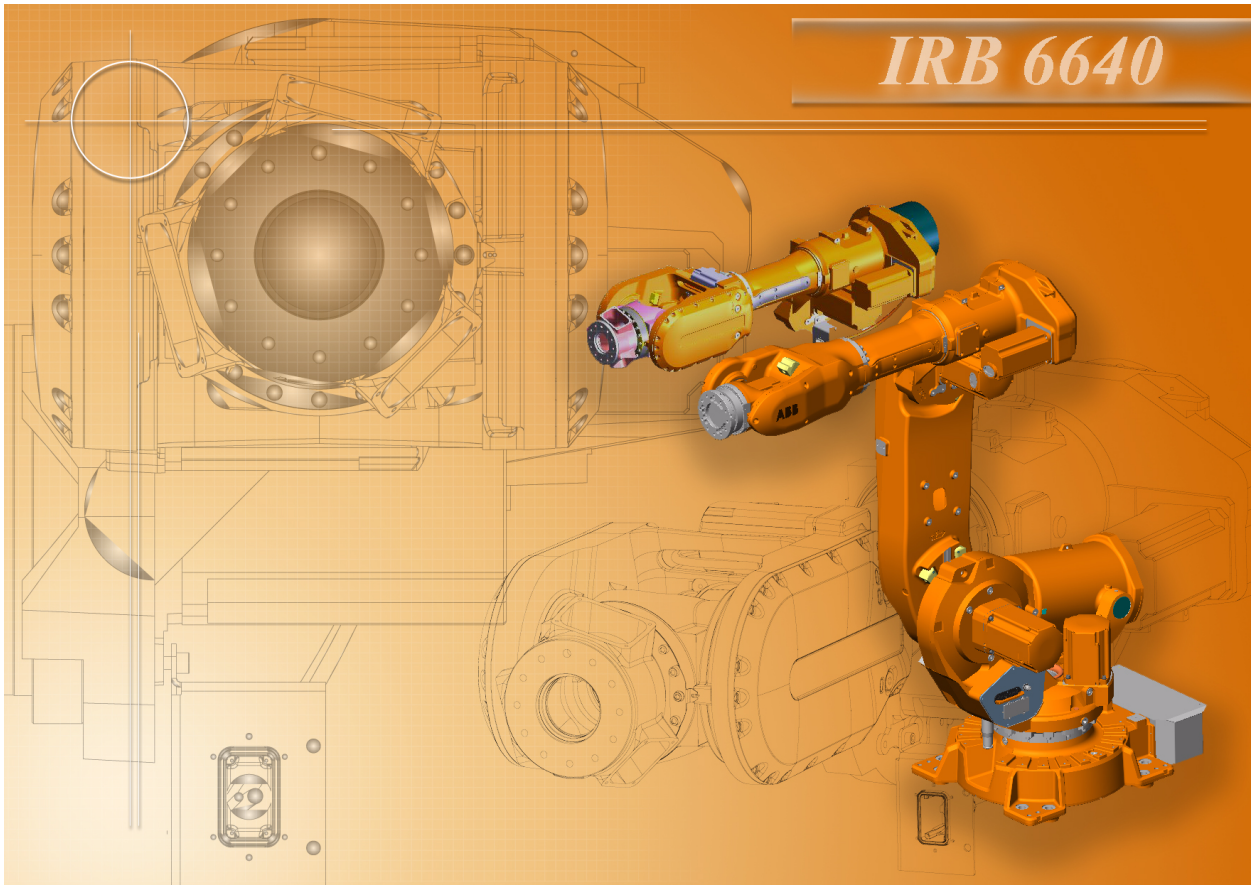
The heart of Robotics

Product manual

Articulated robot

IRB 6640 - 180/2.55
IRB 6640 - 235/2.55
IRB 6640 - 205/2.75
IRB 6640 - 185/2.8
IRB 6640 - 130/3.2
IRB 6640ID - 200/2.55
IRB 6640ID - 170/2.75
M2004



ABB

Product manual

IRB 6640 - 180/2.55

IRB 6640 - 235/2.55

IRB 6640 - 205/2.75

IRB 6640 - 185/2.8

IRB 6640 - 130/3.2

IRB 6640ID - 200/2.55

IRB 6640ID - 170/2.75

M2004

Document ID: 3HAC026876-001

Revision: C

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Overview

About This Manual

This manual contains instructions for:

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

Usage

This manual should be used during:

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

Who Should Read This Manual?

This manual is intended for:

- installation personnel
- maintenance personnel
- repair personnel.

Prerequisites

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

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

Organization of chapters

The manual is organized in the following chapters:

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

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Continues on next page

Continued

Chapter	Contents
Reference information	Useful information when performing installation, maintenance or repair work. Includes lists of necessary tools, additional documents, safety standards etc.
Spare part / part list	Complete spare part list and complete list of robot components, shown in exploded views.
Exploded views	Detailed illustrations of the robot with reference numbers to the part list.
Circuit diagram	Circuit diagram for the robot.

References

Reference	Document Id
Product specification - IRB 6640	3HAC028284-001
Product manual - SpotPack/DressPack IRB 6640	3HAC028638-001
Product manual - Controller IRC5	3HAC021313-001
Operating manual - IRC5 with Flexpendant	3HAC16590-1
Operating manual - Calibration pendulum	3HAC16578-1
Operating manual - Service Information System	3HAC025709-001
Application manual - Additional axes and stand alone controller	3HAC021395-001
Technical reference manual - System parameter	3HAC17076-1
Application manual - Electronic Position Switches	3HAC027709-001

Revisions

Revision	Description
-	First edition
A	Changes made in: • Prerequisites in section Overview • Oil change in section Maintenance
B	Content updated in section: • 2.9 Making robot ready for operation, Cleanroom / 2.9.1 Additional installation procedure
C	Changes made in: • Section Maintenance, Repair and Spare part list regarding new lower arm and new balancing device.

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Product documentation, M2004

General

The robot documentation is divided into a number of categories. This listing is based on the type of information contained within the documents, regardless of whether the products are standard or optional. This means that any given delivery of robot products **will not contain all** documents listed, only the ones pertaining to the equipment delivered.

However, all documents listed may be ordered from ABB. The documents listed are valid for M2004 robot systems.

Product manuals

All hardware, robots and controllers, will be delivered with a **Product manual** that contains:

- Safety information
- Installation and commissioning (descriptions of mechanical installation, electrical connections)
- Maintenance (descriptions of all required preventive maintenance procedures including intervals)
- Repair (descriptions of all recommended repair procedures including spare parts)
- Additional procedures, if any (calibration, decommissioning)
- Reference information (article numbers for documentation referred to in Product manual, procedures, lists of tools, safety standards)
- Part list
- Foldouts or exploded views
- Circuit diagrams

Technical reference manuals

The following manuals describe the robot software in general and contain relevant reference information:

- **RAPID Overview**: An overview of the RAPID programming language.
- **RAPID Instructions, Functions and Data types**: Description and syntax for all RAPID instructions, functions and data types.
- **System parameters**: Description of system parameters and configuration workflows.

Application manuals

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

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, CD with PC software)
- How to use the application
- Examples of how to use the application

Continues on next page

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Continued

Operating manuals

This group of manuals is aimed at those having first hand operational contact with the robot, that is production cell operators, programmers and trouble shooters. The group of manuals includes:

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

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How to read the product manual

Reading the procedures

The procedures contain references to figures, tools, material etc. The references are read as described below.

References to figures

The procedures often include references to components or attachment points located on the robot/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 *rear attachment screws, 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, dimensions.

The denomination in the procedure for the component or attachment point corresponds to the denomination 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 *sealing, 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 chapter *Safety*.

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1 Safety

1.1. Introduction

Overview

The safety information in this manual is divided in two categories:

- general safety aspects, important to attend to before performing any service work on the robot. These are applicable for all service work and are found in section *General safety information*.
- specific safety information, pointed out in the procedure at the moment of the danger. How to avoid and eliminate the danger is either detailed directly in the procedure, or further detailed in separate instructions, found in section *Safety related instructions*.

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1.2 General safety information

1.2.1. 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, which can influence the safety of the total 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 robots must be familiar with the operation and handling of the industrial robot, described in the applicable documents, for example:

- *Operating Manual - IRC5 with FlexPendant* (M2004)
- *Product Manual*

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. Via this interface, an external safety function can interact with other machines and peripheral equipment. 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	Product manual for the robot	Installation and commissioning
Changing operating modes	Operating manual - IRC5 with FlexPendant (RobotWare 5.0)	Operating modes
Restricting the working space	Product manual for the robot	Installation and commissioning

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1.2.2. Safety risks

1.2.2.1. Safety risks during installation and service work on robot

Overview

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

General risks during installation and service

- The instructions in the Product Manual, chapter Installation and Commissioning 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 the robot must have the appropriate training for the robot system in question and in any safety matters associated with it.

Nation/region specific regulations

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

Non-voltage related risks

- Safety zones, which must be crossed before admittance, must be set up in front of the 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.
- 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, you run the risk of being crushed by the parallel arm.
- 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, that is, do not climb on the robot motors or other part during service work. There is a serious risk of slipping because of the high temperature of the motors or oil spills that can occur on the robot.

To be observed by the supplier of the complete system

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

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1.2.2.1. Safety risks during installation and service work on robot

Continued

Complete robot

Safety risk	Description
Hot components!	 **CAUTION!** Motors and gears are HOT after running the robot! Touching motors and gears may result in burns! With higher environment temperature more surfaces on the robot are getting HOT and may result in burns too!
Removed parts may result in collapse of robot!	 **WARNING!** Take any necessary measures to ensure that the robot does not collapse as parts are removed, e.g. secure the lower arm with fixtures if removing motor, axis 2.

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!

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1.2.2.2. Safety risks related to tools/workpieces

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 workpieces in the event of a power failure or a disturbance of the controller.



CAUTION!

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

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1.2.2.3. Safety risks related to pneumatic/hydraulic systems

General

Special safety regulations apply to pneumatic and hydraulic systems.

Residual energy

- Residual energy may be present in these systems. After shutdown, particular care must be taken.
- The pressure in pneumatic and hydraulic systems must be released before starting to repair them.

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.

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1.2.2.4. Safety risks during operational disturbances

General

- The industrial robot is a flexible tool which 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.

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1.2.2.5. Risks associated with live electric parts

Voltage related risks, general

- Although troubleshooting may, on occasion, need to be carried out while the power supply is turned on, the robot must be turned off (by setting the mains switch to OFF) when repairing faults, disconnecting electric leads and disconnecting or connecting units.
- The mains supply to the robot must be connected in such a way that it can be turned off outside the robot's working space.

Voltage related risks, IRC5 controller

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

- Be aware of stored electrical energy (DC link, Ultracapacitor bank unit) in the controller.
- Units such as I/O modules, can be supplied with power from an external source.
- The mains supply/mains switch
- The transformers
- The power unit
- The control power supply (230 VAC)
- The rectifier unit (400-480 VAC and 700 VDC. Note: Capacitors!)
- The drive unit (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.

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 in the Product manual).

Voltage related risks, tools, material handling devices, etc

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

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1.2.3. Safety actions

1.2.3.1. Safety fence dimensions

General

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

Dimensioning

Dimension the fence or enclosure to enable it 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 *Product Specification - Description, Robot Motion*).

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

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1.2.3.2. Fire extinguishing



NOTE!

Use a CARBON DIOXIDE (CO_2) extinguisher in the event of a fire in the robot system (robot or controller)!

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1.2.3.3. Emergency release of the robot’s arm

Description

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

How to release the brakes is detailed in section:

- *Manually releasing the brakes on page 61*

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

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!

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1.2.3.4. Brake testing

When to test

During operation the holding brake of each axis motor wear normally. A test may be performed to determine whether the brake can still perform its function.

How to test

The function of the holding brake of each axis motor may be checked as detailed below:

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

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

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1.2.3.5. Risk of disabling function "Reduced speed 250 mm/s"

NOTE!

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

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1.2.3.6. Safe use of the FlexPendant

NOTE!

The enabling device is a push button located on the side of the FlexPendant which, when pressed halfway in, takes the system to MOTORS ON. When the enabling device is released or pushed all the way in, the robot is taken to the MOTORS OFF state.

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

- The enabling device must never be rendered inoperative 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.
- The programmer must always bring the FlexPendant with him/her, when entering the robot's working space. This is to prevent anyone else taking control of the robot without the programmer knowing.

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, robot operation is impossible.

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 is detailed in *Operating manual - IRC5 with FlexPendant*.

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1.2.3.7. Work inside the robot's working range



WARNING!

If work must be carried out within the robot’s work envelope, 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 operative and to block operation from a computer link or remote control panel.
- The robot’s speed is limited to max. 250 mm/s when the operating mode selector is in 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.
- Pay attention to the rotating axes of the robot! Keep a distance to the axes in order not to 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 section *Brake testing on page 24*.

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1.2.3.8. Signal lamp (optional)

Description

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

Function

The lamp is active in MOTORS ON mode.

Further information

Further information about the MOTORS ON/MOTORS OFF mode may be found in the controller documentation.

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1.2.3.9. Translate the information on safety and information labels

Labels on the product

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.

Translation possibilities

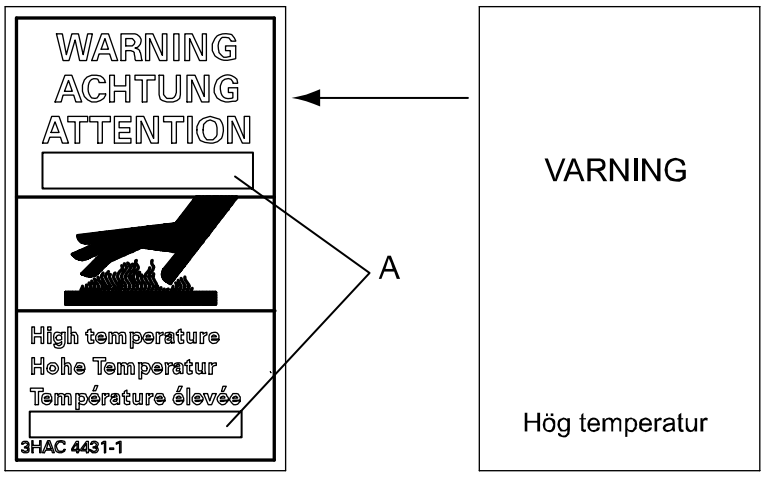
The labels fitted to the product contain space for adding a fourth language underneath the three standard languages (English, German and French).

Add a local language to the label by:

- Using a transparent sticker over the standard label with text added in a fourth language. Drawings detailing the design (text, figure, dimensions) of the standard labels can be ordered from ABB. Notice that each label is identified according to the article number located in the lower corner of the label.

Example of transparent sticker

The figure below shows the location of the free space on one of the labels on the robot, where the fourth language can be added. The figure also shows a transparent sticker, containing the text in Swedish.



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A	Free space for adding a fourth language

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1.3 Safety related instructions

1.3.1. Safety signals, general

General

This section specifies all dangers that may arise from performing the work detailed in the manual. Each danger is detailed in its own section consisting 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.
- An instruction of how to eliminate the danger to facilitate performing the activity at hand.

Danger levels

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

Symbol	Designation	Signification
 danger	DANGER	Warns that an accident *will* 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 etc.
 warning	WARNING	Warns that an accident *may* 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.
 Electrical shock	ELECTRICAL SHOCK	The electrocution or electrical shock symbol indicates electrical hazards which could result in severe personal injury or death.
 caution	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.

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Continued

Symbol	Designation	Signification
 Electrostatic discharge (ESD)	ELECTROSTATIC DISCHARGE (ESD)	The electrostatic discharge (ESD) symbol indicates electrostatic hazards which could result in severe damage to the product.
 Note	NOTE	Note symbols alert you to important facts and conditions.
 Tip	TIP	Tip symbols direct you to specific instructions, where to find additional information or how to perform a certain operation in an easier way.

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1.3.2. DANGER - Moving robots are potentially lethal!

Description

Any moving robot is a potentially lethal machine.

When running the robot, it 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 in RobotWare 5.0 is detailed in section *How to use the hold-to-run function* in the *Operating manual - IRC5 with FlexPendant*.
3.	Make sure no personnel are present within the working range of the robot before pressing the start button.	

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1.3.3. 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 (repair, installation or maintenance):

	Action
1.	Remove all service tools and foreign objects from the robot and its working area!
2.	Install all safety equipment properly!
3.	Make sure all personnel are standing at a safe distance from the robot, that is out of its reach behind safety fences, etc!
4.	Pay special attention to the function of the part previously serviced!

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

Description

The brake release unit has push buttons for 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.

In case 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.	Check the push buttons of the brake release unit 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!

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1.3.5. WARNING - The unit is sensitive to ESD!

Description

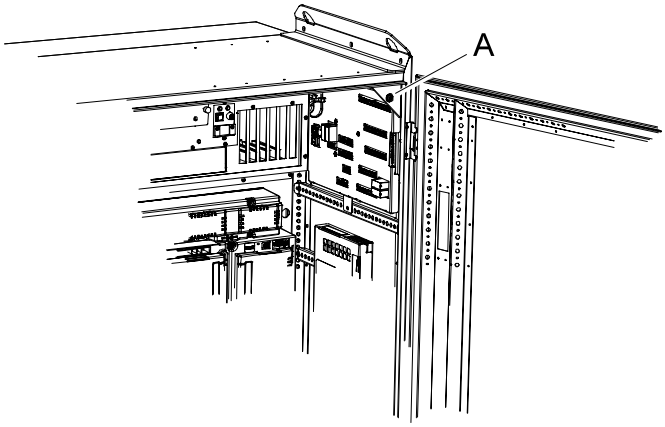
ESD (electrostatic discharge) is the transfer of electrical static charge between two bodies at different potentials, either through direct contact or through an induced electrical field. When handling parts or their containers, personnel not grounded may potentially transfer high static charges. This 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 wrist strap button is located in the right corner as shown in the illustration below.



xx0500002171

A	Wrist strap button

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1.3.6. WARNING - Safety risks during work with gearbox oil

Description

When handling the gearbox oil, there are several dangers to both personal injuries and product damages! Following safety information must be regarded before performing any work with the oil in the gearboxes!

Warnings and elimination

Warning	Description	Elimination / Action
 - **Hot oil!**	Changing and draining gearbox oil may require handling hot oil of up to 90 °C!	Make sure that protective gear like goggles and gloves are always worn during this activity.
 - **Possible pressure build up in gearbox!**	When opening the oil plug, there may be pressure present in the gearbox, causing oil to spray from the opening!	Open oil plug carefully and keep away from the opening. Do not overfill the gearbox when filling.
 - **Do not overfill!**	Overfilling of gearbox oil can lead to internal over-pressure inside the gearbox which in turn may: • damage seals and gaskets • completely press out seals and gaskets • prevent the robot from moving freely.	Make sure not to overfill the gearbox when filling with oil! After filling, check the correct oil level.
 - **Do not mix types of oil!**	Mixing types of oil may cause severe damage to the gearbox!	When filling gearbox oil, do not mix different types of oil unless specified in the instruction. Always use the type of oil specified by the manufacturer!
 - **Heat up the oil!**	Warm oil drains quicker than cold oil.	When changing gearbox oil, first run the robot for a time to heat up the oil.
 - **Specified amount depends on drained volume!**	The specified amount of oil is based on the total volume of the gearbox. When changing the oil, the amount of refilled oil may differ from the specified amount, depending on how much oil has previously been drained from the gearbox.	After refilling, check the oil level.

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2 Installation and commissioning

2.1. Introduction

General

This chapter contains information for installing the robot to the working site.

More detailed technical data, such as load diagram, permitted extra loads (equipment) and location of extra loads (equipment), may be found in the Product Specification for the robot.

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2.2. Robot transportation precautions

General

This section details ABB approved transportation precautions for ABB robots.

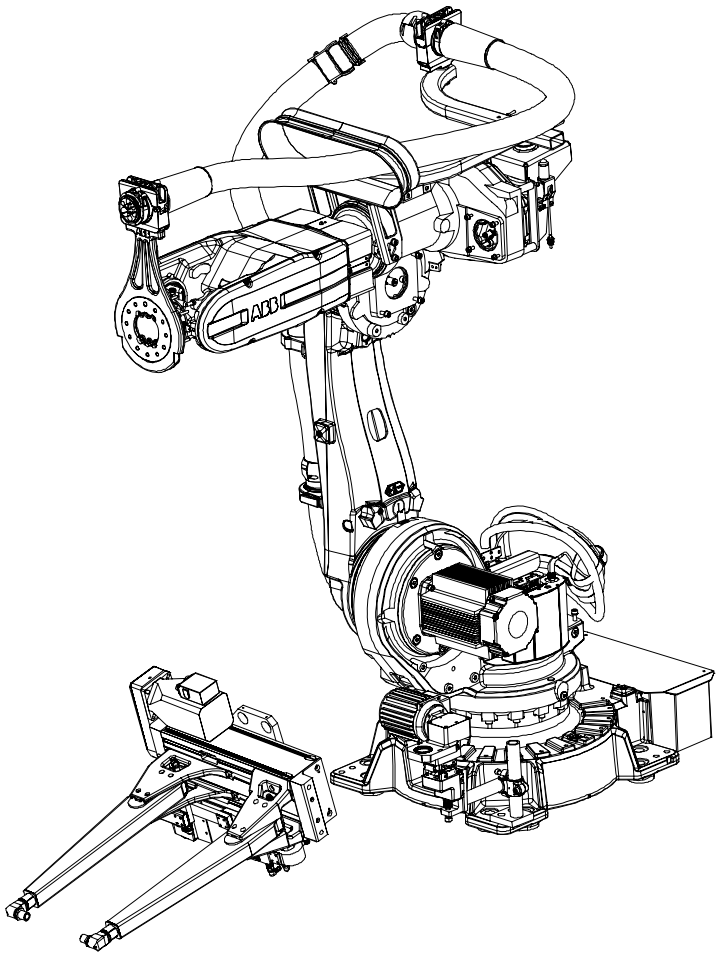
CAUTION!

All transportation in or outside the plant, must be carried out according to description in method 1.If transportation according to method 1 is not possible, use method 2.

Transportation in any other way than method 1 or 2 can seriously damage the robot.If the robot is incorrectly transported and the instructions are not followed, the robot is not covered by the warranty and ABB will not accept any compensation claim.

Method 1

Transportation according to method 1 is strongly recommended by ABB.



xx0800000030

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

- Always remove the tool before transportation of the robot.
- Always place the robot in the ABB recommended transport position, detailed in section *Risk of tipping/stability*.
- Always read and follow the instructions in section *Pre-installation procedure.*

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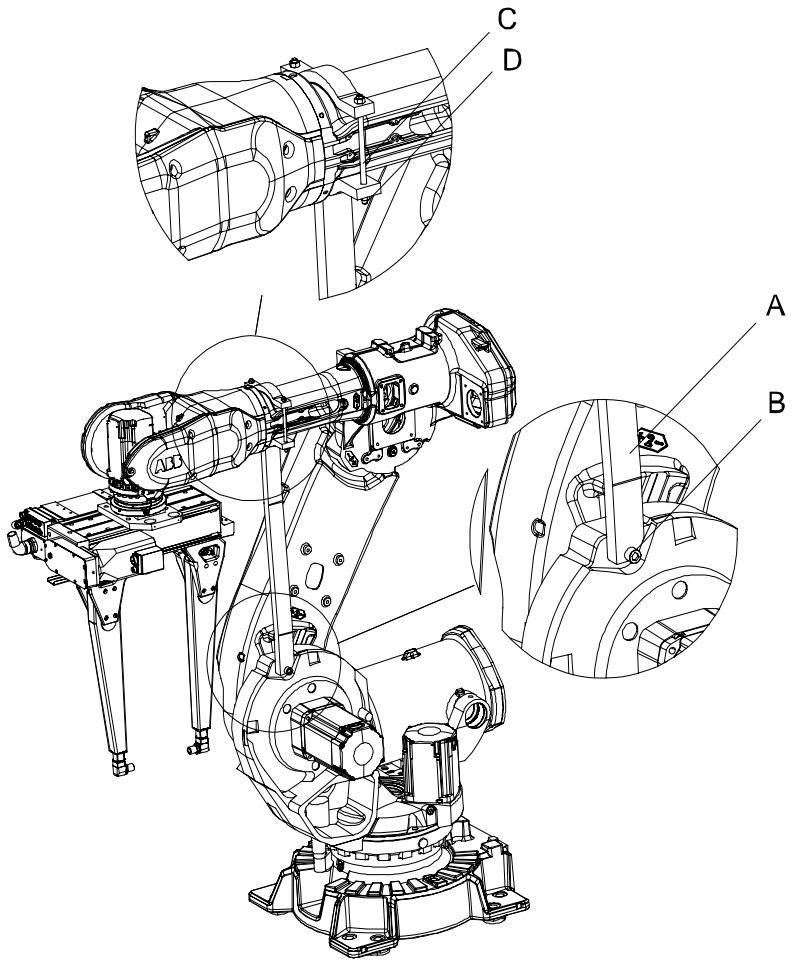
Method 2

Transportation according to method 2 is approved by ABB, if use of method 1 is not possible.

Always follow these instructions when transporting an ABB robot according to method 2:

- Always read and follow the instructions in section *Securing the robot.*
- Always place the robot in the ABB recommended transport position for robot with tool, detailed in sub section *Transport position with a mounted tool*.
- Always use the recommended transport support detailed in sub section *Recommended transport support*.

IRB7600/IRB66XX



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A	Transport Support
B	Hexagon socket head cap screw M16x140
C	Threaded bar M10x200
D	Nut M10

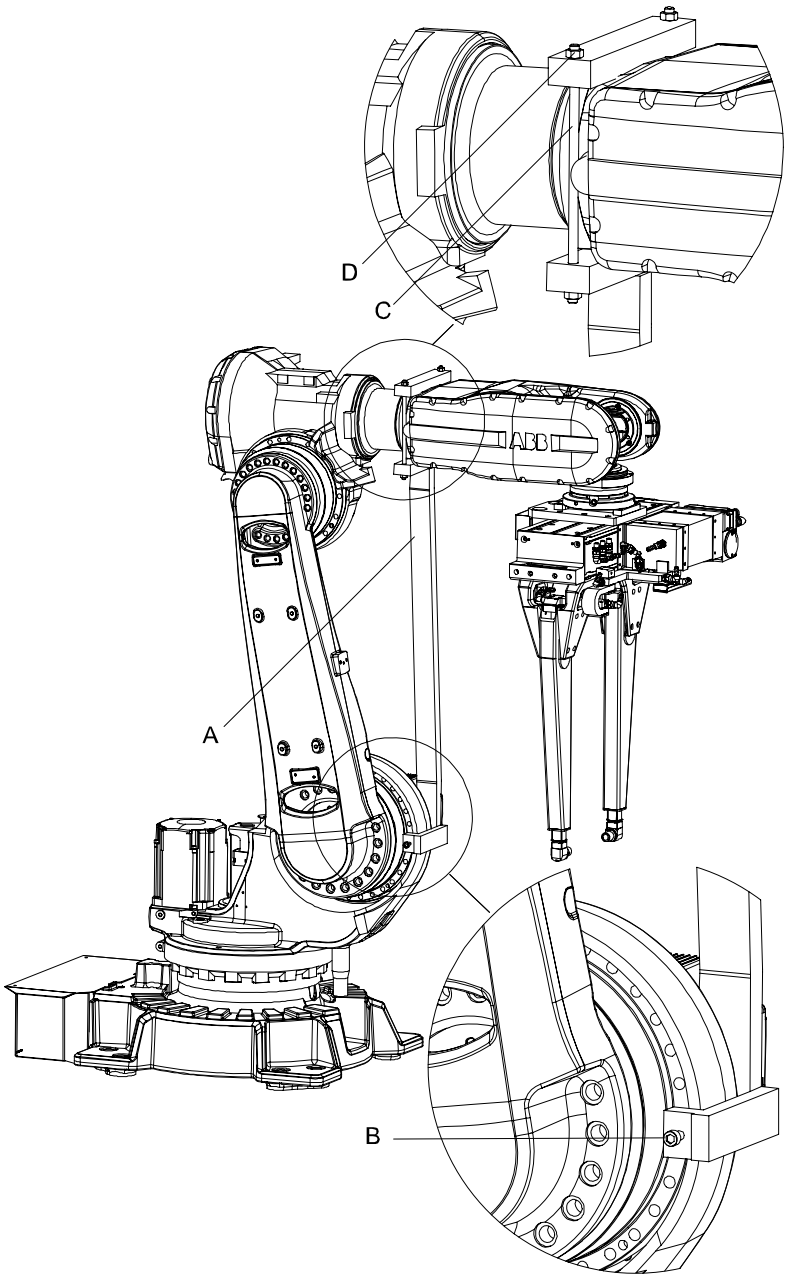
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2.2. Robot transportation precautions

Continued

IRB6620



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A	Transport Support
B	Hexagon socket head cap screw M10x50
C	Threaded bar M10x280
D	Nut M10

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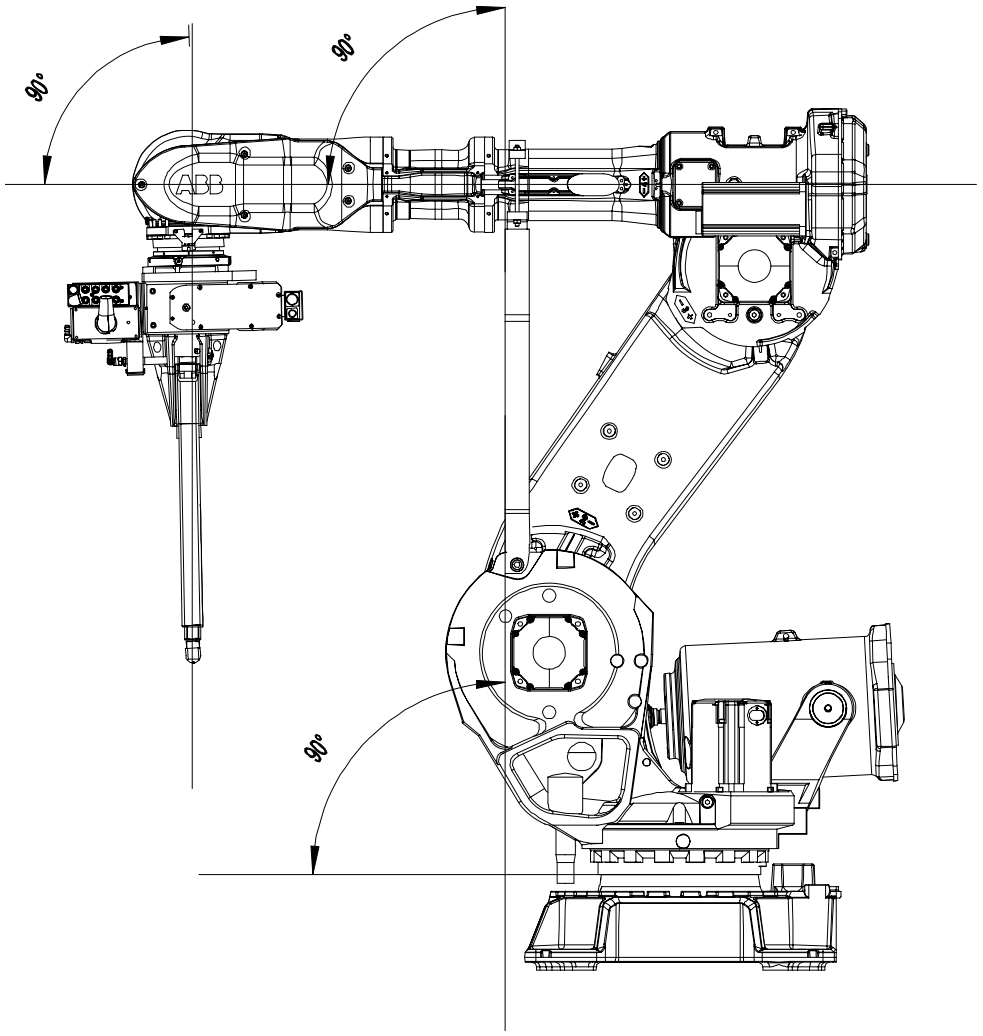
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Transport position with a transport support

All transportation of the robot with tool must follow these instructions.

IRB 7600/IRB 66XX



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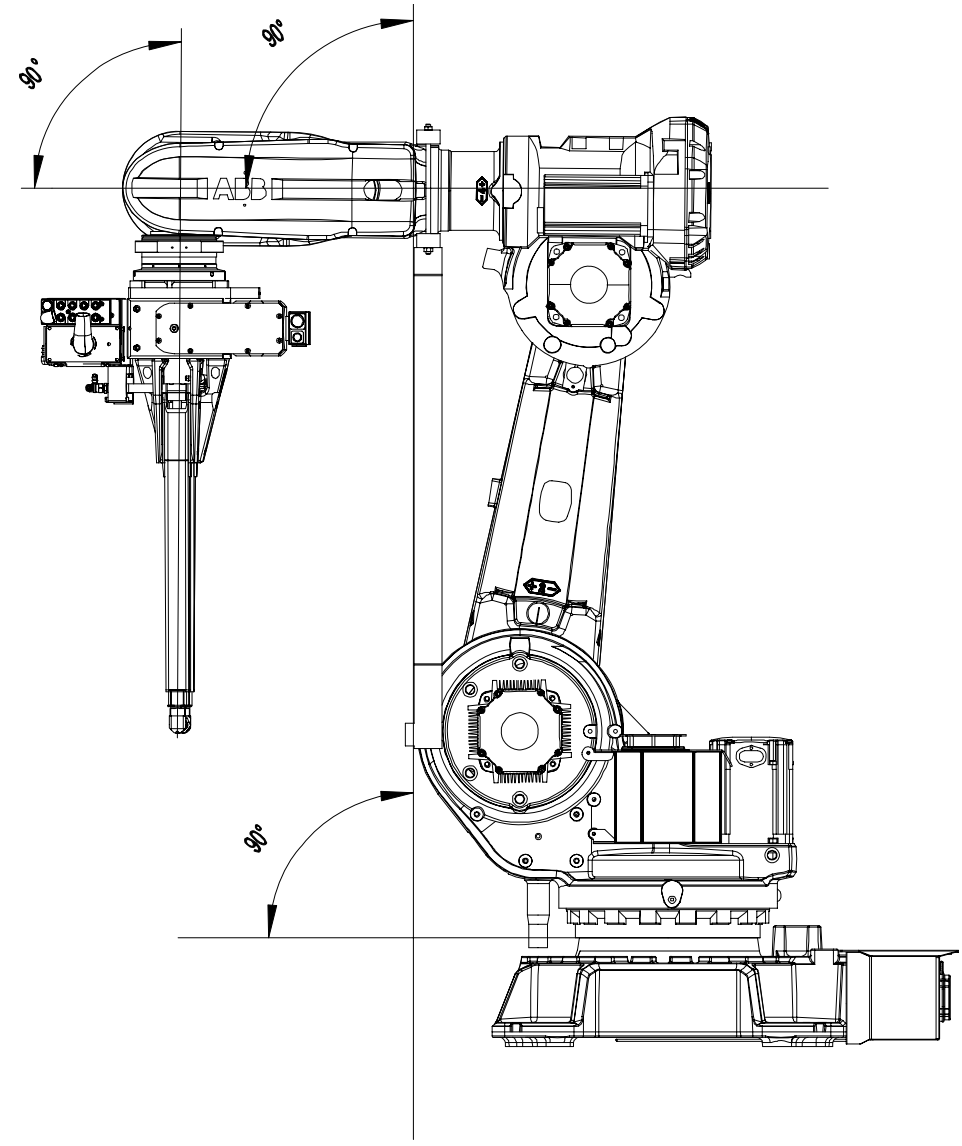
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2.2. Robot transportation precautions

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IRB 6620



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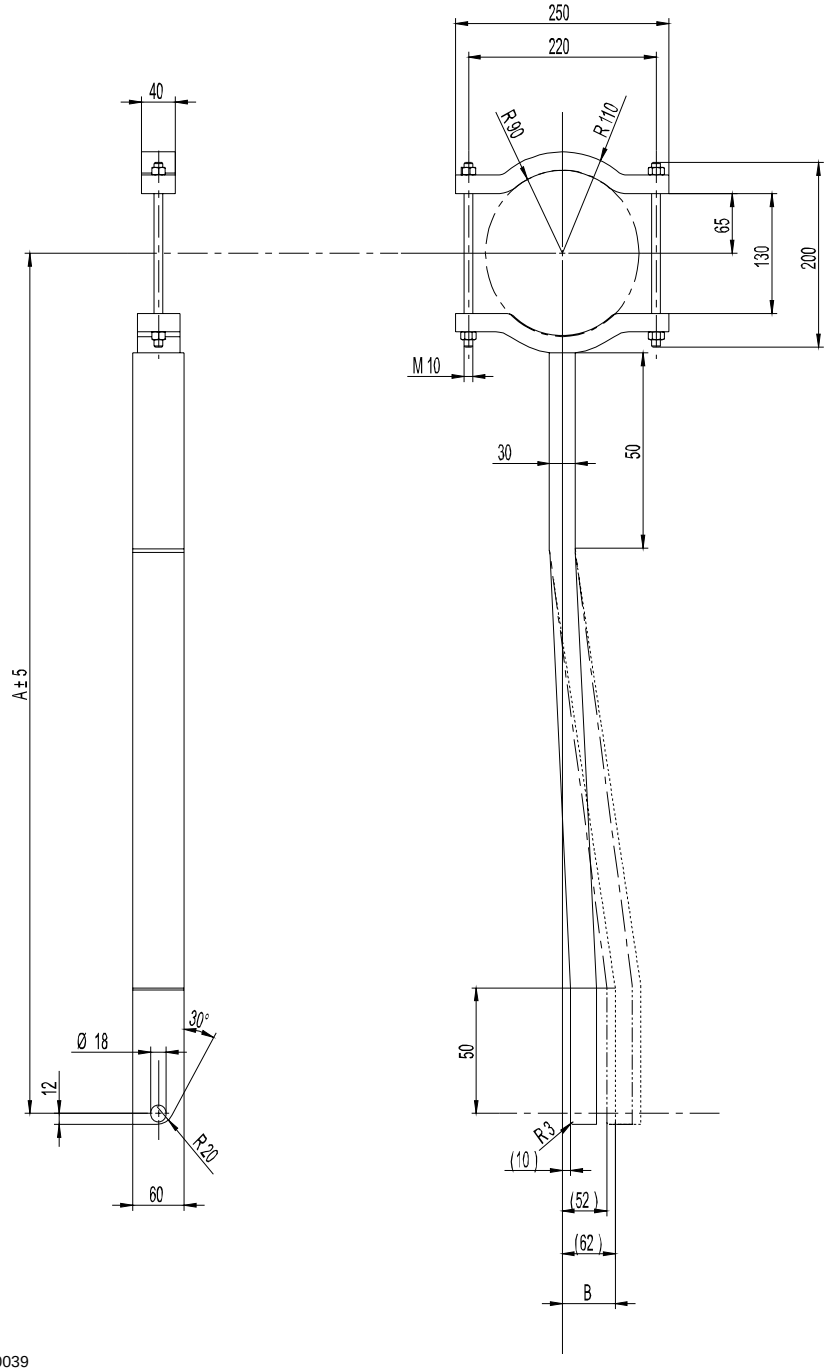
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Recommended transport support

Always use the recommended transport support when transporting a robot with tool.

IRB 7600/IRB 66XX

	IRB6600 IRB6650	2,55	2,75	2,8	3,0	3,0	3,2	IRB6640	2,55	2,75	2,8	3,2	IRB7600	2,3	2,55	2,8	3,05	3,5
	Lower arm L	1075	1280	1075	1075	1280		Lower arm L	1075	1280	1075	1280						
A		900	1130	700	570	995	830		940	1160	785	860			890	730	730	600
B		62	62	62	62	62	62		10	10	10	10		52	52	52	52	52



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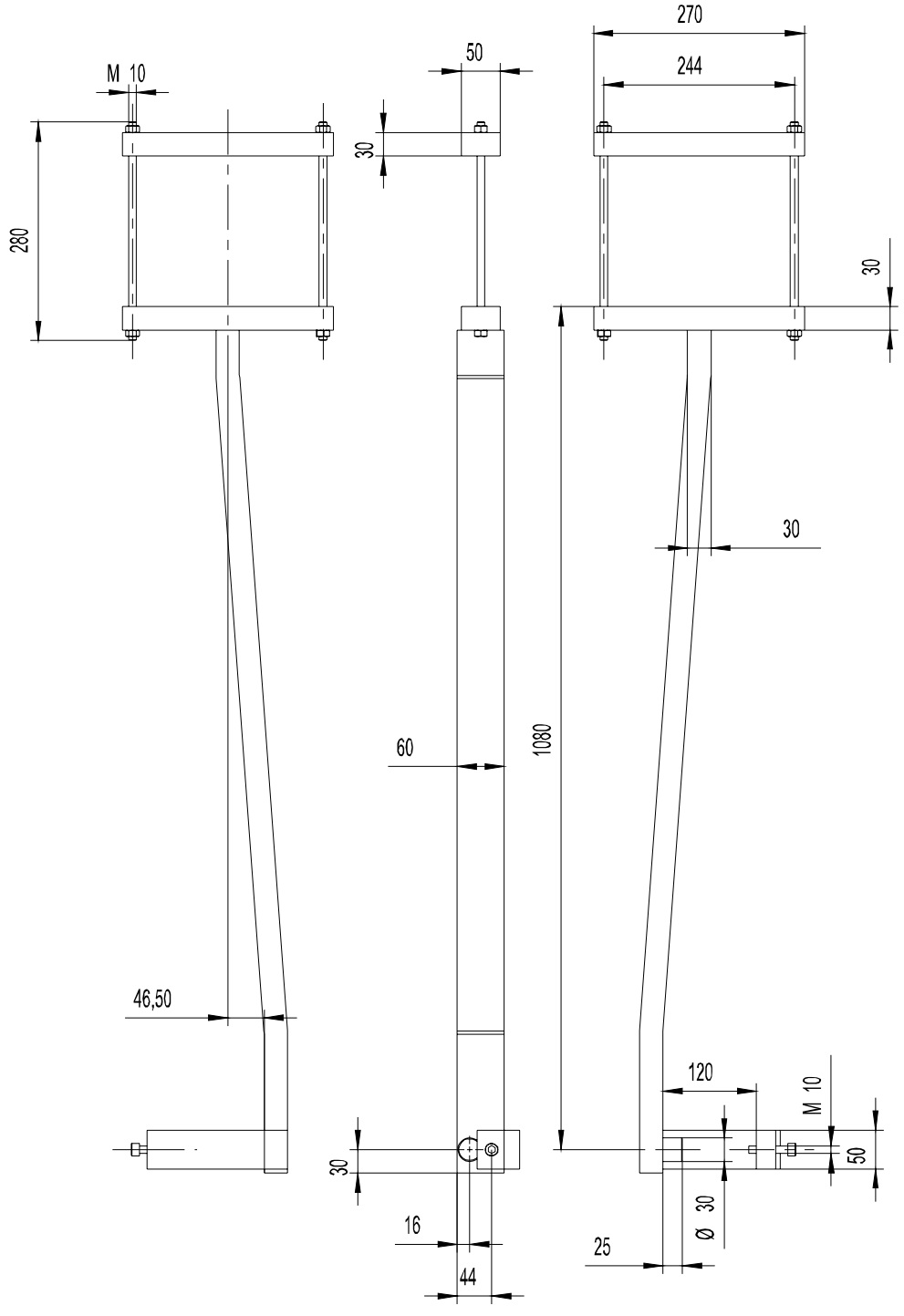
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2.2. Robot transportation precautions

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IRB 6620



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2.3. Securing the robot

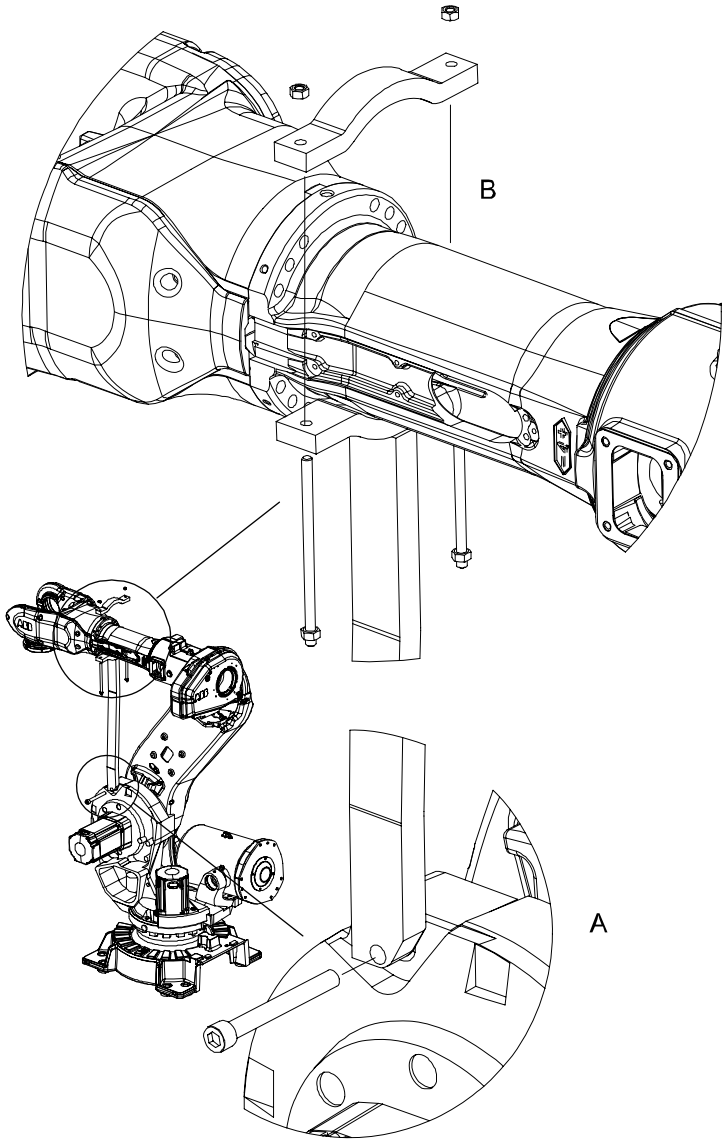
General

This section describes how to secure the robot using the transport support.

DANGER!

Releasing the brakes is a hazardous action that may cause injury and damage property. It must be done with great care and only when absolutely necessary.

Securing the robot



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2.3. Securing the robot

Continued

	Action	Note
1.	Mount the transport support lower end to the robot using the recommended screw joint, (A) in figure.	Do not tightening the screw. See attachment point for the specific robot in section *Transport position with a mounted tool*.
2.	Jog the robot into a position as near above as possible to the recommended transport position for the specific robot. specified in section *Transport position with a mounted tool*.	**CAUTION!** Do not try to jog the robot to the exact position (max distance 1mm).
3.	Use the brake release for axis 3 to reach the final resting position on the transport support, see section *Manually releasing the brakes*.	See attachment point for the specific robot in section *Transport position with a mounted tool*
4.	Tightening all the attachment screws (A) and (B) in figure with the brake release for axis 3 still activated starting with the lower end attachment screw.	**CAUTION!** Do not attempt to tightening any attachment screw without first release the brakes, this can seriously damage the robot.
5.	Use the brake release for axis 5 and 6 to reach the final resting position for the tool, see section *Manually releasing the brakes*	

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2.4 Unpacking

2.4.1. Pre-installation procedure

General

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

The checklist below details what must be observed before proceeding with the actual installation of the robot:

	Action
1.	Make sure only qualified installation personnel conforming to all national and local codes are allowed to perform the installation.
2.	Visually inspect the robot to make sure it is not damaged.
3.	Make sure the lifting device used is suitable to handle the weight of the robot as specified in *Weight, robot on page 47*.
4.	If the robot is not installed directly, it must be stored as described in *Storage conditions, robot on page 48*.
5.	Make sure the expected operating environment of the robot conforms to the specifications as described in *Operating conditions, robot on page 48*.
6.	Before taking the robot to its installation site, make sure the site conforms to *Loads on foundation, robot on page 48*, *Requirements, foundation on page 48* and *Protection classes, robot on page 49*.
7.	Before moving the robot, please observe *Risk of tipping / stability on page 53* regarding risk of tipping!
8.	When these prerequisites are met, the robot may be taken to its installation site as described in section: *On-site installation*.

Weight, robot

The table below shows the weights of the different models:

Robot model	Weight
IRB 6640 -180/2.55	1300 kg *
IRB 6640 - 235/2.55	1310 kg *
IRB 6640 - 205/2.75	1320 kg *
IRB 6640 - 185/2.8	1320 kg *
IRB 6640 - 130/3.2	1340 kg *
IRB 6640ID - 200/2.55	1395 kg *
IRB 6640ID - 170/2.75	1405 kg *

* Weight of robot excluding DressPack.

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Loads on foundation, robot

The table below shows the various forces and torques working on the foundation during different kinds of operation, in relation to the base coordinate system.

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!

Force	Endurance load (operation)	Max. load (emergency stop)
Force xy	± 8.5 kN	± 20.4 kN
Force z	15.0 ± 9.0 kN	15.0 ± 20.0 kN
Torque xy	± 20.1 kNm	± 45.2 kNm
Torque z	± 5.1 kNm	± 10.6 kNm

Requirements, foundation

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

Requirement	Value	Note
Min. levelity	0.5 mm	
Max. tilt	5°	The limit for the maximum load on the robot is reduced if the robot is tilted. Contact ABB for further information about acceptable loads.
Min. resonance frequency	22 Hz	

Storage conditions, robot

The table below shows the allowed storage conditions for the robot:

Parameter	Value
Min. ambient temperature	-25° C
Max. ambient temperature	+55° C
Max. ambient temperature (less than 24 hrs)	+70° C
Max. ambient humidity	Max. 95% at constant temperature

Operating conditions, robot

The table below shows the allowed operating conditions for the robot:

Parameter	Value
Min. ambient temperature	+5° C
Max. ambient temperature	+50° C
Max. ambient humidity	Max. 95% at constant temperature
Max. ambient humidity (Foundry Prime)	100% if robot installed and maintained in accordance with the the manual.

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Continued

Protection classes, robot

The table below shows the protection class of the robot:

Equipment	Protection class
Robot	IP 67
Cooling fans (option)	IP 54

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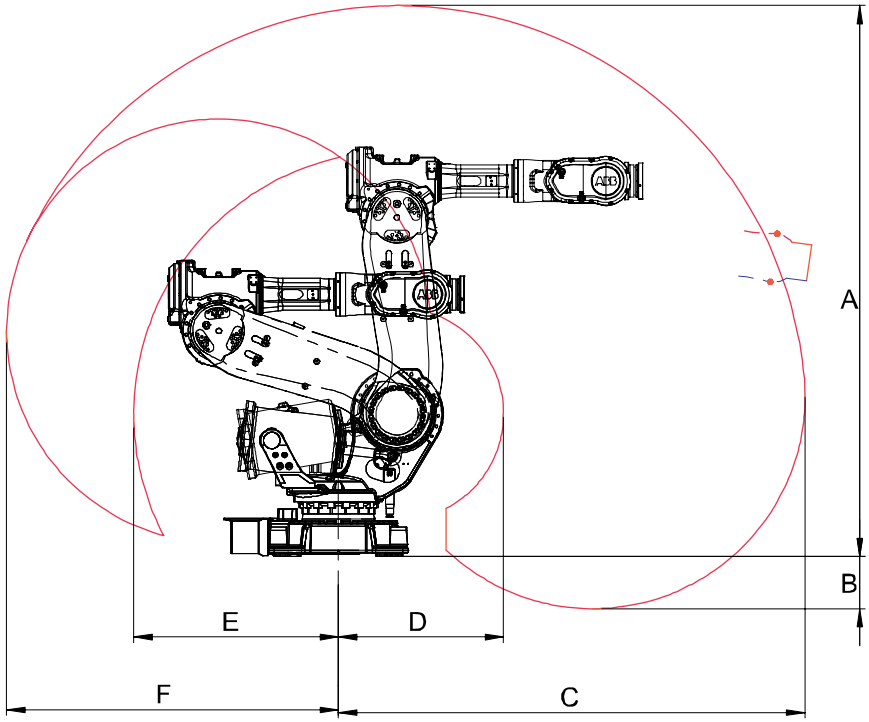
2.4.2. Working range and type of motion

Working range

The following figures show the working ranges of the robot models. The extreme positions of the robot arm are specified at the wrist center (dimensions in mm).

IRB 6640 - 180/2.55, 235/2.55, 205/2.75, 185/2.8, 130/3.2 & IRB 6640ID - 200/2.55, 170/2.75

The illustration below shows the unrestricted working range. Measurements for the different robot variants, are shown as A to F, in the illustration below.



xx0600003396

Robot model	A	B	C	D	E	F
IRB 6640-2.55	3013 mm	284 mm	2550 mm	903 mm	1119 mm	1814 mm
IRB 6640-2.75	3219 mm	268 mm	2755 mm	961 mm	1252 mm	1999 mm
IRB 6640-2.8	3261 mm	533 mm	2800 mm	1004 mm	1324 mm	2061 mm
IRB 6640-3.2	3665 mm	713 mm	3200 mm	1067 mm	1604 mm	2445 mm
IRB 6640ID-2.55	3013 mm	284 mm	2550 mm	903 mm	1549 mm	1814 mm
IRB 6640ID-2.75	3219 mm	268 mm	2755 mm	961 mm	1682 mm	1999 mm

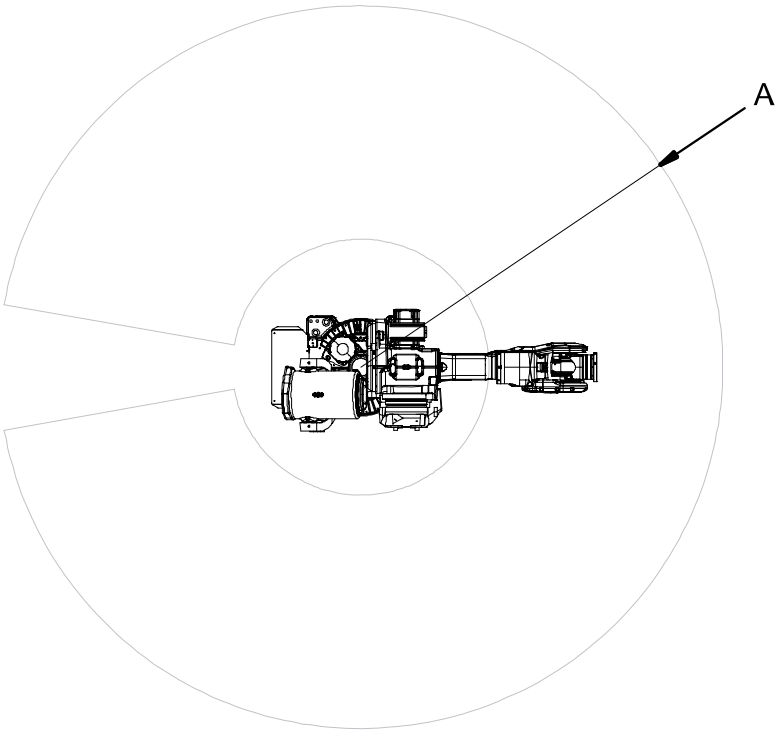
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Turning radius

The turning radius, shown as A in the figure below, is specified for the different robot models below the figure.



xx0600003399

IRB 6640 - 2.55	2550 mm
IRB 6640 - 2.75	2755 mm
IRB 6640 - 2.8	2800 mm
IRB 6640 - 3.2	3200 mm
IRB 6640ID - 2.55	2550 mm
IRB 6640ID - 2.75	2755 mm

Type of motion

Axis	Type of motion	Range of movement	Note
1	Rotation motion	+170° to -170°	Movement range can be set to: +220º to -220º (option 561-1)
2	Arm motion	+85º to -65º	
3	Arm motion	+70º to -180º	
4	Wrist motion	+300º to -300º	IRB 6640ID: the range of movement is the combined value for axis 4 and 6 together.
5	Bend motion	IRB 6640: +120º to -120º IRB 6640ID: +100º to -100º	

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2.4.2. Working range and type of motion

Continued

Axis	Type of motion	Range of movement	Note
6	Turn motion	IRB 6640: +360º to -360º (default), ± 96 revolutions IRB 6640ID: +300º to -300º ±300º max [1)]	

[1)] The minimum combination of axes 4 and 6.

NOTE!

There are limitations of the range of movement with a DressPack/SpotPack application fitted to the robot! See product manual SpotPack/DressPack IRB 6640. Art. no. in *References*.

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2.4.3. Risk of tipping / stability

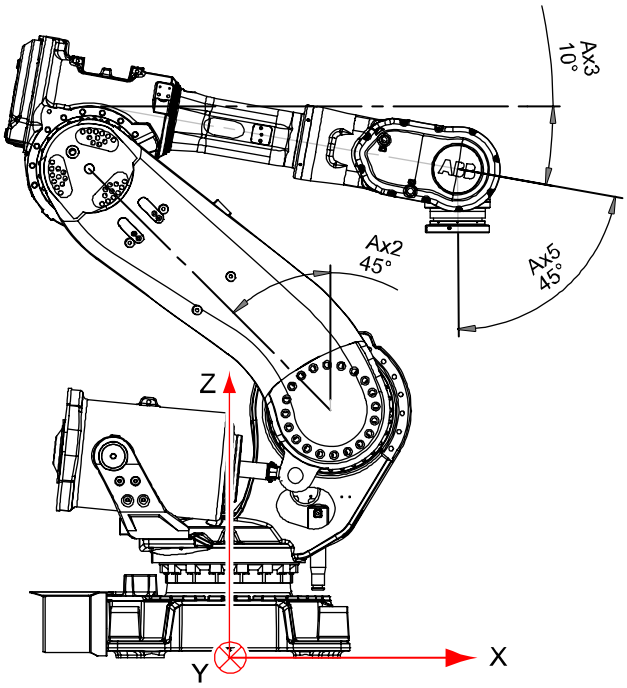
Risk of tipping

When 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.

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

Stabililty

The figure below shows the robot in its shipping position, which also is its most stable position.



xx0600003400

WARNING!

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

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2.5 On-site installation

2.5.1. Lifting the robot with fork lift

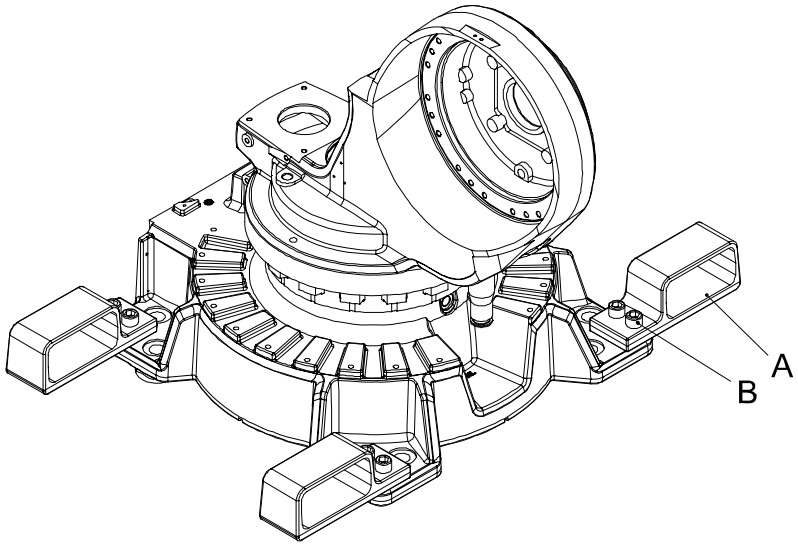
General

The robot may be moved using a fork lift, provided that available special aids are used.

This section describes how to attach the fork lift equipment to the robot.

Fork lift device set

The fork lift device set, is fitted to the robot as shown in the figure below.



xx0600002910

A	Fork lift pocket
B	Attachment screw M20x50 quality 8.8 (2 pcs x 4)

Required equipment

Equipment, etc	Art. no.	Note
Fork lift device set	3HAC025040-003	
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.

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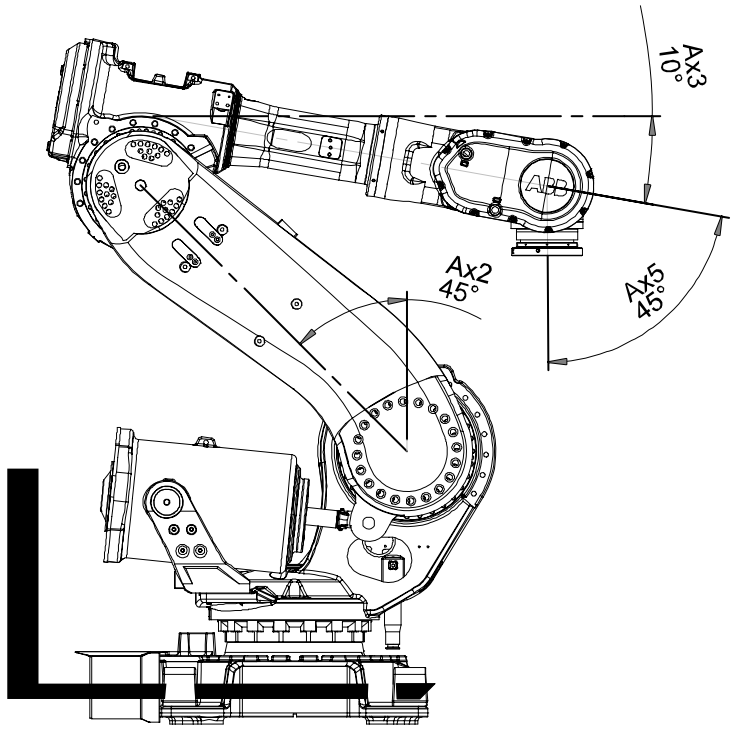
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Lifting the robot with fork lift

The procedure below details how to secure the fork lift set in order to lift the robot and move it using fork lift ONLY!

The illustration below shows the position of the robot when lifting it with fork lift.



xx0600003401

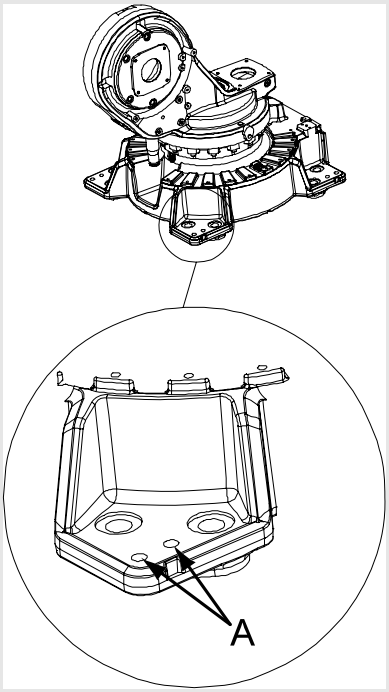
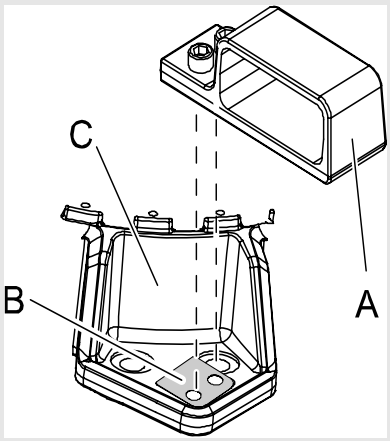
	Action	Note
1.	Move the robot to the position as shown in the figure above! **NOTE!** No load is permitted on the robot!	Release the brakes if required as detailed in section *Manually releasing the brakes on page 61*.
2.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	

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2.5.1. Lifting the robot with fork lift

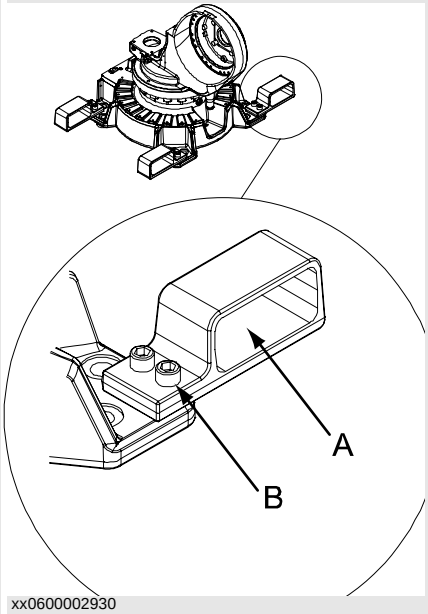
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	Action	Note
3.	Fit the four fork lift pockets on the base of the robot with its attachment screws.	Make sure the original screws are always used (or replacements of equivalent quality: M20x50, quality 8.8)! Attachment points on the robot are shown in the figure below.  xx0600002927 • A: Attachment holes for fork lift
4.	**NOTE!** For **Cleanroom** robots, *protective plates* are applied between the *fork lifting pocket* and the *robot base*, in order to prevent from particle emission when lifting.	 xx0800000042 Parts: • A: Fork lifting pocket • B: Protective plate • C: Robot base

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Continued

	Action	Note
5.	Double check that all four fork lift pockets are properly secured before lifting.	 xx0600002930 • A: Fork lift pocket • B: Attachment screw M20x50 quality 8.8 (2 pcs x 4). Tightening torque : 300 Nm
6.	Insert the fork lift forks into the pockets.	
7.	**CAUTION!** The robot weighs up to 1450 kg depending on variant! (See lifting instruction for details) All lifting equipment used must be sized accordingly!	**NOTE!** When the robot is equipped with forklift pockets an extra weight of 90 kg must be added!
8.	Carefully lift the robot and move it to its installation site. **NOTE!** Move the robot with low speed!	
9.	**WARNING!** Personnel must not, under any circumstances, be present under the suspended load!	

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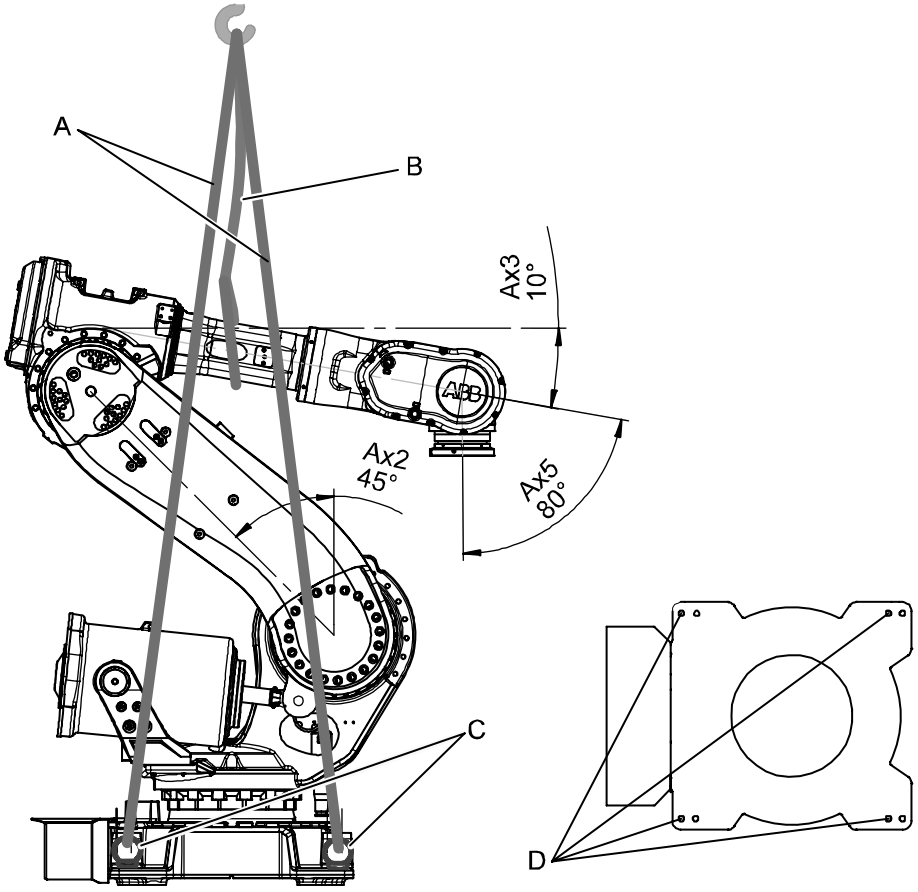
2.5.2. Lifting robot with roundslings

General

The robot may be lifted with roundslings according to the illustration below. The illustration is identical with the label attached to the robot's lower arm.

Attachment points

The figure below shows how to attach the roundslings to the robot.



xx0600003455

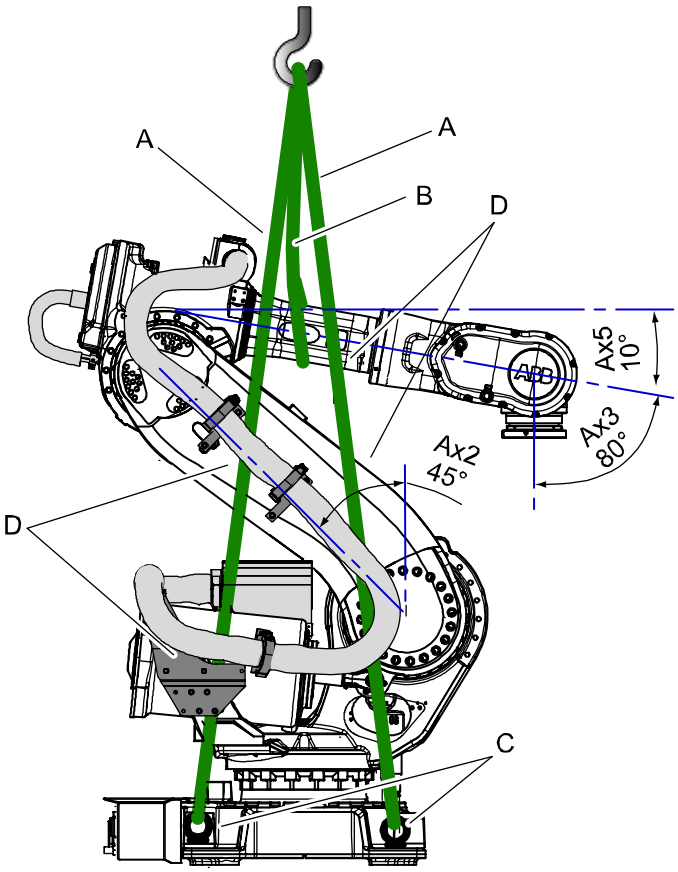
IRB 6640 standard.

-	Lifting instruction 3HAC027647-001
A	Roundsling robot, 2.5 m (4 pcs)
B	Roundsling upper arm, 2 m. **Note!** Make a loop around the upper arm and wrap the roundsling twice around the upper arm! **Do not stretch!**
C	Lifting eye M20 (4 pcs). **Note!** Fit lifting eyes in the rear holes.
D	Holes for lifting eyes in the robotbase. (Rear holes)

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xx0800000059

IRB 6640, Cleanroom variant

A	Roundsling robot, 2.5 m (4 pcs). **NOTE!** It is important to apply the roundsling the way the figure shows. If not, the cable harness will be damaged.
B	Roundsling upper arm, 2 m. **NOTE!** Make a loop around the upper arm and wrap the roundsling twice around the upper arm! Do not stretch!
C	Lifting eye M20 (4 pcs). **NOTE!** Fit lifting eyes in the rear holes!
D	Positions for cellular plastic. **NOTE!** Do not lift without! See procedure below for more specific information where to apply the cellular plastic.

Sling specification

Sling type	Qty	Lifting capacity	Length / Note
Roundsling, robot	4 pcs	2 000 kg	2.5 m
Roundsling, upper arm	1 pc	2 000 kg	**Note!** Do not stretch! 2 m Secures against rotation.

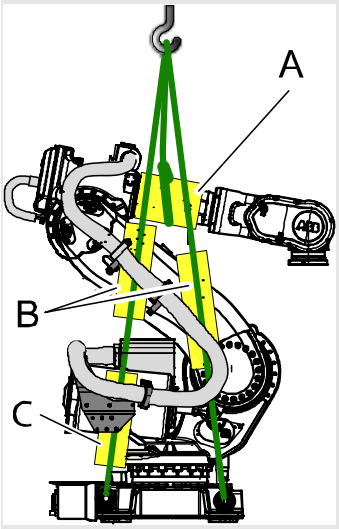
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2.5.2. Lifting robot with roundslings

Continued

Lifting with roundslings

	Action	Note
1.	Attach the roundslings to the robot according to the figure *Attachment points on page 58*.	**NOTE!** For Cleanroom robots it is important to apply the roundslings: • between robot harness and lower arm • behind the side bracket, balancing cylinder.
2.	**NOTE!** For **Cleanroom** robots apply a protection where the lifting equipment and roundslings will rub against the paint of the robot. In order to prevent from particle emission while lifting, put for example a 20 mm thick *cellular plastic sheet* around the places on the robot where the lifting equipment may rub against the paint. Put the 20 mm cellular plastic sheet as extra protection in the following places: • Around the upper arm • Lower arm • Balancing device • Around motor axis 2 (Not shown in figure)	 xx0800000060 Protective cellular plastic sheets at: • A: Upper arm • B: Lower arm • C: Balancing device
3.	**CAUTION!** The robot weighs up to 1450 kg depending on variant! (See lifting instruction for details) All lifting equipment used must be sized accordingly!	**NOTE!** If the robot is equipped with *fork lift pockets* an extra weight of 90 kg must be added to the robot weight!
4.	**WARNING!** Personnel must not, under any circumstances, be present under the suspended load!	

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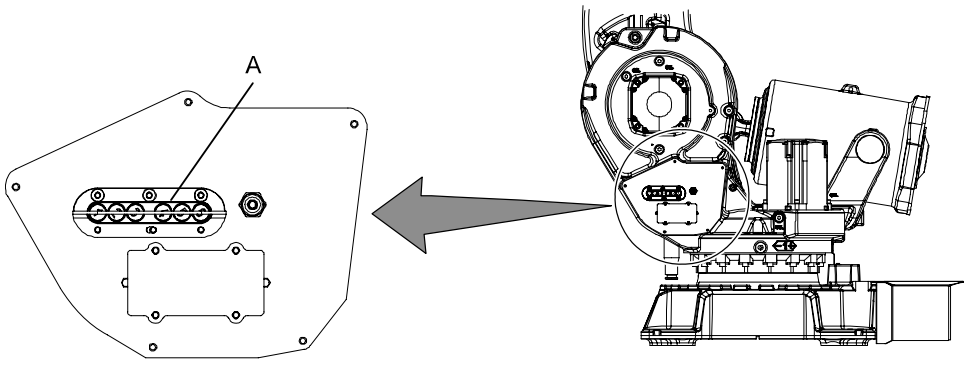
2.5.3. Manually releasing the brakes

General

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

Location of brake release unit

The internal brake release unit is located at the frame, as shown in the figure below.



xx0600003402

A	Internal brake release unit with push buttons.

Releasing the brakes

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

	Action	Note
1.	The internal brake release unit is located on the frame beside motor axis 1. The internal brake release unit is equipped with six buttons for controlling the axes brakes. The buttons are numbered according to the numbers of the axes. If the robot is not connected to the controller, power must be supplied to the connector R1.MP according to section *Supplying power to connector R1.MP on page 62*.	
2.	**DANGER!** When releasing the holding brakes, the robot axes may move very quickly and sometimes in unexpected ways! Make sure no personnel is near the robot arm!	
3.	Release the holding brake on a particular robot axis by pressing the corresponding button on the internal brake release panel and keeping it depressed. The brake will function again as soon as the button is released.	

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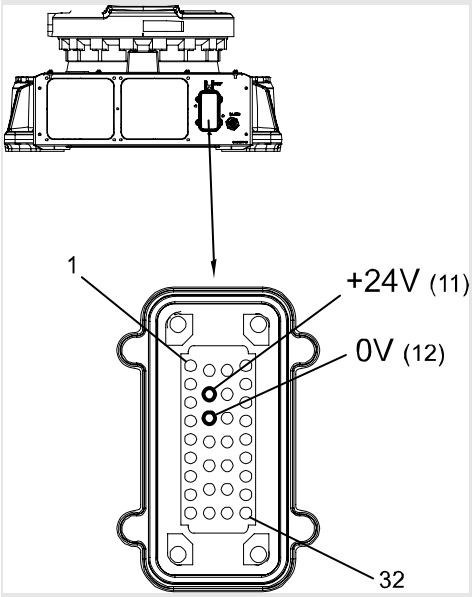
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2.5.3. Manually releasing the brakes

Continued

Supplying power to connector R1.MP

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

	Action	Note
1.	**DANGER!** Incorrect connections, such as supplying power to the wrong pin, may cause all brakes to be released simultaneously!	
2.	Supply 0V on pin 12 and 24V on pin 11.	 xx0600002937

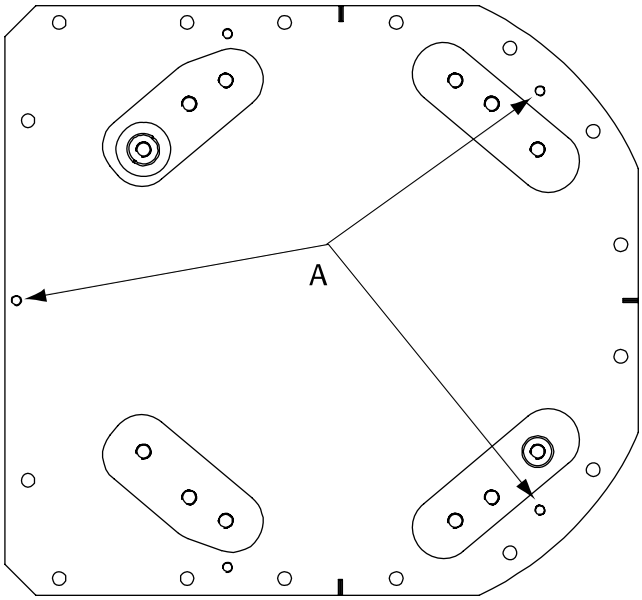
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2.5.4. Lifting the base plate

Required equipment

Equipment	Art. no.	Note
Lifting eye, M16	3HAC14457-4	3 pcs
Lifting slings		3 pcs Length: approx. 2 m

Hole configuration



xx0200000096

A	Attachment holes for lifting eyes (x3)

Lifting, base plate

	Action	Note
1.	**CAUTION!** The base plate weighs 353 kg! All lifting equipment used must be sized accordingly!	
2.	Fit the lifting eyes in the three lifting holes.	Shown in the figure *Hole configuration on page 63*.
3.	Fit the lifting slings to the eyes and to the lifting device.	

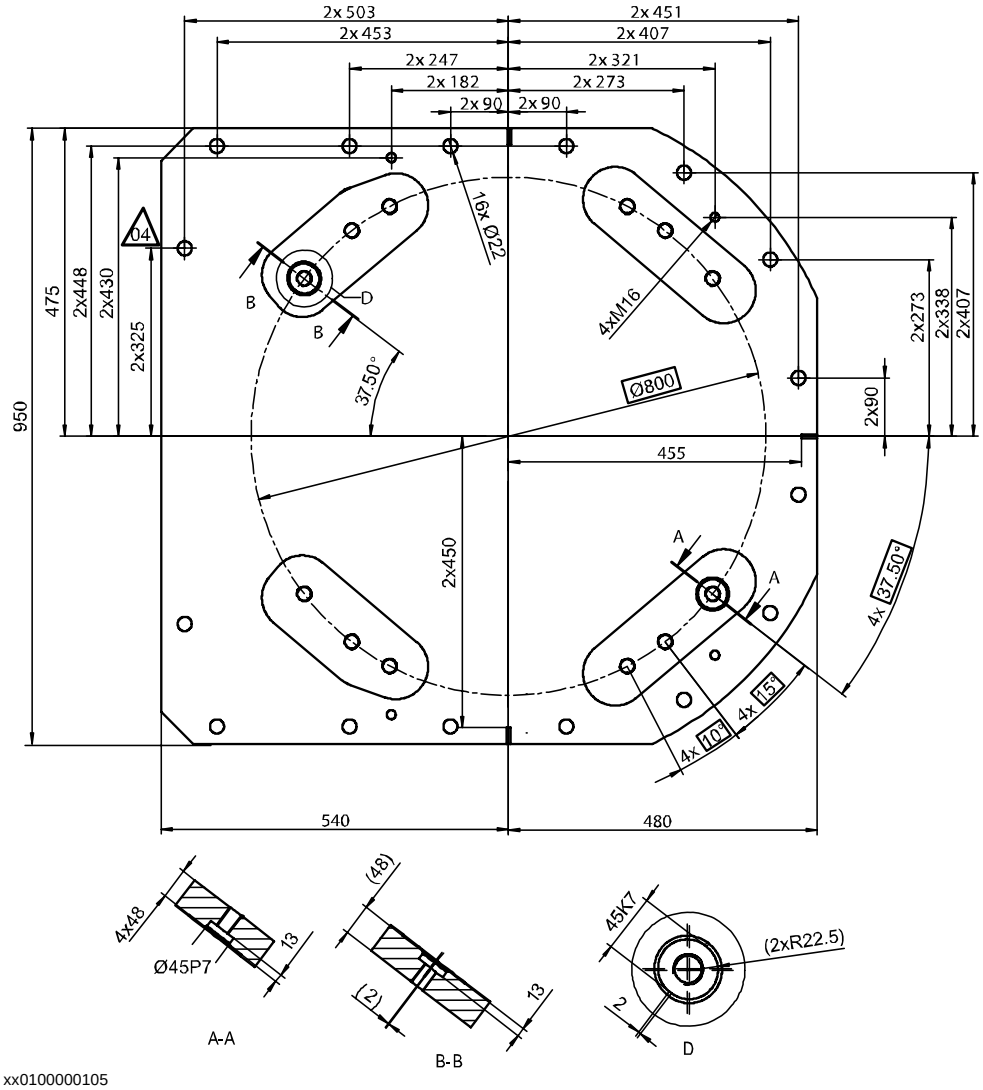
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2.5.5. Securing the base plate

General

This section details how to secure the base plate.

Base plate, dimensions

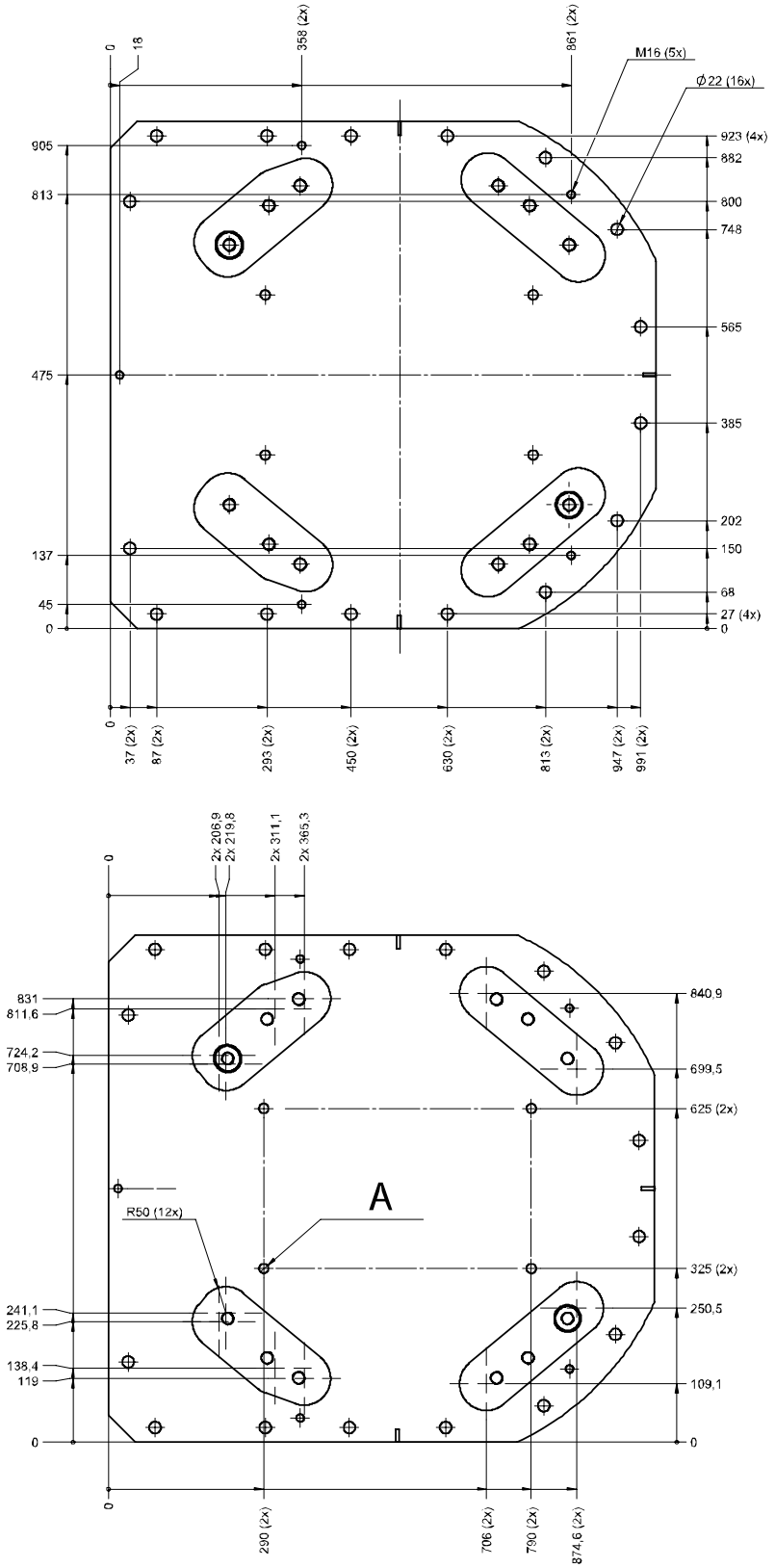


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xx0400000715

A	Four holes for alternative clamping, 4x Ø18

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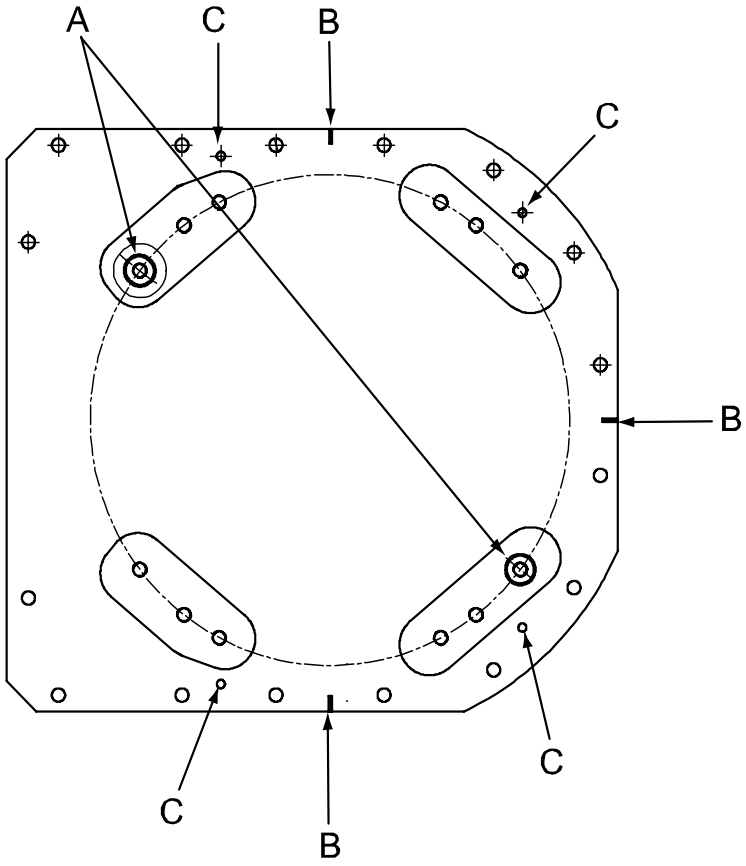
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2.5.5. Securing the base plate

Continued

Base plate, grooves and holes

The illustration below shows the orienting grooves and guide sleeve holes in the base plate.



xx0300000045

A	Guide sleeve holes (2 pcs)
B	Orienting grooves (3 pcs)
C	Levelling bolts, attachment holes (4 pcs)

Required equipment

Equipment	Art. no.	Note
Base plate	3HAC12937-9	Includes • guide sleeves, 3HAC12937-3 • levelling screws, 9ADA120-79 • attachment screws and washers for securing the robot to the base plate. A drawing of the base plate itself may be ordered from ABB Robotics!
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
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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Recommendations, quality

The table specifies any recommendations made by ABB:

Variable	Recommendation
Recommended foundation quality 1	Steel fibre reinforced concrete foundation, 30 kg/m3, class K30, t=250 mm
Recommended foundation quality 2	Sturdy concrete foundation, double reinforced by ø10 mm steel bars, distance 140 mm, class K25, t=250
Recommended bolt quality and dimension	Hilti HDA-P, M20 x 250/50 (maximum thickness of base plate = 50 mm) Hilti HDA-P, M20 x 250/100 (maximum thickness of base plate = 100 mm)

Base plate

This section details how to secure the base plate to the foundation.

	Action	Note
1.	Make sure the foundation is level.	
2.	 **CAUTION!** The base plate weighs 353 kg! All lifting equipment used must be sized accordingly!	
3.	Orient the base plate in relation to the robot work location using the three *grooves* in the base plate.	Shown in the figure *Base plate, grooves and holes on page 66*.
4.	Lift the base plate to its mounting position.	Detailed in section *Lifting the base plate on page 63*.
5.	Use the base plate as a template and drill 16 attachment holes as required by the selected bolt dimension.	If possible, observe the recommendations specified in section *Recommendations, quality on page 67*. ABB does not assume any responsibility for other foundation qualities, due to great variations in the foundation properties.
6.	Fit the base plate and use the *levelling bolts* to level the base plate.	Shown in the figure *Base plate, grooves and holes on page 66*.
7.	If required, fit strips of sheet metal underneath the base plate to fill any gaps.	
8.	Secure the base plate to the foundation with screws and sleeves.	
9.	Recheck the four robot contact surfaces on the base plate to make sure they are level and flat. If they are not, pieces of sheet metal or similar may be used to bring the base plate to a level position.	Maximum allowed deviation: 0.5 mm

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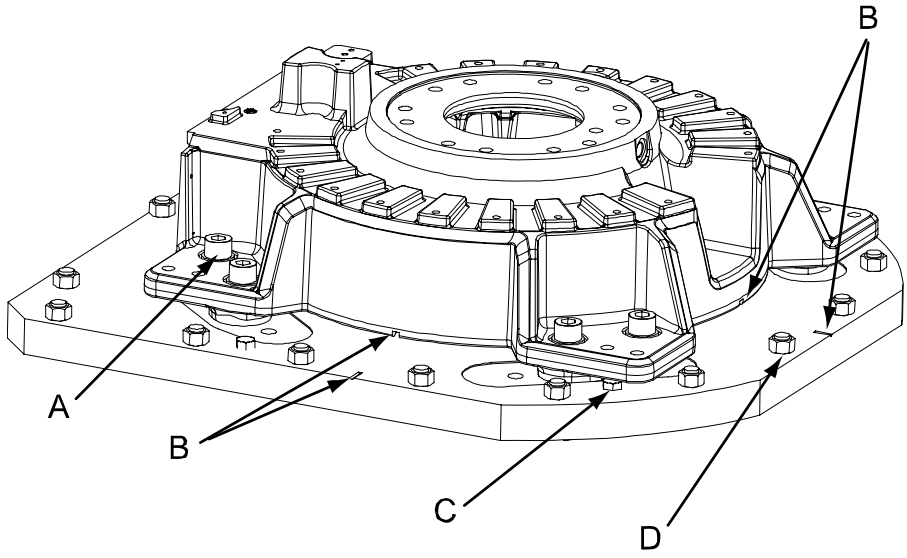
2.5.6. Orienting and securing the robot

General

This section details how to orient and secure the robot to the base plate in order to run the robot safely. The requirements made on the foundations are shown in the following tables and figures.

Illustration, robot fitted to base plate

The illustration below shows the robot base fitted to the base plate.



xx0600002933

A	Robot attachment bolts and washers, 8 pcs (M24 x 100)
B	Orienting grooves in the robot base and in the base plate
C	Levelling screws. **Note!** Remove before the robot base is fitted!
D	Base plate attachment screws

Attachment screws

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

Suitable screws, lightly lubricated:	M24 x 100
Quality:	Quality 8.8
Suitable washer:	Thickness: 4 mm Outer diameter: 44 mm Inner diameter: 25 mm
Tightening torque:	725 Nm

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Securing the robot

The procedure below details how to secure the robot to the base plate after fitting the plate to the foundation.

	Action	Note
1.	Lift the robot.	Detailed in section *Lifting robot with roundslings on page 58*.
2.	Move the robot to the vicinity of its installation location.	
3.	Fit two guide sleeves to the *guide sleeve holes* in the base plate.	**NOTE!** One of the guide sleeve holes is elongated!
4.	Guide the robot gently using two M24 screws while lowering it into its mounting position.	Make sure the robot base is correctly fitted onto the guide sleeves!
5.	Fit the *bolts and washers* in the base attachment holes.	Specified in*Attachment screws on page 68*. Shown in the figure *Illustration, robot fitted to base plate on page 68*. **NOTE!** Lightly lubricate the screws before assembly!
6.	Tighten the bolts in a criss-cross pattern to ensure that the base is not distorted.	

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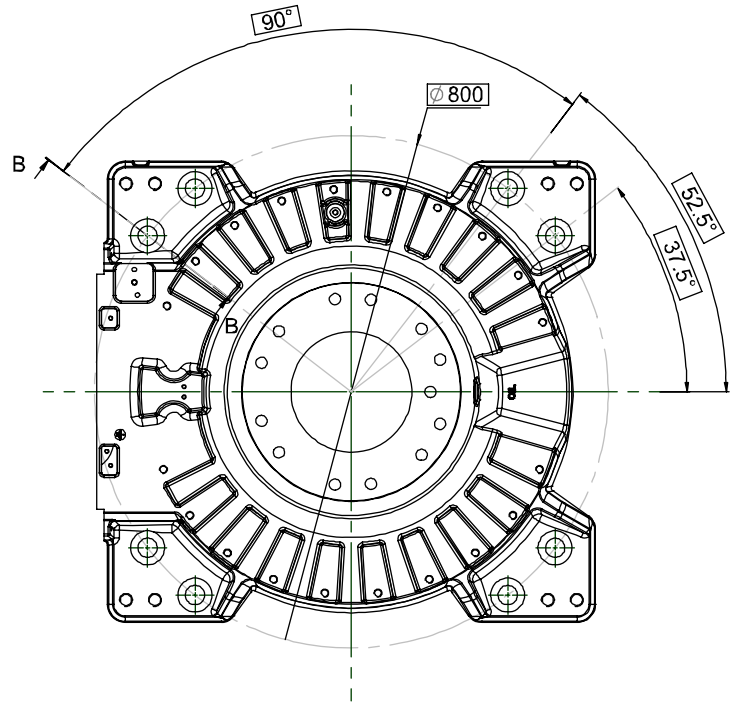
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2.5.6. Orienting and securing the robot

Continued

Hole configuration, base

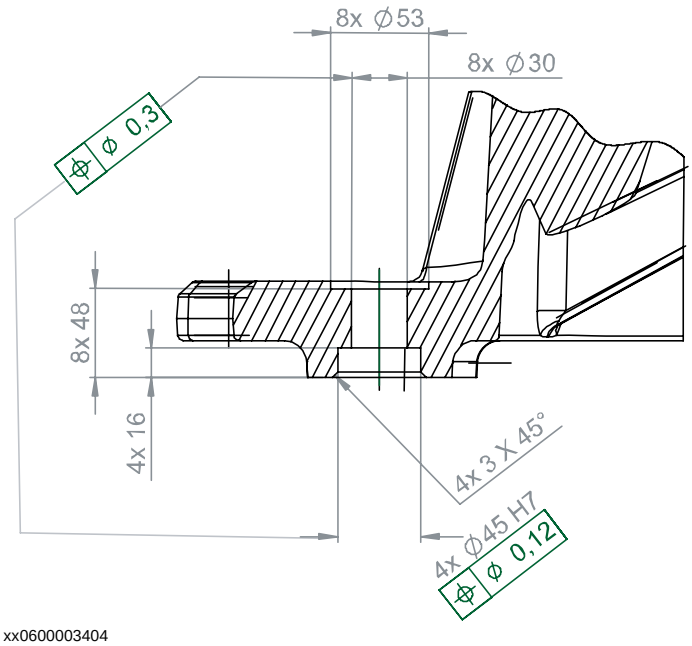
The illustration below shows the hole configuration used when securing the robot.



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Cross section, guide sleeve hole

The illustration below shows the cross section of the guide sleeve holes.



xx0600003404

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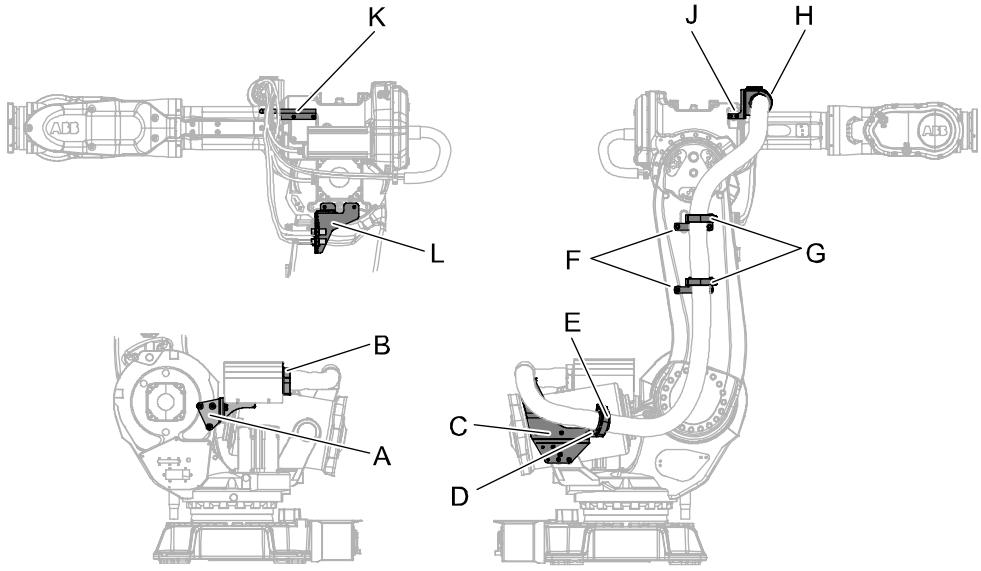
2.5.7. Fitting cable package attachments (Cleanroom)

Overview

This section details how to fit the cable attachments for the cable harness (Cleanroom). How to replace the cable harness itself is detailed in section *Replacement of cable harness, Cleanroom on page 207*.

Location of cable harness attachments (Cleanroom)

The cable harness attachments are located as shown in the figure below.



xx0800000022

A	Shelf
B	Gripping clamp
C	Side bracket balancing cylinder
D	Lower bracket
E	Gripping clamp
F	Bracket for cable clamp
G	Gripping clamp
H	Gripping clamp
J	Bracket for cable clamp
K	Cable guide
L	Connection plate axis 3

Required equipment

Equipment	Part no.	Note
Locking liquid	-	Loctite 243
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.

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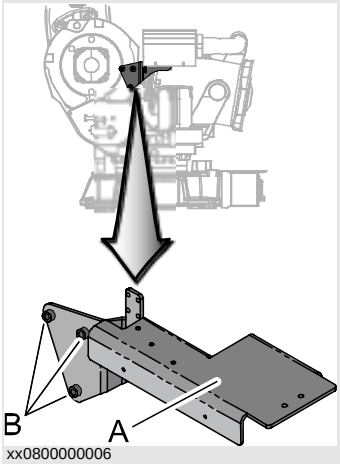
2.5.7. Fitting cable package attachments (Cleanroom)

Continued

Equipment	Part 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.

Fitting of cable package attachments - lower end

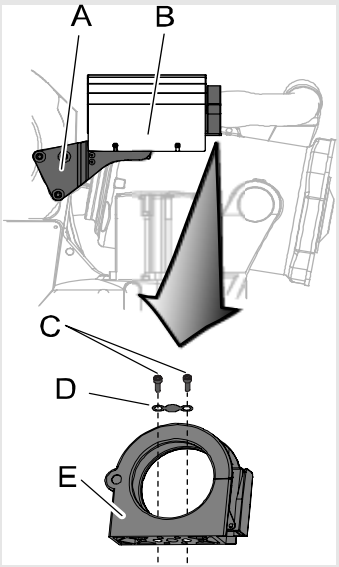
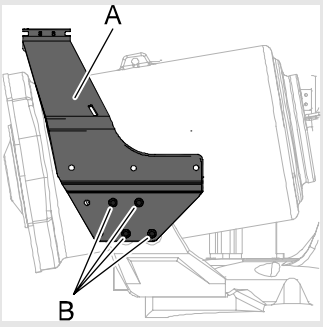
The procedure below details how to install the attachments at the lower end of the cable harness (Cleanroom).

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Fit the *shelf* to the frame with its *attachment screws*. Lock screws with *locking liquid*.	Locking liquid is specified in *Required equipment on page 71*.  xx0800000006 Parts: • A: Shelf • B: Attachment screws M10x16 quality 8.8-A3F (3 pcs)

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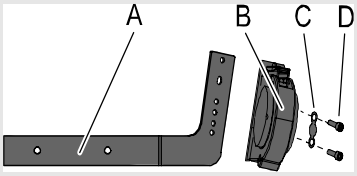
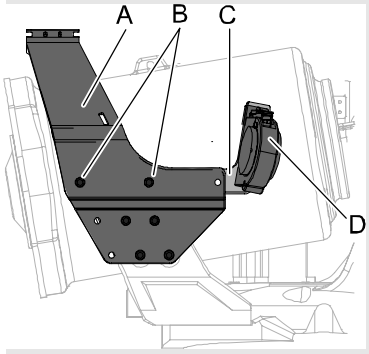
	Action	Note
3.	Fit the *gripping clamp* to the shelf with its *attachment screws*. Lock screws with *locking liquid*.	Locking liquid is specified in *Required equipment on page 71*.  xx0800000008 Parts: • A: Shelf • B: Cover • C: Attachment screws M8x16 quality 8.8-A2F (2 pcs) • D: Washer 2 holes • E: Gripping clamp
4.	Fit the *side bracket, balancing cylinder* with its *attachment screws*. Lock screws with *locking liquid*. The screws are supplied with the kit.	Locking liquid is specified in *Required equipment on page 71*.  xx0800000010 Parts: • A: Side bracket balancing cylinder • B: Attachment screws M10x16 quality 8.8-A3F (4 pcs)

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2.5.7. Fitting cable package attachments (Cleanroom)

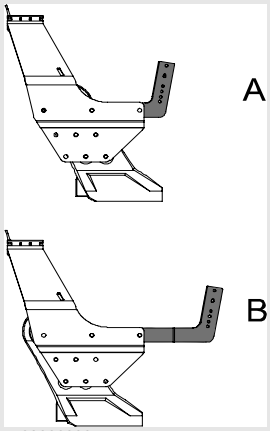
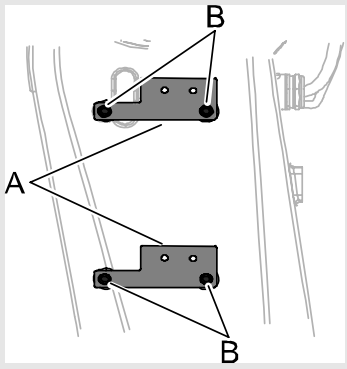
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	Action	Note
5.	Fit the *gripping clamp* to the *lower bracket*, balancing cylinder with its *attachment screws*. Lock screws with *locking liquid*. The screws are supplied with the kit.	Locking liquid is specified in *Required equipment on page 71*.  xx0800000010 Parts: • A: Lower bracket • B: Gripping clamp • C: Washer 2 holes • D: Attachment screws M8x16 quality 8.8-A2F (2 pcs)
6.	Then attach the *lower bracket* (with the *gripping clamp* already fitted) to the *side bracket balancing cylinder* with its *attachment screws*. Lock screws with *locking liquid*. The screws are supplied with the kit.	Locking liquid is specified in *Required equipment on page 71*.  xx0800000013 Parts: • A: Side bracket balancing cylinder • B: Attachment screws M10x16 quality 8.8-A3F (2 pcs) • C: Lower bracket • D: Gripping clamp

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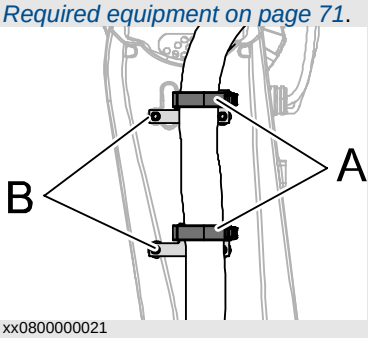
	Action	Note
7.	**NOTE!** The lower bracket is fitted slightly different depending on robot variant. See figure to the right!	 xx0800000014 • A: SW 2.55 • B: SW 2.75
8.	Fit the two *brackets for cable clamp* on the lower arm with its *attachment screws*. Lock screws with *locking liquid*.	Locking liquid is specified in *Required equipment on page 71*.  xx0800000019 Parts: • A: Bracket for cable clamp • B: Attachment screws M12x25 quality 8.8-A3F (2 + 2 pcs)

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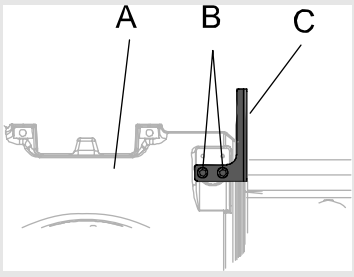
2.5.7. Fitting cable package attachments (Cleanroom)

Continued

	Action	Note
9.	Fit the *gripping clamp* to the *bracket for cable clamp* with its *attachment screws* , M8x16 quality 8.8-A2F (2 pcs) and washer 2 holes (2 pcs). Lock screws with locking liquid. The screws are supplied with the kit.	Locking liquid is specified in *Required equipment on page 71*.  xx0800000021 Parts: • A: Gripping clamp • B: Bracket for gripping clamp

Fitting of cable package attachments - upper end

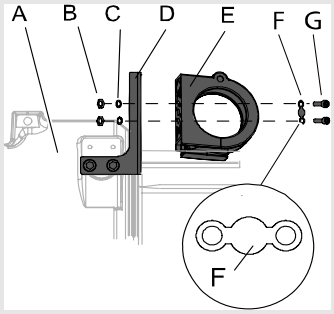
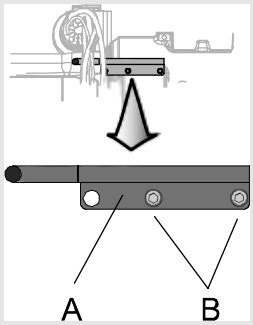
The procedure below details how to install the attachments at the upper end of the cable harness (Cleanroom).

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Fit the *bracket for cable clamp* on top of the armhouse with its *attachment screws*. Lock screws with *locking liquid*. The screws are supplied with the kit.	Locking liquid is specified in *Required equipment on page 71*.  xx0800000027 Parts: • A: Armhouse • B: Attachment screws M12x25 quality 8.8-A3F (2 pcs) • C: Bracket for cable clamp

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Continued

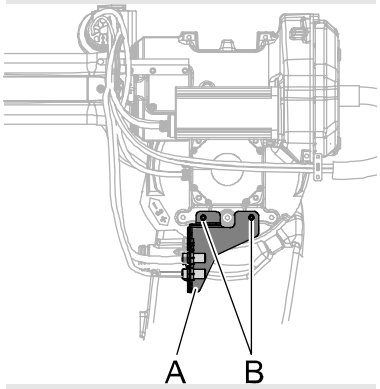
	Action	Note
3.	Fit the *gripping clamp* to the bracket for cable clamp with: • attachment screws (2 pcs) • washer 2 holes • washers (2 pcs) • locking nuts M8 (2 pcs) Lock screws with *locking liquid*. The screws are supplied with the kit.	Locking liquid is specified in *Required equipment on page 71*.  xx0800000023 Parts: • A: Armhouse • B: Locking nut M8 • C: Washer • D: Bracket for cable clamp • E: Gripping clamp • F: Washer 2 holes • G: Attachment screws M8x25 quality 8.8-A2F (2 pcs)
4.	Fit the *cable guide* on the side of the armhouse with its *attachment screws*. Lock screws with *locking liquid*. The screws are supplied with the kit.	Locking liquid is specified in *Required equipment on page 71*.  xx0800000025 Parts: • A: Cable guide • B: Attachment screws M8x25 quality 8.8-A2F (2 pcs)

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2.5.7. Fitting cable package attachments (Cleanroom)

Continued

	Action	Note
5.	Fit the *connection plate axis 3* with its *attachment screws*. Lock screws with *locking liquid*. The screws are supplied with the kit.	Locking liquid is specified in *Required equipment on page 71*.  xx0800000026 Parts: • A: Connection plate axis3 • B: Attachment screws M10x16 quality 8.8-A3F (2 pcs)

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2.5.8. Fitting equipment on robot

General

The robot features mounting holes for additional equipment.

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

NOTE!

For **Cleanroom** robots there may not be any additional equipment fitted to the robot **except** in the following places:

- turning disk
- armhouse
- frame.

Additional cables from base to upper arm, may **not** be fitted to Cleanroom robots!

NOTE!

The robot IRB 6640ID is delivered with DressPack and there may not be any additional equipment fitted to the robot, except at the turning disk and the frame.

Illustration, fitting of extra equipment on lower arm

The illustrations below shows the mounting holes available for fitting extra equipment on the lower arm.

Make sure not to damage the robot cabling on the inside of the lower arm when fitting extra equipment. Always use appropriate attachment screws!

Note! Extra equipment may **not** be mounted on the lower arm of IRB 6640ID!

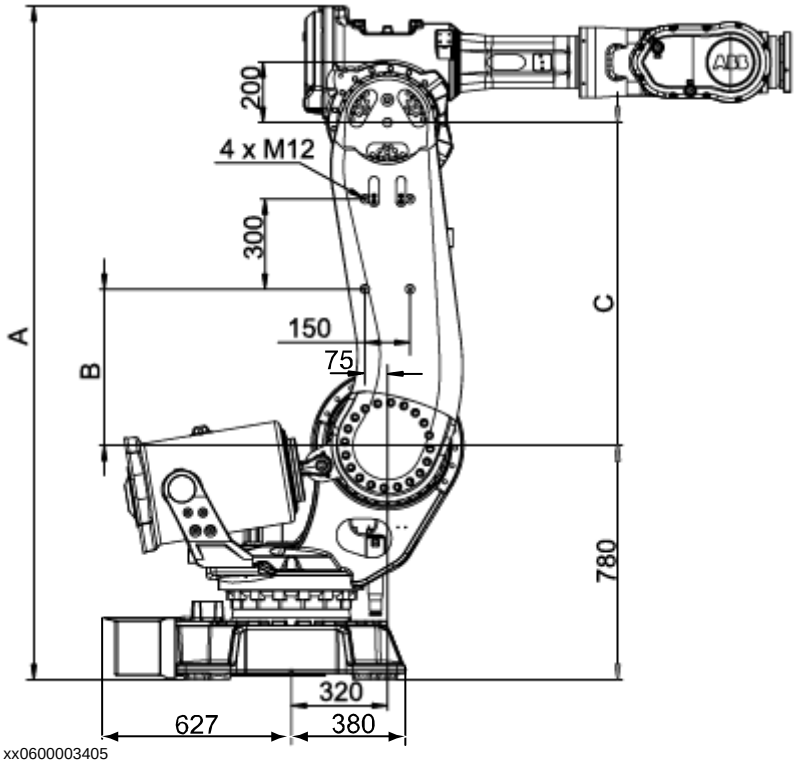
Note! Extra equipment may **not** be fitted on the lower arm of **Cleanroom** robots!

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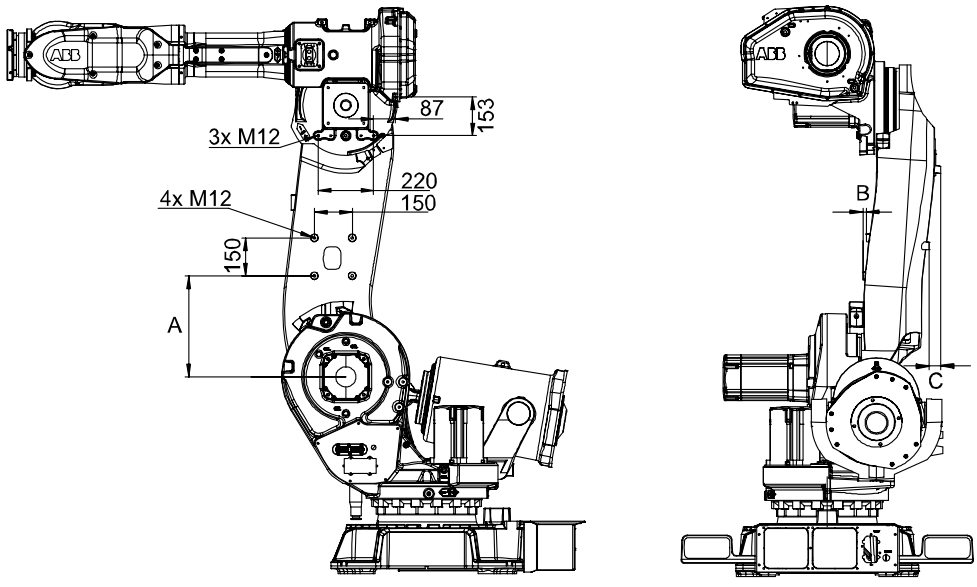
2.5.8. Fitting equipment on robot

Continued



xx0600003405

Robot variant	A	B	C
IRB 6640 - 2.55	2240 mm	520 mm	1075 mm
IRB 6640 - 2.75	2445 mm	725 mm	1280 mm
IRB 6640 - 2.8	2240 mm	520 mm	1075 mm
IRB 6640 - 3.2	2445 mm	725 mm	1280 mm
IRB 6640ID - 2.55	2240 mm	520 mm	1075 mm
IRB 6640ID - 2.75	2445 mm	725 mm	1280 mm



xx0600003406

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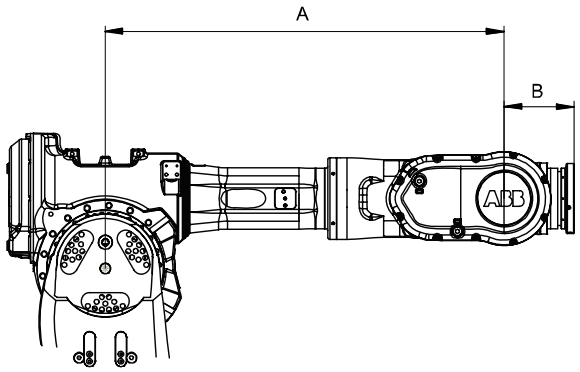
Continued

Robot variant	A	B	C
IRB 6640 - 2.55	400 mm	13 mm	40 mm
IRB 6640 - 2.75	500 mm	13 mm	30 mm
IRB 6640 - 2.8	400 mm	13 mm	40 mm
IRB 6640 - 3.2	500 mm	13 mm	30 mm
IRB 6640ID - 2.55	400 mm	13 mm	40 mm
IRB 6640ID - 2.75	500 mm	13 mm	30 mm

Illustration, fitting of extra equipment on upper arm

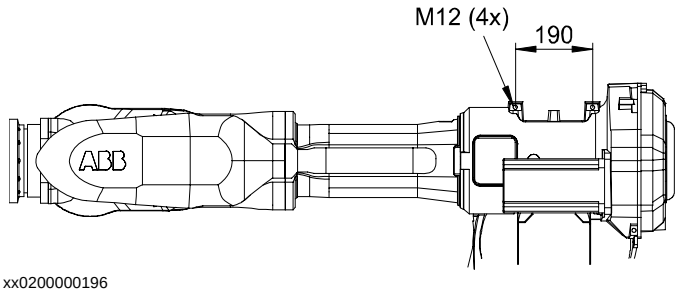
The illustrations below shows the mounting holes available for fitting extra equipment on the upper arm.

Note! Extra equipment may not be fitted on the upper arm of IRB 6640ID and Cleanroom robots!



xx0600003414

Robot variant	A	B
IRB 6640 - 2.55	1142 mm	200 mm
IRB 6640 - 2.75	1142 mm	200 mm
IRB 6640 - 2.8	1392 mm	200 mm
IRB 6640 - 3.2	1592 mm	200 mm
IRB 6640ID	1142 mm	290 mm
IRB 6640ID	1142 mm	290 mm



xx0200000196

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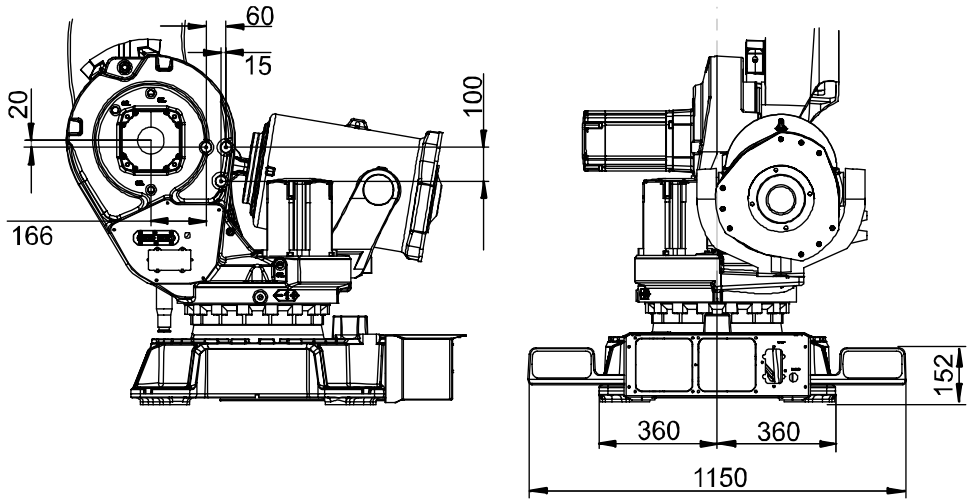
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2.5.8. Fitting equipment on robot

Continued

Illustration, fitting of extra equipment on frame

The illustration below shows the mounting holes available for fitting extra equipment on the frame.



xx0600003416

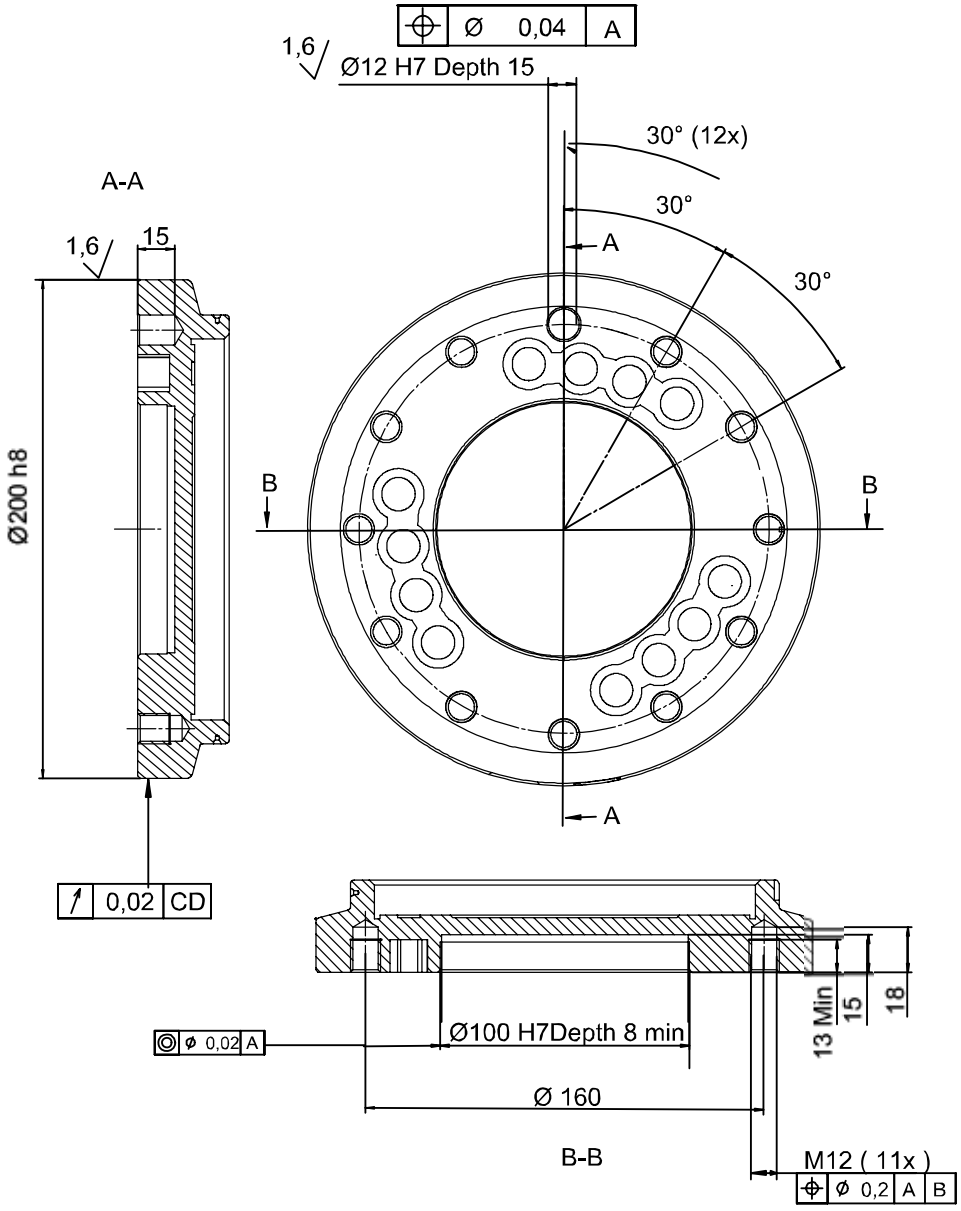
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Illustration, fitting on turning disk

The illustration below shows the mounting holes available for fitting equipment on the turning disk.



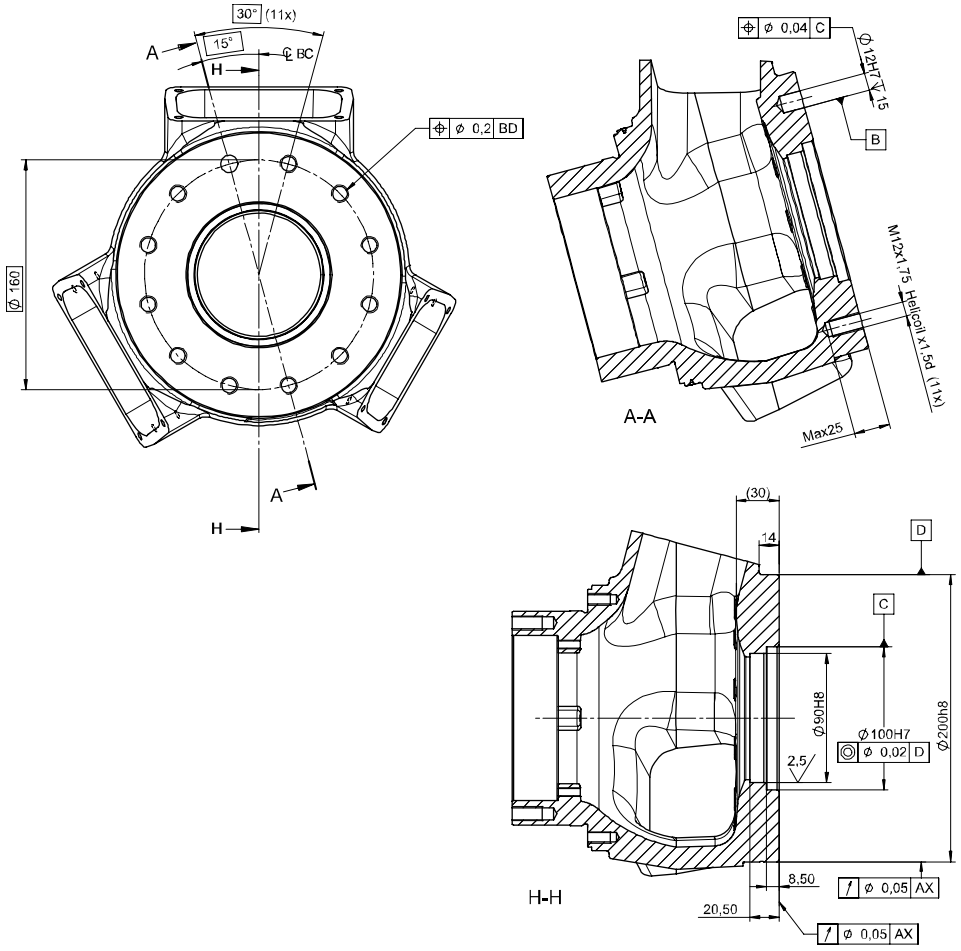
xx0200000197

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2.5.8. Fitting equipment on robot

Continued



xx0500001580

-	Turning disk unit for robot versionIRB 6640ID.

Fastener quality

When fitting tools on the turning disk (see the figures above), only use screws with quality 12.9. When fitting other equipment standard screws with quality 8.8 may be used.

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2.5.9. Installation of cooling fan for motors, axes 1 and 2 (option)

General

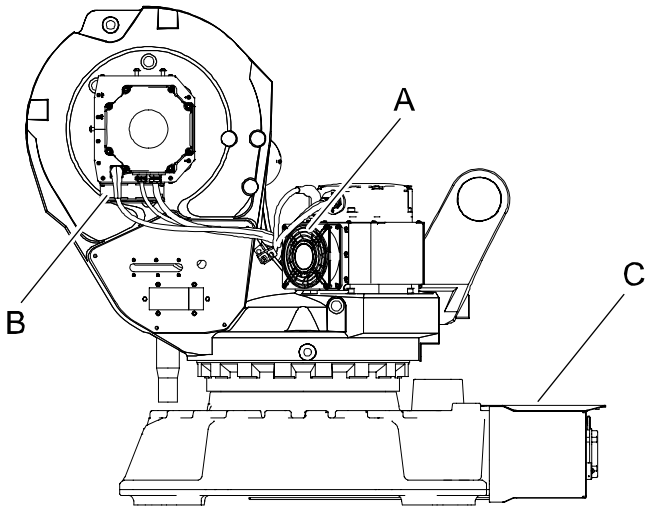
A cooling fan can be installed on the motors of axes 1and 2. However, cooling fans for axes 1 and 2 can not be combined!

The cabling for the fans is available as:

- separate cabling for axis 1 or 2, including only connections for the cooling fans on axes 1 or 2. Installation of this cabling is detailed in section *Installation, separate fan cabling axis 1 or 2 on page 89*.

Location of cooling fans

The fans are installed on the motors, axes 1-2, as shown in the figure below.



xx0700000116

A	Cooling fan, axis 1
B	Cooling fan, axis 2
C	Rear cover plate

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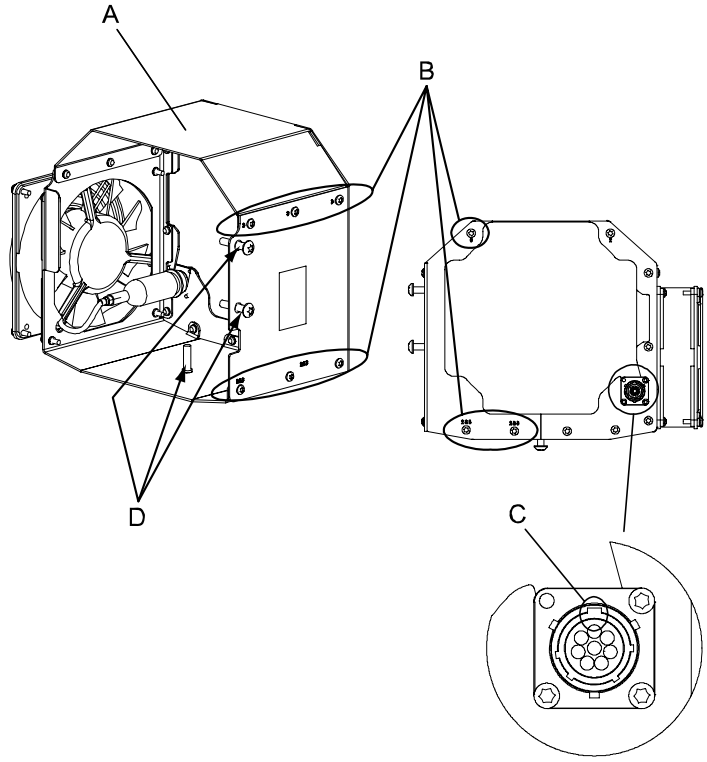
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2.5.9. Installation of cooling fan for motors, axes 1 and 2 (option)

Continued

Cooling fan

The details of the cooling fan are shown in the figure below.



xx0500002158

A	Fanbox
B	Attachment screws, fanbox plates (9 pcs)
C	Groove in the connector
D	Tightening screws, fanbox (3 pcs)

Required equipment

Equipment	Art. no.	Note
Cooling fan	3HAC15374-1	
Cabling, cooling fans, axes 1 or 2.	3HAC023599-001	Choose this cabling if equipping the robot with cooling fans on axis 1 or 2 .
Plate for customer connections	3HAC025778-001	An additional connection plate must be fitted to the robot base, if not already installed. The plate is shown in the figure *Plate for customer connections, at base on page 87*.
Additional cabling to and inside the controller	-	
Material set fan axes 1 and 2	3HAC023999-001	
Cable harness inside controller	3HAC025488-001	
Locking liquid	-	Loctite 243. Used for the three tightening screws.

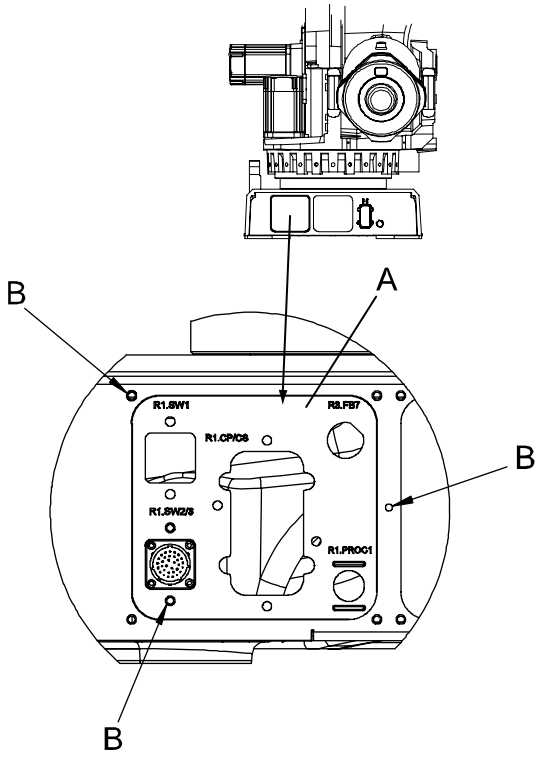
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Continued

Equipment	Art. no.	Note
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
Circuit diagram	- 3HAC025744-001	See chapter *Circuit diagram*.
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.

Plate for customer connections, at base



xx0500002301

A	Plate for customer connections
B	Attachment screws, 3 pcs, M6x16 quality 8.8-A2F

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2.5.9. Installation of cooling fan for motors, axes 1 and 2 (option)

Continued

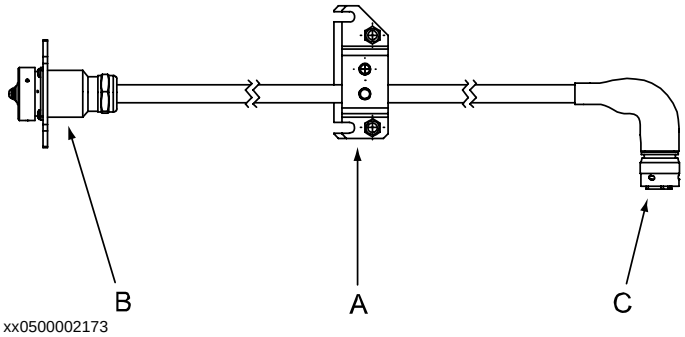
Installation, fan

The procedure below details how to install the cooling fan on motors, axes 1 or 2 .

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Prepare the fanbox for installation: • disassemble the two parts of the box by removing the nine *attachment screws* • loosen the three *tightening screws*, to avoid damaging the surfaces of the motor when fitting the fanbox • turn the connector to the correct position; axis 1: groove pointing inwards, as shown in the figure *Cooling fan on page 86*. Position for axis 2 is shown in the same figure.	Shown in the figure *Cooling fan on page 86*.
3.	Temporarily lift the motor cabling out of the way of the current motor to make room for the fanbox.	
4.	Fit the parts of the fanbox to the motor and reassemble with the nine *attachment screws*.	
5.	Lift the box (axis 1) so that it does not rest directly on the robot and secure the box with the three tightening screws, using locking liquid. Tighten them properly so that the box is firmly attached to the motor.	
6.	Install the cabling and make adjustments in RobotWare, as described in the following procedures.	

Separate cabling for axis 1 or 2

The figure below shows the cabling used only for the fan on axis 1 or 2.



xx0500002173

A	Cable bracket
B	Connector R1.SW2/3, connected to the robot base
C	Connector R3.FAN2, connected to the fan of axis 1or 2

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Installation, separate fan cabling axis 1 or 2

The procedure below details how to install the separate cabling for the cooling fan of axis 1 or 2.

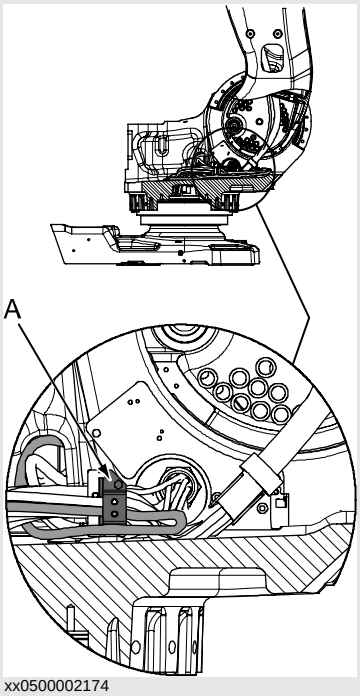
	Action	Note
1.	Move the robot to its calibration position.	Shown in section *Calibration scales and correct axis position on page 376*.
2.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Remove the *rear cover plate* from the robot base.	Shown in the figure *Location of cooling fans on page 85*.
4.	Remove the cable bracket (A)	Shown in the figure *Separate cabling for axis 1 or 2 on page 88*
5.	Fit the *plate for customer connections*, if not already fitted, to the connection plate of the robot base.	Shown in the figure *Plate for customer connections, at base on page 87*. Art. no. is specified in *Required equipment on page 86*.
6.	Run the cabling up through the base and frame, beneath the balancing device.	

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2.5.9. Installation of cooling fan for motors, axes 1 and 2 (option)

Continued

	Action	Note
7.	Secure the *cable bracket* to the bracket of the robot cabling inside the frame. Run the cable underneath the robot cabling and out through the side of the frame, at motor, axis 1 . The correct cable run is shown in the figure to the right! **NOTE!** There is a risk of the balancing device damaging the cable if it is not protected by the robot cabling!	 xx0500002174 A. Cable bracket. Also shown in the figure *Separate cabling for axis 1 or 2 on page 88*.
8.	Connect the connector R3.FAN2 to the fan of axis 1or 2.	**NOTE!** Fans on both axis 1 and 2 can not be used at the same time!
9.	Connect the connector R1.SW2/3 to the base of the robot. Make sure that the cabling, run through the frame and base, is not twisted and runs freely from the robot cabling.	
10.	Refit the rear cover plate to the robot base.	
11.	Install additional cabling to and inside the controller. Also make adjustments in RobotWare, as described in the following procedure.	Cable is specified in section *Fan cables, robot base to control cabinet (option) on page 100*.

Adjustments in RobotWare

	Action	Note
1.	Modify the settings in RobotWare to include the cooling fans.	RobotWare 5.0: change the settings in the Modifying options dialogue, by using the Modify Controller System Wizard in the System Builder of RobotStudio. Read more about modifying the system in *Operating manual - RobotStudio*.

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2.5.10. Loads

General

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



CAUTION!

Incorrect defined loads may result in operational stops or major damage on the robot.

References

Load diagrams, permitted extra loads (equipment) and their positions are specified in the *Product Specification*. The loads must also be defined in the software as detailed in *Operating manual IRC5 with FlexPendant*.

Stop time and braking distances

Robot motor brake performance depends on any loads attached. For further information about brake performance, please contact ABB.

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2.6 Restricting the working range

2.6.1. 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 axis may be restricted:

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

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

Notice that adjustments must also be made in the software. References to software manuals are given in the following installation procedures.

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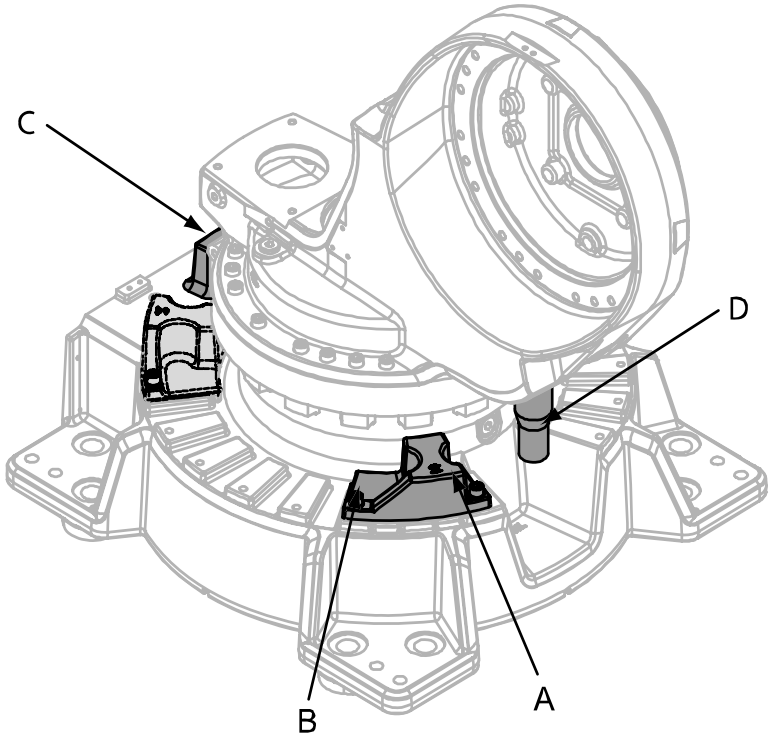
2.6.2. Mechanically restricting the working range of axis 1

General

The working range of axis 1 is limited by fixed mechanical stops and can be reduced by adding additional mechanical stops giving 7.5 or 15 graduation, between 22.5° and 135° in both directions.

Mechanical stops, axis 1

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



xx0600002938

A	Movable mechanical stop
B	Attachment screw plus washer, M12 x 40 quality 12.9 (2 pcs)
C	Fixed mechanical stop
D	Mechanical stop pin axis 1

Required equipment

Equipment, etc.	Art. no.	Note
Mechanical stop for axis 1, 7.5°	3HAC025204-003	Includes attachment screws and an assembly drawing.
Mechanical stop for axis 1, 15°	3HAC025204-003	Includes attachment screws and an assembly drawing.
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.

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2.6.2. Mechanically restricting the working range of axis 1

Continued

Equipment, etc.	Art. no.	Note
Technical reference manual - System parameters (RobotWare 5.0)	-	Art. no. is specified in section *References*.

Installation, mechanical stops axis 1

The procedure below details how to fit the mechanical stops of axis 1 to the robot. An assembly drawing is also enclosed with the product.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Fit the additional mechanical stop to the frame according to the figure *Mechanical stops, axis 1 on page 93*.	Tightening torque: 120 Nm.
3.	 **NOTE!** To utilize the option 561-1 "Extended working range axis 1" the software working range limitations must be re-defined. The motion configuration parameter "arm/rob1_1/Upper Joint Bound" and "arm/rob1_1/Lower Joint Bound" must be changed to 3.84 resp. -3.84. The values are in radians that is 220 deg. = 3.84 rad.	The system parameters that must be changed in RobotWare 5.0 (Upper joint bound and Lower joint bound) are further detailed in *Technical reference manual - System parameters*.
4.	 **WARNING!** If the mechanical stop is deformed after a hard collision, it must be replaced!	

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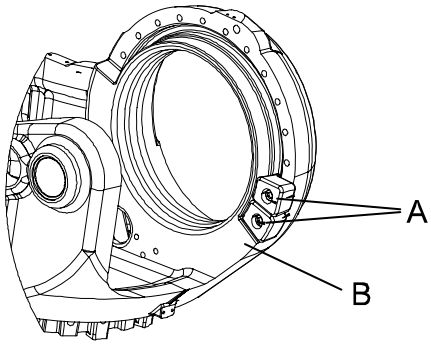
2.6.3. Mechanically restricting the working range of axis 2

General

The working range of axis 2 is limited by fixed mechanical stops and can be reduced by adding up to six additional mechanical stops with 15 graduation in respective direction.

Mechanical stops, axis 2

The illustration below shows the mounting position of the mechanical stops on axis 2.



xx0700000117

The figure shows IRB 7600 but the principle is the same.

A	Additional stops, axis 2
B	Fixed stop, axis 2

Required equipment

Equipment, etc.	Art. no.	Note
Mechanical stop set, axis 2	3HAC020885-001	Includes six stops, attachment screws, washers and assembly drawings.
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
Technical reference manual - System parameters (RobotWare 5.0)	-	Art. no. is specified in section *References on page 8*.

Installation, mechanical stops axis 2

The procedure below details how to fit the mechanical stops for axis 2 to the robot. An assembly drawing is also enclosed with the product.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	

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2.6.3. Mechanically restricting the working range of axis 2

Continued

	Action	Note
2.	Fit and tighten the additional stops in a row, starting from the fixed stop.	Tightening torque: 115 Nm. Shown in the figure *Mechanical stops, axis 2 on page 95*.
3.	The software working range limitations must be re-defined to correspond to the changes in the mechanical limitations of the working range.	The system parameters that must be changed in RobotWare 5.0 (Upper joint bound and Lower joint bound) are further detailed in *Technical reference manual - System parameters*.
4.	 **WARNING!** If the mechanical stop is deformed after a hard collision, it must be replaced!	

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2.6.4. Mechanically restricting the working range of axis 3

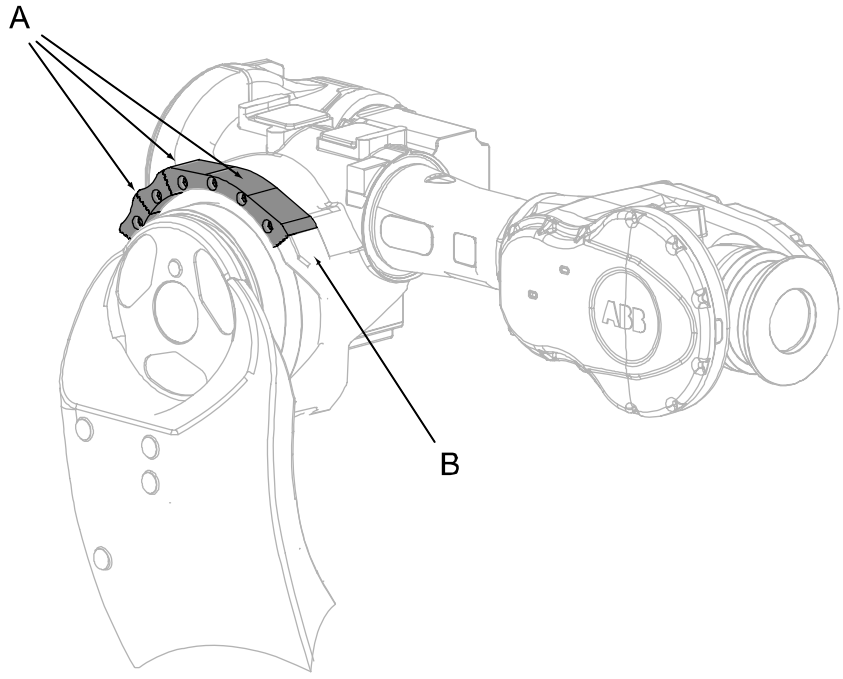
General

The working range of axis 3 is limited by fixed mechanical stops and can be reduced by adding additional mechanical stops with 20 graduation in respective direction.

Mechanical stops, axis 3

The illustration below shows the mounting position of the mechanical stops on axis 3.

The figure shows IRB 7600 but the principle is the same.



xx0300000048

A	Additional mechanical stops
B	Fixed mechanical stop

Required equipment

Equipment, etc.	Art. no.	Note
Mechanical stop set, axis 3	3HAC13128-1	Includes: • six stops, one with 80° restriction, 3HAC12708-3 (use when limitation angle >=80), and five with 20°, 3HAC12708-1. • attachment screws.
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
Technical reference manual - System parameters (RobotWare 5.0)	-	Art. no. is specified in section *References on page 8*.

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Continued

Installation, mechanical stops axis 3

The procedure below details how to fit the mechanical stops for axis 3 to the robot. An assembly drawing is also enclosed with the product.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Mount and tighten the additional stops in a row, starting from the fixed stop.	Shown in the figure *Mechanical stops, axis 3 on page 97*
3.	**NOTE!** The software working range limitations must be re-defined to correspond to the changes in the mechanical limitations of the working range.	The system parameters that must be changed in RobotWare 5.0 (Upper joint bound and Lower joint bound) are further detailed in *Technical reference manual - System parameters*.
4.	**WARNING!** If the mechanical stop is deformed after a hard collision, it must be replaced!	

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2.7 Electrical connections

2.7.1. Robot cabling and connection points

General

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 99*.
Fan cables (option)	Handles supply to and feedback from any cooling fan on the robot. Specified in the table *Fan cables, robot base to control cabinet (option) on page 100*.
Customer cables (option)	Handles communication with equipment fitted on the robot by the customer, including databus communication, low voltage signals and high voltage power supply + protective ground. See the product manual for the controller [1)].
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 *Application manual - Additional axes and stand alone controller (M2004)*[1)].

[1)] Art. no. is specified in section *References on page 8*.

The cable categories are divided into sub-categories, specified below:

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	3HAC11818-1
Robot cable, power, 15 m	3HAC11818-2

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2.7.1. Robot cabling and connection points

Continued

Cable	Art. no.
Robot cable, power, 22 m	3HAC11818-3
Robot cable, power, 30 m	3HAC11818-4

Robot cable, signals

Cable	Art. no.
Robot cable, signal, shielded, 7 m	3HAC7998-1
Robot cable, signal, shielded, 15 m	3HAC7998-2
Robot cable, signal, shielded, 22 m	3HAC7998-3
Robot cable, signal, shielded, 30 m	3HAC7998-4

Fan cables, robot base to control cabinet (option)

These cables are *not* included in the standard delivery, but are included in the delivery if the fan option is ordered. Fans can also be ordered without cables. The cables are completely pre-manufactured and ready to plug in.

Cabling to be installed on the robot is specified in section *Installation of cooling fan for motors, axes 1 and 2 (option) on page 85*.

Cabling between robot base and control cabinet, cooling fans.

The cables specified below are specific for the IRC5 controller and used when the robot is equipped with cooling fans. The cabling for the cooling fans runs all the way from the robot base to the inside of the cabinet.

If equipping the robot with cooling fans, use the cabling specified below. The cables for cooling fans listed below are used together with a distributing cable, also specified below.

Cable	Art. no.	Connection point
Distributing cable	3HAC022708-001	Robot base: R1.SW2/3
Harness - cooling, 7 m	3HAC022723-001	Distributing cable: R1.FAN.SW2/3 Inside cabinet: A43.X10 and A43.X11
Harness - cooling, 15 m	3HAC022723-004	Distributing cable: R1.FAN.SW2/3 Inside cabinet: A43.X10 and A43.X11
Harness - cooling, 22 m	3HAC022723-005	Distributing cable: R1.FAN.SW2/3 Inside cabinet: A43.X10 and A43.X11
Harness - cooling, 30 m	3HAC022723-006	Distributing cable: R1.FAN.SW2/3 Inside cabinet: A43.X10 and A43.X11

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2.8 Making robot ready for operation (Foundry Prime)

2.8.1. Additional installation procedure

General

Robots delivered with the Foundry Prime protection are specially designed to work in water jet cleaning cells with 100% humidity and alkaline detergent. To ensure that the protection offers the best reliability, some measures are needed during installation of the robot according to the procedures below.

NOTE!

For best reliability, it is of highest importance that the special maintenance instructions for the Foundry Prime robot are followed and documented.

Commissioning

- Never switch off the overpressure in motors and serial measurement compartment during cooling down of robot after it has been switched off.
- When turning off a cleaning cell we recommend that the humid air inside a cell is ventilated out, to avoid that the humid air is sucked into gearboxes for example, due to the raised vacuum when cooled down.

Environmental conditions

The table below details the environmental conditions.

Parameter	Value
Humidity	100%
Washing detergent with pH	<9.0
Washing detergent must contain rust inhibitor and be approved by ABB	
Cleaning bath temperature	<60°C, used in a typical waterjet cleaning application at suitable speed.

Air specification for pressurizing of robot

The air must be dry and clean, such as instrument air. The table below details the air specifications.

Parameter	Value
Dew point	<+2°C at 6 bar
Solid particle size	<5 microns
Oil content	<1 ppm (1 mg/m3)
Pressure to robot	0.2 - 0.3 bar

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2.8.1. Additional installation procedure

Continued

WARNING!

If the pressurized air contains oil, it could result in a brake failure in the motors and cause the robot arms to fall down, leading to personal injury or physical damage.

WARNING!

If the air pressure exceeds the specified, it could result in a brake failure in the motors and cause the robot arms to fall down, leading to personal injury or physical damage.

NOTE!

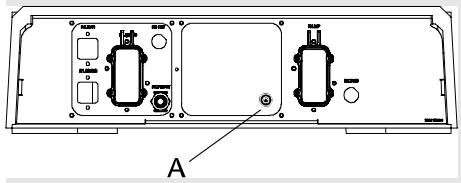
To secure the supply of air pressure, it is recommended to use a pressure sensor.

Pressurize the motors, balancing device and serial measurement board cavity

The robots are prepared with hoses to the motors and the serial measurement board cavity to enable pressurizing of them.

WARNING!

The robot must be pressurized also when it is switch off, to avoid that the humid environmental air is sucked into the motors when cooling down.

	Action	Note
1.	Connect a compressed air hose to air connector on robot base.	 xx0700000450 • A: Air connection, outside diameter = 6 mm.
2.	Protect the screws on the Harting connector on the robot base from corrosion with Mercasol 3106.	Do this when the controller cables are connected.
3.	Pressurize the robot.	See *Air specification for pressurizing of robot on page 101* for correct pressure.
4.	Inspect the air system.	See *Inspection of air hoses (Foundry Prime) on page 138*.

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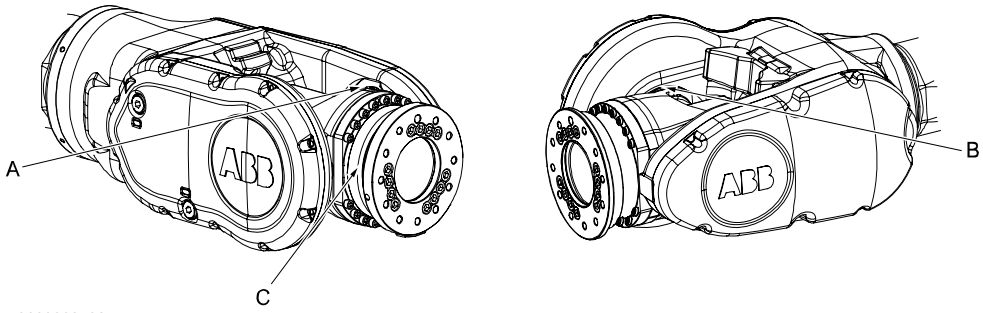
Protecting robot from high pressure water

WARNING!

No part of the robot should be exposed to direct high pressure jet of water. The sealings between the moving parts on the wrist should not be exposed to direct or rebounding high-pressure jet of water.

Protection points at the wrist joints

The illustration below shows points that are particularly sensitive to water spray.



xx0600002792

A	Axis 5, bearing support side
B	Axis 5, bearing gear side
C	Axis 6, mounting flange - gear house

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2.8.2. Commissioning (Foundry Prime)

General

The following should be taken in consideration when running a robot in a water jet application cell:



CAUTION!

Never switch off the overpressure in motors and serial measurement compartment during cooling down of robot after it has been switched off.



NOTE!

To reduce the risk for corrosion due to condensation in gearboxes, it is recommendable that the robot is running with high speed on each axes at least on one occasion each hour. This is to lubricate the gearbox cavities.



NOTE!

When turning off a cleaning cell we recommend that the humid air is ventilated out from the cell, to avoid that the humid air is sucked into gearboxes for example, due to the raised vacuum when cooled down.

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2.9 Making robotready for operation, (Cleanroom)

2.9.1. Additional installation procedure, Cleanroom

General

Cleanroom robots are specially designed to work in a cleanroom environment.

Cleanroom robots are designed in order to prevent from particle emission from the robot. For example is maintenance work possible to perform without cracking the paint. The robot is painted with four layers of polyurethane paint. The last layer being a varnish over labels in order to simlify cleaning.

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

Cleanroom class 5

Particle emission from the robot fulfill Cleanroom class 5 standard according to DIN EN ISO 14644-1.

Preparations before commissioning a Cleanroom robot

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

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2.9.1. Additional installation procedure, Cleanroom

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3 Maintenance

3.1. Introduction

Structure of this chapter

This chapter details all maintenance activities recommended for the robot and any external units of the robot.

It is based on the maintenance schedule, located in 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 information required to perform the activity, that is, required tools and materials.

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

Safety information

Before any service 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 describe danger and safety risks when performing the procedures. Read the chapter *Safety* before performing any service work.

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3.2 Maintenance schedule and expected component life

3.2.1. Specification of maintenance intervals

Description

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

- Calendar time: specified in months regardless of whether the robot system is run or not
- Operating time: specified in operating hours. More frequent running of the robot 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 is further detailed in the Operating manual *Service Information System*. Document number can be found in section *References*.

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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 table below.

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

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

Values for these are specified in *Expected component life on page 114*.

Activities and intervals, standard equipment

The table below specifies the required maintenance activities and intervals:

Maintenance activity	Equipment	Interval	Detailed in section
Cleaning	Robot	-	*Cleaning, robot on page 185*
Inspection	Axis 1 gear, oil level	12 mths [1)]	*Inspection, oil level gearbox axis 1 on page 115*
Inspection	Axis 2 gear, oil level	12 mths [1)]	*Inspection, oil level gearbox axis 2 on page 117*
Inspection	Axis 3 gear, oil level	12 mths [1)]	*Inspection, oil level gearbox axis 3 on page 119*
Inspection	Axis 4 gear, oil level	12 mths	*Inspection, oil level gearbox axis 4 on page 121*
Inspection	Axis 5 gear, oil level	12 mths	*Inspection, oil level, gearbox axis 5 on page 123*
Inspection	Axis 6 gear, oil level	12 mths [1)]	*Inspection, oil level gearbox axis 6 on page 125*
Inspection	Balancing device	12 mths	*Inspection, balancing device on page 128*
Inspection	Robot harness	12 mths	*Inspection, cable harness on page 133*
Inspection	Information labels	12 mths	*Inspection, information labels on page 139*
Inspection	Damper axes 2-5	12 mths	*Inspection, damper axes 2-5 on page 146*
Inspection	Mechanical stop, axis 1	12 mths	*Inspection, mechanical stop, axis 1 on page 142*
Changing	Axis 1 gear oil: Kyodo Yushi TMO 150	First change after: 6 000 h Second change after: 24 000 h [9)]	Do not mix with other oils! *Oil change, gearbox axis 1 on page 154*
Changing	Axis 2 gear oil: Kyodo Yushi TMO 150	First change after: 6 000 h Second change after: 24 000 h [9)]	Do not mix with other oils! *Oil change, gearbox axis 2 on page 157*

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3.2.2. Maintenance schedule

Continued

Maintenance activity	Equipment	Interval	Detailed in section
Changing	Axis 3 gear oil: Kyodo Yushi TMO 150	First change after: 6 000 h Second change after: 24 000 h [9]	Do not mix with other oils! *Oil change, gearbox, axis 3 on page 160*
Changing	Axis 4 gear oil: Mobilgear 600 XP 320	24 000 h [1]	*Oil change, gearbox, axis 4 on page 163*
Changing	Axis 5 gear oil : Mobilgear 600 XP 320	24 000 h [1]	*Oil change, gearbox, axis 5 on page 166*
Changing	Axis 6 gear oil: Kyodo Yushi TMO 150 (IRB 6640)	First change after: 6 000 h Second change after: 24 000 h [9]	Do not mix with other oils! *Oil change, gearbox axis 6 on page 169*
Changing	Axis 6 gear oil: Mobilgear 600 XP320 (IRB 6640ID)	12 000 h [1]	*Oil change, gearbox axis 6 on page 169*
Replacement	Axis 1 gearbox	As specified by the SIS, or typically 96 mths	*Replacement of gearbox, axis 1*
Replacement	Axis 2 gearbox	As specified by the SIS, or typically 96 mths	*Replacement of gearbox axis 2*
Replacement	Axis 3 gearbox	As specified by the SIS, or typically 96 mths	*Replacement of gearbox, axis 3 on page 361*
Replacement	Axis 4 gearbox [5]	96 mths [2]	*Replacement of upper arm on page 260*
Replacement	Axis 5 gearbox [6]	96 mths [2]	*Replacement of complete wrist unit on page 252*
Replacement	Axis 6 gearbox	96 mths[1]	*Replacement of gearbox, axis 6 on page 368*
Replacement	Robot harness	See note below [3]	*Replacement of cable harness, axes 1-6 on page 193* *Replacement of cable harness, Cleanroom on page 207* *Replacement of cable harness, axes 5-6 - IRB 6640ID on page 228*
Replacement	SMB Battery pack	36 mths	*Replacement of SMB battery on page 172*
Lubrication	Balancing device bearing	12 000 h [4]	*Lubrication of spherical roller bearing, balancing device on page 175*

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Continued

- [1] If the robot is run at ambient temperatures higher than 50°C, the equipment may require maintenance more frequently.
- [2] The service time for gearboxes, axes 4 and 5, is not calculated by the SIS, see expected life in section *Expected component life on page 114*.
- [3] Replace when damage is detected or when approaching life limit as specified in *Expected component life on page 114*.
- [4] The interval is the same as the interval for changing axis 2 gear oil because of the similarity of the type and degree of operation. Always lubricate the front eye bearing after refitting the balancing device shaft!
- [5] It is recommended to replace the complete upper arm house, instead of only replacing the gearbox.
- [6] It is recommended to replace the complete wrist unit, instead of only replacing the gearbox.
- [9] "24 000 h" = 6000 h + 18000 h.

Activities and intervals, optional equipment

The table below specifies the required maintenance activities and intervals for common optional equipment. Maintenance of other external equipment for the robot is detailed in separate documentation.

Maintenance activity	Equipment	Interval	Detailed in section
Inspection	Signal lamp		*Inspection, signal lamp (option) on page 148*
Inspection	Mechanical stop axes 1-2-3	12 mths	*Inspection, additional mechanical stops on page 144*

Activities and intervals, Foundry Prime

The table below specifies the required maintenance activities and intervals for Foundry Prime.

Maintenance activity	Equipment	Interval	Detailed in section
Inspection Replacement	Cable harness	6 mths If required [6]	*Inspection, cable harness on page 133* *Replacement of cable harness, axes 1-6 on page 193*
Inspection	Air hoses	6 mths	*Inspection of air hoses (Foundry Prime) on page 138*
Inspection	Balancing device	12 mths	*Inspection, balancing device on page 128*
Inspection	Information labels	12 mths	*Inspection, information labels on page 139*
Inspection	Damper axes 2-5	12 mths	*Inspection, damper axes 2-5 on page 146*
Inspection	Mechanical stop, axis 1	12 mths	*Inspection, mechanical stop, axis 1 on page 142*

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3.2.2. Maintenance schedule

Continued

Maintenance activity	Equipment	Interval	Detailed in section
Analysis	Oil gearbox axis 6	3000h or 6 mths [2)]	*Inspection, oil level gearbox axis 6 on page 125*
Changing	Axis 1 gear, oil: Kyodo Yushi TMO 150	6000h	*Oil change, gearbox axis 1 on page 154*
Changing	Axis 2 gear, oil: Kyodo Yushi TMO 150	6000h	*Oil change, gearbox axis 2 on page 157*
Changing	Axis 3 gear, oil: Kyodo Yushi TMO 150	6000h	*Oil change, gearbox, axis 3 on page 160*
Changing	Axis 4 gear oil: Mobilgear 600 XP 320	12000h	*Oil change, gearbox, axis 4 on page 163*
Changing	Axis 5 gear oil: Mobilgear 600 XP 320	12000h	*Oil change, gearbox, axis 5 on page 166*
Changing	Axis 6 gear, oil: Kyodo Yushi TMO 150	3000h or 6 mths [1)]	*Oil change, gearbox axis 6 on page 169*
Replacement	SMB Battery pack	36 mths	*Replacement of SMB battery on page 172*
Replacement	Axis 1 gearbox	As specified by the SIS, or typically 96 mths	*Replacement gearbox axis 1 on page 345*
Replacement	Axis 2 gearbox	As specified by the SIS, or typically 96 mths	*Replacement gearbox axis 2 on page 354*
Replacement	Axis 3 gearbox	As specified by the SIS, or typically 96 mths	*Replacement of gearbox, axis 3 on page 361*
Replacement	Axis 4 gearbox [4)]	96 mths [3)]	*Replacement of upper arm on page 260*
Replacement	Axis 5 gearbox [5)]	96 mths [3)]	*Replacement of complete wrist unit on page 252*
Replacement	Axis 6 gearbox	24 mths [6)]	*Replacement of gearbox, axis 6 on page 368*
Rust preventing	Wrist bearing	6 mths	*Rust preventive measures, support bearing in wrist (Foundry Prime) on page 183*
Rust preventing	Axis 1 sealing	6 mths	*Rust preventive measures, bearing axis 1 (Foundry Prime) on page 177*

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- [1] If the robot is working in cleanings cells that are not emptied when the robot is switched off, the oil may be replaced more frequently. See also *Analysis of water content in oil, gearbox axis 6 (Foundry Prime) on page 127*.
- [2] Analyse water content in oil in gearbox axis 6 first time after 3000H or 6 mounths. If the working conditions changes, analyse again after 3000h or 6 mounths.
- [3] The service time for gearboxes, axes 4 and 5, is not calculated by the SIS, see expected life in section *Expected component life on page 114*.
- [4] It is recommended to replace the complete upper arm house, instead of only replacing the gearbox.
- [5] It is recommended to replace the complete wrist unit, instead of only replacing the gearbox.
- [6] The guarantee does not apply to effects or wear caused by environmental factors.

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3.2.3. Expected component life

General

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

Expected life

Component	Expected life	Note
Cabling for robot, 7th axisand fan	4,000,000 cycles axis 1 ±180º 2,000,000 cycles axis 1 ±220º	See note [1]
Balancing device	2,000,000 cycles	See note [2]
Gearbox	40,000h	See note [3]

[1] The expected life can also be affected by assemblage of cabling other than standard options. The given life is based on a test cycle that for every axis starts from the calibration position to minimum angle to maximum angle and back to the calibration position. Deviations from this cycle will result in differences in expected life! The life may also be affected by acid or alkaline environment.

[2] The given life for the balancing device is based on a test cycle that starts from the initial position and goes to maximum extension, and back. Deviations from this cycle will result in differences in expected life!

[3] The robot is dimensioned for a life of 8 years (350,000 cycles per year) in a normal spot welding application. Depending on the actual application, the life of individual gearboxes may vary greatly from this specification. The Service Information System (SIS), integrated in the robot software, keeps track of the gearbox life in each individual case and will notify the user when a service is due. For Foundry Prime robots, working in 100% humidity, other service intervalls may be required.

The SIS for an M2004 system is described in the *Operating manual - Service Information System*. Document number can be found in section *References on page 8*.

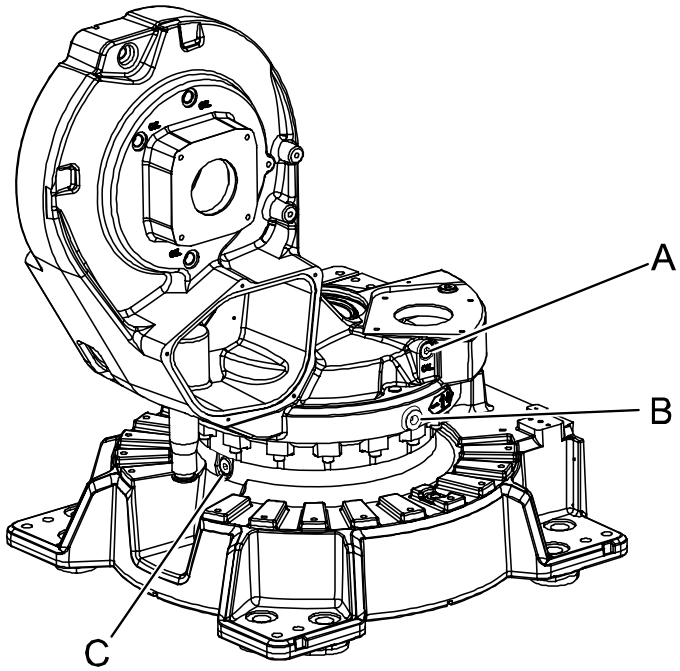
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3.3 Inspection activities

3.3.1. Inspection, oil level gearbox axis 1

Location of gearbox

The axis 1 gearbox is located between the frame and base. The oil plugs are shown in the figure below.



xx0600003449

A	Oil plug, filling
B	Oil plug, inspection
C	Oil plug, draining

Required equipment

Equipment	Art. no.	Note
Lubricating oil	3HAC032140-001	Kyodo Yushi TMO 150 **Note!** Do not mix with other oil types!
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
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. Inspection, oil level gearbox axis 1

Continued

Inspection, oil level gearbox, axis 1

The procedure below details how to inspect the oil level in gearbox axis 1.

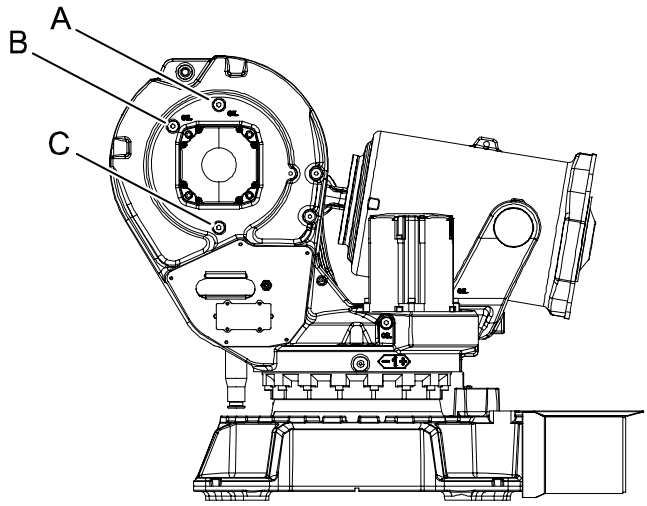
	Action	Note
1.	 **WARNING!** Handling gearbox oil involves several safety risks. Before proceeding, please observe the safety information in section *WARNING - Safety risks during work with gearbox oil on page 36*.	
2.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Open the *oil plug, inspection.*	Shown in the figure *Location of gearbox on page 115*.
4.	Required oil level: max. 5 mm below the oil plug hole!	
5.	Add oil if required.	Art. no. is specified in *Required equipment on page 115*. Further information about how to fill the oil may be found in section *Filling oil, axis 1 on page 155*.
6.	Refit the oil plug, inspection.	Tightening torque: 24 Nm.

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3.3.2. Inspection, oil level gearbox axis 2

Location of gearbox

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



xx0600003451

A	Oil plug, inspection
B	Oil plug, filling
C	Oil plug, draining

Required equipment

Equipment etc.	Art. no.	Note
Lubricating oil	3HAC032140-001	Kyodo Yushi TMO 150 **Note!** Do not mix with other oil types!
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
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.

Inspection, oil level gearbox 2

The procedure below details how to inspect the oil level in gearbox axis 2.

	Action	Note
1.	**WARNING!** Handling gearbox oil involves several safety risks. Before proceeding, please observe the safety information in section *WARNING - Safety risks during work with gearbox oil on page 36*.	

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3.3.2. Inspection, oil level gearbox axis 2

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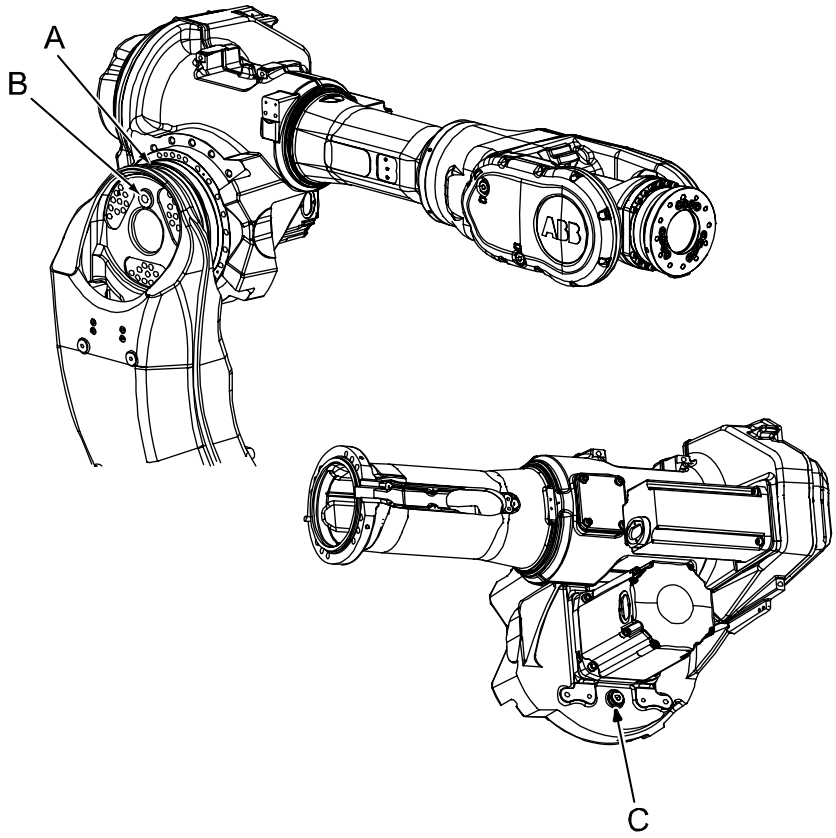
	Action	Note
2.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Open the *oil plug, filling.*	Shown in the figure *Location of gearbox on page 117*.
4.	Measure the oil level at the oil plug, filling. Required oil level: max. 5 mm below the oil plug hole.	Shown in the figure *Location of gearbox on page 117*.
5.	Add oil if required.	Art. no. is specified in *Required equipment on page 117*. Filling of oil is detailed further in section *Filling, oil on page 158*.
6.	Refit the oil plug, filling.	Tightening torque: 24 Nm.

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3.3.3. Inspection, oil level gearbox axis 3

Location of gearbox

The axis 3 gearbox is located in the upper arm rotational center as shown in the figure below.



xx0200000230

A	Gearbox axis 3
B	Oil plug, filling
C	Oil plug, draining

Required equipment

Equipment, etc.	Art. no.	Note
Lubricating oil	3HAC023140-001	Kyodo Yushi TMO 150 **Note!** Do not mix with other oil types!
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
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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Inspection, oil level gearbox 3

The procedure below details how to inspect the oil level in the gearbox axis 3.

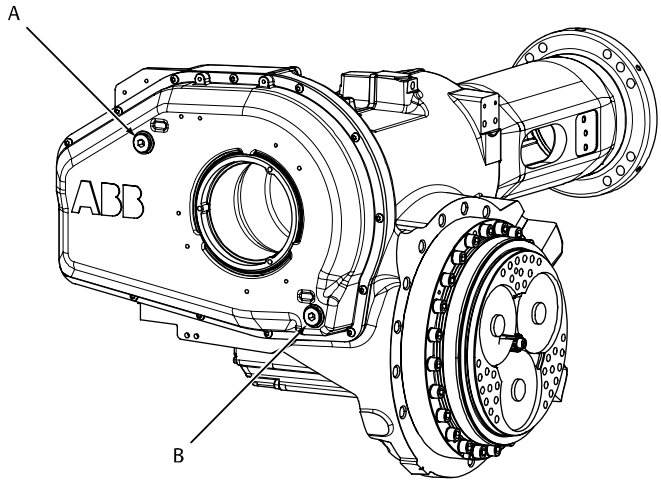
	Action	Note
1.	 **WARNING!** Handling gearbox oil involves several safety risks. Before proceeding, please observe the safety information in section *WARNING - Safety risks during work with gearbox oil on page 36*.	
2.	Move the robot to the calibration position.	Detailed in section *Calibration scales and correct axis position on page 376*.
3.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
4.	Open the *oil plug, filling.*	Shown in the figure *Location of gearbox on page 119*.
5.	Required oil level: max. 5 mm below the oil plug hole.	
6.	Add oil if required.	Art. no. is specified in *Required equipment on page 119*. Further information about how to fill the oil may be found in section *Filling, oil on page 161*.
7.	Refit the oil plug, filling.	Tightening torque: 24 Nm.

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3.3.4. Inspection, oil level gearbox axis 4

Location of gearbox

The axis 4 gearbox is located in the rearmost part of the upper arm as shown in the figure below.



xx0200000231

A	Oil plug, filling
B	Oil plug, draining

Required equipment

Equipment, etc.	Art. no.	Note
Lubricating oil	11712016-604	Mobilgear 600 XP 320
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
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.

Inspection, oil level gearbox 4

The procedure below details how to inspect the oil level in gearbox axis 4.

	Action	Note
1.	**WARNING!** Handling gearbox oil involves several safety risks. Before proceeding, please observe the safety information in section *WARNING - Safety risks during work with gearbox oil on page 36*.	
2.	Move the robot to the calibration position.	Shown in section *Calibration scales and correct axis position on page 376*.

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3.3.4. Inspection, oil level gearbox axis 4

Continued

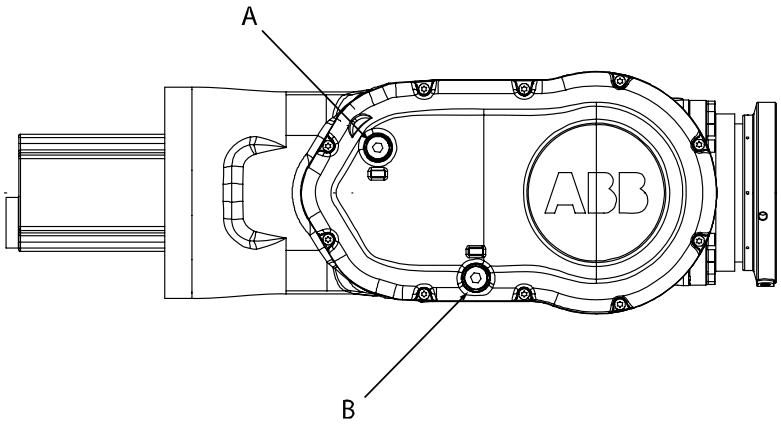
	Action	Note
3.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
4.	Open the *oil plug, filling.*	Shown in the figure *Location of gearbox on page 121*.
5.	Required oil level: max 10 mm below the oil plug hole.	
6.	Add oil if required.	Art. no. is specified in *Required equipment on page 121*. Further information about how to fill the oil may be found in section *Filling, oil on page 164*.
7.	Refit the oil plug.	Tightening torque: 24 Nm.

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3.3.5. Inspection, oil level, gearbox axis 5

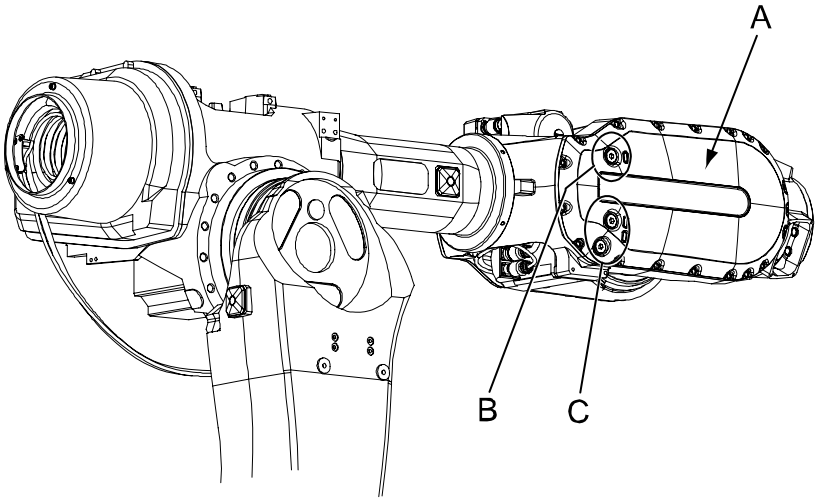
Location of gearbox

The axis 5 gearbox is located in the wrist unit as shown in the figure below.



xx0200000232

A	Oil plug, filling
B	Oil plug, draining



xx0500002013

-	The figure above shows the wrist unit of IRB 6640ID
A	Wrist unit, axis 5
B	Oil plug, filling
C	Oil plugs, draining

Required equipment

Equipment etc.	Art. no.	Note
Lubricating oil	11712016-604	Mobilgear 600 XP 320
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.

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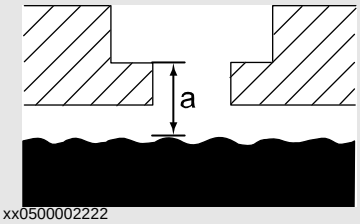
3.3.5. Inspection, oil level, gearbox axis 5

Continued

Equipment etc.	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.

Inspection, oil level gearbox 5

The procedure below details how to inspect the oil level in gearbox axis 5.

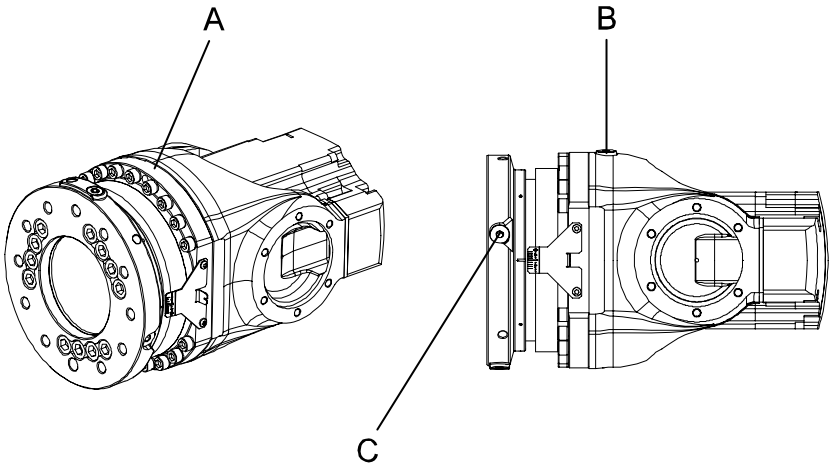
	Action	Note
1.	 **WARNING!** Handling gearbox oil involves several safety risks. Before proceeding, please observe the safety information in section *WARNING - Safety risks during work with gearbox oil on page 36*.	
2.	Turn the wrist unit in a way that both oil plugs are facing upwards.	
3.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
4.	Open the *oil plug, filling.*	Shown in the figure *Location of gearbox on page 123*.
5.	Measure the oil level. Required oil level to the upper edge of the oil plug hole (a): 30mm.	 xx0500002222
6.	Add oil if required.	Art. no. is specified in *Required equipment on page 123*. Further information about how to fill the oil may be found in section *Filling, oil, axis 5 on page 167*.
7.	Refit the oil plug.	Tightening torque: 24 Nm.

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3.3.6. Inspection, oil level gearbox axis 6

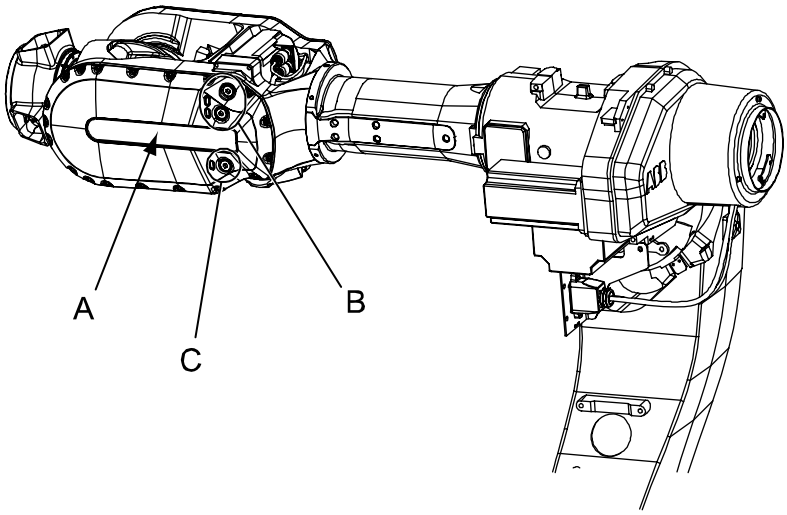
Location of gearbox

The axis 6 gearbox is located in the wrist unit as shown in the figure below.



xx0400001092

A	Gearbox, axis 6
B	Oil plug, filling
C	Oil plug, draining



xx0500002017

-	The figure above shows the wrist unit of IRB 6640ID
A	Gearbox, axis 6
B	Oil plugs, draining
C	Oil plug, filling

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3.3.6. Inspection, oil level gearbox axis 6

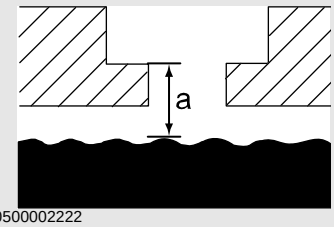
Continued

Required equipment

Equipment	Art. no.	Note
Lubricating oil (IRB 6640)	3HAC032140-001	Kyodo Yushi TMO 150 **Note!** Do not mix with other oil types!
Lubricating oil (IRB 6640ID)	11712016-604	Mobilgear 600 XP 320
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
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.

Inspection, oil level gearbox 6

The procedure below details how to inspect the oil level in gearbox axis 6.

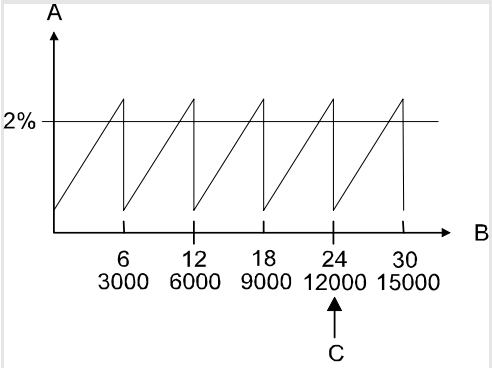
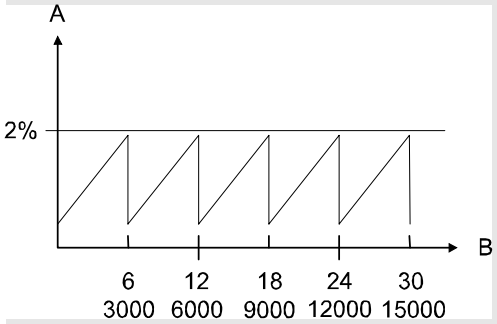
	Action	Note
1.	**WARNING!** Handling gearbox oil involves several safety risks. Before proceeding, please observe the safety information in section *WARNING - Safety risks during work with gearbox oil on page 36*.	
2.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Make sure the *oil plug, filling* is facing upwards and open it.	Shown in the figure *Location of gearbox on page 125*.
4.	Measure the oil level. • 55 mm ± 5 mm • 15 mm (IRB 6640ID)	 xx0500002222
5.	Add oil if required.	Art. no. is specified in *Required equipment on page 126*. Further information about how to fill the oil may be found in section *Filling, oil, axis 6 on page 171*.
6.	Refit the oil plug, filling.	Tightening torque: 24 Nm.

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Analysis of water content in oil, gearbox axis 6 (Foundry Prime)

When changing oil, check for water content in oil. An analysis can be ordered from the oil manufacturer Shell.

	If:	Then....
1.	More than 2% water in oil, • With more than 2% water content there is a risk for corrosion in the gearbox and reduced viscosity in the oil.	replacement of gearbox axis 6 is required every two years  xx0600003155 • A: Water content in oil from gearbox axis 6 • B: Months or hours in operation • C: Replacement of gearbox axis 6
2.	Less than 2% water in oil,	normal replacement interval is required for gearbox axis 6, as specified by SIS or typically 96 months (as on a standard robot).  xx0600003156 • A: Water content in oil from gearbox axis 6 • B: Months or hours in operation

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3.3.7. Inspection, balancing device

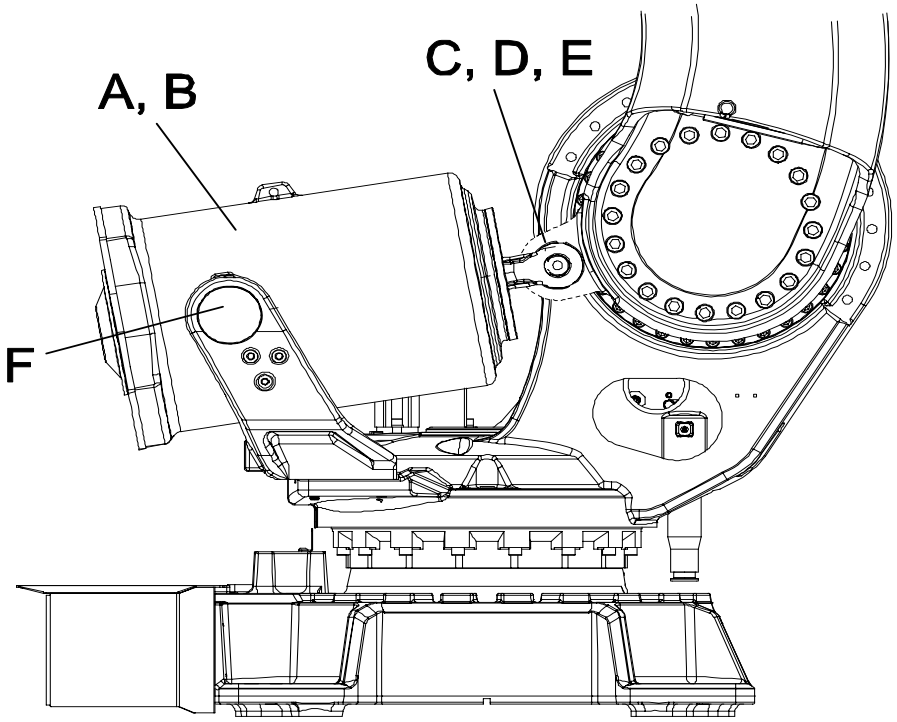
General

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

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

Inspection points, balancing device

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



xx0600003431

A	Balancing device
B	Piston rod (inside balancing device)
C	Fork / Link ear
D	Shaft
E	Retaining ring, bore
F	Attachments in cradle

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Continued

Required equipment

Equipment, etc.	Spare part no.	Art. no.	Note
Maintenance parts, cradle	3HAC029054-001		For maintenance of balancing device 3HAC028470-001. Includes: • bearings, o-rings and seals.
Maintenance parts, shaft	3HAC029288-001		For maintenance of balancing device 3HAC028470-001. Includes: • bearing, o-ring and sealing
Securing screw			Securing screw in the shaft. M16 x 180 Locking liquid must be used when fitting the screw (Loctite 243)!
Toolkit for maintenance		3HAC021984-001	
Puller for separator		4552-2 (Bahco)	Used for removing the spherical roller bearings.
Separator		4551-C (Bahco)	Used for removing the spherical roller bearings.
Standard toolkit		3HAC15571-1	The content is defined in section *Standard toolkit on page 394*.
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.

Check for dissonance

The check points are shown in the figure *Inspection points, balancing device on page 128*.

	Check for dissonance from...	If dissonance is detected...
1.	• bearing at the ear • bearings at the balancing devices attachments.	... perform maintenance according to given instructions in Maintenance kit, bearings and seals. The replacement of the bearing at the ear is also detailed in section *Replacement of spherical roller bearing, balancing device (old and new) on page 281*. Art. no. for the kit and the documentation are specified in section *Required equipment on page 129*.

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3.3.7. Inspection, balancing device

Continued

	Check for dissonance from...	If dissonance is detected...
2.	• cylinder (a tapping sound, caused by the springs inside the cylinder).	...replace the balancing device or consult ABB Robotics. How to replace the device is detailed in section *Replacement of balancing device*. This section also specifies the spare part number!
3.	• piston rod (squeaking may indicate worn plain bearings, internal contamination or insufficient lubrication).	... perform maintenance according to given instructions in Maintenance kit, complete. Art. no. for the kit and the documentation are specified in section *Required equipment on page 129*.

Check for damage

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

The check points are shown in the figure *Inspection points, balancing device on page 128*.

	Check for damage on...	If damage is detected...
1.	• the piston rod (part of the piston rod that is visible at the front of the balancing device).	... perform maintenance according to given instructions in Maintenance kit, complete. Art. no. for the kit and the documentation are specified in section *Required equipment on page 129*.

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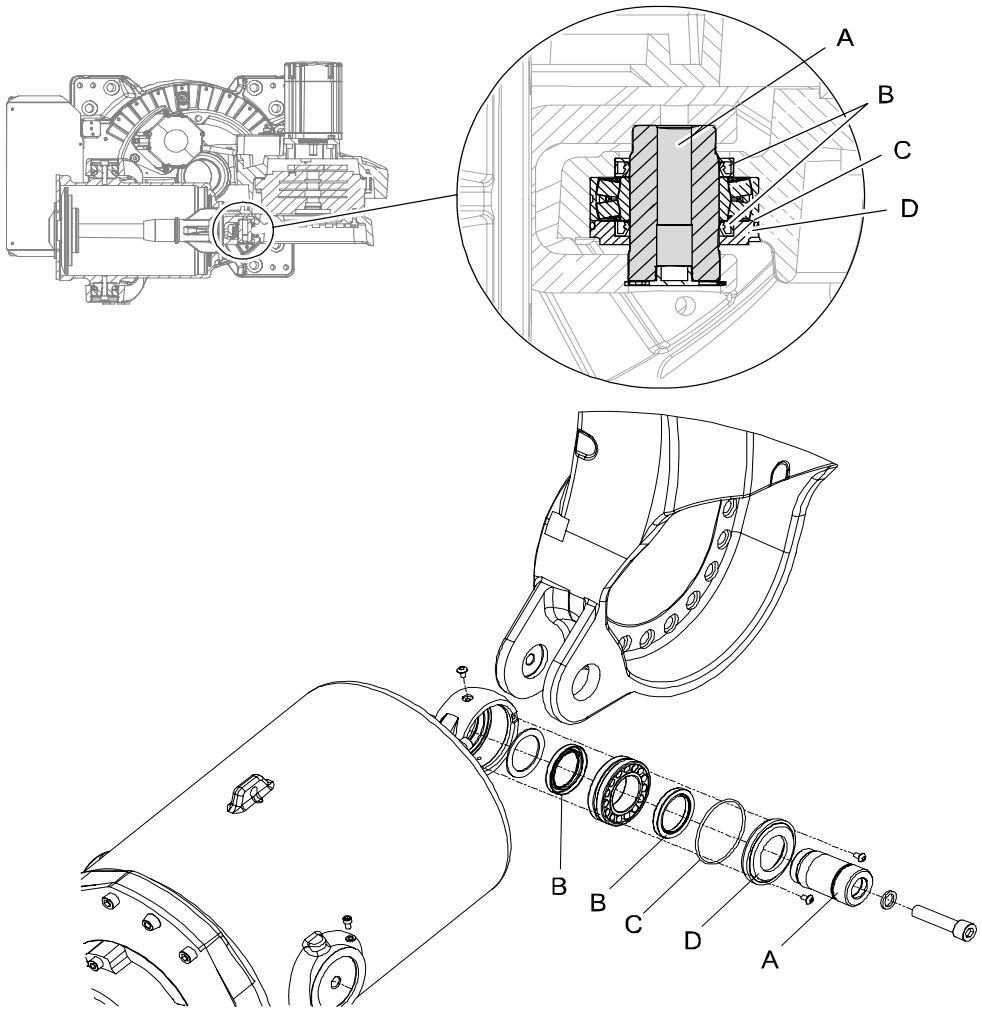
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Check for leakage

The front ear of the balancing device is lubricated with grease. After filling, excessive grease may normally be forced out between the shaft and the sealing ring in the sealing spacer. This is normal behaviour and must not be confused with incorrect leaks from the ear.

Leaks at the o-rings, however, are not acceptable and must be attended to immediately in order to avoid any damage to the bearing!

Check the o-rings in the front ear of the balancing device for leaks, as shown and detailed below.



xx0700000111

A	Shaft
B	Sealing ring (radial) 2 pcs
C	O-ring
D	Sealing washer

	Action	Note
1.	Clean the area at the front ear from old grease.	
2.	Run the robot for some minutes, in order to move the balancing device piston.	

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3.3.7. Inspection, balancing device

Continued

	Action	Note
3.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
4.	Check the o-rings at the front ear for leakage. Replace the o-rings, if any leaks are detected. Excessive grease from between the shaft and the sealing ring is normal and is not considered as a leak!	The o-rings are included in the *Maintenance kit, bearings and seals*, already assembled with sealing spacers and sealing rings. Art. no. for the kit is specified in *Required equipment on page 129*. The replacement of the complete bearing is also detailed in section *Replacement of spherical roller bearing, balancing device (old and new) on page 281*. Incorrect leakage is shown in the previous figure.

Check for contamination / lack of free space

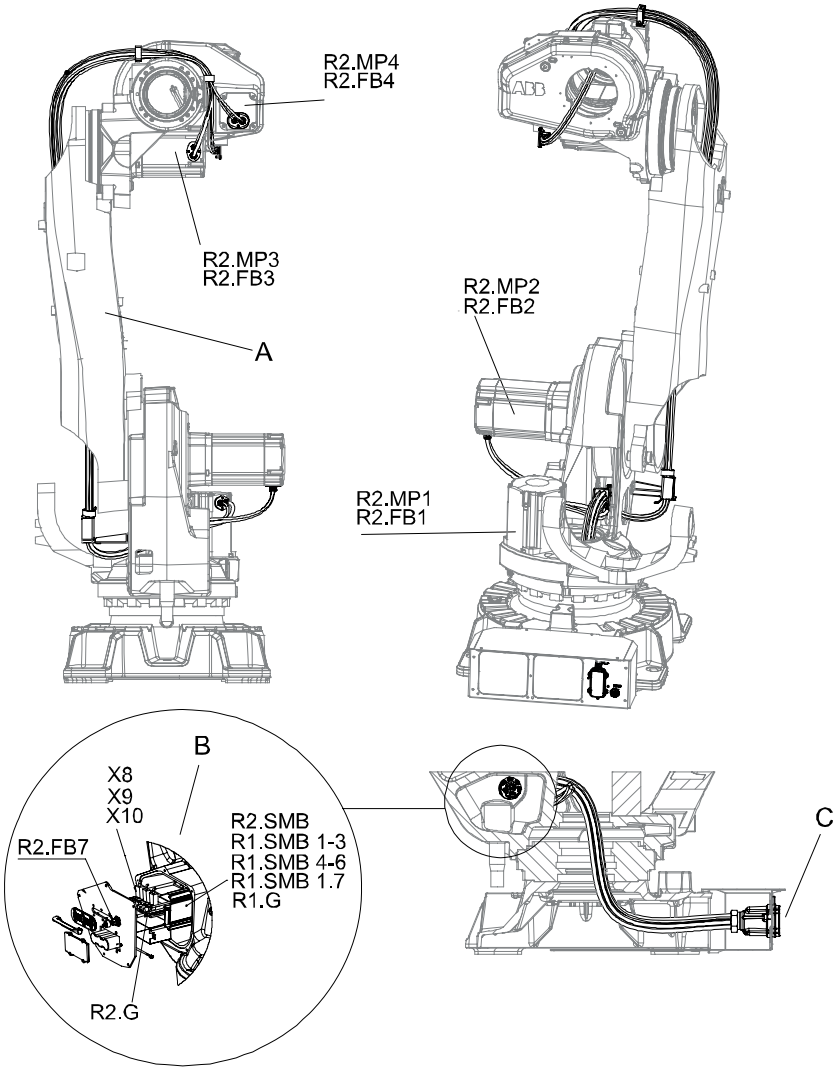
	Action
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.
2.	Check that there are no obstacles inside the frame, that could prevent the balancing device from moving freely. See the figure *Inspection points, balancing device on page 128*. Keep the areas around the balancing device clean and free from objects, such as service tools.

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3.3.8. Inspection, cable harness

Location of cable harness, axes 1-4

The robot cable harness, axes 1-4, is located as shown in the figure below.



xx0600003434

IRB 6640 standard

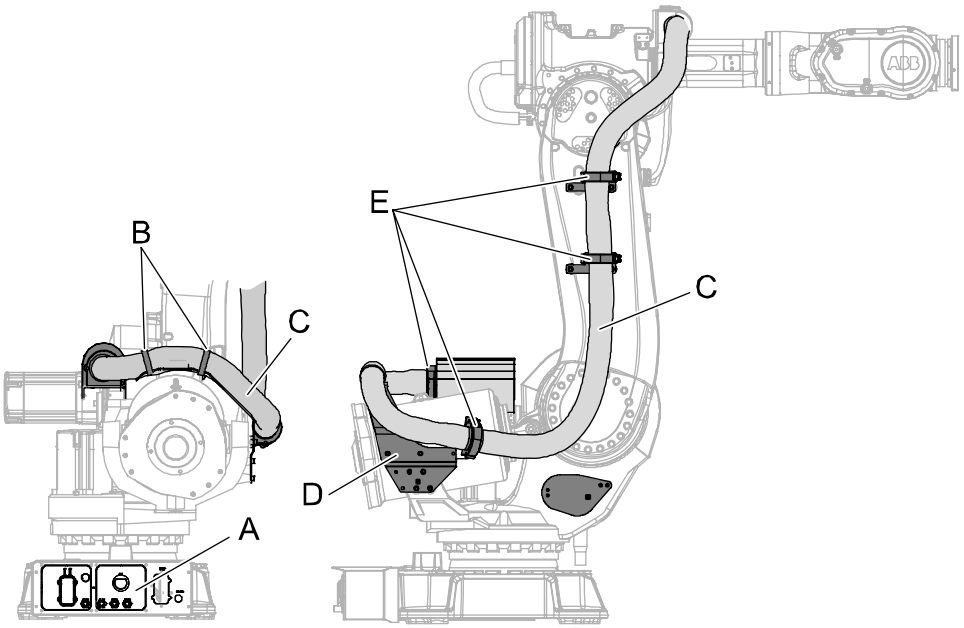
A	Lower arm
B	SMB/BU unit
C	Connectors at base

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3.3.8. Inspection, cable harness

Continued



xx0800000044

IRB 6640 Cleanroom variant.

A	Connectors at base
B	Velcro straps
C	Cable harness
D	Side bracket balancing cylinder
E	Gripping clamp (4 pcs)

Required equipment

Equipment, etc.	Art. no.	Note
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
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	3HAC025744-001	See chapter *Circuit diagram*.

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Continued

Inspection, cable harness 1-4

The procedure below details how to inspect the cable harness of axes 1-4.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Make an overall visual inspection of the cable harness, in order to detect wear and damage.	
3.	Check the *connectors at the base*.	Shown in the figure *Location of cable harness, axes 1-4 on page 133*.
4.	**NOTE!** If the robot is used in a Foundry Prime application, check the *cables* for cracks in insulation.	
5.	Check that *velcro straps* are properly attached to the *side bracket balancing cylinder*. **NOTE!** For **Cleanroom** robots, check all cable attachments as well as *velcro straps*. Make sure the cable harness is properly attached to the robot and isn't damaged.	Location shown in the figure *Location of cable harness, axes 1-4 on page 133*.
6.	Replace the cable harness if wear, cracks or damage is detected.	Detailed in section *Replacement of cable harness, axes 1-6 on page 193*. Detailed in section *Replacement of cable harness, Cleanroom on page 207*.

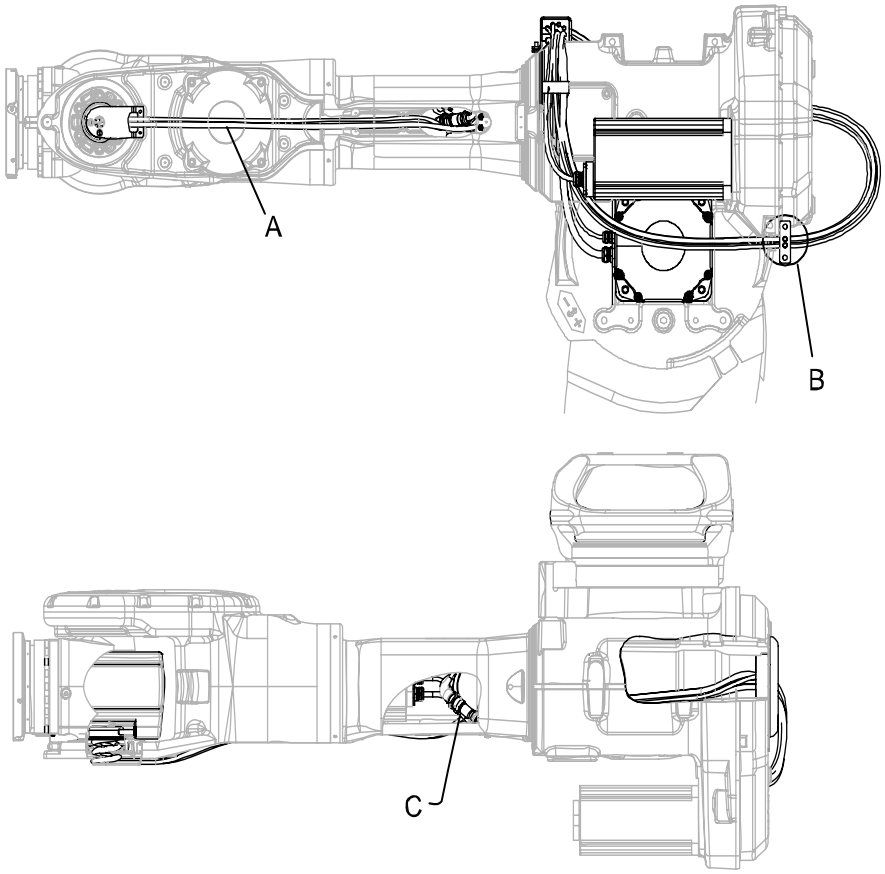
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Location of cabling axes 5-6

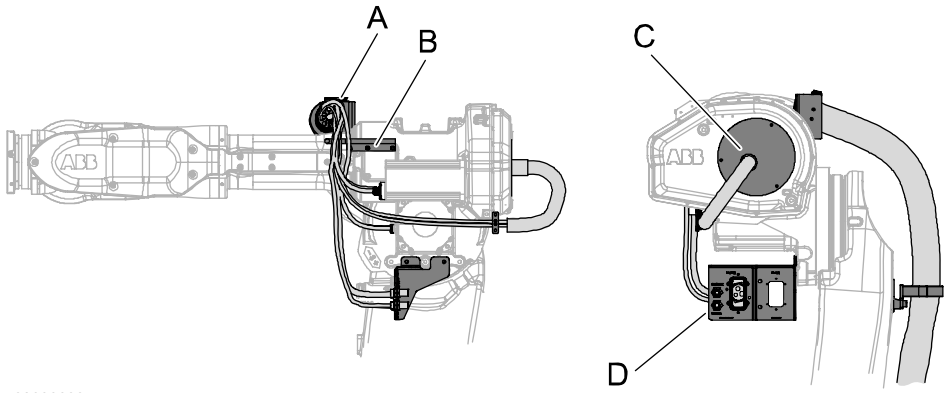
The robot cable harness, axes 5-6, is located as shown in the figure below.



xx0600003435

IRB 6640 standard

A	Cable harness axes 5-6
B	Cable attachment, rear of upper arm
C	Cable attachment, upper arm tube



xx0800000045

IRB 6640 Cleanroom variant.

A	Gripping clamp
B	Cable guide

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Continued

C	Cover
D	Connectors at connection plate ax 3

Inspection, cable harness, axes 5-6

The procedure below details how to inspect the cable harness of axes 5-6.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Make an overall visual inspection of the cable harness, in order to detect wear and damage.	
3.	Check the *attachments at the rear of the upper arm and in the upper arm tube.* **NOTE!** For **Cleanroom** robots also check the *connectors at the division point*. Make sure the *connection plate axis 3* is not bent or in any other way damaged.	Shown in the figure *Location of cabling axes 5-6 on page 136*.
4.	**NOTE!** For **Cleanroom** robots, check all cable attachments as well as *velcro straps*. Also check that the cable harness is fitted correctly at the *cable guide* on the armhouse. Make sure the cable harness is properly attached to the robot and isn't damaged.	Shown in the figure *Location of cabling axes 5-6 on page 136*.
5.	**NOTE!** If the robot is used in a Foundry Prime application, check the *cables* for cracks in insulation.	Shown in the figure *Location of cable harness, axes 1-4 on page 133*.
6.	Replace the cable harness if wear, cracks or damage is detected.	Detailed in section *Replacement of cable harness, axes 1-6 on page 193*. Detailed in section *Replacement of cable harness, axes 5-6 - IRB 6640ID on page 228*. Detailed in section *Replacement of cable harness, Cleanroom on page 207*.

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3.3.9. Inspection of air hoses (Foundry Prime)

General

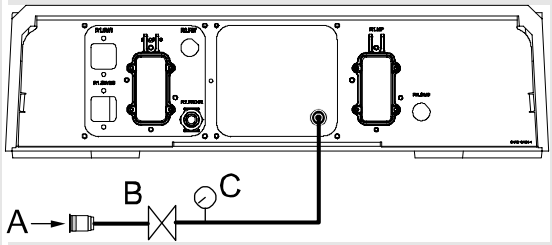
The air hoses on Foundry Prime robots must be inspected for leakage every six month.

Required equipment

Equipment, etc.	Art. no.	Note
Leak detection spray	-	
Pressure gauge	-	
Cut off valve	-	

Procedure

For this test it is recommended that the air supply to the robot has a pressure gauge and a cut-off valve connected.

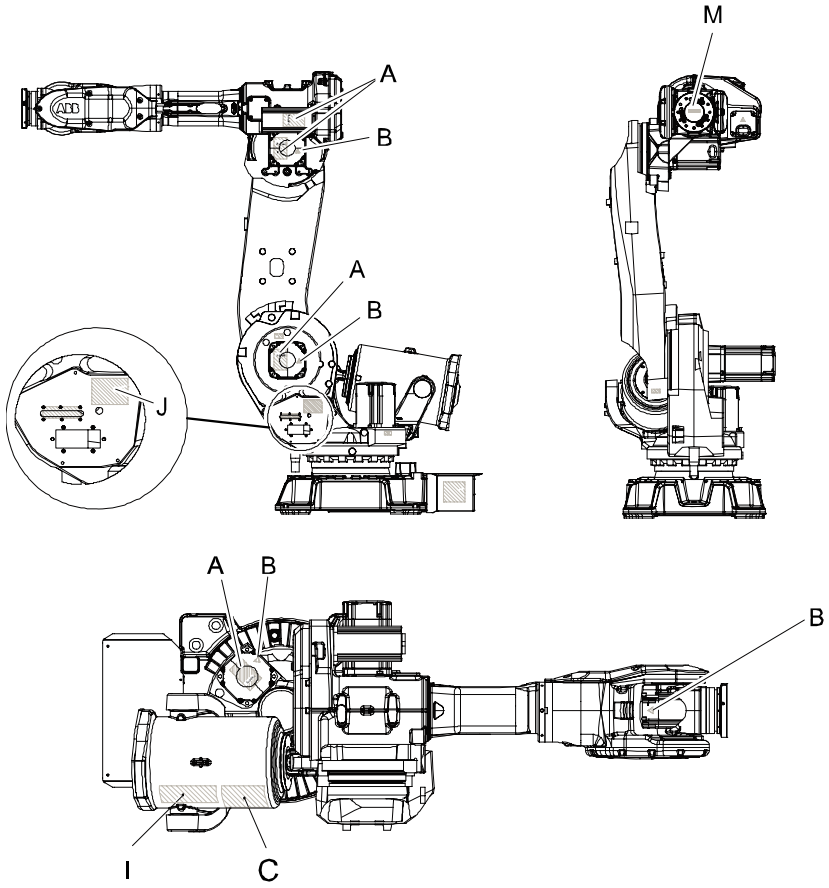
	Action	Note
1.	Apply compressed air to the air connector on robot base, and raise the pressure with the knob until the correct value is shown on the pressure gauge.	Recommended pressure: 0.2-0.3 bar  xx0600002794 • A: Air Connection • B: Cut-off valve • C: Pressure gauge
2.	Close the cut-off valve.	It should take at least 5 sec. for the pressure to reach 0 bar.
3.	The time is < 5 seconds: • If the answer is **YES**: Localise the leakage by following the procedures below. • If the anser is **NO**: The system is OK. Remove the leak-testing equipment.	
4.	Pressurize by opening the Cut-off valve.	
5.	Spray suspected leak areas with *leak detection spray*. Bubbles indicate a leak.	
6.	When the leak has been localized: take the necessary measures to correct the leak.	

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3.3.10. Inspection, information labels

Location of labels

The figures below show the location of the information labels to be inspected.



xx0600003457

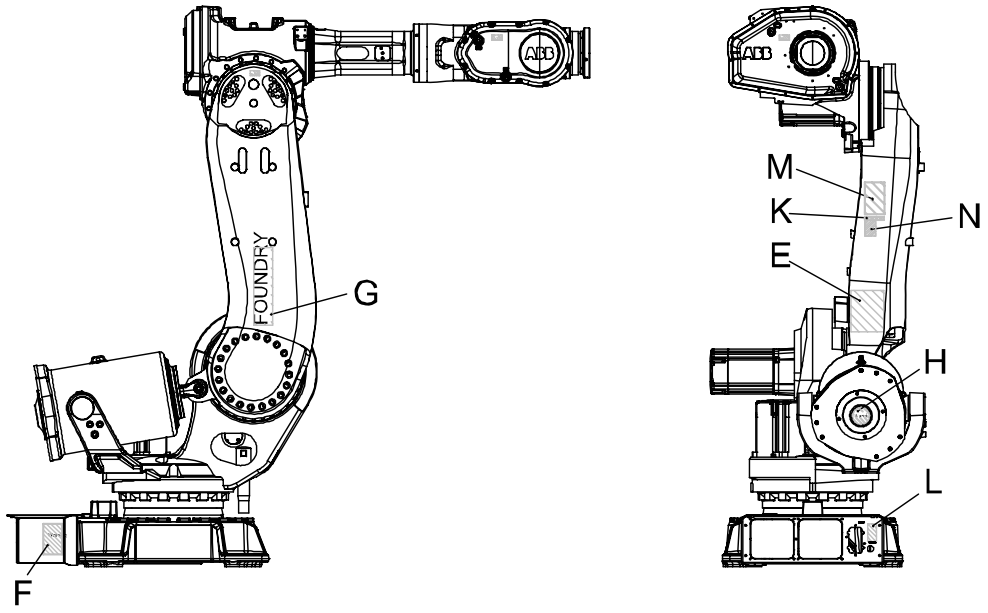
A	Warning label "High temperature", 3HAC4431-1 (4 pcs)
B	Warning sign, symbol of flash (located on motor cover), 3HAC1589-1 (5 pcs)
C	Instruction label "Safety instruction", 3HAC4591-1
I	Warning label, tools are not allowed around the balancing device during operation, 3HAC020611-001
J	Warning label "Shut off power", 3HAC17804-1
M	Serial no. from rating label
-	Information labels about type of oil, at gearboxes and at robot base

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3.3.10. Inspection, information labels

Continued



xx0600003456

E	Instructional label "Lifting the robot", 3HAC026908-001
F	Warning label "Robot can tip forward...", 3HAC9191-1
G	Foundry logotype, 3HAC8256-1
H	Warning label "Stored energy", 3HAC9526-1
K	Abs-Acc information sign, 3HAC14257-1
N	Label calibration, 3HAC024307-001
M	Serial no. from rating label
L	UL-label, 3HAC2763-1

Required equipment

Equipment	Art. no.	Note
Labels and plate set	3HAC8711-1	Includes all labels specified in the two previous figures! The labels are in english.
Label set, oil labels	3HAC021505-002 3HAC025700-001 (IRB 6640ID)	Includes only the oil labels at the gearboxes and at the robot base. Are fitted to the robot if the gearboxes include Kyodo Yushi TMO 150.

Inspection, labels

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	

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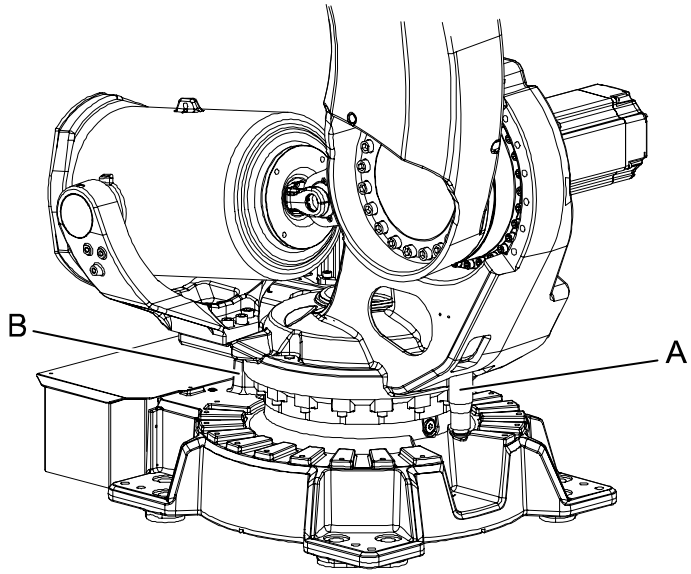
	Action	Note
2.	Check the labels, located as shown in the figures *Location of labels on page 139*.	
3.	Replace any missing or damaged labels.	Art. no. is specified in *Required equipment on page 140*.

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3.3.11. Inspection, mechanical stop, axis 1

Location of mechanical stop

The mechanical stop axis 1 is located at the base as shown in the figure below.



xx0600003436

A	Mechanical stop pin, axis 1
B	Fixed stop pin

Required equipment

Equipment, etc.	Art. no.	Note
Mechanical stop ax 1	3HAC024014-001	To be replaced when damaged.
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.

Inspection, mechanical stop

The procedure below details how to inspect the mechanical stop axis 1.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Inspect the *mechanical stop,* axis 1.	Shown in the figure *Location of mechanical stop on page 142*.

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Continued

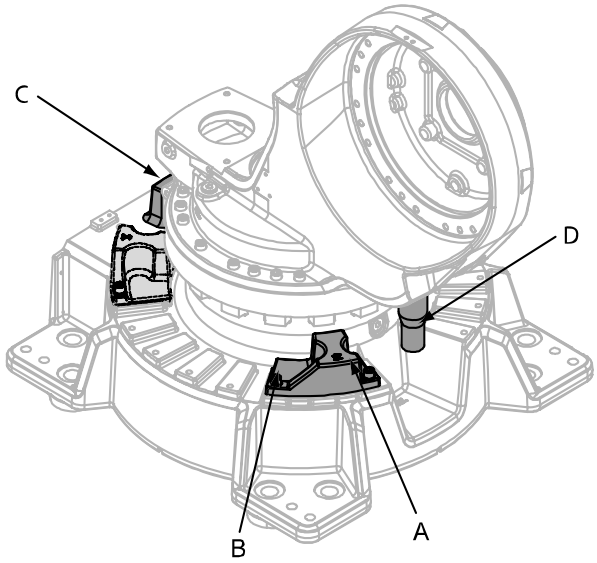
	Action	Note
3.	If the stop pin is bent or damaged, it must be replaced!  **NOTE!** The expected life of gearboxes can be reduced as a result of collissions with the mechanical stop.	Art. no. is specified in *Required equipment on page 142*.

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3.3.12. Inspection, additional mechanical stops

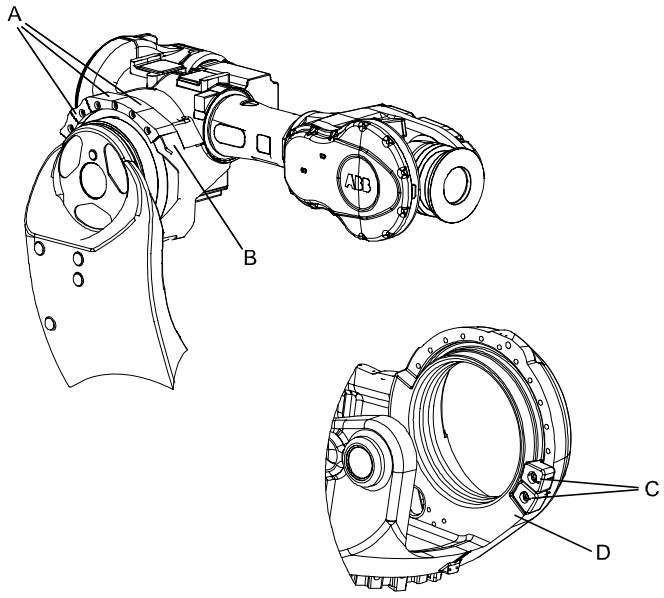
Location of mechanical stops

The figures below shows the location of the additional mechanical stops on axes 1, 2 and 3 .



xx0600002938

A	Additional stop, axis 1
B	Attachment screws and washers (2 pcs)
C	Fixed stop
D	Mechanical stop pin, axis 1



xx0600003438

A	Additional stops, axis 3
B	Fixed stop, axis 3
C	Additional stops, axis 2

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Continued

D	Fixed stop, axis 2

Required equipment

Equipment etc.	Art. no.	Note
Mechanical stop set, axis 1	3HAC025204-003	Includes: • Stop +15°/-7.5° • Stop +7.5°/-15° • Attachment screws plus washers • Document for movable mechanical stop
Mechanical stop axis 2	3HAC020885-001	Includes: • Mechanical stop pin • Attachment screw and washer • Document for mechanical stop pin
Mechanical stop set, axis 3	3HAC025290-003	Includes: • Mechanical stop pin • Attachment screw and washer • Document for mechanical stop pin
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.

Inspection, mechanical stops

The procedure below details how to inspect the additional mechanical stops on axes 1,2 and 3.

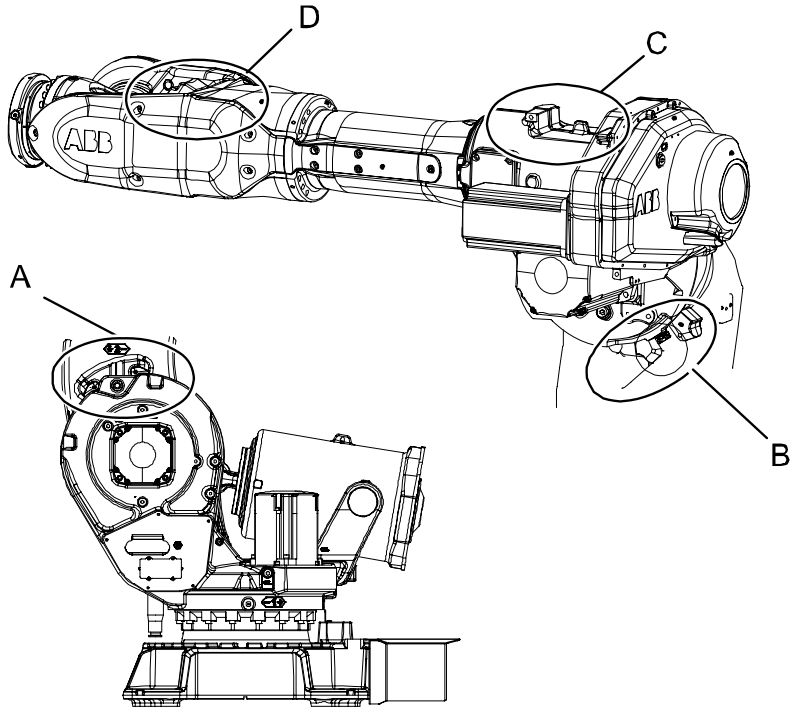
	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Check the *additional stops* on axes 1, 2 and 3 for damage.	Shown in the figure *Location of mechanical stops on page 144*.
3.	Make sure the stops are properly attached. Correct tightening torque, mechanical stop axis 1: 120 Nm.	
4.	If any damage is detected, the *mechanical stops* must be replaced! Correct attachment screws (lubricated with Molycote 1000): • Axis 1: M12 x 40 • Axis 2: M16 x 50 • Axis 3: M16 x 60	Art. no. is specified in *Required equipment on page 145*.

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3.3.13. Inspection, damper axes 2-5

Location of dampers

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



xx0600003440

A	Damper, axis 2 (2 pcs)
B	Damper, axis 3 (2 pcs)
C	Damper, axis 4 (1 pc)
D	Damper, axis 5 (2 pcs) (IRB 6640ID: 4 pcs)

Required equipment

A damper must be replaced if damaged!

Equipment	Spare part/ art. no.	Note
Damper axis 2	3HAC12991-1	
Damper axis 3	3HAC12320-1	
Damper axis 4	3HAC13564-1	
Damper axis 5	3HAB4337-2	
Damper 1, axis 5	3HAC021325-001	IRB 6640ID (2 pcs)
Damper 2, axis 5	3HAC021675-001	IRB 6640ID (2 pcs)
Standard toolkit	3HAC15571-1	The content is defined in section *Standard toolkit on page 394*.

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Inspection, dampers

The procedure below details how to inspect the dampers, axes 2-5.

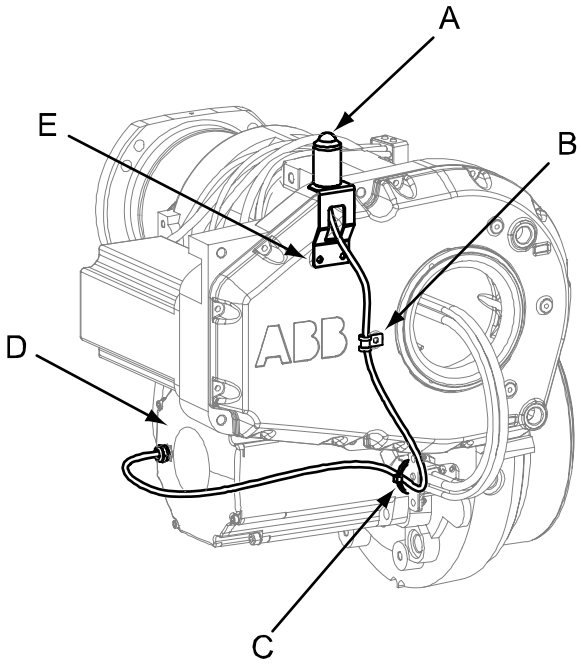
	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Check all *dampers* for damage, and for cracks or existing impressions larger than 1 mm. To inspect the damper axis 4, remove the two covers on top of the upper arm!	Shown in the figure *Location of dampers on page 146*.
3.	Check attachment screws for deformation.	
4.	If any damage is detected, the damper must be replaced with a new one!	Art. no. is specified in *Required equipment on page 146*.

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3.3.14. Inspection, signal lamp (option)

Location of signal lamp

The signal lamp is located as shown in the figure below. Note that the position can differ depending on how the customer harness for axis 4-6 is mounted. See assembly drawing on the current harness for alternative positioning.



xx0600003071

A	UL signal lamp
B	Clamp
C	Cable strap, outdoor
D	Motor, axis 3
E	Attachment screw, M6x8 quality 8-A2F(2 pcs)

Required equipment

Equipment, etc.	Art. no.	Note
Signal lamp	3HAC10830-1	To be replaced in case of detected damage.
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
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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Continued

Inspection, signal lamp

The procedure below details how to inspect the function of the signal lamp.

	Action	Note
1.	Check that the signal lamp is lit, when the motors are put in operation ("MOTORS ON").	
2.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	If the lamp is not lit, trace the fault by: • Checking whether the *signal lamp* is broken. If so, replace it. • Checking the cable connections. • Measuring the voltage in connectors motor axis 3 (=24V). • Checking the cabling. Replace cabling if a fault is detected.	Art. no. is specified in *Required equipment on page 148*.

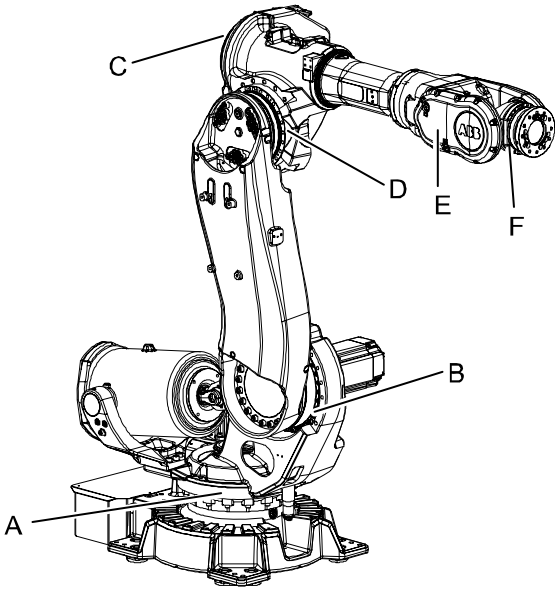
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3.4 Replacement / Changing activities

3.4.1. Type of oil in gearboxes

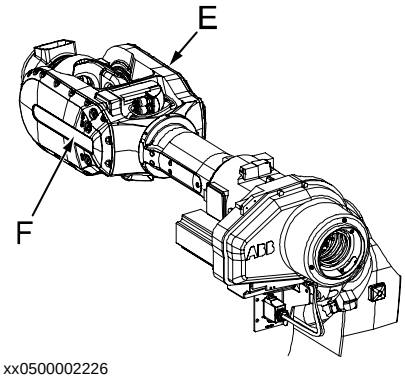
Location of gearboxes

The figure show the location of the gearboxes on the robot.



xx0600003442

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



xx0500002226

E	Axis 5 gearbox, IRB 6640ID
F	Axis 6 gearbox, IRB 6640ID

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Type of oil - historically used

The gearboxes of the robot have historically been filled with different types of oils. Today only the types of oil specified in the table is recommended.

NOTE!

When there is a change of oil types in the gearbox, it need to be rinsed. See *Rinsing gearbox on page 153*.

CAUTION!

When filling gearbox oil, do not mix different types of oil as this may cause severe damage to the gearbox! Always use the type of oil specified in the table!

If oils are mixed, the gearbox must be thoroughly rinsed! See *Rinsing gearbox on page 153*.

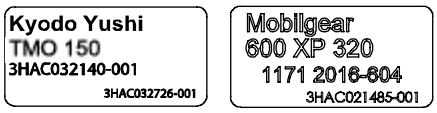
Type of oil - currently used

The table show which types of oil is used in gearboxes.

Gearbox	Type of oil	Art. no.	Amount
Axis 1	Kyodo Yushi TMO 150	3HAC032140-001	6,100 ml
Axis 2	Kyodo Yushi TMO 150	3HAC032140-001	5,800 ml
Axis 3	Kyodo Yushi TMO 150	3HAC032140-001	2,500 ml
Axis 4	Mobilgear 600 XP320	11712016-604	8,100 ml
Axis 5	Mobilgear 600 XP320	11712016-604	IRB 6640: 6,700 ml IRB 6640ID: 5,000 ml
Axis 6IRB 6640	Kyodo Yushi TMO 150	3HAC032140-001	450 ml
Axis 6, IRB 6640ID	Mobilgear 600 XP320	11712016-604	6,000 ml

Labels next to oil plugs

Labels located next to oil plugs of each gearbox show which type of oil it contains. All gearboxes must have the correct label clearly visible.



xx0800000230

Labels located next to oil plugs	Currently used types of oils



xx0800000241

Historically used types of oil	Need to be replaced, if currently used.

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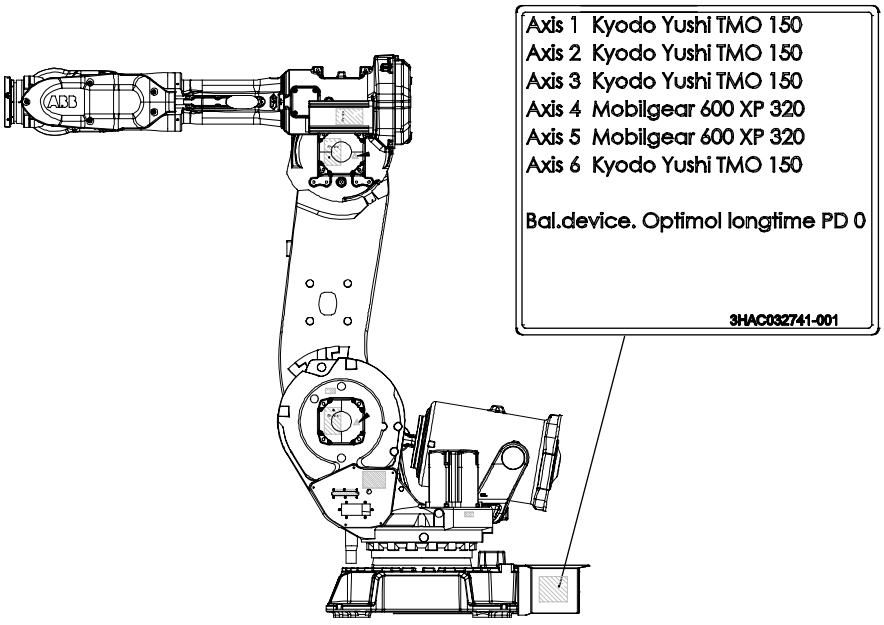
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3.4.1. Type of oil in gearboxes

Continued

Labels at robot base

Label located at robot base show the types of oil in all gearboxes.



xx0600003448

-	Label at robot base. Currently used types of oil.

Mixed types of oil may cause may cause severe damage!

When refilling or replacing oil in a gearbox it is important to first check which type of oil is recommended to use in the gearbox. See *Type of oil - currently used on page 151*. If the oil used is other than the one in the list of currently used types of oil, it is recommended to replace the oil.

As Kyodo Yushi TMO 150 (as well as Shell Tivela S 150) is not compatible with mineral oil, contamination with other types of oil in the gearboxes is not accepted! Equipment used in handling of Kyodo Yushi (as well as Shell Tivela S 150) must be carefully cleaned before use!

In case of changing the type of oil, the gearbox therefor must be thoroughly rinsed! See *Rinsing gearbox on page 153*.

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Continued

NOTE!

When filling gearbox oil, do not mix different types of oil as this may cause severe damage to the gearbox! Always use the oil recommended by the manufacturer!

Rinsing gearbox

Depending on which types of oil are mixed and which type of oil shall be filled in the gearbox after rinsing, use the appropiate procedure.

The same applies if the type of oil shall be changed in the gearbox.

NOTE!

What is said about Kyodo Yushi TMO 150, also applies to Shell Tivela S 150.

What is said about Mobilgear 600 XP320, also applies to Mobil Gearlube X320.

Kyodo Yushi TMO 150 mixed with Optimol Optigear RMO 150/Optigear RO 150

Use this procedure to rinse the contaminated gearbox if the oil types Kyodo Yushi TMO 150 and Optimol Optigear RMO 150/Optigear RO 150 are mixed.

- Flush the gearbox properly three times with the correct type of oil. Use a service program when flushing.
- Refill the gearbox with the correct type of oil.

Kyodo Yushi TMO 150 mixed with Mobilgear 600 XP320

Use this procedure to rinse the contaminated gearbox if the gearbox shall contain Kyodo Yushi TMO 150 and it is mixed with Mobilgear 600 XP320.

- Flush the gearbox properly three times with Kyodo Yushi TMO 150. Use a service program when flushing.
- Refill the gearbox with Kyodo Yushi TMO 150.

Equipment

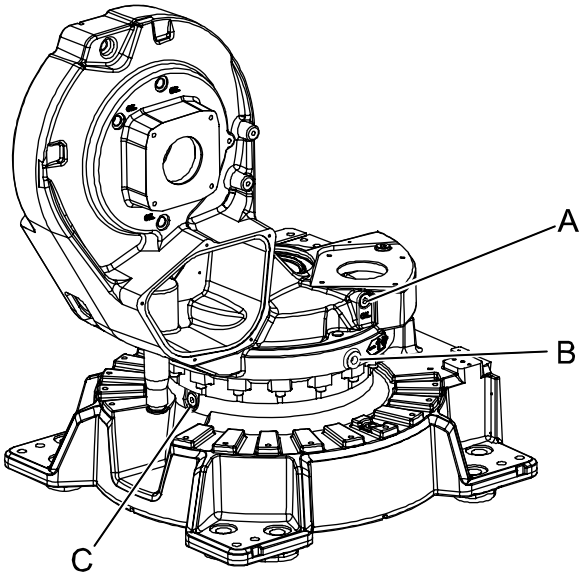
Equipment	Art. no.	Note
Label set	See Spare Parts.	Includes small labels to each gearbox and the complete label to be fitted at the robot base. **NOTE!** The correct labels must be fitted to the robot in case of changing of oil types!
Oil change equipment	3HAC021745-001	Includes pump with outlet pipe.

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3.4.2. Oil change, gearbox axis 1

Location of oil plugs

The axis 1 gearbox is located between the frame and base. The oil plugs for filling and inspection are shown in the figure below.



xx0600003449

A	Oil plug, filling
B	Oil plug, inspection
C	Oil plug, draining

Required equipment

Equipment, etc.	Art. no.	Amount	Note
Lubricating oil	3HAC032140-001	6,000 ml	Kyodo Yushi TMO 150 **Note!** Do not mix with other oil types!
Oil collecting vessel	-		Capacity: 8,000 ml.
Oil exchange equipment	3HAC021745-001		The content is defined in section *Special tools on page 395*.
Standard toolkit	-		The content is defined in section *Standard toolkit on page 394*.

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Draining oil, axis 1

The procedure below details how to drain the oil in gearbox axis 1.

When using the oil exchange equipment, follow the instructions enclosed with the kit. Art. no. for the kit is specified in *Required equipment on page 154*.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
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 oil on page 36*.	
3.	Collect the drained oil in an oil vessel.	Vessel capacity is specified in *Required equipment on page 154*.
4.	Remove the *oil plug, filling*, in order to drain the oil quicker!	Shown in the figure *Location of oil plugs on page 154*.
5.	Open the oil plug, draining and drain the oil into the vessel.	 **NOTE!** The draining is time-consuming. Elapsed time depends on the temperature of the oil.
6.	Refit the *oil plug, draining*.	

Filling oil, axis 1

The procedure below details how to fill the oil in gearbox axis 1.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	

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3.4.2. Oil change, gearbox axis 1

Continued

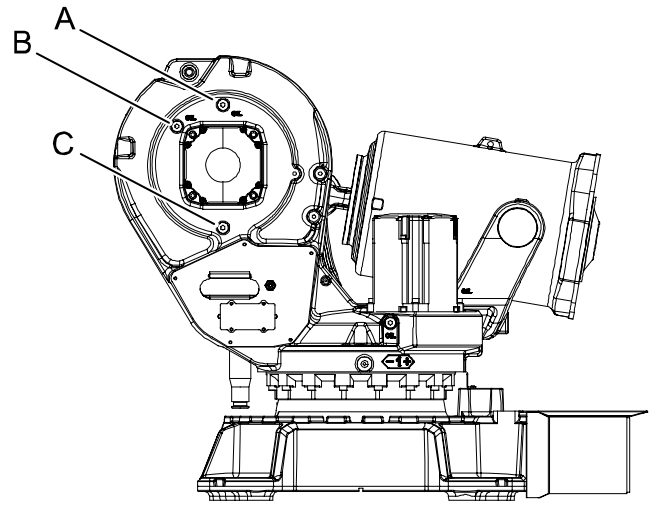
	Action	Note
2.	 **WARNING!** Handling gearbox oil involves several safety risks. Before proceeding, please observe the safety information in section *WARNING - Safety risks during work with gearbox oil on page 36*.	
3.	Open the *oil plug, filling.*	Shown in the figure *Location of oil plugs on page 154*.
4.	Refill the gearbox with *lubricating oil.* The amount of oil to be refilled depends on the amount previously being drained. The correct oil level is detailed in section *Inspection, oil level gearbox axis 1 on page 115*.	Art. no. and the total amount are specified in *Required equipment on page 154*.
5.	 **NOTE!** Don´t mix Kyodo Yushi TMO 150 with other oil types!	Detailed in section *Oil in gearboxes*.
6.	Refit the *oil plug, filling*.	Tightening torque: 24 Nm.

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3.4.3. Oil change, gearbox axis 2

Location of oil plugs

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



xx0600003451

A	Oil plug, inspection
B	Oil plug, filling
C	Oil plug, draining

Required equipment

Equipment, etc.	Art. no.	Amount	Note
Lubricating oil	3HAC032140-001	5,800 ml	Kyodo Yushi TMO 150 **Note!** Do not mix with other oil types!
Oil collecting vessel	-		Capacity: 6,000 ml.
Oil exchange equipment	3HAC021745-001		The content is defined in section *Special tools on page 395*.
Standard toolkit	-		The content is defined in section *Standard toolkit on page 394*.

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3.4.3. Oil change, gearbox axis 2

Continued

Draining, oil

The procedure below details how to drain the oil in gearbox axis 2.

When using the oil exchange equipment, follow the instructions enclosed with the kit. Art. no. for the kit is specified in *Required equipment on page 157*.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
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 oil on page 36*.	
3.	Remove the *oil plug, draining,* and drain the gearbox oil using a hose with nipple and an oil collecting vessel. Remove the *oil plug, filling* in order to drain the oil quicker!	Shown in the figure *Location of oil plugs on page 157*. Vessel capacity is specified in *Required equipment on page 157*.  **NOTE!** Draining is time-consuming. Elapsed time varies depending on the temperature of the oil.
4.	Refit the oil plug.	Tightening torque: 24 Nm.

Filling, oil

The procedure below details how to fill oil into the gearbox, axis 2.

When using the oil exchange equipment, follow the instructions enclosed with the kit. Art. no. for the kit is specified in *Required equipment on page 157*.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	

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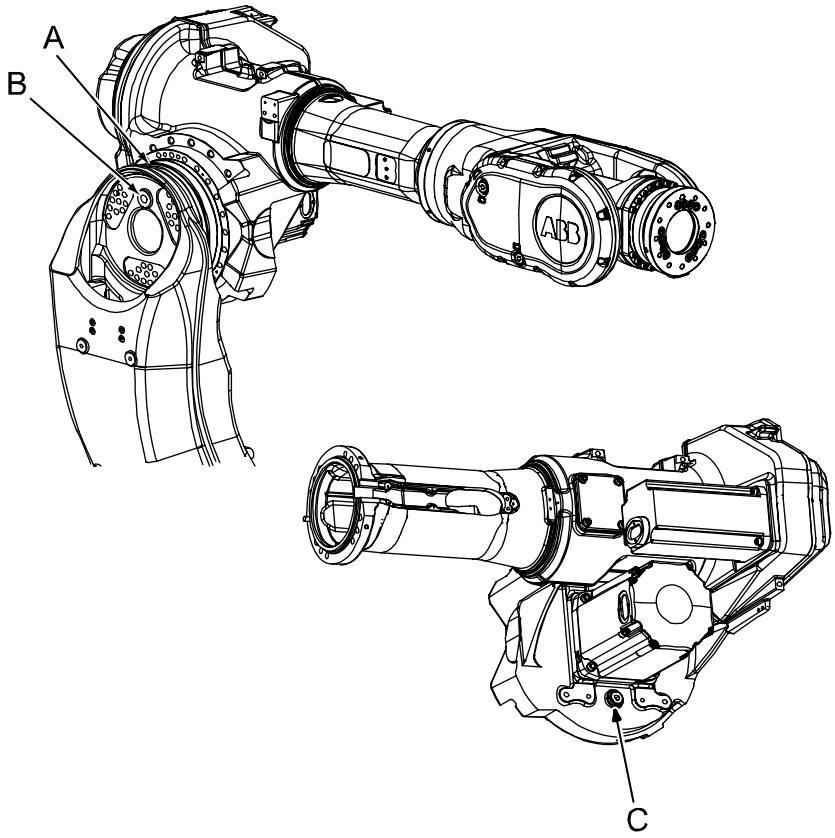
	Action	Note
2.	 **WARNING!** Handling gearbox oil involves several safety risks. Before proceeding, please observe the safety information in section *WARNING - Safety risks during work with gearbox oil on page 36*.	
3.	Remove the *oil plug, filling* and the *oil plug, inspection*.	Shown in the figure *Location of oil plugs on page 157*.
4.	Refill the gearbox with *lubricating oil.* The amount of oil to be refilled depends on the amount previously being drained. The correct oil level is detailed in section *Inspection, oil level gearbox axis 2 on page 117*.	Art. no. and total amount are specified in *Required equipment on page 157*.
5.	 **NOTE!** Don´t mix Kyodo Yushi TMO 150 with other oil types!	Detailed in section *Oil in gearboxes*.
6.	Refit the oil plug.	Tightening torque: 24 Nm.

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3.4.4. Oil change, gearbox, axis 3

Location of gearbox

The axis 3 gearbox is located in the upper arm rotational center as shown in the figure below.



xx0200000230

A	Gearbox axis 3
B	Oil plug, filling
C	Oil plug, draining

Required equipment

Equipment, etc.	Art. no.	Amount	Note
Lubricating oil	3HAC032140-001	2,500 ml	Kyodo Yushi TMO 150 **Note!** Do not mix with other oil types!
Oil exchange equipment	3HAC021745-001		The content is defined in section *Special tools on page 395*.
Oil collecting vessel	-		Capacity: 3,000 ml.
Standard toolkit	-		The content is defined in section *Standard toolkit on page 394*.

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Continued

Draining, oil

The procedure below details how to drain oil from the gearbox, axis 3.

When using the oil exchange equipment, follow the instructions enclosed with the kit. Art. no. for the kit is specified in *Required equipment on page 160*.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
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 oil on page 36*.	
3.	Remove the *oil plug, draining,* and drain the gearbox oil using a hose with nipple and an oil collecting vessel. Remove the *oil plug, filling* in order to drain the oil quicker!	Shown in the figure *Location of gearbox on page 160*. Vessel capacity is specified in *Required equipment on page 160*. **NOTE!** Draining is time-consuming. Elapsed time varies depending on the temperature of the oil.
4.	Refit the oil plug.	Tightening torque: 24 Nm.

Filling, oil

The procedure below details how to fill oil to the gearbox, axis 3.

When using the oil exchange equipment, follow the instructions enclosed with the kit. Art. no. for the kit is specified in *Required equipment on page 160*.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	

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3.4.4. Oil change, gearbox, axis 3

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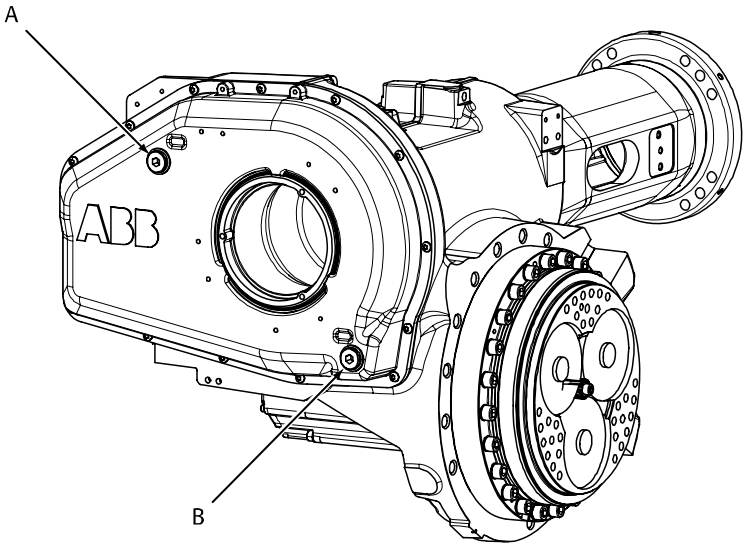
	Action	Note
2.	 **WARNING!** Handling gearbox oil involves several safety risks. Before proceeding, please observe the safety information in section *WARNING - Safety risks during work with gearbox oil on page 36*.	
3.	Remove the *oil plug, filling.*	Shown in the figure *Location of gearbox on page 160*.
4.	Refill the gearbox with *lubricating oil.* The amount of oil to be refilled depends on the amount previously being drained. The correct oil level is detailed in section *Inspection, oil level gearbox axis 3 on page 119*.	Art. no. and total amount are specified in *Required equipment on page 160*.
5.	 **NOTE!** Don´t mix Kyodo Yushi TMO 150 with other oil types!	Detailed in section *Oil in gearboxes*.
6.	Refit the oil plug.	Tightening torque: 24 Nm.

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3.4.5. Oil change, gearbox, axis 4

Location of gearbox

The axis 4 gearbox is located in the rearmost part of the upper arm as shown in the figure below.



xx0200000231

A	Oil plug, filling
B	Oil plug, draining

Required equipment

Equipment, etc.	Art. no.	Amount	Note
Lubricating oil	11712016-604	8,100 ml	Mobilgear 600 XP 320
Oil exchange equipment	3HAC021745-001		The content is defined in section *Special tools on page 395*.
Oil collecting vessel	-		Capacity: 9,000 ml.
Standard toolkit	-		The content is defined in section *Standard toolkit on page 394*.

Draining, oil

The procedure below details how to drain the oil in the gearbox, axis 4.

When using the oil exchange equipment, follow the instructions enclosed with the kit. Art. no. for the kit is specified in *Required equipment on page 163*.

	Action	Note
1.	Run the upper arm -45° from the calibration position.	

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3.4.5. Oil change, gearbox, axis 4

Continued

	Action	Note
2.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	 **WARNING!** Handling gearbox oil involves several safety risks. Before proceeding, please observe the safety information in section *WARNING - Safety risks during work with gearbox oil on page 36*.	
4.	Drain the oil from the gearbox into an vessel by opening the*oil plug, draining.* Remove the *oil plug, filling* in order to drain the oil quicker!	Shown in the figure *Location of gearbox on page 163*. Vessel capacity is specified in *Required equipment on page 163*.
5.	Run the upper arm back to its calibration position (horizontal position).	Shown in section *Calibration scales and correct axis position on page 376*.
6.	Refit the oil plug, draining.	Tightening torque: 24 Nm.

Filling, oil

The procedure below details how to fill the oil in the gearbox, axis 4.

When using the oil exchange equipment, follow the instructions enclosed with the kit. Art. no. for the kit is specified in *Required equipment on page 163*.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
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 oil on page 36*.	

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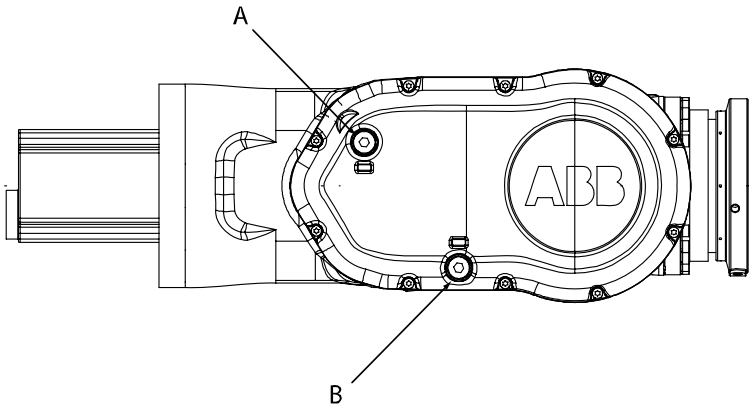
	Action	Note
3.	Refill the gearbox with *lubricating oil* through the *oil plug, filling.* The amount of oil to be refilled depends on the amount previously being drained. The correct oil level is detailed in section *Inspection, oil level gearbox axis 4 on page 121*.	Shown in the figure *Location of gearbox on page 163*. Art. no. and total amount are specified in *Required equipment on page 163*.
4.	Refit the oil plug, filling.	Tightening torque: 24 Nm.

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3.4.6. Oil change, gearbox, axis 5

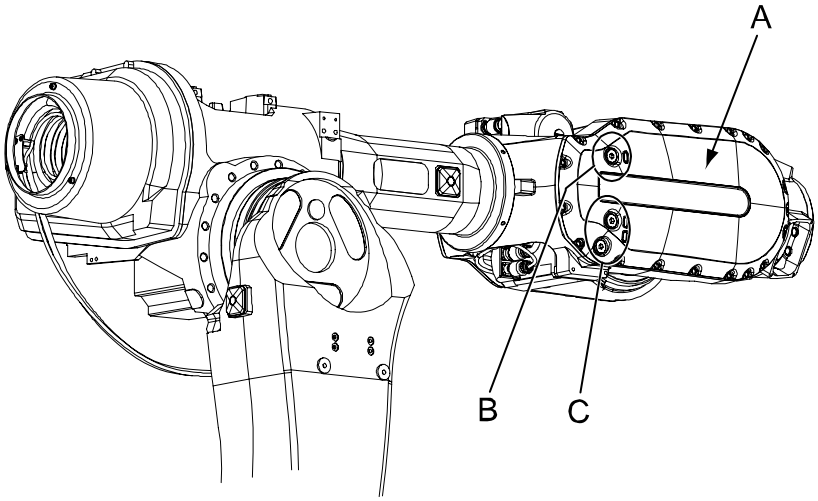
Location of gearbox

The axis 5 gearbox is located in the wrist unit as shown in the figure below.



xx0200000232

A	Oil plug, filling
B	Oil plug, draining



xx0500002013

A	Wrist unit of IRB 6640ID
B	Oil plug, filling
C	Oil plug, draining

Required equipment

Equipment, etc.	Art. no.	Amount	Note
Lubricating oil	11712016-604	IRB 6640: 6,700 ml IRB 6640ID: 5,000 ml	Mobilgear 600 XP 320

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Continued

Equipment, etc.	Art. no.	Amount	Note
Oil exchange equipment	3HAC021745-001		The content is defined in section *Special tools on page 395*.
Oil collecting vessel	-		Capacity: 7,000 ml.
Standard toolkit	-		The content is defined in section *Standard toolkit on page 394*.

Draining, oil, axis 5

The procedure below details how to change the oil in gearbox, axis 5.

When using the oil exchange equipment, follow the instructions enclosed with the kit. Art. no. for the kit is specified in *Required equipment on page 166*.

	Action	Note
1.	Run axis 4 to a position where the oil plug, draining, is facing downwards.	
2.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	 **WARNING!** Handling gearbox oil involves several safety risks. Before proceeding, please observe the safety information in section *WARNING - Safety risks during work with gearbox oil on page 36*.	
4.	Drain the oil from the gearbox by opening the *oil plug, draining.* Remove the *oil plug, filling* in order to drain the oil quicker!	Shown in the figure *Location of gearbox on page 166*. Vessel capacity is specified in *Required equipment on page 166*.
5.	Refit the oil plug, draining.	Tightening torque: 24 Nm.

Filling, oil, axis 5

The procedure below details how to change the oil in gearbox, axis 5.

When using the oil exchange equipment, follow the instructions enclosed with the kit. Art. no. for the kit is specified in *Required equipment on page 166*.

	Action	Note
1.	Run axis 4 to a position where the oil plug, filling, is facing upwards.	

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3.4.6. Oil change, gearbox, axis 5

Continued

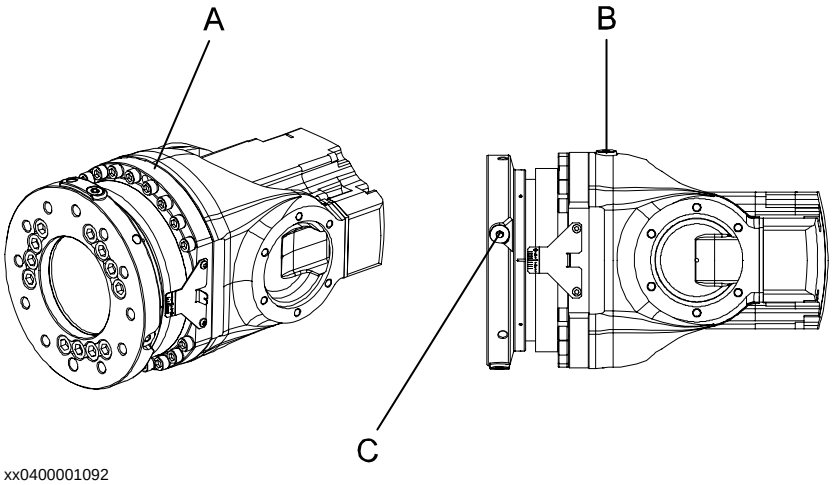
	Action	Note
2.	 **WARNING!** Handling gearbox oil involves several safety risks. Before proceeding, please observe the safety information in section *WARNING - Safety risks during work with gearbox oil on page 36*.	
3.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
4.	Refill the gearbox with *lubricating oil* through the *oil plug, filling.* The amount of oil to be refilled depends on the amount previously being drained. The correct oil level is detailed in section *Inspection, oil level, gearbox axis 5 on page 123*.	Shown in the figure *Location of gearbox on page 166*. Art. no. and total amount are specified in *Required equipment on page 166*.
5.	Refit the oil plug, filling.	Tightening torque: 24 Nm.

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3.4.7. Oil change, gearbox axis 6

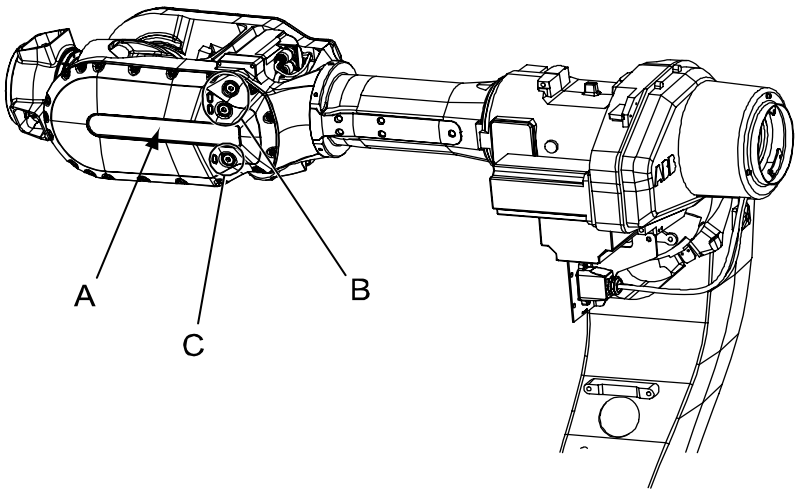
Location of gearbox

The axis 6 gearbox is located in the center of the wrist unit as shown in the figure below.



xx0400001092

A	Gearbox, axis 6
B	Oil plug, filling
C	Oil plug, draining



xx0500002017

-	The figure above shows the wrist unit of IRB 6640ID
A	Gearbox, axis 6
B	Oil plug, draining
C	Oil plug, filling

Required equipment

Equipment, etc.	Art. no.	Amount	Note
Lubricating oilIRB 6640ID	11712016-604	6,000 ml	Mobilgear 600 XP 320

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3.4.7. Oil change, gearbox axis 6

Continued

Equipment, etc.	Art. no.	Amount	Note
Lubricating oil IRB 6640	3HAC032140-001	450 ml	Kyodo Yushi TMO 150 **Note!** Don´t mix with other oil types!
Oil exchange equipment	3HAC021745-001		The content is defined in section *Special tools on page 395*.
Oil collecting vessel	-		Vessel capacity: 500 ml 7,000 ml (IRB 6640ID)
Standard toolkit	-		The content is defined in section *Standard toolkit on page 394*.

Draining, oil, axis 6

The procedure below details how to drain oil from the gearbox, axis 6.

When using the oil exchange equipment, follow the instructions enclosed with the kit. Art. no. for the kit is specified in *Required equipment on page 169*.

	Action	Note
1.	IRB 6640: Run the robot to a position where the *oil plug, draining* of axis 6 gearbox is facing downwards and the *oil plug, filling*, is facing upwards. IRB 6640ID: Run the robot to a position where the *oil plug, draining* is facing downwards.	Shown in the figure *Location of gearbox on page 169*.
2.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	 **WARNING!** Handling gearbox oil involves several safety risks. Before proceeding, please observe the safety information in section *WARNING - Safety risks during work with gearbox oil on page 36*.	
4.	Drain the oil from the gearbox into a vessel by removing the oil plug.	Vessel capacity is specified in *Required equipment on page 169*.
5.	Refit the oil plug, draining.	Tightening torque: 24 Nm.

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Filling, oil, axis 6

The procedure below details how to fil oil in the gearbox, axis 6.

When using the oil exchange equipment, follow the instructions enclosed with the kit. Art. no. for the kit is specified in *Required equipment on page 169*.

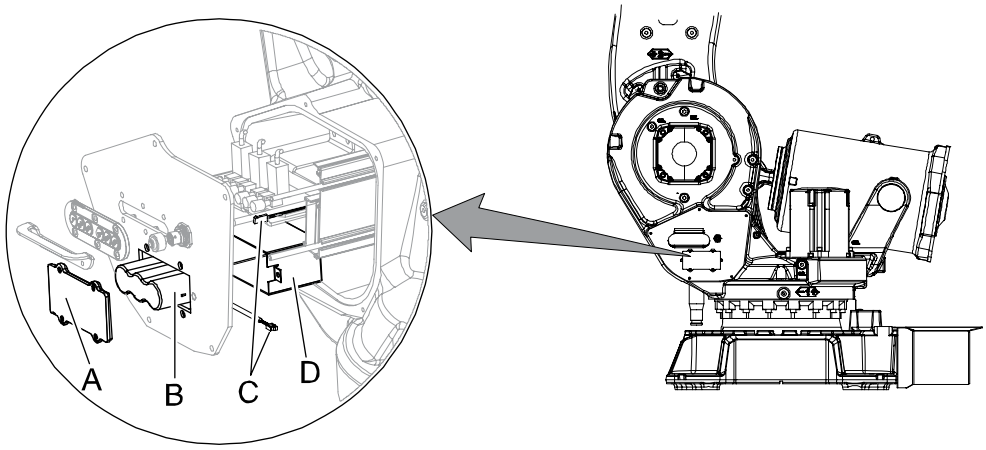
	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	 **WARNING!** Handling gearbox oil involves several safety risks. Before proceeding, please observe the safety information in section *WARNING - Safety risks during work with gearbox oil on page 36*.	
3.	Remove the *oil plug, filling.*	Shown in the figure *Location of gearbox on page 169*.
4.	Refill the gearbox with *lubricating oil.* The amount of oil to be refilled depends on the amount previously being drained. The correct oil level is detailed in section *Inspection, oil level gearbox axis 6 on page 125*.	Art. no. and the total amount are specified in *Required equipment on page 169*.
5.	 **NOTE!** Don´t mix Kyodo Yushi TMO 150 with other oil types!	Detailed in section *Oil in gearboxes*.
6.	Refit the oil plug.	Tightening torque: 24 Nm.

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3.4.8. Replacement of SMB battery

Location of SMB battery

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



xx0600003444

A	Cover, battery box
B	Battery pack
C	Cable, battery
D	Battery holder

Required equipment

Equipment, etc.	Spare part no.	Note
Battery pack	3HAC16831-1	Battery includes protection circuits. Replace it only with given spare part no. or an ABB approved equivalent.
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
Circuit Diagram	- 3HAC025744-001	See chapter *Circuit diagram*.

Removal, battery

The procedure below details how to remove the SMB battery.

	Action	Note
1.	Move the robot to its calibration position.	This is done in order to facilitate the updating of the revolution counter.

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Continued

	Action	Note
2.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	 esd **WARNING!** The unit is sensitive to ESD, before handling the unit please observe the safety information in section *WARNING - The unit is sensitive to ESD! on page 35*	
4.	Remove the *SMB battery cover* by unscrewing its attachment screws.	Shown in the figure *Location of SMB battery on page 172*.
5.	Pull out the battery and disconnect the *battery cable*.	Shown in the figure *Location of SMB battery on page 172*.
6.	Remove the *SMB battery.* Battery includes protection circuits. Replace it only with the specified spare part or with an ABB approved equivalent.	Shown in the figure *Location of SMB battery on page 172*.

Refitting, battery

The procedure below details how to refit the SMB battery.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	 esd **WARNING!** The unit is sensitive to ESD, before handling the unit please observe the safety information in section *WARNING - The unit is sensitive to ESD! on page 35*	

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3.4.8. Replacement of SMB battery

Continued

	Action	Note
3.	Reconnect the *battery cable* to the *SMB battery pack* and fit it to the frame.	Art. no. is specified in *Required equipment on page 172*. Shown in the figure *Location of SMB battery on page 172*.
4.	Secure the *SMB battery cover* with its attachment screws.	Shown in the figure *Location of SMB battery on page 172*.
5.	Update the revolution counter.	Detailed in chapter Calibration - section *Updating revolution counters on page 378*.
6.	 **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 33*.	

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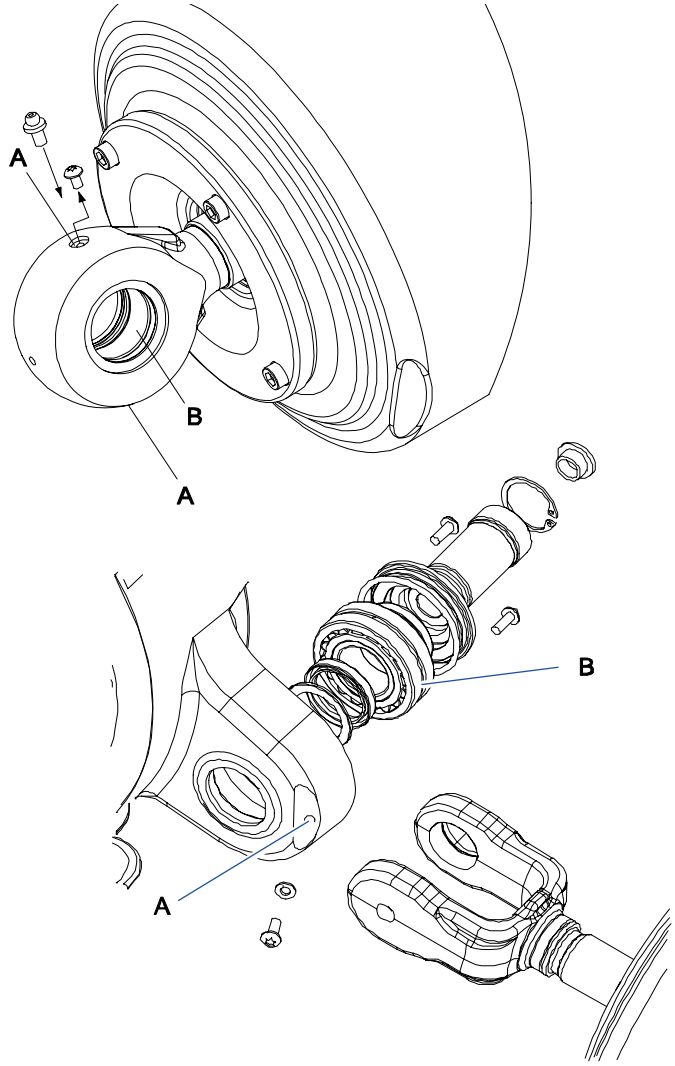
3.5 Lubrication activities

3.5.1. Lubrication of spherical roller bearing, balancing device

Location of bearing

The spherical roller bearing is located at the front ear of the balancing device, as shown in the figure below.

Note! The balancing device must be mounted on the robot when lubricating the bearing!



xx0700000361

A	Lubrication hole on ear
B	Spherical roller bearing

Required equipment

Equipment, etc.	Art. no.	Note
Grease	3HAA1001-294	
Lubrication nipple		M6.
Grease pump	-	

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3.5.1. Lubrication of spherical roller bearing, balancing device

Continued

Lubrication, balancing device bearing

The procedure below details how to lubricate the spherical roller bearing.

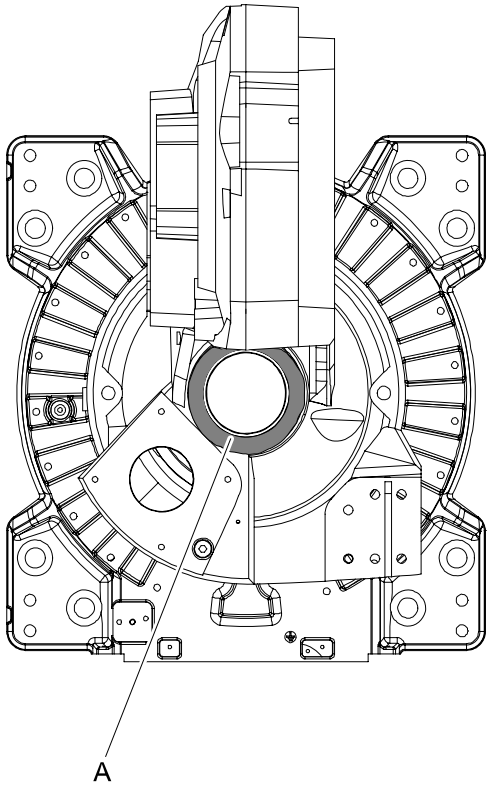
	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Lubricate the spherical roller bearing through the lubrication nipple in the ear with *grease.* Fill until excessive grease is forced out between the shaft and the sealing spacer.	Art. no. and amount is specified in *Required equipment on page 175*! Shown in the figure *Location of bearing on page 175*! The balancing device must be mounted on the robot when lubricating the bearing!
3.	Clean the area from any excessive grease and check the area once again after operation of the robot, in order to make sure there is no incorrect leakage from the o-rings.	Read more about the inspection in section Inspection, balancing device - *Check for leakage on page 131*.

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3.5.2. Rust preventive measures, bearing axis 1 (Foundry Prime)

Location of bearing axis 1

The bearing axis 1 is located as shown in the illustration. (View from above).



xx0700000445

A	Plastic ring (cable guide)

Required equipment

Equipment	Art. no.	Note
Brush	-	
Rust preventive	3HAC026621-001	Equivalent: • Mercasol 3106
Standard toolkit		The content is defined in section *Standard toolkit on page 394*.
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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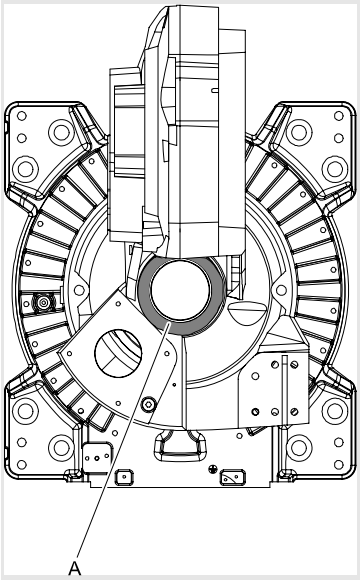
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3.5.2. Rust preventive measures, bearing axis 1 (Foundry Prime)

Continued

Procedure

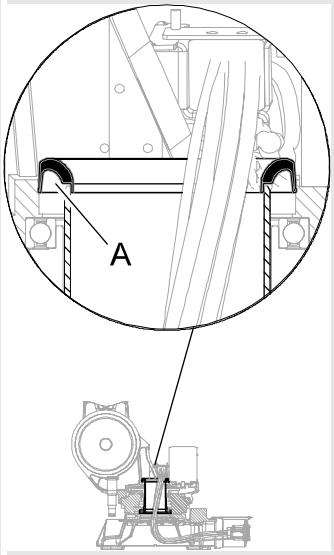
The following procedure details how to grease the bearing axis 1.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Remove the plastic ring.	 xx0700000445 Parts: • A: Plastic ring
3.	Wipe the surface under the ring.	

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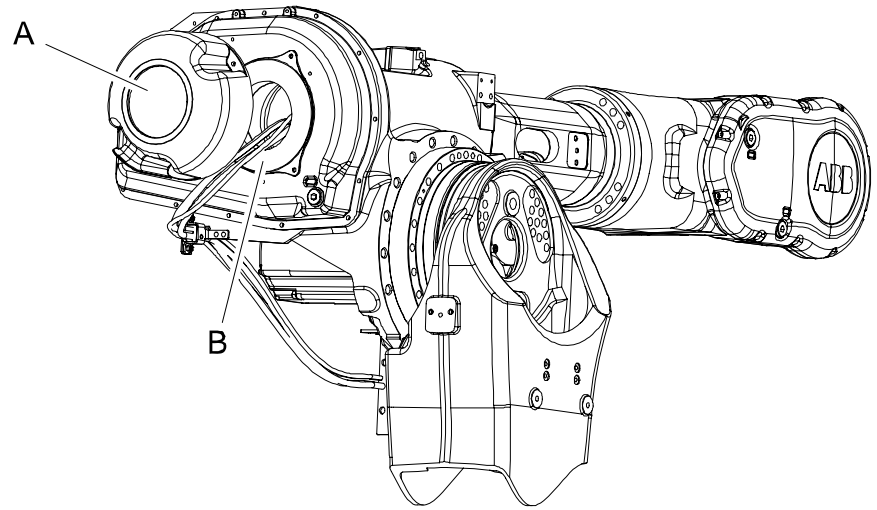
	Action	Note
4.	Apply rust preventive on the radial sealing with a brush.	 xx0700000455 Parts: • A: Area where Mercasol 3106 shall be applied
5.	Refit the *plastic ring*.	

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3.5.3. Rust preventive measures, bearing axis 4 (Foundry Prime)

Overview

The bearing axis 4 is located as shown in the illustration below.



xx0500002869

A	Plastic cover
B	Plastic ring

Required equipment

Equipment	Art. no.	Note
Brush	-	
Rust preventive	3HAC026621-001	Equivalent: • Mercasol 3106
Standard toolkit		The content is defined in section *Standard toolkit on page 394*.
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.

Procedure

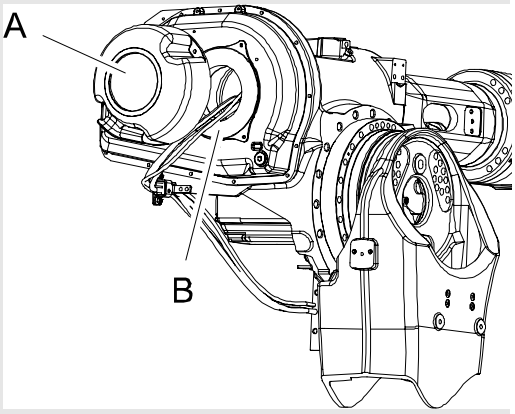
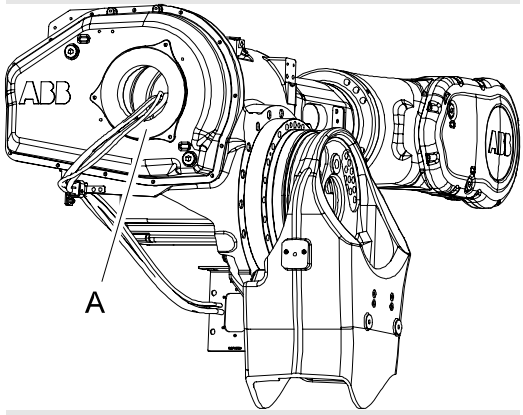
The procedure below details how to grease the bearing axis 1.

	Action	Note
1.	Put the robot in a suitable position.	

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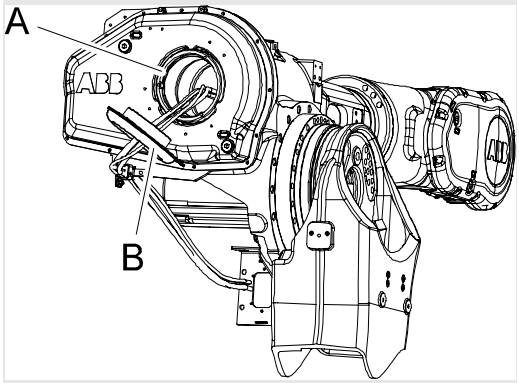
	Action	Note
2.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Remove the *plastic cover* at the rear end of the upper arm.	 xx0600002872 Parts: • A: Plastic cover • B: Plastic ring
4.	Remove the *plastic ring* that covers the bearing.	 xx0600002871 Parts: • A: Plastic ring
5.	Wipe the surface under the *plastic ring*.	

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3.5.3. Rust preventive measures, bearing axis 4 (Foundry Prime)

Continued

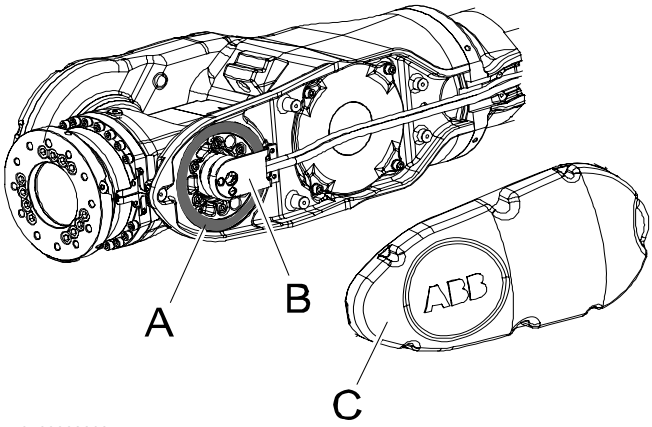
	Action	Note
6.	Apply rust preventive on the *radial sealing and the rear part of the tube* with a brush.	 xx0600002868 Parts: • A: Radial sealing and rear part of tube • B: Plastic ring
7.	Refit the *plastic ring* and *cover*.	

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3.5.4. Rust preventive measures, support bearing in wrist (Foundry Prime)

Location of bearing

The support bearing in the wrist is located as shown in the illustration.



xx0500002863

A	Bearing
B	Cable bracket
C	Cover

Required equipment

Equipment	Art. no.	Note
Brush	-	
Rust preventive	3HAC026621-001	Equivalent: • Mercasol 3106
Standard toolkit		The content is defined in section *Standard toolkit on page 394*.
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.

Greasing bearings

The procedure below details how to grease the bearing in the wrist.

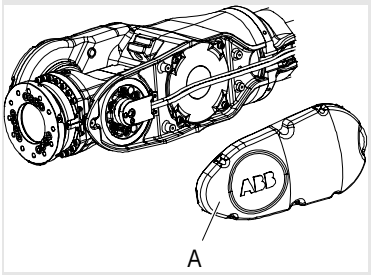
	Action	Note
1.	Put the robot and the upper arm in a suitable position.	

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3.5.4. Rust preventive measures, support bearing in wrist (Foundry Prime)

Continued

	Action	Note
2.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Dismantle the air hose from motor axis 6.	
4.	Tighten the hose clamp on motor axis 6, and remove the air hose.	
5.	Remove the cover according to the illustration.	 xx0600002864 • A: Cover
6.	Apply rust preventive on the bearing and cable bracket with the brush.	See *Location of bearing on page 183*.
7.	Refit the *cover*.	
8.	Perform a leakdown test.	See *Inspection of air hoses (Foundry Prime) on page 138*.

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3.6 Cleaning activities

3.6.1. Cleaning, robot

General

The protection class is IP 67, that is the robot is watertight.

Activities

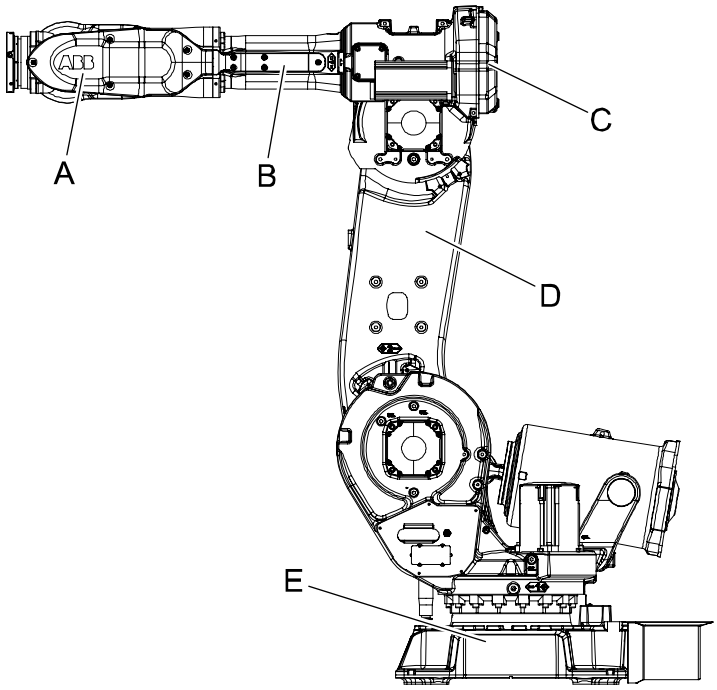
This instruction specifies how to clean the robot.

Periodicity

The periodicity of cleaning the robot varies a great deal depending on the actual environment and function of the robot. Clean a contamined robot as required.

Special points

Special points to be observed are shown in the figure below:



xx0600003447

A	Spiral cables to motor 6
B	Inside of upper arm tube
C	Rear of upper arm tube
D	Inside of lower arm
E	Inside of base/axis 1

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3.6.1. Cleaning, robot

Continued

Required equipment

Equipment, etc.	Art. no.	Note
Steam cleaner	-	• Water pressure at nozzle: max. 2,500 kN/m ^{2} (25 bar) • Type of nozzle: fan jet, min. 45° spread • Flow: max. 100 litres/min. • Water temperature: max. 80° C
High pressure water cleaner	-	• Max. water pressure on enclosures: 50 kN/m ^{2} (0.5 bar) • Fan jet nozzle should be used, min. 45° spread • Flow: max. 100 litres/min.

Do's and don'ts!

The section below 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 paintwork, rust inhibitors, signs, or labels!
- Always check that all protective covers are fitted to the robot before cleaning!

Never!

- Never point the water jet at bearing seals, contacts, and other seals!
- Never spray from a distance closer than 0.4 m!
- Never remove any covers or other protective devices before cleaning the robot!
- Never use any cleaning agents, for example compressed air or solvents, other than those specified above!
- Never spray with a high pressure cleaner onto the sealing cup at the bottom of the motor 6 spiral cable (item A in the figure Special points)!
- Although the robot is watertight, avoid spraying connectors and similar items with a high pressure cleaner!

Foundry Plus versions

In working environments, for example foundries, where the robot may be exposed to fluids that dry to make a crusty surface, for example release agents, clean the cable harnesses to prevent the crust damaging the cables:

- Clean the spiral wound cables to motor 6 (item A in the figure *Special points on page 185*) with water and a cloth!
- Clean the remaining sections of the cable harnesses as detailed above!

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4 Repair

4.1. Introduction

Structure of this chapter

This chapter details all repair activities recommended for the robot and any external units of the robot.

It is made up of separate procedures, each detailing a specific repair activity. Each procedure contains all 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 robot.

Required equipment

All equipment required to perform a specific repair activity is listed together with the current procedure.

The equipment is also gathered in different lists in the chapter *Reference information*.

Safety information

Before any service 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 describe danger and safety risks when performing specific steps in a procedure. Make sure to read through the chapter *Safety* before commencing any service work.

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4.2 General procedures

4.2.1. Performing a leak-down test

General

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.	Art. no.	Note
Leakdown tester	3HAC0207-1	
Leak detection spray	-	

Procedure

	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 *leakdown tester*. Adapters may be required, which are included in the leakdown tester kit.	Art. no. is specified in *Required equipment on page 188*.
3.	Apply compressed air, and raise the pressure with the knob until the correct value is shown on the manometer.	Recommended value: 0.2 - 0.25 bar (20 - 25 kPa)
4.	Disconnect the compressed air supply.	
5.	Wait for approx. 8-10 minutes. No pressure loss must be detected.	If the compressed air is significantly colder or warmer than the gearbox to be tested, a slight pressure increase or decrease respectively may occur. This is quite normal.
6.	Was any pressure drop evident? Localize the leak as detailed below. Remove the leakdown tester, and refit the oil plug. The test is complete.	
7.	Spray suspected leak areas with *leak detection spray*. Bubbles indicate a leak.	
8.	When the leak has been localized: take the necessary measures to correct the leak.	

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4.2.2. Mounting instructions for bearings

General

This section details 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 instructions below when 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 all parts included in the bearing fitting are free from burrs, grinding waste and other contamination. Cast components must be free from foundry sand.	
3.	Bearing rings, inner rings and roller elements must under no circumstances be subjected to direct impact. Furthermore, the roller elements must not be exposed to any stresses during the assembly work.	

Assembly of tapered bearings

Follow the previous instructions for assembly of all bearings, when mounting a tapered bearing on the robot.

In addition to those instructions, the procedure below 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 at 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 lifespan of the bearing.	

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Continued

Greasing of bearings

The bearings must be greased after assembly, according to instructions below:

- 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.
- 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 detailed below:

- *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.

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4.2.3. Mounting instructions for seals

General

This sections details how to mount different types of seals to the robot.

Equipment

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

Rotating seals

The procedure below details 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: • 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, as it may result in future leakage.	
3.	Lubricate the seal with *grease* just before fitting. (Not too early as there is a risk of dirt and foreign particles adhering to the seal.) Fill the space between the dust tongue and sealing lip to 2/3 with grease. The rubber coated external diameter must also be greased, unless otherwise specified.	Art. no. is specified in *Equipment on page 191*.
4.	Mount the seal correctly with a mounting tool. Never hammer directly on the seal as this may result in leakage.	

Flange seals and static seals

The procedure below details 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.

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4.2.3. Mounting instructions for seals

Continued

	Action
2.	Clean the surfaces properly and in accordance with ABB recommendations.
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 procedure below details 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, etc.	Defective o-rings may not be used.
3.	Check the o-ring grooves. The grooves must be geometrically correct and free from pores and contamination.	Defective o-rings may not be used.
4.	Lubricate the o-ring with grease.	
5.	Tighten the screws evenly when assembling.	

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4.3 Complete robot

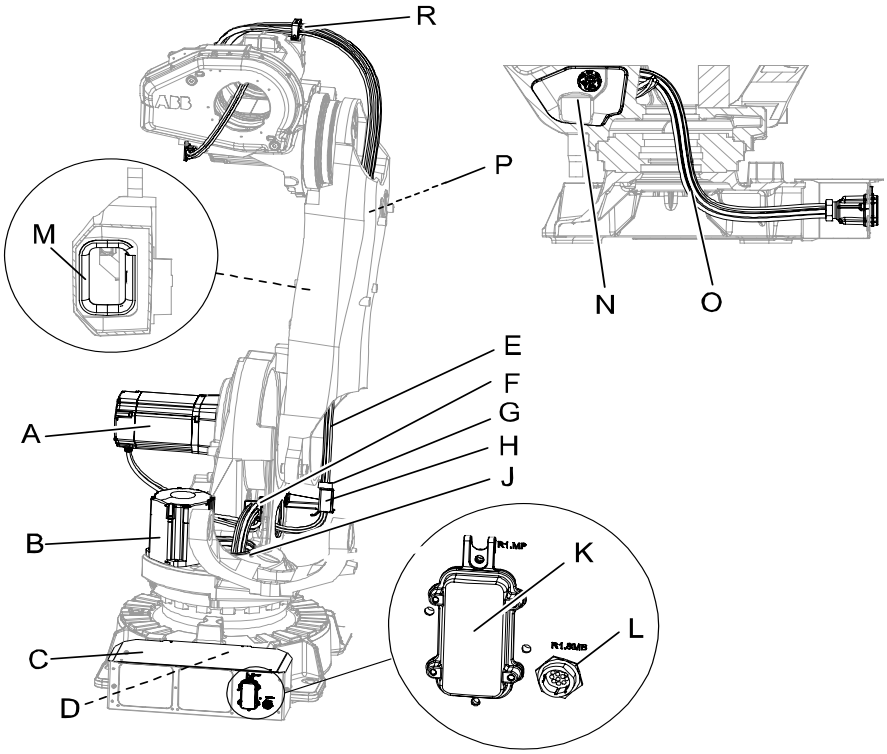
4.3.1. Replacement of cable harness, axes 1-6

General

This section details how to replace the cable harness that runs undivided from axis 1 to axis 6.

Location of cable harness

The cable harness of axes 1-6 is run throughout the robot as shown in the figure below.



xx0700000102

A	Connectors at motor, axis 2 (R2.FB2, R2.MP2)
B	Connectors at motor, axis 1 (R2.FB1, R2.MP1)
C	Rear cover plate
D	Earth (attachment point is placed under the cover plate)
E	Cable harness
F	Cable holder
G	Velcro strap
H	Guide plate ax 2
J	Cable guide
K	Connector R1.MP
L	Connector R1.SMB
M	Cable protector (placed inside the lower arm)
N	Position for SMB and brake release units
O	Cable harness (cut away view)
P	Velcro strap (inside lower arm on metal clamp)

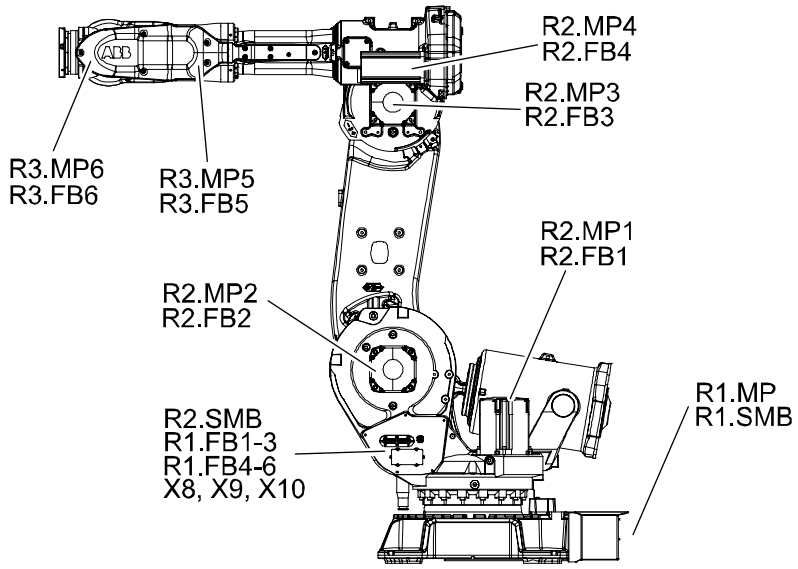
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4.3.1. Replacement of cable harness, axes 1-6

Continued

R	Cable gland (armhouse)



xx0700000107

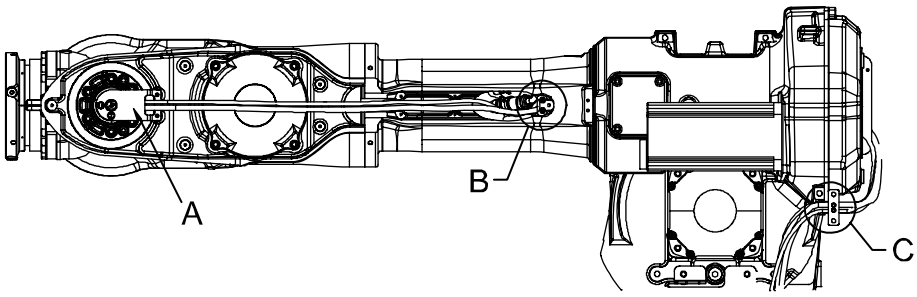
Required equipment

Equipment	Spare part no.	Note
Cable harness, axes 1-6	3HAC027435-001	
Brush	-	Option Foundry Prime
Rust preventive	3HAC026621-001	Option Foundry Prime Equivalent: • Mercasol 3106
Gasket	3HAC3537-1	Motor axes 1-5
Gasket	3HAC12877-1	Motor axis 6
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
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	3HAC025744-001	See chapter *Circuit diagram*.

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Cable brackets of the upper arm

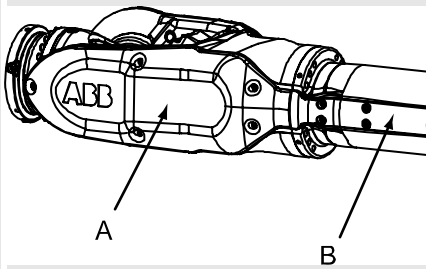


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A	Cable bracket, wrist unit
B	Cable bracket, upper arm tube
C	Cable attachment, rear

Removal, cable harness - upper arm

The procedure below details how to remove the cable harness from the upper arm of the robot.

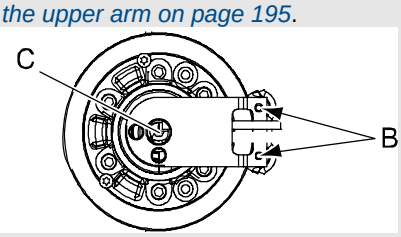
	Action	Note
1.	In order to facilitate refitting of cable harness, run the robot to the specified position: • Axis 1: 0 ° • Axis 2: 0 ° • Axis 3: 0 ° • Axis 4: 0 ° • Axis 5: +90 ° • Axis 6: no significance	Axes 2 and 3 may be tilted slightly to improve access.
2.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Remove the *cover, wrist unit* and the *cover, upper arm tube*.	 xx0200000214 A. Cover, wrist unit B. Cover, upper arm tube

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4.3.1. Replacement of cable harness, axes 1-6

Continued

	Action	Note
4.	**NOTE!** Axis 5 must be oriented in the correct position (+90º) to allow the motor 6 cover to open!	
5.	Remove the cover of motor, axis 6 and disconnect all connectors beneath.	
6.	Loosen the *cable bracket, wrist unit* by undoing the three attachment screws. Two of the attachment screws are visibly located at the rear of the bracket and the third is located at the bottom of the cable bracket, in the center.	Shown in the figure *Cable brackets of the upper arm on page 195*.  xx0200000254 • B: Attachment screws, rear of cable bracket (2 pcs) • C: Attachment screw, bottom of cable bracket
7.	Pick out the cabling from motor, axis 6.	
8.	Loosen the *cable bracket, upper arm tube* by undoing the two screws on top of the tube.	Shown in the figure *Cable brackets of the upper arm on page 195*.
9.	Disconnect the two *connectors (R3.FB5 and R3.MP5)* inside the tube.	Shown in the figure *Location of cable harness on page 193*.
10.	Remove eventual cable straps from the harness.	
11.	Remove the *cable attachment, rear.*	Shown in the figure *Cable brackets of the upper arm on page 195*.
12.	Remove the covers of motors axes 3 and 4 and disconnect all connectors beneath. Pick out the cabling from the motors.	
13.	Gently pull the cable harness out from the upper arm tube.	
14.	Tie the connectors into bundles, to avoid damaging them during further removal.	
15.	Continue removing the cable harness as detailed in following procedure.	

Removal, cable harness - lower arm, frame and base

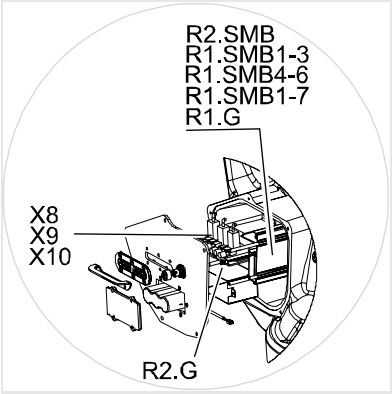
The procedure below details how to remove the cable harness from the lower arm, frame and base.

	Action	Note
1.	Remove the *rear cover plate* from the robot by removing its attachment screws.	Shown in the figure *Location of cable harness on page 193*.
2.	Disconnect the *earth cable* beneath the rear cover plate.	Position shown in the figure *Location of cable harness on page 193*.

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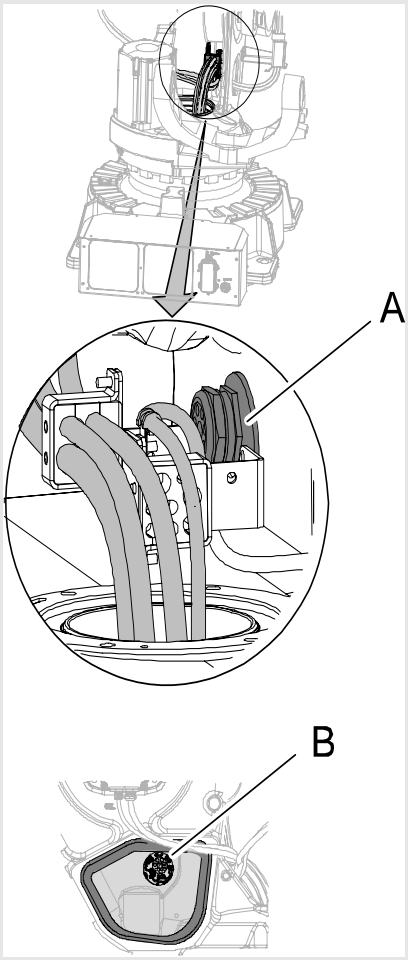
	Action	Note
3.	Disconnect connectors *R1.MP and R1.SMB*.	Shown in the figure *Location of cable harness on page 193*.
4.	Remove the cable holder on the frame securing the cable harness.	
5.	Pull the cable and connectors up through the cable guide in the center of the frame.	
6.	Disconnect all connectors at motors 1 and 2.	
7.	Open the SMB cover carefully. The cable between the battery and the SMB-unit may stay connected, in order to avoid an update of the revolution counter. Be careful not to let the weight of the cover strain the cable! In order to remove the cover completely, the connector R1.G must be disconnected! This causes a necessary updating of the revolution counter!	
8.	Disconnect connectors R2.SMB, R1.SMB1-3, R1.SMB4-6 from the SMB unit. Disconnect X8, X9 and X10 from the brake release unit.	 xx0700000104

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4.3.1. Replacement of cable harness, axes 1-6

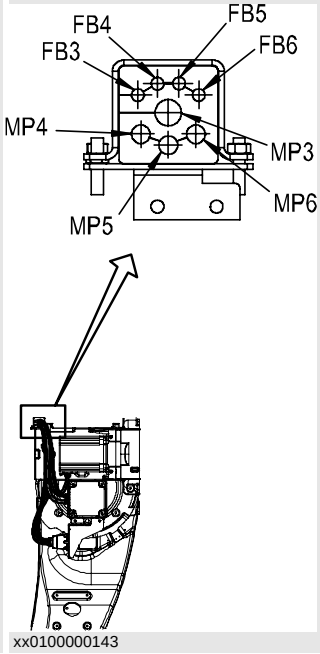
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	Action	Note
9.	Remove the *cable gland* by removing the four *attachment screws* from inside the SMB recess.	 xx0700000109 • A: Cable gland • B: Attachment screws, inside SMB recess
10.	Remove the velcro strap and cable gland	

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Continued

	Action	Note
11.	Remove the cable gland securing the cables to the arm house.	 xx0100000143
12.	Remove the *velcro strap* from the harness at the guide plate ax 2 at the lower arm.	Shown in the figure *Location of cable harness on page 193*.
13.	Remove the cable harness from the cable guide plate ax 2.	
14.	Disconnect all connectors at motors 3 and 4.	
15.	Gently pull the cable harness out.	

Refitting, cable harness - lower arm, frame and base

The procedure below details how to refit the lower end of the cable harness to the robot.

How to refit the upper end is detailed in section *Refitting, cable harness - upper arm on page 202*.

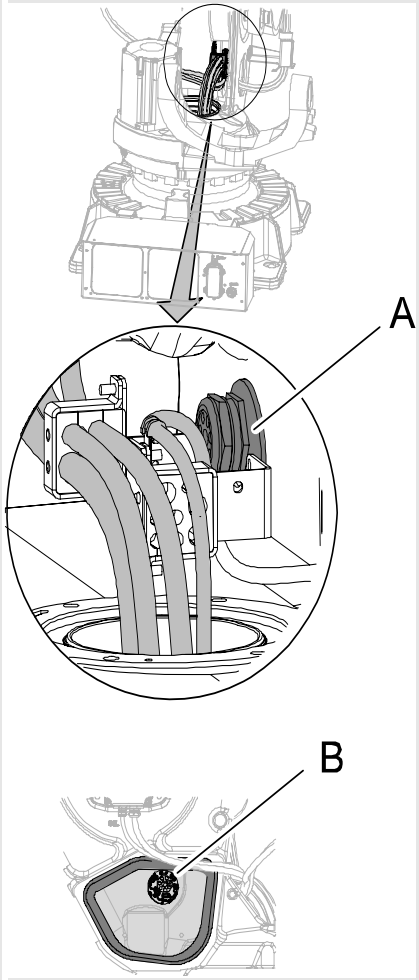
	Action	Note
1.	**NOTE!** On Foundry Prime robots: Apply rust preventive around all dismantled covers and attachment screws with a brush.	See *Required equipment on page 194*.
2.	Pull the cable and connectors down through the *cable guide* in the center of the frame.	Shown in the figure *Location of cable harness on page 193*. Make sure the cables are not twisted with each other or with eventual customer harnesses! Make a note of the correct positions of the connectors!

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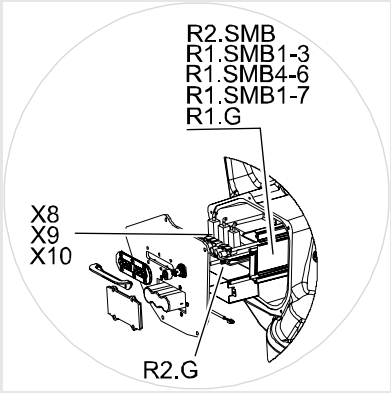
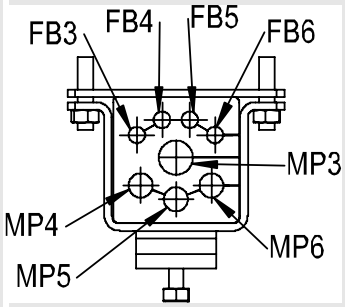
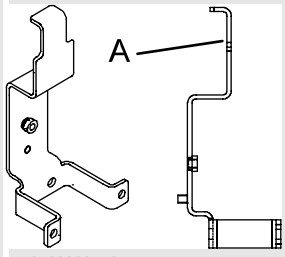
4.3.1. Replacement of cable harness, axes 1-6

Continued

	Action	Note
3.	Reconnect connectors *R1.MP and R1.SMB* at the base.	Shown in the figure *Location of cable harness on page 193*. Make a note of the correct positions of the connectors!
4.	Reconnect the earth cable.	Position shown in the figure *Location of cable harness on page 193*.
5.	Refit the *rear cover plate* to the robot with its attachment screws.	Shown in the figure *Location of cable harness on page 193*.
6.	Reconnect all connectors at motors 1 and 2.	
7.	**NOTE!** On Foundry Prime robots: When dismantling the cables from the motors, the gasket must be replaced.	See *Required equipment on page 194*.
8.	Secure the *cable gland* with four *attachment screws* from inside the SMB recess. Refit the *velcro strap*. (Shown in the figure *Location of cable harness on page 193*.)	 xx0700000109 • A: Cable gland • B: Attachment screws, inside SMB recess

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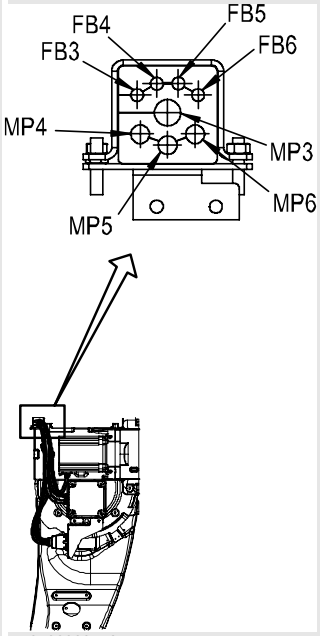
	Action	Note
9.	Reconnect connectors R2.SMB, R1.SMB1-3, R1.SMB4-6 to the SMB unit. Reconnect X8, X9 and X10 to the brake release unit. Reconnect R1.G if it has been disconnected.	 xx0700000104
10.	Secure the SMB cover with its attachment screws.	
11.	**WARNING!** Before continuing any service work, please observe the safety information in section *WARNING - The brake release buttons may be jammed after service work on page 34*!	
12.	Pull the cable harness through the lower arm.	
13.	Refit the metal clamp on the inside of the lower arm. Then refit the cable harness to the metal clamp with the velcro strap and cable gland.	 xx0100000142  xx0700000472 • A: Position of velcro strap

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4.3.1. Replacement of cable harness, axes 1-6

Continued

	Action	Note
14.	Refit the cable gland securing the cables to the arm house. **NOTE!** The cable harness is delivered in a pretwisted state. Make sure not to affect this by twisting the cable harness further in any direction.	 xx0100000143

Refitting, cable harness - upper arm

The procedure below details how to refit the upper end of the cable harness to the robot.

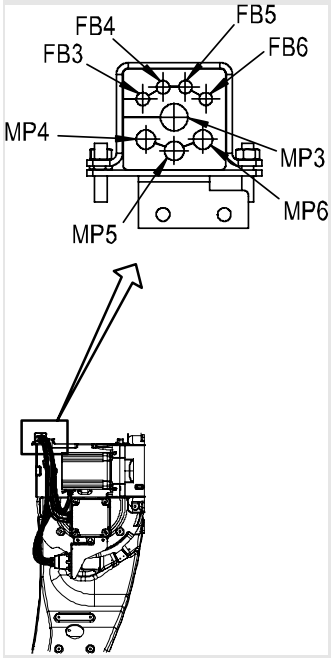
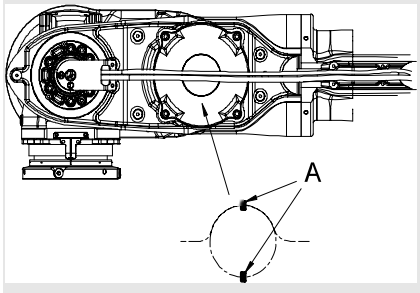
How to refit the lower end is detailed in section *Refitting, cable harness - lower arm, frame and base on page 199*.

	Action	Note
1.	Before refitting the upper end of the cable harness, the lower end must first be refitted.	Detailed in section *Refitting, cable harness - lower arm, frame and base on page 199*.

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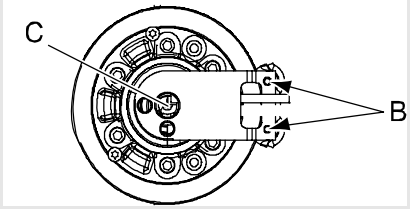
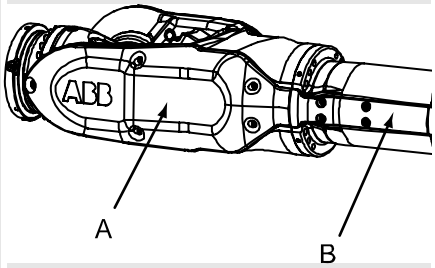
	Action	Note
2.	Refit the *cable gland* securing the cables in the armhouse. **NOTE!** The cable harness is delivered pretwisted. Make sure not to affect this by twisting the cable harness further in any direction.	Shown in the figure *Location of cable harness on page 193*.  xx0100000143
3.	Reconnect all connectors at motors 3 and 4.	
4.	Secure the cable harness to the *guide plate* axis 2.	Shown in the figure *Location of cable harness on page 193*.
5.	Refit the *velcro strap* at the guide plate axis 2.	Shown in the figure *Location of cable harness on page 193*.
6.	Gently insert the cable harness from the rear into the upper arm.	
7.	Connect the two connectors inside the upper arm tube, R2.FB5 and R3.MP5 and secure the *cable bracket* with its two attacment screws to the tube.	Shown in the figure *Cable brackets of the upper arm on page 195*.
8.	Place the cabling to motor axis 6 correctly on the upper arm and gently pull the connectors through the hole on top of the wrist unit to motor axis 6. In case of excess of cable length: • put the excess cable in a loop in the area shown in the figure and secure with cable straps. Cables are longer in order to fit different upper arm lengths.	 xx0200000185 • A: Cable straps

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4.3.1. Replacement of cable harness, axes 1-6

Continued

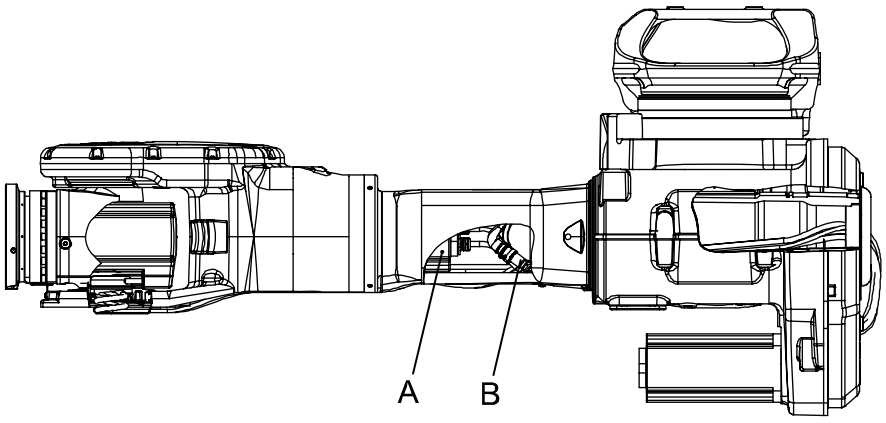
	Action	Note
9.	Fasten the cable bracket, wrist unit with its three *attachment screws*. Two screws are visible at the *rear attachment point* of the bracket and the third is located at the *bottom of the cable bracket*, in the center.	 xx0200000254 • B: Attachment screws, rear attachment point of cable bracket • C: Attachment screw, bottom of cable bracket
10.	Reconnect the connectors to motor, axis 6 and refit the motor cover.	
11.	Refit the *cover, upper arm tube* and the *cover, wrist unit*. Make sure the cabling is placed correctly when refitting the covers, and does not get jammed.	 xx0200000214 Parts: • A: Cover, wrist unit • B: Cover, upper arm tube
12.	If any cable straps have been removed, refit them to the harness.	
13.	Refit the *cable attachment, rear.*	Shown in the figure *Cable brackets of the upper arm on page 195*.
14.	If the connection between the SMB battery and the SMB unit has been broken, the revolution counters now must be updated!	Detailed in section *Updating revolution counters on page 378*.
15.	**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 33*.	

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4.3.2. Replacement of cabling, axis 5 motorIRB 6640

Location of cabling

The separate cables for the axis 5 motor are located inside the upper arm tube, as shown in the figure below.



xx0500002294

A	Motor axis 5 with connectors R4.FB5 and R4.MP5
B	Connectors R3.FB5 and R3.MP5

Required equipment

Equipment	Spare part no.	Note
Cable harness axis 5	3HAC14139-1	
Circuit diagram	3HAC025744-001	
Standard toolkit		The content is defined in section *Standard toolkit on page 394*.
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.

Removal, cabling axis 5 motor

The procedure below details how to remove the cabling from the axis 5 motor.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Remove the complete wrist unit.	Detailed in section: • IRB 6640:*Removal, wrist unit on page 253*. • IRB 6640ID: *Removal, wrist unit on page 258*.

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Continued

	Action	Note
3.	Remove the cover of motor, axis 5.	
4.	Disconnect all connectors at motor, axis 5.	
5.	Remove the cable gland cover at the cable exit by unscrewing its two attachment screws.	
6.	Remove the cable, axis 5.	

Refitting, cabling axis 5 motor

The procedure below details how to refit the cabling to the motor of axis 5.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Reconnect all connectors at motor, axis 5.	
3.	Refit the cable gland cover at the cable exit with its two attachment screws.	
4.	Refit the cover of motor, axis 5.	
5.	Refit the complete wrist unit.	Detailed in section: • IRB 6640:*Refitting, wrist unit on page 254*. • IRB 6640ID: *Refitting, wrist unit on page 258*.
6.	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*.
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 33*.	

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4.3.3. Replacement of cable harness, Cleanroom

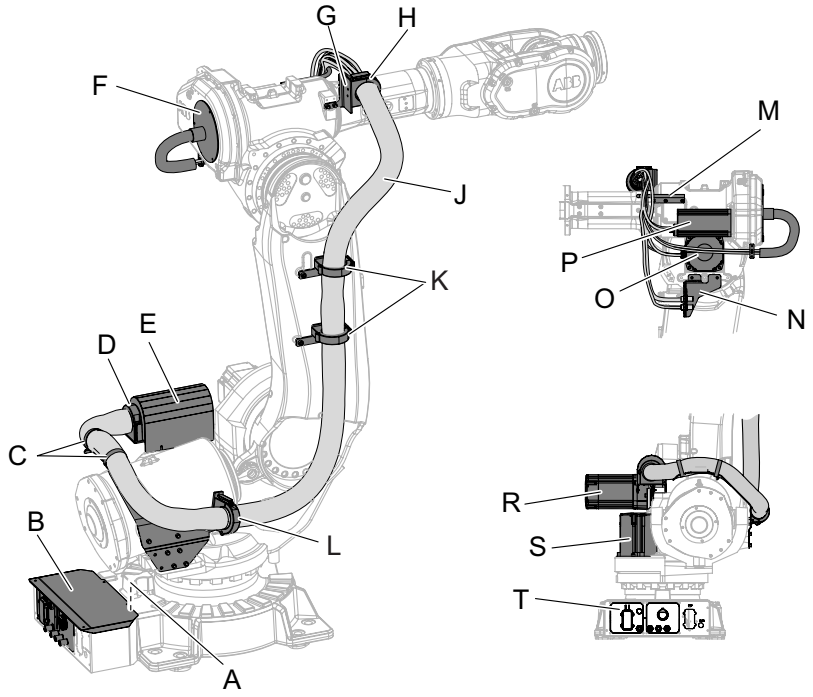
General

This section details how to replace the cable harness, Cleanroom.

Fitting of cable attachments is detailed in section *Fitting cable package attachments (Cleanroom)*.

Location of cable harness, Cleanroom

The illustration below shows the location of the cable harness, Cleanroom.



xx0800000054

A	Earth (placed under rear cover plate)
B	Rear cover plate
C	Velcro straps
D	Gripping clamp, shelf
E	Cover, shelf
F	Cover, armhouse
G	Bracket for metal clamp
H	Gripping clamp, armhouse
J	Cable harness, Cleanroom
K	Gripping clamps, lower arm
L	Gripping clamp, lower bracket
M	Cable guide
N	Connection plate, axis 3
O	Motor axis 3
P	Motor axis 4
R	Motor axis 2

Continues on next page

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Continued

S	Motor axis 1
T	Connectors at base

Required equipment

Equipment	Spare part no.	Note
Cable harness, Cleanroom	3HAC029840-001	
Gasket	3HAC3537-1	Motor, axes 1.5
Gasket	3HAC12877-1	Motor, axis 6
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
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	3HAC025744-001	See chapter *Circuit diagram*.

Removal cable harness - lower end

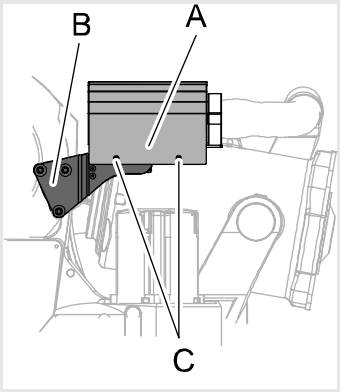
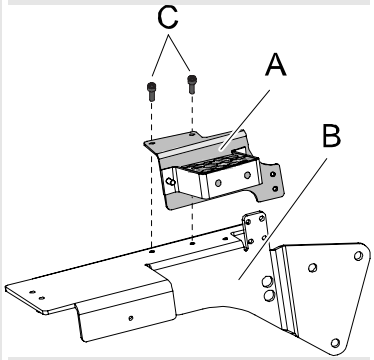
The procedure below details how to remove the lower end of the cable harness, Cleanroom.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	**CAUTION!** The cable package is sensitive to mechanical damage. They must be handled with care, especially the connectors, in order to avoid damaging them.	
3.	Remove the *rear cover plate* from the robot by removing its attachment screws.	Shown in the figure *Location of cable harness, Cleanroom on page 207*.
4.	Disconnect connectors *R1.MP* and *R1.SMB* at the base.	
5.	Disconnect the *earth cable*.	Shown in the figure *Location of cable harness, Cleanroom on page 207*.
6.	Disconnect all connectors at *motor axis 1* and *motor axis 2*.	Shown in the figure *Location of cable harness, Cleanroom on page 207*.

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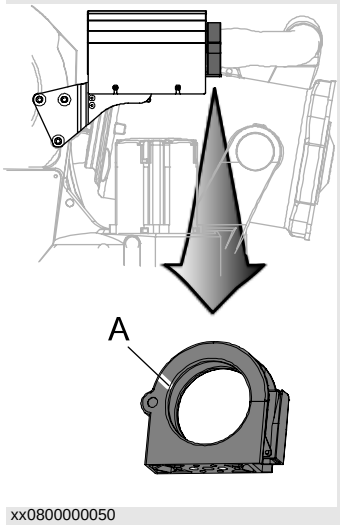
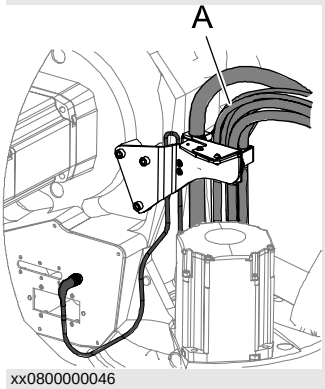
	Action	Note
7.	Remove the *cover* on the *shelf* by removing its *attachment screws*.	 xx0800000049 Parts: • A: Cover • B: Shelf • C: Attachment screws M6x16 quality 8.8-A2F (4 pcs)
8.	Remove the *bracket* on the cable harness from the *shelf* by removing its *attachment screws*.	 xx0800000047 Parts: • A: Cable bracket (part of cable harness) • B: Shelf • C: Attachment screws M6x16 quality 8.8-A2F (2 pcs)

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4.3.3. Replacement of cable harness, Cleanroom

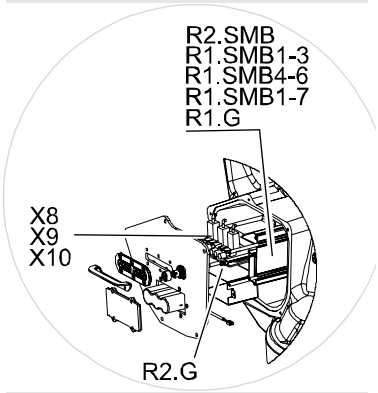
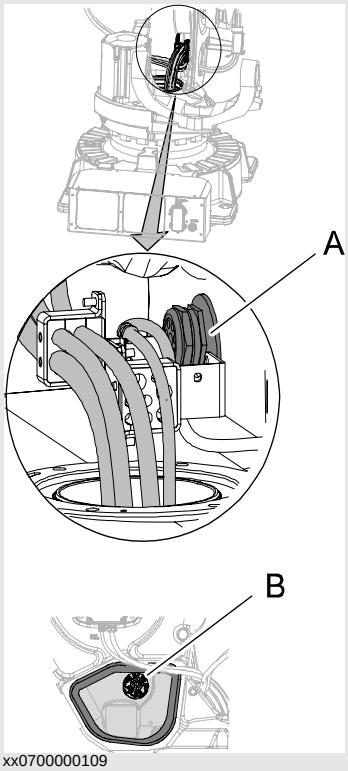
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	Action	Note
9.	Open the *gripping clamp* and remove the cable harness from the shelf.	 xx0800000050 Parts: • A: Gripping clamp
10.	Pull the *cable harness* and connectors carefully up through the cable guide in the center of the frame.	 xx0800000046 Parts: • A: Cable harness
11.	Open the SMB cover by removing its attachment screws. The cable between the battery and the SMB unit may stay connected, in order to avoid an update of the revolution counter. **NOTE!** Be careful not to let the weight of the cover strain the cable! **NOTE!** In order to remove the SMB cover completely, the connector R1.G must be disconnected. This causes a necessary updating of the revolution counter!	

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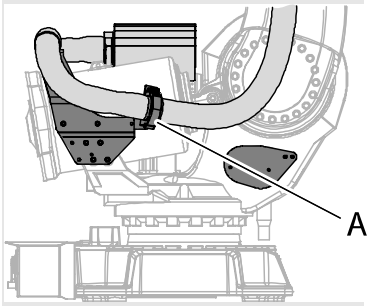
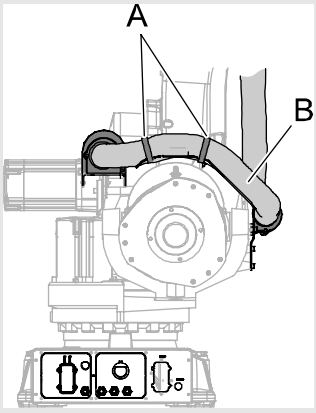
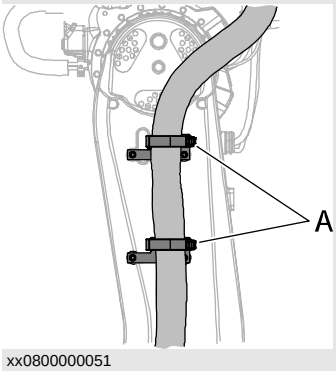
	Action	Note
12.	Disconnect connectors: • R2.SMB, R1.SMB1-3, R1.SMB4-4 to the SMB unit • X8, X9, X10 to the brake release unit	 xx0700000104
13.	Remove the *cable gland* by removing its *attachment screws* from inside the SMB recess.	 xx0700000109 Parts: • A: Cable gland • B: Attachment screws, (inside SMB recess), 4 pcs

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4.3.3. Replacement of cable harness, Cleanroom

Continued

	Action	Note
14.	Open the *gripping clamp* on the lower bracket and remove the cable harness.	 xx0800000053 Parts: • A: Gripping clamp
15.	Remove the *velcro straps* on the side bracket, balancing device.	 xx0800000052 Parts: • A: Velcro starps • B: Cable harness
16.	Open the *gripping clamp* on the lower arm and remove the cable harness.	 xx0800000051 Parts: • A: Gripping clamps
17.	Continue removal of the upper end of the cable harness.	

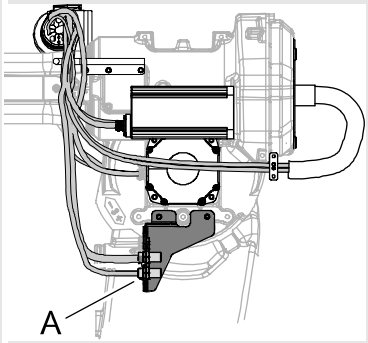
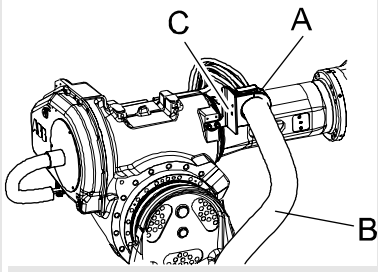
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Removal cable harness - upper end

The procedure below details how to remove the upper end of the cable harness, Cleanroom.

	Action	Note
1.	Remove the *cover* at the back of the upper arm tube by removing its attachment screws.	Shown in the figure *Location of cable harness, Cleanroom on page 207*.
2.	Remove the *cable harness* from motor axis 5 and motor axis 6, as well as from the wrist. This procedure is the same as for the standard cable harness of the robot.	Detailed in section *Removal, cable harness - upper arm on page 195*.
3.	Remove the *cable clamp* on the armhouse by removing its attachment screws.	Shown in the figure *Location of cable harness, Cleanroom on page 207*.
4.	Disconnect all connectors at *motor axis 3* and motor axis 4.	Shown in the figure *Location of cable harness, Cleanroom on page 207*.
5.	Carefully pull out the cable harness from the upper arm tube.	
6.	Disconnect all *connectors* at the connection plate axis 3.	 xx0800000055 Parts: • A: Connectors (at connection plate axis 3)
7.	Open the the *gripping clamp* on the *bracket for cable clamp*.	 xx0800000056 Parts: • A: Gripping clamp • B: Cable harness • C: Bracket for cable clamp
8.	Remove the cable harness from the robot.	

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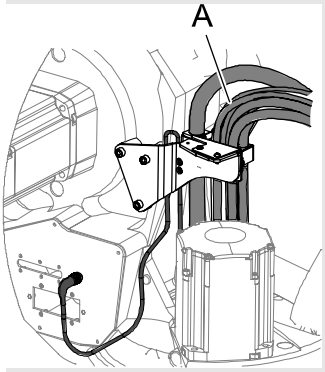
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4.3.3. Replacement of cable harness, Cleanroom

Continued

Refitting cable harness - lower end

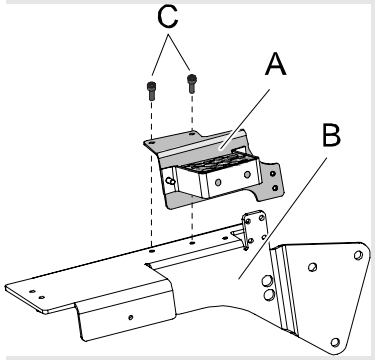
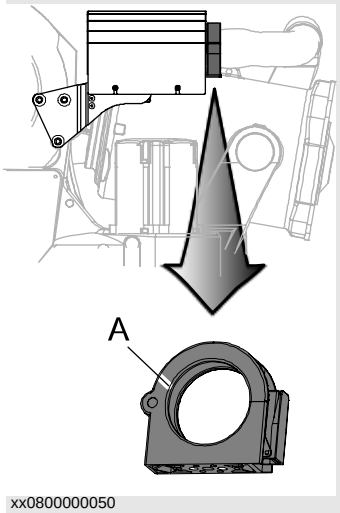
The procedure below details how to refit the lower end of the cable harness, Cleanroom.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	**CAUTION!** The cable package is sensitive to mechanical damage. They must be handled with care, especially the connectors, in order to avoid damaging them.	
3.	Push the *cable harness* and connectors carefully down through the cable guide in the center of the frame. Make sure that the cables are not twisted with each other!	 xx0800000046 Parts: • A: Cable harness
4.	Reconnect the earth cable.	Shown in the figure *Location of cable harness, Cleanroom on page 207*.
5.	Reconnect the *connectors* R1.MP and R1.SMB *at base*.	Shown in the figure *Location of cable harness, Cleanroom on page 207*.
6.	Refit the *rear cover plate* with its attachment screws.	Shown in the figure *Location of cable harness, Cleanroom on page 207*.

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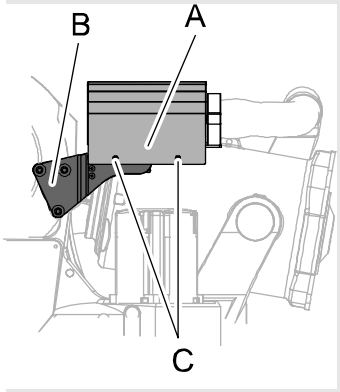
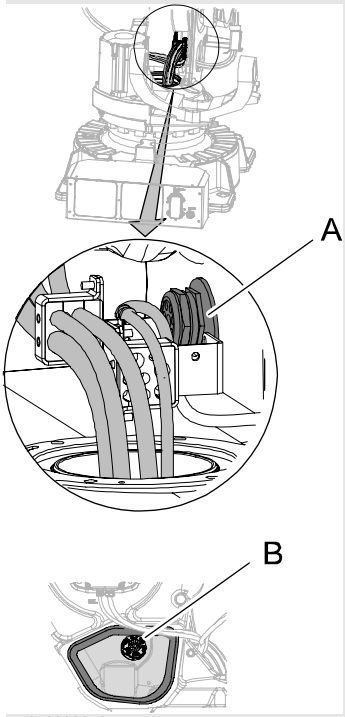
	Action	Note
7.	Fit the *bracket* on the cable package to the *shelf* with its *attachment screws*.	 xx0800000047 Parts: • A: Cable bracket (part of cable harness) • B: Shelf • C: Attachment screws M6x16 quality 8.8-A2F (2 pcs)
8.	Secure the cable harness to the *gripping clamp* on the shelf.	 xx0800000050 Parts: • A: Gripping clamp
9.	Reconnect all connectors at *motor axis 1* and *motor axis 2*.	Shown in the figure *Location of cable harness, Cleanroom on page 207*.

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4.3.3. Replacement of cable harness, Cleanroom

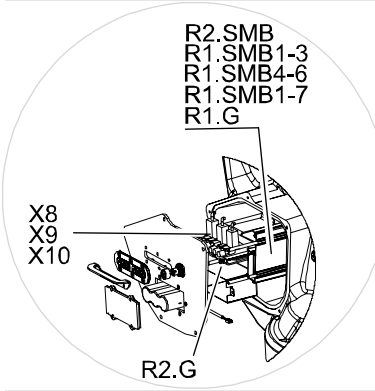
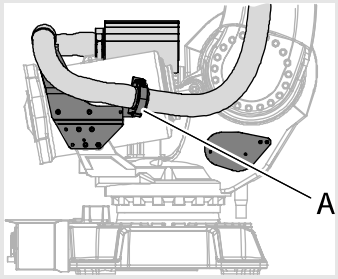
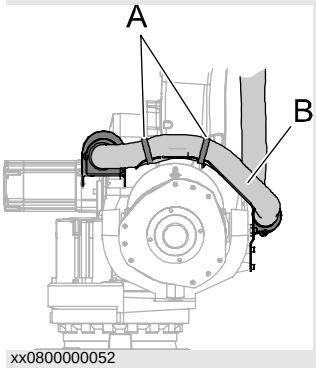
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	Action	Note
10.	Refit the *cover* on the *shelf* with its *attachment screws*.	 xx0800000049 Parts: • A: Cover • B: Shelf • C: Attachment screws M6x16 quality 8.8-A2F (4 pcs)
11.	Secure the *cable gland* with its *attachment screws* from inside the *SMB recess*.	 xx0700000104 Parts: • A: Cable gland • B: Attachment screws (inside SMB recess), 4 pcs

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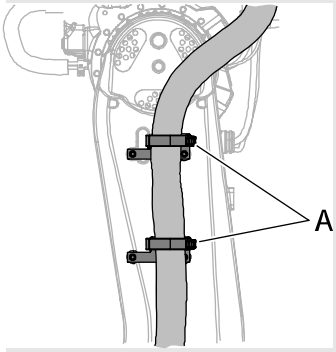
	Action	Note
12.	Reconnect connectors: • R2.SMB, R1.SMB1-3, R1.SMB4-6 to the SMB unit • X8, X9, X10 to the brake release unit • R1.G battery cable (if it has been reconnected)	 xx0700000104
13.	Secure the SMB cover with its attachment screws.	
14.	**WARNING!** Before continuing any service work, please observe the safety information in section *WARNING - The brake release buttons may be jammed after service work on page 34*!	
15.	Secure the cable harness to the *gripping clamp* on the lower bracket.	 xx0800000053 Parts: • A: Gripping clamp
16.	Secure the *cable harness* with the *velcro straps* to the side bracket balancing cylinder.	 xx0800000052 Parts: • A: Velcro straps • B: Cable harness

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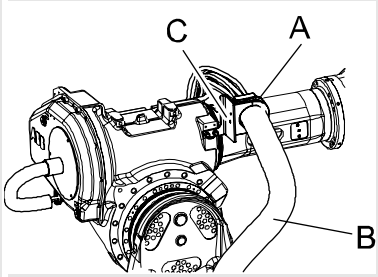
4.3.3. Replacement of cable harness, Cleanroom

Continued

	Action	Note
17.	Secure the cable harness to the *gripping clamps* on the lower arm.	 xx0800000051 Parts: • A: Gripping clamps
18.	Continue refitting of the upper end of the cable harness.	

Refitting cable harness - upper end

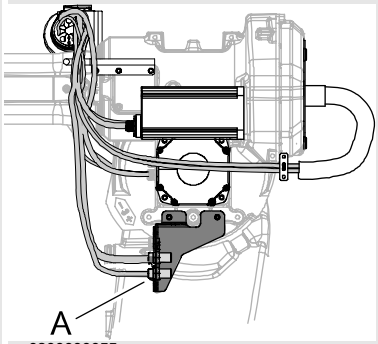
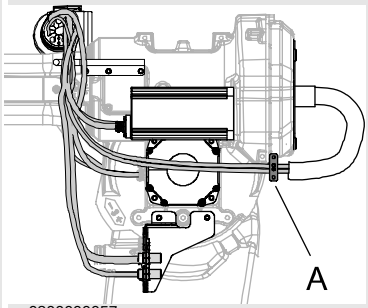
The procedure below details how to refit the upper end of the cable harness, Cleanroom.

	Action	Note
1.	Start refitting of the cable harness by refitting the lower end.	Detailed in section *Refitting cable harness - lower end on page 214* above.
2.	Secure the *cable harness* to the *gripping clamp* on the *bracket for cable clamp*.	 xx0800000056 Parts: • A: Gripping clamp • B: Cable harness • C: Bracket for cable clamp
3.	Place the cable harness in the *cable guide* on the upper armhouse.	Shown in the figure *Location of cable harness, Cleanroom on page 207*.

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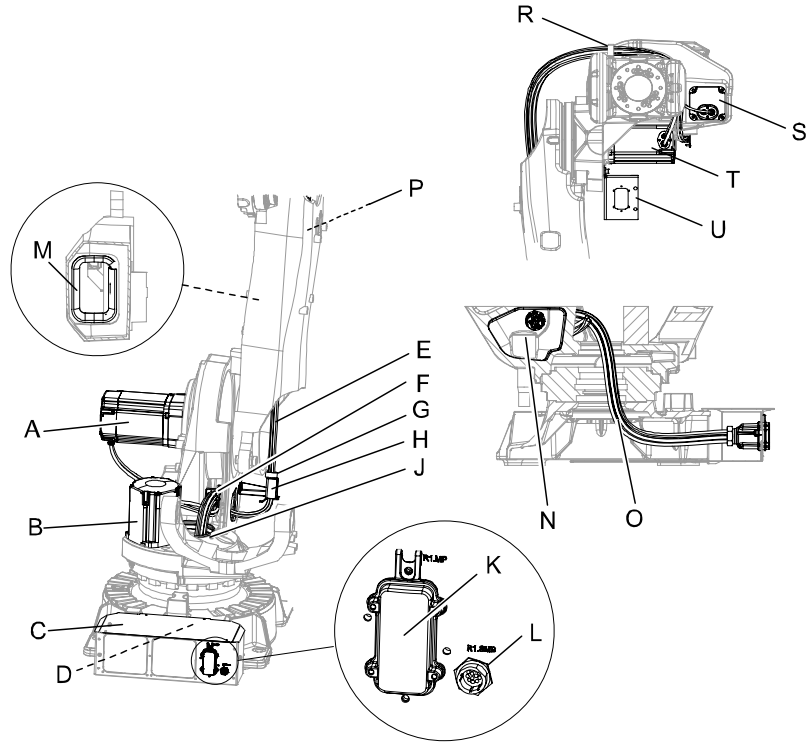
	Action	Note
4.	Reconnect all *connectors* on the connection plate axis 3.	 xx0800000055 Parts: • A: Connectors (at connection plate axis 3)
5.	Reconnect all connectors at *motor axis 3* and *motor axis 4*.	Shown in the figure *Location of cable harness, Cleanroom on page 207*.
6.	Fit the *metal clamp* to the armhouse with its attachment screws.	 xx0800000057 Parts: • A: Metal clamp
7.	Carefully insert the cable harness from the rear, into the upper arm tube.	
8.	Continue refitting the *cable harness* to motor axis 5 and motor axis 6 as well as to the wrist. This procedure is the same as for the standard cable harness of the robot.	Detailed in section *Refitting, cable harness - upper arm on page 202*.
9.	Fit the *cover* at the back of the upper arm tube with its attachment screws.	Shown in the figure *Location of cable harness, Cleanroom on page 207*.
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 33*.	

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4.3.4. Replacement of cable harness, axes 1-4- IRB 6640ID

Location of cable harness

The cable harness for axes 1-4 is run throughout the base, frame and lower arm as shown in the figure below.



xx0700000470

A	Connectors at motor axis 2 (R2.FB2, R2.MP2)
B	Connectors at motor axis 1(R2.FB1, R2.MP1)
C	Rear cover plate
D	Earth (attachment point is placed under the cover plate)
E	Cable harness
F	Cable holder
G	Velcro strap
H	Guide plate axis 2
J	Cable guide
K	Connector R1.MP
L	Connector R1.SMB
M	Cable protector (placed inside the lower arm)
N	Position for SMB and brake release units
O	Cable harness (cut away view)
P	Velcro strap (inside lower arm)
R	Cable gland (armhouse)
S	Connectors at motor axis 4 (R2.FB4, R2.MP4)
T	Connectors at motor axis 3 (R2.FB3, R2.MP3)
U	Cable division point

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Continued

Required equipment

Equipment, etc.	Spare part no.	Art. no.	Note
Cable harness axes 1-4 IRB 6640ID - 200/2.55	3HAC025503-001		Includes a cable protection that must be fitted to the lower arm, and a velcro strap for the harness going up inside the lower arm!
Cable harness axes 1-4 IRB 6640ID - 170/2.75	3HAC025504-001		Includes a cable protection that must be fitted to the lower arm, and a velcro strap for the harness going up inside the lower arm!
Locking liquid			Loctite 638 Used to secure the attachment screws for the attachment plate inside the frame.
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.
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*.

Removal, cable harness, axes 1-4

The procedure below details how to remove the cable harness, axes 1-4.

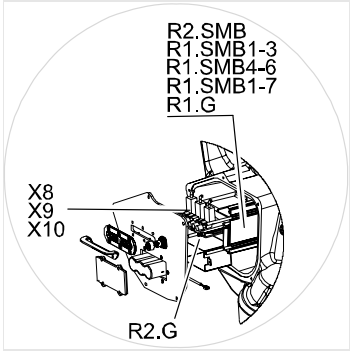
	Action	Note
1.	In order to facilitate refitting of cable harness, run the robot to the specified position: • Axis 1: 0 ° • Axis 2: 0 ° • Axis 3: 0 ° • Axis 4: 0 ° • Axis 5: +90 ° • Axis 6: no significance	Axes 2 and 3 may be tilted slightly to improve access.
2.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Remove the *rear cover plate* from the robot by removing its attachment screws.	Shown in the figure *Location of cable harness on page 220*.

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4.3.4. Replacement of cable harness, axes 1-4- IRB 6640ID

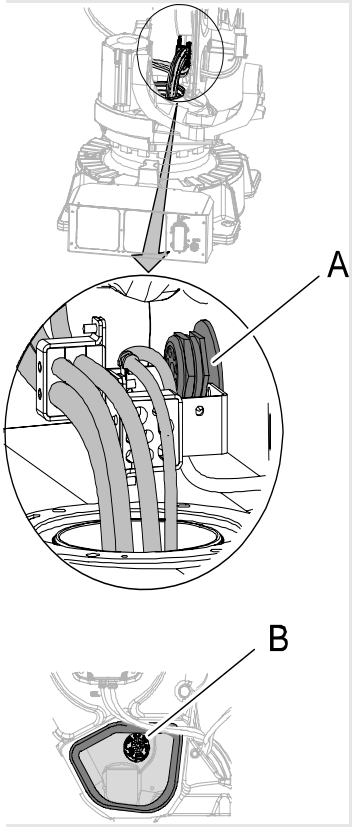
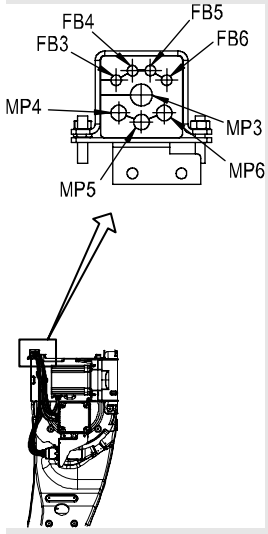
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	Action	Note
4.	Disconnect the *earth cable*.	Attachment point is shown in the figure *Location of cable harness on page 220*!
5.	Disconnect connectors *R1.MP and R1.SMB*.	Attachment points are shown in the figure *Location of cable harness on page 220*.
6.	Pull the cable and connectors up through the cable guide in the center of the frame.	
7.	Disconnect all connectors at motors 1 and 2.	Specified and shown in the figure *Location of cable harness on page 220*!
8.	Open the SMB cover carefully. The cable between the battery and the SMB-unit may stay connected, in order to avoid an update of the revolution counter. Be careful not to let the weight of the cover strain the cable! In order to remove the cover completely, the connector R1.G must be disconnected! This causes a necessary updating of the revolution counter!	
9.	Disconnect connectors R2.SMB, R1.SMB1-3, R1.SMB4-6 from the SMB unit. Disconnect X8, X9 and X10 from the brake release unit.	 0700000104

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Continued

	Action	Note
10.	Remove: • the cable gland by removing the four attachment screws from inside the SMB recess.	 xx0700000109 • A: Cable gland • B: Attachment screws (inside SMB recess)
11.	Remove the cable gland securing the cables inside the lower arm.	
12.	Remove the cable gland securing the cables to the arm house.	 xx0100000143.wmf
13.	Remove the *velcro strap* from the harness at the cable fixing bracket at the arm house.	Shown in the figure *Location of cable harness on page 220*.

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4.3.4. Replacement of cable harness, axes 1-4- IRB 6640ID

Continued

	Action	Note
14.	Disconnect *connector R2.M5/6* at the cable division point.	Shown in the figure *Location of cable harness on page 220*!
15.	Disconnect all connectors at motor 3 and motor 4.	Specified and shown in the figure *Location of cable harness on page 220*!
16.	Gently pull the cable harness out.	

Refitting, cable harness, axes 1-4

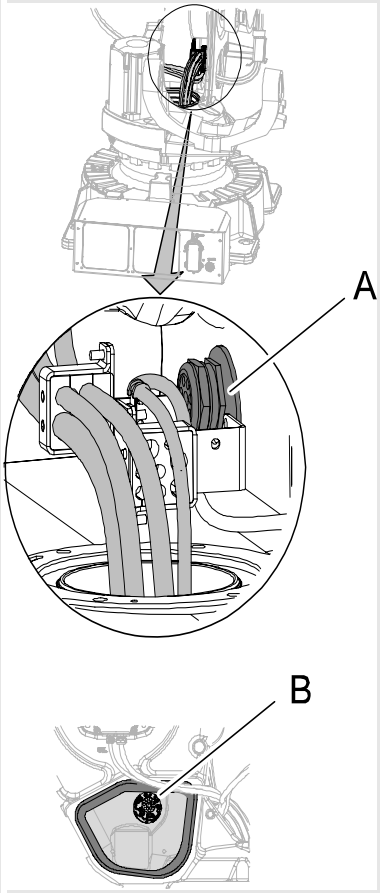
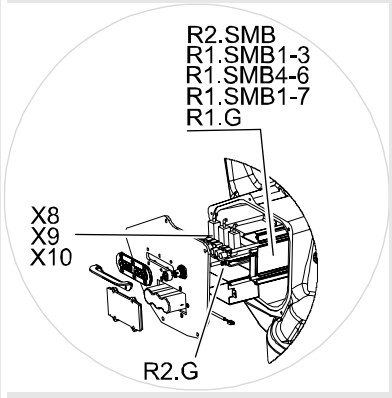
The procedure below details how to refit the cable harness, axes 1-4.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	In order to facilitate refitting of cable harness, move the robot to the specified position: • Axis 1: 0 degrees • Axis 2: 0 degrees • Axis 3: 0 degrees • Axis 4: 0 degrees • Axis 5: +90 degrees • Axis 6: no significance	Axes 2 and 3 may be tilted slightly to improve access.
3.	Pull the cable and connectors down through the cable guide in the center of the frame.	Make sure the cables are not twisted with each other or with eventual customer harnesses! Make a note of the correct positions of the connectors!
4.	Reconnect connectors *R1.MP and R1.SMB* at the rear cover plate.	Make a note of the correct positions of the connectors! Attachment point is shown in the figure *Location of cable harness on page 220*.
5.	Reconnect the earth cable.	Attachment point is shown in the figure *Location of cable harness on page 220*!
6.	Refit the *rear cover plate* to the robot with its attachment screws.	Shown in the figure *Location of cable harness on page 220*.
7.	Reconnect all connectors at motors 1 and 2.	Specified and shown in the figure *Location of cable harness on page 220*!

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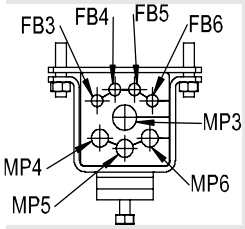
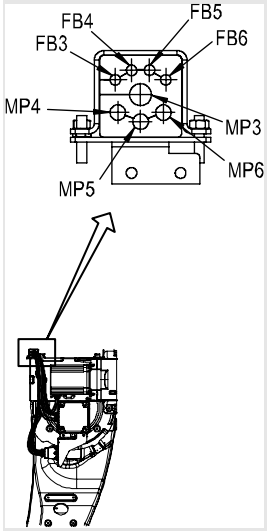
	Action	Note
8.	Secure the *cable gland* with four *attachment screws* from inside the SMB recess.	 xx0700000109 • A: Cable gland • B: Attachment screws, inside SMB recess
9.	Reconnect connectors R2.SMB, R1.SMB1-3, R1.SMB4-6 to the SMB unit. Reconnect X8, X9 and X10 to the brake release unit. Reconnect R1.G if it has been disconnected.	 xx0700000104
10.	Secure the SMB cover with its attachment screws.	

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4.3.4. Replacement of cable harness, axes 1-4- IRB 6640ID

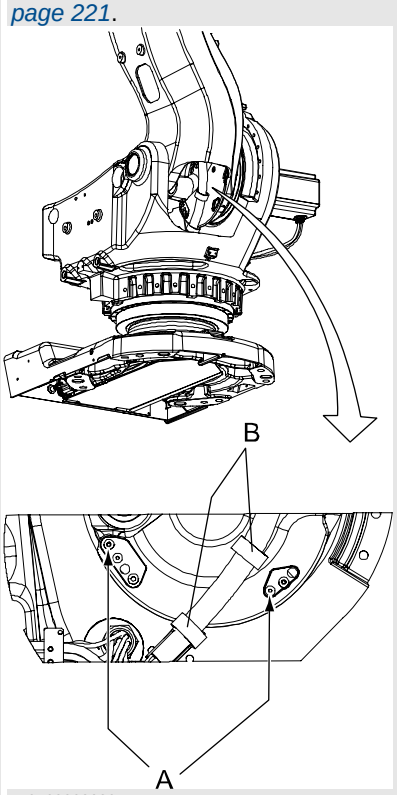
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	Action	Note
11.	**WARNING!** Before continuing any service work, please observe the safety information in section *WARNING - The brake release buttons may be jammed after service work on page 34*!	
12.	Pull the cable harness through the lower arm.	
13.	Refit the cable gland securing the cables inside the lower arm.	 xx0100000142
14.	Refit the cable gland securing the cables to the arm house. Make sure not to twist the harness!	 xx0100000143
15.	Reconnect all connectors at motor 3 and motor 4.	Specified and shown in the figure *Location of cable harness on page 220*!
16.	Reconnect the *connector R2.M5/6* gently at the cable division point. Be careful not to bend the attachment plate when fastening the screws!	Shown in the figure *Location of cable harness on page 220*! M6, 2 pcs.
17.	Secure the cable harness to the upper arm house by refitting the *velcro strap* to the cable bracket at the upper arm house.	Shown in the figure *Location of cable harness on page 220*!

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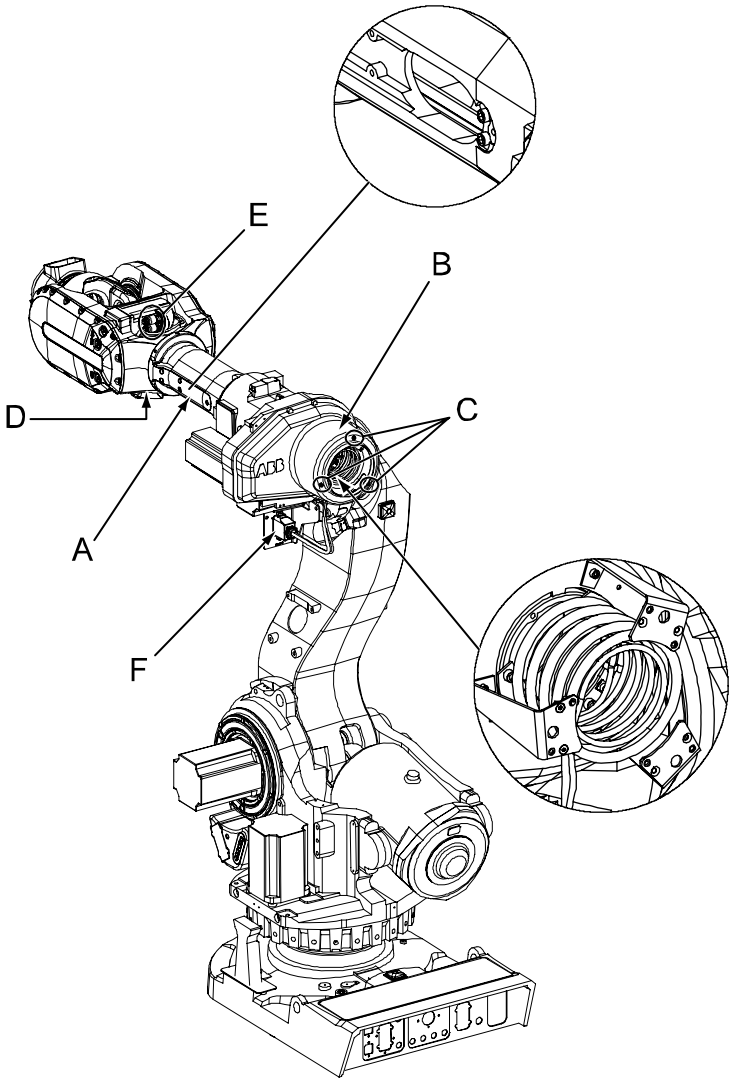
	Action	Note
18.	Fit a cable protection to the lower arm, if not already mounted, with two securing screws (A), M6x16. Secure the cable harness with two velcro straps (B), with a distance of approximately 180 mm. Fix the strap by wrapping it two turns around the largest cable before wrapping around the complete harness.	Both the protection and the strap are included in the spare part no., specified in *Required equipment on page 221*.  xx0500002320
19.	Refit the cable harness to the *guide plate axis 2*.	Shown in the figure *Location of cable harness on page 220*.
20.	Refit the *velcro strap* at the guide plate axis 2.	Shown in the figure *Location of cable harness on page 220*.
21.	If the connection between the SMB battery and the SMB unit has been broken, the revolution counters must now be updated!	Detailed in the Calibration chapter - section *Updating revolution counters on page 378*.
22.	**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 33*.	

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4.3.5. Replacement of cable harness, axes 5-6 - IRB 6640ID

Location of cable harness, axes 5-6

The cable harness of axes 5-6 is run inside the upper arm, as shown in the figure below.



xx0500001896

A	Cover, upper arm tube
B	Hood, upper arm housing
C	Attachment screws and washers (3 pcs), hood, upper arm housing
D	Connectors at motor axis 5; R3.FB5 and R3.MP5
E	Connectors at motor axis 6; R3.FB6 and R3.MP6
F	Connector at cable harness division point; R2.M5/6

Required equipment

Equipment	Spare part no.	Art. no.	Note
Cable harness axes 5-6	3HAC024815-001		
Cable grease		3HAC 14807-1	Optitemp RB 1

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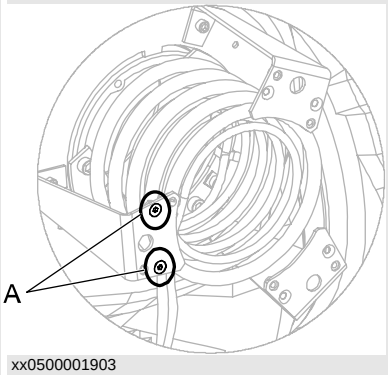
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Equipment	Spare part no.	Art. no.	Note
Standard toolkit			The content is defined in section *Standard toolkit on page 394*.
Product manual - SpotPack/DressPack			Art. no. is specified in section *References*.

Removal, cable harness axes 5-6

The procedure below details how to remove the cable harness from the upper arm.

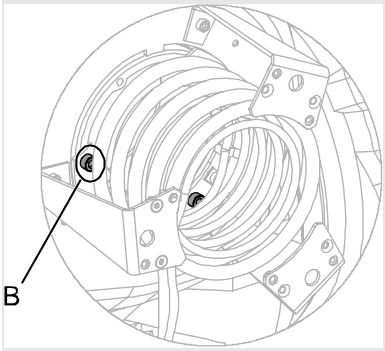
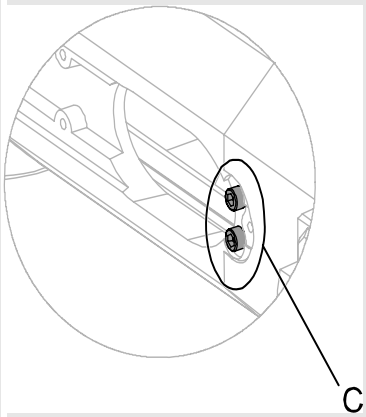
	Action	Note
1.	Run the robot to its calibration position.	
2.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Remove the process cabling from the upper arm, if any.	How to remove the DressPack harness from the upper arm and wrist unit is detailed in the *Product manual - SpotPack/DressPack*.
4.	Remove the *cover* from the upper arm tube and the *hood* from the upper arm housing.	Shown in the figure *Location of cable harness, axes 5-6 on page 228*.
5.	Disconnect all the connectors at the axis 5 and 6 motors, and the connector at the cable harness division point.	The connectors are specified and shown in the figure *Location of cable harness, axes 5-6 on page 228*.
6.	Remove the two *cable clamps* (A) from the bracket at the back of the upper arm housing.	 xx0500001903

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4.3.5. Replacement of cable harness, axes 5-6 - IRB 6640ID

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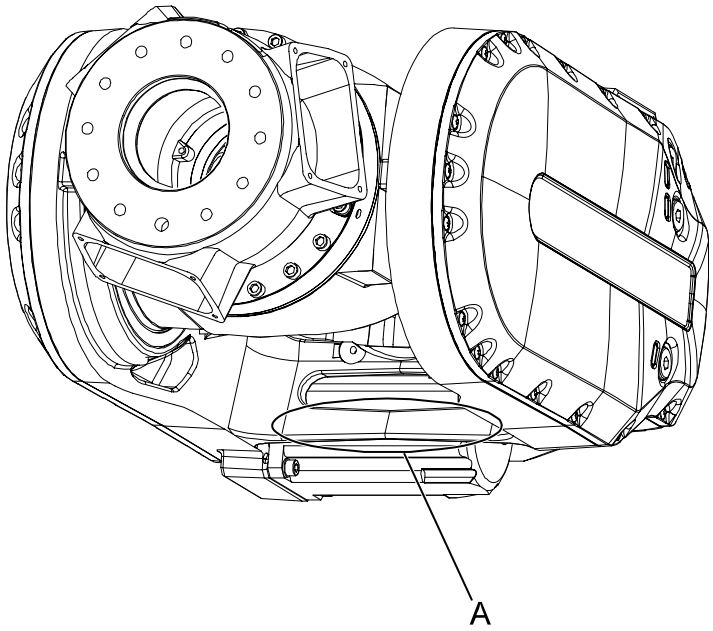
	Action	Note
7.	Remove the cable bracket from the upper arm housing by removing the three *attachment screws* (B). Leave the cabling fitted to the bracket.	 xx0500001905
8.	Loosen the *cable clamp* (C) inside of the upper arm tube.	 xx0500001904
9.	Remove all velcro straps and cable ties holding the cabling inside the wrist unit.	
10.	Pull out the cabling from the wrist unit and the upper arm tube. Be careful not to damage the connectors!	

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Cable layout, wrist unit

The figure below shows how to run and attach the cabling inside the wrist unit.



xx0500002014

A	Location inside the wrist unit where to strap the cabling, next to the axis 5 motor.

Refitting, cable harness axes 5-6

The procedure below details how to refit the cable harness to the upper arm.

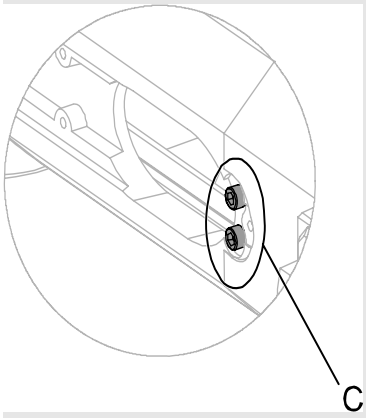
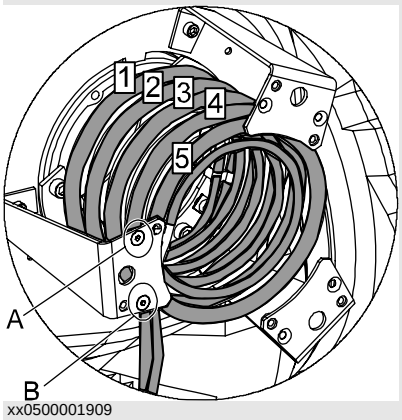
	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Make sure all the cable clamps and brackets are attached properly to the new *cable harness*.	Spare part no. is specified in *Required equipment on page 228*.
3.	Insert the cable harness through the upper arm tube and pull out the motor connectors at the wrist unit.	

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4.3.5. Replacement of cable harness, axes 5-6 - IRB 6640ID

Continued

	Action	Note
4.	Secure the *cable clamp* (C) inside the upper arm tube.	 xx0500001904
5.	Place the cabling inside the wrist unit according to the cable layout shown in the figure *Cable layout, wrist unit on page 231* and fasten it with velcro straps. Reconnect the *connectors* to the axis 5 and 6 motors.	Shown in the figure *Location of cable harness, axes 5-6 on page 228*.
6.	Wind the cabling in a spiral with four free turns. Secure the fifth turn with two clamps (A and B) to the bracket. **NOTE!** The cable clamps should be positioned approximately 1 m from the connector R2.M5/6. **NOTE!** Adjust the clamps to make the bend of the fifth turn equal with the others, creating a symmetrical spiral.	 xx0500001909 • A: Attachment point for the power cable, R3.MP. • B: Attachment point for the signal cable, R3.FB.
7.	Grease the cabling with *cable grease*.	Art. no. is specified in *Required equipment on page 228*.
8.	Refit the *cover* to the upper arm tube and the *hood* to the upper arm housing.	Shown in the figure *Location of cable harness, axes 5-6 on page 228*.
9.	Reconnect the *connector R2.M5/6* at the cable harness division point.	Shown in the figure *Location of cable harness, axes 5-6 on page 228* .
10.	Update the revolution counters!	Detailed in section *Updating revolution counters on page 378*.

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	Action	Note
11.	 **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 33*.	

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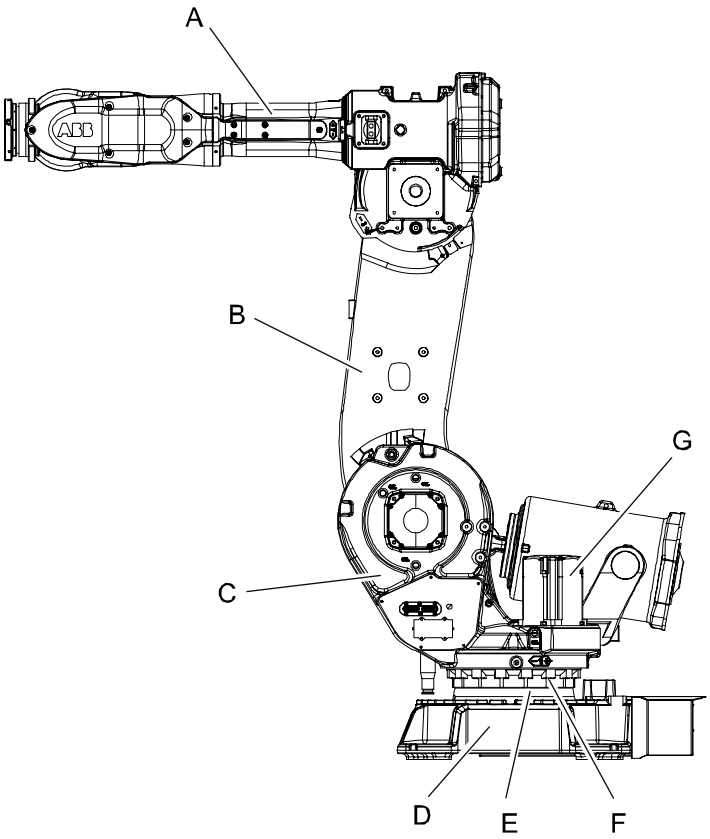
4.3.6. Replacement of complete arm system

Location of arm system

The complete arm system is defined as the complete robot except for the base and gearbox axis 1. This is shown in the figure below.

A more detailed view of the component and its position may be found in chapter *Upper arm including wrist unit, motors ax. 3- 6 (IRB 6640 and IRB 6640ID) on page 409* .

Detailed in section *Lower arm to upper arm on page 407*.



xx0700000352

A	Upper arm
B	Lower arm
C	Frame
D	Base
E	Gearbox, axis 1
F	Attachment screws base M12x80, quality 12.9 Gleitmo (16 pcs)
G	Motor, axis 1

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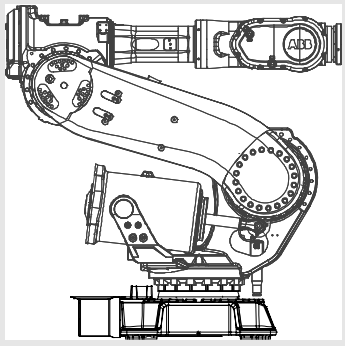
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Required equipment

Equipment, etc.	Art. no.	Note
Guide pins M12 x 130	3HAC022637-001	Used to guide the complete arm system when refitting. Always use the guide pins in pairs! In order to make the refitting easier, it is recommended to use two guide pins of different lengths. Notice that longer guide pins than 140 mm will not be possible to remove from the frame because lack of space after refitting!
Roundslings	-	
Hoisting block	-	Used to adjust the length of the lifting chain.
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
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.

Removal, arm system

The procedure below details how to lift and remove the complete arm system.

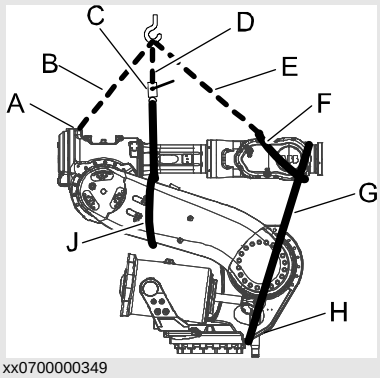
	Action	Note
1.	Make sure the robot is positioned as shown in figure to the right. If it is not, position it that way.	Release the brakes if necessary, as detailed in section *Manually releasing the brakes on page 61*.  xx0700000351
2.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Drain the oil from gearbox axis 1.	Detailed in section *Oil change, gearbox axis 1 on page 154*.

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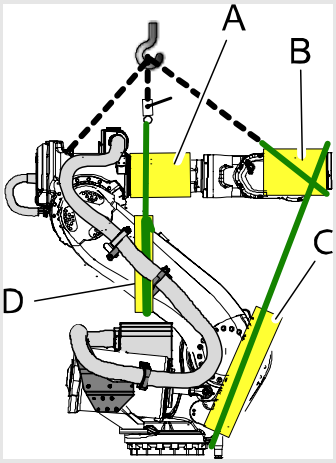
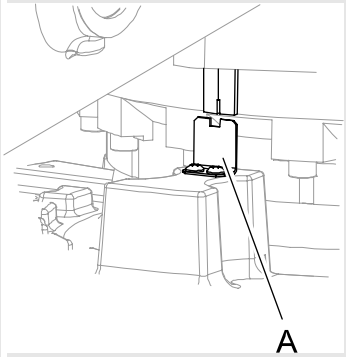
4.3.6. Replacement of complete arm system

Continued

	Action	Note
4.	Loosen the cable connectors from the base and pull up the cabling from the base, through the hole in the center of the frame.	Detailed in section *Replacement of cable harness, axes 1-6 on page 193*. Detailed in section *Replacement of cable harness, Cleanroom on page 207*.
5.	Remove the motor, axis 1.	Detailed in section *Replacement of motor, axis 1 on page 300*.
6.	Run the overhead crane to a position above the robot.	
7.	Fit the *lifting device* and adjust it as detailed in the enclosed *instructions*. Also fit a *hoisting block* to the *roundsling* put around the lower arm. Used to adjust the balance of the arm system in order to lift it completely level.	Art. no. is specified in *Required equipment on page 235*. Make sure the lift is done completely level! How to adjust the lift is described in the enclosed instruction to the lifting device! **Read the instructions before lifting!**  xx0700000349 • A: Lifting eye (on armhouse) • B: Lifting chain • C: Hoisting block • D: Lifting chain • E: Lifting chain • F: Roundsling (put in a loop around the wrist on the inside) • G: Roundsling (used to eliminate any load through the brake on motor axis 3) • H: Position for roundsling G, put behind the mechanical stop pin. • J: Roundsling (put in a loop around the lower arm)

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	Action	Note
8.	**NOTE!** For **Cleanroom** robots apply a protection where the lifting equipment and roundslings will rub against the paint of the robot. In order to prevent from particle emission while lifting, put for example a 20 mm thick *cellular plastic sheet* around the places on the robot where the lifting equipment may rub against the paint. Put the 20 mm cellular plastic sheet as extra protection in the following places: • Around the upper arm • Wrist • Lower arm/Frame	 xx0800000061 Protective cellular plastic sheets at: • A: Upper arm • B: Wrist • C: Lower arm/Frame
9.	Remove the *calibration plate* from the bottom of the frame.	 xx0700000380 Parts: • A: Calibration plate
10.	Unfasten the arm system from the base by unscrewing its 16*attachment screws.*	Shown in the figure *Location of arm system on page 234*.
11.	Fit the two *guide pins* in two opposite screw holes.	Art. no. is specified in section *Required equipment on page 235*.
12.	**CAUTION!** The complete arm system weighs 1250 kg! All lifting equipment used must be sized accordingly!	

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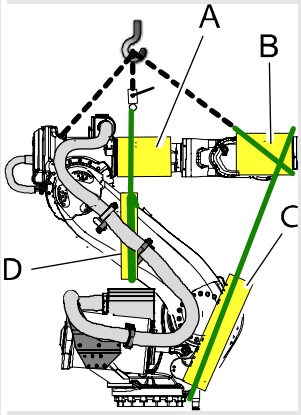
4.3.6. Replacement of complete arm system

Continued

	Action	Note
13.	Lift the arm system carefully and secure it in a safe area. Always move the robot at very low speeds, making sure it does not tip. Continue lifting even if the arm system turns out to be unbalanced despite earlier adjustments! The risk of damaging the interfaces is bigger if the load is lowered unbalanced!	Make sure all hooks and attachments stay in the correct position while lifting the arm system and that the lifting device does not wear against sharp edges.

Refitting, arm system

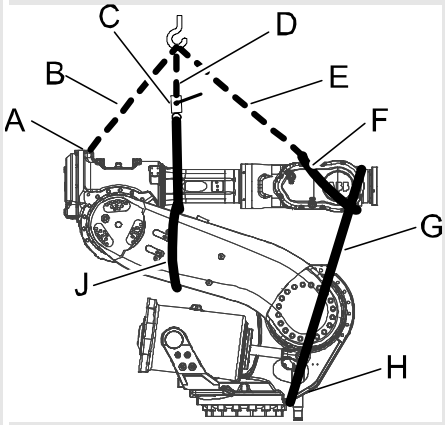
The procedure below details how to lift and refit the complete arm system.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	**NOTE!** For **Cleanroom** robots apply a protection where the lifting equipment and roundslings will rub against the paint of the robot. In order to prevent from particle emission while lifting, put for example a 20 mm thick *cellular plastic sheet* around the places on the robot where the lifting equipment may rub against the paint. Put the 20 mm cellular plastic sheet as extra protection in the following places: • Around the upper arm • Wrist • Lower arm/Frame	 xx0800000061 Protective cellular plastic sheets at: • A: Upper arm • B: Wrist • C: Lower arm/Frame

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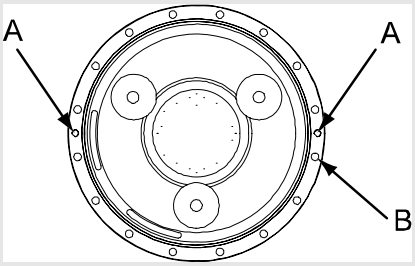
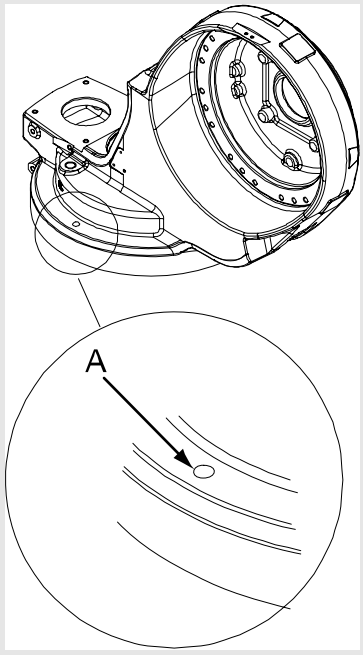
	Action	Note
3.	Fit the lifting device as detailed in the figure to the right. Also fit a *hoisting block* to the *roundsling* put around the lower arm. Used to adjust the balance of the arm system in order to lift it completely level.	Art. no. is specified in *Required equipment on page 235*. Make sure the lift is done completely level! How to adjust the lift is described in the enclosed instruction to the lifting device. **Read the instructions before lifting!** Releasing the brakes are detailed in section *Manually releasing the brakes on page 61*.  xx0700000349 Parts: • A: Lifting eye (on armhouse) • B: Lifting chain • C: Hoisting block • D: Lifting chain • E: Lifting chain • F: Roundsling (put in a loop around the wrist on the inside) • G: Roundsling (used to eliminate any load through the brake on motor axis 3) • H: Position for roundsling G, put behind the mechanical stop pin. • J: Roundsling (put in a loop around the lower arm)
4.	**CAUTION!** The complete arm system weighs 1250 kg! All lifting equipment used must be sized accordingly!	
5.	Lift the complete arm system and move it at very low speed, making sure it does not tip! Make sure the lift is done completely level. Adjust the length of the chains as detailed in enclosed instruction or with a hoisting block.	Make sure all the hooks and attachments stay in the correct position while lifting the robot!

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4.3.6. Replacement of complete arm system

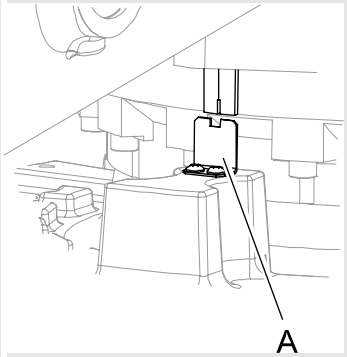
Continued

	Action	Note
6.	Fit the two *guide pins* to the holes in gearbox axis 1, as shown in the figure to the right.	Dimension is specified in *Required equipment on page 235*.  xx0600003095 The figure below shows the gearbox, axis 1. • A : Attachment holes for guide pins, M12 in gearbox axis 1. • B : Hole for attachment screw.
7.	Look through the empty mounting hole of motor 1 to assist in aligning the assembly during refitting of the arm system. Lower the arm system with guidance from the guide pins previously fitted to the gearbox axis 1. Fit the guide pins in the corresponding holes in the frame as shown in the figure to the right. **NOTE!** The refitting must be made completely level! Make sure the lifting device is adjusted prior to refitting of arm system.	This is a complex task to be performed with utmost care in order to avoid injury or damage!  xx0600003093 • A : Holes in frame for guide pins, shown from above.
8.	Refit 14 of the 16 attachment screws before the arm system is completely lowered.	
9.	Remove the guide pins and secure the arm system to the base with its 16*attachment screws and washers.*	Shown in the figure *Location of arm system on page 234*. M12 x 80, 12.9 quality gleitmo. Tightening torque: 105 Nm. Reused screws may be used, providing they are lubricated as detailed in section *Screw joints on page 390* before fitting.

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Continued

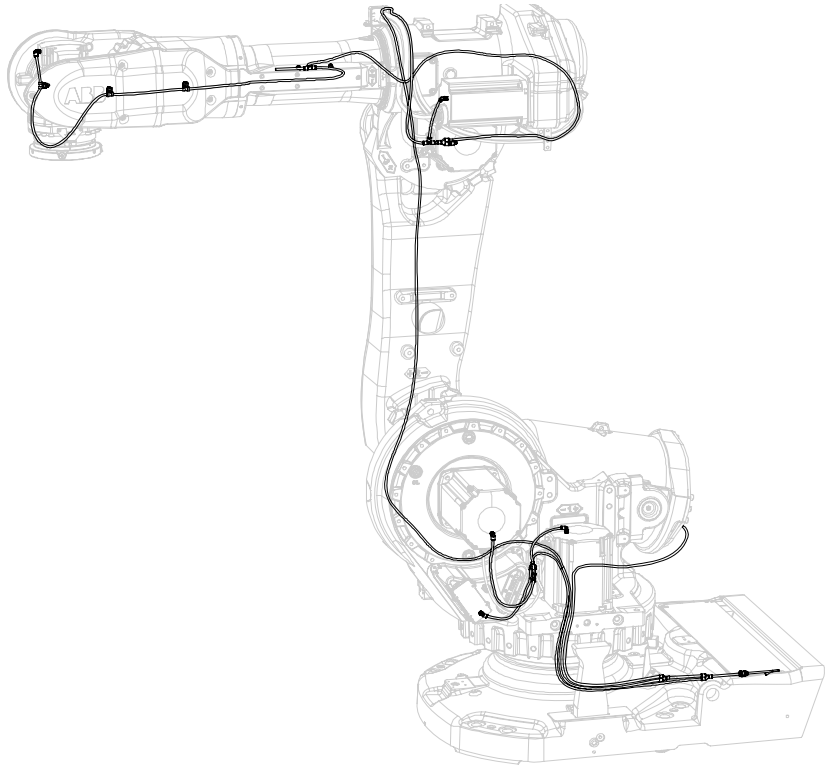
	Action	Note
10.	Refit the *calibration plate* at the bottom of the frame.	 xx0700000380 Parts: • A: Calibration plate
11.	Refit the *motor axis 1*.	Detailed in section *Replacement of motor, axis 1 on page 300*.
12.	Refit the *cabling* in the base.	Detailed in section *Replacement of cable harness, axes 1-6 on page 193*. Detailed in section *Replacement of cable harness, Cleanroom on page 207*.
13.	Perform a *leak-down test* of the gearbox axis 1.	Detailed in section *Performing a leak-down test on page 188*.
14.	Refill the gearbox axis 1 with lubricating oil.	Detailed in section *Oil change, gearbox axis 1 on page 154*.
15.	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*.
16.	**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 33*.	

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4.3.7. Replacement of air nipple and hose (Foundry Prime)

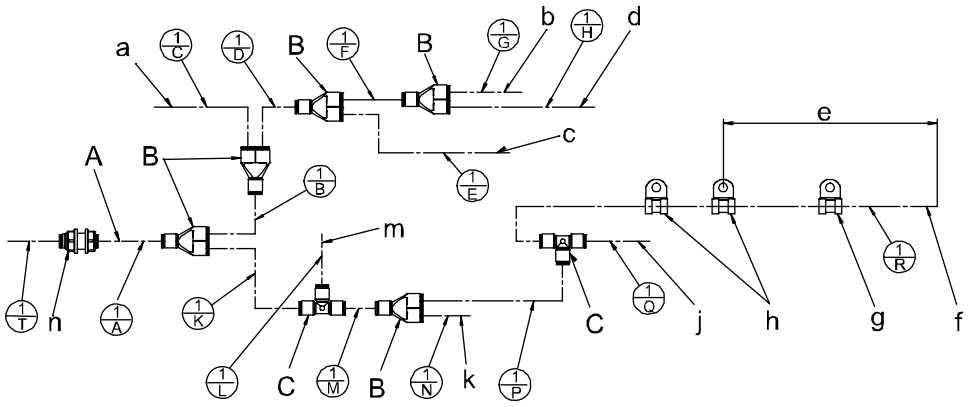
Location

The illustration below shows the routing of the Foundry Prime air hose.



xx0500002176

Hose lengths



xx0700000449

Pos 1A	Hose length 40 mm
Pos 1B	Hose length 40 mm
Pos 1C	Hose length 1520 mm
Pos 1D	Hose length 1090 mm
Pos 1E	Hose length 310 mm
Pos 1F	Hose length 35 mm

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Continued

Pos 1G	Hose length 250 mm
Pos 1H	Hose length 540 mm
Pos 1K	Hose length 4020 mm
Pos 1L	Hose length 195 mm
Pos 1M	Hose length 40 mm
Pos 1N	Hose length 40 mm
Pos 1P	Hose length 1605 mm
Pos 1Q	Hose length 100 mm (for option 2.8 m/185 kg: 350 mm)
Pos 1R	Hose length 1490 mm (for option 2.8 m/185 kg: 1740 mm)
Pos 1S	Hose length 570 mm
Pos 1T	Hose length 100 mm
A	Pneumatic hose
B	Y-plug connector
C	T-plug connector
a	Balancing cylinder, rear end
b	Motor axis 1
c	Battery cover
d	Motor axis 2
e	Length = Pos 1S
f	Motor axis 6
g	Rubber clamp on attachment plate (tilthouse)
h	Rubber clamp on wrist cover
j	Motor axis 5
k	Motor axis 3
m	Motor axis 4
n	Bulkhead plug connector in plate at base

Required equipment

Equipment	Art. no.	Pos. in illustration
Velcro strap	3HAC12625-1	9 (only in illustrations below)
Cable straps	21662055-3	8 (only in illustrations below)
Elbow fitting	3HAC026511-001	6 (only in illustrations below)
Rubber clamp	3HAC026523-001	5
T-plug connector	3HAC026515-001	4
Y-plug connector	3HAC026514-001	3
Bulkhead plug connector	3HAC026513-001	2
Hose	3HAC026526-001	1

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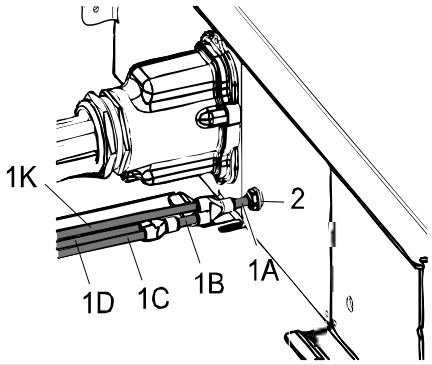
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4.3.7. Replacement of air nipple and hose (Foundry Prime)

Continued

Procedure

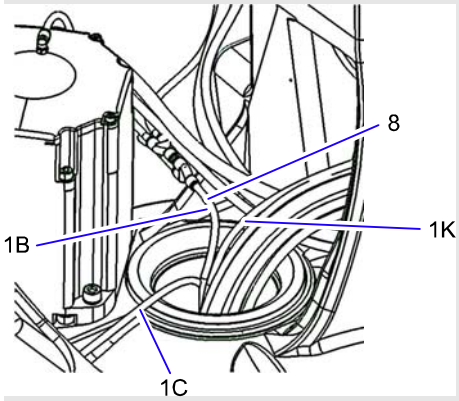
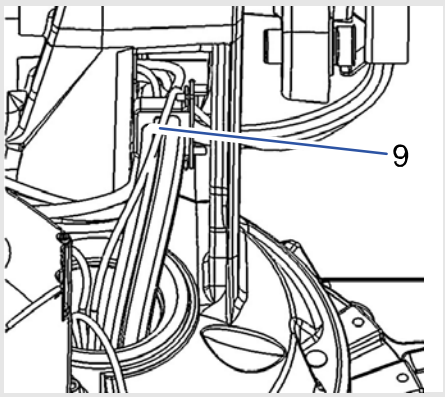
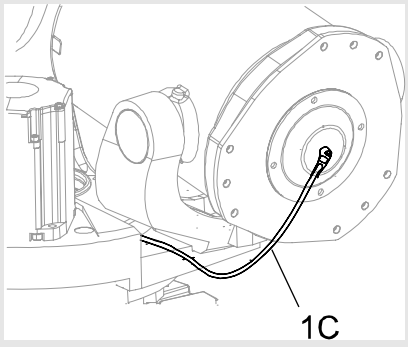
The following procedures details how to replace the Foundry Prime air nipples and hose. The pos. no. in following procedures correspond to the illustration in *Hose lengths on page 242*and the table in *Required equipment on page 243*

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot.	
2.	Locate the damaged hose or air connector, and continue to replace the damaged hose. Route the hose according to the illustrations in the procedure below.	
3.	Connection at base.	 xx0600003042 Items in illustration are detailed in *Required equipment on page 243* and *Hose lengths on page 242*.

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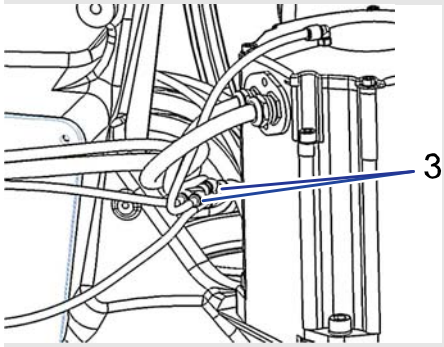
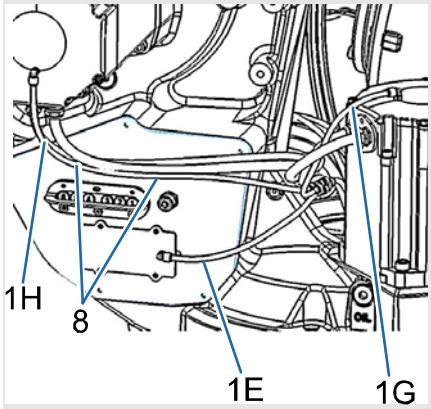
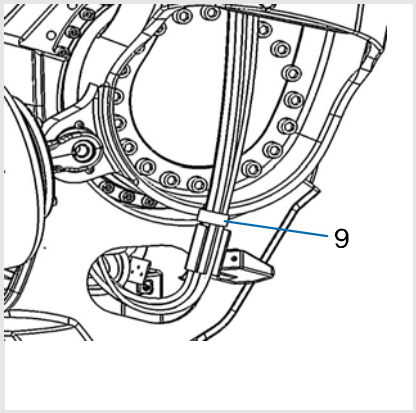
	Action	Note
4.	Axis 1	 xx0700000458 Items in illustration are detailed in *Required equipment on page 243* and *Hose lengths on page 242*.  xx0700000459 Item in illustration is detailed in *Required equipment on page 243*.
5.	Balancing device.	 xx0700000456 Item in illustration is detailed in *Hose lengths on page 242*.

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4.3.7. Replacement of air nipple and hose (Foundry Prime)

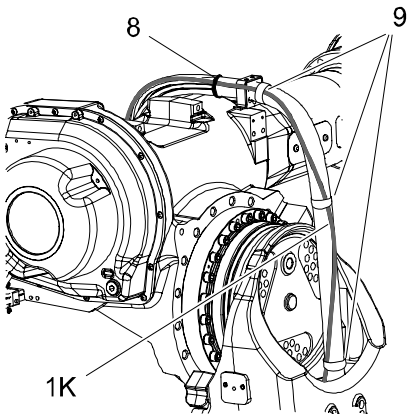
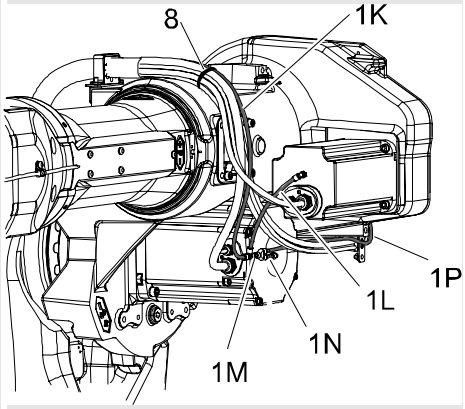
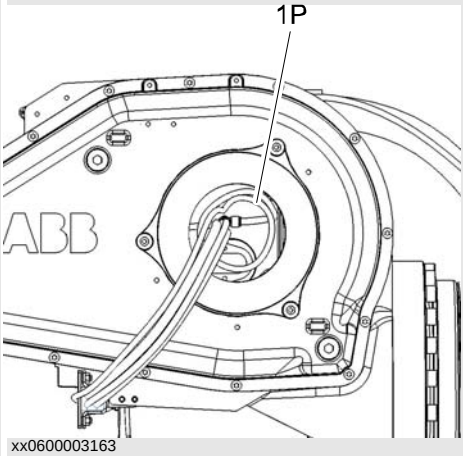
Continued

	Action	Note
6.	Axis 1-2	Items in illustrations are detailed in *Hose lengths on page 242* and *Required equipment on page 243* .  xx0700000460  xx0700000461  xx0700000462 • A: Air hose beneath velcro strap

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Continued

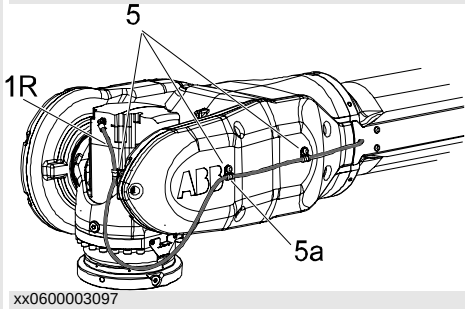
	Action	Note
7.	Upper arm housing.	 xx0600003046  xx0600003047
8.	Tube shaft.	 xx0600003163 • 1P: Lay the hose in a spiral in the tube shaft.

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4.3.7. Replacement of air nipple and hose (Foundry Prime)

Continued

	Action	Note
9.	Wrist. **NOTE!** Make sure the cable length from 5a to the nipple of axis 6 = S, see *Hose lengths on page 242*.	 xx0600003097

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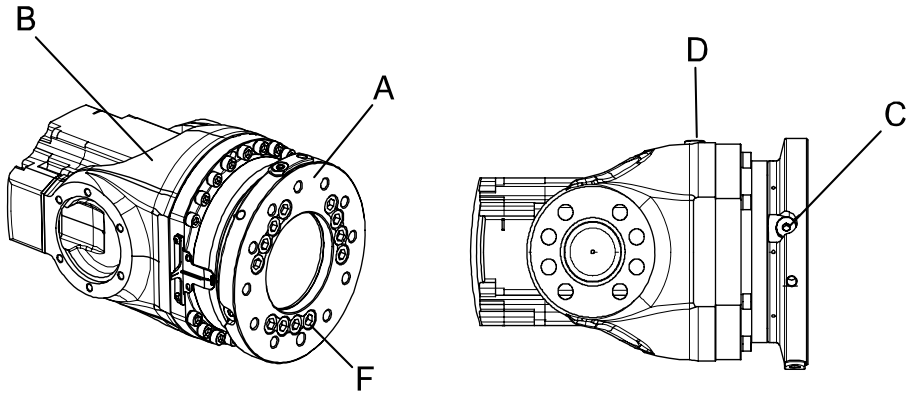
4.4 Upper and lower arm

4.4.1. Replacement of turning disk

Location of turning disk

The turning disk is located in the front of the wrist housing, as shown in the figure below.

A more detailed view of the component and its position may be found in chapter *Upper arm including wrist unit, motors ax. 3- 6 (IRB 6640 and IRB 6640ID) on page 409* .



xx0200000217

A	Turning disk
B	Wrist unit
C	Oil plug, draining
D	Oil plug, filling
F	Attachment screws (12 pcs)

Required equipment

Equipment, etc.	Spare part no.	Art. no.	Note
Turning disk, dia. 200	3HAC13752-1		For IRB 6620 Foundry Plus. O-rings are not included!
O-ring		3HAB3772-64 (1 pc) 3HAB3772-61 (12 pcs)	Must be replaced when replacing the turning disk!
Grease		3HAB3537-1	Used to lubricate the o-rings.
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.
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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4.4.1. Replacement of turning disk

Continued

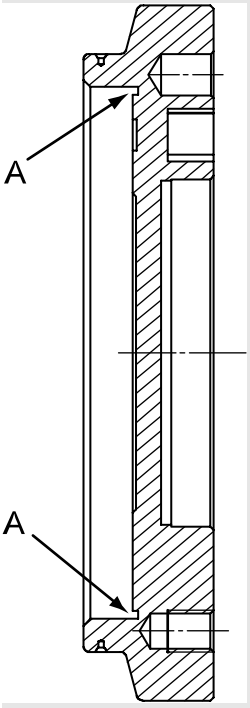
Removal, turning disk

The procedure below details how to remove the turning disk.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Remove any equipment fitted to the turning disk.	
3.	Run the robot to a position where the *oil plug, draining* of axis 6 gearbox faces downwards.	Shown in the figure *Location of turning disk on page 249*.
4.	Drain the oil from gearbox 6.	Detailed in section *Oil change, gearbox axis 6 on page 169*.
5.	Remove the turning disk by unscrewing its *attachment screws*.	Shown in the figure *Location of turning disk on page 249*.

Refitting, turning disk

The procedure below details how to refit the turning disk.

	Action	Note
1.	Lubricate the turning disk *o-ring* with *grease.* Fit the o-ring to the rear of the turning disk. Also fit the 12 o-rings, when refitting the attachment screws.	Art. no. is specified in *Required equipment on page 249*.  xx0200000218 • A: Sealing surface, o-ring

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Continued

	Action	Note
2.	Secure the turning disk with its *attachment screws*.	12 pcs, M12 x 30, 12.9 quality UNBRAKO, tightening torque: 100 Nm. Reused screws may be used, providing they are lubricated as detailed in section *Screw joints on page 390* before fitting.
3.	Perform a *leak-down test* of the gearbox axis 6.	Detailed in section *Performing a leak-down test on page 188*.
4.	Refill the gearbox 6 with oil.	Detailed in section *Oil change, gearbox axis 6 on page 169*.
5.	Refit any equipment removed during disassembly, to the turning disk.	
6.	 **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 33*.	

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4.4.2. Replacement of complete wrist unit

Wrist unit for robot models IRB 6640ID

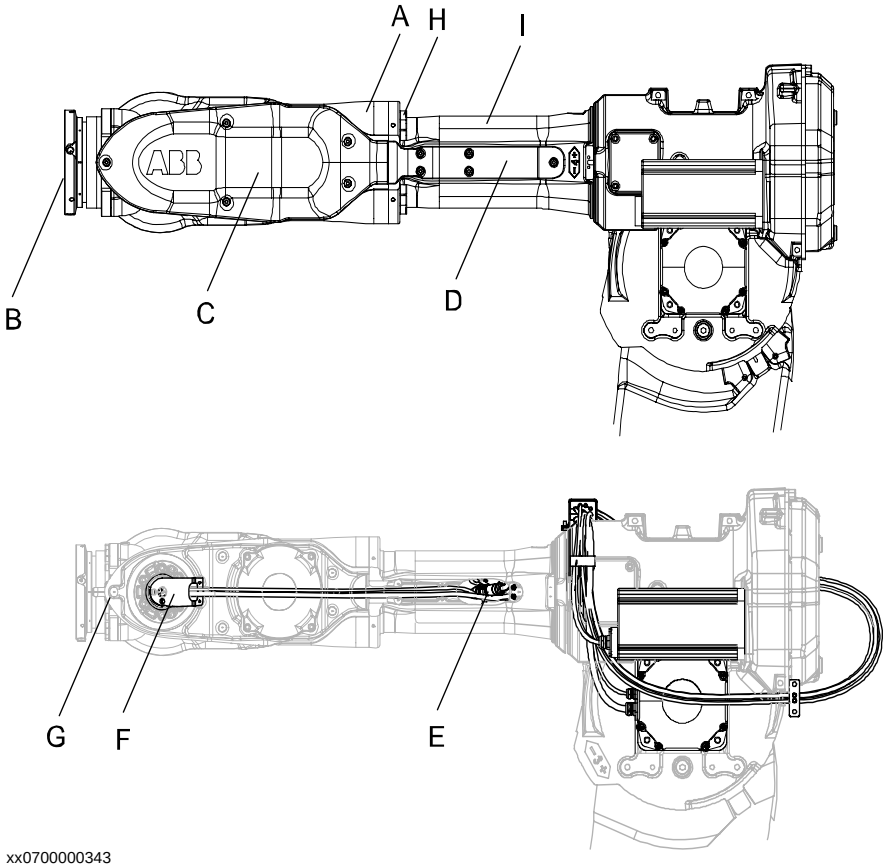
This section is valid for robot models IRB 6640. How to replace the wrist of the models IRB 6640ID is detailed in section *Replacement of complete wrist unit, IRB 6640ID on page 257*.

Location of wrist unit

The wrist unit is located in the frontmost part of the upper arm as shown in the figure below.

A more detailed view of the component and its position may be found in chapter *Upper arm including wrist unit, motors ax. 3- 6 (IRB 6640 and IRB 6640ID) on page 409* .

Upper arm including wrist unit, motors ax. 3- 6 (IRB 6640 and IRB 6640ID) on page 409.



xx0700000343

A	Wrist unit
B	Turning disk
C	Cover, wrist unit
D	Cover, upper arm tube
E	Connectors, upper arm tube, with cable bracket (R3.FB5, R3.MP5)
F	Cable bracket
G	Attachment piont for lifting tool, wrist unit
H	Wrist unit attachment screws and washers
I	Upper arm tube

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Continued

Required equipment

Equipment etc.	Spare part no.	Art. no.	Note
Wrist, type 2	3HAC16626-2		
Turning disk	3HAC13752-1		
Guide pins M12 x 200 Guide pins M12 x 200		3HAC13056-3 3HAC13056-3	Always use guide pins in pairs!
Lifting tool, wrist unit		3HAC13605-1 3HAC13605-1	
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.
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		3HAC025744-001	See chapter *Circuit diagram*.

Removal, wrist unit

The procedure below details how to remove the complete wrist unit.

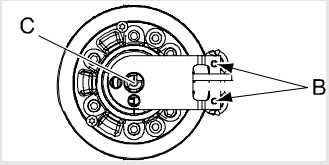
	Action	Note
1.	Remove all equipment fitted to the turning disk.	
2.	Turn axis 4 to a position where the *cover, upper arm tube and wrist unit,* faces upwards. Also turn axis 5 so that the turning disk faces to the side in order to allow access to the motor 6 cover.	Shown in the figure *Location of wrist unit on page 252*.
3.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
4.	Remove the *cover, wrist unit*.	Shown in the figure *Location of wrist unit on page 252*.
5.	Remove the *cover, upper arm tube.*	Shown in the figure *Location of wrist unit on page 252*.
6.	Remove the cover of motor, axis 6 and disconnect all connectors beneath.	

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4.4.2. Replacement of complete wrist unit

Continued

	Action	Note
7.	Loosen the *cable bracket, wrist unit* on top of the wrist by undoing the three attachment screws. Two of the *attachment screws* are visibly located at the rear of the bracket and the third located at the bottom of the cable bracket, in the center.	Shown in the figure *Location of wrist unit on page 252*.  xx0200000254 • B: Attachment screws, rear of cable bracket (2 pcs) • C: Attachment screw, bottom of cable bracket
8.	Pick out the cabling from motor, axis 6 and place it safely on the tube.	
9.	Loosen the *cable bracket* in the upper arm tube by undoing the two screws on top of the tube.	Shown in the figure *Location of wrist unit on page 252*.
10.	Disconnect the *motor axis 5* by disconnecting the two connectors in the upper arm tube (R3.FB5, R3.MP5).	Shown in the figure *Location of wrist unit on page 252*.
11.	Fit the *lifting tool* to the wrist unit.	Art. no. is specified in *Required equipment on page 253*.
12.	**CAUTION!** The complete wrist unit weighs 130 kg! All lifting equipment used must be sized accordingly!	
13.	Slightly raise the wrist unit to unload the screw joint, facilitating removing the attachment screws.	
14.	Remove the *wrist unit attachment screws and washers*.	Shown in the figure *Location of wrist unit on page 252*.
15.	Pull the wrist unit out, lift it away and place it on a secure surface.	

Refitting, wrist unit

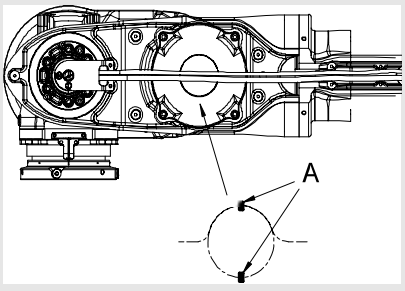
The procedure below details how to refit the complete wrist unit.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Fit two *guide pins, M12* in the upper arm tube, in two of the holes for the *wrist unit attachment screws.*	Art. no. is specified in *Required equipment on page 253*. Shown in the figure *Location of wrist unit on page 252*.

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Continued

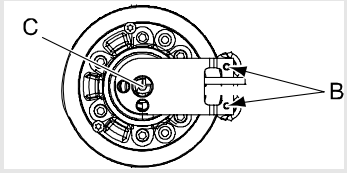
	Action	Note
3.	Fit the *lifting tool* to the wrist unit.	Art. no. is specified *Location of wrist unit on page 252*.
4.	**CAUTION!** The complete wrist unit weighs 130 kg! All lifting equipment used must be sized accordingly!	
5.	Lift the wrist unit and guide it to the upper arm tube with help of the guide pins. Make sure the cabling from motor, axis 5 is safely run into the arm tube and does not get jammed.	
6.	Secure the wrist unit with 10 of the 12 *attachment screws* and *washers*.	Shown in the figure *Location of wrist unit on page 252*. 12 pcs: M12 x 50, 12.9 quality UNBRAKO, tightening torque: 115 Nm. Reused screws may be used, providing they are lubricated as detailed in section *Screw joints on page 390* before fitting.
7.	Remove the guide pins and secure the two remaining attachment screws as detailed above.	
8.	Remove the lifting tool from the wrist unit.	
9.	Reconnect the motor axis 5 by connecting the two *connectors inside the upper arm tube* (R3.FB5, R3.MP5) and secure the cable bracket with the two attachment screws to the tube.	Shown in the figure *Location of wrist unit on page 252*.
10.	**NOTE!** Axis 5 must be oriented in the correct position (+90º) to allow the motor 6 cover to open!	
11.	Place the cabling to motor axis 6 correctly on the upper arm and gently pull the connectors through the hole on top of wrist unit to motor, axis 6. In case of excess of cable length: • put the excess cable in a loop in the area shown in the figure and secure with with *cable straps*. Cables are longer in order to fit different upper arm lengths.	 xx0200000185 Parts: • A: Cable straps

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4.4.2. Replacement of complete wrist unit

Continued

	Action	Note
12.	Fasten the *cable bracket* at top of the wrist unit with three *attachment screws*. Two of them are visible at the *rear attachment point* and the third is located on the *bottom* of the cable bracket, in the center.	Shown in the figure *Location of wrist unit on page 252*.  xx0200000254 • B: Attachment screws, rear attachment point of cable bracket (2 pcs) • C: Attachment screw, bottom of cable bracket
13.	Reconnect the connectors to motor, axis 6 and refit the motor cover.	
14.	Refit the *cover, upper arm tube.*	Shown in the figure *Location of wrist unit on page 252*.
15.	Refit the *cover, wrist unit.*	Shown in the figure *Location of wrist unit on page 252*.
16.	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*.
17.	Refit any equipment previously removed from the turning disk.	
18.	**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 33*.	

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4.4.3. Replacement of complete wrist unit, IRB 6640ID

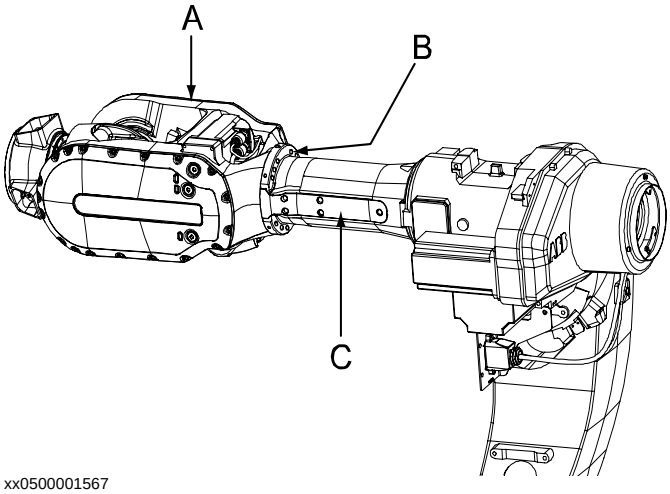
Wrist unit for robot models IRB 6640ID

This section is only valid for robot models IRB 6640ID. How to replace the wrist unit on the models IRB 6640 is detailed in section *Replacement of complete wrist unit on page 252*.

Location of wrist unit

The wrist unit is located in the frontmost part of the upper arm as shown in the figure below.

A more detailed view of the component and its position may be found in chapter *Upper arm including wrist unit, motors ax. 3- 6 (IRB 6640 and IRB 6640ID) on page 409* .



xx0500001567

A	Wrist unit
B	Attachment screws and washers, wrist unit
C	Upper arm tube

Required equipment

Equipment	Spare part no.	Art. no.	Note
Wrist, process	3HAC024793-001		
Guide pins M12 x 200 Guide pins M12 x 200		3HAC13056-3 3HAC13056-3	Always use guide pins in pairs!
Lifting slings		-	
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.
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*.
Product manual - DressPack/SpotPack		-	Art. no. is specified in section *References*.

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4.4.3. Replacement of complete wrist unit, IRB 6640ID

Continued

Removal, wrist unit

The procedure below details how to remove the complete wrist unit from the robot.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Remove all equipment fitted to the turning disk.	
3.	Remove the integrated spotpack cabling.	How to remove the DressPack harness from the upper arm and wrist unit is detailed in the *Product manual - DressPack/SpotPack*.
4.	Disconnect the connectors from motors, axes 5 and 6. Loosen the cabling from the wrist unit.	
5.	Support the weight of the wrist unit with lifting slings.	
6.	 **CAUTION!** The complete wrist unit weighs 187 kg! All lifting equipment used must be sized accordingly!	
7.	Slightly raise the wrist unit to unload the screw joint, facilitating removal of the attachment screws.	
8.	Remove the attachment screws and washer from the wrist unit.	
9.	Lift away the wrist unit and place it on a secure surface. Be careful not to damage the cabling and the motor connectors while running them through the wrist during removal!	

Refitting, wrist unit

The procedure below details how to refit the complete wrist unit to the robot.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Fit the two *guide pins* in the upper arm tube, in two of the attachment holes for the wrist unit.	Art. no. is specified in *Required equipment on page 257Required equipment on page 257*.

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Continued

	Action	Note
3.	 **CAUTION!** The complete wrist unit weighs 187 kg! All lifting equipment used must be sized accordingly!	
4.	Attach the lifting slings to the wrist unit and lift it to the upper arm tube.	
5.	Insert the cabling and connectors through the wrist unit and match the wrist against the upper arm tube with guidance from the guide pins.	
6.	Secure the wrist unit with 10 of the 12 *attachment screws and washers*.	Shown in the figure *Location of wrist unit on page 257Location of wrist unit on page 257*. 12 pcs; M12 x 50, 12.9 quality UNBRAKO. Tightening torque: 115 Nm. Reused screws may be used, providing they are lubricated as detailed in section *Screw joints on page 390* before fitting.
7.	Remove the guide pins and secure the two remaining attachment screws as detailed above.	
8.	Reconnect the motor connectors to the motors, axes 5 and 6. Fasten the cabling as shown in the cable layout in the figure *Cable layout, wrist unit on page 231*.	
9.	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*.
10.	Refit any equipment previously removed from the turning disk.	
11.	 **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 33*.	

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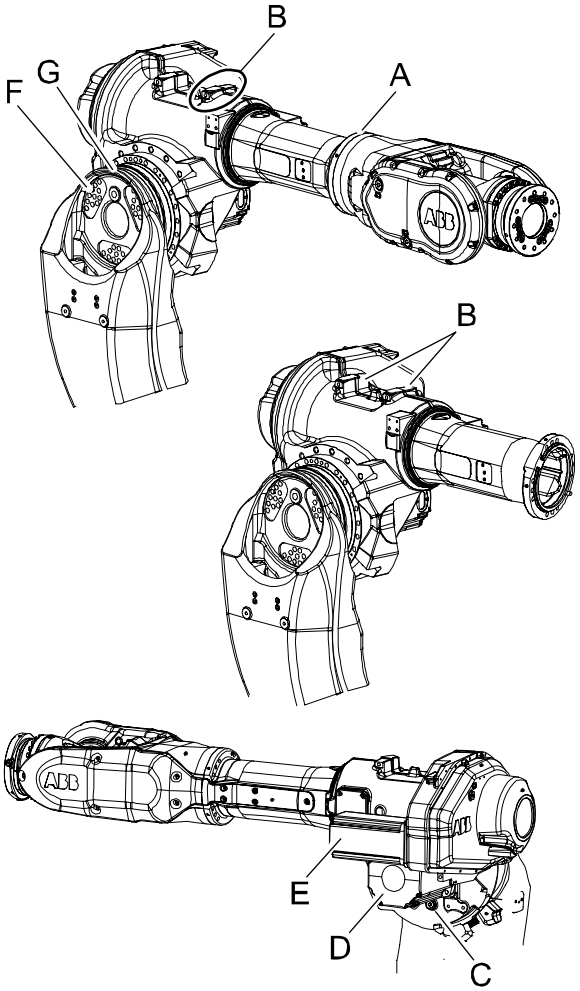
4.4.4. Replacement of upper arm

Location of upper arm

The upper arm is located on top of the robot as shown in the following figure. The complete upper arm includes the wrist unit but this section also describes how to remove the upper arm when there is no wrist unit mounted.

Note! The lifting device is attached differently depending on whether the wrist unit is mounted on the upper arm or not. The attachment points are shown in the following figure.

A more detailed view of the component and its position may be found in chapter *Exploded views* in the *Product manual, reference information*.



xx0700000345

A	Attachment hole for lifting eye, M12 (if the wrist unit is mounted)
B	Attachment for lifting device, upper arm, 2 pcs (if there is no wrist unit mounted)
C	Oil plug, draining, gearbox axis 3
D	Motor, axis 3
E	Motor, axis 4
F	Attachment screws and washers, upper arm
G	Sealing, axes 2/3 (between lower arm and gearbox axis 3)

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Required equipment

Equipment	Art. no.	Note
Sealing, axis 2/3	3HAC17212-1	Always use a new sealing when refitting the upper arm!
Washer, axis 3 (3 pcs)	3HAC12703-1	To be replaced if damaged.
Guide pins, sealing axis 2/3 80 mm	3HAC14628-1	For guiding "Sealing, axis 2/3".
Guide pins, sealing axis 2/3 100 mm	3HAC14628-2	For guiding "Sealing, axis 2/3".
Power supply	-	24 VDC, max 1,5A For releasing the brakes.
Rotation tool	3HAC17105-1	Used to rotate the motor shaft beneath the motor cover, when brakes are released with 24 VDC power supply.
Lifting eye VLBG M12	3HAC16131-1	
Lifting device, upper arm	3HAC15994-1 3HAC15994-1	
Lifting tool (chain)	3HAC15556-1	To be used together with lifting eye, M12 and lifting device, upper arm.
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
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.

Removal, upper arm

The procedure below details how to remove the upper arm.

	Action	Note
1.	Remove all equipment fitted to turning disk.	
2.	Move the upper arm to a horizontal position. Rotate axis 4 so that the *attachment hole for lifting eye* is faced upwards!	Shown in the figure *Location of upper arm on page 260*.
3.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
4.	**Upper arm including wrist unit:** Fit the *lifting eye, VLBG M12* to the *attachment hole for lifting eye* on the upper arm tube.	Art. no. is specified in *Required equipment on page 261*. Shown in the figure *Location of upper arm on page 260*.

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4.4.4. Replacement of upper arm

Continued

	Action	Note
5.	**Upper arm including wrist unit:** Fit one of the pieces included in *lifting device, upper arm* to the front *attachment for lifting device* on the upper arm. **Upper arm without wrist unit:** Fit the *lifting device, upper arm* to both *attachments for lifting device*.	Art. no. is specified in *Required equipment on page 261*. Attachment point is shown in the figure *Location of upper arm on page 260*. **NOTE!** The different attachment points, depends on whether the wrist unit is mounted or not!
6.	Fasten the *lifting tool (chain)* onto the lifting eye, the lifting device and an overhead crane.	Art. no. is specified in *Required equipment on page 261*.
7.	Drain the oil from gearbox axis 3.	Detailed in section *Oil change, gearbox, axis 3 on page 160*.
8.	Remove the cover on top of the motors, axis 3 and 4 and disconnect all connectors inside the motors.	
9.	Remove the *cable harness upper arm* and place it in a way that it will not be damaged in the proceeding procedure of removing the upper arm.	Detailed in section *Removal, cable harness - upper arm on page 195*. Detailed in section *Replacement of cable harness, Cleanroom on page 207*.
10.	**CAUTION!** The complete upper arm weighs 380 kg without any additional equipment fitted! Use a suitable lifting device to avoid injury to personnel!	
11.	**NOTE!** For **Cleanroom** robots apply a protection where the lifting equipment and roundslings will rub against the paint of the robot. In order to prevent from particle emission while lifting, put for example a 20 mm thick cellular plastic sheet around the places on the robot where the lifting equipment may rub against the paint.	
12.	Raise the lifting equipment to take the weight of the upper arm.	
13.	In order to release the brake of the axis 3 motor, connect the 24 VDC power supply. **NOTE!** When releasing the brake, the position of the upper arm is adjusted to the position given by the lifting equipment.	Connect to connector R2.MP3 • +: pin 2 • -: pin 5

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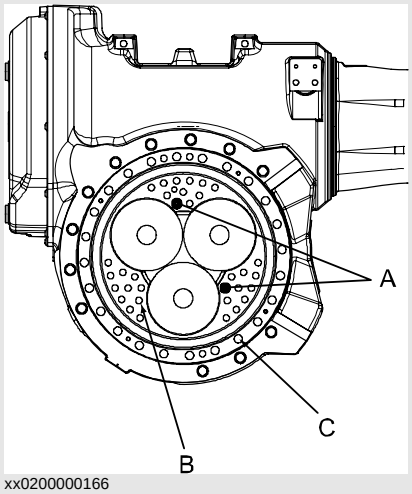
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	Action	Note
14.	Carefully remove the *attachment screws and washers, upper arm.*	Shown in the figure *Location of upper arm on page 260*.
15.	Lift the upper arm and place it on a secure surface. Make sure the lift is done completely level! In case of necessary adjustments, use the shortening loops on the lifting tool (chain), but make sure to place the chain the right way through the loops!	
16.	Remove the *sealing, axis 2/3* from the lower arm.	Shown in the figure *Location of upper arm on page 260*.

Refitting, upper arm

The procedure below details how to refit the upper arm.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Fit the two *guide pins, sealing axis 2/3* in two of the attachment screw holes on gearbox 3, see figure to the right. Guide the new *sealing, axis 2/3* into position on gearbox 3, using the guide pins.	Always use a new sealing when reassembling! Art. no. is specified in *Required equipment on page 261*.  xx0200000166 A. Holes for the guide pins (sealing axis 2/3). B. Holes for the upper arm attachment screws (33 pcs). C. Holes for the gearbox attachment screws (not affected in this instruction).

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4.4.4. Replacement of upper arm

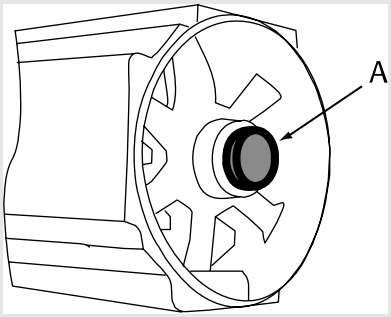
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	Action	Note
3.	**Upper arm including wrist unit:** Fit the *lifting eye, VLBG M12* to the *attachment hole, lifting eye* on the wrist unit.	Art. no. is specified in *Required equipment on page 261*. Shown in the figure *Location of upper arm on page 260*.
4.	**Upper arm including wrist unit:** Fit one of the pieces included in the *lifting device, upper arm* to the front *attachment for the lifting device* on the upper arm. **Upper arm without wrist unit:** Fit the *lifting device, upper arm* to the both *attachments for the lifting device* on the upper arm.	Art. no. is specified in *Required equipment on page 261*. Attachment points are shown in the figure *Location of upper arm on page 260*.  **NOTE!** The different attachment points, depends on whether the wrist unit is mounted or not!
5.	In order to release the brake of the axis 3 motor, connect the 24 VDC power supply, after removing the motor cover.	Connect to connector R2.MP3 • +: pin 2 • -: pin 5
6.	Fasten the *lifting tool (chain)* onto the lifting eye, the lifting device and an overhead crane.	Art. no. is specified in *Required equipment on page 261*.
7.	 **CAUTION!** The complete upper arm weighs 380 kg without any additional equipment fitted! Use a suitable lifting device to avoid injury to personnel!	
8.	 **NOTE!** For **Cleanroom** robots apply a protection where the lifting equipment and roundslings will rub against the paint of the robot. In order to prevent from particle emission while lifting, put for example a 20 mm thick cellular plastic sheet around the places of the robot where the lifting equipment may rub against the paint.	
9.	Lift the upper arm and move to its mounting position. Make sure the lift is done completely level!	

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Continued

	Action	Note
10.	Fit in the gearbox attachment holes with the attachment holes on the lower arm with the guide pins. It may be necessary to turn the gear by rotating the motor pinion with a *rotation tool, motor* beneath the motor cover.	Art. no. is specified in *Required equipment on page 261*.  xx0200000165 The rotation tool is used beneath the motor cover, directly on the motor shaft as shown in figure above. • A: Rotation tool
11.	Fit the three *washers* to be placed beneath the attachment screws.	Shown in the figure *Location of upper arm on page 260*.
12.	Insert 31 of the 33 *attachment screws, upper arm* into the attachment holes in the lower arm. Do not remove the guide pins until the attachment screws are tightened as detailed below.	Shown in the figure *Location of upper arm on page 260*. Removing the plastic mechanical stops may be required before fitting the upper arm. If guide pins are removed before the screws are tightened, the sealing can be involuntarily moved into wrong position.
13.	Secure the lower arm to gearbox axis 3, with the attachment screws.	33 pcs: M12 x 50; 12.9 quality UNBRAKO, tightening torque: 120 Nm. Reused screws may be used, providing they are lubricated as detailed in section *Screw joints on page 390* before fitting.
14.	Remove the guide pins and fit the two remaining attachment screws. Tighten them as detailed above!	
15.	Disconnect the brake release voltage and remove the rotation tool from the motor.	
16.	Remove the lifting devices.	
17.	Refit any cabling removed during the removal process.	
18.	Reconnect all connectors inside motors, axis 3 and 4. Refit the motor covers.	
19.	Perform a leakdown test.	Detailed in section *Performing a leak-down test on page 188*.
20.	Refill the gearbox with oil.	Detailed in section *Oil change, gearbox, axis 3 on page 160*.

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4.4.4. Replacement of upper arm

Continued

	Action	Note
21.	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*.
22.	 **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 33*.	

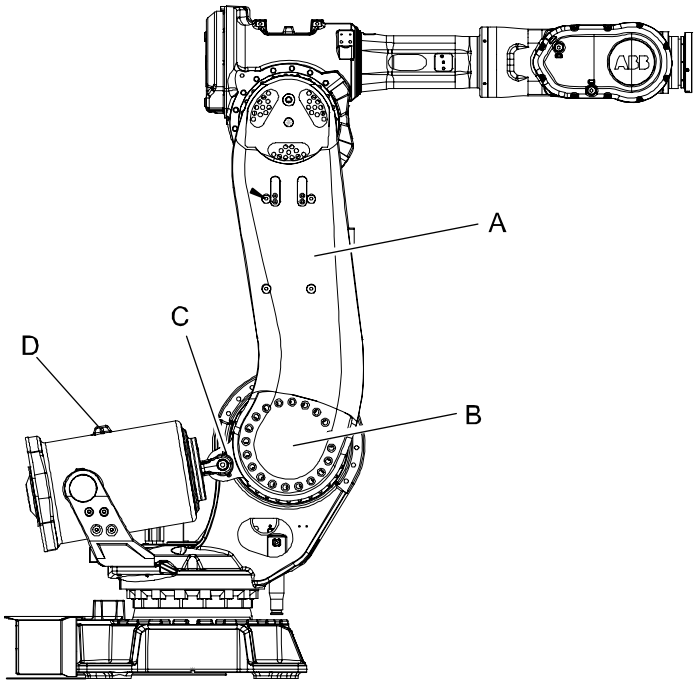
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4.4.5. Replacement of complete lower arm

Location of lower arm

The lower arm is located as shown in the figure below.

A more detailed view of the component and its position may be found in chapter *Exploded views* in the *Product manual, reference information*.



xx0700000347

A	Lower arm
B	Pivot point, axis 2
C	Front shaft, balancing device
D	Attachment for lifting equipment, balancing device

Required equipment

Equipment, etc.	Art. no.	Note
Bearing	3HAC12441-2	Always use a new bearing when reassembling!
Sealing, axis 2/3	3HAC17212-1	Always use a new sealing when reassembling!
Puller tool, balancing device shaft	3HAC12475-1	
Lifting tool, lower arm	3HAC14691-1	Tool that may be rent from ABB Robotics. Includes: • two guidings, 3HAC 14446-1, must be used for guiding the sealing, axis 2/3.
Rotation tool	3HAC17105-1	Used to rotate the motor pinion and gear if necessary, when brakes are released.
Press tool, axis 2 bearing	3HAC13527-1	

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4.4.5. Replacement of complete lower arm

Continued

Equipment, etc.	Art. no.	Note
Retaining ring plier	-	
Grease	3HAB3537-1	For lubrication of the shaft hole.
Isopropanol	11771012-208	For cleaning of the shaft.
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
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.

Removal, lower arm

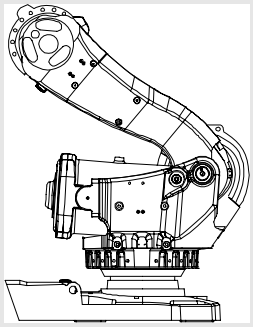
The procedure below details how to remove the complete lower arm.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Remove the *upper arm*.	Detailed in section *Removal, upper arm on page 261*.
3.	Disconnect and remove the *cables* from inside the lower arm. Release any cable attachments.	Detailed in section *Replacement of cable harness, axes 1-6 on page 193*. **NOTE!** For Cleanroom robots it is necessary to remove the complete cable harness from base, frame and lower arm. The removal procedure is detailed in section *Replacement of cable harness, Cleanroom on page 207*.
4.	Apply the *shackle* to the balancing device and raise to unload the weight of the device.	Art. no. is specified in *Required equipment on page 267*. Attachment is shown in the figure *Location of lower arm on page 267*.
5.	Unload the balancing device in order to make the piston rod and front ear adjustable when pulling the front shaft out.	Detailed in section *Unloading the balancing device (old and new) on page 294*.
6.	Remove the securing screw from the balancing device *front shaft.*	Shown in the figure *Location of lower arm on page 267*.

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Continued

	Action	Note
7.	Apply the *puller tool, balancing device shaft* to the shaft of the balancing device, through the hole in the frame. The shaft has a M20 thread diameter, as shown in the figure to the right. Pull the shaft out using the puller tool and the *hydraulic pump.*	Art. no. is specified in *Required equipment on page 267*. **NOTE!** The dimension of the shaft puller tool is M20. Do not mix up with the shaft press tool used when mounting the shaft.
8.	Lower the balancing device until it rests safely against the bottom of the frame.	
9.	Move the lower arm backwards to the lowest position possible.	The figure shows IRB 6600 but the position of the lower arm shall be the same.  xx0300000015
10.	**NOTE!** For **Cleanroom** robots apply a protection where the lifting equipment and roundslings will rub against the paint of the robot. In order to prevent from particle emission while lifting, put for example a 20 mm thick cellular plastic sheet around the places on the robot where the lifting equipment may rub against the paint.	
11.	Apply the *lifting tool* to the lower arm.	Art. no. is specified in *Required equipment on page 267*.
12.	Drain the oil from gearbox 2.	Detailed in section *Oil change, gearbox axis 2 on page 157*.
13.	**CAUTION!** The lower arm weighs 160 kg! All lifting equipment used must be sized accordingly!	
14.	Raise the tool to unload the lower arm.	
15.	Remove the lower arm shaft and all additional components, as detailed in section *Removal, lower arm shaft*.	

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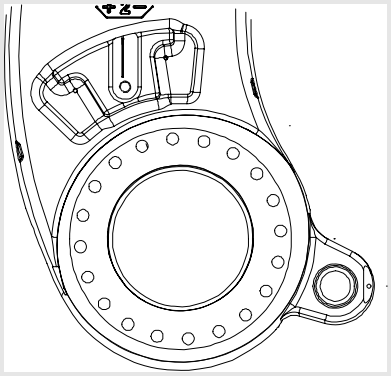
4.4.5. Replacement of complete lower arm

Continued

	Action	Note
16.	Remove the *attachment screws and washers* that attach the lower arm to the gearbox axis 2.	
17.	Lift the lower arm and place it on a secure surface.	

Refitting, lower arm

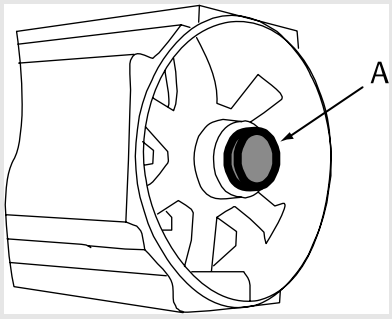
The procedure below details how to refit the lower arm.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Fit two guideing pins in two opposite attachment holes of the lower arm.	 xx0700000348
3.	Fit the new *sealing, axis 2/3* on the guidings.	Always use a new sealing when reassembling! Art. no. is specified in *Required equipment on page 267*.
4.	**NOTE!** For **Cleanroom** robots apply a protection where the lifting equipment and roundslings will rub against the paint of the robot. In order to prevent from particle emission while lifting, put for example a 20 mm thick cellular plastic sheet around the places on the robot where the lifting equipment may rub against the paint.	
5.	Apply the *lifting tool* to the lower arm.	Art. no. is specified in *Required equipment on page 267*.

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Continued

	Action	Note
6.	**CAUTION!** The lower arm weighs 160 kg! All lifting equipment used must be sized accordingly!	
7.	Lift the lower arm and move it to its mounting position.	
8.	In case the hole pattern of the lower arm and the gearbox axis 2 does not match, use power supply to release the motor axis 2 brakes and rotate the pinion and gear with the *rotational tool.*	Connect power supply to connector R2.MP2 • +: pin 2 • -: pin 5  xx0200000165 The rotation tool (A) is used beneath the motor cover, directly on the motor shaft as shown in figure above. Art. no. is specified in *Required equipment on page 267*.
9.	Disconnect the power supply, if used.	
10.	Secure the lower arm with 18 of the 20*attachment screws and washers* in gearbox, axis 2.	20 pcs: M16 x 50, tightening torque: 300 Nm. Reused screws may be used, providing they are lubricated as detailed in section *Screw joints on page 390* before fitting.
11.	Remove the guidings and secure the two remaining screws as detailed above!	
12.	Remove the lifting tool from the lower arm.	
13.	Refit and restore the balancing device.	Detailed in section *Refitting of balancing device*.
14.	Refit the upper arm.	Detailed in section *Refitting, upper arm on page 263*.
15.	Perform a leak-down test.	Detailed in section *Performing a leak-down test on page 188*.
16.	Refill the gearbox with oil.	Detailed in section *Oil change, gearbox axis 2 on page 157*.

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4.4.5. Replacement of complete lower arm

Continued

	Action	Note
17.	Refit and reconnect all cables inside the lower arm. Resecure any cable attachments.	Detailed in section *Refitting, cable harness, axes 1-4 on page 224*. Detailed in section *Replacement of cable harness, Cleanroom on page 207*.
18.	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*.
19.	 **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 33*.	

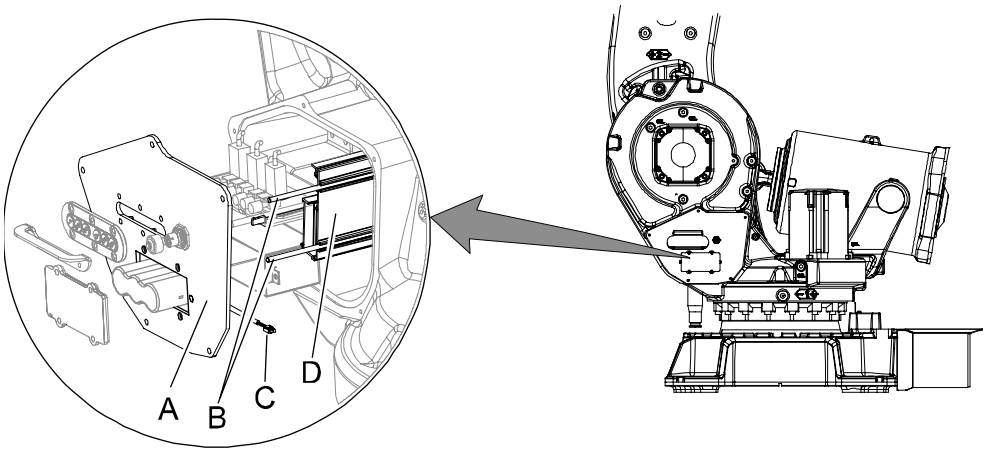
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4.5 Frame and base

4.5.1. Replacement of SMB unit

Location of SMB unit

The SMB unit (SMB = serial measurement board) is located on the left hand side of the frame as shown in the figure below.



xx0700000121

A	SMB cover
B	Pins
C	Battery cable
D	SMB unit

Required equipment

Equipment, etc.	Spare part no.	Art. no.	Note
SMB unit	3HAC16014-1		
SMB unit	3HAC022286-001		
Brush		-	Option: Foundry prime
Rust preventive	3HAC026621-001		Option: Foundry prime Equivalent: • Mercasol 3106
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.
Circuit Diagram		- 3HAC025744-001	See chapter *Circuit diagram*.

Removal, SMB unit

The procedure below details how to remove the SMB unit.

	Action	Note
1.	Move the robot to the calibration position.	

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4.5.1. Replacement of SMB unit

Continued

	Action	Note
2.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	 esd **WARNING!** The unit is sensitive to ESD, before handling the unit please observe the safety information in section *WARNING - The unit is sensitive to ESD! on page 35*	
4.	Remove the *SMB cover* by unscrewing its attachment screws.	Shown in the figure *Location of SMB unit on page 273*.
5.	Remove the connectors X8, X9 and X10 from the brake release board, if need of more space.	
6.	Remove the nuts and washers from the *pins* securing the board.	Shown in the figure *Location of SMB unit on page 273*.
7.	Gently disconnect the connectors from the SMB unit when pulling the board out.	Connectors R1.SMB1-3, R1.SMB4-6 and R2.SMB
8.	Disconnect the *battery cable* from the SMB unit.	Shown in the figure *Location of SMB unit on page 273*.

Refitting, SMB unit

The procedure below details how to refit the SMB unit.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	 esd **WARNING!** The unit is sensitive to ESD, before handling the unit please observe the safety information in section *WARNING - The unit is sensitive to ESD! on page 35*	
3.	Connect the *battery cable* to the SMB unit.	Shown in the figure *Location of SMB unit on page 273*.

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Continued

	Action	Note
4.	Connect all connectors to the SMB board and fit the *SMB unit* onto the *pins*.	Art. no. is specified in *Required equipment on page 273*. Shown in the figure *Location of SMB unit on page 273*. R1.SMB1-3, R1.SMB4-6 and R2.SMB
5.	Secure the SMB unit to the pins with the nuts and washers.	
6.	If disconnected, reconnect the connectors X8, X9 and X10 to the brake release board.	
7.	Secure the *SMB cover* with its attachment screws.	Shown in the figure *Location of SMB unit on page 273*.
8.	Update the revolution counter!	Detailed in chapter Calibration - section *Updating revolution counters on page 378*.
9.	 **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 33*.	

Replacement of SMB unit (Foundry Prime)

Robots working with Foundry Prime and that have the special tightness for this application require special repair routines to maintain the tightness level.

The repair must be done according to the previous repair procedure with the following additions.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	 esd **WARNING!** The unit is sensitive to ESD, before handling the unit please observe the safety information in section *WARNING - The unit is sensitive to ESD! on page 35*	
3.	Remove the SMB unit as detailed in *Removal, SMB unit on page 273*	

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4.5.1. Replacement of SMB unit

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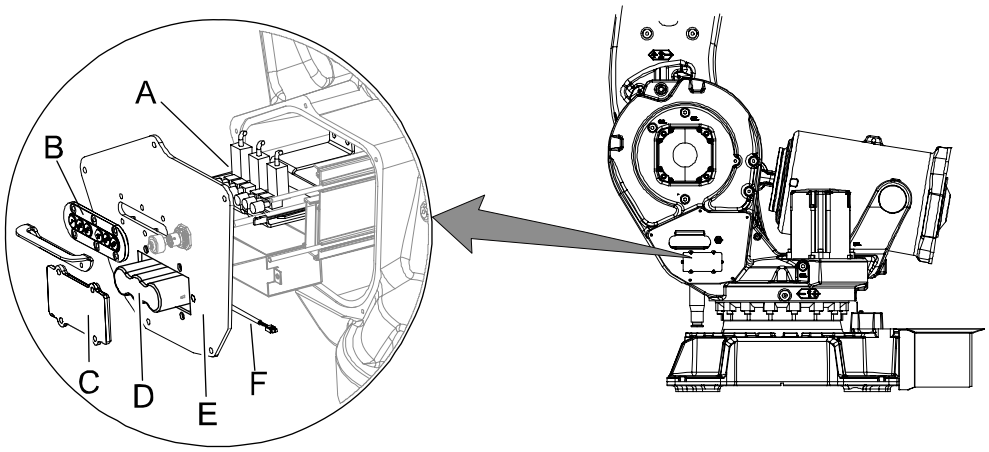
	Action	Note
4.	Refit the new SMB unit according to step 3 - 6 in *Refitting, SMB unit on page 274*	
5.	**NOTE!** Make sure that the gasket under the SMB cover is not damaged! Secure the SMB cover with its attachment screws.	
6.	Apply rust preventive on the surface around the SMB cover and under/on top of the screw heads.	
7.	Perform a leakdown test according to *Inspection of air hoses (Foundry Prime) on page 138*.	
8.	Update the revolution counter!	Detailed in chapter Calibration - section *Updating revolution counters on page 378*.
9.	**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 33*.	

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4.5.2. Replacement of brake release unit

Location of brake release unit

The brake release unit is located together with the SMB unit on the left hand side of the frame, right next to the gearbox, axis 2, as shown in figure below.



xx0700000123

A	Brake release unit
B	Push button guard
C	Battery cover
D	Battery
E	SMB cover
F	Battery cable

Required equipment

Equipment, etc.	Art. no.	Note
Brake release unit with buttons	3HAC16035-1	Located together with the SMB-unit at the left hand side of the frame.
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
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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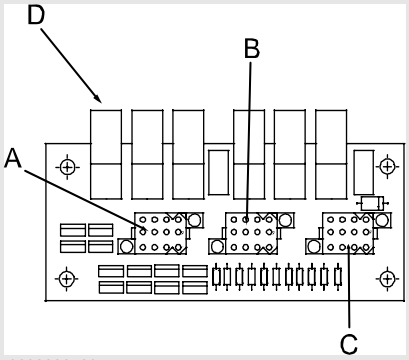
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4.5.2. Replacement of brake release unit

Continued

Removal, brake release unit

The procedure below details how to remove the brake release unit.

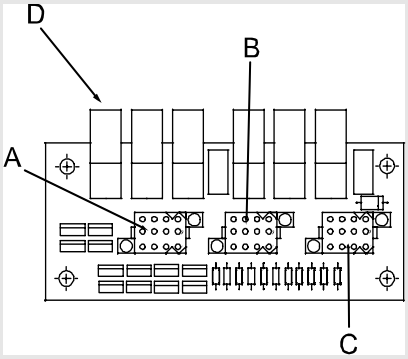
	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	 esd **WARNING!** The unit is sensitive to ESD, before handling the unit please observe the safety information in section *WARNING - The unit is sensitive to ESD! on page 35*	
3.	Remove the *push button guard* from the SMB cover.	Shown in the figure *Location of brake release unit on page 277*. The guard must be removed to ensure a correct refitting of the brake release unit.
4.	Let the battery stay connected, to avoid the need of synchronization of the robot!	Shown in the figure *Location of brake release unit on page 277*.
5.	Disconnect the connectors X8, X9 and X10 from the *brake release unit.*	 xx0200000129 • A: Connector X8 • B: Connector X9 • C: Connector X10 • D: Push buttons Location of brake release unit is shown in the figure *Location of brake release unit on page 277*.
6.	Remove the brake release unit from the bracket by removing the four attachment screws.	

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Continues on next page

Refitting, brake release unit

The procedure below details how to refit the brake release unit.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	 esd **WARNING!** The unit is sensitive to ESD, before handling the unit please observe the safety information in section *WARNING - The unit is sensitive to ESD! on page 35*	
3.	Fasten the *brake release unit* on the bracket with the attachment screws. Make sure the unit is positioned as straight as possible on the bracket! The push buttons can otherwise get jammed when the SMB cover is refitted.	Shown in the figure *Location of brake release unit on page 277*. Art. no. is specified in *Required equipment on page 277*.
4.	Connect the connectors X8, X9 and X10 to the brake release unit.	 xx0200000129 • A: Connector X8 • B: Connector X9 • C: Connector X10 • D: Push buttons
5.	Refit the *SMB cover* with its attachment screws. The push button guard must not be mounted on the cover before the check described below is made!	Shown in the figure *Location of brake release unit on page 277*.

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4.5.2. Replacement of brake release unit

Continued

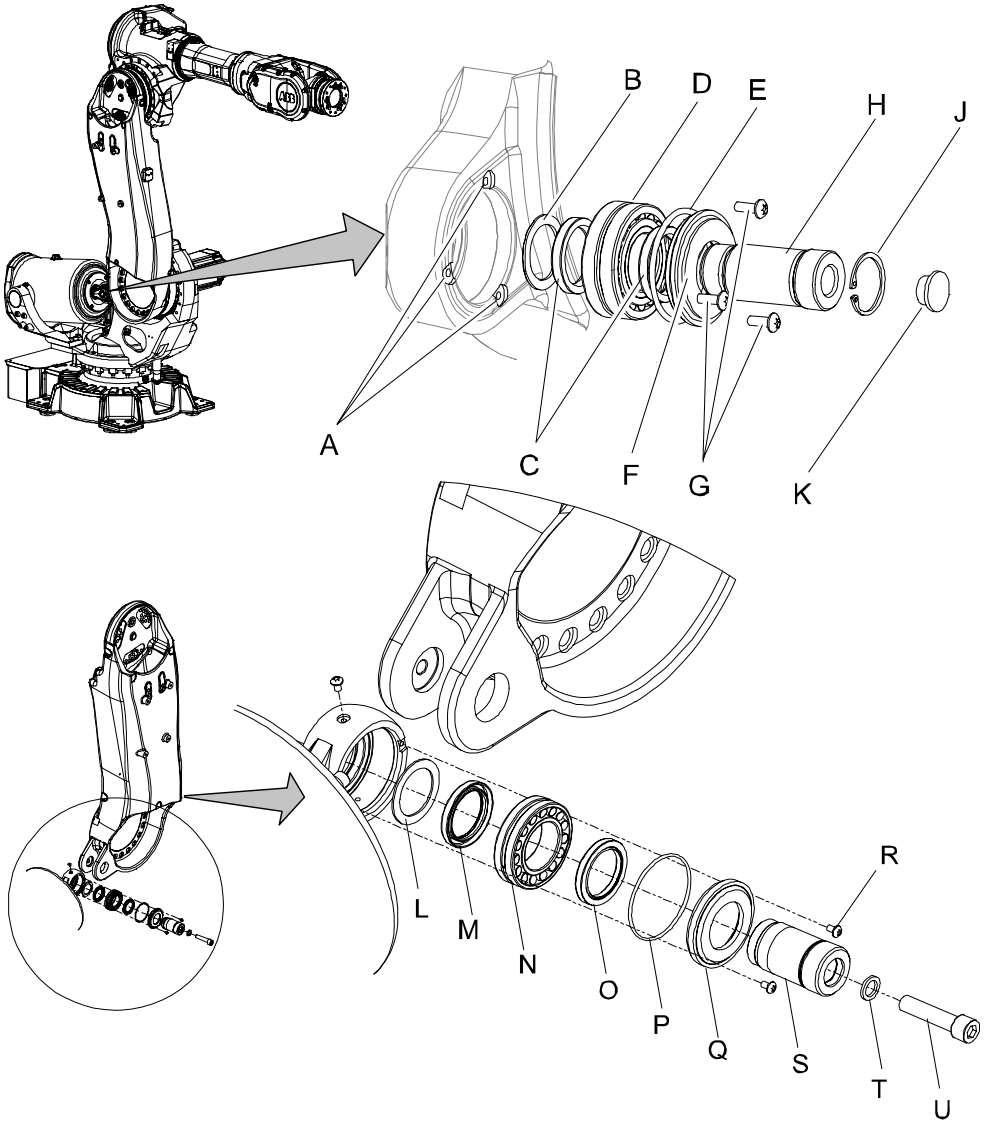
	Action	Note
6.	 **WARNING!** Before continuing any service work, please observe the safety information in section *WARNING - The brake release buttons may be jammed after service work on page 34*!	
7.	Refit the *push button guard* to the SMB cover.	Shown in the figure *Location of brake release unit on page 277*.
8.	If the battery has been disconnected the revolution counter must be updated.	Detailed in the Calibration chapter - section *Updating revolution counters on page 378*.
9.	 **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 33*.	

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4.5.3. Replacement of spherical roller bearing, balancing device (old and new)

Location of bearing

The bearing is located at the front ear of the balancing device, as shown in the figure below.



xx0700000115

	Lower arm 3HAC023627-001
	Lower arm 3HAC027033-001
A	Holes for attachment screws (3 pcs)
B	Washer
C	Sealing ring, radial (2 pcs)
D	Spherical roller bearing
E	O-ring
F	Sealing washer
G	Attachment screws M6x16 (3 pcs)
H	Shaft
J	Retaining ring, bore

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4.5.3. Replacement of spherical roller bearing, balancing device (old and new)

Continued

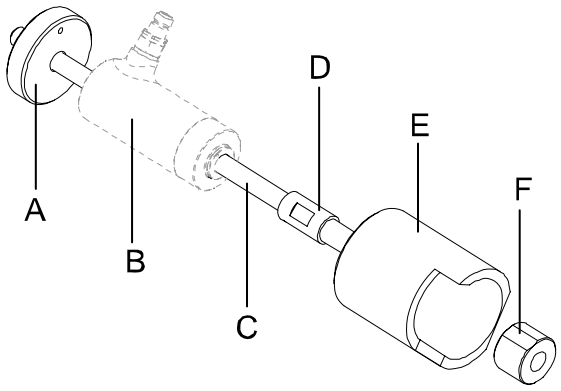
K	Protection plug
	Lower arm 3HAC031985-001
	Lower arm 3HAC032177-001
L	Washer
M	Radial seal w dustlipp 50x68x8
N	Spherical roller bearing
O	Radial seal w dustlipp 50x68x8
P	O-ring
Q	End cover
R	Torx pan head screw
S	Shaft
T	Washer
U	Hex socket head cap screw M16x70

Required equipment

Equipment	Spare part no.	Art. no.	Note
Maintenance parts, shaft	3HAC029288-001		Includes the parts shown in the figure above.
Grease		3HAB3537-1	For lubrication of the components.
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.

Tool set

The parts of the tool set for replacement of the spherical roller bearing are shown in the figure below.



xx0700000359

A	Knurled nut
B	Hydraulic cylinder (ordered separately)
C	Threaded bar, M16
D	Nut

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Continued

E	Mounting tool
F	Press nut

Removal, bearing

The procedure below details how to remove the bearing from the balancing device front ear.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Remove the balancing device from the robot.	Detailed in section *Removal on page 287*.
3.	Insert the threaded bar through the bearing.	
4.	Fit the press tool to the threaded bar. Secure with the knurled nut and press nut at each end of the threaded bar.	
5.	Press out the bearing from the front ear.	

Refitting, bearing

The procedure below details how to refit the bearing to the balancing device front ear.

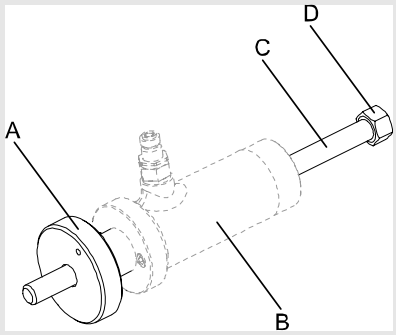
	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Grease the inside walls of the front ear.	

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4.5.3. Replacement of spherical roller bearing, balancing device (old and new)

Continued

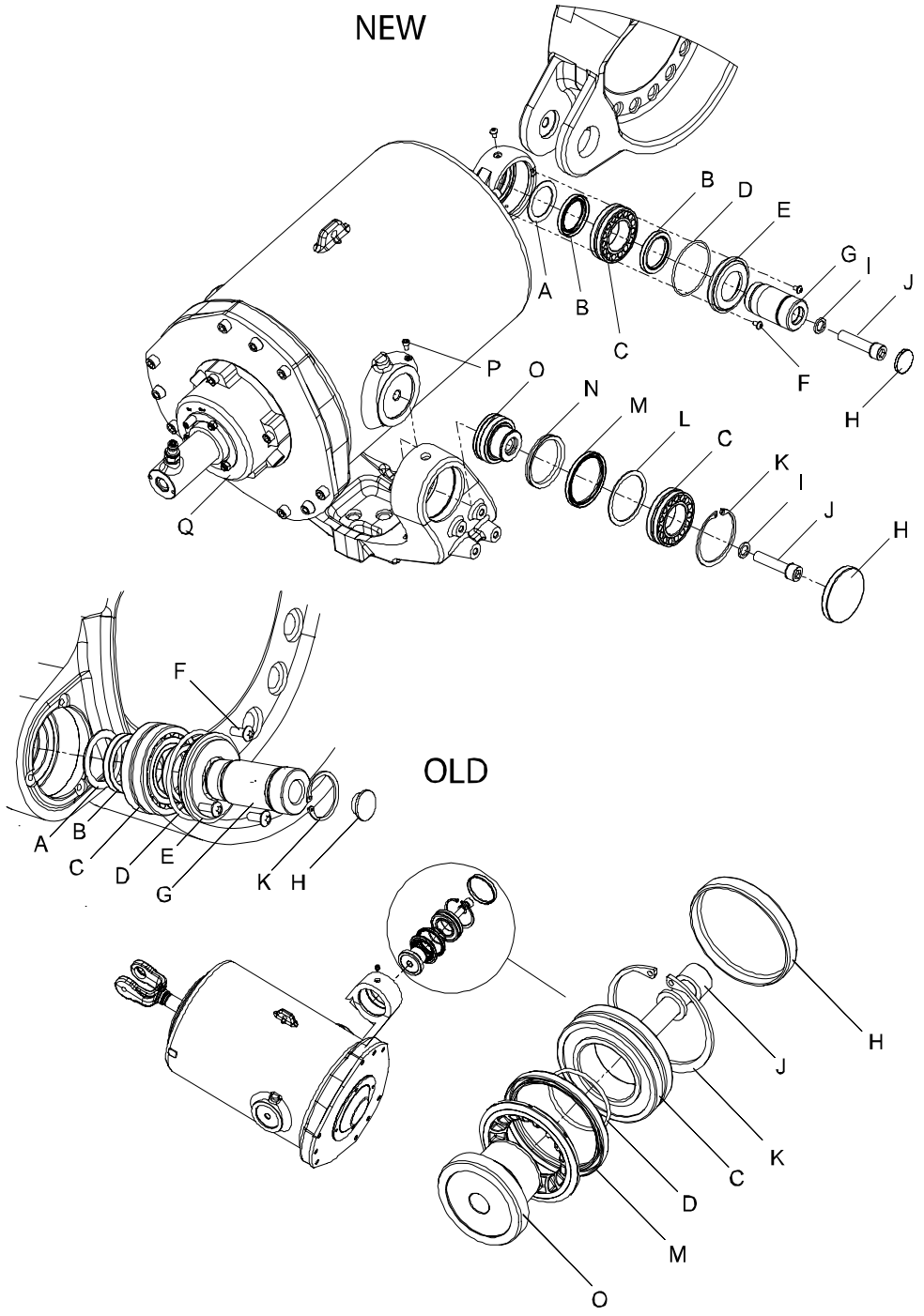
	Action	Note
3.	Insert the threaded bar through the new bearing and place it in the front ear. Also fit the press tool. Secure with the knurled nut and press nut at each end of the threaded bar.	 xx0700000360 Parts: • A: Knurled nut • B: Press tool (ordered separately) • C: Threaded bad, M16 • D: Nut M16
4.	Press in the bearing properly inside the ear.	
5.	Apply grease to the new sealing rings and o-rings and fit them.	
6.	Press in the sealing rings and sealing washer.	
7.	Refit the balancing device to the robot.	Detailed in section *Refitting on page 290*.
8.	Lubricate the spherical roller bearing in the ear. **NOTE!** The balancing device must be mounted on the robot when lubrication is performed!	Detailed in section *Lubrication of spherical roller bearing, balancing device on page 175*.
9.	Make sure no incorrect leakage occures. It could indicate damaged o-rings.	Further information is available in section *Check for leakage on page 131*.
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 33*.	

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4.5.4. Replacement of balancing device (old and new)

Location of balancing device

The balancing device is located on rear top of the frame as shown in the figure below.



xx0700000094

A	Washer
B	Radial seal w dustlipp
C	Spherical roller bearing
D	O-ring

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4.5.4. Replacement of balancing device (old and new)

Continued

E	End cover
F	Torx pan head screw M6x10
G	Shaft
H	VK cover
I	Washer
J	Hex socket head cap screw
K	Retaining ring,bore
L	Washer
M	Radial Sealing
N	V-ring
O	Shaft end
P	Hex socket head cap screw
Q	Hydraulic pump

Required equipment

Equipment	Spare part no.	Art. no.	Note
Balancing device			(New) (Old) *Spare Parts, balancing device 3HAC028470-001 and 3HAC030868-001 on page 401*
Gasket, end cover			To be replaced if damaged!
Maintenance parts, shaft			Detailed in *Spare Parts, balancing device 3HAC028470-001 and 3HAC030868-001 on page 401*.
Maintenance parts, cradle			Detailed in *Spare Parts, balancing device 3HAC028470-001 and 3HAC030868-001 on page 401*
Locking screw			M16x60 quality 12.9 Gleitmo For securing the lower arm.
Bearing grease		3HAB3537-1	For lubricating the o-rings and the shaft.
Grease		3HAA1001-294	35 ml, Optimol PDO For lubrication of spherical roller bearing in ear.
Grease pump		-	To lubricate spherical roller bearing.
Brush		-	Option: Foundry prime
Rust preventive		3HAC026621-001	Option: Foundry prime Equivalent: • Mercasol 3106
Shackle, balancing device		3HAC020997-001	
Lifting tool (chain)		3HAC15556-1	
Press tool, balancing device		3HAC020902-001	For unloading and restoring tha balancing device.
Dismantle and mounting tool		3HAC028920-001	To be used on shaft

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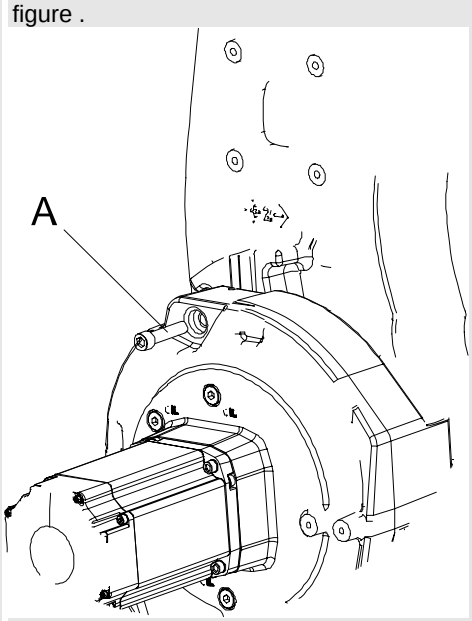
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Continued

Equipment	Spare part no.	Art. no.	Note
Puller tool, balancing device		3HAC12475-1	
Press tool, balancing device shaft		3HAC17129-1	
Hydraulic cylinder		3HAC11731-1	To be used with the press and puller tools.
Hydraulic pump, 80 MPa		3HAC13086-1	To be used with the hydraulic cylinder.
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.
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.

Removal

The procedure below details how to remove the balancing device.

	Action	Note
1.	Move the lower arm to a position close to the calibration position.	
2.	Secure the lower arm to the frame by inserting the *locking screw* into the attachment hole in the frame.	Attachment hole for the locking screw is shown in the figure .  xx0800000249 • A Locking screw Art. no. is specified in *Required equipment*.

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4.5.4. Replacement of balancing device (old and new)

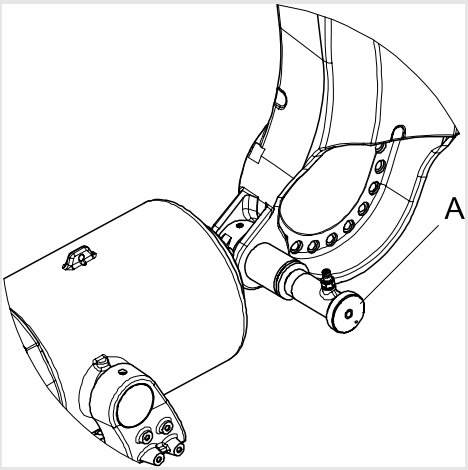
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	Action	Note
3.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
4.	Remove all equipment, if any, on or close to the balancing device.	
5.	For **Cleanroom** robots - remove the lower end of the cable harness.	Detailed in section *Replacement of cable harness, Cleanroom on page 207*.
6.	 **CAUTION!** The balancing device weighs 210 kg! All lifting equipment used must be sized accordingly!	
7.	Fit the *shackle* to the balancing device and raise to unload the weight.	Art. no. is specified in *Required equipment*. Where to attach the shackle is shown in the figure *Location of balancing device on page 285*.
8.	*Unload* the balancing device with the *press tool* in order to make the piston rod and front ear adjustable when pulling the shaft out.	Art. no. is specified in *Required equipment*. Detailed in section *Unloading the balancing device (old and new) on page 294*.
9.	Remove the*protection plug* covering the shaft in the center of the piston rod shaft front eye.	Shown in the figure *Location of balancing device on page 285*.  **NOTE!** The protection plug must also be refitted after the refitting of the balancing device! Don´t loose it!
10.	Remove the retaining ring, bore securing the shaft.	(Old lower arm)
11.	Remove the hex socket head cap screw M16x70 securing the piston rod shaft front eye.	(New lower arm)

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	Action	Note
12.	Apply the *puller tool, balancing device shaft* to the shaft and pull it out.	Art. no. is specified in *Required equipment on page 286*.  xx0800000250 • A Puller tool,
13.	Perform the following procedure of pulling out the shafts on both sides of the cradle.	(Old lower arm)
14.	Remove the *VK cover* in order to reach the *shaft* holding the balancing device. Hit the VK cover gently at the bottom part of it with a plastic hammer or similair and tilt it out.	Shown in the figure *Location of balancing device on page 285*. **NOTE!** Remove the VK cover gently. There is grease on the inside which will come out when the VK cover is removed.
15.	Wipe off all residual grease inside the hole.	
16.	Remove the *retaining ring, bore*.	Shown in the figure *Location of balancing device on page 285*.
17.	Remove the *attachment screw* securing the shaft.	Shown in the figure *Location of balancing device on page 285*.
18.	Fit the *puller tool balancing device* to the shaft and pull out the shaft only far enough in order to make it possible to remove the balancing device.	Art. no. is specified in *Required equipment on page 286*.
19.	*Restore* the balancing device.	Detailed in section *Restoring the balancing device on page 297*.
20.	Lift the balancing device gently backwards to a secure area.	

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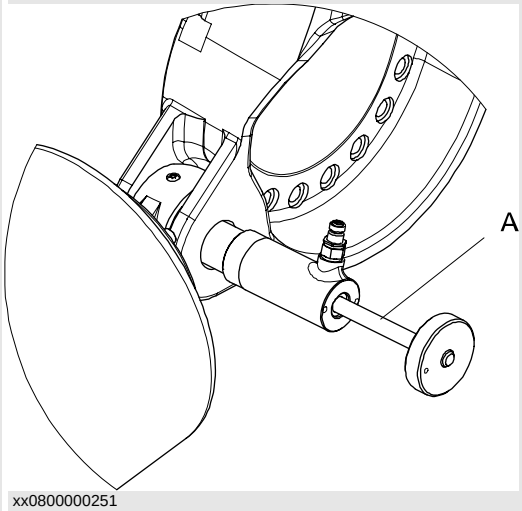
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4.5.4. Replacement of balancing device (old and new)

Continued

Refitting

The procedure below details how to refit the balancing device.

	Action	Note
1.	Fit the shackle to the balancing device.	Art. no. is specified in *Required equipment*. Where to attach the shackle is shown in the figure *Location of balancing device on page 285*.
2.	**CAUTION!** The balancing device weighs 210 kg! All lifting equipment used must be sized accordingly!	
3.	Lift the balancing device to the back of the robot.	
4.	Perform the following procedure of refitting the shafts on both sides of the cradle before refitting of the shaft at the piston rod shaft front eye.	
5.	Raise the balancing device to a position where the shafts may be refitted.	
6.	*Unload* the balancing device with the *press tool*.	Art. no. is specified in *Required equipment on page 286*. Detailed in section *Unloading the balancing device (old and new) on page 294*.
7.	Clean the hole from residual paint and grease. Lubricate the hole in the balancing cylinder where the shaft shall be fitted, with *grease*.	Art. no. is specified in *Required equipment on page 286*.
8.	Apply the *shaft press tool* to the shaft and press it back in place.	Art. no. is specified in *Required equipment on page 286*.  xx0800000251 • A Shaft press tool

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Continued

	Action	Note
9.	Refit the *attachment screw* securing the shaft.	Shown in the figure *Location of balancing device on page 285*. Attachment screw M16x70 quality 12.9 Gleitmo Tightening torque:300 Nm
10.	Refit the *retaining ring, bore*.	Shown in the figure *Location of balancing device on page 285*.
11.	Refit the *VK cover*.	Shown in the figure *Location of balancing device on page 285*.
12.	Lubricate the bearing on the shaft with grease through the lubrication hole on top of the cradle by removing the screw. Fill with *grease pump* until excessive grease pierces between the shaft and the sealing spacer.	Art. no. is specified in *Required equipment on page 286*.
13.	Remove any residual paint and grease in the hole of the shaft at the piston rod shaft front eye.	
14.	Lubricate the shaft with *grease*.	Art. no. is specified in *Required equipment on page 286*.
15.	Apply the *press tool* to the *shaft* at the piston rod shaft front eye and refit the shaft.	Art. no. is specified in *Required equipment on page 286*. Shown in the figure *Location of balancing device on page 285*.
16.	Refit the *retaining ring, bore*.	Shown in the figure *Location of balancing device on page 285*.
17.	Refit the *protection plug*.	Shown in the figure *Location of balancing device on page 285*.
18.	Lubricate the bearing in the ear with *grease* through the lubricating nipple, with a *grease pump*. Fill until excessive grease pierces between the shaft and the sealing spacer.	Art. no. is specified in *Required equipment on page 286*.
19.	For **Cleanroom** robots - refit the lower end of the cable harness.	Detailed in section *Replacement of cable harness, Cleanroom on page 207*.
20.	*Restore* the balancing device.	Detailed in *Restoring the balancing device on page 297*.

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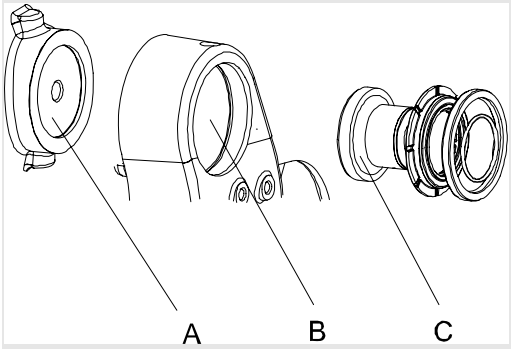
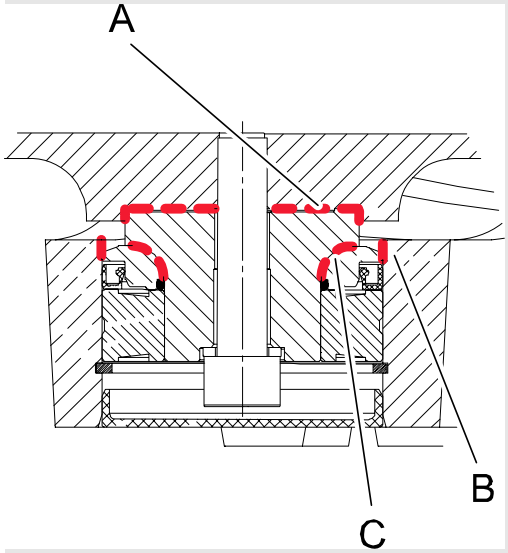
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Replacement of balancing device (Foundry prime) old and new.

Robots working with Foundry Prime and that have the special tightness for this application require special repair routines to maintain the tightness level.

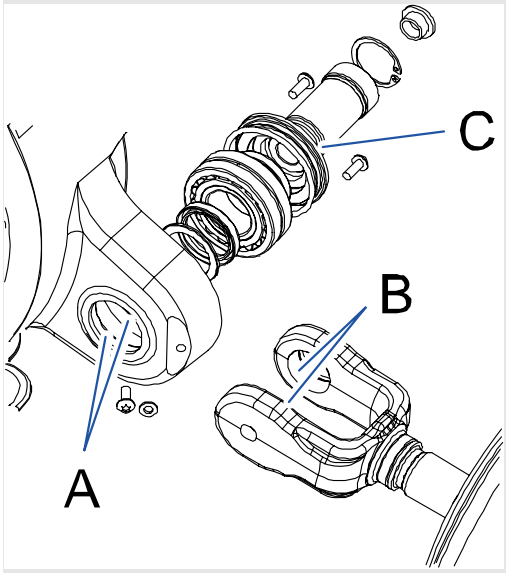
The repair must be done according to the previous repair procedures with the following additions when refitting the balancing device.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Apply Mercasol 3106 to the shafts and holes in on both sides of cradle.	 xx0700000452 Cut away view below!  xx0700000453 • A: Mercasol, surface on balancing device • B: Mercasol, hole in cradle • C: Mercasol on shaft

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	Action	Note
3.	Apply Mercasol 3106 on the following machined surfaces on the balancing device: • holes in the lower arm ear • holes in the rod bracket • shaft.	 xx0700000454 • A: Machined surfaces in lower arm ear • B: Machined surfaces in rod bracket • C: Machined surfaces on shaft
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 33*.	

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4.5.5. Unloading the balancing device (old and new)

Prerequisite

This section details how to unload the balancing device with the press tool.

The lower arm must be secured before unloading the balancing device! How to secure the lower arm is detailed in the current repair activity, for example removal of the balancing device.

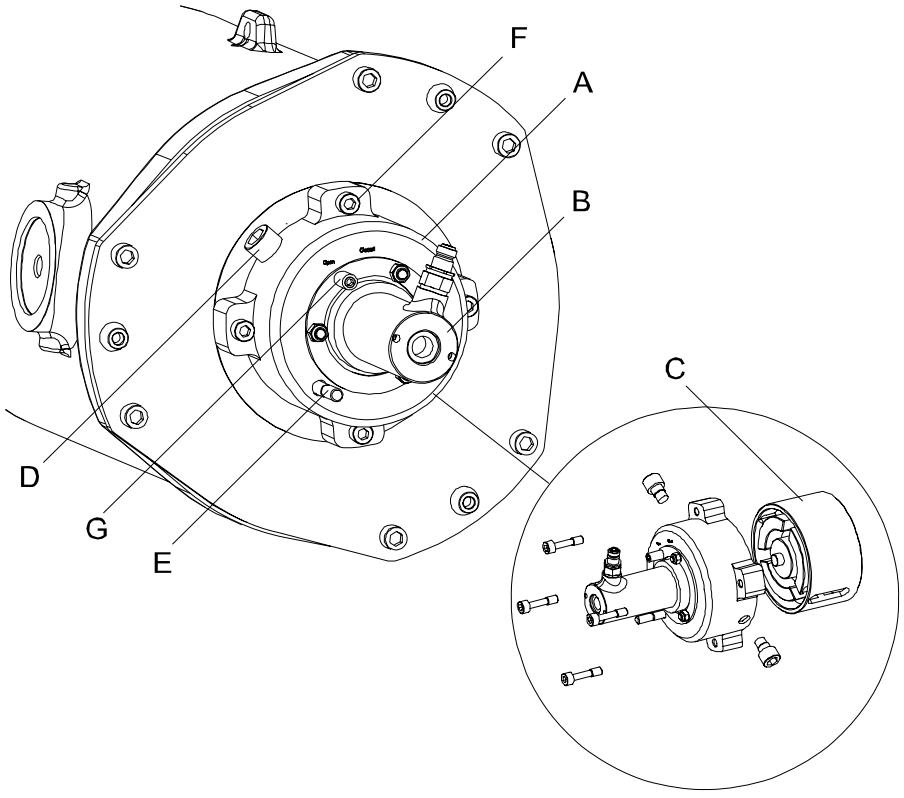
DANGER!

There is a high tensioned spring inside the balancing device, incorrect handling may cause injuries and damage property.

Press tool and hydraulic cylinder

The figure below shows the hydraulic cylinder mounted on the press tool.

The press tool includes two press devices that are used to different models of the balancing device.



xx0200000174

A	Press block
B	Hydraulic cylinder
C	Press device
D	Bolt, press device
E	Moving pin with marking
F	Bolt (4 pcs)
G	Pin, attached to the fix plate

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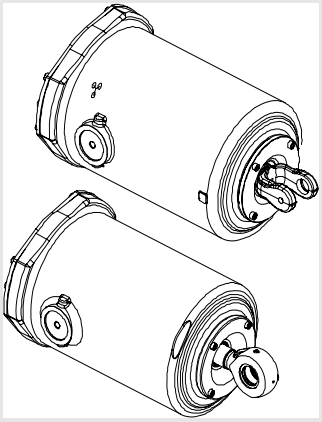
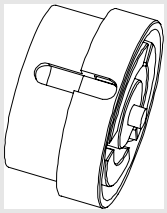
Required equipment

Equipment, etc.	Art. no.	Note
Press tool, balancing device	3HAC020902-001	Includes • press device 3HAC15767-2 • press device 3HAC18100-1 Choose the correct device, depending on model of balancing device.
Hydraulic cylinder	3HAC11731-1	To be used with the press tool.
Hydraulic pump, 80 MPa	3HAC13086-1	To be used with the hydraulic cylinder.
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.

Using the correct press device

The different designs of the balancing device require different versions of the press device, included in the complete press tool. The table below specifies which press device to use to which balancing device.

The article number of the balancing device may be found on a label at the rear of the balancing device.

Balancing device	Press device
 xx0700000475	Art. no: 3HAC15767-1  xx0300000599

Unloading the balancing device

The procedure below details how to use the press tool in order to unload the balancing device. How to remove the press tool, is detailed in section *Restoring the balancing device on page 297*.

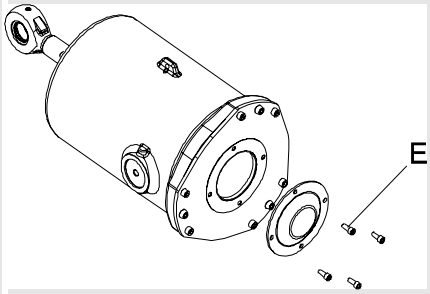
	Action	Note
1.	Fit the *moving pin* to the current press device.	Choose the correct press device, according to the table *Using the correct press device on page 295*. The moving pin is shown in the figure *Press tool and hydraulic cylinder on page 294*.

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4.5.5. Unloading the balancing device (old and new)

Continued

	Action	Note
2.	Fit the correct press device and moving pin to the press tool. Secure with the *bolt, press device.* **NOTE!** Make sure the bolt is secured properly!	Shown in the figure *Press tool and hydraulic cylinder on page 294*.
3.	Remove the *rear cover* of the balancing device, by unscrewing the *attachment screws*. **DANGER!** DO NOT! remove any other screws then the rear cover attachment screws.	 xx0700000422 • E: Rear cover attachment screws, 4 pcs
4.	Fit the *press tool* to the rear of the balancing device with enclosed *bolts.* Tighten them properly!	Art. no. is specified in *Required equipment on page 295*. See the figure *Press tool and hydraulic cylinder on page 294*.
5.	Fit the *hydraulic cylinder* to the press tool.	Art. no. is specified in *Required equipment on page 295*. See the figure *Press tool and hydraulic cylinder on page 294*.
6.	Connect the *hydraulic pump* to the cylinder.	Art. no. is specified in *Required equipment on page 295*.
7.	Increase the pressure and press until the marking on the *moving pin* indicates the correct position (in level with the pressure block).	See the figure *Press tool and hydraulic cylinder on page 294*. Do not apply more pressure than necessary, it could damage bearings and sealings at the shaft.
8.	Turn the *fix plate* to position "Closed" in order to lock the tool in loaded condition.	See the figure *Press tool and hydraulic cylinder on page 294*.
9.	Unload the hydraulic cylinder.	
10.	The hydraulic cylinder may now be removed from the tool, when necessary.	

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4.5.6. Restoring the balancing device

Overview

This section details how to restore the balancing device and how to remove the press tool from the device.

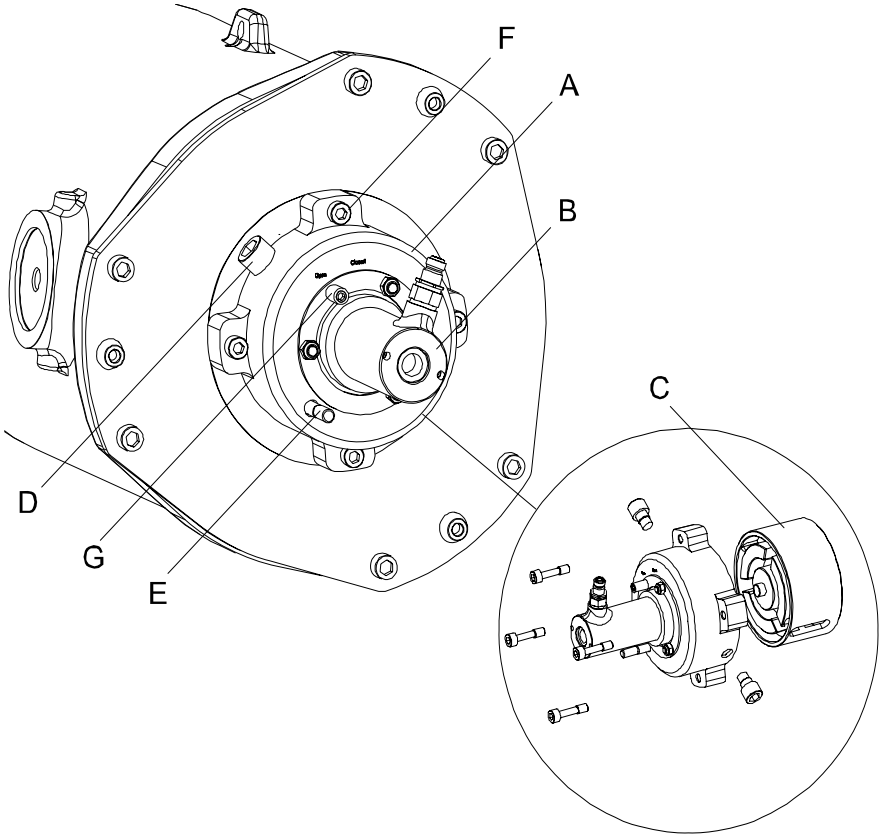
DANGER!

There is a high tensioned spring inside the balancing device, incorrect handling may cause injuries and damage property.

Press tool and hydraulic cylinder

The figure below shows the hydraulic cylinder mounted on the press tool.

The press tool includes two press devices that are used to different models of the balancing device.



xx0200000174

A	Press block
B	Hydraulic cylinder
C	Press device
D	Bolt, press device
E	Moving pin with marking
F	Bolt (4 pcs)
G	Pin, attached to the fix plate

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4.5.6. Restoring the balancing device

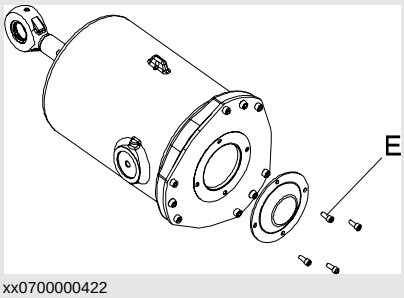
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Required equipment

Equipment, etc.	Art. no.	Note
Hydraulic cylinder	3HAC11731-1	To be used with press tool.
Hydraulic pump, 80 MPa	3HAC13086-1	To be used with hydraulic cylinder.
Brush	-	
Rust preventive	3HAC026621-001	Equivalent: • Mercasol 3106
Locking liquid	-	Loctite 577 Used to secure the attachment screws of the rear cover at the end of the balancing device.
Standard toolkit	3HAC15571-1	The content is defined in section *Standard toolkit on page 394*.

Restoring the balancing device

The procedure below details how to restore the balancing device, that is removing the press tool.

	Action	Note
1.	Refit the *hydraulic cylinder* to the press tool, in case it has been removed.	Shown in the figure *Press tool and hydraulic cylinder on page 297*.
2.	Press with the cylinder and the hydraulic pump until the *fix plate* is movable again. Turn the pin on the fix plate to position "Open".	Shown in the figure *Press tool and hydraulic cylinder on page 297*! Do not apply more pressure than necessary, it could damage bearings and sealings at the shaft.
3.	Unload the cylinder and make sure the *moving pin* indicates that the tool has returned to its starting position.	Shown in the figure *Press tool and hydraulic cylinder on page 297*!
4.	Remove the hydraulic cylinder.	
5.	Remove the press tool by unscrewing the *bolts*.	Shown in the figure *Press tool and hydraulic cylinder on page 297*!
6.	Refit the gasket to the rear of the balancing device.	
7.	Refit the rear cover to the balancing device with its attachment screws, using locking liquid.	 xx0700000422 • E: 4 pcs: M10x30, tightening torque: 50 Nm. Locking liquid is specified in *Required equipment on page 298*.

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Continued

	Action	Note
8.	 **DANGER!** The rear cover of the balancing device is a safety device for the piston rod during operation! Make sure the cover is properly secured before commissioning of the robot!	

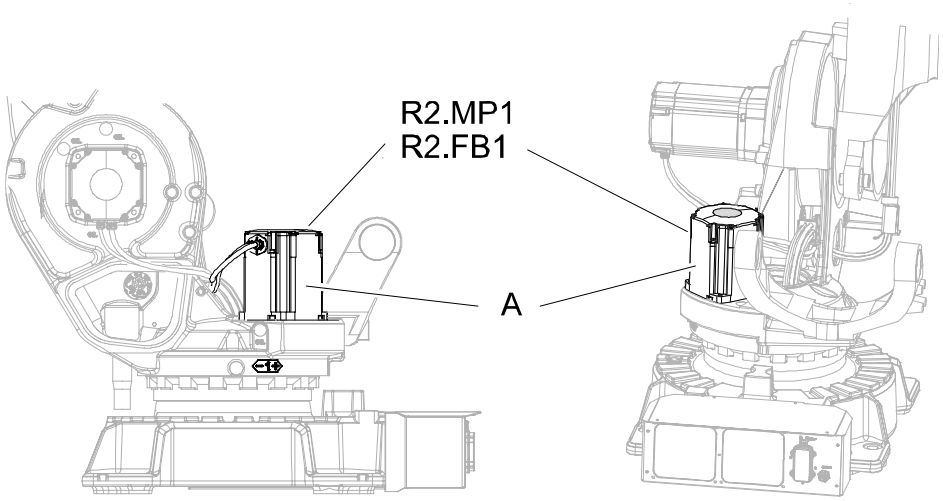
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4.6 Motors

4.6.1. Replacement of motor, axis 1

Location of motor

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



xx0700000085

A	Motor, axis 1

Required equipment

Equipment, etc.	Spare part no.	Art. no.	Note
Motor, axis 1	3HAC028477-001		Includes • motor • pinion • o-ring 21522012-430
O-ring		21522012-430	Must be replaced when reassembling motor!
Sikaflex 521FC		3HAC026759-001	Option Foundry Prime
Brush		-	Option Foundry Prime
Mercasol 3106		3HAC026621-001	Option Foundry Prime
Gasket		3HAC3438-1	Option Foundry Prime Must be replaced if the cabling is dismantled from the motor.
Grease		3HAB3537-1	Used to lubricate the o-ring.
Removal tool, motor M12x		3HAC14631-1 3HAC14631-1	Always use the removal tools in pairs!
Lifting tool, motor ax 1, 4, 5		3HAC14459-1	
Power supply		-	24 VDC, max. 1,5 A For releasing the brakes.

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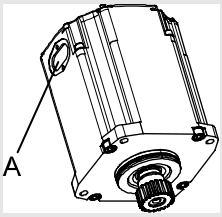
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Continued

Equipment, etc.	Spare part no.	Art. no.	Note
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.
Calibration Pendulum toolkit		3HAC15716-1	Complete kit that also includes operating manual.
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		3HAC025744-001	See chapter *Circuit diagram*.

Removal, motor axis 1

The procedure below details how to remove motor, axis 1.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Remove the cover for connector access on top of the motor by unscrewing its four attachment screws.	
3.	Remove the cable gland cover at the cable exit by unscrewing its two attachment screws. **NOTE!** Make sure the gasket is not damaged!	 xx0200000199 • A: Cable gland cover
4.	Disconnect all connectors beneath the motor cover.	
5.	Apply *lifting tool, motor axis 1, 4, 5* to the motor.	Art. no. is specified in *Required equipment on page 300*.
6.	In order to release the brakes, connect the 24 VDC power supply.	Connect to connector R2.MP1 • +: pin 2 • -: pin 5
7.	Remove the motor by unscrewing its four *attachment screws* and plain washers.	Shown in the figure *Location of motor on page 300*.

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4.6.1. Replacement of motor, axis 1

Continued

	Action	Note
8.	If required, press the motor out of position by fitting *removal tool, motor* to the motor attachment screw holes.	Art. no. is specified in *Required equipment on page 300*. Always use the removal tools in pairs!
9.	**CAUTION!** The motor weighs 25 kg! All lifting equipment used must be sized accordingly!	
10.	Lift the motor to get the pinion away from the gear and disconnect the brake release voltage.	
11.	Remove the motor by gently lifting it straight up.	

Refitting, motor axis 1

The procedure below details how to refit motor, axis 1.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Make sure the *o-ring* on the circumference of the motor is seated properly. Lightly lubricate the o-ring with *grease.*	Art no. is specified in *Required equipment on page 300*.
3.	**CAUTION!** The motor weighs 25 kg! All lifting equipment used must be sized accordingly!	
4.	Apply the *lifting tool, motor axis 1, 4, 5* to the motor.	Art no. is specified in *Required equipment on page 300*.
5.	In order to release the brake, connect the 24 VDC power supply.	Connect to connector R2.MP1 • +: pin 2 • -: pin 5
6.	Fit the motor, making sure the motor pinion is properly mated to gearbox of axis 1.	Make sure the motor is turned the correct way, that is connection of motorcable as shown in the figure-*Location of motor on page 300*. Make sure the motor pinion does not get damaged!
7.	Secure the motor with its four attachment screws and plain washers.	M10 x 40, tightening torque: 50 Nm.
8.	Disconnect the brake release voltage.	
9.	Reconnect all connectors beneath the motor cover.	

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Continued

	Action	Note
10.	Refit the cable gland cover at the cable exit with its two attachment screws.	Make sure the cover is tightly sealed!
11.	Refit the motor cover with its four attachment screws.	Make sure the cover is tightly sealed!
12.	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*.
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 33*.	

Replacement of the motor axis 1 (Foundry Prime)

Robots working with Foundry Prime and that have the special tightness for this application require special repair routines to maintain the tightness level.

The repair must be done according to the previous repair procedures with the following additions.

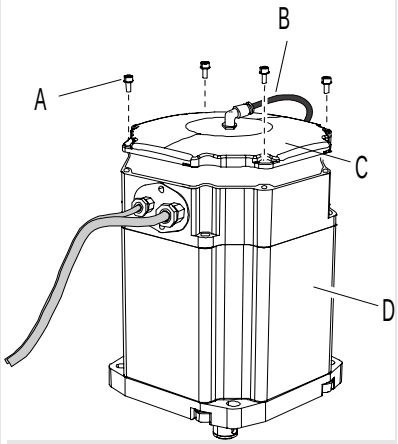
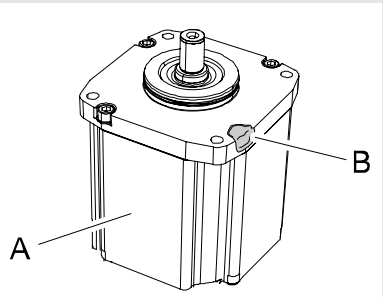
	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	

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4.6.1. Replacement of motor, axis 1

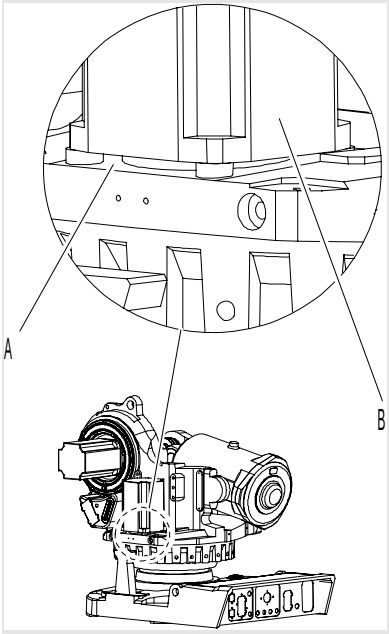
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	Action	Note
2.	Remove the cover for connector access on top of the motor by unscrewing its four attachment screws.	 xx0600002874 • A: Attachment screw • B: Air hose • C: Top cover • D: Motor unit
3.	**NOTE!** Keep the old *top cover*, with the air nipple mounted.	
4.	Remove the motor unit, according to step 5 and forwards in section *Removal, motor axis 1 on page 301*.	
5.	Fill the four screw recesses on the new motor with Sikaflex. (After hardening, Sikaflex can be formed with a knife)	 xx0600002875 • A: Motor unit • B: Sikaflex in screw recesses
6.	Continue to refit the new motor according to section, *Refitting, motor axis 1 on page 302*.	

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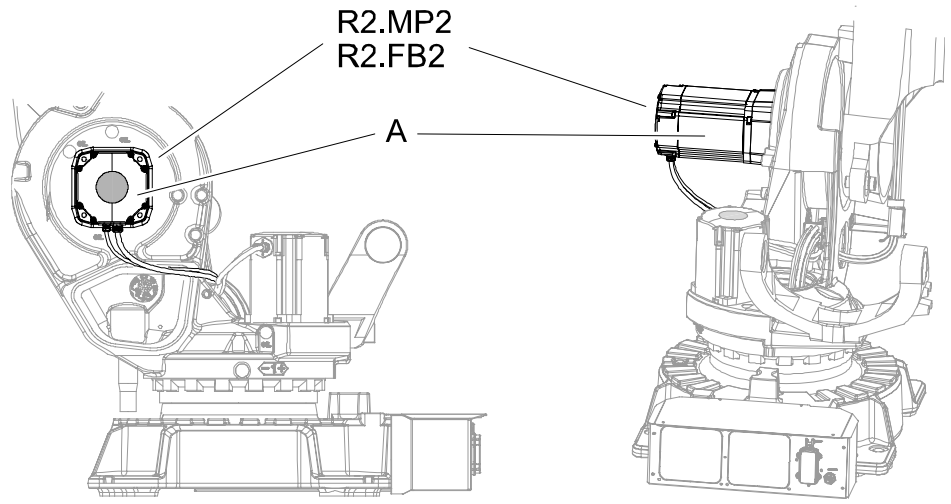
	Action	Note
7.	After mounting the motor on the robot, the surface between the motor and the base frame must be protected with Mercasol 3106.	 xx0600002877 • A: Base frame • B: Motor unit
8.	Perform a leak test according to *Inspection of air hoses (Foundry Prime) on page 138*	

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4.6.2. Replacement of motor axis 2

Location of motor

The motor, axis 2, is located on the left hand side of the robot as shown in the figure below.



xx0700000086

A	Motor, axis 2

Required equipment

Equipment, etc.	Spare part no.	Art. no.	Note
Motor including pinion	3HAC024518-003		Includes • motor • pinion • o-ring 2152 2012-430
O-ring		21522012-430	Must be replaced when reassembling motor!
Sikaflex 521FC		3HAC026759-001	Option Foundry Prime.
Gasket		3HAC3438-1	Option Foundry Prime Must be replaced if the cablling is dismantled from the motor.
Grease		3HAB3537-1	For lubricating the o-ring.
Locking screw		3HAA1001-266	M16 x 60 For securing the lower arm.
Removal tool, motor M12x		3HAC14631-1	Always use the removal tools in pairs!
Guide pins M10 x 150		3HAC15521-2	For guiding the motor. Guides are to be used in pairs!
Lifting tool, motor ax 2, 3, 4		3HAC15534-1	
Extension bar, 300 mm for bits 1/2"		3HAC12342-1	

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Continued

Equipment, etc.	Spare part no.	Art. no.	Note
Power supply		-	24 VDC, 1.5 A For releasing the brakes.
Rotation tool		3HAC17105-1	Used to rotate the motor pinion when mating it to the gear, when brakes are released with 24VDC power supply.
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.
Calibration Pendulum toolkit		3HAC15716-1	Complete kit that also includes operating manual.
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		3HAC025744-001	See chapter *Circuit diagram*.

Removal, motor

The procedure below details how to remove the motor, axis 2.

	Action	Note
1.	Move the robot to a position close enough to its calibration position, to allow the lock screw to be inserted into the*hole for lock screw* .	Shown in the figure *Location of motor on page 306*.
2.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Lock the lower arm by inserting the *lock screw* into the hole.	Art. no. and dimension is specified in *Required equipment on page 306*.
4.	Drain the oil from gearbox, axis 2.	Detailed in section *Oil change, gearbox axis 2 on page 157*.
5.	Remove the cover on top of the motor by unscrewing its four attachment screws.	
6.	Remove the *cable gland cover* at the cable exit by unscrewing its two attachment screws.	Shown in the figure *Location of motor on page 306*. Make sure the gasket is not damaged!
7.	Disconnect all connectors beneath the motor cover.	

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4.6.2. Replacement of motor axis 2

Continued

	Action	Note
8.	 **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!	Use the lock screw to lock the lower arm, as detailed above!
9.	In order to release the brake, connect the 24 VDC power supply.	Connect to connector R2.MP2 • +: pin 2 • -: pin 5
10.	Remove the motor by unscrewing its four attachment screws and plain washers.	
11.	Fit the two *guide pins* in two of the *motor attachment holes.*	Art. no. is specified in *Required equipment on page 306*. Shown in the figure *Location of motor on page 306*.
12.	If required, press the motor out of position by fitting the *removal tool, motor* to the remaining *motor attachment holes.*	Art. no. is specified in *Required equipment on page 306*. Shown in the figure *Location of motor on page 306*. Always use the removal tools in pairs!
13.	Remove the removal tools and fit the *lifting tool, motor axis 2, 3, 4* to the motor.	Art. no. is specified in *Required equipment on page 306*.
14.	Lift the motor to get the pinion away from the gear.	Make sure the motor pinion does not get damaged!
15.	Remove the motor by gently lifting it straight out and place it on a secure surface. Disconnect the brake release voltage.	

Refitting, motor

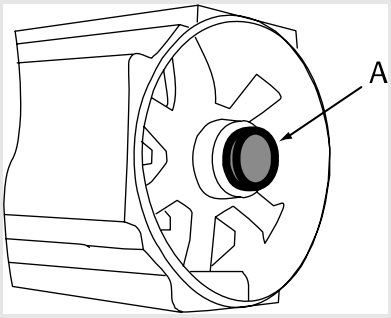
The procedure below details how to refit the motor axis 2.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Make sure the *o-ring* on the circumference of the motor is seated properly. Lightly lubricate the o-ring with *grease.*	Art. no. is specified in *Required equipment on page 306*.
3.	In order to release the brake, remove the cover on top of the motor and connect the 24 VDC power supply.	Connect to connector R2.MP2 • +: pin 2 • -: pin5

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	Action	Note
4.	Fit the *lifting tool, motor axis 2, 3, 4* to the motor.	Art. no. is specified in *Required equipment on page 306*.
5.	Fit the two *guide pins* in the two lower *motor attachment holes.*	Art. no. is specified in *Required equipment on page 306*. Shown in the figure *Location of motor on page 306*.
6.	Lift the motor and guide it on to the guide pins, as close to the correct position as possible without pushing the motor pinion into the gear. Make sure that the motor is turned the right direction, that is the cables facing downwards.	
7.	Remove the lifting tool and allow the motor to rest on the guide pins.	
8.	Use the *rotation tool* in order to rotate the motor pinion when mating it to the gear (see the figure to the right). Fit the motor, making sure the motor pinion is properly mated to the gear of gearbox axis 2 and that it doesn´t get damaged.	Art. no. is specified in *Required equipment on page 306*.  xx0200000165 The rotation tool is used beneath the motor cover, directly on the motor shaft as shown in figure above. • A: Rotation tool
9.	Remove the guide pins.	
10.	Secure the motor with four attachment screws and plain washers.	M10 x 40, tightening torque: 50 Nm. Reused screws may be used, providing they are lubricated as detailed in section *Screw joints on page 390* before fitting.
11.	Disconnect the brake release voltage.	
12.	Reconnect all connectors beneath the motor cover.	Connect in accordance with markings on connectors.
13.	Refit the *cable gland cover* at the cable exit with its two attachment screws.	Shown in the figure *Location of motor on page 306*.
14.	Refit the cover on top of the motor with its four attachment screws.	Make sure the cover is tightly sealed!
15.	Remove the lock screw from the *hole for lock screw.*	Shown in the figure *Location of motor on page 306*.
16.	Perform a leak down test.	Detailed in *Performing a leak-down test on page 188*.
17.	Refill the gearbox with oil.	Detailed in section *Oil change, gearbox axis 2 on page 157*.

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Continued

	Action	Note
18.	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*.
19.	 **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 33*.	

Replacement of the motor axis 2 (Foundry Prime)

Robots working with Foundry Prime and that have the special tightness for this application require special repair routines to maintain the tightness level.

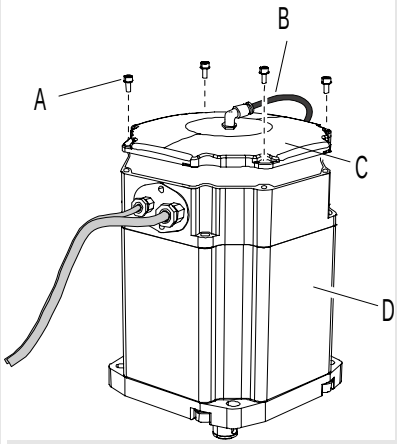
The repair must be done according to the previous repair procedures with the following additions.

	Action	Note
1.	Move the robot to a position close enough to its calibration position, to allow the lock screw to be inserted into the *hole for lock screw.*	Shown in the figure *Location of motor on page 306*.
2.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot!	
3.	Lock the lower arm by inserting the *lock screw* into the hole.	Art. no. and dimension is specified in *Required equipment on page 306*.
4.	Drain the oil from gearbox, axis 2.	Detailed in section *Oil change, gearbox axis 2 on page 157*.

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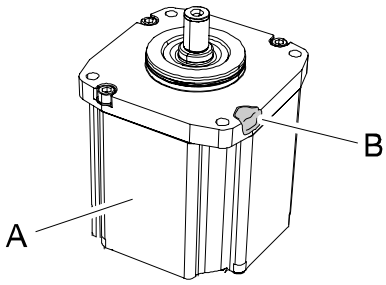
	Action	Note
5.	Remove the cover for connector access on top of the motor by unscrewing its four attachment screws.	 xx0600002874 • A: Attachment screw • B: Air hose • C: Top cover • D: Motor unit
6.	Disconnect all connectors beneath the motor cover.	
7.	**NOTE!** Keep the old *top cover* with the air nipple mounted.	
8.	**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!	
9.	After the weight of the lower arm is properly secured, continue removal of the motor unit, as detailed in section *Removal, motor on page 307*.	

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4.6.2. Replacement of motor axis 2

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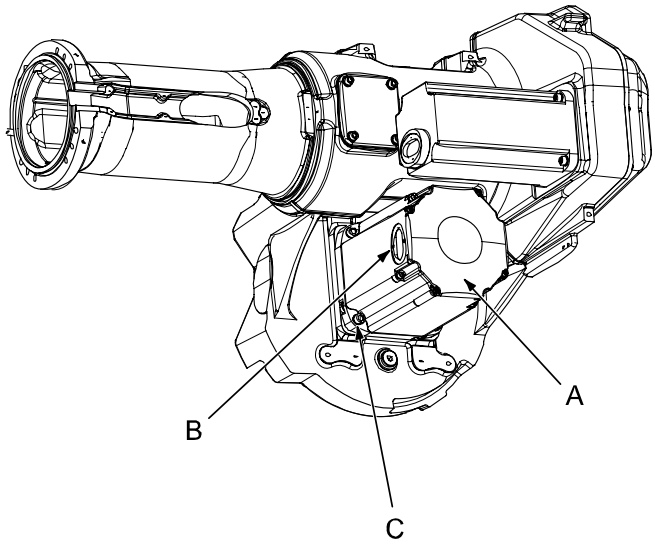
	Action	Note
10.	Fill the four screw recesses on the new motor with Sikaflex. (After hardening, Sikaflex can be formed with a knife)	 xx0600002875 • A: Motor unit • B: Sikaflex in screw recesses
11.	Continue to refit the new motor according to section, *Refitting, motor on page 308*.	
12.	Perform a leak test according to *Inspection of air hoses (Foundry Prime) on page 138*.	

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4.6.3. Replacement of motor, axis 3

Location of motor

The motor axis 3 is located on the left hand side of the robot as shown in the figure below.



xx0200000186

A	Motor axis 3
B	Cable gland cover, motor axis 3
C	Motor attachment holes (4 pcs)

Required equipment

Equipment, etc.	Spare part no.	Art. no.	Note
Motor including pinion	3HAC15885-2		Includes • motor • pinion • o-ring 21522012-430
O-ring		21522012-430	Must be replaced when reassembling motor!
Sikaflex 521FC		3HAC026759-001	Option: Foundry Prime
Gasket		3HAC3438-1	Option: Foundry Prime
Grease		3HAB3537-1	For lubricating the o-ring.
Removal tool, motor M12x		3HAC14631-1	Always use the removal tools in pairs!
Lifting tool, motor ax 2, 3, 4		3HAC15534-1	
Washers for mech stop axis 3		3HAA1001-186	
Guide pins M10 x 100		3HAC15521-1	For guiding the motor.
Guide pins M10 x 150		3HAC15521-2	For guiding the motor.

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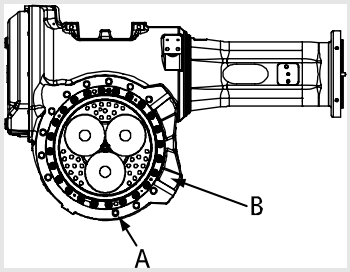
4.6.3. Replacement of motor, axis 3

Continued

Equipment, etc.	Spare part no.	Art. no.	Note
Rotation tool		3HAC17105-1	Used to rotate the motor pinion when mating it to the gear, when brakes are released with 24 VDC power supply.
Power supply		-	24 VDC, max. 1.5 A For releasing the brakes.
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.
Calibration Pendulum toolkit		3HAC15716-1	Complete kit that also includes operating manual.
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		3HAC025744-001	See chapter *Circuit diagram*.

Removal, motor

The procedure below details how to remove motor, axis 3.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Unload the upper arm of the robot by either: • Use a fork lift to rest the upper arm onto. • Use lifting slings and an overhead crane to rest the upper arm. • Use a mechanical stop to rest the upper arm. Fit the mechanical stop in the attachment hole (A) with tightening torque: 115 Nm. The upper arm must be positioned as horizontal as possible!	 xx0300000051 Fit the mechanical stop to the third and final attachment hole (A), below the fixed stop (B) in the upper arm. See the figure above!
3.	Drain the oil from gearbox axis 3.	Detailed in section *Oil change, gearbox, axis 3 on page 160*.

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Continued

	Action	Note
4.	Remove any equipment hindering access to motor axis 3.	
5.	Remove the cover on top of the motor by unscrewing its four attachment screws.	
6.	Remove the *cable gland cover* at the cable exit by unscrewing its two securing screws.	Shown in the figure *Location of motor on page 313*. Make sure the gasket is not damaged!
7.	Disconnect all connectors beneath the motor cover.	
8.	 **DANGER!** Secure the weight of the upper arm properly before releasing the brakes of motor, axis 3. When releasing the holding brakes of the motor, the upper arm will be movable and may fall down!	
9.	Release the brake by connecting the 24 VDC power supply.	Connect to connector R2.MP3 • +: pin 2 • -: pin 5
10.	Unscrew the motors four *attachment screws and plain washers* .	Shown in the figure *Location of motor on page 313*.
11.	Fit the two *guide pins* in two of the motor attachment screw holes.	Art. no. is specified in *Required equipment on page 313*.
12.	Press the motor out of position by fitting *removal tool, motor* to the remaining motor attachment screw holes.	Art. no. is specified in *Required equipment on page 313*. Always use the removal tools in pairs!
13.	Apply the *lifting tool, motor axis 2 ,3, 4* to the motor.	Art. no. is specified in *Required equipment on page 313*.
14.	 **CAUTION!** The motor weighs 27 kg! All lifting equipment used must be sized accordingly!	
15.	Lift the motor to get the pinion away from the gear.	
16.	Remove the motor by gently lifting it straight out and disconnect the brake release voltage.	Make sure the motor pinion is not damaged!

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4.6.3. Replacement of motor, axis 3

Continued

Refitting, motor

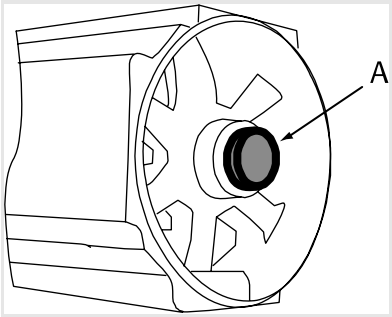
The procedure below details how to refit motor, axis 3.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Make sure the *o-ring* on the circumference of the motor is seated properly. Lightly lubricate it with *grease*.	Art no. is specified in *Required equipment on page 313*.
3.	Fit the *lifting tool, motor axis 2, 3, 4* to the motor.	Art no. is specified in *Required equipment on page 313*.
4.	Fit the two *guide pins* in the two lower *motor attachment holes.*	Art no. is specified in *Required equipment on page 313*. Shown in the figure *Location of motor on page 313*
5.	 **CAUTION!** The motor weighs 27 kg! All lifting equipment used must be sized accordingly!	
6.	Lift the motor and guide it onto the guide pins, as close to the correct position as possible without pushing the motor pinion into the gear.	
7.	Remove the lifting tool and allow the motor stay on the guide pins.	
8.	In order to release the brake, connect the 24 VDC power supply.	Connect to connector R2.MP3 • +: pin 2 • -: pin 5

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Continued

	Action	Note
9.	Use the *rotation tool* in order to rotate the motor pinion when mating it to the gear! Fit the motor, making sure the motor pinion is properly mated to the gear of gearbox, axis 3.	Art no. is specified in *Required equipment on page 313*. Make sure the motor pinion does not get damaged! Make sure the motor is turned the right direction, that is the cables facing forwards.  xx0200000165 The rotation tool is used beneath the motor cover, directly on the motor shaft as shown in figure above. • A: Rotation tool.
10.	Remove the guide pins.	
11.	Secure the motor with four attachment screws and plain washers.	4 pcs: M10 x 40, tightening torque: 50 Nm.
12.	Disconnect the brake release voltage.	
13.	Reconnect all connectors beneath the motor cover.	Connect in accordance with markings on connectors.
14.	Refit the *cable gland cover* at the cable exit with its two attachment screws.	Make sure the cover is tightly sealed! Shown in the figure *Location of motor on page 313*.
15.	Refit the cover on top of the motor with its four attachment screws.	Make sure the cover is tightly sealed!
16.	Remove the equipment used to unload the upper arm.	
17.	Perform a leak-down test.	Detailed in section *Performing a leak-down test on page 188*.
18.	Refill the gearbox with oil.	Detailed in section *Oil change, gearbox, axis 3 on page 160*.
19.	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*.

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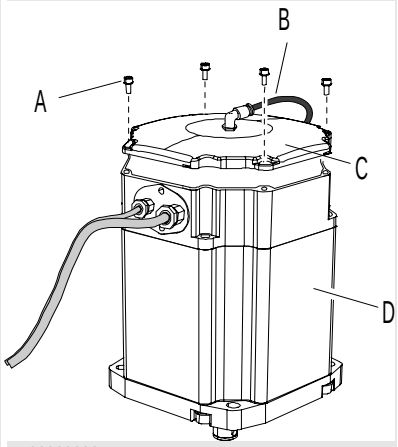
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	Action	Note
20.	**DANGER!** Make sure all safety requirements are met when performing the first test run. These are further detailed in section *DANGER - First test run may cause injury or damage! on page 33*.	

Replacement of the motor axis 3 (Foundry Prime)

Robots working with Foundry Prime and that have the special tightness for this application require special repair routines to maintain the tightness level.

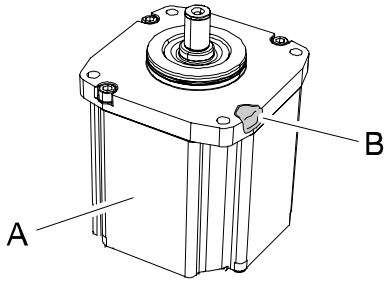
The repair must be done according to the previous repair procedures with the following additions.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Remove the motor according to step 2 - 4 in *Removal, motor on page 314*.	
3.	Remove the cover for connector access on top of the motor by unscrewing its four attachment screws.	 xx0600002874 • A: Attachment screw • B: Air hose • C: Top cover • D: Motor unit

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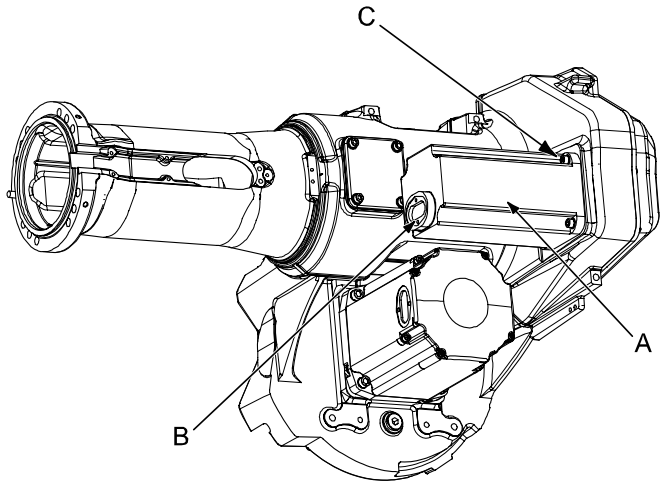
	Action	Note
4.	**NOTE!** Keep the old *top cover* with the air nipple mounted.	
5.	Continue removal of the motor unit, according to step 6 and forwards in section *Removal, motor on page 314*.	
6.	Fill the four screw recesses on the new motor with Sikaflex. (After hardening, Sikaflex can be formed with a knife)	 xx0600002875 • A: Motor unit • B: Sikaflex in screw recesses
7.	Continue to refitt the new motor according to section, *Refitting, motor on page 316*.	
8.	Perform a leak test according to *Inspection of air hoses (Foundry Prime) on page 138*.	

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4.6.4. Replacement of motor, axis 4

Location of motor

The motor axis 4 is located on the left hand side of the upper arm as shown in the figure below.



xx0200000202

A	Motor, axis 4
B	Cable gland cover, motor axis 4
C	Motor attachment holes (4 pcs)

Required equipment

Equipment, etc.	Spare part no.	Art. no.	Note
Motor including pinion	3HAC15889-2		Includes • motor • pinion • o-ring 21522012-430
O-ring		21522012-430	Must be replaced when reassembling motor!
Sikaflex 521FC		3HAC026759-001	Option Foundry Prime
Gasket		3HAC3438-1	Option Foundry Prime
Lifting tool, motor ax 1, 4, 5		3HAC14459-1	
Grease		3HAC3537-1	Used to lubricate the o-ring.
Removal tool. motor M10x		3HAC14972-1	Always use the removal tools in pairs!
Rotation tool		3HAC17105-1	Used to rotate the motor pinion when mating it to the gear, when brakes are released with 24 VDC power supply.
Power supply		-	24 VDC, max. 1,5 A For releasing the brakes.
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.

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Continued

Equipment, etc.	Spare part no.	Art. no.	Note
Calibration Pendulum toolkit		3HAC15716-1	Complete kit that also includes operating manual.
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		3HAC025744-001	See chapter *Circuit diagram*.

Removal, motor axis 4

The procedure below details how to remove the motor, axis 4.

	Action	Note
1.	Move the robot to a position where the upper arm is pointed straight up. This position enables the motor to be replaced without draining the gear oil, which in turn saves time. Any other position of the upper arm requires a draining of oil from the gearbox for axis 4.	Draining of oil is described in section *Draining, oil on page 163*.
2.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Remove the *cable gland cover* at the cable exit of the motor by unscrewing its two attachment screws.	Shown in the figure *Location of motor on page 320*. Make sure the gasket is not damaged!
4.	Remove the cover on top of the motor by unscrewing its four attachment screws.	
5.	Disconnect all connectors beneath the motor cover.	
6.	In order to release the brake, connect the 24 VDC power supply.	Connect to connector R2.MP4 • +: pin 2 • -: pin 5
7.	Unscrew the motors four *attachment screws and plain washers.*	Shown in the figure *Location of motor on page 320*.
8.	Fit the two *guide pins* in two of the motor attachment screw holes.	
9.	If required, press the motor out of position by fitting *removal tool, motor* to the motor attachment screw holes.	Art. no. is specified in *Required equipment on page 320*. Always use the removal tools in pairs!

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Continued

	Action	Note
10.	Lift the motor to get the pinion away from the gear and disconnect the brake release voltage.	
11.	Remove the motor by gently lifting it straight out.	Make sure the motor pinion is not damaged!

Refitting, motor axis 4

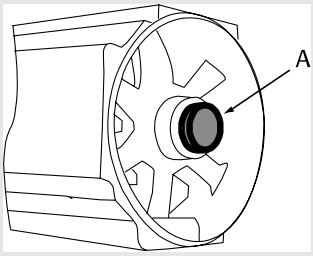
The procedure below details how to refit motor, axis 4.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Make sure the *o-ring* on the circumference of the motor is seated properly. Lightly lubricate the o-ring with *grease.*	Art. no. is specified in *Required equipment on page 320*.
3.	Fit the *lifting tool* to the motor.	Choose the correct lifting tool: • lifting tool, motor axis 1, 4 and 5, if the upper arm is positioned vertically • lifting tool, motor axis 2, 3 and 4, if the upper arm is positioned horizontally. Art. no. is specified in *Required equipment on page 320*.
4.	In order to release the brakes, connect the 24 VDC power supply.	Connect to connector R2.MP4: • +: pin 2 • -: pin 5
5.	Fit the two *guide pins* in two of the*motor attachment holes.*	Art. no. is specified in *Required equipment on page 320*. Shown in the figure *Location of motor on page 320*.
6.	Fit the motor, with guidance of the pins, making sure the motor pinion is properly mated to the gear of gearbox 4.	Make sure the motor pinion does not get damaged!

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	Action	Note
7.	Use the *rotation tool* in order to rotate the motor pinion when mating it to the gear! Fit the motor, making sure the motor pinion is properly mated to the gear, axis 4.	Art. no. is specified in *Required equipment on page 320*. Make sure the motor pinion does not get damaged! Make sure the motor is turned the right direction, that is the cables facing forwards.  xx0200000165 The rotation tool is used beneath the motor cover, directly on the motor shaft as shown in figure above. • A: Rotation tool.
8.	Remove the guide pins.	
9.	Secure the motor with four attachment screws and plain washers.	4 pcs: M8 x 25, tightening torque: 24 Nm.
10.	Disconnect the brake release voltage.	
11.	Reconnect all connectors beneath the motor cover.	
12.	Refit the cover on top of the motor with its four attachment screws.	Make sure the cover is tightly sealed!
13.	Refit the *cable gland cover* at the cable exit with its two attachment screws.	Shown in the figure *Location of motor on page 320*.
14.	Perform a leak-down test if gearbox has been drained.	Detailed in section *Performing a leak-down test on page 188*.
15.	Refill the gearbox with oil if drained.	Detailed in section *Filling, oil on page 164*.
16.	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*.
17.	 **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 33*.	

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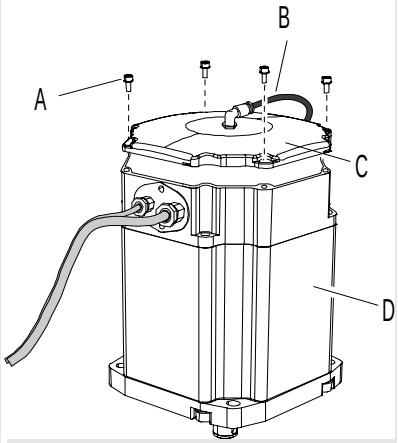
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Replacement of the motor axis 4 (Foundry Prime)

Robots working with Foundry Prime and that have the special tightness for this application require special repair routines to maintain the tightness level.

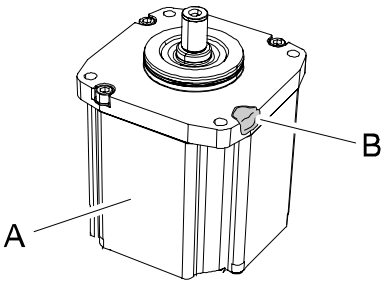
The repair must be done according to the previous repair procedures with the following additions.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Remove the cover for connector access on top of the motor by unscrewing its four attachment screws.	 xx0600002874 • A: Attachment screw • B: Air hose • C: Top cover • D: Motor unit
3.	**NOTE!** Keep the old *top cover* with the air nipple mounted.	
4.	Remove the motor unit, according to step 4 to 12 in section *Removal, motor axis 4 on page 321*.	

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	Action	Note
5.	Fill the four screw recesses on the new motor with Sikaflex. (After hardening, Sikaflex can be formed with a knife)	 xx0600002875 • A: Motor unit • B: Sikaflex in screw recesses
6.	Continue to refit the new motor according to section, *Refitting, motor axis 4 on page 322*.	
7.	Perform a leak test according to *Inspection of air hoses (Foundry Prime) on page 138*.	

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4.6.5. Replacement of motor, axis 5. IRB 6640

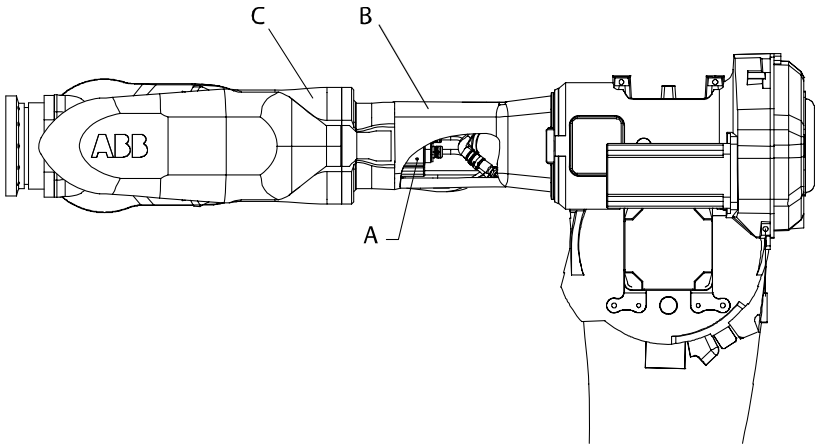
Reused pinion

The pinion in the motor, axis 5, is matched with the beveral gear for axis 5. When the motor is replaced the pinion must therefore be removed from the dismounted motor and fitted onto the new motor shaft as detailed in this section.

Location of motor

The motor axis 5 is located inside the upper arm tube, but attached to the wrist unit, as shown in the figure below.

A more detailed view of the component and its position may be found in chapter *Upper arm including wrist unit, motors ax. 3- 6 (IRB 6640 and IRB 6640ID) on page 409* .



xx0200000204

A	Motor, axis 5
B	Upper arm tube
C	Wrist unit

Required equipment

Equipment, etc.	Spare part no.	Art. no.	Note
Motor	3HAC17484-10		Does not include pinion. Use the pinion from the motor to be replaced. Includes o-ring 21522012-430.
Set of shim, motor		3HAC7941-28	Used to obtain the correct distance between motor flange and outer surface of motor pinion.
O-ring		21522012-430	Must be replaced when reassembling motor!
Sikaflex 521FC		3HAC026759-001	Option Foundry Prime
Brush		-	Option Foundry Prime
Mercasol 3106		3HAC026620-001	Option Foundry Prime

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Continued

Equipment, etc.	Spare part no.	Art. no.	Note
Gasket		3HAC3438-1	Option Foundry Prime Must be replaced if the cabling is dismantled from the motor.
Grease		3HAC3537-1	For lubricating the o-ring.
Isopropanol		11771012-208	For cleaning motor pinion and motor pinion hole.
Mineral oil		CS 320	For lubrication of pinion shaft and pinion hole.
Removal tool, motor M10x		3HAC14972-1	Always use the removal tools in pairs!
Oil injector / max 500 MPa		3HAC021590-001	For pressing out the pinion, motor 5.
Motor press pinion		3HAC021883-001	For pressing the pinion on to the new motor.
Measuring tool		6896134-GN	
Guide pins M8 x 100		3HAC15520-1	For guiding the motor.
Guide pins M8 x 150		3HAC15520-2	For guiding the motor.
Power supply		-	24 VDC, 1.5 A For releasing the brakes.
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.
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		3HAC025744-001	See chapter *Circuit diagram*.

Removal, motor, axis 5

The procedure below details how to remove motor, axis 5.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Drain the oil from gearbox axis 5.	Detailed in section *Oil change, gearbox, axis 5 on page 166*.
3.	Remove the wrist unit.	Detailed in section *Removal, wrist unit on page 253*.

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	Action	Note
4.	Place the wrist unit safely on a workbench, in a fixture or similar.	
5.	Remove the cover on top of the motor by unscrewing its four attachment screws.	
6.	Remove the cable gland cover at the cable exit by unscrewing its two attachment screws.	
7.	Disconnect all connectors beneath the motor cover and remove theseparate cable of the axis 5 motor.	
8.	In order to release the brake, connect the 24 VDC power supply.	Connect to either: - connector R4.MP5 (in the motor): • + : pin 2 • - : pin 5 - connector R3.MP5 (on the separate cable, if not removed): • +: pin C • -: pin D
9.	Remove the motor by unscrewing its four attachment screws and plain washers.	
10.	Fit the two *guide pins* in two of the motor attachment screw holes.	Art. no. is specified in *Required equipment on page 326*.
11.	If required, press the motor out of position by fitting *removal tool, motor, M10* to the motor attachment screw holes.	Art. no. is specified in *Required equipment on page 326*. Always use the removal tools in pairs and diagonally!
12.	Lift the motor to get the pinion away from the gear and disconnect the brake release voltage.	Make sure the motor pinion is not damaged!
13.	Remove the motor by gently lifting it straight out.	Keep track of the shims between the motor flange and the wrist housing.
14.	Measure the distance between the motor flange, included eventual shims, and the outer surface of the pinion, with *measuring tool.*	Art. no. is specified in *Required equipment on page 326*. Make a note of the distance.
15.	Press out the pinion from the dismounted motor, with the equipment included in the *oil injector* kit.  **NOTE!** If the pinion is damaged the complete wrist unit must be replaced!	Replacing the complete wrist unit is detailed in section *Replacement of complete wrist unit on page 252*. Art. no. is specified in *Required equipment on page 326*.

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Refitting, motor, axis 5

The procedure below details how to refit motor, axis 5.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Make sure the *o-ring* on the circumference of the motor is seated properly. Lightly lubricate the *o-ring* with *grease.*	Art. no. is specified in *Required equipment on page 326*.
3.	Clean the pinion and the pinion hole in the motor, with *isopropanol.* **NOTE!** If the pinion is damaged the complete wrist unit must be replaced!	Art. no. is specified in *Required equipment on page 326*. Replacing the complete wrist unit is detailed in section *Replacement of complete wrist unit on page 252*.
4.	Apply a thin film of *mineral oil* to the pinion shaft and the pinion hole in order to make the pinion run smoothly and to achieve an even friction torque when assembling the pinion.	Art. no. is specified in *Required equipment on page 326*.
5.	Place the motor and pinion in the *press fixture*.	Art. no. is specified in *Required equipment on page 326*.
6.	Press the pinion onto the new motor and check the pressing force. For an axis diameter of 15.5 mm, use min. pressing force: 18.5 kN and max. pressing force: 39.5 kN.	If the pressing force is outside the given range or if the pinion "jumps" in bit by bit, it must be dismounted, checked, cleaned and oiled before it is assembled once again!
7.	Measure the distance between the motor flange and the outer surface of the pinion with the *measuring tool.* Modify the distance with *shims* in order to obtain the same distance as measured when dismounting the old motor (+ 0-0,05 mm).	Art. no. is specified in *Required equipment on page 326*.
8.	In order to release the brake, connect the 24 VDC power supply.	Connect to either: - connector R4.MP5 (in the motor): • +: pin 2 • -: pin 5 - connector R3.MP5 (on the separate cable, if not removed): • +: pin C • - : pin D
9.	Fit the two *guide pins* in two of the motor attachment holes.	Art. no. is specified in *Required equipment on page 326*.

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	Action	Note
10.	Fit the motor, with guidance from the pins, making sure the motor pinion is properly mated to the gear of axis 5.	Make sure the motor pinion does not get damaged!
11.	Secure the motor with four attachment screws and plain washers.	4 pcs: M8 x 25; tightening torque: 24 Nm.
12.	Disconnect the brake release voltage.	
13.	Refit theseparate cable of the axis 5 motor and reconnect all connectors beneath the motor cover.	
14.	Refit the cable gland cover at the cable exit with its two attachment screws.	
15.	Refit the cover on top of the motor with its four attachment screws.	Make sure the cover is tightly sealed!
16.	Perform a leak-down test.	Detailed in section *Performing a leak-down test on page 188*.
17.	Refit the wrist unit.	Detailed in section *Refitting, wrist unit on page 254*.
18.	Refill the gear with oil.	Detailed in section *Oil change, gearbox, axis 5 on page 166*.
19.	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*.
20.	**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 33*.	

Replacement of the motor axis 5 (Foundry Prime)

Robots working with Foundry Prime and that have the special tightness for this application require special repair routines to maintain the tightness level.

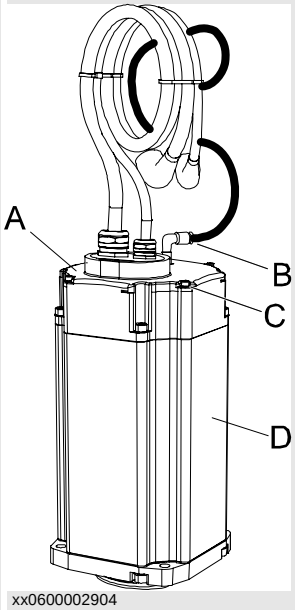
The repair must be done according to the previous repair procedures with the following additions.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	

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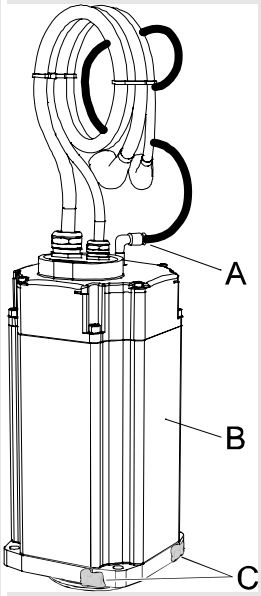
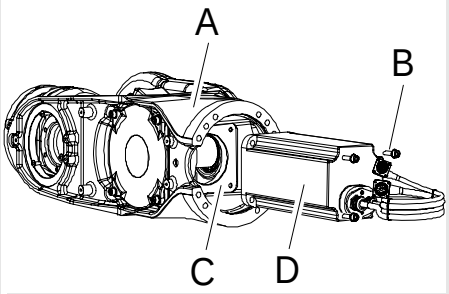
	Action	Note
2.	Perform step 2 - 4 in *Removal, motor, axis 5 on page 327*	
3.	Remove the cover for connector access on top of the motor by unscrewing its four attachment screws.	 xx0600002904 • A: Attachment screw • B: Air hose • C: Top cover • D: Motor unit
4.	**NOTE!** Keep the old *top cover* with air nipple mounted.	
5.	Disconnect all connectors beneath the motor cover and remove the separate cable of the axis 5 motor.	
6.	Continue to remove the motor unit, according to step 8 and forwards in section *Removal, motor, axis 5 on page 327*.	

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4.6.5. Replacement of motor, axis 5. IRB 6640

Continued

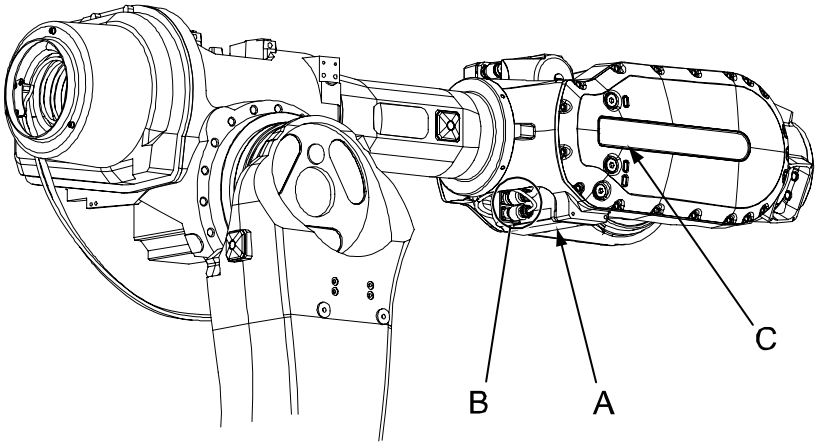
	Action	Note
7.	Fill the four screw recesses on the new motor with Sikaflex. (After hardening, Sikaflex can be formed with a knife)	 xx0600002880 • A: Air hose • B: Motor unit • C: Sikaflex in screw recesses
8.	Continue to refit the new motor according to section, *Refitting, motor axis 1 on page 302*.	
9.	After mounting the motor in the wrist, the surface between the motor and the wrist must be protected with Mercasol 3106.	 xx0600002879 • A: Wrist unit • B: Attachment screw (4 pcs) • C: Surface to protect with Mercasol • D: Motor unit
10.	Perform a leak test according to *Inspection of air hoses (Foundry Prime) on page 138*.	

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4.6.6. Replacement of motor, axis 5, IRB 6640ID

Location of motor, axis 5

The motor of axis 5 is located on the bottom side of the wrist, when axis 4 is placed in calibration position.



xx0500001573

A	Motor, axis 5
B	Motor connectors, R3.MP5 and R3.FB5
C	Wrist side with the axis 5 gearbox

Required equipment

Equipment	Spare part no.	Art. no.	Note
Motor including pinion	3HAC023745-003		Includes o-ring 3HAB 3772-22.
Grease		3HAB 3537-1	For lubricating the o-ring.
Power supply		-	24 VDC, 1.5A For releasing the brakes.
Allen key and socket		-	A specific length is required for accessing the attachment screws of the motor. The dimensions are shown in the figure *Removal tools, motor attachment screws on page 334*.
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.
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*.

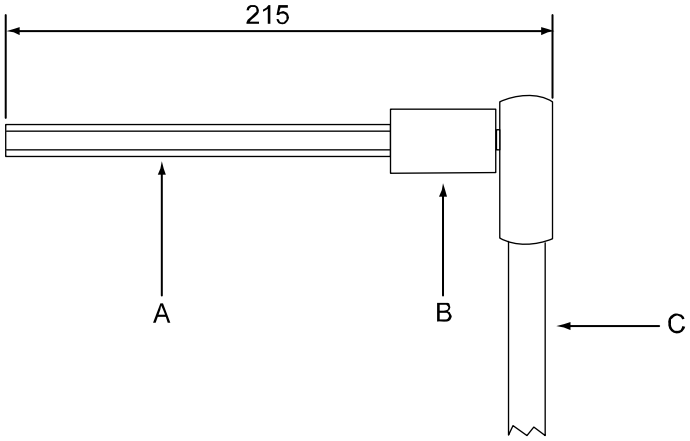
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Continued

Removal tools, motor attachment screws

The figure below shows the required dimensions of the tools, in order to access the attachment screws of the motor.



xx0500002271

A	Allen key, Ø 6 mm
B	Socket, Ø 12 mm
C	Torque wrench

Removal, motor axis 5

The procedure below details how to remove the motor, axis 5.

	Action	Note
1.	Move axis 4 +90º so that the gearbox of axis 5 is faced downwards. This makes it possible to remove the motor without draining the gearbox oil.	
2.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Disconnect the *motor connectors* from the axis 5 motor.	Shown in the figure *Location of motor, axis 5 on page 333*.
4.	In order to release the brakes, connect the 24 VDC power supply to the motor.	Connect to connector R3.MP5: • + : pin C • - : pin D
5.	Remove the three attachment screws of the motor.	Dimensions of the tools are specified in the figure *Removal tools, motor attachment screws on page 334*.
6.	Remove the motor by gently lifting it straight out. Lift carefully to get the pinion away from the gear.	
7.	Disconnect the brake release voltage.	

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Refitting, motor axis 5

The procedure below details how to refit the motor, axis 5.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Make sure the *o-ring* on the circumference of the *motor* is seated properly. Replace it if damaged. Lightly lubricate the o-ring with *grease*.	Article numbers are specified in *Required equipment on page 333*.
3.	In order to release the brakes, connect the 24 VDC power supply to the motor.	Connect to connector R3.MP5: • + : pin C • - : pin D
4.	Fit the motor, making sure the motor pinion is properly mated to the gear of axis 5.	
5.	Secure the motor with the three attachment screws and washers.	3 pcs: M8x25. Tightening torque: 24 Nm. Dimensions of the tools are specified in the figure *Removal tools, motor attachment screws on page 334*.
6.	Disconnect the brake release and reconnect the *motor connectors*.	Shown in the figure *Location of motor, axis 5 on page 333*.
7.	Perform a leak-down test.	Detailed in section *Performing a leak-down test on page 188*.
8.	Refill the axis 5 gearbox with oil, if previously drained.	Filling is detailed in section *Filling, oil, axis 5 on page 167*.
9.	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*.
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 33*.	

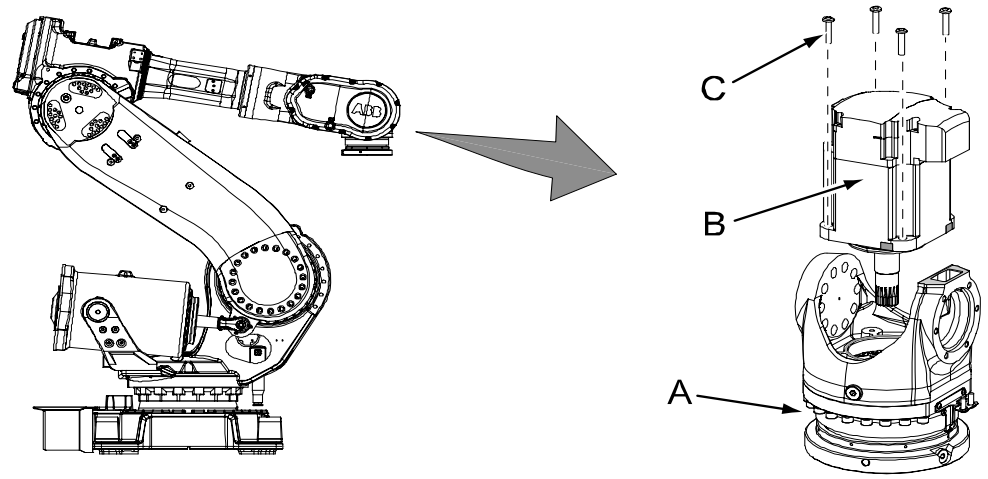
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4.6.7. Replacement of motor, axis 6, IRB 6640, IRB 6620/Foundry Plus

Location of motor

The motor axis 6 is located in the center of the wrist unit as shown in the figure below.

A more detailed view of the component and its position may be found in chapter *Upper arm including wrist unit, motors ax. 3- 6 (IRB 6640 and IRB 6640ID) on page 409* .



xx0700000126

A	Gearbox, axis 6
B	Motor, axis 6
C	Attachment screws (4 pcs)

Required equipment

Equipment, etc.	Spare part no.	Art. no.	Note
Motor including pinion	3HAC15991-4		Includes: • motor • pinion • o-ring 21522012-430
O-ring		21522012-430	Must be replaced when reassembling motor!
Brush		-	Option Foundry Prime
Mercasol 3106	3HAC026621-001		Option Foundry Prime
Sikaflex 521FC	3HAC026759-001		Option Foundry Prime
Loctite 574			
Loctite 480			
Gasket	3HAC12877-1		Must be replaced when replacing motor
Removal tool, motor M10x		3HAC14972-1	Always use the removal tools in pairs!
Guide pins M8 x 100		3HAC15520-1	For guiding the motor.
Guide pins M8 x 150		3HAC15520-2	For guiding the motor.
Power supply		-	24 VDC, 1.5 A For releasing the brakes.

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Continued

Equipment, etc.	Spare part no.	Art. no.	Note
Grease		3HAB3537-1	For lubricating the o-ring.
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.
Calibration Pendulum toolkit		3HAC15716-1	Complete kit that also includes operating manual.
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		3HAC025744-001	See chapter *Circuit diagram*.

Removal, motor

The procedure below details how to remove the motor, axis 6.

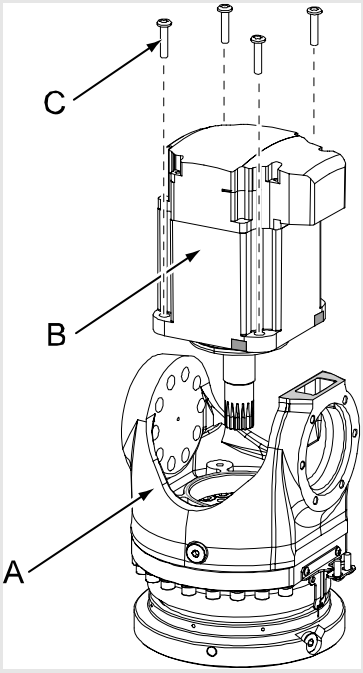
	Action	Note
1.	Move the robot to a position where the motor in axis 6 is pointed straight up. This position enables the motor to be replaced without draining the gear oil, which in turn saves time.	Shown in the figure *Location of motor on page 336*.
2.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Remove the rear motor cover by unscrewing the five attachment screws.	
4.	Disconnect all connectors beneath the cover.	
5.	In order to release the brake, connect the 24 VDC power supply.	Connect to connector R3.MP6 • +: pin 2 • -: pin 5

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4.6.7. Replacement of motor, axis 6, IRB 6640, IRB 6620/Foundry Plus

Continued

	Action	Note
6.	Remove the motor by unscrewing its four attachment screws and plain washers.	 xx0600003038 • A: Tilthouse • B: Motor, axis 6 • C: Attachment screws (4 pcs)
7.	If required, press the motor out of position by fitting *removal tool, motor* to the motor attachment screw holes.	Art. no. is specified in *Required equipment on page 336*. Always use the removal tools in pairs!
8.	Lift the motor carefully to get the pinion away from the gear and disconnect the brake release voltage.	Make sure the motor pinion is not damaged!
9.	Remove the motor by gently lifting it straight out.	

Refitting, motor

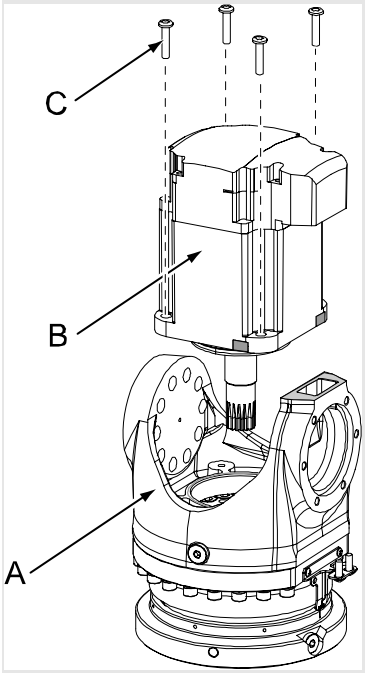
The procedure below details how to refit motor, axis 6.

	Action	Note
1.	Make sure the *o-ring* on the circumference of the motor is seated properly. Lightly lubricate the o-ring with *grease*.	Art. no. is specified in *Required equipment on page 336*.
2.	In order to release the brake, connect the 24 VDC power supply.	Connect to connector R3.MP6 • +: pin 2 • -: pin 5
3.	Fit the two *guide pins* in two of the motor attachment holes.	Art. no. is specified in *Required equipment on page 336*.

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Continued

	Action	Note
4.	Fit the motor, with guidance from the pins, making sure the motor pinion is properly mated to the gear of gearbox, axis 6.	Make sure the pinion on the motor shaft is not damaged!  xx0600003038 • A: Tilthouse • B: Motor, axis 6 • C: Attachment screws
5.	Remove the guide pins.	
6.	Secure the motor with its four attachment screws and plain washers.	4 pcs: M8 x 25, tightening torque: 24 Nm.
7.	Disconnect the brake release voltage.	
8.	Reconnect all connectors beneath the motor cover.	
9.	Refit the cover on top of the motor with its five attachment screws.	Make sure the cover is tightly sealed!
10.	**NOTE!** On Foundry Prime robots: When changing motor, keep the cover from the old motor.	
11.	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*.

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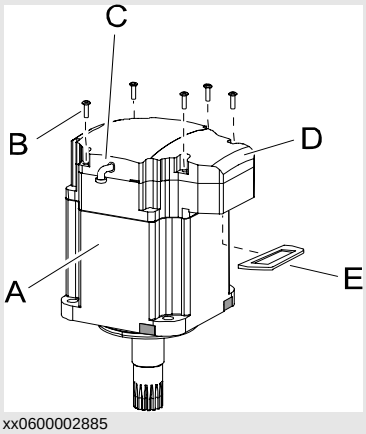
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	Action	Note
12.	**DANGER!** Make sure all safety requirements are met when performing the first test run. These are further detailed in section *DANGER - First test run may cause injury or damage! on page 33*.	

Replacement of the motor axis 6 (Foundry Prime)

Robots working with Foundry Prime and that have the special tightness for this application require special repair routines to maintain the tightness level.

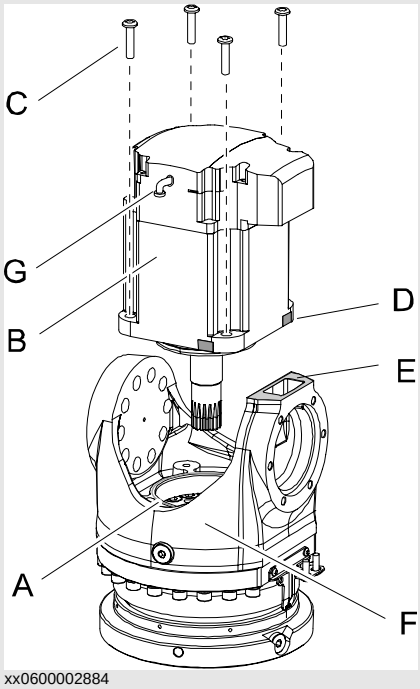
The repair must be done according to the previous repair procedure with the following additions.

	Action	Note
1.	Move the robot to a position where the motor in axis 6 is pointed straight up. This position enables the motor to be replaced without draining the gear oil, which in turn saves time.	
2.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Remove the rear motor cover by unscrewing the five attachment screws.	 xx0600002885 • A: Motor unit • B: Attachment screw (5 pcs) • C: Air nipple • D: Rear motor cover • E: Gasket • G: Air nipple

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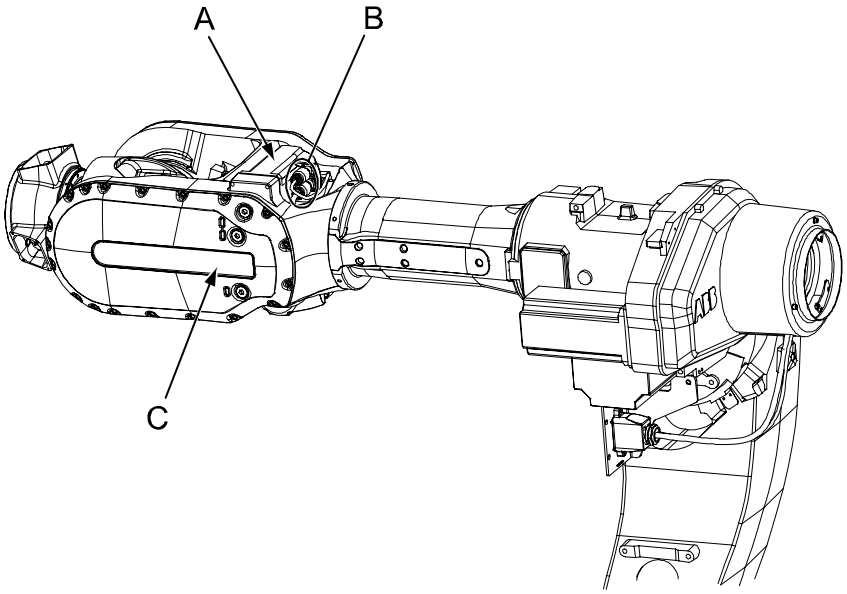
	Action	Note
4.	Continue to remove the motor unit, according to step 6 and forwards in *Removal, motor on page 337*.	
5.	**NOTE!** Keep the old *rear motor cover* with the air nipple.	
6.	Fill the four screw recesses on the new motor with Sikaflex. (After hardening, Sikaflex can be formed with a knife)	 xx0600002884 • A: Mercasol 3106 • B: Motor unit • C: Attachment screw (4pcs) • D: Sikaflex in screw recesses • E: Loctite 570 • F: Tilt house
7.	Apply Mercasol 3106 on the surface between *tilt house* and *motor* (pinion side), and Loctite 570 between *gasket* and tilt house.	
8.	Continue to refit the new motor according to section, *Refitting, motor on page 338*.	
9.	Perform a leak test according to *Inspection of air hoses (Foundry Prime) on page 138*	

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4.6.8. Replacement of motor, axis 6, IRB 6640ID

Location of motor, axis 6

The motor of axis 6 is located on top of the wrist, when axis 4 is placed in calibration position.



xx0500001574

A	Motor, axis 6
B	Motor connectors, R3.MP6 and R3.FB6
C	Wrist side with axis 6 gearbox inside

Required equipment

Equipment	Spare part no.	Art. no.	Note
Motor including pinion	3HAC023746-003		Includes o-ring 3HAB 3772-22.
Grease		3HAB 3537-1	For lubricating the o-ring.
Power supply		-	24 VDC, 1.5 A For releasing the brakes.
Allen key and socket		-	A specific length is required for accessing the attachment screws of the motor. The dimensions are shown in the figure *Removal tools, motor attachment screws on page 334*.
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.
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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Continued

Equipment	Spare part no.	Art. no.	Note
Circuit diagram		-	See chapter *Circuit diagram* in the *Product manual, reference information*.

Removal, motor axis 6

The procedure below details how to remove the motor, axis 6.

	Action	Note
1.	Move axis 4 -90º so that the axis 6 gearbox is facing downwards. This enables the motor to be replaced without draining the gearbox oil from axis 6.	
2.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Disconnect the *motor connectors*.	Shown in the figure *Location of motor, axis 6 on page 342*.
4.	In order to release the brakes, connect the 24 VDC power supply to the motor.	Connect to connector R3.MP6: • + : pin C • - : pin D
5.	Unfasten the motor by unscrewing its three attachment screws and washers.	Dimensions of the tools are specified in the figure *Removal tools, motor attachment screws on page 334*.
6.	Remove the motor by gently lifting it straight out. Lift carefully to get the pinion away from the gear.	
7.	Disconnect the brake release voltage.	

Refitting, motor axis 6

The procedure below details how to refit the motor, axis 6.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Make sure the *o-ring* on the circumference of the *motor* is seated properly. Ligthly lubricate with *grease*.	The article numbers are specified in *Required equipment on page 342*.

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4.6.8. Replacement of motor, axis 6, IRB 6640ID

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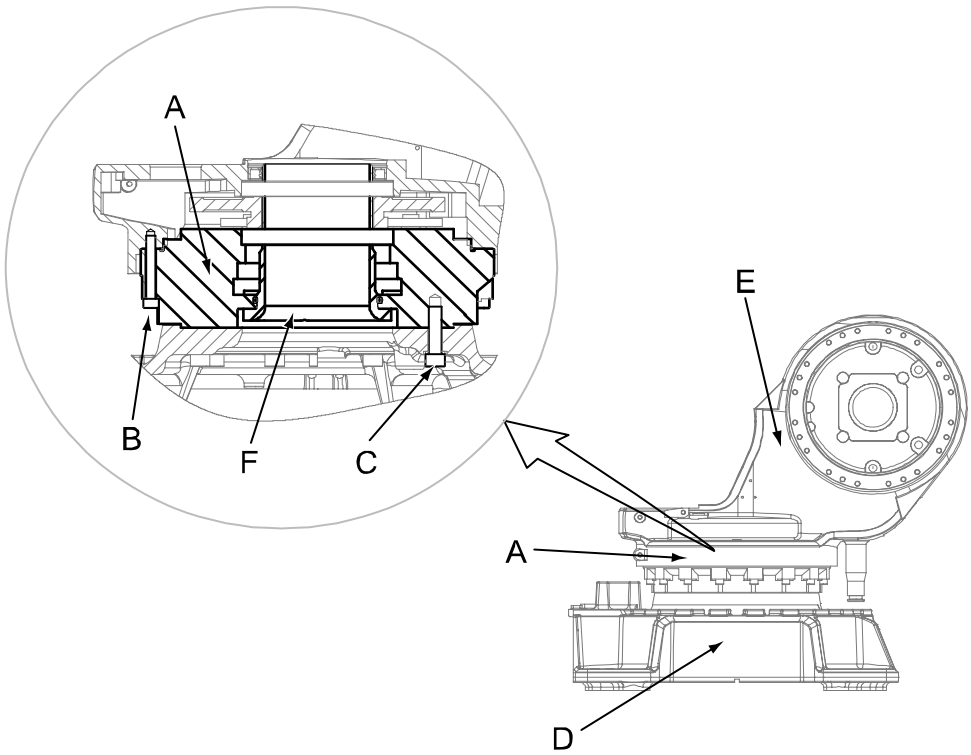
	Action	Note
3.	In order to release the brakes, connect the 24 VDC power supply to the motor.	Connect to connector R3.MP6: • + : pin C • - : pin D
4.	Fit the motor, making sure the motor pinion is properly mated into the gear of axis 6.	
5.	Secure the motor with its three attachment screws and washers.	3 pcs, M8x25. Tightening torque: 24 Nm. Dimensions of the tools are specified in the figure *Removal tools, motor attachment screws on page 334*.
6.	Disconnect the brake release voltage.	
7.	Reconnect the motor connectors.	Shown in the figure *Location of motor, axis 6 on page 342*.
8.	Perform a leak-down test.	Detailed in section *Performing a leak-down test on page 188*.
9.	Refill the axis 6 gearbox with oil, if previously drained.	Detailed in section *Filling, oil, axis 6 on page 171*.
10.	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*.
11.	 **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 33*.	

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4.7 Gearboxes

4.7.1. Replacement gearbox axis 1

Location of gearbox axis 1



xx0600003068

A	Gearbox, axis 1 RV 320C-191.35
B	Attachment screw, M12x80 quality 12.9 gleitmo (16 pcs)
C	Attachment screw, M16x60 quality 12.9 gleitmo (12 pcs)
D	Base
E	Frame
F	Cable guide

Required equipment

Equipment, etc.	Spare part no.	Art. no.	Note
Gearbox, axis 1		3HAC026114-001	Includes: • gearbox • o-ring
O-ring		3HAB3772-93	Replace only when damaged.
Support, base and gear axis 1		3HAC15535-1	Consists of 4 pcs.
Guide pins			Always use guiding pins in pairs.

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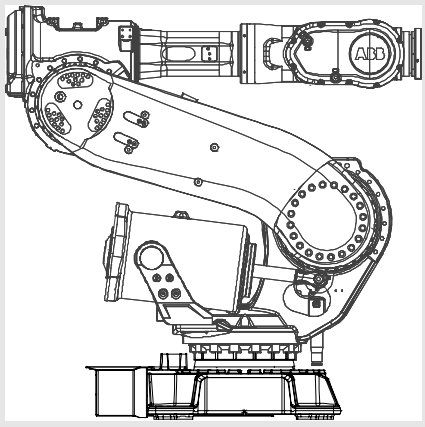
4.7.1. Replacement gearbox axis 1

Continued

Equipment, etc.	Spare part no.	Art. no.	Note
Lifting tool		3HAC026597-001	Instruction 3HAC026600-002 is enclosed.
Lifting tool		3HAC15556-1	Used to lift gearbox axis 1 and frame.
Lifting eye (2 pcs)		3HAC025333-005	Used together with lifting tool 3HAC15556-1.
Grease		3HAB3537-1	For lubricating o-rings.
Brush		-	Option Foundry Prime
Rust preventive	3HAC026621-001		Option Foundry Prime Equivalent: • Mercasol 3106
Standard tools		-	The content is defined in section *Standard toolkit on page 394*.
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.

Removal

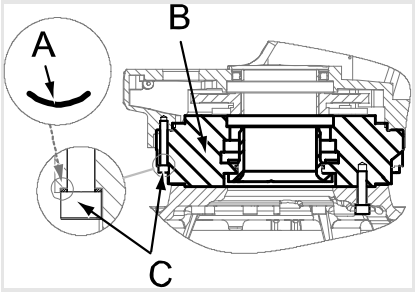
The procedure below details how to remove the gearbox axis 1.

	Action	Note
1.	Move the robot to the position shown in the figure to the right.	 xx0700000351
2.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Drain the oil from gearbox axis 1.	Detailed in section *Oil change, gearbox axis 1 on page 154*.

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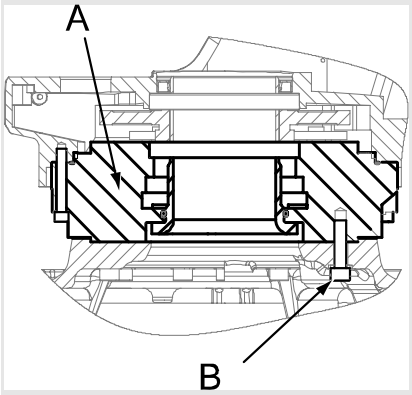
	Action	Note
4.	Remove motor, axis 1.	Detailed in section *Replacement of motor, axis 1 on page 300*.
5.	Remove the lower end of thecable harness. Secure the cable harness to the robot in a safe way, that it will not be damaged in the continued removal procedure. **NOTE!** For Cleanroom robots the procedure is detailed in section *Replacement of cable harness, Cleanroom on page 207*.	Detailed in section *Replacement of cable harness, axes 1-6 on page 193*.
6.	Remove the complete armsystem.	Detailed in section *Replacement of complete arm system on page 234*.
7.	Remove the attachment screws and serrated lock washers securing the gearbox axis 1 to the frame.	 xx0600003070 • A: Serrated lock washer • B: Gearbox, axis 1 • C: Attachment screw, M12x80
8.	Lift the robot (without the base) and put it safely on its side on the floor.	
9.	Remove the robot´s attachments screws in order to unfasten the base from the foundation.	Detailed in section *Orienting and securing the robot on page 68*.
10.	Fit two *lifting eyes* on each side of the gearbox and secure it with a roundsling.	Art. no. is specified in *Required equipment on page 345*.
11.	Attach the *lifting tool* to the gearbox.	Art. no. is specified in *Required equipment on page 345*.
12.	**CAUTION!** The complete gearbox unit and base weighs 241 kg together! (Base: 133 kg, gearbox unit: 108 kg.) All lifting equipment used must be sized accordingly!	
13.	Lift the robot base with gearbox axis 1, to allow fitting the *support, base and gear axis 1* on each side of the base.	Art. no. is specified in *Required equipment on page 345*.

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4.7.1. Replacement gearbox axis 1

Continued

	Action	Note
14.	Fit the support, base and gear axis 1. Make sure the base remains in a stable position before performing any work underneath the base!	
15.	Unscrew the 12 attachment screws and washers securing the gearbox to the base.	 xx0600003069 • A: Gearbox, axis 1 • B: Attachment screw, M16x60
16.	**CAUTION!** The gearbox weighs 108 kg! All lifting equipment used must be sized accordingly!	
17.	Remove the gearbox.	

Refitting

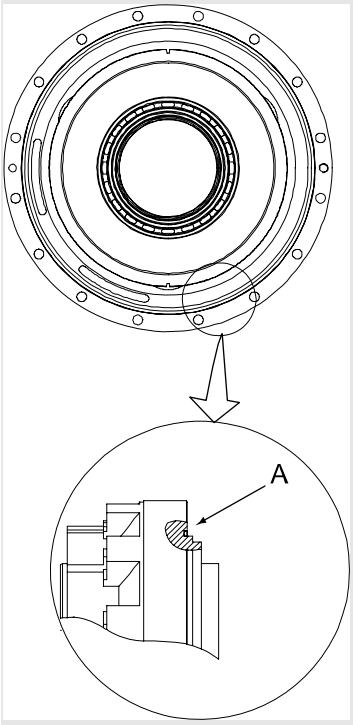
The procedure below details how to remove the gearbox axis 1.

	Action	Note
1.	If the base not already is resting on the *support base and gear, axis 1*, this should be done first.	Mounting of the *support base and gear, axis 1* is detailed in section *Removal on page 346*.

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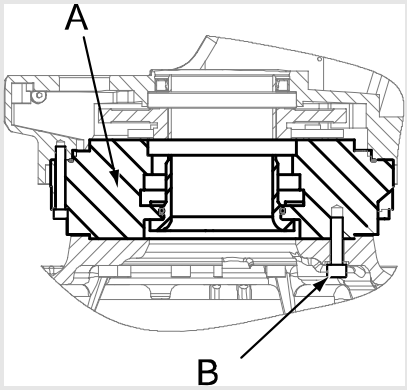
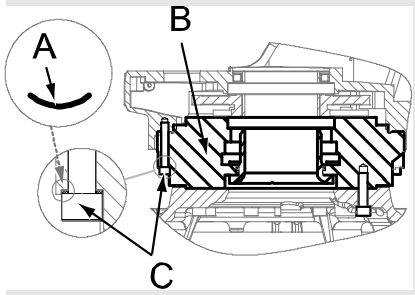
	Action	Note
2.	Make sure the *o-ring* is fitted to the gearbox as shown in the figure to the right. Lightly lubricate the o-ring with grease.	Art. no. is specified in *Required equipment on page 345*.  xx0200000055 • A : O-ring (Gearbox shown from the side)
3.	Refit the *cable guide* in the center of gearbox 1 with its attachment screws.	Shown in the figure *Location of gearbox axis 1 on page 345*.
4.	Fit two *lifting eyes* on each side of the gearbox and secure it with a roundsling.	Art. no. is specified in *Required equipment on page 345*.
5.	Fit two guide pins in two of the attachment holes, parallel to each other.	
6.	**CAUTION!** The gearbox weighs 108 kg! All lifting equipment used must be sized accordingly!	
7.	Lift the gearbox on to the guide pins and lower it carefully to its mounting position.	

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4.7.1. Replacement gearbox axis 1

Continued

	Action	Note
8.	Refit the gearbox to the base with its attachment screws and washers.	Shown in the figure *Location of gearbox axis 1 on page 345*. M16x60 quality 12.9 (12 pcs) Tightening torque: 300 Nm.  xx0600003069 • A: Gearbox, axis 1 • B: Attachment screw, M16x60
9.	**CAUTION!** The complete gearbox unit and base weighs 241 kg together! (Base: 133 kg, gearbox unit: 108 kg.) All lifting equipment used must be sized accordingly!	
10.	Lift the robot base and gearbox 1 to allow removing the support, base and gear.	
11.	Secure the base to the mounting site.	Detailed in section *Orienting and securing the robot on page 68*.
12.	Refit the complete armsystem.	Detailed in section *Replacement of complete arm system on page 234*.
13.	Refit the robot to the base with its attachment screws and serrated lock washers. **NOTE!** The orientation of the serrated lock washer must be fitted as is shown in the figure to the right!	Shown in the figure *Location of gearbox axis 1 on page 345*. M12x80 quality 12.9 (16 pcs) Tightening torque: 105 Nm.  xx0600003069 • A: Serrated lock washer • B: Gearbox, axis 1 • C: Attachment screw, M12x80

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Continued

	Action	Note
14.	Refit the lower end of thecable harness.  **NOTE!** For Cleanroom robots the procedure is detailed in section *Replacement of cable harness, Cleanroom on page 207*.	Detailed in section *Replacement of cable harness, axes 1-6 on page 193*.
15.	Refit motor, axis 1.	Detailed in section *Replacement of motor, axis 1 on page 300*.
16.	Fill oil in gearbox axis 1.	Detailed in section *Oil change, gearbox axis 1 on page 154*.
17.	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*.
18.	 **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 33*.	

Refitting, gearbox axis 1 (Foundry Prime)

Robots working with Foundry Prime and that have the special tightness for this application require special repair routines to maintain the tightness level.

The repair must be done according to the previous repair procedures with the following additions.

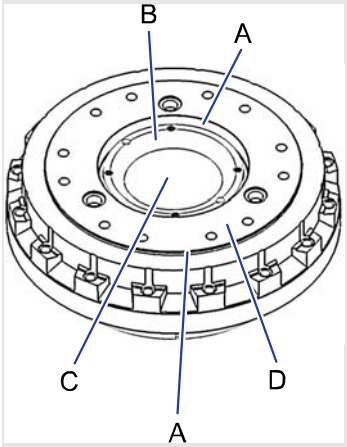
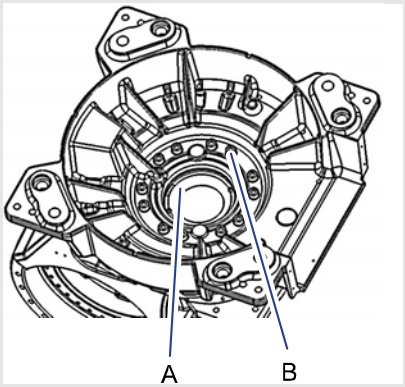
	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	

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4.7.1. Replacement gearbox axis 1

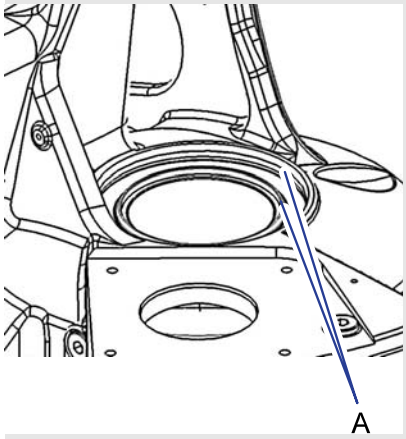
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	Action	Note
2.	Apply Mercasol 3106 on sealing surfaces, in the gap and in the tube on gearbox axis 1.	 xx0700000463 • A: Sealing surfaces • B: Gap • C: Tube • D: Do not apply rust preventive on this surface!
3.	Apply Mercasol 3106 on washers, screwheads and unpainted surfaces on base and gear.	 xx0700000464 • A: Unpainted surface • B: Screwhead and washer

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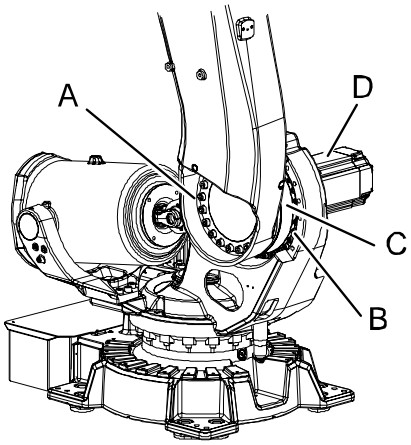
	Action	Note
4.	Apply Mercasol 3106 on all machined surfaces and on the radial seals underneath the cable guide.	 xx0700000465 • A: Machined surfaces
5.	**DANGER!** Make sure all safety requirements are met when performing the first test run. These are further detailed in section *DANGER - First test run may cause injury or damage! on page 33*.	

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4.7.2. Replacement gearbox axis 2

Location of gearbox axis 2

The gearbox axis 2 is located in the lower arm rotational center.



xx0700000357

A	Attachment screws, M16x60 quality Gleitmo (12 pcs)
B	Attachment screws, M12x80 quality Gleitmo (16 pcs)
C	Gearbox, axis 2
D	Motor, axis 2

Required equipment

Equipment, etc	Spare part no.	Art. no.	Note
Gearbox, axis 2		3HAC024316-001	Includes: • gearbox • o-ring
O-ring		3HAB3772-91	
Brush		-	Option Foundry Prime
Rust preventive		3HAC026621-001	Option Foundry Prime Equivalent: • Mercasol 3106
Grease		3HAB3537-1	For lubricating o-rings.
Lifting tool		3HAC026597-001	Instruction 3HAC026600-002 is enclosed.
Lifting tool		3HAC025214-001	For lifting gearbox
Roundsling		-	
Guide pins			Always use in pair.
Crank		3HAC020999-001	Used to turn the gear in correct position.
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.

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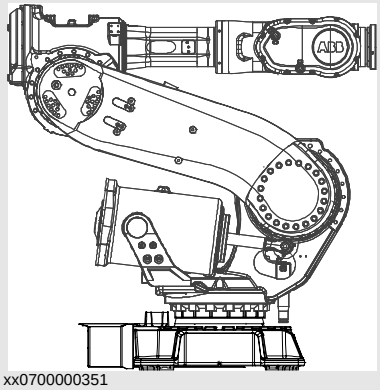
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Equipment, etc	Spare part no.	Art. no.	Note
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.			These procedures include references to the tools required.

Removal

The procedure below details how to remove gearbox axis 2.

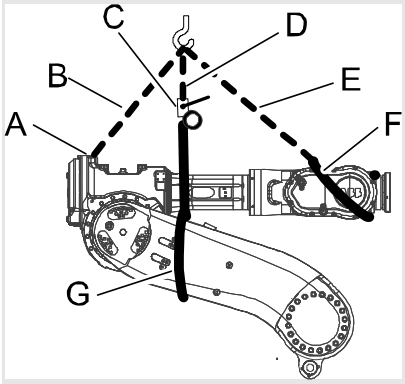
	Action	Note
1.	Move the robot to the position, shown in the figure to the right.	 xx0700000351
2.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
3.	Drain the oil from gearbox axis 2.	Detailed in section *Oil change, gearbox axis 2 on page 157*.
4.	**CAUTION!** The upper and lower arms (incl. gearboxes axes 2 and 3) weighs 455 kg. All lifting equipment used must be sized accordingly!	

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4.7.2. Replacement gearbox axis 2

Continued

	Action	Note
5.	Fit the lifting tool on the upper and lower arms as shown in the figure to the right. Secure the robot in an overhead crane.	 xx0700000350 Parts: • A: Lifting eye (on armhouse) • B: Lifting chain • C: Hoisting block • D: Lifting chain • E: Lifting chain • F: Roundsling (put in a loop around the wrist on the inside) • G: Roundsling (put in a loop around the lower arm)
6.	Remove the lower end of the cable harness. **NOTE!** For Cleanroom robots the procedure is detailed in section *Replacement of cable harness, Cleanroom on page 207*.	Detailed in section *Replacement of cable harness, axes 1-6 on page 193*.
7.	Let the removed part of the cable harness hang lose, without it getting damaged when removal is proceeded.	
8.	Remove the attachment screws M16x60 (12 pcs) securing the lower arm to gearbox axis 2.	Shown in the figure *Location of gearbox axis 2 on page 354*.
9.	Remove the upper and lower arms and let them hang lifted while removing the gearbox from the frame.	
10.	Remove the attachment screws M12x80 (16 pcs) securing the gearbox to the frame.	Shown in the figure *Location of gearbox axis 2 on page 354*.
11.	Remove motor axis 2.	Detailed in section *Replacement of motor axis 2 on page 306*.
12.	Fit two guide pins in two of the holes, parallel to each other.	

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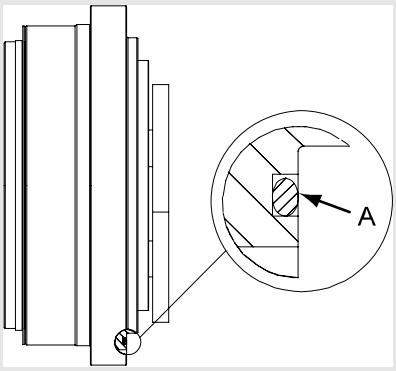
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	Action	Note
13.	**CAUTION!** The gearbox weighs 98 kg! All lifting equipment used must be sized accordingly!	
14.	Fit the *lifting tool* for lifting the gearbox, in the uppermost hole and secure it with a roundsling.	Art. no. is specified in *Required equipment on page 354*.
15.	Remove the gearbox and put it in a place where it is not damaged.	
16.	Wipe clean from residual oil and paint.	

Refitting

The procedure below details how to refit gearbox axis 2.

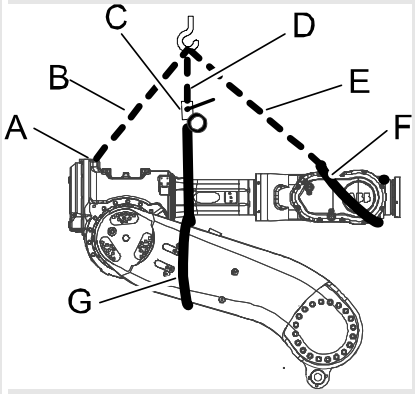
	Action	Note
1.	Make sure the o-ring is fitted to the gearbox. Lightly lubricate it with grease.	 xx0600003128 • A : O-ring 3HAB3772-91
2.	**CAUTION!** The gearbox weighs 98 kg! All lifting equipment used must be sized accordingly!	
3.	Fit the *lifting tool* for lifting the gearbox in the uppermost hole of the gearbox and secure it with a roundsling.	Art. no. is specified in *Required equipment on page 354*.
4.	Fit two guide pins in two of the attachment holes, parallel to each other.	
5.	Lift the gearbox on to the guide pins and push it in mounting position.	
6.	Refit the gearbox with its attachment screws.	M12x80 (16 pcs) Tightening torque: 120 Nm.

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4.7.2. Replacement gearbox axis 2

Continued

	Action	Note
7.	**CAUTION!** The upper and lower arms (incl. gearboxes axes 2 and 3) weighs 455 kg. All lifting equipment used must be sized accordingly!	
8.	Fit the lifting tool on the upper and lower arms and secure the robot in an overhead crane.	 xx0700000350 Parts: • A: Lifting eye (on armhouse) • B: Lifting chain • C: Hoisting block • D: Lifting chain • E: Lifting chain • F: Roundsling (put in a loop around the wrist on the inside) • G: Roundsling (put in a loop around the lower arm)
9.	Use a crank in the gearbox in order to find the holes for the attachment screws.	
10.	Refit the lower arm to the gearbox axis 2 with its attachment screws.	M16x60 (12 pcs) Tightening torque: 300 Nm.
11.	Refit motor axis 2.	Detailed in section *Replacement of motor axis 2 on page 306*.
12.	Refit the lower end of the cable harness. **NOTE!** For Cleanroom robots the procedure is detailed in section *Replacement of cable harness, Cleanroom on page 207*.	Detailed in section *Replacement of cable harness, axes 1-6 on page 193*.
13.	Fill the gearbox axis 2 with oil.	Detailed in section *Oil change, gearbox axis 2 on page 157*.

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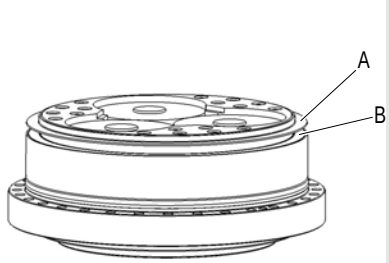
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	Action	Note
14.	Recalibrate the robot.	Calibration is detailed in a separate calibration manual, enclosed with the calibration tools. General calibration information is included in section *Calibration information*.
15.	**DANGER!** Make sure all safety 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 33*.	

Refitting, gearbox axis 2 (Foundry Prime)

Robots working with Foundry Prime and that have the special tightness for this application require special repair routines to maintain the tightness level.

The repair must be done according to the previous repair procedures with the following additions.

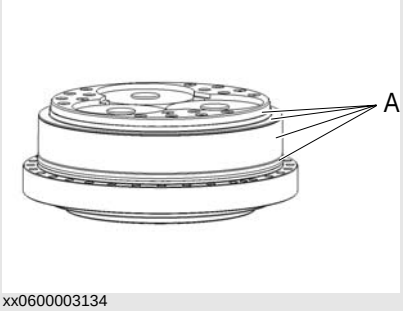
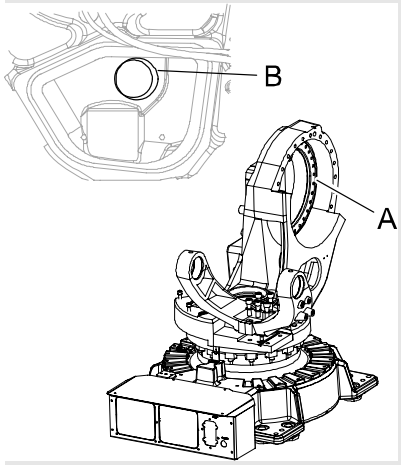
	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Lift the protection ring and apply Mercasol 3106 between gear and protection ring.	 xx0600003136 • A: Protection ring • B: Mercasol on surface

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4.7.2. Replacement gearbox axis 2

Continued

	Action	Note
3.	Apply Mercasol 3106 on the gear according to the illustration to the right before assembly.	 xx0600003134 • A: Mercasol 3106 on surfaces
4.	Apply Mercasol 3106 on the outer edge around the machined surface where the gear is fitted. Apply Sikaflex in the hole for cable harness to the SMB/BU unit, before harness is fitted.	 xx0700000457 • A: Mercasol 3106 on outer edge around gear, machined surface • B: Sikaflex in hole for cable harness to SMB/BU unit
5.	**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 33*.	

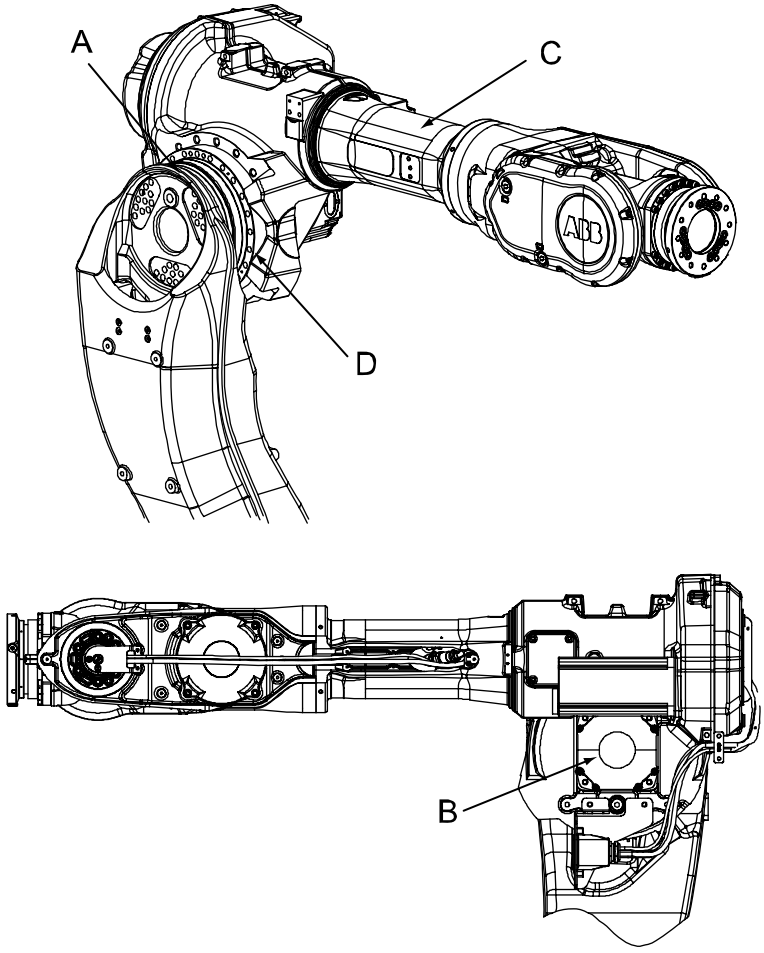
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4.7.3. Replacement of gearbox, axis 3

Location of gearbox

The axis 3 gearbox is located in the upper arm rotational center as shown in the figure below.

A more detailed view of the component and its position may be found in chapter *Exploded views* in the *Product manual, reference information*.



xx0200000194

A	Gearbox, axis 3
B	Motor, axis 3
C	Upper arm
D	Attachment screws, gearbox (24 pcs)

Required equipment

Equipment, etc.	Spare part no.	Art. no.	Note
Gearbox	3HAC021127-001		Includes • gearbox • o-ring. Does not include the sealing, axis 2/3!
O-ring		3HAB3772-68	1 pc on the gearbox.

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4.7.3. Replacement of gearbox, axis 3

Continued

Equipment, etc.	Spare part no.	Art. no.	Note
Grease		3HAB3537-1	For lubricating the o-rings.
Brush		-	Option Foundry Prime
Rust preventive		3HAC026621-001	Option Foundry Prime Equivalent: • Mercasol 3106
Sealing, axis 2/3		3HAC17212-1	A new sealing must be used on each assembly!
Mech stop ax 3		3HAC12708-1	Used to secure the upper arm. Use attachment screws 3HAB3409-86 (M16 x 60).
Washers for mech stop axis 3		3HAA1001-186	
Lifting eye M12		3HAC14457-3	
Guide pins M12 x 200 Guide pins M12 x 200		3HAC13056-3 3HAC13056-3	For guiding the gearbox. Use guides in pairs!
Guide pins M12 x 250 Guide pins M12 x 250		3HAC13056-4 3HAC13056-4	For guiding the gearbox. Use guides in pairs!
Guide pins, sealing ax 2/3, 80mm		3HAC14628-1 3HAC14628-1	For guiding the sealing, axis 2/3. Use guides in pairs!
Guide pins, sealing ax 2/3, 100mm		3HAC14628-2 3HAC14628-2	For guiding the sealing, axis 2/3. Use guides in pairs!
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.
Calibration Pendulum toolkit		3HAC15716-1	Complete kit that also includes operating manual.
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.

Removal, gearbox axis 3

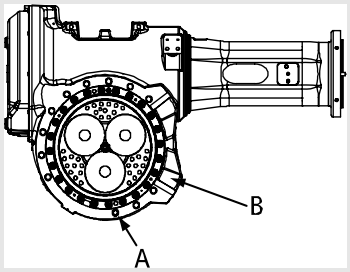
The procedure below details how to remove gearbox, axis 3.

	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	

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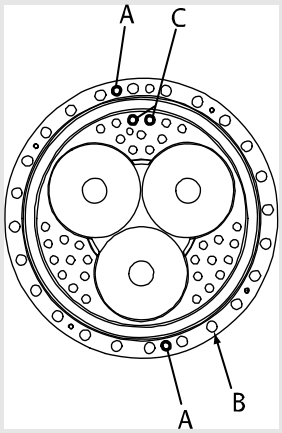
	Action	Note
2.	Secure the upper arm in a horizontal position using a *mechanical stop.* Fit the mechanical stop to the *third and final attachment hole*, below the *fixed mechanical stop* in the upper arm, shown in the figure to the right. Tightening torqure: 115 Nm.	Art. no. is specified in *Required equipment on page 361*.  xx0300000051 • A: Third and final attachment hole • B: Fixed mechanical stop
3.	Remove the *motor, axis 3*.	Detailed in section *Removal, motor on page 314*. **NOTE!** When removing the motor axis 3, the brake on axis 3 is released. Make sure the upper arm is secured and disabled to move!
4.	Remove the *upper arm*.	Detailed in section *Removal, upper arm on page 261*.
5.	Remove the *sealing, axis 2/3* between the gearbox and lower arm.	On reassembly a new sealing must be used! Art. no. is specified in *Required equipment on page 361*.
6.	Place the upper arm safely on a workbench, in a fixture or similar.	
7.	Remove the *attachment screws, gearbox.*	Shown in the figure *Location of gearbox on page 361*.
8.	Fit the two *guide pins* in 180° relation to each other in the gearbox attachment screw holes.	Art. no. is specified in *Required equipment on page 361*.

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4.7.3. Replacement of gearbox, axis 3

Continued

	Action	Note
9.	Fit the *lifting eye* to the gearbox, in one of the attachment screw holes that attaches the gearbox to the lower arm (position C in the figure to the right). If required, use screws in the holes (A) shown in the figure to the right to press the gearbox free.	Art. no. is specified in *Required equipment on page 361*.  xx0200000201 • A: M12 holes for pressing the gearbox out • B: Attachment screw holes, gearbox - upper arm • C: Attachment screw holes, gearbox - lower arm
10.	**CAUTION!** The gearbox weighs 60 kg! All lifting equipment used must be sized accordingly!	
11.	Remove the gearbox, with guidance from the guide pins, using an overhead crane or similar.	

Refitting, gearbox axis 3

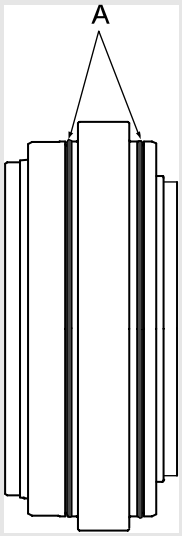
The procedure below details how to refit gearbox, axis 3.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Turn the upper arm in such a position that the gear mating surface faces upwards.	
3.	Fit two *guide pins* in 180° relation to each other in the holes in the upper arm, used for the gearbox attachment screws.	Art. no. is specified in *Required equipment on page 361*.

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Continued

	Action	Note
4.	**CAUTION!** The gearbox weighs 60 kg! All lifting equipment used must be sized accordingly!	
5.	Fit the *lifting eye* to the gearbox.	Art. no. is specified in *Required equipment on page 361*.
6.	Make sure the *o-rings* are fitted to the gearbox. Apply *grease* to the o-rings to make sure they stick in their grooves during assembly. Replace if damaged!	Art. no. is specified in *Required equipment on page 361*.  xx0200000173 • A: O-ring, gearbox axis 3
7.	Lift the gearbox to its mounting position.	
8.	Turn the gearbox to align the attachment screw holes with those in the upper arm.	
9.	Fit the gearbox onto the guide pins and slide it into position.	Make sure the o-rings are seated properly and the gearbox correctly oriented!
10.	Remove the lifting tool.	
11.	Secure the gearbox with 22 of the 24 gearbox attachment screws. Remove the guide pins and tighten the remaining two screws.	24 pcs: M12 x 60. Tightening torque: 115 Nm. Reused screws may be used, providing they are lubricated as detailed in section *Screw joints on page 390* before fitting.
12.	Refit the upper arm with a new *sealing, axis 2/3* .	Art. no. is specified in *Required equipment on page 361*. Detailed in section *Refitting, upper arm on page 263*.
13.	Refit the motor.	Detailed in section *Refitting, motor on page 316*.
14.	Remove the mechanical stop used to secure the upper arm.	

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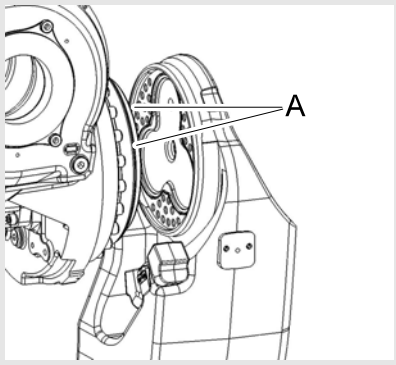
Continued

	Action	Note
15.	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*.
16.	**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 33*.	

Refitting, gearbox axis 3 (Foundry Prime)

Robots working with Foundry Prime and that have the special tightness for this application require special repair routines to maintain the tightness level.

The repair must be done according to the repair chapter in the Product Manual with the following additions.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Apply Mercasol on surfaces on lower arm and gear before assembly. Area where Mercasol shall be applied: • gaps around screw heads and washers.	 xx0600003138 • A: Apply Mercasol 3106 on surfaces

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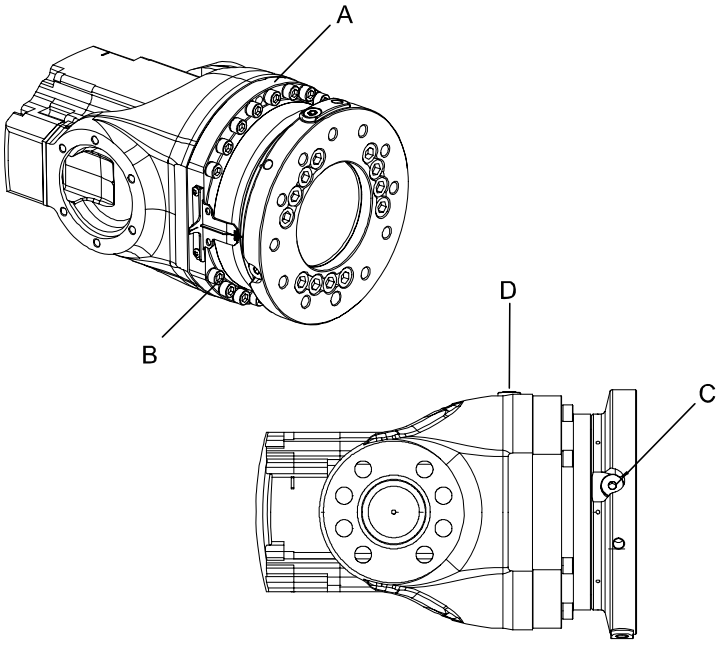
	Action	Note
3.	 **DANGER!** Make sure all safety requirements are met when performing the first test run. These are further detailed in section *DANGER - First test run may cause injury or damage! on page 33*.	

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4.7.4. Replacement of gearbox, axis 6

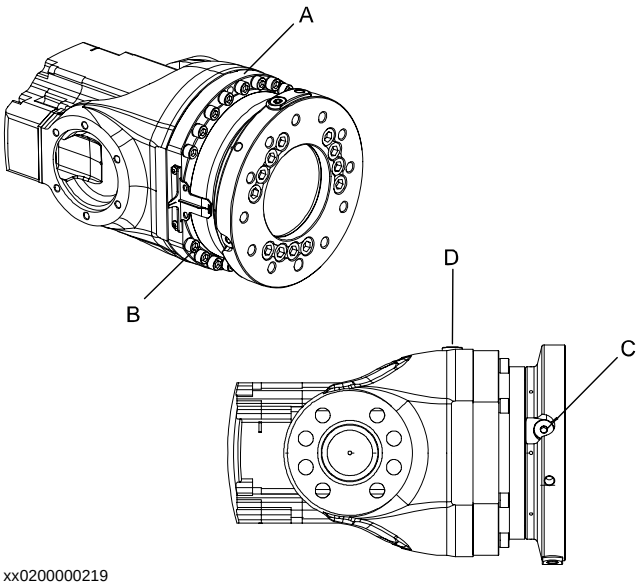
Location of gearbox

The axis 6 gearbox is located in the center of the wrist unit as shown in the figure below.



xx0200000219

A	Gearbox, axis 6
B	Attachment screws and washers, gearbox (18 pcs)
C	Oil plug, draining
D	Oil plug, filling
-	O-ring (not shown in figure)



xx0200000219

A	Gearbox, axis 6 (IRB 6620 Foundry Plus)

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Continued

B	Attachment screws and washers
C	Oil plug, draining
D	Oil plug, filling

Required equipment

Equipment, etc.	Spare part no.	Art. no.	Note
Gearbox	3HAC10828-13		Includes o-ring 3HAB3772-57.
Washers		3HAA1001-172	Not included in gearbox! Replace only when damaged!
O-ring		3HAB3772-58 3HAB3772-64 3HAB3772-61	Must be replaced when reassembling gearbox!
Grease		3HAB3537-1	For lubricating the o-ring.
Brush		-	Option Foundry Prime
Rust preventive		3HAC026621-001	Option Foundry Prime Equivalent: • Mercasol 3106
Standard toolkit		-	The content is defined in section *Standard toolkit on page 394*.
Calibration Pendulum toolkit		3HAC15716-1	Complete kit that also includes operating manual.
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.

Removal, gearbox

The procedure below details how to remove gearbox, axis 6.

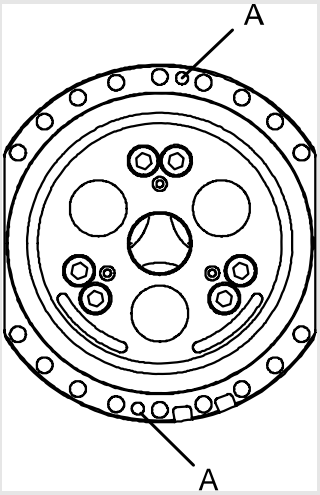
	Action	Note
1.	 **DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	
2.	Drain the oil from gearbox, axis 6.	Detailed in section *Oil change, gearbox axis 6 on page 169*.
3.	Remove the *turning disk*.	Detailed in section *Removal, turning disk on page 250*.
4.	Remove the gearbox by unscrewing its 18 *attachment screws*.	Shown in the figure *Location of gearbox on page 368*.

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4.7.4. Replacement of gearbox, axis 6

Continued

	Action	Note
5.	If required, apply M8 screws to the holes shown in the figure beside to press the gearbox out.	 xx0200000220 • A: M8 holes for pressing out the gearbox
6.	Remove the gearbox axis 6 by lifting it out carefully.	Be careful not to damage the motor pinion!

Refitting, gearbox

The procedure below details how to refit gearbox, axis 6.

	Action	Note
1.	**DANGER!** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot! For Foundry Prime robots: Do not turn off the air pressure to motors and SMB.	

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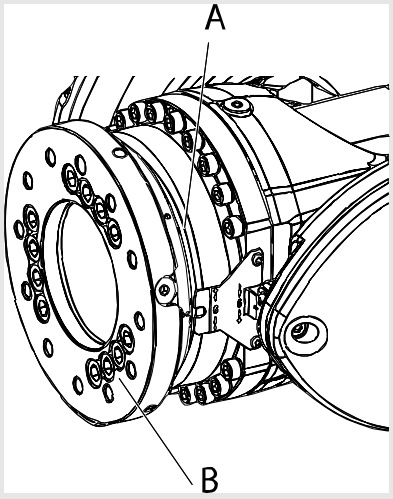
	Action	Note
2.	Make sure the *o-ring* is fitted to the rear of the gearbox. Lubricate the o-ring with *grease.*	Art. no. is specified in *Required equipment on page 369*.  xx0100000132 • A: O-ring, gearbox axis 6
3.	Release the holding brake of motor axis 6.	Detailed in section *Manually releasing the brakes on page 61*.
4.	Insert the *gearbox, axis 6* into the wrist unit.	Art. no. is specified in *Required equipment on page 369*. Shown in the figure *Location of gearbox on page 368*. Make sure the gears of the gearbox mate with the gears of the motor!
5.	Secure the gearbox with the *attachment screws and washers.*	Shown in the figure *Location of gearbox on page 368*. 8 pcs : M8 x 40, 12.9 quality UNBRAKO, Tightening torque: 30 Nm. Reused screws may be used, providing they are lubricated as detailed in section *Screw joints on page 390* before fitting.
6.	Refit the *turning disk*.	Detailed in section *Refitting, turning disk on page 250*.

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4.7.4. Replacement of gearbox, axis 6

Continued

	Action	Note
7.	If the robot is going to work in a water jet application cell: • apply Mercasol 3106 on unpainted surfaces between gearbox and turning disk • apply Mercasol 3106 on the screw heads in the front of the turning disk.	 xx0600003143 • A: Unpainted surface between gearbox and turning disk • B: Screw heads
8.	Perform a *leak-down test*.	Detailed in section *Performing a leak-down test on page 188*.
9.	Refill the gearbox with oil.	Detailed in section *Oil change, gearbox axis 6 on page 169*.
10.	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*.
11.	**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 33*.	

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5 Calibration information

5.1. Introduction

General

This chapter includes general information about different calibration methods and also details procedures that do not require specific calibration equipment.

When the robot system must be recalibrated, it is done according to documentation enclosed with the calibration tools.

When to calibrate

The system must be calibrated if any of the below occurs.

The resolver values are changed

If resolver values are changed, the robot must be recalibrated using the calibration methods supplied from ABB. Calibrate the robot carefully with standard calibration. The different methods are briefly described in section *Calibration methods on page 374*, and further detailed in separate Calibration manuals.

If the robot has Absolute Accuracy calibration, it is also recommended but not always needed to be calibrated for new Absolute Accuracy.

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

Contents of the revolution counter memory are lost

If the contents of the revolution counter memory are lost, the counters must be updated as detailed in section *Updating revolution counters on page 378*. 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 robot is changed for other reachability, it needs to be recalibrated for new resolver values.

If the robot has Abslolute Accuracy calibration, it needs to be calibrated for new Absolute Accuracy.

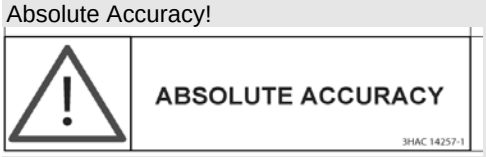
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5.2. Calibration methods

Overview

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

Types of calibration

Type of calibration	Description	Calibration method
Standard calibration	The calibrated robot is positioned at home position, that is the axes positions (angles) are set to 0º. Standard calibration data is found in the file calib.cfg, supplied with the robot at delivery. The file identifies the correct resolver/motor position corresponding to the robot home position. From deliveries together with RobotWare 5.0.5 and higher, the data will instead be found on the SMB (serial measurement board) in the robot, and not in a separate file.	Calibration Pendulum (standard method)
Absolute Accuracy calibration (optional)	Based on standard calibration, and besides positioning the robot at home position, the Absolute Accuracy calibration also compensates for: • mechanical tolerances in the robot structure • deflection due to load. Absolute Accuracy calibration focuses on positioning accuracy in the Cartesian coordinate system for the robot. Absolute Accuracy data is found in the file absacc.cfg, supplied with the robot at delivery. The file replaces the calib.cfg file and identifies motor positions as well as absacc-compensation parameters. From deliveries together with RobotWare 5.0.6 and higher, the data will instead be found on the SMB (serial measurement board) in the robot, and not in a separate file. A robot calibrated with AbsAcc has a sticker next to the identification plate of the robot. To regain 100% Absolute Accuracy performance, the robot must be recalibrated for Absolute Accuracy!  xx0400001197	CalibWare

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Calibration methods

Each calibration method is detailed in a separate manual. Below is a brief description of the methods available.

Calibration Pendulum - standard method

Calibration Pendulum is the standard method for calibration of all ABB robots (except IRB 6400R, IRB 640, IRB 1400H and IRB 4400S) and is also the most accurate method for the standard type of calibration. It is the recommended method in order to achieve proper performance.

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 for *Calibration Pendulum*, which describes the method and the different routines further.

CalibWare - Absolute Accuracy calibration

In order to achieve a good positioning in the Cartesian coordinate system, Absolute Accuracy is used as a TCP calibration. The tool CalibWare guides through the calibration process and calculates new compensation parameters. This is further detailed in the application manual *Absolute Accuracy Calibware 2.0*.

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

References

Article numbers for the calibration tools are listed in section *Special tools on page 395*.

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

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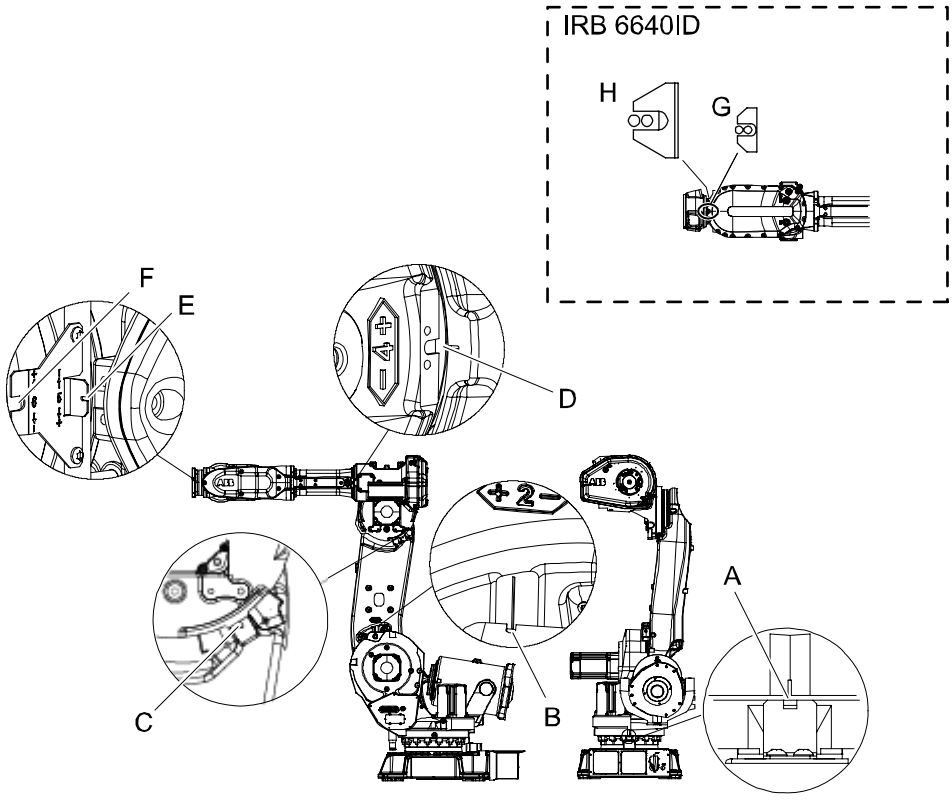
5.3. Calibration scales and correct axis position

Introduction

This section specifies the calibration scale positions and/or correct axis position for all robot models.

Calibration scales/marks, IRB 6640 and IRB 6640ID

The figure below shows the positions of the calibration marks on the robot.



xx0700000340

A	Calibration mark axis 1
B	Calibration mark axis 2
C	Calibration mark axis 3
D	Calibration mark axis 4
E	Calibration mark axis 5
F	Calibration mark axis 6

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5.4. Calibration movement directions for all axes

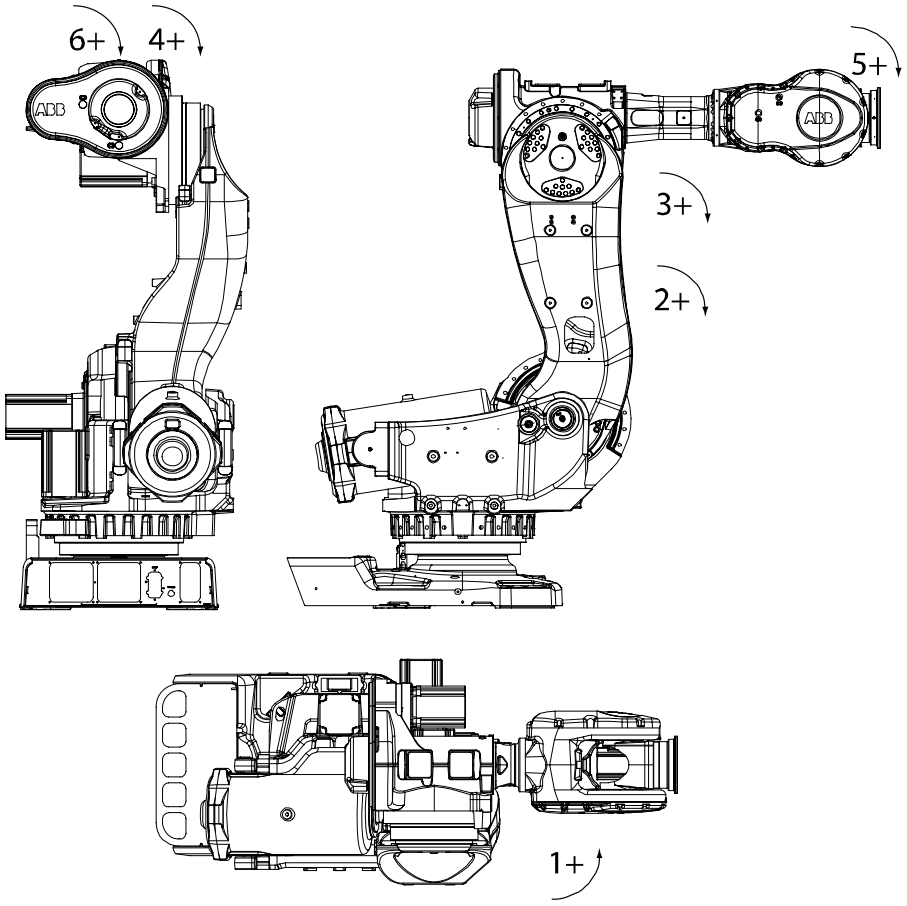
Overview

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 etc. Positive directions are shown in the figure below.

This is normally handled by the robot calibration software.

Calibration movement directions, 6 axes

Note! The figure shows an IRB 7600, but 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

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5.5. Updating revolution counters

General

This section details how to perform a rough calibration of each robot axis, that is updating the revolution counter value for each axis, using the pendant.

Step 1 - Manually running the robot to the calibration position

This procedure details the first step when updating the revolution counter; manually running the robot to the calibration position.

	Action	Note
1.	Select axis-by-axis motion mode.	
2.	Jog the robot to place the *calibration marks* within the tolerance zone. IRB 140, 1400, 2400, 4400, 6600ID/ 6650ID, 6640ID: Axes 5 and 6 must be positioned together!	Shown in section *Calibration scales and correct axis position on page 376*.
3.	When all axes are positioned, store the revolution counter settings.	Detailed in section: *Step 2 - Storing the revolution counter setting with the FlexPendant on page 379* (RobotWare 5.0).

Correct calibration position of axis 4 and 6

When running the robot to calibration position, it is extremely important to make sure that axes 4 and 6 of the below mentioned robots are positioned correctly. The axes can be calibrated at the wrong turn, resulting in wrong calibrated robot.

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

At delivery the robot 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 below 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 uneven gear ratio. This affects the following robots:

Robot variant	Axis 4	Axis 6
IRB 6640 -180/2.55	Yes	No
IRB 6640 - 235/2.55, 205/ 2.75, 185/2.8, 130/3.2	Yes	Yes
IRB 6640ID - 170/2.75, 200/ 2.55	Yes	No

If the calibration 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 calibration marks again (try both directions, if needed).

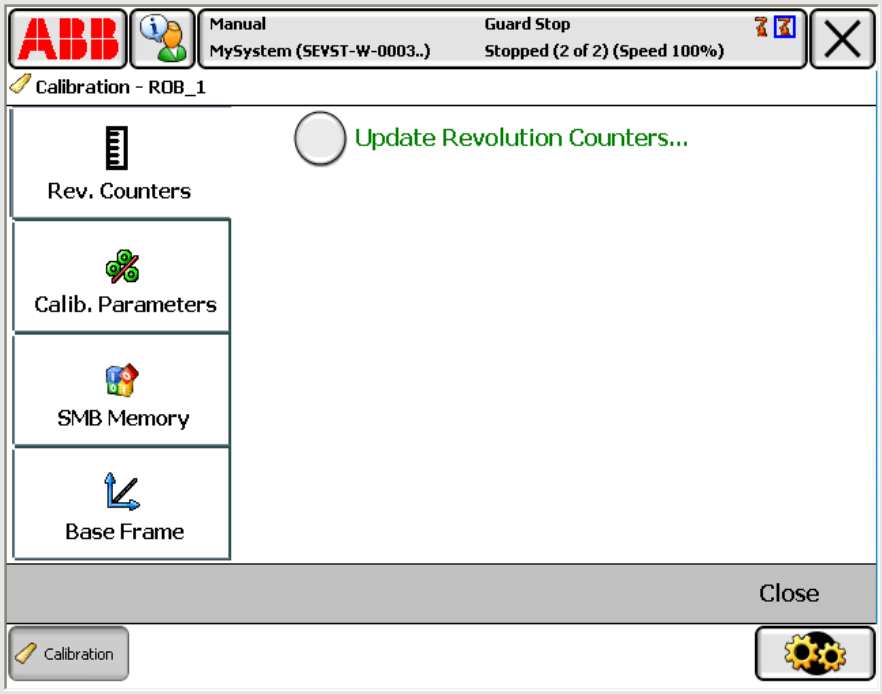
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Step 2 - Storing the revolution counter setting with the FlexPendant

This procedure details the second step when updating the revolution counter; storing the revolution counter setting with the FlexPendant (RobotWare 5.0).

	Action
1.	On the **ABB** menu, tap **Calibration**. All mechanical units connected to the system are shown along with their calibration status.
2.	Tap the mechanical unit in question. A screen is displayed: tap **Rev. Counters**.  en0400000771
3.	Tap **Update Revolution Counters...**. A dialog box is displayed, warning that updating the revolution counters may change programmed robot positions: • Tap **Yes** to update the revolution counters. • Tap **No** to cancel updating the revolution counters. Tapping **Yes** displays the axis selection window.
4.	Select the axis to have its revolution counter updated by: • Ticking in the box to the left • Tapping **Select all** to update all axes. Then tap **Update**.
5.	A dialog box is displayed, warning that the updating operation cannot be undone: • Tap **Update** to proceed with updating the revolution counters. • Tap **Cancel** to cancel updating the revolution counters. Tapping **Update** updates the ticked revolution counters and removes the tick from the list of axes.

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5.5. Updating revolution counters

Continued

	Action
6.	 **CAUTION!** If a revolution counter is incorrectly updated, it will cause incorrect robot positioning, which in turn may cause damage or injury! Check the calibration position very carefully after each update. See section *Checking the calibration position on page 381*.

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5.6. Checking the calibration position

General

Check the calibration position 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 teach pendant.

Using a MoveAbsJ instruction on the FlexPendant, IRC5

This section describes how to create a program, which runs all the robot axes to their zero 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: `MoveAbsJ [[0,0,0,0,0,0],[9E9,9E9,9E9,9E9,9E9,9E9]]\NoEOffs, v1000, z50, Tool0`	
5.	Run the program in manual mode.	
6.	Check that the calibration marks for the axes align correctly. If they do not, update the revolution counters!	The calibration marks are shown in section *Calibration scales and correct axis position on page 376*. How to update the revolution counters is detailed in section *Updating revolution counters on page 378*.

Using the Jogging window on the FlexPendant, IRC5

This section describes how to jog the robot to all axes zero position.

	Action	Note
1.	Tap Jogging in the ABB menu.	
2.	Tap Motion mode to choose group of axes to jog.	
3.	Tap axis 1-3 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 calibration marks for the axes align correctly. If they do not, update the revolution counters!	The calibration marks are shown in section *Calibration scales and correct axis position on page 376*. How to update the counters is detailed in section *Updating revolution counters on page 378*.

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5.6. Checking the calibration position

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6 Decommissioning

6.1. Introduction

Introduction

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

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

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 is 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 (that 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 is installed.

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6.2. Environmental information

Hazardous material

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

Dispose the 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 etc.
Neodymium	Brakes, motors
Plastic / rubber (PVC)	Cables, connectors, drive belts etc.
Oil, grease	Gearboxes
Aluminium	Covers, sync. brackets

Oil and grease

Where possible, arrange for the oil and grease to be recycled. Dispose of via an authorized person/contractor in accordance with local regulations. Do no dispose of oil and grease near lakes, ponds, ditches, down drains, or on to soil. Incineration must be carried out under controlled conditions in accordance with local regulations.

Also note that:

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

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6.3. Decommissioning of balancing device

General

There is much energy stored in the balancing device. Therefore a special procedure is required to dismantle it. The coil springs inside the balancing device exert a potentially lethal force unless dismantled properly.

The device must be dismantled by a decommissioning company.

Required equipment

Equipment	Art. no.	Note
Standard toolkit	-	The content is defined in section *Standard toolkit on page 394*.
Cutting torch		For opening housing and cutting coils
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.



DANGER!

Do not under any circumstances, deal with the balancing device in any other way than that detailed in the product documentation! For example, attempting to open the balancing device is potentially lethal!

Action on field, decommissioning

The procedure below details the actions to perform on field, when the balancing device is to be decommissioned.

	Action	Note
1.	Remove the balancing device from the robot.	Detailed in section *Removal of balancing device*.
2.	Send the device to a decommissioning company.	Make sure the decommissioning company is well informed about the stored energy built up by high tensioned compression springs and that the device contains some grease. The following procedure contains useful information about decommissioning.

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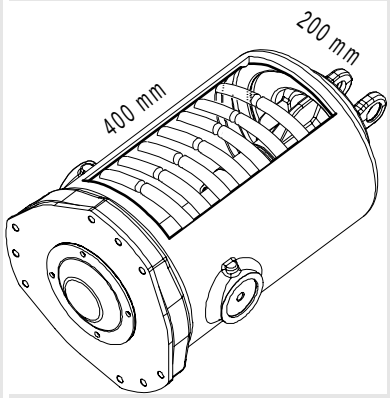
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6.3. Decommissioning of balancing device

Continued

Decommissioning at decommissioning company, balancing device

The instruction below details how to decommission the balancing device. Contact ABB Robotics for further consultation.

	Action	Note
1.	**DANGER!** There is stored energy built up by high tensioned compression springs inside the balancing device! The device also contains some grease!	
2.	Place the device on a workbench or similar. Make sure it is clamped in position with a vice or similar.	
3.	Open a hole in the side of the housing as shown in the figure.	Use a cutting torch. The measurements shown below are maximum values!  xx0700000391
4.	Cut the coils of the three springs inside the housing as specified below: • Outer spring: cut at least five coils! • Middle spring: cut at least four coils! • Inner spring: cut at least four coils!	Use a cutting torch.
5.	Double-check the number of coils cut and make sure all the tension in the springs 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.

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7.2. Applicable Safety Standards

Standards, general

The robot is designed in accordance with the requirements of:

- EN ISO 10218-1: 2006 Robots for industrial environments - Safety requirements - Part 1 Robot.
- EN 292-1 - Basic terminology.
- EN 292-2 - Technical principles.
- EN 418 - Emergency stop.
- EN 563 - Temperatures of surfaces.
- EN 954-1 - Safety related parts of control systems.
- EN ISO 60204-1: 2005 Safety of machinery - Electrical equipment of machines - Part 1 General requirements.
- EN 1050 - Principles for risk assessment.
- ANSI/RIA 15.06-1999 - Industrial robots, safety requirements.
- DIN 19258 - Interbus-S, International Standard

Standards, robot cell

The following standards are applicable when the robot is part of a robot cell:

- EN 953 - Fixed and moveable guards
- EN 811 - Safety distances to prevent danger zones being reached by the lower limbs.
- EN 349 - Minimum gaps to avoid crushing of parts of the human body.
- EN 294 - Safety distances to prevent danger zones being reached by the upper limbs.
- EN 1088 - Interlocking devices
- EN 999 - The positioning of protective equipment in respect of approach speeds of the human body.
- ISO 11 161 - Industrial automation systems - Safety of intergrated manufacturing systems.

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7.3. Unit conversion

Converter table

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

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

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7.4. Screw joints

General

This section details how to tighten the various types of screw joints on the robot.

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

UNBRAKO screws

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

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

Gleitmo treated screws

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

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

Screws lubricated in other ways

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

In such cases, proceed as follows:

1. Apply lubricant to the screw thread.
2. Apply lubricant between the plain washer and screw head.
3. Tighten to the torque specified in section *Tightening torque on page 391* below. 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

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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 tables below. Any **special torques** are specified in the Repair, Maintenance or Installation procedure descriptions. **Any special torque specified overrides the standard torque!**
- Use the *correct tightening torque* for each type of screw joint.
- Only use *correctly calibrated* torque keys.
- Always *tighten the joint by hand*, and never use pneumatical 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%**!

The table below specifies the recommended standard tightening torque for *oil-lubricated screws* with *slotted or cross-recess head screws.*

Dimension	Tightening torque (Nm) Class 4.8, oil-lubricated
M2.5	0.25
M3	0.5
M4	1.2
M5	2.5
M6	5.0

The table below specifies the recommended standard tightening torque for *oil-lubricated screws* with *Allen head screws.*

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
M24	725	960	1150

The table below specifies the recommended standard tightening torque for *Molycote-lubricated screws* with *Allen head screws.*

Dimension	Tightening torque (Nm) Class 10.9, Molycote-lubricated	Tightening torque (Nm) Class 12.9, Molycote-lubricated
M8	28	35
M10	55	70
M12	96	120

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Continued

Dimension	Tightening torque (Nm) Class 10.9, Molycote-lubricated	Tightening torque (Nm) Class 12.9, Molycote-lubricated
M16	235	280
M24	790	950

The table below specifies the recommended standard tightening torque for *water and air connectors* when *one* or *both* connectors are made of *brass*.

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

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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 high-lighted in this way.

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

Example

Below is an example of how a weight specification is presented, inside a procedure table:

	Action	Note
	 **CAUTION!** The motor weighs 32 kg! All lifting equipment used must be sized accordingly!	

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7.6. Standard toolkit

General

All service (repairs, maintenance and installation) procedures contain 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 table below.

This way, the tools required are the sum of the Standard Toolkit and any tools listed in the instruction.

Contents, standard toolkit

Qty	Tool	Rem.
1	Ring-open-end spanner 8-19 mm	
1	Socket head cap 5-17 mm	
1	Torx socket no: 20-60	
1	Box spanner set	
1	Torque wrench 10-100 Nm	
1	Torque wrench 75-400 Nm	
1	Ratchet head for torque wrench 1/2	
2	Hexagon-headed screw M10x100	
1	Socket head cap no: 14, socket 40 mm bit L 100 mm	
1	Socket head cap no: 14, socket 40 mm bit L 20 mm	To be shortened to 12 mm
1	Socket head cap no: 6, socket 40 mm bit L 145 mm	
1	Socket head cap no: 6, socket 40 mm bit L 220 mm	

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7.7. Special tools

General

All service instructions contain lists of tools required to perform the specified activity. The required tools are a sum of standard tools, defined in section *Standard toolkit on page 394*, and of special tools, listed directly in the instructions and also gathered in this section.

Basic tools

The table below specifies the tools in the basic toolkit (3HAC15571-3) that are used for the current robot model. This toolkit is necessary primarly when removing and refitting the motors.

The tools are also listed directly in the instructions.

Description	Qty	Art. no.
Bolts (M16 x 60) for Mech stop ax 3	2	3HAB3409-86
Guide pins M8 x 100	2	3HAC15520-1
Guide pins M8 x 150	2	3HAC15520-2
Guide pins M10 x 100	2	3HAC15521-1
Guide pins M10 x 150	2	3HAC15521-2
Lifting tool, wrist unit	1	3HAC13605-1
Lifting tool, motor ax 1, 4, 5	1	3HAC14459-1
Lifting tool, motor ax 2, 3, 4	1	3HAC15534-1
Mech stop ax 3	2	3HAC12708-1 3HAC12708-3
Removal tool, motor M10x	2	3HAC14972-1 Fits motors, axes 4, 5 and 6.
Removal tool, motor M12x	2	3HAC14631-1 Fits motors axes 1, 2 and 3.
Rotation tool	1	3HAC17105-1
Standard toolkit (content described in section *Standard toolkit on page 394*)	1	3HAC15571-1
Washers for mech stop axis 3	2	3HAA1001-186

Special tools

The table below specifies the special tools required during several of the service procedures. The tools may be ordered separately and are also specified directly in concerned instructions in the *Product manual, procedures*.

Description	Qty	Art. no.
Gearbox crank, axis 2	1	3HAC020999-001
Guide pins M12 x 130	2	3HAC022637-001
Guide pins M12 x 150	2	3HAC13056-2
Guide pins M12 x 200	2	3HAC13056-3
Guide pins M12 x 250	1	3HAC13056-4
Guide pins M16 x 300	2	3HAC13120-5

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Description	Qty	Art. no.
Guide pins, sealing ax 2/3, 100mm	1	3HAC14628-2
Guide pins, sealing ax 2/3, 80mm	1	3HAC14628-1
Hydraulic cylinder	1	3HAC11731-1
Hydraulic pump, 80 MPa	1	3HAC13086-1
Hydraulic pump, 150 MPa (Glycerin)	1	3HAC021563-012
Lifting device, base	1	3HAC15560-1
Lifting device, upper arm	1	3HAC15994-1
Lifting eye VLBG M12	1	3HAC16131-1
Lifting eye M16	2	3HAC14457-4
Lifting tool (chain)	1	3HAC15556-1
Lifting tool, gearbox axis 2	1	3HAC020386-001
Measuring tool	1	6896134-GN
Motor press pinion	1	3HAC021883-001
Oil injector / max 500 MPa	1	3HAC021590-001
Press tool, axis 2 bearing	1	3HAC13527-1
Puller device, axis 2 shaft	1	3HAC021563-001
Press tool, balancing device	1	3HAC020902-001
Press tool, balancing device shaft	1	3HAC17129-1
Puller tool, balancing device shaft	1	3HAC12475-1
Support, base	1	3HAC15535-1
Tool set balancing device	1	

Calibration equipment, Levelmeter (alternative method)

The table below specifies the calibration equipment required when calibrating the robot with the alternative method, Levelmeter Calibration.

Description	Art. no.	Note
Angel bracket	68080011-LP	
Calibration bracket	3HAC13908-9	
Calibration tool ax1	3HAC13908-4	
Levelmeter 2000 kit	6369901-347	Includes one sensor.
Measuring pin	3HAC13908-5	
Sensor fixture	68080011-GM	
Sensor plate	3HAC0392-1	
Sync. adapter	3HAC13908-1	
Turn disk fixture	3HAC68080011-GU	

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Calibration equipment, Calibration Pendulum

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

Description	Art. no.	Note
Calibration Pendulum toolkit	3HAC15716-1	Complete kit that also includes operating manual.

Oil exchange equipment

The table below specifies the recommended equipment for oil exhange.

Description	Art. no.	Note
Oil exchange equipment	3HAC021745-001	Includes • vacuum pump with regulator, hose and coupling • couplings and adapters • pump (manual) with hose and coupling • graduated measuring glass • oil gun • user instructions.

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7.8. Lifting equipment and lifting instructions

General

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

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

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

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8 Spare Part List IRB 6640

8.1. Base frame

Spare parts

Item	Part.	Spare part no.	Description
101		3HAC027851-001	Gearbox axis 1 RV 320C - 191.35 (IRB 6640 - 180/2.55, 235/2.55, 185/2.8, 205/2.75, 130/3.2) (IRB 6640ID - 200/2.55, 170/2.75)
102	3HAC026393-001		Frame
103	3HAC026771-001		Base
104	9ADA205-75		Set screw, cup point
105	3HAC024014-001		Stop pin
107	3HAC11581-4		Oil seal for "Pipe" (RV-320C-191.35)
108	3HAB3537-1		Bearing grease
109	3HAB3409-86		Hex socket head cap screw
110	3HAA1001-186		Washer
111	3HAB3409-74		Hex socket head cap screw
112	3HAC026169-001		Serrated lock washer
113	3HAB3772-97		O-ring
114	3HAC16721-1		Magnetic plug
115	3HAB3537-1		Bearing grease
116	3HAC4836-1		Protection plug
117	3HAC026892-001		Protection pipe ax 1
118	9ADA618-56		Torx pan head screw

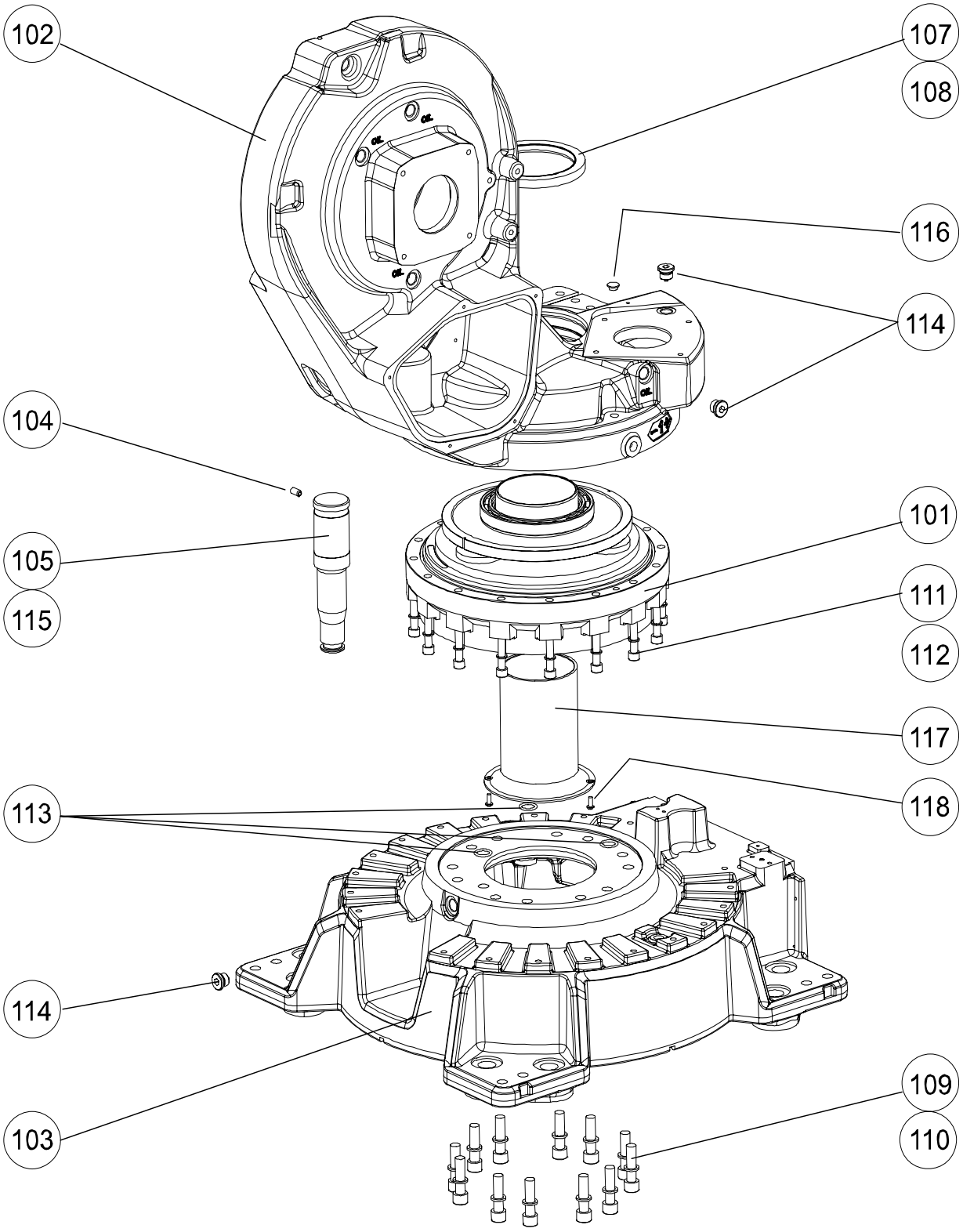
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8.1. Base frame

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Illustration



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8.2. Spare parts - Balancing device

Spare Parts, balancing device 3HAC028470-001 and 3HAC030868-001

Item	Part	Spare part no.	Description
104		3HAC028470-001	Balancing device, standard
104		3HAC030868-001	Balancing device, Cleanroom
406	3HAB3409-84		Hex socket head cap screw
410	3HAC026582-001		Cradle
419	3HAC020537-001		Washer
420	9ADA183-22		Hex socket head cap screw
Set	**3HAC029288-001**		**Maintenance set, Cradle**
407	3HAA1001-186	Cradle set	Washer
409	3HAB3702-29	Cradle set	Radial Sealing
411	3HAA2167-19	Cradle set	Spherical roller bearing
412	3HAC026584-001	Cradle set	Shaft
413	3HAC17085-1	Cradle set	Spacer Ring
414	21520431-23	Cradle set	O-ring
415	9ABA137-33	Cradle set	Retaining ring,bore
416	3HAA2166-28	Cradle set	VK-Cover
417	3HAB3409-88	Cradle set	Hex socket head cap screw
Set	3HAC029054-001		**Maintenance set. Shaft**
401	3HAC029445-001	Shaft set	Shaft
402	3HAA2167-21	Shaft set	Spherical roller bearing
403	3HAC029452-001	Shaft set	Sealing washer
404	9ABA137-20	Shaft set	Retaining ring,bore
405	9ADA618-56	Shaft set	Torx pan head screw
408	3HAC029451-001	Shaft set	Washer
423	3HAC4836-21	Shaft set	Protection plug
427	3HAB3772-102	Shaft set	O-ring
428	3HAC11581-5	Shaft set	Sealing ring (radial)
429	9ADA618-53		Torx pan head screw

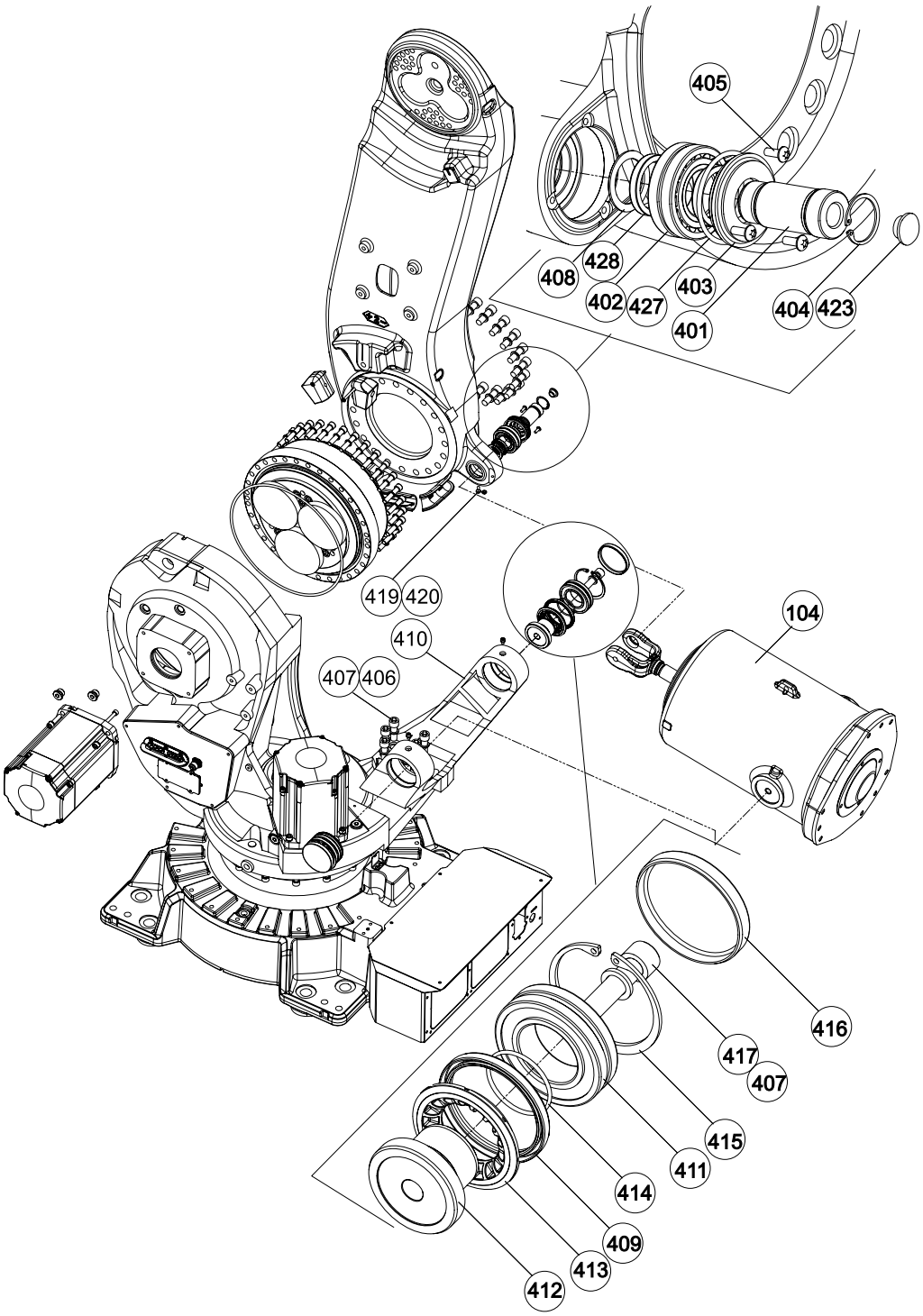
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8.2. Spare parts - Balancing device

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Spare Parts, balancing device 3HAC026268-003/3HAC027987-003

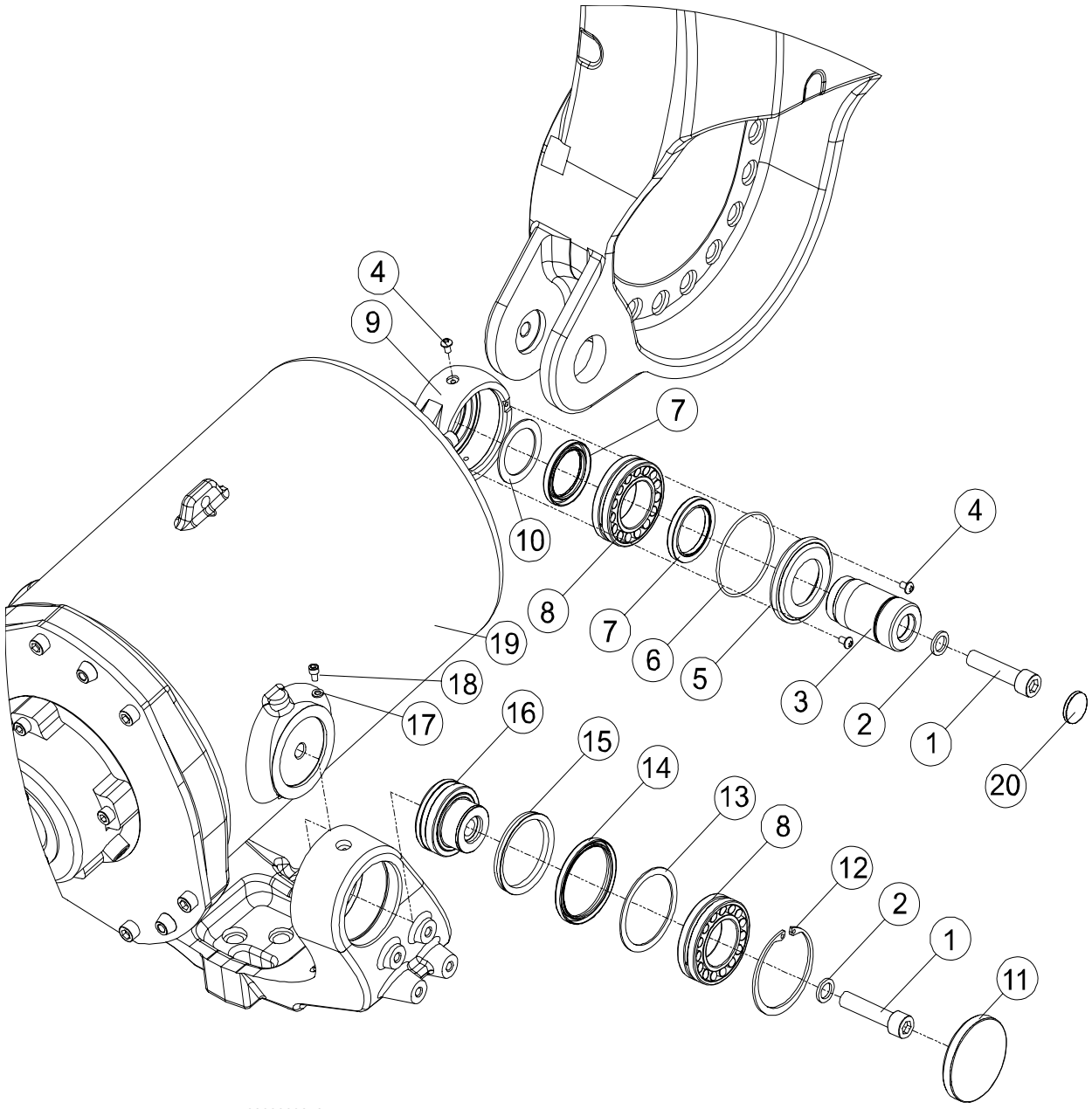
Item	Part	Spare part no.	Description
1	3HAB3409-88		Hex socket head cap screw
2	3HAA1001-186		Washer
3	3HAC032228-001		Shaft
4	9ADA618-54		Torx pan head screw
5	3HAC031955-001		End cover
6	3HAB3772-121		O-ring
7	3HAB3701-35		Radial seal w dustlipp 50x68x8
8	3HAA2167-19		Spherical roller bearing
9	3HAC031929-003		Link ear
10	3HAC031964-001		Washer
11	3HAA2166-28		VK-Cover
12	9ABA137-33		Retaining ring,bore
13	3HAC032460-001		Washer
14	3HAB3702-29		Radial Sealing
15	3HAB3732-27		V-ring V-75A
16	3HAC032227-001		Shaft end
17	3HAC020537-001		Washer
18	9ADA183-22		Hex socket head cap screw
19		3HAC026268-003	Balancing device (Standard)
19		3HAC027987-003	Balancing device (Foundry Prime)
20	3HAA2166-12		VK- cover

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8.2. Spare parts - Balancing device

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8.3. Frame to lower arm

Part list

Item	Part	Spare part no.	Description
2		3HAB3772-91	O-ring
301		3HAC025819-001	Rot. AC motor incl. pinion axis 2, standard (IRB 6640 - 180/2.55, 235/2.55, 185/2.8, 205/2.75, 130/3.2) (IRB 6640ID - 200/2.55, 170/2.75)
301		3HAC029784-001	Rot. AC motor incl. pinion, axis 2 (Foundry Prime)
301		3HAC030800-001	Rot. AC motor incl. pinion, axis 2 (Cleanroom)
302		3HAC024518-003	Rot. AC motor incl. pinion axis 1, standard (IRB 6640 - 180/2.55, 235/2.55, 185/2.8, 205/2.75, 130/3.2) (IRB 6640ID - 200/2.55, 170/2.75)
302		3HAC029783-001	Rot. AC motor incl. pinion, axis 1 (Foundry Prime)
302		3HAC030794-001	Rot. AC motor incl. pinion, axis 1 (Cleanroom)
303	3HAB3409-50		Hex socket head cap screw
304	3HAB4233-1		Washer
305		3HAC024316-001	Reduction gear (axis 2) RV-550E i=242,73 (IRB 6640 - 180/2.55, 235/2.55, 185/2.8, 205/2.75, 130/3.2) (IRB 6640ID - 200/2.55, 170/2.75)
306	3HAB3409-71		Hex socket head cap screw
307	3HAA1001-134		Washer
310	3HAC16721-1		Magnetic plug
311	9ADA618-56		Torx pan head screw
312	3HAC024859-001		Sync. plate
316	9ADA624-65		Torx counters. head screw
317	3HAB3409-84		Hex socket head cap screw
318	3HAA1001-186		Washer
319	3HAC12991-1		Damper axis 2
321	3HAC14300-1		Cable protector

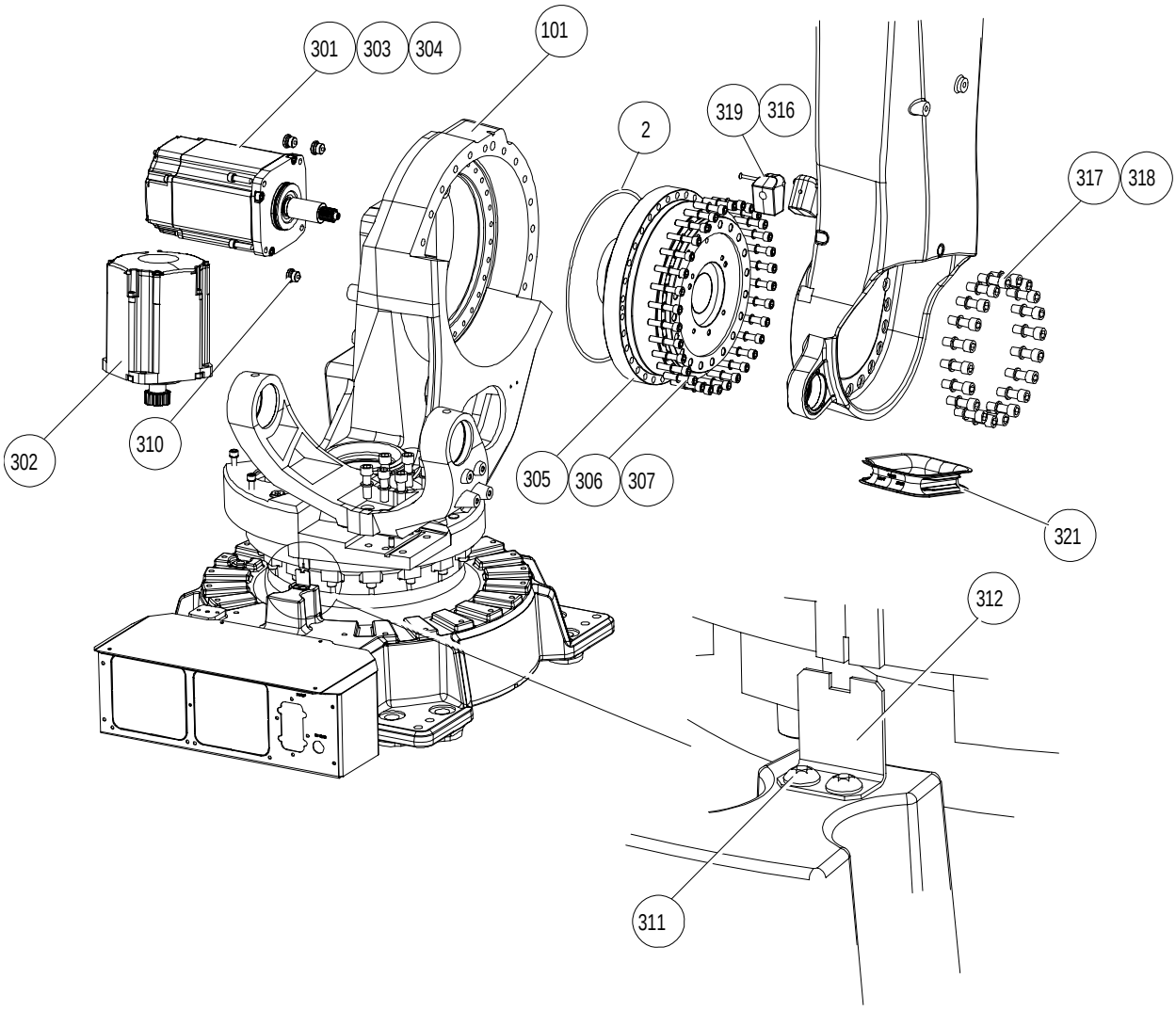
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8.3. Frame to lower arm

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8.4. Lower arm to upper arm

Part list

Item	Parts	Spare part no.	Description
1		3HAC021127-001	RV410F-270,176 assembly Gearbox axis 3 (IRB 6640 - 180/2.55, 235/2.55, 185/2.8, 205/2.75, 130/3.2) (IRB 6640ID - 200/2.55, 170/2.75)
3	3HAB3409-71		Hex socket head cap screw
4	3HAA1001-134		Washer
105	3HAC023627-001		Lower arm, Short
105	3HAC027033-001		Lower arm, Long
105	3HAC031985-001		Lower arm, Short (New)
105	3HAC032177-001		Lower arm, Long (New)
310	3HAC16721-1		Magnetic plug
313	3HAB3409-69		Hex socket head cap screw
314	3HAC12703-1		Washer axis3
315	3HAC12320-1		Damper axis 3
316	9ADA624-65		Torx counters. head screw
320	3HAC17212-1		Sealing axis 2/3

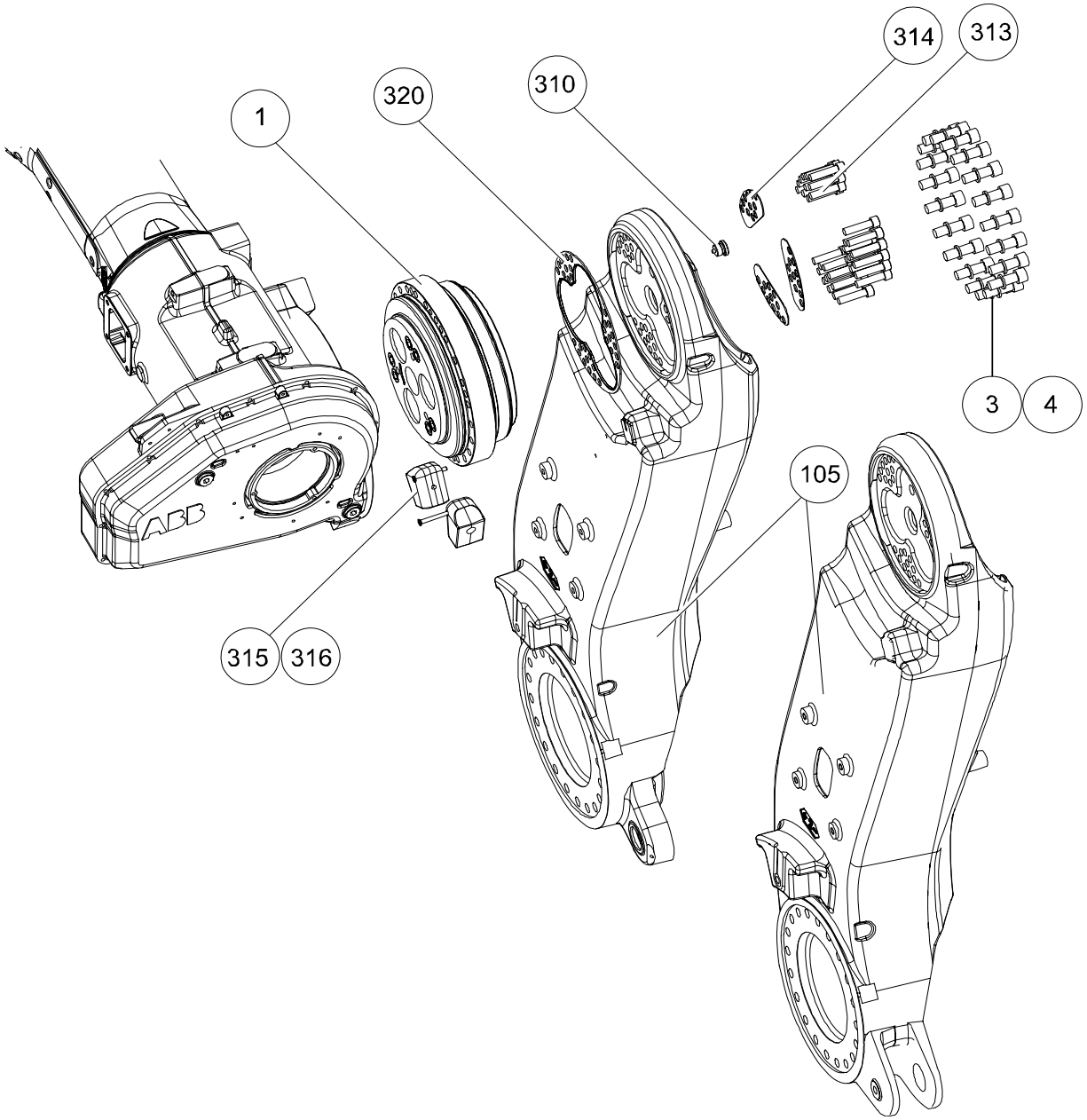
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8.4. Lower arm to upper arm

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8.5. Upper arm including wrist unit, motors ax. 3- 6 (IRB 6640 and IRB 6640ID)

Part list

Item	Spare Part no.	Description
103	3HAC16627-3	Wrist unit 1 (IRB 6640 - 180/2.55)
103	3HAC16626-2	Wrist unit 2 (IRB 6640 - 235/, 185/2.8, 205/2.75, 130/3.2)
103	3HAC024793-001	Wrist unit ID (IRB 6640ID - 200/2.55, 170/2.75)
103.4.1	3HAC9744-5	Turning disk (diameter 200) (IRB 6640 - 180/2.55)
103.4.1	3HAC13752-1	Turning disk (diameter 200) (IRB 6640 - 235/2.55, 185/2.8, 205/2.75, 130/3.2)
103.4.1	3HAC025571-001	Turning disk (diameter 200) (Foundry prime, Cleanroom)
103.4.1	3HAC030264-001	Turning disk, Cleanroom (Cleanroom)
103.4.2	3HAC10828-10	RV 70F-125,8 assembly Gearbox axis 6 (IRB 6640 - 180/2.55)
103.4.2	3HAC10828-13	RV 70F-125,8 assembly Gearbox axis 6 (IRB 6640 - 235/2.55, 185/2.8, 205/2.75, 130/3.2)
103.2.1	3HAC17484-7	Rotational AC motor, axis 5 (Fitted inside upper arm tube) (IRB 6640 - 180/2.55)
103.2.1	3HAC17484-10	Rotational AC motor, axis 5 (Fitted inside upper arm tube) (IRB 6640 - 235/2.55, 185/2.8, 205/2.75, 130/3.2)
103.1	3HAC023745-003	Rotational AC motor, axis 5 (IRB 6640ID - 200/2.55, 170/2.75)
103.2.1	3HAC026982-001	Rotational AC motor, axis 5 (Fitted inside upper arm tube) (Foundry Prime)
103.4.4	3HAC15990-4	Rotational AC motor M10, axis 6 (Standard, IRB 6640 - 180/2.55)
103.4.4	3HAC030828-001	Rotational AC motor, axis 6 (Cleanroom, IRB 6640 - 180/2.55)
103.4.4	3HAC15991-4	Rotational AC motor M10, axis 6 (Standard, IRB 6640 - 235/2.55, 185/2.8, 205/2.75, 130/3.2)
103.4.4	3HAC030829-001	Rotational AC motor, axis 6 (Cleanroom, IRB 6640 - 235/2.55, 185/2.8, 205/2.75, 130/3.2)
103.5	3HAC023746-003	Rotational AC motor, axis 6 (IRB 6640ID - 200/2.55, 170/2.75)
103.4.4	3HAC026983-001	Rotational AC motor, axis 6 (Foundry Prime)

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8.5. Upper arm including wrist unit, motors ax. 3- 6 (IRB 6640 and IRB 6640ID)

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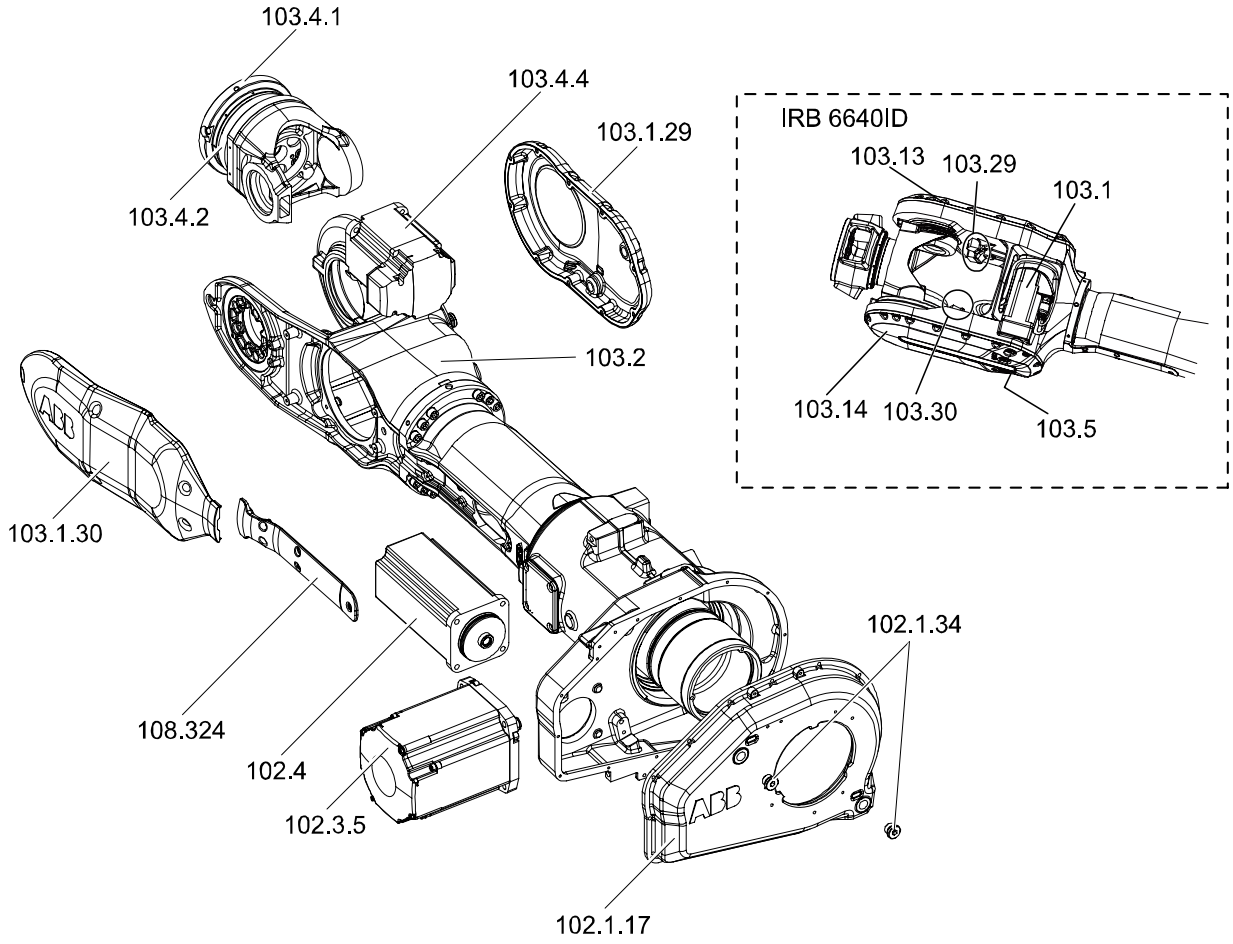
Item	Spare Part no.	Description
102.3.5	3HAC15885-2	Rot. AC motor incl. pinion, axis 3 (Standard, IRB 6640 -180/2.55, 235/2.55, 185/2.8, 205/2.75, 130/3.2) (IRB 6640ID - 200/2.55, 170/2.75)
102.3.5	3HAC029785-001	Rot. AC motor incl. pinion, axis 3 (Foundry Prime)
102.3.5	3HAC030825-001	Rot. AC motor incl. pinion, axis 3 (Cleanroom)
102.4	3HAC15887-2	Rot. AC motor incl. pinion, axis 4 (Standard, IRB 6640 - 180/2.55)
102.4	3HAC15889-2	Rot. AC motor incl. pinion, axis 4 (Standard, IRB 6640 - 235/2.55, 185/2.8, 205/2.75, 130/3.2) (IRB 6640ID - 200/2.55, 170/2.75)
102.4	3HAC026977-001	Rot. AC motor incl. pinion, axis 4 (Foundry Prime)
102.4	3HAC030826-001	Rot. AC motor incl. pinion, axis 4 (Cleanroom)
102.1.17	3HAC12149-3	Cover ax4 with gasket
102.1.34	3HAC16721-1	Magnetic plug
103.1.29	3HAC8081-8	Cover with gasket
103.1.29	3HAC030866-001	Wrist cover (Cleanroom)
103.1.30	3HAC022172-001	Cable cover, casting
103.1.30	3HAC030867-001	Wrist cover (Cleanroom)
108.324	3HAC12844-1	Cable cover
	3HAC15859-2	Arm extension 250 mm (IRB 6640 - 185/2.8)
	3HAC15859-3	Arm extension 450 mm (IRB 6640 - 130/3.2)

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8.6. Cable harness and SMB unit

Part list

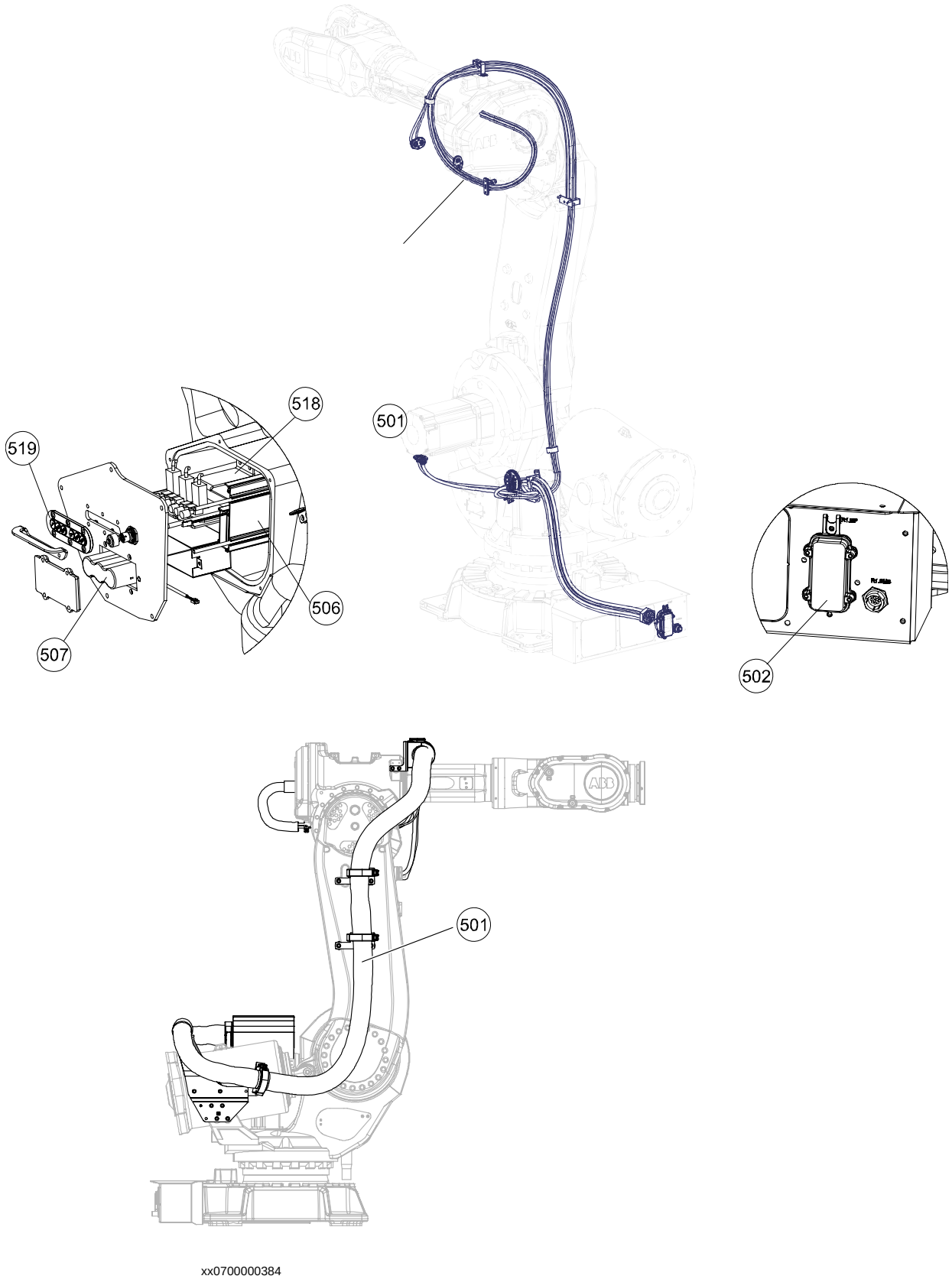
Item	Part	Spare part no.	Description
501	3HAC024385-001		Manipulator harness, axis 1-6 (Standard, IRB 6640 - 180/2.55, 235/2.55, 185/2.8)
501	3HAC024386-001		Manipulator harness, axis 1-6 (Standard, IRB 6640 - 205/2.75, 130/3.2)
501	3HAC14139-1		Manipulator harness axis 5 (Standard, IRB 6640 - 180/2.55, 235/2.55, 205/2.75, 185/2.8, 130/3.3)
501	3HAC025503-001		Manipulator harness, axis 1-4 (IRB 6640ID - 200/2.55)
501	3HAC025504-001		Manipulator harness, axis 1-4 (IRB6640ID - 170/2.75)
501	3HAC029840-001		Manipulator harness, axis 1-6 / MH ax 1-3 cable (Cleanroom)
501	3HAC023717-001		Manipulator harness axes 5-6 (IRB6640ID - 200/2.55, 170/2.75)
502	3HAC11774-3		Adapter, complete
506	3HAC022286-001		Serial measurement unit DSQC 633
507	3HAC16831-1		Battery pack
518	3HAC16035-1		BU w. buttons DSQC 563
519	3HAC6499-1		Push button guard

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Illustrations



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8.6. Cable harness and SMB unit

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9 Circuitdiagrams

9.1. Introduction

Overview

This chapter includes the circuit diagram for the robot.

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Sweden

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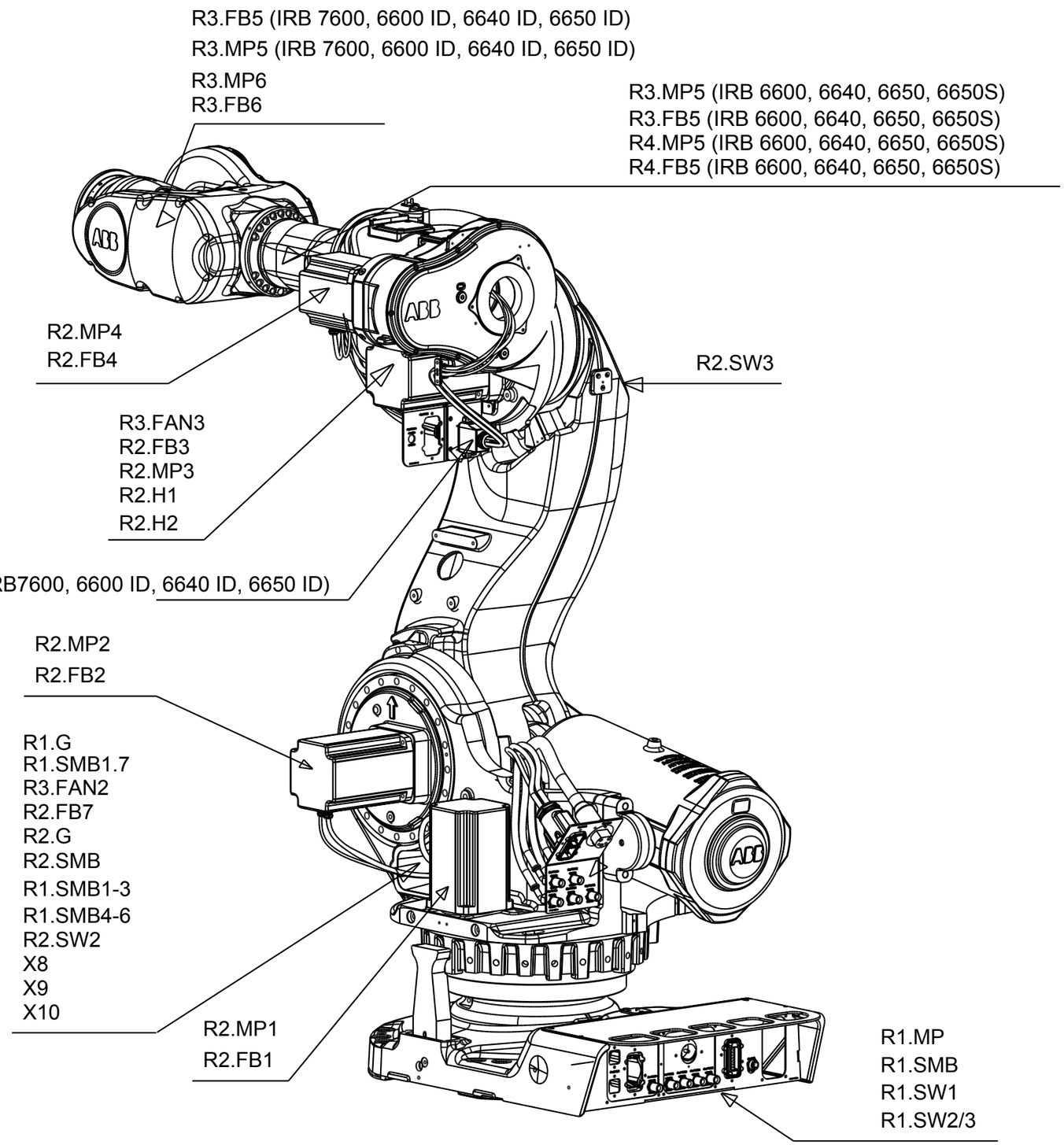
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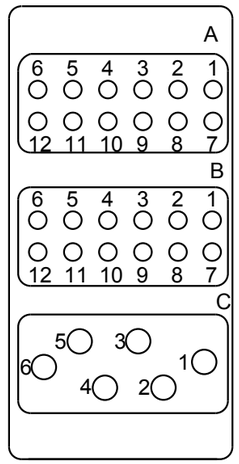
Valid For:
This circuit diagram is valid for the following cable harness assemblies:
3HAC 024385-001 Manipulator harness axis 1-6 (IRB 6600 / 6640)
3HAC 024386-001 Manipulator harness axis 1-6 (IRB 6640 / 6650 / 6650S)
3HAC14940-1 rev 3 and later. Manipulator harness axis 1-4 (IRB 6600 ID / 6640 ID / 7600)
3HAC16331-1 rev 1 and later. Manipulator harness axis 1-4 (IRB 6640 ID / 6650 ID)
3HAC14139-1 Manipulator harness axis 5 (IRB 6600 / 6640 / 6650 / 6650S)
3HAC11440-1 Manipulator harness axis 5-6 (IRB 7600)
3HAC023717-001 Manipulator harness axis 5-6 (IRB 6600 ID / 6640 ID / 6650 ID)
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3HAC16659-1 Pos Sw/ Fan cable harness (IRB 6650 / 6650 ID / 6650S)
3HAC023599-001 Fan cable harness (IRB 6600 / 6640 / 6650 / 6600 ID / 6640 ID / 6650 ID / 6650S /6660 / 7600)
3HAC026733-001 Manipulator harness axis 1-6 (IRB 6660)
3HAC028206-001 UL signal lamp (IRB 6660)

See circuit diagram 3HAC13347-1 in the following cases:
- If IRB6600, 6650 or 6650S with 3HAC14940-1, 3HAC16331-1
- If cable harness 3HAC14940-1 rev 2 or earlier
- If cable harness 3HAC16331-1 rev 0

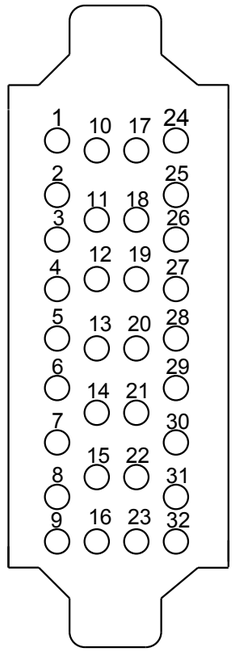
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R2.M5/6
(On IRB7600, 6600 ID,
6640 ID, 6650 ID)

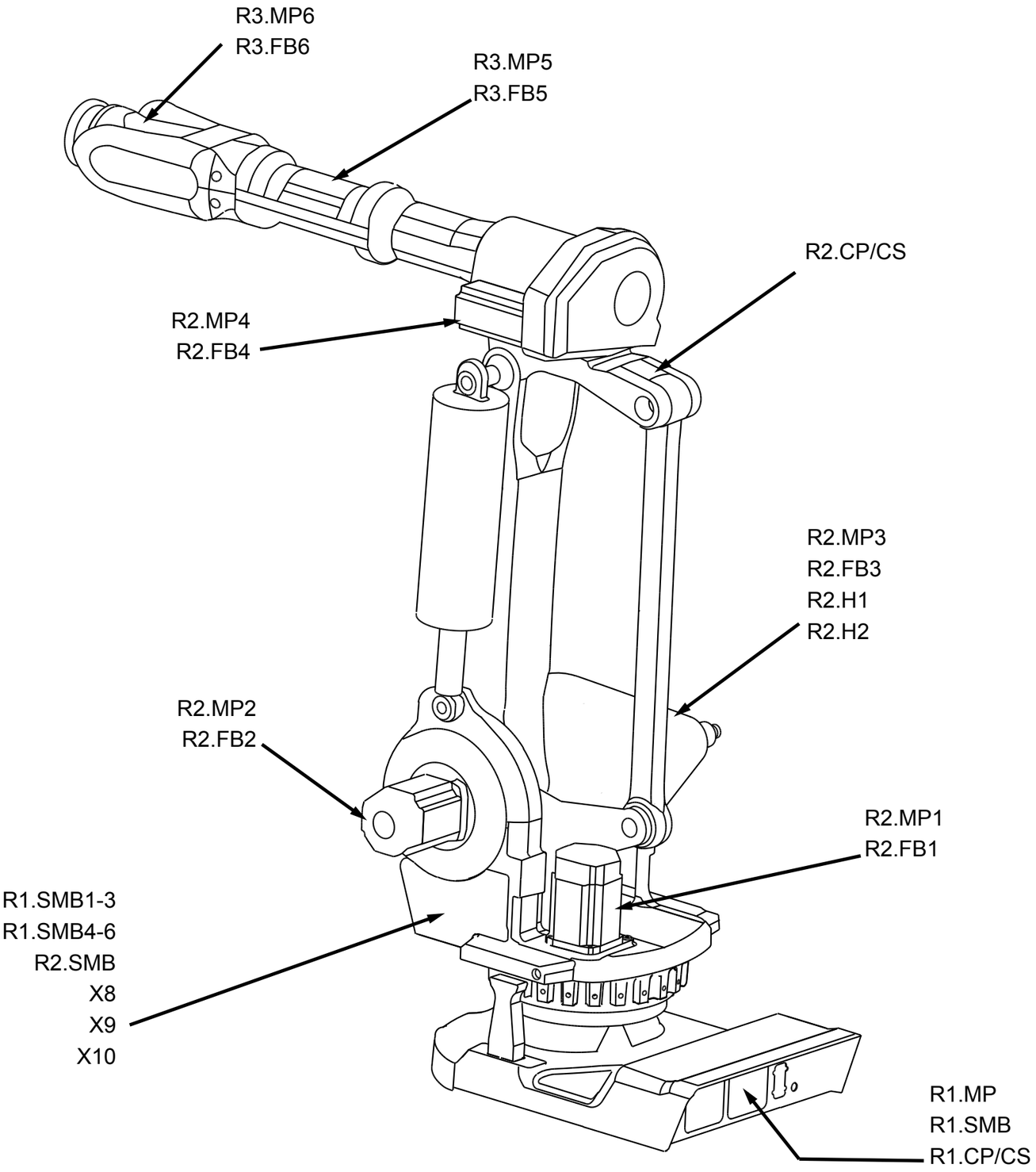


R1.MP



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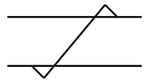
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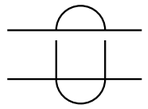
M	Motor
B	Brake
PTC	Temp sensor (PTC- resistor)
R	Resolver
G	Battery Pack
BU	Brake Release Unit
FB	Feedback unit
SMB	Serial Measurment Board
FAN	Fan
SW	Position switch
Keypin	Location pin to avoid mismatch



Protective Earth



Twisted wires



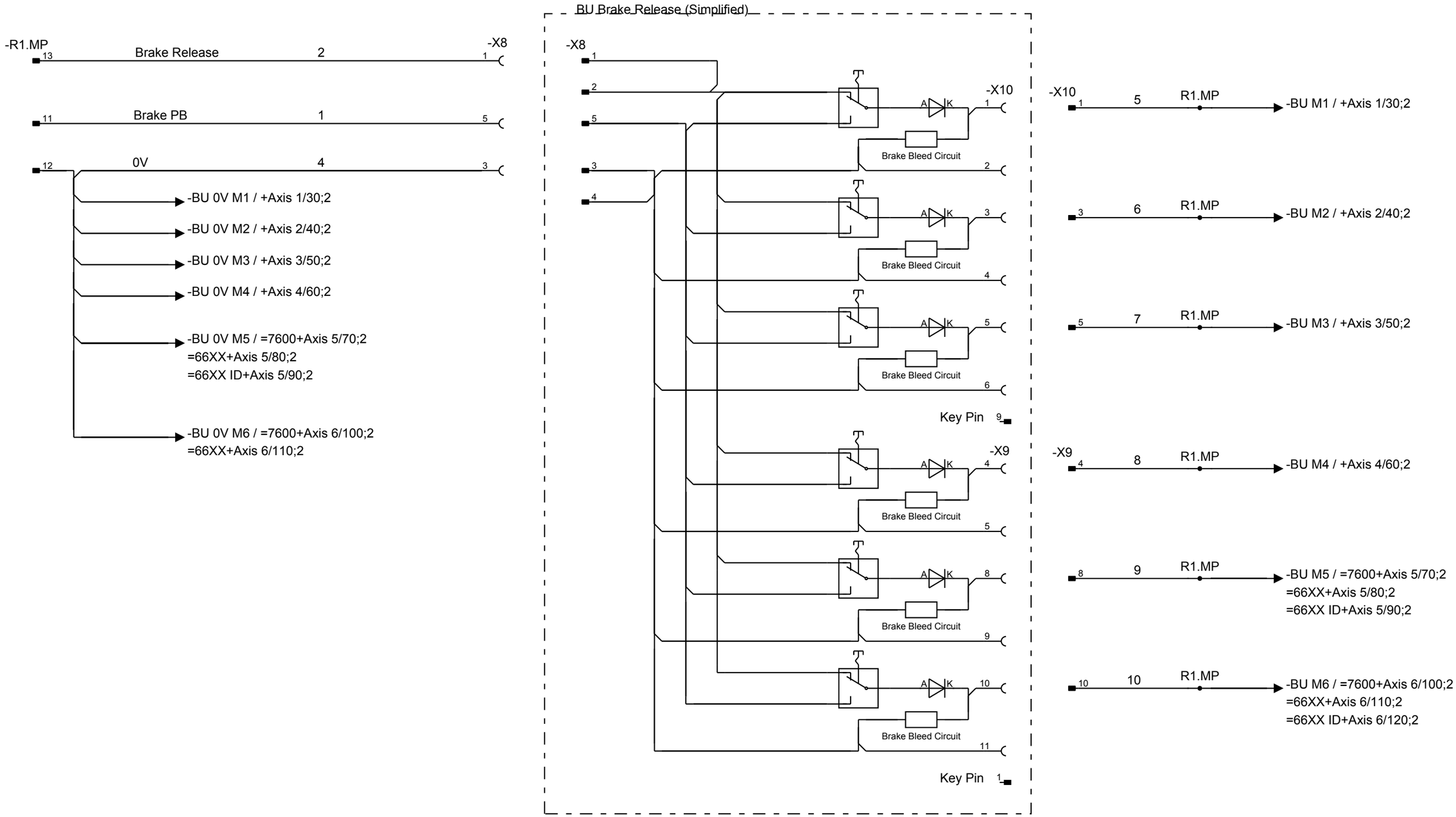
Screened wires

XX — Any number i.e. 66XX can be 6600, 6640, 6660 or 6650

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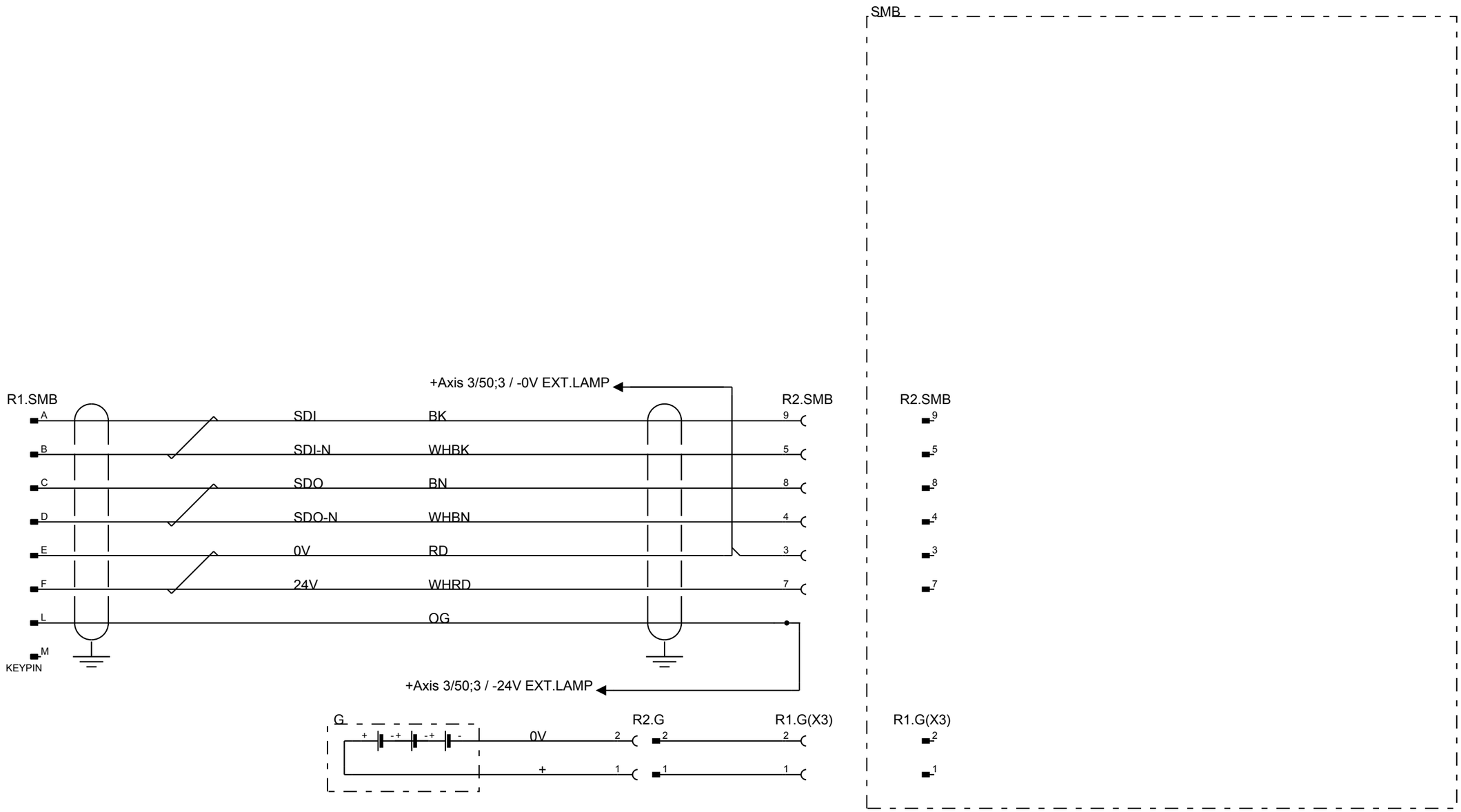
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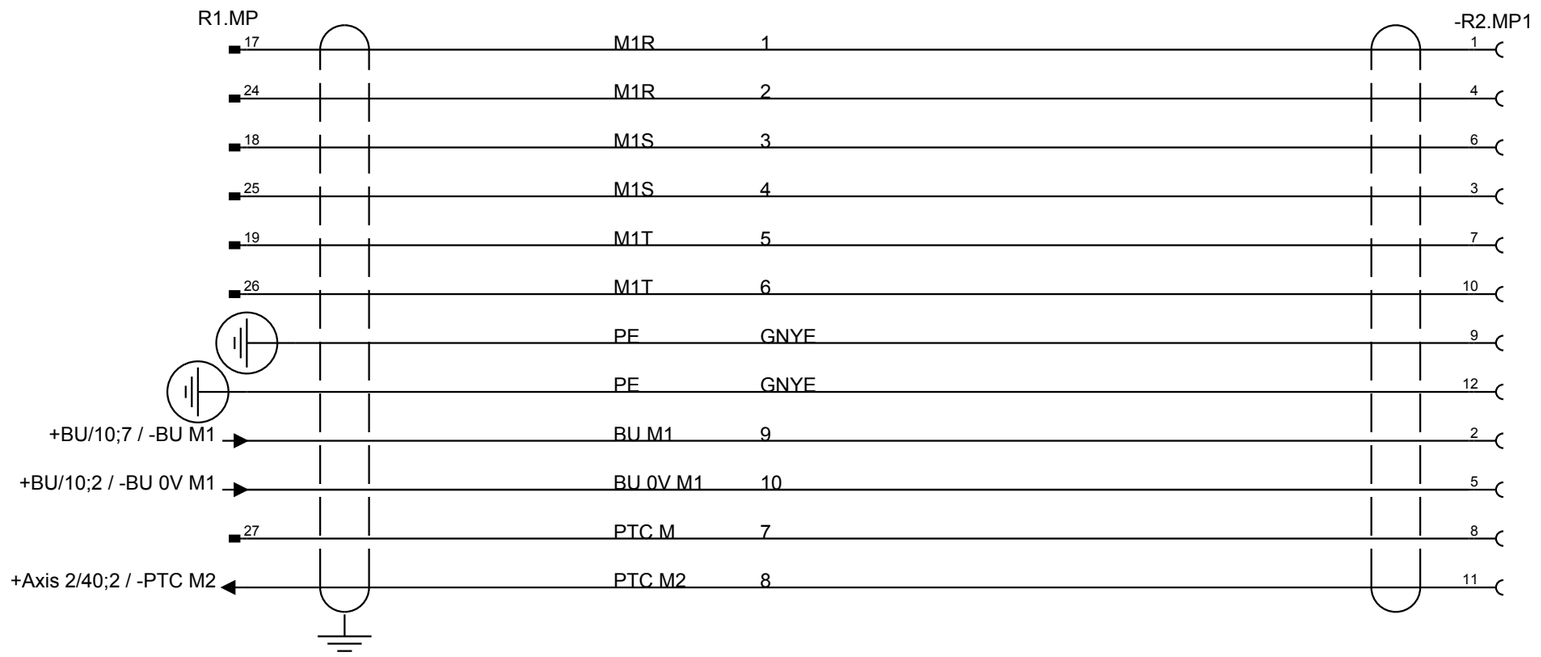
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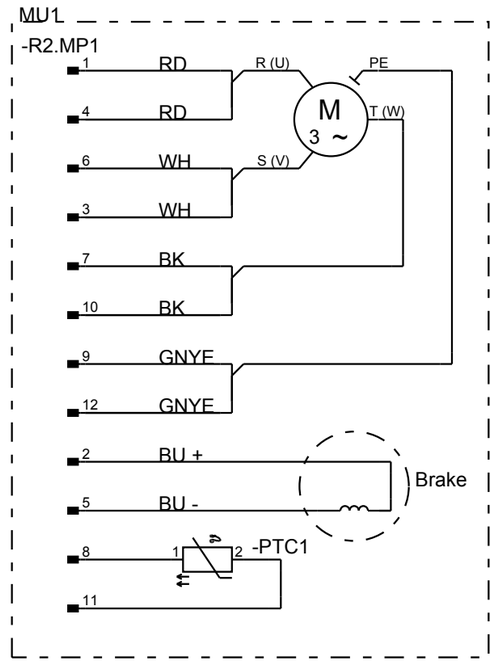
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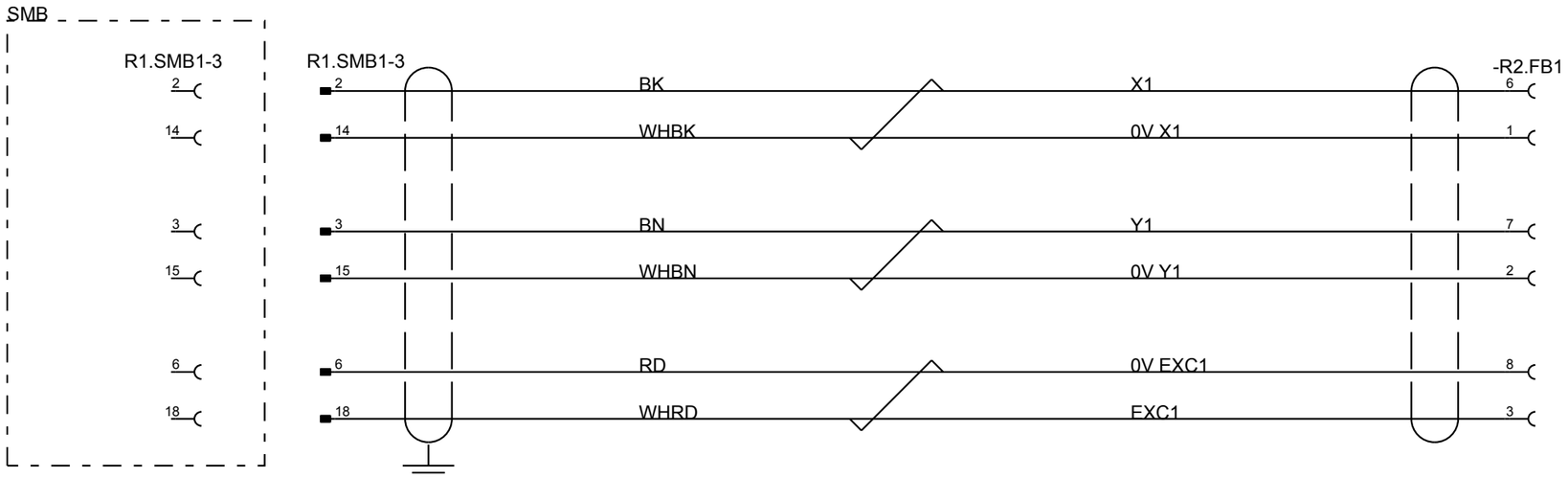


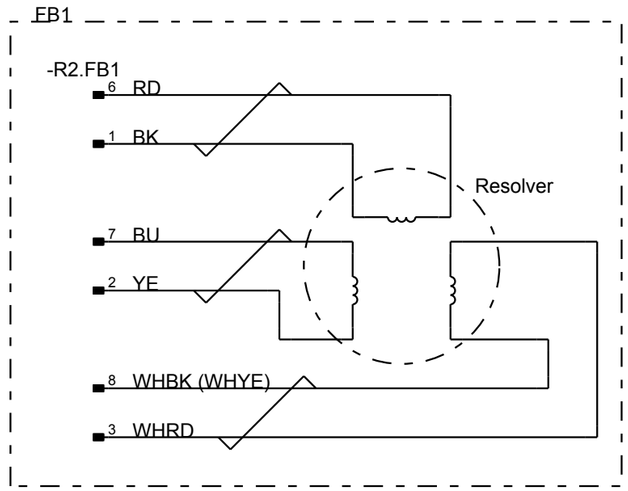
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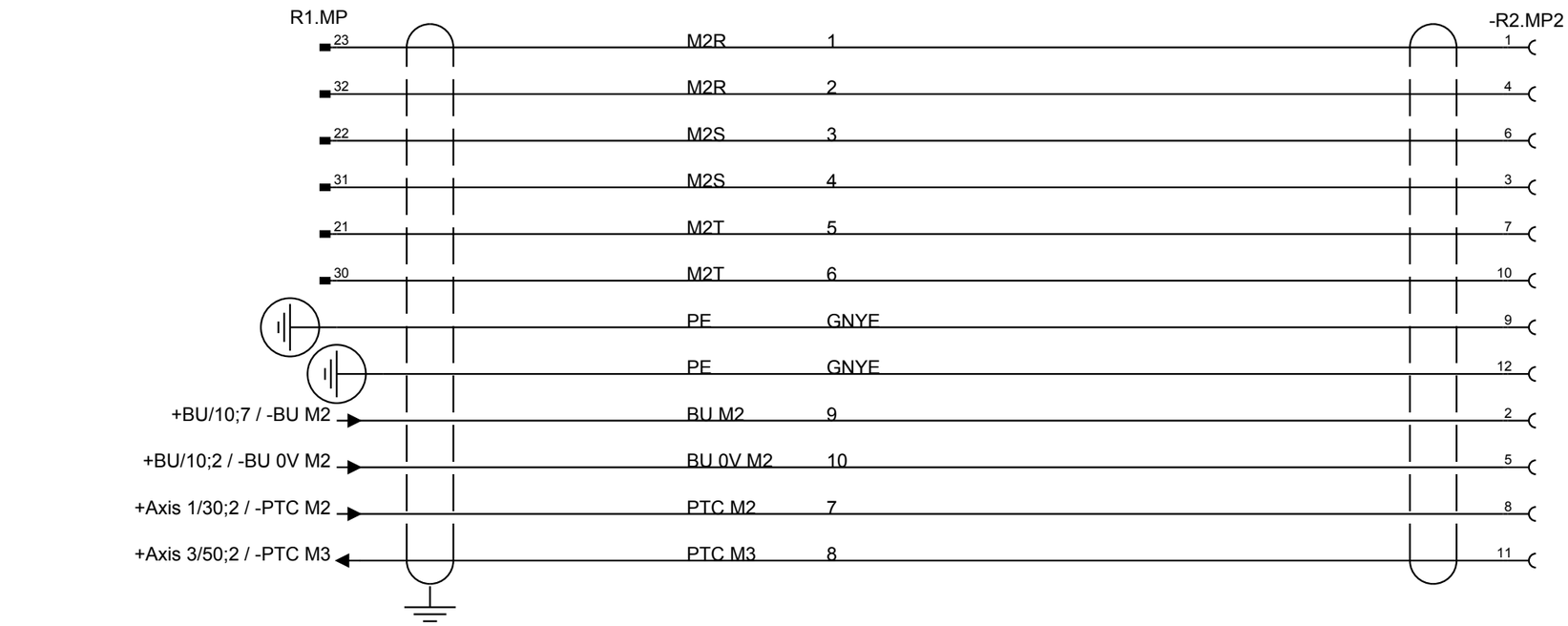






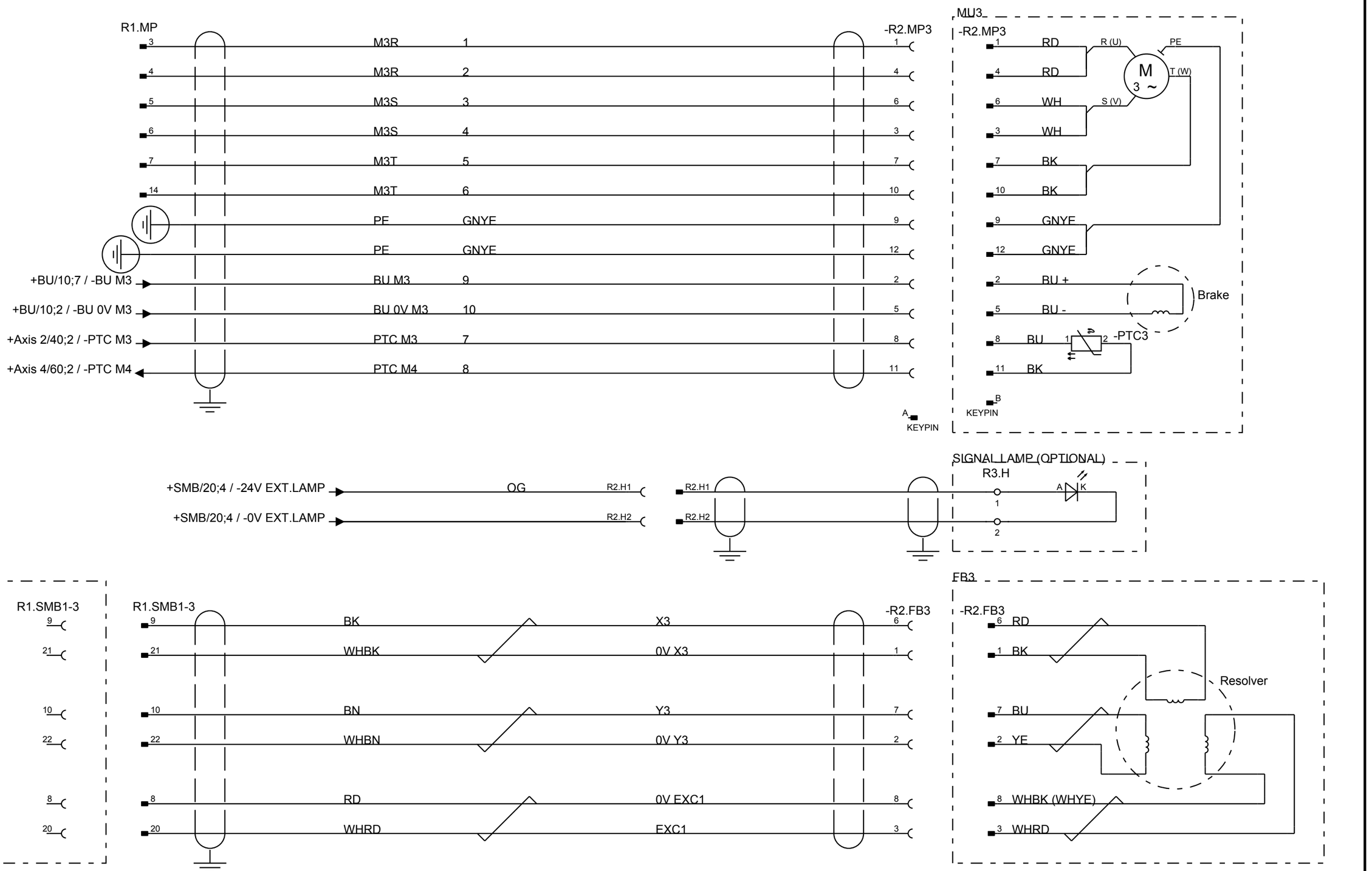
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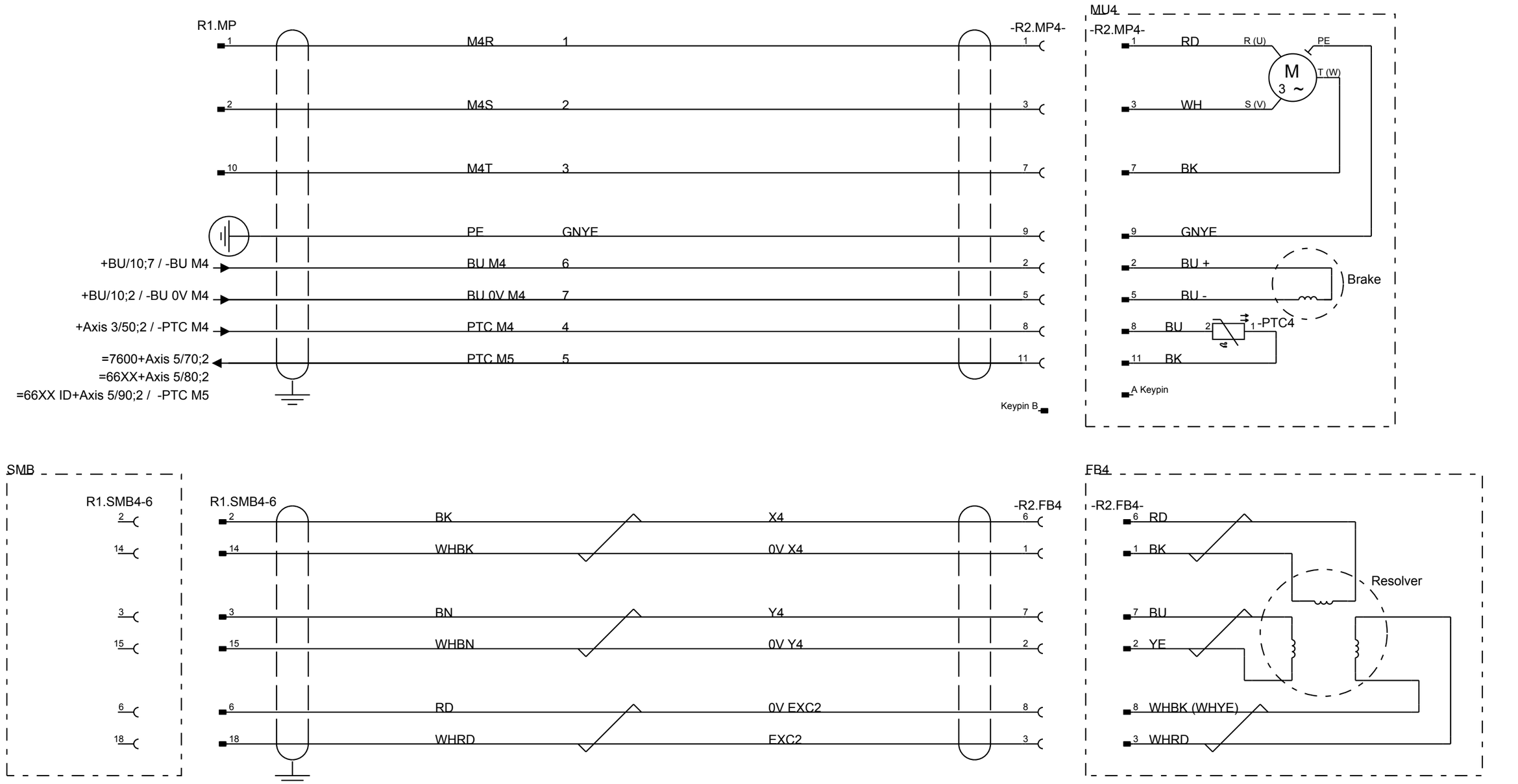
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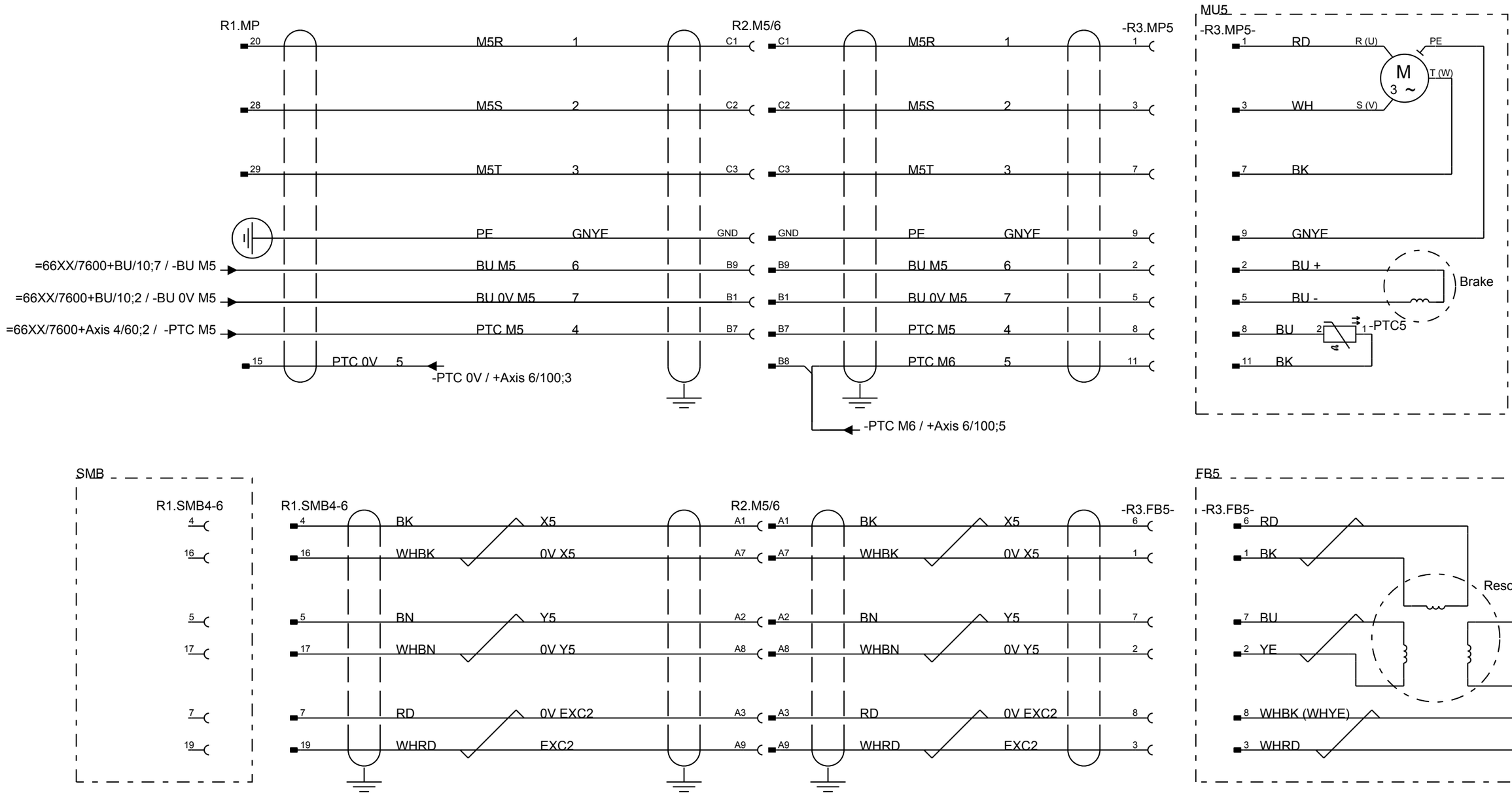
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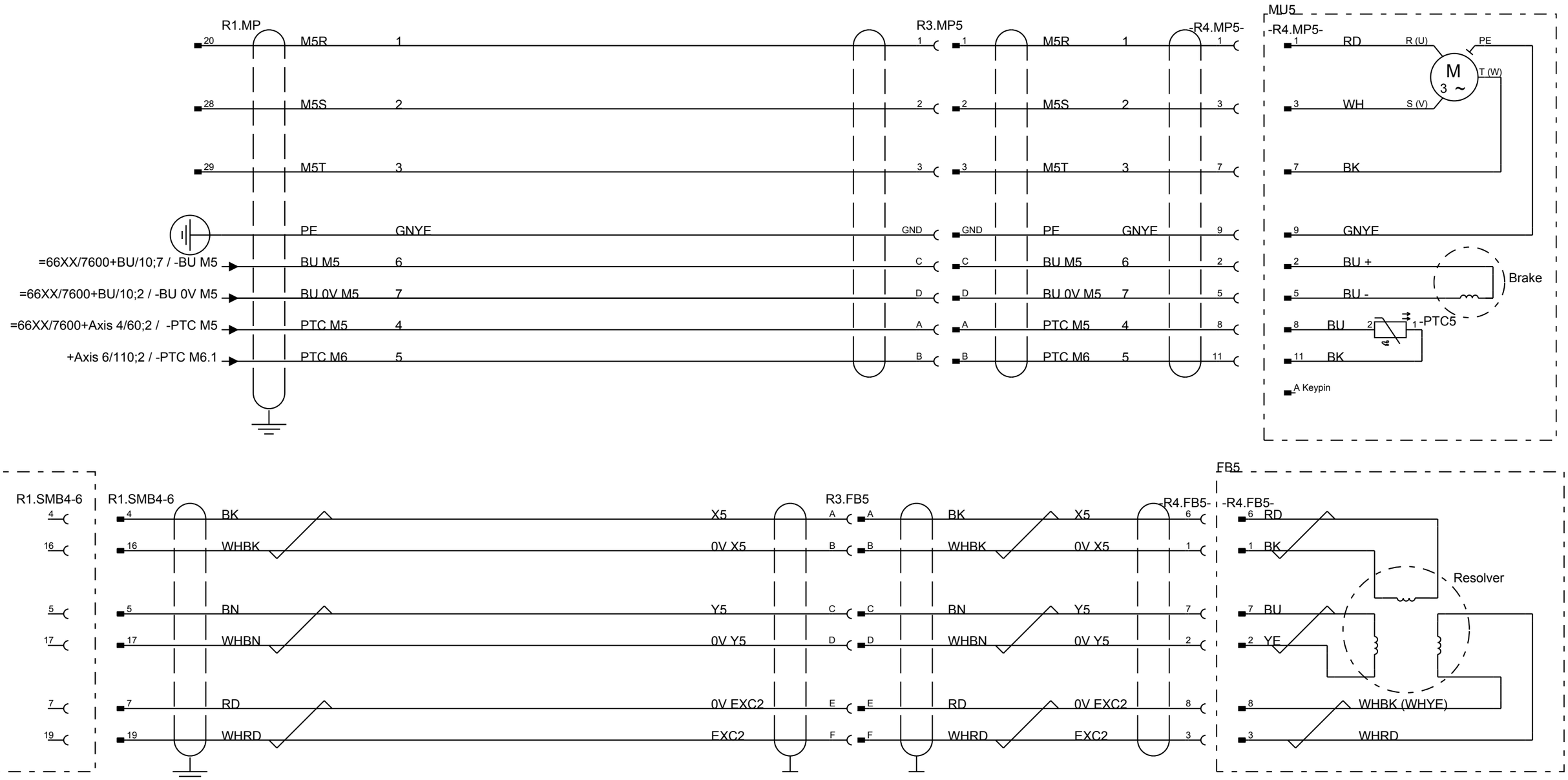
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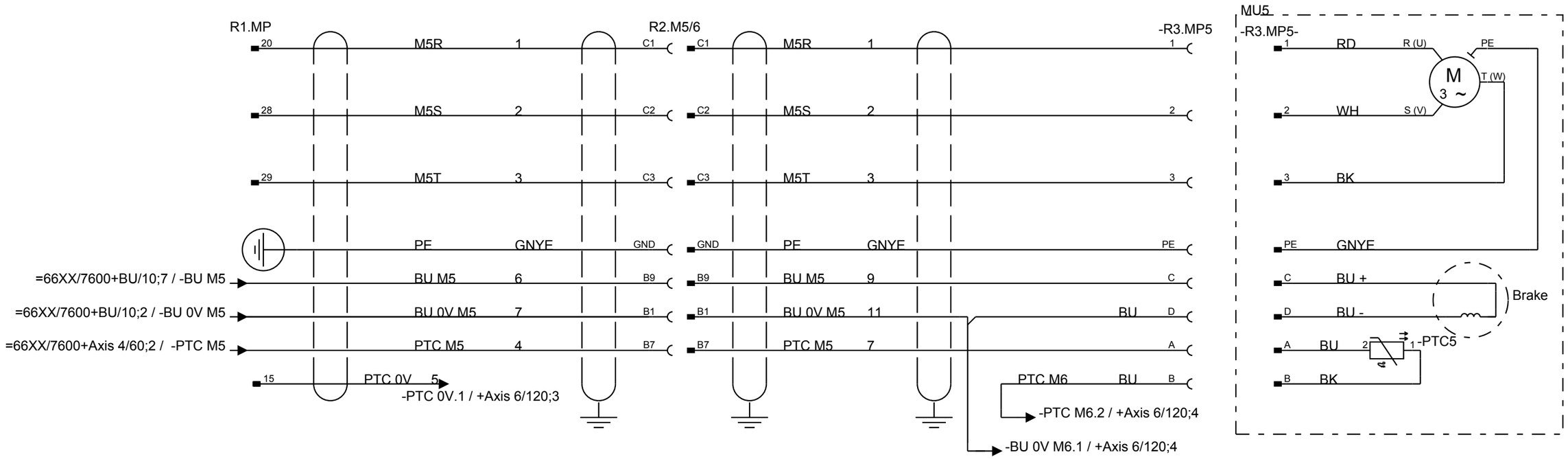
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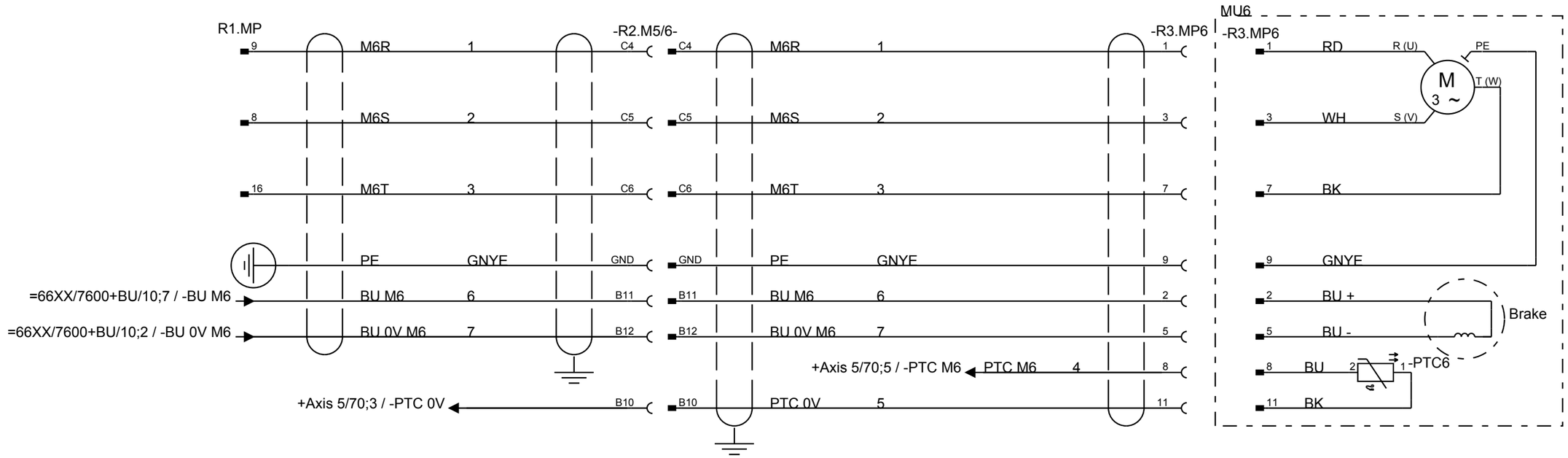


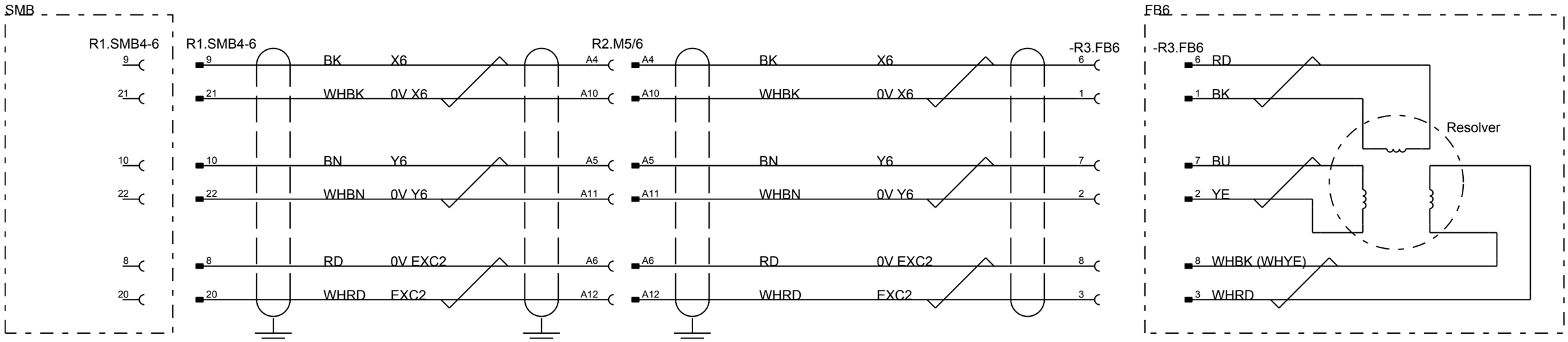
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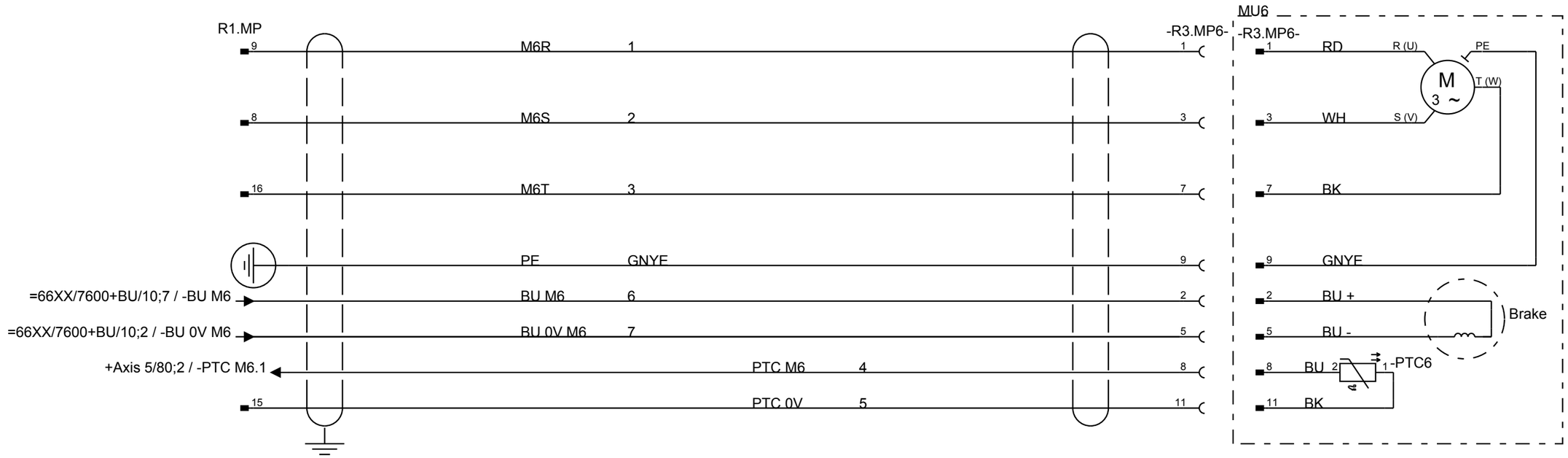


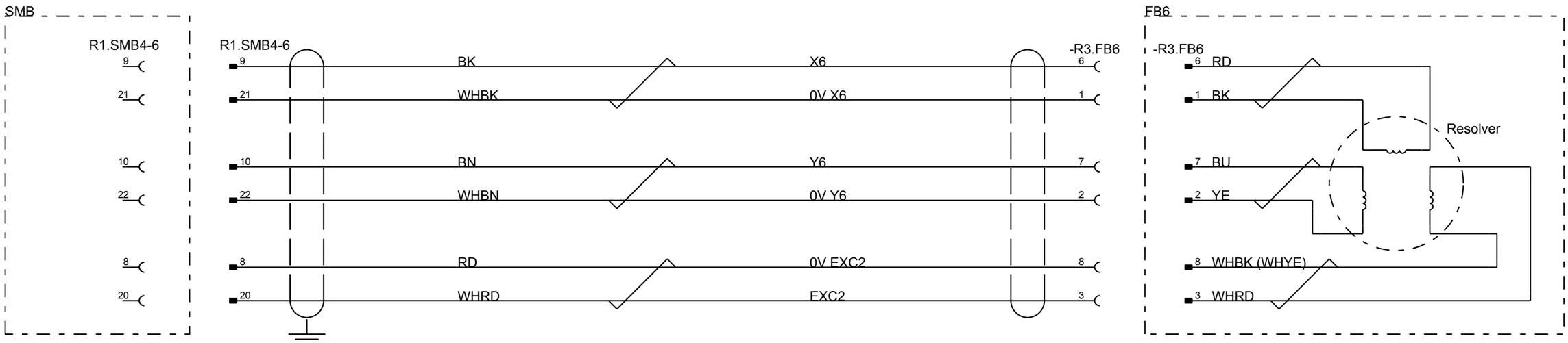


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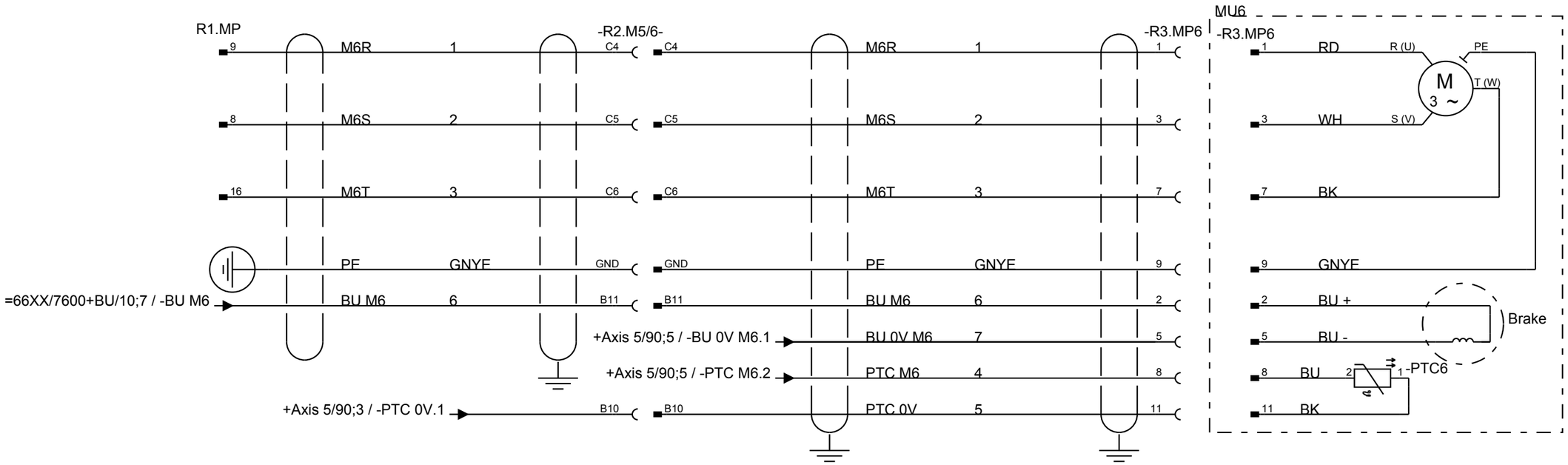
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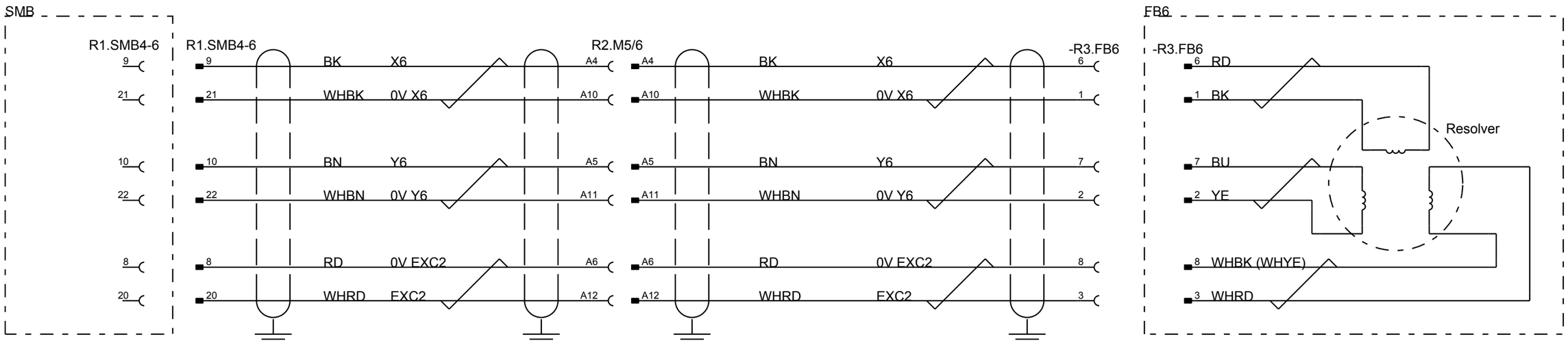




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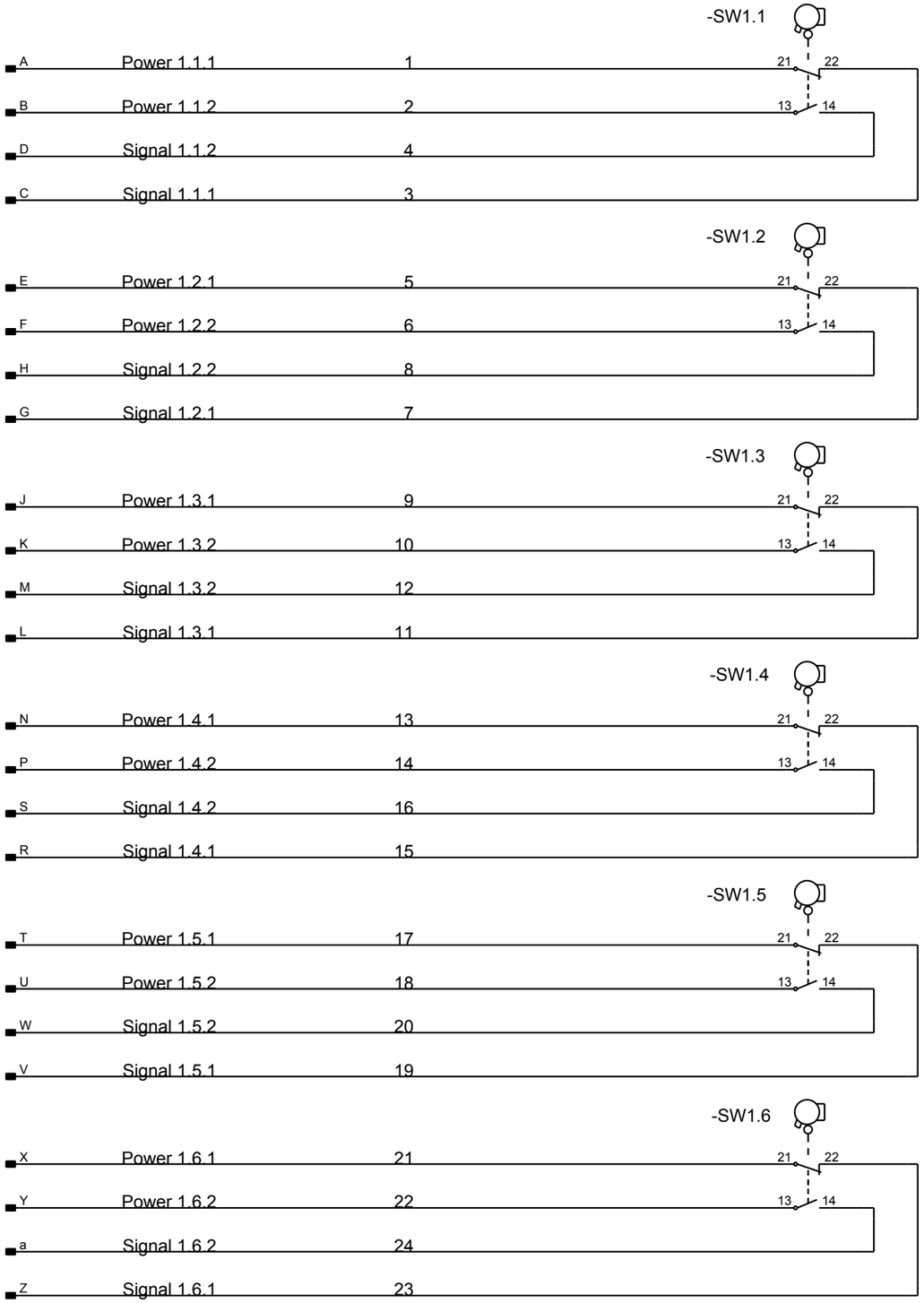
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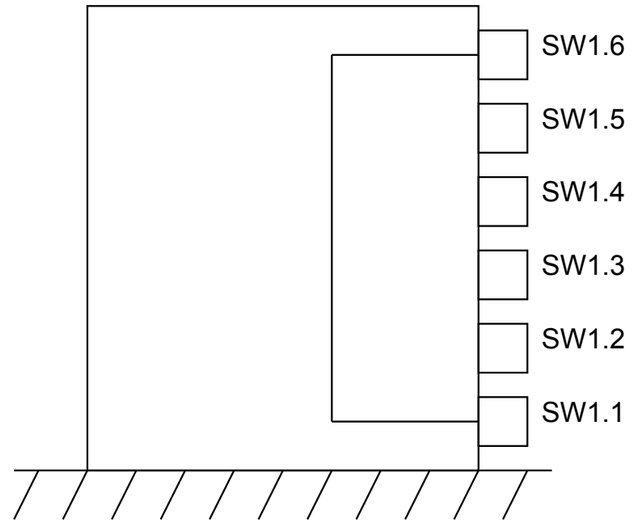


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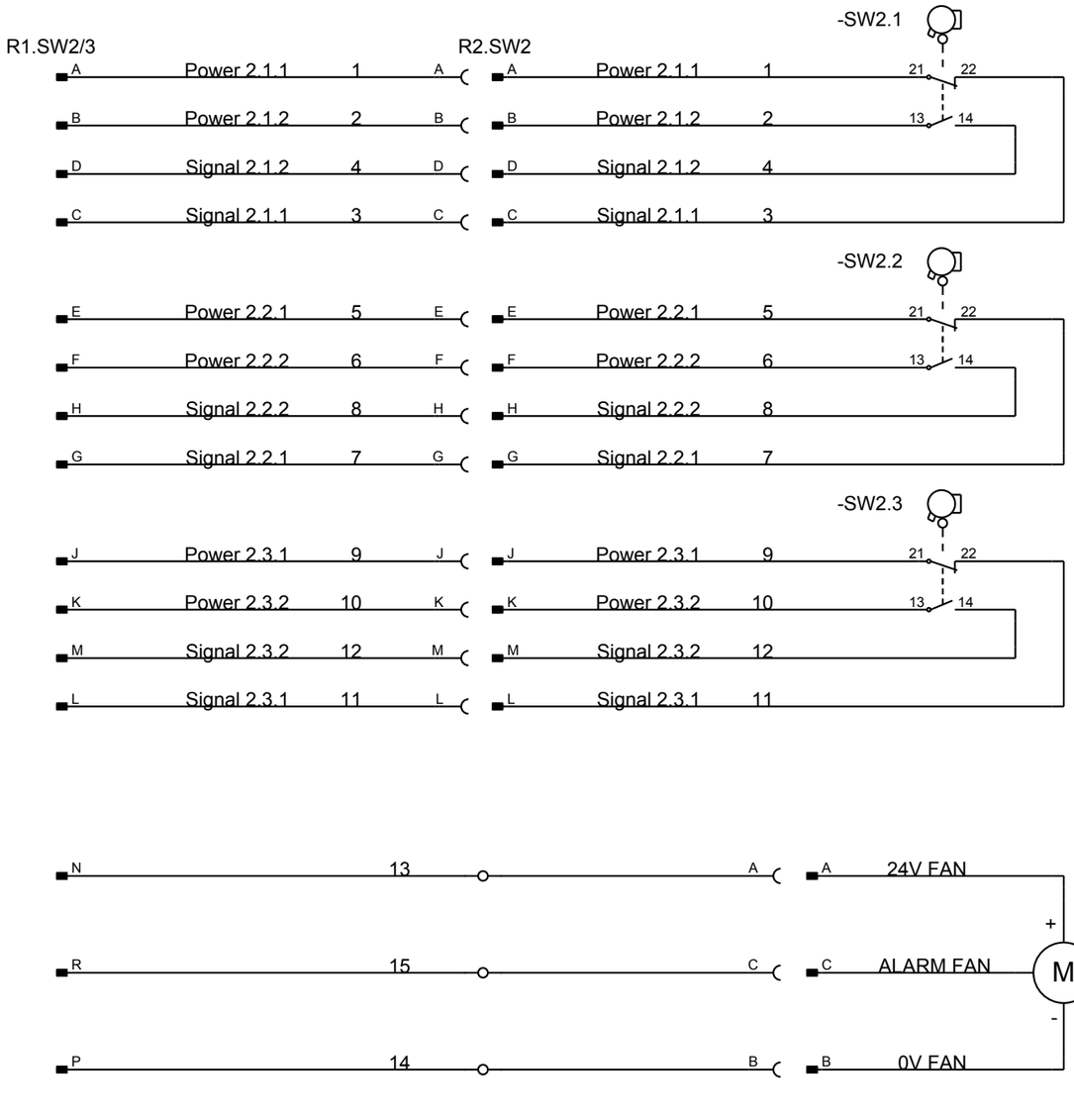
Location of position switches



Position switches
Axis 1

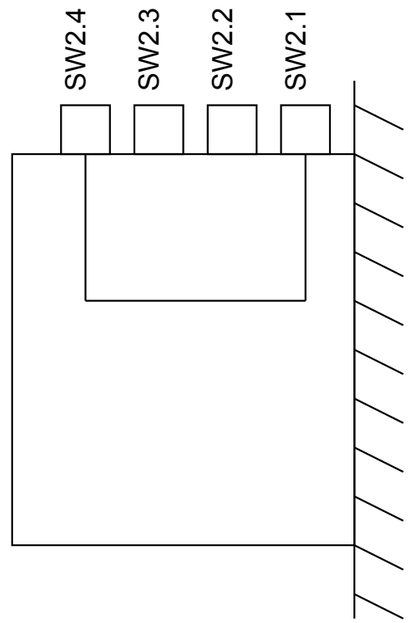
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Position switches
Axis 2

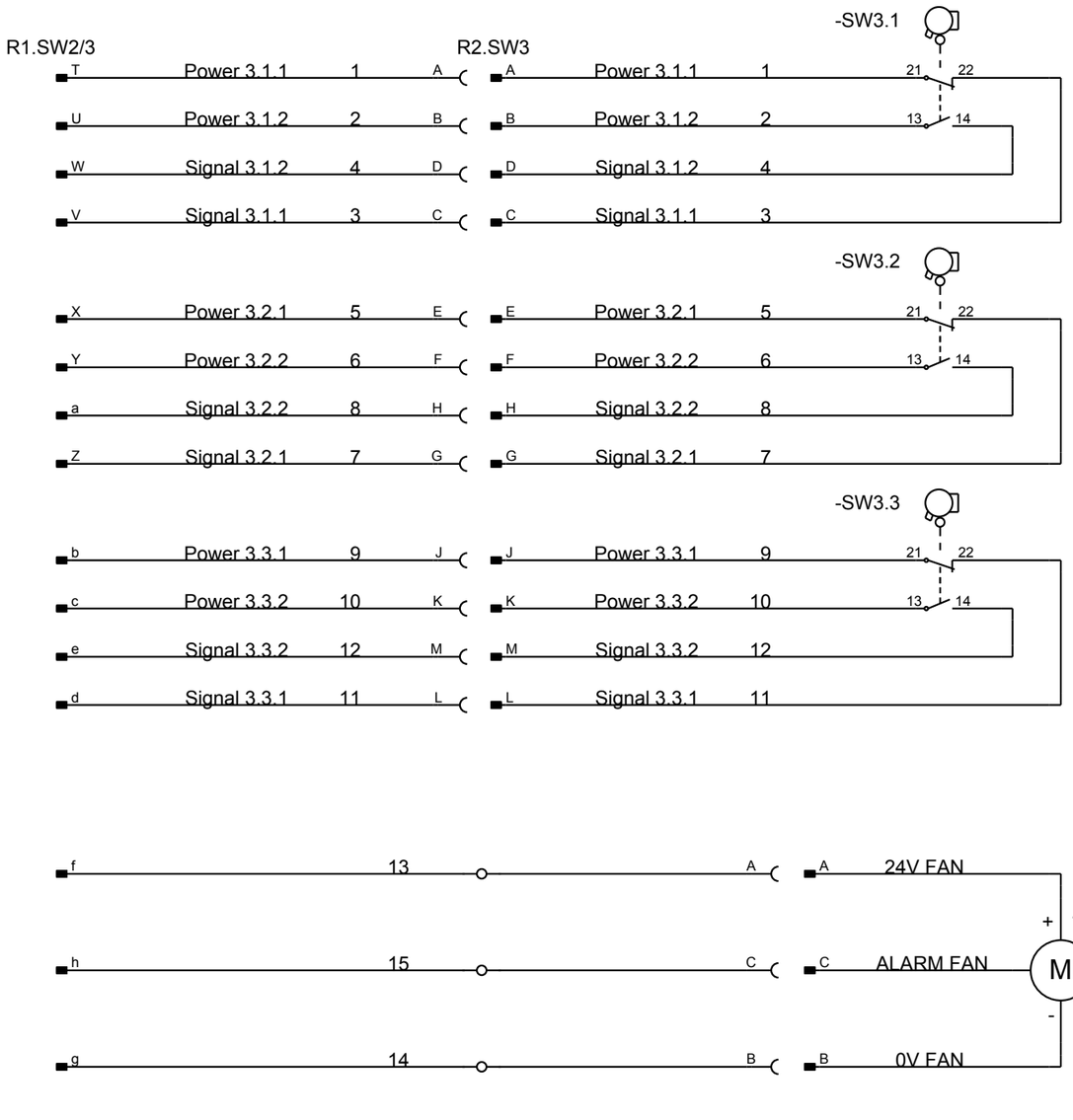
Location of position switches



Fan axis 1 or 2

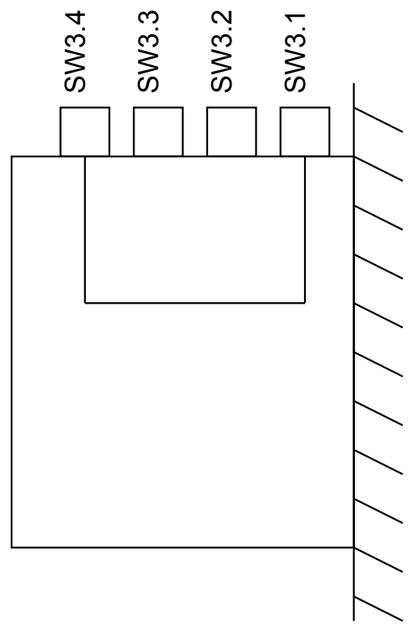
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Position switches
Axis 3

Location of Position switches



Fan axis 3

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