

Product manual

IRB 1520

Power and productivity
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Product manual

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IRC5

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Overview of this manual

About this manual

This manual contains instructions for:

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

Usage

This manual should be used during:

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

Who should read this manual?

This manual is intended for:

- installation personnel
 - maintenance personnel
 - repair personnel.
-

Prerequisites

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

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

Organization of chapters

The manual is organized in the following chapters:

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

Continues on next page

Overview of this manual

Continued

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

References

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

Document name	Document ID
<i>Product manual, spare parts - IRB 1520</i>	3HAC043436-001
<i>Circuit diagram - IRB 1520</i>	3HAC039498-007
<i>Product specification - IRB 1520</i>	3HAC043437-001
<i>Operating manual - General safety information</i> ⁱ	3HAC031045-001
<i>Product manual - IRC5</i> IRC5 with main computer DSQC 639.	3HAC021313-001
<i>Product manual - IRC5</i> IRC5 with main computer DSQC1000.	3HAC047136-001
<i>Operating manual - IRC5 with FlexPendant</i>	3HAC050941-001
<i>Operating manual - Service Information System</i>	3HAC050944-001
<i>Operating manual - Calibration Pendulum</i>	3HAC16578-1
<i>Application manual - Additional axes and stand alone controller</i>	3HAC051016-001
<i>Application manual - CalibWare Field 5.0</i>	3HAC030421-001
<i>Technical reference manual - Lubrication in gearboxes</i>	3HAC042927-001
<i>Technical reference manual - System parameters</i>	3HAC050948-001

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

Revisions

Revision	Description
-	First edition.
A	This revision includes the following updates: <ul style="list-style-type: none">• All data about type of lubrication in gearboxes is moved from the manual to a separate lubrication manual, see Type and amount of oil in gearboxes on page 125.• Changed pin number for 24V connection, see Manually releasing the brakes on page 73.• A new SMB unit and battery is introduced, with longer battery lifetime.

Continues on next page

Revision	Description
B	This revision includes the following updates: <ul style="list-style-type: none">• Added information about risks when scrapping a decommissioned robot, see <i>Scraping of robot on page 303</i>.• The working range for axis 5 is corrected.• Note about the placement of connectors in ID-upper arm added in Repair instructions. See <i>Replacing the cable harness - upper end on page 179</i> and <i>Replacing the wrist unit, IRB 1600ID-4/1.5 on page 212</i>.• Note about handling the wrist during replacement added. See <i>Replacing the wrist unit, IRB 1600ID-4/1.5 on page 212</i>.
C	This revision includes the following updates: <ul style="list-style-type: none">• Minor corrections.
D	This revision includes the following updates: <ul style="list-style-type: none">• Updated section <i>Setting the system parameters for a suspended or tilted robot on page 78</i>.

Product documentation, IRC5

Categories for user documentation from ABB Robotics

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

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

Product manuals

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

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

Technical reference manuals

The technical reference manuals describe reference information for robotics products.

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

Continues on next page

Application manuals

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

An application manual generally contains information about:

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

Operating manuals

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

The group of manuals includes (among others):

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

How to read the product manual

Reading the procedures

The procedures contain 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</i> , gearbox.	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</i> , axis 2 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 15](#).

Illustrations

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

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

1 Safety

1.1 Introduction to safety information

Overview

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

- General safety aspects, important to attend to before performing any service work on the robot. These are applicable for all service work and are found in [General safety information on page 16](#).
- Safety signals and symbols shown in the manual and on the robot, warning for different types of dangers, are found in [Safety signals and symbols on page 39](#).
- 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 46](#).

1 Safety

1.2.1 Introduction to general safety information

1.2 General safety information

1.2.1 Introduction to general safety information

Definitions

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

Sections

The general safety information is divided into the following sections.

Contents	Examples of content
General information	<ul style="list-style-type: none">• safety, service• limitation of liability• related information
Safety risks lists dangers relevant when working with the product. The dangers are split into different categories.	<ul style="list-style-type: none">• safety risks during installation or service• risks associated with live electrical parts
Safety actions describes actions which may be taken to remedy or avoid dangers.	<ul style="list-style-type: none">• fire extinguishing• safe use of the teach pendant or jogging device
Safety stops describes different types of stops.	<ul style="list-style-type: none">• stopping functions• description of emergency stop• description of safety stop

1.2.2 Safety in the robot system

Validity and responsibility

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

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

- *Operating manual - IRC5 with FlexPendant*
- *Operating manual - General safety information*¹
- *Product manual*

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

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

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

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

Connection of external safety devices

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

Limitation of liability

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

Related information

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

Continues on next page

1 Safety

1.2.2 Safety in the robot system

Continued

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

1.2.3.1 Safety risks during installation and service work on robots

1.2.3 Safety risks

1.2.3.1 Safety risks during installation and service work on robots

Overview

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

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

General risks during installation and service

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

Spare parts and special equipment

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

Personal protective equipment

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

Nation/region specific regulations

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

Non-voltage related risks

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

Continues on next page

1 Safety

1.2.3.1 Safety risks during installation and service work on robots

Continued

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

To be observed by the supplier of the complete system

When integrating the robot with external devices and machines:

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

Complete robot

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

Continues on next page

1.2.3.1 Safety risks during installation and service work on robots

Continued

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

Cabling

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

Gearboxes and motors

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

1 Safety

1.2.3.2 CAUTION - Hot parts may cause burns!

Description

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

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

Elimination

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

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

1.2.3.3 Safety risks related to tools/work pieces

Safe handling

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

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

Safe design

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

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



CAUTION

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

1 Safety

1.2.3.4 Safety risks related to pneumatic/hydraulic systems

General

Special safety regulations apply to pneumatic and hydraulic systems.



Note

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

Residual energy

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

Safe design

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

1.2.3.5 Safety risks during operational disturbances**General**

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

Qualified personnel

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

Extraordinary risks

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

1 Safety

1.2.3.6 Risks associated with live electric parts

1.2.3.6 Risks associated with live electric parts

Voltage related risks, general

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

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

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

All work must be performed:

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

Voltage related risks, controller

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

- Be aware of stored electrical energy (DC link, Ultracapacitor bank unit) in the controller.
- Units such as I/O modules, can be supplied with power from an external source.
- The 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

Voltage related risks, robot

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

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

See chapter *Installation and commissioning on page 61*.

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

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

1 Safety

1.2.4.1 Safety fence dimensions

1.2.4 Safety actions

1.2.4.1 Safety fence dimensions

General

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

Dimensioning

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

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

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

1.2.4.2 Fire extinguishing



Note

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

1 Safety

1.2.4.3 Emergency release of the robot arm

1.2.4.3 Emergency release of the robot arm

Description

In an emergency situation, the brakes on the robot axes can 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 73.*](#)

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

Increased injury

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

1.2.4.4 Brake testing

When to test

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

How to test

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

- 1 Run each robot axis to a position where the combined weight of the robot arm and any load is maximized (maximum static load).
- 2 Switch the motor to the MOTORS OFF.
- 3 Inspect and verify that the axis maintains its position.
If the robot does not change position as the motors are switched off, then the brake function is adequate.

1 Safety

1.2.4.5 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".

1.2.4.6 Safe use of the jogging device

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, operating the robot is impossible.



Note

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

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

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

Hold-to-run function

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

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

1 Safety

1.2.4.7 Work inside the working range of the robot



WARNING

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

- The operating mode selector on the controller must be in the manual mode position to render the enabling device operational and to block operation from a computer link or remote control panel.
- The maximum speed of the robot is limited to 250 mm/s when the operating mode selector is in the position *Manual mode with reduced speed*. This should be the normal position when entering the working space.
The position *Manual mode with full speed (100%)* may only be used by trained personnel who are aware of the risks that this entails. *Manual mode with full speed (100%)* is not available in USA or Canada.
- Pay attention to the rotating axes of the robot. Keep away from axes to not get entangled with hair or clothing. Also, be aware of any danger that may be caused by rotating tools or other devices mounted on the robot or inside the cell.
- Test the motor brake on each axis, according to the section [Brake testing on page 31](#).
- To prevent anyone else from taking control of the robot, always put a safety lock on the cell door and bring the enabling device with you when entering the working space.



WARNING

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

1.2.5 Safety stops

1.2.5.1 What is an emergency stop?

Definition of emergency stop

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

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

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

- A category 0 stop, immediately stopping the robot actions by disconnecting power from the motors.
- A category 1 stop, stopping the robot actions with power available to the motors so that the robot path can be maintained. When completed, power is disconnected from the motors.

The default setting is a category 0 stop. However, category 1 stops are preferred since they minimize unnecessary wear on the robot and the actions needed to return the system back to production. Consult your plant or cell documentation to see how your robot 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 robot.

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

Classification of stops

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

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

Continues on next page

1 Safety

1.2.5.1 What is an emergency stop?

Continued

If the stop is...	... then it is classified as...
category 1	controlled

Emergency stop buttons

In a robot system there are several emergency stop buttons 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. There can also be other types of emergency stops on your robot. Consult your plant or cell documentation to see how your robot system is configured.

1.2.5.2 What is a safety stop or protective stop?

1.2.5.2 What is a safety stop or protective stop?

Definition of safety stops

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

The robot system can be configured so that the safety stop results in either:

- A category 0 stop, immediately stopping the manipulator actions by disconnecting power from the motors.
- A category 1 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 a category 1 stop.

Category 1 stops are preferred since they minimize unnecessary wear on the manipulator and the actions needed to return the system back to production. Consult your plant or cell documentation to see how your robot system is configured.



Note

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



Note

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

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

Classification of stops

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

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

Continues on next page

1 Safety

1.2.5.2 What is a safety stop or protective stop?

Continued

Type of safety stops

Safety stops are activated through special signal inputs to the controller, see *Product manual - IRC5*.

The inputs are intended for safety devices such as cell doors, light curtains, or light beams.

Safety stop:	Description:
Automatic mode stop (AS)	Disconnects drive power in automatic mode. In manual mode this input is inactive.
General stop (GS)	Disconnects drive power in all operating modes.
Superior stop (SS)	Disconnects drive power in all operating modes. Intended for external equipment.



Note

Use normal program stop for all other types of stop.

1.3 Safety signals and symbols

1.3.1 Safety signals in the manual

Introduction to safety signals

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

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

Danger levels

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

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

Continues on next page

1 Safety

1.3.1 Safety signals in the manual

Continued

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

1.3.2 Safety symbols on product labels

Introduction to labels

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

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

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



Note

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

Types of labels

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

The safety labels are language independent, they only use graphics. See [Symbols on safety labels on page 41](#).

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

Symbols on safety labels

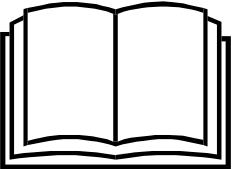
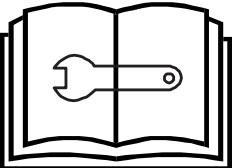
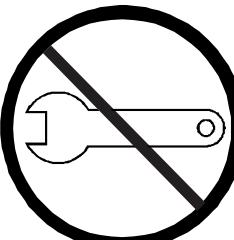
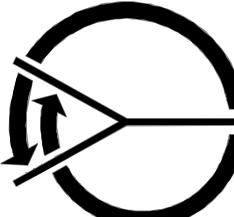
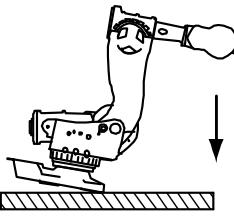
Symbol	Description
	Warning! Warns that an accident <i>may</i> occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion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

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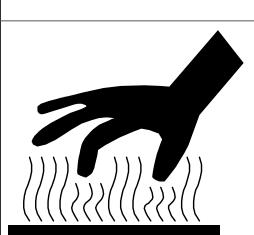
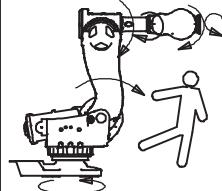
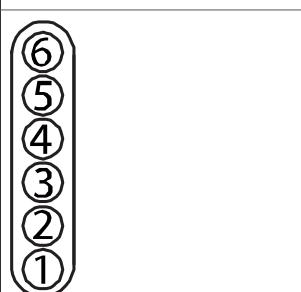
1 Safety

1.3.2 Safety symbols on product labels

Continued

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

Continues on next page

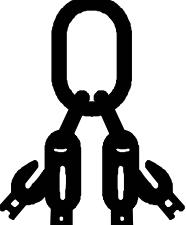
Symbol	Description
 xx0900000817	Crush Risk of crush injuries.
 xx0900000818	Heat Risk of heat that can cause burns.
 xx0900000819	Moving robot The robot can move unexpectedly.
 xx0900000820	Brake release buttons

Continues on next page

1 Safety

1.3.2 Safety symbols on product labels

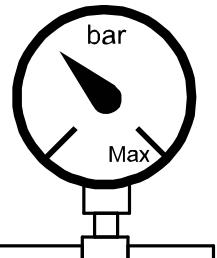
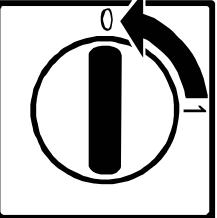
Continued

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 product labels

Continued

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

1 Safety

1.4.1 DANGER - Moving robots are potentially lethal!

1.4 Safety related instructions

1.4.1 DANGER - Moving robots are potentially lethal!

Description

Any moving robot is a potentially lethal machine.

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

Elimination

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

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

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

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

Elimination

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

	Action
1	Remove all service tools and foreign objects from the robot and its working area.
2	Verify that the robot is secured to its position, see installation section in the product manual for the robot.
3	Verify that the fixture and work piece are well secured, if applicable.
4	Install all safety equipment properly.
5	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.
6	Pay special attention to the function of the part that previously was serviced.

Collision risks**CAUTION**

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

1 Safety

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

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

Description

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



DANGER

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

Elimination

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

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

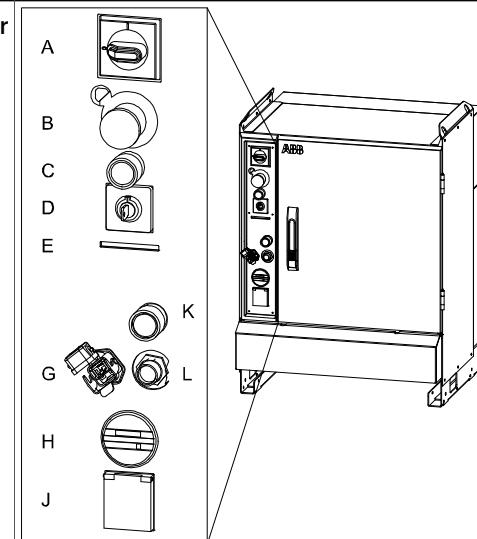
1.4.4 DANGER - Make sure that the main power has been switched off!

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

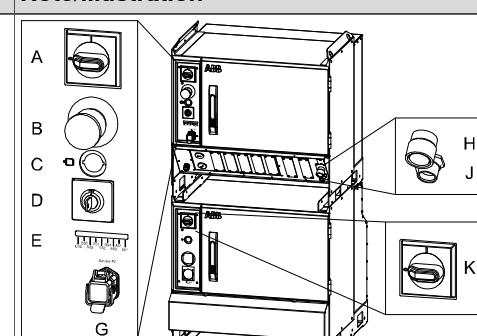
Description

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

Elimination, Single Cabinet Controller

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

Elimination, Dual Cabinet Controller

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

1 Safety

1.4.5 WARNING - The unit is sensitive to ESD!

Description

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

Elimination

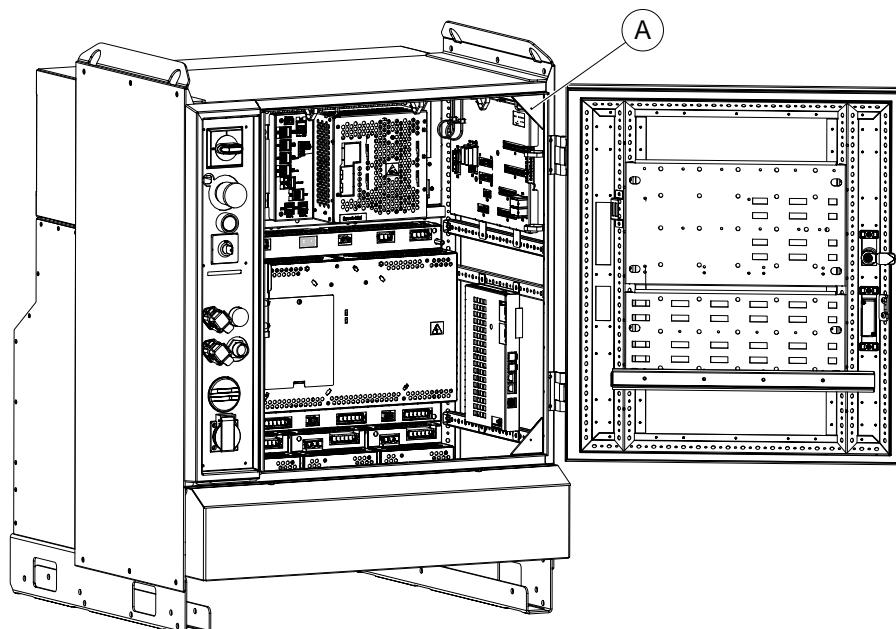
	Action	Note
1	Use a wrist strap	Wrist straps must be tested frequently to ensure that they are not damaged and are operating correctly.
2	Use an ESD protective floor mat.	The mat must be grounded through a current-limiting resistor.
3	Use a dissipative table mat.	The mat should provide a controlled discharge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

Location of wrist strap button

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

IRC5

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



xx1300000856

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

1.4.6 WARNING - Safety risks during handling of batteries

Description

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

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



Note

Appropriate disposal regulations must be observed.

Elimination

	Action	Note
1	Do not short circuit, recharge, puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of the product. Risk of fire or explosion.	Operating temperatures are listed in Pre-installation procedure on page 62 .
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 Safety

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

Description

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



Note

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



Note

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



Note

Appropriate disposal regulations must be observed.



Note

Take special care when handling hot lubricants.

Warnings and elimination

Warning	Description	Elimination/Action
 xx0100000002 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

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

Continued

Warning	Description	Elimination/Action
 xx0100000002 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, verify that the level is correct.</p>
 xx0100000002 Do not mix types of oil	<p>Mixing types of oil may cause severe damage to the gearbox.</p>	<p>When filling gearbox oil, do not mix different types of oil unless specified in the instructions. Always use the type of oil specified by the manufacturer!</p>
 xx0100000098 Heat up the oil	<p>Warm oil drains quicker than cold oil.</p>	<p>When changing gearbox oil, first run the robot for a time to heat up the oil.</p>
 xx0100000004 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 filling, verify that the level is correct.</p>
 xx0100000003 Contaminated oil in gear boxes	<p>When draining the oil make sure that as much oil as possible is drained from the gearbox. The reason for this is to drain as much oil sludge and metal chips as possible from the gearbox. The magnetic oil plugs will take care of any remaining metal chips.</p>	

1 Safety

1.5.1 Special safety instructions

1.5 Arc welding related safety

1.5.1 Special safety instructions

Welding robot system

The following points should be observed in all work in or around the welding robot system:

- Consider the welding robot equipment as a single unit.
- The welding robot system consists of many different parts, which in addition to the robot, also includes positioners and other peripheral equipment.
- The entire system communicates via electrical signals and can therefore bring about movements in completely different components to those directly affected.

Workplace

The following points should be observed in all work in or around the workplace:

- Make sure that the workplace is in order before the system is put into operation. If malfunctions are discovered on or in the system, these must be rectified before starting.
- Consult trained personnel or the system manager if your own knowledge is insufficient to implement the measures.

Before operation

The following points should be observed before putting the welding robot system into operation:

- All guards and all safety equipment must be fitted before the robot system is started.
- The safety equipment must not be disengaged, bypassed or in any other way modified so that it does not provide the intended protection.
- Test running with the operating mode selector (key switch) in the 100% position should only be carried out by qualified personnel who are aware of the risks this involves.

During operation

The following points should be observed when the welding robot system is in operation:

- Do not remain within the risk zone (the robot and positioner working area) when the system is operational. If it is absolutely essential that you remain within the risk zone in order to carry out the work, the following must be observed.
 - Never work alone in the risk zone when the system is in operation. One person should stand outside the risk zone to stop the equipment if a hazard arises while work is being carried out inside the risk zone.
 - Exercise extreme care when operating the robot/positioner. Always remember that these can perform unexpected movements when executing a program.

Continues on next page

Even when the robot system seems to perform the same movement pattern over and over again for an extended period, the pattern can suddenly change.

- Be aware that weld splatter represents a fire and burn risk

During maintenance work

The following points should be observed before beginning maintenance work:

- Bring the jogging device for the robot system with you when entering the risk zone so that no one else can start the robot system.
- Make sure to release the enabling device when the robot or positioner does not need to be operated.
- The robot system will be in standby mode with the motors shut off. The operating mode selector (key switch) on the control cabinet's control panel will be in the "Manual reduced speed <250 mm/s" position, and the enabling device must then be used to operate the robot system. In this mode the robot and positioner movements are limited to a speed of no more than 250 mm/s.

1 Safety

1.5.2 Protective equipment

1.5.2 Protective equipment

General

Do not wear loose-fitting garments or belts, bracelets, etc., that can become entangled in the robot or positioner. Always use the prescribed personal protective equipment.

Personal protective equipment

Personnel should have the following protective equipment:

Equipment	Description
Safety goggles	Protect the eyes against loose particles, sharp edges and sharp components.
Welding helmet with welding glass	Protect the eyes and skin against radiation and burn injuries.
Dry and undamaged gloves	Protect against radiation and burn injuries, as well as electric shocks.
Dry and undamaged protective clothing	Protect against radiation and burn injuries, as well as electric shocks.
Shoes with insulated soles	Protect against radiation and burn injuries, as well as electric shocks.
Ear protection	Protects hearing when using certain welding settings.
Protective screens and curtains	Protect other persons located in the vicinity of the station.

1.5.3 Light barriers

Light barriers function

The light barriers in the robot system are used to stop the robot and positioner if anyone enters the risk zone where moving parts are activated. The light barriers can, where appropriate, be replaced by hatches, sliding doors or gates.

Pre reset

A pre-reset button is located inside the service area. It is used in connection with resetting the safety circuits for the light barriers. The pre-reset prevents unintentional starting when the operator is inside the service area.

	Action
1	Press the pre-reset button (this permits a pre-reset of the safety circuits for the light barriers of 10 seconds).
2	Press and hold the <i>start button (operator ready button)</i> on the operator panel within 10 seconds.

1 Safety

1.5.4 Risk of fire



WARNING

There is a risk of fire in connection with welding.

Safety measures

The following points should be observed:

- Observe local fire regulations for welding.
- Clean the area around the workplace regularly and ensure that the area is free of combustible material.
- Check that all connections in the welding current circuit are properly tightened. Poor contact can result in inferior welding results and a risk of fire.
- Check that the cables are correctly dimensioned. Cables that are underdimensioned can constitute a fire risk due to overheating.

Fire extinguishing

Use carbon dioxide (CO₂) if the equipment catches fire.

1.5.5 Risk of explosion

Gas cylinders

There is a great risk of the gas cylinders exploding in the event of a fire. Observe local safety instructions with regard to the handling and storing of gas cylinders.

1 Safety

1.5.6 Risk of electric shock



WARNING

The welding wire is live during the welding process even before the arc is ignited.

Safety measures

The following points should be observed:

- Do not mix up the phase and grounding conductors when connecting the equipment to the mains supply.
- The workpiece, fixtures and positioner are usually in direct contact with the welding circuit, and should therefore be regarded as live.
- Do not touch live parts of the equipment with your bare hands or with damp gloves.
- Equip the operator station with an insulating mat.
- The welding circuit shall not be grounded without necessary measures being taken to ensure proper functioning of the grounding conductor.
- The welding circuit must not be broken during the welding process.

2 Installation and commissioning

2.1 Introduction

General

This chapter contains assembly instructions and information for installing the IRB 1520 at the working site.

More detailed technical data can be found in the *Product specification* for the IRB 1520, such as:

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

Safety information

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

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



Note

If the IRB 1520 is connected to power, always make sure that the robot is connected to *protective earth* before starting any installation work!

For more information see:

- *Product manual - IRC5*

2 Installation and commissioning

2.2.1 Pre-installation procedure

2.2 Unpacking

2.2.1 Pre-installation procedure

Introduction

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

Checking the pre-requisites for installation

Installation personnel working with an ABB robot must:

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

	Action
1	Visually inspect the robot to make sure that it is not damaged.
2	Make sure that the lifting accessory used is suitable to handle the weight of the robot as specified in: <ul style="list-style-type: none">• <i>Weight, robot on page 62</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 64</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 64</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 63</i>• <i>Protection classes, robot on page 64</i>• <i>Requirements, foundation on page 64</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 69</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 70</i>
8	Install required equipment, if any.

Weight, robot

The table shows the weight of the robot.

The weight does not include the weight of the DressPack.

Robot model	Weight
IRB 1520	170 kg



Note

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

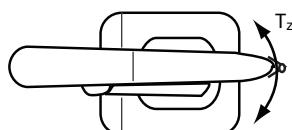
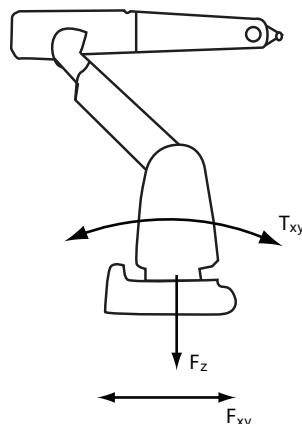
The weight does not include the weight of the DressPack.

Continues on next page

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.



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

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



Note

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

Floor mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	$\pm 1900 \text{ N}$	$\pm 4300 \text{ N}$
Force z	$1850 \pm 900 \text{ N}$	$1850 \pm 2350 \text{ N}$
Torque xy	$\pm 1550 \text{ Nm}$	$\pm 3900 \text{ Nm}$
Torque z	$\pm 390 \text{ Nm}$	$\pm 1200 \text{ Nm}$

Suspended

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	$\pm 1900 \text{ N}$	$\pm 4250 \text{ N}$

Continues on next page

2 Installation and commissioning

2.2.1 Pre-installation procedure

Continued

Force	Endurance load (in operation)	Max. load (emergency stop)
Force z	- 1850 ±750 N	-1850 ±2350 N
Torque xy	± 1550 Nm	± 3900 Nm
Torque z	± 390 Nm	± 1200 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	0.5 mm	Flat foundations give better repeatability of the resolver calibration compared to original settings on delivery from ABB. The value for levelness aims at the circumstance of the anchoring points in the robot base.
Maximum tilt	15°	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)	+75° 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°
Maximum ambient temperature	+45°
Maximum ambient humidity	95% at constant temperature (gaseous only)

Protection classes, robot

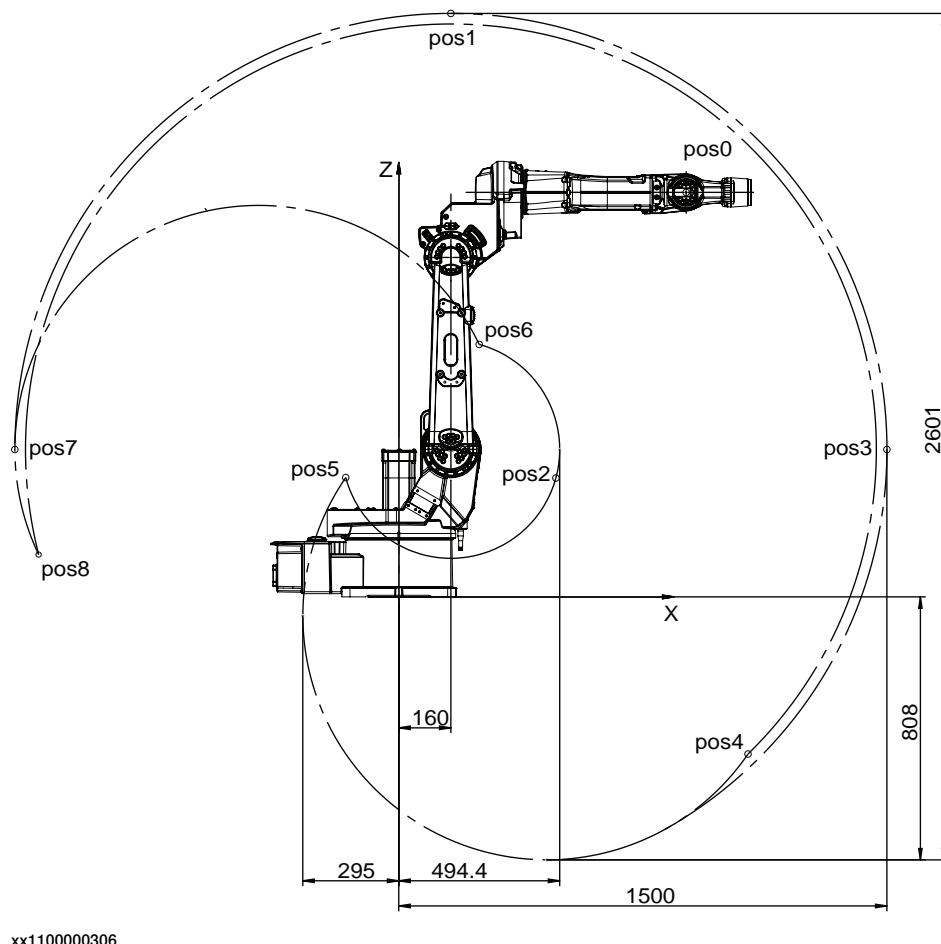
The table shows the available protection types of the robot, with the corresponding protection class.

Protection type	Protection class
Manipulator, protection type Standard	IP40

2.2.2 Working range

Illustration, restricted working range IRB 1520ID - 4/1.5

The working range is restricted if the robot features an Arc Welding package. This illustration shows the restricted working range of the robot.



Continues on next page

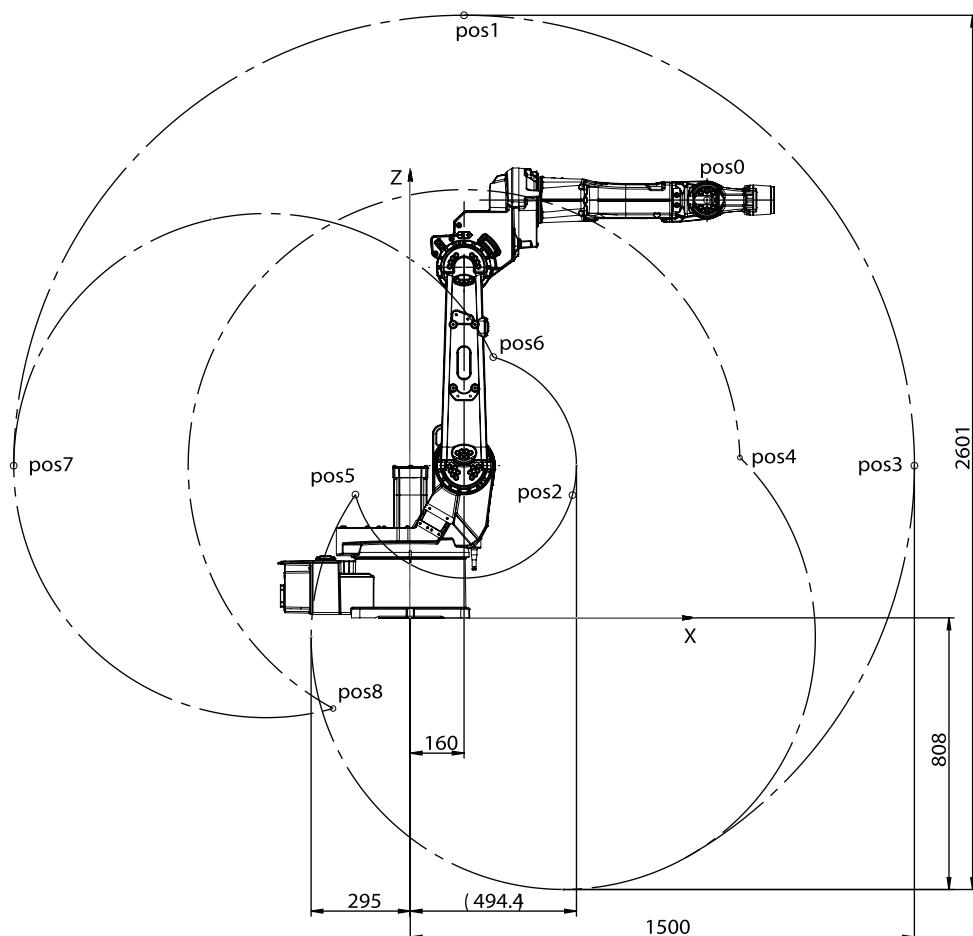
2 Installation and commissioning

2.2.2 Working range

Continued

Illustration, unrestricted working range IRB 1520ID - 4/1.5

This illustration shows the unrestricted working range of the robot.



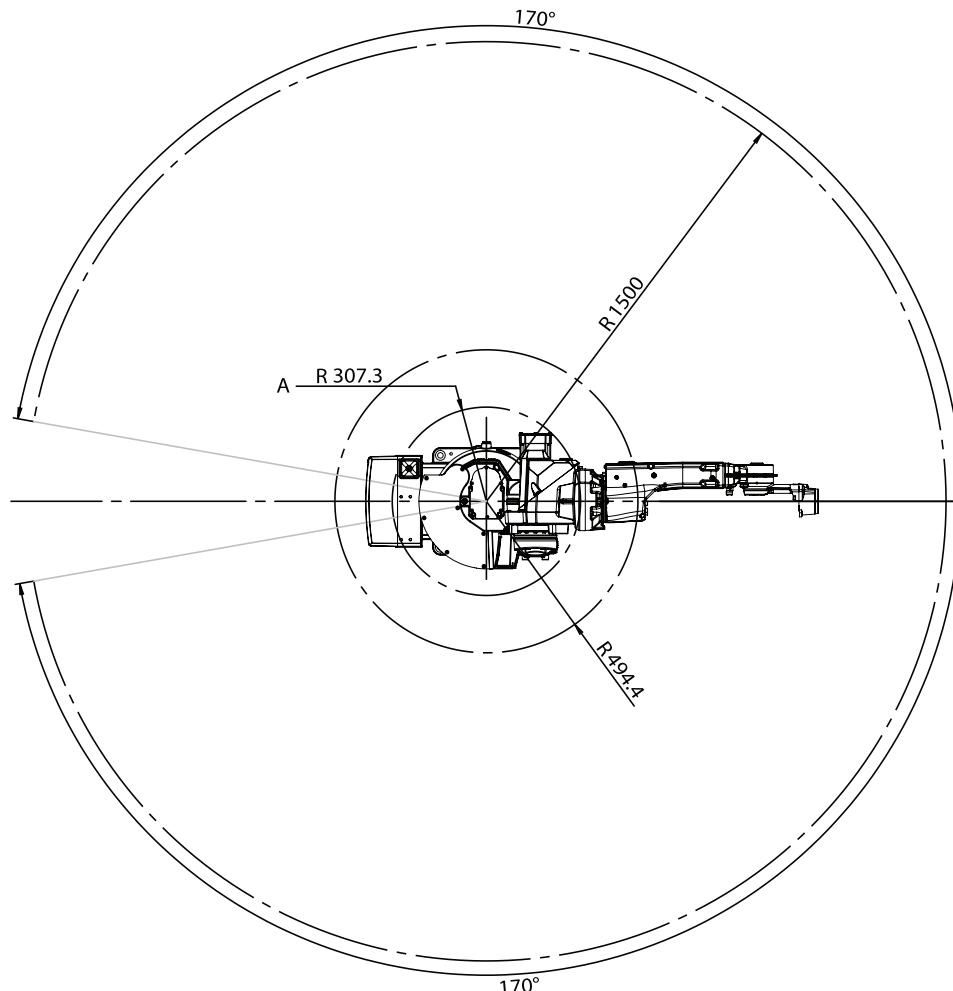
Positions at wrist center and angle of axes 2 and 3

This table shows the distances to the different positions of the wrist center, shown in the previous figures.

Position in the figure	Positions at wrist center (mm)		Angle (degrees)	
	X	Z	axis 2	axis 3
pos0	883	1243	0°	0°
pos1	160	1793	0°	-74.5°
pos2	482.7	365.4	0°	+80°
pos3	1500	453	+90°	-74.5°
pos4 (restricted working range)	1073.2	-482.8	+150°	-100°
pos4 (unrestricted working range)	636.2	-192.3	+150°	-180°
pos5	-163.1	366.8	+150°	+80°

Continues on next page

Position in the figure	Positions at wrist center (mm)		Angle (degrees)	
pos6	246.8	775.9	-90°	+80°
pos7	-1180	453	-90°	-74.5°
pos8 (restricted working range)	-1106.9	130.1	-90°	-100°
pos8 (unrestricted working range)	-574.1	-938.9	-90°	-180°

Turning radius

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A	Minimum turning radius of axis 1
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Working range

Axis	IRB 1520ID - 4/1.5	Note
Axis 1	+170° to -170°	
Axis 2	+150° to -90°	

Continues on next page

2 Installation and commissioning

2.2.2 Working range

Continued

Axis	IRB 1520ID - 4/1.5	Note
Axis 3	+80° to -100°	Value for restricted working range, due to usage of Arc Welding package.
	+80° to -180°	Value for unrestricted working range.
Axis 4	+155° to -155°	Default value.
Axis 5	+135° to -135°	
Axis 6	+200° to -200°	Default value.
	+288 to -288 revolutions	Maximum value. The default working range for axis 6 can be extended by changing parameter values in the software.

2.2.3 Risk of tipping/stability

Risk of tipping

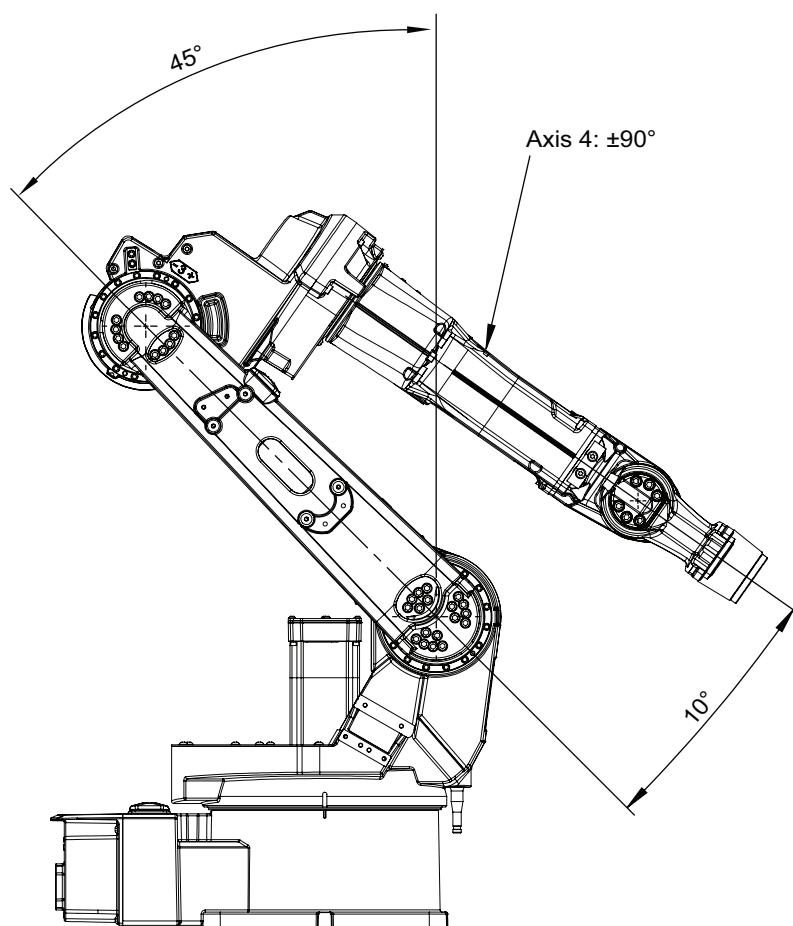
If the robot is not fastened to the foundation and standing still, the robot is not stable in the whole working area. Moving the arms will displace the center of gravity, which may cause the robot to tip over.

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.



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WARNING

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

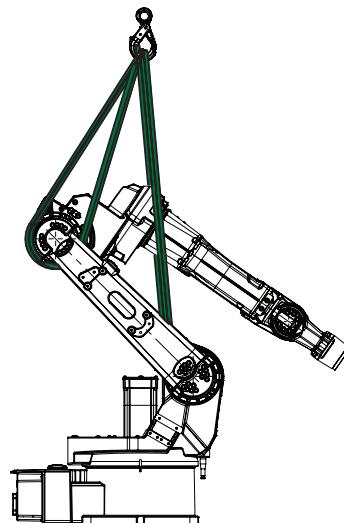
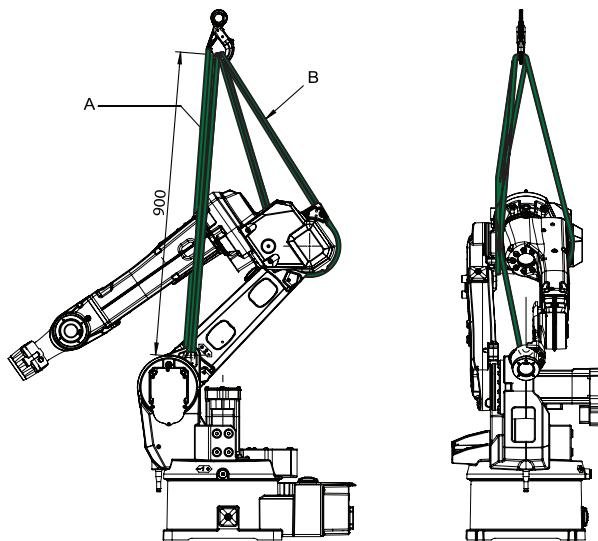
2 Installation and commissioning

2.3.1 Lifting robot with roundslings

2.3 On-site installation

2.3.1 Lifting robot with roundslings

Attaching the roundslings



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A	Roundsling folded in U-shape and put through the lifting lug
B	Roundsling folded in U-shape and put around the axis 3 gearbox

Required equipment

Equipment	Art. no.	Note
Overhead crane	-	Lifting capacity: 1,000 kg.
Roundsling	-	Length: 2 m. Quantity: 2 pcs. Lifting capacity: 1,000 kg.

Continues on next page

Lifting the robot with roundslings

Use this procedure to lift the robot with roundslings.

	Action	Note
1	Move the robot to an appropriate lifting position.	See Risk of tipping/stability on page 69 .
2	Fold the two roundslings in U-shape and attach them as follows: <ul style="list-style-type: none">• run one roundsling through the lug in the frame, run it on both sides of the upper arm and secure it safely at the overhead crane.• put the other roundsling around the axis 3 gearbox and secure it safely at the overhead crane.	Make sure the roundslings do not rub against any sharp edges. Capacity for the roundslings are specified in Required equipment on page 70 . See attachment in Attaching the roundslings on page 70 .
3	 CAUTION The IRB 1520 robot weighs 170 kg. All lifting accessories used must be sized accordingly!	
4	 WARNING Personnel must not, under any circumstances, be present under the suspended load!	
5	Raise the overhead crane to lift the robot.	

2 Installation and commissioning

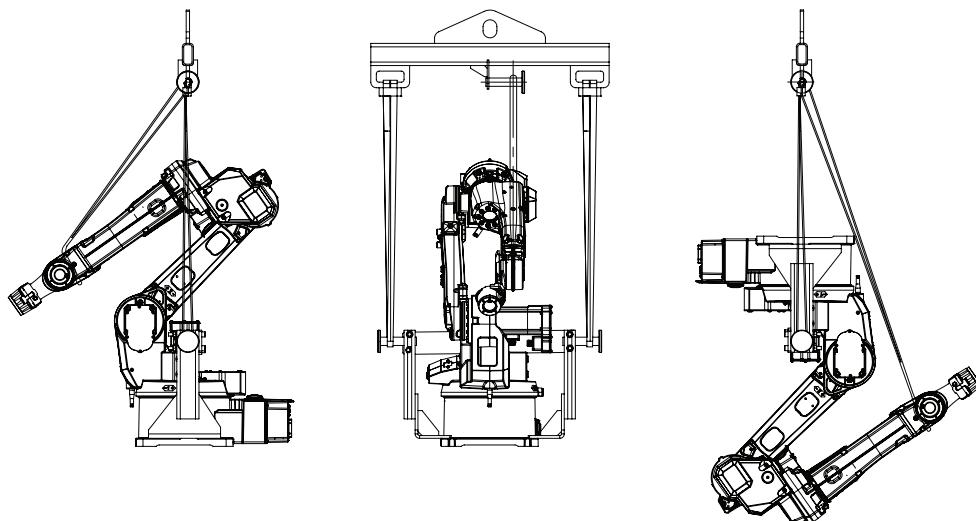
2.3.2 Lifting and turning a suspended mounted robot

2.3.2 Lifting and turning a suspended mounted robot

Introduction

How to lift and turn the robot to a suspended position using the turning accessory is described in the lifting instruction delivered with the turning accessory. Article numbers for the accessory and the instruction is specified in [Special tools on page 313](#). Contact ABB for more information.

Illustration



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2.3.3 Manually releasing the brakes

General

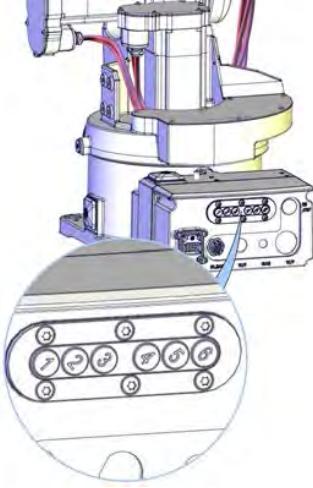
The section below details how to release the holding brakes of each axis' motor.

This may be done in one of three ways:

- using the brake release unit 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.

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

Use this procedure to release the holding brakes with the internal brake release unit.

	Action	Note
1	<p>The internal brake release unit is located at the base of the robot and equipped with six buttons for controlling the axes brakes. The buttons are numbered according to the numbers of the axes.</p>	 <p>Figure 2.1: Brake release buttons</p>
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 or beneath the robot arm!</p>	
3	<p>Release the holding brake on a particular robot axis by pressing the corresponding button on the internal brake release panel and keeping it depressed.</p> <p>The brake will function again as soon as the button is released.</p>	

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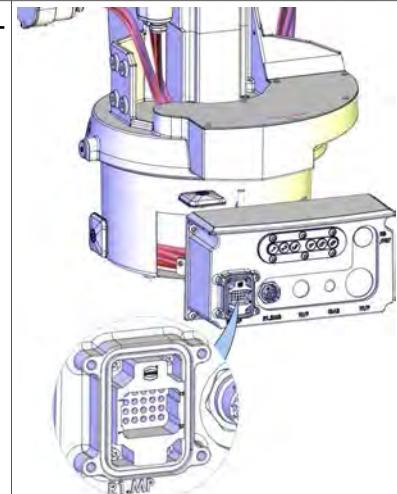
2 Installation and commissioning

2.3.3 Manually releasing the brakes

Continued

Using the brake release unit with an external power supply

This section details how to release the holding brakes with the internal brake release unit using an external voltage supply. This is done if the robot is not connected to the controller.

Action	Note
1  DANGER Incorrect connections, such as supplying power to the wrong pin, may cause all brakes to be released simultaneously!	Also, be careful not to interchange the 24V and 0V pins. If they are mixed up, damage can be caused to a resistor diode and to the system board.
2 Connect an external power supply to connector R1.MP.	 xx1100000390 Supply: <ul style="list-style-type: none">• 0V on pin 12• 24V on pin 11
3 Push the brake release button to release the holding brakes, according to the previous procedure.	

2.3.4 Orienting and securing the robot

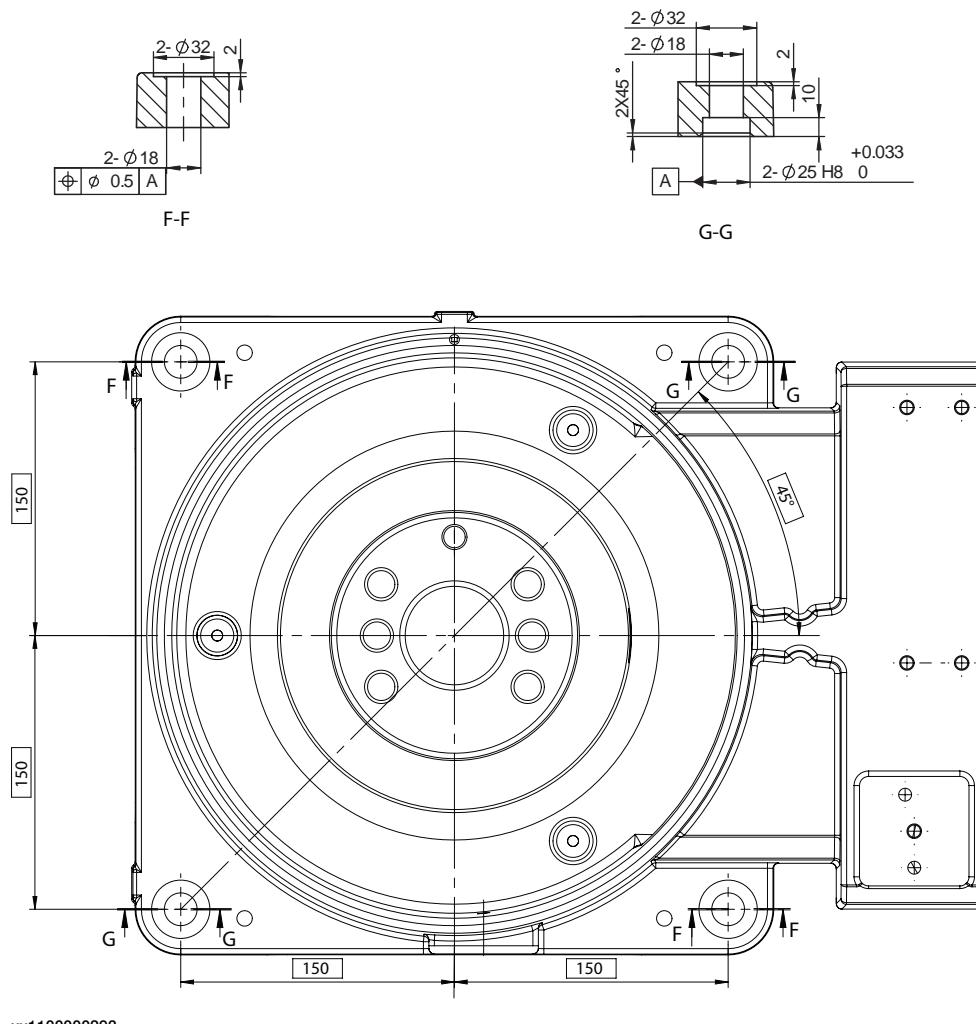
General

This section details how to orient and secure the robot at a horizontal level at the installation site.

Hole configuration, base

The figure shows the hole pattern and dimensions of the robot base.

Two of the holes in the base (view G-G) are designed to include a guiding sleeve.



xx1100000293

Attachment bolts, specification

Attachment bolts	4 pcs M16 x 45
Washers	30 x 17 x 3
Quality	8.8
Tightening torque	200 Nm

Continues on next page

2 Installation and commissioning

2.3.4 Orienting and securing the robot

Continued

Guiding sleeves

Use a pair of guiding sleeves to make the robot installation easier.

External diameter: 25 mm. Internal diameter: 18 mm.

Orienting and securing the robot to installation site

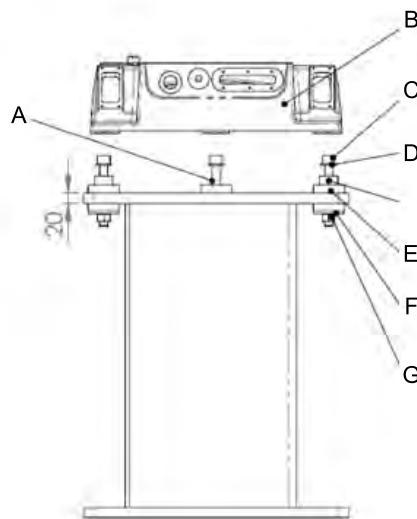
	Action	Note
1	Make sure the installation site for the robot conforms to the specifications in section Pre-installation procedure on page 62 .	
2	Prepare the installation site with attachment holes.	Hole configuration of the base is shown in the figure Hole configuration, base on page 75 .
3	Lift the robot to the installation site.	Detailed in section Lifting robot with roundslings on page 70 .
4	Guide the robot gently using two of the attachment bolts while lowering it into its mounting position.	
5	Fit and tighten the <i>bolts and washers</i> in the base attachment holes.	Specified in section Attachment bolts, specification on page 75 .

Isolating AW manipulator



CAUTION

If the manipulator is used for arc welding and is mounted on a pedestal, make sure that the manipulator is isolated from the pedestal with isolators.



A	Attachment point, front (no guide sleeve)
B	Manipulator base
C	Screw M16x120
D	Plain washer

Continues on next page

2 Installation and commissioning

2.3.4 Orienting and securing the robot

Continued

E	Guide sleeve
F	Isolator
G	Nut M16

2 Installation and commissioning

2.3.5 Setting the system parameters for a suspended or tilted robot

General

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



Note

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



Note

The allowed mounting positions are described in the product specification for the robot. The requirements on the foundation are described in [Requirements, foundation on page 64](#).

System parameters



Note

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

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

Gamma Rotation

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

Gravity Beta

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

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

Continues on next page

Gravity Alpha

If the robot is mounted on a wall (rotated around the x-axis), then the robot base frame and the system parameter *Gravity Alpha* must be redefined. The value of *Gravity Alpha* should then be $\pm\pi/2$ ($\pm3.141593/2$).

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



Note

The system parameter *Gravity Alpha* is not supported for all robot types. It is not supported for IRB 140, IRB 1410, IRB 1600ID, IRB 2400, IRB 4400, IRB 6400R, IRB 6400 (except for IRB 6400 200/2.5 and IRB 6400 200/2.8), IRB 6600, IRB 6650, IRB 6650S and IRB 7600 (except for IRB 7600 325/3.1).

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



Note

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

Gamma Rotation

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

Mounting angles and values

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

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

Example of position	Mounting angle (<i>A</i> °)	<i>Gravity Beta</i>
Floor mounted	0°	0.000000 (Default)
Suspended mounting	180°	3.141593

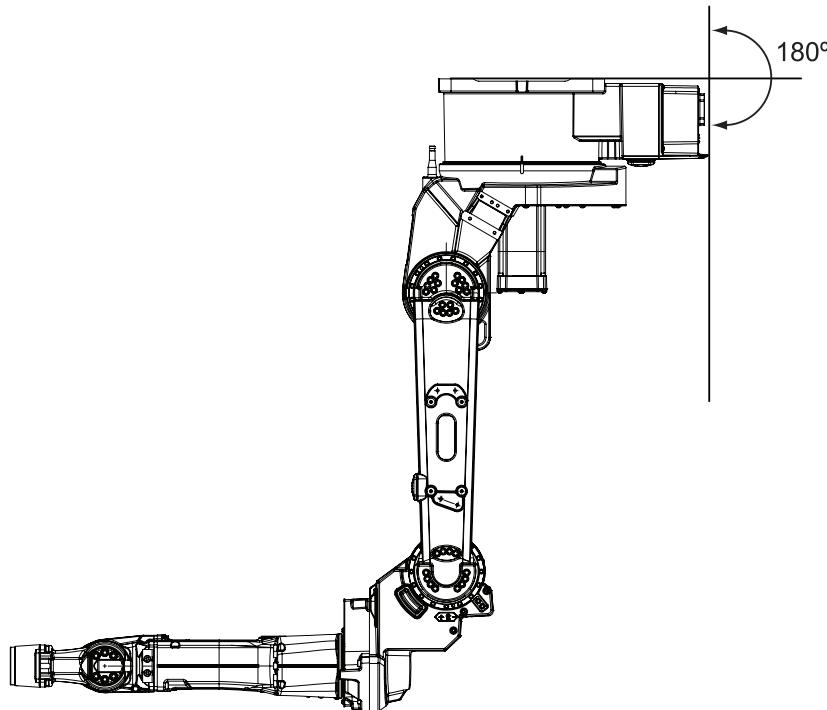
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2 Installation and commissioning

2.3.5 Setting the system parameters for a suspended or tilted robot

Continued

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



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-	Suspended mounting, mounting angle 180°
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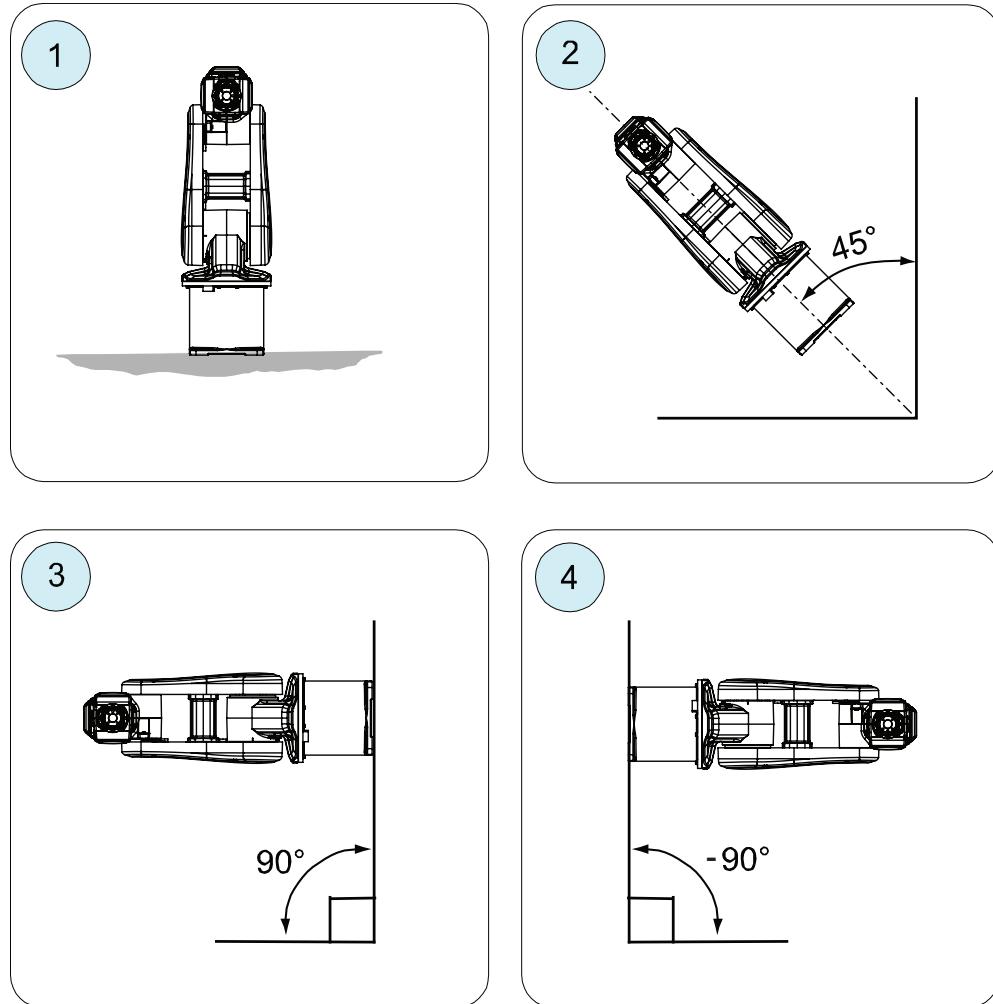
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2.3.5 Setting the system parameters for a suspended or tilted robot

Continued

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

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



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Pos	Mounting angle	Gravity Alpha
1	0° (Floor mounted)	0
2	45° (Tilted)	0.785398
3	90° (Wall)	1.570796
4	-90° (Wall)	-1.570796



Note

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

Continues on next page

2 Installation and commissioning

2.3.5 Setting the system parameters for a suspended or tilted robot

Continued

Defining the parameter in the IRC5 software

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

How to calculate a new value is detailed in [*Mounting angles and values on page 79*](#).

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

The system parameters are redefined in the **Configuration Editor**, in RobotStudio or on the FlexPendant.

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

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

General

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



CAUTION

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

References

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

- *Operating manual - IRC5 with FlexPendant*

Stopping time and braking distances

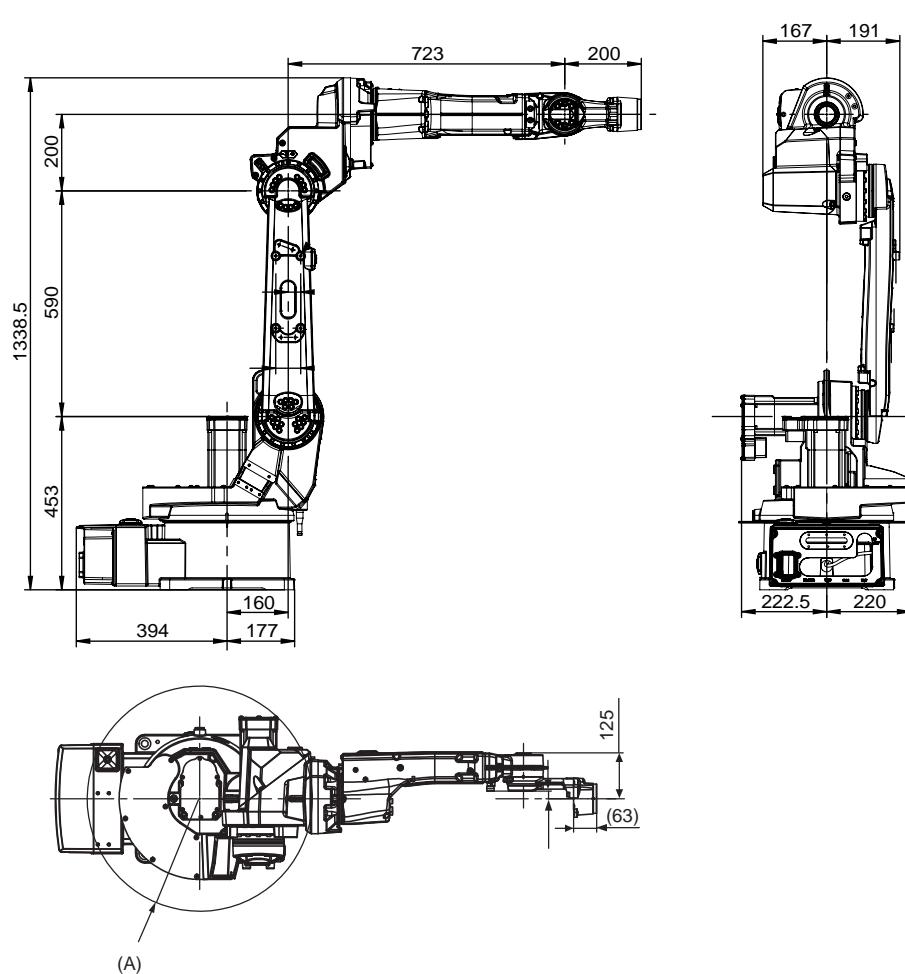
The performance of the motor brake depends on if there are any loads attached to the robot. For more information, see product specification for the robot.

2 Installation and commissioning

2.3.7 Fitting equipment on the robot (robot dimensions)

Robot dimensions

The figure shows the dimension of the robot.



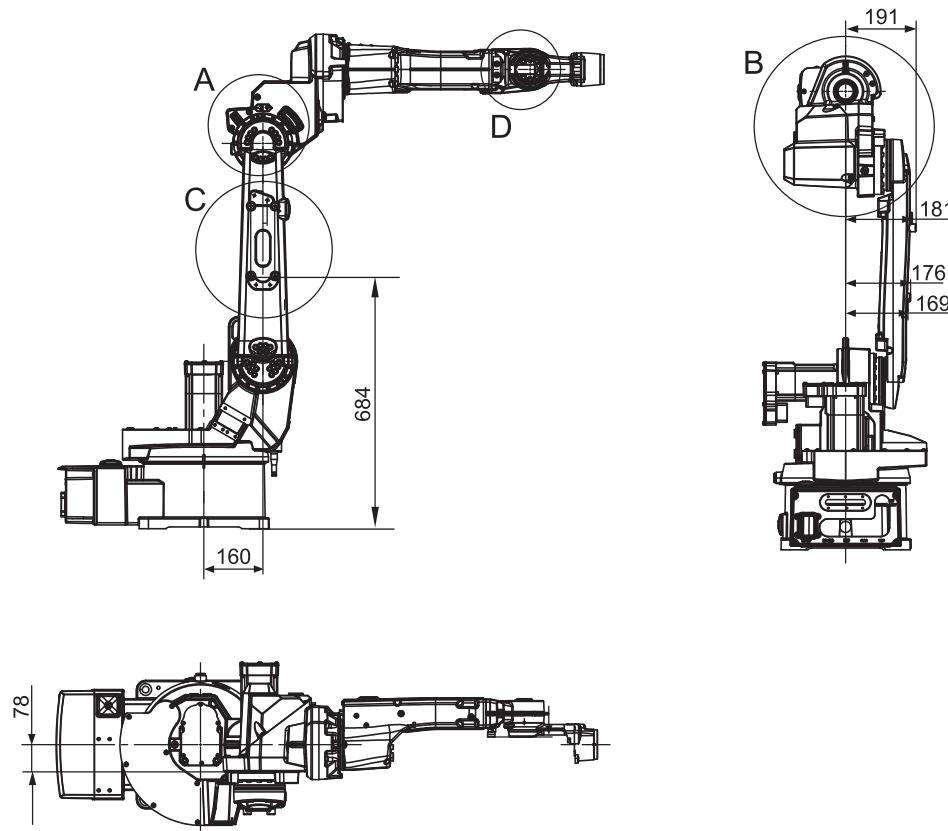
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A	Minimum turning radius R=307 mm
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Attachment holes and dimensions

Extra loads can be mounted on the wrist, the upper arm housing, and on the lower arm. The attachment holes are shown in the figures in this section.



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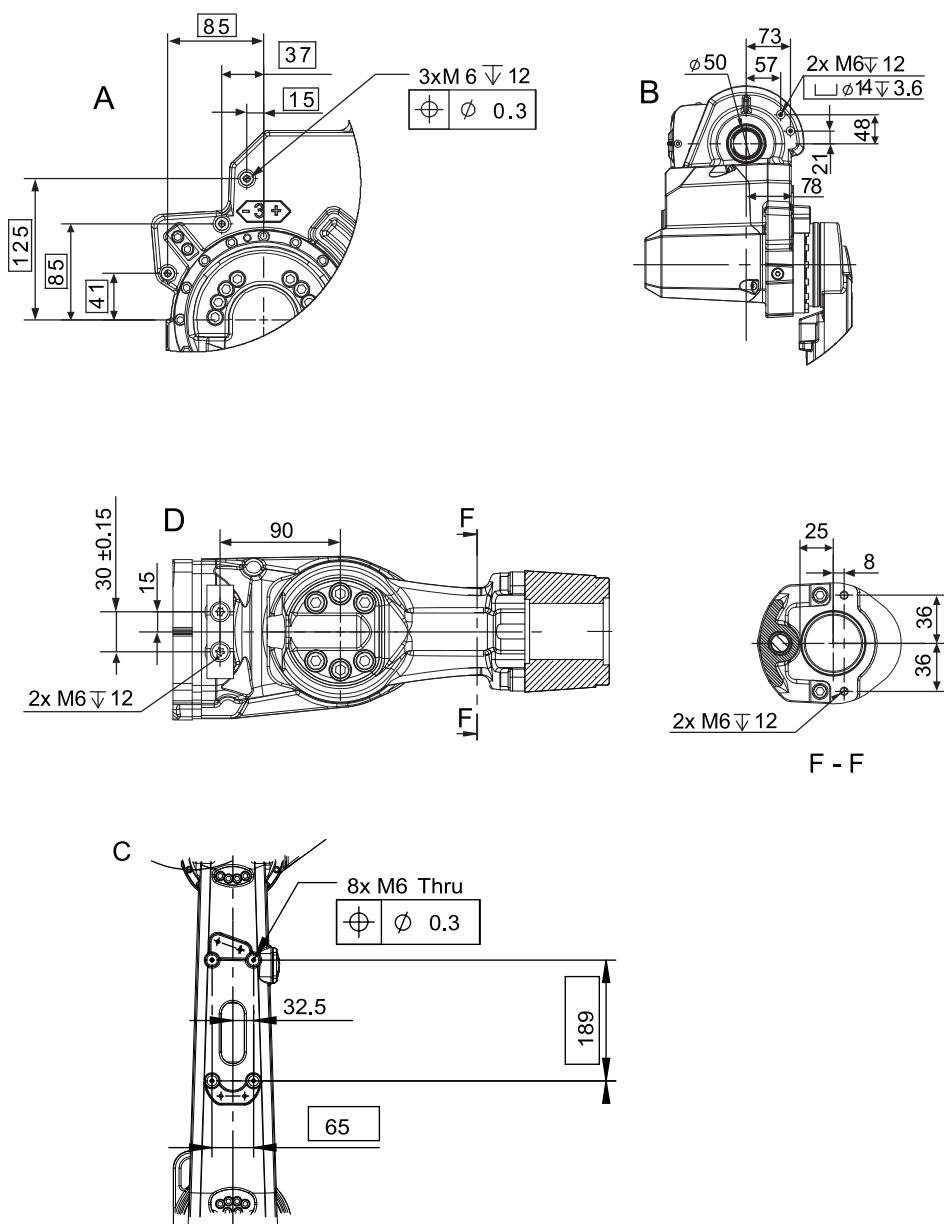
Figure 2.2: Overview of attachment holes and dimensions

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2 Installation and commissioning

2.3.7 Fitting equipment on the robot (robot dimensions)

Continued

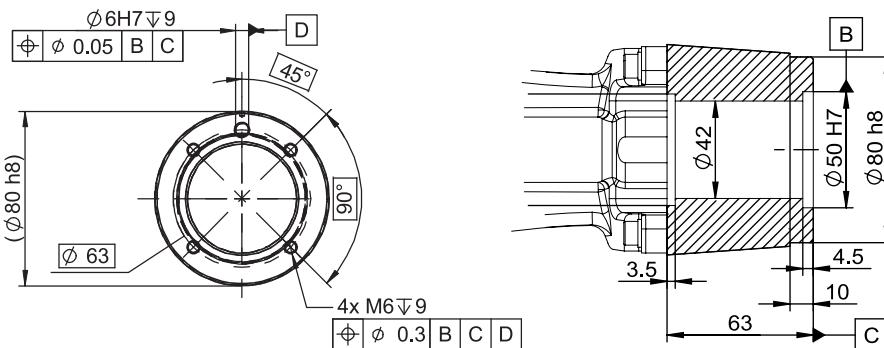


xx1100000303

Figure 2.3: Detailed illustrations of attachment holes on the robot

Continues on next page

Tool flange dimensions



xx1100000305

Figure 2.4: Tool flange dimensions

Fastener quality

When fitting tools on the turning disk, use only screws with quality 12.9. When fitting equipment on other places, standard screws with quality 8.8 can be used.

2 Installation and commissioning

2.4.1 Introduction

2.4 Restricting the working range

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.

The working range of the following axes may be restricted:

- Axis 3, hardware (mechanical stop). The mechanical stop must be installed on axis 3 if the robot features an Arc Welding package.

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 Installation of additional mechanical stops on axis 3

General

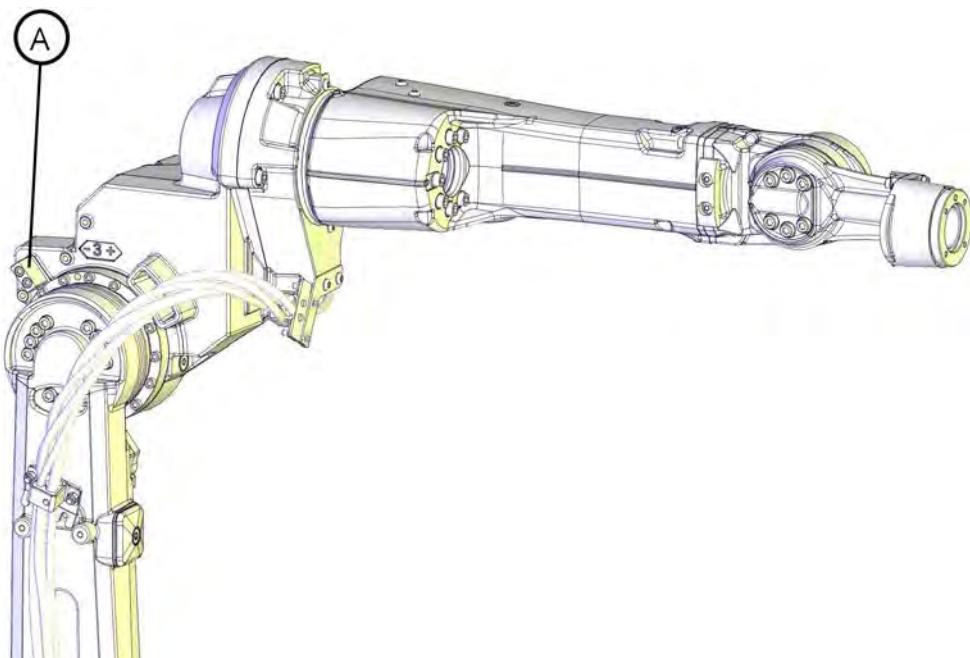
This section details how to install an additional mechanical stop on axis 3 in order to restrict the working range of the axis.

Restrictions in working range

If the robot features an Arc Welding package, the working range of axis 3 must be restricted with the additional mechanical stop.

Illustration, mechanical stop, axis 3

The mechanical stop is installed at the upper arm housing, as shown in the figure below.



xx1100000351

A	Additional mechanical stop, axis 3
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Required equipment

Equipment	Art. no.	Note
Mechanical stop, axis 3	See Spare parts on page 315 .	
<i>Technical reference manual - System parameters</i>	-	Art. no. is specified in References on page 10 .

Continues on next page

2 Installation and commissioning

2.4.2 Installation of additional mechanical stops on axis 3

Continued

Installation of mechanical stop, axis 3

The procedure below details how to install the mechanical stop to axis 3.

Action	Note
1  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
2 Fit the mechanical stop to the two mounting holes at the upper arm housing, with the two attachment screws and washers. Tighten the screws.	See Illustration, mechanical stop, axis 3 on page 89 . 2 pcs: M6 x 40, quality 12.9, tightening torque: 14 Nm
3 Adjust the software working range limitations (system parameter configuration) to correspond to the mechanical limitations.	The system parameters that must be changed (<i>Upper joint bound</i> and <i>Lower joint bound</i>) are described in Technical reference manual - System parameters .
4  WARNING If the <i>mechanical stop pin</i> is deformed after a hard collision, it must be replaced! Deformed <i>movable stops</i> and/or <i>additional stops</i> as well as deformed <i>attachment screws</i> must also be replaced after a hard collision.	

2.5 Electrical connections

2.5.1 Robot cabling and connection points

Introduction

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

Main cable categories

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

Cable category	Description
Robot cables	Handles power supply to and control of the robot's motors as well as feedback from the serial measurement board. Specified in the table Robot cables on page 91 .
Customer cables (option)	Handles communication with equipment fitted on the robot by the customer, low voltage signals and high voltage power supply + protective ground. The customer cables also include the air hose. See the product manual for the controller, see document number in References on page 10 .
External axes cables (option)	Handles power supply to and control of the external axes' motors as well as feedback from the servo system. See the <i>Application manual - Additional axes and stand alone controller (M2004)</i> , see document number in References on page 10 .

Robot cables

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

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

Robot cable, power

Cable	Art. no.
Robot cable, power: 7 m	3HAC040503-001
Robot cable, power: 15 m	3HAC040503-002

Robot cable, signals

Cable	Art. no.
Robot cable signal, shielded: 7 m	3HAC2493-1
Robot cable signal, shielded: 15 m	3HAC2530-1

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3 Maintenance

3.1 Introduction

Structure of this chapter

This chapter describes all the maintenance activities recommended for the IRB 1520.

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

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

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

Safety information

Observe all safety information before conducting any service work!

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



Note

If the IRB 1520 is connected to power, always make sure that the IRB 1520 is connected to protective earth before starting any maintenance work!

For more information see:

- *Product manual - IRC5*

3 Maintenance

3.2.1 Specification of maintenance intervals

3.2 Maintenance schedule and expected component life

3.2.1 Specification of maintenance intervals

Introduction

The intervals are specified in different ways depending on the type of maintenance activity to be carried out and the working conditions of the IRB 1520:

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

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. Values for these are specified in the section [Expected component life on page 97](#)

Instructions for how to perform the different maintenance activities are found in sections:

- [Inspection activities on page 98](#)
- [Replacement activities on page 125](#)
- [Cleaning activities on page 150](#)

Activities and intervals, standard equipment

The following table specifies the required maintenance activities and intervals.

Maintenance activity	Equipment	Interval
Cleaning	Robot	Cleaning the IRB 1520 on page 150
Inspection	Oil level in axis-1 gearbox	Every 12 months.
Inspection	Oil level in axis-2 gearbox	Every 12 months.
Inspection	Oil level in axis-3 gearbox	Every 12 months.
Inspection	Oil level in axis-4 gearbox	Every 48 months.
Inspection	Oil level in axis-5 gearbox	Every 48 months.
Inspection	Oil level in axis-5-6 gearbox (ID)	Every 12 months.
Inspection	Oil level in axis-6 gearbox	No inspection needed.
Inspection	Robot harness	Every 12 months ⁱ .
Inspection	Information labels	Every 12 months.
Inspection	Dampers	Every 12 months.
Inspection	Mechanical stop	Every 12 months.
Change	Oil in axis-1 gearbox	First change when DTC ⁱⁱ reads: • 6,000 hours Second change when DTC ⁱⁱ reads: • 24,000 hours Following changes: • Every 24,000 hours.
Change	Oil in axis-2 gearbox	First change when DTC ⁱⁱ reads: • 6,000 hours Second change when DTC ⁱⁱ reads: • 24,000 hours Following changes: • Every 24,000 hours.

Continues on next page

3 Maintenance

3.2.2 Maintenance schedule

Continued

Maintenance activity	Equipment	Interval
Change	Oil in axis-3 gearbox	First change when DTC ⁱⁱ reads: <ul style="list-style-type: none">• 6,000 hours Second change when DTC ⁱⁱ reads: <ul style="list-style-type: none">• 24,000 hours Following changes: <ul style="list-style-type: none">• Every 24,000 hours.
Change	Oil in axis-4 gearbox	No change needed.
Change	Oil in axis-5 gearbox	No change needed.
Change	Oil in axis-5-6 gearbox	First change when DTC ⁱⁱ reads: <ul style="list-style-type: none">• 6,000 hours Second change when DTC ⁱⁱ reads: <ul style="list-style-type: none">• 24,000 hours Following changes: <ul style="list-style-type: none">• Every 24,000 hours.
Change	Oil in axis-6 gear	No change needed.
Overhaul	Robot	Every: <ul style="list-style-type: none">• 40,000 hours .
Replacement	Battery pack, measurement system of type RMU101 or RMU102 (3-pole battery contact)	36 months or battery low alert ⁱⁱⁱ
Replacement	Battery pack, measurement system with 2-pole battery contact, e.g. DSQC633A	Battery low alert ^{iv}

i Replace when damage or cracks is detected or life limit is approaching that specified in section [Expected component life on page 97](#).

ii DTC = Duty Time Counter. Shows the operational time of the robot.

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

See the replacement instruction for more details.

iv The battery low alert (38213 **Battery charge low**) is displayed when remaining backup capacity (robot powered off) is less than 2 months. The 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 with a battery shutdown service routine. See *Operating manual - IRC5 with FlexPendant* for instructions.

3.2.3 Expected component life

General

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

Expected component life

Component	Expected life	Note
Robot cable harness	40,000 hours	See note i

- i The expected life can also be affected by grouping harnesses/cables other than standard options. The life expectancy is based on a test cycle that for every axis goes from the calibration position to minimum angle, to maximum angle and back to the calibration position. Deviations from this test cycle will result in differences in expected life!

3 Maintenance

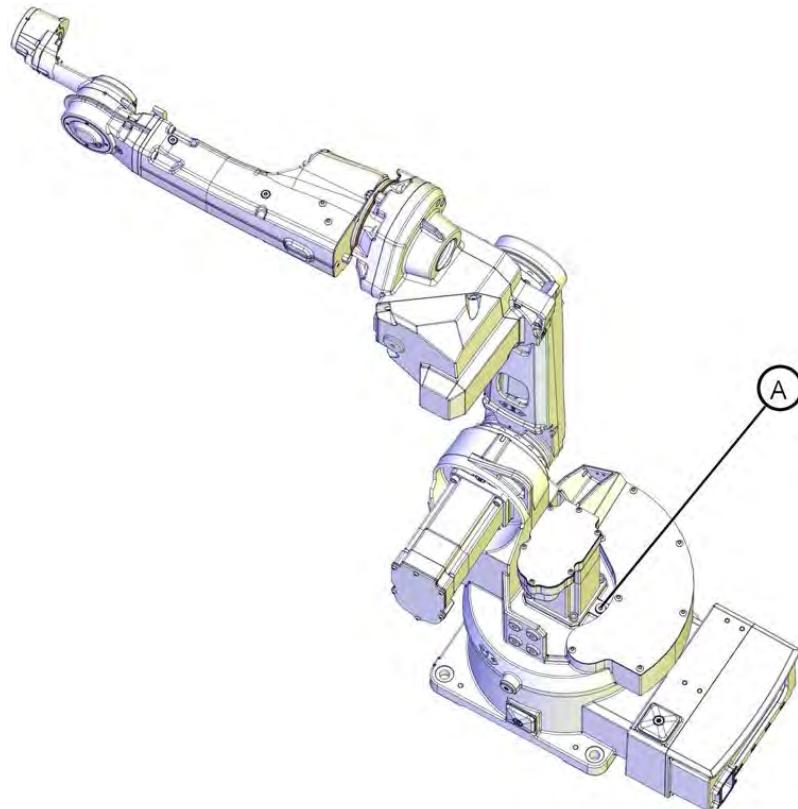
3.3.1 Inspecting the oil level, axis-1 gearbox

3.3 Inspection activities

3.3.1 Inspecting the oil level, axis-1 gearbox

Location of oil plugs

The axis 1 gearbox is located between the frame and base of the robot. The oil plug for inspection is shown in the figure.



xx1100000339

A	Oil plug, inspection
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Required equipment

Equipment	Note
Lubrication oil	See section Type of lubrication in gearboxes on page 125 .
Standard toolkit	Content is defined in section Standard tools on page 312 .
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.

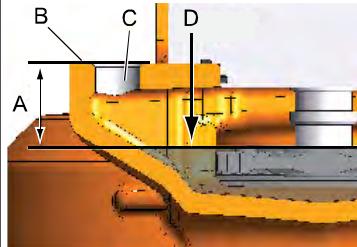
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3.3.1 Inspecting the oil level, axis-1 gearbox

Continued

Inspecting oil level, axis-1 gearbox (floor mounted)

Use this procedure to inspect the oil level in the axis-1 gearbox, when the robot is floor mounted.

Action	Note
1  WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	
2  DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
3  CAUTION The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
4 Open the <i>oil plug, inspection.</i>	See Location of oil plugs on page 98 .
5 Measure the oil level at the oil plug hole. Required oil level: <ul style="list-style-type: none"> • 39 mm ± 3 mm below the surface for the motor flange. The oil level shall only just start to be observed when looking through the oil filling hole. See figure!	 xx1000000824 Parts: <ul style="list-style-type: none"> • A: 39 mm ± 3 mm • B: Surface for motor flange • C: Filling hole • D: Oil level
6 Add oil if required.	How to fill oil is described in section: <ul style="list-style-type: none"> • Changing the oil, axis 1 gearbox on page 128
7 Refit the oil plug, inspection.	Tightening torque: <ul style="list-style-type: none"> • 10 Nm

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3 Maintenance

3.3.1 Inspecting the oil level, axis-1 gearbox

Continued

Inspecting oil level, axis 1-gearbox (suspended robot)

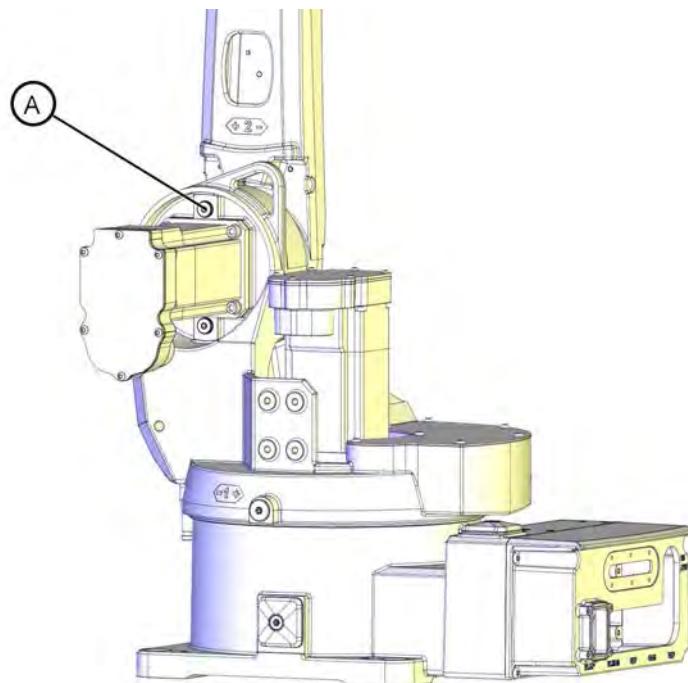
Use this procedure to inspect the oil level in the axis-1 gearbox.

Action	Note
1  WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
3 Lift down the robot from its suspended position and secure it on the floor.	See Lifting and turning a suspended mounted robot on page 72 .
4  CAUTION The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
5 Open the <i>oil plug inspection</i> on the axis-1 gearbox.	See the figure in: <ul style="list-style-type: none">• Location of oil plugs on page 98
6 Required oil level: <ul style="list-style-type: none">• 22 mm ± 3 mm below the surface for the motor flange.	
7 Add oil if required.	How to fill oil is described in section: <ul style="list-style-type: none">• Changing the oil, axis 1 gearbox on page 128
8 Refit the oil plug.	Tightening torque: <ul style="list-style-type: none">• 10 Nm

3.3.2 Inspecting the oil level, axis 2 gearbox

Location of axis 2 gearbox

The axis 2 gearbox is located in the lower arm rotational center, underneath the motor attachment. The oil plugs are shown in the figure.



xx1100000445

A	Oil plug, inspection
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Required equipment

Equipment	Note
Oil plug sealing washer, gearbox	3HAC029646-001
Lubrication oil	See section Type of lubrication in gearboxes on page 125 .
Standard toolkit	Content is defined in section Standard tools on page 312 .
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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3 Maintenance

3.3.2 Inspecting the oil level, axis 2 gearbox

Continued

Inspecting oil level, axis 2 gearbox

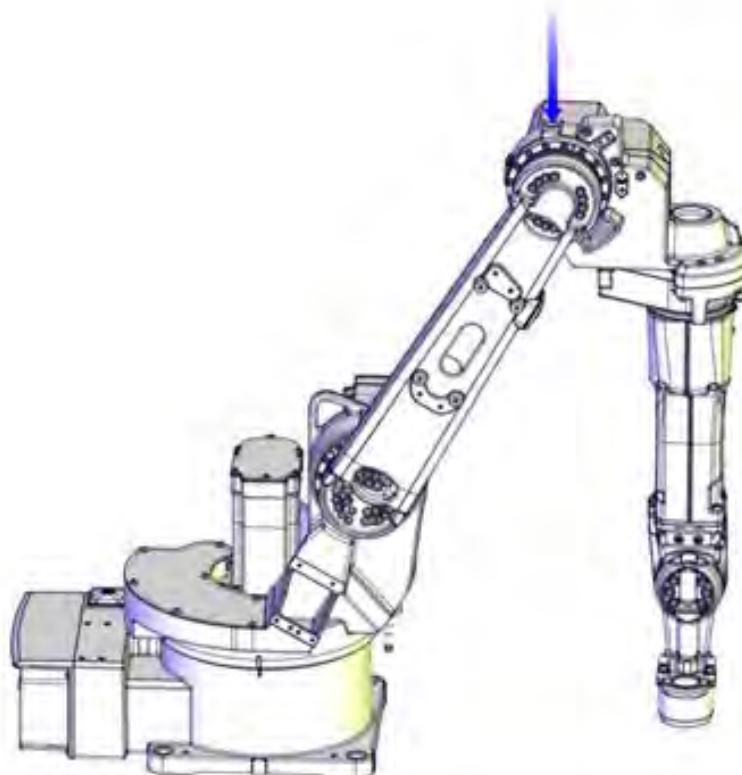
Use this procedure to inspect the oil level in the axis 2 gearbox. A suspended robot must be taken down and secured standing on the floor for inspection.

Action	Note
1  WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
3  CAUTION The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
4 If the robot is suspended, lift it down from its suspended position and secure it on the floor. Then open the oil plug for inspection.	See Lifting and turning a suspended mounted robot on page 72 . See Location of axis 2 gearbox on page 101 .
5 Measure the oil level at the oil plug hole. Required oil level: <ul style="list-style-type: none">• $23 \text{ mm} \pm 3 \text{ mm}$ below the lower edge of the oil plug hole.	
6 Add oil if required.	How to fill oil is described in section <ul style="list-style-type: none">• Changing the oil, axis-2 gearbox on page 133
7 Refit the oil plug, filling.  Note Before refitting the oil plug in the gearbox, always replace the oil plug sealing washer with a new one. If not there is a risk of leakage.	Tightening torque: <ul style="list-style-type: none">• 10 Nm

3.3.3 Inspecting the oil level, axis 3 gearbox

Location of axis 3 gearbox

The axis 3 gearbox is located in the upper arm rotational center, underneath the motor attachment. The oil plug for inspection is shown in the figure.



xx1100000443

-	Oil plug, inspection
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Required equipment

Equipment	Note
Lubrication oil	See section Type of lubrication in gearboxes on page 125 .
Standard toolkit	Content is defined in section Standard tools on page 312 .
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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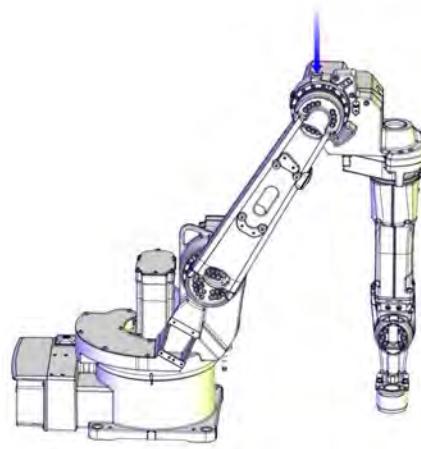
3 Maintenance

3.3.3 Inspecting the oil level, axis 3 gearbox

Continued

Inspecting the oil level, axis 3 gearbox

Use this procedure to inspect the oil level in the axis 3 gearbox. A suspended robot must be taken down and secured standing on the floor for inspection.

Action	Note
1  WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	
2 Move both the upper and lower arm so that the upper arm points straight down. The oil plug for inspection must be completely perpendicular.  xx1100000443	
3  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
4  CAUTION The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
5 Open the <i>oil plug for inspection</i> .	See the figure in: <ul style="list-style-type: none">• Location of axis 3 gearbox on page 103
6 Measure the oil level at the oil plug hole. Required oil level: <ul style="list-style-type: none">• 42 mm from the flange of the oil plug hole.	

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3.3.3 Inspecting the oil level, axis 3 gearbox

Continued

	Action	Note
7	Add oil if required.	How to fill oil is described in section: • <i>Changing the oil, axis-3 gearbox on page 137</i>
8	Refit the oil plug.	Tightening torque: • in armhouse: 10 Nm • in gearbox: 3 Nm

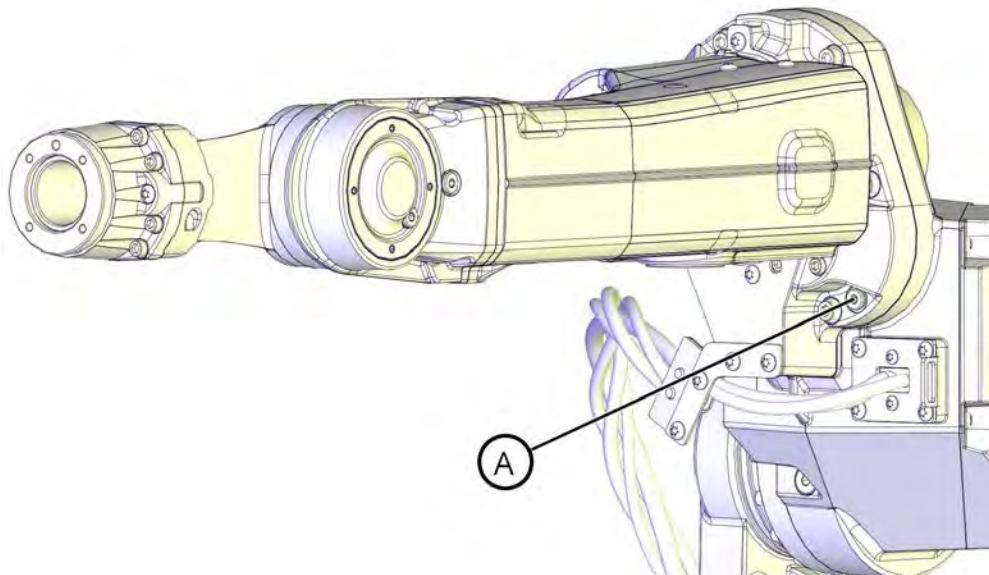
3 Maintenance

3.3.4 Inspecting the oil level, axis 4 gearbox

3.3.4 Inspecting the oil level, axis 4 gearbox

Location of axis 4 gearbox

The axis 4 gearbox is located in the upper armhouse. The oil plug is shown in the figure.



xx1100000447

A	Oil plug, inspection
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Required equipment

Equipment	Note
Lubrication oil	See section Type of lubrication in gearboxes on page 125 .
Standard toolkit	Content is defined in section Standard tools on page 312 .
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.

Inspecting the oil level, axis 4 gearbox

Use this procedure to inspect the oil level in the axis 4 gearbox. A suspended robot must be taken down and secured standing on the floor for inspection.

Action	Note
1 WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	

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3.3.4 Inspecting the oil level, axis 4 gearbox

Continued

Action	Note
2 Move the robot to where the upper arm points straight up and the oil plug hole is on top of the axis 4 gearbox.	 xx1100000476
3  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
4  CAUTION The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
5 Open the <i>oil plug</i> .	See the figure in: <ul style="list-style-type: none">• Location of axis 4 gearbox on page 106
6 Measure the oil level at the oil plug hole. Required oil level: <ul style="list-style-type: none">• 35 mm ± 3 mm below the oil plug flange.	
7 Add oil if required.	
8 Refit the oil plug, filling.	Tightening torque: <ul style="list-style-type: none">• 10 Nm

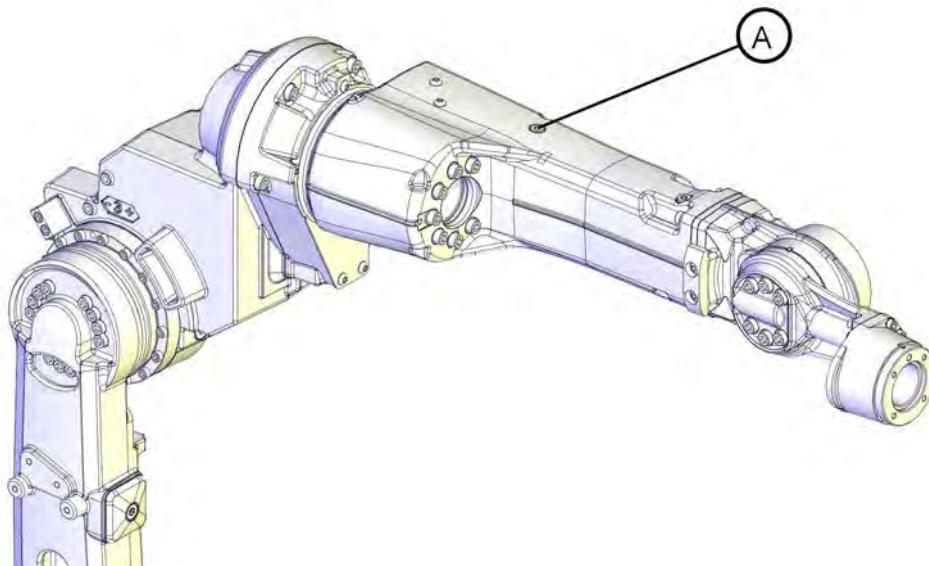
3 Maintenance

3.3.5 Inspecting the oil level, axis 5 gearbox

3.3.5 Inspecting the oil level, axis 5 gearbox

Location of axis 5 gearbox

The axis 5 gearbox is located inside the upper arm. The oil plug is shown in the figure.



xx1100000448

A	Oil plug for inspection
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Required equipment

Equipment	Art. no.	Note
Lubricating oil	1171 2016-604	Mobil Gear XP320 15 ml Note! Do not mix with other oils!
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.

Inspecting oil level, axis 5 gearbox

Use this procedure to inspect the oil level in the axis 5 gearbox. A suspended robot must be taken down and secured standing on the floor for inspection.

Action	Note
<p>1</p> <p> WARNING</p> <p>Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52.</p>	

Continues on next page

Action	Note
2 Rotate the upper arm so that the oil plug is on top of the upper arm and is completely perpendicular.	See Location of axis 5 gearbox on page 108 .
3  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
4  CAUTION The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
5 Open the oil plug.	See Location of axis 5 gearbox on page 108 .
6 Measure the oil level at the oil plug hole. Required oil level: <ul style="list-style-type: none">• 30 mm ± 3 mm below the lower edge of the oil plug hole.	
7 Add oil if required.	
8 Refit the oil plug, filling.	Tightening torque: <ul style="list-style-type: none">• 10 Nm

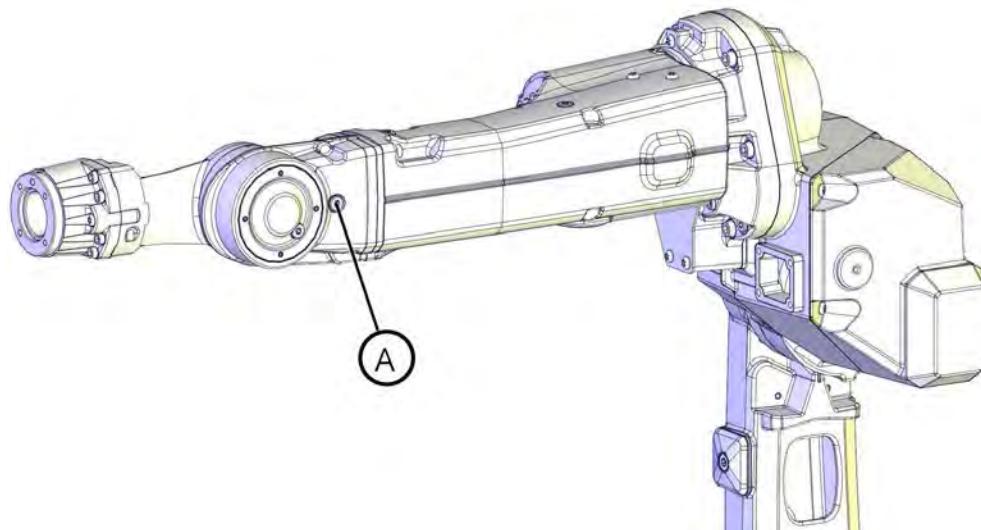
3 Maintenance

3.3.6 Inspecting the oil level, axis 5-6 gearbox

3.3.6 Inspecting the oil level, axis 5-6 gearbox

Location of axis 5-6 gearbox

The axis 5-6 gearbox is located in the wrist unit. The oil plug for inspection is shown in the figure.



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A	Oil plug for inspection
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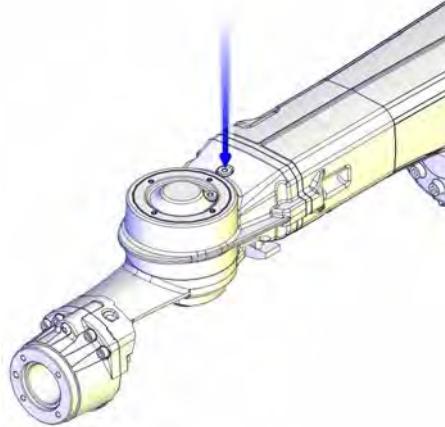
Required equipment

Equipment	Art. no.	Note
Lubricating oil	3HAC0860-1	Optimol Optigear BM 100 Note! Do not mix with other oils! 130 ml Amount at oil change: 110 ml Note! Do not mix with other oils!
Standard toolkit	-	Content is defined in section Standard tools on page 312 .
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

Inspecting oil level, axis 5-6 gearbox

Use this procedure to inspect the oil level in the axis 5-6 gearbox. A suspended robot must be taken down and secured standing on the floor for inspection.

Action	Note
1  WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	
2 Rotate axis 4 +90° so that the oil plug is on top of the wrist unit and is completely perpendicular.	 xx1100000477
3  DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
4  CAUTION The gearbox can contain an excess of pressure that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
5 Open the oil plug.	
6 Measure the oil level at the oil plug hole. Required oil level: <ul style="list-style-type: none"> • 25 mm ± 3 mm from the oil plug flange. 	
7 Add oil if required.	How to fill oil is described in section <ul style="list-style-type: none"> • Changing the oil in axes 5 and 6 gearboxes, ID on page 142

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3 Maintenance

3.3.6 Inspecting the oil level, axis 5-6 gearbox

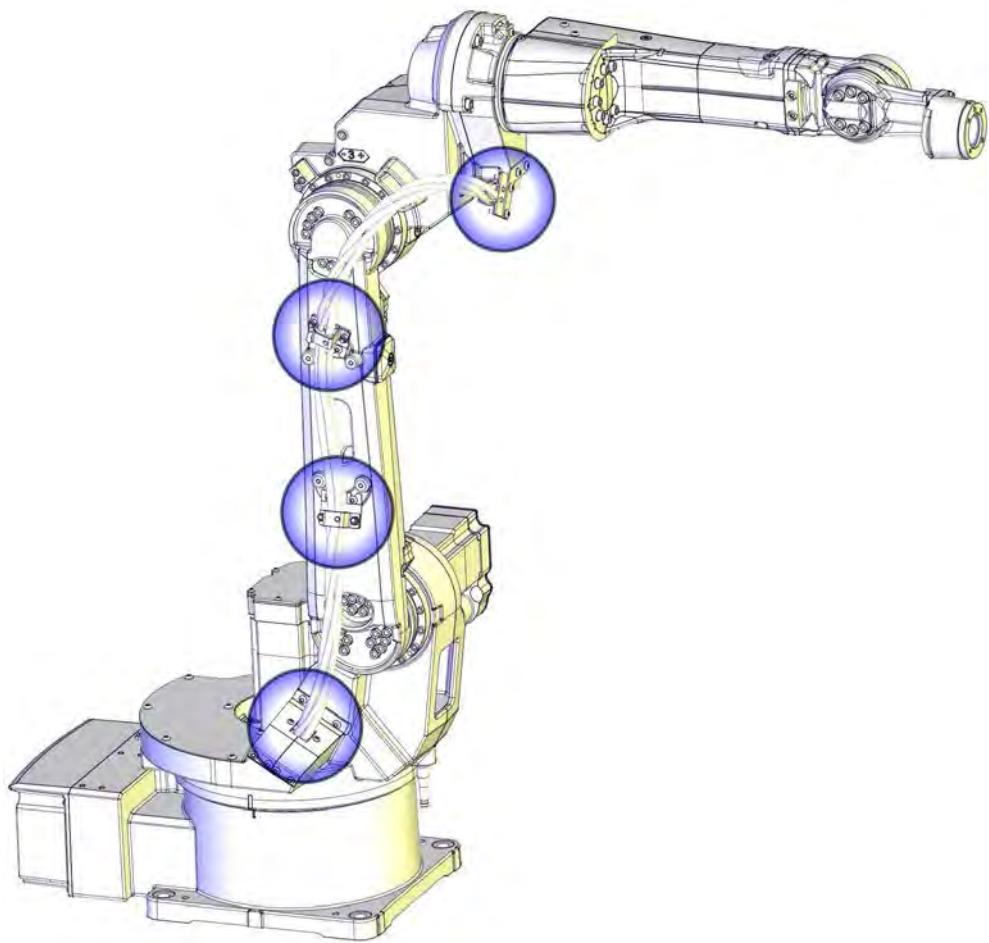
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	Action	Note
8	Refit the oil plug, filling.	Tightening torque: • 4-6 Nm

3.3.7 Inspecting the cable harness

Location of cable harness

The figure shows the location of the cable harness.



xx1100000467

Required equipment

Equipment	Note
Standard toolkit	Content is defined in section Standard tools on page 312 .
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 317 .

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3 Maintenance

3.3.7 Inspecting the cable harness

Continued

Inspecting the cable harness

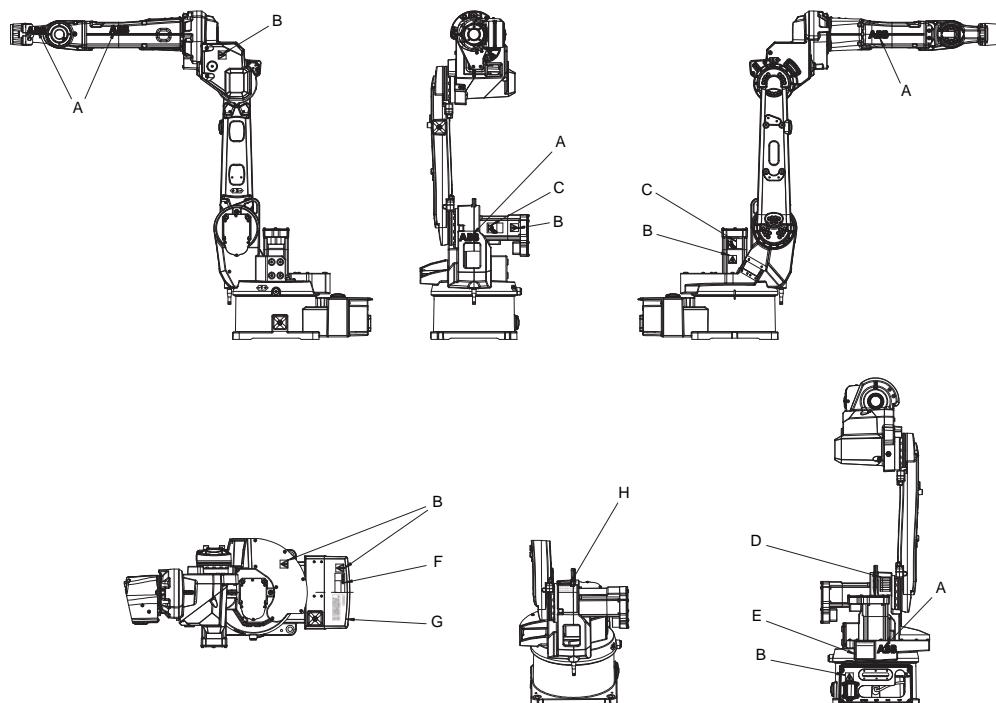
Use this procedure to inspect the cable harness. The inspection points are shown in the figure [Location of cable harness on page 113](#)

Action	Note
1  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
2 Make an overall visual inspection of the cable harness in order to detect wear or damage.	
3 Check the <i>connectors at the base</i> .	
4 Check the <i>connectors at the armhouse</i> .	
5 Check all <i>brackets and straps</i> are properly attached to the robot.	
6 Replace the cable harness if wear, cracks or damage is detected.	How to replace the cable harness is described in Repair on page 153 .

3.3.8 Inspecting information labels

Location of information labels

The figure shows the location of the information labels to be inspected.



xx1100000468

A	ABB logotype
B	Warning sign - Symbol of flash
C	Instruction plate - High temperature
D	Calibration label
E	Rating label
F	Instruction plate - Brake release unit
G	Oil quantity label
H	Instruction plate - Lifting of robot

Required equipment

Equipment	Spare part no.	Note
Labels	For spare part number of a specific label see Spare parts on page 315 .	Labels are sold separately.

Continues on next page

3 Maintenance

3.3.8 Inspecting information labels

Continued

Inspecting labels

Use this procedure to inspect the labels on the robot.

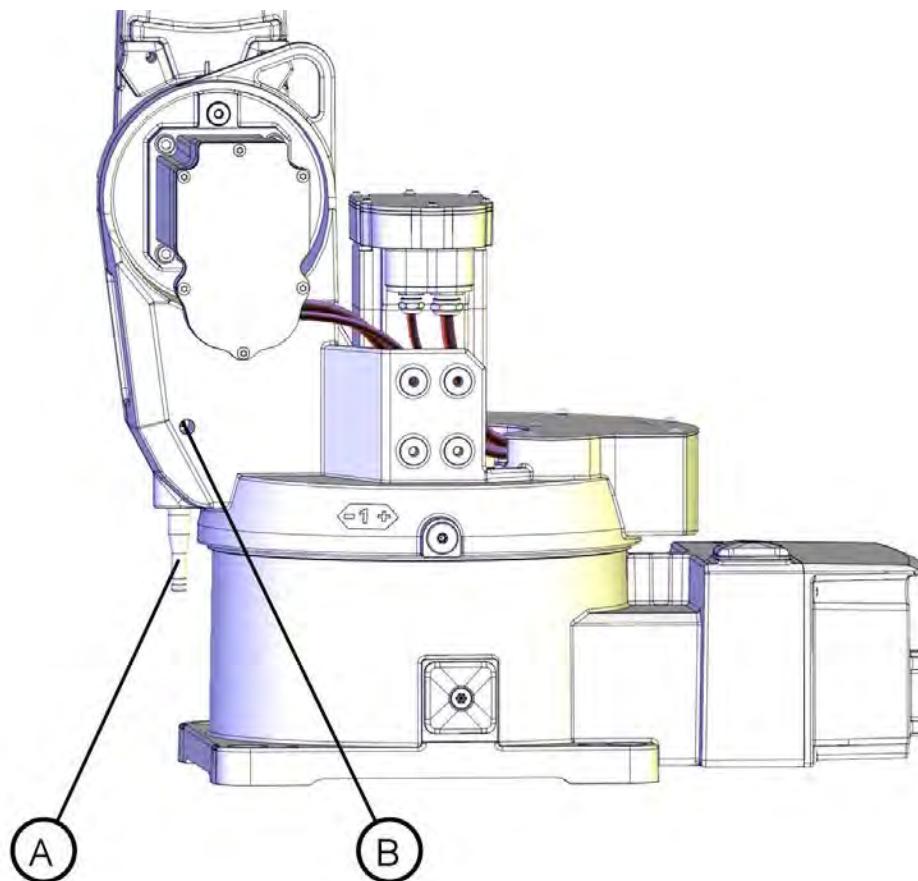
Action	Note
1  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
2 Check all labels.	See the figure in Location of information labels on page 115 .
3 Replace any missing or damaged labels.	

3.3.9 Inspecting the mechanical stop pin, axis 1

3.3.9 Inspecting the mechanical stop pin, axis 1

Location of mechanical stop pin, axis 1

The mechanical stop pin is located on the frame as shown in the figure.



xx1100000444

A	Mechanical stop pin
B	Stop screw

Required equipment

Equipment	Art. no.	Note
Mechanical stop pin axis 1	See Spare parts on page 315 .	
Standard toolkit		Content is defined in section Standard tools on page 312 .
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

3 Maintenance

3.3.9 Inspecting the mechanical stop pin, axis 1

Continued

Inspection of mechanical stop pin, axis 1

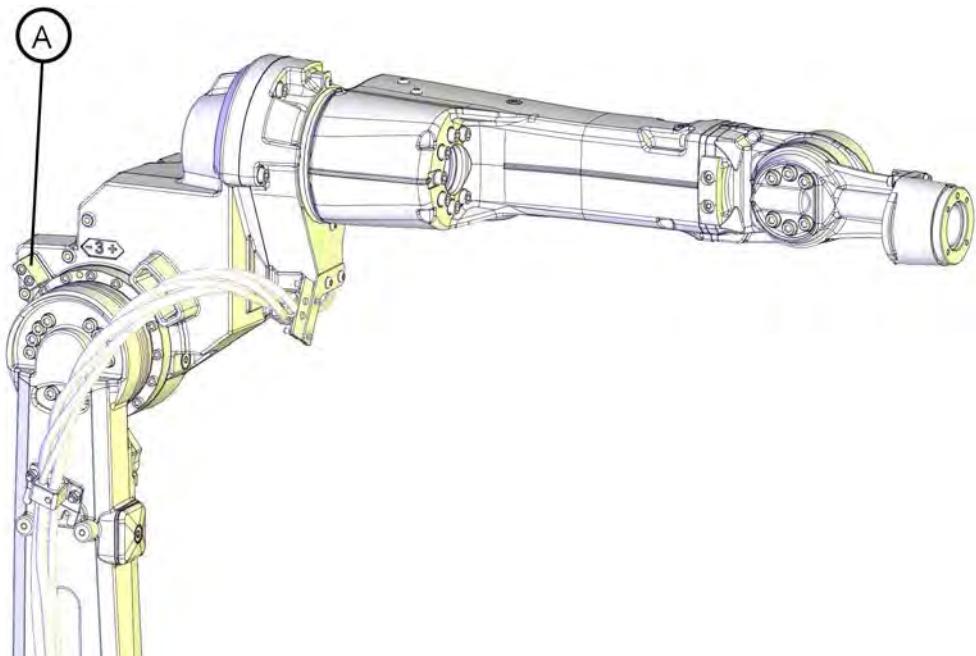
Use this procedure to inspect the mechanical stop pin, axis 1.

Action	Note
1  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
2 Regularly check that the <i>mechanical stop pin</i> is not bent or damaged in any other way.	See the figure in: <ul style="list-style-type: none">• Location of mechanical stop pin, axis 1 on page 117
3  Note If the mechanical stop pin has been deformed or damaged, it must be replaced.	
4 Check that the mechanical stop pin is properly attached.	

3.3.10 Inspecting, additional mechanical stops

Location of additional mechanical stops

Additional mechanical stops are provided for axes 3 and 4.



xx1100000351

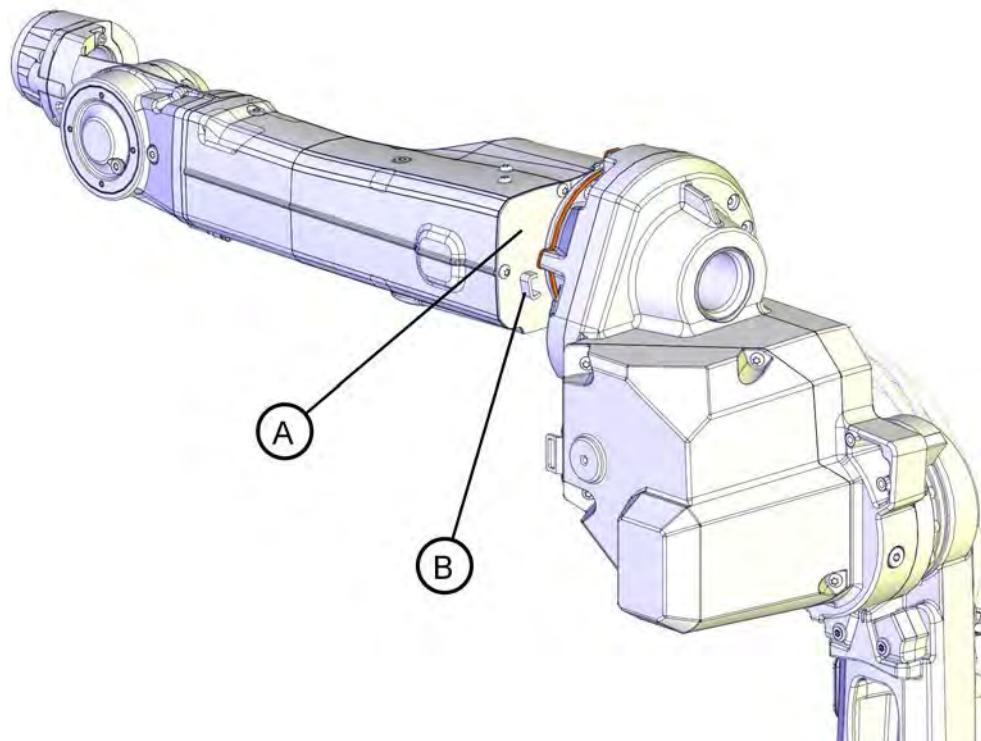
A	Additional mechanical stop, axis 3
---	------------------------------------

Continues on next page

3 Maintenance

3.3.10 Inspecting, additional mechanical stops

Continued



xx1100000469

A	Metal sheet
B	Additional mechanical stop, axis 4 (welding on the metal sheet)

Required equipment

Equipment	Spare part no.	Note
Additional mechanical stops	See Spare parts on page 315 .	
Standard toolkit	-	Content is defined in section Standard tools on page 312 .

Inspecting, mechanical stops

Use this procedure to inspect additional mechanical stops on axes 3 and 4.

Action	Note
<p>1</p> <p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply <p>to the robot, before entering the robot working area.</p>	
2	Check <i>additional stops</i> on axes 3 and 4 for damage. See Location of additional mechanical stops on page 119 .

Continues on next page

3.3.10 Inspecting, additional mechanical stops

Continued

	Action	Note
3	Make sure the stops are properly attached. Correct tightening torque, mechanical stops: <ul style="list-style-type: none">• Axis 3: 14 Nm.	
4	If any damage is detected, the <i>mechanical stops</i> must be replaced! Correct attachment screws: <ul style="list-style-type: none">• Axis 3: M6 x 40, quality 12.9 (2 pcs)• Axis 4: M6 x 8, quality 8.8 (3 pcs)	Art. no. is specified in Required equipment on page 120 .

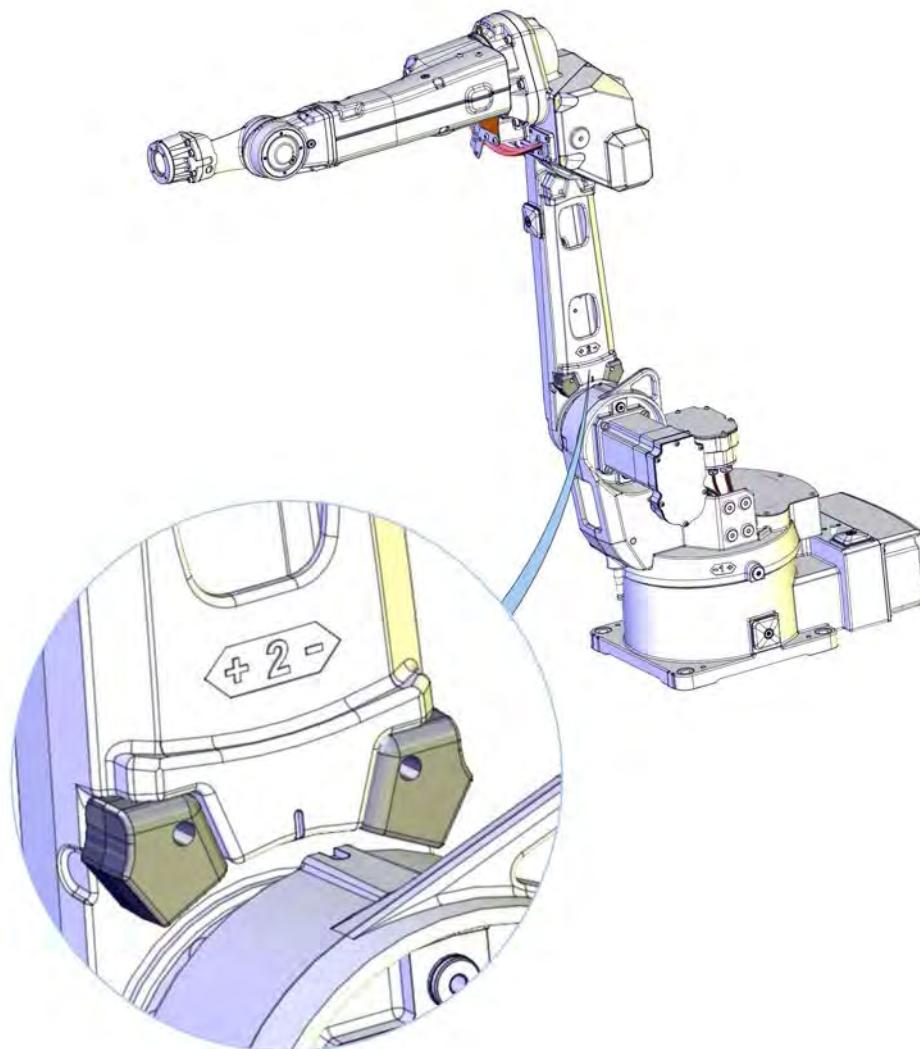
3 Maintenance

3.3.11 Inspecting dampers

3.3.11 Inspecting dampers

Location of dampers

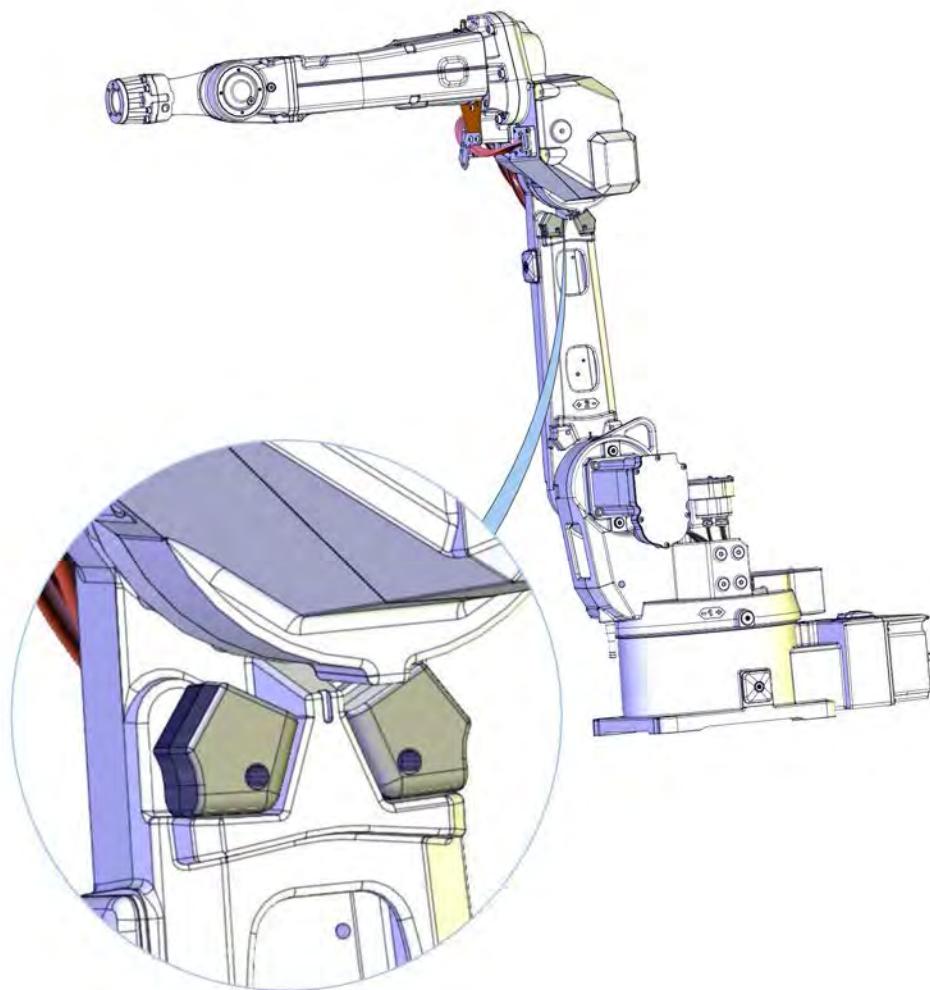
The figure shows the location of all dampers to be inspected.



xx1100000356

-	Dampers, axis 2
---	-----------------

Continues on next page



xx1100000357

-	Dampers, axis 3
---	-----------------

Required equipment

Equipment	Spare part no.	Note
Damper	See Spare parts on page 315 .	
Standard toolkit	-	Content is defined in section Standard tools on page 312 .

Continues on next page

3 Maintenance

3.3.11 Inspecting dampers

Continued

Inspecting dampers

Use this procedure to inspect the dampers.

	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
2	Check all <i>dampers</i> for damage or cracks.	See the figure in: <ul style="list-style-type: none">• Location of dampers on page 122
3	Check all dampers for existing impressions larger than 2-3 mm.	
4	Check attachment screws for deformation.	
5	If any damage is detected the damper must be replaced.	

3.4 Replacement activities

3.4.1 Type of lubrication in gearboxes

Introduction

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

Type and amount of oil in gearboxes

Information about the *type of lubrication*, *article number* as well as the *amount* in the specific gearbox can be found in *Technical reference manual - Lubrication in gearboxes*. 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 immediately 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 a 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.

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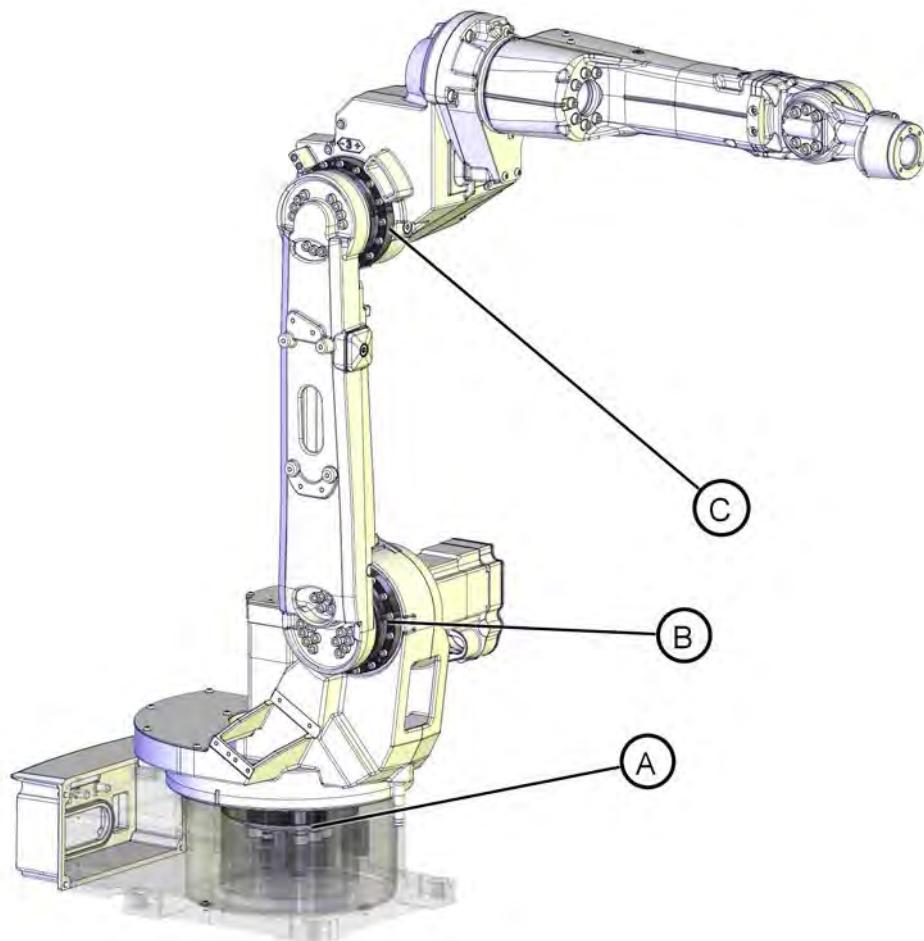
3 Maintenance

3.4.1 Type of lubrication in gearboxes

Continued

Location of gearboxes

The figure shows the location of the gearboxes.



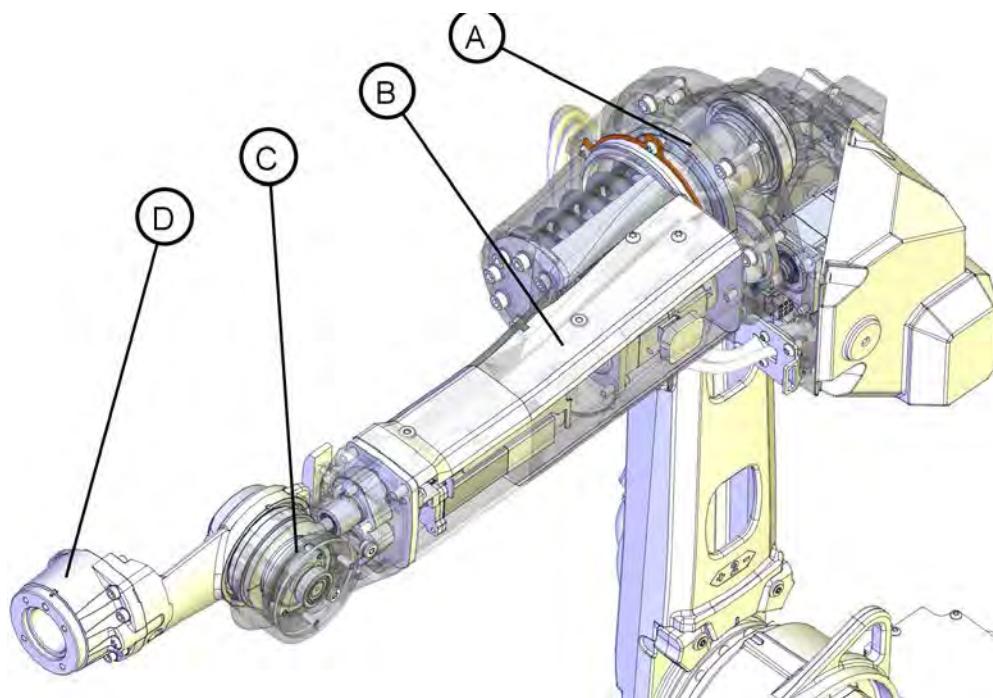
xx1100000336

A	Axis 1 gearbox
B	Axis 2 gearbox
C	Axis 3 gearbox

Continues on next page

3.4.1 Type of lubrication in gearboxes

Continued



xx1100000337

A	Axis 4 gearbox
B	Axis 5 gearbox
C	Axis 5 and 6 gearbox
D	Axis 6 gearbox

Equipment

Equipment	Note
Oil dispenser	Includes pump with outlet pipe. Use the suggested dispenser or a similar one: <ul style="list-style-type: none">• Orion OriCan art. no. 22590 (pneumatic)
Nipple for quick connect fitting, with o-ring	

3 Maintenance

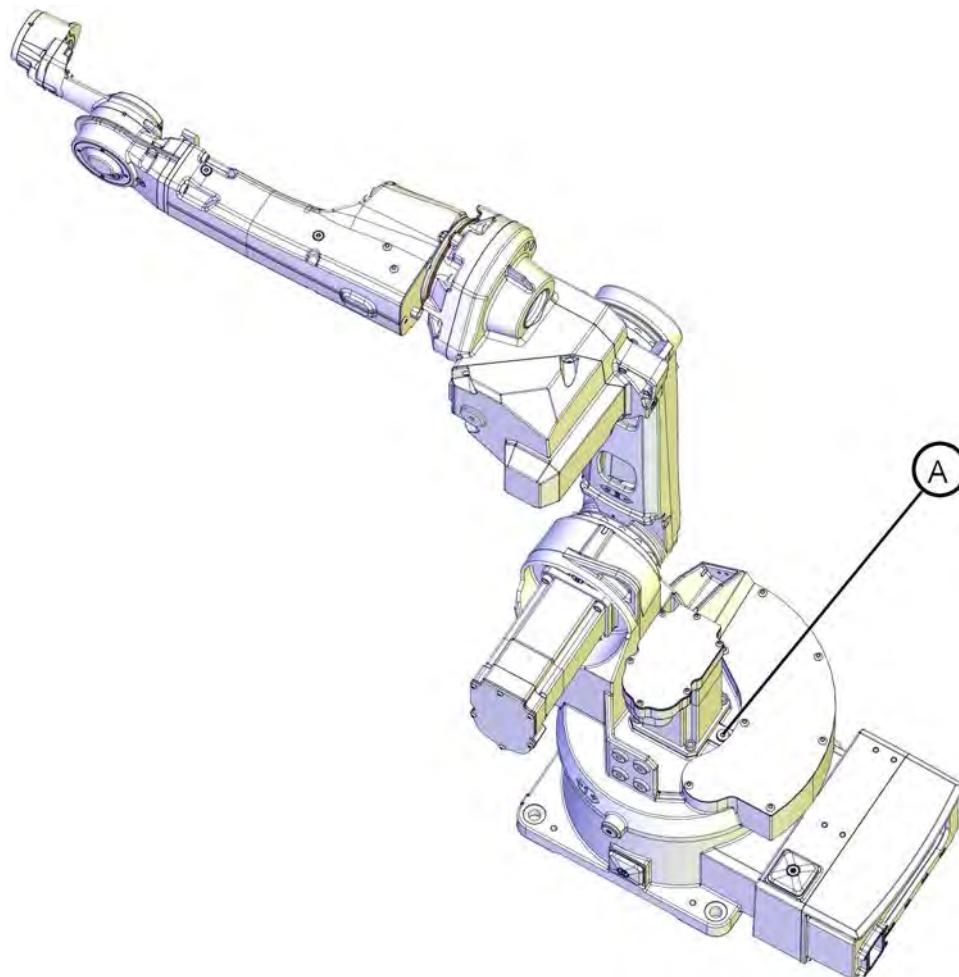
3.4.2 Changing the oil, axis 1 gearbox

3.4.2 Changing the oil, axis 1 gearbox

Location of oil plugs

The axis 1 gearbox is located between the frame and base of the robot.

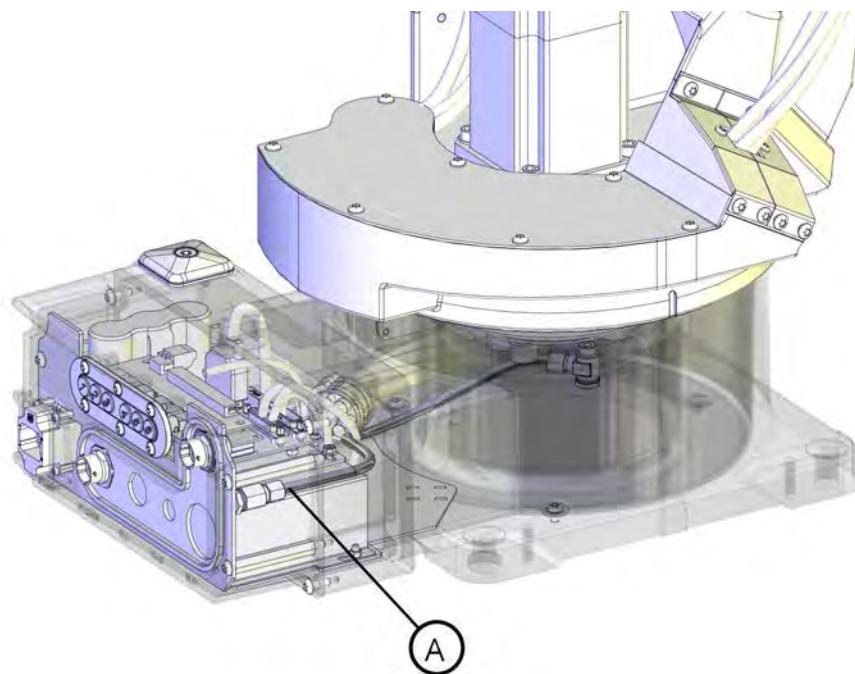
The oil plug is shown in the figure.



xx1100000339

A	Oil plug for filling
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Continues on next page



xx1100000338

A	Draining hose
---	---------------

Required equipment

Equipment	Note
Lubricating oil	Information about the oil is found in <i>Technical reference manual - Lubrication in gearboxes</i> . See Type and amount of oil in gearboxes on page 125 .
Oil collecting vessel	The capacity of the vessel must be sufficient to take the complete amount of oil.
Compressed air	Used to accelerate the draining procedure.
Standard toolkit	Content is defined in section Standard tools on page 312 .
Other tools and procedures may be required.	See references to these procedures in the step-by-step instructions below.

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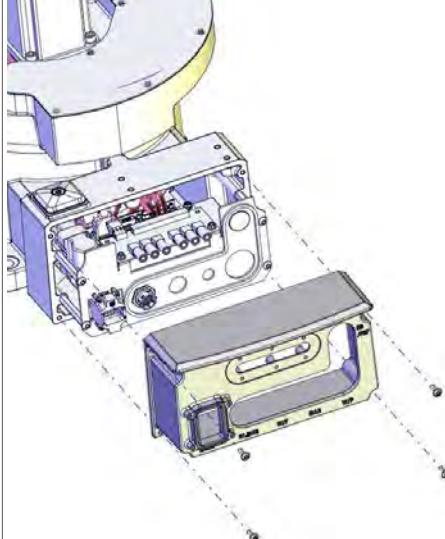
3 Maintenance

3.4.2 Changing the oil, axis 1 gearbox

Continued

Draining, axis 1 gearbox

Use this procedure to drain the gearbox of oil. A suspended robot must be taken down and secured standing on the floor for oil change.

Action	Note
1  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
2  WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52.	
3 Remove the push button guard from the base.	
4 Remove the centering piece from the push button unit.	
5 Remove the base cover.  xx1100000315	
6 Cut the straps that hold the oil draining hose fastened inside the robot base.	
7 Pull out the oil draining hose so that it reaches the oil collecting vessel.	

Continues on next page

	Action	Note
8	 CAUTION The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
9	Open the oil plug at the end of the hose and place the hose end at the oil collecting vessel to collect the oil.	
10	Open the oil plug for filling and use compressed air to accelerate the process. Maximum pressure allowed: 10 kPa.	See Location of oil plugs on page 128 .  Note Draining is time-consuming. Elapsed time varies depending on the temperature of the oil.
11	 WARNING Used oil is hazardous material and must be disposed of in a safe way. See section Decommissioning on page 301 for more information.	
12	 Note There will be some oil left in the gearbox after draining.	
13	Refit the <i>oil plugs</i> .	See Required equipment on page 129 . Tightening torque: 10 Nm
14	Fasten the oil draining hose inside the base with straps.	
15	Refit the base cover.	
16	Refit the centering piece to the push button unit.	
17	Refit the push button guard to the base.	

Continues on next page

3 Maintenance

3.4.2 Changing the oil, axis 1 gearbox

Continued

Filling oil, axis 1 gearbox

Use this procedure to fill the gearbox with oil. A suspended robot must be taken down and secured standing on the floor for oil change.

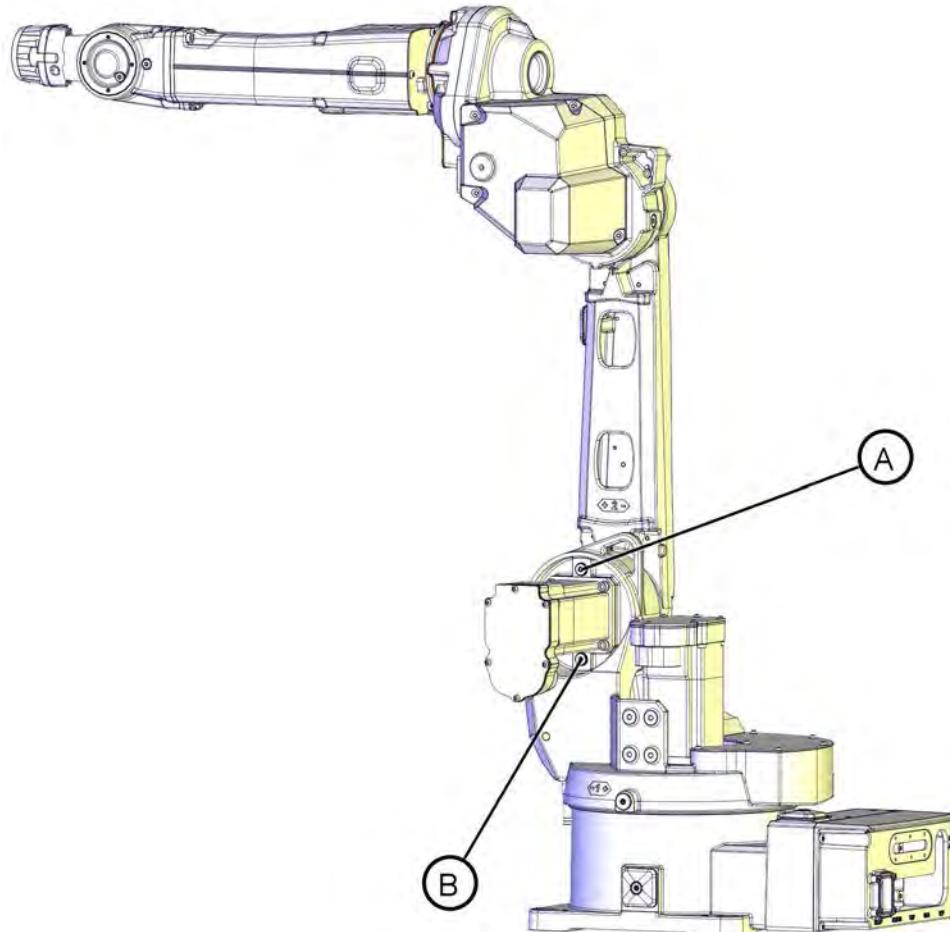
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
2	 WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	
3	 CAUTION The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
4	Open the <i>oil plug for filling</i> .	See Location of oil plugs on page 128 .
5	Refill the gearbox with <i>lubricating oil</i> .  Note The amount of oil to be filled depends on the amount previously being drained.	Where to find type of oil and total amount is detailed in Type and amount of oil in gearboxes on page 125 .
6	Inspect the oil level.	How to inspect the oil level is described in Inspecting the oil level, axis-1 gearbox on page 98 .
7	Refit the <i>oil plug</i> .	Tightening torque: 10 Nm.

3.4.3 Changing the oil, axis-2 gearbox

Location of oil plugs

The axis-2 gearbox is located in the lower arm rotational center, underneath the motor attachment.

Oil plugs are shown in the figure.



xx1100000340

A	Oil plug for filling (draining when sealing mounted)
B	Oil plug for draining (filling when sealing mounted) (Quick connect fitting)

Required equipment

Equipment	Note
Oil plug sealing washer, gearbox	3HAC029646-001
Lubricating oil	Information about the oil is found in <i>Technical reference manual - Lubrication in gearboxes</i> . See Type and amount of oil in gearboxes on page 125 .
Oil collecting vessel	The capacity of the vessel must be sufficient to take the complete amount of oil.

Continues on next page

3 Maintenance

3.4.3 Changing the oil, axis-2 gearbox

Continued

Equipment	Note
Nipple (TEMA IF 3820 S06)	To be fitted on a hose, and then used for draining connected to the <i>quick connect fitting</i> . See Location of oil plugs on page 133 .
Standard toolkit	Content is defined in section Standard tools on page 312 .

Draining, axis-2 gearbox

Use this procedure to drain the gearbox of oil.

	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
2	 WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	
3	 CAUTION The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
4	Either <ul style="list-style-type: none">• connect a nipple to the <i>quick connect fitting</i> in the hole for drainingor• remove the <i>quick connect fitting</i>.	See the figure in: <ul style="list-style-type: none">• Location of oil plugs on page 133
5	Open the <i>oil plug, filling</i> .	See the figure in: <ul style="list-style-type: none">• Location of oil plugs on page 133  Note Drainage will be quicker if the oil plug, filling is removed.

Continues on next page

Action	Note
6 Drain the gearbox oil using an <i>oil collecting vessel</i> .	 Note Draining is time-consuming. Elapsed time varies depending on the temperature of the oil.
7  WARNING Used oil is hazardous material and must be disposed of in a safe way. See section Decommissioning on page 301 for more information.	
8  Note There will be some oil left in the gearbox after draining.	
9 Refit <i>oil plug</i> .  Note Before refitting the oil plug in the gearbox, always replace the oil plug sealing washer with a new one. If not there is a risk of leakage.	Tightening torque: • 10 Nm

Filling oil, axis-2 gearbox

Use this procedure to fill the gearbox with oil.

Action	Note
1  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
2  WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	

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3 Maintenance

3.4.3 Changing the oil, axis-2 gearbox

Continued

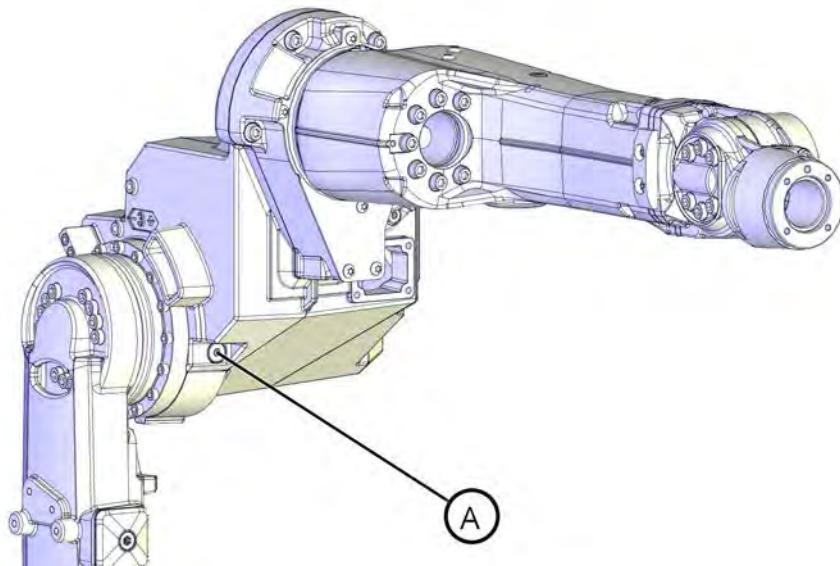
	Action	Note
3	 CAUTION The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
4	Open <i>oil plug, filling</i> .	See the figure in: • Location of oil plugs on page 133
5	Refill the gearbox with <i>lubrication oil</i> .  Note The amount of oil to be filled depends on the amount previously being drained.	Where to find type of oil and total amount is detailed in Type and amount of oil in gearboxes on page 125 .
6	Inspect the oil level.	How to inspect the oil level is described in section: • Inspecting the oil level, axis 2 gearbox on page 101
7	Refit <i>oil plug</i> .  Note Before refitting the oil plug in the gearbox, always replace the oil plug sealing washer with a new one. If not there is a risk of leakage.	Tightening torque: • 10 Nm

3.4.4 Changing the oil, axis-3 gearbox

Location of oil plugs

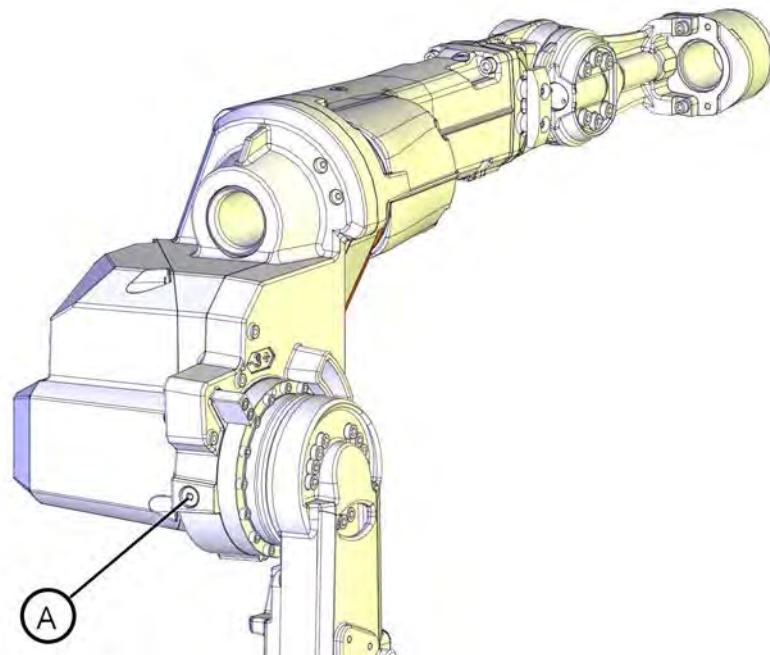
The axis-3 gearbox is located in the upper arm rotational center.

Oil plugs are shown in the figure.



xx1100000341

A	Oil plug, gearbox
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xx1100000342

A	Oil plug, armhouse
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3 Maintenance

3.4.4 Changing the oil, axis-3 gearbox

Continued

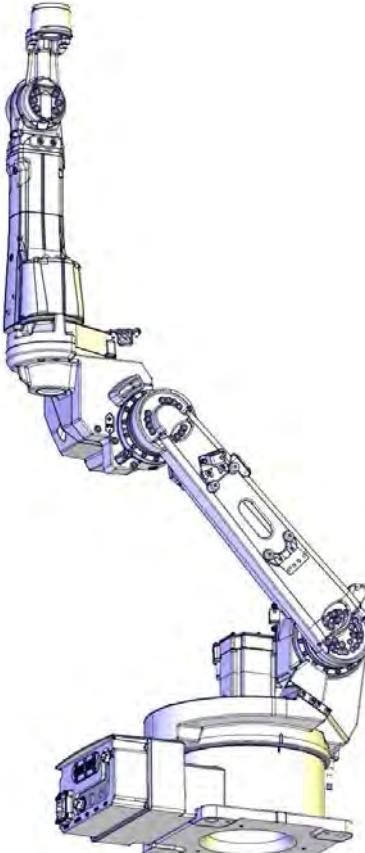
Required equipment

Equipment	Note
Lubricating oil	Information about the oil is found in <i>Technical reference manual - Lubrication in gearboxes</i> . See Type and amount of oil in gearboxes on page 125 .
Oil collecting vessel	The capacity of the vessel must be sufficient to take the complete amount of oil.
Oil dispenser	One example of oil dispenser can be found in section: <ul style="list-style-type: none">• Type of lubrication in gearboxes on page 125
Funnel	 xx1200000862
Standard toolkit	Content is defined in section Standard tools on page 312 .

Continues on next page

Draining, axis-3 gearbox

Use this procedure to drain the gearbox of oil.

Action	Note
1 Move the lower arm -45° and the upper arm -90° so that the oil plug in the armhouse is faced downwards.	 xx1100000487
2 <p> DANGER</p> <p>Turn off all:</p> <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply <p>to the robot, before entering the robot working area.</p>	
3 <p> WARNING</p> <p>Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52.</p>	

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3 Maintenance

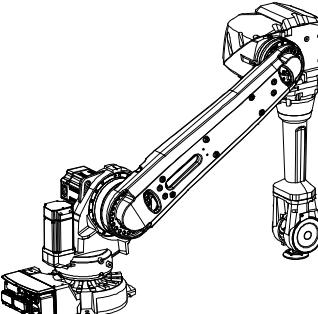
3.4.4 Changing the oil, axis-3 gearbox

Continued

Action	Note
4  CAUTION The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
5 Open the <i>oil plug, armhouse</i>	See the figure in: • Location of oil plugs on page 137
6	See the figure in: • Location of oil plugs on page 137
7 Drain the gearbox oil using an <i>oil collecting vessel</i> .	 Note Draining is time-consuming. Elapsed time varies depending on the temperature of the oil.
8  WARNING Used oil is hazardous material and must be disposed of in a proper way. See section <i>Decommissioning</i> for more information.	
9 Refit oil plugs.	Tightening torque: • in armhouse: 10 Nm • in gearbox: 3 Nm

Filling oil, axis-3 gearbox

Use this procedure to fill the gearbox with oil.

Action	Note
1 Move the upper arm to a position where the wrist is pointing towards the floor as shown in the figure.	 xx0800000329
2  DANGER Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Continues on next page

Action	Note
3  WARNING Handling gearbox oil involves several safety risks. Before proceeding, please read the safety information in the section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	
4  CAUTION The gearbox can contain an excess of pressure that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
5 Open the <i>oil plug, armhouse</i> .	See the figure in: <ul style="list-style-type: none"> Location of oil plugs on page 137
6 Refill the gearbox with <i>lubricating oil</i> .  Tip Use a funnel.  Note The amount of oil to be filled depends on the amount previously being drained.	Where to find type of oil and total amount is detailed in Type and amount of oil in gearboxes on page 125 .
7 Inspect the <i>oil level</i> .	How to inspect oil is described in section: <ul style="list-style-type: none"> Inspecting the oil level, axis 3 gearbox on page 103
8 Refit the <i>oil plug</i> .	Tightening torque: <ul style="list-style-type: none"> in armhouse: 10 Nm in gearbox: 3 Nm

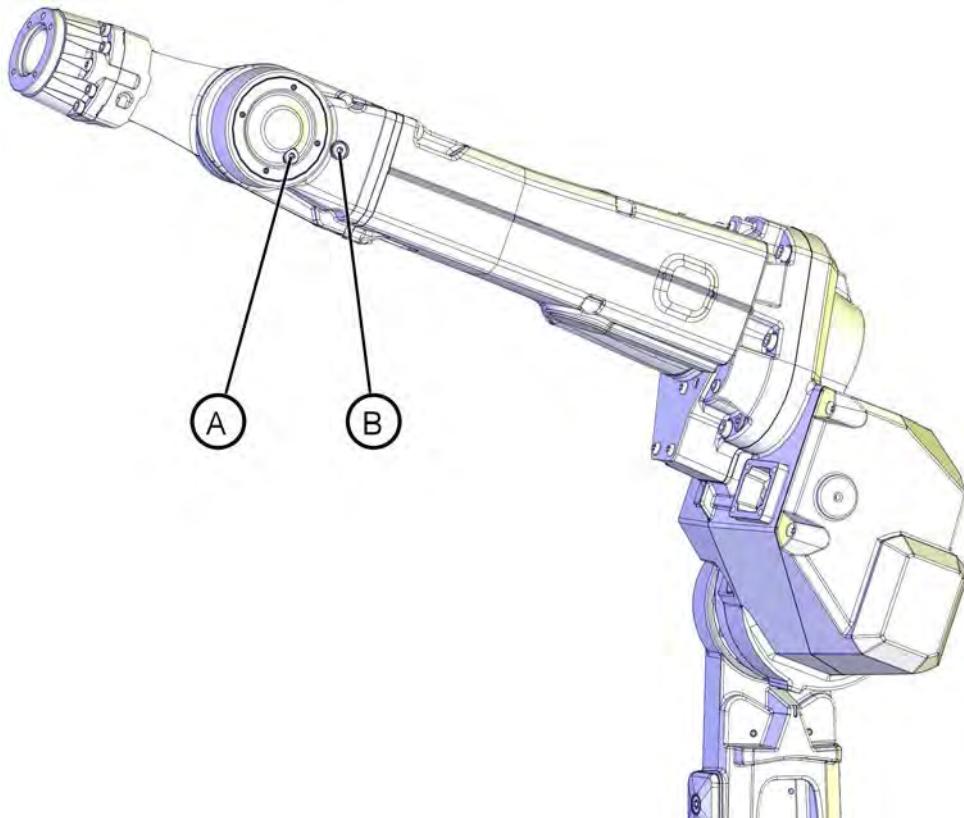
3 Maintenance

3.4.5 Changing the oil in axes 5 and 6 gearboxes, ID

3.4.5 Changing the oil in axes 5 and 6 gearboxes, ID

Location of oil plugs, axis 5-6 gearbox

The oil plugs for the axis 5-6 gearbox are located in the wrist unit as shown in the figure below.



xx1100000343

A	Oil plug, draining and filling
B	Ventilation plug

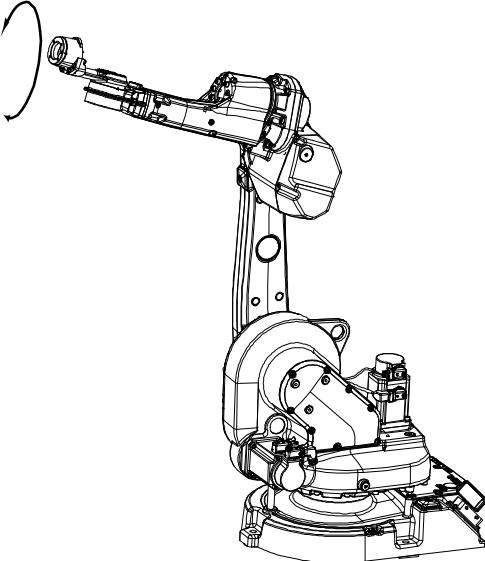
Required equipment

Equipment	Note
Lubricating oil	Information about the oil is found in <i>Technical reference manual - Lubrication in gearboxes</i> . See Type and amount of oil in gearboxes on page 125 .
Oil collecting vessel	The capacity of the vessel must be sufficient to take the complete amount of oil.
Standard toolkit	Content is defined in section Standard tools on page 312 .
Other tools and procedures may be required.	See references to these procedures in the step-by-step instructions below.

Continues on next page

Draining, axis 5-6 gearbox

Use this procedure to drain the axis 5-6 gearbox.

	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
2	 WARNING Handling gearbox oil involves several safety risks. Before proceeding, please observe the safety information in section WARNING - Safety risks during work with gearbox lubricants (oil or grease) on page 52 .	
3	Position the robot as shown in the figure to the right: <ul style="list-style-type: none"> • upper arm: upwards for a standing robot. • axis 4: - 90°, to a position where the oil plug (A) is faced downwards.  Note The total amount of oil will not be drained. There will remain approximately 20 ml in the wrist unit.	The capacity of the vessel must be sufficient to take the complete amount of oil. The figure shows IRB 1600 but the upper arm position is the same for the IRB 1520.  xx0700000033
4	 CAUTION The gearbox can contain an <i>excess of pressure</i> that can be hazardous. Open the oil plug carefully in order to let out the excess pressure.	
5	Remove the oil plug (A) and the ventilation plug (B).	Shown in figure Location of oil plugs, axis 5-6 gearbox on page 142 .

Continues on next page

3 Maintenance

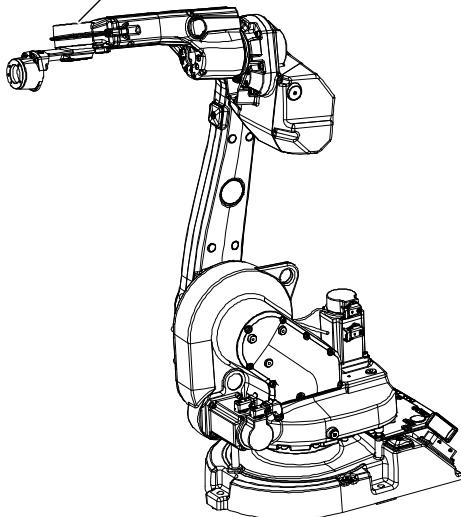
3.4.5 Changing the oil in axes 5 and 6 gearboxes, ID

Continued

	Action	Note
6	Drain the wrist of oil.	About 100 ml
7	Refit the oil plugs.	Tightening torque: 4-6 Nm.

Filling oil, axis 5-6 gearbox

Use this procedure to fill the axis 5-6 gearbox with oil.

	Action	Note
1	Position the robot as shown in the figure to the right: <ul style="list-style-type: none">axis 4: + 90°, to a position where the oil plug (A) is faced upwards.	The figure shows IRB 1600 but the upper arm position is the same for the IRB 1520.  xx0700000034 A Oil plugs
2	Fill new oil in the wrist. Check the oil level to make sure the filled amount of oil is correct.	Where to find type of oil and total amount is detailed in Type and amount of oil in gearboxes on page 125 . See Inspecting the oil level, axis 5-6 gearbox on page 110 .
3	Refit the oil plug and the ventilation plug.	Tightening torque: 4-6 Nm.

3.4.6 Replacing the battery pack



Note

The battery low alert (38213 **Battery charge low**) is displayed when the battery needs to be replaced. The recommendation to avoid an unsynchronized robot is to keep the power to the controller turned on until the battery is to be replaced. For an SMB board with 3-pole battery contact (RMU101 3HAC044168-001 or RMU102 3HAC043904-001), the lifetime of a new battery is typically 36 months. For an SMB board with 2-pole battery contact, the 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 for longer production breaks with a battery shutdown service routine. See *Operating manual - IRC5 with FlexPendant* for instructions.



WARNING

See instructions for batteries, [WARNING - Safety risks during handling of batteries on page 51](#).

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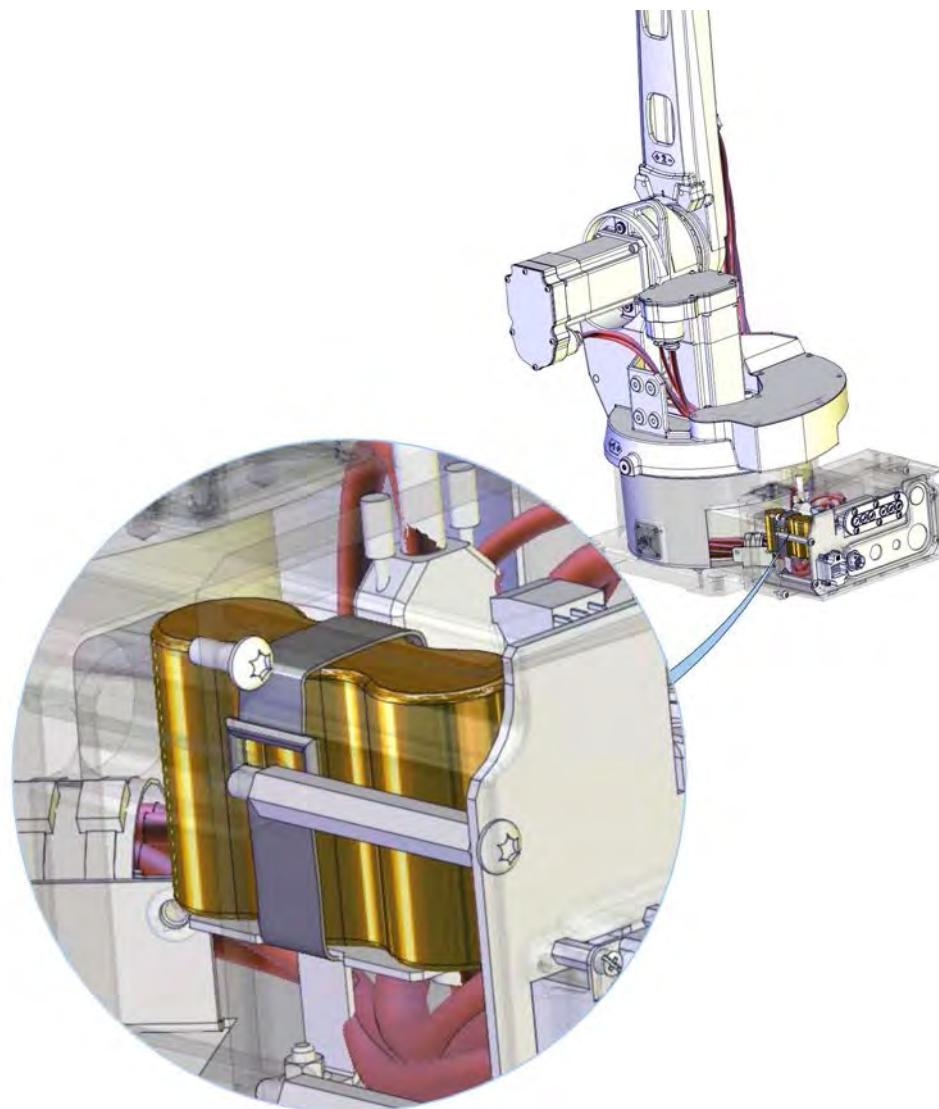
3 Maintenance

3.4.6 Replacing the battery pack

Continued

Location of battery pack

The battery pack for the measurement system is located inside the base of the robot, as shown in the figure below.



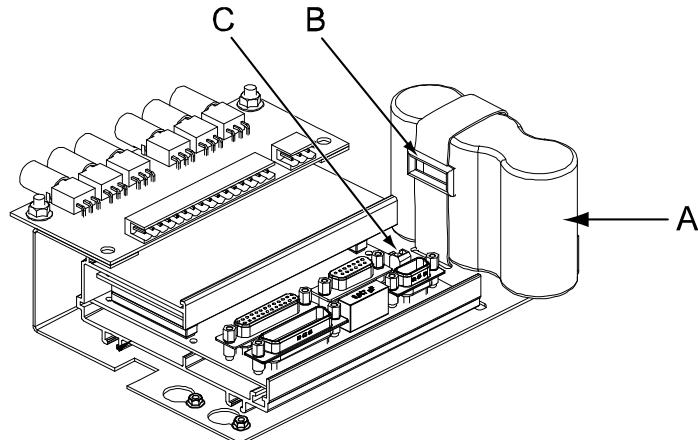
xx1100000319

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Battery pack on serial measurement unit

The battery pack is attached to the serial measurement unit as shown in the figure below.

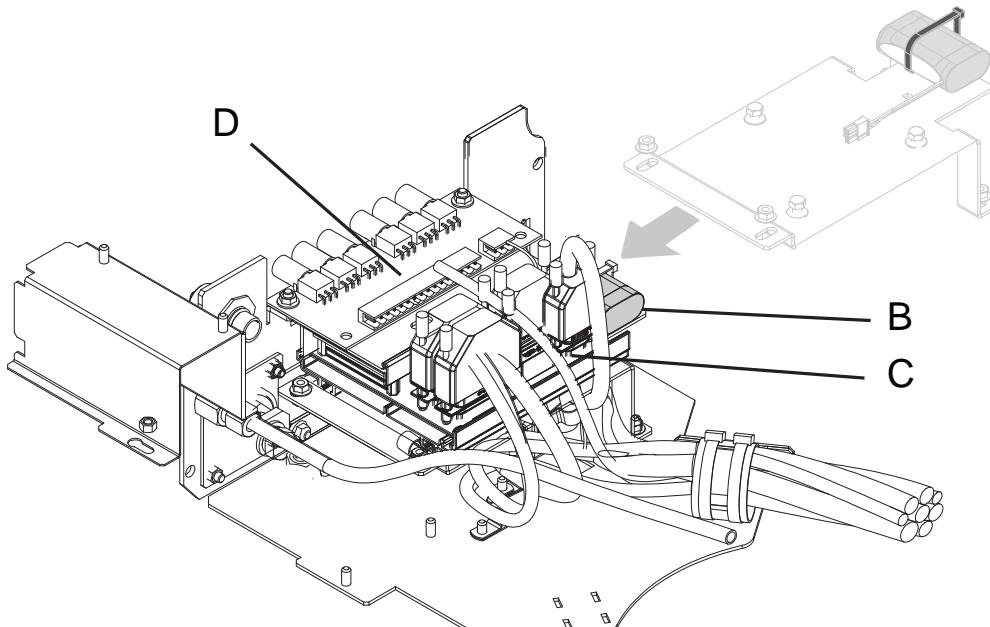
DSQC 633A



xx0500001393

A	Battery pack battery (2-pole battery contact)
B	Velcro strap
C	Connector X3

RMU 101



xx1300000330

B	Battery pack (3-pole battery contact)
C	Serial measurement board RMU 101
D	BU unit

Continues on next page

3 Maintenance

3.4.6 Replacing the battery pack

Continued

Required equipment



Note

There are two variants of SMB units and batteries. One with 2-pole battery contact and one with 3-pole battery contact. The variant with the 3-pole battery contact has longer lifetime for the battery.

It is important that the SMB unit uses the correct battery. Make sure to order the correct spare parts. Do not replace the battery contact!

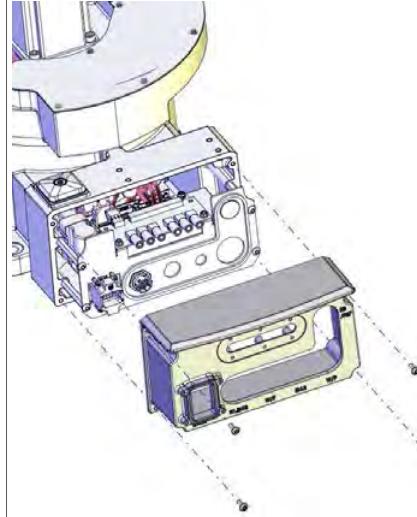
Equipment	Spare part no.	Note
Serial measurement board	See Spare parts on page 315 .	
Battery pack	See Spare parts on page 315 .	
Standard toolkit	-	Content is defined in section Standard tools on page 312 .
Circuit diagram	-	See chapter Circuit diagram on page 317 .

Replacement, battery pack

The procedure below details how to replace the battery pack.

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

Continues on next page

Action	Note
2 Remove the <i>base cover</i> from the robot by unscrewing its attachment screws.	 xx1100000315
3 Disconnect the battery from the serial measurement unit.	
4 Valid for battery pack with 2-pole battery contact: Open the velcro strap and remove the battery pack.	
5 Valid for battery pack with 3-pole battery contact. Cut the cable strap and remove the battery pack.	
6 Fit the new <i>battery pack</i> and connect it to the serial measurement unit (X3).	See Battery pack on serial measurement unit on page 147 .
7 Valid for battery pack with 2-pole battery contact: Close the velcro strap around the battery pack.	
8 Valid for battery pack with 3-pole battery contact. Secure the battery with a cable strap.	
9 Refit the <i>base cover</i> to the robot.	See Location of battery pack on page 146 .
10 Update the revolution counters.	Detailed in section Updating revolution counters on page 296 .

3 Maintenance

3.5.1 Cleaning the IRB 1520



WARNING

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

General

To secure high uptime it is important that the IRB 1520 is cleaned regularly. The frequency of cleaning depends on the environment in which the manipulator works. Different cleaning methods are allowed depending on the type of protection of the IRB 1520.



Note

Always verify the protection type of the robot before cleaning.

Oil spills

Oil spills from gearboxes

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

- 1 Inspect that the oil level in the suspected gearbox is according to the recommendations, see [Inspection activities on page 98](#).
- 2 Write down the oil level.
- 3 Inspect the oil level again after, for example, 6 months.
- 4 If the oil level is decreased then replace the gearbox.

Oil spills discolors painted surfaces

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



Note

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

Dos and don'ts!

This section specifies some special considerations when cleaning the robot.

Always!

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

Continues on next page

Never!

- Never use compressed air to clean the robot!
- Never use solvents that are not approved by ABB to clean the robot!
- Never remove any covers or other protective devices before cleaning the robot!

Cleaning methods

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

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

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.

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4 Repair

4.1 Introduction

Structure of this chapter

This chapter describes all repair activities recommended for the IRB 1520 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 1520.

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 305](#).

Safety information

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



Note

If the IRB 1520 is connected to power, always make sure that the IRB 1520 is connected to *earth* before starting any repair work.

For more information see:

- *Product manual - IRC5*

4 Repair

4.2.1 Performing a leak-down test

4.2 General procedures

4.2.1 Performing a leak-down test

When to perform a leak-down test

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

Required equipment

Equipment, etc.	Article number	Note
Leak-down tester	3HAC0207-1	
Leak detection spray	-	

Performing a leak-down test

Action	Note
1 Finish the refitting procedure of the motor or gear in question.	
2 Remove the topmost oil plug on the gear in question and replace it with the <i>leak-down tester</i> . Regulators, which are included in the leak-down test, may be required.	Art. no. is specified in Required equipment on page 154 .
3 Use caution, apply compressed air and raise the pressure with the knob until the correct value is shown on the manometer.  CAUTION The pressure must under no circumstance be higher than 0.25 bar (20 - 25 kPa). Also during the time when the pressure is raised!	Correct value: 0.2 - 0.25 bar (20 - 25 kPa)
4 Disconnect the compressed air supply.	
5 Wait for approximately 8-10 minutes and make sure that no pressure loss occurs.	If the compressed air is significantly colder or warmer than the gearbox to be tested, a slight pressure increase or decrease may occur. This is quite normal.
6 If any pressure drop occurred, then localize the leak as described in step 7. If no pressure drop occurred, then remove the leak-down tester and refit the oil plug. The test is complete.	
7 Spray any suspected leak areas with the <i>leak detection spray</i> . Bubbles indicate a leak.	
8 When the leak has been localized, take the necessary measures to correct the leak.	

4.2.2 Mounting instructions for bearings

General

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

Equipment

Equipment, etc.	Art. no.	Note
Grease	3HAB3537-1	Used to grease the bearings, if not specified otherwise.

Assembly of all bearings

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

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

Assembly of tapered bearings

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

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

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

Greasing of bearings

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

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

Continues on next page

4 Repair

4.2.2 Mounting instructions for bearings

Continued

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

Grease the different types of bearings as following description:

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

4.2.3 Mounting instructions for seals

General

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

Equipment

Equipment, etc.	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 157 .
4	Mount the seal correctly with a mounting tool. Never hammer directly on the seal as this may result in leakage.	

Continues on next page

4 Repair

4.2.3 Mounting instructions for seals

Continued

Flange seals and static seals

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

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

O-rings

The following procedure describes how to fit o-rings.

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

4.3 Complete manipulator

4.3.1 Replacing the cable harness - lower end

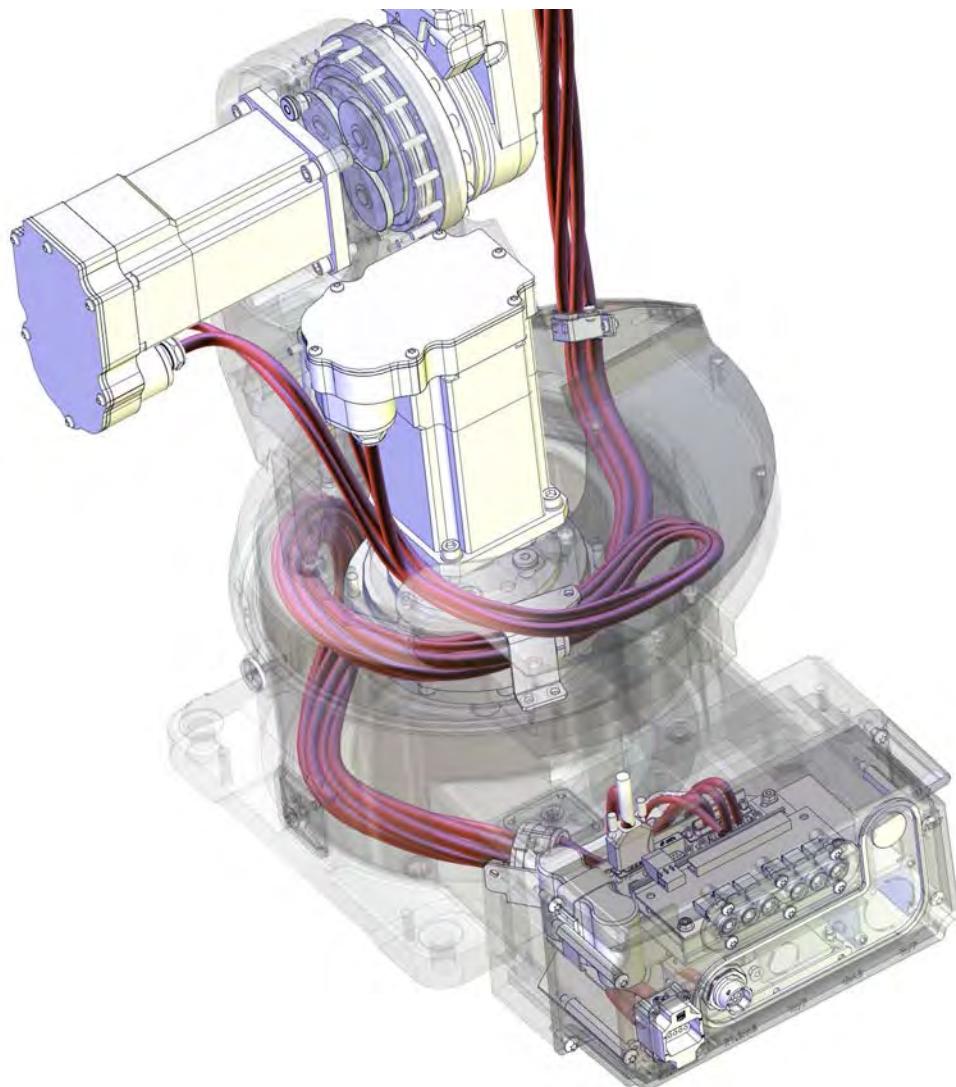
Introduction

This section describes how to replace the lower end of the cable harness.

How to replace the cable harness in the upper end is described in section [Replacing the cable harness - upper end on page 179](#).

Location of cable harness - lower end

The lower end of the cable harness is located as shown in the figure.



xx1100000313

Continues on next page

4 Repair

4.3.1 Replacing the cable harness - lower end

Continued

Required equipment

Equipment	Art. no.	Note
Cable harness	See <i>Spare parts on page 315</i> .	
Standard toolkit		Content is defined in section <i>Standard tools on page 312</i> .
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.

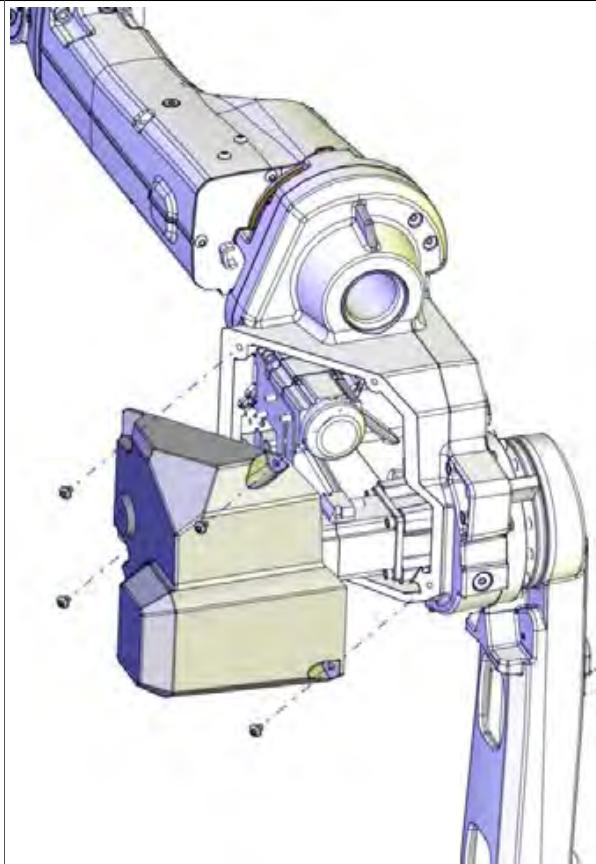
Removing the cable harness - lower end

Use this procedure to remove the lower end of the cable harness.

	Action	Note
1	Jog the robot to the calibration position.	
2	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

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4.3.1 Replacing the cable harness - lower end
Continued

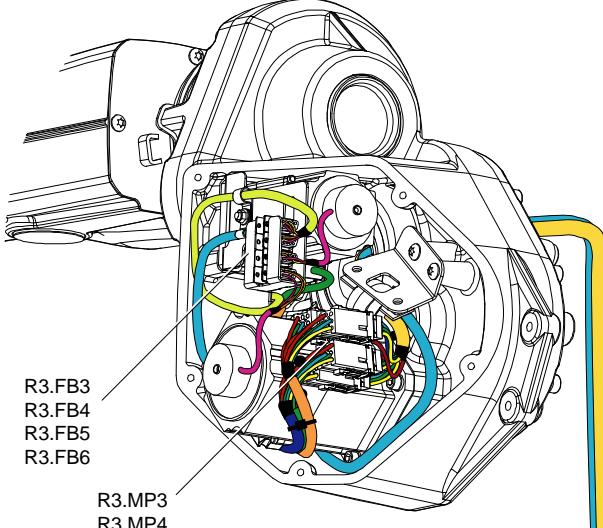
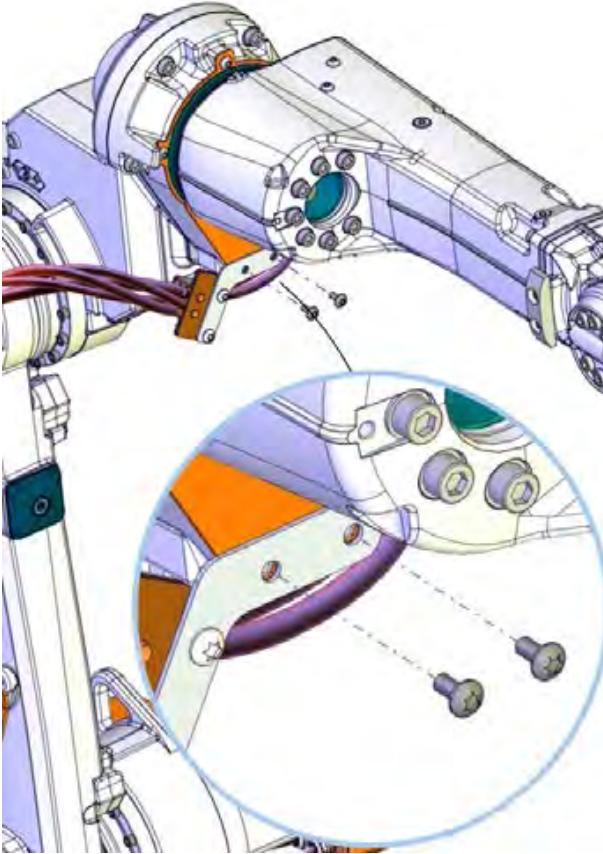
Action	Note
3 Remove the armhouse cover.	 xx1100000349
4 Disconnect all connectors inside the armhouse.  Note Make a note of how the cables are run on the bracket.	

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4 Repair

4.3.1 Replacing the cable harness - lower end

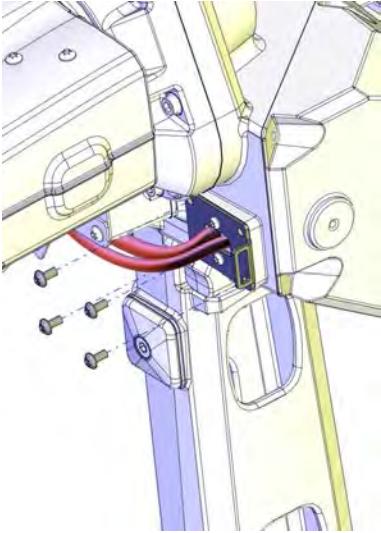
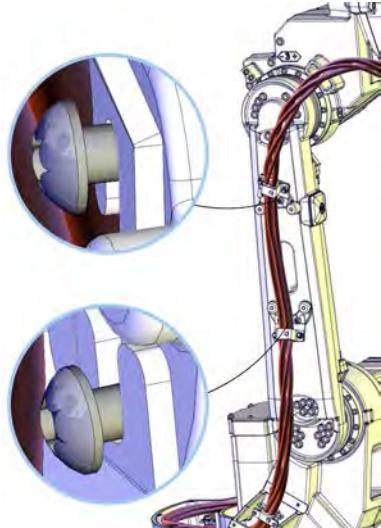
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Action	Note
5 Remove the straps and brackets that holds the cable harness in the arm-house.	 <p>xx0700000105</p>
6 Unscrew the attachment screws (2 pcs) that holds the bracket of the cable harness to the upper arm.	 <p>xx1100000327</p>

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4.3.1 Replacing the cable harness - lower end

Continued

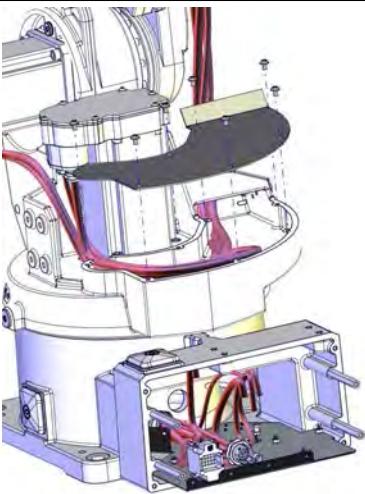
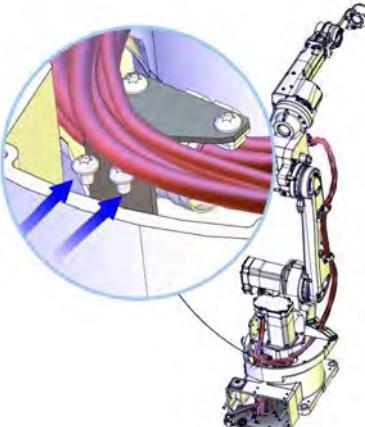
Action	Note
7 Unscrew the attachment screws (4 pcs) of the bracket that holds the cable harness to the armhouse.	 xx1100000328
8 Unscrew the attachment screws (2 + 2 pcs) that holds the cable harness to the lower arm just enough to be able to slide the brackets of the cable harness off the screws.	 xx1100000326

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4 Repair

4.3.1 Replacing the cable harness - lower end

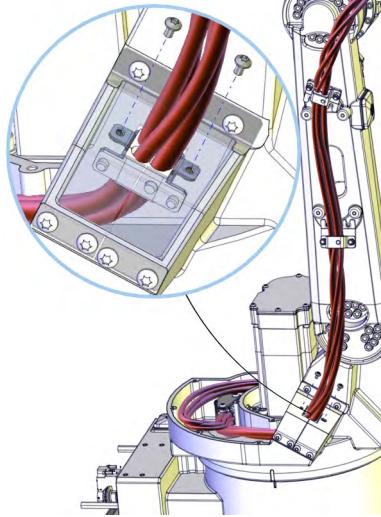
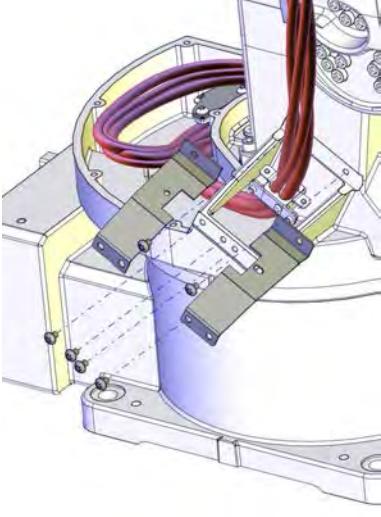
Continued

Action	Note
9 Unscrew the attachment screws that holds the frame cover in order to reach the cable harness below.	 xx1100000322
10 Unscrew the attachment screws (2 pcs) of the bracket that holds the cable harness inside the frame.	 xx1100000323

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4.3.1 Replacing the cable harness - lower end

Continued

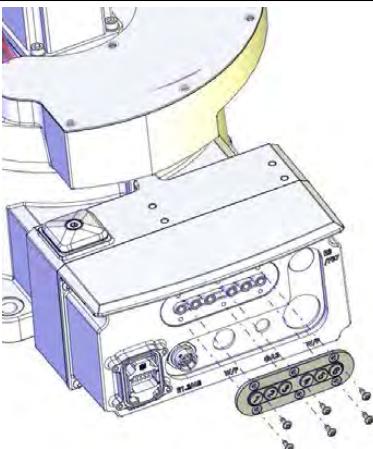
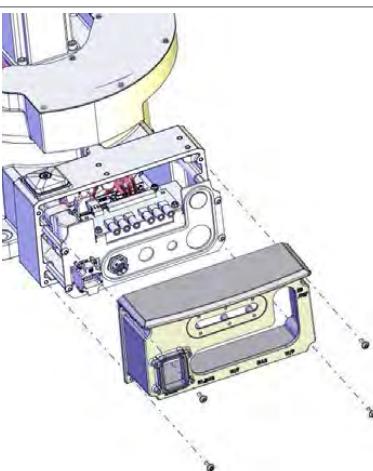
Action	Note
11 Unscrew the attachment screws (2 pcs) that holds the bracket of the cable harness to the two covers. The bracket is under the covers.	 xx1100000324
12 Remove the two covers by unscrewing its attachment screws.	 xx1100000325
13 Remove the covers of the axes 1 and 2 motors and disconnect all connectors - R2.MP1, R2.FB1, R2.MP2 and R2.FB2,	See Replacing motors on axis 1 and 2 on page 246 .

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4 Repair

4.3.1 Replacing the cable harness - lower end

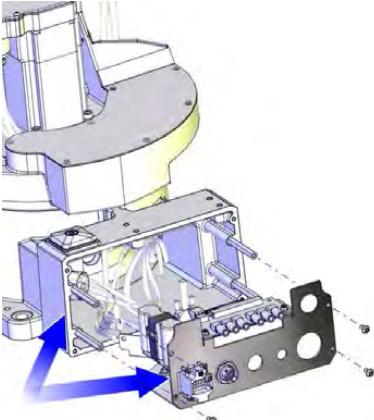
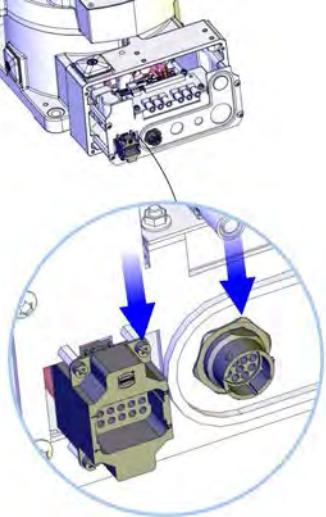
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Action	Note
14 Remove the push button guard and centering piece. This is done in order to be able to refit the push buttons correctly later.	 xx1100000314
15 Remove the base cover.	 xx1100000315

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4.3.1 Replacing the cable harness - lower end

Continued

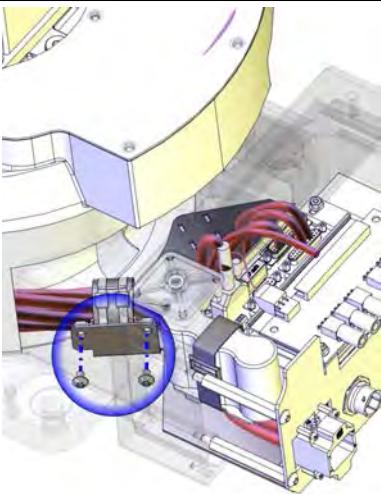
Action	Note
16 Unscrew the attachment screws that holds the plate for connector and pull it out carefully approximately 150 mm.	 xx1100000316
17 Disconnect all connectors to the SMB and push button units.	See Replacing the serial measurement unit on page 232 . See Replacing the push button unit on page 240 .
18 Unscrew the two connectors on the plate for connector.	 xx1100000317

Continues on next page

4 Repair

4.3.1 Replacing the cable harness - lower end

Continued

Action	Note
19 Unscrew the attachment screws for the bracket inside the base that holds the cable harness to the fastening plate.	 xx1100000321
20 Unscrew the earth cable on the fastening plate.	
21 Unscrew all cable clamps that holds the cable harness to the fastening plate.	
22 Remove the cable harness carefully from the frame into the base and pull it out at the rear of the base.	

Refitting the cable harness - lower end

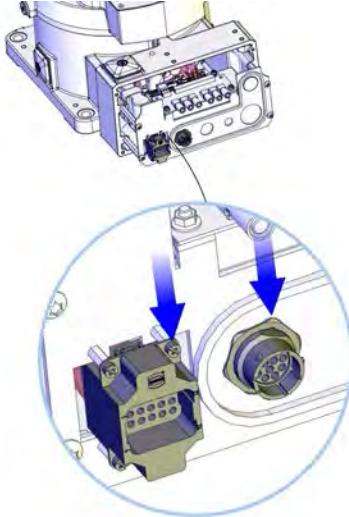
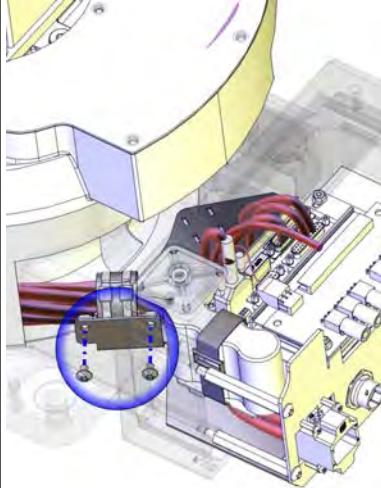
Use this procedure to refit the lower end of the cable harness.

Action	Note
1 Apply cable grease on the plastic parts inside base and frame, if needed.	
2 Connect the earth cable to the fastening plate.	
3 Reconnect all connectors to SMB and push button units.	See Replacing the serial measurement unit on page 232 . See Replacing the push button unit on page 240 .

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4.3.1 Replacing the cable harness - lower end

Continued

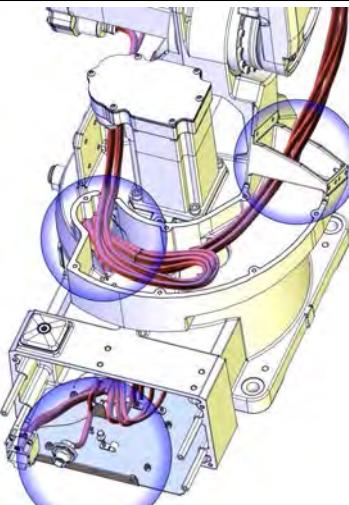
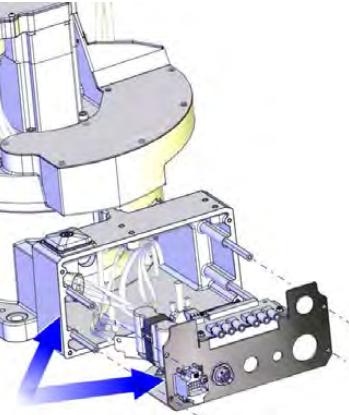
Action	Note
4 Fit the two connectors on the plate for connector.	 <p>xx1100000317</p>
5 Secure the bracket of the cable harness to the fastening plate in the base with its attachment screws (2 + 2 pcs).	 <p>xx1100000321</p>
6 Refit all cable clamps and straps securing the cable harness to the fastening plate.	

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4 Repair

4.3.1 Replacing the cable harness - lower end

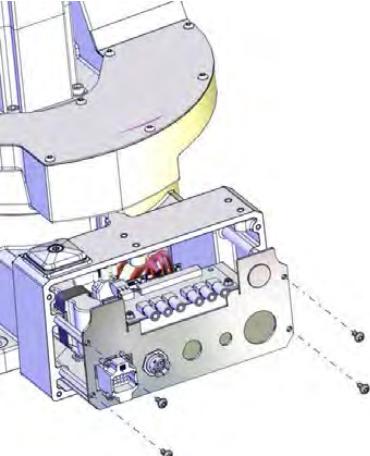
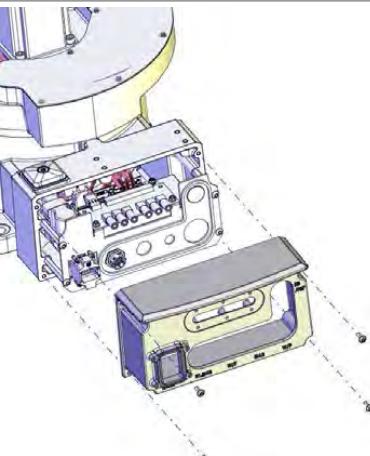
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Action	Note
7 Run the cable harness carefully into the base and frame, up through the holes in the frame and to the lower arm.	 xx1100000331
8 Push very carefully in the plate for connector and fastening plate in to the base. Check that the cable harness is placed correctly.  CAUTION Be careful not to damage the cable harness in the process. The space is cramp.	 xx1100000316

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4.3.1 Replacing the cable harness - lower end

Continued

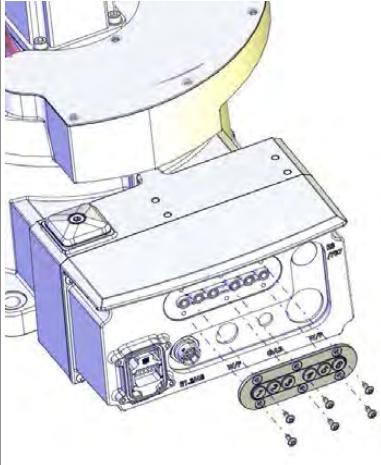
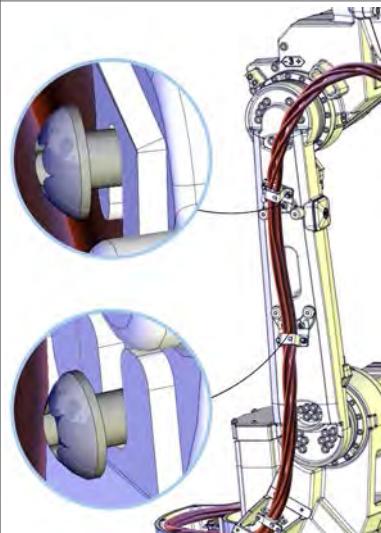
	Action	Note
9	Secure the plate for connector with its attachment screws (4 pcs).	 xx1100000329
10	Refit the base cover.	 xx1100000315

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4 Repair

4.3.1 Replacing the cable harness - lower end

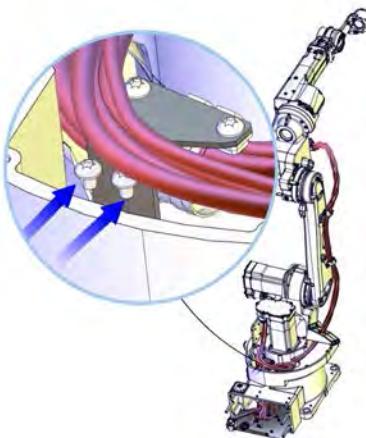
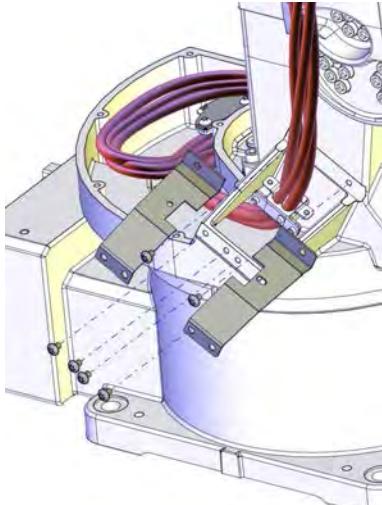
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Action	Note
11 Refit the push button guard.	 xx1100000314
12 Place the brackets of the cable harness on the attachment screws (2 + 2 pcs) in the lower arm and secure the cable harness.	 xx1100000326

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4.3.1 Replacing the cable harness - lower end

Continued

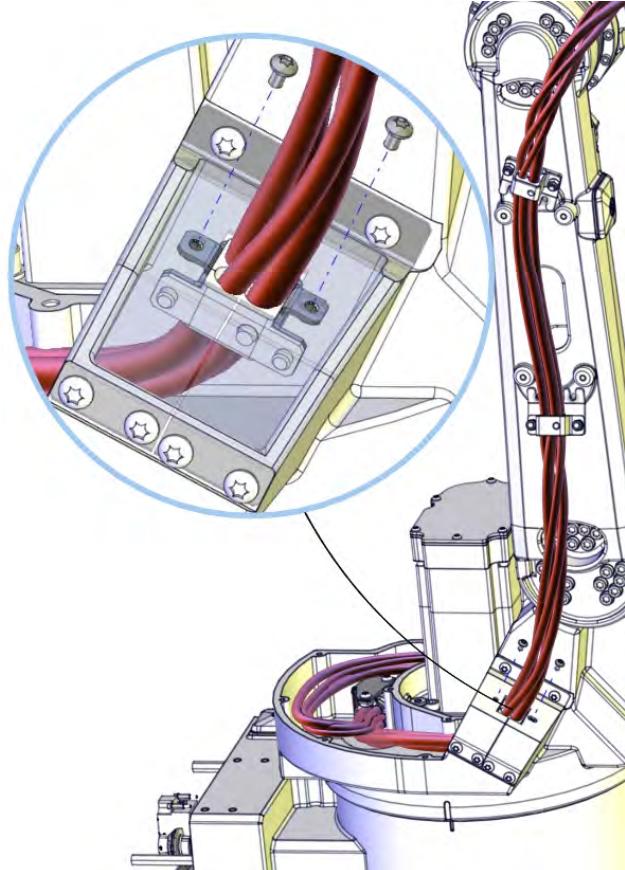
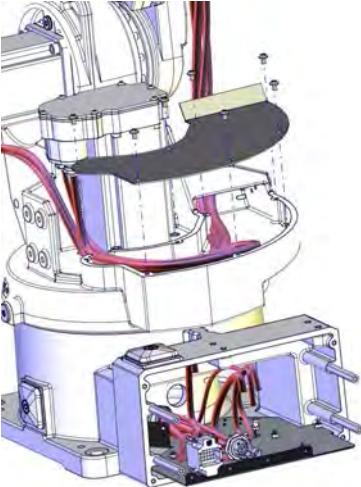
Action	Note
13 Secure the cable harness with the bracket inside the frame with its attachment screws (2 + 2 pcs).	 xx1100000323
14 Fit one of the two covers with its attachment screws.	 xx1100000325
15 Attach the bracket of the cable harness with one screw. Do not secure the screw at this point. It must be possible to match the hole for the other screw.	
16 Fit the other of the two covers with its attachment screws.	

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4 Repair

4.3.1 Replacing the cable harness - lower end

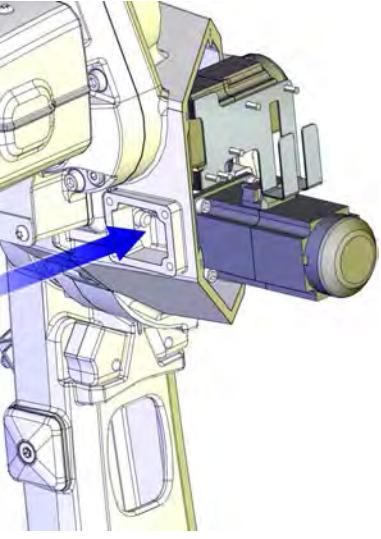
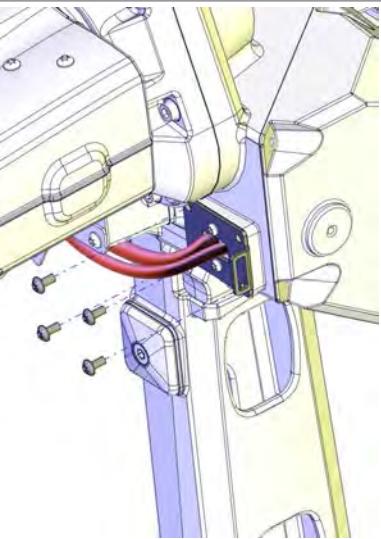
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Action	Note
17 Secure the bracket of the cable harness to the two covers with its attachment screws.	 xx1100000324
18 Check that the cable harness is placed correctly in the base and frame.	See figure Location of cable harness - lower end on page 159 .
19 Fit the cover on the frame.	 xx1100000322

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4.3.1 Replacing the cable harness - lower end

Continued

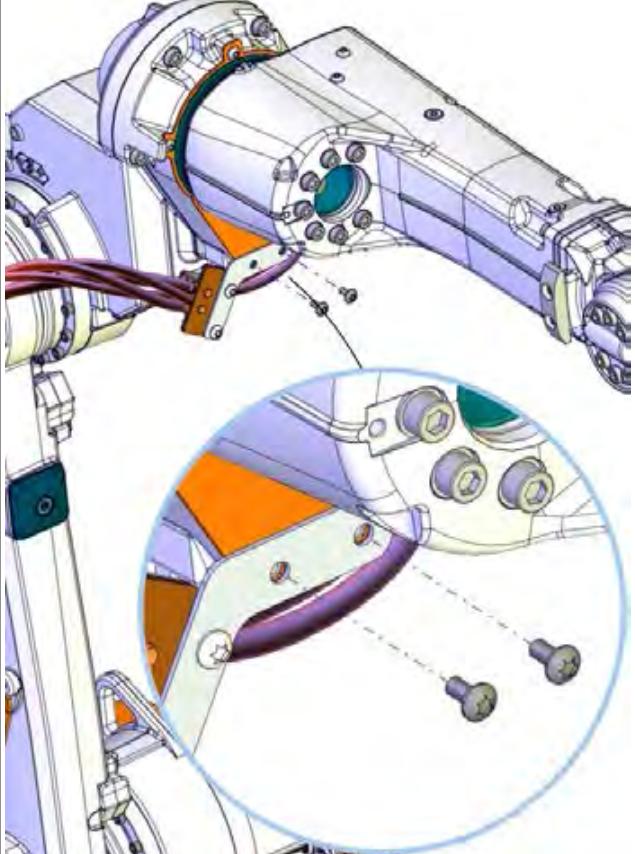
	Action	Note
20	Insert the cable harness carefully through the hole in the armhouse.	 xx1100000330
21	Secure the cable harness to the armhouse by fitting the bracket with its attachment screws (4 pcs).	 xx1100000328

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4 Repair

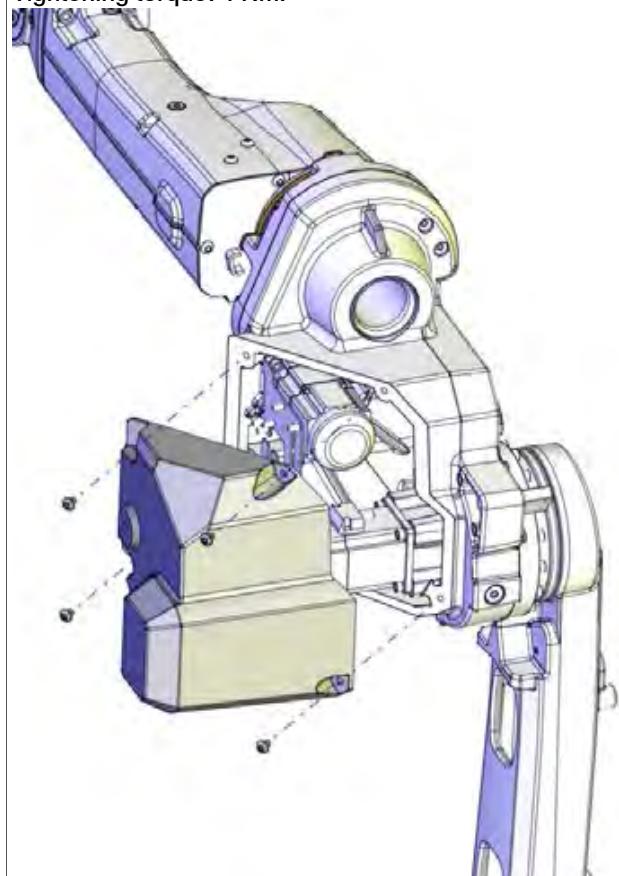
4.3.1 Replacing the cable harness - lower end

Continued

Action	Note
22 Secure the cable harness to the bracket in the upper arm with its attachment screws (2 pcs).	 xx1100000327
23 Reconnect the connectors to motors axes 3 and 4.	See on page ? .

Continues on next page

4.3.1 Replacing the cable harness - lower end
Continued

	Action	Note
24	Refit the armhouse cover.	<p>Tightening torque: 4 Nm.</p>  <p>xx1100000349</p>
25	Reconnect the connectors to the motors for axis 1 and 2.	See Replacing motors on axis 1 and 2 on page 246 .
26	 WARNING <p>Before continuing any service work, please observe the safety information in section WARNING - The brake release buttons may be jammed after service work on page 48!</p>	
27	Recalibrate the robot.	<p>Calibration is described in a separate calibration manual enclosed with the calibration tools.</p> <p>General calibration information is included in section Calibration information on page 291.</p>

Continues on next page

4 Repair

4.3.1 Replacing the cable harness - lower end

Continued

Action	Note
28  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in section DANGER - First test run may cause injury or damage! on page 47.	

4.3.2 Replacing the cable harness - upper end

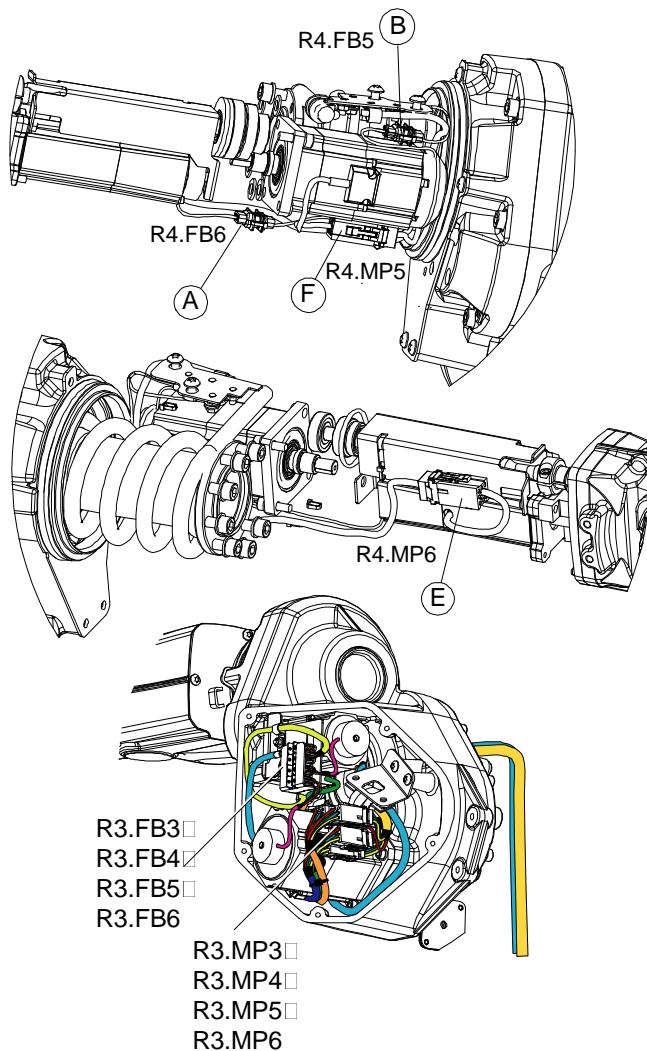
Introduction

How to remove the cable harness in the lower end see section [Replacing the cable harness - lower end on page 159](#).

This section describes how to replace the upper end of the cable harness.

Location of cable harness - upper end

The upper end of the cable harness is located inside the armhouse and arm tube, as shown in the figure. The figure shows the IRB 1600ID but is also applicable to IRB 1520.



xx0700000038

Required equipment

Equipment	Art. no.	Note
Cable harness	See Spare parts on page 315 .	

Continues on next page

4 Repair

4.3.2 Replacing the cable harness - upper end

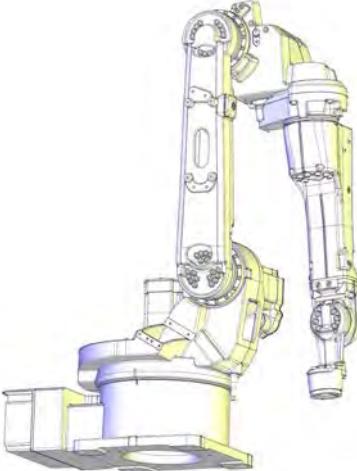
Continued

Equipment	Art. no.	Note
Standard toolkit	-	Content is defined in section Standard tools on page 312 .
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 cable harness - upper end

Use these procedures to remove the upper end of the cable harness.

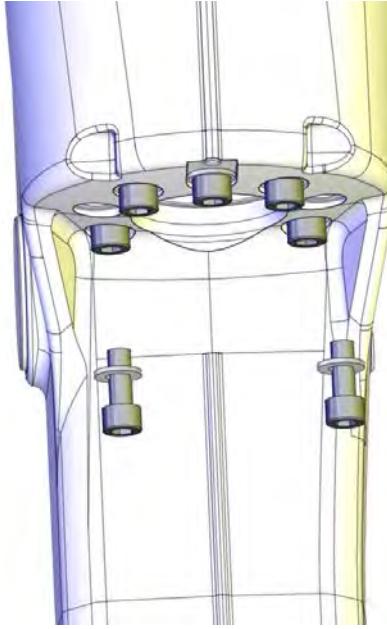
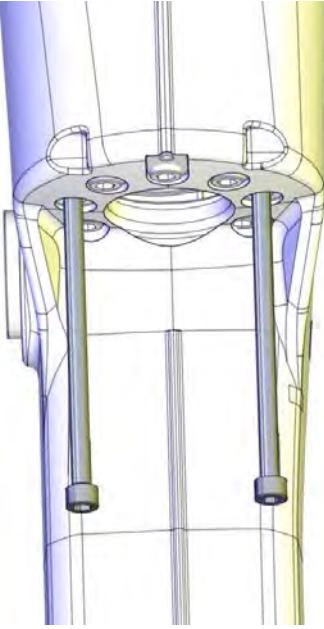
Preparations

Action	Note
1 Jog the upper arm to a vertical position with the wrist pointing at the floor.	 xx1100000439
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
3 Remove all extra equipment fitted on the upper arm and wrist.	

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4.3.2 Replacing the cable harness - upper end

Continued

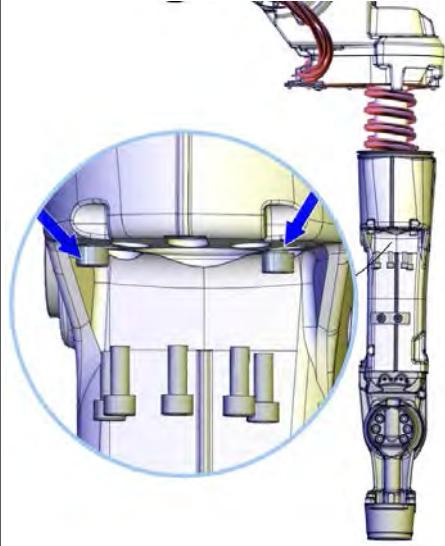
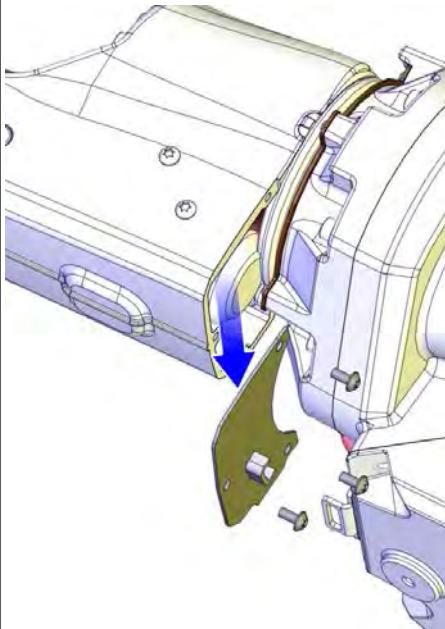
Action	Note
4 Unscrew two of the attachment screws holding the arm tube, diagonal to each other.	 xx1100000472
5 Fit two threaded bars (M8) with nuts fitted at the bottom end. Length: 120 mm	 xx1100000473

Continues on next page

4 Repair

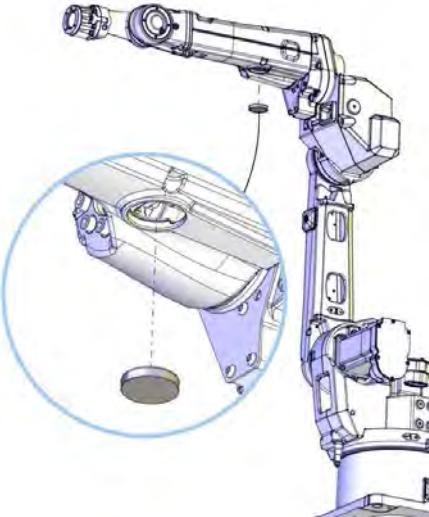
4.3.2 Replacing the cable harness - upper end

Continued

Action	Note
6 Unscrew and remove the remaining attachment screws and let the arm tube carefully glide down on the threaded bars until it rests on the nuts.	 xx1100000474
7 Unscrew the attachment screws (3 pcs) holding the cover with mechanical stop and remove the cover.	 xx1100000411

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Removing motor cables and arm tube

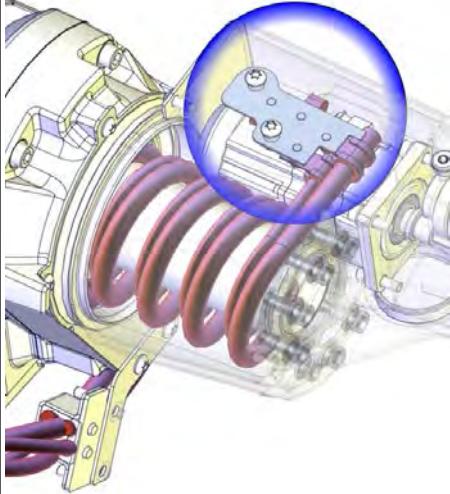
Action	Note
1 Remove the VK cover on the arm tube.	 xx1100000394
2 Disconnect the connectors of the axis 6 motor through the hole for the VK cover.  Note <i>It is not needed to remove the motor.</i>	
3 Disconnect the connectors of the axis 5 motor.  Note <i>It is not needed to remove the motors.</i>	
4 Carefully pull out the cables of the axes 5 and 6 motors from the arm tube.	
5 Remove the support ring and V-ring from the arm tube and place them temporarily on the cable harness spiral.	

Continues on next page

4 Repair

4.3.2 Replacing the cable harness - upper end

Continued

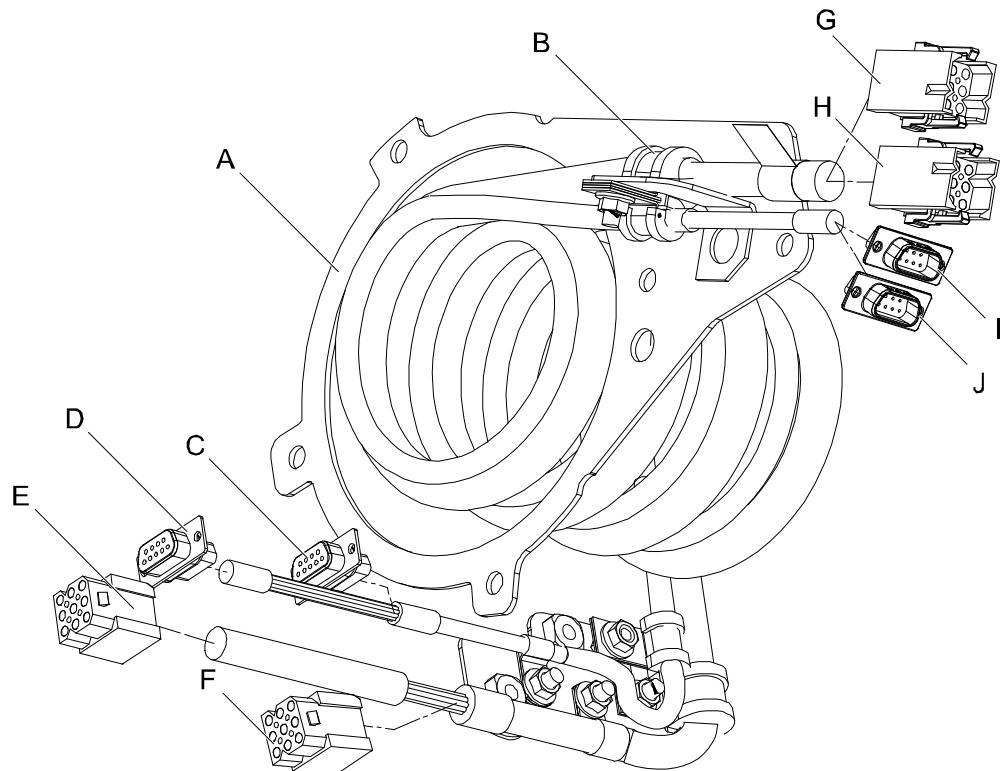
Action	Note
6 Unscrew the attachment screws (2 pcs) on top of the arm tube, that holds the bracket which secures the cable harness inside the arm tube.	 xx1100000410
7 Carefully lift the cable harness out off the arm tube.	
8 Hold the arm tube and unscrew the two threaded bars (M8).	
9 Carefully lower the arm tube without causing any damage to the cable harness and put it somewhere safe.	
10 Remove the support ring and V-ring.	

Continues on next page

4.3.2 Replacing the cable harness - upper end
Continued

Removing the cable harness spiral

The cable harness spiral is shown in the figure:



xx0700000099

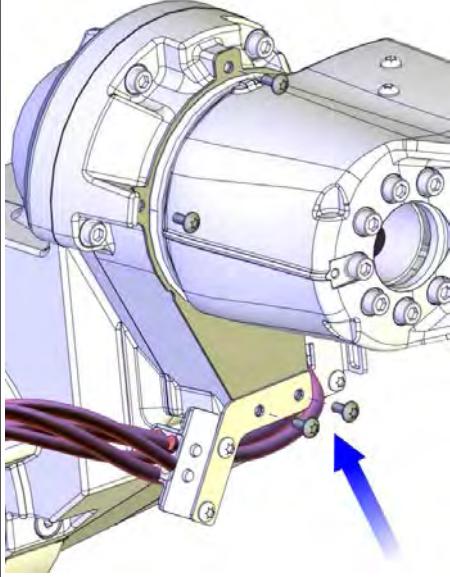
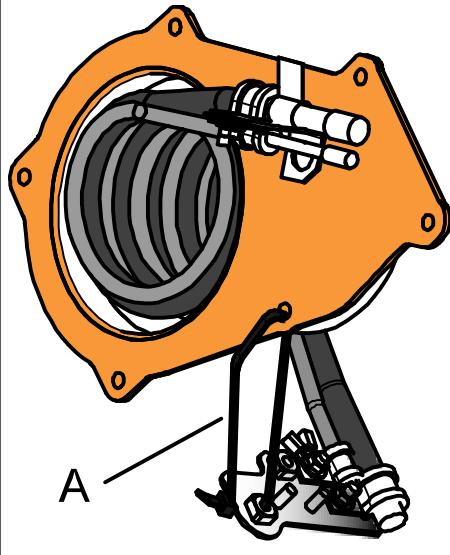
A	Cover plate
B	Clamp
C	R4.FB5
D	R4.FB6
E	R4.MP6
F	R4.MP5
G	R3.MP5
H	R3.MP6
I	R3.FB5
J	R3.FB6

Continues on next page

4 Repair

4.3.2 Replacing the cable harness - upper end

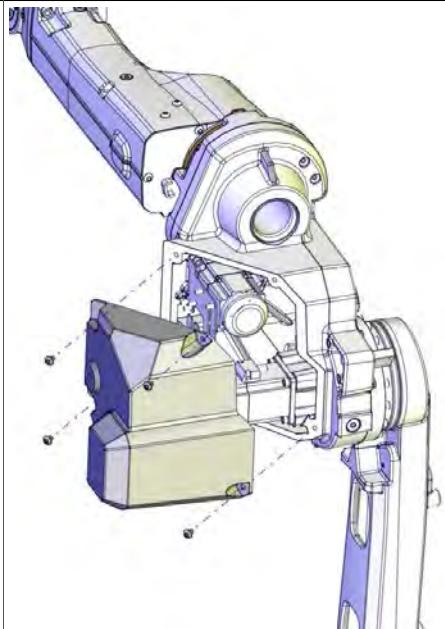
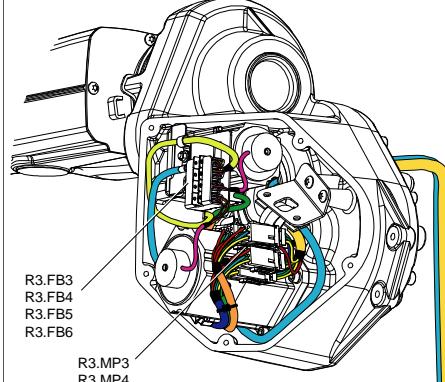
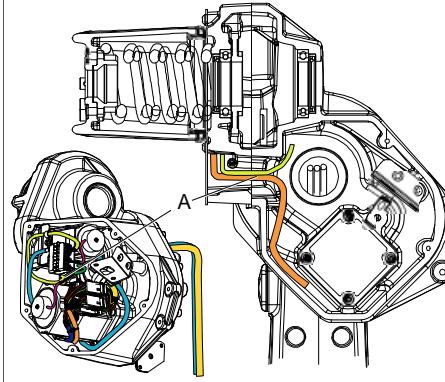
Continued

Action	Note
<p>1 Remove the attachment screws (6 pcs) that holds the cover of the cable harness spiral on the armhouse.</p> <p> Note</p> <p>The lower attachment screws (2 pcs) also holds the bracket of the cable harness</p>	 xx1100000420
<p>2 Secure the spiral of the cable harness with a cable strap or similar as shown in the figure, in order to keep the spiral in position.</p>	 xx1000001004 A: Cable strap

Continues on next page

4.3.2 Replacing the cable harness - upper end

Continued

Action	Note
3 Remove the cover on the armhouse.	 xx1100000349
4 Disconnect the connectors in the armhouse that need to be disconnected in order to remove the cable harness in the upper arm.  Note Make a note of how the cables are run on the bracket.	 R3.FB3 R3.FB4 R3.FB5 R3.FB6 R3.MP3 R3.MP4 R3.MP5 R3.MP6 xx0700000105
5 Wrap the connectors with some plastic film and tape in order to protect them from contamination.	
6 Pull the cable harness carefully out off the armhouse.	 xx0700000114

Continues on next page

4 Repair

4.3.2 Replacing the cable harness - upper end

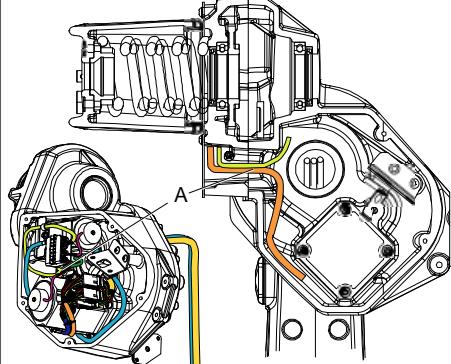
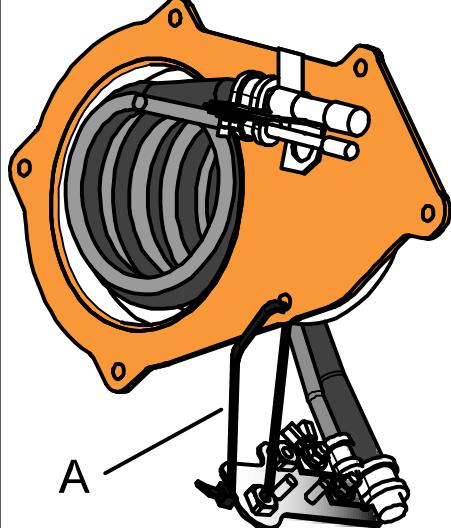
Continued

Action	Note
7 Remove the cable harness carefully.	

Refitting the cable harness - upper end

Use these procedures to refit the upper end of the cable harness.

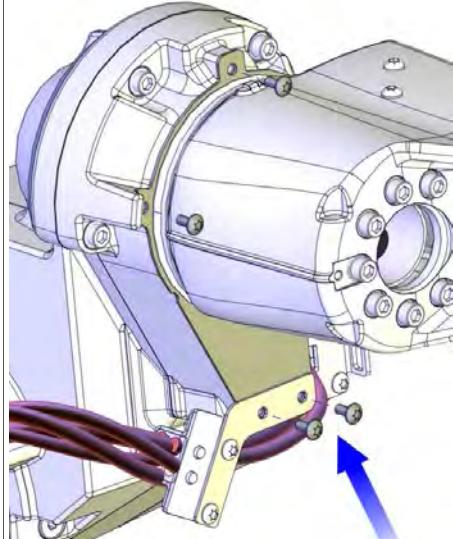
Preparations

Action	Note
1 Wipe clean the area behind the cover inside the armhouse, from old residues of grease.	
2 Wrap the connectors with some plastic film and tape, in order to protect them from contamination.	
3 Run the cable harness into the armhouse through the passage (A).	 xx0700000114
4 Apply cable grease on the cables inside the armhouse.	
5 Place the cover and the cable harness spiral into its position.  Note Do <i>not</i> remove the cable strap at this point!	 xx1000001004 A: Cable strap

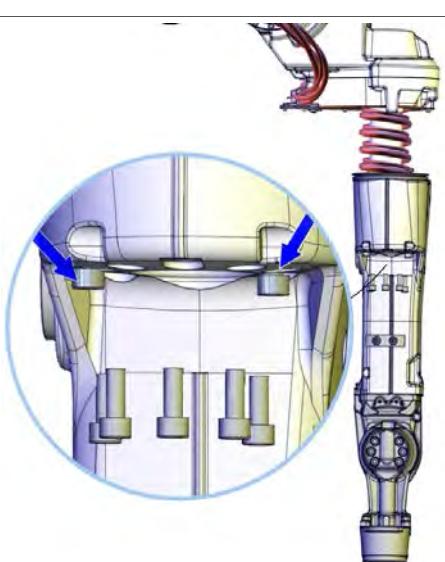
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4.3.2 Replacing the cable harness - upper end

Continued

Action	Note
<p>6 Refit the cover with its attachment screws except the one where the cable strap is fitted.</p> <p>Note</p> <p>The two lower attachment screws also holds the bracket securing the cable harness to the armhouse. Refit the bracket at the same time.</p>	 <p>xx1100000420</p>

Refitting the cable harness spiral - part 1

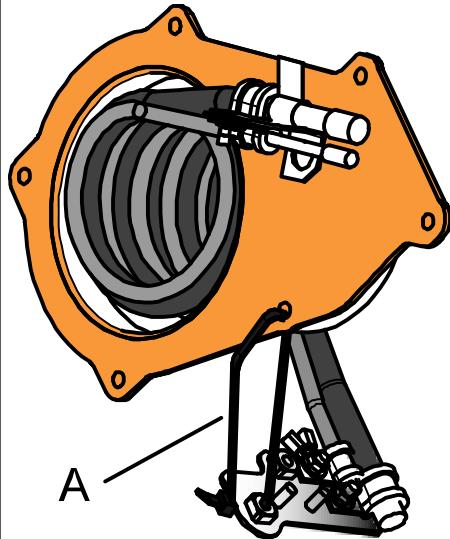
Action	Note
1 Place the support ring and V-ring temporarily on the cable harness spiral.	
2 Fit two threaded bars (M8) in two of the attachment holes diagonal to each other.	
3 Lift the arm tube on to the threaded bars and fit the nuts at the end of the bars.	
4 Lower the arm tube carefully and let it rest on the nuts.	 <p>xx1100000474</p>

Continues on next page

4 Repair

4.3.2 Replacing the cable harness - upper end

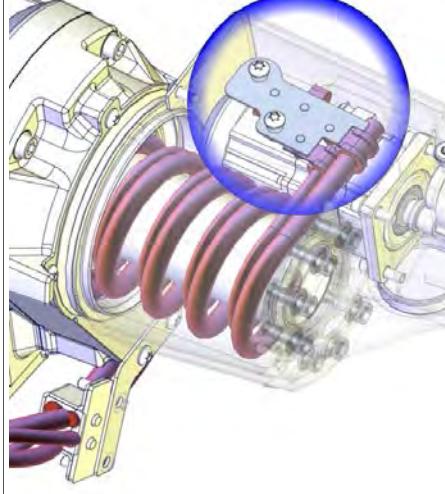
Continued

Action	Note
<p>5</p> <p>! CAUTION</p> <p>When the spiral of the cable harness is arranged check that:</p> <ul style="list-style-type: none"> • none of the cables are twisted • the two cables running in the spiral runs parallel to each other all the way • the cables are not arranged too tight or too loose. 	
<p>6</p> <p>Hold the cable harness spiral with one hand and cut the cable strap.</p> <p>! CAUTION</p> <p>When the cable strap is cut, the spiral of the cable harness can unwind and the cables can start to cross each other.</p>	 <ul style="list-style-type: none"> • A: Cable strap
<p>7</p> <p>Wind the cable harness spiral carefully in a tight fitting and then release it 3/4 of a revolution.</p> <p>i Note</p> <p>Check that the cable harness spiral is fitted correctly. The two cables must not cross each other!</p>	

Continues on next page

4.3.2 Replacing the cable harness - upper end

Continued

Action	Note
8 Without causing the cable harness spiral to unwind, fit the bracket holding the cable harness to the arm tube.	 xx1100000410

Refitting the cable harness spiral - part 2

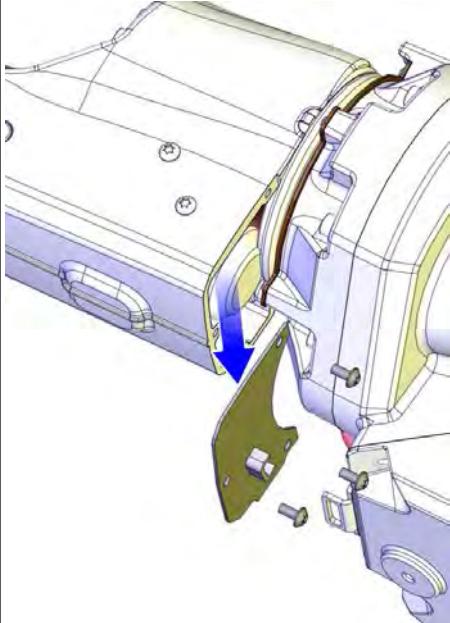
Action	Note
1 Run the cable harness to the axes 5 and 6 motors down into the arm tube.	
2 Pull out the motor cables to the axis 6 motor through the hole for the VK-cover.	
3 Reconnect the connectors to the axis 5 motor.	
4 Reconnect the connectors to the axis 6 motor.	
5 Secure the FB connectors on the axes 5 and 6 motors with cable straps.	 Note When reconnecting the connectors R4.FB6 and R4.MP6, make sure to push the connectors towards the wrist as far away from the axis 5-6 cable spiral as possible, to avoid grease to accumulate on the resolver connector.

Continues on next page

4 Repair

4.3.2 Replacing the cable harness - upper end

Continued

Action	Note
6 Refit the cover with the mechanical stop.	 xx1100000411
7 Refit the support ring and V-ring in the arm tube.	
8 Check that the cable harness spiral still is correctly fitted. If not, refit the spiral.	
9 Apply cable grease on the cable harness spiral.	
10 Fit the remaining attachment screw where the cable strap earlier was fitted.	

Refitting the arm tube

Action	Note
1 Lift the arm tube carefully while at the same time check that the position of the cable harness is correct.	
2 Check that the sealing ring and V-ring are in the correct position in the arm tube.	
3 Secure the arm tube with the attachment screws possible to fit at this point.	Tightening torque: 24 Nm.
4 In order to release the brakes for axis 4 see Manually releasing the brakes on page 73 .	

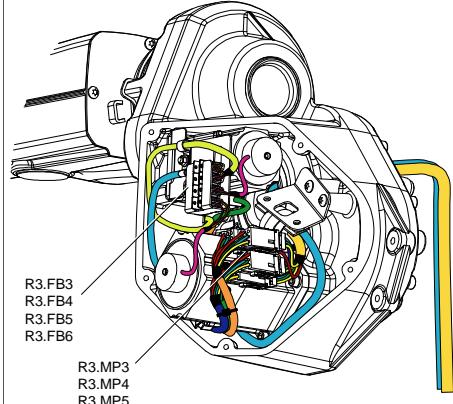
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4.3.2 Replacing the cable harness - upper end

Continued

Action	Note
<p>5 Move axis 4 manually very gently to each end position and check that the cable harness can move correctly without being stretched too much.</p> <p>! CAUTION</p> <p>Too much force when turning axis 4 can result in damage to the cable harness!</p> <p>i Note</p> <p>It is very important to check that the cable harness spiral is not stretched to much! If stretched too much there is a risk of damage to the cable harness!</p>	
<p>6 i Note</p> <p>If axis 4 is not running correctly the spiral of the cable harness must be refitted!</p>	

Concluding refitting

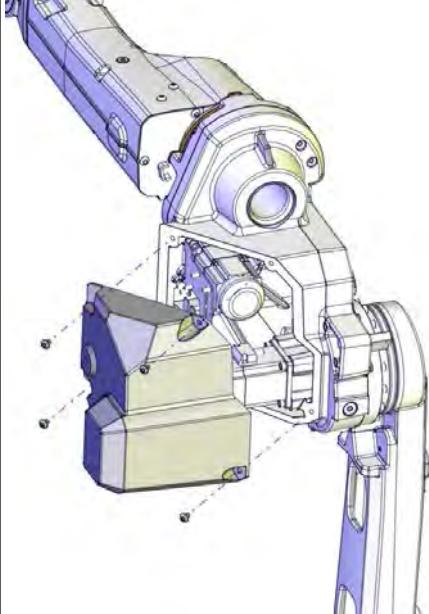
Action	Note
1 Reconnect the connectors in the armhouse.	 <p>R3.FB3 R3.FB4 R3.FB5 R3.FB6 R3.MP3 R3.MP4 R3.MP5 R3.MP6 xx0700000105</p>

Continues on next page

4 Repair

4.3.2 Replacing the cable harness - upper end

Continued

Action	Note
2 Refit the armhouse cover.	Tightening torque: 4 Nm.  xx1100000349
3 Recalibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section Calibration information on page 291 .
4  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in section DANGER - First test run may cause injury or damage! on page 47 .	

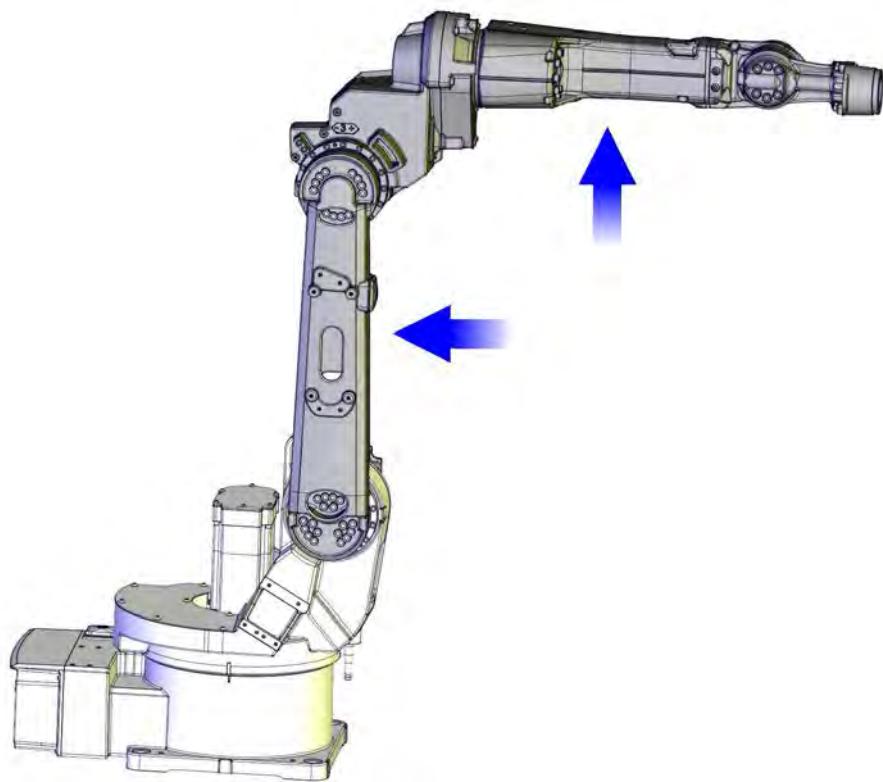
4.3.3 Replacing the complete arm system

Introduction

The complete arm system consists of the complete upper and lower arms.

Location of the complete arm system

The complete armsystem is located as shown in the figure.



xx1100000438

Required equipment

Equipment	Art. no.	Note
Standard toolkit	-	Content is defined in section Standard tools on page 312 .

Continues on next page

4 Repair

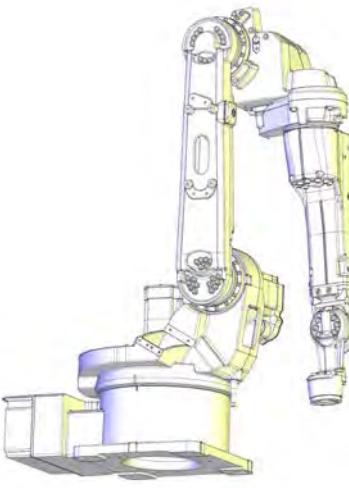
4.3.3 Replacing the complete arm system

Continued

Equipment	Art. no.	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.

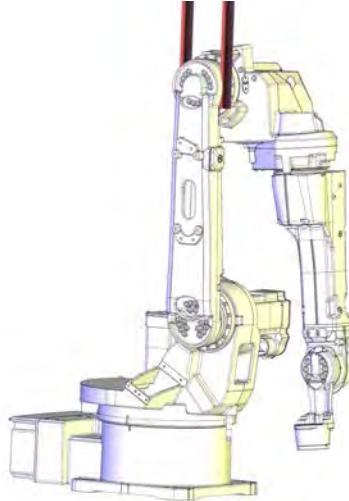
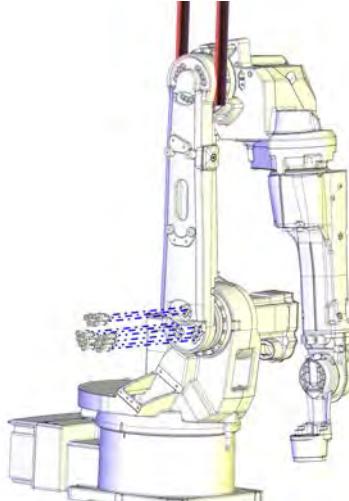
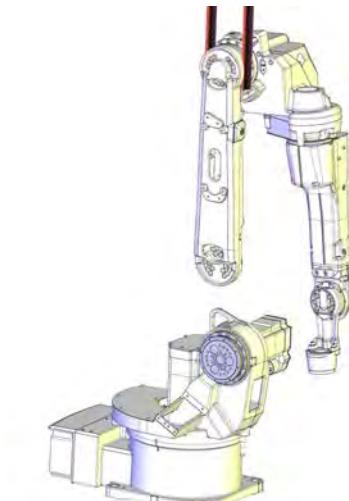
Removing the complete arm system

Use this procedure to remove the complete arm system.

Action	Note
1 Jog the robot to a vertical position as shown in the figure. The upper arm shall be placed with the wrist pointing at the floor.	 xx1100000439
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
3 Remove the cable harness from armhouse and lower arm.	See Replacing the cable harness - lower end on page 159 .
4  CAUTION The robot arm system weighs 55 kg. All lifting accessories used must be sized accordingly!	

Continues on next page

4.3.3 Replacing the complete arm system
Continued

Action	Note
5 Secure the weight of the complete arm system with a roundsling in an overhead crane or similar as shown in the figure.	 xx1100000442
6 Unscrew the attachment screws (18 pcs) and washers holding the lower arm to gearbox axis 2.	 xx1100000440
7 Carefully lift away the complete arm system and put it somewhere safe.	 xx1100000441

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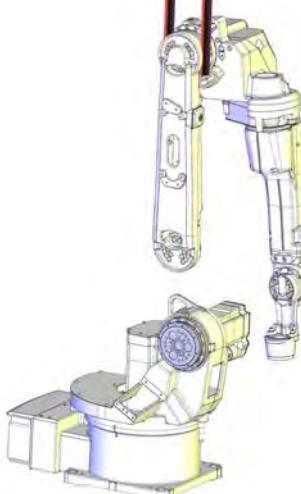
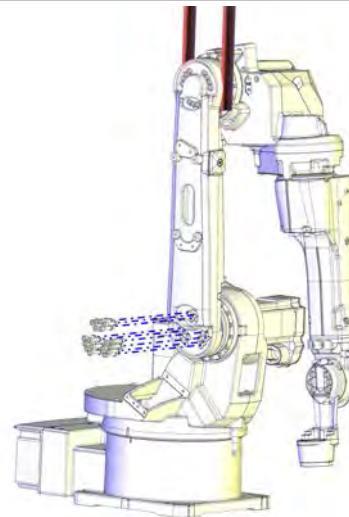
4 Repair

4.3.3 Replacing the complete arm system

Continued

Refitting the complete arm system

Use this procedure to refit the complete arm system.

Action	Note
1 Wipe clean all mating surfaces on lower arm and frame with isopropanol.	
2  CAUTION The robot arm system weighs 55 kg. All lifting accessories used must be sized accordingly!	
3 Secure the weight of the complete arm system with a roundsling in an overhead crane or similar as shown in the figure.	 xx1100000441
4 Secure the complete arm system to the gearbox axis 2 with its attachment screws and washers.	 xx1100000440 Tightening torque: 34 Nm. M8x40 (18 pcs)
5 Refit the cable harness in the lower arm and armhouse.	See Replacing the cable harness - lower end on page 159 .

Continues on next page

4.3.3 Replacing the complete arm system

Continued

	Action	Note
6	Recalibrate the robot.	Calibration is detailed in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section <i>Calibration information on page 291</i> .
7	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in section <i>DANGER - First test run may cause injury or damage! on page 47</i> .	

4 Repair

4.4.1 Replacing the complete upper arm ID

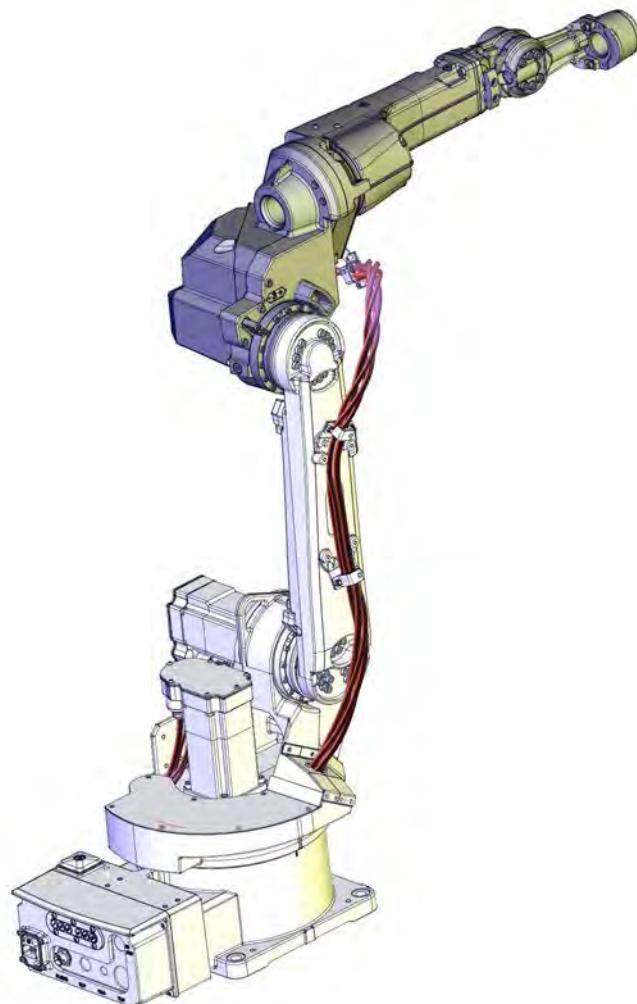


Note

Recalibration of robot axis 3-6 is required after replacement of upper arm.

Location of the complete upper arm

The complete upper arm is located as shown in the figure.



xx1100000347

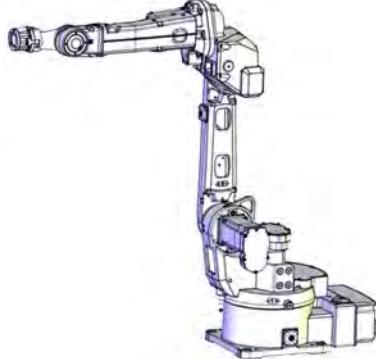
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Required equipment

Equipment	Art. no.	Note
Upper arm, spare	For spare part number, see: • Spare parts on page 315 .	Includes the wrist unit. All gearboxes are filled with oil at delivery.
Standard toolkit	-	Content is defined in section Standard tools on page 312 .

Removing the complete upper arm

Use this procedure to remove the complete upper arm.

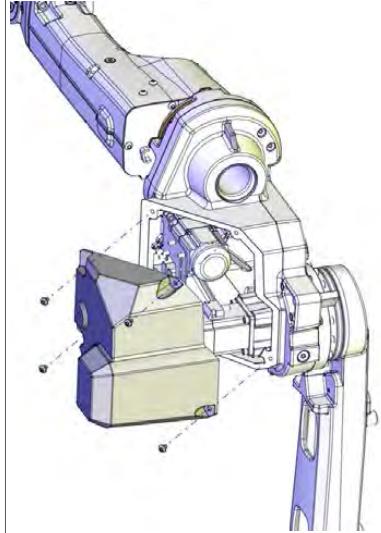
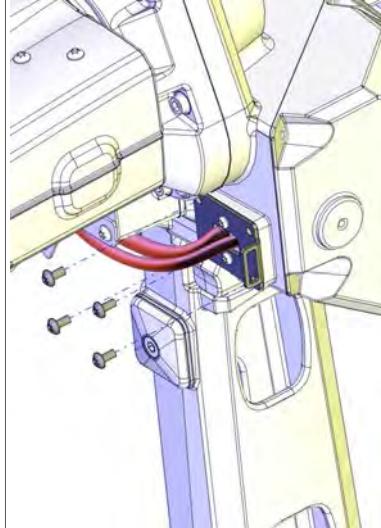
	Action	Note
1	Jog the axis 3 to -90°.	
2	Drain the axis 3 gearbox.	See Changing the oil, axis-3 gearbox on page 137 .
3	Jog the robot to the synchronization position.	 xx1100000348
4	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	

Continues on next page

4 Repair

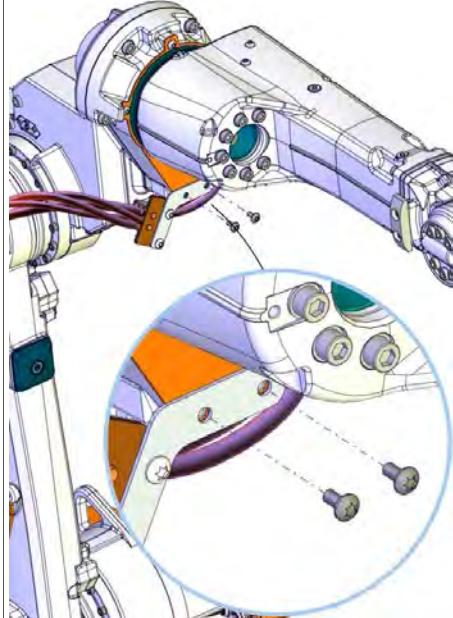
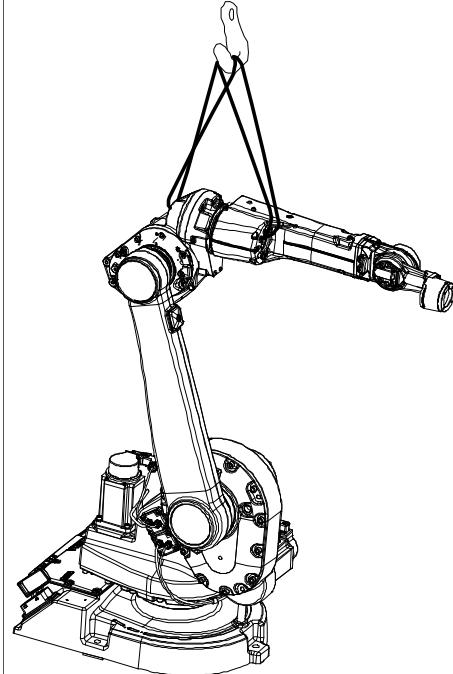
4.4.1 Replacing the complete upper arm ID

Continued

	Action	Note
5	Remove the armhouse cover.	 xx1100000349
6	Disconnect all connectors inside the armhouse and loosen the cabling from straps and brackets.	See Replacing the cable harness - upper end on page 179 .
7	Remove the bracket holding the cable harness to the armhouse and pull out the cable harness.	 xx1100000328

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4.4.1 Replacing the complete upper arm ID
Continued

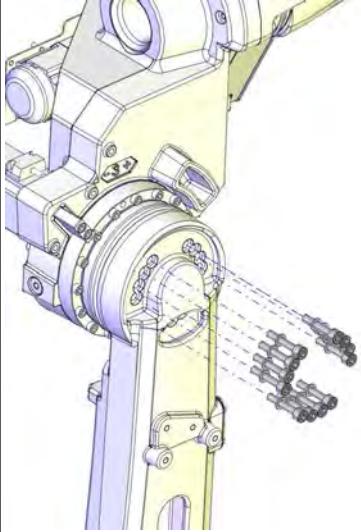
Action	Note
8 Unscrew the screws securing the cable harness to the bracket.	 xx1100000327
9  CAUTION The robot upper arm weighs 35 kg. All lifting accessories used must be sized accordingly!	
10 Secure the weight of the upper arm with a roundsling. Apply the roundsling through the hole in the upper arm. See figure!	 xx0700000060 <p>The figure shows IRB 1600ID but the way to secure the upper arm with the roundsling is the same on IRB 1520.</p>

Continues on next page

4 Repair

4.4.1 Replacing the complete upper arm ID

Continued

Action	Note
11 Remove the axis 3 motor.	See <i>Replacing motors on axes 3 and 4 on page 256</i> .
12 Remove the attachment screws that secure the axis 3 gearbox to the lower arm.	 xx1100000350
13 Carefully lift away the upper arm and put it somewhere safe.	

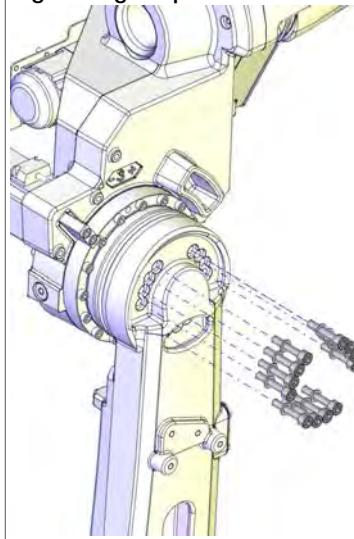
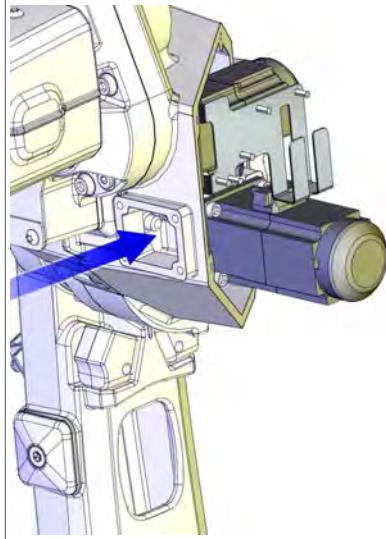
Refitting the complete upper arm

Use this procedure to refit the complete upper arm.

Action	Note
1 Wipe the contact surfaces clean on both the upper and lower arm.	
2  CAUTION The robot upper arm weighs 35 kg. All lifting accessories used must be sized accordingly!	
3 Attach a roundsling to the upper arm and lift it.	
4 Move the upper arm to the mounting position.	

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4.4.1 Replacing the complete upper arm ID
Continued

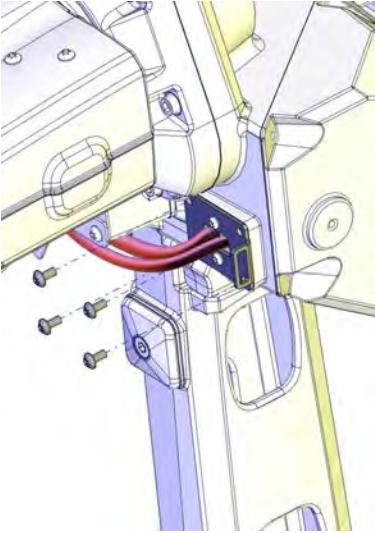
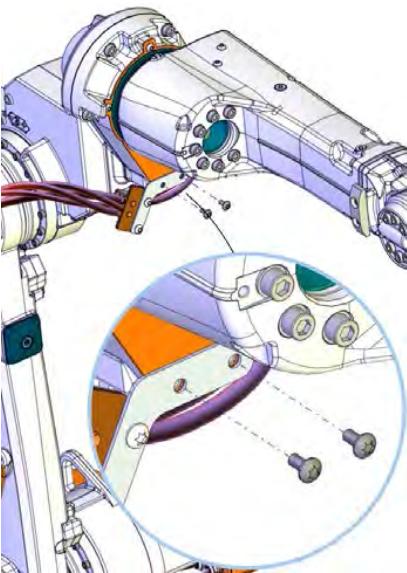
Action	Note
5 Secure the upper arm to the lower arm with its attachment screws and washers.	 <p>Tightening torque: 34 Nm. xx1100000350 Hex socket head cap screw M8x40 quality 12.9 Gleitmo (12 pcs)</p>
6 Refit the motor.	See Replacing motors on axes 3 and 4 on page 256 .
7 Insert the cable harness through the hole and into the armhouse.	 <p>xx1100000330</p>

Continues on next page

4 Repair

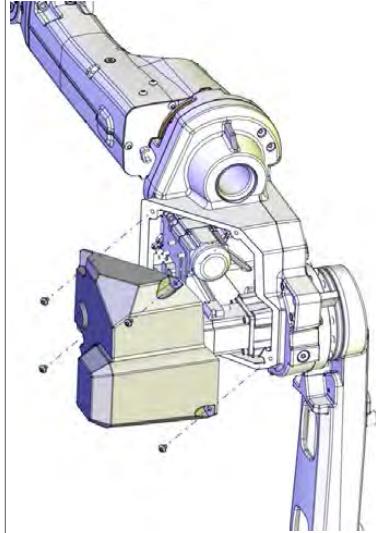
4.4.1 Replacing the complete upper arm ID

Continued

Action	Note
8 Secure the cable harness to the armhouse with the bracket.	 xx1100000328
9 Refit the cable harness to the bracket.	 xx1100000327
10 Connect all the connectors in the armhouse and secure the cabling with brackets and straps.	See on page ?, Replacing motor on axis 5 on page 263 and Replacing the axis 6 motor on page 267 .
11 Check the gaskets in the armhouse cover. Replace if damaged!	

Continues on next page

4.4.1 Replacing the complete upper arm ID
Continued

Action	Note
12 Refit the armhouse cover. Tightening torque: 4 Nm.	 xx1100000349
13 Refill the axis 3 gearbox with oil.	See Changing the oil, axis-3 gearbox on page 137 .
14 Recalibrate the robot.	Calibration is detailed in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section Calibration information on page 291 .
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 47 .	

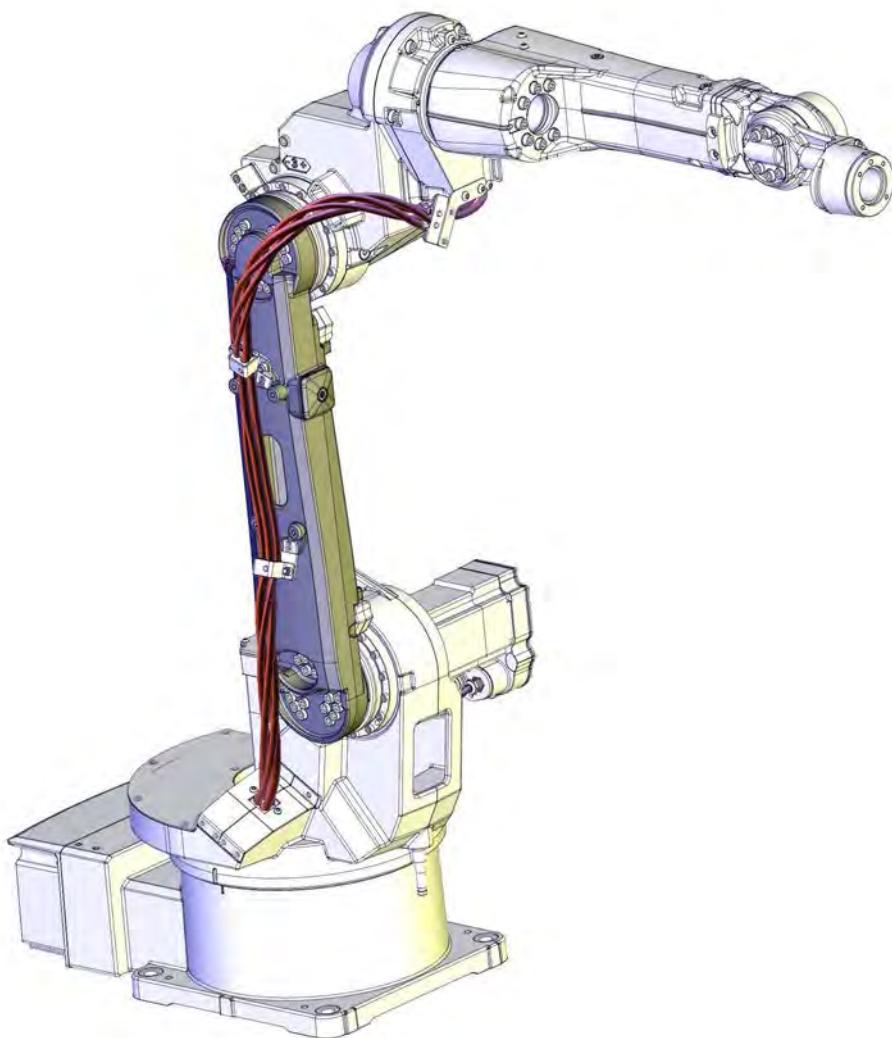
4 Repair

4.4.2 Replacing the complete lower arm

4.4.2 Replacing the complete lower arm

Location of lower arm

The lower arm is located on the robot as shown in the figure.



xx1100000352

Required equipment

Equipment	Art. no.	Note
Lower arm	See Spare parts on page 315 .	
Isopropanol	-	Used to clean the mating surfaces.
Locking liquid	-	Loctite 574
Standard toolkit	-	Content is defined in section Standard tools on page 312 .

Continues on next page

4.4.2 Replacing the complete lower arm

Continued

Equipment	Art. no.	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.

Removing the lower arm

Use this procedure to remove the lower arm.

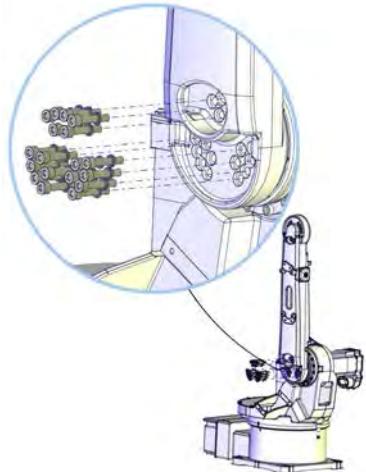
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
2	Disconnect the connectors of the cable harness to the lower end in the armhouse.	See Replacing the cable harness - lower end on page 159 .
3	Pull out the cable harness from the armhouse.	
4	Remove the cable harness from the lower arm.	See Replacing the cable harness - lower end on page 159 .
5	Remove the complete upper arm.	See section Replacing the complete upper arm ID on page 200 .
6	 CAUTION The robot lower arm weighs 20 kg. All lifting accessories used must be sized accordingly!	
7	Secure the weight of the lower arm with a roundsling in an overhead crane or similar.	

Continues on next page

4 Repair

4.4.2 Replacing the complete lower arm

Continued

Action	Note
8 Unscrew the attachment screws and washers securing the lower arm to gearbox axis 2.	 xx1100000353
9 Lift away the lower arm in a way that the cable harness is not damaged and put it somewhere safe.	

Refitting the lower arm

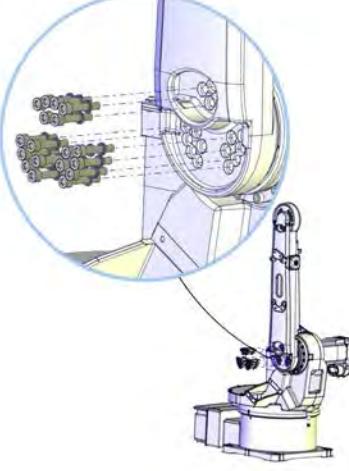
Use this procedure to refit the complete lower arm.

Action	Note
1 Wipe the contact surfaces clean on both the lower arm and gearboxes on axes 2 and 3 with isopropanol.	
2  CAUTION The robot lower arm weighs 20 kg. All lifting accessories used must be sized accordingly!	
3 Secure the weight of the lower arm with a roundsling in an overhead crane or similar and lift it in position.	

Continues on next page

4.4.2 Replacing the complete lower arm

Continued

Action	Note
4 Secure the lower arm to gearbox axis 2 with its attachment screws and washers.	 xx1100000353 Hex socket head cap screw M8x40 quality 12.9 Gleitmo (18 pcs) Tightening torque: 34 Nm.
5 Refit the cable harness on the lower arm.	See Replacing the cable harness - lower end on page 159 .
6 Refit the upper arm.	See section Replacing the complete upper arm ID on page 200 .
7 Refit the lower end of the cable harness in the armhouse and reconnect the connectors.	See Replacing the cable harness - lower end on page 159 .
8 Recalibrate the robot!	Calibration is detailed in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section Calibration information on page 291 .
9  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 47 .	

4 Repair

4.4.3 Replacing the wrist unit, IRB 1600ID-4/1.5

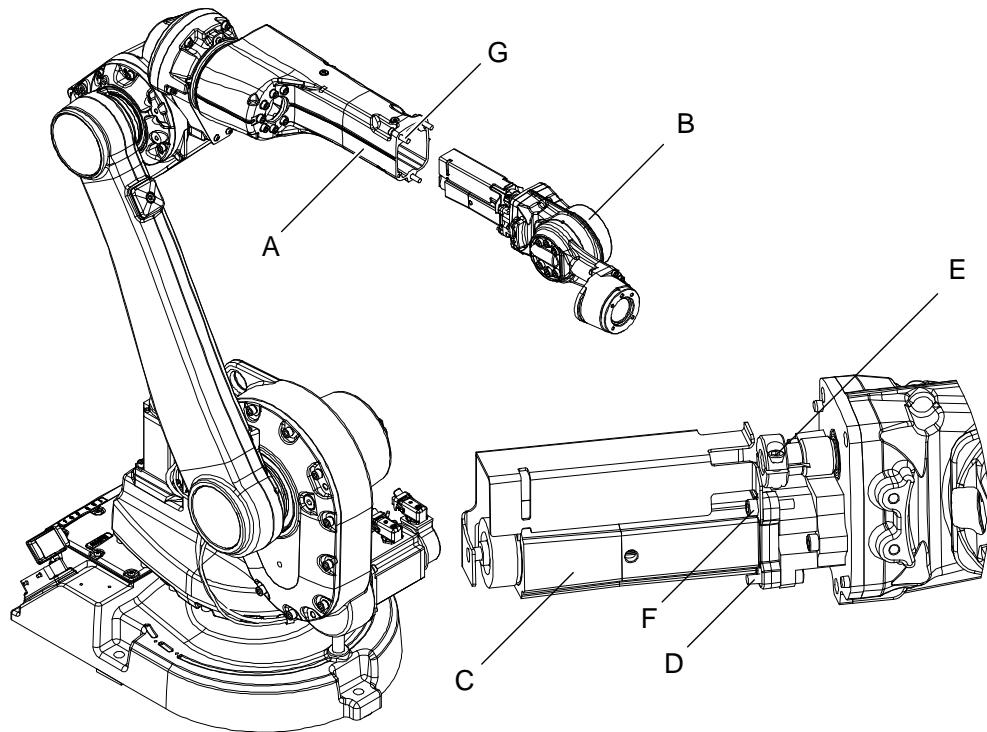


Note

After replacement of motors/motor or gearbox in a manipulator, recalibration is required.

Location of wrist unit

The wrist unit is located in the frontmost part of the upper arm.



xx0700000025

The figure shows the IRB 1600ID but the wrist unit, as shown, is also valid for IRB 1520.

A	Upper arm
B	Wrist
C	Motor axis 6
D	Hexagon socket head screw M5x25
E	Hexagon socket head screw M5X16 (10.9) (Short head)
F	Hexagon socket head screw M5x25
G	Hexagon socket head screw M8x35

Required equipment

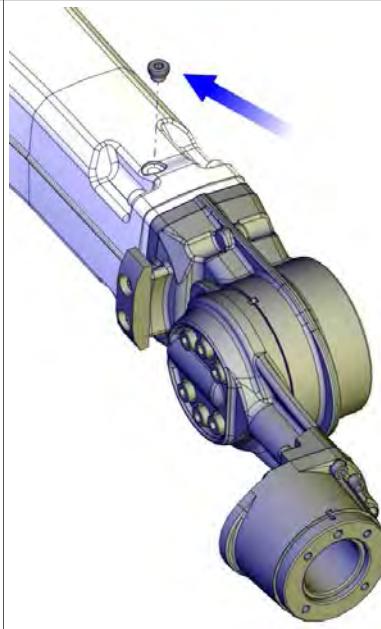
Equipment	Art. No.	Note
Wrist, ID	See Spare parts on page 315 .	

Continues on next page

Equipment	Art. No.	Note
O-ring		
Grease	3HAC3537-1	For lubricating the o-ring sealing plate.
Standard toolkit		Content is defined in section Standard tools on page 312 .
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 wrist unit

Use this procedure to remove the complete wrist unit.

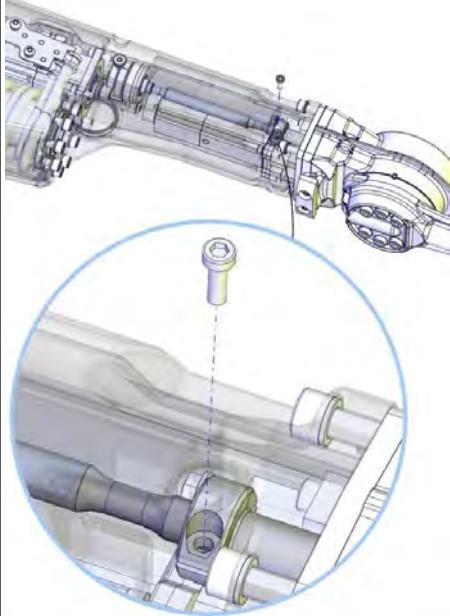
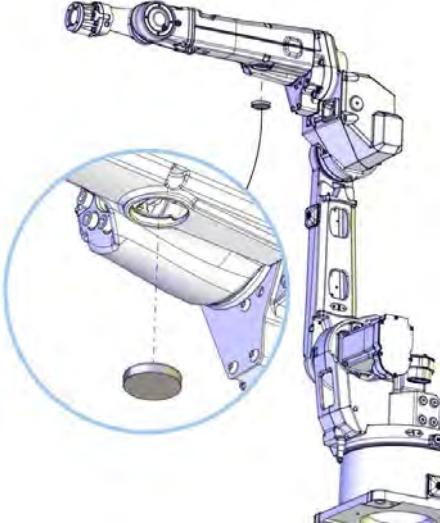
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
2	Remove all extra equipment fitted on upper arm and wrist.	
3	Remove the plug covering the attachment screw below.	 xx1100000354

Continues on next page

4 Repair

4.4.3 Replacing the wrist unit, IRB 1600ID-4/1.5

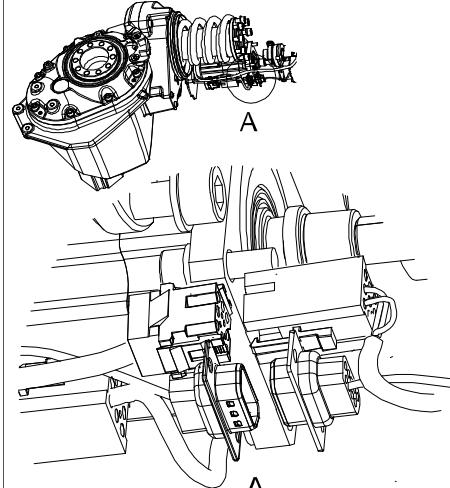
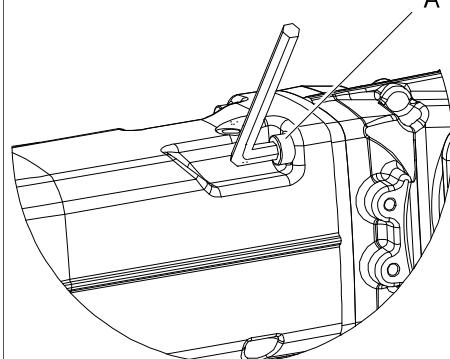
Continued

Action	Note
4 Open the flexible coupling securing the wrist to the driving shaft for motor axis 5, by unscrewing the attachment screw.	 xx1100000355
5 Remove the VK-Cover.	 xx1100000394
6 Gently pull the cables out through the hole for the VK-cover in the armtube.	

Continues on next page

4.4.3 Replacing the wrist unit, IRB 1600ID-4/1.5

Continued

Action	Note
7 Disconnect the connectors R4.FB6 and R4.MP6 to motor axis 6, through the hole for the VK cover.	 <p>xx0700000053</p> <ul style="list-style-type: none"> A: Connectors R4.FB6 & R4.MP6
8 Remove the attachment screws securing the wrist.	 <p>xx0700000052</p> <ul style="list-style-type: none"> A: Hex socket head cap screw M8x35 quality 8.8-A2F (3 pcs)
9 Remove the wrist with motor 6 from the upper arm tube and put it on a work bench or similar.	<p>CAUTION</p> <p>Be careful when handling the wrist. Always hold on the casting, do not hold on the wrist cover. This can damage the sealing which will cause oil leakage.</p>

Refitting the wrist unit

Use this procedure to refit the complete wrist unit.

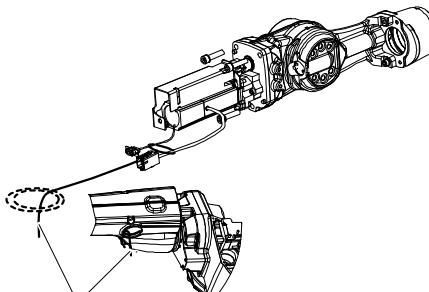
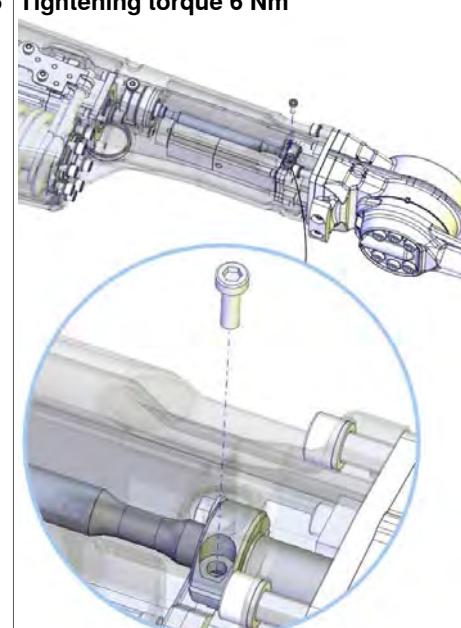
Action	Note
1 Move the wrist (with the axis 6 motor fitted) to the mounting site.	
2 Apply a string or similar to the cable harness and run it out through the hole for the VK cover.	

Continues on next page

4 Repair

4.4.3 Replacing the wrist unit, IRB 1600ID-4/1.5

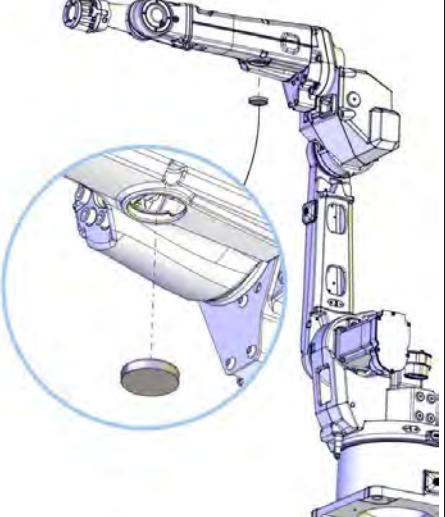
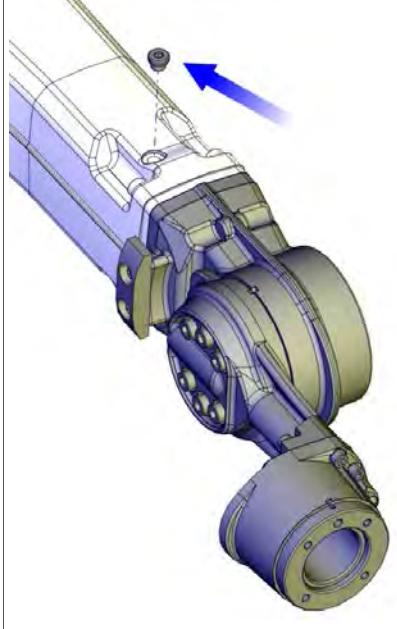
Continued

Action	Note
3 Carefully fit the wrist (with motor axis 6 fitted) to the upper arm tube, using the string to pull the cable harness back through the hole for the VK cover.	 xx0700000093 A: String
4 Secure the wrist with its attachment screws and washers.	M8x35 8.8-A2F (3 pcs) Tightening torque 24 Nm
5 Reconnect connectors R4.FB6 and R4.MP6, through the hole for the VK cover.	i Note <p>When reconnecting the connectors R4.FB6 and R4.MP6, make sure to push the connectors towards the wrist as far away from the axis 5-6 cable spiral as possible, to avoid grease to accumulate on the resolver connector.</p>
6 Secure the flexible coupling with the M5x16 screw.	Tightening torque 6 Nm  xx1100000355

Continues on next page

4.4.3 Replacing the wrist unit, IRB 1600ID-4/1.5

Continued

Action	Note
7 Refit the VK cover.	 xx1100000394
8 Refit the plug. Tightening torque 6 Nm	 xx1100000354
9 Recalibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section Calibration information on page 291 .

Continues on next page

4 Repair

4.4.3 Replacing the wrist unit, IRB 1600ID-4/1.5

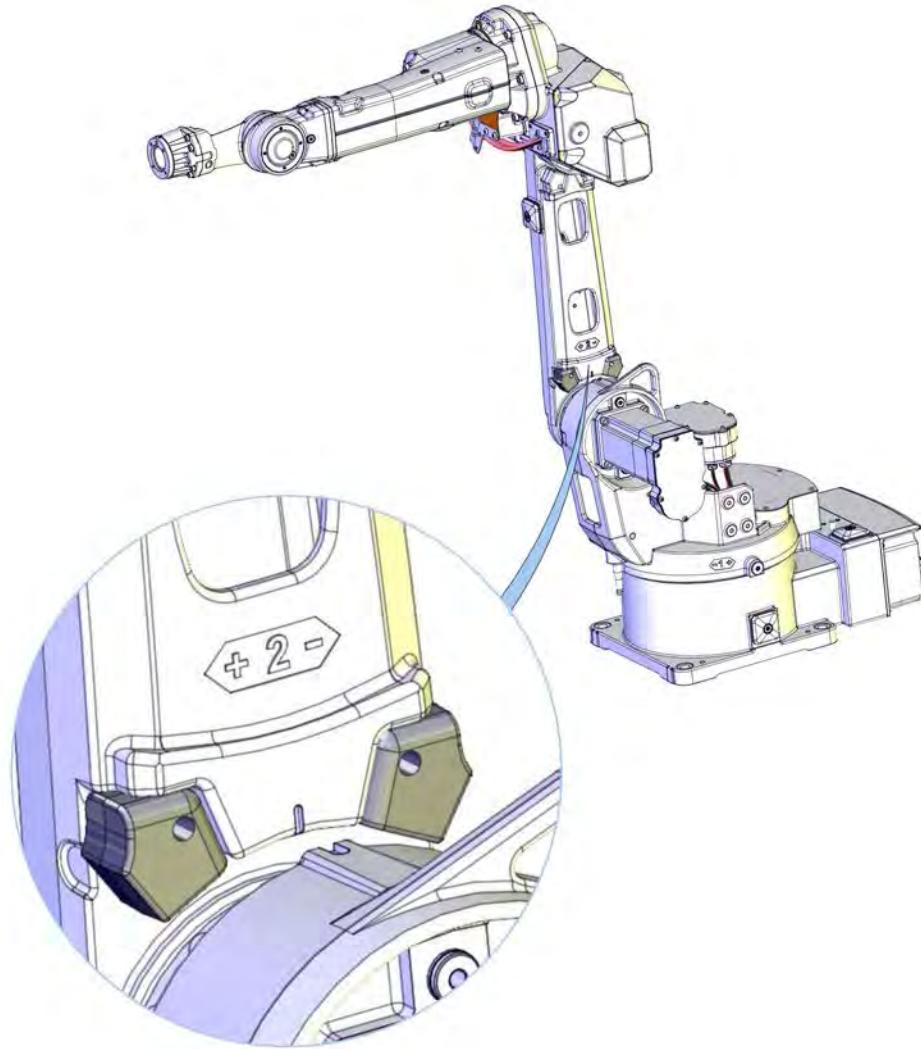
Continued

Action	Note
10  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in section <i>DANGER - First test run may cause injury or damage! on page 47.</i>	

4.4.4 Replacing the damper, axis 2

Location of damper, axis 2

The dampers are located as shown in the figure.



xx1100000356

Required equipment

Equipment, etc.	Art. no.	Note
Damper, axis 2	See Spare parts on page 315 .	
Standard toolkit	-	Content is defined in section Standard tools on page 312 .
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

4.4.4 Replacing the damper, axis 2

Continued

Removing the damper

Use this procedure to remove the damper.

Action	Note
1 Run the robot to a position where it is best to enable access to the attachment screw of the damper.	
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
3 Remove the damper by unscrewing the attachment screw and washer.	

Refitting the damper

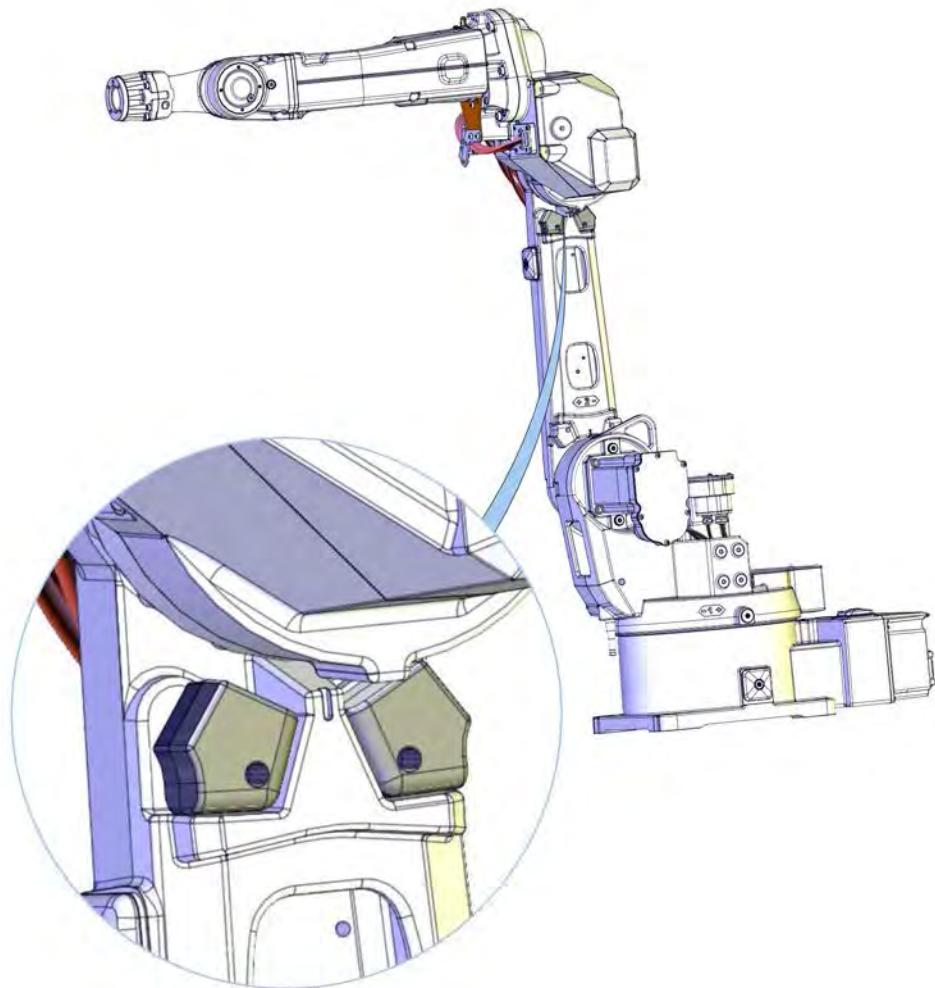
Use this procedure to refit the damper.

Action	Note
1 Run the robot to a position where it is best to enable access to the attachment screw of the damper.	
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
3 Secure the damper with the attachment screw and washer.	M6x60 quality 8.8-A2F
4  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 47</i> .	

4.4.5 Replacing the damper, axis 3

Location of damper, axis 3

The dampers are located as shown in the figure.



xx1100000357

Required equipment

Equipment, etc.	Art. no.	Note
Damper, axis 3	See Spare parts on page 315 .	
Standard toolkit		Content is defined in section Standard tools on page 312 .

Continues on next page

4 Repair

4.4.5 Replacing the damper, axis 3

Continued

Removing the damper axis 3

Use this procedure to remove the damper.

Action	Note
1 Run the robot to a position where it is best to enable access to the attachment screw of the damper.	
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
3 Remove the damper by unscrewing the attachment screw and washer.	

Refitting the damper axis 3

Use this procedure to refit the damper.

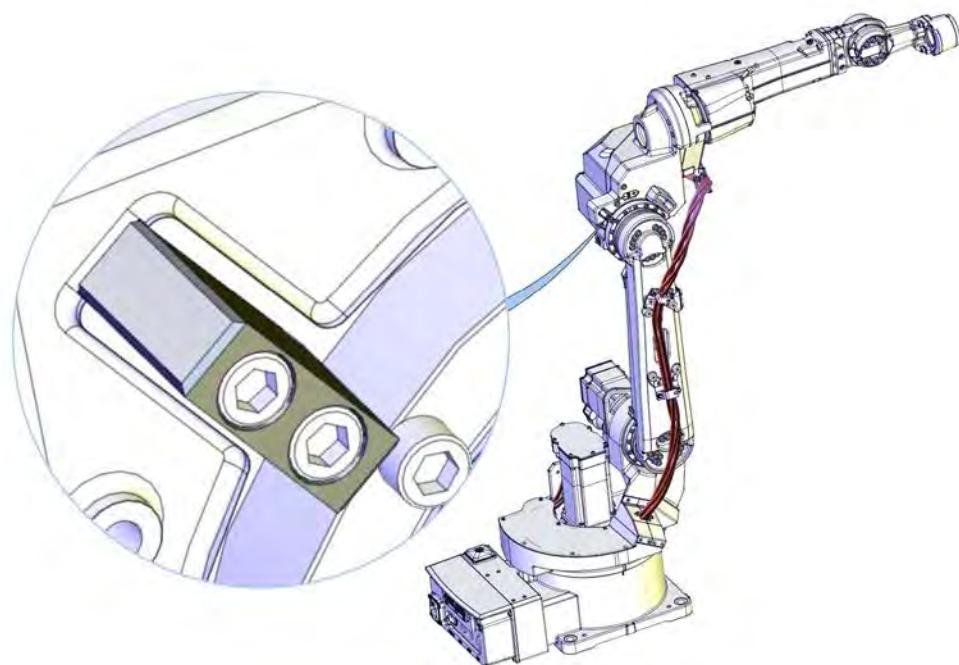
Action	Note
1 Run the robot to a position where it is best to enable access to the attachment screw of the damper.	
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
3 Secure the damper with the attachment screw and washer.	M6x60 quality 8.8-A2F
4  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 47</i> .	

4.4.6 Replacing the mechanical stop axis 3, ID variant

4.4.6 Replacing the mechanical stop axis 3, ID variant

Location of the mechanical stop axis 3

The mechanical stop axis 3 is located as shown in the figure.



xx1100000358

Required equipment

Equipment	Art. no.	Note
Mechanical stop	See Spare parts on page 315 .	
Standard tools		Content is defined in section Standard tools on page 312 .

Continues on next page

4 Repair

4.4.6 Replacing the mechanical stop axis 3, ID variant

Continued

Removing the mechanical stop axis 3

Use this procedure to remove the mechanical stop.

Action	Note
1 Run the robot to a position that enables access to the mechanical stop.	
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
3 Remove the mechanical stop.	

Refitting the mechanical stop axis 3

Use this procedure to refit the mechanical stop.

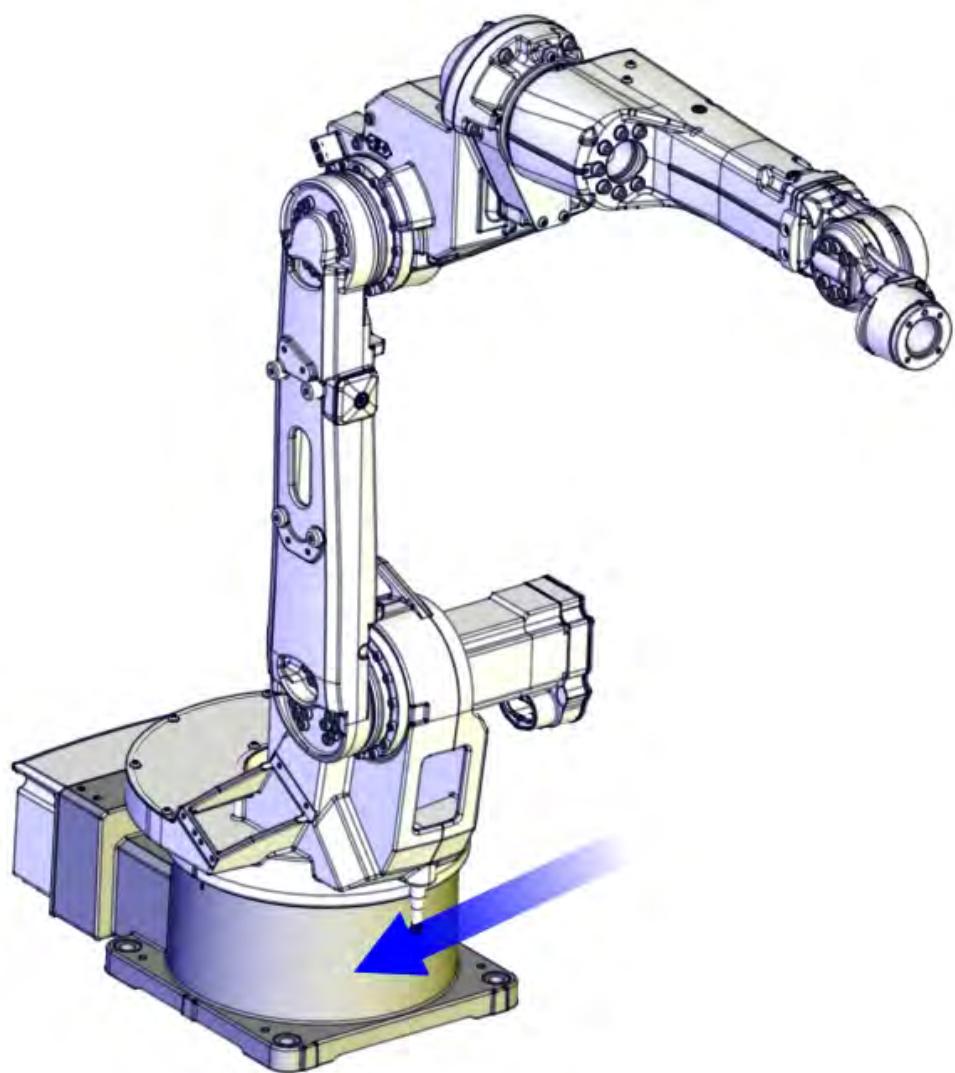
Action	Note
1 Refit the mechanical stop with its attachment screws.	Attachment screws: M6x35 quality 8.8-A2F (2 pcs)
2  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <i>DANGER - First test run may cause injury or damage! on page 47.</i>	

4.5 Frame and base

4.5.1 Replacing the base

Location of the base

The location of the base is shown in the figure.



xx1100000437

Continues on next page

4 Repair

4.5.1 Replacing the base

Continued

Required equipment

Equipment	Art. No.	Note
Base	See Spare parts on page 315 .	
O-rings	See Spare parts on page 315 .	
Guide pins	3HAC039940-001	Always use the guide pins in pairs.
Standard toolkit	-	Content is defined in section Standard tools on page 312 .
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 base

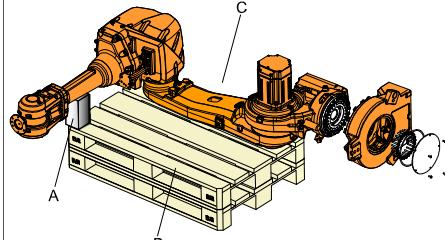
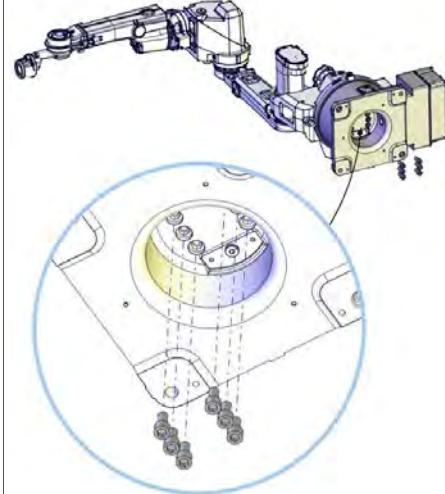
Use this procedure to remove the base.

	Action	Note
1	Jog the robot to the calibration position.	
2	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
3	Drain the axis 1 gearbox.	See Draining, axis 1 gearbox on page 130 .
4	Remove the cable harness in base and frame.	See Replacing the cable harness - lower end on page 159 .
5	Pull out the cable harness from the base and frame and place it in a way that it will not be damaged in the continued procedure.	
6	 CAUTION The IRB 1520 robot weighs 170 kg. All lifting accessories used must be sized accordingly!	See Lifting robot with roundslings on page 70 .
7	Secure the weight of the robot with a roundsling in an overhead crane or similar.	
8	Unscrew the bolts securing the robot to the foundation.	

Continues on next page

4.5.1 Replacing the base

Continued

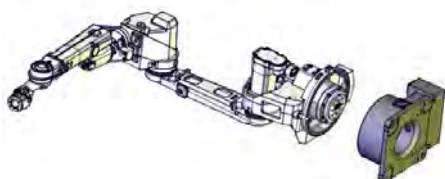
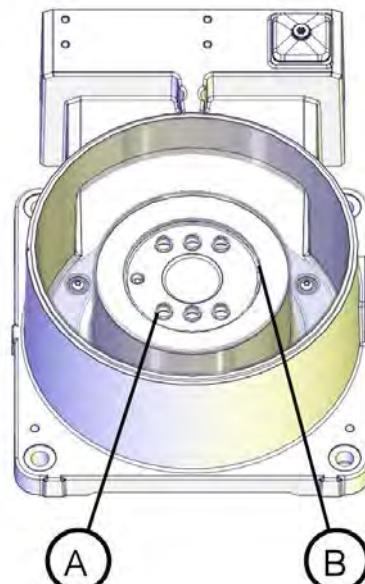
Action	Note
9 Lift the robot and put it safely on its side on some pallets or similar. Let it rest on the lower arm. See figure!	<p>The figure shows IRB 4600 but the principle is the same for IRB 1520.</p>  <p>xx0800000352</p> <ul style="list-style-type: none"> • A: Support for upper arm • B: Loading pallets • C: Robot
10  CAUTION The robot base weighs 42 kg. All lifting accessories used must be sized accordingly!	
11 Secure the weight of the base in a roundsling in an overhead crane or similar.	
12 Unscrew the oil drain hose from the base.	
13 Unscrew the attachment screws (6 pcs) securing the base to the axis 1 gearbox.	 <p>xx1100000389</p>

Continues on next page

4 Repair

4.5.1 Replacing the base

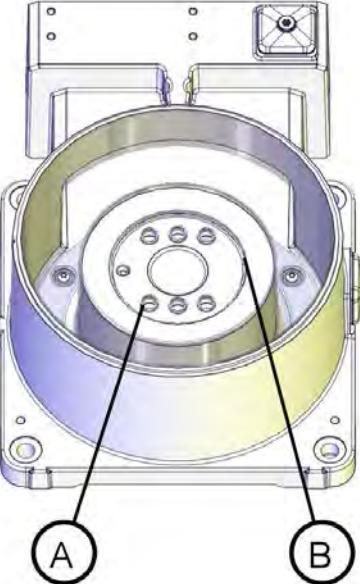
Continued

Action	Note
14 Remove the base.	 xx1100000388
15 Check the o-rings! Replace if damaged.	 xx1100000536 <ul style="list-style-type: none">• A: O-rings, 6 pcs (15.5x1.5)• B: O-ring, 1 pc (131x2)
16 Unscrew the attachment screws holding the base cable protection and remove it.	Keep it in a clean place. It will be refitted on the new base.

Continues on next page

Refitting the base

Use this procedure to refit the base.

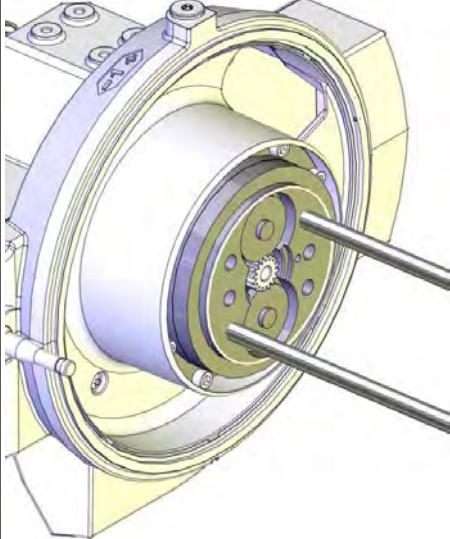
Action	Note
1 Wipe clean the mating surfaces on the base and gearbox with isopropanol.	
2 Fit the base cable protection in the base with its attachment screws.	Tightening torque: 4 Nm. M6x8 (3 pcs)
3  CAUTION The robot base weighs 42 kg. All lifting accessories used must be sized accordingly!	
4 Secure the weight of the base with round-slings and lift it to the mounting site.	
5 Lift up the base into a vertical position.	
6 Apply grease on the big o-ring (131x2) and fit it in position to its groove in the base. Replace if damaged!	 xx1100000536 <ul style="list-style-type: none"> • A: O-ring, 6 pcs (15.5x1.5) • B: O-ring, 1 pc (131x2)

Continues on next page

4 Repair

4.5.1 Replacing the base

Continued

Action	Note
7 Fit two guide pins in opposite holes, diagonal to each other.	Guide pins are specified in Required equipment on page 226 .  xx1100000535
8 Apply grease and fit the six o-rings into the grooves at the screw holes in the base. Replace o-rings if damaged!	
9 Put four attachment screws into the holes of the base. Do not put screws in the holes where the guide pins are fitted in the frame.	
10 Place the base very carefully on the guide pins, in order to keep screws and o-rings in position.	
11 Fasten the four attachment screws carefully but do not tighten them yet. It must still be possible to remove the guide pins and replace them with the remaining attachment screws.	Replace the o-rings if needed!
12 Remove the guide pins and replace them with the remaining attachment screws.	
13 Secure the base to gearbox axis 1 with its attachment screws.	Tightening torque: 150 Nm M14x25 (6 pcs)
14 Refit the oil drain hose to the base.	
15 Secure the oil tube with cable straps inside the base.	
16  CAUTION The IRB 1520 robot weighs 170 kg. All lifting accessories used must be sized accordingly!	

Continues on next page

Action	Note
17 Secure the weight of the robot with round-slings and lift it carefully up from the pallets.	
18 Refit the robot to the foundation with its bolts.	
19 Refit the cable harness in frame and base.	See Replacing the cable harness - lower end on page 159 .
20 Refit the base cover with its attachment screws.	
21 Perform a leak-down test!	See Performing a leak-down test on page 154 .
22 Fill axis 1 gearbox with oil.	See Filling oil, axis 1 gearbox on page 132 .
23 Recalibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section Calibration information on page 291 .
24  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in section DANGER - First test run may cause injury or damage! on page 47 .	

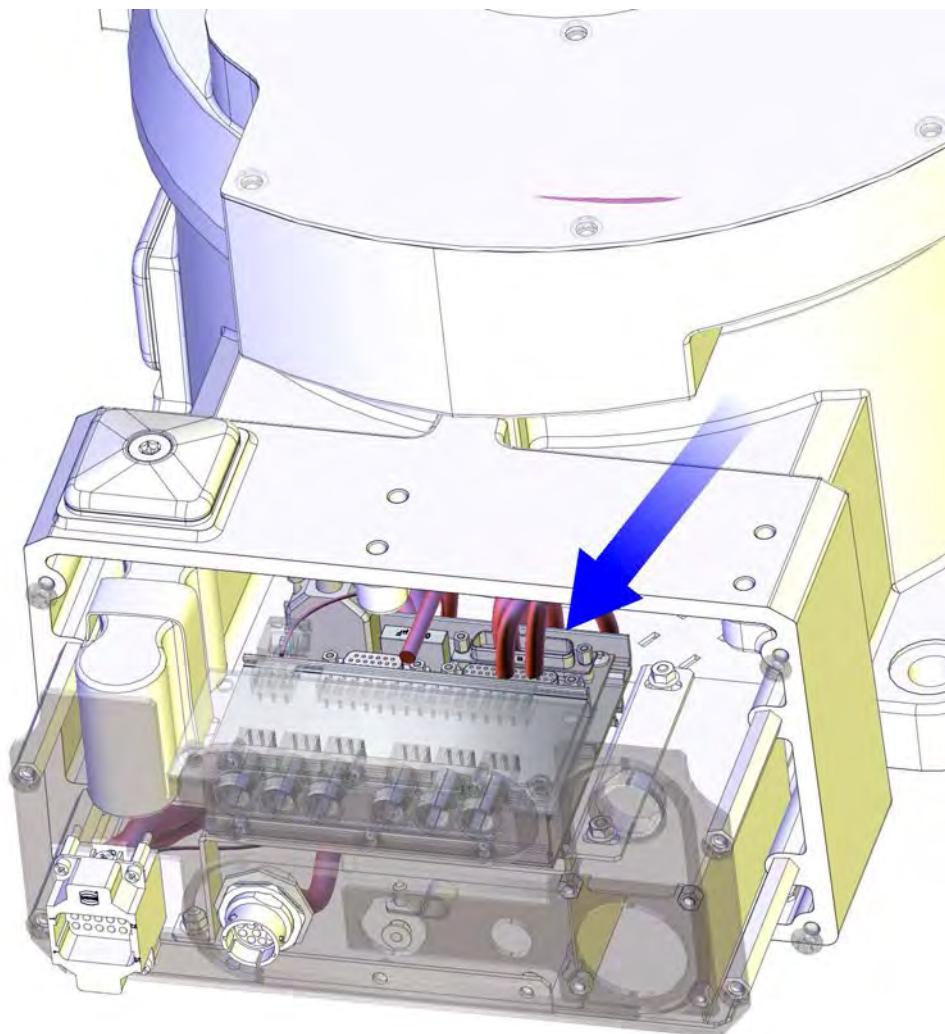
4 Repair

4.5.2 Replacing the serial measurement unit

4.5.2 Replacing the serial measurement unit

Location of serial measurement unit

The serial measurement unit is located inside the base of the robot, as shown in the figure.



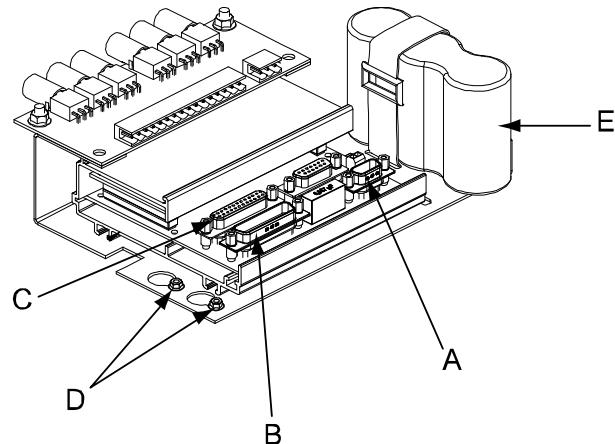
xx1100000332

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Serial measurement unit layout

The complete spare part of the serial measurement unit is shown in the figure.

DSQC 633A



xx0500001391

A	Connector SMB
B	Connector SMB1-4
C	Connector SMB 3-6
D	Hexagon nuts (totally 4 pcs)
D	Hexagon nuts (totally 2 pcs). Only the outer nuts are used.
E	Battery pack (2-pole battery contact)

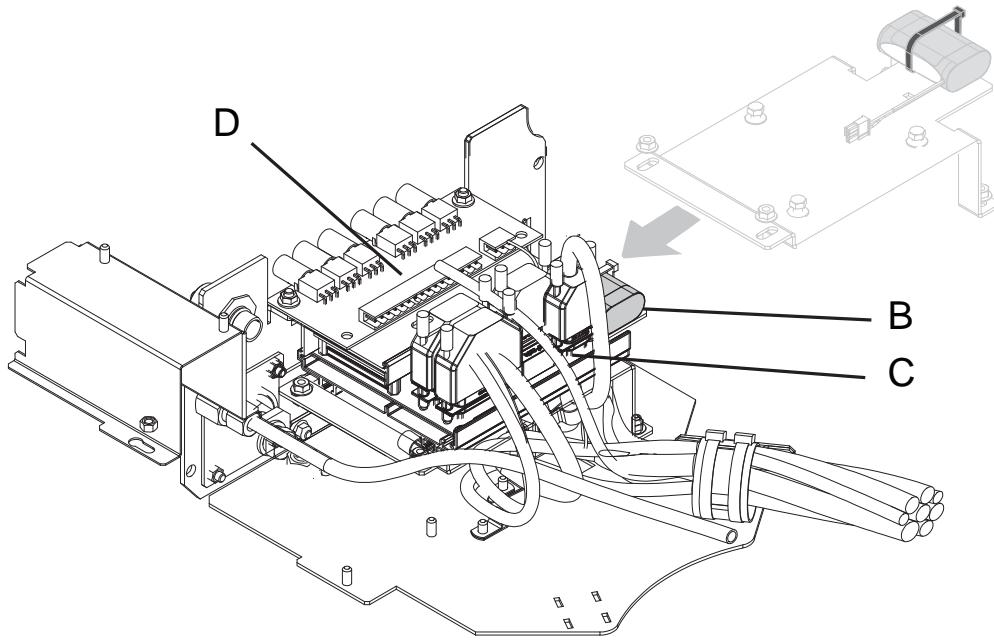
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4 Repair

4.5.2 Replacing the serial measurement unit

Continued

RMU 101



xx1300000330

B	Battery pack (3-pole battery contact)
C	Serial measurement board RMU 101
D	BU unit

Required equipment



Note

There are different variants of SMB units and batteries. The variant with the 3-pole battery contact has longer lifetime for the battery.

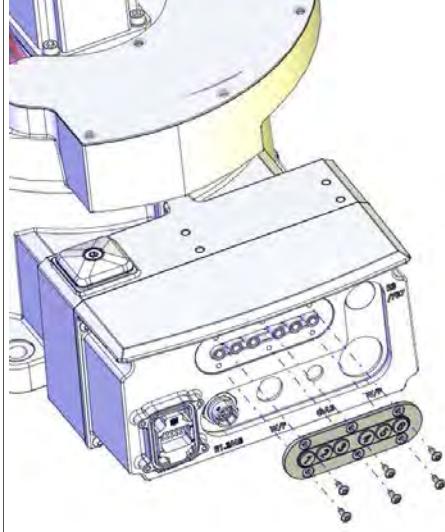
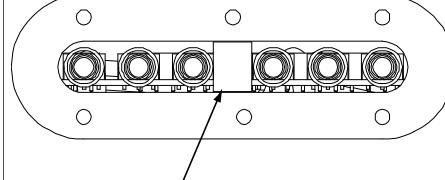
It is important that the SMB unit uses the correct battery. Make sure to order the correct spare parts. Do not replace the battery contact!

Equipment	Art. no.	Note
Serial measurement unit	See Spare parts on page 315 .	
Battery pack	See Spare parts on page 315 .	
Gasket, base cover	See Spare parts on page 315 .	
Centering piece	3HAC025815-001	Fitted to the push button unit in order to align it correctly. Replace if damaged.
Standard toolkit	-	Content is defined in section Standard tools on page 312 .
Circuit diagram	-	See chapter Circuit diagram on page 317 .

Continues on next page

Removing the serial measurement unit

Use this procedure remove the serial measurement unit.

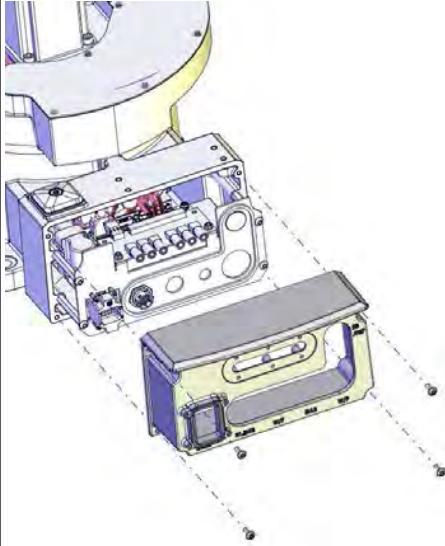
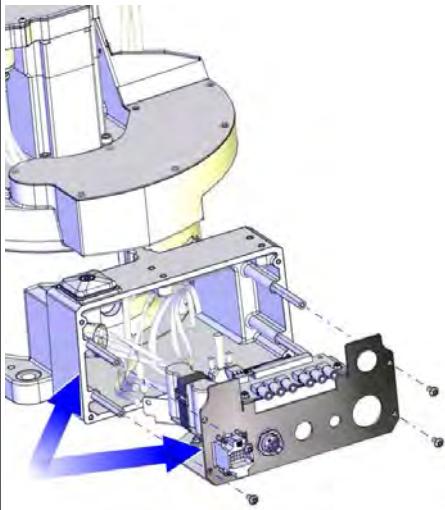
Action	Note
<p>1</p>  DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
<p>2</p> Remove the push button guard from the base.	The push button guard must be removed to ensure a correct refitting of the push buttons.  xx1100000314
<p>3</p> Remove the centering piece from the push button unit.	 xx0600002776 <ul style="list-style-type: none"> • B: Centering piece

Continues on next page

4 Repair

4.5.2 Replacing the serial measurement unit

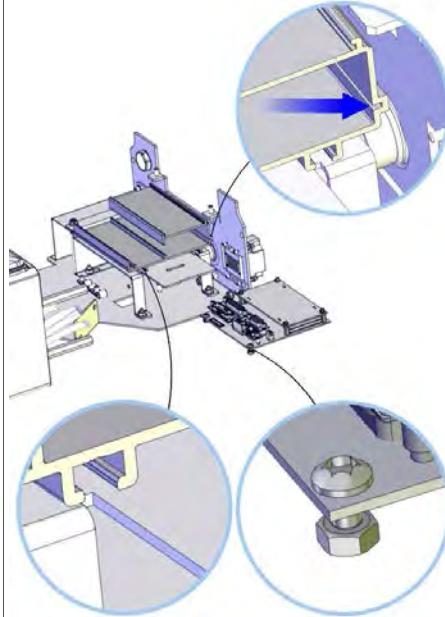
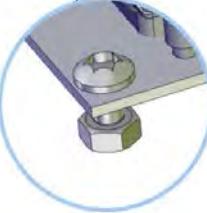
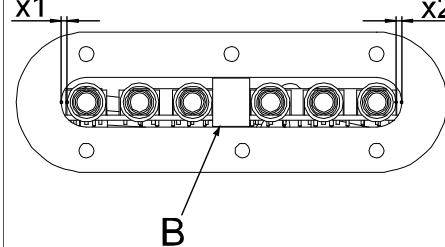
Continued

Action	Note
4 Remove the base cover.	 xx1100000315
5 Unscrew the attachment screws that holds the plate for connector (with SMB and push button units) and pull it carefully out approximately 150 mm.	 xx1100000316
6 Disconnect all the connectors to the serial measurement unit and push button units.	
7 Unscrew the two nuts that holds the push button guard.	
8 Unscrew the nuts (4 pcs) on the plate of the SMB and remove it.	
9 Turn over the plate with the SMB unit fitted and unscrew the attachment screws that holds the SMB unit and remove it.	

Continues on next page

Refitting the serial measurement unit

Use this procedure refit the serial measurement unit.

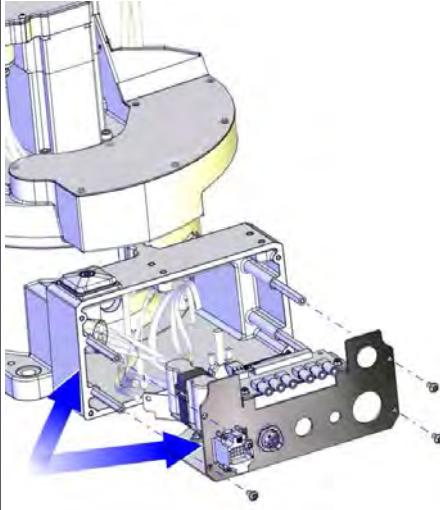
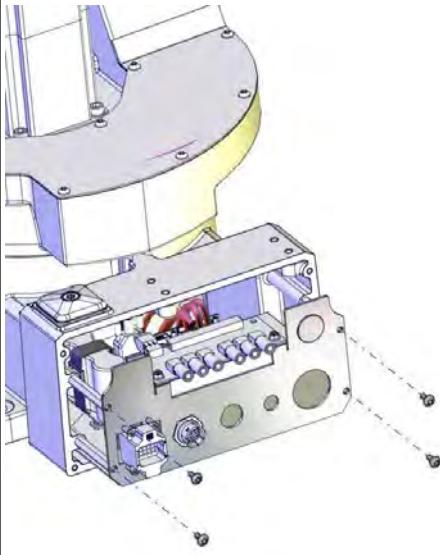
Action	Note
1 Fit the SMB to the plate with its attachment screws (3 pcs).	   xx1100000335
2 Secure the SMB fitted on the plate with its attachment screws (4 pcs).	
3 Refit the push button unit with its nuts (2 pcs).	Make sure the unit is placed as straight as possible. The push buttons can otherwise get jammed.
4 Reconnect all the connectors.	Shown in the figure Serial measurement unit layout on page 233 .
5 Refit the centering piece (B) to the push button unit in order to align it vertically. Also make sure that the unit is correctly aligned sideways: the measurements x1 and x2 in the figure to the right should not differ more than 1 mm from each other!	 xx0600002777 Art. no. for the centering piece is specified in Required equipment on page 234 .

Continues on next page

4 Repair

4.5.2 Replacing the serial measurement unit

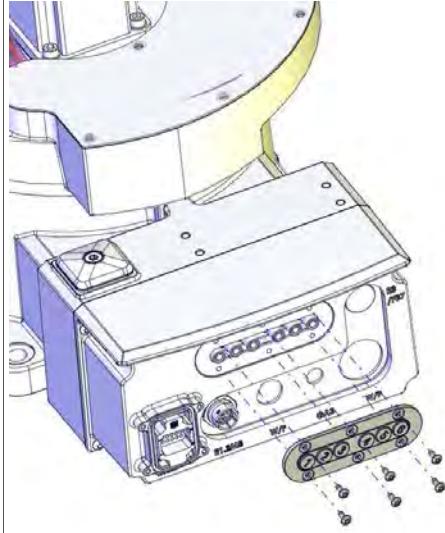
Continued

Action	Note
6 Push the plate for connector (with SMB and push button units fitted) carefully into the base. Be careful not to damage any of the components or cable harness in the process!	 xx1100000316
7 Secure the plate for connector with its attachment screws.	 xx1100000329
8 Refit the base cover.	Shown in the figure Location of serial measurement unit on page 232 .

Continues on next page

4.5.2 Replacing the serial measurement unit

Continued

Action	Note
9 Refit the push button guard to the robot base.	 xx1100000314
10  WARNING Before continuing any service work, please observe the safety information in section WARNING - The brake release buttons may be jammed after service work on page 48!	
11 Check the gasket of the base cover. Replace it if damaged.	
12 Update the revolution counters!	Detailed in section Updating revolution counters on page 296 .

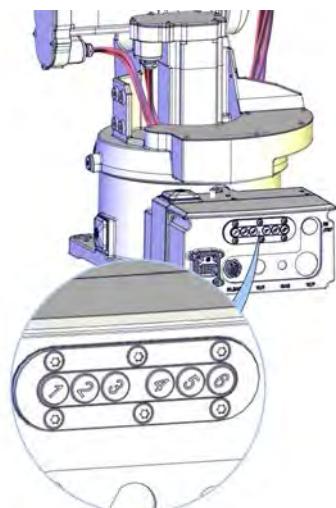
4 Repair

4.5.3 Replacing the push button unit

4.5.3 Replacing the push button unit

Location of push button unit

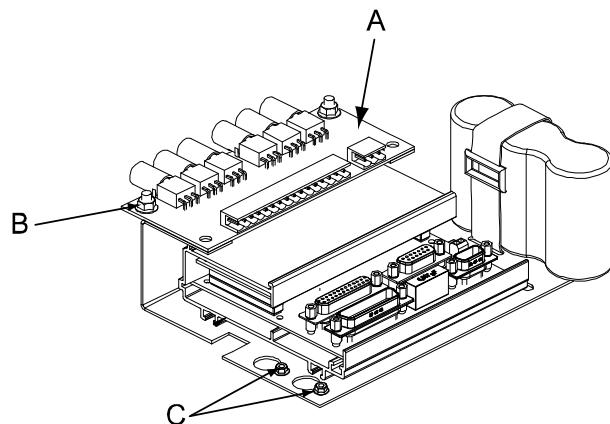
The push button unit for brake release is located inside the base of the robot.



xx1100000312

Push button unit on serial measurement unit

The push button unit is attached to the serial measurement unit as shown in the figure.



xx0500001394

A	Push button unit
B	Hexagon nuts (2 pcs)
C	Hexagon nuts, SMB unit (4 pcs). Only the outer ones are used.

Required equipment

Equipment	Art. no.	Note
Push button unit	See Spare parts on page 315 .	Includes brake release board and push buttons.
Gasket, base cover	3HAC 022047-001	

Continues on next page

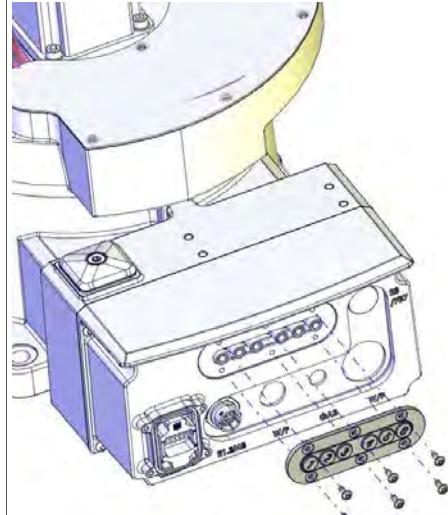
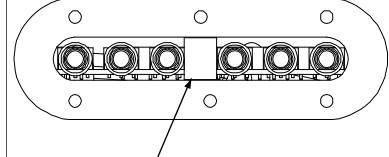
4.5.3 Replacing the push button unit

Continued

Equipment	Art. no.	Note
Centering piece	3HAC025815-001	Fitted to the push button unit in order to align it correctly. Replace if damaged.
Standard toolkit		Content is defined in section Standard tools on page 312 .

Removing the push button unit

Use this procedure to remove the push button unit.

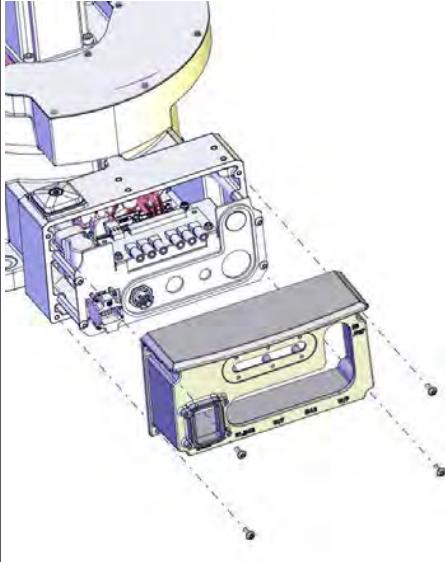
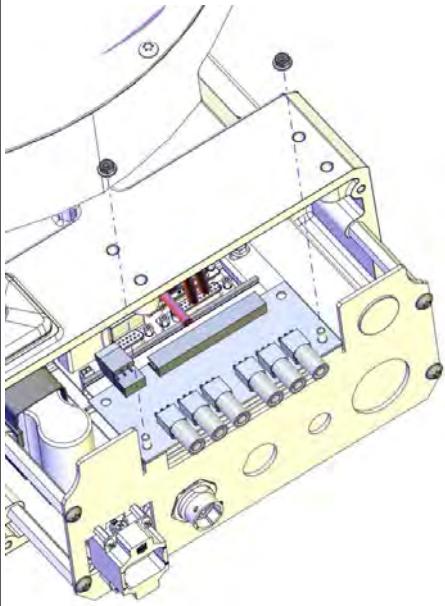
	Action	Note
1	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
2	Remove the push button guard from the base.	The push button guard must be removed to ensure a correct refitting of the push button unit.  xx1100000314
3	Remove the centering piece from the push button unit.	 xx0600002776 <ul style="list-style-type: none"> • B: Centering piece

Continues on next page

4 Repair

4.5.3 Replacing the push button unit

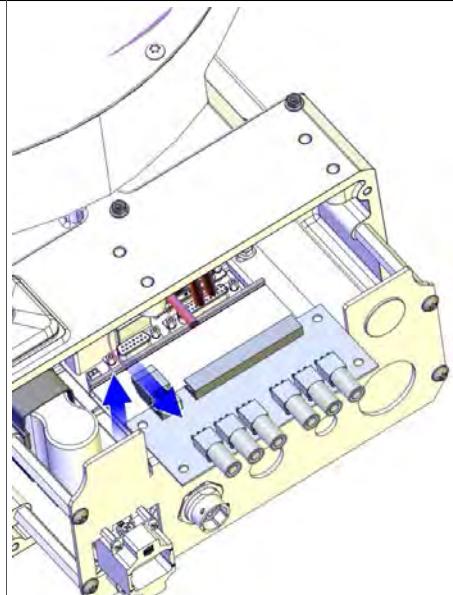
Continued

Action	Note
4 Remove the <i>base cover</i> from the robot.	 xx1100000315
5 Unscrew the nuts securing the push button unit to the SMB unit.	 xx1100000345

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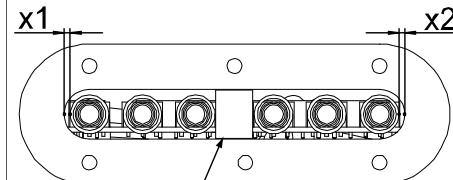
4.5.3 Replacing the push button unit

Continued

Action	Note
6 Lift the push button unit up and pull it carefully out a little in order to be able to disconnect the connectors. Do not stretch the cables!	 xx1100000344
7 Remove the push button unit by lifting it up.	

Refitting the push button unit

Use this procedure to refit the push button unit.

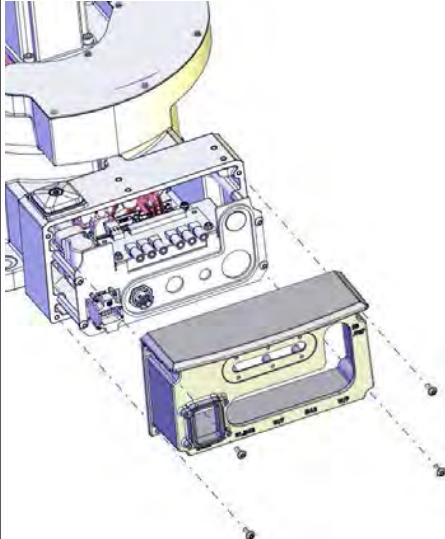
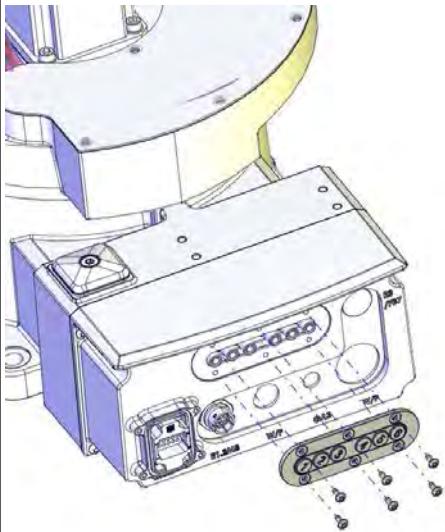
Action	Note
1  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
2 Fit the push button unit to the serial measurement unit in the robot base.	
3 Secure the unit with the two hexagon nuts..	
4 Reconnect all connectors to the push button unit.	
5 Refit the centering piece (B) to the push button unit in order to align it vertically. Also make sure that the unit is correctly aligned sideways: the measurements x1 and x2 in the figure to the right should not differ more than 1 mm from each other!	 x1 x2 B xx0600002777

Continues on next page

4 Repair

4.5.3 Replacing the push button unit

Continued

Action	Note
6 Refit the base cover.	 xx1100000315
7 Refit the push button guard to the robot base.	 xx1100000314
8  WARNING Before continuing any service work, please observe the safety information in section WARNING - The brake release buttons may be jammed after service work on page 48!	
9 Update the revolution counters!	Detailed in section Updating revolution counters on page 296 .

Continues on next page

	Action	Note
10	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in section <i>DANGER - First test run may cause injury or damage! on page 47.</i>	

4 Repair

4.6.1 Replacing motors on axis 1 and 2

4.6 Motors

4.6.1 Replacing motors on axis 1 and 2

Introduction

This section describes how to replace motors on axes 1 and 2.

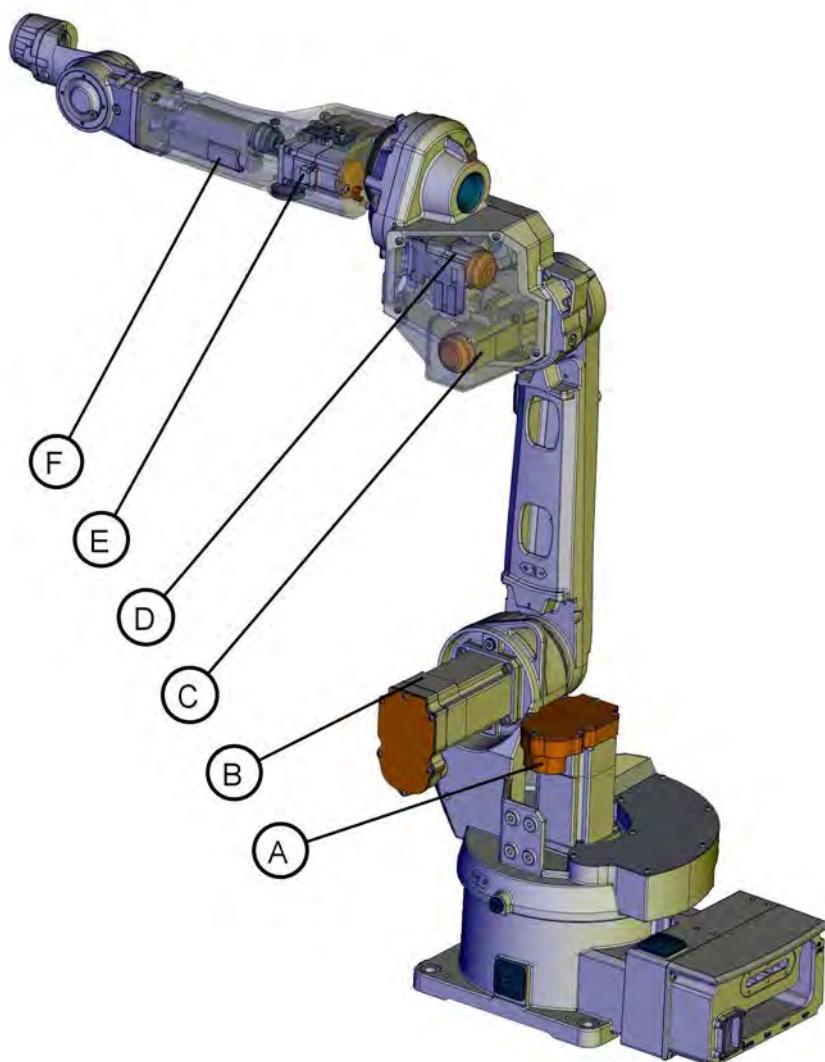
How to replace motors on axes 3 and 4 see section [on page ?](#).

How to replace the motor on axis 5 see section [Replacing motor on axis 5 on page 263](#).

How to replace the motor on axis 6 see section [Replacing the axis 6 motor on page 267](#).

Location of motors on axes 1 and 2

The motors are located as shown in the figure.



xx1100000282

Continues on next page

4.6.1 Replacing motors on axis 1 and 2

Continued

A	Motor axis 1
B	Motor axis 2
C	Motor axis 3 (inside armhouse)
D	Motor axis 4 (inside armhouse)
E	Motor axis 5 (inside upper arm)
F	Motor axis 6 (inside upper arm)

Required equipment

Equipment	Art. no.	Note
Motor	See Spare parts on page 315 .	
O-ring, motor	See Spare parts on page 315 .	
Connection box	See Spare parts on page 315 .	
Motor cover	See Spare parts on page 315 .	Includes o-rings.
Standard toolkit	-	Content is defined in section Standard tools on page 312 .
Special toolkit	-	Content is defined in section Special tools on page 313 .
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.

Position of the robot

Place the robot in the recommended position in order to facilitate replacement of motors.

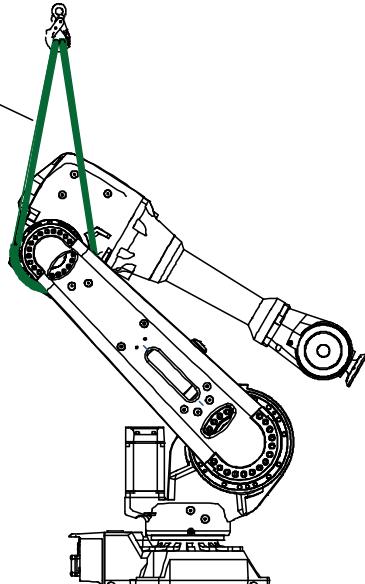
Motor	Position
Axis 1 motor	Calibration position.

Continues on next page

4 Repair

4.6.1 Replacing motors on axis 1 and 2

Continued

Motor	Position
Axis 2 motor	<p>Jog the robot to the position shown in the figure until it almost rests on the damper of axis 3.</p> <p>DANGER</p> <p>Secure the weight of the lower arm properly before releasing the brakes of motor, axis 2! When releasing the holding brakes of the motor, the lower arm will be movable and may fall down!</p>  <p>xx0800000391</p> <p>The figure shows the IRB 4600 but the principle is the same for IRB 1520.</p>

Draining gearboxes

The table specifies if the oil needs to be drained from the gearboxes.



Note

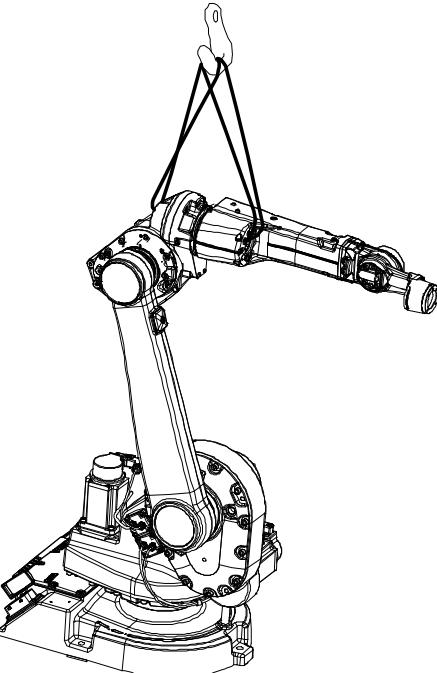
These recommendations are valid if the method how to position the robot described above, is followed.

Motor	Action
Axis 1 motor	Draining is not needed provided that the recommended procedure for removal is followed.
Axis 2 motor	Drain the axis 2 gearbox as described in Changing the oil, axis-2 gearbox on page 133 .

Continues on next page

Removing the axes 1 and 2 motors

Use this procedure to remove the axes 1 and 2 motors.

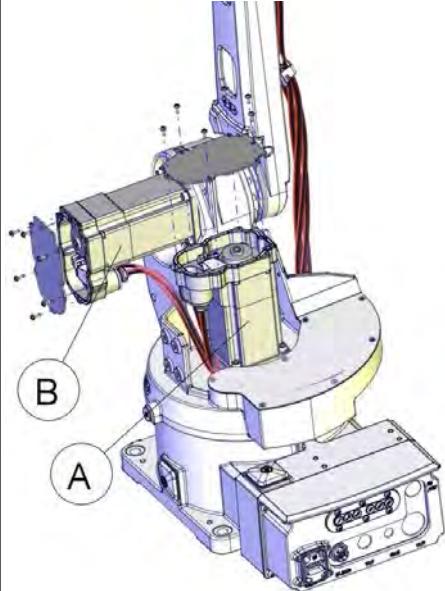
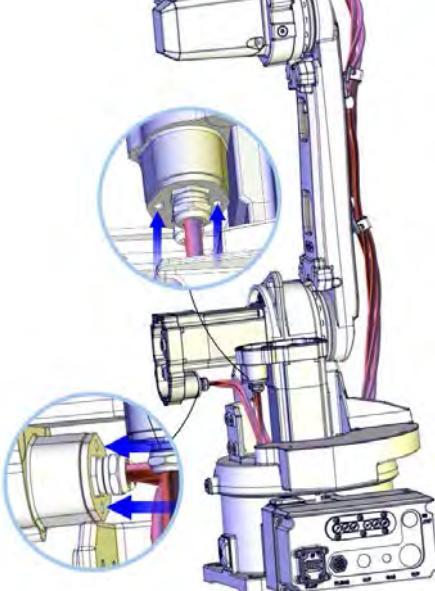
	Action	Note
1	Jog the robot to the position described above depending on which motor shall be replaced.	
2	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
3	 DANGER Secure the weight of the lower arm properly before releasing the brakes of motor, axis 2! When releasing the holding brakes of the motor, the lower arm will be movable and may fall down!	 xx0700000060
4	Only applicable to the axis 2 motor! DANGER See Changing the oil, axis-2 gearbox on page 133 . Drain the axis 2 gearbox.	

Continues on next page

4 Repair

4.6.1 Replacing motors on axis 1 and 2

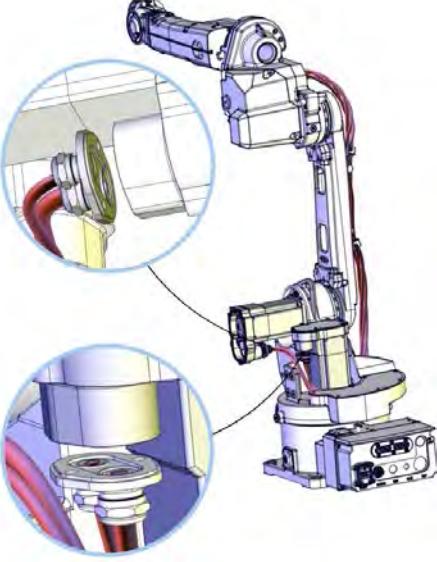
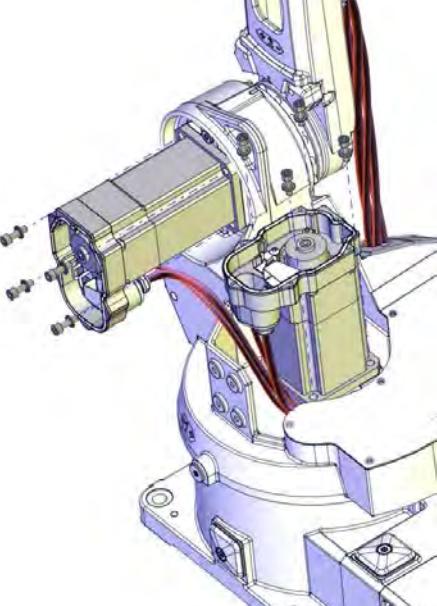
Continued

Action	Note
5 Remove the motor cover in order to reach the connectors.	 <p>xx1100000375</p> <ul style="list-style-type: none"> • A: Axis 1 motor • B: Axis 2 motor
6 Disconnect the connectors inside.	
7 Unscrew the attachment screws that holds the motor plate.	 <p>xx1100000376</p>

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4.6.1 Replacing motors on axis 1 and 2

Continued

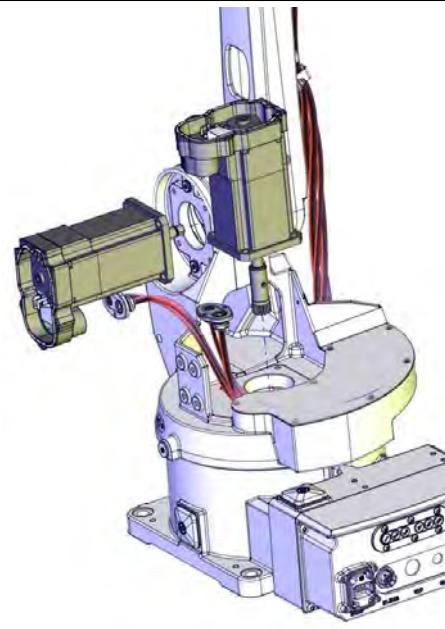
Action	Note
8 Pull carefully out the motor cables.	 xx1100000377
9 Remove the connection box.	
10 Unscrew the attachment screws securing the motor. Use a 300 mm extension for bits 1/2".	 xx1100000378
11 Only applicable to the axis 2 motor! Fit two guide pins in opposite holes.	

Continues on next page

4 Repair

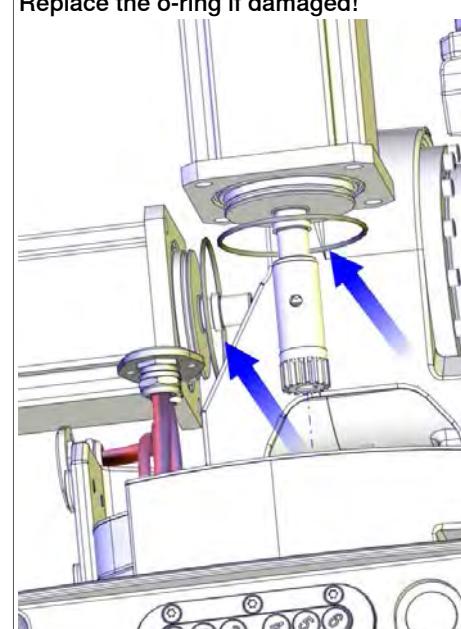
4.6.1 Replacing motors on axis 1 and 2

Continued

Action	Note
12 Remove the motor by lifting it out carefully, making sure the motor pinion is not damaged while moving it away from the gear.	 xx1100000379

Refitting the axes 1 and 2 motors

Use this procedure to refit the axes 1 and 2 motors.

Action	Note
1 Wipe clean all assembly surfaces!	
2 Only applicable to the axis 2 motor! Fit two guide pins in opposite holes.	
3 Make sure the o-ring on the circumference of the motor is seated properly.	Replace the o-ring if damaged!  xx1100000380

Continues on next page

4.6.1 Replacing motors on axis 1 and 2

Continued

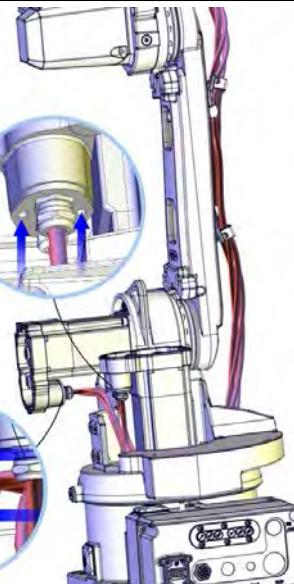
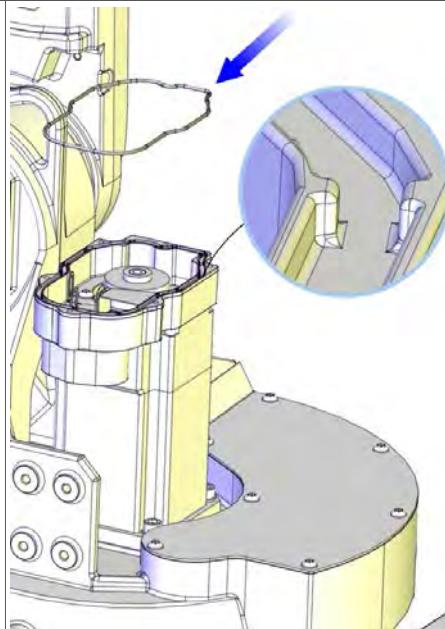
Action	Note
4 Lubricate the o-ring with grease.	
5 Only applicable to the axis 2 motor! Place the motor on the guide pins.	
6 Fit the motor carefully, making sure the pinion is properly mated to the gears.	
7 Fit the connection box with its attachment screws.	
8 Secure the motor with its attachment screws. Use a 300 mm extension for bits 1/2". Tightening torque axis 1 motor: 20 Nm Tightening torque axis 2 motor: 20 Nm	<p>xx1100000375</p> <ul style="list-style-type: none"> A: Axis 1 motor B: Axis 2 motor
9 Carefully insert the motor cables through the connection box of the motor.	<p>xx1100000377</p>

Continues on next page

4 Repair

4.6.1 Replacing motors on axis 1 and 2

Continued

Action	Note
10 Refit the motor plate to the connection box.	 xx1100000376
11 Connect all connectors.	
12 Check the o-ring on the motor cover. Replace if damaged!	 xx1100000285
13 Only applicable to the axis 2 motor! Perform a leak-down test of the axis 2 gearbox!	See Performing a leak-down test on page 154 .
14 Only applicable to the axis 2 motor! Refill the axis 2 gearbox with oil.	See Changing the oil, axis-2 gearbox on page 133 .
15 Refit the motor cover.	

Continues on next page

4.6.1 Replacing motors on axis 1 and 2

Continued

	Action	Note
16	Recalibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section <i>Calibration information on page 291</i> .
17	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in section <i>DANGER - First test run may cause injury or damage! on page 47</i> .	

4.6.2 Replacing motors on axes 3 and 4

4.6.2 Replacing motors on axes 3 and 4

Introduction

This section describes how to replace motors on axes 3 and 4.

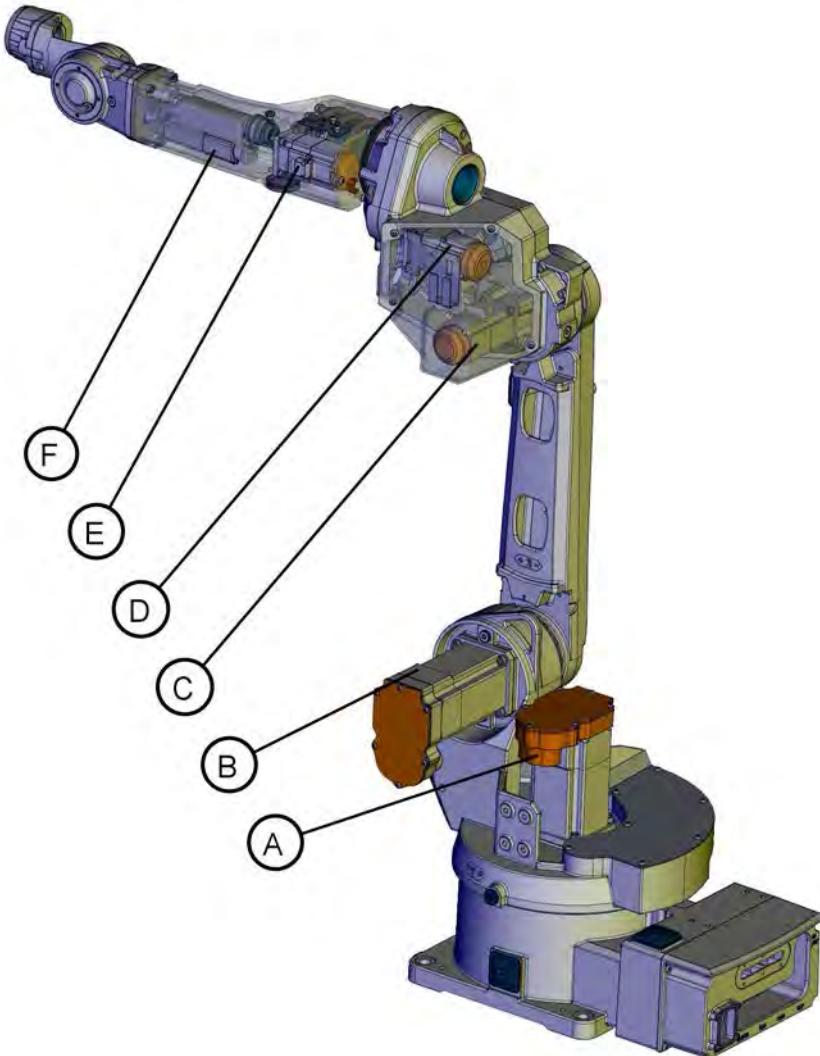
How to replace motors on axes 1 and 2 see section [Replacing motors on axis 1 and 2 on page 246](#).

How to replace the motor on axis 5 see section [Replacing motor on axis 5 on page 263](#).

How to replace the motor on axis 6 see section [Replacing the axis 6 motor on page 267](#).

Location of motors on axes 3 and 4

The motors are located as shown in the figure.



xx1100000282

Continues on next page

A	Axis 1 motor
B	Axis 2 motor
C	Axis 3 motor
D	Axis 4 motor
E	Axis 5 motor
F	Axis 6 motor

Required equipment

Equipment	Art. no.	Note
Motor	See Spare parts on page 315 .	
O-ring, motor	See Spare parts on page 315 .	
Standard toolkit	-	Content is defined in section Standard tools on page 312 .
Special tools	-	Content is defined in section Special tools on page 313 .
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.

Position of robot

Place the robot in the position recommended in order to facilitate replacing of motors.



DANGER

Secure the arm system before removing any motor! The brake is located in the motor and is therefore released when the motor is removed!

Motor	Position
Axis 3 motor	Jog the upper arm to a vertical position with the wrist pointing at the floor after the oil is drained.
Axis 4 motor	Jog the upper arm to a vertical position with the wrist pointing at the floor.

Draining gearboxes

The table specifies if the oil needs to be drained from the gearboxes.



Note

These recommendations are valid if the method how to position the robot described above, is followed.

Continues on next page

4 Repair

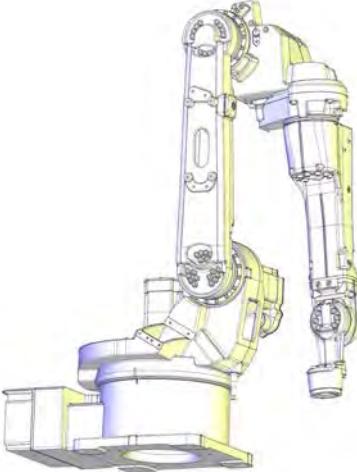
4.6.2 Replacing motors on axes 3 and 4

Continued

Motor	Action
Axis 3 motor	Drain the axis 3 gearbox as described in Changing the oil, axis-3 gearbox on page 137 .
Axis 4 motor	Draining is not needed provided that the recommended procedure for removal is followed.

Removing the axes 3 and 4 motors

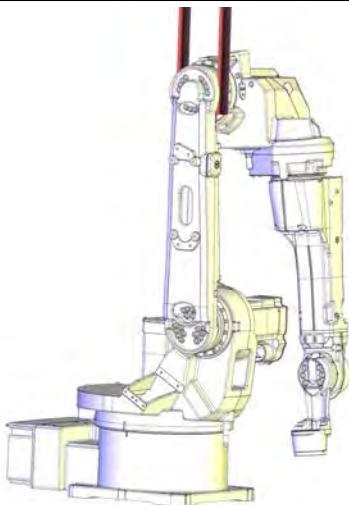
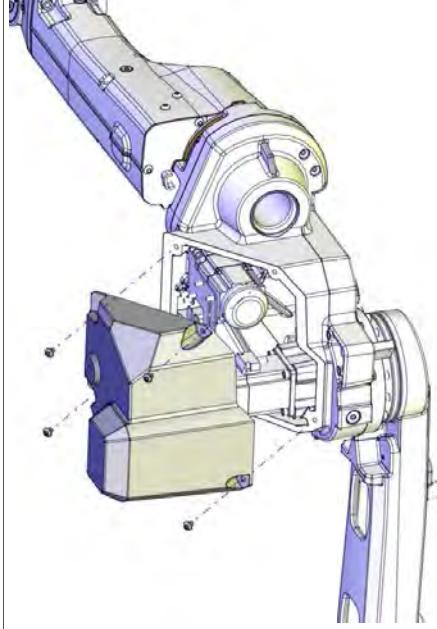
Use this procedure to remove the axes 3 and 4 motors.

	Action	Note
1	Only applicable to the axis 3 motor! Drain the oil from the gearbox.	Drain the axis 3 gearbox as described in Changing the oil, axis-3 gearbox on page 137 .
2	Jog the upper arm to vertical position with the wrist pointing at the floor.	 xx1100000439
3	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	

Continues on next page

4.6.2 Replacing motors on axes 3 and 4

Continued

Action	Note
4  DANGER Secure the arm system before removing any motor! The brake is located in the motor and is therefore released when the motor is removed!	 xx1100000442
5 Remove the armhouse cover.	 xx1100000349
6 Remove the strap and disconnect the motor connectors.	
7 Unscrew the attachment screws securing the motor. Use a 300 mm extension for bits 3/8".	
8 Remove the motor by lifting it carefully straight out, making sure the motor pinion is not damaged while moving it away from the gear.	

Continues on next page

4 Repair

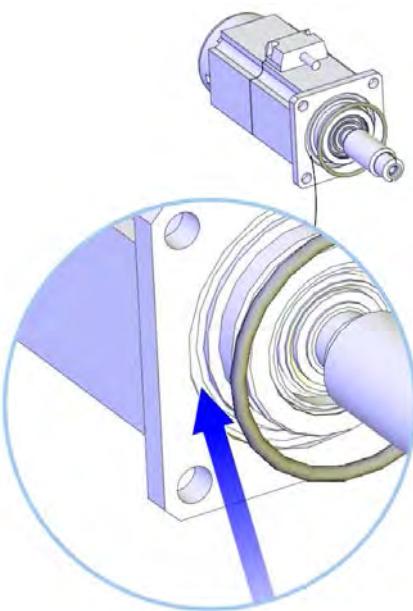
4.6.2 Replacing motors on axes 3 and 4

Continued

Refitting the axes 3 and 4 motors

Use this procedure to refit the axes 3 and 4 motors.

Preparations

Action	Note
1 Wipe clean all assembly surfaces with isopropanol.	
2 Make sure that motor pinion is not damaged or scratched.	
3 Make sure the o-ring on the circumference of the motor is seated properly. Replace if damaged!	
4 Lubricate the o-ring with grease.	

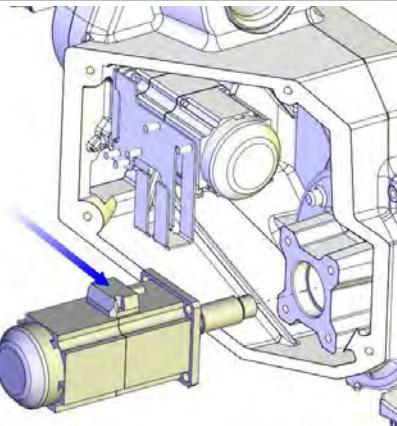
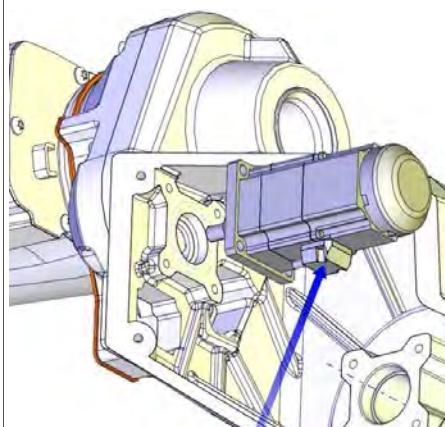
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4.6.2 Replacing motors on axes 3 and 4

Continued

Refitting the axes 3 and 4 motors

Use this procedure to refit the axes 3 and 4 motors.

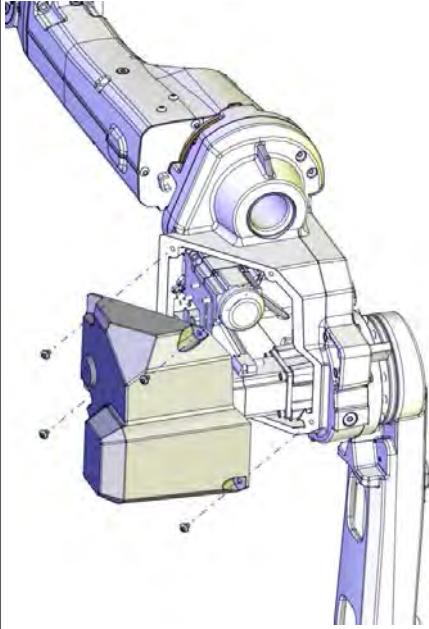
Action	Note
1 Make sure the motor is turned the correct way, that is that the cable inlet is positioned as shown in the figures.	 xx1100000497
	 xx1100000498
2 Place the motor carefully in its mounting position, making sure the motor pinion is properly mated to the gear.	
3 Secure the motor with its attachment screws and plain washers. Use a 300 mm extension for bits 3/8".	Tightening torque motor axis 3: 8 Nm. M6x25 (4 pcs) Tightening torque motor axis 4: 10 Nm. M6x20 (4 pcs)
4 Reconnect the connectors.	
5 Refit the cables inside the armhouse.	
6 Only applicable to the axis 3 motor! Perform a leak-down test of the axis 3 gearbox!	See Performing a leak-down test on page 154 .
7 Only applicable to the axis 3 motor! Refill the axis 3 gearbox with oil.	See Changing the oil, axis-3 gearbox on page 137 .

Continues on next page

4 Repair

4.6.2 Replacing motors on axes 3 and 4

Continued

Action	Note
8 Refit the armhouse cover. Tightening torque: 14 Nm.	 xx1100000349
9 Recalibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section Calibration information on page 291 .
10  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in section DANGER - First test run may cause injury or damage! on page 47 .	

4.6.3 Replacing motor on axis 5

Introduction

This section describes how to replace motor on axis 5.

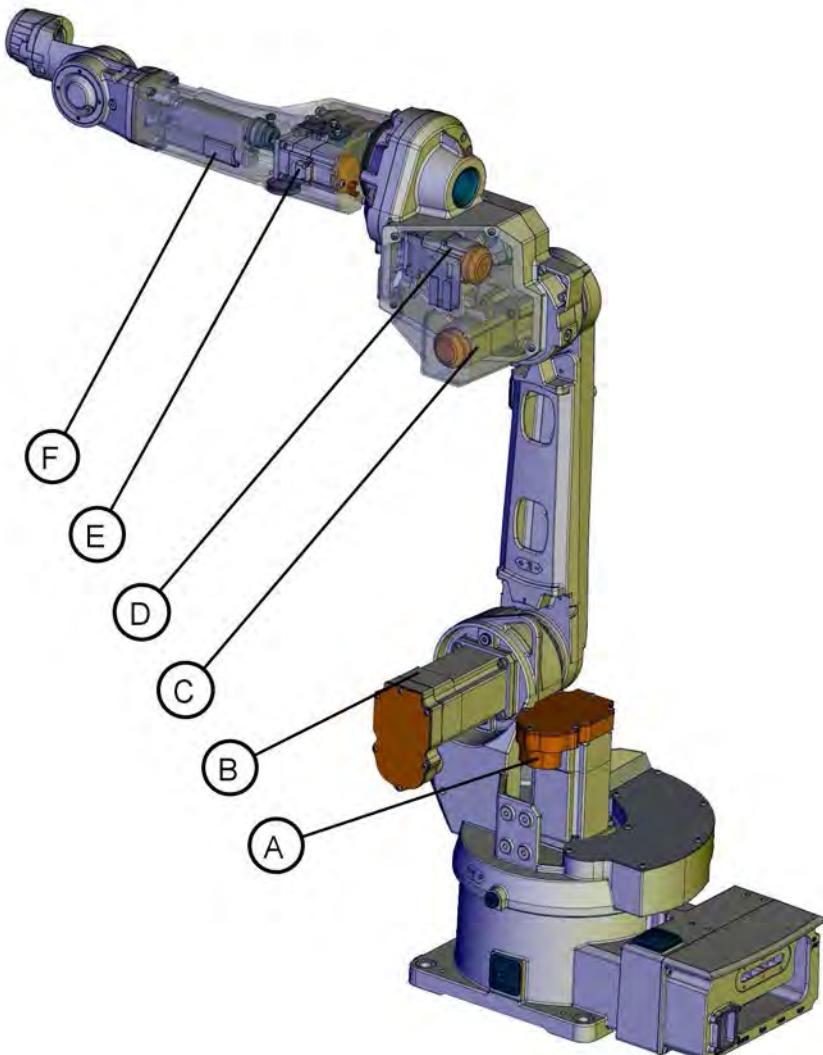
How to replace the motors on axes 1 and 2 see section [Replacing motors on axis 1 and 2 on page 246](#).

How to replace the motors on axes 3 and 4 see section [on page ?](#).

How to replace the motor on axis 6 see section [Replacing the axis 6 motor on page 267](#).

Location of the axis 5 motor

The motors are located as shown in the figure.



xx1100000282

A	Axis 1 motor
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Continues on next page

4 Repair

4.6.3 Replacing motor on axis 5

Continued

B	Axis 2 motor
C	Axis 3 motor
D	Axis 4 motor
E	Axis 5 motor
F	Axis 6 motor

Required equipment

Equipment	Art. no.	Note
Motor	See Spare parts on page 315 .	
O-ring, motor	See Spare parts on page 315 .	
Standard toolkit	-	Content is defined in section Standard tools on page 312 .
Special toolkit	-	Content is defined in section Special tools on page 313 .
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.

Position of robot

Place the robot in the position recommended in order to facilitate replacing of motors.

Motor	Position
Axis 5 motor	Jog the upper arm to a vertical position with the wrist pointing at the floor.

Draining gearbox

The table specifies if the oil needs to be drained from the gearbox.



Note

These recommendations are valid if the method how to position the robot described above, is followed.

Motor	Action
Axis 5 motor	Draining is not needed provided that the recommended procedure for removal is followed.

Removing the axis 5 motor

Use this procedure to remove the axis 5 motor.

	Action	Note
1	Jog the robot to the recommended position.	

Continues on next page

Action	Note
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
3 Remove the cables to the motor.	The armtube (with the wrist fitted) need to be opened as described in Replacing the cable harness - upper end on page 179 .
4 Unscrew the attachment screws securing the motor.	
5 Remove the motor by lifting it out carefully, making sure the motor pinion or gear are not damaged while lifting it away.	

Refitting the axis 5 motor

Use this procedure to refit the axis 5 motor.

Preparations

Action	Note
1 Wipe clean all assembly surfaces.	
2 Make sure that the pinion is not damaged or scratched.	
3 Make sure that the o-ring on the circumference is seated properly. Replace if damaged!	
4 Lubricate the o-ring with some grease.	
5 Make sure that the motor will be fitted in the correct position.	

Refitting the axis 5 motor

Action	Note
1 Place the motor carefully in its mounting position.	
2 Secure the motor with its attachment screws.	Tightening torque: 10 Nm.
3 Refit the cables to the axis 5 motor.	Follow the instructions in section Replacing the cable harness - upper end on page 179 in order to refit cables and arm tube.
4 Recalibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section Calibration information on page 291 .

Continues on next page

4 Repair

4.6.3 Replacing motor on axis 5

Continued

	Action	Note
5	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in section <i>DANGER - First test run may cause injury or damage! on page 47.</i>	

4.6.4 Replacing the axis 6 motor

Introduction

This section describes how to replace motor on axis 6.

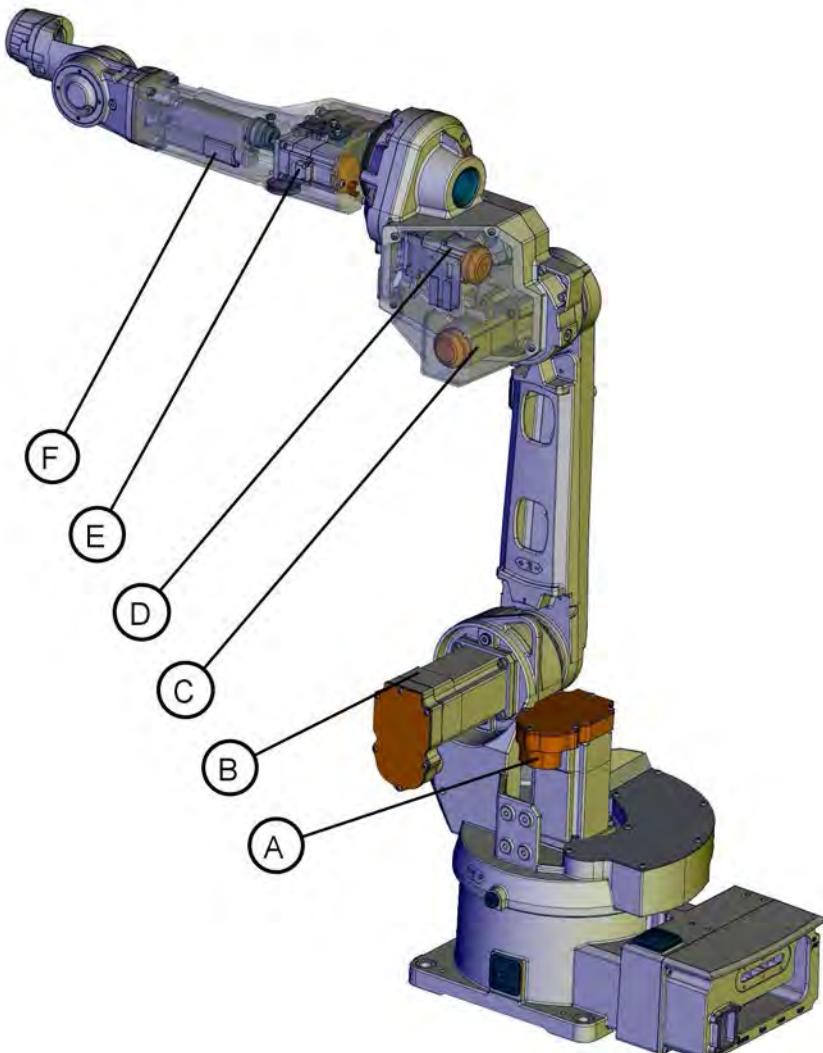
How to replace the motors on axes 1 and 2 see section [Replacing motors on axis 1 and 2 on page 246](#).

How to replace the motors on axes 3 and 4 see section [on page ?](#).

How to replace the motor on axis 5 see section [Replacing the axis 6 motor on page 267](#).

Location of the axis 6 motor

The motors are located as shown in the figure.



xx1100000282

A	Axis 1 motor
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Continues on next page

4 Repair

4.6.4 Replacing the axis 6 motor

Continued

B	Axis 2 motor
C	Axis 3 motor
D	Axis 4 motor
E	Axis 5 motor
F	Axis 6 motor

Required equipment

Equipment	Art. no.	Note
Motor	See Spare parts on page 315 .	
Standard toolkit	-	Content is defined in section Standard tools on page 312 .
Special toolkit	-	Content is defined in section Special tools on page 313 .
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.

Position of robot

Place the robot in the position recommended in order to facilitate replacing of motors.

Motor	Position
Axis 6 motor	Jog the robot to the calibration position.

Draining gearbox

The table specifies if the oil needs to be drained from the gearboxes.

	Note
These recommendations are valid if the method how to position the robot described above, is followed.	

Motor	Action
Axis 6 motor	Draining is not needed provided that the recommended procedure for removal is followed.

Releasing the brakes

Connect the 24 VDC power supply for brake release to R1.MP.

Connect to pins:

	Pin
0V	Pin 12
24V	Pin 13

Continues on next page

Removing the axis 6 motor

Use this procedure to remove the axis 6 motor.

	Action	Note
1	Jog the robot to the recommended position.	
2	 DANGER Turn off all: <ul style="list-style-type: none"> • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
3	Remove the wrist.	See Replacing the wrist unit, IRB 1600ID-4/1.5 on page 212 .
4	Move the wrist to a workbench and place it with the axis 6 motor pointing upwards.	Placing the wrist in this position will make it possible to replace the motor without draining the oil from the gearbox.
5	In order to release the brakes connect the 24VDC power supply to the motor.	
6	 Note Do not move the gears in the wrist when the motor is removed! When refitting the motor the gears in the wrist shall be in the same position as they were before the removal.	
7	Open the flexible coupling securing the motor.	
8	 Note Do not remove the attachment screws securing the bracket!	
9	Remove the motor by lifting it out carefully, making sure the motor pinion or gear are not damaged while lifting it away.	

Refitting the axis 6 motor

Use this procedure to refit the axis 6 motor.

Preparations

	Action	Note
1	Wipe clean all assembly surfaces.	
2	Make sure that the pinion is not damaged or scratched.	

Continues on next page

4 Repair

4.6.4 Replacing the axis 6 motor

Continued

Action	Note
3 Make sure that the o-ring on the circumference is seated properly. Replace if damaged!	
4 Lubricate the o-ring with some grease.	
5 Make sure that the motor will be fitted in the correct position.	

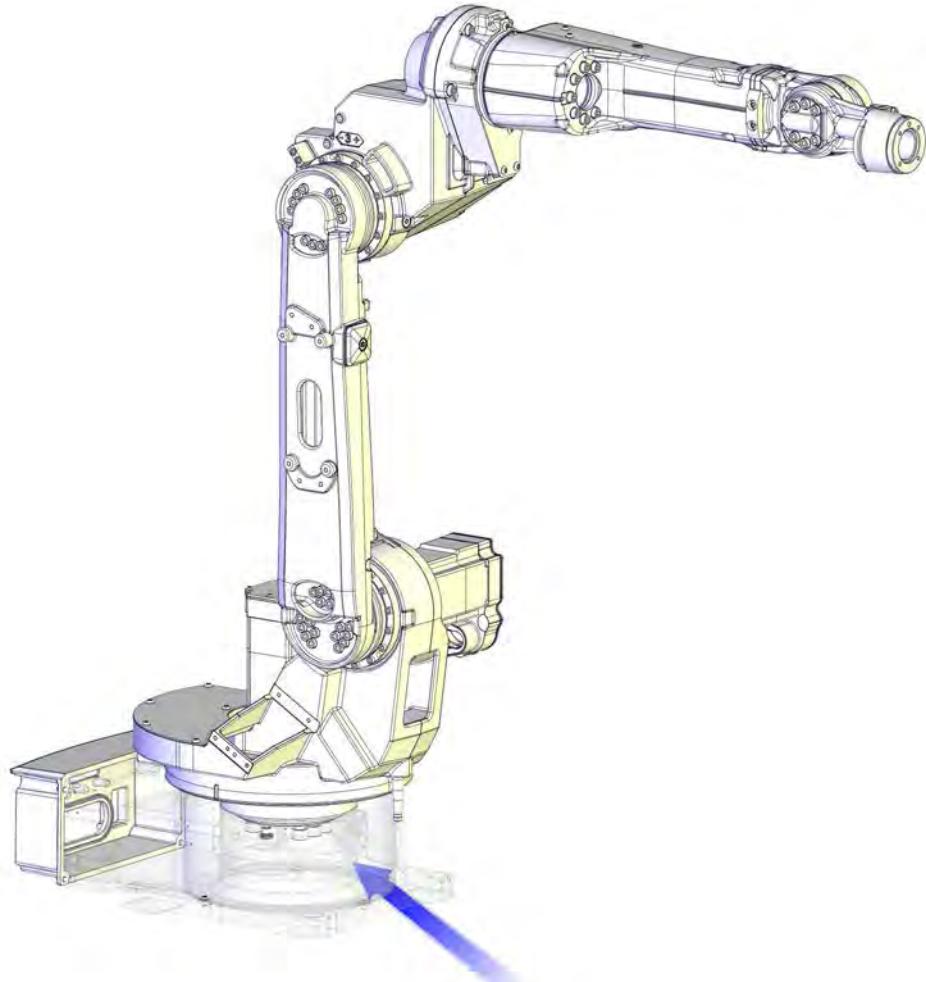
Refitting the axis 6 motor

Action	Note
1 Place the motor carefully in its mounting position with the wrist still placed on a work-bench.  Note Do not move the gears in the wrist when the motor is removed! When refitting the motor the gears in the wrist shall be in the same position as they were before the removal.	
2 In order to release the brakes connect the 24VDC power supply to the motor.	
3 Secure the motor with its attachment screws.	Tightening torque: 6 Nm M5x25
4 Refit the flexible coupling securing the axes 6 motor to the rod.	
5 Refit the wrist.	See Replacing the wrist unit, IRB 1600ID-4/1.5 on page 212 .
6 Recalibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section Calibration information on page 291 .
7  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in section DANGER - First test run may cause injury or damage! on page 47 .	

4.7 Gearboxes

4.7.1 Replacing the axis 1 gearbox

Location of axis 1 gearbox



xx1100000383

Required equipment

Equipment	Art. no.	Note
Gearbox, axis 1	See Spare parts on page 315 .	
O-rings	See Spare parts on page 315 .	
Base	See Spare parts on page 315 .	
Guide pins	3HAC15520-1	M8 x 100 Always use guide pins in pairs!
Lifting accessories	-	
Standard toolkit	-	Content is defined in section Standard tools on page 312 .

Continues on next page

4 Repair

4.7.1 Replacing the axis 1 gearbox

Continued

Equipment	Art. no.	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.

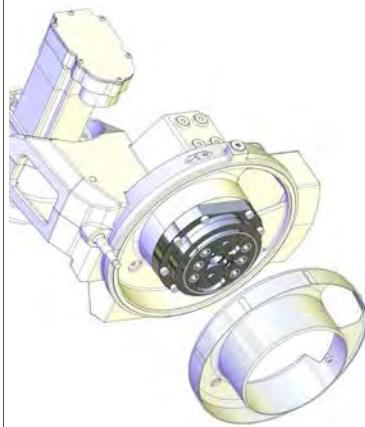
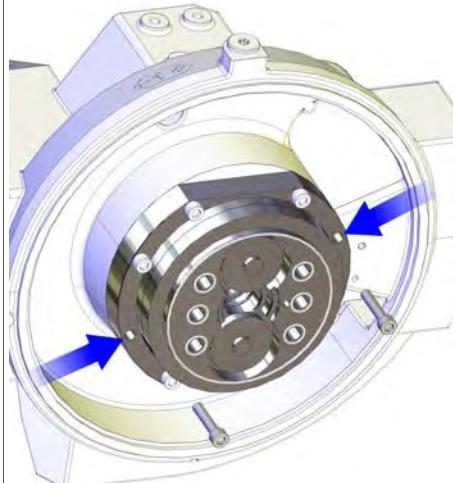
Removing the axis 1 gearbox

Use this procedure to remove the axis 1 gearbox from the base.

	Action	Note
1	Jog the robot to the calibration position.	
2	Drain the gearbox.	See Changing the oil, axis 1 gearbox on page 128 .
3	 DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
4	 CAUTION The IRB 1520 robot weighs 170 kg. All lifting accessories used must be sized accordingly!	
5	Remove the base.  Note The referred instructions for how to replace the base includes how to put the robot in a position best suited to facilitate the removal of base and axis 1 gearbox.	See Replacing the base on page 225 .

Continues on next page

4.7.1 Replacing the axis 1 gearbox
Continued

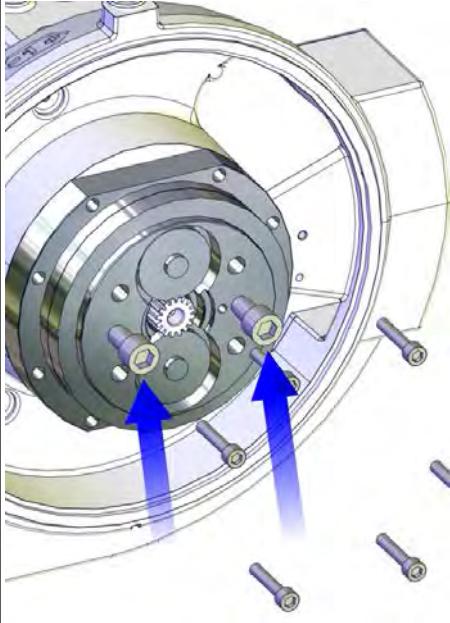
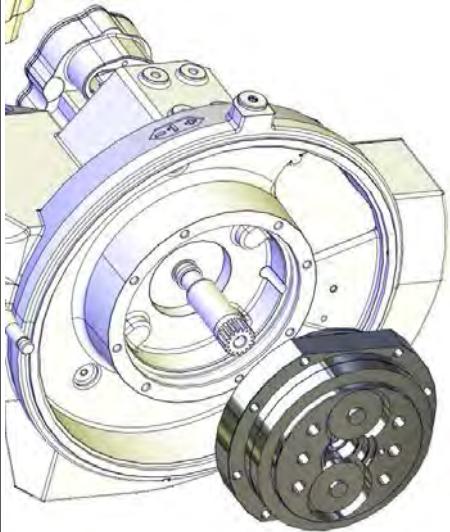
Action	Note
6 Unscrew the attachment screws holding the frame cable protection and remove it.	 xx1100000435
7 Unscrew two attachment screws securing the gearbox and fit two guide pins in opposite holes.	Guide pins are specified in Required equipment on page 271 .  xx1100000450 Always use guide pins in pairs!
8 Unscrew the remaining attachment screws securing the gearbox.	

Continues on next page

4 Repair

4.7.1 Replacing the axis 1 gearbox

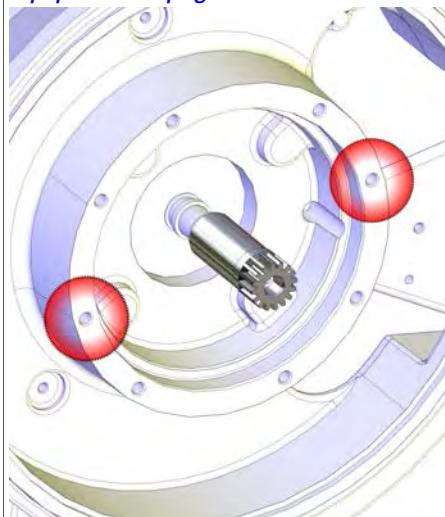
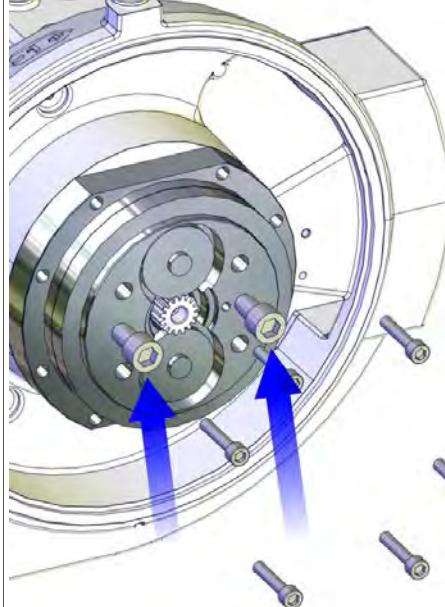
Continued

Action	Note
9 Apply two of the M14 screws.	 xx1100000451
 CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	
10 Remove the gearbox carefully in order not to damage the motor pinion.	 xx1100000452

Continues on next page

Refitting the axis 1 gearbox

Use this procedure to refit the axis 1 gearbox.

Action	Note
1 Wipe all contact surfaces clean on the gearbox and on the robot with isopropanol.	
2 Fit two guide pins in opposite holes in the frame.	Guide pins are specified in <i>Required equipment on page 271</i> . 
3 Fit two M14 screws diagonally in the gearbox screw holes, to be used as handles.	
4  CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	

Continues on next page

4 Repair

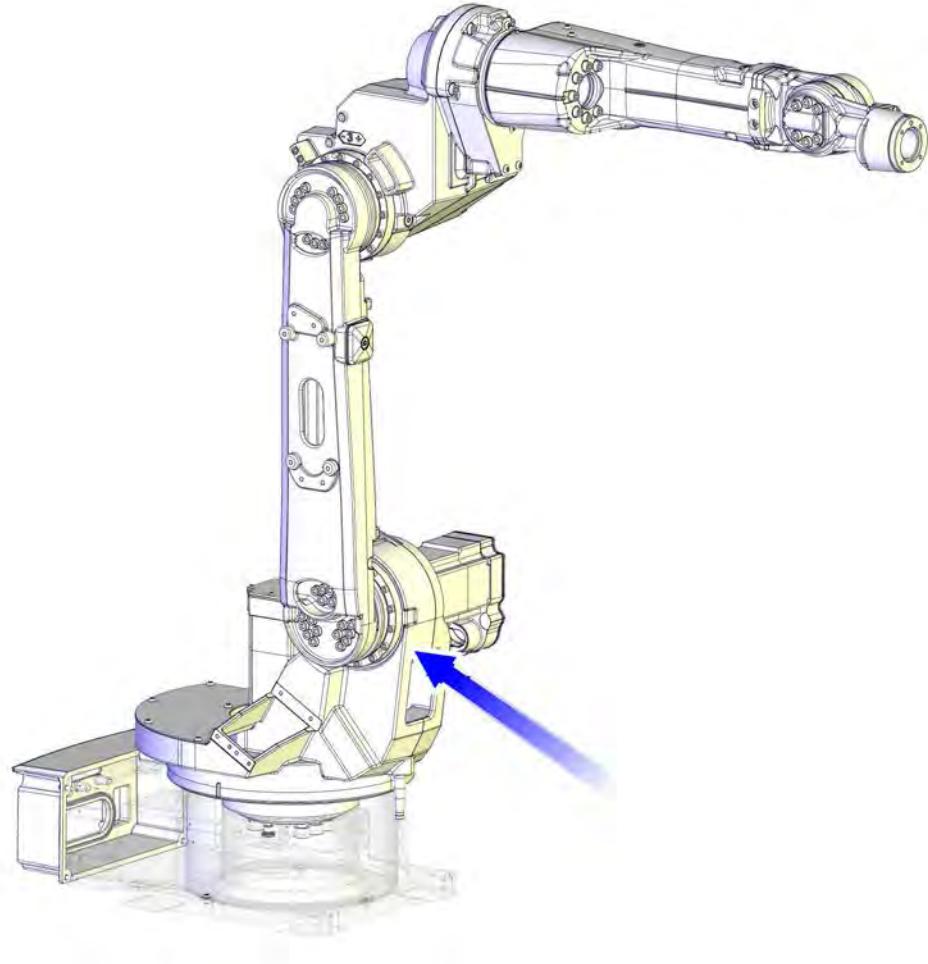
4.7.1 Replacing the axis 1 gearbox

Continued

	Action	Note
5	Slide the gearbox on the guide pins into position in the frame.	
6	Secure the gearbox with six of the attachment screws.	Tightening torque: 34 Nm M8x40
7	Remove the guide pins and the two M14 screws.	
8	Fit the two remaining attachment screws securing the gearbox.	Tightening torque: 34 Nm M8x40
9	Refit the base.	See Replacing the base on page 225 .
10	Perform a leak-down test.	See Performing a leak-down test on page 154 .
11	Refill gearbox with oil.	See Changing the oil, axis 1 gearbox on page 128 .
12	Recalibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section Calibration information on page 291 .
13	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in section DANGER - First test run may cause injury or damage! on page 47 .	

4.7.2 Replacing the axis 2 gearbox

Location of axis 2 gearbox



xx1100000384

Required equipment

Equipment	Art. no.	Note
Gearbox, axis 2	See Spare parts on page 315 .	
Lifting accessories		
Standard toolkit	-	Content is defined in section Standard tools on page 312 .
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

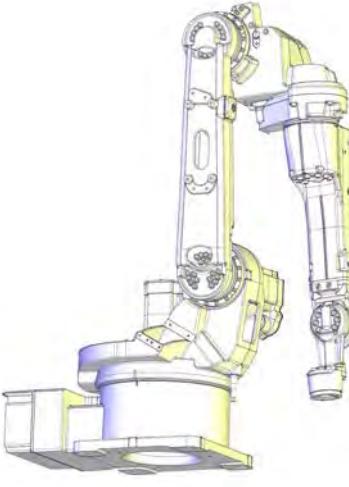
4 Repair

4.7.2 Replacing the axis 2 gearbox

Continued

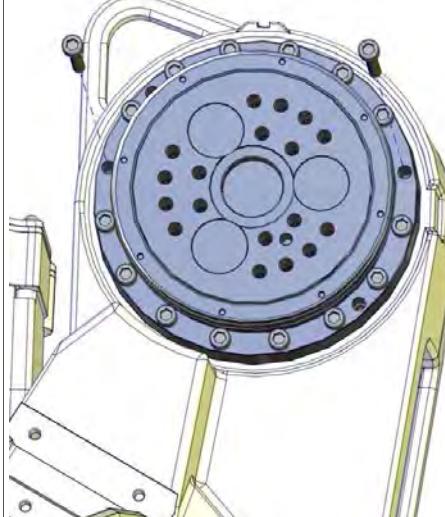
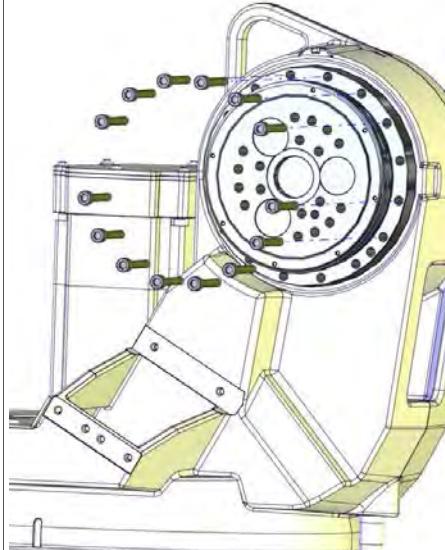
Removing the axis 2 gearbox

Use this procedure to remove the axis 2 gearbox.

Action	Note
1 Jog the robot to the position shown in the figure.	 xx1100000439
2  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
3 Drain the axis 2 gearbox of oil.	See Changing the oil, axis-2 gearbox on page 133 .
4  CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	
5 Remove the axis 2 motor.	See Removing the axes 1 and 2 motors on page 249 .
6 Remove the cable harness from base and frame.	See Replacing the cable harness - lower end on page 159 .
7 Remove the complete arm system.	See Replacing the complete arm system on page 195 .

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4.7.2 Replacing the axis 2 gearbox
Continued

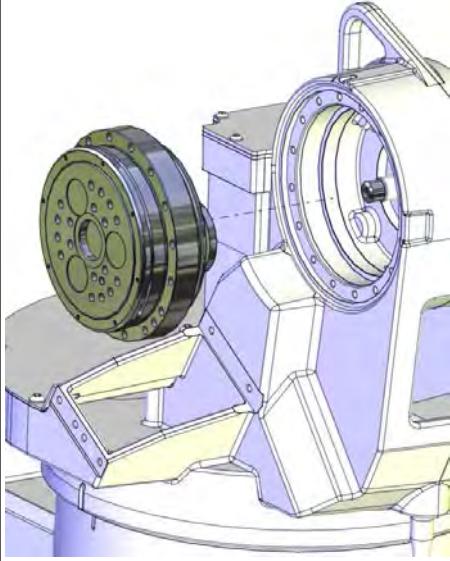
Action	Note
8 Remove two attachment screws and fit two guide pins in opposite holes.	 xx1100000455
9 Unscrew the remaining attachment screws securing the gearbox.	 xx1100000456
10 If needed use the threaded holes on the gearbox and press out the gearbox.	

Continues on next page

4 Repair

4.7.2 Replacing the axis 2 gearbox

Continued

Action	Note
11 Slide the gearbox out on the guide pins and remove it.	 xx1100000457

Refitting the axis 2 gearbox

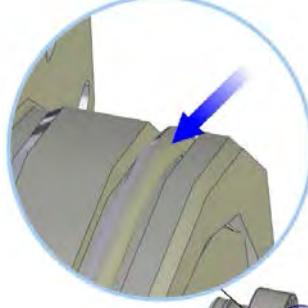
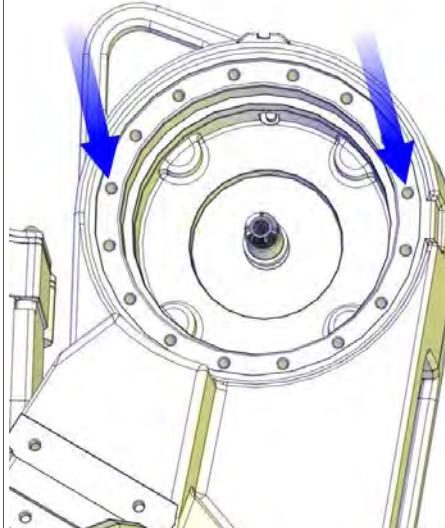
Use this procedure to refit the axis 2 gearbox.

Action	Note
1 Wipe all contact surfaces clean on gearbox and robot.	
2 Check the cable protection.	 xx1100000459

Continues on next page

4.7.2 Replacing the axis 2 gearbox

Continued

Action	Note
3 Check the o-ring. Replace if damaged!	  xx1100000458
4 Put some grease on the o-ring.	
5 Fit two guide pins in opposite holes.	 xx1100000460 <p>Always use guide pins in pairs!</p>
6 Put the gearbox on the guide pins and slide it in position.	
7 Secure the gearbox with its attachment screws.	Tightening torque: 17 Nm. M6x40 (16 pcs)
8 Remove the guide pins and fit the two remaining attachments screws.	Tightening torque: 17 Nm.

Continues on next page

4 Repair

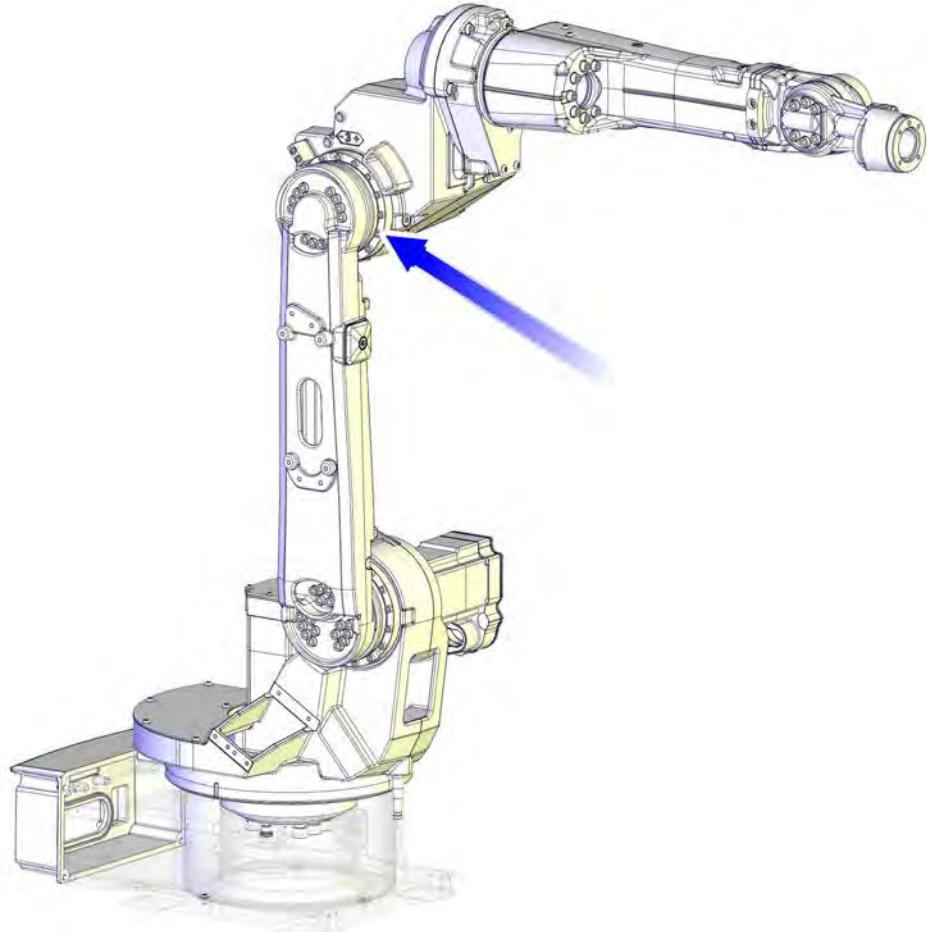
4.7.2 Replacing the axis 2 gearbox

Continued

	Action	Note
9	Refit the complete arm system.	See <i>Replacing the complete arm system on page 195</i> .
10	 CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	
11	Refit the axis 2 motor. Mate pinion and gear carefully.	See <i>Replacing motors on axis 1 and 2 on page 246</i> .
12	Refit the cable harness in the base and frame.	See <i>Replacing the cable harness - lower end on page 159</i> .
13	Perform a leak-down test.	See <i>Performing a leak-down test on page 154</i> .
14	Refill oil in the gearbox.	See <i>Changing the oil, axis-2 gearbox on page 133</i> .
15	Recalibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section <i>Calibration information on page 291</i> .
16	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in section <i>DANGER - First test run may cause injury or damage! on page 47</i> .	

4.7.3 Replacing the axis 3 gearbox

Location of axis 3 gearbox



xx1100000385

Required equipment

Equipment	Art. no.	Note
Gearbox, axis 3	See Spare parts on page 315 .	
Lifting accessories		
Standard toolkit	-	Content is defined in section Standard tools on page 312 .
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

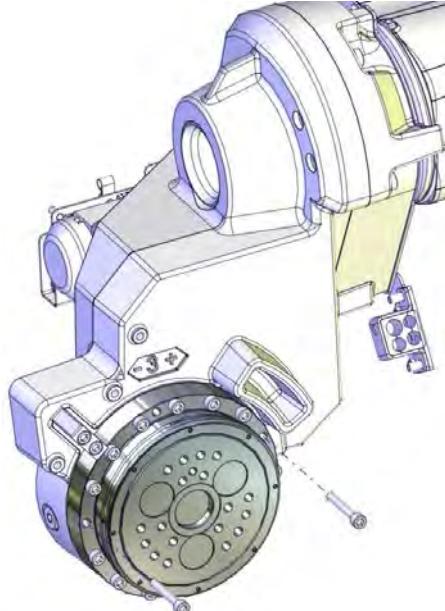
4 Repair

4.7.3 Replacing the axis 3 gearbox

Continued

Removing the axis 3 gearbox

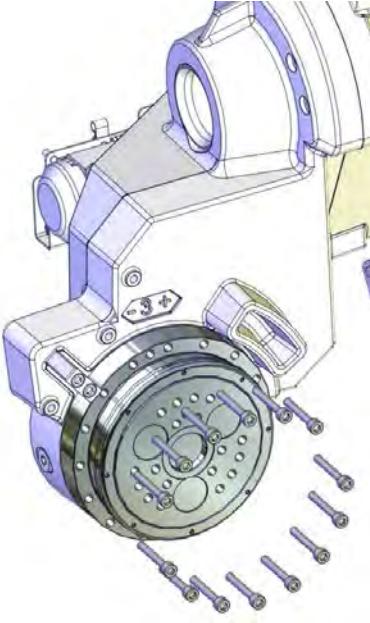
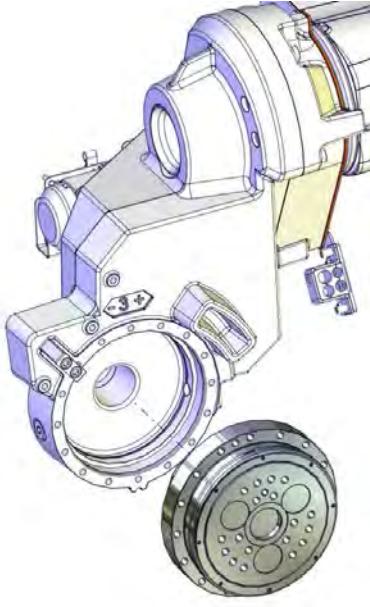
Use this procedure to remove the axis 3 gearbox.

Action	Note
1 Drain the axis 3 gearbox from oil.	See Changing the oil, axis-3 gearbox on page 137 .
2 Jog the robot to the synchronization position.	
3  DANGER Turn off all: <ul style="list-style-type: none">• electric power supply• hydraulic pressure supply• air pressure supply to the robot, before entering the robot working area.	
4  CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	
5 Remove the axis 3 motor.	See on page ? .
6 Remove the cable harness in the upper arm.	See Replacing the cable harness - upper end on page 179 .
7 Remove the complete upper arm.	See Replacing the complete upper arm ID on page 200 .
8 Place the complete upper arm on a work-bench, some pallets or similar.	
9 Remove two of the attachment screws and fit two guide pins in opposite holes.	 xx1100000463 Always use guide pins in pairs.

Continues on next page

4.7.3 Replacing the axis 3 gearbox

Continued

Action	Note
10 Unscrew the remaining attachment screws securing the gearbox.	 xx1100000464
11 If needed use the threaded holes on the gearbox and press out the gearbox.	
12 Slide the gearbox out on the guide pins and remove it.	 xx1100000465

Refitting the axis 3 gearbox

Use this procedure to refit the axis 3 gearbox.

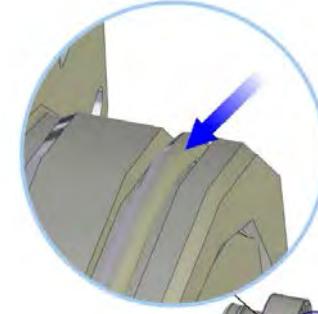
Action	Note
1 Wipe clean all mating surfaces on lower arm and frame with isopropanol.	

Continues on next page

4 Repair

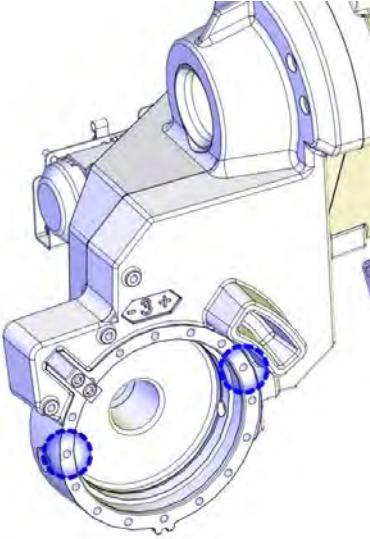
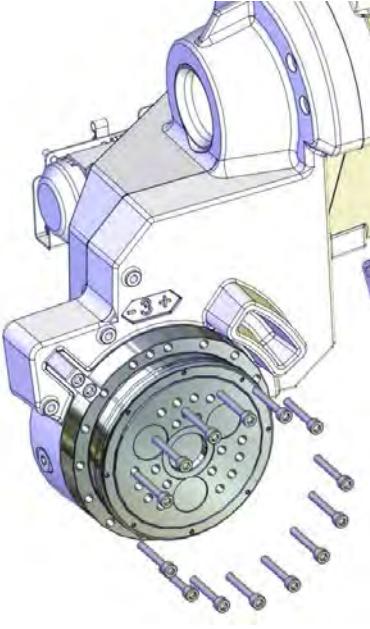
4.7.3 Replacing the axis 3 gearbox

Continued

Action	Note
2 Check the protection ring.	 xx1100000459
3 Check the o-ring. Replace if damaged!	  xx1100000458
4 Put some grease on the o-ring.	

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4.7.3 Replacing the axis 3 gearbox
Continued

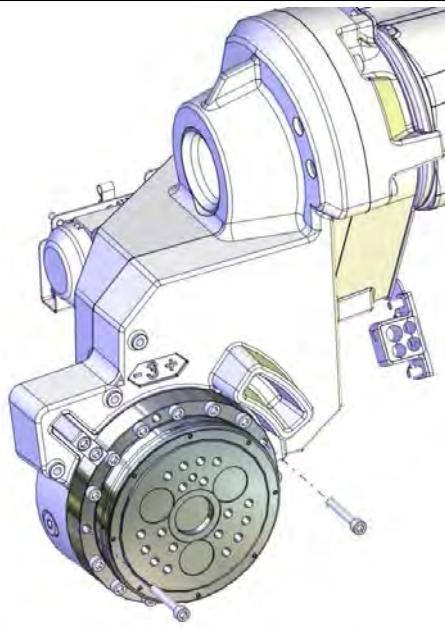
Action	Note
5 Fit two guide pins in opposite holes for attachment screws.	 xx1100000466
6 Place the gearbox on the guide pins and slide it in position.	
7 Secure the gearbox with its attachment screws.	 xx1100000464 <p>Tightening torque: 14 Nm. M6x40 (16 pcs)</p>

Continues on next page

4 Repair

4.7.3 Replacing the axis 3 gearbox

Continued

Action	Note
8 Remove the guide pins and fit the two remaining attachment screws.	 xx1100000463 Tightening torque: 14 Nm. M6x40
9 Refit the complete upper arm.	See Replacing the complete upper arm ID on page 200 .
10  CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	
11 Refit the axis 3 motor. Mate pinion and gear carefully!	See on page ? .
12 Refit the cable harness.	See Replacing the cable harness - upper end on page 179 .
13 Perform a leak-down test.	See Performing a leak-down test on page 154 .
14 Refill the gearbox with oil.	See Changing the oil, axis-3 gearbox on page 137 .
15 Recalibrate the robot.	Calibration is described in a separate calibration manual enclosed with the calibration tools. General calibration information is included in section Calibration information on page 291 .

Continues on next page

	Action	Note
16	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in section <i>DANGER - First test run may cause injury or damage! on page 47.</i>	

4.7.4 Service work on axes 4, 5 and 6 gearboxes

4.7.4 Service work on axes 4, 5 and 6 gearboxes

Replacing of gearboxes

The gearboxes of axes 4, 5 and 6 are intended to run without requiring any repairs or maintenance work. This implies that they must under *no circumstances* be opened or serviced.

If the gearboxes require replacement:

- axis 4: the complete upper arm is to be replaced. This procedure is detailed in section [Replacing the complete upper arm ID on page 200](#).
- axes 5 and 6: the complete wrist unit is to be replaced. This procedure is detailed in section [Replacing the wrist unit, IRB 1600ID-4/1.5 on page 212](#).

5 Calibration information

5.1 When to calibrate

When to calibrate

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

The resolver values are changed

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

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

The revolution counter memory is lost

If the revolution counter memory is lost, the counters must be updated. See [Updating revolution counters on page 296](#). This will occur when:

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

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

The robot is rebuilt

If the robot is rebuilt, for example, after a crash or when the reach ability of a robot is changed, it needs to be recalibrated for new resolver values.

5 Calibration information

5.2 Calibration methods

5.2 Calibration methods

Overview

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

Types of calibration

Type of calibration	Description	Calibration method
Standard calibration	<p>The calibrated robot is positioned at synchronization position, that is when the positions of the axes (angles) are set to 0°.</p> <p>Standard calibration data is found on the SMB (serial measurement board) in the robot.</p> <p>For robots with RobotWare 5.04 or older, the calibration data is delivered in a file, calib.cfg, supplied with the robot at delivery. The file identifies the correct resolver/motor position corresponding to the robot home position.</p>	Calibration Pendulum

Brief description of calibration methods

Calibration Pendulum method

Calibration Pendulum is a standard calibration method for calibration of all ABB robots (except IRB 6400R, IRB 640, IRB 1400H, and IRB 4400S).

Two different routines are available for the Calibration Pendulum method:

- Calibration Pendulum II
- Reference calibration

The calibration equipment for Calibration Pendulum is delivered as a complete toolkit, including the *Operating manual - Calibration Pendulum*, which describes the method and the different routines further.

References

Article numbers for the calibration tools are listed in the section [Special tools on page 313](#).

The calibration equipment for Calibration Pendulum is delivered as a complete toolkit, including the *Operating manual - Calibration Pendulum*, which describes the method and the different routines further.

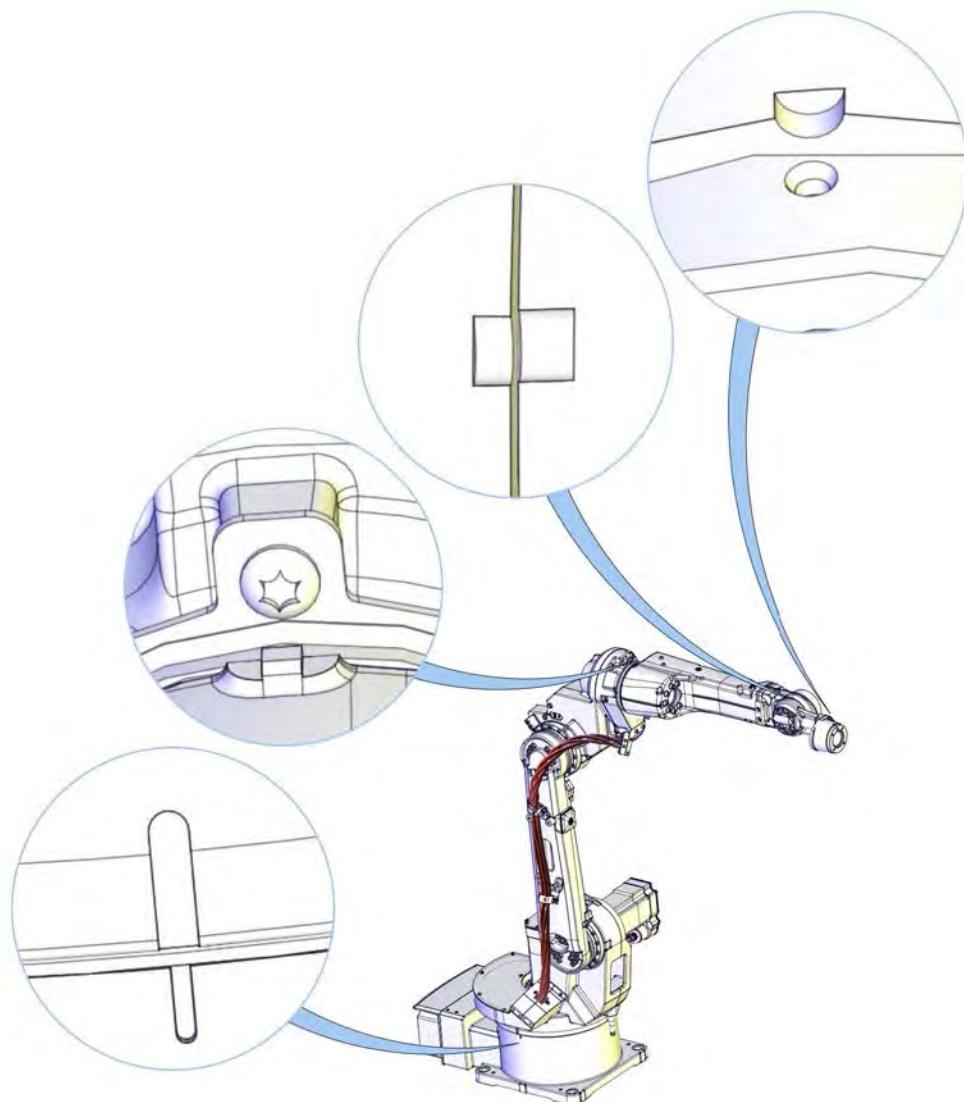
5.3 Synchronization marks and correct axis position

Introduction

This section specifies the synchronization mark positions and/or correct axis positions.

Synchronization marks, IRB 1520ID

The illustrations shows the position of the calibration marks on all axes of the robot.



xx1100000363

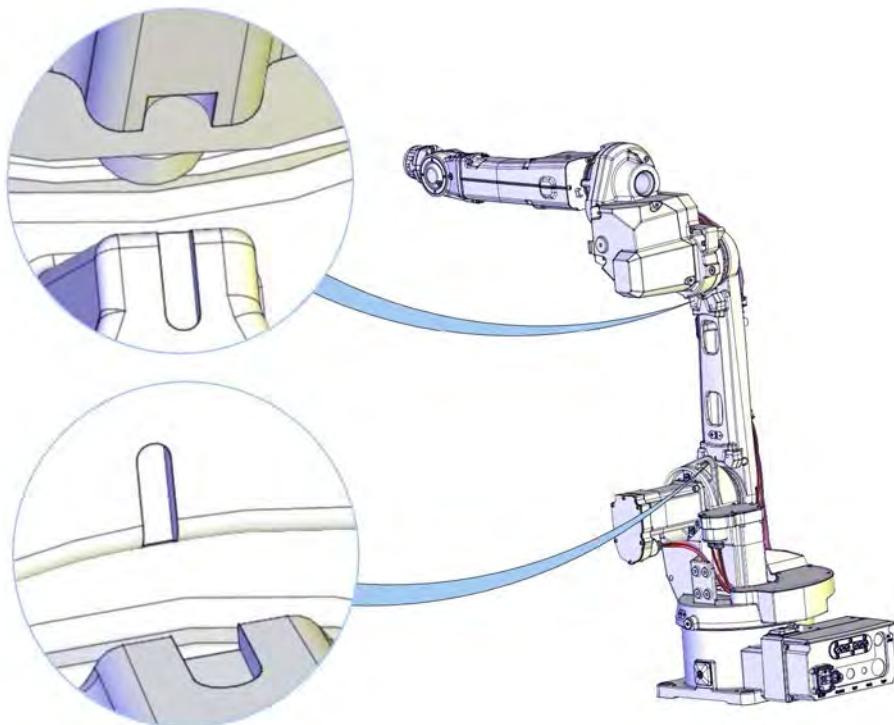
Figure 5.1: Calibration marks (from bottom left to top right): Axis 1, axis 4, axis 5 and axis 6.

Continues on next page

5 Calibration information

5.3 Synchronization marks and correct axis position

Continued



xx1100000364

Figure 5.2: Calibration marks (from top to bottom): Axis 3 and axis 2.

5.4 Calibration movement directions for all axes

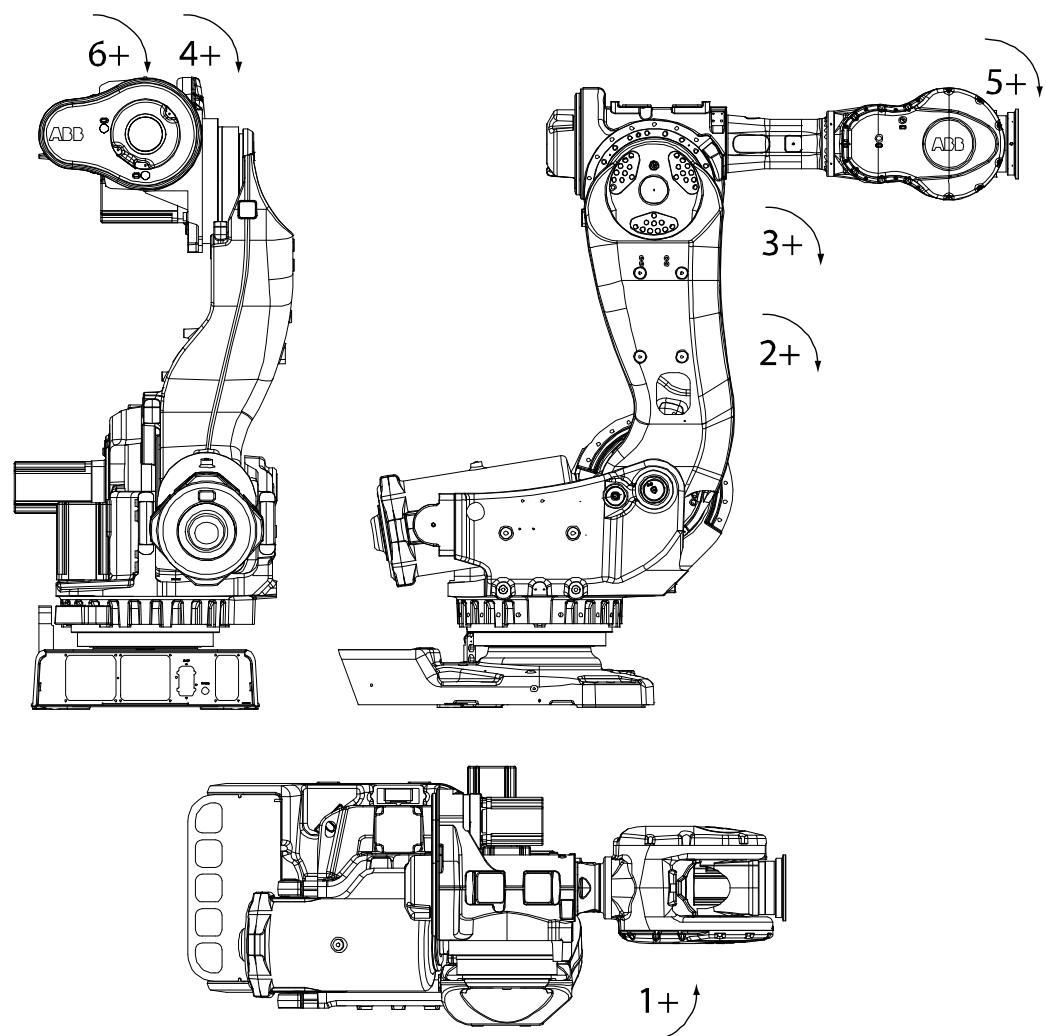
Overview

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

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

Manual movement directions, 6 axes

Note! The graphic shows an IRB 7600. The positive direction is the same for all 6-axis robots, except the positive direction of axis 3 for IRB 6400R, which is in the opposite direction!



xx0200000089

5 Calibration information

5.5 Updating revolution counters

5.5 Updating revolution counters

Introduction

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

Step 1 - Manually running the manipulator to the synchronization position

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

Action	Note
1 Select axis-by-axis motion mode.	
2 Jog the manipulator to align the synchronization marks.	See Synchronization marks and correct axis position on page 293 .
3 When all axes are positioned, update the revolution counter.	Step 2 - Updating the revolution counter with the FlexPendant on page 297 .

Correct calibration position of axis 4 and 6

When jogging the manipulator to synchronization position, it is extremely important to make sure that axes 4 and 6 of the following mentioned manipulators are positioned correctly. The axes can be calibrated at the wrong turn, resulting in an incorrect manipulator calibration.

Make sure the axes are positioned according to the correct calibration values, not only according to the synchronization marks. The correct values are found on a label, located either on the lower arm, underneath the flange plate on the base or on the frame.

At delivery the manipulator is in the correct position, do NOT rotate axis 4 or 6 at power up before the revolution counters are updated.

If one of the following mentioned axes are rotated one or more turns from its calibration position before updating the revolution counter, the correct calibration position will be lost due to non-integer gear ratio. This affects the following manipulators:

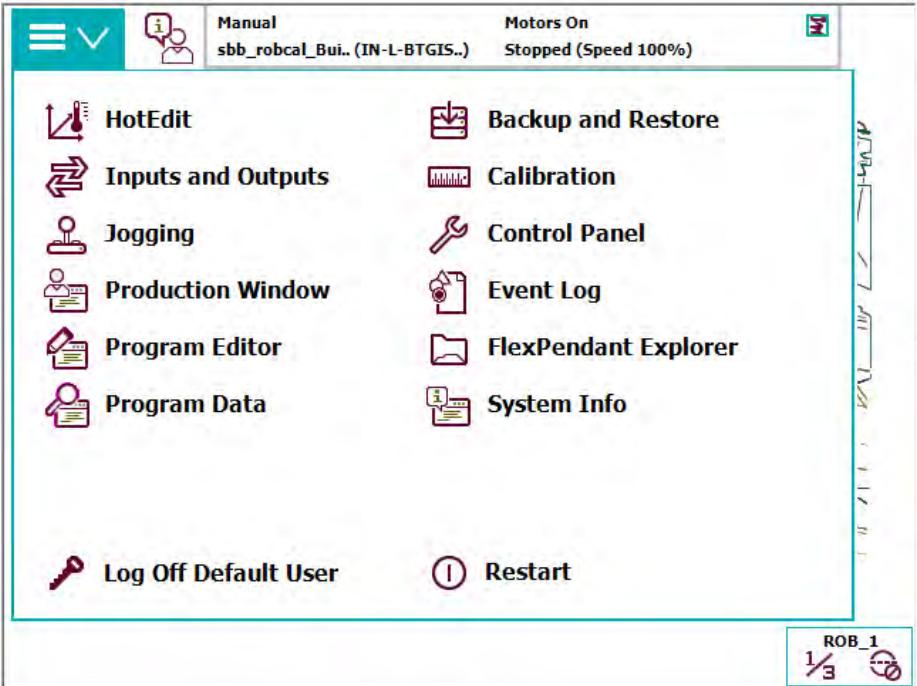
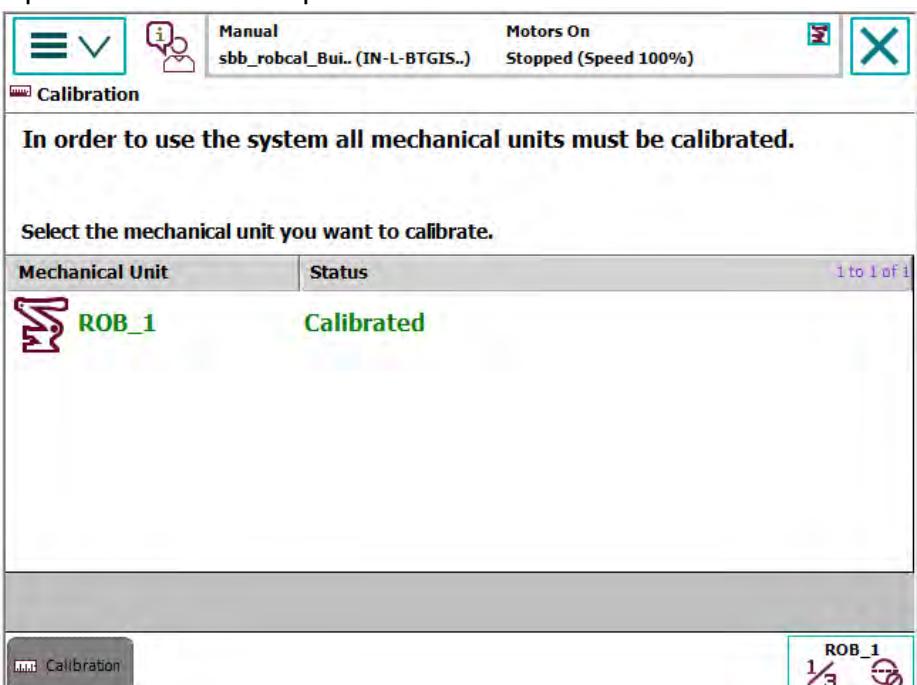
Manipulator variant	Axis 4	Axis 6
IRB 1520ID	No	No

If the synchronization marks seem to be wrong (even if the motor calibration data is correct), try to rotate the axis one turn, update the revolution counter and check the synchronization marks again (try both directions, if needed).

Continues on next page

Step 2 - Updating the revolution counter with the FlexPendant

Use this procedure to update the revolution counter with the FlexPendant (IRC5).

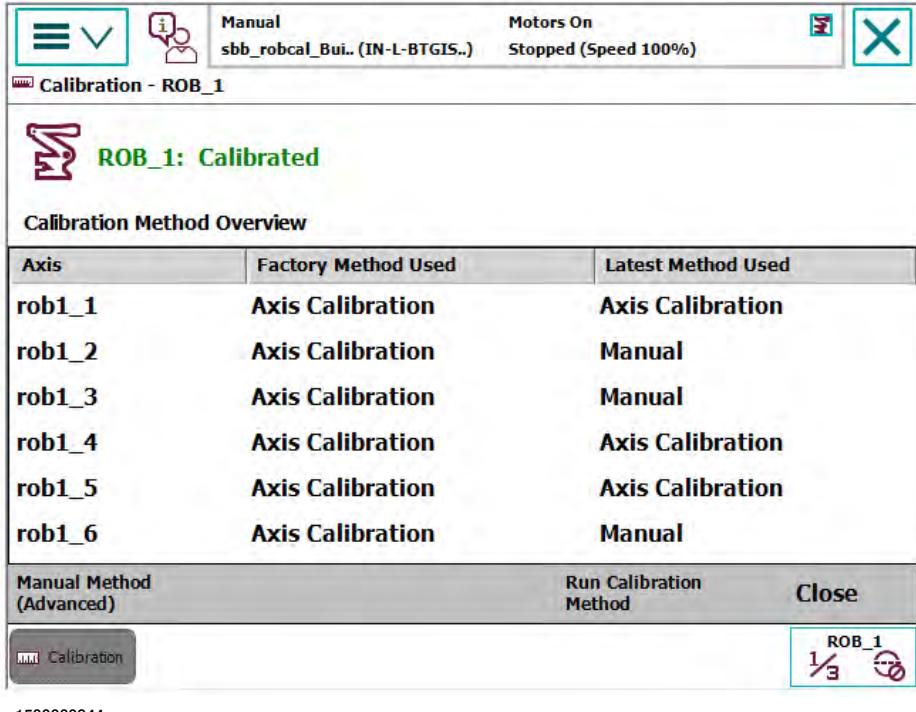
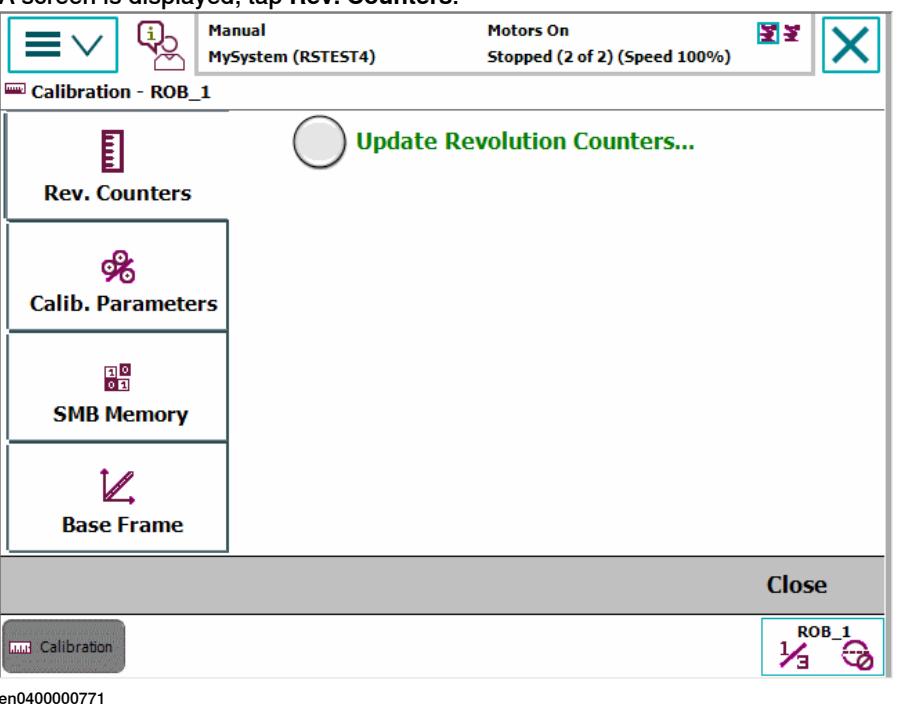
Action
<p>1 On the ABB menu, tap Calibration.</p>  <p>The screenshot shows the ABB menu interface. At the top, it says 'Manual sbb_robcal_Bui.. (IN-L-BTGIS..)' and 'Motors On Stopped (Speed 100%)'. Below the menu bar is a list of icons and their corresponding functions: HotEdit, Backup and Restore; Inputs and Outputs, Calibration; Jogging, Control Panel; Production Window, Event Log; Program Editor, FlexPendant Explorer; Program Data, System Info. At the bottom left is a 'Log Off Default User' button, and at the bottom right is a 'Restart' button. The 'Calibration' icon is highlighted with a red box.</p>
<p>2 All mechanical units connected to the system are shown with their calibration status. Tap the mechanical unit in question.</p>  <p>The screenshot shows the 'Calibration' screen. At the top, it says 'Manual sbb_robcal_Bui.. (IN-L-BTGIS..)' and 'Motors On Stopped (Speed 100%)'. Below the title, it says 'In order to use the system all mechanical units must be calibrated.' A table titled 'Select the mechanical unit you want to calibrate.' shows one entry: 'Mechanical Unit' (ROB_1) and 'Status' (Calibrated). At the bottom left is a 'Calibration' button, and at the bottom right is a 'ROB_1' button with a page number '1/3'.</p>

Continues on next page

5 Calibration information

5.5 Updating revolution counters

Continued

Action																						
3	<p>This step is valid for RobotWare 6.02 and later.</p> <p>Calibration method used at factory for each axis is shown, as well as calibration method used during last field calibration.</p> <p>Tap Manual Method (Advanced).</p>  <table border="1"><thead><tr><th>Axis</th><th>Factory Method Used</th><th>Latest Method Used</th></tr></thead><tbody><tr><td>rob1_1</td><td>Axis Calibration</td><td>Axis Calibration</td></tr><tr><td>rob1_2</td><td>Axis Calibration</td><td>Manual</td></tr><tr><td>rob1_3</td><td>Axis Calibration</td><td>Manual</td></tr><tr><td>rob1_4</td><td>Axis Calibration</td><td>Axis Calibration</td></tr><tr><td>rob1_5</td><td>Axis Calibration</td><td>Axis Calibration</td></tr><tr><td>rob1_6</td><td>Axis Calibration</td><td>Manual</td></tr></tbody></table> <p>xx1500000944</p>	Axis	Factory Method Used	Latest Method Used	rob1_1	Axis Calibration	Axis Calibration	rob1_2	Axis Calibration	Manual	rob1_3	Axis Calibration	Manual	rob1_4	Axis Calibration	Axis Calibration	rob1_5	Axis Calibration	Axis Calibration	rob1_6	Axis Calibration	Manual
Axis	Factory Method Used	Latest Method Used																				
rob1_1	Axis Calibration	Axis Calibration																				
rob1_2	Axis Calibration	Manual																				
rob1_3	Axis Calibration	Manual																				
rob1_4	Axis Calibration	Axis Calibration																				
rob1_5	Axis Calibration	Axis Calibration																				
rob1_6	Axis Calibration	Manual																				
4	<p>A screen is displayed, tap Rev. Counters.</p>  <p>en0400000771</p>																					

Continues on next page

Action
5 Tap Update Revolution Counters.... A dialog box is displayed, warning that updating the revolution counters may change programmed robot positions: <ul style="list-style-type: none">• Tap Yes to update the revolution counters.• Tap No to cancel updating the revolution counters. Tapping Yes displays the axis selection window.
6 Select the axis to have its revolution counter updated by: <ul style="list-style-type: none">• Ticking in the box to the left• Tapping Select all to update all axes. Then tap Update .
7 A dialog box is displayed, warning that the updating operation cannot be undone: <ul style="list-style-type: none">• Tap Update to proceed with updating the revolution counters.• Tap Cancel to cancel updating the revolution counters. Tapping Update updates the selected revolution counters and removes the tick from the list of axes.
8  CAUTION If a revolution counter is incorrectly updated, it will cause incorrect manipulator positioning, which in turn may cause damage or injury! Check the synchronization position very carefully after each update. See Checking the synchronization position on page 300 .

5 Calibration information

5.6 Checking the synchronization position

5.6 Checking the synchronization position

Introduction

Check the synchronization position of the robot before beginning any programming of the robot system. This may be done:

- Using a **MoveAbsJ** instruction with argument zero on all axes.
- Using the **Jogging** window on the FlexPendant.

Using a **MoveAbsJ** instruction

Use this procedure to create a program that runs all the robot axes to their synchronization position.

Action	Note
1 On ABB menu tap Program editor .	
2 Create a new program.	
3 Use MoveAbsJ in the Motion&Proc menu.	
4 Create the following program: <pre>MoveAbsJ [[0,0,0,0,0,0], [9E9,9E9,9E9,9E9,9E9,9E9]] \NoEOffs, v1000, fine, tool0</pre>	
5 Run the program in manual mode.	
6 Check that the synchronization marks for the axes align correctly. If they do not, update the revolution counters.	See Synchronization marks and correct axis position on page 293 and Updating revolution counters on page 296 .

Using the jogging window

Use this procedure to jog the robot to the synchronization position of all axes.

Action	Note
1 On the ABB menu, tap Jogging .	
2 Tap Motion mode to select group of axes to jog.	
3 Tap to select the axis to jog, axis 1, 2, or 3.	
4 Manually run the robots axes to a position where the axis position value read on the FlexPendant, is equal to zero.	
5 Check that the synchronization marks for the axes align correctly. If they do not, update the revolution counters.	See Synchronization marks and correct axis position on page 293 and Updating revolution counters on page 296 .

6 Decommissioning

6.1 Introduction

Introduction

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

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

General

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

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

6 Decommissioning

6.2 Environmental information

6.2 Environmental information

Hazardous material

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

Dispose components properly to prevent health or environmental hazards.

Material	Example application
Batteries, NiCad or Lithium	Serial measurement board
Copper	Cables, motors
Cast iron/nodular iron	Base, lower arm, upper arm
Steel	Gears, screws, base frame, and so on.
Neodymium	Brakes, motors
Plastic/rubber	Cables, connectors, drive belts, and so on.
Oil, grease	Gearboxes
Aluminium	Covers, synchronization brackets

Oil and grease

Where possible, arrange for oil and grease to be recycled. Dispose of via an authorized person/contractor in accordance with local regulations. Do not dispose of oil and grease near lakes, ponds, ditches, down drains, or onto soil. Incineration must be carried out under controlled conditions in accordance with local regulations.

Also note that:

- Spills can form a film on water surfaces causing damage to organisms.
Oxygen transfer could also be impaired.
- Spillage can penetrate the soil causing ground water contamination.

6.3 Scrapping of robot

Important when scrapping the robot



DANGER

When a robot is disassembled while being scrapped, it is very important to remember the following before disassembling starts, in order to prevent injuries:

- Always remove all batteries from the robot. If a battery is exposed to heat, for example from a blow torch, it will explode.
- Always remove all oil/grease in gearboxes. If exposed to heat, for example from a blow torch, the oil/grease will catch fire.
- When motors are removed from the robot, the robot will collapse if it is not properly supported before the motor is removed.

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7 Reference information

7.1 Introduction

General

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

7 Reference information

7.2 Applicable safety standards

7.2 Applicable safety standards

Standards, EN ISO

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

Standard	Description
EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN ISO 13849-1	Safety of machinery, safety related parts of control systems - Part 1: General principles for design
EN ISO 13850	Safety of machinery - Emergency stop - Principles for design
EN ISO 10218-1	Robots for industrial environments - Safety requirements -Part 1 Robot
EN ISO 9787	Robots and robotic devices -- Coordinate systems and motion nomenclatures
EN ISO 9283	Manipulating industrial robots, performance criteria, and related test methods
EN ISO 14644-1 ⁱ	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 ⁱⁱ	Arc welding equipment - Part 1: Welding power sources
EN IEC 60974-10 ⁱⁱ	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 Only robots with protection Clean Room.

ⁱⁱ 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

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 Reference information

7.4 Screw joints

7.4 Screw joints

General

This section describes how to tighten the various types of screw joints on the IRB 1520.

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

UNBRAKO screws

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

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

Gleitmo treated screws

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

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

Screws lubricated in other ways

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

In such cases, proceed as follows:

- 1 Apply lubricant to the screw thread.
- 2 Apply lubricant between the plain washer and screw head.
- 3 Screw dimensions of M8 or larger must be tightened with a torque wrench. Screw dimensions of M6 or smaller may be tightened without a torque wrench if this is done by trained and qualified personnel.

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

Tightening torque

Before tightening any screw, note the following:

- Determine whether a **standard** tightening torque or **special** torque is to be applied. The **standard torques** are specified in the following tables. Any **special torques** are specified in the repair, maintenance or installation procedure descriptions. Any **special torque specified overrides the standard torque!**
- Use the *correct* tightening torque for each type of screw joint.
- Only use *correctly calibrated* torque keys.

Continues on next page

- Always *tighten the joint by hand*, and never use pneumatic tools.
- Use the *correct tightening technique*, that is *do not jerk*. Tighten the screw in a slow, flowing motion.
- Maximum allowed total deviation from the specified value is 10%!

Oil-lubricated screws with slotted or cross-recess head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws with slotted or cross-recess head screws*. Any special torque specified in the repair, maintenance or installation procedure overrides the standard torque!

Oil-lubricated screws with allen head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws with allen head screws*. Any special torque specified in the repair, maintenance or installation procedure overrides the standard torque!

Dimension	Tightening torque (Nm) Class 8.8, oil-lubricated	Tightening torque (Nm) Class 10.9, oil-lubricated	Tightening torque (Nm) Class 12.9, oil-lubricated
M5	6	-	-
M6	10	-	-
M8	24	34	40
M10	47	67	80
M12	82	115	140
M16	200	290	340
M20	400	560	670
M24	680	960	1150

Lubricated screws (Molycote, Gleitmo or equivalent) with allen head screws

The following table specifies the recommended standard tightening torque for *screws lubricated with Molycote 1000, Gleitmo 603 or equivalent with allen head screws*. Any special torque specified in the repair, maintenance or installation procedure overrides the standard torque!

Dimension	Tightening torque (Nm) Class 10.9, lubricated ⁱ	Tightening torque (Nm) Class 12.9, lubricated ⁱ
M8	28	35
M10	55	70
M12	96	120
M16	235	280
M20	460	550
M24	790	950

ⁱ Lubricated with Molycote 1000, Gleitmo 603 or equivalent

Continues on next page

7 Reference information

7.4 Screw joints

Continued

Water and air connectors

The following table specifies the recommended standard tightening torque for *water and air connectors* when *one or both* connectors are made of *brass*. Any special torque specified in the repair, maintenance or installation procedure overrides the standard torque!

Dimension	Tightening torque Nm - Nominal	Tightening torque Nm - Min.	Tightening torque Nm - Max.
1/8	12	8	15
1/4	15	10	20
3/8	20	15	25
1/2	40	30	50
3/4	70	55	90

7.5 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 170 kg. All lifting accessories used must be sized accordingly!	

7 Reference information

7.6 Standard tools

7.6 Standard tools

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	Ring-open-end spanner 8-19 mm
1	Socket head cap 2.5-17 mm
1	Torx socket no: 20-60
1	Torque wrench 4-200 Nm
1	Small screwdriver
1	Plastic mallet
1	Ratchet head for torque wrench 1/2"
1	Socket head cap no: 5, socket 1/2" bit L 20 mm
1	Socket head cap no: 6, socket 1/2" bit L 20 mm
1	Socket head cap no: 8, socket 1/2" bit L 20 mm
1	Socket head cap no: 10, socket 1/2" bit L 20 mm
1	Socket head cap no: 12, socket 1/2" bit L 20 mm
1	Socket head cap no: 14, socket 1/2" bit L 20 mm
1	100 mm extension, 1/2" square drive
1	Small cutting plier
1	T-handle with ball head

7.7 Special tools

Special tools

Tool	Art. no.	Note
Guide pin	3HAC15520-1	M8 x 100 Used for replacement of axis 1 gearbox. Always use the guide pins in pairs.
Guide pin	3HAC041574-001	M6 x 100 Used for axis 1 and 2. Always use the guide pins in pairs.
Guide pin	3HAC039940-001	Used for replacing the base. Always use the guide pins in pairs.

Lifting accessory

Equipment	Art. no.
Lifting and turning tool for suspended robot	3HAC041569-001 Includes instruction 3HAC041419-002.

Calibration equipment, Calibration Pendulum

The following table specifies the calibration equipment needed when calibrating the robot with the Calibration Pendulum method.

Tools	Art. no.	Note
Calibration Pendulum tool set	3HAC15716-1	Complete kit that also includes operating manual.
Calibration tool set	3HAC041422-001	Additional equipment to the Calibration Pendulum tool set, required for calibration of axis 1. Includes calibration tool block, parallel pins and a protection screw.

7 Reference information

7.8 Lifting accessories and lifting instructions

General

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

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

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

8 Spare parts

8.1 Spare part lists and illustrations

Location

Spare parts and exploded views are not included in the manual but delivered as a separate document on the documentation DVD.

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9 Circuit diagram

9.1 Circuit diagrams

Overview

The circuit diagrams are not included in this manual, but delivered as separate documents on the documentation DVD. See the article numbers in the tables below.

Controllers

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRC5</i>	<i>3HAC024480-011</i>
<i>Circuit diagram - IRC5 Compact</i>	<i>3HAC049406-003</i>
<i>Circuit diagram - IRC5 Panel Mounted Controller</i>	<i>3HAC026871-020</i>
<i>Circuit diagram - Euromap</i>	<i>3HAC024120-004</i>

Robots

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRB 120</i>	<i>3HAC031408-003</i>
<i>Circuit diagram - IRB 140 type C</i>	<i>3HAC6816-3</i>
<i>Circuit diagram - IRB 260</i>	<i>3HAC025611-001</i>
<i>Circuit diagram - IRB 360</i>	<i>3HAC028647-009</i>
<i>Circuit diagram - IRB 460</i>	<i>3HAC036446-005</i>
<i>Circuit diagram - IRB 660</i>	<i>3HAC025691-001</i>
<i>Circuit diagram - IRB 760</i>	<i>3HAC025691-001</i>
<i>Circuit diagram - IRB 1200</i>	<i>3HAC046307-003</i>
<i>Circuit diagram - IRB 1410</i>	<i>3HAC2800-3</i>
<i>Circuit diagram - IRB 1600 type A</i>	<i>3HAC021351-003</i>
<i>Circuit diagram - IRB 1520</i>	<i>3HAC039498-007</i>
<i>Circuit diagram - IRB 2400</i>	<i>3HAC6670-3</i>
<i>Circuit diagram - IRB 2600</i>	<i>3HAC029570-007</i>
<i>Circuit diagram - IRB 4400/4450S</i>	<i>3HAC9821-1</i>
<i>Circuit diagram - IRB 4600</i>	<i>3HAC029038-003</i>
<i>Circuit diagram - IRB 6400RF</i>	<i>3HAC8935-1</i>
<i>Circuit diagram - IRB 6600 type A</i>	<i>3HAC13347-1 3HAC025744-001</i>
<i>Circuit diagram - IRB 6600 type B</i>	<i>3HAC13347-1 3HAC025744-001</i>
<i>Circuit diagram - IRB 6620</i>	<i>3HAC025090-001</i>
<i>Circuit diagram - IRB 6620 / IRB 6620LX</i>	<i>3HAC025090-001</i>

Continues on next page

9 Circuit diagram

9.1 Circuit diagrams

Continued

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRB 6640</i>	<i>3HAC025744-001</i>
<i>Circuit diagram - IRB 6650S</i>	<i>3HAC13347-1</i> <i>3HAC025744-001</i>
<i>Circuit diagram - IRB 6660</i>	<i>3HAC025744-001</i> <i>3HAC029940-001</i>
<i>Circuit diagram - IRB 6700</i>	<i>3HAC043446-005</i>
<i>Circuit diagram - IRB 7600</i>	<i>3HAC13347-1</i> <i>3HAC025744-001</i>
<i>Circuit diagram - IRB 14000</i>	<i>3HAC050778-003</i>

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