ROBOTICS

Product specification

IRB 4400

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Product specification

IRB 4400/60
IRB 4400/L10

OmniCore

Document ID: 3HAC087216-001

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Original instructions.

Table of contents

Overview of this product specification 7

1 Description 9

1.1 Structure 9
1.1.1 Introduction to structure 9
1.1.2 Different robot variants 12
1.2 Standards 16
1.2.1 Applicable standards 16
1.3 Installation 17
1.3.1 Introduction to installation 17
1.3.2 Technical data 18
1.3.3 Mounting the manipulator 22
1.4 Calibration and references 25
1.4.1 Calibration methods 25
1.4.2 Fine calibration 27
1.4.3 Absolute Accuracy calibration 28
1.5 Load diagrams 30
1.5.1 Introduction to load diagrams 30
1.5.2 Maximum load and moment of inertia for full and limited axis 5 movement 33
1.5.3 Wrist torque 34
1.6 Mounting equipment 35
1.7 Maintenance and troubleshooting 38
1.8 Robot motion 39
1.8.1 Robot stopping distances and times 43
1.9 Signals 44

2 Specification of variants and options 45

2.1 Introduction to variants and options 45
2.2 Manipulator 46
2.3 Floor cables 48
2.4 Application manipulator 49
2.5 Connector kits manipulator 50
2.5.1 Base - Connector kits 51
2.5.2 Axis 3 - Connector kits 52
2.6 Application floor cables 53
2.7 Warranty 54

3 Accessories 55

3.1 Introduction to accessories 55

Index 57

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Overview of this product specification

About this product specification

It describes the performance of the manipulator or a complete family of manipulators in terms of:

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

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.

Users

It is intended for:

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

References

Reference	Document ID
Product specification - OmniCore V line	*3HAC074671-001*
Product manual - IRB 4400	*3HAC022032-001*

Revisions

Revision	Description
A	First edition.
B	Published in release 24D. The following updates are done in this revision: • Updated the section *Technical data on page 18*.

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1 Description

1.1 Structure

1.1.1 Introduction to structure

Robot family

The IRB 4400 is a 6-axis industrial robot, designed specifically for manufacturing industries that use flexible robot-based automation. The robot has built-in process ware, an open structure that is specially adapted for flexible use, and can communicate extensively with external systems.

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 *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 are 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

1.1.1 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

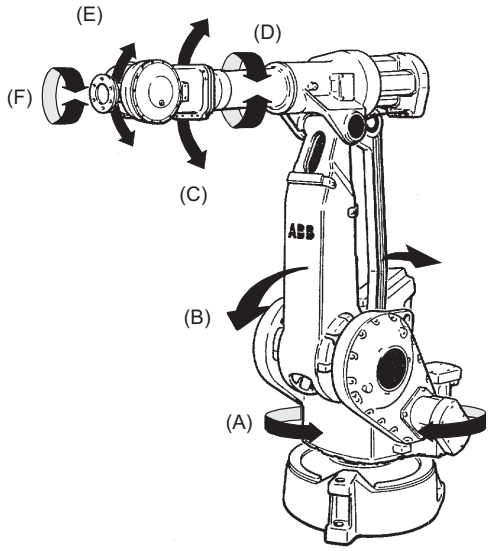
The Foundry Plus 2 robot can be cleaned with appropriate washing equipment according to the robot product manual. Appropriate cleaning and maintenance is required to maintain the protection, for example can rust preventive be washed off with wrong cleaning method.

Available robot variants

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

See *Specification of variants and options on page 45* for robot versions and other options not selectable together with Foundry Plus 2.

Manipulator axes



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A	Axis 1	B	Axis 2
C	Axis 3	D	Axis 4

Continues on next page

E	Axis 5	F	Axis 6

1.1.2 Different robot variants

General

The IRB 4400 is available in two variants, to be floor mounted (no tilting allowed around X-axis or Y-axis).

Robot variant	Handling capacity (kg)	Reach (m)
IRB 4400/60	60	1.96
IRB 4400/L10	10	2.55

Manipulator weight

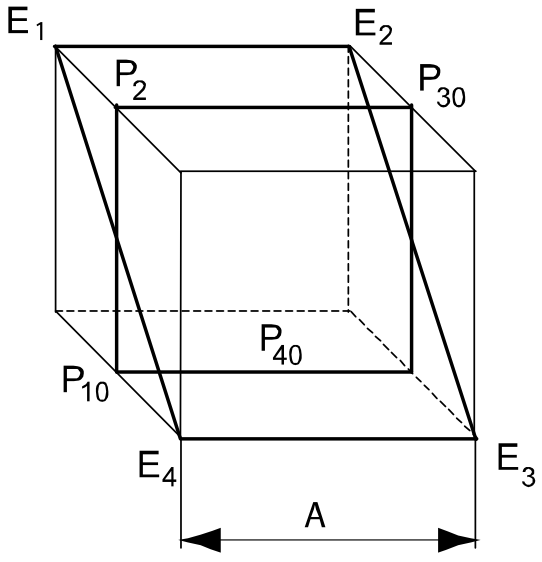
Robot type	Weight
IRB 4400/60	1040 kg
IRB 4400/L10	1040 kg

Other technical data

Data	Description	Note
Airborn noise level	The sound pressure level outside the working space	< 70 dB (A) Leq (acc. to Machinery directive 2006/42/EG)

Power consumption at max load

Type of Movement	All variants
ISO Cube Max. velocity	1.2 kW



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Pos	Description
A	630 mm [i]

[i] 1000 mm valid for IRB 4400/L10

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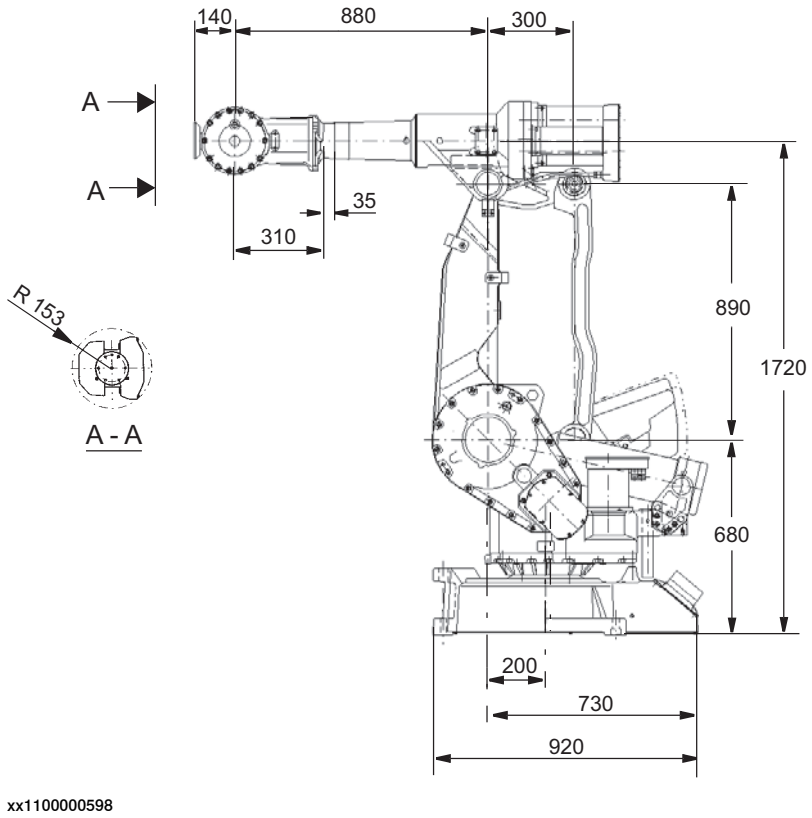
Power factor (cos φ)

The power factor is above 0.95 at a steady state power consumption higher than 2.0 kW, when the IRB 4400 is connected to the OmniCore V line.

Dimensions IRB 4400/60



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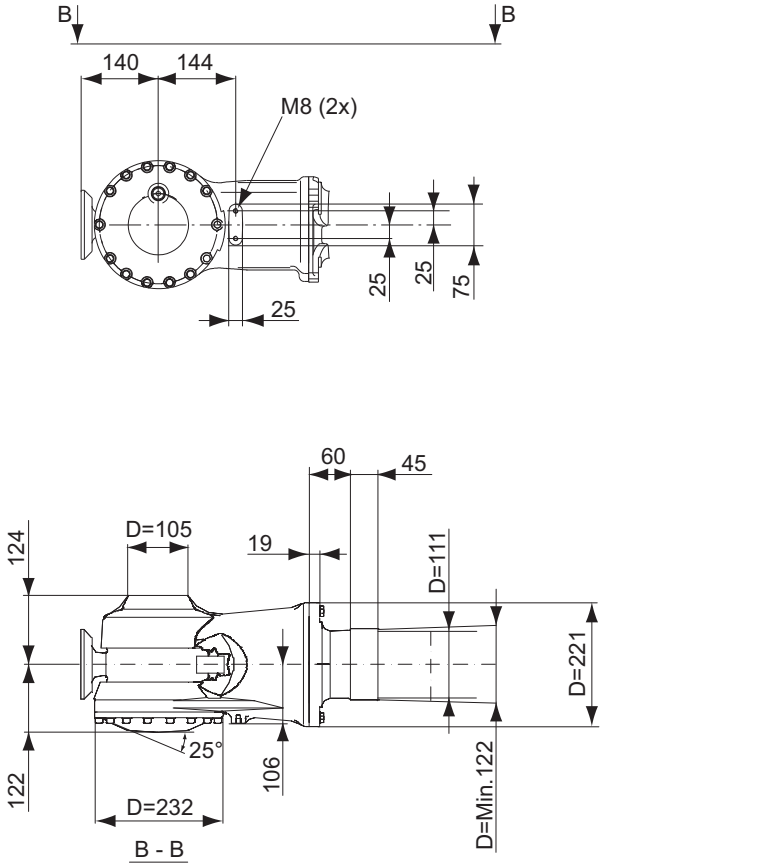
1.1.2 Different robot variants

Continued



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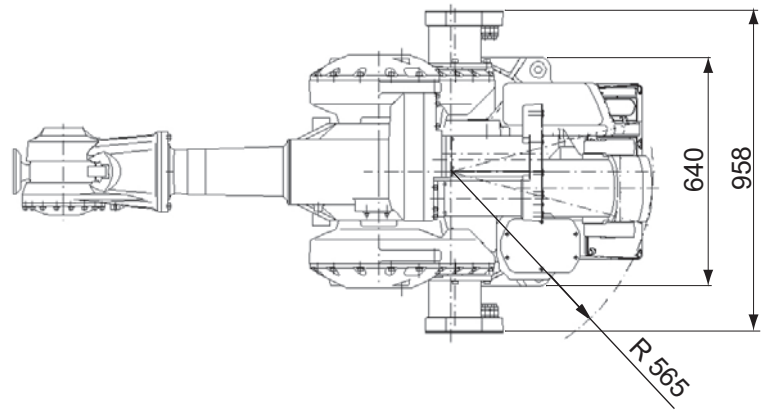

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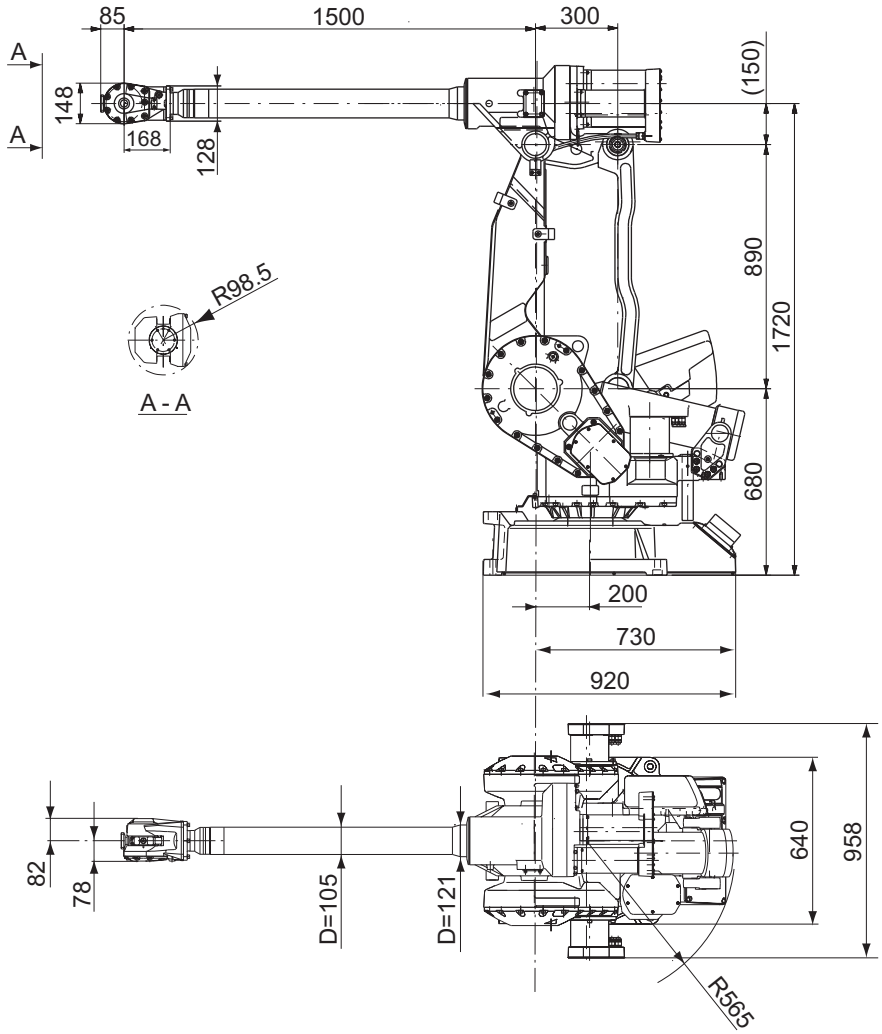
Dimensions IRB 4400/L10



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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 60204-1	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
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.

1.3 Installation

1.3.1 Introduction to installation

General

The IRB 4400 is designed for floor mounting (no tilting allowed around X-axis or Y-axis). A end effector of max. weight 10 to 60 kg, including payload, can be mounted on the mounting flange (axis 6). See section Load diagrams.

Extra loads

Extra loads can be mounted on the upper arm and on the base. There are holes for mounting extra equipment, see section Mounting equipment.

Working range limitations

The working range of axes 1-2 can be limited by mechanical stops and axis 3 by limit switches.

Explosive environments

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

1.3.2 Technical data

Weight, robot

The table shows the weight of the robot.

Robot model	Weight
IRB 4400	1300 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°	

Note

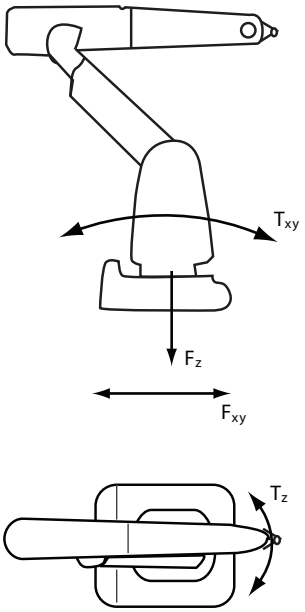
The actual mounting angle must always be configured in the system parameters, otherwise the performance and lifetime is affected. See the product manual for details.

Continues on next page

Loads on foundation, robot

The illustration shows the directions of the robots stress forces.

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



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

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

Note

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

WARNING

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

Floor mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 7500 N	± 9000 N
Force z	+9500 ± 2000 N	+9500 ± 3000 N
Torque xy	± 14000 Nm	± 16000 Nm
Torque z	± 2000 Nm	± 4000 Nm

Continues on next page

1.3.2 Technical data
Continued

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	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	- **Note** It may affect the manipulator lifetime 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 *Motion Process Mode*.

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 possibly 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)

Operating conditions, robot

The table shows the allowed operating conditions for the robot:

Parameter	Value
Minimum ambient temperature	+5° C
Maximum ambient temperature	+45° C
Maximum ambient humidity	95% at constant temperature

Continues on next page

Protection classes, robot

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

Protection type	Protection class[i]
Manipulator, protection type Standard	IP54
Manipulator, protection type Foundry Prime	IP67, steam washable

[i] According to IEC 60529.

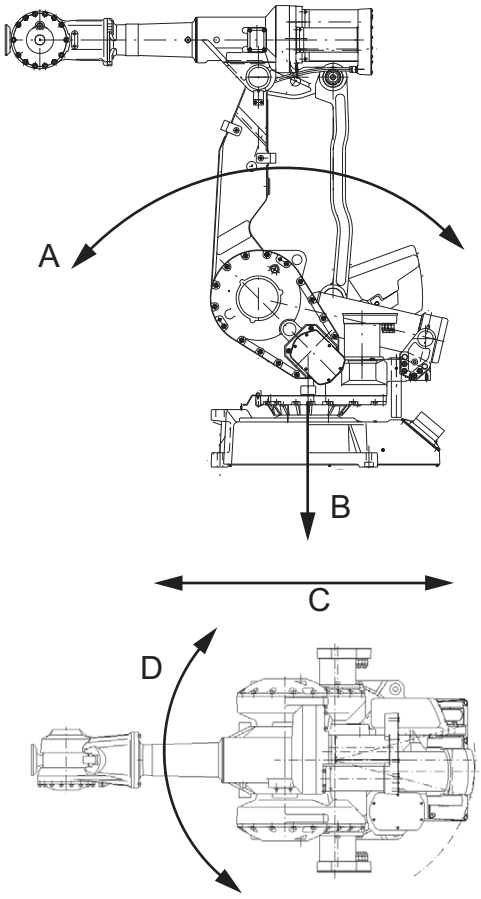
1.3.3 Mounting the manipulator

Maximum load in relation to the base coordinate system

Maximum load IRB 4400

Floor Mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 7500 N	± 9000 N
Force z	+9500 ± 2000 N	+9500 ± 3000 N
Torque xy	± 14000 Nm	± 16000 Nm
Torque z	± 2000 Nm	± 4000 Nm



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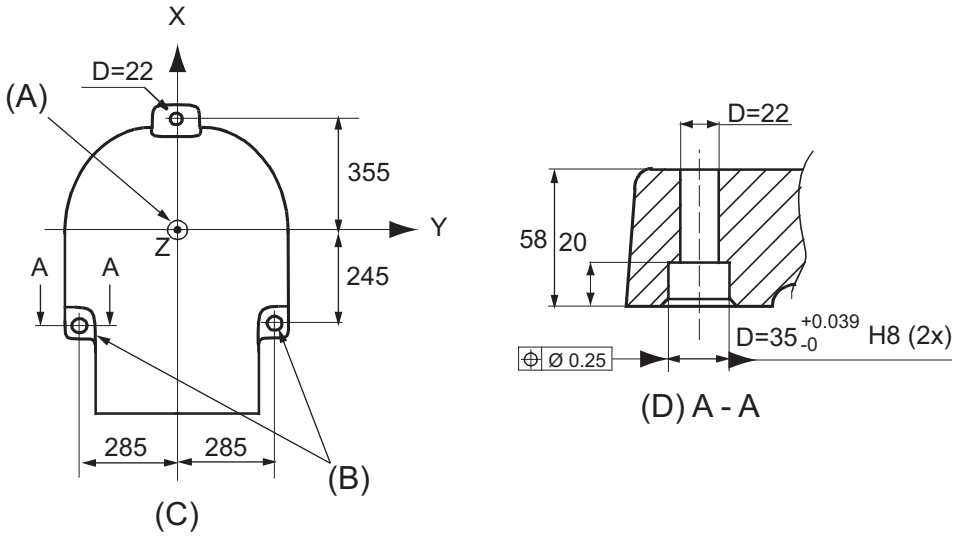
A	Torque$_{xy}$ (T_{xy})
B	Force $_{z}$ (F_{z})
C	Force $_{xy}$ (F_{xy})
D	Torque $_{z}$ (T_{z})

Continues on next page

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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Pos	Description
A	Z= center line
B	The same dimensions
C	View from bottom of the base
D	Section

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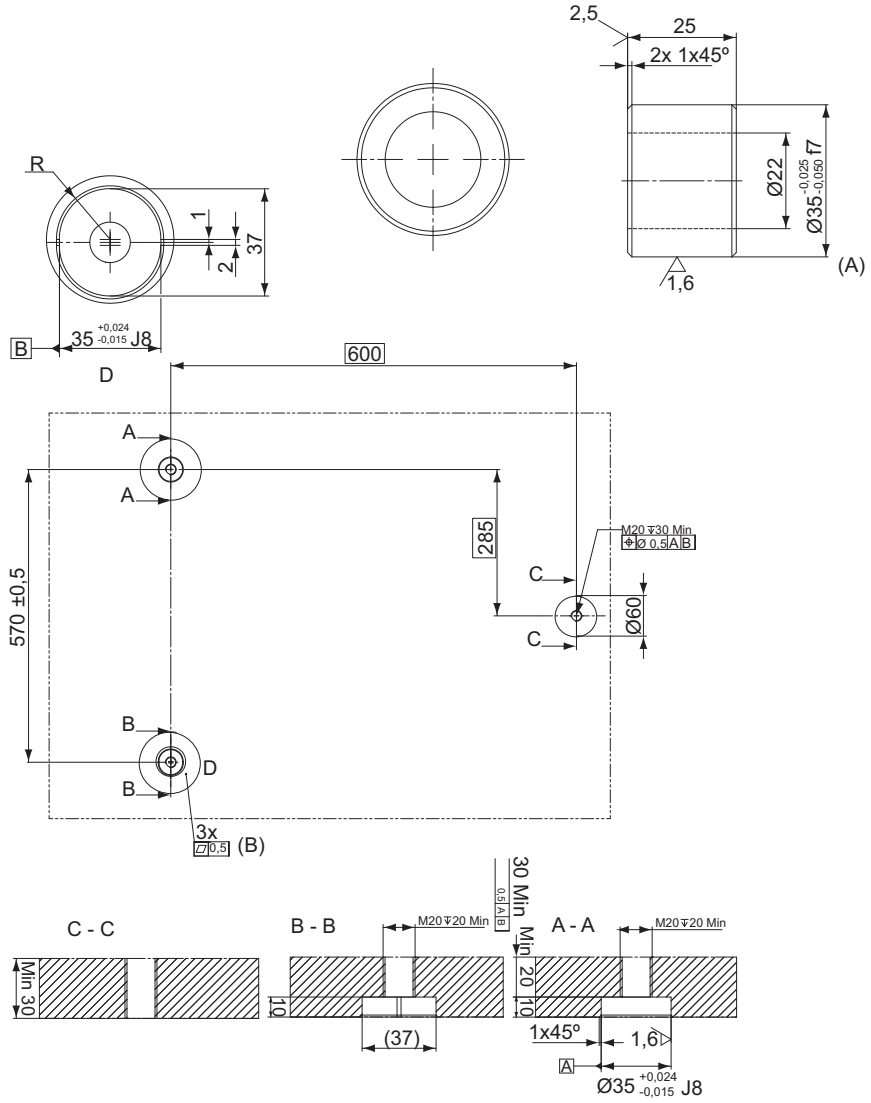
1.3.3 Mounting the manipulator
Continued

Mounting surface and bushings



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Pos	Description
A	Surface treatment, ISO 2081 Fe/Zn 8 c2 Guide bushings
B	Common zone

1.4 Calibration and references

1.4.1 Calibration methods

Overview

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

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.	Calibration Pendulum Levelmeter calibration (alternative method)
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 and 5. **Note** For advanced users, it is also possible to use the do the wrist optimization using the RAPID instruction `WristOpt`, see *Technical reference manual - RAPID Instructions, Functions and Data types*. This instruction is only available for OmniCore robots.	Wrist Optimization

Continues on next page

1.4.1 Calibration methods
Continued

Brief description of calibration methods

Calibration Pendulum method

Calibration Pendulum is a standard calibration method for calibration of some ABB robots. On OmniCore, this calibration method is only used on IRB 1510, IRB 1520, IRB 2400, and IRB 4400.

Two different routines are available for the Calibration Pendulum method:

- Calibration Pendulum II
- Reference calibration

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

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*.

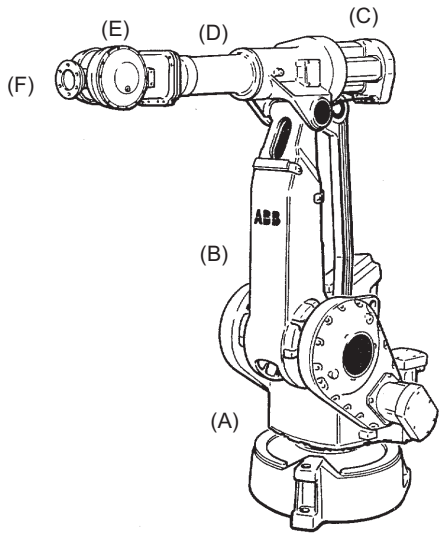
If a service operation is done to a robot with the option Absolute Accuracy, a new absolute accuracy calibration is required in order to establish full performance. For most cases after replacements that do not include taking apart the robot structure, standard calibration is sufficient.

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.

1.4.2 Fine calibration

General

Fine calibration is made using the Calibration Pendulum, see *Operating manual - Calibration Pendulum*.



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Pos	Description	Pos	Description
A	Axis 1	B	Axis 2
C	Axis 3	D	Axis 4
E	Axis 5	F	Axis 6

Calibration

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

1.4.3 Absolute Accuracy calibration

Purpose

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

Here are some examples of when this accuracy is important:

- Exchangeability of robots
- Offline programming with no or minimum touch-up
- Online programming with accurate movement and reorientation of tool
- Programming with accurate offset movement in relation to 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.

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.

Continues on next page

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
- 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 4400/60 IRB 4400/L10	0.30	0.75	100

1.5 Load diagrams

1.5.1 Introduction to 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, and an extra load of 15 kg at the upper arm housing, 5 kg at the wrist and 35 kg at the frame for IRB 4400/60.

The load diagrams include a nominal payload inertia, J_0 of 0.04 kgm^2, and an extra load of 15 kg at the upper arm housing, 2 kg at the wrist and 35 kg at the frame for IRB 4400/L10.

At different moment of inertia the load diagram will be changed. For robots that are allowed tilted, wall 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.

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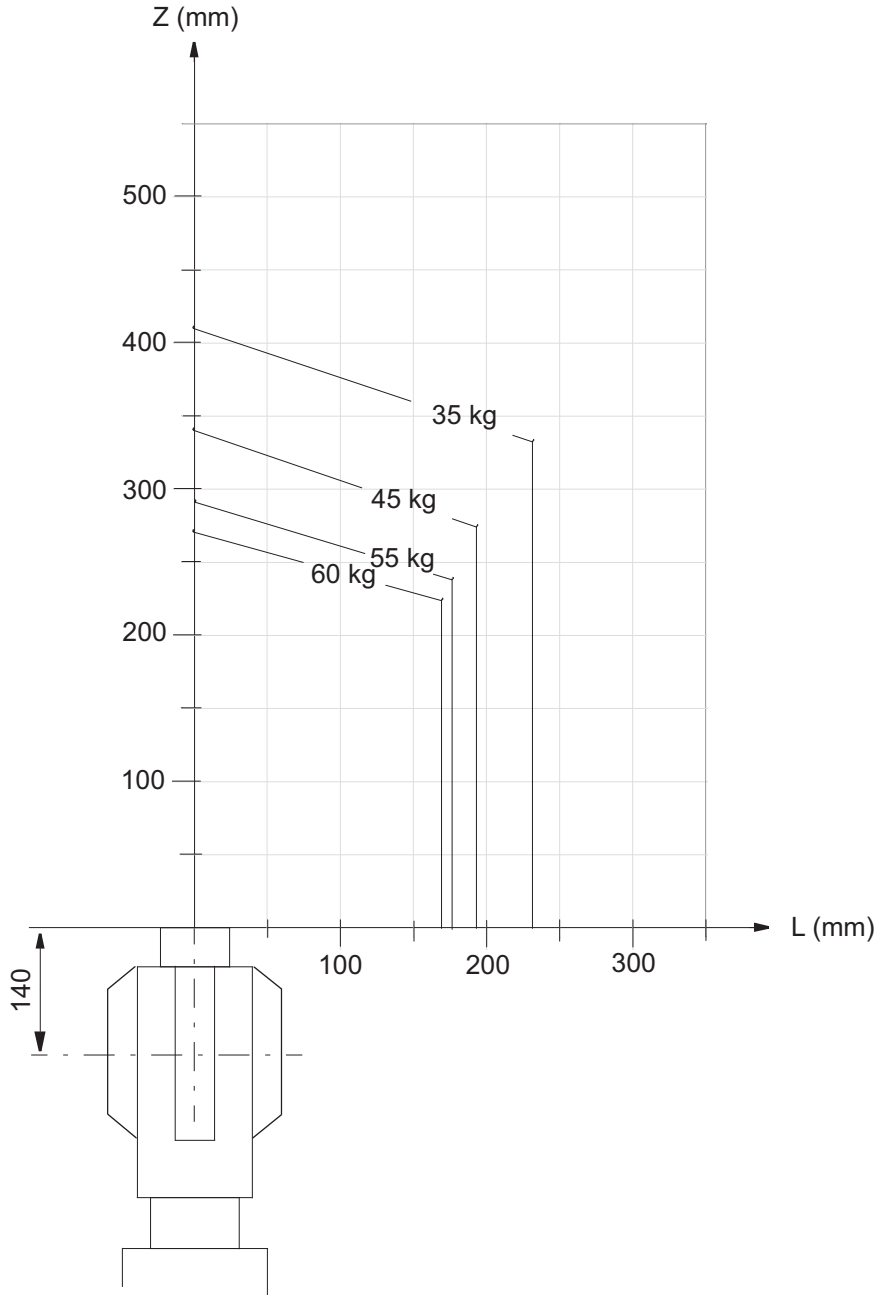
Load diagram IRB 4400/60



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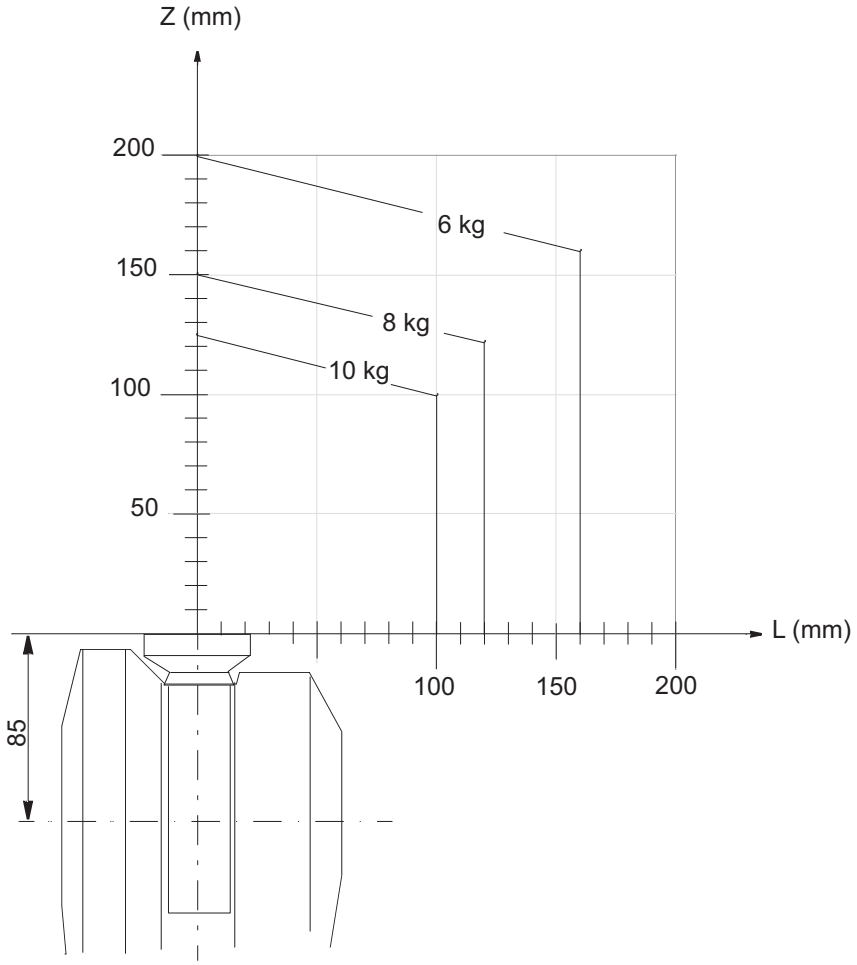
1.5.1 Introduction to load diagrams
Continued

Load diagram IRB 4400/L10



1.5.2 Maximum load and moment of inertia for full and limited axis 5 movement

Information

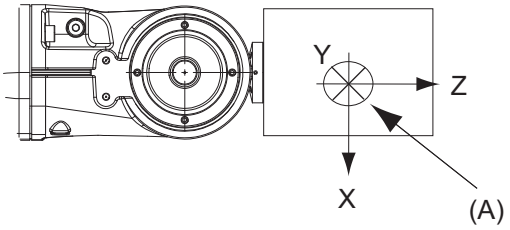
Note

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=sqr(x^2 + y^2).

Full movement of axis 5 (±120°)

Axis	Robot type	Maximum moment of interia
5	IRB 4400/60	Ja5 = Load x (($Z + 0,14^2 + L^2$) + max (J_{0x}, J_{0y}) ≤ 30.0 kgm^2
6	IRB 4400/60	Ja6 = Load x L^2 + J_{0Z} ≤ 17.5 kgm^2

Axis	Robot type	Maximum moment of interia
5	IRB 4400/L10	Ja5 = Load x (($Z + 0,085^2 + L^2$) + max (J_{0x}, J_{0y}) ≤ 1.15 kgm^2
6	IRB 4400/L10	Ja6 = Load x L^2 + J_{0Z} ≤ 0.70 kgm^2



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1.5.3 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.

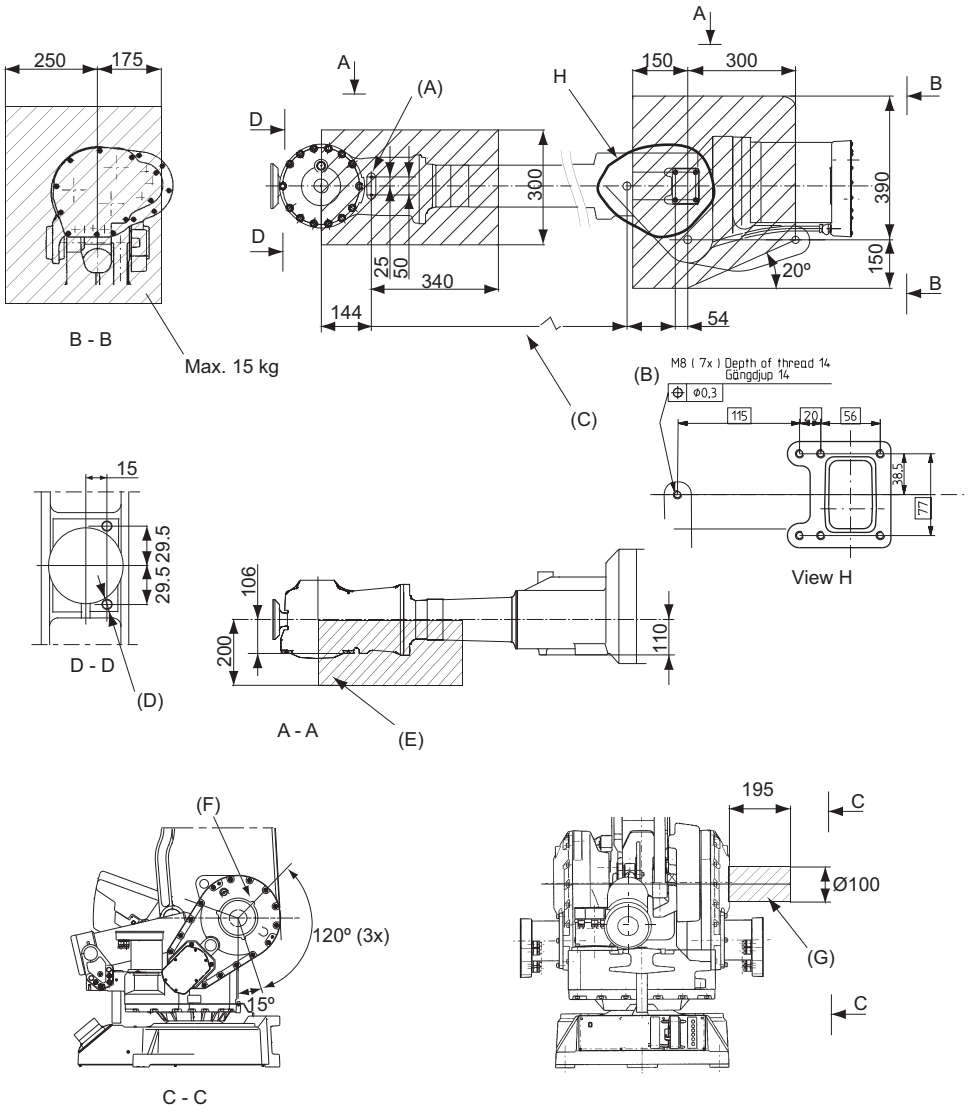
Robot type	Max wrist torque axis 4 and 5	Max wrist torque axis 6	Max torque valid at load
IRB 4400/60	242 Nm	98.9 Nm	60 kg
IRB 4400/L10	20.6 Nm	9.81 Nm	10 kg

1.6 Mounting equipment

Upper arm and base

The robot is supplied with tapped holes on the upper arm and on the base for mounting extra equipment.

IRB 4400/60



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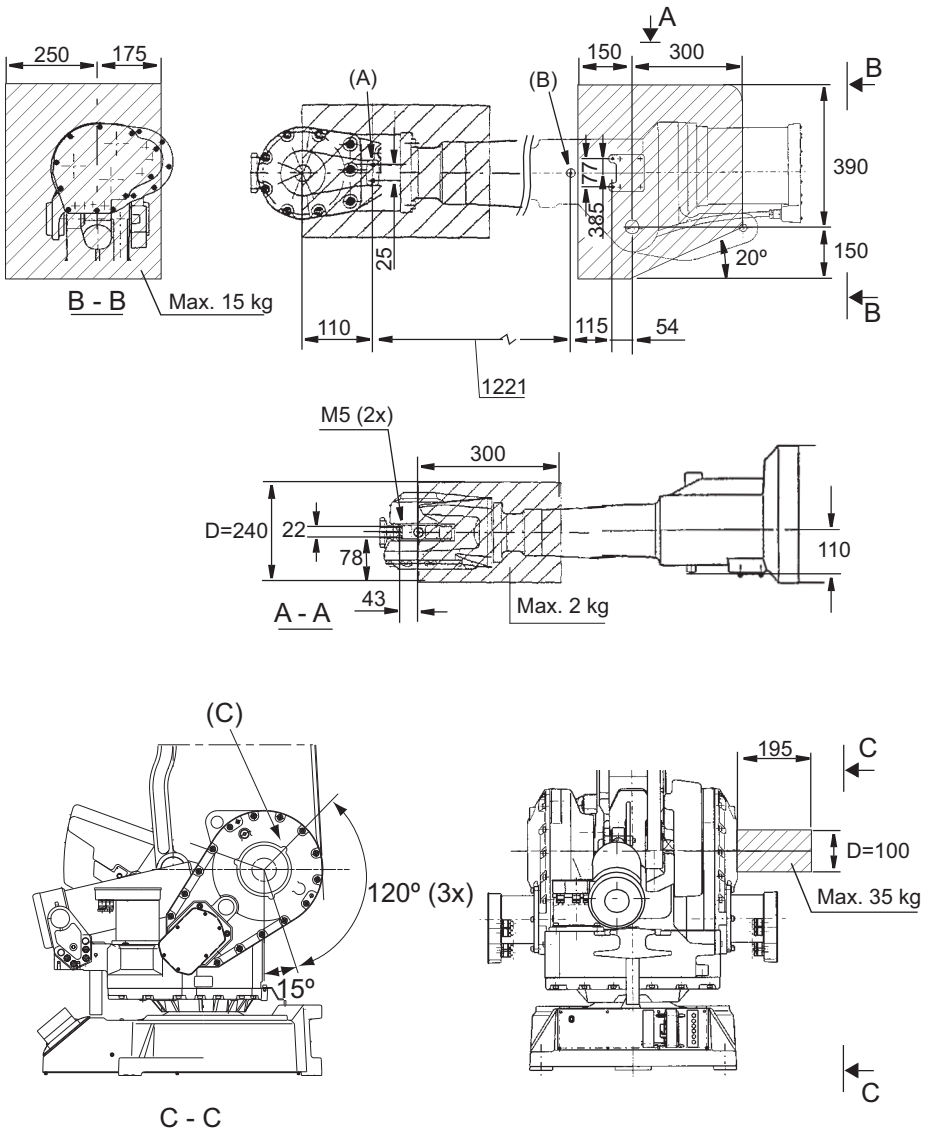
Pos	Description
A	M8 (x2) Used if option 218-6 is chosen, depth of thread 9 mm
B	M8 (x7) Depth of thread 14 mm
C	571 mm
D	M6 (2x) tapped depth 12 mm
E	Max. 5 kg at max handling weight

Continues on next page

1.6 Mounting equipment
Continued

Pos	Description
F	M8 (x3) R= 92 mm, depth 16 mm (if option 34-1 is chosen these holes are occupied)
G	Max. 35 kg

IRB 4400/L10



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Pos	Description
A	M6 (x2) Depth of thread 15 mm
B	M8 (x3) Depth of thread 14 mm
C	M8 (x3) R= 92 mm, depth of thread 16 mm (If option 34-1 is chosen these holes are occupied)

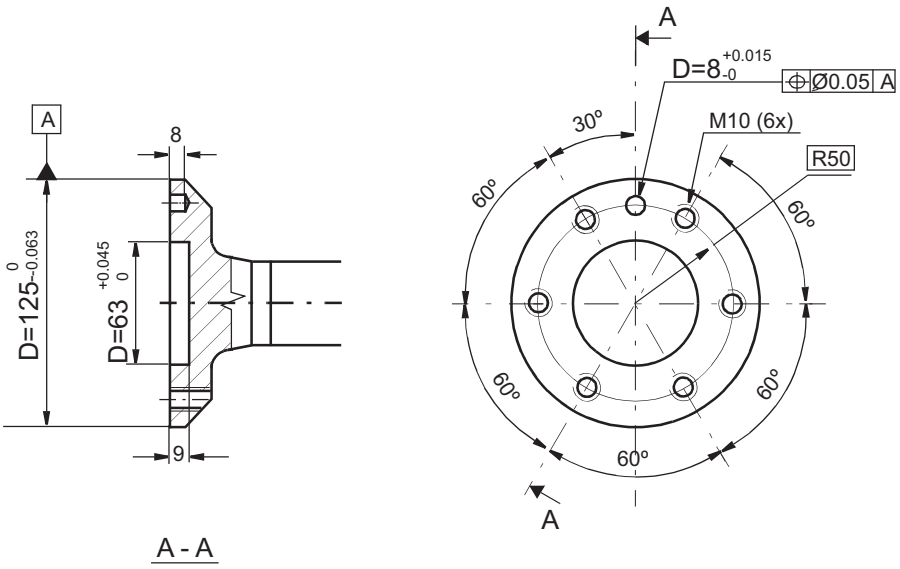
Continues on next page

Note

Maximum loads must never be exceeded!

Tool flange

IRB 4400/60



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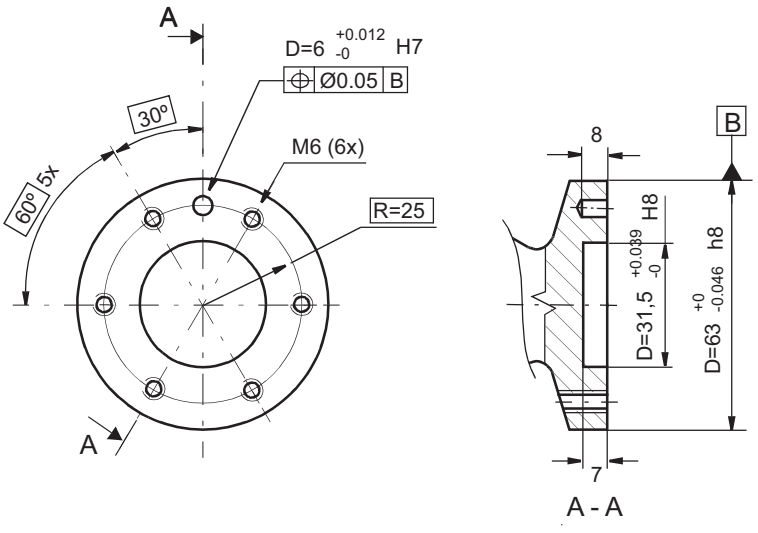
IRB 4400/L10



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For fastening of gripper tool flange to Robot tool flange every one of the screw holes for 6 screws, quality class 12.9 shall be used. Min. 10 mm used thread length.

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

General

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

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

Maintenance

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

1.8 Robot motion

Introduction to robot motion

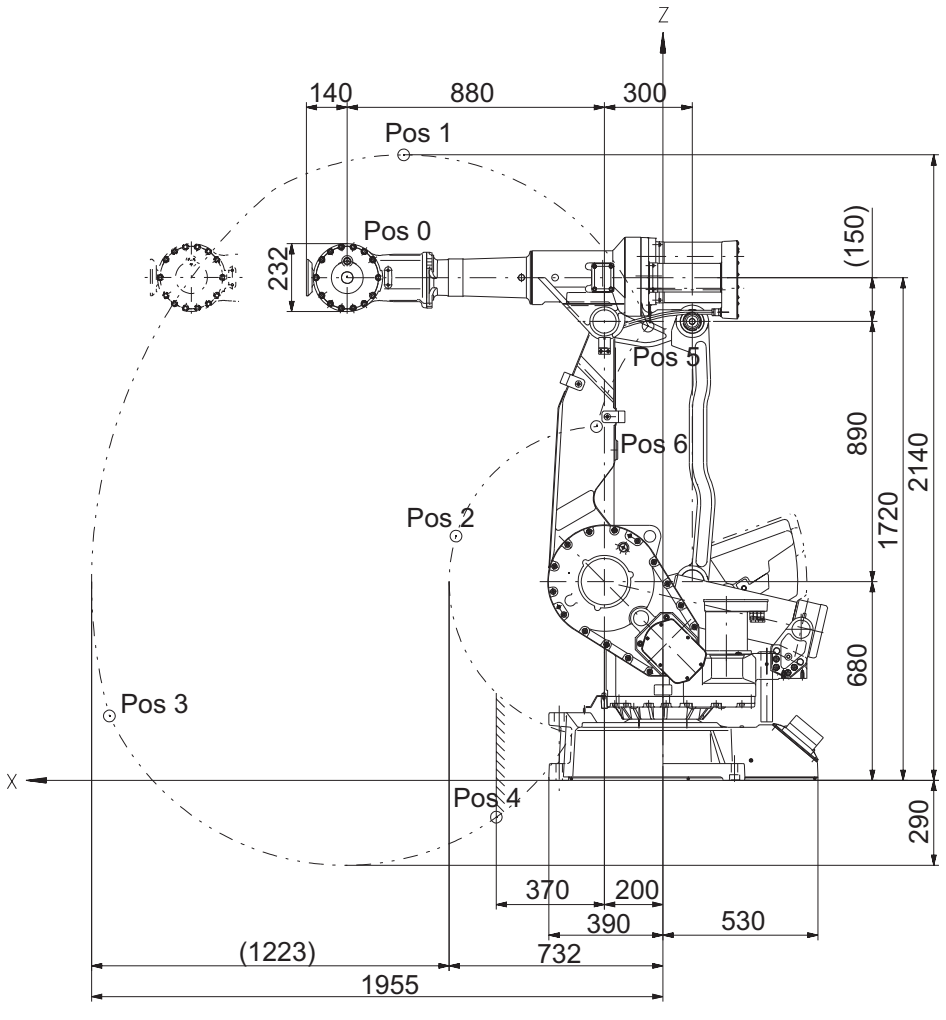
Axis	Type of motion	Range of movement
1	Rotation motion	+ 165° to - 165°
2	Arm motion	+ 95° to - 70°
3	Arm motion	+ 65° to - 60°
4	Rotation motion	+ 200° to - 200°
5	Bend motion	+ 120° to - 120°
6	Turn motion	+ 400° to - 400° + 200 [i] rev.[ii] to - 200 rev. Max.[iii]

i + 183 rev to - 183 rev valid for IRB 4400/L10

ii rev. = Revolutions

iii The default working range for 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).

IRB 4400/60



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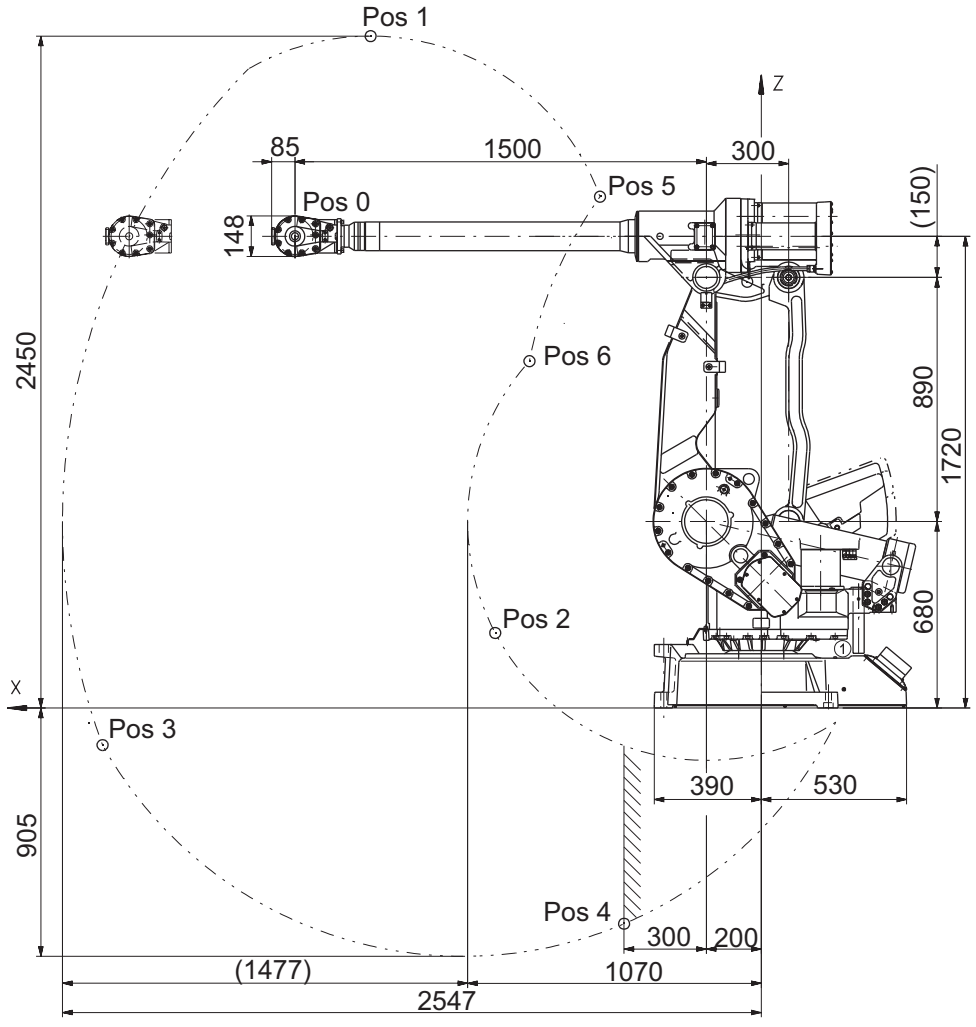
1.8 Robot motion
Continued

Positions at wrist center (mm) and angle (degrees):

Position no (see figure above)	Position (mm) X	Position (mm) Z	Angle (degrees) Axis 2	Angle (degrees) Axis 3
0	1080	1720	0	0
1	887	2140	0	-30
2	708	836	0	65
3	1894	221	95	-60
4	570	-126	95	40
5	51	1554	-70	40
6	227	1210	-70	65

IRB 4400/L10



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Positions at wrist center (mm) and angle (degrees):

Position no (see figure above)	Position (mm) X	Position (mm) Z	Angle (degrees) Axis 2	Angle (degrees) Axis 3
0	1700	1720	0	0

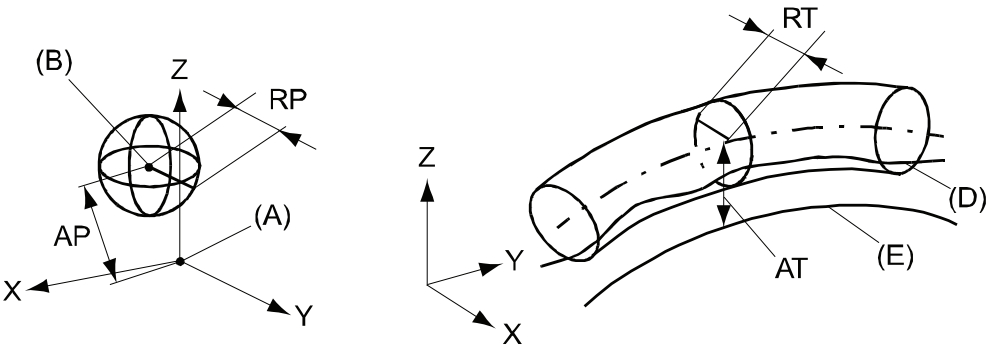
Continues on next page

Position no (see figure above)	Position (mm) X	Position (mm) Z	Angle (degrees) Axis 2	Angle (degrees) Axis 3
1	1424	2450	0	-30
2	970	274	0	65
3	2401	-135	95	-60
4	500	-786	95	24
5	588	1864	-70	40
6	845	1265	-70	65

Performance according to ISO 9283

At rated maximum load, maximum offset and 1.6 m/s velocity on the inclined ISO test plane, 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.



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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 4400/60	IRB 4400/L10
Pose repeatability, RP (mm)	0.06	0.05
Pose accuracy, AP[i] (mm)	0.03	0.04
Linear path repeatability, RT[ii] (mm)	0.09	0.16
Linear path accuracy, AT[ii] (mm)	0.36	0.34

Continues on next page

Description	IRB 4400/60	IRB 4400/L10
Pose stabilization time, (PSt) to within 0.2 mm of the position (s)	0.27	0.25

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

ii The values AT and RT, for IRB 4400/60, are measured at a velicity of 250 mm/s

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

Velocity

Maximum axis speed

Robot type	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
IRB 4400/60	150 °/s	120 °/s	120 °/s	225 °/s	250 °/s	330 °/s
IRB 4400/L10	150 °/s	150 °/s	150 °/s	370 °/s	330 °/s	381 °/s

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

Continues on next page

1.8.1 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 Signals

To connect extra equipment on the manipulator, there are cables integrated into the manipulator's cabling, one FCI UT07 14 12SH44N connector and one FCI UT07 18 23SH44N connector on the rear part of the upper arm.

Hose for compressed air is also integrated into the manipulator. There is an inlet (R1/4") at the base and an outlet (R1/4") on the rear part of the upper arm.

Type	Quantity	Value
Signals	23	50 V, 250 mA
Power	10	250 V, 2 A
Air	1	Max. 8 bar, inner hose diameter 8 mm

2 Specification of variants and options

2.1 Introduction to variants and options

General

The different variants and options for the IRB 4400 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.

2.2 Manipulator

Manipulator variant

Option	IRB Type	Handling capacity (kg) / Reach (m)
3300-111	IRB 4400/60	60/1.96
3300-112	IRB 4400/L10	10/2.55

Manipulator color

Option	Description	Note
209-1	ABB Orange standard	
209-2	ABB White standard	
209-196	ABB grey standard	
209-202	ABB Graphite White standard	Standard color
209-	The robot is painted with the chosen RAL-color.	

Manipulator protection

Option	Description
3350-540	Base 54, IP54
3352-10	Foundry Plus2 67, IP67

Requirements

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

Note

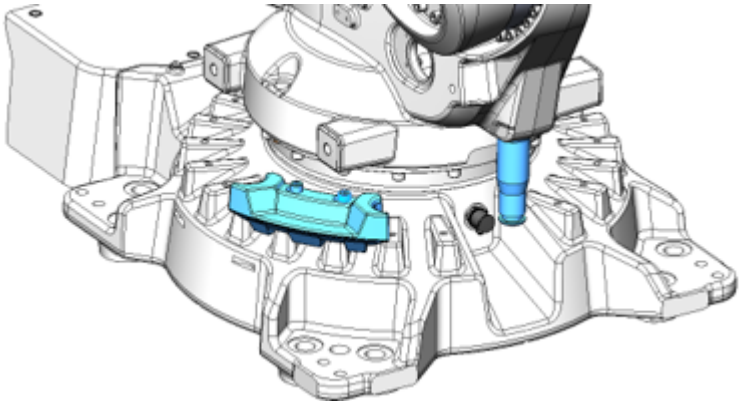
It is strongly recommended, if Foundry Plus robots in another color than ABB orange is required, that only colors in a yellow nuance are selected, if not the robot can look discolored after a while in the foundry environment. The protection is still preserved in any color.

Limited working range

Option	Description
3323-4	Axis 1 work range lim.

Continues on next page

The manipulator can be equipped with adjustable mechanical stops. This is to mechanically limit the working range on axis 1. The mechanical stops are delivered alongside the robot (not installed).



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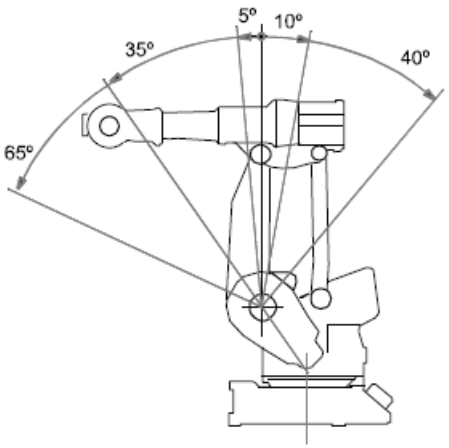
Working range limit-Axis 2

To increase the safety of the robot, the working range of axis 2 can be restricted.

Option	Description
3338-1	Axis 2-work range lim. Stop lugs for restricting the working area. The figure below illustrates the mounting positions of the stops.



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2.3 Floor cables

Manipulator cable length

Option	Lengths
3200-1	3 m
3200-2	7 m
3200-3	15 m
3200-4	22 m
3200-5	30 m

2.4 Application manipulator

DressPack base-axis 3

Option	Description	Additional information
3325-11	MH Parallel	

2.5 Connector kits manipulator

General

Below is an example of how a connector kit and its parts can look like.

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Continues on next page

2.5.1 Base - Connector kits

Available options

		DressPack options		
Option	Name	3325-1x	3325-5x	3325-6x
3330-2	CP/CS, Proc 1 base	X	X	

Note

Servo power connection kits are not available.

Option CP/CS, Proc 1 on base - 3330-2

R1. CP/CS and Proc 1 on base

This option offers a kit with connectors. This must be assembled by the customer. The kit contains:

- 1 Hose fittings (swivel nut adapter, (½", M22x1.5 Brass, 24 degree seal))
- Connector with:

1 pcs Hood Foundry (Harting)	HAN EMC / M 40
1 pcs Hinged frame (Harting)	Shell size 16
2 pcs Multicontact, female (Harting)	Type HD (25 pin)
1 pcs Multicontact, female (Harting)	Type DD (12 pin)
1 pcs Multicontact, female (Harting)	Type EE (8 pin)
10 pcs Female crimp contacts	For 1.5 mm^2
10 pcs Female crimp contacts	For 0.5 mm^2
10 pcs Female crimp contacts	For 1.0 mm^2
10 pcs Female crimp contacts	For 2.5 mm^2
12 pcs Female crimp contacts	For 0.14 - 0.37 mm^2
45 sockets	For 0.2 - 0.56 mm^2
Assembly Accessories to complete connector	
Assembly instruction	

2.5.2 Axis 3 - Connector kits

Available options

		DressPack options	Description
Option	Name	3325-1x	
3333-2	CP/CS bus, Proc 1 axis 3	X	UTOW

Option CP/CS/CBus, Proc 1 axis 3 - 3333-2

CP/CS/CBus, Proc 1 axis 3 on tool side for option 3326-1x and 3326-3x.

This kit offers a kit with connectors to be mounted at toolside of axis 3.

This must be assembled by the customer.

The kit contains:

- 1 Hose fitting (Parker Push lock (1/2", M22x1.5 Brass, 24 degree seal))
- Connector with:

CP/CS	
1 pcs UTOW Pin connector 26p, bayonet	UTOW61626PH, Shell size 16
26 pcs Pin	RM18W3K, 0.5-0.82 mm^2
CBUS	
1 pcs UTOW Pin connector 10p, bayonet	UTOW61210PH, Shell size 12
10 pcs Pin	RM18W3K, 0.5-0.82 mm^2
Ethernet	
1 pcs Pin connector M12	Harting 21 03 881 1405
4 pcs Pin	Harting 09670005576, 0.13-0.33 mm^2

2.6 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	

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].

2.7 Warranty

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 *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 *Customer Delivery Date* or latest 18 months after *Factory Shipment Date*, 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 *Factory Shipment Date* or from activation date of standard warranty in WebConfig. **Note** Special conditions are applicable, see *Robotics Warranty Directives*.

3 Accessories

3.1 Introduction to accessories

General

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

Basic software and software options for robot and PC

For more information, see *Product specification - OmniCore V line* .

Robot peripherals

- Track Motion
- Motor Units
- Positioners

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Index

A
Absolute Accuracy, 28
Absolute Accuracy, calibration, 26
accessories, 55
ambient humidity
  operation, 20
  storage, 20
ambient temperature
  operation, 20
  storage, 20

C
calibration
  Absolute Accuracy type, 25
  standard type, 25
calibration, Absolute Accuracy, 26
Calibration Pendulum, 27
CalibWare, 25
category 0 stop, 43
category 1 stop, 43
compensation parameters, 28

F
fine calibration, 27
foundation
  requirements, 20

H
humidity
  operation, 20
  storage, 20

L
loads on foundation, 19

O
operating conditions, 20
options, 45

P
product standards, 16
protection classes, 21
protection type, 21

R
requirements on foundation, 20
robot
  protection class, 21
  protection types, 21

S
safety standards, 16
standards, 16
standard warranty, 54
stock warranty, 54
stopping distances, 43
stopping times, 43
storage conditions, 20

T
temperatures
  operation, 20
  storage, 20
torques on foundation, 19

V
variants, 45

W
warranty, 54
weight, 18

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