



Product manual

IRBT 4004/6004/7004

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Product manual

IRBT 4004

IRBT 6004

IRBT 7004

IRC5

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Original instructions.

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Overview of this manual

About this manual

This manual contains instructions for:

- mechanical and electrical installation of the track motion
- maintenance of the track motion
- mechanical and electrical repair of the track motion.

Usage

This manual should be used during:

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

Who should read this manual?

This manual is intended for:

- installation personnel
- maintenance personnel
- repair personnel.

Prerequisites

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

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

Organization of chapters

The manual is organized in the following chapters:

Chapter	Contents
Safety, service	Safety information that must be read through before performing any installation or service work on robot. Contains general safety aspects as well as more specific information on how to avoid personal injuries and damage to the product.
Installation and commissioning	Required information about lifting and installation of the track motion and installation of cabling. Information about how to get the system running, including information about some of the important parameters to set.
Maintenance	Step-by-step procedures that describe how to perform maintenance of the track motion. Based on a maintenance schedule that may be used to plan periodical maintenance.
Repair	Step-by-step procedures that describe how to perform repair activities of the track motion. Based on available spare parts.
Calibration	Information about calibration of the system.
Decommissioning	Environmental information about the track motion and its components.

Continues on next page

Overview of this manual

Continued

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

References

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

Document name	Document ID
<i>Product manual, spare parts - IRBT 4004/6004/7004</i>	3HAC042864-001
<i>Product specification - IRBT 4004/6004/7004</i>	3HEA802965-001
<i>Operating manual - General safety information</i> ⁱ	3HAC031045-001
<i>Product specification - IRB 4400</i>	3HAC042478-001
<i>Product specification - IRB 4600</i>	3HAC032885-001
<i>Product specification - IRB 6600/6650</i>	3HAC023933-001
<i>Product specification - IRB 6660</i>	3HAC028207-001
<i>Product specification - IRB 7600</i>	3HAC023934-001
<i>Product manual - IRC5</i> IRC5 with main computer DSQC 639.	3HAC021313-001
<i>Product manual - IRC5</i> IRC5 with main computer DSQC1000.	3HAC047136-001
<i>Operating manual - IRC5 with FlexPendant</i>	3HAC050941-001
<i>Operating manual - Calibration Pendulum</i>	3HAC16578-1
<i>Operating manual - Service Information System</i>	3HAC050944-001
<i>Application manual - Additional axes and stand alone controller</i>	3HAC051016-001
<i>Technical reference manual - Lubrication in gearboxes</i>	3HAC042927-001
<i>Technical reference manual - System parameters</i>	3HAC050948-001
<i>Operating instructions - Centralized lubrication pump 203 DC (Lincoln Quicklub)</i>	2.1L-38002-I10
<i>Operating instructions - Progressive metering devices, model SSV & SSV M (Lincoln Quicklub)</i>	2.2L-20001-I11
<i>Operating instructions - Printed circuit board for pump 203 (Lincoln Quicklub)</i>	2.6L-28006-B10

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

Revisions

Revision	Description
-	First edition.
A	Configurations for 6620 and 6640 added. Section Repair updated
B	New Guide rail added with hole cc.105 mm.

Continues on next page

Revision	Description
	New lubrication instruction for the linear guides. New figures in the instruction Change Track Motion cable harness.
C	Configurations for IRB 4600 added. Section Maintenance schedule, interval for replacement of battery pack changed.
D	<p>Content updated in chapter/section:</p> <ul style="list-style-type: none"> • Decommissioning chapter added. • Clarification about loads. <p>The chapter Safety updated with:</p> <ul style="list-style-type: none"> • Updated safety signal graphics for the levels Danger and Warning. • New safety labels on the manipulators.
E	<p>This revision includes following updates/corrections:</p> <ul style="list-style-type: none"> • Information about maximum permitted loads corrected, see Foundation on page 86. • Added the section Defining base frame on page 273. • Tables with cable information corrected and edited, see Flexible cables in the Spare parts. • Track motion IRT 104 is removed throughout the complete manual. • Information about film of oil to be wiped off prior to installation is removed, see Cleaning. • Options Zone division and Position switches are removed throughout the complete manual. • IRB 6600 removed from load table and force data for emergency stop updated for all robots, see Forces on page 59. • Expansion shell bolts, for securing the track motion to the floor, is removed throughout the manual. • Changed titles in sections, Connections on page 120. • Added lubricants, Required equipment on page 145. • Added calibration tool for mirrored layouts, Extra toolkit on page 288. • Added new illustrations for calibration, see Fine calibration on page 269. • Removed documentation for LINCOLN QUICKLUB® from Product manual, see LINCOLN QUICKLUB® on page 277.
F	<p>This revision includes following updates/corrections:</p> <ul style="list-style-type: none"> • Restructuring work throughout the manual which means that some sections might have been moved to different chapters, renamed etc. • The spare parts are moved from this product manual to a separate manual, <i>Product manual, spare parts - IRBT 4004/6004/7004</i>. • Changed oil to cable grease in section Replacing the cable harness on page 234. • Changed the cable layout in the cable chain, see Illustration, refitting the cable chain on page 240. Also added information in the instruction when refitting cables that power and signal cables can not be placed in the same tray in the cable chain and that the cables should be strapped individually, see Refitting the cable chain on page 249. • Added a warning about bolts that are fastened to the end of the guide rails to serve as temporary stops, when the track is delivered as divided sections, see Assembling the sections of the track motion IRBT 4004/6004/7004 (Longer than 9m) on page 92.

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Overview of this manual

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Revision	Description
	<ul style="list-style-type: none">Some general tightening torques have been changed/added, see updated values in Screw joints on page 283.The calibration tool is reconstructed. Instructions for how to use the new tool are updated, see Measuring reference values for zero position on page 268 and Fine calibration on page 269. New article number for the tool, see Special tools on page 288.Diameter of a hole in the stand has changed from 24 mm to 25 mm, see Hole configuration on page 88.Changes made in the instruction for replacing the gearbox, for example the gear wheel replacement is now added, information about Loctite for the gear wheel protection shield screws is added and the type of oil in gearbox is changed, see Replacing the gearbox (including the motor) and the gear wheel on page 172.Added information about factory settings of automatic lubrication, see Automatic lubrication on page 136.Updated figures that show position of connectors on controller, see Connectors on Drive Module on page 123.Added WARNING - Safety risks during handling of batteries on page 53.
G	This revision includes following updates/corrections: <ul style="list-style-type: none">More detailed information about how to strap and secure cables, throughout the manual.Instruction for test run is added to the procedure of replacing cabling, see Test run on page 245.Several corrections and completions are added to the section for technical data and measurements, regarding required space for installation etc., see Technical data for the track motion on page 74.Measurement is added to the figure Dimension in section Hole configuration on page 88.Added instructions for inspection of drive motor, see Inspecting the drive motor.Changed the illustrations for cable layout in the cable chain, see Illustration, refitting the cable chain on page 240.
H	This revision includes following updates/corrections: <ul style="list-style-type: none">Corrected description for maximum floor loads, see Operating requirements on page 58, and Hole configuration on page 88.Measurement added to figure in section Required space for installation of single carriage track (standard) on page 75.Measurement for the width of the track motion changed in figure, section Positioning the stand on page 95.Measurement for the height of the track motion changed in figure, section Dimensions on page 79.An attachment plate for cables is added to the track motion. See figures in sections Track motion IRBT 4004/6004/7004 overview on page 90, Adjusting cables and covers on page 124, on page ? etc.The maintenance schedule is updated. Following scheduled activities are removed: inspection of drive motor and electrical operation, replacement of gearbox and motor. Following scheduled activities are added: cleaning of linear guides, inspection of linear guides, inspection of cable chain content, replacement of ball elements and gear wheel.Position numbers of figure in section Removing the cable chain on page 236 are corrected.Note is removed in Forces on page 59.

Continues on next page

Revision	Description
	<ul style="list-style-type: none"> Information about expansion-shell anchor bolts is removed, section Screws for fastening manipulator to base on page 89. New motor is added throughout the manual, see for example section Two versions of the track motion motor on page 183. All information about gearbox oil is moved to the manual Technical reference manual - Lubrication in gearboxes. Updated the drawing of the shims used for aligning the track geometrically, see Geometric alignment of track motion IRBT 4004/6004/7004 on page 96. The wiring diagrams are removed from the manual and are now only found in the circuit diagrams, see references in Circuit diagrams on page 293. A new SMB unit and battery is introduced, with longer battery lifetime.
J	<p>This revision includes following updates/corrections:</p> <ul style="list-style-type: none"> Minor corrections made throughout the manual. Reference to a circuit diagram that is valid for motor Type A is added, see Circuit diagrams on page 293. Information regarding both mechanical and electrical installation, brake release etc. is added, when changing a non-Type A motor to a Type A motor, see Replacing the motor on page 182 and Changing the track motion motor to Type A on page 194. Inspection of oil brush is added to the maintenance schedule, see Maintenance schedule on page 139. A procedure for how to inspect the oil brush is also added to the manual, see Inspecting the brush on page 158. Additional information about alignment of the track is added, see Geometric alignment of track motion IRBT 4004/6004/7004 on page 96. New section about storing the cable chain is added, see Storing the cable chain on page 63. Replacement of glide shoes is added to the maintenance schedule, see Maintenance schedule on page 139. Cable chain Murrplastik is added throughout the manual. New sections added to the manual: <ul style="list-style-type: none"> - Replacing the cable chain on page 247 - Lifting and fitting the cable chain Murrplastik on page 115 - Replacing the side links, glide shoes and covers on page 254 - Replacing the cables on page 258
K	<p>This revision includes following updates/corrections:</p> <ul style="list-style-type: none"> Illustrations are updated. Holes for guide pins are removed in the foundation. Illustration and formula for required space are changed. Instruction for replacing the SMB unit is added.
L	<p>This revision includes following updates/corrections:</p> <ul style="list-style-type: none"> Illustration and text are updated in section Replacing the gearbox (including the motor) and the gear wheel on page 172. Minor corrections.
M	<p>This revision includes following updates/corrections:</p> <ul style="list-style-type: none"> Added note about fatigue calculations to Force table, see Forces on page 59. Updated measurement of position A for travel lengths of single and double carriage, see Travel length on page 74. Updated length of Murrplastik cable chain, see Formula for single carriage track on page 76.

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Overview of this manual

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Revision	Description
	<ul style="list-style-type: none">Updated the software installation chapter, see Software installation on page 126.Updated dimension drawings of the carriage table, IRBT 6004 and IRBT 7004, see Measures of the carriage table on page 82.Added maximum floor loads for IRB 6700, see Operating requirements on page 58.Added expected component life for the linear bearings on IRBT 6004/IRB 6700, see Expected component life on page 142.
N	This revision includes following updates/corrections: <ul style="list-style-type: none">Measures for required space for single carriage track adjusted
P	This revision includes following updates/corrections: <ul style="list-style-type: none">Maintenance activity added; Testing the manual feed for Auto lubricationGrease name change (Longtime PD 2 → Tribol GR 100-2 PD)Information about orienting IRB 7600 and pedestal added. See Orienting manipulator IRB7600 and pedestal on page 102A note with a reference to special tools section in "Replacement of ball elements" addedStep "Remove cylindrical pin" in "Replacement of ball elements" addedNew illustration with protection plate on Murrplastic cable chainSection Connections is updated.
Q	Published in release R16.2. The following updates are done in this revision: <ul style="list-style-type: none">Added information about screw joint for connecting plate, see Assembling the cover and side plates on page 103.Added information about installation order of cable chain covers, see Installation order of covers on page 257.Added information about base frame configuration, see Base frame configuration on page 133.Added information about what repair measures to take at a breakdown of ball elements and linear guides, see Repair actions at breakdown on page 213 and Repair actions at breakdown on page 209.Added information about repair activities regarding hydraulic hoses and the grease pump, see Replacing the hydraulic hose and repair of the grease pump on page 265.Added information about maximum inserted thread of grease nipple and importance of verification of lubricant coming out from lubrication tube during refitting, in Replacing the ball elements on page 213. The section is also restructured due to a new version of ball element, that does not require that the ball element bracket is removed for replacement of ball elements. The section is also made valid for IRBT 4004 and some information is added based on assembly instructions in production.
R	Published in release R17.1. The following updates are done in this revision: <ul style="list-style-type: none">Information regarding "Castrol Longtime PD1" removed.

Product documentation, IRC5

Categories for user documentation from ABB Robotics

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

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

Product manuals

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

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

Technical reference manuals

The technical reference manuals describe reference information for robotics products.

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

Continues on next page

Application manuals

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

An application manual generally contains information about:

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

Operating manuals

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

The group of manuals includes (among others):

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

How to read the product manual

Reading the procedures

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

References to figures

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

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

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

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

References to required equipment

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

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

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

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

Safety information

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

Read more in the chapter [Safety on page 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.

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1 Safety

1.1 Introduction to safety information

Overview

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

- General safety aspects, important to attend to before performing any service work on the robot. These are applicable for all service work and are found in [General safety information on page 20](#).
- Safety signals and symbols shown in the manual and on the robot, warning for different types of dangers, are found in [Safety signals and symbols on page 41](#).
- Specific safety information, pointed out in the procedures. How to avoid and eliminate the danger is either described directly in the procedure, or in specific instructions in the section [Safety related instructions on page 49](#).

1 Safety

1.2.1 Introduction to general safety information

1.2 General safety information

1.2.1 Introduction to general safety information

Definitions

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

Sections

The general safety information is divided into the following sections.

Section	Examples of content
<i>Safety in the manipulator system on page 21</i>	This section describes the following: <ul style="list-style-type: none">• safety, service• limitation of liability• related information
<i>Protective stop and emergency stop on page 23</i>	This section describes protective stop and emergency stop.
<i>Safety risks on page 24</i>	This section lists dangers relevant when working with the product. The dangers are split into different categories. <ul style="list-style-type: none">• safety risks during installation or service• risks associated with live electrical parts
<i>Safety actions on page 33</i>	This section describes actions which may be taken to remedy or avoid dangers. <ul style="list-style-type: none">• fire extinguishing• safe use of the teach pendant or jogging device

1.2.2 Safety in the manipulator system

Validity and responsibility

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

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

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

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

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

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

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

Connection of external safety devices

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

Limitation of liability

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

Related information

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

Continues on next page

1 Safety

1.2.2 Safety in the manipulator system

Continued

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

1.2.3 Protective stop and emergency stop

Overview

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

1 Safety

1.2.4.1 Safety risks during installation and service work on robots

1.2.4 Safety risks

1.2.4.1 Safety risks during installation and service work on robots

Overview

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

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

General risks during installation and service

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

Spare parts and special equipment

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

Personal protective equipment

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

Nation/region specific regulations

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

Non-voltage related risks

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

Continues on next page

1.2.4.1 Safety risks during installation and service work on robots

Continued

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

To be observed by the supplier of the complete system

When integrating the robot with external devices and machines:

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

Complete robot

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

Continues on next page

1 Safety

1.2.4.1 Safety risks during installation and service work on robots

Continued

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

Cabling

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

Gearboxes and motors

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

1.2.4.2 CAUTION - Hot parts may cause burns!

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

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

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

Elimination

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

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

1 Safety

1.2.4.3 Safety risks related to tools/work pieces

1.2.4.3 Safety risks related to tools/work pieces

Safe handling

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

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

Safe design

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

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



CAUTION

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

1.2.4.4 Safety risks related to pneumatic/hydraulic systems

General

Special safety regulations apply to pneumatic and hydraulic systems.



Note

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

Residual energy

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

Safe design

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

1 Safety

1.2.4.5 Safety risks during operational disturbances

General

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

Qualified personnel

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

Extraordinary risks

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

1.2.4.6 Risks associated with live electric parts

Voltage related risks, general

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

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

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

All work must be performed:

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

Voltage related risks, IRC5 controller

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

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

Continues on next page

1 Safety

1.2.4.6 Risks associated with live electric parts

Continued

Voltage related risks, robot

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

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

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

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

1.2.5 Safety actions

1.2.5.1 Safety fence dimensions

General

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

Dimensioning

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

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

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

1 Safety

1.2.5.2 Fire extinguishing



Note

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

1.2.5.3 Emergency release of the robot arm

Description

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

How to release the brakes is detailed in the section:

- *Manually releasing the brakes* in the product manual for the robot.

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

Increased injury

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



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 arm.

1 Safety

1.2.5.4 Brake testing

1.2.5.4 Brake testing

When to test

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

How to test

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

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

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

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



Note

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

1 Safety

1.2.5.6 Safe use of the jogging device

1.2.5.6 Safe use of the jogging device

Three-position enabling device

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

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



Note

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

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

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

Hold-to-run function

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

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

1.2.5.7 Work inside the working range of the robot



WARNING

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

- The operating mode selector on the controller must be in the manual mode position to render the three-position enabling device operational and to block operation from a computer link or remote control panel.
- The maximum speed of the robot is limited to 250 mm/s when the operating mode selector is in the position *Manual mode with reduced speed*. This should be the normal position when entering the working space.
The position *Manual mode with full speed (100%)* may only be used by trained personnel who are aware of the risks that this entails. *Manual mode with full speed (100%)* is not available in USA or Canada.
- Pay attention to the rotating axes of the robot. Keep away from axes to not get entangled with hair or clothing. Also, be aware of any danger that may be caused by rotating tools or other devices mounted on the robot or inside the cell.
- Test the motor brake on each axis, according to the section [Brake testing on page 36](#).
- To prevent anyone else from taking control of the robot, always put a safety lock on the cell door and bring the three-position enabling device with you when entering the working space.



WARNING

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

1 Safety

1.2.5.8 Signal lamp (optional)

1.2.5.8 Signal lamp (optional)

Description

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

Function

The lamp is active in MOTORS ON mode.

Further information

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

1.3 Safety signals and symbols

1.3.1 Safety signals in the manual

Introduction to safety signals

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

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

Danger levels

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

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

Continues on next page

1 Safety

1.3.1 Safety signals in the manual

Continued

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

1.3.2 Safety symbols on product labels

Introduction to labels

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

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

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



Note

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

Types of labels

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

The safety labels are language independent, they only use graphics. See [Symbols on safety labels on page 43](#).

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

Symbols on safety labels

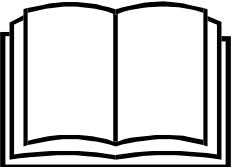
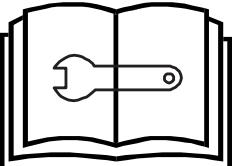
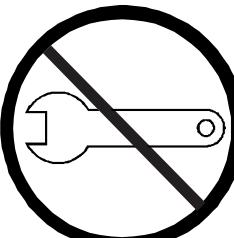
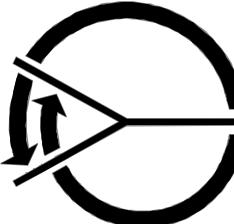
Symbol	Description
	Warning! Warns that an accident <i>may</i> occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion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

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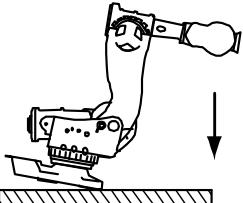
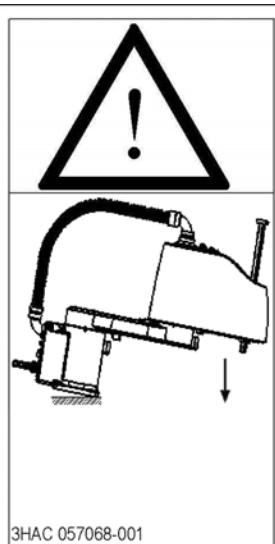
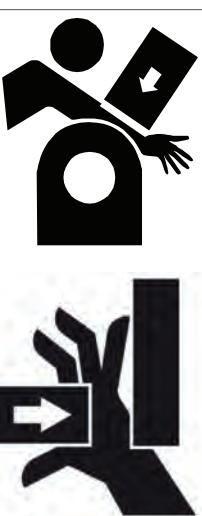
1 Safety

1.3.2 Safety symbols on product labels

Continued

Symbol	Description
 xx0900000813	See user documentation Read user documentation for details. Which manual to read is defined by the symbol: <ul style="list-style-type: none">• No text: <i>Product manual</i>.• EPS: <i>Application manual - Electronic Position Switches</i>.
 xx0900000816	Before disassemble, 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

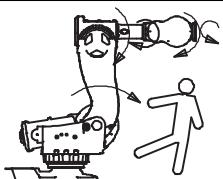
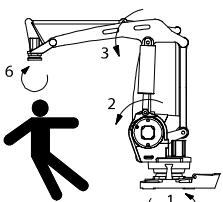
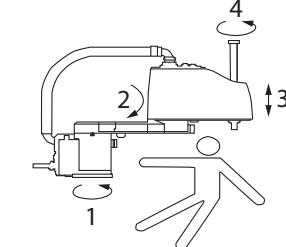
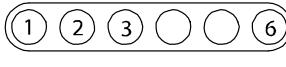
Symbol	Description
 xx0900000810	Tip risk when loosening bolts The robot can tip over if the bolts are not securely fastened.
 3HAC 057068-001	
 xx0900000817	Crush Risk of crush injuries.
 xx0900000818	Heat Risk of heat that can cause burns.

Continues on next page

1 Safety

1.3.2 Safety symbols on product labels

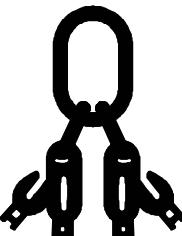
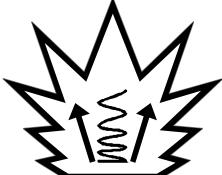
Continued

Symbol	Description
 xx0900000819	Moving robot The robot can move unexpectedly.
 xx1000001141	
 xx1500002616	
 xx0900000820	Brake release buttons
 xx1000001140	
 xx0900000821	Lifting bolt

Continues on next page

1.3.2 Safety symbols on product labels

Continued

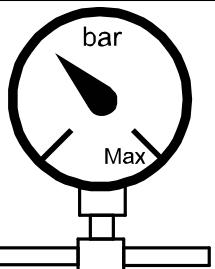
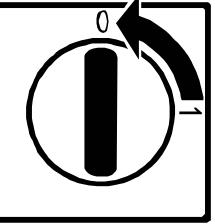
Symbol	Description
 xx1000001242	Chain sling with shortener
 xx0900000822	Lifting of robot
 xx0900000823	Oil Can be used in combination with prohibition if oil is not allowed.
 xx0900000824	Mechanical stop
 xx1000001144	No mechanical stop
 xx0900000825	Stored energy Warns that this part contains stored energy. Used in combination with <i>Do not disassemble</i> symbol.

Continues on next page

1 Safety

1.3.2 Safety symbols on product labels

Continued

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

1.4.1 DANGER - Moving robots are potentially lethal!

1.4 Safety related instructions

1.4.1 DANGER - Moving robots are potentially lethal!

Description

Any moving robot is a potentially lethal machine.

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

Elimination

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

1 Safety

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

Description

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

Elimination

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



DANGER

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

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

Collision risks



CAUTION

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

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

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

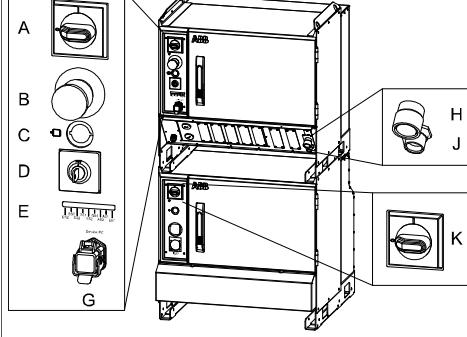
Description

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

Elimination, IRC5 Single Cabinet Controller

	Action	Note/illustration
1		

Elimination, IRC5 Dual Cabinet Controller

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

1 Safety

1.4.4 WARNING - The unit is sensitive to ESD!

Description

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

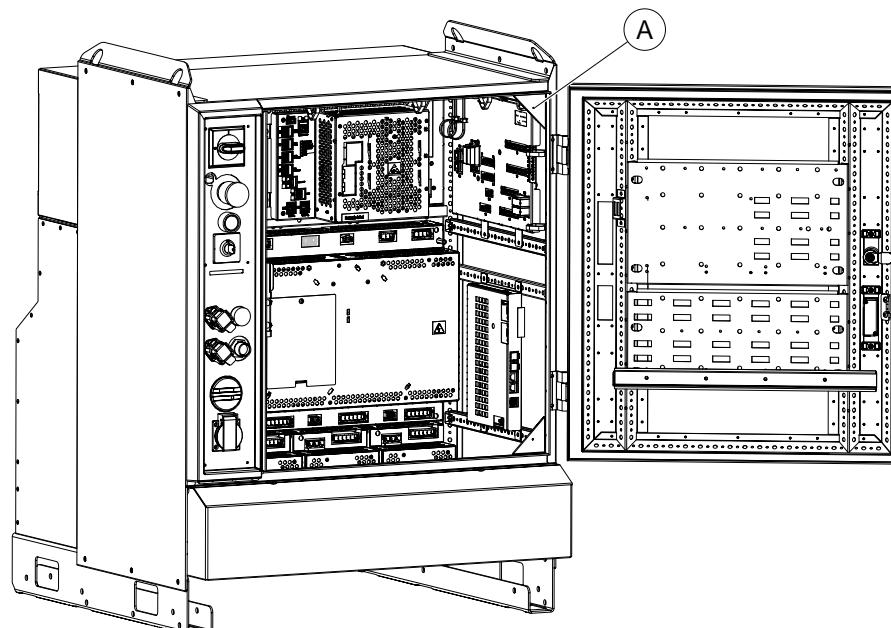
Elimination

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

Location of wrist strap button

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

IRC5



A Wrist strap button

1.4.5 WARNING - Safety risks during handling of batteries

Description

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

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



Note

Appropriate disposal regulations must be observed.

Elimination

	Action	Note
1	Do not short circuit, recharge, puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of the product. Risk of fire or explosion.	Operating temperatures are listed in <i>Operating requirements on page 58</i> .
2	Use safety glasses when handling the batteries.	
3	In the event of leakage, wear gloves and chemical apron.	
4	In the event of fire, use self-contained breathing apparatus.	

1 Safety

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

Description

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



Note

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



Note

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



Note

Appropriate disposal regulations must be observed.



Note

Take special care when handling hot lubricants.

Warnings and elimination

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

Continues on next page

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

Continued

Warning	Description	Elimination/Action
 xx0100000002 Do not overfill	<p>Overfilling of gearbox lubricant can lead to internal over-pressure inside the gearbox which in turn may:</p> <ul style="list-style-type: none"> • damage seals and gaskets • completely press out seals and gaskets • prevent the robot from moving freely. 	<p>Make sure not to overfill the gearbox when filling it with oil or grease!</p> <p>After filling, verify that the level is correct.</p>
 xx0100000002 Do not mix types of oil	<p>Mixing types of oil may cause severe damage to the gearbox.</p>	<p>When filling gearbox oil, do not mix different types of oil unless specified in the instructions. Always use the type of oil specified by the manufacturer!</p>
 xx0100000098 Heat up the oil	<p>Warm oil drains quicker than cold oil.</p>	<p>When changing gearbox oil, first run the robot for a time to heat up the oil.</p>
 xx0100000004 Specified amount depends on drained volume	<p>The specified amount of oil or grease is based on the total volume of the gearbox. When changing the lubricant, the amount refilled may differ from the specified amount, depending on how much has previously been drained from the gearbox.</p>	<p>After filling, verify that the level is correct.</p>
 xx0100000003 Contaminated oil in gear boxes	<p>When draining the oil make sure that as much oil as possible is drained from the gearbox. The reason for this is to drain as much oil sludge and metal chips as possible from the gearbox. The magnetic oil plugs will take care of any remaining metal chips.</p>	

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2 Installation and commissioning

2.1 Before starting the track motion

Do this before starting the track motion

The following steps should be carried out before starting the track motion IRBT 4004/6004/7004.

	Action	Reference
1	Unpack the track motion.	Compare the delivery check to the identification plate and verify for acceptance according to Acceptance inspection on page 62 . Lifting and moving track motion IRBT 4004/6004/7004 on page 67 .
2	Read through and follow the information and instructions for on-site installation of the track motion.	On-site installation on page 86 .
3	Align and level the track motion IRBT 4004/6004/7004.	Correct the track motion according to Geometric alignment of track motion IRBT 4004/6004/7004 on page 96 .
4	Assemble the manipulator and the cable tray.	Assembling the cable tray and manipulator on page 101 .
5	Install the cable chain and connect all cables.	Electrical installation on page 108 .
6	Adjust cable length.	Adjusting cables and covers on page 124 .
7	Connect voltage to the system.	Electrical installation on page 108 .
8	Start up the system.	Starting the system for the first time on page 126 .
9	Load software to the system.	Creating and downloading a system on page 127 .
10	Update the revolution counters.	Updating the revolution counter on the track motion on page 132 .

2 Installation and commissioning

2.2 Operating requirements

2.2 Operating requirements

Protection standards

Protection type	Protection class
Standard	IP65
Foundry	IP65

Explosive environments

The track motion must not be located or operated in an explosive environment.

Ambient temperature

Description	Standard/Option	Temperature
Track motion during operation	Standard	+ 5°C ⁱ (41°F) to + 50°C (122°F)
For the controller	Standard/Option	See <i>Product specification - Controller IRC5 with FlexPendant</i>
For short periods (not exceeding 24 hours)	Standard	Up to + 70°C (158°F)

ⁱ At low environmental temperature < 10°C is, as with any other machine, a warm-up phase recommended to be run with the robot. Otherwise there is a risk that the robot stops or runs with lower performance due to temperature dependent oil- and grease viscosity.

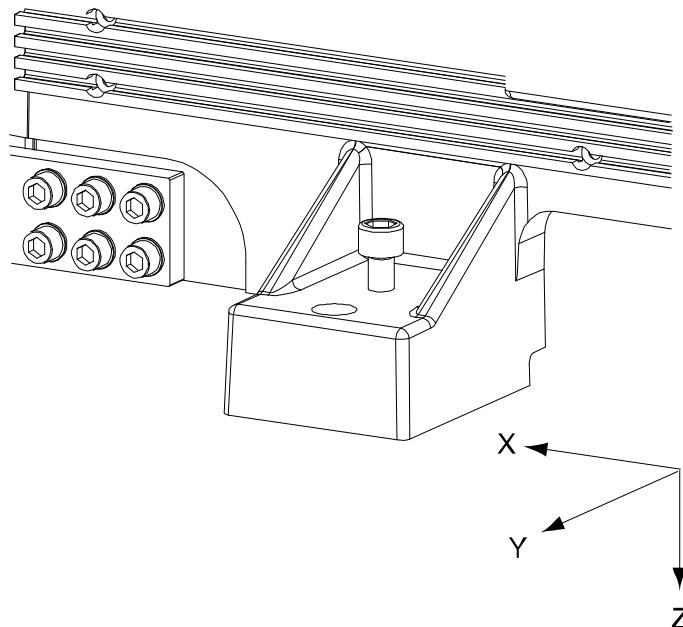
Relative humidity

Description	Relative humidity
Complete track during transportation and storage	Max. 95% at constant temperature
Complete track during operation	Max. 95% at constant temperature

Continues on next page

Forces

Maximum floor loads in relation to the base coordination system and indicated per each stand of the section of the track, see figure below.



xx1000000945

Robot	Endurance load in operation (kN)		Max. load at Emergency stop (kN)	
	Fxy	Fz	Fxy	Fz
IRB 4400	± 3	1.5 ± 5	± 6.5	3 ± 9
IRB 4600	± 3	1.5 ± 5	± 6.5	1.5 ± 9
IRB 4600 with pedestal	± 3	1.5 ± 6	± 6.5	1.5 ± 10
IRB 6650S	± 7	5 ± 15	± 14	5 ± 30
IRB 6650S with pedestal	± 7	5 ± 18	± 14	5 ± 36
IRB 6620	± 3	3 ± 19	± 9	3 ± 34
IRB 6620 with pedestal	± 3	3 ± 18	± 9	3 ± 35
IRB 6640	± 4	5 ± 24	± 10	5 ± 42
IRB 6640 with pedestal	± 4	5 ± 25	± 10	5 ± 45
IRBT 6004/IRB 6700-200 kg ⁱ	± 3.5	4.5 ± 22	± 8	4.5 ± 43
IRBT 6004/IRB 6700-200 kg ⁱ with pedestal	± 3.5	5.5 ± 24	± 8	5.5 ± 45
IRBT 6004/IRB 6700-235 kg ⁱⁱ	± 3.5	5 ± 23	± 8	5 ± 49
IRBT 6004/IRB 6700-235kg ⁱⁱ with pedestal	± 3.5	5.5 ± 24	± 8	5.5 ± 51
IRBT 6004/IRB 6700-300 kg ⁱⁱⁱ	± 4	5.5 ± 27	± 11	5.5 ± 51

Continues on next page

2 Installation and commissioning

2.2 Operating requirements

Continued

Robot	Endurance load in operation (kN)		Max. load at Emergency stop (kN)	
	Fxy	Fz	Fxy	Fz
IRBT 6004/IRB 6700-300 kg ⁱⁱⁱ with pedestal	± 4	6.5 ±28	± 11	6.5 ±55
IRB 7600	± 11	8 ± 24	± 22	8 ± 51
IRB 7600 with pedestal	± 11	8 ± 26	± 22	8 ± 56

i IRB 6700-200/2.60, IRB 6700-155/2.85

ii IRB 6700-235/2.65, IRB 6700-205/2.80, IRB 6700-175/3.05, IRB 6700-150/3.20

iii IRB 6700-300/2.70, IRB 6700-245/3.00



Note

If doing fatigue calculations with combined tension (Fz) and shear loads (Fxy), the shear loads (Fxy) are allowed to be reduced with a factor 0.7.

2.3 Zone division

Division of the track

The purpose of the zone division is to divide the track into zones. Read about SafeMove in the *Product manual - IRC5*. Document ID is specified in [References on page 10](#).

2 Installation and commissioning

2.4.1 Acceptance inspection

2.4 Unpacking

2.4.1 Acceptance inspection

Identification plate

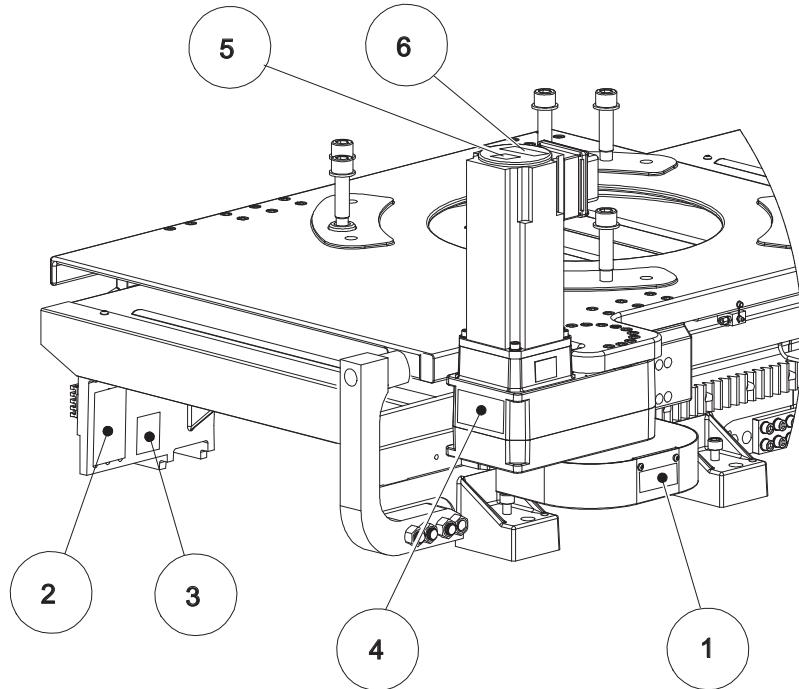


Tip

Always try to determine if the goods are as ordered, and that the package is not damaged before unpacking.

To identify the delivery, check the identification plate and compare it to the delivery note.

The identification plates are shown in the figure.



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1	ABB logotype
2	Rating label
3	Calibration label
4	Instruction label
5	Warning sign
6	Warning label

2.4.2 Storage

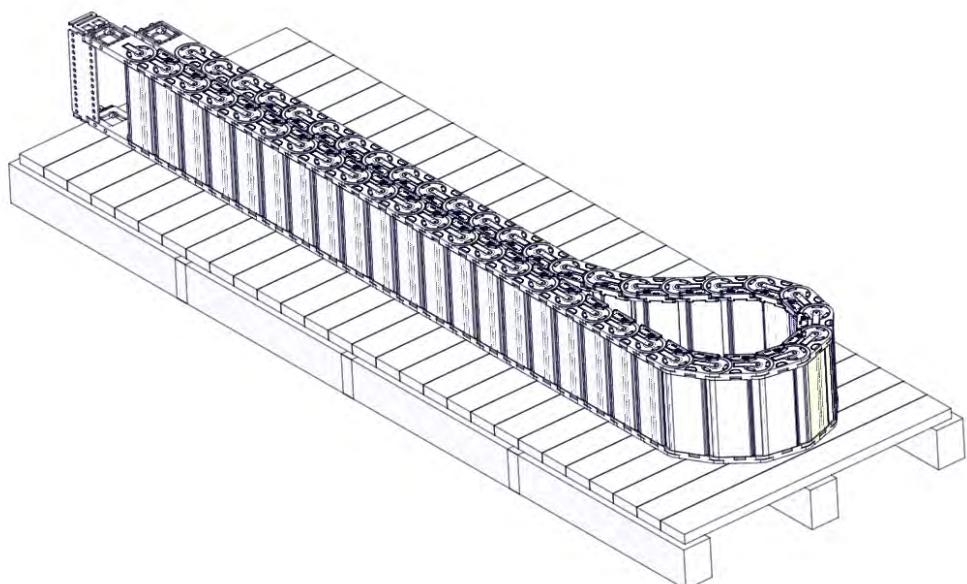
2.4.2.1 Storing the cable chain

Two methods for storage

There are two methods for storing spare / not in use cable chains.

Method 1: folded in half

For complete chains with strapping in place and the strapping plates attached to the chains, the chain can only be folded in half. The chain can either be folded so that the chain is lying on itself or laid on its side.



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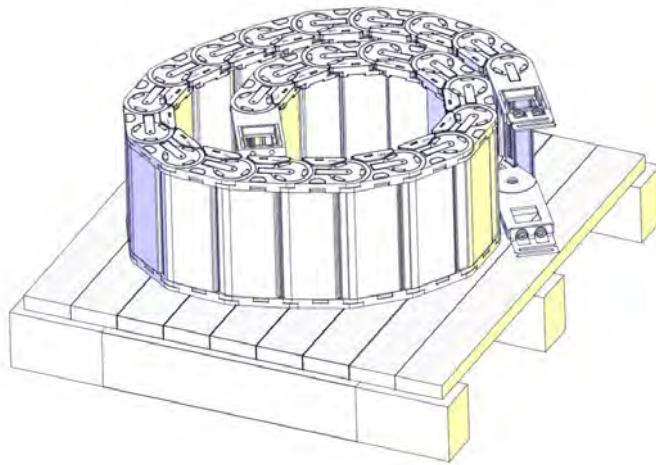
2 Installation and commissioning

2.4.2.1 Storing the cable chain

Continued

Method 2: rolled up

For complete chains with or without strapping in place or strapping in place and the strapping plate not connected to the chain, the chain can be rolled up and stored lying on its side



xx1300000885

Moving the cable chain from storage

To move the chain from storage to track, see [*Lifting and fitting the cable chain Murrplastik on page 115.*](#)

2.4.3 Unpacking

Inspection

The track motion IRBT 4004/6004/7004 is wrapped in plastic. Unpack the track and check for any visible transport damage. If the track motion IRBT 4004/6004/7004 is damaged, contact ABB.

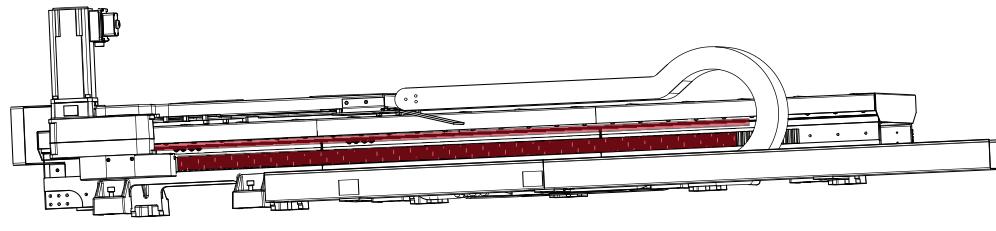
Contents

As standard the track motion IRBT 4004/6004/7004 includes the following on delivery:

- 1-3 track motion IRBT 4004/6004/7004 sections depending on the length
- Robot cabinet
- Lincoln Central Lubrication system: P203-2XN-1K6-24-2

Cleaning

Before transport the track motion IRBT 4004/6004/7004 has been protected against rust by a thin film of oil that has been applied before packing. The figure shows the pre-lubricated areas.



Note

Do not clean any of the pre lubricated parts of the track motion IRBT 4004/6004/7004.

	Action	Note
1	Wipe off any surplus oil using a lint-free cloth.	

2 Installation and commissioning

2.4.4.1 Actions before lifting

2.4.4 Moving the track motion

2.4.4.1 Actions before lifting

Removing cover plates

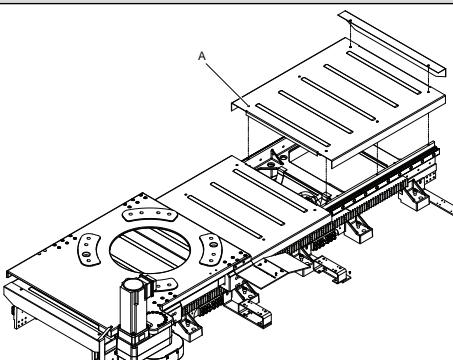
Before lifting the track motion IRBT 4004/6004/7004 always remove the pre-mounted cover plates that cover the lifting eyes.



WARNING

Never attempt to lift the Track Motion IRBT 4004/6004/7004 if the carriage is not in the centered position

Preparations before lifting

	Action	Note
1	Remove the six M10 socket head cap screw (A) holding the cover plate using standard tools.	 xx1100000711 A Socket head cap screw 6X M10
2	If the carriage is not in the centered position, move it by hand to the midpoint of the track.	Described in Moving the carriage manually on page 99 .

2.4.4.2 Lifting and moving track motion IRBT 4004/6004/7004

Actions before lifting



CAUTION

Read through the safety instructions carefully, before the track motion IRBT 4004/6004/7004 is unpacked and installed.

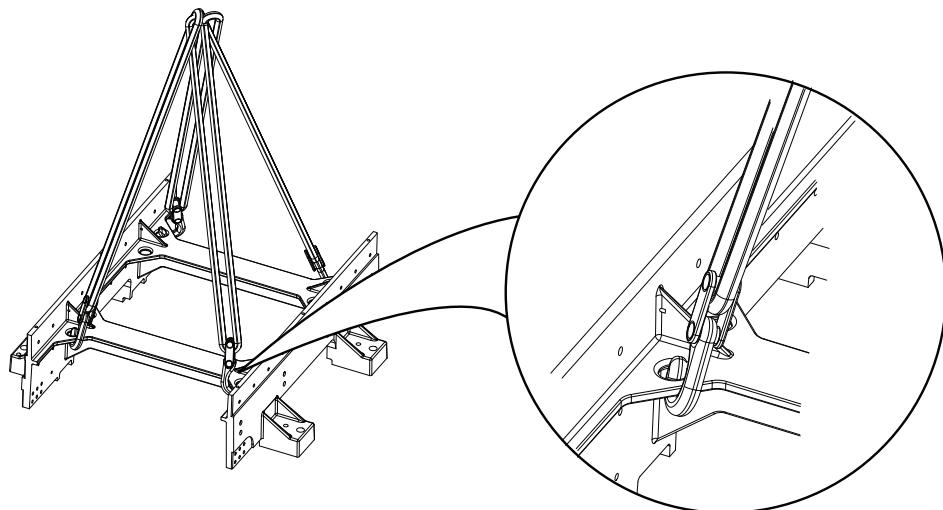


WARNING

Never lift the track motion IRBT 4004/6004/7004 in sections longer than 9 meters.
Never lift the track motion IRBT 4004/6004/7004 using a overhead crane without first removing the cover plates.

Lifting eyes on track motion

The construction of the track motion offers a number of lifting eyes. To prevent damage only use the lifting eyes according to the tables in [Lifting zones on page 68](#) and [Lifting weight on page 73](#).



xx1100000697

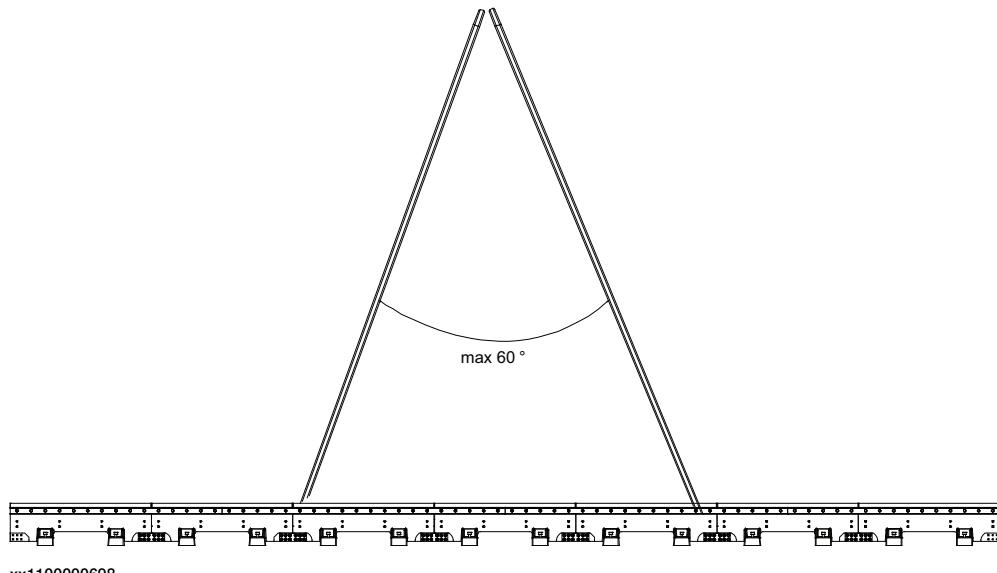
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2 Installation and commissioning

2.4.4.2 Lifting and moving track motion IRBT 4004/6004/7004

Continued

Lifting zones



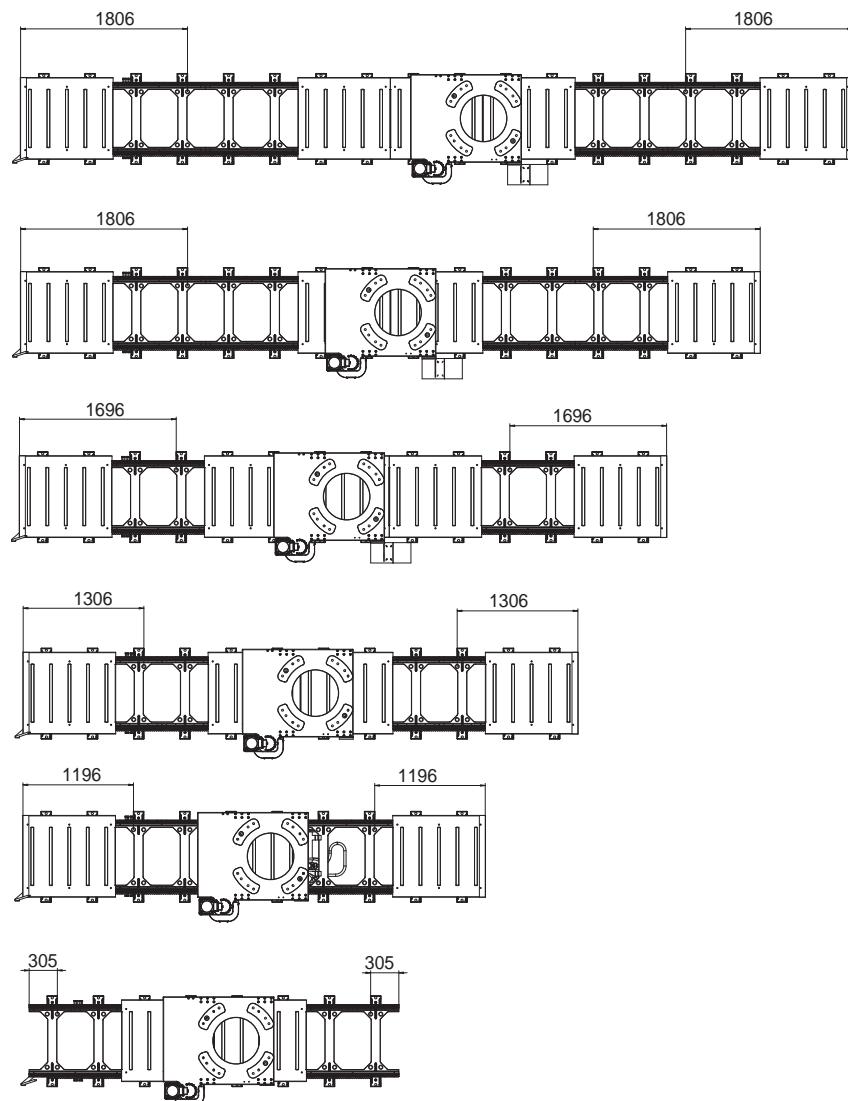
WARNING

Never place lifting straps wider than a combined angel of max. 60°.

Continues on next page

3-9 sections lift

The illustration shows the eye on the track motion IRBT 4004/6004/7004 where the lifting straps should be placed.



xx1100000699

Track motion length	Lifting eye from left	Lifting eye from right
9 sections	(8) distance 1806 mm	(8) distance 1806 mm
8 sections	(8) distance 1806 mm	(8) distance 1806 mm
7 sections	(7) distance 1696 mm	(7) distance 1696 mm
6 sections	(6) distance 1306 mm	(6) distance 1306 mm
5 sections	(5) distance 1196 mm	(5) distance 1196 mm
4 sections	(2) distance 305 mm	(2) distance 305 mm
3 sections	(2) distance 305 mm	(2) distance 305 mm

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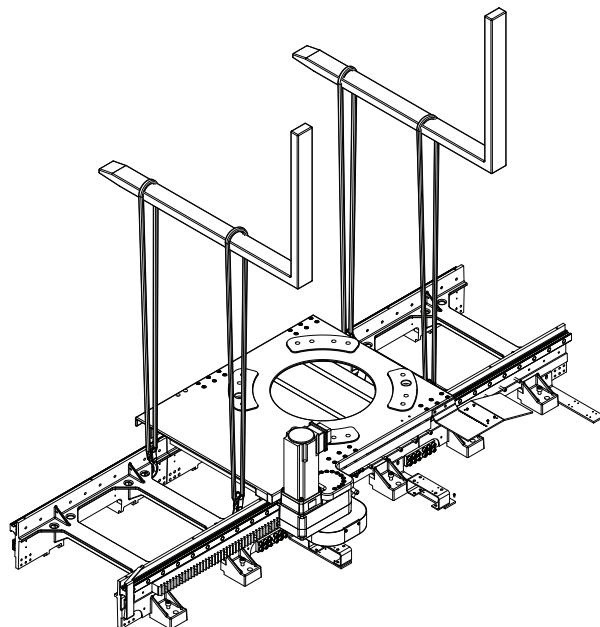
2 Installation and commissioning

2.4.4.2 Lifting and moving track motion IRBT 4004/6004/7004

Continued

Lifting using fork lift

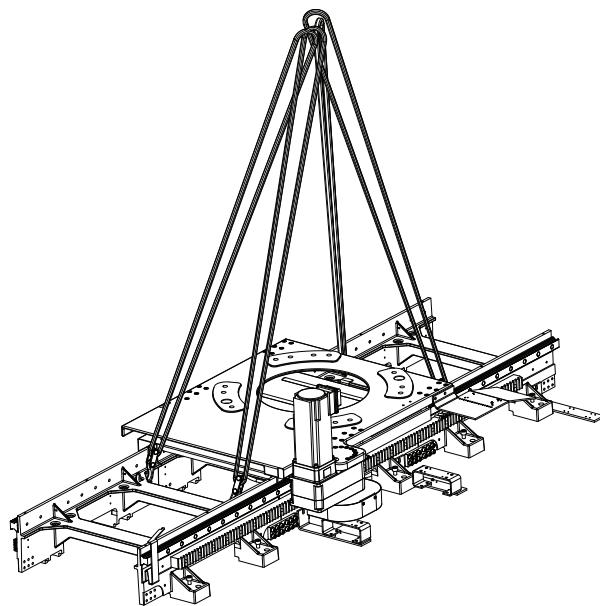
Proceed as follows to lift the track motion IRBT 4004/6004/7004 using the fork lift.



xx1100000712

Lifting using an overhead crane

Proceed as follows to lift the track motion IRBT 4004/6004/7004 using an overhead crane.

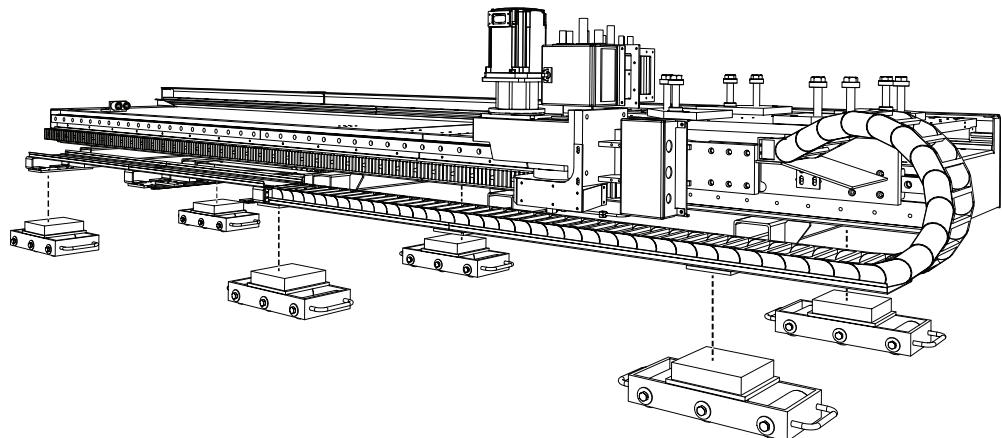


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Moving the track motion using roller dollies

Lift the IRBT 4004/6004/7004 according to lifting instructions, and place roller dollies under the stand's ground plates. Depending on the length of the track motion, the number of roller dollies varies. See table for information.



xx1400002005

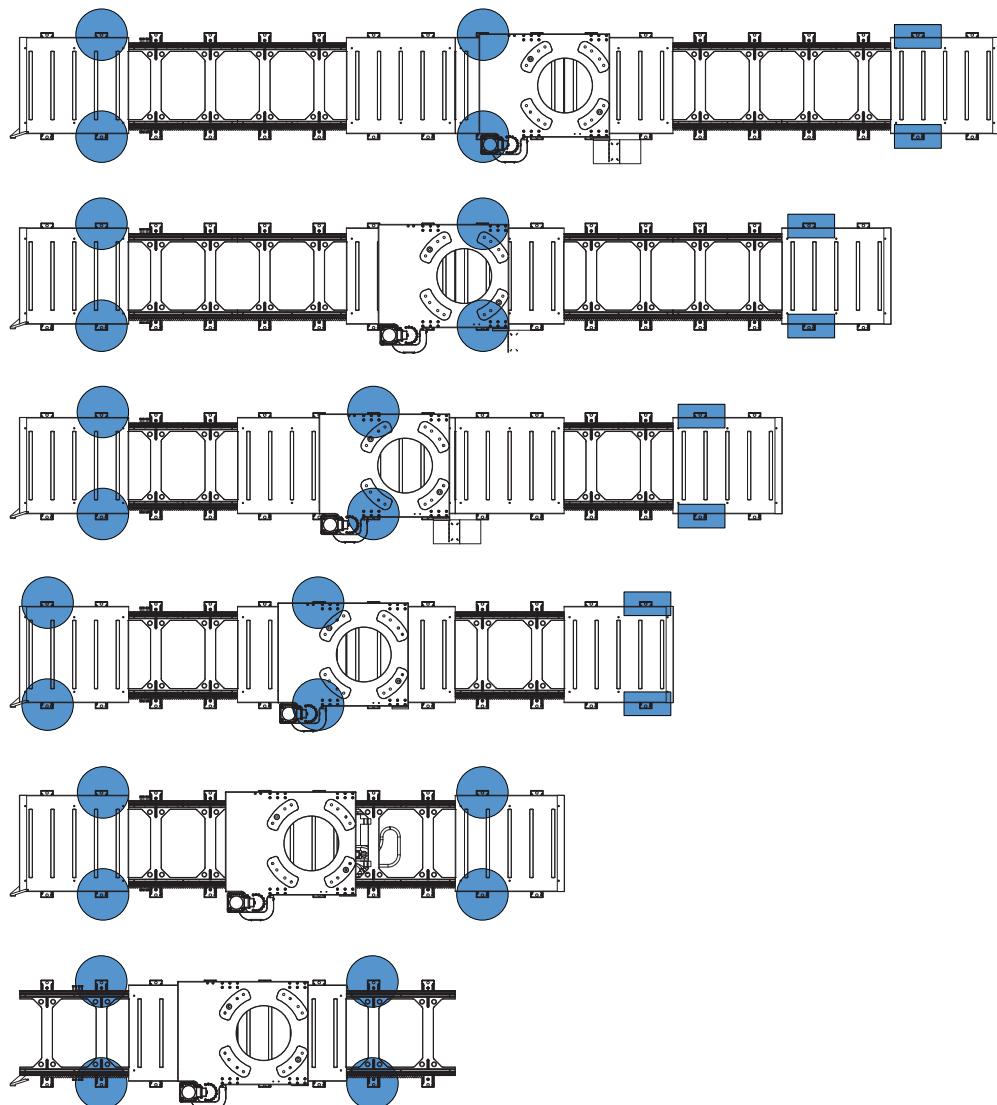
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2 Installation and commissioning

2.4.4.2 Lifting and moving track motion IRBT 4004/6004/7004

Continued

The type of roller dolly and the placement of the two types is shown in the following illustration and table.



xx1400002006

Track motion length	Roller dollies with steering	Fixed roller dollies
9 sections	4 pcs	2 pcs
8 sections	4 pcs	2 pcs
7 sections	4 pcs	2 pcs
6 sections	4 pcs	2 pcs
5 sections	4 pcs	2 pcs
4 sections	4 pcs	-
3 sections	4 pcs	-

2.4.4.3 Lifting weight

Track motion IRBT 4004/6004/7004 weight

For accurate weight, read the identification plates on the track motion IRBT 4004/6004/7004. The position of the identification plates are described in [Identification plate on page 62](#).

The weights are also listed in [Weight of track motion with single carriage on page 80](#) and [Required space for installation of double carriage track \(option 1088-2\) on page 77](#).



WARNING

Never lift the track motion IRBT 4004/6004/7004 in sections longer than 9 meters.

Never lift the track motion IRBT 4004/6004/7004 using a overhead crane without first removing the cover plates.

2 Installation and commissioning

2.4.5 Technical data for the track motion

2.4.5 Technical data for the track motion

Travel length

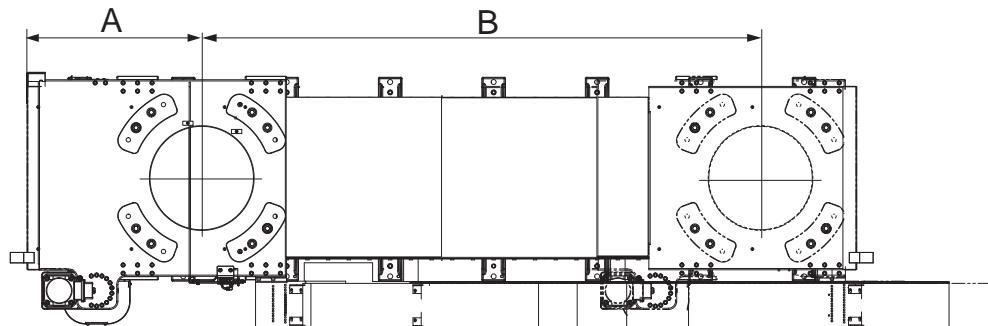
The IRBT track motion is available in 3 different types.

IRBT type	Designed for	Travel length (m) ⁱ	
		Singe carriage (standard track)	Double carriage
IRBT 4004	IRB 4400 (all versions) IRB 4600 (all versions)	1.9 to 19.9 (in steps of 1 m)	3.7 to 18.7 (in steps of 1 m)
IRBT 6004	IRB 6650S (all versions) IRB 6620 IRB 6640 (all versions) IRB 6700 (all versions)	1.7 to 19.7 (in steps of 1 m)	3.3 to 18.3 (in steps of 1 m)
IRBT 7004	IRB 7600 (all versions)	1.7 to 19.7 (in steps of 1 m)	3.3 to 18.3 (in steps of 1 m)

ⁱ Travel length is the distance the carriage(s) can move.

Single carriage

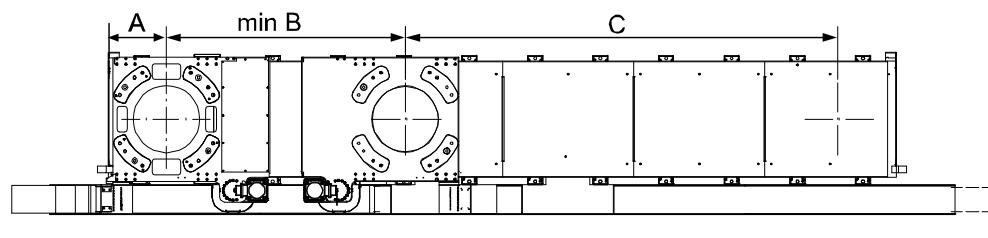
Below is an example of travel length for a 4 m stand with single carriage.



Pos	Description
A	IRBT 4004 L=646 mm IRBT 6004/7004 L=841 mm
B	IRBT 4004 Travel length= 2.9 m IRBT 6004/7004 Travel length=2.7 m

Double carriage

Below is an example of travel length for a 6 m stand with double carriage.



Continues on next page

Pos	Description
A	IRBT 4004 L= 646 mm IRBT 6004/7004 L= 461 mm
B	IRBT 4004 L= 1200 mm IRBT 6004/7004 L= 1780 mm
C	IRBT 4004 Travel length= 3700 mm IRBT 6004/7004 Travel length=3300 mm

Required space for installation of single carriage track (standard)



Note

The tables only give the space that the track motion itself requires. In addition there probably needs to be additional space at the ends of the track motion at the installation site. Add space as required.

Required space for installation - with cable chain Brevetti

The table below shows the required space for installation of single carriage track motions with different travel lengths, when using the cable chain Brevetti.

Travel length (m) ⁱ		Sections (pcs)	Required space for installation (m) ^{ii iii}
IRBT 4004	IRBT 6004/ 7004	Value of N	
1.9	1.7	3	3.766
2.9	2.7	4	4.766
3.9	3.7	5	5.766
4.9	4.7	6	6.766
5.9	5.7	7	7.766
6.9	6.7	8	8.766
7.9	7.7	9	9.766
8.9	8.7	10	10.766
9.9	9.7	11	11.766
10.9	10.7	12	12.766
11.9	11.7	13	13.766
12.9	12.7	14	14.766
13.9	13.7	15	15.766
14.9	14.7	16	16.766
15.9	15.7	17	17.766
16.9	16.7	18	18.766
17.9	17.7	19	19.766
18.9	18.7	20	20.766
19.9	19.7	21	21.766

ⁱ The travel length is illustrated in [Travel length on page 74](#).

ⁱⁱ The measurement for the required space is valid when using the cable chain Brevetti.

ⁱⁱⁱ How to calculate the required space is described in [Formula for single carriage track on page 76](#).

Continues on next page

2 Installation and commissioning

2.4.5 Technical data for the track motion

Continued

Required space for installation - with cable chain Murrplastik

The table below shows the required space for installation of single carriage track motions with different travel lengths, when using the cable chain Murrplastik.

Travel length (m) ⁱ	IRBT 4004	IRBT 6004/ 7004	Sections (pcs)	Required space for installation (m) ^{ii iii}
			Value of N	
1.9		1.7	3	4.231
2.9		2.7	4	5.231
3.9		3.7	5	6.231
4.9		4.7	6	7.231
5.9		5.7	7	8.231
6.9		6.7	8	9.231
7.9		7.7	9	10.231
8.9		8.7	10	11.231
9.9		9.7	11	12.231
10.9		10.7	12	13.231
11.9		11.7	13	14.231
12.9		12.7	14	15.231
13.9		13.7	15	16.231
14.9		14.7	16	17.231
15.9		15.7	17	18.231
16.9		16.7	18	19.231
17.9		17.7	19	20.231
18.9		18.7	20	21.231
19.9		19.7	21	22.231

ⁱ The travel length is illustrated in [Travel length on page 74](#).

ⁱⁱ The measurement for the required space is valid when using the cable chain Murrplastik.

ⁱⁱⁱ How to calculate the required space is described in [Formula for single carriage track on page 76](#).

Formula for single carriage track

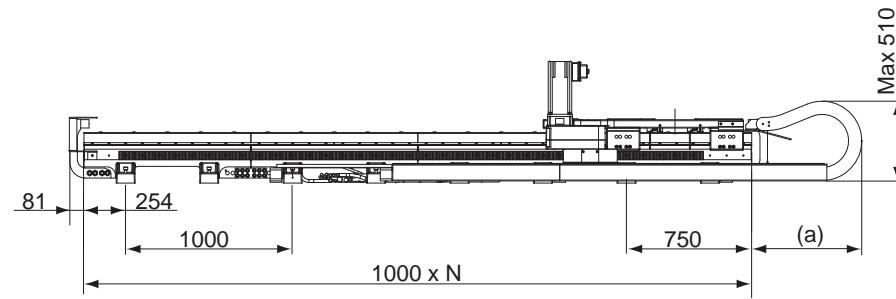
Required space for a single carriage track is determined with the following formula:

$$\text{Required space (mm)} = 81 + (1000 \times N) + (a)$$

Value of N is equal to the number of sections, defined in previous tables.

Continues on next page

For the number (a), see figure.



xx1000000941

(a)	Cable chain Brevetti: max. 680 mm
	Cable chain Murrplastik: max. 1150 mm

Required space for installation of double carriage track (option 1088-2)



Note

The tables only give the space that the track motion itself requires. In addition there probably needs to be additional space at the ends of the track motion at the installation site. Add space as required.

Required space for installation - with cable chain Brevetti

The table below shows the required space for installation of double carriage track motions with different travel lengths, when using the cable chain Brevetti.

Travel length (m) ⁱ	Sections (pcs)	Required space for installation (m) ^{ii iii}
IRBT 4004	IRBT 6004/ 7004	Value of N
3.7	3.3	6
		7.800
4.7	4.3	7
		8.800
5.7	5.3	8
		9.800
6.7	6.3	9
		10.800
7.7	7.3	10
		11.800
8.7	8.3	11
		12.800
9.7	9.3	12
		13.800
10.7	10.3	13
		14.800
11.7	11.3	14
		15.800
12.7	12.3	15
		16.800
13.7	13.3	16
		17.800
14.7	14.3	17
		18.800
15.7	15.3	18
		19.800
16.7	16.3	19
		20.800
17.7	17.3	20
		21.800

Continues on next page

2 Installation and commissioning

2.4.5 Technical data for the track motion

Continued

Travel length (m) ⁱ	Sections (pcs)	Required space for installation (m) ^{ii iii}
18.7	18.3	21

ⁱ The travel length is illustrated in [Travel length on page 74](#).

ⁱⁱ The measurement for the required space is valid when using the cable chain Brevetti on the track motion.

ⁱⁱⁱ How to calculate the required space is described in [Formula for double carriage track on page 78](#).

Required space for installation - with cable chain Murrplastik

The table below shows the required space for installation of double carriage track motions with different travel lengths, when using the cable chain Murrplastik.

Travel length (m) ⁱ	Sections (pcs)	Required space for installation (m) ^{ii iii}
IRBT 4004	IRBT 6004/ 7004	Value of N
3.7	3.3	6
4.7	4.3	7
5.7	5.3	8
6.7	6.3	9
7.7	7.3	10
8.7	8.3	11
9.7	9.3	12
10.7	10.3	13
11.7	11.3	14
12.7	12.3	15
13.7	13.3	16
14.7	14.3	17
15.7	15.3	18
16.7	16.3	19
17.7	17.3	20
18.7	18.3	21

ⁱ The travel length is illustrated in [Travel length on page 74](#).

ⁱⁱ The measurement for the required space is valid when using the cable chain Murrplastik on the track motion.

ⁱⁱⁱ How to calculate the required space is described in [Formula for double carriage track on page 78](#).

Formula for double carriage track

To install track motions with two carriages (double carriage) the cable chain requires to be fitted differently at the frame than when fitting it on a single carriage. The different fitting makes the cable chain stand out more on a double than on a single carriage.

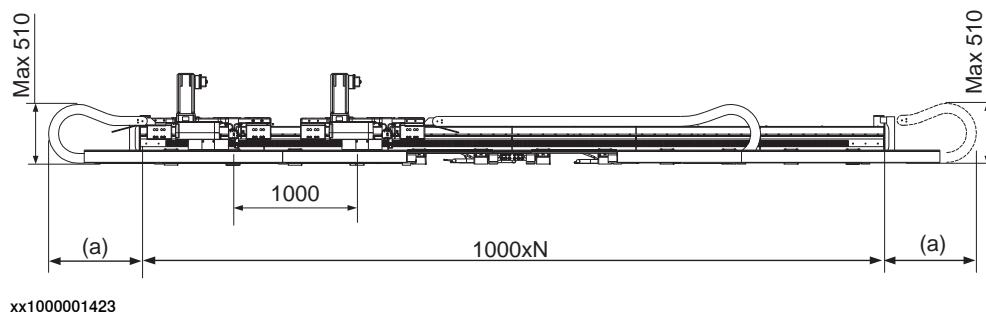
Required space for a double carriage track is determined with the following formula:

$$\text{Required space (mm)} = a + (1000 \times N) + a$$

Value of N is equal to the number of sections, defined in previous tables.

Continues on next page

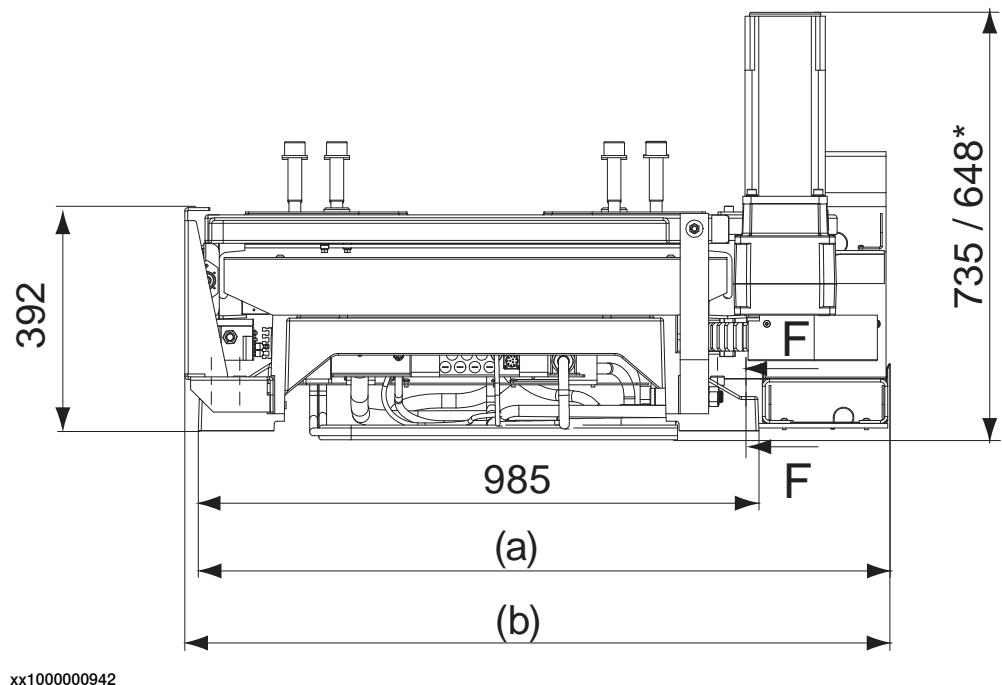
For the number (a), see figure.



(a)	Cable chain Brevetti: max. 900 mm Cable chain Murrplastik: max. 1150 mm
-----	--

Example: there are 6 sections in a double carriage for travel length 3.7 m (IRBT 4004). The required space, if using a cable chain from Murrplastik, is therefore: $1150 + (1000 \times 6) + 1150 = 8300$ mm.

Dimensions



*	Valid for track motions with motor type A (the motor is marked with an "A" on its side).
(a)	Cable chain Brevetti: 1215 mm Cable chain Murrplastik: 1325 mm
(b)	Cable chain Brevetti: 1238 mm Cable chain Murrplastik: 1350 mm

Continues on next page

2 Installation and commissioning

2.4.5 Technical data for the track motion

Continued

Weight of track motion and number of joined sections in transport

Weight of track motion with single carriage

Travel length (m) ⁱ		Joined sections in transport	Weight (kg)	
IRBT 4004	IRBT 6004/ 7004		IRBT 4004	IRBT 6004/ 7004
1.9	1.7	1	1023	1014
2.9	2.7	1	1234	1227
3.9	3.7	1	1430	1420
4.9	4.7	1	1659	1633
5.9	5.7	1	1871	1840
6.9	6.7	1	2083	2047
7.9	7.7	1	2295	2254
8.9	8.7	2	2507	2461
9.9	9.7	2	2719	2668
10.9	10.7	2	2931	2875
11.9	11.7	2	3143	3082
12.9	12.7	2	3355	3289
13.9	13.7	2	3567	3496
14.9	14.7	2	3779	3703
15.9	15.7	2	3991	3910
16.9	16.7	2	4203	4117
17.9	17.7	3	4415	4324
18.9	18.7	3	4627	4531
19.9	19.7	3	4839	4738

ⁱ The travel length is illustrated in [Travel length on page 74](#).

Weight of track motion with double carriage

Travel length (m) ⁱ		Joined sections in transport	Weight (kg)	
IRBT 4004	IRBT 6004 and IRBT 7004		IRBT 4004	IRBT 6004/7004
3.7	3.3	1	2056	2061
4.7	4.3	1	2228	2111
5.7	5.3	1	2425	2361
6.7	6.3	1	2622	2511
7.7	7.3	2	2811	2661
8.7	8.3	2	3000	2811
9.7	9.3	2	2189	2961
10.7	10.3	2	3378	3111
11.7	11.3	2	3567	3261

Continues on next page

Travel length (m) ⁱ		Joined sections in transport	Weight (kg)	
12.7	12.3	2	3756	3411
13.7	13.3	2	3945	3561
14.7	14.3	2	4134	3711
15.7	15.3	2	4323	3861
16.7	16.3	3	4512	4011
17.7	17.3	3	4701	4161
18.7	18.3	3	4890	4311

ⁱ The travel length is illustrated in [Travel length on page 74](#).

Weight of pedestal

Robot pedestal	IRBT 4004	IRBT 6004/ IRBT 7004
Height: 250 mm	212 kg	230 kg
Height: 500 mm ⁱ	271 kg	326 kg

ⁱ Only available for IRBT 4004 and 6004.

Airborne noise level

The sound pressure level outside the working space.

IR(B)T type	Level
IRBT 4004	< 77 dB (A) / 1m
IRBT 6004	< 76 dB (A) / 1m
IRBT 7004	< 73 dB (A) / 1m

Power consumption at max load

Type of Movement	IR(B)T
-	Within specification for respective robot. A power consumption measurement of a track motion with manipulator could be done with a simulated cycle in RobotStudio. See <i>Operating manual - RobotStudio</i> .

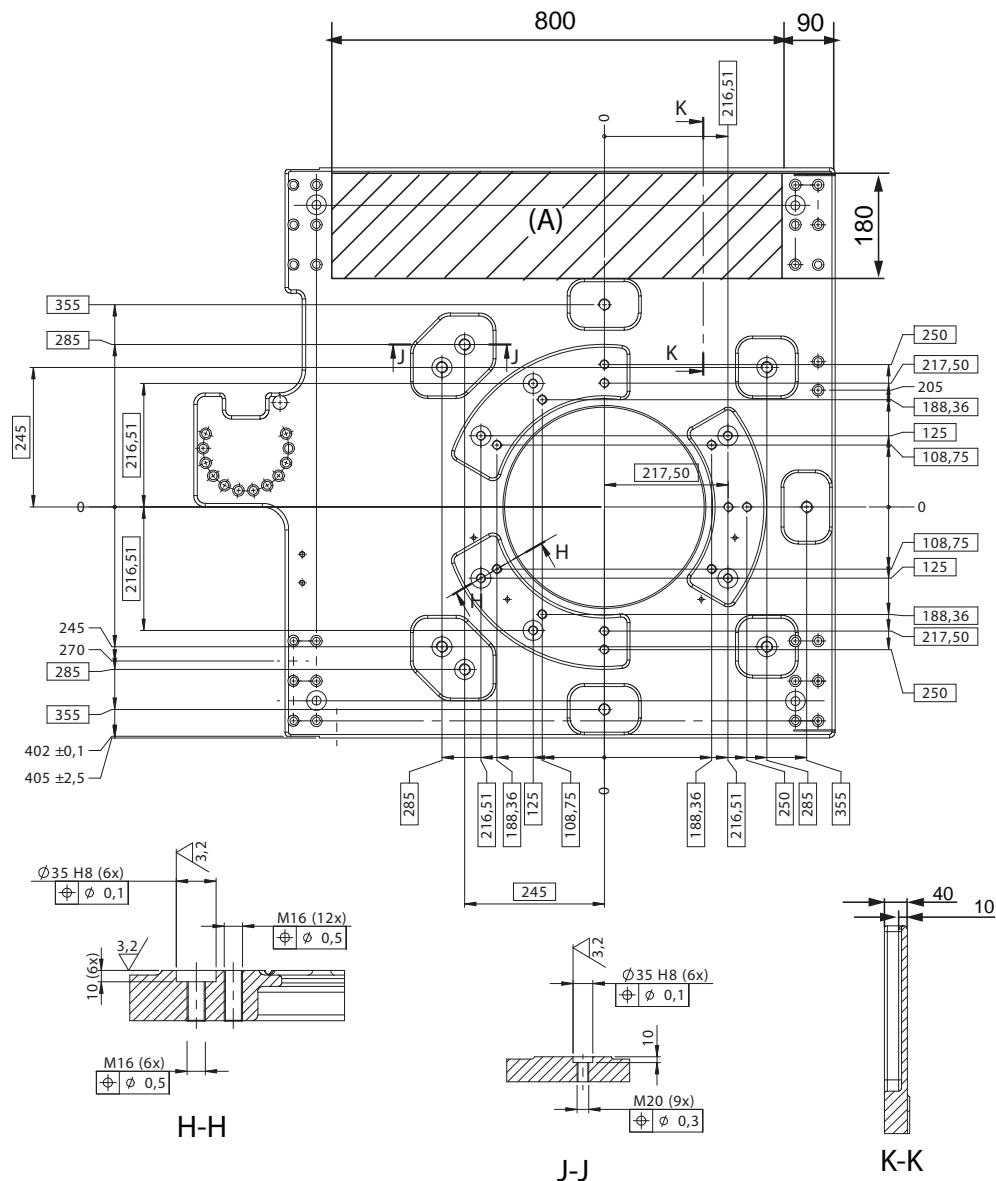
2 Installation and commissioning

2.4.6 Measures of the carriage table

2.4.6 Measures of the carriage table

IRBT 4004

Use the hole configuration for the manipulator when designing fixtures to be used on the track. The figure below shows the dimensions in mm. Both tables on double track are the same.



xx1000000943

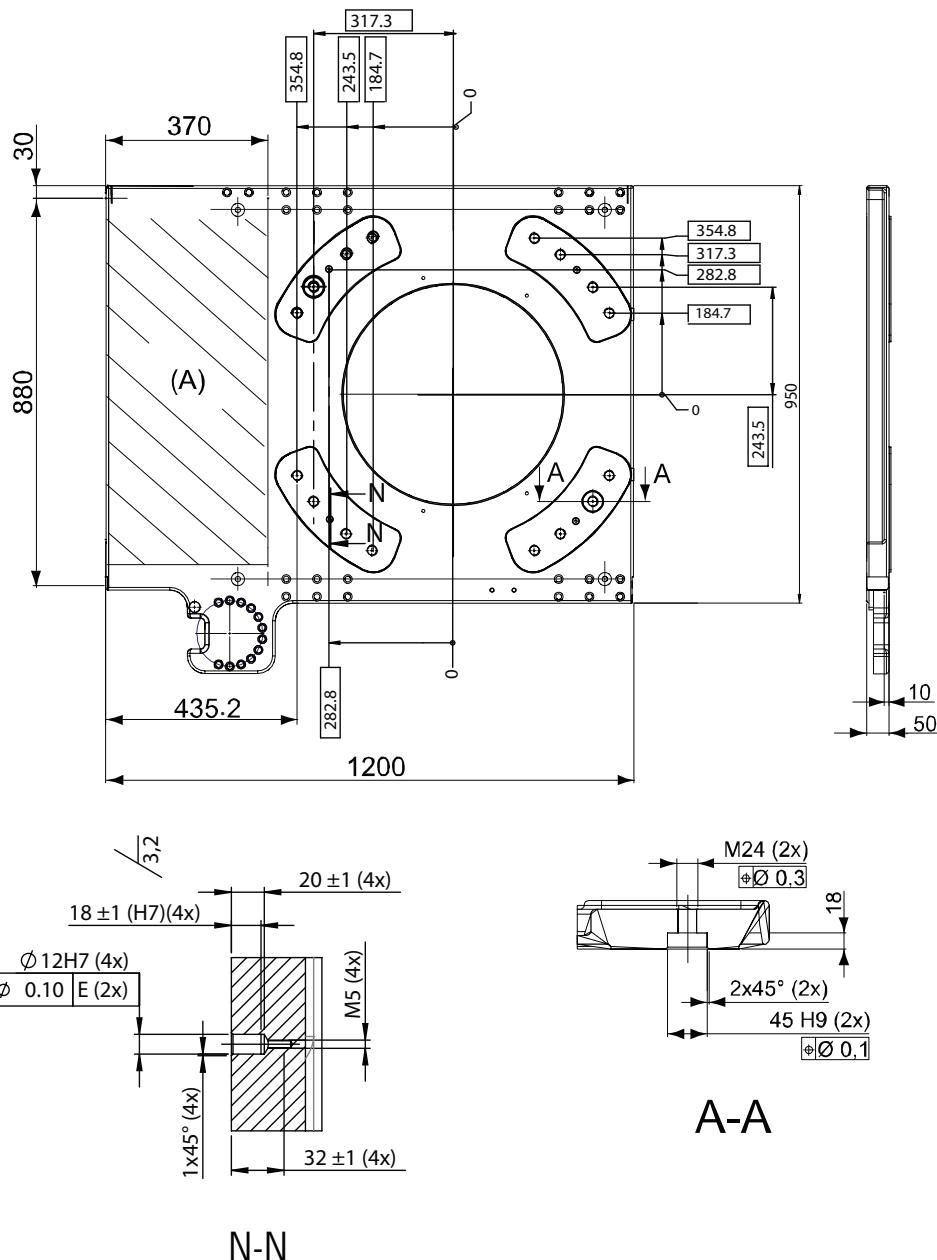
Pos	Description
A	Drilling allowed within the marked area.

Continues on next page

IRBT 6004 and IRBT 7004

Standard carriage

The figure below shows the standard carriage for IRBT 6004/7004.



xx1000000944

Pos	Description
A	Drilling allowed within the marked area.

Continues on next page

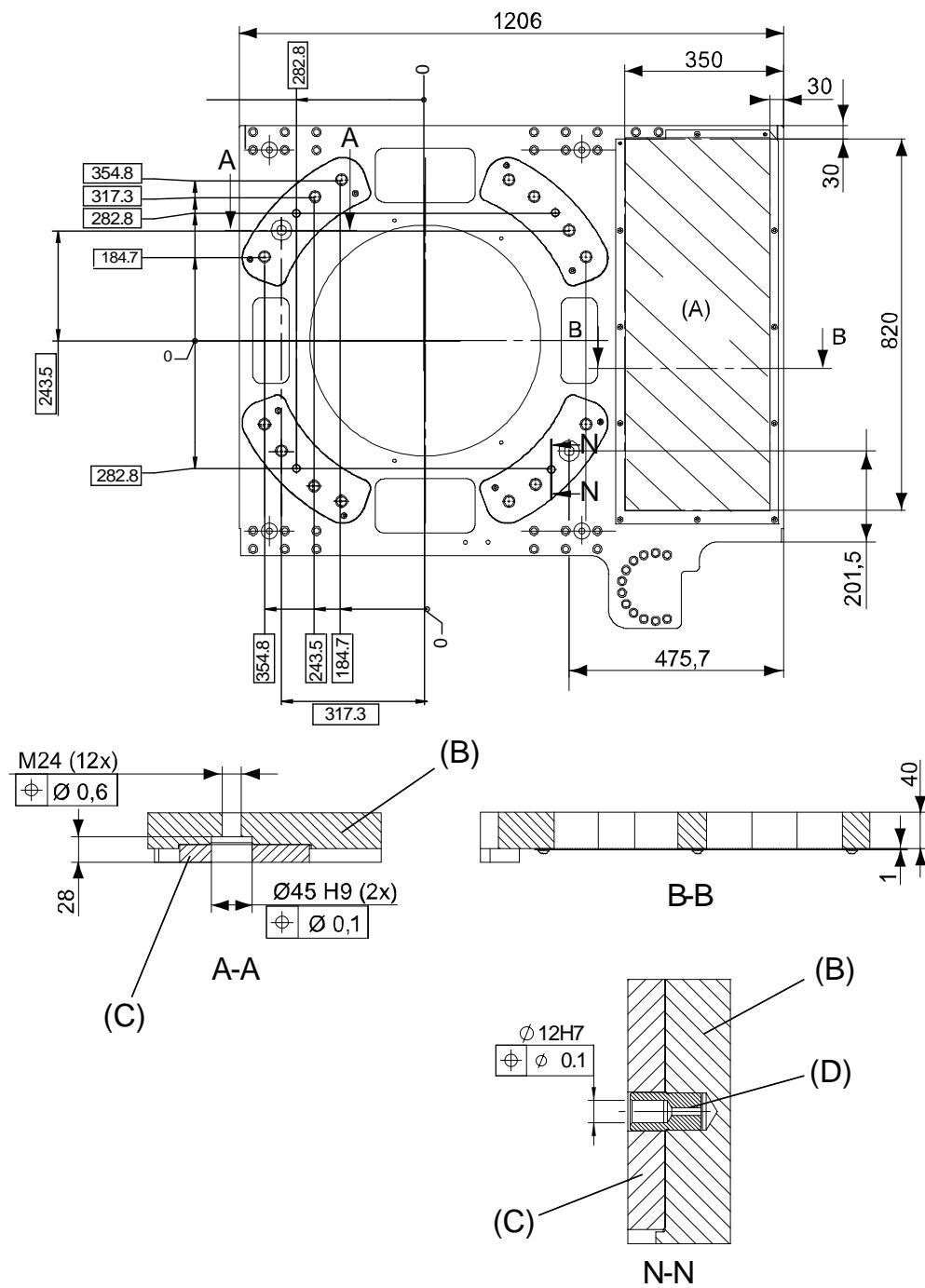
2 Installation and commissioning

2.4.6 Measures of the carriage table

Continued

Carriage plate

The figure below shows the carriage plate that is used as a second added carriage for a double track or as a single carriage as mirrored, for track motions IRBT 6004/7004.



xx000001281

Pos	Description
(A)	Drilling allowed within the marked area.
(B)	Carriage plate

Continues on next page

2 Installation and commissioning

2.4.6 Measures of the carriage table

Continued

Pos	Description
(C)	Distance plate (fitted to the carriage at delivery)
(D)	Adapter for guide pin (fitted to the carriage at delivery)

2 Installation and commissioning

2.5.1 Foundation

2.5 On-site installation

2.5.1 Foundation

Robustness

The foundation must withstand the static loads caused by the weight of the equipment and the dynamic loads generated by the movement of the carriage and the manipulator.

Incline

The foundation must be designed so that the track motion IRBT 4004/6004/7004 can be mounted without the incline exceeding 0.5 mm/m in the direction of travel and 0.2 mm/m across this.

Maximum load

The maximum load for the different tracks:

Type	Permitted load
IRBT 4004	IRB 4400/4600 payload ⁱ + pedestal + 500 kg
IRBT 6004	IRB 6600/6650 payload ⁱ + pedestal + 100 kg
IRBT 7004	IRB 7600 payload ⁱ + pedestal + 100 kg

ⁱ Robot payload is specified in the Product specification for the robot. See document number of Product specifications in section [References on page 10](#).

Forces

See the maximum floor loads in section [Forces on page 59](#).

2.5.2 Mounting bolts

Mounting bolts

Chemical anchor bolts, bolting towards steel foundation, are recommended to secure the track motion IRBT 4004/6004/7004 to the floor. However, the mounting bolts are not supplied since they must be selected on the basis of the material the foundation is made of.

Choose mounting bolts so that they:

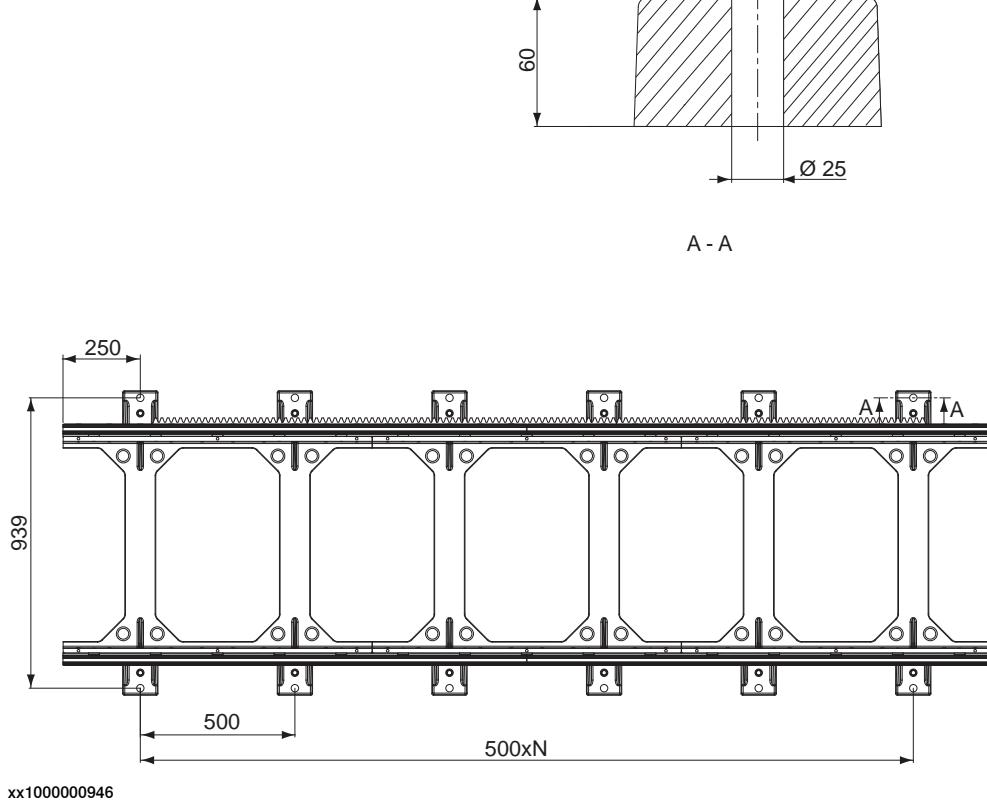
- Are suitable for the foundation.
- Can bear the dynamic loads.
- Are able to bear the combined dynamic loads that can occur when the manipulator and carriage move.
- Fit in the holes in the stand, Ø 25 mm.

2 Installation and commissioning

2.5.3 Hole configuration

2.5.3 Hole configuration

Dimension



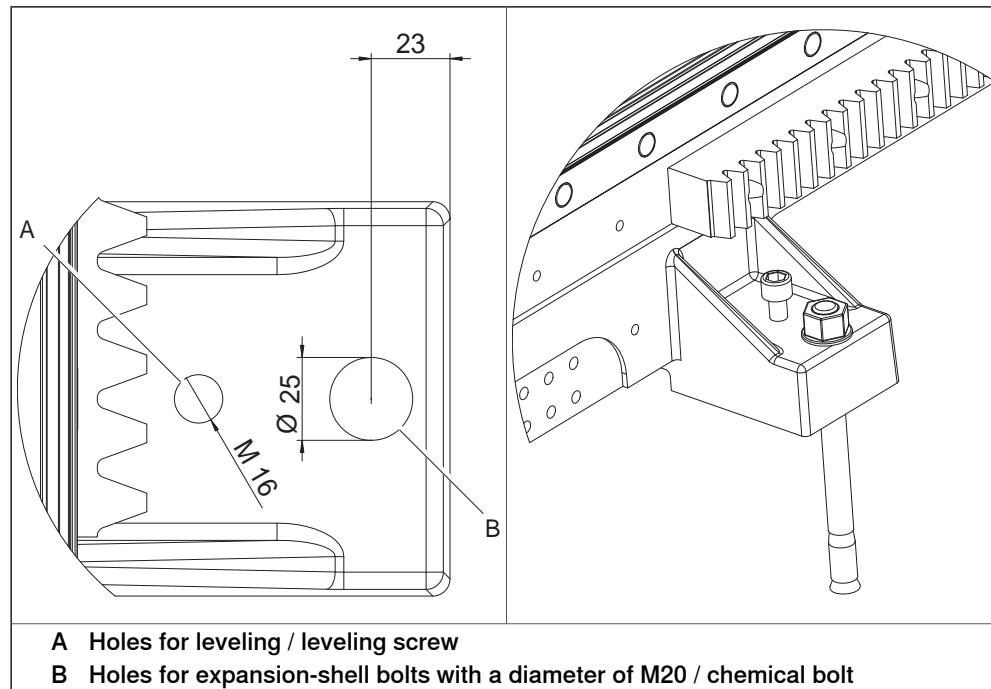
The table shows the value of N in the figure above with different travel lengths.

Travel length IRBT 4004 / IRBT 6006 and IRBT 7004	Total length of the stand	Quantity N
1.9 / 1.7 m	3 m	5
2.9 / 2.7 m	4 m	7
3.9 / 3.7 m	5 m	9
etc.		

Continues on next page

Hole configuration

The stand's ground plates have holes for assemble. The hole configuration on the right side (shown in figure) is the same as the hole configuration on the left side.

**Screws for fastening manipulator to base**

Recommended screws for fastening the manipulator to the base	
Steel structure	M20 x 90 8.8 with 4 mm flat washer
Concrete floor	M20 i

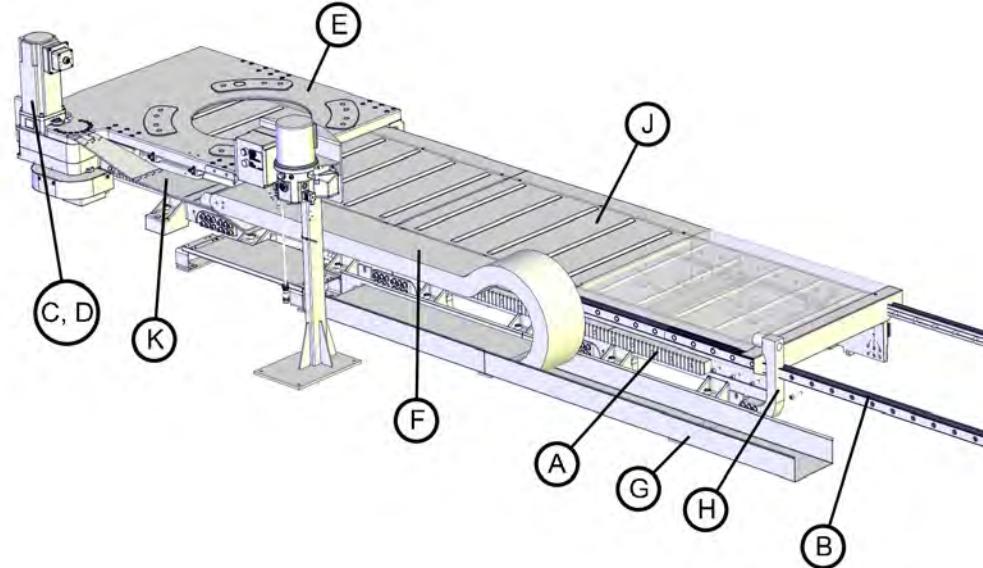
i The type and dimension of screws depend on the foundation conditions. See description for maximum floor loads in [Operating requirements on page 58](#).

2 Installation and commissioning

2.5.4 Track motion IRBT 4004/6004/7004 overview

2.5.4 Track motion IRBT 4004/6004/7004 overview

Track motion content



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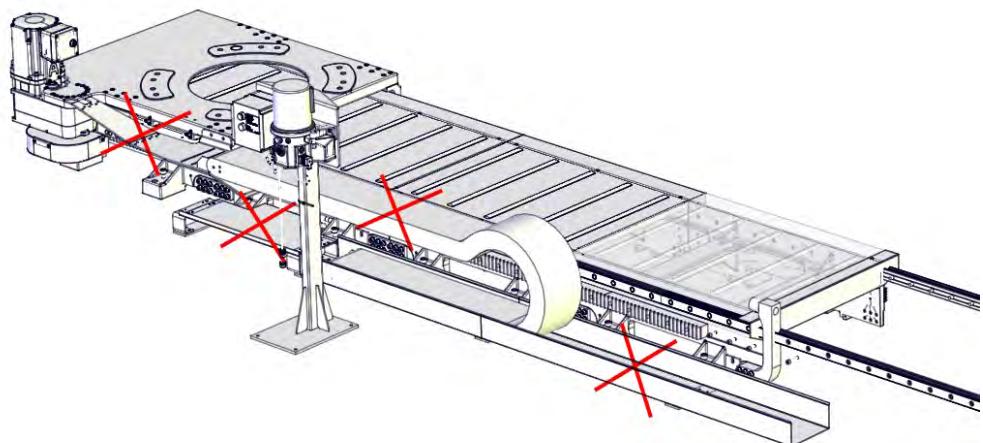
A	Gear rack
B	Linear guides
C	Motor
D	Gearbox
E	Carriage
F	Cable chain
G	Cable tray
H	Mechanical stop
J	Protecting plate
K	Attachment plate for cabling

The same components are used in standard, doubled and mirrored layout variants. The only exception is for IRBT 6004 and 7004, where the carriage differs for the mirrored carriage.

Continues on next page

Easily damaged parts on the track motion

Do not step on the locations marked in the figure since they are easily damaged.



xx1300000797

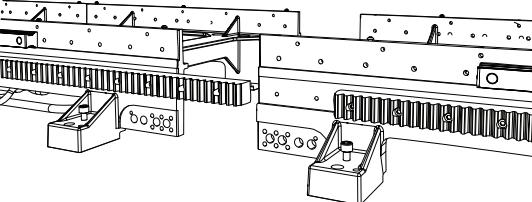
2 Installation and commissioning

2.5.5 Assembling the sections of the track motion IRBT 4004/6004/7004 (Longer than 9m)

2.5.5 Assembling the sections of the track motion IRBT 4004/6004/7004 (Longer than 9m)

Assembling the track motion

The track motion is delivered in one complete unit up to 9 meters. Tracks longer than 9 meters are divided, and delivered in sections as described in [Weight of track motion with single carriage on page 80](#) and [Required space for installation of double carriage track \(option 1088-2\) on page 77](#). Use the following procedure to assemble the sections of the track motion IRBT 4004/6004/7004.

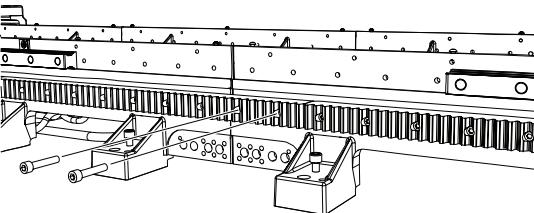
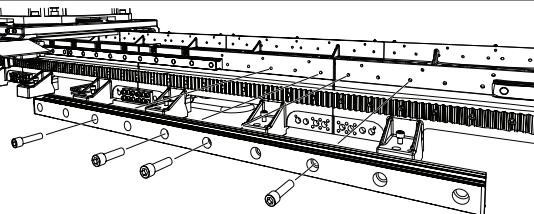
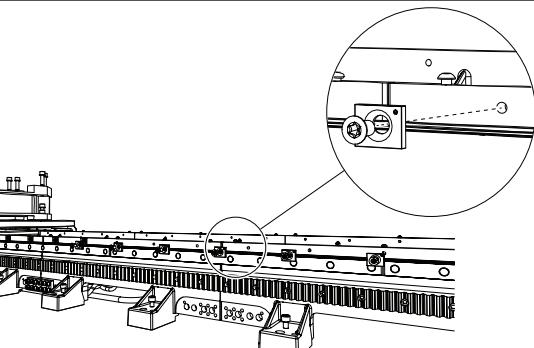
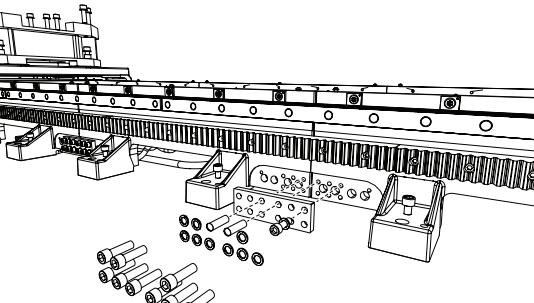
Action	Note
1 Lift the sections to desired location.	Weight is specified in Weight of track motion with single carriage on page 80 and Required space for installation of double carriage track (option 1088-2) on page 77 .
2 Remove the bolts that are used as temporary stops on both sides of the track.  WARNING A track motion that is divided in sections has a bolt fastened to the end of the guide rails on both sides of the track in order to avoid the carriages from derailing during shipping. The bolts act as temporary stops and must be removed before assembling the sections.	
3 Release the axis 7 motor brake by connecting external power supply to connector J1.XP7.	Without option Robot Servo Gun <ul style="list-style-type: none">• 24 V DC to pin f.5• 0 V DC to pin f.9 With option Robot Servo Gun <ul style="list-style-type: none">• 24 V DC to pin f.6• 0 V DC to pin f.10
4 Press the break release button on motor to move the carriage.	
5 Align the two sections roughly, and remove the covers.  Note Make sure that correct section ends are assembled together by checking the labeling.	 xx1400000826
6 Push the two sections together saving a gap of about 10-12 mm between the two sections.	

Continues on next page

2 Installation and commissioning

2.5.5 Assembling the sections of the track motion IRBT 4004/6004/7004 (Longer than 9m)

Continued

	Action	Note
	<p>Assemble the gear racks using four (2), Hex socket head cap screw M10x50.</p> <p>Set the screw joint loosely.</p>	 <p>xx1400000827</p>
7	<p>Assemble the Guide rails first using four (4), Hex socket head cap screw M12x40.</p> <p>Set the screw joint loosely.</p>	 <p>xx1400000815</p>
8	<p>Assemble the six (6) pressure washers with countersunk screws M8x20.</p> <p>Set the screw joint loosely.</p>	 <p>xx1400000816</p>
9	<p>Assemble the rest of the Hex socket head cap screw M12x40 (6) in the Guide rail.</p> <p>Set the screw joint loosely.</p>	
10	<p>Assemble the Joint bracket using two (2) guide pins, and ten (10), Hex socket head cap screw M12x40.</p> <p>Set the screw joint loosely.</p> <p>Note In order to reach the same acceptable accuracy as in the manufacturing process, the joint bracket is drilled with a 16 mm and assembled using split pins. Make sure to turn the bracket according to the marking. Reassemble the pins, using a hammer.</p>	 <p>xx1400000817</p>
11	Repeat the assembling in the same order, on the other side of the track motion.	

Continues on next page

2 Installation and commissioning

2.5.5 Assembling the sections of the track motion IRBT 4004/6004/7004 (Longer than 9m)

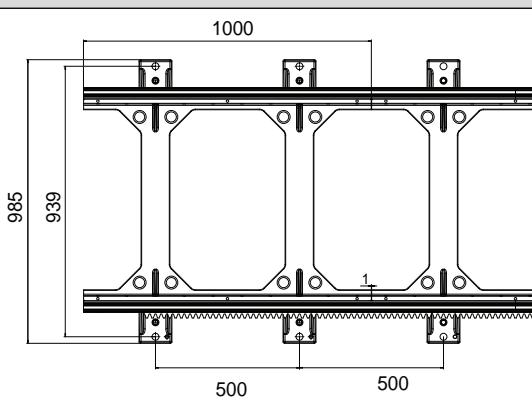
Continued

Action	Note
12 Use a torque wrench to tighten all screw joints. See Screw joints on page 283 .  Note All screw joints should be cross-tightened.	
13 Continue the assembly as described in section Positioning the stand on page 95 .	

2.5.6 Positioning the stand

Positioning the stand

Use this procedure to position the stand modules.

	Action	Note
1	Position the track motion at the intended work site.	
2	Use the leveling screws to raise the track.	
3	Drill all holes according to the screw manufacturers recommendation for the specific foundation.	
4	Mount shims to fill up the gap between the foot and the floor.	<p> Note</p> <p>The track motion must be adjusted with Laser leveling tools before use, described in Geometric alignment of track motion IRBT 4004/6004/7004 on page 96.</p>

2 Installation and commissioning

2.5.7 Geometric alignment of track motion IRBT 4004/6004/7004

2.5.7 Geometric alignment of track motion IRBT 4004/6004/7004

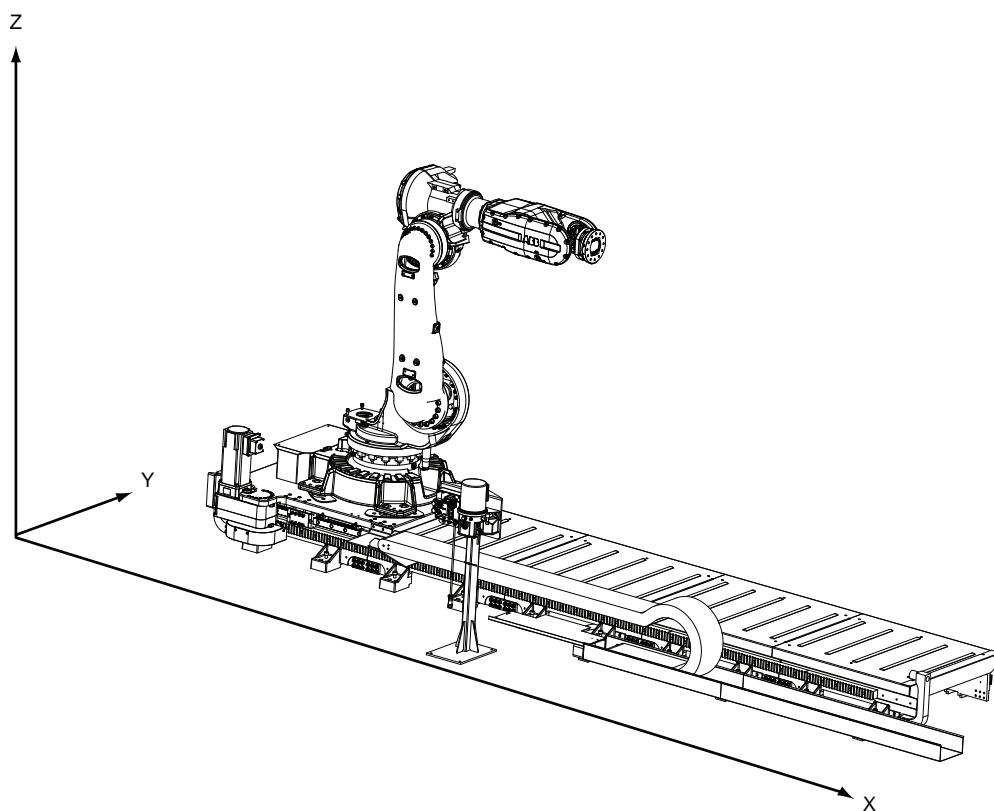
Align the track geometrically with a laser level

The geometric alignment of the track motion is done in order to adjust the carriage horizontally along the entire travel length. Use a laser level.

Required equipment

Equipment	Art. no.	Note
Laser level	-	

Directions



xx1100000723

Track alignment in different directions



Note

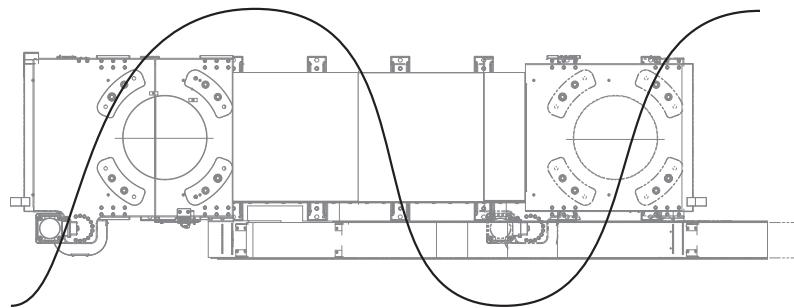
The origin of coordinates is located in the manipulator's base zero.

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Alignment in Y direction

The figure shows the possible variation along the Y-axis.

The track should be laser aligned to within ± 0.2 mm from the origin, along the entire Y-axis.

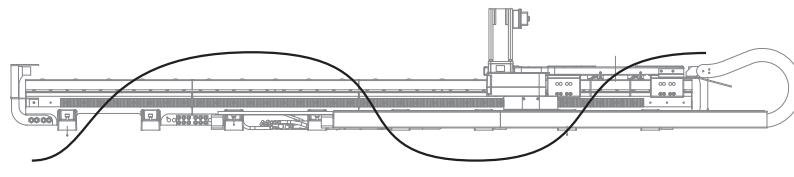


xx1300000799

Alignment in X direction

The figure shows the possible variation along the X-axis.

The track should be laser aligned to within ± 0.5 mm from the origin, along the entire X-axis.

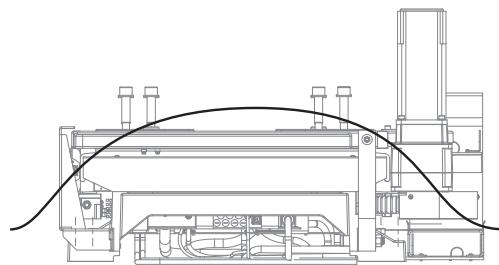


xx1300000800

Alignment in Z direction

The figure shows the twist / possible variation along the Z-axis.

The track should be laser aligned to within ± 0.5 mm from the origin, along the Z-axis.



xx1300000801

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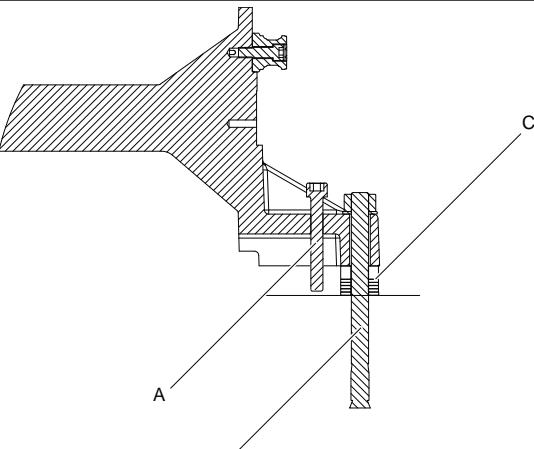
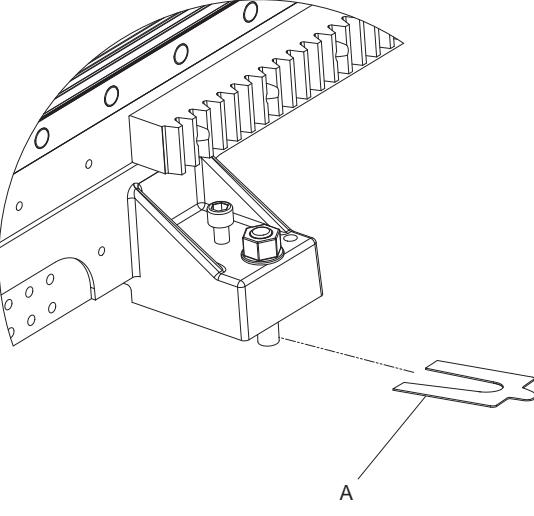
2 Installation and commissioning

2.5.7 Geometric alignment of track motion IRBT 4004/6004/7004

Continued

Shimming the track

Use this procedure to shim the track during laser leveling.

Action	Note
5 Screw the leveling bolts (A) in or out to raise or lower the ground plate in question.	 <p>xx1100000724</p> <p>A Leveling bolt B Bolt C Shim</p>
6 Add/remove shim(s) to fill up the gap between the foot and the floor. When the gap is gone, slack the tension on the leveling bolt and let the foot rest on the shim(s). Use shims with thickness 0.1 mm, 0.3 mm, 0.7 mm, 1 mm, 3 mm or 7 mm. Use dimensions shown in the figure.	 <p>xx1100000708</p> <p>A Shim</p> <p>Technical drawing of a shim (A) showing dimensions: height = 110 ± 0.5 mm, width = 115 ± 0.5 mm, thickness = 57.5 ± 0.5 mm, and radii R10 and R15 at the top corners.</p> <p>xx1100000709</p> <p>Tighten with tightening torque recommended for the used bolt.</p>
7 Tighten the mounting bolts when the level of the complete track motion is adjusted.	
8 Remove/slack leveling bolt.	

2.5.8 Moving the carriage manually

Releasing the brake

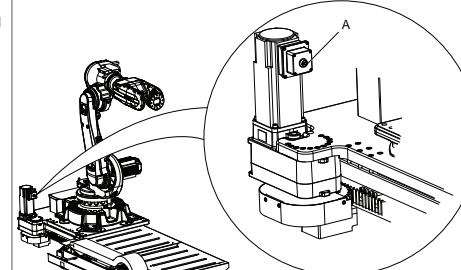
The carriage can be moved manually if necessary by connecting the power cable to the controller and releasing the brake.

If there is no voltage to the motor, 24 VDC can be connected directly to the motor as described in [Releasing the brake with external 24V DC on page 99](#).



Note

For motors that are not type A, the BRB option must be installed. See the different appearances of the motors in section [Two versions of the track motion motor on page 183](#).

	Action	Note
1	Connect all cables to the controller as described in The cabling from the controller on page 118 .	
2	Start up the controller as described in Connectors on Drive Module on page 123 .	
3	Press the brake release button (A) shown in the figure.	 xx1100000717
4	Push the carriage to the desired location by hand.	

Releasing the brake with external 24V DC

24V DC can be connected directly to the motor on axis 7 using an 24V DC converter and a connector cable.



CAUTION

The motor brakes on the track motion IRBT 4004/6004/7004 are phase dependent. Incorrect polarity can cause damage to vital parts.

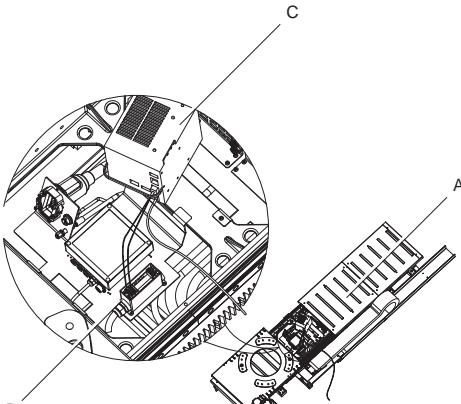
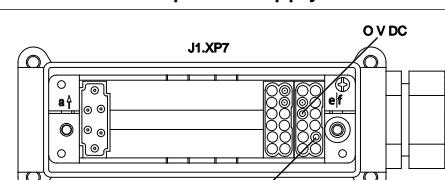
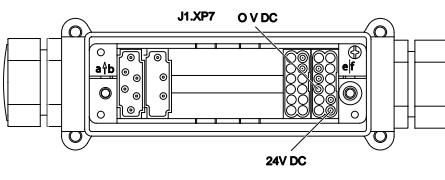
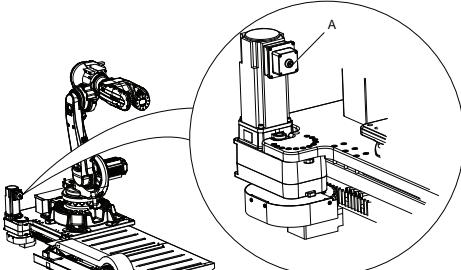
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2 Installation and commissioning

2.5.8 Moving the carriage manually

Continued

Release the axis 7 motor brake

Action	Note
1 Remove the six socket head cap screws that hold the cover plate (A).	 <p>A Cover plate B Connector J1.XP7 C External power supply 24V DC</p>
2 Connect the external power supply to the contact J1.XP7. Connect 24V DC to pin f.5. Connect 0V DC to pin f.9. With option: Robot Servo Gun Connect 24V DC to pin f.6. Connect 0V DC to pin f.10.	 <p>Figure 2.1: Without option Robot Servo Gun</p>  <p>Figure 2.2: With option Robot Servo Gun</p>
3 Press the brake release button (A) on the motor to move the carriage.	

2.6 Assembling the cable tray and manipulator

2.6.1 Assembling the manipulator

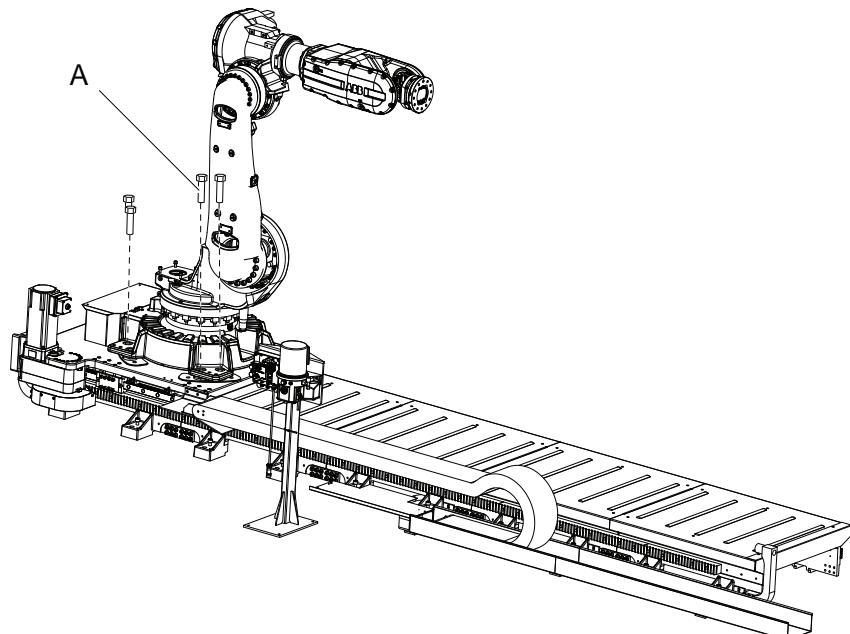
Assembly position

The manipulator should be assembled in one of following two positions:

- InLine: Neutral position for axis 1 aligned in line with the Track Motion's direction of travel.
- 90°: Neutral position for axis 1 aligned at 90° to the Track Motion's direction of travel.

To assemble the manipulator to the carriage, follow the installation instructions for the specific manipulator, see section Installation and commissioning in the Product manual for the manipulator.

Manipulator assembled on carriage



xx1100000726

A Robot assembly bolts

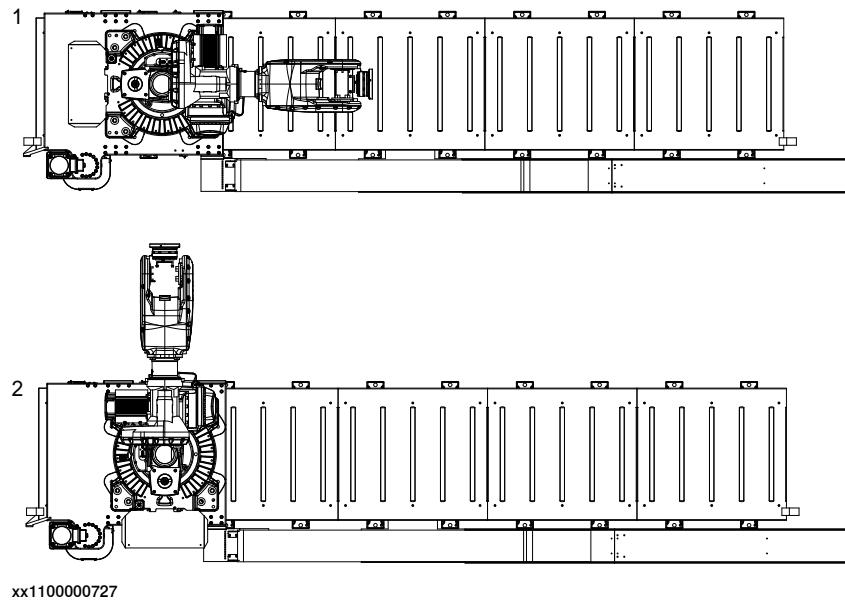
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2 Installation and commissioning

2.6.1 Assembling the manipulator

Continued

Manipulator positions on track motion



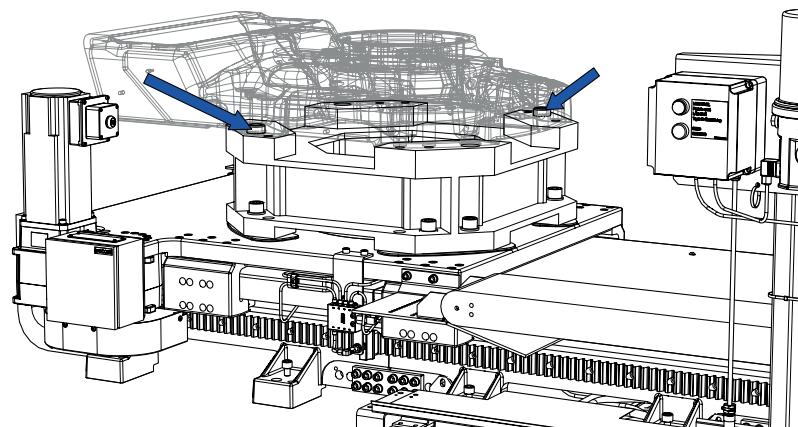
xx1100000727

1 In line

2 90°

Orienting manipulator IRB7600 and pedestal

On delivery, the pedestal (if ordered) is mounted in an inline position. If the manipulator shall be turned 90 ° in any direction, the pedestal must also be rotated in the same direction due to the fact that the guide pins only fits the manipulator base according to the illustration.



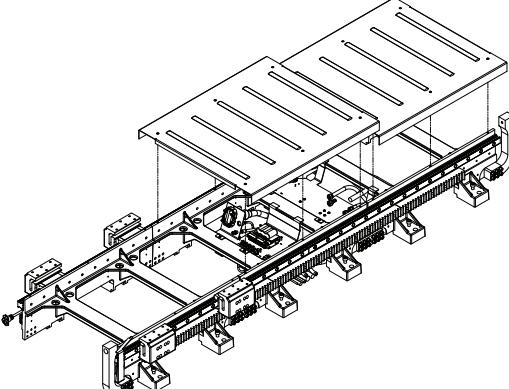
xx1500002376

Illustration shows IRB 7600 manipulator base and pedestal in an inline position.

2.6.2 Assembling the cover and side plates

Assemble the cover and side plates

Use this procedure to assemble the cover and end plates.

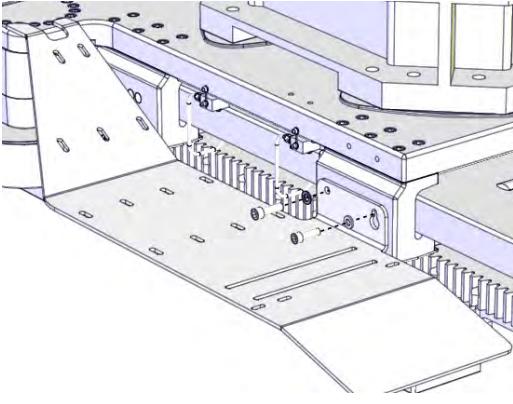
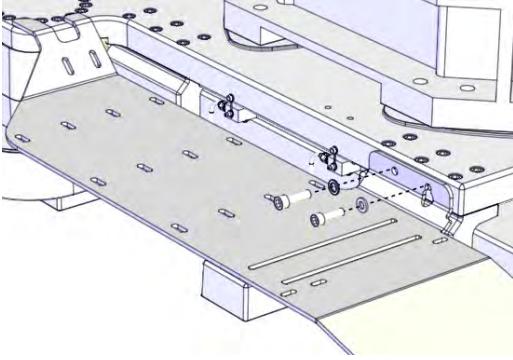
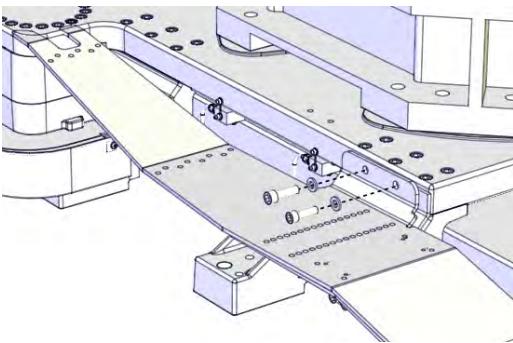
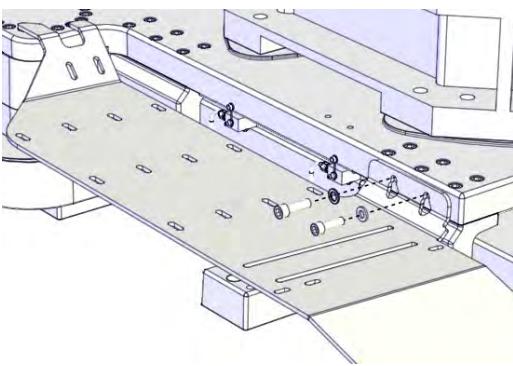
	Action	Note
1	Assemble cover plates over all joints.	
2	Assemble the end plates on the track motion's short ends.	 xx1100000728

Continues on next page

2 Installation and commissioning

2.6.2 Assembling the cover and side plates

Continued

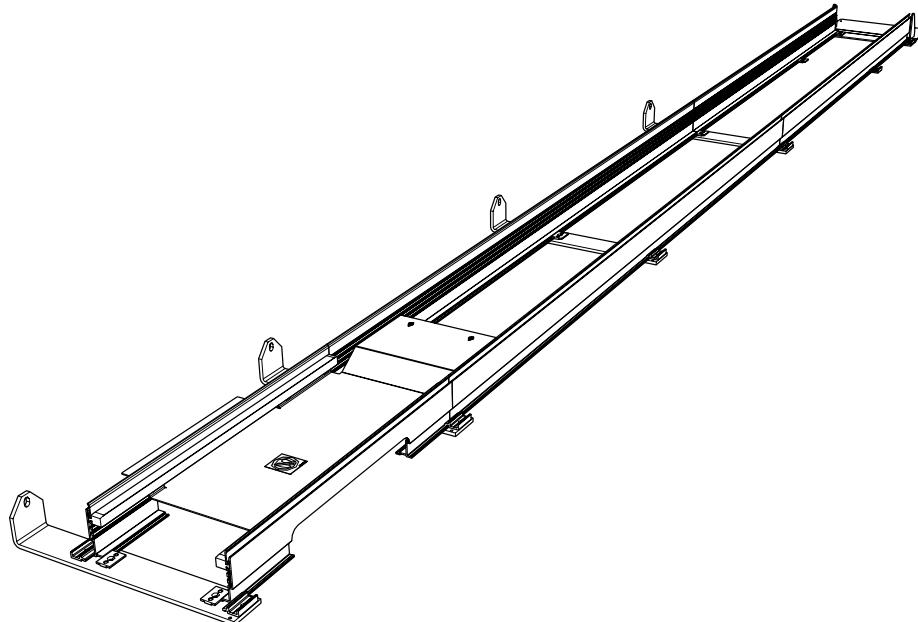
Action	Note
3 Assemble the connecting plate to the carriage.	<p>Note</p> <p>The figures show different designs of the plate as well as different installation locations depending on the design of the plate.</p> <p>Tip</p> <p>The slotted hole can be used to simplify installation of the plate. Insert one of the screws, then hang the plate upon the screw using the slotted hole. After that, insert the other screw and finally tighten both screws. Use standard tightening torque.</p>  <p>xx1600000516</p>  <p>xx1600000517</p>  <p>xx1600000346</p>  <p>xx1600000577</p>

2.6.3 Assembling the cable tray

Two different designs

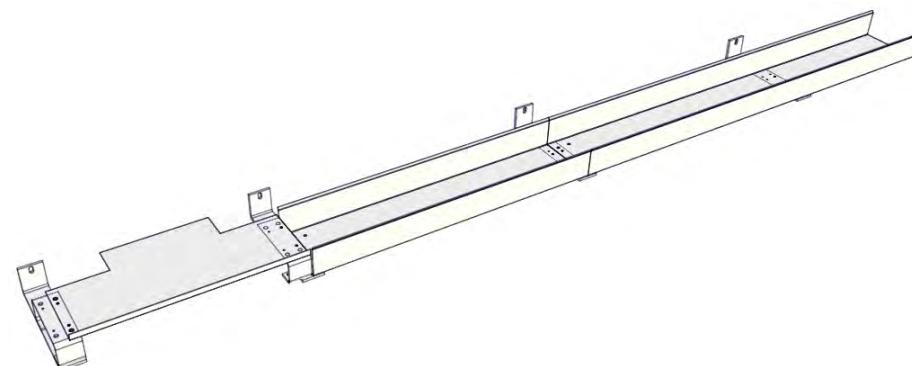
There are two designs of the cable tray. Use the correct assembling instruction depending on your design.

- The cable tray made for the cable chain Murrplastik is made of aluminium profiles, fastened to each other by brackets and thereby forming a tray. It is fastened to the track motion by the brackets.



xx1300001026

- The cable tray made for the cable chain Brevetti is a solid tray that is fastened to the track motion with guide plates.



xx1300001027

Continues on next page

2 Installation and commissioning

2.6.3 Assembling the cable tray

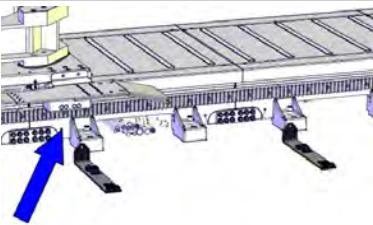
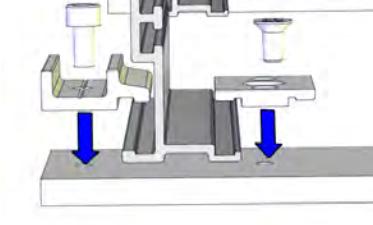
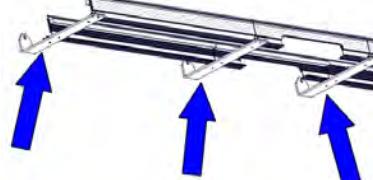
Continued

Assembling the cable tray for the cable chain Murrplastik

Use extra support if the track is raised

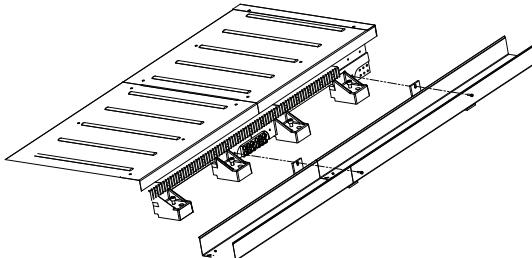
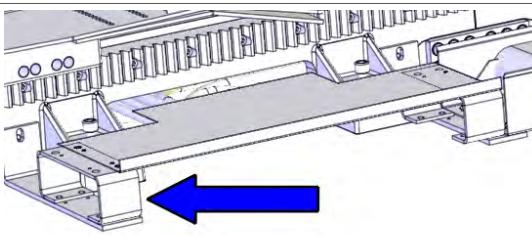
If the track is raised between 10 - 50 mm off the ground, M6 machine feet should be added to the cable chain brackets. When distance exceeds 50 mm the cable chain brackets must be supported by other means.

Assembling the cable tray

	Action	Note
1	<p>Fit the cable chain brackets to the track motion.</p> <p> Note</p> <p>Mounting location of the brackets depends on the placement of the aluminium profile with the cut-out. Plan the placement of the profiles!</p> <p>The aluminium profiles are designed in lengths: 0.3 m, 1 m, 1.3 m, 1.7 m and 2 m. The length of the cut-out profile is 0.7 m. Take this into consideration when fitting the brackets to the track motion so that the brackets are fitted at the correct mounting holes.</p> <p>The placement of the cut-out profile depends on cable chain length. See Lifting and fitting the cable chain Murrplastik on page 115.</p>	 xx1300001001
2	Place the aluminium profiles onto the brackets.	 xx1300001002
3	Fasten the profiles by securing the clamping profiles with screws.	 xx1300001003
4	Use a spirit level to check that the tray is level. If needed, adjust the leveling bolts or shim the brackets that hold the tray (shown in figure).	 xx1300000929

Continues on next page

Assembling the cable tray for the cable chain Brevetti

Action	Note
1 Bolt the cable tray's guide plates on to the plates. Gently tap on the side if the positions of the holes are not aligned.	 xx1100000729
2 If the travel length of the completed track motion is 5.7 meters or more, a raised support for the cable chain should be placed at the end of the cable tray. The raised support should be fitted on the center ground plate (with an odd number of ground plates), or on the next following ground plate in the direction of travel (with an even number).	 xx1300000798

2 Installation and commissioning

2.7.1 Routing the robot's cable harness

2.7 Electrical installation

2.7.1 Routing the robot's cable harness

General

The following information describes how to route the cables in various robot positions. The robot's cable harness fits, regardless of which one of the two possible positions the robot is placed in on the carriage.

Note that the routing always starts with the robot power cable.



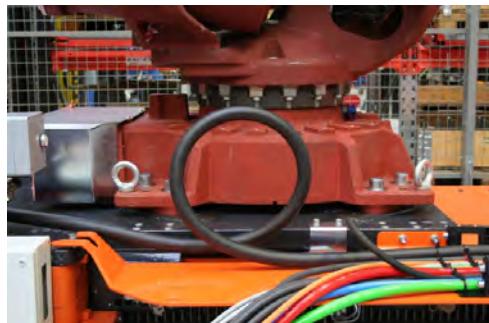
CAUTION

Make sure that the cable chain cannot come into contact with any moving parts.

Continues on next page

2.7.1.1 IRB 6640 inline

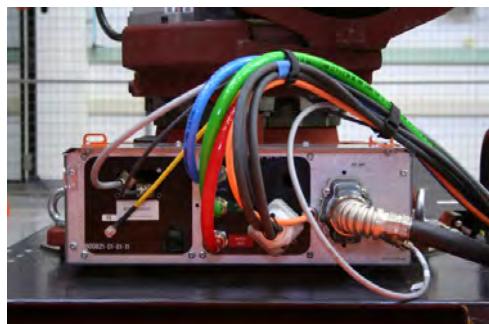
Illustrations



xx1400000623



xx1400000624



xx1400000625



xx1400000626

2 Installation and commissioning

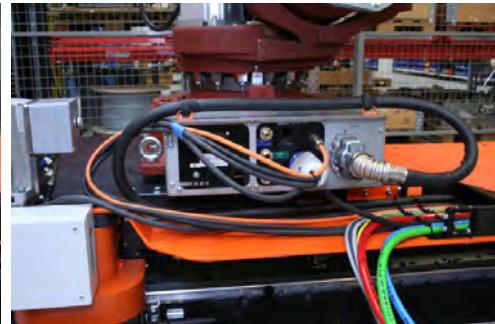
2.7.1.2 IRB 6640 90°

2.7.1.2 IRB 6640 90°

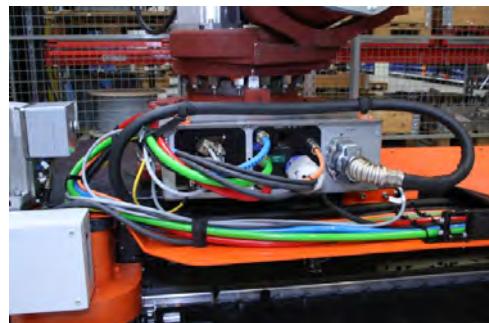
Illustrations



xx1400000627



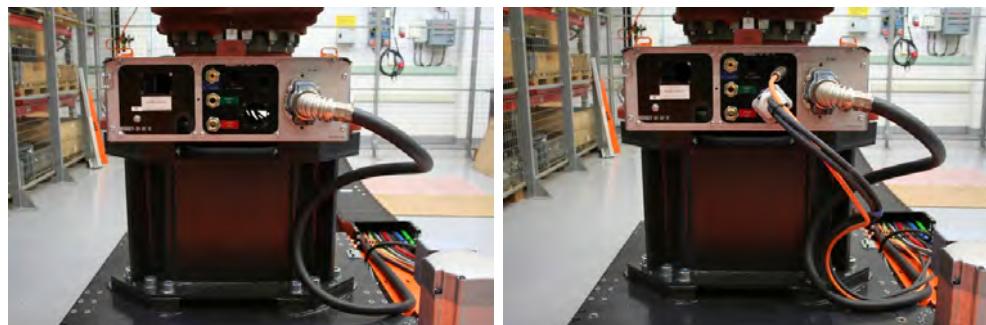
xx1400000628



xx1400000629

2.7.1.3 IRB 6640 pedestal inline

Illustrations



2 Installation and commissioning

2.7.1.4 IRB 6640 pedestal 90°

Illustrations



xx1400000630

xx1400000631



xx1400000632

xx1400000633

2.7.1.5 IRB 7600 inline

Illustrations



xx1400000637



xx1400000638



xx1400000639



xx1400000640

2 Installation and commissioning

2.7.1.6 IRB 7600 90°

2.7.1.6 IRB 7600 90°

Illustrations



xx1400000641

xx1400000642



xx1400000643

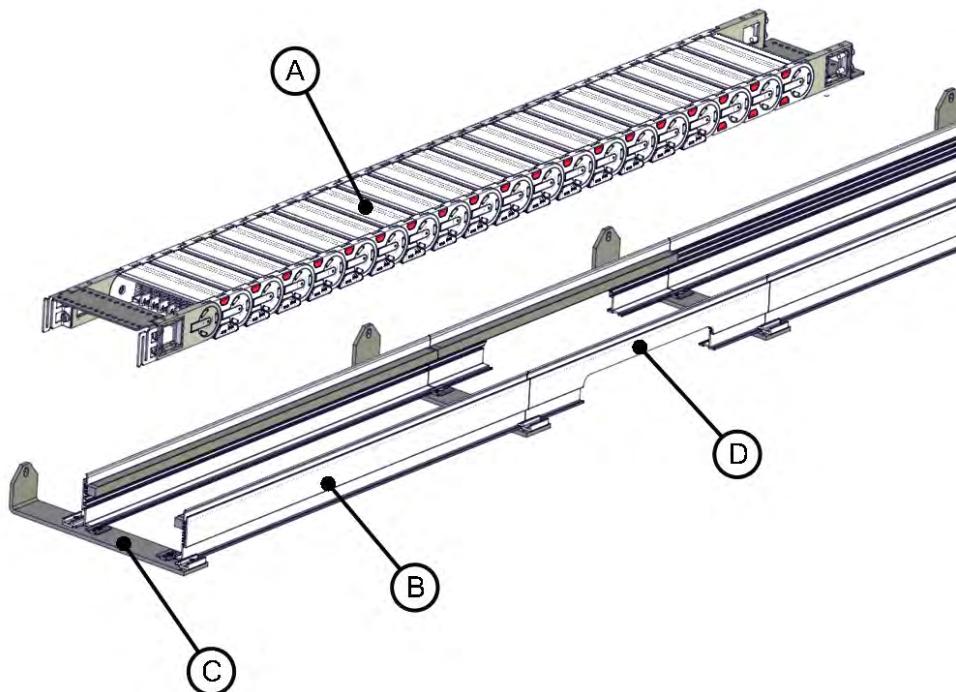
xx1400000644

2.7.2 Lifting and fitting the cable chain Murrplastik

2.7.2 Lifting and fitting the cable chain Murrplastik

Illustration, cable chain and cable tray made of aluminium profiles

The figure shows the cable chain Murrplastik and the cable tray designed for the cable chain.



xx1300000926

A	Cable chain
B	Aluminium profile
C	Cable chain bracket
D	Aluminium profile with cut-out

Plan the job

Cable chains are easily damaged through improper handling. Chains longer than 4 meters are heavy and cumbersome to move. In order to prevent personal injury and damage to the chain please pay attention while handling.

Read the procedure through closely before installing the chain and plan the job in advance, in regard to the actual installation site.

To move the chain from storage to track, use one of the methods described in this section. Method 2 requires an overhead crane.

Required equipment

Equipment	Art. no.	Note
Lifting slings, standard	-	Quantity depends on track motion length. Required if using lifting method 1.

Continues on next page

2 Installation and commissioning

2.7.2 Lifting and fitting the cable chain Murrplastik

Continued

Equipment	Art. no.	Note
Lifting sling, extra wide (50 mm)	-	Required if using lifting method 2.
Overhead crane	-	

Method 1: lifting the cable chain that is folded in half

	Action	Note
1	 CAUTION The complete cable chain weighs 8 - 15 kg / meter (depending on content). All lifting accessories used must be sized accordingly!	
2	Place the chain so that it is folded in half lying flat.	
3	Place lifting slings on the two ends and in the middle. If the folded chain is longer than 4 meters then extra lifting slings should be placed so that the chain is supported every two meters.	 xx1300000887
4	Lift the cable chain to the installation position above the cable tray. The chain should be placed so that both ends are in the middle of the track, at the aluminium profile that has a cut-out.	 xx1300000932
5	There is no space for the lifting slings to stay fitted to the chain once it is lowered into the tray, therefore these must be removed before the cable chain is placed inside the tray. Lower the fixed and movable ends first, then continue lowering bit by bit until the complete chain is fitted into the tray, while at the same time removing the lifting slings one by one.	

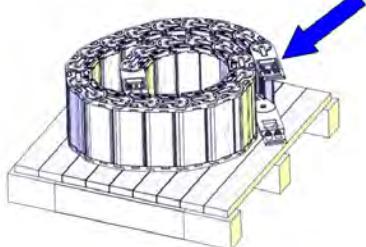
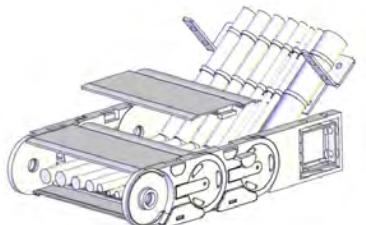
Method 2: lifting the cable chain that is rolled

This procedure requires an overhead crane.

	Action	Note
1	 CAUTION The complete cable chain weighs 8 - 15 kg / meter (depending on content). All lifting accessories used must be sized accordingly!	

Continues on next page

2.7.2 Lifting and fitting the cable chain Murrplastik Continued

	Action	Note
2	With the chain lying on its side, secure the loose end to ensure that the chain can not unroll during the lift.	 xx1300000888
3	Lift the chain so that it is standing upright and insert a wide lifting sling (50 mm) through the center of the chain.	
4	Lift the cable chain to the installation position above the cable tray. The chain should be placed so that both ends are in the middle of the track, at the aluminium profile that has a cut-out.	 xx1300000889
5	Lower the cable chain into the cable tray. The ends of the chain should be in the middle of the track.	
6	In order to keep the correct length for long chains that are to be rolled, the strapping plate as well as the first cover and clips are removed. Refit these parts during installation.	 xx1300000890

Installing the cable chain into the tray

How to install the cable chain into the tray is described in [Refitting the cable chain on page 249](#).

2 Installation and commissioning

2.7.3 The cabling from the controller

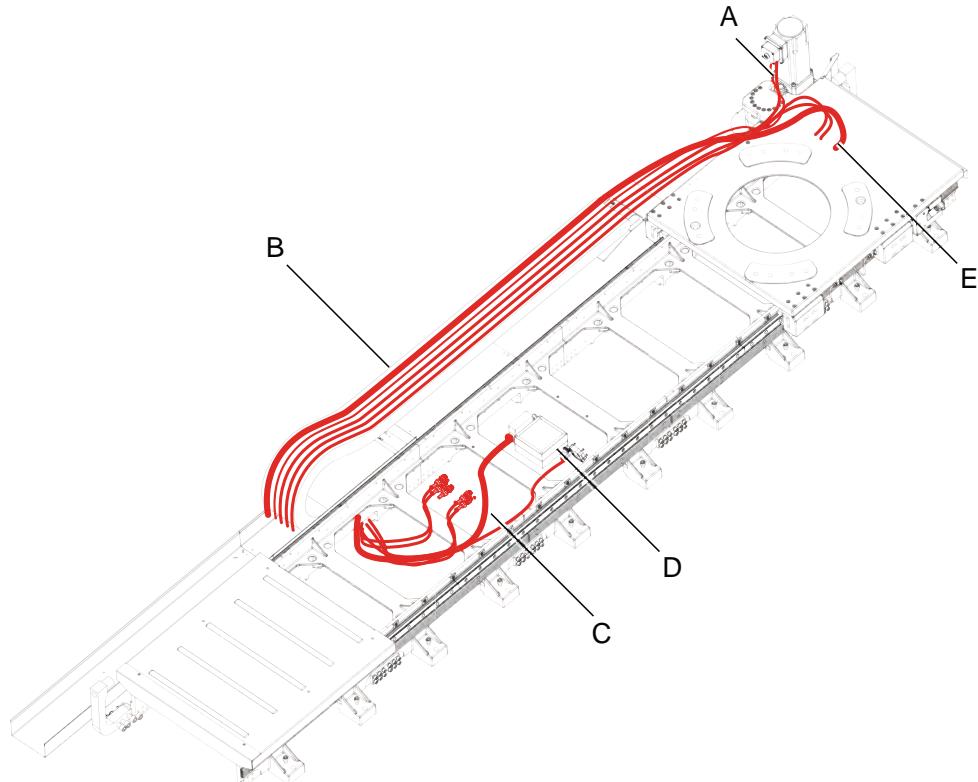
2.7.3 The cabling from the controller

Cable run

Cabling between the control equipment and the track motion contact plate should be run through cable conduits on the floor.

Connection points

The cable harness that normally connects the control equipment with the manipulator and carriage is connected to the track motion's standard contact plate and customer contact plate.

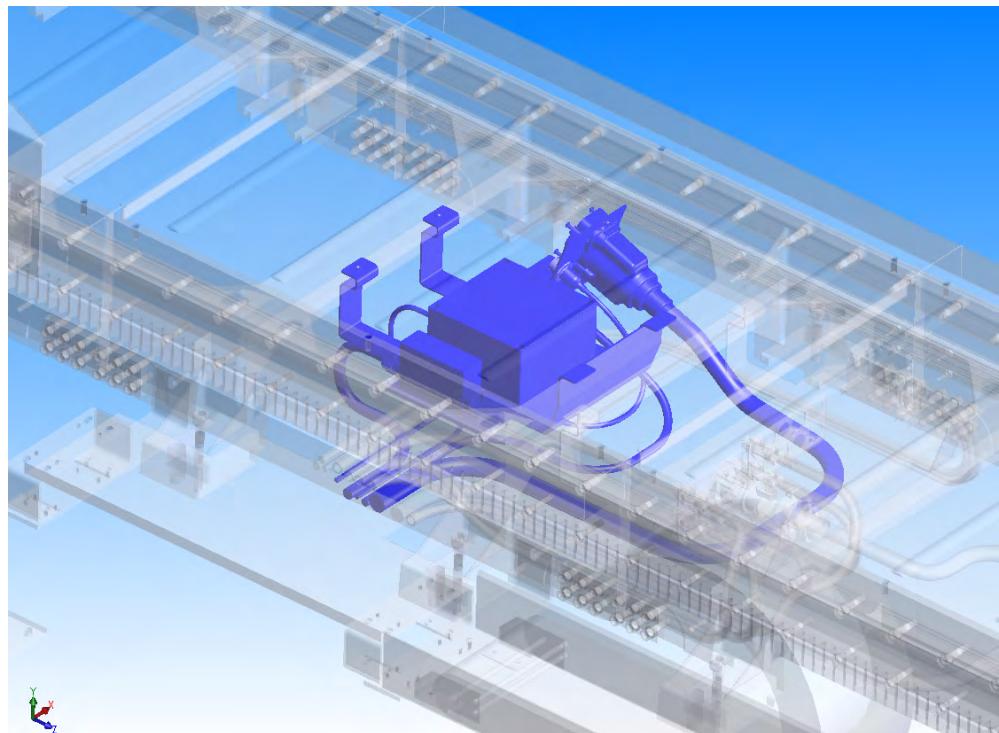


xx1100000730

A	IRBT Power and signal cables
B	Cable chain
C	Customer cables
D	IRB / IRBT Power and signal cables
E	IRB Power and signal cables

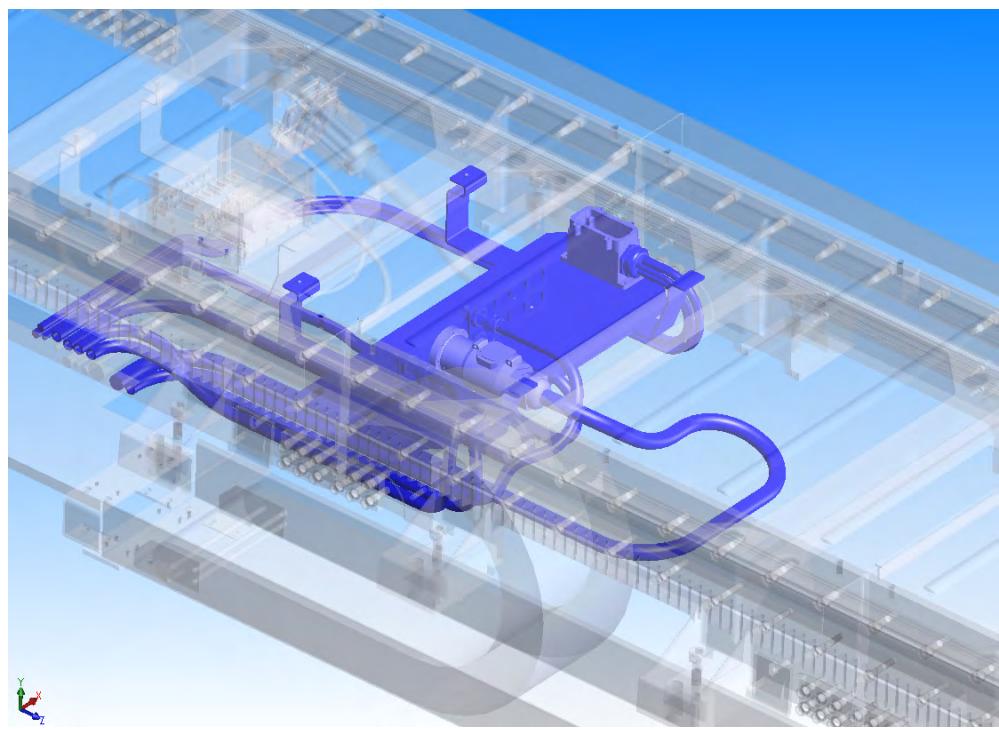
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Connection points, Standard contact plate



xx1100000731

Connection points, Customer contact plate



xx1100000732

2 Installation and commissioning

2.7.4.1 Introduction

2.7.4 Connections

2.7.4.1 Introduction

Connections

The wiring diagrams are described in section [*Circuit diagrams on page 293.*](#)

2.7.4.2 Assembly of the cable MS2 XS/P41

Assembly of the cable

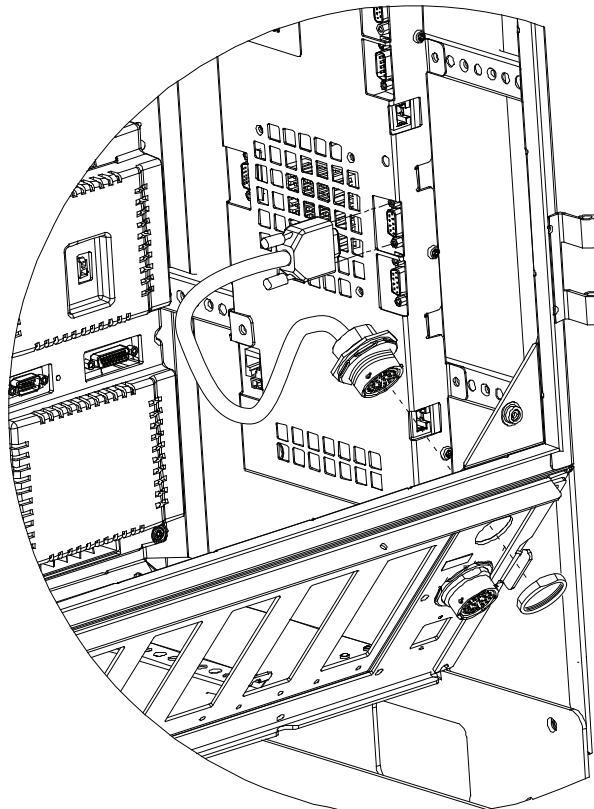
The following section describes the assembly of the additional axes SMB connection on IRC5 controller front panels.



WARNING

Disconnect all electrical supply before installation of the cable.

Location of the cable



xx1100000710

Connecting the cable

	Action	Note
1	Connect the cable harness MS2 XS/P41 to the connector XP2.	

2 Installation and commissioning

2.7.4.3 Connectors on the controller

General

The following section describes the connectors on the front panel of the IRC5 controller.

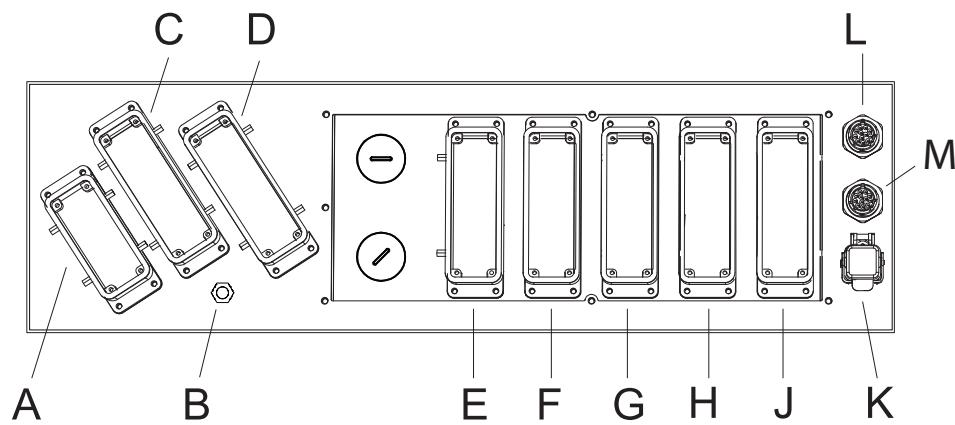


CAUTION

Always inspect the connector for dirt or damage before connecting it to the controller. Clean or replace any damaged parts.

Connectors

The following details the connection interface on the IRC5 controller.



	Description
A	XP.0 Mains connection
B	Earth connection point
C	XS.1 Robot power connection
D	XS.7 Additional axes power connection
E	XS.13/XS.5 Customer power/signals external connection
F	XS.10 Customer options
G	XS.11 Customer options
H	XS.12 Customer options
J	X3 Customer safety signals
K	XS.28 Network connection
L	XS.41 Additional axes SMB connection
M	XS.2 Robot SMB connection

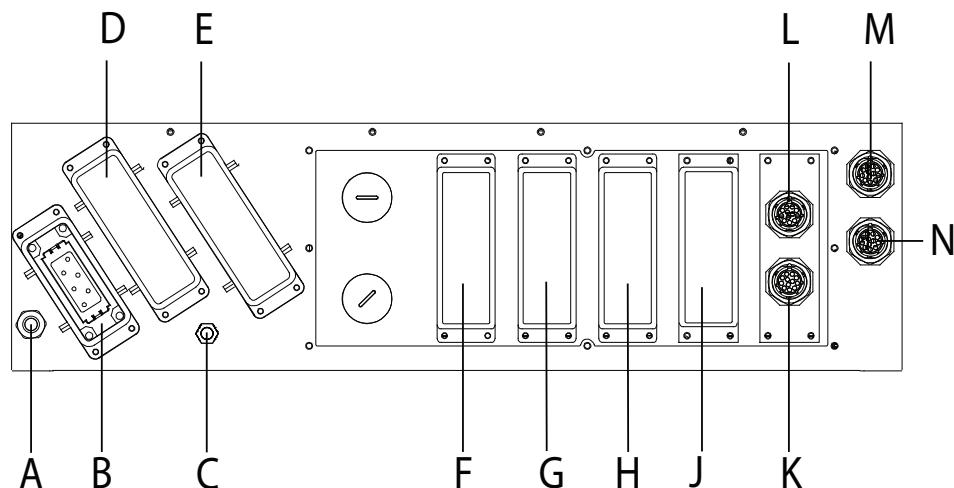
2.7.4.4 Connectors on Drive Module

General

The following section describes the connectors on the Drive Module. The Drive Module is detailed in section Installation of additional Drive Module in *Product manual - IRC5*.

Connections

The following details the connectors on the front panel of the Drive Module.



xx0600002931

	Description
A	Power connection to Control Module
B	A4.X0: Mains connection to transformer
C	Earth connection point
D	A4.X1: Robot power connection
E	A4.X7: External axes power connection
F	A4.XX: Customer options
G	A4.XX: Customer options
H	A4.XX: Customer options
J	A4.XX: Customer options
K	Communication cabling between Control/Drive Module
L	Communication cabling between Control/Drive Module
M	A4.XS41: Additional axes SMB connection
N	A4.XS2: Robot SMB connection

2 Installation and commissioning

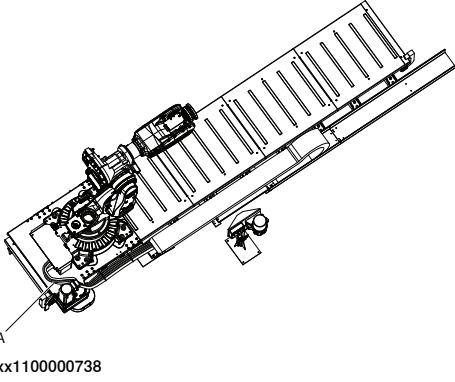
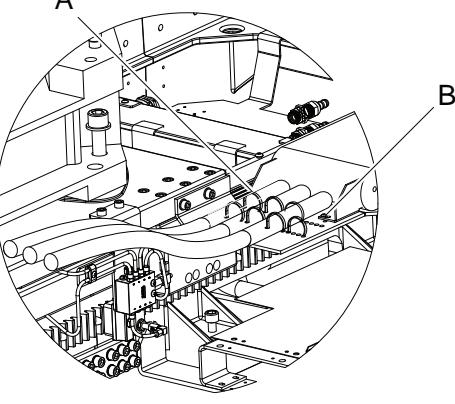
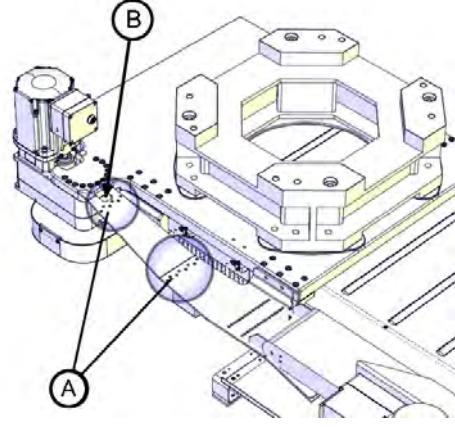
2.7.5.1 Adjusting cables and covers

2.7.5 Adjustments

2.7.5.1 Adjusting cables and covers

Adjustments

Use this procedure to adjust cables and covers.

Action	Note
<p>1 Adjust cables (A) and covers. If the cover is used for the cable chain, make sure there is no risk of collision and that the covers are well tightened.</p>	 <p>A xx1100000738</p>
<p>2 Make sure all cables are well secured and without risk for premature wear against plates or additional equipment. The cables exiting the chain, on both the moving and fixed end, need to be strapped individually at least twice in order to strain relief correctly. If there are not enough holes available in the connection plates for individual strapping, the cables should be secured in such a way that they can not move. Depending on the mounting position (default straight or 90°) the cables may need adjustment in length. Make sure no floor cables are in risk of collision with moving parts.</p>	 <p>A B xx1100000792</p> <p>A Cable straps B Torx pan head screw Suitable cable ties are specified in Required equipment on page 235.</p>
<p>1 Check that the cables are attached to the attachment plate with straps (A). Check that the track motion motor cables are placed in the slot located at the end of the plate (B). Check that the motor and resolver cables are bended 90° when directed up to the motor.</p> <p>CAUTION Do not stand on the chain or cables.</p>	 <p>B A xx1200000884</p>

2.7.6 Inspection points of cable chain Murrplastik prior to start-up

2.7.6 Inspection points of cable chain Murrplastik prior to start-up

Important inspection points prior to start-up of track

Please use the inspection sheet below to check that the installation of the cable chain Murrplastik is complete, before the track is commissioned.

Inspection sheet

Cable inspection

Inspection	Yes	No
All cables in the radius can be moved lengthways?		
Cable clearance in both end positions of the travel distance checked?		
Cable clearance in end positions after approximately 4 weeks of operation checked?		
Strain relief present at moving end?		
Strain relief present at fixed end?		

Cable chain inspection

Inspection	Yes	No
All covers closed?		
Internal separators in place?		
Moving end aligned with guide channel?		
Chain brackets tightened and secured using Nylock nuts on the moving end and Loctite on the fixed?		
Support and strapping plate on carriage correctly arranged and tight?		

Guide channel inspection

Inspection	Yes	No
Guide channel free of foreign objects?		
Channel internal width > 2 mm and < 6 mm than chain outside width?		
Transition of glide rail to chain lower run at same height?		
Channel joints arranged flush and unobstructed?		
Strain relief located in the guide channel below the glide rail?		
Guide channel running parallel to the moving end guide?		
Gap between glide bars, if any, eliminated?		
Glide bars don't move. Screw holding glide bars at least one every two meters?		

2 Installation and commissioning

2.8.1 Starting the system for the first time

2.8 Software installation

2.8.1 Starting the system for the first time

General

Make sure that all steps of the physical installation is completed, see *Before starting the track motion on page 57*.

How to start the controller for the first time after the physical installation has been completed is described in *Operating manual - Getting started, IRC5 and RobotStudio*.

System status after startup

After startup, only the manipulator is configured in the controller. It will not be possible to jog or program using the track motion.

To activate the track motion, it is necessary to use RobotStudio to create a new system with the track motion settings and download the new system to the robot controller, see *Creating and downloading a system on page 127*.

2.8.2 Creating and downloading a system

Introduction

The PC application RobotStudio is used for creating and downloading systems to the controller.

The procedure how to create and download a system is different depending on if the controller is installed with RobotWare 5 or RobotWare 6. RobotStudio version 6 or later supports both procedures.



Note

In RobotStudio, use System Builder to create and modify systems based on RobotWare 5. Use Installation Manager to create and modify systems with RobotWare 6 and later.

For more information, see *Operating manual - RobotStudio*.

Before modifying the system

Before modifying the system it is recommended to take a backup of the system and put all axes of the robot and any external axes are in their zero positions.

Creating a system for RobotWare 5

In RobotWare 5, the track motion is loaded as an additional option to the system. Before creating the system, the track motion mediapool must be installed to the PC. The license file for the track motion is generic and is included in the RobotWare installation.

Use this procedure to create and download the system.

	Action
1	<p>On the RobotWare DVD, open the folder Additional Options\Track Motion .</p> <p> Note</p> <p>For track motions with motor Type A, open the folder Additional Options\Track Motion Type A . For more information about Type A, see Changing the track motion motor to Type A on page 194.</p>
2	Run the setup.exe file and complete the installation.
3	Create a new system based on the existing system using the System Builder in RobotStudio.
4	In the Add Additional Options window, click Enter key and browse to the installed track motion mediapool: ... ABB Industrial IT\Robotics IT\MediaPool\Track.5.xx.xxxx
5	Select, open, and add the generic license file XX-XXXXX_TRACK.kxt .
6	In the Modify Options window, node TRACK , select and modify the options that suits your track motion. For example motion type, robot orientation, length etc.
7	In the Modify Options window, node DriveModule , add the additional drive unit that controls your track motion, ADU-790A in position X3 .
8	Complete the System Builder wizard.

Continues on next page

2 Installation and commissioning

2.8.2 Creating and downloading a system

Continued

	Action
9	Download the system and restart the controller.
10	Load the necessary system parameters, system modules, and program modules from the backup and restart the controller.  Note Do not restore the old motor configuration file <i>moc.cfg</i> , this will remove the track motion settings. Instead, use Load parameters and replace duplicates from the Configuration window on the FlexPendant Control Panel.
11	Update the revolution counters, see Updating the revolution counter on the track motion on page 132 .

For more detailed instructions on using the System Builder, see *Operating manual - RobotStudio*.

Creating a system for RobotWare 6

In RobotWare 6, the track motion is loaded as an Add-In. The track motion Add-In does not require a license.

Use this procedure to create and download the system.

	Action
1	Create a new system based on the existing system using the Installation Manager in RobotStudio.
2	In the Products tab, click Add and select the <i>RobotWare</i> and <i>TrackMotion</i> product manifests.
3	In the Licenses tab, add the license for RobotWare. The track motion does not require a license.
4	In the Options tab, Drive Modules pane, add the additional drive unit (ADU) that controls your track motion.
5	In the Options tab, Drive Modules pane, select and modify the options that suits your track motion. For example motion type, robot orientation, length etc.  Note For track motions with motor Type A, select the <i>IRBT x004 Type A x,x m</i> options. For more information about Type A, see Changing the track motion motor to Type A on page 194 .
6	Complete the Installation Manager wizard.
7	Download the system and restart the controller.
8	Load the necessary system parameters, system modules, and program modules from the backup and restart the controller.  Note Do not restore the old motor configuration file <i>moc.cfg</i> , this will remove the track motion settings. Instead, use Load parameters and replace duplicates from the Configuration window on the FlexPendant Control Panel.
9	Update the revolution counters, see Updating the revolution counter on the track motion on page 132 .

Continues on next page

For more detailed instructions on using the Installation Manager, see *Operating manual - RobotStudio*.

2 Installation and commissioning

2.8.3 Arm load

2.8.3 Arm load

Extra load

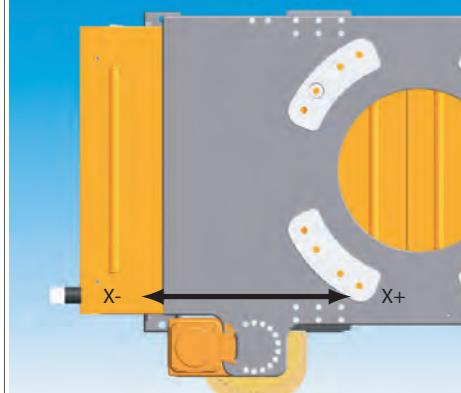
If the system has an extra load (kg) located on the carriage, for example a pedestal, the weight has to be described for the system in the Arm Load parameters.

See *Technical reference manual - System parameters*.

2.8.4 Check travel length

Checking the traveling length

The different travel length working areas are defined on the basis of the calibration mark. The travel length is set to maximum in the parameter file for the ordered travel length.

Action	Note
1 Jog the carriage X+ direction to the end position approx. 50mm from the X+ mechanical stop.	 xx1100000740
2 Check the travel length on the FlexPendant.	It should read the same as the ordered travel length.
3 Jog the carriage X- direction to the end position approx. 50mm from the X- mechanical stop = sync position.	
4 Check the travel length on the FlexPendant.	It should read "0".

2 Installation and commissioning

2.8.5 Updating the revolution counter on the track motion

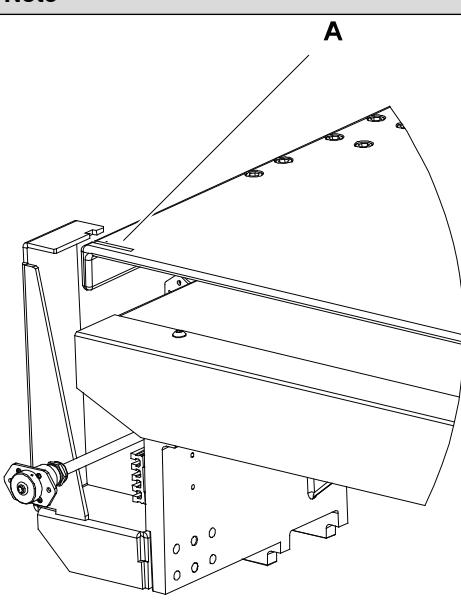
General

Before the robot system can be used, the resolvers need to be updated. Update the revolution counter in accordance with the instructions below.

For information on how to update the revolution counter on the manipulator, see the corresponding product manual for the manipulator.

Updating revolution counters

Use the procedure below to update the revolution counter.

Action	Note
1 Jog the carriage in -X direction at low speed (Non sync speed).	
2 Stop the carriage with the machined incision (A) with in the syncplate gap.	
3 On the FlexPendant, tap the ABB menu.	
4 Tap Calibration, then tap Track 1, then tap Update Revolution Counters.	A dialog is displayed.
5 Tap Yes.	
6 Tap Track and then tap Update.	A dialog is displayed.
7 Tap Update.	The selected revolution counter is updated.

2.8.6 Base frame configuration

2.8.6.1 Introduction

General

To ensure that the robot works properly in linear on its track motion, it is necessary that the orientation of the robot relative to the track is properly declared.

If the customer installation differs from the default selections available in Installation Manager it might be necessary to change the orientation of the robot relative to the track according to the examples below, see [Configuration examples on page 134](#).

Mounting directions

The manipulator can be mounted in two directions on a standard carriage, in line and 90 degrees, and in two directions on a mirrored carriage, in line and -90 degrees. Other mounting orientations are not allowed.

For more information, see [Assembling the cable tray and manipulator on page 101](#).

System parameters

This is a brief description of the parameters used when configuring the base frame for robots on track motion. For more information, see the respective parameter in [Technical reference manual - System parameters](#).

Robot

These parameters belongs to the type *Robot* in the topic *Motion*.

Parameter	Description
Base Frame q1 Base Frame q2 Base Frame q3 Base Frame q4	<i>Base Frame q1-q4</i> defines the quaternions of the robot base frame orientation in relation to the world frame.
Gamma Rotation	<i>Gamma Rotation</i> defines the orientation of the robot foot on the travel carriage.  Note The <i>Gamma Rotation</i> parameter is useful only for robots on track when the 7 axes high performance motion parameter is set. This parameter is not used for all robot types.

Single

These parameters belongs to the type *Single* in the topic *Motion*.

Parameter	Description
Base Frame q1 Base Frame q2 Base Frame q3 Base Frame q4	<i>Base Frame q1-q4</i> defines the quaternions of the track motion base frame orientation in relation to the world frame.
Use Joint	<i>Use Joint</i> defines which joint data to use for the track motion.

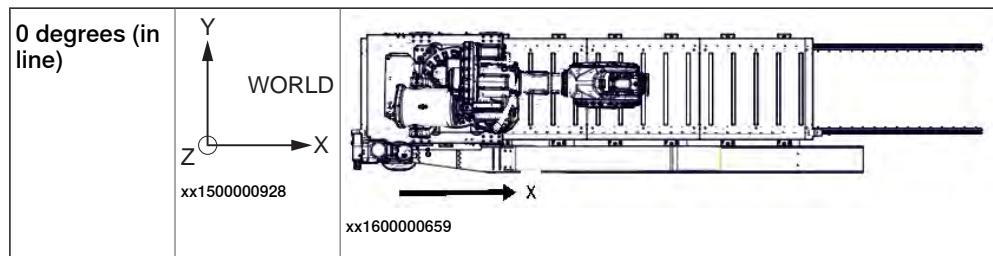
2 Installation and commissioning

2.8.6.2 Configuration examples

2.8.6.2 Configuration examples

Standard carriage

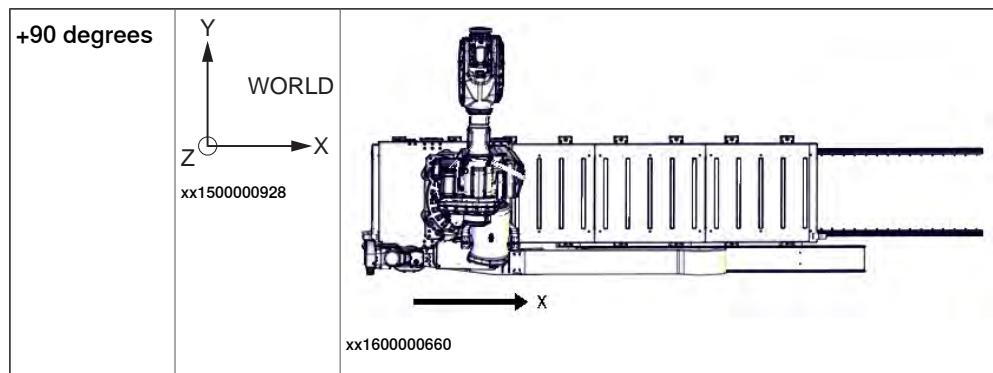
IRB 0° (in line) in relation to the World coordinate system



- Positive travel direction x in World coordinates

Parameter	Robot (ROB_1)	Track motion (TRACK_1)
Base Frame q1	1	1
Base Frame q2	0	0
Base Frame q3	0	0
Base Frame q4	0	0
Gamma Rotation	0	-
Use Joint	-	track1

IRB rotated 90° in relation to the World coordinate system



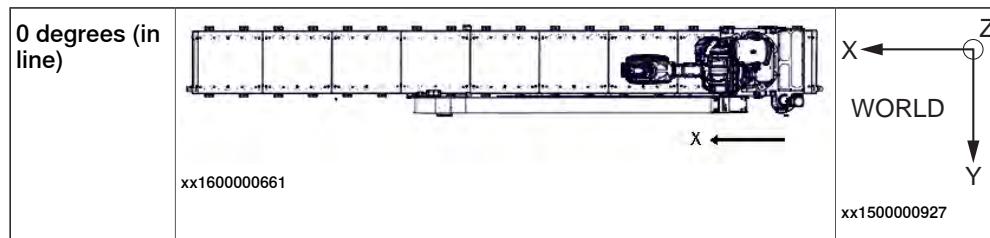
- Positive travel direction x in World coordinates

Parameter	Robot (ROB_1)	Track motion (TRACK_1)
Base Frame q1	0.707107	1
Base Frame q2	0	0
Base Frame q3	0	0
Base Frame q4	0.707107	0
Gamma Rotation	1.570796	-
Use Joint	-	track1

Continues on next page

Mirrored carriage

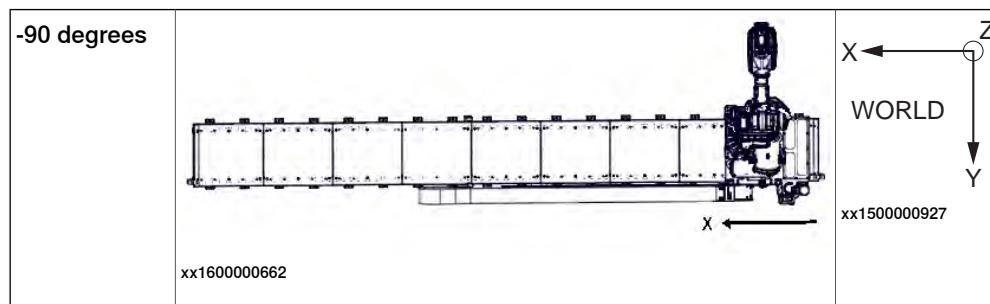
IRB in line 0° in relation to the World coordinate system



- Positive travel direction x in World coordinates

Parameter	Robot (ROB_1)	Track motion (TRACK_1)
Base Frame q1	1	1
Base Frame q2	0	0
Base Frame q3	0	0
Base Frame q4	0	0
Gamma Rotation	0	-
Use Joint	-	track1-lin

IRB rotated -90° in relation to the World coordinate system



- Positive travel direction x in World coordinates

Parameter	Robot (ROB_1)	Track motion (TRACK_1)
Base Frame q1	0.707107	1
Base Frame q2	0	0
Base Frame q3	0	0
Base Frame q4	-0.707107	0
Gamma Rotation	-1.570796	-
Use Joint	-	track1-lin

2 Installation and commissioning

2.9 Automatic lubrication

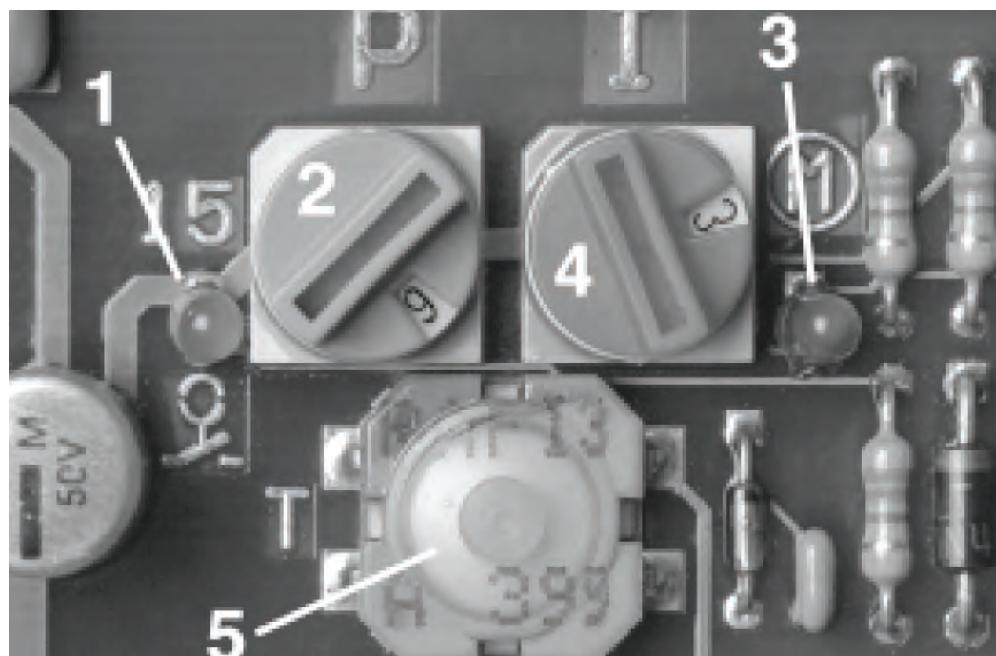
2.9 Automatic lubrication

Factory settings of pause time and lubrication time

Time setting of the lubrication cycle is described in document *Operating instructions - Printed circuit board for pump 203 (Lincoln Quicklub)* (2.6L-28006-B10).

The factory settings at delivery are:

- Jumper position with ControlPCP is V11 (see description on page 5 in *Operating instructions - Printed circuit board for pump 203 (Lincoln Quicklub)*). This means that the pause time is set in hours and the lubrication time is set in seconds.
- Blue rotary switch is set on 2, which gives 2 h pause time.
- Red rotary switch is set on 4, which gives 32 s lubrication time.



xx1100000925

- 1 LED, left-hand
- 2 Blue rotary switch to set pause time
- 3 LED, right hand
- 4 Red rotary switch to set lubricating time
- 5 Push button for additional lubrication

Grease amount at factory settings

The pump delivers 2.8 ccm per minute.

The time setting above gives 1.4 ccm for each lubrication period to the distribution unit. 50% goes to the brush lubrication of the rack and 12.5% goes to each runner block.

3 Maintenance

3.1 Introduction

Structure of this chapter

This chapter describes all the maintenance activities recommended for the IRBT 4004/6004/7004.

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!



Note

If the IRBT 4004/6004/7004 is connected to power, always make sure that the IRBT 4004/6004/7004 is connected to protective earth before starting any maintenance work!

For more information see:

- *Product manual - IRC5*

3 Maintenance

3.2.1 Specification of maintenance intervals

3.2 Maintenance schedule and expected component life

3.2.1 Specification of maintenance intervals

Introduction

The intervals are specified in different ways depending on the type of maintenance activity to be carried out and the working conditions of the IRBT 4004/6004/7004:

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

3.2.2 Maintenance schedule

General

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

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

The inspection intervals *do not* specify the life of each component. Values for these are specified in the section [Expected component life on page 142](#)

Activities and intervals, standard equipment

The table below specifies the required maintenance activities and intervals.

Maintenance activity	Equipment	Interval
Cleaning and lubrication (if there is no automatic lubrication system mounted)	Ball element and gear racks	Every 100 km
Cleaning	Linear guides	Every 100 km
Inspection	Brush	Every 3 months
Inspection	Cable chain	Every 3 months
Inspection	Linear guides	Every 3 months
Inspection	Cables and connectors at robot base, track motor and interchange to floor cable	Every 12 months
Inspection	Mechanical stops	Every 12 months
Inspection	Gearbox, back lash	Every 12 months
Inspection	Mounting bolts	Every 12 months
Adjustment of leveling	Complete track motion	Every 12 months
Replacement	SMB battery pack	Battery low alert ⁱ
Replacement	Linear guide	When expected life is reached or if disturbances occur.
Replacement	Ball elements	When linear guides are replaced.
Replacement	Gear wheel and racks	When play can not be adjusted to specified ⁱⁱ level.
Replacement	Glide shoes ⁱⁱⁱ	When gliding surface thickness is 1.5 mm or less. ^{iv}

ⁱ 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.

ⁱⁱ The play is specified in [Adjusting the gearbox back lash on page 179](#).

ⁱⁱⁱ Glide shoes have been introduced to the chains in 2013. These have been provided to simplify and reduce the time associated with changing links.

^{iv} The first glide shoes to wear out will be located at the point where the chain first makes contact with itself during operation.

Continues on next page

3 Maintenance

3.2.2 Maintenance schedule

Continued

Activities and intervals, optional equipment

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

Maintenance activity	Equipment	Interval
Check the level	Automatic lubrication system	Every 1 months
Test the manual feed	Automatic lubrication system	Every 1 months

3.2.3 Gearbox oil

Where to find information about gearbox oil

Please see *Technical reference manual - Lubrication in gearboxes*
(3HAC042927-001) for information about gearbox oil.

3 Maintenance

3.2.4 Expected component life

3.2.4 Expected component life

General

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

Expected component life

Component	Expected life	Note
Cabling for robot, 7th axis	4,000,000 cycles ⁱ	ⁱⁱ
Cable chain	Whichever occurs first: 2,000,000 cycles ⁱⁱⁱ or 18,000,000 gliding meters ^{iv} + addition 18,000,000 gliding meters if gliding shoes are changed .	^v
Gearboxes	40,000 hours	
Linear bearings IRBT 4004	200,000,000 meters	^{vi}
Linear bearings IRBT 6004/6600	10,000,000 meters	
Linear bearings IRBT 6004/6620	40,000,000 meters	
Linear bearings IRBT 6004/6640	15,000,000 meters	
Linear bearings IRBT 6004/IRB 6700-200 kg ^{vii}	20,000,000 meters	
Linear bearings IRBT 6004/IRB 6700-235 kg ^{viii}	15,000,000 meters	
Linear bearings IRBT 6004/IRB 6700-300 kg ^{ix}	10,000,000 meters	
Linear bearings IRBT 7004	5,000,000 meters	

ⁱ The track motion is dimensioned for a life of 8 years (450,000 cycles per year) in a normal application

ⁱⁱ The expected life can also be affected by assemblage of cabling other than standard options. The given life is based on a test cycle that for every axis starts from the calibration position to minimum angle to maximum angle and back to the calibration position.

Deviations from this cycle will result in differences in expected life! See the note in the Product specification about warranty, when running the track motion IRBT 4004/6004/7004 in a cold environment (0°C to 5°C).

ⁱⁱⁱ A cycle is comprised of two strokes / changes in direction.

^{iv} A gliding meter is described as the chain making contact with itself or the glide bars. Chains on tracks shorter than 6 meters travel distance do not have gliding contact.

^v Due to process cycle variation and varying lengths of tracks the chains' lifetime is calculated on two parameters, gliding meters and bending cycles. When maximum limit of either parameter is reached the complete chain and/or cables should be replaced.

In order to maximize the chains lifetime ensure to optimize the software and cell layout to reduce the amount of travel and cycles.

^{vi} The indicated expected component life represents a statistical life for the combined track and robot movement. The expected life strongly depends on the motion pattern, use of pedestal, and the extension of the robot arm system.

^{vii} IRB 6700-200/2.60, IRB 6700-155/2.85

^{viii} IRB 6700-235/2.65, IRB 6700-205/2.80, IRB 6700-175/3.05, IRB 6700-150/3.20

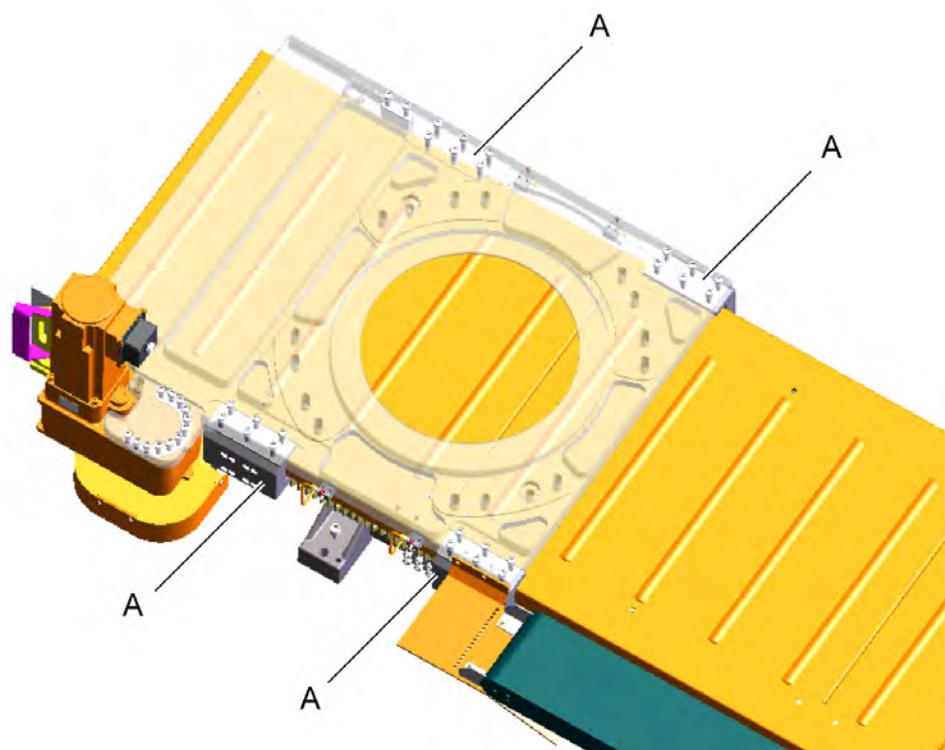
^{ix} IRB 6700-300/2.70, IRB 6700-245/3.00

3.3 Activities 100 km

3.3.1 Cleaning and lubricating the ball element

Location of ball element

The ball element is located as shown in figure.



xx1100000742

A	Ball elements
---	---------------

Required equipment

Equipment, etc.	Art. no.	Note
Longtime Lubricant	-	Klüber Microlube GB0
Lubrication gun	-	

Lubricating the ball element

Use this procedure to lubricate the ball element.

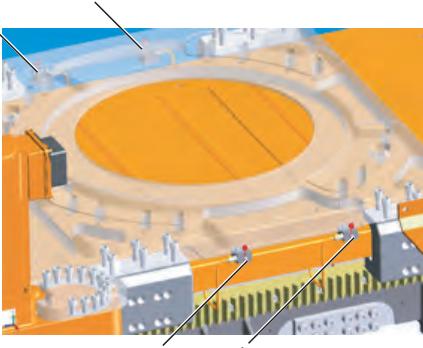
Action	Note
Lubricate each ball element using a lubrication gun in two steps, total amount 9.4 cm ² .	

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3 Maintenance

3.3.1 Cleaning and lubricating the ball element

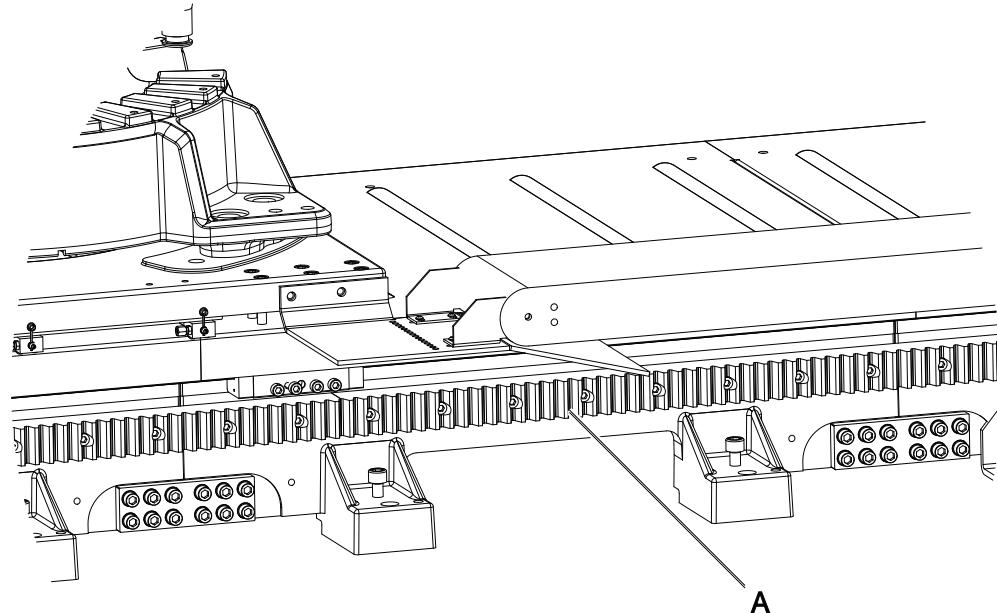
Continued

Action	Note
1 Apply the first partial quantity of lubricant, approx. 4.7 cm^2 , in each element.	
2 Move (jog) the carriage 50 cm in both directions.	
3 Apply the second partial quantity of lubricant, approx. 4.7 cm^2 , in each element.	
4 Move (jog) the carriage 50 cm in both directions.	
5 Check whether a film of lubricant is visible on the guide rail.	 xx1100000743 A Ball element grease nipples

3.3.2 Cleaning and lubricating the gear racks

Location of gear racks

The gear racks are located as shown in figure.



xx1100000744

A	Gear racks
---	------------

Required equipment

Equipment, etc.	Art. no.	Note
Lubricant, standard lubrication	-	Tribol GR 100-2 PD
Lubricant, standard lubrication	-	Shell, Alvania WR2
Lubricant, automatic lubrication	-	Klüber Microlube GB0
Lint free cloth	-	

Lubricating the gear racks

Use this procedure to lubricate the gear racks.

	Action	Note
1	Inspect the gear racks, clean if necessary.	Use lint free cloth
2	Use a brush to lubricate the gear rack.	

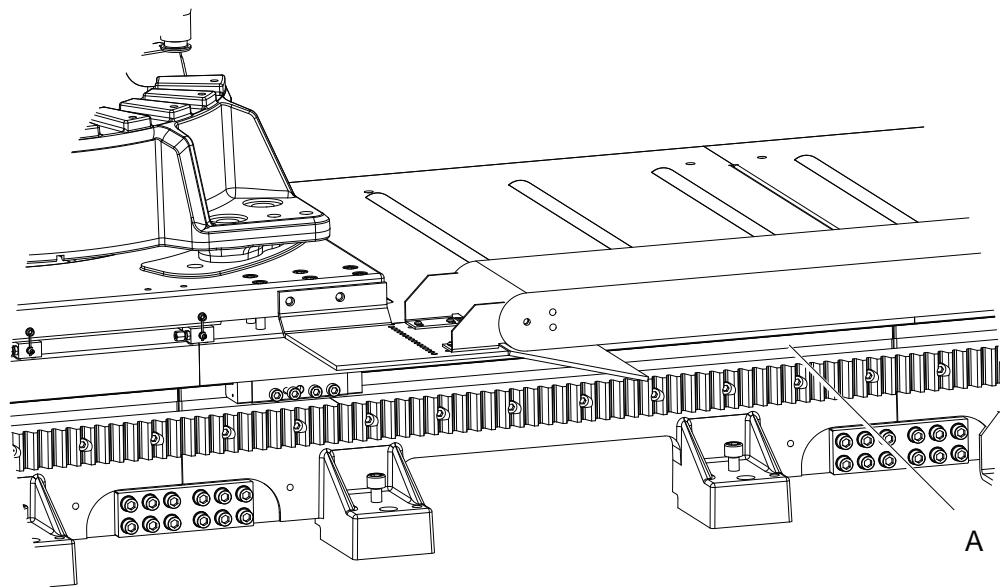
3 Maintenance

3.3.3 Cleaning the linear guides

3.3.3 Cleaning the linear guides

Location of linear guides

The linear guides are located as shown in figure.



xx1100000745

A	Linear guides
---	---------------

Required equipment

Equipment, etc.	Art. no.	Note
Lint free cloth	-	

Cleaning the linear guides

Use this procedure to clean the linear guides.

Action	Note
1 Clean the linear guides with a lint free cloth.	

3.4.1 Inspecting the lubrication system

3.4 Activities 1 month

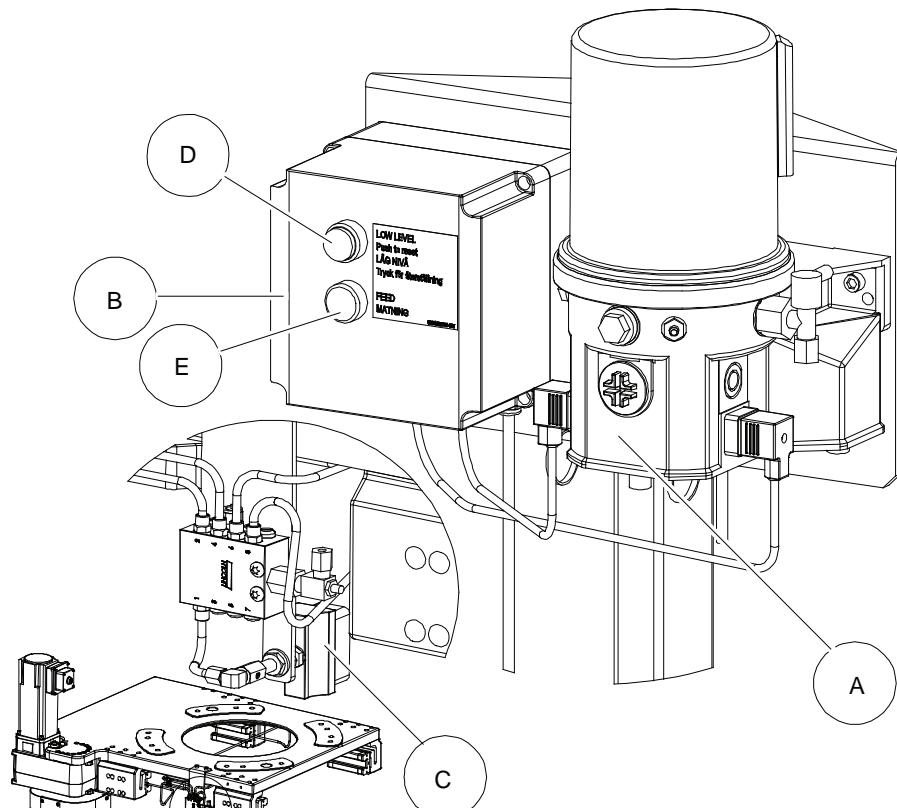
3.4.1 Inspecting the lubrication system

Overview

If the track motion is equipped with an automatic lubrication system the level of the lubricant should be checked according to the maintenance schedule (see [Activities and intervals, optional equipment on page 140](#)), even if the system should apply the lubricant equally over a longer period. The timer is only active when the system is in Auto mode.

Location of lubrication system

The lubrication system is located as shown in the figure.



xx1100000793

A	Grease pump
B	Control unit grease pump
C	Oil brush
D	Low level indicator
E	Feed (manual)

Continues on next page

3 Maintenance

3.4.1 Inspecting the lubrication system

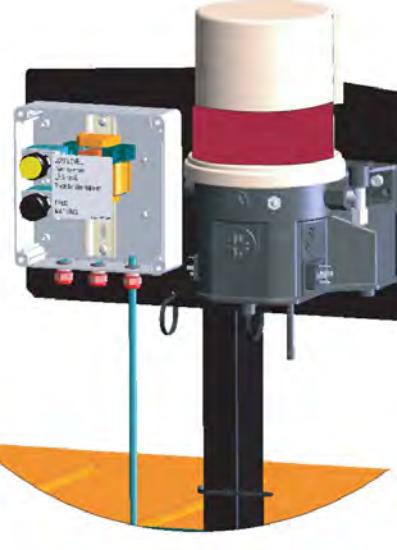
Continued

Required equipment

Equipment, etc.	Art. no.	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 287 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.

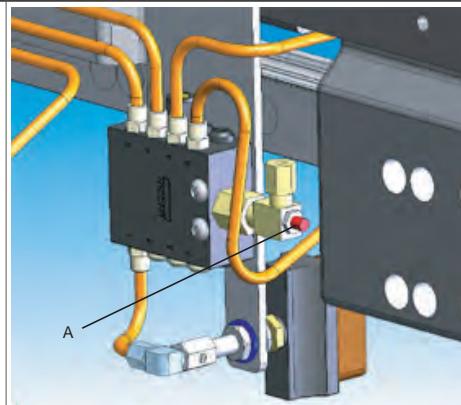
Checking the grease level

Use this procedure to check the grease level of the lubrication system.

Action	Note
1 Read the lubricant level on the transparent scale. If too much lubricant has been used, fill up the grease reservoir. For more information, see Circuit diagrams on page 293 .	 xx1100000794

Checking the performance

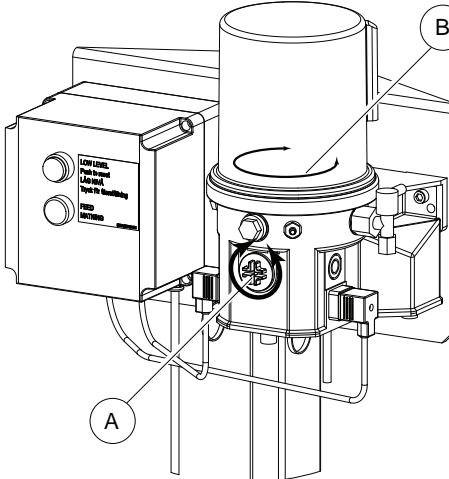
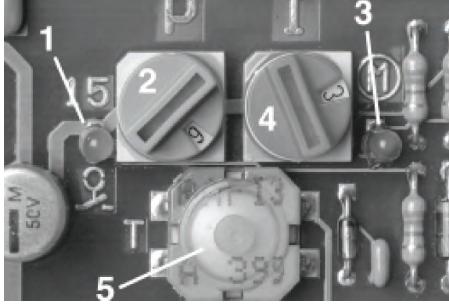
Use this procedure to check the performance of the lubrication system.

Action	Note
1 In the case of a blockage in the system, the grease pushes out the red pin at the pressure limiting valve, this is a fault indication.	 xx1100000795

Continues on next page

3.4.1 Inspecting the lubrication system

Continued

Action	Note
2 Check that the stirring paddle (B) rotates clockwise during the operating time. To control the electrical functions, open the inspection plug (A).	 xx1100000796
3 Check if power is applied to the circuit board: LED (1) is lit if OK. Press push button (5) >2 seconds LED (3) is lit if OK. For more information see section Automatic lubrication on page 136 and Circuit diagrams on page 293 .	 xx1100000925 <ul style="list-style-type: none"> 1 LED, left-hand 2 Blue rotary switch to set pause time 3 LED, right hand 4 Red rotary switch to set lubricating time 5 Push button for additional lubrication
4  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 50 .	

3 Maintenance

3.4.2 Testing the manual feed

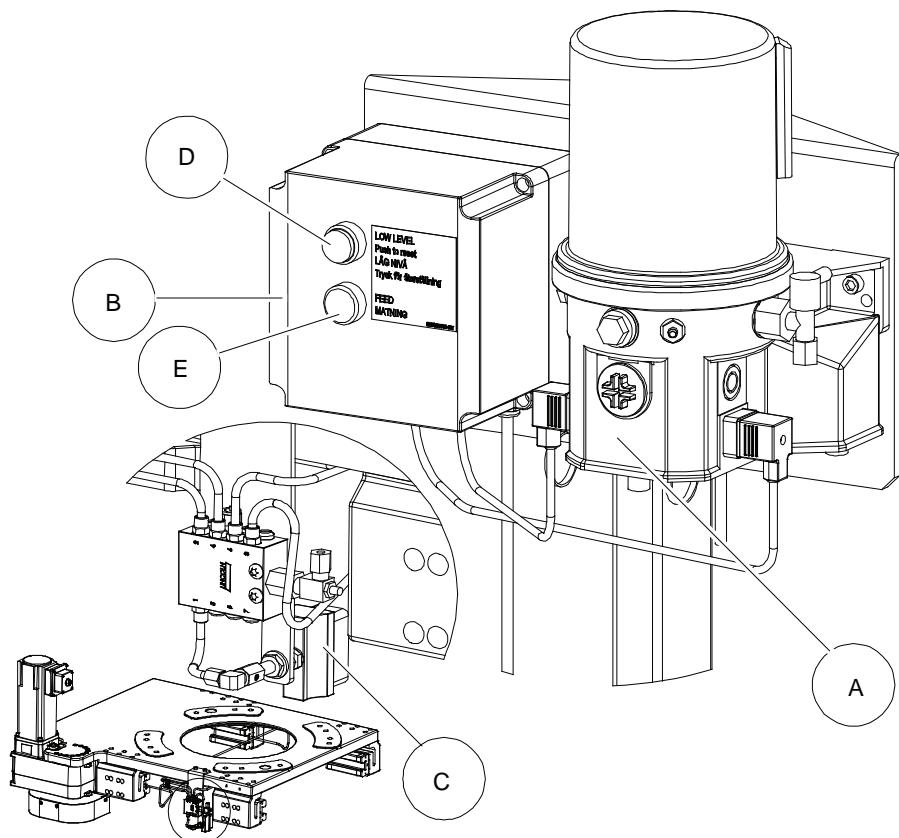
3.4.2 Testing the manual feed

Overview

If the track motion is equipped with an automatic lubrication system the level of the lubricant should be checked according to the maintenance schedule (see [Activities and intervals, optional equipment on page 140](#)), even if the system should apply the lubricant equally over a longer period. The timer is only active when the system is in Auto mode.

Location of lubrication system

The lubrication system is located as shown in the figure.



xx1100000793

A	Grease pump
B	Control unit grease pump
C	Oil brush
D	Low level indicator
E	Feed (manual)

Required equipment

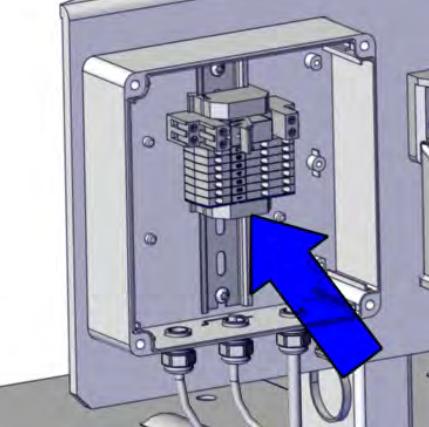
Equipment, etc.	Art. no.	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 287 .

Continues on next page

Equipment, etc.	Art. no.	Note
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.

Testing the manual feed

Use this procedure to check the function of the lubrication system.

	Action	Note
1	Press the button "Feed" on the control unit grease pump.	
2	Only for Control unit grease pump marked rev.05 or later: If the pump is not working, make sure the fuses are ok.	 xx1500002146

3 Maintenance

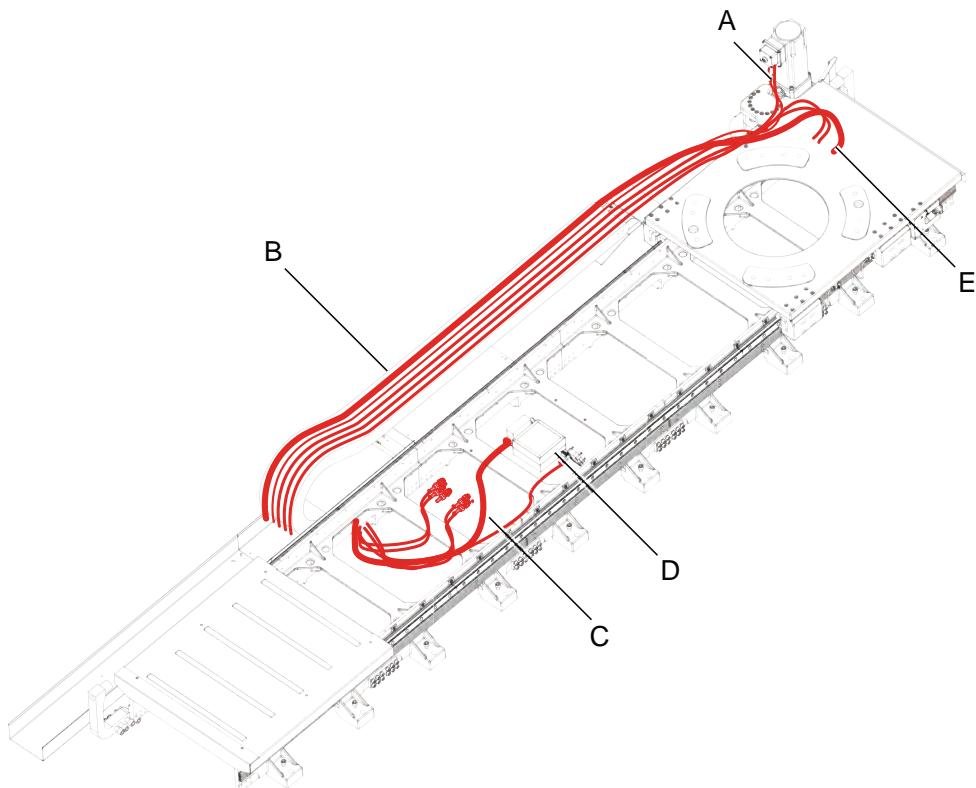
3.5.1 Inspecting the cable chain

3.5 Activities 3 months

3.5.1 Inspecting the cable chain

Location of harness

The track motion harness is located as shown in figure.



xx1100000730

A	Motor cables
B	Cable chain
C	Customer cables
D	Standard cables
E	Manipulator cables

Required equipment

Equipment, etc.	Art. no.	Note
Visual inspection	-	
Cable ties	21662055-6	Needed if the cable strapping needs to be improved. Use heavy duty cable ties with minimum width: 7.6 mm.
Locking liquid	-	Loctite 243 Used if loose screws are detected.

Continues on next page

Checking the emergency stop

	Action	Note
1	Allow the track motion to stop.	
2	Press in the emergency stop.	
3	Try to start the track motion.	

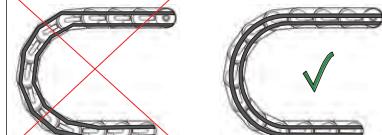
Inspecting the junction boxes

	Action	Note
1	Check, and rectify if necessary, the junction boxes with regard to damage, connections and tightness.	

Inspecting the cable chain Brevetti

	Action	Note
1	Check the links of the cable chain. Replace if necessary.	See Replacing the cable harness on page 234 .
2	Check the attachment points of the cable chain. Replace if necessary.	See Replacing the cable harness on page 234 .

Inspecting the cable chain Murrplastik**Inspecting the cables**

	Action	Note
1	Move the carriage to one end and open the covers on the outside bend.	
2	Check that the cables are in the neutral axis (center line of the link) of the chain as shown in the figure. If cables are found to be too loose or too tight then they need to be adjusted.	 xx1200000518
3	Repeat the check of the cables in the neutral axis with the carriage in the middle and at the other end.	
4	Make an overall inspection of the cables. If a cable is found to corkscrew it needs to be replaced immediately. If cables have worn through the outer cover they must be replaced. Some dust can be expected from the cables as they rub against the dividers in the chain.	

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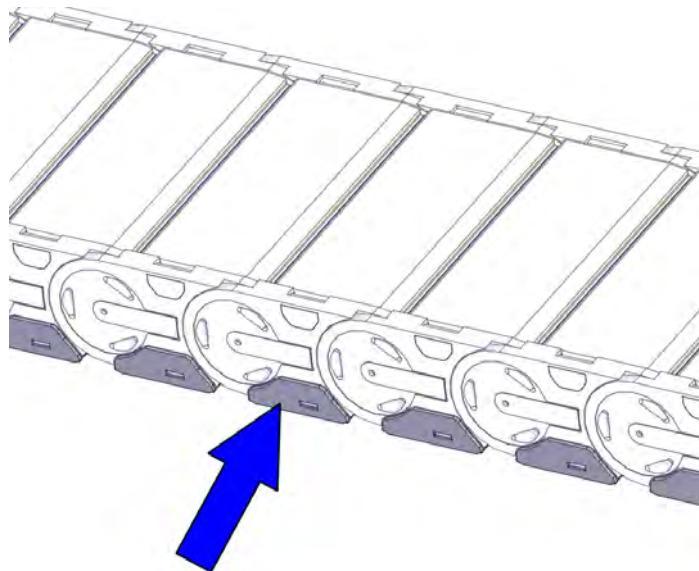
3 Maintenance

3.5.1 Inspecting the cable chain

Continued

Location of the glide shoes

The figure shows the location of the glide shoes on the cable chain.



xx1300000899

Inspecting the glide shoes

	Action	Note
1	Check the thickness of the glide shoes. If it is less than 1.5 mm the glide shoes must be replaced. Normally only the glide shoes in the area that make first contact when the chain transitions into gliding mode need to be checked. However due to process cycle variation in factories it is recommended to check all the glide shoes for the first inspection and note the point of wear for the next inspection.	
2	Make an overall inspection of the glide shoes. Replace broken or missing shoes.	See Replacing the glide shoes on page 256 .

Inspecting the strapping

	Action	Note
1	Check that strapping is in place. Each cable is required to be individually strapped down, and not bunched together. If insufficient holes are available in the connection plates for individual strapping with cable ties, the cables should be secured in such a way that they cannot move. Only use heavy duty cable ties, specified in Required equipment on page 152 . If strapping has been replaced ensure that a paint pen is used to mark both sides of the cable tie.	

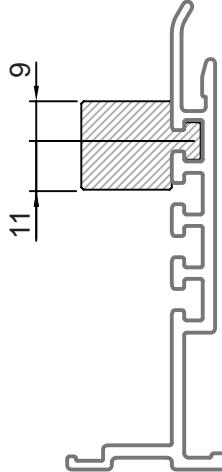
Inspecting the profiles

	Action	Note
1	Make an overall inspection of the cable chain and the channel area. Remove foreign objects, if any.	

Continues on next page

3.5.1 Inspecting the cable chain

Continued

Action	Note
2 Ensure that the plastic guide piece located between the aluminum profiles with the cut-out is in place.	
3 Check that all clamps holding the tray are secure and in place. If some are loose the screws need to have locking liquid applied and then tightened.	Loctite 243.
4 The glide bars are kept in place by a nut and screw at each end of the bar. Ensure that the screws are in place and tightened. The figure shows the orientation of the glide bars, if they need to be refitted. Notice that the shorter side (9 mm) is oriented upwards.	 xx1300001081

Inspecting the fasteners

Action	Note
1 Check bolts and screws on the attaching plates and brackets. If found to be loose they need to be removed, have locking liquid applied to them and then be refitted and tightened.	Loctite 243.

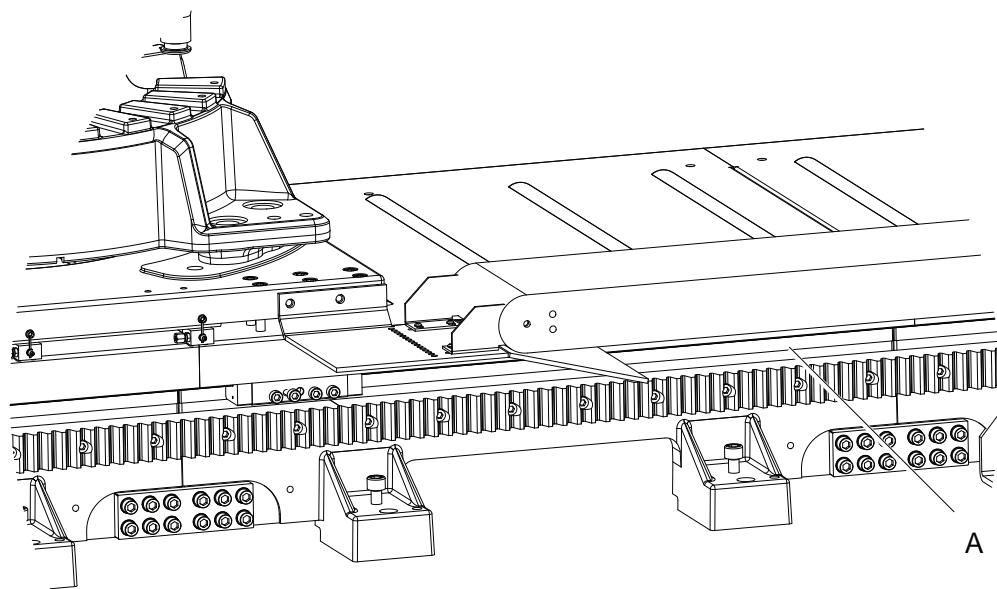
3 Maintenance

3.5.2 Inspecting the linear guides

3.5.2 Inspecting the linear guides

Location of linear guides

The linear guides are located as shown in figure.



xx1100000745

A	Linear guides
---	---------------

Required equipment

Equipment, etc.	Art. no.	Note
Visual inspection	-	

Inspecting the linear guides

Use this procedure to inspect the linear guides.

Action	Note
1 Inspect the linear guides for contamination and clean if necessary.	Use a lint free cloth.
2 Check the guide surface of the linear guides for damages or wear. If wear or damage is detected, replace all linear guides and ball elements on the concerned side. Worn out or damaged guides can be caused by the robot stopping occasionally with overload in the track axis.	See Replacing the linear guides on page 209 and Replacing the ball elements on page 213 .

Continues on next page

Inspecting the automatic lubrication system

Action	Note
1 Check the lubrication function by pumping manually and checking the indicator pin on the distribution block ⁱ . The pin should move slowly up and down. It normally takes a number of feedings to see as the distribution goes stepwise in the block.	
2 Change the setting if there is too much or too little lubricant.	See <i>Operating instructions - Printed circuit board for pump 203 (Lincoln Quicklub)</i> .

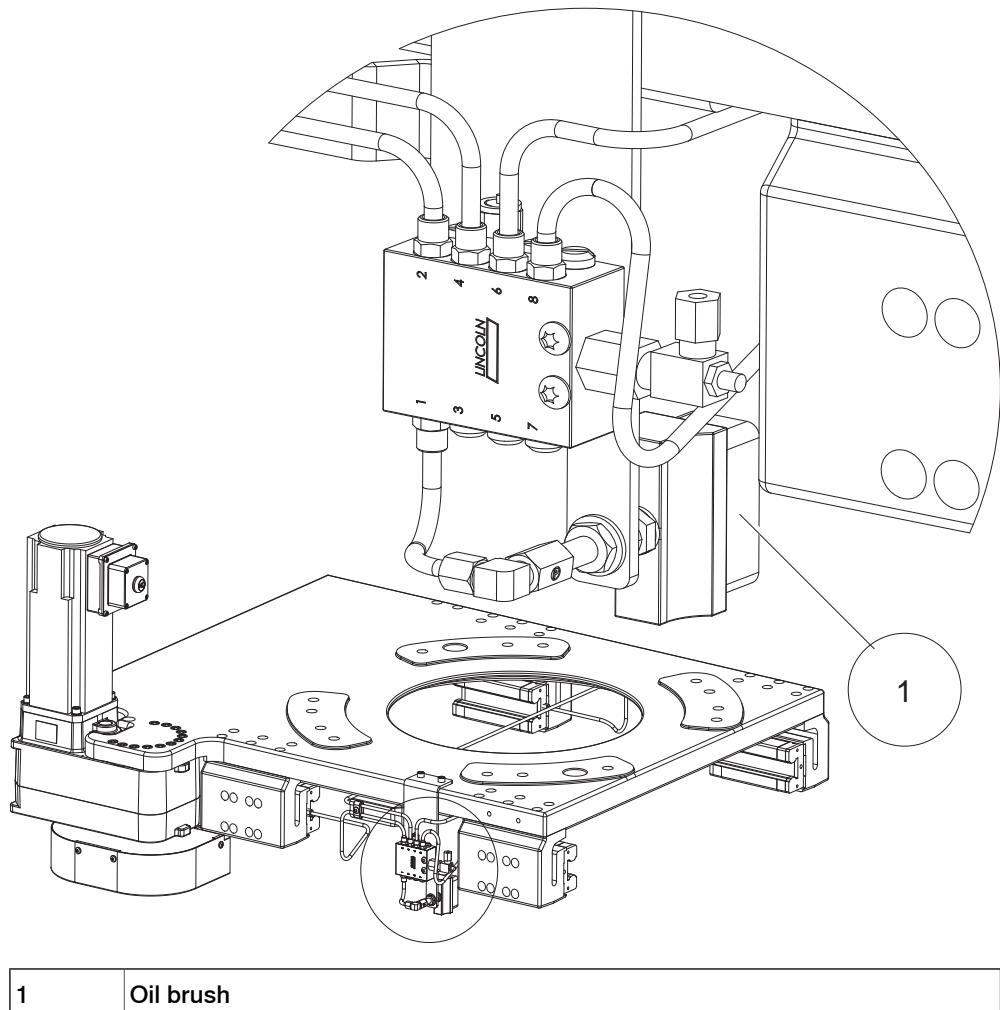
ⁱ It may take some time before the pin is activated in the block.

3 Maintenance

3.5.3 Inspecting the brush

3.5.3 Inspecting the brush

Location of brush



Required equipment

Equipment, etc.	Art. no.	Note
Visual inspection	-	

Inspecting the brush

Use this procedure to inspect the brush.

Action	Note
1 Inspect the brush for wear. The brush bristles should go at least 5 mm into the gear rack. Replace the brush, if necessary.	See Replacing the oil brush on page 263 .

3.6 Activities 12 months

3.6.1 Inspecting the cables and connectors

Required equipment

Equipment, etc.	Art. no.	Note
Visual inspection	-	

Inspecting the connectors

Use this procedure to check the connectors.

	Action	Note
1	Check that the connectors at the robot base, track motor and interchange to the floor cable are correctly fitted and that there is no risk of loose connections.	

Inspecting the cables

Use this procedure to check the cables.

	Action	Note
1	Check if any cables have been damaged through wear or pinching. If damaged then replace the cable.	
2	Check if any cables rub against sharp edges. If so, route the cable so that it runs freely.	See cable routing in on page ? .
3	Check strain relief of cables and hoses. Marking should be close to the corresponding strap. If not, pull the hose/cable to the correct position and strap it.	

Fault finding

The following information is provided to assist fault finding.

Cables that have failed due to incorrect installation typically show the following symptoms:

- Knotting of conductors underneath the cable jacket.
- Cables twist around one another within a cable carrier system.
- Cables are sticking out between the cable carrier crossbars and getting caught in the bend radius.
- Cables entangled with other cables and crossbars tearing them apart.
- Loss of conductivity through simple breaking of cable conductors.

Common causes of cable failure when operating in a cable chain:

- Cables used are not designed for use in continuous flexing operation.
- Cables are packed too tight inside the carrier cavities.
- Cables are not properly adjusted (see [Adjusting cables and covers on page 124](#)).

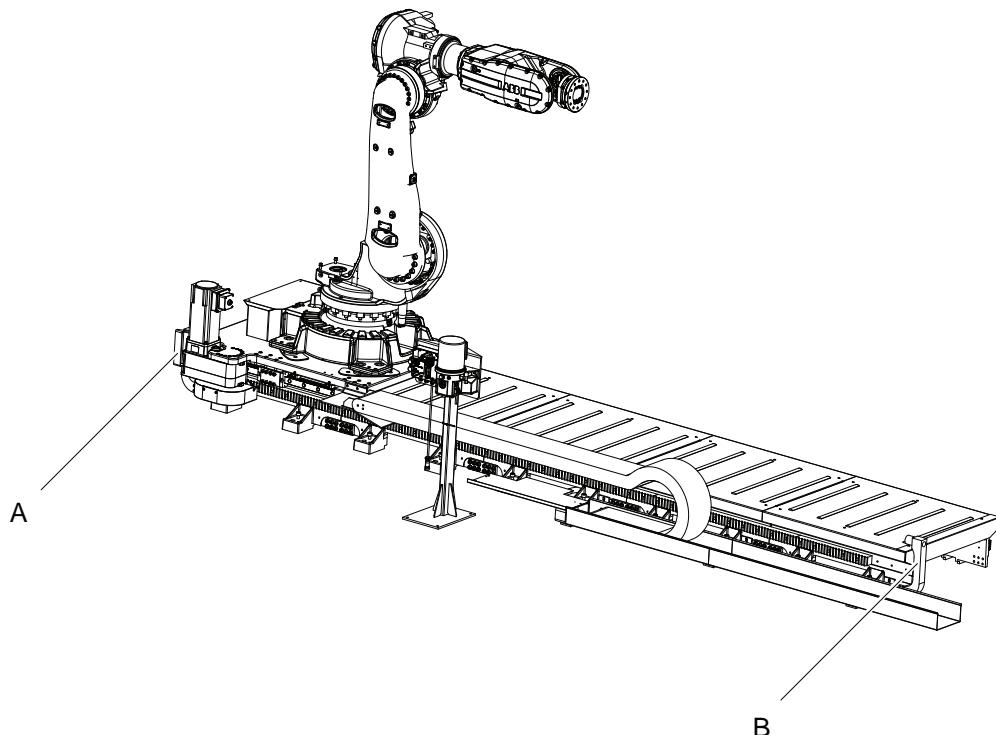
3 Maintenance

3.6.2 Inspecting the mechanical stops

3.6.2 Inspecting the mechanical stops

Location of mechanical stops

The mechanical stops are located as shown in figure.



xx1100000746

A	Mechanical stops left
B	Mechanical stops right

Required equipment

Equipment, etc.	Art. no.	Note
Visual inspection	-	

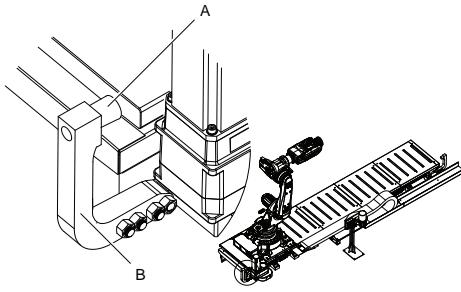
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3.6.2 Inspecting the mechanical stops

Continued

Inspecting the mechanical stops

Use this procedure to inspect the mechanical stops.

	Action	Note
1	Visually inspect the mechanical stops for damage.	 <p>xx1100000747</p> <p>A Rubber buffer B Mechanical stop</p>
2	If the mechanical stops are damaged, replace them.	

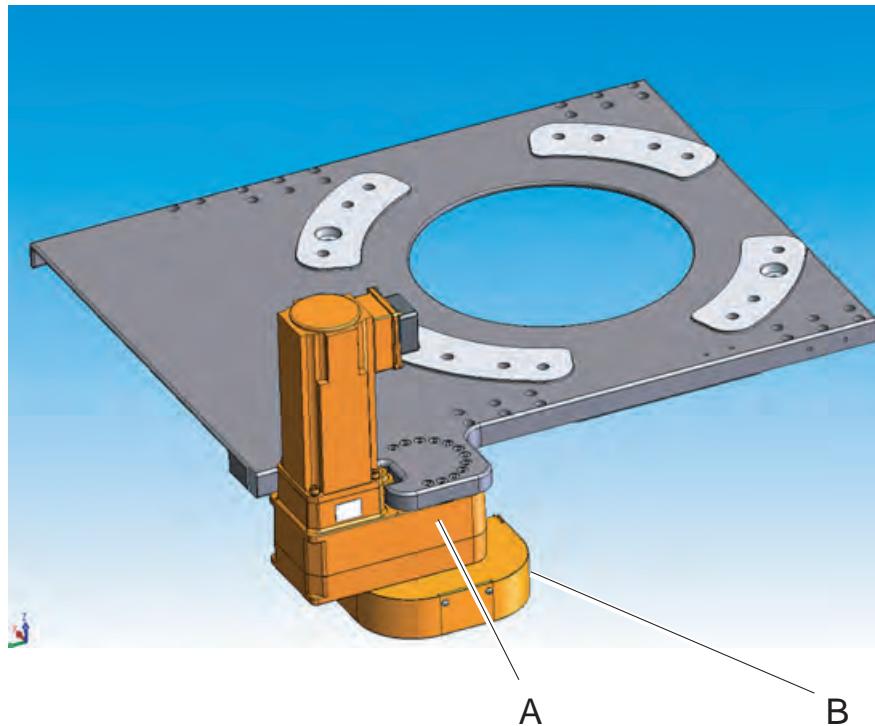
3 Maintenance

3.6.3 Inspecting the gearbox, back lash

3.6.3 Inspecting the gearbox, back lash

Location of gearbox

The gearbox is located as shown in figure.



xx1100000748

A	Gearbox
---	---------

Required equipment

Equipment, etc.	Art. no.	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 287 .

Inspecting the gearbox, back lash

Use this procedure to inspect the gearbox, back lash.

	Action	Note
1	See Adjusting the gearbox back lash on page 179 .	

3.6.4 Adjusting the leveling

Adjusting the leveling

Follow the procedure in [*Geometric alignment of track motion IRBT 4004/6004/7004 on page 96*](#) to adjust the leveling on the track motion.

3 Maintenance

3.7.1 Replacing the SMB battery pack

3.7 Activities 36 months

3.7.1 Replacing the SMB battery pack



Note

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

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

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



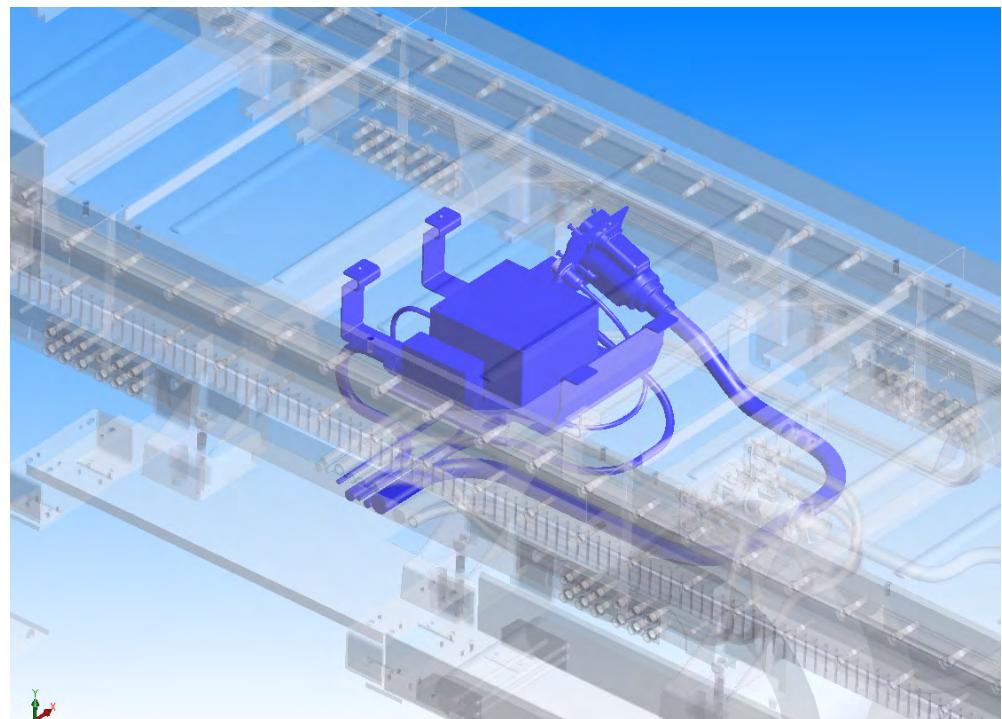
WARNING

See instructions for batteries, [WARNING - Safety risks during handling of batteries on page 53](#).

Continues on next page

Location of SMB battery pack

The SMB battery pack is located in the SMB box. The box can be located either under the track motion, or on the side of the carriage. The principle for how to replace the battery is the same even if the location varies.



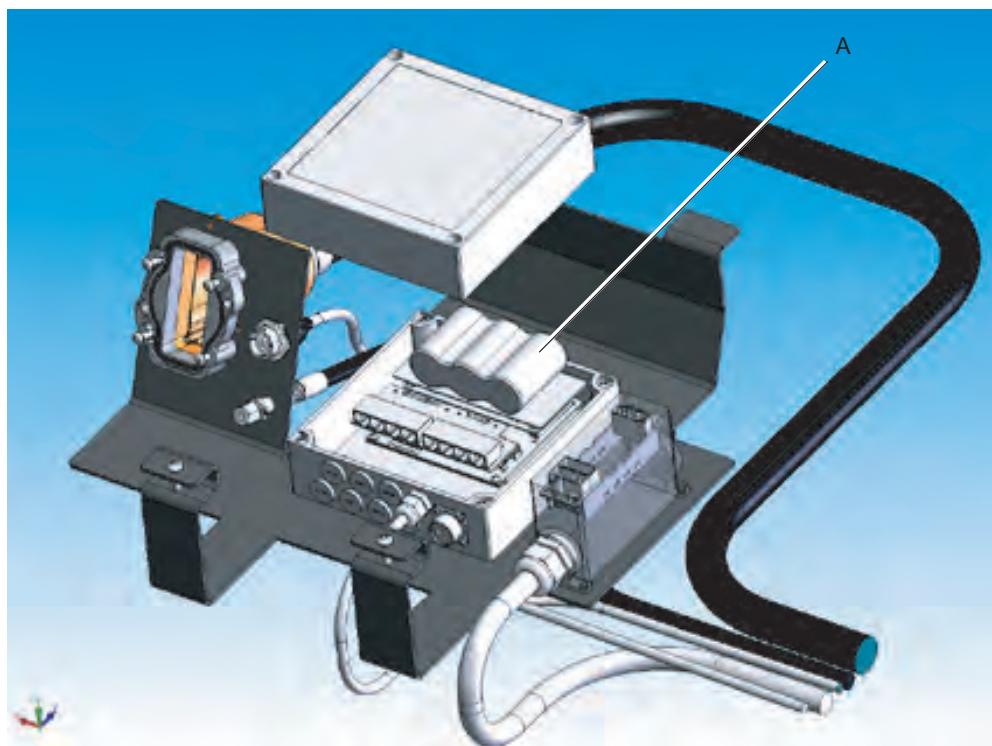
xx1100000731

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3 Maintenance

3.7.1 Replacing the SMB battery pack

Continued



xx1100000749

A	SMB battery pack
---	------------------

Required equipment



Note

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

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

Equipment, etc.	Art. no.	Note
Standard toolkit	-	Content is defined in section Standard toolkit on page 287 .

Replacing the SMB battery pack

Use this procedure to replace the SMB battery pack.

Action	Note
1  DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot and for the track motion.	
2 For boxes located under the track motion, remove the cover plate from the standard contact plate.	

Continues on next page

3.7.1 Replacing the SMB battery pack

Continued

	Action	Note
3	Remove the cover and locate the battery.	
4	Disconnect the cables and remove the battery.	
5	Fit the new battery in the reverse order.	
6	Fit the cover.	
7	Update the revolution counter on the track motion.	See Updating the revolution counter on the track motion on page 132 .

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4 Repair

4.1 Introduction

Structure of this chapter

This chapter describes all repair activities recommended for the IRBT 4004/6004/7004 and any external unit.

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



WARNING

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

Required equipment

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

The details of equipment are also available in different lists in the chapter [Reference information on page 279](#).

Safety information

There are general safety information and specific safety information. The specific safety information describes the danger and safety risks while performing specific steps in a procedure. Make sure to read through the chapter [Safety on page 19](#) before commencing any service work.



Note

If the IRBT 4004/6004/7004 is connected to power, always make sure that the IRBT 4004/6004/7004 is connected to earth before starting any repair work.

For more information see:

- *Product manual - IRC5*

4 Repair

4.2.1 Mounting instructions for seals

4.2 General procedures

4.2.1 Mounting instructions for seals

General

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

Equipment

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

Rotating seals

The procedure below describes how to fit rotating seals.



CAUTION

Please observe the following before commencing any assembly of seals:

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

Action	Note
1 Check the seal to ensure that: <ul style="list-style-type: none">• The seal is of the correct type (provided with cutting edge).• There is no damage to the sealing edge (feel with a fingernail).	
2 Inspect the sealing surface before mounting. If scratches or damage are found, the seal must be replaced since it may result in future leakage.	
3 Lubricate the seal with grease just before fitting. (Not too early - there is a risk of dirt and foreign particles adhering to the seal.) Fill 2/3 of the space between the dust tongue and sealing lip with grease. The rubber coated external diameter must also be greased, unless otherwise specified.	Article number is specified in Equipment on page 170 .
4 Mount the seal correctly with a mounting tool. Never hammer directly on the seal as this may result in leakage.	

Continues on next page

Flange seals and static seals

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

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

O-rings

The following procedure describes how to fit o-rings.

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

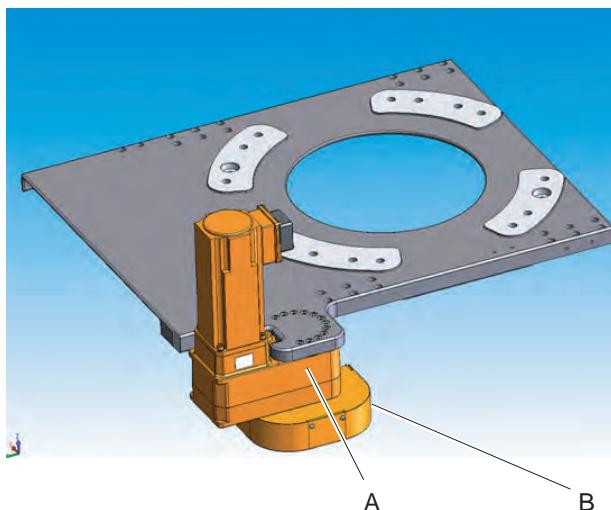
4 Repair

4.3 Replacing the gearbox (including the motor) and the gear wheel

4.3 Replacing the gearbox (including the motor) and the gear wheel

Location of gearbox and gear wheel

The gearbox, motor and gear wheel are part of the drive unit and located as shown in figure.



xx1100000748

A	Gearbox TMA 2 and motor
B	Gear wheel (located inside the gear wheel protection)

Required equipment

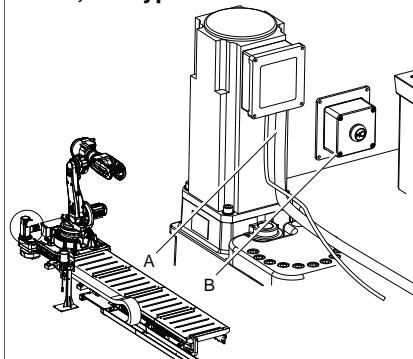
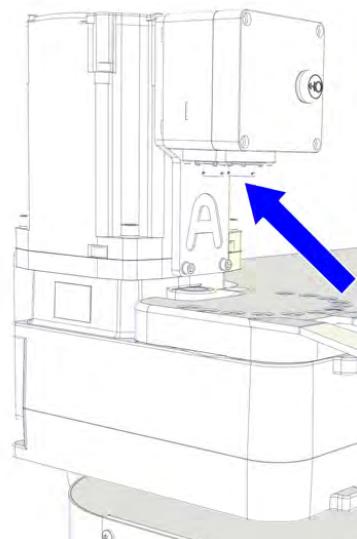
Equipment, etc.	Art. no.	Note
Gearbox including motor	Spare part number is specified in: <ul style="list-style-type: none">• Spare parts on page 291.	
Gear wheel	Spare part number is specified in: <ul style="list-style-type: none">• Spare parts on page 291.	
Gear wheel protection	Spare part number is specified in: <ul style="list-style-type: none">• Spare parts on page 291.	Replace if damaged.
Locking liquid	3HAB7116-1	Loctite 243
Calibration tool	See Special tools on page 288 .	
Standard toolkit	-	Content is defined in section Standard toolkit on page 287 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.

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4.3 Replacing the gearbox (including the motor) and the gear wheel Continued

Removing the drive unit

Use this procedure to remove the drive unit from the track motion.

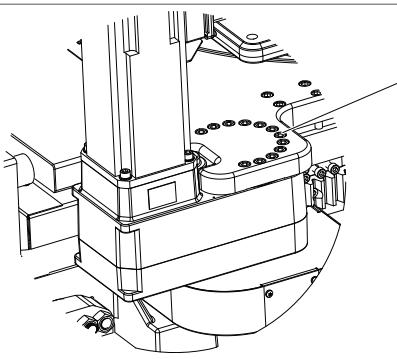
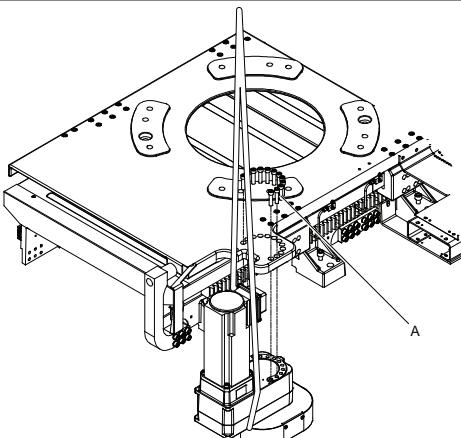
	Action	Note
1	 CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	
2	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot and for the track motion.	
3	Measure reference values for the zero position of the track motion by using a calibration tool.	See Measuring reference values for zero position on page 268 .
4	Remove the cables from the motor.	Motor, not type A:  xx1100000750 A Cable unit, Motor B BRB option contact Motor, type A:  xx1300000058

Continues on next page

4 Repair

4.3 Replacing the gearbox (including the motor) and the gear wheel

Continued

Action	Note
5  CAUTION The complete drive unit weighs 90 kg. All lifting accessories used must be sized accordingly!	
6 Fit lifting accessories to the drive unit.	
7 Remove the drive unit by removing all 12 screws (A).	 xx1100000751 A Hex socket head cap screw M12x40, 12 pcs
8 Lift away the drive unit.	 xx1100000752 A Hex socket head cap screw M12x40, 12 pcs

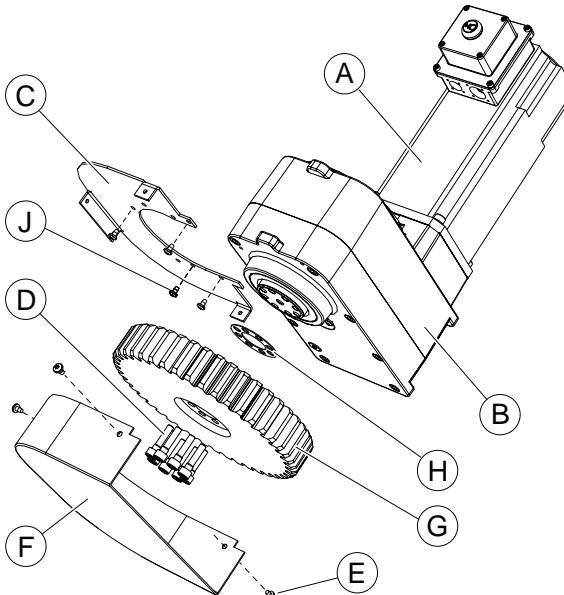
Removing the gear wheel and gearbox

Use this procedure to remove the gear wheel and the gearbox from the drive unit.

Action	Note
1  CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	

Continues on next page

4.3 Replacing the gearbox (including the motor) and the gear wheel Continued

Action	Note
2 Remove the drive unit from the track motion, as described in previous procedure.	
3 Remove the lower part of the gear wheel protection (F) by removing the four screws (E).	
4 Remove the gear wheel (G) and the friction washer (H), by removing the eight screws M10x40 (D).	
5 Remove the upper part of the gear wheel protection (C) from the gearbox, if the gearbox is to be replaced.  Note Do not mix the screws for the upper and lower protection shield.	 xx1100000753 <ul style="list-style-type: none"> A Motor B Gearbox C Gear wheel protection, upper part D Screw M10x40, 8 pcs E Screw M6x10, lower wheel protection, 4 pcs (self-tapping) F Gear wheel protection, lower part G Gear wheel H Friction washer I - J Screw M6x10, upper wheel protection (4 pcs for standard design, 3 pcs for mirrored design)

Assembling and refitting the drive unit

Use this procedure to assemble the drive unit and fit it to the track motion.

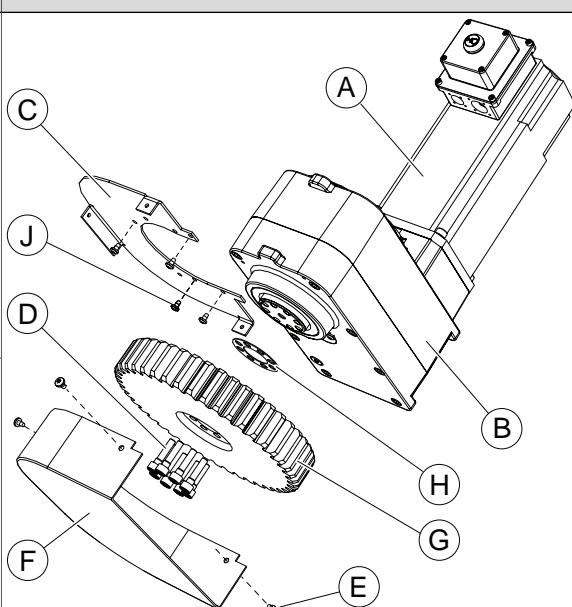
Action	Note
1  CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	

Continues on next page

4 Repair

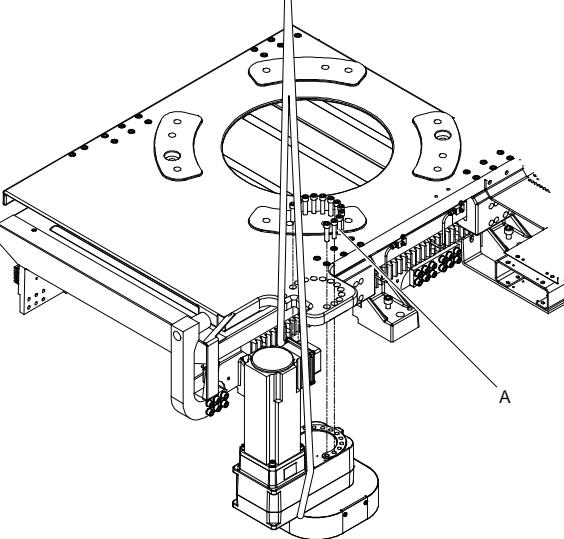
4.3 Replacing the gearbox (including the motor) and the gear wheel

Continued

Action	Note
2 Fit the upper part of the gear wheel protection (C) to the gearbox with screws M6x10 (J). Use locking liquid.	 <p>WARNING Do NOT use self-tapping screws! Do not mix the screws for the upper and lower protection shield.</p>
3 Fit the the friction washer (H) and gear wheel (G) to the gearbox and secure with eight screws (D). Tightening torque: 79 Nm.	<p>xx1100000753</p> <p> A Motor B Gearbox C Gear wheel protection, upper part D Screw M10x40, 8 pcs E Screw M6x10, lower wheel protection, 4 pcs, self-tapping F Gear wheel protection, lower part G Gear wheel H Friction washer I - J Screw M6x10, upper wheel protection (4 pcs for standard design, 3 pcs for mirrored design) </p>
4  CAUTION The complete drive unit weighs 90 kg. All lifting accessories used must be sized accordingly!	

Continues on next page

4.3 Replacing the gearbox (including the motor) and the gear wheel Continued

Action	Note
5 Fit lifting accessories to the complete drive unit and lift it to mounting position.	
6 Refit the drive unit to the track motion and secure with the 12 screws. (How to tighten the screws and which tightening torque to use is described in Adjusting the gearbox back lash on page 179 .)	 xx1100000752 A Hex socket head cap screw M12x40, 12 pcs
7 Adjust gearbox back lash.	See Adjusting the gearbox back lash on page 179 .
8 Refit the lower part of the gear wheel protection (F) to the drive unit with the four screws M6x10 (E). Use the self-tapping screws. Use locking liquid. (References are shown in figure in step 2.)	

Continues on next page

4 Repair

4.3 Replacing the gearbox (including the motor) and the gear wheel

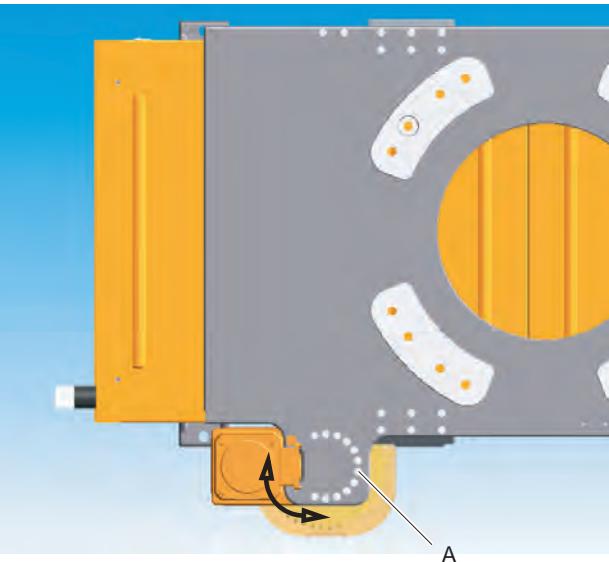
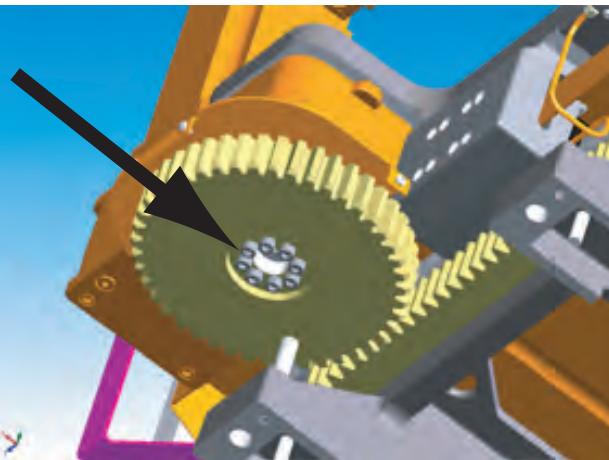
Continued

Action	Note
9 Reconnect the cables. Ensure the cables are at 90°.	<p>Motor, not type A:</p> <p>xx1100000750</p> <p>A Cable unit, Motor B BRB option contact</p> <p>Motor, type A:</p> <p>xx1300000058</p>
10 Calibrate the track motion. Use previously measured reference values for the zero position.	See Fine calibration on page 269 .
11  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 50.	

4.4 Adjusting the gearbox back lash

Adjusting the gearbox back lash

Use this procedure to adjust the gearbox back lash.

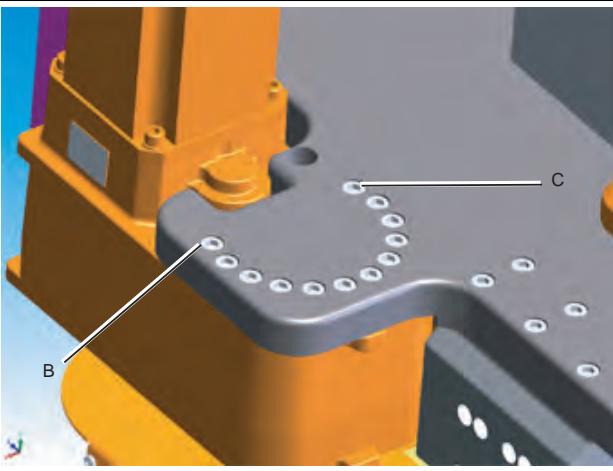
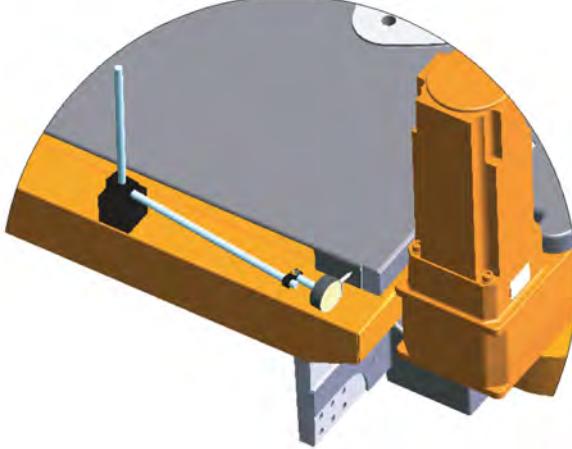
	Action	Note
1	<p>Loose all socket head cap screws except screw (A). Socket head cap screw (A) Tightening torque: 40 Nm. (Socket head cap screw (A) is the joint screw).</p>	 xx1100000754 A Joint screw
2	<p>Push by hand the drive unit against the gear rack.</p>	 xx1100000755

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4 Repair

4.4 Adjusting the gearbox back lash

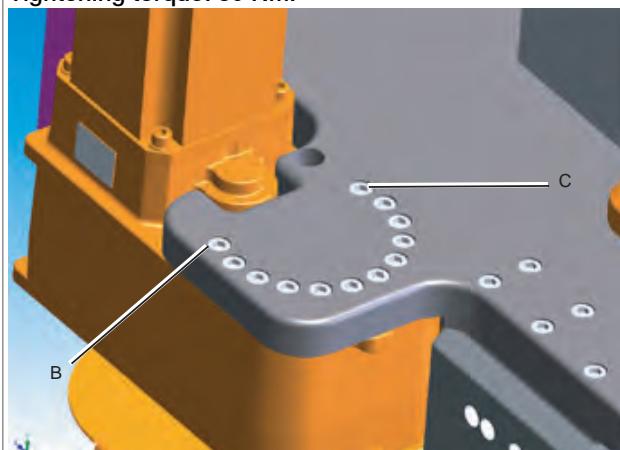
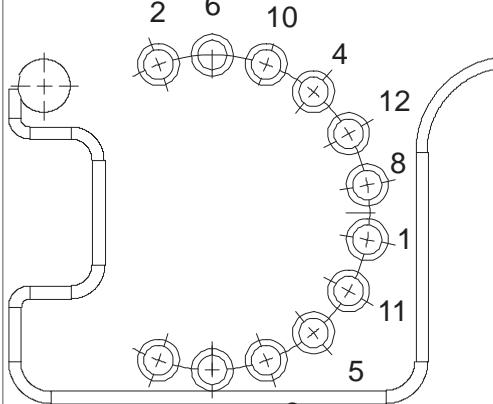
Continued

Action	Note
3 Tighten the lock screws (B) and (C). Tightening torque: 40 Nm.	 xx1100000756 <p style="text-align: center;"> A - B Lock screw C Lock screw </p>
4 Fit the indicator clock as shown in figure.	 xx1100000757
5 Push the carriage by hand until the gear wheel is in contact with the next cog on the gear rack.	X+ direction
6 Reset the indicator clock.	
7 Push the carriage by hand in the opposite direction until the gear wheel is in contact with the next cog on the gear rack.	X- direction
8 Check the reading on the indicator clock.	The play should be between 0.07-0.13 mm.
9 Go back to step 6, push the carriage 1000 mm.	X+ direction
10 Continue with step 7 to step 9.	

Continues on next page

4.4 Adjusting the gearbox back lash

Continued

Action	Note
11 If the gap is OK, then tighten the lock screws (B) and (C) in figure.	<p>Tightening torque: 80 Nm.</p>  <p>xx1100000756</p> <p>A - B Lock screw C Lock screw</p>
12 If the gap is not OK then repeat step 6 to step 10.	
13 Tighten all 12 screws in a spread sequence.	<p>Tightening torque: 120 Nm.</p>  <p>xx1100000758</p>

4 Repair

4.5 Replacing the motor

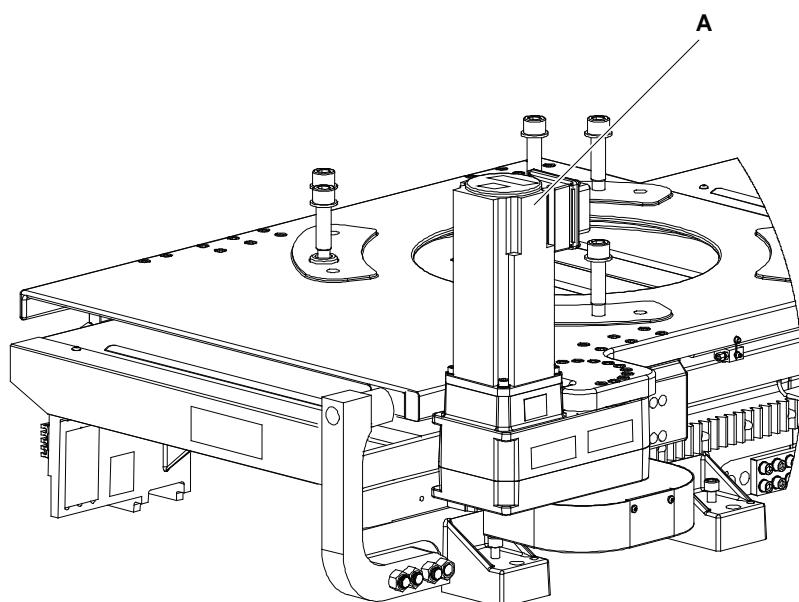
4.5 Replacing the motor

Changing version of motor

There are two versions of the track motion motor. If changing from one version to another, see [Changing the track motion motor to Type A on page 194](#) instead of this replacement procedure.

Location of motor

The motor is located as shown in the figure.



xx1100000759

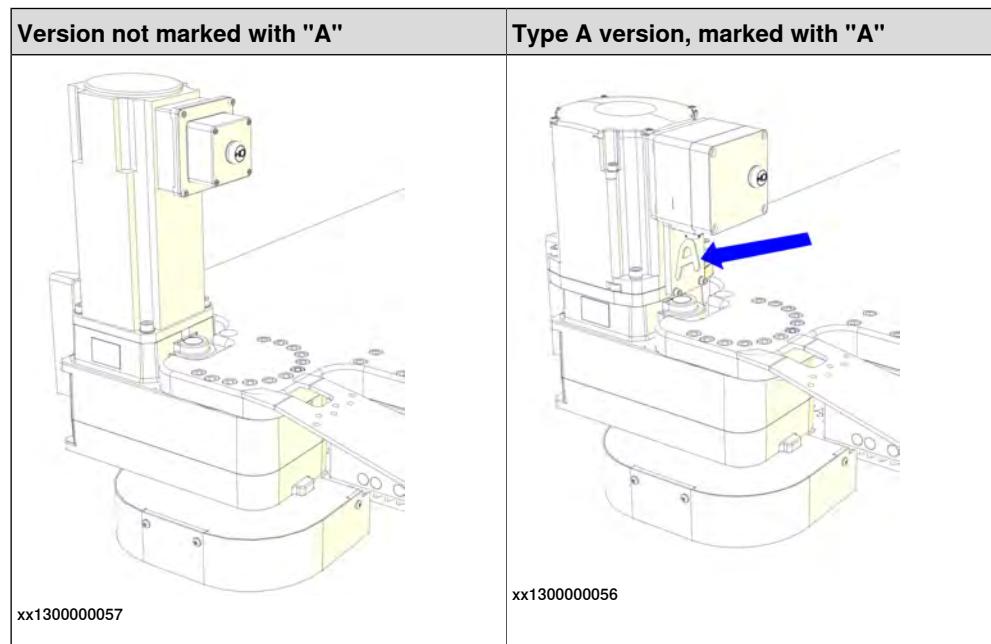
A	Motor
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Two versions of the track motion motor

The figures show the visual differences between motor Type A and the version that is not Type A.

The replacement procedures differ between the two versions of the motor.

**Required equipment**

Equipment, etc.	Art. no.	Note
Motor	Spare part number is specified in: • Spare parts on page 291 .	
O-ring	3HAB3772-107	Valid for type A motor. Always use a new o-ring when replacing the motor!
Calibration tool	See Special tools on page 288 .	
Standard toolkit	-	Content is defined in section Standard toolkit on page 287 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.

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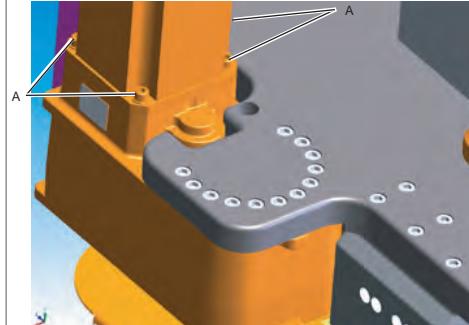
4 Repair

4.5 Replacing the motor

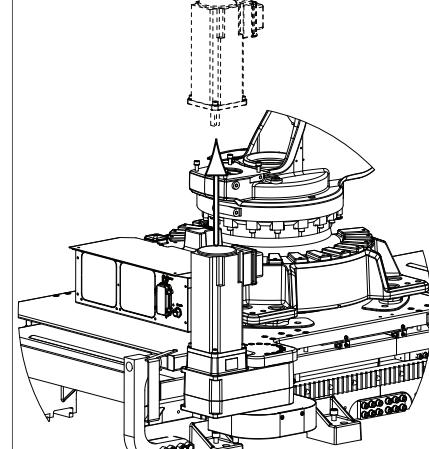
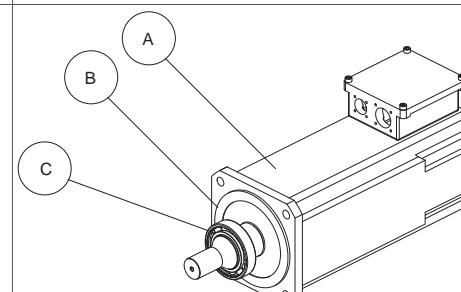
Continued

Removing the motor - version not marked with "A"

Use this procedure to remove the motor.

	Action	Note
1	 CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	
2	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot and for the track motion.	
3	Measure reference values for the zero position of the track motion by using a calibration tool.	See Measuring reference values for zero position on page 268 .
4	Remove the cover from the top of the motor.	
5	Remove the cable gland cover at the cable exit.	
6	Disconnect all connectors beneath the motor cover.	
7	In order to release the brake, connect the 24 VDC power supply.	Connect to motor connector: • + : pin L • - : pin M
8	Remove the four screws that hold the motor.	 xx1100000760
9	 CAUTION The motor weighs 26 kg. All lifting accessories used must be sized accordingly!	

Continues on next page

	Action	Note
10	Remove the motor.	 xx1100000761
11	Remove the gasket from the machined contact surface of the motor.	 xx1100000762 A AC Motor B Machined contact surface C Axle drive bearing

Refitting the motor - version not marked with "A"

Use this procedure to refit the motor.

	Action	Note
1	 CAUTION The motor weighs 26 kg. All lifting accessories used must be sized accordingly!	

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4 Repair

4.5 Replacing the motor

Continued

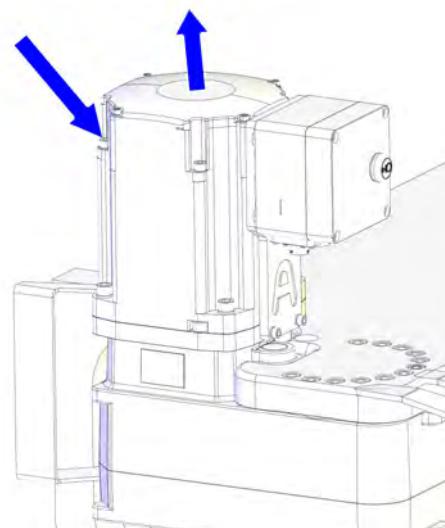
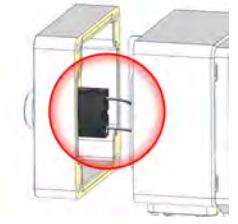
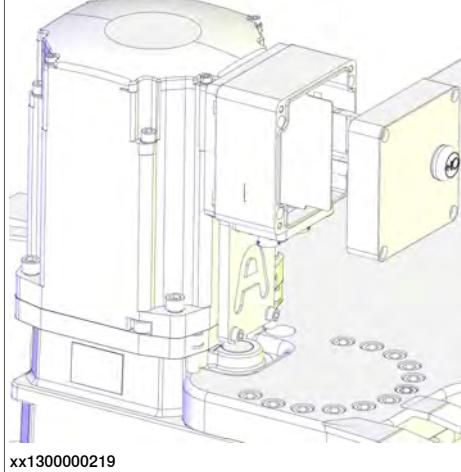
Action	Note
2 Fit the new gasket on the motors machined contact surfaces.	 xx1100000762 <p>A AC Motor B Machined contact surface C Axe drive bearing</p>
3 In order to release the brake, connect the 24 VDC power supply.	Connect to motor connector: <ul style="list-style-type: none"> + : pin L - : pin M
4 Secure the motor with four screws and plain washers. If required, use the extension 300 mm for bits 1/2".	Tightening torque: 47 Nm.
5 Remove the 24 VDC power supply.	
6 Reconnect all connectors beneath the motor cover.	
7 Refit the cable gland cover at the cable exit with its two attachment screws.	
8 Refit the cover on top of the motor with its four attachment screws.	
9 Calibrate the track motion. Use previously measured reference values for the zero position.	See Fine calibration on page 269 .
10  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 50 .	

Removing the Type A motor - marked with "A"

Use this procedure to remove the motor.

Action	Note
1  CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	

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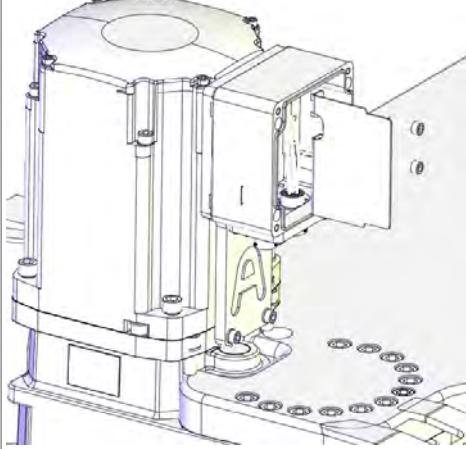
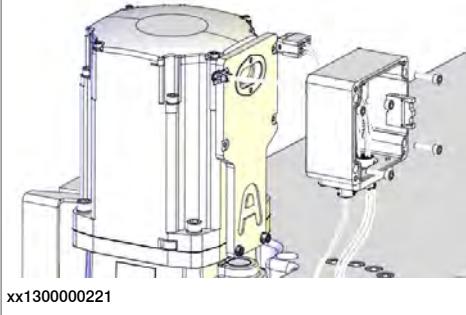
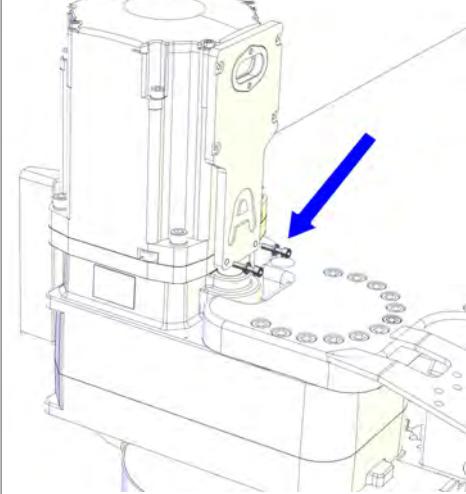
Action	Note
2  DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot and for the track motion.	
3 Measure reference values for the zero position of the track motion by using a calibration tool. See Measuring reference values for zero position on page 268 .	
4 Unscrew the motor cover screws and remove the motor cover.	 xx1300000220
5 Disconnect the motor cables.	
6  CAUTION The brake release cables are attached to the cover and need to be released before the cover can be completely removed!  xx1300000448	 xx1300000219
1 Remove the attachment screws of the connection box cover and pull the cover carefully off the connection box until the contact block can be reached. 2 Pull out the contact block from the push button unit. 3 Remove the connection box cover.	

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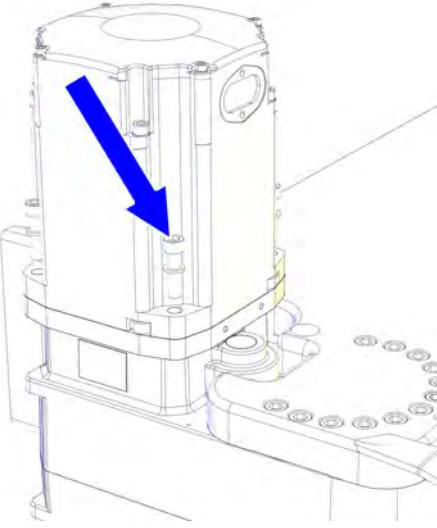
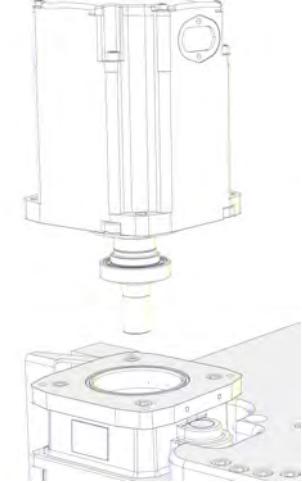
4 Repair

4.5 Replacing the motor

Continued

Action	Note
7 Remove the plate from the connection box.	 xx1300000449
8 Unscrew the attachment screws of the connection box and run the cables carefully out through the motor cable gland as removing the box from the motor. Place the connection box aside.	 xx1300000221
9 Remove the adapter plate by removing the two screws.	 xx1300000059
10 In order to release the brake, connect the 24 VDC power supply.	Connect to motor connector: • + : pin L • - : pin M

Continues on next page

Action	Note
11 Remove the four screws that secure the motor.	 xx1300000230
12  CAUTION The motor weighs 26 kg. All lifting accessories used must be sized accordingly!	
13 Remove the motor.	 xx130000060 <p>Type A motor.</p>

Continues on next page

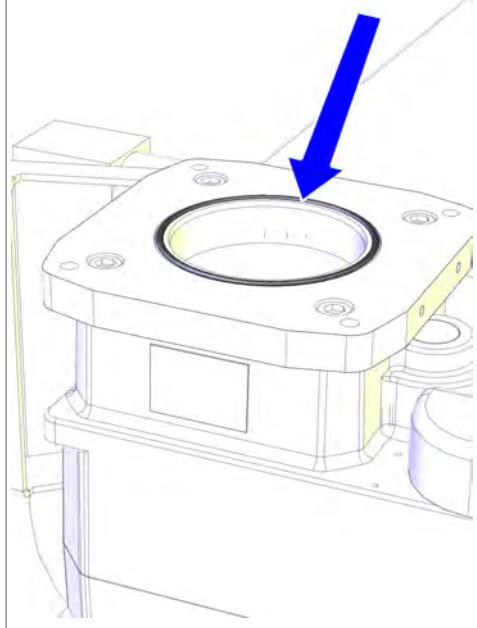
4 Repair

4.5 Replacing the motor

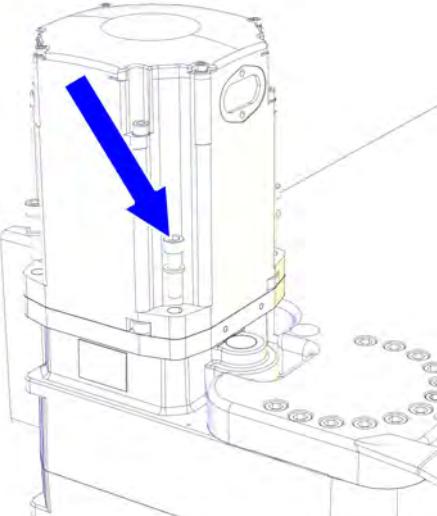
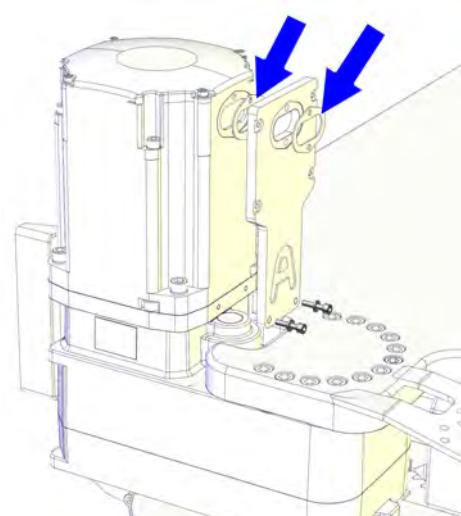
Continued

Refitting the Type A motor - marked with "A"

Use this procedure to refit the motor.

Action	Note
1  CAUTION The motor weighs 26 kg. All lifting accessories used must be sized accordingly!	
2 Replace the o-ring.	O-ring: 3HAB3772-107
	 xx1300000061
3 Unscrew the motor cover screws and remove the motor cover.	
4 In order to release the brake, connect the 24 VDC power supply.	Connect to motor connector: • + : pin L • - : pin M

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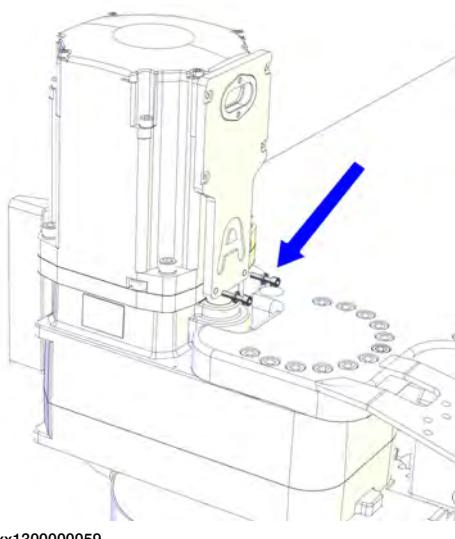
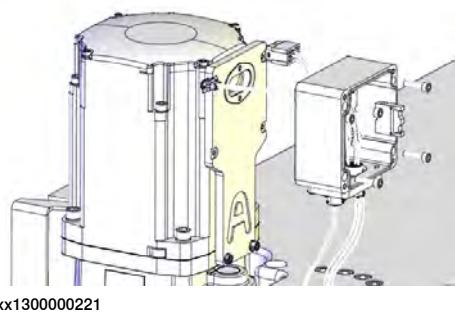
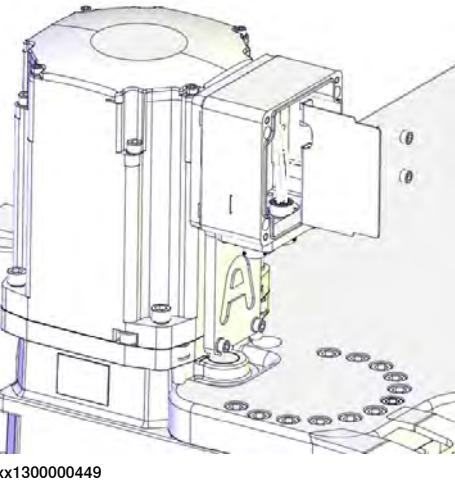
Action	Note
5 Secure the motor with four screws and plain washers. If required, use the extension 300 mm for bits 1/2".	Tightening torque: 47 Nm.  xx1300000230
6 Remove the 24 VDC power supply.	
7 Check both gaskets. Replace them if damaged.	 xx1300000222

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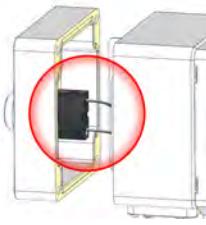
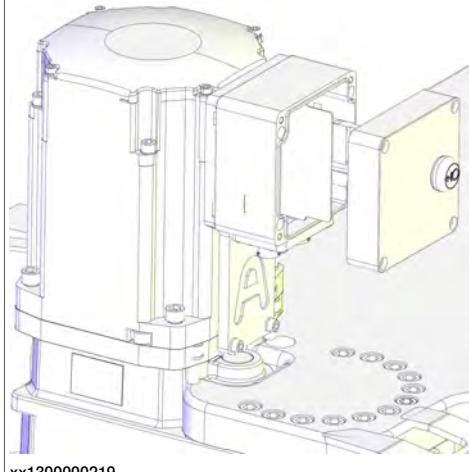
4 Repair

4.5 Replacing the motor

Continued

Action	Note
8 Secure the bracket to the motor with the two screws and washers. Do not tighten yet.	 xx1300000059
9 Run the motor cables to the inside of the motor and refit the connection box with the attachment screws. Do not tighten yet.	 xx1300000221
10 Refit the plate to the connection box.	 xx1300000449
11 Tighten the bracket, connection box and plate screws.	Tightening torque: 10 Nm.
12 Reconnect all connectors beneath the motor cover.	
13 Refit the motor cover with its attachment screws and washers.	

Continues on next page

	Action	Note
14	Snap on the contact block to the push button unit.	 xx1300000448
15	Refit the connection box cover and secure with the attachment screws and washers.	 xx1300000219
16	Calibrate the track motion. Use previously measured reference values for the zero position.	See Fine calibration on page 269 .
17	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 50 .	

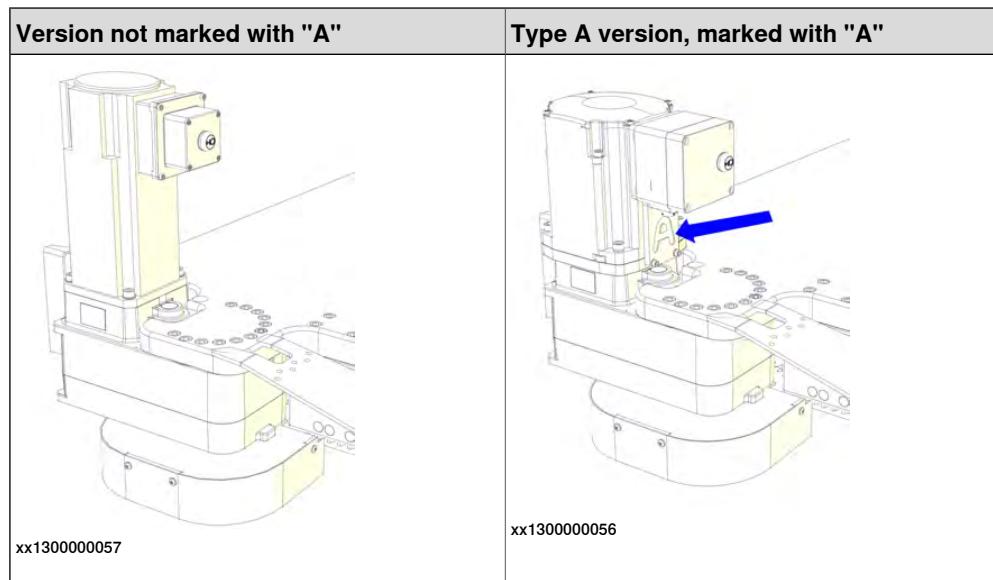
4 Repair

4.6 Changing the track motion motor to Type A

4.6 Changing the track motion motor to Type A

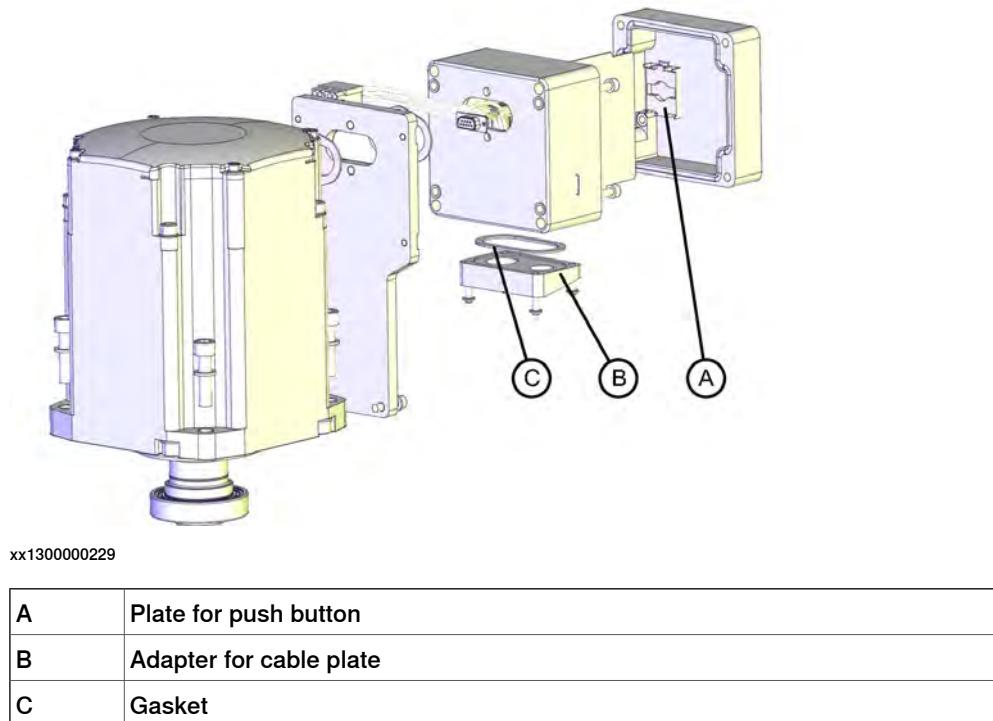
Two versions of the track motion motor

The figures show the visual differences between Type A of track motion motor and the version that is not Type A.



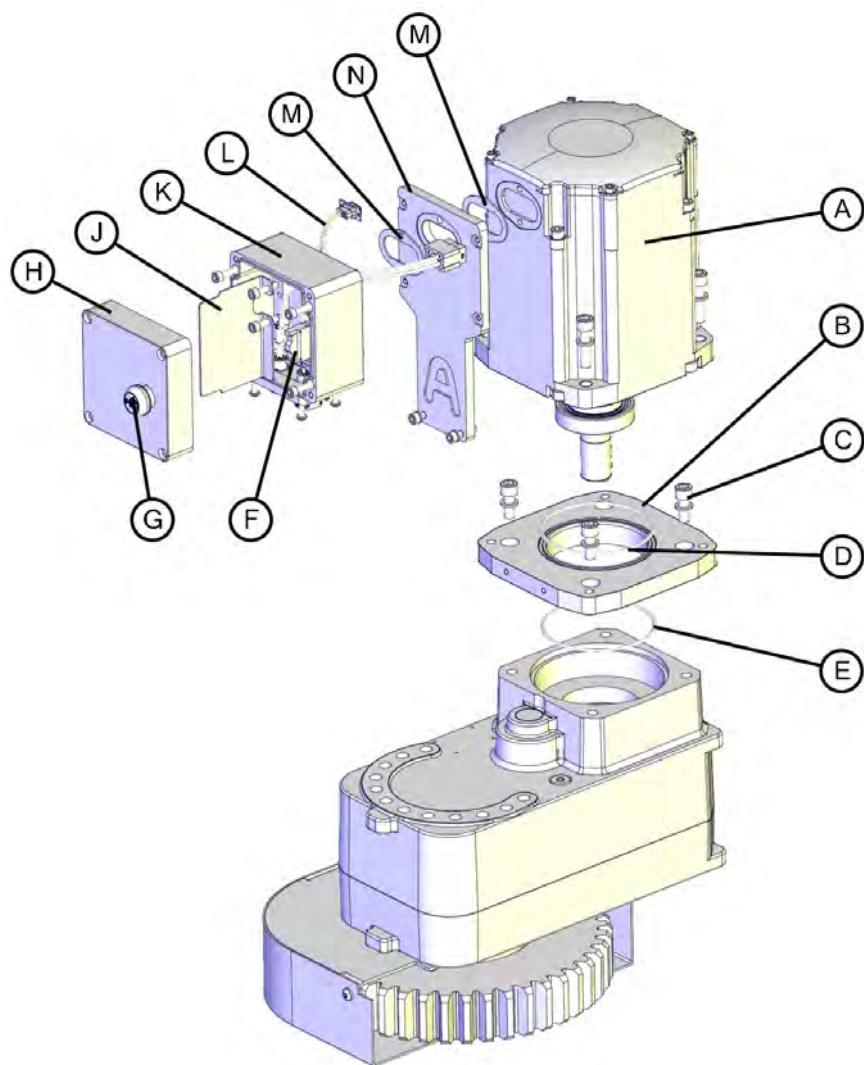
Exploded views of Type A motor

The figures show exploded views of the Type A version of the track motion motor.



Continues on next page

4.6 Changing the track motion motor to Type A
Continued



xx1300000228

A	Motor
B	Adapter plate
C	Screws M10x25, 4 pcs
D	O-ring, diameter 102 mm
E	O-ring, diameter 134 mm
F	Contact NO
G	Brake release push button
H	Connection box cover
J	Plate
K	Connection box
L	Cables
M	Gasket, 2 pcs
N	Bracket

Continues on next page

4 Repair

4.6 Changing the track motion motor to Type A

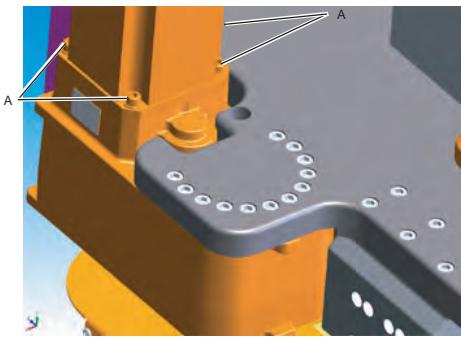
Continued

Required equipment

Equipment	Art. no.	Note
Motor, Type A	See Spare parts on page 291 .	
Adapter cable kit	See Spare parts on page 291 .	Required when connecting the Type A motor to track motion cabling without bayonet cabling
Grease	3HAB3537-1	Used to lubricate the o-rings.

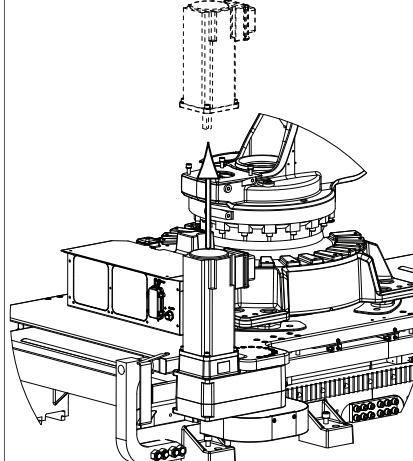
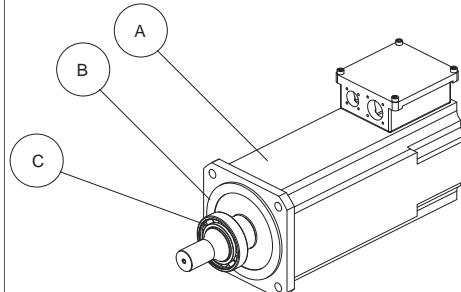
Removing the motor - version not marked with "A"

Use this procedure to remove the motor.

	Action	Note
1	 CAUTION Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	
2	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot and for the track motion.	
3	Measure reference values for the zero position of the track motion by using a calibration tool.	See Measuring reference values for zero position on page 268 .
4	Remove the cover from the top of the motor.	
5	Remove the cable gland cover at the cable exit.	
6	Disconnect all connectors beneath the motor cover.	
7	In order to release the brake, connect the 24 VDC power supply.	Connect to motor connector: • + : pin L • - : pin M
8	Remove the four screws that hold the motor.	 xx1100000760

Continues on next page

4.6 Changing the track motion motor to Type A
Continued

	Action	Note
9	 CAUTION The motor weighs 26 kg. All lifting accessories used must be sized accordingly!	
10	Remove the motor.	 xx1100000761
11	Remove the gasket from the machined contact surface of the motor.	 xx1100000762 A AC Motor B Machined contact surface C Axle drive bearing

Fitting the Type A motor - marked with "A"

Use these procedures to fit the motor and install it to track motion cabling without bayonet fitting.

Mechanical installation

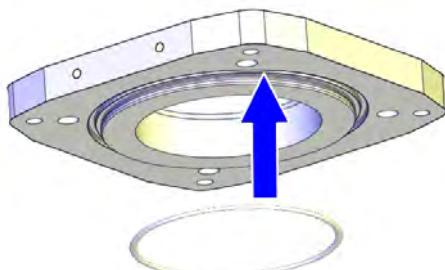
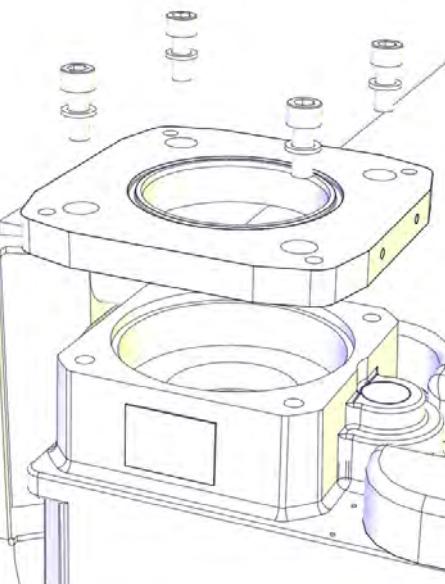
	Action	Note
1	 CAUTION The motor weighs 26 kg. All lifting accessories used must be sized accordingly!	

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4 Repair

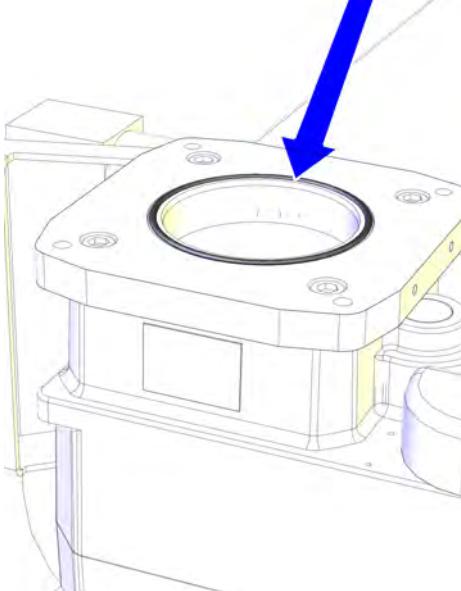
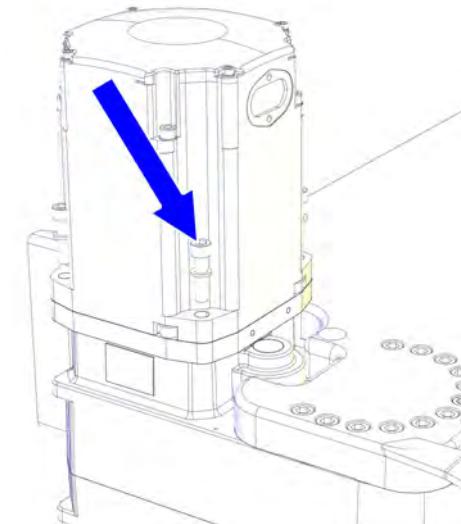
4.6 Changing the track motion motor to Type A

Continued

Action	Note
2 Fit the o-ring to the adapter plate. Lubricate with grease to make it stick to the groove.	 xx1300000441
3 Fit the adapter plate to the drive unit and secure with screws and washers.	Tightening torque: 47 Nm.  xx1300000751

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4.6 Changing the track motion motor to Type A
Continued

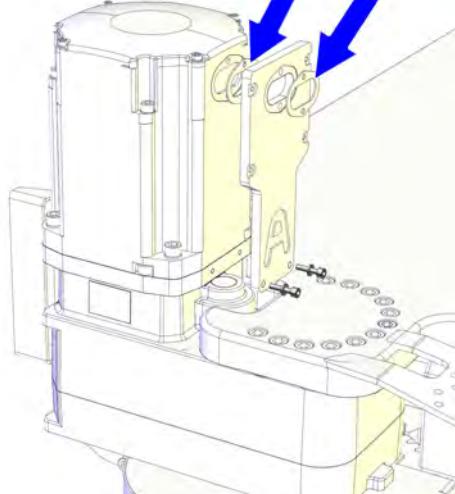
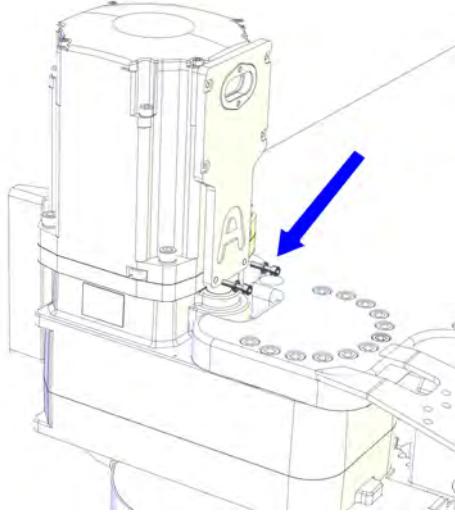
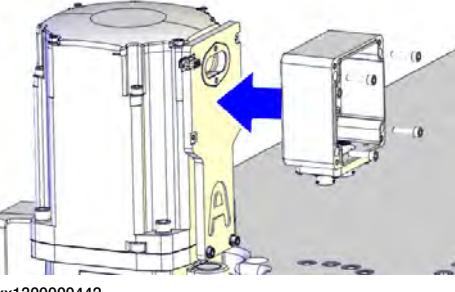
	Action	Note
4	Fit the o-ring to the adapter plate. Lubricate with grease to make it stick to the groove.	 xx1300000061
5	Remove the motor cover.	
6	In order to release the brake, connect the 24 VDC power supply.	Connect to motor connector: • + : pin L • - : pin M
7	Secure the motor with four screws and plain washers. If required, use the extension 300 mm for bits 1/2".	Tightening torque: 47 Nm.  xx1300000230
8	Remove the 24 VDC power supply.	

Continues on next page

4 Repair

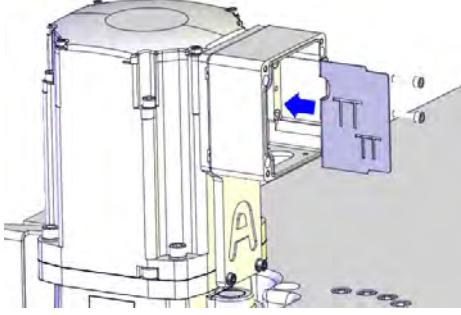
4.6 Changing the track motion motor to Type A

Continued

Action	Note
9 Fit the both gaskets.	 xx1300000222
10 Secure the bracket to the motor with the two screws and washers.	<p> Note</p> <p>Do not tighten the screws until the connection box and the plate are fitted, as described in following steps.</p>  xx1300000059
11 Fit the connection box to the motor with the attachment screws.	 xx1300000442

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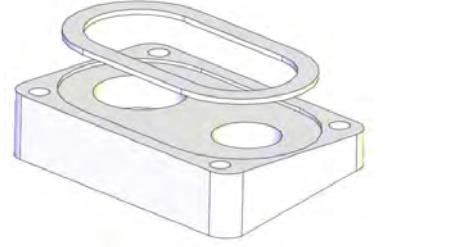
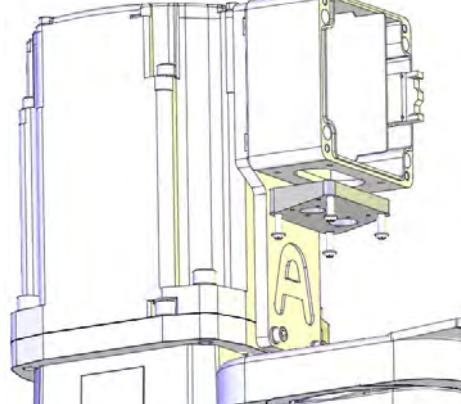
4.6 Changing the track motion motor to Type A *Continued*

Action	Note
12 Fit the plate to the connection box with the attachment screws.	
13 Tighten all the screws.	Tightening torque: 10 Nm.

Electrical installation

Use this procedure to install the motor to track motion cabling without bayonet fitting, using the adapter cable kit.

Parts marked with italic are included in the adapter cable kit.

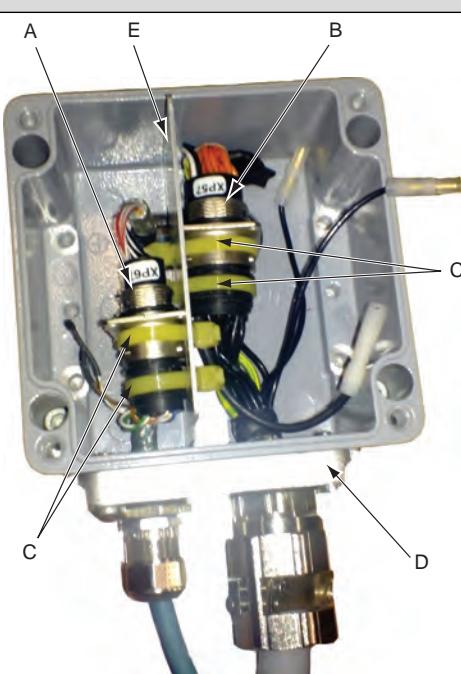
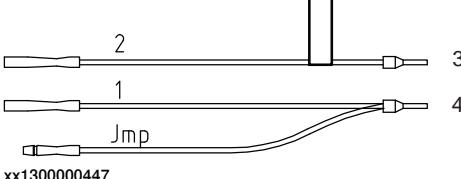
Action	Note
1 Insert the <i>adapter cable</i> from inside the connection box, through the cable gland, into the motor, and connect to the motor power connector and signal connector.	
2 Fit the <i>gasket</i> to the <i>adapter cable plate</i> .	
3 Fit the <i>adapter cable plate</i> to the motor.	

Continues on next page

4 Repair

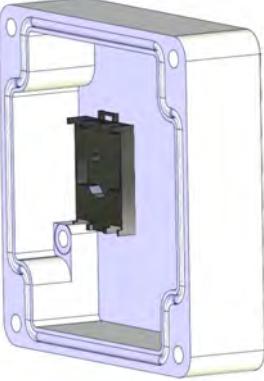
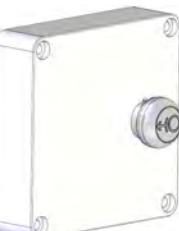
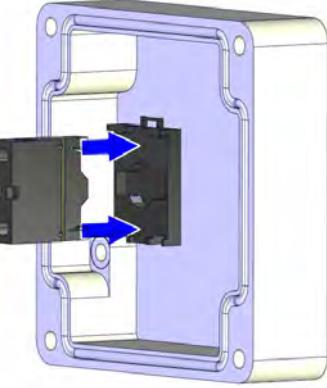
4.6 Changing the track motion motor to Type A

Continued

Action	Note
4 Run the power and signal track motion cables into the connection box. Place the power cabling on the right side of the plate and signal cabling on the left side of the plate. Secure the cabling to the adapter cable plate (D).	
5 Connect the signal (A) and power (B) connectors inside the connection box, place the connectors at the grooves in the plate (E) and secure them with one cable strap each (C).  Tip Pre-fit the cable straps to the plate prior to connecting the connectors and tighten the straps once the connectors are connected and placed in their grooves respectively.	
6 Connect the <i>electrical kit</i> for brake release to the track motion power cabling according to the cable markings. <ul style="list-style-type: none">• Connect cable 1 to cable 1.• Connect cable 2 to cable 2.• Connect cable Jmp to cable Jmp.	
7 Connect the electrical kit to the <i>contact block</i> according to the figure.	<ul style="list-style-type: none">• 1, 2, Jmp = markings on the cable.• 3, 4 = connections on the push button unit contact block.

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**4.6 Changing the track motion motor to Type A
Continued**

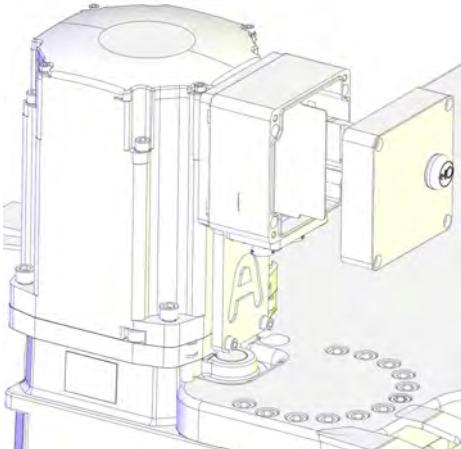
	Action	Note
8	Assemble and fit the push button unit to the connection box cover.	 xx1300000444  xx1300000445
9	Snap on the contact block to the push button unit.	 xx1300000448  xx1300000446

Continues on next page

4 Repair

4.6 Changing the track motion motor to Type A

Continued

Action	Note
10 Refit the connection box cover and secure with the attachment screws and washers.	 xx1300000219
11 Refit the motor cover with its attachment screws and washers.	
12 Calibrate the track motion. Use previously measured reference values for the zero position.	See Fine calibration on page 269 .
13  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 50 .	

Changes in the software

When changing the track motion motor to Type A, it is also necessary to upgrade the additional option software for the track motion to Type A.

The track motion Type A software is found on the RobotWare DVD in the *Additional options* folder, from release 5.15.00.01 or later.



Note

It is only necessary to upgrade the additional option software for the track motion.
It is not necessary to upgrade the RobotWare.

Use this procedure to make necessary changes in the software.

Action	Note
1 Install the additional option software for the track motion Type A to the MediaPool on the PC.	
2 Create a backup of the current system on the controller.	
3 Use the SystemBuilder in RobotStudio to upgrade the controller system with the additional option software for the track motion Type A.	

Continues on next page

4.6 Changing the track motion motor to Type A*Continued*

	Action	Note
4	C-start the system on the controller.	
5	Download the upgraded system to the controller	
6	Restore the backup.	

For more information on how to build and modify systems using the SystemBuilder in RobotStudio, see *Operating manual - RobotStudio*.

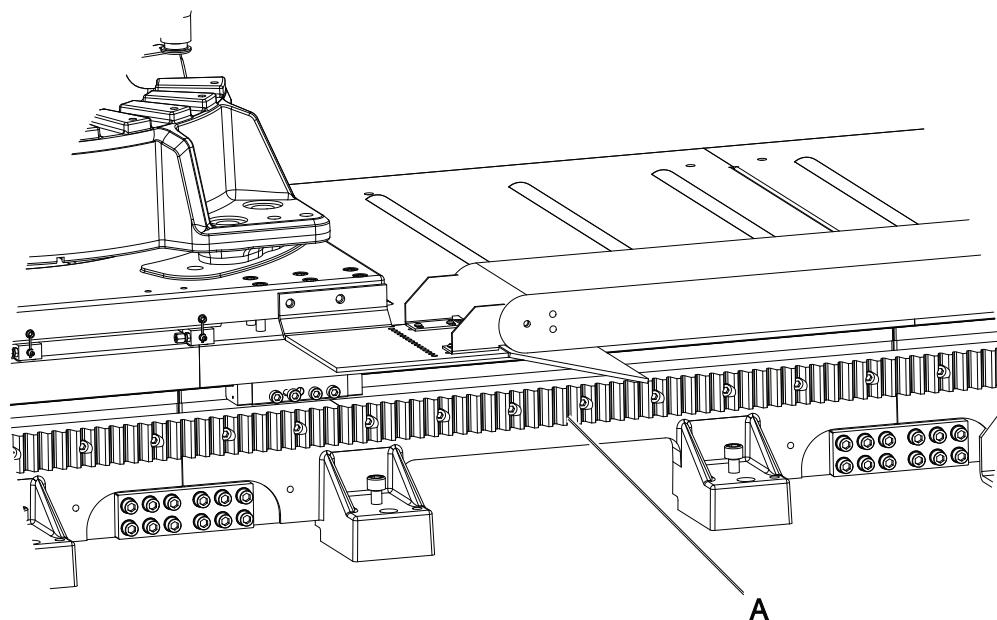
4 Repair

4.7 Replacing the gear racks

4.7 Replacing the gear racks

Location of gear racks

The gear racks are located as shown in the figure.



xx1100000744

A	Gear racks
---	------------

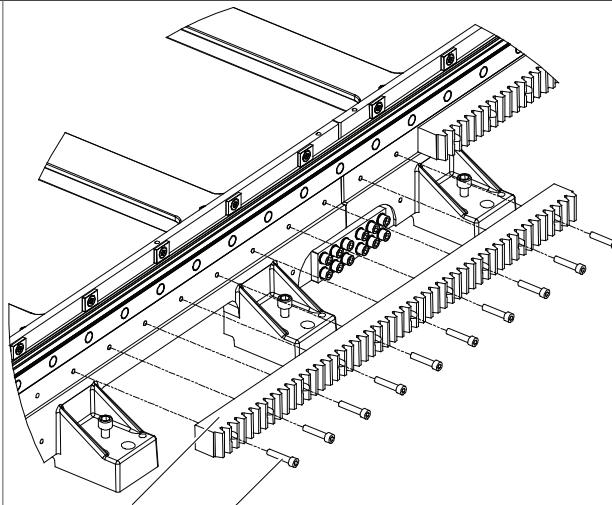
Required equipment

Equipment, etc.	Art. no.	Note
Gear rack	Spare part number is specified in: <ul style="list-style-type: none">Spare parts on page 291.	
Gear rack used as a meshing gauge	3HxD1000-467	
Standard toolkit	-	Content is defined in section Standard toolkit on page 287.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.

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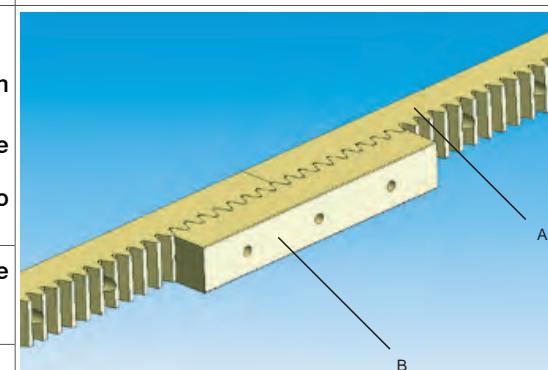
Removing the gear racks

Use this procedure to remove the gear racks.

	Action	Note
1	Remove all ten hex socket head cap screws M10x50 (B) that hold the gear rack (A).	 <p>xx1100000763</p> <p>A Gear rack B Hex socket head cap screw M10x50</p>

Refitting the gear racks

Use this procedure to refit the gear racks.

	Action	Note
1	Fit all ten hex socket head cap screws M10x50 (B) that hold the gear rack (A).	Socket head cap screw (B) soft tighten.
2	Check using the supplied teeth-meshing gauge (B) that the joints on the laid gear rack have a smooth transition. If the teeth on the test piece and the gear rack do not mesh, continue with step 3. Otherwise go directly to step 6.	 <p>xx1100000764</p> <p>A Gear rack B Gear rack meshing gauge 3HXD1000-467</p>
3	If the teeth on the test piece and the gear rack do not mesh, loosen the bolts on the prefitted gear racks.	
4	Adjust the transition by using the play on the mountings on the prefitted gear racks.	
5	Secure the prefitted gear racks. Tightening torque: 50 Nm.	
6	Secure the gear rack section. Tightening torque: 50 Nm. If additional sections are to be assembled, repeat the procedure.	

Continues on next page

4 Repair

4.7 Replacing the gear racks

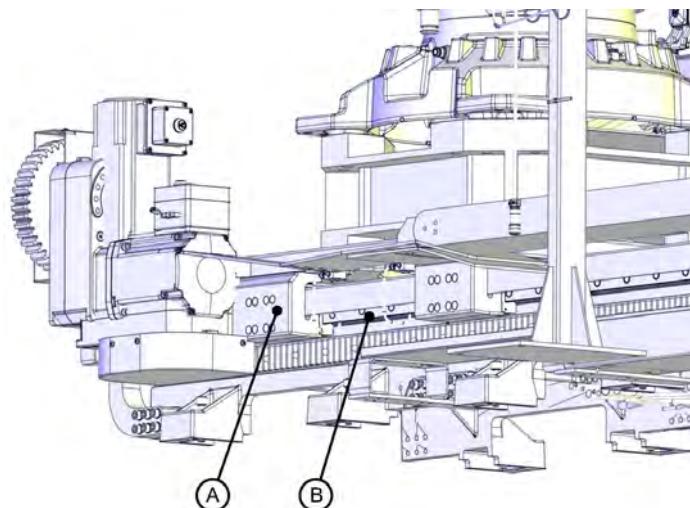
Continued

	Action	Note
7	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <i>DANGER - First test run may cause injury or damage! on page 50.</i>	

4.8 Replacing the linear guides

Repair actions at breakdown

If a breakdown has occurred on a ball element or linear guide, use this procedure to take proper repair measures.



xx1600000893

A	Ball elements (underneath the bracket), totally 4 pcs
B	Linear guide

	Action	Note
1	Inspect the linear guides on the same side of the track as where the damage has occurred. Replace damaged linear guides, if any.	
2	Inspect the two ball elements on the same side of the track as where the damaged guide is installed. Replace both ball elements, if any of the ball elements are damaged. If both ball elements are damaged: replace also the ball elements on the other side as a preventive maintenance procedure.	See Replacing the ball elements on page 213 .

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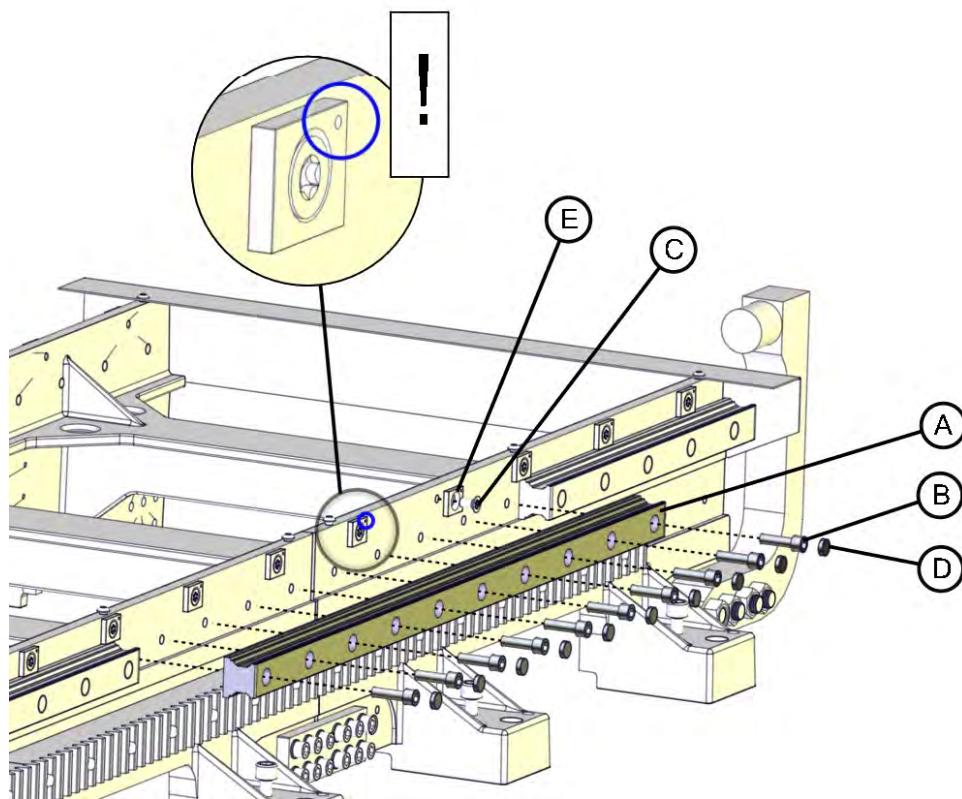
4 Repair

4.8 Replacing the linear guides

Continued

Location of linear guides

The linear guides are located as shown in the figure.



xx1600000971

A	Linear guides
B	Hex socket head cap screw M12x40
C	Torx screw M10x20
D	Cover
E	Locking washer

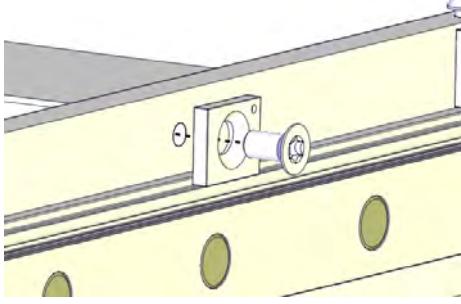
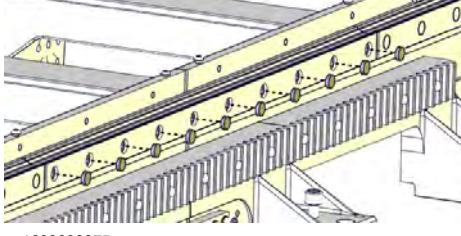
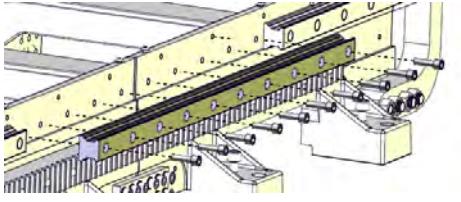
Required equipment

Equipment, etc.	Art. no.	Note
Linear guides	Spare part number is specified in: • Spare parts on page 291 .	
Standard toolkit	-	Content is defined in section Standard toolkit on page 287 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.

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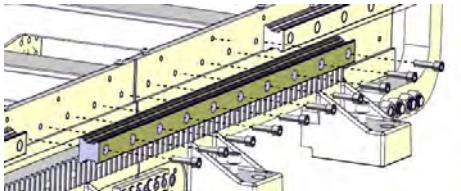
Removing the linear guides

Use this procedure to remove the linear guides.

	Action	Note
1	Remove the cover plates over the linear guide to change.	Use standard tools.
2	Remove all the torx screws M10x20 and locking washers.	 xx1600000976
3	Remove the screw covers.	 xx1600000975
4	Remove the linear guides by removing all the hex socket head cap screws M12x40.	 xx1600000973

Refitting the linear guides

Use this procedure to refit the linear guides.

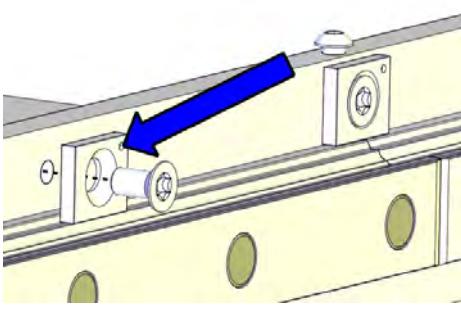
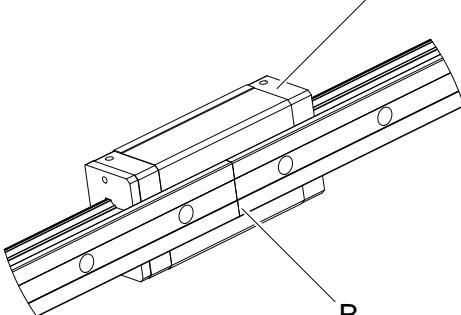
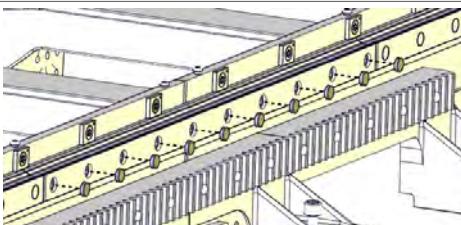
	Action	Note
1	Fit the linear guides with the hex socket head cap screws M12x40. Use standard tools, slightly tighten. Valid for linear guides from Bosch-Rexroth: Maximum gap between the linear guides: 0.5 mm. Valid for linear guides from INA: Maximum gap between the linear guides: 0.05 mm.	 xx1600000973

Continues on next page

4 Repair

4.8 Replacing the linear guides

Continued

Action	Note
2 Fit all the locking washers with the torx screws M10x20. Make sure the mark on the washer is positioned in the upper right corner, see figure. Tightening torque: 45 Nm.	 xx1600000972
3 Valid for linear guides from Bosch-Rexroth: Use a ball element to adjust the sections. Tighten the hex socket head cap screws M12x40. Valid for linear guides from INA: Feel with a finger at the section joint that the linear guide sections are in line with each other. Tighten the hex socket head cap screws M12x40. Tightening torque: 120 Nm.	 xx1100000766 A Ball element B Section joint
4 Fit the screw covers.	 xx1600000974
5  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 50.	

4.9 Replacing the ball elements

Overview

This section contains instructions for replacement of the ball elements, which requires removal of following components:

- Bracket for ball element (runner block)
- Ball elements (runner block)
- Mechanical stops
- Gearbox and motor (only required when replacing ball elements on the motor side of the carriage, when an IRB 7600 is mounted in 90° position on the track motion)

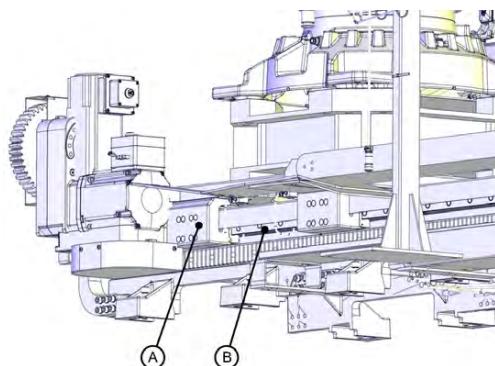


Note

As an alternative method to the following instructions on how to replace the ball elements there is a tool kit (Running block replacement tool) with an enclosed instruction. See [Special tools on page 288](#) more information.

Repair actions at breakdown

If a breakdown has occurred on a ball element (runner block), use this procedure to take proper repair measures.



xx1600000893

A	Ball elements (underneath the bracket), totally 4 pcs
B	Linear guide

	Action	Note
1	Inspect both ball elements on the same side of the track as where the damaged ball element is installed. If only one ball element is damaged: replace the both ball elements installed on the same side of the track. If both ball elements are damaged: replace also the ball elements on the other side as a preventive maintenance procedure.	
2	Inspect the linear guides on the same side of the track as where the damaged ball element is installed. Replace damaged linear guides, if any.	See Replacing the linear guides on page 209 .

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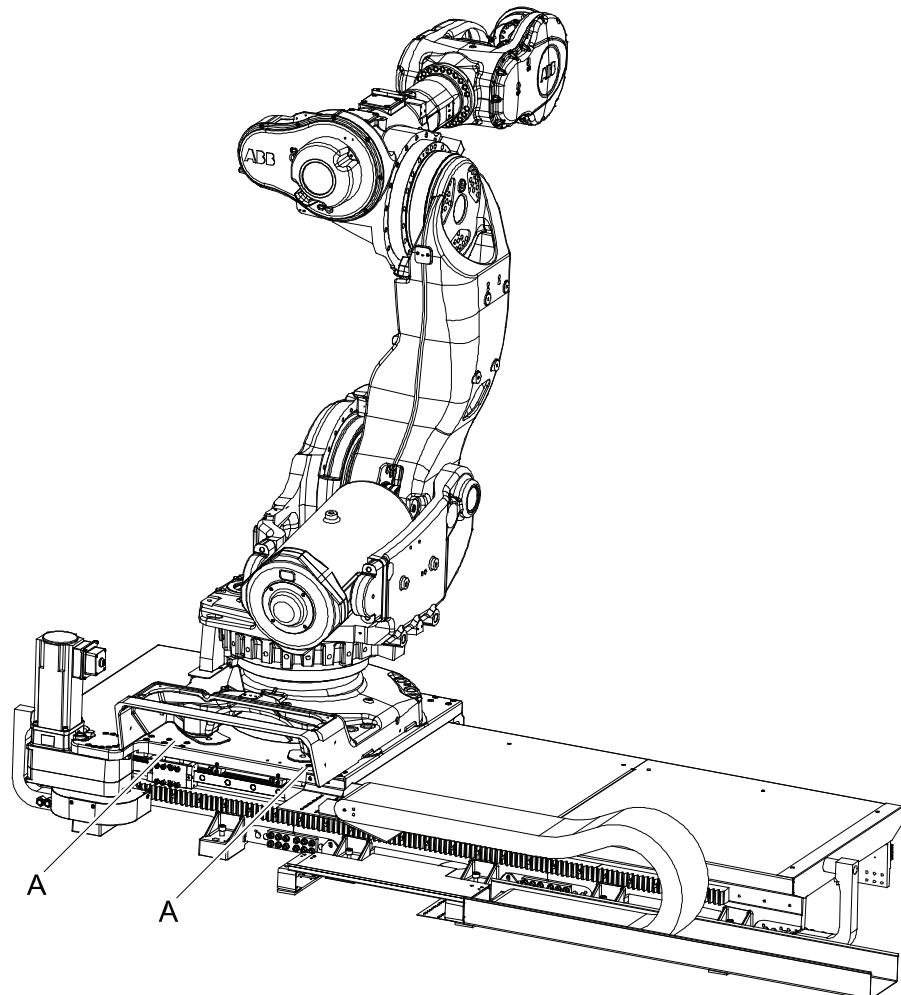
4 Repair

4.9 Replacing the ball elements

Continued

Position of robot

The position of an IRB 7600 that is rotated 90°, prevents removal of the ball element on the carriage motor side, it is therefore always necessary to lift the IRB 7600 to access the hex socket head cap screws. Check lifting instructions in the Installation chapter in *Product manual - IRB 7600*.



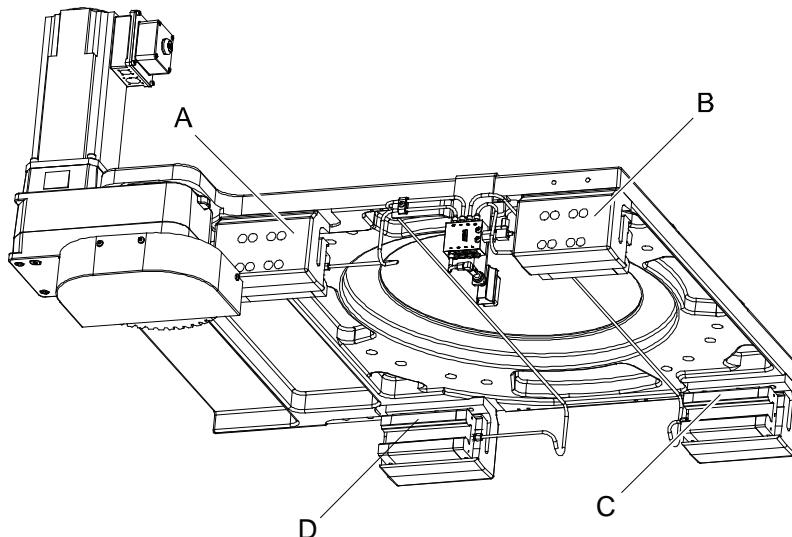
xx1100000767

A	Hex socket head cap screws
---	----------------------------

Continues on next page

Location of ball elements

The ball elements are located as shown in the figure.



xx1100000768

A	Ball element position A (getting access to the ball element requires removal of the gearbox and motor, see Getting access to the ball elements on a track motion for IRB 7600, 90° motor side on page 217).
B	Ball element position B
C	Ball element position C
D	Ball element position D

Required equipment

Equipment, etc.	Art. no.	Note
Ball elements	Spare part number is specified in: • Spare parts on page 291 .	
Jack	-	Capacity > 2000 kg.
Cylindrical pin extractor tool	3HAC044742-001	
Lifting accessories IRB 7600	-	See Product manual - IRB 7600
Feeler	-	1 mm
Calibration tool	See Special tools on page 288 .	
Standard toolkit	-	Content is defined in section Standard toolkit on page 287 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.

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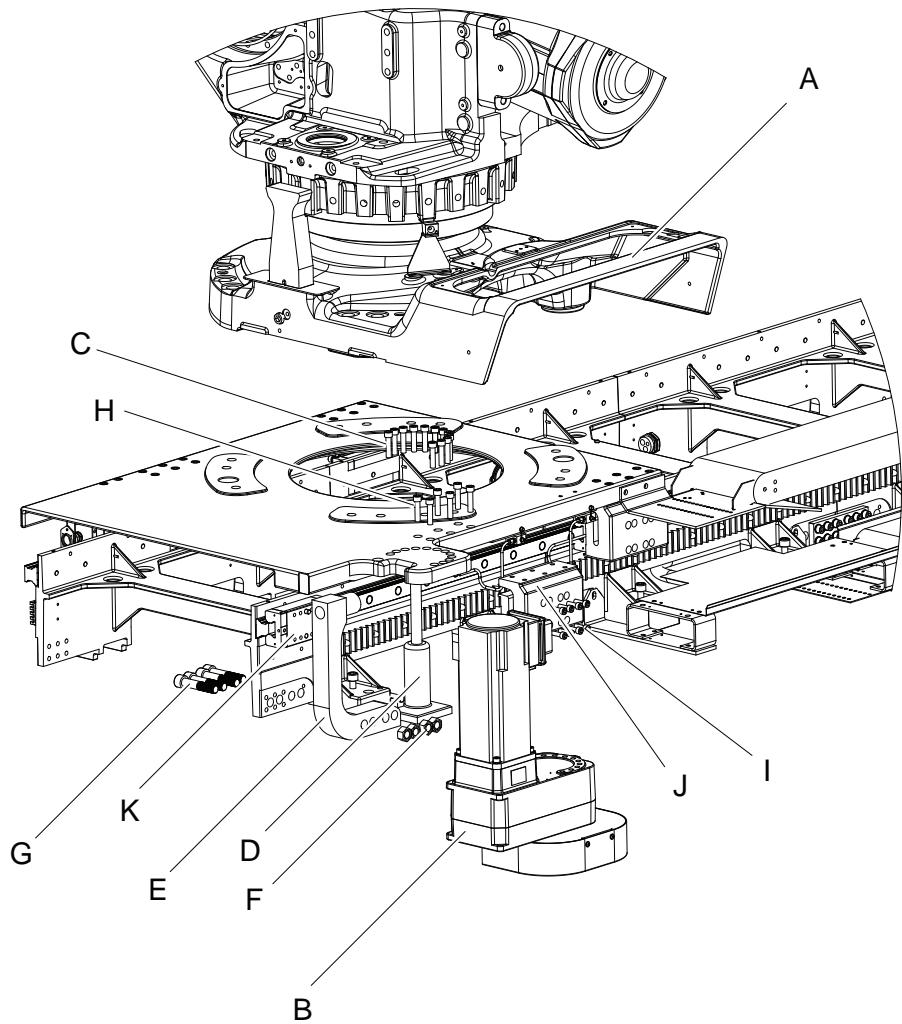
4 Repair

4.9 Replacing the ball elements

Continued

Illustration of removal of ball elements, IRB 7600, 90° motor side

The figure shows details for removal of ball elements on the motor side when an IRB 7600, 90° is mounted.



xx1100000769

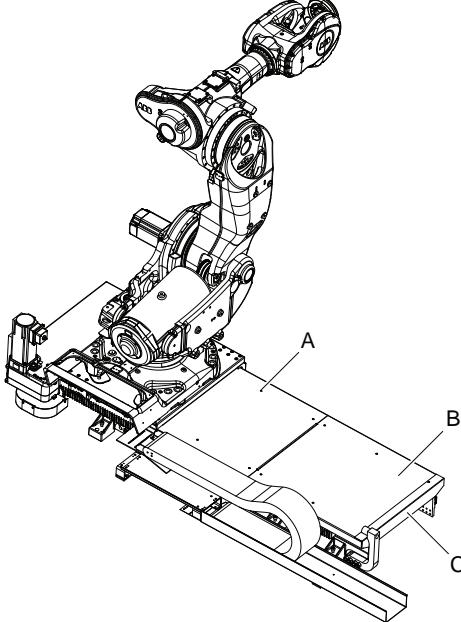
A	IRB 7600, 90°
B	Gearbox and motor
C	12 x Hex socket head cap screw M12x50
D	Jack > 2000 kg
E	Mecanical stop
F	Hexagon nuts
G	Socket Head Cap Screw MC6S M20x100
H	6 x Hex socket head cap screw
I	8 x Hex socket head cap screw
J	Bracket for runner block
K	Ball elements (runner block)

Continues on next page

Getting access to the ball elements

Getting access to the ball elements on a track motion for IRB 7600, 90° motor side

Use this procedure to get access to the ball elements on the motor side of a track motion for IRB 7600, mounted 90° (position A in figure *Location of ball elements on page 215*).

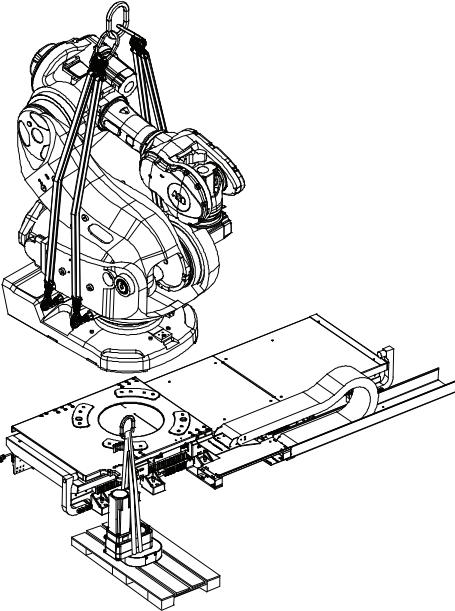
Action	Note
 Tip If removing a ball element on a double carriage track, the removal is simplified by first removing an 1 meter long linear guide nearby the ball element.	See <i>Replacing the linear guides on page 209</i> .
2 Measure reference values for the zero position of the track motion by using a calibration tool.	See <i>Measuring reference values for zero position on page 268</i> .
3 Remove all the socket head cap screws holding the top covers and the end protections, using standard tools. To move the carriage without power see <i>Releasing the brake with external 24V DC on page 99</i> .	 xx1100000770 A Socket head cap screw 6X M10 B Top cover for IRBT C End protection

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4 Repair

4.9 Replacing the ball elements

Continued

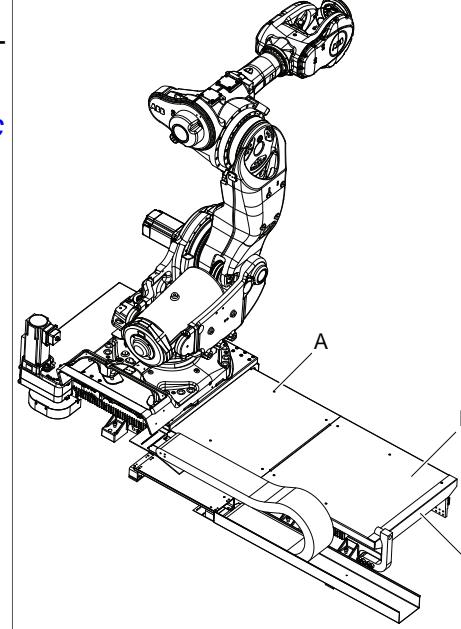
Action	Note
4 Lift the robot according to lift instructions in section Installation and commissioning in <i>Product manual - IRB 7600</i> .	 xx0700000394
5  CAUTION The gearbox weighs 90 kg. All lifting accessories used must be sized accordingly!	
6 Remove the gearbox and the motor according to Replacing the gearbox (including the motor) and the gear wheel on page 172 and Replacing the motor on page 182 .	

Getting access to the ball elements on a track motion for all but IRB 7600, 90° motor side

Use this procedure to get access to the ball elements on the track motion for all but IRB 7600, 90° motor side (position B, C, D in figure [Location of ball elements on page 215](#)).

Action	Note
1  Tip If removing a ball element on a double carriage track, the removal is simplified by first removing an 1 meter long linear guide nearby the ball element.	See Replacing the linear guides on page 209 .
2 Measure reference values for the zero position of the track motion by using a calibration tool.	See Measuring reference values for zero position on page 268 .

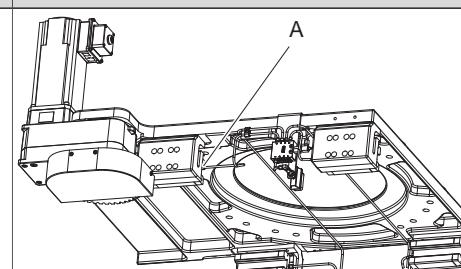
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Action	Note
<p>3 Remove all the socket head cap screws holding the top covers and the end protections, using standard tools.</p> <p>To move the carriage without power see Releasing the brake with external 24V DC on page 99.</p>	 <p>xx1100000770</p> <p>A Socket head cap screw 6X M10 B Top cover for IRBT C End protection</p>

Replacing a complete ball element assembly (ball element and bracket)

Removing the ball element assembly

Use this procedure to remove the ball element if the ball element bracket has eight access holes (no access hole for the parallel pins). The whole ball element and bracket assembly must be removed from the carriage.

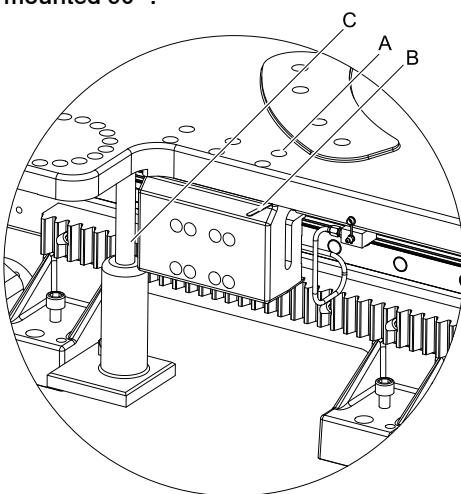
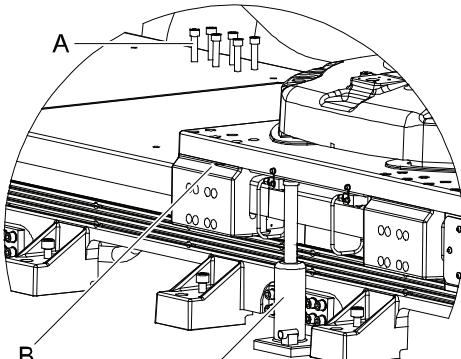
Action	Note
1 Remove the lubrication tube from the ball element.	 <p>xx1100000772</p> <p>A Lubrication tube nipple</p>

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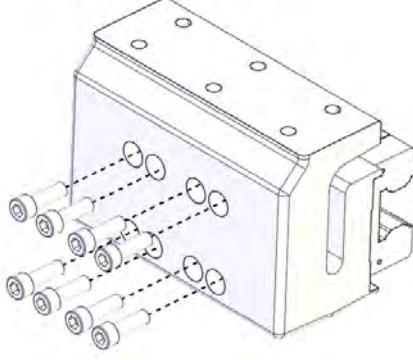
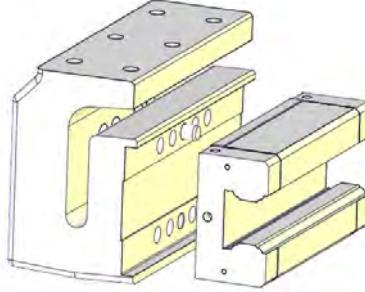
4 Repair

4.9 Replacing the ball elements

Continued

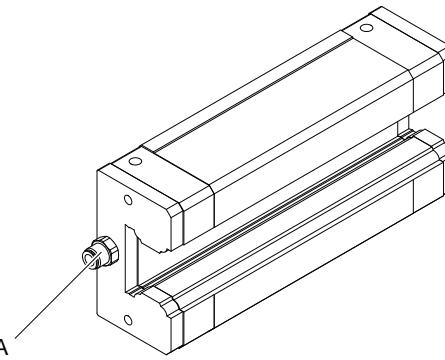
Action	Note
<p>2 Remove all the hex socket head cap screws (A) that hold the bracket to the carriage. Use a jack (C) to rise the robot and the carriage max. 1 mm, use a feeler (B).</p> <p>WARNING</p> <p>Rising the carriage more than 1 mm can seriously damage the remaining three ball elements!</p>	<p>Motor side of track motion for IRB 7600, mounted 90°:</p>  <p>xx1600000986</p> <p>A Hex socket head cap screw B Feeler 1mm C Jack >2000 kg</p> <p>Track motion for all but IRB 7600, 90° motor side:</p>  <p>xx1100000774</p> <p>A Hex socket head cap screw B Feeler 1mm C Jack >2000 kg</p>
3 Remove the mechanical stops.	See Replacing the mechanical stops on page 229 .
4 Slide the ball element assembly off the linear guide.	

Continues on next page

Action	Note
5 Remove all the hex socket head cap screws holding the bracket to the damaged ball element.	 xx1600000981
6 Use a screwdriver to separate the bracket from the ball element.	 xx1600000982

Refitting the ball element assembly

Use this procedure to refit the ball element if the ball element bracket has eight access holes (no access hole for the parallel pins). The ball element and bracket are assembled prior to installation onto the carriage.

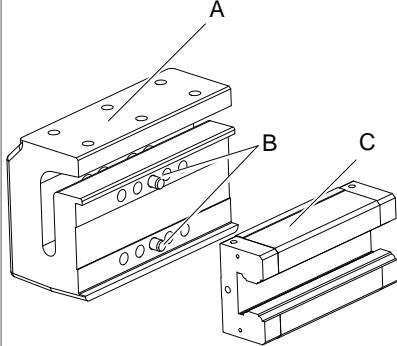
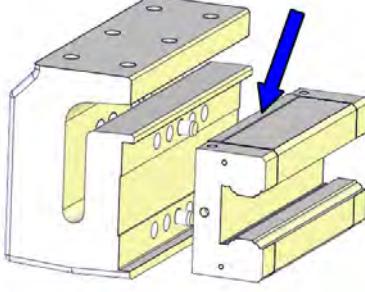
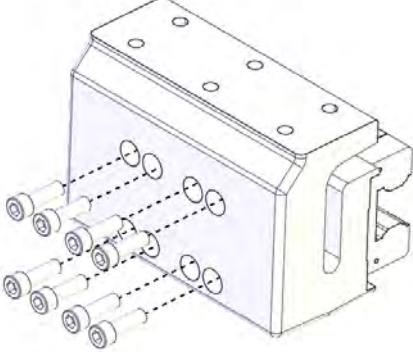
Action	Note
1 Install a straight grease nipple to the ball element. Install it on the correct side of the ball element: when the ball element is fitted to the linear guide, the nipples on the ball elements must point towards each other. Tighten the nipple carefully so the plastic thread does not get damaged. The nipple thread inserted into the ball element must not exceed 8 mm.	 xx1100000776 A Grease nipple

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4 Repair

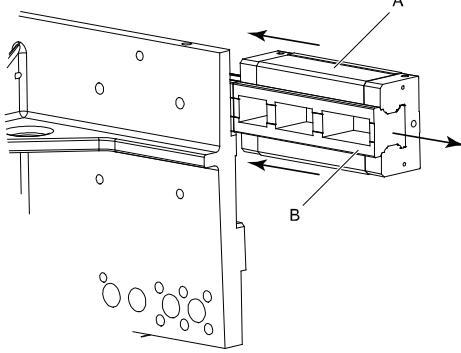
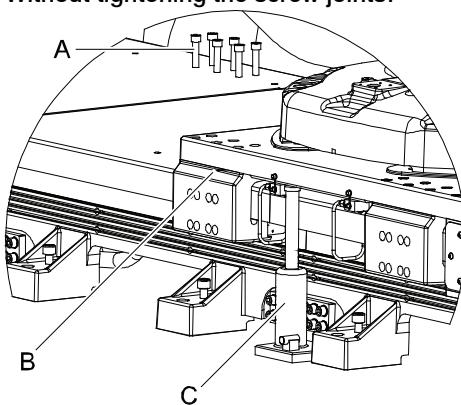
4.9 Replacing the ball elements

Continued

Action	Note
2 Fit two parallel pins to the bracket.	 xx1100000775 <p>A Bracket for ball element B Parallel pins C Ball elements (runner block)</p>
3 Turn the side of the ball element with the difference in level upwards and fit the ball element to the bracket.	 xx1600000977
4 Secure the bracket to the ball element with the eight hex socket head cap screw.	Tightening torque: 70 Nm.  xx1600000981
5 Slide the ball element assembly onto the linear guide.	

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4.9 Replacing the ball elements *Continued*

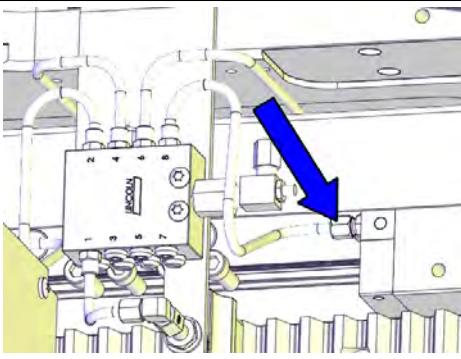
	Action	Note
6	<p>Note</p> <p>For easy assemble of the ball elements, always use the plastic gauge.</p> <p>Note</p> <p>Ball elements with Viton sealing (Foundry option), out side mounted only.</p>	 <p>xx1100000777</p> <p>A Ball elements (runner block) B Gauge</p>
7	Secure the bracket to the carriage using six hex socket head cap screws (A).	<p>Without tightening the screw joints!</p>  <p>xx1100000774</p> <p>A Hex socket head cap screw B Feeler 1mm C Jack >2000 kg</p>
8	Remove the feeler (B) and the jack (C).	
9	Tighten the joints for the bracket to the carriage.	Tightening torque: 120 Nm.
10	Verify that the lubrication system is functioning properly by supplying grease with the push-button on the automatic lubrication system control unit and checking if grease comes out from the lubrication tube that will be connected to the ball element.	

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4 Repair

4.9 Replacing the ball elements

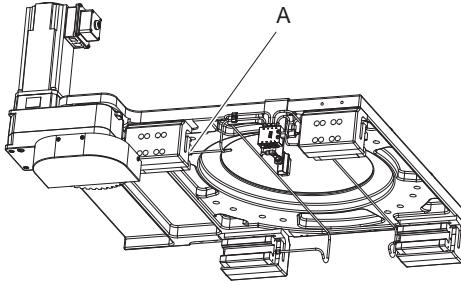
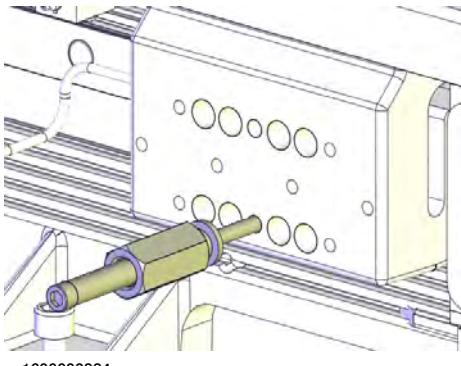
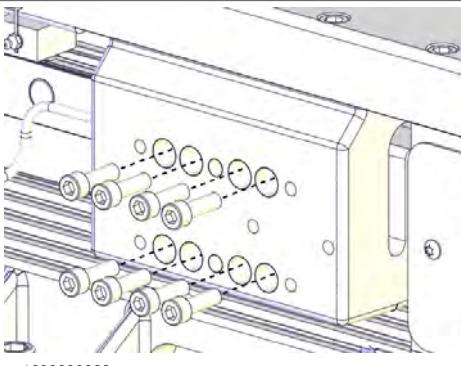
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Action	Note
11 After verification of grease supply from the tube is made, connect the lubrication tube to the grease nipple on the ball element.	 xx1600000906
12 Refit the gearbox and motor, if removed.  Note Adjust gearbox back lash, see Adjusting the gearbox back lash on page 179 .	See Replacing the gearbox (including the motor) and the gear wheel on page 172 . See Replacing the motor on page 182 .
13 Refit the mechanical stops.	See Replacing the mechanical stops on page 229 .
14 Grease all ball elements before start up.	
15 Calibrate the track motion. Use previously measured reference values for the zero position.	See Fine calibration on page 269 .
16  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 50 .	

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Replacing a ball element without removing the bracket**Removing the ball element**

Use this procedure to remove the ball element if the ball element bracket has 10 access holes (including two access holes for the parallel pins). The ball element can be removed from the carriage without removing the ball element bracket from the carriage.

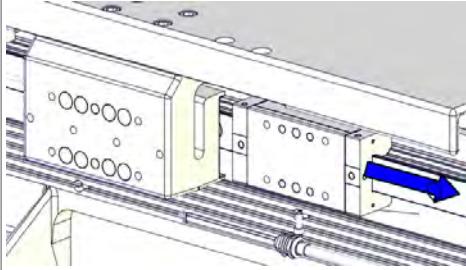
Action	Note
1 Remove the lubrication tube from the ball element.	 xx1100000772 A Lubrication tube nipple
2 Remove the mechanical stops.	See Replacing the mechanical stops on page 229 .
3 Remove the two parallel pins using the extractor tool.	 xx1600000984
4 Remove all the hex socket head cap screws holding the bracket to the damaged ball element.	 xx1600000983

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4 Repair

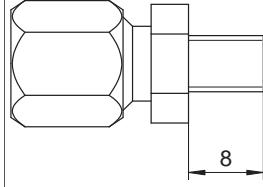
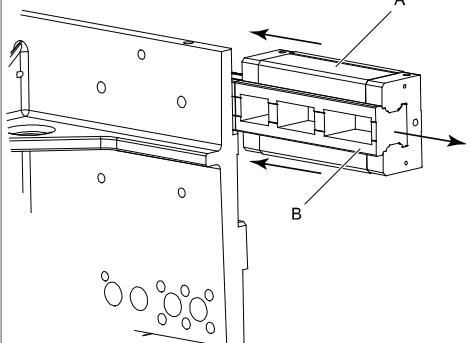
4.9 Replacing the ball elements

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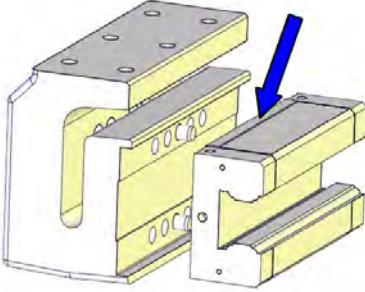
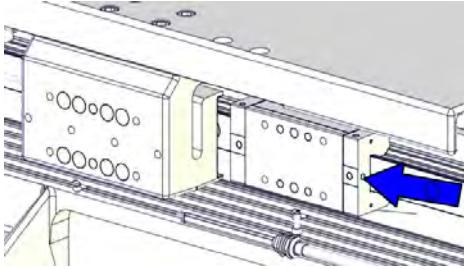
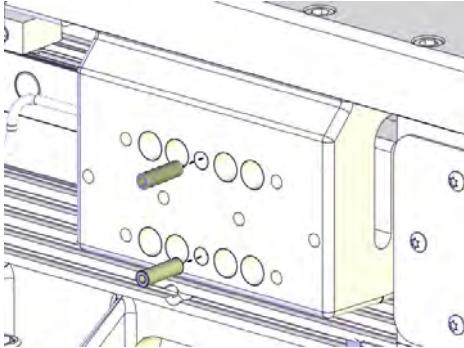
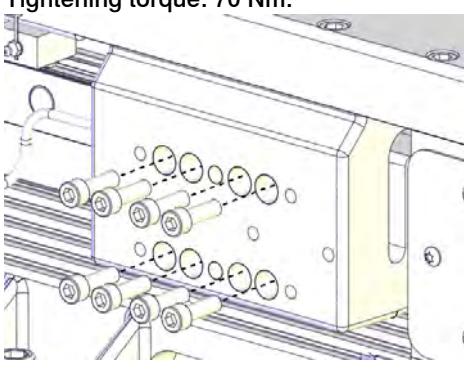
Action	Note
5 Slide the ball element off the linear guide.	 xx160000985

Refitting the ball element

Use this procedure to refit the ball element if the ball element bracket has 10 access holes (including two access holes for the parallel pins) and the bracket is already installed on the carriage.

Action	Note
1 Install a straight grease nipple to the ball element. Install it on the correct side of the ball element: when the ball element is fitted to the linear guide, the nipples on the ball elements must point towards each other. Tighten the nipple carefully so the plastic thread does not get damaged. The nipple thread inserted into the ball element must not exceed 8 mm.	 xx160000905
2 <p> Note For easy assemble of the ball elements, always use the plastic gauge.</p> <p> Note Ball elements with Viton sealing (Foundry option), out side mounted only.</p>	 xx1100000777

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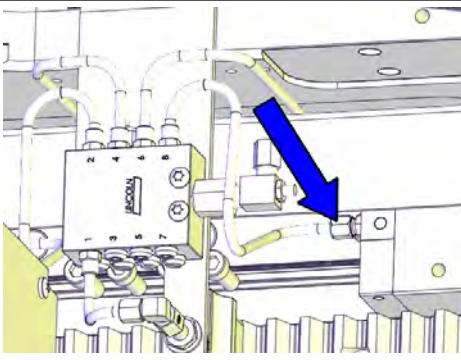
Action	Note
3 Turn the side of the ball element with the difference in level upwards and slide the ball element into mounting position.	 xx1600000977
	 xx1600000987
4 Fit two parallel pins to the bracket and ball element. The threaded end of the pin must be outwards in order to be able to remove the pin with the extractor tool if removing the ball element in the future.	 xx1600000978
5 Secure the ball element to the bracket with the eight hex socket head cap screw.	Tightening torque: 70 Nm.  xx1600000983
6 Remove the jack.	

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4 Repair

4.9 Replacing the ball elements

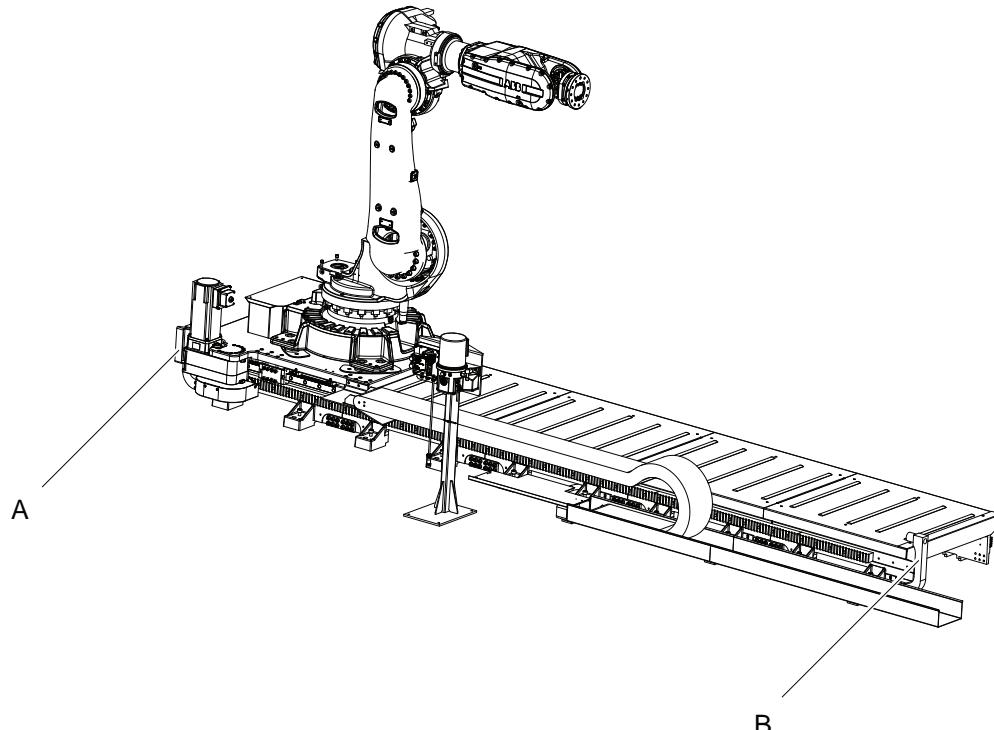
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Action	Note
7 Verify that the lubrication system is functioning properly by supplying grease with the push-button on the automatic lubrication system control unit and checking if grease comes out from the lubrication tube that will be connected to the ball element.	
8 After verification of grease supply from the tube is made, connect the lubrication tube to the grease nipple on the ball element.	 xx1600000906
9 Fit the gearbox and motor, if removed.  Note Adjust gearbox back lash, see Adjusting the gearbox back lash on page 179 .	See Replacing the gearbox (including the motor) and the gear wheel on page 172 . See Replacing the motor on page 182 .
10 Fit the mechanical stops.	See Replacing the mechanical stops on page 229 .
11 Grease all ball elements before start up.	
12 Calibrate the track motion. Use previously measured reference values for the zero position.	See Fine calibration on page 269 .
13  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 50 .	

4.10 Replacing the mechanical stops

Location of mechanical stops

The mechanical stops are located as shown in the figure.



xx1100000746

A	Mechanical stops, left
B	Mechanical stops, right

Required equipment

Equipment, etc.	Art. no.	Note
Mechanical stops	Spare part number is specified in: • Spare parts on page 291 .	
Standard toolkit	-	Content is defined in section Standard toolkit on page 287 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.

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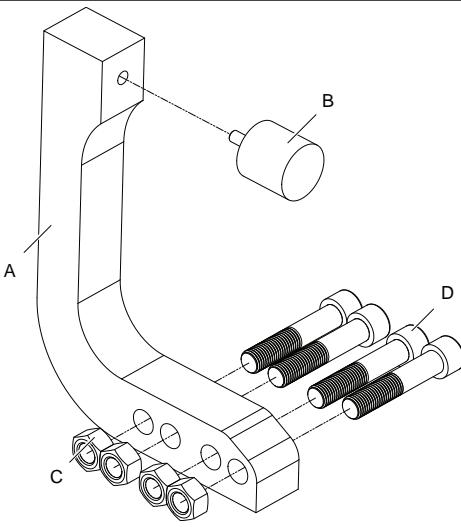
4 Repair

4.10 Replacing the mechanical stops

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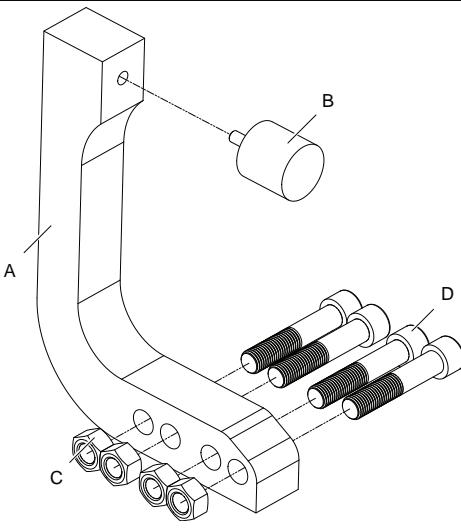
Removing the mechanical stops

Use this procedure to remove the mechanical stops.

Action	Note
1 If only the rubber damper (B) is damaged: remove the rubber damper.	 xx1100000778
2 If the mechanical stops (A) are damaged: remove all four hexagon socket head cap screws MC6S M20x100 (D).	

Refitting the mechanical stops

Use this procedure to refit the mechanical stops.

Action	Note
1 Fit the rubber buffers (B).	 xx1100000778
2 Fit the hexagon nuts (C) and fit all four hexagon socket head cap screws MC6S M20x100 (D).	Tightening torque: 90 Nm

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	Action	Note
3	 DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 50.	

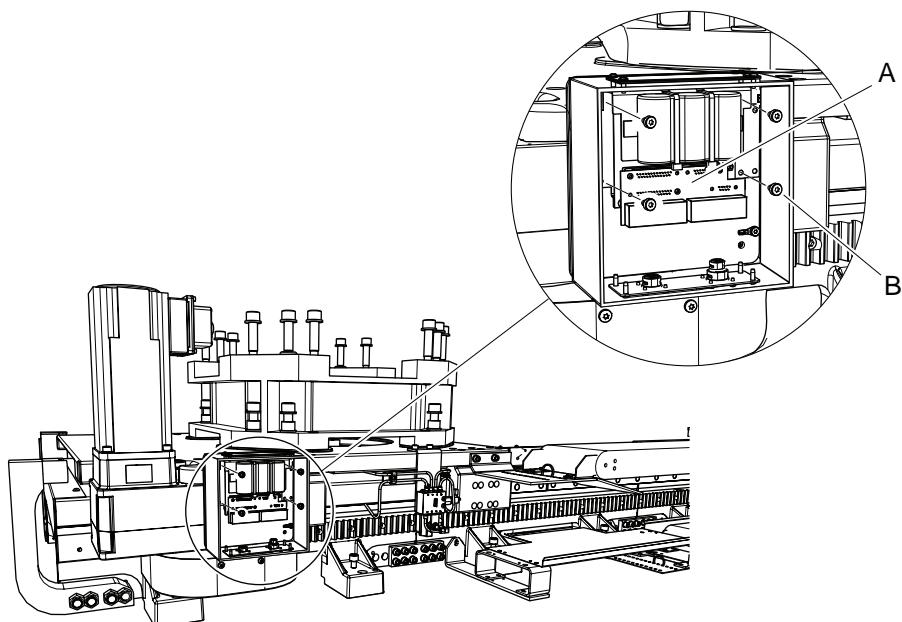
4 Repair

4.11 Replacing the SMB unit

4.11 Replacing the SMB unit

Location of SMB unit

The SMB unit is located as shown in the figure.



xx1400000739

A	SMB unit
B	Attachment screw (4 pcs)

Required equipment

Equipment, etc.	Art. no.	Note
SMB unit	Spare part number is specified in: <ul style="list-style-type: none">• Spare parts on page 291.	
Standard toolkit	-	Content is defined in section Standard toolkit on page 287 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.

Removing the SMB unit

Use this procedure to remove the SMB unit.

Action	Note
1 Place the track motion in calibration position.	

Continues on next page

	Action	Note
2	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot and for the track motion.	See Measuring reference values for zero position on page 268 .
3	Unscrew attachment screws, and open cover to serial measurement unit box.	
4	Remove four attachment screws B, see Location of SMB unit on page 232 .	
5	Remove the SMB unit A, see Location of SMB unit on page 232 .	

Refitting the SMB unit

Use this procedure to refit the the SMB unit.

	Action	Note
1	Fit the SMB unit A, see Location of SMB unit on page 232 .	
2	Fit the four attachment screws B, see Location of SMB unit on page 232 .	Tightening torque: 2.5 Nm
3	Close the cover to serial measurement unit box, and secure with the attachment screws.	
4	Calibrate the track motion. Use previously measured reference values for the zero position.	See Fine calibration on page 269 .

4 Repair

4.12.1 Replacing the cable harness

4.12 Repair procedures for cable chain Brevetti

4.12.1 Replacing the cable harness

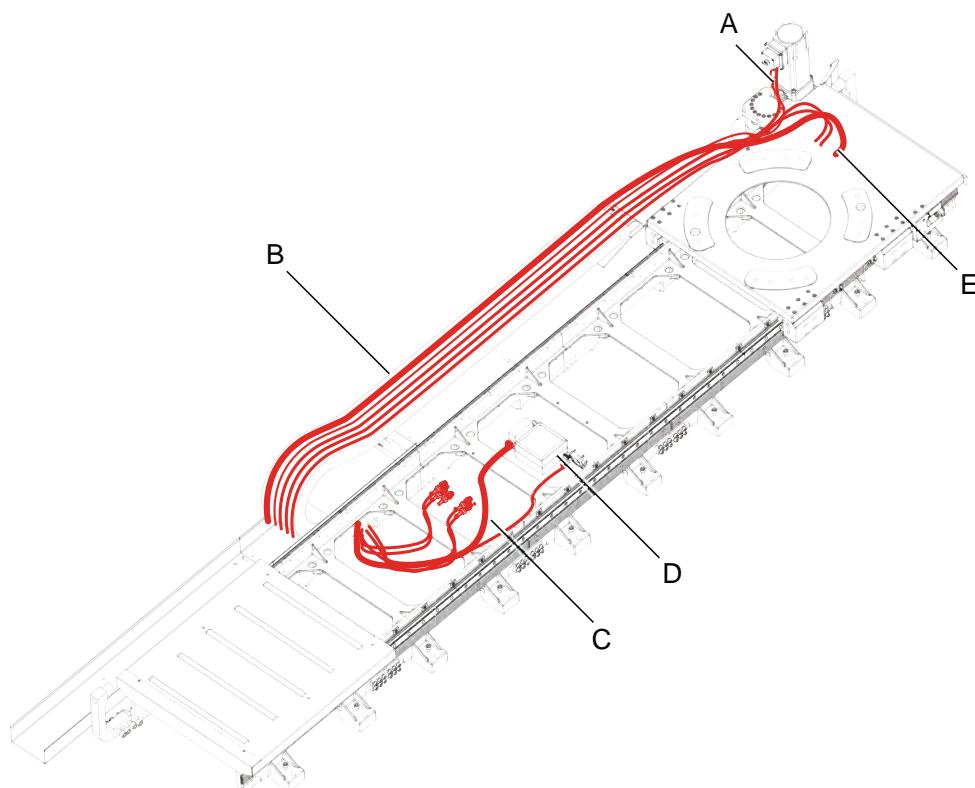
Overview

This section describes replacement of track motion cable harness including removal and refitting of following components:

- Cable chain (Brevetti)
- Cable harness Customer
- Cable harness Standard
- Cable harness Manipulator
- Motor Cable harness

Location of cable harness

The cable harness is located as shown in the figure.



xx1100000730

A	Motor cables Axis 7
B	Cable chain
C	Customer cables
D	Standard cables
E	Manipulator cables

Continues on next page

4.12.1 Replacing the cable harness
Continued

Required equipment

Equipment, etc.	Art. no.	Note
Cables	Spare part number is specified in: • <i>Spare parts on page 291.</i>	Cables must be designed for use in continuous flexing operation.
Cable chain parts	Spare part number is specified in: • <i>Spare parts on page 291.</i>	
Cable grease		
Cable ties	21662055-6	Use heavy duty cable ties with minimum width: 7.6 mm.
Vacuum cleaner	-	
Standard toolkit	-	Content is defined in section <i>Standard toolkit on page 287.</i>
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.
Circuit diagram	-	See <i>Circuit diagrams on page 293.</i>

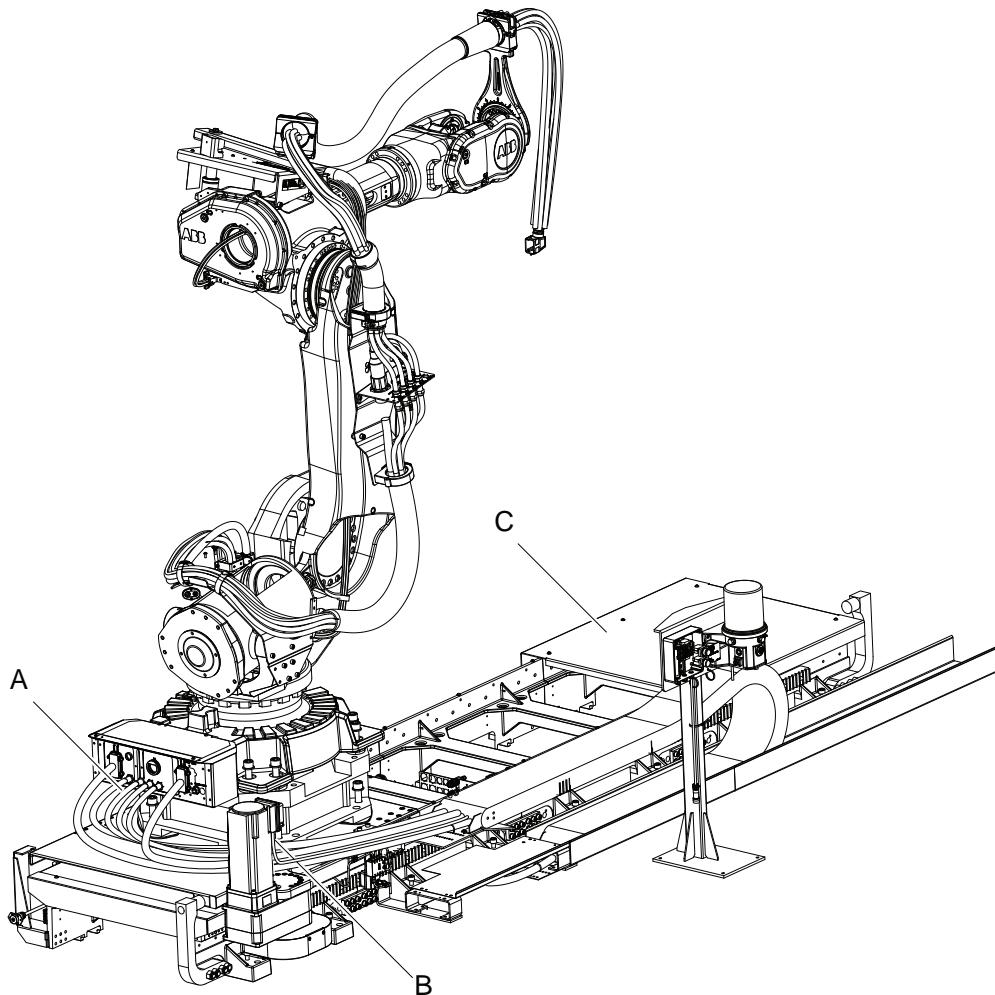
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4 Repair

4.12.1 Replacing the cable harness

Continued

Illustration, removing the cable chain



xx1100000779

A	Cable harness manipulator
B	Cable harness, track motion IRBT 4004/6004/7004 motor
C	Cover plate

Removing the cable chain

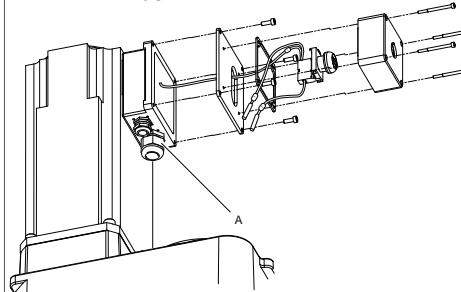
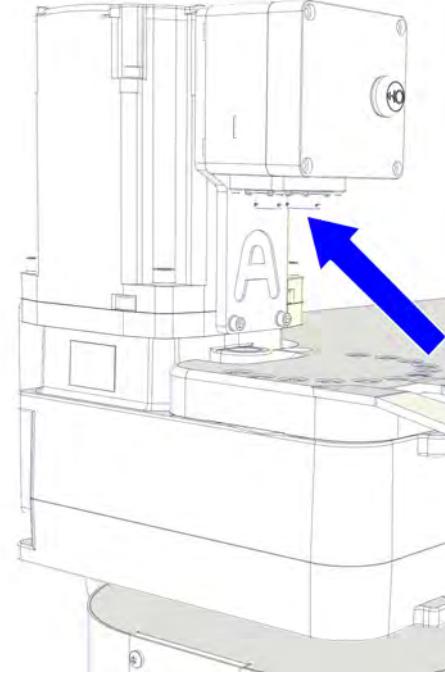
Use this procedure to remove the cable chain.

	Action	Note
1	 Tip Remove all cover plates before turning off all electric power. Without 24V DC the carriage can not be moved. If the cables to the release brakes are damaged, follow instructions in <i>Moving the carriage manually on page 99</i> .	

Continues on next page

4.12.1 Replacing the cable harness

Continued

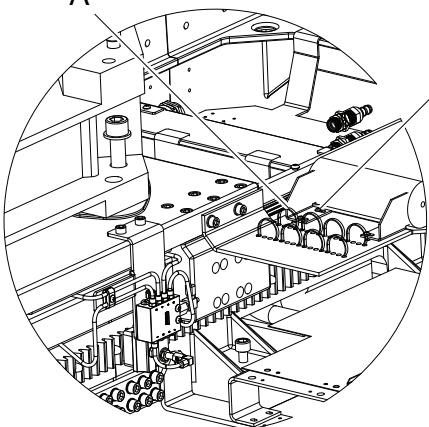
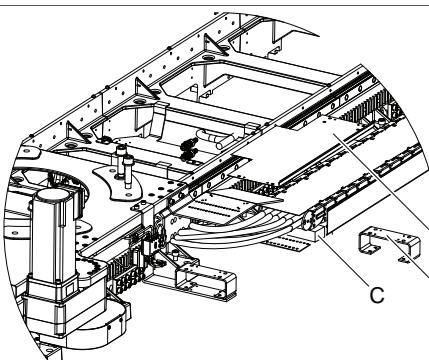
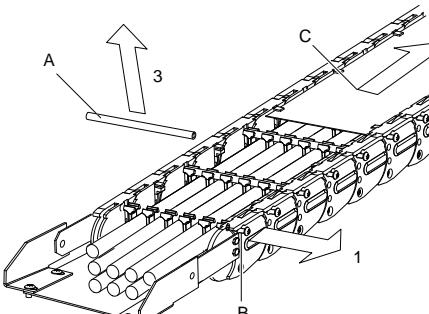
Action	Note
2  DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot and for the track motion.	
3 Disassemble all cables from the robot base cable interface (A).	See Illustration, removing the cable chain on page 236 .
4 Disassemble all cables from the track motion motor (B).	See Illustration, removing the cable chain on page 236 . Motor, not type A:  xx1100000780 A Cable inlet Type A motor:  xx1300000058

Continues on next page

4 Repair

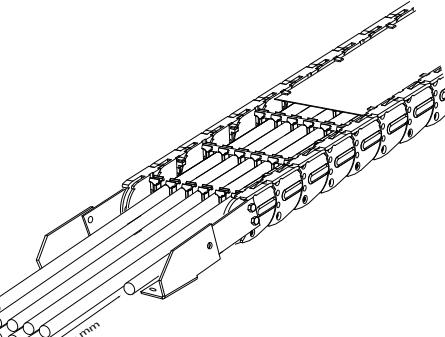
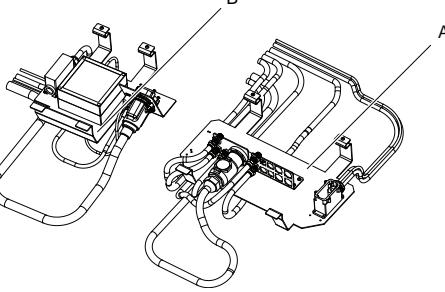
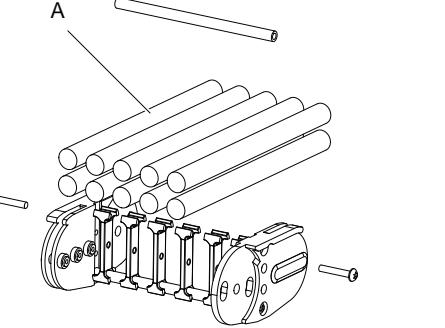
4.12.1 Replacing the cable harness

Continued

Action	Note
5 Cut all cable straps using standard tools, and disassemble the screws holding the cable chain.	 <p>xx1100000781</p> <p>A Cable straps B Torx pan head screw</p>
6 Lift up the cable chain and straighten it out.	
7 Loosen and remove the protection plate for the cable chain. Cut all cable straps using standard tools, and remove the screws that hold the cable chain. Lift up the cable chain and rest it on distance planks. Loosen and remove the distance for cable tray.	 <p>xx1100000782</p> <p>A Protection plate for cable chain B Distance for cable tray C Distance plank</p>
8 Remove the cable chain. 1 Remove the upper torx pan head screws that hold the aluminium rods. 2 Slide away the cable protection. 3 Remove all upper aluminium rods.	 <p>xx1100000783</p> <p>A Aluminium rod B Torx pan head screw C Cable protection</p>

Continues on next page

4.12.1 Replacing the cable harness
Continued

	Action	Note
9	 Tip <p>Before removing damaged cables, measure the length of the damaged cable projecting from the end of the cable chain. This will facilitate refitting.</p>	 xx1100000785
10	 Tip <p>Before removing damaged cables, remember the placement in the cable chain. This will facilitate refitting.</p>	The placement of all cables is shown in Illustration, refitting the cable chain on page 240 .
11	<p>Remove the damaged cables from the customer contact plate and the standard contact plate.</p>  Tip <p>Before removing damaged cables, note down the location on the contact plate. This will facilitate refitting.</p>	 xx1100000784 A Customer contact plate B Standard contact plate
12	Remove the cables.	 xx1100000787 A Cables

Continues on next page

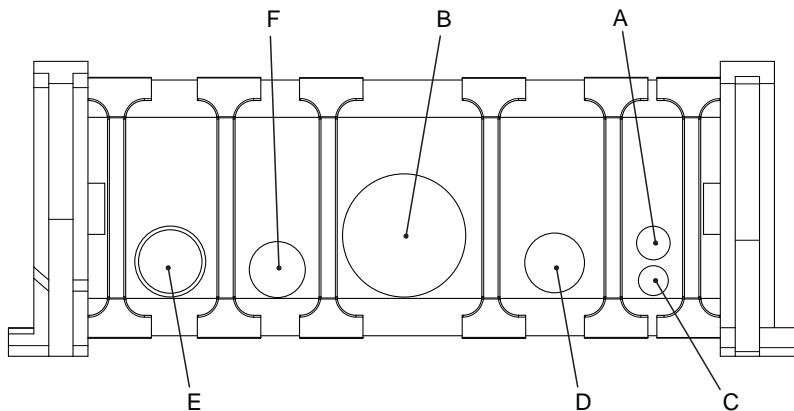
4 Repair

4.12.1 Replacing the cable harness

Continued

Illustration, refitting the cable chain

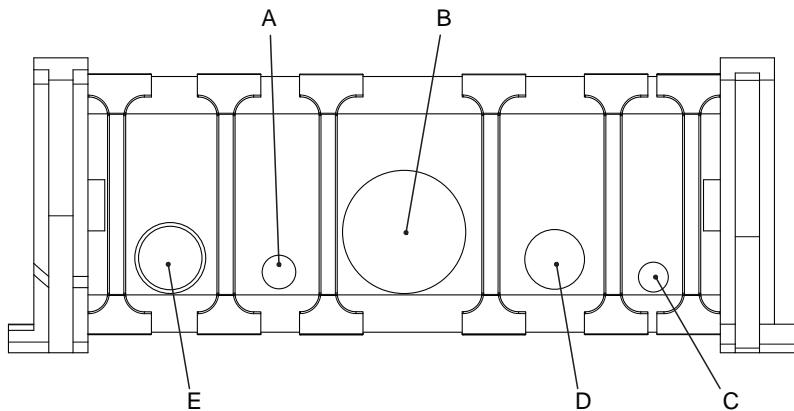
Cable layout, material handling - with hydraulic hose



xx1200000678

	Diameter in mm	Description
A	9	Signal cable IRB
B	31	Power cable IRB R1.MP
C	9	Signal cable IRBT
D	16	Power cable IRBT J1
E	19	Media hose
F	12	Hydraulic hose

Cable layout, material handling - without hydraulic hose



xx1200000677

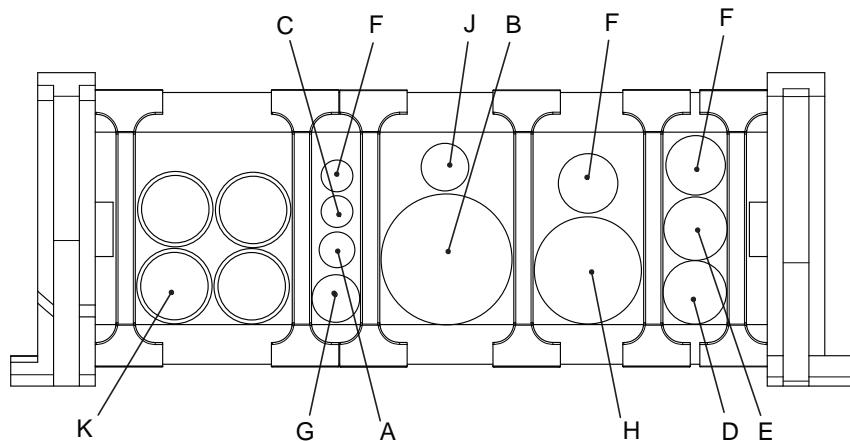
	Diameter in mm	Description
A	9	Signal cable IRB
B	31	Power cable IRB R1.MP
C	9	Signal cable IRBT
D	16	Power cable IRBT J1
E	19	Media hose

Continues on next page

4.12.1 Replacing the cable harness

Continued

Cable layout, spot welding



xx1200000679

	Diameter in mm	Description
A	9	Signal cable IRB
B	31	Power cable IRB R1.MP
C	9	Signal cable IRBT
D	16	Power cable IRBT J1
E	12	8 axis power cable/M8
F	8.5	Customer cable CP/CS
F	13.5	Customer cable CP/CS
F	13.7	Customer cable CP/CS
G	12	Cable splitbox J1-XS101
H		Weld power cable
J	12	Hydraulic hose
K		Media hoses

Refitting the cable harness and cable chain

Use this procedure to refit the cable harness.

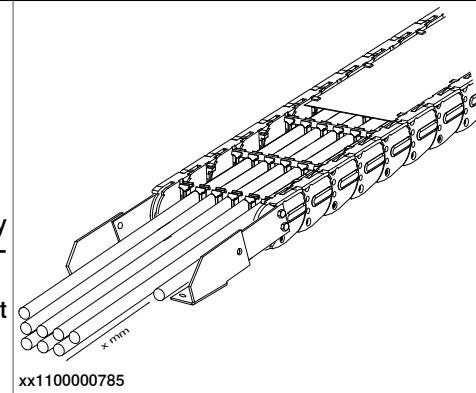
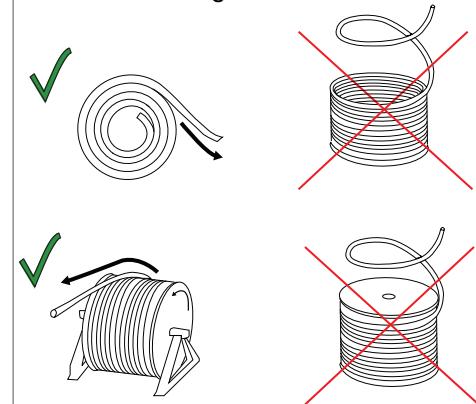
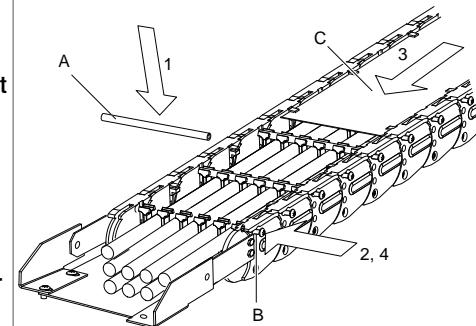
	Action	Note
1	Clean the cable chain and look for wear on the cable chain. Wear on the cable chain can cause damage to the cables.	

Continues on next page

4 Repair

4.12.1 Replacing the cable harness

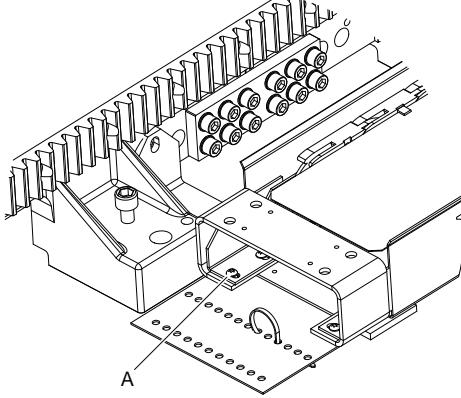
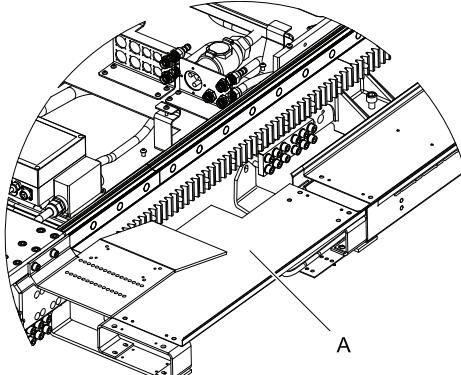
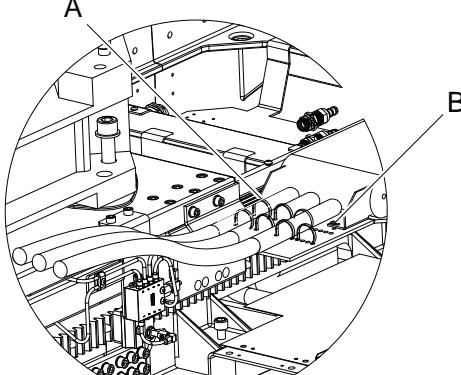
Continued

Action	Note
<p>2 Fit the new cables, use the same length projecting from the cable chain as for the damaged cable.</p> <p>Note</p> <p>Correct placement of cables in the cable chain is vital and will prevent unnecessary wear of the cables. Also the following matters must be considered:</p> <ul style="list-style-type: none"> • Keep unlike components apart, that is separate power and signals. • Keep unlike cable or hose jacket materials apart. • Only put cables of similar size in the same compartments. • Do not remove dividers. • If replacing a cable, check that other cables are in good condition and that they are not twisted. • Do not pack the cables too tight inside the carrier cavities. <p>CAUTION</p> <p>Adding cables that are not covered in the standard layouts could seriously reduce the expected component life of the chain.</p>	 <p>See placement of all cables in Illustration, refitting the cable chain on page 240.</p> <p>When installing cables or hoses into the carrier system, they should be laid into the carrier without twist. Cables or hoses should not be simply pulled off the reel. Instead, they should be properly uncoiled as shown in the figure below.</p> 
<p>3 Fit the chain in this sequence:</p> <ol style="list-style-type: none"> 1 Fit all aluminium rods. 2 Fit all torx pan head screws (without tightening). 3 Fit the cable protection. <p>Tip</p> <p>Use cable grease on the cable protection for easy assemble.</p> <ol style="list-style-type: none"> 4 Tighten all torx pan head screws. Tightening torque: 8 Nm. 	 <p>A Aluminium rod B Torx pan head screw C Cable protection</p>

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4.12.1 Replacing the cable harness

Continued

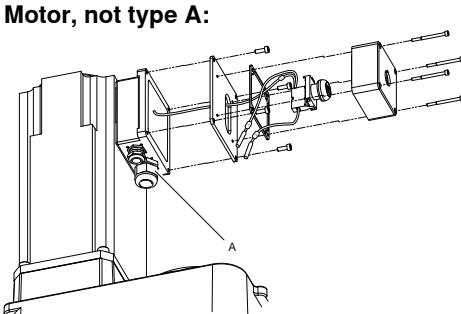
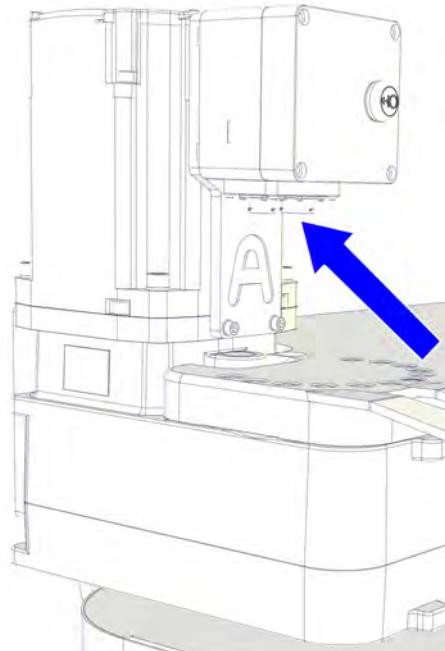
Action	Note
4 Fit the distance for the cable tray, use the two torx pan head screws (A).	 xx1100000790 <p>A Torx pan head screw</p>
5 Fit the protection plate for the cable chain, using the four screws.	 xx1100000791 <p>A Protection plate for cable chain</p>
6 Fit the cable chain using the four torx pan head screws (B).	 xx1100000792 <p>A Cable straps B Torx pan head screw</p>
7 Strap all the cables (A). The cables exiting the chain, on both the moving and fixed end, need to be strapped individually at least twice in order to strain relief correctly. If there are not enough holes available in the connection plates for individual strapping, the cables should be secured in such a way that they can not move.	<p>Suitable cable ties are specified in Required equipment on page 235.</p>

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4 Repair

4.12.1 Replacing the cable harness

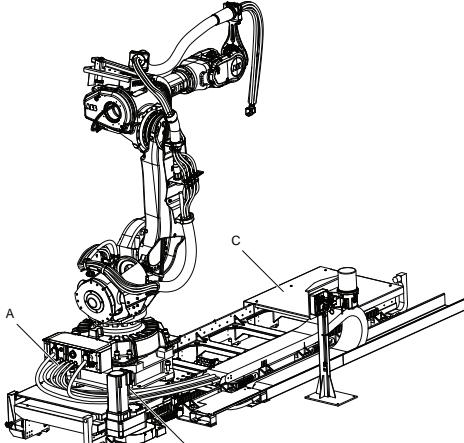
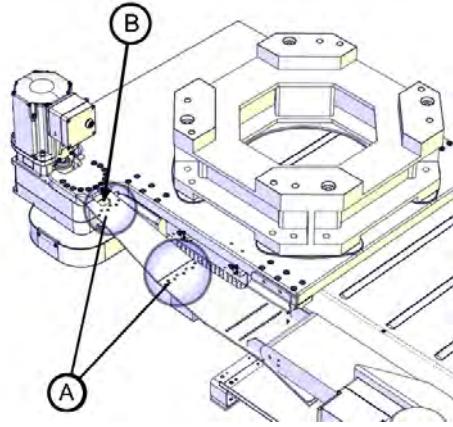
Continued

Action	Note
8 Fit all cables to the motor.	<p>Motor, not type A:</p>  <p>xx1100000780</p> <p>A Cable inlet</p> <p>Type A motor:</p>  <p>xx1300000058</p>

Continues on next page

4.12.1 Replacing the cable harness

Continued

Action	Note
9 Fit all cables to the manipulator base.	 <p>A Cable harness manipulator B Cable harness, track motion motor</p>
10 Place the track motion motor cables in the slot located at the end of the plate (B). Fasten the cables to the attachment plate with straps (A). Bend the motor and resolver cables 90° when directing them up to the motor.	<p> CAUTION</p> <p>Do not stand on the chain or cables.</p> 
11  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section <i>DANGER - First test run may cause injury or damage! on page 50</i> .	
12 Perform a test run before powering up the track to full speed and duty cycle.	See Test run on page 245 .

Test run

Use this procedure to check the installation of the cabling.

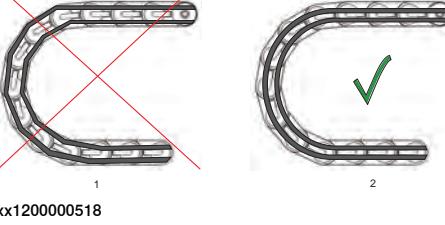
Action	Note
1 Run the system at low speed and insure that everything runs freely and smoothly without the carrier, cables and/or hoses binding.	

Continues on next page

4 Repair

4.12.1 Replacing the cable harness

Continued

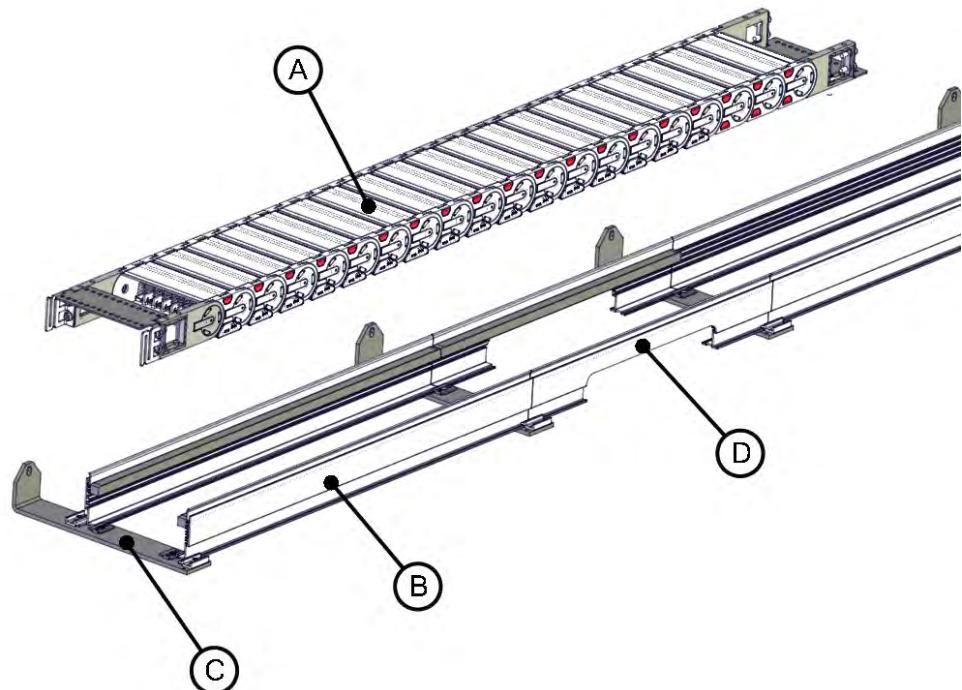
Action	Note
2 After 50 cycles, check that the cables and hoses are not installed too tight (stretched between carrier bars) or too loose (hanging on the carrier bars). Optimally, aim for the center line of the link of the carrier system, as shown in the figure.	 xx1200000518
3 Adjust the carrier position or alignment, if needed.	
4 Adjust the position and length of cables and/or hoses, if needed.	
5 If adjustments are made, repeat steps 1 to 4.	
6 Tighten all screws.	
7 The track is now ready to be powered up to full speed and duty cycle. Check the tightening torque on fastening screws after 500 cycles. Adjust, if needed. Periodically check to see if the cable strain relief is still in place.	

4.13 Repair procedures for cable chain Murrplastik

4.13.1 Replacing the cable chain

Illustration, cable chain and cable tray made of aluminium profiles

The figure shows the cable chain Murrplastik and the cable tray designed for the cable chain.



xx1300000926

A	Cable chain
B	Aluminium profile
C	Cable chain bracket
D	Aluminium profile with cut-out

Required equipment

Equipment, etc.	Art. no.	Note
Cable chain	Spare part number is specified in: • Spare parts on page 291 .	
Cable chain parts	Spare part number is specified in: • Spare parts on page 291 .	
Locking liquid	-	Loctite 243

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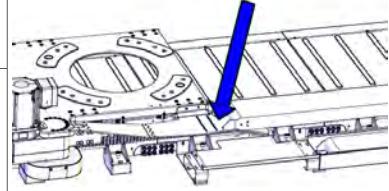
4 Repair

4.13.1 Replacing the cable chain

Continued

Equipment, etc.	Art. no.	Note
Plastic clips	-	Replace if damaged.
NYLOC nuts	-	Replace with new nuts, if removed. NYLOC nuts can only be used once.
Standard toolkit	-	Content is defined in section Standard toolkit on page 287 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.
Circuit diagram	-	See Circuit diagrams on page 293 .

Removing the cable chain

	Action	Note
1	Move the carriage so that the drive unit and the grease distribution block is away from the fixed end of the cable chain.	
2	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot and for the track motion.	
3	Take a note of how the cabling is strapped on the carriage. Pay special attention to how the IRB power cable is routed.	
4	Remove the strapping that ties the cabling to the carriage.	
5	 CAUTION Cooling water may run out. Protect the connectors from getting wet.	
6	 Note Water may spill out.	
7	Make a marking on the moving end of the chain to show its location relative to the connecting plate. This will facilitate alignment during refitting.	
8	Loosen the two screws that hold the cable chain to the connecting plate on the carriage.	 xx1300000930

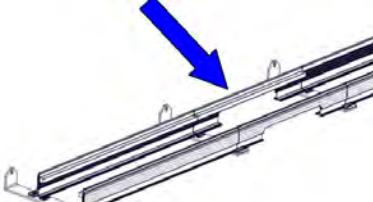
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4.13.1 Replacing the cable chain
Continued

Action	Note
9 Loosen the bracket where the cables are strapped to the chain. With this bracket in place the chain can be folded only once.	
10 Roll out the cable chain away from the carriage.	
11 Remove the two plastic clips located in the middle section of the cable tray. If they get damaged, replace them with new clips during refitting.	
12 Loosen the clamping brackets at both ends of the middle section until you can remove the chain.	
13 Loosen the two screws of the fixed end of the cable chain.	
14 Disconnect the harness from the connection plate (J1).	
15 Roll the cable chain and bundle it to be able to lift it away. If it is short it can be two folded and lifted away.	

Refitting the cable chain

Refitting

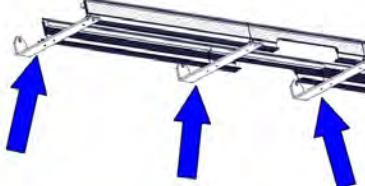
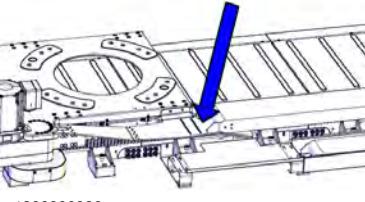
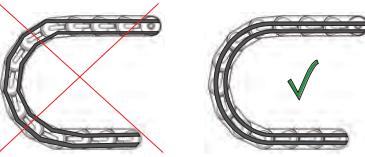
Action	Note
1  Note If any part of the cable chain tray has been removed, use Loctite 243 when refitting parts. Also note that the NYLOC nuts can only be used once.	
2 Move the carriage to the gliding side of the cable tray (section with glide bars).	
3 Place the cable chain into the cable tray, in the section without glide bars. If using lifting slings, ensure that these are removed before lowering the chain into the tray so as not to bend the tray.  CAUTION Cable chains are easily damaged through improper handling. See Lifting and fitting the cable chain Murrplastik on page 115 for important information about how to handle and lift the cable chain into the cable tray.	
4 Remove the aluminium profiles that have a cutout.	 xx1300000928

Continues on next page

4 Repair

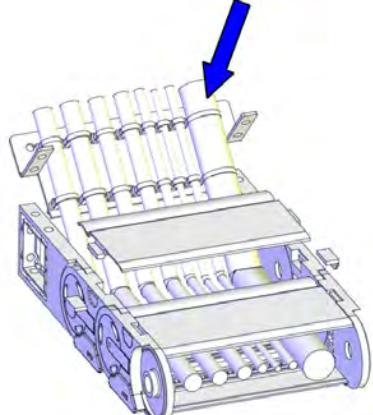
4.13.1 Replacing the cable chain

Continued

Action	Note
5 Install the top and bottom strapping plates to the chain and tighten the screws. If the chain was rolled up with strapping plates attached, then the last bottom cover is probably removed. Fit it to the chain.	 xx1300000927
6 Route the harness through the opening of the tray and connect to the connection plate (J1). Ensure the harness is made as flat as possible without cables piling up. Pay special attention to the rather stiff IRB power cable.	
7 Refit the aluminium profiles with the cutout.	Use Loctite 243.
8 Use a spirit level to check that the chain is level in the tray. If needed, adjust the leveling bolts or shim the brackets that hold the tray (shown in figure).	 xx1300000929
9 Align the moving end of the chain by loosening and adjusting the bolts on the connecting plate attached to the carriage.	 xx1300000930
10 Check that all cable(s) and/or hose(s) are not installed too tight or too loose inside the carrier system when clamping them into place. Optimally, aim for the neutral axis (center line of the link) of the chain as shown in the figure. To ensure that the cables are in the neutral axis, move the carriage to one end and open the links in the bend of the chain. Adjust cable length as necessary, move the carriage to the opposite side and recheck.	 xx1200000518

Continues on next page

4.13.1 Replacing the cable chain
Continued

Action	Note
11 Bend and connect the IRB power cable. Strap it into position according to the figure. It is essential to start with the stiffest cable and to strap it into position in order to have room for it without interference from the rest of the harness.	 xx1300000931
12 Connect all floor cabling and hoses to the connection plate (J1).	
13 Switch on the power and jog all axes to check that the cabling is correctly connected.	
14 Check that all process cabling and hoses are working properly.	
15 Run a few strokes in jogging mode and check that the chain is gliding properly upon itself and is correctly adjusted sideways.	

Test run

Action	Note
1 Run the system at low speed and insure that everything runs freely and smoothly without the chain, cables and/or hoses binding.	
2 Adjust the chain position or alignment, if needed.	
3 Adjust the position and length of cables and/or hoses, if needed.	
4 If adjustments are made, repeat steps 1 to 3.	
5 Tighten all screws.	
6 The track is now ready to be powered up to full speed and duty cycle. Check the tightening torque on fastening screws after 500 cycles. Adjust, if needed. The use of serrated lock washers, snap rings and other locking means is not permitted in this part of the track.	

Continues on next page

4 Repair

4.13.1 Replacing the cable chain

Continued

Adjusting the cable tray for spare part chains that are longer than the original

Chains longer than the original chain can be installed on single carriage tracks. In order to do this the fixed point of the chain and the cut-out profile will need to be moved, to allow for the extra length. Ensure that the replacement chain is not longer than twice the track length.

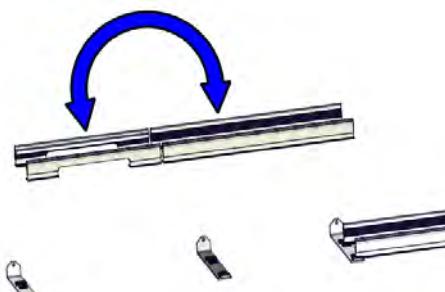
Principle of creating more space for a longer cable chain

The cable chain is fastened at the cut-out profile in the cable tray. By moving the cut-out profile forwards, and thereby moving the fixed point forwards, more space is created in the cable tray to suit for a longer cable chain.

The example given below for swapping places of the aluminium profiles creates one extra meter of space in the cable tray.

More brackets and profiles may need to be swapped around if the chain is excessively long.

Adjusting the cable tray

	Action	Note
1	Remove the old chain.	See Removing the cable chain on page 248 .
2	Remove the profiles shown in the figure.	 xx1300000933
3	Remove the glide bars from the two profiles shown in the figure.	 xx1300000934
4	Swap places of the profiles.	 xx1300000935

Continues on next page

4.13.1 Replacing the cable chain

Continued

Action	Note
5 Move the bracket so that it lines up under the profile divisions.	 xx1300000936
6 Refit the profiles to the brackets.	 xx1300000937
7 Continue to swap places of the profiles until the correct length is achieved.	
8 Refit the black support clip that links the two cut-out profiles.	
9 Fit the new chain to the cable tray.	See Lifting and fitting the cable chain Murrplastik on page 115 .
10 Attach the chain at both the fixed and moving end.	
11 Ensure that the glide bars are flush with the chains fixed bracket.	
12 Move the carriage back and forth to both mechanical stops to ensure the chain is the correct length.	
13 Complete the installation of the new cable chain.	See on page ? .

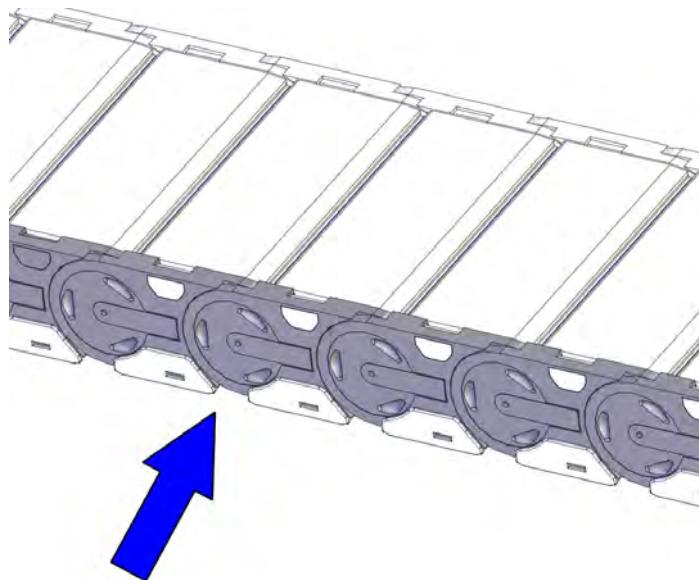
4 Repair

4.13.2 Replacing the side links, glide shoes and covers

4.13.2 Replacing the side links, glide shoes and covers

Location of the side links

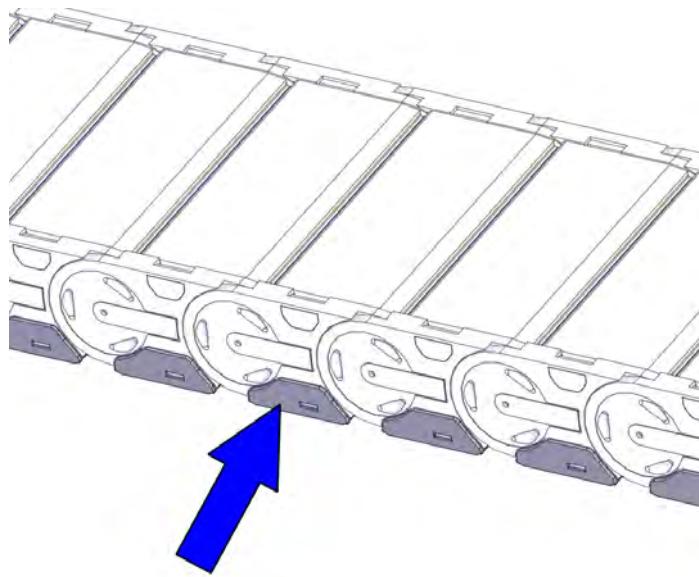
The figure shows the location of the side links on the cable chain.



xx1300000892

Location of the glide shoes

The figure shows the location of the glide shoes on the cable chain.



xx1300000899

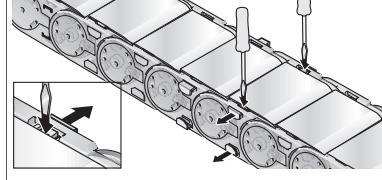
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Required equipment

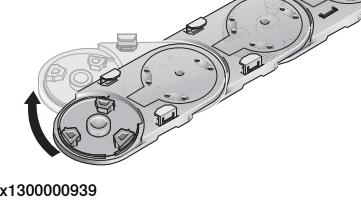
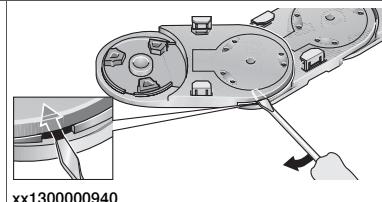
Equipment	Art. no.	Note
Side link	Spare part number is specified in:	
Glide shoes	<ul style="list-style-type: none"> • Spare parts on page 291. 	
Standard toolkit	-	Content is defined in section Standard toolkit on page 287 .

Opening the covers

To replace a side link, the top and bottom cover must first be removed.

	Action	Note
1	Place wooden blocks under the chain to facilitate the removal and refitting of covers in the inner bend.	
2	Open the red clips on the cover to be removed with a screwdriver and on one cover before and one after, in order to release the chains pre-tension.	 xx1300000938
3	Note the orientation of the covers in order to facilitate refitting.	
4	To remove the first cover, loosen the cover before and after it by inserting a screwdriver into the slot above the catcher. Work along the chain from left to right removing covers from both the top and bottom.	

Removing the side link

	Action	Note
1	Remove the top and bottom cover according to the previous procedure.	
2	Bend the links until two marks on the side line up.	 xx1300000939
3	Separate the two links by inserting a screwdriver and pushing down until the links separate.	 xx1300000940

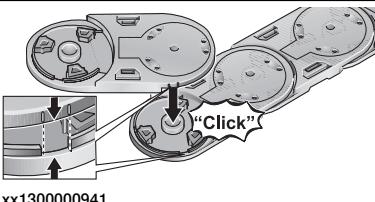
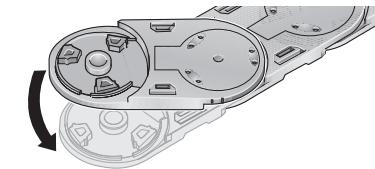
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4 Repair

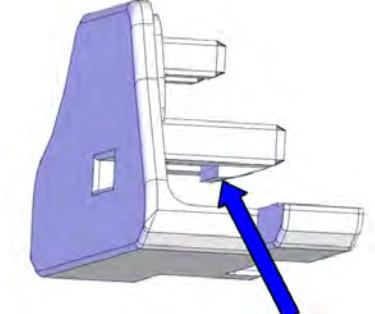
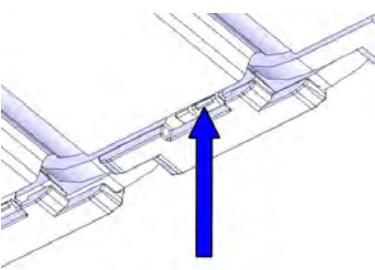
4.13.2 Replacing the side links, glide shoes and covers

Continued

Refitting the side link

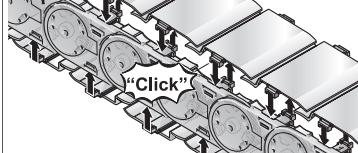
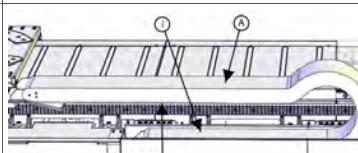
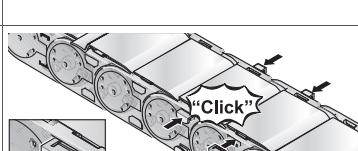
Action	Note
1 Position the links so that the two marks on the side line up. Press the links together until they snap together.	 xx1300000941
2 Rotate the link to "close" it.	 xx1300000942

Replacing the glide shoes

Action	Note
1 Remove the glide shoes by pushing in the clips with a screwdriver and then pulling out the glide shoes.	 xx1300001004  xx1300001005
2 Refit the glide shoes by pushing it into place until it snaps.	

Continues on next page

Closing the covers

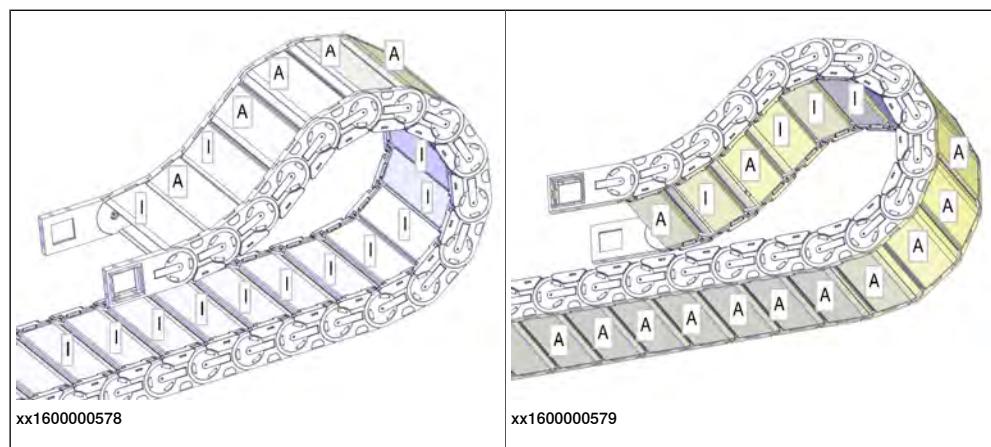
Action	Note
1 Fit the cover with the dividers / shelving system to check if the cables are lying in the chain correctly. Press the cover against the chain until they snap together.	 xx1300000943
2 Fit the rest of the covers. Ensure correct orientation of the covers. Covers marked with an "I" should be placed on the inside bend and covers marked with an "A" should be on the outside bend.	 xx1300000898
3 Close the red clips.	 xx1300000944

Installation order of covers

The covers are marked with the letter "I" (inner) or the letter "A" (outer).

Ensure correct orientation of the covers. Covers marked with an "I" should be placed on the inside bend and covers marked with an "A" should be on the outside bend.

This is valid for all covers, except the first and third cover counted from the moving end of the cable chain. For the first and the third cover an opposite cover should be installed, as shown in the figures.



4 Repair

4.13.3 Replacing the cables

4.13.3 Replacing the cables

Required equipment

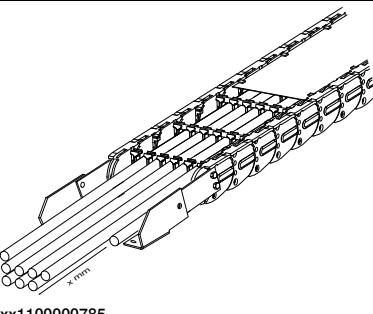
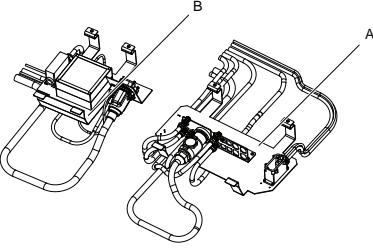
Equipment, etc.	Art. no.	Note
Cables	Spare part number is specified in: <ul style="list-style-type: none">• Spare parts on page 291.	Cables must be designed for use in continuous flexing operation.
Cable chain parts	Spare part number is specified in: <ul style="list-style-type: none">• Spare parts on page 291.	
Cable ties	21662055-6	Use heavy duty cable ties with minimum width: 7.6 mm.
Standard toolkit	-	Content is defined in section Standard toolkit on page 287 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.
Circuit diagram	-	See Circuit diagrams on page 293 .

Removing the cable

	Action	Note
1	 Tip Remove all cover plates before turning off all electric power. Without 24V DC the carriage can not be moved. If the cables to the release brakes are damaged follow instructions in Moving the carriage manually on page 99 .	
2	 Tip Spot welding chains have shelving systems and the cable that requires replacement might be on the bottom. If this is the case then move the carriage to the other end so that the bend is located closest to the carriage. Remove the chain from the carriage side.	
3	 DANGER Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot and for the track motion.	

Continues on next page

4.13.3 Replacing the cables
Continued

Action	Note
4  Tip Before removing damaged cables, measure the length of the damaged cable projecting from the end of the cable chain. This will facilitate refitting.	 xx1100000785
5  Tip Before removing damaged cables, remember the placement in the cable chain. This will facilitate refitting.	
6  Tip Before removing damaged cables, note down the location on the contact plate. This will facilitate refitting.	 xx1100000784 A Customer contact plate B Standard contact plate
7 Remove the cable to be replaced.	

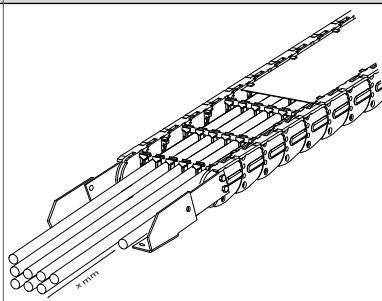
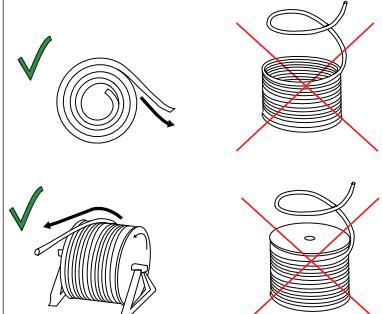
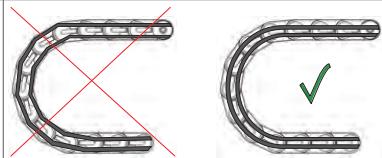
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4 Repair

4.13.3 Replacing the cables

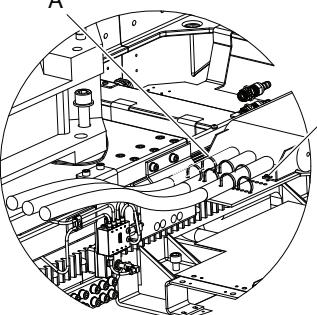
Continued

Refitting the cable

Action	Note
<p>1 Fit the new cable(s), use the same length projecting from the cable chain as for the damaged cable.</p> <p> Note</p> <p>Correct placement of cables in the cable chain is vital and will prevent unnecessary wear of the cables. Also the following matters must be considered:</p> <ul style="list-style-type: none"> • Keep unlike components apart, that is separate power and signals. • Keep unlike cable or hose jacket materials apart. • Only put cables of similar size in the same compartments. • Do not remove dividers. • If replacing a cable, check that other cables are in good condition and that they are not twisted. • Do not pack the cables too tight inside the carrier cavities. <p> CAUTION</p> <p>Adding cables that are not covered in the standard layouts could seriously reduce the expected component life of the chain.</p>	 <p>xx1100000785</p> <p>See placement of all cables in Illustration, refitting the cable chain on page 240.</p> <p>When installing cables or hoses into the carrier system, they should be laid into the carrier without twist. Cables or hoses should not be simply pulled off the reel. Instead, they should be properly uncoiled as shown in the figure below.</p>  <p>xx1200000517</p>
<p>2 Check that all cable(s) and/or hose(s) are not installed too tight or too loose inside the carrier system when clamping them into place. Optimally, aim for the neutral axis (center line of the link) of the chain as shown in the figure.</p> <p>To ensure that the cables are in the neutral axis, move the carriage to one end and open the links in the bend of the chain. Adjust cable length as necessary, move the carriage to the opposite side and recheck.</p>	 <p>xx1200000518</p> <p>Wrong: If cables bend radius is too big or installed incorrectly it forces the cable to push against the inner or outer sides of the chain.</p> <p>Right: if correctly installed the cable should fit comfortably in the chains cavity</p>

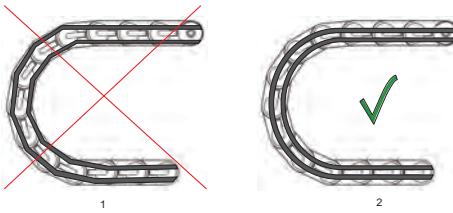
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4.13.3 Replacing the cables
Continued

Action	Note
3 Strap the new cable(s) (A) and connect it/them. The cables exiting the chain, on both the moving and fixed end, need to be strapped individually at least twice in order to strain relief correctly. If there are not enough holes available in the connection plates for individual strapping, the cables should be secured in such a way that they can not move.	 xx1100000792 A Cable straps B Torx pan head screw Suitable cable ties are specified in Required equipment on page 258 .
4 Refit the covers.	See Closing the covers on page 257 .
5 Mark the cables with a paint pen on both sides of the strapping.	
6  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 50 .	
7 Perform a test run before powering up the track to full speed and duty cycle.	See Test run on page 245 .

Test run

Use this procedure to check the installation of the cabling.

Action	Note
1 Run the system at low speed and insure that everything runs freely and smoothly without the carrier, cables and/or hoses binding.	
2 After 50 cycles, check that the cables and hoses are not installed too tight (stretched between carrier bars) or too loose (hanging on the carrier bars). Optimally, aim for the center line of the link of the carrier system, as shown in the figure.	 xx1200000518
3 Adjust the carrier position or alignment, if needed.	
4 Adjust the position and length of cables and/or hoses, if needed.	
5 If adjustments are made, repeat steps 1 to 4.	

Continues on next page

4 Repair

4.13.3 Replacing the cables

Continued

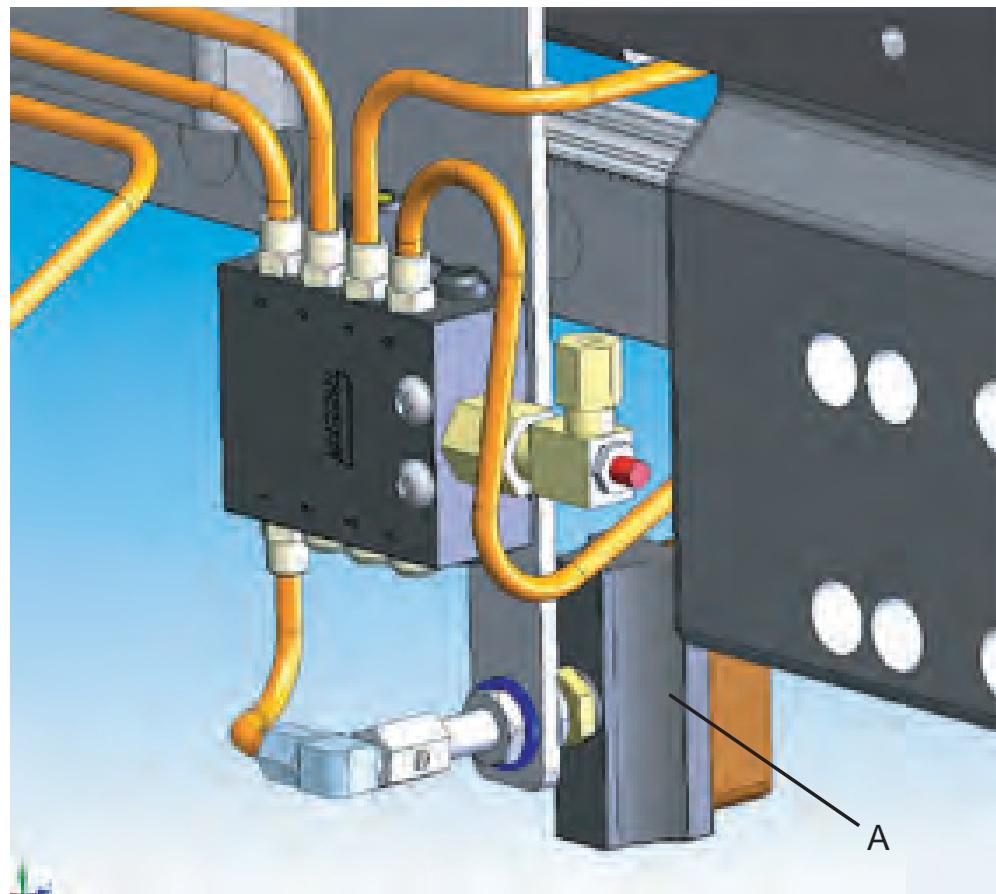
	Action	Note
6	Tighten all screws.	
7	The track is now ready to be powered up to full speed and duty cycle. Check the tightening torque on fastening screws after 500 cycles. Adjust, if needed. Periodically check to see if the cable strain relief is still in place.	

4.14 Automatic lubrication system

4.14.1 Replacing the oil brush

Location of oil brush

The oil brush is located as shown in the figure.



xx1100000797

A	Oil brush
---	-----------

Required equipment

Equipment, etc.	Art. no.	Note
Oil brush	Spare part number is specified in: • Spare parts on page 291 .	
Standard toolkit	-	Content is defined in section Standard toolkit on page 287 .
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.

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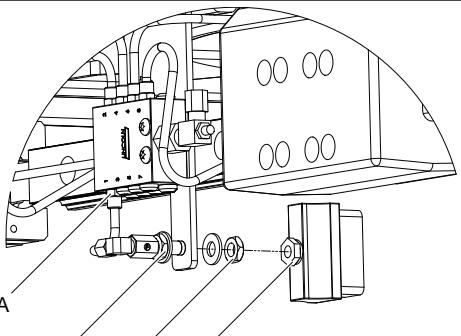
4 Repair

4.14.1 Replacing the oil brush

Continued

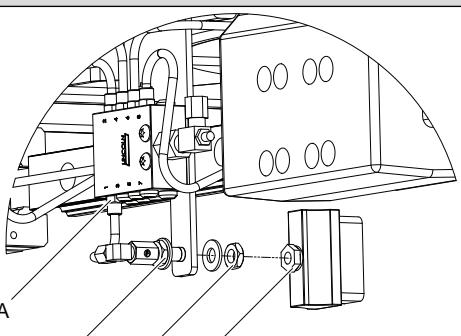
Removing the oil brush

Use this procedure to remove the oil brush.

Action	Note
1 Slightly loosen the one-way flow valve M10x1-Ø6 (A).	 xx1100000798
2 Loosen the nut (B) and the counter nut (C).	
3 Remove the oil brush (D).	A One-way flow valve M10x1-Ø6 B Nut C Nut D Oil brush

Refitting the oil brush

Use this procedure to refit the oil brush.

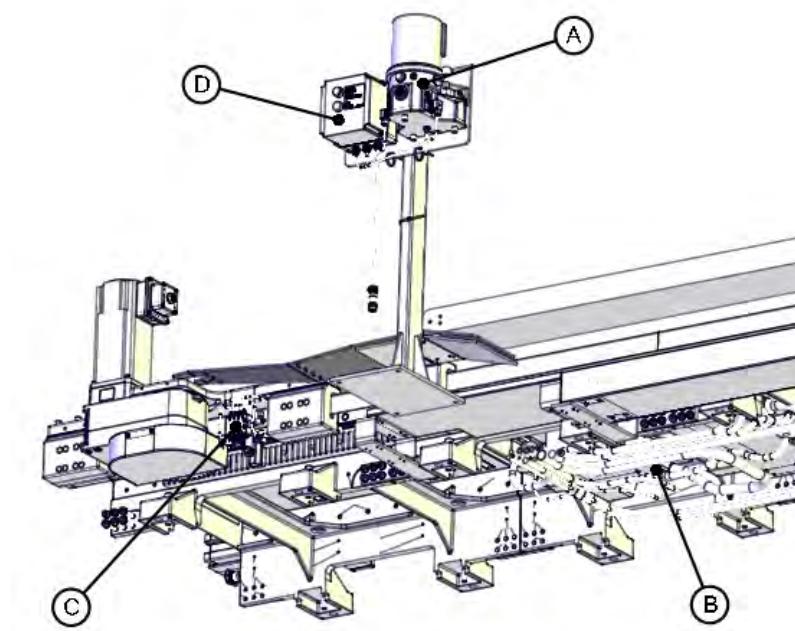
Action	Note
1 Fit the new oil brush (D).	 xx1100000798
2 Adjust the pressure of the brush by using the nuts (B) and (C).	
3 Tighten the one-way flow valve (A).	A One-way flow valve M10x1-Ø6 B Nut C Nut D Oil brush
4  DANGER Make sure all safety requirements are met when performing the first test run. These are further detailed in the section DANGER - First test run may cause injury or damage! on page 50.	

4.14.2 Replacing the hydraulic hose and repair of the grease pump

4.14.2 Replacing the hydraulic hose and repair of the grease pump**Replacing the hydraulic hoses****Location of hydraulic hoses**

The fixed hydraulic hose runs from the grease container (A) to the track motion contact plate (B), secured on the floor.

The flexible hydraulic hose runs from the track motion contact plate (B), in the cable chain, and to the grease distribution block (C).



xx1600000904

A	Grease container
B	Contact plate
C	Grease distribution block
D	Automatic lubrication system control unit

Replacing the hydraulic hoses

- Fill the new hose with grease before fitting it to the track.
- If replacing the flexible hydraulic hose in the cable chain, follow the same procedure as for replacing cables in the cable chain, see [Replacing the cables on page 258](#).

Repairing the grease pump

- Replacement of the pump parts is described in *Operating instructions - Centralized lubrication pump 203 DC (Lincoln Quicklub)*.
- After pump repair, perform a operational test. Loosen the hydraulic hose at the grease distribution block and check that grease is coming out of the hose when supplying grease with the push-button on the automatic lubrication system control unit.

Continues on next page

4 Repair

4.14.2 Replacing the hydraulic hose and repair of the grease pump

Continued

Filling the grease pump reservoir

- Filling of the reservoir is described in *Operating instructions - Centralized lubrication pump 203 DC (Lincoln Quicklub)*.
- If the reservoir has been run empty, verify that the hydraulic hoses are filled with grease before putting the pump in operational mode. No air should be present in the lubrication system.



Tip

Verify by loosening the hydraulic hose at either the contact plate or at the grease distribution block and check that grease is coming out of the hose when supplying grease with the push-button on the automatic lubrication system control unit.

5 Calibration

5.1 When to calibrate

When to calibrate

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

The resolver values are changed

If resolver values are changed, the robot must be recalibrated using the calibration methods supplied by ABB. Calibrate the track motion carefully with standard calibration.

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

This is detailed in [Fine calibration on page 269](#).

The revolution counter memory is lost

If the revolution counter memory is lost, the counters must be updated. See

[Updating the revolution counter on the track motion on page 132](#). 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 track motion is rebuilt

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

This is detailed in [Fine calibration on page 269](#).

5 Calibration

5.2 Measuring reference values for zero position

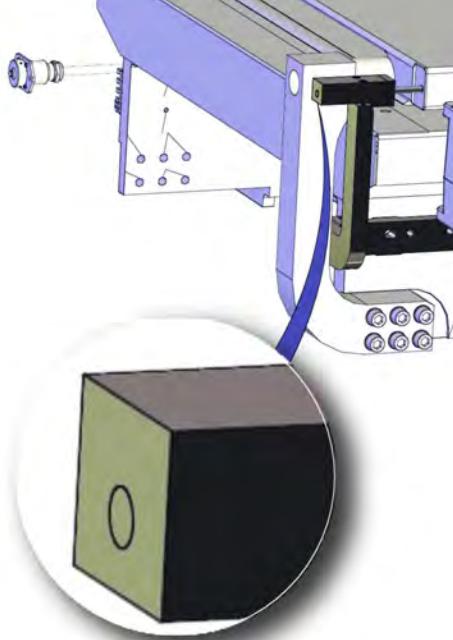
5.2 Measuring reference values for zero position

Zero position measures for calibration procedure

The zero position of each track motion is unique due to possible earlier differences in positioning for calibration. Before replacing parts that affect the calibration position (for example a motor or part of transmission) or rebuilding the track, the zero position of the specific track must be documented by using the calibration tool. The measured values are later on used as reference values at fine calibration.

Measuring reference values for zero position

Use this procedure to measure reference values for the zero position.

Action	Note
1  WARNING Make sure no persons are on the track motion when the carriage is in motion. Also make sure that the track motion's cover plates are free from loose objects, otherwise they can get trapped between the carriage and the plates.	
2 Fit the calibration tool to the track motion.	See Fitting the calibration tool on page 270 .
3 Jog the carriage to zero position with the FlexPendant.	
4 Look at the calibration tool and make a note of the calibration pin position. The end of the pin can either be aligned with the surface of the housing, as shown in the figure. But it can also extend from the housing or be inside the housing. Measure the distance, if any, from the pin end to the surface of the housing, write it down and save it for future reference.	 xx1200000006

5.3 Fine calibration

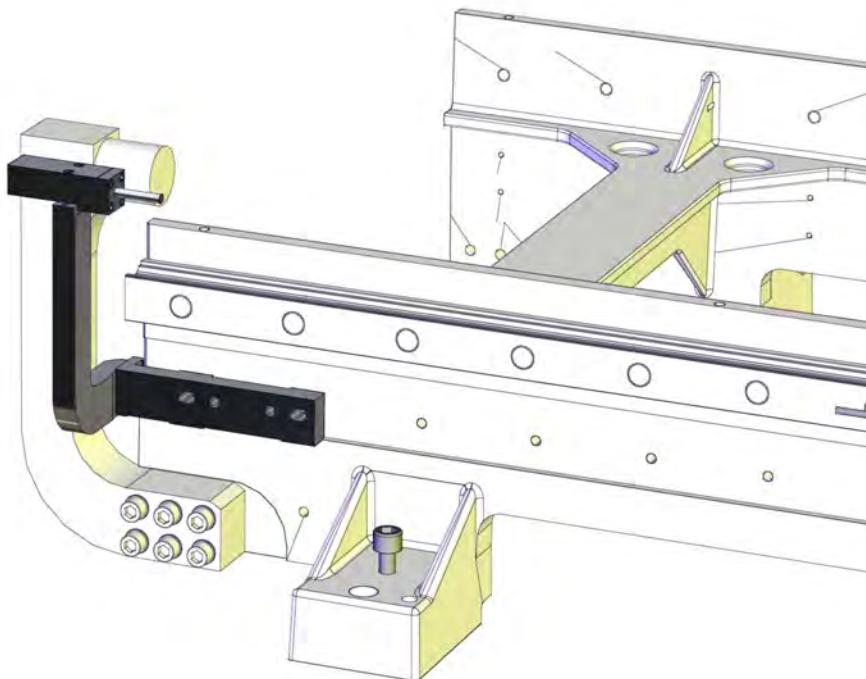
General

If resolver values are changed, the robot must be recalibrated using the calibration methods supplied from ABB.

In order to perform fine calibration there must be reference values available for the zero position. See [Measuring reference values for zero position on page 268](#).

Location of calibration tool

The calibration tool is mounted on the track motion as shown in the figure.



xx1200000002

Required equipment

Equipment etc.	Article number	Note
Calibration tool	3HAC042466-001	Attachment screws 9DA183-52 (M10x35), 2 pcs, required. Not included with the calibration tool.
Calibration tool, mirrored	3HAC042467-001	Attachment screw 9DA183-52 (M10x35), 1 pc, required. Not included with the calibration tool.
Cleaning agent	-	Isopropanol
Reference values	-	Noted during measurement of the zero position, see Measuring reference values for zero position on page 268 .

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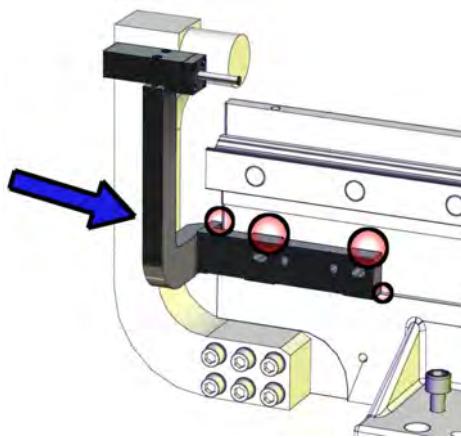
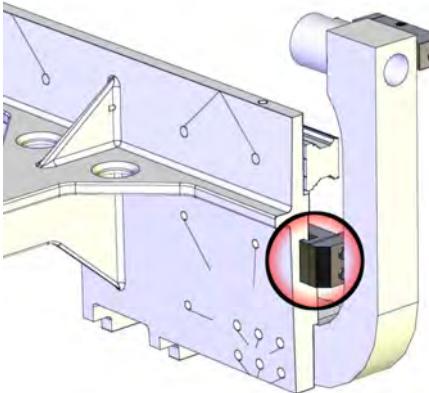
5 Calibration

5.3 Fine calibration

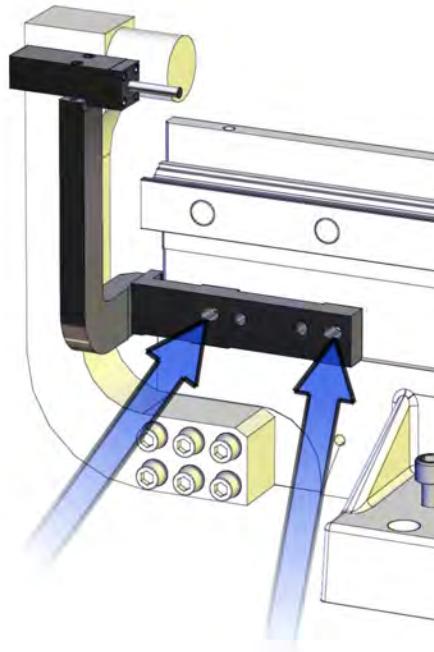
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Fitting the calibration tool

Use this procedure to fit the calibration tool to the track motion.

Action	Note
1  WARNING Make sure no persons are on the track motion when the carriage is in motion. Also make sure that the track motion's cover plates are free from loose objects, otherwise they can get trapped between the carriage and the plates.	
2 Clean the assembly surfaces on the track motion and on the calibration tool with isopropanol.	
3 Put the calibration tool on the border that runs along the track motion. Push the tool downwards and sideways, so that the contact surfaces lie against each other. The surfaces are shown by circles in the figures.	See Location of calibration tool on page 269 .  xx1200000003  xx1200000004

Continues on next page

Action	Note
4 Secure the tool with screws M10x35. Ensure that all contact surfaces lie against each other when the calibration tool is fitted.	 xx1200000005 <p>Note</p> <p>The mirrored version only requires one screw.</p>

Calibrating

Use this procedure to perform fine calibration.

Action	Note
1  WARNING Make sure no persons are on the track motion when the carriage is in motion. Also make sure that the track motion's cover plates are free from loose objects, otherwise they can get trapped between the carriage and the plates.	
2  Note The track motion does not need to be calibrated during restart. The resolvers only need to be calibrated when commissioning the system.	
3 Jog the carriage in -X direction at low speed (Non sync speed) towards the calibration tool and against the calibration pin.	

Continues on next page

5 Calibration

5.3 Fine calibration

Continued

Action	Note
4 Stop the carriage when the calibration pin is in correct position, according to the previously measured <i>reference values</i> . The carriage is now in calibration position.	Noted during measurement of the zero position, see Measuring reference values for zero position on page 268 .
5 On the FlexPendant, tap the ABB menu.	
6 Tap Calibration, then tap Track, then tap Calibration Parameters.	
7 Tap Yes at Fine Calibration.	
8 Tap Track and then tap Calibrate.	
9 Fine calibration is performed.	

5.4 Defining base frame

General

To run coordinated axes, the base frame must be defined. See *Application manual - Additional axes and stand alone controller (Coordinated track motion)*.

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6 Decommissioning

6.1 Environmental information

Hazardous material

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

Dispose components properly to prevent health or environmental hazards.

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

Oil and grease

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

Also note that:

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

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7 LINCOLN QUICKLUB®

7.1 Documentation for LINCOLN QUICKLUB®

Where to find the manual

The owner manual and operating instructions for LINCOLN QUICKLUB® are not included in this manual, but delivered as separate documents on the documentation DVD. Document numbers are specified in *References on page 10*.

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8 Reference information

8.1 Introduction

General

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

8 Reference information

8.2 Applicable standards

8.2 Applicable standards



Note

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

Standards, EN ISO

The product is designed in accordance with the requirements of:

Standard	Description
EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN ISO 13849-1	Safety of machinery, safety related parts of control systems - Part 1: General principles for design
EN ISO 13850	Safety of machinery - Emergency stop - Principles for design
EN ISO 10218-1	Robots for industrial environments - Safety requirements -Part 1 Robot
EN ISO 9787	Robots and robotic devices -- Coordinate systems and motion nomenclatures
EN ISO 9283	Manipulating industrial robots, performance criteria, and related test methods
EN ISO 14644-1 ⁱ	Classification of air cleanliness
EN ISO 13732-1	Ergonomics of the thermal environment - Part 1
EN IEC 61000-6-4 (option 129-1)	EMC, Generic emission
EN IEC 61000-6-2	EMC, Generic immunity
EN IEC 60974-1 ⁱⁱ	Arc welding equipment - Part 1: Welding power sources
EN IEC 60974-10 ⁱⁱ	Arc welding equipment - Part 10: EMC requirements
EN IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1 General requirements
IEC 60529	Degrees of protection provided by enclosures (IP code)

ⁱ Only robots with protection Clean Room.

ⁱⁱ Only valid for arc welding robots. Replaces EN IEC 61000-6-4 for arc welding robots.

European standards

Standard	Description
EN 614-1	Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles
EN 574	Safety of machinery - Two-hand control devices - Functional aspects - Principles for design

Continues on next page

Other standards

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

8 Reference information

8.3 Unit conversion

8.3 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	

8.4 Screw joints

General

This section describes how to tighten the various types of screw joints on the IRBT 4004/6004/7004.

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

UNBRAKO screws

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

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

Gleitmo treated screws

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

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

Screws lubricated in other ways

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

In such cases, proceed as follows:

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

Lubricant	Article number
Molycote 1000 (molybdenum disulphide grease)	11712016-618

Tightening torque

Before tightening any screw, note the following:

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

Continues on next page

8 Reference information

8.4 Screw joints

Continued

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

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

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

Oil-lubricated screws with allen head screws

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

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

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

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

Dimension	Tightening torque (Nm) Class 10.9, lubricated 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 Molykote 1000, Gleitmo 603 or equivalent

Continues on next page

Water and air connectors

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

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

8 Reference information

8.5 Weight specifications

8.5 Weight specifications

Definition

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

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

Example

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

	Action	Note
	 CAUTION The robot weighs xx kg. All lifting accessories used must be sized accordingly!	

8.6 Standard toolkit

General

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

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

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

Contents, standard toolkit

Qty	Tool
1	Ring-open-end spanner 8-19 mm
1	Socket head cap 2.5-17 mm
1	Torx socket no: 20-60
1	Torque wrench 10-120 Nm
1	Ratchet head for torque wrench 1/2
1	Hex bit socket head cap no. 5 socket 1/2", bit length=20 mm
1	Hex bit socket head cap no. 6 socket 1/2", bit length=20 mm
1	Hex bit socket head cap no. 8 socket 1/2", bit length=20 mm
1	Small cutting plier
1	Plastic mallet
1	Small screwdriver

8 Reference information

8.7 Special tools

8.7 Special tools

Extra toolkit

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 287](#), and of special tools, listed directly in the instructions and also gathered in this section.

Special tools

Qty	Tool	Article number	Note
1	Gear rack used as a meshing gauge (for control of smooth transition between the joints on the laid gear rack)	3HxD1000-467	
1	Calibration tool	3HAC042466-001	Attachment screws 9DA183-52 (M10x35), 2 pcs, required. Not included with the calibration tool.
1	Calibration tool, mirrored	3HAC042467-001	Attachment screw 9DA183-52 (M10x35), 1 pc, required. Not included with the calibration tool.
1	Runner block replacement tool	3HAC044740-001	Including: <ul style="list-style-type: none">• Cylindrical pin extractor• Push tool for runner block• Replacement instruction

8.8 Lifting accessories and lifting instructions

General

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

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

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

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9 Spare parts

9.1 Spare part lists and illustrations

Location

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

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10 Circuit diagrams

10.1 Circuit diagrams

Overview

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

Controllers

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRC5</i>	<i>3HAC024480-011</i>
<i>Circuit diagram - IRC5 Compact</i>	<i>3HAC049406-003</i>
<i>Circuit diagram - IRC5 Panel Mounted Controller</i>	<i>3HAC026871-020</i>
<i>Circuit diagram - Euromap</i>	<i>3HAC024120-004</i>
<i>Circuit diagram - Spot welding cabinet</i>	<i>3HAC057185-001</i>

Robots

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRB 120</i>	<i>3HAC031408-003</i>
<i>Circuit diagram - IRB 140 type C</i>	<i>3HAC6816-3</i>
<i>Circuit diagram - IRB 260</i>	<i>3HAC025611-001</i>
<i>Circuit diagram - IRB 360</i>	<i>3HAC028647-009</i>
<i>Circuit diagram - IRB 460</i>	<i>3HAC036446-005</i>
<i>Circuit diagram - IRB 660</i>	<i>3HAC025691-001</i>
<i>Circuit diagram - IRB 760</i>	<i>3HAC025691-001</i>
<i>Circuit diagram - IRB 1200</i>	<i>3HAC046307-003</i>
<i>Circuit diagram - IRB 1410</i>	<i>3HAC2800-3</i>
<i>Circuit diagram - IRB 1600/1660</i>	<i>3HAC021351-003</i>
<i>Circuit diagram - IRB 1520</i>	<i>3HAC039498-007</i>
<i>Circuit diagram - IRB 2400</i>	<i>3HAC6670-3</i>
<i>Circuit diagram - IRB 2600</i>	<i>3HAC029570-007</i>
<i>Circuit diagram - IRB 4400/4450S</i>	<i>3HAC9821-1</i>
<i>Circuit diagram - IRB 4600</i>	<i>3HAC029038-003</i>
<i>Circuit diagram - IRB 6400RF</i>	<i>3HAC8935-1</i>
<i>Circuit diagram - IRB 6600 type A</i>	<i>3HAC13347-1 3HAC025744-001</i>
<i>Circuit diagram - IRB 6600 type B</i>	<i>3HAC13347-1 3HAC025744-001</i>
<i>Circuit diagram - IRB 6620</i>	<i>3HAC025090-001</i>

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10 Circuit diagrams

10.1 Circuit diagrams

Continued

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRB 6620 / IRB 6620LX</i>	3HAC025090-001
<i>Circuit diagram - IRB 6640</i>	3HAC025744-001
<i>Circuit diagram - IRB 6650S</i>	3HAC13347-1 3HAC025744-001
<i>Circuit diagram - IRB 6660</i>	3HAC025744-001 3HAC029940-001
<i>Circuit diagram - IRB 6700</i>	3HAC043446-005
<i>Circuit diagram - IRB 7600</i>	3HAC13347-1 3HAC025744-001
<i>Circuit diagram - IRB 14000</i>	3HAC050778-003
<i>Circuit diagram - IRB 910SC</i>	3HAC056159-002

Track motions

Product	Article numbers for circuit diagrams
<i>Circuit diagram - IRBT IRB 6600/7600 i</i>	3HEA803013-001
<i>Circuit diagram - IRBT IRB 4400/4400F i</i>	3HEA803014-001
<i>Circuit diagram - IRBT IRB 4600 i</i>	3HAC033657-001
<i>Circuit diagram - IRBT 4004/6004/7004 ii</i>	3HAC043574-001

i Not valid for motor Type A.

ii Valid for motor Type A.

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