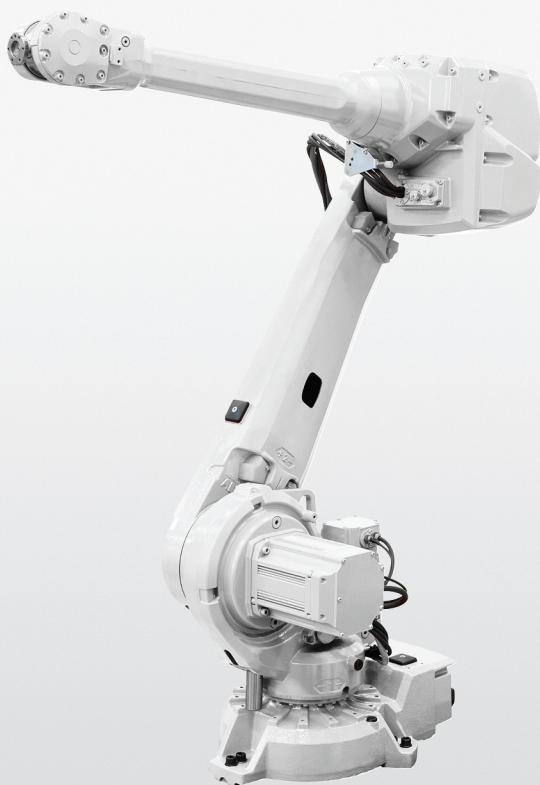


ROBOTICS

Product specification

IRB 4600



Trace back information:
Workspace 26-1 version a8
Checked in 2026-04-15
Skribenta version 5.6.019

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: P

The information in this manual is subject to change without notice and should not be construed as a commitment by ABB. ABB assumes no responsibility for any errors that may appear in this manual.

Except as may be expressly stated anywhere in this manual, nothing herein shall be construed as any kind of guarantee or warranty by ABB for losses, damage to persons or property, fitness for a specific purpose or the like.

In no event shall ABB be liable for incidental or consequential damages arising from use of this manual and products described herein.

This manual and parts thereof must not be reproduced or copied without ABB's written permission.

Keep for future reference.

Additional copies of this manual may be obtained from ABB.

Original instructions.

Table of contents

Overview of this specification	7
1 Description	9
1.1 Structure	9
1.1.1 Introduction to structure	9
1.1.2 Different robot variants	14
1.2 Standards	17
1.2.1 Applicable standards	17
1.3 Impacting robot lifetime	18
1.4 Installation	24
1.4.1 Introduction to Installation	24
1.4.2 Technical data	25
1.4.3 Mounting the manipulator	29
1.5 Calibration	33
1.5.1 Calibration methods	33
1.5.2 Fine calibration	35
1.5.3 Absolute Accuracy calibration	37
1.5.4 Calibration tools for Axis calibration	39
1.5.5 Synchronization marks and axis movement directions	40
1.5.5.1 Synchronization marks and synchronization position for axes	40
1.5.5.2 Calibration movement directions for all axes	42
1.6 Robot load and load diagrams	43
1.6.1 Introduction to Robot load and load diagrams	43
1.6.2 Load diagrams	44
1.6.3 Maximum load and moment of inertia for full and limited axis 5 (centerlinedown) movement	51
1.6.4 Wrist torque	53
1.6.5 Maximum TCP acceleration	54
1.7 Mounting equipment	55
1.7.1 Information about mounting equipment	55
1.8 Maintenance and troubleshooting	64
1.8.1 Introduction to Maintenance and Troubleshooting	64
1.9 Robot motion	65
1.9.1 Introduction to Robot Motion	65
1.9.2 Performance according to ISO 9283	67
1.9.3 Velocity	68
1.9.4 Robot stopping distances and times	69
1.10 Cooling fan for axis 1 and 2 motor	70
1.11 Customer connections	71
1.11.1 Customer connection on robot	71
2 Specification of variants and options	75
2.1 Introduction to variants and options	75
2.2 Manipulator	76
2.3 Floor cables	81
2.4 Application manipulator	82
2.5 Application floor cables	83
Index	85

This page is intentionally left blank

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
- Integrators and customers

References

Reference	Document ID
<i>Product specification - OmniCore V line RW 7 (RobotWare 7)</i>	3HAC074671-001
<i>Product specification - OmniCore V line RW 8 (RobotWare 8)</i>	3HAC098717-001
<i>Product manual - IRB 4600</i>	3HAC033453-001
<i>Product manual - IRB 4600 Foundry Prime</i>	3HAC040585-001

Revisions

Revision	Description
A	First edition.
B	Published in release 22A. The following updates are done in this revision: • Updated path repeatability table.
C	Published in release 22B. The following updates are done in this revision: • Clarified description of option Inverted mounting position (3317-1) for manipulators with protection type Foundry Prime. • Robot weight of each variant is updated.
D	Published in release 22C. The following updates are done in this revision: • Add RAL code in manipulator color. • Descriptions for <i>Foundry Prime2 67</i> [3352-14] updated.

Continues on next page

Revision	Description
E	Published in release 23C. The following updates are done in this revision: • Updated the description for <i>Foundry cable guard</i> [3315-1]. • New option <i>ABB white standard</i> [209-2] and <i>Cleanroom 5</i> [3351-5] added.
F	Published in release 23D. The following updates are done in this revision: • New option <i>Servo cable 1 axis - Length</i> [3206-x] added. • Added support for OmniCore V400XT.
G	Published in release 24A. The following updates are done in this revision: • Added DressPack options for CC-Link.
H	Published in release 24B. The following updates are done in this revision: • Removed incorrect options. • Added DressPack options for EtherCAT.
J	Published in release 24C. The following updates are done in this revision: • The option for inverted mounting is phased out. • Minor corrections.
K	Published in release 24D. The following updates are done in this revision: • Added options for cooling fans for axis 1 and 2. • Added 22 m process cables. • Updated the section Technical data on page 25.
L	Published in release 25A. The following updates are done in this revision: • The options for cooling fans on axis 1 and 2 are removed as they are not yet available to order.
M	Published in release R25.2. The following updates are done in this revision: • Updated the information about loads on the frame. • Added options for cooling fans for axis 1 and 2, with limitations.
N	Published in release 25.3. The following updates are made in this revision: • Corrected measurements of bushing at mounting surface. • Company name updated to reflect current legal entities. • Updated portal name from myABB to ABB Robotics One.
P	Published in release 26.1. The following updates are made in this revision: • Removed duplication of robot weight specification. • Added missing acceleration data for variant IRB 4600-45/2.05. • Company name updated to reflect current legal entities. • Added support for RobotWare 8.

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 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 the product specification for the robot controller.

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 the product specification for the robot controller.

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.

Continues on next page

1 Description

1.1.1 Introduction to structure

Continued

Clean room robots



valid until: July 28, 2028

Fraunhofer

TESTED[®] DEVICE

ABB

IRB 4600-60/2.05

Report No. AB 2306-1436

xx2300001232

Particle emission from the robot fulfill Clean room class 5 standard according to DIN EN ISO 14644-1.

Clean room robots are specially designed to work in a clean room environment.

According to IPA test result:

The robot IRB 4600 is suitable for use in clean rooms fulfilling the Air Cleanliness Class 5 according to ISO 14644-1, when operated at a capacity of 50%.

The robot IRB 4600 is suitable for use in clean rooms fulfilling the Air Cleanliness Class 5 according to ISO 14644-1, when operated at a capacity of 100%.

Clean room robots are designed in order to prevent from particle emission from the robot. For example is, frequent maintenance work possible to perform without cracking the paint. The robot is painted with four layers of polyurethane paint. The last layer being a varnish over labels in order to simplify cleaning. The paint has been tested regarding outgassing of Volatile Organic Compounds (VOC) and been classified in accordance with ISO 14644-8.

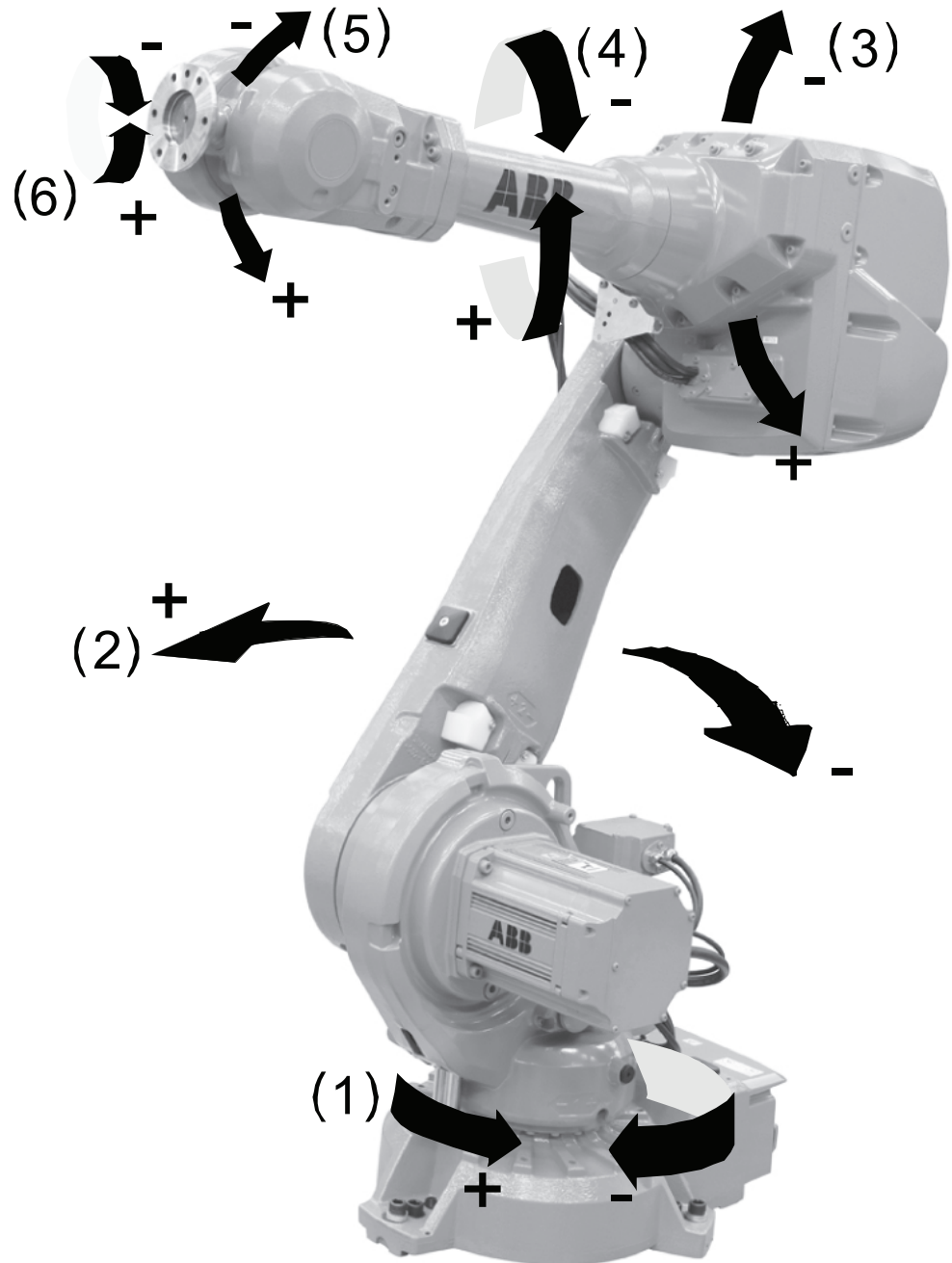
Classification of airborne molecular contamination, see below:

Parameter				Outgassing amount		
Area (m ²)	Test duration (s)	Temp (°C)	Performed test	Total detected (ng)	Normed based on 1m ² and 1s(g)	Classification in accordance to ISO 14644-8
4.5E-03	3600	23	TVOC	2848	1.7E-07	-6.8
4.5E-03	60	90	TVOC	46524	1.7E-04	-3.8

Classification results in accordance with ISO 14644-8 at different test temperatures.

Continues on next page

Manipulator axes



xx1800001381

1 Description

1.1.2 Different robot variants

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



Note

Only IRB 4600-60/2.05 and IRB 4600-40/2.55 can be selected with protection Cleanroom.

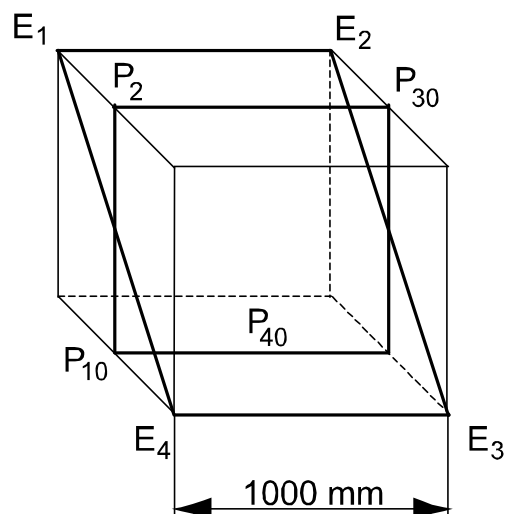
Airborne noise level

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 (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



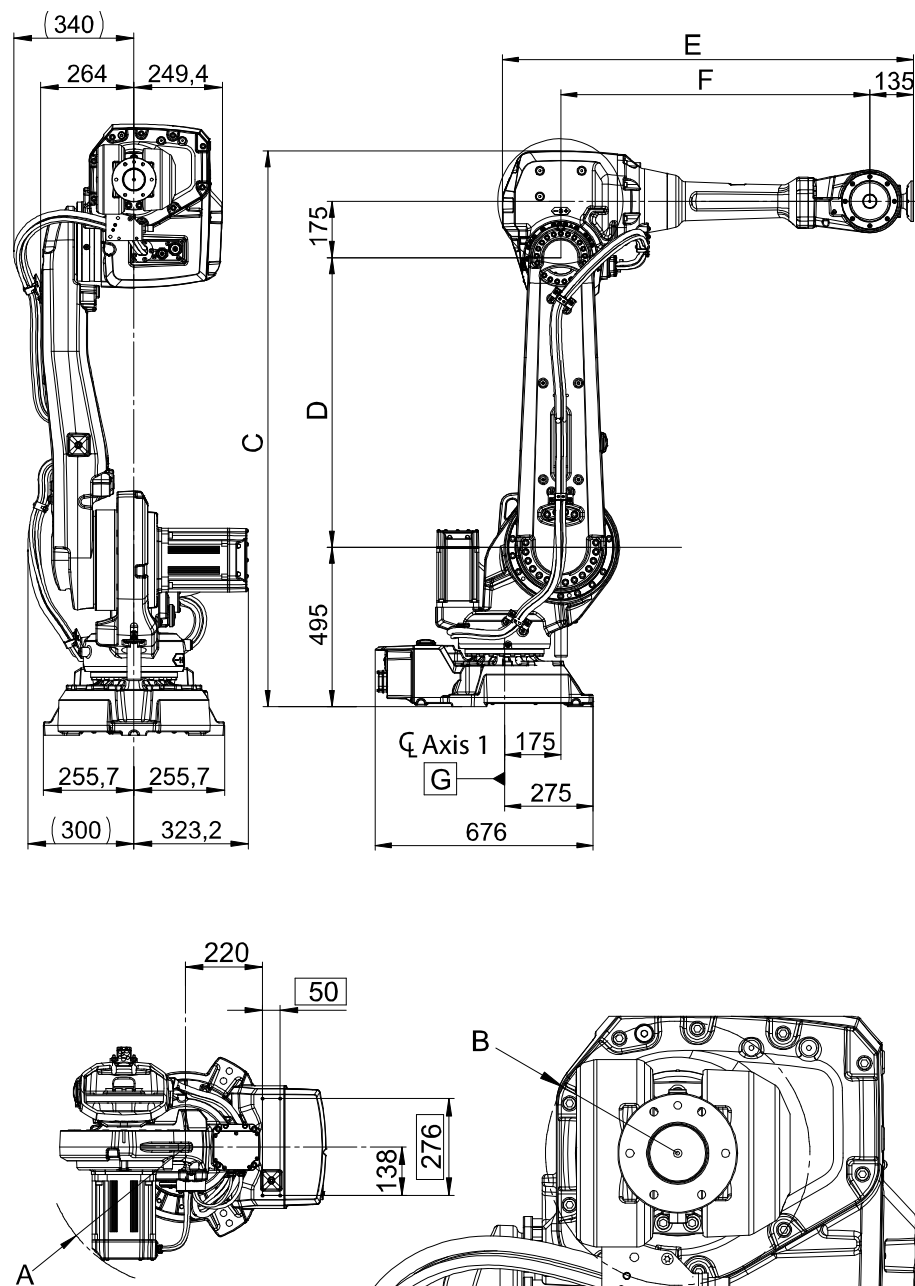
xx0800000420

Continues on next page

Power factor ($\cos \phi$)

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.

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

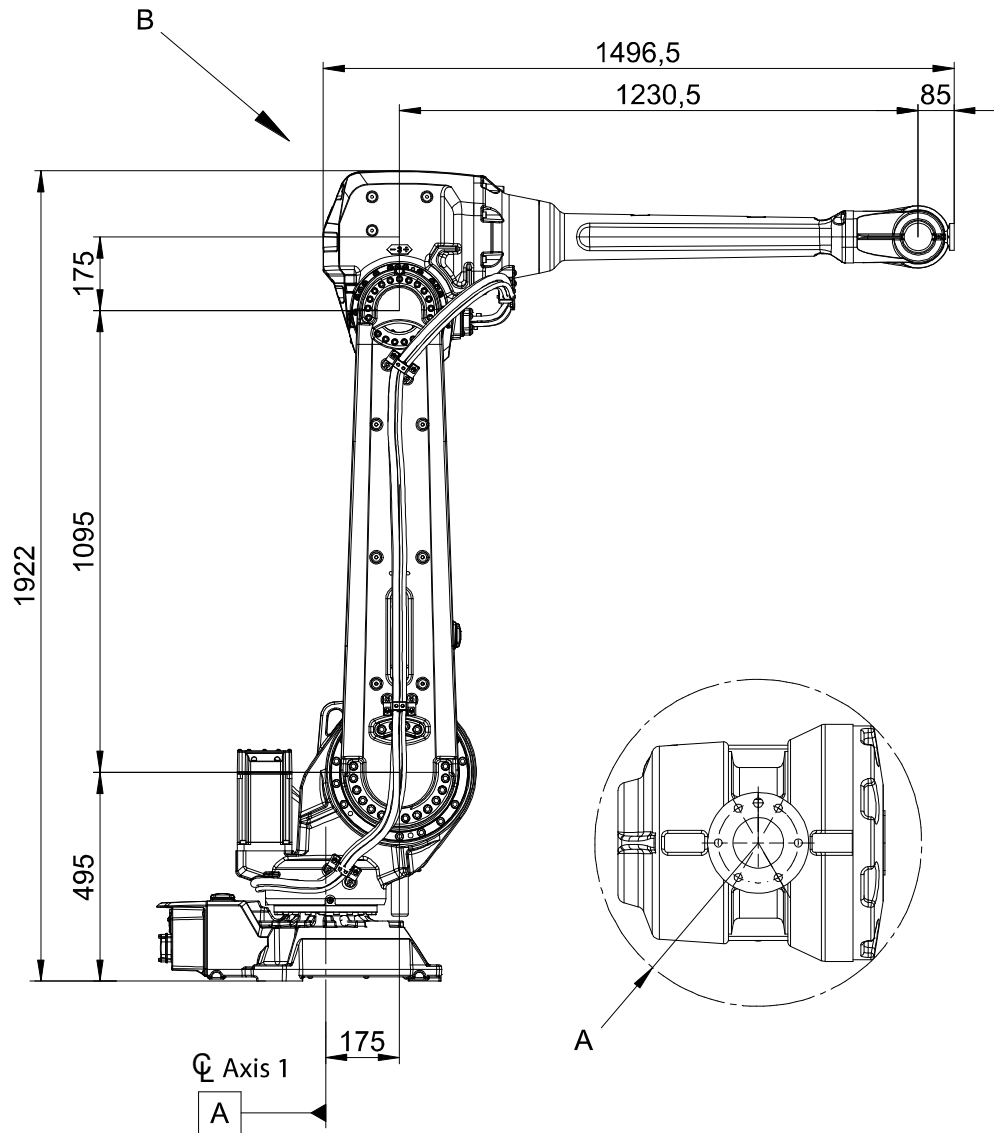
Continues on next page

1 Description

1.1.2 Different robot variants
Continued

Variant	C	D	E	F
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

Dimensions IRB 4600-20/2.50



xx0800000428

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

This product is designed according to the global product standard ISO 10218-1:2025, *Robots for industrial environments - Safety requirements - Part 1 Robots*. In case of deviation from ISO 10218-1:2025, 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
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
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
IEC 61326-3-1	Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – General industrial applications

Region specific standards

Standard	Description
UL 1740 (option) CSA Z434 (option)	Standards For Safety - Robots and Robotic Equipment Industrial robots and robot Systems - General safety requirements Valid for USA and Canada.

1 Description

1.3 Impacting robot lifetime

1.3 Impacting robot lifetime

Introduction

The expected lifetime of a robot is an important factor when planning an installation. This information is aiming to help you to maximize the lifetime of your robot and avoid unnecessary downtime or repair.

The lifetime of a robot is influenced by the following, but not limited to, factors:

- [Robot type selection on page 18](#)
- [Duty factor on page 18](#)
- [Environmental conditions on page 19](#)
- [Application and usage on page 19](#)
- [Design limitations on page 20](#)
- [Maintenance on page 21](#)
- [Individual lifetime variability on page 21](#)
- [Extreme usage on page 21](#)

Robot type selection

Selecting the right robot for the application is generally done based on payload and reach criteria, but other factors can influence the selection, such as the duty factor. Selecting the most suitable variant is crucial to achieve the expected high performance, uptime, and lifetime. Always select a robot in accordance with the intended use, see [Introduction to structure on page 9](#).

ABB robots are capable of high accelerations and speeds. It is generally recommended to use RobotStudio to find out if a robot model is suitable for a specific application and duty factor. RobotStudio is an excellent tool to help with the assessment of the duty factor and the selection of the most suitable robot variant.

This robot is not specifically designed for use in demanding applications with a very high duty factor. If used in such conditions, a significant reduction in lifetime is possible for all axes, depending on the cycle. See [Extreme usage on page 21](#).

When selecting the robot variant, consider using application-specific robot, and suitable protection type.



Note

Use the Mechanical Analysis add-in in RobotStudio (see details below) for help with the assessment, or get technical support from ABB.

Duty factor

Duty factor is the percentage of time the robot is moving divided by the total time, including movement and wait time during the complete robot work cycle. It is a measurement of how much the robot is being used. Gearbox lifetime is reduced more rapidly by a higher duty cycle than by a lower one. See [Extreme usage on page 21](#).

Continues on next page



Note

The duty factor impact on lifetime can be analyzed in the add-in *Mechanical Analysis* in RobotStudio (see details below) and *Service Information System* (SIS) data in the controller. Contact ABB to analyze the SIS data.

Environmental conditions

Following factors within environmental conditions of the robot has an impact on the robot lifetime:

- Temperature:

The robot usage at high temperatures can lead to gearbox and motor cooling problems. Observe operating temperature limits stated in manipulator product manual.

- High humidity can be caused by the environment or the application. A high humidity can cause water being accumulated in the gearbox oil, which leads to requiring more frequent oil change. See [Operating conditions, robot on page 28](#), and [Storage conditions, robot on page 27](#).
- Exposure to chemicals might impact sealings, which can cause oil leakage.
- Vibrations caused by not following the foundation requirements might cause reduction of lifetime, for example for bearings. See [Requirements, foundation on page 27](#).
- Cleaning. Wrong cleaning can cause particles entering the sealings which can cause oil leakage. Proper cleaning is described in *Product manual - IRB 4600*.

Application and usage

Following factors within robot application and usage has an impact on the robot lifetime:

- Payload definition and overload:

It is important to define the payload within specification and correctly defined tool data. See section [Load diagrams on page 44](#), and *Technical reference manual - RAPID Overview*.

The service routine for load identification, *LoadIdentify*, is available to support tool data definition. See *Operating manual - OmniCore*.

- Acceleration/deceleration:

The gearbox lifetime is reduced more rapidly by high accelerations/decelerations than by lower ones.



Note

Smoother movements bring reduced energy consumption.

Continues on next page

1 Description

1.3 Impacting robot lifetime

Continued



Note

Acceleration/deceleration can be modified with the instruction AccSet. See *Technical reference manual - RAPID Overview*.

Acceleration/deceleration is optimized by using automatic path planning functionality, either offline, or in RobotStudio, or using the online software.

- Limited movements:

If the range or the rotation angle for an axis is 10° or less, the expected life of the reduction gears may be reduced due to poor lubrication of internal parts or the internal parts being subject to a concentrated load. Add extra lubrication motion to the robot program or to maintenance schedule.



Note

Use RobotStudio *Signal Analyzer* or get technical support from ABB.

- High forces applied externally to the manipulator:

Some applications or not correctly programmed paths apply external forces to the manipulator, which might reduce its lifetime. Example of external force: gripper under constraint when gripping a part or load sharing between multiple robots.

- Number of collisions:

Collisions, especially at high speed and/or with high loads reduce the lifetime of the gearboxes. Avoid collisions and set collision detection sensitivity to the appropriate level.



Note

See the application manual for the controller software, section *Collision detection*, listed in [References on page 7](#).

- Number of emergency stops:

Emergency stops, especially at high speed and/or high loads reduce the lifetime of the gearboxes. Whenever permitted by risk assessment, set the robot stopping functions to stop category 1.



Note

See the product manual for the robot controller, listed in [References on page 7](#).

Design limitations

See the section *Expected component life* in *Product manual - IRB 4600*.

Continues on next page

Maintenance

The maintenance and use of the robot will affect the performance and lifetime. For example:

- Preventive maintenance will optimize the lifetime of the robot. The recommended maintenance activities and intervals are described in *Product manual - IRB 4600*.
- Observance of lubricant types and maintenance periods recommended by ABB.
- Possible pollution of the lubricant by an external cause, for example, water in the oil caused by high humidity.
- Extreme usage, for example high duty factor or environmental factors, will affect the maintenance schedule, for example, shorter intervals for oil change.

Contact your local ABB office to get technical support from ABB.

Individual lifetime variability

The lifetime varies with individual robots. For example, a cycle with a lower duty factor may fail earlier than one with a higher duty factor. But a cycle with a higher duty factor is more likely to fail earlier than a cycle with lower duty factor.

Extreme usage

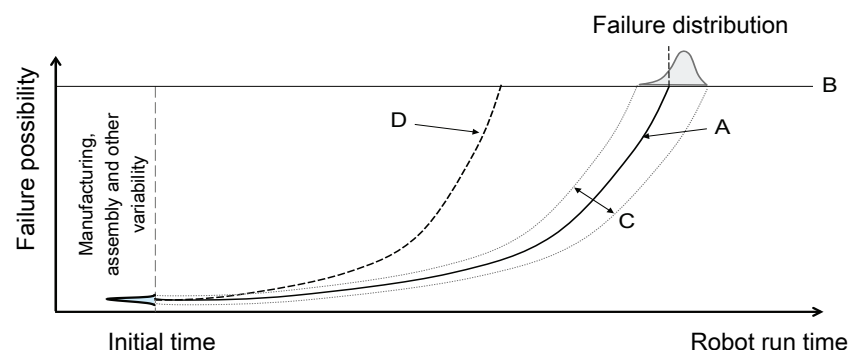
Examples of extreme usage in regard to movement: a stress index range that shows up as red (51) in the RobotStudio add-in *Mechanical Analysis*, press tending application, very severe palletizing applications, major use of axis 1, 2, or 3 movement.

The controller can issue a duty factor warning on the FlexPendant, if applicable. See the chapter *Troubleshooting* in *Product manual - IRB 4600*.

Extreme usage requires specific maintenance, for example, shorter interval for oil change. See *Maintenance schedule* in *Product manual - IRB 4600*.

Summary

The diagram illustrates the relationship between robot run time and failure possibility.



xx2500001942

A	Design lifetime
---	-----------------

Continues on next page

1 Description

1.3 Impacting robot lifetime

Continued

B	Failure threshold
C	Individual variability
D	Negatively affected lifetime

The curve (A) represents the design lifetime, showing how failure probability increases over time following a normal distribution pattern. The failure threshold (B) indicates the point at which component failure becomes likely.

Individual variability between robots is shown by the dotted lines (C), representing the natural variation in component life due to manufacturing, assembly, and other factors. This variability means that while most robots will follow the design lifetime curve, some individual units may experience earlier or later failures within the normal distribution.

As highlighted with the curve (D) in the diagram, robot lifetime can be negatively affected by not following best practices in the key areas discussed in this chapter:

- [Robot type selection on page 18](#)
- [Duty factor on page 18](#)
- [Environmental conditions on page 19](#)
- [Application and usage on page 19](#)
- [Maintenance on page 21](#)

By adhering to the recommendations outlined in each of these sections, users can maximize their robot's operational lifetime and ensure performance stays within the design lifetime curve, avoiding premature failure and unnecessary downtime.

Available tools

There are several tools available throughout the lifecycle of an ABB robot, from support with selecting the most suitable manipulator and optimizing its lifetime, to operation, maintenance, and repair:

ABB toolbox	Type	Product lifecycle		
		Sales, pre-study	Installation, commissioning	Operation, maintenance, repair
Product specification	Document	x	x	
Product manual	Document		x	x
Mechanical Analysis add-in	Add-in in RobotStudio	x	x	x
Service Information System (SIS) / Condition Based Maintenance (CBM)	RobotWare functionality / Customer service analysis		x	x
Connected Services	Hardware and Software		x	x
Automatic Path Planning	RobotStudio functionality and online software	x	x	(x)

Continues on next page

ABB toolbox	Type	Product lifecycle		
		Sales, pre-study	Installation, commissioning	Operation, maintenance, repair
Signal Analyzer / TuneMaster	RobotStudio functionality / Software	x	x	x
ABB support	Customer support	x	x	x

1 Description

1.4.1 Introduction to Installation

1.4 Installation

1.4.1 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 44](#).

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 55](#)

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.

1.4.2 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

1 Description

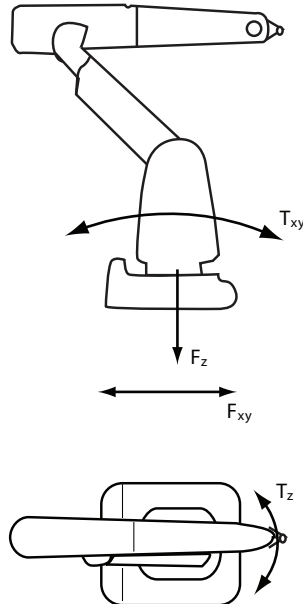
1.4.2 Technical data

Continued

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.



xx1100000521

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

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

1 Description

1.4.2 Technical data

Continued

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 / Suitability class ⁱⁱ
Manipulator, protection type Standard	IP 67
Manipulator, protection type Foundry Prime	IP 67
Manipulator, protection type Foundry Plus	IP 67
Manipulator, protection type Clean Room	ISO5 ⁱⁱⁱ

ⁱ According to IEC 60529.

ⁱⁱ Air Cleanliness Class for Clean Room robots was accessed in compliance with DIN EN ISO 14644-1, -14.

ⁱⁱⁱ Protection type Clean Room is only valid for variant IRB 4600 - 60/2.05 and IRB 4600 - 40/2.55.

1.4.3 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

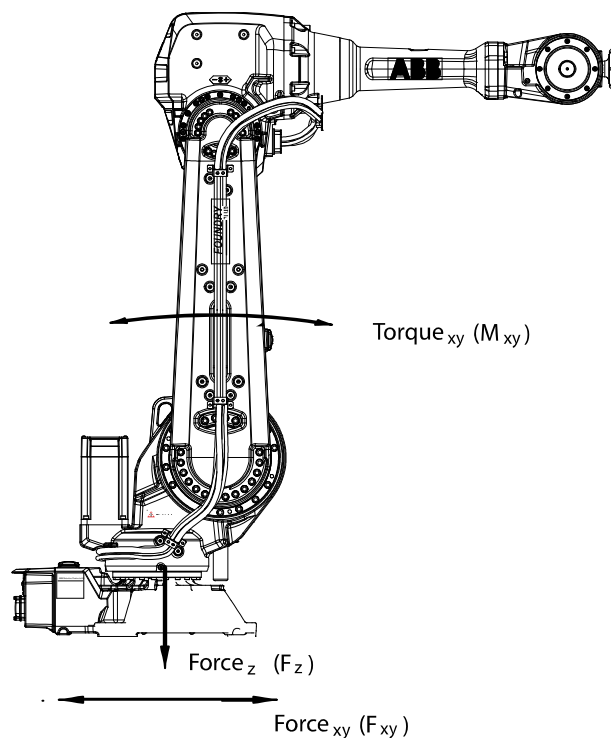
Inverted

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



Note

The inverted mounting is not available for the variants with cleanroom option.



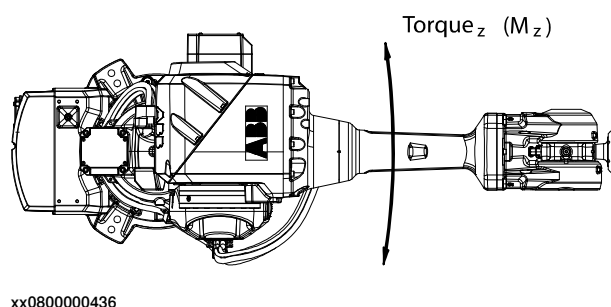
xx0800000435

Continues on next page

1 Description

1.4.3 Mounting the manipulator

Continued

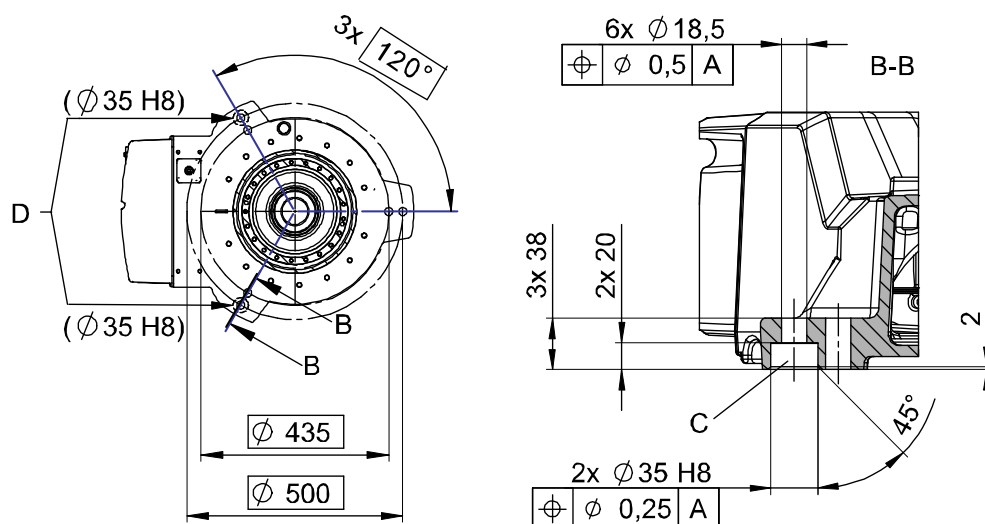


xx080000436

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

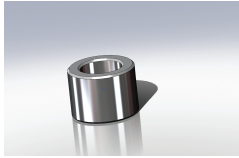
C	Hole for guide sleeve
D	Rear bolt holes

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

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.  xx1200000885
Level surface requirements	 xx0300000251	



Note

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

Continues on next page

1.5 Calibration

1.5.1 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: - Mechanical tolerances in the robot structure - Deflection 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. A robot calibrated with Absolute accuracy has the option information printed on its name plate (OmniCore). To regain 100% Absolute accuracy performance, the robot must be recalibrated for absolute accuracy after repair or maintenance that affects the mechanical structure.	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.  Note For advanced users, it is also possible to do the wrist optimization using the RAPID instruction <code>WristOpt</code> , see <i>Technical reference manual - RAPID Instructions, Functions and Data types</i> . This instruction is only available for OmniCore robots.	Wrist Optimization

Continues on next page

1 Description

1.5.1 Calibration methods

Continued

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
- 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*.

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.

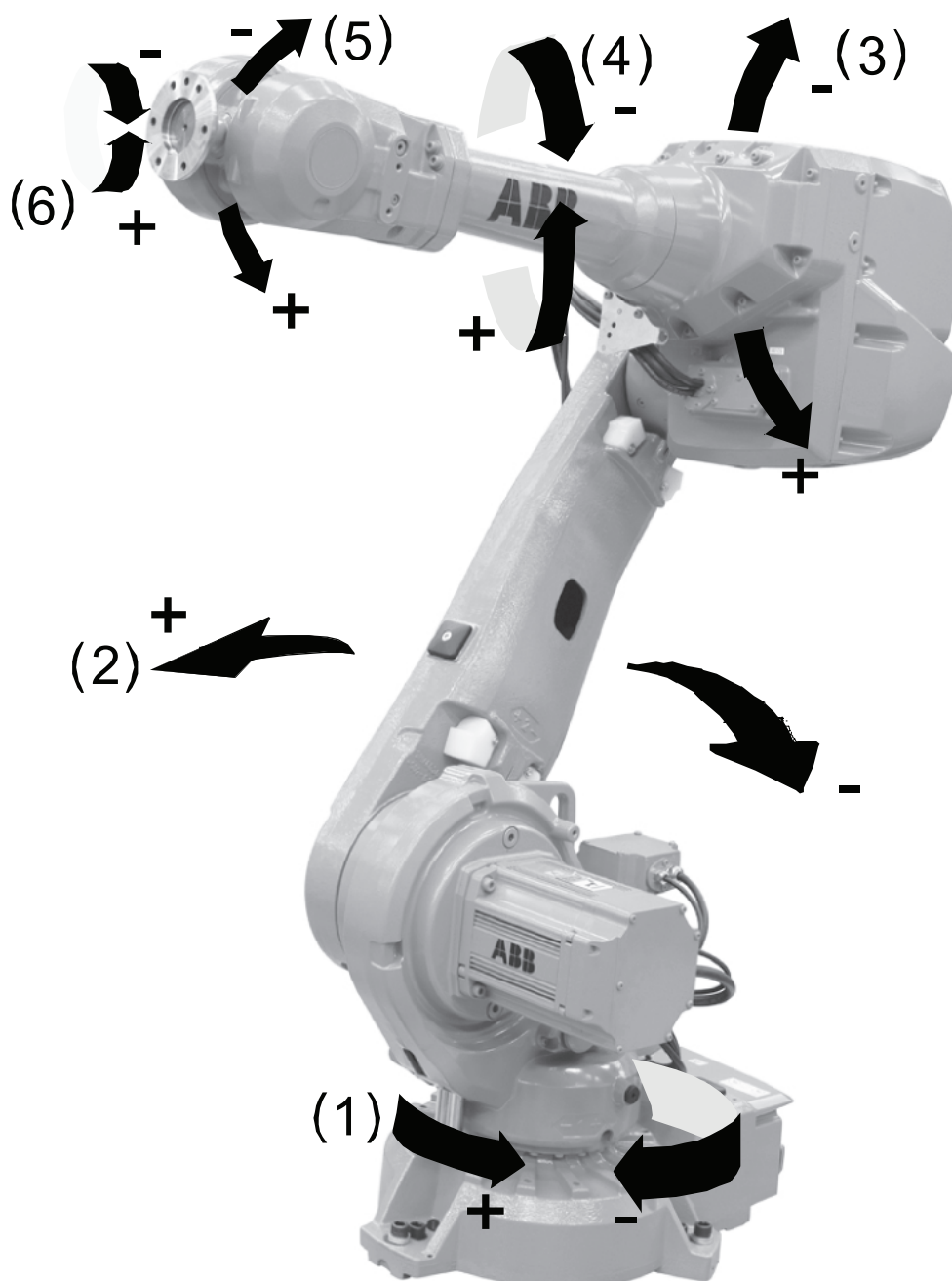
The Absolute Accuracy option varies according to the robot mounting position. This is printed on the robot name plate for each robot. The robot must be in the correct mounting position when it is recalibrated for absolute accuracy.

1.5.2 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.



xx1800001381

Calibration	Position
Calibration of all axes	All axes are in zero position

Continues on next page

1 Description

1.5.2 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

1.5.3 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

1.5.3 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 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:

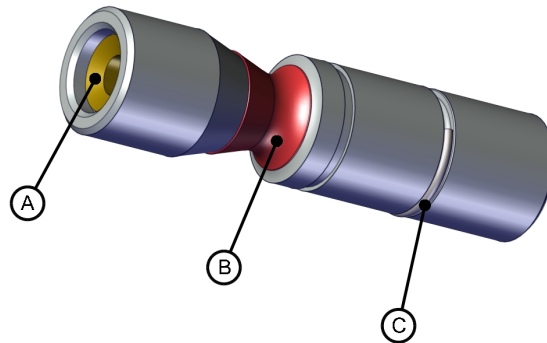
Robot	Positioning accuracy (mm)		
	Average	Max	% Within 1 mm
IRB 4600-60/2.05	0.50	1.00	98
IRB 4600-45/2.05	0.40	0.80	100
IRB 4600-40/2.55	0.40	1.00	98
IRB 4600-20/2.50	0.40	0.80	100

1.5.4 Calibration tools for Axis calibration

Calibration tools

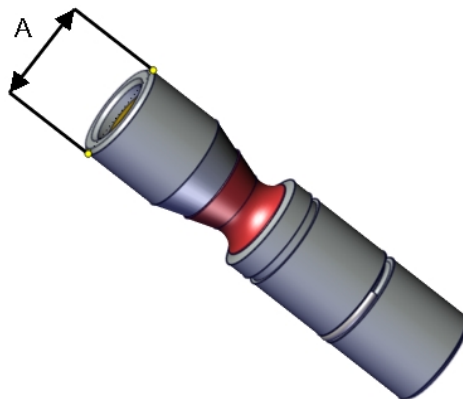
**WARNING**

If any part is missing or damaged, the tool must be replaced immediately.



xx1500001914

A	Tube insert
B	Plastic protection
C	Steel spring ring



xx1500000951

A	Outer diameter
---	----------------

If including the calibration tool in a local periodic check system, the following measures should be checked.

- Outer diameter within $\varnothing 12g4$ mm, $\varnothing 8g4$ mm or $\varnothing 6g5$ mm (depending on calibration tool size).
- Straightness within 0.005 mm.

1 Description

1.5.5.1 Synchronization marks and synchronization position for axes

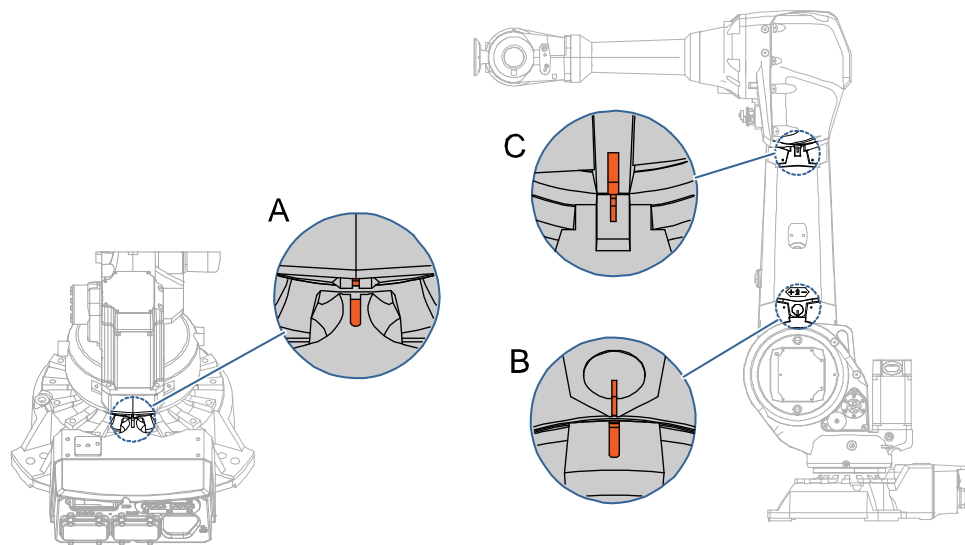
1.5.5 Synchronization marks and axis movement directions

1.5.5.1 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,



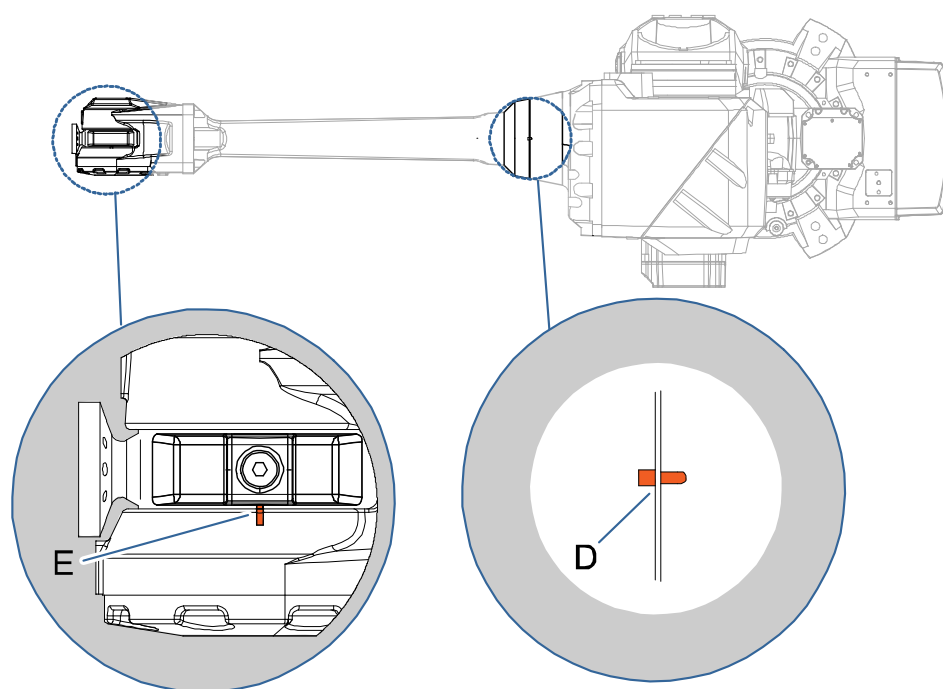
xx0800000312

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

Continues on next page

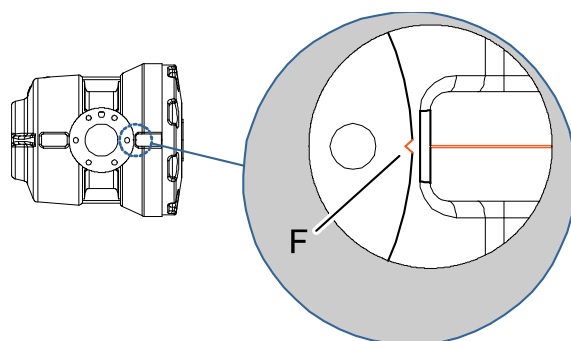
1.5.5.1 Synchronization marks and synchronization position for axes

Continued



xx0800000320

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



xx0800000321

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

1 Description

1.5.5.2 Calibration movement directions for all axes

1.5.5.2 Calibration movement directions for all axes

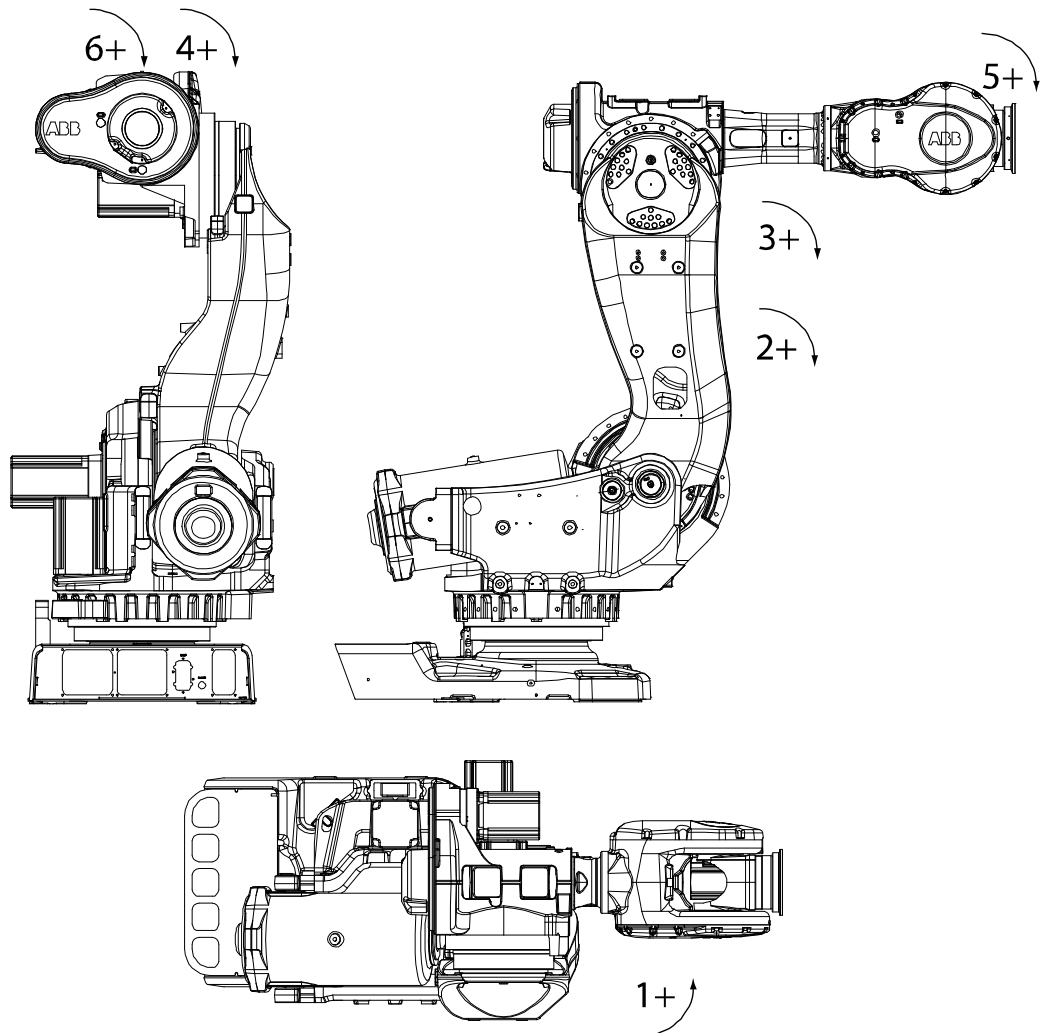
Overview

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!



xx0200000089

1.6 Robot load and load diagrams

1.6.1 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.

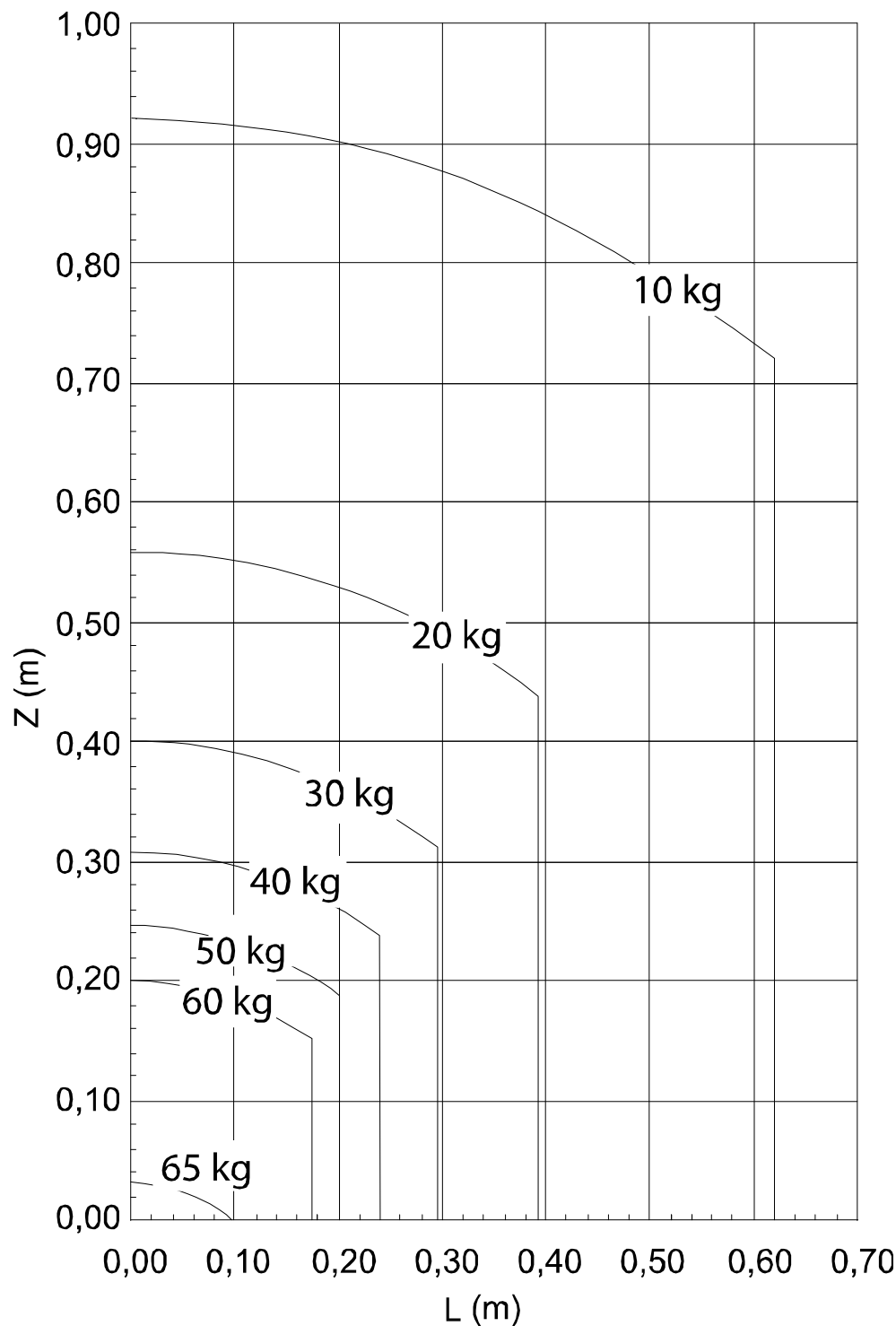
The result from RobotLoad is only valid within the maximum loads and tilt angles. There is no warning if the maximum permitted arm load is exceeded. For over-load cases and special applications, contact ABB for further analysis.

1 Description

1.6.2 Load diagrams

1.6.2 Load diagrams

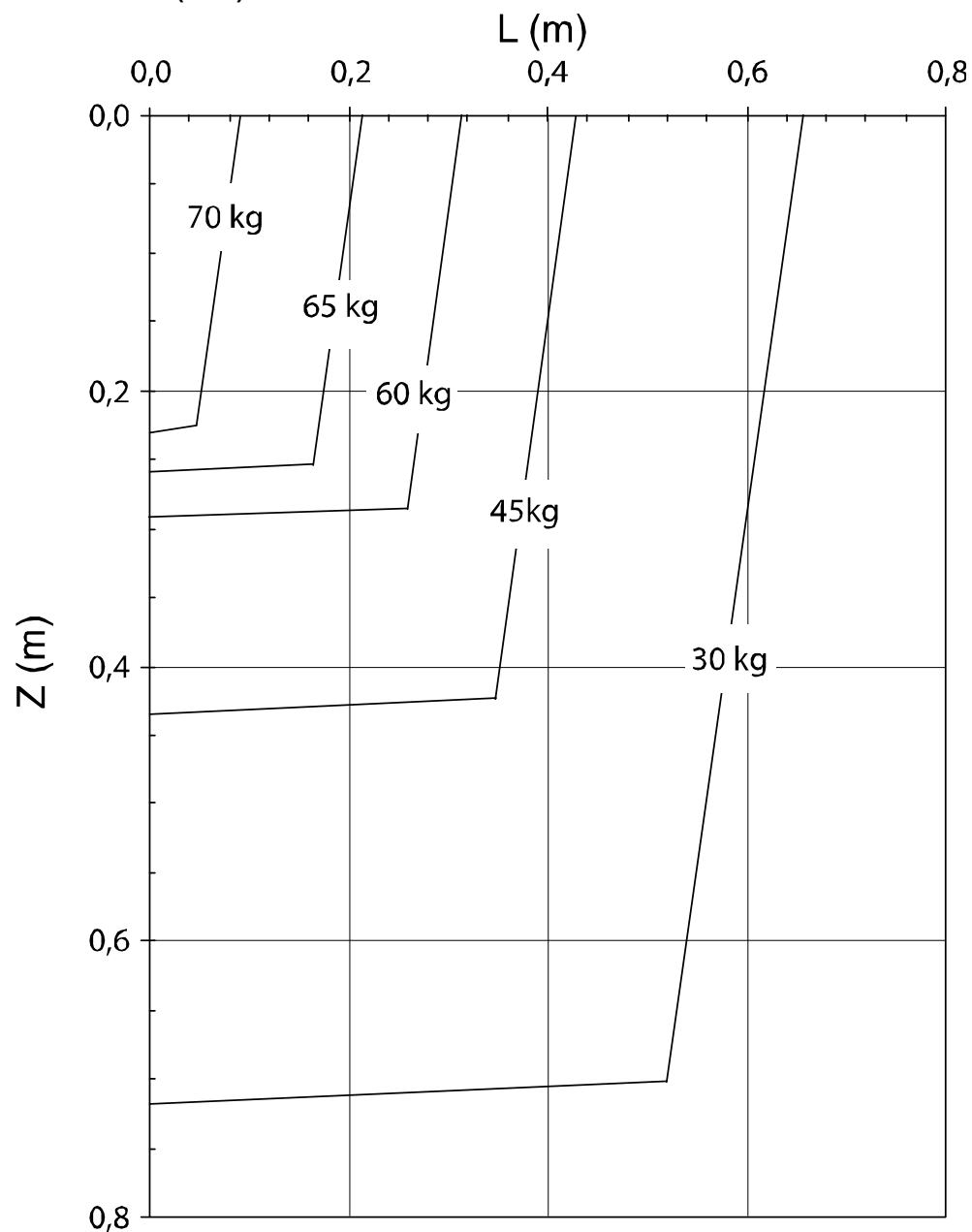
IRB 4600 - 60/2.05



xx0800000448

Continues on next page

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



xx0900000070

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

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

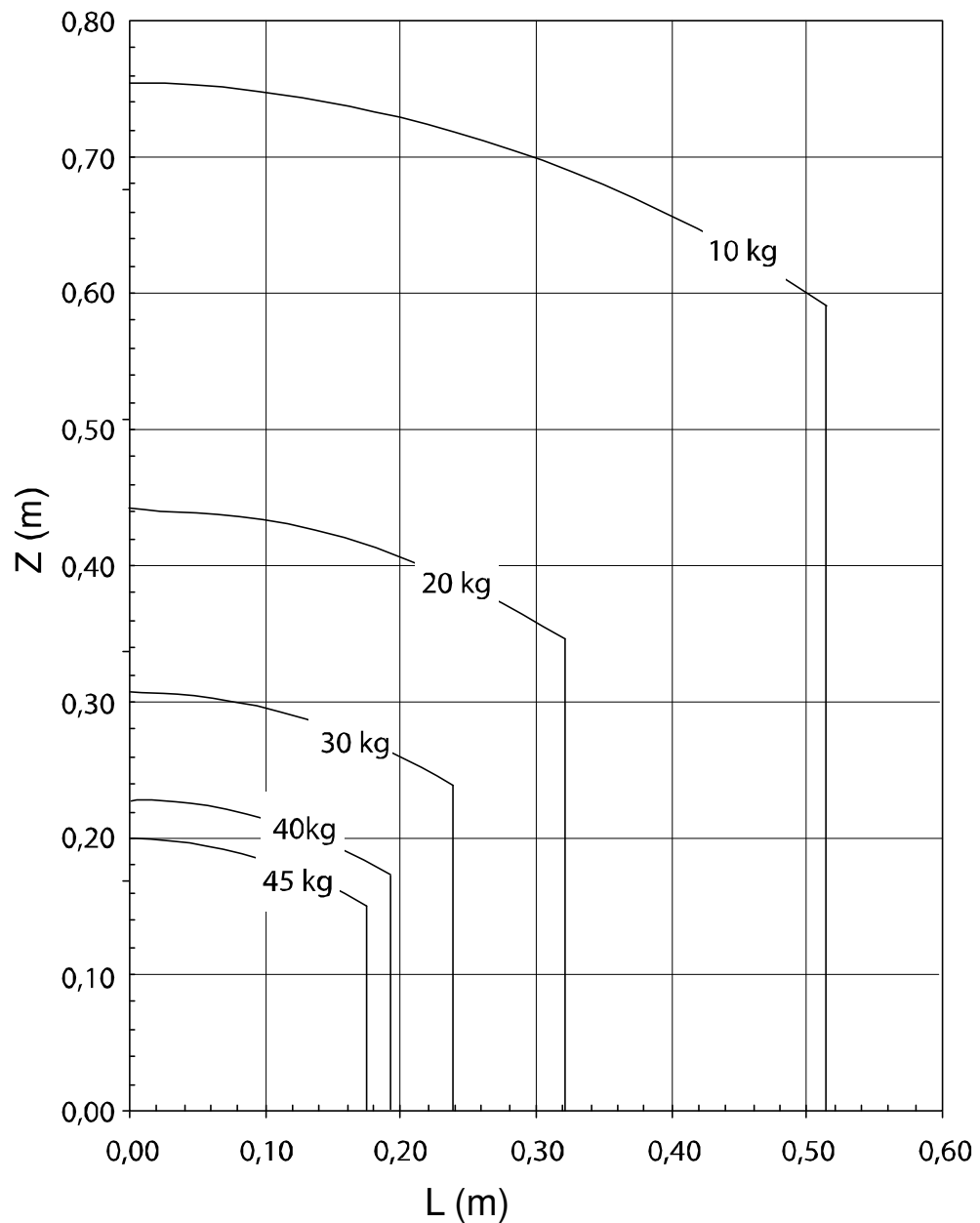
Continues on next page

1 Description

1.6.2 Load diagrams

Continued

IRB 4600 - 45/2.05



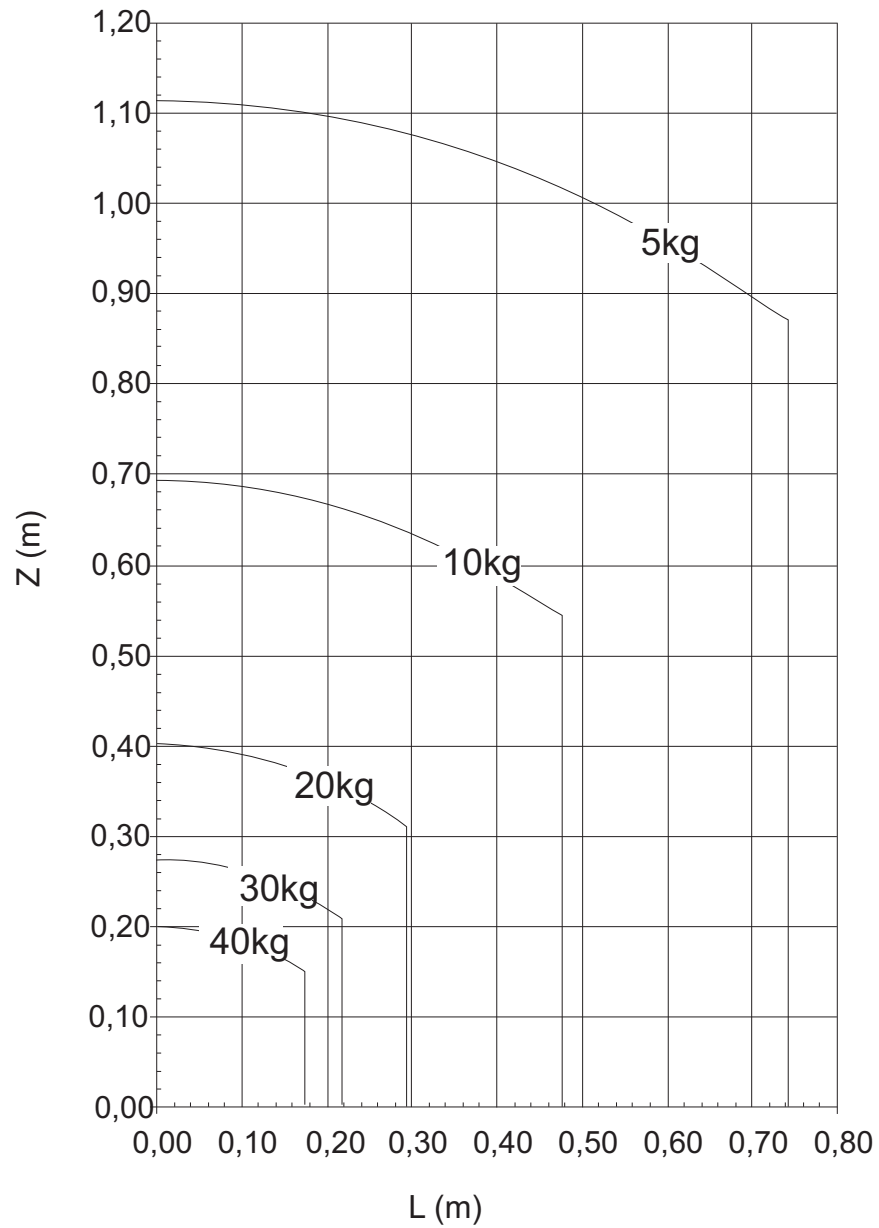
xx0900000069

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



xx0800000447

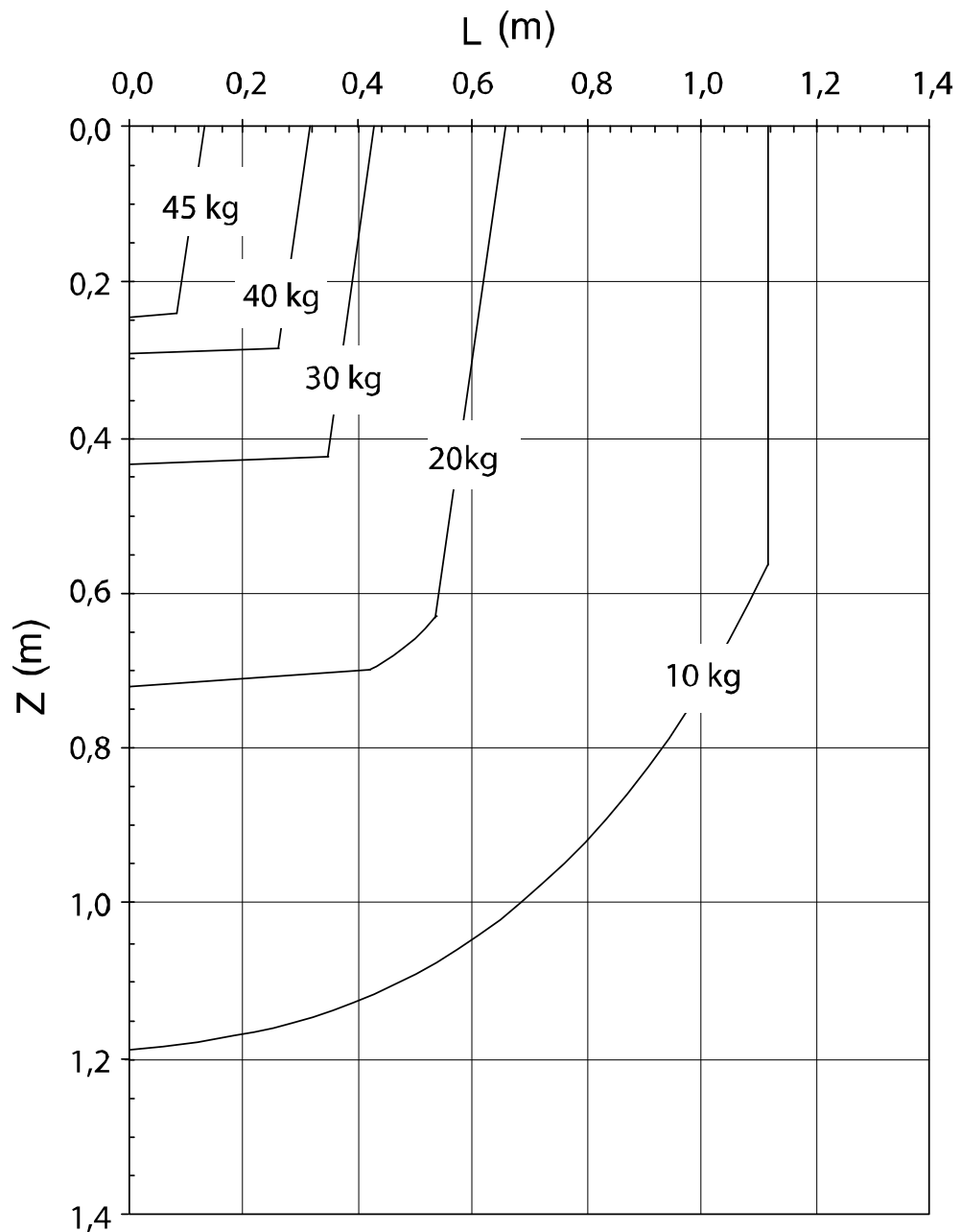
Continues on next page

1 Description

1.6.2 Load diagrams

Continued

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



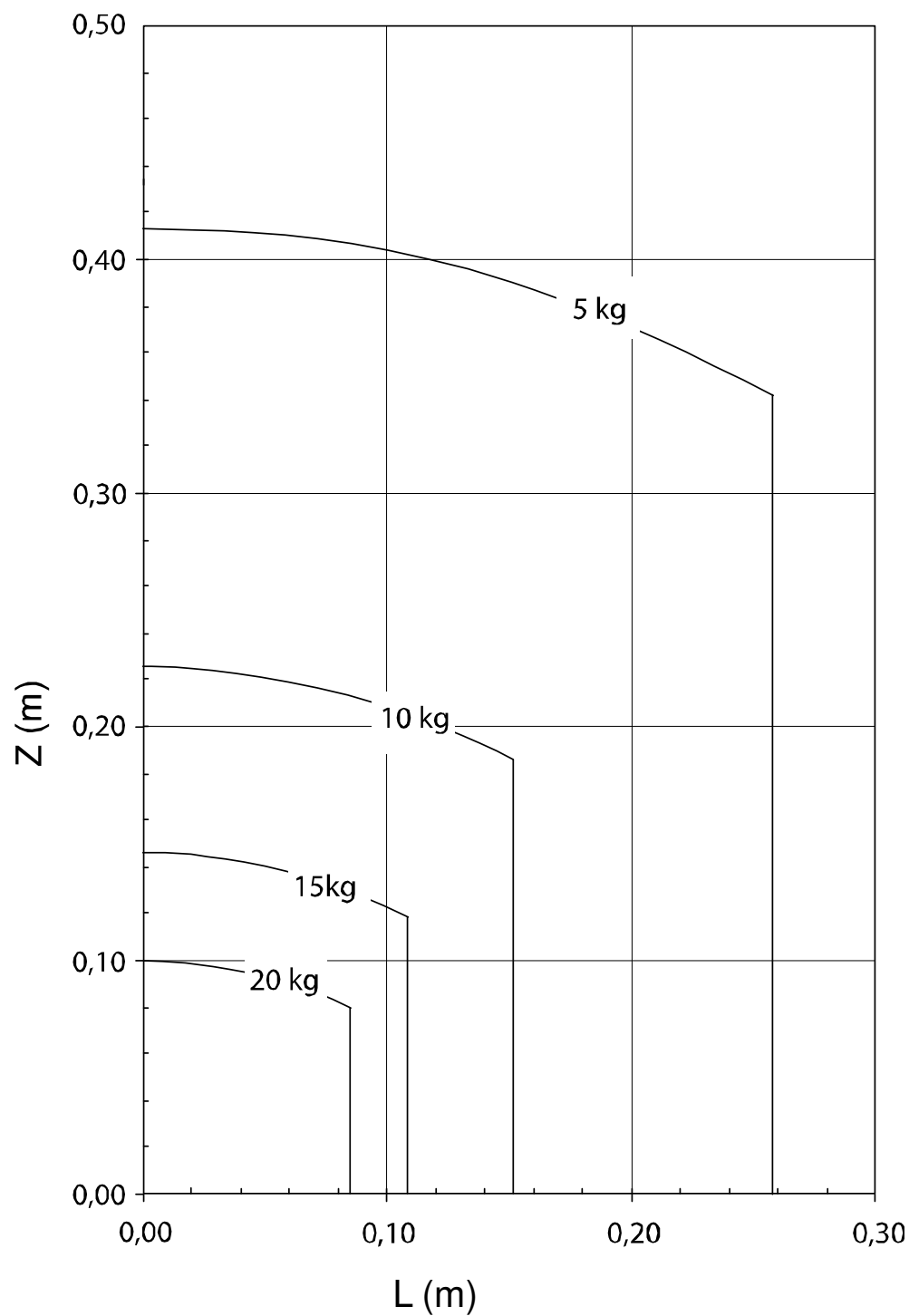
xx0900000068

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

	Description
Max load	47 kg
$Z_{\max}$	0.157 m
$L_{\max}$	0.044 m

Continues on next page

IRB 4600 - 20/2.50



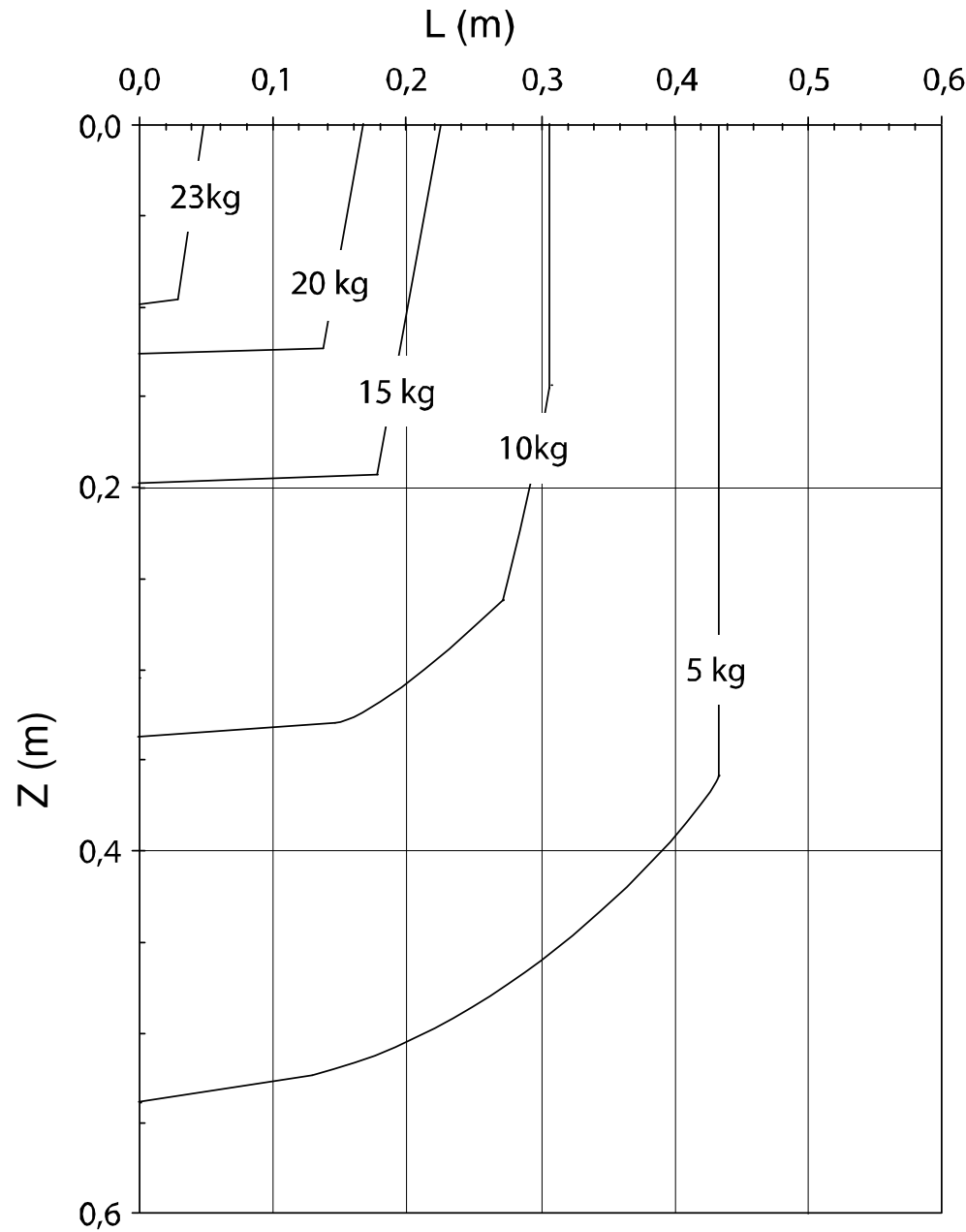
xx0900000071

Continues on next page

1 Description

1.6.2 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

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

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

Information

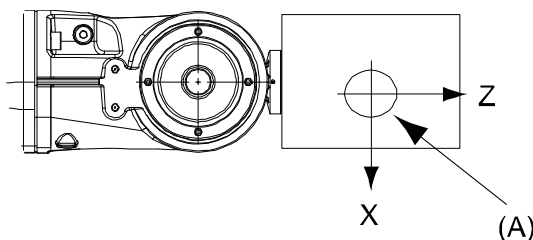


Note

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	$Ja6 = \text{Load} \times L^2 + J_{oz} \leq 1 \text{ kgm}^2$



xx0800000458

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.

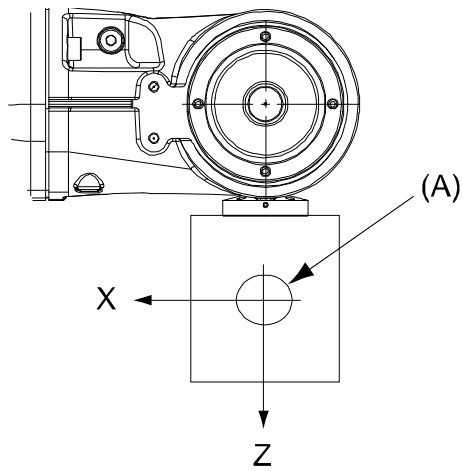
Continues on next page

1 Description

1.6.3 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.

1.6.4 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

1.6.5 Maximum TCP acceleration

1.6.5 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 - 45/2.05	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).

1.7 Mounting equipment

1.7.1 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 57.](#))

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**

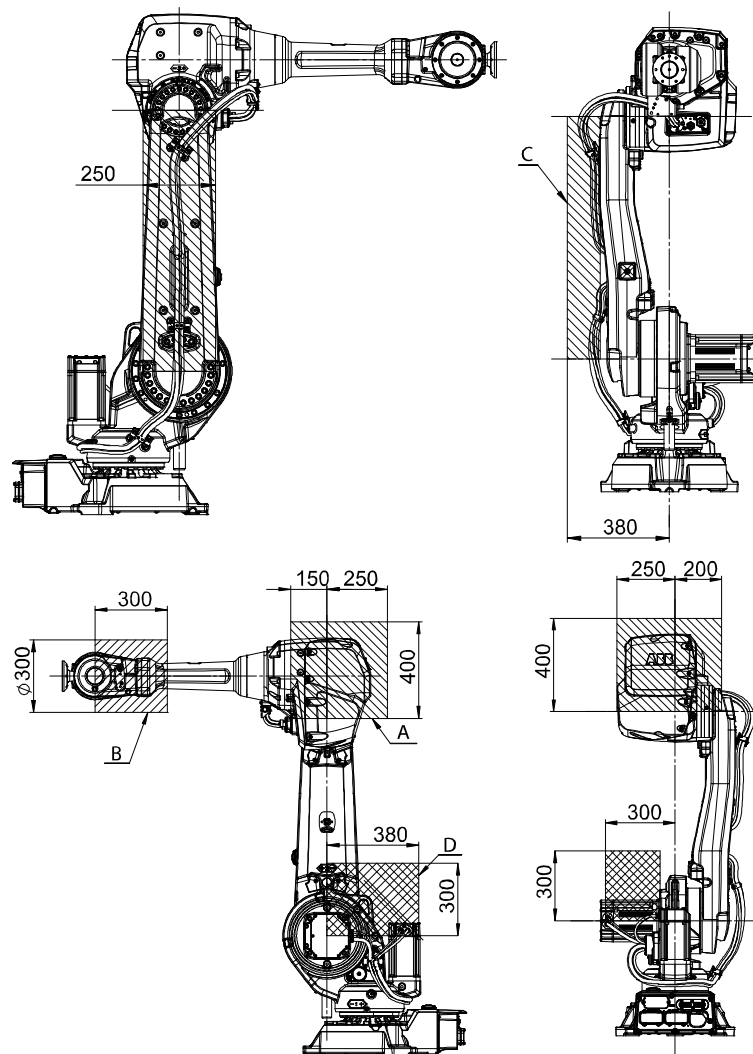
Maximum load on the frame (area D) must not be exceeded.

Continues on next page

1 Description

1.7.1 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

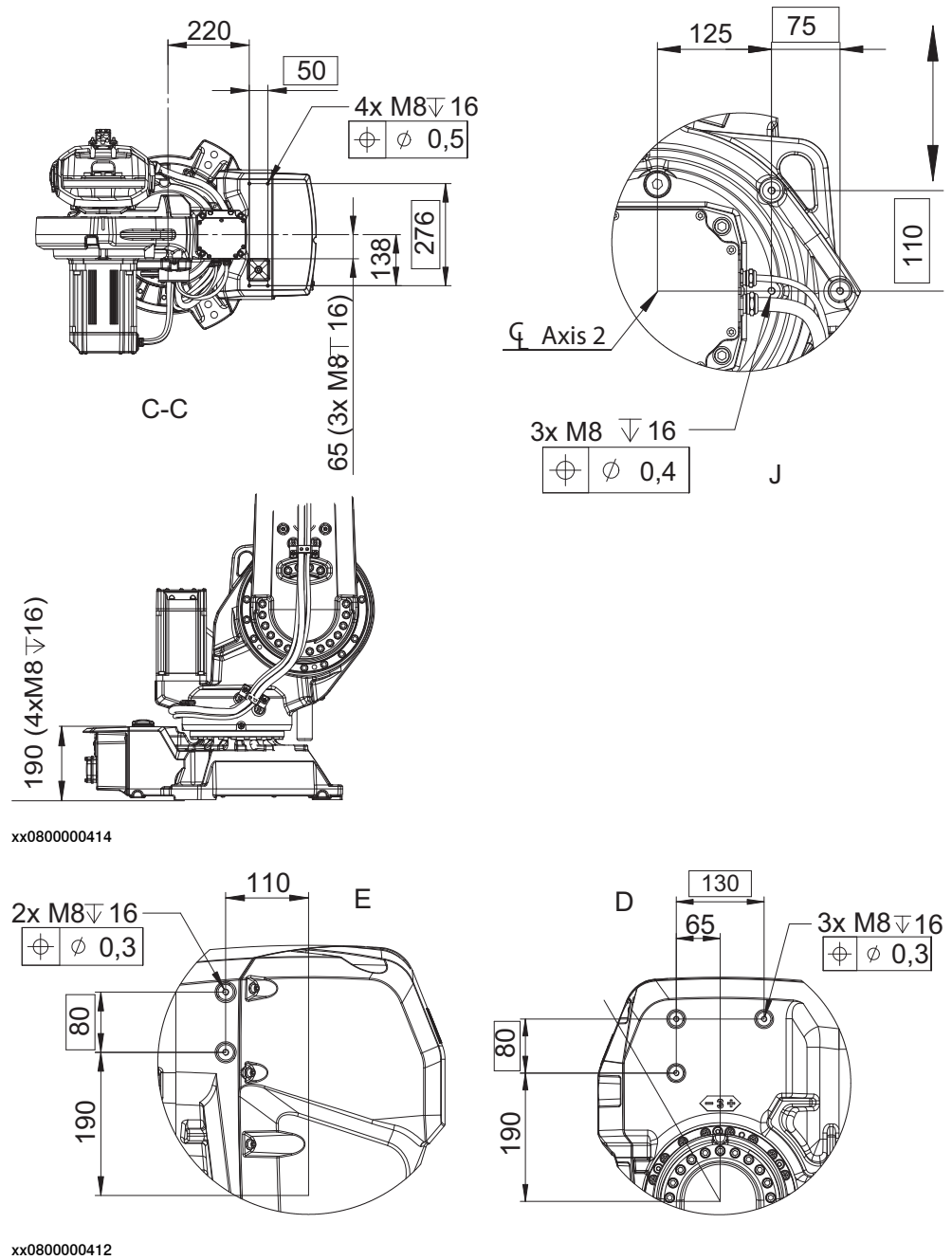
a. Payload + B max 60kg

b. Payload + B max 45kg

c. Payload + B max 40kg

Continues on next page

Holes for mounting of extra equipment

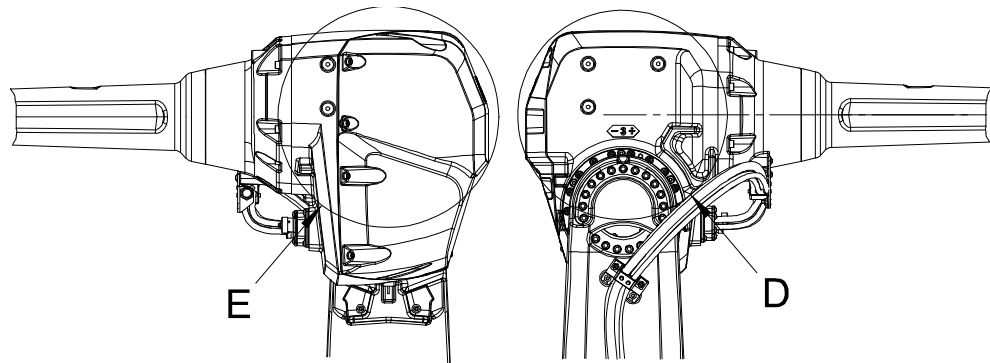


Continues on next page

1 Description

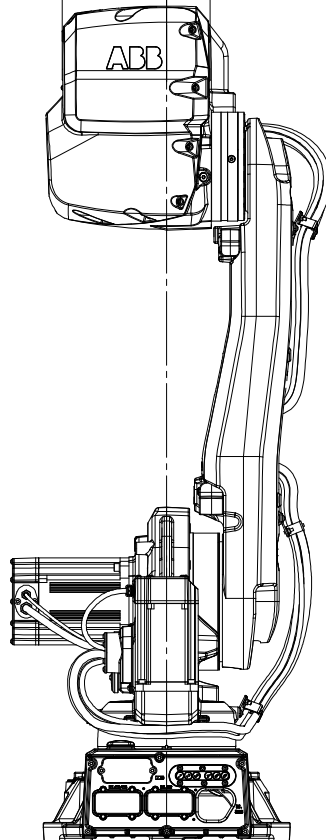
1.7.1 Information about mounting equipment

Continued



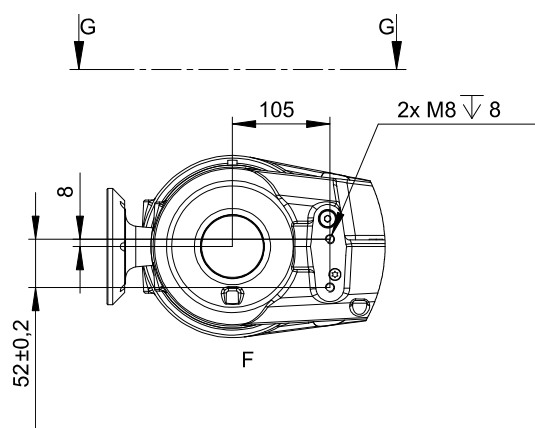
xx0800000419

216 (2x M8 ∇ 16) 90 (3x M8 ∇ 16)

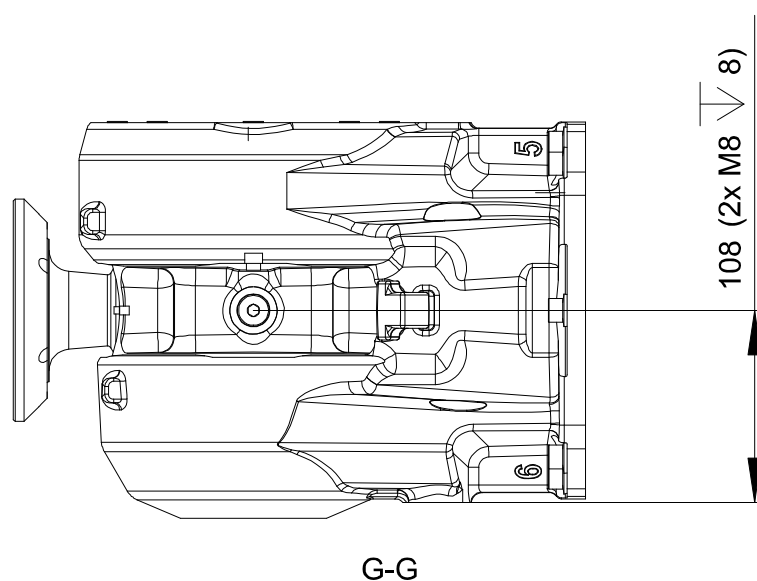


xx0800000418

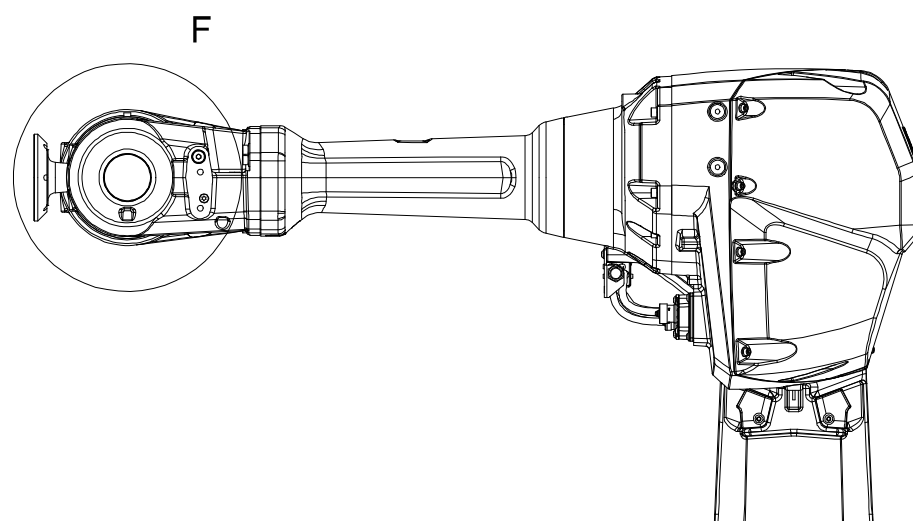
Continues on next page



xx0800000416



xx0800000417

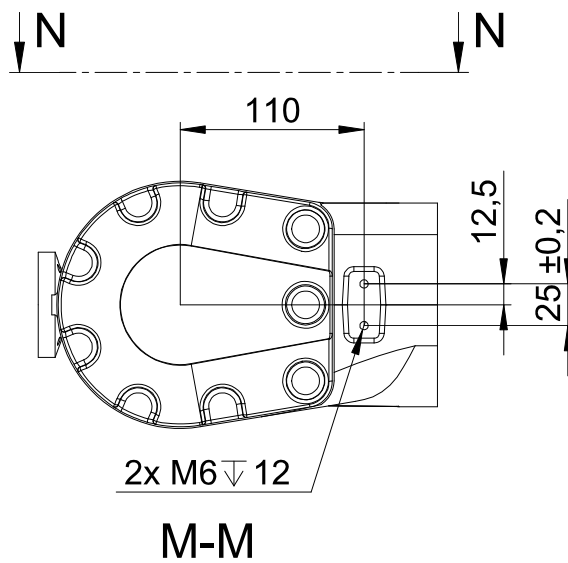


xx0800000421

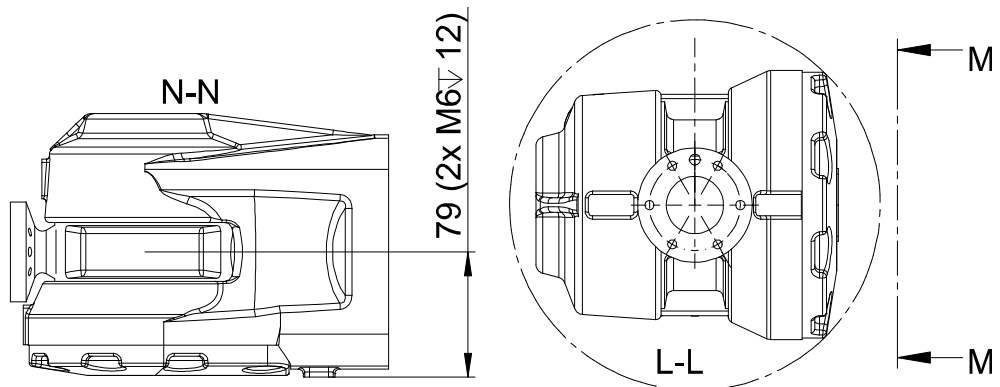
1 Description

1.7.1 Information about mounting equipment

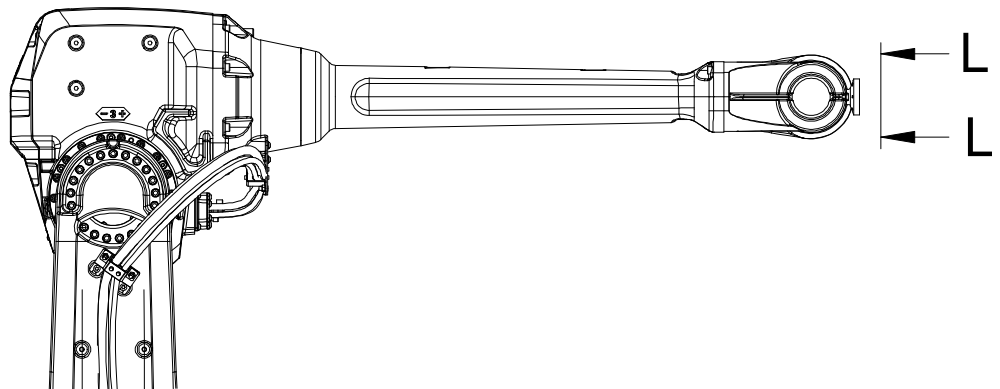
Continued



xx0800000409



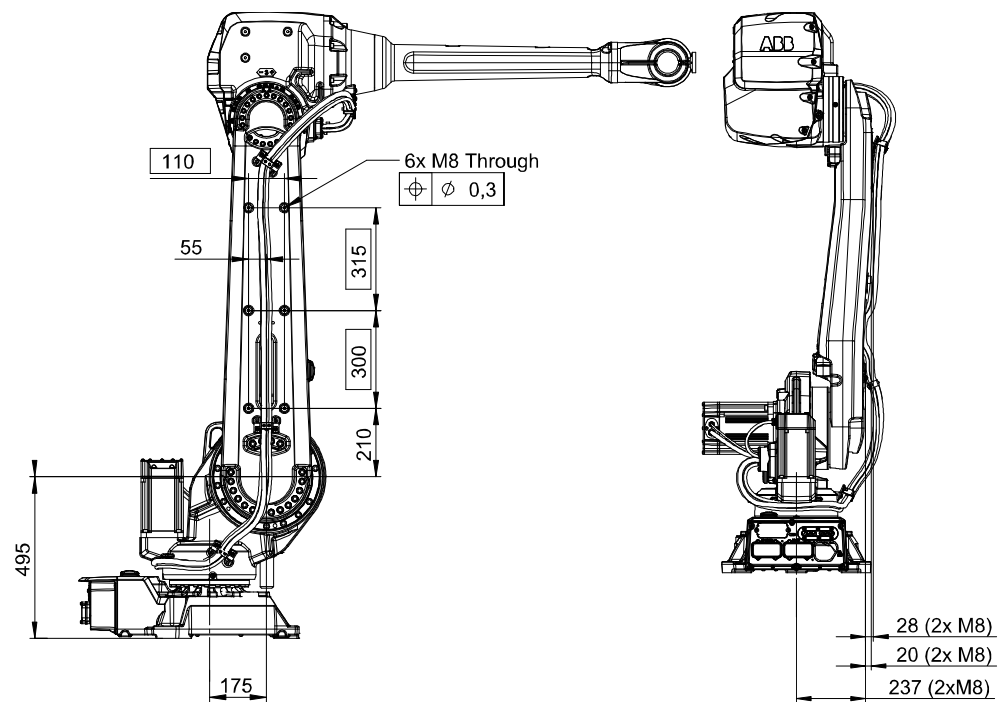
xx0800000408



xx0800000411

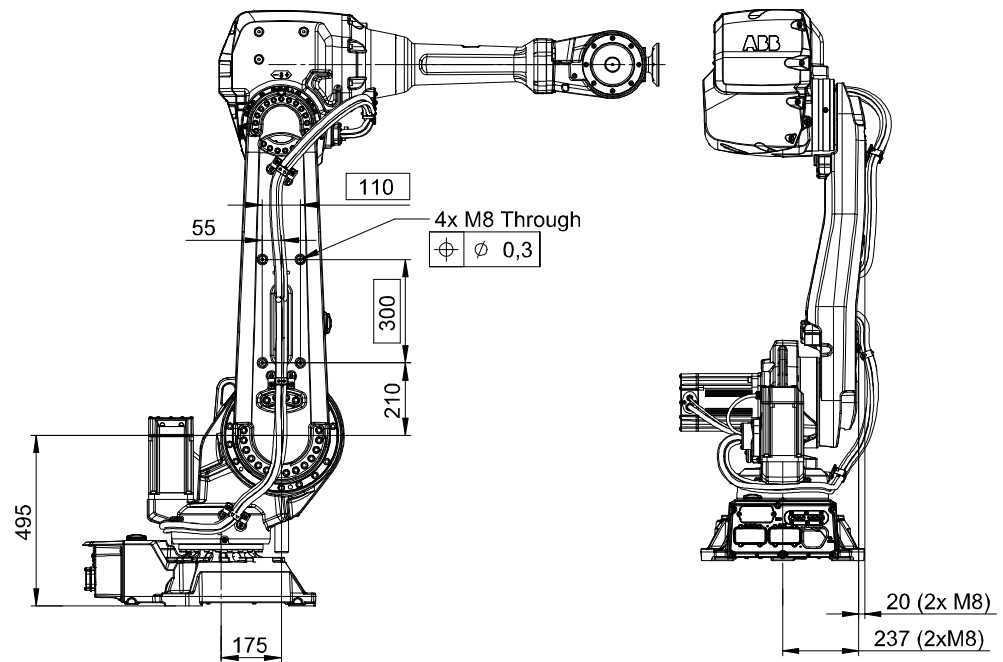
IRB 4600-40/2.55 and IRB 4600-20/2.50

Continues on next page



xx0800000423

IRB 4600 60(45)/2.05



xx0800000425

Continues on next page

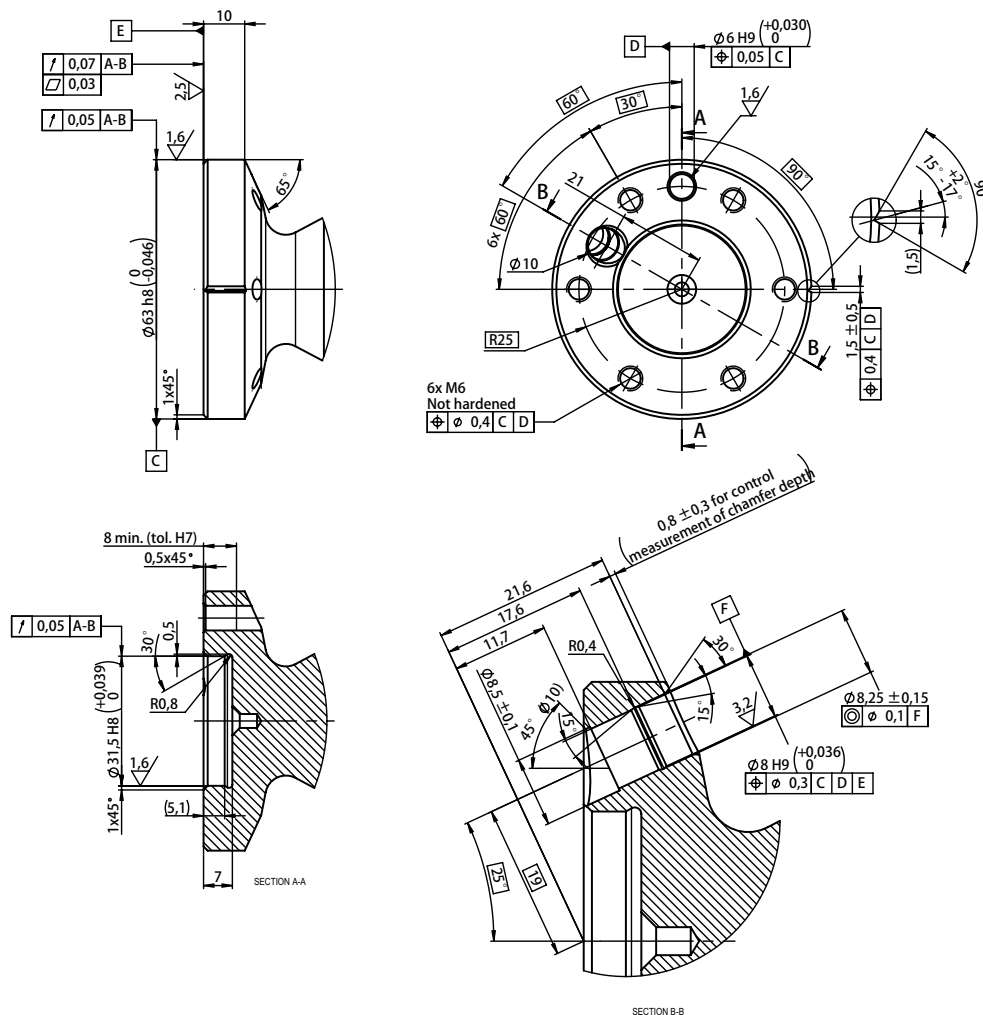
1 Description

1.7.1 Information about mounting equipment

Continued

Tool flange

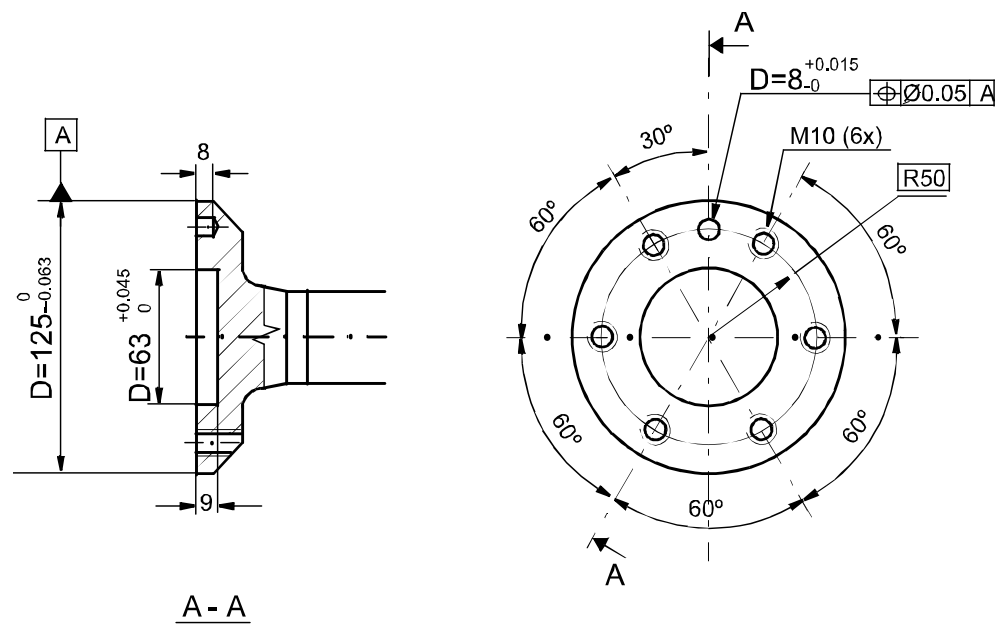
IRB 4600-20/2.50



xx0800000449

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

Continues on next page



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

1.8.1 Introduction to Maintenance and Troubleshooting

1.8 Maintenance and troubleshooting

1.8.1 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.

1.9 Robot motion

1.9.1 Introduction to Robot Motion

IRB 4600

Axis	Type of motion	Range of movement
1	Rotation Motion	For all variants without Cleanroom option: + 180° to - 180°
		With Cleanroom option (60kg & 40kg variants) only: + 165° to - 165°
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°.

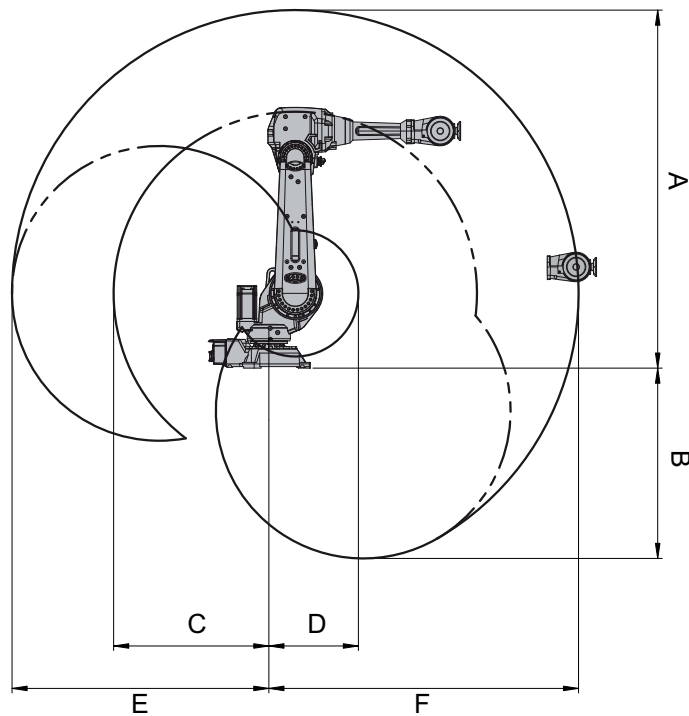
Continues on next page

1 Description

1.9.1 Introduction to Robot Motion

Continued

Working range, floor mounted



xx0900000119

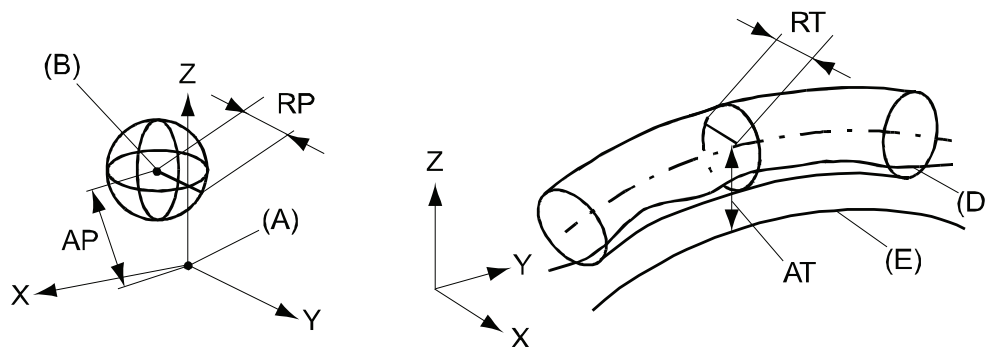
Variant	Pos. A	Pos. B	Pos. C	Pos. D	Pos. E	Pos. F
IRB 4600-60/2.05	2371 mm	1260 mm	1028 mm	593 mm	1701 mm	2051 mm
IRB 4600-45/2.05	2371 mm	1260 mm	1028 mm	593 mm	1701 mm	2051 mm
IRB 4600-40/2.55	2872 mm	1735 mm	1393 mm	680 mm	2202 mm	2552 mm
IRB 4600-20/2.50	2833 mm	1696 mm	1361 mm	665 mm	2163 mm	2513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

1.9.2 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

1.9.3 Velocity

1.9.3 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.

1.9.4 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

1.10 Cooling fan for axis 1 and 2 motor

1.10 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.

1.11 Customer connections

1.11.1 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.

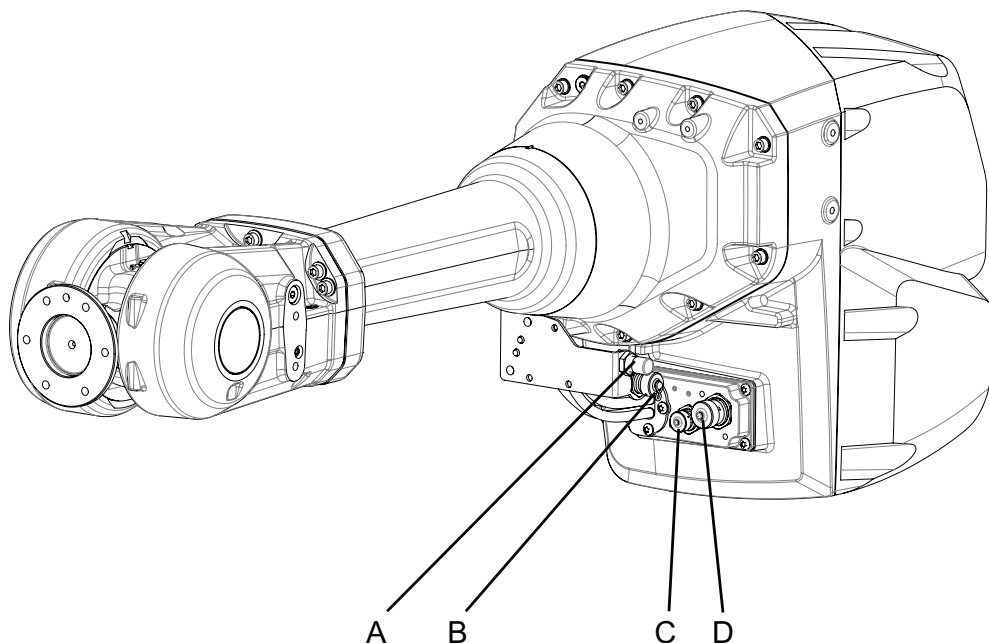


Note

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

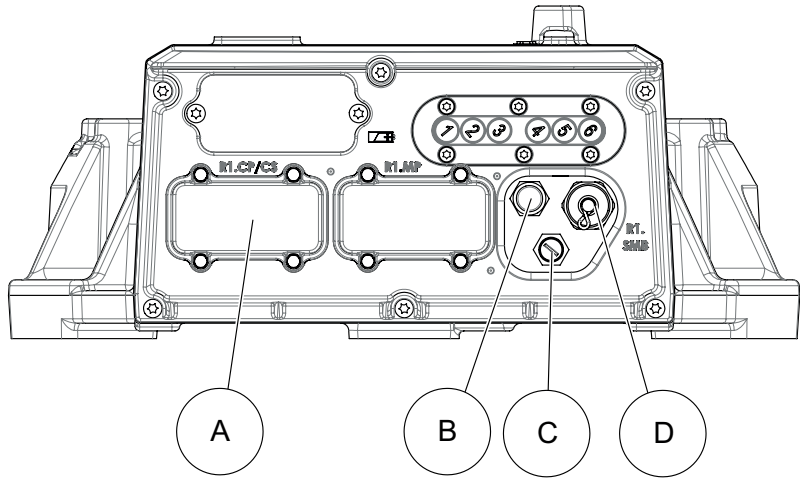
ⁱ Use a straight ethernet connector. Using an angled connector causes a collision risk with R2.CP, R2.CBUS or R2.CP/CS.

Continues on next page

1 Description

1.11.1 Customer connection on robot Continued

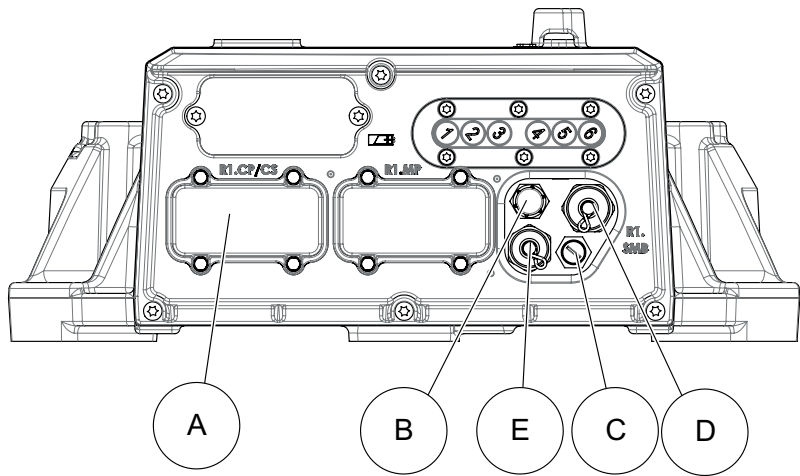
Customer connections base



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 (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	• 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	• Hose coupling • M12 connector, male
R2.CP/R2.CS	R2.CP/R2.CS	3HAC025396-001	• 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	• 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

Continues on next page

1 Description

1.11.1 Customer connection on robot

Continued

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

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	Color	RAL code ⁱ
209-1	ABB orange standard Standard color with protection option 3352-10 Foundry Plus2	NCS 2070-Y60R
209-2	ABB White standard Standard color with protection option 3351-5 Cleanroom 5	RAL 9003
209-202	ABB Graphite White standard Standard color with protection option 3350-670 Base 67	RAL 7035
209-196	ABB grey standard Standard color with protection option 3352-14 Foundry Prime2 67	NCS 4001-R59B
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.

Manipulator protection

Option	Description
3350-670	Base 67, IP67
3352-10	Foundry Plus2 67, IP67
3352-14	Foundry Prime2 67
3351-5	Cleanroom 5

Requirements

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

Continues on next page

Limitations

When ordering IRB 4600 OmniCore with option *Foundry Prime2 67* [3352-14] it can only be combined with the following warranty options:

- 438-1 Standard Warranty
- 438-8 Stock warranty

Foundry Prime 2 67 cannot be combined with:

- 3315-1 Foundry cable guard
- 3320-1 Cooling fan axis 1
- 3321-1 Cooling fan axis 2
- 3323-2 Axis 1 adjustable 22.5°
- 3322-1 FB7 on base

Cleanroom cannot be selected with:

- 3300-31 IRB 4600-45/2.05
- 3300-33 IRB 4600-20/2.50
- 3320-1 Cooling fan axis 1
- 3321-1 Cooling fan axis 2
- 3315-1 Foundry cable guard



Note

Base 67 includes IP67, according to standard IEC 60529.



Note

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

Continues on next page

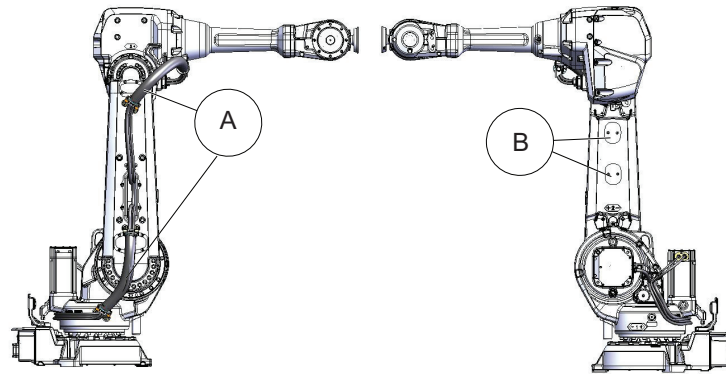
2 Specification of variants and options

2.2 Manipulator

Continued

CleanRoom (60/2.05, 40/2.55)

Generally, the modifications in Cleanroom 5 [3351-5] consists of three sections: cable harness, cover sets and new painting.



xx2300001223

Pos	Description
A	Protection tube for cable harness between axis1&2 , 2&3 to avoid particles dropping out.
B	Cover sets

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
3320-1	Cooling fan axis 1
3321-1	Cooling fan axis 2

Limitations

The option *Cooling fan for axis 1 and axis 2* is only available for manipulator with protection type *Standard*.

The option *Cooling fan for axis 1 and axis 2* is not available for *DressPack* options *MH DeviceNet*, *MH EtherNet*, *MH CC-Link* or *MH EtherCat*.

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.

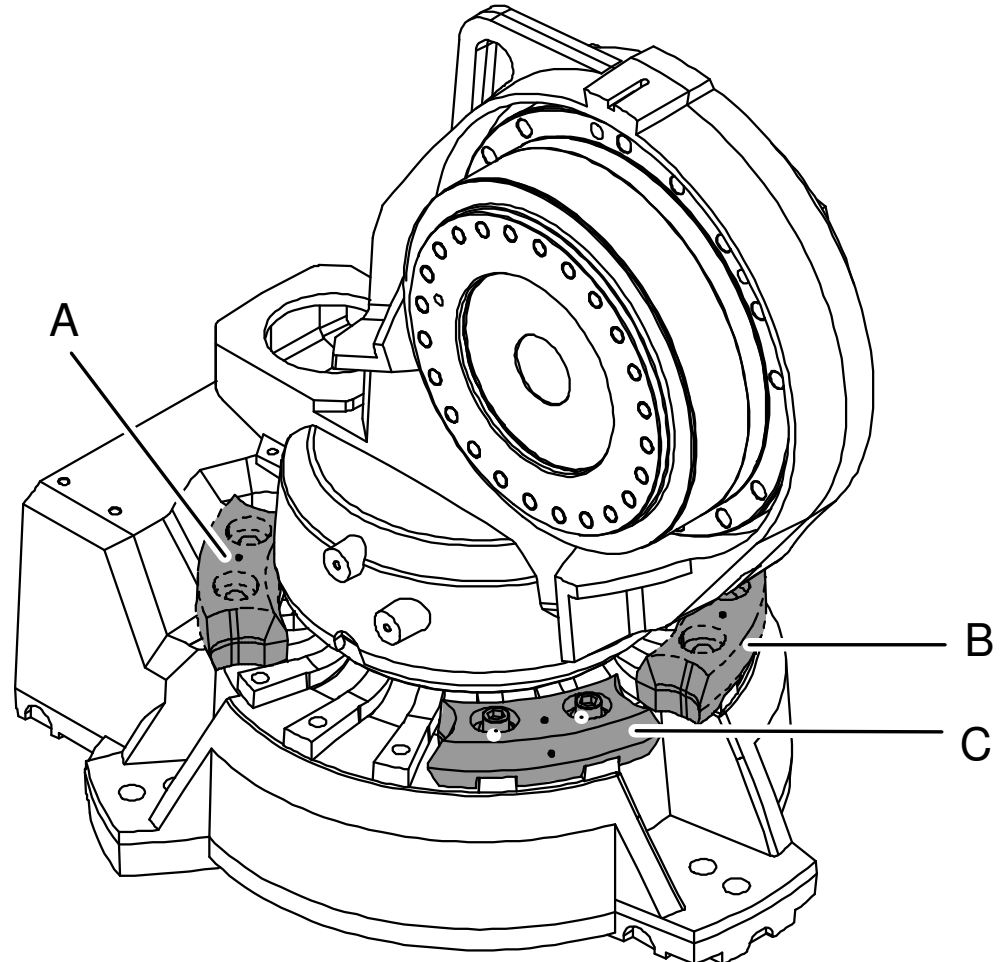
Option	Type	Description
3315-1	Foundry Cable Guard	For extra protection of cables. Requires option 3352-10 Foundry Plus2.

Continues on next page

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°



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 restrains 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

Continues on next page

2 Specification of variants and options

2.2 Manipulator

Continued

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]

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	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.  Note Special conditions are applicable, see <i>Robotics Warranty Directives</i>.

2.3 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)

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

2.4 Application manipulator

2.4 Application manipulator

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

2.5 Application floor cables

Parallel cable - Length

Option	Description	Note
3201-2	7 m	
3201-3	15 m	
3201-4	22 m	
3201-5	30 m	

Ethernet cable - Length



Note

Occupies 1 Ethernet port.

Option	Description	Note
3202-2	7 m	Includes Parallel cable
3202-3	15 m	Includes Parallel cable
3202-4	22 m	Includes Parallel cable
3202-5	30 m	Includes Parallel cable

DeviceNet cable - Length

Option	Description	Note
3204-2	7 m	Includes Parallel cable
3204-3	15 m	Includes Parallel cable
3204-4	22 m	Includes Parallel cable
3204-5	30 m	Includes Parallel cable

Servo cable 1 axis - Length

Option	Description	Note
3206-2	7 m	
3206-3	15 m	
3206-4	22 m	
3206-5	30 m	

EtherCat cable - Length



Note

Occupies 1 Ethernet port.

Option	Description	Note
3210-2	7 m	Includes Parallel cable

Continues on next page

2 Specification of variants and options

2.5 Application floor cables

Continued

Option	Description	Note
3210-3	15 m	Includes Parallel cable
3210-4	22 m	Includes Parallel cable
3210-5	30 m	Includes Parallel cable

MCB Servo cable 1 axis

Option	Description	Note
3212-2	7 m	

Requirements

This option requires options DressPack base-axis 3 and Motor Connection Kit [3069-x].

Index

A

- Absolute Accuracy, 37
- Absolute Accuracy, calibration, 34
- ambient humidity
 - operation, 28
 - storage, 27
- ambient temperature
 - operation, 28
 - storage, 27

C

- calibration
 - Absolute Accuracy type, 33
 - standard type, 33
- calibration, Absolute Accuracy, 34
- calibration marks, 40
- calibration position
 - scales, 40
- calibration scales, 40
- CalibWare, 33
- category 0 stop, 69
- category 1 stop, 69
- compensation parameters, 37

D

- direction of axes, 42

F

- fine calibration, 35
- foundation
 - requirements, 27

H

- humidity
 - operation, 28
 - storage, 27

L

- loads on foundation, 26

N

- negative directions, axes, 42

O

- operating conditions, 28
- options, 75

P

- positive directions, axes, 42
- product standards, 17
- protection classes, 28
- protection type, 28

R

- requirements on foundation, 27
- robot
 - protection class, 28
 - protection types, 28

S

- safety standards, 17
- scales on robot, 40
- standards, 17
- standard warranty, 79
- stock warranty, 79
- stopping distances, 69
- stopping times, 69
- storage conditions, 27
- sync marks, 40

T

- temperatures
 - operation, 28
 - storage, 27
- torques on foundation, 26

V

- variants, 75

W

- warranty, 79
- weight, 25



ABB Robotics Sweden AB
S-721 71 VÄSTERÅS, Sweden
Telephone +46 10-732 50 00

ABB Robotics Norway AS
Nordlysvegen 7, N-4340 BRYNE, Norway
Box 265, N-4349 BRYNE, Norway
Telephone: +47 22 87 2000

ABB Robotics (Shanghai) Limited
No. 39, 99 Miaoqiao Road,
Pudong New Area,
Shanghai, 201315, China
Telephone: +86 21 6105 6666

ABB Robotics LLC
1250 Brown Road
Auburn Hills, MI 48326
USA
Telephone: +1 248 391 9000

abb.com/robotics