ROBOTICS

Product manual

IRBT 4004/6004/7004

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Product manual

IRBT 4004
IRBT 6004
IRBT 7004

IRC5

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Additional copies of this manual may be obtained from ABB.

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.

Product manual scope

The manual covers covers all variants and designs of the IRBT 4004/6004/7004. Some variants and designs may have been removed from the business offer and are no longer available for purchase.

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.

Continues on next page

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

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

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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. 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	Content updated in chapter/section: • Decommissioning chapter added. • Clarification about loads. The chapter Safety updated with: • Updated safety signal graphics for the levels Danger and Warning. • New safety labels on the manipulators.
E	This revision includes following updates/corrections: • Information about maximum permitted loads corrected, see *Foundation on page 72*. • Added the section *Defining base frame on page 285*. • 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 43*. • Expansion shell bolts, for securing the track motion to the floor, is removed throughout the manual. • Changed titles in sections, *Connections on page 109*. • Added lubricants, *Required equipment on page 150*. • Added calibration tool for mirrored layouts, *Extra toolkit on page 302*. • Added new illustrations for calibration, see *Fine calibration on page 281*. • Removed documentation for LINCOLN QUICKLUB® from Product manual, see *LINCOLN QUICKLUB® on page 291*.
F	This revision includes following updates/corrections: • 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, *Product manual, spare parts - IRBT 4004/6004/7004*. • Changed oil to cable grease in section *Replacing the cable harness on page 241*. • Changed the cable layout in the cable chain, see *Illustration, refitting the cables on page 247*. Also added information in the instruction when refitting cables that power and signal cables can not

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Revision	Description
	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 256*. • 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 78*. • Some general tightening torques have been changed/added, see updated values in *Screw joints on page 297*. • The calibration tool is reconstructed. Instructions for how to use the new tool are updated, see *Measuring reference values for zero position on page 280* and *Fine calibration on page 281*. New article number for the tool, see *Special tools on page 302*. • Diameter of a hole in the stand has changed from 24 mm to 25 mm, see *Hole configuration on page 74*. • 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 176*. • Added information about factory settings of automatic lubrication, see *Automatic lubrication on page 138*. • Updated figures that show position of connectors on controller, see *Connectors on Drive Module on page 113*. • Added *Handling of batteries*.
G	This revision includes following updates/corrections: • 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 252*. • 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 59*. • Measurement is added to the figure Dimension in section *Hole configuration on page 74*. • 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 cables on page 247*.
H	This revision includes following updates/corrections: • Corrected description for maximum floor loads, see *Operating requirements on page 42*, and *Hole configuration on page 74*. • Measurement added to figure in section *Required space for installation of single carriage track (standard) on page 60*. • Measurement for the width of the track motion changed in figure, section *Positioning the stand on page 83*. • Measurement for the height of the track motion changed in figure, section *Dimensions on page 64*. • An attachment plate for cables is added to the track motion. See figures in sections *Track motion IRBT 4004/6004/7004 overview on page 76*, *Adjusting cables and covers on page 125*, *Refitting the cable harness and cable chain on page 248* etc. • The maintenance schedule is updated. Following scheduled activities are removed: inspection of drive motor and electrical operation, replacement of gearbox and motor.

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Revision	Description
	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 243* are corrected. • Note is removed in *Forces on page 43*. • Information about expansion-shell anchor bolts is removed, section *Screws for fastening manipulator to base on page 75*. • New motor is added throughout the manual, see for example section *Two versions of the track motion motor on page 189*. • 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 84*. • The wiring diagrams are removed from the manual and are now only found in the circuit diagrams, see references in *Circuit diagrams on page 307*. • A new SMB unit and battery is introduced, with longer battery lifetime.
J	This revision includes following updates/corrections: • 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 307*. • 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 188* and *Changing the track motion motor to Type A on page 200*. • Inspection of oil brush is added to the maintenance schedule, see *Maintenance schedule on page 143*. A procedure for how to inspect the oil brush is also added to the manual, see *Inspecting the brush on page 165*. • Additional information about alignment of the track is added, see *Geometric alignment of track motion IRBT 4004/6004/7004 on page 84*. • New section about storing the cable chain is added, see *Storing the cable chain on page 49*. • Replacement of glide shoes is added to the maintenance schedule, see *Maintenance schedule on page 143*. • Cable chain Murrplastik is added throughout the manual. New sections added to the manual: - *Replacing the cable chain on page 254* - *Lifting and fitting the cable chain Murrplastik on page 104* - *Replacing the side links, glide shoes and covers on page 261* - *Replacing the cables on page 265*
K	This revision includes following updates/corrections: • 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	This revision includes following updates/corrections: • Illustration and text are updated in section *Replacing the gearbox (including the motor) and the gear wheel on page 176*. • Minor corrections.

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Revision	Description
M	This revision includes following updates/corrections: • Added note about fatigue calculations to Force table, see *Forces on page 43*. • Updated measurement of position A for travel lengths of single and double carriage, see *Travel length on page 59*. • Updated length of Murrplastik cable chain, see *Formula for single carriage track on page 61*. • Updated the software installation chapter, see *Software installation on page 127*. • Updated dimension drawings of the carriage table, IRBT 6004 and IRBT 7004, see *Measures of the carriage table on page 67*. • Added maximum floor loads for IRB 6700, see *Operating requirements on page 42*. • Added expected component life for the linear bearings on IRBT 6004/IRB 6700, see *Expected component life on page 146*.
N	This revision includes following updates/corrections: • Measures for required space for single carriage track adjusted
P	This revision includes following updates/corrections: • Maintenance activity added; Testing the manual feed for Auto lubrication • Grease 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 98* • A note with a reference to special tools section in "Replacement of ball elements" added • Step "Remove cylindrical pin" in "Replacement of ball elements" added • New illustration with protection plate on Murrplastic cable chain • Section Connections is updated.
Q	Published in release R16.2. The following updates are made in this revision: • Added information about screw joint for connecting plate, see *Assembling the cover and side plates on page 99*. • Added information about installation order of cable chain covers, see *Installation order of covers on page 264*. • Added information about base frame configuration, see *Base frame configuration on page 134*. • Added information about what repair measures to take at a breakdown of ball elements and linear guides, see *Repair actions at breakdown on page 220* and *Repair actions at breakdown on page 215*. • 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 276*. • 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 220*. 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 made in this revision: • Information regarding *Castrol Longtime PD1* removed.

Continues on next page

Revision	Description
S	Published in release R17.2. The following updates are made in this revision: • Caution about removing metal residues added in sections about SMB boards. • Updated list of applicable standards.
T	Published in release R18.1. The following updates are made in this revision: • Added section, Cut the paint or surface on the robot before replacing parts. • Safety restructured. • Information about myABB Business Portal added. • Updated image - fault indication in case of a blockage.
U	Published in release R18.2. The following updates are made in this revision: • Updated interval in *Maintenance schedule on page 143*. • Added grease to lubricate linear guides in relevant sections. • Need to replace all linear guides on one side of the track if damage occurs. • Updated lubricant number, see *Screw joints on page 297*. • Improvements made to following procedures: - *Assembling the sections of the track motion IRBT 4004/6004/7004 (Longer than 9m) on page 78* - *Geometric alignment of track motion IRBT 4004/6004/7004 on page 84* - *Assembling the cable tray and manipulator on page 97* • Picture of switches belonging to the automatic lubrication system updated. • Information added regarding required space for cable tray during installation of track motion sections to floor. • Safety information added to *Moving the carriage manually on page 91*. • Removed General procedures (from section 4).
V	Published in release 19B. The following updates are made in this revision: • Added warning about grease for linear guides. • Added illustration for cable layout of cable chains from Murrplastik, and added information about pneumatic hoses. See *Replacing the cables on page 265*.
W	Published in release 19D. The following updates are made in this revision: • Added procedure for how to install an optional pedestal to the track motion carriage. • Added pictures that show the labeling of parted sections, see *Assembling the sections of the track motion IRBT 4004/6004/7004 (Longer than 9m) on page 78*. • Information about functional ground added throughout the manual.
X	Published in release 20A. The following updates are made in this revision: • Permitted extra maximum load on IRBT 4004 corrected to 50 kg, see *Maximum load on page 72*. • Replaced article number and name of grease, previously 3HAB3537-1.
Y	Published in release 20B. The following updates are made in this revision: • Updated figure that shows pedestal orientation on track motion.

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Revision	Description
	• Updated diameter of pre-drilled joint bracket holes for split pins. See *Assembling the sections of the track motion IRBT 4004/6004/7004 (Longer than 9m) on page 78*.
Z	Published in release 20C. The following updates are made in this revision: • Information about protective earth added into new section, see *Grounding point on page 116*. • Updated weight of track with single and double carriage, and weight of pedestal.
AA	Published in release 20D. The following updates are made in this revision: • Updated the values for gearbox backlash, see *Adjusting the gearbox backlash on page 185*. • Added information about mechanical stops.
AB	Published in release 21A. The following updates are made in this revision: • Type of grease changed from Klüber Microlube GB0 to Total CERAN CA. through out the document.
AC	Published in release 21C. The following updates are made in this revision: • Unit for amount of grease changed from 2 to 3. • New article number for customer connection plate. 3HXD1000-621 is now 3HAC079958-001, and a bracket for Profinet with screws are added. See *Customer connection plate*
AD	Published in release 22A. The following updates are made in this revision: • The tolerance when aligning the track motion in Y-direction is changed. See *Alignment in Y direction on page 85*.
AE	Published in release 22C. The following updates are made in this revision: • Corrected information about meshing gauge for gear racks. • Added information about white line on cables to avoid twisted cabling at installation. • Added a section that describes assembly of M12 Ethernet/PROFINET male connector at the manipulator base.
AF	Published in release 23B. The following updates are made in this revision: • New section added, see section *Delivery quick-guide on page 96*. • New section added, see section *Functional earth grounding on page 117*. • Minor corrections in illustration, see *Identification plate on page 46*.
AG	Published in release 23D. The following updates are made in this revision: • Updated the section Refitting the linear guide. • Added dimensions of MurrPlastik cables. • Updated the section Lubricating the ball element with information about maximum pressure.

Product documentation

Categories for user documentation from ABB Robotics

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

Tip

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

Product manuals

Manipulators, controllers, DressPack, 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.
- Troubleshooting.
- Decommissioning.
- Reference information (safety standards, unit conversions, screw joints, lists of tools).
- Spare parts list with corresponding figures (or references to separate spare parts lists).
- References to circuit diagrams.

Technical reference manuals

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

Application manuals

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

An application manual generally contains information about:

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

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- 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 troubleshooters.

How to read the product manual

Reading the procedures

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

References to figures

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

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

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

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

References to required equipment

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

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

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

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

Safety information

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

Read more in the chapter *Safety on page 21*.

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 Safety information

1.1.1 Limitation of liability

Limitation of liability

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

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

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

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

Spare parts and equipment

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

1.1.2 Requirements on personnel

General

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

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

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

Personal protective equipment

Use personal protective equipment, as stated in the instructions.

1.2 Safety signals and symbols

1.2.1 Safety signals in the manual

Introduction to safety signals

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

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

Hazard levels

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

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

Continues on next page

1.2.1 Safety signals in the manual
Continued

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

1.2.2 Safety symbols on manipulator labels

Introduction to symbols

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

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

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

Types of symbols

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

The safety labels are language independent, they only use graphics. See *Symbols on safety labels on page 25*.

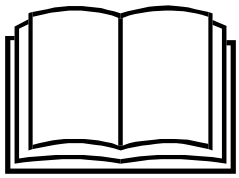
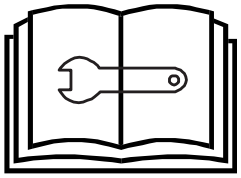
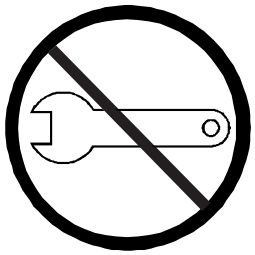
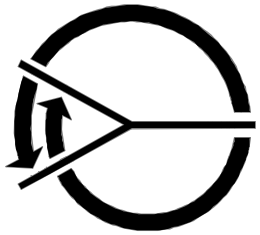
The information labels can contain information in text.

Symbols on safety labels

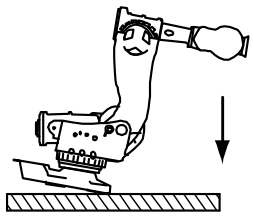
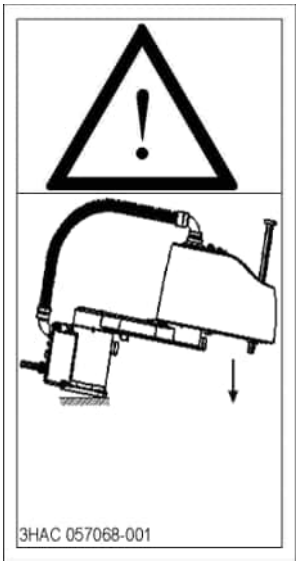
Symbol	Description
 xx0900000812	**Warning!** Warns that an accident *may* occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical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

Continues on next page

1.2.2 Safety symbols on manipulator labels
Continued

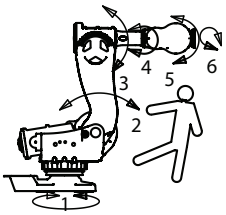
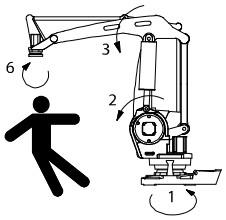
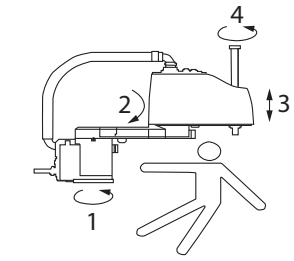
Symbol	Description
 xx0900000813	**See user documentation** Read user documentation for details. Which manual to read is defined by the symbol: • No text: *Product manual*. • EPS: *Application manual - Electronic Position Switches*.
 xx0900000816	**Before disassembly, see product manual**
 xx0900000815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

Continues on next page

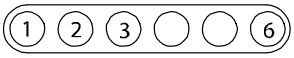
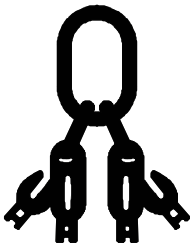
Symbol	Description
 xx0900000810  xx1500002402	**Tip risk when loosening bolts** The robot can tip over if the bolts are not securely fastened.
  xx0900000817	**Crush** Risk of crush injuries.

Continues on next page

1.2.2 Safety symbols on manipulator labels
Continued

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

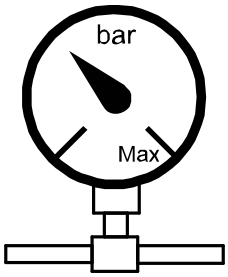
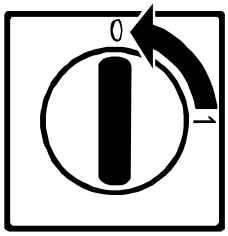
Continues on next page

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

Continues on next page

1.2.2 Safety symbols on manipulator labels

Continued

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

1.3 Robot stopping functions

Protective stop and emergency stop

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

For more information see:

- *Product manual - IRC5*

1.4 Safety during installation and commissioning

National or regional regulations

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

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

The integrator of the robot system is required to perform a risk assessment.

Layout

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

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

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

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

Hazards due to noise emission from the robot needs to be considered.

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

Allergenic material

See *Environmental information on page 288* for specification of allergenic materials in the product, if any.

Securing the robot to the foundation

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

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

Using lifting accessories and other external equipment

Ensure that all equipment used during installation, service and all handling of the robot are in correct condition for the intended use.

Electrical safety

Incoming mains must be installed to fulfill national regulations.

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

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

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

Continues on next page

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

Note

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

Safety devices

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

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

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

Other hazards

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

- Water
- Compressed air
- Hydraulics

End-effector hazards require particular attention for applications which involve close human collaboration with the robot.

Pneumatic or hydraulic related hazards

Note

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

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

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

Dump valves should be used in case of emergency.

Shot bolts should be used to prevent tools, etc., from falling due to gravity.

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

Verify the safety functions

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

1.5 Safety during operation

Automatic operation

Verify the application in the operating mode manual reduced speed, before changing mode to automatic and initiating automatic operation.

Unexpected movement of robot arm

WARNING

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

1.6 Safety during maintenance and repair

1.6.1 Safety during maintenance and repair

General

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

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

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

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

Make sure that there are no tools, loose screws, turnings, or other unexpected parts remaining after maintenance or repair work.

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

Hot surfaces

Surfaces can be hot after running the robot, and touching these may result in burns. Allow the surfaces to cool down before maintenance or repair.

Allergic reaction

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

Gearbox lubricants (oil or grease)

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

Note

Take special care when handling hot lubricants.

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

Continues on next page

1.6.1 Safety during maintenance and repair
Continued

Warning	Description	Elimination/Action
 **Allergic reaction**	When working with lubricants there is a risk of an allergic reaction.	Make sure that protective gear like goggles and gloves are always worn.
 **Possible pressure build-up in gearbox**	When opening the oil or grease plug, there may be pressure present in the gearbox, causing lubricant to spray from the opening.	Open the plug carefully and keep away from the opening. Do not overfill the gearbox when filling.
 **Do not overfill**	Overfilling of gearbox lubricant can lead to internal over-pressure inside the gearbox which in turn may: • damage seals and gaskets • completely press out seals and gaskets • prevent the robot from moving freely.	Make sure not to overfill the gearbox when filling it with oil or grease. After filling, verify that the level is correct.
 **Do not mix types of oil**	Mixing types of oil may cause severe damage to the gearbox.	When filling gearbox oil, do not mix different types of oil unless specified in the instructions. Always use the type of oil specified for the product.
 **Oil residues**	Oil residues might be present in a drained gearbox and spilled when separating a motor and gearbox during repair.	Make sure that protective gear like goggles/protective visor, gloves and arm protection are always worn during this activity. Put oil absorbent cloth or paper at appropriate locations to catch any oil residues.
 **Heat up the oil**	Warm oil drains quicker than cold oil.	Run the robot before changing the gearbox oil, if possible.
 **Specified amount depends on drained volume**	The specified amount of oil or grease is based on the total volume of the gearbox. When changing the lubricant, the amount refilled may differ from the specified amount, depending on how much has previously been drained from the gearbox.	After filling, verify that the level is correct.

Continues on next page

Warning	Description	Elimination/Action
 **Contaminated oil in gearboxes**	For lifetime reasons always drain as much oil as possible from the gearbox. The magnetic oil plugs will gather residual metal chips.	

Hazards related to batteries

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

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

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

Operating temperatures are listed in *Ambient temperature on page 42*.

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

Related information

See also the safety information related to installation and operation.

1.6.2 Emergency release of the robot axes

Description

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

How to release the brakes is described in the section:

- *Releasing the brake on page 91*.

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

Increased injury

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

DANGER

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

Make sure no personnel is near or beneath the robot.

1.7 Safety during troubleshooting

General

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

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

DANGER

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

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

Related information

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

1.8 Safety during decommissioning

General

See section *Decommissioning on page 287*.

If the robot is decommissioned for storage, take extra precaution to reset safety devices to delivery status.

2 Installation and commissioning

2.1 Overview of installation and commissioning procedure

Installation and commissioning steps

Carry out the following steps after delivery, to install and commission 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 46*. *Lifting and moving track motion IRBT 4004/6004/7004 on page 52*.
2	Read through and follow the information and instructions for on-site installation of the track motion.	*On-site installation on page 72*.
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 84*.
4	Assemble the manipulator and the cable tray.	*Assembling the cable tray and manipulator on page 97*.
5	Install the cable chain and connect all cables.	*Electrical installation on page 104*.
6	Adjust cable length.	*Adjusting cables and covers on page 125*.
7	Connect voltage to the system.	*Electrical installation on page 104*.
8	Start up the system.	*Starting the system for the first time on page 127*.
9	Load software to the system.	*Creating and downloading a system on page 128*.
10	Update the revolution counters.	*Updating the revolution counter on the track motion on page 133*.

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 *Product specification - Controller IRC5 with FlexPendant*
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 run with lower performance due to temperature dependent oil- and grease viscosity.

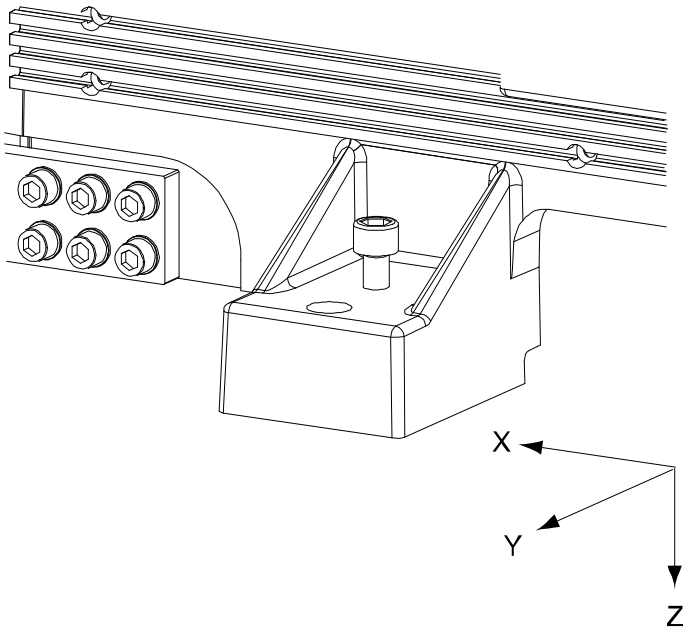
Relative humidity

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

2.2 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*.

2.4 Unpacking

2.4.1 Acceptance inspection

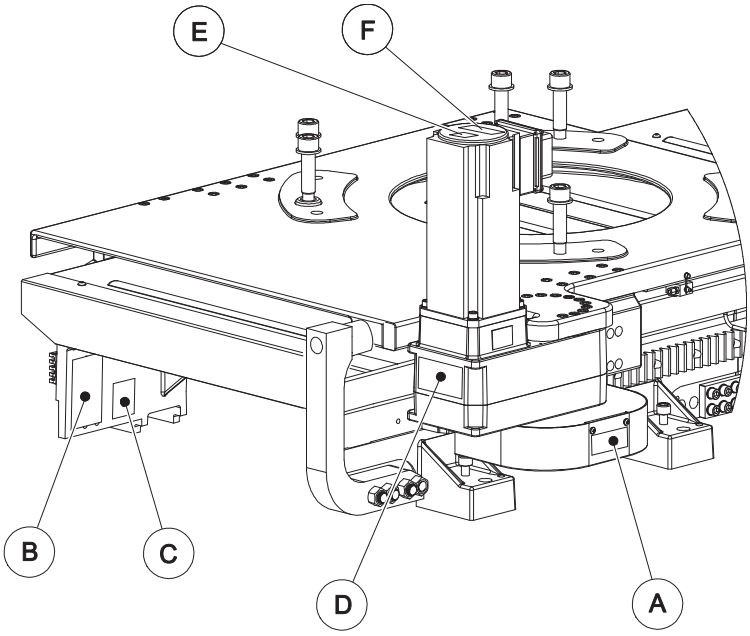
Identification plate

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.



xx1100000695

A	ABB logotype
B	Rating label
C	Calibration label
D	Instruction label
E	Warning sign
F	Warning label

2.4.2 Unpacking

Inspection at delivery

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 in delivery

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

- 1-3 pallets with various number of track motion sections, depending on the total track motion length. See *Number of sections on pallets on page 47*.
- Robot cabinet
- Lincoln Central Lubrication system: P203-2XN-1K6-24-2

Number of sections on pallets

If the complete track motion IRBT 4004/6004/7004 consists of more than 9 sections, the delivery is divided on several pallets. The table below specifies the number of sections on each pallet.

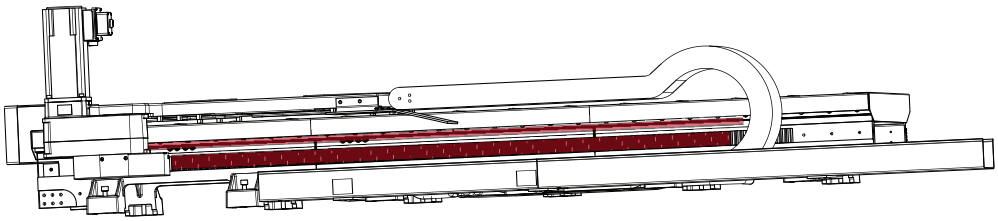
Number of sections for complete track motion	Division (number of sections on each pallet)		
	Single carriage track	Mirrored carriage track	Double carriage track
10	3+7	7+3	5+5
11	4+7	7+4	5+6
12	5+7	7+5	6+6
13	4+9	9+4	-
14	5+9	9+5	7+7
15	6+9	9+6	8+7
16	7+9	9+7	8+8
17	8+9	9+8	9+8
18	6+9+3	3+9+6	9+9
19	8+8+3	3+8+8	9+7+3
20	7+9+4	4+8+8	3+7+7+3
21	8+9+4	4+9+8	3+7+8+3

Continues on next page

2.4.2 Unpacking
Continued

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.



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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.	

2.4.3 Storage

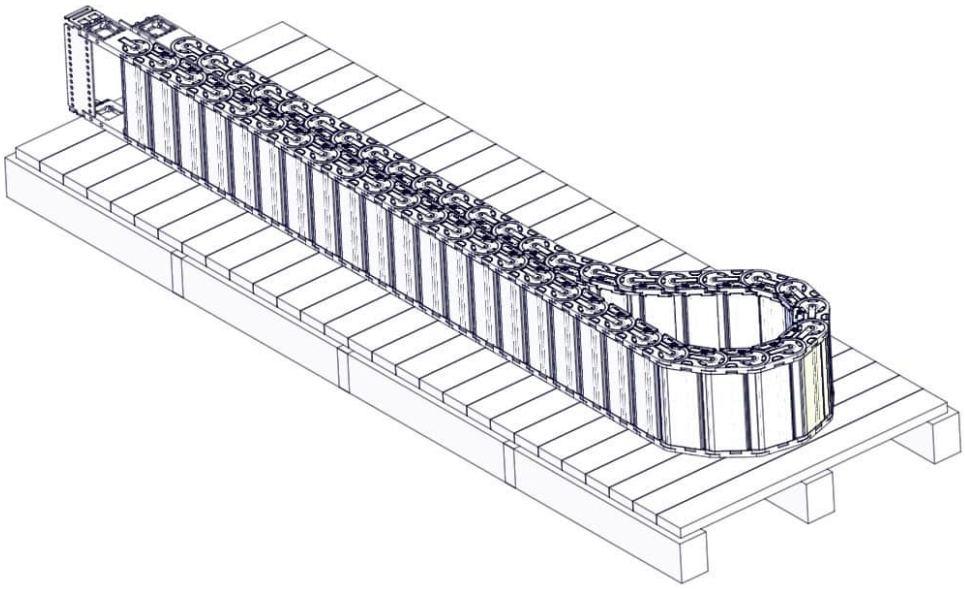
2.4.3.1 Storing the cable chain

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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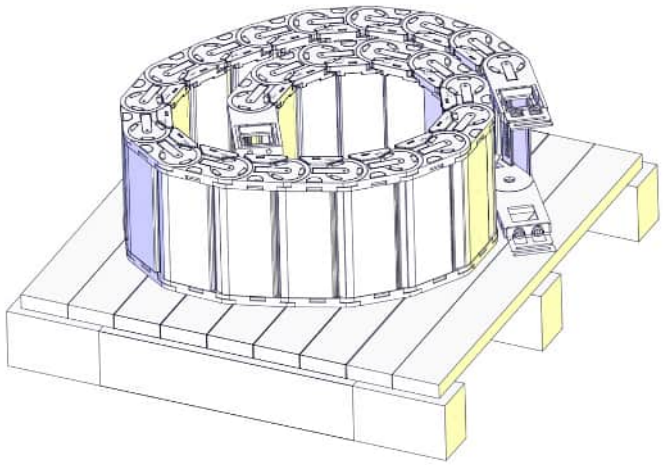
Continues on next page

2.4.3.1 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

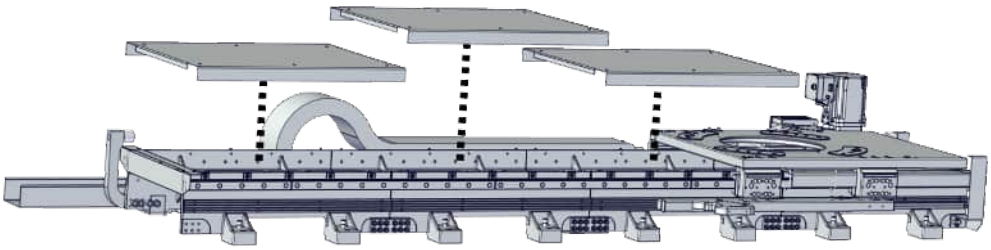
To move the chain from storage to track, see *Lifting and fitting the cable chain Murrplastik on page 104*.

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.



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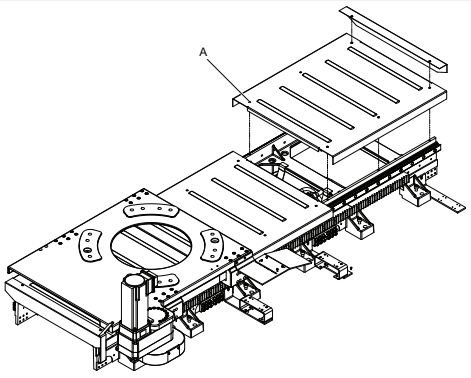
WARNING

Never attempt to lift the Track Motion IRBT 4004/6004/7004 if the carriage is not in the centered position. Any lifting or moving of the track unit will require a realignment check to be performed.

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 91*.

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.

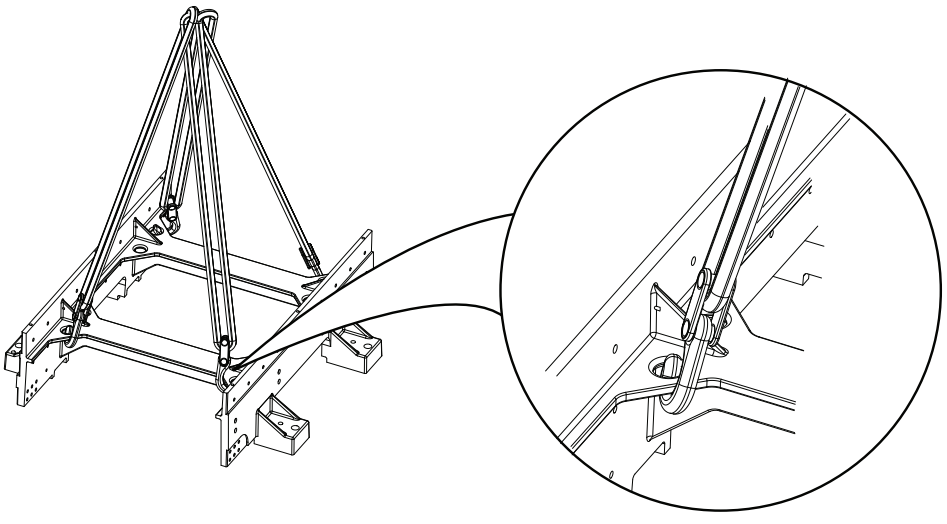
Never lift the track motion IRBT 4004/6004/7004 using a overhead crane without first removing the cover plates.

WARNING

Never attempt to lift the Track Motion IRBT 4004/6004/7004 if the carriage is not in the centered position. Any lifting or moving of the track unit will require a realignment check to be performed.

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 53* and *Lifting weight on page 58*.



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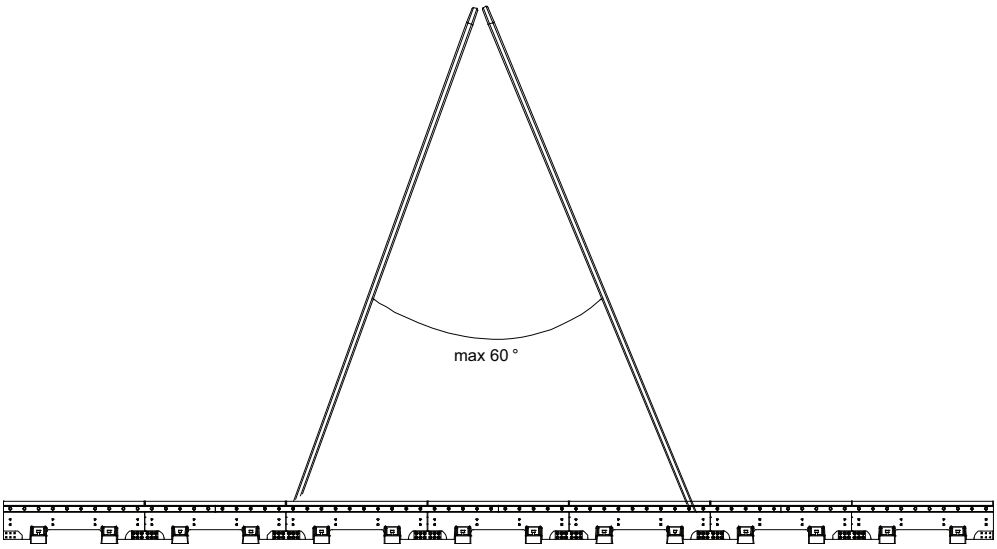
Lifting zones



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WARNING

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

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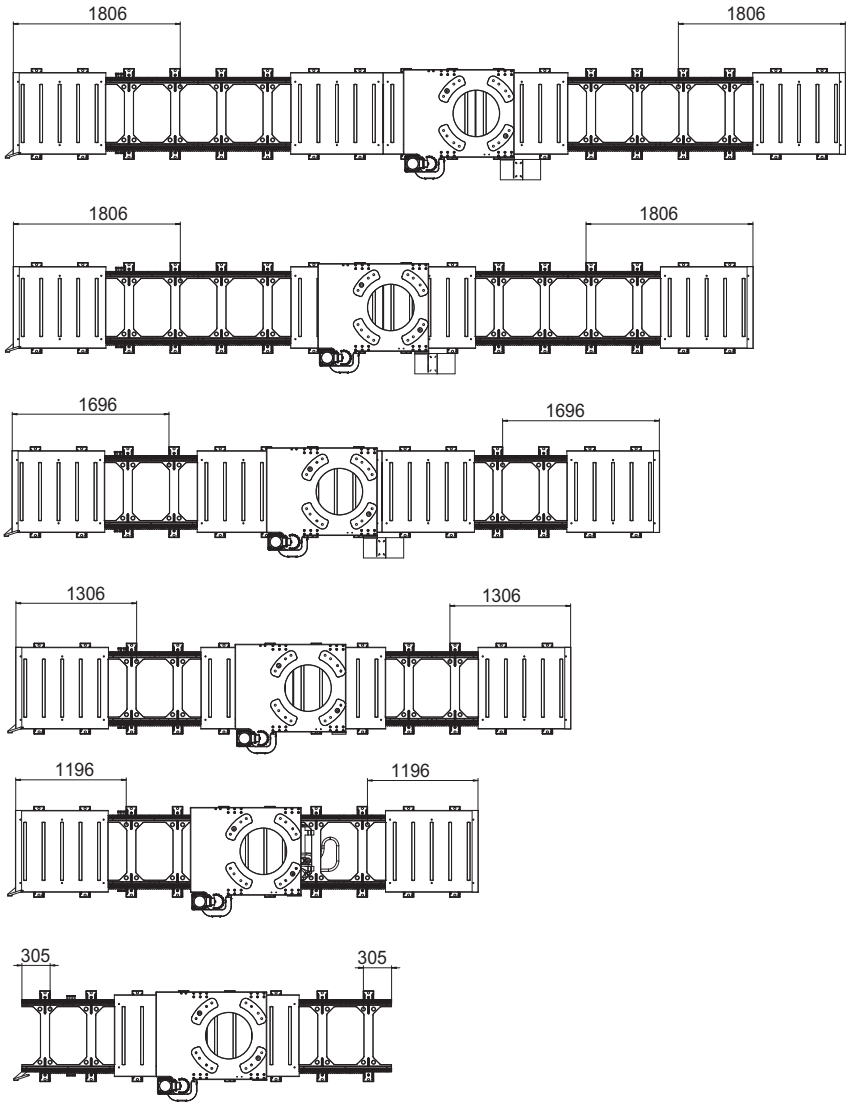
2.4.4.2 Lifting and moving track motion IRBT 4004/6004/7004
Continued

3-9 sections lift

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



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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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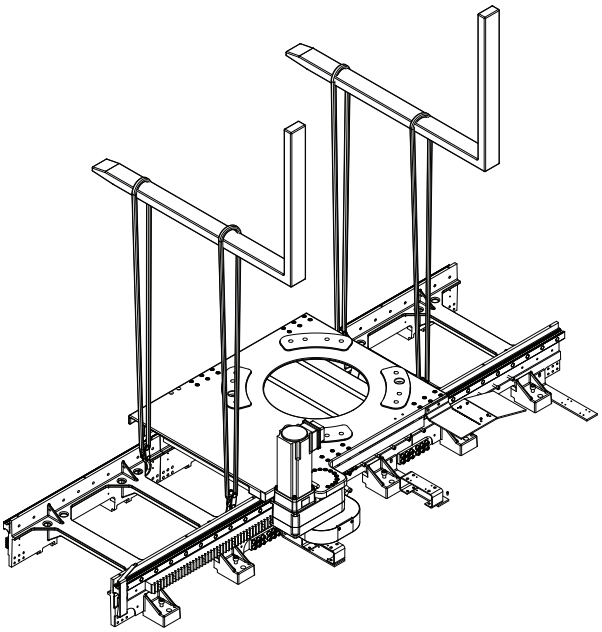
Lifting using fork lift

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



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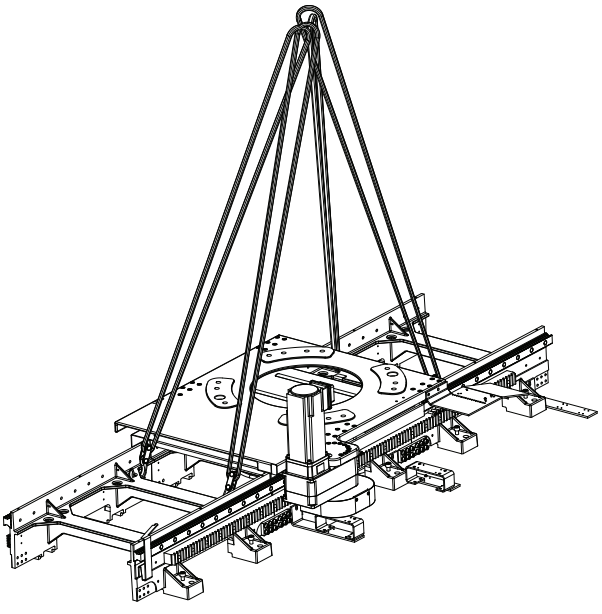
Lifting using an overhead crane

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



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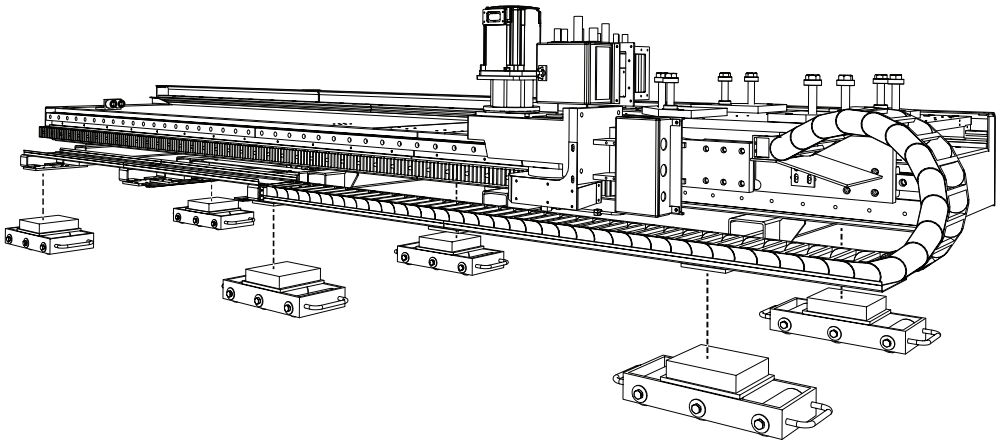
2.4.4.2 Lifting and moving track motion IRBT 4004/6004/7004
Continued

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.



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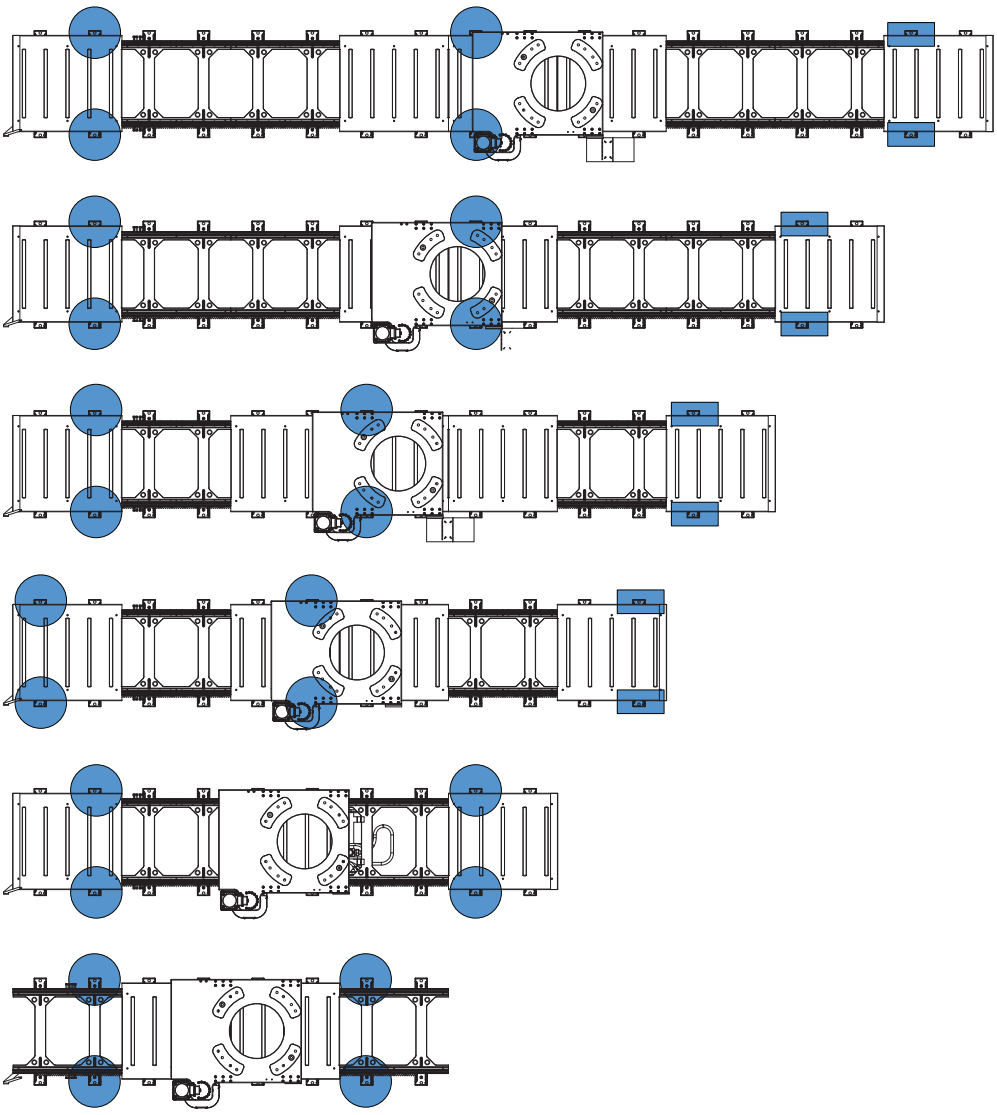
The type of roller dolly and the placement of the two types is shown in the following illustration and table.



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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 46*.

The weights are also listed in *Weight of track with single carriage excluding packaging on page 65* and *Required space for installation of double carriage track (option 1088-2) on page 62*.

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.

2.4.5 Technical data for the track motion

Travel length

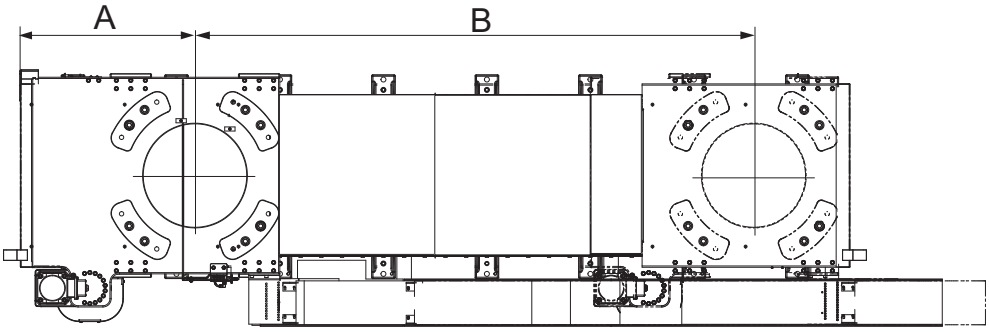
The IRBT track motion is available in 3 different types.

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.



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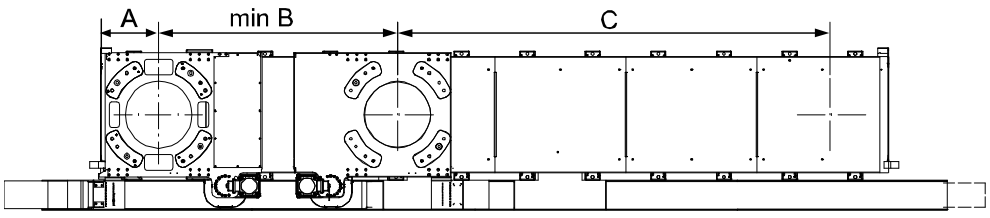
Pos	Description
A	IRBT 4004 L=646 mm IRBT 6004/7004 L=841 mm
B	IRBT 4004 Travel length= 2.9 m IRBT 6004/7004 Travel length=2.7 m

Double carriage

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



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2.4.5 Technical data for the track motion
Continued

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 propably 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 59*.
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 61*.

Continues on next page

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]		Sections (pcs)	Required space for installation (m) [ii iii]
IRBT 4004	IRBT 6004/ 7004	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 59*.
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 61*.

Formula for single carriage track

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

Required space (mm) = 81 + (1000 x N) + (a)

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

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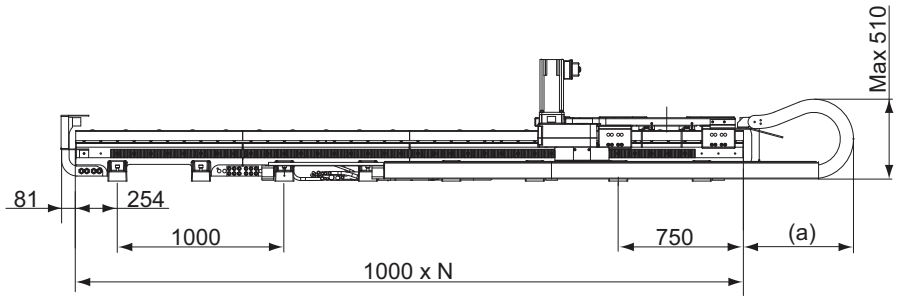
2.4.5 Technical data for the track motion
Continued

For the number (a), see figure.



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(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 propably 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

Travel length (m) [i]		Sections (pcs)	Required space for installation (m) [ii iii]
18.7	18.3	21	22.800

i The travel length is illustrated in *Travel length on page 59*.
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 63*.

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	8.300
4.7	4.3	7	9.300
5.7	5.3	8	10.300
6.7	6.3	9	11.300
7.7	7.3	10	12.300
8.7	8.3	11	13.300
9.7	9.3	12	14.300
10.7	10.3	13	15.300
11.7	11.3	14	16.300
12.7	12.3	15	17.300
13.7	13.3	16	18.300
14.7	14.3	17	19.300
15.7	15.3	18	20.300
16.7	16.3	19	21.300
17.7	17.3	20	22.300
18.7	18.3	21	23.300

i The travel length is illustrated in *Travel length on page 59*.
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 63*.

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:

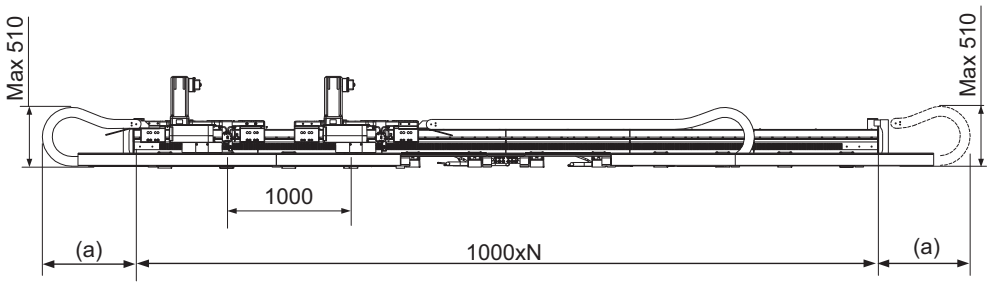
Required space (mm) = a + (1000xN) + a

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

Continues on next page

2.4.5 Technical data for the track motion
Continued

For the number (a), see figure.



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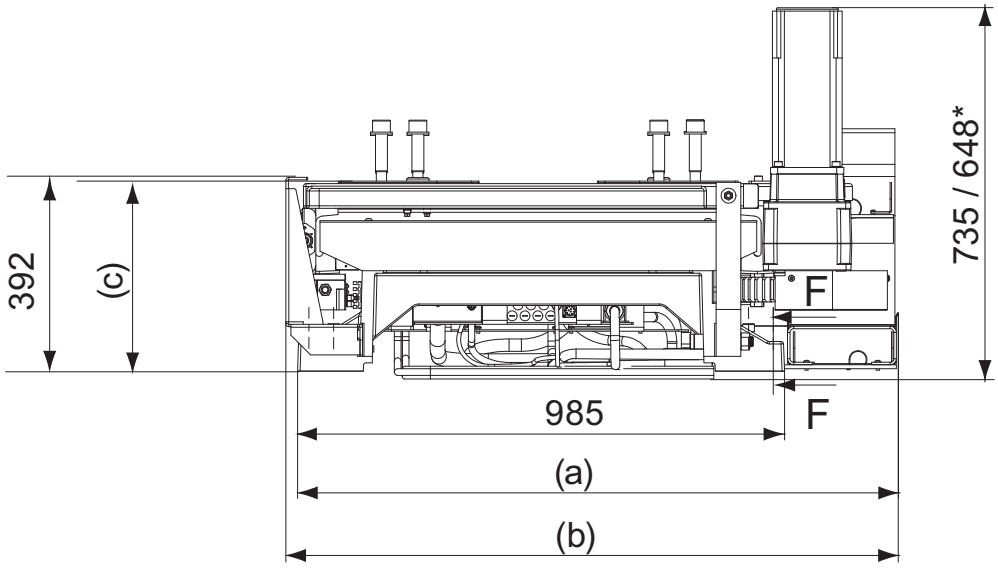
(a)	Cable chain Brevetti: max. 900 mm
	Cable chain Murrplastik: max. 1150 mm

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 therefor: 1150 + (1000x6) + 1150 = 8300 mm.

Dimensions



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*	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
(c)	For IRBT 6004/7004: 384.5 mm For IRBT 4004: 374.5 mm

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Mechanical stops

There are no adjustable mechanical stops on the IRBT. This needs to be considered while doing a risk assessment of the complete installation, the track can however be order in different lengths.

Weight of track with carriage excluding packaging

Weight of track with single carriage excluding packaging

Travel length (m) [i]		Weight (kg)	
IRBT 4004	**IRBT 6004/ 7004**	**IRBT 4004**	**IRBT 6004/ 7004**
1.9	1.7	1050	1079
2.9	2.7	1259	1288
3.9	3.7	1468	1497
4.9	4.7	1677	1706
5.9	5.7	1886	1915
6.9	6.7	2095	2124
7.9	7.7	2304	2333
8.9	8.7	2513	2542
9.9	9.7	2722	2751
10.9	10.7	2931	2960
11.9	11.7	3140	3169
12.9	12.7	3349	3378
13.9	13.7	3558	3587
14.9	14.7	3767	3796
15.9	15.7	3976	4005
16.9	16.7	4185	4214
17.9	17.7	4394	4423
18.9	18.7	4603	4632
19.9	19.7	4812	4841

[i] The travel length is illustrated in *Travel length on page 59*.

Weight of track with double carriage excluding packaging

Travel length (m) [i]		Weight (kg)	
IRBT 4004	**IRBT 6004/ 7004**	**IRBT 4004**	**IRBT 6004/7004**
3.7	3.3	2104	2215
4.7	4.3	2313	2424
5.7	5.3	2522	2633
6.7	6.3	2731	2842
7.7	7.3	2940	3051
8.7	8.3	3149	3260
9.7	9.3	3358	3469

Continues on next page

2.4.5 Technical data for the track motion
Continued

Travel length (m) [i]		Weight (kg)	
10.7	10.3	3567	3678
11.7	11.3	3776	3887
12.7	12.3	3985	4096
13.7	13.3	4194	4305
14.7	14.3	4403	4514
15.7	15.3	4612	4723
16.7	16.3	4821	4932
17.7	17.3	5030	5141
18.7	18.3	5239	5350

[i] The travel length is illustrated in *Travel length on page 59*.

Weight of pedestal

Robot pedestal	IRBT 4004	IRBT 6004/ IRBT 7004
Height: 250 mm	238 kg	230 kg
Height: 500 mm [i]	288 kg	330 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

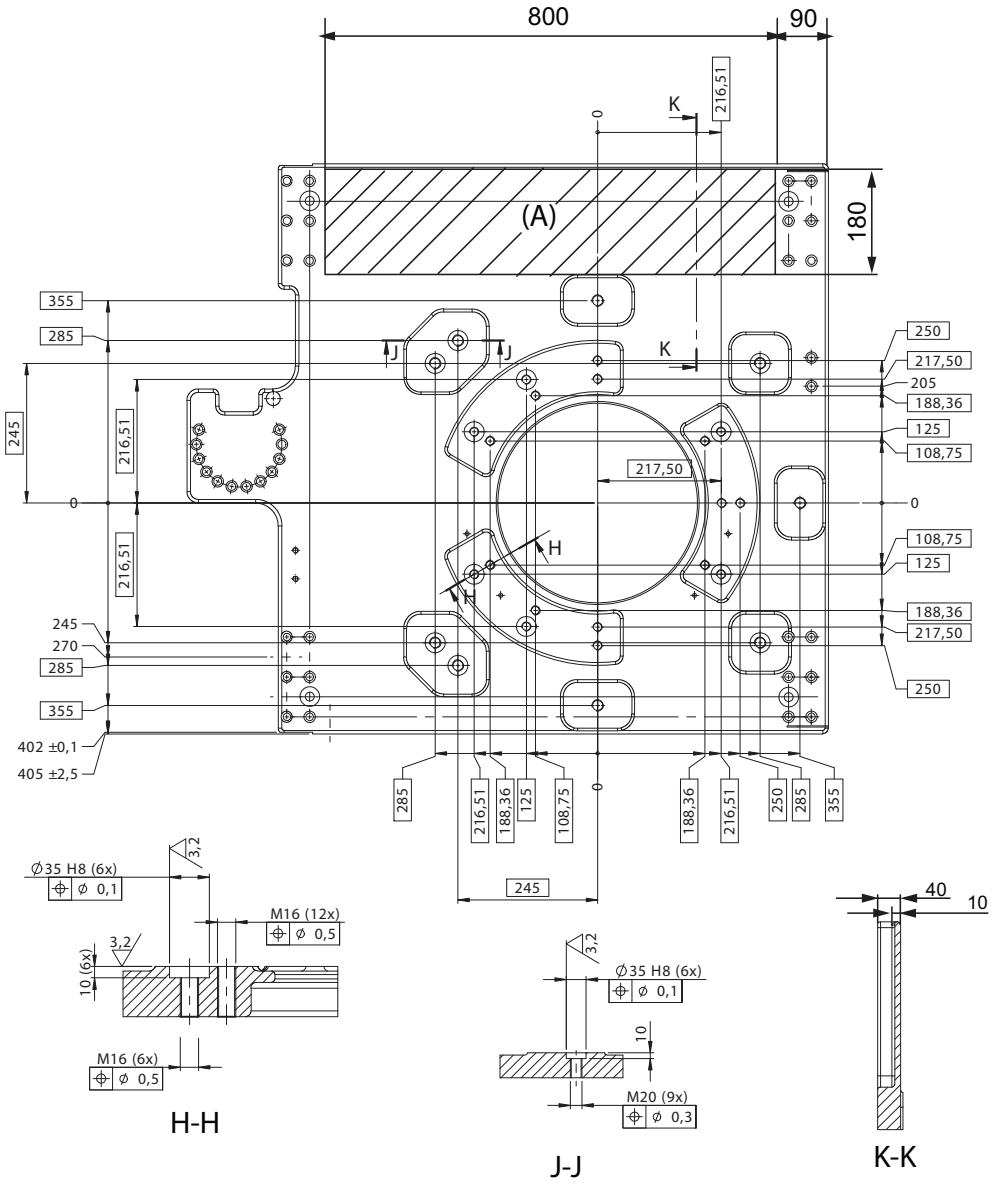
Power consumption at max load

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 *Operating manual - RobotStudio*.

2.4.6 Measures of the carriage table

IRBT 4004

Use the hole configuration for the manipulator when designing fixures 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.

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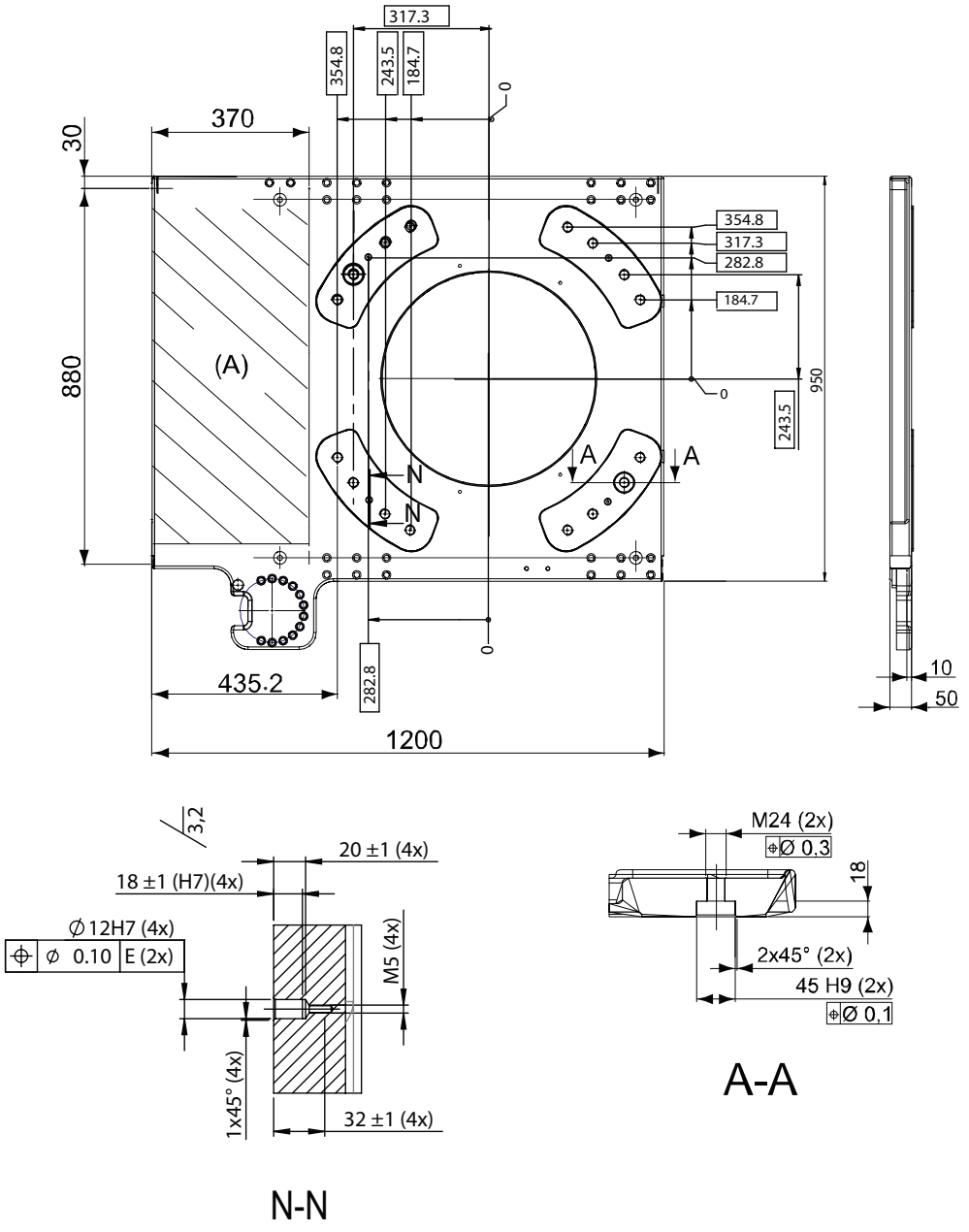
2.4.6 Measures of the carriage table
Continued

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.

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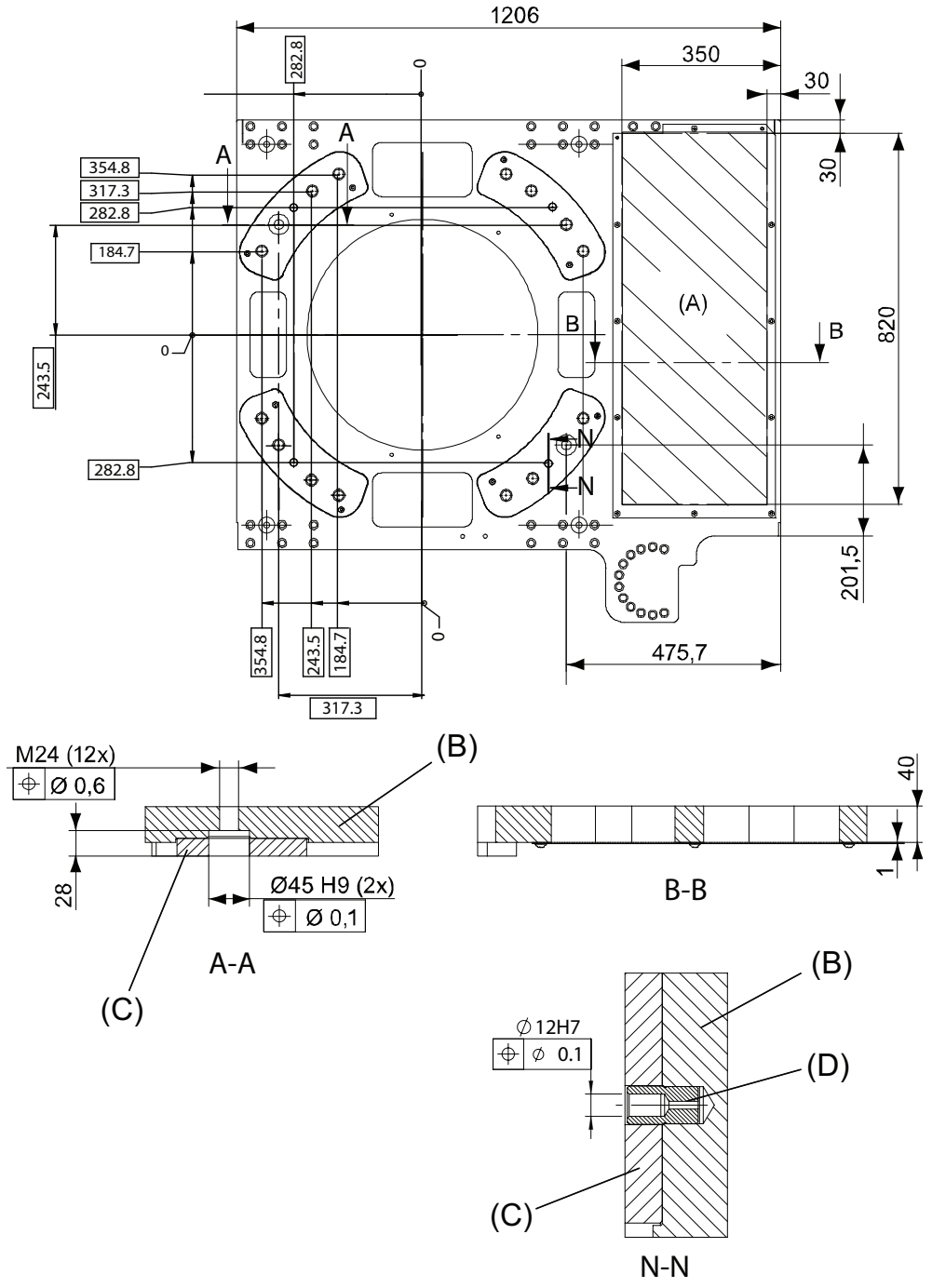
Carriage plate

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.



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

Continues on next page

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)

2.4.7 The unit is sensitive to ESD

Description

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

Safe handling

Use one of the following alternatives:

- Use a wrist strap.

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

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

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

2.5 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 + 50 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 43*.

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:

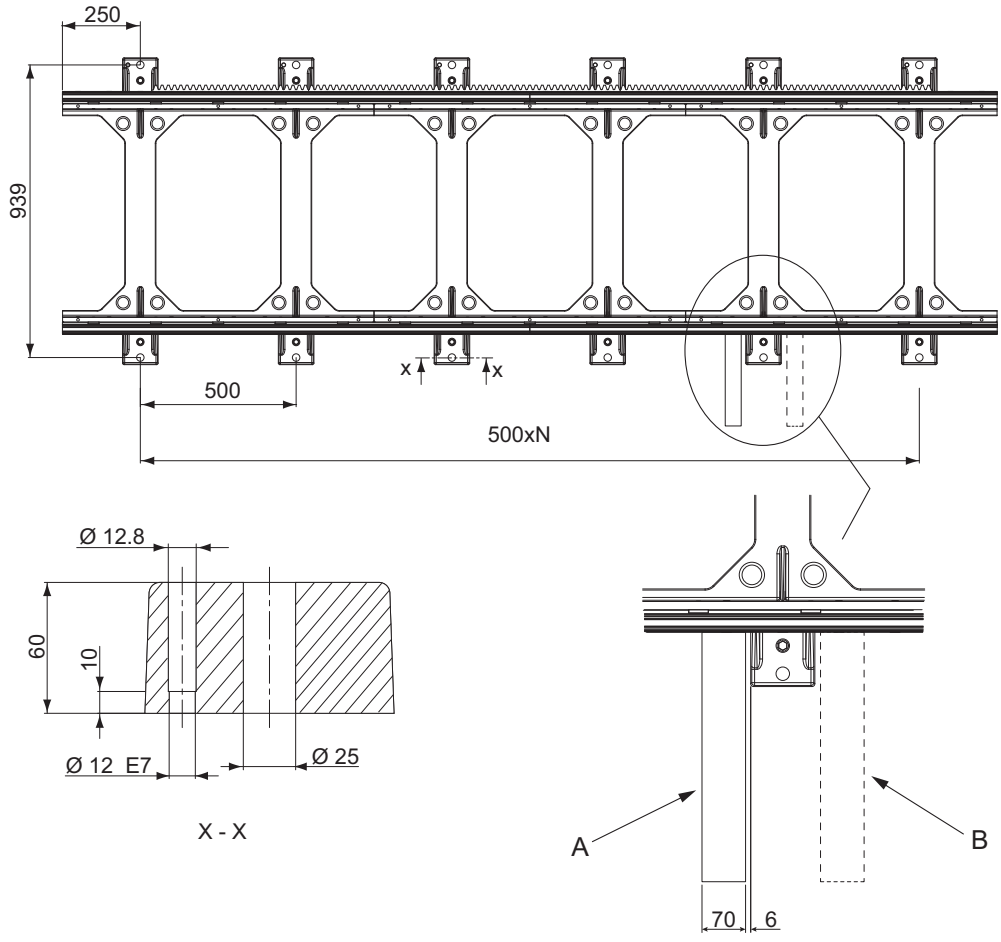
- Are suitable for the foundation.
- Can bear the dynamic loads.
- Are able to bear the combined dynamic loads that can occur when the manipulator and carriage move.
- Fit in the holes in the stand, Ø 25 mm.

2.5.3 Hole configuration

Dimension

Note

The cable tray brackets will be installed on the track motion right next to and inline with the the ground plates. If installing mounting plates beneath the ground plates (optional), make sure that the mounting plate bolt heads will not interfere with the cable tray brackets to be installed.



xx1800001379

A	Cable tray bracket, position for standard (non-mirrored) track motion
B	Cable tray bracket, position for mirrored track motion

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

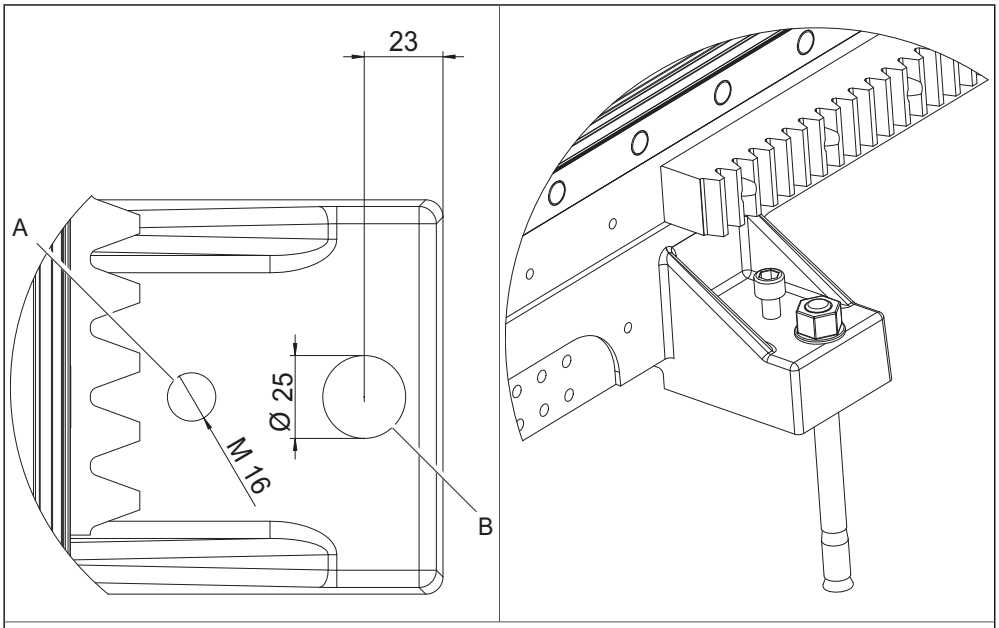
Travel length IRBT 4004 / IRBT 6006 and IRBT 7004	Total length of the stand	Quantity N
1.9 / 1.7 m	3 m	5
2.9 / 2.7 m	4 m	7
3.9 / 3.7 m	5 m	9

Continues on next page

Travel length IRBT 4004 / IRBT 6006 and IRBT 7004	Total length of the stand	Quantity N
etc.		

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.



A Holes for leveling / leveling screw
B Holes for expansion-shell bolts with a diameter of M20 / chemical bolt

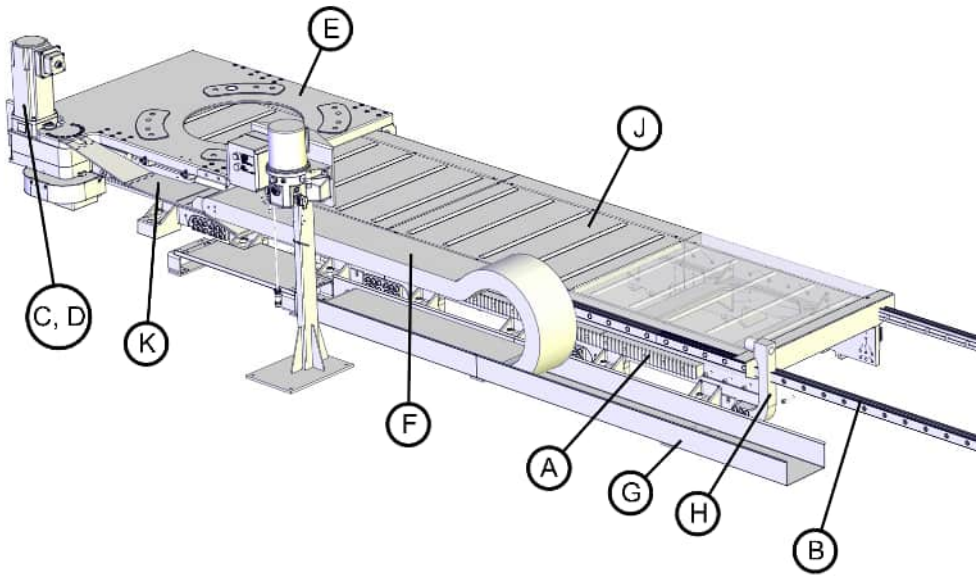
Screws for fastening manipulator to base

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 42*.

2.5.4 Track motion IRBT 4004/6004/7004 overview

Track motion content



xx1100000714

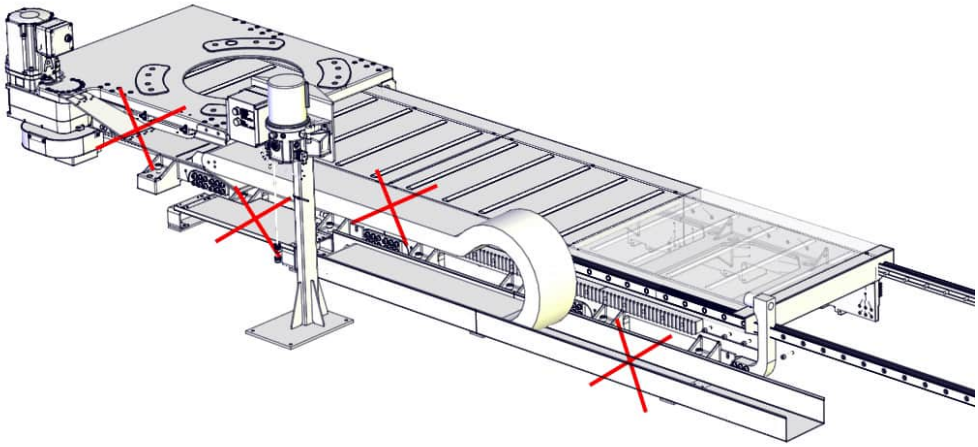
A	Gear rack
B	Linear guides
C	Motor
D	Gearbox
E	Carriage
F	Cable chain
G	Cable tray
H	Mechanical stop
J	Protecting plate
K	Attachment plate for cabling

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

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

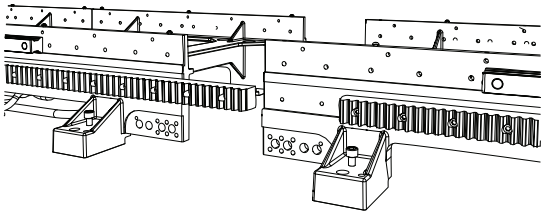
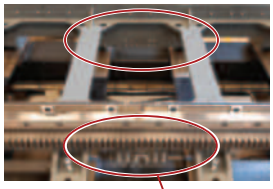
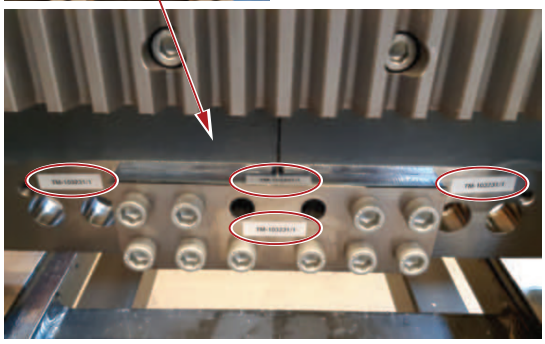
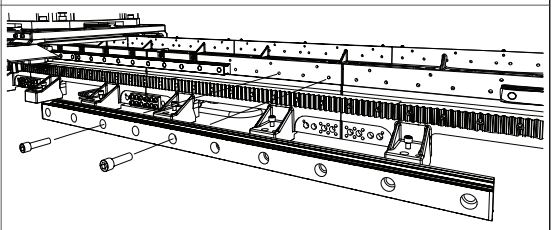
Preparation of assembling the track motion

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 with single carriage excluding packaging on page 65* and *Required space for installation of double carriage track (option 1088-2) on page 62*. 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 with single carriage excluding packaging on page 65* and *Required space for installation of double carriage track (option 1088-2) on page 62*.
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 • 24 V DC to pin f.5 • 0 V DC to pin f.9 With option Robot Servo Gun • 24 V DC to pin f.6 • 0 V DC to pin f.10
4	Press the brake release button on the motor to move the carriage.	
5	Continue the assembly as described in section *Assembling the track motion on page 79*.	

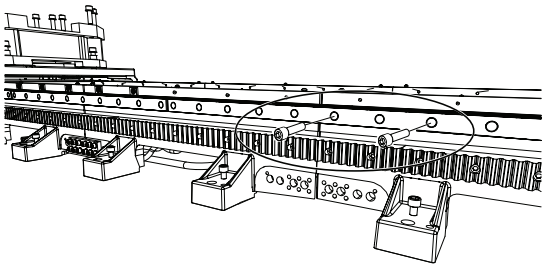
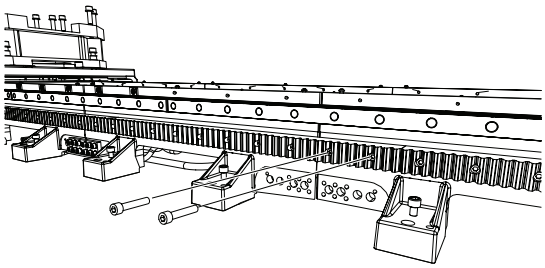
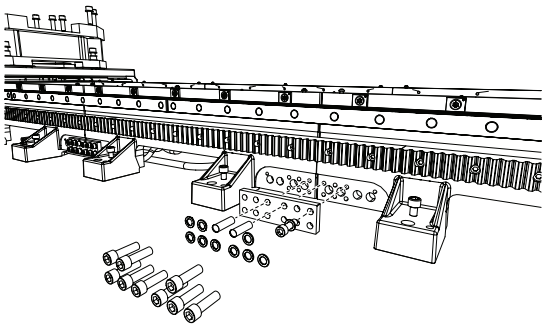
Continues on next page

Assembling the track motion

	Action	Note
1	Align the two sections roughly, and remove the covers. **Note** Make sure that correct section ends are assembled together by checking the labeling.	 xx1400000826   xx1900001760
2	Push the two sections together saving a gap of about 10-12 mm between the two sections.	
3	Assemble a guide rail to one section using two hex socket head cap screws M12x40. Repeat on the opposite side of the track with the second guide rail. Set the screw joint loosely. **CAUTION** Make sure the guide rails are assembled to the correct position on the track by checking the labeling.	 xx1400000815

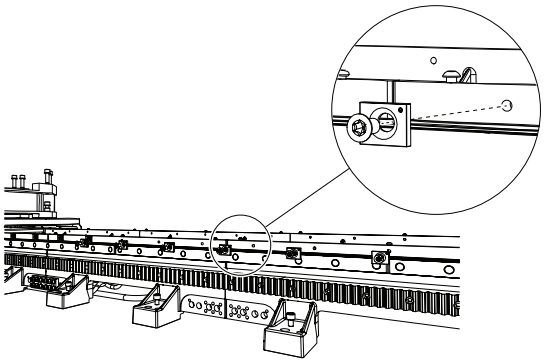
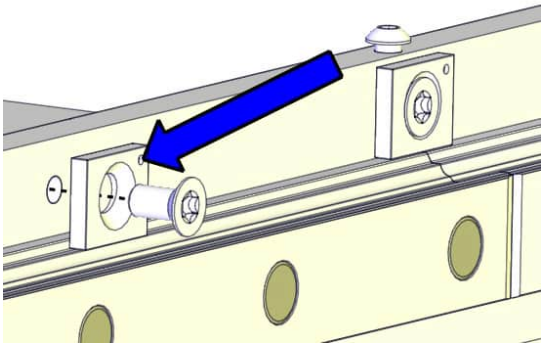
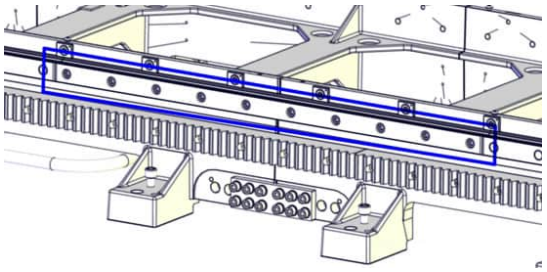
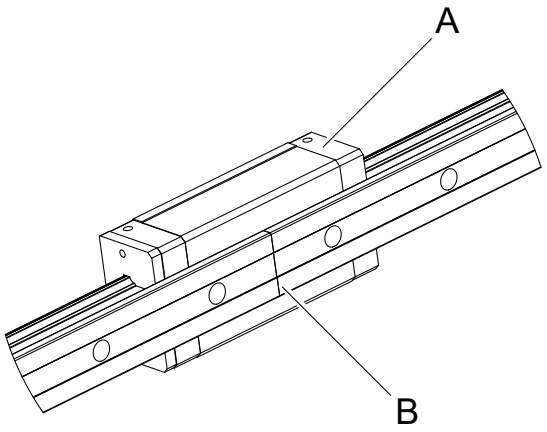
Continues on next page

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

	Action	Note
4	Push the sections tightly together, and secure the guide rail to the other section using two hex socket head cap screws M12x40. Set the screw joint loosely. Repeat on the opposite side of the track with the second guide rail. **Note** If the sections are not level with each other, the guide rails will not fit to the other section. Use the leveling screws at the ground plates to adjust the horizontal plane.	 xx1800001273
5	Assemble the gear racks using two hex socket head cap screws M10x50. Set the screw joint loosely.	 xx1400000827
6	Assemble the rest of the hex socket head cap screws M12x40 in each guide rail. Set the screw joint loosely.	
7	Assemble the joint brackets on both sides of the track, using two guide pins, and ten hex socket head cap screws M12x40. Set the screw joint loosely. **Note** In order to reach the same acceptable accuracy as in the manufacturing process, the joint bracket is drilled with a 14 mm hole and assembled using split pins. Make sure to turn the bracket according to the marking. Reassemble the pins, using a hammer. (Joint brackets delivered prior to 2017-11-03 have drilled holes with diameter 16 mm.)	 xx1400000817

Continues on next page

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

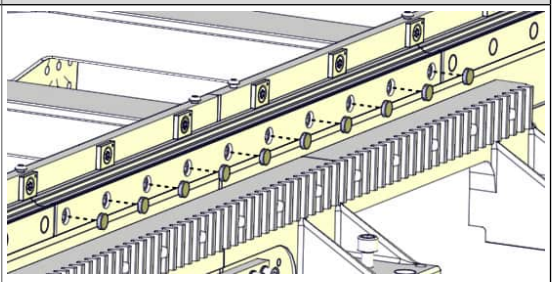
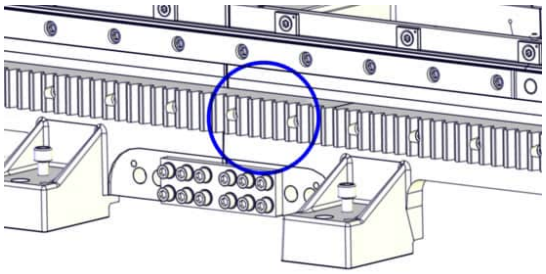
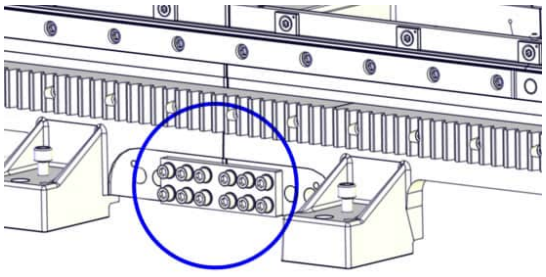
	Action	Note
8	Assemble the six locking washers with torx screws M10x20, on both sides of the track. Make sure the mark on the washer is positioned in the upper right corner, see figure. Tightening torque: 45 Nm.	 xx1400000816  xx1600000972
9	Tighten the hex socket head cap screws M12x40 for the linear guide rails. Tightening torque: 120 Nm. **Valid for linear guides from Bosch-Rexroth:** Check the joint between the linear guides by gliding a ball element over the joint. If the ball element jams, loosen the rail screws and adjust until the joint is completely level. Re-tighten the screws. **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. Loosen the rail screws if necessary and adjust until the joint is completely level. Re-tighten the screws.	 xx1800001404  xx1100000766 A Ball element B Section joint

Continues on next page

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

	Action	Note
10	Continue the assembly as described in section *Fit the screw covers and screw joints on page 82*. **Note** Do not remove the plastic holder of the bearing until the bearing as been slid onto the guide rail.	

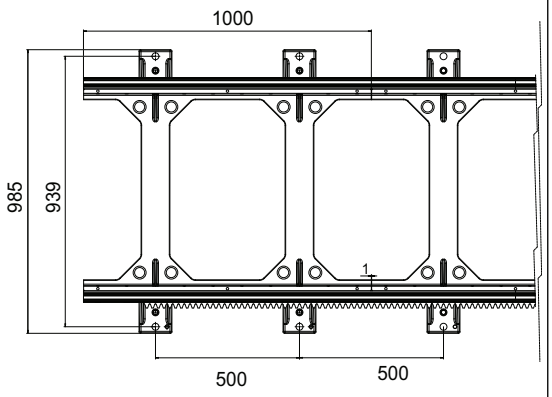
Fit the screw covers and screw joints

	Action	Note
11	Fit the screw covers in both linear guides. **CAUTION** Align the covers. If covers are mounted with a gap, dirt may gather in the hole and may damage the linear bearing, which leads to shorter lifetime.	 xx1600000974
12	Tighten the gear rack screw joints. Tightening torque: 70 Nm.	 xx1800001274
13	Tighten all joint bracket screw joints. Tightening torque: 120 Nm.	 xx1800001275

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.	 xx1100000722
2	Use the leveling screws to raise the track.	
3	Drill all holes according to the screw manufactures recommendation for the specific foundation.	
4	Mount shims to fill up the gap between the foot and the floor.	**Note** 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 84*.

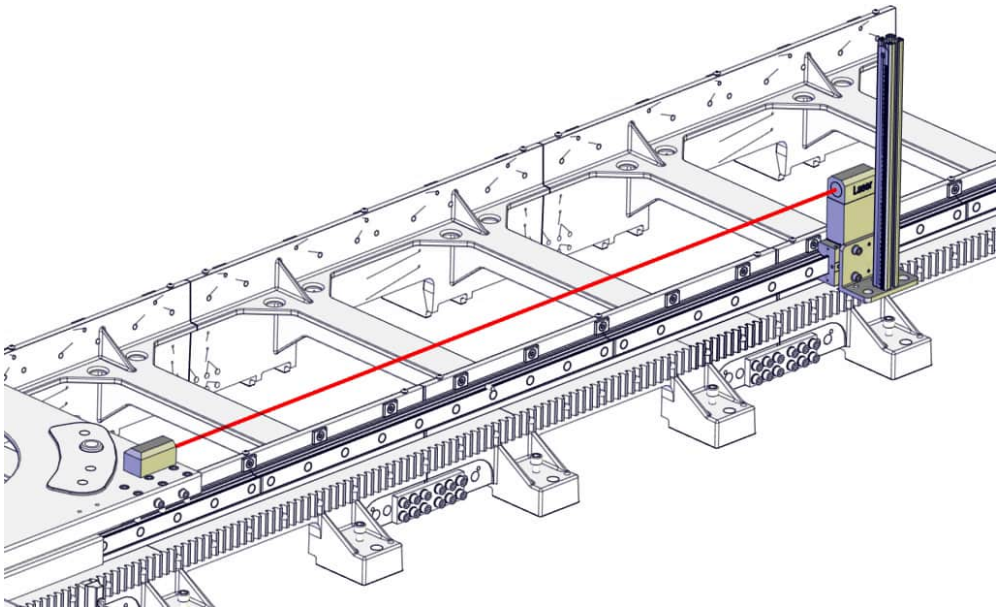
2.5.7 Geometric alignment of track motion IRBT 4004/6004/7004

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. A laser-level system is recommended for the alignment of the track system and can be rented at an industrial equipment company. If renting equipment is not a possibility, ABB refers to these two examples of equipment combinations to be used as leveling systems:

1. Acoem Fixturlaser NXA Pro.
2. DEWALT DW096PK 26X Automatic Optical Level Kit and a stainless-steel ruler with an accuracy of 0.1 mm with 5R rigidness or more.

Run the laser level along the linear guide to verify its alignment in x and y direction. When one side of the track is aligned, move the laser level to the opposite linear guide and redo the alignment on that side also.



xx1800001283

Aligning directions

Laser align the track in following directions:

- *Alignment in Y direction on page 85*
- *Alignment in X direction on page 86*
- *Alignment in Z direction on page 87*

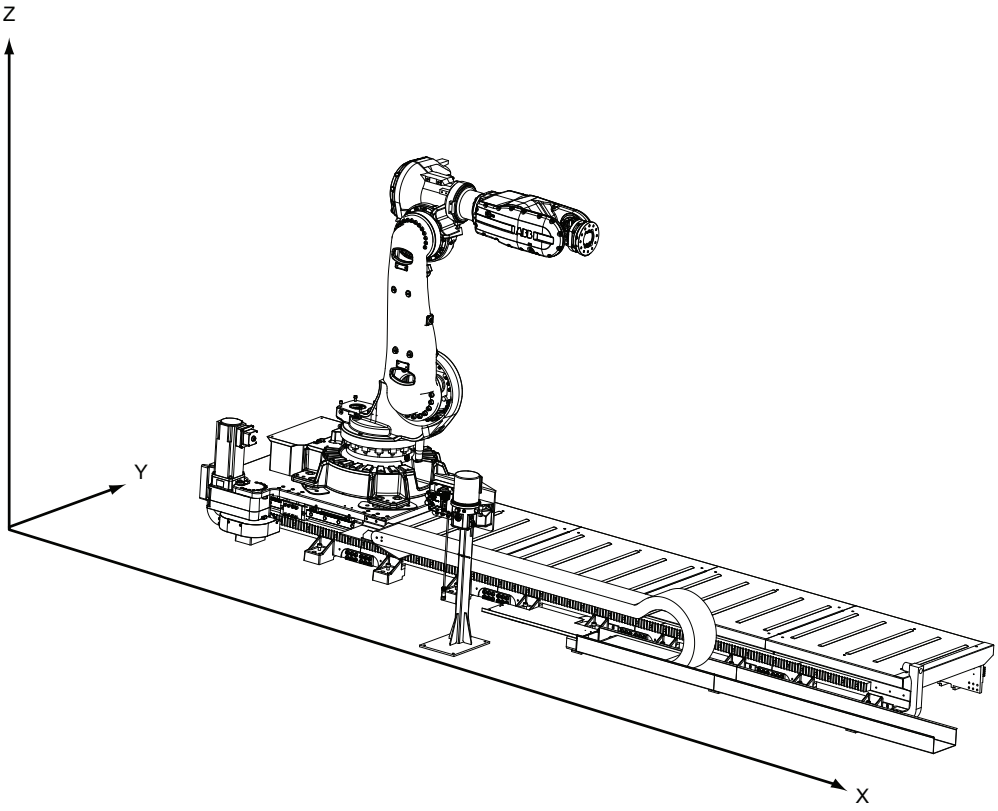
Required equipment

Equipment	Art. no.	Note
Laser level	-	

Continues on next page

Track alignment in different directions

Directions



xx1100000723

Note

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

Alignment in Y direction

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

The track should be laser aligned between each section.

Measure the transitions between the guiderail. The offset in Y-direction must correspond to a tolerance +/- 0.1 mm.

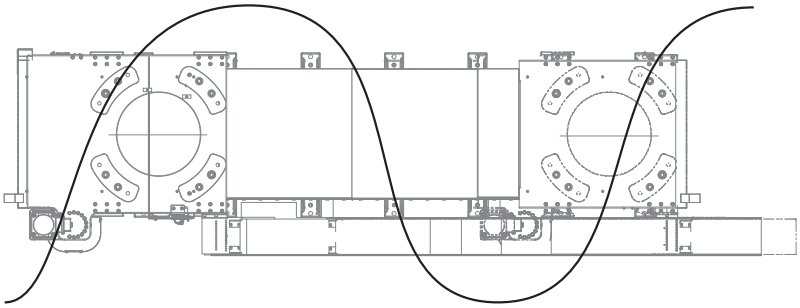
The distance between the guiderail should not be greater than 0,05 mm.

Note

The alignment of the track motion along the Y-axis is crucial for the service life of the linear bearings.

Continues on next page

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



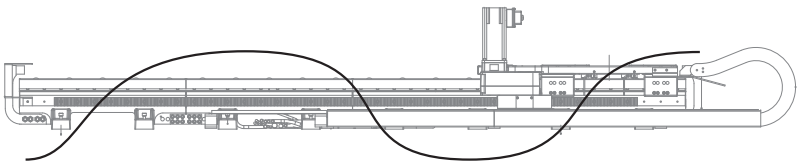
xx1300000799

Alignment in X direction

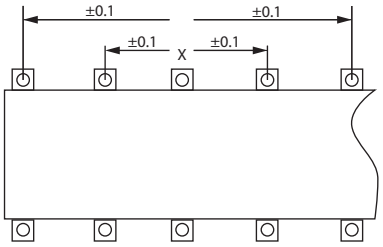
The figure shows the possible variation along the X-axis.

The track should be laser aligned to within ± 0.1 mm from the origin, according to the following instruction.

Use shims to align in X direction, if required. See *Shimming the track on page 88*.



xx1300000800

	Action	Note
1	Measure the track position along the X-axis. 1 Start at the third foot from the edge of the track (marked with an X). 2 Measure the tolerance to four different section's feet, according to the figure, two in each direction (0.5 m between the feet). 3 All measuring values has to be inside the tolerance, ± 0.1 mm. 4 If required, use shims to align in X direction. See *Shimming the track on page 88*. 5 Continue the measuring by moving the start point one section at a time, along the track, measuring two sections in both directions. 6 Make sure that the tolerances are met in each measure.	 xx1800002287

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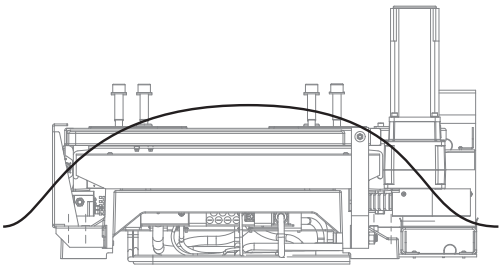
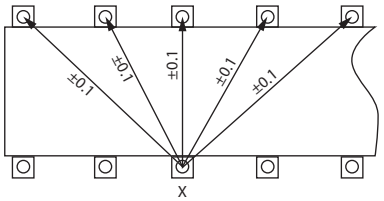
Alignment in Z direction

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

The track should be laser aligned to within ± 0.1 mm from the origin, according to the following instruction.



xx1300000801

	Action	Note
1	Measure the track position along the Z-axis. 1 Start at the third foot from the edge of the track (marked with an X). 2 Measure the tolerances across the track to five different section's feet, according to the figure. 3 All measuring values has to be inside the tolerance ± 0.1 mm. 4 Continue the measuring by moving the start point one section at a time, along the track, measuring the sections according to the figure. 5 Make sure that the tolerances are met in each measure.	 xx1800002288

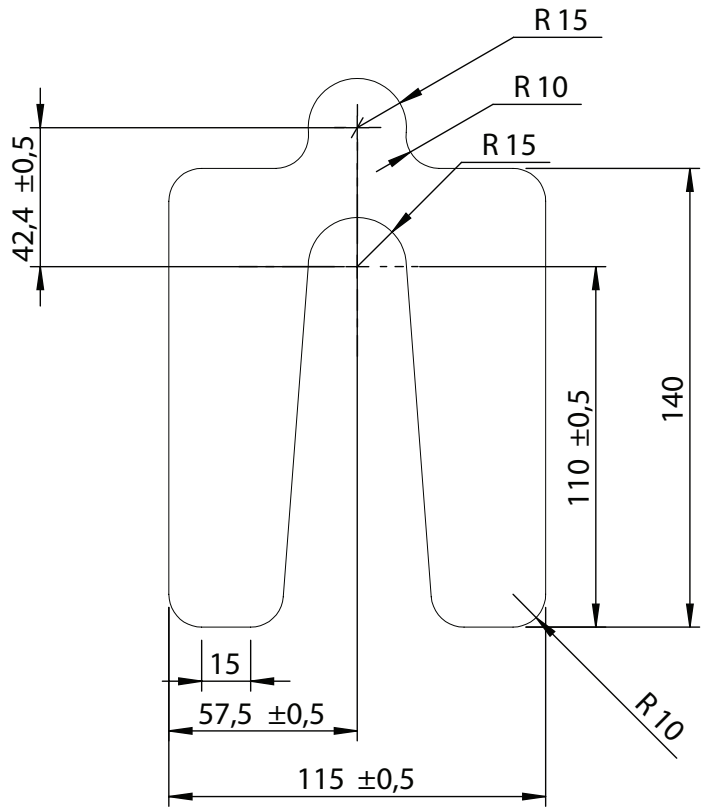
Continues on next page

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

Shimming the track

Dimension drawing for shims

Required dimensions for the shims used for levelling the track are shown in the figure. Thickness: 0.025 mm, 0.05 mm, 0.1 mm, 0.3 mm, 0.7 mm, 1 mm, 3 mm or 7 mm.



xx1100000709

The IRBT 4004/6004/7004 is dimensioned to distribute the forces along its total foot area.

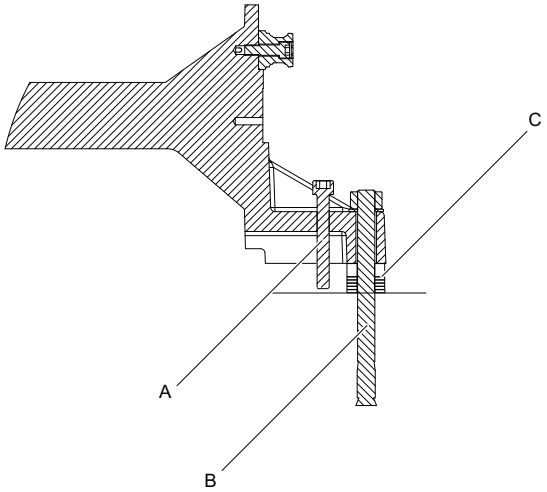
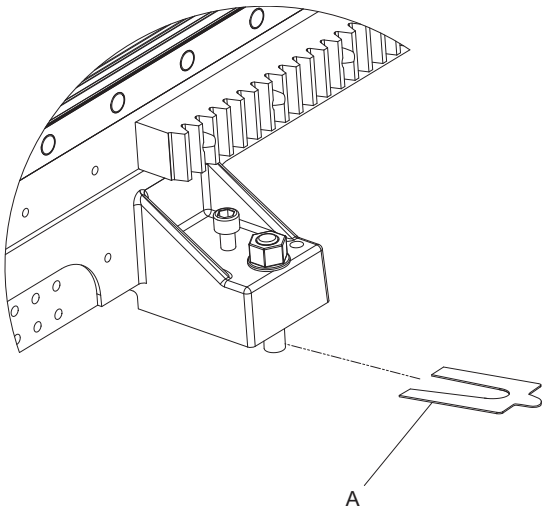
WARNING

The shims used for levelling must be manufactured according to the shim dimensions given in the figure, otherwise warranty can be voided. Incorrectly dimensioned shims can cause vibration and/or movement of the track.

Continues on next page

Levelling the track with shims

Use this procedure to level the track with shims during laser leveling.

	Action	Note
1	Screw the leveling bolts (A) in or out to raise or lower the foot plate in question.	 xx1100000724 A Leveling bolt B Bolt C Shim
2	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). Tighten with tightening torque recommended for the used bolt. Dimensions for the shims are shown in *Dimension drawing for shims on page 88*. **Tip** Always aim to use as few shims as possible underneath the foot area.	 xx1100000708 A Shim
3	Tighten the mounting bolts when the complete track motion is levelled.	

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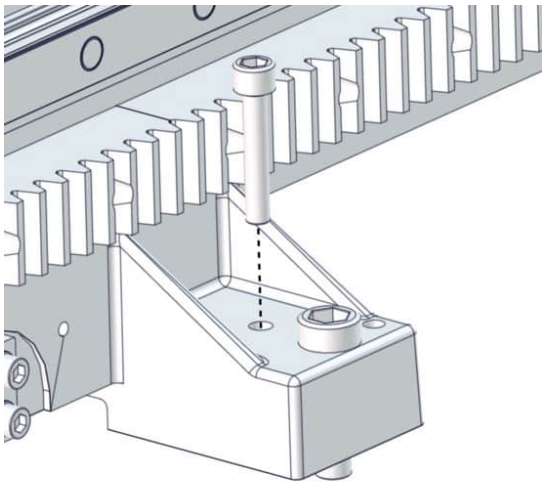
2.5.7 Geometric alignment of track motion IRBT 4004/6004/7004

Continued

	Action	Note
4	Remove the leveling bolt from the foot.	 xx1800001276

2.5.8 Moving the carriage manually

CAUTION

The carriage must never be moved manually if the motor or the drive unit are removed from the track motion.

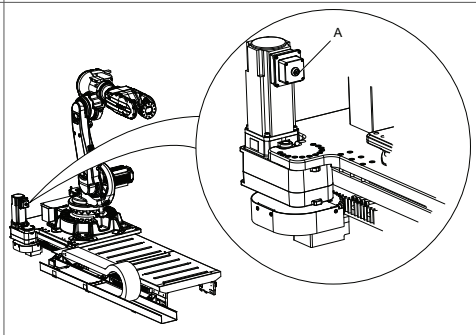
Releasing the brake

The carriage can be moved manually by connecting the power cable to the controller and then 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 91*.

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 189*.

	Action	Note
1	Connect all cables to the controller as described in *The cabling from the controller on page 107*.	
2	Start up the controller as described in *Connectors on Drive Module on page 113*.	
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.

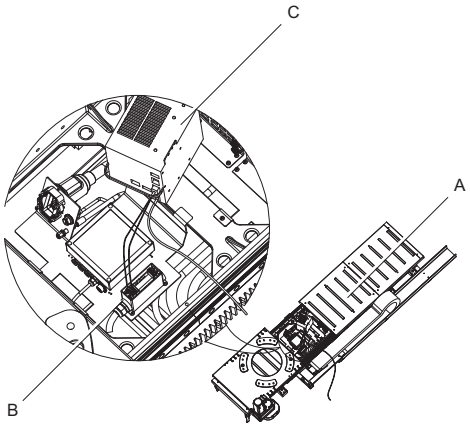
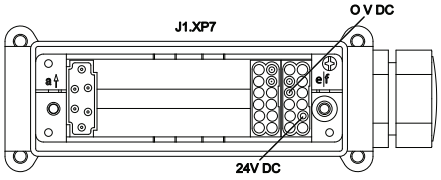
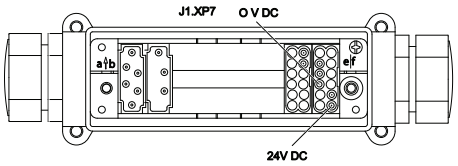
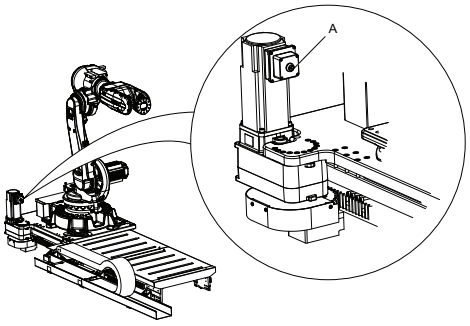
CAUTION

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

Continues on next page

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).	 xx1100000703 A Cover plate B Connector J1.XP7 C External power supply 24V DC
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.	 xx1100000718 *Figure 2.1: Without option Robot Servo Gun*  xx1100000719 *Figure 2.2: With option Robot Servo Gun*
3	Press the brake release button (A) on the motor to move the carriage.	 xx1100000717

2.5.9 Assembling the pedestal (option)

Overview

The pedestal, if ordered, is not mounted to the track motion at delivery.

Install the pedestal to the track motion according to this section.

Required equipment

Equipment	Track motion	Article number	Note
Lifting eye, M16	IRBT 4004	-	3 pcs
Lifting eye, M24	IRBT 6004, IRBT 7004	-	4 pcs
Lifting slings	All	-	Lifting capacity according to *Weight of pedestal on page 93*.

Weight of pedestal

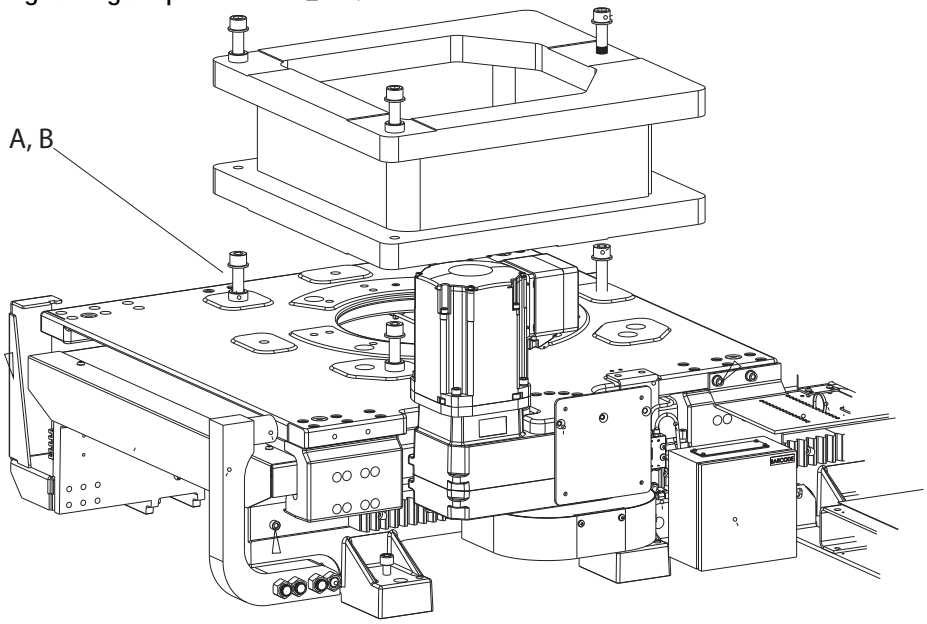
Pedestal	Height	Weight
Pedestal IRBT 4004	250 mm	238 kg
	500 mm	288 kg
Pedestal IRBT 6004, IRBT 7004	250 mm	230 kg
	500 mm	330 kg

Assembling the IRBT 4004 pedestal

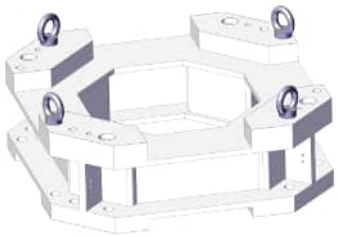
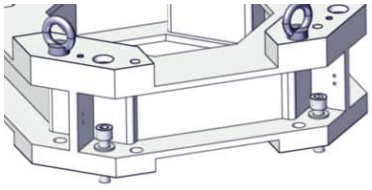
	Action	Note
1	Fit lifting eyes to the pedestal.	Lifting eye, M16 (3 pcs)  xx1900001597
2	Lift the pedestal to the mounting position using lifting slings.	Weight is specified in *Weight of pedestal on page 93*.

Continues on next page

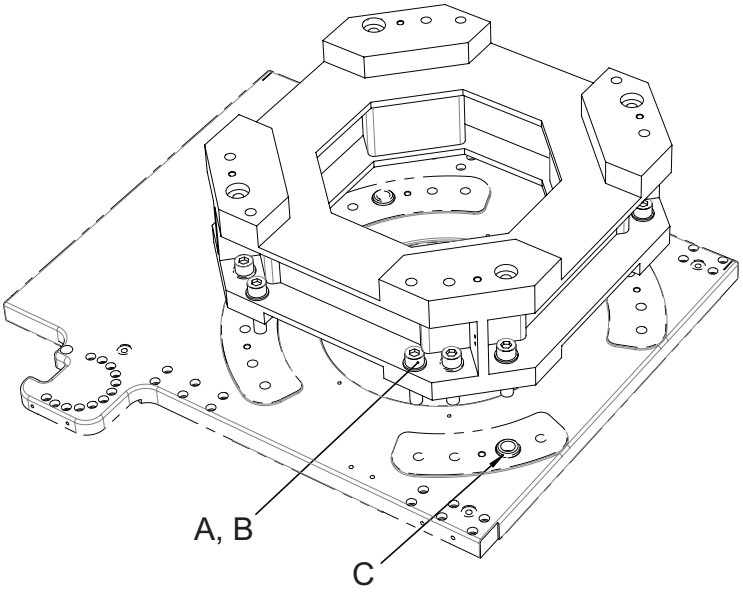
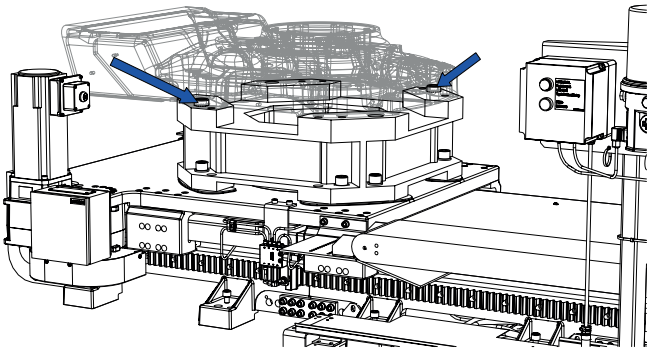
2.5.9 Assembling the pedestal (option)
Continued

	Action	Note
3	Lower the pedestal to the track motion and secure with enclosed attachment screws and washers. Tightening torque: 385 Nm ± 10%.  xx1900001566 A Hex socket head cap screw: 9ADA183-109 (M20x100 Steel 8.8-A2F, 3 pcs) B Plain washer: 9ADA312-11 (21x37x3 Steel - A3F, 3 pcs)	

Assembling the IRBT 6004, IRBT 7004 pedestal

	Action	Note
1	Verify that the guide sleeves are installed in the track motion carriage.	
2	Fit lifting eyes to the pedestal.	Lifting eye, M24 (4 pcs)  xx1900001567
3	Lift the pedestal to the mounting position using lifting slings.	Weight is specified in *Weight of pedestal on page 93*.
4	Insert washers and screws in two of the attachment screw holes, to use as guidance when lowering the pedestal against the mounting interface of the track motion. Hex socket head cap screw: 9ADA183-127 (M24x100 Steel 8.8-A4F) Plain washer: 9ADA312-12 (25x44x4 Steel - A2F)	 xx1900001598

Continues on next page

	Action	Note
5	Lower the pedestal to the track motion and secure with enclosed attachment screws and washers. Tightening torque: 665 Nm ± 10%. **Note** The robot mounting hole pattern is not equal on all sides of the pedestal. Make sure to orient the pedestal as shown in the figure.  xx1900001538 A Hex socket head cap screw: 9ADA183-127 (M24x100 Steel 8.8-A4F, 12 pcs) B Plain washer: 9ADA312-12 (25x44x4 Steel - A2F, 12 pcs) C Guide sleeve, 2 pcs **Note** If the IRB 7600 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 fit the manipulator base according to the illustration.  xx1500002376 Illustration shows IRB 7600 manipulator base and pedestal in an inline position.	

2.5.10 Delivery quick-guide

The delivery quick-guide is a document that can be found on myABB Business Portal, *www.abb.com/myABB*. The document is included with the delivery of the track motion and contains information from *Product manual - IRBT 4004/6004/7004* (*3HAC028506-001*).

2.6 Assembling the cable tray and manipulator

2.6.1 Assembling the manipulator

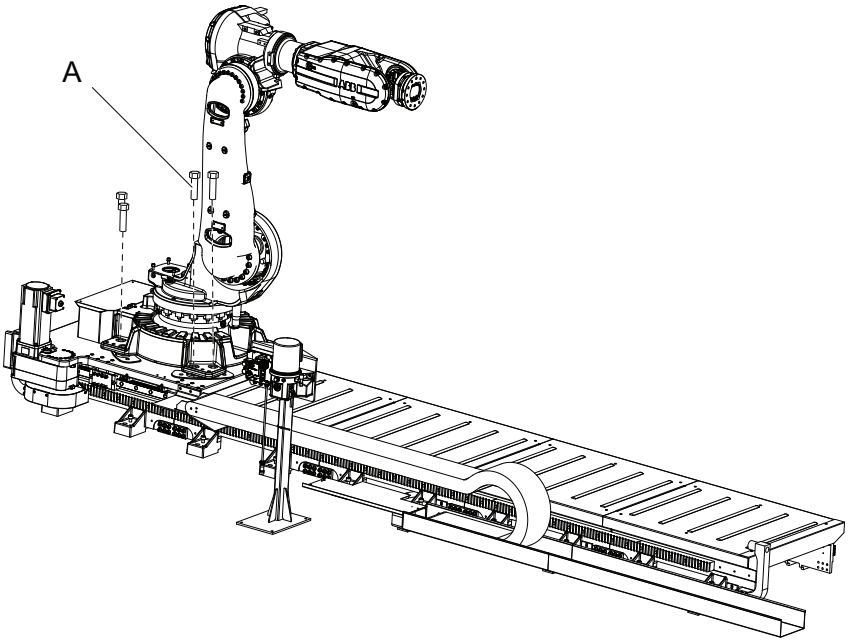
Assembly position

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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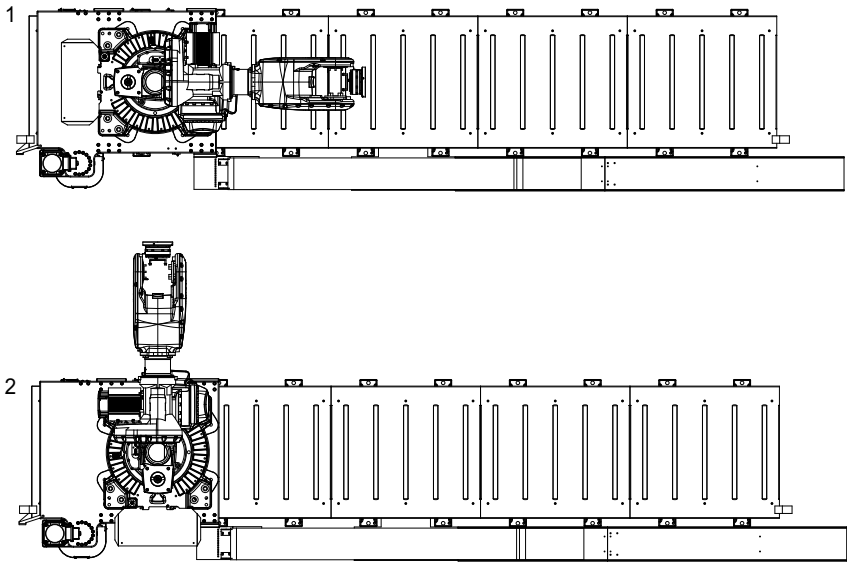
2.6.1 Assembling the manipulator
Continued

Manipulator positions on track motion

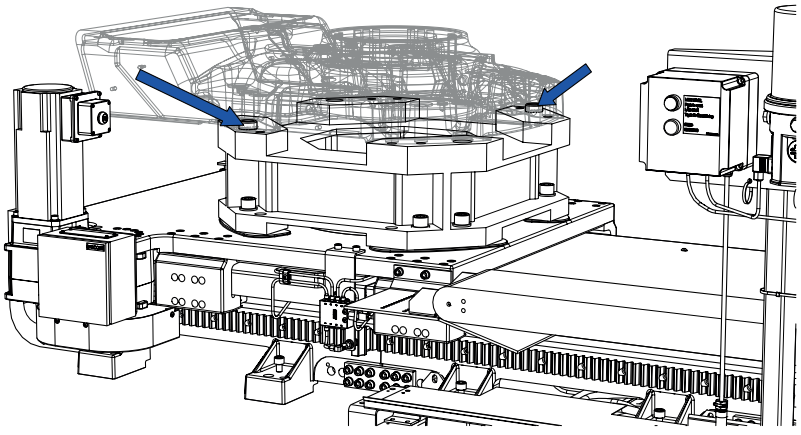


xx1100000727

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.



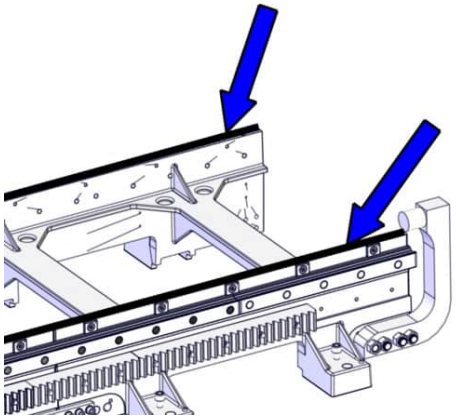
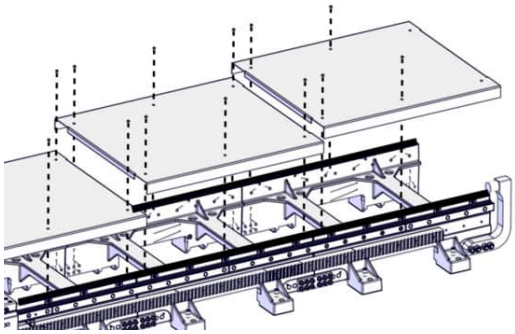
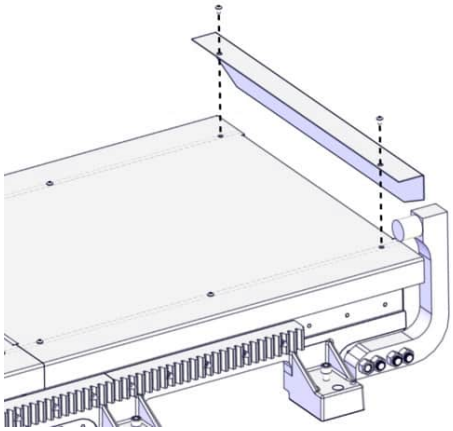
xx1500002376

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	Check the both gaskets running on top of the sections. Ensure that they are fastened properly and will not fall off during fitting of the cover plates. Replace if damaged. **Tip** The gasket has a vibration/noise reducing purpose.	 xx1800001405
2	Assemble cover plates over all joints.	 xx1800001406
3	Assemble the end plates on the track motion's short ends.	 xx1800001407

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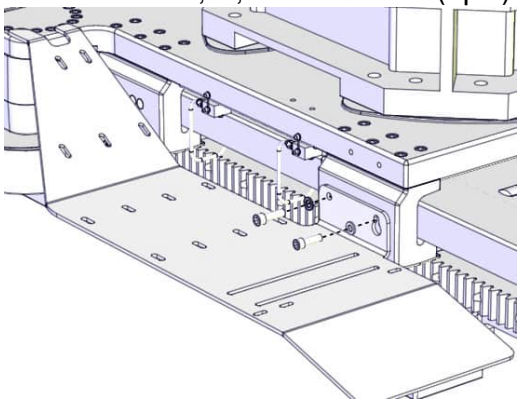
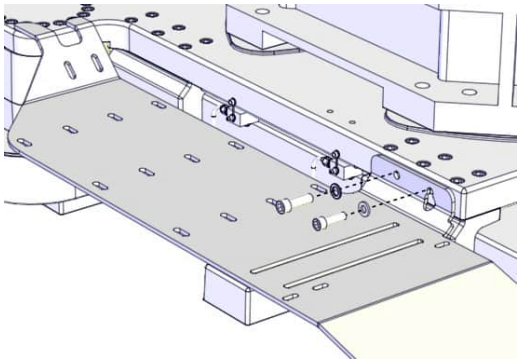
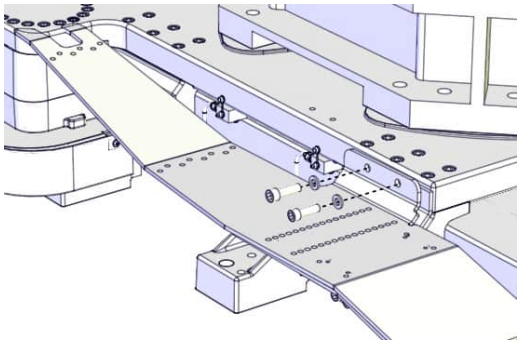
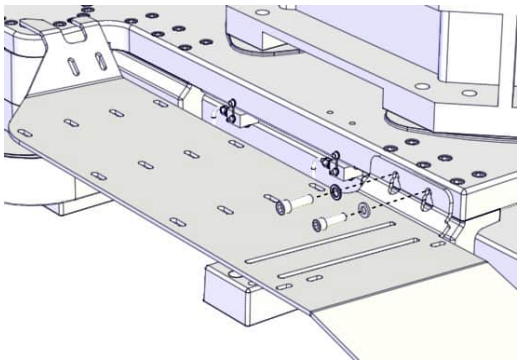
2.6.2 Assembling the cover and side plates

Continued

	Action	Note
4	Assemble the connecting plate to the carriage. **Note** The figures show different designs of the plate as well as different installation locations depending on the design of the plate. **Tip** 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.	Screws: M10x25 Steel 8.8-A3F (2 pcs). Washers: DIN 125, 10,5x20x2 Steel-A3F (2 pcs).  xx1600000516  xx1600000517  xx1600000346  xx1600000577

2.6.3 Assembling the cable tray

Two different designs

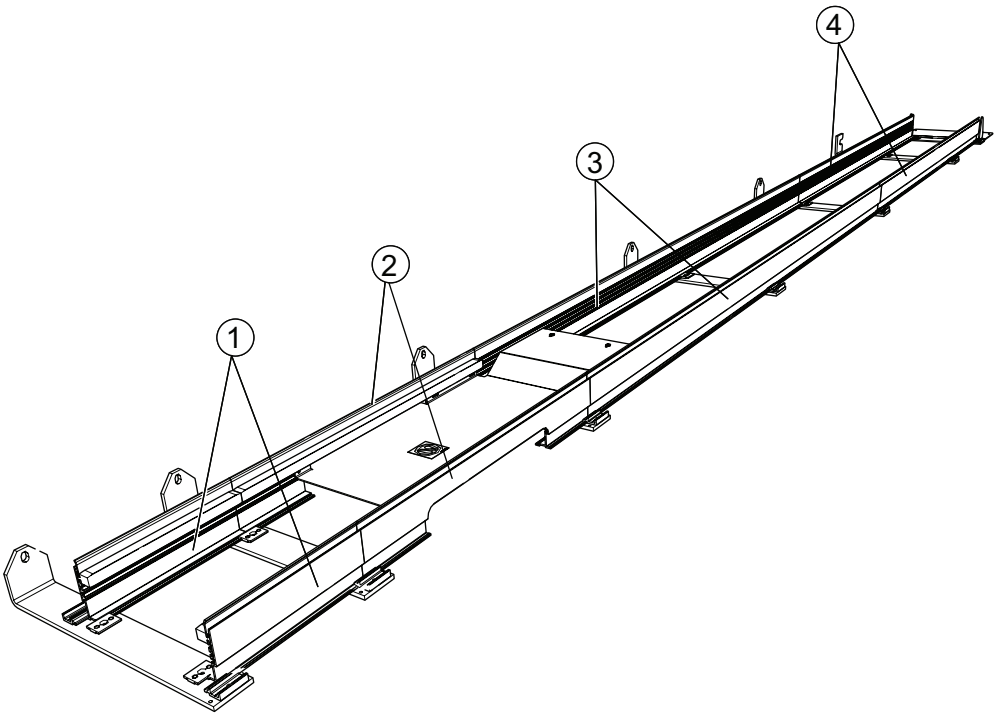
There are two designs of the cable tray. Use the correct assembling instruction depending on your design.

Cable tray for cable chain Murrplastik

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.

WARNING

If the cable tray is not complete with all required profiles and brackets, there is a risk of damage to the cable chain and vibration in the track carriage. Make sure to install all required parts.



xx1700000976

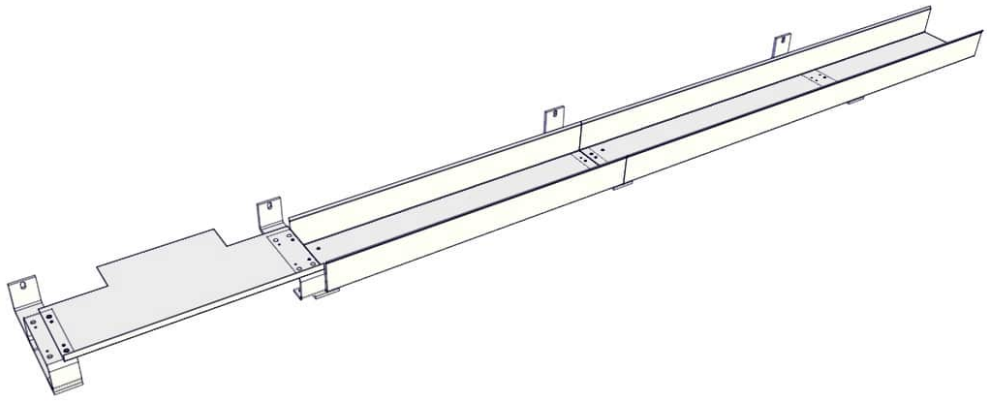
Item	Description	Dimension/Note
1	Aluminium profile	Length: 300 mm
2	Aluminium profile with cut-out	Length: 700 mm
3	Aluminium profile	Length: 2,000 mm
4	Aluminium profile	Length: 1,500 mm
-	Aluminium profile	Length: 1,000 mm
	Available for purchase but not included in the configuration shown in the spare part illustration.	Length: 1,300 mm

Continues on next page

2.6.3 Assembling the cable tray
Continued

Cable tray for cable chain Brevetti

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



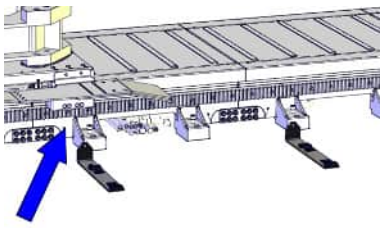
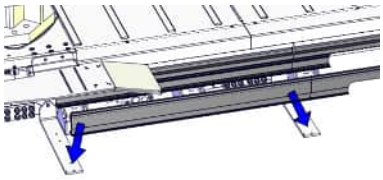
xx1300001027

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.

Assemling the cable tray

	Action	Note
1	Fit the cable chain brackets to the track motion. **Note** Mounting location of the brackets depends on the placement of the aluminium profile with the cut-out. Plan the placement of the profiles! The aluminium profiles are designed in lengths: 0.3 m, 1 m, 1.3 m, 1.5 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. The placement of the cut-out profile depends on cable chain length. See *Lifting and fitting the cable chain Murrplastik on page 104*.	 xx1300001001
2	Place the aluminium profiles onto the brackets.	 xx1300001002

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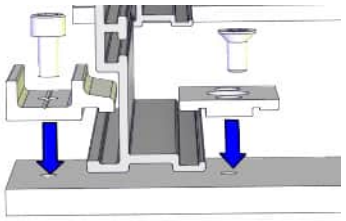
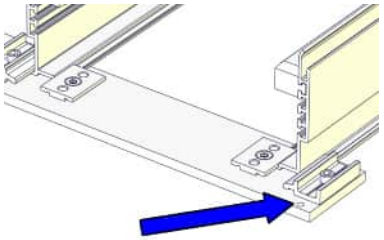
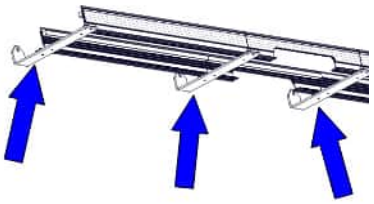
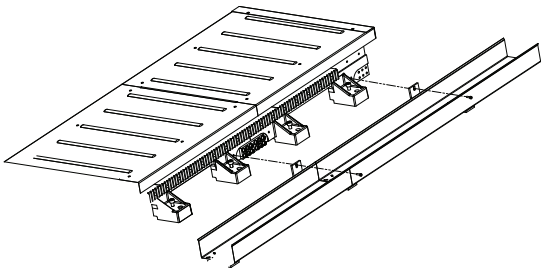
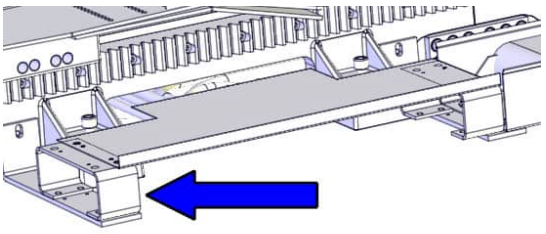
	Action	Note
3	Fasten the profiles by securing the clamping profiles with screws.	 xx1300001003
4	Use a spirit level to check that the tray is level. If needed, adjust by inserting M6 leveling bolts or shim the brackets that hold the tray (shown in figure).	 xx1800001408  xx1300000929

Assembling the cable tray for the cable chain Brevetti

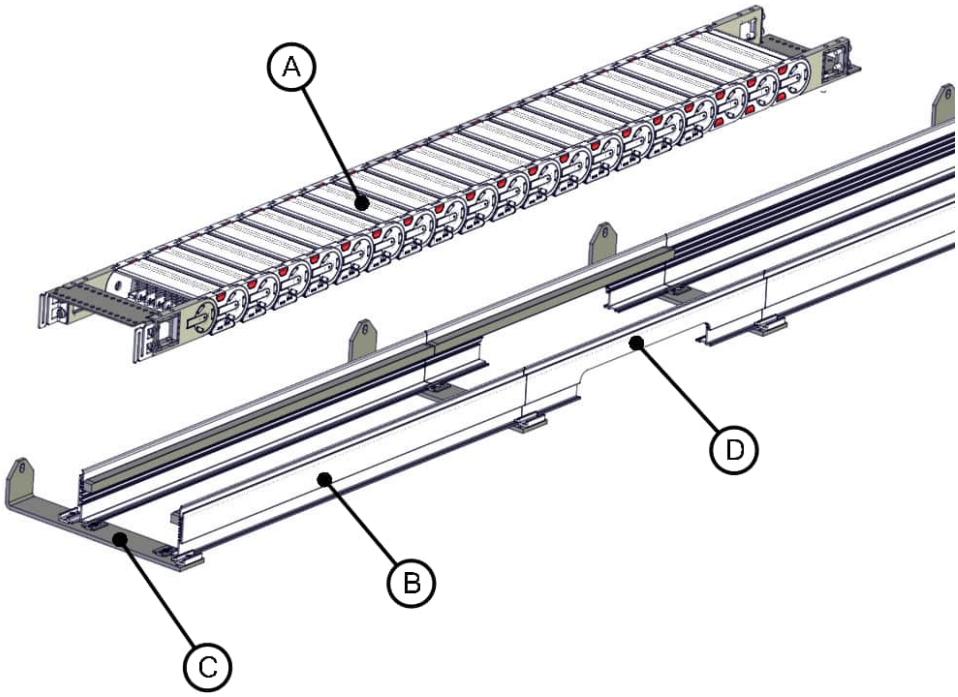
	Action	Note
1	Bolt the cable tray's guide plates on to the plates. Gently tap on the side if the positions of the holes are not aligned.	 xx1100000729
2	If the travel length of the completed track motion is 5.7 meters or more, a raised support for the cable chain should be placed at the end of the cable 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

2.7 Electrical installation

2.7.1 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.

Continues on next page

Required equipment

Equipment	Art. no.	Note
Lifting slings, standard	-	Quantity depends on track motion length. Required if using lifting method 1.
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.	 xx1300000887
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.	
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.	

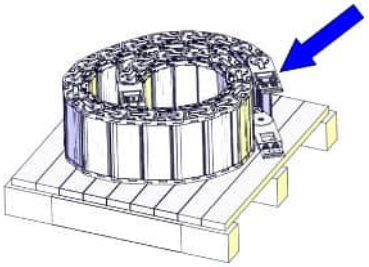
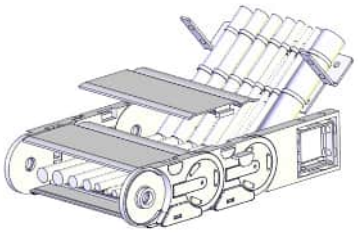
Method 2: lifting the cable chain that is rolled

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

2.7.1 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.	 xx1300000889
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.	
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 256*.

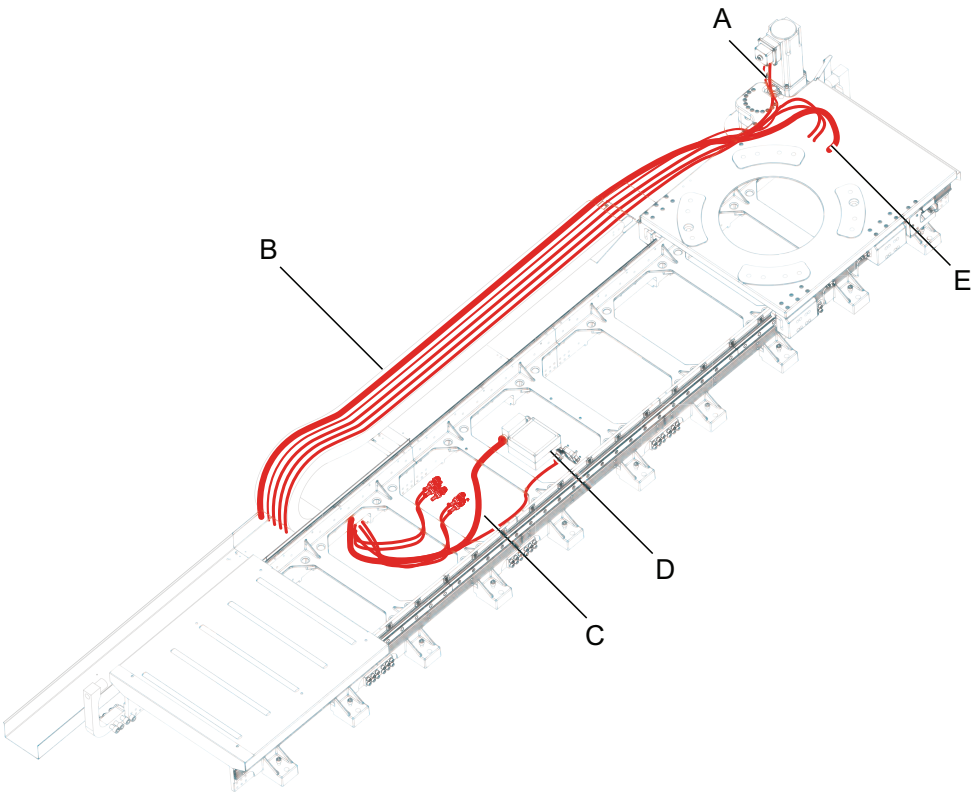
2.7.2 The cabling from the controller

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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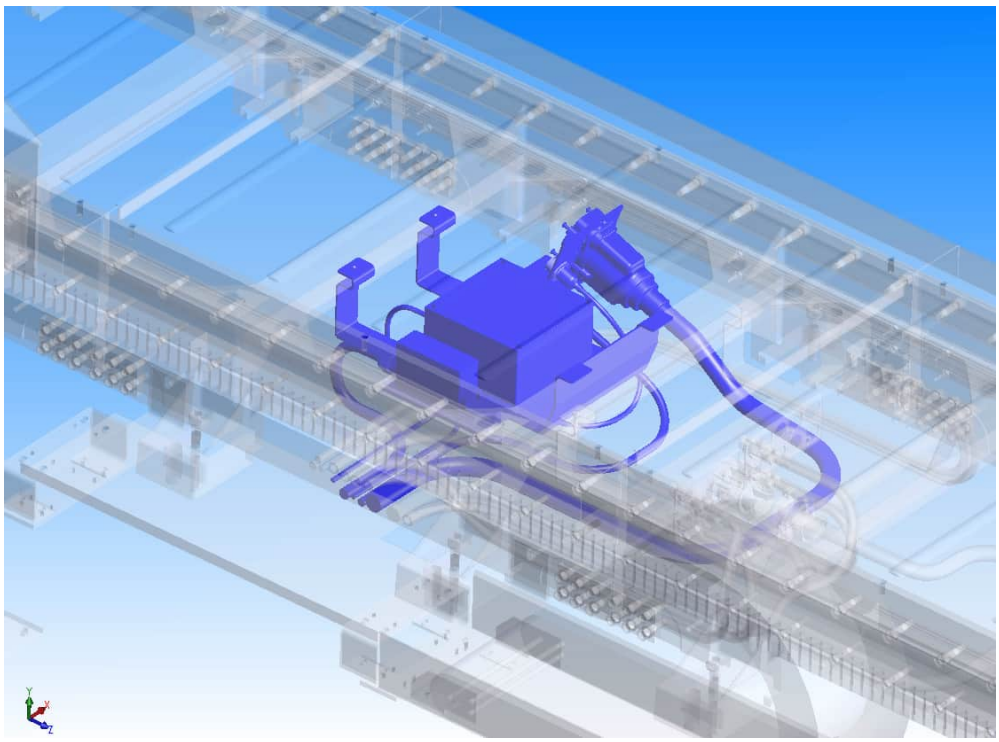
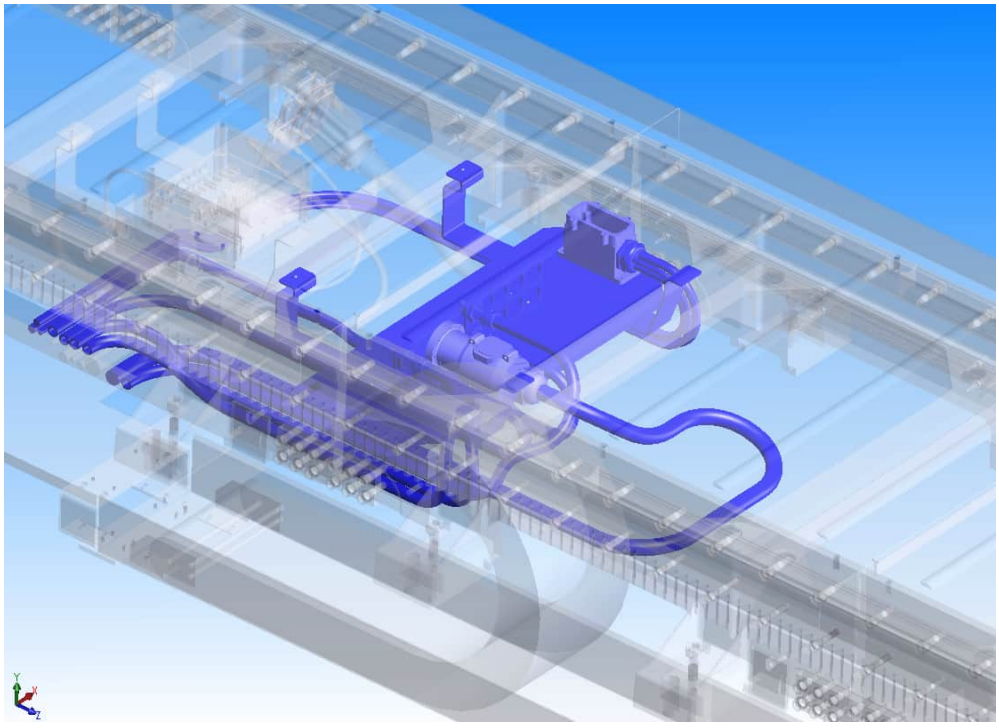
2.7.2 The cabling from the controller
Continued

Connection points, Standard contact plate



xx1100000731

Connection points, Customer contact plate



xx1100000732

2.7.3 Connections

2.7.3.1 Introduction

Connections

The wiring diagrams are described in section *Circuit diagrams on page 307*.

2.7.3.2 Assembly of the cable MS2 XS/P41

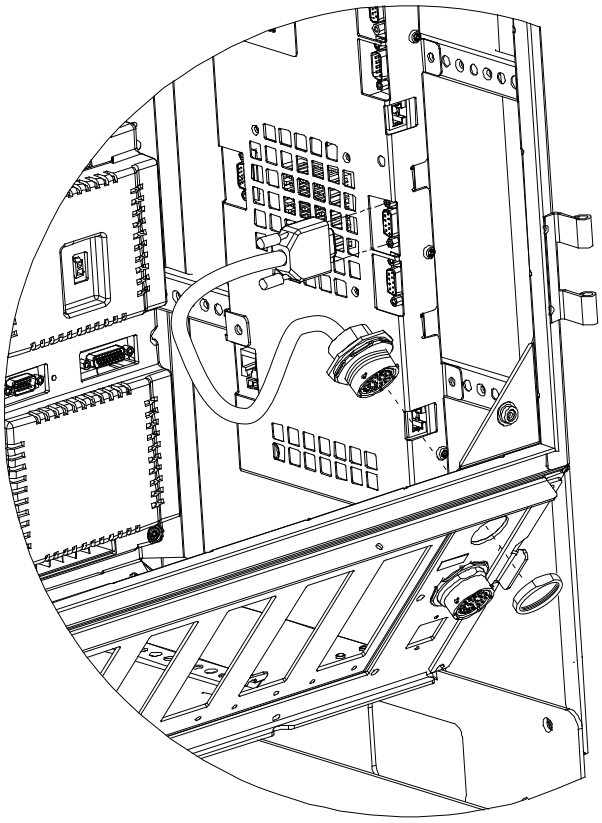
Assembly of the cable

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.	

2.7.3.3 Connectors on the controller

General

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

CAUTION

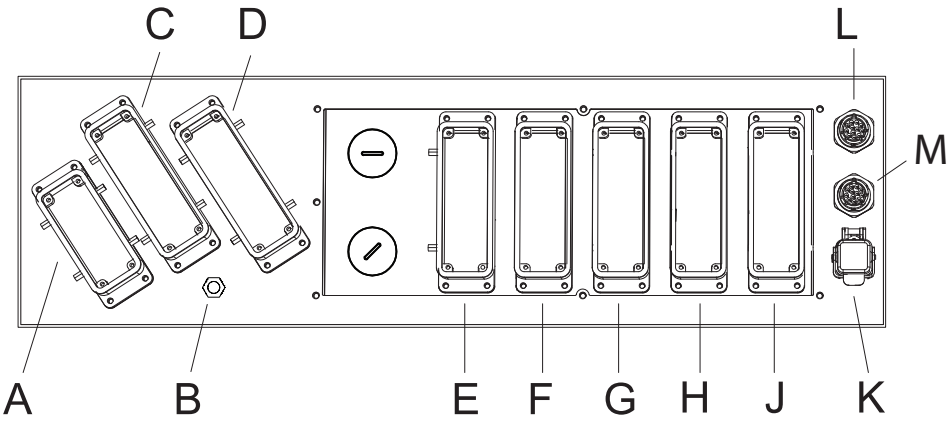
Always inspect the connector for dirt or damage before connecting it to the controller. Clean or replace any damaged parts.

Note

It is important that the earth connection point (B) is connected to a ground plane, in order to avoid disturbance.

Connectors

The following details the connection interface on the IRC5 controller. See also the circuit diagram, *Circuit diagram - IRC5*.



xx0500001852

	Description	Reference on the circuit diagram
A	Mains connection	XP.0
B	Earth connection point	
C	Robot power connection	XS.1
D	Additional axes power connection	XS.7
E	Customer power/signals external connection	XS.13/XS.5
F	Customer options	XS.10
G	Customer options	XS.11
H	Customer options	XS.12
J	Customer safety signals	X3
K	Network connection	XS.28

Continues on next page

2.7.3.3 Connectors on the controller
Continued

	Description	Reference on the circuit diagram
L	Additional axes SMB connection	XS.41
M	Robot SMB connection	XS.2

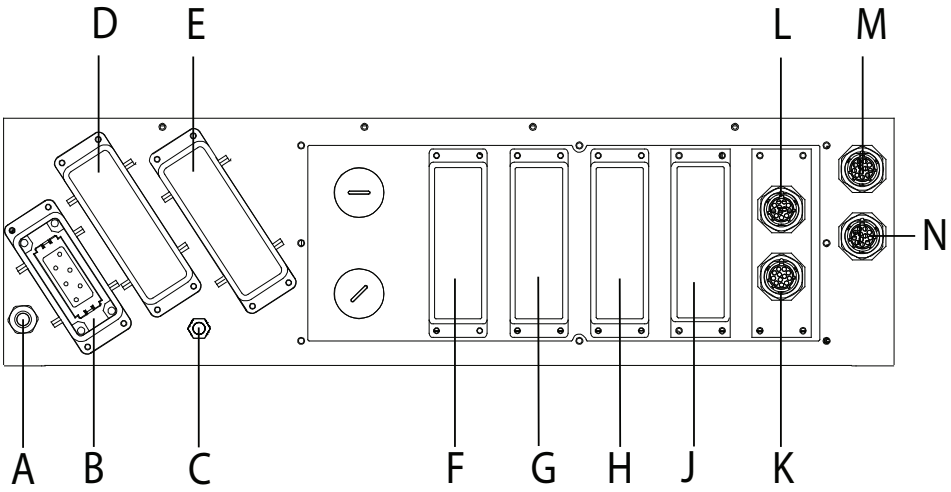
2.7.3.4 Connectors on Drive Module

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

2.7.3.5 Assembly of M12 Ethernet/PROFINET connector

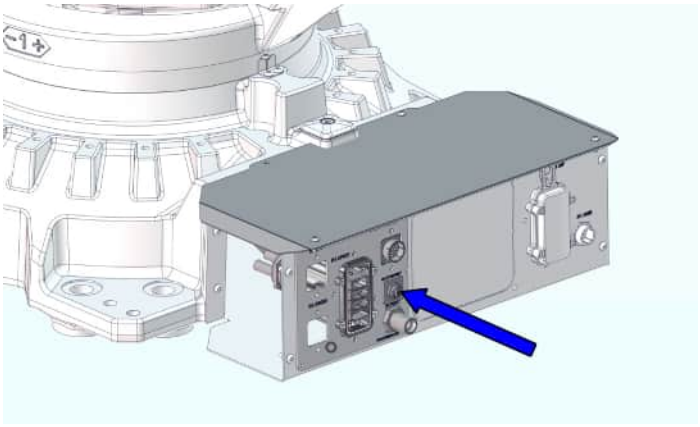
General

If the robot is configured with Ethernet/PROFINET, there is an Ethernet cable connected between the manipulator base contact plate and the customer contact plate beneath the track motion.

The M12 male Ethernet connector connected to the manipulator base contact plate must be tightened with correct torque and by using proper torque tool. Use tools as described in this section.

Connection point of Ethernet/PROFINET connector

The M12 connector for Ethernet/PROFINET is connected to the manipulator base contact plate shown in the figure.



xx2200001292

Use the correct tool and torque depending on connector type

The M12 male Ethernet connector connected to the manipulator base, could be either a Harting connector or a Phoenix connector. Use the correct torque tool and tightening torque depending on which connector is installed.

Connector appearance	Manufacturer	Torque tool	Tightening torque
 xx2200001291	Harting	M12 dynamometric screwdriver SW15 Article number: 09 99 000 0646 (article number at Harting Technology Group)  xx2200001261	0.6 Nm

Continues on next page

Connector appearance	Manufacturer	Torque tool	Tightening torque
 xx2200001285	Phoenix	M12 torque screwdriver and M12 assembly tool (bit) Article number: TSD 04 SAC (article number at Phoenix Contact) SAC BIT M12-D15 (article number at Phoenix Contact)  xx2200001262	0.4 Nm

CAUTION

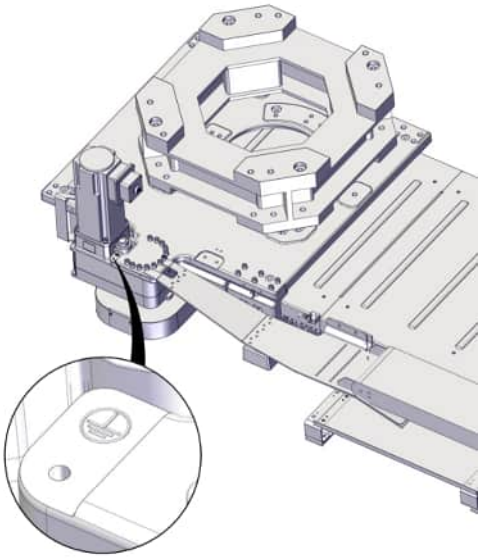
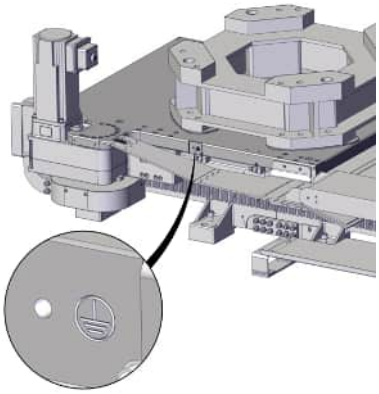
If the M12 Ethernet connector is not tightened correctly, there is a risk that the connector can loosen and the cable shield gets disconnected, which will require retightening with the correct torque tools.

For secure connection, always tighten with the correct torque tools.

2.7.3.6 Grounding point

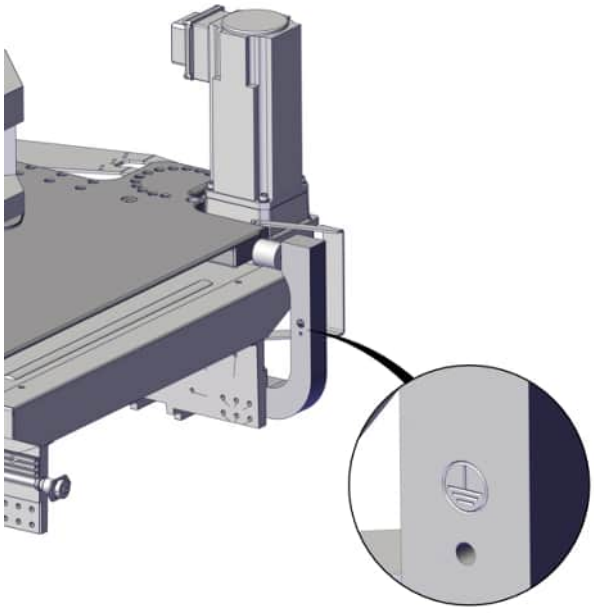
Grounding and bonding point on track motion

There is a grounding/bonding point on the track motion. The grounding/bonding point is used for potential equalizing between control cabinet, track motion and any peripheral devices.

IRBT 4004	IRBT 6004, IRBT 7004
 xx2000001498	 xx2000001497

Grounding point for track motion stand

There is also a grounding/bonding point for the track motion stand, located at the mechanical stop.



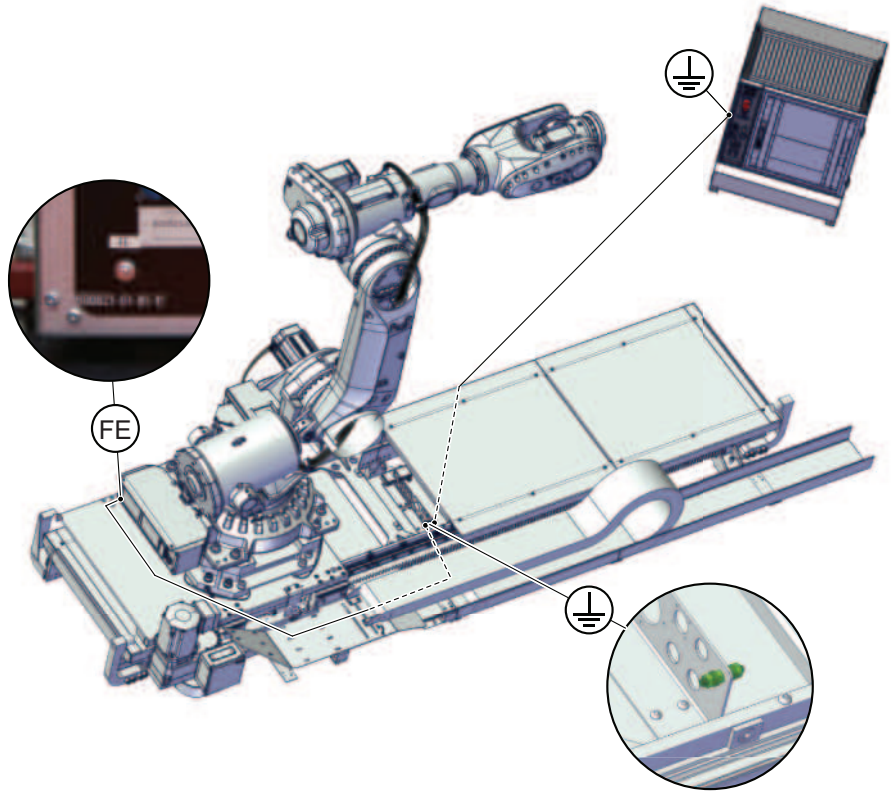
xx2000001509

Continues on next page

Functional earth grounding

The functional earth grounding for the dresspack consists of separate cables and grounding points (i.e., screws) on the control cabinet, the customer connection plate-J1 in the middle of the track motion stand, and the connector plate on the manipulator. ABB supplies the ground cable from the track motion connection plate-J1 to the connector plate on the manipulator.

The protective earth connection between the control cabinet and the robot consists of two conductors which are included in the robot power cables.



xx2300000698

2.7.4 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.

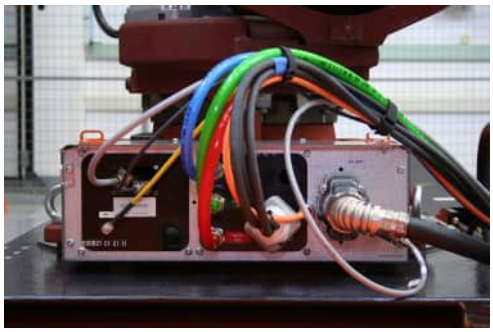
Continues on next page

2.7.4.1 IRB 6640 inline

Illustrations


xx1400000623


xx1400000624

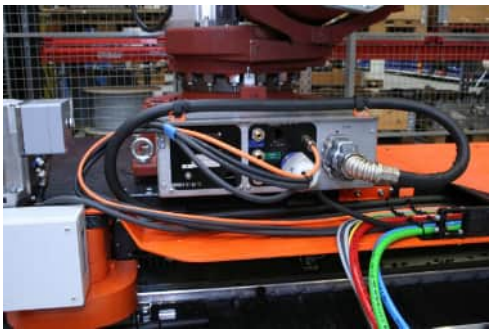

xx1400000625


xx1400000626

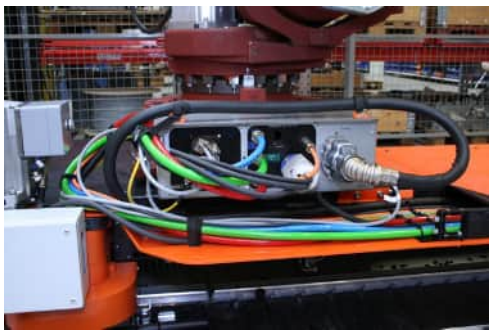
2.7.4.2 IRB 6640 90°

Illustrations

xx1400000627



xx1400000628



xx1400000629

2.7.4.3 IRB 6640 pedestal inline

Illustrations

xx1400000634

xx1400000635

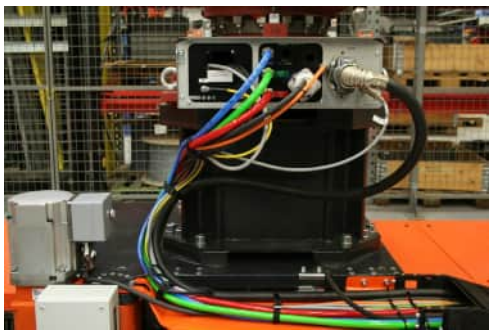
xx1400000636

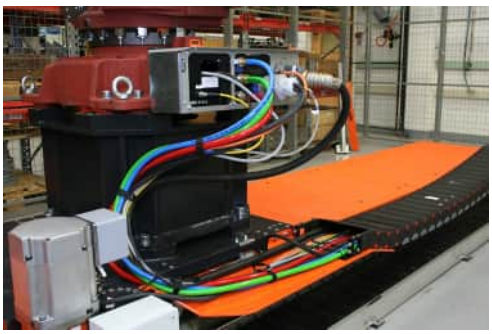
2.7.4.4 IRB 6640 pedestal 90°

Illustrations


xx1400000630


xx1400000631


xx1400000632

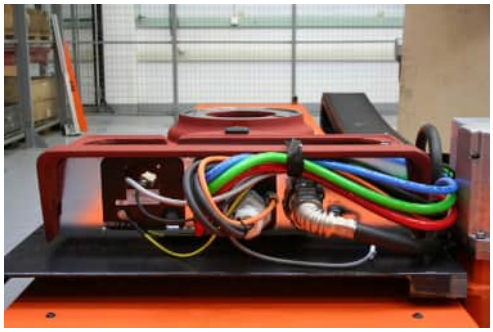

xx1400000633

2.7.4.5 IRB 7600 inline

Illustrations

xx1400000637

xx1400000638



xx1400000639

xx1400000640

2.7.4.6 IRB 7600 90°

Illustrations


xx1400000641


xx1400000642


xx1400000643

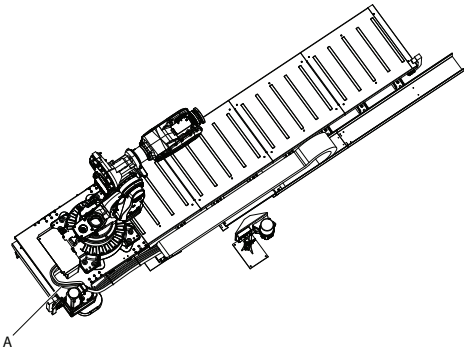
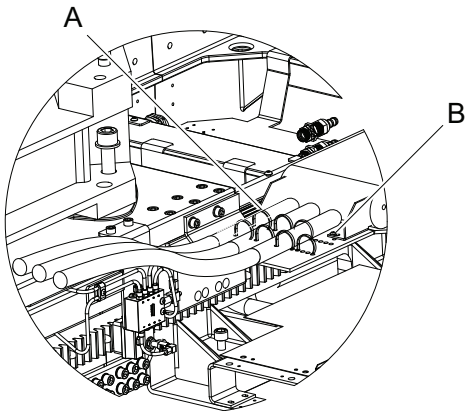
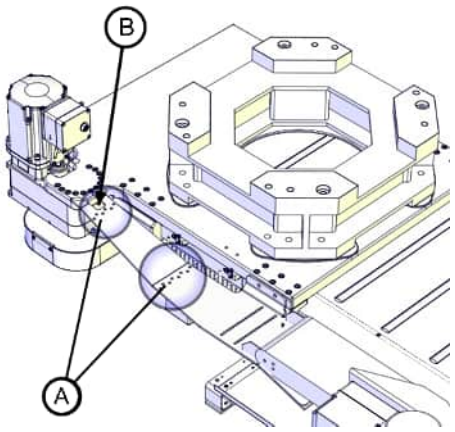

xx1400000644

2.7.5 Adjustments

2.7.5.1 Adjusting cables and covers

Adjustments

Use this procedure to adjust cables and covers.

	Action	Note
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.	 xx1100000738
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.	 xx1100000792 A Cable straps B Torx pan head screw Suitable cable ties are specified in *Required equipment on page 242*.
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 90º when directed up to the motor. **CAUTION** Do not stand on the chain or cables.	 xx1200000884

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?		

2.8 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 *Overview of installation and commissioning procedure on page 41*.

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 128*.

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	In the RobotWare package, open the folder *\Additional Options\Track Motion*. **Note** 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 200*.
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

	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 *moc.cfg*, 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 133*.

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 *RobotWare* and *TrackMotion* 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 *IRBT x004 Type A x,x m* options. For more information about Type A, see *Changing the track motion motor to Type A on page 200*.
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 *moc.cfg*, 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 133*.

Continues on next page

2.8.2 Creating and downloading a system
Continued

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

2.8.3 Arm load

Extra load

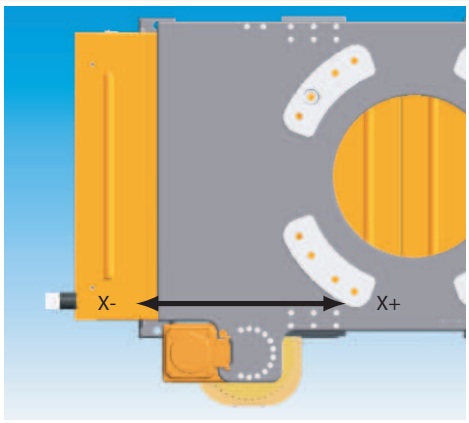
If the system has an extra load (kg) located on the carriage, for example a pedestal, the weight has to be described for the system in the Arm Load parameters.

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".

2.8.5 Updating the revolution counter on the track motion

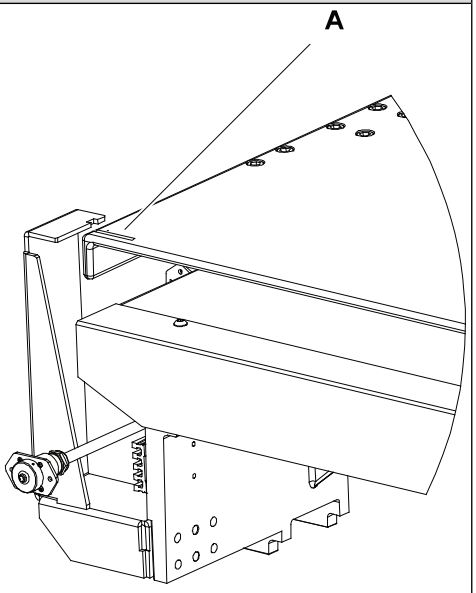
General

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).	 xx1100000741
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 135*.

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 97*.

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	*Base Frame q1-q4* defines the quaternions of the robot base frame orientation in relation to the world frame.
Gamma Rotation	*Gamma Rotation* defines the orientation of the robot foot on the travel carriage. **Note** The *Gamma Rotation* 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

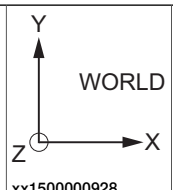
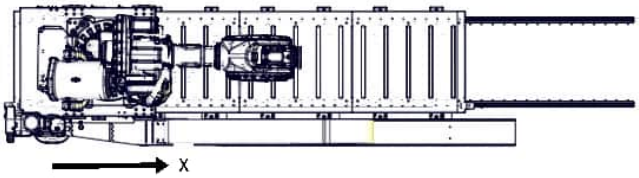
These parameters belongs to the type *Single* in the topic *Motion*.

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

2.8.6.2 Configuration examples

Standard carriage

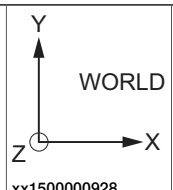
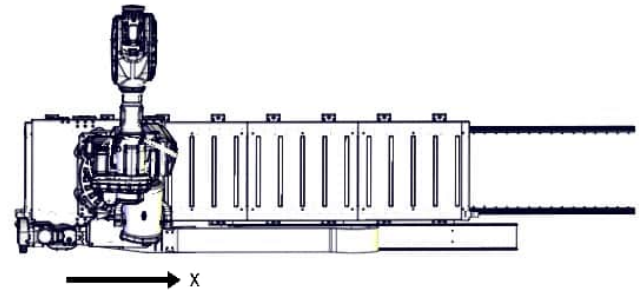
IRB 0° (in line) in relation to the World coordinate system

0 degrees (in line)	 xx1500000928	 xx1600000659

- 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

+90 degrees	 xx1500000928	 xx1600000660

- Positive travel direction x in World coordinates

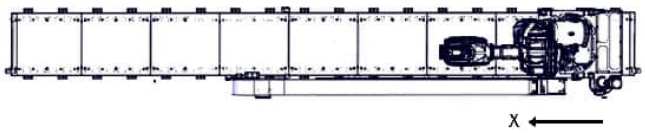
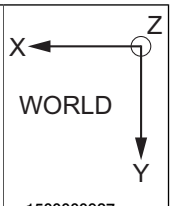
Parameter	Robot (*ROB_1*)	Track motion (*TRACK_1*)
Base Frame q1	0.707107	1
Base Frame q2	0	0
Base Frame q3	0	0
Base Frame q4	0.707107	0
Gamma Rotation	1.570796	-
Use Joint	-	track1

Continues on next page

2.8.6.2 Configuration examples
Continued

Mirrored carriage

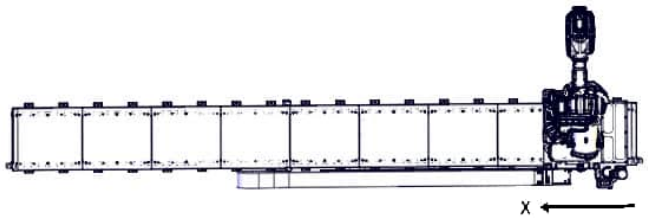
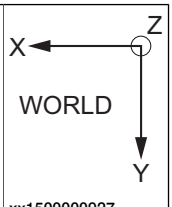
IRB in line 0° in relation to the World coordinate system

0 degrees (in line)	 xx1600000661	 xx1500000927

- 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

-90 degrees	 xx1600000662	 xx1500000927

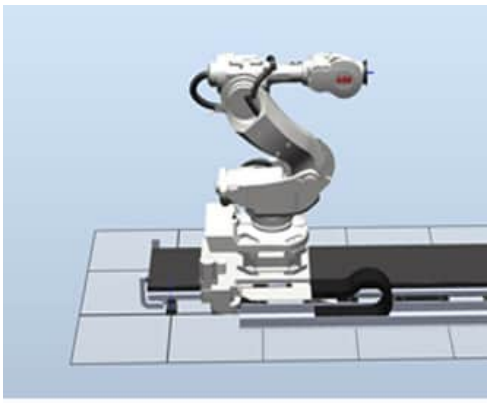
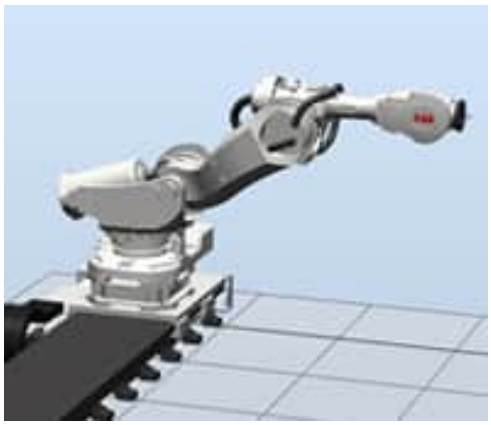
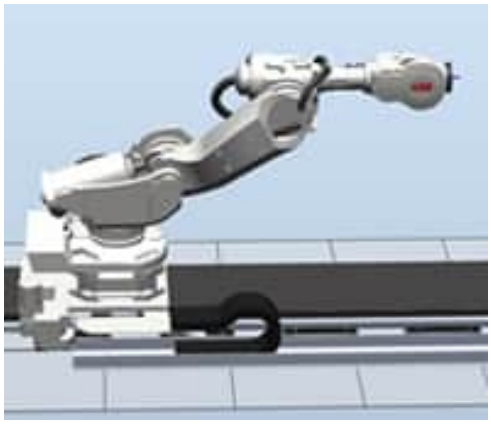
- Positive travel direction x in World coordinates

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

2.8.7 Motion pattern effects on expected component life

IRB position during travel

It is highly recommended that the center of gravity of the robot arm system is as close to the center of gravity of IRBT carriage, during travel, as possible. Operation with extension of the robot arm system, combined with intense or high load operation, may significantly decrease the expected component life cycle.

Recommended position - Low load on linear bearings	Not recommended position - High load on linear bearings
 xx1800002234	 xx1800002236
 xx1800002235	 xx1800002237

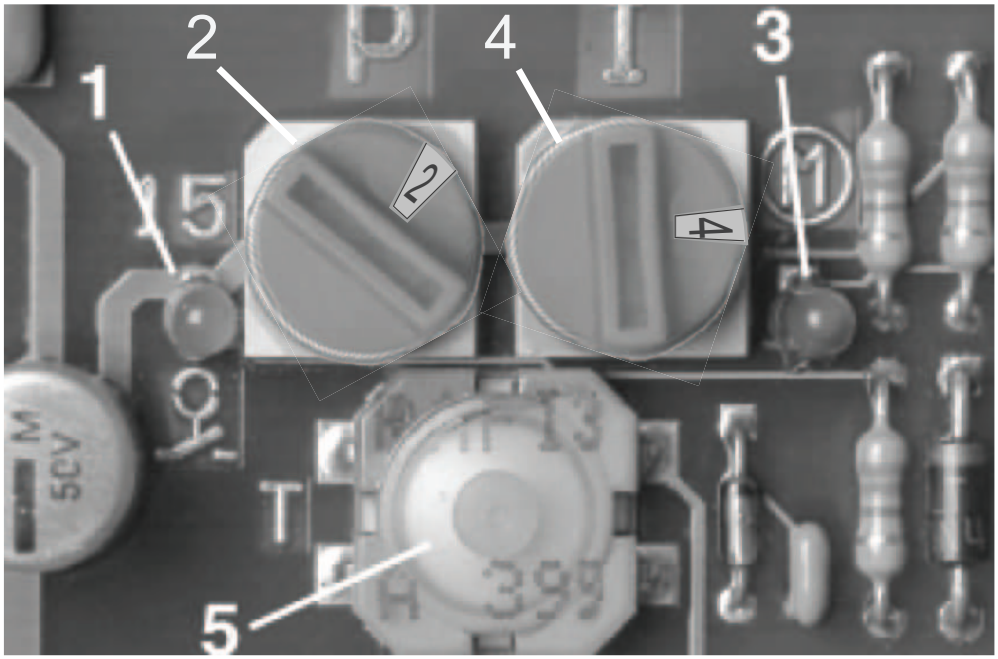
2.9 Automatic lubrication

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.



xx1800001471

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.

2.10 Test run after installation, maintenance, or repair

Safe handling

Use the following procedure after installation, maintenance, or repair, before initiating motion.

DANGER

Initiating motion without fulfilling the following aspects, may increase the risk for injury or cause damage to the robot.

	Action
1	Remove all tools and foreign objects from the robot and its working area.
2	Verify that the robot is properly secured to its position by all screws, before it is powered up.
3	Verify that any safety equipment installed to secure the position or restrict the robot motion during service activity is removed.
4	Verify that the fixture and work piece are well secured, if applicable.
5	Verify that all safety equipment is installed, as designed for the application.
6	Verify that no personnel are inside the safeguarded space.
7	If maintenance or repair has been done, verify the function of the part that was maintained.
8	Verify the application in the operating mode manual reduced speed.

Collision risks

CAUTION

When programming the movements of the robot, always identify potential collision risks before initiating motion.

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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 21* before performing any service work.

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

Note

If the IRBT 4004/6004/7004 is connected to power, always make sure that the IRBT 4004/6004/7004 is connected to protective earth and a residual current device (RCD) before starting any maintenance work.

For more information see:

- *Product manual - IRC5*
- *Grounding point on page 116*.

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.
- Travel distance: specified in kilometers. Intense use means more frequent maintenance activities.

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

3.2.2 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 146*

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 [i]
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 [ii]
Replacement	Linear guide	When expected life is reached, if disturbances occur or if damage is noted at inspection.
Replacement	Ball elements	When linear guides are replaced, when end of life is reached or disturbances occur.
Replacement	Gear wheel and racks	When play can not be adjusted to specified [iii] level.
Replacement	Glide shoes [iv]	When gliding surface thickness is 1.5 mm or less. [v]

[i] Failure in following the maintenance cleaning and lubrication activities can result in significant reduction of the expected component life and unexpected breakdown of the ball element.

[ii] 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.

[iii] The play is specified in *Adjusting the gearbox backlash on page 185*.

Continues on next page

3.2.2 Maintenance schedule
Continued

[iv] Glide shoes have been introduced to the chains in 2013. These have been provided to simplify and reduce the time associated with changing links.
[v] The first glide shoes to wear out will be located at the point where the chain first makes contact with itself during operation.

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[i]
Test the manual feed	Automatic lubrication system	Every 1 months[i]

[i] Failure in following the maintenance lubrication activities can result in significant reduction of the expected component life and unexpected breakdown of the ball element.

3.2.3 Gearbox oil

Where to find information about gearbox oil

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

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 - Linear bearings

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.

It is important that the installation requirement stated by ABB is met, otherwise the expected component life can be significantly reduced and warranty be voided. Please contact your local ABB Customer Service office if there is any uncertainty with the installation requirements or installation procedure.

Component	Expected life	Note
Linear bearings IRBT 4004	200,000,000 meters	
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[i]	20,000,000 meters	
Linear bearings IRBT 6004/IRB 6700-235 kg[ii]	15,000,000 meters	
Linear bearings IRBT 6004/IRB 6700-300 kg[iii]	10,000,000 meters	
Linear bearings IRBT 7004	5,000,000 meters	When pedestal is used, one can expect a decrease in expected component life of 10-20%, depending on extension of the robot arm system.

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

The linear bearings are sensitive to contamination. To keep a long life of the bearings, do not clean the robot cell/track with compressed air, as this swirls dust into the bearings.

Expected component life - other parts

Component	Expected life	Note
Cabling for robot, 7th axis	4,000,000 cycles [i]	ii

Continues on next page

Component	Expected life	Note
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	

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.

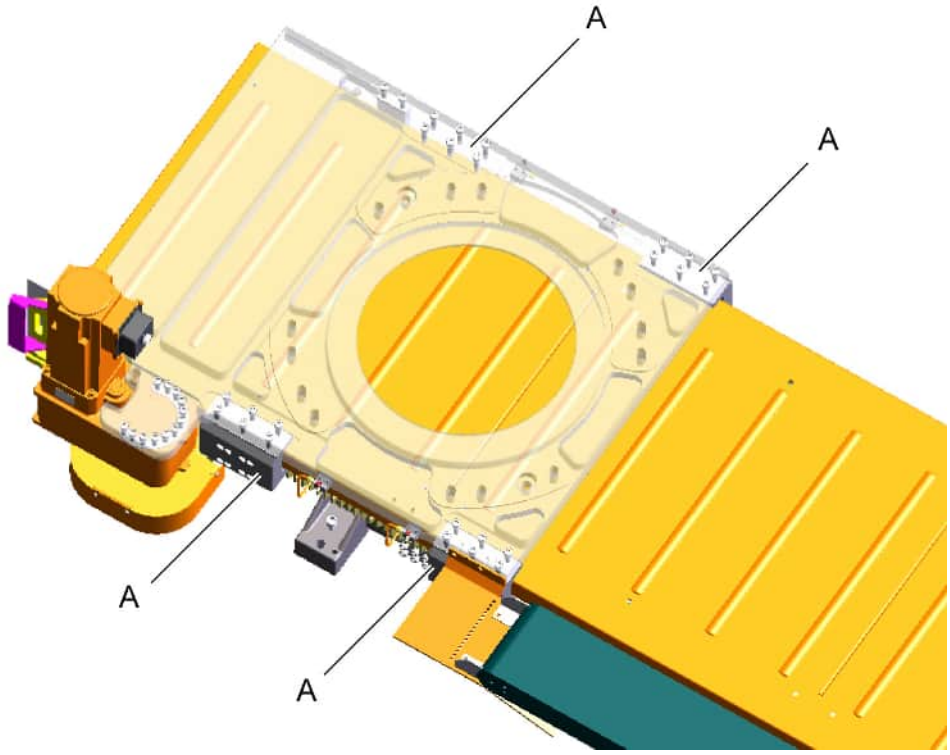
In order to maximize the chains lifetime ensure to optimize the software and cell layout to reduce the amount of travel and cycles.

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

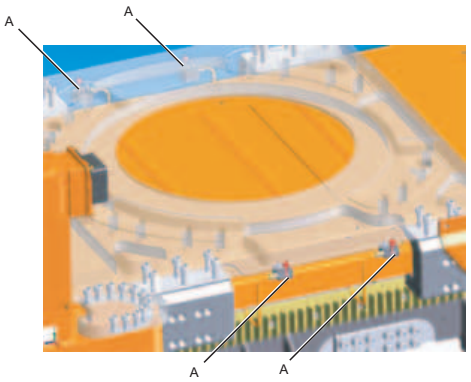
Equipment, etc.	Article number	Note
Longtime lubricant	-	Total CERAN CA **WARNING** The grease used causes serious eye irritation and may cause an allergic skin reaction. **CAUTION** It is critical to use the correct grease, otherwise the expected component life can be reduced.

Continues on next page

Equipment, etc.	Article number	Note
Lubrication gun	-	Maximum pressure when lubricating: 28 bar.

Lubricating the ball element

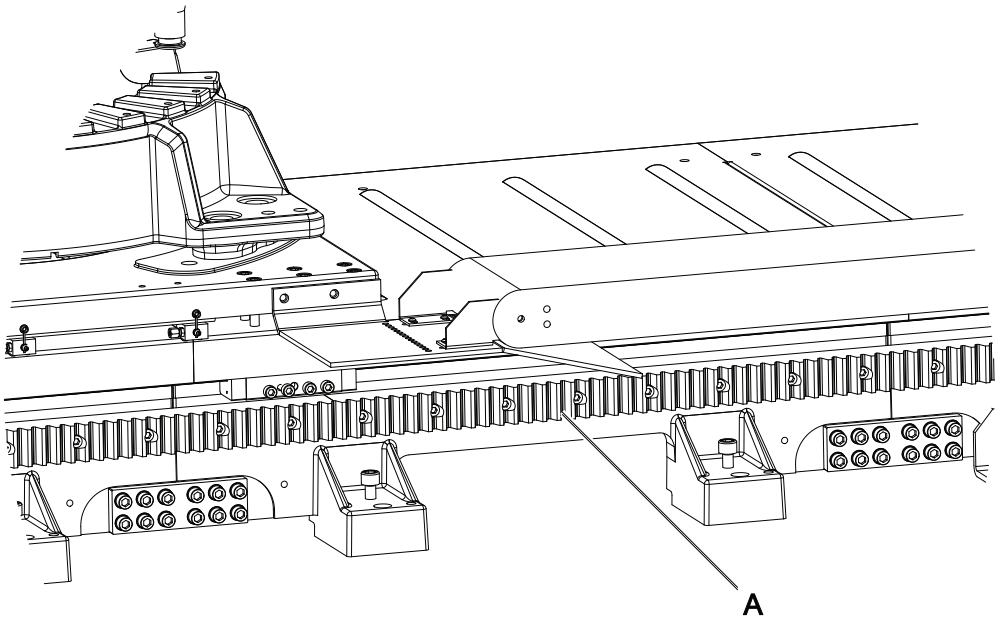
Use this procedure to lubricate the ball element.

	Action	Note
	Lubricate each ball element using a lubrication gun in two steps, total amount 9.4 cm^3.	**CAUTION** It is critical to add enough grease to maintain the function, otherwise the expected component life can be reduced. **Note** Maximum pressure when lubricating: 28 bar.
1	Apply the first partial quantity of lubricant, approximately 4.7 cm^3, in each element.	 xx1100000743 A Ball element grease nipples
2	Move (jog) the carriage 50 cm in both directions.	
3	Apply the second partial quantity of lubricant, approx. 4.7 cm^3, 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.	

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.	Article number	Note
Lubricant, standard lubrication	-	Tribol GR 100-2 PD
Lubricant, standard lubrication	3HAC042536-001	Shell Gadus S2
Lubricant, automatic lubrication	-	Total CERAN CA **WARNING** The grease used causes serious eye irritation and may cause an allergic skin reaction. **CAUTION** It is critical to use the correct grease, otherwise the expected component life can be reduced.
Lint free cloth	-	

Continues on next page

Lubricating the gear racks

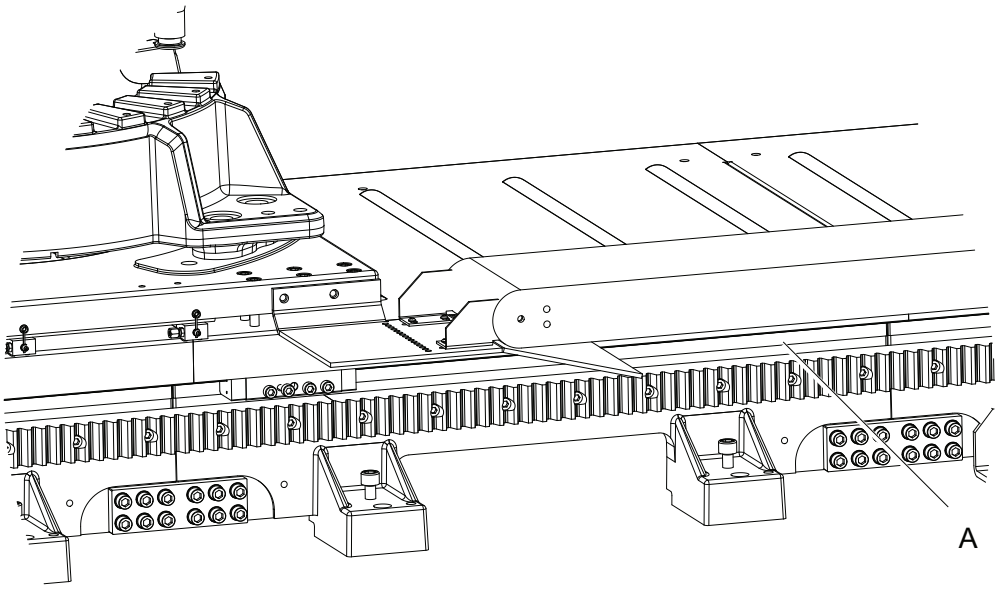
Use this procedure to lubricate the gear racks.

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

3.3.3 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.	Article number	Note
Lint free cloth	-	
Longtime lubricant	-	Total CERAN CA **WARNING** The grease used causes serious eye irritation and may cause an allergic skin reaction.

Cleaning the linear guides

Use this procedure to clean the linear guides.

	Action	Note
1	Clean the linear guides with a lint free cloth.	
2	Lubricate the linear guides after cleaning. **WARNING** The grease used causes serious eye irritation and may cause an allergic skin reaction.	Use Total CERAN CA.

3.4 Activities 1 month

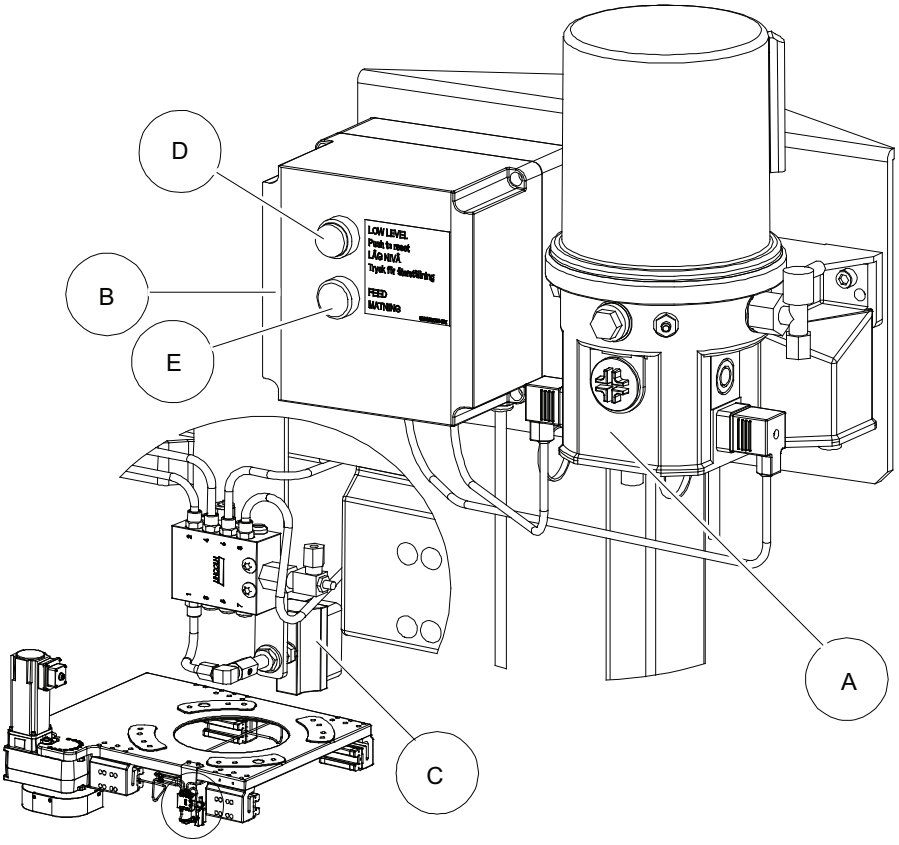
3.4.1 Inspecting the lubrication system

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 144*), 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

3.4.1 Inspecting the lubrication system

Continued

Required equipment

Equipment, etc.	Art. no.	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 301*.
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

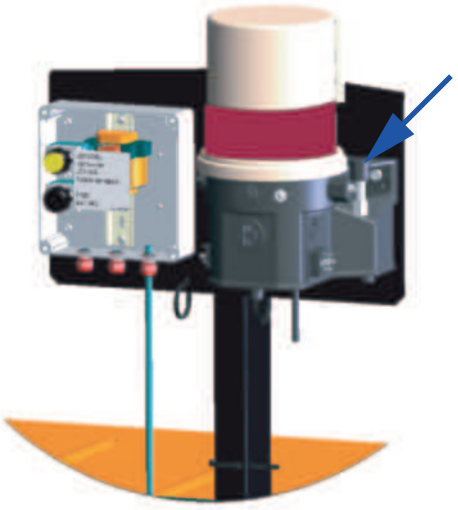
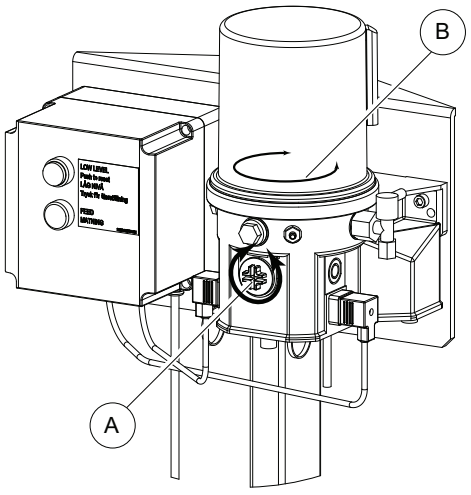
Use this procedure to check the grease level of the lubrication system.

	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 307*.	 xx1100000794

Continues on next page

Checking the performance

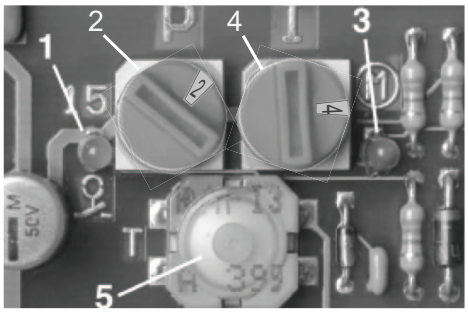
Use this procedure to check the performance of the lubrication system.

	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.	 xx1800000168
2	Check that the stirring paddle (B) rotates clockwise during the operating time. To control the electrical functions, open the inspection plug (A).	 xx1100000796

Continues on next page

3.4.1 Inspecting the lubrication system

Continued

	Action	Note
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 138* and *Circuit diagrams on page 307*.	 xx1800001471 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. See *Test run after installation, maintenance, or repair on page 139*.	

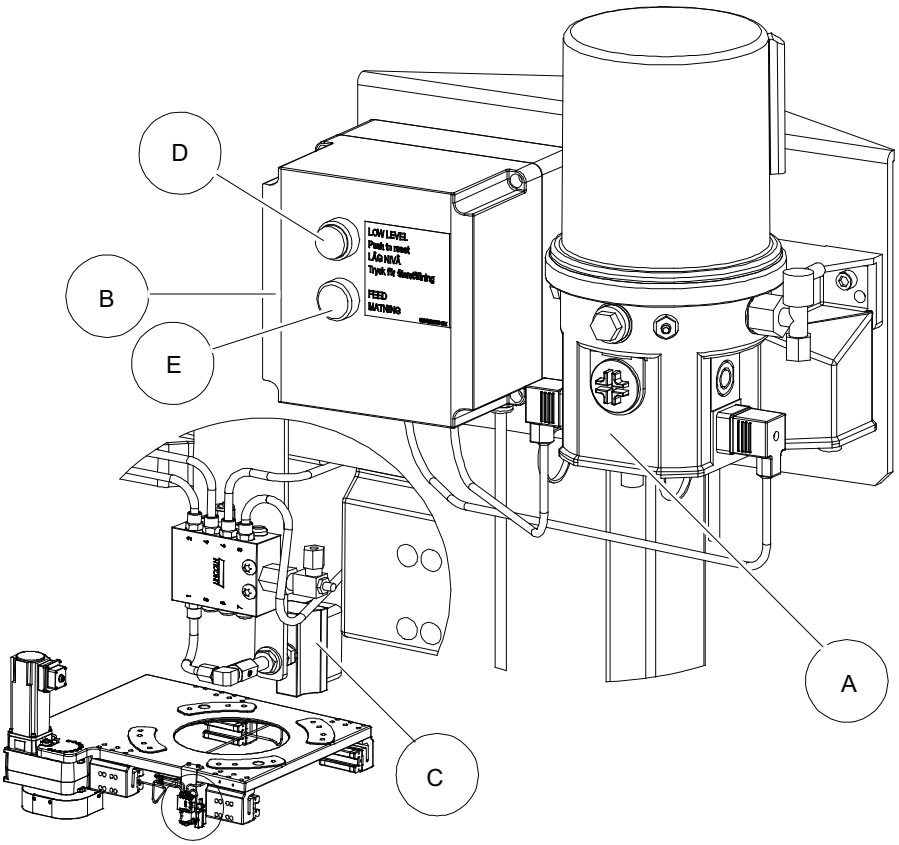
3.4.2 Testing the manual feed

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 144*), 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 301*.

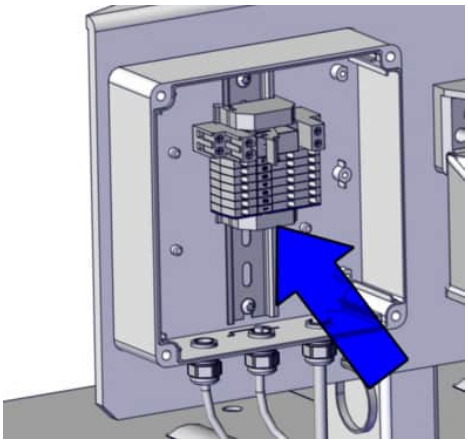
Continues on next page

3.4.2 Testing the manual feed
Continued

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

Testing the manual feed

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

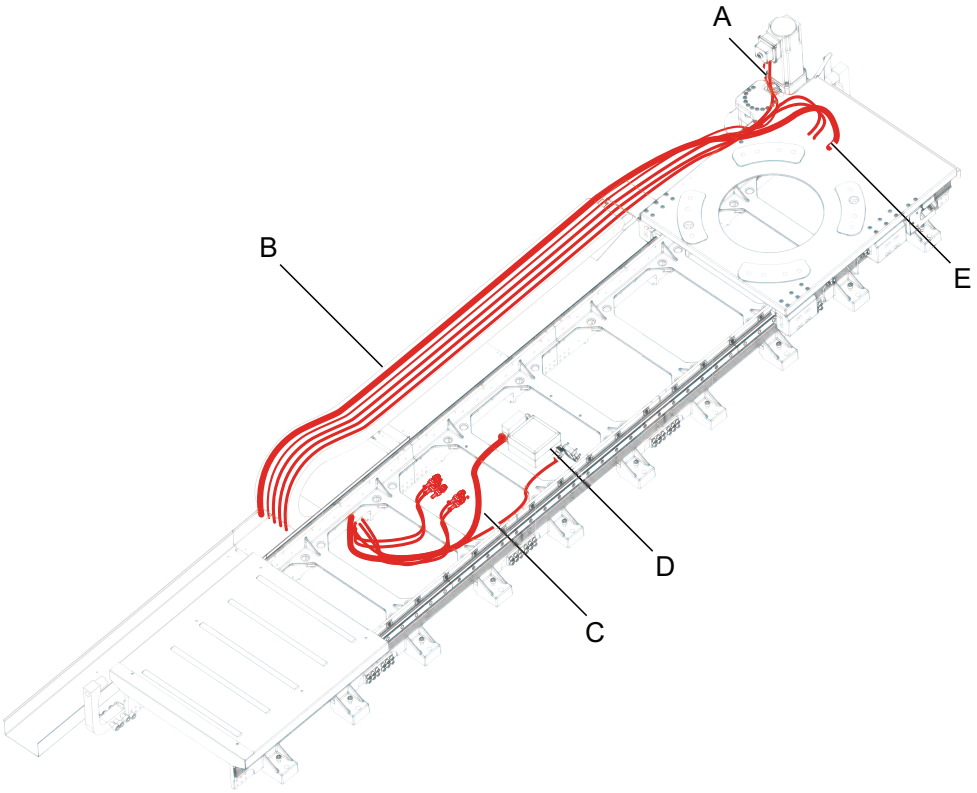
	Action	Note
1	Press the button "Feed" on the control unit grease pump.	
2	**Only for Control unit grease pump marked rev.05 or later:** If the pump is not working, make sure the fuses are ok.	 xx1500002146

3.5 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

3.5.1 Inspecting the cable chain
Continued

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

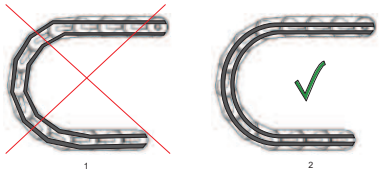
	Action	Note
1	Check, and rectify if necessary, the junction boxes with regard to damage, connections and tightness.	

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 241*.
2	Check the attachment points of the cable chain. Replace if necessary.	See *Replacing the cable harness on page 241*.

Inspecting the cable chain Murrplastik

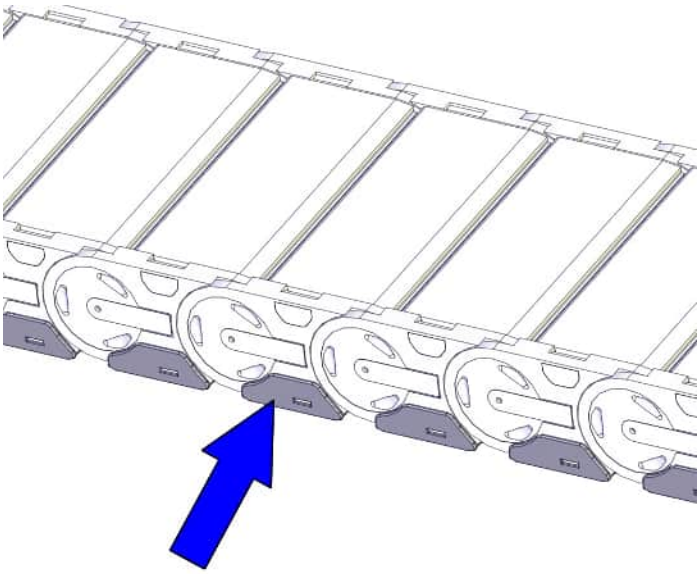
Inspecting the cables

	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.	

Continues on next page

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 263*.

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 159*. If strapping has been replaced ensure that a paint pen is used to mark both sides of the cable tie.	

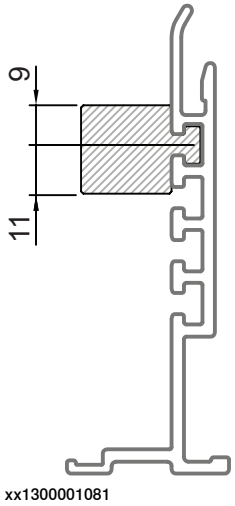
Inspecting the profiles

	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.	

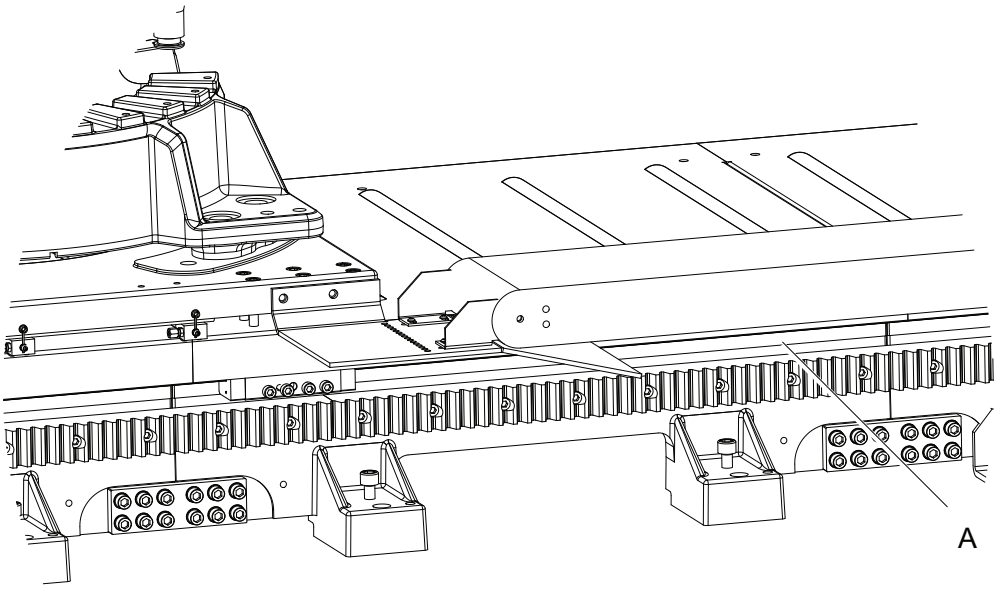
Inspecting the fasteners

	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.

3.5.2 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.	Article number	Note
Visual inspection	-	

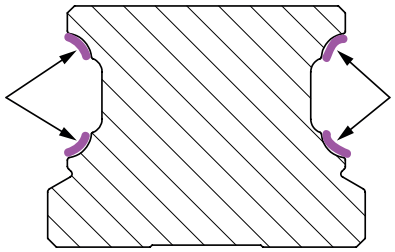
Inspecting the linear guides

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. • Lubricate the linear guides after cleaning. Use Total CERAN CA. **WARNING** The grease used causes serious eye irritation and may cause an allergic skin reaction.

Continues on next page

3.5.2 Inspecting the linear guides
Continued

	Action	Note
2	Check the guide surface of the linear guides for damages or wear. • If visual wear is detected, use a finger to feel the surface in the ball races. • If roughness or uneven surfaces in the ball races are found, the linear guides needs to be replaced. • Wear or uneven surfaces outside the ball races are not critical to achieve function. Worn out or damaged guides can be caused by the robot stopping occasionally with overload in the track axis.	If wear or damage is detected, replace all linear guides and ball elements on the concerned side. Always lubricate new linear guides. See *Replacing the linear guides on page 215* and *Replacing the ball elements on page 220*.  xx1800002271 Ball races surfaces

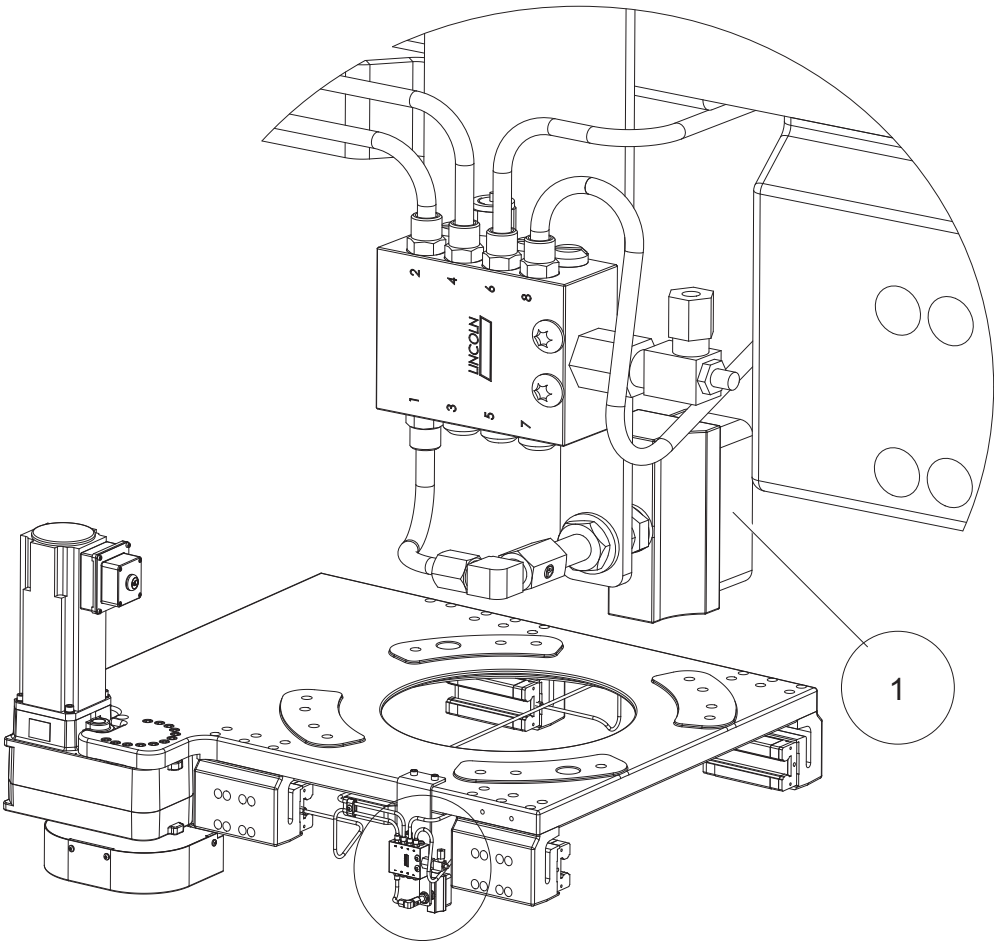
Inspecting the automatic lubrication system

	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 *Operating instructions - Printed circuit board for pump 203 (Lincoln Quicklub)*.

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

3.5.3 Inspecting the brush

Location of brush



1	Oil 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 274*.

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 *Refitting the cable harness and cable chain on page 248*.
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.

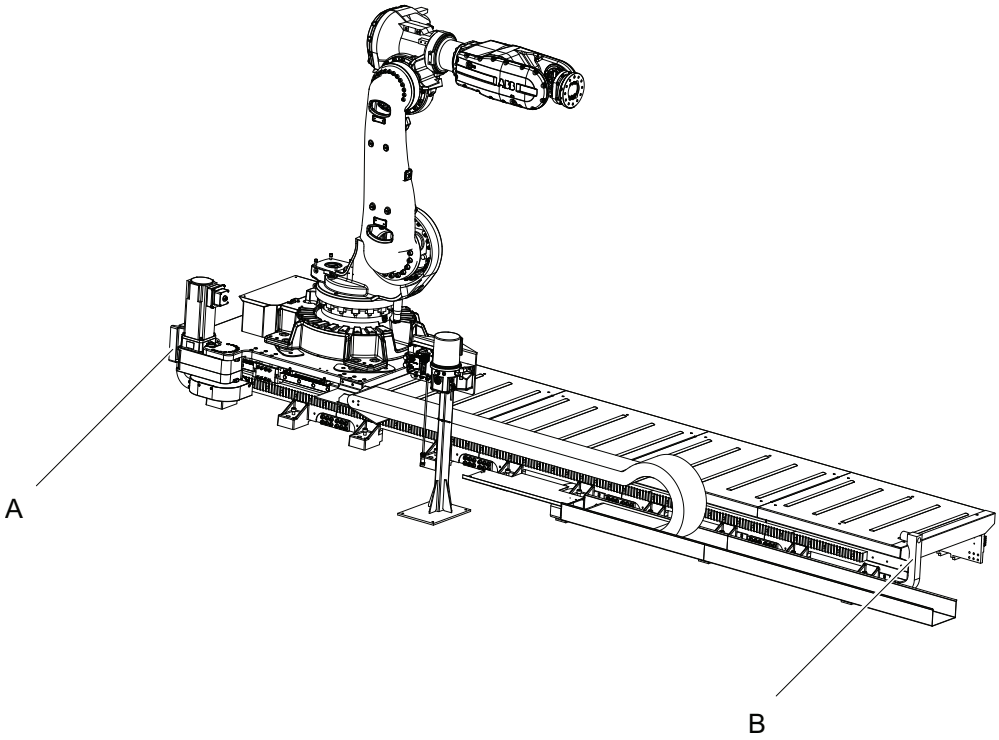
Common causes of cable failure when operating in a cable chain:

- 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 125*).

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

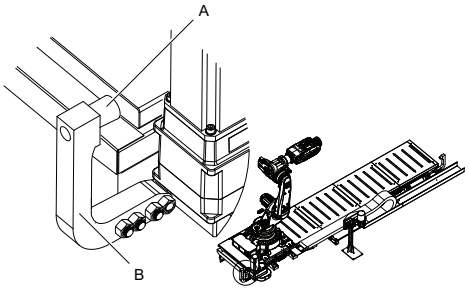
Equipment, etc.	Art. no.	Note
Visual inspection	-	

Continues on next page

3.6.2 Inspecting the mechanical stops
Continued

Inspecting the mechanical stops

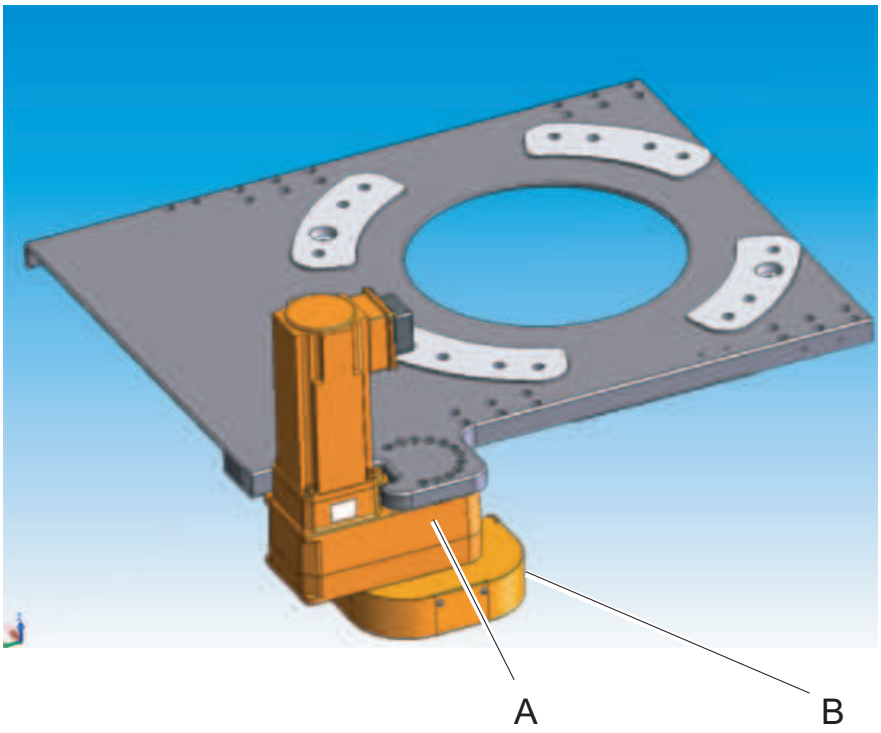
Use this procedure to inspect the mechanical stops.

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

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 301*.

Inspecting the gearbox, back lash

Use this procedure to inspect the gearbox, back lash.

	Action	Note
1	See *Adjusting the gearbox backlash on page 185*.	

3.6.4 Adjusting the leveling

Adjusting the leveling

Follow the procedure in *Geometric alignment of track motion IRBT 4004/6004/7004 on page 84* to adjust the leveling on the track motion.

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

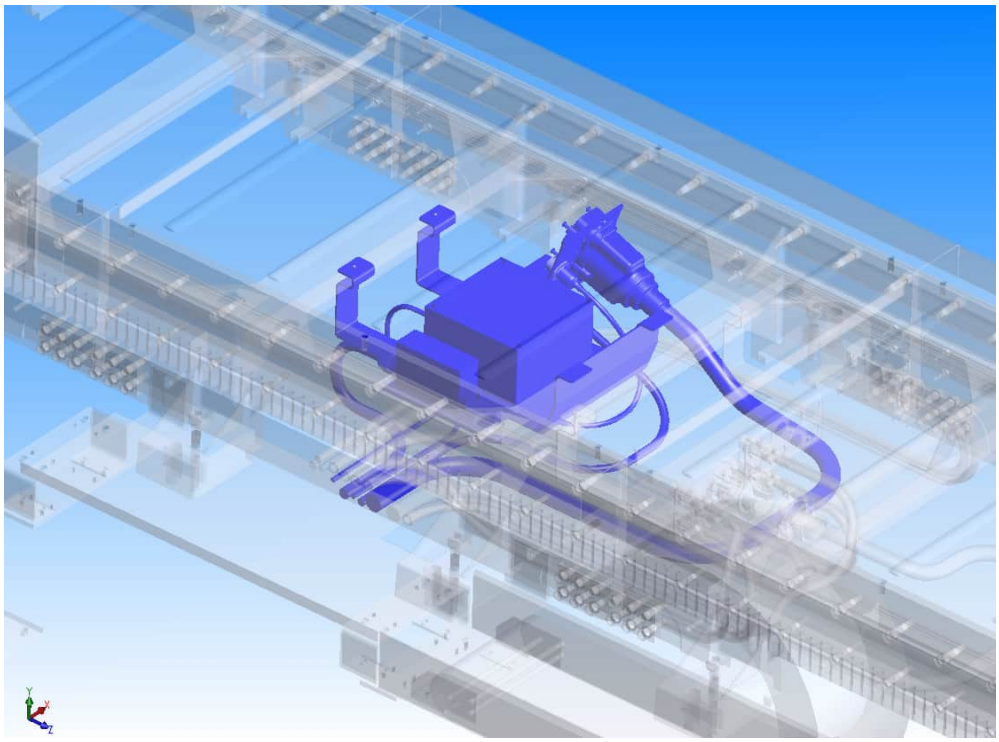
See *Hazards related to batteries on page 37*.

Continues on next page

3.7.1 Replacing the SMB battery pack
Continued

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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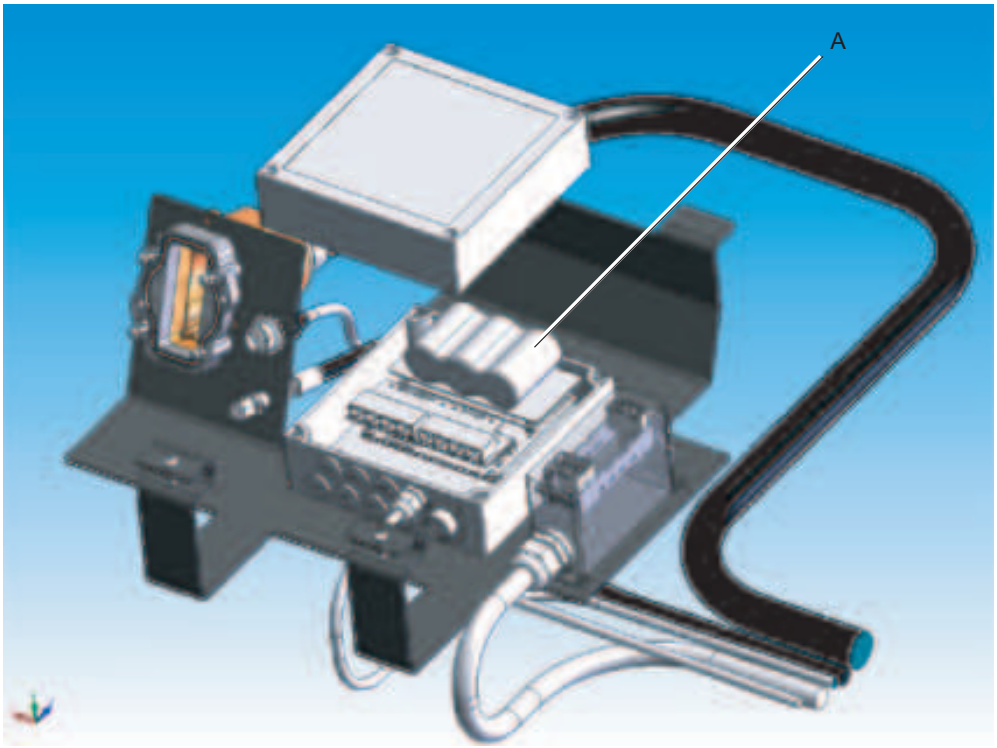


xx1100000749

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 301*.

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.  **CAUTION** Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.	
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 133*.

4 Repair

4.1 Introduction

Structure of this chapter

This chapter describes repair activities for the IRBT 4004/6004/7004. Each procedure contains the information required to perform the activity, for example spare parts numbers, required special tools, and materials.

WARNING

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

Report replaced units

Note

When replacing a part on the IRBT 4004/6004/7004, report to your local ABB the serial number, the article number, and the revision of both the replaced unit and the replacement unit.

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

Safety information

Make sure to read through the chapter *Safety on page 21* 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 protective earth and a residual current device (RCD) before starting any repair work.

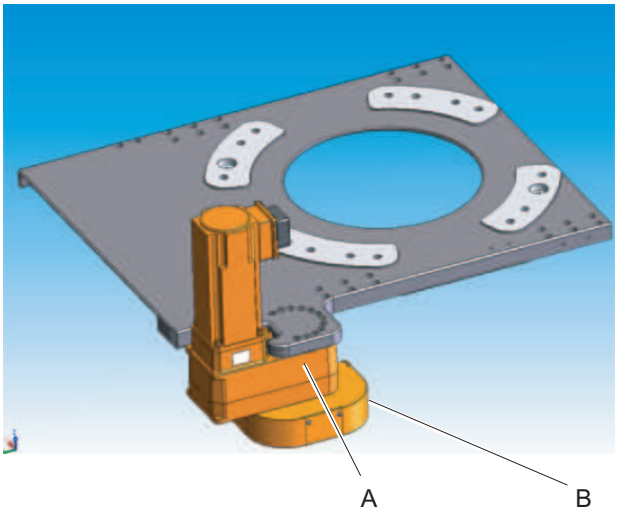
For more information see:

- *Product manual - IRC5*

4.2 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: • *Spare parts on page 305*.	
Gear wheel	Spare part number is specified in: • *Spare parts on page 305*.	
Gear wheel protection	Spare part number is specified in: • *Spare parts on page 305*.	Replace if damaged.
Locking liquid	3HAB7116-1	Loctite 243
Calibration tool	See *Special tools on page 302*.	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 301*.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.

Continues on next page

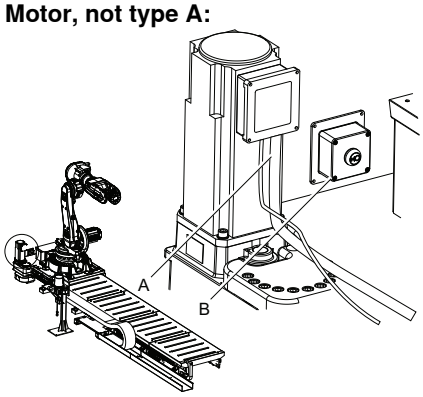
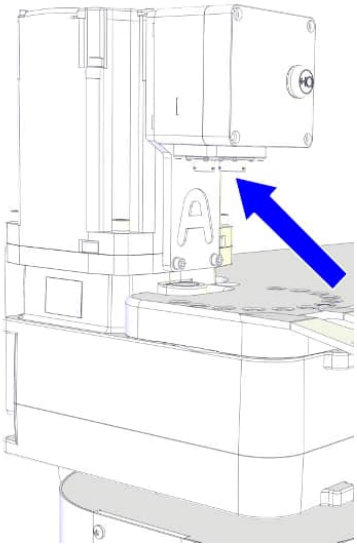
Removing the drive unit

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

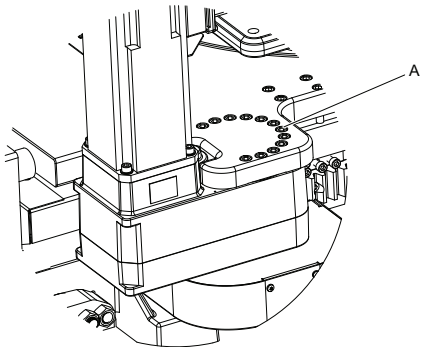
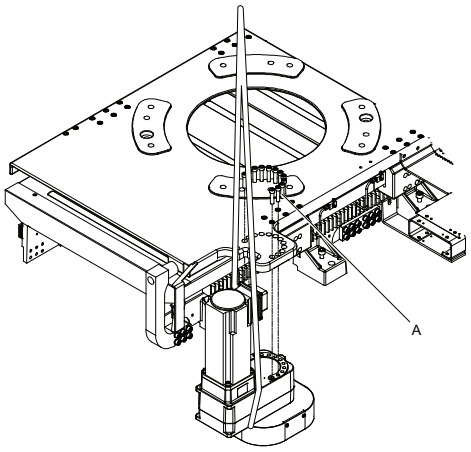
	Action	Note
1	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!	
2	**DANGER** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot and for the track motion.	
3	Clean the linear guide rails and then measure reference values for the zero position of the track motion by using a calibration tool.	See *Measuring reference values for zero position on page 280*.

Continues on next page

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

	Action	Note
4	Remove the cables from the motor.	**Motor, not type A:**  xx1100000750 A Cable unit, Motor B BRB option contact **Motor, type A (with a bracket):**  xx1300000058
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.	

Continues on next page

	Action	Note
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

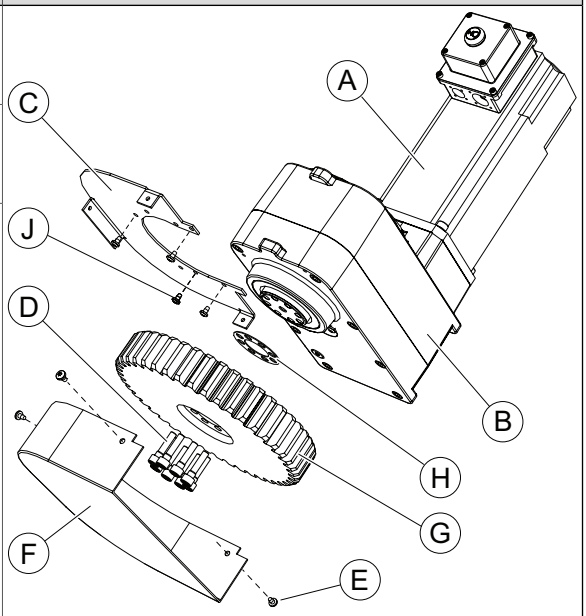
Removing the gear wheel and gearbox

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!	
2	Remove the drive unit from the track motion, as described in previous procedure.	

Continues on next page

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

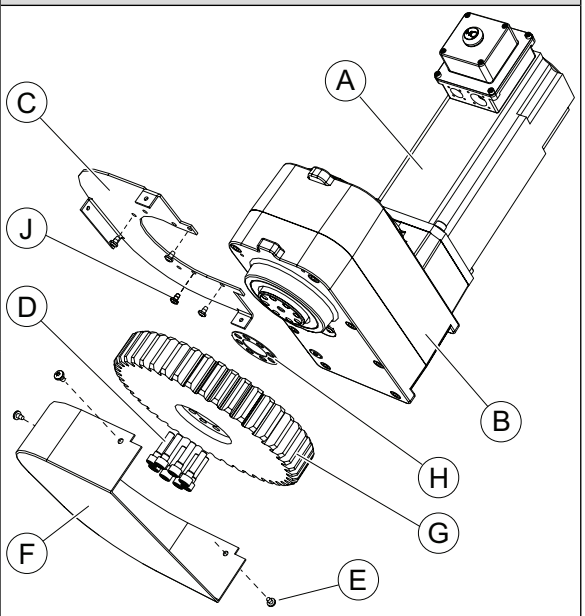
	Action	Note
3	Remove the lower part of the gear wheel protection (F) by removing the four screws (E).	 xx1100000753 A Motor B Gearbox C Gear wheel protection, upper part D Screw M10x40, 8 pcs E Screw M6x10, lower wheel protection, 4 pcs (self-tapping) F Gear wheel protection, lower part G Gear wheel H Friction washer I - J Screw M6x10, upper wheel protection (4 pcs for standard design, 3 pcs for mirrored design)
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.	

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

	Action	Note
2	Fit the upper part of the gear wheel protection (C) to the gear-box with screws M6x10 (J). Use locking liquid. **WARNING** Do NOT use self-tapping screws! Do not mix the screws for the upper and lower protection shield.	 xx1100000753 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)
3	Fit the the friction washer (H) and gear wheel (G) to the gearbox and secure with eight screws (D). Tightening torque: 79 Nm.	
4	**CAUTION** The complete drive unit weighs 90 kg. All lifting accessories used must be sized accordingly!	

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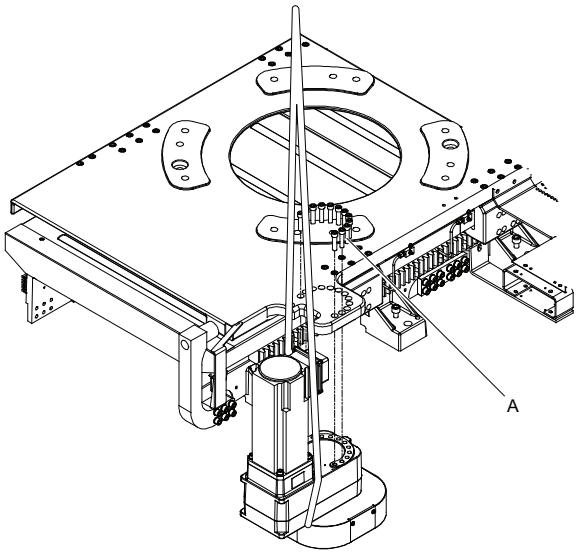
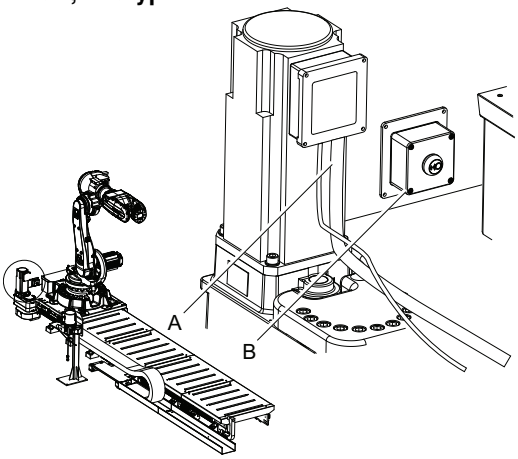
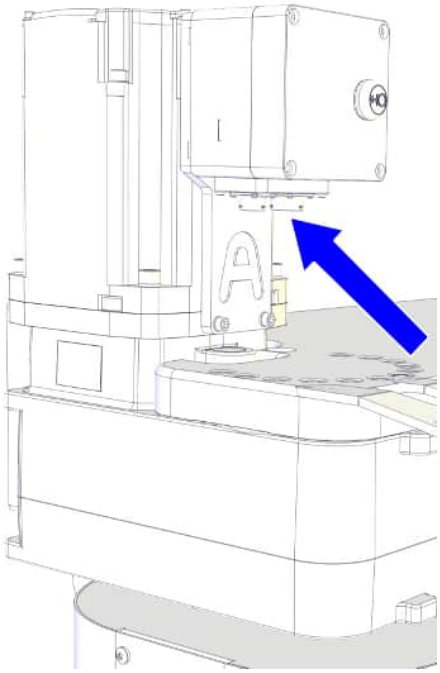
4.2 Replacing the gearbox (including the motor) and the gear wheel
Continued

	Action	Note
5	Fit lifting accessories to the complete drive unit and lift it to mounting position.	 xx1100000752 A Hex socket head cap screw M12x40, 12 pcs
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 backlash on page 185*.)	
7	Adjust gearbox back lash.	See *Adjusting the gearbox backlash on page 185*.
8	Refit the lower part of the gear wheel protection (F) to the drive unit with the 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

	Action	Note
9	Reconnect the cables. Ensure the cables are at 90º.	**Motor, not type A:**  xx1100000750 A Cable unit, Motor B BRB option contact **Motor, type A (with a bracket):**  xx1300000058
10	Clean the guide rails (before moving the carriage).	
11	Calibrate the track motion. Use previously measured reference values for the zero position.	See *Fine calibration on page 281*.

Continues on next page

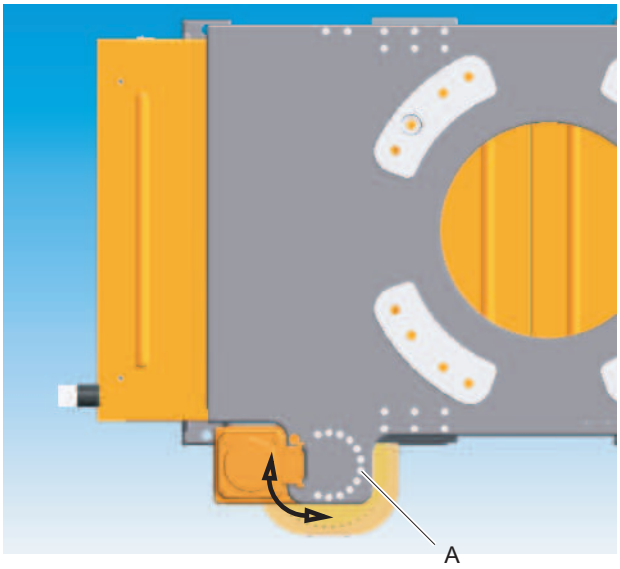
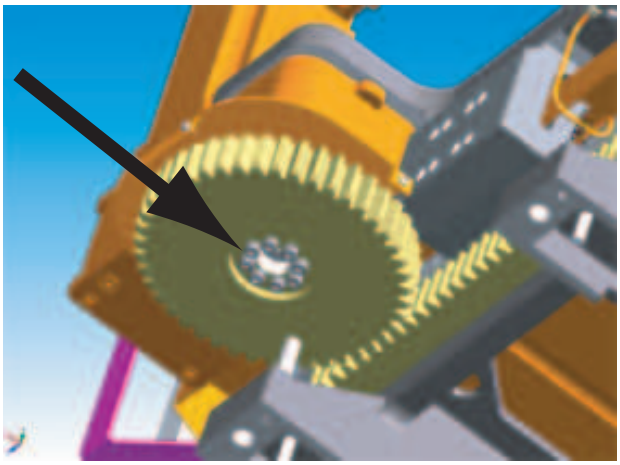
4.2 Replacing the gearbox (including the motor) and the gear wheel
Continued

	Action	Note
12	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 139*.	

4.3 Adjusting the gearbox backlash

Adjusting the gearbox backlash

Use this procedure to adjust the gearbox backlash.

	Action	Note
1	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).	 xx1100000754 A Joint screw
2	Push by hand the drive unit against the gear rack.	 xx1100000755

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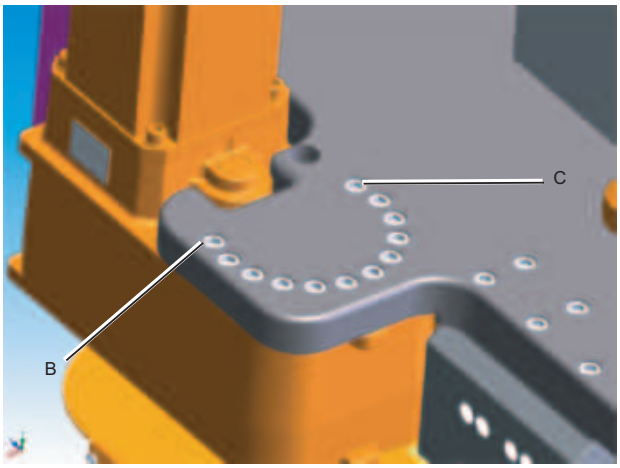
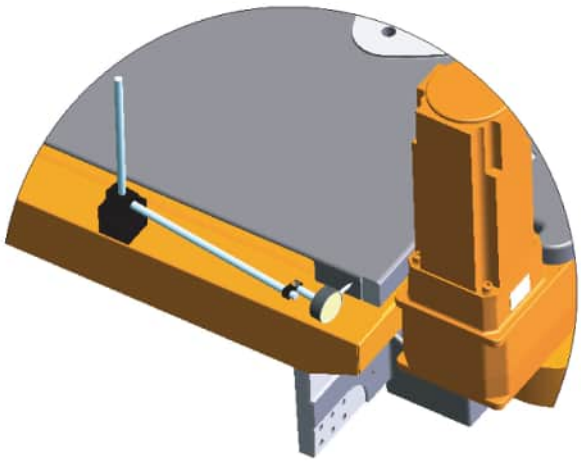
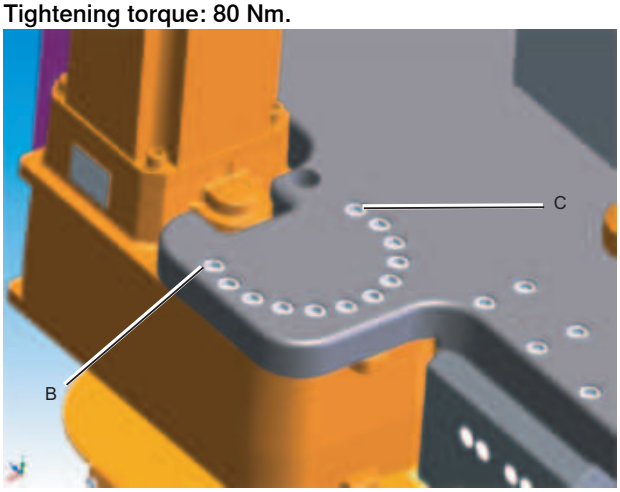
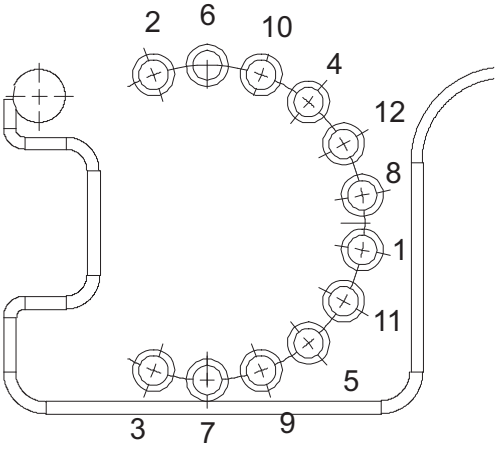
	Action	Note
3	Tighten the lock screws (B) and (C). Tightening torque: 40 Nm.	 xx1100000756 A - B Lock screw C Lock screw
4	Fit the indicator clock as shown in figure.	 xx1100000757
5	Push the carriage by hand until the gear wheel is in contact with the next cog on the gear rack.	X+ direction
6	Reset 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.	Recommended backlash value at synchronization position: 0.07-0.15 mm. At random positions the backlash value can deviate. Typical values: 0.02-0.20 mm.
9	Go back to *step 6*, push the carriage 1000 mm.	X+ direction

Continues on next page

	Action	Note
10	Continue with *step 7* to *step 9*.	
11	If the gap is OK, then tighten the lock screws (B) and (C) in figure.	Tightening torque: 80 Nm.  xx1100000756 A - B Lock screw C Lock screw
12	If the gap is not OK then repeat *step 6* to *step 10*.	
13	Tighten all 12 screws in a spread sequence.	Tightening torque: 120 Nm.  xx1100000758

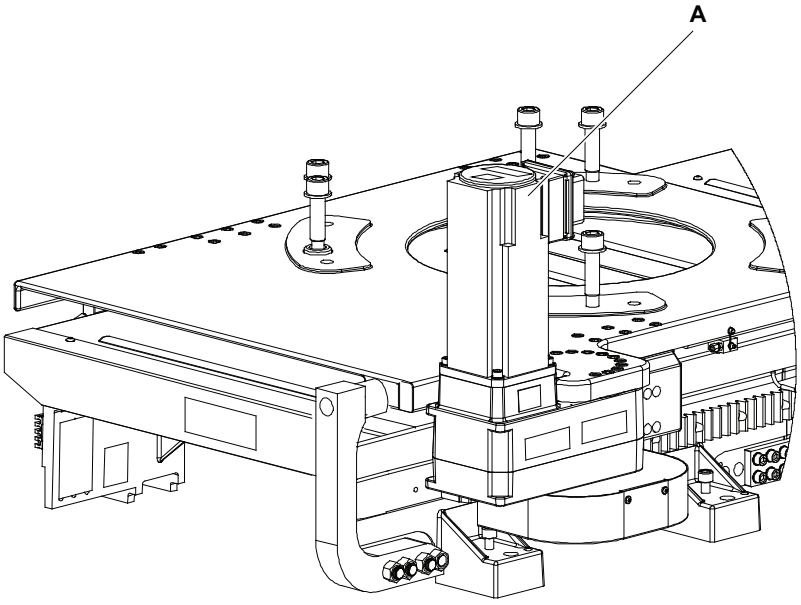
4.4 Replacing the motor

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 200* instead of this replacement procedure.

Location of motor

The motor is located as shown in the figure.



xx1100000759

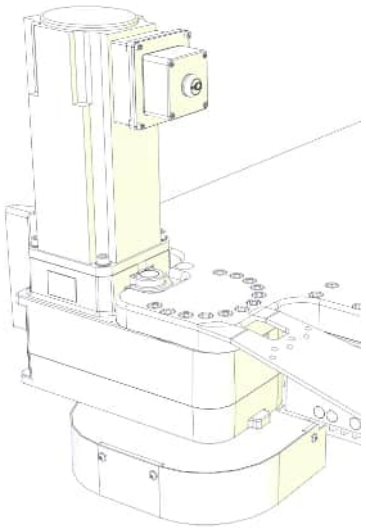
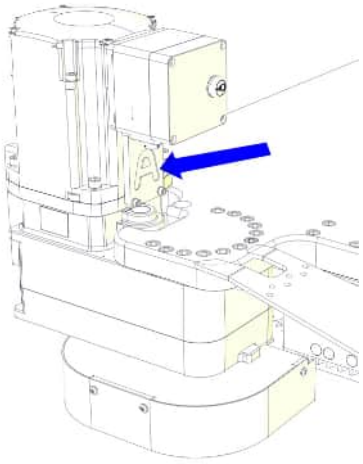
A	Motor

Continues on next page

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.

Version not marked with "A"	Type A version, marked with "A"
 xx1300000057	 xx1300000056

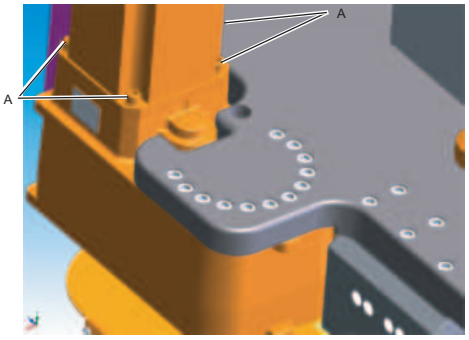
Required equipment

Equipment, etc.	Art. no.	Note
Motor	Spare part number is specified in: • *Spare parts on page 305*.	
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 302*.	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 301*.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.

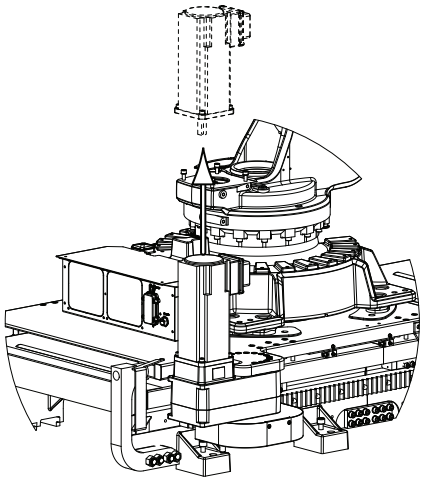
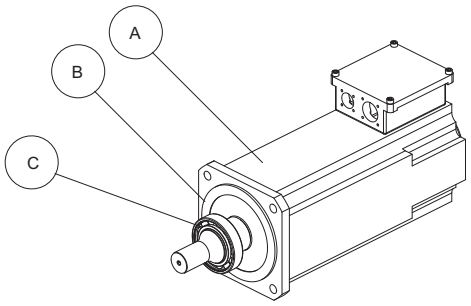
Continues on next page

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	Clean the linear guide rails and then 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 280*.
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

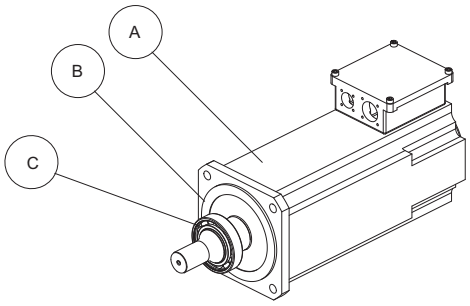
	Action	Note
10	Remove the motor.	 xx1100000761
11	Remove the gasket from the machined contact surface of the motor.	 xx1100000762 A AC Motor B Machined contact surface C Axle drive bearing

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!	

Continues on next page

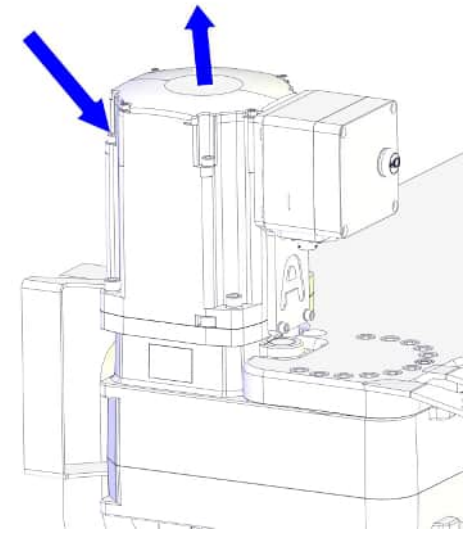
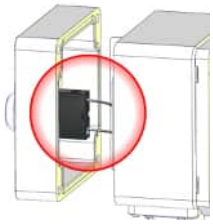
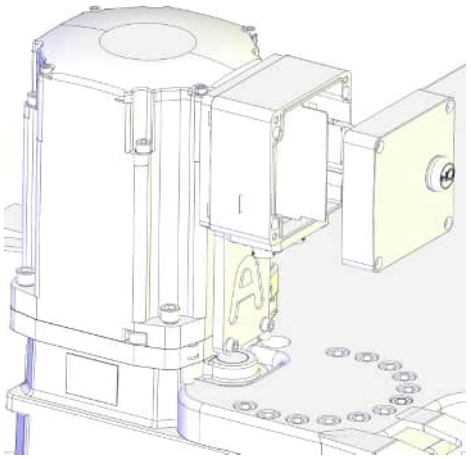
	Action	Note
2	Fit the new gasket on the motors machined contact surfaces.	 xx1100000762 A AC Motor B Machined contact surface C Axle drive bearing
3	In order to release the brake, connect the 24 VDC power supply.	Connect to motor connector: • + : pin L • - : pin M
4	Secure the motor with four screws 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	Clean the guide rails (before moving the carriage).	
10	Calibrate the track motion. Use previously measured reference values for the zero position.	See *Fine calibration on page 281*.
11	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 139*.	

Removing the Type A motor - marked with "A"

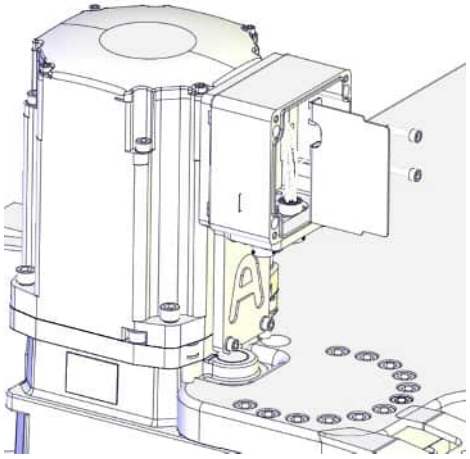
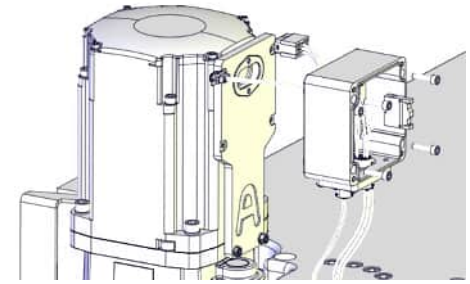
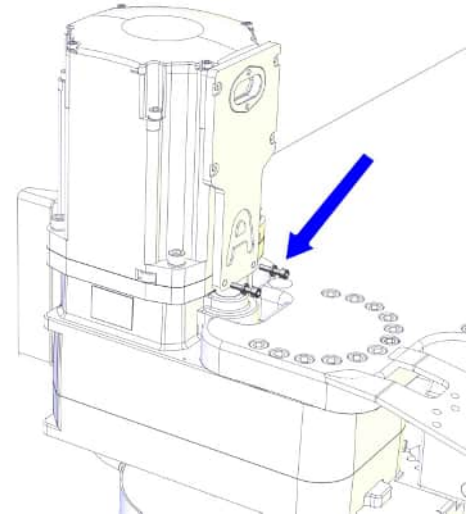
Use this procedure to remove the motor.

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

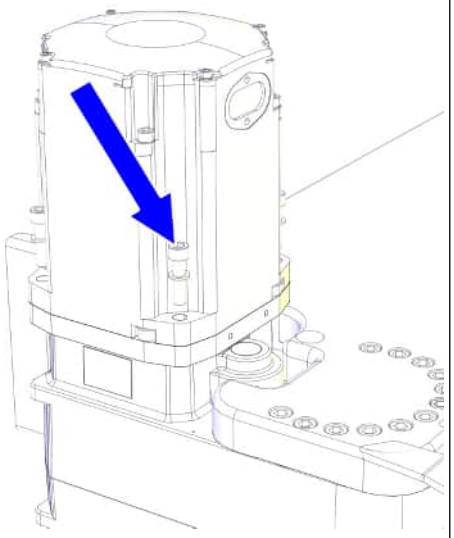
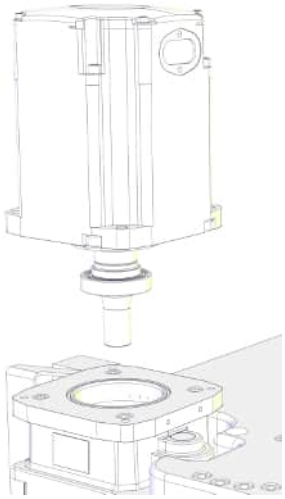
Continues on next page

	Action	Note
2	**DANGER** Turn off all electric power, hydraulic and pneumatic pressure supplies to the robot and for the track motion.	
3	Clean the linear guide rails and then 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 280*.
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 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.	 xx1300000219

Continues on next page

	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

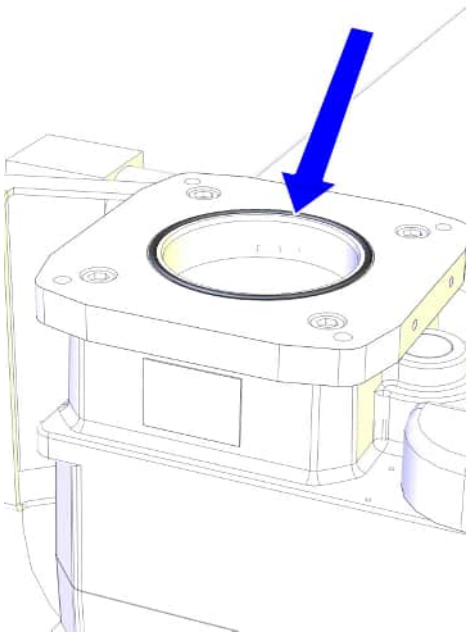
Continues on next page

	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.	 xx1300000060 Type A motor.

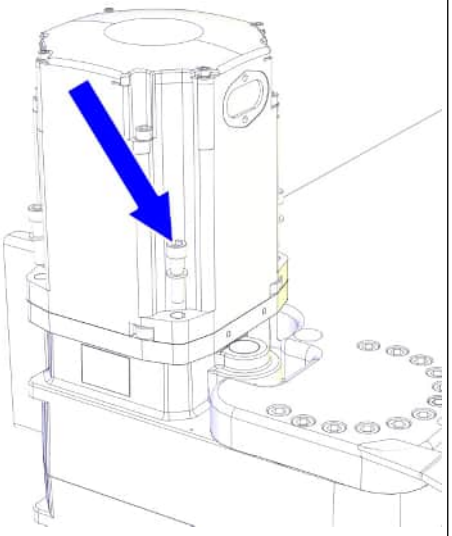
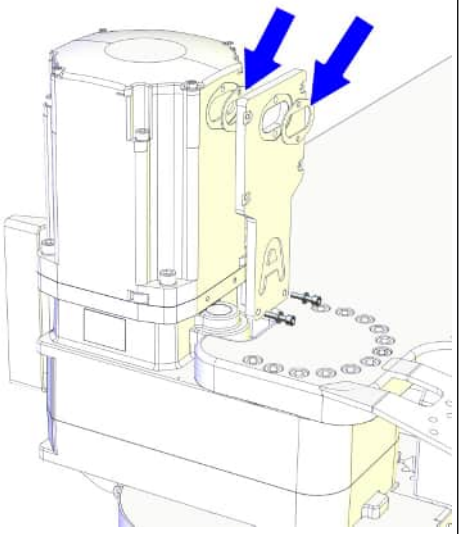
Continues on next page

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

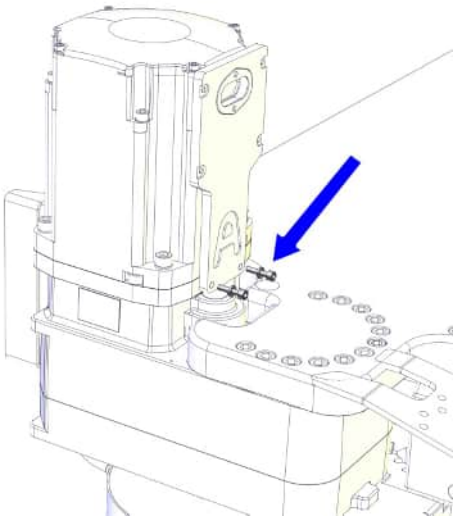
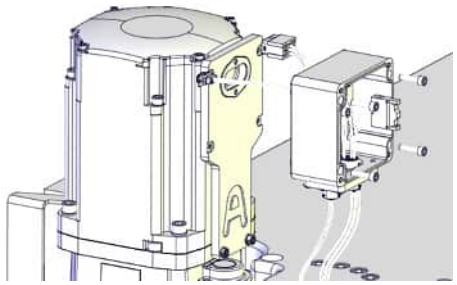
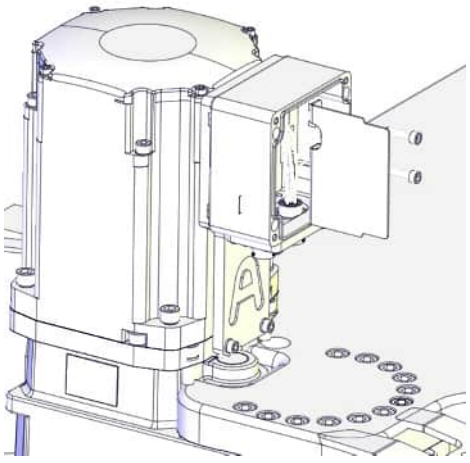
Continues on next page

	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

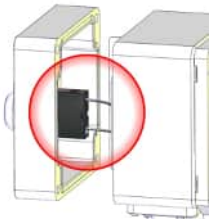
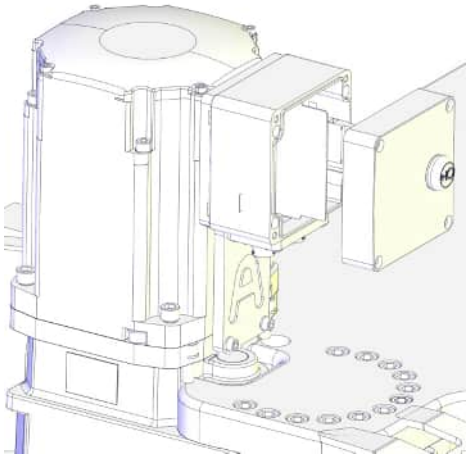
Continues on next page

4.4 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.	

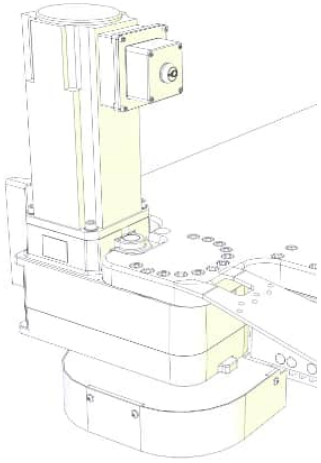
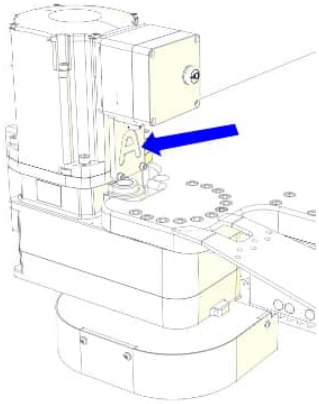
Continues on next page

	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	Clean the guide rails (before moving the carriage).	
17	Calibrate the track motion. Use previously measured reference values for the zero position.	See *Fine calibration on page 281*.
18	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 139*.	

4.5 Changing the track motion motor to Type A

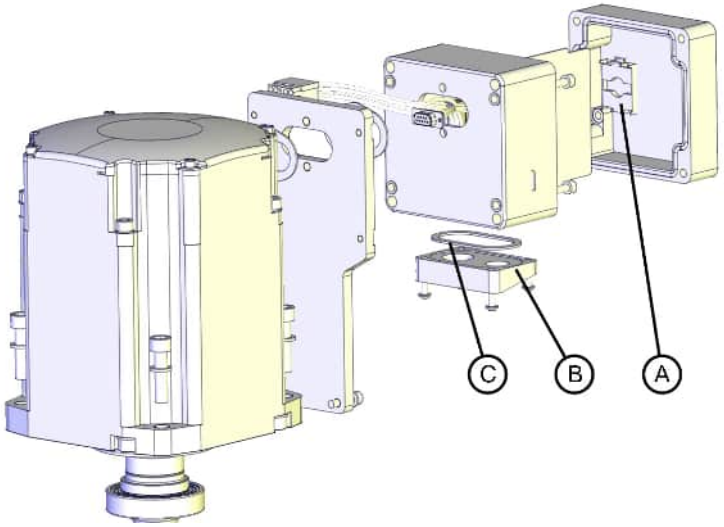
Two versions of the track motion motor

The figures show the visual differences between Type 0 of track motion motor and Type A.

Type 0	Type A, with a bracket
 xx1300000057	 xx1300000056

Exploded views of Type A motor

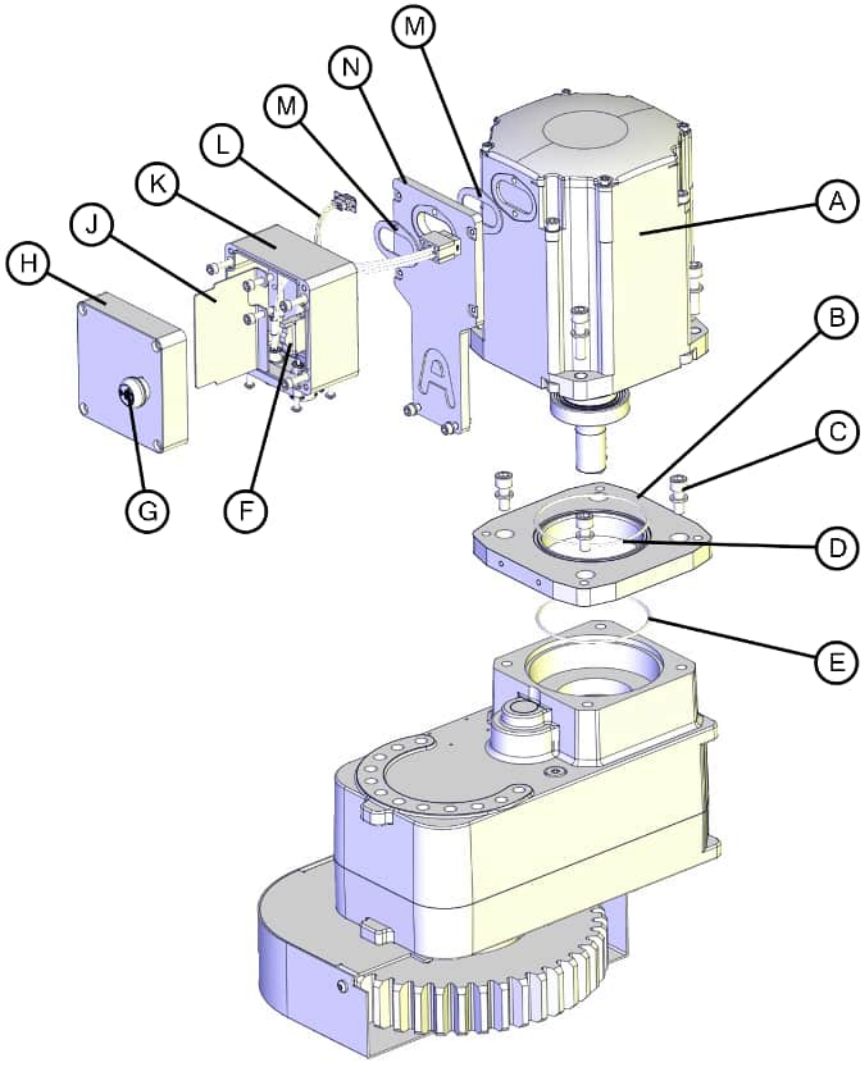
The figures show exploded views of the Type A version of the track motion motor.



xx1300000229

A	Plate for push button
B	Adapter for cable plate
C	Gasket

Continues on next page



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

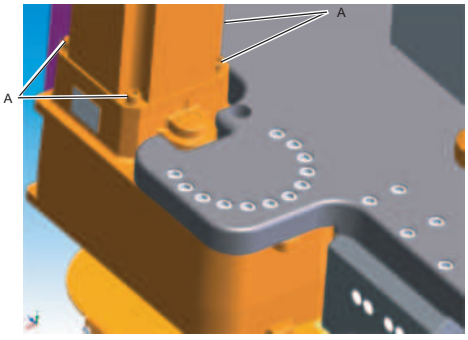
Continues on next page

Required equipment

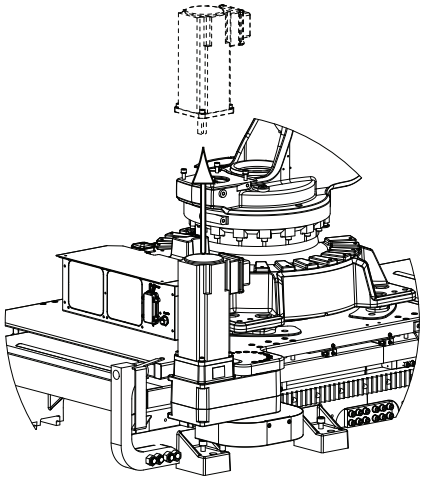
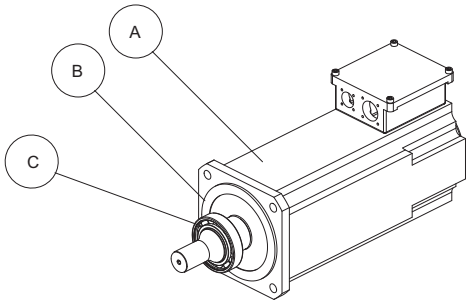
Equipment	Art. no.	Note
Motor, Type A	See *Spare parts on page 305*.	
Adapter cable kit	See *Spare parts on page 305*.	Required when connecting the Type A motor to track motion cabling without bayonet cabling
Grease	3HAC042536-001	Shell Gadus S2 Used to lubricate the o-rings.

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	Clean the linear guide rails and then 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 280*.
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

	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.

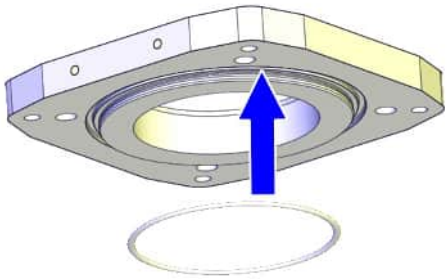
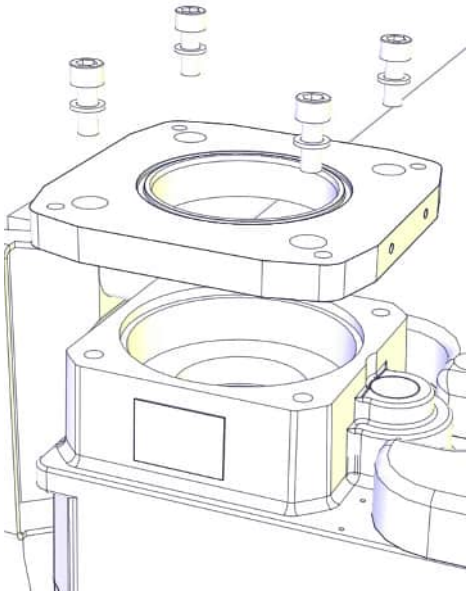
Mechanical installation

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

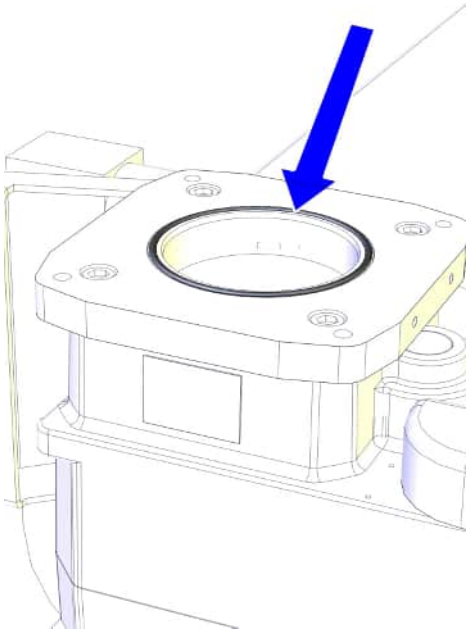
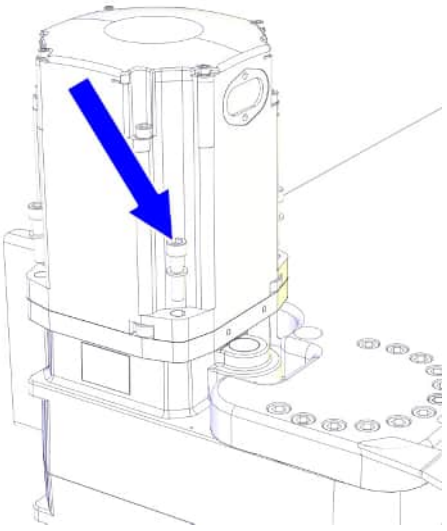
Continues on next page

4.5 Changing the track motion motor to Type A

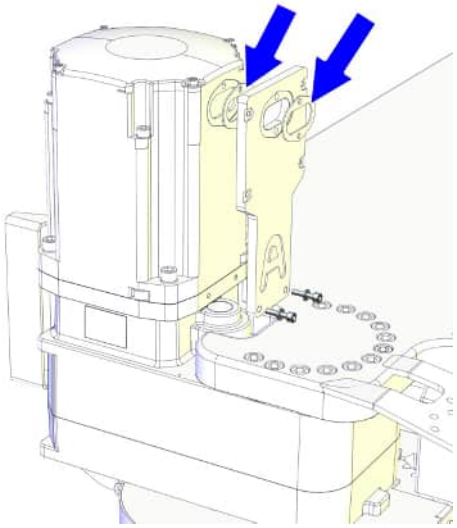
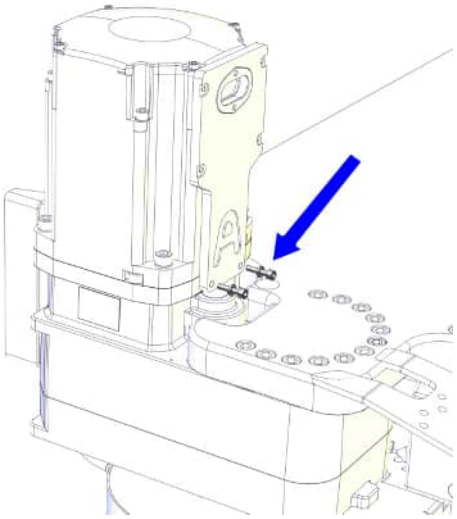
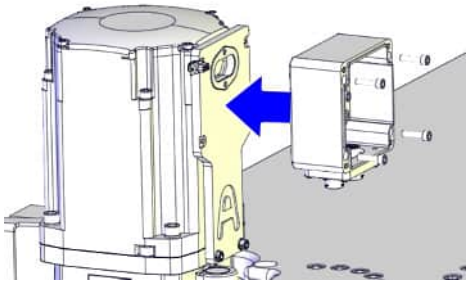
Continued

	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

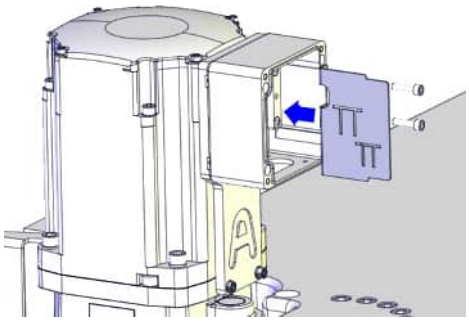
Continues on next page

	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

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

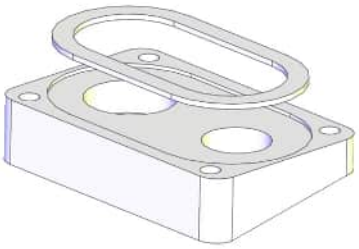
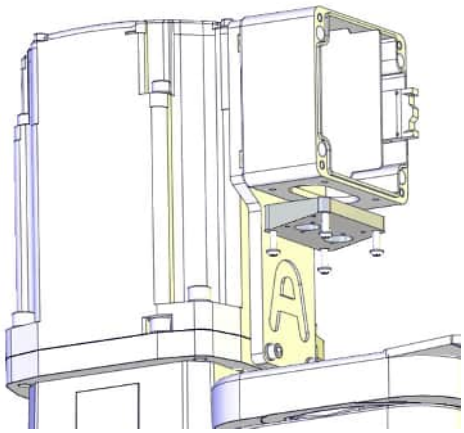
Continues on next page

	Action	Note
12	Fit the plate to the connection box with the attachment screws.	 xx1300000443
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 adapter cable 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 gasket to the adapter cable plate.	 xx1300000450
3	Fit the adapter cable plate to the motor.	 xx1300000451

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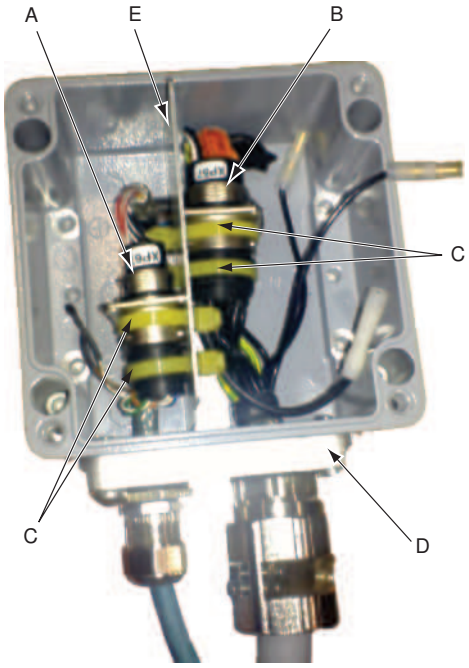
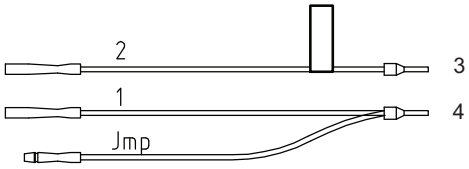
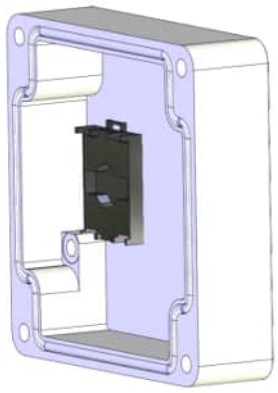
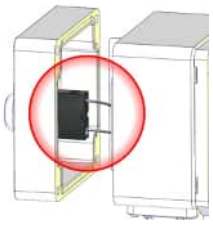
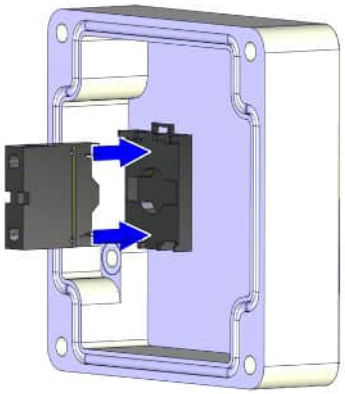
4.5 Changing the track motion motor to Type A

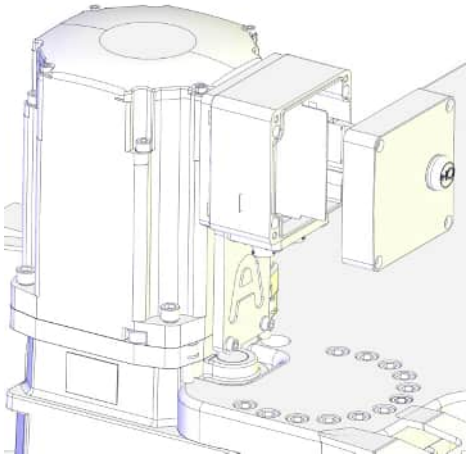
Continued

	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).	 xx1300000727
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 electrical kit for brake release to the track motion power cabling according to the cable markings. • Connect cable 1 to cable 1. • Connect cable 2 to cable 2. • Connect cable Jmp to cable Jmp.	 xx1300000447
7	Connect the electrical kit to the contact block according to the figure.	• 1, 2, Jmp = markings on the cable. • 3, 4 = connections on the push button unit contact block.

Continues on next page

	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

	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	Clean the guide rails (before moving the carriage).	
13	Calibrate the track motion. Use previously measured reference values for the zero position.	See *Fine calibration on page 281*.
14	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 139*.	

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 in the RobotWare package 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.	

Continues on next page

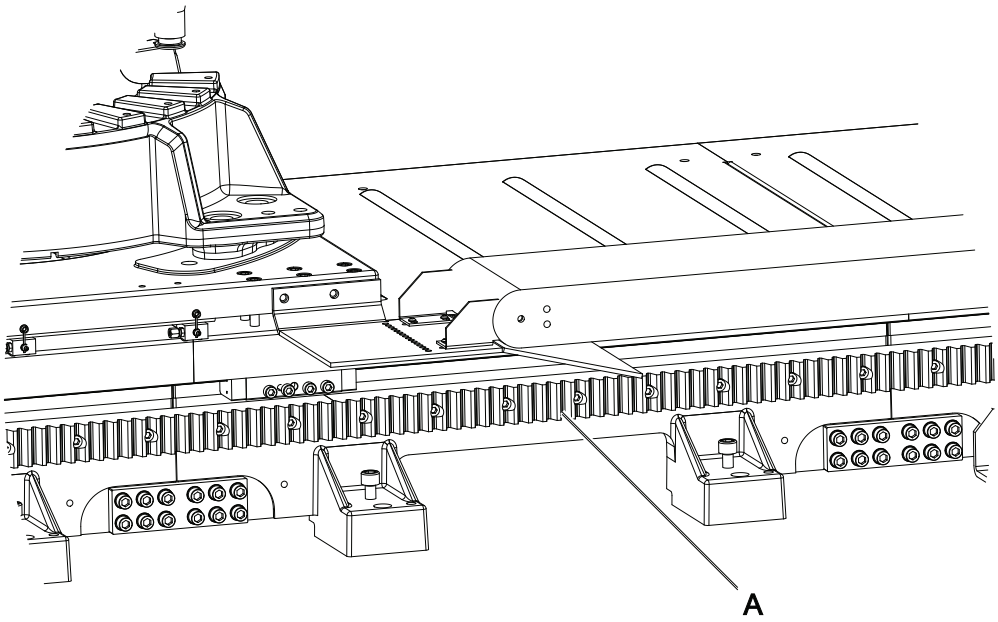
	Action	Note
3	Use the SystemBuilder in RobotStudio to upgrade the controller system with the additional option software for the track motion Type A.	
4	C-start the system on the controller.	
5	Download the upgraded system to the controller	
6	Restore the backup.	

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

4.6 Replacing the gear racks

Location of gear racks

The gear racks are located as shown in the figure.



xx1100000744

A	Gear racks

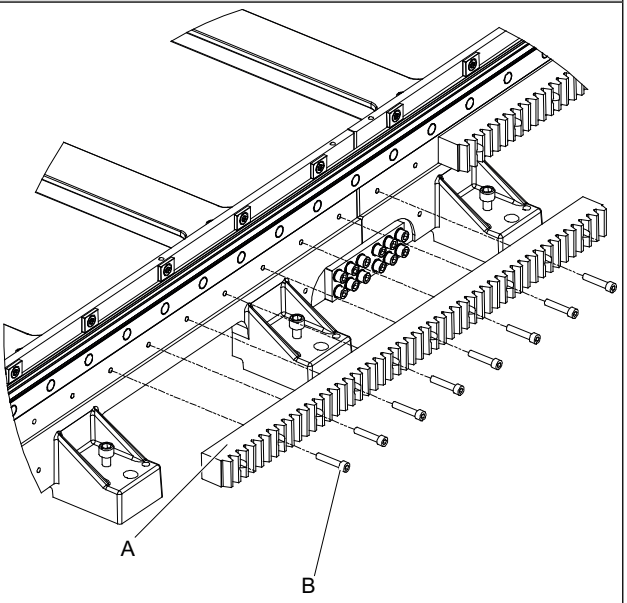
Required equipment

Equipment, etc.	Art. no.	Note
Gear rack	Spare part number is specified in: • *Spare parts on page 305*.	
Meshing gauge, gear rack	3HXD1000-467	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 301*.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.

Continues on next page

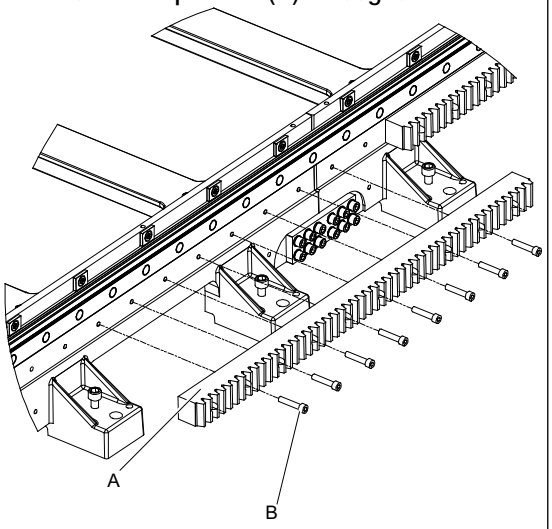
Removing the gear racks

Use this procedure to remove the gear racks.

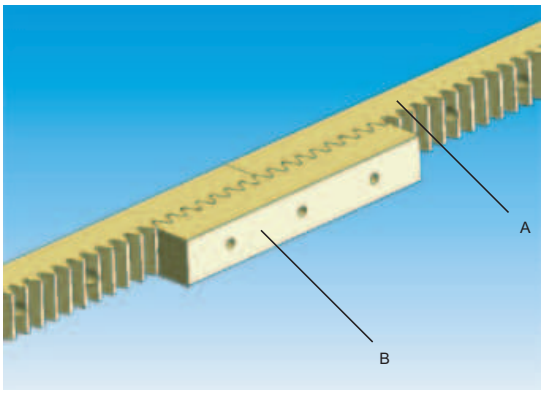
	Action	Note
1	Remove all ten hex socket head cap screws M10x50 (B) that hold the gear rack (A).	 xx1100000763 A Gear rack B Hex socket head cap screw M10x50

Refitting the gear racks

Use this procedure to refit the gear racks.

	Action	Note
1	Leave the outer holes empty, and fit eight hex socket head cap screws, M10x50 that hold the gear rack (A). **Tip** The outer holes are used to fasten the meshing gauge.	Socket head cap screw (B) soft tighten.  xx1100000763 A Gear rack B Hex socket head cap screw M10x50

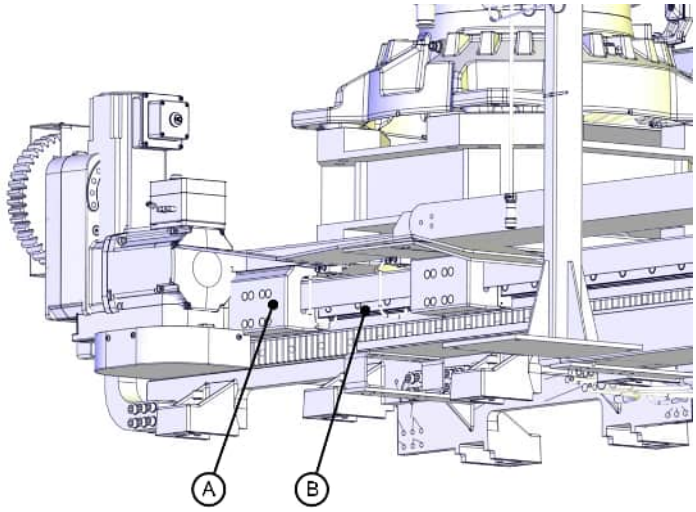
Continues on next page

	Action	Note
2	Use the meshing gauge (B) to check that the joints on the laid gear rack have a smooth transition. Fit the meshing gauge in the outer holes and tighten it to the gear rack with 70 Nm. If the teeth on the meshing gauge and the gear rack do not mesh, continue with *step 3*. Otherwise go directly to *step 5*.	 xx1100000764 A Gear rack B Meshing gauge 3HXD1000-467
3	If the teeth on the meshing gauge and the gear rack do not mesh, loosen the bolts on the pre-fitted gear racks.	
4	Adjust the transition by using the play on the mountings on the pre-fitted gear racks.	
5	Secure the pre-fitted gear racks. Tightening torque: 70 Nm.	
6	Remove the meshing gauge and fit the remaining hex socket head cap screws, M10x50. Tightening torque: 70 Nm.	
7	Secure the gear rack section. Tightening torque: 70 Nm. If additional sections are to be assembled, repeat the procedure.	
8	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 139*.	

4.7 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

CAUTION

If not all parts are replaced during a breakdown, lifetime will be reduced.

	Action	Note
1	Replace all linear guides on the same side of the track as where the damage has occurred. • Inspect the linear guides on the other side of the track.	
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 220*.

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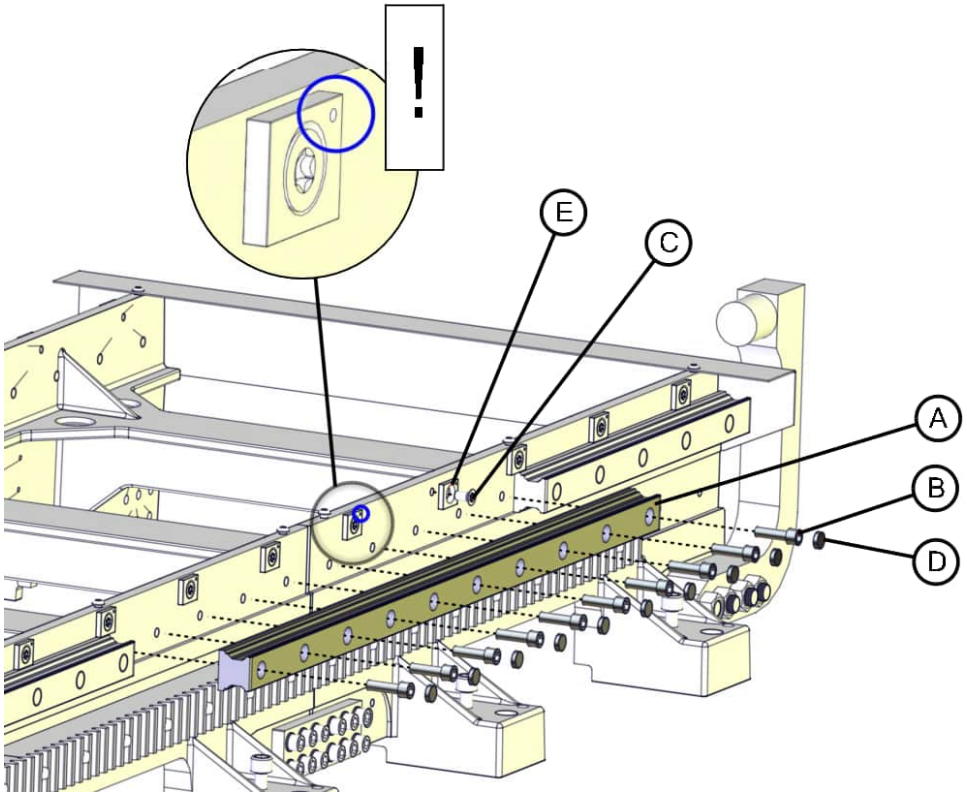
Location of linear guides

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

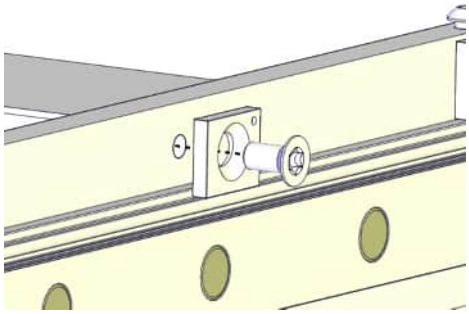
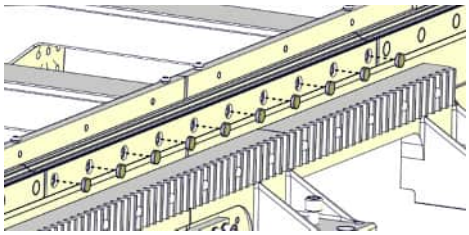
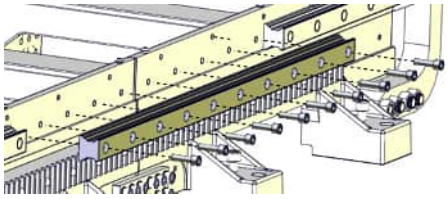
Equipment, etc.	Article number	Note
Linear guides	Spare part number is specified in: • *Spare parts on page 305*.	
Cover, screws	3HEA802820-001	Valid for linear guides from Bosch-Rexroth.
	3HAC042178-005	Valid for linear guides from INA
Standard toolkit	-	Content is defined in section *Standard toolkit on page 301*.

Continues on next page

Equipment, etc.	Article number	Note
Total CERAN CA	-	**WARNING** The grease used causes serious eye irritation and may cause an allergic skin reaction.
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 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. **Tip** The cover will not be reused, the covers can be scrapped.	 xx1600000975
4	Remove the linear guides by removing all the hex socket head cap screws M12x40.	 xx1600000973

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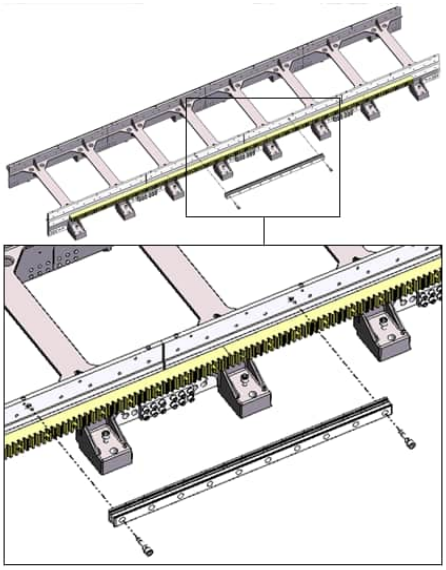
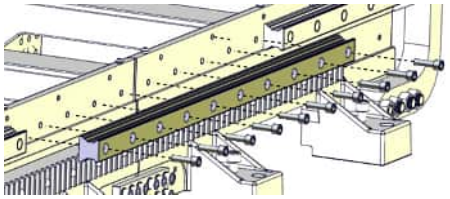
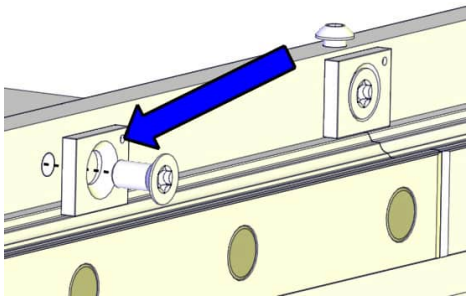
Refitting the linear guides

Use this procedure to refit the linear guides.

	Action	Note
1	Attach the first linear guide to the middle of the frame with a hex socket head cap screw M12x40 at each end of the guide, see figure. **Note** Make sure that the screws are correctly aligned with the center of their respective hole before attaching the first linear guide to the frame, as this will affect all the other linear guides. **Note** Attach the first linear guide from the middle of the frame assembly, and work outwards.	 xx2300001178
2	Fit the linear guides with the hex socket head cap screws M12x40, loose tightening. The guides need to be against the frame, but adjustable. **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.	Use standard tools.  xx1600000973
3	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. If used, replace the two guiding bolts with M12x40 screws.	 xx1600000972

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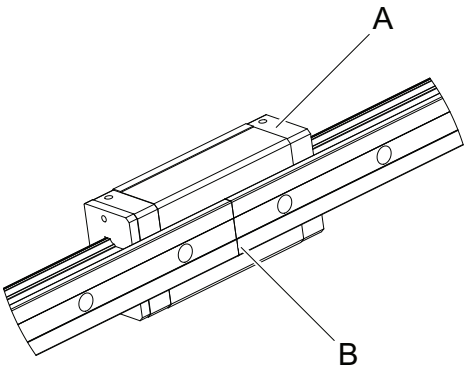
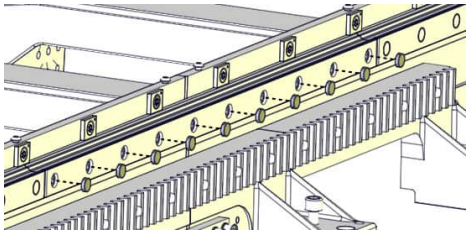
	Action	Note
4	**Valid for linear guides from Bosch-Rexroth:** Use a ball element to adjust the sections. Tighten the hex socket head cap screws M12x40. **Valid for linear guides from INA:** Feel with a finger at the section joint that the linear guide sections are in line with each other. Tighten the hex socket head cap screws M12x40. Tightening torque: 120 Nm.	 xx1100000766 A Ball element B Section joint
5	Fit the screw covers. **CAUTION** Align the covers. If covers are mounted with a gap, dirt may gather in the hole and may damage the linear bearing, which leads to shorter lifetime. Replace if damaged.	 xx1600000974
6	Lubricate the linear guides.	Use Total CERAN CA. **WARNING** The grease used causes serious eye irritation and may cause an allergic skin reaction.
7	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 139*.	

4.8 Replacing the ball elements

Overview

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

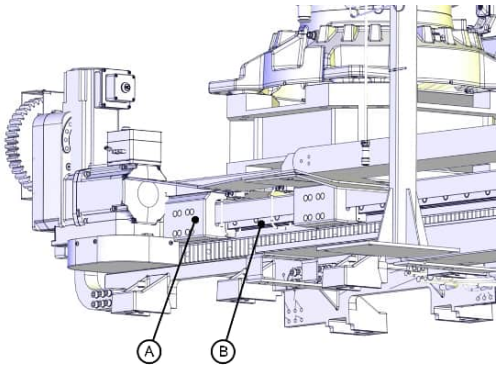
- Bracket for ball element (runner block)
- Ball elements (runner block)
- Mechanical stops
- Gearbox and motor (only required when replacing ball elements on the motor side of the carriage, when an IRB 7600 is mounted in 90º position on the track motion)

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 302* 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 all linear guides on both sides of the track. If any damaged linear guides are found, replace all linear guides on that side of the track.	See *Replacing the linear guides on page 215*.

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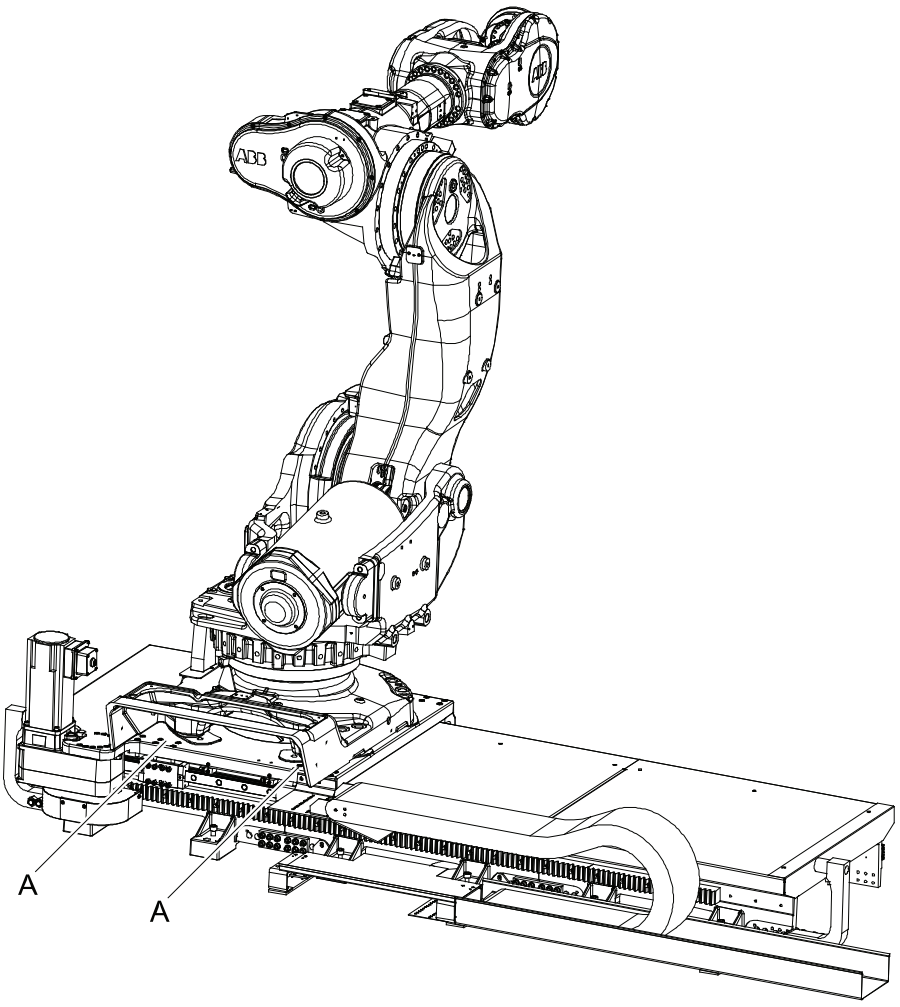
Position of robot

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

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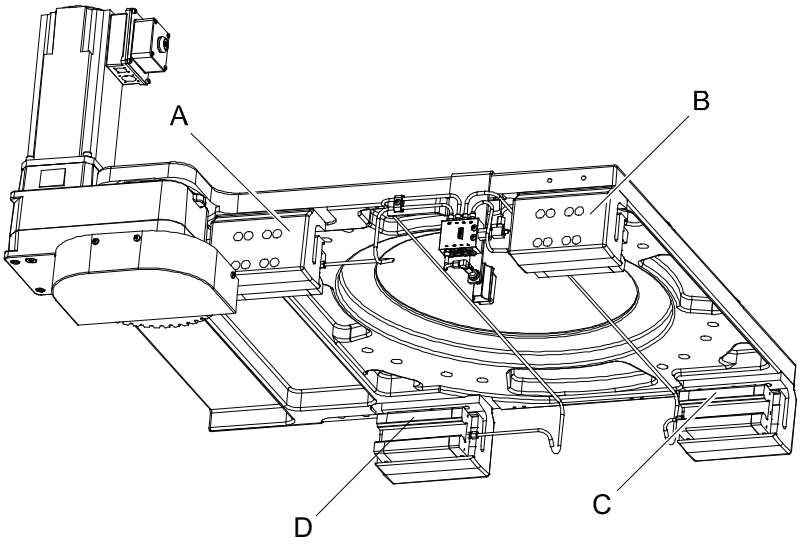
4.8 Replacing the ball elements
Continued

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 224*).
B	Ball element position B
C	Ball element position C
D	Ball element position D

Required equipment

Equipment, etc.	Article number	Note
Ball elements	Spare part number is specified in: • *Spare parts on page 305*.	
Jack	-	Capacity > 2,000 kg
Runner block replacement tool	3HAC044740-002	
Cylindrical pin extractor tool	3HAC044742-001	Enclosed in 3HAC044740-002.
Lifting accessories IRB 7600	-	See *Product manual - IRB 7600*
Feeler	-	1 mm
Calibration tool	See *Special tools on page 302*.	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 301*.
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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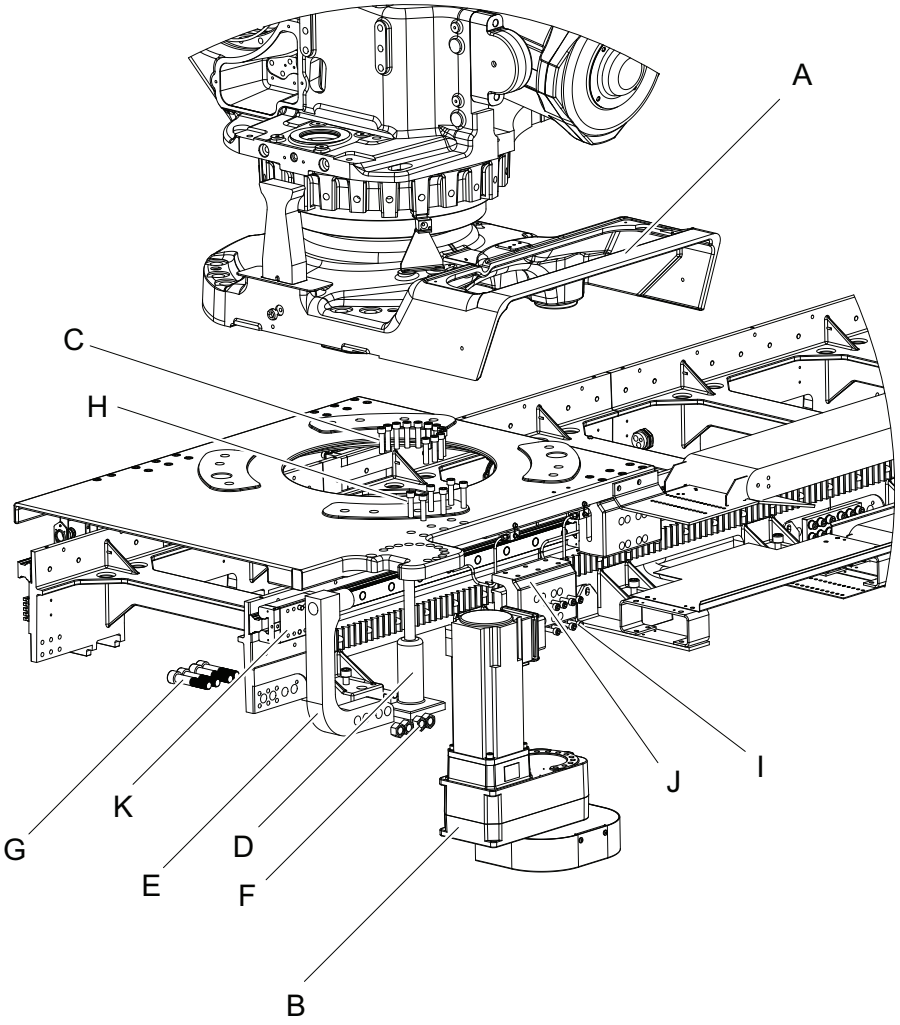
Illustration of removal of ball elements, IRB 7600, 90° motor side

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



xx1100000769

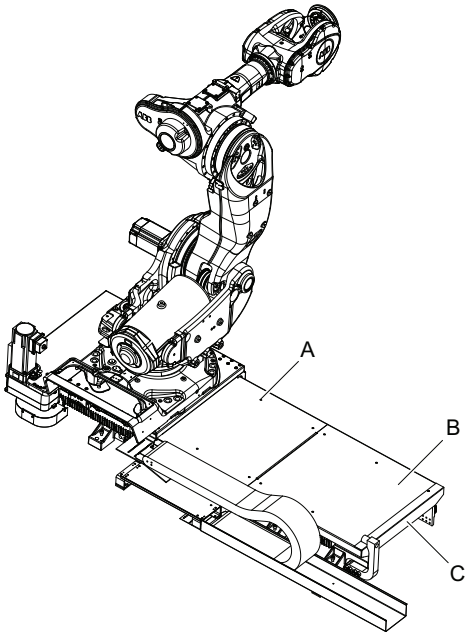
A	IRB 7600, 90°
B	Gearbox and motor
C	12 x Hex socket head cap screw M12x50
D	Jack > 2000 kg
E	Mecanical stop
F	Hexagon nuts
G	Socket Head Cap Screw MC6S M20x100
H	6 x Hex socket head cap screw
I	8 x Hex socket head cap screw
J	Bracket for runner block
K	Ball elements (runner block)

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 222*).

	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 215*.
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 280*.
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 *Releasing the brake with external 24V DC on page 91*.	 xx1100000770 A Socket head cap screw 6X M10 B Top cover for IRBT C End protection

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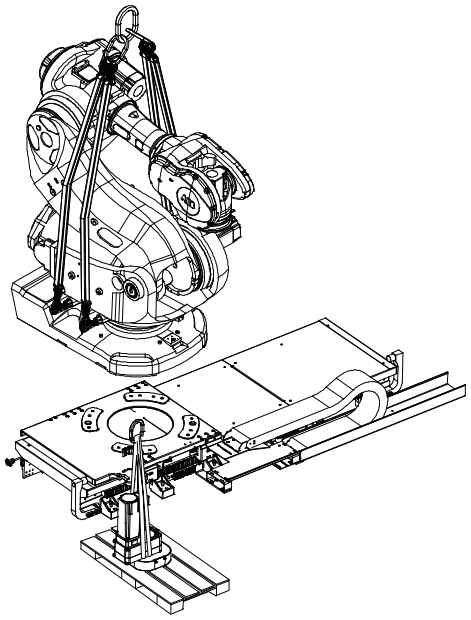
	Action	Note
4	Lift the robot according to lift instructions in section Installation and commissioning in *Product manual - IRB 7600*.	 xx0700000394
5	**CAUTION** The gearbox weighs 90 kg. All lifting accessories used must be sized accordingly!	
6	Remove the gearbox and the motor according to *Replacing the gearbox (including the motor) and the gear wheel on page 176* and *Replacing the motor on page 188*.	

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 222*).

	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 215*.
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 280*.

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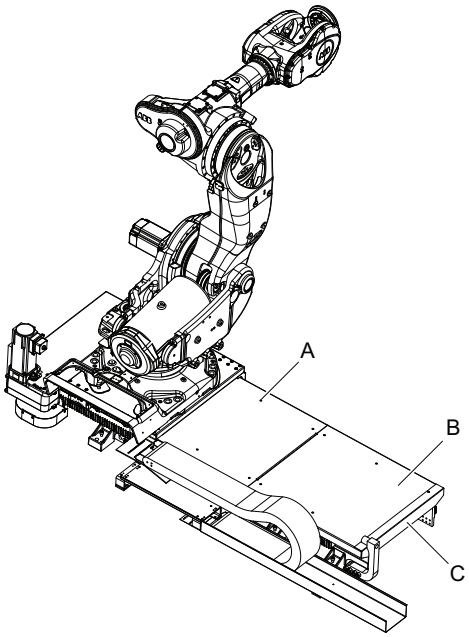
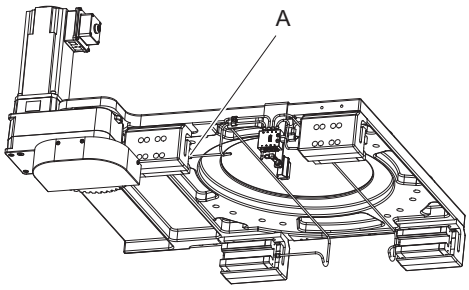
	Action	Note
3	Remove all the socket head cap screws holding the top covers and the end protections, using standard tools. To move the carriage without power see *Releasing the brake with external 24V DC on page 91*.	 xx1100000770 A Socket head cap screw 6X M10 B Top cover for IRBT C End protection

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.	 xx1100000772 A Lubrication tube nipple

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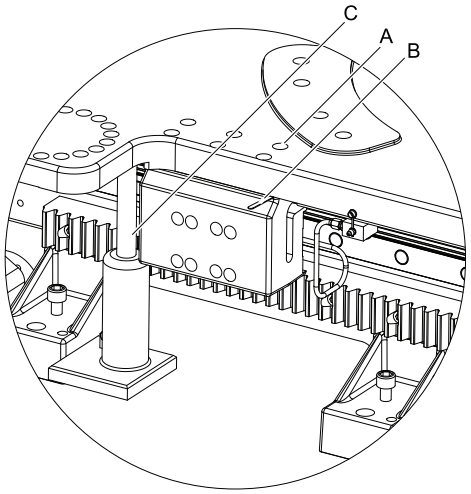
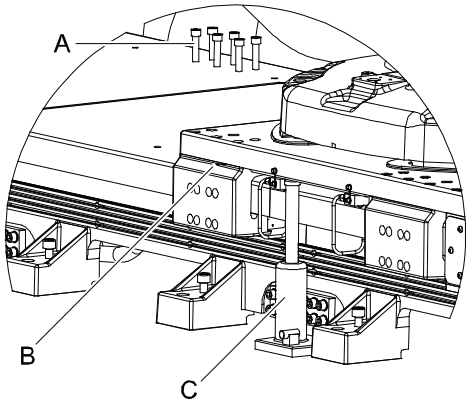
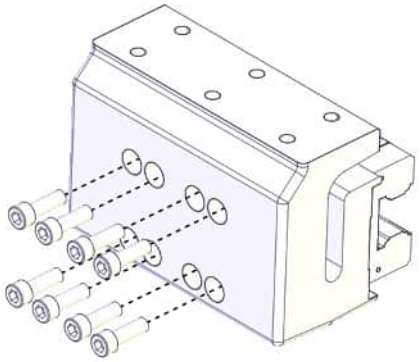
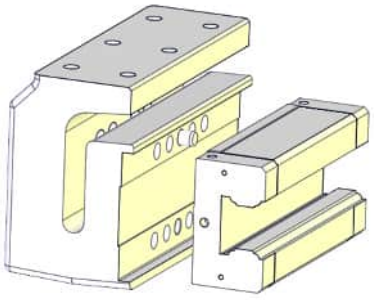
	Action	Note
2	Remove all the hex socket head cap screws (A) that hold the bracket to the carriage. Use a jack (C) to rise the robot and the carriage max. 1 mm, use a feeler (B). **WARNING** Rising the carriage more than 1 mm can seriously damage the remaining three ball elements!	Motor side of track motion for IRB 7600, mounted 90°:  xx1600000986 A Hex socket head cap screw B Feeler 1mm C Jack >2000 kg Track motion for all but IRB 7600, 90° motor side:  xx1100000774 A Hex socket head cap screw B Feeler 1mm C Jack >2000 kg
3	Remove the mechanical stops.	See *Replacing the mechanical stops on page 237*.
4	Slide the ball element assembly off the linear guide.	

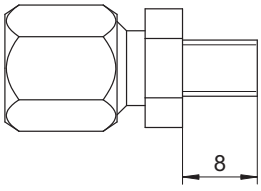
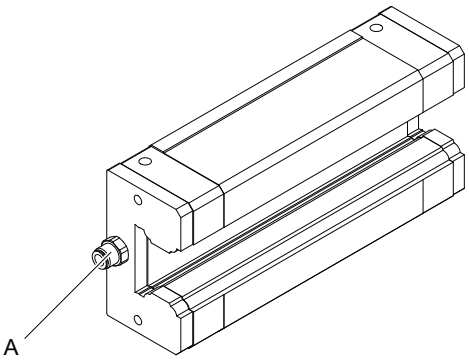
Continues on next page

4.8 Replacing the ball elements
Continued

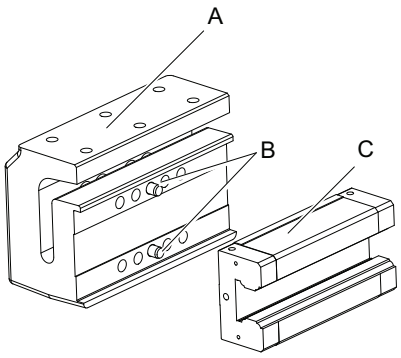
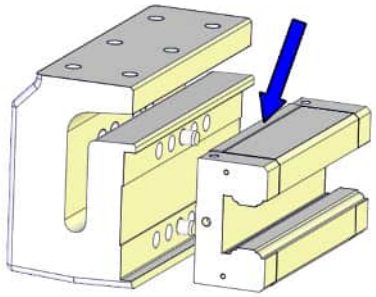
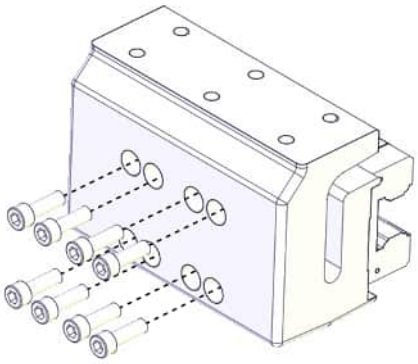
	Action	Note
5	Remove all the hex socket head cap screws holding the bracket to the damaged ball element.	 xx1600000981
6	Use a screwdriver to separate the bracket from the ball element.	 xx1600000982

Refitting the ball element assembly

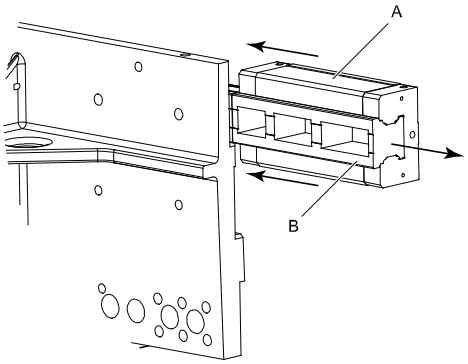
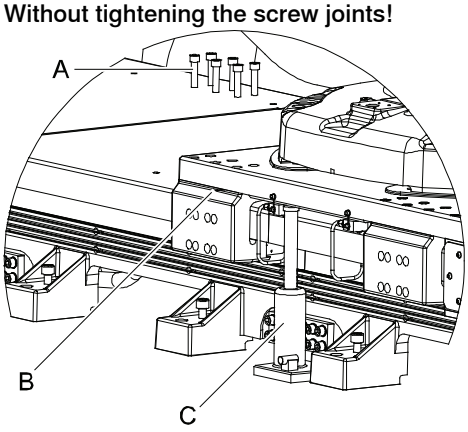
Use this procedure to refit the ball element if the ball element bracket has eight access holes (no access hole for the parallel pins). The ball element and bracket are assembled prior to installation onto the carriage.

	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.  xx1600000905	 xx1100000776 A Grease nipple

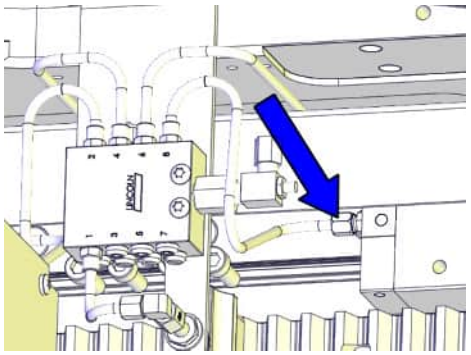
Continues on next page

	Action	Note
2	Fit two parallel pins to the bracket.	 xx1100000775 A Bracket for ball element B Parallel pins C Ball elements (runner block)
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.	

Continues on next page

	Action	Note
6	**Note** For easy assemble of the ball elements, always use the plastic gauge. **Note** Ball elements with Viton sealing (Foundry option), out side mounted only.	 xx1100000777 A Ball elements (runner block) B Gauge
7	Secure the bracket to the carriage using six hex socket head cap screws (A).	Without tightening the screw joints!  xx1100000774 A Hex socket head cap screw B Feeler 1mm C Jack >2000 kg
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.	

Continues on next page

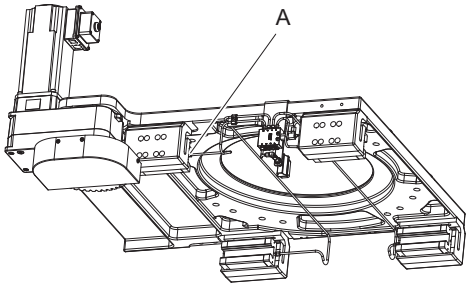
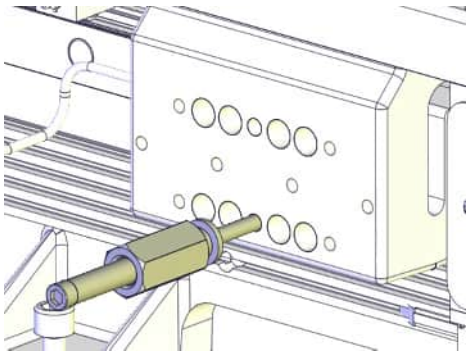
	Action	Note
11	After verification of grease supply from the tube is made, connect the lubrication tube to the grease nipple on the ball element.	 xx1600000906
12	Refit the gearbox and motor, if removed. **Note** Adjust gearbox back lash, see *Adjusting the gearbox backlash on page 185*.	See *Replacing the gearbox (including the motor) and the gear wheel on page 176*. See *Replacing the motor on page 188*.
13	Refit the mechanical stops.	See *Replacing the mechanical stops on page 237*.
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 281*.
16	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 139*.	

Continues on next page

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 237*.
3	Remove the two parallel pins using the extractor tool.	 xx1600000984

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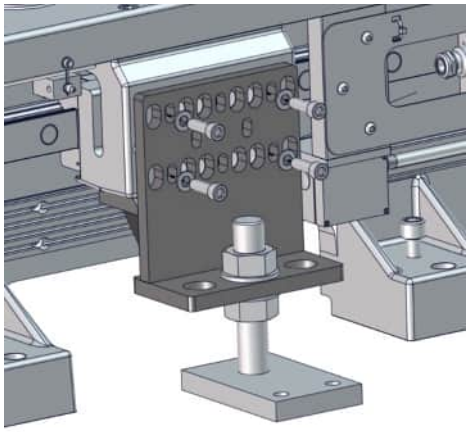
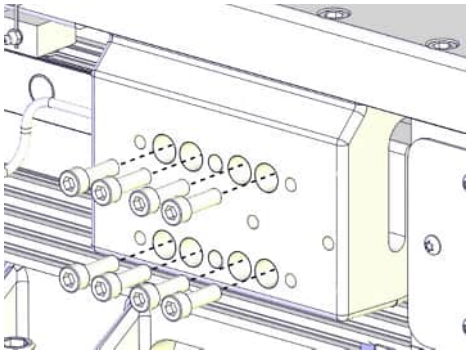
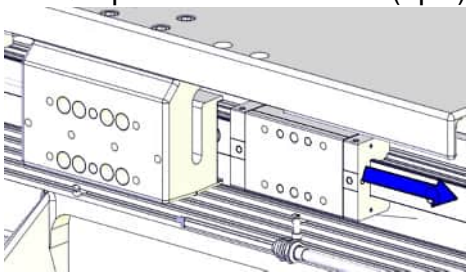
	Action	Note
4	Fit the runner block replacement tool to the bracket loosely with enclosed screws and nuts.	Runner block replacement tool: 3HAC044740-002. Hex socket head cap screw: 9ADA183-52 (M10x35 8.8-A3F). Nuts: 9ADA312-8.
5	Turn the nut beneath the shelf so that the shelf makes contact against the bracket. Tighten the screws.	 xx1800002284
6	Remove all the hex socket head cap screws holding the bracket to the damaged ball element.	 xx1600000983
7	Slide the ball element off the linear guide, using the cylindrical pin extractor tool.	Push tool pieces: 3HAC047742-002 (2 pcs)  xx1600000985

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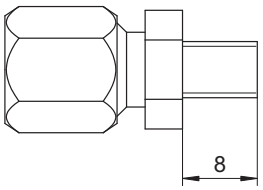
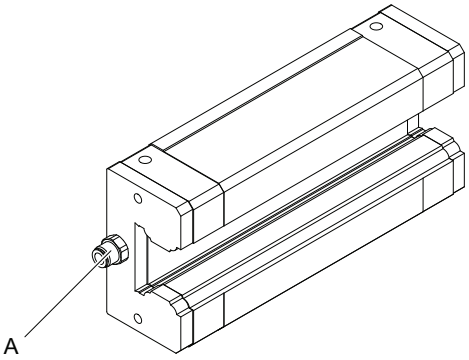
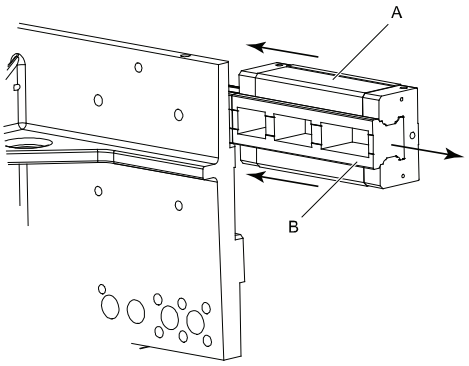
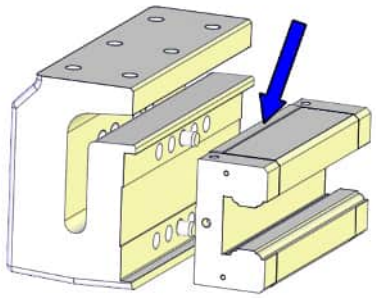
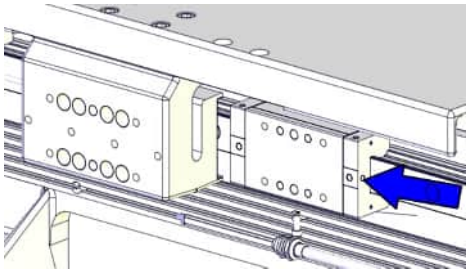
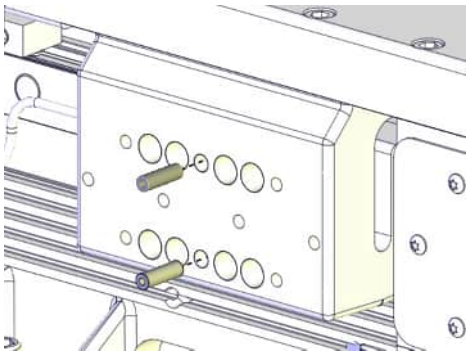
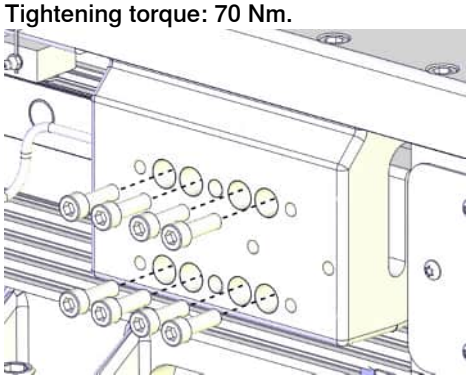
4.8 Replacing the ball elements
Continued

Refitting the ball element

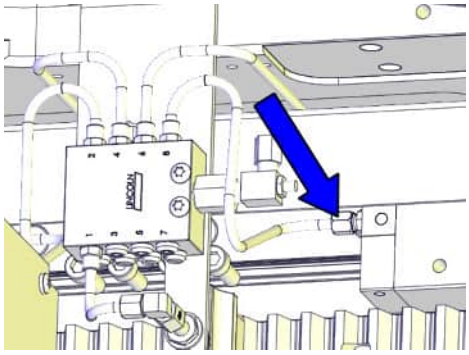
Use this procedure to refit the ball element if the ball element bracket has 10 access holes (including two access holes for the parallel pins) and the bracket is already installed on the carriage.

	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.  xx1600000905	 xx1100000776 A Grease nipple
2	**Note** For easy assemble of the ball elements, always use the plastic gauge. **Note** Ball elements with Viton sealing (Foundry option), out side mounted only.	 xx1100000777 A Ball elements (runner block) B Gauge

Continues on next page

	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.	

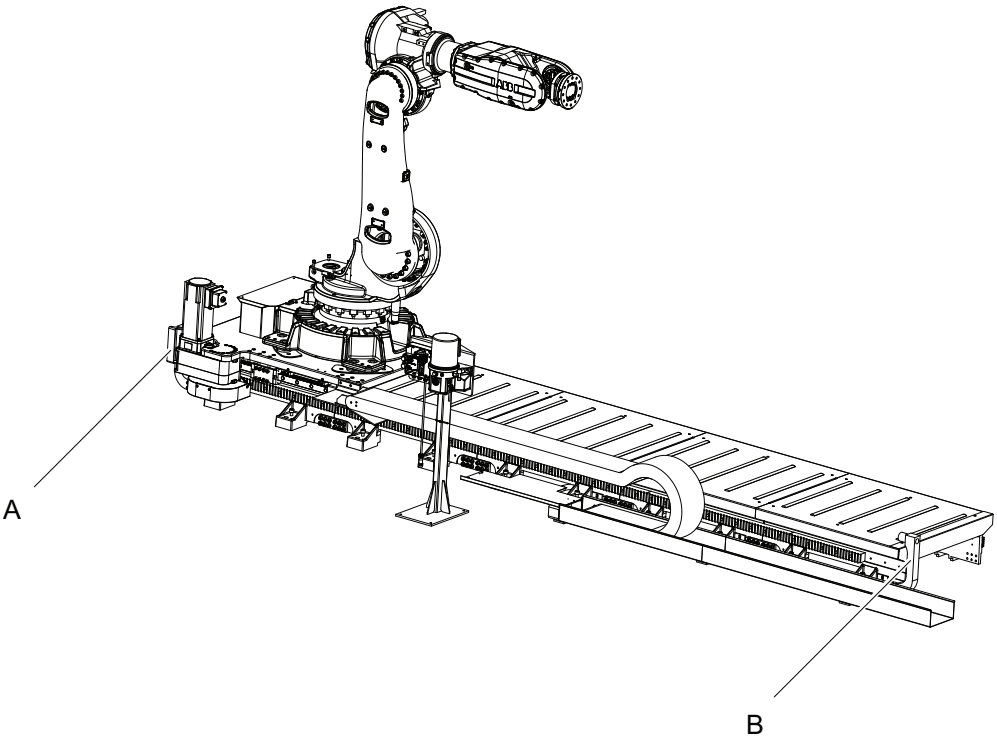
Continues on next page

	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 backlash on page 185*.	See *Replacing the gearbox (including the motor) and the gear wheel on page 176*. See *Replacing the motor on page 188*.
10	Fit the mechanical stops.	See *Replacing the mechanical stops on page 237*.
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 281*.
13	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 139*.	

4.9 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 305*.	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 301*.
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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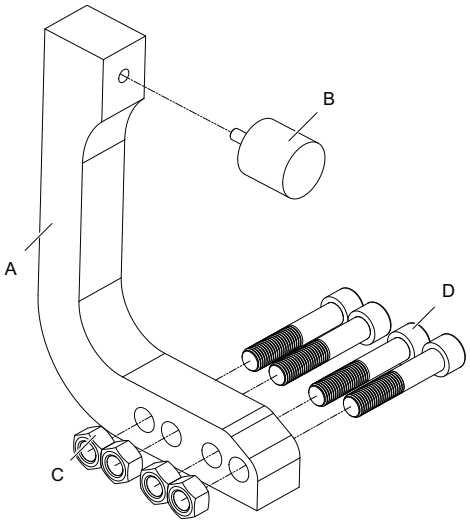
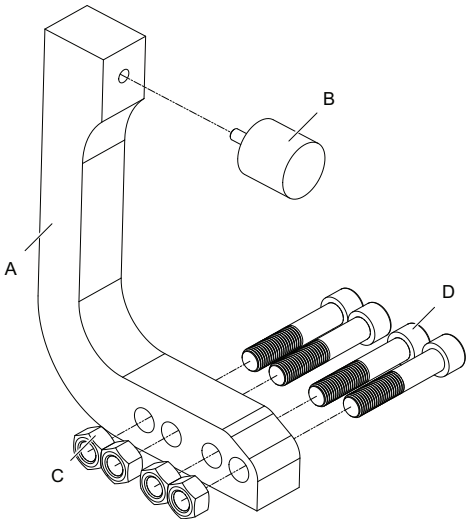
Removing the mechanical stops

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

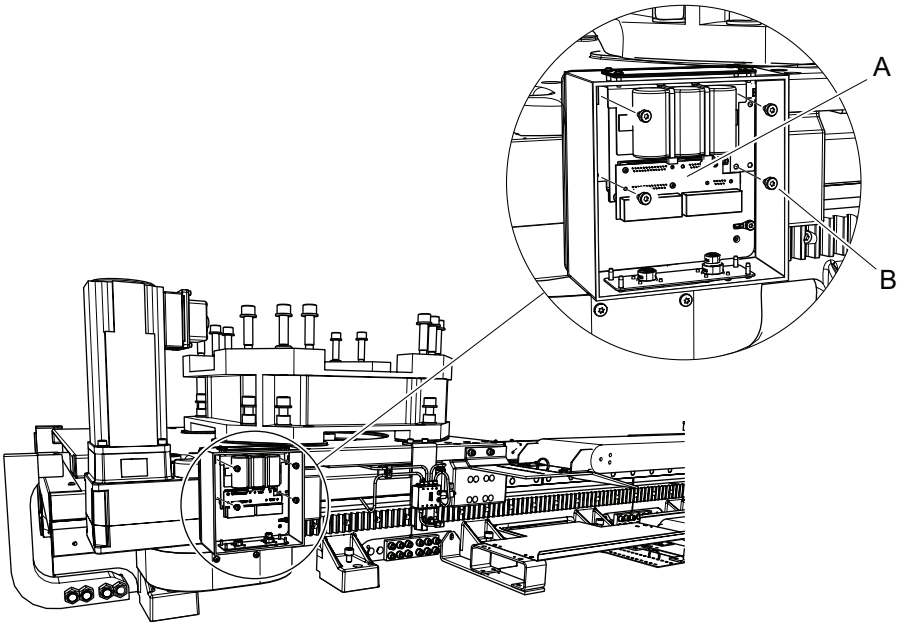
Use this procedure to refit the mechanical stops.

	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
3	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 139*.	

4.10 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: • *Spare parts on page 305*.	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 301*.
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 280*.
3	Unscrew attachment screws, and open cover to serial measurement unit box.  **CAUTION** Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.	
4	Remove four attachment screws B, see *Location of SMB unit on page 239*.	
5	Remove the SMB unit A, see *Location of SMB unit on page 239*.	

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 239*.	
2	Fit the four attachment screws B, see *Location of SMB unit on page 239*.	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 281*.

4.11 Repair procedures for cable chain Brevetti

4.11.1 Replacing the cable harness

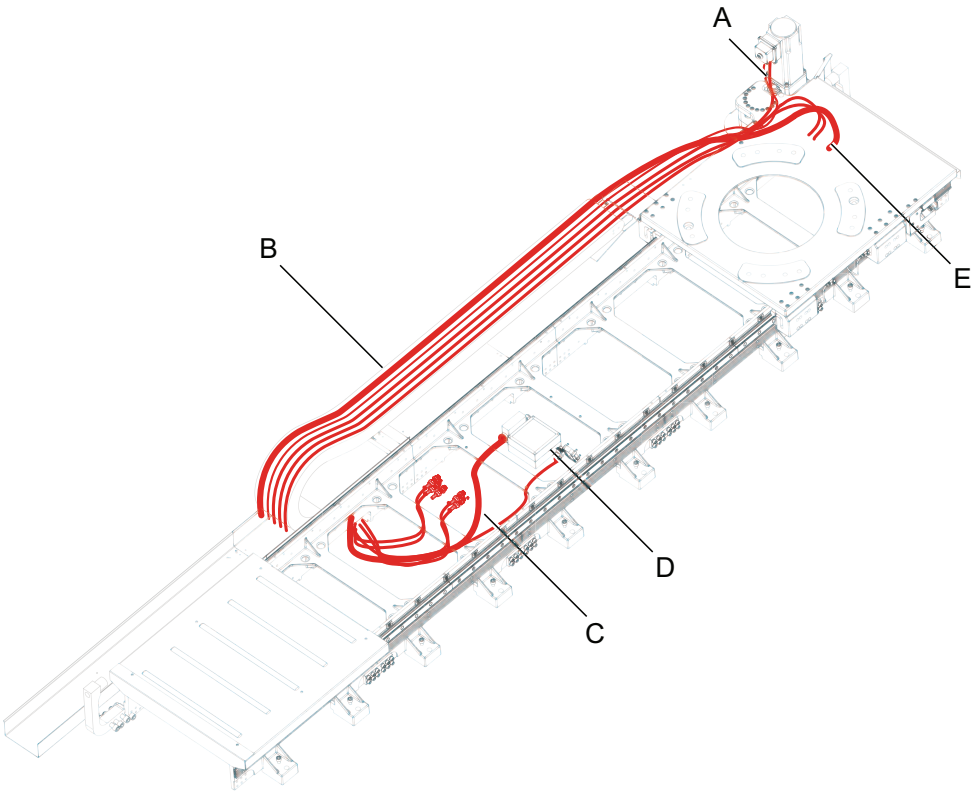
Overview

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

4.11.1 Replacing the cable harness

Continued

Required equipment

Equipment, etc.	Art. no.	Note
Cables	Spare part number is specified in: • *Spare parts on page 305*.	Cables must be designed for use in continuous flexing operation.
Cable chain parts	Spare part number is specified in: • *Spare parts on page 305*.	
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 *Standard toolkit on page 301*.
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 307*.

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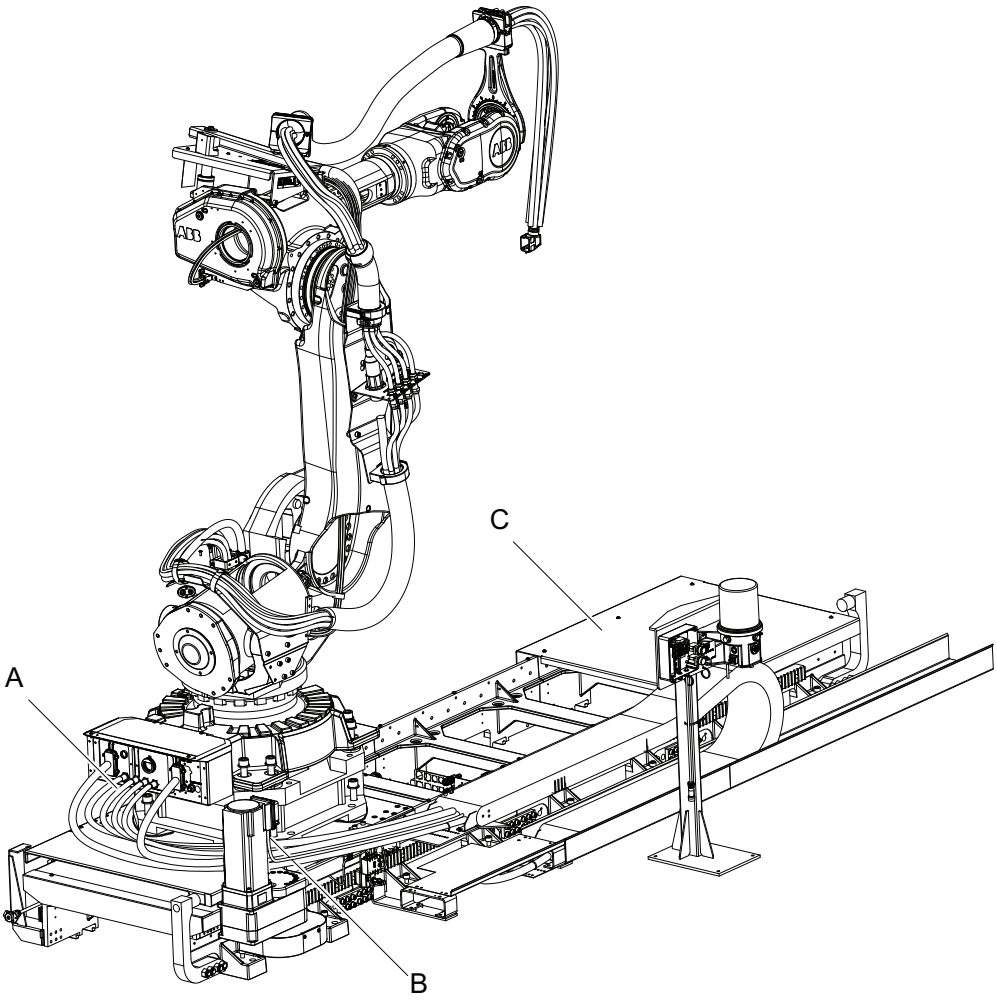
Illustration, removing the cable chain



xx1100000779

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

Removing the cable chain

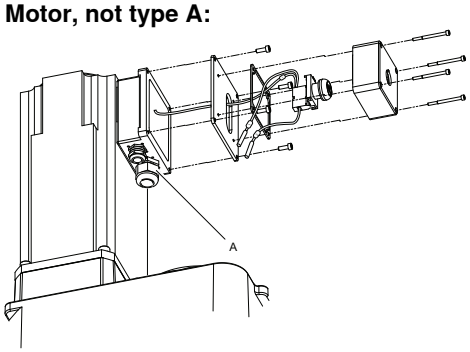
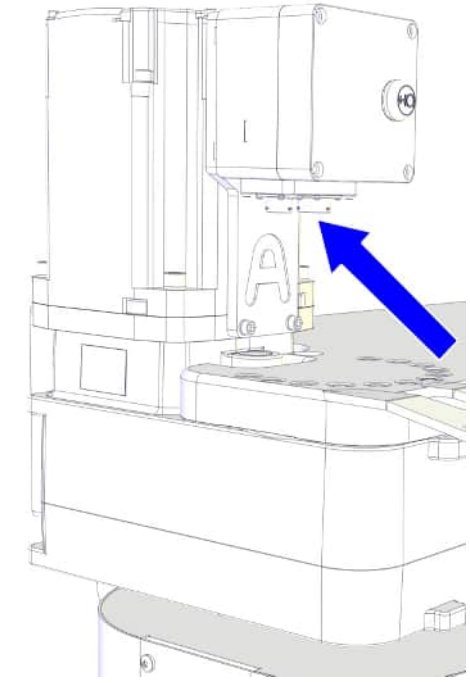
Use this procedure to remove the cable chain.

	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 *Moving the carriage manually on page 91*.	

Continues on next page

4.11.1 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 243*.
4	Disassemble all cables from the track motion motor (B).	See *Illustration, removing the cable chain on page 243*. **Motor, not type A:**  xx1100000780 A Cable inlet **Type A motor:**  xx1300000058

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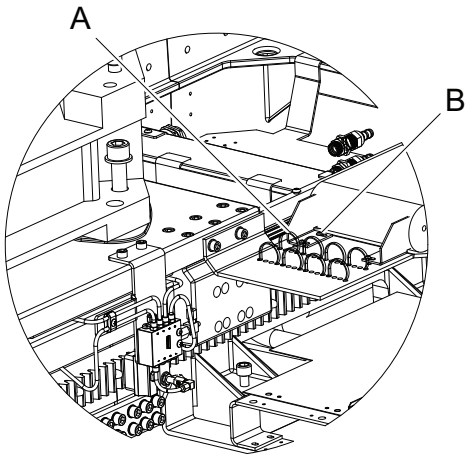
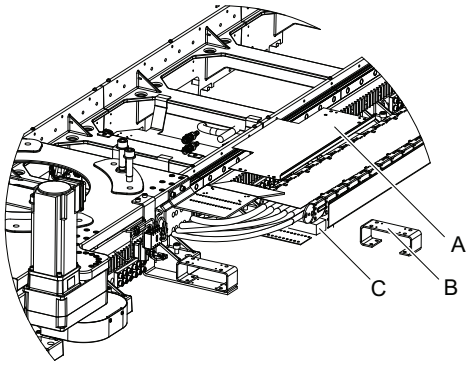
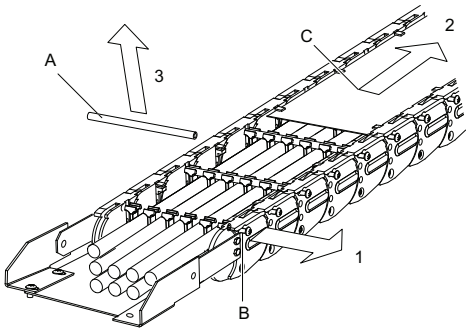
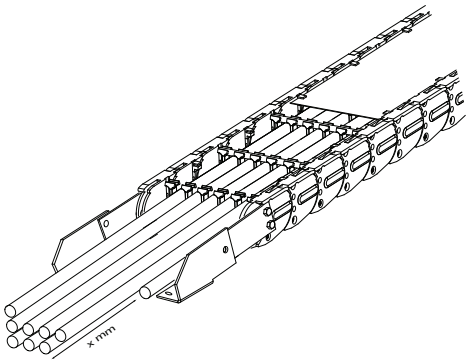
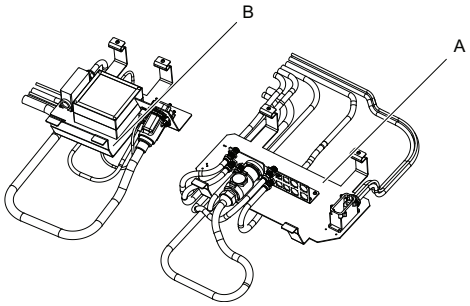
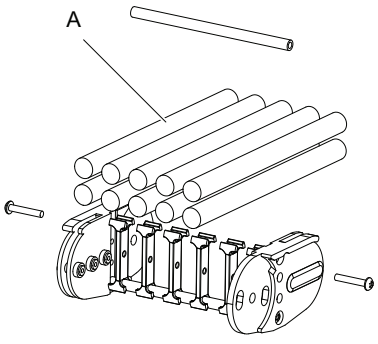
	Action	Note
5	Cut all cable straps using standard tools, and disassemble the screws holding the cable chain.	 xx1100000781 A Cable straps B Torx pan head screw
6	Lift up the cable chain and straighten it out.	
7	Loosen and remove the protection plate for the cable chain. Cut all cable straps using standard 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.	 xx1100000782 A Protection plate for cable chain B Distance for cable tray C Distance plank
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.	 xx1100000783 A Aluminium rod B Torx pan head screw C Cable protection

Continues on next page

4.11.1 Replacing the cable harness

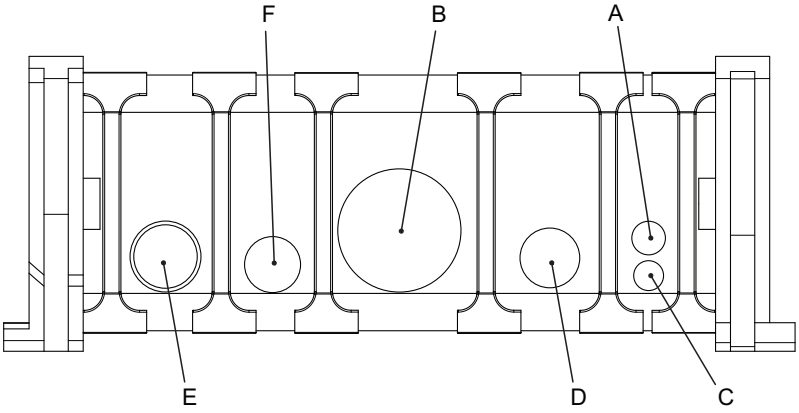
Continued

	Action	Note
9	**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
10	**Tip** Before removing damaged cables, remember the placement in the cable chain. This will facilitate refitting.	The placement of all cables is shown in *Illustration, refitting the cables on page 247*.
11	Remove the damaged cables from the customer contact plate and the standard contact plate. **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
12	Remove the cables.	 xx1100000787 A Cables

Continues on next page

Illustration, refitting the cables

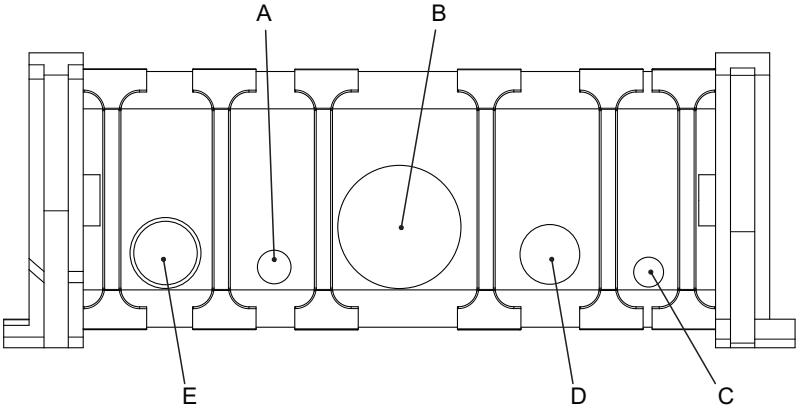
Cable layout, material handling - with hydraulic hose



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



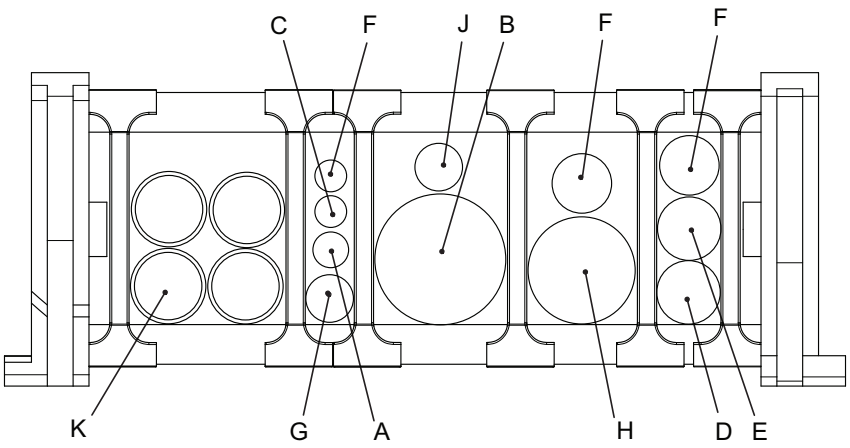
xx1200000677

	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

4.11.1 Replacing the cable harness
Continued

Cable layout, spot welding



xx1200000679

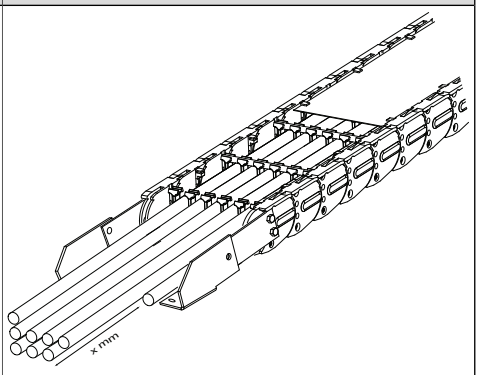
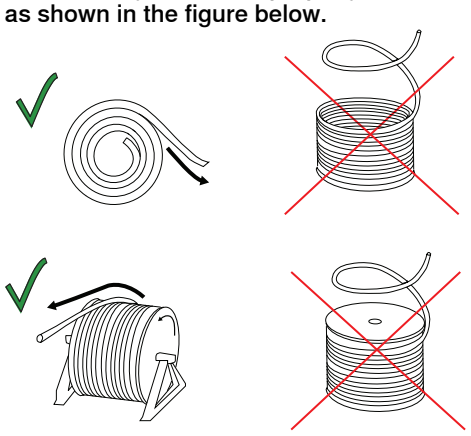
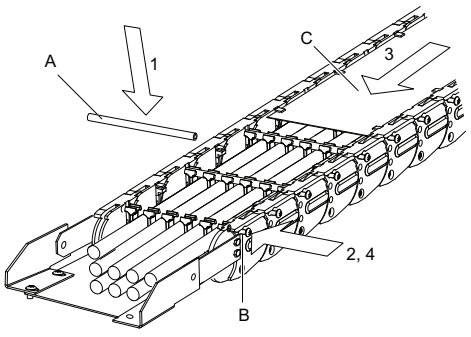
	Diameter in mm	Description
A	9	Signal cable IRB
B	31	Power cable IRB R1.MP
C	9	Signal cable IRBT
D	16	Power cable IRBT J1
E	12	8 axis power cable/M8
F	8.5	Customer cable CP/CS
F	13.5	Customer cable CP/CS
F	13.7	Customer cable CP/CS
G	12	Cable splitbox J1-XS101
H		Weld power cable
J	12	Hydraulic hose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

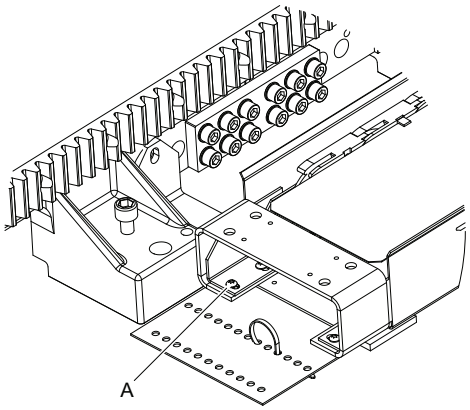
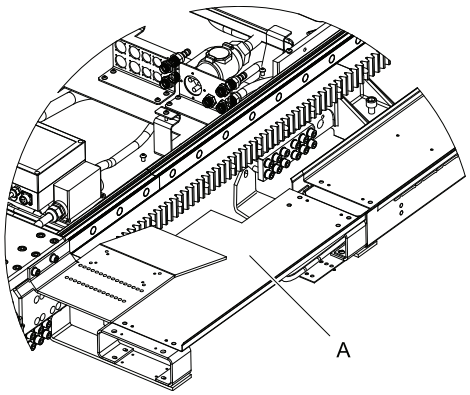
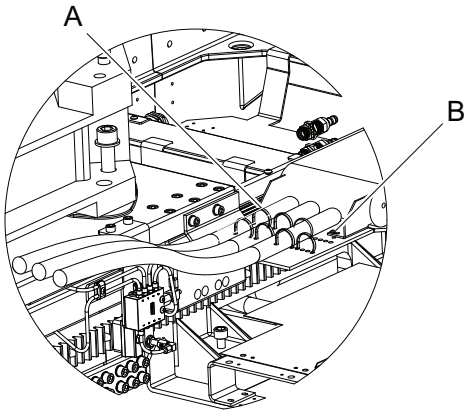
Continues on next page

	Action	Note
2	Fit the new cables, use the same length projecting from the cable chain as for the damaged cable. **Note** 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: • 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. **CAUTION** Adding cables that are not covered in the standard layouts could seriously reduce the expected component life of the chain.	 xx1100000785 See placement of all cables in *Illustration, refitting the cables on page 247*. 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.  xx1200000517
3	Fit the chain in this sequence: 1 Fit all aluminium rods. 2 Fit all torx pan head screws (without tightening). 3 Fit the cable protection. **Tip** Use cable grease on the cable protection for easy assemble. 4 Tighten all torx pan head screws. Tightening torque: 8 Nm.	 xx1100000789 A Aluminium rod B Torx pan head screw C Cable protection

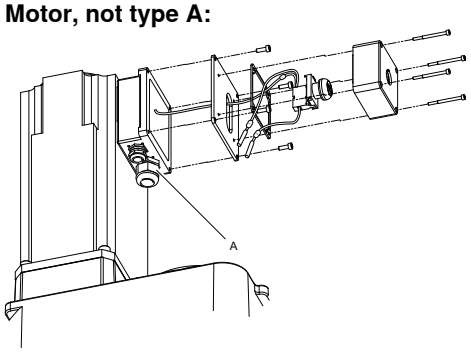
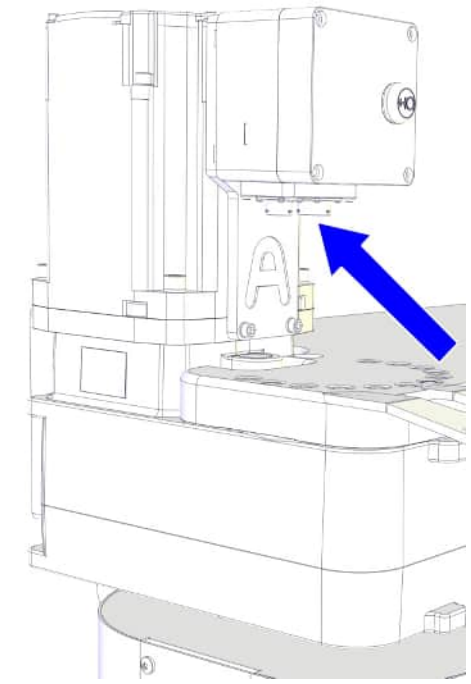
Continues on next page

4.11.1 Replacing the cable harness

Continued

	Action	Note
4	Fit the distance for the cable tray, use the two torx pan head screws (A).	 xx1100000790 A Torx pan head screw
5	Fit the protection plate for the cable chain, using the four screws.	 xx1100000791 A Protection plate for cable chain
6	Fit the cable chain using the four torx pan head screws (B).	 xx1100000792 A Cable straps B Torx pan head screw Suitable cable ties are specified in *Required equipment on page 242*.
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.	

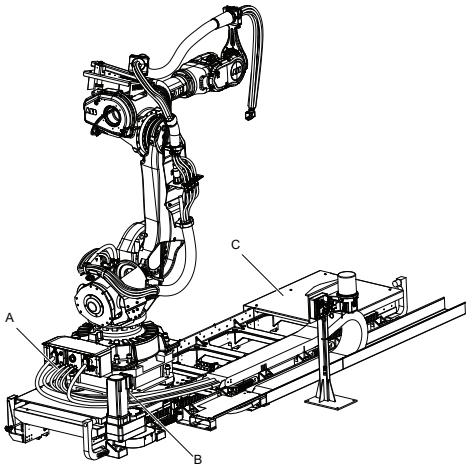
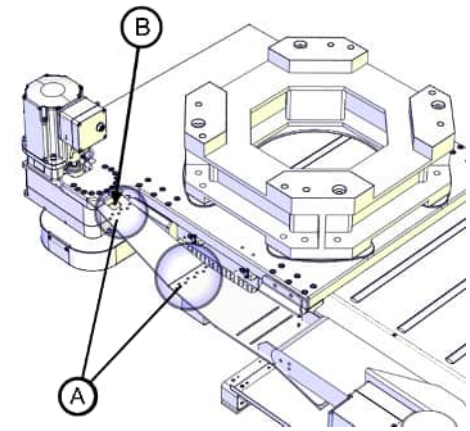
Continues on next page

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

Continues on next page

4.11.1 Replacing the cable harness

Continued

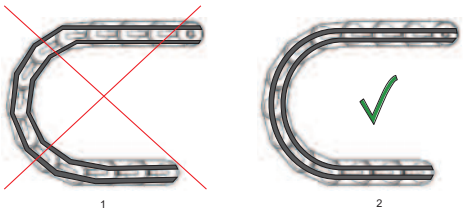
	Action	Note
9	Fit all cables to the manipulator base.	 xx1100000779 A Cable harness manipulator B Cable harness, track motion motor
10	Place the track motion motor cables in the slot located at the end of the plate (B). Fasten the cables to the attachment plate with straps (A). Bend the motor and resolver cables 90º when directing them up to the motor. **CAUTION** Do not stand on the chain or cables.	 xx1200000884
11	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 139*.	
12	Perform a test run before powering up the track to full speed and duty cycle.	See *Test run on page 252*.

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

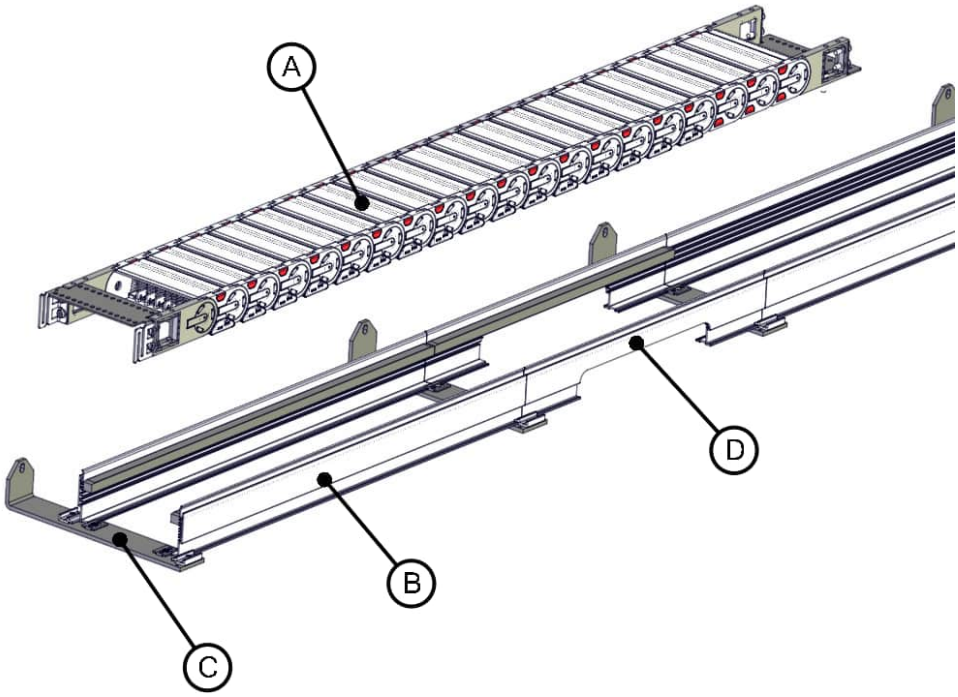
	Action	Note
2	After 50 cycles, check that the cables and hoses are not installed too tight (stretched between carrier bars) or too loose (hanging on the carrier bars). Optimally, aim for the center line of the link of the carrier system, as shown in the figure.	 xx1200000518
3	Adjust the carrier position 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.	

4.12 Repair procedures for cable chain Murrplastik

4.12.1 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 305*.	
Cable chain parts	Spare part number is specified in: • *Spare parts on page 305*.	

Continues on next page

Equipment, etc.	Art. no.	Note
Customer connection plate J1	3HAC079958-001	Includes connection for functional ground cable. Required to be exchanged if installing ground cable for functional ground and the connection is missing in the current plate.
Bracket, Profinet	3HAC033751-001	
Torx pan head screw (4 pcs)	9ADA618-23	M3x8
Locking liquid	3HAC041807-004	Loctite 2400
Locking liquid	-	Loctite 243
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 301*.
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 307*.

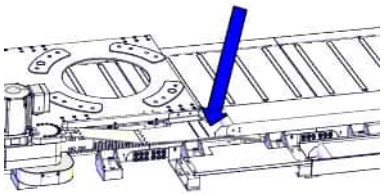
Removing the cable chain

	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	Disconnect the power and signal cable, and the media hose, on the carriage. **CAUTION** Cooling water may run out. Protect the connectors from getting wet.	

Continues on next page

4.12.1 Replacing the cable chain

Continued

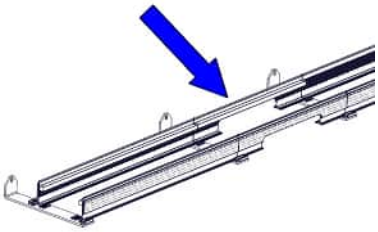
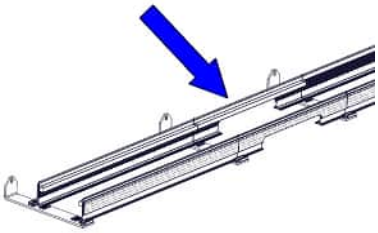
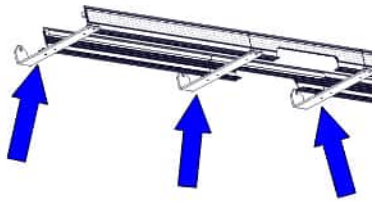
	Action	Note
6	Disconnect the connectors for power, signal and media at the floor end of the cable chain. **Note** Water may spill out.	
7	Make a marking on the moving end of the chain to show its location relative to the connecting plate. This will facilitate alignment during refitting.	 xx1300000930
8	Loosen the two screws that hold the cable chain to the connecting plate on the carriage.	
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).	

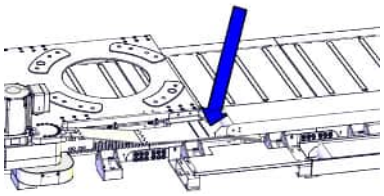
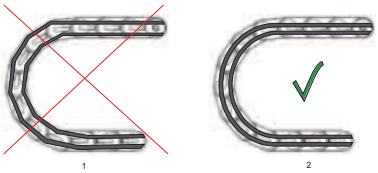
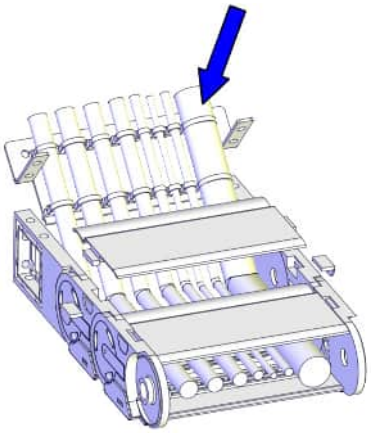
Continues on next page

	Action	Note
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 104* 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
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 propably 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. **WARNING** If the cable tray is not complete with all required profiles and brackets, there is a risk of damage to the cable chain and vibration in the track carriage. Make sure to install all required parts.	Use Loctite 243.  xx1300000928
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

Continues on next page

4.12.1 Replacing the cable chain

Continued

	Action	Note
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
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*.	

Continues on next page

	Action	Note
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.	

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.

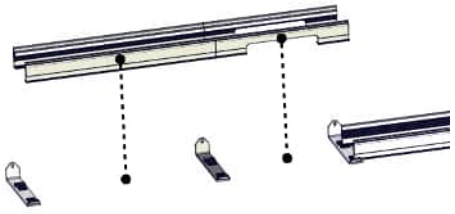
Principle of creating more space for a longer cable chain

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.

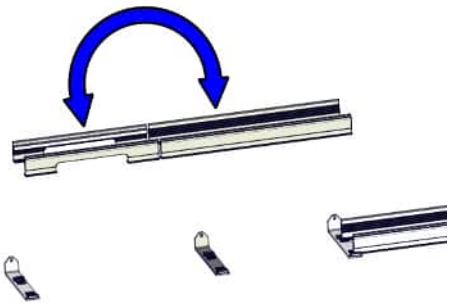
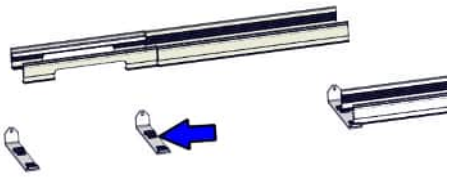
Adjusting the cable tray

	Action	Note
1	Remove the old chain.	See *Removing the cable chain on page 255*.
2	Remove the profiles shown in the figure.	 xx1300000933
3	Remove the glide bars from the two profiles shown in the figure.	 xx1300000934

Continues on next page

4.12.1 Replacing the cable chain

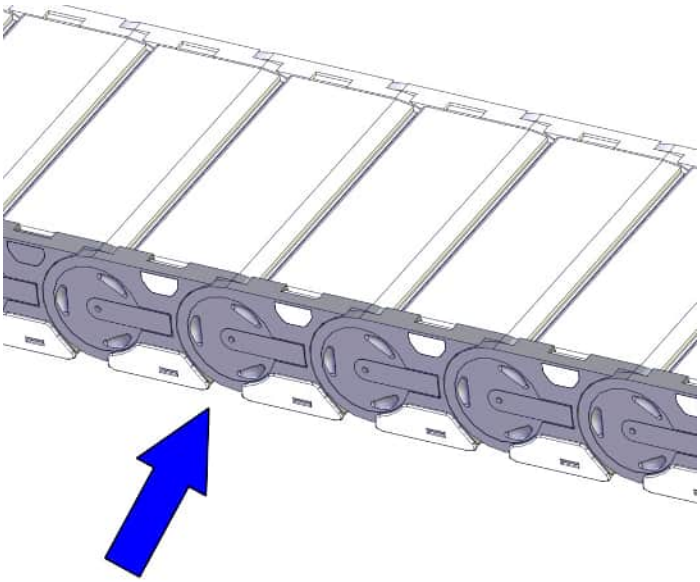
Continued

	Action	Note
4	Swap places of the profiles.	 xx1300000935
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 104*.
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.	

4.12.2 Replacing the side links, glide shoes and covers

Location of the side links

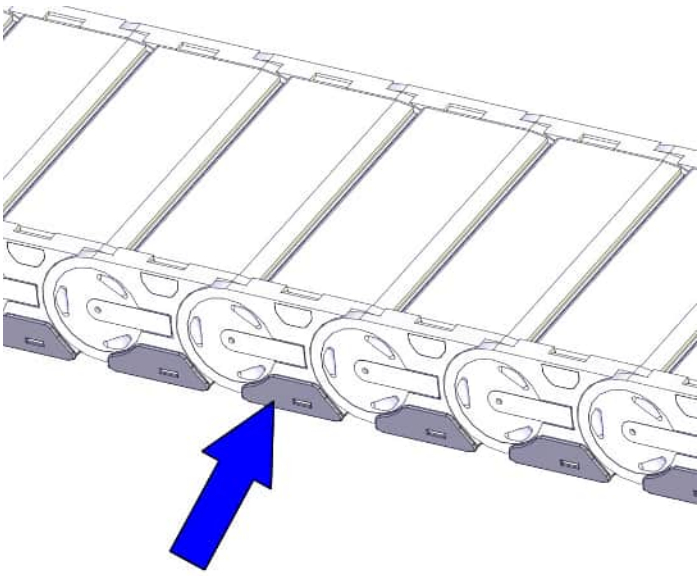
The figure shows the location of the side links on the cable chain.



xx1300000892

Location of the glide shoes

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



xx1300000899

Continues on next page

4.12.2 Replacing the side links, glide shoes and covers

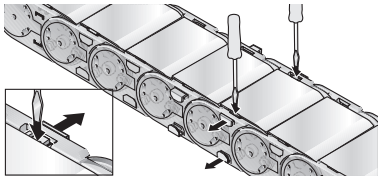
Continued

Required equipment

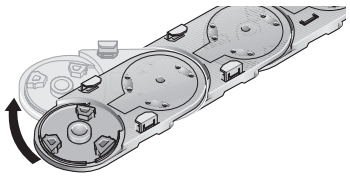
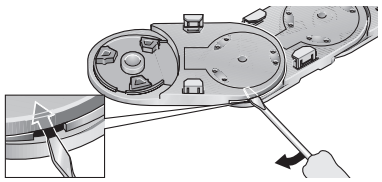
Equipment	Art. no.	Note
Side link	Spare part number is specified in: • *Spare parts on page 305*.	
Glide shoes		
Standard toolkit	-	Content is defined in section *Standard toolkit on page 301*.

Opening the covers

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

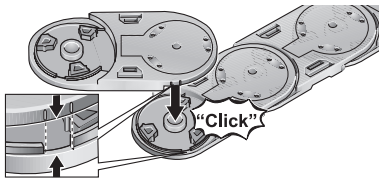
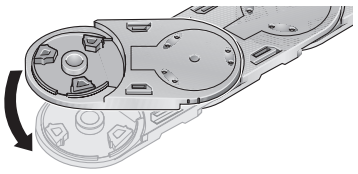
	Action	Note
1	Place wooden blocks under the chain to facilitate the removal and refitting of covers in the inner bend.	
2	Open the red clips on the cover to be removed with a screwdriver and on one cover before and one after, in order to release the chains pre-tension.	 xx1300000938
3	Note the orientation 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

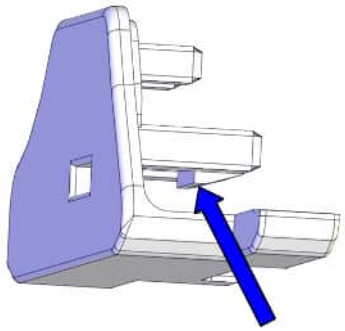
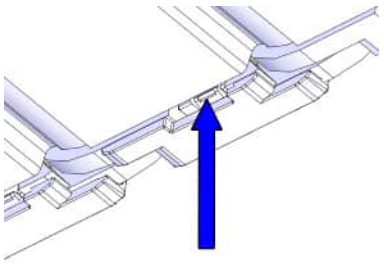
	Action	Note
1	Remove the top and bottom cover according to the previous procedure.	
2	Bend the links until two marks on the side line up.	 xx1300000939
3	Separate the two links by inserting a screwdriver and pushing down until the links separate.	 xx1300000940

Continues on next page

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

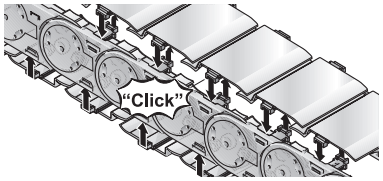
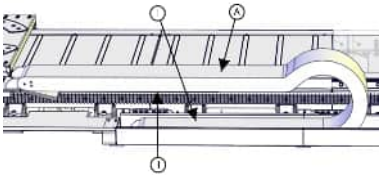
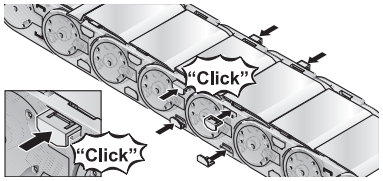
Replacing the glide shoes

	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

4.12.2 Replacing the side links, glide shoes and covers
Continued

Closing the covers

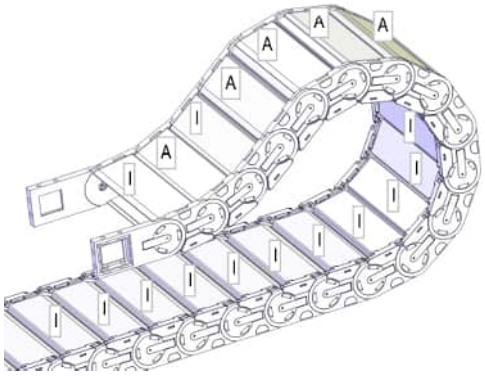
	Action	Note
1	Fit the cover with the dividers / shelving system to check if the cables are lying in the chain correctly. Press the cover against the chain until they snap together.	 xx1300000943
2	Fit the rest of the covers. Ensure correct orientation of the covers. Covers marked with an "I" should be 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

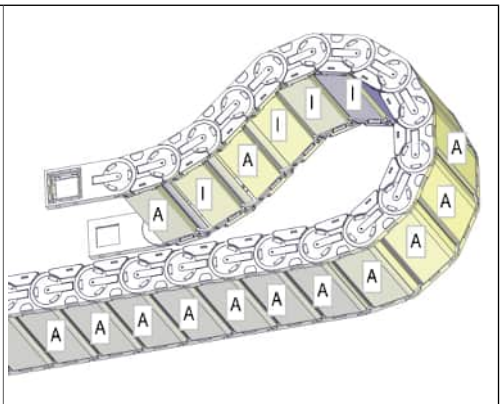
The covers are marked with the letter "I" (inner) or the letter "A" (outer).

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.



xx1600000578



xx1600000579

4.12.3 Replacing the cables

Required equipment

Equipment, etc.	Art. no.	Note
Cables	Spare part number is specified in: • *Spare parts on page 305*.	Cables must be designed for use in continuous flexing operation.
Cable chain parts	Spare part number is specified in: • *Spare parts on page 305*.	
Customer connector plate J1	3HAC079958-001	Includes connection for functional ground cable. Required to be exchanged if installing ground cable for functional ground and the connection is missing in the current plate.
Bracket, Profinet	3HAC033751-001	
Torx pan head screw (4 pcs)	9ADA618-23	M3x8
Locking liquid	3HAC041807-004	Loctite 2400
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 301*.
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 307*.

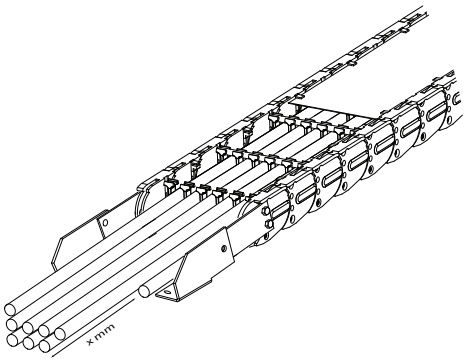
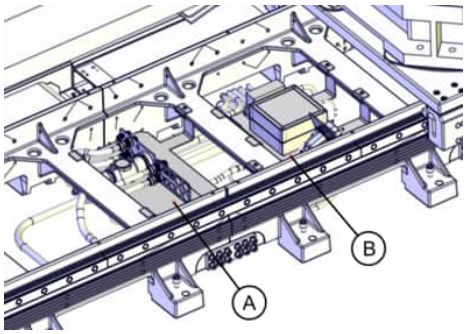
Removing the cable

	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 damage follow instructions in *Moving the carriage manually on page 91*.	

Continues on next page

4.12.3 Replacing the cables

Continued

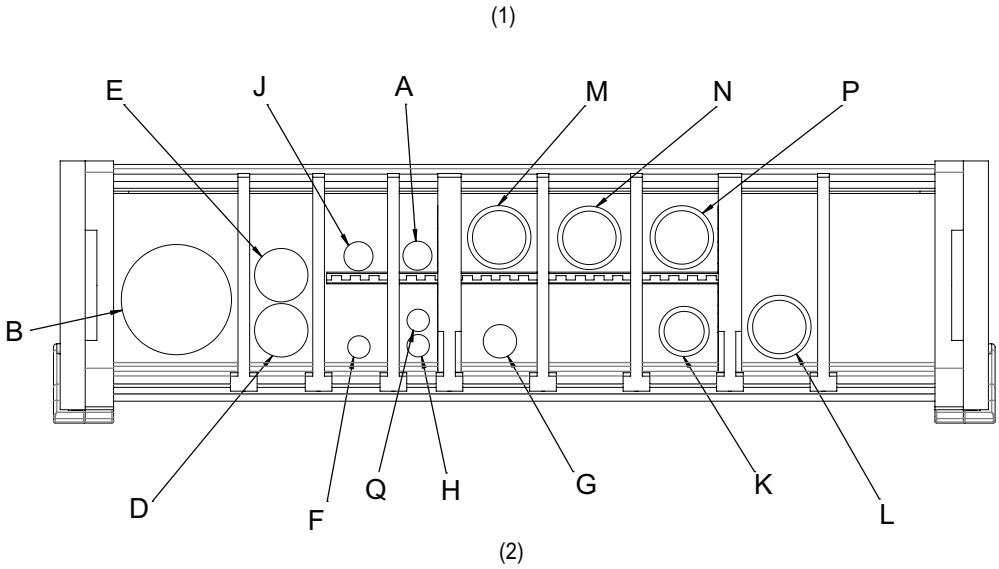
	Action	Note
2	Move the carriage to the far end, bend closest to the middle, and loosen the bolts on the fixed end. Unfold the bend so that the chain is flat. **Tip** Spot welding chains have shelving systems and the cable that requires replacement might be on the bottom. If this is the case then move 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.	
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	Remove the damaged cables from the customer contact plate and the standard contact plate. **Tip** Before removing damaged cables, note down the location on the contact plate. This will facilitate refitting.	 xx1900002005
7	Remove the cable to be replaced.	

Continues on next page

Illustration, refitting cables

View seen from movable end.

Cable layout, material handling



xx1900001106

	Diameter in mm	Description
(1)		Outer bend
(2)		Inner bend
A	9	Signal cable IRB
B	31	Power cable IRB R1.MP
D	16	Power cable IRBT
E	12	8 axis power cable *i*
F	13,7	Customer signal cable
G	9,5	Customer power cable CP / CS Parallel
	9,5	Customer power cable CP / CS Ethernet
	13,3	Customer power cable CP / CS CANBus
	13,3	Customer power cable CP / CS Profibus
H	9	Signal cable SMB IRBT *i*
J	9	CANBus
	6,5	Ethernet
	8	Profibus
K	12	Hydraulic hose
L	19	Media hose PROC1
M	19	Media hose PROC2
N	19	Media hose PROC3
P	19	Media hose PROC4

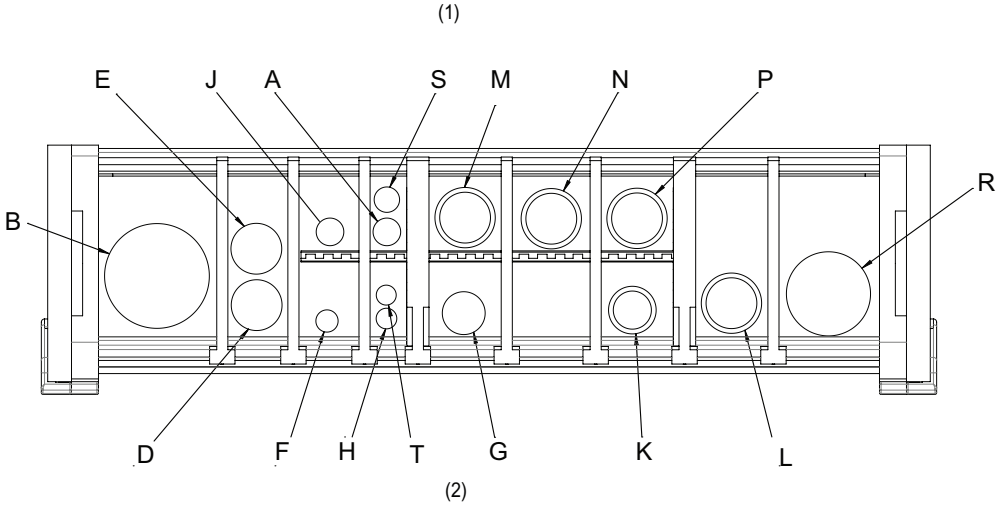
Continues on next page

4.12.3 Replacing the cables
Continued

	Diameter in mm	Description
Q	7	Functional ground [ii]

i Option with 8:th axis.
ii The functional ground cable only exists in cable chains with option CP/CS Ethernet (1014-6) on IRBT 6004 and IRBT 7004.

Cable layout, spot welding



xx1900001121

	Diameter in mm	Description
(1)		Outer bend
(2)		Inner bend
A	9	Signal cable IRB
B	31	Power cable IRB R1.MP
D	16	Power cable IRBT
E	12	8 axis power cable [i]
F	13.7	Customer signal cable
G	9,5	Customer power cable CP / CS Parallel
	9,5	Customer power cable CP / CS Ethernet
	13,3	Customer power cable CP / CS CANbus
	13,3	Customer power cable CP / CS Profibus
H	9	Signal cable SMB IRBT [i]
J	9	CANBus
	6,5	Ethernet
	8	Profibus
K	12	Hydraulic hose
L	19	Media hose PROC1
M	19	Media hose PROC2
N	19	Media hose PROC3

Continues on next page

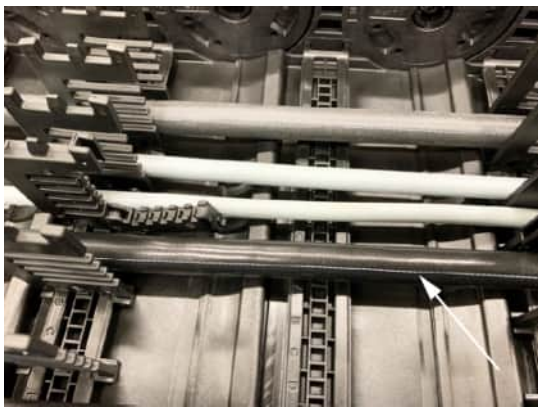
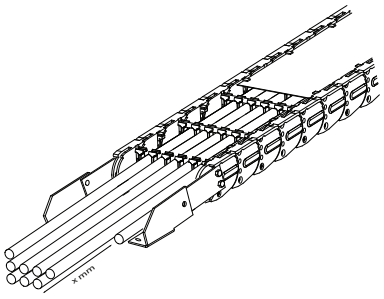
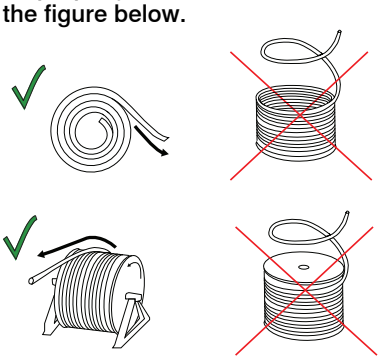
	Diameter in mm	Description
P	19	Media hose PROC4
R	26	Weld power
S	12	Cable split box
T	7	Functional ground [ii]

i Option with 8:th axis.

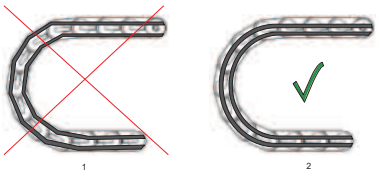
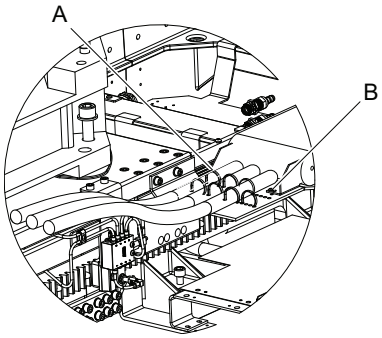
ii The functional ground cable only exists in cable chains with option CP/CS Ethernet (1014-6) on IRBT 6004 and IRBT 7004.

Continues on next page

Refitting the cable

	Action	Note
1	Fit the new cable(s), use the same length projecting from the cable chain as for the damaged cable. **Note** 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: • 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. • The pneumatic hose, if any, must be placed in a fullsized compartment (no shelf), since it expands when pressurized. **Note** When installing cables or hoses into the carrier system, they must be laid into the carrier without twist. The power cable has a white line to show alignment. The white line needs to be assembled straight in the cable chain.  xx2200001227 **Note** Fill the grease hose with grease before installation.	 xx1100000785 See placement of all cables in *Illustration, refitting cables on page 267*. To avoid twisted cables, cables or hoses should not be simply pulled off the reel. Instead, they should be properly uncoiled as shown in the figure below.  xx1200000517 **CAUTION** Adding cables that are not covered in the standard layouts could seriously reduce the expected component life of the chain.

Continues on next page

	Action	Note
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. 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 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. Right: if correctly installed the cable should fit comfortably in the chains cavity
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 265*.
4	Refit the covers.	See *Closing the covers on page 264*.
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. See *Test run after installation, maintenance, or repair on page 139*.	
7	Perform a test run before powering up the track to full speed and duty cycle.	See *Test run on page 252*.

Test run

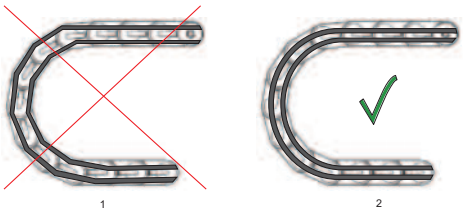
Use this procedure to check the installation of the cabling.

	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

4.12.3 Replacing the cables

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.	

4.12.4 Addition of functional ground (CP/CS Ethernet)

Configuration of customer connection plates

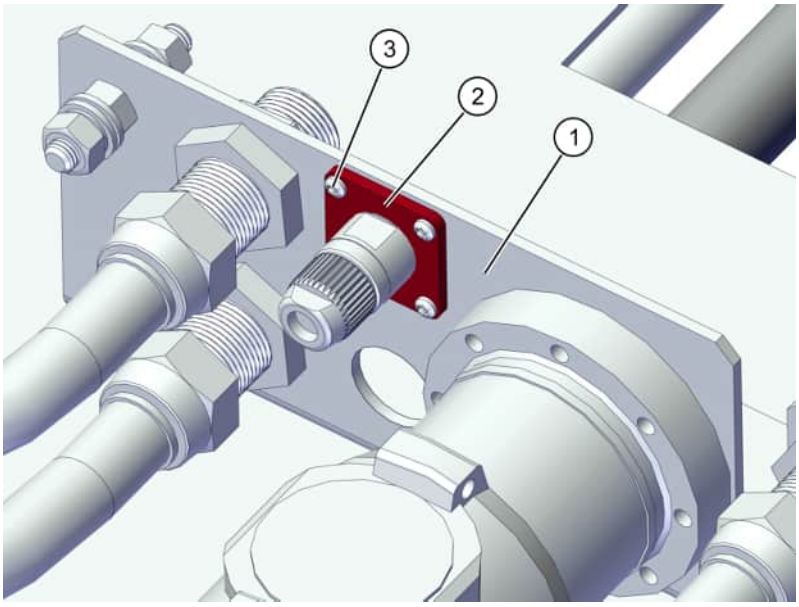
Only for CP/CS Ethernet and for spare part replacement.

The cable chain spare part with option CP/CS Ethernet (1014-6) includes functional ground. If the installed cable chain has not included functional ground previously, or if the functional ground cable is added, the customer connection plate J1 must be replaced.

Required equipment

Spare part	Article number	Note
Customer connection plate J1	3HXD1000-621	Includes connection for functional ground cable.

Location of customer connection plate



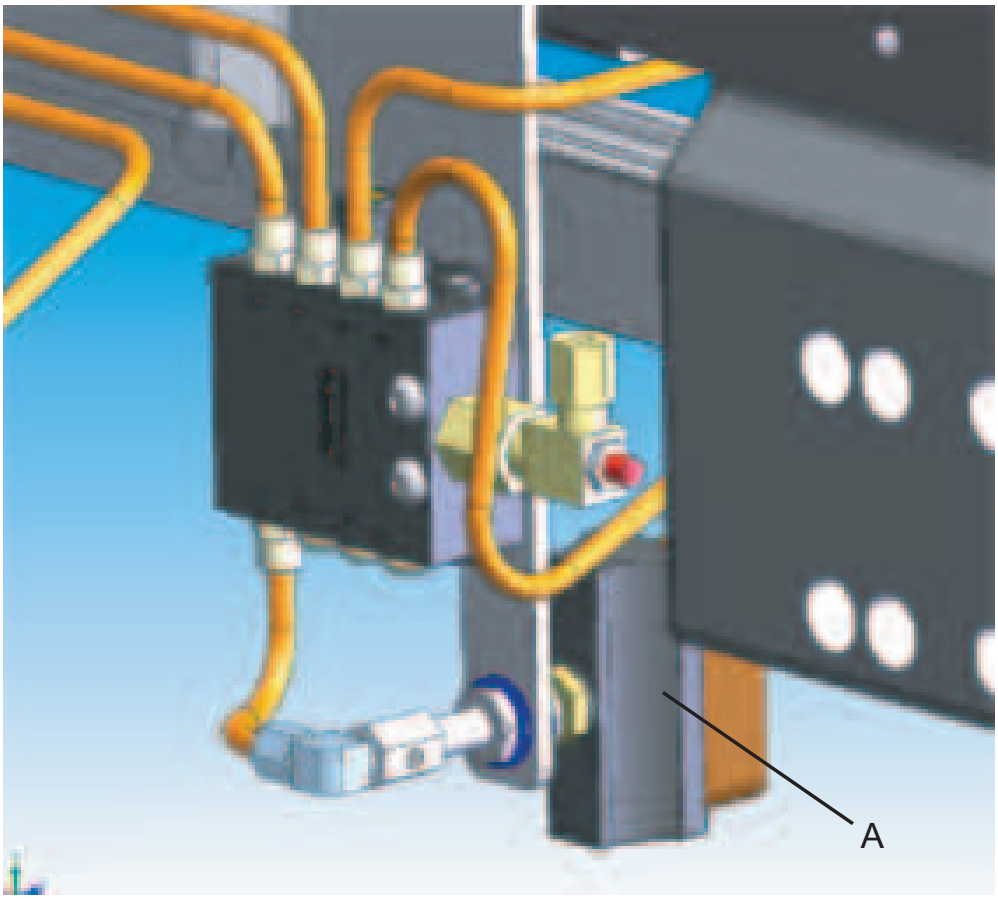
xx1900002006

4.13 Automatic lubrication system

4.13.1 Replacing the oil brush

Location of oil brush

The oil brush is located as shown in the figure.



xx1100000797

A	Oil brush

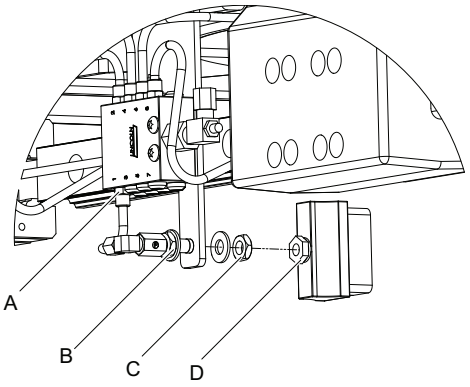
Required equipment

Equipment, etc.	Art. no.	Note
Oil brush	Spare part number is specified in: • *Spare parts on page 305*.	
Standard toolkit	-	Content is defined in section *Standard toolkit on page 301*.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.		These procedures include references to the tools required.

Continues on next page

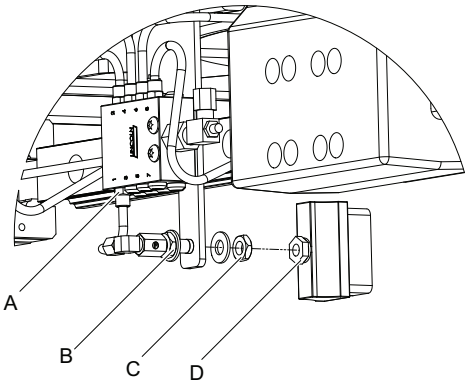
Removing the oil brush

Use this procedure to remove the oil brush.

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

Refitting the oil brush

Use this procedure to refit the oil brush.

	Action	Note
1	Fit the new oil brush (D).	 xx1100000798 A One-way flow valve M10x1-Ø6 B Nut C Nut D Oil brush
2	Adjust the pressure of the brush by using the nuts (B) and (C).	
3	Tighten the one-way flow valve (A).	
4	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 139*.	

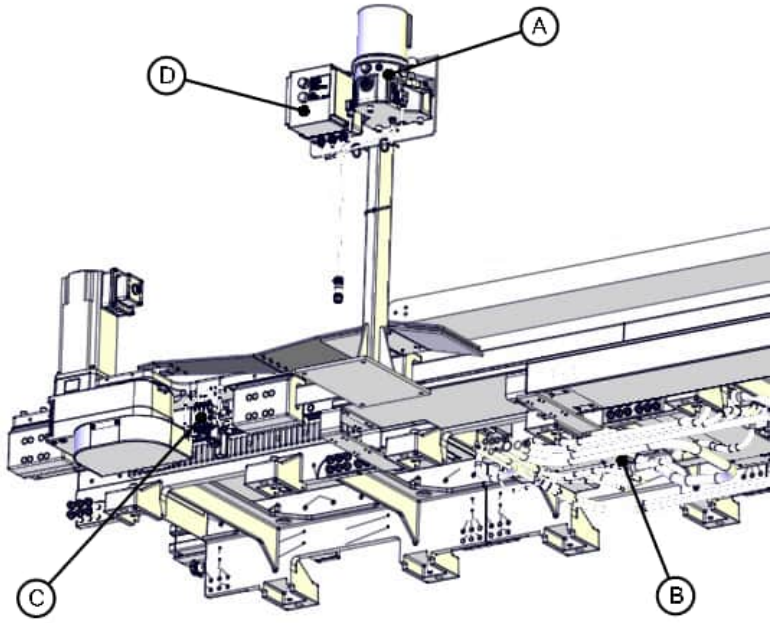
4.13.2 Replacing the hydraulic hose and repair of the grease pump

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

Note

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 265*.

Repairing the grease pump

- Replacement of the pump parts is described in *Operating instructions - Centralized lubrication pump 203 DC (Lincoln Quicklub)*.

Continues on next page

- 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.

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.

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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 281*.

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 133*. 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 281*.

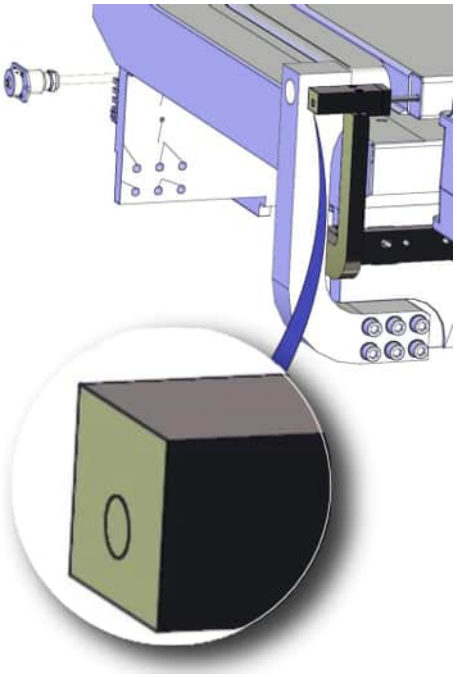
5.2 Measuring reference values for zero position

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 effect 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 282*.
3	Clean the linear guide rails.	See *Cleaning the linear guides on page 152*.
4	Jog the carriage to zero position with the FlexPendant.	
5	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

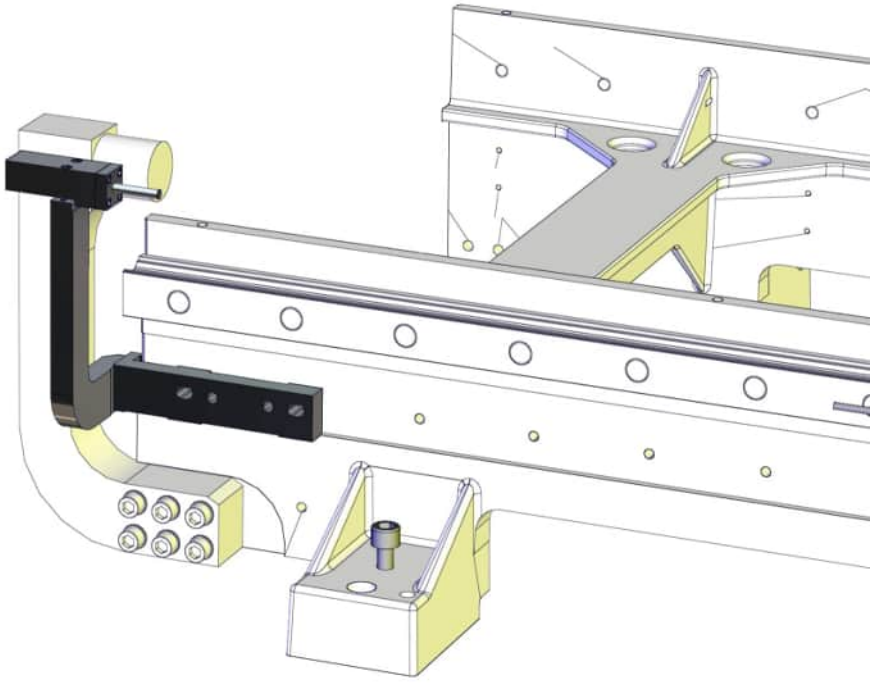
General

If resolver values are changed, the robot must be re-calibrated 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 280*.

Location of calibration tool

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



xx1200000002

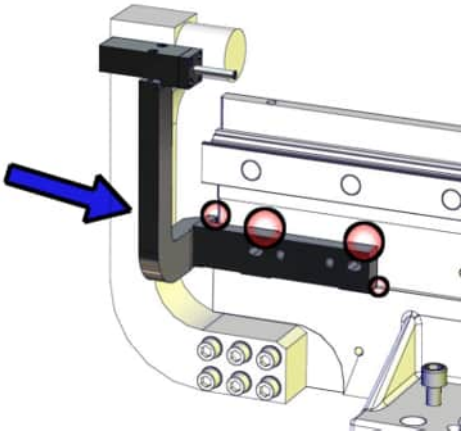
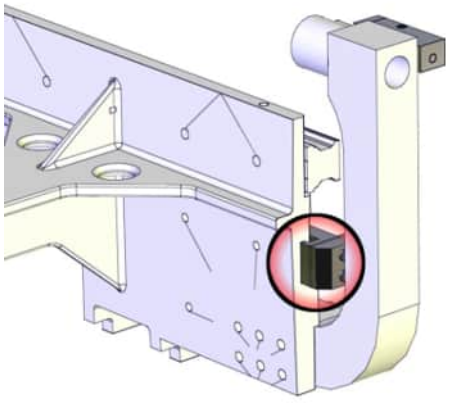
Required equipment

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 280*.

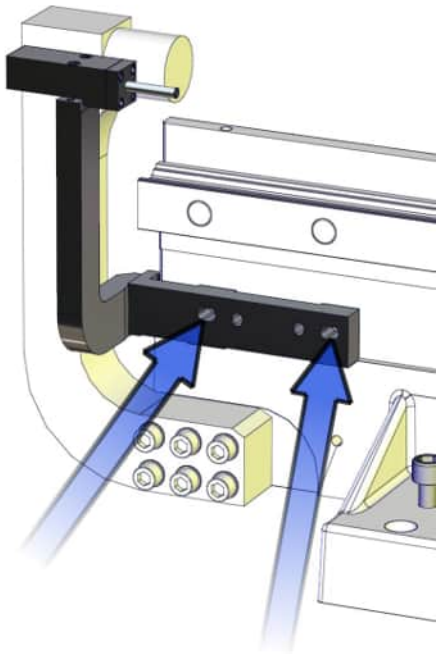
Continues on next page

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	Clean the linear guide rails.	See *Cleaning the linear guides on page 152*.
4	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 281*.  xx1200000003  xx1200000004

Continues on next page

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

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

5.3 Fine calibration
Continued

	Action	Note
4	Stop the carriage when the calibration pin is in correct position, according to the previously measured *reference values*. The carriage is now in calibration position.	Noted during measurement of the zero position, see *Measuring reference values for zero position on page 280*.
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 standalone controller* (*Coordinated track motion*).

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6 Decommissioning

6.1 Introduction to decommissioning

Introduction

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

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

> **Note**
>
> The decommissioning process shall be preceded by a risk assessment.

Disposal of materials used in the robot

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

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

See also *Environmental information on page 288*.

Transportation

Prepare the robot or parts before transport, this to avoid hazards.

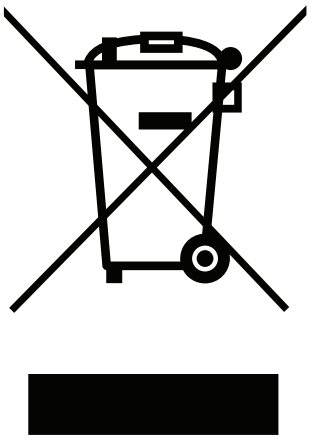
6.2 Environmental information

Introduction

ABB robots contain components in different materials. During decommissioning, all materials should be dismantled, recycled, or reused responsibly, according to the relevant laws and industrial standards. Robots or parts that can be reused or upcycled helps to reduce the usage of natural resources.

Symbol

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



xx1800000058

Materials used in the product

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

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

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

Continues on next page

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. 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.

8.2 Applicable standards

Note

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

General

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

Normative standards as referred to from ISO 10218-1

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

Deviations from ISO 10218-1:2011 for IRBT 4004/6004/7004

Deviations from the standard are motivated for IRBT 4004/6004/7004 in the table below.

Requirement	Deviation for IRBT 4004/6004/7004	Motivation
§5.12.1 Limiting the range of motion by adjustable stops (§5.12.2) or by safety functions (§5.12.3).	IRBT 4004/6004/7004 does not have adjustable mechanical stops.	The track motion is designed as segments, which can be reduced to limit the range of motion.

Region specific standards and regulations

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
ANSI/UL 1740	Safety standard for robots and robotic equipment
CAN/CSA Z 434-03	Industrial robots and robot Systems - General safety requirements

Continues on next page

Other standards used in design

Standard	Description
ISO 9787:2013	Robots and robotic devices -- Coordinate systems and motion nomenclatures
IEC 61000-6-2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
IEC 61000-6-4	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
ISO 13732-1:2006	Ergonomics of the thermal environment - Part 1
IEC 60974-1:2012 [i]	Arc welding equipment - Part 1: Welding power sources
IEC 60974-10:2014 [i]	Arc welding equipment - Part 10: EMC requirements
ISO 14644-1:2015 [ii]	Classification of air cleanliness
IEC 60529:1989 + A2:2013	Degrees of protection provided by enclosures (IP code)

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

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 ABB robots.

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

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. It is recommended by ABB for M6-M20 screw joints. 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.

Generally, screws are lubricated with *Gleitmo 603* mixed with *Geomet 500* or *Geomet 702* in proportion 1:3. *Geomet* thickness varies according to screw dimensions, refer to the following.

Dimension	Lubricant	Geomet thickness
M6-M20 (any length except M20x60)	*Gleitmo 603* + *Geomet 500*	3-5 µm
M6-M20 (any length except M20x60)	*Gleitmo 603* + *Geomet 720*	3-5 µm
M20x60	*Gleitmo 603* + *Geomet 500*	8-12 µm
M20x60	*Gleitmo 603* + *Geomet 720*	6-10 µm

Screws lubricated in other ways

Screws lubricated with Molykote 1000 or Molykote P1900 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.

Continues on next page

Lubricant	Article number
Molykote 1000 (molybdenum disulphide grease)	3HAC042472-001
Molykote P1900 (molybdenum disulphide grease)	3HAC070875-001

Tightening torque

Before tightening any screw, note the following:

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

Tightening torque for 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.*

Note

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

Tightening torque for oil-lubricated screws with allen head screws

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

Note

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

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

Continues on next page

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
M24	680	960	1150

Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws

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

Note

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

Dimension	Tightening torque (Nm) Class 10.9, lubricated [i]	Tightening torque (Nm) Class 12.9, lubricated [i]
M5		8
M6		14
M8	28	35
M10	55	70
M12	96	120
M16	235	300
M20	460	550
M24	790	950

[i] Lubricated with Molycote 1000, Gleitmo 603 or equivalent

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 arm weighs 25 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

8.7 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 301*, 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: • 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.

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 for registered users on myABB Business Portal, *www.abb.com/myABB*.

Tip

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

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10 Circuit diagrams

10.1 Circuit diagrams

Overview

The circuit diagrams are not included in this manual, but are available for registered users on myABB Business Portal, *www.abb.com/myABB*.

See the article numbers in the tables below.

Controllers

Product	Article numbers for circuit diagrams
Circuit diagram - IRC5	*3HAC024480-011*

Manipulators

Product	Article numbers for circuit diagrams
Circuit diagram - IRB 120	*3HAC031408-003*
Circuit diagram - IRB 140 type C	*3HAC6816-3*
Circuit diagram - IRB 260	*3HAC025611-001*
Circuit diagram - IRB 360	*3HAC028647-009*
Circuit diagram - IRB 390	*3HAC060545-009*
Circuit diagram - IRB 460	*3HAC036446-005*
Circuit diagram - IRB 660	*3HAC025691-001*
Circuit diagram - IRB 760	*3HAC025691-001*
Circuit diagram - IRB 1200	*3HAC046307-003*
Circuit diagram - IRB 1410	*3HAC2800-3*
Circuit diagram - IRB 1600/1660	*3HAC021351-003*
Circuit diagram - IRB 1520	*3HAC039498-007*
Circuit diagram - IRB 2400	*3HAC6670-3*
Circuit diagram - IRB 2600	*3HAC029570-007*
Circuit diagram - IRB 4400/4450S	*3HAC9821-1*
Circuit diagram - IRB 4600	*3HAC029038-003*
Circuit diagram - IRB 6620	*3HAC025090-001*
Circuit diagram - IRB 6620 / IRB 6620LX	*3HAC025090-001*
Circuit diagram - IRB 6640	*3HAC025744-001*
Circuit diagram - IRB 6650S	*3HAC13347-1* *3HAC025744-001*
Circuit diagram - IRB 6660	*3HAC025744-001* *3HAC029940-001*
Circuit diagram - IRB 6700 / IRB 6790	*3HAC043446-005*

Continues on next page

10.1 Circuit diagrams
Continued

Product	Article numbers for circuit diagrams
Circuit diagram - IRB 7600	*3HAC13347-1* *3HAC025744-001*
Circuit diagram - IRB 14000	*3HAC050778-003*
Circuit diagram - IRB 910SC	*3HAC056159-002*

Track motions

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

i Not valid for motor Type A.
ii Valid for motor Type A.

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