ROBOTICS

Product manual

IRB 360

Trace back information:
Workspace 21B version a6
Checked in 2021-05-31
Skribenta version 5.4.005

Product manual

IRB 360 - 1/800
IRB 360 - 1/1130
IRB 360 - 1/1600
IRB 360 - 3/1130
IRB 360 - 6/1600
IRB 360 - 8/1130

IRC5, OmniCore

Document ID: 3HAC030005-001

Revision: AA

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Keep for future reference.

Additional copies of this manual may be obtained from ABB.

Original instructions.

Table of contents

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Overview of this manual

About this manual

This manual contains instructions for:

- mechanical and electrical installation of the IRB 360
- maintenance of the IRB 360
- mechanical and electrical repair of the IRB 360

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

- *Standard*
- *Clean Room*
- *Wash*

Usage

This manual should be used during:

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

Note

It is the responsibility of the integrator to conduct a hazard and risk analysis of the final application and to ensure its safety.

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

Who should read this manual?

This manual is intended for:

- installation personnel
- maintenance personnel
- repair personnel.

Prerequisites

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

- be trained by ABB and have the required knowledge of mechanical and electrical installation/repair/maintenance work.
- be trained to respond to emergencies or abnormal situations.

Product manual scope

The manual covers all variants and designs of the IRB 360. Some variants and designs may have been removed from the business offer and are no longer available for purchase.

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References

Tip

All documents can be found via myABB Business Portal, *www.abb.com/myABB*.

IRC5

Reference	Document ID
Product manual, spare parts - IRB 360	*3HAC049101-001*
Circuit diagram - IRB 360	*3HAC028647-009*
Product specification - IRB 360	*3HAC029963-001*
Safety manual for robot - Manipulator and IRC5 or OmniCore controller [i]	*3HAC031045-001*
Product manual - IRC5 IRC5 with main computer DSQC 639.	*3HAC021313-001*
Product manual - IRC5 IRC5 with main computer DSQC1000.	*3HAC047136-001*
Circuit diagram - IRC5	*3HAC024480-011*
Product manual - IRC5 Compact IRC5 with main computer DSQC 639.	*3HAC035738-001*
Product manual - IRC5 Compact IRC5 with main computer DSQC1000.	*3HAC047138-001*
Circuit diagram - IRC5 Compact	*3HAC049406-003*
Product manual - IRC5 Panel Mounted Controller IRC5 with main computer DSQC 639.	*3HAC027707-001*
Product manual - IRC5 Panel Mounted Controller IRC5 with main computer DSQC1000.	*3HAC047137-001*
Circuit diagram - IRC5 Panel Mounted Controller	*3HAC026871-020*
Circuit diagram - Euromap	*3HAC024120-004*
Operating manual - IRC5 with FlexPendant	*3HAC050941-001*
Operating manual - Calibration Pendulum	*3HAC16578-1*
Operating manual - Service Information System	*3HAC050944-001*
Application manual - Additional axes and stand alone controller	*3HAC051016-001*
Application manual - Controller software IRC5	*3HAC050798-001*
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*

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Reference	Document ID
Technical reference manual - System parameters	*3HAC050948-001*
Application manual - Electronic Position Switches	*3HAC050996-001*

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

OmniCore

Reference	Document ID
Product manual, spare parts - IRB 360	*3HAC049101-001*
Circuit diagram - IRB 360	*3HAC028647-009*
Product specification - IRB 360	*3HAC029963-001*
Safety manual for robot - Manipulator and IRC5 or OmniCore controller i	*3HAC031045-001*
Product manual - OmniCore C30	*3HAC060860-001*
Operating manual - OmniCore	*3HAC065036-001*
Application manual - Controller software OmniCore	*3HAC066554-001*
Technical reference manual - Lubrication in gearboxes	*3HAC042927-001*
Technical reference manual - System parameters	*3HAC065041-001*

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

Revisions

Revision	Description
-	First edition
A	This revision includes the following additions and/or changes: • Section *What is an emergency stop?* added to chapter *Safety*. • Section *Maintenance schedule*: Interval for replacement of battery pack changed.
B	This revision includes the following additions and/or changes: • Implementation of IRB 360 1/1600.

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Revision	Description
C	This revision includes the following additions and/or changes: • Chapter Maintenance sections *Regular maintenance on page 93*, *Telescopic shaft, axis 4, standard on page 96*, *Telescopic shaft, wash down, axis 4 on page 98*, *Telescopic shaft, stainless, axis 4 on page 100* and *Bar system on page 106* updated concerning collisions. • Chapter Maintenance section *Bar system on page 106* updated on how to measure the distance between the bearing holders. • Circuit diagrams are not included in this document but delivered as separate files. • List of standards updated, see *Applicable standards on page 256*. • Spare parts chapter - art. no. updated for telescopic shaft and upper arm. Updates in the chapter *Safety*: • Updated safety signal graphics for the levels *Danger* and *Warning*, see *Safety signals in the manual on page 21*. • New safety labels on the manipulators, see *Safety symbols on manipulator labels on page 23*. • Revised terminology: *robot* replaced with *manipulator*.
D	This revision includes the following additions and/or changes: • Minor updates in the chapter *Calibration*.
E	This revision includes the following additions and/or changes: • Added caution regarding swivel cup, see *Fitting equipment on robot on page 66*. • Updated instructions for cleaning, see *Cleaning activities on page 138*. • Updated tightening sequence, see *Replacement of base cover gasket on page 162*. • Updated refitting instruction, see *Replacement of brake release button on page 225*. • Added information about when to update resolver values, see *When to calibrate on page 229*. • Updated information in *Environmental information on page 252*. • Updated spare parts, see *Spare parts in the base*.
F	This revision includes the following updates: • A new block, about general illustrations, added in section *How to read the product manual on page 18*. • New Option 864-1 connection FB7 on robot base.
G	This revision includes the following updates: • Spare part number for the telescopic shaft (1600) is corrected, see *Spare parts - telescopic shaft*. • Some general tightening torques have been changed/added, see updated values in *Screw joints on page 157*. • Maintenance interval regarding replacement of the telescopic shaft is changed from 8,000 hours to 4,000 hours, see *Maintenance schedule IRB 360 on page 94*. • Added information about batteries.

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Revision	Description
H	This revision includes the following updates: • Variant IRB 360 - 8/1130 is added to the manual. • Information about type and volume of oil in gearboxes is removed from the manual, and is instead now available in the *Technical reference manual - Lubrication in gearboxes - 3HAC042927-001*. More information in section *Type of lubrication in gearboxes on page 127*. • Added *Cut the paint or surface on the robot before replacing parts on page 160*. • Added information about an alternative bearing ring, see *Spare parts* and *Bar system on page 106*. • A new SMB unit and battery is introduced, with longer battery lifetime. • New article numbers for set screws, see *Spare parts, telescopic shafts*. • Corrected directions in figure for calibration movement and jogging directions, see *Calibration movement directions for all axes on page 232*.
J	This revision includes the following updates: • Variant IRB 360 - 6/1600 is added to the manual. • Corrected the protection class for protection typ Standard, see *Protection classes on page 46*. • Changed the tightening torque, see *Replacement of motor axis 4 on page 204*. • Added information about visual difference between bearing ring versions, see *Different versions of bearing rings require different maintenance procedures on page 106*. • Universal joint 3HAC028132-001 is replaced with 3HAC046664-001, see *Spare parts - telescopic shafts*.
K	This revision includes the following updates: • Illustrations of placement of labels updated. • Added information about risks when scrapping a decommissioned robot, see *Scrapping of robot on page 254*. • *Spare parts and exploded views* are not included in this document but delivered as a separate document. See *Product manual, spare parts - IRB 360*. • Mechanical interface of IRB 360 - 8/1130 and IRB 360 - 6/1600 updated.
L	This revision includes the following updates: • Added information in calibration chapter, see *Using the jogging window on the FlexPendant on page 247*. • Clarification made about when to choose standard calibration vs. ring calibration, see *Types of calibration on page 230*. • Clarification made about measured distance between bearing holders, regarding wear on bearing rings, see *Distance between bearing holders on page 108*. • Minor corrections
M	This revision includes the following updates: • Updated instructions for cleaning, see *Cleaning activities on page 138*. • Minor corrections
N	This revision includes the following updates: • Minor corrections

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Revision	Description
P	Published in release R16.2. The following updates are done in this revision: • Corrections due to updates in terminology. • Warning about high center of gravity during transport added. • Updates about parameter *Calibration Position (cal_position)* in *Calibration information on page 229*. • Added information about tightening torque in section *Replacement of movable plate on page 180*.
Q	Published in release R17.1. The following updates are done in this revision: • Major updates in cleaning section. • Updates regarding checking the calibration position. • Measurement method in Maintenance added.
R	Published in release R17.2. The following updates are done in this revision: • Caution about removing metal residues added in sections about SMB boards. • Updated list of applicable standards. • Changed torque on oil plug (Gear-motor unit axis 4). • Section *Start of robot in cold environments on page 89* added. • Updated figure on motor axis 4. • Added a note in the instruction *Removal on page 190*. • Updated maintenance schedule with sealing ring (v-ring) and the affected cleaning instructions. • Updated information regarding extra load mass.
S	Published in release R18.1. The following updates are done in this revision: • Safety restructured. • Updated information regarding extra load mass. • Added sections in *General procedures on page 152*. • Minor update of graphics in the calibration chapter. • Information about myABB Business Portal added.
T	Published in release R18.2. The following updates are done in this revision: • Added section for inspection of labels in maintenance chapter. • Grease article number updated (is 3HAC042560-001, was 3HAC029132-001)
U	Published in release R18.2. The following updates are done in this revision: • Reference updated.
V	Published in release 19B. The following updates are made in this revision: • New touch up color Graphite White available. See *Cut the paint or surface on the robot before replacing parts on page 160*.
W	Published in release 19D. The following updates are made in this revision: • Sealing compound Sikaflex 521 FC replaced by Trans7 from Trans Clear. • Requirement to paint touch up color on refitted joints sealed with Trans7 is removed.
X	Published in release 20A. The following updates are made in this revision: • Changed the repair procedure for replacing parallel arms. • Clarified and added information in mounting instructions for rotating sealings, see *Mounting instructions for sealings on page 154*.
Y	Published in release 20C. The following updates are made in this revision: • Updated information regarding the fact that installation instructions no longer are enclosed with bearing rings 3HAC2091-1, see *Different versions of bearing rings require different maintenance procedures on page 106*.

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Revision	Description
Z	Published in release 21A. The following updates are made in this revision: • Added information on supporting OmniCore controller. • Added image showing distance between bearing holders on IRB 360 WDS, see *Distance between bearing holders on page 108*. • Corrected image of calibration marks location, see *Replacing of calibration marks on page 211*. • Updated the instruction *Manually releasing the brakes on page 64*. • Size of grease nipple on telescopic shaft clarified, see *Telescopic shaft, stainless, axis 4 on page 100*. • Text regarding fastener quality is updated, see *Fastener quality on page 72*.
AA	Published in release 21B. The following updates are made in this revision: • Text regarding Measuring backlash axis-4 is uppdated.

Product documentation

Categories for user documentation from ABB Robotics

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

Tip

All documents can be found via myABB Business Portal, *www.abb.com/myABB*.

Product manuals

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

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

Technical reference manuals

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

Application manuals

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

An application manual generally contains information about:

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

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Operating manals

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

How to read the product manual

Reading the procedures

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

References to figures

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

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

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

	Action	Note/Illustration
8.	Remove the *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 and dimensions.

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

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

	Action	Note/Illustration
3.	Fit a new *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 the chapter *Safety on page 19*.

Illustrations

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

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

1 Safety

1.1 Safety information

1.1.1 Limitation of liability

Limitation of liability

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

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

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

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

Spare parts and equipment

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

1.1.2 Requirements on personnel

General

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

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

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

Personal protective equipment

Use personal protective equipment, as stated in the instructions.

1.2 Safety signals and symbols

1.2.1 Safety signals in the manual

Introduction to safety signals

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

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

Hazard levels

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

For more information, see standard ISO 13849.

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

Continues on next page

1.2.1 Safety signals in the manual
Continued

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

1.2.2 Safety symbols on manipulator labels

Introduction to symbols

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

Symbols are used in combinations on the labels, describing each specific warning. The descriptions in this section are generic, the labels can contain additional information such as values.

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

Types of symbols

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

The safety labels are language independent, they only use graphics. See *Symbols on safety labels on page 23*.

The information labels can contain information in text.

Symbols on safety labels

Symbol	Description
 xx0900000812	**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.
 xx0900000811	**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.
 xx0900000839	**Prohibition** Used in combinations with other symbols.

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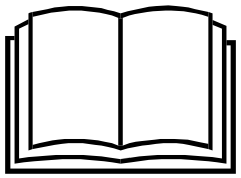
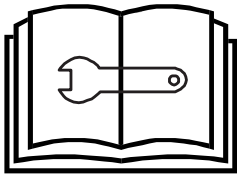
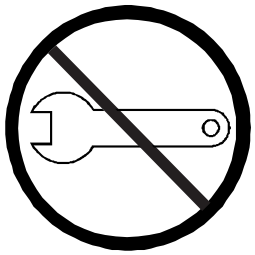
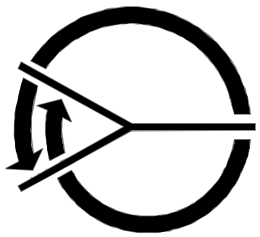
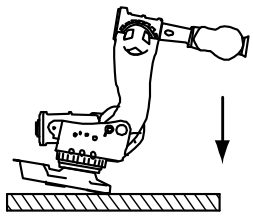
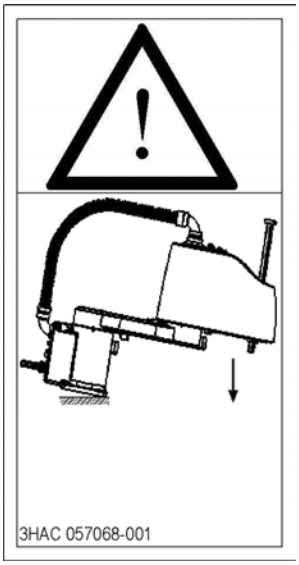
1.2.2 Safety symbols on manipulator labels
Continued

Symbol	Description
 xx0900000813	**See user documentation** Read user documentation for details. Which manual to read is defined by the symbol: • No text: *Product manual*. • EPS: *Application manual - Electronic Position Switches*.
 xx0900000816	**Before disassembly, see product manual**
 xx0900000815	**Do not disassemble** Disassembling this part can cause injury.
 xx0900000814	**Extended rotation** This axis has extended rotation (working area) compared to standard.
 xx0900000808	**Brake release** Pressing this button will release the brakes. This means that the robot arm can fall down.

Continues on next page

Symbol	Description
 xx0900000810  xx1500002402	**Tip risk when loosening bolts** The robot can tip over if the bolts are not securely fastened.
  xx0900000817	**Crush** Risk of crush injuries.

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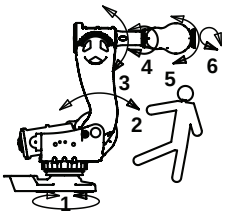
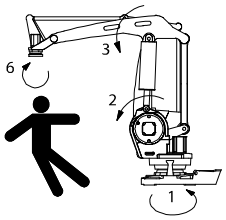
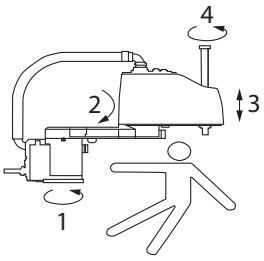
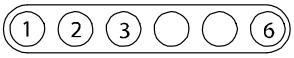
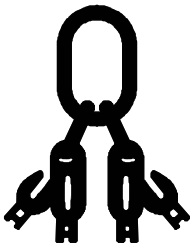
1.2.2 Safety symbols on manipulator labels
Continued

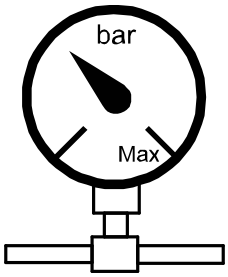
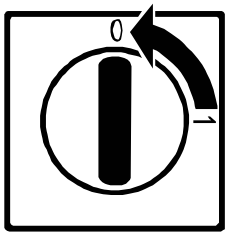
Symbol	Description
 xx0900000818  xx1300001087	**Heat** Risk of heat that can cause burns. (Both signs are used)
 xx0900000819  xx1000001141  xx1500002616	**Moving robot** The robot can move unexpectedly.

Continues on next page

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

Continues on next page

1.2.2 Safety symbols on manipulator labels
Continued

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

1.3 Robot stopping functions

Protective stop and emergency stop

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

For more information see:

- *Product manual - OmniCore C30*
- *Product manual - IRC5*
- *Product manual - IRC5 Compact*
- *Product manual - IRC5 Panel Mounted Controller*

1.4 Installation and commissioning

National or regional regulations

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

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

The integrator of the robot system is required to perform an assessment of the hazards and risks.

Layout

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

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

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

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

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

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

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

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

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

Allergenic material

See *Environmental information on page 252* for specification of allergenic materials in the product, if any.

Securing the robot to the foundation

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

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

Continues on next page

Electrical safety

The mains power must be installed to fulfill national regulations.

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

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

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

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

Note

Use a CARBON DIOXIDE (CO_2) extinguisher in the event of a fire in the robot.

Safety devices

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

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

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

Other hazards

WARNING

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

A robot may perform unexpected limited movement.

WARNING

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

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

- Water
- Compressed air
- Hydraulics

Continues on next page

Pneumatic or hydraulic related hazards

Note

The pressure in the complete pneumatic or hydraulic systems must be released before service and maintenance.

All components in the robot system that remain pressurized after switching off the power to the robot must be marked with clearly visible drain facilities and a warning sign that indicates the hazard of stored energy.

Loss of pressure in the robot system may cause parts or objects 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.

All pipes, hoses, and connections have to be inspected regularly for leaks and damage. Damage must be repaired immediately.

Verify the safety functions

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

1.5 Operation

1.5.1 Unexpected movement of robot arm

Unexpected movement of robot arm

WARNING

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

A robot may perform unexpected limited movement.

WARNING

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

1.6 Maintenance and repair

1.6.1 Maintenance and repair

General

Corrective maintenance must only be carried out by personnel trained on the robot.

Maintenance or repair must be done with all electrical, pneumatic, and hydraulic power switched off, that is, no remaining hazards.

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

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

Make sure that there are no loose screws, turnings, or other unexpected parts remaining after work on the robot has been performed.

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

Hot surfaces

Surfaces can be hot after running the robot. Touching the surfaces may result in burns.

Allow the parts to cool down before maintenance or repair.

Allergic reaction

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

Gearbox lubricants (oil or grease)

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

Note

Take special care when handling hot lubricants.

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

Continues on next page

Warning	Description	Elimination/Action
 **Allergic reaction**	When working with lubricants there is a risk of an allergic reaction.	Make sure that protective gear like goggles and gloves are always worn.
 **Possible pressure build-up in gearbox**	When opening the oil or grease plug, there may be pressure present in the gearbox, causing lubricant to spray from the opening.	Open the plug carefully and keep away from the opening. Do not overfill the gearbox when filling.
 **Do not overfill**	Overfilling of gearbox lubricant 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 it with oil or grease. After filling, verify that the level is correct.
 **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 instructions. Always use the type of oil specified for the product.
 **Heat up the oil**	Warm oil drains quicker than cold oil.	Run the robot before changing the gearbox oil, if possible.
 **Specified amount depends on drained volume**	The specified amount of oil or grease is based on the total volume of the gearbox. When changing the lubricant, the amount refilled may differ from the specified amount, depending on how much has previously been drained from the gearbox.	After filling, verify that the level is correct.
 **Contaminated oil in gearboxes**	For lifetime reasons always drain as much oil as possible from the gearbox. The magnetic oil plugs will gather residual metal chips.	

Hazards related to batteries

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

Continues on next page

1.6.1 Maintenance and repair
Continued

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

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

Operating temperatures are listed in *Operating conditions on page 46*.

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

Unexpected movement of robot arm

WARNING

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

A robot may perform unexpected limited movement.

WARNING

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

Related information

See also the safety information related to installation and operation.

1.6.2 Emergency release of the robot axes

Description

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

How to release the brakes is described in the section:

- *Manually releasing the brakes on page 64*.

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

Increased injury

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

DANGER

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

Make sure no personnel is near or beneath the robot.

1.6.3 Brake testing

When to test

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

How to test

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

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

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

Note

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

1.7 Troubleshooting

General

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

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

DANGER

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

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

WARNING

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

A robot may perform unexpected limited movement.

WARNING

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

Related information

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

1.8 Decommissioning

General

See section *Decommissioning on page 251*.

Unexpected movement of robot arm

WARNING

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

A robot may perform unexpected limited movement.

WARNING

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

2 Installation and commissioning

2.1 Introduction to installation and commissioning

General

This chapter contains assembly instructions and information for installing the IRB 360 at the working site.

See also the product manual for the robot controller.

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

Safety information

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

There are general safety aspects that must be read through, as well as more specific safety information that describes the danger and safety risks when performing the procedures. Read the chapter *Safety on page 19* before performing any installation work.

Note

If the IRB 360 is connected to power, always make sure that the robot is connected to protective earth and a residual current device (RCD) before starting any installation work.

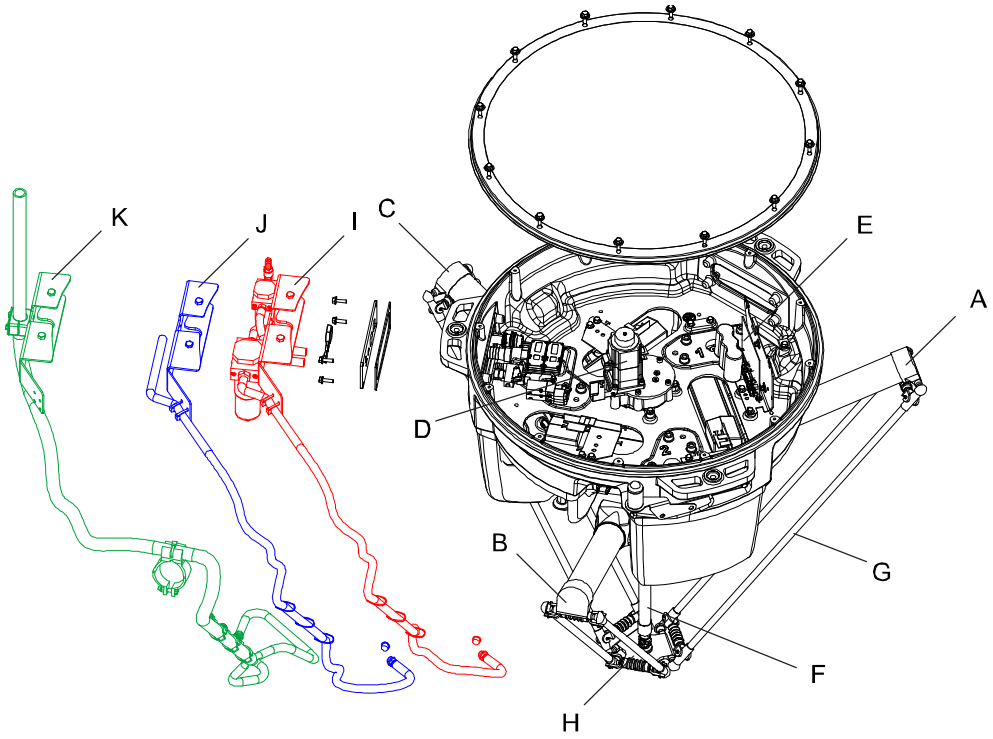
For more information see:

- *Product manual - OmniCore C30*
- *Product manual - IRC5*
- *Product manual - IRC5 Compact*
- *Product manual - IRC5 Panel Mounted Controller*

2.2 Structure manipulator

Manipulator structure

The figure shows the manipulator structure and components.



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A	Upper arm axis 1
B	Upper arm axis 2
C	Upper arm axis 3
D	Axis-4 motor
E	SMB unit
F	Telescopic shaft axis 4
G	Parallel arm
H	Movable plate
I	Vacuum kit (optional)
J	Medium house set (optional)
K	Large house set (optional)

2.3 Unpacking

2.3.1 Pre-installation procedure

General

This instruction is primarily 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 check-list below details what must be observed before proceeding with the actual installation of the robot:

> **Note**
>
> Read and follow these instructions before installation of the robot.

	Action	Detailed in section:
1	Make sure only qualified installation personnel conforming to all national and local codes are allowed to perform the installation.	
2	Make sure the robot has not been damaged, by visually inspecting its exterior.	Check especially following items: • Composite arms (upper arms and bar system); no hacks • Joint balls; no scratches • Ventilation hose; no holes
3	Make sure the lifting accessory to be used is dimensioned to handle the weight of the robot.	.
4	If the robot is not to be installed directly, it must be stored.	
5	Make sure the appointed operating environment of the robot conforms to the specifications.	
6	Before taking the robot to its installation site, make sure the site conforms to applicable requirements.	
7	Before moving the robot, make sure it does not tip over!	
8	When these prerequisites have been met, the robot may be taken to its installation site.	For assemble of the robot, see section *Assembling the robot IRB 360 on page 49*

Weight

The following table shows the weight of the robot model.

Robot model	Weight
Standard	120 kg (264.5 pounds)
Wash-Down (WD)	120 kg (264.5 pounds)

Continues on next page

2.3.1 Pre-installation procedure
Continued

Robot model	Weight
Wash-Down stainless (WDS)	145 kg (319.6 pounds)

Note

The stainless version is not available for the IRB 360 used with OmniCore controllers.

Loads on foundation

The following tables show the various forces and torques working on the robot during different kinds of operation.

See figure below the tables.

Robot version IRB 360 - 1/800, IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/1600

Force N	Max. load in operation
Fx	±330 N
Fy	±260 N
Fz	-1500 ±170 N

Torque Nm	Max. load in operation
Mx	±200 Nm
My	±230 Nm
Mz	±100 Nm

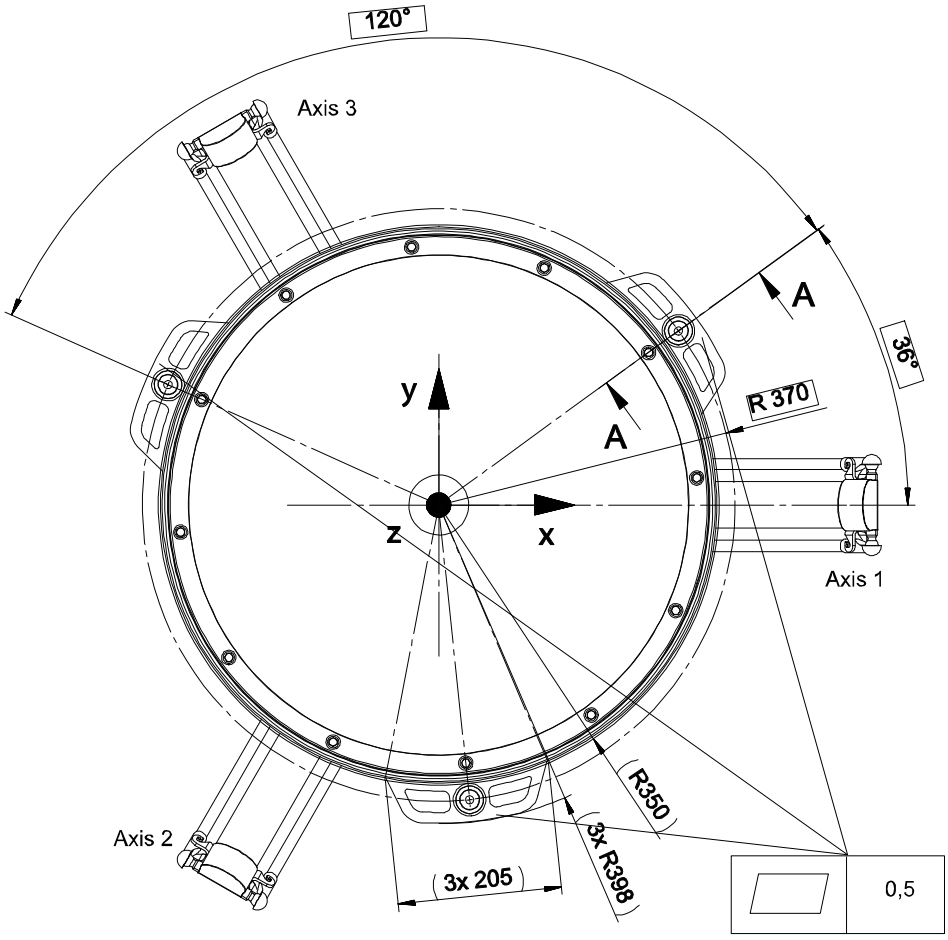
Robot version IRB 360 - 8/1130, IRB 360 - 6/1600

Force N	Max. load in operation
Fx	±550 N
Fy	±500 N
Fz	-1500 ±460 N

Torque Nm	Max. load in operation
Mx	±380 Nm
My	±440 Nm
Mz	±180 Nm

Continues on next page

Illustration



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The three support points of the manipulator base box shall be mounted against three flat surfaces within the specification above. Shims is used if necessary.

Requirements, foundation

The following subsections show the requirements for the foundation regarding stiffness and forces.

Stiffness of robot frame

The stiffness of the robot frame must be designed to minimize the influence on the dynamic behavior of the robot. It is recommended that a frame with a lowest natural frequency (with the robot mounted in the frame) higher than 17 Hz is used for robot versions IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/800, IRB 360 - 1/1600 and a frame with a lowest natural frequency higher than 40 Hz is used for robot version IRB 360 - 8/1130, IRB 360 - 6/1600. TuneServo can be used for adapting the robot tuning to a non-optimal foundation.

Forces

Maximum force in each fixing point are 500 N referring to the z-direction in the base coordinate system, regarding coordinate system see *Product specification - IRB 360*. A robot frame is not included in the delivery.

Continues on next page

2.3.1 Pre-installation procedure
Continued

Storage conditions

The following table shows the allowed storage conditions for the robot.

Parameter	Value
If the equipment is not going to be installed straight away, it must be stored in a dry area at an ambient temperature between.	-25°C to +55°C

Operating conditions

The following table shows the allowed operating conditions for the robot.

Parameter	Value
Ambient temperature	0°C to +45°C.
Relative humidity	Max. 95% at constant temperature

Protection classes

The following table shows the protection class of the robot.

Equipment	Protection class
Standard (Std.)	IP54
Wash-Down (WD)	IP67
Wash-Down Stainless (WDS)	IP69K
Clean Room, Stainless Clean Room	IP54

Note

The stainless version is not available for the IRB 360 used with OmniCore controllers.

2.3.2 Transport

General

This section describes how to transport the manipulator.

Note

The transport shall be made by qualified personnel and should conform to all national and local codes.

Transport position

Whenever the manipulator is transported, it must be in mounting position. It is not allowed to turn the manipulator up side down.

When air transport is used, the robot must be located in a pressure-equalized area.

WARNING

The center of gravity for IRB 360 during transport is very high, 804-810 mm from the bottom. It might tilt and fall when carried on a forklift.

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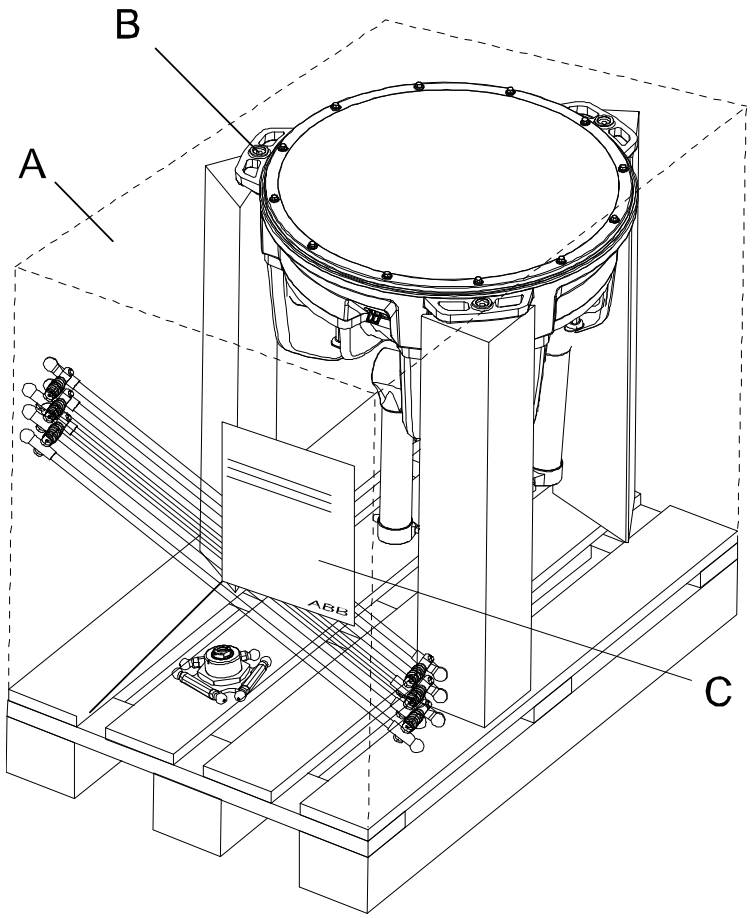
2.3.2 Transport
Continued



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A	Robot delivery box
B	Securing point x3
C	Robot delivery note

2.3.3 Assembling the robot IRB 360

Overview

Follow these steps to assemble the robot after unpacking.

Assembling the robot

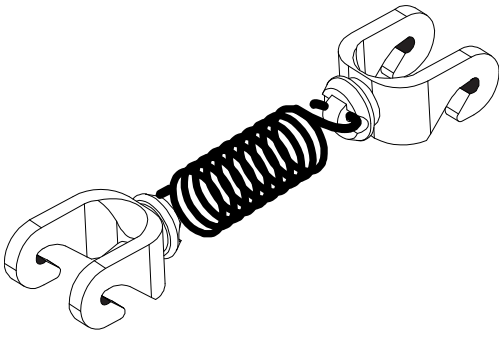
	Action	Note
1	Prepare the working site according to sections:	*Amount of required space on page 57* *Orienting and securing the robot frame on page 58*.
2	Lift the robot according to instructions in sections:	*Lifting the robot with fork lift on page 53*. *Lifting the robot with roundslings on page 55*. *Pre-installation procedure on page 43*
3	Secure the robot according to section:	*Orienting and securing the robot on page 60*.
4	Assemble the parallel arms according to section:	*Replacement of parallel arms on page 169*.
5	Assemble the telescopic shaft according to section:	*Replacement of telescopic shaft on page 184*.
6	Assemble the movable plate according to section:	*Replacement of movable plate on page 180*.
7	Connect the controller and the manipulator.	*Robot cabling and connection points on page 87*.

CAUTION

Before mounting external equipment on the robot, first read the section *Fitting equipment on robot on page 66*.

Assembly options

To facilitate cleaning, it is possible to use the spring units without the rubber bellows, if that is preferred due to hygienic or other reasons.



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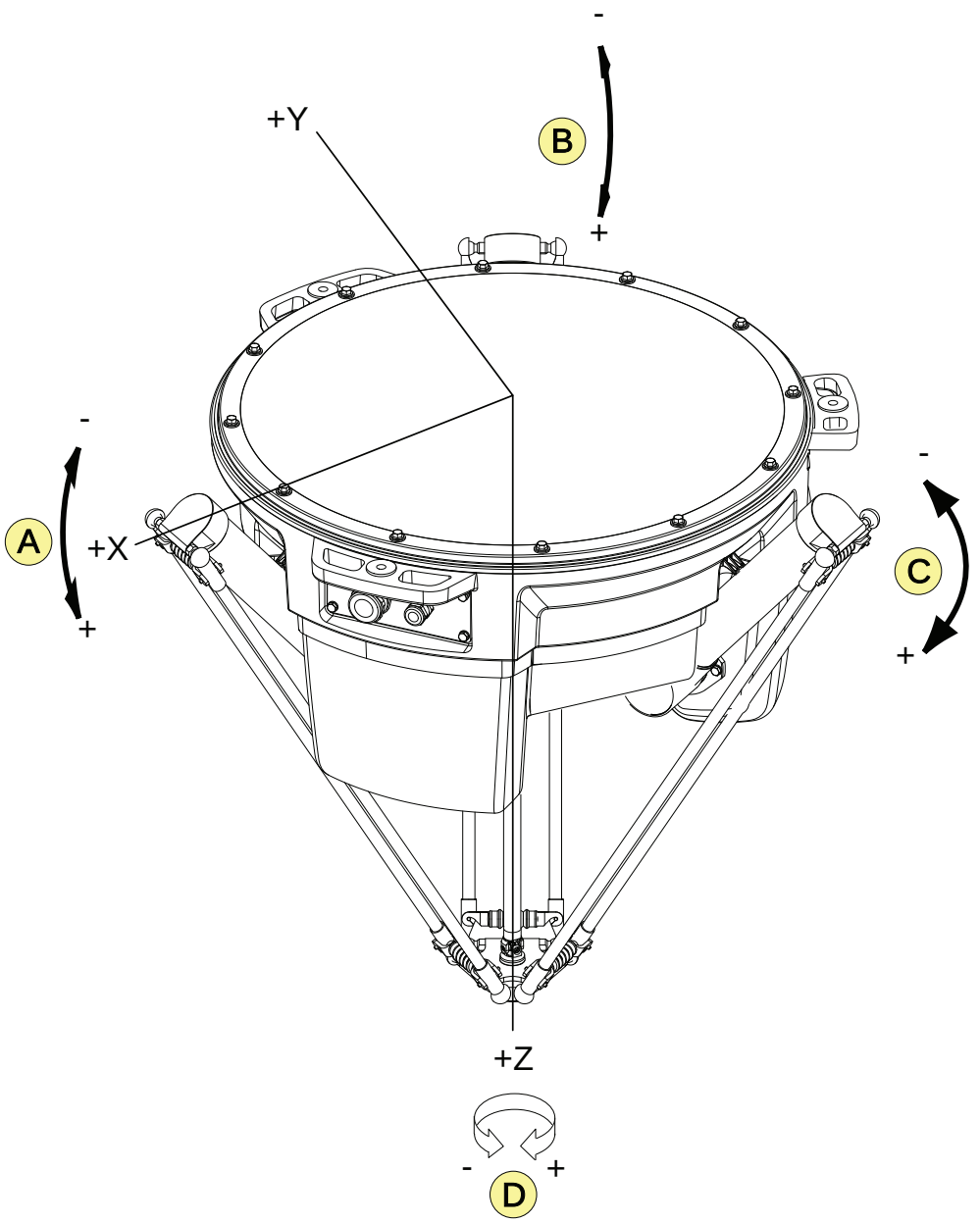
2.3.4 Working range and type of motion

Motion pattern



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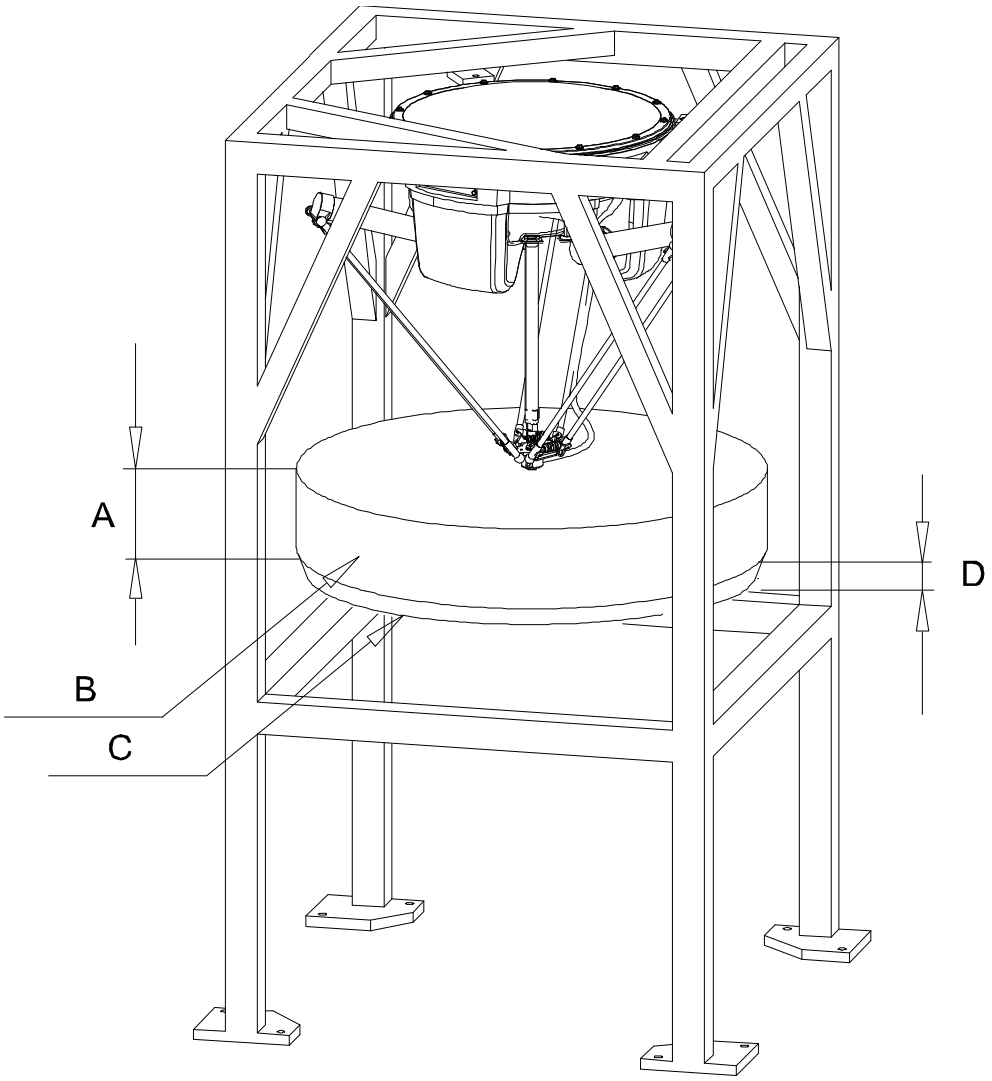
A	Axis 1
B	Axis 2
C	Axis 3
D	Axis 4

Continues on next page

Working range



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Robot variant	Measurement A	Diameter B	Diameter C	Measurement D
IRB 360 - 1/1130	250 mm	1130 mm	967 mm	50 mm
IRB 360 - 3/1130	250 mm	1130 mm	967 mm	50 mm
IRB 360 - 1/800	200 mm	800 mm	-	-
IRB 360 - 1/1600	300 mm	1600 mm	1440 mm	50 mm
IRB 360 - 6/1600	305 mm	1600 mm	1200 mm	155 mm
IRB 360 - 8/1130	250 mm	1130 mm	750 mm	100 mm

2.3.5 The unit is sensitive to ESD

Description

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

Safe handling

Use one of the following alternatives:

- Use a wrist strap.

  Wrist straps must be tested frequently to ensure that they are not damaged and are operating correctly.
- Use an ESD protective floor mat.

  The mat must be grounded through a current-limiting resistor.
- Use a dissipative table mat.

  The mat should provide a controlled discharge of static voltages and must be grounded.

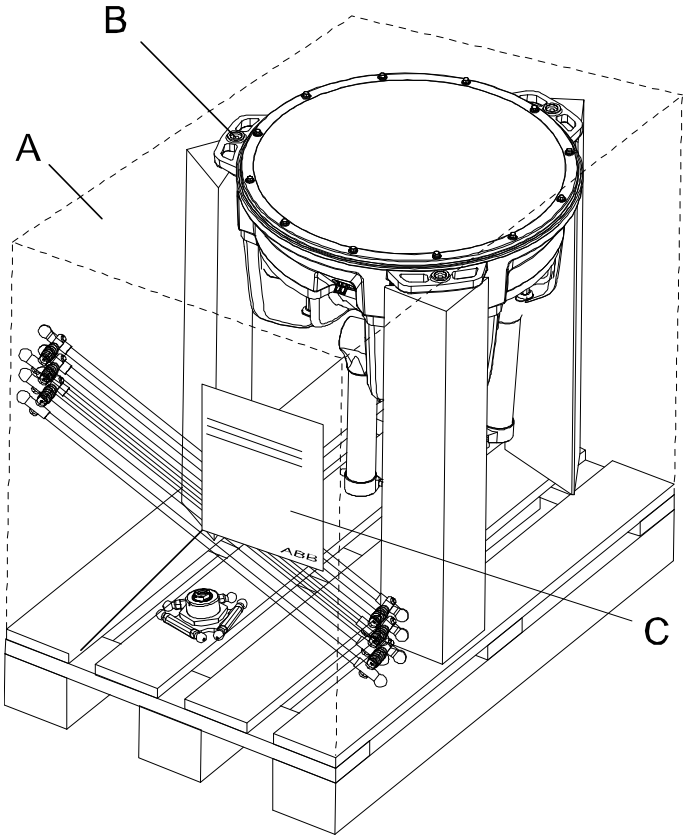
2.4 On-site installation

2.4.1 Lifting the robot with fork lift

WARNING

Never walk under a suspended load!

Lifting position



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A	Robot package top
B	Robot package securing point x3
C	Delivery note

Recommended equipment

Equipment	Art.no.	Note
Fork lift		

Continues on next page

2.4.1 Lifting the robot with fork lift
Continued

Lifting the robot

	Action	Note
1	**CAUTION** The delivery package weighs 200 kg! All lifting accessories used must be sized accordingly.	
2	Lift the robot package to the installation site.	

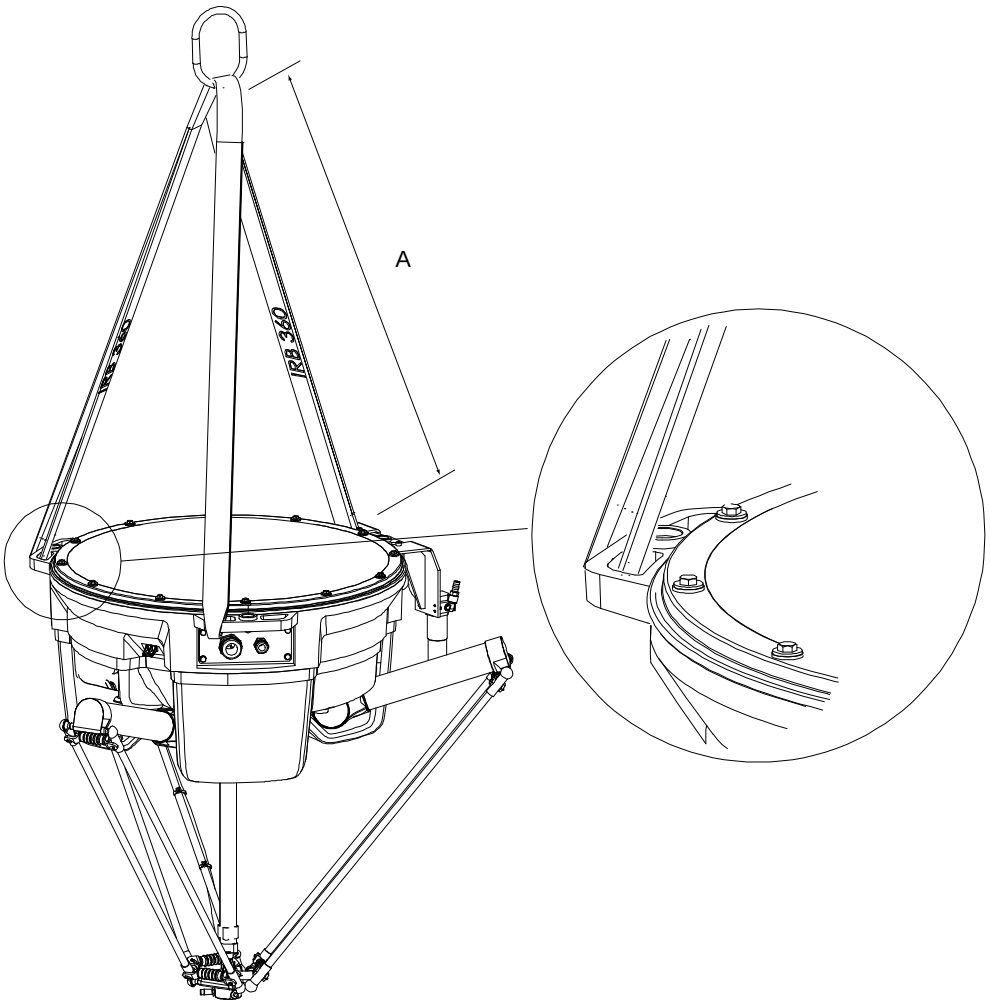
2.4.2 Lifting the robot with roundslings

WARNING

Never walk under a suspended load!

The best way to lift the manipulator is to use lifting straps and a traverse crane. The lifting strap dimensions must comply with the applicable standards for lifting.

Lifting position



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A	L= 500 mm (20 inch)

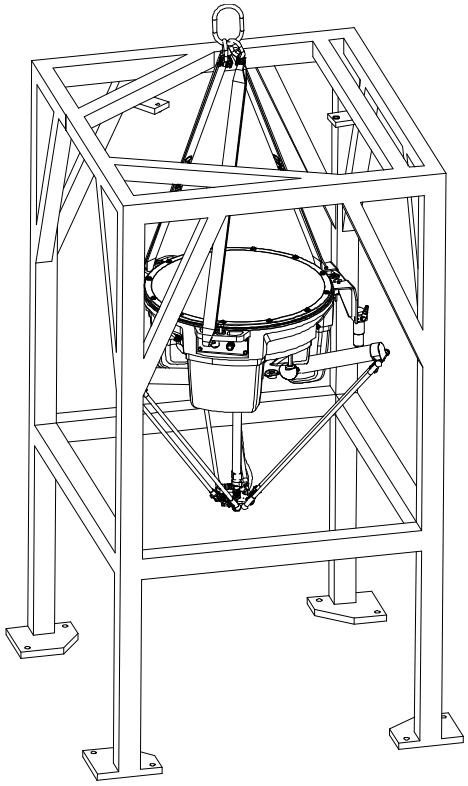
Recommended equipment

Equipment	Art.no.	Note
Roundslings		

Continues on next page

2.4.2 Lifting the robot with roundslings
Continued

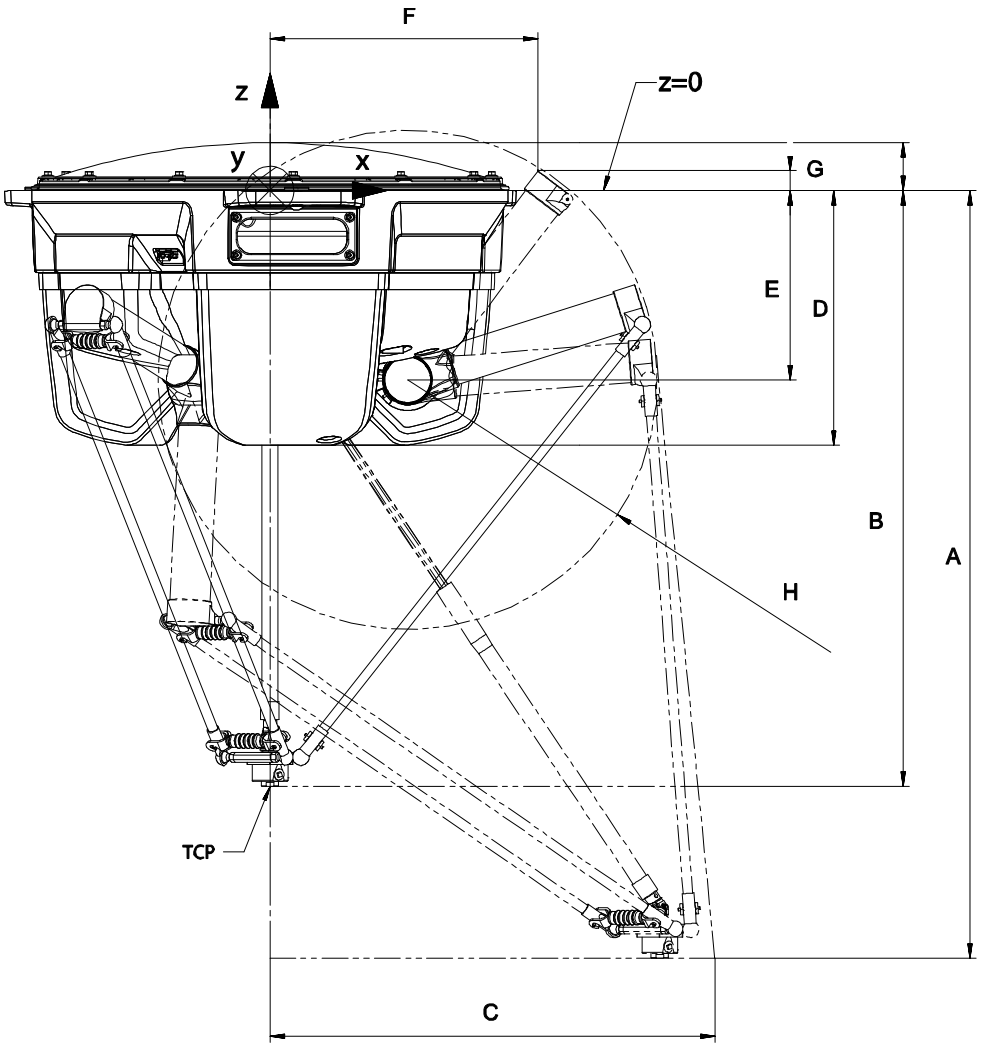
Lifting the robot with roundslings

	Action	Note
1	Attach the roundslings to the robot base box, see figure *Lifting position on page 55*. **CAUTION** The IRB 360 weighs 120 kg (Std) and 145 kg (WDS). All lifting accessories used must be sized accordingly.	 xx0700000466

2.4.3 Amount of required space

Required space

The following figure shows the required amount of space to operate the manipulator.



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Dimensions

Variant	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)
IRB 360 - 1/1130 IRB 360 - 3/1130	1115	865	647	370	275	389.5	28.50	R366
IRB 360 - 8/1130	1142	892	650	370	275	389.5	28.50	R366
IRB 360 - 1/800	1160	960	481	370	275			R251
IRB 360 - 1/1600	1412	1112	880	370	275	438	95	R447
IRB 360 - 6/1600	1412.5	1107.5	883	370	275	478.9	148.3	R515

2.4.4 Orienting and securing the robot frame

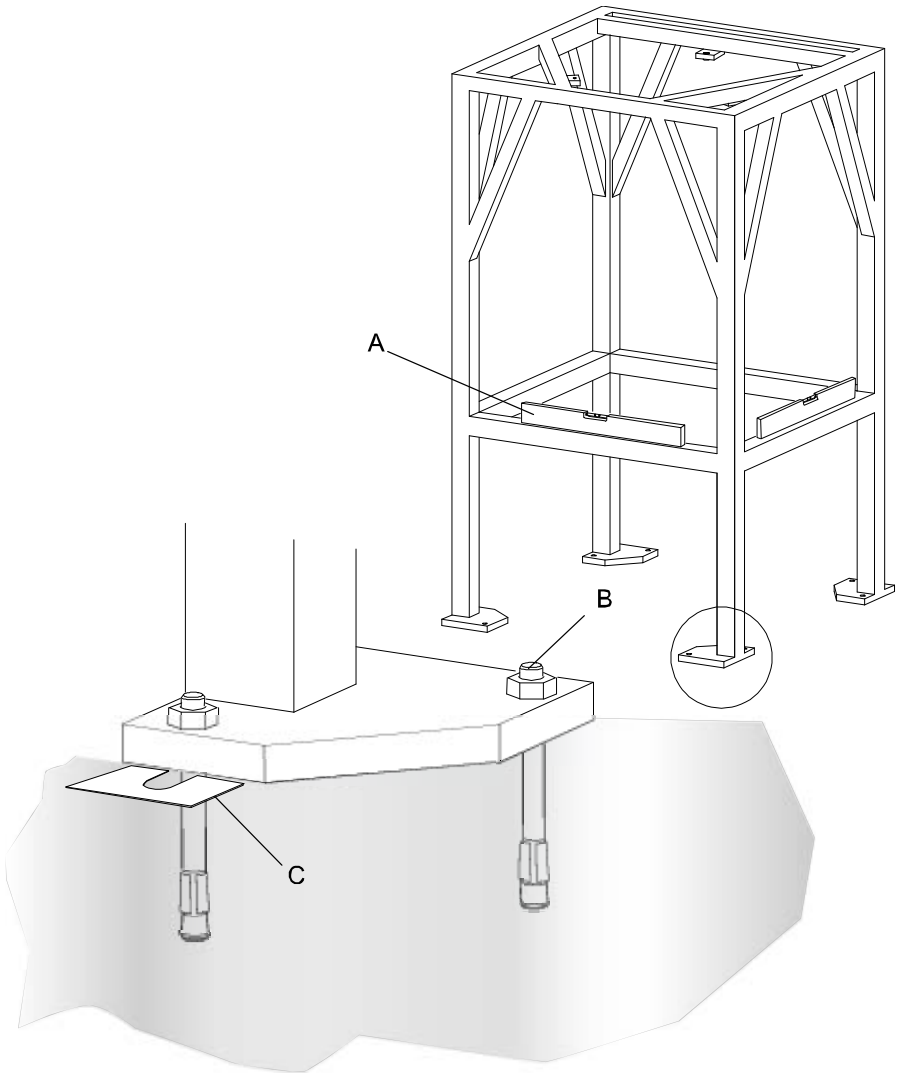
General

This section details how to orient and secure the robot frame at a horizontal level at the installation site in order to run the robot safely.

WARNING

Make sure that the robot frame is secured before mounting the robot.

Illustration



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A	Spirit level
B	Chemical or mechanical expander bolts
C	Shim

Continues on next page

Required equipment and references

Equipment	Spare part no.	Note
Spirit level		
Shim		*Shim drawing on page 59*
Chemical bolts or mechanical expanding bolts.		
Standard tools		*Standard toolkit on page 260*

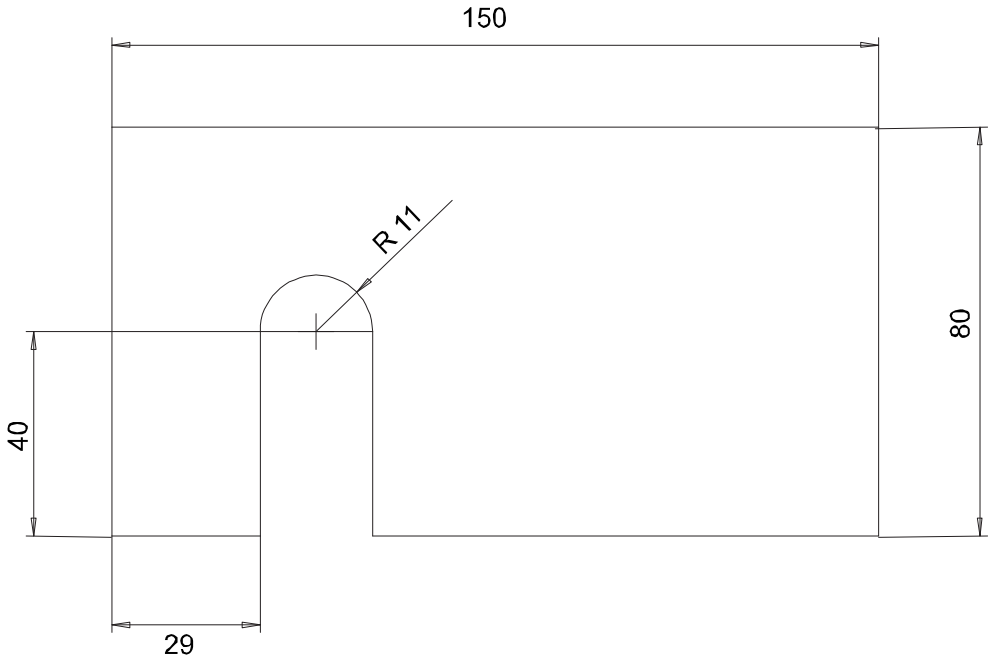
References
Pre-installation procedure on page 43

Orienting and securing

	Action	Note
1	Make sure the installation site for the robot conforms to the specifications in section *Pre-installation procedure on page 43*.	
2	Prepare the installation site.	
3	Use a water level to level the robot frame.	Use shim for leveling. Example of shim shown in *Shim drawing on page 59*
4	Secure the robot frame to the floor.	Use chemical or mechanical expander bolts.

Shim drawing

Example of shim.



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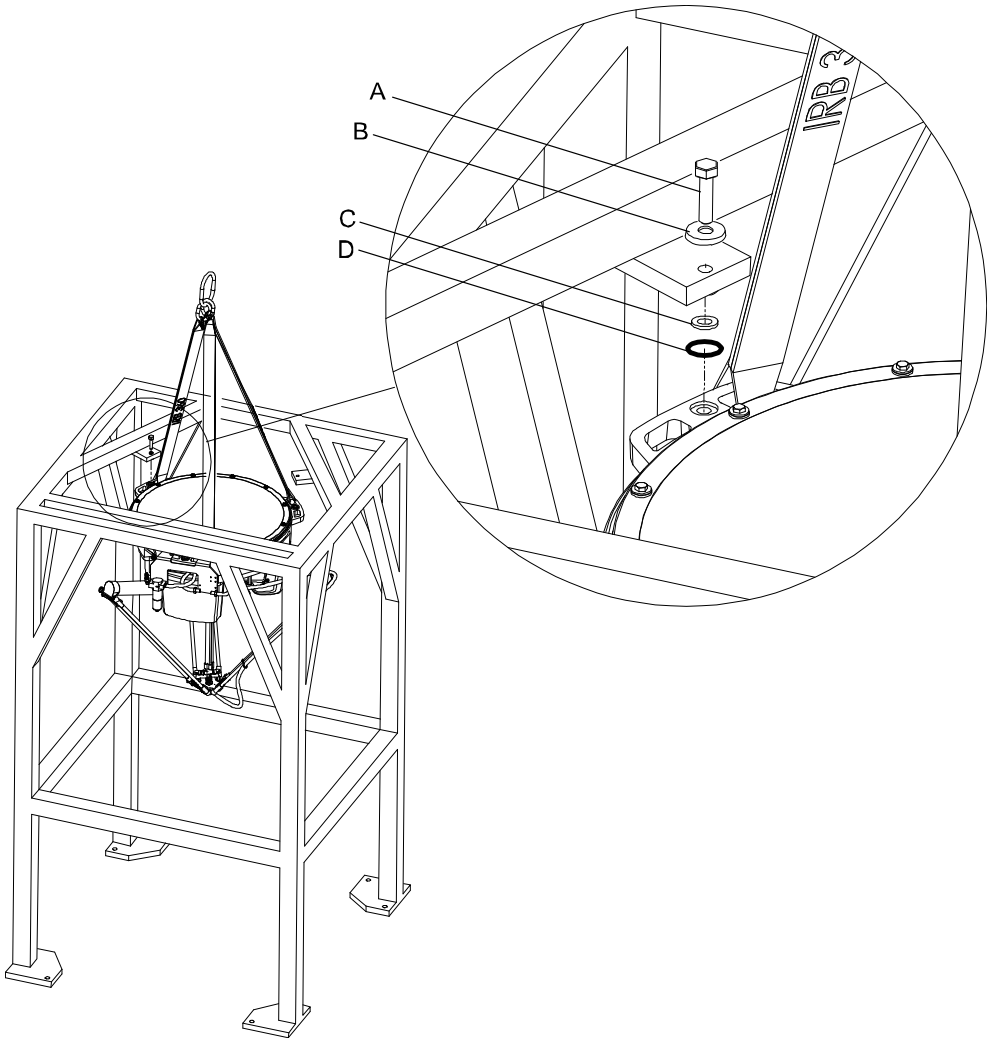
2.4.5 Orienting and securing the robot

General

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

Illustration



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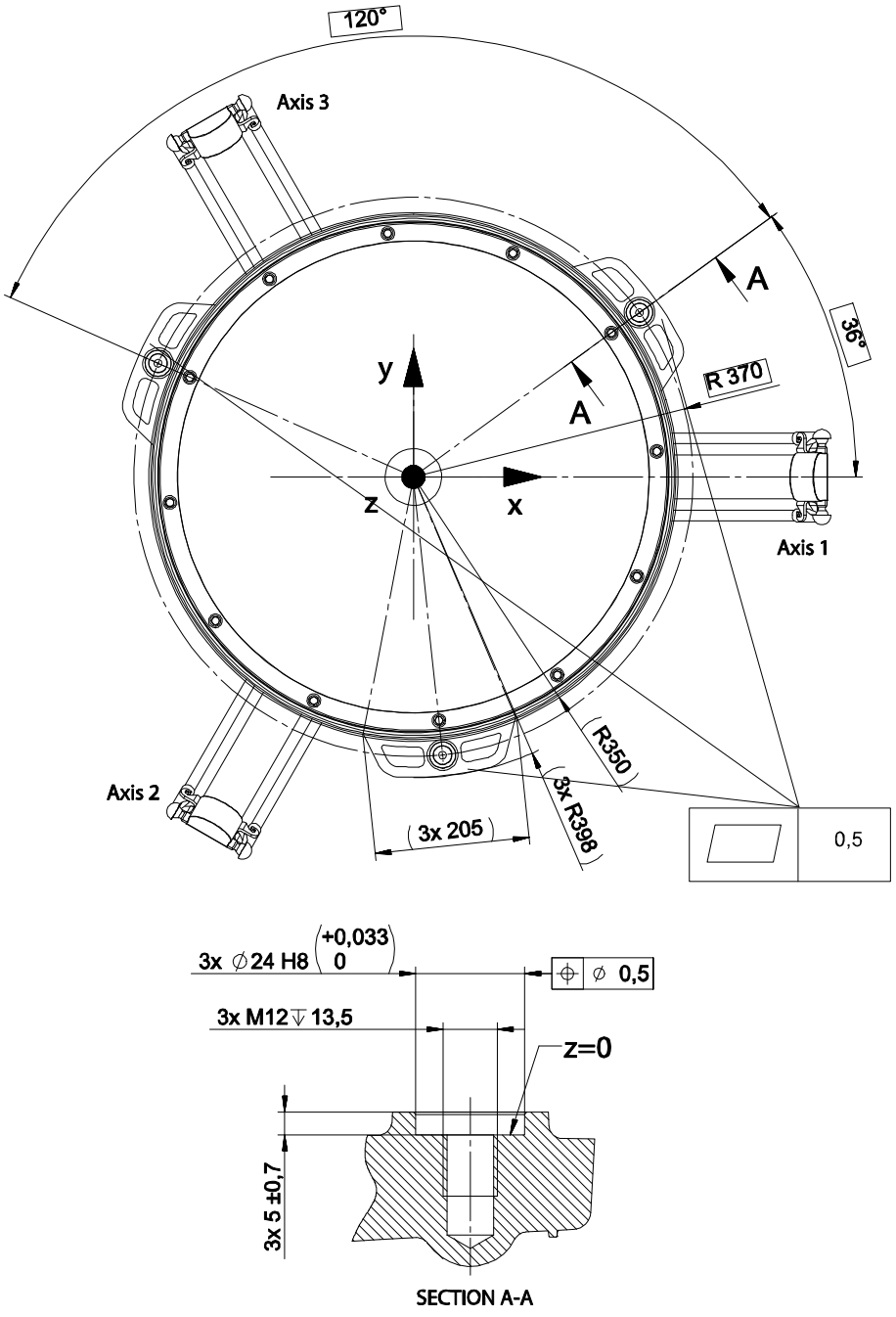
A	Screw M12
B	Bonded seal washer, rubber/metal
C	Spacer, metal
D	Washer, EPDM-rubber compressed 50%.

Required equipment

Equipment, etc.	Spare part no.	Note
Standard tools	*Standard toolkit on page 260*	

Continues on next page

Hole configuration, base



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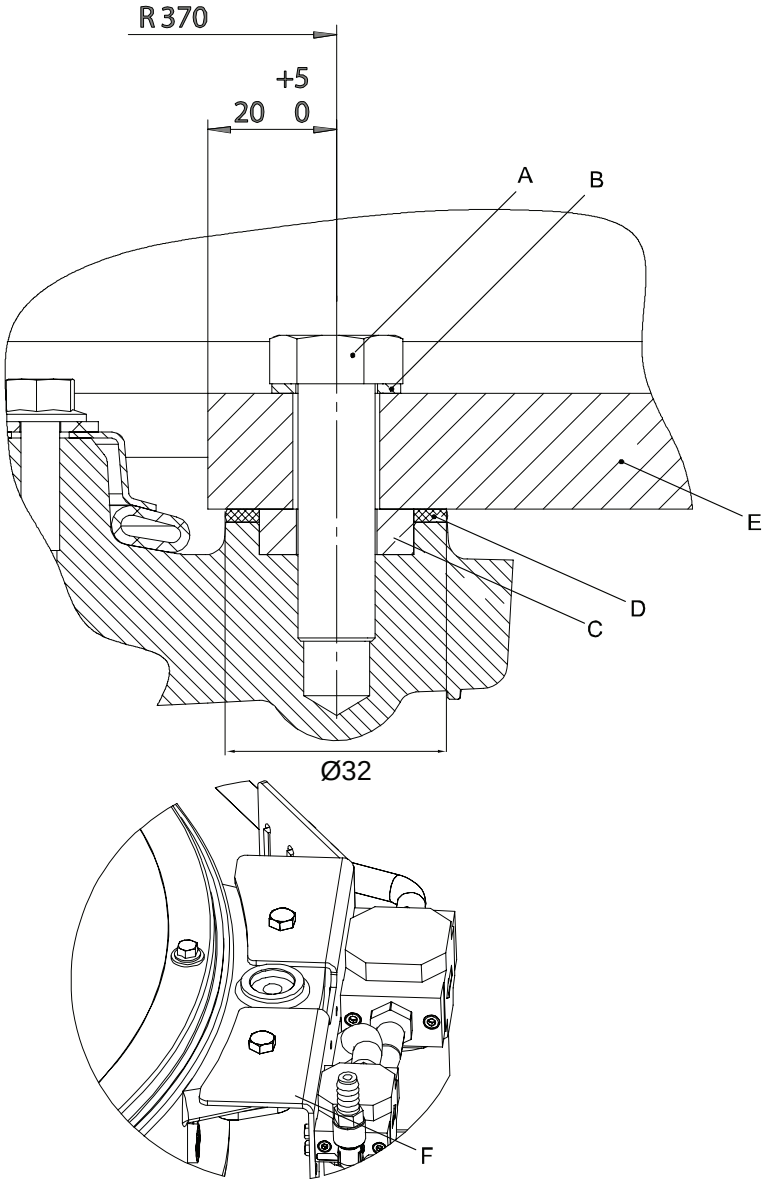
The three support points of the manipulator base box shall be mounted against three flat surfaces with a flatness within the specification. Use shims if necessary.

Continues on next page

2.4.5 Orienting and securing the robot
Continued

Attachment bolts, specification



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A	Screw M12
B	Bonded seal washer, rubber/metal.
C	Spacer, metal
D	Washer, EPDM-rubber compressed 50%.
E	Robot frame
F	Bracket

Attachments	Dimensions
Attachment bolts, 3 pcs.	M12x (50) The length of the screws depend on the design of the robot frame
Bonded seal washer, rubber/metal, 3 pcs.	

Continues on next page

Attachments	Dimensions
Washer, EPDM-rubber compressed 50%, 3 pcs.	*Illustration on page 60*
Spacer, metal, 3 pcs.	*Illustration on page 60*

Orienting and securing

	Action	Note
1	Make sure the installation site for the robot conforms to the specifications in section *Pre-installation procedure on page 43*.	
2	Prepare the installation site.	Detailed in section *Orienting and securing the robot frame on page 58*
3	Lift the robot to the installation site.	Detailed in section *Lifting the robot with fork lift on page 53* and in section *Lifting the robot with roundslings on page 55*
4	**Note** If use of ABB's vacuum system is intended, make sure there is a space left for the bracket (F).	
5	Fit and tighten the bolts and washers in the base attachment holes.	The screw joint must be able to withstand the stress loads defined in section *Pre-installation procedure on page 43*.

2.4.6 Manually releasing the brakes

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.

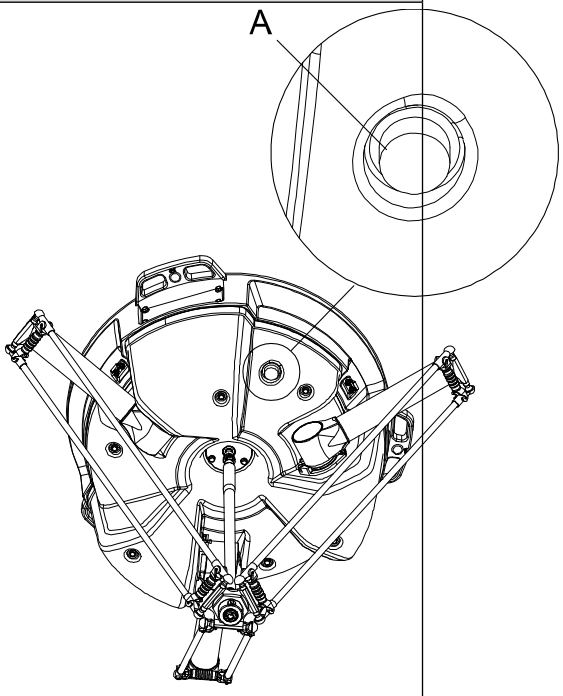
General

This section describes how to release the holding brakes.

The brake release button is located on the base of the robot, close to the center.

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

This procedure details how to release the holding brakes with push-buttons, when the robot is connected to the controller.

	Action	Note
1	The internal brake release unit is located at the base of the robot.	 xx0700000435 A Brake release button
2	Press and hold the brake release button (keep it pressed in). The brake will function again as soon as the button is released.	

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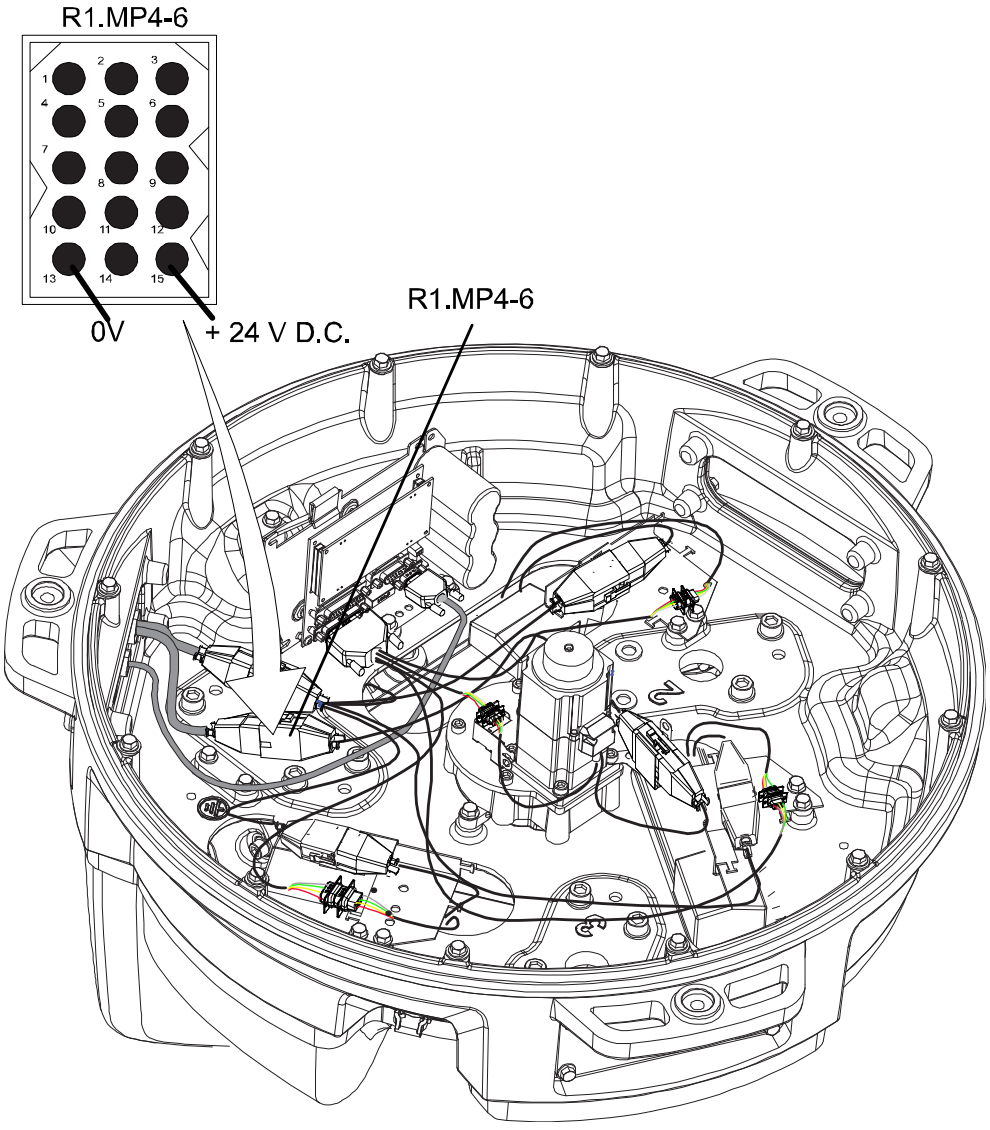
Using the brake release unit with an external power supply

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



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Note

Be careful **not to interchange the 24 V and 0 V pins**. If they are mixed-up, electrical components can be damaged.

	Action	Note
1	Connect an external power +24V supply to the FCI connector (pin 13 to 0V and pin 15 to +24V).	See cable harness in *Spare parts - cable harness*.
2	Press and hold the brake release button (keep it pressed in). The brake will function again as soon as the button is released.	

2.4.7 Fitting equipment on robot

Overview

This section describes how to fit equipment on the IRB 360.

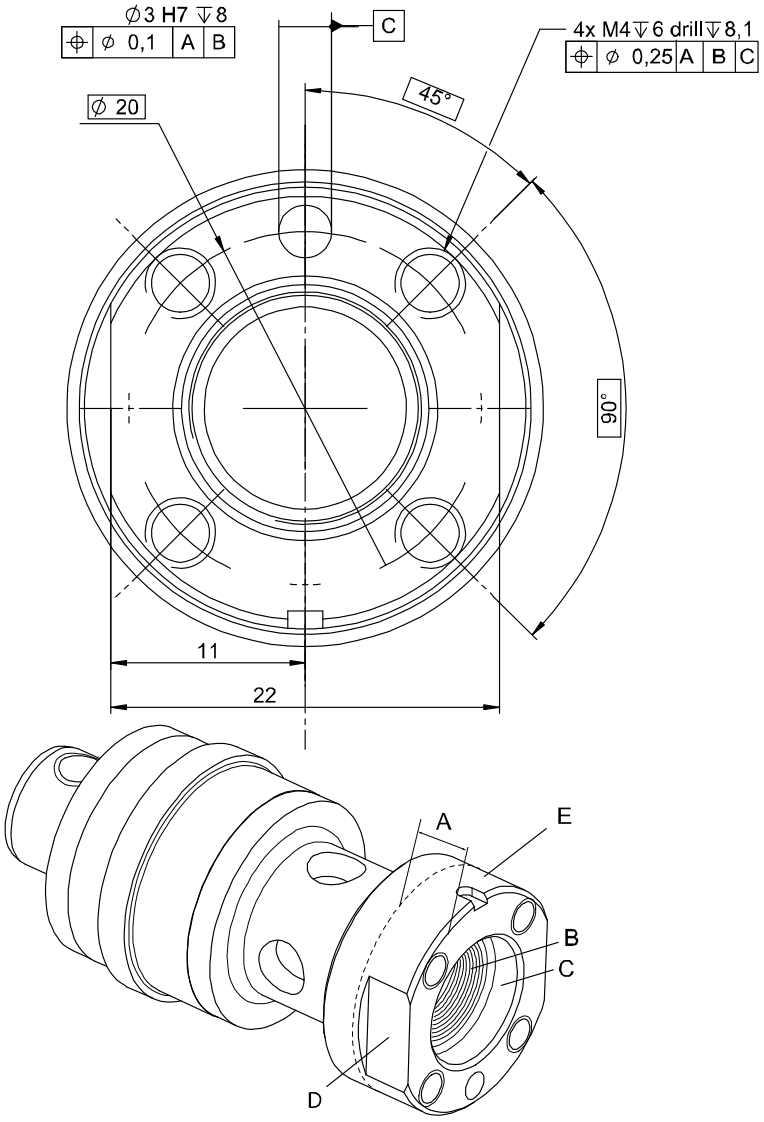
Note

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

Continues on next page

Mechanical interface

STD - IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/800, IRB 360 - 1/1600



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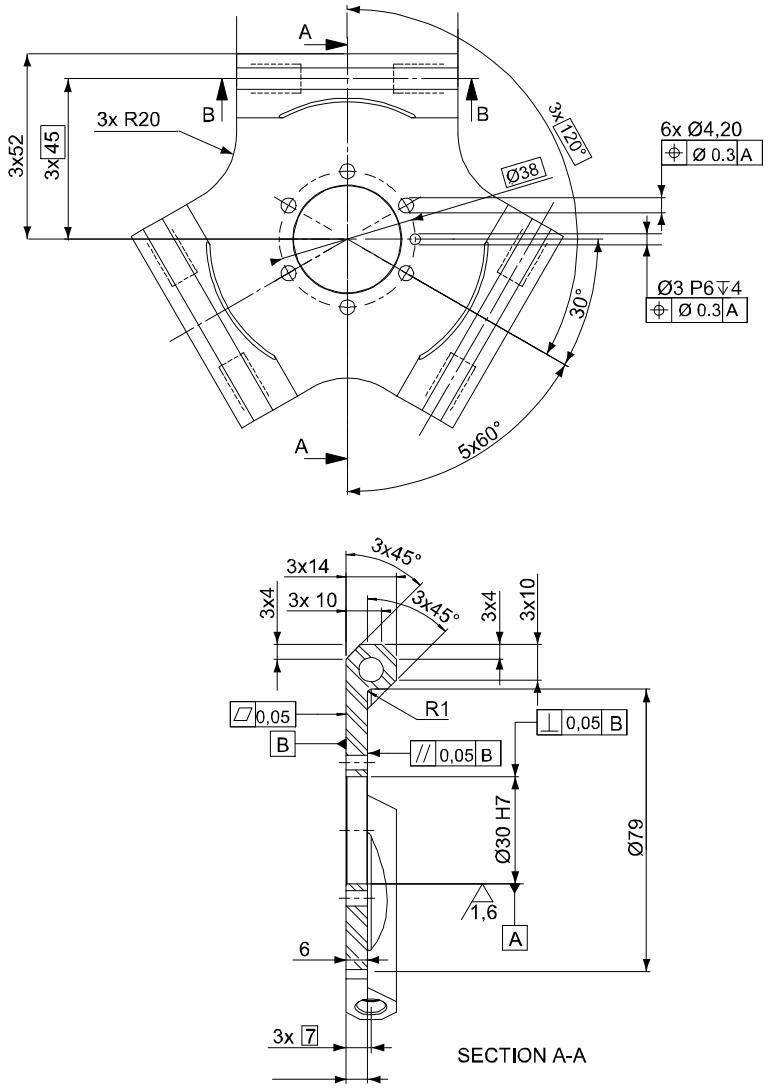
A	Free space, depth 6 mm
B	R1/4”
C	Ø14 H8 depth 4 mm
D	Key grip = width 22 mm height 5.5 mm
E	Ø25 h8 depth 6 mm

Continues on next page

2.4.7 Fitting equipment on robot
Continued

3D - IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/800, IRB 360 - 1/1600



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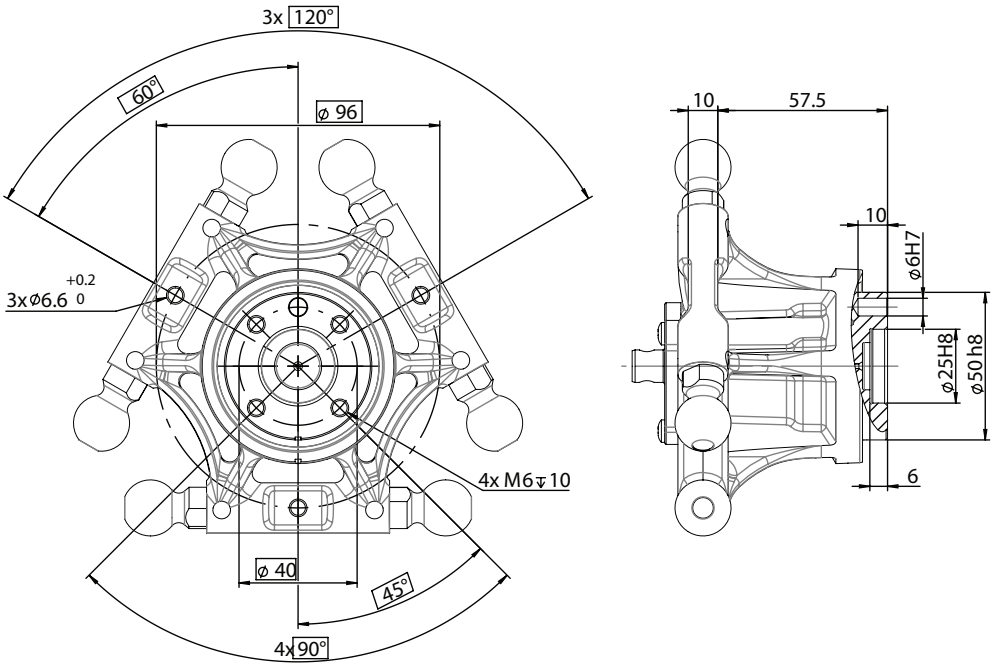
IRB 360 - 8/1130, IRB 360 - 6/1600



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Required equipment

Equipment	Article number	Note
Standard tools	-	*Standard toolkit on page 260*
Open end spanner	-	22 mm

Mounting equipment R1/4” on movable plate with swivel

CAUTION

Never drill a hole in the manipulator without first consulting maintenance/repair personnel or the design department at ABB.

CAUTION

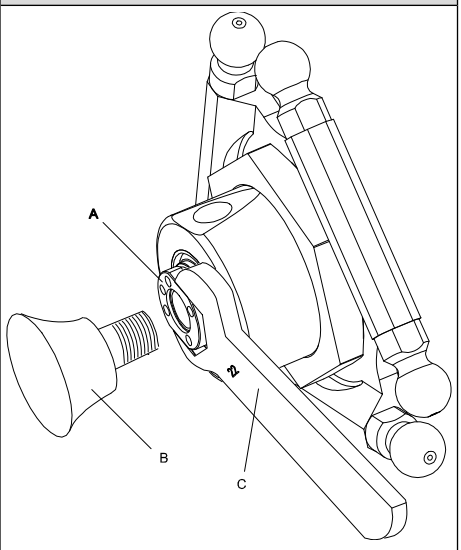
Never remove the swivel cup. The cup protects the bearings.

	Action	Note
1	Attach the tool to the mounting flange.	Fitting R1/4”

Continues on next page

2.4.7 Fitting equipment on robot

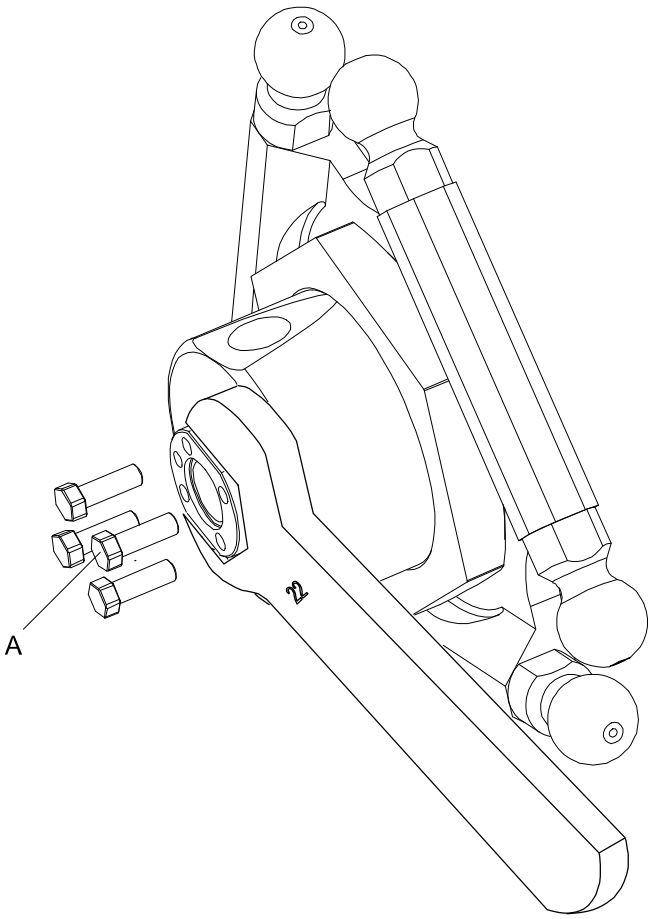
Continued

	Action	Note
2	**CAUTION** If the movable plate is equipped with a swivel: Always use an open-end spanner 22 m or similar on the mounting flange, when tightening.	 xx0700000490 A – Mounting flange B – Tool (fitting R1/4") C – Open-end spanner 22 mm
3	**Note** If axial tool movement using axis 4 is intended, use a locking liquid or a lock screw to prevent rotation of tool. If a high frequent use of linear tool movement is intended, use a tool with mounting flange.	

Continues on next page

Mounting equipment to flange on movable plate with swivel

IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/800, IRB 360 - 1/1600



xx0700000523

A	4 pcs Screws M4

	Action	Note
1	Attach the tool to the mounting flange.	
2	**CAUTION** Always use an open-end spanner 22 mm or similar on the mounting flange, when tightening.	

Attachment screws

Attachments	Note
Suitable screws, lightly lubricated:	M4 (Length depending on tool)
Suitable washer.	
Tightening torque.	See section *Screw joints on page 157*.

Continues on next page

2.4.7 Fitting equipment on robot
Continued

Fastener quality

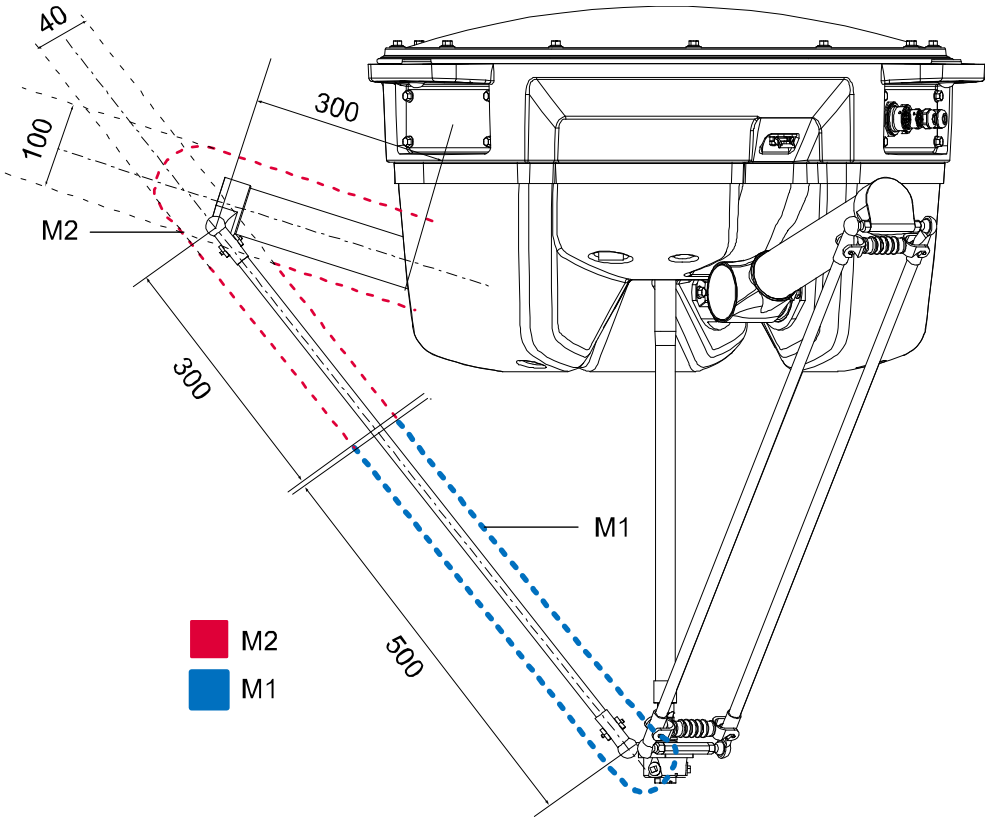
When fitting tools on the tool flange, only use screws with quality 12.9. For other equipment use suitable screws and tightening torque for your application.

2.4.8 Loads

General

This section describes loads from external equipment. For information about general loads and diagrams see *Product specification - IRB 360*.

Extra equipment attached to the manipulator arms



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M1	Limitation lines for center of gravity for M1
M2	Limitation lines for center of gravity for M2

The robot is tuned for handling the weight of a vacuum system or a medium sized hose. Other equipment attached to M1 and/or M2 should be calculated as a point load located in the same position as TCPO. This point load needs to be added to the calculation of the users normal tool load and declared in used tooldata, see *Extra load mass to be calculated on page 73*.

Extra load mass to be calculated

Part on arm system	Weight	Action
M1	0-175 g	Allowed. Do not calculate the extra load mass.
	175 g - 350 g	Calculate the extra load mass by subtracting the weight with 175 g. i
	350 g and above	Not allowed.

Continues on next page

2.4.8 Loads
Continued

Part on arm system	Weight	Action
M2	0-175 g	Allowed. Do not calculate the extra load mass.
	175 g - 350 g	Calculate the extra load mass by subtracting the weight with 175 g. [i]
	350 g and above	Not allowed.

i Combine the extra load mass weight of M1 and M2 together and add the weight as a point mass in the center of the customer interface (TCP 0). This addition can be done in the tool definition or the payload definition. If only one of M1 or M2 needs to be calculated, add only that extra load mass subtracted with 175g in TCP 0.

Example of calculating the extra load mass

If the extra equipment (excluding option equipments) attached to M1 has the load mass of 210 g and the extra equipment attached on M2 has the load mass of 240 g, then the calculated extra load mass for M1 is (210 g - 175 g = 35 g) and for M2 (240 g - 175 g = 65 g). Adding together the calculated load mass for M1 and M2 (35 g + 65 g = 100 g) gives the correct amount of 100 g located at the same position as TCP0. This point load needs to be added to the calculation of the users tool load and declared in used tooldata.

2.5 Installation of options

2.5.1 Installation of safety lamp (option 213-1)

General

This section describes installation of safety lamp.

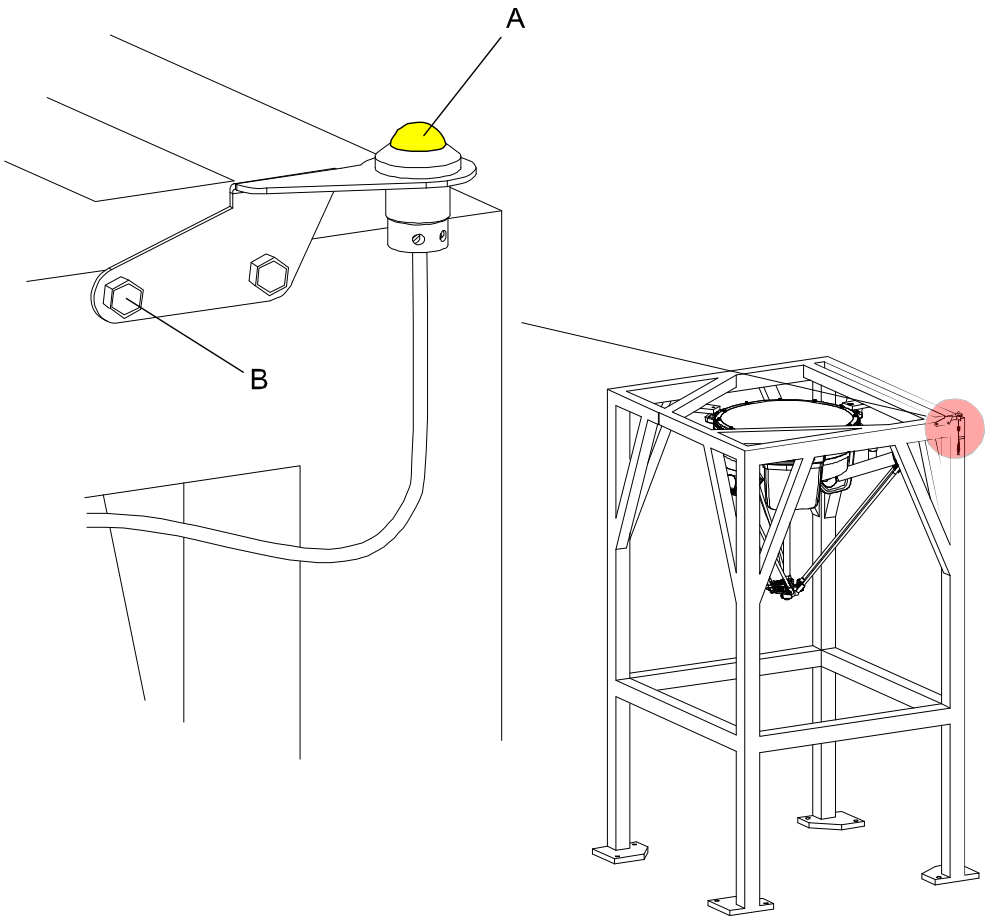
DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Location



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A	Warning lamp.
B	Screw M8 of suitable length.

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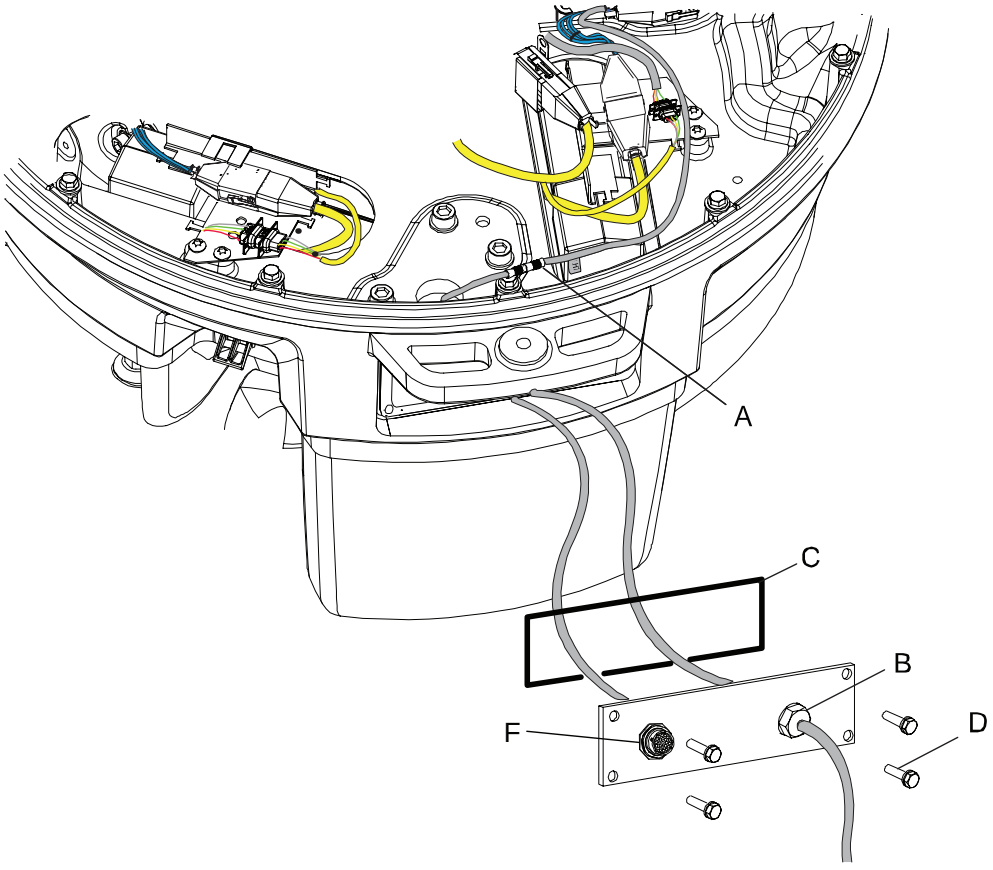
2.5.1 Installation of safety lamp (option 213-1)
Continued

Required equipment and references

Equipment	Spare Part No.	Note
Standard tools.		*Standard toolkit on page 260*
Safety lamp (option).	*Spare parts - customer options signal lamp IRB 360.*	
Cover	3HAC028966-006	
Cover gasket	3HAC028972-001	

References
Replacement of base cover gasket on page 162
Standard toolkit on page 260

Installation



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A	Safety lamp connectors R3.H1and R3.H2
B	Lead-through in cover plate for the optional safety lamp.
C	Cover gasket 3HAC028972-001
D	4pcs Screw M6x20
F	FB7 connector for resolver signals for axis 7 (Option 864-1)

Continues on next page

	Action	Note
1	Remove the base cover	Described in section *Replacement of base cover gasket on page 162*
2	Replace the cover plate with the optional safety lamp cover plate with gasket.	**Tightening torque 4 Nm**
3	Locate the connectors R3.H1 - R3.H2 and connect the safety lamp harness to it.	
4	Mount the safety lamp.	Placement is optional.

2.5.2 Installation of (optional) customer connections IRB 360

General

This section describes installation of customer connections.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

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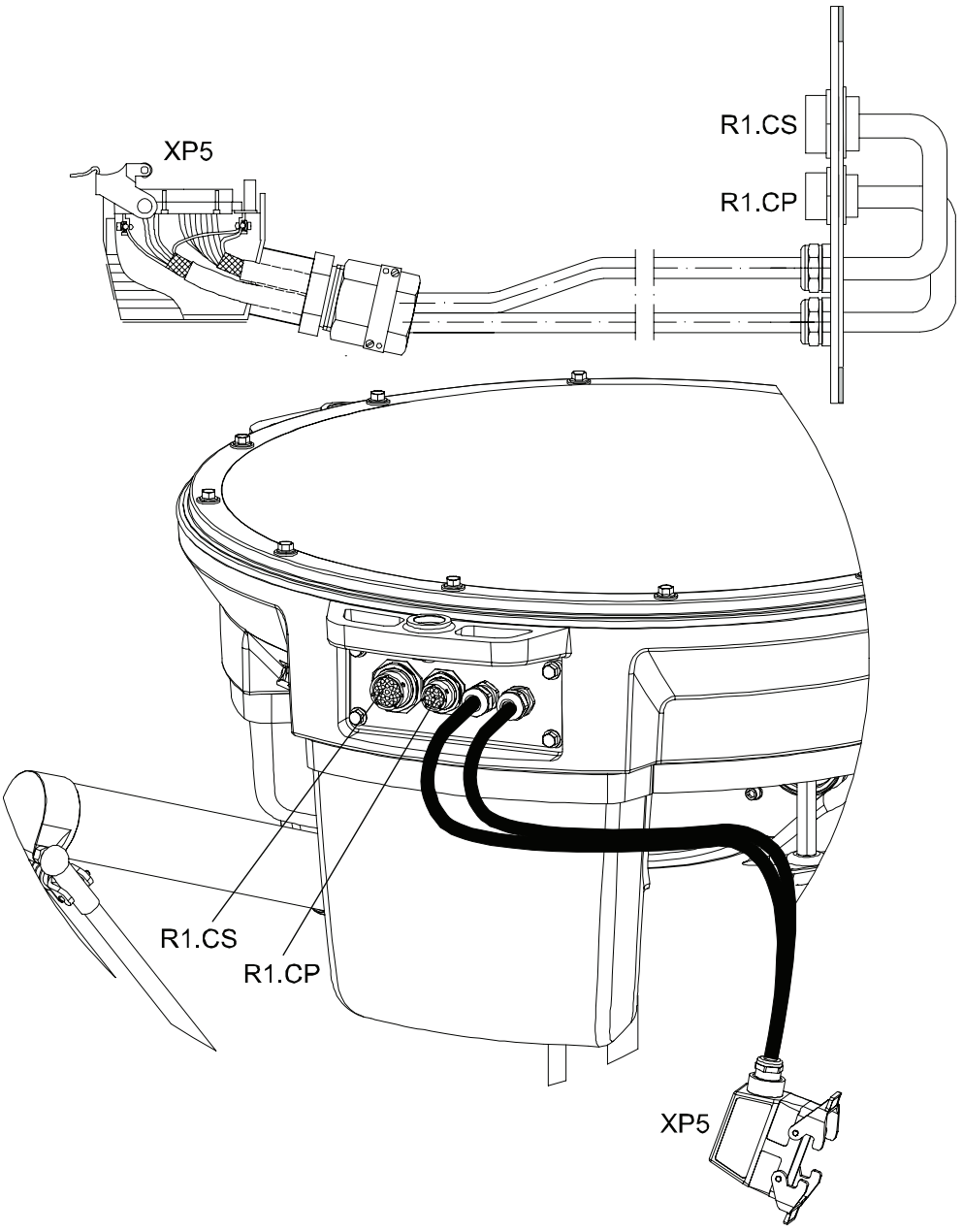
Location



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Connections in customer cable

Wire	Spec.	Connection point A			Connection point B			Note
		Desig-nation	Term	Type	Desig-nation	Term	Type	
Power								
1	RD	XP5	A1	2	R1.CP	1	13	
2	BU	XP5	B1	2	R1.CP	2	13	
3	GN	XP5	C1	2	R1.CP	3	13	

Continues on next page

2.5.2 Installation of (optional) customer connections IRB 360
Continued

Wire	Spec.	Connection point A			Connection point B			Note
		Desig-nation	Term	Type	Desig-nation	Term	Type	
4	YE	XP5	D1	2	R1.CP	4	13	
5	WH	XP5	A2	2	R1.CP	5	13	
6	BK	XP5	B2	2	R1.CP	6	13	
7	BN	XP5	C2	2	R1.CP	8	13	
8	VT	XP5	D2	2	R1.CP	9	13	
9	OG	XP5	A3	2	R1.CP	10	13	
10	PK	XP5	B3	2	R1.CP	11	13	
11	TQ							Conductor to cut off.
12	GY	XP5	Earth	19	R1.CP	12	13	i
SHIELD		XP5	Earth Ref. (DP shield)	20		Earth (shield)		0V (ground) ii
Signals								
	Pair							
1.1	1 WH	XP5	B5	4	R1.CS	1	15	
1.2	1 BU	XP5	C5	4	R1.CS	2	15	
2.1	2 WH	XP5	D5	4	R1.CS	3	15	
2.2	2 OG	XP5	A6	4	R1.CS	4	15	
3.1	3 WH	XP5	B6	4	R1.CS	5	15	
3.2	3 GN	XP5	C6	4	R1.CS	6	15	
4.1	4 WH	XP5	D6	4	R1.CS	7	15	
4.2	4 BN	XP5	A7	4	R1.CS	8	15	
5.1	5 WH	XP5	B7	4	R1.CS	9	15	
5.2	5 GY	XP5	C7	4	R1.CS	10	15	
6.1	6 RD	XP5	D7	4	R1.CS	11	15	
6.2	6 BU	XP5	A8	4	R1.CS	12	15	
7.1	7 RD	XP5	B8	4	R1.CS	13	15	
7.2	7 OG	XP5	C8	4	R1.CS	14	15	
8.1	8 RD	XP5	D8	4	R1.CS	15	15	
8.2	8 GN	XP5	A9	4	R1.CS	16	15	
9.1	9 RD	XP5	B9	4	R1.CS	17	15	
9.2	9 BN	XP5	C9	4	R1.CS	18	15	
10.1	10 RD	XP5	D9	4	R1.CS	19	15	
10.2	10 GY	XP5	A10	4	R1.CS	20	15	
11.1	11 BK	XP5	B10	4	R1.CS	21	15	
11.2	11 BU	XP5	C10	4	R1.CS	22	15	

Continues on next page

Wire	Spec.	Connection point A			Connection point B			Note
		Desig-nation	Term	Type	Desig-nation	Term	Type	
12.1	12 BK	XP5	D10	4	R1.CS	23	15	
12.2	12 OG							Conductor to cut off.
13.1	13 BK							Conductor to cut off.
13.2	13 GN							Conductor to cut off.
14.1								Conductor to cut off.
14.2								Conductor to cut off.
15.1								Conductor to cut off.
15.2								Conductor to cut off.
16.1								Conductor to cut off.
16.2								Conductor to cut off.
Shield		XP5	Earth Ref. (DP shield)	20				0V (Ground) [ii]

i Use green/yellow shrinking hose on free conductors, in both ends.
ii Dual press both shields, and connect them to earth.

Installation

	Action	Note
1	Remove the standard cover plate.	
2	Fit the self-adhesive gasket on the customer cover plate.	
3	Install the customer cable harness.	Use standard tools.
4	Assemble the customer cover plate using the four attachment screws.	Tightening torque 4 Nm

2.5.3 Installation of vacuum system (option 218-9)

General

This section describes installation of (optional) vacuum system on an IRB 360.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

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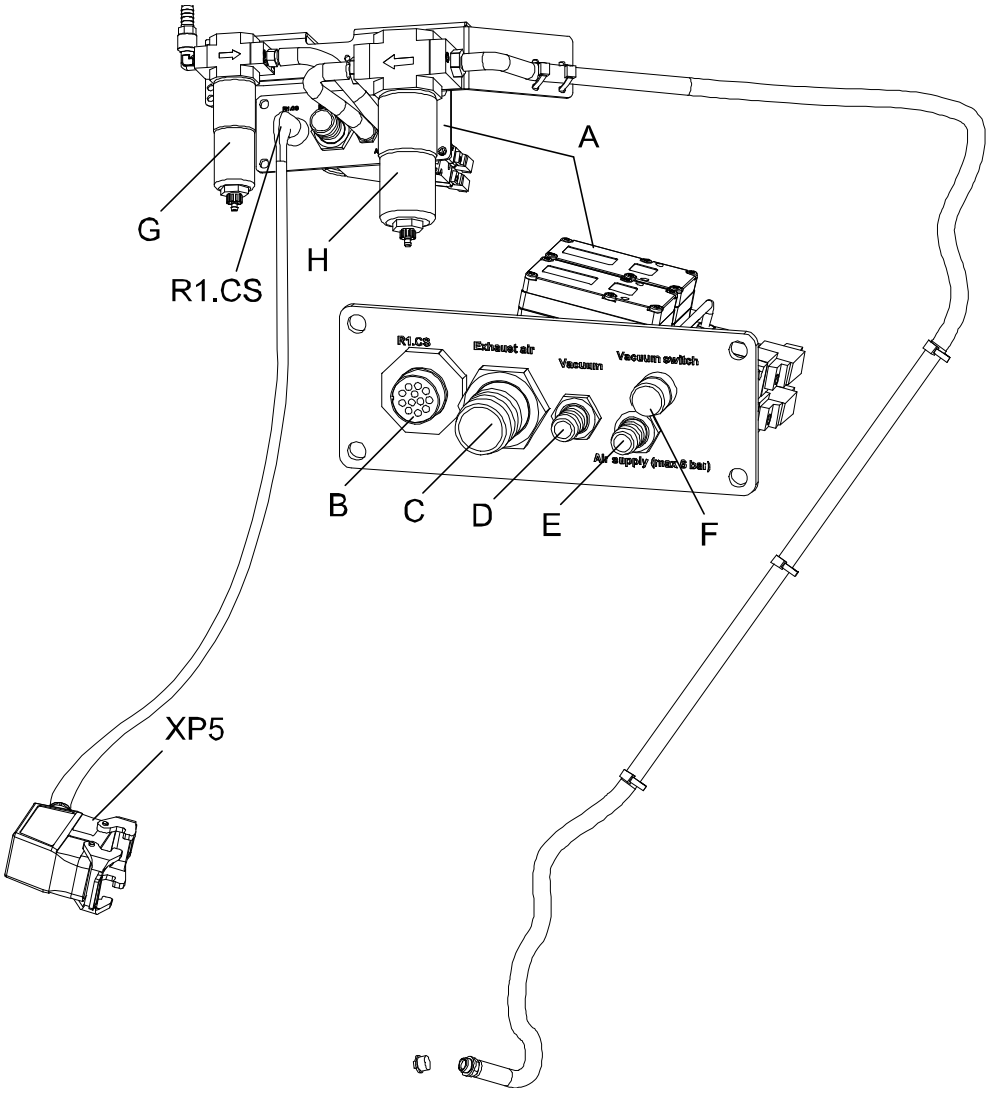
Locations



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A	Ejector unit
B	R1.CS
C	Exhaust air
D	Vacuum In
E	Compressed air in (max. 6 bar)
F	Vacuum switch
G	Air filter (compressed air side)
H	Air filter (vacuum side)

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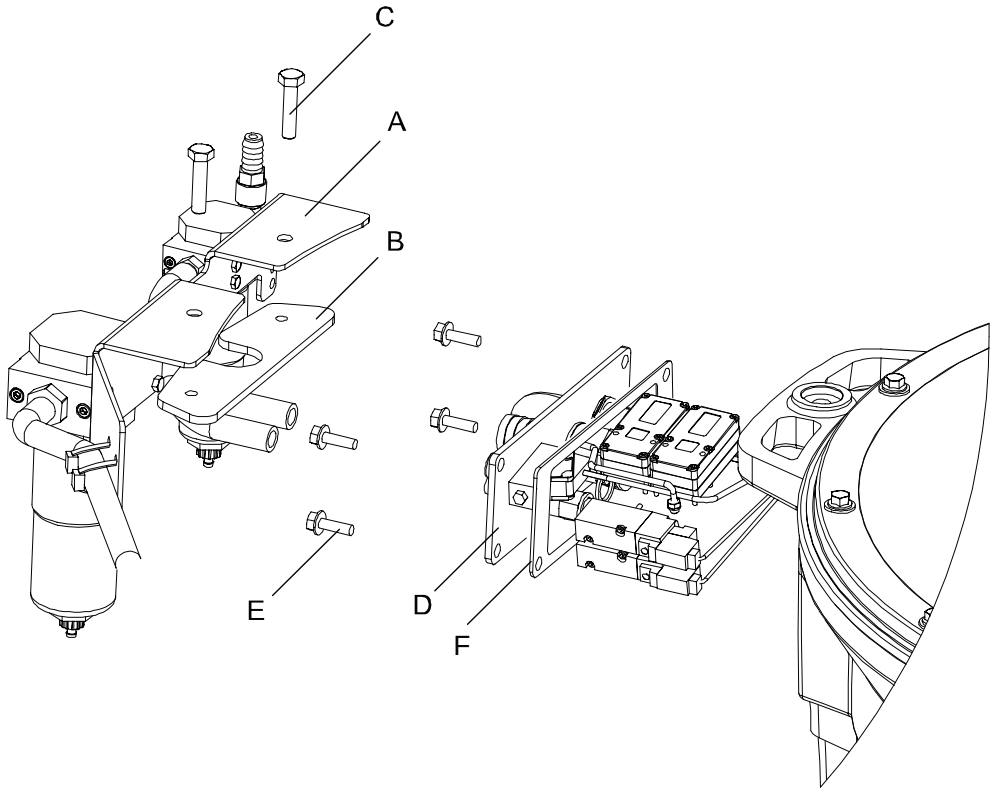
2.5.3 Installation of vacuum system (option 218-9)
Continued

Mechanical installation ejector



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A	Attachment
B	Bracket
C	Hexagon head screw, M8x35 (Steel 8.8-A2F)
D	Ejector unit
E	Hexagon bolt with flange, M6 x 20 (A2 DIN6921)
F	Gasket

	Action	Note
1	Follow the refitting instructions in section *Replacement of ejector unit on page 218*	

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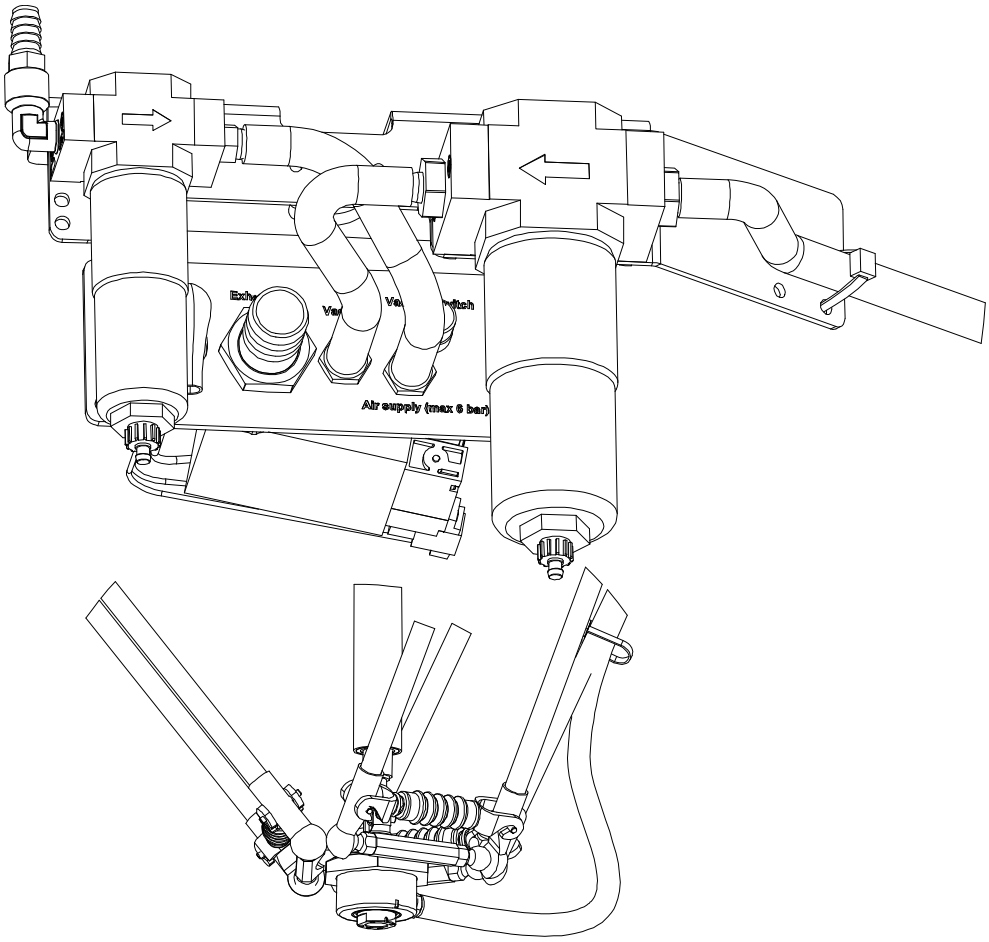
Installation of hoses



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	Action	Note
1	Follow the refitting instructions in section *Replacement of vacuum hoses on page 213*.	

Electrical installation

When connecting to IRC5 controller

	Action	Note
1	Assemble the customer cable 3HAC14860-X.	X = Depending on length, see section *Robot cabling and connection points on page 87*
2	Use connection R1.CS on the front of the ejector unit, and the other end to the XP5 socket on the controller.	

When connecting to OmniCore controller

	Action	Note
1	Assemble the customer cable 3HAC14860-X.	X = Depending on length, see section *Robot cabling and connection points on page 87*

Continues on next page

2.5.3 Installation of vacuum system (option 218-9)
Continued

	Action	Note
2	Use connection R1.CS on the front of the ejector unit.	
3	Cut open the XP5 connector into several open ends.	
4	Assemble the open ends to the local I/O on the controller.	

2.6 Electrical connections

2.6.1 Robot cabling and connection points

General

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

Cable categories

Cable category	Description
Robot power cables	Handles power supply to the robot's motors.
Robot signal cables	Handles signals from the controller to the robot's motors, as well as feedback from the serial measurement board.
Customer cables (option)	Handles communication with equipment fitted on the robot by the customer, low voltage signals and high voltage power supply + protective ground.

Robot control cable

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 (IRC5) XP1 (OmniCore)	R1.MP1-3 R1.MP4-6
Robot cable, (signals)	Transfers resolver data from and power supply to the serial measurement board.	S (IRC5) XP2 (OmniCore)	X1(SMB)

Robot control cable (power and signal) for IRC5

These cables are sold in pair, including both one robot cable power, and one robot cable signal.

Cable	Art. no.
Robot control cable 3 m	3HAC029903-001
Robot control cable 7 m	3HAC029903-002
Robot control cable 15 m	3HAC029903-003
Robot control cable 22 m	3HAC029903-004
Robot control cable 30 m	3HAC029903-005

Robot control cable (power and signal) for Panel Mounted Controller

These cables are included in the standard delivery for the Panel Mounted Controller. The cable needs to be cut off and prepared to fit the controller's connection points, as described in the product manual for the controller.

Cable	Art. no.
Robot control cable 7 m	3HAC029903-002

Continues on next page

2.6.1 Robot cabling and connection points
Continued

Robot control cable (power and signal) for OmniCore

These cables are sold in pair, including both one robot cable power, and one robot cable signal.

Cable	Art. no.
Robot control cable 3 m	3HAC062959-003
Robot control cable 7 m	3HAC062959-004
Robot control cable 15 m	3HAC062959-005
Robot control cable 22 m	3HAC062959-006
Robot control cable 30 m	3HAC062959-007

Customer connections

Customer connection (optional)

These cables including both power and signals are optional and **can not be combined with customer vacuum connections**.

Cable	Art. no.
Customer control cable 3 m	3HAC030198-001
Customer control cable 7 m	3HAC030198-002
Customer control cable 15 m	3HAC030198-003
Customer control cable 22 m	3HAC030198-004
Customer control cable 30 m	3HAC030198-005

Customer vacuum connection (optional)

Signal cables for vacuum are optional and **can not be combined with customer connections**.

Cable	Art. no.
Customer control cable 3 m	3HAC14860-7
Customer control cable 7 m	3HAC14860-1
Customer control cable 15 m	3HAC14860-2
Customer control cable 22 m	3HAC14860-3
Customer control cable 30 m	3HAC14860-4

2.7 Start of robot in cold environments

Introduction

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

Problems with starting the robot

Event message from Motion Supervision

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

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

Robot stopping with other event message

Use this procedure if the robot is not starting.

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

Adjusting the speed and acceleration during warm-up

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

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

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

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3 Maintenance

3.1 Introduction

Structure of this chapter

This chapter describes all the maintenance activities recommended for the IRB 360.

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

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

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

Safety information

Observe all safety information before conducting any service work.

There are general safety aspects that must be read through, as well as more specific safety information that describes the danger and safety risks when performing the procedures. Read the chapter *Safety on page 19* before performing any service work.

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

Note

If the IRB 360 is connected to power, always make sure that the IRB 360 is connected to protective earth and a residual current device (RCD) before starting any maintenance work.

For more information see:

- *Product manual - OmniCore C30*
- *Product manual - IRC5*
- *Product manual - IRC5 Compact*
- *Product manual - IRC5 Panel Mounted Controller*
- *Robot cabling and connection points on page 87*.

3.2 Maintenance schedule

3.2.1 Specification of maintenance intervals

Introduction

The intervals are specified in different ways depending on the type of maintenance activity to be carried out and the working conditions of the IRB 360:

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

  The SIS used in M2004 is further described in the *Operating manual - Service Information System*.

  The SIS used in OmniCore is further described in the *Operating manual - IRC5 with FlexPendant*.

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

3.2.2 Regular maintenance

Recommendation

The robot is designed to be able to work under very demanding conditions with a minimum of maintenance. Time between services can vary depending on the influence of the environment the robot is exposed for. We strongly recommend that at every stop in production, especially after collisions and after every wash down, the robot is inspected concerning the following parts.

Inspect regularly

- Telescopic shaft
- Spring units
- Bars
- Universal joints

Preventive maintenance

Nevertheless, certain routine checks and preventive maintenance must be carried out at specified periodic intervals, as shown in the following table.

Preventive maintenance	Note
Clean the robot.	As described in section *Cleaning activities on page 138*.
Lubricate sealings: • At regular intervals • When needed.	Recommended lubrication, see section: • *Mounting instructions for bearings on page 152*

3.2.3 Maintenance schedule IRB 360

Maintenance schedule

Maintenance activity	Equipment	Daily	400h	500h	4,000h 2 year	30,000h 5 year
Inspection	Clean Room robot	x [i]				
Inspection	Telescopic shaft			x		
Inspection	Vacuum system			x [ii]	x	
Inspection	Bar system			x	x	
Inspection	Upper arms				x	
Inspection	Spring unit			x [iii]		
Inspection	Movable plate				x	
Inspection	Sealing ring (V-ring)			x *i*		
Inspection	Information labels					
Grease	Telescopic shaft (WDS)			x [iv]		
Grease	Bearing rings 3HAC2091-1 [v]		x			
Changing	Telescopic shaft including universal joints				x	
Changing	Gearboxes oil, axes 1, 2, and 3					x [vi]
Changing	Gearbox oil, axis 4					x *vi*
Replacement	Battery pack, measurement system of type RMU101 or RMU102 (3-pole battery contact)					36 months or battery low alert [vii]
Replacement	Battery pack, measurement system with 2-pole battery contact, e.g. DSQC633A				24 months or battery low alert [viii]	

i Check for abnormal wear or contamination.

ii Only if option is chosen. Change interval is dependant on the material in picked objects. Porous objects may cause shorter cleaning intervals.

iii Grease if the spring units make a grinding sound.

iv Check for abnormal wear or contamination

v There are two different types of bearing rings, 3HAC028087-001 is maintenance-free, 3HAC2091-1 must be lubricated according to maintenance schedule. See *Different versions of bearing rings require different maintenance procedures on page 106*.

vi Oil should only be changed once after the first 30,000 h.

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

See the replacement instruction for more details.

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

Continues on next page

Check regularly

Check regularly:

- Wear of bearing ring in joints of the arm system.
- For any oil leaks. If a major oil leak is discovered, call for service personnel.
- For excessive play in gears. If play develops, call for service personnel.
- That the cabling between the control cabinet and robot is not damaged.
- Wear of plain bearings in telescopic shaft (wash-down protection).

Cleaning

Cleaning:

- Clean the robot exterior with a cloth when necessary. Do not use aggressive solvents which may damage paint or cabling. See section *Cleaning activities on page 138*.
- Cleaning instructions for wash down version, see section *Cleaning activities on page 138*.

3.3 Inspection activities

3.3.1 Telescopic shaft, axis 4, standard

General

This section describes maintenance on the telescopic shaft, axis 4, with the interval 500 hours.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

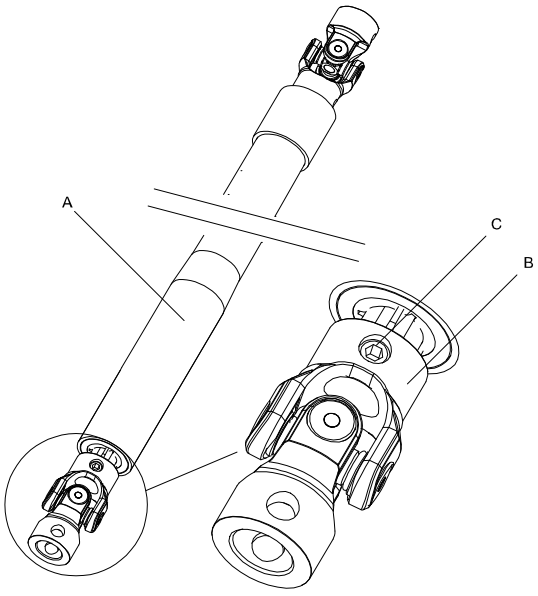
Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Note

The wear on the bearings depends on the payload, cycle, environment, and lubrication.

Telescopic shaft



xx0700000556

A	Telescopic shaft (STD)
B	Universal joint
C	Set screw, dog point

Continues on next page

Required equipment and references

	Required equipment	Note
	Standard tools	*Standard toolkit on page 260*.

References
Replacement of telescopic shaft on page 184
Spare parts, telescopic shaft.

Interval 500 h

	Action	Note
1	Check and retighten the set screws in the universal joints.	Described in section *Replacement of telescopic shaft on page 184*.

Interval 4000 h

	Action	Note
1	Change the telescopic shaft and the universal joint.	*Spare parts, telescopic shaft*

After a collision and/or if arms have fallen off

	Action	Note
1	Remove any remaining parts of the bar system from the *movable plate*.	**CAUTION** Be careful when pulling out the *telescope* to full length.
2	Check for damages on the *universal joint*.	How to replace the universal joint, see section: • *Replacement of universal joint on page 187*
3	Move the *movable plate* in different directions in order to check if there are any indications of reduced moving ability of the *universal joint*.	How to replace the universal joint, see section: • *Replacement of universal joint on page 187*

3.3.2 Telescopic shaft, wash down, axis 4

General

This section describes maintenance on the telescopic shaft (wash down), axis 4 interval 500 and 4000 h

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

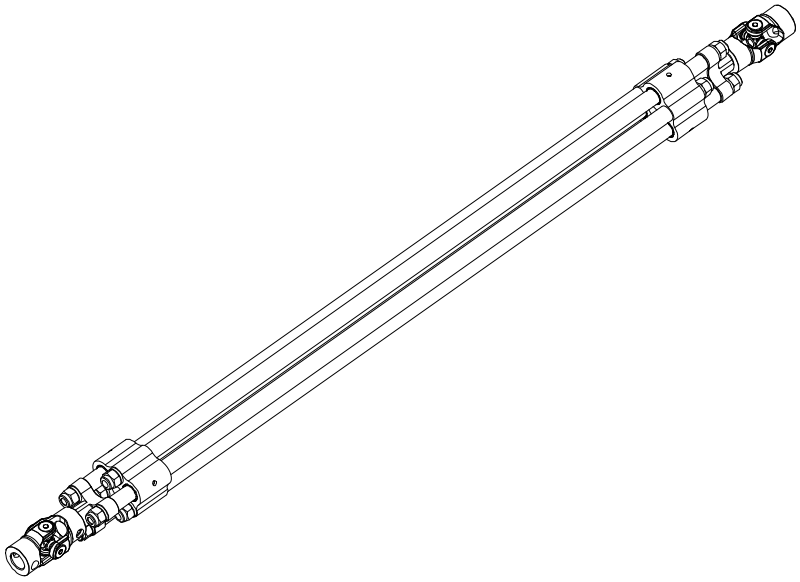
Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Note

The wear on the bearings depends on the payload, cycle, environment, and lubrication.

Telescopic shaft



xx0700000717

Required equipment and references

References
Replacement of telescopic shaft on page 184
Spare parts, telescopic shaft.

Continues on next page

Interval 500 h

	Action	Note
1	Check and retighten set screws.	
2	If the linear bushings are worn out or if the backlash is excessive, change the telescopic shaft and the universal joint.	Described in section *Replacement of telescopic shaft on page 184*.

Interval 4000 h

	Action	Note
1	Change the telescopic shaft and the universal joint.	*Spare parts, telescopic shaft*

After a collision and/or if arms have fallen off

	Action	Note
1	Remove any remaining parts of the *bar system* from the *movable plate*.	**CAUTION** Be careful when pulling out the *telescope* to full length.
2	Check for damages on the *universal joint*.	How to replace the universal joint, see section: • *Replacement of universal joint on page 187*
3	Move the *movable plate* in different directions in order to check if there are any indications of reduced moving ability of the *universal joint*.	How to replace the universal joint, see section: • *Replacement of universal joint on page 187*

3.3.3 Telescopic shaft, stainless, axis 4

General

This section describes maintenance on the telescopic shaft (stainless), axis 4 interval 500 and 4000 h

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Note

The wear on the bearings depends on the payload, cycle, environment, and lubrication.

Note

The stainless version is not available for the IRB 360 used with OmniCore controllers.

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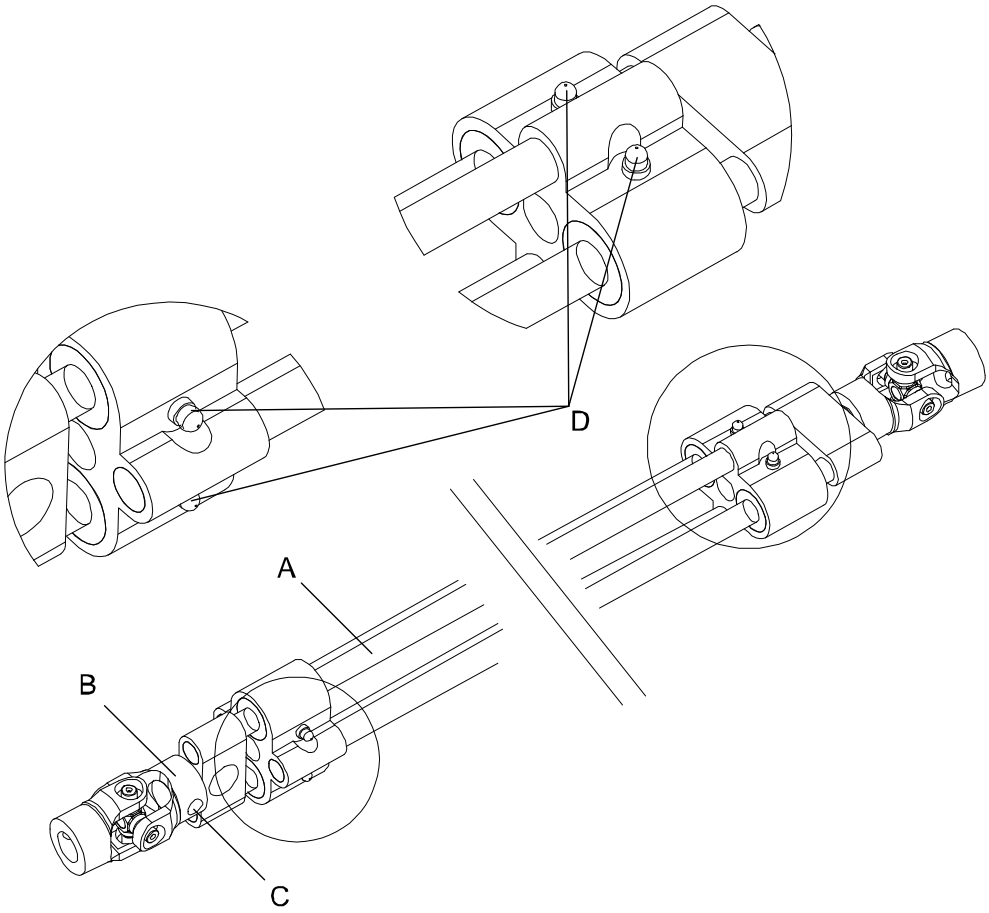
Telescopic shaft



xx0700000498

A	Telescopic shaft (WDS)
B	Universal joint
C	Set screw, dog point
D	Grease nipple (ball-type, DIN 3402)

Required equipment and references

Required equipment	Spare part No.	Note
Grease gun		For ball-type nipples (DIN 3402)
Grease	*Grease specification on page 263*.	
Telescopic shaft	*Spare parts, telescopic shaft*	
Standard tools	*Standard toolkit on page 260*.	

References
Spare parts, telescopic shaft
Replacement of telescopic shaft on page 184

Continues on next page

3.3.3 Telescopic shaft, stainless, axis 4
Continued

Interval 500 h

	Action	Note
1	Check and retighten the set screws in the universal joints.	
2	Lubricate the linear bushing, using a shot lubricator.	
3	If the linear bushing are worn out or if the backlash is excessive, replace the telescopic shaft.	Described in section *Replacement of telescopic shaft on page 184*

Interval 4000 h

	Action	Note
1	Change the telescopic shaft and the universal joints.	*Spare parts, telescopic shaft*

After a collision and/or if arms have fallen off

	Action	Note
1	Remove any remaining parts of the *bar system* from the *movable plate*.	**CAUTION** Be careful when pulling out the *telescope* to full length.
2	Check for damages on the *universal joint*.	How to replace the universal joint, see section: • *Replacement of universal joint on page 187*
3	Move the *movable plate* in different directions in order to check if there are any indications of reduced moving ability of the *universal joint*.	How to replace the universal joint, see section • *Replacement of universal joint on page 187*

3.3.4 Vacuum system (optional)

General

This section describes maintenance on the vacuum system, with the intervals 500 and 4000 hours.

Note

Only use in lubricated air.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

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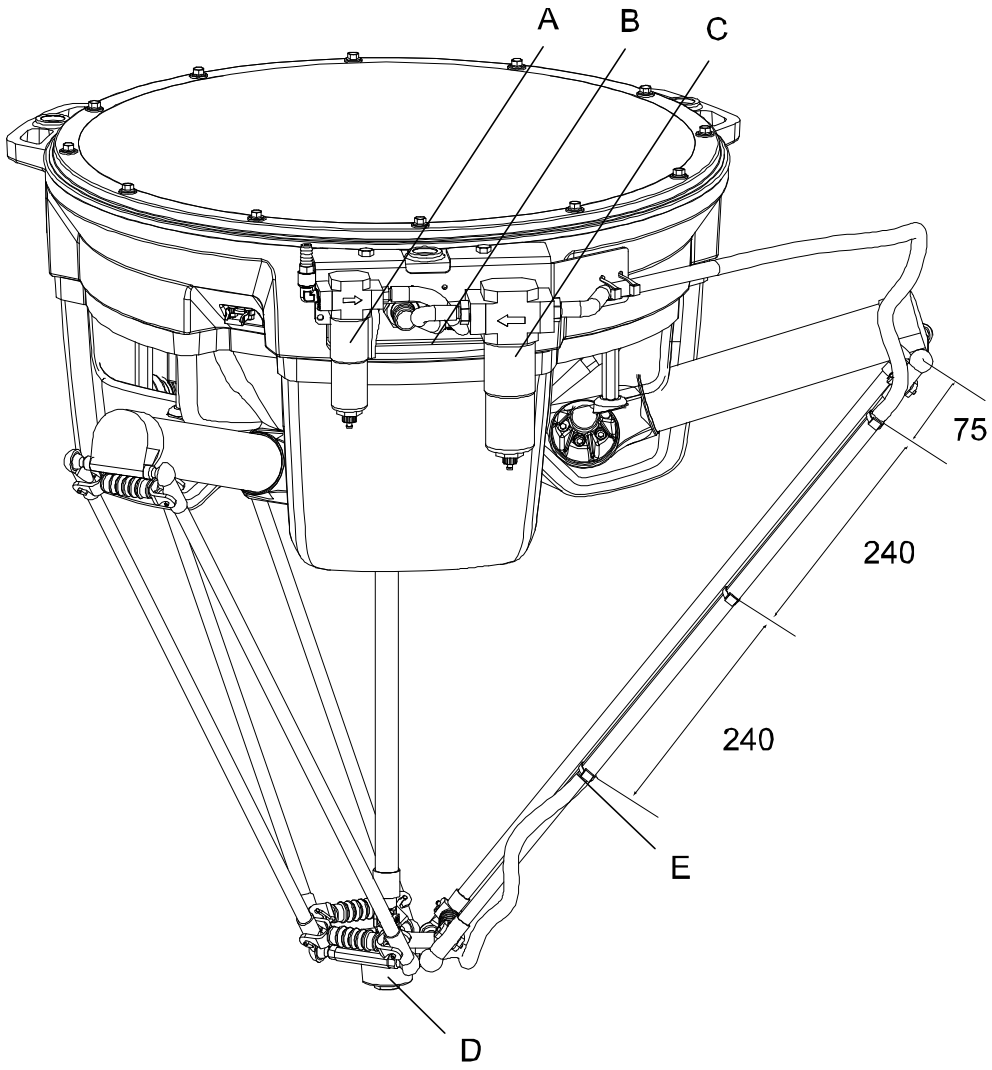
3.3.4 Vacuum system (optional)
Continued

Vacuum system



xx0700000499

A	Air filter inlet
B	Ejector unit
C	Air filter inlet vacuum
D	Swivel cup
E	Hose clamp

Required equipment and references

Required equipment	Spare part no.	Note
Pneumatic valve unit	*Spare parts, ejector unit*.	

References
Replacement of ejector unit on page 218
Draining of water separation filter on page 216

Continues on next page

Interval 500 h

	Action	Note
1	Empty air filter and check the position of the clamps for the hose.	Described in section *Draining of water separation filter on page 216*.
2	Correct the positions on the outer clamps.	Positions shown in figure.
3	Check that the air supply is dry and clean.	Particle size must not exceed 5 µm

Interval 4,000 h or 2 Years

	Action	Note
1	Replace pneumatic valves.	The service life of the valves is $4x10^7$ cycles. Described in section *Replacement of ejector unit on page 218*

3.3.5 Bar system

General

This section describes maintenance on the bar system, with the intervals 500 and 4000 hours.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Note

The wear on the bearing rings depends on the payload, number of cycles, and environment. Collisions can damage the bearing rings!

CAUTION

The spring units must be removed according to the description in section *Replacement of parallel arms on page 169*or they will be damaged.

Note

Never use grease on the bar system.

Different versions of bearing rings require different maintenance procedures

Valid for robot versions: IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/800, IRB 360 - 1/1600.

At delivery the robot is equipped with bearing rings 3HAC028087-001. These are maintenance free.

In specific environments the bearing rings 3HAC028087-001 might have been changed to bearing rings 3HAC2091-1 after delivery. These must be lubricated regularly.

The bearing rings 3HAC028087-001 are white. The bearing rings 3HAC2091-1 are grey.

Required equipment and references

Required equipment	Spare part no.	Note
Bearing rings	For article number see: • *Spare parts - parallel arm system, IRB 360*.	

Continues on next page

Required equipment	Spare part no.	Note
Grease	-	Required for non-maintenance free bearing rings. • Mobilgrease FM 102 • Optimol Obeen UF 2 See *Different versions of bearing rings require different maintenance procedures on page 106*.

References
Replacement of bearing rings on page 177

After a collision and/or if arms have fallen off

	Action	Note
1	Check for damages on *bearing rings*. If needed, replace.	How to change bearing rings, see section: • *Replacement of bearing rings on page 177*
2	Check for contamination and/or residues of grease.	If needed clean the bearing rings with ethanol.
3	Lubricate bearing rings that are not maintenance-free (see *Different versions of bearing rings require different maintenance procedures on page 106*).	Type of grease, see *Required equipment and references on page 106*.

Maintenance activity with interval 500 hours or 1 year

	Action	Note
1	Check for wear on *bearing rings*, listen for screeching. Replace if needed.	How to replace bearing rings, see section: • *Replacement of bearing rings on page 177*
2	Lubricate bearing rings that are not maintenance free (see *Different versions of bearing rings require different maintenance procedures on page 106*).	Type of grease, see *Required equipment and references on page 106*.

Maintenance activity with interval 4,000 hours or 2 years

	Action	Note
1	Check surface of tube for cracks or damages.	Replace if damaged.
2	Check the distance between the bearing holders.	See *Distance between bearing holders on page 108*.
3	If needed, replace damaged parts as described in the repair chapter.	

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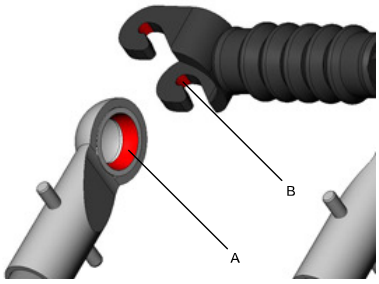
3.3.5 Bar system
Continued

Bar system wear



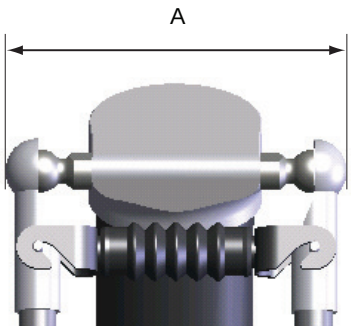
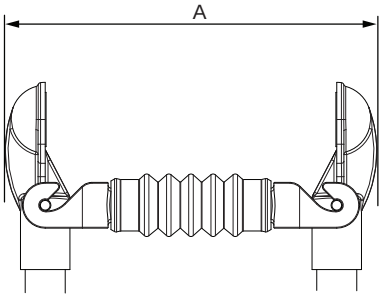
xx0700000484

A	Wear on bearing rings
B	Wear on spring unit forks

Distance between bearing holders

Note

The bearing will normally wear a lot during the first hours of operation (0.1-0.5 mm). It may also show wear in the form of dust and small particles. After this initial run-in, wear will reduce significantly.

	Action	Note
1	Measure the distance A between the bearing holders, according to the figure. Refer to the table below to see what distance requires replacement of the bearing ring. Replace the bearing ring, if required, according to section *Replacement of bearing rings on page 177*.	IRB 360 Std:  xx1000000018 IRB 360 WDS:  xx2000002385

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Robot variant	Distance A		
	Initial value	Value that requires replacement of the bearing ring	Worn out value [i]
IRB 360 - 1/1130	126 mm (Std)	<125 mm (Std)	124 mm (Std)
IRB 360 - 3/1130 IRB 360 - 1/800 IRB 360 - 1/1600	130 mm (WDS)	<129 mm (WDS)	128 mm (WDS)
IRB 360 - 8/1130 IRB 360 - 6/1600	130 mm	<129 mm	128 mm

[i] The bearing ring is worn out and requires immediate replacement. Operating the robot beyond this value will cause permanent damage to the arm system components.

3.3.6 Joint balls

General

This section describes maintenance on the joint balls, with the interval 4000 hours.

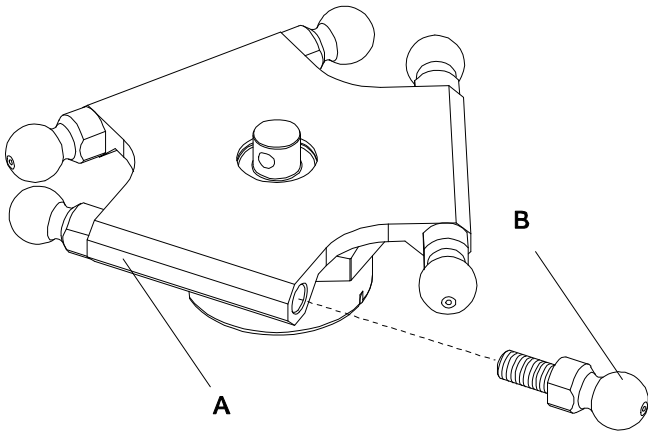
DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Check joint balls



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A	Movable plate
B	Joint balls

Required equipment and references

Required equipment	Spare part No.	Note
Standard tools		*Standard toolkit on page 260*
Pliers for parallel arms	3HAC6194-1	

References
Replacement of joint balls on page 189

Interval 4,000 hours or 2 years

	Action	Note
1	Check surface of joint balls for cracks or burrs.	If necessary replace the part as described in *Replacement of joint balls on page 189*

3.3.7 Upper arms

General

This section describes maintenance on the upper arms, with the interval 4000 hours.

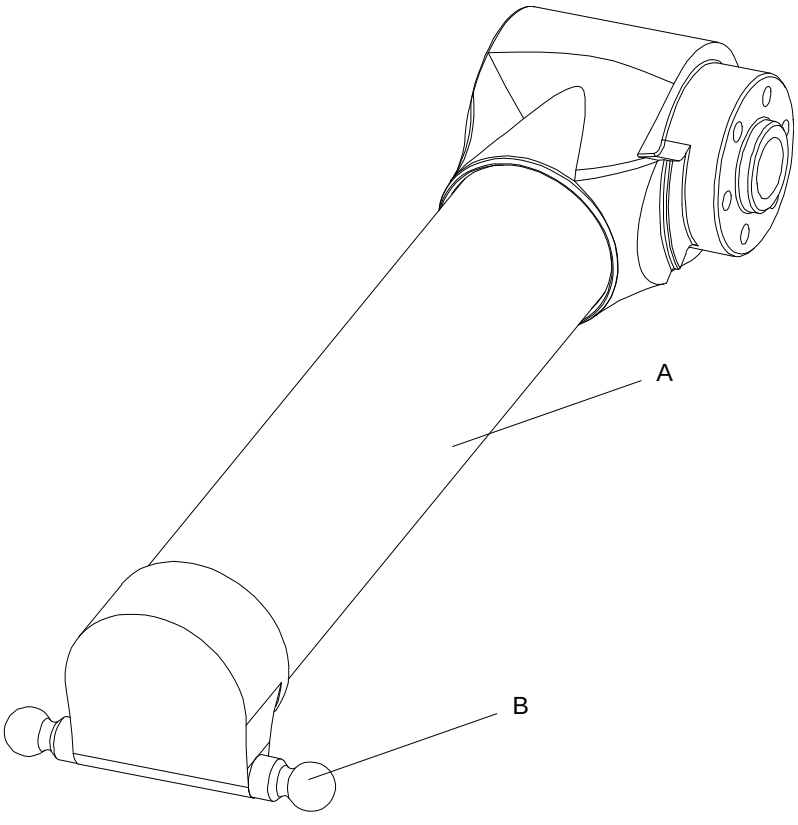
DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Check upper arm



xx0700000501

A	Upper arm tube
B	Joint balls

Continues on next page

3.3.7 Upper arms
Continued

Required equipment and references

Required equipment	Spare part no.	Note
Standard tools		*Standard toolkit on page 260*

References
Replacement of joint balls on page 189
Replacement of upper arm on page 174

Interval 4,000 hours or 2 years

	Action	Note
1	Check the surface of the tube for cracks.	If necessary replace the part as described in section *Replacement of upper arm on page 174*
2	Check surface of joint balls for cracks or burrs.	If necessary replace the part as described in *Replacement of joint balls on page 189*

3.3.8 Hoses

General

This section describes maintenance on the hoses with the interval 500 hours.

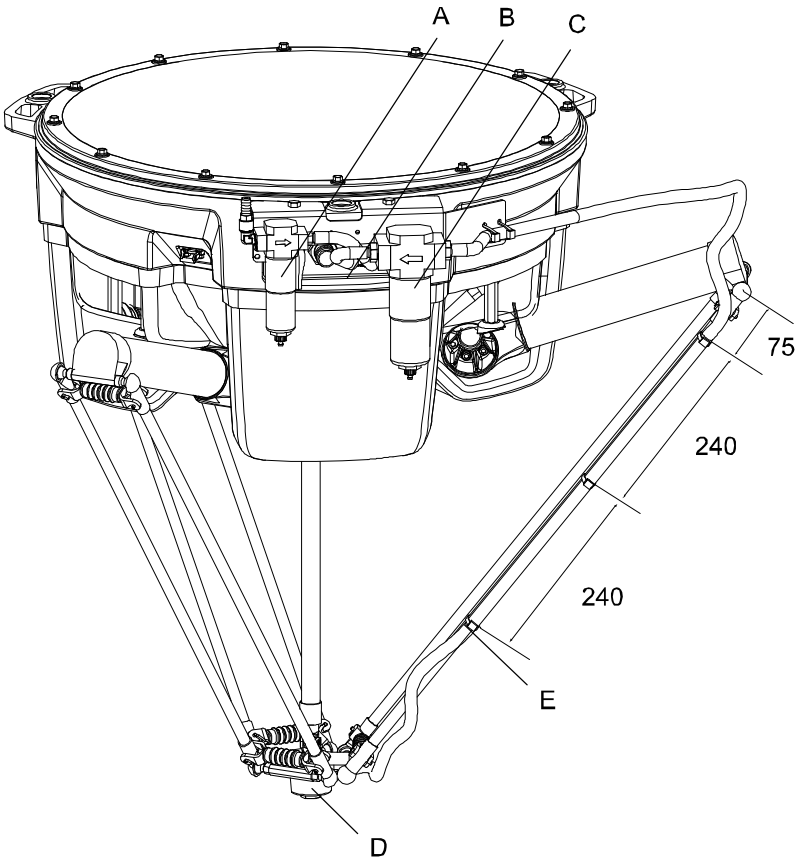
DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Check hoses



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A	Air filter inlet.
B	Ejector unit
C	Air filter inlet vacuum.
D	Swivel cup
E	Hose clamp

Continues on next page

3.3.8 Hoses
Continued

Required equipment and references

Required equipment	Spare part no.	Note
Standard tools		*Standard toolkit on page 260*

References
Replacement of vacuum hoses on page 213

Interval 500 hours

	Action	Note
1	Check the entire hose and make sure there are no folds or surface damage.	If necessary, exchange the part as described in *Replacement of vacuum hoses on page 213*

3.3.9 Spring units

General

This section describes maintenance on the spring units with the interval 500 hours.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

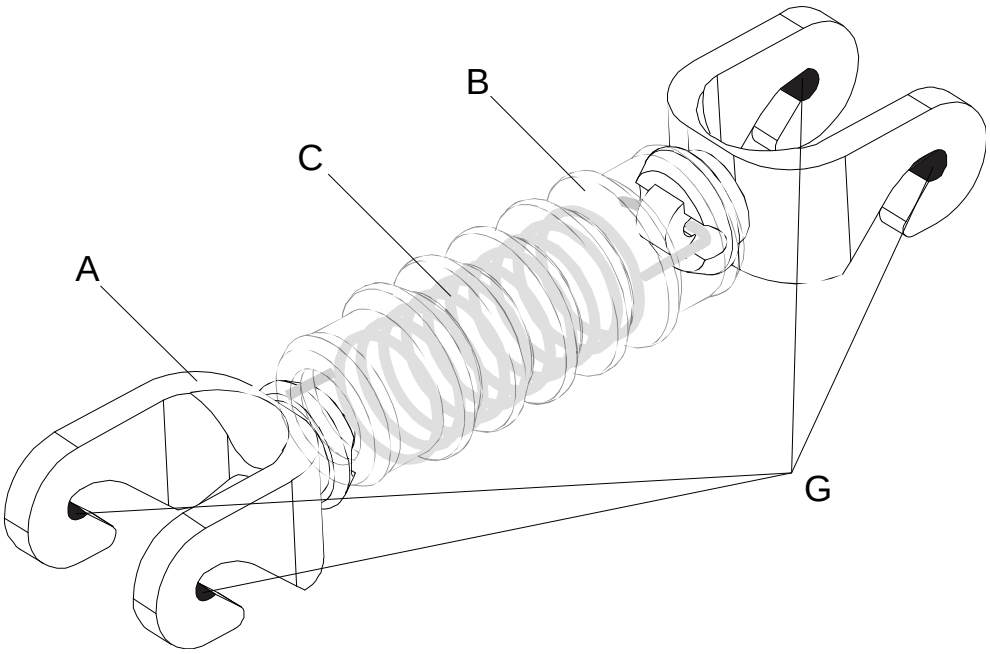
- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

CAUTION

The spring units must be removed according to the description in section *Replacement of parallel arms on page 169*or they will be damaged.

Check spring units

IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/800, IRB 360 - 1/1600



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A	Hook
B	Spring
C	Rubber bellow
G	Greasing points

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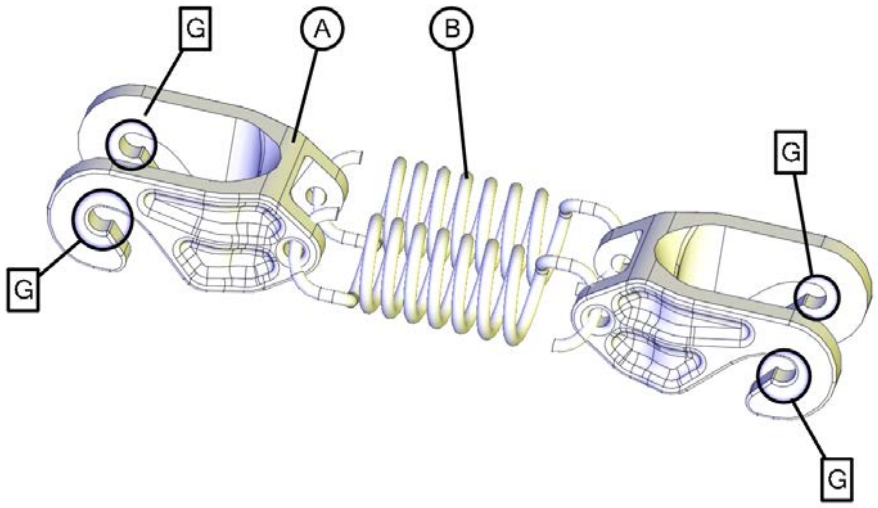
3.3.9 Spring units
Continued

IRB 360 - 8/1130, IRB 360 - 6/1600



xx1300000162

A	Hook
B	Spring
G	Greasing points

Required equipment and references

Required equipment	Spare part no.	Note
Grease	*Grease specification on page 263*	
Standard tools	*Standard toolkit on page 260*	
Spring	*Spare parts - lower arm system, IRB 360.*	

References
Replacement of parallel arms on page 169

Interval 500 hours

	Action	Note
1	Check the forks for wear.	If necessary exchange the part as described in *Replacement of parallel arms on page 169*
2	If necessary (if the spring units make a grinding sound) apply grease to all wear surfaces.	Shown in figure as (G)

3.3.10 Movable plate

General

This section describes maintenance on the movable plate, with the interval 4,000 hours.

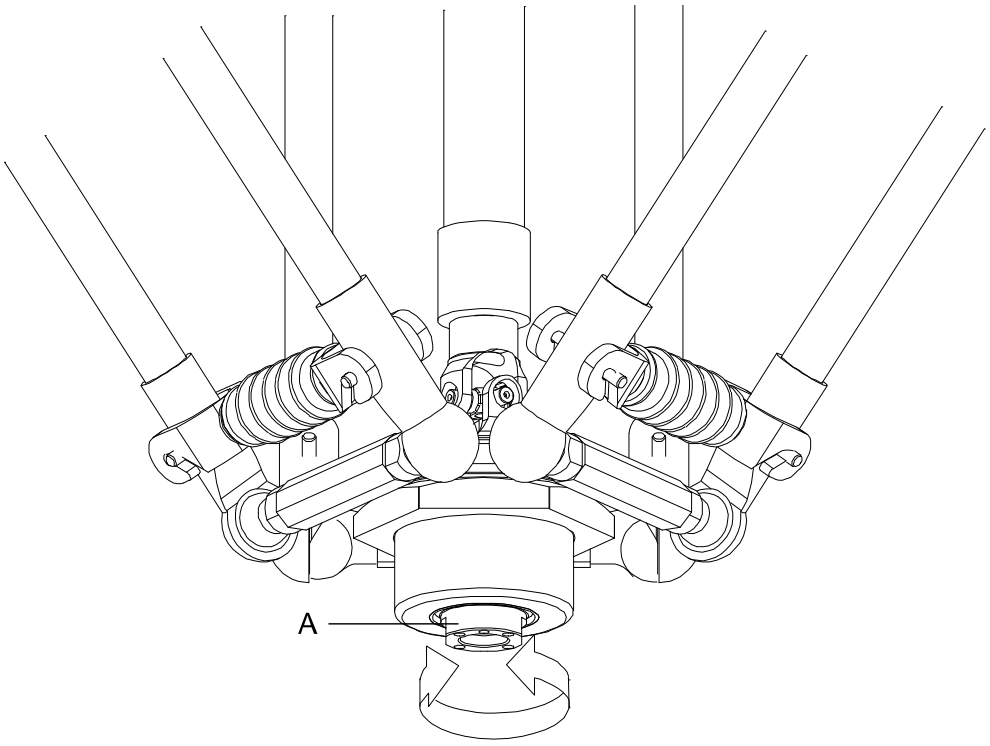
DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Check movable plate



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A	Tool interface axis 4

Required equipment and references

Required equipment	Spare part no.	Note
Movable plate	*Spare parts, movable plate*.	
Standard tools	*Standard toolkit on page 260*.	

Continues on next page

3.3.10 Movable plate
Continued

References
Replacement of movable plate on page 180

Interval 4000 hours

CAUTION

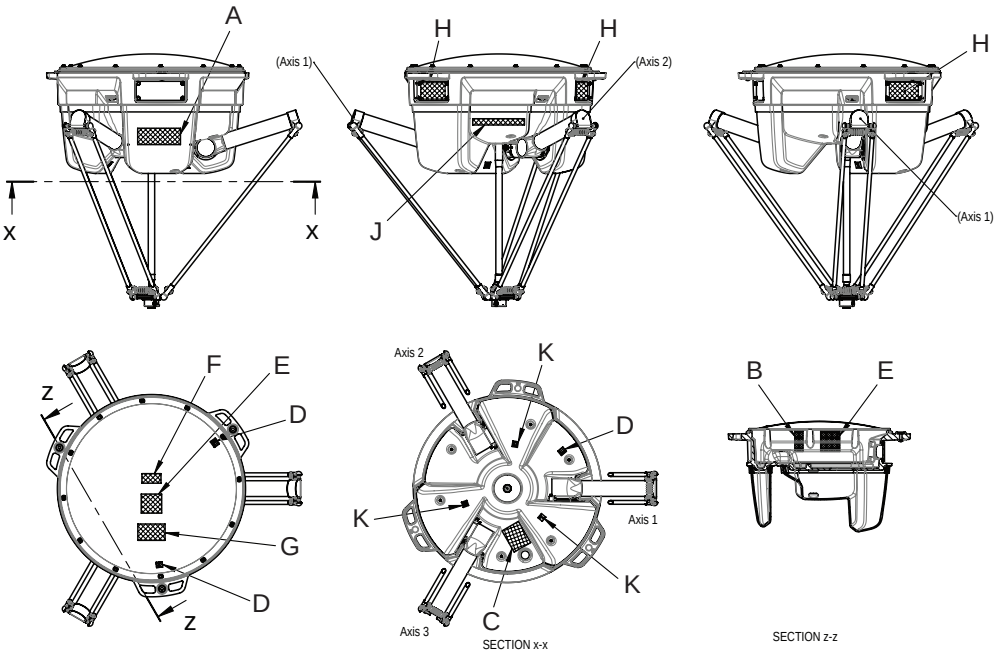
Never force axial movement to the swivel or tool interface without first releasing the brakes, it will damage the telescopic shaft.

	Action	Note
1	**Release the holding brakes on the robot axis 4.**	As described in section *Manually releasing the brakes on page 64*.
2	Check axis 4 so that the rotation is smooth.	If necessary replace the movable plate as described in *Replacement of movable plate on page 180*

3.3.11 Inspecting information labels

Location of information labels

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



xx1800001185

A	ABB logotype
B	Calibration label
C	Warning label - Brake release
D	Warning label - Electricity (symbol of flash) (3 pcs)
E	Rating label (2 pcs)
F	UL/UR label
G	Instruction label **Before dismantling see product manual**
J	Label, FlexPicker
K	Axis marking

Required equipment

Equipment	Spare part number	Note
Labels	See *Spare part lists on page 269*.	

Continues on next page

3.3.11 Inspecting information labels
Continued

Inspecting labels

Use this procedure to inspect the labels on the robot.

	Action	Note
1	 **DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the robot working area.	
2	Check all labels.	See the figure in *Location of information labels on page 119*.
3	Replace any missing or damaged labels.	

3.4 Replacement/changing activities

3.4.1 Changing the battery in the measuring system

Note

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

For an SMB board with 3-pole battery contact (RMU101 3HAC044168-001 or RMU102 3HAC043904-001), the lifetime of a new battery is typically 36 months.

For an SMB board with 2-pole battery contact, the typical lifetime of a new battery is 36 months if the robot is powered off 2 days/week or 18 months if the robot is powered off 16 h/day. The lifetime can be extended for longer production breaks with a battery shutdown service routine. See *Operating manual - IRC5 with FlexPendant* for instructions.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

CAUTION

Always read the specific instructions for Clean Room robots before doing any repair work, see *Cut the paint or surface on the robot before replacing parts on page 160*.

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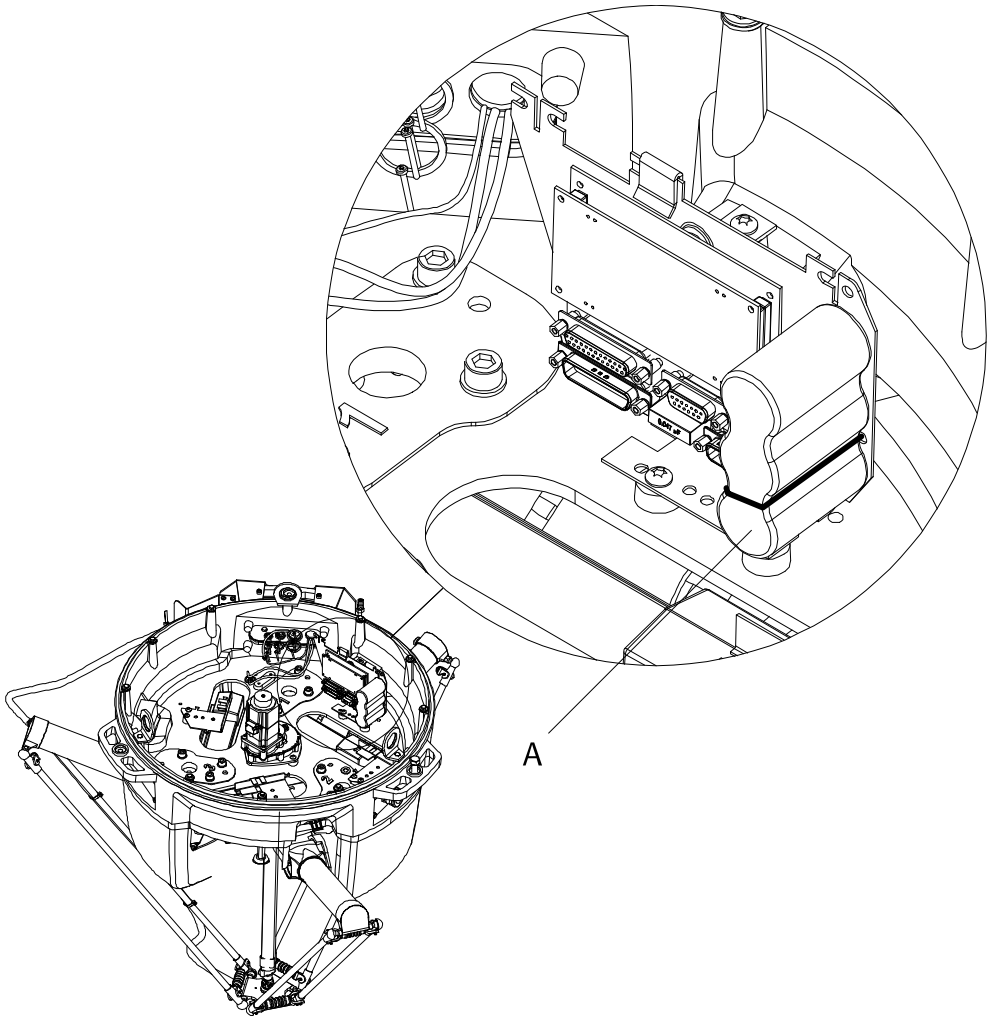
3.4.1 Changing the battery in the measuring system
Continued

Location SMB

DSQC 633A



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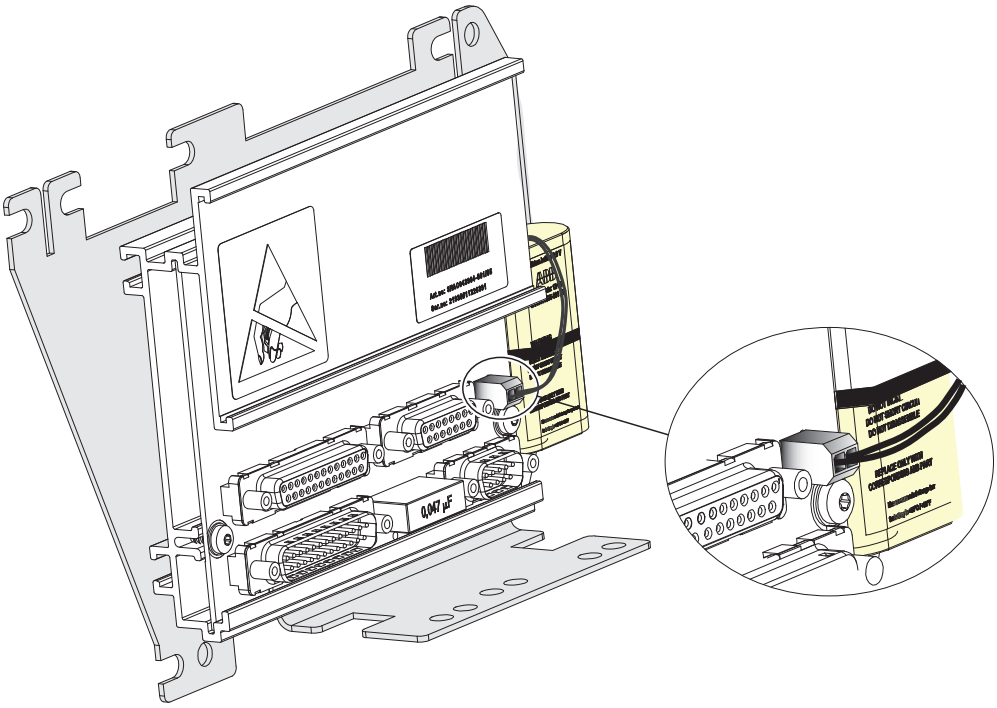
A	SMB battery

Continues on next page

RMU 101



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Required equipment and references

Note

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

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

Tools and wear parts	Spare part no.	Note
Battery unit	See *Product manual, spare parts - IRB 360*.	Lithium battery
Standard tools		*Standard toolkit on page 260*
Battery retainer (strap)		

References
Updating revolution counters on page 243
Replacement of base cover gasket on page 162

Continues on next page

3.4.1 Changing the battery in the measuring system
Continued

Changing the battery

DANGER

Turn off all electric power, hydraulic, and pneumatic pressure supplies to the robot.

	Action	Note
1	Remove the (12pcs) M6 screws holding the base cover.	Described in section *Replacement of base cover gasket on page 162*.
2	Remove the base cover. **CAUTION** Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures. **CAUTION** Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.	
3	Disconnect the battery from the serial measurement board. Connection (X3).	
4	Cut the strap and remove the battery pack. Use standard tools.	**Note** Used batteries must never be thrown away! They must be handled as hazardous waste!
5	Connect the new battery to the serial measurement board. Connection (X3).	
6	Refit the battery to the SMB, using a strap.	
7	Check the base cover gasket.	Replace if damaged.
8	Refit the base cover using the (12pcs) M6 screws.	Described in section *Replacement of base cover gasket on page 162*.
9	Update the revolution counters.	Described in section *Updating revolution counters on page 243*.

3.4.2 Changing the telescopic shaft including universal joints

General

This section describes maintenance on the telescopic shaft with the interval 4000 hours or 2 years.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

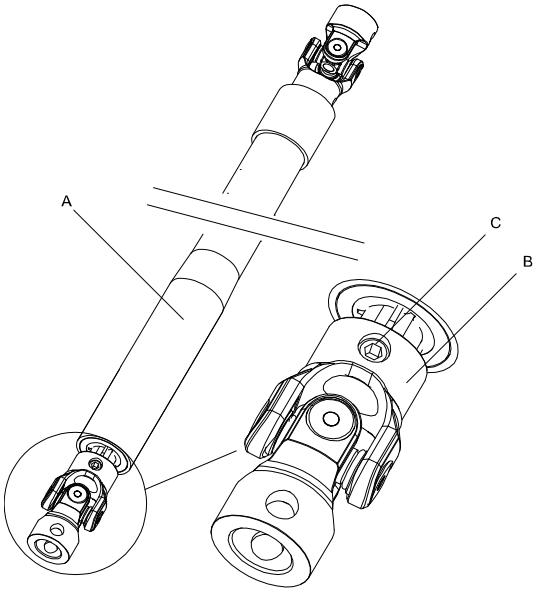
Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Note

The wear on the bearings depends on the payload, cycle, environment, and lubrication.

Telescopic shaft



xx0700000556

A	Telescopic shaft (STD)
B	Universal joint
C	Set screw, dog point

Continues on next page

3.4.2 Changing the telescopic shaft including universal joints
Continued

Required equipment and references

	Required equipment	Note
	Standard tools	*Standard toolkit on page 260*.

References
Replacement of telescopic shaft on page 184
Spare parts, telescopic shaft.

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

Interval 4,000 h or 2 Years

	Action	Note
1	Change the telescopic shaft and the universal joints.	Described in section *Replacement of telescopic shaft on page 184*.

After a collision and/or if arms have fallen off

See *After a collision and/or if arms have fallen off on page 97*.

3.5 Lubrication activities

3.5.1 Type of lubrication in gearboxes

Introduction

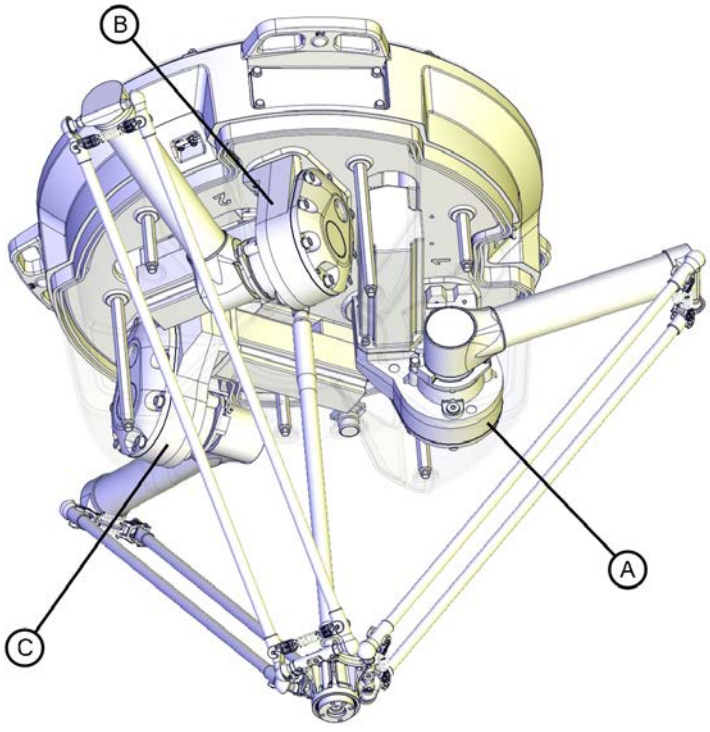
This section describes where to find information about the type of lubrication, article number and the amount of lubrication in the specific gearbox. It also describes the equipment needed when working with lubrication.

Type and amount of oil in gearboxes

Information about the type of lubrication, article number as well as the amount in the specific gearbox can be found in *Technical reference manual - Lubrication in gearboxes* available for registered users on myABB Business Portal, *www.abb.com/myABB*.

Location of gearboxes

The figure shows the location of the gearboxes.



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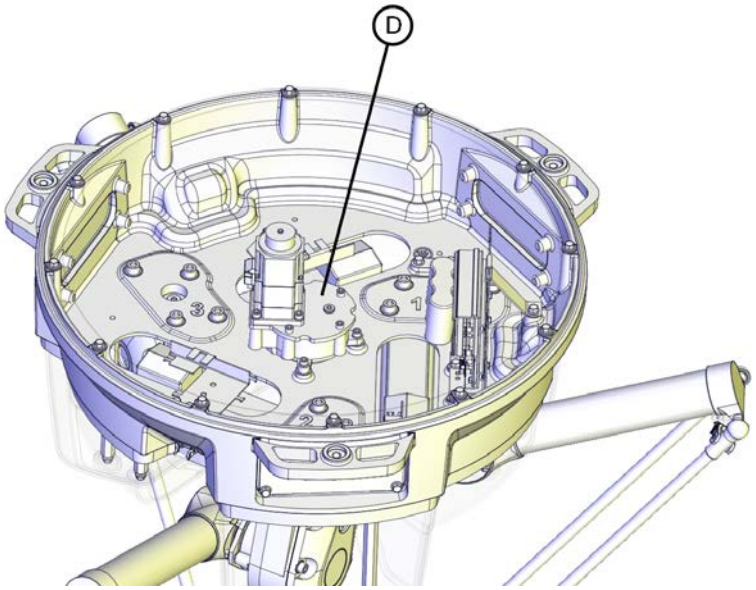
3.5.1 Type of lubrication in gearboxes
Continued



xx1300000178

A	Axis-1 gearbox
B	Axis-2 gearbox
C	Axis-3 gearbox
D	Axis-4 gearbox

3.5.2 Gearboxes, axes 1- 4

General

This section describes maintenance on axis-1-4 gearboxes regarding oil change (3D version only 1-3).

WARNING

Gearbox oil can be very hot, take necessary measures to collect the oil.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

CAUTION

Always read the specific instructions for Clean Room robots before doing any repair work, see *Cut the paint or surface on the robot before replacing parts on page 160*.

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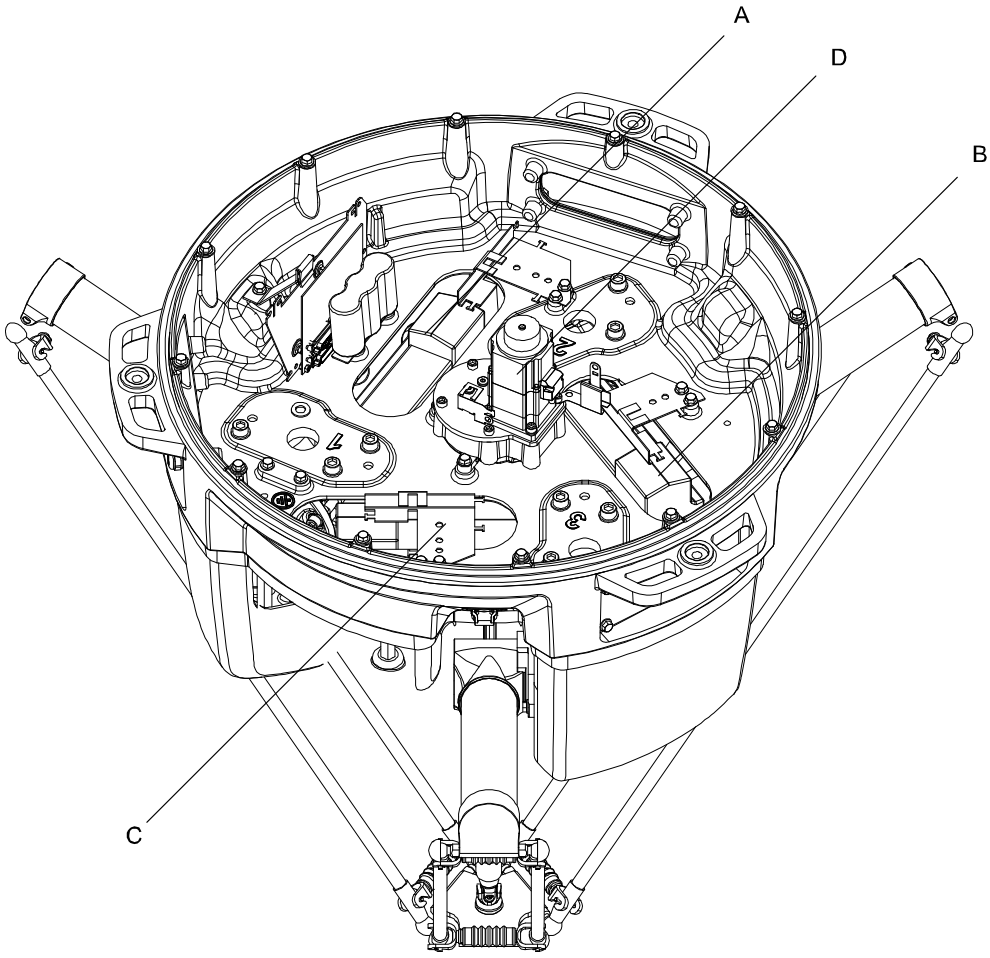
3.5.2 Gearboxes, axes 1- 4
Continued

Location of gearboxes



xx0700000505

A	Gearbox axis 1
B	Gearbox axis 2
C	Gearbox axis 3
D	Gearbox axis 4 (not in 3D version)

Required equipment and references

Required equipment	Spare part No.	Note
Standard tools		*Standard toolkit on page 260*
Gaskets base		*Spare parts, gaskets in the base*
Gaskets cover		*Spare parts, transmission cover*
Spare parts, gear units axis 1- 3		*Spare parts, gear units axis 1- 3*
Spare parts, gear units axis 4		*Spare parts, gear unit axis 4*
Locking liquid		Loctite 243
Sealing compound	3HAC073510-001	Trans7

Continues on next page

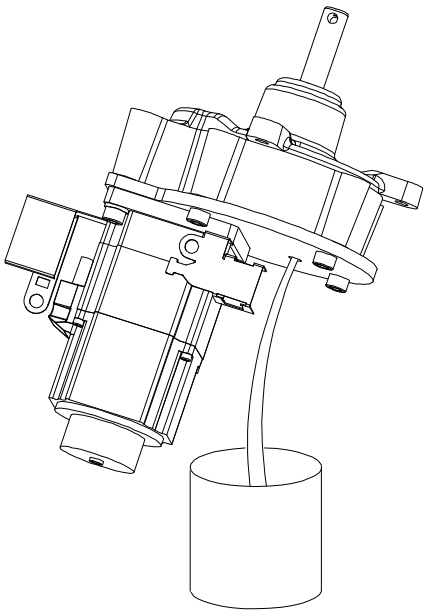
References
Replacement of base cover gasket on page 162
Replacement of parallel arms on page 169
Replacement of telescopic shaft on page 184
Replacement of upper arm on page 174

Interval 30,000 hours or 5 years

Oil change in axis 4, (not in 3D version)

Note

Oil should only be changed once after the first 30,000 h.

	Action	Note
1	Remove the base cover.	Described in section *Replacement of base cover gasket on page 162*.
2	Remove the gearbox and motor axis 4.	Described in section *Replacement of gearbox unit 4 on page 196*.
3	Remove the oil plug, and drain the oil from gearbox 4.	 xx0700000728
4	Fill new oil through the plug holes, with specified volume.	Types and volumes of oil are specified in the *Technical reference manual - Lubrication in gearboxes - 3HAC042927-001*.

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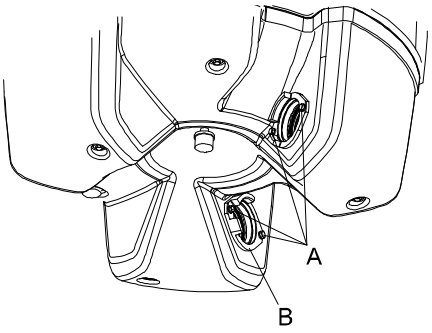
3.5.2 Gearboxes, axes 1- 4
Continued

	Action	Note
5	Refit the oil plug, apply Loctite 243. **Note** If the sealing ring on the sealing plug is damaged, change the sealing plug. **Note** Some robots have two oil plugs.	Tightening torque: 3 Nm .
6	Refit the (12 pcs) M6 screws holding the base cover. (If necessary, change the sealings)	Described in section *Replacement of base cover gasket on page 162*.

Interval 30,000 hours or 5 years

Oil change in axis 1-3

	Action	Note
1	Remove the (12 pcs) M6 screws holding the base cover.	Described in section *Replacement of base cover gasket on page 162*.
2	Remove the parallel arms.	Described in section *Replacement of parallel arms on page 169*.
3	Remove the telescopic shaft	Described in section *Replacement of telescopic shaft on page 184*.
4	Remove the 3 pcs VK-covers.	Use a screwdriver
5	Remove the 3x6 pcs M6x40 holding the upper arms.	Described in section *Replacement of upper arm on page 174*.
6	Remove the 6 pcs M6x20 (A) holding the 3 pcs flange (B) and the 3 pcs upper arm sealing rings.	 xx0700000509 A Screw M6x20 B Flange

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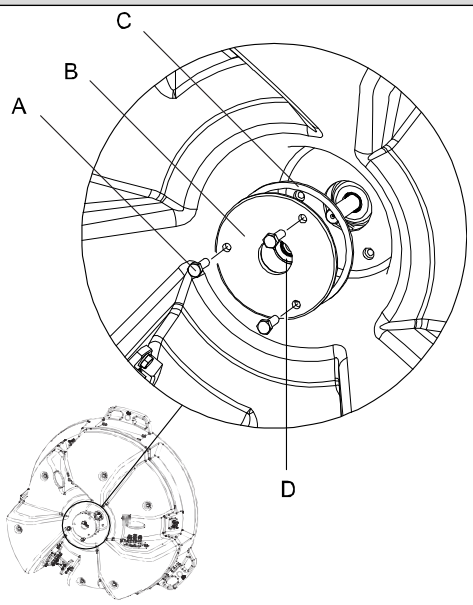
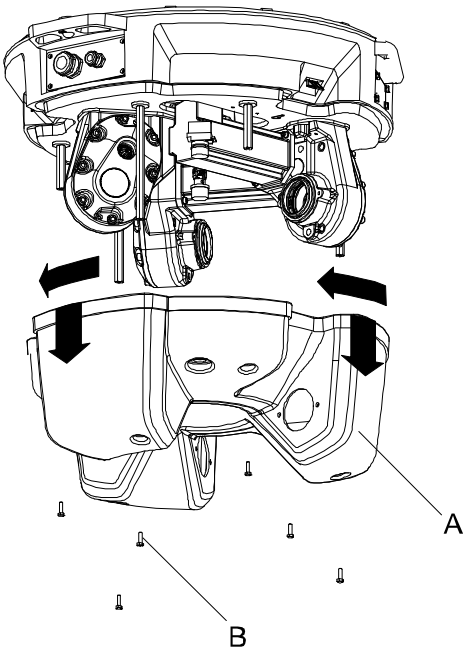
	Action	Note
7	Remove the 3 pcs M6x20 flange screws (A). Remove the flange cover (B). Remove the flange gasket ax 4 (C). Remove the sealing ring (D).	 xx0700000647 A M6x20 flange screws. B Flange cover ax 4 (in 3D version without center hole) C Flange gasket ax 4 D Sealing ring w. dust lip (not in 3D version)
8	Remove the 6 pcs M6x20 flange screws (B) holding the transmission cover (A). **CAUTION** On the WD. or WDS. robots the transmission cover and sealing is glued on to the robot using sealing compound. When removing the transmission cover use a screwdriver to carefully separate the sealing from the sealing compound. Carefully remove the sealing compound from the robot and transmission cover.	 xx0700000510 A Transmission cover B Flange screw M6x20
9	Remove the transmission cover.	**Note** Remove the cables to the brake release, described in section *Replacement of brake release button on page 225*.

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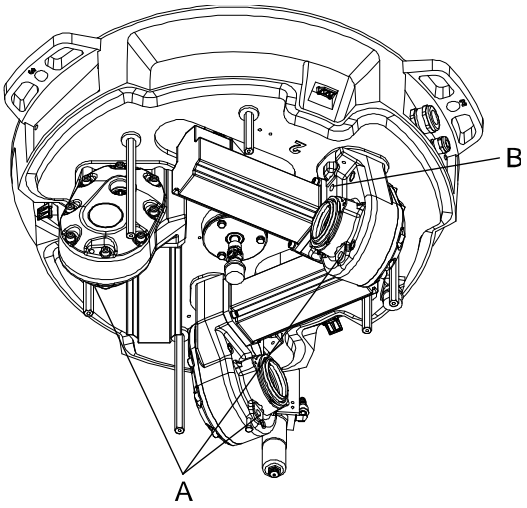
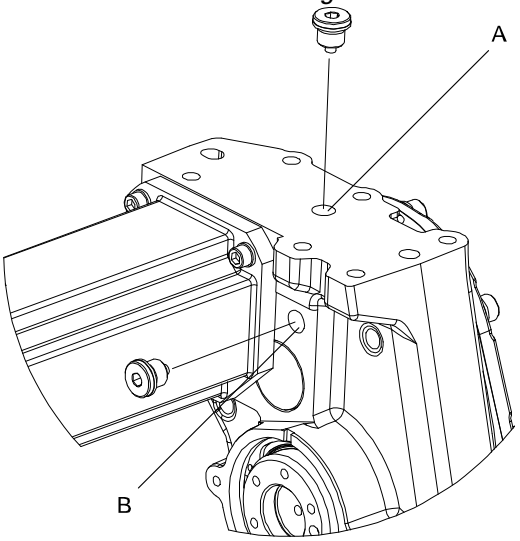
3.5.2 Gearboxes, axes 1- 4
Continued

	Action	Note
10	Remove the magnetic plugs and drain the gearboxes, one by one.	 xx0700000511 A Magnetic plugs B Oil level plug
11	**Note** Clean the magnetic plugs before assemble.	
12	Refit the magnetic plug (A), change the sealing washers if necessary.	**Tightening torque 10-12 Nm**.
13	The oil is filled through the plug holes (A) with specified volume, **check oil level by removing the oil level plug (B)**.	Types and volumes of oil are specified in the *Technical reference manual - Lubrication in gearboxes - 3HAC042927-001*.  xx0700000729

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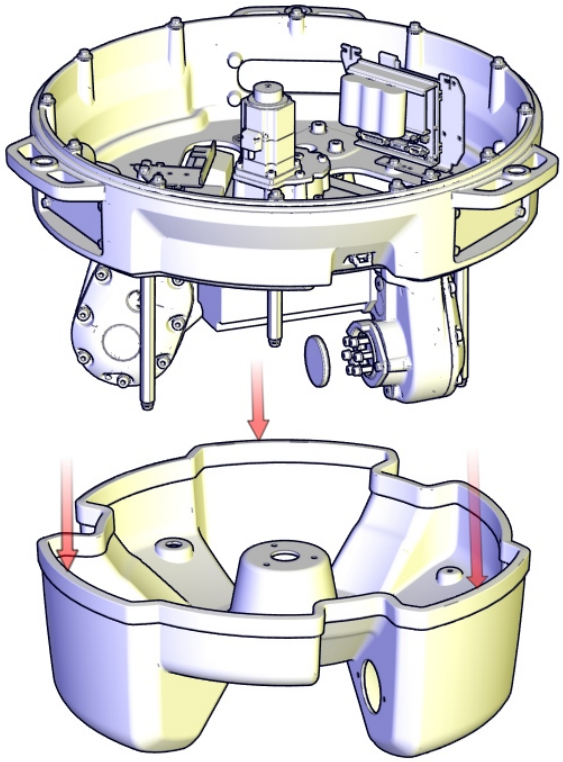
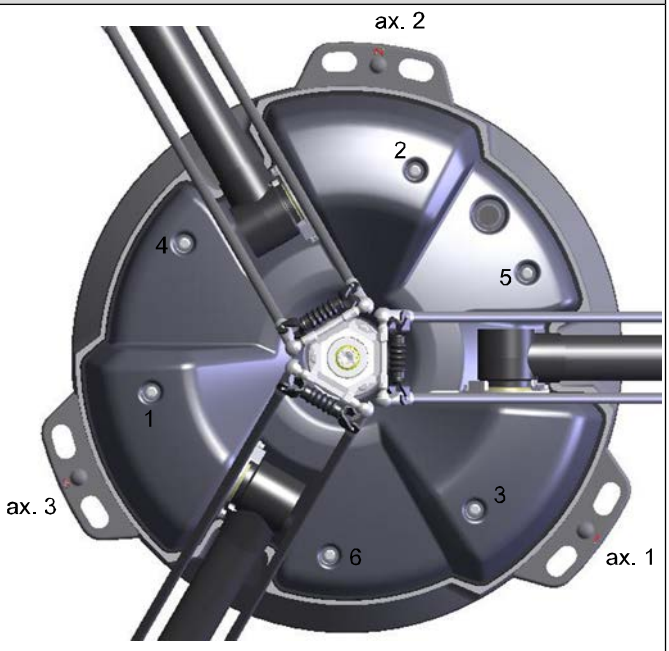
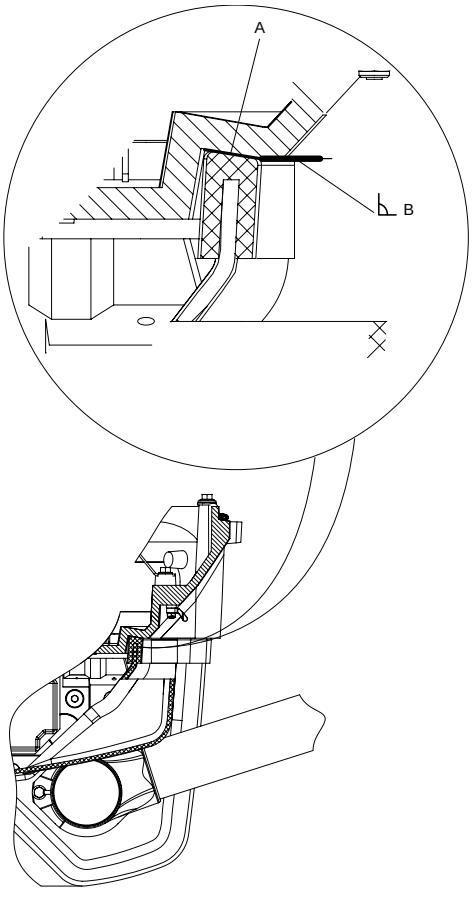
	Action	Note
14	On WD. and WDS. Clean the cover sealing upper surface using ethanol. **Note** Make sure that all old sealing compound is removed.	 xx1100000543
15	Apply a 5 mm string of sealing compound on the sealing upper surface.	

Continues on next page

3.5.2 Gearboxes, axes 1- 4
Continued

	Action	Note
16	Refit the transmission cover using the 6pcs M6 x 20 hexagon bolt with flange. Use locking liquid (loctite 243). **Note** Follow the tightening sequence in the figure.	 xx0800000024 **Tightening torque 4 Nm.**
17	After tightening, check that the sealing compound fills the entire gap according to figure, position B. Remove excessive compound or fill up if needed.	 xx1100000540

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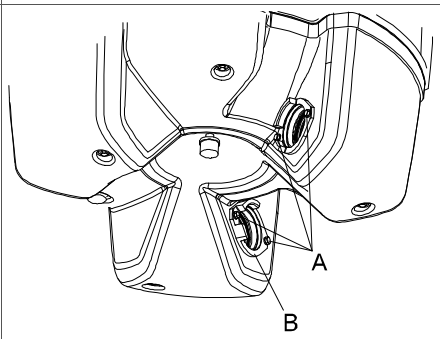
	Action	Note
18	Refit the 3 pcs flange and the 3 pcs flange gasket, using the 6 pcs M6x20. Apply locking liquid (Loctite 243). (Change the gaskets if necessary.)	**Tightening torque 4 Nm.**
19	Refit the 3 pcs upper arm sealing rings. Apply locking liquid (loctite 243). Change the sealings if necessary.	 xx0700000509 A Screw M6x20 B Flange
20	Refit the 3 upper arms using the 6 x 3 pcs M6x40. Apply locking liquid (loctite 243).	Described in section *Replacement of upper arm on page 174*.
21	Mount new VK-covers on the upper arms.	Apply locking liquid (loctite 243).
22	Refit all parallel arms.	Described in section *Replacement of parallel arms on page 169*.
23	Refit the telescopic shaft.	Described in section *Replacement of telescopic shaft on page 184*
24	Refit base cover.	**CAUTION** The base cover has sharp edges, use protective gloves. Described in section *Replacement of base cover gasket on page 162*

3.6 Cleaning activities

3.6.1 Introduction

Washing standards

The manipulator is tested to fulfill the following standards according to IEC60529:2001.

- Standard: IP54
- Wash down: IP67
- Wash down stainless: IP69K according to ISO 20653:2001
- Clean Room: IP54

Note

The stainless version is not available for the IRB 360 used with OmniCore controllers.

Cleaning overview

Protection type	Cleaning method				
	Vacuum Cleaner	Wipe with cloth	Rinse with water	High pressure water or steam	Detergents
Standard	Yes	Yes	No	No	No
Wash down	Yes	Yes	Yes[i]	Yes[ii]	Yes
Wash down stainless	Yes	Yes	Yes	Yes[iii]	Yes
Clean room	Yes	Yes	No	No	No

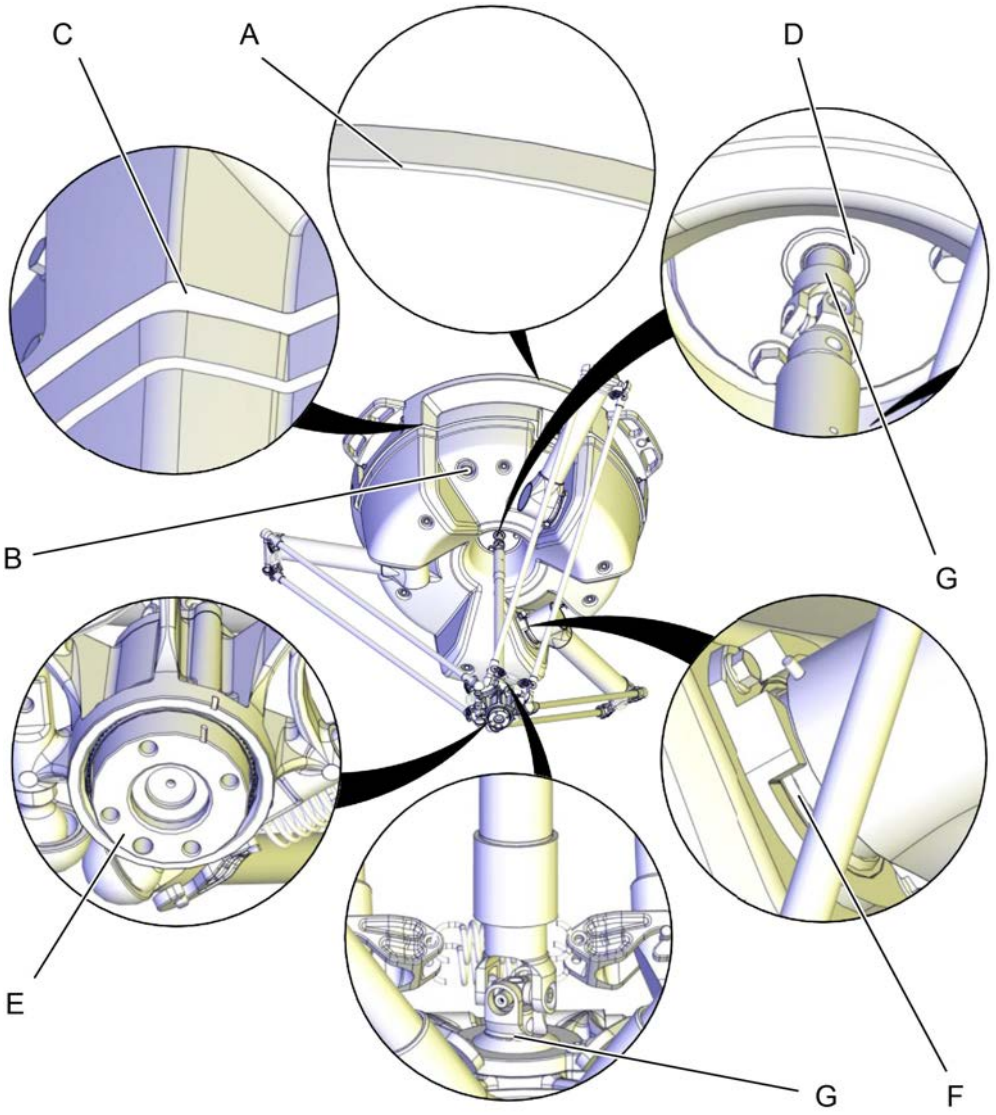
i It is highly recommended that the water contains a rust-prevention solution.
ii It is highly recommended that the water and steam contains rust preventive, without cleaning detergents.
iii See recommended water temperature and pressure.

Continues on next page

Sensitive spots

Sensitive spots for direct flushing.

> **Note**
>
> This applies for **IRB 360 WD** and **IRB 360 WDS** versions. If standard version parts is used in a **WD** or **WDS** version robot the robot must be cleaned as a standard version robot.



xx2100000169

A	Base cover gasket	E	Movable plate
B	Brake release button	F	Upper arm sealing rings
C	Transmission cover gasket	G	Universal joints
D	Axis 4 sealing ring		

Continues on next page

3.6.1 Introduction
Continued

Cleaning with water and steam

Instructions for rinsing with water

The IRB 360 with protection types Wash down and Wash down stainless can be cleaned by rinsing with water (water cleaner).

The following list defines the prerequisites:

- Maximum water pressure at the nozzle: 700 kN/m2 (7 bar)
- Fan jet nozzle should be used, min. 45° spread
- Minimum distance from nozzle to encapsulation: 0.4 meters
- Maximum water temperature: 80°C
- Maximum flow: 20 liters/min

Instructions for steam or high pressure water cleaning

The IRB 360 with protection types Wash down and Wash down stainless can be cleaned using a steam cleaner or high pressure water cleaner.

The following list defines the prerequisites:

- Maximum water pressure at the nozzle: 2,500 kN/m2 (25 bar)
- Fan jet nozzle should be used, min. 45° spread
- Minimum distance from nozzle to encapsulation: 0.4 meters
- Maximum water temperature: 80°C

3.6.2 Standard cleaning

Overview

The standard version of IRB 360 is not manufactured for wash down applications, and must not be cleaned with water.

Note

If some part of a standard version robot is stainless the robot must still be cleaned as a standard version robot.

Note

The stainless version is not available for the IRB 360 used with OmniCore controllers.

Required equipment

Equipment	Note
Vacuum cleaner	
Cloth	

Cleaning instructions

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

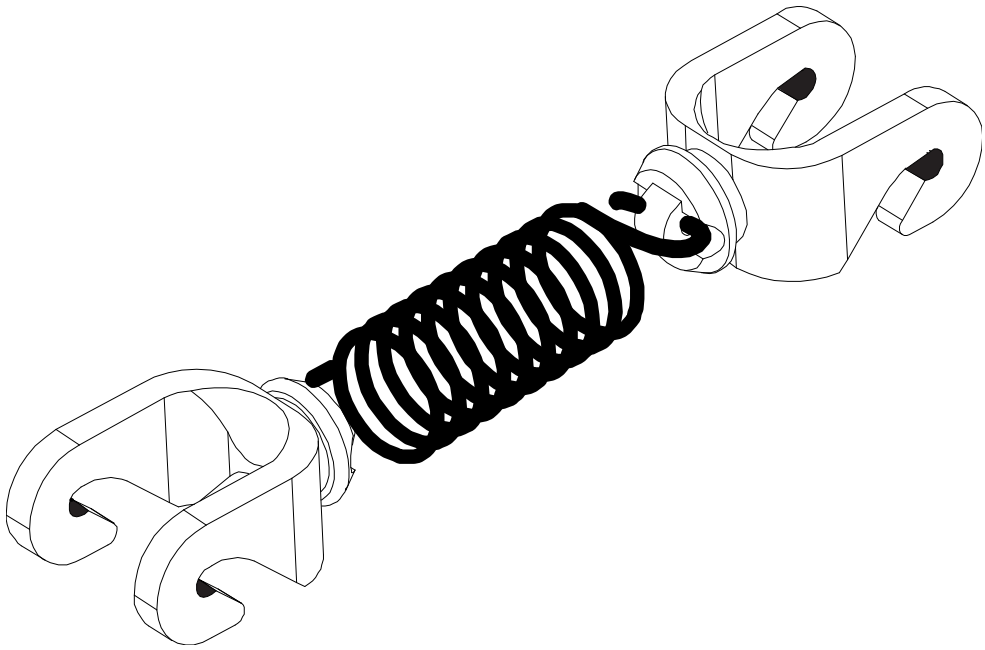
	Action	Note
1	Use a vaccum cleaner to remove loose particles.	
2	Use a dry or moistened cloth to wipe off the dirt and dust.	

Continues on next page

3.6.2 Standard cleaning
Continued

Optional use of rubber belows - IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/800, IRB 360 - 1/1600

To simplify cleaning, it is possible to use the spring units without the rubber bellows.



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To remove the rubber bellows, see section *Replacement of parallel arms on page 169*.

3.6.3 Wash down cleaning

Required equipment

Equipment	Note
High pressure washer	
Cloth	

Usable detergents

Detergent	Type	Old designation
Detergent	Topaz LD1	P3-Topax 12
Disinfectant	P3-Topax 990	P3-Topax 99

Cleaning instructions

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

	Action	Note
1	Pre-rinse with water for removal of rough soil. See figure for *Sensitive spots on page 139*.	• Water temperature: max. 80 °C
2	Foam the whole external surface with detergent.	• Detergent: Topaz LD1, • Concentration: 3 % • Water temperature: 40 - 60 °C
3	Let the detergent work for approx 20 minutes to retain effective cleaning properties. Ensure that the solvent does not dry on the surface.	
4	Rinse thoroughly with water.	
5	Apply the disinfectant. Time, concentration, and water temperature are chosen to reach the desired effect.	• Detergent: P3-topactive DES • Concentration: 1 - 2%. • Water temperature: 10 - 40 °C • Time approx. 20 min.
6	Rinse thoroughly with water.	
7	After cleaning bearing races, swivel cup sealing and sealing ring (V-ring), lubricate them with provision classified grease.	

Continues on next page

3.6.3 Wash down cleaning

Continued

	Action	Note
8	If the labels on the robot are damaged in the cleaning procedure, apply new labels.	Described in section *Replacement of labels on page 208*

3.6.4 Wash down stainless cleaning

Note

The stainless version is not available for the IRB 360 used with OmniCore controllers.

Required equipment

Equipment	Note
High pressure washer	

Usable detergents

The stainless version is verified against the following detergents.

Detergent	Type	Old designation
Detergent	Topaz MD4	Topmaxx 421
Detergent	Topaz CL2	P3-topax M 55
Detergent	Topaz AC3	P3-topax 56
Disinfectant	P3-topactive DES	

Cleaning instructions

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

	Action	Note
1	Pre-rinse with water for removal of rough soil with low pressure. See figure for *Sensitive spots on page 139*.	• Water temperature: max. 80 °C
2	Foam the whole external surface with detergent.	• Detergent: TOPAZ MD4 • Concentration: 3 % • Water temperature: 40 - 60 °C
3	Let the detergent work for approx 20 minutes to retain effective cleaning properties. Ensure that the solvent does not dry on the surface.	
4	Rinse thoroughly with water.	

Continues on next page

3.6.4 Wash down stainless cleaning

Continued

	Action	Note
5	Apply the disinfectant. Time, concentration, and water temperature are chosen to reach the desired effect.	• Detergent: P3-topactive DES • Concentration: 1 - 2%. • Water temperature: 10 - 40 °C • Time approx. 20 min.
6	Rinse thoroughly with water.	
7	After cleaning bearing races, swivel cup sealing and sealing ring (V-ring), lubricate them with provision classified grease.	
8	If the labels on the robot are damaged in the cleaning procedure, apply new labels.	Described in section *Replacement of labels on page 208*

3.6.5 Clean room cleaning

Required equipment

Equipment	Note
Vacuum cleaner	
Cloth	

Usable detergents

Detergent	Note
Light cleaning detergent	
Isopropyl alcohol	

Cleaning instructions

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

	Action	Note
1	Use a vacuum cleaner to remove loose particles.	
2	Use a cloth with cleaning detergent or Isopropyl alcohol to wipe off the dirt and dust.	

3.7 Measuring activities

3.7.1 Measuring backlash axis 4

General

This section describes measuring of the backlash on axis 4.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

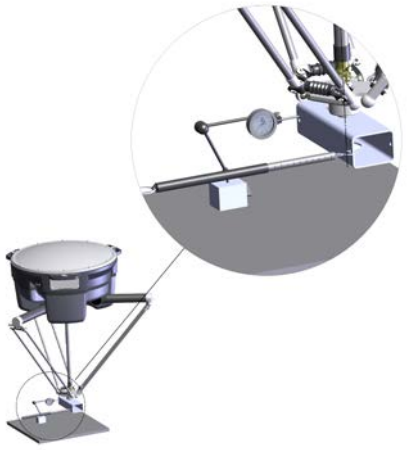
Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

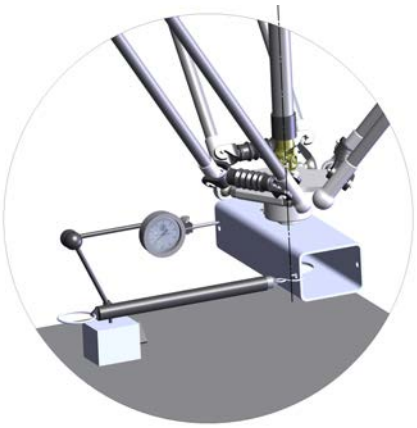
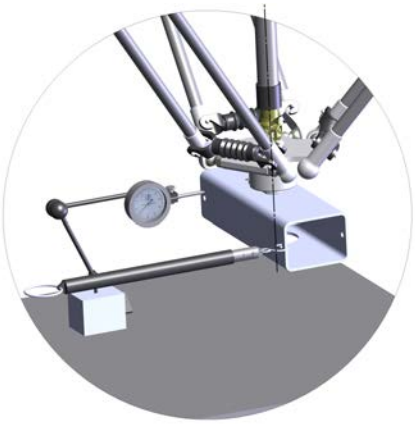
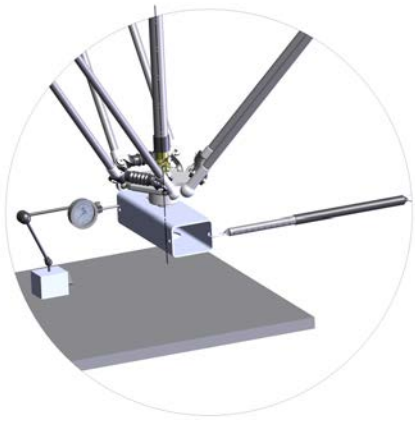
Required equipment and references

Required equipment	Note
Indicator clock	
Dynamometer	
Tool	(square tube, length = min. 250 mm)

Measuring backlash

	Action	Note
1	Attache the tool on manipulator.	For fastening of tool on robot, see hole pattern in *Fitting equipment on robot on page 66*.
2	Place the indicator clock on a metallic surface placed underneath the manipulator.	
3	Apply torque 1 Nm, i.e. 10N on a distance of 100 mm from center of rotation.	 xx1700000046

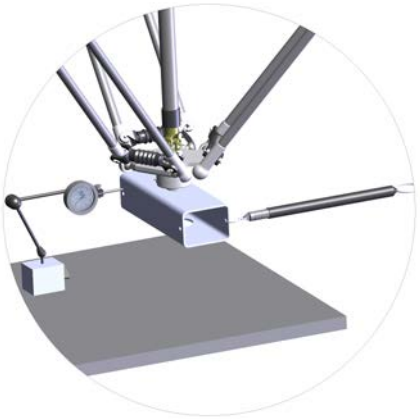
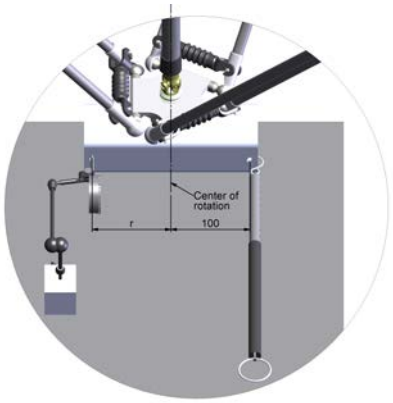
Continues on next page

	Action	Note
4	Decrease force to 0N.	 xx1700000047
5	Apply torque 0,2 Nm, i.e. 2N on a distance of 100 mm from center of rotation.	 xx1700000048
6	Register first measurement point.	
7	Apply torque 1 Nm in the other direction, i.e. 10 N on a distance of 100 mm from center of rotation.	 xx1700000049
8	Decrease force to 0N.	

Continues on next page

3.7.1 Measuring backlash axis 4

Continued

	Action	Note
9	Apply torque 0,2 Nm, i.e. 2 N on a distance of 100 mm from center of rotation.	 xx1700000050
10	Register second measurement point.	
11	Calculate the angular backlash as the difference between measurement point 1 and 2 multiplied by 360 and then divided by 2*pi*r. **Note** r is the distance from center of rotation to where the measurement is done.	 xx1700000051

4 Repair

4.1 Introduction

Structure of this chapter

This chapter describes repair activities for the IRB 360. Each procedure contains the information required to perform the activity, for example spare parts numbers, required special tools, and materials.

WARNING

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

Report replaced units

Note

When replacing a part on the IRB 360, report to your local ABB the serial number, the article number, and the revision of both the replaced unit and the replacement unit.

This is particularly important for safety equipment to maintain the safety integrity of the installation.

Safety information

Make sure to read through the chapter *Safety on page 19* before commencing any service work.

Note

If the IRB 360 is connected to power, always make sure that the IRB 360 is connected to protective earth and a residual current device (RCD) before starting any repair work.

For more information see:

- *Product manual - OmniCore C30*
- *Product manual - IRC5*
- *Product manual - IRC5 Compact*
- *Product manual - IRC5 Panel Mounted Controller*

Note

The stainless version is not available for the IRB 360 used with OmniCore controllers.

4.2 General procedures

4.2.1 Mounting instructions for bearings

General

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

Equipment

Equipment, etc.	Article number	Note
Grease	*Grease specification on page 263*.	

Assembly of all bearings

Attend to the following instructions while mounting a bearing on the robot.

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

Assembly of tapered bearings

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

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

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

Greasing of bearings

Note

This instruction is not valid for solid oil bearings.

Continues on next page

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

- The bearings must not be completely filled with grease. However, if space is available beside the bearing fitting, the bearing may be totally filled with grease when mounted, as excessive grease will be pressed out from the bearing when the robot is started.
- During operation, the bearing should be filled to 70-80% of the available volume.
- Ensure that grease is handled and stored properly to avoid contamination.

Grease the different types of bearings as following description:

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

4.2.2 Mounting instructions for sealings

General

This section describes how to mount different types of sealings.

Equipment

Consumable	Article number	Note
Grease	*Grease specification on page 263*.	

Rotating sealings

The procedure below describes how to fit rotating sealings.

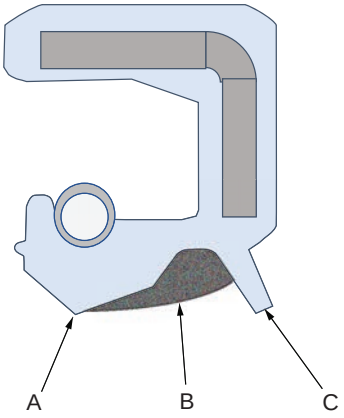
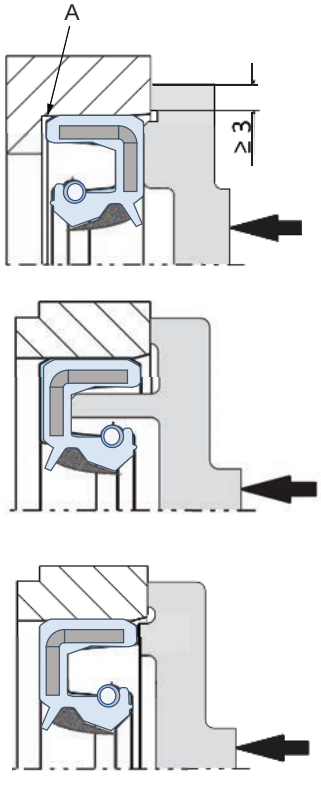
CAUTION

Please observe the following before commencing any assembly of sealings:

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

	Action	Note
1	Check the sealing to ensure that: • The sealing is of the correct type. • There is no damage on the main lip.	
2	Inspect the shaft surface before mounting. If scratches or damage are found, the shaft must be replaced since it may result in future leakage. Do not try to grind or polish the shaft surface to get rid of the defect.	

Continues on next page

	Action	Note
3	Lubricate the sealing with grease just before fitting. (Not too early - there is a risk of dirt and foreign particles adhering to the sealing.) Fill 2/3 of the space between the dust lip and the main lip with grease. If the sealing is without dust lip, just lubricate the main lip with a thin layer of grease.	Article number is specified in *Equipment on page 154*.  xx2000000071 **A** Main lip **B** Grease **C** Dust lip
4	Mount the sealing correctly with a mounting tool. Never hammer directly on the sealing as this may result in leakage.	 xx2000000072 **A** Gap
5	Make sure that no grease is left on the robot surface.	

Continues on next page

4.2.2 Mounting instructions for sealings
Continued

Flange sealings and static sealings

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

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

O-rings

The following procedure describes how to fit o-rings.

	Action	Note
1	Ensure that the correct o-ring size is used.	
2	Check the o-ring for surface defects, burrs, shape accuracy, or deformation.	Defective o-rings, including damaged or deformed o-rings, may not be used.
3	Check the o-ring grooves. The grooves must be geometrically correct and should be free of pores and contamination.	
4	Lubricate the o-ring with grease.	
5	Tighten the screws evenly while assembling.	
6	Check that the o-ring is not squashed outside the o-ring groove.	
7	Make sure that no grease is left on the robot surface.	

4.2.3 Screw joints

General

This section describes how to tighten the various types of screw joints on ABB robots.

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

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.

Tightening torque

Before tightening any screw, note the following:

- Determine whether a **standard** tightening torque or **special** torque is to be applied. The **standard torques** are specified in the following tables. Any **special torques** are specified in the repair, maintenance or installation procedure descriptions. **Any special torque specified overrides the standard torque!**
- Use the *correct tightening torque* for each type of screw joint.
- Only use *correctly calibrated* torque keys.
- Always *tighten the joint by hand,* and never use pneumatic tools.
- Use the *correct tightening technique*, that is *do not* jerk. Tighten the screw in a slow, flowing motion.
- Maximum allowed total deviation from the specified value is **10%!**

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

> **Note**
>
> A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Oil-lubricated screws with allen head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws* with *allen head screws.*

> **Note**
>
> A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Continues on next page

4.2.3 Screw joints
Continued

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

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

The following table specifies the recommended standard tightening torque for *screws lubricated with Molycote 1000, Gleitmo 603 or equivalent* with *allen head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

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

i Lubricated with Molycote 1000, Gleitmo 603 or equivalent

Water and air connectors

The following table specifies the recommended standard tightening torque for *water and air connectors* when *one* or *both* connectors are made of *brass*.

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque Nm - Nominal	Tightening torque Nm - Min.	Tightening torque Nm - Max.
1/8	12	8	15
1/4	15	10	20
3/8	20	15	25

Continues on next page

Dimension	Tightening torque Nm - Nominal	Tightening torque Nm - Min.	Tightening torque Nm - Max.
1/2	40	30	50
3/4	70	55	90

4.2.4 Cut the paint or surface on the robot before replacing parts

General

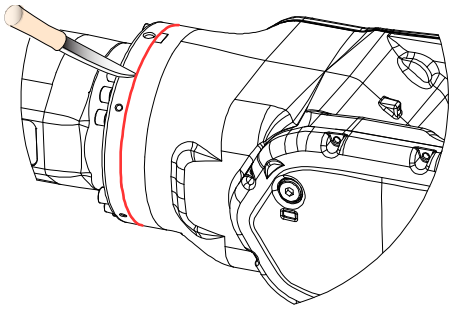
Follow the procedures in this section whenever breaking the paint of the robot during replacement of parts.

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

Required equipment

Equipment	Spare parts	Note
Sealing compound	3HAC073510-001	Trans7
Tooling pin		Width 6-9 mm, made of wood.
Cleaning agent		Ethanol
Knife		
Lint free cloth		
Touch up paint Clean Room	3HAC036639-001	White

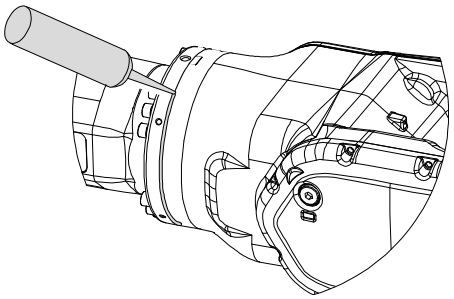
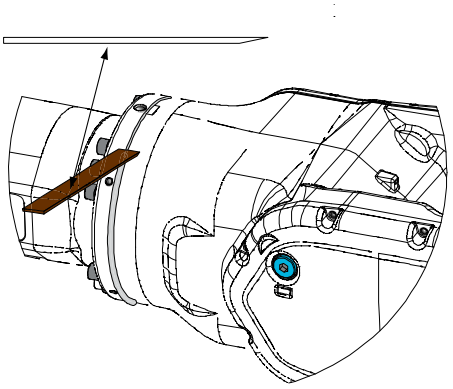
Removing

	Action	Description
1	Cut the paint with a knife in the joint between the part that will be removed and the structure, to avoid that the paint cracks.	 xx0900000121
2	Carefully grind the paint edge that is left on the structure to a smooth surface.	

Refitting

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

Continues on next page

	Action	Description
3	Seal all refitted joints with sealing compound.	 xx0900000122
4	Use the tooling pin to even out the surface of the sealing compound.	 xx0900000125
5	Use Touch up paint Clean Room, white to paint any damaged surfaces. **Note** Always read the instruction in the product data sheet in the paint repair kit for Clean Room.	3HAC036639-001

Note

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

4.3 Complete robot

4.3.1 Replacement of base cover gasket

General

This section describes how to replace the base cover gasket.

DANGER

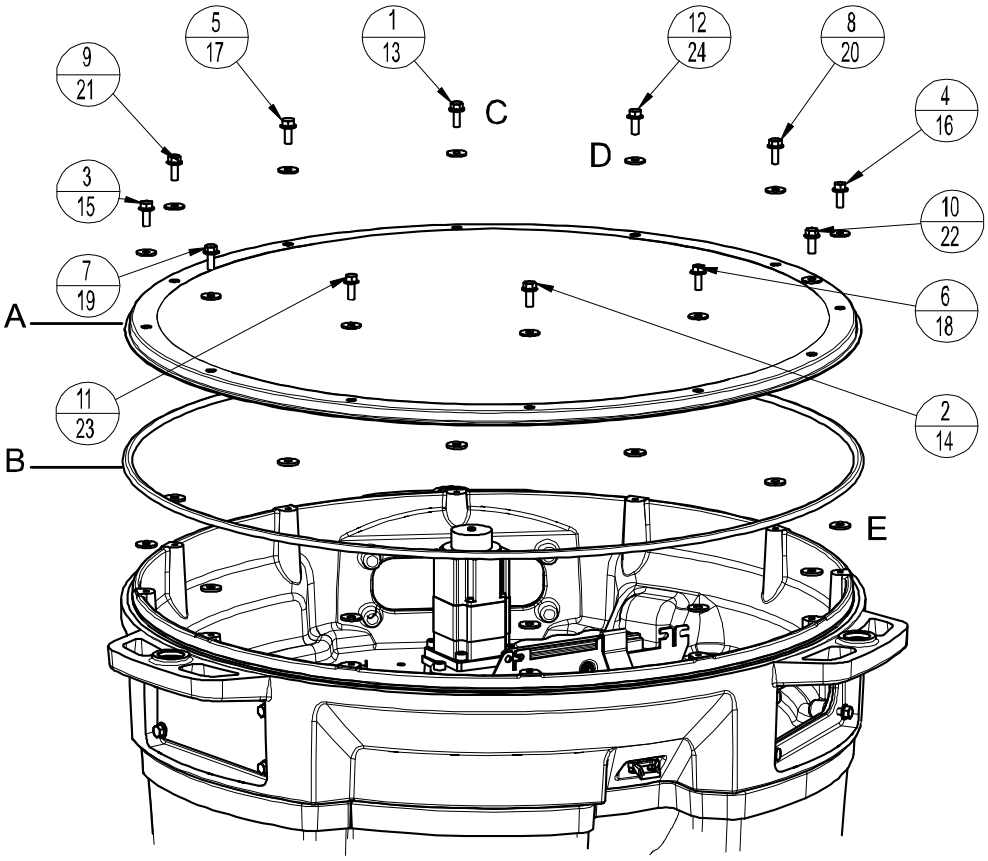
Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Continues on next page

Location and tightening sequence



xx0700000553

A	Base cover
B	Hollow o-ring (Base cover)
C	Flange screw M6x20 (12 pcs)
D	Plastic washer (12 pcs)
E	Rubber gasket (12 pcs)

Required equipment and references

Equipment	Spare part number	Note
Hollow o-ring (base cover)	See *Product manual, spare parts - IRB 360*.	
Standard tools		*Standard toolkit on page 260*
Plastic washer	See *Product manual, spare parts - IRB 360*.	
Rubber gasket	See *Product manual, spare parts - IRB 360*.	

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

Continues on next page

4.3.1 Replacement of base cover gasket

Continued

Removal

	Action	Note
1	Remove the *flange screws* and *washers* and check them.	If necessary, change them.
2	Remove the *base cover*.	**CAUTION** The base cover has sharp edges, use protective gloves.
3	Remove and discard the *hollow o-ring*.	See article number in *Product manual, spare parts - IRB 360*.
4	Remove and discard the *rubber gaskets*.	See article number in *Product manual, spare parts - IRB 360*.

Refitting

	Action	Note
1	Refit new *rubber gaskets*.	
2	Refit a new *hollow o-ring*.	**Note** Do not lubricate the hollow o-ring for the base cover, it can slip out of position when cleaning.
3	Refit the *base cover*.	**CAUTION** The base cover has sharp edges, use protective gloves.
4	Refit the *flange screws* with *plastic washers*. **Note** Check that the washers are not damaged. Replace if needed. **Note** Always tighten the base cover screws in two rounds.	See tightening sequence *Location and tightening sequence on page 163*. Use **tightening torque 4 Nm** for both rounds.

4.3.2 Replacement of serial measurement board

General

This section describes how to replace the SMB unit (serial measurement board).

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

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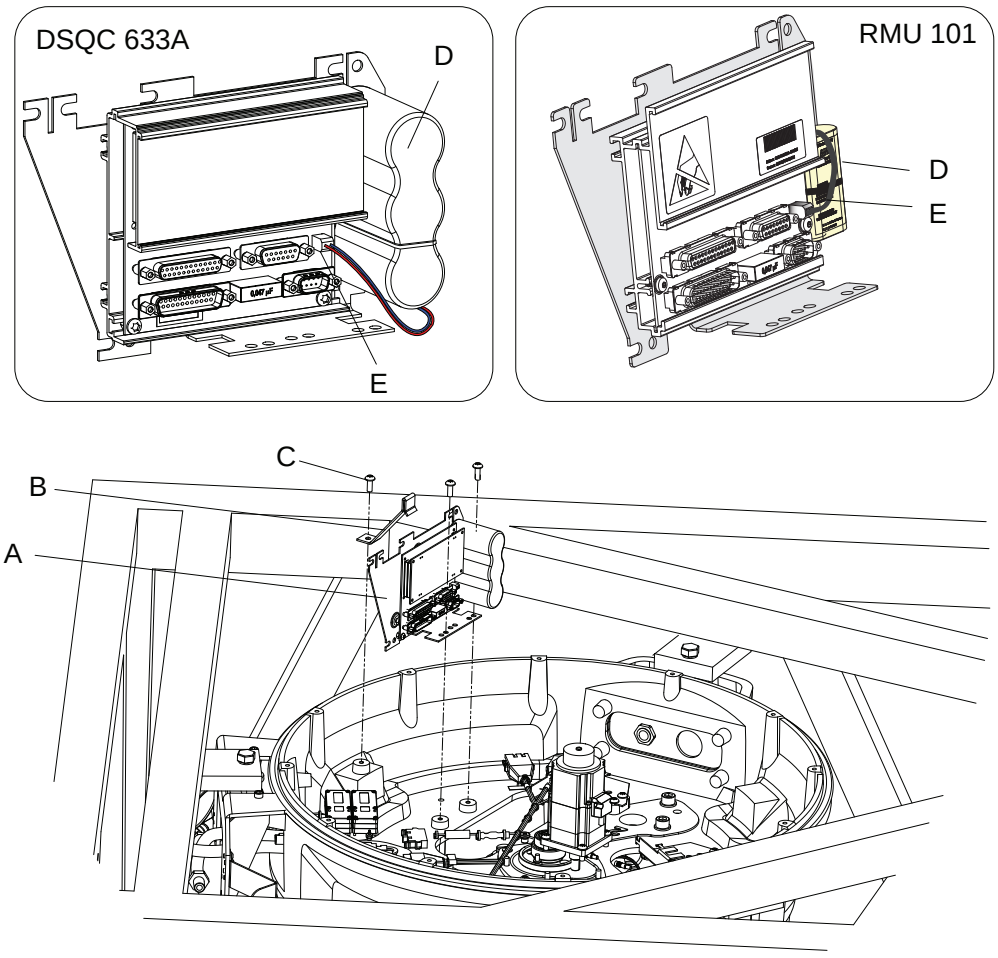
4.3.2 Replacement of serial measurement board
Continued

Location



xx1300000354

A	SMB unit
B	Bracket SMB unit
C	3 pcs flange screw M6 x 20
D	SMB battery
E	SMB battery contact (X3)

Required equipment and references

Note

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

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

Equipment	Spare part no.	Note
Standard tools		*Standard toolkit on page 260*

Continues on next page

Equipment	Spare part no.	Note
Serial measurement unit	See *Product manual, spare parts - IRB 360*.	
Base cover gasket	See *Product manual, spare parts - IRB 360*.	(If damaged)
Plastic washer	See *Product manual, spare parts - IRB 360*.	(If damaged)

References
Circuit diagram - IRB 360
Updating revolution counters on page 243.
Replacement of base cover gasket on page 162

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

Removal SMB unit

	Action	Note
1	Remove the base cover.	Described in section *Replacement of base cover gasket on page 162*
2	Remove the three(3) flange screws holding the bracket for the SMB unit.	Use standard tools
3	Disconnect all the cables from the SMB unit.	
4	Remove the SMB unit.	

Note

This product contains certain materials considered hazardous. This product **must** be disposed of in accordance with the current legislation of the country in which the robot and control unit is installed.

Refitting SMB unit

Note

Check the new battery, using a voltameter. It should read approx +12V.

	Action	Note
1	Refit the new SMB unit.	
2	Connect all cables.	As described in circuit diagram 3HAC028647-009
3	Refit the bracket using the three(3) flange screws.	**Tightening torque 4 Nm**
4	Refit the base cover.	Described in section *Replacement of base cover gasket on page 162*

Continues on next page

4.3.2 Replacement of serial measurement board

Continued

	Action	Note
5	Update the revolution counters.	Described in section *Updating revolution counters on page 243*

4.3.3 Replacement of parallel arms

General

This section describes how to change the parallel arms.

DANGER

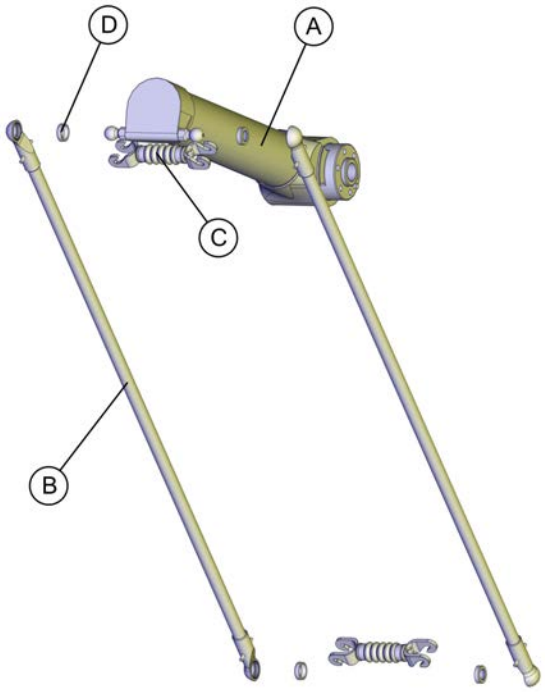
Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Location

IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/800, IRB 360 - 1/1600



xx0700000488

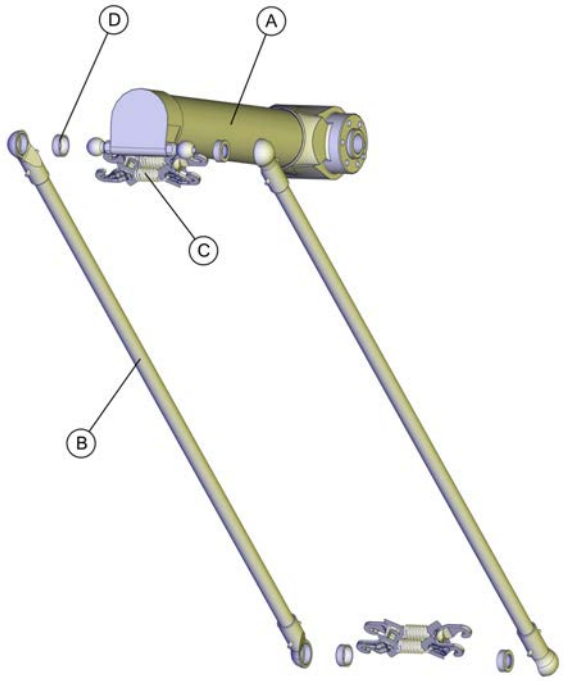
A	Upper arm
B	Parallel arm
C	Spring unit
D	Bearing ring

Continues on next page

4.3.3 Replacement of parallel arms

Continued

IRB 360 - 8/1130, IRB 360 - 6/1600



xx1300000163

A	Upper arm
B	Parallel arm
C	Spring unit
D	Bearing ring

Required equipment and references

Equipment	Spare part no.	Note
Standard tools		*Standard toolkit on page 260*
Pliers for parallel arms	3HAC6194-1	
Parallel arms	See *Product manual, spare parts - IRB 360*.	

References
Spring units on page 115
Special tools on page 261

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

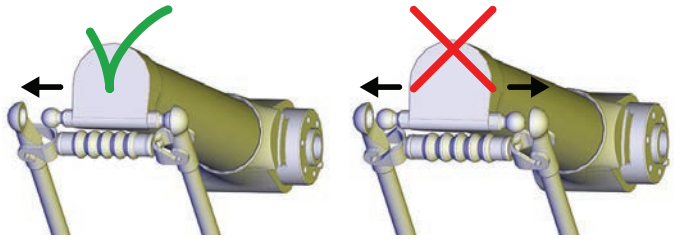
Continues on next page

Removing the parallel arms

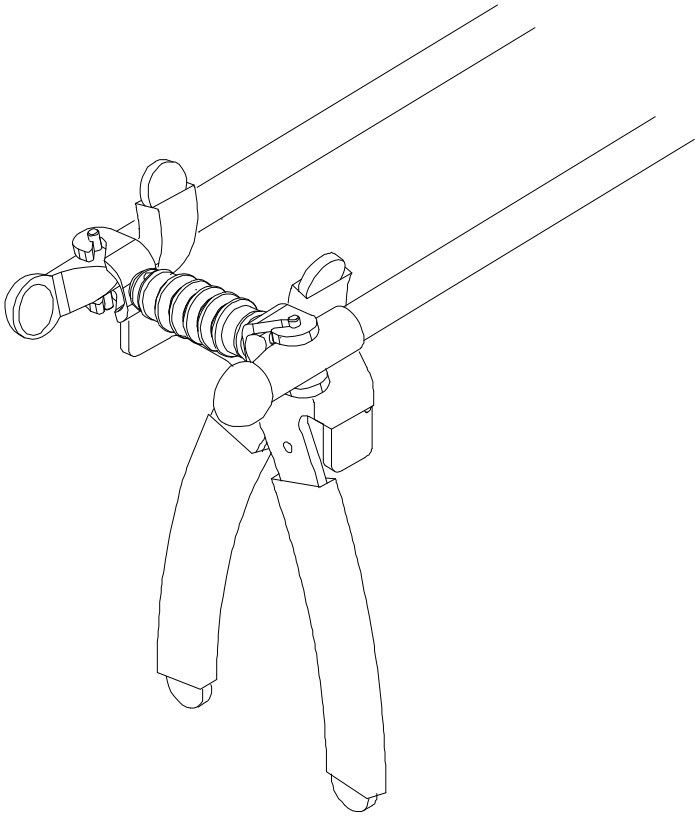
Illustrations

CAUTION

Never use unnecessary force when removing the springs. Only work on one side or the spring will be overstressed.



xx0700000525



xx0700000555

Continues on next page

4.3.3 Replacement of parallel arms
Continued

Removing the parallel arms

Use the procedure to remove the parallel arms.

	Action	Note
1	Remove the parallel arms by using the pliers, either on the left side or the right side, **not both**.	Use the pliers according to *Illustrations on page 171*. Article number is specified in *Required equipment and references on page 170*. **Note** Press with the tool on the aluminium surface, not on the carbon fiber, or the parallel arms may be damaged.
2	Remove the springs.	By hand.

Refitting the parallel arms

CAUTION

Never use unnecessary force when refitting the springs. Only work on one side or the spring will be overstressed.

Refitting the parallel arms

Use the procedure to refit the parallel arms.

	Action	Note
1	Fit the springs on the parallel arms.	By hand. Apply grease according to section *Spring units on page 115*
2	Refit the parallel arm to the upper arm by using the pliers, either on the left side or the right side, **not both**.	Use the pliers according to *Illustrations on page 171*. Article number is specified in *Required equipment and references on page 170*. **Note** Press with the tool on the aluminium surface, not on the carbon fiber, or the parallel arms may be damaged.
3	Refit the parallel arm to the movable plate by using the pliers, either on the left side or the right side, **not both**.	Use the pliers according to *Illustrations on page 171*. Article number is specified in *Required equipment and references on page 170*. **Note** Always mount the movable plate with the axis 4 calibration mark in direction axis 1.

Continues on next page

	Action	Note
4	Recalibrate the robot.	See *Calibration information on page 229*.

4.3.4 Replacement of upper arm

General

This section describes replacement of upper arm.

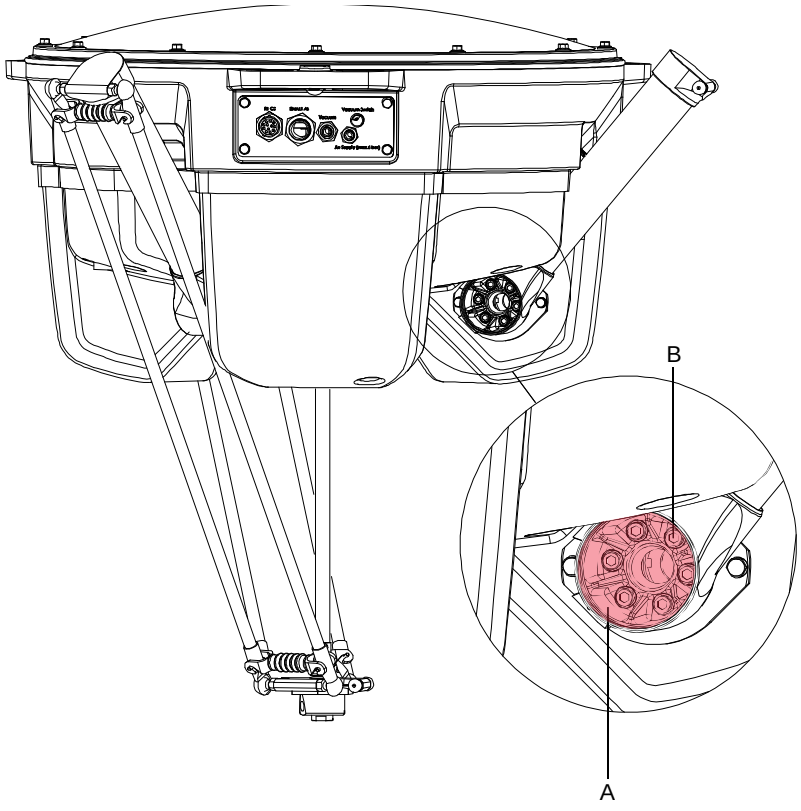
DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Location



xx0700000595

A	VK- cover
B	6x hex socket head cap screw M6 x 40 (12.9 gleitmo) and 6x plain washer 6.4x12x1.6 steel A2-F

Continues on next page

Required equipment and references

Equipment	Spare part No.	Note
Standard tools		*Standard toolkit on page 260*
Upper arm	See *Product manual, spare parts - IRB 360*.	
Sealing ring	See *Product manual, spare parts - IRB 360*.	
Flange gasket ax.1-3	See *Product manual, spare parts - IRB 360*.	
VK-cover	See *Product manual, spare parts - IRB 360*.	
Locking liquid		Loctite 243

References
Standard toolkit on page 260
Replacement of parallel arms on page 169
Mounting instructions for sealings on page 154

CAUTION

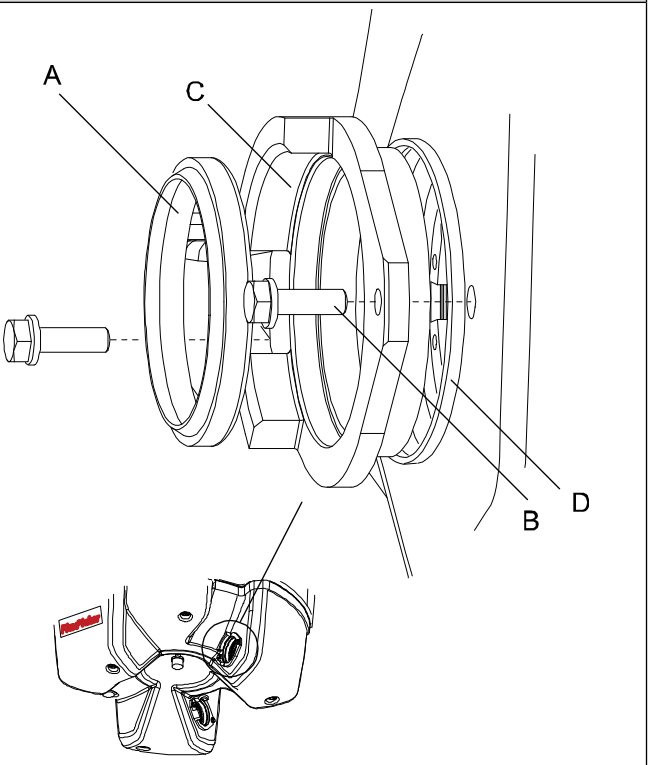
Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

Removal

	Action	Note
1	Remove the parallel arm on the specific upper arm.	Described in section *Replacement of parallel arms on page 169*
2	Remove the VK-cover	Use a screwdriver.
3	Remove the six screws	6x Hex socket head cap screw M6 x 40 (12.9 gleitmo) and 6x plain washer 6.4x12x1.6 Steel A2-F
4	Remove the upper arm.	
5	**Note** Always check the condition of the sealing ring and the flange gasket	

Continues on next page

4.3.4 Replacement of upper arm
Continued

	Action	Note
6	Remove the two flangescrews (B) holding the flange (C). If necessary, change the sealing ring (A) and the flange gasket (D). **Note** Do not use the sealing ring (A) on robots with protection Clean Room or Stainless Clean Room.	 xx0700000601

Refitting

	Action	Note
1	Refit the flange with the new mounted sealing ring, using the two screws with Loctite 243 and the new flange gasket. **Tip** *Mounting instructions for sealings on page 154*	**Tightening torque 4 Nm.**
2	Refit the upper arm using the 6x hex socket head cap screw M6 x 40 (12.9 Gleitmo) and 6x plain washer 6.4x12x1.6 steel A2-F.	**Tightening torque 11 Nm.**
3	Fit a new VK-cover.	By hand.
4	Refit the parallel arm.	Described in section *Replacement of parallel arms on page 169*.
5	Recalibrate the robot.	See *Calibration information on page 229*.

4.3.5 Replacement of bearing rings

General

This section describes how to change bearing rings in the parallel arms.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Required equipment and references

Equipment	Spare part no.	Note
Bearing ring	See *Product manual, spare parts - IRB 360*.	
Standard tools		*Standard toolkit on page 260*.
Drifter		Only required for robot versions: IRB 360 - 1/800, IRB 360 - 1/1130, IRB 360 - 3/1130 and IRB 360 - 1/1600. *Special tools on page 261*
Dolly		
Pliers for parallel arms		*Special tools on page 261*
Grease	-	Valid for robot versions: IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/800, IRB 360 - 1/1600. Required for non-maintenance free bearing rings. • Mobilgrease FM 102 • Optimol Obeen UF 2 See *Different versions of bearing rings require different maintenance procedures on page 106*.

References
Replacement of parallel arms on page 169
Special tools on page 261

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

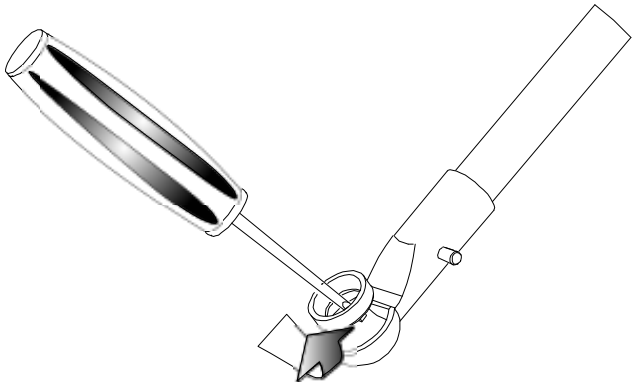
Continues on next page

4.3.5 Replacement of bearing rings
Continued

CAUTION

Never use unnecessary force when removing the springs. Only work on one side or the spring will be overstressed.

Removal

	Action	Note
1	Remove the parallel arms by hand or using tool, left or right side, **not both**.	According to section *Replacement of parallel arms on page 169*.
2	Remove the bearing ring using a screwdriver.	 xx0700000486

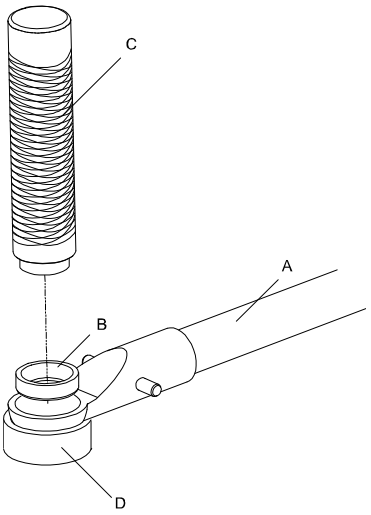
Refitting

CAUTION

Never use unnecessary force when refitting the springs. Only work on one side or the spring will be overstressed.

	Action	Note
1	Place a new bearing ring into the joint socket.	

Continues on next page

	Action	Note
2	Valid for robot versions: IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/800, IRB 360 - 1/1600. 1 Place the parallel arm in the dolly. 2 Put the drifter into the bearing ring and knock it gently down to its resting position. 3 Lubricate bearing rings that are not maintenance-free (see *Different versions of bearing rings require different maintenance procedures on page 106*).	 xx0700000524 A Parallel arm B Bearing ring C Drifter D Dolly Type of grease for non-maintenance-free bearing rings, see *Required equipment and references on page 177*.
3	Valid for robot versions: IRB 360 - 8/1130, IRB 360 - 6/1600. Push the bearing ring into its resting position by hand.	
4	Refit the parallel arms to the upper arm, left or right side, **not both**.	By hand or using tool according to section *Replacement of parallel arms on page 169*
5	Run the robot for six (6) hours for the bearing rings to wear in.	
6	Wipe clean the joint balls and the bearing rings.	

4.3.6 Replacement of movable plate

General

This section describes how to replace the movable plate.

DANGER

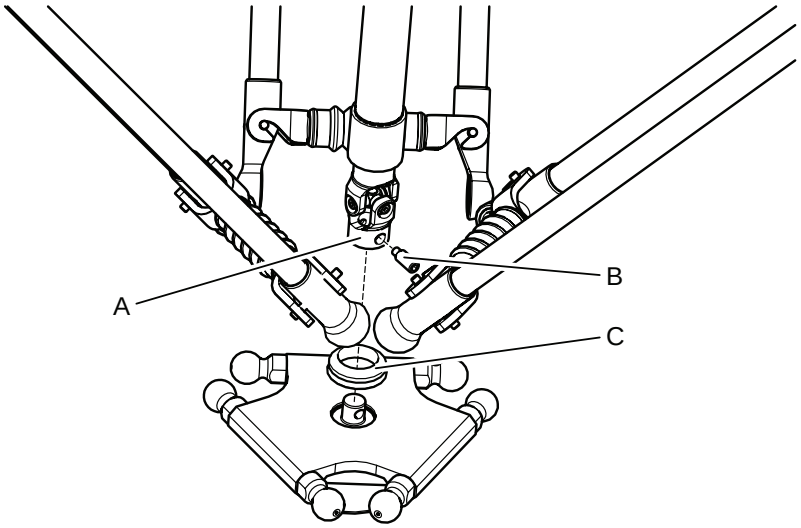
Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Location

IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/800, IRB 360 - 1/1600

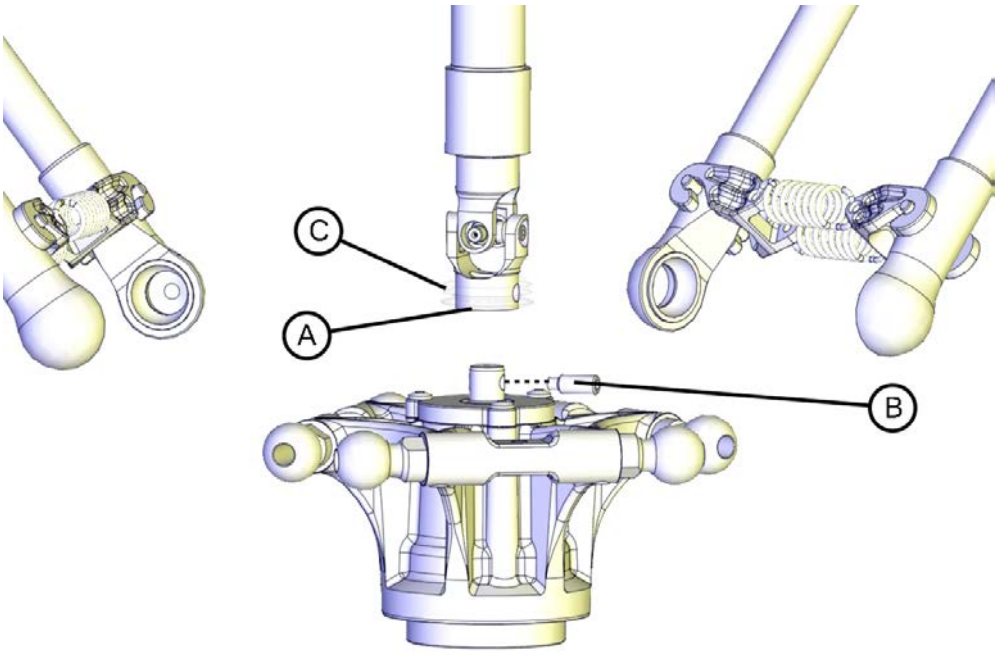


xx0700000532

A	Universal joint
B	Set screw, dog point
C	Sealing ring (V-ring)

Continues on next page

IRB 360 - 8/1130, IRB 360 - 6/1600



xx1300000165

A	Universal joint
B	Set screw, dog point
C	V-ring sealing (transparent in the figure)

Required equipment and references

Equipment	Spare part number	Note
Spare parts, movable plate	See *Product manual, spare parts - IRB 360*.	
Locking liquid	-	Loctite 243.
Standard tools	-	*Standard toolkit on page 260*

References
Replacement of parallel arms on page 169
Replacement of vacuum hoses on page 213

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

Continues on next page

4.3.6 Replacement of movable plate

Continued

Removal

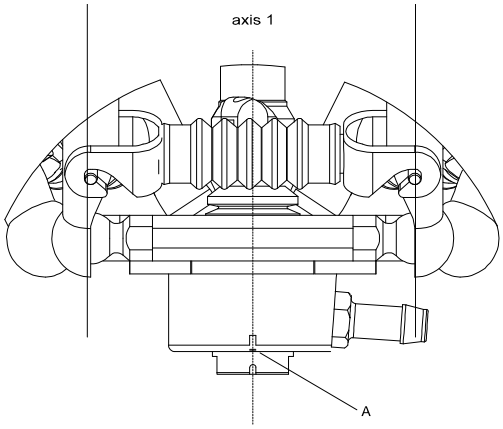
CAUTION

The spring units must be removed according to the description in section *Replacement of parallel arms on page 169* or they will be damaged.

	Action	Note
1	Remove all air / vacuum hoses from the swivel cup on the movable plate.	Described in section *Replacement of vacuum hoses on page 213*
2	Remove all three parallel arms from the movable plate.	Described in section *Replacement of parallel arms on page 169*.
3	Hold the movable plate while raising the sealing ring (C) and removing the set screw (B) that locks the universal joint. Remove the movable plate from the telescopic shaft.	Use standard tools.

Calibration mark, axis 4

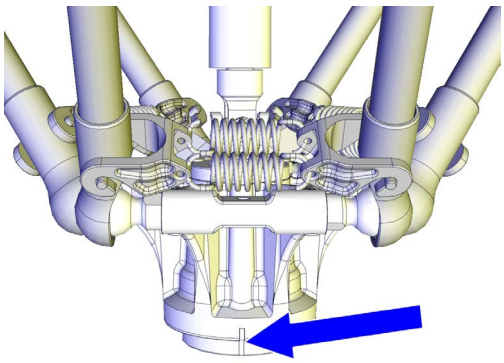
IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/800, IRB 360 - 1/1600



xx0700000629

A	Axis 4 calibration mark

IRB 360 - 8/1130, IRB 360 - 6/1600



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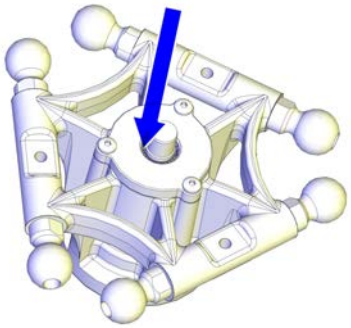
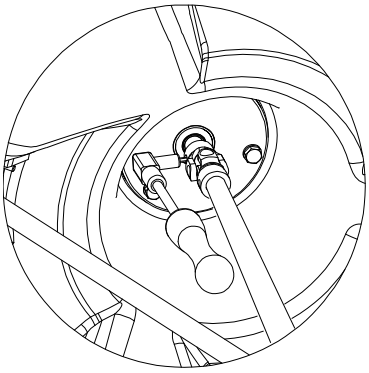
Refitting

CAUTION

Never use unnecessary force when refitting the springs. Only work on one side or the spring will be overstressed.

	Action	Note
1	For robot versions IRB 360 - 8/1130, IRB 360 - 6/1600: Check the radial seal.	 xx1300000202
2	Refit the movable plate to the telescopic shaft and lock the universal joint by refitting the set screw (B). Use locking liquid (Loctite 243).	Use standard tools.  xx0700000613 Tightening torque for set screw 3HAC12846-2 (M6x16 A2): 7 Nm Tightening torque for set screw 3HAC12846-3 (M6x16 FZB): 9.5 Nm Tightening torque for set screw 3HAC12846-4 (M6x16 A4): 8.5 Nm **Tip** Use a 90° angled bit holder.
3	Push the sealing ring (C) back in place.	
4	Refit the parallel arms to the movable plate.	Described in section *Replacement of parallel arms on page 169*
5	Refit the air / vacuum hoses to the swivel cup on the movable plate.	Described in section *Replacement of vacuum hoses on page 213*.

4.3.7 Replacement of telescopic shaft

General

This section describes how to change the telescopic shaft.

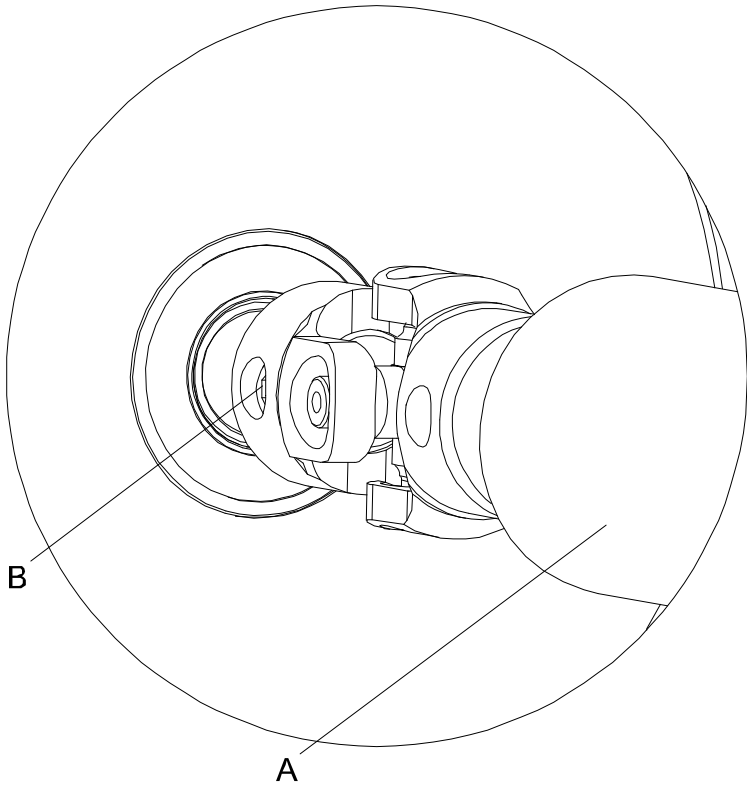
DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Location



xx0700000538

A	Telescopic shaft
B	Set screw

Required equipment and references

Equipment	Spare part no.	Note
Standard tools		*Standard toolkit on page 260*

Continues on next page

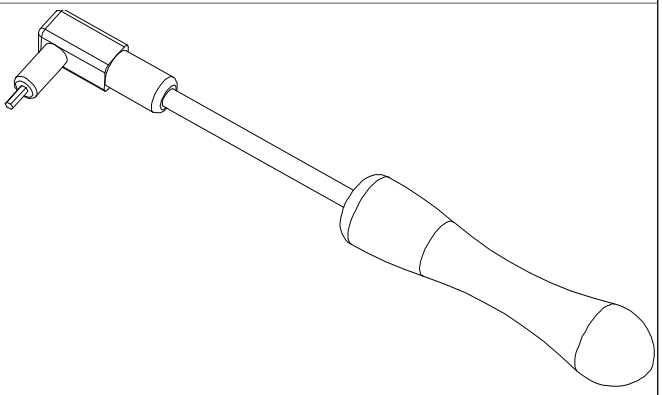
Equipment	Spare part no.	Note
Telescopic shaft	See *Product manual, spare parts - IRB 360*.	
Universal joint	See *Product manual, spare parts - IRB 360*.	
90° angled bit holder		
Locking liquid		Loctite 243

References
Replacement of parallel arms on page 169
Replacement of movable plate on page 180

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

Removal

	Action	Note
1	Remove the parallel arms.	Described in section *Replacement of parallel arms on page 169*
2	Remove the movable plate.	Described in section *Replacement of movable plate on page 180*
3	Remove the upper set screw.	 xx0700000612 **Tip** Use a 90° angled bit holder.
4	Remove the telescopic shaft.	

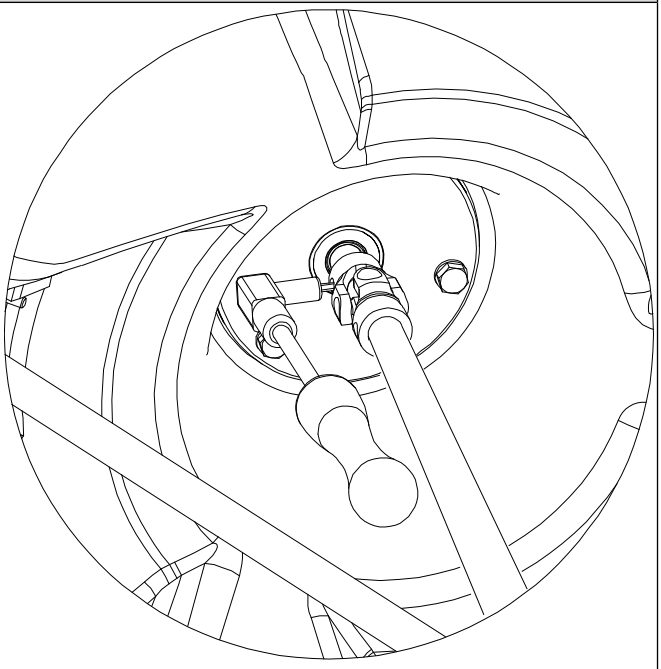
Refitting

	Action	Note
1	Refit the telescopic shaft.	

Continues on next page

4.3.7 Replacement of telescopic shaft

Continued

	Action	Note
2	Refit the upper set screw, **use locking liquid (Loctite 243)**.	 xx0700000613 Tightening torque for set screw 3HAC12846-2 (M6x16 A2): • 7 Nm. Tightening torque for set screw 3HAC12846-3 (M6x16 FZB): • 9.5 Nm. Tightening torque for set screw 3HAC12846-4 (M6x16 A4): • 8.5 Nm. **Tip** Use a 90° angled bit holder.
3	Refit the movable plate, **use locking liquid (Loctite 243)**.	Described in section *Replacement of movable plate on page 180*.
4	Refit the parallel arms.	Described in section *Replacement of parallel arms on page 169*.

4.3.8 Replacement of universal joint

General

This section describes how to change the universal joint.

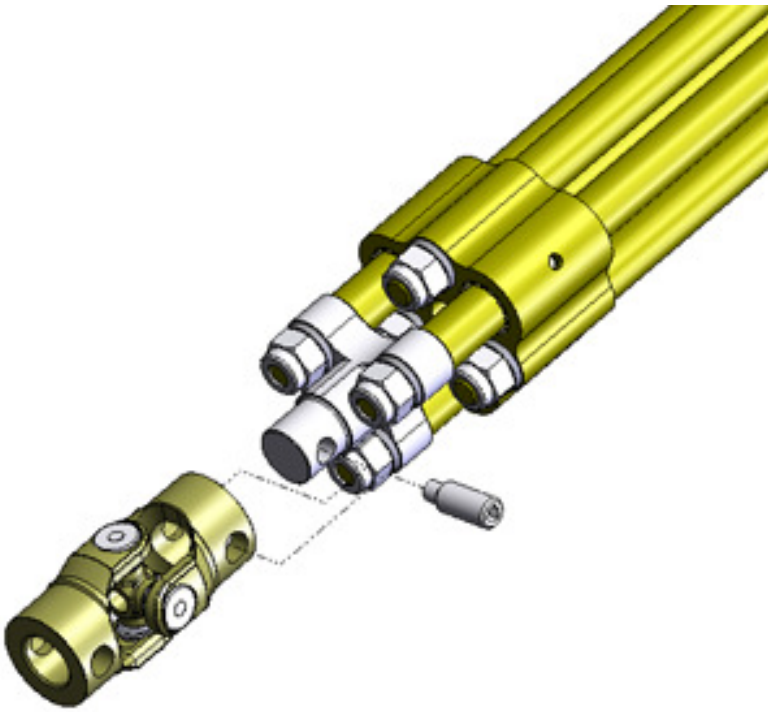
DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Location



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Required equipment and references

Equipment	Spare part no.	Note
Standard tools	*Standard toolkit on page 260*.	
Locking liquid		Loctite 243
Universal joint	See *Product manual, spare parts - IRB 360*.	

Continues on next page

4.3.8 Replacement of universal joint

Continued

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

Removal

	Action	Note
1	Remove the telescopic shaft.	See section *Replacement of telescopic shaft on page 184*.
2	Remove the set screw locking the universal joint on the telescopic shaft.	Use standard tools.
3	Remove the universal joint.	

Refitting

	Action	Note
1	Refit the universal joint.	Use locking liquid (Loctite 243).
2	Refit the set screw in order to lock the universal joint to the telescopic shaft.	Use locking liquid (Loctite 243). Tightening torque for set screw 3HAC12846-2 (M16x6 A2): • 7 Nm. Tightening torque for set screw 3HAC12846-3 (M16x6 FZB): • 9.5 Nm. Tightening torque for set screw 3HAC12846-4 (M16x6 A4): • 8.5 Nm.
3	Refit the telescopic shaft.	See section *Replacement of telescopic shaft on page 184*.

4.3.9 Replacement of joint balls

General

This section describes how to change the joint balls.

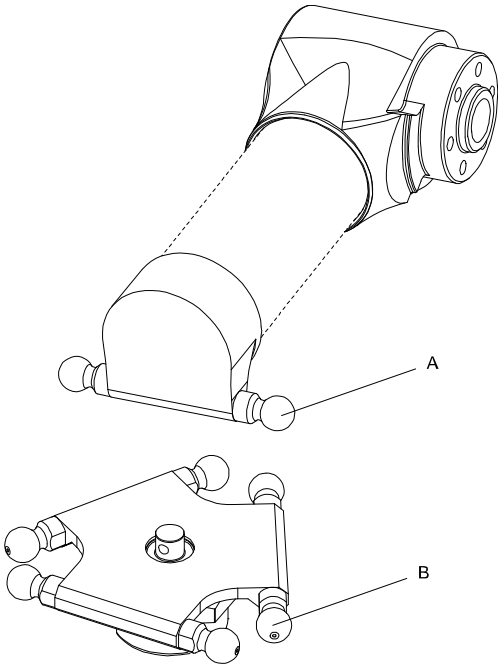
DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Location



xx0700000534

A	Joint ball
B	Joint ball

Required equipment and references

Equipment	Spare part no.	Note
Standard tools		*Standard toolkit on page 260*
Joint ball	See *Product manual, spare parts - IRB 360*.	
Pliers for parallel arms	3HAC6194-1	
Locking liquid		Loctite 243

Continues on next page

4.3.9 Replacement of joint balls

Continued

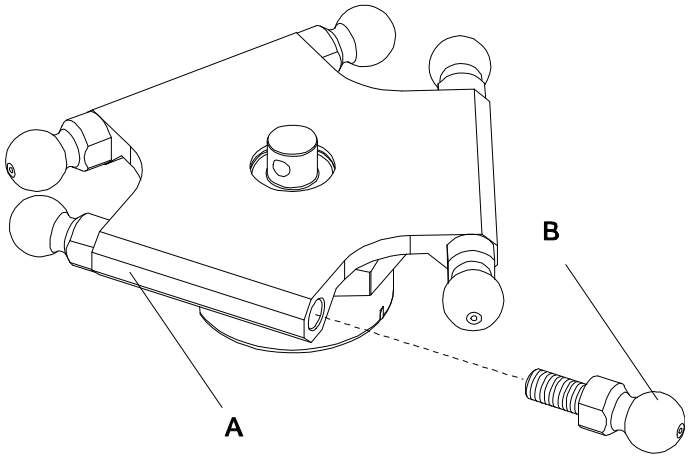
Equipment	Spare part no.	Note
Activator		Loctite 7649

References
Replacement of parallel arms on page 169
Replacement of movable plate on page 180

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

Removal



xx0700000500

A	Movable plate
B	Joint ball movable plate

CAUTION

Never use unnecessary force when removing the springs. Only work on one side or the spring will be overstressed.

	Action	Note
1	Remove the parallel arms.	Described in section *Replacement of parallel arms on page 169*.
2	Remove the movable plate.	Described in section *Replacement of movable plate on page 180*
3	Remove the joint balls. **Note** Locking liquid secures the joint balls to the movable plate. A heat gun must be used if the movable plate is stainless, for other materials it is optional. Do not aim the heat on plastic parts.	Use standard tools.

Continues on next page

Refitting

CAUTION

Never use unnecessary force when refitting the springs. Only work on one side or the spring will be overstressed.

	Action	Note
1	Refit the joint balls using loctite 243. For the best result, use spray activator (Loctite 7649) on the stainless joint balls.	**Tightening torque 11 Nm**.
2	Refit the movable plate.	Described in section *Replacement of movable plate on page 180*.
3	Refit the parallel arms.	Described in section *Replacement of parallel arms on page 169*.
4	Run the robot for six (6) hours for the bearing rings to wear in.	
5	Wipe clean the joint balls and the bearing rings.	

4.3.10 Replacement of gearbox unit 1- 3

General

This section describes replacing gearbox 1-3 with motor (gearbox unit).

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

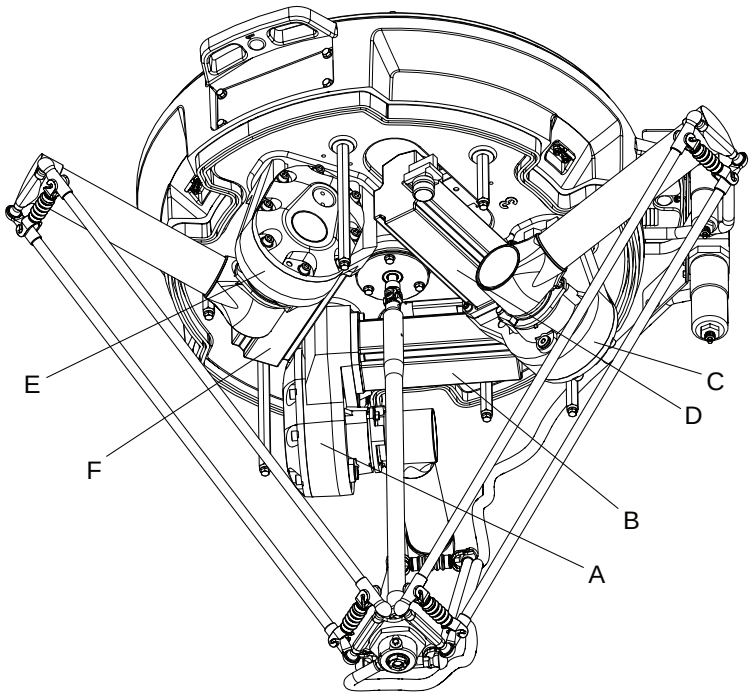
- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Note

This action demands standard calibration of the robot. Described in section *Calibration method on page 230*.

Continues on next page

Location



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A	Gearbox ax 1
B	Motor ax 1
C	Gearbox ax 2
D	Motor ax 2
E	Gearbox ax 3
F	Motor ax 3

Required equipment and references

Equipment	Spare part no.	Note
Standard tools	*Standard toolkit on page 260*.	
Gearbox with motor (axes 1-3)	See *Product manual, spare parts - IRB 360*.	
Gaskets	See *Product manual, spare parts - IRB 360*.	

References
Gearboxes, axes 1- 4 on page 129
Circuit diagram 3HAC028647-009
Calibration method on page 230

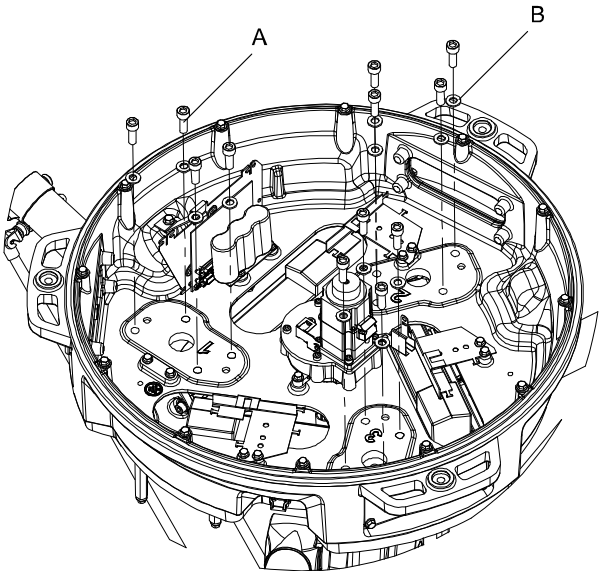
Continues on next page

4.3.10 Replacement of gearbox unit 1- 3
Continued

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

Removal

	Action	Note
1	Remove arm system.	*Replacement of bearing rings on page 177*
2	Remove the transmission cover	Described in section *Gearboxes, axes 1- 4 on page 129*, Method 2.
3	Remove the base cover	Described in section *Replacement of base cover gasket on page 162*
4	Disconnect the motor connectors, R3.FB1-3 and R3.MP1-3.	
5	Remove the four hex socket head cap screw M10 x 30 with washers. **WARNING** This action will loosen the gearbox unit **weight 16 kg**.	Described in section *Gearboxes, axes 1- 4 on page 129*, Method 2.  xx0700000539 A Hex socket head cap screw M10 x 30 B Plain washer 16.5x20x2 steel A3F

Refitting

	Action	Note
1	Refit the gearbox unit, using the four hex socket head cap screw M10 x 30 with washer 16.5x20x2 steel A3F. **Note** Gearbox unit weight 16 Kg.	**Tightening torque 33 Nm**.

Continues on next page

	Action	Note
2	Connect the motor connectors, R3.FB1-3 and R3.MP1-3.	Described in circuit diagram, see *Circuit diagram - IRB 360*, *3HAC028647-009*.
3	Refit the base cover	Described in section *Replacement of base cover gasket on page 162*
4	Refit the transmission cover.	Described in section *Gearboxes, axes 1- 4 on page 129*, Method 2.
5	Refit the arm system.	Described in section *Gearboxes, axes 1- 4 on page 129*, Method 2.
6	Recalibrate the robot.	See *Calibration information on page 229*.

4.3.11 Replacement of gearbox unit 4

General

This section describes replacing gearbox 4 with motor (gearbox unit)

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

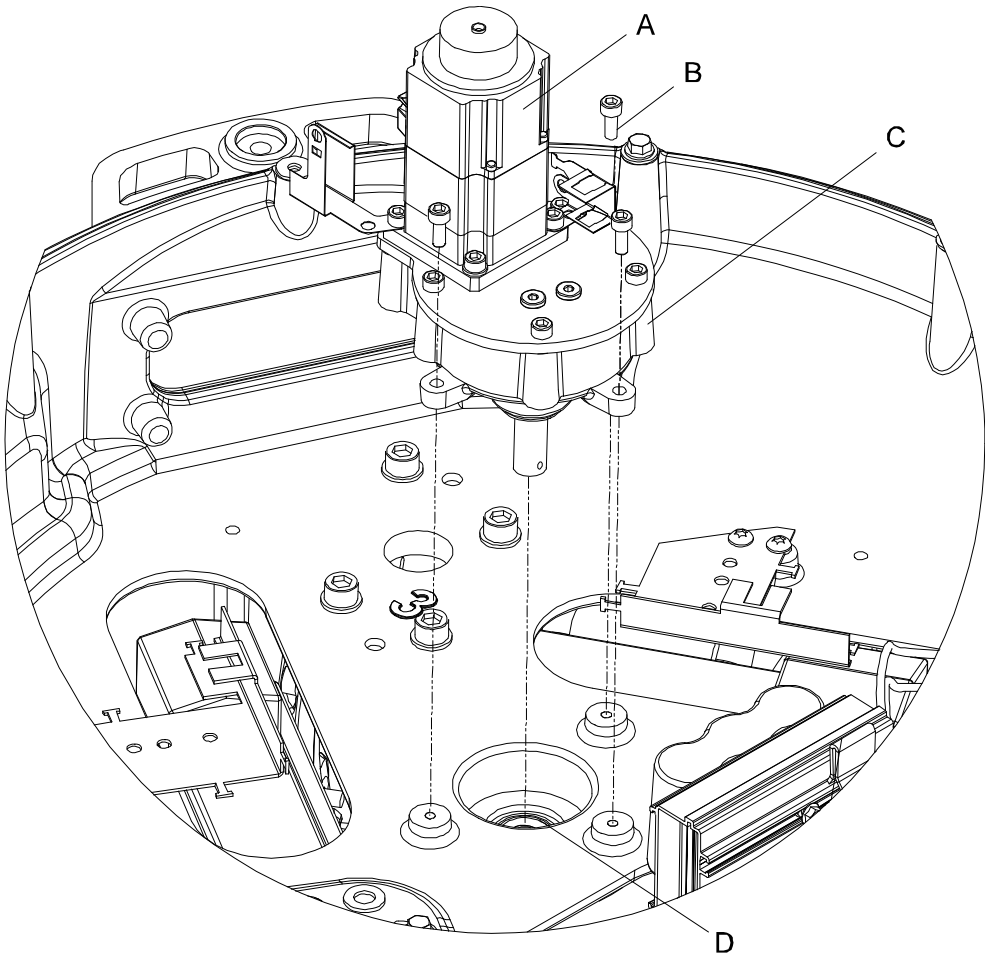
- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Note

This action demands standard calibration of the robot. Described in section *Calibration method on page 230*.

Continues on next page

Location



xx0700000547

A	Gearbox motor axis 4
B	Hexagon socket head screw 3x (M6x25) with plain washer 6,4x12x1,6 steel A2F
C	Gearbox axis 4
D	Sealing ring w. dust lip

Required equipment and references

Equipment	Spare Part No.	Note
Gearbox unit axis 4	See *Product manual, spare parts - IRB 360*.	
Standard tools	*Standard toolkit on page 260*.	
Sealing rings	See *Product manual, spare parts - IRB 360*.	
Locking liquid		Loctite 243

References
Replacement of telescopic shaft on page 184
Replacement of base cover gasket on page 162

Continues on next page

4.3.11 Replacement of gearbox unit 4

Continued

References
Calibration method on page 230

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

Removal

	Action	Note
1	Remove the (12 pcs) M6 flange screws holding the base cover.	Use standard tools. Described in section *Replacement of base cover gasket on page 162*
2	Disconnect the motor connectors: R3.FB4 and R3.MP4.	
3	Remove the telescopic shaft.	Described in section *Replacement of telescopic shaft on page 184*.
4	Remove the 3x hexagon socket head screw (M6x25) with plain washer 6,4x12x1,6 steel A2F(B).	Shown in figure
5	Remove the gearbox unit axis 4.	
6	Remove the sealing ring w. dust lip.	

Refitting

	Action	Note
1	Refit a new sealing ring, apply grease.	See section *Grease on sealings on page 264*.
2	Refit the axis 4 gearbox unit.	
3	Refit the 3x hexagon socket head screw (M6x25) with plain washer 6,4x12x1,6 steel A2F(B).	**Tightening torque 9 Nm**.
4	Refit the telescopic shaft.	Described in section *Replacement of telescopic shaft on page 184*.
5	Reconnect the motor connectors, R3.FB4 and R3.MP4.	
6	Refit the (12 pcs) M6 screws holding the base cover.	Use standard tools. Described in section *Replacement of base cover gasket on page 162*
7	Calibrate the robot.	Described in section *Calibration information on page 229*.

4.3.12 Replacement of motor axis 1-3

General

This section describes replacement of motor axis 1-3.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

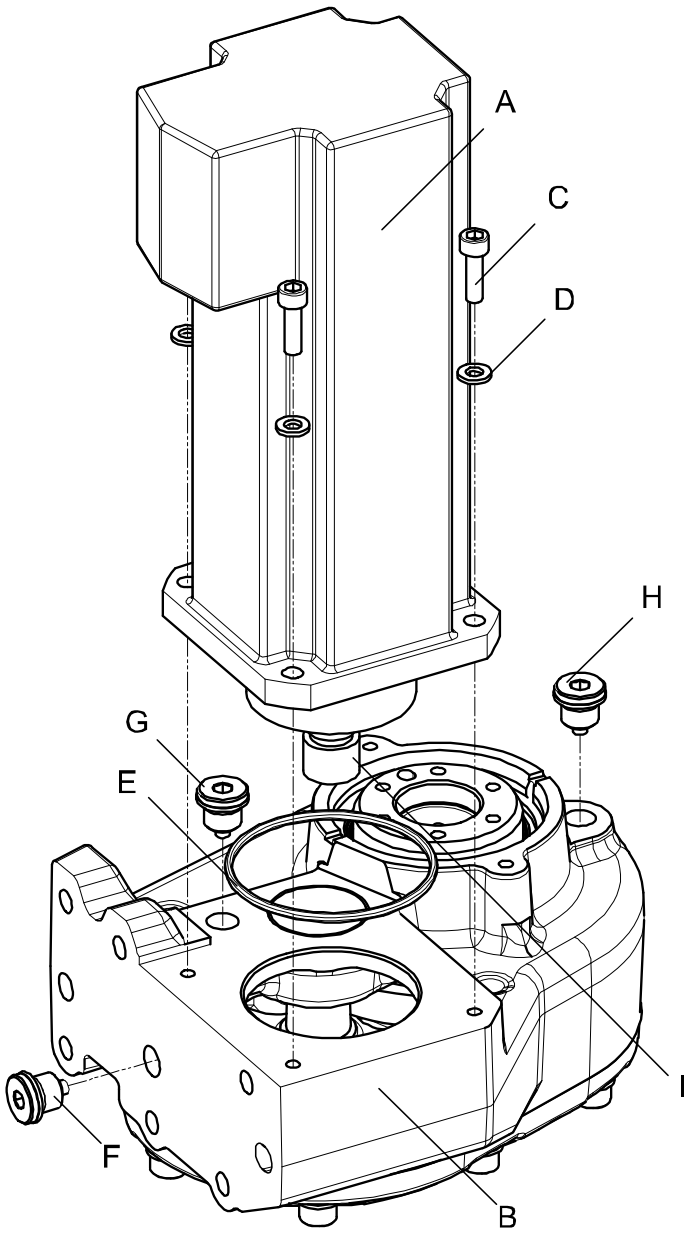
Note

This action demands standard calibration of the robot. Described in section *Calibration method on page 230*.

Continues on next page

4.3.12 Replacement of motor axis 1-3
Continued

Location



xx0700000541

A	Motor 1-3
B	Gearbox 1-3
C	Hex socket head cap screw M6x20 8.8 gleitmo605
D	Washer 6,4x12x1,6 steel A2F
E	Nitrile rubber O-ring 67,5x3,0
F	Oil plug
G	Oil plug (upper oil level hole)
H	Oil plug
I	Gear Z1/1-3, 16 cog

Continues on next page

Required equipment and references

Equipment	Spare part no.	Note
Standard tools		*Standard toolkit on page 260*
O-ring	See *Product manual, spare parts - IRB 360*.	
AC motor	See *Product manual, spare parts - IRB 360*.	
Locking liquid		Loctite 243

References
Replacement of gearbox unit 1- 3 on page 192
Grease specification on page 263

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

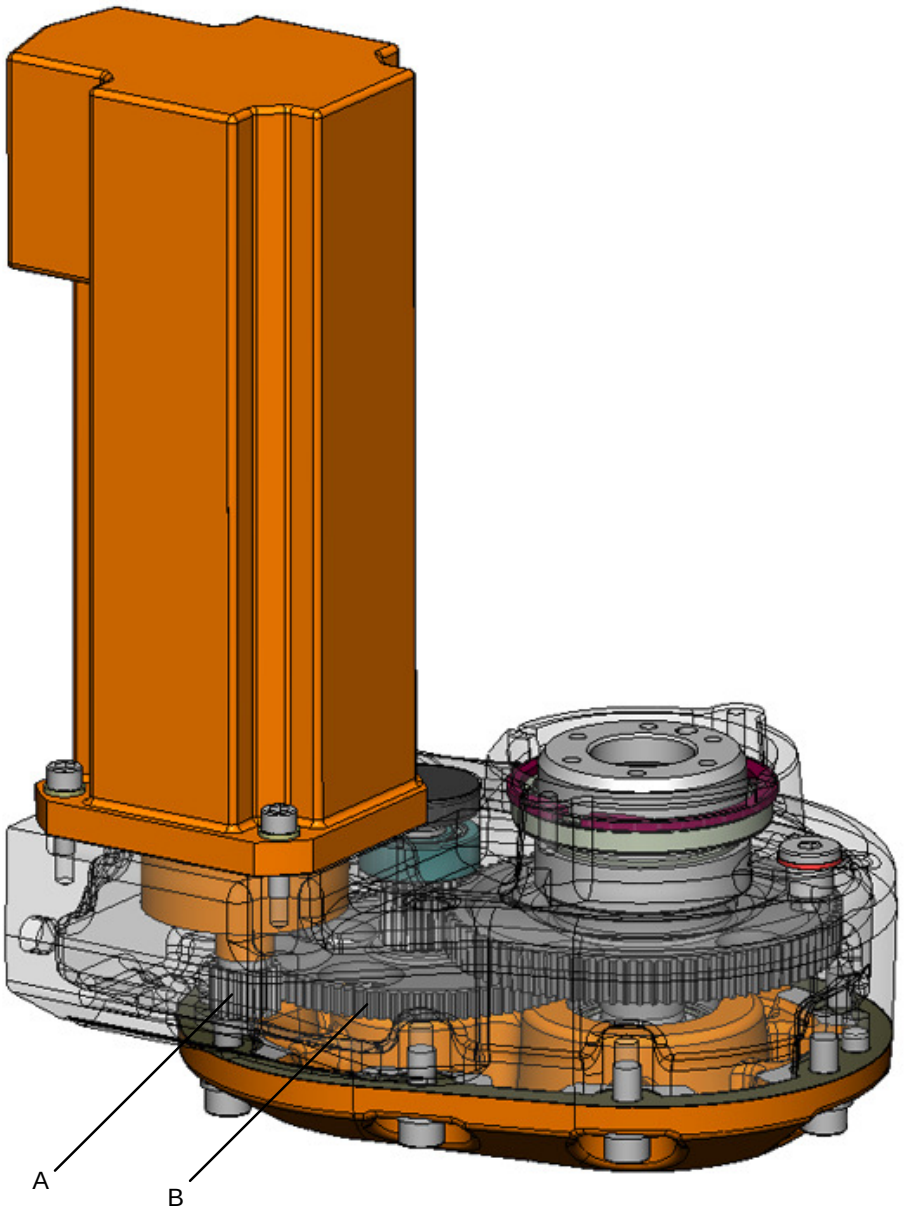
Removal

	Action	Note
1	Remove the gearbox unit 1-3.	Described in section *Replacement of gearbox unit 1- 3 on page 192*.
2	Unscrew the three screws (C) holding the motor.	Shown in figure *Location on page 200*
3	Remove the motor.	**DANGER** Oil will be running out of the motor attachment hole when removing the motor! The oil can be hot. Take any necessary measures to collect the oil.

Continues on next page

4.3.12 Replacement of motor axis 1-3
Continued

Refitting

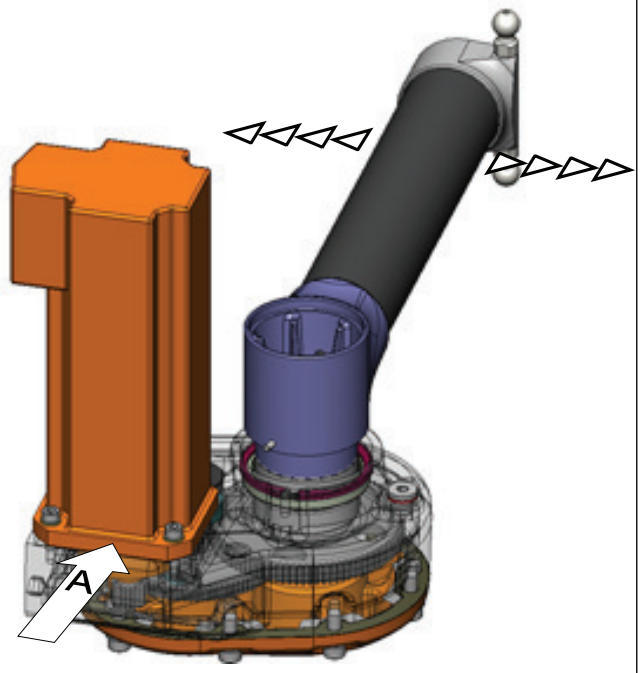


xx0700000616

A	Motor pinion
B	Gear Z2/1-3, 90 cog

	Action	Note
1	Fit a new O-ring (E) onto the motor flange, lubricate the o-ring with grease FM222.	Shown in figure *Location on page 200*.

Continues on next page

	Action	Note
2	Insert the new motor, do not tighten the screws.	**CAUTION** Fit the motor, making sure the motor pinion is properly mated to the gear wheel, do not use force or the motor pinion may get damaged.
3	Refit the upper arm temporarily, to be used to feel the backlash.	
4	Push on the motor flange gently in direction A, at the same time as you feel for the backlash by moving the upper arm back and forward.	 xx0700000620
5	Ensure that the gear is kept absolutely still. Apply loctite 243 and tighten the screws (C).	Shown in figure *Location on page 200* **Tightening torque 9 Nm**.
6	Check through the upper oil level hole that gear wheel (B) is axially movable	Shown in figure *Refitting on page 202*.
7	Fill the gearbox with oil.	Specified in section *Grease specification on page 263*.
8	Refit the gearbox unit 1-3	Described in section *Replacement of gearbox unit 1- 3 on page 192*.
9	Recalibrate the robot.	See *Calibration information on page 229*.

4.3.13 Replacement of motor axis 4

General

This section describes replacement of motor axis 4.

Note

This action demands standard calibration of the robot. Described in section *Calibration method on page 230*.

DANGER

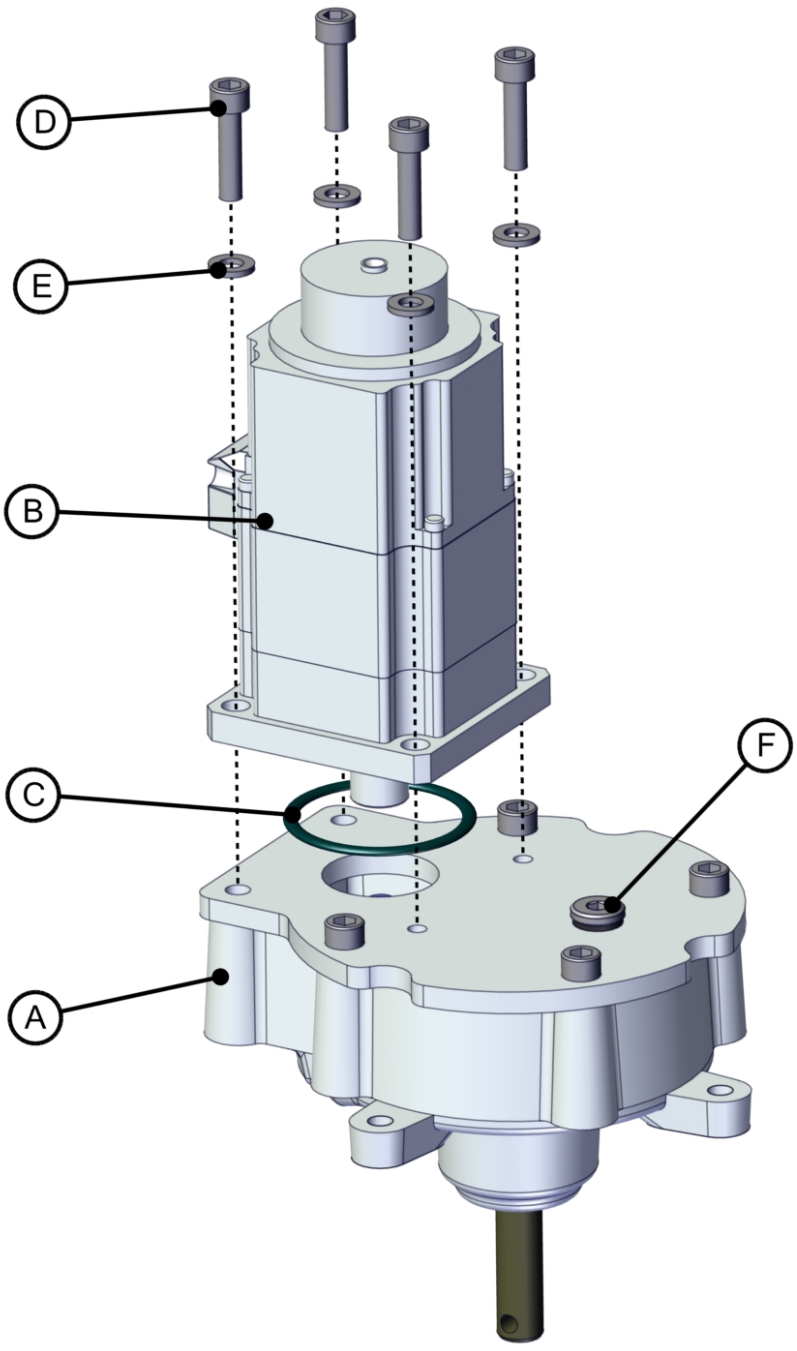
Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

Continues on next page

Location



xx1700001146

A	Gearbox axis 4
B	Rotational ac motor
C	O-ring, nitrile rubber
D	Hex socket head cap screw M6x25 8.8
E	Washer 6,4x12x1,6 A2F
F	Oil plug

Continues on next page

4.3.13 Replacement of motor axis 4
Continued

Required equipment and references

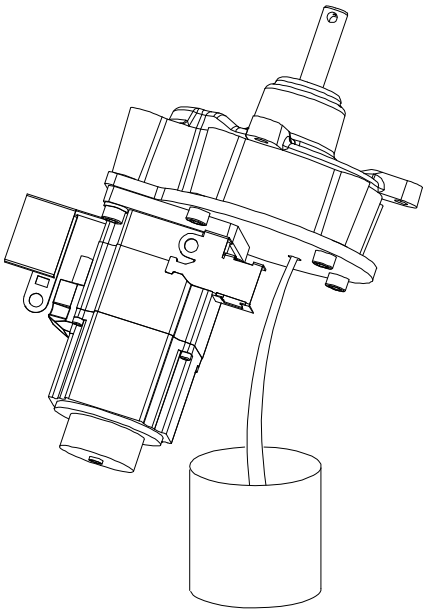
Equipment	Spare part no.	Note
Standard tools		*Standard toolkit on page 260*
O-ring, nitrile rubber	See *Product manual, spare parts - IRB 360*.	
Loctite 243	See *Product manual, spare parts - IRB 360*.	

References
Replacement of base cover gasket on page 162
Replacement of gearbox unit 4 on page 196
Standard toolkit on page 260
Grease specification on page 263

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

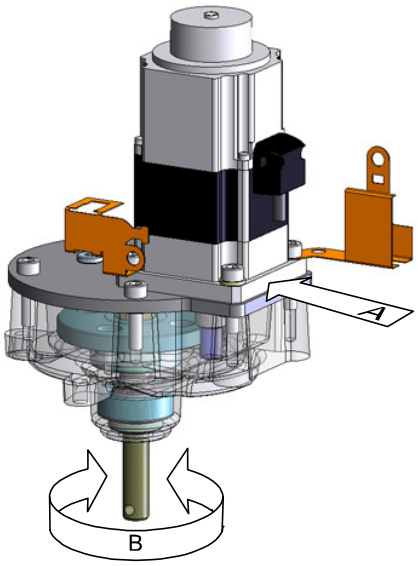
Removal

	Action	Note
1	Remove the base cover.	See *Replacement of base cover gasket on page 162*.
2	Remove the gearbox with motor.	See *Replacement of gearbox unit 4 on page 196*.
3	Remove the oil plug, and drain the oil.	 xx0700000728

Continues on next page

	Action	Note
4	Remove the motor.	**DANGER** Oil will be running out of the motor attachment hole when removing the motor! The oil can be hot. Take any necessary measures to collect the oil.

Refitting

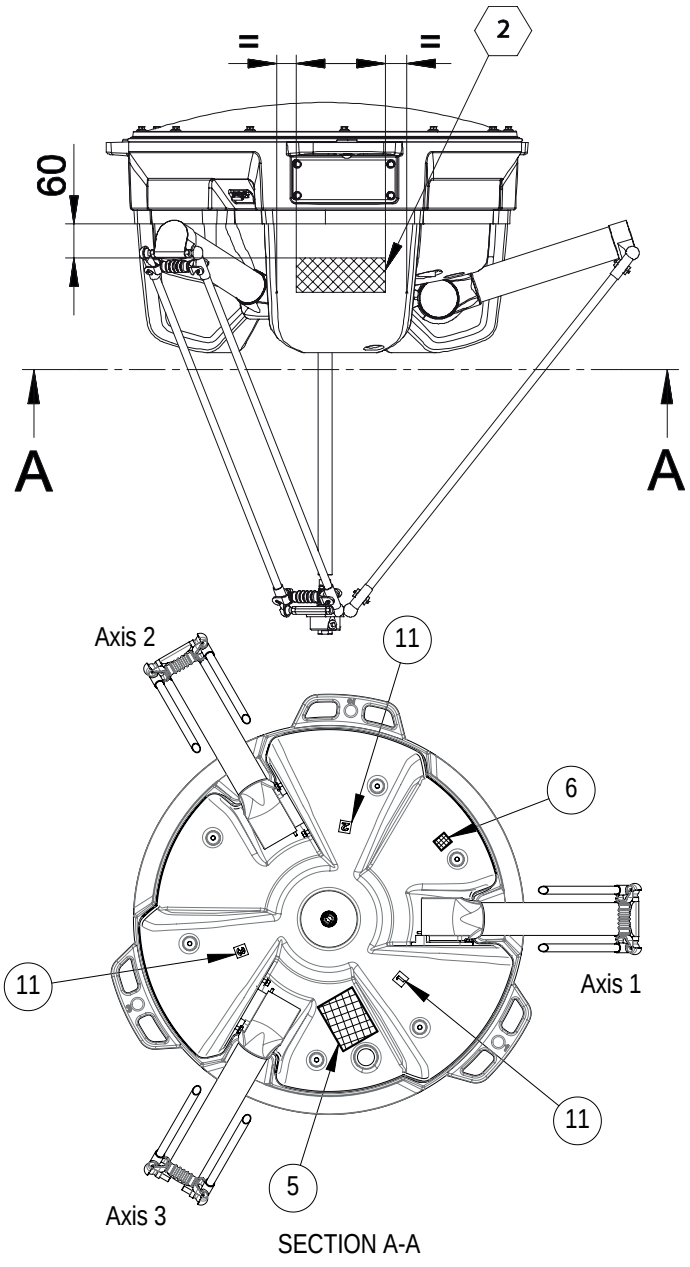
	Action	Note
1	Fit the new o-ring (C) onto the motor flange, lubricate the o-ring with grease FM 222.	Lubrication specified in section *Grease specification on page 263*.
2	Insert the new motor, do not tighten the screws.	**CAUTION** Fit the motor, making sure the motor pinion is properly mated to the gear wheel, do not use force or the motor pinion may get damaged.
3	Push on the motor flange gently in direction A, at the same time as you feel for the backlash by moving the outgoing axis (B) back and forward.	 xx0700000621
4	Make sure that the gear is kept absolutely still. Apply Loctite 243 and tighten the screw (D). In figure *Location on page 205*.	Tightening torque: 10 Nm
5	Check the play again.	If there is a backlash, loosen the screws (D) and go back to step 3.
6	Fill the gearbox with oil.	Lubrication specified in section *Grease specification on page 263*.
7	Refit the gear box with motor.	Described in section *Replacement of gearbox unit 4 on page 196*.
8	Refit the base cover.	Described in section *Replacement of base cover gasket on page 162*.

4.3.14 Replacement of labels

General

This section describes replacement and positioning of labels on the IRB 360.

Label positioning



xx0700000691

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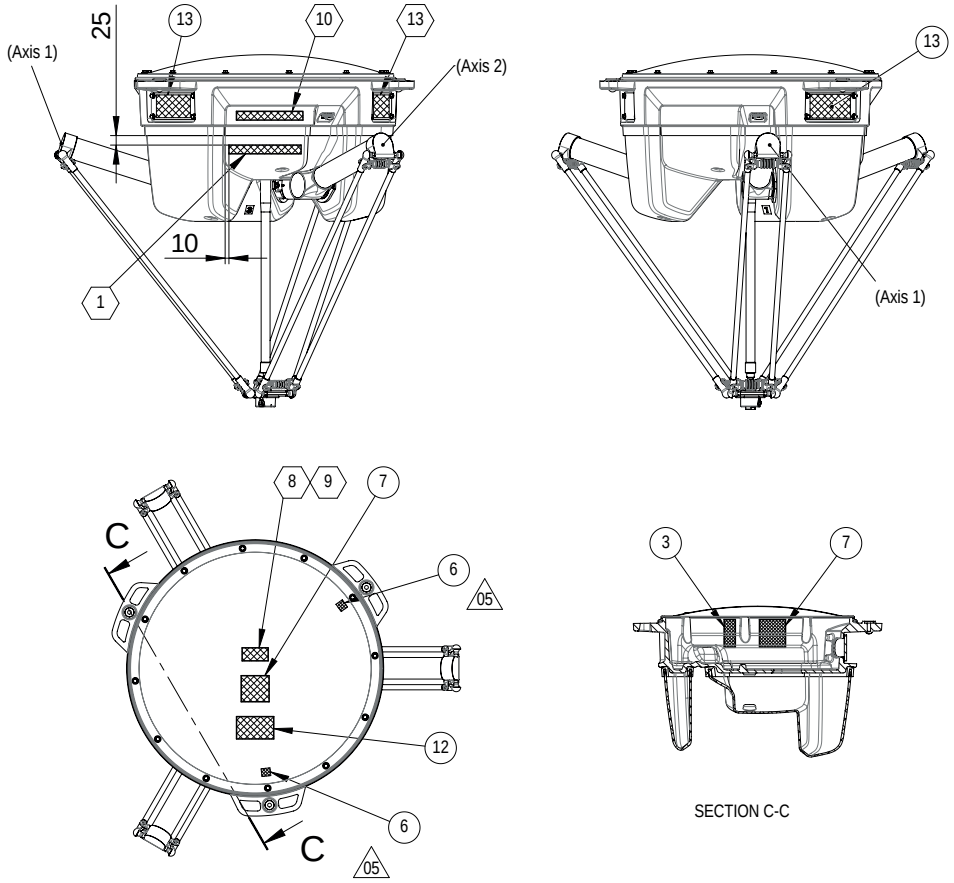


xx0700000692

1	Label, Flex Picker-red 190x23
2	ABB-Logotype 69x157
3	Calibration values
5	Instruction plate (brake release)
6	Warning sign 24x21 (electric warning)
7	Rating label
8	UL-label 70x35
9	UL-label 70x35
10	Cleanroom Logotype
11	Axis marks
12	Instruction plate
13	Transport protection label

Required equipment and references

Equipment	Spare part no.	Note
Label-set	See *Product manual, spare parts - IRB 360*.	

Continues on next page

4.3.14 Replacement of labels
Continued

Assemble

	Action	Note
1	Make sure the surface is clean.	
2	Assemble the labels according to the illustrations.	

4.3.15 Replacing of calibration marks

Overview

This section describes replacement of calibration marks on an IRB 360.

Replace a calibration mark if it is damaged.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

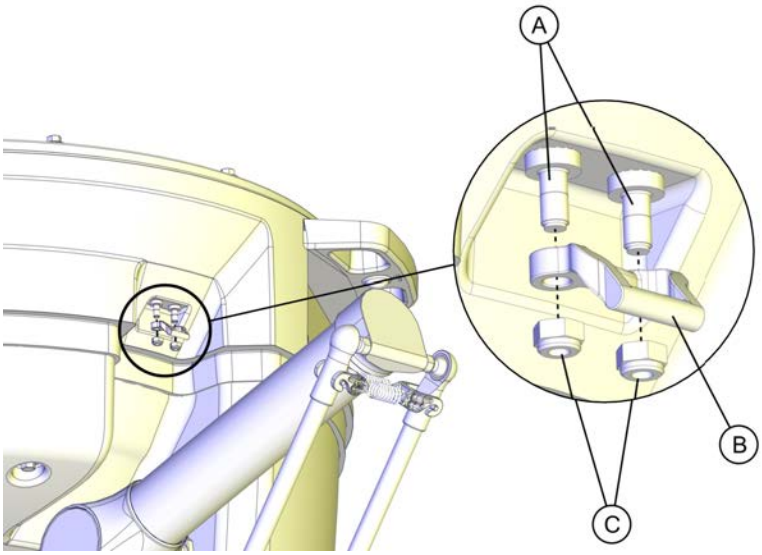
Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

CAUTION

Always read the specific instructions for Clean Room robots before doing any repair work, see *Cut the paint or surface on the robot before replacing parts on page 160*.

Location



xx2000002386

A	Dowel for calibration mark
B	Calibration mark (plastic)
C	2 pcs M5 prevailing torque type hexagon nut non metallic insert style1.

Continues on next page

4.3.15 Replacing of calibration marks

Continued

Required equipment and references

Equipment	Spare part no.	Note
Standard tools	*Standard toolkit on page 260*.	
Calibration mark	See *Product manual, spare parts - IRB 360*.	

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

Remove

	Action	Note
1	Remove the two M5 nuts.	Use standard tools.
2	Remove the calibration mark.	

Refitting

	Action	Note
1	Refit a new calibration mark.	
2	Refit the two M5 nuts.	**Tightening torque 4Nm.**

4.4 Vacuum system

4.4.1 Replacement of vacuum hoses

General

This section describes replacement of hoses in the vacuum system.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

CAUTION

Always read the specific instructions for Clean Room robots before doing any repair work, see *Cut the paint or surface on the robot before replacing parts on page 160*.

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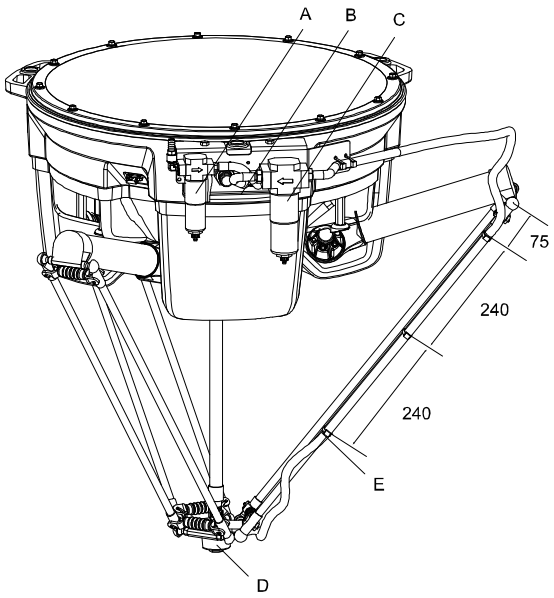
4.4.1 Replacement of vacuum hoses

Continued

Location



xx0700000499

A	Air filter inlet.
B	Ejector unit
C	Air filter inlet vacuum.
D	Swivel cup
E	Hose clamp

Required equipment

Equipment	Spare part no.	Note
Standard tools		
Spare hose set		

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

Removal

	Action	Note
1	Open all straps.	
2	Pull the hose out from the swivel.	
3	Pull the hose out from the air filter.	

Refitting

	Action	Note
1	Fit a new hose on the swivel.	

Continues on next page

	Action	Note
2	Fix the hose, do not tighten, against the three clamps on the parallel arm.	
3	Twist the hose and fit it on the air filter.	
4	Adjust the hose.	
5	Tighten the straps.	
6	Make a small program (low velocity) and check that the hose runs freely.	
7	Fit a new hose on the swivel.	
8	Fix the hose, do not tighten, against the three clamps on the parallel arm.	

4.4.2 Draining of water separation filter

General

This section describes:

- Air filter change in the vacuum system
- Emptying water separation filter

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

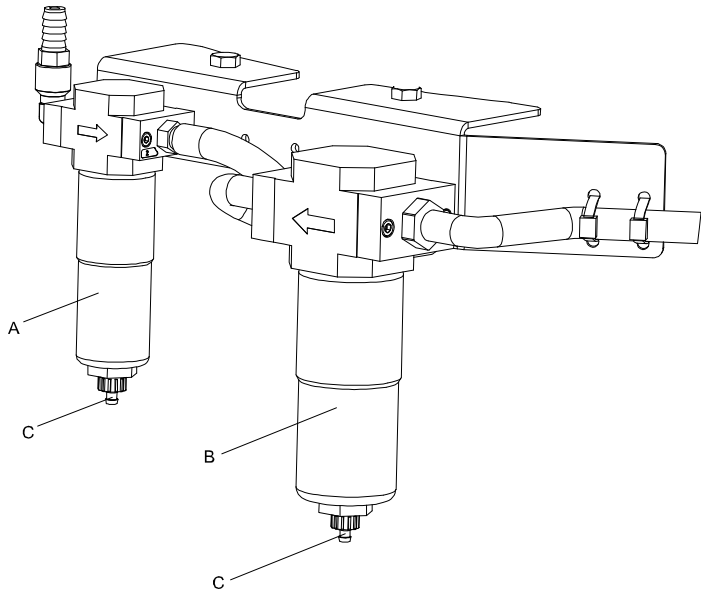
Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

CAUTION

Always read the specific instructions for Clean Room robots before doing any repair work, see *Cut the paint or surface on the robot before replacing parts on page 160*.

Location



xx0700000544

A	Air filter (comp)
B	Air filter (Vac)
C	Water separation bottom nipple

Continues on next page

Removal water

	Action
1	Drain the water separation filter, opening the bottom nipple (C).

4.4.3 Replacement of ejector unit

General

This section describes replacement of ejector unit.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

CAUTION

Always read the specific instructions for Clean Room robots before doing any repair work, see *Cut the paint or surface on the robot before replacing parts on page 160*.

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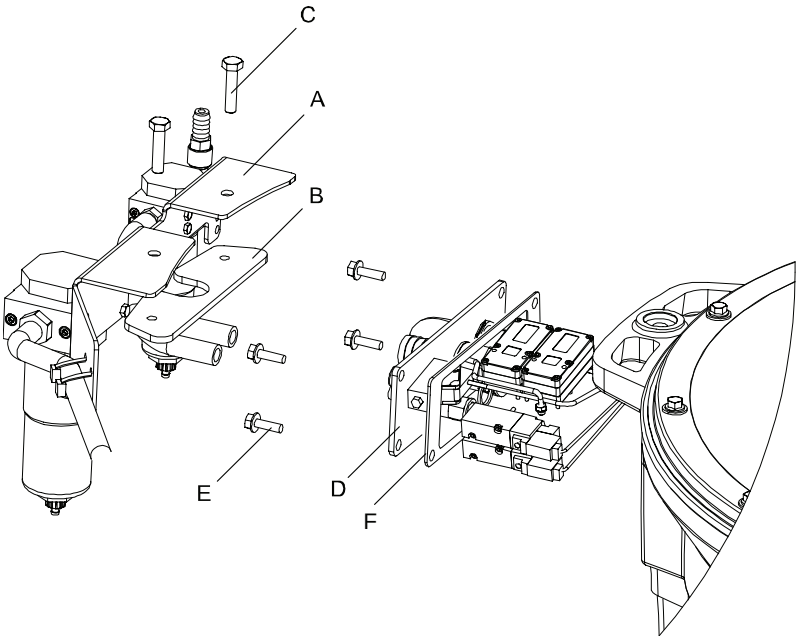
Location



xx0700000714

A	Attachment
B	Bracket
C	Hexagon head screw, M8x35 (Steel 8.8-A2F)
D	Ejector unit
E	Hexagon bolt with flange, M6 x 20 (A2 DIN6921)
F	Gasket

Required equipment and references

Equipment	Spare part no.	Note
Standard tools		
Spare parts	*Spare parts, ejector unit*.	

References
Spare parts, ejector unit.
Replacement of base cover gasket on page 162.

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

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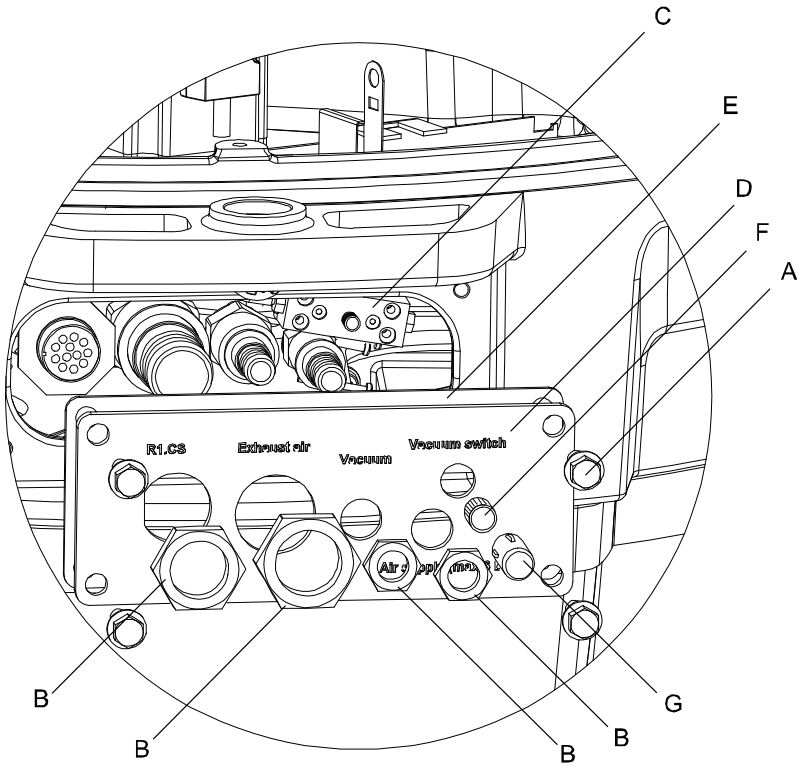
4.4.3 Replacement of ejector unit
Continued

Illustration



xx0700000704

A	Hexagon bolt with flange M6x20 (A2 DIN6921)
B	Nuts for the air nozzles
C	Ejector unit
D	Front plate
E	Gasket
F	Pressure guard nut
G	Pressure guard cap

Removal

	Action	Note
1	Disconnect the air supply, vacuum hoses, and signal cable from the ejector unit.	
2	Remove the base cover.	Described in section *Replacement of base cover gasket on page 162*.
3	Remove the 2x hexagon socket head cap screw M8x35 holding the filter holder, and remove the filters.	Use standard tools.
4	Remove all the nuts for the air nozzles, pressure guard cap and the pressure guard nut.	
5	Remove the ejector unit inwards direction.	

Continues on next page

	Action	Note
6	Remove the 4x hexagon bolt with flange M6x20 holding the front plate, and remove the plate and the gasket.	

Refitting

	Action	Note
1	Refit the front plate and the gasket using the 4x hexagon bolt with flange M6x20. (if needed, replace the gasket)	**Tightening torque 4 Nm**.
2	Refit the ejector unit from the inside.	
3	Refit all the nuts for the air nozzles, pressure guard cap and the pressure guard nut.	**Tightening torque 4 Nm.**
4	Refit the filters using the 2x hexagon socket head cap screw M8x35.	Use standard tools.
5	Reconnect the air supply, vacuum hoses and signal cable from the ejector unit.	
6	Refit the base cover.	*Replacement of base cover gasket on page 162*

4.5 Cable harness

4.5.1 Replacement of cable harness

General

This section describes replacement of complete cable harness.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

CAUTION

Always read the specific instructions for Clean Room robots before doing any repair work, see *Cut the paint or surface on the robot before replacing parts on page 160*.

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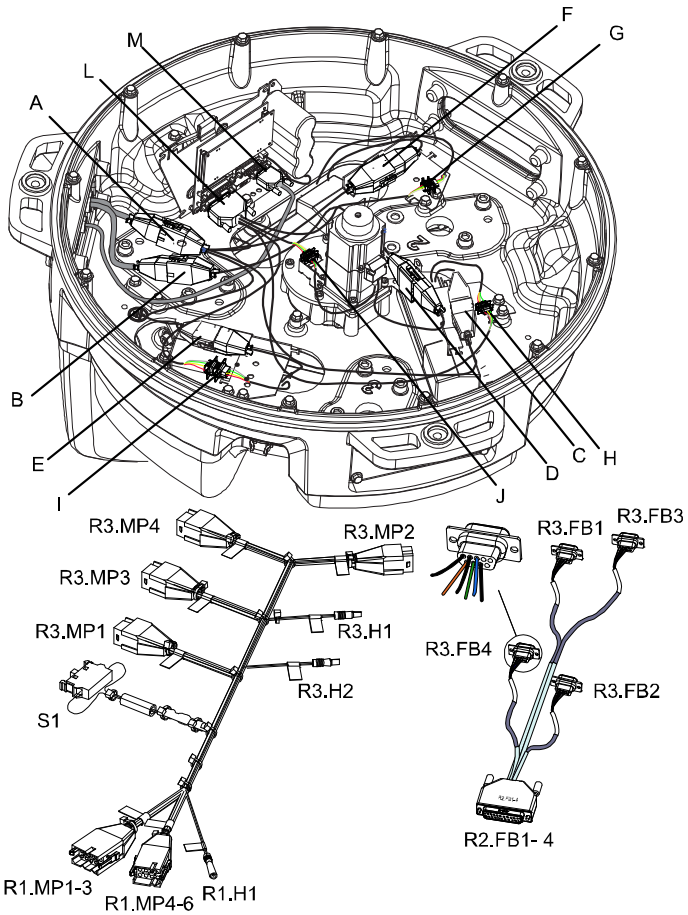
Location



xx0700000562

A	R1.MP 1-3
B	R1.MP 4-6
C	R3.MP2
D	R3.MP4
E	R3.MP3
F	R3.MP1
G	R3.FB1
H	R3.FB2
I	R3.FB3
J	R3.FB4
M	X1(SMB)
L	X2(SMB) - R3.FB1-4

Required equipment and references

Equipment	Spare part no.	Note
Standard tools		*Standard toolkit on page 260*.

Continues on next page

4.5.1 Replacement of cable harness

Continued

Equipment	Spare part no.	Note
Cable harness		*Spare parts - cable harness*.
Cut-off pliers		

References
Replacement of base cover gasket on page 162.
Circuit diagram 3HAC028647-009.

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

Removal

	Action	Note
1	Remove the base cover.	Described in section *Replacement of base cover gasket on page 162*
2	Remove the cable straps holding the cable harness, using a cut-off pliers.	
3	Disconnect all connections.	
4	Remove the cable harness.	

Refitting

	Action	Note
1	Refit the new cable harness.	
2	Connect all connections.	Described in circuit diagram, see *Circuit diagram - IRB 360, 3HAC028647-009*.
3	Strap all cable connections to there connector brackets.	
4	Refit the base cover.	Described in section *Replacement of base cover gasket on page 162*.

4.5.2 Replacement of brake release button

Introduction

This section describes replacement of brake release button on the IRB 360.

DANGER

Turn off all electrical power, hydraulic and pneumatic pressure supplies before entering the workspace of the manipulator.

Also read the safety sections:

- *Pneumatic or hydraulic related hazards on page 32*
- *Electrical safety on page 31*
- *Maintenance and repair on page 34*

CAUTION

Always read the specific instructions for Clean Room robots before doing any repair work, see *Cut the paint or surface on the robot before replacing parts on page 160*.

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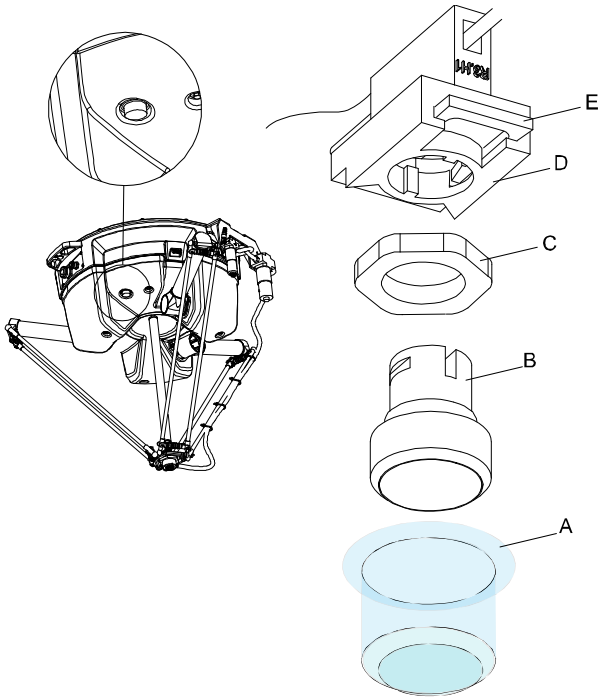
4.5.2 Replacement of brake release button

Continued

Location



xx0700000650

A	Cover
B	Brake release button
C	Plastic nut
D	Contact
E	Locking device

Required equipment

Equipment	Spare Part no.	Note
Standard tools	*Standard toolkit on page 260*.	*Spare parts, Brake release button*.

CAUTION

Always cut the paint with a knife and grind the paint edge when disassembling parts. See *Cut the paint or surface on the robot before replacing parts on page 160*.

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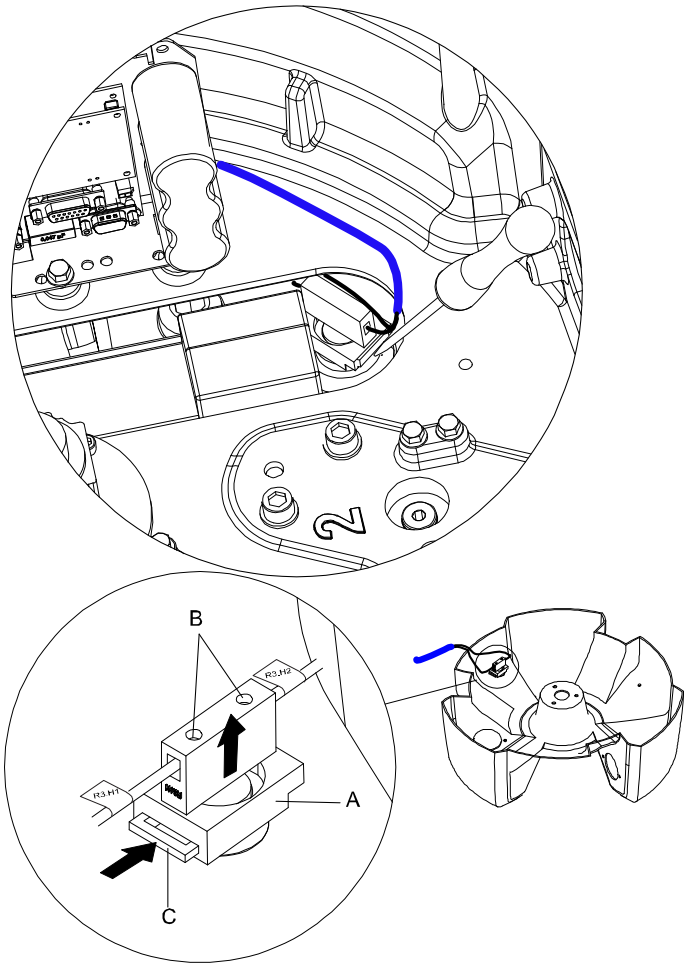
Removal



xx0700000644

A	Brake release contact
B	Cable locking screw
C	Locking device

	Action	Note
1	Remove the base cover. **CAUTION** Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.	*Replacement of base cover gasket on page 162*. **CAUTION** The base cover has sharp edges, use protective gloves.
2	Remove the *contact* from the push button, pushing in the *locking device*.	**Tip** Use a screw driver to push in the locking device.

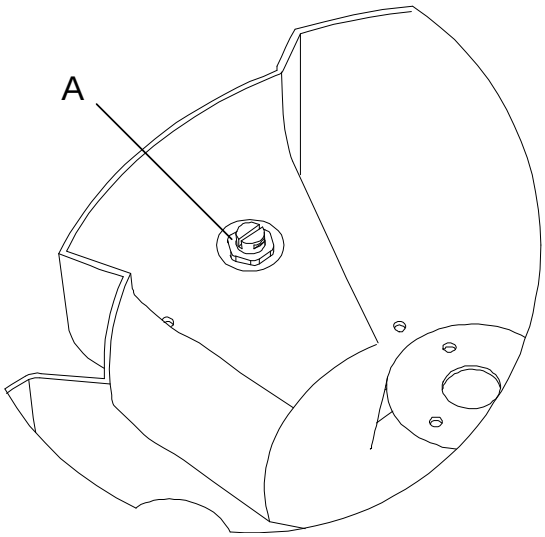
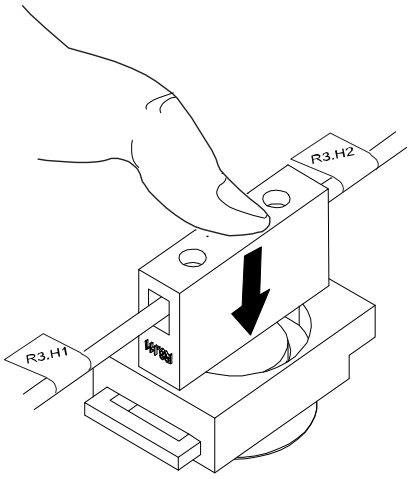
Continues on next page

4.5.2 Replacement of brake release button

Continued

	Action	Note
3	Loosen the plastic nut and remove the push button from the transmission cover.	Use standard tools.

Refitting

	Action	Note
1	Refit the push button to the transmission cover using the *plastic nut*. **Note** Mount the button cover or the robot will not fulfill the IP67 and IP69K classification.	 xx0700000651
2	Press to refit the contact.	 xx0800000011 **Tip** Refit the cables to the contact before this step.
3	Refit the base cover.	*Replacement of base cover gasket on page 162* **CAUTION** The base cover has sharp edges, use protective gloves.

5 Calibration information

5.1 When to calibrate

When to calibrate

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

The resolver values are changed

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

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

The revolution counter memory is lost

If the revolution counter memory is lost, the counters must be updated. See *Updating revolution counters on page 243*. This will occur when:

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

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

The robot is rebuilt

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

The resolver values must be updated if the robot is stopped with the emergency stop or by breaking a safety chain, and after running in to a mechanical stop.

Robot is not floor mounted

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

5.2 Calibration method

Overview

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

Types of calibration

Type of calibration	Description	Calibration method
Standard calibration	Standard calibration is performed if resolver values are changed or the robot is rebuilt (see *When to calibrate on page 229*). The robot is positioned at calibration position, that is when the positions of the axes 1-3 (angles) are set to parameter values found in *Calibration Position*, see type *Arm*, topic *Motion* in *Technical reference manual - System parameters*. Standard calibration data is found on the SMB (serial measurement board) in the robot. For robots with RobotWare 5.04 or older, the calibration data is delivered in a file, calib.cfg, supplied with the robot at delivery. The file identifies the correct resolver/motor position corresponding to the robot home position.	Calibration by hand with activated brake release, using the calibration marks.
Factory reset	A factory reset (calibration with a calibration ring) can be performed after a gearbox or an upper arm has been replaced to ensure enhanced robot arm accuracy than when performing standard calibration. Factory reset alters the robot's unique production settings for axis 1-3. To perform ring calibration, the parallel arms must first be removed from the robot. The upper arms must then be positioned vertically so that the calibration ring can be fitted to them. Making a factory reset with the calibration ring requires specific calibration equipment and software, and is performed by ABB. Please contact ABB. The parameter *Calibration Position* (cal_position) is set at the ABB factory, and is a robot specific parameter. For more information about parameter *Calibration Position*, see topic *Motion*, type *Arm* in *Technical reference manual - System parameters*.	Ring calibration

Calibration methods

The calibration method for the IRB 360 is different from other robots, and normal calibration methods are not applicable.

Calibration by hand

Standard calibration is detailed in section *Calibrating axis 1-3 on page 234*.

Continues on next page

Ring calibration

A factory reset using ring calibration requires specific calibration equipment and is performed by ABB. Please contact ABB.

Ring calibration is measuring each contact point for axis 1-3 and modifies cal_position. The Ring calibration method gives a better nominal kinematics and the modified cal_positions will help to get back to the same points when calibrating with Standard calibration.

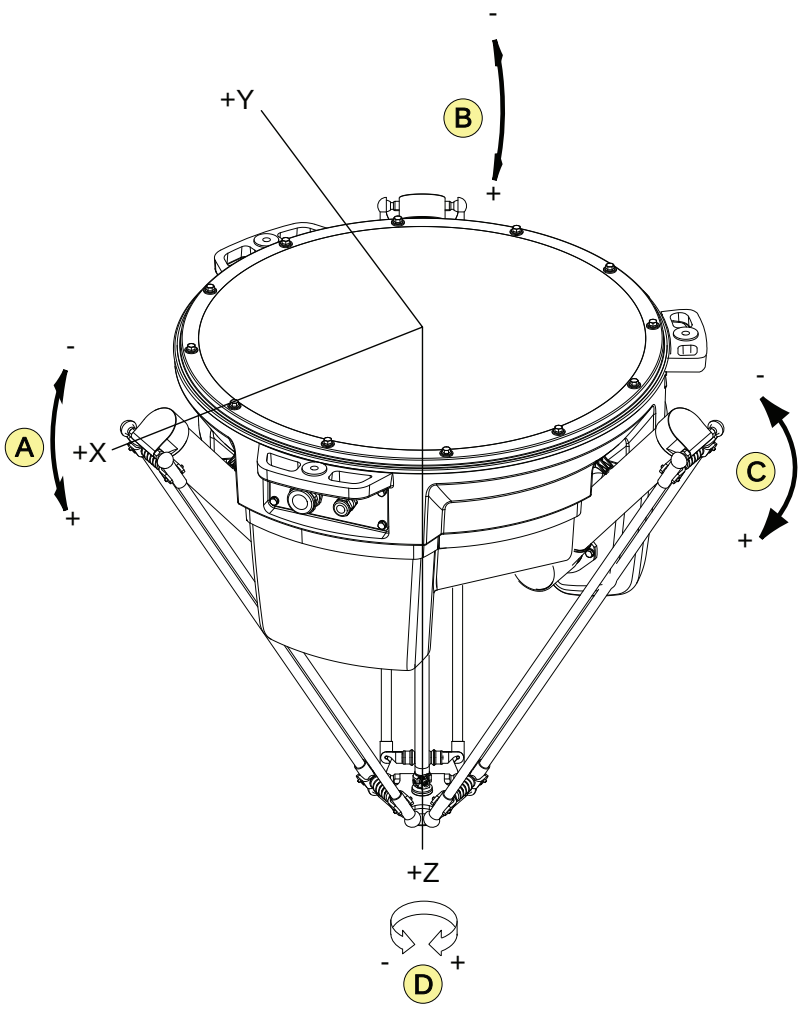
5.3 Calibration movement directions for all axes

Overview

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

Calibration movement and jogging directions

The following graphic shows the positive and negative directions for each axis and the linear directions when jogging the robot in the base coordinate system.



xx0700000448

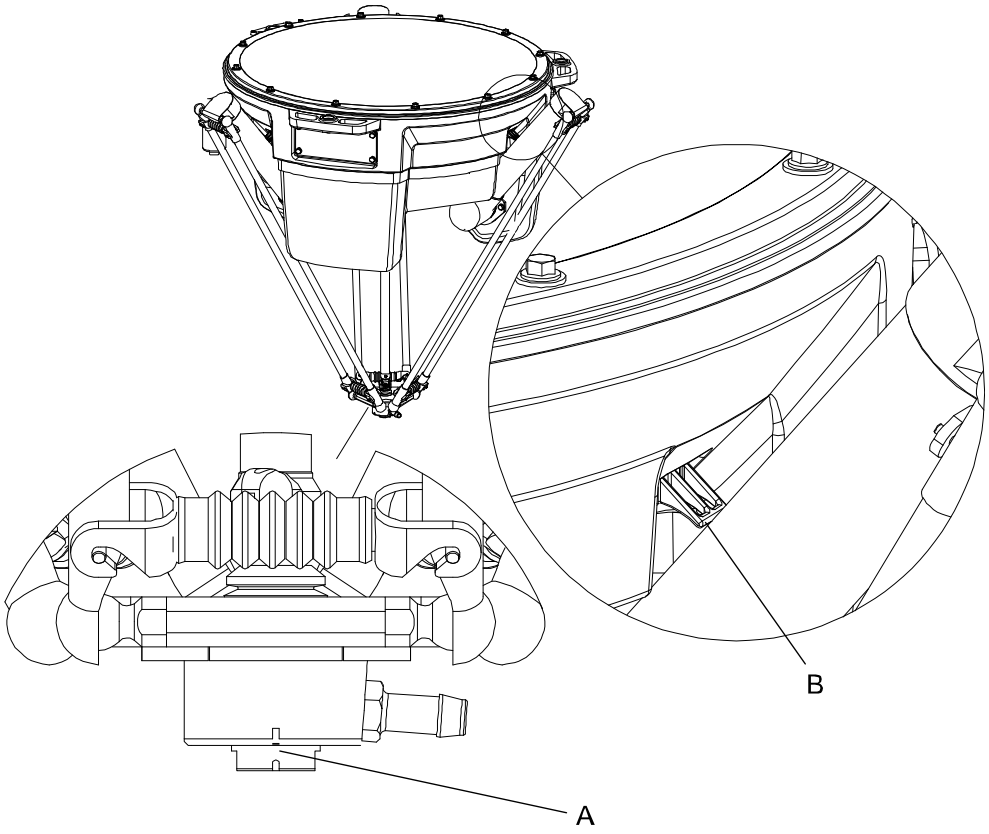
A	Axis 1
B	Axis 2
C	Axis 3
D	Axis 4

5.4 Synchronization marks and synchronization position for axes

Introduction

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

Synchronization marks, IRB 360



xx0700000569

A	Calibration mark axis 4
B	Calibration marks axis 1-3

5.5 Calibrating axis 1-3

General

This section is valid for IRB 360 all models. It describes how to perform the actual fine calibration of axis 1-3.

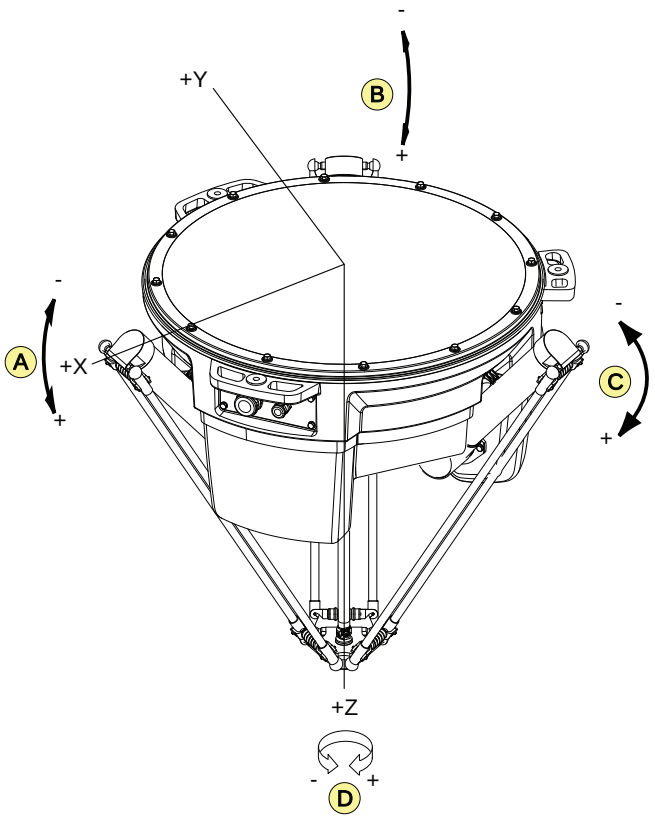
If the robot needs to have a factory reset instead, please contact ABB. See *Calibration method on page 230*.

The calibration positions are shown in *Checking the synchronization position on page 247*

Note

Calibration should be performed by specially trained personnel.

Axis moving directions



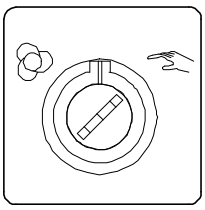
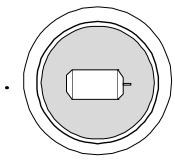
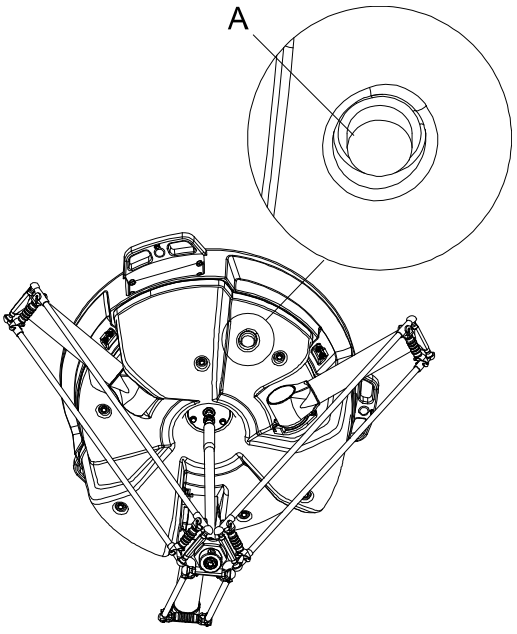
xx0700000448

A	Axis 1
B	Axis 2
C	Axis 3
D	Axis 4

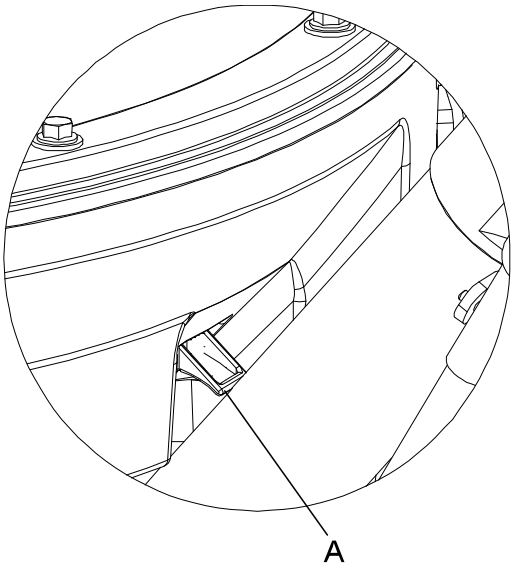
Continues on next page

Calibrating axes 1-3

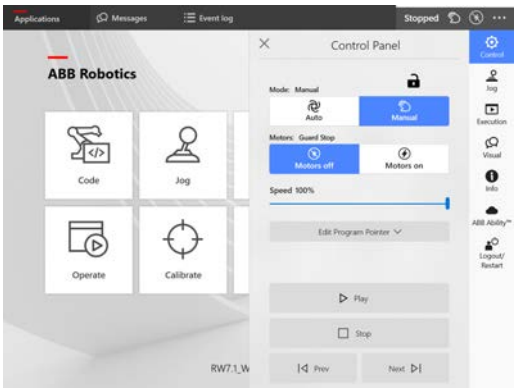
When connecting to IRC5 controller

	Action	Note
1	On the FlexPendant, press the stop button.	
2	On the controller, set the key switch into manual position.	 xx0700000625
3	Check the motors off button, make sure that the button flashes.	 en0400000795
4	Press the brake release button to release the brakes.	 xx0700000435 A Brake release button

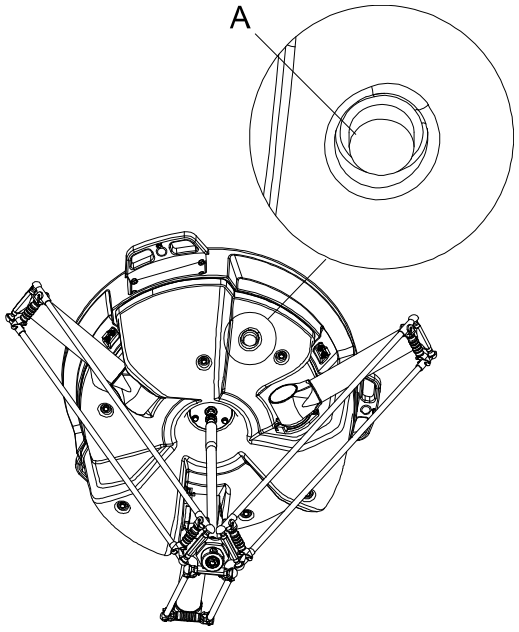
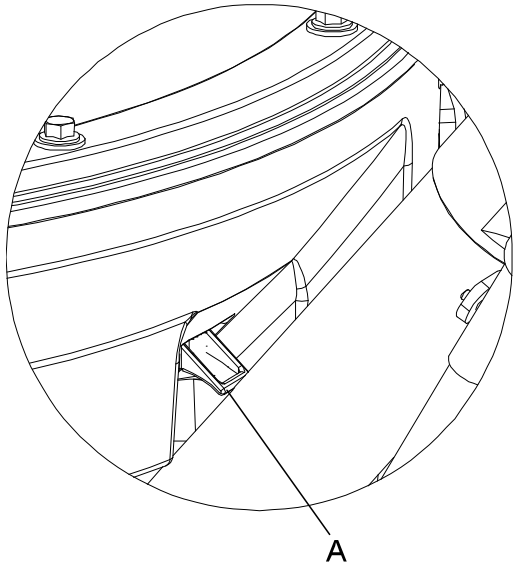
Continues on next page

	Action	Note
5	Push the upper arm very gently against the calibration device. **Note** Always calibrate one axis a time, starting with axis 1.	 xx0700000626 A Calibration device
6	When the upper arm reaches the calibration device, apply the brake.	The upper arm is now in calibration position.
7	Store the resolver value by doing a fine calibration.	Described in section *Fine calibration procedure on FlexPendant on page 240*
8	Release the brakes and gently pull the calibrated upper arm in to a horizontal position.	
9	Return to step *4*, and proceed with axis 2 and 3.	

When connecting to OmniCore controller

	Action	Note
1	On the FlexPendant, press the stop button.	
2	On the FlexPendant, press **Manual** to switch to manual mode.	 xx2000002535
3	On the FlexPendant, press **Motor Off** to set the robot as motor off status.	

Continues on next page

	Action	Note
4	Press the brake release button to release the brakes.	 xx0700000435 A Brake release button
5	Push the upper arm very gently against the calibration device. **Note** Always calibrate one axis a time, starting with axis 1.	 xx0700000626 A Calibration device
6	When the upper arm reaches the calibration device, apply the brake.	The upper arm is now in calibration position.
7	Store the resolver value by doing a fine calibration.	Described in section *Fine calibration procedure on FlexPendant on page 240*
8	Release the brakes and gently pull the calibrated upper arm in to a horizontal position.	
9	Return to step *4*, and proceed with axis 2 and 3.	

5.6 Calibrating axis 4

General

This section is valid for IRB 360 all models. It describes how to perform the actual fine calibration of axis 4.

The calibration positions are shown in *Checking the synchronization position on page 247*

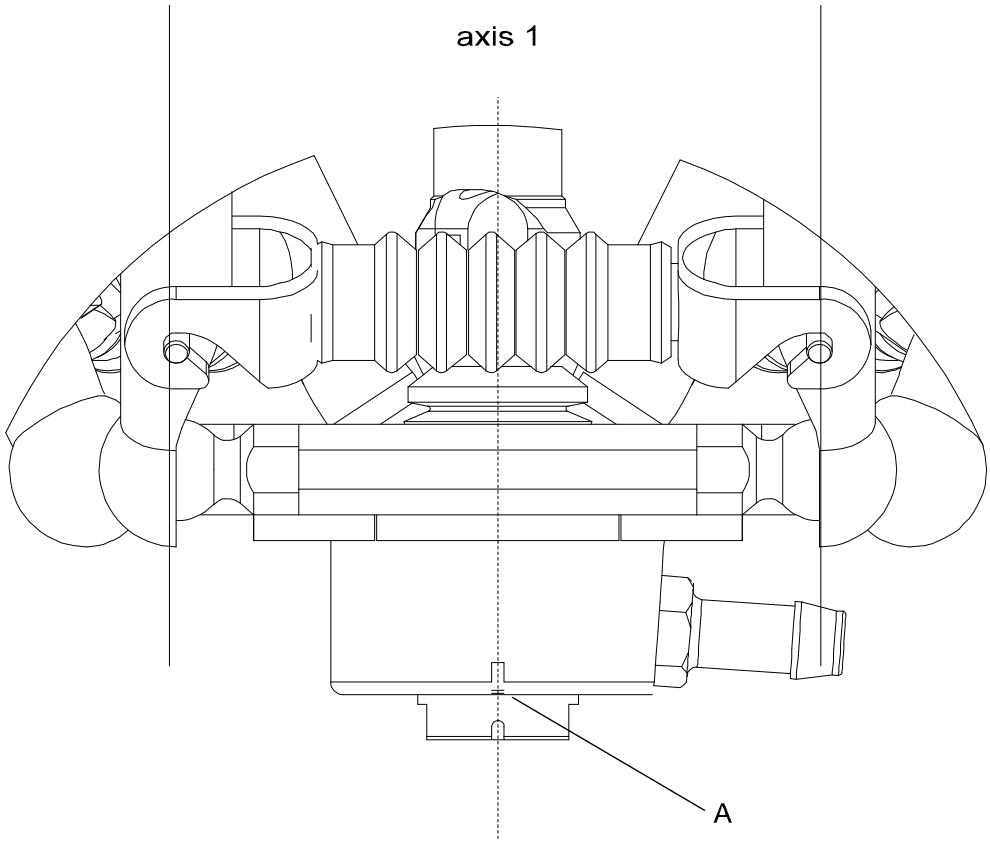
The axes moving directions are shown in *Calibrating axis 1-3 on page 234*.

Note

Calibration should be performed by specially trained personnel.

Location

IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/800, IRB 360 - 1/1600

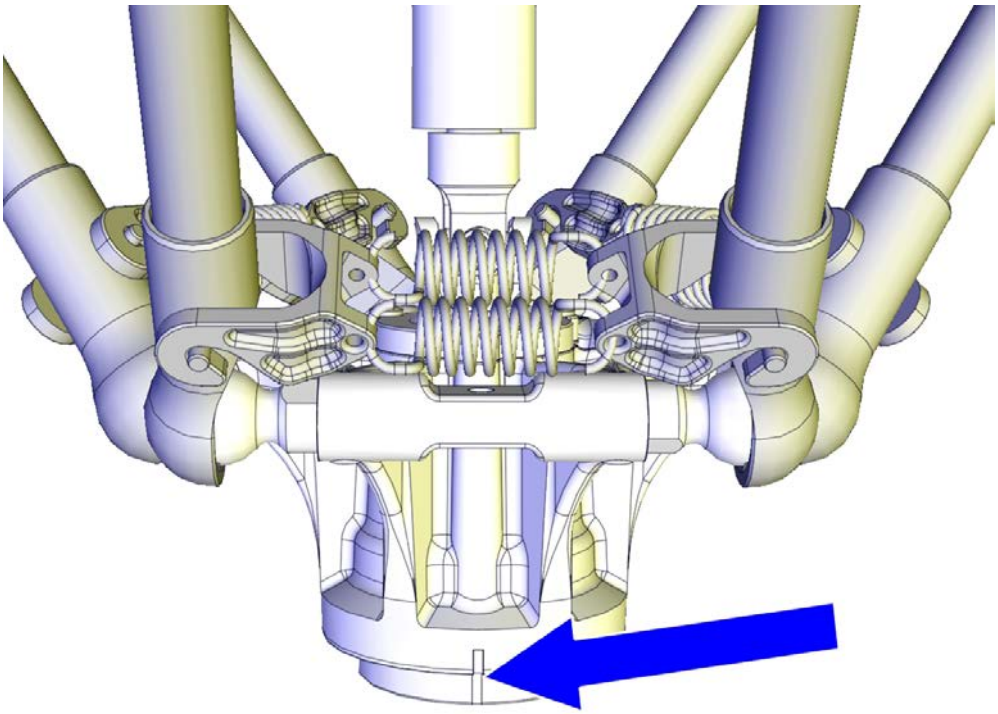


xx0700000629

A	Axis 4 calibration mark

Continues on next page

IRB 360 - 8/1130, IRB 360 - 6/1600



Calibrating axis 4

	Action	Note
1	In manual mode, tap **Jogging**/**Jog** in the ABB menu.	
2	Tap **Motion mode** to choose group of axes to jog.	
3	Tap **Axis 4-6** to jog axis 4.	
4	Jog axis 4 so that the calibration marks are in line.	See figure in *Location on page 238*.
5	Store the resolver value by doing a fine calibration.	Described in section *Fine calibration procedure on FlexPendant on page 240*.
6	Check the position.	Described in section *Checking the synchronization position on page 247*

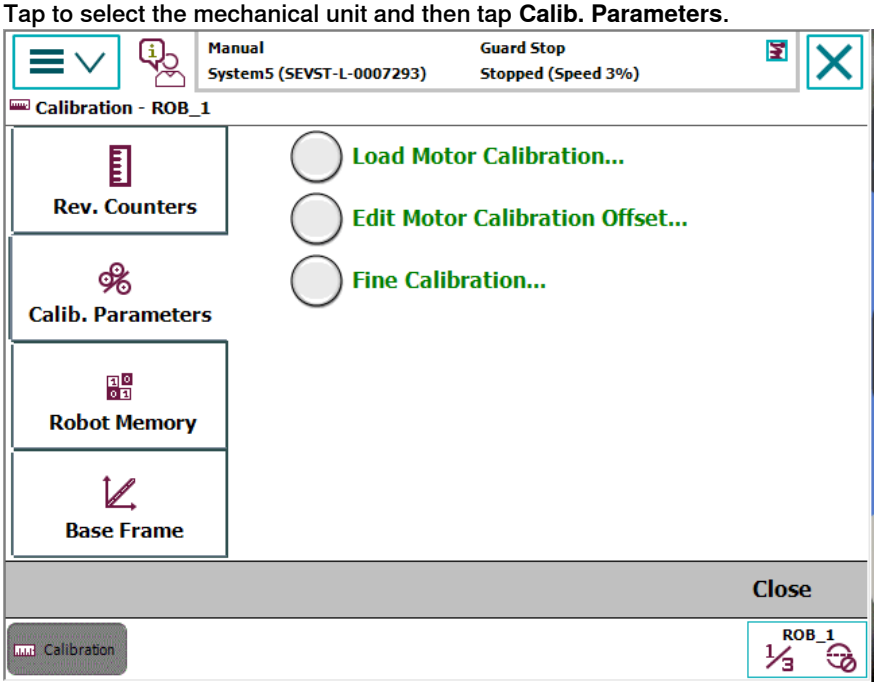
5.7 Fine calibration procedure on FlexPendant

Overview

This section describes how to use the FlexPendant when performing a fine calibration of the robot.

Fine calibration procedure when connecting to IRC5 controller

Use this procedure to fine calibrate using the FlexPendant.

	Action
1	On the **ABB** menu, tap **Calibration**. All mechanical units connected to the system are shown along with their calibration status.
2	Tap to select the mechanical unit and then tap **Calib. Parameters**.  xx1500001762
3	Tap **Fine Calibration...**. A dialog box is displayed, warning that updating the revolution counters may change programmed robot positions: • Tap **Yes** to proceed. • Tap **No** to cancel.
4	Select the check-box for the axis to calibrate.
5	Tap **Calibrate**. A dialog box is displayed, warning that calibration of the selected axes will be changed, which cannot be undone: • Tap **Calibrate** to proceed. • Tap **Cancel** to cancel. Tapping **Calibrate** results in briefly displaying a dialog box, announcing that the calibration process has started. The axis is calibrated and the system returns to the list of available mechanical units.

Continues on next page

Performing the fine calibration procedure when connecting to OmniCore controller

Note

If the calibration status is **Not calibrated**, the fine calibration must be performed before running the axis calibration procedure.

WARNING

Before starting the calibration procedure, you must jog each axis and bring the robot to synchronization position and make sure that all the notches are matched.

	Action	Note
1	On the start screen, tap **Calibrate**.	
2	Select **Calibration** from the menu. The **Mechanical Units** page displays a list of available mechanical units. **Note** This step is required only if you are not already in the **Mechanical Unit** page when you open **Calibrate**. **Note** The **Mechanical Unit** page is displayed only if there are more than one mechanical unit available. Otherwise, the calibration summary page for the available mechanical unit is displayed.	
3	Select the unit that needs to be calibrated from the **Mechanical Unit** list. The calibration summary for the selected mechanical unit is displayed.	
4	On the right pane tap **Calibration Methods**.	
5	Tap **Calibration Parameters**. The calibration parameters are displayed.	
6	Tap **Fine Calibration**. A dialog box is displayed, urging you to use external equipment to perform the actual calibration. Make sure all necessary calibration equipment is fitted for the axis to be calibrated. A warning that performing fine calibration can change programmed robot positions is also displayed: • Tap **Yes** to proceed. • Tap **No** to cancel.	
7	Select the check-box for the current axis/axes to be calibrated.	

Continues on next page

5.7 Fine calibration procedure on FlexPendant
Continued

	Action	Note
8	Tap **Calibrate**. A dialog box is displayed, warning that calibration of the selected axes will be changed, which cannot be undone: • Tap **Calibrate** to proceed. • Tap **Cancel** to cancel. Tapping **Calibrate** results in briefly displaying a dialog box, announcing that the calibration process has started. The axis is calibrated and the system returns to the list of available mechanical units.	
9	Tap **OK**. The fine calibration process is complete.	

5.8 Updating revolution counters

Introduction

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

Step 1 - Manually moving the manipulator to the synchronization position

Use this procedure to manually move the manipulator to the calibration position.

> **Note**
>
> Calibration should be performed by specially trained personnel.

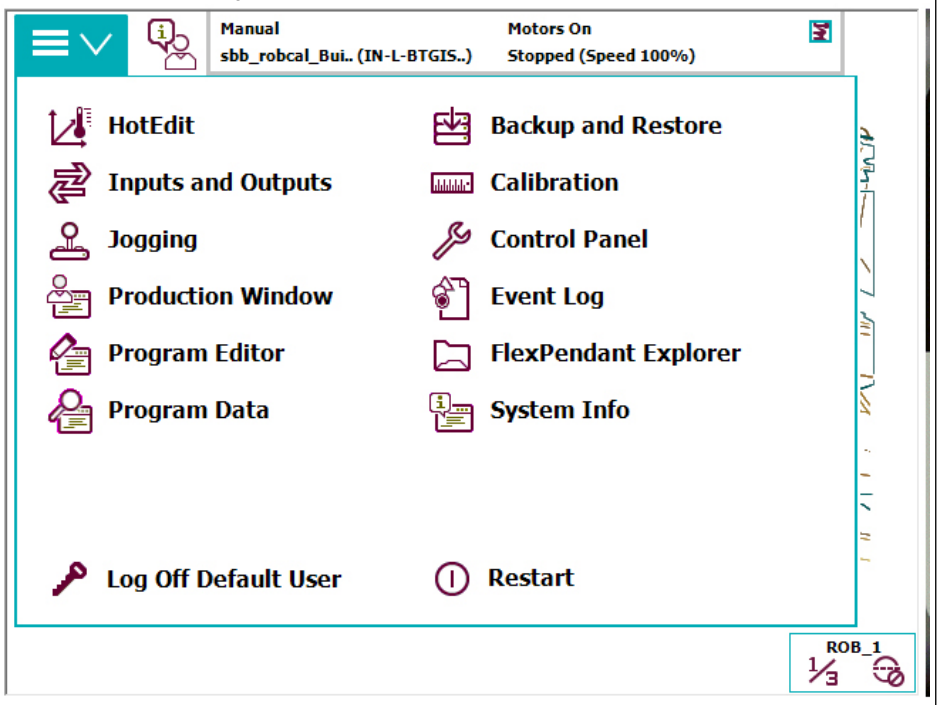
	Action	Note
1	Manually move the manipulator to the calibration position for axes 1-3	See *Calibrating axis 1-3 on page 234*, steps 1 to 6.
2	Manually move the manipulator to the calibration position for axis 4	See *Calibrating axis 4 on page 238*, steps 1 to 4.
3	Continue with step 2, *Step 2 - Updating the revolution counter with the FlexPendant on page 243*.	

Step 2 - Updating the revolution counter with the FlexPendant

When connecting to IRC5 controller

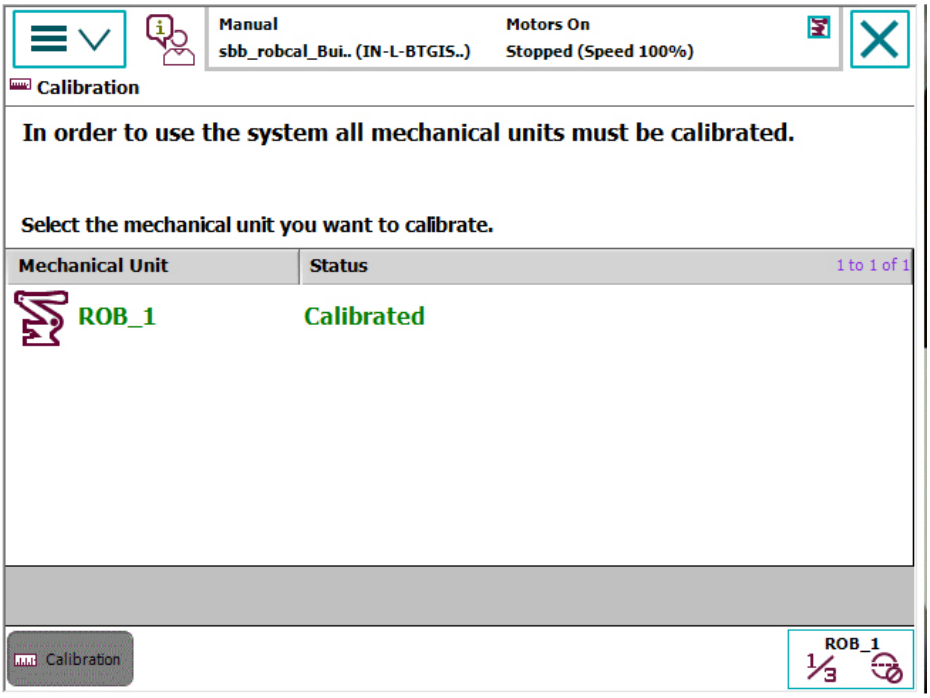
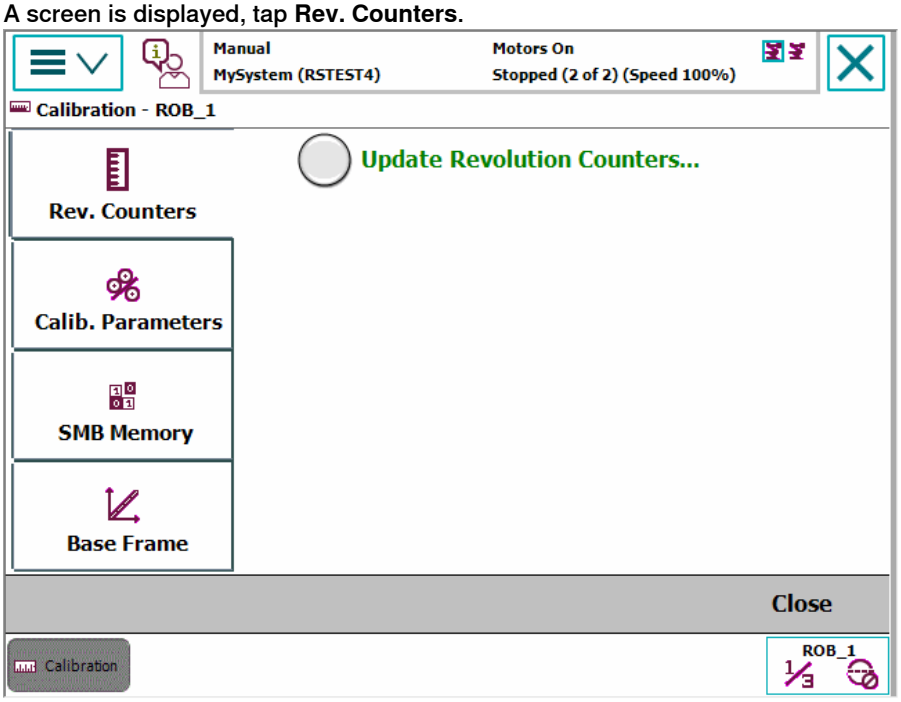
Use this procedure to update the revolution counter with the FlexPendant (IRC5).

	Action
1	On the **ABB** menu, tap **Calibration**.



xx1500000942

Continues on next page

	Action
2	All mechanical units connected to the system are shown with their calibration status. Tap the mechanical unit in question.  xx1500000943
3	A screen is displayed, tap **Rev. Counters**.  en0400000771

Continues on next page

	Action
4	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.
5	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**.
6	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 selected revolution counters and removes the tick from the list of axes.
7	**CAUTION** If a revolution counter is incorrectly updated, it will cause incorrect manipulator positioning, which in turn may cause damage or injury! Check the synchronization position very carefully after each update. See *Checking the synchronization position on page 247*.

When connecting to OmniCore controller

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

	Action
1	On the start screen, tap **Calibrate**.
2	Select **Calibration** from the menu. The **Mechanical Units** page displays a list of available mechanical units. **Note** This step is required only if you are not already in the **Mechanical Unit** page when you open **Calibrate**. **Note** The **Mechanical Unit** page is displayed only if there are more than one mechanical unit available. Otherwise, the calibration summary page for the available mechanical unit is displayed.
3	Select the mechanical unit for which revolution counter need to be updated.
4	The calibration summary page for the selected mechanical unit is displayed. Calibration method used at factory for each axis is shown, as well as calibration method used during last field calibration.
5	Tap **Calibration Methods** on the right pane. The calibration options are displayed.
6	Tap **Revolution Counters**.
7	In the **Selection** column select the axes for which revolution counters need to be updated.

Continues on next page

5.8 Updating revolution counters
Continued

	Action
8	Tap **Update**. 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** and a confirmation window is displayed.
9	Tap **OK**. The revolution counter for the selected axes is updated.
10	**CAUTION** If a revolution counter is incorrectly updated, it will cause incorrect manipulator positioning, which in turn may cause damage or injury! Check the synchronization position very carefully after each update. See *Checking the synchronization position on page 247*.

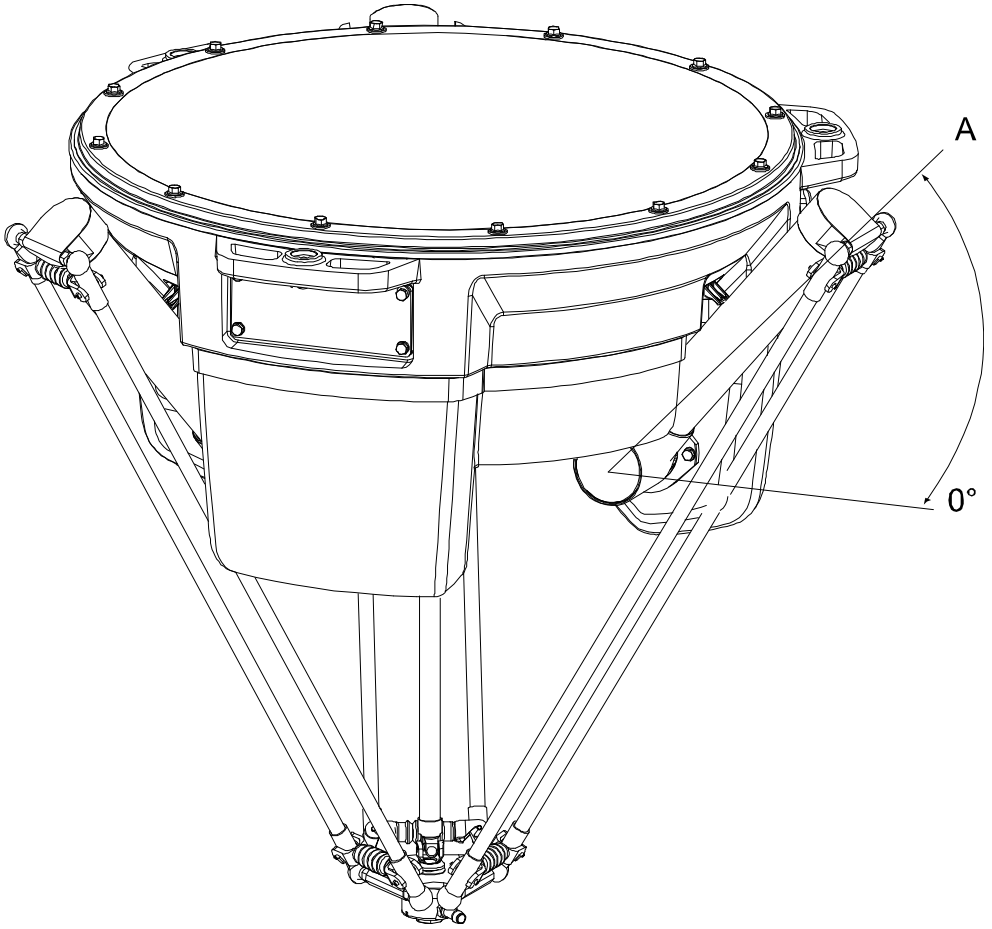
5.9 Checking the synchronization position

Introduction

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

- In manual mode using brake release and move all axis by hand.

Using the jogging window on the FlexPendant



xx0700000627

A	Calibration position for axis 1-3.

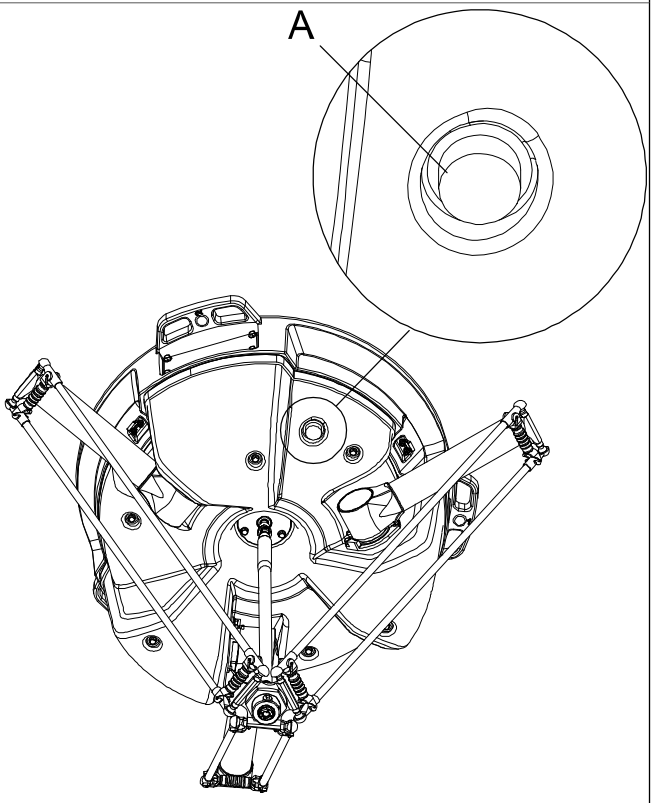
Note

A position where all three axes are in calibration position at the same time (like in figure) is not possible. Check or calibrate one axis a time, then set the calibrated axis horizontal.

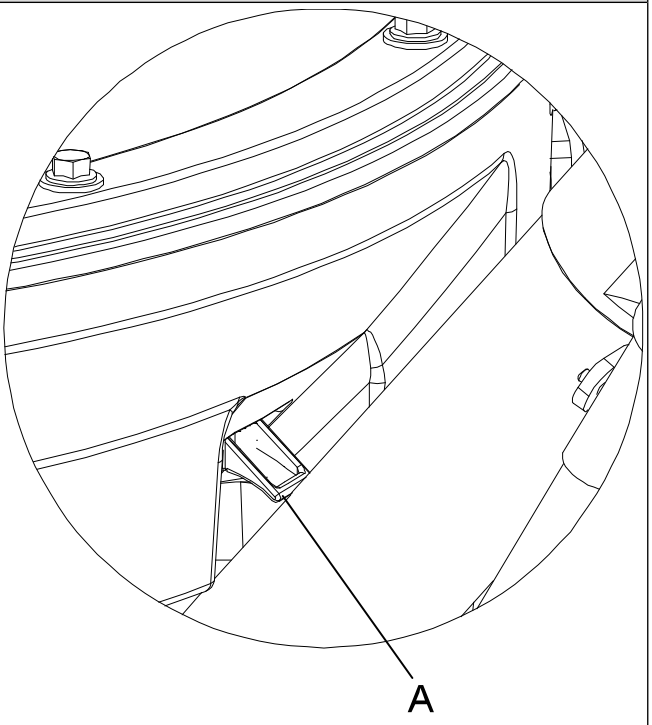
	Action	Note
1	In manual mode, tap **Jogging**/**Jog** in the ABB menu.	Manual mode described in the section *Calibrating axis 1-3 on page 234*.

Continues on next page

5.9 Checking the synchronization position
Continued

	Action	Note
2	Tap **Motion mode** to select group of axes to jog.	
3	Tap to select the axis to jog, axis 1, 2, or 3.	
4	Press the brake release button to release the brakes.	 xx0700000435 A Brake release button

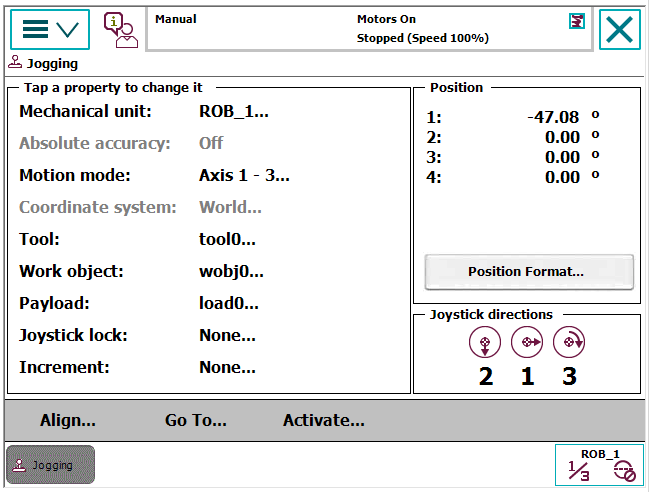
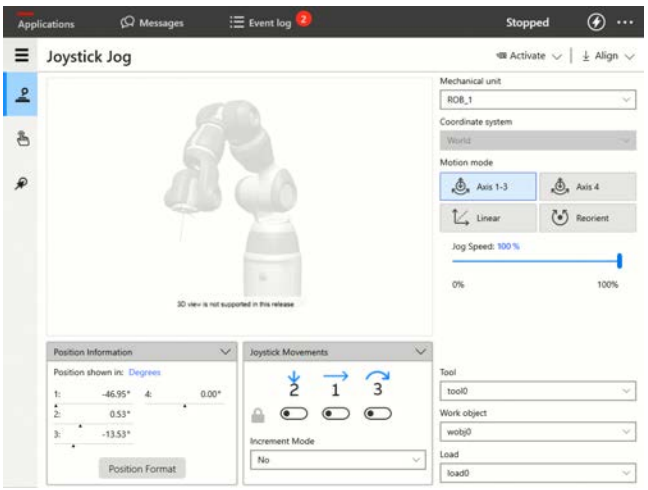
Continues on next page

	Action	Note
5	Push the upper arm very gently against the calibration device. **Note** Always check one axis at a time, starting with axis 1.	 xx0700000626 A Calibration device

Continues on next page

5.9 Checking the synchronization position

Continued

	Action	Note
6	Check the position of axis 1 in jogging window and compare with parameter *Calibration Position*.	 xx0700000628  xx2000002536 The parameter *Calibration Position* (cal_position) is set at the ABB factory, and is a robot specific parameter. For more information about parameter *Calibration Position*, see topic *Motion*, type *Arm* in *Technical reference manual - System parameters*.
7	The value in the jogging window should be within the tolerance ±0.1 °, If the axis position is not ok, calibrate the axis again, see *Ring calibration on page 231*.	
8	If the axis position is ok return to step *4* and check axes 2 and 3.	

6 Decommissioning

6.1 Introduction

Introduction

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

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

General

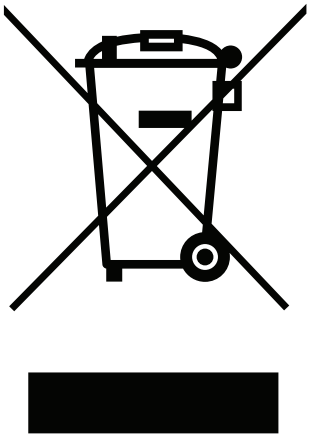
All used grease/oils and dead batteries **must** be disposed of in accordance with the current legislation of the country in which the robot and the control unit are installed.

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

6.2 Environmental information

Symbol

The following symbol indicates that the product must not be disposed of as common garbage. Handle each product according to local regulations for the respective content (see table below).



xx1800000058

Hazardous material

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

Dispose components properly according to local regulations to prevent health or environmental hazards.

Material	Example application
Aluminium	Motor housings, telescopic shafts (standard, WD)
Batteries, Lithium	Serial measurement board
Carbon fiber	Upper arms, tube bars
Cast iron/nodular iron	Gear housings, base box (standard, WD)
Copper	Cables, motors
Neodymium	Brakes, motors
Oil, grease	Gearboxes
Plastic/rubber	Cables, connectors, transmission cover, and so on.
Stainless steel	Base box (WDS), telescopic shafts (WDS)
Steel	Gears, screws, joints, brackets, and so on.

Oil and grease

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

Continues on next page

Also note that:

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

6.3 Scrapping of robot

Important when scrapping the robot

DANGER

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

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

7 Reference information

7.1 Introduction

General

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

7.2 Applicable standards

Note

The listed standards are valid at the time of the release of this document. Phased out or replaced standards are removed from the list when needed.

General

The product is designed in accordance with ISO 10218-1:2011, Robots for industrial environments - Safety requirements -Part 1 Robots, and applicable parts in the normative references, as referred to from ISO 10218-1:2011. In case of deviations from ISO 10218-1:2011, these are listed in the declaration of incorporation which is part of the product delivery.

Normative standards as referred to from ISO 10218-1

Standard	Description
ISO 9283:1998	Manipulating industrial robots - Performance criteria and related test methods
ISO 10218-2	Robots and robotic devices - Safety requirements for industrial robots - Part 2: Robot systems and integration
ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
ISO 13849-1:2006	Safety of machinery - Safety related parts of control systems - Part 1: General principles for design
ISO 13850	Safety of machinery - Emergency stop - Principles for design
IEC 60204-1:2005	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
IEC 62061:2005	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems

Region specific standards and regulations

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
ANSI/UL 1740	Safety standard for robots and robotic equipment
CAN/CSA Z 434-14	Industrial robots and robot Systems - General safety requirements

Other standards used in design

Standard	Description
ISO 9787:2013	Robots and robotic devices -- Coordinate systems and motion nomenclatures
IEC 61000-6-2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
IEC 61000-6-4 (option 129-1)	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments

Continues on next page

Standard	Description
ISO 13732-1:2008	Ergonomics of the thermal environment - Part 1
IEC 60974-1:2012[i]	Arc welding equipment - Part 1: Welding power sources
IEC 60974-10:2014[i]	Arc welding equipment - Part 10: EMC requirements
ISO 14644-1:2015[ii]	Classification of air cleanliness
IEC 60529:1989 + A2:2013	Degrees of protection provided by enclosures (IP code)

i Only valid for arc welding robots. Replaces IEC 61000-6-4 for arc welding robots.
ii Only robots with protection Clean Room.

7.3 Unit conversion

Converter table

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

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

7.4 Weight specifications

Definition

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

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

Example

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

	Action	Note
	CAUTION The arm weighs 25 kg. All lifting accessories used must be sized accordingly.	

7.5 Standard toolkit

General

All service (repairs, maintenance, and installation) procedures contains lists of tools required to perform the specified activity.

All special tools required are listed directly in the procedures while all the tools that are considered standard are gathered in the standard toolkit and defined in the following table.

This way, the tools required are the sum of the standard toolkit and any tools listed in the instruction.

Contents, standard toolkit

Qty	Tool
1	Ring-open-end spanner 7-35mm
1	Socket head cap 3, 5, 8 mm
1	Torque wrench 4-33 Nm
1	Small screwdriver
1	Plastic mallet
1	Ratchet head for torque wrench 1/2
1	Cut-off pliers
1	90° angled bit holder
	Spirit level

7.6 Special tools

General

All service instructions contain lists of tools required to perform the specified activity. The required tools are a sum of standard tools, defined in the section *Standard toolkit on page 260*, and of special tools, listed directly in the instructions and also gathered in this section.

Special tools

The following table specifies the special tools required during service procedures. The tools are also specified directly in concerned procedures for repair.

Description	Art.no.	Robot variant
Press tool for bearing (Drifter for mounting bearing rings.)	3HAC4184-1	IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/800, IRB 360 - 1/1600
Press tool (Dolly for joint socket when inserting new bearing rings.)	3HAC4182-1	IRB 360 - 1/1130, IRB 360 - 3/1130, IRB 360 - 1/800, IRB 360 - 1/1600
Pliers for parallel arms	3HAC6194-1	All variants.
Heat gun (Required if the moveable plate is stainless, see *Removal on page 190*.)	-	-

Note

The stainless version is not available for the IRB 360 used with OmniCore controllers.

7.7 Lifting accessories and lifting instructions

General

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

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

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

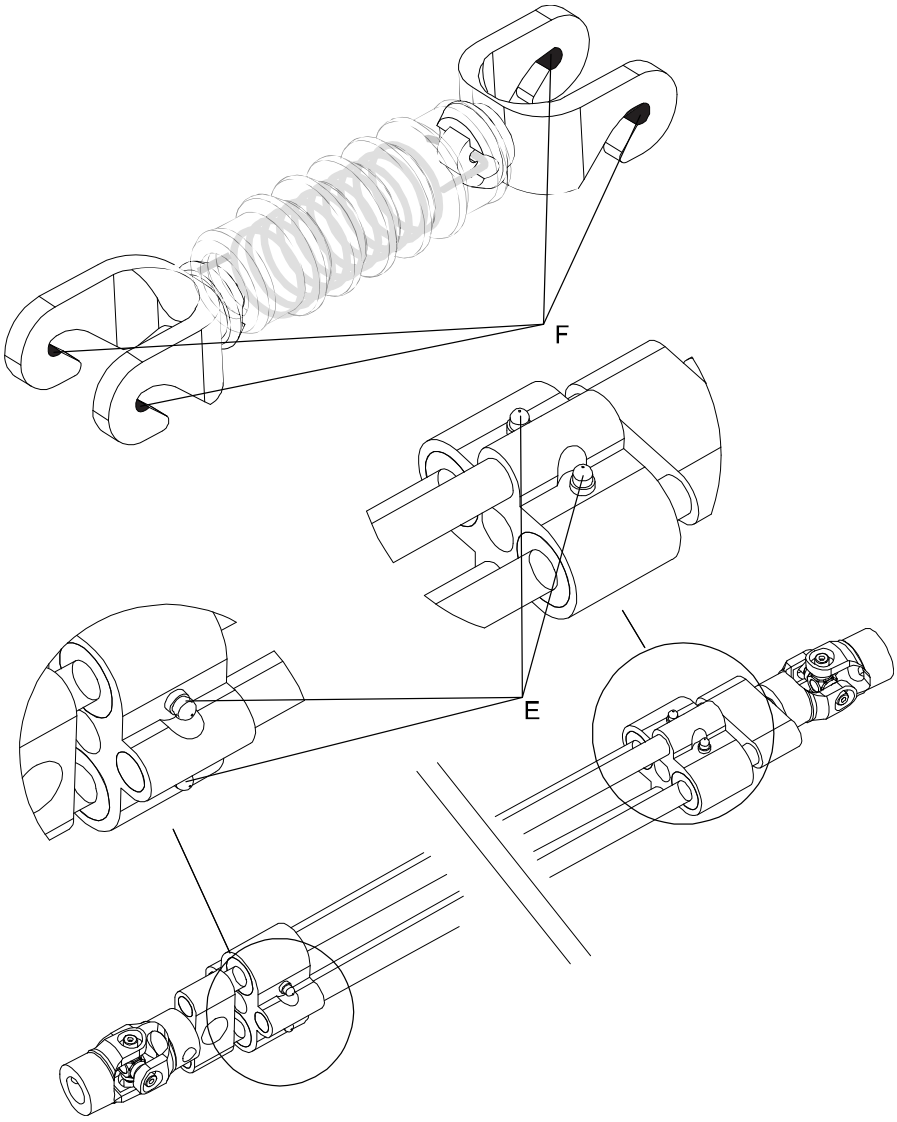
7.8 Grease specification

Oil in gearboxes

The types and volumes of oil in the gearboxes are defined in the *Technical reference manual - Lubrication in gearboxes - 3HAC042927-001*.

This is detailed in section *Type of lubrication in gearboxes on page 127*.

Grease in robot



xx0700000725

Pos.	For:	Type	Spare part number	Amount
E	Telescopic shaft WDS	Food accepted FM 222	3HAC042560-001	
F	Spring units	Food accepted FM 222	3HAC042560-001	

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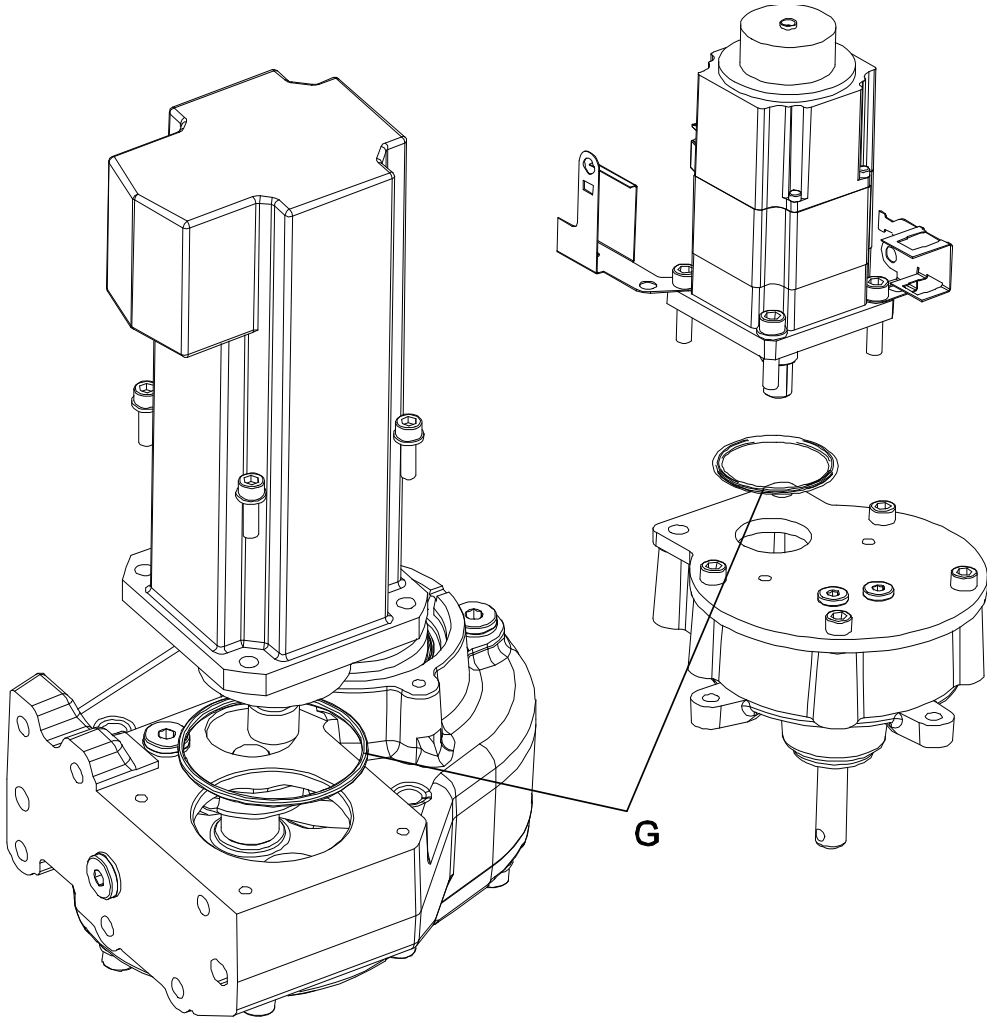
7.8 Grease specification
Continued

Grease on sealings



xx0700000706

Pos.	For:	Type	Spare part number	Amount
G	O-rings in gear units	Food accepted FM 222	3HAC042560-001	

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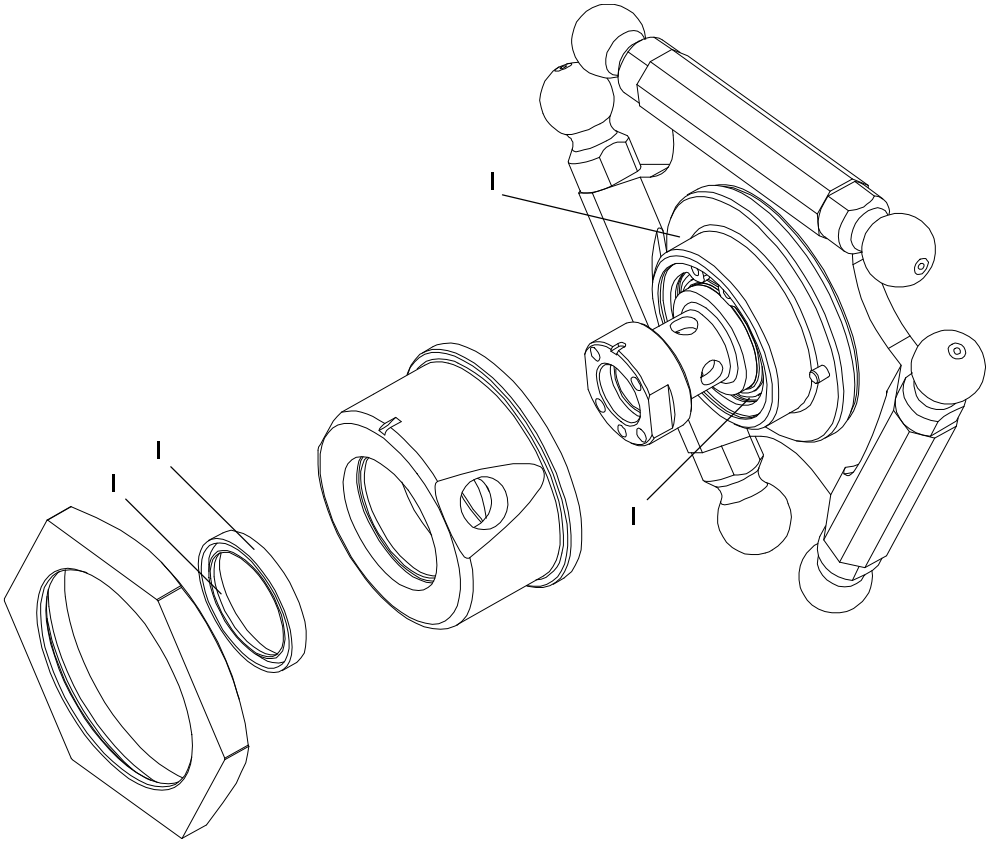

xx0800000003

Pos.	For:	Type	Spare part number	Amount
I	Grease in swivel	Food accepted FM 222	3HAC042560-001	

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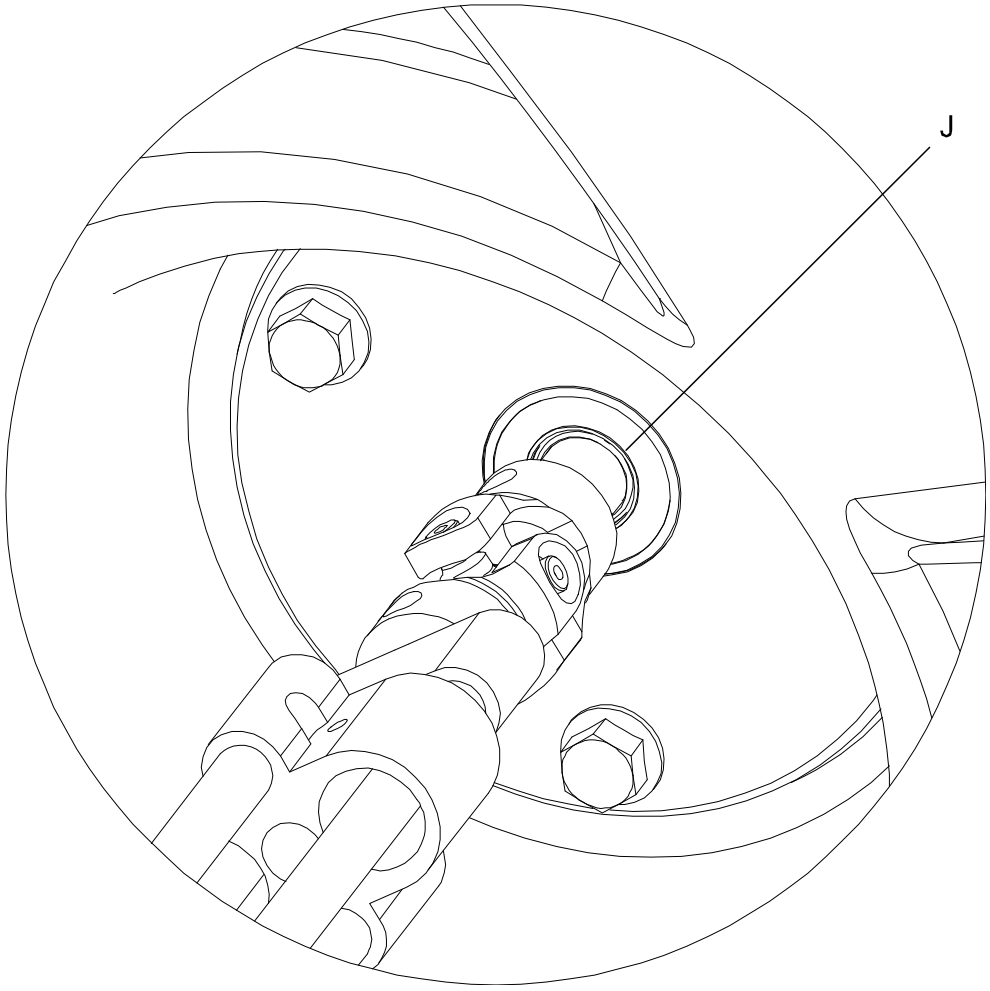
7.8 Grease specification
Continued



xx0800000004

Pos.	For:	Type	Spare part number	Amount
J	Grease in ax 4	Food accepted FM 222	3HAC042560-001	

Grease on bearing rings

Note

Only lubricate bearing rings 3HAC2091-1. Bearing rings 3HAC028087-001 must not be lubricated!

Read about the difference in *Different versions of bearing rings require different maintenance procedures on page 106*.

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Required equipment	Article number	Note
Grease	-	Required for non-maintenance free bearing rings. • FM 222 (was Mobilgrease FM 102 or Optimol Obeen UF 2) See *Different versions of bearing rings require different maintenance procedures on page 106*.

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8 Spare part lists

8.1 Spare part lists and illustrations

Location

Spare parts and exploded views are not included in the manual but delivered as a separate document for registered users on myABB Business Portal, *www.abb.com/myABB*.

Tip

All documents can be found via myABB Business Portal, *www.abb.com/myABB*.

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