

ABB Robotics

Product manual IRB 120



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Product manual

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IRB 120T - 3/0.6

M2004

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Overview of this manual

About this manual

This manual contains instructions for:

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

Usage

This manual should be used during:

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

Who should read this manual?

This manual is intended for:

- installation personnel
 - maintenance personnel
 - repair personnel.
-

Prerequisites

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

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

Organization of chapters

The manual is organized in the following chapters:

Chapter	Contents
Safety	Safety information that must be read through before performing any installation or service work on the robot. Contains general safety aspects as well as more specific information on how to avoid personal injuries and damage to the product.
Installation and commissioning	Required information about lifting and installation of the robot.
Maintenance	Step-by-step procedures that describe how to perform maintenance of the robot. Based on a maintenance schedule that may be used to plan periodical maintenance.
Repair	Step-by-step procedures that describe how to perform repair activities of the robot. Based on available spare parts.
Calibration information	Procedures that do not require specific calibration equipment. General information about calibration.
Decommissioning	Environmental information about the robot and its components.
Reference information	Useful information when performing installation, maintenance or repair work. Includes lists of necessary tools, additional documents, safety standards etc.

Continues on next page

Overview of this manual

Continued

Chapter	Contents
Spare part / part list	Complete spare part list and complete list of robot components, shown in exploded views.
Exploded views	Detailed illustrations of the robot with reference numbers to the part list.
Circuit diagram	Reference to the circuit diagram for the robot.

References

Reference	Document Id
<i>Product specification - IRB 120</i>	3HAC035960-001
<i>Product manual - IRC5</i>	3HAC021313-001
<i>Product manual - IRC5 Compact</i>	3HAC035738-001
<i>Product manual - IRC5 Panel Mounted Controller</i>	3HAC027707-001
<i>Technical reference manual - Lubrication in gearboxes</i>	3HAC042927-001
<i>Operating manual - IRC5 with FlexPendant</i>	3HAC16590-1
<i>Operating manual - Emergency safety information</i>	3HAC027098-001 Same document number regardless of language.
<i>Operating manual - General safety information</i> ⁱ	3HAC031045-001

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

Revisions

Revision	Description
-	First edition
A	This revision includes the following additions and/or changes: <ul style="list-style-type: none">• Section "<i>Product documentation, M2004</i>" added.• Section "<i>How to read the product manual</i>" added.• Safety chapter- Updated safety signal graphics for levels Danger! and Warning! See section <i>Safety signals in the manual on page 37</i>.• Safety chapter - New safety labels on the manipulators, see <i>Safety symbols on manipulator labels on page 39</i>.• Safety chapter - Revised terminology: <i>robot</i> replaced with <i>manipulator</i>.• Safety chapter - Information not applicable to IRB 120 in <i>WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 49</i> removed.• Installation chapter - Illustration updated in <i>Risk of tipping/stability on page 58</i>.• Installation chapter - Attachment screws added in <i>Lifting the robot with roundslings on page 59</i>.• Installation chapter - Value in illustration updated in <i>Orienting and securing the robot on page 65</i>.• Installation chapter - Section <i>Setting the system parameters for a suspended robot on page 70</i> new.• Installation chapter - Section <i>Robot cabling and connection points on page 78</i> updated.• Installation chapter - Section <i>Customer connections on robot on page 79</i> art. no. on connection at upper arm updated.

Continues on next page

Revision	Description
	<ul style="list-style-type: none"> • Maintenance chapter - Value for timing belt tension axis 5 updated. • Repair chapter - New chapter. • Calibration chapter - Section Calibrating axes 1 - 6 on page 196 updated. • Calibration chapter - Section Synchronization marks axes 1-6 on page 202 updated. • Reference information chapter - New chapter. • Spare parts chapter - Article numbers and illustrations updated.
B	<p>This revision includes the following additions and/or changes:</p> <ul style="list-style-type: none"> • Installation chapter - Lifting capacity of roundslings updated. See: Lifting the robot with roundslings on page 59. • Installation chapter - New illustration showing IRB 120 added. See: Setting the system parameters for a suspended robot on page 70. • Repair chapter - Illustrations xx0900001009 and xx0900000782 updated. See: Removing the cable harness on page 106 and Refitting the cable harness on page 118. • Repair chapter - Illustration xx0900000924 updated. See: Replacing the upper arm on page 136. • Repair chapter - Motor axis 4 now delivered as part of the upper arm. The procedures Removal and Refitting are updated accordingly. See: Replacing the upper arm on page 136. • Repair chapter - Motor axis 4 now delivered as part of the upper arm. The section is updated accordingly. See: Replacing motor axis 4, with gearbox on page 181. • Repair chapter - Illustration xx0900001009 updated. See: Replacing motor axis 5 on page 182. • Calibration chapter updated. See sections: Calibrating axes 1 - 6 on page 196 and Synchronization marks axes 1-6 on page 202. • Reference information chapter - "Other standards" added. See: Applicable safety standards on page 208. • Reference information chapter - Standard toolkit updated. See: Standard toolkit on page 213. • Spare parts chapter - Motor axis 4 (art. no. 3HAC037282-001) removed. Now part of the upper arm. See: Spare parts - Upper arm unit on page 222. • Circuit diagram - Updated after circuit diagrams now are delivered as separate files. See: About circuit diagrams on page 227.
C	<p>This revision includes the following additions and/or changes:</p> <ul style="list-style-type: none"> • Repair chapter - Text added on how to position axis 5. See section Removing the cable harness on page 106. • Repair chapter - Text added on how to position axis 5. See section Refitting the cable harness on page 118. • Repair chapter - Text added on how to position axis 5. See section Replacing the upper arm on page 136. • Calibration chapter - Text added about updating the revolution counters. See section Calibrating axes 1 - 6 on page 196. • Calibration chapter - Introduction updated. See section Synchronization marks axes 1-6 on page 202. • Spare parts chapter - Illustration xx0900000544 updated. See section Spare parts upper arm unit on page 222.
D	<p>This revision includes the following additions and/or changes:</p> <ul style="list-style-type: none"> • A new block, about general illustrations, added in section How to read the product manual on page 15. • Clean Room protection added. • Illustrations updated throughout the manual.

Continues on next page

Overview of this manual

Continued

Revision	Description
	<ul style="list-style-type: none">Calibration chapter - Text removed: <i>Updating the revolution counters</i>.Added WARNING - Safety risks during handling of batteries on page 48.
E	This revision includes the following additions and/or changes: <ul style="list-style-type: none">Section "Expected component life" removed from the manual.Added inspection activity for regular/daily inspection of robot to the maintenance schedule, see <i>Maintenance schedule on page 83</i>.Added the spare part number for the gearbox grease in section Type of grease, gearboxes.Changed the working range of axis 3, see <i>Working range and type of motion on page 56</i>.Changed the illustration that shows the mounting surface of the tool flange, see <i>Fitting equipment on robot on page 67</i>.Added variant IRB 120T - 3/0.6 to the manual.
F	This revision includes the following additions and/or changes: <ul style="list-style-type: none">Information regarding disassembly of Clean Room robots added to concerned repair instructions.All data about type of lubrication in gearboxes is moved from the manual to a separate lubrication manual, see <i>Type and amount of oil in gearboxes on page 96</i>.Added data for extended working range of axis 6, see <i>Working range and type of motion on page 56</i>.

Product documentation, M2004

Categories for manipulator documentation

The manipulator documentation 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 M2004 manipulator systems.

Product manuals

Manipulators, controllers, DressPack/SpotPack, and most other hardware will be 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.

Application manuals

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

Continues on next page

Continued

An application manual generally contains information about:

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

Operating manuals

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

The group of manuals includes (among others):

- *Operating manual - Emergency safety information*
- *Operating manual - General safety information*
- *Operating manual - Getting started, IRC5 and RobotStudio*
- *Operating manual - Introduction to RAPID*
- *Operating manual - IRC5 with FlexPendant*
- *Operating manual - RobotStudio*
- *Operating manual - Trouble shooting IRC5, for the controller and manipulator.*

How to read the product manual

Reading the procedures

The procedures contain references to figures, tools, material, and so on. The references are read as described below.

References to figures

The procedures often include references to components or attachment points located on the manipulator/controller. The components or attachment points are marked with *italic text* in the procedures and completed with a reference to the figure where the current component or attachment point is shown.

The denomination in the procedure for the component or attachment point corresponds to the denomination in the referenced figure.

The table below shows an example of a reference to a figure from a step in a procedure.

	Action	Note/Illustration
8.	Remove the <i>rear attachment screws, gearbox</i> .	Shown in the figure Location of gearbox on page xx .

References to required equipment

The procedures often include references to equipment (spare parts, tools, etc.) required for the different actions in the procedure. The equipment is marked with *italic text* in the procedures and completed with a reference to the section where the equipment is listed with further information, that is article number and dimensions.

The designation in the procedure for the component or attachment point corresponds to the designation in the referenced list.

The table below shows an example of a reference to a list of required equipment from a step in a procedure.

	Action	Note/Illustration
3.	Fit a new <i>sealing, axis 2</i> to the gearbox.	Art. no. is specified in Required equipment on page xx .

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 17](#).

Illustrations

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

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

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1 Safety

1.1 Introduction to safety information

Overview

The safety information in this manual is divided into two 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 18](#).
- 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 37](#).

1 Safety

1.2.1 Safety in the manipulator system

1.2 General safety information

1.2.1 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 manipulator is installed.

The users of ABB industrial manipulators 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 manipulator system are designed and installed correctly. Personnel working with manipulators must be familiar with the operation and handling of the industrial manipulator as described in the applicable documents, for example:

- *Operating manual - IRC5 with FlexPendant*
- *Product manual*

Connection of external safety devices

Apart from the built-in safety functions, the manipulator 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 manipulator.

Limitation of liability

Any information given in this manual regarding safety must not be construed as a warranty by ABB that the industrial manipulator 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 manipulator</i>	Installation and commissioning
Changing operating modes	<i>Operating manual - IRC5 with FlexPendant</i>	Operating modes
Restricting the working space	<i>Product manual for the manipulator</i>	Installation and commissioning

1.2.2.1 Safety risks during installation and service work on manipulators

1.2.2 Safety risks

1.2.2.1 Safety risks during installation and service work on manipulators

Overview

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

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

General risks during installation and service

- The instructions in the product manual in the chapter *Installation and commissioning* must always be followed.
- Emergency stop buttons must be positioned in easily accessible places so that the manipulator 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 the manipulator 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 manipulator 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 manipulator system.

Nation/region specific regulations

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

Non-voltage related risks

- Safety zones, which must be crossed before admittance, must be set up in front of the manipulator'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 manipulator's working space.

Continues on next page

1 Safety

1.2.2.1 Safety risks during installation and service work on manipulators

Continued

- The axes are affected by the force of gravity when the brakes are released. In addition to the risk of being hit by moving manipulator parts, there is a risk of being crushed by the parallel arm (if there is one).
- Energy stored in the manipulator for the purpose of counterbalancing certain axes may be released if the manipulator, 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 manipulator as a ladder, which means, do not climb on the manipulator motors or other parts during service work. There is a risk of the manipulator being damaged.

To be observed by the supplier of the complete system

- 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 manipulator

Safety risk	Description
Hot components!	 CAUTION Motors and gears are HOT after running the manipulator! Touching motors and gears may result in burns! With a higher environment temperature, more surfaces on the manipulator will get HOT and may also result in burns.
Removed parts may result in collapse of manipulator!	 WARNING Take any necessary measures to ensure that the manipulator does not collapse as parts are removed, e.g. secure the lower arm according to repair instruction if removing motor, axis 2.
Removed cables to the measurement system	 WARNING If the internal cables for the measurement system have been disconnected during repair or maintenance, then the revolution counters must be updated.

Continues on next page

1.2.2.1 Safety risks during installation and service work on manipulators

*Continued***Cabling**

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

Gearboxes and motors

Safety risk	Description
Gears may be damaged if excessive force is used!	 CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!
Dangerous balancing device!	 WARNING <i>Do not</i> 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!

1 Safety

1.2.2.2 CAUTION - Hot parts may cause burns!

Description

During normal operation, many manipulator parts become hot, especially the drive motors and gears. 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 manipulator get hot and may result in burns.

Elimination

The instructions below detail how to avoid the dangers specified above:

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

1.2.2.3 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 manipulator 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 Safety

1.2.2.4 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 manipulator 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 checked 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.

1.2.2.5 Safety risks during operational disturbances**General**

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

Qualified personnel

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

Extraordinary risks

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

1 Safety

1.2.2.6 Risks associated with live electric parts

1.2.2.6 Risks associated with live electric parts

Voltage related risks, general

Work on the electrical equipment of the manipulator 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 mains switch to OFF) when repairing faults, disconnecting electric leads and disconnecting or connecting units.
- The mains supply to the robot must be connected in such a way that it can be turned off from outside the robot's working space.

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

All work must be performed:

- by qualified personnel
- on machine/manipulator 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 mains supply/mains 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

Continued

Voltage related risks, manipulator

A danger of high voltage is associated with the manipulator 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).

See chapter *Installation and commissioning on page 51*.

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

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

1 Safety

1.2.3.1 Safety fence dimensions

1.2.3 Safety actions

1.2.3.1 Safety fence dimensions

General

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

Dimensioning

Dimension the fence or enclosure to enable it to withstand the force created if the load being handled by the manipulator is dropped or released at maximum speed. Determine the maximum speed from the maximum velocities of the manipulator axes and from the position at which the manipulator 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 manipulator.

1.2.3.2 Fire extinguishing



Note

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

1 Safety

1.2.3.3 Emergency release of the manipulator's arm

Description

In an emergency situation, any of the manipulator's axes may be released manually by pushing the brake release buttons .

How to release the brakes is detailed in the section:

- *Manually releasing the brakes on page 62.*

The manipulator arm may be moved manually on smaller manipulator 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!

1.2.3.4 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 checked as described below:

- 1 Run each manipulator axis to a position where the combined weight of the manipulator arm and any load is maximized (max. static load).
- 2 Switch the motor to the MOTORS OFF position with the operating mode selector on the controller.
- 3 Check that the axis maintains its position.

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

1 Safety

1.2.3.5 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".

1.2.3.6 Safe use of the FlexPendant

Enabling device

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

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



Note

The enabling device is a push-button located on the side of the FlexPendant 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 FlexPendant, 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 manipulator to move.
- Anyone entering the manipulator working space must always bring the FlexPendant with him/her. This is to prevent anyone else from taking control of the manipulator 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 Safety

1.2.3.7 Work inside the manipulator's working range



WARNING

If work must be carried out within the manipulator's work area, the following points must be observed:

- The operating mode selector on the controller must be in the manual mode position to render the enabling device operational and to block operation from a computer link or remote control panel.
- The manipulator's speed is limited to max. 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 manipulator. 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 manipulator or inside the cell.
- Test the motor brake on each axis, according to the section [*Brake testing on page 31*](#).



WARNING

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

1.2.4 Safety stops

1.2.4.1 What is an emergency stop?

Definition of emergency stop

An emergency stop is a state that overrides any other manipulator control, disconnects drive power from the manipulator motors, stops all moving parts, and disconnects power from any potentially dangerous functions controlled by the manipulator system.

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

The manipulator system can be configured so that the emergency stop results in either:

- An uncontrolled stop, immediately stopping the manipulator actions by disconnecting power from the motors.
- A controlled stop, stopping the manipulator actions with power available to the motors so that the manipulator path can be maintained. When completed, power is disconnected from the motors.

The default setting is an uncontrolled stop. However, controlled stops are preferred since they minimize extra, unnecessary wear on the manipulator and the actions needed to return the manipulator system back to production. Please consult your plant or cell documentation to see how your manipulator system is configured.



Note

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



Note

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



Note

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

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

Continues on next page

1 Safety

1.2.4.1 What is an emergency stop?

Continued

Classification of stops

The safety standards that regulate automation and manipulator equipment define categories in which each type of stop applies:

If the stop is...	... then it is classified as...
uncontrolled	category 0 (zero)
controlled	category 1

Emergency stop devices

In a manipulator system there are several emergency stop devices that can be operated in order to achieve an emergency stop. There are emergency stop buttons available on the FlexPendant and on the controller cabinet (on the Control Module on a Dual Cabinet Controller). There can also be other types of emergency stops on your manipulator. Consult your plant or cell documentation to see how your manipulator system is configured.

1.3 Safety related instructions

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 this manual. 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 manipulator labels

Introduction to labels

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

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

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



Note

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

Types of labels

Both the manipulator 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 manipulator system, for example during installation, service, or operation.

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

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

Symbols on safety labels

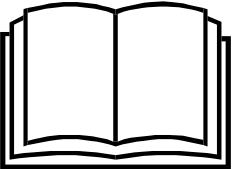
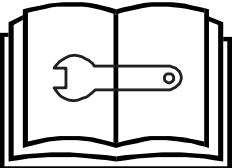
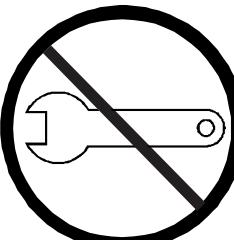
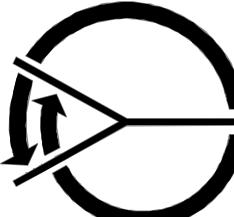
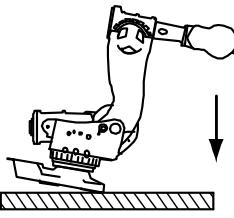
Symbol	Description
	Warning! Warns that an accident <i>may</i> occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion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

Continues on next page

1 Safety

1.3.2 Safety symbols on manipulator labels

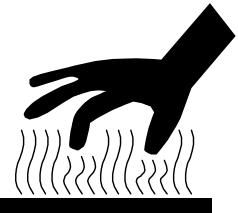
Continued

Symbol	Description
 xx0900000813	See user documentation Read user documentation for details. Which manual to read is defined by the symbol: <ul style="list-style-type: none">• No text: <i>Product manual</i>.• EPS: <i>Application manual - Electronic Position Switches</i>.
 xx0900000816	Before dismantling see product manual
 xx0900000815	Do not dismantle Dismantling this part can cause injury.
 xx0900000814	Extended rotation This axis has extended rotation (working area) compared to standard.
 xx0900000808	Brake release Pressing this button will release the brakes. This means that the manipulator arm can fall down.
 xx0900000810	Tip risk when loosening bolts The manipulator can tip over if the bolts are not securely fastened.

Continues on next page

1.3.2 Safety symbols on manipulator labels

Continued

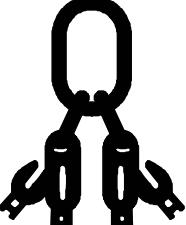
Symbol	Description
 xx0900000817	Crush Risk of crush injuries.
 xx0900000818	Heat Risk of heat that can cause burns.
 xx0900000819	Moving robot The robot can move unexpectedly.
 xx0900000820	Brake release buttons

Continues on next page

1 Safety

1.3.2 Safety symbols on manipulator labels

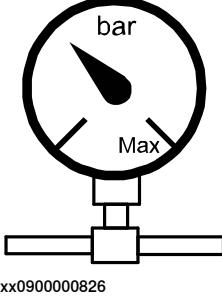
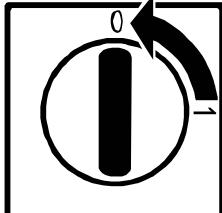
Continued

Symbol	Description
 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
 xx1000001144	No mechanical stop
 xx0900000825	Stored energy Warns that this part contains stored energy. Used in combination with <i>Do not dismantle</i> symbol.

Continues on next page

1.3.2 Safety symbols on manipulator labels

Continued

Symbol	Description
 xx0900000826	Pressure Warns that this part is pressurized. Usually contains additional text with the pressure level.
 xx0900000827	Shut off with handle Use the power switch on the controller.

1 Safety

1.3.3 DANGER - Moving manipulators are potentially lethal!

Description

Any moving manipulator is a potentially lethal machine.

When running, the manipulator 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 manipulator.

Elimination

	Action	Note
1	Before attempting to run the manipulator, make sure all <i>emergency stop equipment</i> 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 manipulator before pressing the start button.	

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

1.3.4 DANGER - First test run may cause injury or damage!**Description**

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

Elimination

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

	Action
1	Remove all service tools and foreign objects from the robot and its working area
2	Check that the fixture and workpiece are well secured, if applicable
3	Install all safety equipment properly
4	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
5	Pay special attention to the function of the part previously serviced

Collision risks**CAUTION**

When programming the movements of the manipulator always check potential collision risks before the first test run.

1 Safety

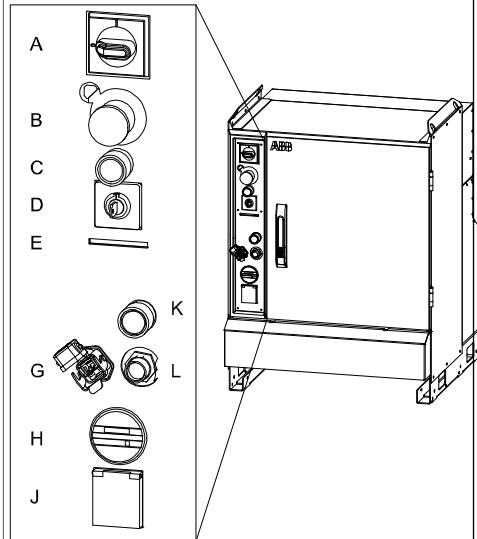
1.3.5 DANGER - Make sure that the main power has been switched off!

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

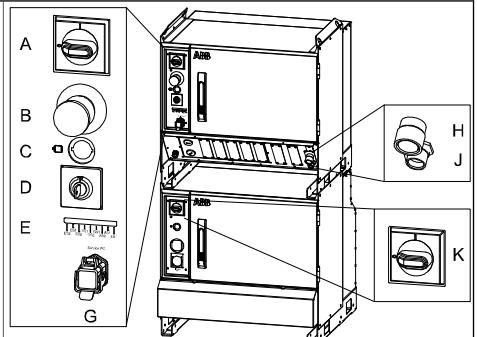
Description

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, Single Cabinet Controller

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

Elimination, Dual Cabinet Controller

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

1.3.6 WARNING - The unit is sensitive to ESD!

1.3.6 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

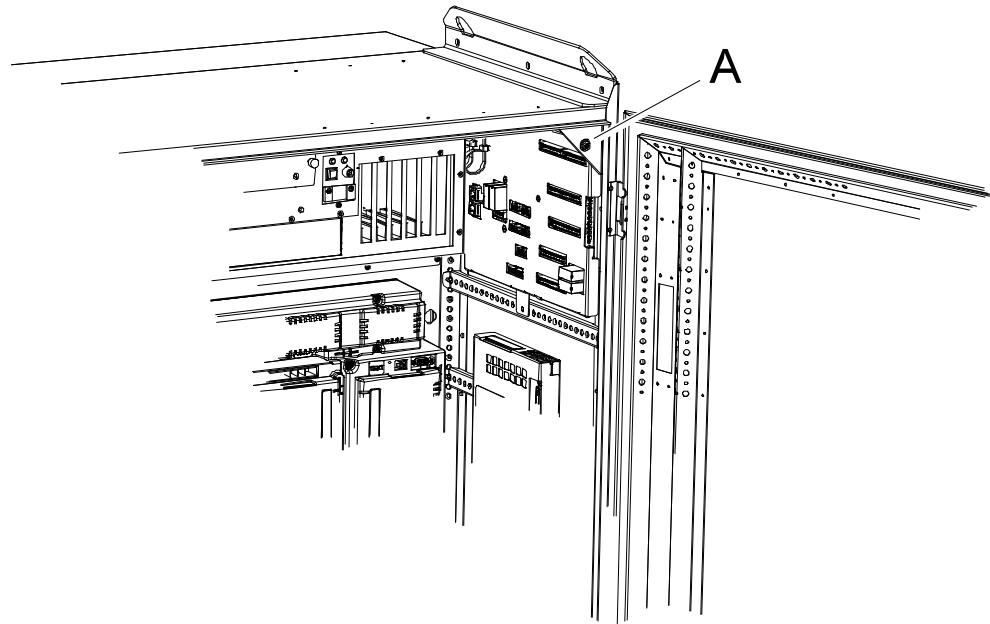
	Action	Note
1	Use a wrist strap	Wrist straps must be tested frequently to ensure that they are not damaged and are operating correctly.
2	Use an ESD protective floor mat.	The mat must be grounded through a current-limiting resistor.
3	Use a dissipative table mat.	The mat should provide a controlled discharge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

The wrist strap button is located in the top right corner.



xx0500002171

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

1 Safety

1.3.7 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 <i>Pre-installation procedure on page 52</i> .
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.	

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

1.3.8 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.

**Note**

Appropriate disposal regulations must be observed.

**Note**

Take special care when handling hot lubricants.

Warnings and elimination

Warning	Description	Elimination/Action
 xx0100000002 Hot oil or grease	Changing and draining gearbox oil or grease may require handling hot lubricant heated up to 90 °C.	Make sure that protective gear like goggles and gloves are always worn during this activity.
 xx0100000002 Allergic reaction	When working with gearbox lubricant there is a risk of an allergic reaction.	Make sure that protective gear like goggles and gloves are always worn.
 xx0100000002 Possible pressure build-up in gearbox	When opening the oil or grease plug, there may be pressure present in the gearbox, causing lubricant to spray from the opening.	Open the plug carefully and keep away from the opening. Do not overfill the gearbox when filling.

Continues on next page

1 Safety

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

Continued

Warning	Description	Elimination/Action
 xx010000002 Do not overfill	<p>Overfilling of gearbox lubricant can lead to internal over-pressure inside the gearbox which in turn may:</p> <ul style="list-style-type: none">• damage seals and gaskets• completely press out seals and gaskets• prevent the robot from moving freely.	<p>Make sure not to overfill the gearbox when filling it with oil or grease!</p> <p>After filling, check the correct level.</p>
 xx010000004 Specified amount depends on drained volume	<p>The specified amount of oil or grease is based on the total volume of the gearbox. When changing the lubricant, the amount refilled may differ from the specified amount, depending on how much has previously been drained from the gearbox.</p>	<p>After refilling, check the lubricant level.</p>

2 Installation and commissioning

2.1 Introduction

General

This chapter contains information for installing the IRB 120 at the working site.

More detailed technical data can be found in the *Product specification* for the IRB 120, such as:

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

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 17](#) before performing any installation work.



Note

If the IRB 120 is connected to power, always make sure that the robot is connected to *protective earth* before starting any installation work!

For more information see:

- *Product manual - IRC5*

2 Installation and commissioning

2.2.1 Pre-installation procedure

2.2 Unpacking

2.2.1 Pre-installation procedure

Introduction

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

Checking the pre-requisites for installation

Installation craftsmen working with an ABB robot must:

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

	Action
1	Visually inspect the robot to make sure that it is not damaged.
2	Make sure that the lifting device used is suitable to handle the weight of the robot as specified in: <ul style="list-style-type: none">• <i>Weight, robot on page 52</i>
3	If the robot is not installed directly, it must be stored as described in: <ul style="list-style-type: none">• <i>Storage conditions, robot on page 54</i>
4	Make sure that the expected operating environment of the robot conforms to the specifications as described in: <ul style="list-style-type: none">• <i>Operating conditions, robot on page 54</i>
5	Before taking the robot to its installation site, make sure that the site conforms to: <ul style="list-style-type: none">• <i>Loads on foundation, robot on page 53</i>• <i>Protection classes, robot on page 55</i>• <i>Requirements, foundation on page 54</i>
6	Before moving the robot, please observe the stability of the robot: <ul style="list-style-type: none">• <i>Risk of tipping/stability on page 58</i>
7	When these prerequisites are met, the robot can be taken to its installation site as described in section: <ul style="list-style-type: none">• <i>On-site installation on page 59</i>
8	Install required equipment, if any.

Weight, robot

The table shows the weight of the robot.

Robot model	Weight
IRB 120	25 kg



Note

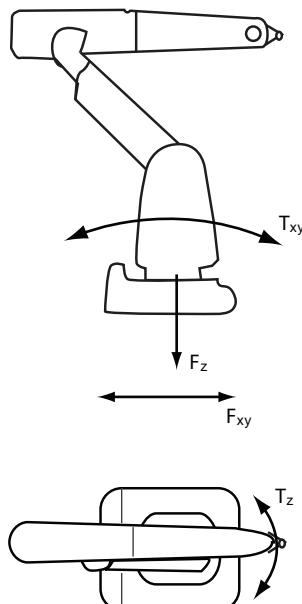
The weight does not include tools and other equipment fitted on the robot!

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Continued

Loads on foundation, robot

The illustration shows the directions of the robots stress forces. The directions are valid for all floor mounted and suspended robots.



xx1100000521

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

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



Note

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

Floor mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 265 N	± 515 N
Force z	-265 ± 200 N	-265 ± 365 N
Torque xy	± 195 Nm	± 400 Nm
Torque z	± 85 Nm	± 155 Nm

Wall mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 470 N	± 735 N
Force z	0 ± 200 N	0 ± 630 N

Continues on next page

2 Installation and commissioning

2.2.1 Pre-installation procedure

Continued

Force	Endurance load (in operation)	Max. load (emergency stop)
Torque xy	±240 Nm	±450 Nm
Torque z	±90 Nm	±175 Nm

Suspended

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	±265 N	±515 N
Force z	265 ±200 N	265 ±365 N
Torque xy	±195 Nm	±400 Nm
Torque z	±85 Nm	±155 Nm

Requirements, foundation

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

Requirement	Value	Note
Maximum deviation from levelness	0.1/500 mm	Flat foundations give better repeatability of the resolver calibration compared to original settings on delivery from ABB. The value for levelness aims at the circumstance of the anchoring points in the robot base. In order to compensate for an uneven surface, the robot can be recalibrated during installation. If resolver calibration is changed this will influence the absolute accuracy.
Maximum tilt	5°	The limit for the maximum payload on the robot is reduced if the robot is tilted from 0°. Contact ABB for further information about acceptable loads.
Minimum resonance frequency	22 Hz	

Storage conditions, robot

The table shows the allowed storage conditions for the robot:

Parameter	Value
Minimum ambient temperature	-25° C
Maximum ambient temperature	+55° C
Maximum ambient temperature (less than 24 hrs)	+70° C
Maximum ambient humidity	95% at constant temperature (gaseous only)

Operating conditions, robot

The table shows the allowed operating conditions for the robot:

Parameter	Value
Minimum ambient temperature	+5° C
Maximum ambient temperature	+45° C

Continues on next page

2.2.1 Pre-installation procedure

Continued

Parameter	Value
Maximum ambient humidity	Max 95% at constant temperature

Protection classes, robot

The table shows the protection class of the robot:

Equipment	Protection class
Manipulator, protection type Standard	IP 30
Manipulator, protection type Clean Room	IP 30

2 Installation and commissioning

2.2.2 Working range and type of motion

2.2.2 Working range and type of motion

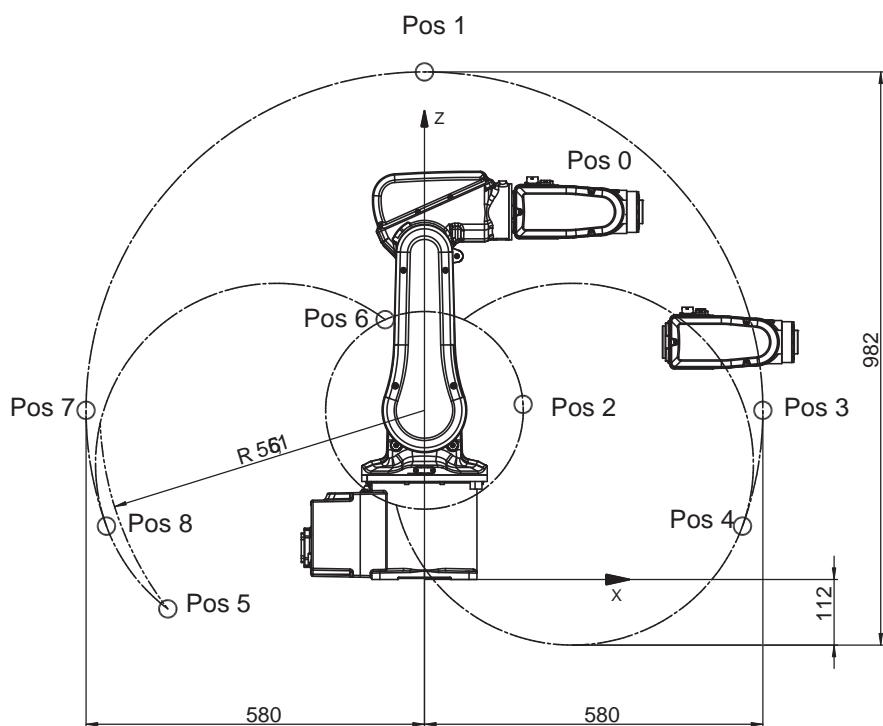
Working range

The figures show the working ranges of the robot.

The extreme positions of the robot arm are specified at the wrist center (dimensions in mm).

Working range

The illustration shows the unrestricted working range of the robot.



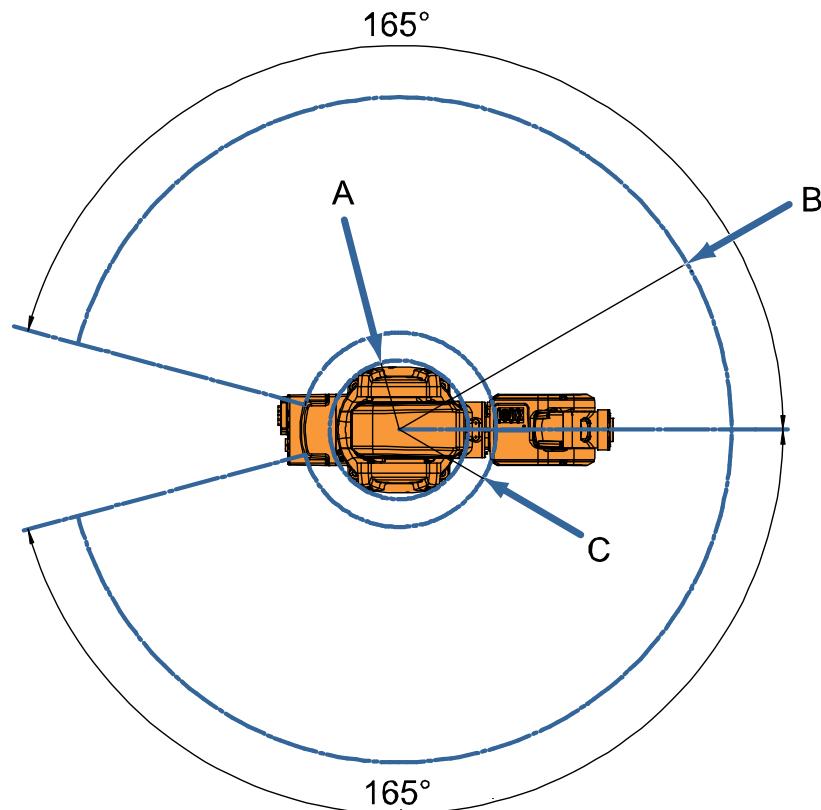
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Pos	Position at wrist center (mm)		Angle (degrees)	
	X	Z	Axis 2	Axis 3
A	302 mm	630 mm	0°	0°
B	0 mm	870 mm	0°	-77°
C	169 mm	300 mm	0°	+70°
D	580 mm	270 mm	+90°	-77°
E	545 mm	91 mm	+110°	-77°
F	-440 mm	-50 mm	-110°	-110°
G	-67 mm	445 mm	-110°	+70°
H	-580 mm	270 mm	-90°	-77°
J	-545 mm	91 mm	-110°	-77°

Continues on next page

*Continued***Turning radius**

The turning radius of robot is shown in the figure.



xx0900000157

Robot variant	Pos. A	Pos. B	Pos. C
IRB 120-3/0.6	R121 ¹⁾	R580	R169.4

1) Minimum turning radius axis 1.

Robot motion

The table specifies the types and ranges of motion in every axes.

Location of motion	Type of motion	Range of movement
Axis 1	Rotation motion	+165° to -165°
Axis 2	Arm motion	+110° to -110°
Axis 3	Arm motion	+70° to -110°
Axis 4	Wrist motion	+160° to -160°
Axis 5	Bend motion	+120° to -120°
Axis 6	Turn motion	+400° to -400° (default) +242 revolutions to -242 revolutions maximum ⁱ

ⁱ The default working range for axis 6 can be extended by changing parameter values in the software. Option 610-1 Independent axis can be used for resetting the revolution counter after the axis has been rotated (no need for "rewinding" the axis).

2 Installation and commissioning

2.2.3 Risk of tipping/stability

2.2.3 Risk of tipping/stability

Risk of tipping

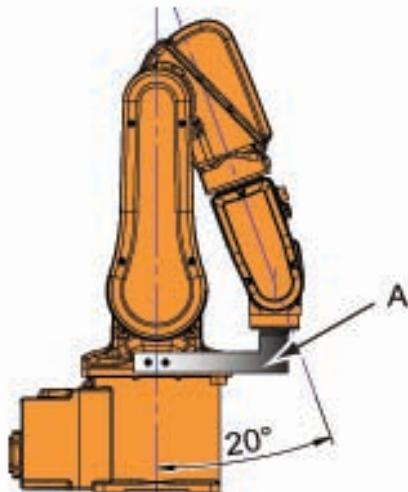
If the robot is not fastened to the foundation and standing still, the robot is not stable in the whole working area. Moving the arms will displace the center of gravity, which may cause the robot to tip over.

The shipping position is the most stable position.

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

Shipping and transport position

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



xx0900000580



WARNING

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

2.3 On-site installation

2.3.1 Lifting the robot with roundslings

Introduction

This procedure details how to lift the robot using roundslings.

Required equipment

Equipment	Note
Overhead crane	-
Roundslings	(Circle) Length: 3 m Lifting capacity: 100 kg
Lifting tool, set	The set includes: <ul style="list-style-type: none">• bracket• attachment screws• washers. <p>For art. no. and details see chapter <i>Reference information</i> section: • Special tools on page 214</p>

Lifting

Attach the roundslings as shown in the figure.



CAUTION

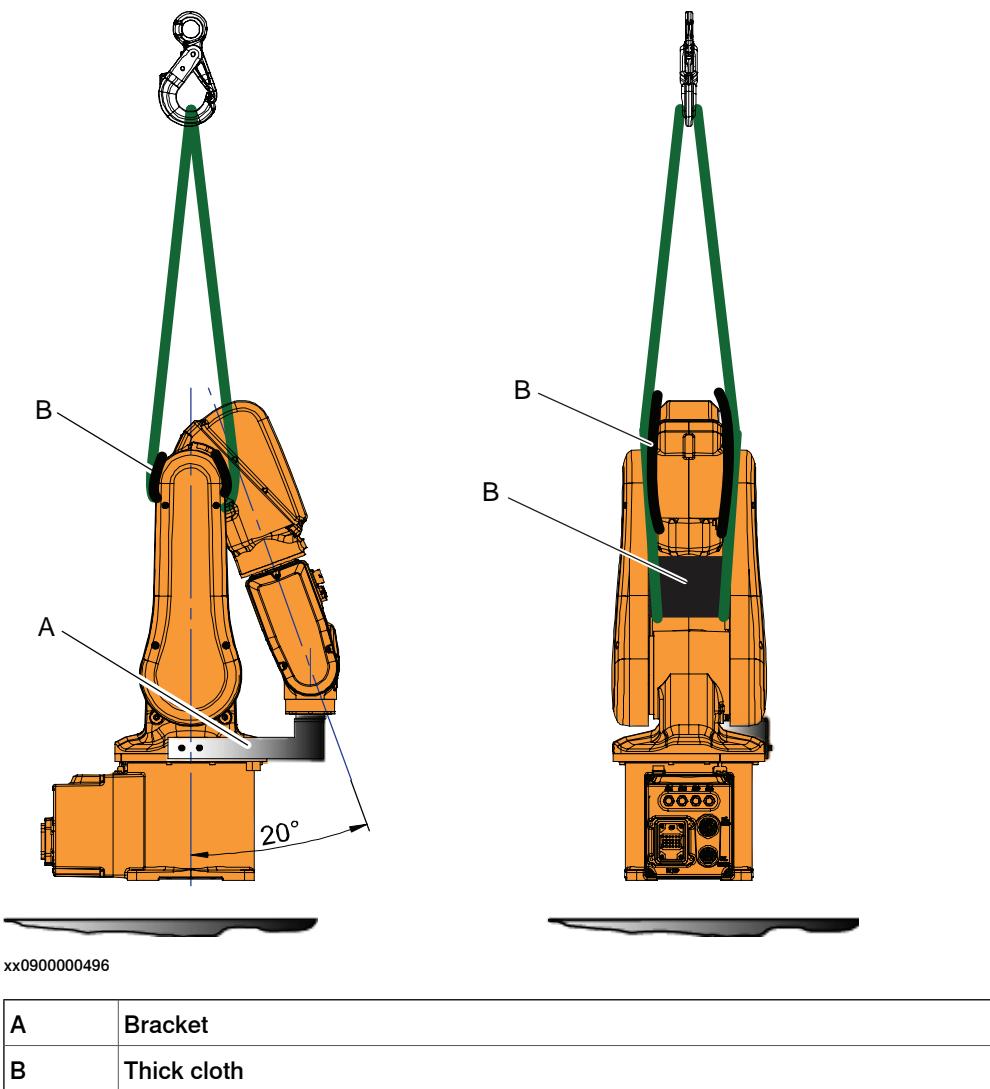
Use a thick cloth between round sling and robot where robot surface directly contact with round sling.

Continues on next page

2 Installation and commissioning

2.3.1 Lifting the robot with roundslings

Continued



Lifting instructions

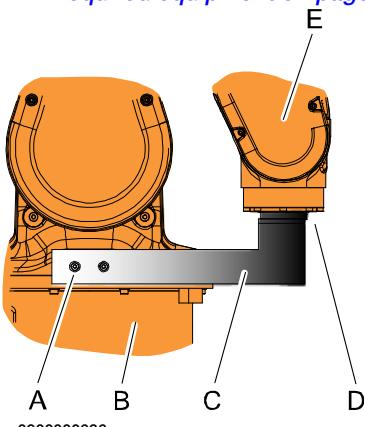
Use this procedure to lift the robot in a safe way.

	Action	Note
1	! CAUTION The IRB 120 robot weighs 25 kg. All lifting accessories used must be sized accordingly!	
2	! CAUTION Attempting to lift the robot in any other position than that recommended may result in the robot tipping over and causing severe damage or injury!	

Continues on next page

2.3.1 Lifting the robot with roundslings

Continued

Action	Note
3  WARNING Personnel must not, under any circumstances, be present under the suspended load!	
4 Move the robot to its most stable position.	Detailed in section: • Risk of tipping/stability on page 58
5  DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
6 Fit the <i>bracket</i> with its attachment screws and washers, in order to secure the upper arm to the base.	<p>See Required equipment on page 59.</p>  <p>xx0900000636</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screws M4x8 quality steel 8.8 ELZN (2 pcs) B: Base C: Bracket D: Attachment screws M5x12 quality 8.8-A2F (2 pcs) E: Upper arm
7 Attach the <i>roundsling</i> .	See the figure in: • Lifting on page 59
8 Lift the robot with an overhead crane.	

2 Installation and commissioning

2.3.2 Manually releasing the brakes

2.3.2 Manually releasing the brakes

Introduction to manually releasing the brakes

This section describes how to release the holding brakes of each axis' motor.

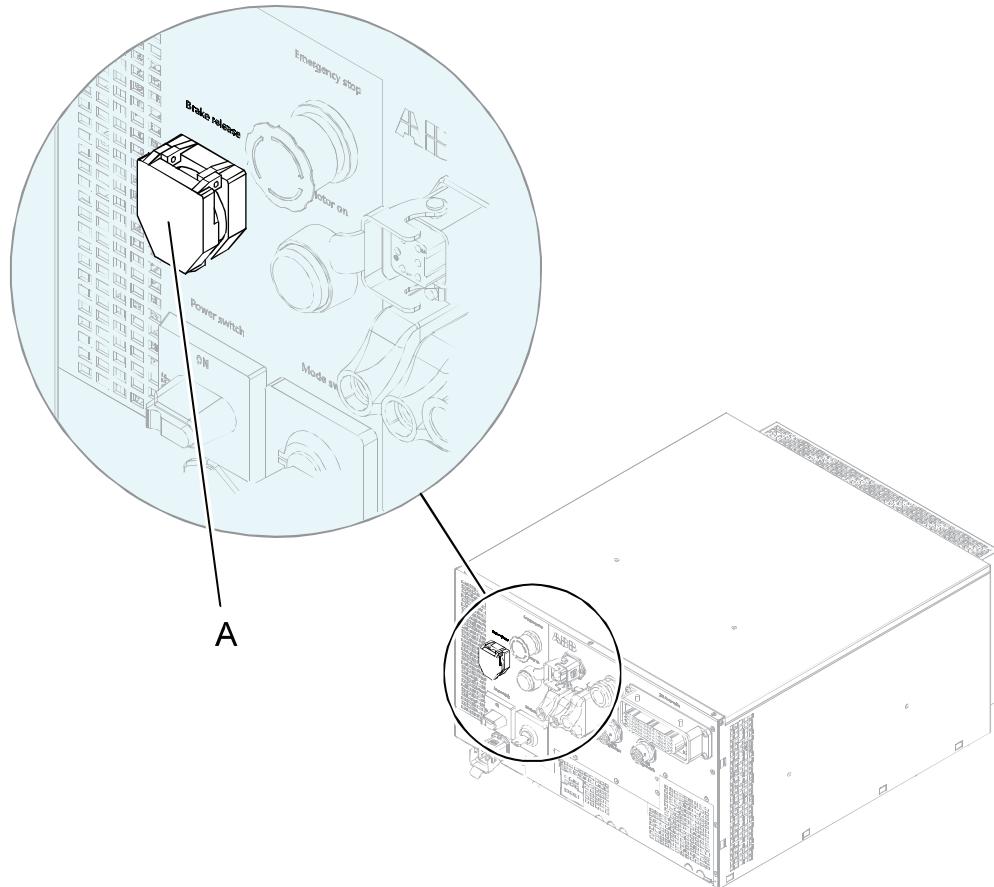
This can be done in three ways:

- using the brake release unit (placed on the front of the IRC5 Compact controller cabinet) when the robot is connected to the controller
- using the brake release unit when the robot is disconnected from the controller, but connected to an external power supply at the connector R1.MP
- using an external voltage supply directly on the motor connector.

Brake release button at the front of IRC5 Compact controller

There is no brake release button placed on the robot. It is placed at the front of the IRC5 Compact controller cabinet, beneath the cover over the brake release button.

See figure:



xx0900000559

A	Brake release button (beneath the cover)
---	--

Continues on next page

*Continued***Using the brake release unit when the robot is connected to the controller**

Use this procedure to release the holding brakes using the internal brake release unit in the controller cabinet.

	Action	Note
1	<p>The <i>brake release button</i> is located on the front of the IRC5 Compact controller cabinet.</p> <p> Note</p> <p>The single brake release button, is used to release the brakes on all axes.</p>	<p>See the figure in:</p> <ul style="list-style-type: none"> • <i>Brake release button at the front of IRC5 Compact controller on page 62</i>
2	<p> DANGER</p> <p>When releasing the holding brakes, the robot axes may move very quickly and sometimes in unexpected ways!</p> <p>Make sure no personnel is near the robot when brakes are released!</p>	
3	<p>Release the holding brakes by pushing the brake release button.</p> <p>The brake will function again as soon as the button is released.</p>	<p> Note</p> <p>The controller must be powered on!</p>

Using the brake release unit with an external power supply

Use this procedure to release the holding brakes, when the robot is not connected to the controller.

	Action	Note
1	<p> Note</p> <p>Be careful not to interchange the 24V and 0V pins.</p> <p>If they are mixed up, damage can be caused to the brake release unit and to the system board.</p>	

Continues on next page

2 Installation and commissioning

2.3.2 Manually releasing the brakes

Continued

Action	Note
2 Connect an external 24VDC power supply to connector R1.MP on the robot base.	 xx0900000638 Connect to connector R1.MP: <ul style="list-style-type: none">A: 0V to pin 12B: 24V to pin 13
3 CAUTION The holding brakes are released to all axes when power is connected to the pins.	

2.3.3 Orienting and securing the robot

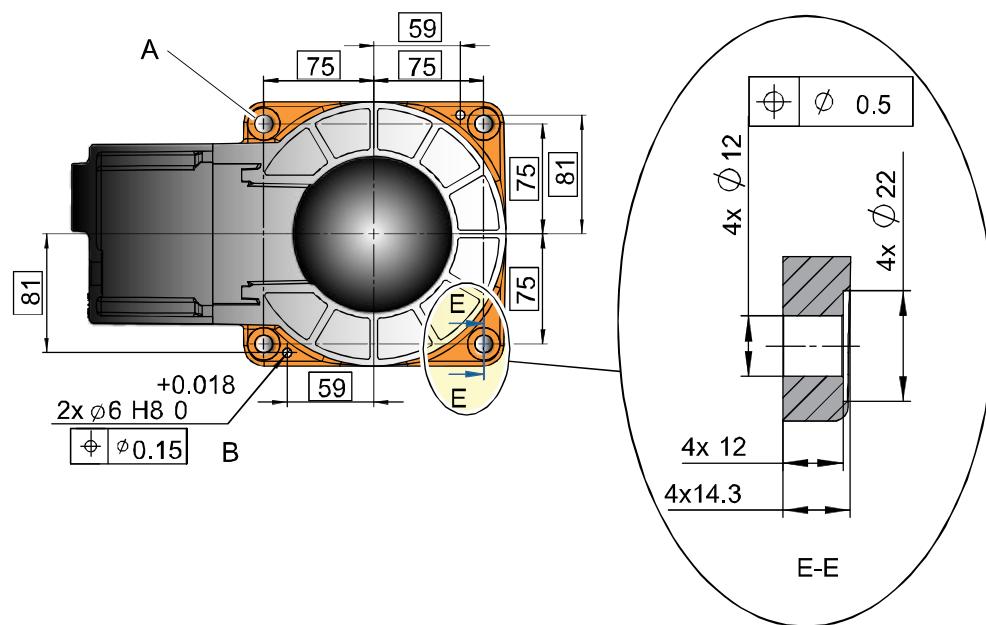
Introduction

This section details how to orient and secure the robot to the foundation or base plate in order to run the robot safely. The requirements made on the foundation are shown in sections:

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

Hole configuration, base

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



xx0900000162

A	Holes for attachment screws (4 pcs)
B	Holes for pins (2 pcs)

Specification, attachment screws and pins

The table specifies the type of securing screws and washers to be used to secure the robot to the foundation or base plate. It also specifies the type of pins to be used.

Securing parts/Facts	Dimension	Note
Securing screws	M10x25 Quality 8.8-A3F	4 pcs
Washers	10	4 pcs
Tightening torque	35 Nm	
Pins	D6x20 ISO 2338-6 m6x30 - A1	2 pcs

Continues on next page

2 Installation and commissioning

2.3.3 Orienting and securing the robot

Continued

Securing parts/Facts	Dimension	Note
Level surface requirements	 0.2 xx0900000643	

Orienting and securing the robot

Use this procedure to orient and secure the robot.

	Action	Info
1	Make sure the installation site for the robot conforms to the specifications in section: <ul style="list-style-type: none">Pre-installation procedure on page 52.	
2	Prepare the installation site with attachment holes.	The hole configuration of the base is shown in the figure in: <ul style="list-style-type: none">Hole configuration, base on page 65
3	 CAUTION The robot weighs 25 kg. All lifting equipment must be sized accordingly!	
4	 CAUTION When the robot is put down after being lifted or transported, there is a risk of it tipping, if not properly secured.	
5	Lift the robot to its installation site.	How to lift the robot is described in section: <ul style="list-style-type: none">Lifting the robot with roundslings on page 59
6	Fit two pins to the holes in the base.	
7	Guide the robot gently, using the attachment screws while lowering it into its mounting position.	Make sure the robot base is correctly fitted onto the pins.
8	Fit the <i>securing screws and washers</i> in the attachment holes of the base.	
9	Tighten the bolts in a criss-cross pattern to ensure that the base is not distorted.	

Securing robot on a mounting plate

When bolting a mounting plate or frame to a concrete floor, follow the general instructions for expansion-shell bolts.

Screw joints must be able to withstand the stress loads defined in section [Loads on foundation, robot on page 53](#).

2.3.4 Fitting equipment on robot

Introduction

The robot features mounting holes for additional equipment.

Access to any of these mounting holes may be obstructed by any additional cabling, equipment etc. fitted by the robot user. Make sure the required mounting holes are accessible when planning the robot cell.



Note

Never drill a hole in the robot without first consulting ABB!

Maximum loads

The table shows the maximum permitted loads for any extra equipment fitted in the holes intended for this purpose. See figure in [Fitting equipment on base and upper arm on page 68](#).

Robot	Max load A (base, on each side)	Max load B (upper arm)
IRB 120	0.5 kg	0.3 kg

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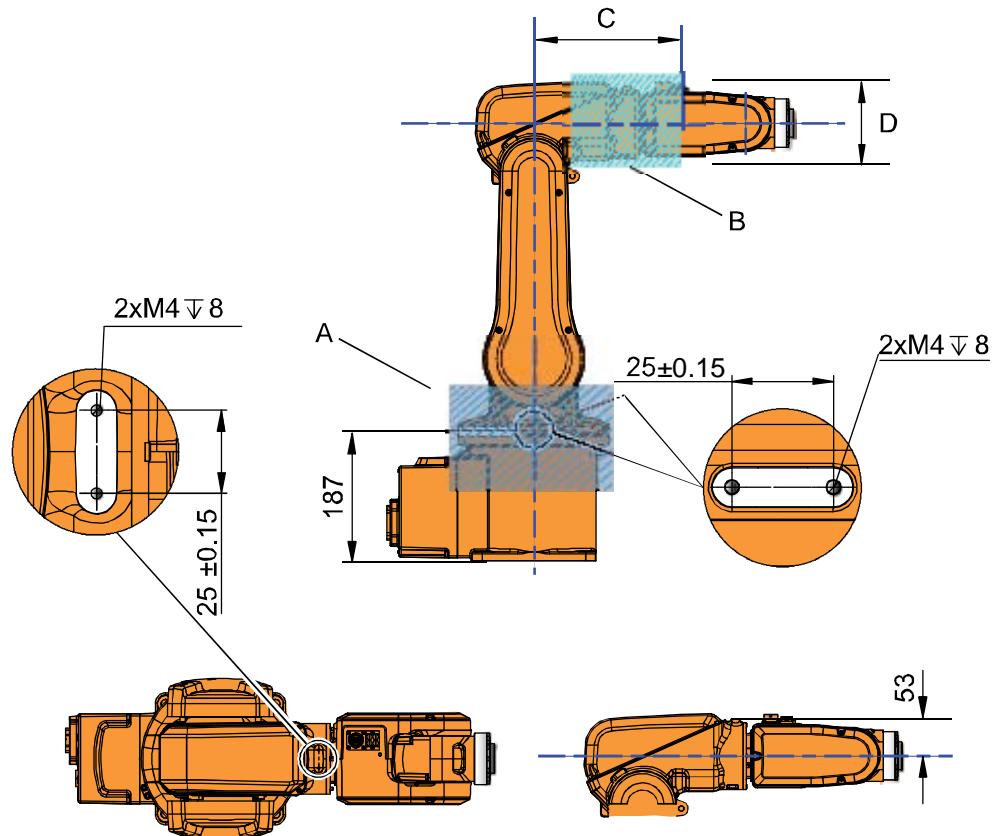
2 Installation and commissioning

2.3.4 Fitting equipment on robot

Continued

Fitting equipment on base and upper arm

The illustration shows the fitting holes available for fitting extra equipment on the base and upper arm of the robot.



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A	Load area base, max load 0.5 kg (on each side)
B	Load area upper arm, max load 0.3 kg
C	Max. 172 mm
D	Max. radius 75 mm

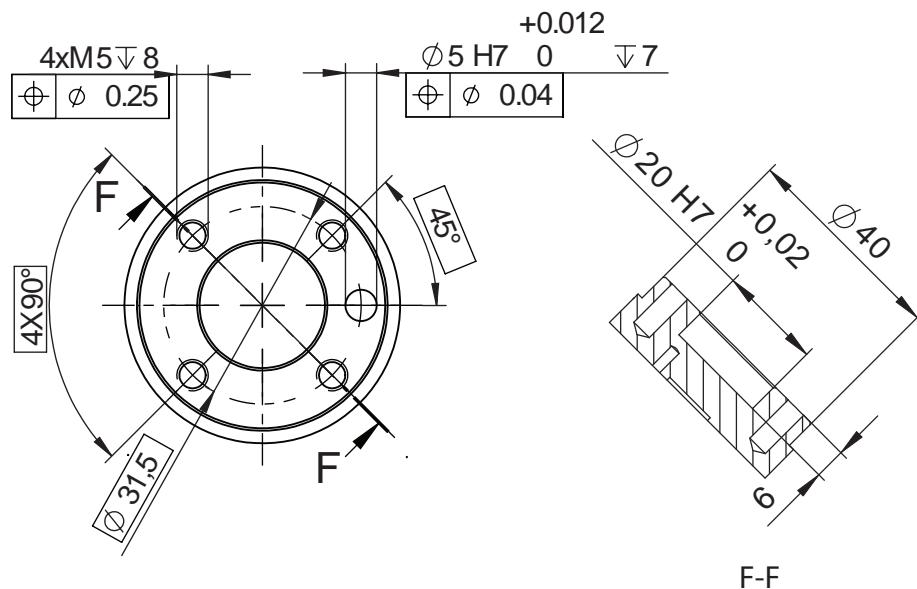
NOTE! Fitting holes at the base of the robot are placed on each side.

Continues on next page

Continued

Fitting equipment on mounting flange

The illustration shows the mechanical interface for the mounting flange.



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2 Installation and commissioning

2.3.5 Setting the system parameters for a suspended robot

General

Initially the system is configured for mounting on the floor, without leaning. The method for mounting the robot in a suspended position is basically the same as for floor mounting.



Note

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

System parameters

If the robot is mounted at any other angle, the system parameter *Gravity Beta* must be updated. *Gravity Beta* specifies the robot's mounting angle expressed in radians.



Note

Gravity Beta must be configured correctly so that the robot system can control the movements in the best possible way. An incorrect definition of the mounting angle (*Gravity Beta*) will result in:

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

Mounting angles and values

The parameter *Gravity Beta* specifies the robot's mounting angle in radians. It is calculated in the following way.

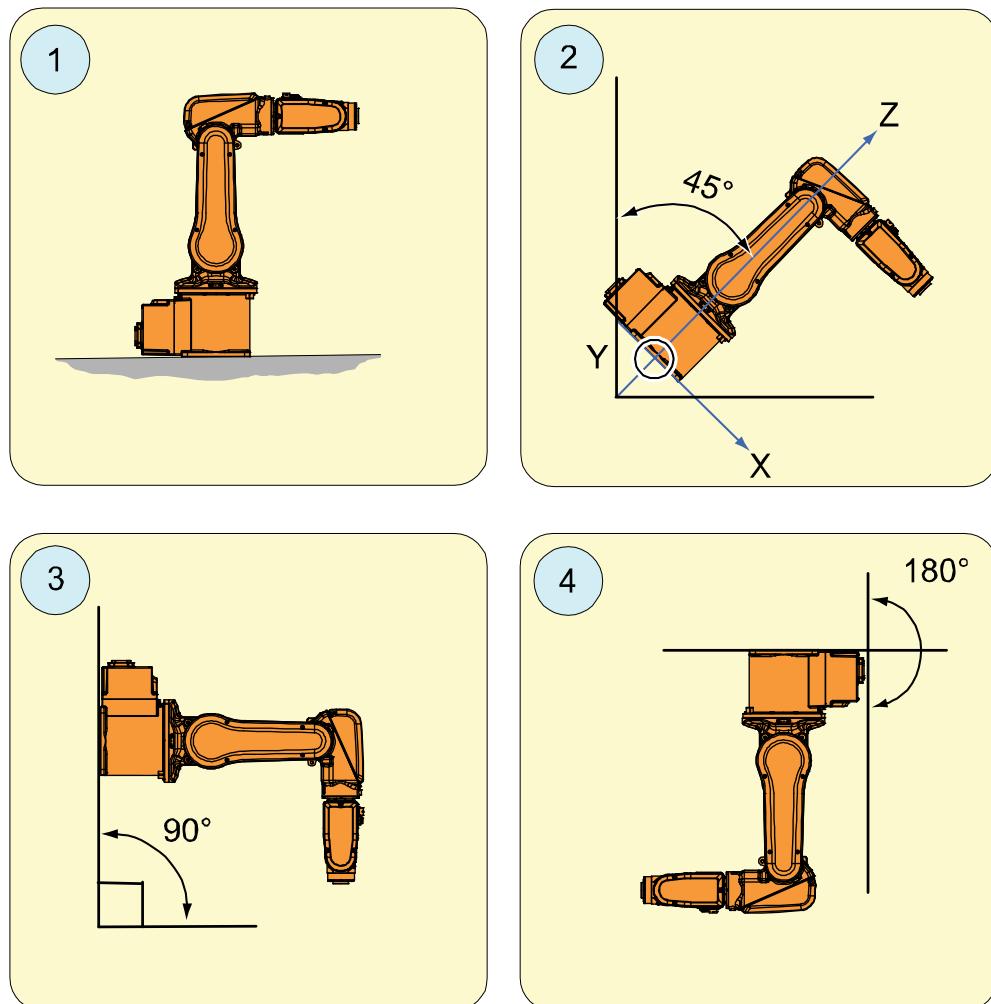
$\text{Gravity Beta} = A^\circ \times 3.141593/180 = B \text{ radians}$, where A is the mounting angle in degrees and B is the mounting angle in radians.

Example of position	Mounting angle (A°)	Gravity Beta
Floor (A)	0°	0.000000 (Default)
Wall (C)	90°	1.570796
Suspended (D)	180°	3.141593

Continues on next page

2.3.5 Setting the system parameters for a suspended robot

Continued



xx1000000126

Pos 1	Floor mounted
Pos 2	Mounting angle 45° (Tilted)
Pos 3	Mounting angle 90° (Wall)
Pos 4	Mounting angle 180° (Suspended)

Defining the parameter in the software

The value of the system parameter *Gravity Beta* must be redefined when changing the mounting angle of the robot. The parameter belongs to the type *Robot*, in the topic *Motion*.

How to calculate a new value is detailed in [Mounting angles and values on page 70](#).

The parameter is described in *Technical reference manual - System parameters*.

The parameter can be edited either with the FlexPendant or in RobotStudio. See *Operating manual - IRC5 with FlexPendant* or *Operating manual - RobotStudio*. Article numbers for the manuals are specified in [References on page 10](#).

2 Installation and commissioning

2.3.6 Loads

2.3.6 Loads

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*.

Stop time and braking distances

Robot motor brake performance depends on any loads attached. For information about brake performance, read the Product Specification for the robot.

2.3.7 Installation of signal lamp



Note

Do not use the signal lamp in a Clean Room environment.

Signal lamp

See the mounting/assembly instruction delivered with the signal lamp option.

2 Installation and commissioning

2.4.1 Introduction

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.

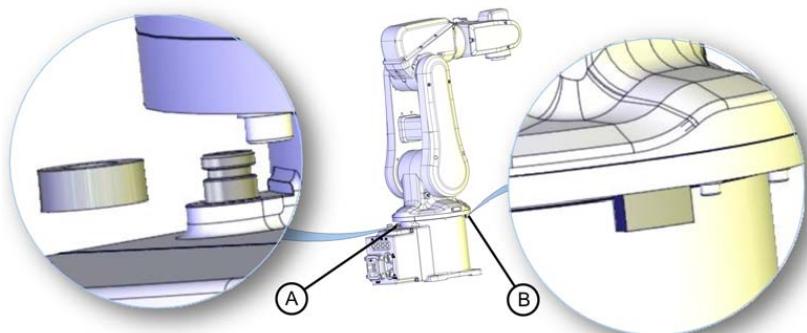
This section describes how to install hardware that restricts the working range.

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

2.4.2 Mechanically restricting the working range

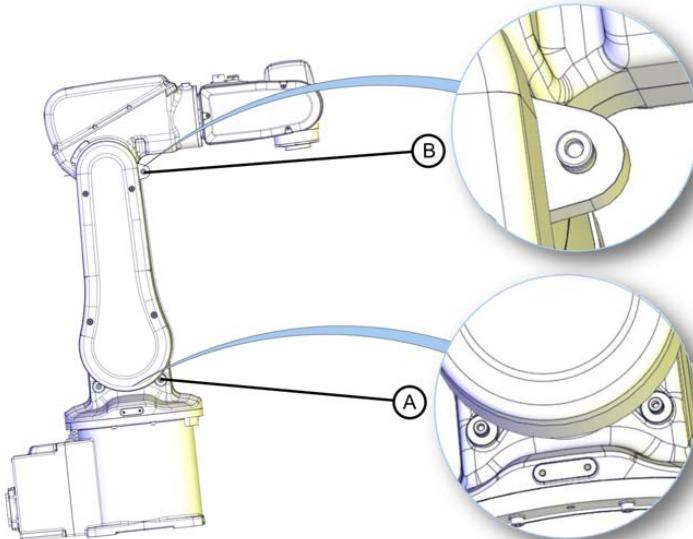
Location of mechanical stops

The figures shows where the mechanical stops are placed on the robot.



xx1000000002

A	Mechanical stop axis 1 (base)
B	Mechanical stop axis 1 (swing plate)



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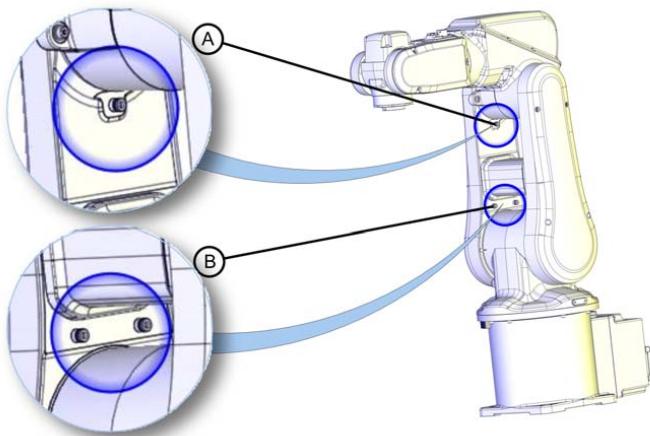
A	Mechanical stop axis 2 (swing housing)
B	Mechanical stops axis 2 (upper arm)

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2 Installation and commissioning

2.4.2 Mechanically restricting the working range

Continued



xx1000000003

A	Mechanical stop axis 3 (lower arm)
B	Mechanical stops axis 2 (lower arm)

2.5 Making robot ready for operation

2.5.1 Additional installation procedure, Clean Room

General

Clean Room robots are specially designed to work in a clean room environment.

Clean Room robots are designed in order to prevent from particle emission from the robot. For example is maintenance work possible to perform without cracking the paint. The robot is painted with four layers of polyurethane paint. The last layer being a varnish over labels in order to simplify cleaning. The paint has been tested regarding outgassing of Volatile Organic Compounds (VOC) and been classified in accordance with ISO 14644-8.

Clean Room parts being replaced must be replaced with parts designed for use in Clean Room environments.

Clean Room class 5

According to IPA test result, the robot IRB 120 is suitable for use in Clean Room environment when these requirements are fulfilled:

- Air cleanliness Class 5 according to ISO 14644-1, when operated at a velocity of 50%.
- Air cleanliness Class 4 according to ISO 14644-1, when operated at a velocity of 100%.

Classification of airborne molecular contamination

Parameter				Outgassing amount		
Area (m ²)	Test duration (s)	Temp (°C)	Performed test	Total detected (ng)	Normed based on 1m ² and 1s(g)	Classification in accordance to ISO 14644-8
4.5E-03	3600	23	TVOC	2848	1.7E-07	-6.8
4.5E-03	60	90	TVOC	46524	1.7E-04	-3.8

Preparations before commissioning a Clean Room robot

During transport and handling of a Clean Room robot, it is likely that the robot has been contaminated with particles of different kinds. Therefore the robot must be minutely cleaned before installation.

Do not apply force on the plastic covers when lifting the robot! This may result in damage or cracks in the paint around the plastic cover.

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

Connection point locations

For information about the connection point locations, see the chapter *Circuit diagram*.

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 the control of the robot's motors as well as feedback from the encoder interface board. Specified in the table in Robot cable, power on page 78 .

The cable categories are divided into sub-categories. See [Robot cables on page 78](#).

Robot cables

The robot cable is included in the standard delivery of the robot. 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, signal	Transfers encoder data from and power supply to the encoder interface board.	XS2	R1.SMB

Robot cable, power

Cable	Art. no.
Robot cable, power: L=3 m	3HAC032694-001
Robot cable, power: L=7 m	3HAC032695-001
Robot cable, power: L=15 m	3HAC032696-001

Robot cable, signal

Cable	Art. no.
Robot cable, signal: L=3 m	3HAC035320-001
Robot cable, signal: L=7 m	3HAC2493-1
Robot cable, signal: L=15 m	3HAC2530-1

2.6.2 Customer connections on robot

Introduction

The customer cables are integrated in the robot and the connectors are placed on the upper arm housing and at the base.

Connectors

The tables describes the connectors on base and upper arm housing.

Connectors, base

Position	Description	Art. no.
Robot	UTOW71210PH06 pin connector 10p, bulkhead	3HAC022117-002
Customer connector	Connector set R1.CP/CS	3HAC037038-001

Connectors, upper arm housing

Position	Description	Art. no.
Robot	UTOW01210SH05 socket connector 10p, flange mounted	3HAC023624-002
Customer connector	Connector set R3.CP/CS	3HAC037070-001

Air, connector

Position	Description	Art. no.
Robot	4xM5	
Customer cable	SMC KJS04-M5 air connector	3HAC032049-001

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2 Installation and commissioning

2.6.2 Customer connections on robot

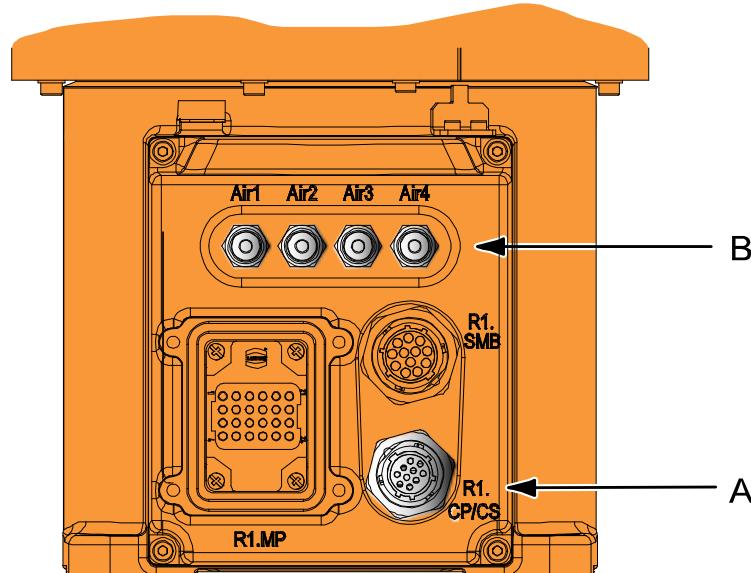
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Customer connections

The location of the customer connections on the base and at the upper arm housing, are shown in the figures:

Customer connections, base

Customer connections, base.

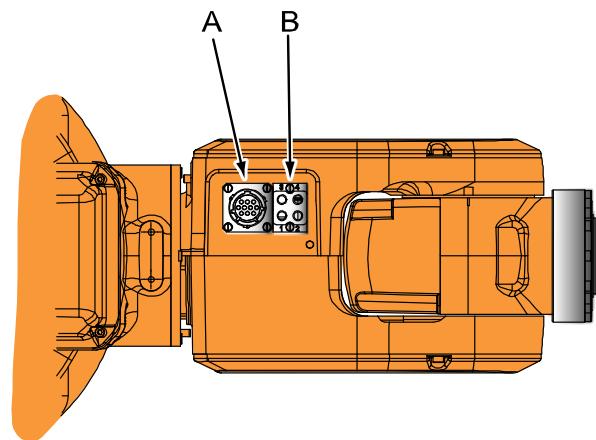


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Pos	Connection	Description	Number	Value
A	R1.CP/CS	Customer power/signal	10	49 V, 500 mA
B	Air	Max 5 bar	4	Inner house diameter 4 mm

Customer connections, upper arm housing

Customer connections, upper arm housing.



xx0900000640

Pos	Connection	Description	Number	Value
A	R3.CP/CS	Customer power/signal	10	49 V, 500 mA
B	Air	Max 5 bar	4	Inner house diameter 4 mm

3 Maintenance

3.1 Introduction

Structure of this chapter

This chapter describes all the maintenance activities recommended for the IRB 120.

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 up 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 17](#) before performing any service work!



Note

If the IRB 120 is connected to power, always make sure that the IRB 120 is connected to protective earth before starting any maintenance work!

For more information see:

- *Product manual - IRC5*

3 Maintenance

3.2.1 Specification of maintenance intervals

3.2 Maintenance schedule

3.2.1 Specification of maintenance intervals

Introduction

The intervals are specified in different ways depending on the type of maintenance activity to be carried out and the working conditions of the IRB 120:

- Calendar time: specified in months regardless of whether the system is running or not.
- Operating time: specified in operating hours. More frequent running means more frequent maintenance activities.
- SIS: specified by the robot's SIS (Service Information System). A typical value is given for a typical work cycle, but the value will differ depending on how hard each part is run. The SIS used in M2004 is further described in the *Operating manual - Service Information System*.

3.2.2 Maintenance schedule

General

The robot, consisting of robot and controller cabinet, must be maintained regularly to ensure its function. The maintenance activities and their respective 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!

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

Activities and intervals, standard equipment

The sections referred to in the table can be found in the different chapters for every maintenance activity.

The table below specifies the required maintenance activities and intervals:

Maintenance activity	Equipment	Interval	Detailed in section:
Inspection	Robot	Regularly ⁱ For Clean Room robots: Daily	Check for abnormal wear or contamination
Inspection	Damper, axes 1, 2 and 3	Regularly ⁱ	Inspecting dampers on page 88
Inspection	Cable harnesses	Regularly ⁱ	Inspection, robot cabling on page 84
Inspection	Timing belts	36 mths ⁱⁱ	Inspecting timing belts on page 90
Inspection	Plastic covers	Regularly ⁱ	Inspecting plastic covers on page 93
Inspection	Mechanical stop pins	Regularly ⁱ	Inspecting mechanical stops on page 85
Replacement	Battery pack, Measurement system	Battery low alert ⁱⁱⁱ	Replacing the battery pack on page 97
Cleaning	Complete robot	Regularly ⁱ	Cleaning, robot on page 100

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

ⁱⁱ Service inspection including dismounting of robot parts shall always be done outside the clean room area.

ⁱⁱⁱ Battery low alert (38213 Battery charge low) is displayed when remaining backup capacity (robot powered off) is less than 2 months. Typical lifetime of a new battery is 36 months if the robot is powered off 2 days/week or 18 months if the robot is powered off 16 h/day. The lifetime can be extended (approx. 3 times) for longer production breaks by a battery shutdown service routine. See *Operating manual - IRC5 with FlexPendant* for instructions.

3 Maintenance

3.3.1 Inspection, robot cabling

3.3 Inspection activities

3.3.1 Inspection, robot cabling

Introduction



CAUTION

Always read the specific instructions for Clean Room robots before doing any repair work, see [Replacing parts on Clean Room robots on page 104](#)

Location, robot cabling

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

Required equipment

Equipment	Note
Standard toolkit	Content is defined in section on page ? .
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.
Circuit diagram	See chapter Circuit diagram on page 227 .

Inspection, robot cabling

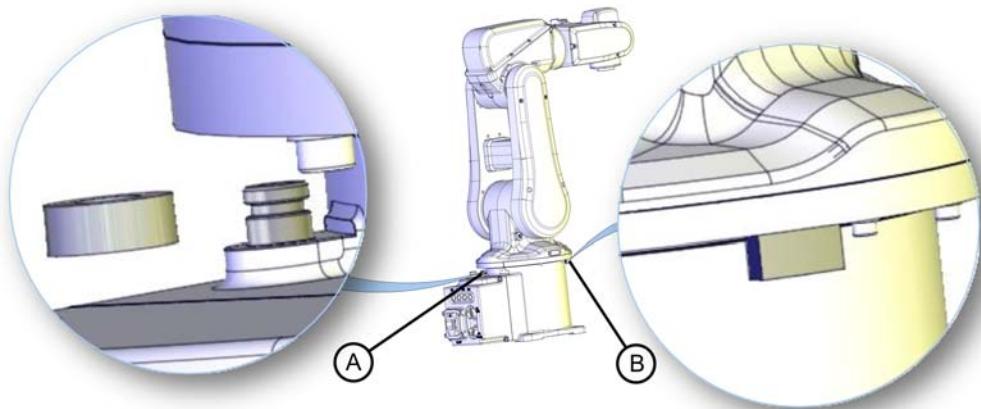
Use this procedure to inspect the robot cabling.

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

3.3.2 Inspecting mechanical stops

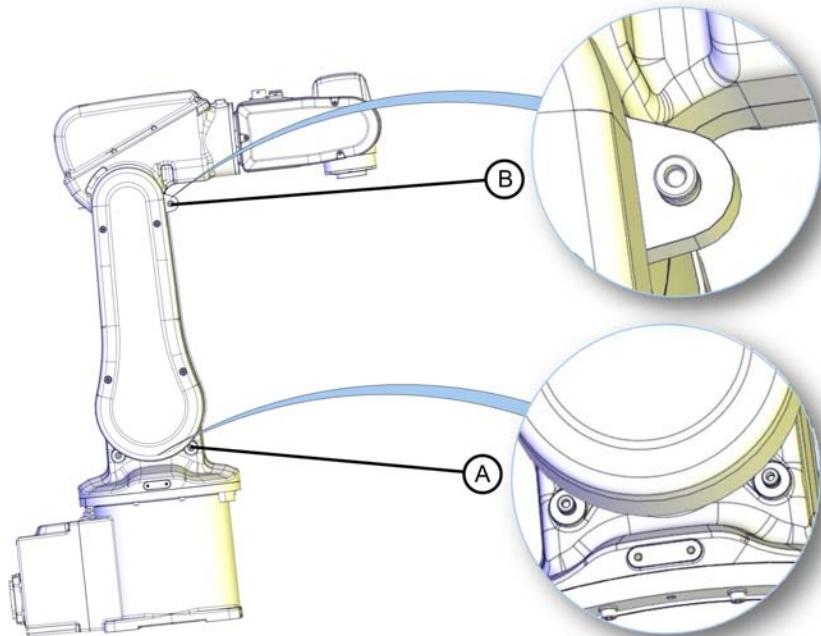
Location of mechanical stops

The mechanical stops on axes 1, 2 and 3 are located as shown in the figures.



xx1000000002

A	Mechanical stop axis 1 (base)
B	Mechanical stop axis 1 (swing plate)



xx0900000583

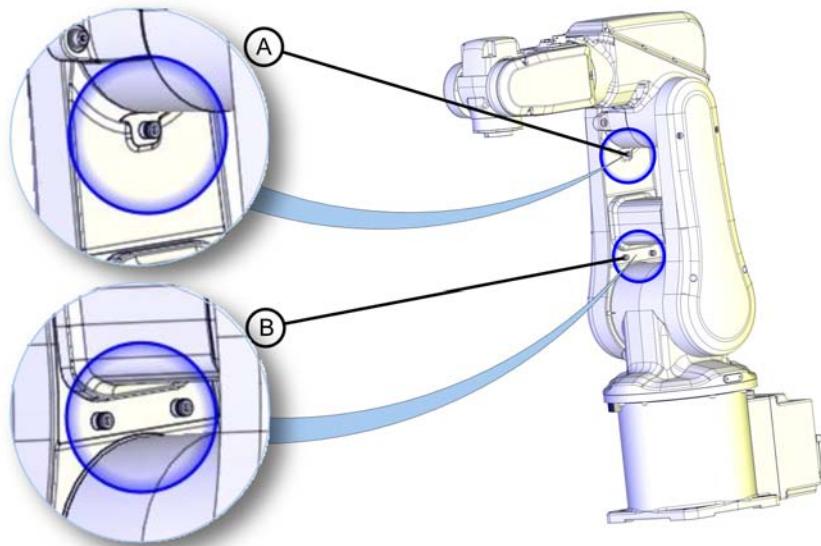
A	Mechanical stops axis 2 (swing housing)
B	Mechanical stop axis 3 (upper arm)

Continues on next page

3 Maintenance

3.3.2 Inspecting mechanical stops

Continued



xx1000000003

A	Mechanical stop axis 3 (lower arm)
B	Mechanical stops axis 2 (lower arm)

Required equipment

Equipment	Note
Mechanical stop, axis 1	For art. no. see: <ul style="list-style-type: none">Spare parts - Axes 1 and 2 on page 217
Mechanical stop, axes 2-3	For art. no. see: <ul style="list-style-type: none">Spare parts - Axis 3 on page 219
Standard toolkit	The content is defined in the section Standard toolkit on page 213 .

Inspecting mechanical stops

Use this procedure to inspect mechanical stops on axes 1, 2 and 3.

	Action	Info
1	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
2	Inspect the <i>mechanical stops</i> .	See the figures in: <ul style="list-style-type: none">Location of mechanical stops on page 85

Continues on next page

3.3.2 Inspecting mechanical stops

Continued

	Action	Info
3	<p>Replace if the mechanical stop is:</p> <ul style="list-style-type: none">• bent• loose• damaged. <p> Note</p> <p>The expected life of gearboxes can be reduced as a result of collisions with the mechanical stop.</p>	

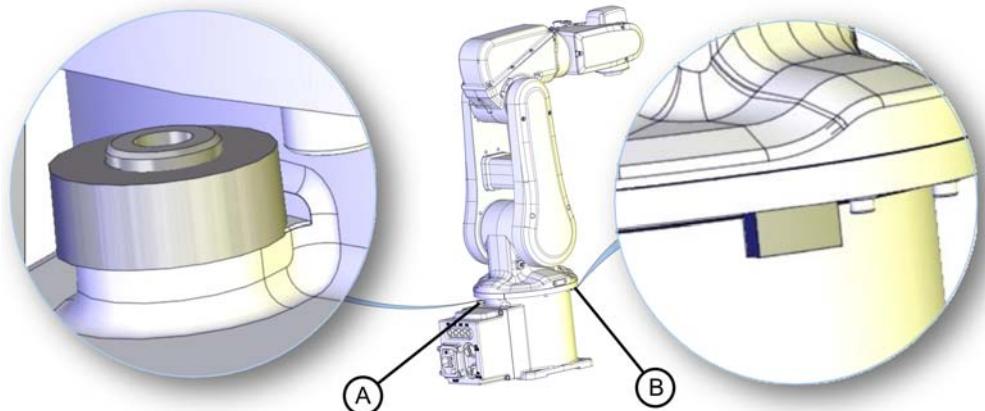
3 Maintenance

3.3.3 Inspecting dampers

3.3.3 Inspecting dampers

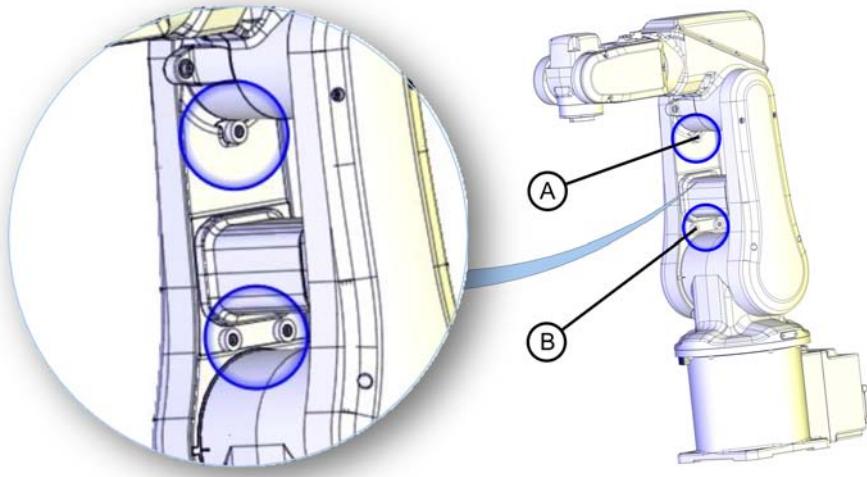
Location of dampers

The location of dampers are shown in the figures.



xx0900000579

A	Damper, axis 1
B	Mechanical stop axis 1 (swing plate)



xx0900000582

A	Damper, axis 3
B	Dampers, axis 2

Required equipment

Equipment	Art. no.	Note
Standard toolkit	-	The content is defined in the section Standard toolkit on page 213 .

Continues on next page

*Continued***Inspecting dampers**

Use this procedure to inspect the dampers.

Action	Info
1  DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
2 Check all <i>dampers</i> for damage such as: <ul style="list-style-type: none">• cracks• existing impressions larger than 1 mm.	See the figure in: <ul style="list-style-type: none">• Location of dampers on page 88
3 Check all <i>attachment screws</i> for deformation.	
4 If any damage is detected, the damper must be replaced with a new one!	

3 Maintenance

3.3.4 Inspecting timing belts

3.3.4 Inspecting timing belts

Introduction



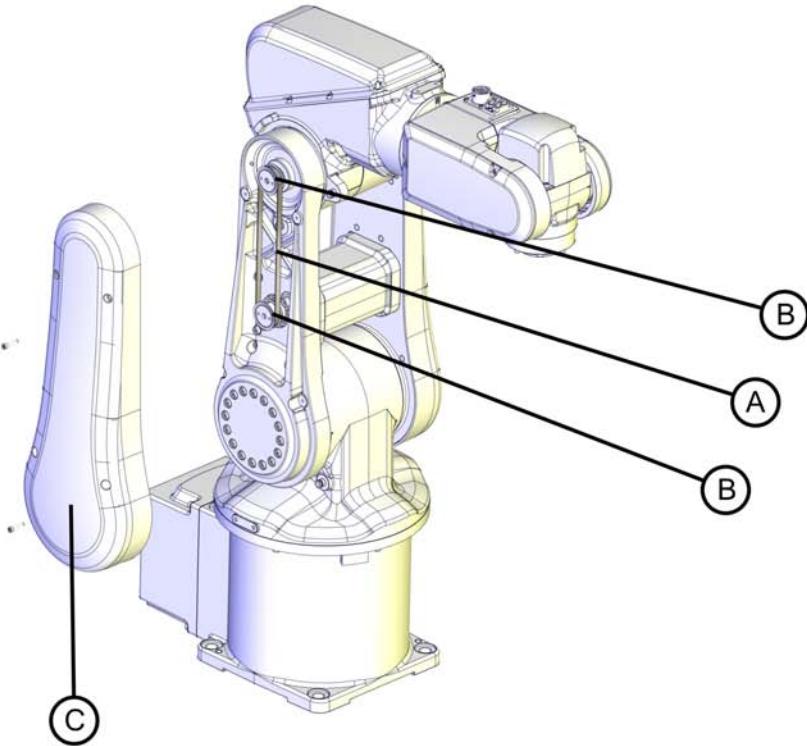
CAUTION

Always read the section "General procedures" before doing any repair work.

[Replacing parts on Clean Room robots on page 104](#)

Location of timing belts

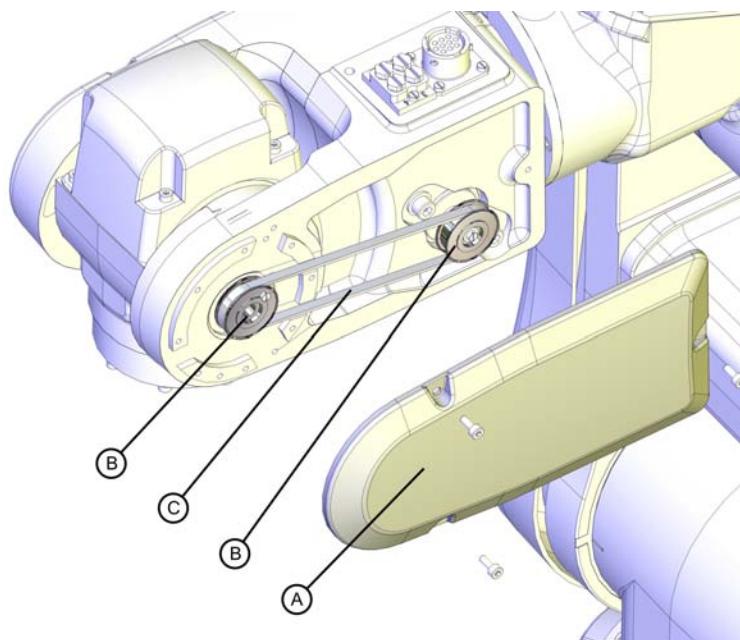
Axes 3 and 5 are fitted with timing belts. These are located as shown in the figures.



xx0900000610

A	Timing belt, axis 3
B	Timing belt pulley (2 pcs)
C	Lower arm cover

Continues on next page

Continued

xx0900000611

A	Wrist side cover
B	Timing belt pulley (2 pcs)
C	Timing belt, axis 5

Required equipment

Equipment	Note
Standard toolkit	The content is defined in the section Standard toolkit on page 213 .
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.

Timing belt tension

The table describes the timing belt tension on axis 3 and 5.

Axis	Timing belt tension
Axis 3	F = 18-19.8N
Axis 5	F = 7.6-8.4N

Inspecting timing belts

Use this procedure to inspect timing belts.

Action	Info
<p>1</p> <p> DANGER</p> <p>Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!</p>	

Continues on next page

3 Maintenance

3.3.4 Inspecting timing belts

Continued

	Action	Info
2	Gain access to each <i>timing belt</i> by removing the plastic cover.	See the figure in: • Location of timing belts on page 90
3	Check the timing belts for damage or wear.	
4	Check the <i>timing belt pulleys</i> for damage.	See the figure in: • Location of timing belts on page 90
5	If any damage or wear is detected, the part must be replaced!	
6	Check each belt for tension. If the belt tension is not correct, adjust it!	For tension values, see: • Timing belt tension on page 91

3.3.5 Inspecting plastic covers

Introduction



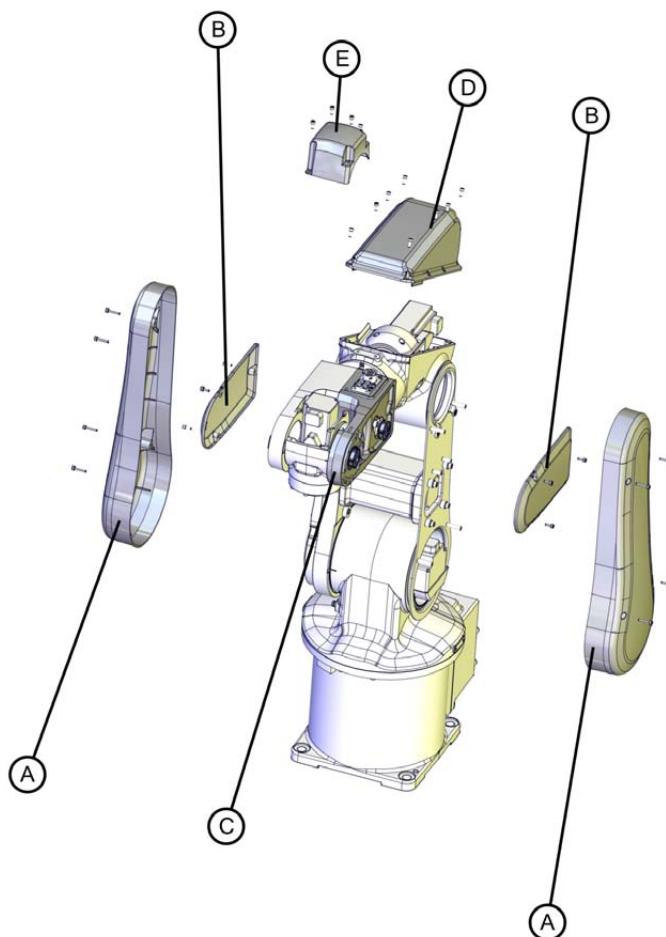
CAUTION

Always read the section "General procedures" before doing any repair work.

[Replacing parts on Clean Room robots on page 104](#)

Location of plastic covers

Plastic covers are located as shown in the figure.



xx0900000607

A	Lower arm cover (2 pcs)
B	Wrist side cover (2 pcs)
C	Wrist support
D	Housing cover
E	Tilt cover

Continues on next page

3 Maintenance

3.3.5 Inspecting plastic covers

Continued

Inspecting plastic covers

Use this procedure to inspect the plastic covers on the robot.

	Action	Info
1	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
2	Check the plastic covers for: <ul style="list-style-type: none">• cracks• other kind of damage.	
3	Replace the plastic cover if cracks or damage is detected.	

3.4 Replacement/changing activities

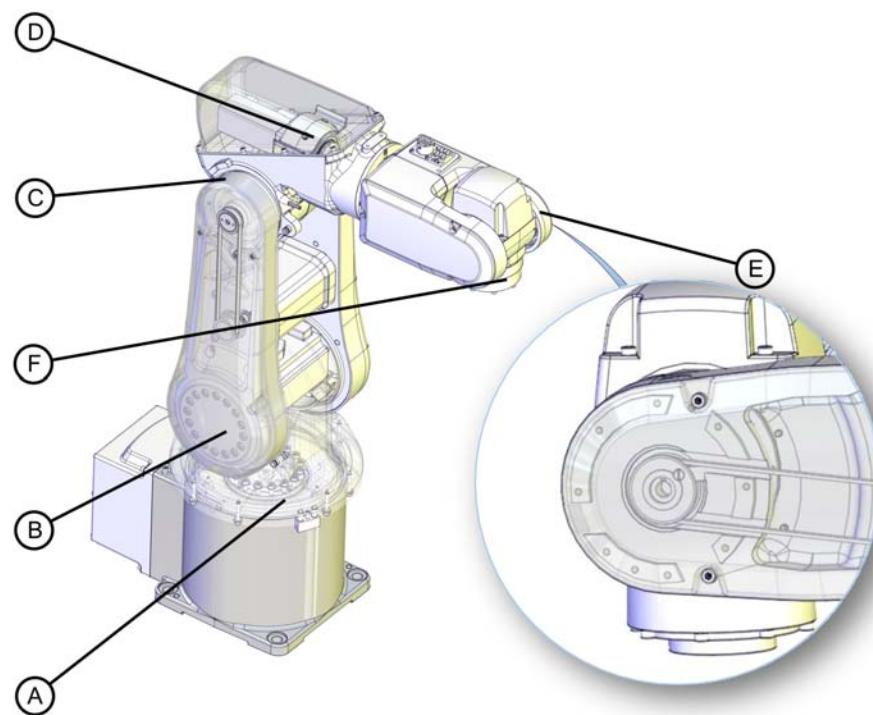
3.4.1 Type of lubrication in gearboxes

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.

Location of gearboxes

The figure shows the location of the gearboxes.



xx0900000612

A	Gearbox, axis 1 (inside the base)
B	Gearbox, axis 2
C	Gearbox, axis 3
D	Gearbox, axis 4
E	Gearbox, axis 5
F	Gearbox, axis 6

Continues on next page

3 Maintenance

3.4.1 Type of lubrication in gearboxes

Continued

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*. Document number is presented in [References on page 10](#). In order to always get the latest information of updates about lubrication in gearboxes, always check on ABB Library for the latest revision of the manual. A new revision will be published on ABB Library immediatly after any updates.

Before starting any inspection, maintenance, or changing activities of lubrication, **always** check ABB Library for the latest revision of this manual. The revision of the manual published on the Documentation DVD (released twice per year) will only contain the latest updates when the Documentation DVD is released. Any updates of the manual in between these releases will be published on ABB Library. Therefore the manual published on the documentation DVD may not contain the latest updates about lubrication. If ABB Library cannot be reached, contact the local ABB Service organisation for more information.

Equipment

Equipment	Note
Oil dispenser	Includes pump with outlet pipe. Use the suggested dispenser or a similar one: • Orion OriCan art. no. 22590 (pneumatic)
Nipple for quick connect fitting, with o-ring	

3.4.2 Replacing the battery pack

Introduction

The section describes how to replace the battery pack on the robot.



CAUTION

Always read the section "General procedures" before doing any repair work.

[Replacing parts on Clean Room robots on page 104](#)

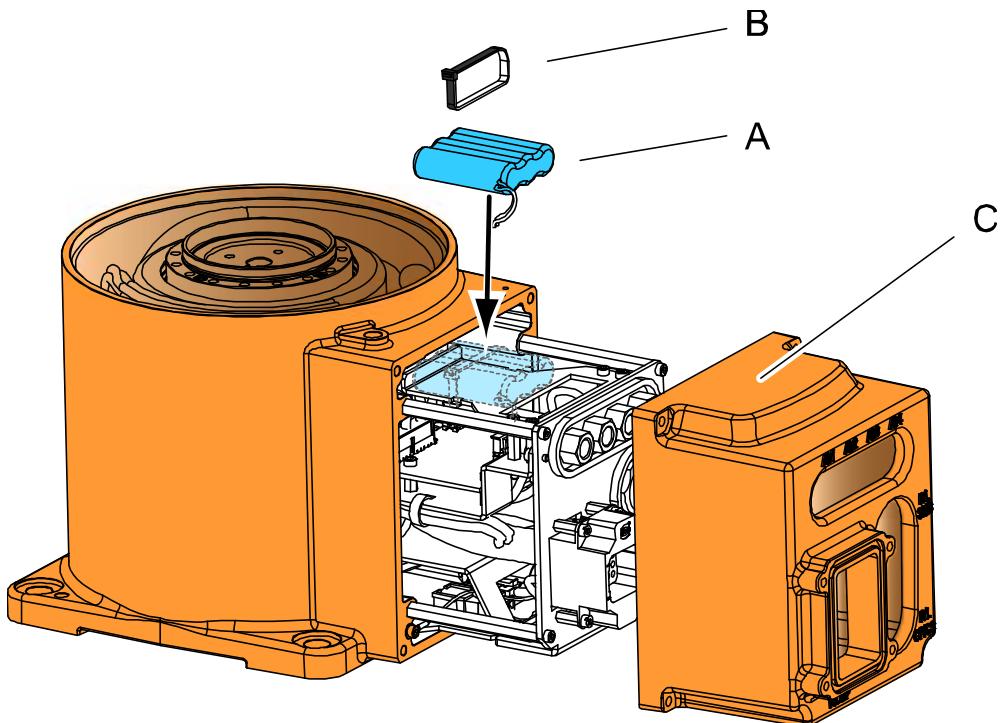


WARNING

See instructions for batteries, [WARNING - Safety risks during handling of batteries on page 48](#).

Location of the battery pack

The location of the battery pack is inside the base cover as shown in the figure.



xx0900000588

A	Cable strap
B	Battery pack
C	Base cover

Continues on next page

3 Maintenance

3.4.2 Replacing the battery pack

Continued

Required equipment

Equipment	Note
Standard toolkit	The content is defined in the section Standard toolkit on page 213 .
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.

Removing the battery pack

Use this procedure to remove the battery pack.

	Action	Info
1	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
2	 CAUTION Always cut the paint with a knife and grind the paint edge when disassembling parts of a Clean Room robot! See Replacing parts on Clean Room robots on page 104	
3	Remove the <i>base cover</i> from the robot by removing its attachment screws.	The <i>battery pack</i> is located inside the base cover as shown in the figure in: <ul style="list-style-type: none">• Location of the battery pack on page 97
4	Disconnect the battery cable from the Encoder Interface Board.	
5	Cut the cable strap.	
6	Remove the battery pack.	

Refitting the battery pack

Use this procedure to refit the battery pack.

	Action	Info
1	Clean Room robots: clean the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
2	Fit the new battery pack with a <i>cable strap</i> .	See the figure in: <ul style="list-style-type: none">• Location of the battery pack on page 97
3	Connect the battery cable to the Encoder Interface Board.	
4	Refit the <i>base cover</i> to the robot with its attachment screws.	See the figure in: <ul style="list-style-type: none">• Location of the battery pack on page 97

Continues on next page

3.4.2 Replacing the battery pack

Continued

Action	Info
5 Clean Room robots: seal and paint the joints that have been opened. See <i>Replacing parts on Clean Room robots on page 104</i>  Note After all repair work, wipe the robot free from particles with spirit on a lint free cloth.	
6 Update the revolution counters.	

3 Maintenance

3.5.1 Cleaning, robot

3.5 Cleaning activities

3.5.1 Cleaning, robot



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 robot is cleaned regularly. The frequency of cleaning depends on the environment in which the robot works. Different cleaning methods are allowed depending on the protection class of the robot.



Note

Always check the serial number label for verification of the robot protection class.

Cleaning activities

The instruction specifies the allowed cleaning methods for the robot.

Cleaning method	Standard robot
Vacuum cleaner	Yes
Wiping with cloth	Yes. Use light cleaning detergent.

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 120 and any external unit.

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

The procedures are gathered in sections, divided according to the component location on the IRB 120.

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 207](#).

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 17](#) before commencing any service work.



Note

If the IRB 120 is connected to power, always make sure that the IRB 120 is connected to *earth* before starting any repair work.

For more information see:

- *Product manual - IRC5*

4 Repair

4.2.1 Mounting instructions for seals

4.2 General procedures

4.2.1 Mounting instructions for seals

General

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

Equipment

Equipment, etc.	Art. no.	Note
Grease	3HAB3537-1	Used to lubricate the seals.

Rotating seals

The procedure below describes how to fit rotating seals.



CAUTION

Please observe the following before commencing any assembly of seals:

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

	Action	Note
1	Check the seal to ensure that: <ul style="list-style-type: none">• The seal is of the correct type (provided with cutting edge).• There is no damage to the sealing edge (feel with a fingernail).	
2	Inspect the sealing surface before mounting. If scratches or damage are found, the seal must be replaced since it may result in future leakage.	
3	Lubricate the seal with <i>grease</i> 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.	Art. no. is specified in Equipment on page 102 .
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

4.2.1 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 Repair

4.2.2 Replacing parts on Clean Room robots

4.2.2 Replacing parts on Clean Room robots

General

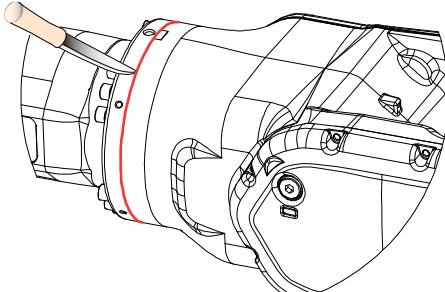
When replacing parts on a Clean Room robot, it is important to make sure that after the replacement, no particles will be emitted from the joint between the structure and the new part, and that the easy cleaned surface is retained.

Required equipment

Equipment	Spare parts	Note
Sealing compound		Sikaflex 521 FC. Color white.
Tooling pin		Width 6-9 mm, made of wood.
Spirit		Etanol
Knife		
Lint free cloth		
Touch up paint Clean Room, White	3HAC036639-001	

Removing

Use this procedure when removing a part for replacement on a Clean Room robot.

Action	Description
<p>1 Cut the paint with a knife in the joint between the part that will be removed and the structure, to avoid that the paint cracks.</p> <p>! CAUTION</p> <p>Be careful not to damage the plastic covers when cutting!</p> <p>! CAUTION</p> <p>Seal glue is filled in the gap between lower arm cover and lower arm (axis 3 timing belt side). The glue should be removed and the surface cleaned.</p>	 xx0900000121
2 Carefully grind the paint edge that is left on the structure to a smooth surface.	

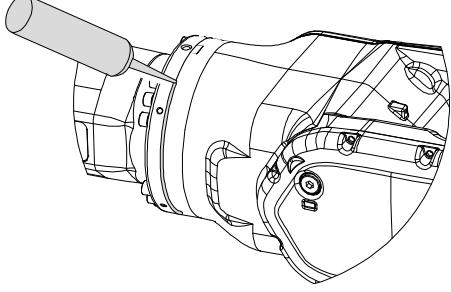
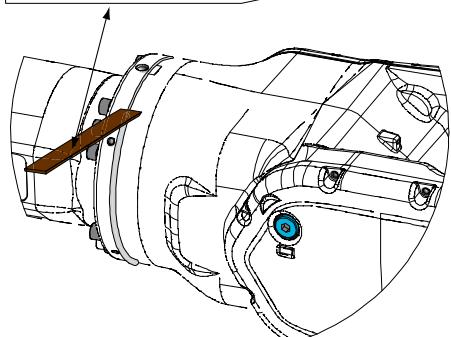
Refitting

Action	Description
1 Before the parts are refitted, clean the joint so that it is free from oil and grease.	Use etanol on a lint free cloth.
2 Place the tooling pin in hot water.	

Continues on next page

4.2.2 Replacing parts on Clean Room robots

Continued

Action	Description
3 Seal all refitted joints with Sikaflex 521FC.	 xx0900000122
4 Use the tooling pin to even out the surface of the Sikaflex seal.	 xx0900000125
5 Wait 15 minutes.	Sikaflex 521FC skin dry time (15 minutes).
6  Note Always read the instruction with Product Data Sheet in the Paint Repair Kit Foundry Prime	3HAC035355-001.
7 Use Touch up paint Clean Room, white to paint the joint.  Note Always read the instruction with Product Data Sheet in the Paint Repair Kit Clean Room	3HAC036639-001.

**Note**

After all repair work, wipe the robot free from particles with spirit on a lint free cloth.

4 Repair

4.3.1 Removing the cable harness

4.3 Cable harness

4.3.1 Removing the cable harness

Introduction

These procedures describes how to remove the complete cable harness in:

- 1 the wrist - [Removing the cable harness in the wrist on page 107](#)
- 2 the upper arm housing - [Removing the cable harness in the upper arm housing on page 112](#)
- 3 the lower arm and swing plate - [Removing the cable harness in the lower arm on page 114](#)
- 4 the base - [Removing the cable harness in the base on page 116.](#)

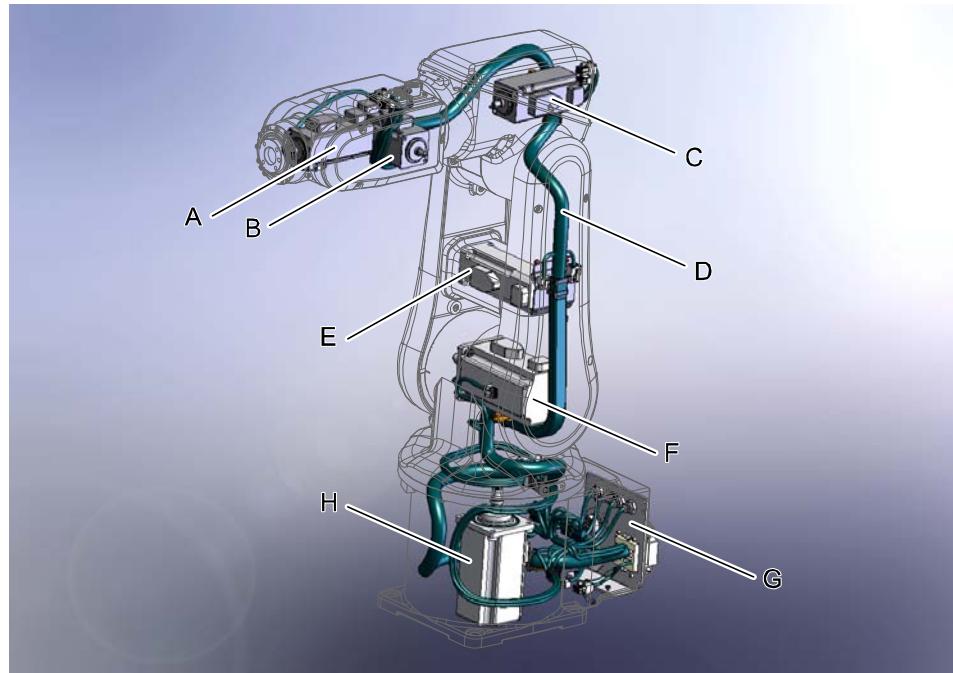


Note

It is necessary to perform the removing in the order as listed above!

Location of the cable harness.

The cable harness is located as shown in the figure.



xx0900000905

A	Motor axis 6
B	Motor axis 5
C	Motor axis 4
D	Cable harness
E	Motor axis 3

Continues on next page

4.3.1 Removing the cable harness

Continued

F	Motor axis 2
G	Plate (part of the cable harness)
H	Motor axis 1

Required equipment

Equipment	Note
Standard toolkit	The content is defined in the section Standard toolkit on page 213 .
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.
Loctite 7063	For removing residues of Loctite.
Loctite 574	
Cable grease	

Removing the cable harness in the wrist

Use this procedure to remove the cable harness in the wrist.

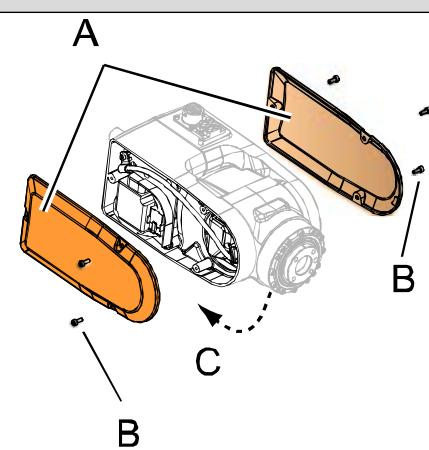
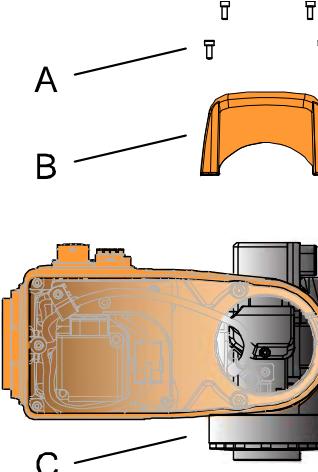
	Action	Info
1	Move axis 5 to a 90° position.	
2	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
3	 CAUTION Always cut the paint with a knife and grind the paint edge when disassembling parts of a Clean Room robot! See Replacing parts on Clean Room robots on page 104	

Continues on next page

4 Repair

4.3.1 Removing the cable harness

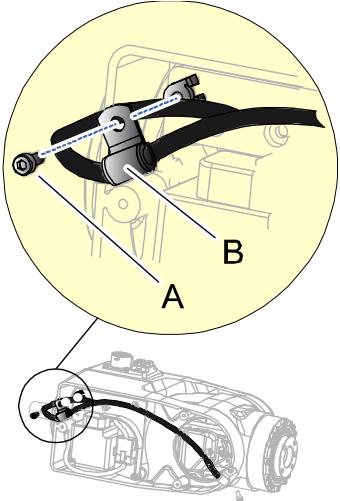
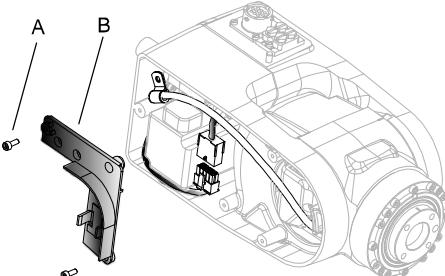
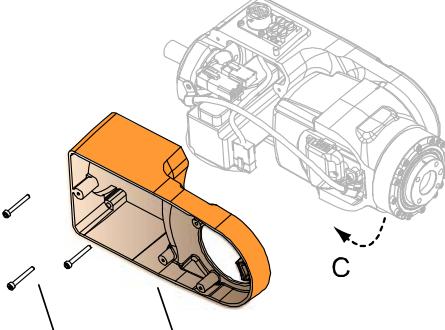
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Action	Info
4 Remove the <i>wrist side covers</i> on both sides.	 <p>xx0900000999</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Wrist side covers (2 pcs) B: Attachment screws (3 + 3 pcs) C: Axis 5 shall be in 90° position
5 Remove the <i>tilt cover</i> .	 <p>xx0900000901</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screws(4 pcs) B: Tilt cover C: Motor axis 6

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4.3.1 Removing the cable harness

Continued

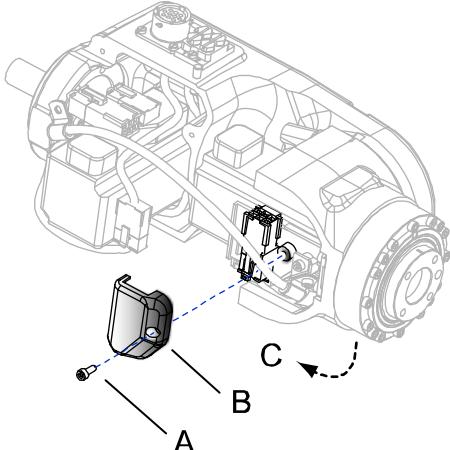
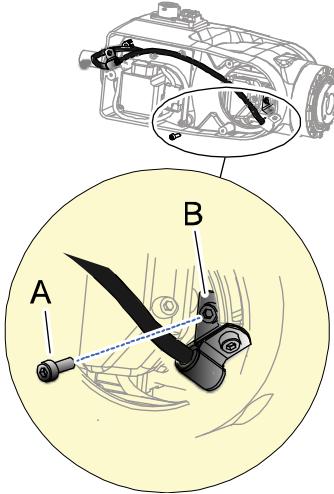
Action	Info
6 Unscrew the <i>attachment screw</i> securing the <i>clamp</i> at motor axis 5.	 <p>xx0900000912</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screw B: Clamp
7 Remove the <i>connector support</i> at axis 5.	 <p>xx0900000888</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screws (2 pcs) B: Connector support
8 Remove the <i>wrist housing (plastic)</i> .	 <p>xx0900000900</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screws (3 pcs) B: Wrist housing (plastic) C: Axis 5 shall be in 90° position

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4 Repair

4.3.1 Removing the cable harness

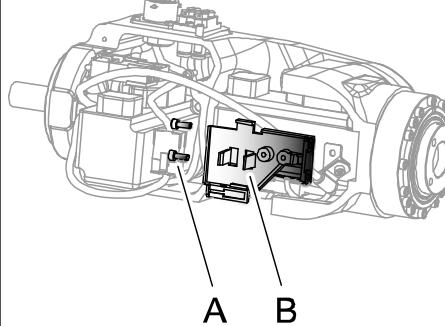
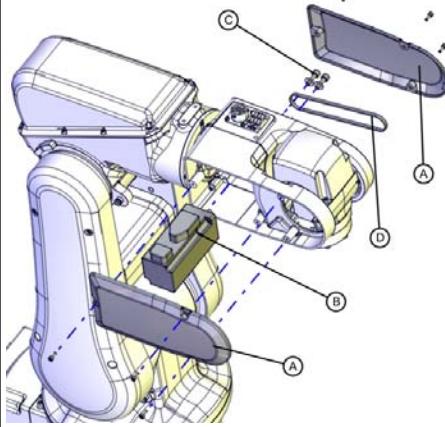
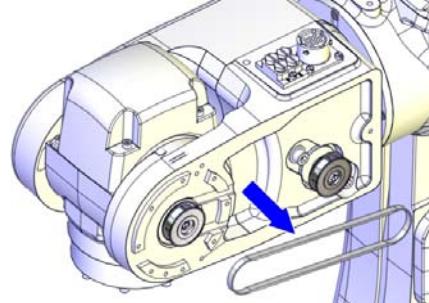
Continued

Action	Info
9 Remove the <i>connector cover</i> .	 <p>xx0900000902</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Attachment screw • B: Connector cover • C: Axis 5 shall be in 90° position
10 Unscrew the <i>attachment screw</i> securing the <i>clamp</i> at motor axis 6.	 <p>xx0900001000</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Attachment screw • B: Clamp
11 Disconnect connectors: • R2.MP5 and R2. ME5, motor axis 5 • R2.MP6 and R2. ME6, motor axis 6.	

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4.3.1 Removing the cable harness

Continued

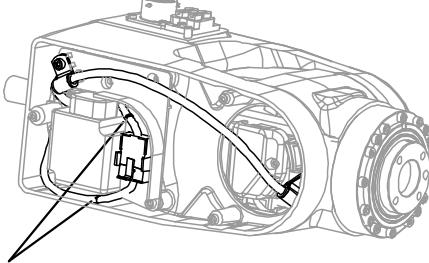
Action	Info
12 Remove the <i>connector support</i> at axis 6. Tip When removing the connector support rotate axis 5 to a 90° position. This is the most convenient position to remove the attachment screws.	 <p>xx0900001020</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screws (2 pcs) B: Connector support
13 Unscrew the <i>attachment screws</i> securing <i>motor axis 5</i> .	<p>See section:</p> <ul style="list-style-type: none"> Replacing motor axis 5 on page 182  <p>xx0900000889</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Wrist cover (2 pcs) B: Motor axis 5 C: Attachment screws and washers (2 + 2 pcs) D: Timing belt
14 Remove the <i>timing belt</i> .	 <p>xx0900001019</p>
15 Remove motor axis 5.	<p>See section:</p> <ul style="list-style-type: none"> Replacing motor axis 5 on page 182

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4 Repair

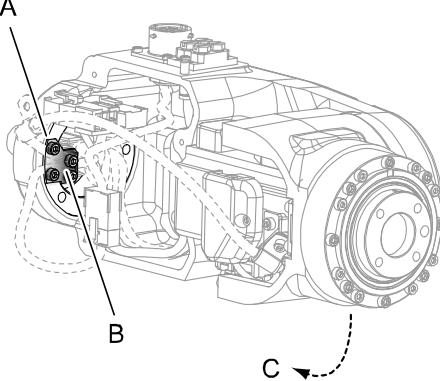
4.3.1 Removing the cable harness

Continued

Action	Info
16 Cut the <i>cable straps</i> .	 <p>A xx0900001009</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Cable straps
17 Disconnect: <ul style="list-style-type: none"> • customer contact R2.CS • air hose. 	

Removing the cable harness in the upper arm housing

Use this procedure to remove the cable harness in the *upper arm housing*.

Action	Info
1  CAUTION Always cut the paint with a knife and grind the paint edge when disassembling parts of a Clean Room robot! See <i>Replacing parts on Clean Room robots</i> on page 104	
2 Unscrew the <i>attachment screws</i> securing the <i>cable bracket</i> in the housing.	 <p>A xx0900001018</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Attachment screws (4 pcs) • B: Cable bracket • C: Axis 5 shall be in 90° position

Continues on next page

4.3.1 Removing the cable harness

Continued

Action	Info
3 Remove the <i>housing cover</i> .	<p>xx0900000782</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Housing cover • B: Attachment screws (8 pcs)
4 Pull the cable harness out of the wrist housing to axis 4.	
5 Disconnect connectors: • R2.MP4 • R2.ME4.	
6 Unscrew the <i>attachment screws</i> securing the two <i>cable brackets</i> on each side of motor axis 4.	<p>xx0900001023</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Cable bracket • B: Cable bracket
7 Pull the cable harness out of the upper arm housing.	

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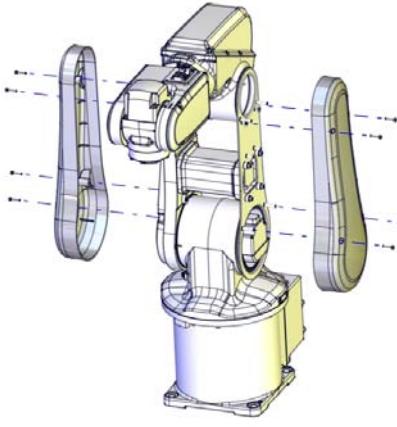
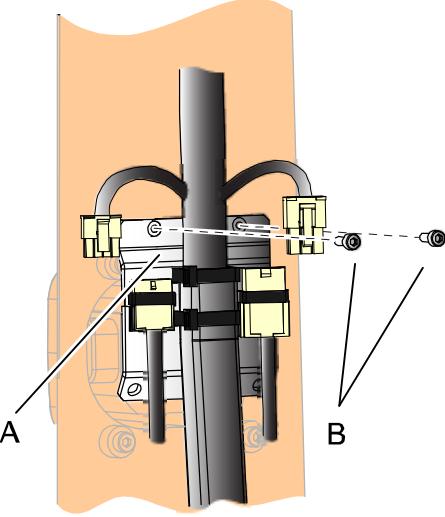
4 Repair

4.3.1 Removing the cable harness

Continued

Removing the cable harness in the *lower arm*

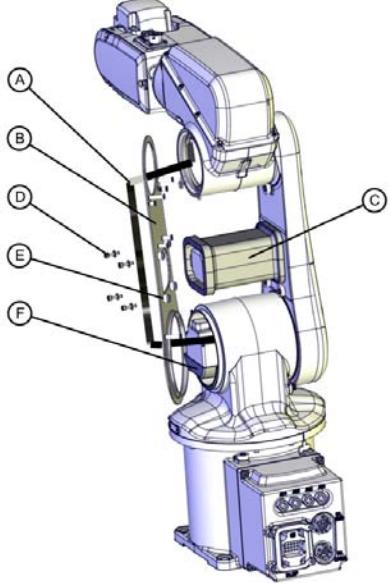
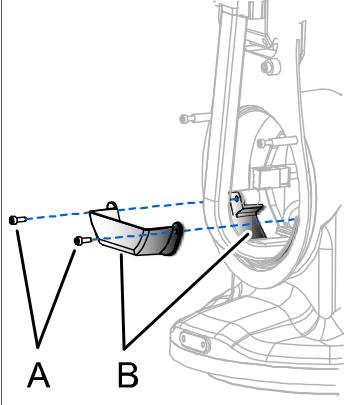
Use this procedure to remove the cable harness in the *lower arm*.

Action	Info
1  CAUTION Always cut the paint with a knife and grind the paint edge when disassembling parts of a Clean Room robot! See <i>Replacing parts on Clean Room robots</i> on page 104	
2 Remove the <i>lower arm covers</i> .	 xx0900000848
3 Pull the <i>cable harness</i> out through the upper arm housing to axis 3.	
4 Detach the <i>cable bracket</i> from the lower arm plate.	 xx0900000879 Parts: <ul style="list-style-type: none">• A: Cable bracket• B: Attachment screws (2 pcs)
5 Disconnect connectors: <ul style="list-style-type: none">• R2.MP3• R2.ME3.	

Continues on next page

4.3.1 Removing the cable harness

Continued

Action	Info
6 Detach the <i>lower arm plate</i> from the <i>motor cover</i> .	 <p>xx0900000851</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Cable harness B: Lower arm plate C: Motor cover D: Attachment screws E: Holes for attachment screws (4 pcs) F: Cable guide
7 Remove <i>cable guide</i> .	 <p>xx0900000857</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screws (2 pcs) B: Cable guide

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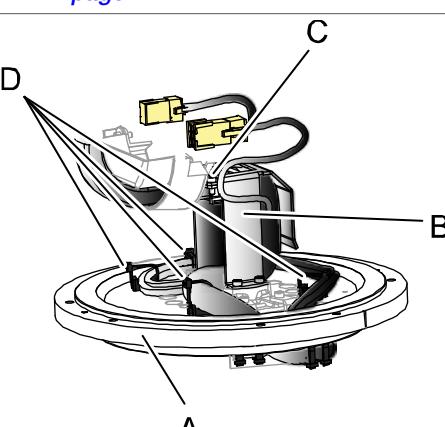
4 Repair

4.3.1 Removing the cable harness

Continued

Removing the cable harness in the base

Use this procedure to remove the cable harness in the base.

Action	Info
1  CAUTION Always cut the paint with a knife and grind the paint edge when disassembling parts of a Clean Room robot! See Replacing parts on Clean Room robots on page 104	
2 Pull the cable harness out through the swing housing.	
3 Separate the <i>lower</i> and <i>upper arms</i> as well as the <i>swing housing</i> from the base.	See section: <ul style="list-style-type: none">• Replacing the lower arm on page 144
4 Cut the <i>cable straps</i> securing the cable harness on the <i>swing plate</i> .	 xx0900000884 Parts: <ul style="list-style-type: none">• A: Swing plate• B: Cable holder• C: Attachment screws (2 pcs)• D: Cable straps (4 pcs)
5 Unscrew the <i>attachment screws</i> securing the cable harness to the <i>cable holder</i> .	
6 Remove <i>motor axis 1 with gearbox</i> .	See section: <ul style="list-style-type: none">• Replacing motor axis 1 with gearbox on page 150
7 Remove the <i>swing plate</i> .	
8 Disconnect connectors: <ul style="list-style-type: none">• R2.MP1• R2.ME1.	
9 Loosen the PE cable.	
10 Remove the <i>EIB board</i> .	See section: <ul style="list-style-type: none">• Replacing the Encoder Interface board on page 129
11 Remove the <i>battery</i> .	See section: <ul style="list-style-type: none">• Replacing the battery pack on page 97
12 Remove the <i>encoder plate</i> .	

Continues on next page

4.3.1 Removing the cable harness*Continued*

	Action	Info
13	Remove the <i>encoder connector</i> on plate.	
14	Remove the <i>complete cable harness</i> .	

4 Repair

4.3.2 Refitting the cable harness

4.3.2 Refitting the cable harness

Introduction

These procedures describes how to refit the complete cable harness in:

- 1 the base - [Refitting the cable harness in the base on page 119](#)
- 2 the lower arm - [Refitting the cable harness in the lower arm on page 120](#)
- 3 the upper arm housing and swing plate - [Refitting the cable harness in the upper arm housing on page 122](#)
- 4 the wrist - [Refitting the cable harness in the wrist on page 124.](#)



Note

It is necessary to perform the refitting in the order as listed above!



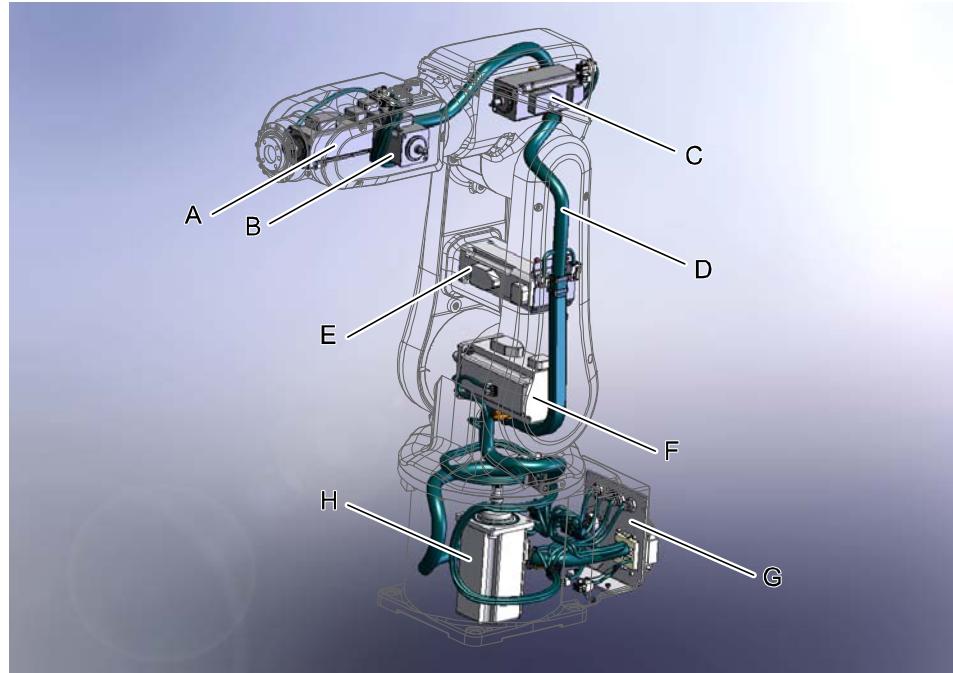
CAUTION

Always read the section "General procedures" before doing any repair work.

[Replacing parts on Clean Room robots on page 104](#)

Location of the cable harness

The cable harness is located as shown in the figure.



xx0900000905

A	Motor axis 6
B	Motor axis 5
C	Motor axis 4

Continues on next page

4.3.2 Refitting the cable harness

Continued

D	Cable harness
E	Motor axis 3
F	Motor axis 2
G	Plate (part of the cable harness)
H	Motor axis 1

Required equipment

Equipment	Note
Standard toolkit	The content is defined in the section Standard toolkit on page 213 .
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.
Loctite 7063	For removing residues of Loctite
Loctite 574	
Cable grease	

**Note**

Apply some cable grease on the cable harness where wear exists and also on the plastic parts of the robot.

Refitting the cable harness in the base

Use this procedure to refit the cable harness in the base.

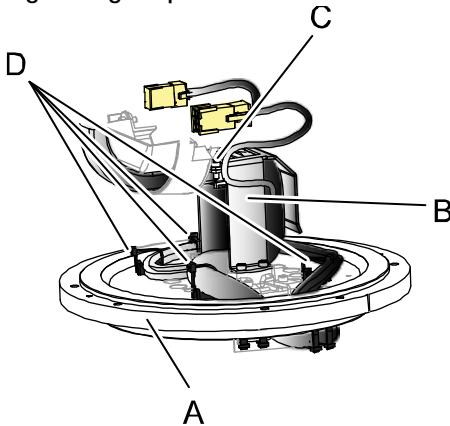
	Action	Info
1	Clean Room robots: clean the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
2	Check that: <ul style="list-style-type: none"> • the cable harness and its parts is clean and without damages. 	
3	Refit the <i>encoder connector</i> on plate.	
4	Refit the <i>encoder plate</i> .	
5	Refit the <i>battery</i> .	See section: <ul style="list-style-type: none"> • Replacing the battery pack on page 97
6	Refit the <i>EIB board</i> .	See section: <ul style="list-style-type: none"> • Replacing the Encoder Interface board on page 129
7	Refit the <i>PE cable</i> .	
8	Refit <i>motor axis 1 with gearbox</i> .	See section: <ul style="list-style-type: none"> • Replacing motor axis 1 with gearbox on page 150
9	Reconnect connectors: <ul style="list-style-type: none"> • R2.MP1 • R2.ME1. 	

Continues on next page

4 Repair

4.3.2 Refitting the cable harness

Continued

	Action	Info
10	Refit the <i>swing plate</i> .	Tightening torque: 4 Nm.
11	Secure the cable harness to the <i>cable holder</i> with the <i>attachment screws</i> .	Tightening torque: 1 Nm.  xx0900000884 Parts: <ul style="list-style-type: none"> • A: Swing plate • B: Cable holder • C: Attachment screws (2 pcs) • D: Cable straps (4 pcs)
12	Secure the <i>cable harness</i> on the <i>swing plate</i> with the <i>cable straps</i> .	
13	Refit the <i>lower arm</i> to the <i>swing housing</i> with its <i>attachment screws</i> .	See section: <ul style="list-style-type: none"> • Replacing the lower arm on page 144
14	Push the cable harness in through the swing housing.	
15	Clean Room robots: seal and paint the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
	 Note After all repair work, wipe the robot free from particles with spirit on a lint free cloth.	

Refitting the cable harness in the *lower arm*

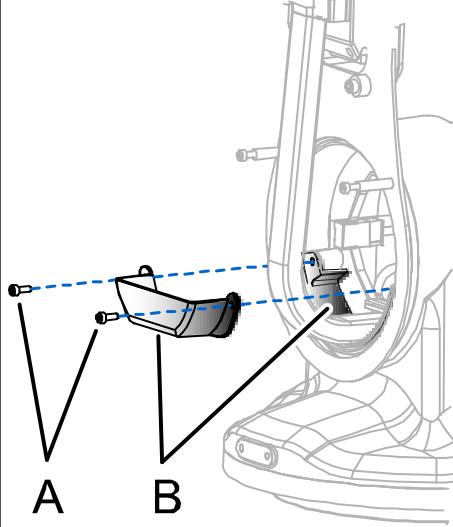
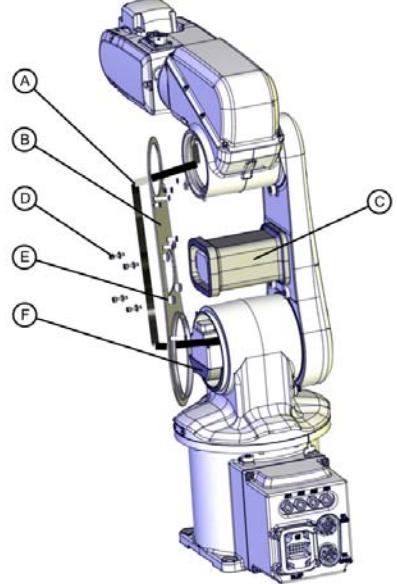
Use this procedure to refit the cable harness in the *lower arm*.

	Action	Info
1	Clean Room robots: clean the joints that have been opened. See Replacing parts on Clean Room robots on page 104	

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4.3.2 Refitting the cable harness

Continued

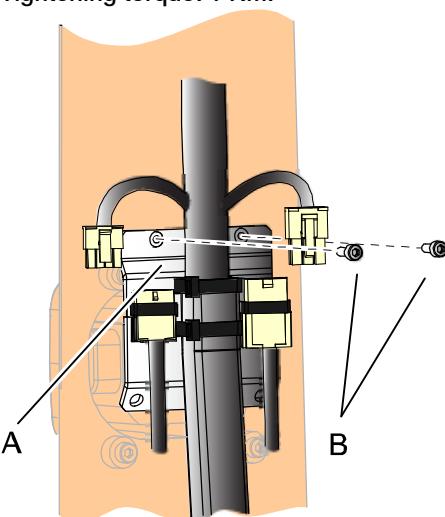
Action	Info
2 Fit the <i>cable guide</i> .	<p>Tightening torque: 1 Nm.</p>  <p>xx0900000857</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screws (2 pcs) B: Cable guide
3 Secure the <i>lower arm plate</i> to the <i>motor cover</i> with its <i>attachment screws</i> .	<p>Tightening torque: 4 Nm.</p>  <p>xx0900000851</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Cable harness B: Lower arm plate C: Motor cover D: Attachment screws (4 pcs) E: Holes for attachment screws (4 pcs) F: Cable guide

Continues on next page

4 Repair

4.3.2 Refitting the cable harness

Continued

Action	Info
4 Refit the <i>cable bracket</i> to the lower arm plate.	<p>Tightening torque: 1 Nm.</p>  <p>xx0900000879</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Cable bracket B: Attachment screws (2 pcs)
5 Reconnect connectors: <ul style="list-style-type: none"> R2.MP3 R2.ME3. 	
6 Push the cable harness in through the upper arm housing.	
7 Clean Room robots: seal and paint the joints that have been opened. See Replacing parts on Clean Room robots on page 104	<p> Note</p> <p>After all repair work, wipe the robot free from particles with spirit on a lint free cloth.</p>

Refitting the cable harness in the upper arm housing

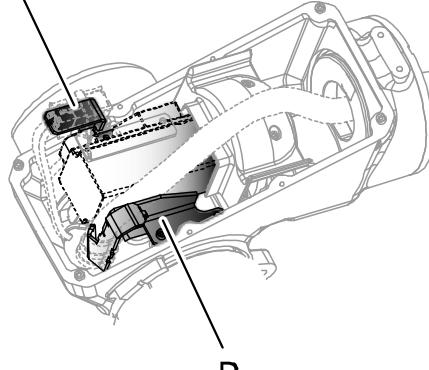
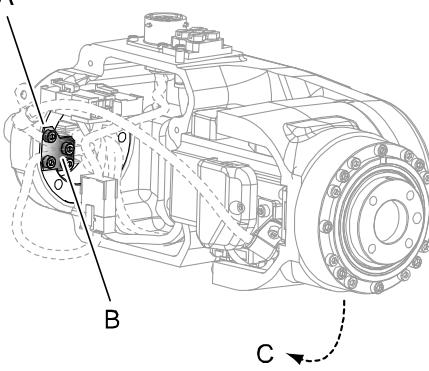
Use this procedure to refit the cable harness in the *upper arm housing*.

Action	Info
1 Clean Room robots: clean the joints that have been opened. See Replacing parts on Clean Room robots on page 104	

Continues on next page

4.3.2 Refitting the cable harness

Continued

Action	Info
2 Refit the two <i>cable brackets</i> , one on each side of motor axis 4, with its attachment screws.	<p>Tightening torque: 1 Nm.</p>  <p>xx0900001023</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Cable bracket • B: Cable bracket
3 Reconnect connectors: <ul style="list-style-type: none"> • R2.MP4 • R2.ME4. 	
4 Push the <i>cable harness</i> in through the <i>wrist housing</i> .	
5 Refit the <i>cable bracket</i> in the housing with its <i>attachment screws</i> .	<p>Tightening torque: 1 Nm.</p>  <p>xx0900001018</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Attachment screws (4 pcs) • B: Cable bracket • C: Axis 5 shall be in 90° position
6 Clean Room robots: seal and paint the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
 Note After all repair work, wipe the robot free from particles with spirit on a lint free cloth.	

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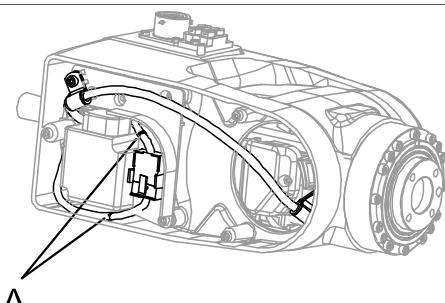
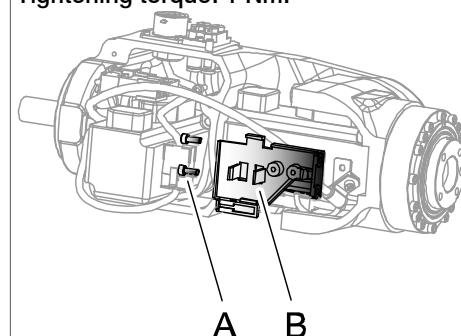
4 Repair

4.3.2 Refitting the cable harness

Continued

Refitting the cable harness in the wrist

Use this procedure to refit the cable harness in the *wrist*.

Action	Info
1 Clean Room robots: clean the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
2 Reconnect: <ul style="list-style-type: none">• customer contact R2.CS• air hoses.	
3 Secure the cable harness with <i>cable straps</i> .	 <p>xx0900001009</p> <p>Parts:<ul style="list-style-type: none">• A: Cable straps</p>
4 Refit <i>motor axis 5 and timing belt</i> .	See section: <ul style="list-style-type: none">• Replacing motor axis 5 on page 182
5 Refit the <i>connector support</i> at axis 6.	Tightening torque: 1 Nm.  <p>xx0900001020</p> <p>Parts:<ul style="list-style-type: none">• A: Attachment screws (2 pcs)• B: Connector support</p>
6 Reconnect connectors: <ul style="list-style-type: none">• R2.MP5 and R2.ME5, motor axis 5• R2.MP6 and R2.ME6, motor axis 6.	

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4.3.2 Refitting the cable harness

Continued

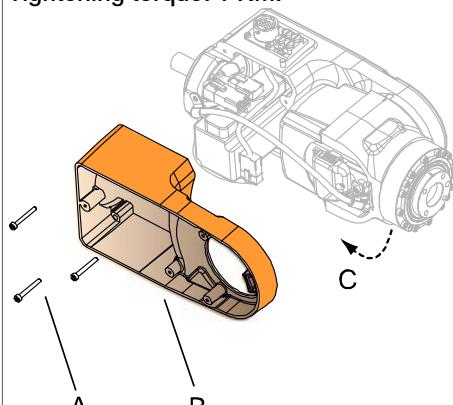
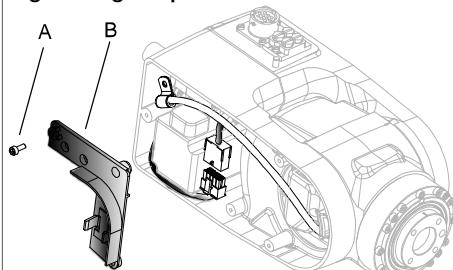
Action	Info
7 Refit the <i>attachment screw</i> securing the <i>clamp</i> at motor axis 6.	<p>Tightening torque: 1 Nm.</p> <p>xx0900001000</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screw B: Clamp
8 Refit the <i>connector cover</i> .	<p>Tightening torque: 1 Nm.</p> <p>xx0900000902</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screw B: Connector cover C: Axis 5 shall be in 90° position

Continues on next page

4 Repair

4.3.2 Refitting the cable harness

Continued

Action	Info
9 Refit <i>wrist housing (plastic)</i> .	<p>Tightening torque: 1 Nm.</p>  <p>xx0900000900</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Attachment screws (3 pcs) • B: Wrist housing (plastic) • C: Axis 5 shall be in 90° position
10 Refit <i>connector support</i> at axis 5.	<p>Tightening torque: 1 Nm.</p>  <p>xx0900000888</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Attachment screws (2 pcs) • B: Connector support

Continues on next page

4.3.2 Refitting the cable harness

Continued

Action	Info
11 Refit the <i>attachment screw</i> securing the <i>clamp</i> at motor axis 5.	<p>Tightening torque: 1 Nm.</p> <p>xx0900000912</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screw B: Clamp
12 Refit the <i>tilt cover</i> .	<p>Tightening torque: 1 Nm.</p> <p>xx0900000901</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screws (4 pcs) B: Tilt cover C: Motor axis 6

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4 Repair

4.3.2 Refitting the cable harness

Continued

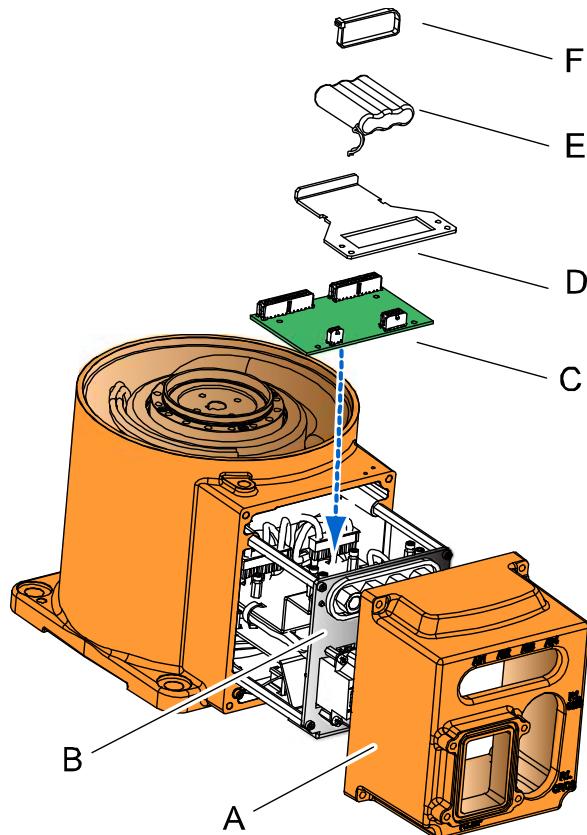
	Action	Info
13	Refit the remaining plastic covers: <ul style="list-style-type: none">• <i>wrist side cover</i>• <i>housing cover and</i>• <i>lower arm cover.</i>	Tightening torque: 1 Nm
14	Clean Room robots: seal and paint the joints that have been opened. See <i>Replacing parts on Clean Room robots on page 104</i>  Note After all repair work, wipe the robot free from particles with spirit on a lint free cloth.	
15	Recalibrate the robot.	See chapter: <ul style="list-style-type: none">• <i>Calibration</i>
16	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <i>DANGER - First test run may cause injury or damage! on page 45</i> .	

4.3.3 Replacing the Encoder Interface board

Introduction

This procedure describes how to replace the Encoder Interface board.

Location of the Encoder Interface board



xx0900000842

A	Base cover
B	Plate
C	Encoder Interface Board (EIB board)
D	Bracket
E	Battery pack
F	Cable strap

Required equipment

Equipment	Note
Standard tools	The content is defined in the section Standard toolkit on page 213 .
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.

Continues on next page

4 Repair

4.3.3 Replacing the Encoder Interface board

Continued

Removing the EIB board

Use this procedure to remove the EIB board.

	Action	Info
1	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
2	 CAUTION Always cut the paint with a knife and grind the paint edge when disassembling parts of a Clean Room robot! See Replacing parts on Clean Room robots on page 104	
3	Remove the <i>base cover</i> .	See the figure in : <ul style="list-style-type: none">• Location of the Encoder Interface board on page 129
4	Remove the attachment screws securing the <i>plate</i> .	See the figure in: <ul style="list-style-type: none">• Location of the Encoder Interface board on page 129
5	Pull carefully out the cable harnessss main a little in order to reach the EIB board.	
6	Disconnect the battery cable.	
7	Remove the <i>bracket</i> where the battery is fitted.	See the figure in: <ul style="list-style-type: none">• Location of the Encoder Interface board on page 129
8	Disconnect connectors: <ul style="list-style-type: none">• R1.ME1-3• R1.ME4-6• R2.EIB.	
9	Remove the <i>EIB board</i> .	See the figure in: <ul style="list-style-type: none">• Location of the Encoder Interface board on page 129

Refitting the EIB board

Use this procedure to refit the EIB board.

	Action	Info
1	Clean Room robots: clean the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
2	Fit the EIB board.	Tightening torque: 2 Nm. See the figure in: <ul style="list-style-type: none">• Location of the Encoder Interface board on page 129
3	Reconnect connectors: <ul style="list-style-type: none">• R1.ME1-3• R1.ME4-6• R2.EIB.	

Continues on next page

4.3.3 Replacing the Encoder Interface board

Continued

Action	Info
4 Fit the <i>plate</i> where the battery is fitted.	See the figure in: • Location of the Encoder Interface board on page 129
5 Reconnect the battery cable.	
6 Push the cable harness main carefully into the <i>base</i> .	 CAUTION Arrange the cable harness inside correctly in a way that: <ul style="list-style-type: none"> it is not damaged in the continued refitting process extra wear will not occur after production is restarted, which will shorten the life of the harness. See section: <ul style="list-style-type: none"> Refitting the cable harness on page 118.
7 Secure the <i>plate</i> with its attachment screws.	Tightening torque: 2 Nm. See the figure in: <ul style="list-style-type: none"> Location of the Encoder Interface board on page 129
8 Refit the <i>base cover</i> .	Tightening torque: 4 Nm. See the figure in: <ul style="list-style-type: none"> Location of the Encoder Interface board on page 129
9 Clean Room robots: seal and paint the joints that have been opened. See Replacing parts on Clean Room robots on page 104	 Note After all repair work, wipe the robot free from particles with spirit on a lint free cloth.
10 Recalibrate the robot.	See chapter: <ul style="list-style-type: none"> Calibration on page 195
11  DANGER	Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 45.

4 Repair

4.4.1 Replacing plastic covers

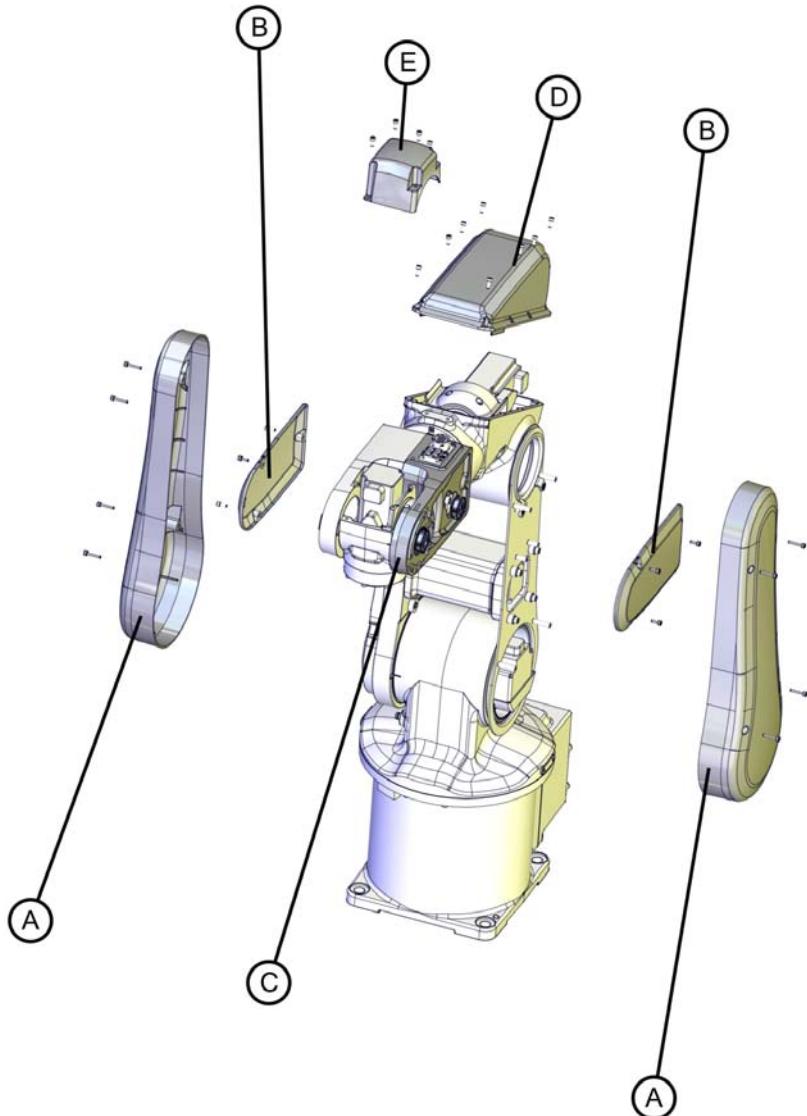
4.4 Plastic covers

4.4.1 Replacing plastic covers

Introduction

The section describes how to replace the plastic covers on the robot.

Continues on next page

*Continued***Location of the plastic covers**

xx0900000607

A	Lower arm cover (2 pcs.)
B	Wrist side cover (2 pcs.)
C	Wrist housing (plastic)
D	Housing cover
E	Tilt cover

Required equipment

Equipment	Note
Standard tools	The content is defined in the section Standard toolkit on page 213 .

Continues on next page

4 Repair

4.4.1 Replacing plastic covers

Continued

Equipment	Note
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.

Attachment screws and tightening torques

The table shows what attachment screws and tightening torques to be used.

Cover	Attachment screw	Screw quality	Qty.	Tightening torque
Lower arm cover	M3x16	Steel 12.9 Black oxide	4+4	1 Nm
Wrist side cover	M3x8	Steel 12.9 Black oxide	3+3	1 Nm
Wrist housing (plastic)	M3x25	Steel 12.9 Black oxide	3	1 Nm
Housing cover	M3x8	Steel 12.9 Black oxide	8	1 Nm
Tilt cover	M3x8	Steel 12.9 Black oxide	4	1 Nm

Removing plastic covers

Use this procedure to remove the plastic covers.

Action	Info
1  DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
2  CAUTION Always cut the paint with a knife and grind the paint edge when disassembling parts of a Clean Room robot! See Replacing parts on Clean Room robots on page 104	
3 Remove the attachment screws securing the plastic cover.	
4 Remove the plastic cover.	
5 If the cover shall be reused, keep it clean and put in a safe place.	

Refitting plastic covers

Use this procedure to refit the plastic covers.

Action	Info
1 Clean Room robots: clean the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
2 Before fitting the plastic cover, check it for cracks or any other damage.	If the plastic cover is cracked or has any other damage it must be replaced with a new one.

Continues on next page

4.4.1 Replacing plastic covers

Continued

Action	Info
3 Fit the plastic cover and secure it with its <i>attachment screws</i> . Which attachment screws to use is described in the table: <ul style="list-style-type: none">• <i>Attachment screws and tightening torques on page 134</i>	
4 For <i>tightening torques</i> , see the table: <ul style="list-style-type: none">• <i>Attachment screws and tightening torques on page 134</i>	
5 Clean Room robots: seal and paint the joints that have been opened. See <i>Replacing parts on Clean Room robots on page 104</i>  Note After all repair work, wipe the robot free from particles with spirit on a lint free cloth.	

4 Repair

4.5.1 Replacing the upper arm

4.5 Upper arm

4.5.1 Replacing the upper arm

Introduction

This procedure describes how to replace the upper arm.



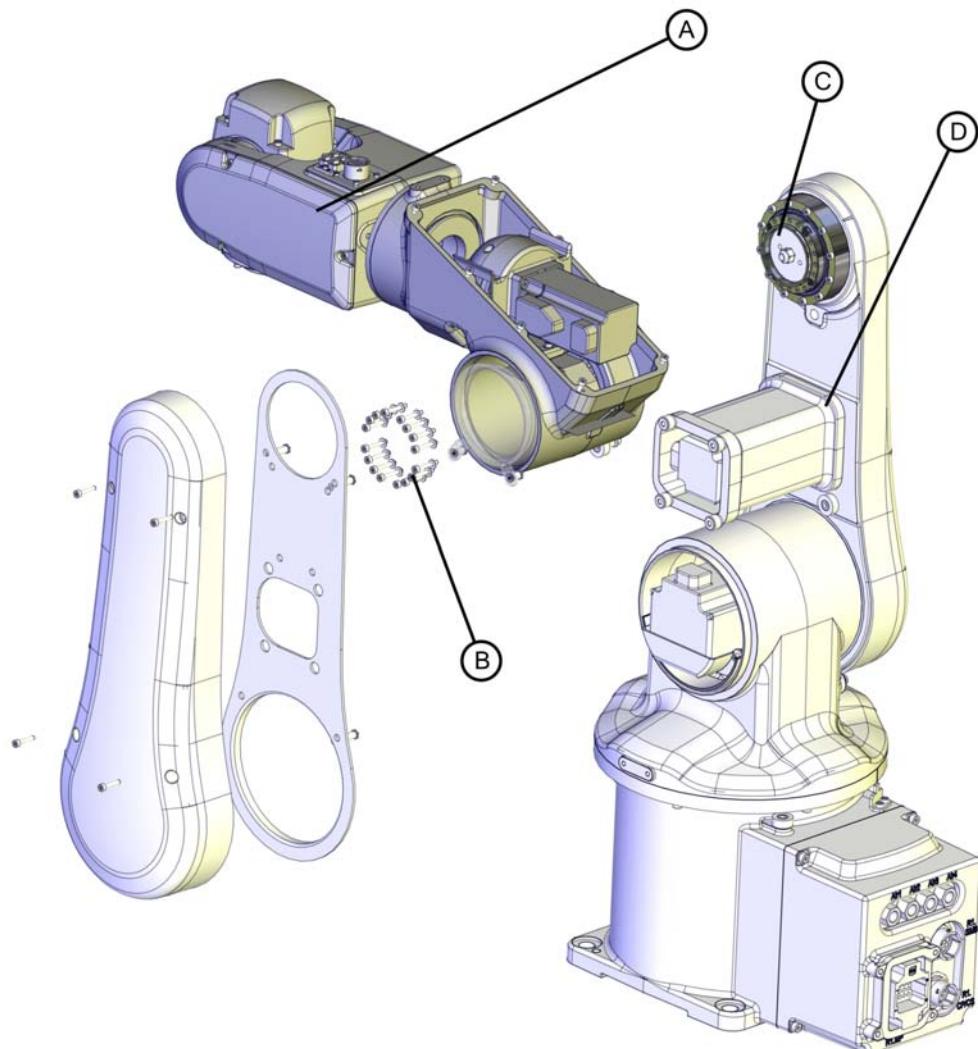
CAUTION

Always read the section "General procedures" before doing any repair work.

[Replacing parts on Clean Room robots on page 104](#)

Location of upper arm

The upper and lower arms are located as shown in the figure.



xx0900000924

A	Upper arm, complete with wrist
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4.5.1 Replacing the upper arm

Continued

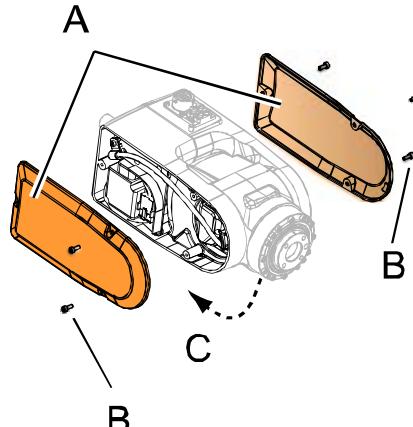
B	Attachment screws (16 pcs)
C	Gearbox, axis 3
D	Lower arm

Required equipment

Equipment	Note
Standard toolkit	The content is defined in the section Standard toolkit on page 213 .
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.
Loctite 7063	For removing residues of Loctite.
Loctite 574	

Removing the upper arm

Use this procedure to remove the upper arm.

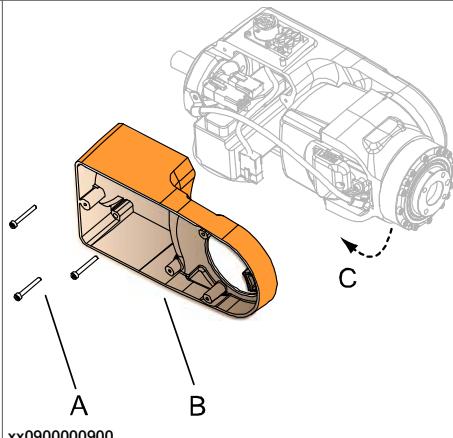
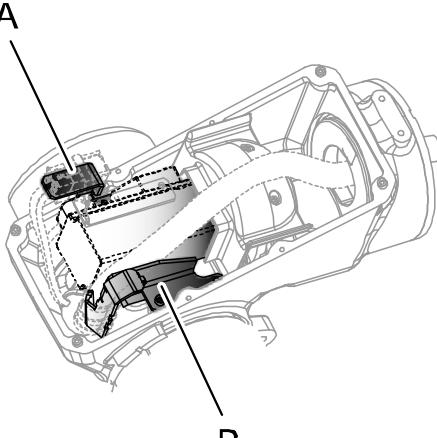
Action	Info
1 Move axis 5 to a 90° position.	
2  DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
3  CAUTION Always cut the paint with a knife and grind the paint edge when disassembling parts of a Clean Room robot! See Replacing parts on Clean Room robots on page 104	
4 Remove the <i>wrist covers</i> .	 xx0900000999 Parts: <ul style="list-style-type: none"> • A: Wrist covers (2 pcs) • B: Attachment screws (3+3 pcs) • C: Axis 5 shall be in 90° position

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4 Repair

4.5.1 Replacing the upper arm

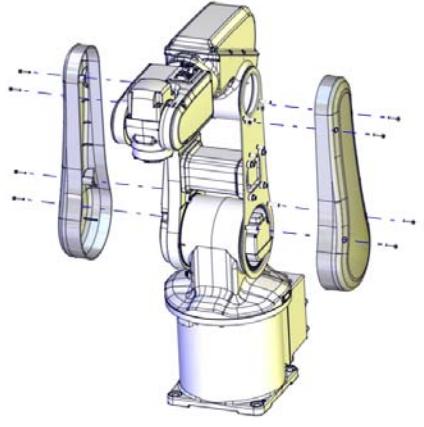
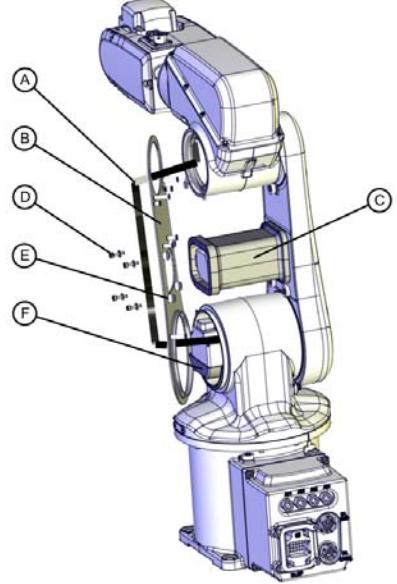
Continued

Action	Info
5 Remove <i>motor axis 5</i> .	See section: • Replacing motor axis 5 on page 182
6 Remove the <i>cable harness</i> in the <i>wrist</i> .	See section: • Removing the cable harness on page 106.
7 Pull the <i>cable harness</i> out of the <i>wrist housing</i> .	
8 Remove the <i>wrist housing (plastic)</i> .	 xx0900000900 <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screws (3 pcs) B: Wrist housing (plastic) C: Axis 5 shall be in 90° position
9 Remove the <i>cable harness</i> in the <i>upper arm housing</i> .	See section: • Removing the cable harness on page 106.
10 Unscrew the attachment screws securing the <i>cable brackets</i> on both sides of motor axis 4.	 xx0900001023 <p>Parts:</p> <ul style="list-style-type: none"> A: Cable bracket B: Cable bracket

Continues on next page

4.5.1 Replacing the upper arm

Continued

Action	Info
11 Remove the <i>lower arm covers</i> on both sides of the robot.	 xx0900000848
12 Remove the <i>cable harness</i> in the <i>lower arm</i> .	See section: <ul style="list-style-type: none"> Removing the cable harness on page 106.
13 Unscrew the <i>attachment screws</i> securing the <i>lower arm plate</i> to the <i>motor cover</i> .	 xx0900000851 <p>Parts:</p> <ul style="list-style-type: none"> A: Cable harness B: Lower arm plate C: Motor cover D: Attachment screws (4 pcs) E: Holes for attachment screws (4 pcs) F: Cable guide
14 Pull out the cable harness through the upper arm housing.	
15 Secure the upper arm by holding it firmly.	
16 Unscrew the <i>attachment screws</i> securing the <i>upper arm with wrist</i> to <i>gearbox axis 3</i> .	See the figure in: <ul style="list-style-type: none"> Location of upper arm on page 136

Continues on next page

4 Repair

4.5.1 Replacing the upper arm

Continued

	Action	Info
17	Remove the upper arm.	

Refitting the upper arm

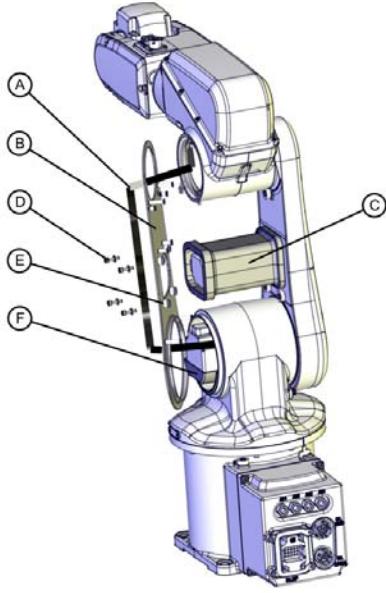
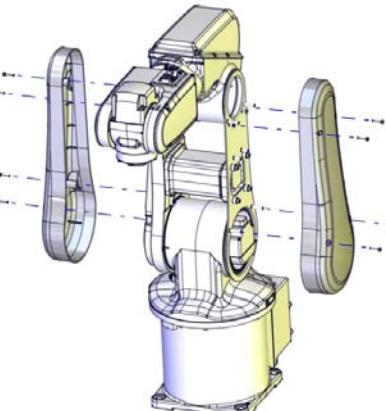
Use this procedure to refit the upper arm.

	Action	Info
1	Clean Room robots: clean the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
2	Check that: <ul style="list-style-type: none">All assembly surfaces are clean and without damages.	
3	Remove old residues of Loctite from the assembly surfaces on gearbox axis 3 and upper arm, using <i>Loctite 7063</i> .	See: <ul style="list-style-type: none">Required equipment on page 137
4	Apply <i>Loctite 574</i> on the assembly surfaces on <i>gearbox axis 3</i> and the <i>upper arm</i> .	
5	Secure the <i>upper arm including wrist</i> to <i>gearbox axis 3</i> with its <i>attachment screws</i> .	Tightening torque: 2 Nm. See the figure in: <ul style="list-style-type: none">Location of upper arm on page 136
6	Push the <i>cable harness</i> into the <i>upper arm housing</i> .	See section: <ul style="list-style-type: none">Refitting the cable harness on page 118

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4.5.1 Replacing the upper arm

Continued

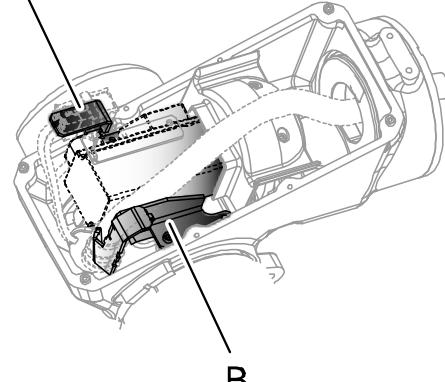
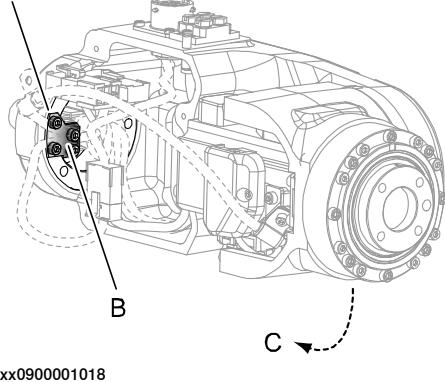
Action	Info
7 Refit the <i>lower arm plate</i> .	<p>Tightening torque: 4 Nm.</p>  <p>xx0900000851</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Cable harness B: Lower arm plate C: Motor cover D: Attachmebt screws (4 pcs) E: Holes for attachment screws (4 pcs) F: Cable guide
8 Secure the <i>cable harness</i> to the <i>lower arm plate</i> .	See section: <ul style="list-style-type: none"> Refitting the cable harness on page 118
9 Refit the <i>lower arm covers</i> .	<p>Tightening torque: 1 Nm.</p>  <p>xx0900000848</p>
10 Secure the <i>cable harness</i> in the <i>upper arm housing</i> .	See section: <ul style="list-style-type: none"> Refitting the cable harness on page 118

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4 Repair

4.5.1 Replacing the upper arm

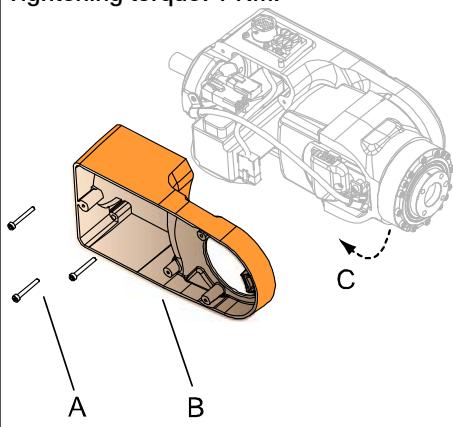
Continued

Action	Info
11 Refit the two <i>cable brackets</i> on either side of motor axis 4.	<p>Tightening torque: 1 Nm.</p>  <p>xx0900001023</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Cable bracket • B: Cable bracket
12 Push the cable harness into the wrist.	
13 Refit the <i>cable bracket</i> .	<p>Tightening torque: 1 Nm.</p>  <p>xx0900001018</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Attachment screws (4 pcs) • B: Cable bracket • C: Axis 5 shall be in 90° position
14 Refit the <i>cable harness</i> in the wrist.	<p>See section:</p> <ul style="list-style-type: none"> • <i>Refitting the cable harness on page 118</i>

Continues on next page

4.5.1 Replacing the upper arm

Continued

Action	Info
15 Refit the <i>wrist housing (plastic)</i> .	<p>Tightening torque: 1 Nm.</p>  <p>xx0900000900</p> <p>Parts:</p> <ul style="list-style-type: none"> Attachment screws (3 pcs) B: Wrist housing (plastic) C: Axis 5 shall be in 90° position
16 Refit motor axis 5.	<p>See section:</p> <ul style="list-style-type: none"> Replacing motor axis 5 on page 182
17 Clean Room robots: seal and paint the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
18 Recalibrate the robot.	<p>See chapter:</p> <ul style="list-style-type: none"> Calibration on page 195.
19  DANGER	<p>Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 45.</p>

4 Repair

4.6.1 Replacing the lower arm

4.6 Lower arm

4.6.1 Replacing the lower arm

Introduction

This procedure describes how to replace the lower arm.

Gearbox axis 3 is included in the lower arm.



CAUTION

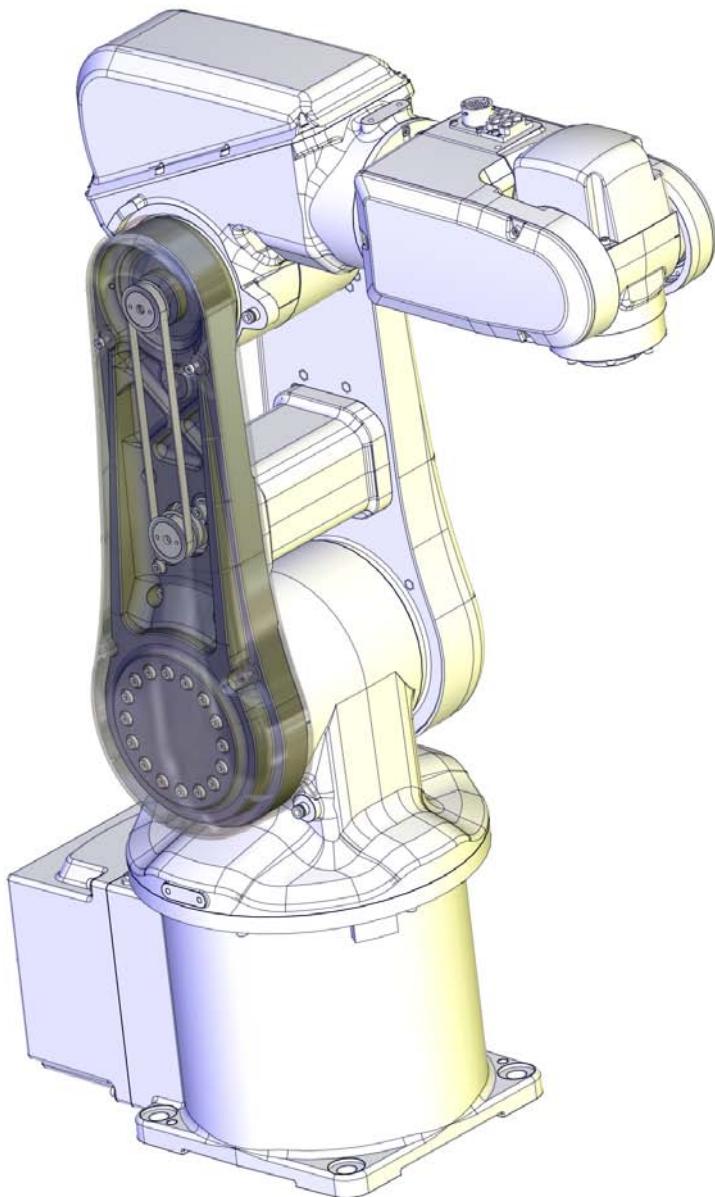
Always read the section "General procedures" before doing any repair work.

[Replacing parts on Clean Room robots on page 104](#)

Continues on next page

*Continued***Location of the lower arm**

The lower arm is located as shown in the figure.



xx1100000961

Required equipment

Equipment	Note
Standard toolkit	The content is defined in the section Standard toolkit on page 213 .
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.
Loctite 7063	For removing residues of Loctite.
Loctite 574	

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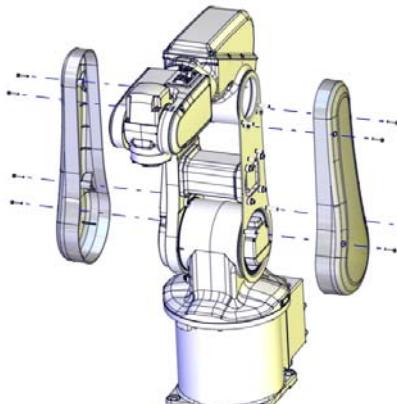
4 Repair

4.6.1 Replacing the lower arm

Continued

Removing the lower arm

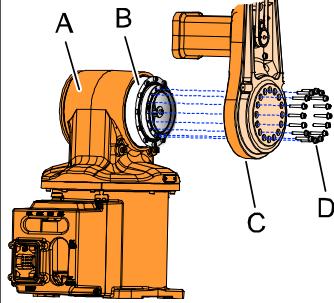
Use this procedure to remove the lower arm.

	Action	Info
1	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
2	 CAUTION Always cut the paint with a knife and grind the paint edge when disassembling parts of a Clean Room robot! See Replacing parts on Clean Room robots on page 104	
3	Remove the <i>lower arm covers</i> on both sides of the robot.	 xx0900000848
4	Remove the <i>cable harness</i> in the <i>lower arm</i> .	See section: • Removing the cable harness in the wrist on page 107
5	Unscrew the attachment screws securing the lower and upper arms and separate the two.	
6	Unscrew the attachment screws securing the motor cover to the lower arm plate.	

Continues on next page

4.6.1 Replacing the lower arm

Continued

Action	Info
7 Unscrew the <i>attachment screws</i> securing the <i>lower arm</i> to <i>gearbox axis 2</i> .	 <p>xx0900000859</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Swing housing B: Gearbox axis 2 C: Lower arm D: Attachment screws (16 pcs)
8 Remove the <i>lower arm</i> .	
9 Remove <i>motor axis 3</i> and <i>timing belt</i> .	See section: <ul style="list-style-type: none"> Replacing motor axis 3 on page 171

Refitting the lower arm

Use this procedure to refit the lower arm.

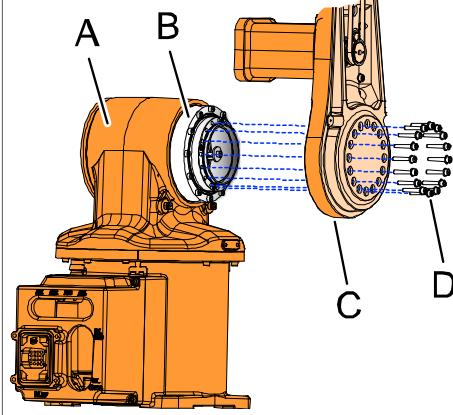
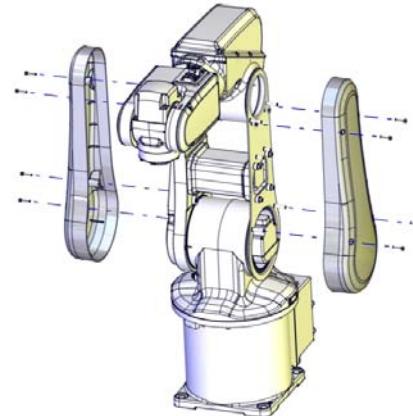
Action	Info
1 Clean Room robots: clean the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
2 Check that: <ul style="list-style-type: none"> all assembly surfaces are clean and without damages. 	
3 Remove old residues of Loctite from the assembly surfaces on gearbox axis 2 and lower arm, using Loctite 7063.	See: <ul style="list-style-type: none"> Required equipment on page 145
4 Apply Loctite 574 on the assembly surfaces on gearbox axis 2 and lower arm.	

Continues on next page

4 Repair

4.6.1 Replacing the lower arm

Continued

Action	Info
5 Refit the <i>lower arm</i> to <i>gearbox axis 2</i> with its <i>attachment screws</i> .	<p>Tightening torque: 4 Nm.</p>  <p>xx0900000859</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Swing housing B: Gearbox axis 2 C: Lower arm D: Attachment screws (16 pcs)
6 Refit the <i>motor cover</i> .	Tightening torque: 4 Nm.
7 Refit <i>motor axis 3</i> .	See section: <ul style="list-style-type: none"> Replacing motor axis 3 on page 171
8 Secure the <i>upper and lower arms</i> with the attachment screws (16 pcs).	Tightening torque: 2 Nm.
9 Refit the <i>cable harness</i> in the <i>lower arm</i> .	See section: <ul style="list-style-type: none"> Refitting the cable harness on page 118
10 Refit the <i>lower arm covers</i> .	Tightening torque: 1 Nm.  <p>xx0900000848</p>
11 Clean Room robots: seal and paint the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
<p> Note</p> <p>After all repair work, wipe the robot free from particles with spirit on a lint free cloth.</p>	

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4.6.1 Replacing the lower arm

Continued

	Action	Info
12	Recalibrate the robot.	See chapter: • Calibration on page 195 .
13	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 45.	

4 Repair

4.7.1 Replacing motor axis 1 with gearbox

4.7 Motors and motors with gearboxes

4.7.1 Replacing motor axis 1 with gearbox

Introduction

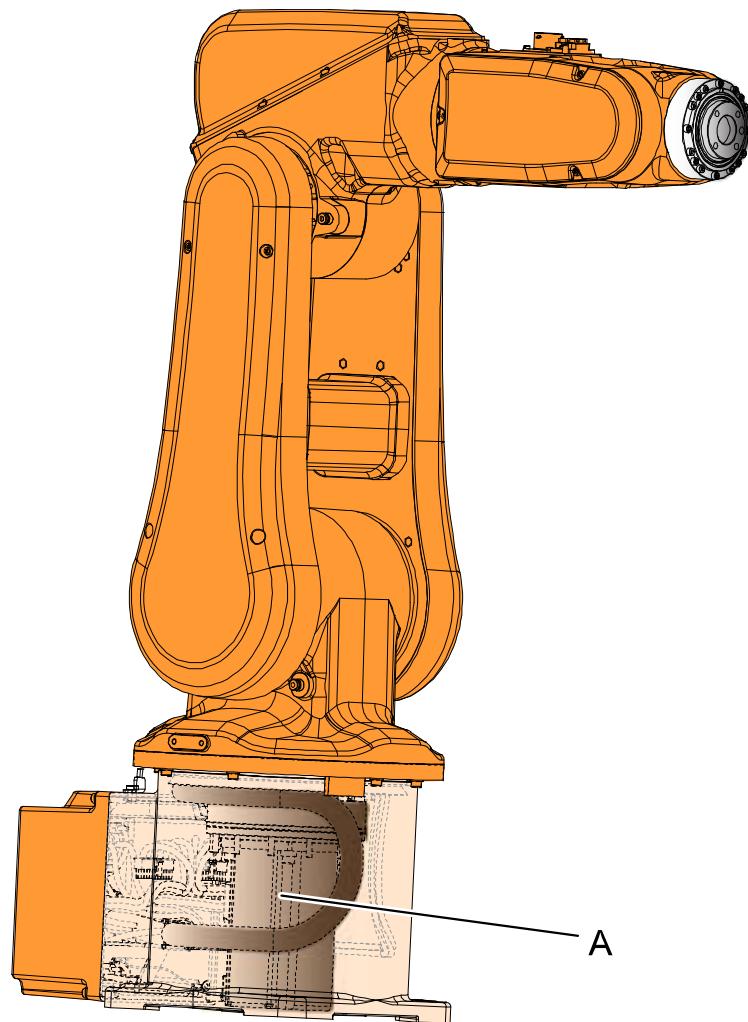
This procedure describes how to replace:

- motor axis 1 with gearbox.

Gearbox axis 1 is a part of motor axis 1 when ordered as a spare part. The procedure below describes the replacement of motor and gearbox axis 1 as one unit. For further information, please contact ABB.

Location of motor axis 1 with gearbox

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



xx0900000871

A	Motor axis 1 with gearbox
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4.7.1 Replacing motor axis 1 with gearbox

Continued

Required equipment

Equipment	Note
Standard toolkit	The content is defined in the section Standard toolkit on page 213 .
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.
Loctite 574	Amount 2 ml
Loctite 7063	For removing residues of Loctite

Removing motor axis 1 with gearbox

Use this procedure to remove motor axis 1 with gearbox.

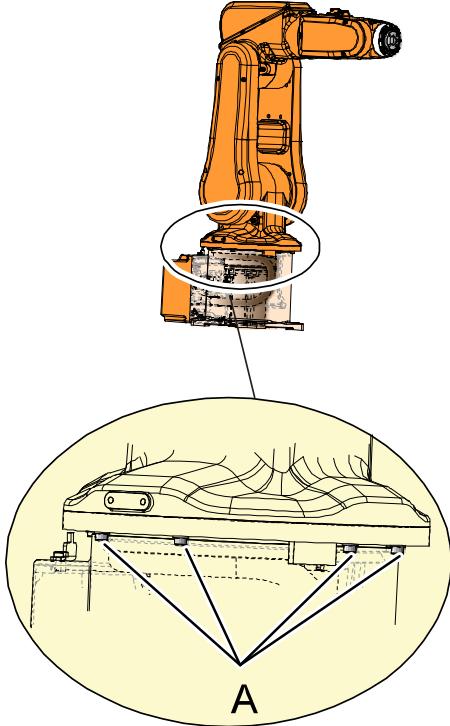
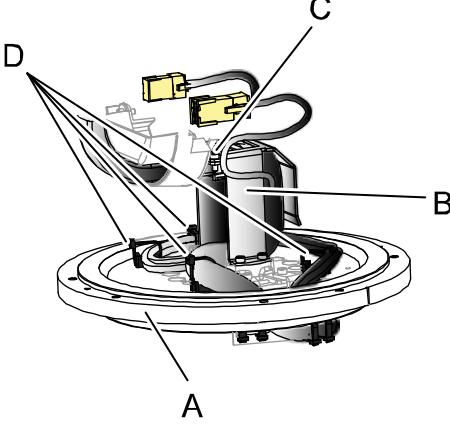
	Action	Info
1	 Note If the robot is fitted in a suspended position it must first be dismounted from this position. The replacing procedure of motor axis 1 must be performed with the robot in an upright position.	
2	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
3	 CAUTION Always cut the paint with a knife and grind the paint edge when disassembling parts of a Clean Room robot! See Replacing parts on Clean Room robots on page 104	
4	Remove the cable harness between axes 6 and 2.	See section: • Removing the cable harness on page 106
5	Pull out the cable harness between axes 6 and 2 through the <i>swing housing</i> .	
6	Release the brakes.	See section: • Manually releasing the brakes on page 62

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4 Repair

4.7.1 Replacing motor axis 1 with gearbox

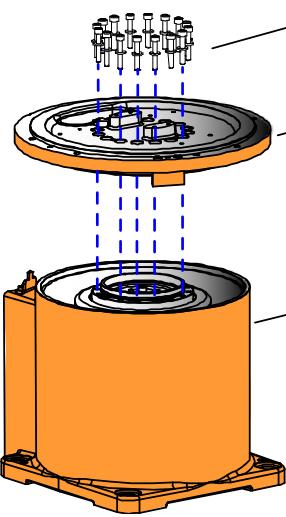
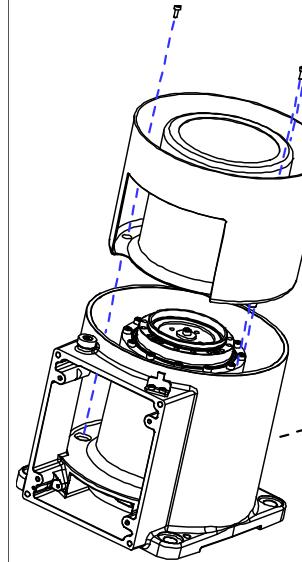
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Action	Info
7 Unscrew the <i>attachment screws</i> securing the <i>swing housing</i> to the <i>swing plate</i> and remove it together with the lower and upper arms.	 xx0900001053 <p>Parts:</p> <ul style="list-style-type: none"> • A: Attachment screws (8 pcs)
8 Cut the <i>cable straps</i> securing the cable harness to the <i>swing plate</i> .	 xx0900000884 <p>Parts:</p> <ul style="list-style-type: none"> • A: Swing plate • B: Cable holder • C: Attachment screws (2 pcs) • D: Cable straps (4 pcs)
9 Remove the <i>attachment screws</i> securing the cable harness to the <i>cable holder</i> .	

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4.7.1 Replacing motor axis 1 with gearbox

Continued

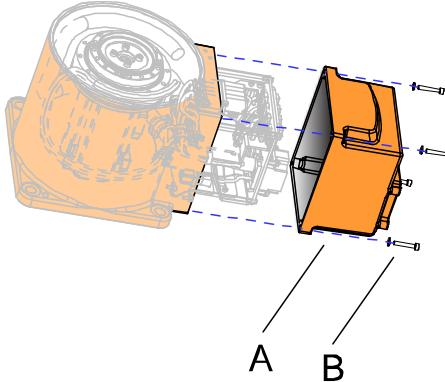
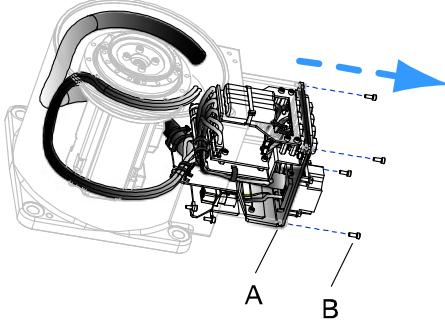
Action	Info
10 Remove the <i>swing plate</i> .	 <p>xx0900000799</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screws and washers (16+16 pcs) B: Swing plate C: Base
11 Remove the <i>cable guide</i> .	 <p>xx0900000800</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screws (3 pcs) B: Cable guide C: Base

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4 Repair

4.7.1 Replacing motor axis 1 with gearbox

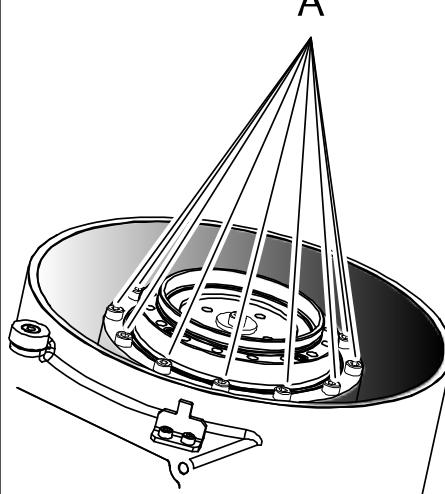
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Action	Info
12 Remove the <i>base cover</i> .	 <p>xx0900000829</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Base cover • B: Attachment screws (4 pcs)
13 Remove the <i>attachment screws</i> securing the <i>plate</i> .	 <p>xx0900000831</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Plate • B: Attachment screws (4 pcs)
14 Carefully pull the <i>cable harness main</i> out a little.	This is done in order to reach the connectors for motor axis 1.
15 Disconnect connectors: • R2.MP1 • R2.ME1.	

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4.7.1 Replacing motor axis 1 with gearbox

Continued

Action	Info
16 Remove the <i>attachment screws</i> securing the <i>gearbox</i> to the support.	 xx0900001054 Parts: • A: Attachment screws (12 pcs)
17 Remove the <i>motor axis 1 with gearbox</i> carefully. ! CAUTION Lift motor and gearbox by holding the <i>support</i> in order not to damage any parts.	

Refitting motor and gearbox axis 1

Use this procedure to refit both motor and gearbox axis 1.

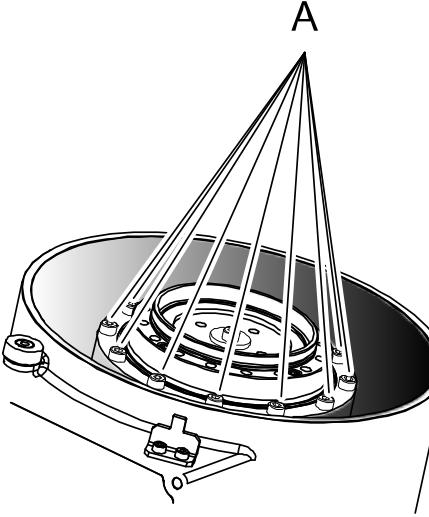
Action	Info
1 Clean Room robots: clean the joints that have been opened. See <i>Replacing parts on Clean Room robots</i> on page 104	
2 Check that: <ul style="list-style-type: none"> • all assembly surfaces are clean and without damages • motor and gearbox are clean and without damages. 	

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4 Repair

4.7.1 Replacing motor axis 1 with gearbox

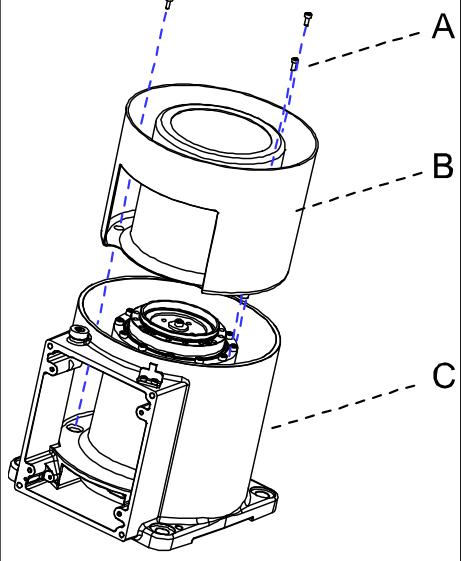
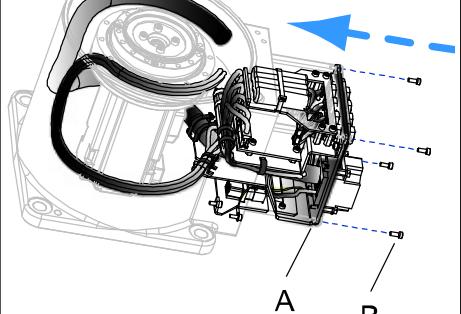
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Action	Info
3 Remove the two <i>bolts with nuts</i> securing motor axis 1 with gearbox while being transported.	 xx0900001050 Parts: <ul style="list-style-type: none">A: Bolt with nut, used during transport (2 pcs)
4 Secure motor axis 1 with gearbox to the base casting with its <i>attachment screws</i> .	Tightening torque: 4 Nm.  xx0900001054 Parts: <ul style="list-style-type: none">A: Attachment screws (12 pcs)

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4.7.1 Replacing motor axis 1 with gearbox

Continued

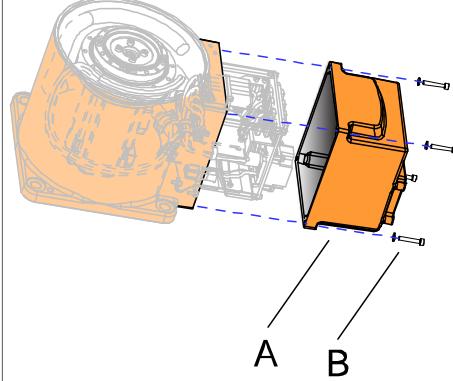
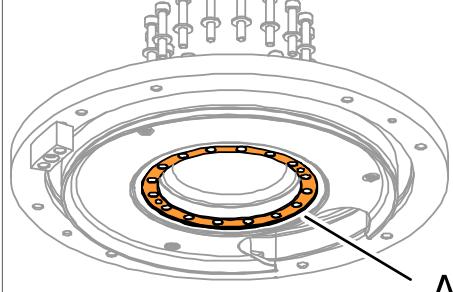
	Action	Info
5	Fit the <i>cable guide</i> .	<p>Tightening torque: 2 Nm.</p>  <p>xx0900000800</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screws (3 pcs) B: Cable guide C: Base
6	Reconnect connectors: • R2.MP1 • R2.ME1.	
7	 DANGER Check that the cable harness is intact and connected correctly on all axes!	
8	Refit the cable harness by carefully pushing it back into the base.  CAUTION Arrange the cable harness inside in a way that it will not be damaged.	See section: <ul style="list-style-type: none"> <i>Refitting the cable harness on page 118</i>  <p>xx0900000836</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Plate B: Attachment screws (4 pcs)
9	Secure the <i>plate</i> of the cable harness with its <i>attachment screws</i> .	Tightening torque: 2 Nm.

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4 Repair

4.7.1 Replacing motor axis 1 with gearbox

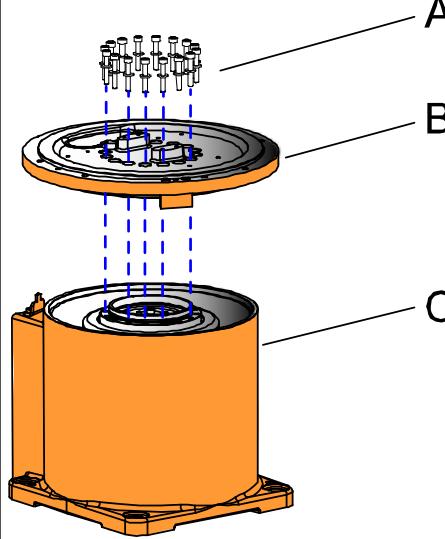
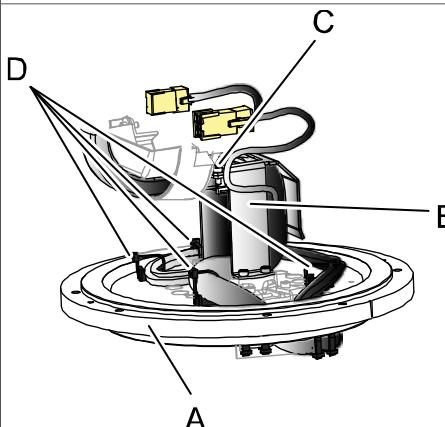
Continued

Action	Info
10 Fit the <i>base cover</i> .	<p>Tightening torque: 4 Nm.</p>  <p>xx0900000829</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Base cover • B: Attachment screws (4 pcs)
11 Clean the <i>assembly surface</i> on the <i>swing plate</i> from old residues of Loctite.	<p>See:</p> <ul style="list-style-type: none"> • Required equipment on page 151  <p>xx0900000835</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Surface where Loctite 574 shall be applied on swing plate
12 Apply Loctite 574 on the assembly surfaces on swing plate and gear.	

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4.7.1 Replacing motor axis 1 with gearbox

Continued

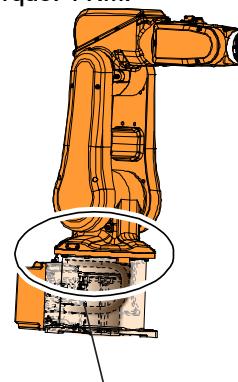
Action	Info
13 Fit the <i>swing plate</i> .	<p>Tightening torque: 4 Nm.</p>  <p>xx0900000799</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Attachment screws and washers (16+16 pcs) • B: Swing plate • C: Base
14 Push the cable harness through the swing housing to motor axis 2.	
15 Fit the cable harness to the <i>cable holder</i> .	 <p>xx0900000884</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Swing plate • B: Cable holder • C: Attachment screws (2 pcs) • D: Cable straps (4 pcs)
16 Secure the cable harness with the <i>cable straps</i> .	
17 Release the brakes.	See section: • <i>Manually releasing the brakes on page 62</i>

Continues on next page

4 Repair

4.7.1 Replacing motor axis 1 with gearbox

Continued

Action	Info
18 Fit the <i>swing housing</i> with <i>lower and upper arms</i> with its <i>attachment screws</i> .	<p>Tightening torque: 4 Nm.</p>  <p>xx0900001053</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Attachment screws (8 pcs)
19 Refit the <i>cable harness</i> from axis 2 to axis 6.	<p>See section:</p> <ul style="list-style-type: none"> <i>Refitting the cable harness on page 118</i>
20 Clean Room robots: seal and paint the joints that have been opened. See <i>Replacing parts on Clean Room robots on page 104</i>	
 Note After all repair work, wipe the robot free from particles with spirit on a lint free cloth.	
21 Recalibrate the robot.	<p>See chapter:</p> <ul style="list-style-type: none"> <i>Calibration on page 195.</i>
 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <i>DANGER - First test run may cause injury or damage! on page 45.</i>	

4.7.2 Replacing motor axis 2, with gearbox

Introduction

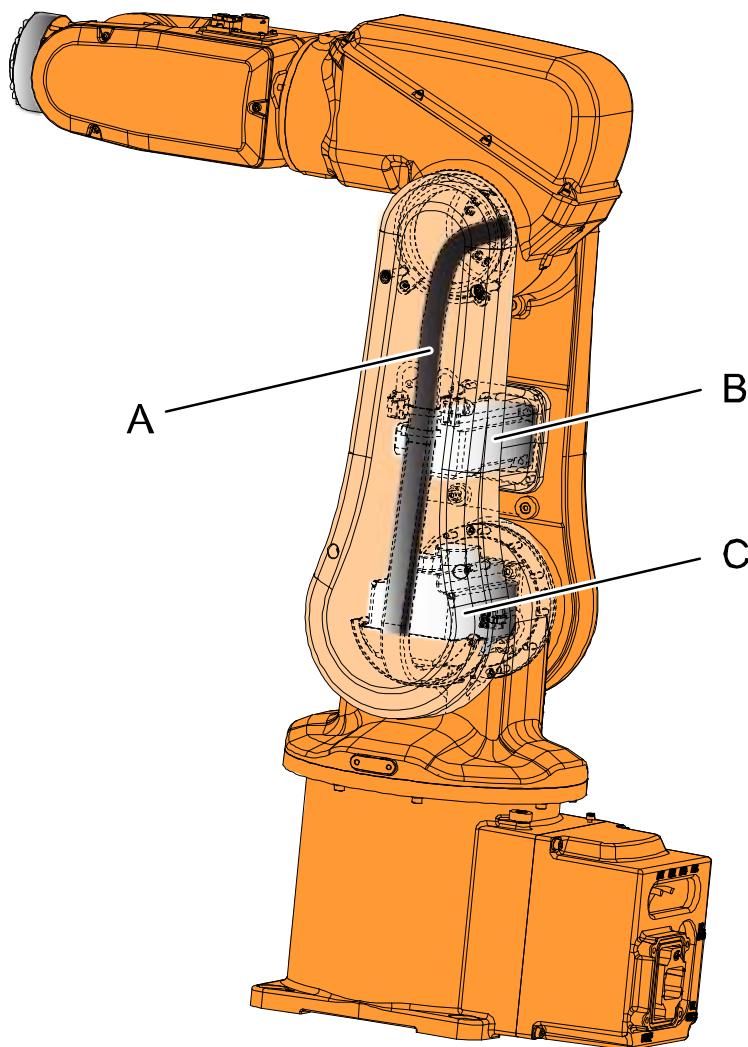
This procedure describes how to replace:

- motor axis 2 with gearbox.

Gearbox axis 2 is a part of motor axis 2 when ordered as a spare part. The procedure below describes the replacement of motor and gearbox axis 2 as one unit. For information how to replace gearbox axis 2, please contact ABB.

Location of motor axis 2 with gearbox

Motor axis 2 with gearbox is located as shown in the figure.



xx0900000847

A	Cable harness
B	Motor axis 3
C	Motor axis 2 with gearbox

Continues on next page

4 Repair

4.7.2 Replacing motor axis 2, with gearbox

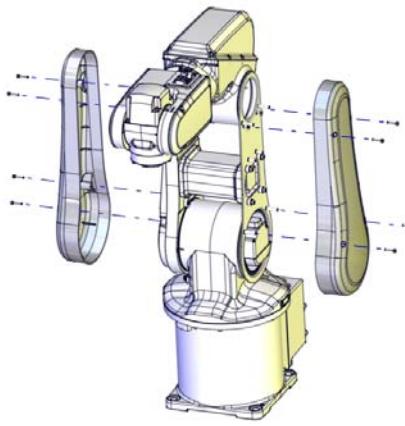
Continued

Required equipment

Equipment	Note
Standard toolkit	The content is defined in the section Standard toolkit on page 213 .
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.
Loctite 7063	For removing residues of Loctite.
Loctite 574	Amount: 2 ml.

Removing motor axis 2 with gearbox

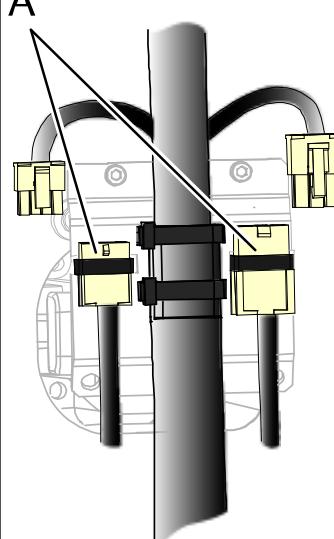
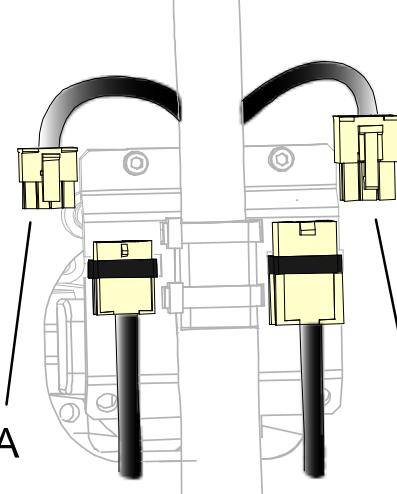
Use this procedure to remove motor axis 2 with gearbox.

	Action	Info
1	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
2	 CAUTION Always cut the paint with a knife and grind the paint edge when disassembling parts of a Clean Room robot! See Replacing parts on Clean Room robots on page 104	
3	Remove the <i>lower arm covers</i> on both sides of the lower arm	 xx0900000848

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4.7.2 Replacing motor axis 2, with gearbox

Continued

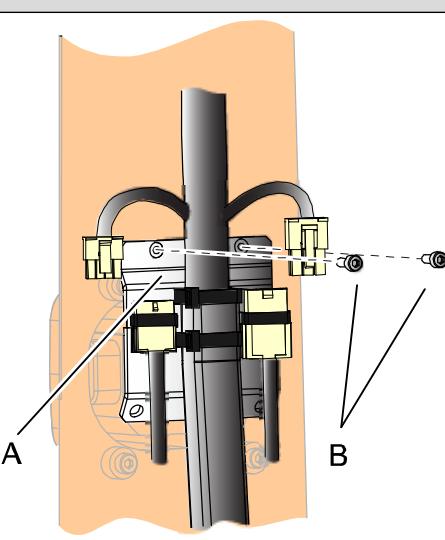
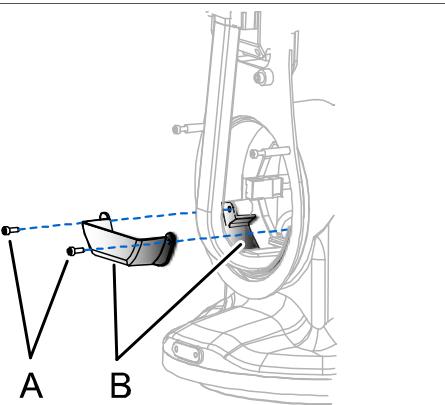
Action	Info
4 Cut the <i>cable straps</i> securing the <i>connectors</i> .	 <p>xx0900000849</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Cable straps (2 pcs)
5 Disconnect connectors: <ul style="list-style-type: none"> R2.MP3 R2.ME3 	 <p>xx0900000850</p> <p>Connectors:</p> <ul style="list-style-type: none"> A: R2.ME3 B: R2.MP3

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4 Repair

4.7.2 Replacing motor axis 2, with gearbox

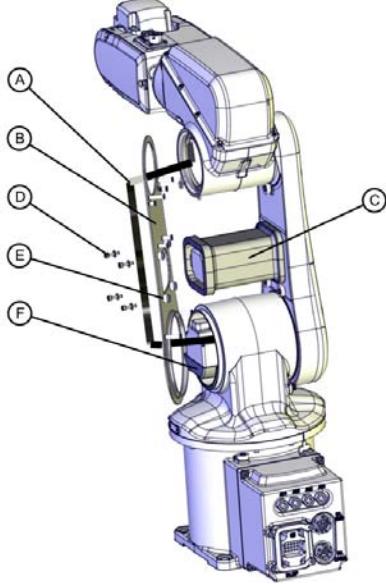
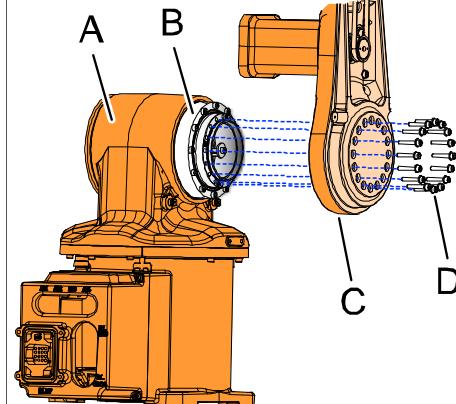
Continued

Action	Info
6 Unscrew the <i>attachment screws</i> securing the <i>cable bracket</i> .	 <p>xx0900000879</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Cable bracket • B: Attachment screws (2 pcs)
7 Remove both <i>cable guides</i> .	 <p>xx0900000857</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Attachment screws (2+2 pcs) • B: Cable guides (2 pcs)

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4.7.2 Replacing motor axis 2, with gearbox

Continued

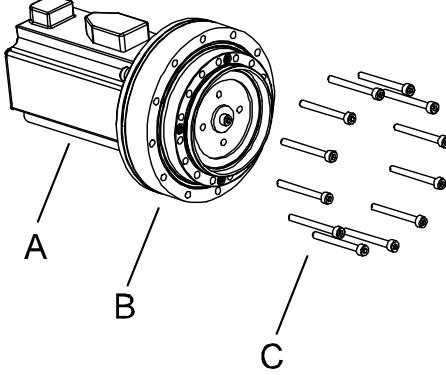
Action	Info
8 Unscrew the <i>attachment screws</i> securing the <i>lower arm plate</i> to the <i>motor cover</i> .	 <p>xx0900000851</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Cable harness B: Lower arm plate C: Motor cover D: Attachment screws (4 pcs) E: Holes for attachment screws (4 pcs) F: Cable guide
9 Unscrew the <i>attachment screws</i> securing the <i>lower arm</i> to <i>gearbox axis 2</i> .	 <p>xx0900000859</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Swing housing B: Gearbox axis 2 C: Lower arm D: Attachment screws (16 pcs)
10 Separate <i>lower arm</i> and <i>swing housing</i> .	
11 Disconnect connectors: <ul style="list-style-type: none"> R2.MP2 R2.ME2 	

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4 Repair

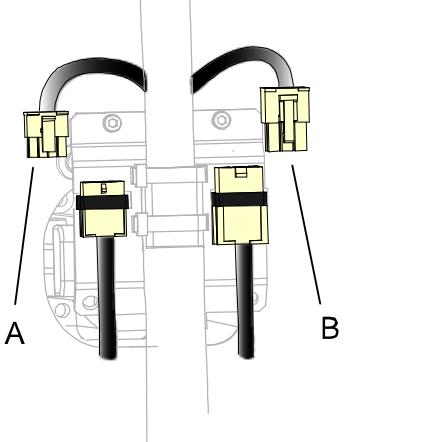
4.7.2 Replacing motor axis 2, with gearbox

Continued

Action	Info
<p>12 Remove gearbox axis 2 together with the motor.</p> <p>CAUTION</p> <p>In order not to damage any parts, hold the two items with a firm grip on the support when removing them.</p>	 <p>xx0900000869</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Motor axis 2 • B: Gearbox axis 1 • C: Attachment screws (12 pcs)

Refitting motor axis 2 with gearbox

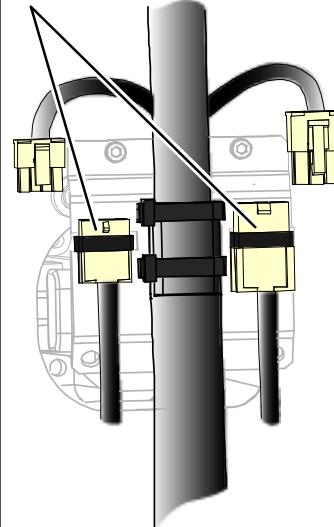
Use this procedure to refit motor axis 2 with gearbox.

Action	Info
1 Clean Room robots: clean the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
2 Before refitting, check that: <ul style="list-style-type: none"> • all assembly surfaces are clean and without damages • motor and gearbox are clean and without damages. 	
3 Reconnect connectors: <ul style="list-style-type: none"> • R2.MP2 • R2.ME2 	 <p>xx0900000850</p> <p>Connectors:</p> <ul style="list-style-type: none"> • A: R2.ME2 • B: R2.MP2

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4.7.2 Replacing motor axis 2, with gearbox

Continued

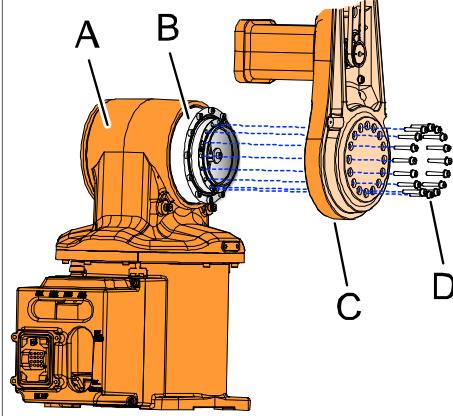
Action	Info
4 Secure the connectors with <i>cable straps</i> .  Note Put the strap tie on the side in order to make the lower arm cover fit well.	A  xx0900000849 Parts: • A: Cable straps (2 pcs)
5 Remove the two bolts with nuts securing motor axis 2 with gearbox while being transported.	 xx0900001050 Parts: • A: Bolt with nut, used during transport (2 pcs)
6 Remove old residues of Loctite from the assembly surfaces on the lower arm.	See: • Required equipment on page 162
7 Apply <i>Loctite 574</i> on the assembly surfaces of the lower arm and gearbox.	
8 Place motor axis 2 with gearbox in the swing housing.  CAUTION In order not to damage any parts, hold the two items with a firm grip on the support when removing them.	

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4 Repair

4.7.2 Replacing motor axis 2, with gearbox

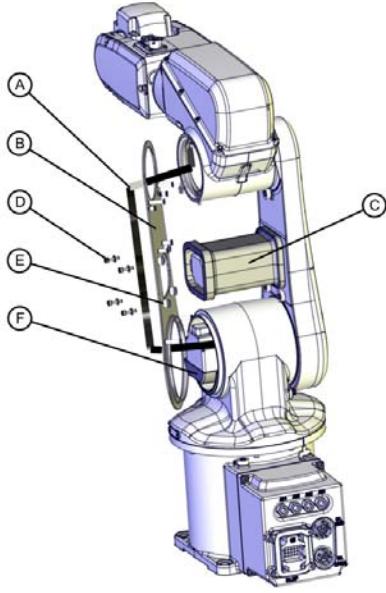
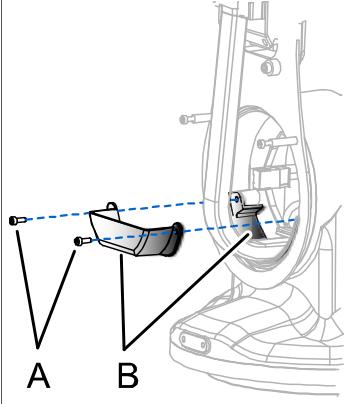
Continued

Action	Info
9 Reconnect connectors: <ul style="list-style-type: none">• R2.MP3• R2.ME3.	
10  DANGER Check that the cable harness is intact and connected correctly on all axes!	
11 Refit the <i>lower arm</i> to the <i>swing housing</i> . with its <i>attachment screws and washers</i> .	Tightening torque: 4 Nm.  xx0900000859 Parts: <ul style="list-style-type: none">• A: Swing housing• B: Gearbox axis 2• C: Lower arm• D: Attachment screws with washers (12+12 pcs)

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4.7.2 Replacing motor axis 2, with gearbox

Continued

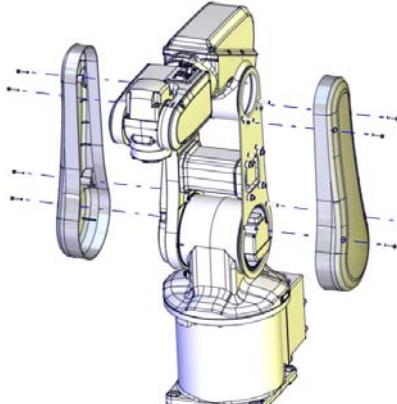
Action	Info
12 Refit the <i>lower arm plate</i> .	<p>Tightening torque: 4 Nm.</p>  <p>xx0900000851</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Cable harness B: Lower arm plate C: Motor cover D: Attachment screws (4 pcs) E: Holes for attachment screws (4 pcs) F: Cable guide
13 Refit the two <i>cable guides</i> .	<p>Tightening torque : 1 Nm.</p>  <p>xx0900000857</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Cable guides (2 pcs)

Continues on next page

4 Repair

4.7.2 Replacing motor axis 2, with gearbox

Continued

	Action	Info
14	Refit the <i>lower arm covers</i> .	<p>Tightening torque: 2 Nm.</p>  <p>xx0900000848</p>
15	<p>Clean Room robots: seal and paint the joints that have been opened. See Replacing parts on Clean Room robots on page 104</p> <p> Note</p> <p>After all repair work, wipe the robot free from particles with spirit on a lint free cloth.</p>	
16	Recalibrate the robot.	<p>See chapter:</p> <ul style="list-style-type: none"> • Calibration on page 195.
17	<p> DANGER</p> <p>Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 45.</p>	

4.7.3 Replacing motor axis 3

Introduction

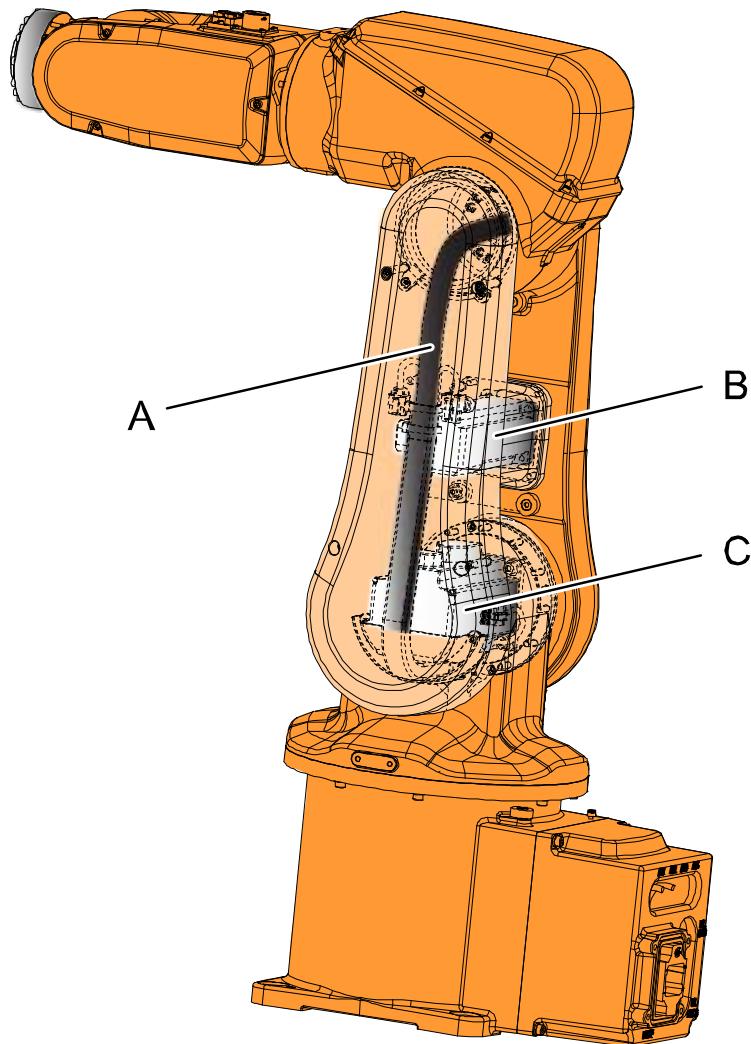
This procedure describes how to replace motor axis 3.

How to replace gearbox axis 3 see section:

- [Replacing gearbox axis 3 on page 191](#)

Location of motor axis 3

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



xx0900000847

A	Cable harness
B	Motor axis 3
C	Motor axis 2

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4 Repair

4.7.3 Replacing motor axis 3

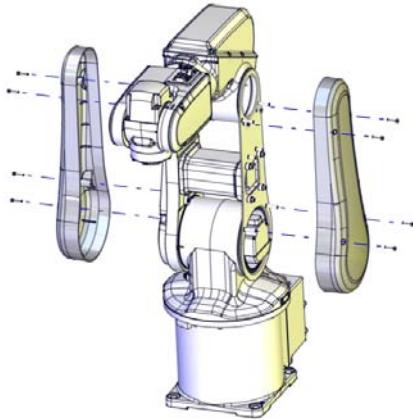
Continued

Required equipment

Equipment	Note
Standard toolkit	The content is defined in the section Standard toolkit on page 213 .
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.
Loctite 574	Amount: 2 ml.

Removing motor axis 3

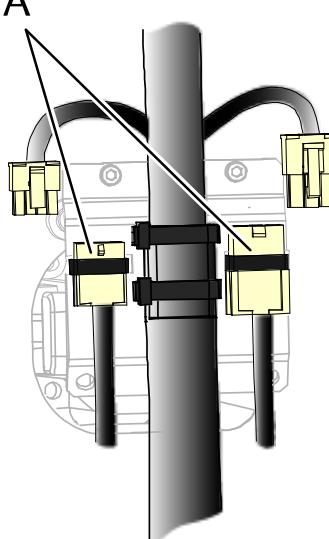
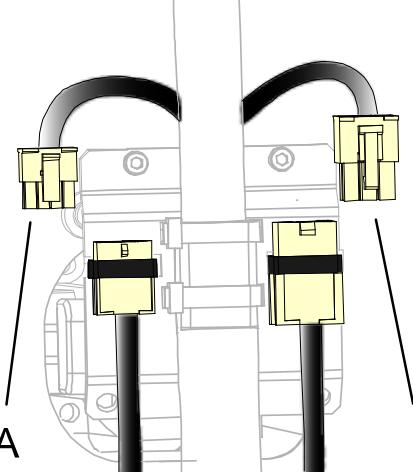
Use this procedure to replace motor axis 3.

Action	Info
1 Secure the arm system before removing motor axis 3.	
2  DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
3  CAUTION Always cut the paint with a knife and grind the paint edge when disassembling parts of a Clean Room robot! See Replacing parts on Clean Room robots on page 104	
4 Remove the <i>lower arm covers</i> on both sides of the lower arm.	 xx0900000848

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4.7.3 Replacing motor axis 3

Continued

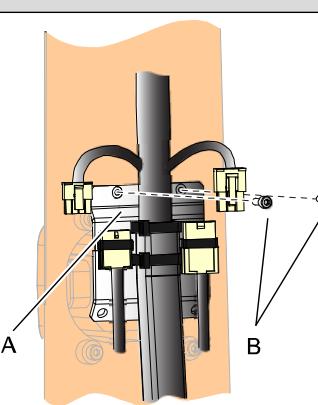
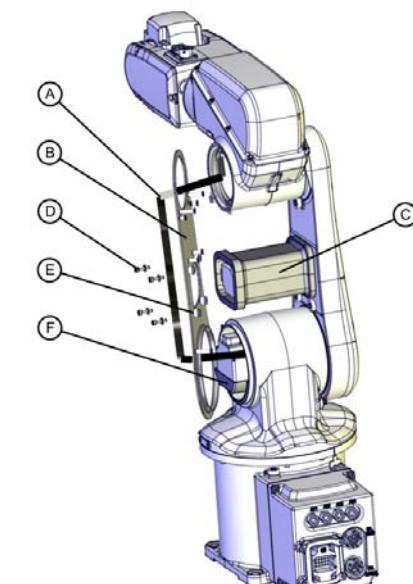
Action	Info
5 Cut the <i>cable straps</i> securing the connectors.	 <p>xx0900000849</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Cable straps (2 pcs)
6 Disconnect connectors: <ul style="list-style-type: none"> R2.MP3 R2.ME3. 	 <p>xx0900000850</p> <p>Parts:</p> <ul style="list-style-type: none"> A: R2.ME3 B: R2.MP3

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4 Repair

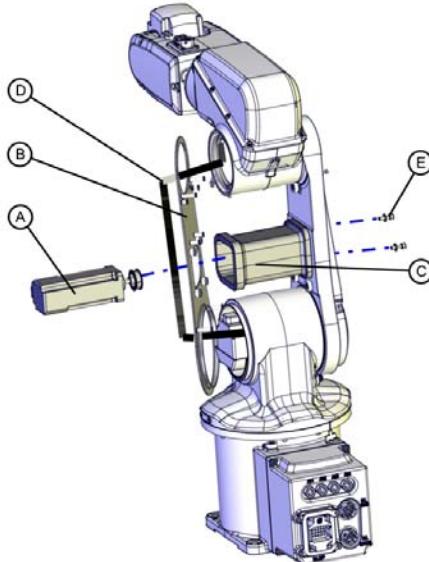
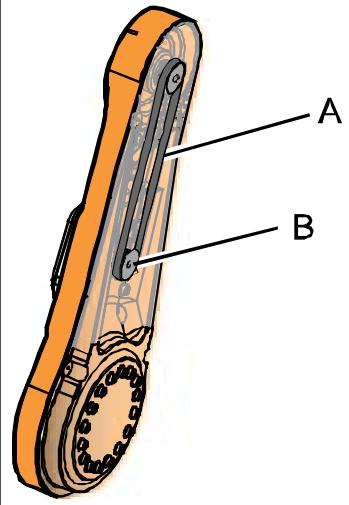
4.7.3 Replacing motor axis 3

Continued

Action	Info
7 Unscrew the <i>attachment screws</i> securing the <i>cable bracket</i> .	 <p>xx0900000879</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Cable bracket • B: Attachment screws (2 pcs)
8 Unscrew the attachment screws securing the <i>lower arm plate</i> to the <i>motor cover</i> .	 <p>xx0900000851</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Cable harness • B: Lower arm plate • C: Motor cover • D: Attachment screws (4 pcs) • E: Holes for attachment screws (4 pcs) • F: Cable guide
9 Move the <i>cable harness</i> and the <i>lower arm plate</i> a little to the side.	

Continues on next page

Continued

Action	Info
10 Unscrew the <i>attachment screws</i> securing the <i>motor axis 3</i> .	 <p>xx0900000875</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Motor axis 3 B: Lower arm plate C: Motor cover D: Cable harness E: Attachment screws (2 pcs)
11 Remove the <i>timing belt</i> from the <i>pulleys</i> on the <i>motor axis</i> .	 <p>xx0900000876</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Timing belt B: Pulleys (2 pcs)
12 Remove the motor.	

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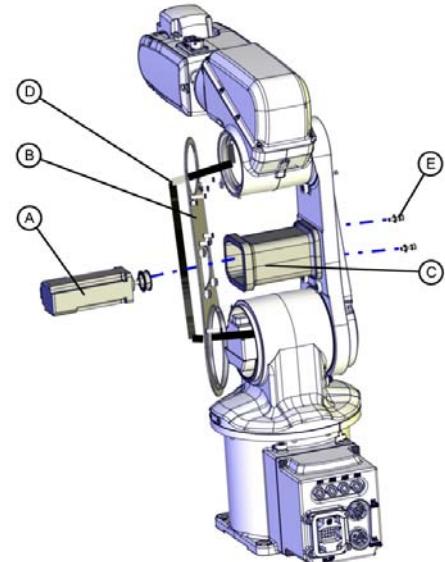
4 Repair

4.7.3 Replacing motor axis 3

Continued

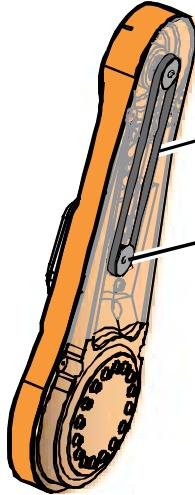
Refitting motor axis 3.

Use this procedure to refit motor axis 3.

Action	Info
1 Clean Room robots: clean the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
2 Check that: <ul style="list-style-type: none">• all assembly surfaces are clean and without damages• motor and gearbox are clean and undamaged.	
3 Place the <i>motor axis 3</i> in the <i>motor cover</i> .	 <p>xx0900000875</p> <p>Parts:</p> <ul style="list-style-type: none">• A: Motor axis 3• B: Lower arm plate• C: Motor cover• D: Cable harness• E: Attachment screws (2 pcs)

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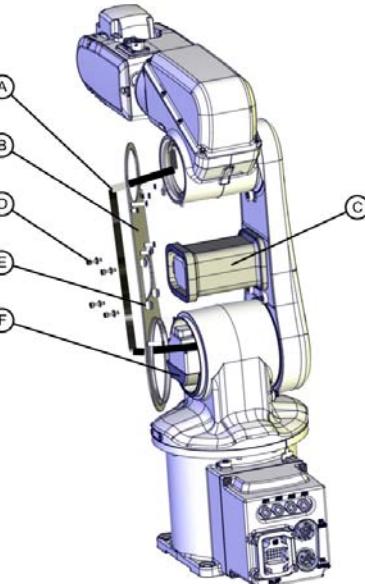
Action	Info
4 Refit the <i>timing belt</i> on the <i>pulleys</i> .	 <p>xx0900000876</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Timing belt B: Pulleys (2 pcs)
5 Tighten the <i>attachment screws and washers</i> securing the motor, just enough to still be able to move the motor.	
6 Move the motor to a position where a good <i>timing belt tension</i> is reached.	<p>Timing belt tension: $F=18-19.8\text{N}$.</p> <p> Note</p> <p>Do not stretch the timing belt too much!</p>
7 Secure the <i>motor axis 3</i> with its <i>attachment screws and washers</i> .	Tightening torque: 5.5 Nm.

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4 Repair

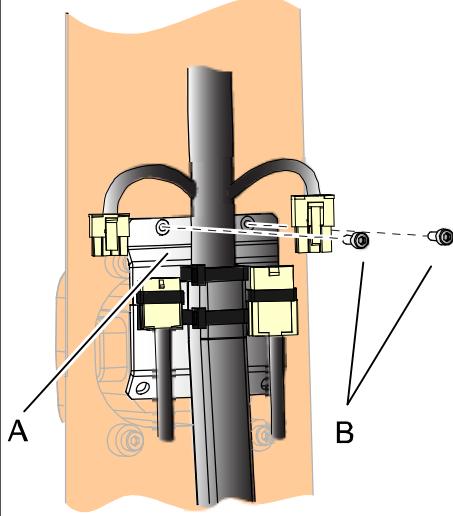
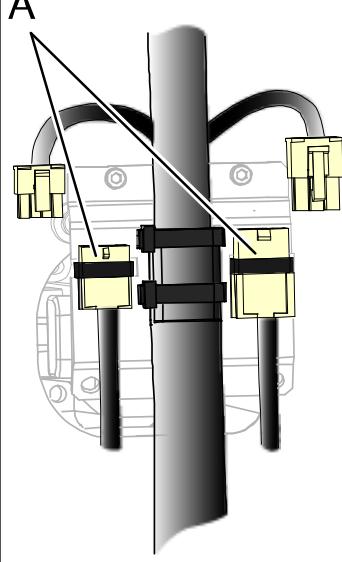
4.7.3 Replacing motor axis 3

Continued

Action	Info
8 Refit the <i>lower arm plate</i> .	<p>Tightening torque: 4 Nm.</p>  <p>xx0900000851</p> <p>Parts:</p> <ul style="list-style-type: none">• A: Cable harness• B: Lower arm plate• C: Motor cover• D: Attachment screws (4 pcs)• E: Holes for attachment screws (4 pcs)• F: Cable guide
9 Reconnect connectors: <ul style="list-style-type: none">• R2.MP3• R2.ME3.	

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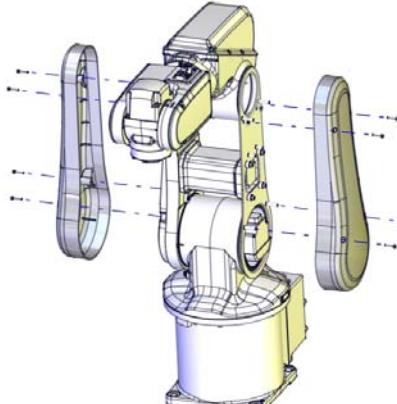
Action	Info
10 Secure the cable harness by refitting the <i>cable bracket</i> to the lower arm plate.	<p>Tightening torque: 1 Nm.</p>  <p>xx0900000879</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Cable bracket B: Attachment screws (2 pcs)
11 Secure the connectors with <i>cable straps</i> .	<p> Note</p> <p>Put the strap tie on the side in order to make the lower arm cover fit well.</p>  <p>xx0900000849</p> <p>Parts:</p> <ul style="list-style-type: none"> A: Cable straps (2 pcs)

Continues on next page

4 Repair

4.7.3 Replacing motor axis 3

Continued

	Action	Info
12	Refit the <i>lower arm covers</i> .	Tightening torque: 1 Nm.  xx0900000848
13	Clean Room robots: seal and paint the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
	 Note After all repair work, wipe the robot free from particles with spirit on a lint free cloth.	
14	Recalibrate the robot.	See chapter: • Calibration on page 195 .
15	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 45 .	

4.7.4 Replacing motor axis 4, with gearbox

Introduction

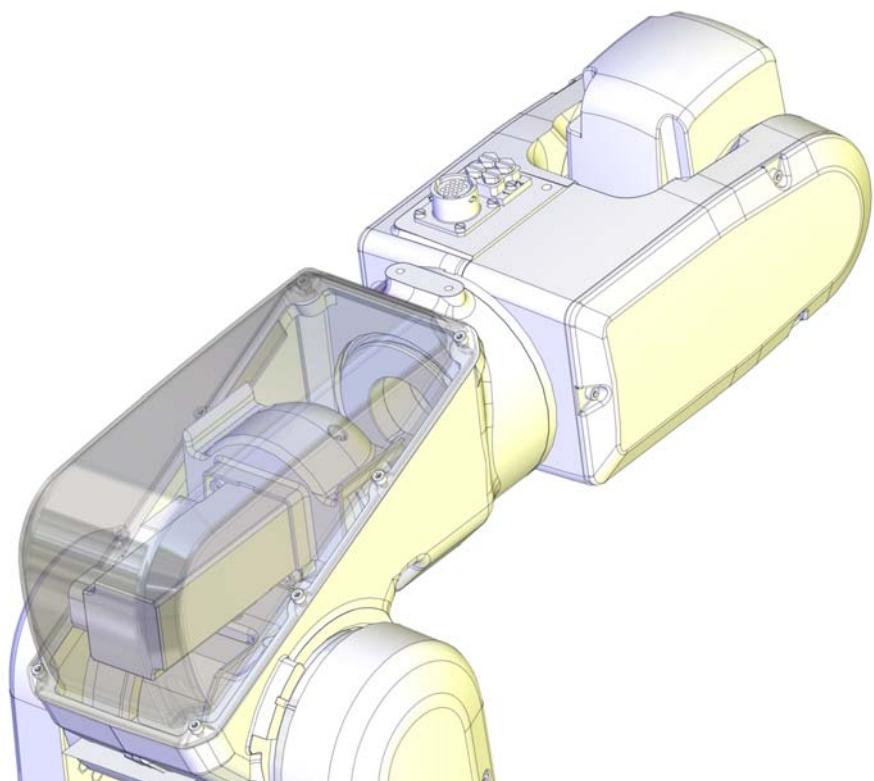
Motor axis 4 is delivered as part of the upper arm when ordered as a spare part.

How to replace the complete upper arm is described in section:

- [*Replacing the upper arm on page 136*](#)

Location of motor axis 4, with gearbox

Motor axis 4, with gearbox is located as shown in the figure:



xx0900000785

4 Repair

4.7.5 Replacing motor axis 5

4.7.5 Replacing motor axis 5

Introduction

This procedure describes how to replace:

- motor axis 5 with pulley.



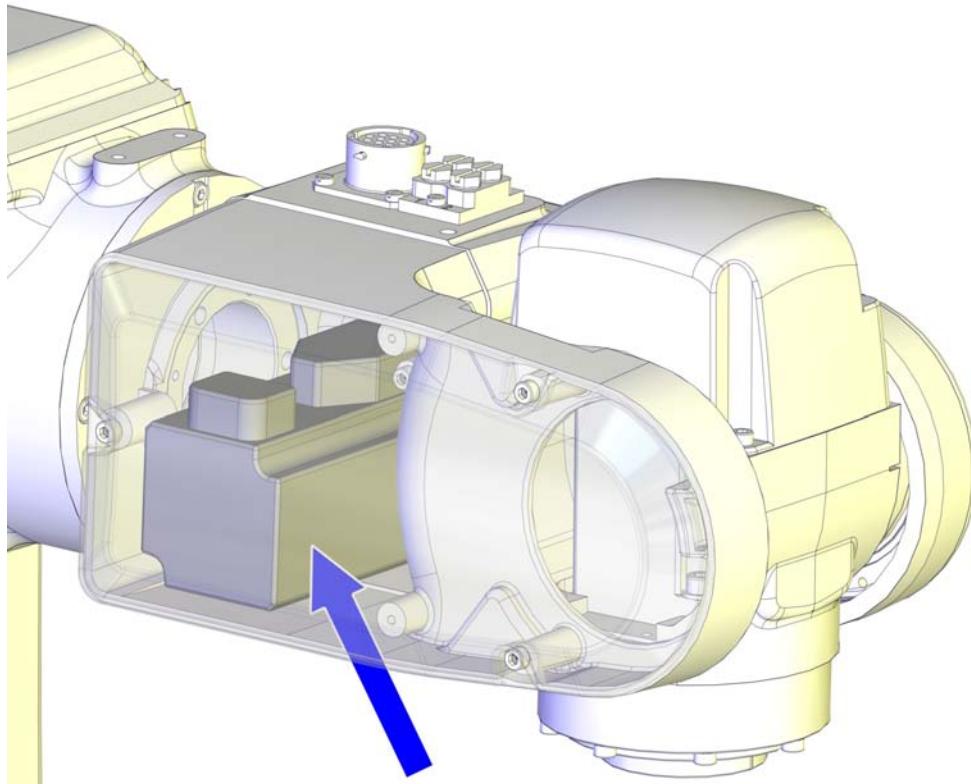
CAUTION

Always read the section "General procedures" before doing any repair work.

[Replacing parts on Clean Room robots on page 104](#)

Location of motor axis 5

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



xx0900000890

Required equipment

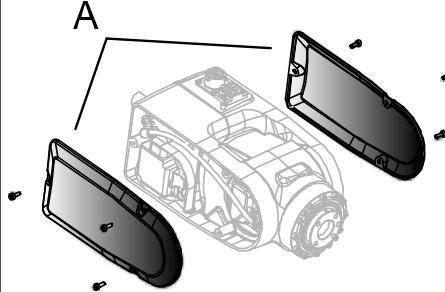
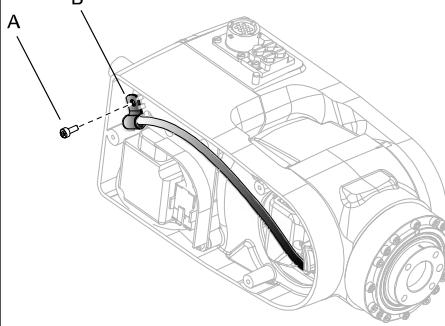
Equipment	Note
Standard toolkit	The content is defined in the section Standard toolkit on page 213 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	These procedures include references to the tools required.

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Removing motor axis 5 with pulley

Use this procedure to remove motor axis 5 with pulley.

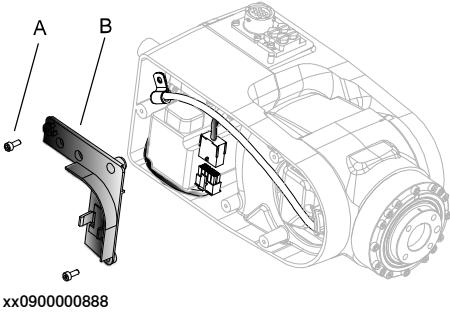
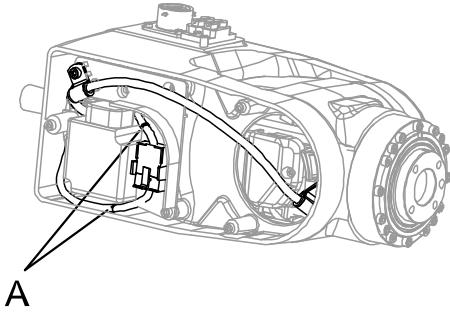
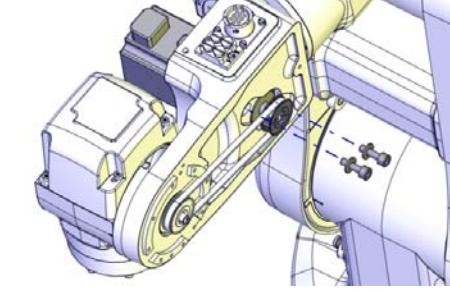
Action	Info
1  DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
2  CAUTION Always cut the paint with a knife and grind the paint edge when disassembling parts of a Clean Room robot! See Replacing parts on Clean Room robots on page 104	
3 Remove the <i>wrist side covers</i> on both sides of the wrist.	 xx0900000886 Parts: <ul style="list-style-type: none"> • A: Wrist side covers (2 pcs)
4 Loosen the <i>attachment screw</i> securing the <i>clamp</i> .	 xx0900000887 Parts: <ul style="list-style-type: none"> • A: Attachment screw • B: Clamp

Continues on next page

4 Repair

4.7.5 Replacing motor axis 5

Continued

Action	Info
5 Remove the <i>connector support</i> .	 <p>xx0900000888</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Attachment screws (2 pcs) • B: Connector support
6 Cut the <i>cable straps</i> .	 <p>xx0900001009</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Cable straps (2 pcs)
7 Disconnect connectors for motor axis 5: <ul style="list-style-type: none"> • R2.MP5 • R2.ME5 	
8 Unscrew the <i>attachment screws</i> securing <i>motor axis 5</i> .	 <p>xx1100000960</p>

Continues on next page

Continued

Action	Info
9 Remove the <i>timing belt</i> from the <i>pulleys</i> .	 xx0900000611 <p>Parts:</p> <ul style="list-style-type: none"> • A: Wrist side cover • B: Pulley (2 pcs) • C: Timing belt
10 Remove the motor with pulley.	

Refitting motor axis 5

Use this procedure to refit motor axis 5.

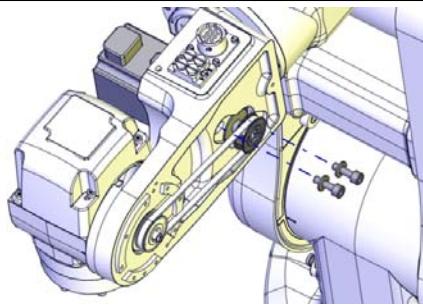
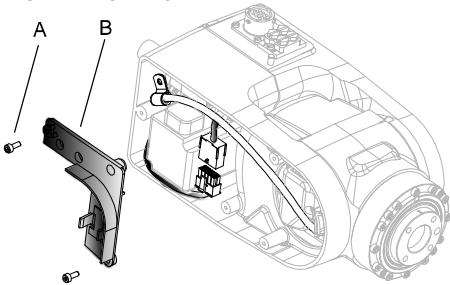
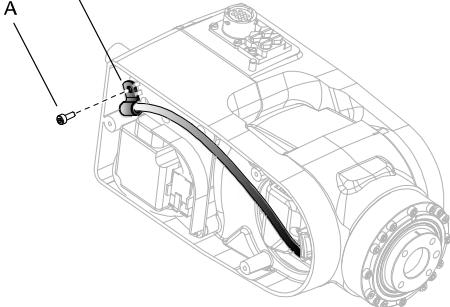
Action	Info
1 Clean Room robots: clean the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
2 Check that: <ul style="list-style-type: none"> • all assembly surfaces are clean and without damages • the motor is clean and undamaged. 	
3 Place the motor in the wrist housing.	
4 Reconnect connectors: <ul style="list-style-type: none"> • R2.MP5 • R2.ME5 	
5 Refit the <i>timing belt</i> on the <i>pulleys</i> .	 xx0900000611 <p>Parts:</p> <ul style="list-style-type: none"> • A: Wrist side cover • B: Pulley (2 pcs) • C: Timing belt

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4 Repair

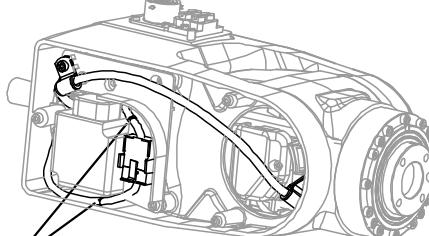
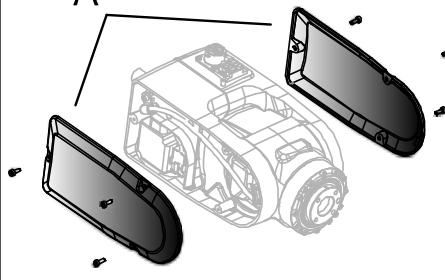
4.7.5 Replacing motor axis 5

Continued

Action	Info
6 Tighten the <i>attachment screws and washers</i> securing the <i>motor</i> , just enough (4 Nm) to still be able to move the motor.	 xx1100000960
7 Move the motor to a position where a good timing belt tension is reached.	 Note Do not stretch the timing belt too much!
8 Secure <i>motor axis 5</i> with its <i>attachment screws and washers</i> .	Tightening torque: 5.5 Nm.
9 Refit the <i>connector support</i> .	Tightening torque: 1 Nm.  xx0900000888 Parts: <ul style="list-style-type: none"> • A: Attachment screws (2 pcs) • B: Connector support
10 Refit the <i>clamp</i> with its <i>attachment screw</i> .	Tightening torque: 1 Nm.  xx0900000887 Parts: <ul style="list-style-type: none"> • A: Attachment screw • B: Clamp

Continues on next page

Continued

Action	Info
11 Secure the cables with <i>cable straps</i> .	 <p>A xx0900001009</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Cable straps (2 pcs)
12 Refit the <i>wrist side covers</i> .	<p>Tightening torque: 1 Nm.</p>  <p>A xx090000886</p> <p>Parts:</p> <ul style="list-style-type: none"> • A: Wrist side covers (2 pcs)
13 Clean Room robots: seal and paint the joints that have been opened. See Replacing parts on Clean Room robots on page 104	
 Note <p>After all repair work, wipe the robot free from particles with spirit on a lint free cloth.</p>	
14 Recalibrate the robot.	See chapter: <ul style="list-style-type: none"> • Calibration on page 195.
15  DANGER <p>Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 45.</p>	

4 Repair

4.7.6 Replacing motor axis 6

4.7.6 Replacing motor axis 6

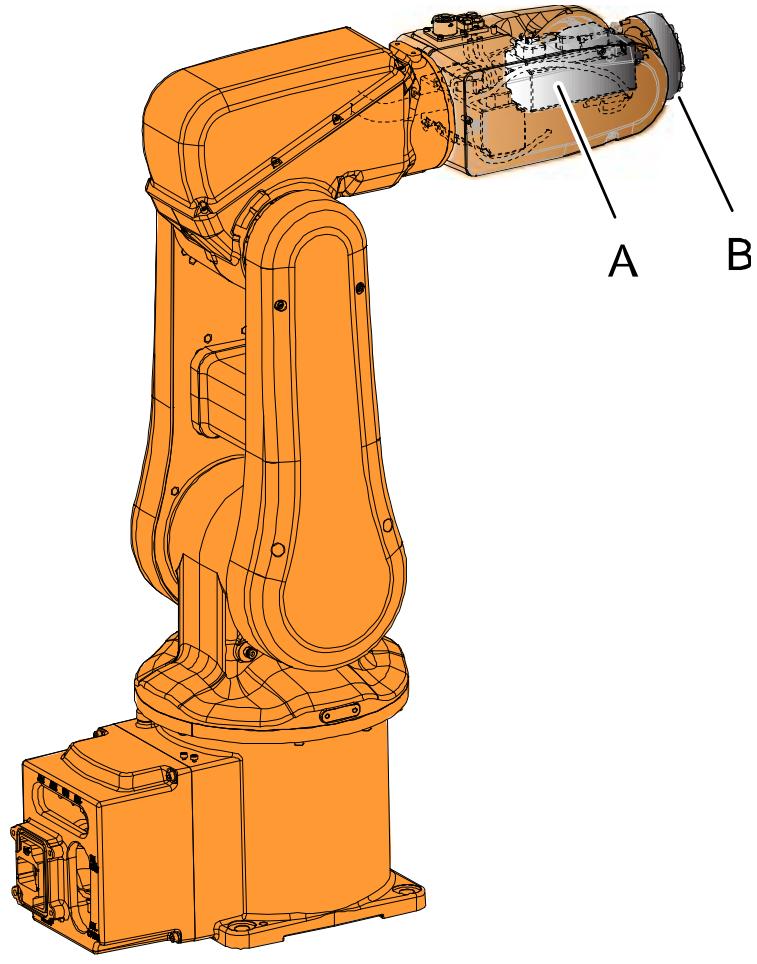
Introduction

The motor axis 6 is delivered as part of the upper arm. How to replace the upper arm see section [Replacing the upper arm on page 136](#).

Motor axis 6 is a part of the upper arm when ordered as a spare part. For more information how to replace motor axis 6, please contact ABB.

Location of motor axis 6

Motor axis 6 is located as shown in the figure.



xx0900000910

A	Motor axis 6
B	Gearbox axis 6

4.8 Gearboxes

4.8.1 Replacing gearbox axis 1

Introduction

The gearbox axis 1 is delivered as a part of motor axis 1. For information how to replace motor with gearbox axis 1, see section *Replacing motor axis 1 with gearbox on page 150*.

4.8.2 Replacing gearbox axis 2

Introduction

The gearbox axis 2 is delivered as a part of motor axis 2. For information how to replace motor with gearbox axis 2, see section [*Replacing motor axis 2, with gearbox on page 161.*](#)

4.8.3 Replacing gearbox axis 3

Overview

Gearbox axis 3 is delivered as a part of the lower arm. For more information how to replace gearbox axis 3, please contact ABB.

Location of gearbox axis 3

Gearbox axis 3 is located as shown in the figure.



xx0900001040

A	Gearbox axis 3
B	Lower arm

4.8.4 Replacing gearbox axis 4

4.8.4 Replacing gearbox axis 4

Introduction

Gearbox axis 4 is delivered as a part of the upper arm.

How to replace the upper arm see:

- [*Replacing the upper arm on page 136*](#)

For more information how to replace gearbox axis 4, please **contact ABB**.

4.8.5 Replacing gearbox axis 5

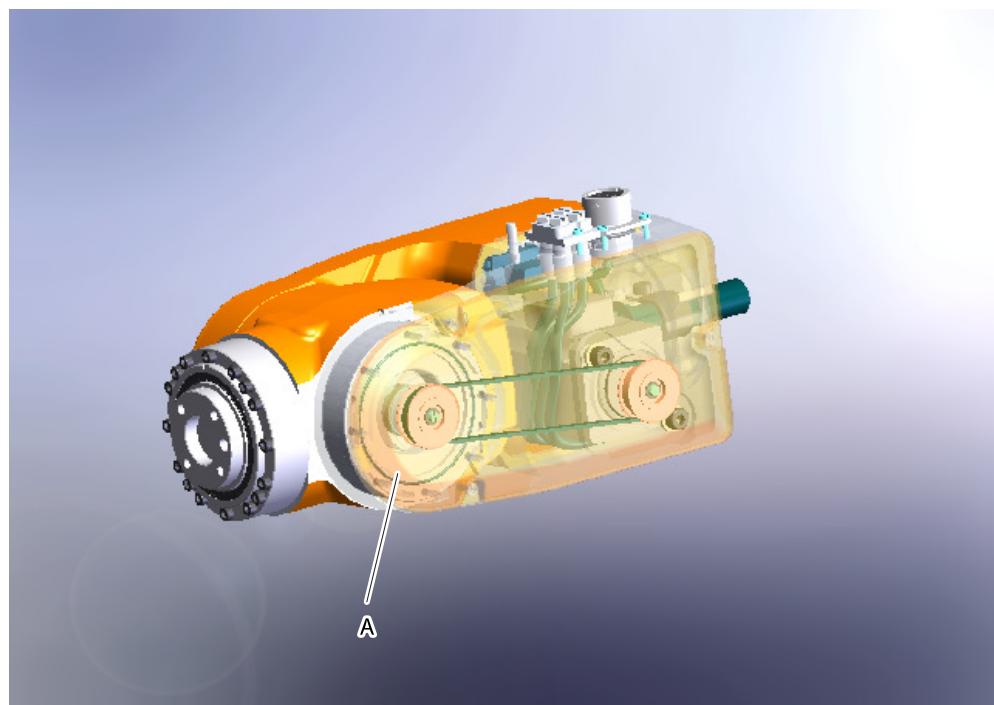
Overview

Gearbox axis 5 is delivered as a part of the upper arm. How to replace the upper arm is described in section [Replacing the upper arm on page 136](#).

For more information how to replace gearbox axis 5, please contact ABB.

Location of gearbox axis 5

Gearbox axis 5 is located as shown in the figure.



xx0900001041

A	Gearbox axis 5
---	----------------

4 Repair

4.8.6 Replacing gearbox axis 6

4.8.6 Replacing gearbox axis 6

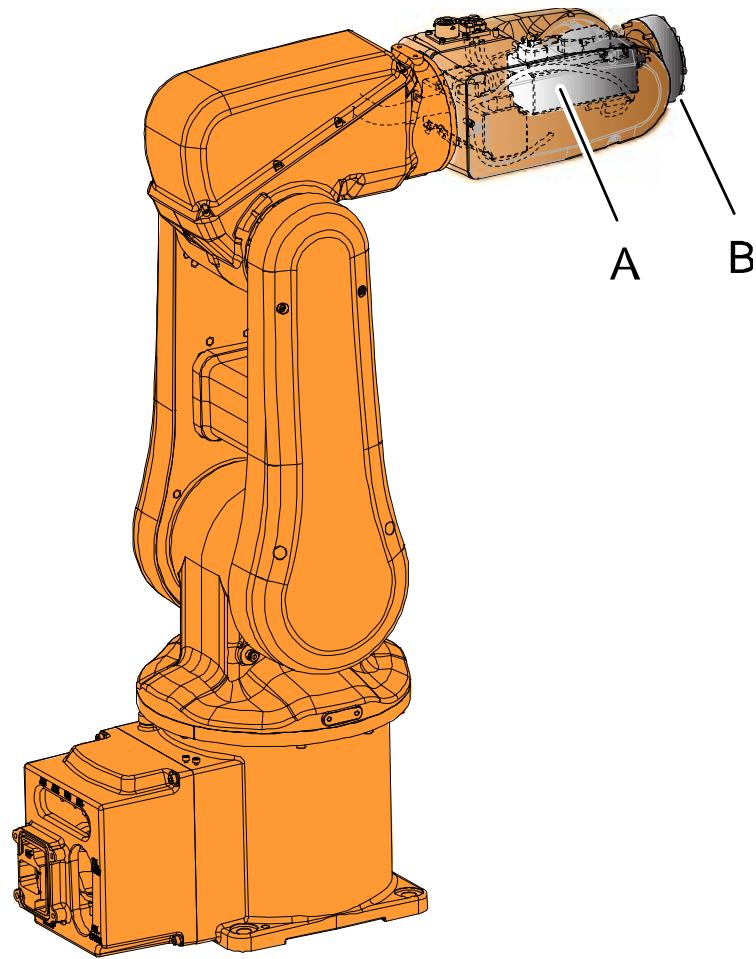
Introduction

The gearbox axis 6 is delivered as part of the upper arm. How to replace the upper arm is described in section [Replacing the upper arm on page 136](#).

For more information how to replace gearbox axis 6, please contact ABB.

Location of gearbox axis 6

Gearbox axis 6 is located as shown in the figure:



xx0900000910

A	Motor axis 6
B	Gearbox axis 6

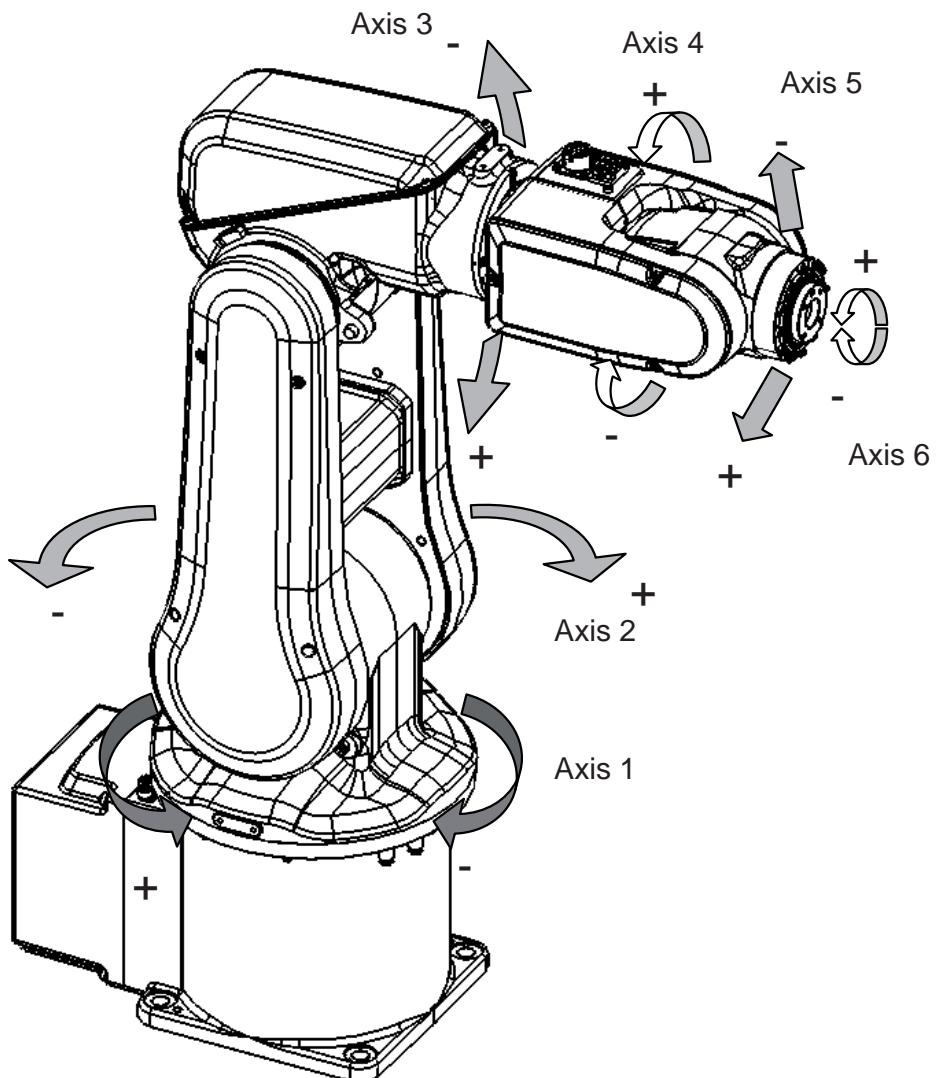
5 Calibration

5.1 Introduction

Introduction

This chapter is a short description how to use the calibration pins and the synchronization marks on the robot.

Manipulator axes



xx0900000262

5 Calibration

5.2 Calibrating axes 1 - 6

5.2 Calibrating axes 1 - 6

Introduction

This section describes how to calibrate the robot and how to use the calibration pins when calibrating.



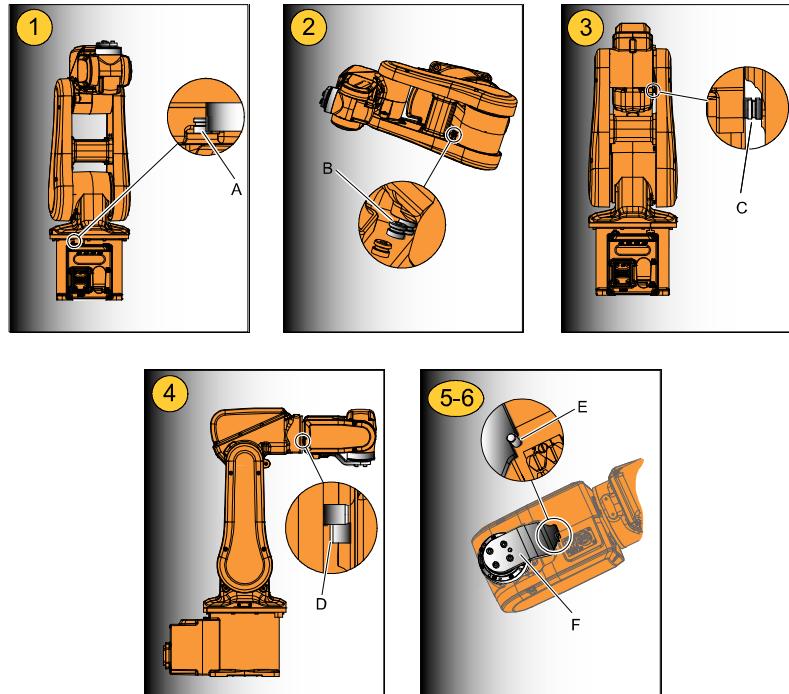
Note

Calibration can be done in the following ways:

- axis 1, 2 and 3 at the same time using the FlexPendant
- axis 4, 5 and 6 at the same time using the FlexPendant
- each axis separately.

Location of calibration pins

The figure shows the position of the calibration pins on axes 1 - 6.



xx0900000627

1	Calibration, axis 1. (Rotate axis 1 -170.2°)
A	Calibration pins, axis 1
2	Calibration, axis 2. (Rotate axis 2 -115.1°)
B	Calibration pins, axis 2
3	Calibration, axis 3. (Rotate axis 3 75.8°)
C	Calibration pins, axis 3
4	Calibration, axis 4. (Rotate axis 4 -174.7°)
D	Calibration pins, axis 4
5-6	Calibration, axis 5-6. (Rotate axis 5 -90° and axis 6 90°)

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Continued

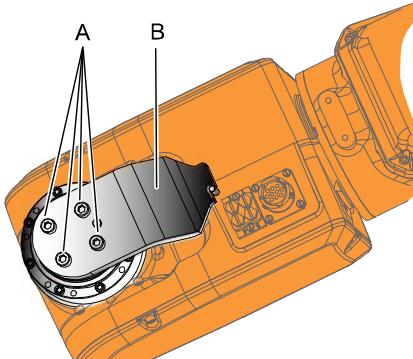
E	Calibration pin, axis 5-6
F	Calibration tool, axis 5-6

Required equipment

Equipment	Note
Standard toolkit	The content is defined in the section Standard toolkit on page 213 .
Calibration tool kit.	For art. no. see chapter Reference information .

Calibration using the FlexPendant

This procedure describes how to calibrate the robot using the FlexPendant.

	Action	Note
1	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
2	Remove all dampers from the <i>calibration pins</i> .	See the figure in: <ul style="list-style-type: none"> Location of calibration pins on page 196
3	Fit the <i>calibration tool</i> on axis 6.	 xx1000000005 Parts: <ul style="list-style-type: none"> A: Attachment screws (4 pcs) B: Calibration tool
4	Release the brakes.	How to release the brakes see section: <ul style="list-style-type: none"> Manually releasing the brakes on page 62
5	Rotate axes 4, 5 and 6 manually until the two calibration pins of each axis are in contact with each other.	See the figure in: <ul style="list-style-type: none"> Location of calibration pins on page 196
6	Choose fine calibration from Calib menu.	
7	Choose Calibrate on the FlexPendant.	
8	Choose axes 4, 5 and 6 on the FlexPendant and Calibrate .	
9	After calibration is done, use the FlexPendant to jog each axis to zero degree.	

Continues on next page

5 Calibration

5.2 Calibrating axes 1 - 6

Continued

	Action	Note
10	Rotate axes 1, 2 and 3 manually until the two calibration pins of each axis are in contact with each other.	See the figure in: <ul style="list-style-type: none">Location of calibration pins on page 196
11	Choose fine calibration from Calib menu.	
12	Choose axes 1, 2 and 3 on the FlexPendant and Calibrate.	
13	The <i>synchronisation marks</i> on each axis shall now be matched.	See section: <ul style="list-style-type: none">Synchronization marks axes 1-6 on page 202
14	Choose <i>Update Revolution counters</i> from the <i>Calib</i> menu.	
15	Choose <i>Axis 1 to 6</i> on the FlexPendant and update the revolution counters.	

Calibration of axis 1 separately

Use this procedure when calibrating axis 1 separately.

	Action	Info
1	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
2	Remove the dampers from the <i>calibration pins</i> .	See the figure in: <ul style="list-style-type: none">Location of calibration pins on page 196
3	Release the brakes.	See section: <ul style="list-style-type: none">Manually releasing the brakes on page 62
4	Rotate axis 1 manually until the two <i>calibration pins</i> are in contact with each other.	See figure in: <ul style="list-style-type: none">Location of calibration pins on page 196
5	Choose fine calibration from Calib menu.	
6	Choose Calibrate on the the FlexPendant.	
7	Choose axis 1 on the FlexPendant and Calibrate.	
8	After calibration is done use the FlexPendant to jog each axis to zero degree.	
9	The <i>synchronisation marks</i> on axis 1 shall now be matched.	See section: <ul style="list-style-type: none">Synchronization marks axes 1-6 on page 202
10	Choose <i>Update Revolution counters</i> from the <i>Calib</i> menu.	
11	Choose <i>Axis 1</i> on the FlexPendant and update the revolution counters.	

Continues on next page

Continued

Calibration of axis 2 separately

Use this procedure when calibrating axis 2 separately.

Action	Info
1  DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
2 Remove the dampers from the <i>calibration pins</i> .	See the figure in: • Location of calibration pins on page 196
3 Release the brakes.	See section: • Manually releasing the brakes on page 62
4 Rotate axis 2 manually until the two <i>calibration pins</i> are in contact with each other.	See figure 2 in: • Location of calibration pins on page 196
5 Choose fine calibration from Calib menu.	
6 Choose Calibrate on the the FlexPendant.	
7 After calibration is done use the FlexPendant to jog each axis to zero degree.	
8 The <i>synchronisation marks</i> on axis 2 shall now be matched	See section: • Synchronization marks axes 1-6 on page 202
9 Choose <i>Update Revolution counters</i> from the <i>Calib</i> menu.	
10 Choose <i>Axis 2</i> on the FlexPendant and update the revolution counters.	

Calibration of axis 3 separately

Use this procedure when calibrating axis 3 separately.

Action	Info
1  DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
2 Remove the dampers from the <i>calibration pins</i> .	See the figure in: • Location of calibration pins on page 196
3 Release the brakes.	See section: • Manually releasing the brakes on page 62
4 Rotate axis 3 manually until the two <i>calibration pins</i> are in contact with each other.	See figure 3 in: • Location of calibration pins on page 196
5 Choose fine calibration from Calib menu.	
6 Choose Calibrate on the the FlexPendant.	

Continues on next page

5 Calibration

5.2 Calibrating axes 1 - 6

Continued

	Action	Info
7	After calibration is done use the FlexPendant to jog each axis to zero degree.	
8	The <i>synchronisation marks</i> on axis 3 shall now be matched.	See section: <ul style="list-style-type: none">Synchronization marks axes 1-6 on page 202
9	Choose <i>Update Revolution counters</i> from the <i>Calib</i> menu.	
10	Choose <i>Axis 3</i> on the FlexPendant and update the revolution counters.	

Calibration of axis 4 separately

Use this procedure when calibrating axis 4 separately.

	Action	Info
1	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
2	Release the brakes.	See section: <ul style="list-style-type: none">Manually releasing the brakes on page 62
3	Rotate axis 4 manually until the two <i>calibration pins</i> are in contact with each other.	See the figure 4 in: <ul style="list-style-type: none">Location of calibration pins on page 196
4	Choose fine calibration from Calib menu.	
5	Choose Calibrate on the the FlexPendant.	
6	After calibration is done use the FlexPendant to jog each axis to zero degree	
7	The <i>synchronisation marks</i> on axis 4 shall now be matched.	See section: <ul style="list-style-type: none">Synchronization marks axes 1-6 on page 202
8	Choose <i>Update Revolution counters</i> from the <i>Calib</i> menu.	
9	Choose <i>Axis 4</i> on the FlexPendant and update the revolution counters.	

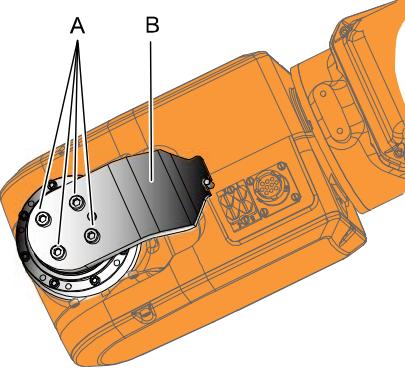
Calibration of axes 5 and 6 using the calibration tool

Use this procedure when calibrating axes 5 and 6 separately.

	Action	Info
1	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	

Continues on next page

Continued

Action	Info
2 Fit the <i>calibration tool</i> on the wrist with its <i>attachment screws</i> .	 xx1000000005 Parts: <ul style="list-style-type: none"> • A: Attachment screws (4 pcs) • B: Calibration tool
3 Release the brakes.	See section: <ul style="list-style-type: none"> • Manually releasing the brakes on page 62
4 Rotate axes 5 and 6 manually until the <i>calibration pin</i> on the wrist and the <i>fork</i> of the tool are in contact with each other.	See figure 5-6 in: <ul style="list-style-type: none"> • Location of calibration pins on page 196
5 Choose fine calibration from Calib menu.	
6 Choose Calibrate on the the FlexPendant.	
7 After calibration is done use the FlexPendant to jog each axis to zero degree.	
8 The <i>synchronisation marks</i> on axes 5 and 6 shall now be matched.	See section: <ul style="list-style-type: none"> • Synchronization marks axes 1-6 on page 202
9 Choose <i>Update Revolution counters</i> from the <i>Calib menu</i> .	
10 Choose <i>Axis 5 to 6</i> on the FlexPendant and update the revolution counters.	

5 Calibration

5.3 Synchronization marks axes 1-6

5.3 Synchronization marks axes 1-6

Introduction

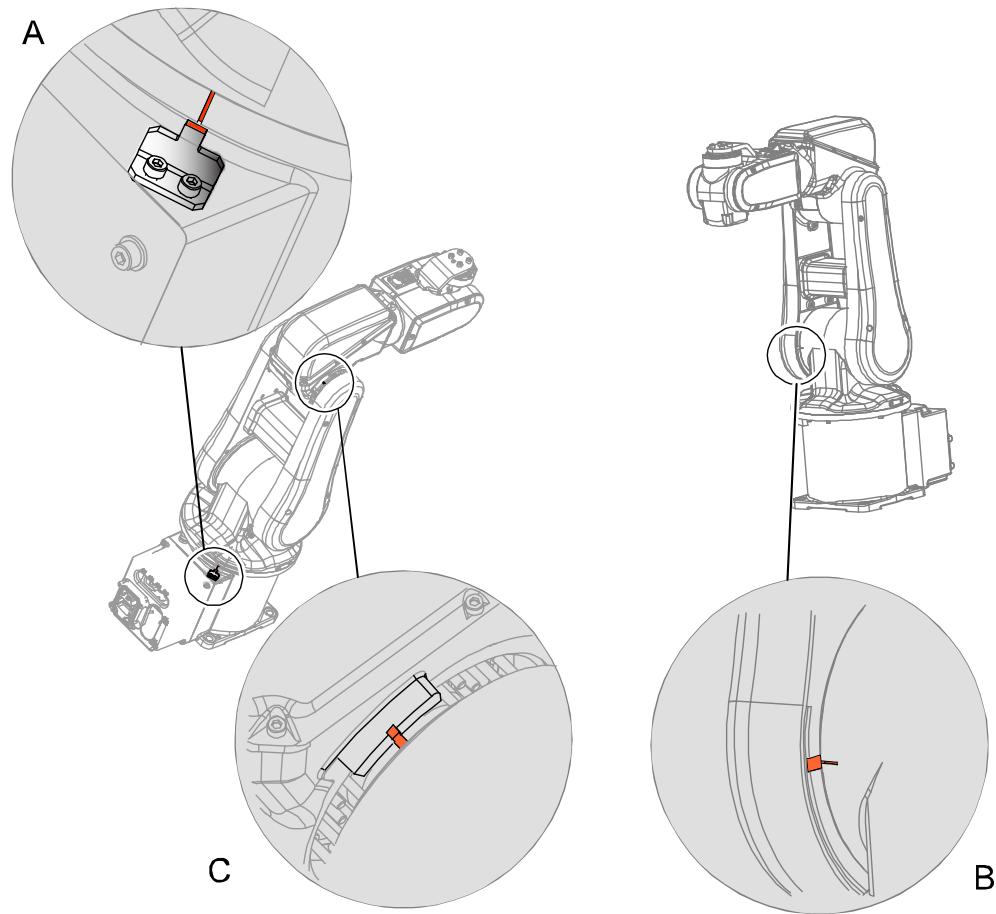
This section specifies the position of the synchronization marks.

These synchronization marks are used for updating encoder revolution by moving each axis to the synchronization position indicated by the marks.

Location of the synchronization marks

The figures shows the synchronization marks on the robot.

The figure shows the synchronization marks on axes 1-3.



xx0900000574

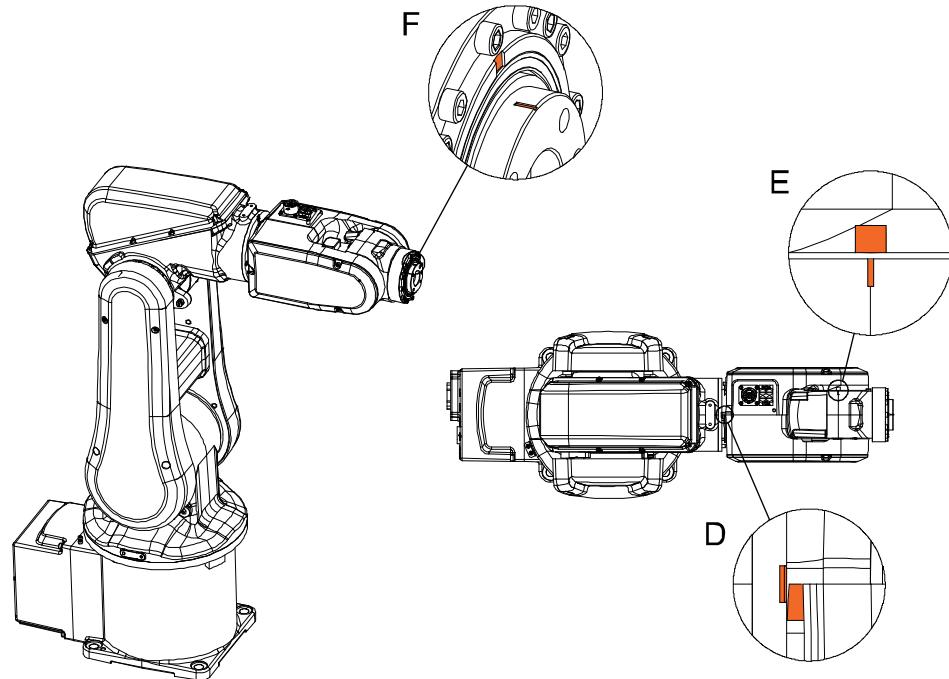
A	Synchronization mark, axis 1
B	Synchronization mark, axis 2
C	Synchronization mark, axis 3

Continues on next page

5.3 Synchronization marks axes 1-6

Continued

The figure shows the synchronization marks on axes 4-6.



xx0900000575

D	Synchronization mark, axis 4
E	Synchronization mark, axis 5
F	Synchronization mark, axis 6

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6 Decommissioning

6.1 Introduction

Introduction

This section contains information to consider when taking a product, robot or controller, out of operation.

It deals with how to handle potentially dangerous components and potentially hazardous materials.

General

All used grease/oils and dead batteries **must** be disposed of in accordance with the current legislation of the country in which the robot and the control unit are installed.

If the robot or the control unit is partially or completely disposed of, the various parts **must** be grouped together according to their nature (which is all iron together and all plastic together), and disposed of accordingly. These parts **must** also be disposed of in accordance with the current legislation of the country in which the robot and control unit are installed.

6 Decommissioning

6.2 Environmental information

6.2 Environmental information

Hazardous material

The table specifies some of the materials in the product and their respective use throughout the product.

Dispose components properly to prevent health or environmental hazards.

Material	Example application
Batteries, NiCad or Lithium	Encoder Interface Board
Copper	Cables, motors
Cast iron/nodular iron	Upper arm
Steel	Gears, screws, shafts, brackets, and so on.
Neodymium	Brakes, motors
Plastic/rubber	Cables, connectors, drive belts, covers, and so on.
Oil, grease	Gearboxes
Aluminium	Structure

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.

7 Reference information

7.1 Introduction

General

This chapter includes general information, complementing the more specific information in the different procedures in the manual.

7 Reference information

7.2 Applicable safety standards

7.2 Applicable safety standards

Standards, EN ISO

The manipulator system is designed in accordance with the requirements of:

Standard	Description
EN ISO 12100 -1	Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology
EN ISO 12100 -2	Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles
EN ISO 13849-1	Safety of machinery, safety related parts of control systems - Part 1: General principles for design
EN ISO 13850	Safety of machinery - Emergency stop - Principles for design
EN ISO 10218-1 ⁱ	Robots for industrial environments - Safety requirements -Part 1 Robot
EN ISO 9787	Manipulating industrial robots, coordinate systems, and motion nomenclatures
EN ISO 9283	Manipulating industrial robots, performance criteria, and related test methods
EN ISO 14644-1 ⁱⁱ	Classification of air cleanliness
EN 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 ⁱⁱⁱ	Arc welding equipment - Part 1: Welding power sources
EN IEC 60974-10 ⁱⁱⁱ	Arc welding equipment - Part 10: EMC requirements
EN IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1 General requirements
IEC 60529	Degrees of protection provided by enclosures (IP code)

ⁱ There is a deviation from paragraph 6.2 in that only worst case stop distances and stop times are documented.

ⁱⁱ Only robots with protection Clean Room.

ⁱⁱⁱ 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
EN 953	Safety of machinery - General requirements for the design and construction of fixed and movable guards

Other standards

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems

Continues on next page

7.2 Applicable safety standards*Continued*

Standard	Description
ANSI/UL 1740 (option 429-1)	Safety standard for robots and robotic equipment
CAN/CSA Z 434-03 (option 429-1)	Industrial robots and robot Systems - General safety requirements

7 Reference information

7.3 Unit conversion

7.3 Unit conversion

Converter table

Use the following table to convert units used in this manual.

Quantity	Units		
Length	1 m	3.28 ft.	39.37 in
Weight	1 kg	2.21 lb.	
Weight	1 g	0.035 ounces	
Pressure	1 bar	100 kPa	14.5 psi
Force	1 N	0.225 lbf	
Moment	1 Nm	0.738 lbf-ft	
Volume	1 L	0.264 US gal	

7.4 Screw joints

General

This section describes how to tighten the various types of screw joints on the IRB 120.

The instructions and torque values are valid for screw joints comprised of metallic materials and do *not* apply to soft or brittle materials.

UNBRAKO screws

UNBRAKO is a special type of screw recommended by ABB for certain screw joints. It features special surface treatment (Gleitmo as described below) and is extremely resistant to fatigue.

Whenever used, this is specified in the instructions, and in such cases, *no other type of replacement screw* is allowed. Using other types of screws will void any warranty and may potentially cause serious damage or injury.

Gleitmo treated screws

Gleitmo is a special surface treatment to reduce the friction when tightening the screw joint. Screws treated with Gleitmo may be reused 3-4 times before the coating disappears. After this the screw must be discarded and replaced with a new one.

When handling screws treated with Gleitmo, protective gloves of **nitrile rubber** type should be used.

Screws lubricated in other ways

Screws lubricated with Molycote 1000 should *only* be used when specified in the repair, maintenance or installation procedure descriptions.

In such cases, proceed as follows:

- 1 Apply lubricant to the screw thread.
- 2 Apply lubricant between the plain washer and screw head.
- 3 Tighten to the torque as described in the procedures.

Lubricant	Art. no.
Molycote 1000 (molybdenum disulphide grease)	11712016-618

7 Reference information

7.5 Weight specifications

7.5 Weight specifications

Definition

In installation, repair, and maintenance procedures, weights of the components handled are sometimes specified. All components exceeding 22 kg (50 lbs) are highlighted in this way.

To avoid injury, ABB recommends the use of a lifting accessory when handling components with a weight exceeding 22 kg. A wide range of lifting accessories and devices are available for each manipulator model.

Example

Following is an example of a weight specification in a procedure:

Action	Note
 CAUTION The robot weighs 25 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
1	Socket head cap 2.5-17 mm
1	Torque wrench 0.5-10 Nm
1	Small screwdriver
1	Plastic mallet
1	Ratchet head for torque wrench 1/2
1	Socket head cap no. 2.5, socket 1/2" bit L 110 mm
1	Small cutting plier
1	T-handle with ball head

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 [on page ?](#), and of special tools, listed directly in the instructions and also gathered in this section.

Calibration tool set

The following table specifies the calibration equipment needed when calibrating axes 5 and 6 of the robot.

Description	Art. no.	Note
Calibration tool set	3HAC037305-001	<p>Includes:</p> <ul style="list-style-type: none">• Calibration tool axes 5 and 6• Attachment screws M5x12 quality Steel 8.8-A2F (4 pcs)• Guide pin

Lifting tool set

The following table specifies the lifting tool set needed when lifting the complete robot.

Description	Art. no.	Note
Lifting tool set	3HAC037304-001	<p>Includes:</p> <ul style="list-style-type: none">• Bracket• Attachment screws (wrist) M5x12 quality steel 8.8-A2F (2 pcs)• Spring washers, conical (wrist) 5.3x11x1.2 quality Steel-mZn12c (2 pcs)• Attachment screws DIN912 (swing housing) M4x8 quality Steel 8.8-ELZN (2 pcs)• Conical spring washers 4 mm (swing housing) 4.3x9x1.3 quality Steel-MZn12C (2 pcs)

7.8 Lifting equipment and lifting instructions

General

Many repair and maintenance activities require different pieces of lifting equipment, which are specified in each procedure.

The use of each piece of lifting equipment is *not* detailed in the activity procedure, but in the instruction delivered with each piece of lifting equipment.

This implies that the instructions delivered with the lifting equipment should be stored for later reference.

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8 Spare parts

8.1 Spare parts - Axes 1 and 2

Spare parts axes 1-2

Link to [Illustration axes 1-2 on page 218](#).

Item	Description	Spare part no. Standard version	Spare part no. Clean-room version
1	Base with mechanical stop	3HAC035896-001	3HAC042144-001
2	Rotational AC motor, including gearbox (axes 1 & 2)	3HAC037281-001	3HAC037281-001
4	Cable guide	3HAC031119-001	3HAC031119-001
6	Mechanical stop pin	3HAC031694-001	3HAC042068-001
9	VK-cover	3HAA2166-23	3HAA2166-23
10	Swing plate with mechanical stop	3HAC035897-001	3HAC042146-001
11	Cable guide	3HAC031133-001	3HAC031133-001
15	Swing housing with mechanical stop	3HAC035900-001	3HAC042147-001
16	Damper	3HAC031871-001	3HAC031871-001
17	Cable guide	3HAC031134-001	3HAC031134-001
18	Cable guide	3HAC031135-001	3HAC031135-001
20	Calibration bracket	3HAC033060-001	3HAC033060-001

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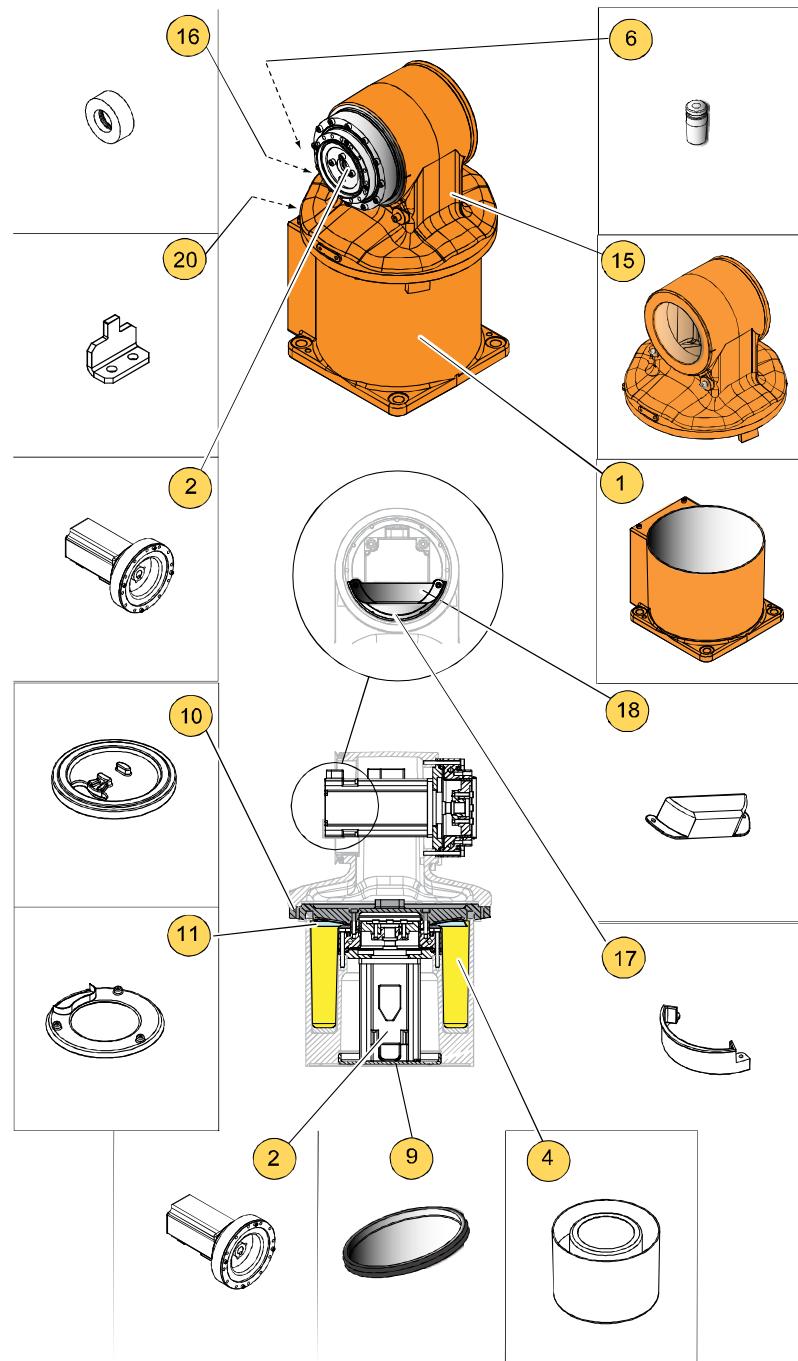
8 Spare parts

8.1 Spare parts - Axes 1 and 2

Continued

Illustration axes 1-2

Link to [Spare parts axes 1-2 on page 217.](#)



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8.2 Spare parts - Axis 3

Spare parts, axis 3

Link to [Illustration, spare parts axis 3 on page 220](#).

Item	Description	Spare part no. Standard version	Spare part no. Clean-room version
1	Lower arm with mechanical stop (Including gearbox axis 3)	3HAC035901-001	3HAC042148-001
2	Motor unit with timing belt wheel	3HAC031904-001	3HAC031904-001
5	Motor cover (axis 3)	3HAC035902-001	3HAC042149-001
10	Timing belt	3HAC031901-001	3HAC031901-001
11	Mechanical stop pins. (Shown in the enlargement in the figure.)	3HAC031694-001	3HAC042068-001
13	Dampers. (Shown in the enlargement in the figure)	3HAC031871-001	3HAC031871-001
6	Lower arm cover	3HAC035904-001	3HAC042151-001

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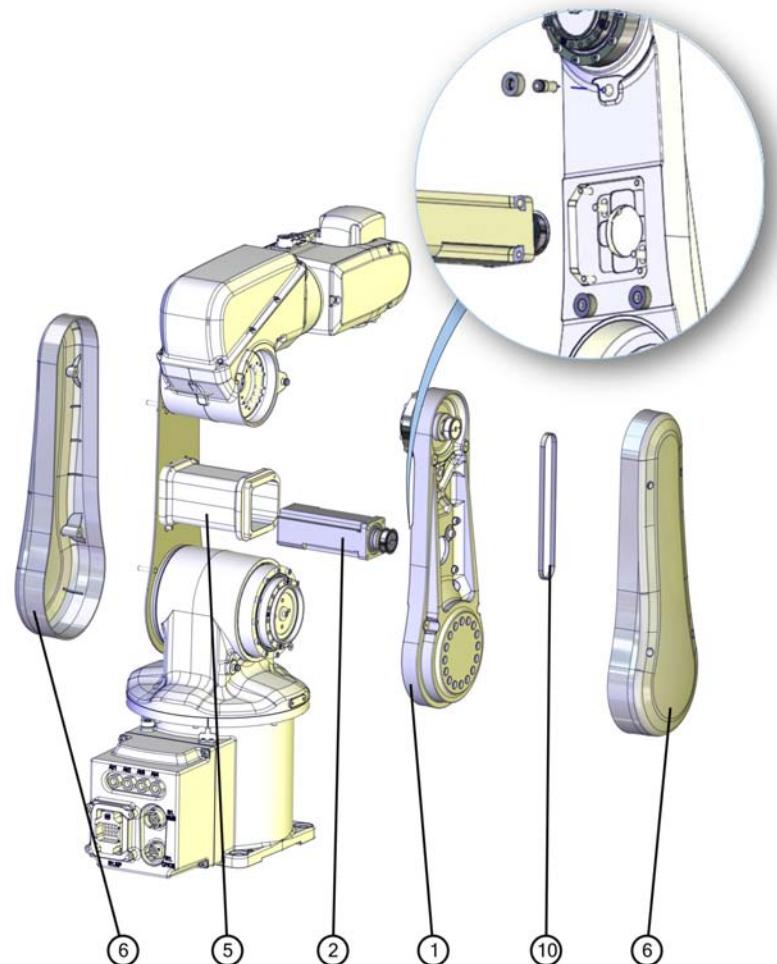
8 Spare parts

8.2 Spare parts - Axis 3

Continued

Illustration, spare parts axis 3

Link to [Spare parts, axis 3 on page 219.](#)



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8.3 Spare parts - Lower arm, side support

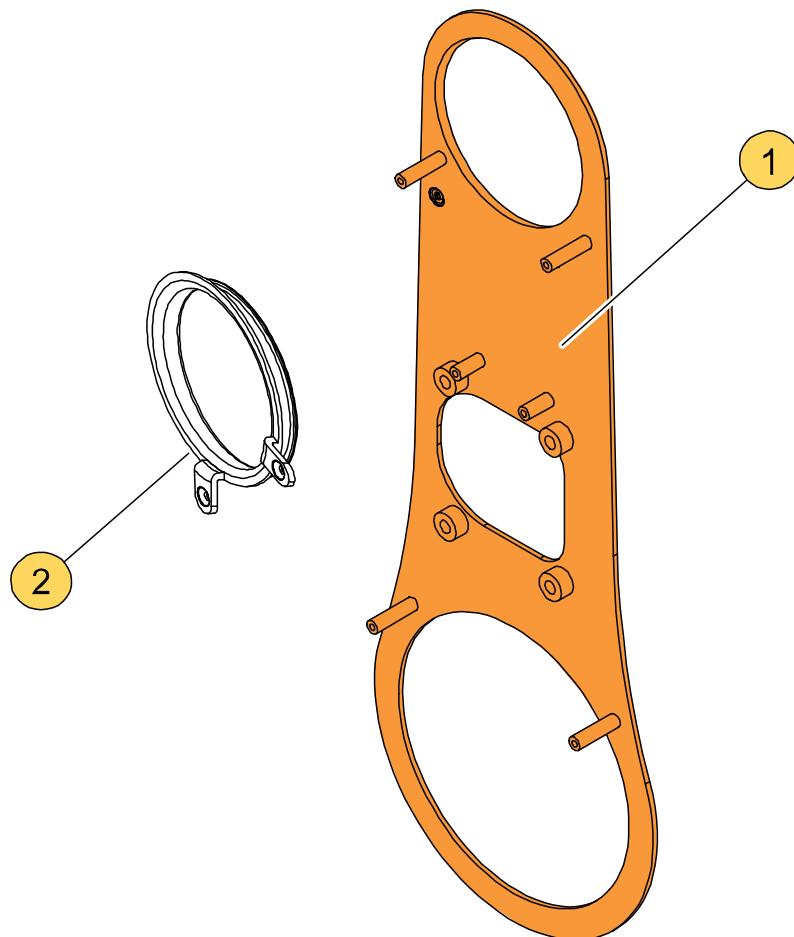
Spare parts, lower arm side support

Link to [Illustration, Lower arm side support on page 221](#).

Item	Description	Spare part no. Standard version	Spare part no. Clean-room version
1	Lower arm, side support	3HAC031894-001	3HAC042152-001
2	Cable protection cover axis 3	3HAC031126-001	3HAC031126-001

Illustration, Lower arm side support

Link to [Spare parts, lower arm side support on page 221](#).



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8 Spare parts

8.4 Spare parts - Upper arm unit

8.4 Spare parts - Upper arm unit

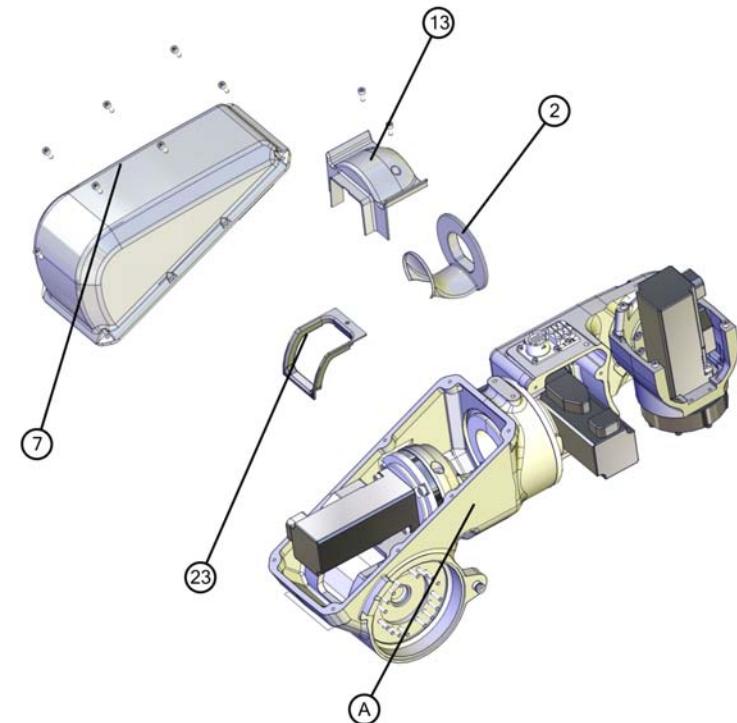
Spare parts upper arm unit

Link to [Illustration, upper arm unit on page 222](#).

Item	Description	Spare part no. Standard version	Spare part no. Clean-room version
A	Upper arm with wrist, mechanical (Motor axes 4 and 6 with gearbox included)	3HAC035914-001	3HAC042153-001
2	Arc shaft cover	3HAC031121-001	3HAC031121-001
13	Cable protector	3HAC031123-001	3HAC031123-001
23	Housing inner cover	3HAC031122-001	3HAC031122-001
7	Housing cover	3HAC035906-001	3HAC042154-001

Illustration, upper arm unit

Link to [Spare parts upper arm unit on page 222](#).



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8.5 Spare parts - Wrist unit

Spare parts. wrist unit

Link to [Illustration, spare parts wrist unit on page 224](#).

Item	Description	Spare part no. Standard version	Spare part no. Clean-room version
4	Carrier ring	3HAC031653-001	3HAC031653-001
7	Motor unit with timing belt pulley	3HAC037303-001	3HAC037303-001
8	Timing belt	3HAC031828-001	3HAC031828-001
(8)	Wrist housing, plastic	3HAC035910-001	3HAC042155-001
(9)	Wrist side cover	3HAC035911-001	3HAC042156-001
(10)	Tilt cover	3HAC035912-001	3HAC042157-001
16	Rotational AC motor with gearbox (Included in the upper arm unit.)	See Spare parts - Upper arm unit on page 222 .	See Spare parts - Upper arm unit on page 222 .

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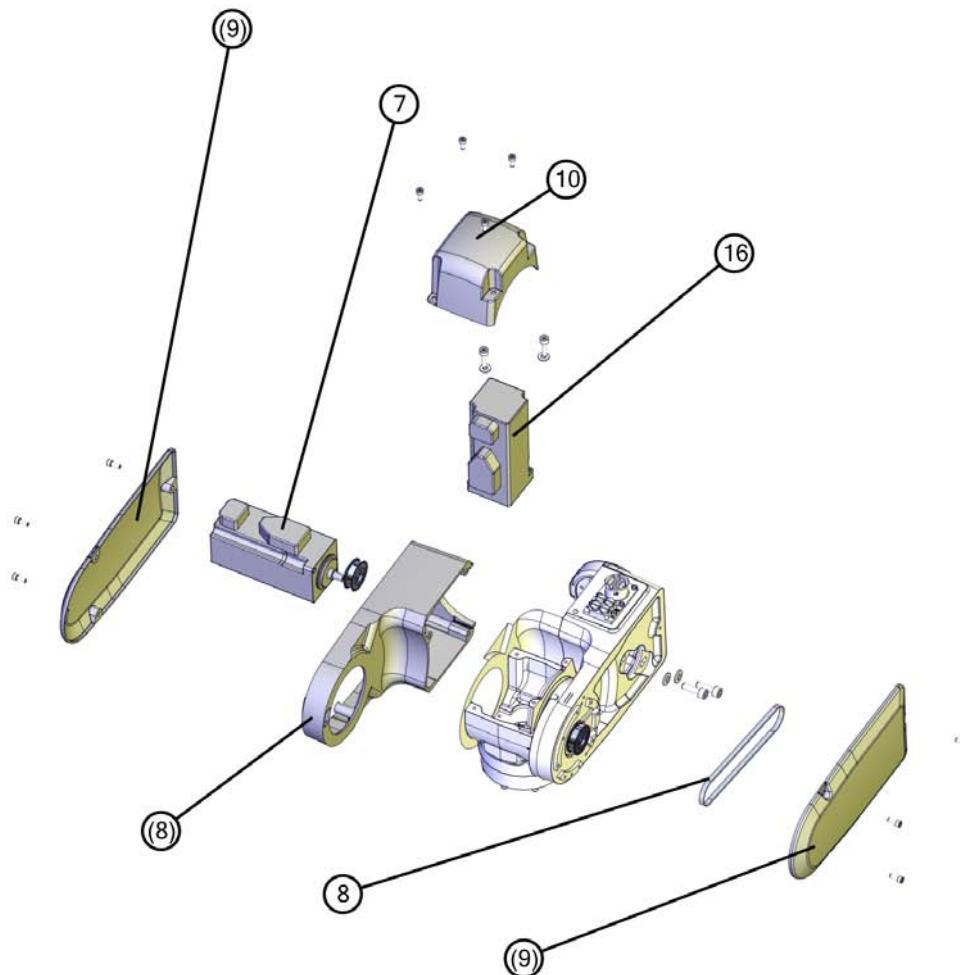
8 Spare parts

8.5 Spare parts - Wrist unit

Continued

Illustration, spare parts wrist unit

Link to [Spare parts. wrist unit on page 223.](#)



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8.6 Spare parts - Cable harness

Introduction

The spare parts in this section covers cable harness.

Item	Description	Spare part no.
	Cable harness main	3HAC032095-001
	Cable harness EIB	3HAC032076-001
	Cable harness CP/CS	3HAC032296-001
	EIB DSQC401	3HAC032243-001
	Battery pack	3HAC033492-001
	Connector set R1.CP/CS	3HAC037038-001
	Connector set R3.CP/CS	3HAC037070-001

8 Spare parts

8.7 Spareparts coating

Surface treatment

Part no.	Description
3HAC036639-001	Touch up paint Clean Room, Wite

9 Circuit diagram

9.1 About 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 (drive system 09)</i>	3HAC024480-005
<i>Circuit diagram - IRC 5 Compact</i>	3HAC031403-003
<i>Circuit diagram - IRC5 Panel Mounted Controller</i>	3HAC026871-006
<i>Circuit diagram - Euromap</i>	3HAC024120-004

Robots

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRB 120</i>	3HAC031408-003
<i>Circuit diagram - IRB 140 type C</i>	3HAC6816-3
<i>Circuit diagram - IRB 260</i>	3HAC025611-001
<i>Circuit diagram - IRB 360</i>	3HAC028647-009
<i>Circuit diagram - IRB 460</i>	3HAC036446-005
<i>Circuit diagram - IRB 660</i>	3HAC025691-001
<i>Circuit diagram - IRB 760</i>	3HAC025691-001
<i>Circuit diagram - IRB 1410</i>	3HAC2800-3
<i>Circuit diagram - IRB 1600 type A</i>	3HAC021351-003
<i>Circuit diagram - IRB 1520</i>	3HAC039498-007
<i>Circuit diagram - IRB 2400</i>	3HAC6670-3
<i>Circuit diagram - IRB 2600</i>	3HAC029570-007
<i>Circuit diagram - IRB 4400/4450S</i>	3HAC9821-1
<i>Circuit diagram - IRB 4600</i>	3HAC029038-003
<i>Circuit diagram - IRB 6400RF</i>	3HAC8935-1
<i>Circuit diagram - IRB 6600 type A</i>	3HAC13347-1 3HAC025744-001
<i>Circuit diagram - IRB 6600 type B</i>	3HAC13347-1 3HAC025744-001
<i>Circuit diagram - IRB 6620</i>	3HAC025090-001
<i>Circuit diagram - IRB 6620 / IRB 6620LX</i>	3HAC025090-001
<i>Circuit diagram - IRB 6640</i>	3HAC025744-001

Continues on next page

9 Circuit diagram

9.1 About circuit diagrams

Continued

Product	Article numbers for circuit diagrams
<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 7600</i>	<i>3HAC13347-1</i> <i>3HAC025744-001</i>

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