

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

OmniCore

Document ID: 3HAC080366-001

Revision: A

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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 OmniCore 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

References

Reference	Document ID
<i>Product specification - OmniCore V line</i>	3HAC074671-001
<i>Product manual - OmniCore V250XT</i>	3HAC073447-001
<i>Product manual - IRB 4600</i>	3HAC033453-001
<i>Product manual - IRB 4600 Foundry Prime</i>	3HAC040585-001

Revisions

Revision	Description
A	First edition.

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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 OmniCore V250XT 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 - OmniCore V line*.

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 - OmniCore V line*.

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

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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 versions

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

See [Specification of variants and options on page 63](#) 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), and motors (IRB 4400) are sealed with a sealing compound.

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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.

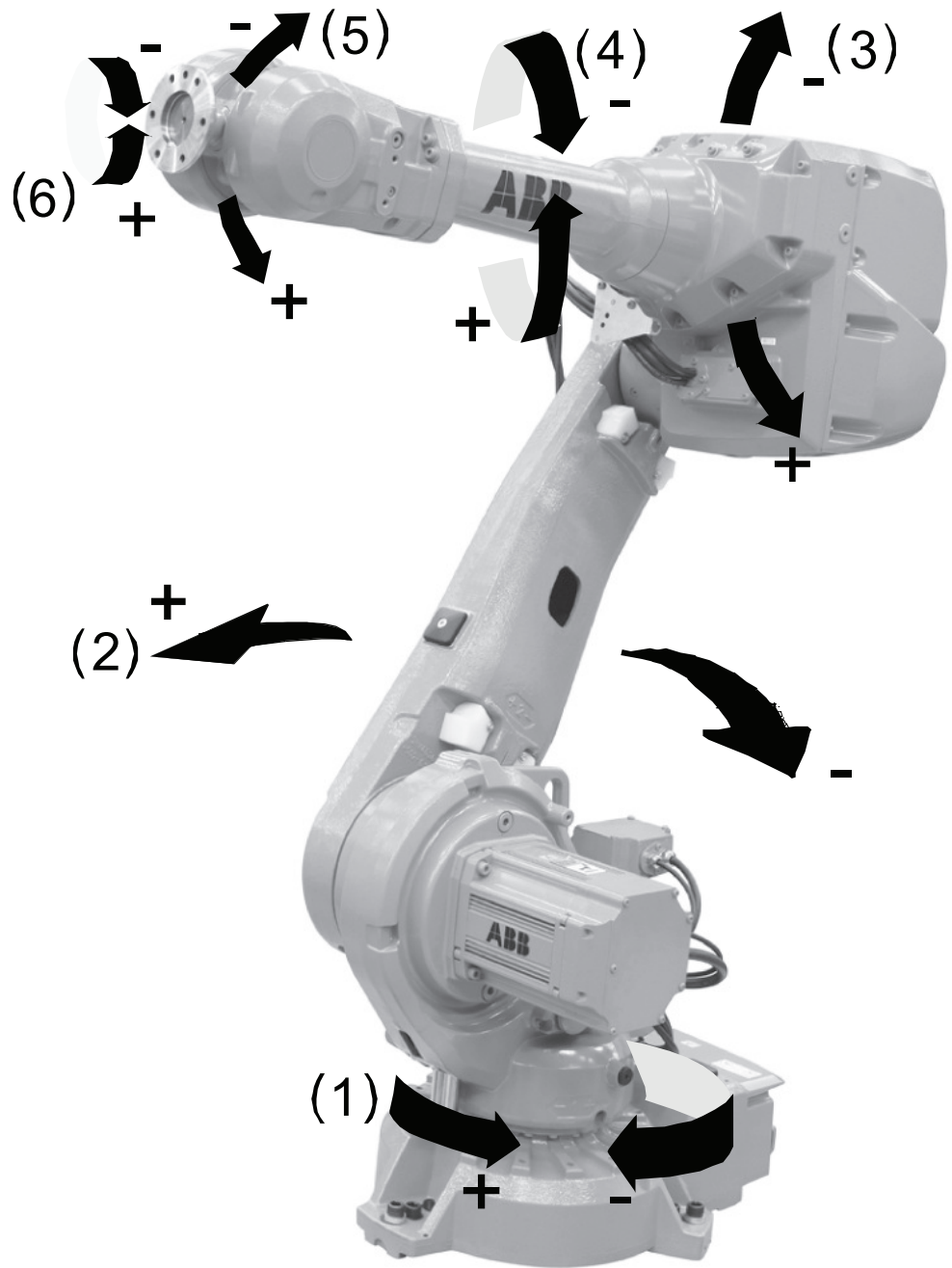
See [Specification of variants and options on page 63](#) for robot versions and other options not selectable together with Foundry Prime.

1 Description

1.1.1 Introduction to Structure

Continued

Manipulator axes



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1.1.2 Different robot versions

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).

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

Manipulator weight

Robot type	Weight
IRB 4600-60/2.05	425 kg
IRB 4600-45/2.05	425 kg
IRB 4600-40/2.55	435 kg
IRB 4600-20/2.50	412 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 load

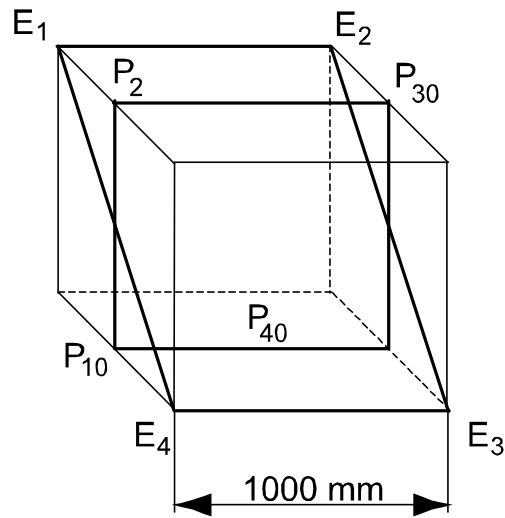
Type of movement	IRB 4600 (all variants)
ISO Cube Max. velocity	1.5 kW
Robot in calibration position	IRB 4600 (all variants)
Brakes engaged	0.16 kW
Brakes disengaged	0.63 kW

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1 Description

1.1.2 Different robot versions

Continued



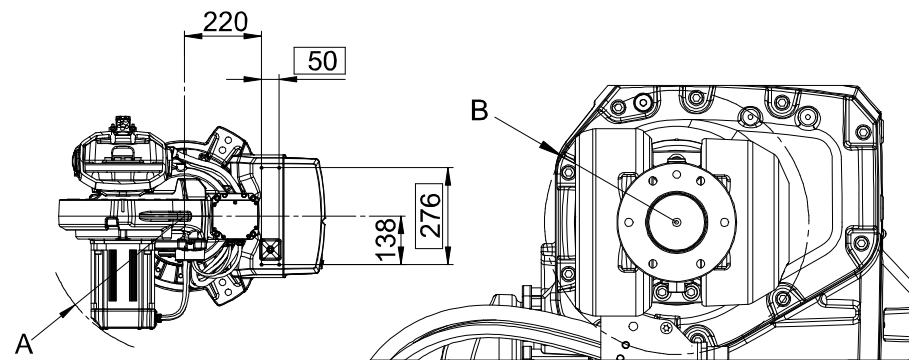
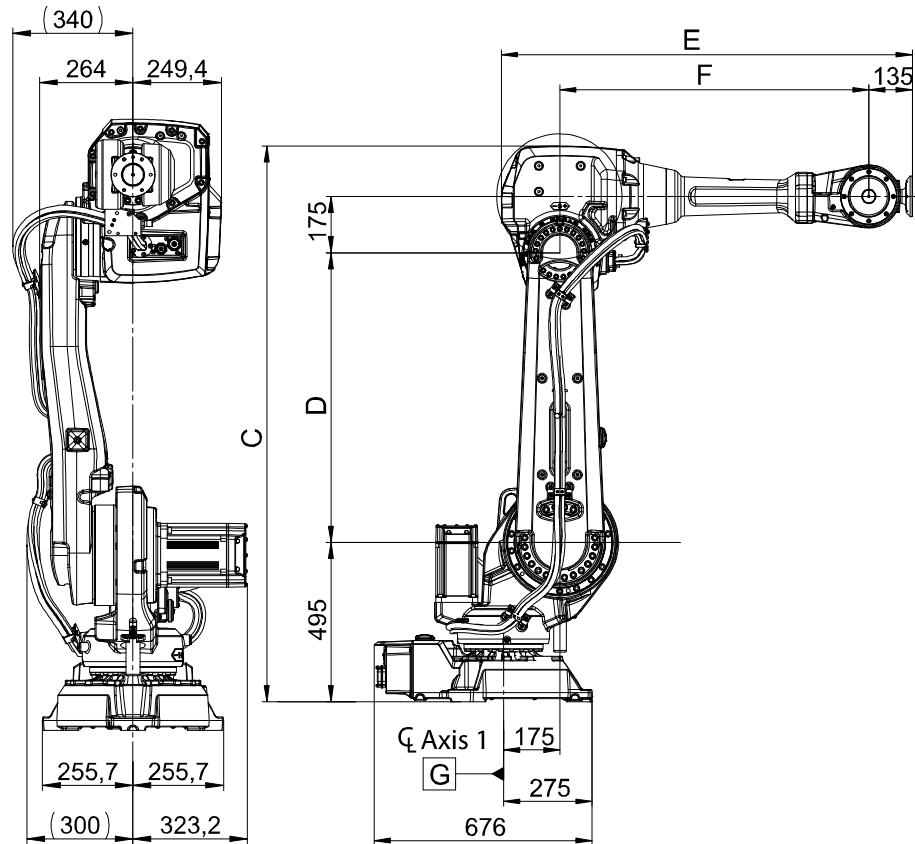
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Power factor ($\cos \varphi$)

The power factor is above 0.95 at a steady state power consumption higher than 2.0 kW, when the IRB 4600 is connected to the OmniCore V line.

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



xx0800000430

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

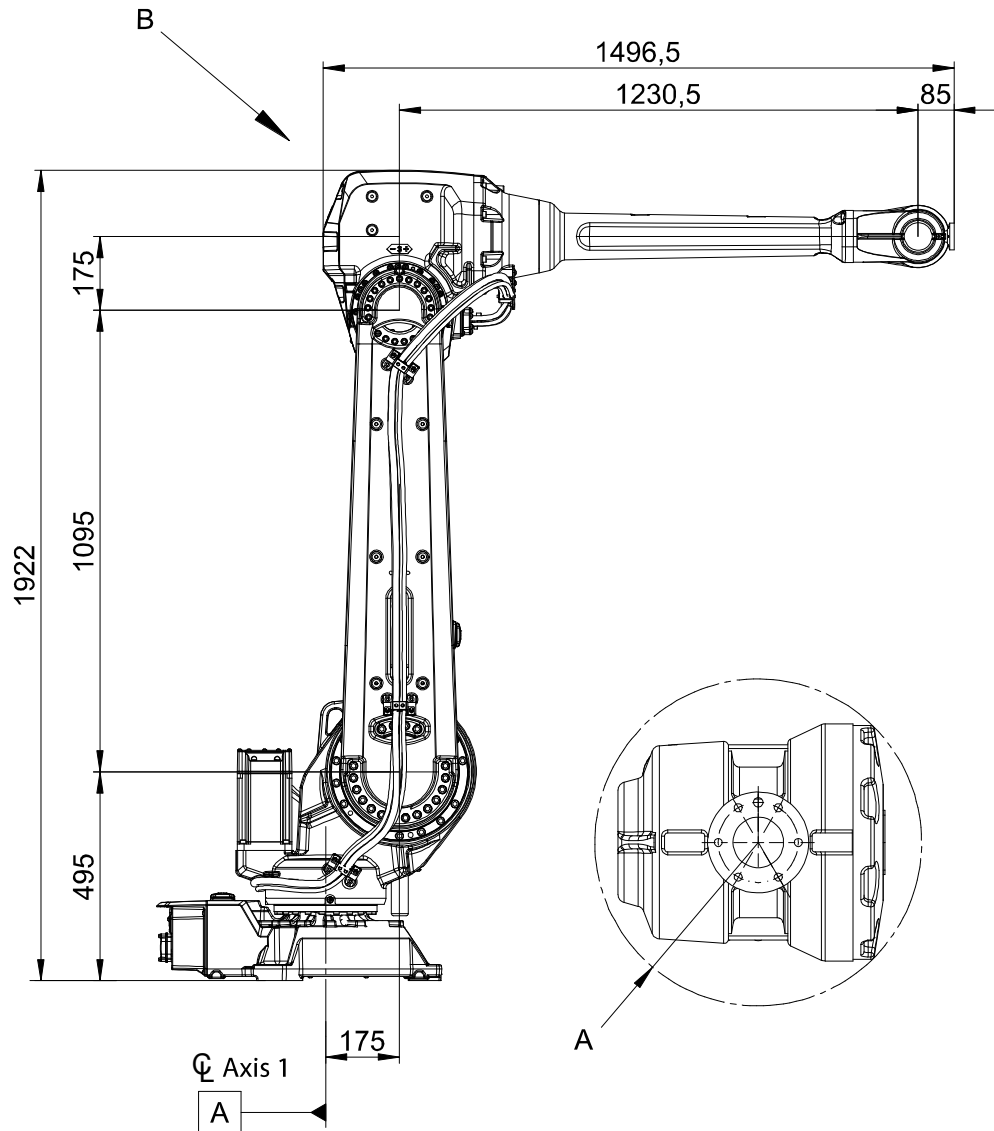
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1 Description

1.1.2 Different robot versions

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

General

The product is compliant 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 deviation from ISO 10218-1:2011, these are listed in the declaration of incorporation. The declaration of incorporation is part of the delivery.

Robot standards

Standard	Description
ISO 9283	Manipulating industrial robots – Performance criteria and related test methods
ISO 9787	Robots and robotic devices – Coordinate systems and motion nomenclatures
ISO 9946	Manipulating industrial robots – Presentation of characteristics

Other standards used in design

Standard	Description
IEC 60204	Safety of machinery - Electrical equipment of machines - Part 1: General requirements, normative reference from ISO 10218-1
IEC 61000-6-2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
IEC 61000-6-4	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
ISO 13849-1:2006	Safety of machinery - Safety related parts of control systems - Part 1: General principles for design, normative reference from ISO 10218-1

Region specific standards and regulations

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

1 Description

1.3.1 Introduction to Installation

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 32](#).

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 43](#)

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.

1.3.2 Operating requirements

Protection standards

Standard IP67 and Foundry Plus IP67.

Explosive environments

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

Ambient temperature

Description	Standard/Option	Temperature
Manipulator during operation	Standard	+ 5 °C ^{a)} (41 °F) to + 45 °C (113 °F)
For the controller	Standard/Option	See Product specification - <i>Product specification - OmniCore V line</i>
Complete robot during transportation and storage	Standard	- 25 °C (- 13 °F) to + 55 °C (131 °F)
For short periods (not exceeding 24 hours)	Standard	up to + 70 °C (158 °F)

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

Relative humidity

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

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

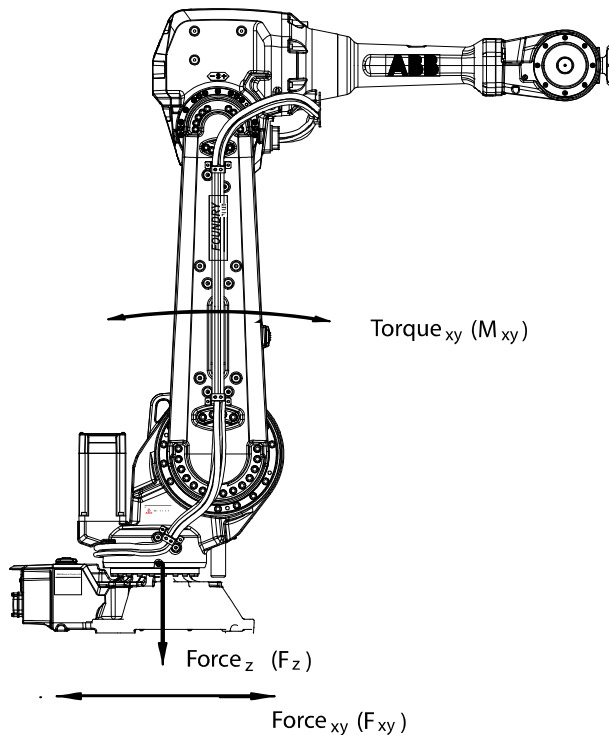
Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	±3940N	±7790 N
Force z	-4350 ±2460N	-4350 ±6360 N
Torque xy	±6850 Nm	±14090 Nm
Torque z	±1610 Nm	±2960 Nm



Note

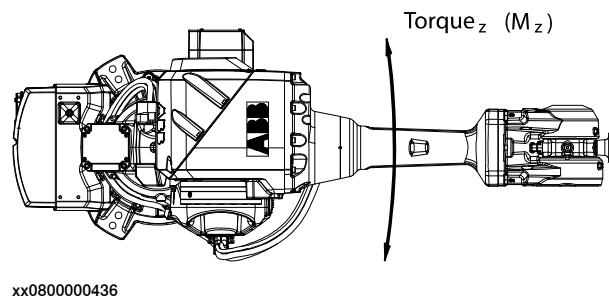
The suspended mounting required option [3317-1] Inverted mounting.

See [Expansion container for inverted mounting of the manipulator on page 23](#)



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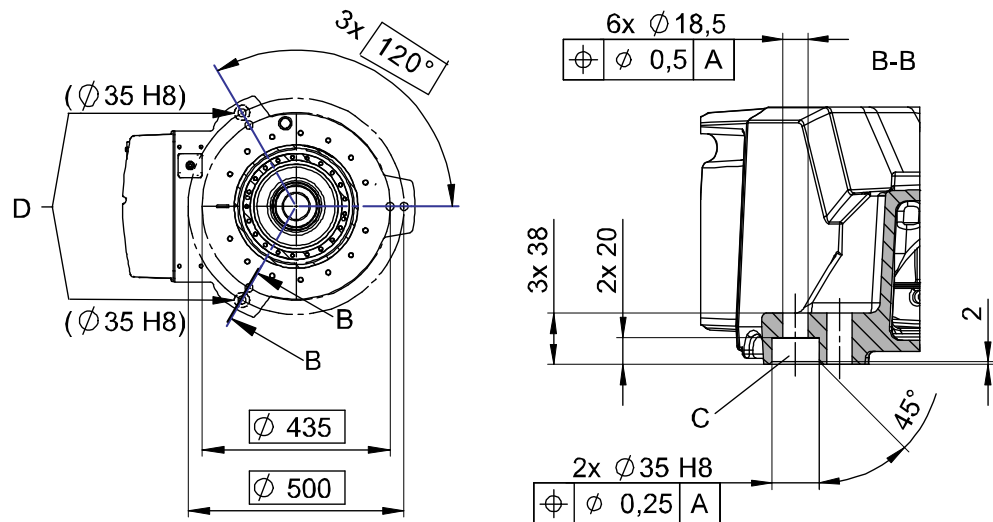
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Note regarding M_{xy} and F_{xy}

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



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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.

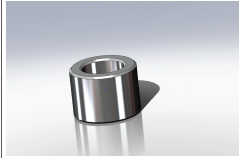
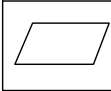
Securing parts/Facts	Dimension	Note
Securing screws, oiled	M16 x 60 (installation directly on foundation) M16 x 70/80 (installation on foundation or base plate, using guide bushings) Quality 8.8	6 pcs 200 Nm
Washers	17 x 30 x 3	6 pcs

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1 Description

1.3.3 Mounting the manipulator

Continued

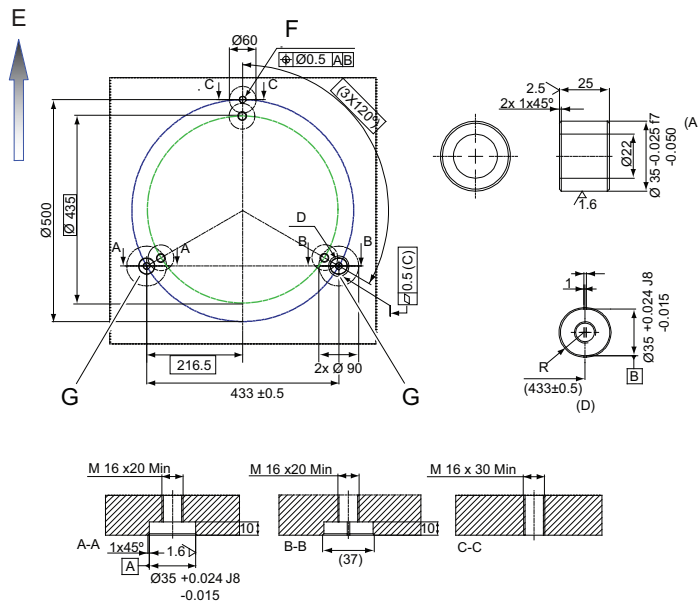
Securing parts/Facts	Dimension	Note
Guide sleeves		<p>Article number: 21510024-169, 2 pcs.</p> <p>Added to the rear bolt holes, to allow the same robot to be re-mounted without program adjustments.</p>  <p>xx1200000885</p>
Level surface requirements	 <p>0.5</p> <p>xx0300000251</p>	



Note

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

Mounting surface and bushings



xx0900000392

(C)	3x common zone
E	Position of the front of the robot
F	4xM16 depth 30, minimum
G	Guide bushing (2 pcs)

1.3.4 Expansion container for inverted mounting of the manipulator



Note

If the robot is used inverted without expansion container, it will cause a reduced lifetime for the gearbox.

Validity of this section

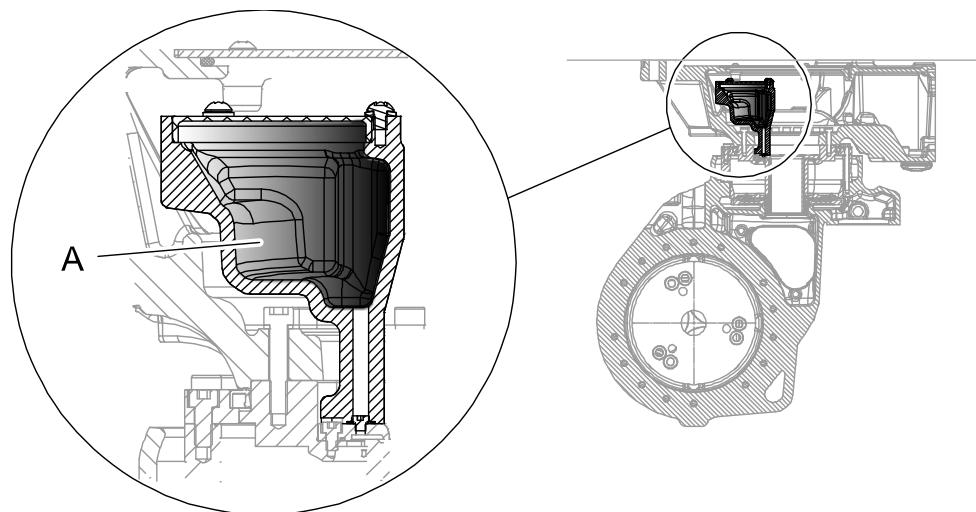
This section is only valid for other design than Type C and Type D, with option [3317-1] Inverted mounting of the manipulator.

Introduction to the expansion container

The expansion container is needed on inverted robots (other design than Type C and Type D) to make sure that the amount of oil in gearbox axis 1 covers all important parts. Robots ordered as suspended robots have the expansion container installed on delivery.

Expansion container

When the robot is fitted in a inverted mounting position, an expansion container for oil must be fitted on gearbox axis 1.



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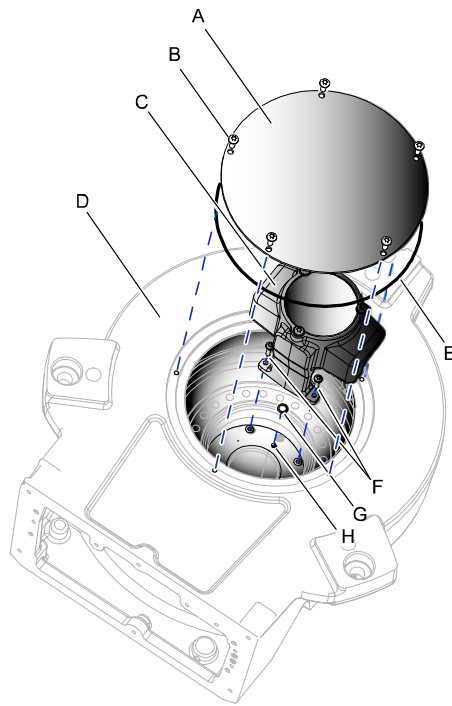
A	Expansion container
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1 Description

1.3.4 Expansion container for inverted mounting of the manipulator

Continued



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A	Cover
B	Attachment screw M6x16, quality 8.8-A2F (5 pcs)
C	Oil expansion container with cover
D	Base
E	O-ring D220x5
F	Attachment screw M5x20, quality 8.8-A2F and washer (2+2 pcs)
G	O-ring D1=9.5 D2=1.6
H	Oil plug (to be removed)

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
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 structure Deflection due to load <p>Absolute accuracy calibration focuses on positioning accuracy in the Cartesian coordinate system for the robot.</p> <p>Absolute accuracy calibration data is found on the SMB (serial measurement board) in the robot.</p> <p>A robot calibrated with Absolute accuracy has the option information printed on its name plate.</p> <p>To regain 100% Absolute accuracy performance, the robot must be recalibrated for absolute accuracy after repair or maintenance that affects the mechanical structure.</p>	CalibWare
Optimization	Optimization of TCP reorientation performance. The purpose is to improve reorientation accuracy for continuous processes like welding and gluing. Wrist optimization will update standard calibration data for axes 4, 5 and 6.	Wrist Optimization

Brief description of calibration methods

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

Continues on next page

1 Description

1.4.1 Calibration methods

Continued

- 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 following routines are available for the Wrist Optimization method:

- Wrist Optimization

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.

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*.

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.

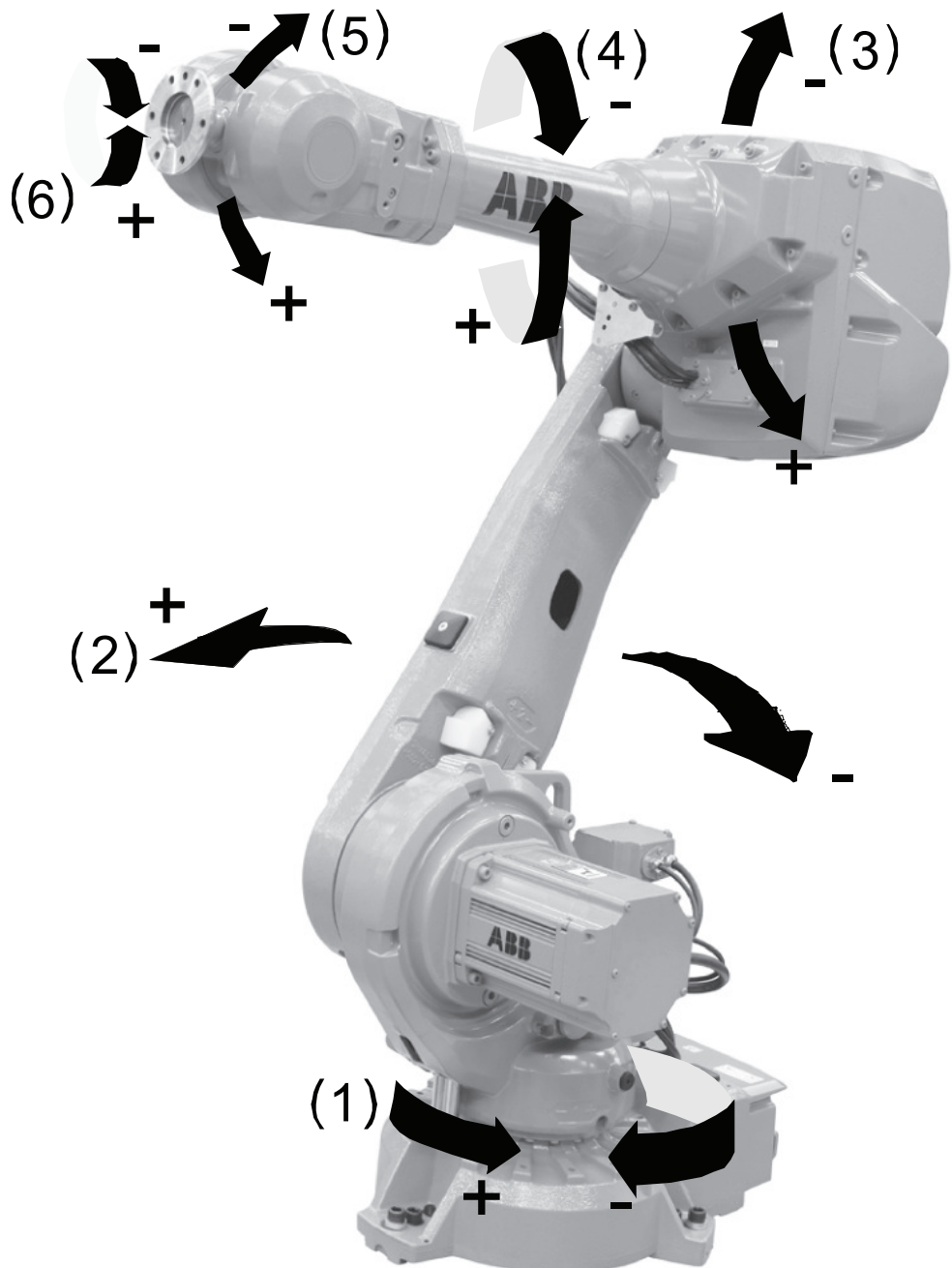
The Absolute Accuracy option varies according to the robot mounting position. This is printed on the robot name plate for each robot. The robot must be in the correct mounting position when it is recalibrated for absolute accuracy.

1.4.2 Fine calibration

Overview

Fine calibration is made using the Axis calibration method, 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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Calibration	Position
Calibration of all axes	All axes are in zero position

Continues on next page

1 Description

1.4.2 Fine calibration

Continued

Calibration	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 eg. vision system 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.

What is included

Every *Absolute Accuracy* robot is delivered with:

- compensation parameters saved on the robot's serial measurement board
- 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. Compensation parameters saved in the robot's serial measurement board 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.

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

Continues on next page

1 Description

1.4.3 Absolute Accuracy calibration

Continued

- 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 jointtarget (`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

1.5 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 - OmniCore*, 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.

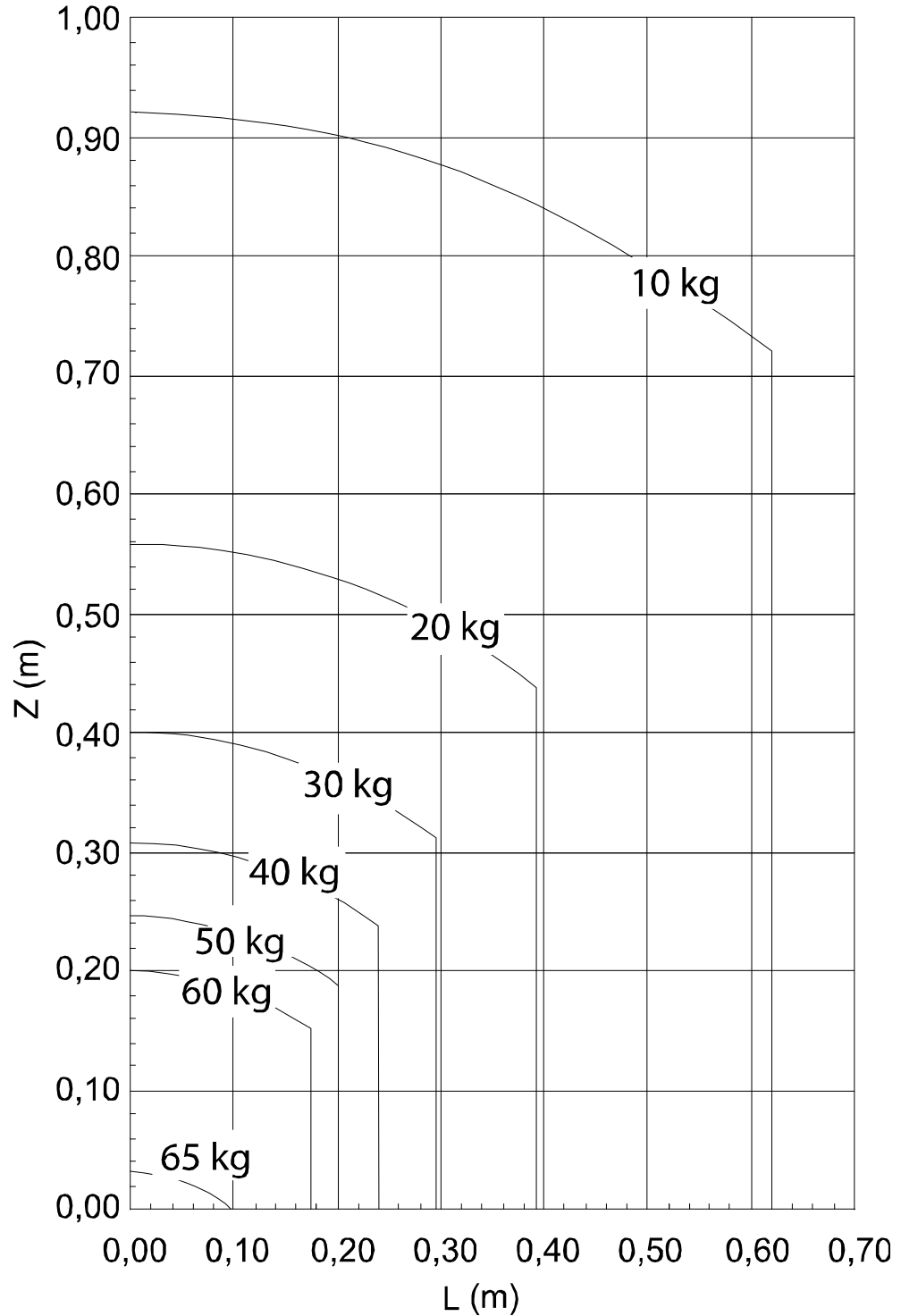
The result from RobotLoad is only valid within the maximum loads and tilt angles. There is no warning if the maximum permitted arm load is exceeded. For over-load cases and special applications, contact ABB for further analysis.

1 Description

1.5.2 Load diagrams

1.5.2 Load diagrams

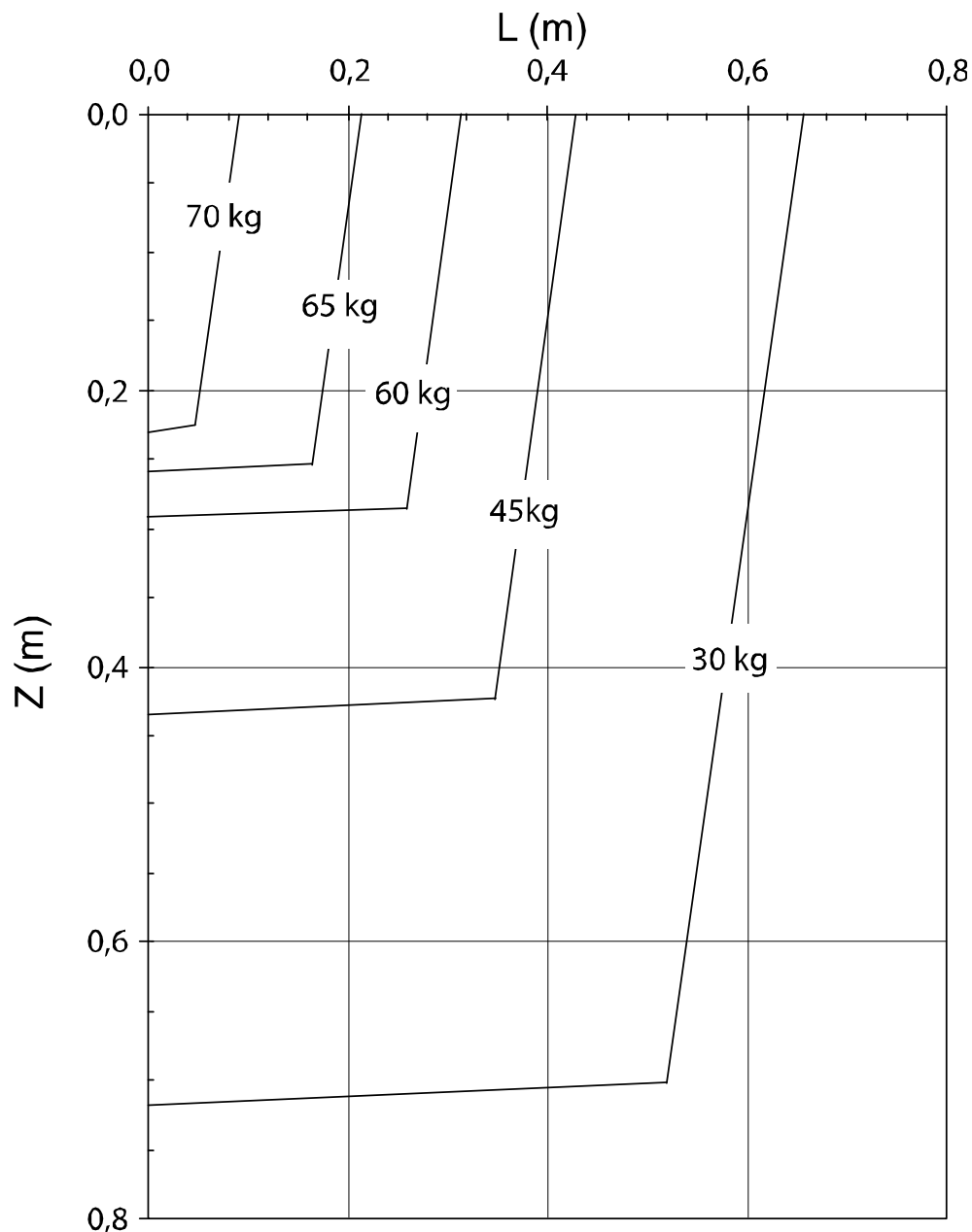
IRB 4600 - 60/2.05



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

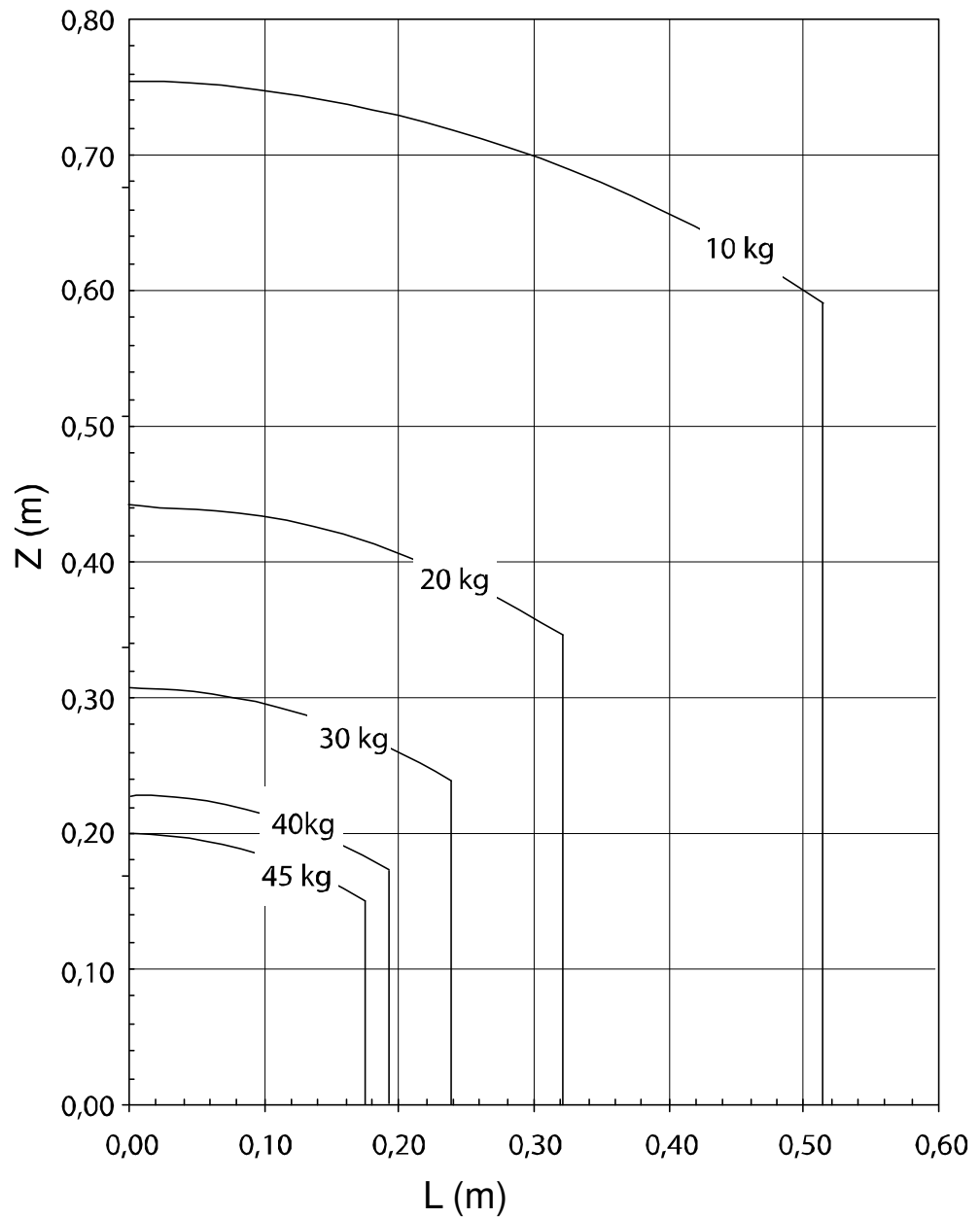
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1 Description

1.5.2 Load diagrams

Continued

IRB 4600 - 45/2.05



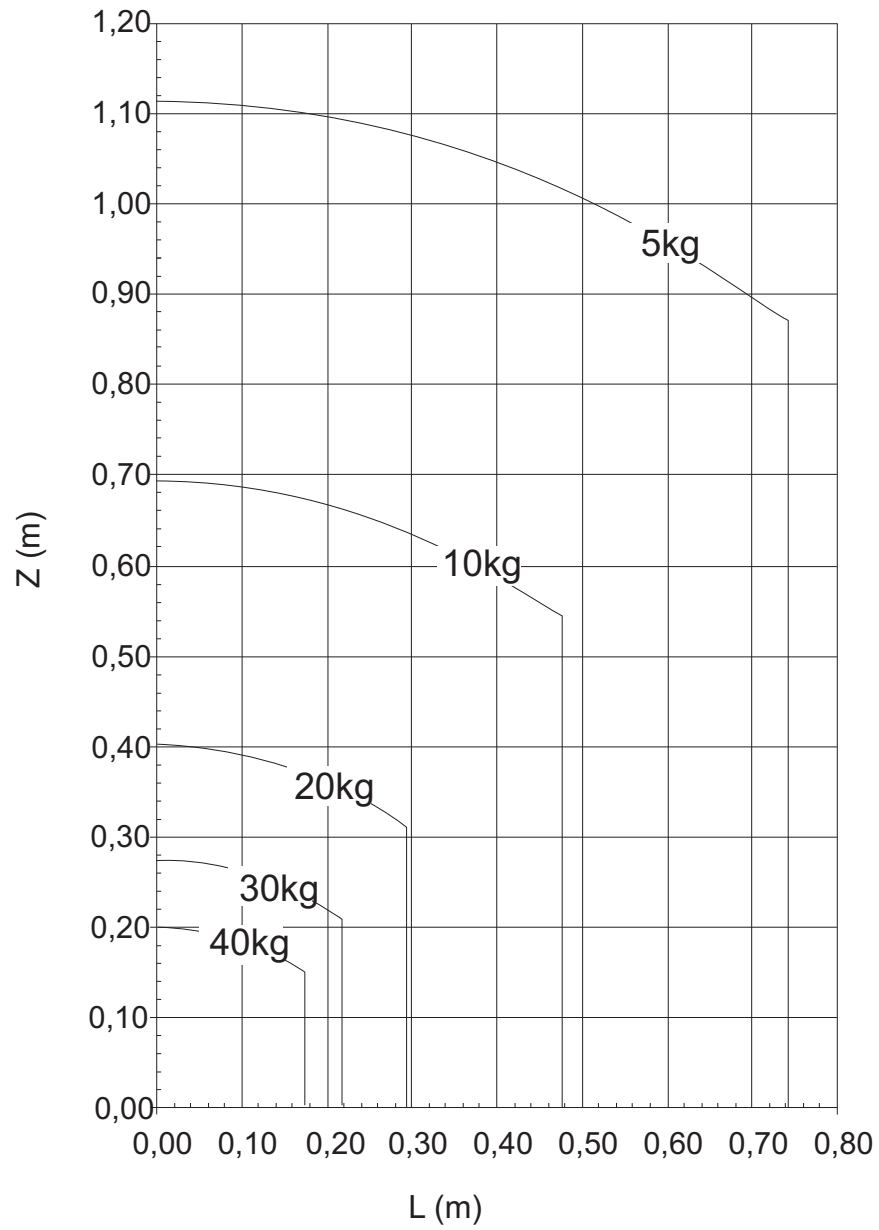
xx090000069

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

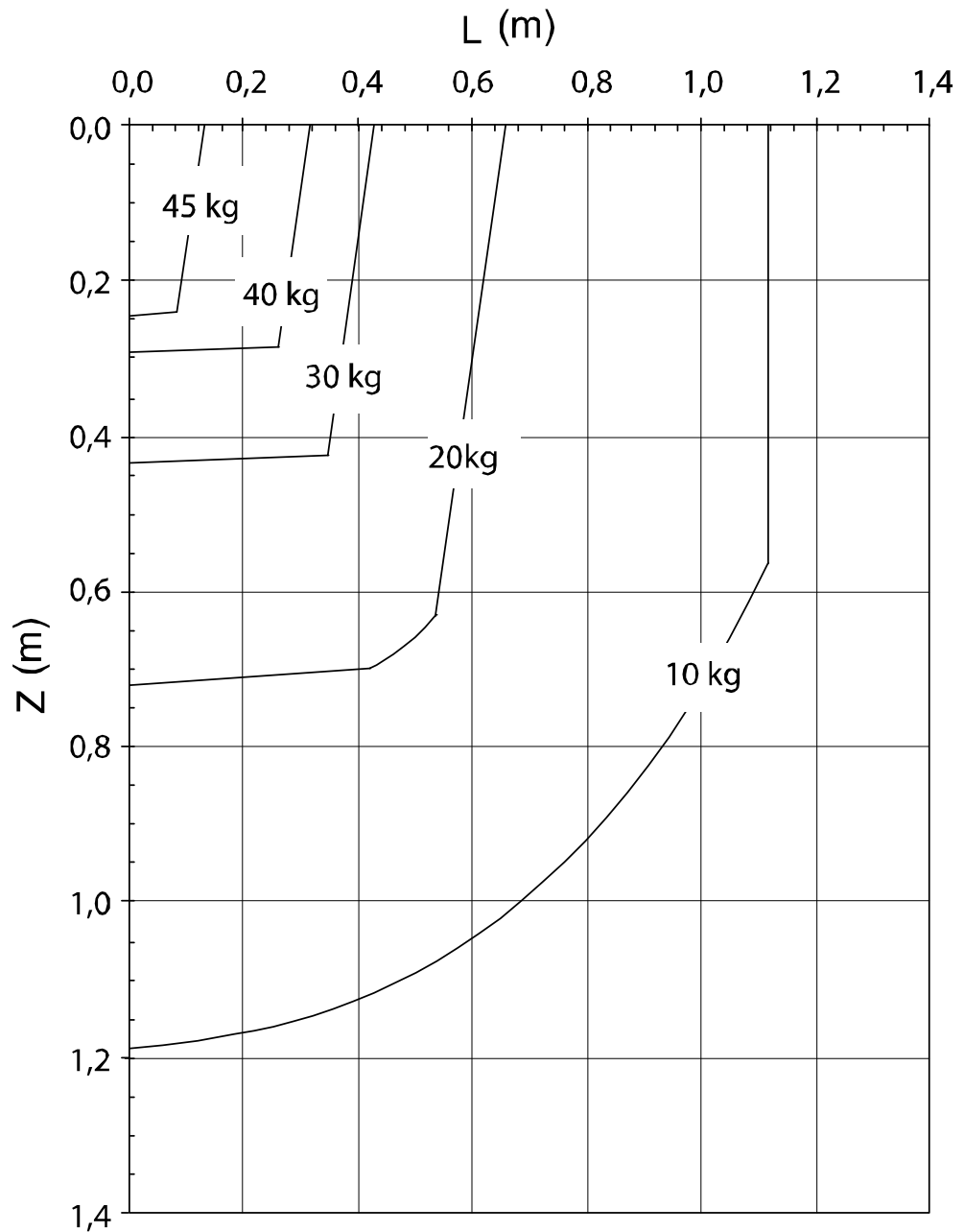
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1 Description

1.5.2 Load diagrams

Continued

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



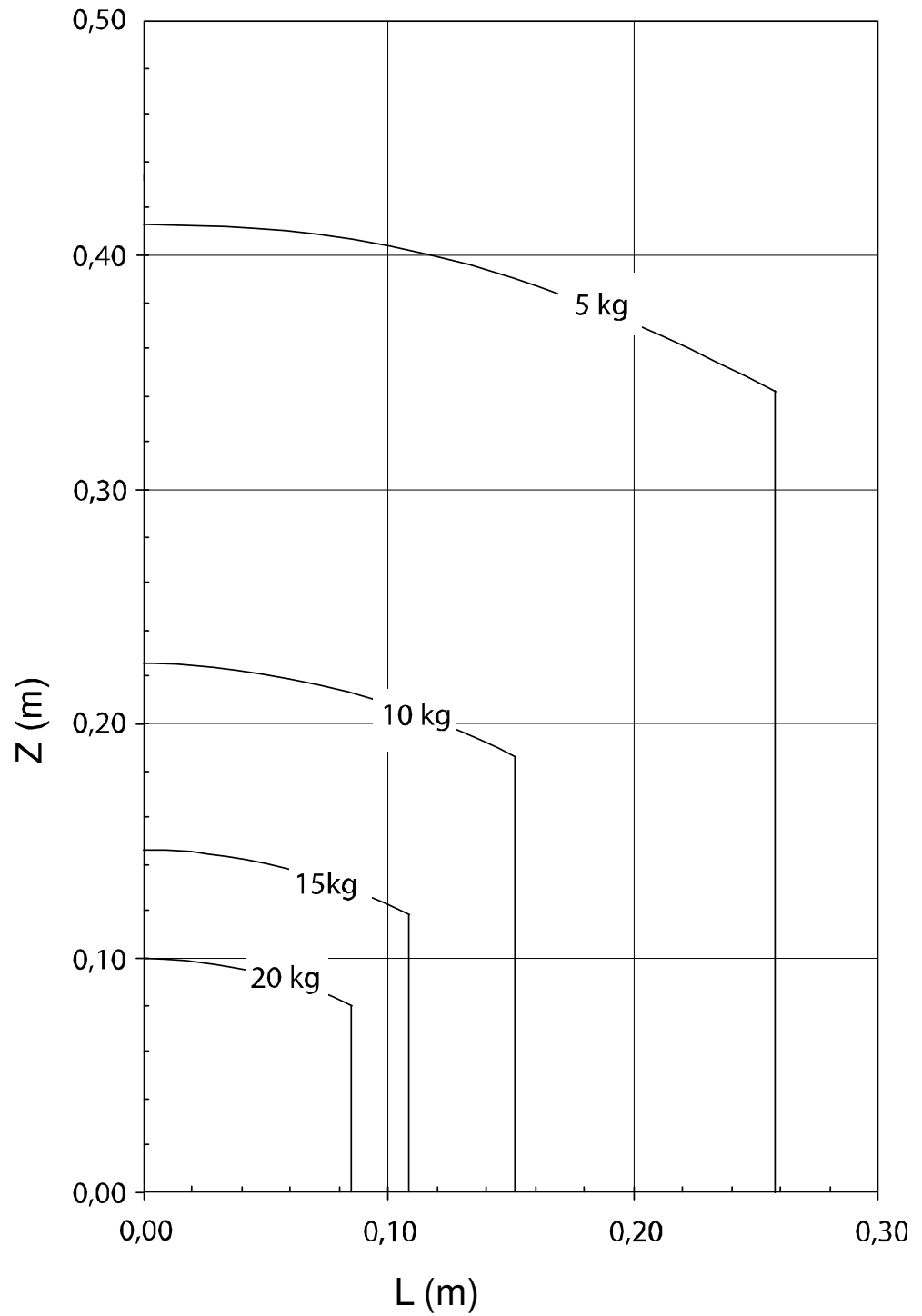
xx0900000068

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

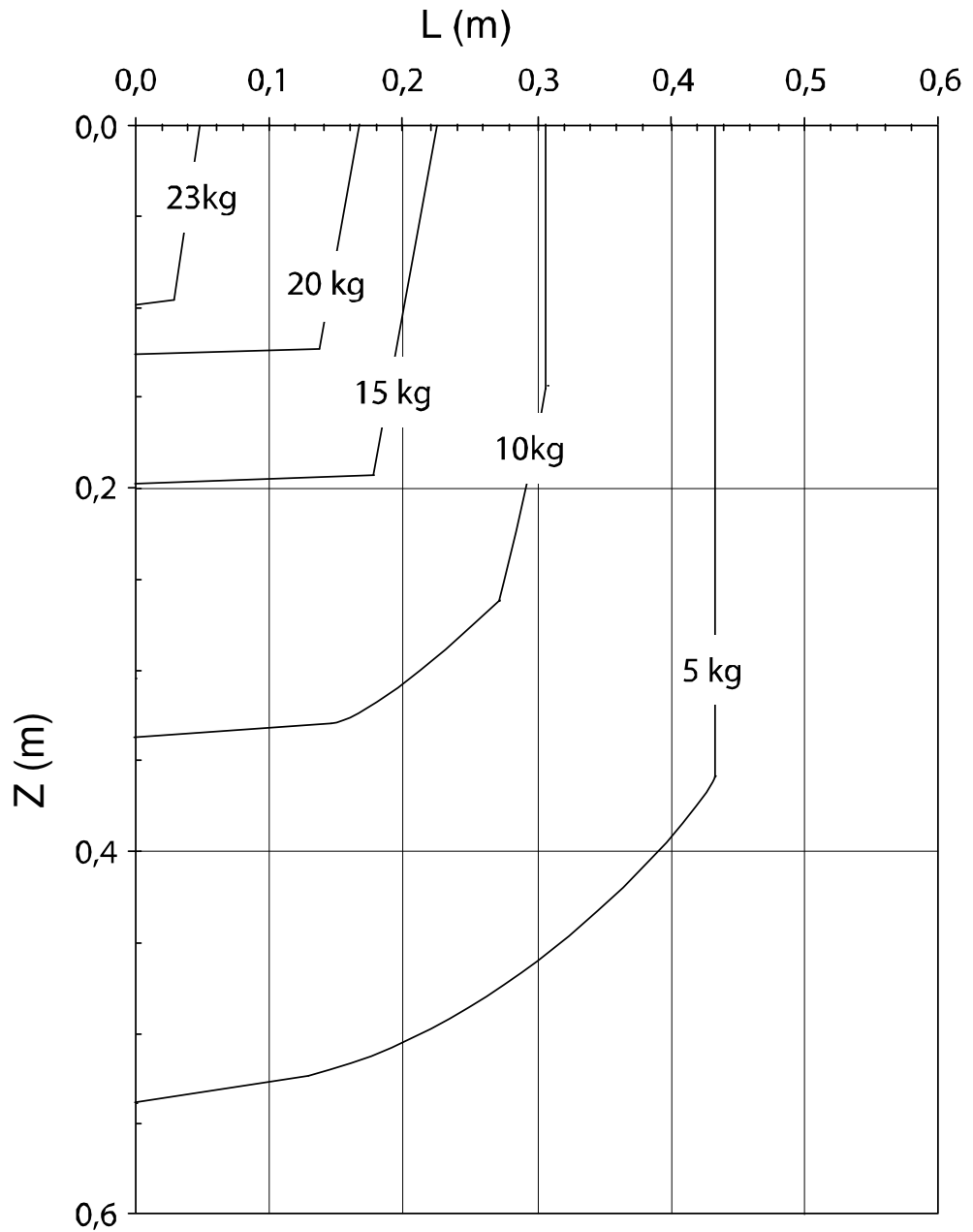
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1 Description

1.5.2 Load diagrams

Continued

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



xx090000067

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

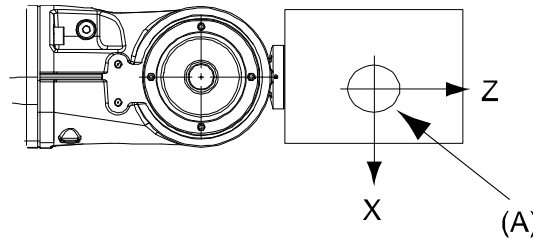


Note

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.

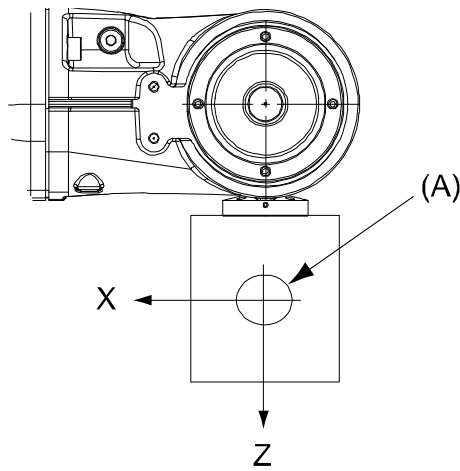
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1 Description

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 then to use RobotStudio.



Note

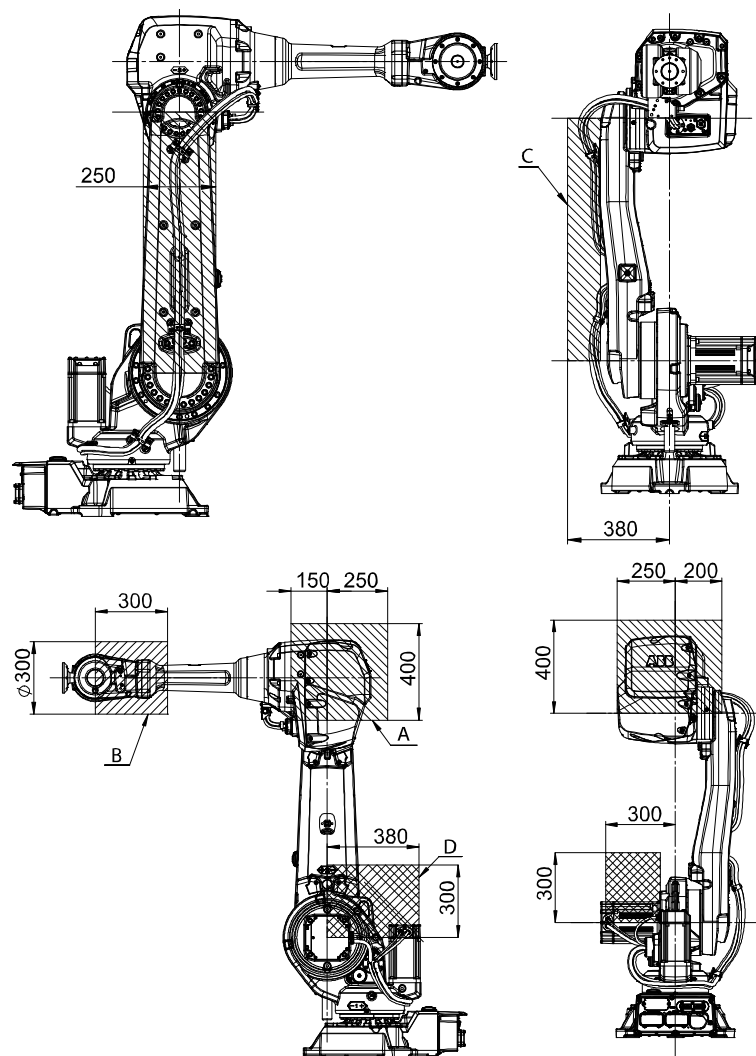
Acceleration levels for emergency stop and controlled motion includes acceleration due to gravitational forces. Nominal load is defined with nominal mass and cog with max offset in Z and L (see the load diagram).

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 44.](#))



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

Continues on next page

1 Description

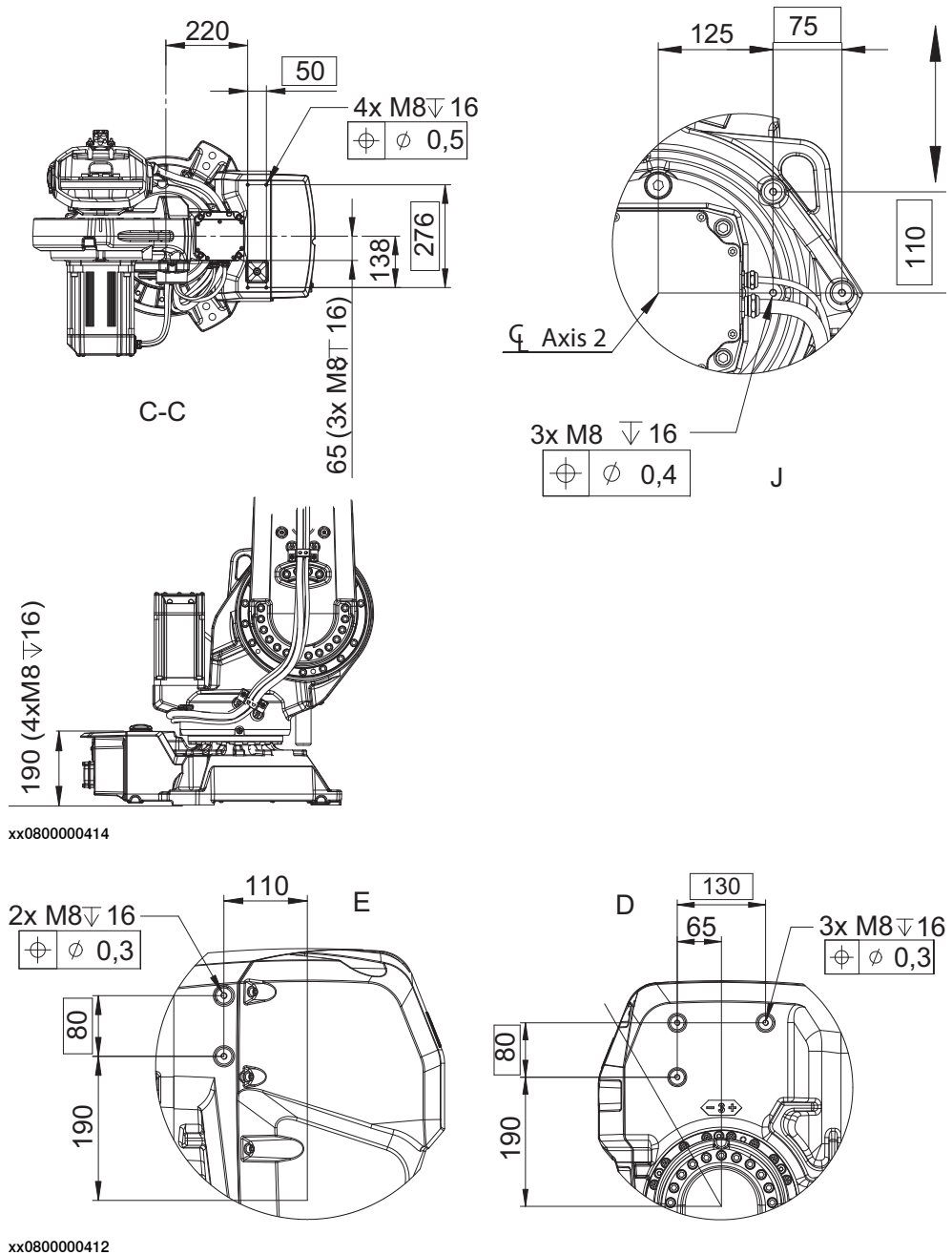
1.6.1 Information about mounting equipment

Continued

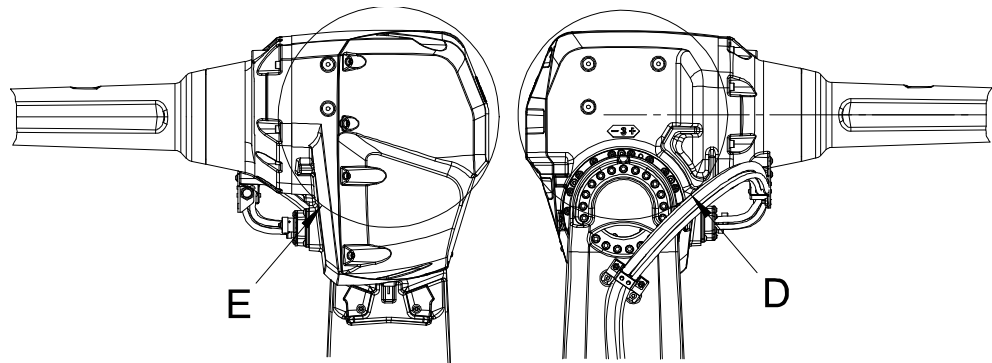
Load area Robot	Max load				
	A	B	C	A+C	D
IRB 4600 - 20/2.50	10 kg	1 kg	10 kg	10 kg	35 kg

- a. Payload + B max 60kg
- b. Payload + B max 45kg
- c. Payload + B max 40kg

Holes for mounting of extra equipment

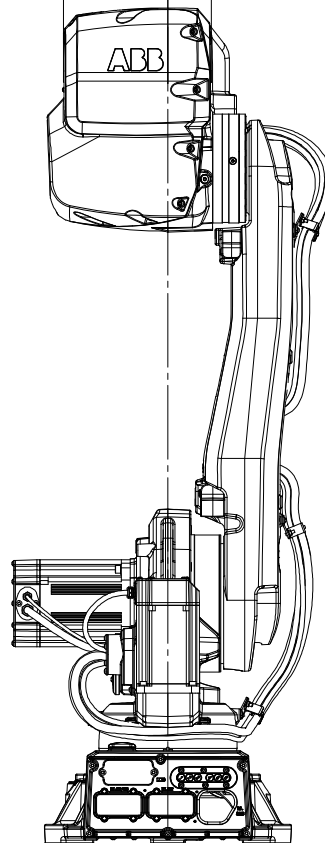


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216 (2x M8 ∇ 16) 90 (3x M8 ∇ 16)

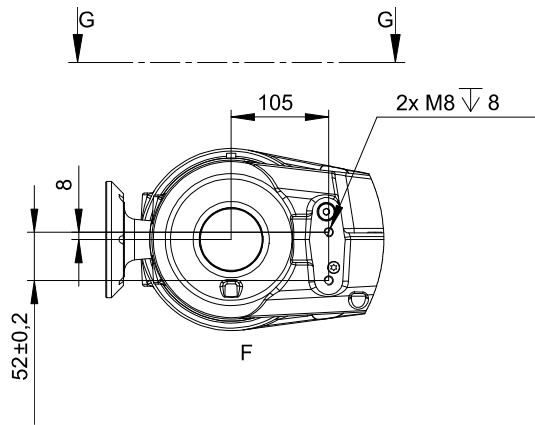


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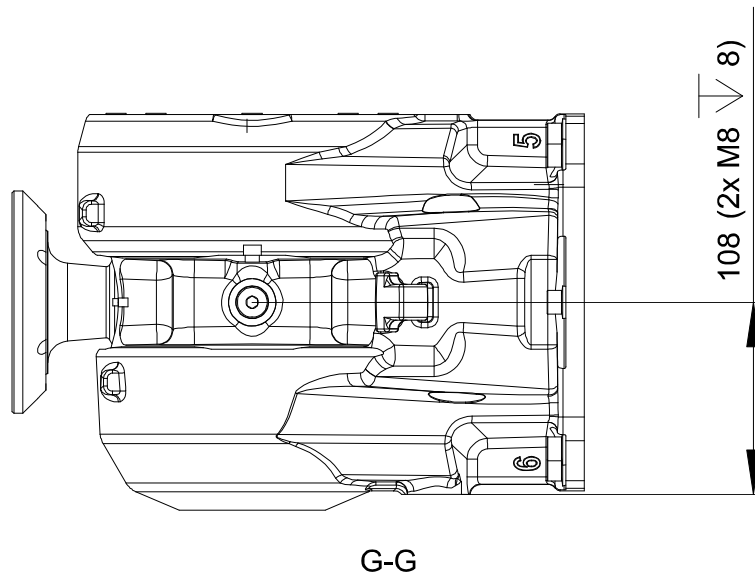
1 Description

1.6.1 Information about mounting equipment

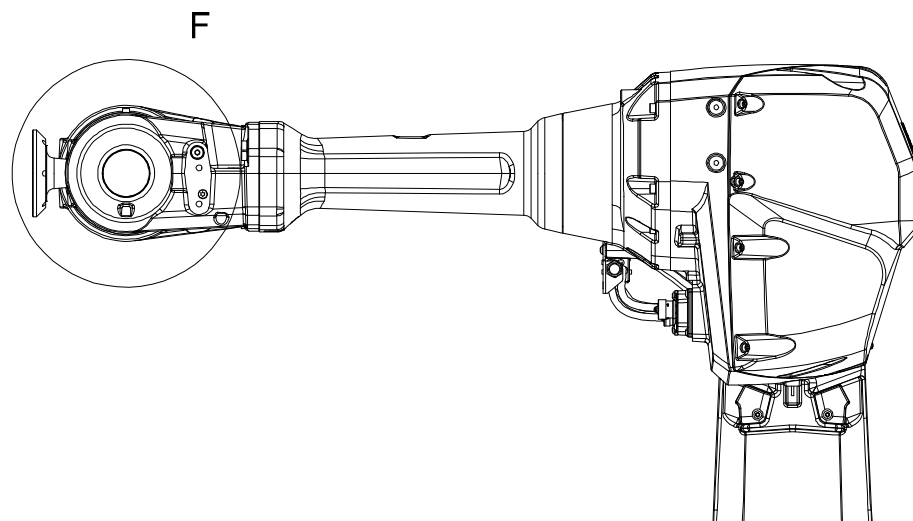
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xx0800000417



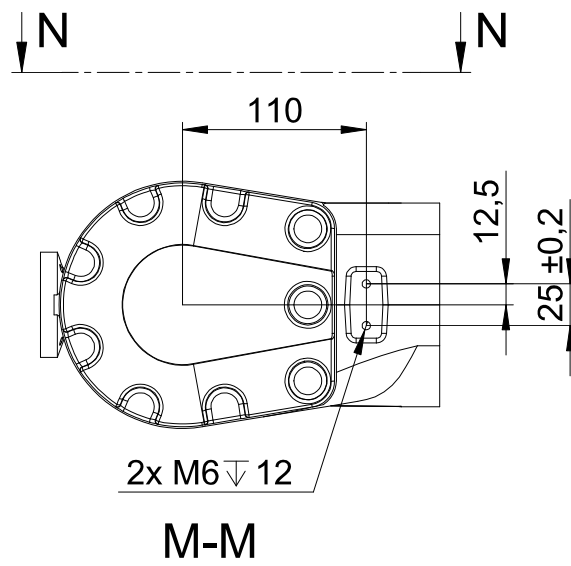
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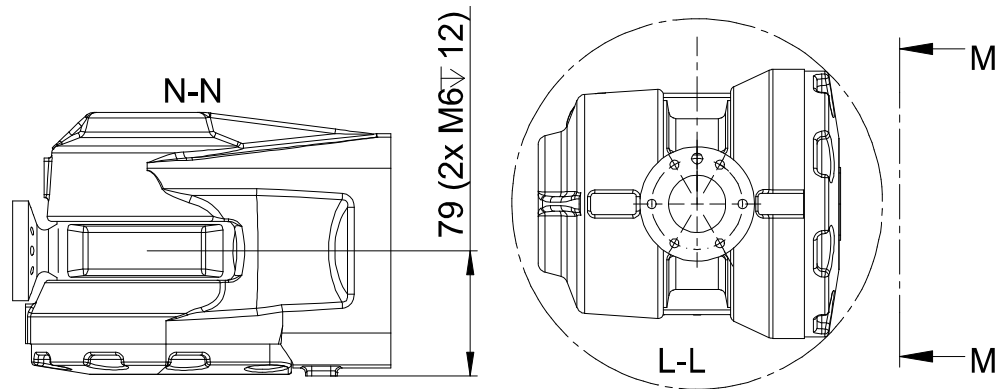
1 Description

1.6.1 Information about mounting equipment

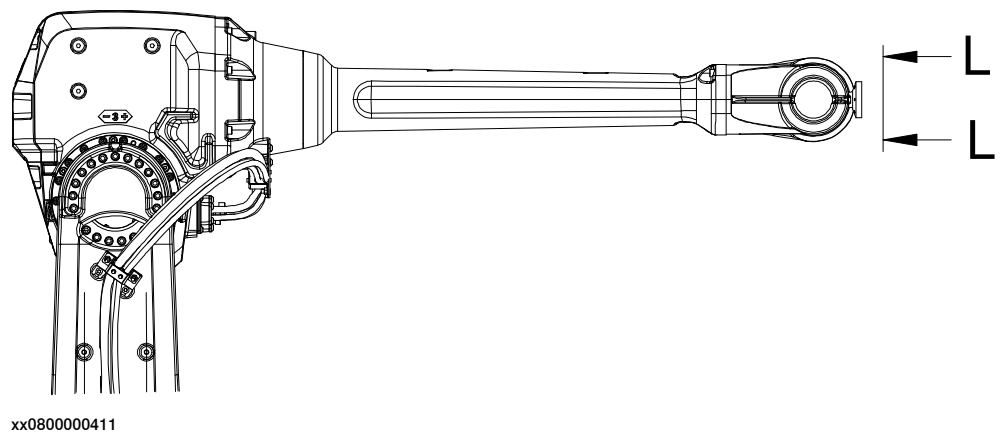
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xx080000408



xx080000411

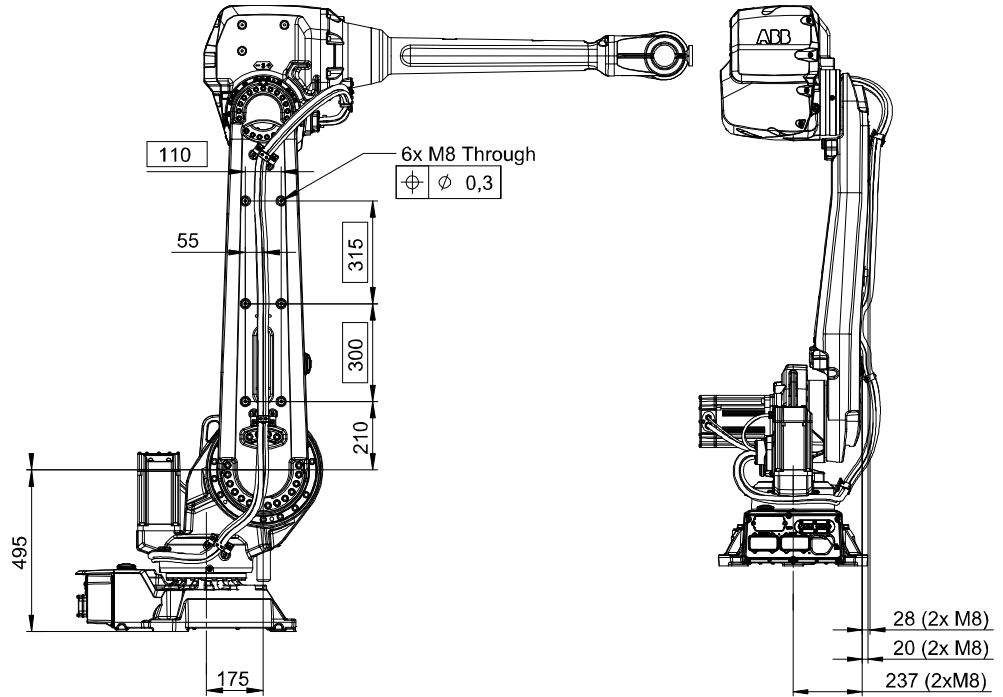
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1 Description

1.6.1 Information about mounting equipment

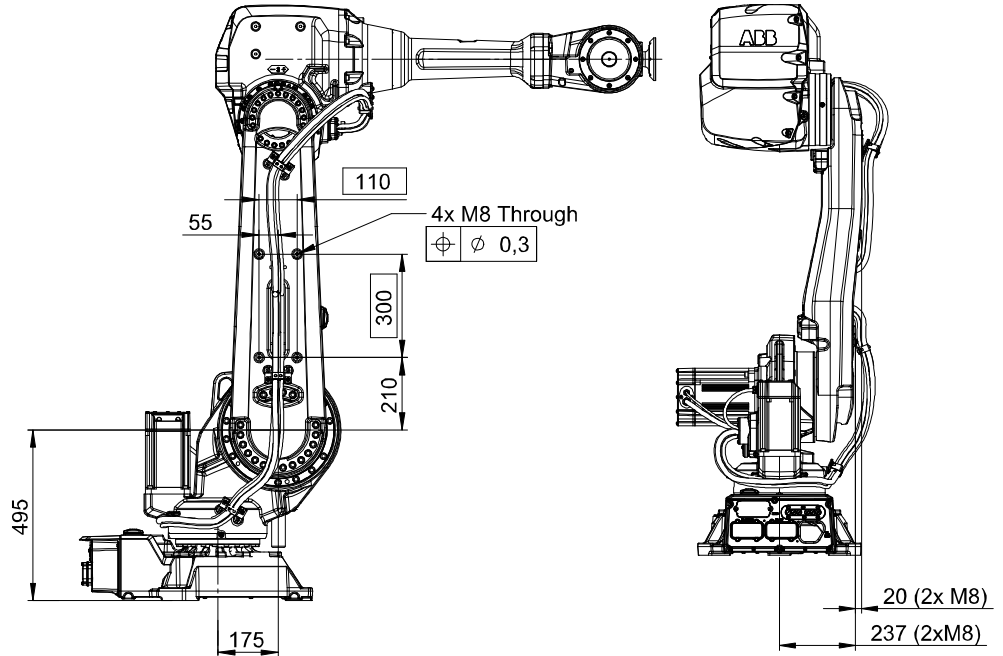
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IRB 4600-40/2.55 and IRB 4600-20/2.50



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IRB 4600 60(45)/2.05

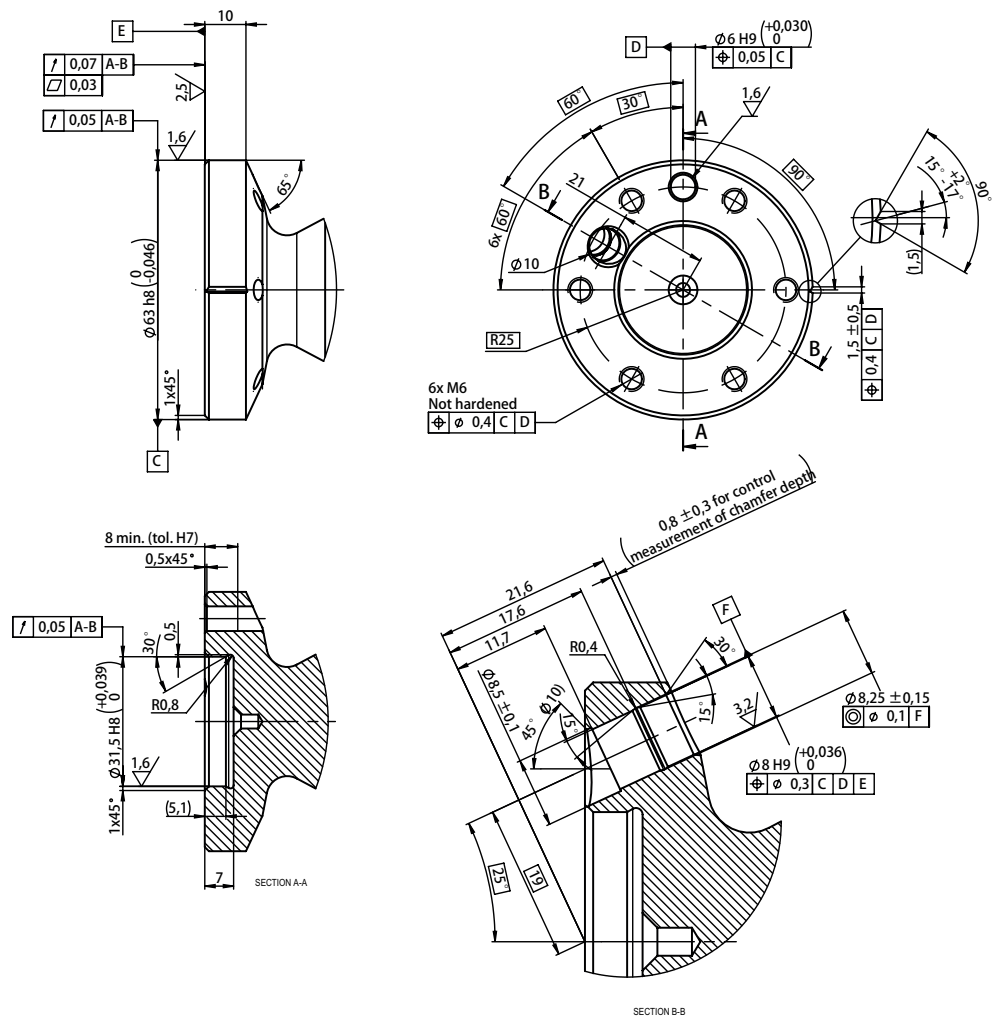


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Tool flange

IRB 4600-20/2.50



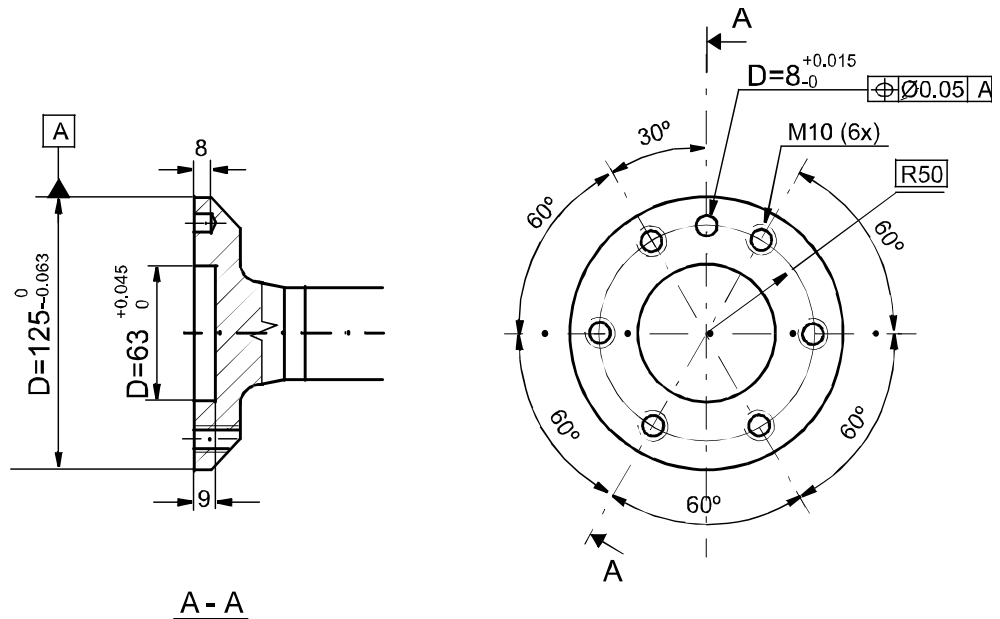
xx080000449

1 Description

1.6.1 Information about mounting equipment

Continued

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



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.

1.7 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 Description

1.8.1 Introduction to Robot Motion

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)

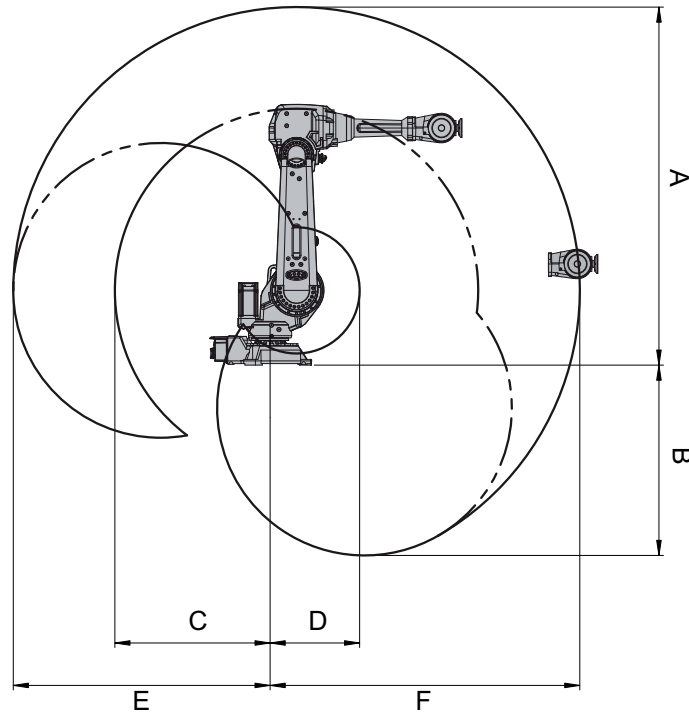


Note

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°.

Continues on next page

Working range, floor mounted



xx090000119

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 Description

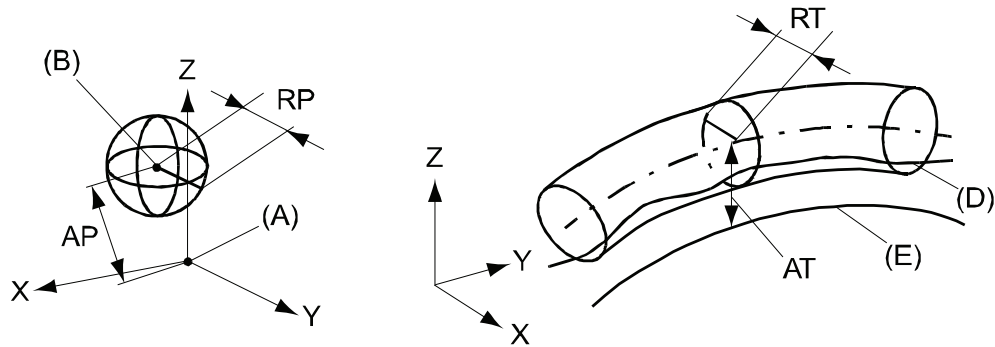
1.8.2 Performance according to ISO 9283

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)	0.46	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.

1.8.3 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 - 45/2.55	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 Description

1.8.4 Robot stopping distances and times

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)*.

1.9 Customer connections

1.9.1 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.

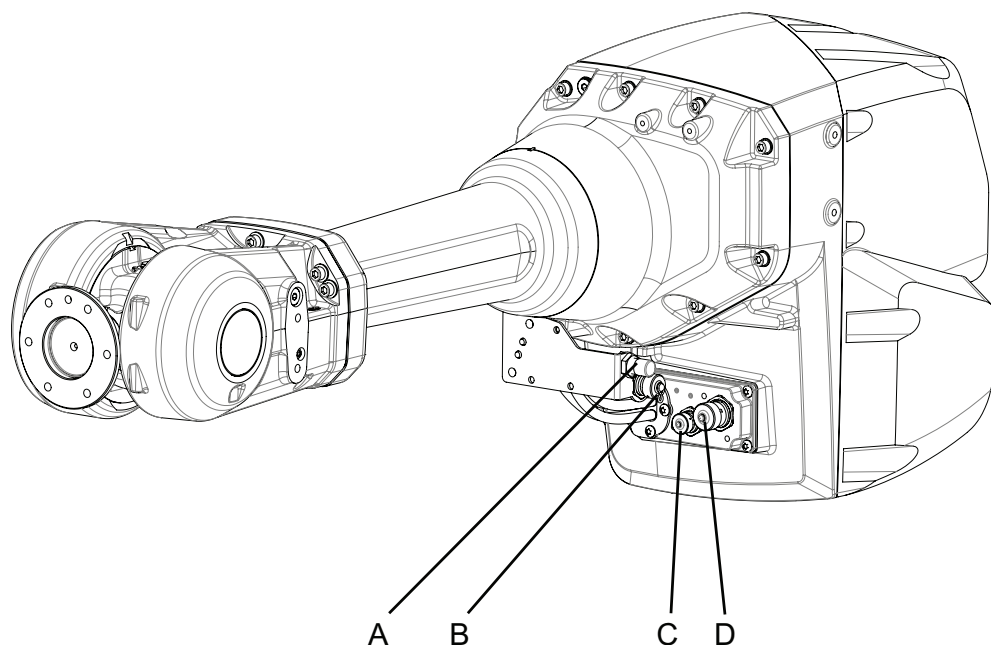


Note

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



xx2000001659

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

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

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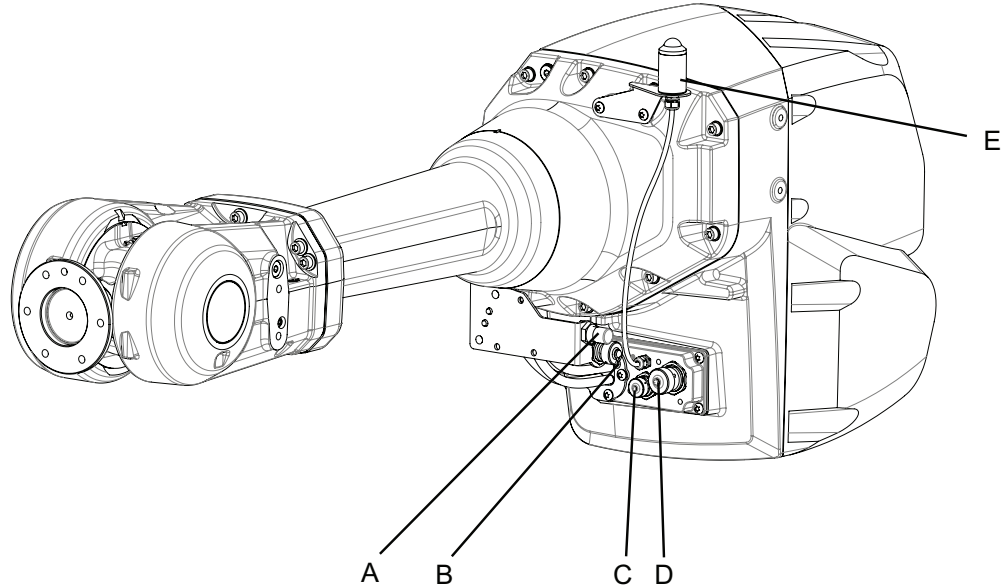
1 Description

1.9.1 Customer connection on robot

Continued

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.



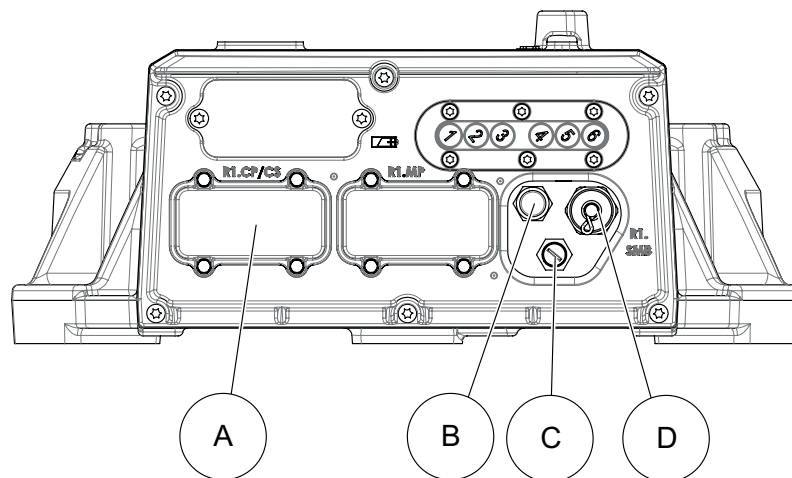
xx2000001660

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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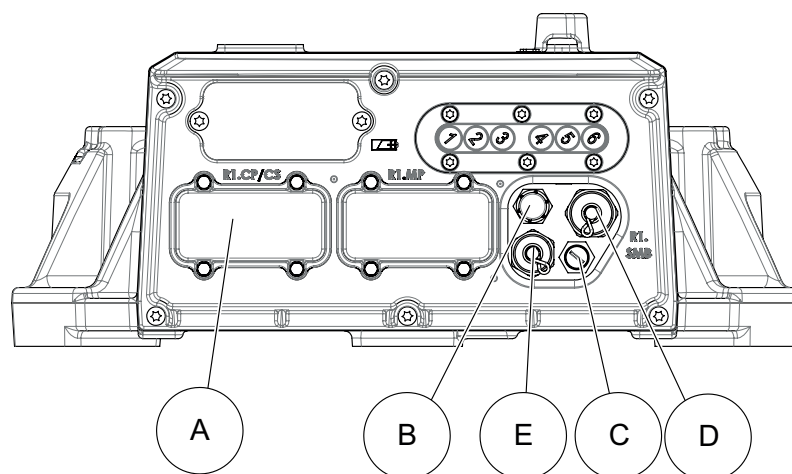
Customer connections base



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

1 Description

1.9.1 Customer connection on robot

Continued

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 (3325-11):

- 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 (3325-13) and DeviceNet, Parallel&Air (3325-12):

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

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

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Signal name	Customer Terminal Controller	Customer Contact on Upper arm, R2	Customer Contact on robot base (cable between robot and controller not supplied)
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
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)
3300-30	IRB 4600	60/2.05
3300-31	IRB 4600	45/2.05
3300-32	IRB 4600	40/2.55
3300-33	IRB 4600	20/2.50

Manipulator color

Option	Description	Note
209-1	ABB Orange standard	
209-196	ABB grey standard	
209-202	ABB Graphite White standard	Standard color
209-4--192	The manipulator is painted with the chosen RAL-color.	



Note

Notice that delivery time for painted spare parts will increase for none standard colors.

Manipulator protection

Option	Description
3350-670	Base 67,IP67
3352-10	Foundry Plus2 67, IP67
3352-14	Foundry Prime

Requirements

The option *Foundry Plus2 67* [3352-10] requires option *Upper arm cover* [3316-1].



Note

Base 67 includes IP67, according to standard IEC 60529.



Note

It's strongly recommended, if Foundry Plus robots in other color than ABB Orange are required, that only colors in a yellow nuance are selected, if not the robot can look miss colored after a while in the foundry environment. The protection is still preserved in any color.

Continues on next page

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
3315-1	Foundry Cable Guard	For extra protection of cables.

Mounting position

Option	Description	Remark
3317-1	Inverted mounting position	



Note

Manipulators delivered for floor mounting must have the option added before changing mounting position to inverted.

Option Foundry prime must be selected when using Inverted mounting position.

See [Expansion container for inverted mounting of the manipulator on page 23](#) for more details about the inverted mounting position.

Electronic Position Switches (EPS)

The mechanical position switches indicating the position of the three main axes are replaced with electronic position switches for up to 7 axes, for increased flexibility and robustness. For more detailed information, see *Product specification - OmniCore V line* and *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°

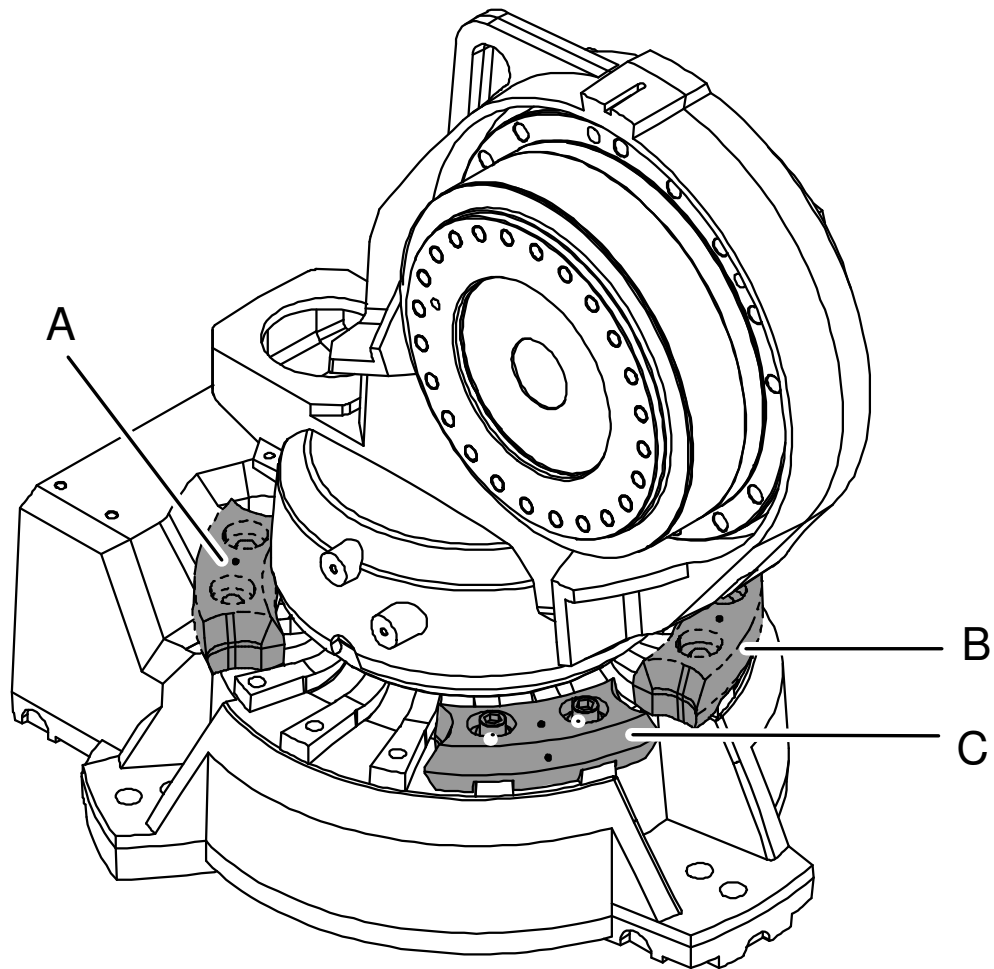
Option	Description
3323-2	Axis 1 adjustable 22.5°

Continues on next page

2 Specification of variants and options

2.2 Manipulator

Continued



xx080000410

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 labour 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 in the ABB Ability service *Condition Monitoring & Diagnostics* 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>

Manipulator cable length

Option	Lengths
3200-2	7 m
3200-3	15 m
3200-4	22 m
3200-5	30 m

2 Specification of variants and options

2.3 Application

2.3 Application

Connection of Parallel/CAN DeviceNet communication

Following information specifies the cable length for Parallel/CAN DeviceNet/Ethernet for connections between cabinets and manipulator.

Option	Lengths
3201-2/3202-2/3204-2	7m
3201-3/3202-3/3204-3	15m
3201-5/3202-5/3204-5	30m

DressPack base-axis 3

Option	Description
3325-11	MH Parallel
3325-12	MH DeviceNet. Includes parallel signals
3325-13	MH EtherNet. Includes parallel signals, Supports ProfiNet, EtherNetIP

Connector kit base

Option	Description
3330-2	CP/CS bus, Proc 1 base

Connector kit axis 3

Option	Description
3333-2	CP/CS bus, Proc 1 axis3

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