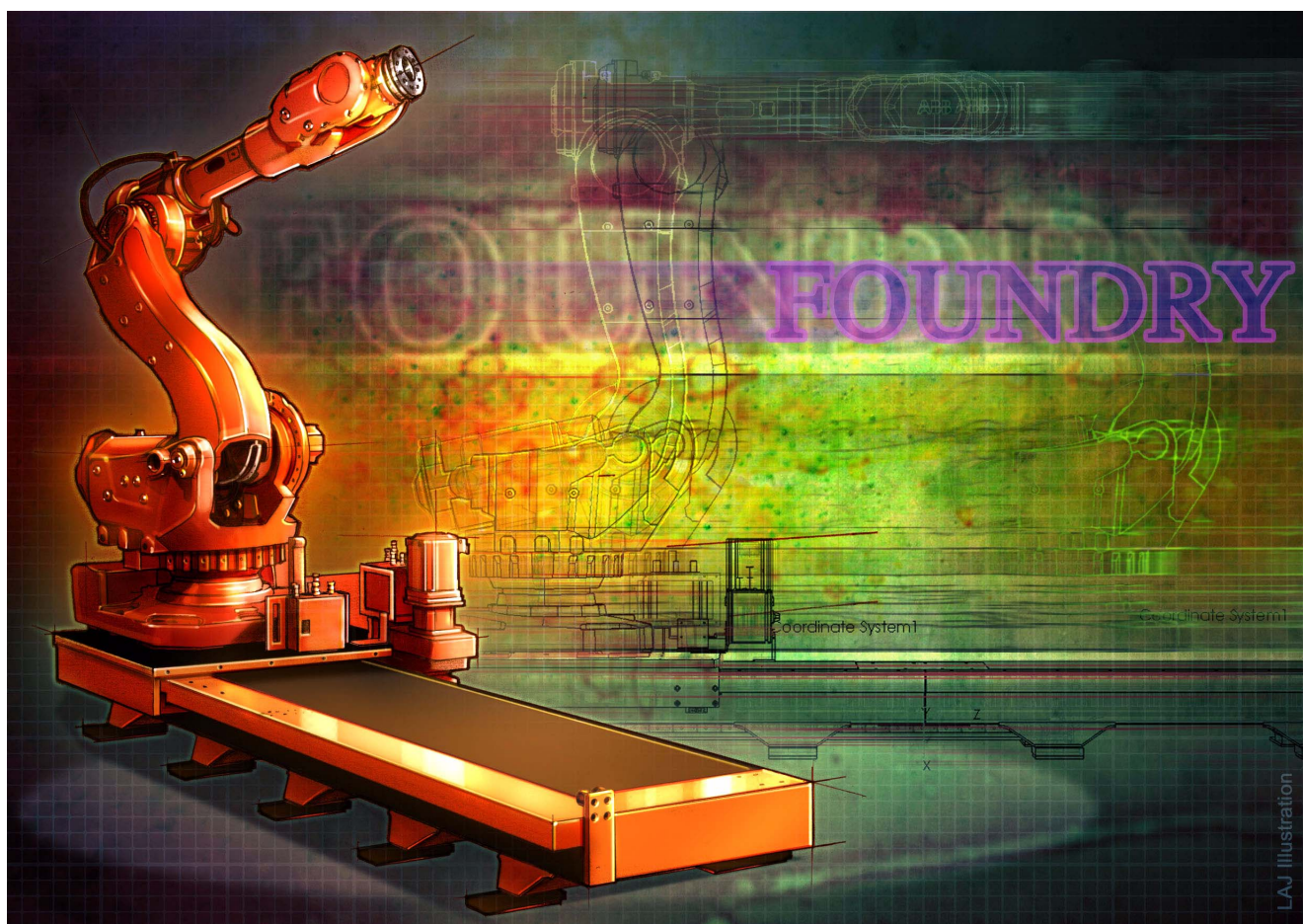


Product Manual

Track Motion Foundry

IRBT 4003F/6003F/7003F

3HXD 7109-1 Rev. 8, February 2006



The information in this document is subject to alteration without prior notice and should not be regarded as an undertaking from ABB Automation Technologies AB. ABB Automation Technologies AB assumes no responsibility for errors that may occur in this document.

ABB Automation Technologies AB bears no responsibility for damage that is a consequence of using this document or the software or hardware described in this document.

The document, or parts of it, may not be reproduced or copied without prior permission from ABB Automation Technologies AB. It may neither be imparted to a third party nor otherwise be used without authorization. Infringement hereof will be subject to action in accordance with applicable laws.

Further copies of this document can be obtained from ABB Automation Technologies AB at current prices.

© 2003 ABB Automation Technologies AB

ABB Automation Technologies AB
Robotics & Manufacturing
SE-695 82 Laxå
Sweden

Contents	Specification	Tab 1:
Product Manual	Description	1
Track Motion	Safety instructions	5
Foundry	Technical specifications and requirements	9
IRBT 4003F/ 6003F/7003F	Variants and options	15
	Installation and operation	Tab 2:
	Unpacking and handling	1
	Mechanical installation	5
	Electrical installation	17
	Commissioning	23
	Maintenance	Tab 3:
	Maintenance intervals	1
	Maintenance instructions	3
	Spare parts	19

Tab 1: Specification

1 Description	1
1.1 General	1
1.2 Principle layout	2
1.2.1 IRBT 4003F/6003F/7003F	2
1.3 Terms and concepts	3
1.3.1 Definitions	3
2 Safety instructions	5
2.1 Description	5
2.2 Safety with Unpacking and handling	5
2.2.1 Lifting instructions	5
2.3 Safety with mechanical installation	6
2.3.1 Safety distance	6
2.4 Safety with Assembling the cable channel and robot	6
2.4.1 Assemble the robot	6
2.5 Safety with Electrical installation	6
2.5.1 The robot's cable harness	6
2.6 Safety with Commissioning	7
2.6.1 Calibration	7
2.6.2 Checking the working area	7
3 Technical specifications and requirements	9
3.1 Performance	9
3.1.1 IRBT 4003F IRB 4400 (Low voltage)	9
3.1.2 IRBT 6003F IRB 6400R (Low voltage)	9
3.1.3 IRBT 6003F IRB 6600 (High voltage)	10
3.1.4 IRBT 7003F IRB 7600 (High voltage)	10
3.2 Dimensions	11
3.2.1 Length measurement	11
3.2.2 Width and height measurements	12
3.3 Load on cover plate	13
3.3.1 Max load	13
3.4 Technical requirements for the robot	14
3.4.1 Hardware requirements	14
4 Variants and options	15
4.1 Variants and options to the IRBT 4003F/6003F/7003F	15
4.1.1 Connection cable	15
4.1.2 Power cable	15
4.1.3 Ordering list	15
4.1.4 Options	16

1 Description

1.1 General

Track Motion IRBT 4003F/6003F/7003F expands the movement pattern of the robot with an extra degree of programmable freedom.

**High performance
- High precision**

IRBT 4003F/6003F/7003F has a powerful motor and an advanced gearbox. Together they give the track motion good acceleration and speed performance at the same time as precision is extremely high.

Function

The track motion is supplied with carriage and adaptor plate for robot models: IRB 7600, 6600, 6400R or IRB 4400. No further adaptation is necessary, which means easy installation. The design of the track motion has also been adapted to give the shortest possible installation time.

Movement on the track motion is programmed using the robot controller in the same way as the robot's other axes.

Cable chain

IRBT 4003F/6003F/7003F has a covered, steel cable chain.

Flexibility

As the track motion is based on two and three metre modules makes it very flexible. There is also a possibility to add one or more modules at a later date.

**Fully-fitted cover
plates**

The track motion's cover plate is a full length "Tear plate". This means IRBT 4003F/6003F/7003F is sealed and easy to keep clean. The plate is also safe to walk on.

Description

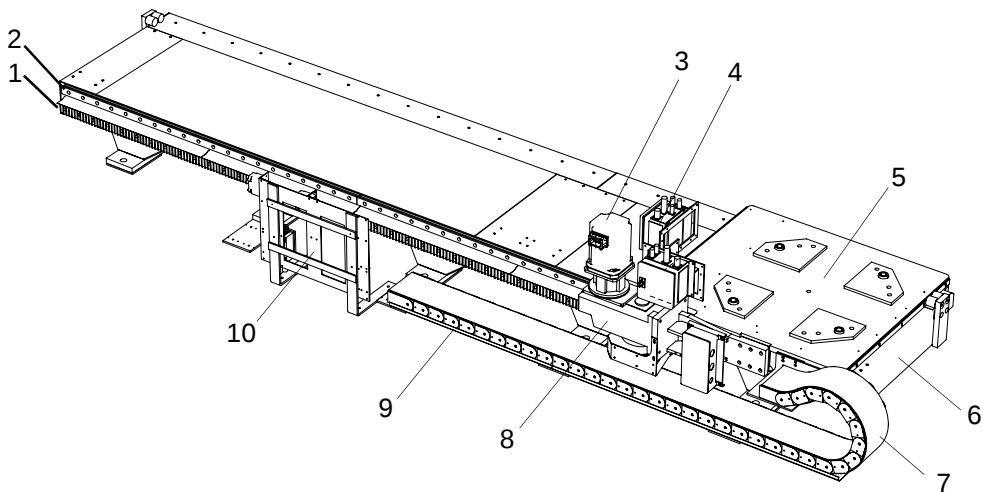
Principle layout

1.2 Principle layout

Track Motion IRBT 4003F/6003F/7003F is available in a basic version where the cable chain is protected by a steel band.

1.2.1 IRBT 4003F/6003F/7003F

The illustration shows the principle layout of the track motion.



IRBT 4003F/6003F/7003F

Component parts

The table refers to the positions in the illustration above.

Description	Item
Gear rack	1
Linear guides	2
Motor	3
Brake release box only for the IRB 6600 and IRB 7600	4
Carriage	5
End-plate	6
Cable chain	7
Gearbox	8
Cable tray	9
Connection point J	10

1.3 Terms and concepts

1.3.1 Definitions

The table below lists terms and concepts used in the documentation.

Name	Definition
Robot system	Robot and Track Motion together.
Robot	Manipulator and controller together (IRB 6400R/IRB 4400/IRB 6600 and IRB 7600).
Manipulator	The mechanical, moving part of the robot.
Controller	Controller of the type S4Cplus.
Track Motion	Carriage, stand and cable chain as well as associated parts, assembled (IRBT 4003F/6003F/7003F).
Carriage	The moving part, on which the manipulator is mounted.
Stand	The assembled framework for the track motion.
Stand module	Track motion systems with a travel length greater than 4.7 metres are supplied with the stand in modules that are interconnected according to the instructions in " Mechanical installation " sektion 2 .
Travel length	The carriage's maximum movement range.

Description

Terms and concepts

2 Safety instructions

2.1 Description

There are safety instructions in this chapter for all steps that involve a risk of personal injury or material damage. In addition, they are written out by the instructions for each step.

General warnings where the intention is to avoid difficulties are only set out by the instruction in question.

Key to symbols

The different types of warnings are set out in the following chapters according to the table below:

Symbol	Importance
	Warns for the risk of personal injury or serious damage to the product. Always follow the instructions expressed in association with this symbol.
	Draws your attention to the fact that damage to the product can occur if a measure is not performed or is performed incorrectly.
	Information about important details.

2.2 Safety with Unpacking and handling

Read carefully through the safety instructions, before the track motion is unpacked and installed.

2.2.1 Lifting instructions

Only units that are 6 metres or shorter may be lifted. If the units are joined, the joints must be prefitted on delivery.

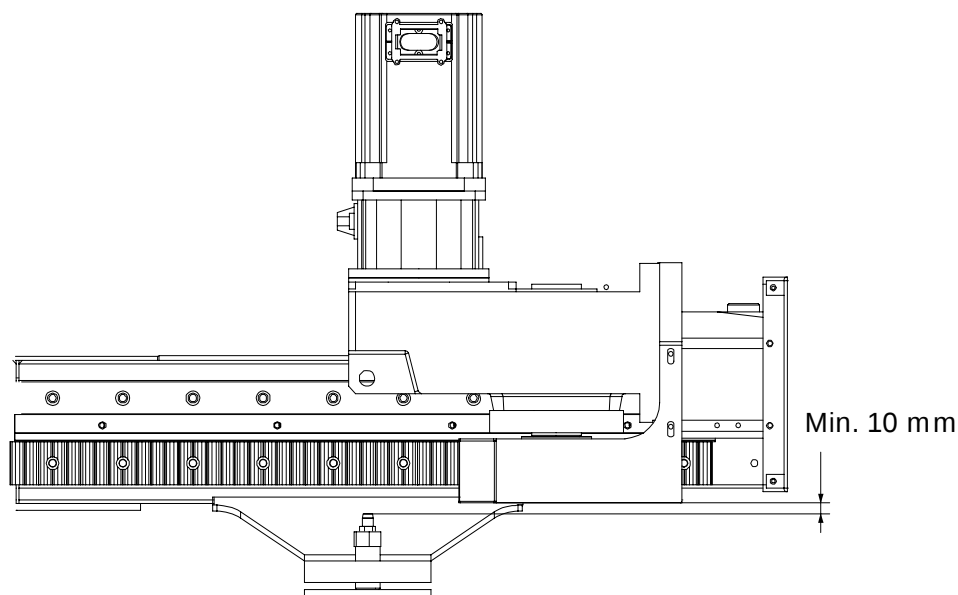
Safety instructions

Safety with mechanical installation

2.3 Safety with mechanical installation

2.3.1 Safety distance

The distance between the expander bolt and the gear wheel guard must be at least 10 mm. See the illustration.



Distance between levelling bolt and gear wheel guard.

2.4 Safety with Assembling the cable channel and robot

2.4.1 Assemble the robot

Always refer to the documentation for the manipulator when the manipulator is to be lifted.

2.5 Safety with Electrical installation

2.5.1 The robot's cable harness

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

2.6 Safety with Commissioning

2.6.1 Calibration

Make sure no persons are on the track motion when the carriage moves. Also make sure that the track motion's cover plates are free from loose objects, otherwise these can become trapped between the carriage and the plates.

2.6.2 Checking the working area

The track motion's working area must be inspected before the system is commissioned.

Safety instructions

Safety with Commissioning

3 Technical specifications and requirements

3.1 Performance

3.1.1 IRBT 4003F IRB 4400 (Low voltage)

The table below contains important technical data for the performance of the track motion.

Function	Performance
Travel length	1.7-7.7 metres in increments of 1 metre.
Travel speed IRBT 4003F	1.6 m/s
Stand length	Travel length + 1.3 metres
Acceleration	1.4 m/s ²
Retardation	1.9 m/s ²
Repeater accuracy ¹	± 0.1 mm
Maximum load IRB 4400	the robot weight +100 kg
Weight carriage	600 kg
stand	270 kg/m
Adaptor for IRB 4400	160 kg
Degree of protection	IP 67
Static play	Contact ABB for information
Dynamic play	Contact ABB for information

1. Repeated stopping in the travel direction, at the same point.

3.1.2 IRBT 6003F IRB 6400R (Low voltage)

The table below contains important technical data for the performance of the track motion.

Function	Performance
Travel length	1.7-7.7 metres in increments of 1 metre.
Travel speed IRB 6003	1.0 m/s
Stand length	Travel length + 1.3 metres
Acceleration	1.5 m/s ²
Retardation	1.6 m/s ²
Repeater accuracy ¹	± 0.1 mm
Maximum load IRB 6600	The robot weight +400 kg
Weight carriage	600 kg
stand	270 kg/m
Degree of protection	IP 67
Static play	Contact ABB for information
Dynamic play	Contact ABB for information

1. Repeated stopping in the travel direction, at the same point.

Technical specifications and requirements

Performance

3.1.3 IRBT 6003F IRB 6600 (High voltage)

The table below contains important technical data regarding the performance of the track motion.

Function	Performance
Travel length	1.7-7.7 metres in increments of 1 metre.
Travel speed IRB 6003	1.0 m/s
Stand length	Travel length + 1.3 metres
Acceleration	1.5 m/s ²
Retardation	1.6 m/s ²
Repeater accuracy ¹	± 0.1 mm
Maximum load IRB 6600	The robot weight +400 kg
Weight carriage	600 kg
stand	270 kg/m
Degree of protection	IP 67
Static play	Contact ABB for information
Dynamic play	Contact ABB for information

1. Repeated stopping in the travel direction, at the same point.

3.1.4 IRBT 7003F IRB 7600 (High voltage)

The table below contains important technical data regarding the performance of the track motion.

Function	Performance
Travel length	1.7-7.7 metres in increments of 1 metre.
Travel speed IRB 7003	1.0 m/s
Stand length	Travel length + 1.3 metres
Acceleration	1.0 m/s ²
Retardation	1.0 m/s ²
Repeater accuracy ¹	± 0.1 mm
Maximum load IRB 6600	The robot weight +400 kg
Weight carriage	600 kg
stand	270 kg/m
Degree of protection	IP 67
Static play	Contact ABB for information
Dynamic play	Contact ABB for information

1. Repeated stopping in the travel direction, at the same point.

3.2 Dimensions

3.2.1 Length measurement

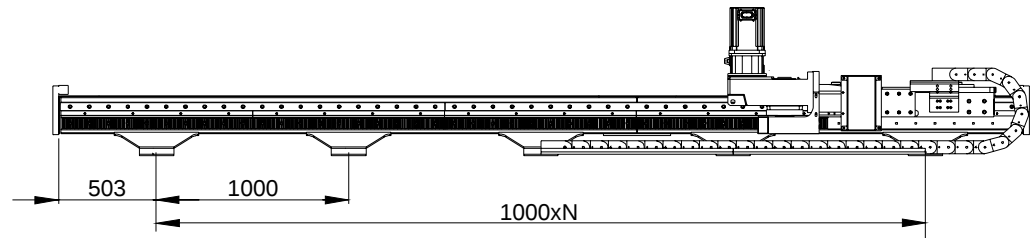


The signal cable on a Foundry track motion with IRB 4400 and IRB6400R has a maximum length of 30 m between BRB and carriage motor. This means that a floor cable harness results in shorter travel lengths. See the table below.

The table below shows the longest possible travel lengths.

Floor cable harness length	Max. travel length
22 m	7.7 m

The illustration shows IRBT 4003/6003/7003 from page



IRBT 4003FS/4003S, length measurement

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

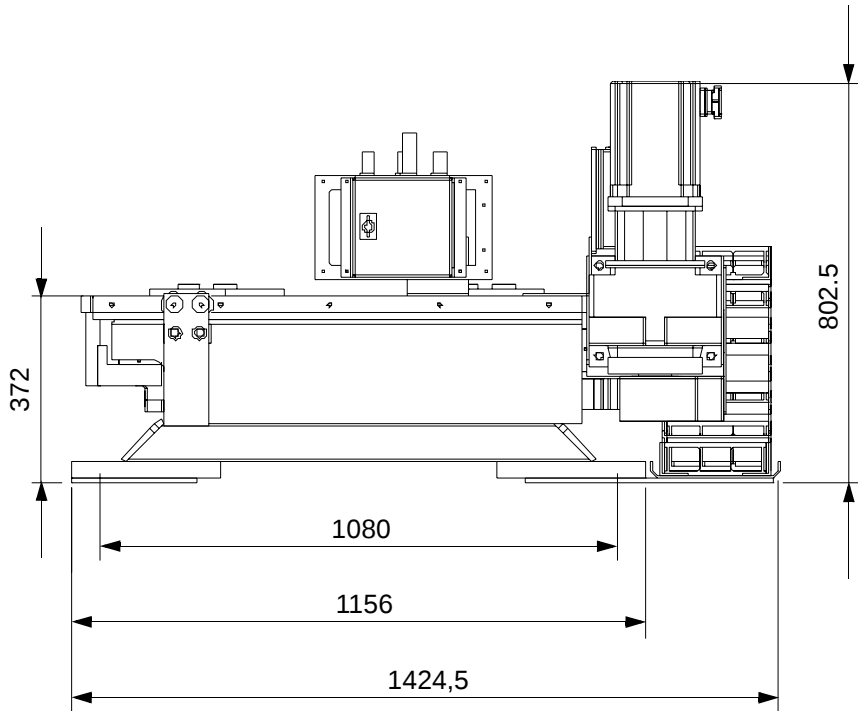
Travel length	Total length of the stand	Quantity N
1.7 m	3 m	2
2.7 m	4 m	3
3.7 m	5 m	4
4.7 m	6 m	5
etc.		

Technical specifications and requirements

Dimensions

3.2.2 Width and height measurements

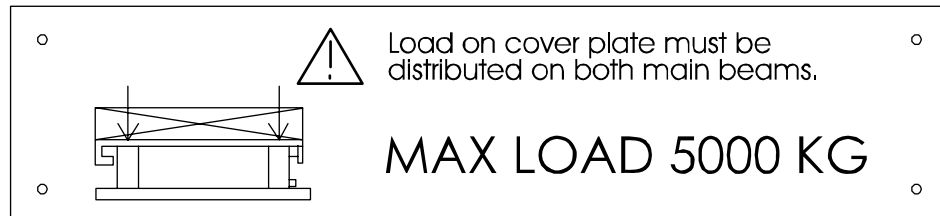
The illustration shows IRBT 4003/6003/7003 from the end-plate.



IRBT 6003S/4003S Compact, width and height measurements

3.3 Load on cover plate

3.3.1 Max load



Technical specifications and requirements

Technical requirements for the robot

3.4 Technical requirements for the robot

On robots of the type IRB 6400R/IRB 4400 the track motion acts as an integrated seventh axis. In order for it to work satisfactorily the robot’s equipment must comply with a number of minimum requirements.

The track motion is designed to work together with the controller of the type S4Cplus, please contact ABB for information about compatibility with other controllers.

3.4.1 Hardware requirements

The robot hardware must be equipped with the following options in order to drive an external axis 7 (Track Motion).

Unit	Option	Notes
IRB 4400	52-7	Drive unit T
IRB 6400R	52-9	Drive unit U
IRB 6600	53-3 (7 axes)	Drive unit W
IRB 7600	53-3 (7 axes)	Drive unit W
Control system S4Cplus	Diskette station	If the operating parameters are to be downloaded directly from the parameter diskette the controller must be equipped with a diskette station. See the robot documentation for other transfer methods.

4 Variants and options

4.1 Variants and options to the IRBT 4003F/6003F/7003F

4.1.1 Connection cable

The robot's standard cables can be used to connect the track motion to the controller.

4.1.2 Power cable

The power cable to the seventh axis is 7, 15 or 22 metres long, measured from the connection point in the centre of the track motion.

4.1.3 Ordering list

The table describes the variants and options that can be order for IRBT 4003F/6003F/7003F. Please contact ABB for further specialisations.

Where the last number of the article number is replaced by "x" this defines the track motion's travel length rounded upwards to the nearest metre. Accordingly, a Track Motion with a travel length of 2.7 metres has the article number 3HXD 1546-3, with a travel length of 3.7 metres the article number will be 3HXD 1546-4, etc.

For cables the last numbers are replaced by "yy" and where the cable length is stated in decimetres.

Variants	Art. no.
Track Motion IRBT 4003F/6003F/7003F	3HXD 1673-x
Cable chain for IRBT 4003F/6003F/7003F	
IRB 4400 M2000	3HXD 1681-2yy
IRB 6400R M2000	3HXD 1681-3yy
IRB 6600/7600	3HXD 1681-1yy
Carriage for	
IRB 4400	3HXD 1657-4
IRB 6400R	3HXD 1657-3
IRB 6600	3HXD 1657-1
IRB 7600	3HXD 1657-2
Axis 7 power cable floor IRB 4400/IRB 6400R	3HXD 1249-yy
Resolver cable IRB 4400/6400R	3HXD 1250-yy
Axis 7 Power cable floor IRB 6600/IRB 7600	3HXD 1601-yy

Variants and options

Variants and options to the IRBT 4003F/6003F/7003F

4.1.4 Options

Option	Art. no.
Central lubrication system with timer	3HXD 0100-374
Axis 1 Position Switch Cable IRB 4400/IRB 6400R	3HXD 1433-yy
Axis 1 Position Switch Cable IRB 6600/IRB 7600	3HXD 1638-yy
Customer Cable, IRB 4400	3HXD 1686-yy
Customer Cable, IRB 6400R	3HXD 1485-yy
Customer Cable, IRB 7600/6600	
CP/CS Canbus/DiviceNet	3HXD 1551-yy
CP/CS Interbus	3HXD 1617-yy
CP/CS Profibus	3HXD 1637-yy
CP/CS	3HXD 1672-yy

Tab 2: Installation and operation

1 Unpacking and handling	1
1.1 Lift	1
1.1.1 Lifting instructions	1
1.1.2 Lifting the track motion	1
1.1.3 The lifting zone	1
1.2 Acceptance inspection	2
1.2.1 Identification	2
1.2.2 Contents	2
1.2.3 Inspection	2
1.2.4 Cleaning	2
1.3 Moving the carriage manually	3
1.3.1 General	3
1.3.2 Release the brake on the BRB-box	3
1.3.3 Release the brake via the drive on the motor.	3
2 Mechanical installation	5
2.1 Foundation	5
2.1.1 Robustness	5
2.1.2 Incline	5
2.1.3 Static loads	5
2.1.4 Dynamic loads	5
2.2 Preparations	6
2.2.1 Recommendations for mounting	6
2.2.2 Hole configuration	6
2.2.3 Base dimensions	7
2.3 Stand assembly	8
2.3.1 Procedure	8
2.3.2 Positioning the stand	9
2.3.3 Adjusting the level	10
2.3.4 Assemble the linear guides	10
2.3.5 Assemble the gear racks	12
2.3.6 Securing the stand to the foundation	13
2.3.7 Assemble the cover plates	13
2.4 Assembling the cable channel and robot	14
2.4.1 Assemble the cable tray	14
2.4.2 Assemble the robot	14
2.5 Mounting the drive unit	15

3	Electrical installation	17
3.1	The robot's cable harness	17
3.1.1	Connection point J1	17
3.1.2	Terminations on J1	17
3.2	Terminations/Wiring diagram	18
3.2.1	Introduction	18
3.3	IRB 6600/IRB 7600 M2000, MH DDU W	19
3.3.1	Wiring diagram	19
3.3.2	Standard cables	19
3.3.3	Optional cables	20
3.4	IRB 6400R M2000	21
3.4.1	Wiring diagram	21
3.4.2	Standard cables	21
3.4.3	Optional cables	21
3.5	IRB 4400 M2000	22
3.5.1	Wiring diagram	22
3.5.2	Standard cables	22
3.5.3	Optional cables	22
4	Commissioning	23
4.0.1	Preparations	23
4.1	Configuration of the controller	24
4.1.1	Load the operating parameters	24
4.1.2	Commutation offset	24
4.1.3	Travel length	24
4.2	Lubricating Track Motion	25
4.2.1	General	25
4.2.2	Set the timer for the central lubrication system	25
4.2.3	Functionality test of the Trabon lubrication system	27
4.3	Calibration	29
4.3.1	Calibrate the track motion	29
4.3.2	Calibration with a restart	29
4.4	Checking the working area	29
4.4.1	Check the working area	29
4.5	Check for abnormal wear and noise	30
4.5.1	Linear guide joints	30
4.5.2	Gear rack joints	30
4.5.3	Gear play	30
4.5.4	Adjust cables and covers	31

1 Unpacking and handling



1.1 Lift

1.1.1 Lifting instructions

Stand modules can be moved using a fork lift truck or an overhead crane.



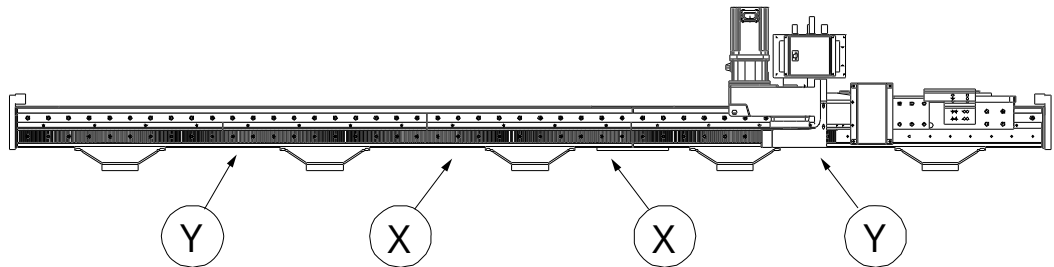
1.1.2 Lifting the track motion

Proceed as follows to lift the track motion:

	Lifting using a fork lift truck	Lifting using an overhead crane
1	Move the carriage as close to the centre of the track motion as possible.	
2	Position the forks along the rail module in the lifting zone as according to position (X) in the figure below.	Dismantle the side covers from the track motion if these are prefitted.
3		Wrap two lifting straps around each side of the carriage according to position (Y) in the figure below.

1.1.3 The lifting zone

The illustration shows the zone on the track motion where the forks can be placed.

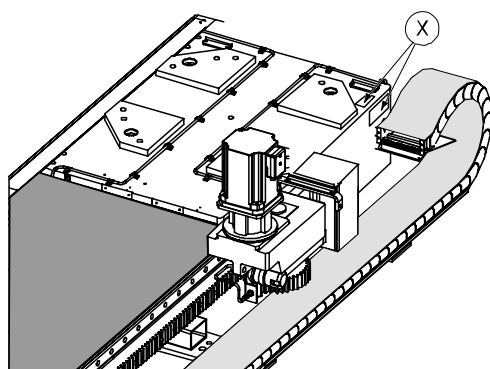


The lifting zone for a fork lift truck (X) and an overhead crane (Y).

1.2 Acceptance inspection

1.2.1 Identification

The identification plates, located by (X), state the carriage type, serial number, delivery date, etc.



Identification plates (X)

1.2.2 Contents

As standard the track motion includes the following on delivery:

- One carriage (with possible adaptor) with the drive unit
The carriage weighs approx.: 600 kg. (+ possible adaptor, 160/193 kg)
- Stand modules and cable chain
The track motion with a travel length greater than 4.7 m are designed with several stand modules interconnected during installation.
- Mounting bolts and guide sleeves
Mounting bolts with washers and guide sleeves for the robot.

1.2.3 Inspection

Unpack the equipment and check for any visible transport damage. If this is the case, contact ABB.

1.2.4 Cleaning

Before transport the equipment has been protected against rust by a thin film of oil that has been applied before packing. This film of oil must be wiped off before installation.

- | | |
|---|---|
| 1 | Wipe off any surplus oil using a lintless cloth |
|---|---|

1.3 Moving the carriage manually

1.3.1 General

Re-calibration must be carried out if the table is moved manually, see Calibration

1.3.2 Release the brake on the BRB-box

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

- 1
- Press in the brake release button.

1.3.3 Release the brake via the drive on the motor

24V DC can be connected to the motor’s power cable, if there is no voltage supply to the motor.

Low voltage motor

The following instructions apply for a low voltage motor.

- 1
- Connect 24V DC between pin M (0V) and L (+24V) on connector MP.M7 (power cable, 3HXD 1249)

High voltage motor

The following instructions apply for a high voltage motor.

- 1
- Connect 24V DC between pin W (0V) and V (+24V) on connector MP.M7/M8 (power cable, 3HXD 1705)

Unpacking and handling

Moving the carriage manually

2 Mechanical installation

2.1 Foundation

2.1.1 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 manipulator, see “*Foundation*” section 2.1.

2.1.2 Incline

The foundation must be designed so that the track motion can be mounted without the incline exceeding 0.5 mm/m in the direction of travel and 0.1 mm/m across this.

2.1.3 Static loads

The table shows the static loads that the foundation must be able to bear.

Load	Value
Distributed load, stand	270 kg/M
Movable, in the direction of travel	
Manipulator	2400 kg
Carriage	600 kg
Adaptor, (IRB 4400)	160 kg
Permitted extra load	
IRB 4400	100 kg
IRB 6400R	300 kg
IRB 6600	400 kg
IRB 7600	700 kg

2.1.4 Dynamic loads

The dynamic loads from the movement of the track motion and manipulator can change direction independent of each other. In these instances where loads are added to each other the foundation must be able to bear these combined loads.

The maximum dynamic loads for the track motion are:

- (Weight, carriage + Weight, manipulator + Weight extra load) x Acceleration
- See the robot documentation with regard to dynamic loads for the robot.



The track motion should not be used so that the maximum loads from the robot and conveyor are added to each other. If, for example, the carriage is used at maximum speed in one direction the robot should be at a standstill or move in the opposite direction.

2.2 Preparations

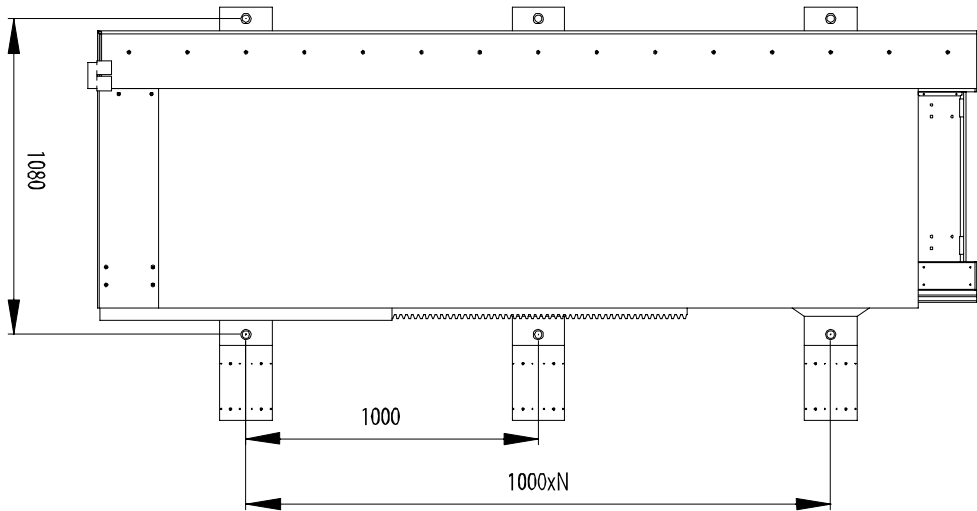
2.2.1 Recommendations for mounting

Chemical anchor bolts are recommended to secure the track motion to the floor. However, the mounting bolts are not supplied as these must be selected based on the material the foundation is made of.

- Mounting bolts
- Choose mounting bolts so that they:
- Are suitable for the foundation
 - Can bear the dynamic loads
 - The bolts must be able to bear the combined dynamic loads that can occur when the manipulator and carriage move, see [Foundation 2.1](#).
 - Fit in the holes in the stand, Ø24 mm

2.2.2 Hole configuration

The stand's ground plates have holes with a diameter of 24 mm.



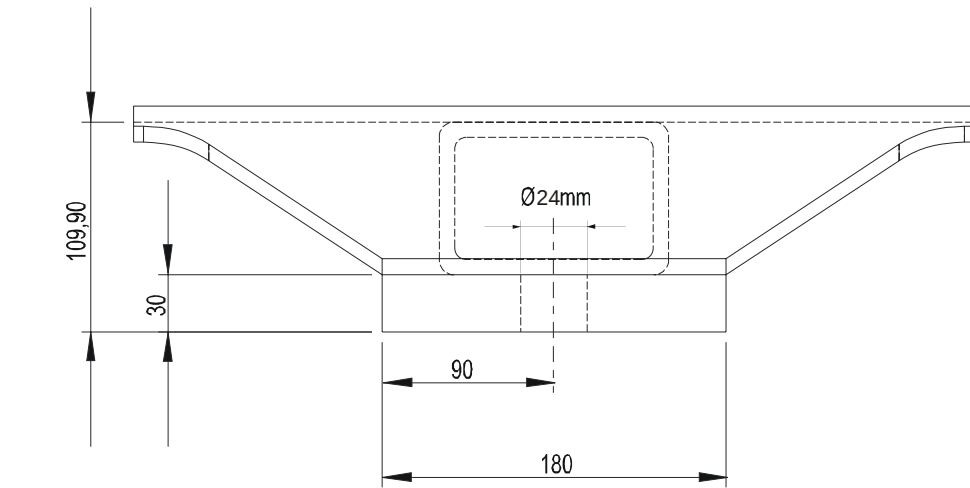
Hole configuration

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

Travel length	Total length of the stand	Quantity N
1.7 m	3 m	2
2.7 m	4 m	3
3.7 m	5 m	4
4.7 m	6 m	5
etc.		

2.2.3 Base dimensions

The illustration show the stand's base seen from the front.



Base dimensions.

2.3 Stand assembly

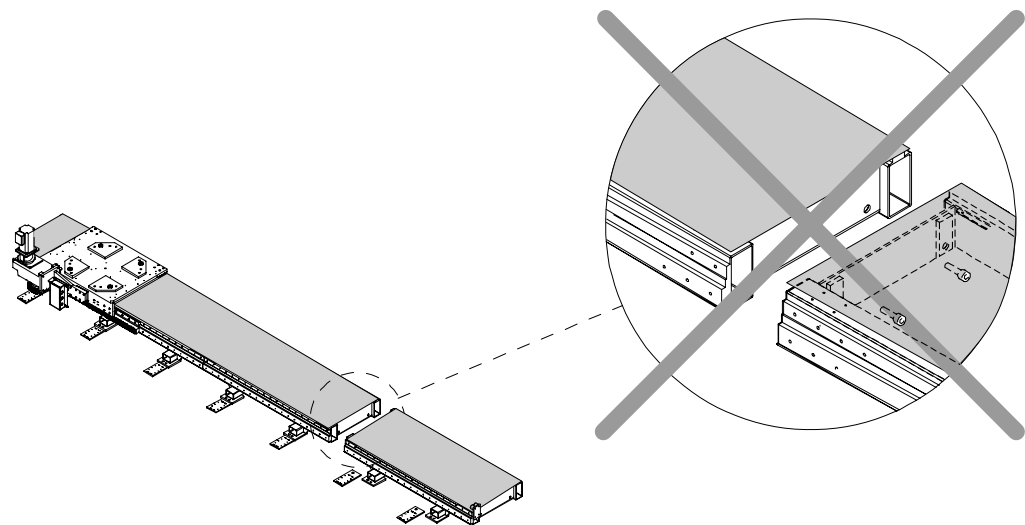
2.3.1 Procedure

The track motion should be assembled as set out in the procedure below. A detailed description of each stage can be found in further on in the manual.

- | | |
|---|--|
| 1 | Assemble the stand modules according to <i>"Positioning the stand"</i> section 2.3.2. |
| 2 | Assemble the linear guides according to <i>"Assemble the linear guides"</i> section 2.3.4. |
| 3 | Assemble the gear racks according to <i>"Assemble the gear racks"</i> section 2.3.5. |
| 4 | Anchor the stand to the foundation according to <i>"Securing the stand to the foundation"</i> section 2.3.6. |
| 5 | Assemble the protective guards and cover plates according to <i>"Assemble the cover plates"</i> section 2.3.7. |
| 6 | Assemble the cable tray according to <i>"Assembling the cable channel and robot"</i> section 2.4. |



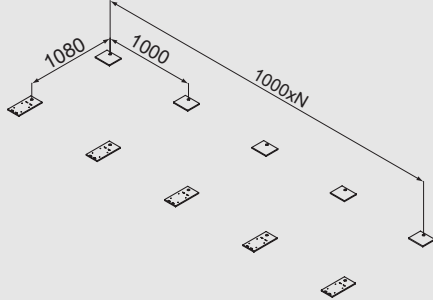
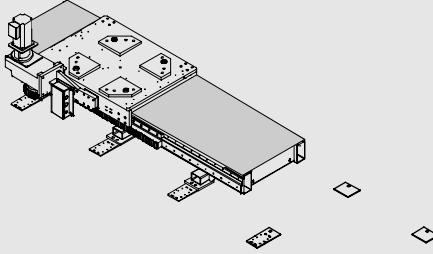
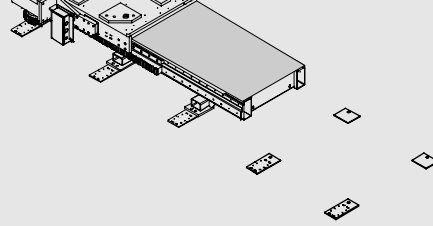
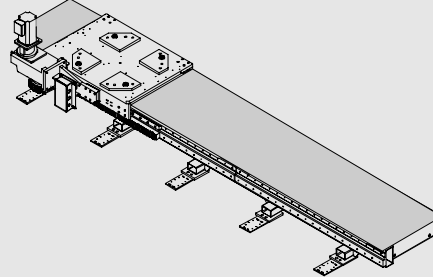
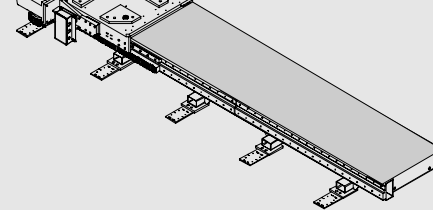
The module's fish bolts are only required on prefitted modules up to six metres that are to be lifted as a single unit. If the track motion consists of more modules, these should not be assembled using fish bolts, see the illustration below.



Assembly without fish bolts.

2.3.2 Positioning the stand

Follow the directions below to position the stand modules:

	Action	Illustration
1	Position the levelling plates on one side of the intended installation site. Position the bottom plates for the cable tray modules on the other side of the installation site.	
2	Position the first stand module, with carriage, precisely on the intended installation site.	
3	Adjust the module according to “Adjusting the level” section 2.3.3 so that it is aligned within the given tolerance. If the track motion is to consist of several modules, continue to step 4. Otherwise move to “Assemble the linear guides” section 2.3.4 .	
4	Position the next module in the direction of travel adjacent to the newly aligned module.	
5	Adjust according to “Adjusting the level” section 2.3.3 so that the machined surfaces (linear guide and gear rack) on this and the previous module are flat and level with each other. If more modules are to be assembled, repeat steps 3 and 4. Otherwise move to “Assemble the linear guides” section 2.3.4 .	

2.3.3 Adjusting the level



First read the information on [sid 2-6](#) and carry out the steps on [sid 2-9](#).

The distance between the expansion bolt and the gear wheel guard must be at least 10 mm, see the safety chapter. 2.3.1

It is recommended to use a laser level in the track motion’s direction of travel and a spirit level across this in order to obtain satisfactory adjustment. Always measure on a machined surface, for example, for the linear guide or gear rack.

Follow the directions below to position the beam units:

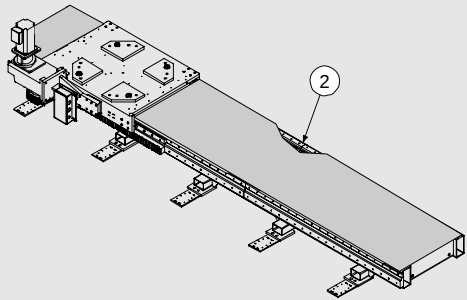
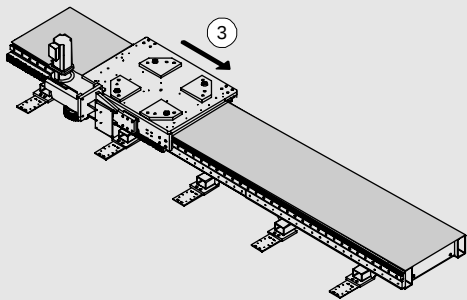
	Action	Illustration
1	Unscrew the locking nut on the levelling bolt, item 1.	
2	Screw the levelling bolts in or out to raise or lower the ground plate in question, item 2.	
3	Repeat all round until the module is aligned within the given tolerance.	
4	Tighten the locking nut on the levelling bolt, item 1.	

2.3.4 Assemble the linear guides

First read the information on [sid 2-6](#) and carry out the steps on [sid 2-9](#).

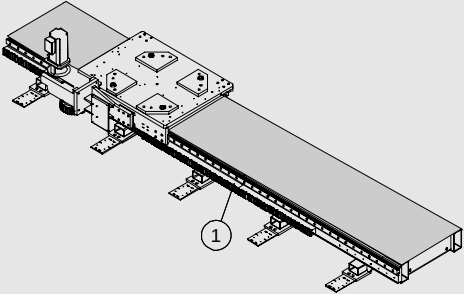
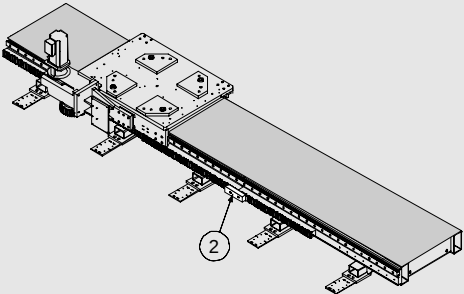
Follow the directions below to assemble the linear guide:

	Action	Illustration
1	Secure the part of the linear guide to be fitted on the side.	

	Action	Illustration
2	Assemble the linear guide on the underside, fitting the bolts loosely at this stage.	
3	Push forward the carriage so that the first ball element overlaps half of the joint. The carriage can be moved manually if 24 VDC is connected to the motor, see “Moving the carriage manually” section 1.3.	
4	Push the carriage forwards, successively tightening the linear guides on the underside. <i>Tightening torque: 50Nm.</i> If more sections are to be assembled, repeat step 1. Otherwise move to “Assemble the gear racks” section 2.3.5.	

2.3.5 Assemble the gear racks

First read the information on [sid 2-6](#) and carry out the steps on [sid 2-9–sid 2-10](#). Follow the directions below to assemble the gear racks:

	Action	Illustration
1	Lay out the section of the gear rack to be assembled against the support edge, and bolt loosely in position.	
2	Check using the supplied teeth-meshing gauge that the joints on the laid gear rack proved a smooth transition. If the teeth on the test piece and the gear rack do not mesh, continue with step 3. Otherwise go directly to step 6.	
3	If the teeth on the test piece and the gear rack do not mesh, loosen the bolts on the prefitted gear racks.	
4	Adjust the transition by using the play on the mountings on the prefitted gear racks.	
5	Secure the prefitted gear racks. <i>Tightening torque: 50Nm.</i>	
6	Secure the assembled gear rack section. <i>Tightening torque: 50Nm.</i> If more sections are to be assembled, repeat step 1. Otherwise move to “Securing the stand to the foundation” section 2.3.6.	

2.3.6 Securing the stand to the foundation

First read the information on [sid 2-6](#) and carry out the steps on [sid 2-9–sid 2-12](#).

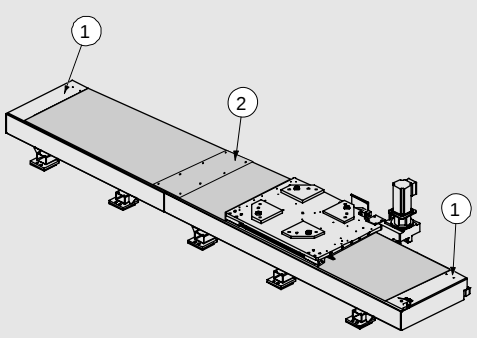
Follow the directions below to secure the track motion to the foundation:

	Action
1	Check that none of the levelling bolts on the track's ground plates are hanging in the air or that the distance between the levelling bolts and the top edge of the ground plates is at least 10 mm. Adjust if necessary according to "Adjusting the level" section 2.3.3 .
2	Move the carriage manually and check using the spirit level along the entire track, both in the direction of travel and across it. The carriage can be moved manually if 24 VDC is connected to the motor, see section 1.3 . Adjust if necessary according to "Adjusting the level" section 2.3.3 .
3	Drill holes for the mounting bolts through the ground plates' mounting holes (max. Ø24). The holes vary depending on the chosen mounting method, see "Recommendations for mounting" section 2.2.1
4	Secure the track motion to the foundation using an appropriate anchoring method. The anchoring method must be adapted to the foundation and the dynamic loads that the track motion generates, see "Foundation" section 2.1 and "Recommendations for mounting" section 2.2.1 .
5	Continue to "Assemble the cover plates" section 2.3.7 .

2.3.7 Assemble the cover plates

First read the information on [sid 2-6](#) and carry out the steps on [sid 2-9–sid 2-13](#).

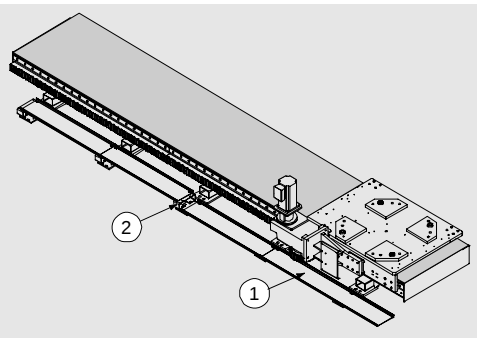
Follow the directions below to assemble the cover plates:

	Action	Illustration
1	Assemble the end plates on the track motion's short ends, see item 1.	
2	Assemble the cover plate, see item 2. (Fitted on all track motions with joints).	

2.4 Assembling the cable channel and robot

2.4.1 Assemble the cable tray

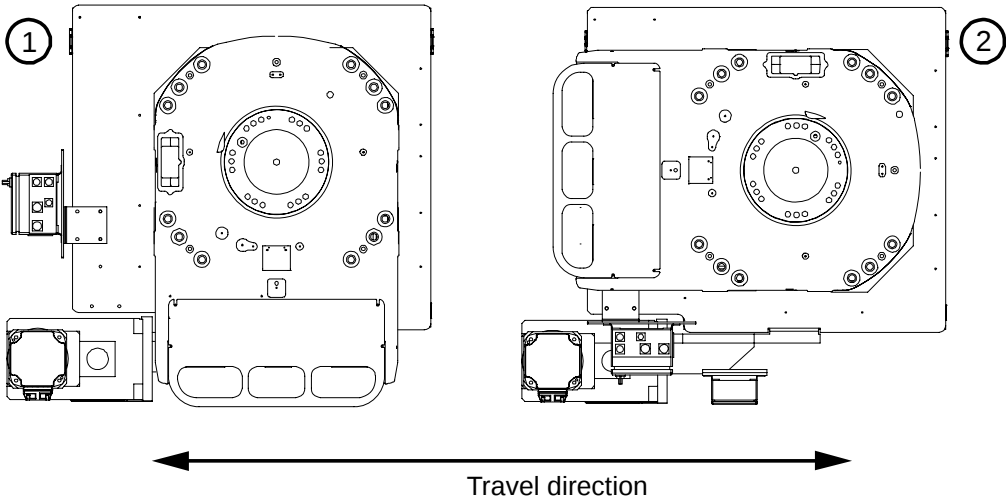
First read the information on [sid 2-6](#) and carry out the steps on [sid 2-9–sid 2-13](#). Follow the directions below to position the cable tray and levelling plates:

	Action	Illustration
1	Bolt the cable tray's guide plates on to the plates. Knock gently on the side if the position of the holes do not align.	
2	If the travel length of the completed track motion is 5.7 metres or more a raised support for the cable chain should be placed in the last cable tray. The raised support should be fitted on the mid-most ground plates (with an odd number of ground plates), or one the closest subsequent ground plate in the direction of travel (with an even number).	

2.4.2 Assemble the robot

Depending on how the order was made the manipulator should be assembled in one of following two positions:

- InLine
Neutral position for axis 1 aligned with the track motion's direction of travel (2).
- 90°
Neutral position for axis 1 aligned 90° with the track motion's direction of travel (1)



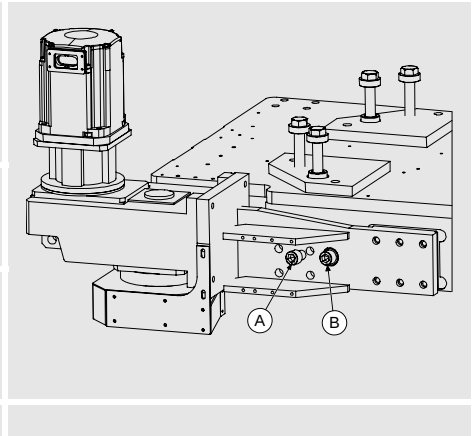
Manipulator assembly positions, InLine (2) and 90° (1).

2.5 Mounting the drive unit



Very important that the gear is align with the gear rack.

- | | |
|---|---|
| 1 | The machined heel on the drive unit shall be placed on the machined heel on the carriage.
Use MC6S-M10×60 (12.9) (6 pcs) and lubricate the thread and under the screw head with moly-cote 1000, tighten them with torque 70Nm. |
| 2 | Adjust the play with the two screws A and B below (M20×1.5).
Grease the screws with molycote grease. |
| 3 | First press the motor inwards with screw B until you have the right play ± 0.1 mm.
See the technical report for tightening torque (approx. 170-190 Nm). |
| 4 | Tighten the screw A with 60 Nm. |



3 Electrical installation

3.1 The robot's cable harness

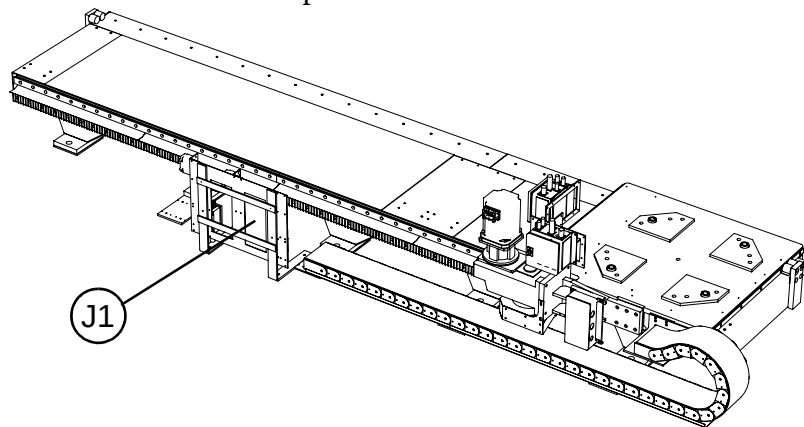
The robot's cable harness is sufficiently long for installation in one of the two possible positions on the carriage. Any surplus should be placed in a coil on the floor, depending on the local conditions.



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

3.1.1 Connection point J1

The cable harness that normally connects the controller with the manipulator and carriage is connected to the track motion's connection point, J1. Ensure there is space available under connection plate.



Connection point J1

3.1.2 Terminations on J1

The following terminations can be found on the track motion's connection point, J1:

- Axis 7 Power Cable
A Harting connector for the track motion's power supply.
- Power Cable axis 1–6
A Harting connector for the manipulator's power supply.
- Signal Cable
A Burndy connector for the manipulator's control signals.
- Customer Cable
Terminal post for connection of option cables.
- Signal cable axis 7
Burndy connector for the track motion's signals.

3.2 Terminations/Wiring diagram

3.2.1 Introduction

The wiring diagram below describes the connections between the controller, manipulator and Track Motion.

The position numbers in the table refer to the positions in the illustration above. Cables marked with (R) in the illustration are supplied with the robot.

Where the last numbers of the article number are replaced by “yy” in the table, the cable length should be stated in decimetres (-70 for 7 metres, -150 for 15 metres and -220 for 22 metres)

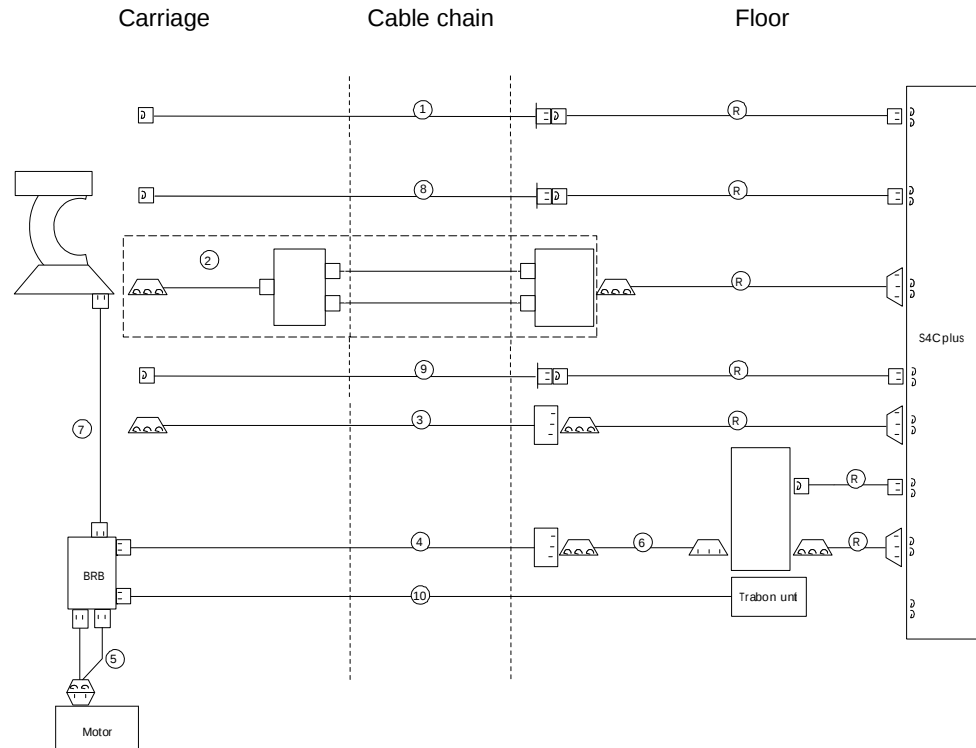


The abbreviation MH used in the following sections stands for: Material Handling.

3.3 IRB 6600/IRB 7600 M2000, MH DDU W

3.3.1 Wiring diagram

ATRM Option 53-3 (7 axes)



Wiring diagram, IRB 6600/IRB 7600 M2000, MH, DDU W

3.3.2 Standard cables

Standard cables	Art. no.	Item
Serial measurement cable axis 1-7	3HXD 1455-yy	1
Axis 1–6 Power cable	3HXD 1519-xx	2
Power/resolver cable axis 7	3HXD 1615-yy	5
Axis 7 Power Cable	3HXD 1602-yy	4
Axis 7 Power cable floor	3HXD 1601-yy	6
Resolver cable axis 7	3HXD 1640-yy	7

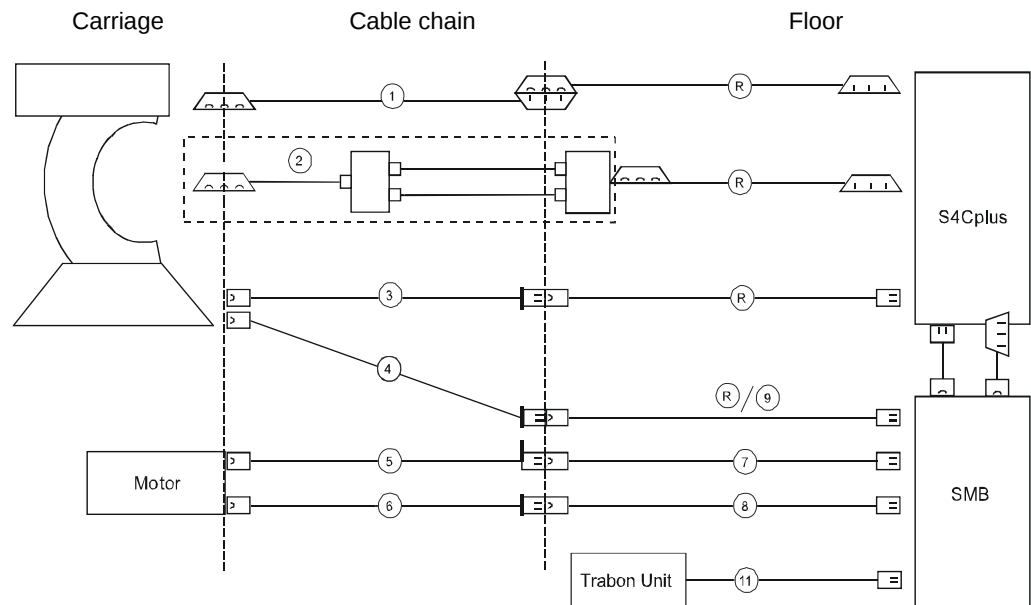
3.3.3 Optional cables

Optional cables	Art. no.	Item
Position Switch Cable axis 1	3HXD 1638-yy	8
Position Switch Cable axis 2-3	3HXD 1691-yy	9
Cable central lubrication	3HXD 1628-yy	10
Robot customer cable harness		
CANBUS/DeviceNet	3HXD 1551-yy	3
INTERBUS	3HXD 1617-yy	3
PROFIBUS	3HXD 1637-yy	3
Parallel	3HXD 1672-yy	3

3.4 IRB 6400R M2000

3.4.1 Wiring diagram

ATRM option 52-9



Wiring diagram, IRB 6400R M2000.

3.4.2 Standard cables

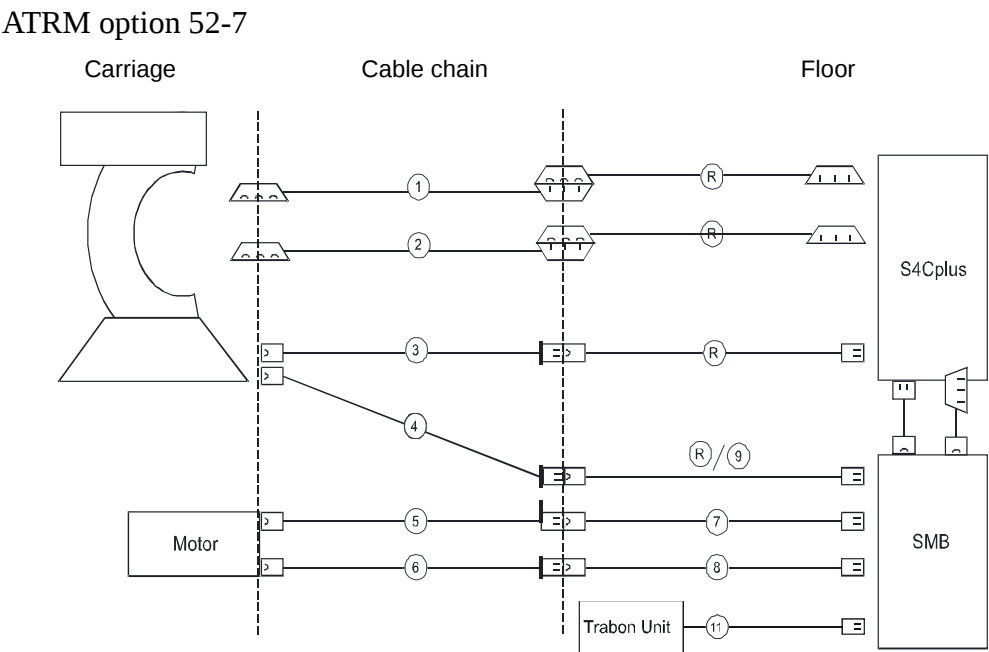
Standard cables	Art. no.	Item
Customer Cable	3HXD 1485-yy	1
Power Cable axis 1–6	3HXD 1489-yy	2
Serial measurement cable axis 1-6	3HXD 1455-yy	4
Motor cable axis 7	3HXD 1378-yy	5
Resolver cable axis 7	3HXD 1379-yy	6
Serial Measurement Cable floor axis 1-6	3HXD 1432-yy	9
Motor cable floor axis 7	3HXD 1249-yy	7
Resolver Cable floor axis 7	3HXD 1250-yy	8

3.4.3 Optional cables

Optional cables	Art. no.	Item
Position Switch Cable axis 1	3HXD 1433-yy	3
Cable central lubrication	3HXD 1318-yy	11

3.5 IRB 4400 M2000

3.5.1 Wiring diagram



3.5.2 Standard cables

Standard cables	Art. no.	Item
Customer cable	3HXD 1486-yy	1
Power Cable axis 1–6	3HXD 1487-yy	2
Serial measurement cable axis 1-6	3HXD 1455-yy	4
Resolver cable axis 7	3HXD 1378-yy	5
Axis 7 Power Cable	3HXD 1379-yy	6
Axis 7 Power cable floor	3HXD 1249-yy	7
Resolver Cable floor axis 7	3HXD 1250-yy	8
Serial Measurement Cable floor axis 1-6	3HXD 1432-yy	9
Axis 7 Power cable floor	3HXD 1253-yy	10

3.5.3 Optional cables

Optional cables	Art. no.	Item
Position Switch Cable axis 1	3HXD 1433-yy	3
Cable central lubrication	3HXD 1318-yy	11

4 Commissioning

4.0.1 Preparations

Before the track motion is commissioned the system must be prepared. The following steps should be carried out before starting the track motion.

Step	Action
1. Configure the controller	Load the operating parameters and configure the controller according to <i>"Load the operating parameters" section 4.1.1.</i>
2. Activate the lubrication system	Activate the automatic lubrication system according to <i>"Lubricating Track Motion" section 4.2.</i>
3. Check lubrication system	Functional test of the Trabon lubrication system according to <i>"Functionality test of the Trabon lubrication system" section 4.2.3.</i>
4. Grease	Grease the rack and pinion.
5. Calibrate	Calibrate the track motion according to <i>"Calibration" section 4.3</i>
6. Correct the drive unit	If abnormal noise, correct according to <i>"Check for abnormal wear and noise" section 4.5.</i> Correct specific torque on adjusting screws according to <i>"Mounting the drive unit" section 2.5.</i>
7. Adjust cables and covers	Check and adjust cables and covers according to <i>"Adjust cables and covers" section 4.5.4.</i>



The carriage can be damaged if tools are placed on the track motion and the weight is not distributed evenly over both frames.

4.1 Configuration of the controller

4.1.1 Load the operating parameters

The track motion must be defined in the system before starting with the operating parameters, which can be found on the supplied diskette.

A description of how to load parameters from diskette to the controller can be found in the robot documentation.

Proceed as follows to load the operating parameters:

- | | |
|---|--|
| 1 | Select the file: Add New Parameters |
| 2 | Load the file T6003S.cfg respective T4003S.cfg |
-

4.1.2 Commutation offset

The IRBT commutation offset is a fixed value that is set at the factory. All IRBT track motions have the same offset value and this does not need to be changed.

4.1.3 Travel length

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

4.2 Lubricating Track Motion

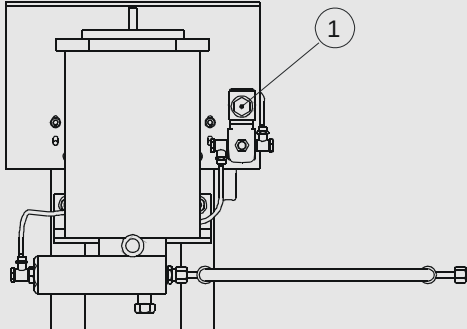
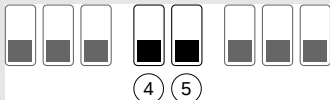
4.2.1 General

The central lubrication system is positioned outside of the track motion and the lubricant is fed, via a hose in the cable chain, to the distribution unit on the carriage.

4.2.2 Set the timer for the central lubrication system

On delivery the timer on the central lubrication system is set to lubricate in cyclic intervals of 0.5-10 s and with an equivalent waiting time between lubrication periods. This setting may need to be changed if too much lubricant is pumped out or if lubrication is unsatisfactory.

Set the timer as follows:

	Action	Illustration
1	Locate the lubrication system timer, item 1..	
2	Set the function using the dipswitches 4 and 5 as set out in the table below.	

Function	Dip-switch
Cyclic lubrication interval: The lubrication valve opens for t_{on} (see step 3) to then close for t_{off} and open again for t_{on} , etc.	
Inverted cyclic lubrication interval: The same as above but with the difference that the cycle starts with the valve closed, i.e. $t_{off} - t_{on} - t_{off}$, etc	
Switch-on impulse: When the power is switched on the lubrication valve opens for t_{on} to then close as long as the power is on.	
Switch-on delay: When the power is switched on a delay is activated for t_{off} before the lubrication valve opens to then remain open as long as the power is switched on.	

3

Set the interval for t_{on} using the dipswitches 1-3 and the interval for t_{off} using the dipswitches 6-8 as set out in the table below.

1

2

3

6

7

8

Time interval	Dip-switch
0.5 - 10 s	
1.5 - 30 s	
5.0 - 100 s	
0.5 min - 10 min	

Time interval	Dip-switch
1.5 min - 30 min	
5.0 min - 100 min	
12.0 min - 240 min	
0.5 h - 10 h	

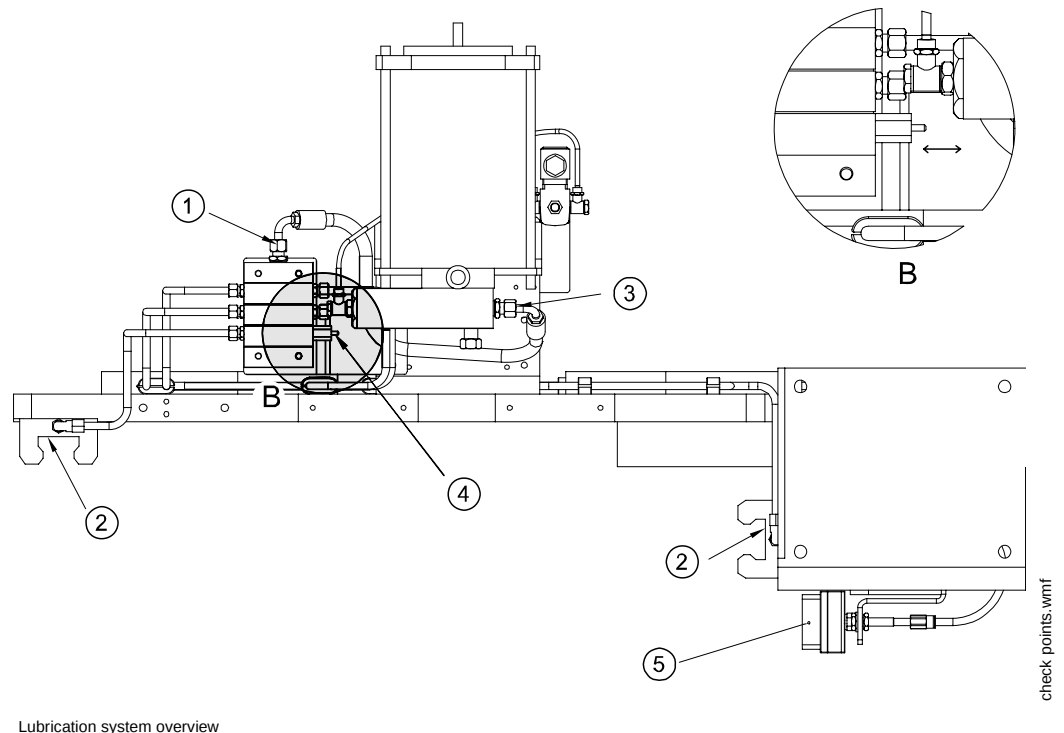
4

Set the time using the potentiometer.
The scale on the potentiometer is proportional to the interval setting. For example, the value 8 on the potentiometer changes from 8 seconds to 8 hours if the interval setting is changed from 0.5-10 s to 0.5-10 h.

4.2.3 Functionality test of the Trabon lubrication system

Perform the functionality test of the Trabon lubrication system when the Track Motion is completely set up and power and air supply is connected.

System overview

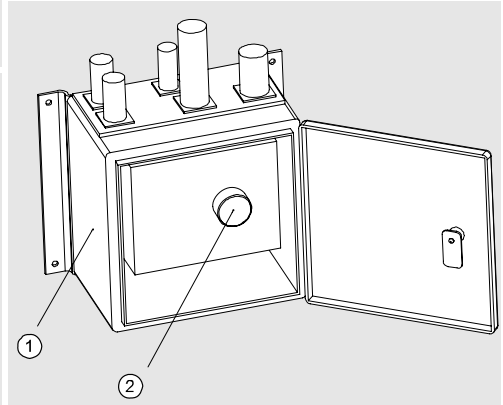


Lubrication system overview

Pos.	Description	Pos.	Description
1	Divider connection	4	Indicator pin
2	Lubrication point	5	Oil brush
3	Pump connection		

Instruction

- 1 Open the lid of the serial measurement box/
brake release box (1).
- 2 Press the brake release button (2) for 1 second.
Release the button and wait 1 second then
press the button again.
Repeat approx. 20 times.



Check following while pressing the button:

- The movement of the indicator pin.
It shall move in and out of the divider valve.
- That grease is coming out of the four lubrication points positioned in the four corners and out of the oil brush.
It may be necessary to press the button several times before grease starts coming out!
As long as the indicator pin is moving it is OK!

If the indicator pin is not moving after pressing the button about 40 times start looking for a blockage.

If it is an air blockage the system needs to be bled. See [“Bleed the system” section 2.1.5](#).
For other blockages see [“Locating blockage in Series-Flo systems” section 2.1.6](#).



4.3 Calibration



4.3.1 Calibrate the track motion

Before the robot system can be used the resolvers need to be calibrated. Perform calibrations according to the instruction below.

	Action	Illustration
1	Calibrate according to the instructions in the robot documentation.	
2	Check that the carriage stops exactly on the calibration mark.	
3	Save the system parameters according to the instructions in the robot documentation.	

4.3.2 Calibration with a restart

A robot system that uses a serial measurement system does not need to be calibrated before a restart, as the robot system automatically monitors the position of the robot in the working area.



The track motion does not need to be calibrated with a restart. The resolvers only need to be calibrated when commissioning the system.

4.4 Checking the working area



4.4.1 Check the working area

Run the system manually using the joystick and check that:

- It can be run in both directions
- Both end positions are reached

4.5 Check for abnormal wear and noise

In the event of abnormal noise when the track motion is commissioned this may be due to incorrect assembly of the linear guides or gear racks or the gear play's meshing pressure needs to be adjusted.

4.5.1 Linear guide joints

Check and adjust the linear guides joints if necessary according to *“Assemble the linear guides”* section 2.3.4.

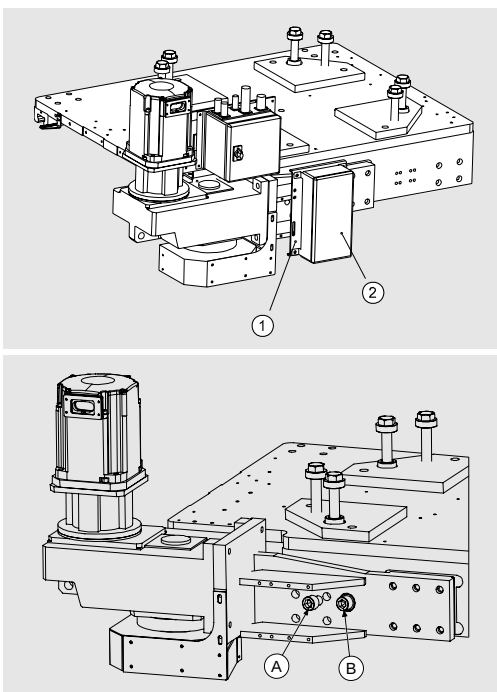
4.5.2 Gear rack joints

Check and adjust the gear racks joints if necessary according to *“Assemble the gear racks”* section 2.3.5.

4.5.3 Gear play

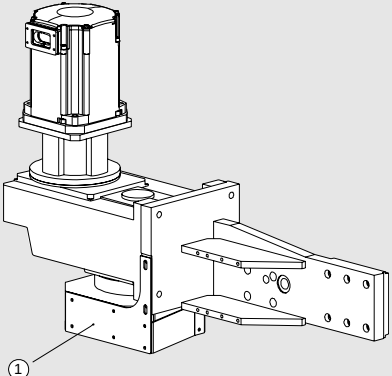
Gear play is adjusted by two adjuster screws on the motor mounting that are adjusted as follows:

- | | |
|---|---|
| 1 | Junction box (2) and mounting plate (1) for the junction box must be removed to gain access to the adjusting bolts of the drive unit. |
| 2 | Press the motor mounting outwards by turning screw A.
Pull the motor mounting inwards by turning bolt B. |
| 3 | Check the play using a dial indicator by pushing the carriage back and forth.
Permitted play: <ul style="list-style-type: none">• static: $\pm 0,1$ mm• dynamic Please contact ABB for information |



4.5.4 Adjust cables and covers

Perform the following adjustments:

1	After transportation and set-up the pinion cover (1) may need some adjusting. Otherwise it may be in contact with the pinion and cause noise and vibration. If noise: Adjust pinion cover before start-up.	
2	Adjust cables and covers: If the cover for the cable chain is used, make sure no risk of collision is possible and that they are well tightened	
3	Make sure all cables are well tightened and no risk for premature wear against plates or additional equipments. - Make sure that cables from cable chain to carriage are well strapped. - Make sure no floor cables are in risk of collision with moving parts.	

Commissioning

Check for abnormal wear and noise

Tab 3: Maintenance

1 Maintenance intervals	1
1.1 Routine checks and preventive maintenance	1
1.1.1 Maintenance chart	1
2 Maintenance instructions	3
2.1 Mechanical maintenance	3
2.1.1 Lubrication of the ball element and rack	3
2.1.2 Inspecting the central lubrication system	3
2.1.3 Filling the central lubrication system	4
2.1.4 Cleaning and lubrication of the gear racks	5
2.1.5 Bleed the system	6
2.1.6 Locating blockage in Series-Flo systems	7
2.1.7 Cleaning the linear guides	15
2.1.8 Check ball element tightening torque	16
2.1.9 Gearbox	16
2.2 Electrical maintenance	17
2.2.1 Inspection of electrical operations	17
2.2.2 Check the emergency stop	17
2.2.3 Inspecting the cabling	17
2.2.4 Check the connectors	17
2.2.5 Inspection of the cable chain	17
2.2.6 Inspection of the junction boxes	18
2.2.7 Inspection of the drive motor	18
2.2.8 Backup battery	18
3 Spare parts	19
3.1 Spare parts independent of length	19
3.1.1 Drive unit IRBT 4003F/6003F/7003F	19
3.1.2 Carriage IRBT 4003F/6003F/7003F	20
3.1.3 Central lubrication system (central unit)	21
3.1.4 Central lubrication system (carriage)	22
3.2 Spare parts dependent on length	23
3.2.1 Cable chain	23
3.2.2 Cable tray	23
3.2.3 Stand	24
3.3 Cables	25
3.3.1 Cable lengths	25

Maintenance intervals

Routine checks and preventive maintenance

1.1.1 Maintenance chart

The track motion is designed to need a minimum of maintenance. However, routine checks and preventive maintenance always need to be carried out at regular intervals.

The maintenance chart describes the routine maintenance and routine checks in chronological order.

Interval	Part	Maintenance	More Info.
Every 100 km (60 miles) or at least once a month	Ball element	Lubricate	sid 3-3
	Gear racks	Clean and lubricate (if there is no automatic lubrication system)	sid 3-5
Each month	Automatic lubrication system	Check the level	sid 3-3
	Electrical operation	Check all electrical operations	sid 3-17
	Cables and connectors	Check visible cables	sid 3-17
	Cable chain	Check the visible cable chain	sid 3-17
	Junction boxes	Check	sid 3-18
	Drive motor	Check	sid 3-18
Every third month	Linear guides	Clean if necessary.	sid 3-15
	Ball element	Check tightening torque	sid 3-16
Every 5000 operating hours	Gearbox	Change the oil	sid 3-15
Every 5 years	Backup battery	Change the battery with signs of discharge	sid 3-18

Maintenance intervals

Routine checks and preventive maintenance

2 Maintenance instructions

2.1 Mechanical maintenance

2.1.1 Lubrication of the ball element and rack

If there is no automatic lubrication system on the track motion the ball element must be lubricated manually.

Lubricate the ball element until the grease is forced out of the end seals, approx: 4.7 cm³ (1.85 in³).

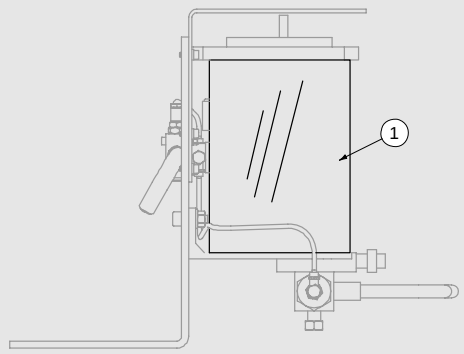
Use ball element grease as set out in NLGI 2, for example:

Manufacturer	Lubricant
Shell	Alvania WR2

2.1.2 Inspecting the central lubrication system

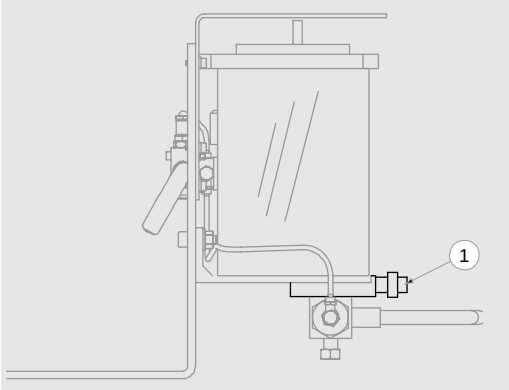
If the track motion is equipped with an automatic lubrication system the level of the lubricant should be checked once a month, even if the system should apply the lubricant equally over a longer period.

Check the lubricant level in the central system as follows:

	Action	Illustration
1	Localise the lubrication system.	
2	Check the level in the transparent lubricant tank. If the lubricant has been used, fill according to .	

2.1.3 Filling the central lubrication system

When the lubricant in the central lubrication system has run out, new lubricant should be added as follows:

	Action	Illustration
1	Connect the supplied filling nipple at position 1	
2	Fill with lubricant as set out in the specification below.	

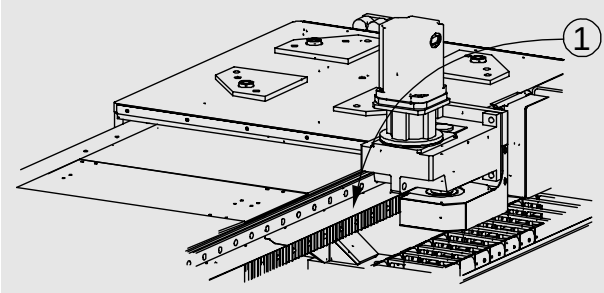
- The tank holds 2.71 kg (6 Lb Cyl)

Use ball element grease as set out in NLGI 1, for example:

Manufacturer	Lubricant
Q8	Q8 Rembrandt EP1
Mobil	Mobilux EP1

2.1.4 Cleaning and lubrication of the gear racks

Clean the gear racks once a month. If there is no automatic lubrication system on the track motion the gear racks must be lubricated manually using one of the following lubricants:

	Action	Illustration
1	Gear rack	

Manufacturer	Lubricant
OPTIMOL	VISCOGEN EPL
BP	MOG
Statoil	ESL10
Mobiloil	Mobiltac 81
Texaco	Texclade

2.1.5 Bleed the system



Note!
If the steps below do not make any change start looking for other blockage than air trapped in the system. See .

	Action	Info/Illustration
1	Disconnect the hose between the pump and the divider valve at the pump connection.	See Fig. 1
2	Press the brake release button in the SMB/BRB for 1 second. Release the button and wait 1 second then press the button again. Keep repeating until nothing but grease comes out of the hose.	
3	Reconnect the hose to the pump connection and disconnect it at the divider connection. Repeat step 2 above.	See Fig. 1
4	Hook up a manual pump to the divider valve and slowly pump in grease, compatible with the grease in the lubrication system. Keep pumping until the indicator pin starts moving in and out of the divider valve.	See Fig. 1
5	Reconnect the hose to the divider valve.	See Fig. 1
6	Press the brake release button in the SMB/BRB for 1 second. Release the button and wait 1 second then press the button again. Repeat until the indicator pin starts moving in and out of the divider valve.	

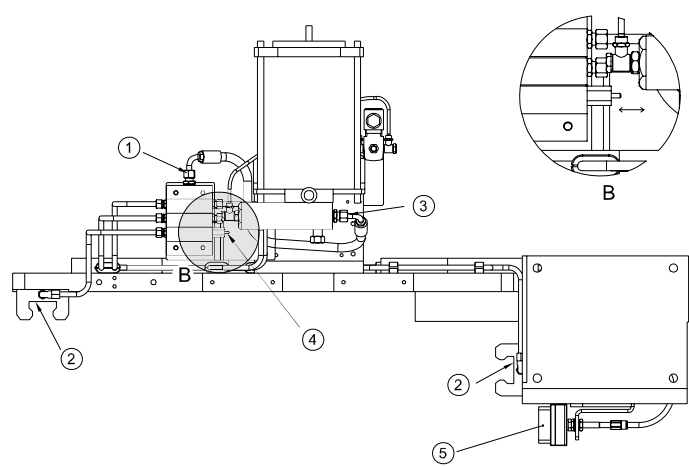


Fig. 1 Lubrication system overview

Item	Description	Item	Description
1	Divider connection	4	Indicator pin
2	Lubrication point	5	Oil brush
3	Pump connection		

2.1.6 Locating blockage in Series-Flo systems

Description

In a Trabon Series-Flo system, free flow of lubricant from the pump through the transmission system and the bearings is necessary.

If any portion of this transmission system (a divider valve, line fitting or any bearing) does not freely accept and pass its portion of the lubricant a blockage has occurred.

This blockage will cause a higher than normal pumping pressure to be developed by the pump.

Depending on the application or system design, this blockage with its resultant high pump pressure will usually cause a complete loss of lubricant flow into the total system and no bearing will be receiving lubricant.

The loss of flow due to a blockage is first indicated with the higher than normal system pressure that is developed by the pump as it attempts to overcome this blockage.

Divider valve

A Series-Flo type divider valve is a manifolded proportioning device consisting of an inlet and end section plus a minimum of three intermediate sections.

The divider valve is manifolded together with tie rods and nuts. A master divider valve is the first divider valve downstream from the lube pump. A secondary divider valve is any divider valve receiving lubricant from the master divider valve.

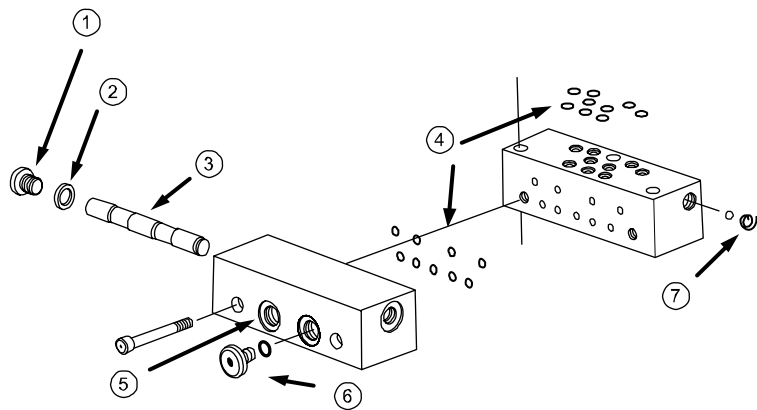


Warning!
Never block a lube outlet that is designed to discharge lubricant.



Fig. 2 Divider valve

divider valve.tif



Intermediate valve.wmf

Fig. 3 Intermediate valve & subplate section

Item	Description	Item	Description
1	Piston enclosure plug	5	Indicator port
2	Enclosure plug gasket	6	Plug
3	Piston	7	Check valve
4	O-rings		

Locating blockage

If any blockage exists in a Trabon Series-Flo system it is caused by one of the following reasons:

- Crushed transmission line in the system
- Blocked bearing in the system
- Improperly drilled fitting in the system
- Blocked divider valve in the system



All servicing and disassembling should be carried out under the cleanest conditions possible.

A blockage will be centrally signalled by a pressure gauge, pressure switch, controller or by the pump relief indicator, exhausting lubricant. Before proceeding as outlined make a visual inspection of the system and check for crushed lines or improper divider valve installation. Verify that each divider valve outlet required to discharge lubricant can do so and that no pipe plugs have been installed in an outlet designed to serve bearing or another divider valve.



Use filtered lubricant only!



Note!
Dirt and foreign material are the worst enemies of any lubricating system!

Procedure

Step 1

- | | |
|---|--|
| 1 | Use a manual pump with gauge. Fill the pump with clean, filtered lubricant common to the system. |
| 2 | Connect the manual pump into the inlet of the master divider valve and slowly operate the pump. If the system will not cycle freely below 1,500 PSI, see step 2. |

Step 2

Master divider valve equipped with performance indicator:

- | | |
|---|--|
| 1 | With a manual pump connected to the master divider valve as outlined in step 1, raise pressure to 2,000 PSI, the indicators in the indicator ports will signal the location of the blockage.
An indicator in the up position indicates pressure is in that outgoing line and signals the blockage is in the area being served from this outlet, as shown in <i>Fig. 4</i> . See step 3. |
| 2 | If no indicator pins are protruding, the blockage is in the master divider valve. |

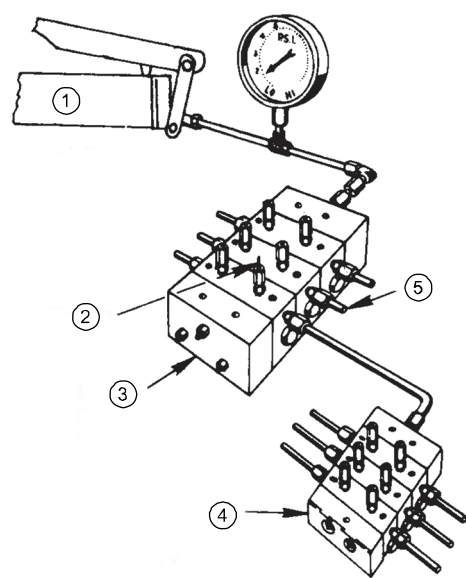


Fig. 4 Locating blockage with hand pump

Item	Description	Item	Description
1	Hand pump	4	Secondary divider valve
2	Indicator pin up	5	Lube outlets
3	Master divider valve		

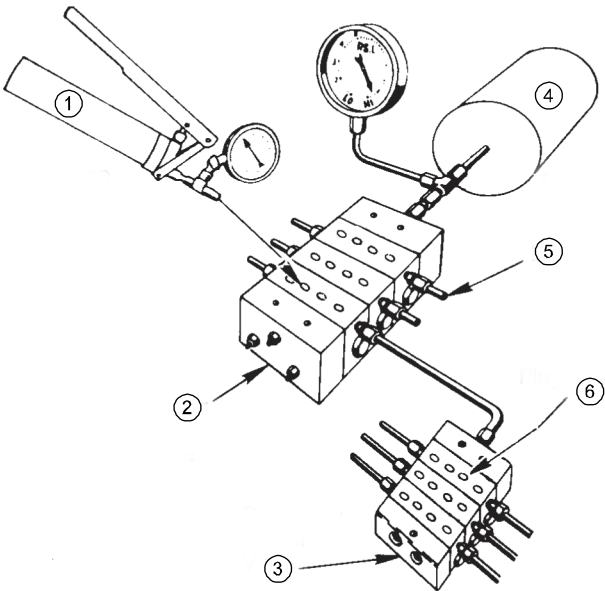
Master divider valve without performance indicators:

1	With a manual pump connected to the master divider valve as outlined in step 1, raise pressure to 2,000 PSI.
2	Remove one at a time each indicator port plug and attempt to operate the manual pump after each plug is removed. Do not exceed 2,000 PSI. If pressure drops and master cycles freely after an indicator port plug is removed then the blockage is downstream in the area that is being served from that outlet. See step 3.
3	If all indicator port plugs are removed and master will not cycle, the blockage is in this divider valve.
	 When indicator port plug of a blocked area is removed a small shot of trapped lubricant will usually surge out of this outlet as the inlet pressure on the divider valve drops.

If testing in step 2 indicates a blockage in the master divider valve, this divider valve must be disassembled and cleaned. See step 5 for instructions on correct procedure.

Step 3

1	Testing accomplished in step 2 has indicated a blockage is downstream of the master divider valve.
2	Install the manual pump in the indicator port of the master divider valve that is common to this blocked area. See Fig. 5.
3	Proceed to downstream secondary divider valve and remove all indicator port plugs.
4	Slowly operate the manual pump. • If lubricant can be discharged freely through each of the indicator ports of this divider valve the blockage is not in the supply line or the divider valve. See step 4. • If lubricant is not freely discharged through the open indicator ports of the secondary divider valve the blockage is in this divider valve or its supply line.
5	Disconnect supply line at secondary inlet fitting and slowly operate the manual pump to verify the location. If the blockage is in the divider valve see step 5.



Locating blockage step 3.wmf

Fig. 5 Locating blockage with hand pump

Item	Description	Item	Description
1	Hand pump	4	System pump
2	Master divider valve	5	Lube outlets
3	Secondary divider valve	6	Indicator port, plugs removed

Maintenance instructions

Mechanical maintenance

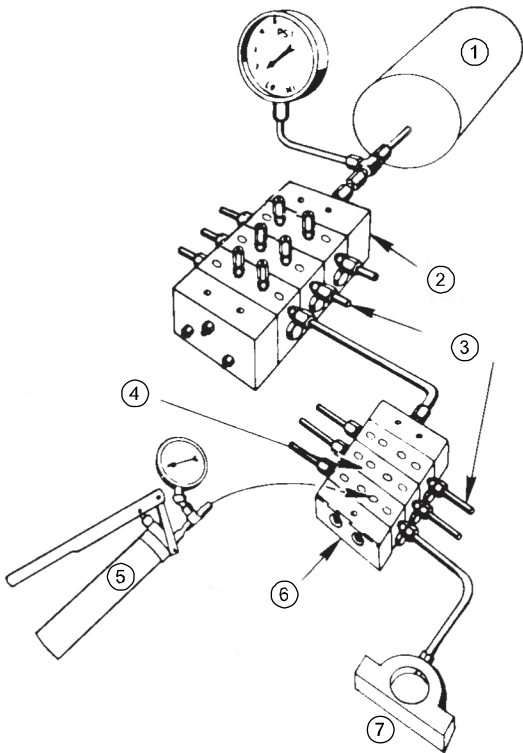
Step 4

- 1

Install a manual pump into each indicator port of secondary divider valve in turn, and slowly operate the pump. See Fig. 6.
- 2

If high pressure exists, blockage has been located.
Look for: **crushed line, tight bearing, improperly drilled fittings and/or lube inlet port.**
- 3

Correct as necessary.



Locating blockage step 4.wmf

Fig. 6 Locating blockage secondary divider valve

Item	Description	Item	Description
1	System pump	5	Hand pump
2	Master divider valve	6	Secondary divider valve
3	Lube outlets	7	Bearing
4	Indicator port, plugs removed		

Step 5

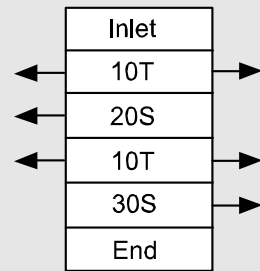
When testing indicates a blockage has occurred in any divider valve, that divider valve must be disassembled and cleaned.



Dirt and foreign material are the worst enemies of any lubricating equipment. All servicing and disassembling should be carried out under the cleanest possible conditions.

Before disassembling any divider valve.

- | | |
|---|---|
| 1 | Make a sketch and note as to the arrangement of the intermediate sections.
For example: INLET 10T-20S-10T-30S END. |
|---|---|



- | | |
|---|--|
| 2 | Also remove end plugs only and try to move each piston back and forth without removing the piston from the intermediate section. |
|---|--|



DO NOT insert hard metal objects into piston bore (i.e., punches, screw drivers, etc.) use a brass rod and hand pressure only!

Maintenance instructions

Mechanical maintenance

If all pistons are movable and there is no indication of a more serious problem:

- 1

Replace end plugs and using a new gasket apply the correct torque. See torque table below.
- 2

Re-test this divider valve using the manual pump. If a piston is jammed, or a hard wax-like substance, or dirt is noted at the end of the piston chamber, proceed with disassembly.
- 3

The divider valve can be dismantled by removing the tie rod nuts.
- 4

With the individual sections on the bench remove the end plug from both ends of the section. Taking one section at a time remove the piston, if it appears to be jammed, try removing it from the other direction.
With badly jammed pistons it may be necessary to use a brass rod and lightly tap piston out.
- 5

Clean sections and pistons in a suitable **clean** solvent until all lubricant has been removed.
- 6

Use compressed air to dry and blow out all ports thoroughly.
- 7

A small wire probe should be used to make sure all passages are clean and open.
- 8

Inspect the cylinder bore and piston carefully for scratches, score marks or other damage.
- 

Note! If either piston or cylinder bore is damaged a new section must be installed. All pistons are selectively fitted to the bore for proper clearance. Care must be taken to install piston only into the intermediate section from which it was removed.
- 9

If divider valve section and piston both appear in good condition, reassemble section making certain that piston slides smoothly but snugly in cylinder bore.
- 10

Repeat cleaning and inspection of each section.
- 11

After all sections have been cleaned, blown out, inspected and found to be in good condition, reassemble the divider valve as indicated by the notes and sketches.



Use all new gaskets and correct torque ratings listed below.
Test operation of divider valve using a manual pump.

Assembly Torque (Ft. Lbs)								
	MJ	M	MV	MVH	MSP/ MH	MX	MXP	MG
Tie rod nuts	12	20	20	24	8	23	9	12
Indicator plugs	7	15	15	15	10	18	15	18
End plugs	15	15	15	15	11	35	35	15
Valve section mounting screw					9		13	

Contamination
blockage

If dirt, foreign material or any other form of contamination is found in a divider valve, cleaning will only temporarily solve contamination blockage problems.

The source of the contamination must be eliminated for satisfactory service.

- The system filtering method must be investigated, filter elements should be inspected or changed as required.
- The reservoir must be inspected and cleaned if necessary.
- The reservoir filling method should be reviewed to eliminate any chance of foreign material entering the reservoir during filling.
- All lubricating systems require filtered lubricant.

Separation
blockage

If a hard wax or soap like material is found in the intermediate section grease separation is occurring.

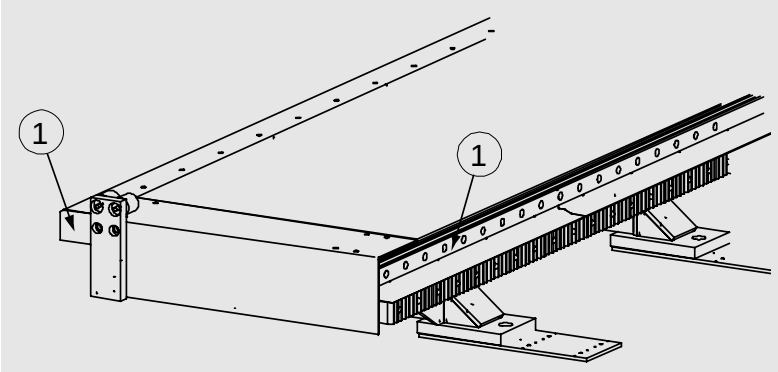
This means that the oil is being squeezed from the grease at normal system operating pressure and the grease thickener is being deposited in the divider valve.

Cleaning the divider valve will usually result in only temporarily solving the problem.

Consult your lubricant supplier for recommendations on alternate lubricants and your local Trabon distributor to verify compatibility with centralized lubricating systems.

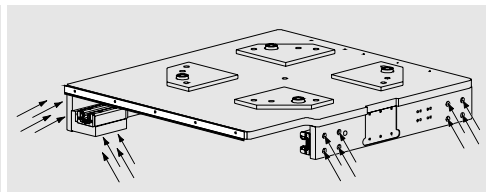
2.1.7 Cleaning the linear guides

Inspect and clean the linear guides if necessary.

	Action	Illustration
1	Linear guide	

2.1.8 Check ball element tightening torque

- 1 Tighten the screws (24 pcs.) with 70 Nm.



2.1.9 Gearbox

The gearbox is filled with oil on delivery. After every 5000 hours of operation the gearbox should be emptied and filled with new oil.

- The gearbox holds 7.8 litres

The oil must comply with the standards for high pressure oil under CLP 198-242 mm²/s/40°C.

Manufacturer	Lubricant
MOBIL	Mobilgear 630
Shell	Omala Oil 220
Statoil	Loadway EP 220

2.2 Electrical maintenance

2.2.1 Inspection of electrical operations

The track motion should be checked monthly with regard to:

- All electrical operations

2.2.2 Check the emergency stop

The operation of the emergency stop should be checked monthly as follows:

	Action
1	Let the carriage be still.
2	Press in the emergency stop.
3	Try to start the track motion.

2.2.3 Inspecting the cabling

Check monthly:

If any cables ...	then ...
have been damaged through wear or pinching	replace the cable.
rub against sharp edges	route the cable so that it runs freely.

2.2.4 Check the connectors

Check monthly:

- that all connectors are made correctly and there is no risk for loose contact.

2.2.5 Inspection of the cable chain

Check monthly the visible part of the cable chain with regard to:

- The link system, replace if necessary.
- Points of attachment, replace if necessary.

2.2.6 Inspection of the junction boxes

Check, and rectify, if necessary, the junction boxes monthly with regard to:

- Damage
- Connections
- Tightness

2.2.7 Inspection of the drive motor

Check the drive motor monthly with regard to:

- Abnormal bearing noise
- Connections

2.2.8 Backup battery

The track motion's serial measurement card uses a battery for the memory backup in order to maintain position data.

The battery is a rechargeable lithium battery.

The battery should be replaced:

- Every five years

or

- When the battery is about to be spent.
This is generally shown by an error code on the teach pendant's character display. Information about error codes can be found in the controller documentation.



In a new system the batteries are charged to full capacity after a few hours in **STANDBY** mode.

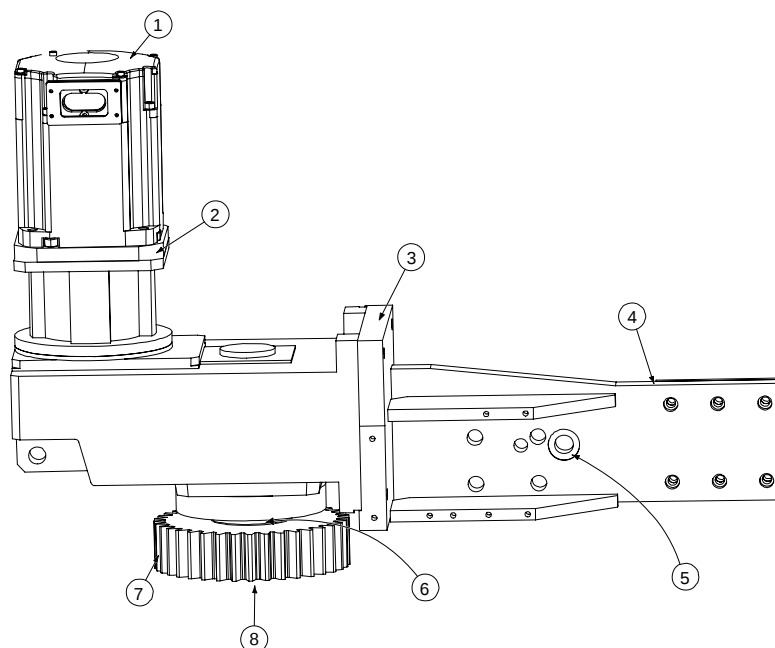
Replace the battery as follows:

	Action	Illustration
1	Localise the battery inside the junction box.	
2	Cut off the cable tie holding the battery.	
3	Disconnect the two-wire cable and remove the battery.	
4	Fit the battery in the reverse order.	

3 Spare parts

3.1 Spare parts independent of length

3.1.1 Drive unit IRBT 4003F/6003F/7003F



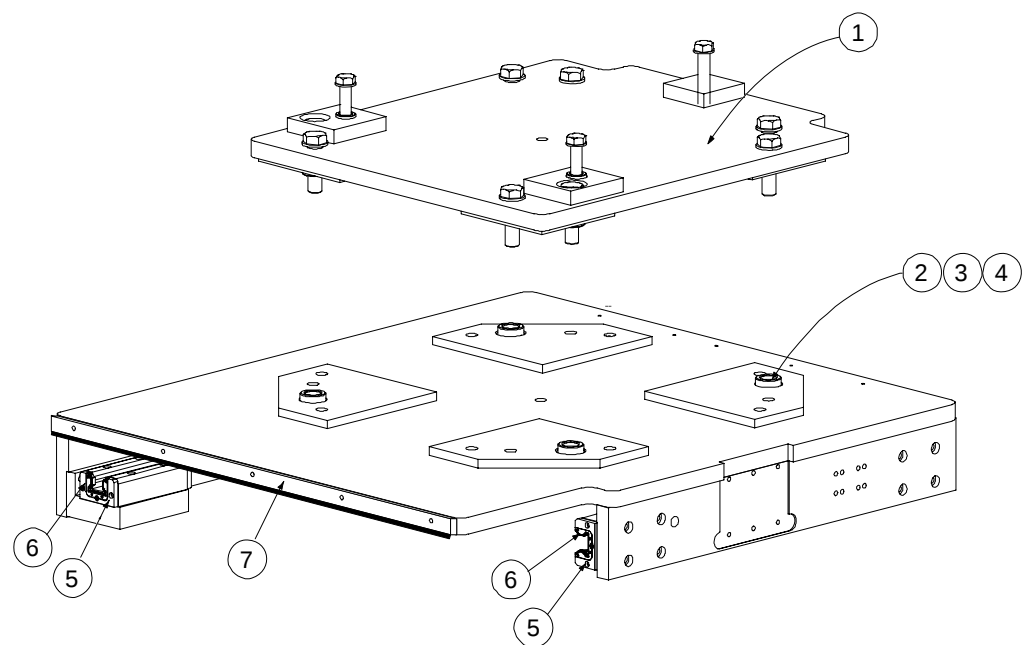
Drive unit IRBT 6003S/4003S

Quantity	Description	Art. no.	Item
1	Drive unit, IRB 4400	3HEA 801 301-001	-
1	Drive unit, IRB 6400R	3HEA 801 371-001	-
1	Drive unit, IRB 6600	3HEA 801 299-001	-
1	Drive unit, IRB 7600	3HEA 801 300-001	-
1	Motor IRB 4400, 6400R Low voltage (Yaskawa)	0506 262 880	1
1	Motor IRB 6600, IRB 7600 High voltage	3HXD 0100-380	1
1	Motor flange for motor 3HAC 10961-6	3HXD 1000-459	2
1	Gear drive, IRB 4400	0506 324 881	3
1	Gear drive IRB 6400R, 6600	0506 324 880	3
1	Gear drive IRB 7600	0506 323 880	3
1	Motor mounting	3HEA 801 171-002	4
2	Socket head cap screw	3HXG 1138-3	5
1	Spacer	3HXD 1000-492	6
1	Gear wheel	3HXD 1000-490	7
1	Retainer sleeve	3HXG 1000-506	8
1	Gearwheel cover (not in figure)	3HXD 0100-348	-

Spare parts

Spare parts independent of length

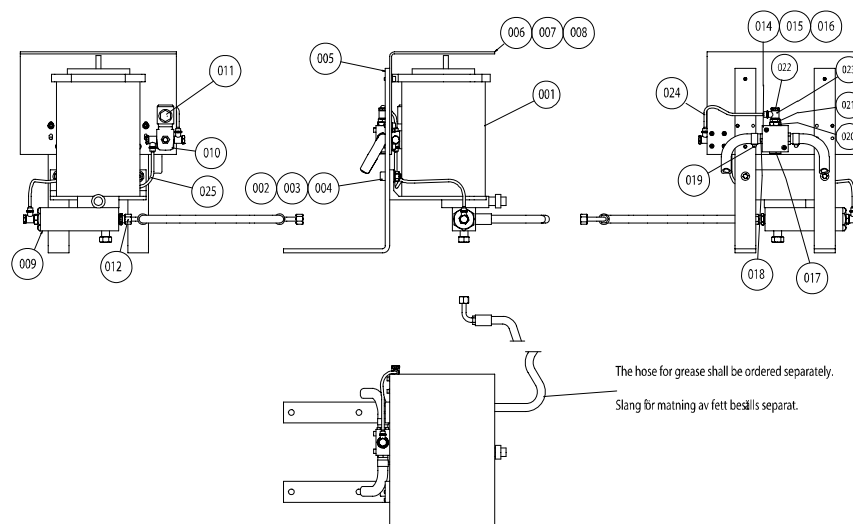
3.1.2 Carriage IRBT 4003F/6003F/7003F



Carriage IRBF 4003/6003/7003

Quantity	Description	Art. no.	Item
Adaptors for robots			
	Adaptor for IRB 4400	3HXD 1658-1	1
4	Adaptor for IRB 6600, IRB 7600	3HXD 1000-273	2
16	Guide sleeve	3HXD 1000-274	3
16	Washer	2121 2017-733	4
4	Ball element	2185 0445-4	5
8	Scraper (linear guide)	3HXD 1000-205	6
2	Scraper	3HXD 1000-606	7

3.1.3 Central lubrication system (central unit)



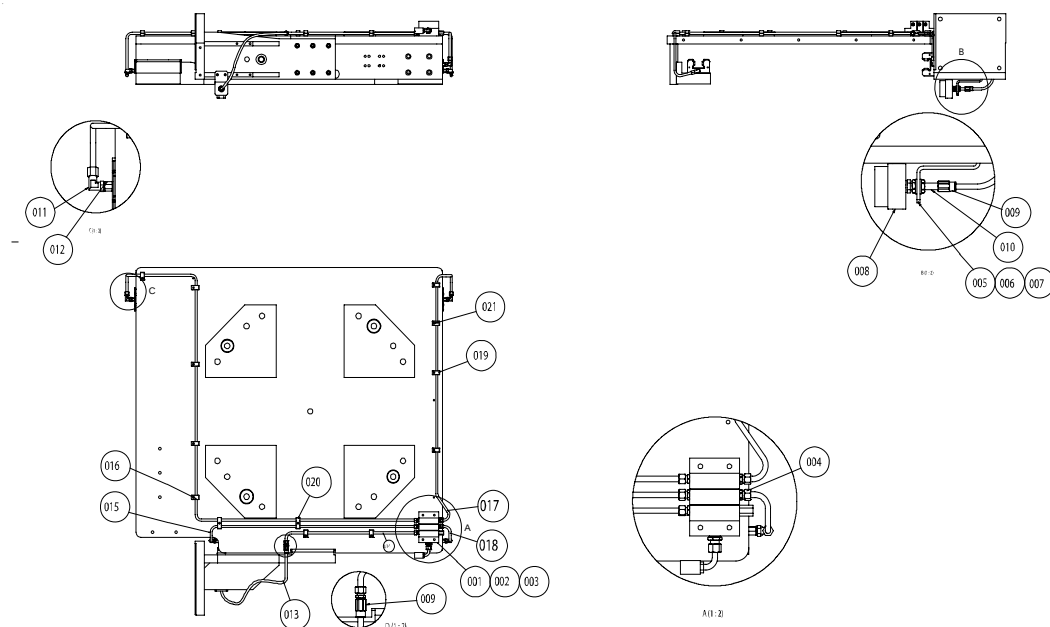
Central lubrication system central unit

Quantity	Description	Art. no.	Item
1	Grease tank Trabon	3HXD 1000-587	001
2	Bolt MC6S M10x30	0192238495	002
2	Washer BRB ST.22/10.5x20.0	0215100023	003
2	Nut &K steel 8.8 M10	0212601110	004
2	Angle bracket lubrication system	3HXD 1000-270	005
1	Cover for angle bracket	3HXD 1000-271	006
4	Bolt MC6S M6x16	0192238368	007
4	Washer BRB ST. 12/6.4x10.5	0215100013	008
1	AL-5 pump Trabon	3HXD 1000-628	009
1	Solenoid valve-Bürkert	3HXD 1000-585	010
1	Timer-Bürkert	3HXD 1000-586	011
2	Straight coupling type GE-8-LR	3HXD 1000-590	012
1	Distribution unit	25291928-3	014
2	Bolt MC6S M5x40	0192238339	015
2	Washer BRB ST. 10/5.3x100.0	02115100011	016
1	Blanking plug	25291920-4	017
2	Hose nipple 3/8x13	25292084-33	018
2	Hose clip 15-24	0252900405	019
1	Reducing nipple	25291921-3	020
2	Reducing nipple o1/4 - i1/8	25291921-2	021
4	Banjo bolt	25291926-2	022
4	Single banjo piece	25291008-2	023
1	Plastic hose PUN-6x1-SW	3HXG 1106-4	024
1	Plastic hose PUN-6x1-SW	3HXG 1106-4	025
1	Central lubrication cable (6400R, 4400)	3HXD 1318-20	
1	Central lubrication cable (6600, 7600)	3HXD 1628-yy	
1	Central lubrication hose	3HXD 1666-yy	

Spare parts

Spare parts independent of length

3.1.4 Central lubrication system (carriage)



Central lubrication system carriage

Quantity	Description	Art. no.	Item
1	Distribution cover Trabon	3HXD 1000-589	001
4	Bolt MC6s M6×40	0192238378	002
1	Washer BRB ST. 12/6.4×10.5	0215100013	003
6	Straight threaded coupling	3HXG 1000-591	004
1	Bracket for the oil brush	3HXD 1000-523	005
2	Bolt MC6S M8×16	0192238449	006
2	Washer BRB ST. 16/8.4×100.5	0215100018	007
1	Oil brush	3HXG 1000-562	008
2	Straight coupling	3HXG 1000-615	009
1	Brush	3HXG 1000-516	010
4	Reducing nipple (long)	3HXD 1000-611	011
4	Thread elbow coupling	3HXG 1000-561	012
1	Polyamide hose 8×1 L=600	3HXD 1583-1	013
1	Hydraulic pipe 8×1	3HXD 1656-1	014
1	Hydraulic pipe 8×1	3HXD 1656-2	015
1	Hydraulic pipe 8×1	3HXD 1656-3	016
1	Hydraulic pipe 8×1	3HXD 1656-4	017
1	Hydraulic pipe 8×1	3HXD 1656-5	018
10	Single pipe clamp	3HXG 1145-1	019
5	Double pipe clamp	3HXG 1145-2	020

3.2 Spare parts dependent on length

3.2.1 Cable chain

Complete cable chain including standard cable harness.



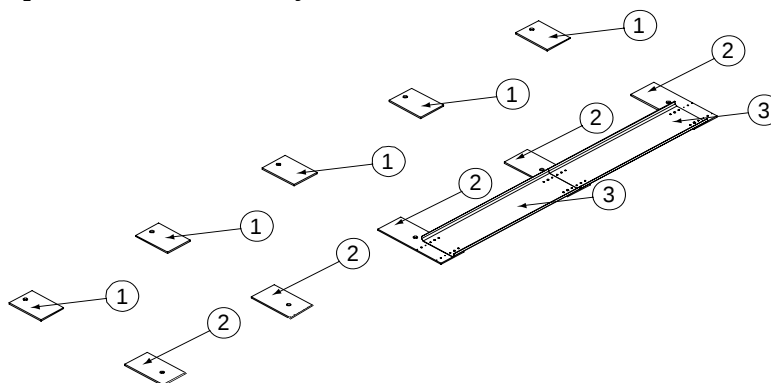
Optional cables are not supplied with the cable chain. These are ordered separately according to .

The “x” in the article number in the table should be replaced by the track motion’s travel length rounded up to the nearest metre. Accordingly, a complete cable chain for IRB 4400 with the travel length of 2.7 metres has the article number 3HXD 1552-23, with a travel length of 3.7 metres the article number will be 3HXD 1552-24, etc.

Quantity	Description	Art. no.
1	Complete cable chain for IRB 6600/IRB 7600	3HXD 1552-1x
1	Complete cable chain for IRB 4400	3HXD 1552-2x
1	Complete cable chain for IRB 6400R	3HXD 1552-3x

3.2.2 Cable tray

Spare parts for the cable tray on IRBT 4003F/6003F/7003F:



Cable tray IRBT 4003F/6003F/7003F

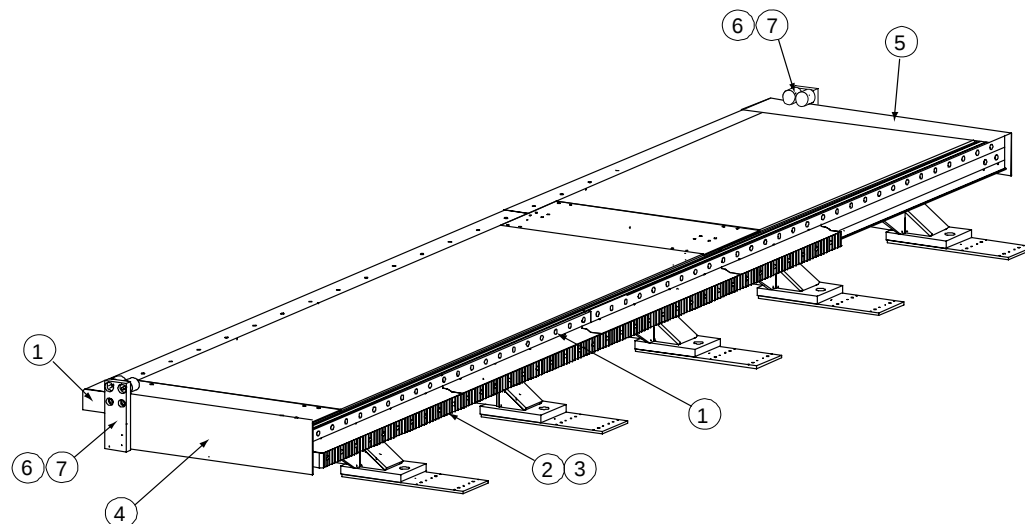
Description	Quantity with different travel lengths							Art. no.	Item
	1.7	2.7	3.7	4.7	5.7	6.7	7.7		
Levelling plates	3	4	6	7	9	10	12	3HXD 1000-414	1
Lower bracket for the cable chain	3	4	4	5	5	6	6	3HXD 1000-410	2
Guide plate for the cable chain	1	1	1	1	1	1	1	3HXD 1000-642	3
Guide plate for the cable chain	-	1	1	2	2	3	3	3HXD 1000-583	4

Spare parts

Spare parts dependent on length

3.2.3 Stand

Spare parts for the stand on IRBT 4003F/6003F/7003F.



Stand IRBT 6003S/4003S

Description	Quantity with different travel lengths							Art. no.	Item
	1.7	2.7	3.7	4.7	5.7	6.7	7.7		
Linear guide 45 L=1000	-	2	-	-	2	-	-	3HXG 1160-1	1
Linear guide 45 L=2000	-	-	2	6	6	2	4	3HXG 1160-2	1
Linear guide 45 L=3000	2	2	2	-	-	4	2	3HXG 1160-3	1
Gear rack L=1000	-	1	-	1	-	1	2	3HXD 1557-1	2
Gear rack L=2000	1	1	2	2	3	3	3	3HXD 1557-2	2
Cover plate, rack	2	3	4	5	6	7	8	3HXD 1000-599	3
Cover plate end (Left)	1	1	1	1	1	1	1	3HXD 1000-597	4
Cover plate end (Right)	1	1	1	1	1	1	1	3HXD 1000-598	5
Mechanical stop	2	2	2	2	2	2	2	3HXD 1000-596	6
Flexible stop	4	4	4	4	4	4	4	2196 065-49	7
Side plate L=2000	-	2	1	-	2	1	-	3HXD 1655-2	-
Side plate L=3000	1	-	1	2	1	2	3	3HXD 1655-3	-

3.3 Cables

3.3.1 Cable lengths

The table shows the cable lengths required for the different connections with different travel lengths. The article numbers for the cables can be found in chapter .

Cable lengths for IRBT 4003F/6003F/7003F:

Description	Cable lengths with different travel lengths							Art. no.
	1.7	2.7	3.7	4.7	5.7	6.7	7.7	
Cables for the manipulator	5	6	7	7	8	8	9	see sid 2-18
Cables to the BRB	5	6	7	7	8	8	8	see sid 2-18
Cables between BRB and Motor	0.5	0.5	0.5	0.5	0.5	0.5	0.5	see sid 2-18
Cable between BRB and manipulator	1.5	1.5	1.5	1.5	1.5	1.5	1.5	see sid 2-18

Index

A

Acceleration 1-9, 1-10
Automatic lubrication system
 Activate 2-25

C

Cable central lubrication .. 2-20,
2-21, 2-22
Cable chain 1-2
Cable tray 1-2, 2-14
Calibration 1-7
Carriage table .. 1-3, 1-15, 2-5
Carriage.....*see Carriage table*
Compact 1-15
Controller 1-3, 1-14
 Connection cable 1-15
 Terminal post J1 2-17
Customer Cable 1-16, 2-21
Customer cable 2-22

D

Degree of protection 1-9, 1-10

E

End plates 2-13
Extra load 2-5

F

Foundation 2-5

G

Gear play 2-30
Gear rack 1-2
Gear racks 2-12
Gearbox 1-2, 3-16

H

Height 1-12

I

InLine 2-14
IRB 7600.....*see Robot*
IRBT 7003S 1-15
 Compact 1-15
 Principal layout 1-2

K

Key to symbols 1-5

L

Length 1-11
Levelling bolts 2-10, 2-13
Levelling plates 2-9
Lift 1-5
Linear guide 1-2, 2-10

M

Manipulator 1-3
 Assemble 1-6, 2-14
 Cable length 3-25
 Dynamic loads 2-5
 Static load 2-5
 Terminal post J1 2-17
Maximum load 1-9, 1-10
Motor 1-2
Motor cable 2-21

P

Position Switch Cable 2-20,
2-21, 2-22
Power Cable 2-22
Power cable 2-19
Power cable floor 1-15

R

Rail module *see Stand module*
Repeater accuracy 1-9, 1-10
Resolver cable 2-19, 2-21,
2-22
Retardation 1-9, 1-10
Robot 1-3
 Connection cable 1-15
 Technical requirements .1-14
 also see Manipulator
Robot system 1-3, 2-29

S

S4Cplus *see Controller*
Safety 1-5
Serial Measurement Box 1-2
Serial measurement cable 2-19,
2-21, 2-22
SMB*see Serial Measurement Box*
..... 1-2
Stand 1-3
 Assembly 2-8
 Dimension table ... 1-11, 2-6
 Length 1-9, 1-10
 Spare parts 3-24
 Weight 1-9, 1-10

Stand module 1-3

T

Terminal post J1 2-17
The lifting zone 2-1
Track Motion 1-3, 1-5, 1-7
 Dimensions 1-9, 1-10
 Calibration 2-29
 Connection point J1 2-17
 Lifting 2-1
 Performance 1-9
 Principal layout 1-2
 Variants 1-15
Track.....*see Track Motion*
Travel length .. 1-3, 1-9, 1-10,
1-11, .1-15, 2-6, 2-14, 2-24,
3-23, 3-24, 3-25
Travel speed 1-9, 1-10

W

Weight 1-9, 1-10
Width 1-12
Working area 2-29

