ROBOTICS

Product specification

IRB 4400

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Product specification

IRB 4400/60
IRB 4400/L10

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Revision: N

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Original instructions.

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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 - Controller IRC5 IRC5 with main computer DSQC1000.	*3HAC047400-001*
Product specification - Controller software IRC5 IRC5 with main computer DSQC1000 and RobotWare 5.6x.	*3HAC050945-001*
Product specification - Controller software IRC5 IRC5 with main computer DSQC1000 and RobotWare 6.	*3HAC050945-001*
Product manual - IRB 4400	*3HAC022032-001*
Product specification - Robot user documentation, IRC5 with RobotWare 6	*3HAC052355-001*

Revisions

Revision	Description
-	• Replaces 3HAC9117-1 (English), 3HAC10768-1 (French), 3HAC10395-1 (German), 3HAC10782-1 (Spanish), and 3HAC10761-1 (Italian) • Table for ambient temperature adjusted • Text for Foundy Prime updated
A	• Machinery directive updated
B	• General updates and minor corrections

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Continued

Revision	Description
C	• General updates and minor corrections • Option Foundry Prime removed • Figure for mounting equipment changed
D	• Text for ISO test adjusted • IRB 4400/L10 added
E	• Minor updates/corrections
F	• Text for Foundry Plus updated.
G	• Drawing main dimension for IRB 4400/L10 updated
H	• Minor corrections/updates
J	• RT and AT adjusted after new ISO measurement
K	• Values changed, see *Performance according to ISO 9283 on page 38* • Screw size of IRB 4400 changed to M20 • Restriction of load diagram added
L	• Updated list of applicable standards. • Drawing view of mounting holes for extra equipment added.
M	Published in release R18.1. The following updates are done in this revision: • Change the general description of load diagrams.
N	Published in release R20D. The following updates are done in this revision: • Warranty section updated. • Updated information about *Absolute Accuracy*.

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

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 multi-tasking, sensor control, etc. For a complete description on optional software, see Product specification - Controller software IRC5.

Foundry Plus

Foundry Plus

The Foundry Plus option is 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 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 robot. The Foundry Plus robot is painted with two-component epoxy on top of a primer for corrosion protection. To further improve the protection additional preventive measures are applied to exposed and crucial areas. Continuous splashing of water or other similar rust formation fluids may case corrosion on the robots unpainted areas, joints, or other unprotected surfaces. Under these circumstances it is recommended to add rust inhibitor to the fluid or take other measures to prevent potential rust formation.The entire robot is IP67 compliant according to IEC 60529 - from base

Continues on next page

1.1.1 Introduction to structure
Continued

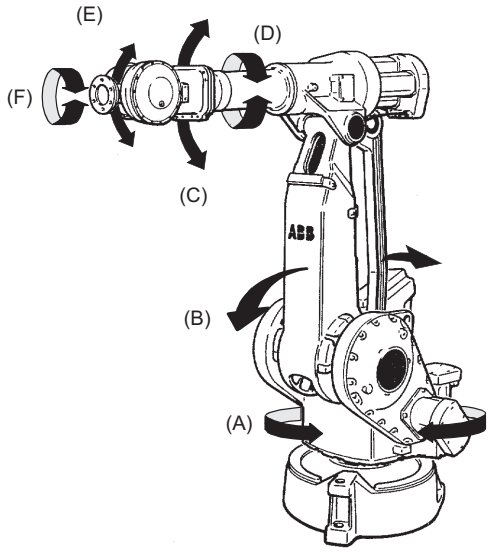
to wrist, which means that the electrical compartments are sealed against water and solid contaminants. Among other things all sensitive parts are better protected than the standard offer.

Selected Foundry Plus features:

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

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

Manipulator axes



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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

1.1.2 Different robot versions

General

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

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

Manipulator weight

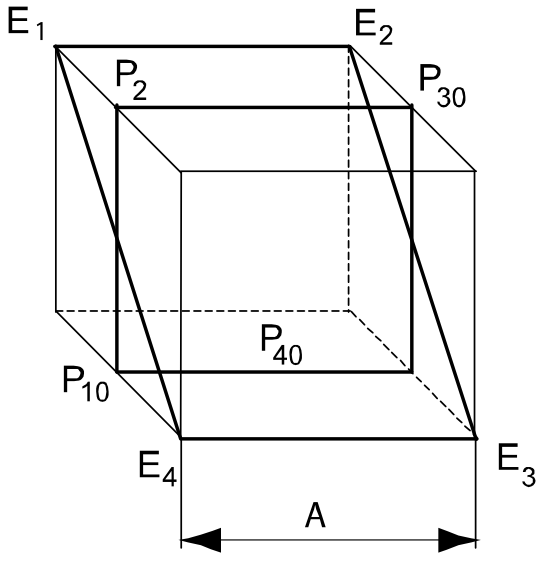
Robot type	Weight
IRB 4400/60	1040 kg
IRB 4400/L10	1040 kg

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	IRB 4400/60	IRB 4400/L10
ISO Cube Max. velocity	1.33 kW	1.28 kW



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Pos	Description
A	630 mm [i]

[i] 1000 mm valid for IRB 4400/L10

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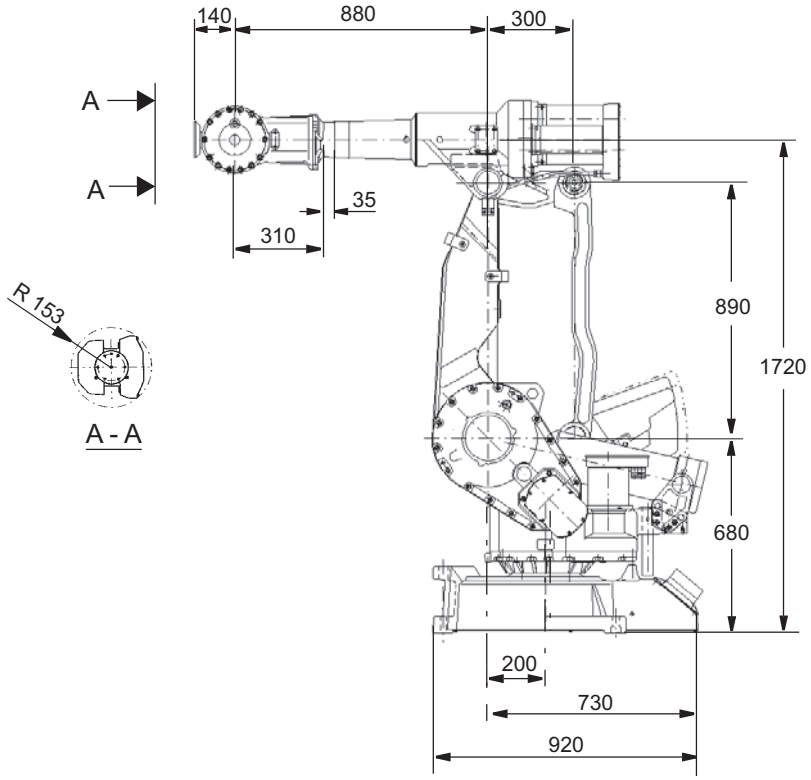
1.1.2 Different robot versions
Continued

Dimensions IRB 4400/60



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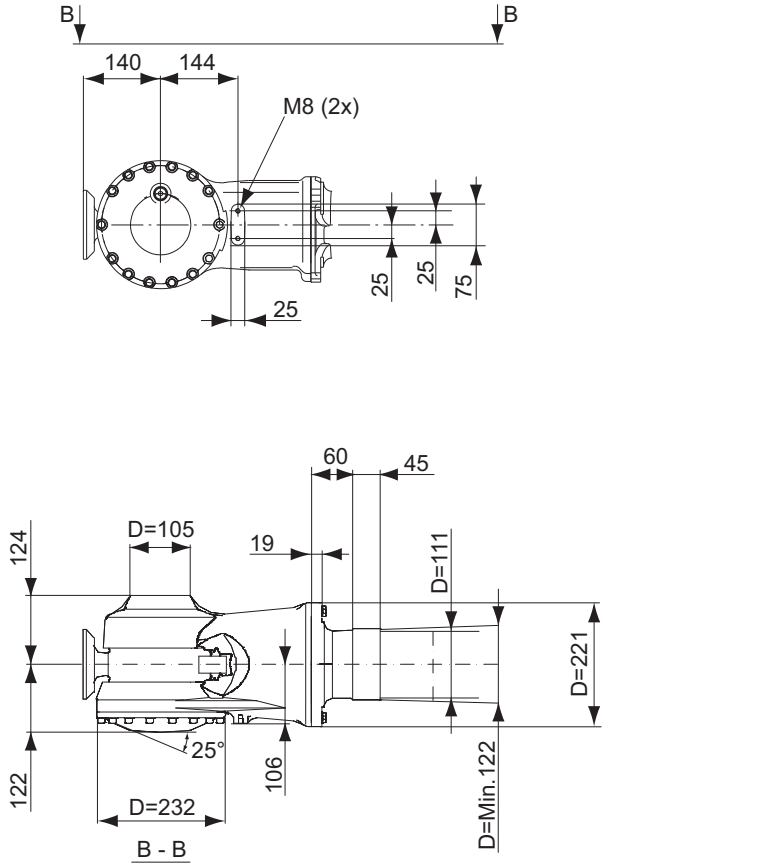

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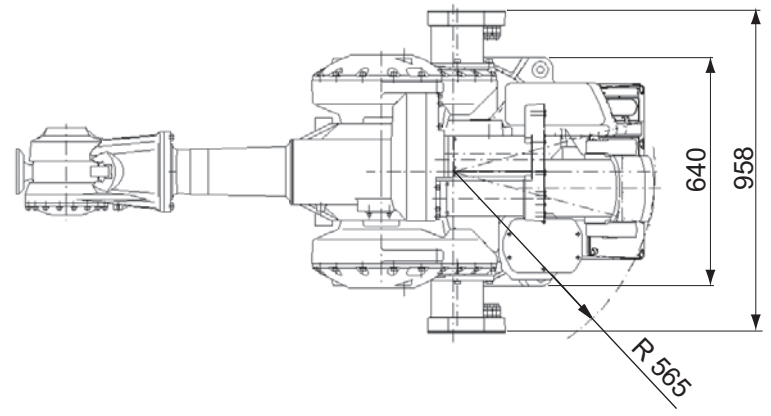

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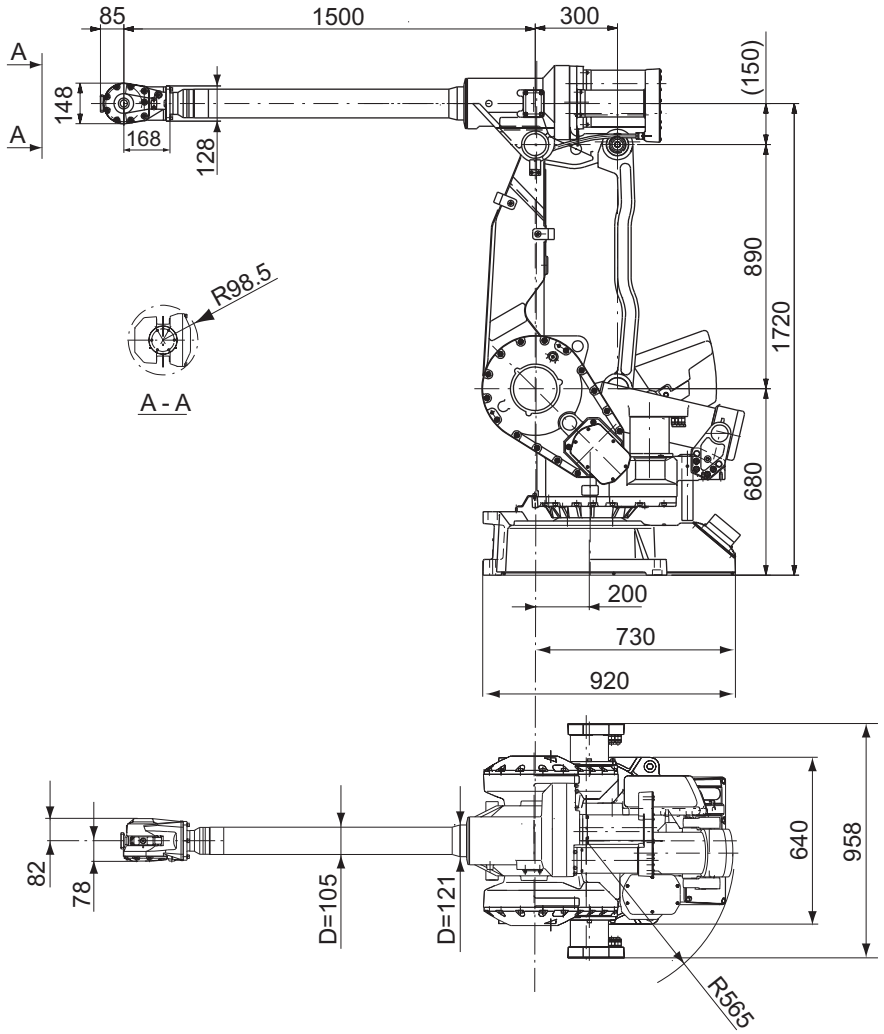
1.1.2 Different robot versions
Continued

Dimensions IRB 4400/L10



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1.2 Standards

1.2.1 Applicable standards

Note

The listed standards are valid at the time of the release of this document. Phased out or replaced standards are removed from the list when needed.

General

The product is designed in accordance with EN ISO 10218-1, Robots for industrial environments - Safety requirements -Part 1 Robot. If there are deviations, these are listed in the declaration of incorporation which is included on delivery.

Standards, EN ISO

The product is designed in accordance with selected parts of:

Standard	Description
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN ISO 13849-1:2015	Safety of machinery, safety related parts of control systems - Part 1: General principles for design
EN ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
ISO 9787:2013	Robots and robotic devices -- Coordinate systems and motion nomenclatures
ISO 9283:1998	Manipulating industrial robots, performance criteria, and related test methods
EN ISO 14644-1:2015 [i]	Classification of air cleanliness
EN ISO 13732-1:2008	Ergonomics of the thermal environment - Part 1
EN 61000-6-4:2007 + A1:2011 IEC 61000-6-4:2006 + A1:2010 (option 129-1)	EMC, Generic emission
EN 61000-6-2:2005 IEC 61000-6-2:2005	EMC, Generic immunity
EN IEC 60974-1:2012 [ii]	Arc welding equipment - Part 1: Welding power sources
EN IEC 60974-10:2014 [ii]	Arc welding equipment - Part 10: EMC requirements
EN IEC 60204-1:2016	Safety of machinery - Electrical equipment of machines - Part 1 General requirements
IEC 60529:1989 + A2:2013	Degrees of protection provided by enclosures (IP code)

i Only robots with protection Clean Room.
ii Only valid for arc welding robots. Replaces EN IEC 61000-6-4 for arc welding robots.

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1.2.1 Applicable standards
Continued

European standards

The product is designed in accordance with selected parts of:

Standard	Description
EN 614-1:2006 + A1:2009	Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles
EN 574:1996 + A1:2008	Safety of machinery - Two-hand control devices - Functional aspects - Principles for design

UL, ANSI, and other standards

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
ANSI/UL 1740	Safety standard for robots and robotic equipment
CAN/CSA Z 434-14	Industrial robots and robot Systems - General safety requirements

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. Electronic Position Switches can be used on all axes for position indicator of manipulator.

1.3.2 Operating requirements

Protection standards

Robot version	Protection Standard IEC60529
Standard manipulator	IP54
Foundry Plus manipulator	IP67, Steam washable

Explosive envirnments

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

Ambient temperature

Description	Standard/Option	Temperature
Manipulator during operation	Standard	+ 5°C [i] (41°F) to + 45°C (113°F)
For the controller	Standard/Option	See Product specification - Controller IRC5 with FlexPendant
Complete robot during transportation and storage	Standard	- 25°C (- 13°F) to + 55°C (131°F)
For short periods (not exceeding 24 hours)	Standard	up to + 70°C (158°F)

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

Relative humidity

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

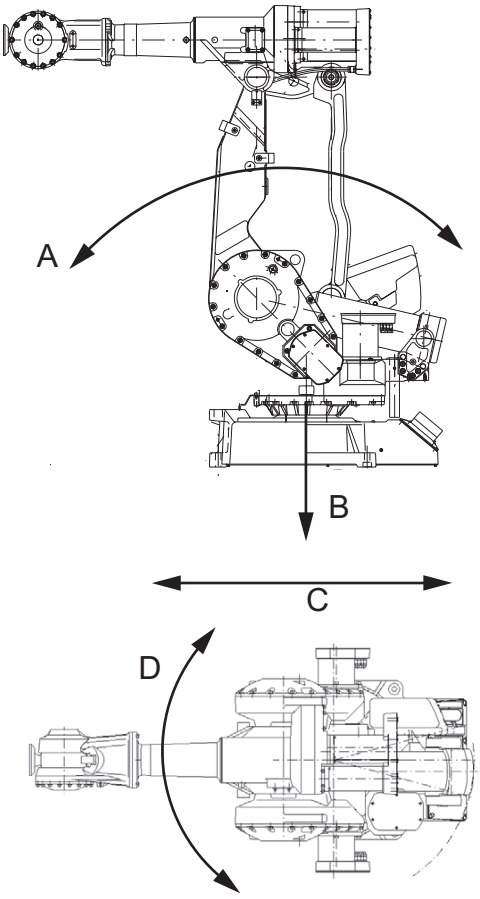
1.3.3 Mounting the manipulator

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)

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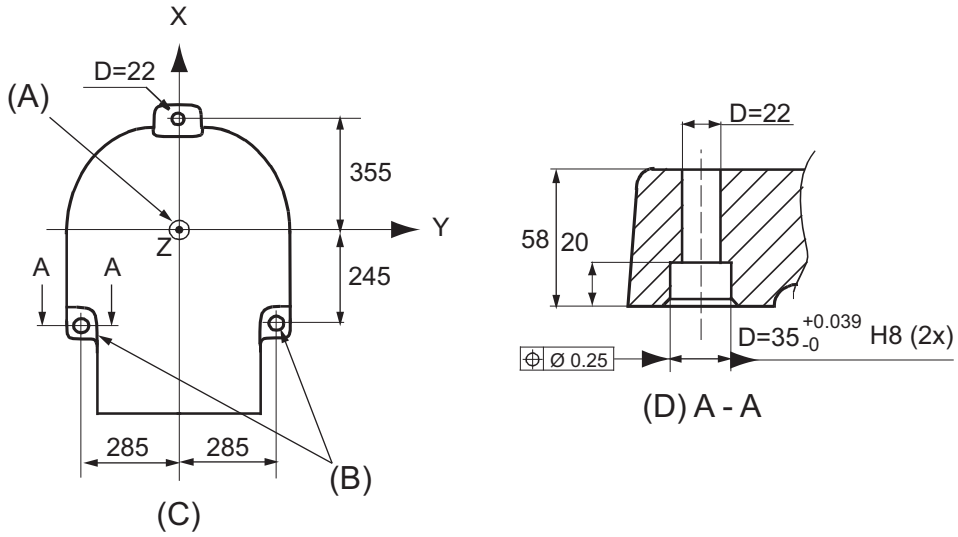
1.3.3 Mounting the manipulator
Continued

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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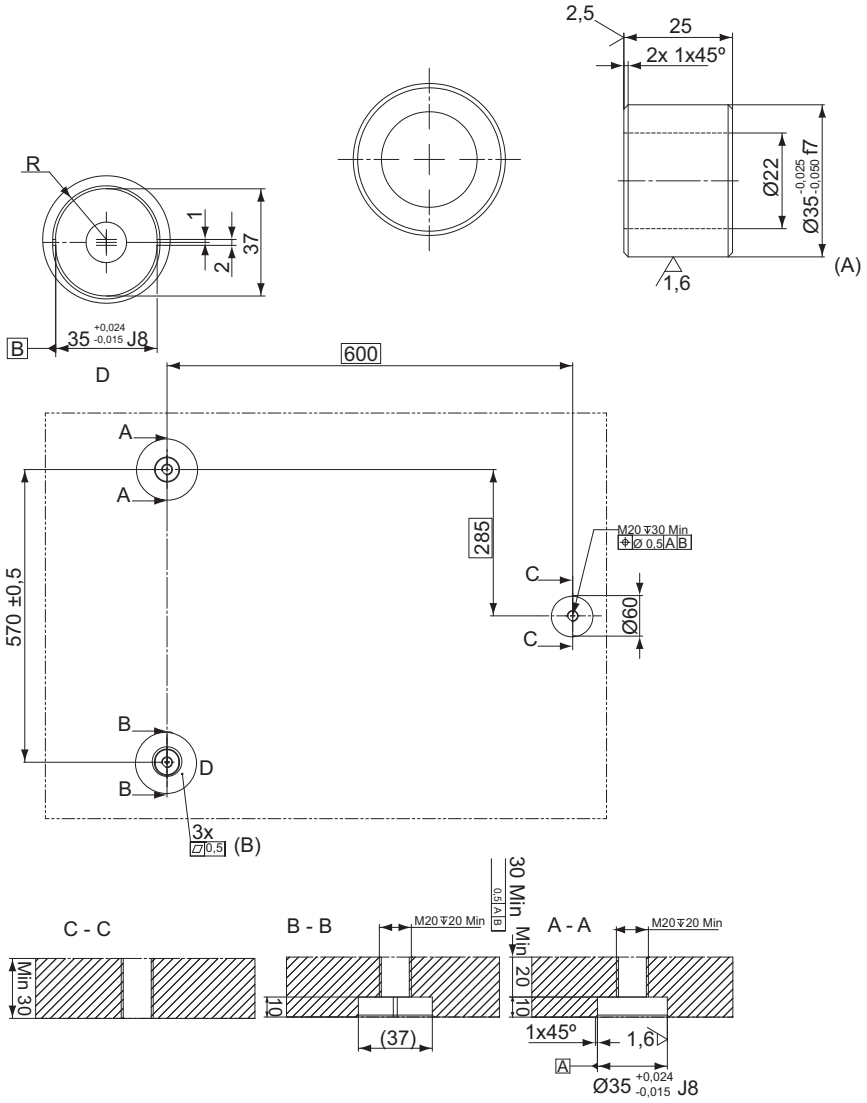
Mounting surface and bushings



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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. For robots with RobotWare 5.04 or older, the calibration data is delivered in a file, calib.cfg, supplied with the robot at delivery. The file identifies the correct resolver/motor position corresponding to the robot home position.	Calibration Pendulum
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 SMB (serial measurement board) in the robot. For robots with RobotWare 5.05 or older, the absolute accuracy calibration data is delivered in a file, absacc.cfg, supplied with the robot at delivery. The file replaces the calib.cfg file and identifies motor positions as well as absolute accuracy compensation parameters. A robot calibrated with Absolute accuracy has a sticker next to the identification plate of the robot. To regain 100% Absolute accuracy performance, the robot must be recalibrated for absolute accuracy after repair or maintenance that affects the mechanical structure.  xx0400001197	CalibWare

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Type of calibration	Description	Calibration method
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.	Wrist Optimization

Brief description of calibration methods

Calibration Pendulum method

Calibration Pendulum is a standard calibration method for calibration of all ABB robots (except IRB 6400R, IRB 640, IRB 1400H, and IRB 4400S).

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 following routines are available for the Wrist Optimization method:

- Wrist Optimization

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

CalibWare - Absolute Accuracy calibration

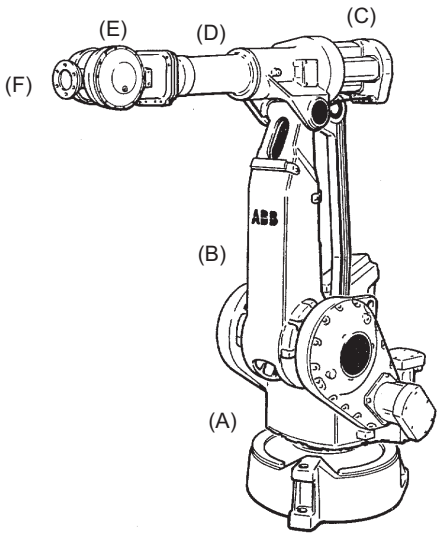
The CalibWare tool guides through the calibration process and calculates new compensation parameters. This is further detailed in the *Application manual - CalibWare Field*.

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

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.

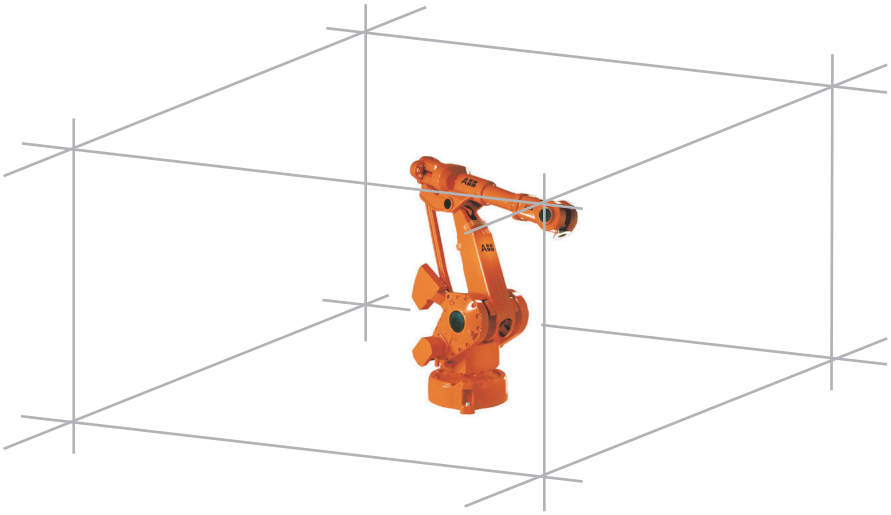
Here are some examples of when this accuracy is important:

- 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.



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What is included

Every *Absolute Accuracy* robot is delivered with:

- compensation parameters saved on the robot's serial measurement board
- a birth certificate representing the *Absolute Accuracy* measurement protocol for the calibration and verification sequence.

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

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1.4.3 Absolute Accuracy calibration
Continued

Absolute Accuracy supports both floor mounted and inverted installations. The compensation parameters differ depending on if the robot is floor mounted or inverted.

When is *Absolute Accuracy* being used

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

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

Absolute Accuracy active

Absolute Accuracy will be active in the following cases:

- Any motion function based on robtargets (e.g. `MoveL`) and ModPos on robtargets
- Reorientation jogging
- 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 and/or loads are outside load diagram is used the following parts can be damaged due to overload:

- motors
- gearboxes
- mechanical structure

WARNING

In the robot system is the service routine LoadIdentify available, which allows the user to make an automatic definition of the tool and load, to determine correct load parameters. Please see *Operating Manual - IRC5 with FlexPendant*, art. No. 3HAC16590-1, for detailed information.

WARNING

Robots running with incorrect load data and/or with loads outside 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 by "RobotLoad"

To easily control a specific load case, use the calculation program ABB RobotLoad. Contact your local ABB organization for more information.

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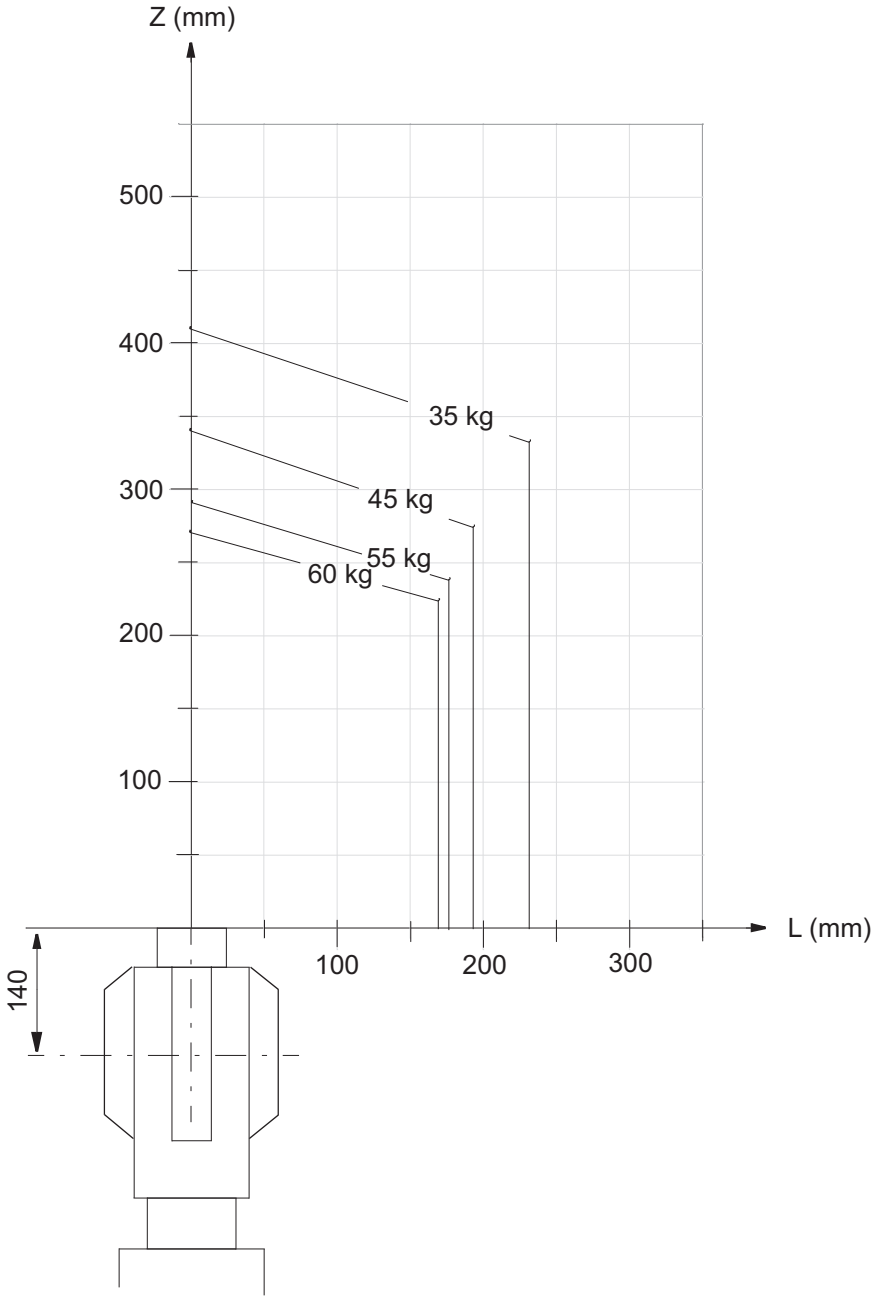
1.5.1 Introduction to load diagrams
Continued

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

Load diagram IRB 4400/60



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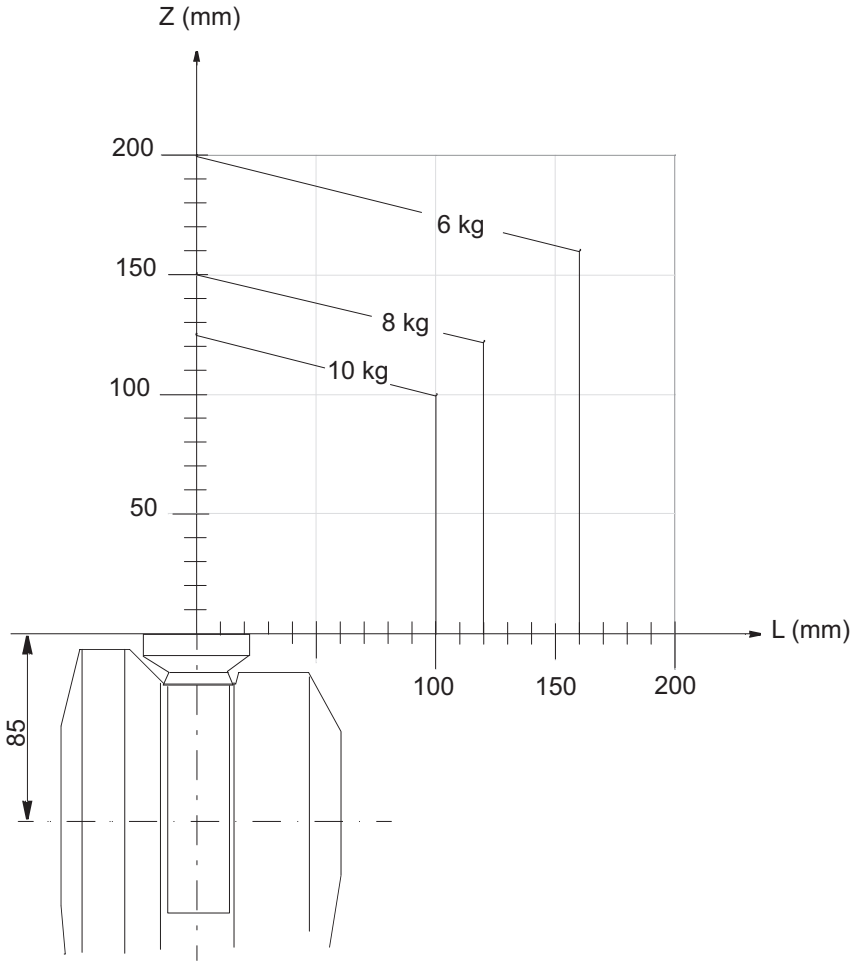
Load diagram IRB 4400/L10



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

Information

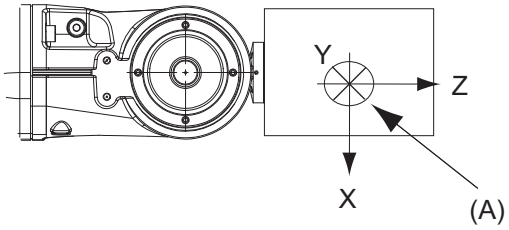
Note

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 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. Also arm loads will influence the permitted load diagram, please contact your local ABB organization.

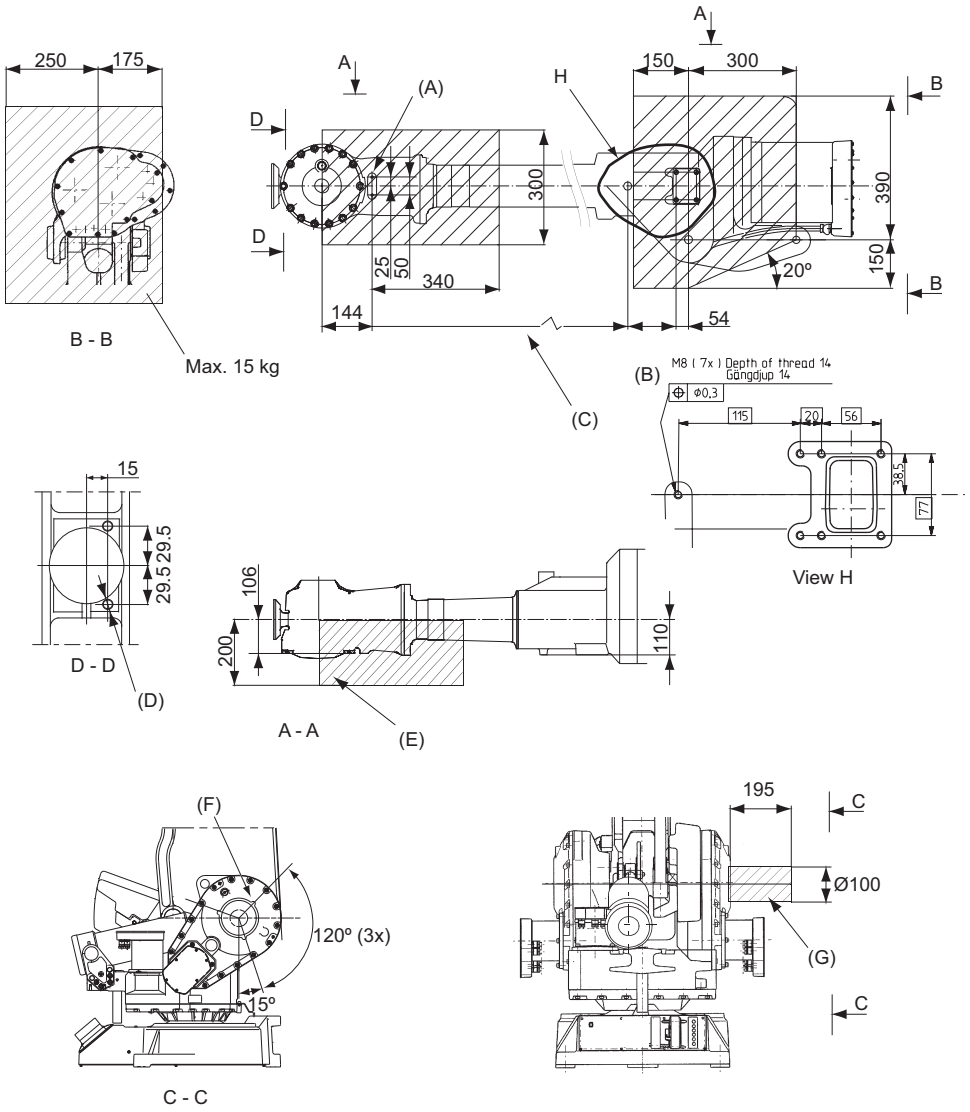
Robot type	Max wrist torque axis 4 and 5	Max wrist torque axis 6	Max torque valid at load
IRB 4400/60	242 Nm	98.9 Nm	60 kg
IRB 4400/L10	20.6 Nm	9.81 Nm	10 kg

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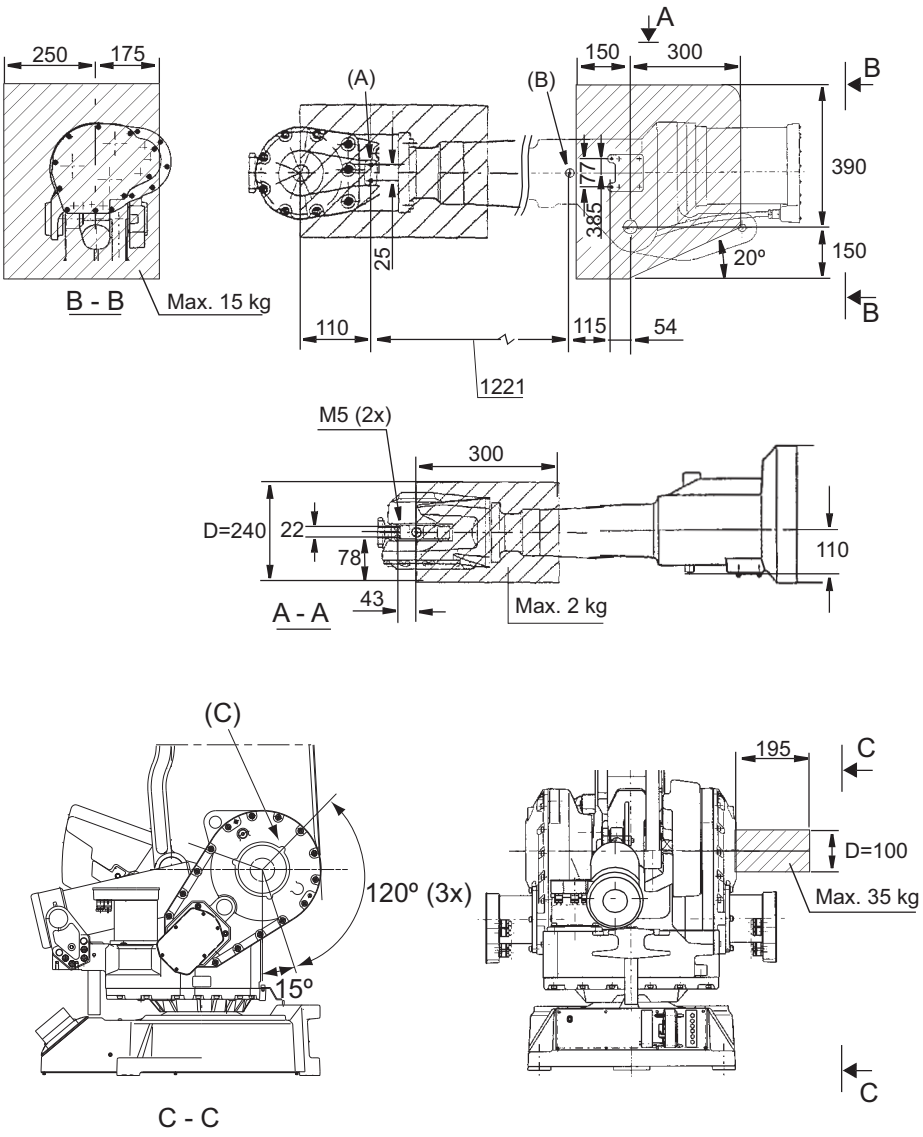
Pos	Description
A	M8 (x2) Used if option 218-6 is chosen, depth of thread 9 mm
B	M8 (x7) Depth of thread 14 mm
C	571 mm
D	M6 (2x) tapped depth 12 mm
E	Max. 5 kg at max handling weight

Continues on next page

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)

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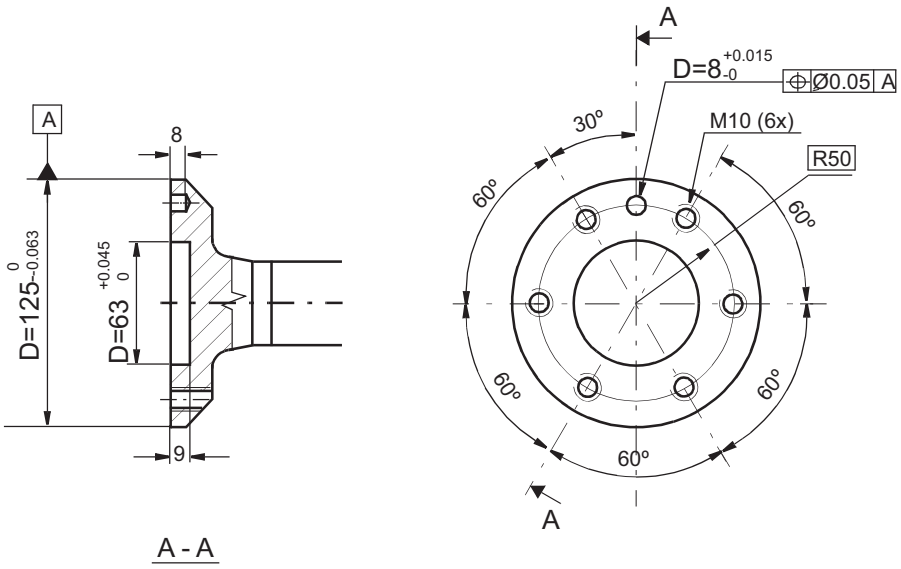
1.6 Mounting equipment
Continued

> **Note**
>
> Maximum loads must never be exceeded!

Tool flange

IRB 4400/60



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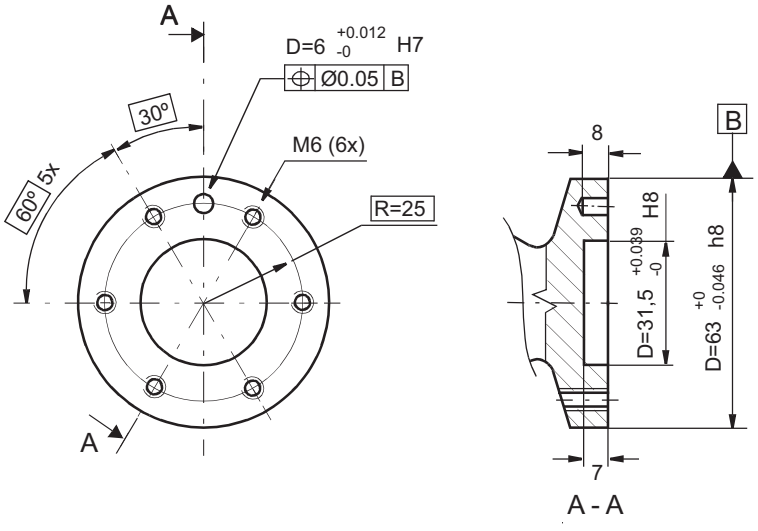
IRB 4400/L10



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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.

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

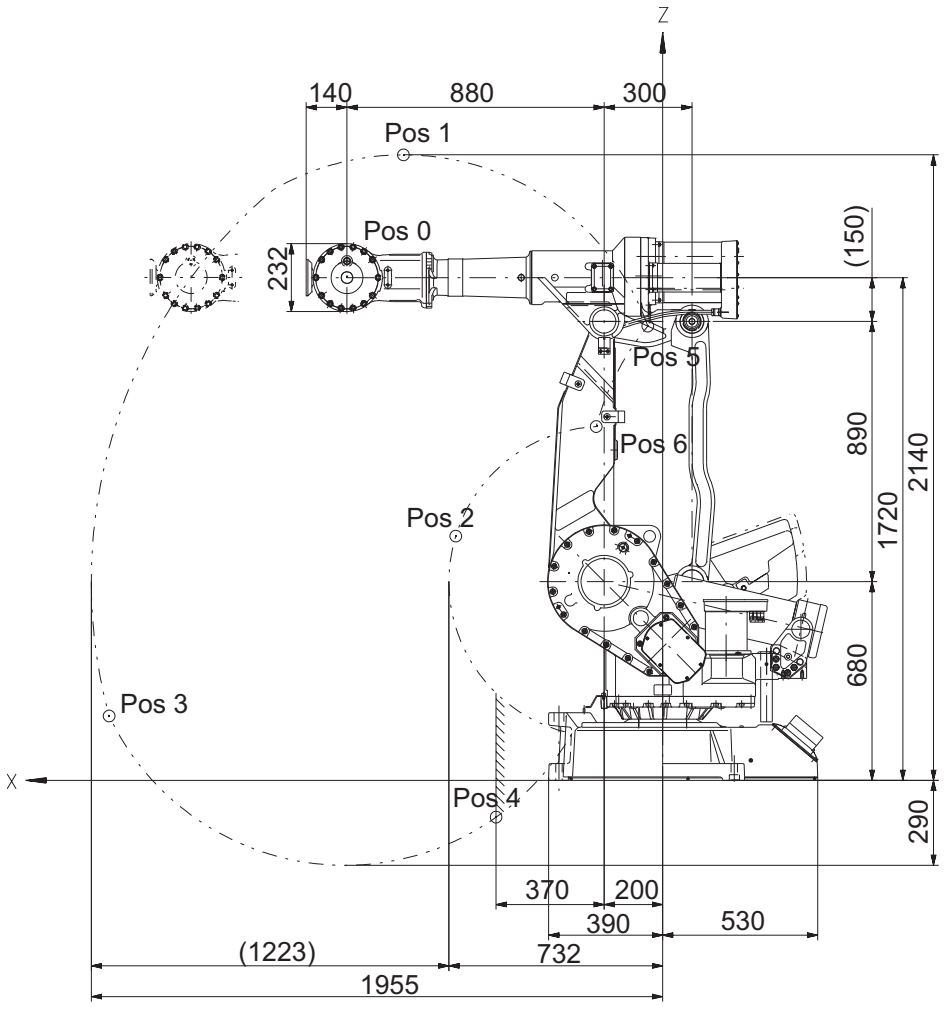
Axis	Type of motion	Range of movement
1	Rotation motion	+ 165° to - 165°
2	Arm motion	+ 95° to - 70°
3	Arm motion	+ 65° to - 60°
4	Rotation motion	+ 200° to - 200°
5	Bend motion	+ 120° to - 120°
6	Turn motion	+ 400° to - 400° + 200 [i] rev.[ii] to - 200 rev. Max.[iii]

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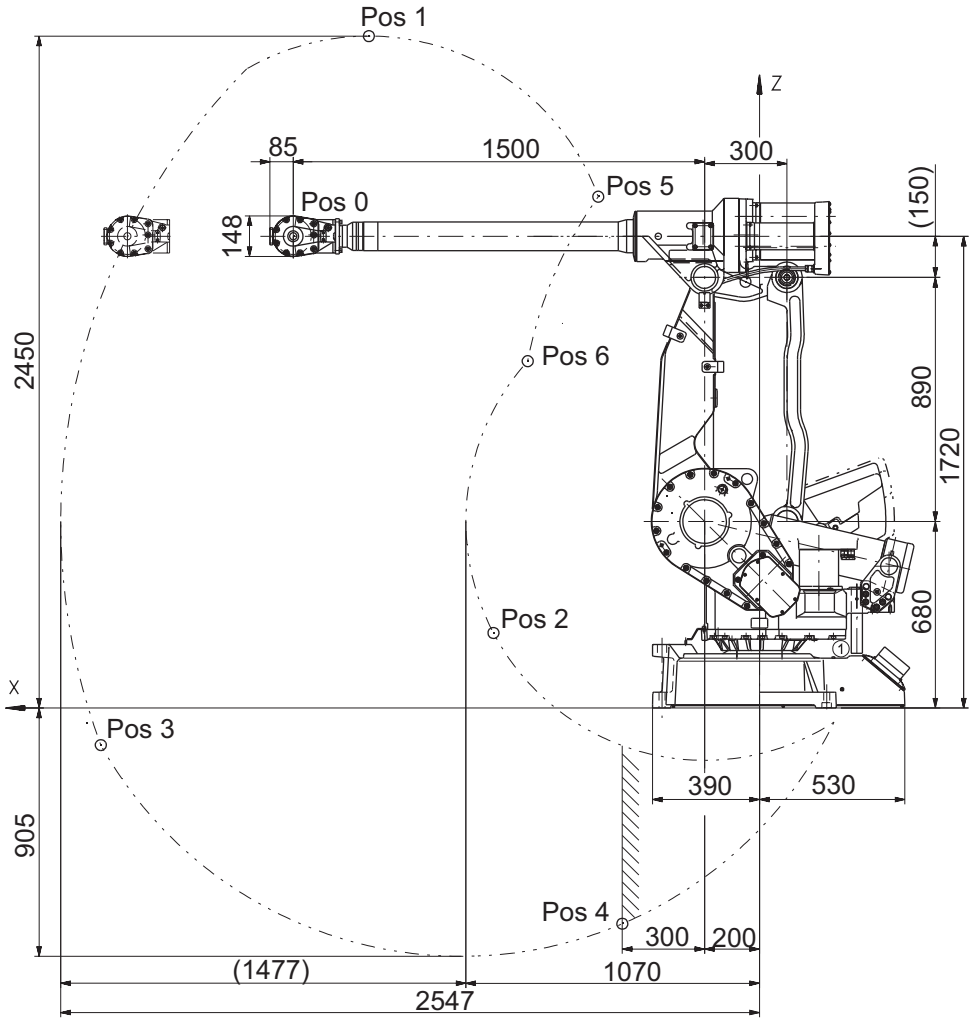
Positions at wrist center (mm) and angle (degrees):

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

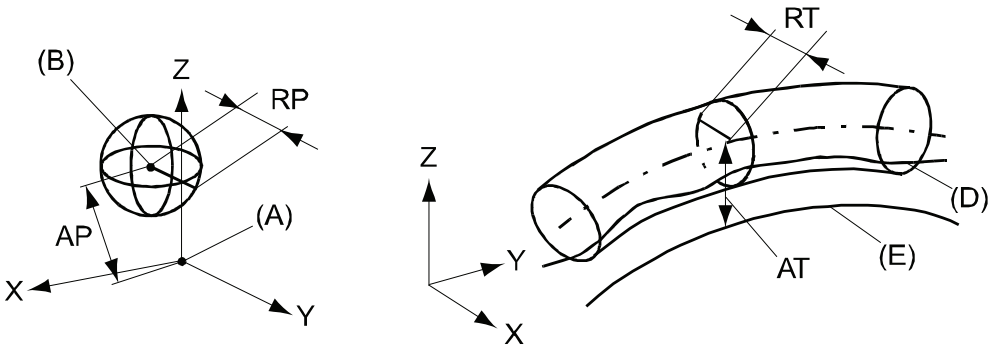
Continues on next page

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)	0.05	0.05
Pose accuracy, AP[i] (mm)	0.03	0.04
Linear path repeatability, RT[ii] (mm)	0.05	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.

Axis resolution

Approx. 0.01° on each axis.

Stopping distance/time

Stopping distance/time for emergency stop (category 0), program stop (category1) and at mains power supply failure at max speed, max stretched out and max load, categories according to EN 60204-1. All results are from tests on one moving axis. All stop distances are valid for floor mounted robot, without any tilting.

Robot type		Category 0		Category 1		Main power failure	
	Axis	A	B	A	B	A	B
IRB 4400/60	1	65	0.9	84	1.0	76	0.9
	2	16	0.3	24	0.4	22	0.3
	3	15	0.3	25	0.4	23	0.3

Robot type		Category 0		Category 1		Main power failure	
	Axis	A	B	A	B	A	B
IRB 4400/L10	1	45	0.6	63	0.8	57	0.7
	2	17	0.2	28	0.3	25	0.3
	3	13	0.2	27	0.3	26	0.3

	Description
A	Stopping distance in degrees
B	Stop time (s)

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

Variants

Option	IRB Type	Handling capacity (kg) / Reach (m)
435-38	IRB 4400/60	60/1.96
435-41	IRB 4400/L10	10/2.55

Manipulator color

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

Note

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

Protection

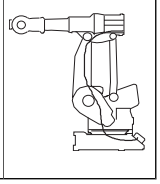
Option	Description
287-4	Standard

Continues on next page

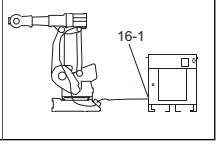
Option	Description
287-3	Foundry Plus The Foundry Plus option is designed for harsh environments where the robot is exposed to sprays of coolants, lubricants and metal spits that are typical for die casting applications or other similar applications. Typical applications are spraying insertion and part extraction of die-casting machines, handling in sand casting and gravity casting, etc. (Please refer to Foundry Prime 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 robot. The Foundry Plus robot is painted with two-component epoxy on top of a primer for corrosion protection. To further improve the protection additional preventive measures are applied to exposed and crucial areas. Continuous splashing of water or other similar rust formation fluids may case corrosion on the robots unpainted areas, joints, or other unprotected surfaces. Under these circumstances it is recommended to add rust inhibitor to the fluid or take other measures to prevent potential rust formation.The entire robot is IP67 compliant according to IEC 60529 - from base to wrist, which means that the electrical compartments are sealed against liquid and solid contaminants. Among other things all sensitive parts are better protected than the standard offer. Selected Foundry Plus features: - Improved sealing to prevent penetration into cavities to secure IP67 - Additional protection of cabling and electronics - Special covers protecting cavities - Well-proven connectors - Rust preventives on screws, washers and unpainted/machined surfaces - Extended service and maintenance program The Foundry Plus robot can be cleaned with appropriate washing equipment according to product manual. Appropriate cleaning and maintenance are required to maintain the Foundry Plus protection, for example can rust preventive be washed off with wrong cleaning method.

Media Interface

Air supply and signals for extra equipment to upper arm.

Option	Description	
218-8	Integrated hose and cables for connection of extra equipment on the manipulator to the rear part of the upper arm.	

Application interface connection to

Option	Description	
16-1 Cabinet [i]	The signals are connected to 12-pole screw terminals, Phoenix MSTB 2.5/12-ST-5.08, to the the controller.	

[i] Note! In a IRC5 MultiMove application additional robots have no Control Module. The screw terminals with internal cabling are then delivered separately to be mounted in the main robot Control Module or in another encapsulation, for example a PLC cabinet.

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Connector kit

Detached connectors, suitable to the connectors for the application interface and position switches.

The kit consists of connectors, pins and sockets.

Option	Description
431-1	For the connectors on the upper arm if application interface, option 218-8 or option 218-6.
239-1	For the connectors on the foot if connection to manipulator, option 16-2.

Safety lamp

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

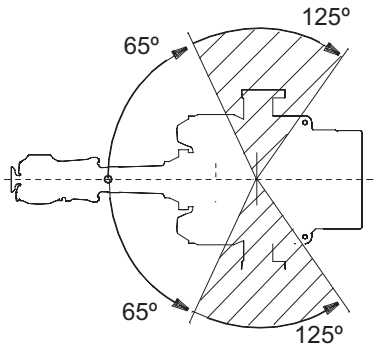
Electronic Position Switches (EPS)

The mechanical position switches indicating the position of the three main axes are replaced with electronic position switches for up to 7 axes, for increased flexibility and robustness. For more detailed information, see *Product specification - Controller IRC5 with FlexPendant* and *Application manual - Electronic Position Switches*.

Working range limit - axis 1

To increase the safety of the robot, the working range of axis 1 can be restriced.

Option	Description
28-1	Axis 1 Two extra stops for restricting the working range. The stops can be mounted within the area from 65º to 125º. See figure below.



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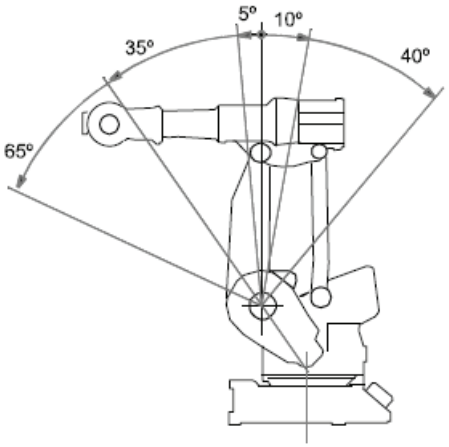
Working range - axis 2

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

Option	Description
32-1	Axis 2 Stop lugs for restricting the working area. The figure below illustrates the mounting positions of the stops.



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Working range - axis 3

To increase the safety of the robot, the working range of axis 3 can be restricted.

Option	Description
34-1	Axis 3 Equipment for electrically restricting the working range in increments of 5°.

Warranty

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

Note

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

Continues on next page

Option	Type	Description
438-1	Standard warranty	Standard warranty is 12 months from *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*.

2.3 Positioners

General

Regarding positioners, see *Product specification - IRBP /D2009*, *3HAC038208-001*.

2.4 Track motion

General

Regarding track motion, see Product Specification 2HEA802965-001.

2.5 Floor cables

2.5.1 Manipulator

Manipulator cable length

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

Connection of Parallel communication

Option	Lengths
94-1	7 m
94-2	15 m
94-4	30 m

2.6 User documentation

User documentation

The user documentation describes the robot in detail, including service and safety instructions.

All documents can be found via myABB Business Portal, *www.myportal.abb.com*.

3 Accessories

3.1 Introduction to accessories

General

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

Basic software and software options for robot and PC

For more information, see *Product specification - Controller IRC5 with FlexPendant* and *Product specification - Controller software IRC5*.

Robot peripherals

- Track Motion
- Motor Units
- Positioners

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