

ROBOTICS

Product specification

IRB 4600



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Product specification

IRB 4600-60/2.05

IRB 4600-45/2.05

IRB 4600-40/2.55

IRB 4600-20/2.50

IRC5

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Overview of this specification

About this product specification

This product specification describes the performance of the manipulator or a complete family of manipulators in terms of:

- The structure and dimensional prints
- The fulfilment of standards, safety, and operating equipment
- The load diagrams, mounting or extra equipment, the motion, and the robot reach
- The specification of available variants and options

The specification covers the manipulator using the IRC5 controller.

Usage

Product specifications are used to find data and performance about the product, for example to decide which product to buy. How to handle the product is described in the product manual.

The specification is intended for:

- Product managers and product personnel
- Sales and marketing personnel
- Order and customer service personnel
- Integrators and customers

References

Reference	Document ID
<i>Product specification - Controller IRC5</i> IRC5 with main computer DSQC1000.	3HAC047400-001
<i>Product specification - Controller software IRC5</i> IRC5 with main computer DSQC1000 and RobotWare 6.	3HAC050945-001
<i>Product manual - IRB 4600</i>	3HAC033453-001
<i>Product manual - IRB 4600 Foundry Prime</i>	3HAC040585-001
<i>Product specification - Robot user documentation, IRC5 with RobotWare 6</i>	3HAC052355-001

Revisions

Revision	Description
-	First edition
A	- Updated/Corrected Load diagram
B	- Corrected working range floor mounted
C	- General updates and corrections
D	- Corrected chapter: Mounting and Bushings
E	- Foundry Plus 2
F	- Foundry Plus 2 update

Continues on next page

Overview of this specification

Continued

Revision	Description
G	- Text for Standards updated, minor changes
H	- Foundry Prime 2 added + minor corrections
J	<ul style="list-style-type: none"> • Table for ambient temperature adjusted • Value added to drawing, Mounting surface and bushings • Minor corrections
K	<ul style="list-style-type: none"> • Machinery directive updated
L	<ul style="list-style-type: none"> • General updates and minor corrections • Foundry Prime 2 added
M	<ul style="list-style-type: none"> • General updates and minor corrections
N	<ul style="list-style-type: none"> • Text for ISO test adjusted • Robot stopping distances and times for category 0 and category 1 stops are moved to a separate document, <i>Product specification - Robot stopping distances according to ISO 10218-1</i>
P	<ul style="list-style-type: none"> • Text for Foundry Plus updated. • General updates and minor corrections
Q	<ul style="list-style-type: none"> • Information about Foundry Prime 2 that was missing in revision P is added
R	<ul style="list-style-type: none"> • Description option 908-1 added. • Tilting around X-axis added
S	<ul style="list-style-type: none"> • Option 224-2 Inverted mounting removed. • Number of M16 threaded holes in base changed.
T	<ul style="list-style-type: none"> • Information regarding limitations for wall mounted manipulator added. • Axis Calibration method added
U	<p>Published in release R17.1. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • Description of Axis Calibration method revised. • Wall mounted removed. • Restriction of load diagram added.
V	<p>Published in release R17.2. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • Updated list of applicable standards. • TCP acceleration information added
W	<p>Published in release R18.1. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • Minor changes.
X	<p>Published in release R18.2. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • Customer Ethernet connection graphic added. • Manipulator axes rotation direction figure updated.
Y	<p>Published in release 19B. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • Changed the designation of air hose. • Updated information about <i>Absolute Accuracy</i>.
Z	<p>Published in release 19C. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • Note added about need to calibrate if the robot is other than floor mounted. See Calibration methods on page 30.

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Revision	Description
AA	Published in release 20C. The following updates are done in this revision: <ul style="list-style-type: none"> • Customer connection section updated. • Minor changes.
AB	Published in release 20D. The following updates are done in this revision: <ul style="list-style-type: none"> • Warranty section updated
AC	Published in release 21C. The following updates are done in this revision: <ul style="list-style-type: none"> • Text regarding fastener quality is updated. • Removed Axis resolution. • Option 224-2 added for inverted mounting position. • Added a note for Foundry Prime 2 [287-6]. • Updated the section of customer connection.
AD	Published in release 22A. The following updates are done in this revision: <ul style="list-style-type: none"> • Updated path repeatability table.
AE	Published in release 22B. The following updates are done in this revision: <ul style="list-style-type: none"> • Clarified description of option Inverted mounting position (224-2) for manipulators with protection type Foundry Prime. • Robot weight of each variant is updated.
AF	Published in release 23C. The following updates are done in this revision: <ul style="list-style-type: none"> • Correction regarding WeldGuide options • Added RAL code in manipulator color
AG	Published in release 24D. The following updates are done in this revision: <ul style="list-style-type: none"> • The option for inverted mounting is phased out. • Updated the section Technical data on page 22.
AH	Published in release R25.2. The following updates are done in this revision: <ul style="list-style-type: none"> • Updated the information about loads on the frame.
AJ	Published in release 25.3. The following updates are made in this revision: <ul style="list-style-type: none"> • Corrected measurements of bushing at mounting surface. • Company name updated to reflect current legal entities. • Updated portal name from myABB to ABB Robotics One.

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1 Description

1.1 Structure

1.1.1 Introduction to structure

Robot family

The IRB 4600 series is ABB Robotics pioneer of the new sharp generation with enhanced and new capabilities. The design has been optimized to make it superior for the targeted applications. The IRB 4600 will focus on further expansion in material handling, machine tending, laser- and water jet cutting, dispensing, measuring, assembly and welding applications.

Operating system

The robot is equipped with the IRC5 controller and robot control software, RobotWare. RobotWare supports every aspect of the robot system, such as motion control, development and execution of application programs, communication etc. see *Product specification - Controller IRC5*.

Safety

Safety standards valid for complete robot, manipulator and controller.

Additional functionality

For additional functionality, the robot can be equipped with optional software for application support - for example gluing and welding, communication features - network communication - and advanced functions such as multitasking, sensor control etc. For a complete description on optional software, see *Product specification - Controller software IRC5*.

Protection type Foundry Plus 2

Robots with the option Foundry Plus 2 are designed for harsh environments where the robot is exposed to sprays of coolants, lubricants and metal spits that are typical for die casting applications or other similar applications.

Typical applications are spraying insertion and part extraction of die-casting machines, handling in sand casting and gravity casting, etc. (Please refer to Foundry Prime robots for washing applications or other similar applications). Special care must be taken in regard to operational and maintenance requirements for applications in foundry as well as in other applications areas. Please contact ABB Robotics Sales organization if in doubt regarding specific application feasibility for the Foundry Plus 2 protected robot.

The robot is painted with two-component epoxy on top of a primer for corrosion protection. To further improve the corrosion protection additional rust preventive are applied to exposed and crucial areas, e.g. has the tool flange a special preventive coating. Although, continuous splashing of water or other similar rust formation fluids may cause rust attach on the robots unpainted areas, joints, or other unprotected surfaces. Under these circumstances it is recommended to add

Continues on next page

1 Description

1.1.1 Introduction to structure

Continued

rust inhibitor to the fluid or take other measures to prevent potential rust formation on the mentioned.

The entire robot is IP67 compliant according to IEC 60529 - from base to wrist, which means that the electrical compartments are sealed against water and solid contaminants. Among other things all sensitive parts are better protected than the standard offer.

Selected Foundry Plus 2 features:

- Improved sealing to prevent penetration into cavities to secure IP67
- Additional protection of cabling and electronics
- Special covers that protect cavities
- Well-proven connectors
- Nickel coated tool flange
- Rust preventives on screws, washers and unpainted/machined surfaces
- Extended service and maintenance program

The Foundry Plus 2 robot can be cleaned with appropriate washing equipment according to the robot product manual. Appropriate cleaning and maintenance is required to maintain the protection, for example can rust preventive be washed off with wrong cleaning method.

Available robot variants

The option Foundry Plus 2 might not be available for all robot variants.

See [Specification of variants and options on page 75](#) for robot versions and other options not selectable together with Foundry Plus 2.

Protection type Foundry Prime 2

Robots with the option Foundry Prime are designed for water jet cleaning of casts and machined parts, and similar very harsh, but proven robotic application environments. Applicability in other applications cannot be guaranteed without prior testing, previous experience or professional judgment by ABB. Please contact ABB Robotics Sales organization if in doubt regarding specific application feasibility.

The manipulator can withstand surrounding solvent based detergents which must be approved by ABB. In addition, the manipulator can withstand indirect spray from jet pressure (max. 600 bar) and 100% humidity (gaseous mixture only).

The manipulator can work in an environment with a cleaning bath temperature < 60° C, typically used in a washing application with moderate robot speed. Surrounding temperature can not be higher than specified for the option.

If fluids that may cause rust formation, for example water, are continuous splashing the robot or are used in the vicinity of the robot it is strongly recommended to add rust inhibitor to the fluid or take other measures to prevent potential rust formation on the robots unpainted areas, joints, or other unprotected, surfaces.

The robot is protected by well-proven sealings for gears and bearings, pressurized motors and electronic compartment, and detergent resistant painting system in three layers (two layer epoxy paint under a protective layer of clear coat).

Non-painted surfaces has rust preventive coating (Mercasol).

Continues on next page

As the robot is designed for very harsh environments, an extended service and maintenance program is required. Special care must be taken when replacing parts or performing other maintenance and service that breaks the paint surface as the paint surface act as a protective barrier. For detailed information of the maintenance program, see chapter Maintenance in the product manual. It is highly recommended to sign a Service Agreement with ABB due to difficult and severe environmental conditions.

The Foundry Prime robot can be cleaned with appropriate washing equipment according to the product manual. Appropriate cleaning and maintenance are required to maintain the Foundry Prime protection, for example can the rust preventive be washed off with wrong cleaning method.

Detergents

General detergent requirements:

- Washing detergent with max pH <9.0, if not stated otherwise
- Washing detergent must be approved by ABB
- ABB maintain a list of approved cleaners/detergents, see 3HAC037554-001
- The washing detergent must:
 - be cleaned continuously
 - contain rust inhibitor
 - be checked regularly for pH value and concentration
 - not use other additives than water without prior testing
- The user must follow the recommendations regarding detergent concentration and pH value
- No other additive than water is guaranteed without prior testing or consultation with ABB. Other additives than water may have a harmful effect on the life time of the robot and its components.

Please contact your local ABB organization for an updated list of approved washing detergents.

Available robot versions

The option Foundry Prime might not be available for all robot versions.

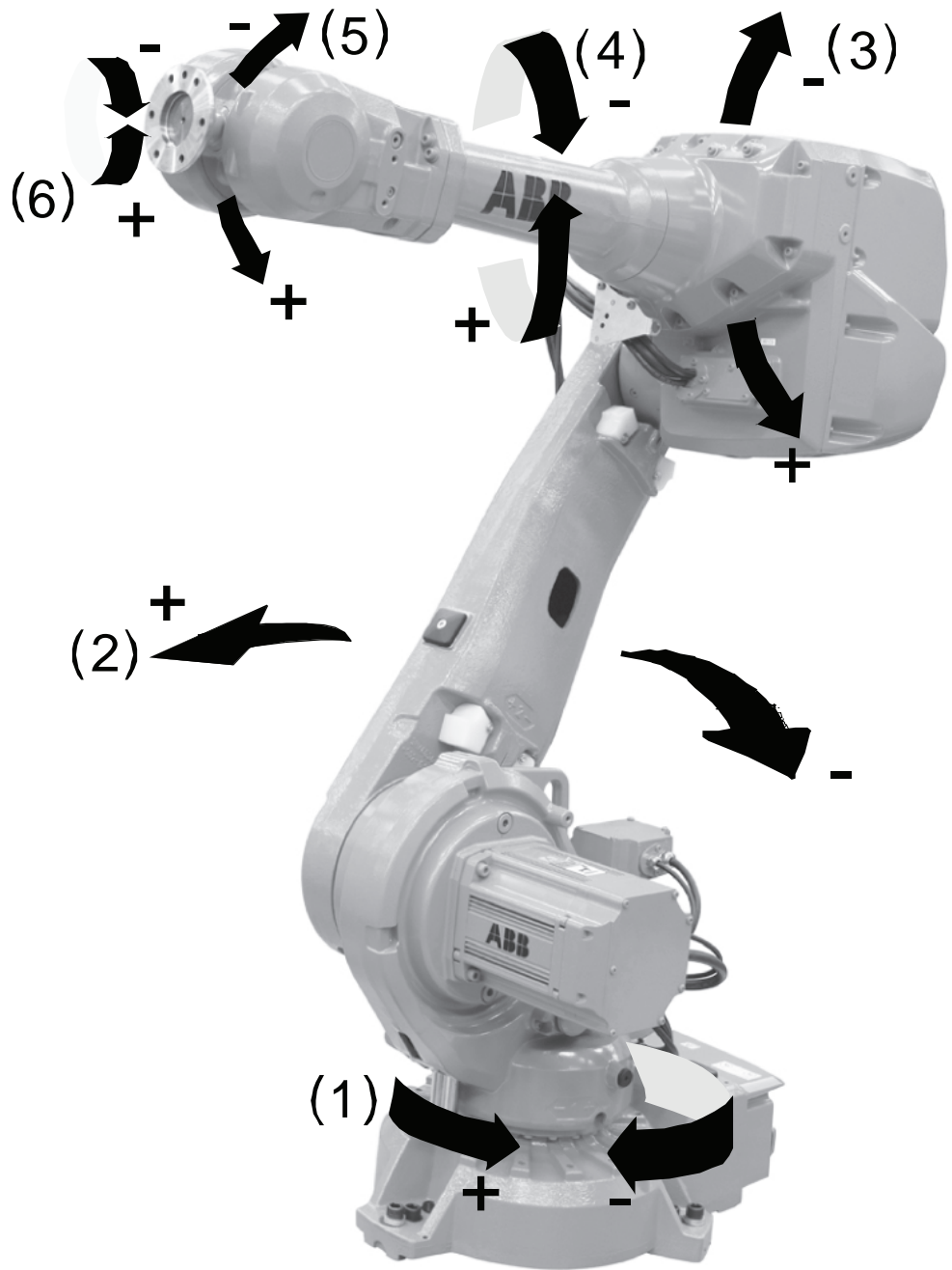
See [Specification of variants and options on page 75](#) for robot versions and other options not selectable together with Foundry Prime.

1 Description

1.1.1 Introduction to structure

Continued

Manipulator axes



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1.1.2 Different robot variants

General

The IRB 4600 is available in four variants and all versions can be floor mounted, inverted or tilted (up to 15 degrees around the Y-axis or X-axis).

Robot variants	Handling capacity (kg)	Reach (m)
IRB 4600-60/2.05	60	2.05
IRB 4600-45/2.05	45	2.05
IRB 4600-40/2.55	40	2.55
IRB 4600-20/2.50	20	2.50

Manipulator weight

Robot variants	Weight
IRB 4600-60/2.05	445 kg
IRB 4600-45/2.05	445 kg
IRB 4600-40/2.55	465 kg
IRB 4600-20/2.50	430 kg

Other technical data

Data	Description	Note
Airborne noise level	The sound pressure level outside the working space	<72 dB (A) Leq (acc. to Machinery directive 2006/42/EG)

Power consumption at max speed (vmax)

Type of movement	IRB 4600			
	-60/2.05	-45/2.05	-40/2.55	-20/2.50
ISO Cube Max. velocity	1.53 kW	1.43 kW	1.62 kW	1.50 kW

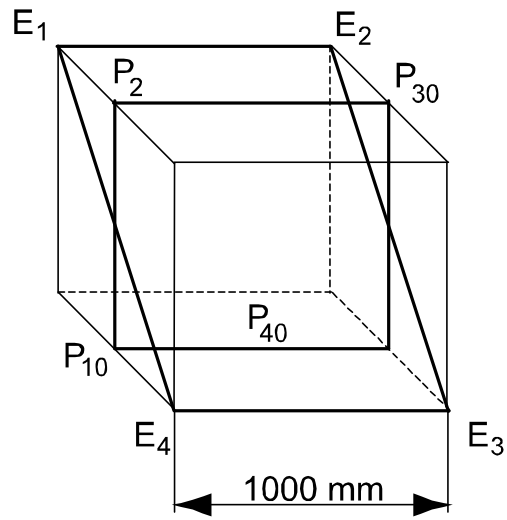
Robot in calibration position	IRB 4600			
	-60/2.05	-45/2.05	-40/2.55	-20/2.50
Brakes engaged	0.24 kW	0.24 kW	0.24 kW	0.24 kW
Brakes disengaged	0.66 kW	0.60 kW	0.65 kW	0.52 kW

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1 Description

1.1.2 Different robot variants

Continued



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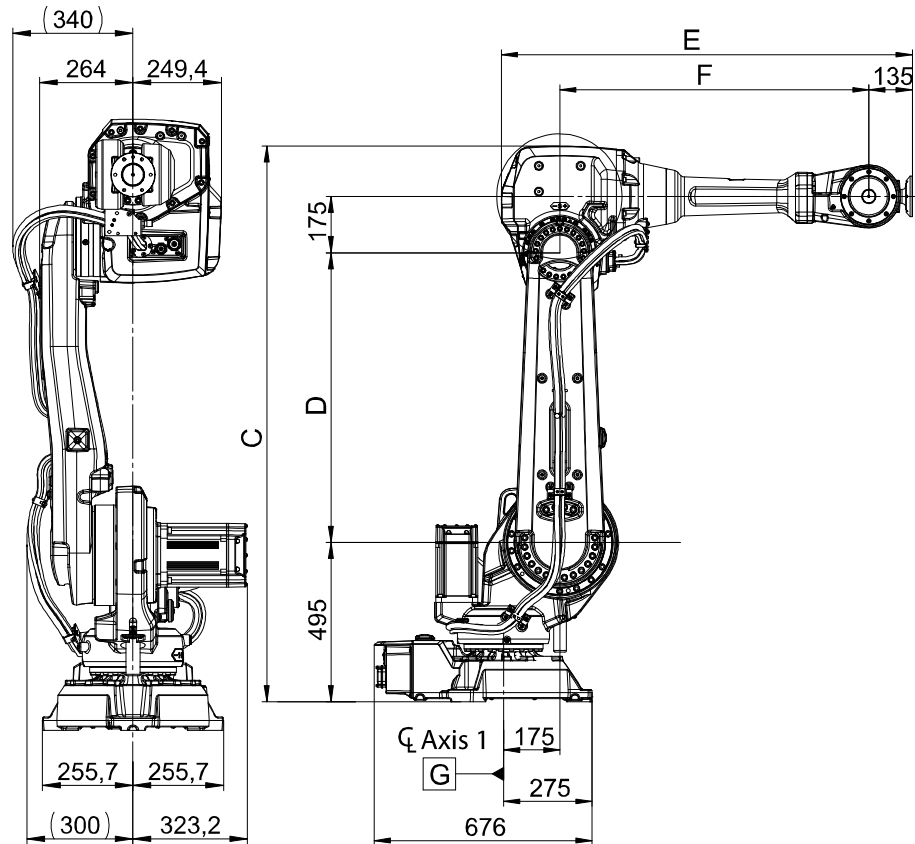
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1 Description

1.1.2 Different robot variants

Continued

Dimensions IRB 4600-60(45)/2.05 and IRB 4600-40/2.55



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A	R 400 Minimum turning radius of axis 1
B	R 138 Minimum turning radius of axis 4

Variant	C	D	E	F
IRB 4600-60/2.05	1,727 mm	900 mm	1,276 mm	960 mm
IRB 4600-45/2.05	1,727 mm	900 mm	1,276 mm	960 mm
IRB 4600-40/2.55	1,922 mm	1,095 mm	1,586 mm	1,270 mm

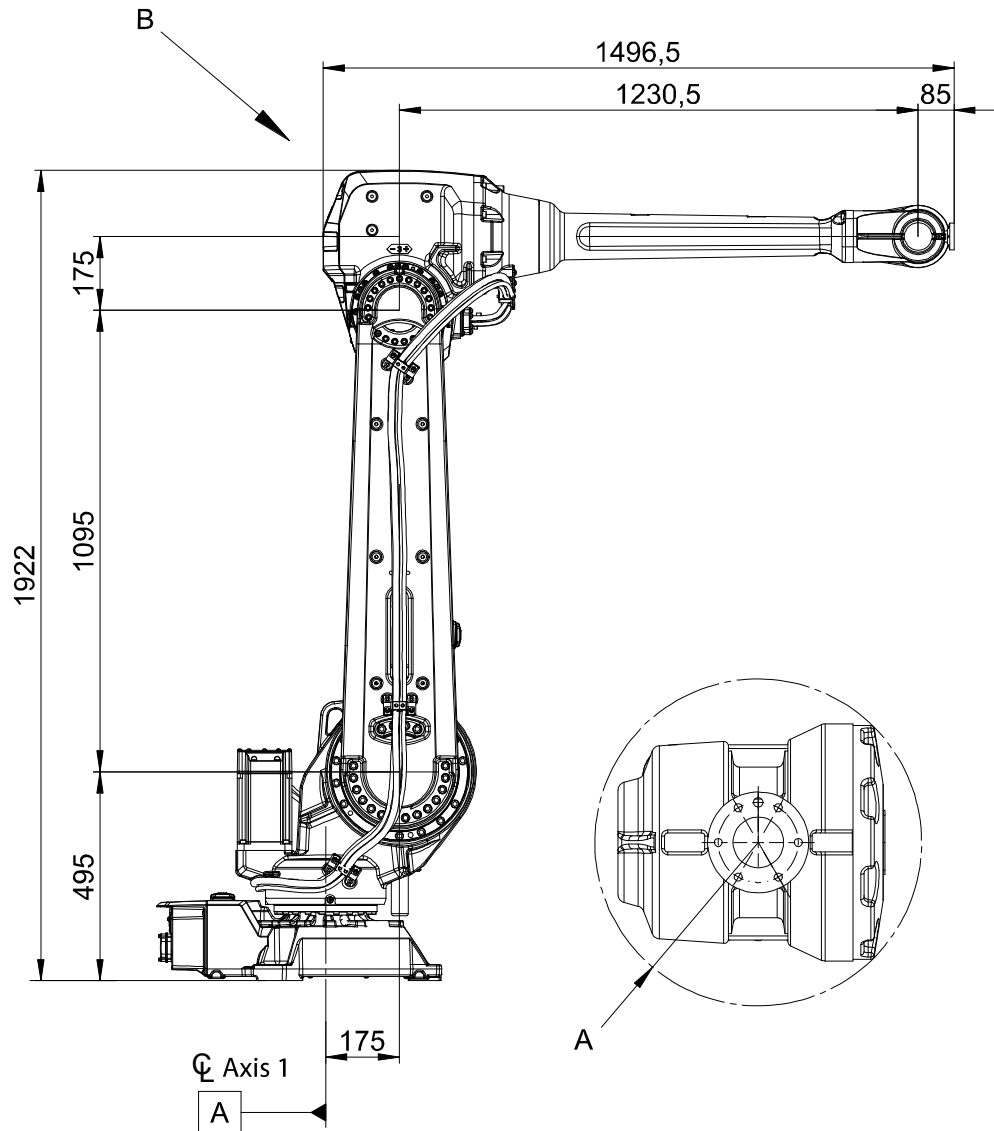
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1 Description

1.1.2 Different robot variants

Continued

Dimensions IRB 4600-20/2.50



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A	R 98 Minimum turning radius of axis 4
B	For all other dimensions see 40-60 kg variants

1.2 Standards

1.2.1 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

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	Industrial robots and robot Systems - General safety requirements

Other standards used in design

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

Continues on next page

1 Description

1.2.1 Applicable standards

Continued

Standard	Description
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.

1.3 Installation

1.3.1 Introduction to Installation

General

The IRB 4600 is available in four versions and all versions can be floor mounted, inverted or tilted (up to 15 degrees around the Y-axis or X-axis), for more details see the product manual(also valid for inverted robot or inverted mounting). Depending on the robot version, an end effector with max. weight of 20 or 60 kg including payload, can be mounted on the tool flange (axis 6). See [Load diagrams on page 42](#).

Extra loads

Extra loads, which are included in the load diagrams, can be mounted on the upper arm. An extra load of 35 kg can also be mounted on the frame of axis 1. See [Information about mounting equipment on page 53](#)

Working range limitations

The working range of axis 1 can be limited by mechanical stops as option. Electronic Position Switches can also be used on all axes for position indication of the manipulator.

Explosive environments

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

1 Description

1.3.2 Technical data

1.3.2 Technical data

Weight, robot

The table shows the weight of the robot.

Robot model	Weight
IRB 4600	465 kg



Note

The weight does not include tools and other equipment fitted on the robot.

Mounting positions

The table shows valid mounting options for the manipulator.

Mounting option	Installation angle	Note
Floor mounted	0°	
Suspended	180°	
Tilted	0-15°	Contact ABB for further information about acceptable loads.



Note

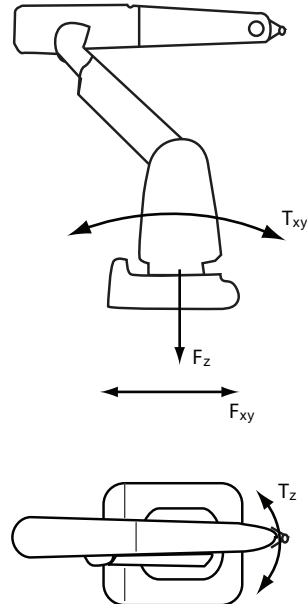
The actual mounting angle must always be configured in the system parameters, otherwise the performance and lifetime is affected. See the product manual for details.

Continues on next page

Loads on foundation, robot

The illustration shows the directions of the robots stress forces.

The directions are valid for all floor mounted, suspended and inverted robots.



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F_{xy}	Force in any direction in the XY plane
F_z	Force in the Z plane
T_{xy}	Bending torque in any direction in the XY plane
T_z	Bending torque in the Z plane

The table shows the various forces and torques working on the robot during different kinds of operation.



Note

These forces and torques are extreme values that are rarely encountered during operation. The values also never reach their maximum at the same time!



WARNING

The robot installation is restricted to the mounting options given in following load table(s).

Floor mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	±3940 N	±7790 N
Force z	4350 ±2460 N	4350 ±6360 N
Torque xy	±6850 Nm	±14090 Nm
Torque z	±1610 Nm	±2960 Nm

Continues on next page

1 Description

1.3.2 Technical data


Continued

Suspended

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	±3940N	±7790 N
Force z	-4350 ±2460N	-4350 ±6360 N
Torque xy	±6850 Nm	±14090 Nm
Torque z	±1610 Nm	±2960 Nm

Requirements, foundation

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

Requirement	Value	Note
Flatness of foundation surface	0.5 mm	Flat foundations give better repeatability of the resolver calibration compared to original settings on delivery from ABB. The value for levelness aims at the circumstance of the anchoring points in the robot base. In order to compensate for an uneven surface, the robot can be recalibrated during installation. If resolver/encoder calibration is changed this will influence the absolute accuracy.
Minimum resonance frequency	22 Hz  Note It may affect the manipulator life-time to have a lower resonance frequency than recommended.	The value is recommended for optimal performance. Due to foundation stiffness, consider robot mass including equipment. ⁱ For information about compensating for foundation flexibility, see the application manual of the controller software, section <i>Motion Process Mode</i> .

ⁱ The minimum resonance frequency given should be interpreted as the frequency of the robot mass/inertia, robot assumed stiff, when a foundation translational/torsional elasticity is added, i.e., the stiffness of the pedestal where the robot is mounted. The minimum resonance frequency should not be interpreted as the resonance frequency of the building, floor etc. For example, if the equivalent mass of the floor is very high, it will not affect robot movement, even if the frequency is well below the stated frequency. The robot should be mounted as rigid as possible to the floor.

Disturbances from other machinery will affect the robot and the tool accuracy. The robot has resonance frequencies in the region 10 – 20 Hz and disturbances in this region will be amplified, although somewhat damped by the servo control. This might be a problem, depending on the requirements from the applications. If this is a problem, the robot needs to be isolated from the environment.

Storage conditions, robot

The table shows the allowed storage conditions for the robot:

Parameter	Value
Minimum ambient temperature	-25° C
Maximum ambient temperature	+55° C
Maximum ambient temperature (less than 24 hrs)	+70° C
Maximum ambient humidity	95% at constant temperature (gaseous only)

Continues on next page

Operating conditions, robot

The table shows the allowed operating conditions for the robot:

Parameter	Value
Minimum ambient temperature	+5°
Maximum ambient temperature	+45°
Maximum ambient humidity	Max. 95% at constant temperature. 100% if the robot is installed and maintained in accordance with the manual.

Protection classes, robot

The table shows the available protection types of the robot, with the corresponding protection class.

Protection type	Protection class ⁱ
Manipulator, protection type Standard	IP 67
Manipulator, protection type Foundry Prime	IP 67
Manipulator, protection type Foundry Plus	IP 67

ⁱ According to IEC 60529.



CAUTION

It is recommended to take the maintenance and repair work out of the clean room environment for Clean Room variants.

The maintenance and repair work may bring up particles and cause pollution during the work. Please contact with ABB service team in advance.



Note

Always remember to reinstall the protection plugs back to the robot after any maintenance or repair work for the Clean Room variants.

1 Description

1.3.3 Mounting the manipulator

1.3.3 Mounting the manipulator

Maximum load

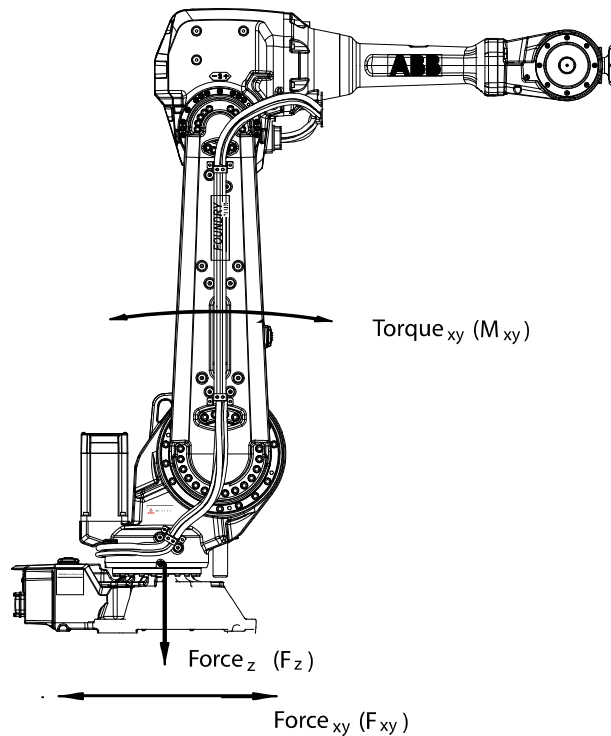
Maximum load in relation to the base coordinate system

Floor Mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	±3940 N	±7790 N
Force z	4350 ±2460 N	4350 ±6360 N
Torque xy	±6850 Nm	±14090 Nm
Torque z	±1610 Nm	±2960 Nm

Inverted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	±3940N	±7790 N
Force z	-4350 ±2460N	-4350 ±6360 N
Torque xy	±6850 Nm	±14090 Nm
Torque z	±1610 Nm	±2960 Nm



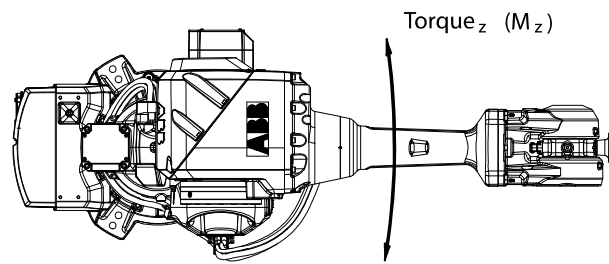
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1 Description

1.3.3 Mounting the manipulator

Continued

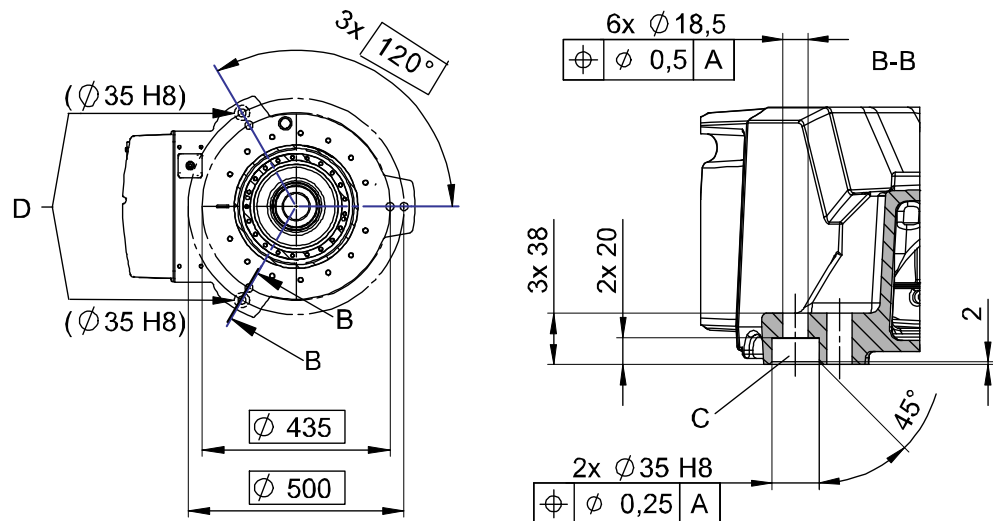


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Note regarding M_{xy} and F_{xy}

The bending torque (M_{xy}) can occur in any direction in the XY-plane of the base coordinate system. The same applies to the transverse force (F_{xy}).

Fastening holes robot base



xx080000271

C	Hole for guide sleeve
D	Rear bolt holes

Attachment bolts, specification

The table below specifies required bolts and washers for securing the robot at installation site.

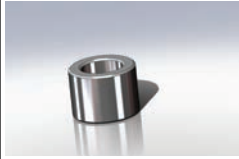
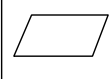
Securing parts/Facts	Dimension	Note
Securing screws, oiled	M16 x 60 (installation directly on steel structure foundation) M16 x 70/80 (installation on steel structure foundation or base plate, using guide bushings) Quality 8.8	6 pcs 200 Nm
Washers	17 x 30 x 3	6 pcs

Continues on next page

1 Description

1.3.3 Mounting the manipulator

Continued

Securing parts/Facts	Dimension	Note
Guide sleeves		Article number: 21510024-169, 2 pcs. Added to the rear bolt holes, to allow the same robot to be re-mounted without program adjustments.  xx120000885
Level surface requirements	 0.5 xx0300000251	

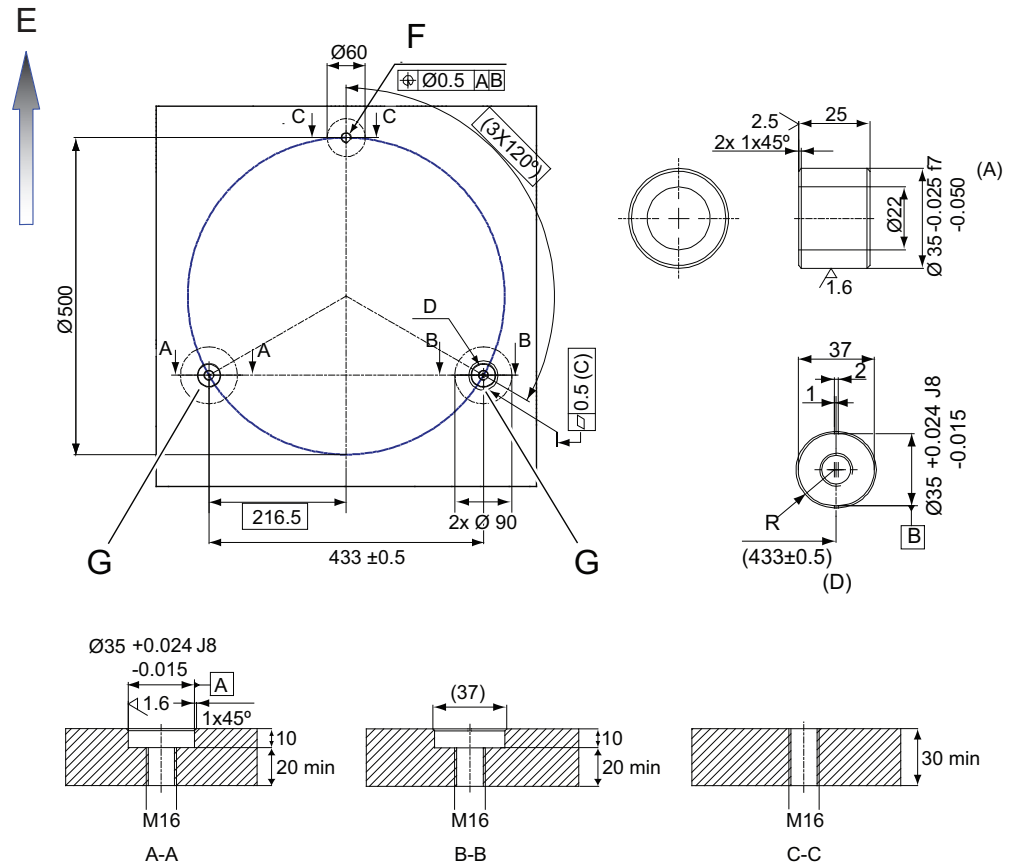


Note

For AbsAcc performance, the chosen guide holes according to Figure above are recommended

Continues on next page

Mounting surface and bushings



xx1700001492

(C)	3x common zone
E	Position of the front of the robot
F	M16 (3 pcs)
G	Guide bushings (2 pcs)

1 Description

1.4.1 Calibration methods

1.4 Calibration

1.4.1 Calibration methods

Overview


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

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

More information is available in the product manual.

Types of calibration

Type of calibration	Description	Calibration method
Standard calibration	The calibrated robot is positioned at calibration position. Standard calibration data is found on the SMB (serial measurement board) or EIB in the robot.	Axis Calibration or Calibration Pendulum ¹
Absolute accuracy calibration (optional)	Based on standard calibration, and besides positioning the robot at synchronization position, the Absolute accuracy calibration also compensates for: <ul style="list-style-type: none">Mechanical tolerances in the robot structureDeflection due to load Absolute accuracy calibration focuses on positioning accuracy in the Cartesian coordinate system for the robot. Absolute accuracy calibration data is found on the serial measurement board (SMB) or other robot memory. For IRC5 robots, the absolute accuracy calibration data is delivered in a file, absacc.cfg, supplied with the robot at delivery. The file replaces the calib.cfg file and identifies motor positions as well as absolute accuracy compensation parameters. A robot calibrated with Absolute accuracy has a sticker next to the identification plate of the robot (IRC5). To regain 100% Absolute accuracy performance, the robot must be recalibrated for absolute accuracy after repair or maintenance that affects the mechanical structure.	CalibWare

**ABSOLUTE ACCURACY**3HAC 14257-1

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Continues on next page

Type of calibration	Description	Calibration method
Optimization	<p>Optimization of TCP reorientation performance. The purpose is to improve reorientation accuracy for continuous processes like welding and gluing.</p> <p>Wrist optimization will update standard calibration data for axes 4, 5 and 6.</p>	Wrist Optimization

- ⁱ The robot is calibrated by either Calibration Pendulum or Axis Calibration at factory. Always use the same calibration method as used at the factory. Information about valid calibration method is found on the calibration label or in the calibration menu on the FlexPendant. If no data is found related to standard calibration, contact the local ABB Service.

Brief description of calibration methods

Calibration Pendulum method

Calibration Pendulum is a standard calibration method for calibration of some ABB robots.

Two different routines are available for the Calibration Pendulum method:

- Calibration Pendulum II
- Reference calibration

The calibration equipment for Calibration Pendulum is delivered as a complete toolkit, including the *Operating manual - Calibration Pendulum*, which describes the method and the different routines further.

Axis Calibration method

Axis Calibration is a standard calibration method for calibration of IRB 4600. It is the recommended method in order to achieve proper performance.

The following routines are available for the Axis Calibration method:

- Fine calibration
- Update revolution counters
- Reference calibration

The calibration equipment for Axis Calibration is delivered as a toolkit.

The actual instructions of how to perform the calibration procedure and what to do at each step is given on the FlexPendant. You will be guided through the calibration procedure, step by step.

Wrist Optimization method

Wrist Optimization is a method for improving reorientation accuracy for continuous processes like welding and gluing and is a complement to the standard calibration method.

The actual instructions of how to perform the wrist optimization procedure is given on the FlexPendant.

CalibWare - Absolute Accuracy calibration

The CalibWare tool guides through the calibration process and calculates new compensation parameters. This is further detailed in the *Application manual - CalibWare Field*.

Continues on next page

1 Description

1.4.1 Calibration methods

Continued

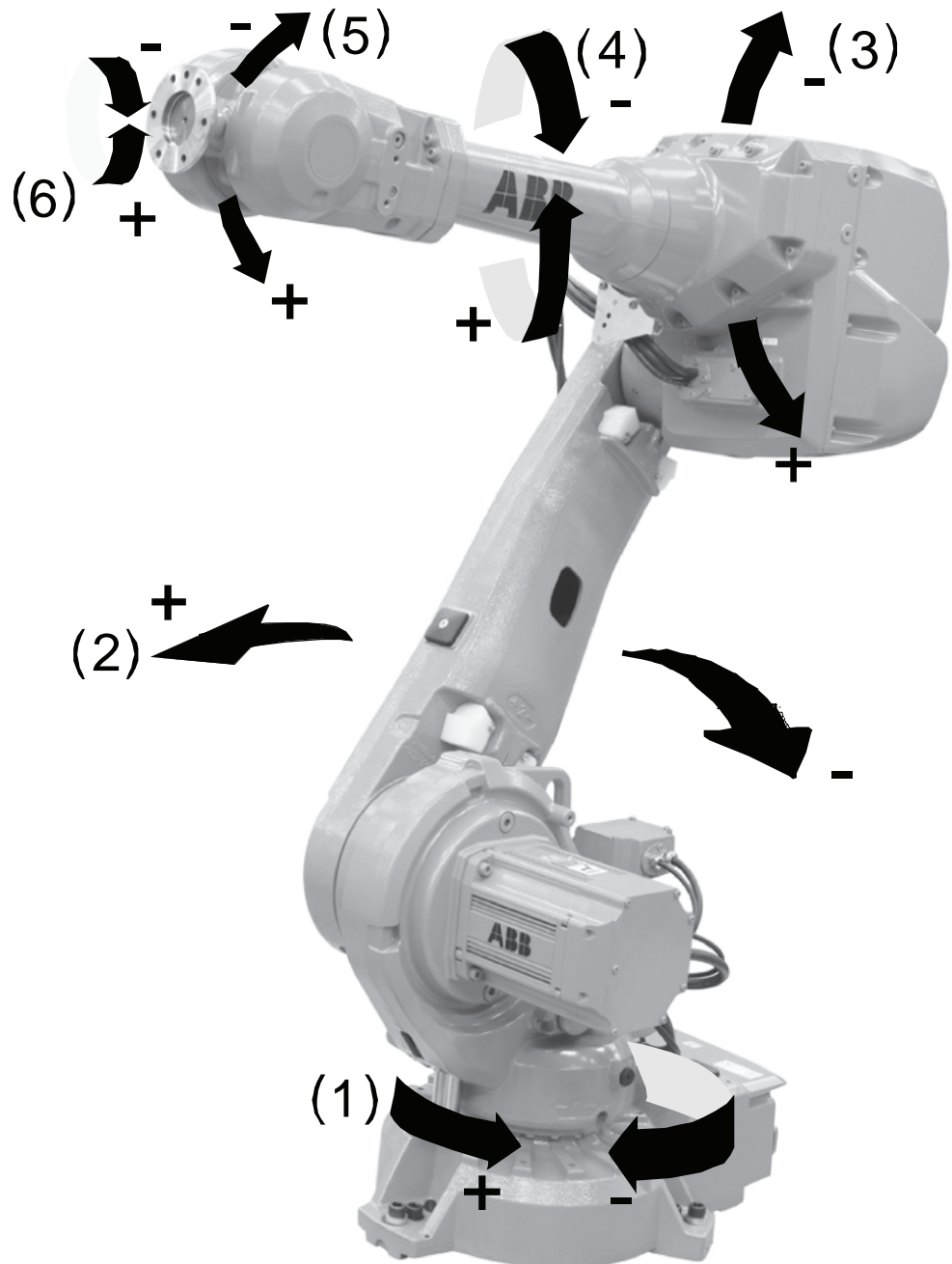
If a service operation is done to a robot with the option Absolute Accuracy, a new absolute accuracy calibration is required in order to establish full performance. For most cases after replacements that do not include taking apart the robot structure, standard calibration is sufficient.

1.4.2 Fine calibration

Overview

Fine calibration is made using the Calibration Pendulum, see *Operating manual - Calibration Pendulum* or *Axis calibration*, see *Product manual - IRB 4600* and *Product manual - IRB 4600 Foundry Prime*.

The following figure shows all axes in zero position.



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Continues on next page

1 Description

1.4.2 Fine calibration

Continued

Calibration	Position
Calibration of all axes	All axes are in zero position
Calibration of axis 1 and 2	Axis 1 and 2 in zero position Axis 3 to 6 in any position
Calibration of axis 1	Axis 1 in zero position Axis 2 to 6 in any position

1.4.3 Absolute Accuracy calibration

Purpose

Absolute Accuracy is a calibration concept that improves TCP accuracy. The difference between an ideal robot and a real robot can be several millimeters, resulting from mechanical tolerances and deflection in the robot structure. *Absolute Accuracy* compensates for these differences.

Here are some examples of when this accuracy is important:

- Exchangeability of robots
- Offline programming with no or minimum touch-up
- Online programming with accurate movement and reorientation of tool
- Programming with accurate offset movement in relation to, for example, vision systems or offset programming
- Re-use of programs between applications

The option *Absolute Accuracy* is integrated in the controller algorithms and does not need external equipment or calculation.



Note

The performance data is applicable to the corresponding RobotWare version of the individual robot.



Note

Singularities might appear in slightly different positions on a real robot compared to RobotStudio, where *Absolute Accuracy* is off compared to the real controller.

What is included

Every *Absolute Accuracy* robot is delivered with:

- compensation parameters saved in the robot memory
- a birth certificate representing the *Absolute Accuracy* measurement protocol for the calibration and verification sequence.

A robot with *Absolute Accuracy* calibration has a label with this information on the manipulator.

Absolute Accuracy supports floor mounted, wall mounted, and ceiling mounted installations. The compensation parameters that are saved in the robot memory differ depending on which *Absolute Accuracy* option is selected.

When is *Absolute Accuracy* being used

Absolute Accuracy works on a robot target in Cartesian coordinates, not on the individual joints. Therefore, joint based movements (e.g. `MoveAbsJ`) will not be affected.

If the robot is inverted, the *Absolute Accuracy* calibration must be performed when the robot is inverted.

Continues on next page

1 Description

1.4.3 Absolute Accuracy calibration

Continued

Absolute Accuracy active

Absolute Accuracy will be active in the following cases:

- Any motion function based on robtargets (e.g. `MoveL`) and ModPos on robtargets
- Reorientation jogging
- Linear jogging
- Tool definition (4, 5, 6 point tool definition, room fixed TCP, stationary tool)
- Work object definition

Absolute Accuracy not active

The following are examples of when Absolute Accuracy is not active:

- Any motion function based on a jointtargt (`MoveAbsJ`)
- Independent joint
- Joint based jogging
- Additional axes
- Track motion



Note

In a robot system with, for example, an additional axis or track motion, the Absolute Accuracy is active for the manipulator but not for the additional axis or track motion.

RAPID instructions

There are no RAPID instructions included in this option.

Production data

Typical production data regarding calibration are:

Robot	Positioning accuracy (mm)		
	Average	Max	% Within 1 mm
IRB 4600-60/2.05	0.50	1.00	98
IRB 4600-45/2.05	0.40	0.80	100
IRB 4600-40/2.55	0.40	1.00	98
IRB 4600-20/2.50	0.40	0.80	100

1.4.4 Synchronization marks and axis movement directions

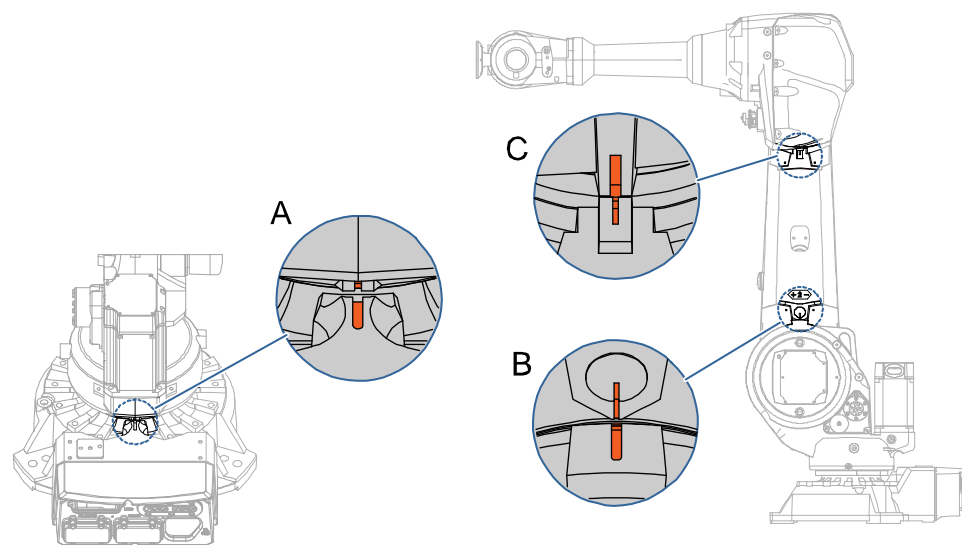
1.4.4.1 Synchronization marks and synchronization position for axes

Introduction

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

Synchronization marks, IRB 4600

IRB 4600-60/2.05, -45/2.05, -40/2.55, -20/2.50



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A	Synchronization mark, axis 1
B	Synchronization mark, axis 2
C	Synchronization mark, axis 3

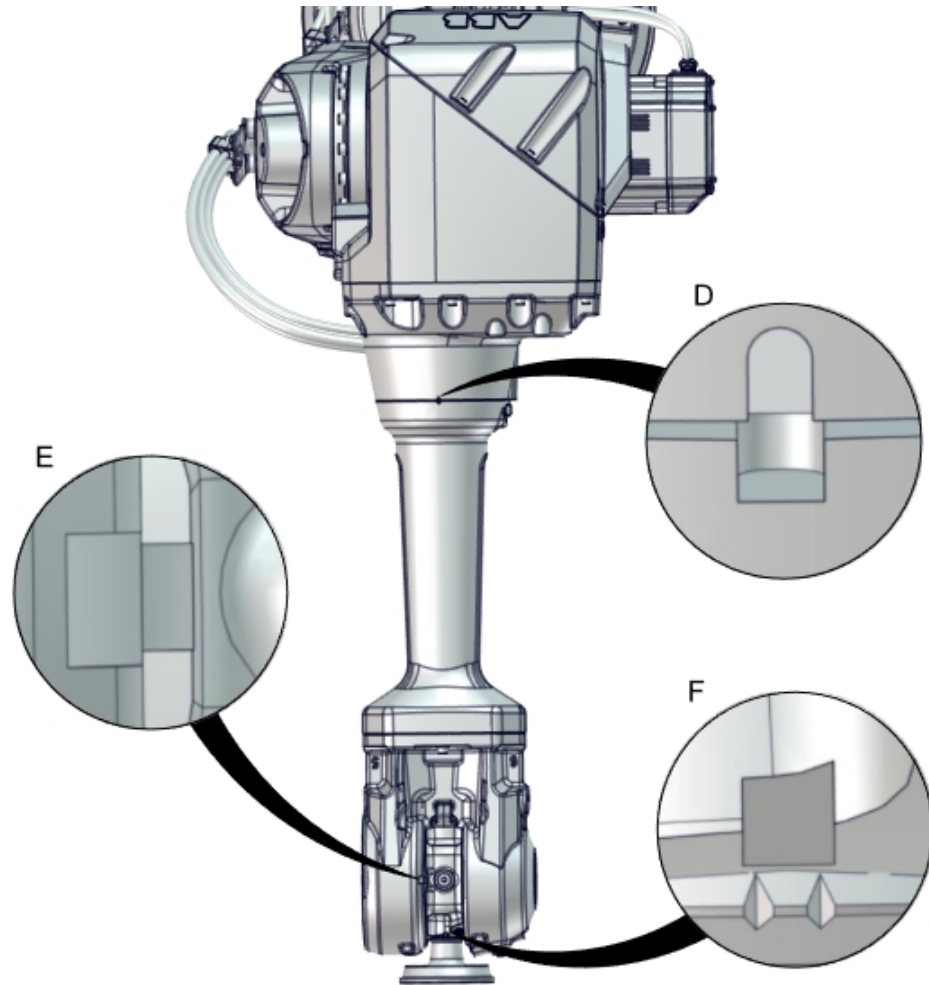
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1 Description

1.4.4.1 Synchronization marks and synchronization position for axes

Continued

IRB 4600 - 60/2.05, -45/2.05, 40/2.55



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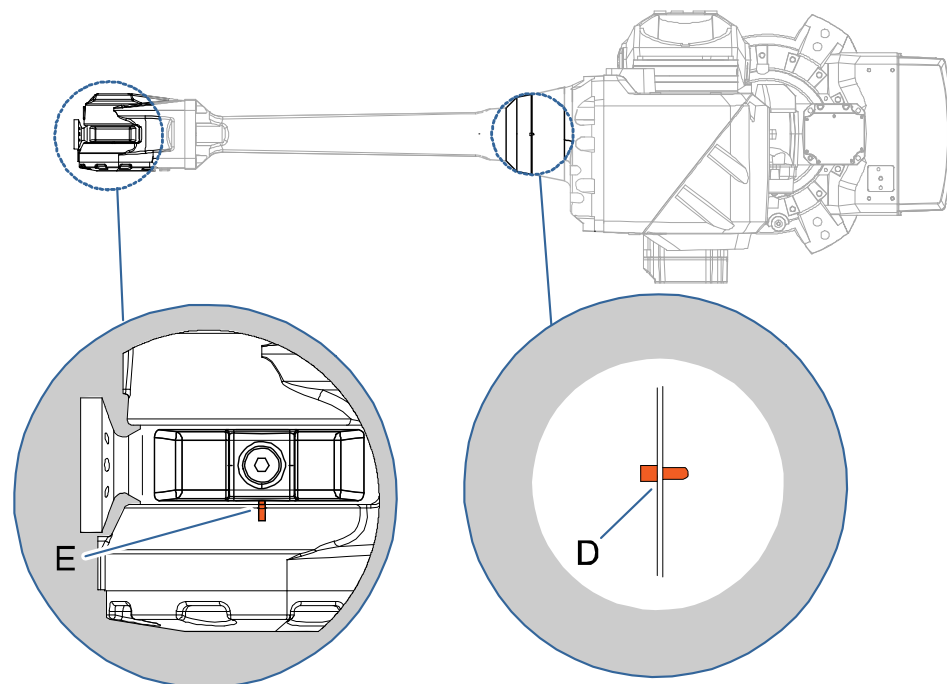
D	Synchronization mark, axis 4
E	Synchronization mark, axis 5
F	Synchronization mark, axis 6 The two tips of the arrows should be inside the corresponding groove on the tilt housing when in synchronization position.

Continues on next page

1.4.4.1 Synchronization marks and synchronization position for axes

Continued

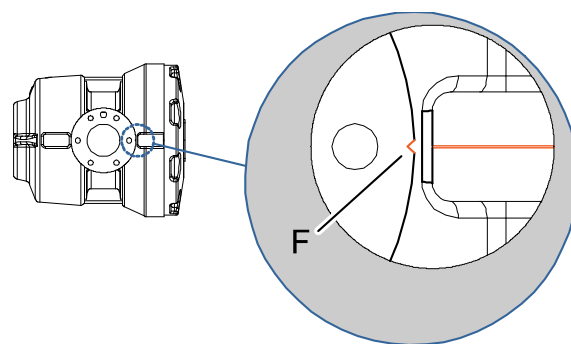
IRB 4600 -20/2.50



xx080000320

D	Synchronization mark, axis 4
E	Synchronization mark, axis 5

IRB 4600 -20/2.50



xx080000321

F	Synchronization mark, axis 6
---	------------------------------

1 Description

1.4.4.2 Calibration movement directions for all axes

1.4.4.2 Calibration movement directions for all axes

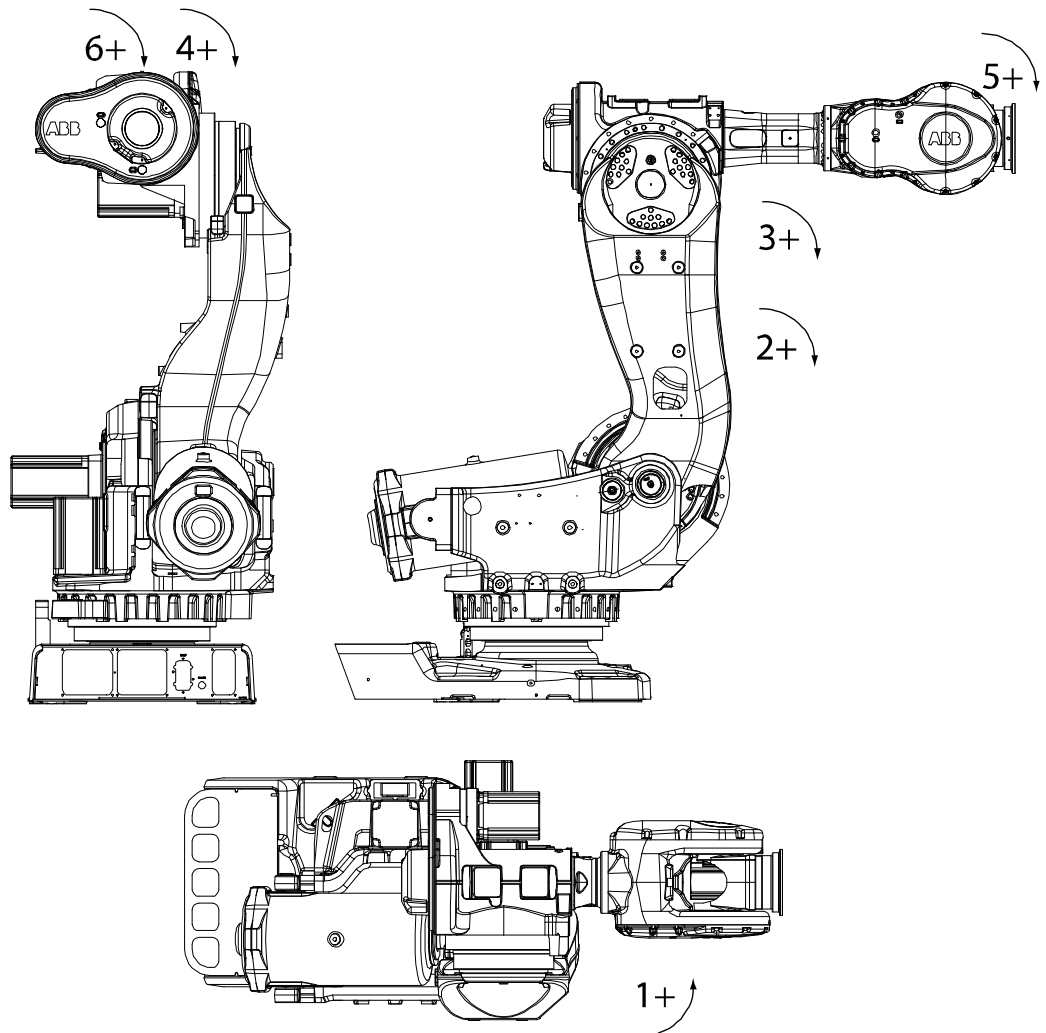
Overview

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

Calibration service routines will handle the calibration movements automatically and these might be different from the positive directions shown below.

Manual movement directions, 6 axes

Note! The graphic shows an IRB 7600. The positive direction is the same for all 6-axis robots, except the positive direction of axis 3 for IRB 6400R, which is in the opposite direction!



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1.5 Robot load and load diagrams

1.5.1 Introduction to Robot load and load diagrams

Information



WARNING

It is very important to always define correct actual load data and correct payload of the robot. Incorrect definitions of load data can result in overloading of the robot.

If incorrect load data is used, and/or if loads outside the load diagram are used, the following parts can be damaged due to overload:

- motors
- gearboxes
- mechanical structure



WARNING

In RobotWare, the service routine LoadIdentify can be used to determine correct load parameters. The routine automatically defines the tool and the load.

See *Operating manual - IRC5 with FlexPendant*, for detailed information.



WARNING

Robots running with incorrect load data and/or with loads outside the load diagram, will not be covered by robot warranty.

General

The load diagrams include a nominal payload inertia, J_0 of 2.5 kgm^2 for IRB 4600-60/2.05, -45/2.05, -40/2.55 and 0.06 kgm^2 for IRB 4600-20/2.50, and an extra load of 15 kg at the upper arm housing for IRB 4600-60/2.05, -45/2.05, -40/2.55 and 10 kg for IRB 4600-20/2.50.

At different moment of inertia the load diagram will be changed. For robots that are allowed tilted, or inverted mounted, the load diagrams as given are valid and thus it is also possible to use RobotLoad within those tilt and axis limits.

Control of load case with RobotLoad

To verify a specific load case, use the RobotStudio add-in RobotLoad.

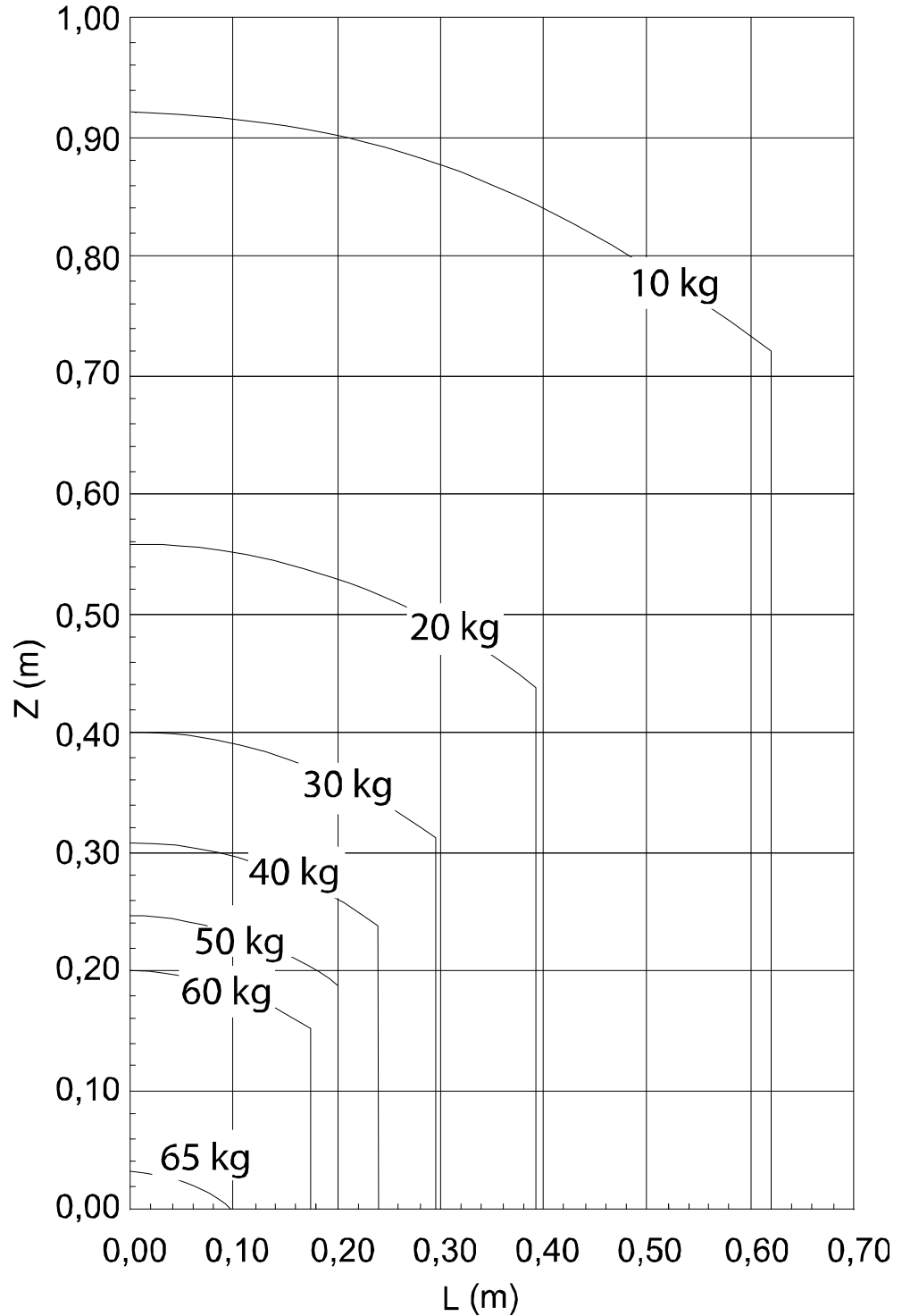
The result from RobotLoad is only valid within the maximum loads and tilt angles. There is no warning if the maximum permitted arm load is exceeded. For over-load cases and special applications, contact ABB for further analysis.

1 Description

1.5.2 Load diagrams

1.5.2 Load diagrams

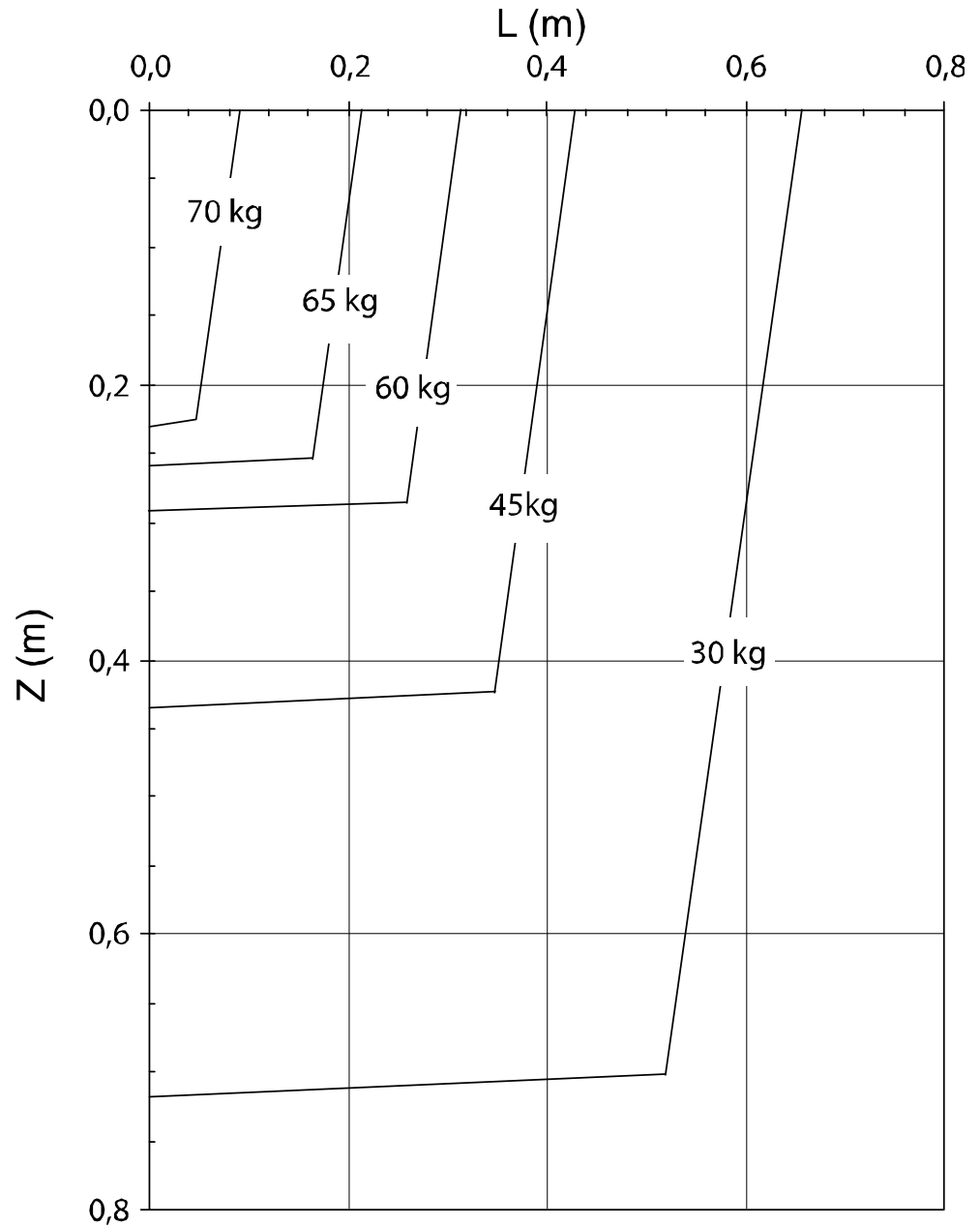
IRB 4600 - 60/2.05



xx080000448

Continues on next page

IRB 4600 - 60/2.05 "Vertical wrist" (+-10)



xx090000070

For wrist down (0 deviation from the vertical line).

	Description
Max load	73 kg
Z _{max}	0.216 m
L _{max}	0.028 m

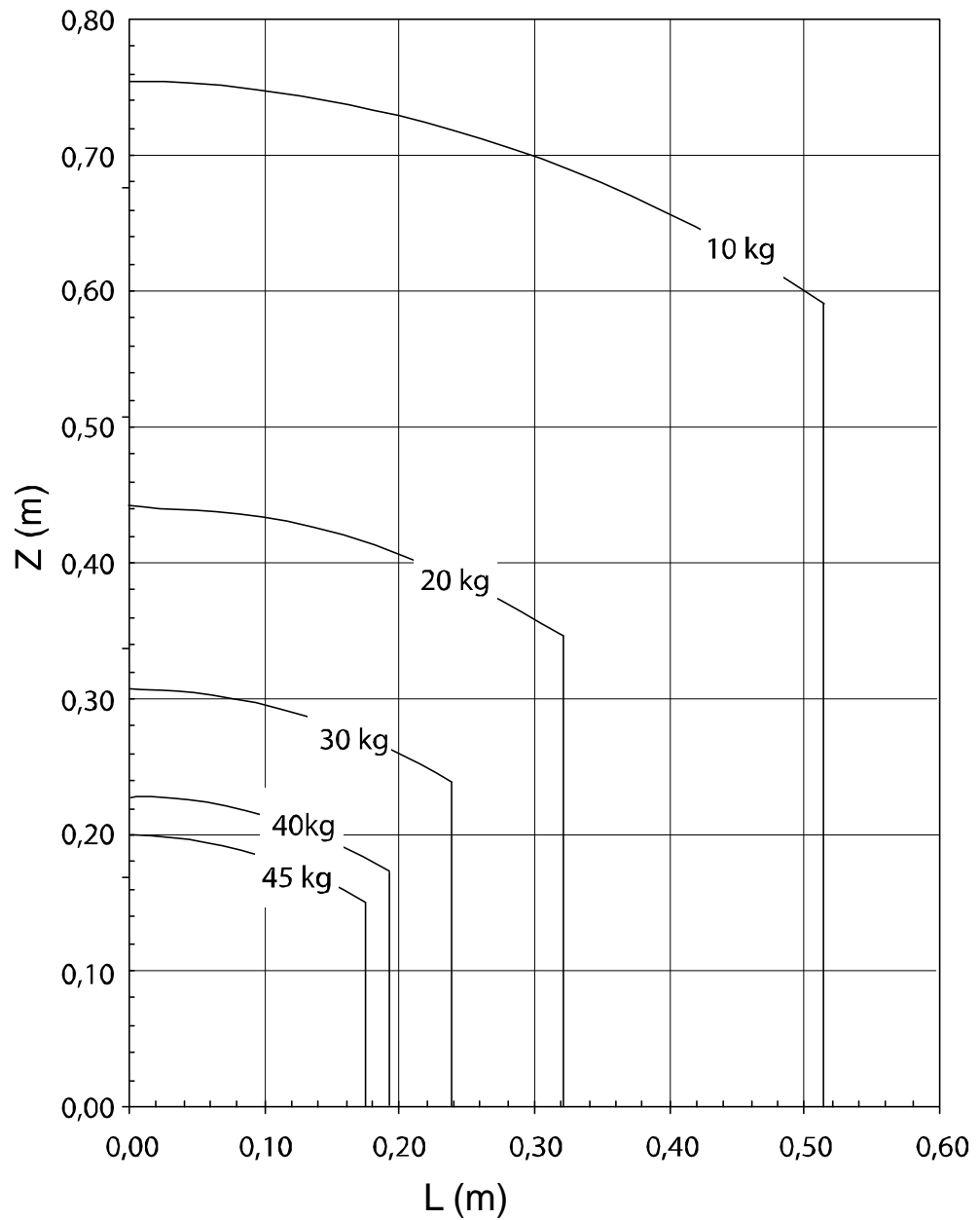
Continues on next page

1 Description

1.5.2 Load diagrams

Continued

IRB 4600 - 45/2.05



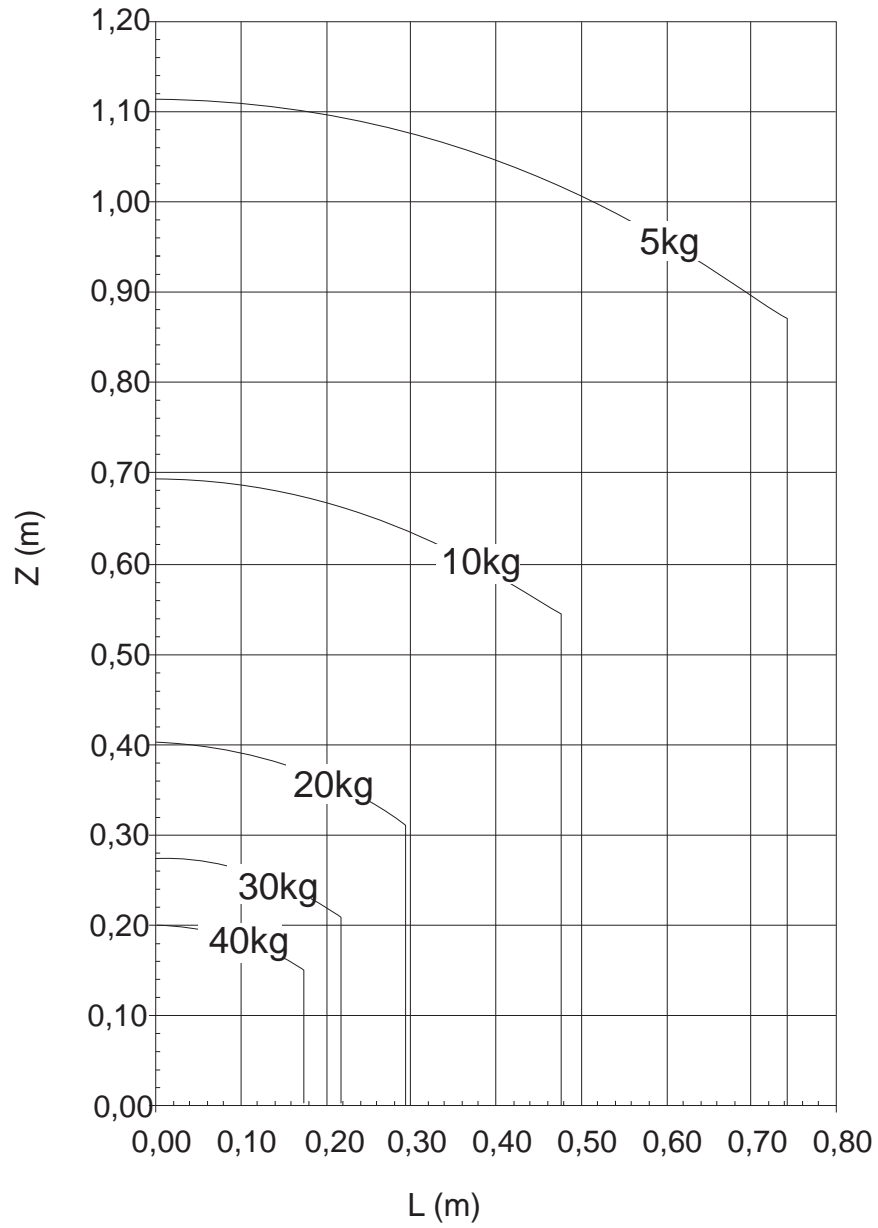
xx090000069

Load diagram for "Vertical wrist" is not applicable for IRB 4600-45/2.05.

The above load diagram also valid for "Vertical wrist", no additional load allowed.

Continues on next page

IRB 4600 - 40/2.55



xx080000447

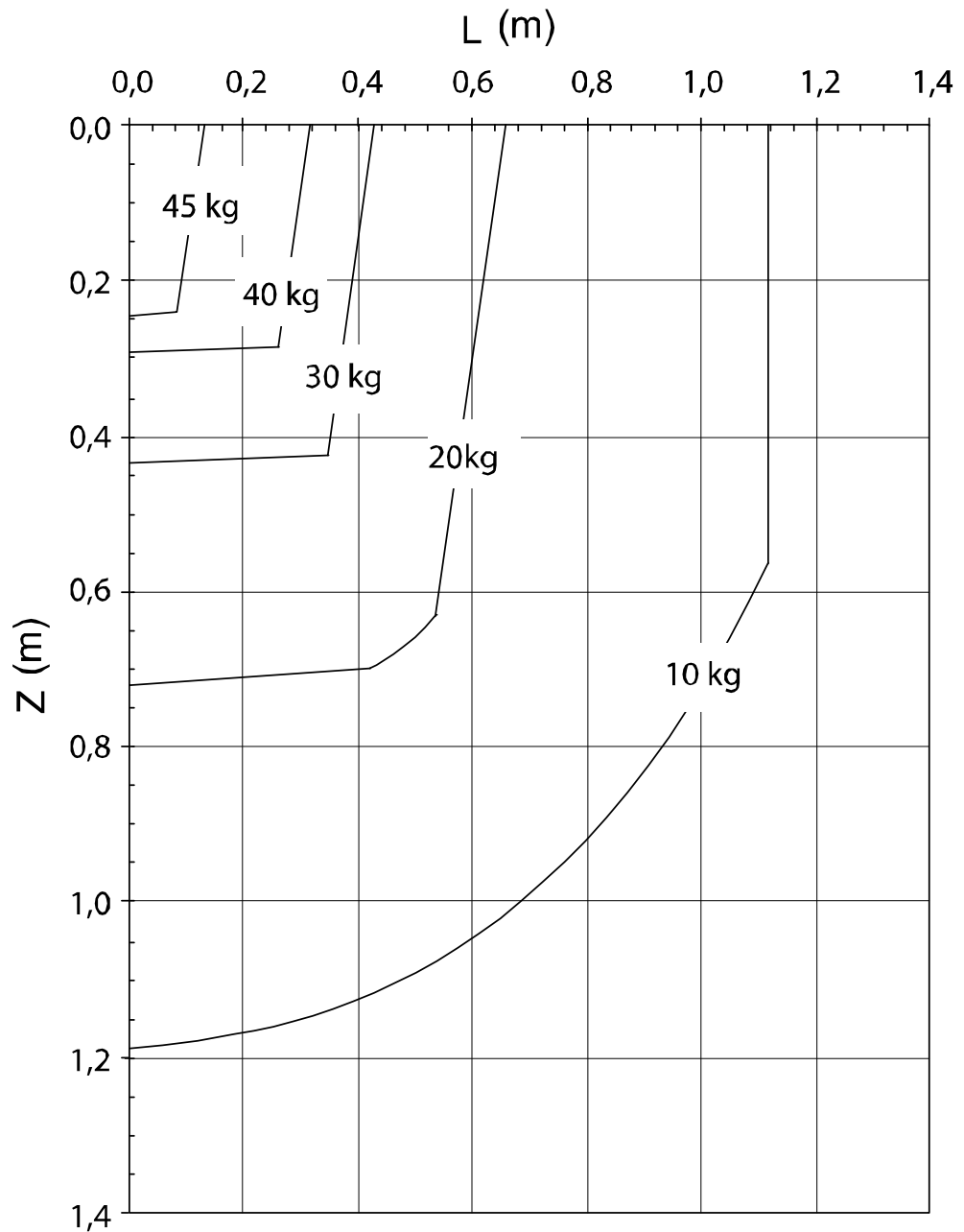
Continues on next page

1 Description

1.5.2 Load diagrams

Continued

IRB 4600 - 40/2.55 "Vertical wrist" (+-10)



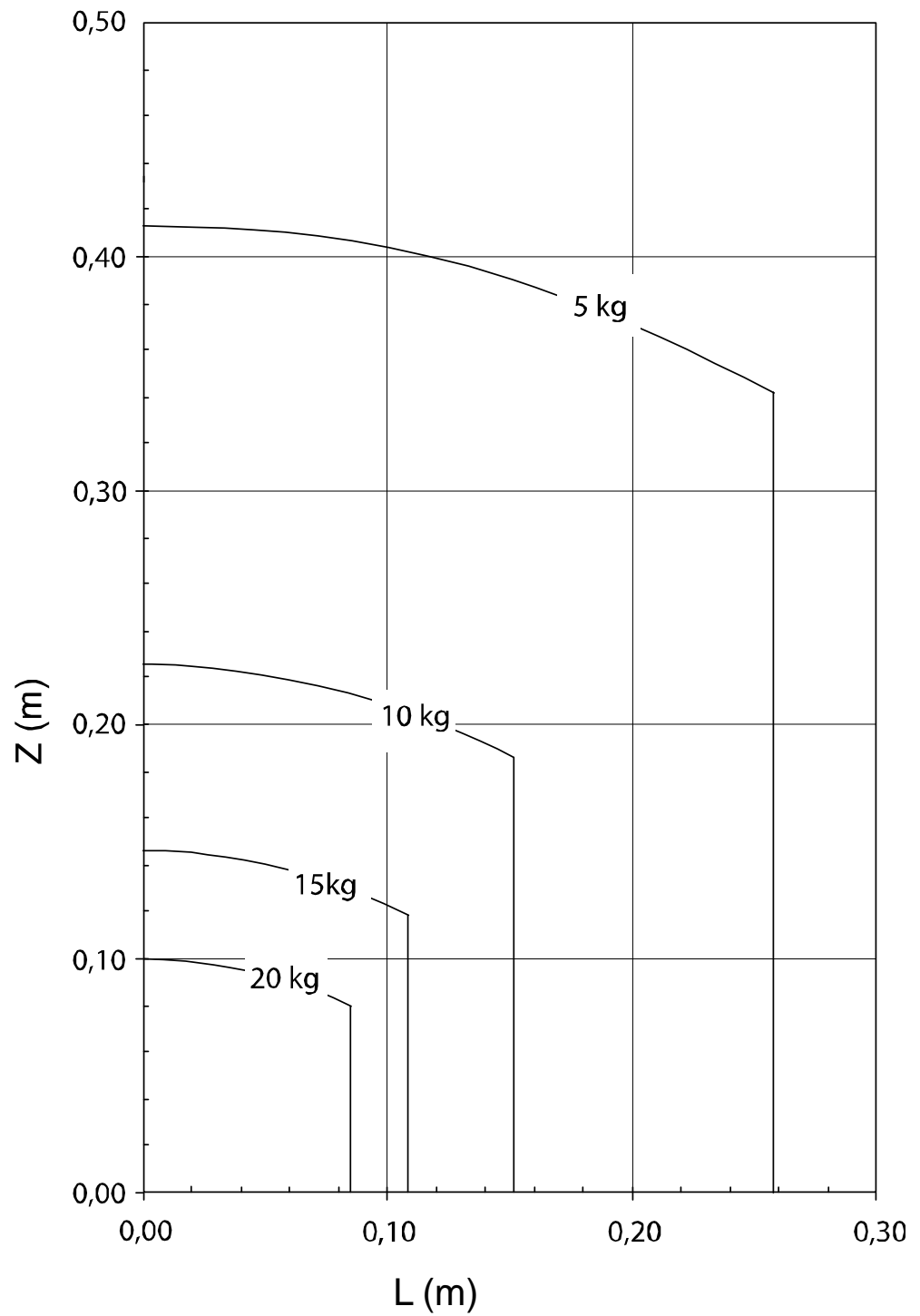
xx0900000068

For wrist down (0 deviation from the vertical line).

	Description
Max load	47 kg
Z _{max}	0.157 m
L _{max}	0.044 m

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IRB 4600 - 20/2.50



xx090000071

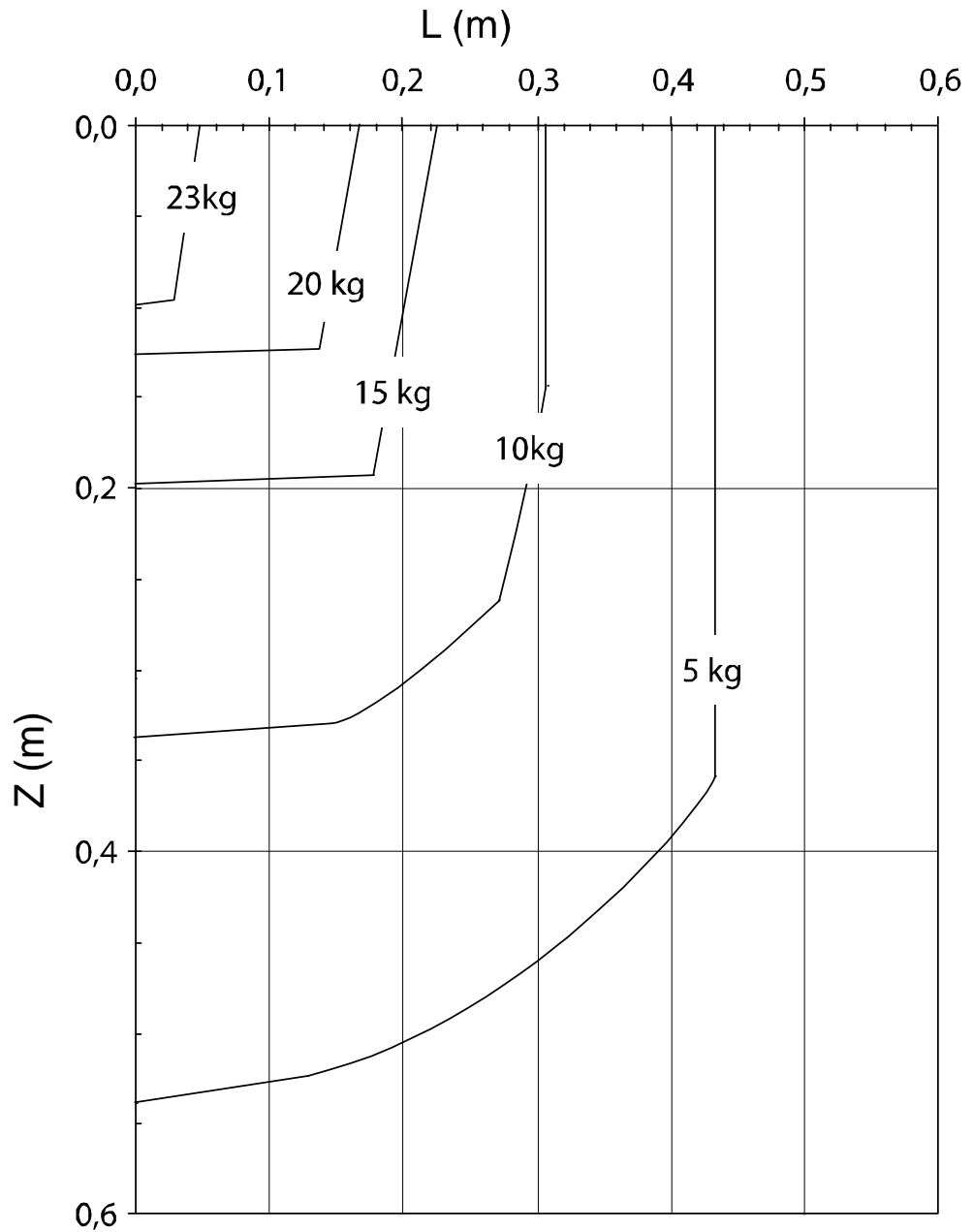
Continues on next page

1 Description

1.5.2 Load diagrams

Continued

IRB 4600 - 20/2.50 "Vertical wrist" (+-10)



xx0900000067

For wrist down (0 deviation from the vertical line).

	Description
Max load	23 kg
Z _{max}	0.1 m
L _{max}	0.06 m

1.5.3 Maximum load and moment of inertia for full and limited axis 5 (centerlinedown) movement

1.5.3 Maximum load and moment of inertia for full and limited axis 5 (centerlinedown) movement

Information

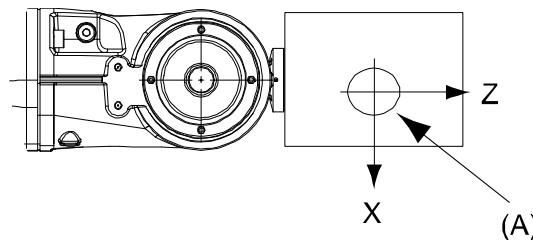


Note

Total load given as: Mass in kg, center of gravity (Z and L) in meter and moment of inertia (J_{ox} J_{oy} J_{oz}) in kgm^2 . $L = \sqrt{x^2 + y^2}$, see Figure 18

Full movement of axis 5

Axis	Robot Type	Maximum moment of inertia
5	60/2.05, 45/2.05	$Ja5 = \text{Load} \times ((Z + 0,135)^2 + L^2) + \max(J_{ox}, J_{oy}) \leq 30 \text{ kgm}^2$
	40/2.55	$Ja5 = \text{Load} \times ((Z + 0,135)^2 + L^2) + \max(J_{ox}, J_{oy}) \leq 20 \text{ kgm}^2$
	20/2.50	$Ja5 = \text{Load} \times ((Z + 0,085)^2 + L^2) + \max(J_{ox}, J_{oy}) \leq 2 \text{ kgm}^2$
6	60/2.05, 45/2.05	$Ja6 = \text{Load} \times L^2 + J_{oz} \leq 20 \text{ kgm}^2$
	40/2.55	$Ja6 = \text{Load} \times L^2 + J_{oz} \leq 15 \text{ kgm}^2$
	20/2.50	$Ja6 = \text{Load} \times L^2 + J_{oz} \leq 1 \text{ kgm}^2$



xx080000458

Pos	Description
A	Center of gravity
	Description
J_{ox}, J_{oy}, J_{oz}	Max. moment of inertia around the X, Y and Z axes at center of gravity.

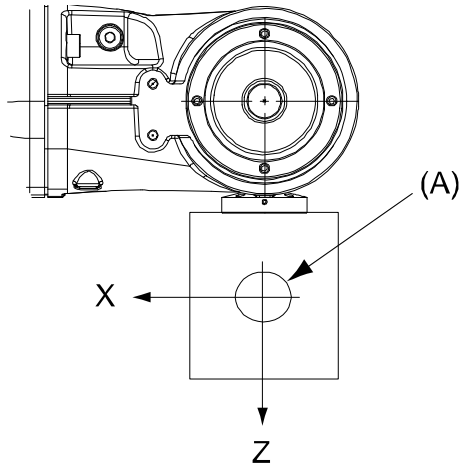
Continues on next page

1 Description

1.5.3 Maximum load and moment of inertia for full and limited axis 5 (centerlinedown) movement Continued

Limited axis 5, center line down

Axis	Robot Type	Maximum moment of inertia
5	60/2.05, 45/2.05	$Ja5 = \text{Load} \times ((Z + 0,135)^2 + L^2) + \max(J_{0x}, J_{0y}) \leq 30 \text{ kgm}^2$
	40/2.55	$Ja5 = \text{Load} \times ((Z + 0,135)^2 + L^2) + \max(J_{0x}, J_{0y}) \leq 20 \text{ kgm}^2$
	20/2.50	$Ja5 = \text{Load} \times ((Z + 0,085)^2 + L^2) + \max(J_{0x}, J_{0y}) \leq 2 \text{ kgm}^2$
6	60/2.05, 45/2.05	$Ja6 = \text{Load} \times L^2 + J_{0z} \leq 20 \text{ kgm}^2$
	40/2.55	$Ja6 = \text{Load} \times L^2 + J_{0z} \leq 15 \text{ kgm}^2$
	20/2.50	$Ja6 = \text{Load} \times L^2 + J_{0z} \leq 1 \text{ kgm}^2$



xx0800000459

Pos	Description
A	Center of gravity
	Description
J_{0x}, J_{0y}, J_{0z}	Max. moment of inertia around the X, Y and Z axes at center of gravity.

1.5.4 Wrist torque

Maximum torque due to payload

The table below shows the maximum permissible torque due to payload:



Note

The wrist torque values are for reference only, and should not be used for calculating permitted load offset (position of center of gravity) within the load diagram, since those also are limited by main axes torques as well as dynamic loads. Furthermore, arm loads will influence the permitted load diagram. To find the absolute limits of the load diagram, use the RobotStudio add-in RobotLoad.

Robot type	Max wrist torque axis 4 and 5	Max wrist torque axis 6	Max torque valid at load
IRB 4600 - 60/2.05	200 Nm	105 Nm	60 kg
IRB 4600 - 45/2.05	145 Nm	77 Nm	45 kg
IRB 4600 - 40/2.55	132 Nm	68 Nm	40 kg
IRB 4600 - 20/2.50	37 Nm	15 Nm	20 kg

1 Description

1.5.5 Maximum TCP acceleration

1.5.5 Maximum TCP acceleration

General

Higher values can be reached with lower loads than the nominal because of our dynamical motion control QuickMove2. For specific values in the unique customer cycle, or for robots not listed in the table below, we recommend to use RobotStudio.

Maximum Cartesian design acceleration for nominal loads

Robot type	E-stop Max acceleration at nominal load COG [m/s ²]	Controlled Motion Max acceleration at nominal load COG [m/s ²]
IRB 4600 - 60/2.05	69	35
IRB 4600 - 40/2.55	77	49
IRB 4600 - 20/2.50	96	65



Note

Acceleration levels for emergency stop and controlled motion includes acceleration due to gravitational forces. Nominal load is defined with nominal mass and cog with max offset in Z and L (see the load diagram).

1.6 Mounting equipment

1.6.1 Information about mounting equipment

General

Extra loads can be mounted on the wrist, the upper arm housing and on the frame. Definitions of load areas and permitted load are shown in. The center of gravity of the extra load shall be within the marked load areas. The robot is supplied with holes for mounting of extra equipment. (See figures in [Holes for mounting of extra equipment on page 55.](#))

The maximum allowed arm load depends on the center of gravity of the arm load and robot payload. Use RobotLoad in RobotStudio to verify individual load cases.



Note

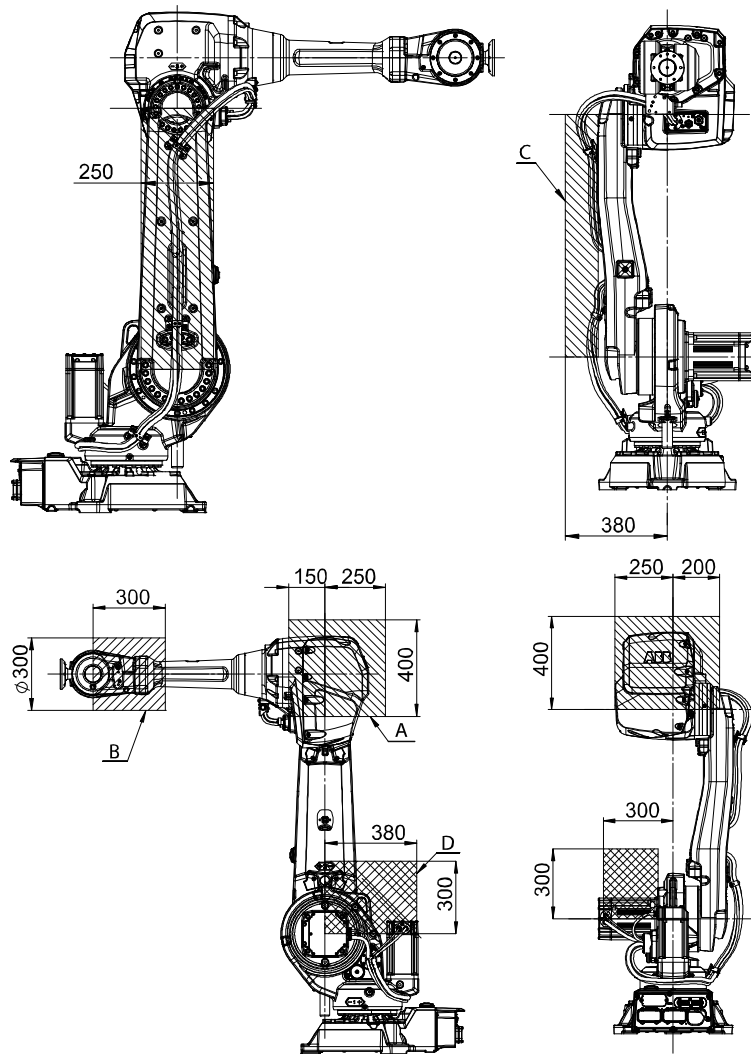
Maximum load on the frame (area D) must not be exceeded.

Continues on next page

1 Description

1.6.1 Information about mounting equipment

Continued



xx0800000434

Load area Robot	Max load				
	A	B	C	A+C	D
IRB 4600 - 60/2.05	15 kg	5 kg ^a	15 kg	15 kg	35 kg
IRB 4600 - 45/2.05	15 kg	5 kg ^b	15 kg	15 kg	35 kg
IRB 4600 - 40/2.55	15 kg	5 kg ^c	15 kg	15 kg	35 kg
IRB 4600 - 20/2.50	10 kg	1 kg	10 kg	10 kg	35 kg

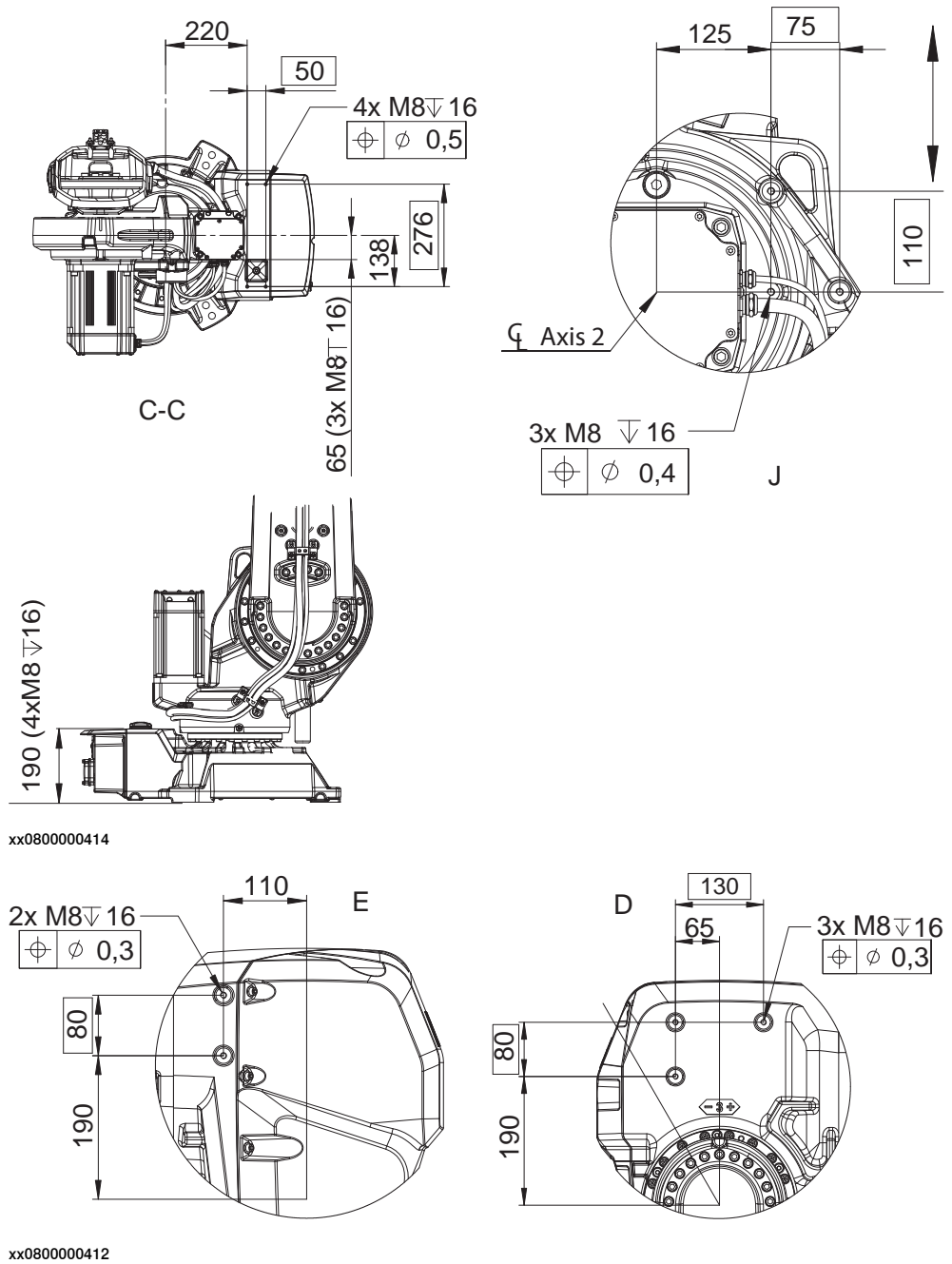
a. Payload + B max 60kg

b. Payload + B max 45kg

c. Payload + B max 40kg

Continues on next page

Holes for mounting of extra equipment

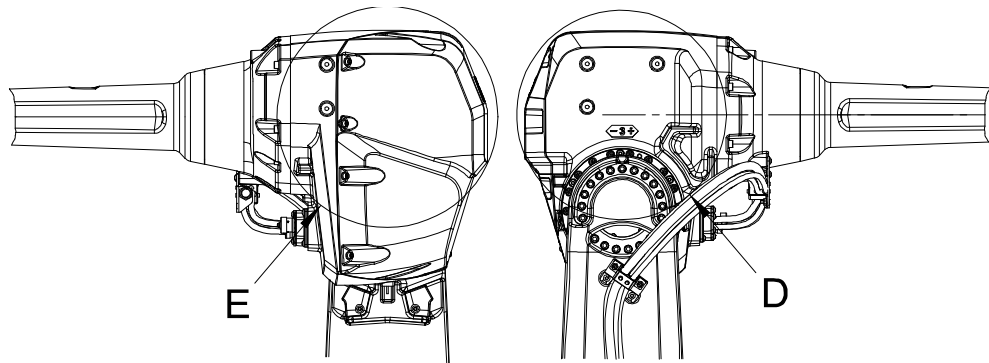


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1 Description

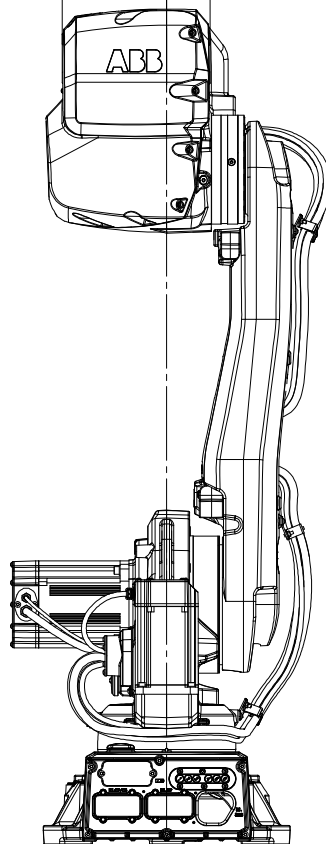
1.6.1 Information about mounting equipment

Continued



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216 (2x M8 ∇ 16) 90 (3x M8 ∇ 16)



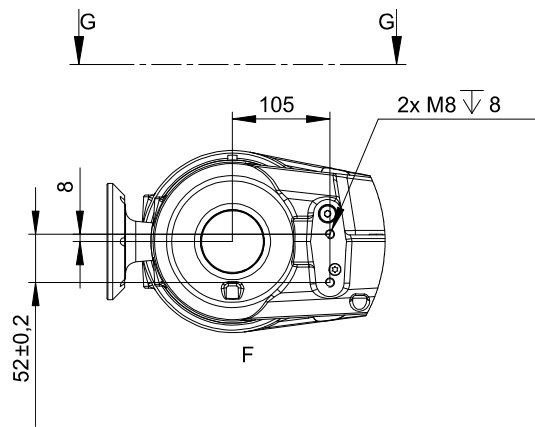
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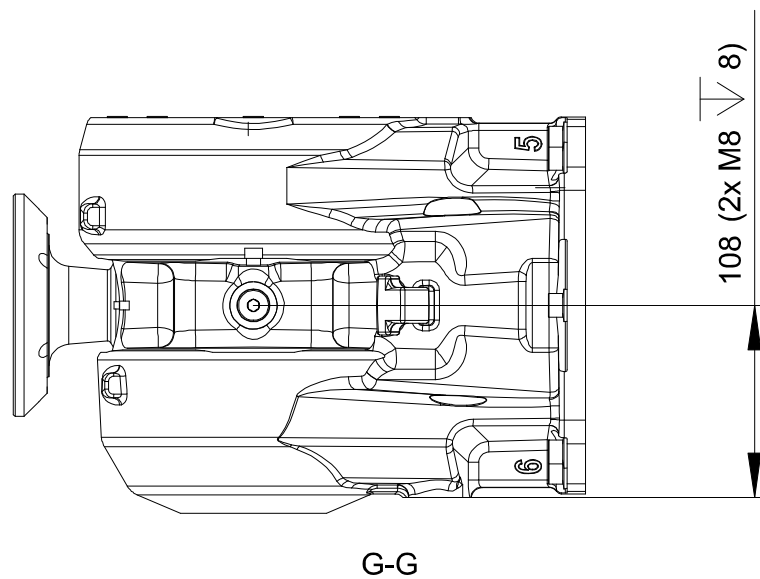
1 Description

1.6.1 Information about mounting equipment

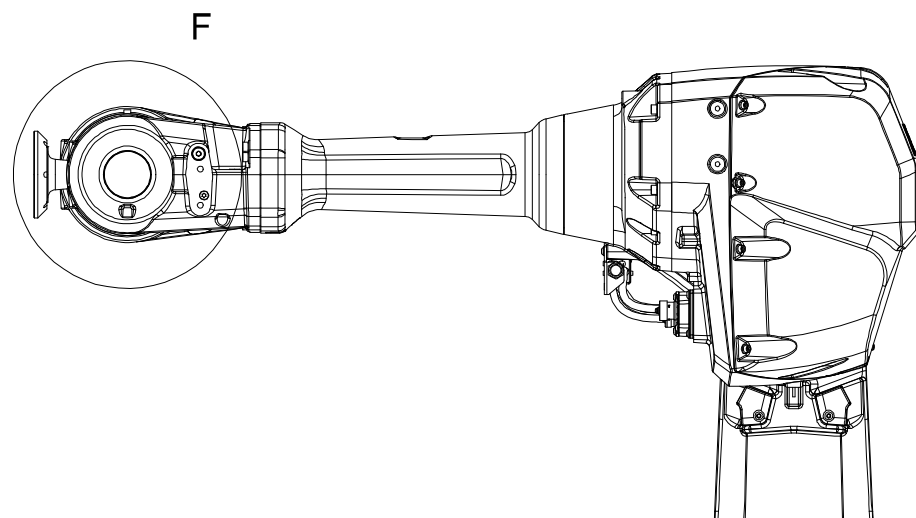
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xx0800000417



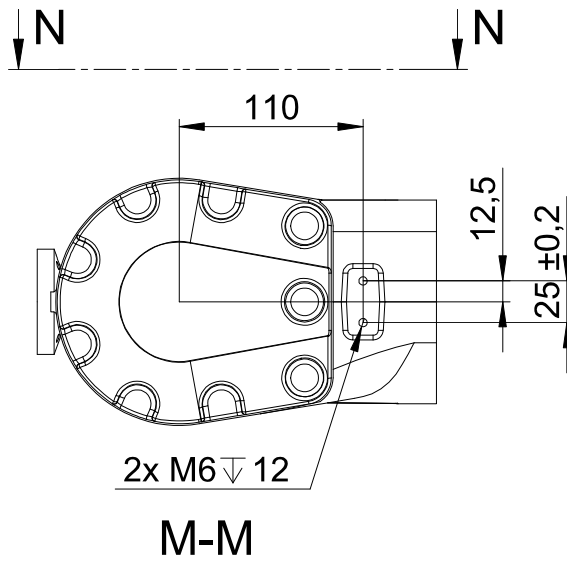
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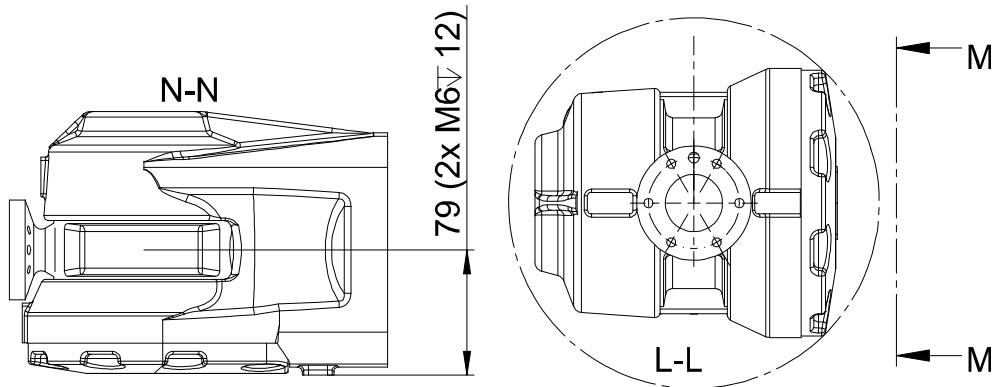
1 Description

1.6.1 Information about mounting equipment

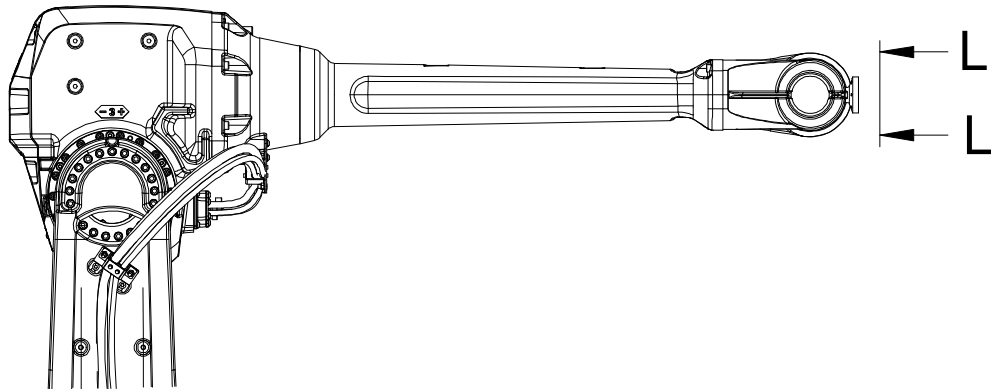
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xx0800000411

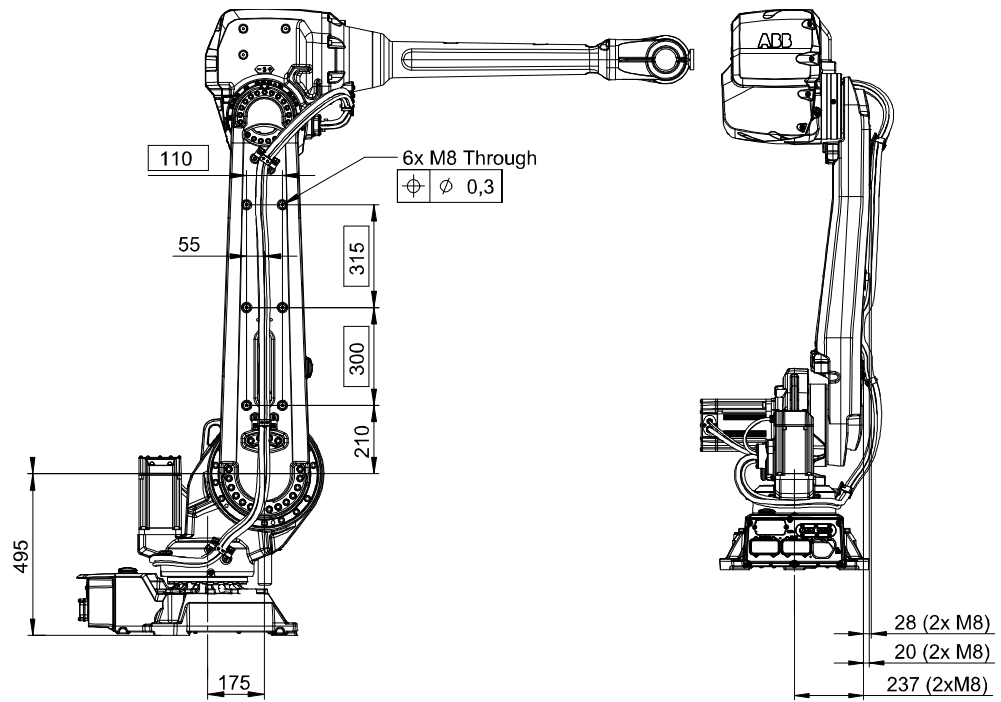
IRB 4600-40/2.55 and IRB 4600-20/2.50

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1 Description

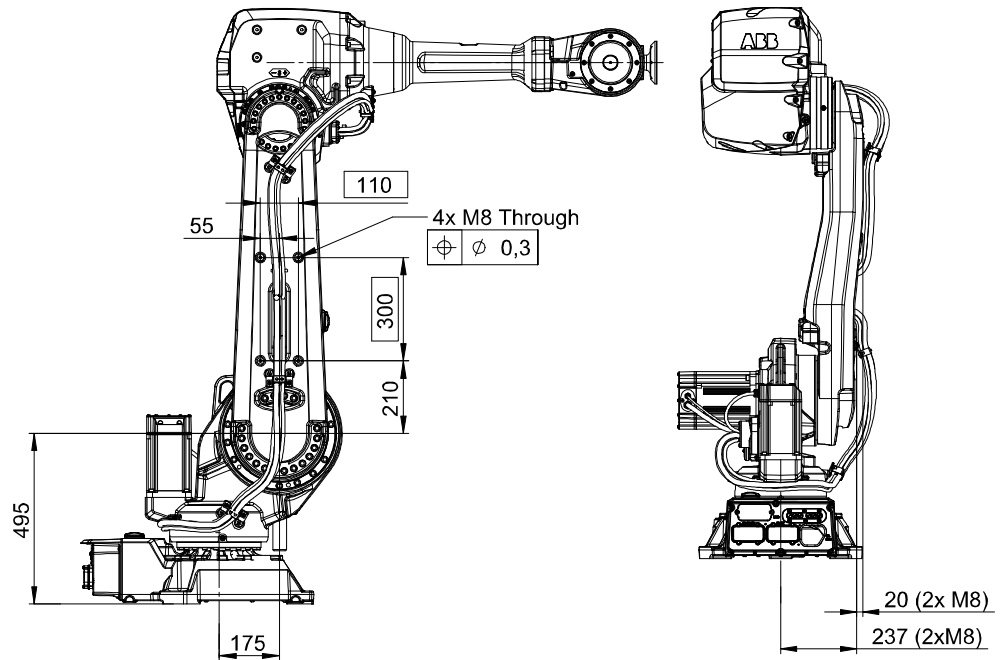
1.6.1 Information about mounting equipment

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IRB 4600 60(45)/2.05



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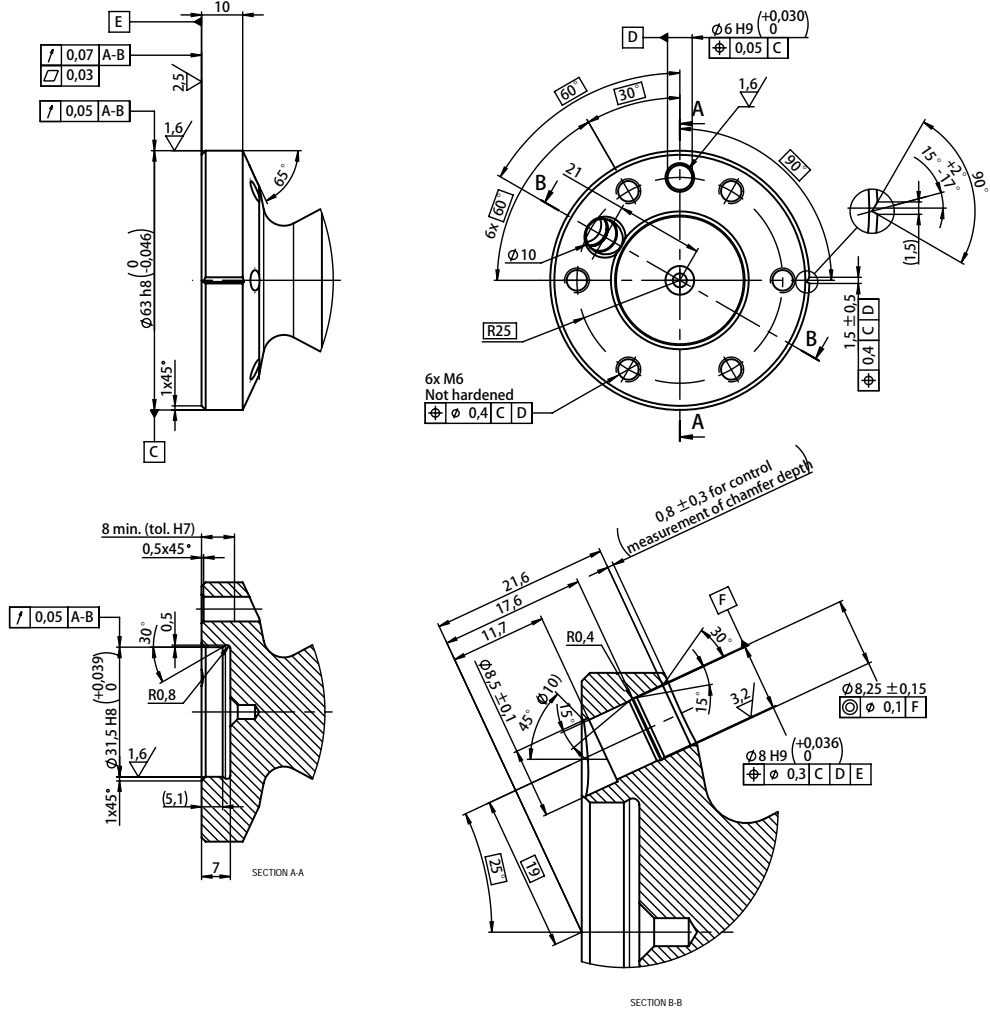
1 Description

1.6.1 Information about mounting equipment

Continued

Tool flange

IRB 4600-20/2.50



xx080000449

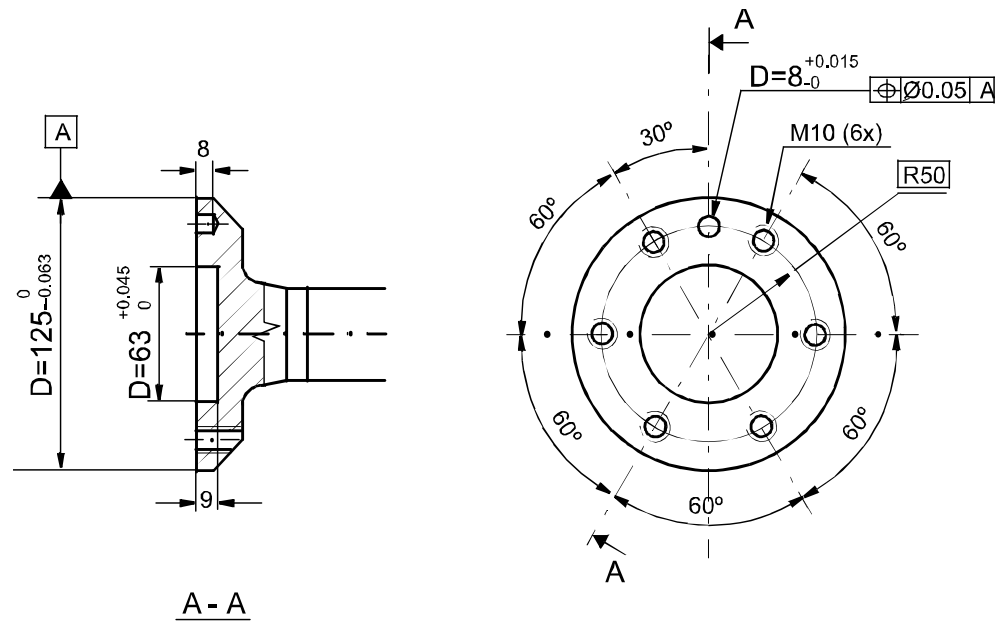
IRB 4600-60/2.05, IRB4600-45/2.05 and IRB 4600-40/2.55

Continues on next page

1 Description

1.6.1 Information about mounting equipment

Continued



xx0800000450

Fastener quality

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

1 Description

1.7.1 Introduction to Maintenance and Troubleshooting

1.7 Maintenance and troubleshooting

1.7.1 Introduction to Maintenance and Troubleshooting

General

The robot requires only minimum maintenance during operation. It has been designed to make it as easy to service as possible:

- Maintenance-free AC motors are used.
- Oil is used for the gear boxes.
- The cabling is routed for longevity, and in the unlikely event of a failure, its modular design makes it easy to change.

Maintenance

The maintenance intervals depend on the use of the robot, the required maintenance activities also depends on selected options. For detailed information on maintenance procedures, see Maintenance section in the Product Manual.

1.8 Robot motion

1.8.1 Introduction to Robot Motion

IRB 4600

Axis	Type of motion	Range of movement
1	Rotation Motion	+ 180° to - 180°
2	Arm motion	+ 150° to - 90°
3	Arm motion	+ 75° to - 180°
4	Rotation motion	+ 400° to - 400° Default + 201 rev. ^a to - 201 rev. Max. ^c
5	Bend motion	+ 120° to - 125° ^b
6	Turn motion	+ 400° to - 400° Default + 241 rev. ^a to - 241 ^c rev. Max. ^d

a. rev. = Revolutions.

b. IRB 4600-20/2.50, + 120° to -120°.

c. Valid for IRB 4600-20/2.50 is + 183 to - 183 rev.

d. The default working range for axis 4 and axis 6 can be extended by changing parameter values in the software. Option 610-1 "Independent axis" can be used for resetting the revolution counter after the axis has been rotated (no need for "rewinding" the axis)



Note

A collision with the air vent mounted on the base for Foundry Prime robots, will occur if axis 1 is in the range of -100° to -180° and axis 2 is moved to a backward position of more than +115°.

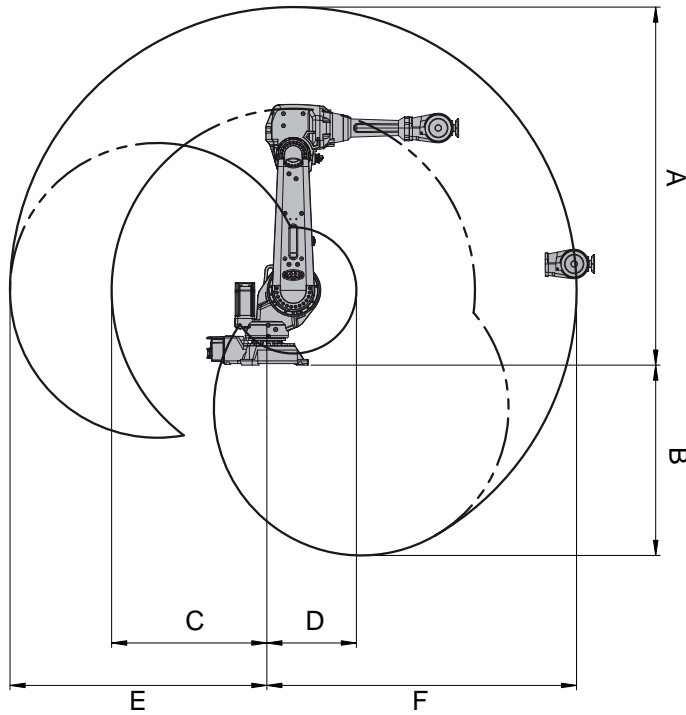
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1 Description

1.8.1 Introduction to Robot Motion

Continued

Working range, floor mounted



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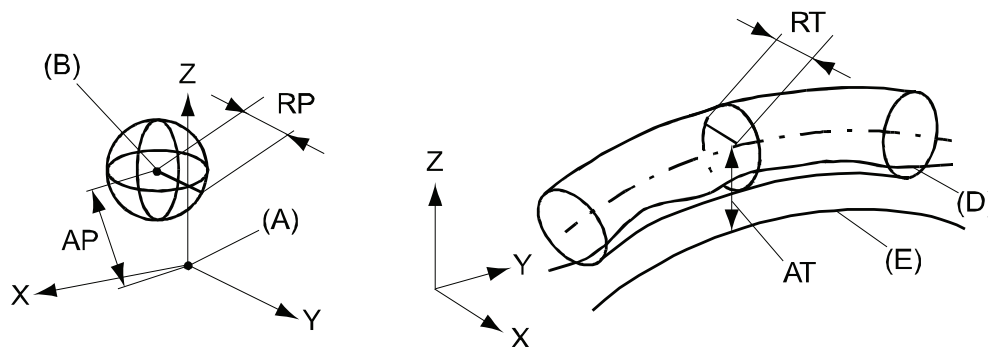
Variant	Pos. A	Pos. B	Pos. C	Pos. D	Pos. E	Pos. F
IRB 4600-60/2.05	2371 mm	1260 mm	1028 mm	593 mm	1701 mm	2051 mm
IRB 4600-45/2.05	2371 mm	1260 mm	1028 mm	593 mm	1701 mm	2051 mm
IRB 4600-40/2.55	2872 mm	1735 mm	1393 mm	680 mm	2202 mm	2552 mm
IRB 4600-20/2.50	2833 mm	1696 mm	1361 mm	665 mm	2163 mm	2513 mm

1.8.2 Performance according to ISO 9283

General

At rated maximum load, maximum offset and 1.6 m/s velocity on the inclined ISO test plane, 1m cube with all six axes in motion. Values in the table below are the average result of measurements on a small number of robots. The result may differ depending on where in the working range the robot is positioning, velocity, arm configuration, from which direction the position is approached, the load direction of the arm system. Backlashes in gearboxes also affect the result.

The figures for AP, RP, AT and RT are measured according to figure below.



xx080000424

Pos	Description	Pos	Description
A	Programmed position	E	Programmed path
B	Mean position at program execution	D	Actual path at program execution
AP	Mean distance from programmed position	AT	Max deviation from E to average path
RP	Tolerance of position B at repeated positioning	RT	Tolerance of the path at repeated program execution

Description	IRB 4600			
	- 60/2.05	-45/2.05	- 40/2.55	- 20/2.50
Pose repeatability, RP (mm)	0.06	0.05	0.06	0.05
Pose accuracy, AP ^a (mm)	0.02	0.02	0.02	0.03
Linear path repeatability, RT ^b (mm)	0.09	0.13	0.28	0.17
Linear path accuracy, AT ^b (mm)	0.74	0.48	0.57	0.93
Pose stabilization time, (PSt) to within 0.4 mm of the position (s)	0.10	0.13	0.40	0.19

a.AP according to the ISO test above, is the difference between the reached position (position manually modified in the cell) and the average position obtained during program execution

b. The values for RT and AT are measured at a velocity of 250 mm/s

The above values are the range of average test results from a number of robots.

1 Description

1.8.3 Velocity

1.8.3 Velocity

Maximum axis speed

Robot Type	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
IRB 4600 - 60/2.05	175 °/s	175 °/s	175 °/s	250 °/s	250 °/s	360 °/s
IRB 4600 - 45/2.05	175 °/s	175 °/s	175 °/s	250 °/s	250 °/s	360 °/s
IRB 4600 - 40/2.55	175 °/s	175 °/s	175 °/s	250 °/s	250 °/s	360 °/s
IRB 4600 - 20/2.50	175 °/s	175 °/s	175 °/s	360 °/s	360 °/s	500 °/s

There is a supervision function to prevent overheating in applications with intensive and frequent movements.

1.8.4 Robot stopping distances and times

Introduction

The stopping distances and times for category 0 and category 1 stops, as required by EN ISO 10218-1 Annex B, are listed in *Product specification - Robot stopping distances according to ISO 10218-1 (3HAC048645-001)*.

1 Description

1.9 Cooling fan for axis 1 and 2 motor

1.9 Cooling fan for axis 1 and 2 motor

Description

A cooling fan can be used to avoid overheating of motors and gears in applications with intensive motion (high average speed and /or high average torque and/or short wait time) of axis 1 and/or axis 2.

Valid protection for cooling fan is IP54. Fan failure stops the robot. The option shall not be used when the robot is placed on a track motion, IRBT.

To determine the use of cooling fans for axis 1 and/or axis 2 motor use the **Gearbox Heat Prediction Tool** in RobotStudio. Contact your local ABB organization for more information.

1.10 Customer connections

1.10.1 Customer connection on robot

Location of customer connection

For the connection of extra equipment to the robot, cables and air hose are integrated into the robot's cabling, and there can be two UTOW71210SH06 and one UTOW71626SH06 connector on the front part of the upper arm.



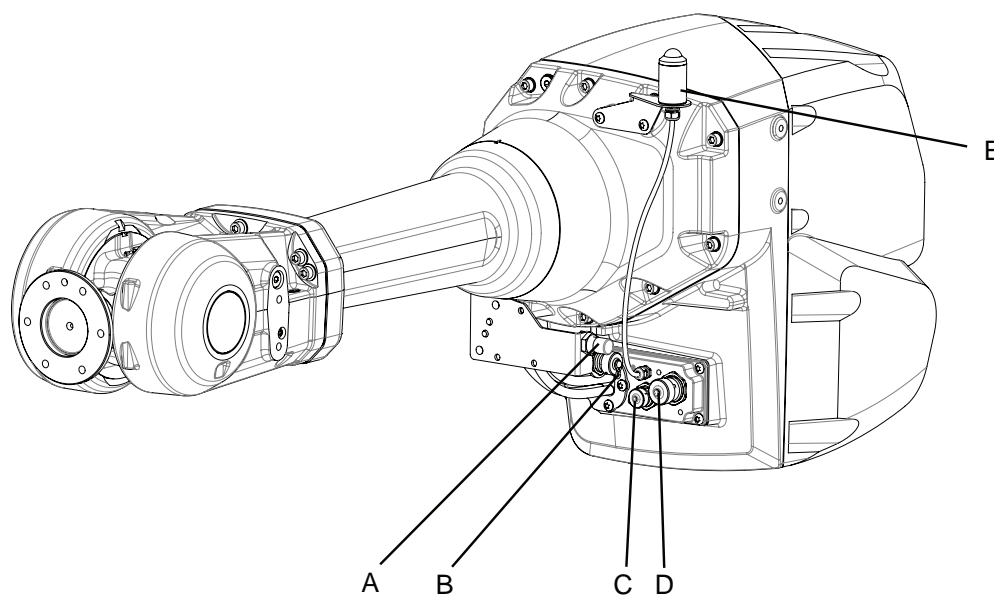
Note

The maximum leakage current for attached equipment must not exceed 10mA.

The customer connections are located on the robot as shown in the figure.

Customer connections on upper arm with signal lamp

The figure shows the customer connections on the upper arm, including the optional signal lamp that can be fitted to the arm house.



xx2000001660

A	R2.PROC1 Air M16x1.5 (24° cone sealing)
B	R2.ETHERNET ⁱ
C	R2.CP or R2.CBUS
D	R2.CS or R2.CP/CS
E	Signal lamp
-	R3.H1 +, R3.H2 - (inside the arm house, not shown in figure)

ⁱ Use a straight ethernet connector. Using an angled connector causes a collision risk with R2.CP, R2.CBUS, R2.CS or R2.CP/CS.

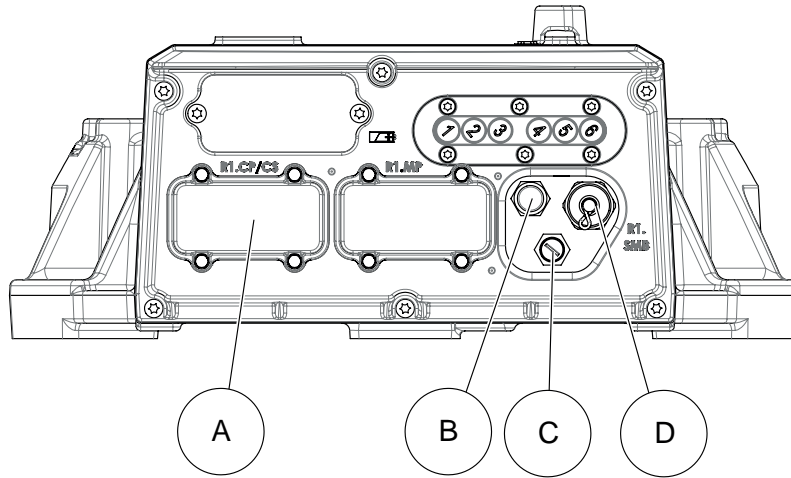
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1 Description

1.10.1 Customer connection on robot

Continued

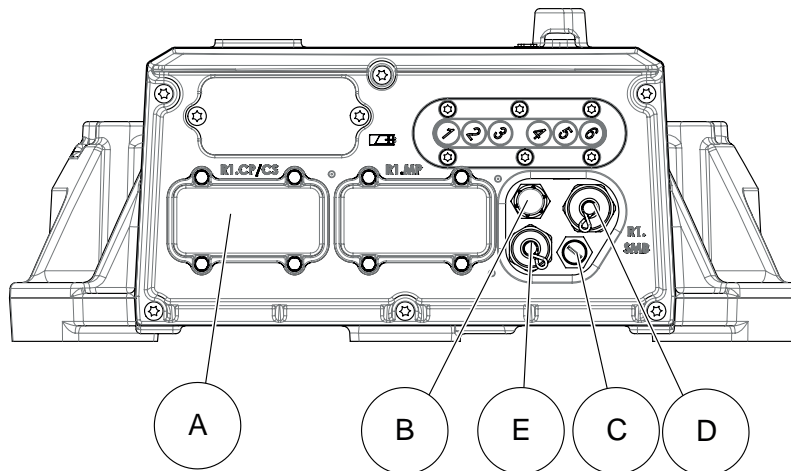
Customer connections base



xx2000001636

A	R1.CP/CS
B	R1.PROC1 (Air M16x1.5)
C	R1.ETHERNET
D	R1.SMB

Customer connections base with 7th axis



xx2000001637

A	R1.CP/CS
B	R1.PROC1 (Air M16x1.5)
C	R1.ETHERNET
D	R1.SMB
E	R2.FB7

Continues on next page

Extra equipment connections

Connections to the:

- air hose (3/8") is located on the front part of the upper arm and at the base. Max. 8 bar. Inner diameter of the air hose: 9.5 mm.

Number of signals, customer connections option Parallel&Air (803-1):

- 23 (50V, 0.5A)
- 9 (300V, 2A). 8 are double crimped in R1.CP/CS and 1 is only accessible in the robot base.
- 1 protective ground

Number of signals, customer connections option Ethernet, Parallel&Air (803-2) and DeviceNet, Parallel&Air (803-3):

- 8 (50V, 0.5A)
- 3 (300V, 2A)
- 2 DeviceNet
- 4 EtherNet
- 1 protective ground

Number of signals, customer connections option Profibus, Parallel&Air (803-4):

- 8 (50V, 0.5A)
- 2 (300V, 2A)
- 2 Profibus
- 1 protective ground

Connection sets

To connect power and signal conductors to the robot base/upper arm connectors, the following parts are recommended.

Connection set	Connector	Art. no.	Content
PROC1 on base	R1.CP/CS	3HAC16667-1	<ul style="list-style-type: none"> • Sockets for cable area of 0.14-2.5 mm² • Hood foundry • Hinged frame, hood • Multicontact-module, female
Connector set on base	R1.ETHER-NET	3HAC033181-001	<ul style="list-style-type: none"> • Hose coupling • M12 connector, male
R2.CP/R2.CS	R2.CP/R2.CS	3HAC025396-001	<ul style="list-style-type: none"> • Pins for cable area 0.21 - 0.93 mm² • Bottle shaped shrinking hose • Angle shaped shrinking hose • Hose coupling
Connector set upper arm	R2.ETHER-NET	3HAC070439-001	<ul style="list-style-type: none"> • Pins for cable area 0.21 - 0.93 mm² • Bottle shaped shrinking hose • Angle shaped shrinking hose

Continues on next page

1 Description

1.10.1 Customer connection on robot

Continued

Power supply connections on the robot

Signal name	Customer Terminal Controller	Customer Contact on Upper arm, R2	Customer Contact on robot base (cable between robot and controller not supplied)
CPA	XP6.1	R2.CP.A	R1.CP/CS.d1
CPB	XP6.2	R2.CP.B	R1.CP/CS.d6
CPC	XP6.3	R2.CP.C	R1.CP/CS.d3
CPD	XP6.4	R2.CP.D	R1.CP/CS.d4
CPE	XP6.1	R2.CP.E	R1.CP/CS.d1
CPF	XP6.2	R2.CP.F	R1.CP/CS.d6
CPG	-	R2.CP.G (Earth)	-
CPH	-	R2.CP.H	R1.CP/CS.d7
CPJ	XP6.3	R2.CP.J	R1.CP/CS.d3
CPK	XP6.4	R2.CP.K	R1.CP/CS.d4

Signal connection on the robot

Signal name	Customer Terminal Controller	Customer Contact on Upper arm, R2	Customer Contact on robot base (cable between robot and controller not supplied)
CSA	XP5.1.1	R2.CS.A	R1.CP/CS.b1
CSB	XP5.1.2	R2.CS.B	R1.CP/CS.b2
CSC	XP5.2.1	R2.CS.C	R1.CP/CS.b3
CSD	XP5.2.2	R2.CS.D	R1.CP/CS.b4
CSE	XP5.2.3	R2.CS.E	R1.CP/CS.b5
CSF	XP5.2.4	R2.CS.F	R1.CP/CS.b6
CSG	XP5.1.9	R2.CS.G	R1.CP/CS.b7
CSH	XP5.1.10	R2.CS.H	R1.CP/CS.b8
CSJ	XP5.1.11	R2.CS.J	R1.CP/CS.b9
CSK	XP5.1.12	R2.CS.K	R1.CP/CS.b10
CSL	XP5.1.3	R2.CS.L	R1.CP/CS.b11
CSM	XP5.1.4	R2.CS.M	R1.CP/CS.b12
CSN	XP5.1.5	R2.CS.N	R1.CP/CS.b13
CSP	XP5.1.6	R2.CS.P	R1.CP/CS.b14
CSR	XP5.3.1	R2.CS.R	R1.CP/CS.b15
CSS	XP5.3.2	R2.CS.S	R1.CP/CS.b16
CST	XP5.3.3	R2.CS.T	R1.CP/CS.b18
CSU	XP5.3.4	R2.CS.U	R1.CP/CS.b19
CSV	XP5.3.5	R2.CS.V	R1.CP/CS.b20
CSW	XP5.3.6	R2.CS.W	R1.CP/CS.b21
CSX	XP5.2.9	R2.CS.X	R1.CP/CS.b22

Continues on next page

Continued

Signal name	Customer Terminal Controller	Customer Contact on Upper arm, R2	Customer Contact on robot base (cable between robot and controller not supplied)
CSY	XP5.2.10	R2.CS.Y	R1.CP/CS.b23
CSZ	XP5.2.11	R2.CS.Z	R1.CP/CS.b24

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2 Specification of variants and options

2.1 Introduction to variants and options

General

The different variants and options for the IRB 4600 are described in the following sections. The same option numbers are used here as in the specification form.

The variants and options related to the robot controller are described in the product specification for the controller.

2 Specification of variants and options

2.2 Manipulator

2.2 Manipulator

Variants

Option	IRB Type	Handling capacity (kg) / Reach (m)
435-87	IRB 4600	60/2.05
435-85	IRB 4600	45/2.05
435-86	IRB 4600	40/2.55
435-94	IRB 4600	20/2.50

Manipulator color

Option	Color	RAL code ⁱ
209-1	ABB orange standard Standard color with protection option 287-3 Foundry Plus	NCS 2070-Y60R
209-2	ABB white standard	RAL 9003
209-196	ABB grey standard Standard color with protection option 287-6 Foundry Prime	NCS 4001-R59B
209-202	ABB Graphite White std Standard color with protection option 287-4 Standard	RAL 7035
209	RAL code should be specified (ABB non-standard colors)	

ⁱ The colors can differ depending on supplier and the material on which the paint is applied.




Note

Notice that delivery time for painted spare parts will increase for ABB non-standard colors.

Protection types

Option	Protection type	Note
287-4	Standard	IP 67
287-3	Foundry Plus 2	See Protection type Foundry Plus 2 on page 11 for a complete description of protection type Foundry Plus 2.

Continues on next page

Option	Protection type	Note
287-6	Foundry Prime 2	<p>See Protection type Foundry Prime 2 on page 12 for a complete description of protection type Foundry Prime 2. Only available for robot versions IRB 4600-60/2.05.</p> <p>The following options are NOT selectable together with option 287-6:</p> <ul style="list-style-type: none"> • 209-2 ABB White standard • 209 RAL code • 213-1 Safety lamp • 87-1 Cooling fan for axis 1 motor • 88-1 Cooling fan for axis 2 motor • 429-1 Underwriters Laboratories • 438-2 Standard + 12 Months • 438-4 Standard + 18 Months • 438-5 Standard + 24 Months • 438-6 Standard + 6 Months • 438-7 Standard + 30 Months • Limitation of working range for axis 1 and 2, see Limitation for Foundry Prime option. <p> Note</p> <p>For an IRB 4600 with Foundry Prime protection, extra oil and expansion container are needed to be able to have it mounted in an inverted position. For the standard and Foundry Plus the extra parts and oil are not needed to be able to have it mounted inverted</p>

Media & Communication

If 803-2, 803-3, or 803-4 is chosen, there are fewer customer connections, see [Customer connections on page 69](#).

Option	Type	Description
803-1	Parallel and air communication	Includes customer power CP and customer signals CS + air.
803-2	Ethernet, parallel and air communication	Includes CP, CS and PROFINET or Ethernet/IP + air.
803-3	DeviceNet, parallel and air communication	Includes CP, CS and Devicenet + air
803-4	PROFIBUS	Includes CP, CS and PROFIBUS + air

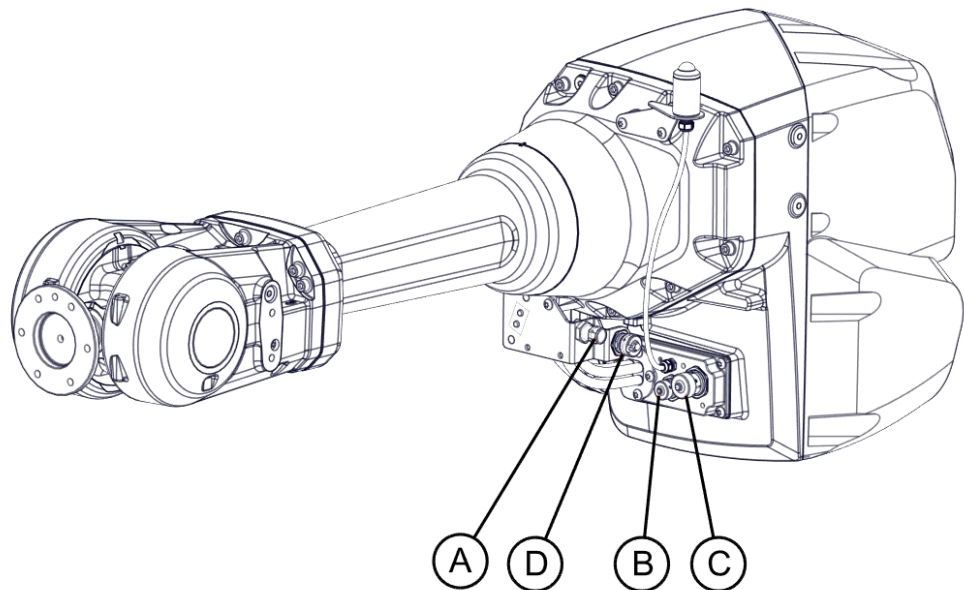
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2 Specification of variants and options

2.2 Manipulator

Continued

Customer connection.



xx1700002241

A	Air M16x1.5 (24° cone sealing)
B	R2.CP
C	R2.CS
D	R2.ETHERNET

Connector kit

The kit consists of connectors, pins and sockets

Option	Description
431-1	For the connectors on the upper arm.
239-1	For the connectors on the foot if connection to manipulator.

Safety lamp

Option	Description
213-1	Safety lamp safety lamp with an orange fixed light can be mounted on the manipulator. The lamp is active in MOTORS ON mode. The safety lamp is required on a UL/UR approved robot.

Cooling fans for axis 1 and 2 motor

To be used to avoid overheating of motors and gears in application with intensive motion (high average speed and/or high average torque and/or short wait time) of axis 1 and axis 2. IP54 valid for cooling fan.

Option	Description
87-1	Cooling fan for axis 1 motor.
88-1	Cooling fan for axis 2 motor.

Continues on next page

Resolver connection, axis 7

A connector for resolver signals for axis 7 located on the base

Option	Description	Remark
864-1	On base	Used together with first additional drive, option 907-1.

Foundry Plus Cable Guard

The manipulator cables are equipped with an additional protection of aluminized leather against e.g. aluminium spitz and flashes and chips from machining.

Option	Type	Description
908-1	Foundry Cable Guard	For extra protection of cables. Requires option 287-3 Foundry Plus.

Electronic Position Switches (EPS)

Electronic Position Switches (EPS) is an additional safety computer in the controller, with the purpose of providing safe output signals representing the position of robot axes. The output signals are typically connected to cell safety circuitry and/or a safety PLC which takes care of interlocking the robot cell, for example in order to prevent robot and operator to enter a common area simultaneously. See *Application manual - Electronic Position Switches*.

Working range limit-Axis 1

The working range of axis 1 can be limited between $\pm 129^\circ$ to $\pm 16.5^\circ$ in steps of 22.5° .

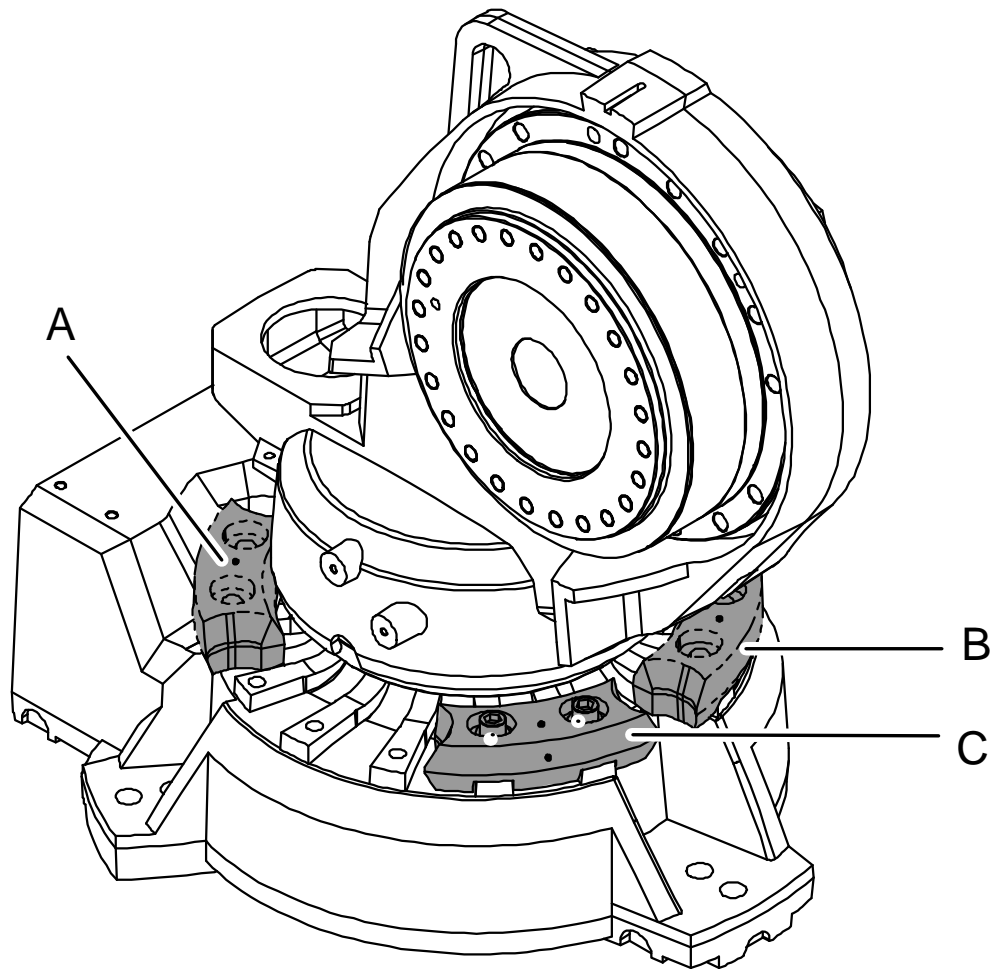
Option	Description
28-1 Axis 1	Two stops for restricting the working range. The stops can be mounted according to example in the figure.

Continues on next page

2 Specification of variants and options

2.2 Manipulator

Continued



xx0800000410

Pos	Description
A	Movable mechanical stop, limited to -129°
B	Movable mechanical stop, limited to $+16.5^\circ$
C	Movable mechanical stop, limited to -16.5°

Warranty


For the selected period of time, ABB will provide spare parts and labor to repair or replace the non-conforming portion of the equipment without additional charges. During that period, it is required to have a yearly *Preventative Maintenance* according to ABB manuals to be performed by ABB. If due to customer restraints no data can be analyzed with ABB Connected Services for robots with OmniCore controllers, and ABB has to travel to site, travel expenses are not covered. The *Extended Warranty* period always starts on the day of warranty expiration. Warranty Conditions apply as defined in the *Terms & Conditions*.



Note

This description above is not applicable for option *Stock warranty* [438-8]

Continues on next page

Option	Type	Description
438-1	Standard warranty	Standard warranty is 12 months from <i>Customer Delivery Date</i> or latest 18 months after <i>Factory Shipment Date</i> , whichever occurs first. Warranty terms and conditions apply.
438-2	Standard warranty + 12 months	Standard warranty extended with 12 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-4	Standard warranty + 18 months	Standard warranty extended with 18 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-5	Standard warranty + 24 months	Standard warranty extended with 24 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-6	Standard warranty + 6 months	Standard warranty extended with 6 months from end date of the standard warranty. Warranty terms and conditions apply.
438-7	Standard warranty + 30 months	Standard warranty extended with 30 months from end date of the standard warranty. Warranty terms and conditions apply.
438-8	Stock warranty	<p>Maximum 6 months postponed start of standard warranty, starting from factory shipment date. Note that no claims will be accepted for warranties that occurred before the end of stock warranty. Standard warranty commences automatically after 6 months from <i>Factory Shipment Date</i> or from activation date of standard warranty in WebConfig.</p> <p> Note</p> <p>Special conditions are applicable, see <i>Robotics Warranty Directives</i>.</p>

2 Specification of variants and options

2.3 Floor cables

2.3 Floor cables

Manipulator cable length

Option	Lengths
210-2	7 m
210-3	15 m
210-4	22 m
210-5	30 m

Application interface Connection to

Option	Name	Description
16-1	Cabinet	The signals are connected to 12-pole screw terminals, Phoenix MSTB 2.5/12-ST-5.08, to the Control Module.

Connection of Parallel/CAN DeviceNet communication

Following information specifies the cable length for Parallel/CAN DeviceNet/Ether-net + PROFIBUS floor cables for connections between cabinets and manipulator.

Option	Lengths
94-1/90-2/859-1/92-2	7m
94-2/90-3/859-2/92-3	15m
90-4/859-3/92-4	22m
94-4/90-5/859-4/92-5	30m

2.4 Floor cables



Note

To comply with the EMC directive, the total cable length (including cables for the motor connection box) must not exceed 30 m between:

Controller and robot (IRB)

Controller and motor & gear units (MU/GU) or track motion (IRT)

Controller and positioner (IRP)

2 Specification of variants and options

2.5 Process

2.5 Process

Process module

Option	Type	Description
768-1	Empty cabinet small	See <i>Product specification - Controller IRC5 with FlexPendant</i> , see chapter 2.2.1
768-2	Empty cabinet large	See <i>Product specification - Controller IRC5 with FlexPendant</i> , chapter 2.2.1

Installation kit

Option	Type	Description
715-1	Installation kit	See <i>Product specification - Controller IRC5 with FlexPendant</i> , chapter 2.2.1

WeldGuide IV

Weldguide IV provides tracking functionality by reading the true impedance values close to the arc at 25 kHz then guides the robot to the correct path. Weldguide IV is designed to track difficult welding joint variations resulting from cast components or other pre-process problems.

Option	Type	Description
992-1	Basic	Occupies one slot and one Ethernet port. Digital I/O or AD Combi I/O is needed for WeldGuide functions. Requires options WG Sensor [994-1] or [995-1], and WeldGuide Multipass [815-2]. Not together with option UL/CSA [429-1].
992-2	Advanced	Includes all <i>Basic</i> functionality and adaptive fill. This feature allows the robot to adjust to the changes in joint width, the weave stroke will increase or decrease, and the travel speed will be adjusted accordingly. Occupies one slot and one Ethernet port. Digital I/O or AD Combi I/O is needed for WeldGuide functions. Requires options WG Sensor [994-1] or [995-1], and WeldGuide Multipass [815-2]. Not together with option UL/CSA [429-1].
994-1	WG Solid core sensor	
995-1	WG Split core sensor	

2.6 Process equipment

Torch service

Option	Type	Description
1037-1	ABB TSC 2013	ABB Torch Service Center. Including: Cleaner, cutter and BullsEye. Occupies I/O signals Dig. 5In/2Out. Requires option Base Dig. 16in/16Out [1541-1].
1037-5	BullsEye	BullsEye stand alone. Requires options RW Arc [633-4], and BullsEye [652-1] or RW Cutting [951-1].

Torch service options

Option	Type	Description
1038-1	Extension pedestal	Extension pedestal for TSC/TC/BullsEye

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3 Accessories

3.1 Introduction to accessories

General

There is a range of tools and equipment available, especially designed for the manipulator.

Basic software and software options for robot and PC

For more information, see *Product specification - Controller IRC5* .

Robot peripherals

- Track Motion
- Motor Units
- Positioners

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