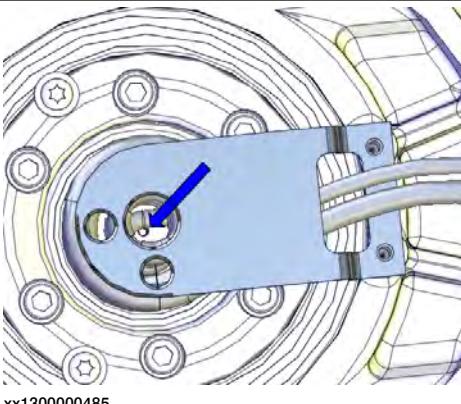
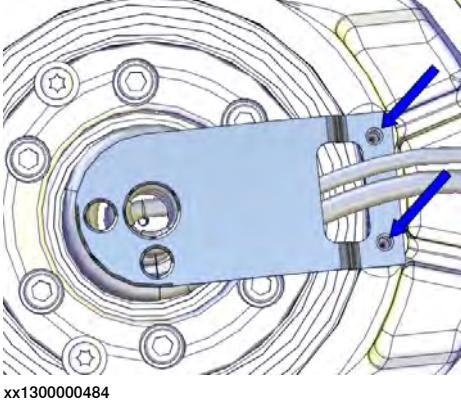
Action	Note
1 Make sure that the cable harness is placed in a way that it will not be damaged when the cover is fitted.	 xx1600002061
2  <b>Note</b> Axis 5 must be in position +90° (or as close as possible) for a correct installation of the cable harness in the wrist. If not, connect the 24 VDC power supply, release the brakes and move axis 5 manually to +90°.	Position +90° of axis 5 makes the turning disc face the floor, if the robot is floor standing.
3 Push the cable harness into the wrist recess and up into the axis-6 motor.	 xx1300000667

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## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

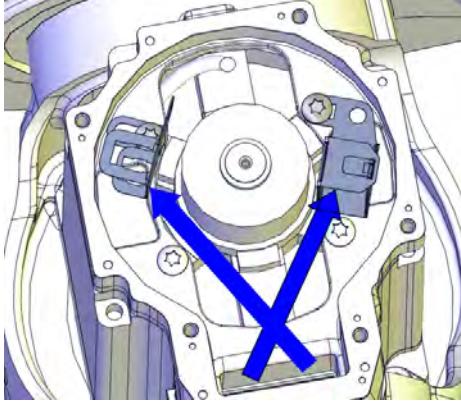
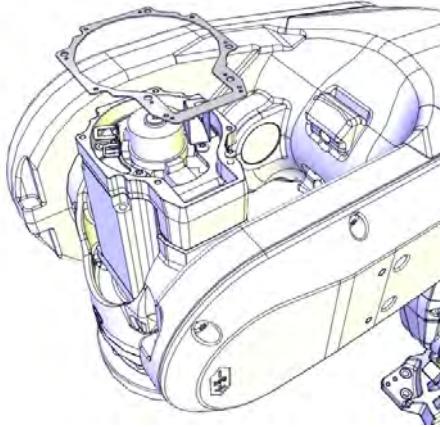
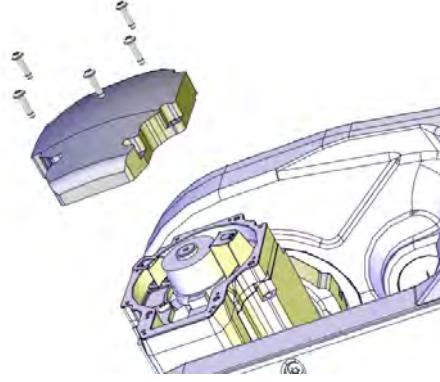
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Action	Note
4 Push the carrier carefully into position.	 xx1300001113
5 Secure the carrier with the M4 screw.   <b>Note</b> The screw is located at the bottom of the carrier.   <b>Tip</b> The attachment screw securing the carrier may be difficult to fit. Make sure the carrier is level and completely pressed against the bottom.	 xx1300000485
6 Secure the cable bracket with its attachment screws.	 xx1300000484

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#### 4.8.4 Replacing the axis-3 gearbox

*Continued*

	Action	Note
7	<p>Reconnect the connectors to the axis-6 motor.</p> <p><b>Note</b></p> <p>Place the resolver cable under the motor cable.</p>	 xx1300000488
8	<p>Make sure the gasket is undamaged. Replace if damaged.</p>	<p>Gasket, 3HAC033489-001</p>  xx1200001095
9	<p><b>CAUTION</b></p> <p>When fitting the motor cover, make sure that none of the cables inside will be damaged.</p>	
10	<p>Refit the motor cover.</p>	 xx1200001080

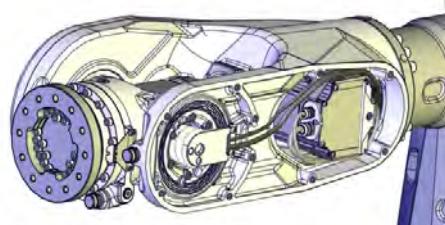
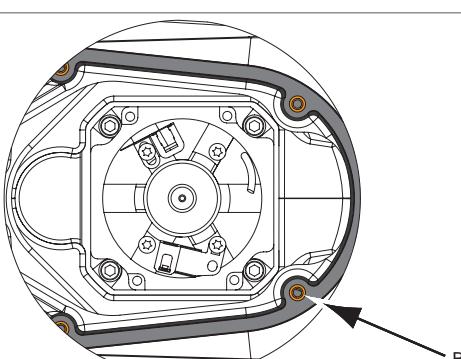
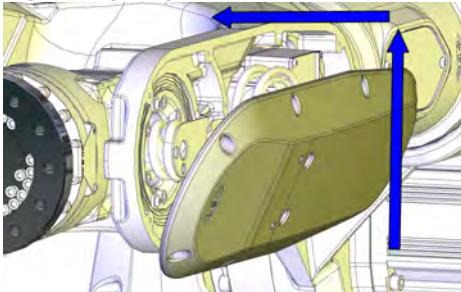
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## 4 Repair

### 4.8.4 Replacing the axis-3 gearbox

*Continued*

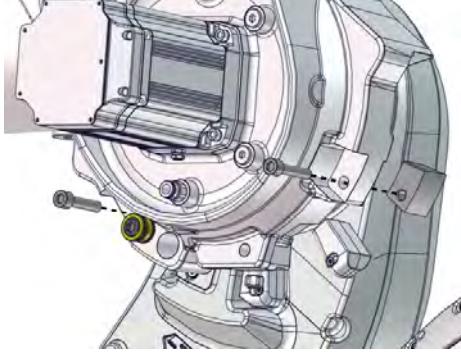
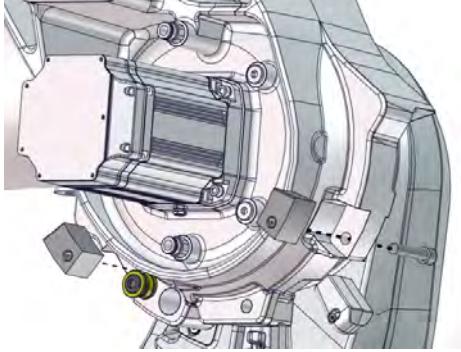
#### Concluding procedure

Action	Note
1 Make sure that the cable harness is placed in a way that it will not be damaged when the wrist cover is fitted.	 xx1600002061
2 Inspect the gasket. Replace if damaged.	
3 <b>Foundry Plus:</b> <ul style="list-style-type: none"> <li>Make sure that the gasket is undamaged on the cover. Replace if damaged.</li> <li>Put washers in the holes of the gasket.</li> <li>Use attachment screws made of stainless steel to fit the wrist cover.</li> </ul>	 xx1400000383 <p>A Protection plugs (2 on wrist cover and 2 on cover axis-5 gearbox)  B Washers (10 pcs) in gasket holes</p>
4 Refit the wrist cover. Use this method not to damage the cable harness: <ol style="list-style-type: none"> <li>Hold the cover tilted. See figure!</li> <li>Put the cable harness inside the cover.</li> <li>Lift the cover, still tilted.</li> <li>Move the upper part of the cover into position.</li> <li>Secure the cover with its attachment screws.</li> </ol>	Tightening torque: 10 Nm.   xx1300000772
5 <b>Foundry Plus:</b> Refit protection plugs.	See figure above!
6 If used, refit the DressPack cable package on the wrist.	

*Continues on next page*

#### 4.8.4 Replacing the axis-3 gearbox

*Continued*

	Action	Note
7	Refill oil in the gearbox.	See <a href="#">Filling oil into the axis-3 gearbox on page 166</a> .
8	Remove the service stops from maintenance position.	 xx1700000449
9	Fit the service stops in their parking position.	Tightening torque: 70 Nm $\pm$ 15 Nm.  xx1700000448
10	Re-calibrate the robot.	Axis Calibration is described in <a href="#">Calibrating with Axis Calibration method on page 691</a> . General calibration information is included in section <a href="#">Calibration on page 683</a> .
11	 <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further described in <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

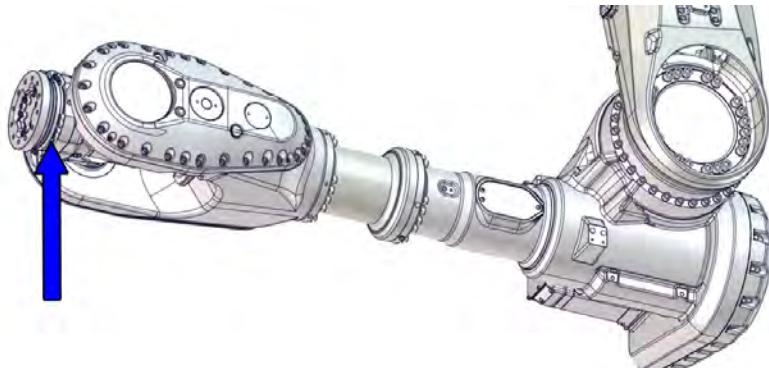
## 4 Repair

### 4.8.5 Replacing the axis-6 gearbox

#### 4.8.5 Replacing the axis-6 gearbox

##### Location of the axis-6 gearbox

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



xx1700000461

##### Spare parts

Spare parts	Spare part number	Note
Axis-6 gearbox	See <i>Product manual, spare parts - IRB 6700</i> .	

##### Required tools and equipment

Equipment, etc.	Article number	Note
Rotation tool	3HAB7887-1	Used to rotate the motor pinion.
24 VDC power supply	-	Used to release the motor brakes.
Leak-down tester	-	
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .

##### Consumables

Equipment, etc	Article number	Note
Grease	3HAB3537-1	Used to lubricate o-rings.
O-ring	3HAB3772-107	D=102x3 Used on motor flange.
Gasket	3HAC033489-001	Used on motor cover.
O-ring	3HAB3772-58	D=151.99x3.53 Used on gearbox.

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### Deciding calibration routine

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

	Action	Note
1	<p>Decide which calibration routine to use for calibrating the robot.</p> <ul style="list-style-type: none"> <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> Find previous reference values for the axis or create new reference values. These values are to be used after the repair procedure is completed, for calibration of the robot. If no previous reference values exist, and no new reference values can be created, then reference calibration is not possible.</p>	Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values. Creating new values requires possibility to move the robot. Read more about reference calibration for Axis Calibration in <a href="#">Reference calibration routine on page 692</a> .
	<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>	

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### Removing the axis-6 gearbox

Use these procedures to remove the axis-6 gearbox.

#### Preparations before removing the axis-6 gearbox

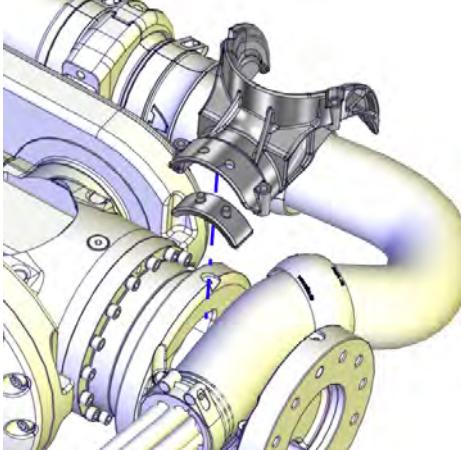
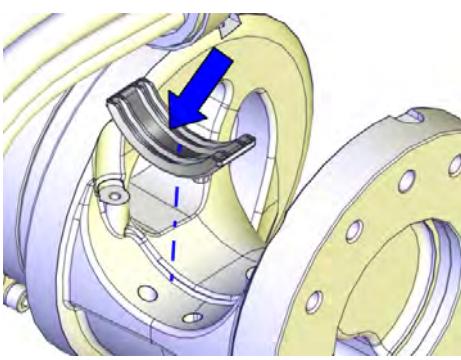
	Action	Note
1	Decide which calibration routine to use, and take actions accordingly prior to beginning the repair procedure.	
2	<p>Jog the robot to:</p> <ul style="list-style-type: none"> <li>• Axis 1 = No significance (as long as the robot is secured to the foundation).</li> <li>• Axis 2 = no significance</li> <li>• Axis 3 = no significance</li> <li>• Axis 4 = 180°</li> <li>• Axis 5 = xx</li> <li>• Axis 6 = xx</li> </ul>	

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## 4 Repair

### 4.8.5 Replacing the axis-6 gearbox

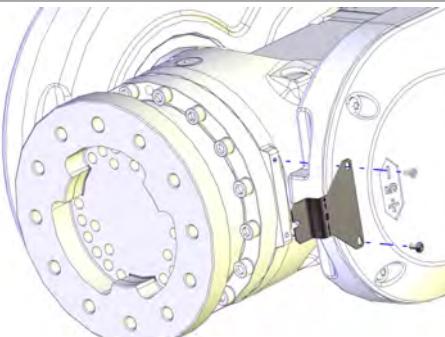
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Action	Note
3  <b>DANGER</b> Turn off all: <ul style="list-style-type: none"> <li>• electric power supply</li> <li>• hydraulic pressure supply</li> <li>• air pressure supply</li> </ul> to the robot, before entering the robot working area.	
4 Remove all equipment fitted on the turning disc.	
5 Drain the gearbox.	See <a href="#">Draining the axis-6 gearbox on page 177</a> .
6 If installed, remove the DressPack axis-6 support.	 xx1400000208
7 Turn the power on temporarily. Jog axis 5 to -55°.	 xx1400000223

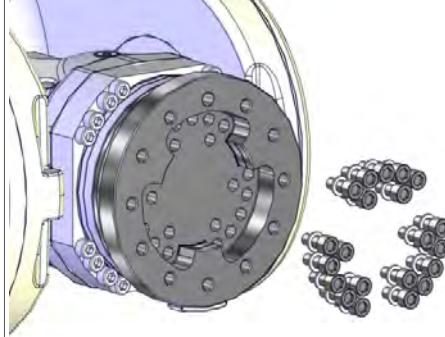
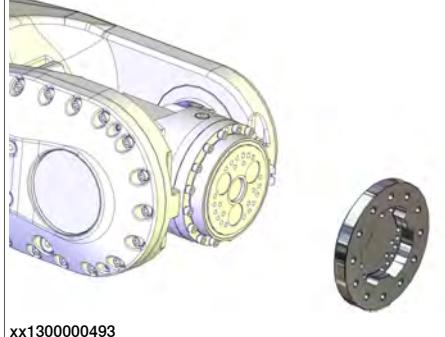
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#### 4.8.5 Replacing the axis-6 gearbox

*Continued*

Action	Note
<b>8</b>  <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.	
<b>9</b> Remove the synchronization plate axis-6.	 xx1300000825

#### Removing the turning disc

Action	Note
<b>1</b> Remove the 21 M10 screws and washers, that secure the turning disc.	 xx1400002195
<b>2</b> Remove the turning disc.	 xx1300000493

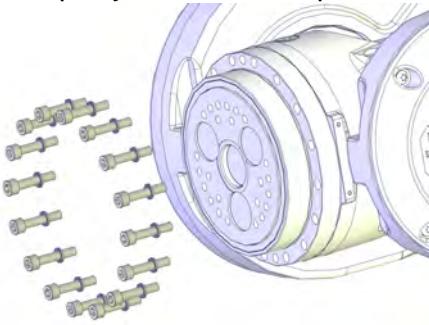
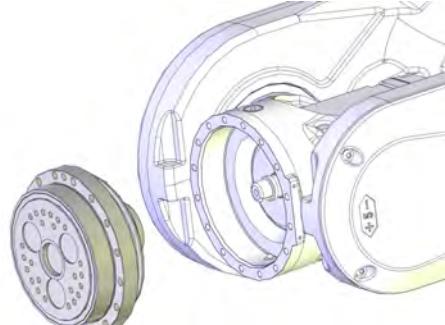
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## 4 Repair

### 4.8.5 Replacing the axis-6 gearbox

*Continued*

#### Removing the axis-6 gearbox

	Action	Note
1	Unscrew the attachment screws that secure the axis-6 gearbox.	 xx1300000826
2	 <b>CAUTION</b> Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
3	If required fit two attachment screws and press out the gearbox.	
4	Use caution and remove the gearbox.	 xx1300000827

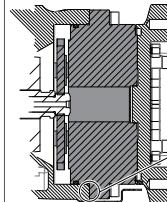
#### Refitting the axis-6 gearbox

Use these procedures to refit the gearbox.

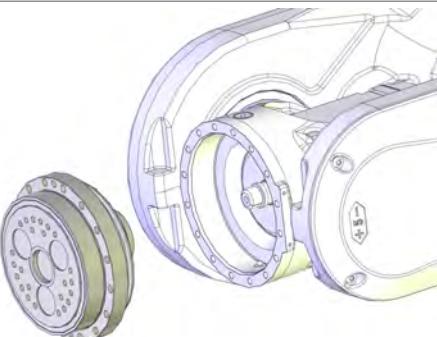
#### Preparations before refitting the axis-6 gearbox

	Action	Note
1	 <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
2	<p>Remove the o-ring and wipe it clean.</p> <p> <b>Note</b></p> <p>The o-ring needs to be cleaned also on a new spare part!</p>	 xx1300000828
3	Check the o-ring. Replace if damaged!	
4	Wipe clean the contact surfaces from any contamination. Also wipe clean the o-ring groove.	
5	Put some grease on the o-ring.	
6	Fit the o-ring in the groove of the gearbox.	
7	<p><i>Foundry Plus:</i> Apply Loctite 574 on the surface shown in the figure.</p>	 xx1400000717

## Refitting the axis-6 gearbox

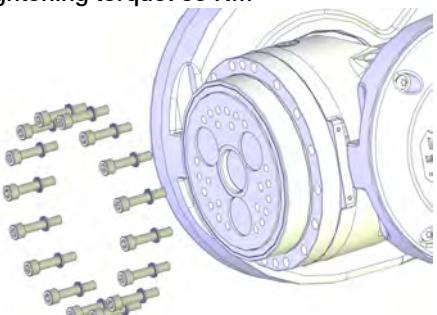
	Action	Note
1	<p> <b>CAUTION</b></p> <p>Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.</p>	
2	<p> <b>CAUTION</b></p> <p>Be careful not to damage motor pinion or gears!</p>	 xx1300000827

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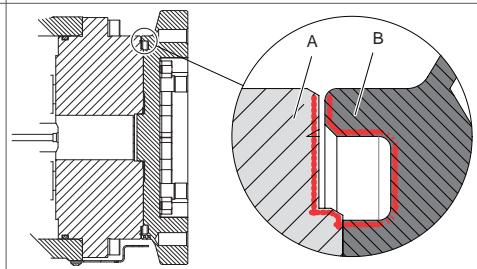
## 4 Repair

### 4.8.5 Replacing the axis-6 gearbox

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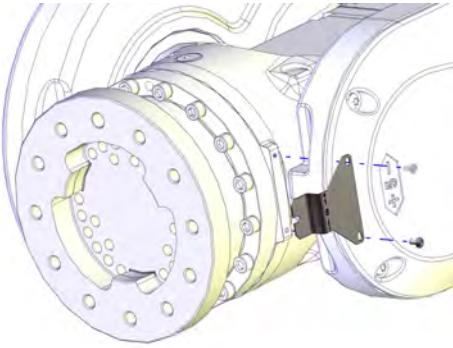
Action	Note
3 Secure the gearbox with its attachment screws.	M8x50 quality 12.9 Gleitmo, 16 pcs Tightening torque: 35 Nm  xx1300000826
4 Perform a leak-down test.	See <a href="#">Performing a leak-down test on page 190</a> .
5 Jog axis-5 to horizontal position.	
6 Refill oil in the gearbox.	See <a href="#">Filling oil into the axis-6 gearbox on page 179</a> .

#### Refitting the turning disc

Action	Note
1 Wipe clean the contact surfaces.	
2 <b>Foundry Plus:</b> Apply Mercasol on the surfaces on turning disc and axis-6 gearbox as shown in the figure.	 xx1400000385
3 Secure the turning disc with its attachment screws and washers.	Tightening torque: 70 Nm Attachment screws: M10x25, Steel 12.9 Gleitmo 603, (21 pcs) Washers: Steel (21 pcs)  xx1400002195

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## Concluding procedure

Action	Note
1 Refit the synchronization plate axis-6.	 xx1300000825
2 Recalibrate the robot.	Axis Calibration is described in <a href="#">Calibrating with Axis Calibration method on page 691</a> . General calibration information is included in section <a href="#">Calibration on page 683</a> .
3  <b>DANGER</b> Make sure all safety requirements are met when performing the first test run. These are further described in <a href="#">DANGER - First test run may cause injury or damage! on page 46</a> .	

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# 5 Calibration

## 5.1 Introduction to calibration

### 5.1.1 Introduction and calibration terminology

#### Calibration information

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

Detailed instructions of how to perform Axis Calibration are given on the FlexPendant during the calibration procedure. To prepare calibration with Axis Calibration method, see [Calibrating with Axis Calibration method on page 691](#).

#### Calibration terminology

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

## 5 Calibration

---

### 5.1.2 Calibration methods

#### 5.1.2 Calibration methods

##### Overview

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

##### Types of calibration

Type of calibration	Description	Calibration method
Standard calibration	The calibrated robot is positioned at calibration position. Standard calibration data is found on the SMB (serial measurement board) or EIB in the robot. For robots with RobotWare 5.04 or older, the calibration data is delivered in a file, calib.cfg, supplied with the robot at delivery. The file identifies the correct resolver/motor position corresponding to the robot home position.	Axis Calibration

##### Brief description of calibration methods

###### Axis Calibration method

Axis Calibration is a standard calibration method for calibration of IRB 6700Inv and is the most accurate method for the standard calibration. It is the recommended method in order to achieve proper performance.

The following routines are available for the Axis Calibration method:

- Fine calibration
- Update revolution counters
- Reference calibration

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

An introduction to the calibration method is given in this manual, see [Calibrating with Axis Calibration method on page 691](#).

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.

---

##### References

Article numbers for the calibration tools are listed in the section [Special tools on page 718](#).

#### 5.1.3 When to calibrate

##### When to calibrate

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

##### The resolver values are changed

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

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 688](#). This will occur when:

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

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

##### The robot is rebuilt

If the robot is rebuilt, for example, after a crash or when the reach ability of a robot is changed, it needs to be recalibrated for new resolver values.

## 5 Calibration

### 5.2.1 Synchronization marks and synchronization position for axes

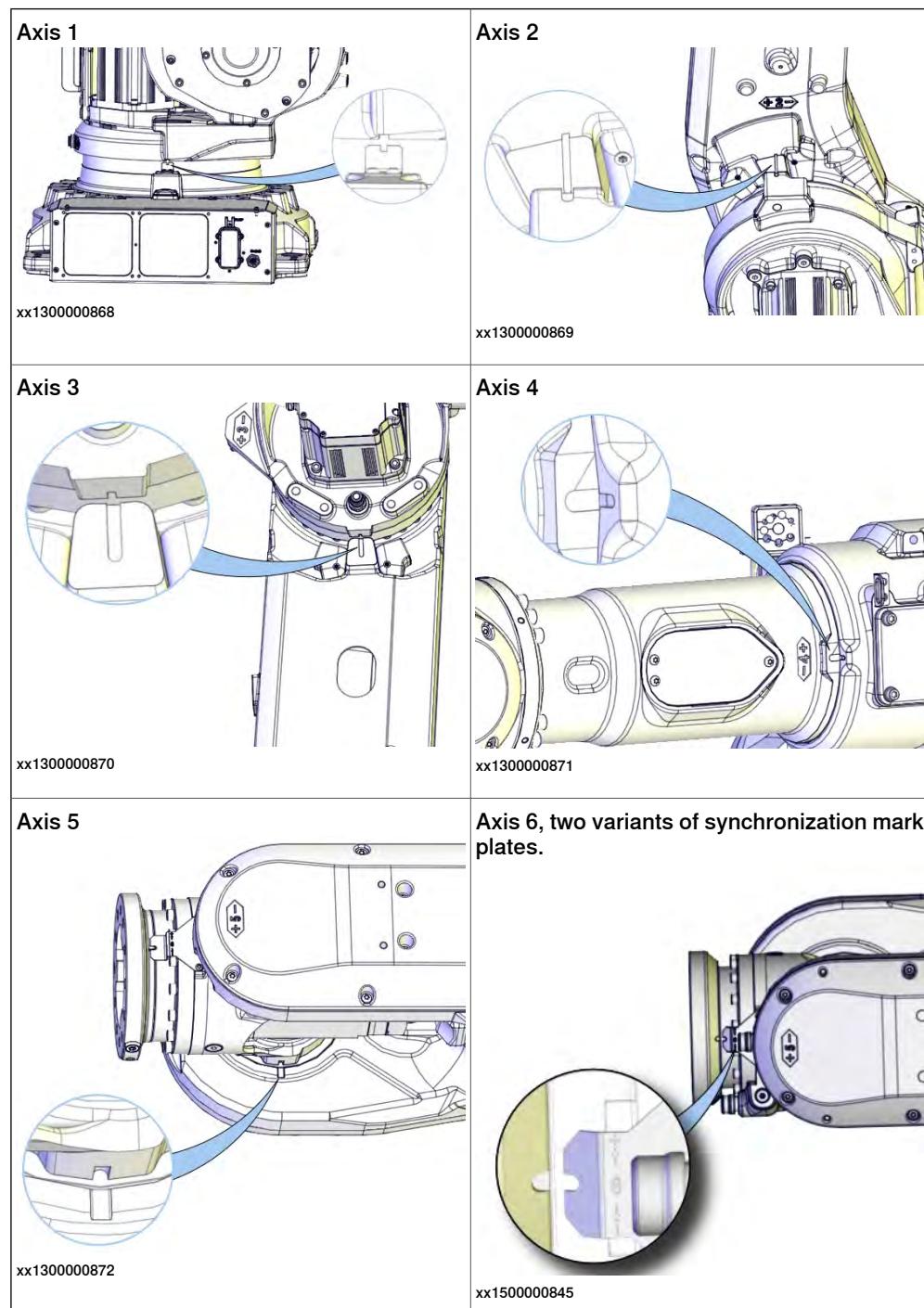
## 5.2 Synchronization marks and axis movement directions

### 5.2.1 Synchronization marks and synchronization position for axes

#### Introduction

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

#### Synchronization marks, IRB 6700



## 5.2.2 Calibration movement directions for all axes

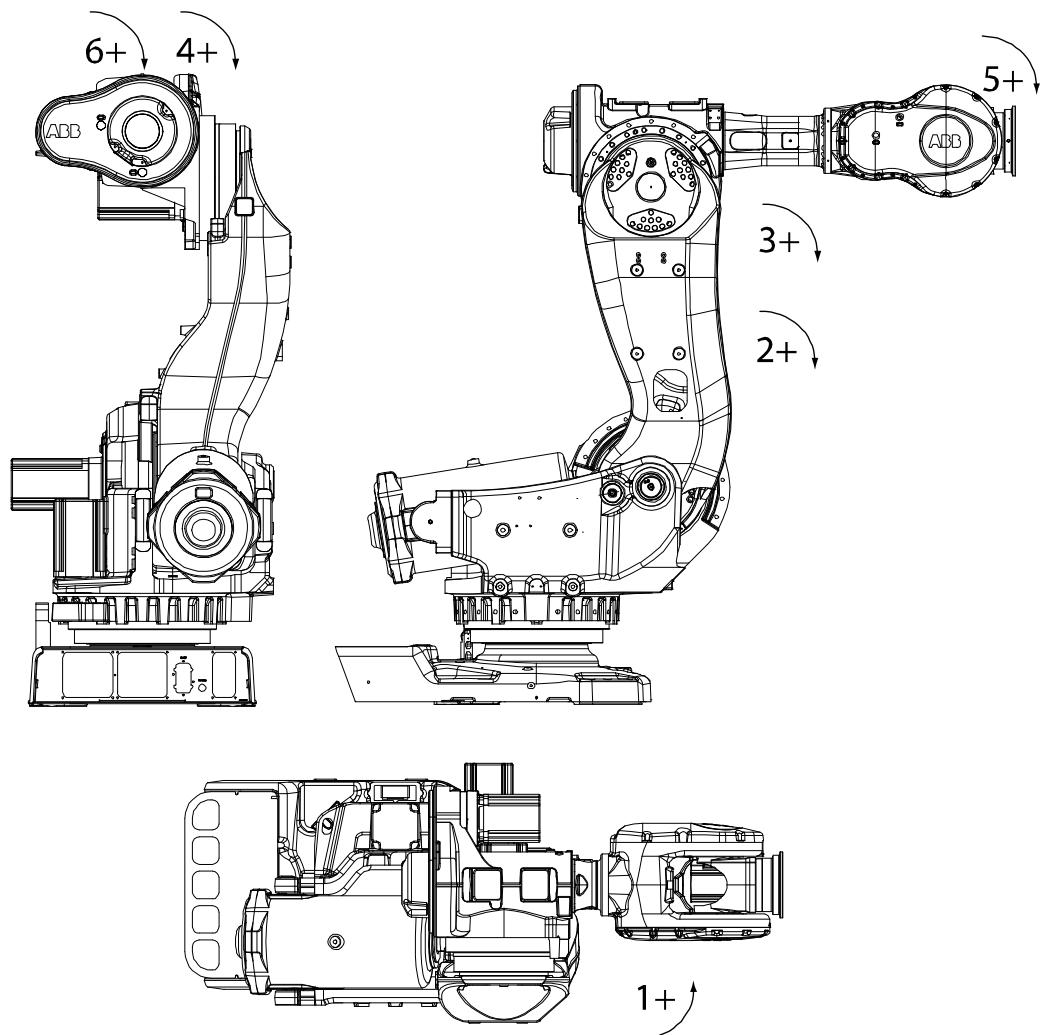
### Overview

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

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

### Manual movement directions, 6 axes

Note! The graphic shows an IRB 7600. The positive direction is the same for all 6-axis robots, except the positive direction of axis 3 for IRB 6400R, which is in the opposite direction!



xx0200000089

## 5 Calibration

### 5.3 Updating revolution counters

#### 5.3 Updating revolution counters

##### Introduction

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

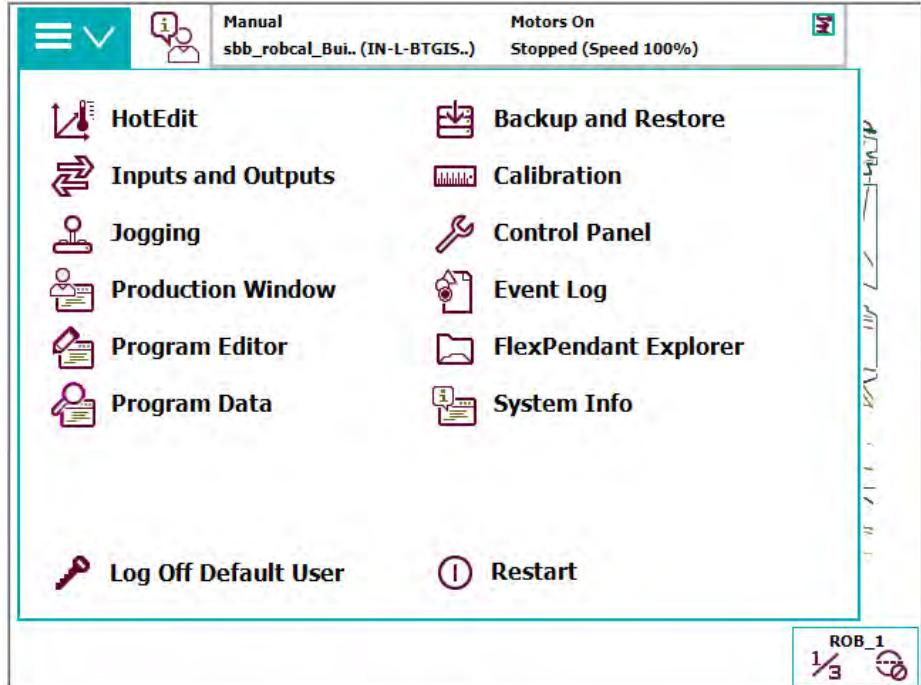
##### Step 1 - Manually running the manipulator to the synchronization position

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

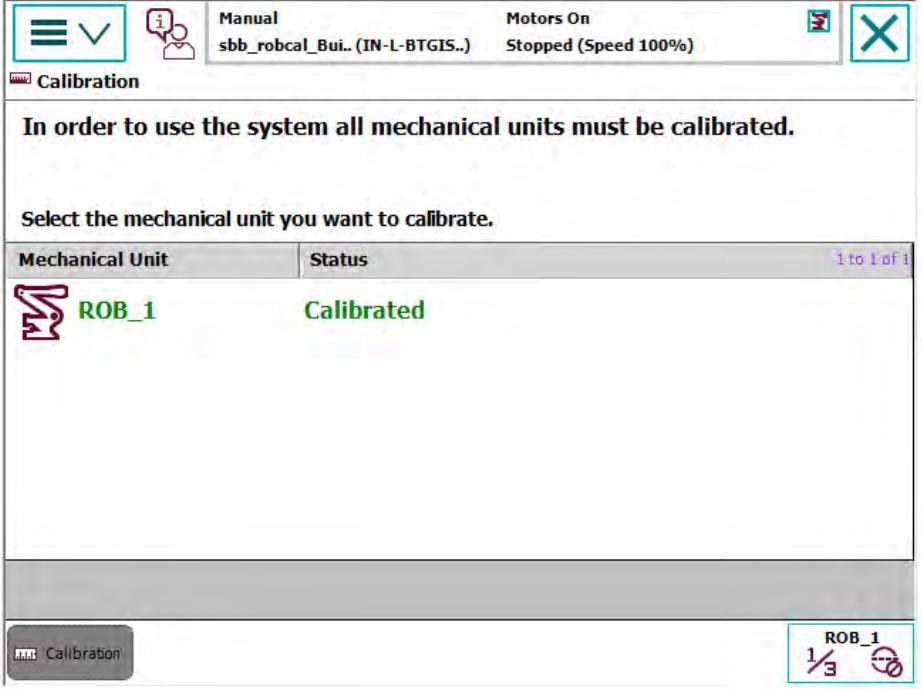
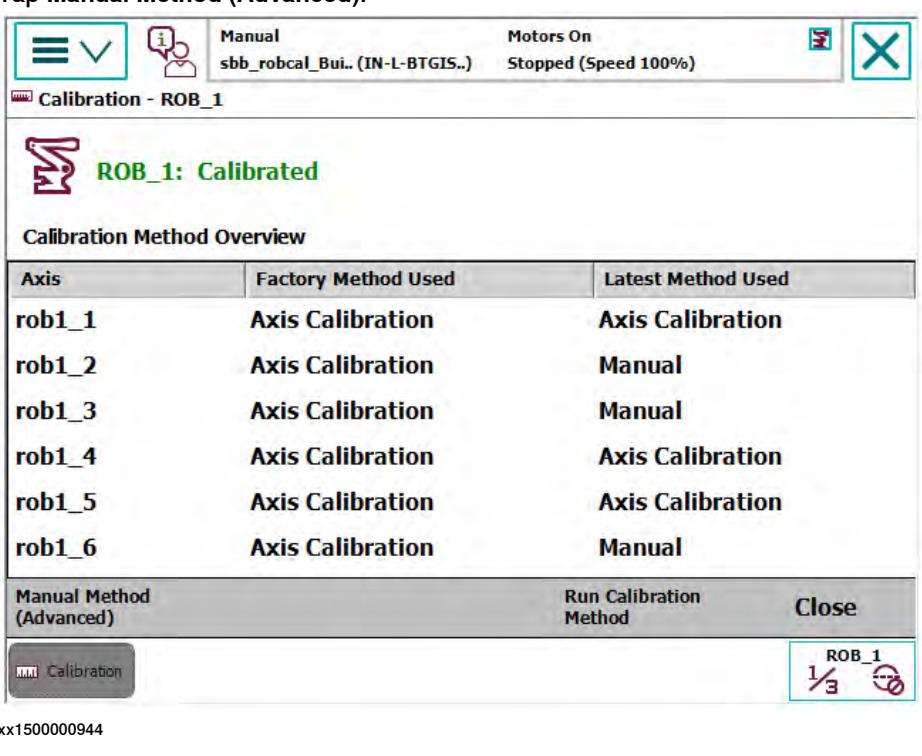
Action	Note
1 Select axis-by-axis motion mode.	
2 Jog the manipulator to align the synchronization marks.	See <a href="#">Synchronization marks and synchronization position for axes on page 686</a> .
3 When all axes are positioned, update the revolution counter.	<a href="#">Step 2 - Updating the revolution counter with the FlexPendant on page 688</a> .

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

Use this procedure to update the revolution counter with the FlexPendant (IRC5).

Action
1 On the ABB menu, tap Calibration. 

Continues on next page

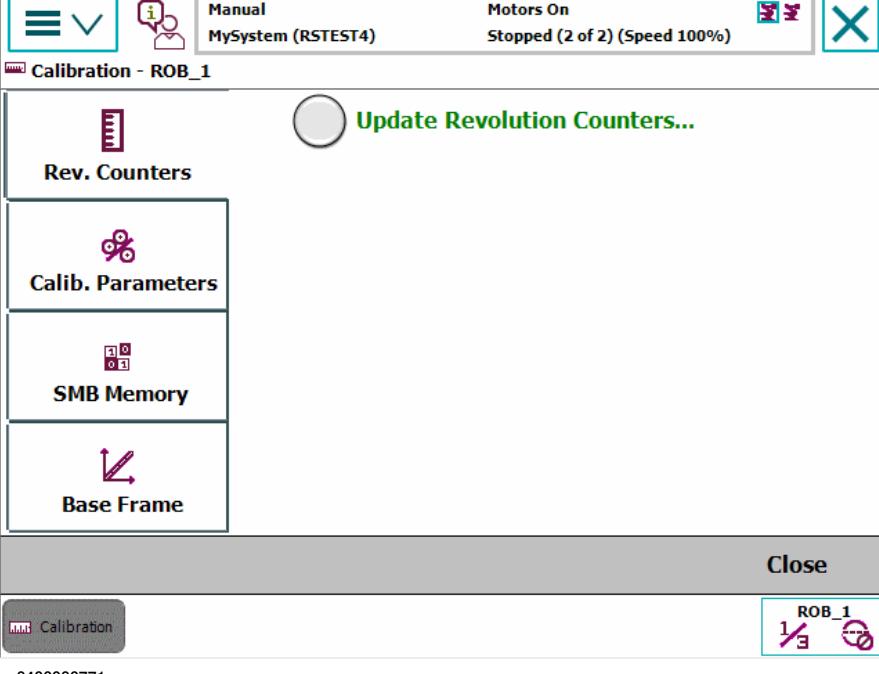
Action																					
<p>2 All mechanical units connected to the system are shown with their calibration status. Tap the mechanical unit in question.</p>  <p>In order to use the system all mechanical units must be calibrated.</p> <p>Select the mechanical unit you want to calibrate.</p> <table border="1"> <thead> <tr> <th>Mechanical Unit</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>ROB_1</td> <td>Calibrated</td> </tr> </tbody> </table> <p>xx1500000943</p>	Mechanical Unit	Status	ROB_1	Calibrated																	
Mechanical Unit	Status																				
ROB_1	Calibrated																				
<p>3 This step is valid for RobotWare 6.02 and later.</p> <p>Calibration method used at factory for each axis is shown, as well as calibration method used during last field calibration.</p> <p>Tap Manual Method (Advanced).</p>  <p>Calibration Method Overview</p> <table border="1"> <thead> <tr> <th>Axis</th> <th>Factory Method Used</th> <th>Latest Method Used</th> </tr> </thead> <tbody> <tr> <td>rob1_1</td> <td>Axis Calibration</td> <td>Axis Calibration</td> </tr> <tr> <td>rob1_2</td> <td>Axis Calibration</td> <td>Manual</td> </tr> <tr> <td>rob1_3</td> <td>Axis Calibration</td> <td>Manual</td> </tr> <tr> <td>rob1_4</td> <td>Axis Calibration</td> <td>Axis Calibration</td> </tr> <tr> <td>rob1_5</td> <td>Axis Calibration</td> <td>Axis Calibration</td> </tr> <tr> <td>rob1_6</td> <td>Axis Calibration</td> <td>Manual</td> </tr> </tbody> </table> <p>Manual Method (Advanced) Run Calibration Method Close</p> <p>xx1500000944</p>	Axis	Factory Method Used	Latest Method Used	rob1_1	Axis Calibration	Axis Calibration	rob1_2	Axis Calibration	Manual	rob1_3	Axis Calibration	Manual	rob1_4	Axis Calibration	Axis Calibration	rob1_5	Axis Calibration	Axis Calibration	rob1_6	Axis Calibration	Manual
Axis	Factory Method Used	Latest Method Used																			
rob1_1	Axis Calibration	Axis Calibration																			
rob1_2	Axis Calibration	Manual																			
rob1_3	Axis Calibration	Manual																			
rob1_4	Axis Calibration	Axis Calibration																			
rob1_5	Axis Calibration	Axis Calibration																			
rob1_6	Axis Calibration	Manual																			

Continues on next page

## 5 Calibration

### 5.3 Updating revolution counters

Continued

	Action
4	A screen is displayed, tap Rev. Counters. 
5	Tap Update Revolution Counters.... A dialog box is displayed, warning that updating the revolution counters may change programmed robot positions: <ul style="list-style-type: none"><li>Tap Yes to update the revolution counters.</li><li>Tap No to cancel updating the revolution counters.</li></ul> Tapping Yes displays the axis selection window.
6	Select the axis to have its revolution counter updated by: <ul style="list-style-type: none"><li>Ticking in the box to the left</li><li>Tapping Select all to update all axes.</li></ul> Then tap Update.
7	A dialog box is displayed, warning that the updating operation cannot be undone: <ul style="list-style-type: none"><li>Tap Update to proceed with updating the revolution counters.</li><li>Tap Cancel to cancel updating the revolution counters.</li></ul> Tapping Update updates the selected revolution counters and removes the tick from the list of axes.
8	 <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 703</a> .

## 5.4 Calibrating with Axis Calibration method

### 5.4.1 Description of Axis Calibration

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

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

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

#### Overview of the Axis Calibration procedure

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

A fixed calibration pin/bushing is installed on each robot axis at delivery.

The Axis Calibration procedure described roughly:

- A removable calibration tool is inserted by the operator into a calibration bushing on the axis chosen for calibration, according to instructions on the FlexPendant.



#### WARNING

Calibrating the robot with Axis Calibration requires special calibration tools from ABB. Using other pins in the calibration bushings may cause severe damage to the robot and/or personnel.



#### WARNING

The calibration tool must be fully inserted into the calibration bushing, until the steel spring ring snaps into place.

- During the calibration procedure, RobotWare moves the robot axis chosen for calibration so that the calibration tools get into contact. RobotWare records values of the axis position and repeats the coming-in-contact procedure several times to get an exact value of the axis position.



#### WARNING

Risk of pinching! The contact force for large robots can be up to 150 kg. Keep a safe distance to the robot.

- The axis position is stored in RobotWare with an active choice from the operator.

*Continues on next page*

## 5 Calibration

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### 5.4.1 Description of Axis Calibration

*Continued*

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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.

If calibrating the robot with reference calibration there must be reference values created before repair is made to the robot, if values are not already available.

Creating new values requires possibility to move the robot. The reference values contain positions of all axes, torque of axes and technical data about the tool installed. The reference value is unique for the current setup of the robot and will be named according to tool name, date etc.

Follow the instructions given in the reference calibration routine on the FlexPendant to create reference values.

When reference calibration is performed, the robot is restored to the status given by the reference values.

##### Update revolution counters

Choose this routine to make a rough calibration of each manipulator axis by updating the revolution counter for each axis, using the FlexPendant.

##### Validation

In the mentioned routines, it is also possible to validate the calibration data.

---

#### Position of robot axes

The axis chosen for calibration is automatically run by the calibration program to its calibration position during the calibration procedure.

In order for the axis to be able to be moved to calibration position, or in order for getting proper access to the calibration bushing, other axes might need to be jogged to positions different from 0 degrees. Information about which axes are allowed to be jogged will be given on the FlexPendant. These axes are marked with **Unrestricted** in the FlexPendant window.

---

#### How to calibrate an inverted robot

The IRB 6700Inv is calibrated inverted in factory, prior to shipping. To recalibrate an inverted robot, use either fine calibration or reference calibration routine.

## 5.4.2 Calibration tools for Axis Calibration

### Calibration tool set

The calibration tools used for Axis Calibration are designed to meet requirements for calibration performance, durability and safety in case of accidental damage.



#### WARNING

Calibrating the robot with Axis Calibration requires special calibration tools from ABB. Using other pins in the calibration bushings may cause severe damage to the robot and/or personnel.

Equipment, etc.	Article number	Note
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.

### Examining the calibration tool

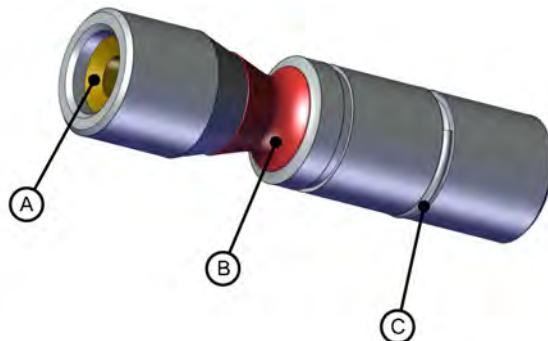
#### Check prior to usage

Before using the calibration tool, make sure that the tube insert, the plastic protection and the steel spring ring are present.



#### WARNING

If any part is missing or damaged, the tool must be replaced immediately.



xx1500001914

A	Tube insert
B	Plastic protection
C	Steel spring ring

#### Periodic check of the calibration tool

If including the calibration tool in a local periodic check system, the following measures should be checked.

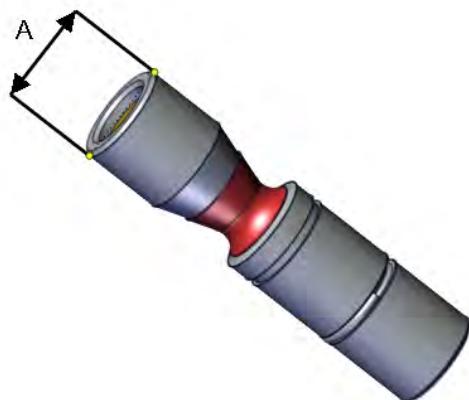
- Outer diameter within Ø12g4 mm, Ø8g4 mm or Ø6g5 mm (depending on calibration tool size).
- Straightness within 0.005 mm.

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## 5 Calibration

### 5.4.2 Calibration tools for Axis Calibration

*Continued*



xx1500000951

A	Outer diameter
---	----------------

#### Identifying the calibrating tools

It is possible to make the calibration tool identifiable with, for example, an RFID chip. The procedure of how to install an RFID chip is described below.



##### Note

The tool identifier is NOT delivered from ABB, it is a customized solution.

	Action	Note
1	<p>It is possible to use any RFID solution, with the correct dimensions. ABB has verified function on some suppliers fulfilling the requirements of NFC compatible devices (13.56 Mhz) according to ISO 14443 or ISO 15693.</p> <p> Note</p> <p>The maximum dimensions on the RFID chip must not exceed Ø7.9 mm x 8.0 mm, Ø5.9 mm x 8.0 mm or Ø3.9 mm x 8.0 mm (depending on calibration tool size).</p>	
2	<p>There is a cavity on one end of the calibration tool in which the RFID chip can be installed.</p> <p>Install the RFID chip according to supplier instructions.</p> <p>Install the chip in flush with the tool end.</p>	

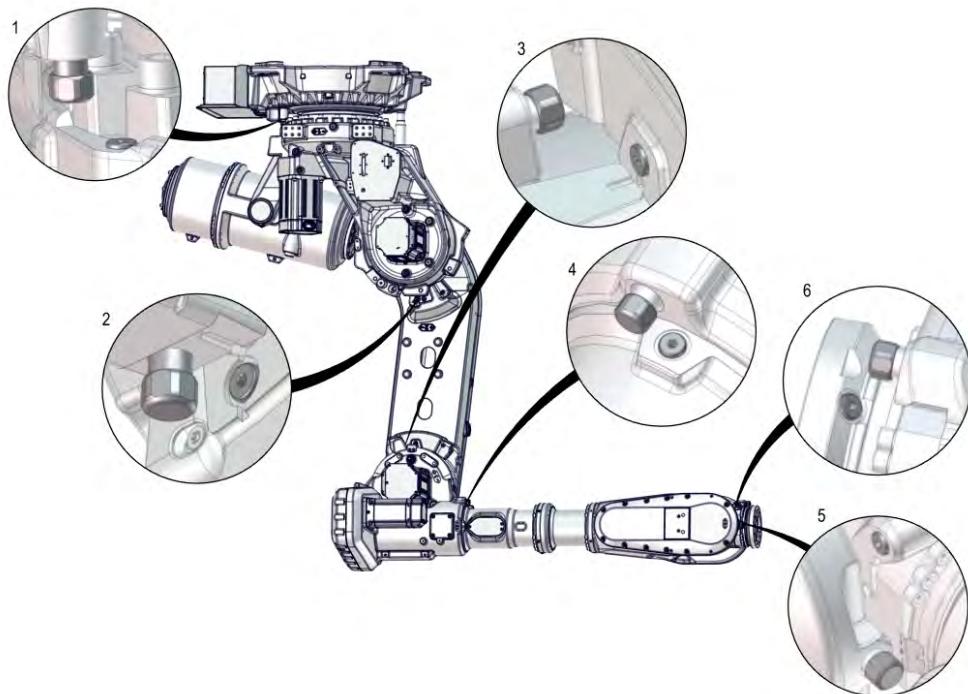
## 5.4.3 Installation locations for the calibration tools

## 5.4.3 Installation locations for the calibration tools

## Location of fixed calibration items

The figure shows how the robot is equipped with items for installation of calibration tools for Axis Calibration (fixed calibration pins and/or bushings). The figure does not show installed calibration tools.

A fixed calibration pin and a bushing for the movable calibration tool are located on each axis as follows.



xx1700000514

## Spare parts

When calibration is not being performed, a protective cover and an o-ring should always be installed on the fixed calibration pin as well as a protective plug, included a sealing, in the bushing. Replace damaged parts with new, if needed.

Spare part	Article number	Note
Protection cover and plug set	3HAC056806-001	Contains replacement calibration pin covers and protective plugs for the bushing.

## 5 Calibration

---

### 5.4.4 Axis Calibration - Running the calibration procedure

#### 5.4.4 Axis Calibration - Running the calibration procedure

##### Required tools

The calibration tools used for Axis Calibration are designed to meet requirements for calibration performance, durability and safety in case of accidental damage.



##### WARNING

Calibrating the robot with Axis Calibration requires special calibration tools from ABB. Using other pins in the calibration holes may cause severe damage to the robot and/or personnel.

Equipment, etc.	Article number	Note
Calibration tool box, Axis Calibration	3HAC055412-001	Delivered as a set of calibration tools.

##### Required consumables

Consumable	Article number	Note
Clean cloth	-	

##### Spare parts

Spare part	Article number	Note
Protection cover and plug set	3HAC056806-001	Contains replacement calibration pin covers and protective plugs for the bushing.

##### Overview of the calibration procedure on the FlexPendant

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

Use the following list to learn about the calibration procedure before running the RobotWare program on the FlexPendant. It gives you a brief overview of the calibration procedure sequence.

After the calibration method has been called for on the FlexPendant, the following sequence will be run.

- 1 Choose calibration routine. The routines are described in [Routines in the calibration procedure on page 692](#).
- 2 Choose which axis/axes to calibrate.
- 3 The robot moves to synchronization position.
- 4 Validate the synchronization marks.
- 5 The robot moves to preparation position.
- 6 Remove the protective cover from the fixed pin and the protection plug from the bushing, if any, and install the calibration tool.
- 7 The robot performs a measurement sequence by rotating the axis back and forth.

*Continues on next page*

## 5.4.4 Axis Calibration - Running the calibration procedure

*Continued*

8 Remove the calibration tool and reinstall the protective cover on the fixed pin and the protection plug in the bushing, if any.

9 The robot moves to verify that the calibration tool is removed.

10 Choose whether to save the calibration data or not.

Calibration of the robot is not finished until the calibration data is saved, as last step of the calibration procedure.

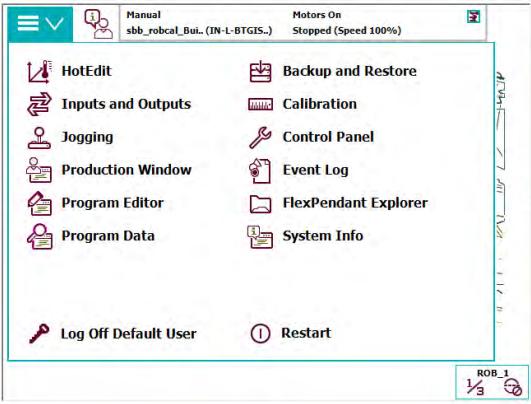
**Preparation prior to calibration**

The calibration procedure is described in the FlexPendant while conducting it.

Action	Note
<p>1  <b>DANGER</b> While conducting the calibration, the robot needs to be connected to power. Make sure that the robots working area is empty, as the robot can make unpredictable movements.</p>	
<p>2 Wipe the calibration tool clean.  <b>Note</b> The calibration method is exact. Dust, dirt or color flakes will affect the calibration value.</p>	Use a clean cloth.

**Starting the calibration procedure**

Use this procedure to call for the Axis Calibration method on the FlexPendant.

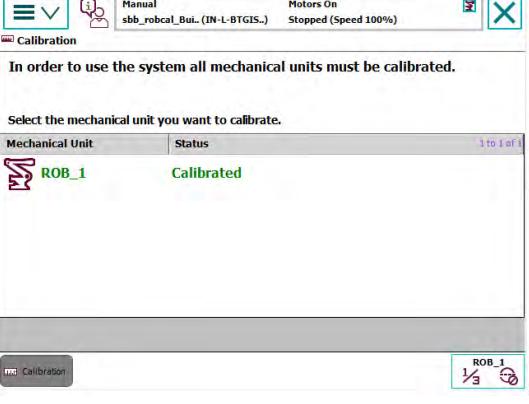
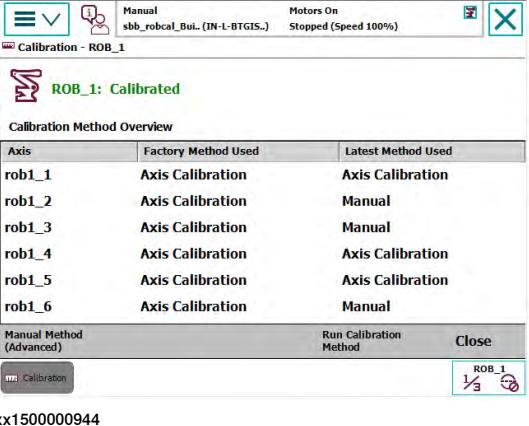
Action	Note
<p>1 On the ABB menu, tap Calibration.</p> 	

*Continues on next page*

## 5 Calibration

### 5.4.4 Axis Calibration - Running the calibration procedure

*Continued*

Action	Note
<p>2 All mechanical units connected to the system are shown with their calibration status. Tap the mechanical unit in question.</p> 	
<p>3 Calibration method used at factory for each axis is shown, as well as calibration method used for the robot during last field calibration. Tap <b>Run Calibration Method</b>. The software will automatically call for the procedure for the valid calibration method.</p> 	The FlexPendant will give all information needed to proceed with Axis Calibration.
<p>4 Follow the instructions given on the FlexPendant.</p>	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 696</a> .

#### 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> .

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## 5.4.4 Axis Calibration - Running the calibration procedure

Continued

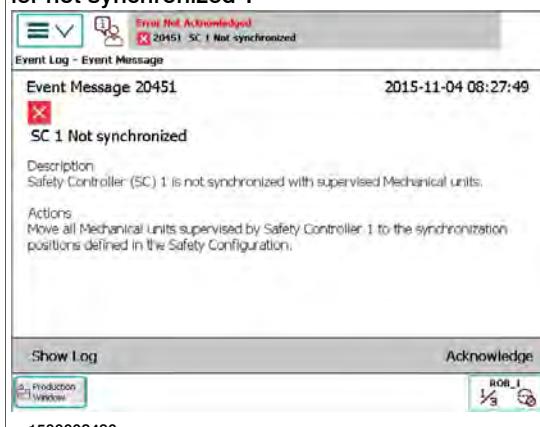
Situation	Action
The RobotWare program is terminated with PP to Main.	<p>Remove the calibration tool, if it is installed, and restart the calibration procedure from the beginning. See <a href="#">Starting the calibration procedure on page 697</a>.</p> <p>If the calibration tool is in contact the robot axis needs to be jogged in order to release the calibration tool. Jogging the axis in wrong direction will cause the calibration tool to break. Directions of axis movement is shown in <a href="#">Calibration movement directions for all axes on page 687</a></p>

**Axis Calibration with SafeMove option**

To be able to run Axis Calibration SafeMove needs to be unsynchronized. The Axis Calibration routine recognizes if the robot is equipped with SafeMove and will force SafeMove to unsynchronize automatically.

However, SafeMove may generate other warning messages anytime during the Axis Calibration routine.

**Safety controller not synchronized - SafeMove message**

	Action	Note
1	<p>SafeMove generates the message "Safety controller not synchronized".</p>  <p>The screenshot shows the 'Event Log - Event Message' window. It displays a single event message: 'Event Message 20451' at '2015-11-04 08:27:49'. The message content is 'SC 1 Not synchronized'. Below the message, there is a 'Description' section stating 'Safety Controller (SC) 1 is not synchronized with supervised Mechanical units.' and an 'Actions' section with the instruction 'Move all Mechanical Units supervised by Safety Controller 1 to the synchronization positions defined in the Safety Configuration.' At the bottom of the window, there are 'Show Log' and 'Acknowledge' buttons. The 'Acknowledge' button has a green checkmark icon and the text '806_1' next to it.</p>	
2	Confirm unsynchronized state by pressing Acknowledge to continue Axis Calibration procedure.	
3	Restart Axis Calibration procedure by pressing Play.	

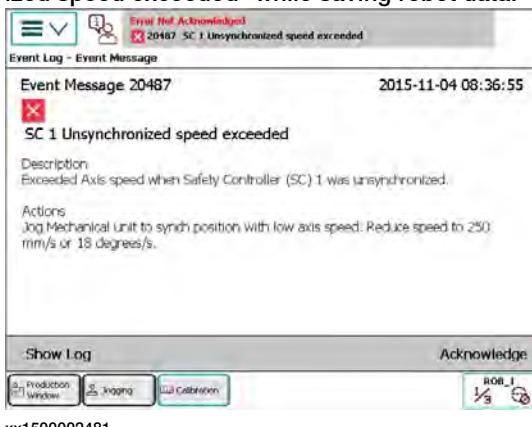
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## 5 Calibration

### 5.4.4 Axis Calibration - Running the calibration procedure

*Continued*

Unsynchronized speed exceeded - SafeMove message while saving robot data

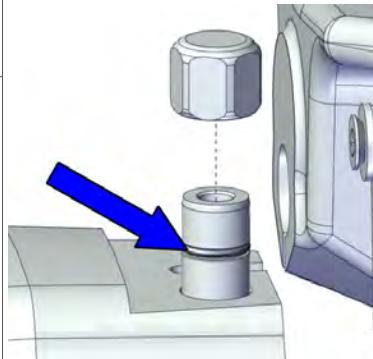
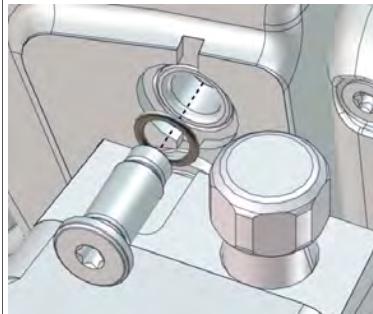
Action	Note
<p>1 SafeMove generates the message "Unsynchronized speed exceeded" while saving robot data.</p>  <p>The screenshot shows the 'Event Log - Event Message' window. It displays an event message for 'SC 1 Unsynchronized speed exceeded' with the timestamp '2015-11-04 08:36:55'. The message details that the exceeded axis speed was when Safety Controller (SC) 1 was unsynchronized. Actions listed include jogging the mechanical unit at low axis speed and reducing speed to 250 mm/s or 18 degrees/s. Buttons for 'Show Log' and 'Acknowledge' are visible, along with tabs for 'Production Window', 'Jogging', 'Axis Calibration', and 'SafeMove Visualizer'. The status bar shows 'xx1500002481'.</p>	
<p>2 Press Acknowledge to continue Axis Calibration procedure.</p>	
<p>3 Restart Axis Calibration procedure by pressing Play.</p>	

Unsynchronized time limit expired - SafeMove message anytime during Axis Calibration routine

Action	Note
<p>1 SafeMove generates the message "Unsynchronized time limit expired" (anytime).</p>  <p>The screenshot shows the 'Event Log - Event Message' window. It displays an event message for 'SC 1 Unsynchronized time limit expired' with the timestamp '2015-11-03 16:45:03'. The message details that available time to move the robot when unsynchronized has expired for Safety Controller (SC) 1. Actions listed include confirming a stop and synchronizing SC 1. Buttons for 'Next', 'Previous', and 'OK' are visible, along with tabs for 'Production Window', 'Axis Calibration', 'JOG', and 'SafeMove Visualizer'. The status bar shows 'xx1500002482'.</p>	
<p>2 Press OK to continue Axis Calibration procedure.</p>	
<p>3 Restart Axis Calibration procedure by pressing Play.</p>	

*Continues on next page*

**After calibration**

	Action	Note
1	Check the o-ring on the fixed calibration pin. Replace if damaged or missing.	 xx1600002102 Protection cover and plug set: 3HAC056806-001.
2	Reinstall the protective cover on the fixed calibration pin on each axis, directly after the axis has been calibrated.  Replace the cover with new spare part, if missing or damaged.	 xx1500000952 Protection cover and plug set: 3HAC056806-001.
3	Reinstall the protective plug and sealing in the bushing on each axis, directly after the axis has been calibrated. Ensure that the sealing is not damaged.  Replace the plug and the sealing with new spare part, if missing or damaged.	

## 5 Calibration

---

### 5.5 Verifying the calibration

#### Introduction

Always verify the results after calibrating *any* robot axis to verify that all calibration positions are correct.

#### Verifying the calibration

Use this procedure to verify the calibration result.

Action	Note
1 Run the calibration home position program twice. Do not change the position of the robot axes after running the program!	See <a href="#">Checking the synchronization position on page 703</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 686</a> .
3 Write down the values on a new label and stick it on top of the calibration label.  The label is located on the lower arm.	
4 Remove any calibration equipment from the robot.	

## 5.6 Checking the synchronization position

### Introduction

Check the synchronization position of the robot before beginning any programming of the robot system. This may be done:

- Using a **MoveAbsJ** instruction with argument zero on all axes.
- Using the **Jogging** window on the FlexPendant.

### Using a **MoveAbsJ** instruction

Use this procedure to create a program that runs all the robot axes to their synchronization position.

	Action	Note
1	On ABB menu tap <b>Program editor</b> .	
2	Create a new program.	
3	Use <b>MoveAbsJ</b> in the <b>Motion&amp;Proc</b> menu.	
4	Create the following program: <pre>MoveAbsJ [[0,0,0,0,0,0], [9E9,9E9,9E9,9E9,9E9,9E9]] \NoEOoffs, 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 686</a> and <a href="#">Updating revolution counters on page 688</a> .

### Using the jogging window

Use this procedure to jog the robot to the synchronization position of all axes.

	Action	Note
1	On the ABB menu, tap <b>Jogging</b> .	
2	Tap <b>Motion mode</b> to select group of axes to jog.	
3	Tap to select the axis to jog, axis 1, 2, or 3.	
4	Manually run the robots axes to a position where the axis position value read on the FlexPendant, is equal to zero.	
5	Check that the synchronization marks for the axes align correctly. If they do not, update the revolution counters.	See <a href="#">Synchronization marks and synchronization position for axes on page 686</a> and <a href="#">Updating revolution counters on page 688</a> .

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# 6 Decommissioning

## 6.1 Environmental information

### Hazardous material

The table specifies some of the materials in the product and their respective use throughout the product.

Dispose components properly to prevent health or environmental hazards.

Material	Example application
Batteries, NiCad or Lithium	Serial measurement board
Copper	Cables, motors
Cast iron/nodular iron	Base, lower arm, upper arm
Steel	Gears, screws, base frame, and so on.
Neodymium	Brakes, motors
Plastic/rubber	Cables, connectors, drive belts, and so on.
Oil, grease	Gearboxes
Aluminium	Covers, synchronization brackets

### Oil and grease

Where possible, arrange for oil and grease to be recycled. Dispose of via an authorized person/contractor in accordance with local regulations. Do not dispose of oil and grease near lakes, ponds, ditches, down drains, or onto soil. Incineration must be carried out under controlled conditions in accordance with local regulations.

Also note that:

- Spills can form a film on water surfaces causing damage to organisms. Oxygen transfer could also be impaired.
- Spillage can penetrate the soil causing ground water contamination.

## **6 Decommissioning**

---

### **6.2 Scrapping of robot**

#### **6.2 Scrapping of robot**

---

##### **Important when scrapping the robot**



##### **DANGER**

When a robot is disassembled while being scrapped, it is very important to remember the following before disassembling starts, in order to prevent injuries:

- Always remove all batteries from the robot. If a battery is exposed to heat, for example from a blow torch, it will explode.
- Always remove all oil/grease in gearboxes. If exposed to heat, for example from a blow torch, the oil/grease will catch fire.
- When motors are removed from the robot, the robot will collapse if it is not properly supported before the motor is removed.

## 6.3 Decommissioning of balancing device

### General

There is much energy stored in the balancing device. Therefore a special procedure is required to disassemble it. The coil springs inside the balancing device exert a potentially lethal force unless disassembled properly.

The device must be disassembled by a decommissioning company.

### Required equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section <a href="#">Standard toolkit on page 717</a> .
Protective clothing that also covers face and hands	-	Must protect against spatter of sparks and flames.
Cutting torch with a long shaft	-	For opening housing and cutting coils. The long shaft is a safety requirement.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.



#### DANGER

*Do not, under any circumstances, deal with the balancing device in any other way than that detailed in the product documentation! For example, attempting to open the balancing device is potentially lethal!*

### Action on field, decommissioning

The procedure below details the actions to perform on field, when the balancing device is to be decommissioned.

	Action	Note
1	Remove the balancing device from the robot.	Detailed in section <a href="#">Replacing the balancing device on page 408</a> .
2	Secure the piston rod.  ! CAUTION  The piston rod is loose and may slide out when the balancing device is secured.	
3	Send the device to a decommissioning company.	Make sure the decommissioning company is well informed about the stored energy built up by high tensioned compression springs and that the device contains some grease.  The following procedure contains useful information about decommissioning.

*Continues on next page*

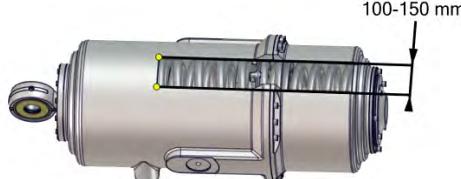
## 6 Decommissioning

### 6.3 Decommissioning of balancing device

*Continued*

#### Decommissioning at decommissioning company, balancing device

The instruction below details how to decommission the balancing device. Contact ABB Robotics for further consultation.

Action	Note
1  <b>DANGER</b>  There is stored energy built up by high tensioned compression springs inside the balancing device! When a coil is cut the released tension creates a spatter of sparks and flames.  The working area must be free of flammable materials. Position the balancing device so that the spatter will be directed away from personnel.	
2 Clamp the device at the working location. Place the device at ground level so that the hole and spring coils are cut from a safe distance and somewhat from above.	
3  <b>DANGER</b>  The hole must be cut as specified in the figure. Pieces of the spring can be thrown out from the cylinder at high speed if the hole is cut larger than specified!	
4 Cut a hole in the housing as shown in the figure.	Use a cutting torch with a long shaft.   xx1600002062
5 Cut all the coils of the springs inside the housing.	Use a cutting torch with a long shaft.
6 Roll the balancing device over and cut an equally large hole on the other side of the device. Then cut all the coils of the springs from that side also.	 xx1600002091
7 Double-check the number of coils cut and make sure all the tension in the springs is removed.	

# 7 Reference information

## 7.1 Introduction

---

### General

This chapter includes general information, complementing the more specific information in the different procedures in the manual.

## 7 Reference information

### 7.2 Applicable standards

#### 7.2 Applicable standards



##### Note

The listed standards are valid at the time of the release of this document. Phased out or replaced standards are removed from the list when needed.

##### Standards, EN ISO

The product is designed in accordance with the requirements of:

Standard	Description
EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN ISO 13849-1	Safety of machinery, safety related parts of control systems - Part 1: General principles for design
EN ISO 13850	Safety of machinery - Emergency stop - Principles for design
EN ISO 10218-1	Robots for industrial environments - Safety requirements -Part 1 Robot
EN ISO 9787	Robots and robotic devices -- Coordinate systems and motion nomenclatures
EN ISO 9283	Manipulating industrial robots, performance criteria, and related test methods
EN ISO 14644-1 <sup>i</sup>	Classification of air cleanliness
EN ISO 13732-1	Ergonomics of the thermal environment - Part 1
EN IEC 61000-6-4 (option 129-1)	EMC, Generic emission
EN IEC 61000-6-2	EMC, Generic immunity
EN IEC 60974-1 <sup>ii</sup>	Arc welding equipment - Part 1: Welding power sources
EN IEC 60974-10 <sup>ii</sup>	Arc welding equipment - Part 10: EMC requirements
EN IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1 General requirements
IEC 60529	Degrees of protection provided by enclosures (IP code)

<sup>i</sup> Only robots with protection Clean Room.

<sup>ii</sup> Only valid for arc welding robots. Replaces EN IEC 61000-6-4 for arc welding robots.

##### European standards

Standard	Description
EN 614-1	Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles
EN 574	Safety of machinery - Two-hand control devices - Functional aspects - Principles for design

*Continues on next page*

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#### Other standards

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
ANSI/UL 1740	Safety standard for robots and robotic equipment
CAN/CSA Z 434-14	Industrial robots and robot Systems - General safety requirements

## **7 Reference information**

---

### **7.3 Unit conversion**

#### **7.3 Unit conversion**

---

##### **Converter table**

Use the following table to convert units used in this manual.

<b>Quantity</b>	<b>Units</b>		
Length	1 m	3.28 ft.	39.37 in
Weight	1 kg	2.21 lb.	
Weight	1 g	0.035 ounces	
Pressure	1 bar	100 kPa	14.5 psi
Force	1 N	0.225 lbf	
Moment	1 Nm	0.738 lbf-ft	
Volume	1 L	0.264 US gal	

## 7.4 Screw joints

### General

This section describes how to tighten the various types of screw joints on the IRB 6700Inv.

The instructions and torque values are valid for screw joints comprised of metallic materials and do *not* apply to soft or brittle materials.

### UNBRAKO screws

UNBRAKO is a special type of screw recommended by ABB for certain screw joints. It features special surface treatment (Gleitmo as described below) and is extremely resistant to fatigue.

Whenever used, this is specified in the instructions, and in such cases, *no other type of replacement screw* is allowed. Using other types of screws will void any warranty and may potentially cause serious damage or injury.

### Gleitmo treated screws

Gleitmo is a special surface treatment to reduce the friction when tightening the screw joint. Screws treated with Gleitmo may be reused 3-4 times before the coating disappears. After this the screw must be discarded and replaced with a new one.

When handling screws treated with Gleitmo, protective gloves of **nitrile rubber** type should be used.

### Screws lubricated in other ways

Screws lubricated with Molycote 1000 should *only* be used when specified in the repair, maintenance or installation procedure descriptions.

In such cases, proceed as follows:

- 1 Apply lubricant to the screw thread.
- 2 Apply lubricant between the plain washer and screw head.
- 3 Screw dimensions of M8 or larger must be tightened with a torque wrench. Screw dimensions of M6 or smaller may be tightened without a torque wrench if this is done by trained and qualified personnel.

Lubricant	Article number
Molycote 1000 (molybdenum disulphide grease)	11712016-618

### Tightening torque

Before tightening any screw, note the following:

- Determine whether a **standard** tightening torque or **special** torque is to be applied. The **standard** torques are specified in the following tables. Any **special** torques are specified in the repair, maintenance or installation procedure descriptions. **Any special torque specified overrides the standard torque!**
- Use the *correct* tightening torque for each type of screw joint.
- Only use *correctly calibrated* torque keys.

*Continues on next page*

## 7 Reference information

### 7.4 Screw joints

*Continued*

- Always *tighten the joint by hand*, and never use pneumatic tools.
- Use the *correct tightening technique*, that is *do not jerk*. Tighten the screw in a slow, flowing motion.
- Maximum allowed total deviation from the specified value is 10%!

#### Oil-lubricated screws with slotted or cross-recess head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws with slotted or cross-recess head screws*. Any special torque specified in the repair, maintenance or installation procedure overrides the standard torque!

#### Oil-lubricated screws with allen head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws with allen head screws*. Any special torque specified in the repair, maintenance or installation procedure overrides the standard torque!

Dimension	Tightening torque (Nm) Class 8.8, oil-lubricated	Tightening torque (Nm) Class 10.9, oil-lubricated	Tightening torque (Nm) Class 12.9, oil-lubricated
M5	6	-	-
M6	10	-	-
M8	24	34	40
M10	47	67	80
M12	82	115	140
M16	200	290	340
M20	400	560	670
M24	680	960	1150

#### Lubricated screws (*Molykote, Gleitmo or equivalent*) with allen head screws

The following table specifies the recommended standard tightening torque for *screws lubricated with Molykote 1000, Gleitmo 603 or equivalent with allen head screws*. Any special torque specified in the repair, maintenance or installation procedure overrides the standard torque!

Dimension	Tightening torque (Nm) Class 10.9, lubricated <sup>i</sup>	Tightening torque (Nm) Class 12.9, lubricated <sup>i</sup>
M8	28	35
M10	55	70
M12	96	120
M16	235	280
M20	460	550
M24	790	950

<sup>i</sup> Lubricated with Molykote 1000, Gleitmo 603 or equivalent

*Continues on next page*

## Water and air connectors

The following table specifies the recommended standard tightening torque for *water and air connectors* when *one or both* connectors are made of *brass*. Any special torque specified in the repair, maintenance or installation procedure overrides the standard torque!

Dimension	Tightening torque Nm - Nominal	Tightening torque Nm - Min.	Tightening torque Nm - Max.
1/8	12	8	15
1/4	15	10	20
3/8	20	15	25
1/2	40	30	50
3/4	70	55	90

## 7 Reference information

---

### 7.5 Weight specifications

#### 7.5 Weight specifications

##### Definition

In installation, repair, and maintenance procedures, weights of the components handled are sometimes specified. All components exceeding 22 kg (50 lbs) are highlighted in this way.

To avoid injury, ABB recommends the use of a lifting accessory when handling components with a weight exceeding 22 kg. A wide range of lifting accessories and devices are available for each manipulator model.

##### Example

Following is an example of a weight specification in a procedure:

	Action	Note
	 <b>CAUTION</b>  The robot weighs 1,750 kg. All lifting accessories used must be sized accordingly!	

## 7.6 Standard toolkit

### General

All service (repairs, maintenance, and installation) procedures contains lists of tools required to perform the specified activity.

All special tools required are listed directly in the procedures while all the tools that are considered standard are gathered in the standard toolkit and defined in the following table.

This way, the tools required are the sum of the standard toolkit and any tools listed in the instruction.

### Contents, standard toolkit

Qty	Tool	Comment
1	Ring-open-end spanner 8-19 mm	
1	Socket head cap 2.5-17 mm	
1	Torx socket no: 20-60	
1	Box spanner set	
1	Torque wrench 10-100 Nm	
1	Torque wrench 75-400 Nm	
1	Ratchet head for torque wrench 1/2	
2	Hexagon-headed screw M10x100	
1	Hexagon-headed screw M16x90	
1	Hex bit socket head cap no. 14 socket 40 mm L=100 mm	
1	Hex bit socket head cap no. 14 socket 40 mm L=20 mm	To be shortened to 12 mm
1	Hex bit socket head cap no. 6 socket 40 mm L=145 mm	
1	Hex bit socket head cap no. 6 socket 40mm bit L=220 mm	
1	Plastic mallet	

## **7 Reference information**

---

### **7.7 Special tools**

#### **7.7 Special tools**

---

##### **General**

All service instructions contain lists of tools required to perform the specified activity. The required tools are a sum of standard tools, defined in the section [\*Standard toolkit on page 717\*](#), and of special tools, listed directly in the instructions and also gathered in this section.

---

##### **Special tools**

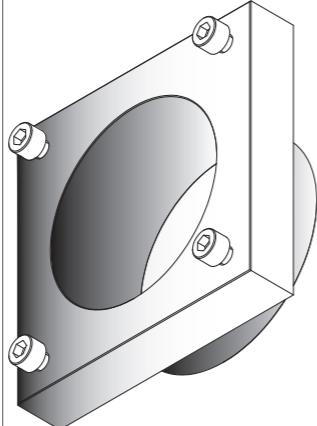
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Tools and equipment with spare part number: (These tools can be ordered from ABB)		Cable harness	SMB	Brake release unit	Lower arm	Upper arm	Wrist	Turning disk	Balancing device	Spherical roller bearing (link ear)	Rear bearing (balancing device)	Axis 1 motor	Axis 2 motor	Axis 3 motor	Axis 4 motor	Axis 5 motor	Axis 6 motor	Axis 1 gearbox	Axis 2 gearbox	Axis 3 gearbox	Axis 6 gearbox
<b>Guide pins</b>																					
3HAC15520-1	Guide pin, M8x100																				
3HAC15521-2	Guide pin, M10x150																	2		2	
3HAC15521-2	Guide pin, M10x150																				
3HAC13056-2	Guide pin, M12x150				x	x	2					2	2	2					x	x	
3HAC13056-3	Guide pin, M12x200				x	x												x	x	x	
3HAC13056-4	Guide pin, M12x250				x													x	x		
3HAC13120-2	Guide pin, M16x150				x													x	x		
3HAC13120-3	Guide pin, M16x200				x												x	x			
<b>Lifting accessories</b>																					
3HAC15556-1	Lifting accessory (chain)	 xx1200001241			x	x					x						x	x	x		
3HAC14459-1	Lifting accessory, motor									x							x				
3HAC15534-1	Lifting accessory, motor									x	x						x				
3HAC046128-001	Lifting accessory, gearbox																x				
3HAC046128-001	Lifting accessory, gearbox																x				
3HAC16131-1	Lifting eye, M12	 xx1200001242			2	2											2	2	2		
3HAC14457-4	Lifting eye, M16	 xx1200001242															2	x			
-	Lifting shackle, 2 pcs SA-10-8-NA1	 xx1200001243			x				x	x	x						x				

Continues on next page

## 7 Reference information

### 7.7 Special tools

Tools and equipment with spare part number: (These tools can be ordered from ABB)		Cable harness	SMB	Brake release unit	Lower arm	Upper arm	Wrist	Turning disk	Balancing device	Spherical roller bearing (link ear)	Rear bearing (balancing device)	Axis 1 motor	Axis 2 motor	Axis 3 motor	Axis 4 motor	Axis 5 motor	Axis 6 motor	Axis 1 gearbox	Axis 2 gearbox	Axis 3 gearbox	Axis 6 gearbox
-	Fender washer Outer diameter: minimum 26 mm, maximum 30 mm, hole diameter: 13 mm, thickness: 3 mm.				x	x										x	x	x			
-	Roundsling, 1.5 m Lifting capacity: 2,000 kg.				x										x	x					
-	Roundsling, 1 m Lifting capacity: 1,000 kg.				x	x			x	x	x	x	x	x		x	x				
Press, puller and unloading tools																					
3HAC12475-6	AdapterM20-M16				x				x <sup>i</sup>							x					
3HAC047273-001	Anvil	 xx1300000675			x				x <sup>i</sup>	x						x					
3HAC028920-001	Dismantle and mounting tool				x				x	x	x					x					
3HAC030662-001	Distance tool	 xx1400000726			x				x	x						x					
3HAC11731-1	Hydraulic cylinder								x	x	x					x					
3HAC13086-1	Hydraulic pump 80 MPa								x	x	x					x					
-	Threaded bar, M16x340				x				x		x					x					
3HAC028920-003	Press tool A	 xx1300000674							x <sup>i</sup>												
Removal tools																					
-	ScrewsM8x75, fully threaded																		3		

Continues on next page

		Tools and equipment with spare part number: (These tools can be ordered from ABB)		Cable harness	SMB	Brake release unit	Lower arm	Upper arm	Wrist	Turning disk	Balancing device	Spherical roller bearing (link ear)	Rear bearing (balancing device)	Axis 1 motor	Axis 2 motor	Axis 3 motor	Axis 4 motor	Axis 5 motor	Axis 6 motor	Axis 1 gearbox	Axis 2 gearbox	Axis 3 gearbox	Axis 6 gearbox
3HAC057339-003	Removal tool M12													x	x	x	x	x	x				
3HAC057339-004	Removal tool M14												x	x	x			x	x				
<b>Other tools</b>																							
-	24 VDC power supply					x	x	x				x	x	x	x	x	x	x	x	x	x	x	
3HAC046645-003	Aligning tool																	x					
-	Long AllenKeySocketIN19L 6-140														x	x	x						
3HAC12342-1	Bits extender											x	x	x				x	x				
3HAC15716-1	Calibration Pendulum toolkit <sup>ii</sup>					x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	
3HAC055412-001	Calibration tool box, Axis Calibration <sup>ii</sup>					x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	
-	Leak-down tester											x	x	x	x	x	x	x	x	x	x	x	
-	Lock screw, M16x120											x			x								
-	Oil collecting vessel												x	x				x	x	x	x	x	
-	Oil dispenser												x	x				x	x	x	x	x	
	Pallet					x	x	x										x	x				
3HAB7887-1	Rotation tool					x	x					x	x	x	x	x	x	x	x	x	x	x	

i Included in Dismantle and mounting tool (3HAC028920-001).

ii The robot is calibrated by either Calibration Pendulum or Axis Calibration at factory. Always use the same calibration method as used at the factory. Information about valid calibration method is found on the calibration label or in the calibration menu on the FlexPendant.

Continues on next page

## **7 Reference information**

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### **7.8 Lifting accessories and lifting instructions**

---

#### **General**

Many repair and maintenance activities require different pieces of lifting accessories, which are specified in each procedure.

The use of each piece of lifting accessories is *not* detailed in the activity procedure, but in the instruction delivered with each piece of lifting accessories.

This implies that the instructions delivered with the lifting accessories should be stored for later reference.

# **8 Spare parts**

## **8.1 Spare part lists and illustrations**

---

**Location**

Spare parts and exploded views are not included in the manual but delivered as a separate document on the documentation DVD.

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# 9 Circuit diagrams

## 9.1 Circuit diagrams

### Overview

The circuit diagrams are not included in this manual, but delivered as separate documents on the documentation DVD. See the article numbers in the tables below.

### Controllers

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRC5</i>	<i>3HAC024480-011</i>
<i>Circuit diagram - IRC5 Compact</i>	<i>3HAC049406-003</i>
<i>Circuit diagram - IRC5 Panel Mounted Controller</i>	<i>3HAC026871-020</i>
<i>Circuit diagram - Euromap</i>	<i>3HAC024120-004</i>
<i>Circuit diagram - Spot welding cabinet</i>	<i>3HAC057185-001</i>

### Robots

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRB 120</i>	<i>3HAC031408-003</i>
<i>Circuit diagram - IRB 140 type C</i>	<i>3HAC6816-3</i>
<i>Circuit diagram - IRB 260</i>	<i>3HAC025611-001</i>
<i>Circuit diagram - IRB 360</i>	<i>3HAC028647-009</i>
<i>Circuit diagram - IRB 460</i>	<i>3HAC036446-005</i>
<i>Circuit diagram - IRB 660</i>	<i>3HAC025691-001</i>
<i>Circuit diagram - IRB 760</i>	<i>3HAC025691-001</i>
<i>Circuit diagram - IRB 1200</i>	<i>3HAC046307-003</i>
<i>Circuit diagram - IRB 1410</i>	<i>3HAC2800-3</i>
<i>Circuit diagram - IRB 1600/1660</i>	<i>3HAC021351-003</i>
<i>Circuit diagram - IRB 1520</i>	<i>3HAC039498-007</i>
<i>Circuit diagram - IRB 2400</i>	<i>3HAC6670-3</i>
<i>Circuit diagram - IRB 2600</i>	<i>3HAC029570-007</i>
<i>Circuit diagram - IRB 4400/4450S</i>	<i>3HAC9821-1</i>
<i>Circuit diagram - IRB 4600</i>	<i>3HAC029038-003</i>
<i>Circuit diagram - IRB 6400RF</i>	<i>3HAC8935-1</i>
<i>Circuit diagram - IRB 6600 type A</i>	<i>3HAC13347-1 3HAC025744-001</i>
<i>Circuit diagram - IRB 6600 type B</i>	<i>3HAC13347-1 3HAC025744-001</i>
<i>Circuit diagram - IRB 6620</i>	<i>3HAC025090-001</i>

*Continues on next page*

## 9 Circuit diagrams

---

### 9.1 Circuit diagrams

*Continued*

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRB 6620 / IRB 6620LX</i>	<i>3HAC025090-001</i>
<i>Circuit diagram - IRB 6640</i>	<i>3HAC025744-001</i>
<i>Circuit diagram - IRB 6650S</i>	<i>3HAC13347-1</i> <i>3HAC025744-001</i>
<i>Circuit diagram - IRB 6660</i>	<i>3HAC025744-001</i> <i>3HAC029940-001</i>
<i>Circuit diagram - IRB 6700</i>	<i>3HAC043446-005</i>
<i>Circuit diagram - IRB 7600</i>	<i>3HAC13347-1</i> <i>3HAC025744-001</i>
<i>Circuit diagram - IRB 14000</i>	<i>3HAC050778-003</i>
<i>Circuit diagram - IRB 910SC</i>	<i>3HAC056159-002</i>

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