ROBOTICS

Product specification

IRB 660

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Product specification

IRB 660-180/3.15
IRB 660-250/3.15

OmniCore

Document ID: 3HAC081955-001

Revision: A

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Original instructions.

Table of contents

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Overview of this specification

About this product specification

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

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

The specification covers the manipulator using the OmniCore controller.

Usage

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

The specification is intended for:

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

References

Reference	Document ID
Product manual - IRB 660	*3HAC025755-001*
Product manual - OmniCore V250XT	*3HAC073447-001*
Product specification - OmniCore V line	*3HAC074671-001*
Product specification - Robot stopping distances according to ISO 10218-1	*3HAC048645-001*

Revisions

Revision	Description
A	First edition.

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1 Description

1.1 Structure

Robot family

IRB 660 is ABB Robotics latest generation of 4-axis palletizing robot, designed with a focus on its high production capacity, short cycle time at a high payload, long reach together with the very high uptime, which is significant for ABB's robots.

It is available in two versions; a handling capacity of 180 kg and 250 kg, both with a reach of 3.15 m.

Customer connections such as power signals, Bus signals and twin air are integrated in the robot, from the robot base to connections at the robot tool flange.

Control 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 *Operating manual - OmniCore*.

We have added a range of software products - all falling under the umbrella designation of Active Safety - to protect not only personnel in the unlikely event of an accident, but also robot tools, peripheral equipment and the robot itself.

The IRB 660 manipulator can be connected to the following robot controllers:

- OmniCore V250XT

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 communication features - network communication - and advanced functions such as multitasking, sensor control etc. For a complete description on optional software, see the *Product manual - OmniCore V250XT*.

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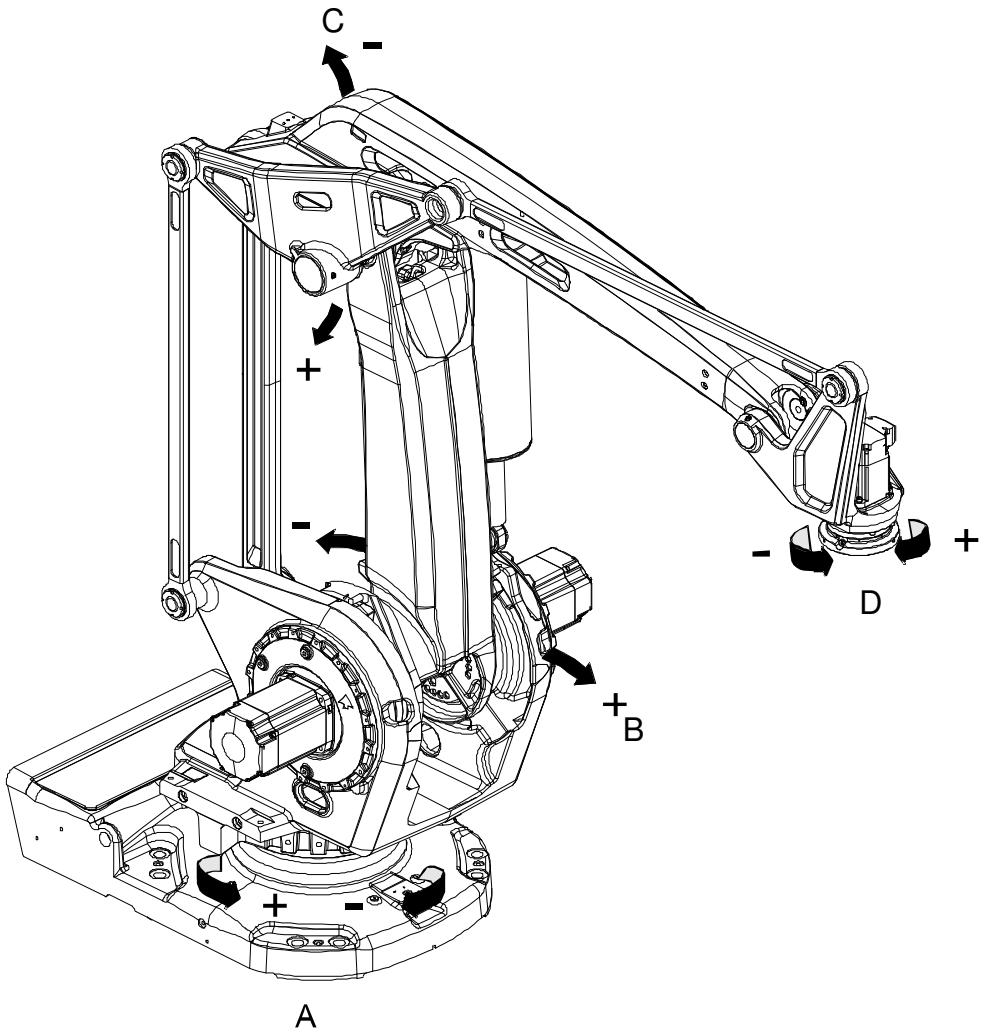
Manipulator axes

The IRB 660 manipulator has 4 axes as shown in the following figure.



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Pos.	Description
A	Axis 1
B	Axis 2
C	Axis 3
D	Axis 6

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1.1.1 Different robot versions

General

The IRB 660 is available in two versions.

Robot type	Handling capacity (kg)	Reach (m)
IRB 660	180	3.15
IRB 660	250	3.15

1.1.2 Definition of version designation

IRB 660 Mounting

Handling capacity/ Reach

	Prefix	Description
Mounting	-	Floor-mounted manipulator
Handling capacity	yyy	Indicates the maximum handling capacity (kg)
Reach	x.x	Indicates the maximum reach at wrist center (m)

Manipulator weight

Robot type	Handling capacity (kg)	Reach (m)	Weight (kg)
IRB 660	180	3.15	1,750
IRB 660	250	3.15	1,750

Other technical data

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

Power consumption at max speed (vmax)

Type of Movement	IRB 660 (all variants)
ISO Cube	1.8 kW

Robot in calibration position	IRB 660 (all variants)
Brakes engaged	0.22 kW
Brakes disengaged	0.84 kW

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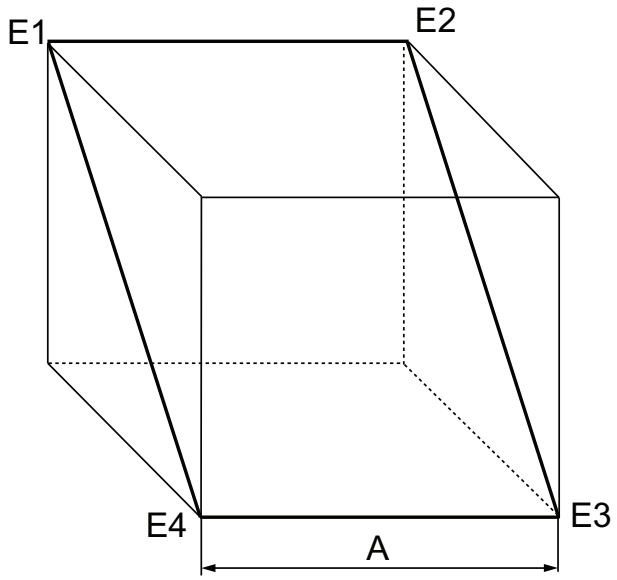
The path E1-E2-E3-E4 in the ISO Cube is shown in the following figure.



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Pos	Description
A	1,000 mm

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 660 is connected to the OmniCore V line.

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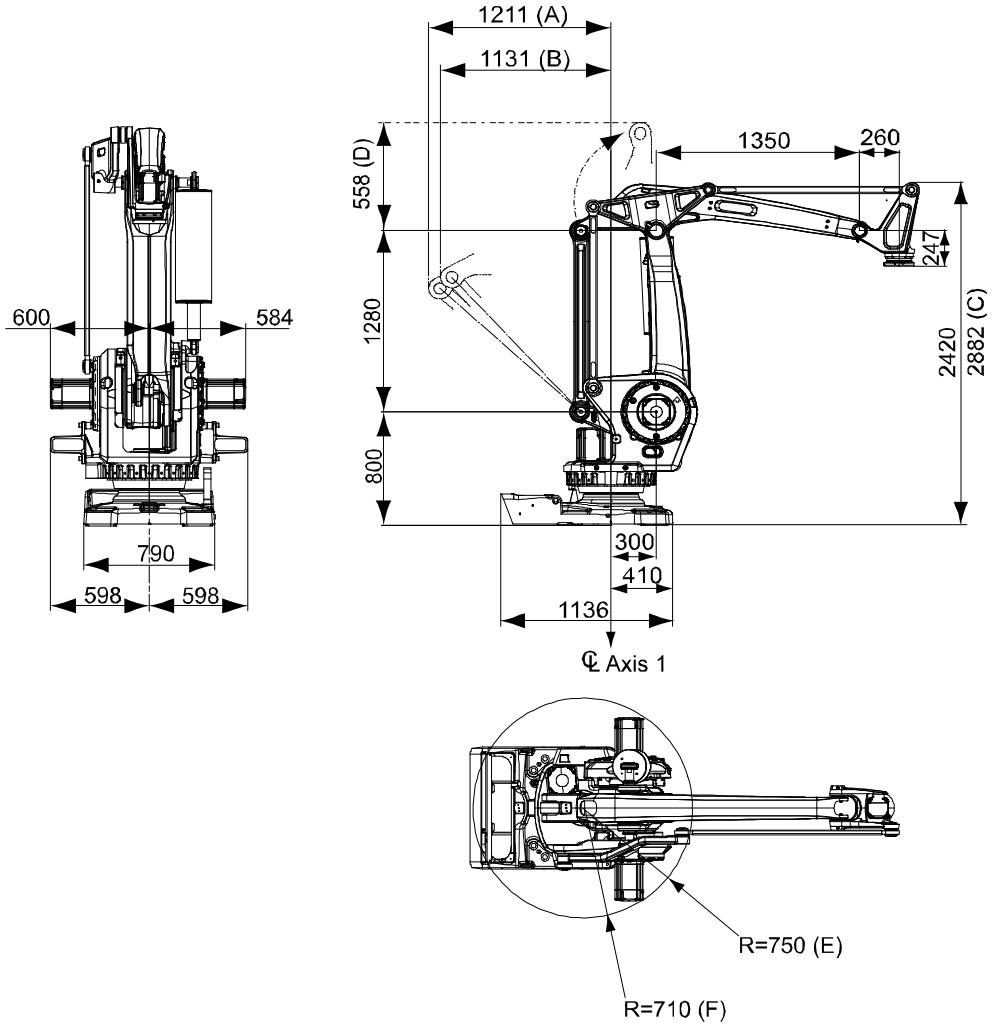
1.1.2 Definition of version designation
Continued

Dimensions of IRB 660

The following figure shows the front, side, and top view of the manipulator (dimensions in mm). Allow 200 mm behind the manipulator foot for cables.



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Position	Description
A	At mechanical stop
B	At max. working range axis 2
C	At max. working range axis 3
D	At min. working range axis 3
E	Radius for fork lift pocket
F	Radius for axis 3 motor

1.2 Standards

1.2.1 Applicable standards

General

The product is compliant with ISO 10218-1:2011, *Robots for industrial environments - Safety requirements - Part 1 Robots*, and applicable parts in the normative references, as referred to from ISO 10218-1:2011. In case of deviation from ISO 10218-1:2011, these are listed in the declaration of incorporation. The declaration of incorporation is part of the delivery.

Robot standards

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

Other standards used in design

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

Region specific standards and regulations

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
ANSI/UL 1740	Safety standard for robots and robotic equipment
CAN/CSA Z 434-03	Industrial robots and robot Systems - General safety requirements
EN ISO 10218-1	Robots and robotic devices — Safety requirements for industrial robots — Part 1: Robots

1.3 Installation

1.3.1 Introduction

General

IRB 660 is designed for floor mounting (no tilting allowed around X or Y axis). Depending on the robot version, an end effector with maximum weight of 180 to 250 kg including payload, can be mounted on the mounting flange (axis 6). For more information on Load diagrams, see *Load diagrams on page 30*.

Working range

The working range of axis 1 can be limited by mechanical stops.

External Mains Transformer

Include an external transformer for mains voltage 200V and 220V.

1.3.2 Operating requirements

Protection standards

Manipulator IP67.

Explosive environments

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

Ambient temperature

Description	Standard/Option	Temperature
Manipulator during operation	Standard	0°C [i] (32°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 recommended to be run with the robot. Below 5° C this warm-up phase is mandatory. 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 humidiy
Complete robot during operation, transportation and storage	Maximum 95% at constant temperature

1.3.3 Mounting the manipulator

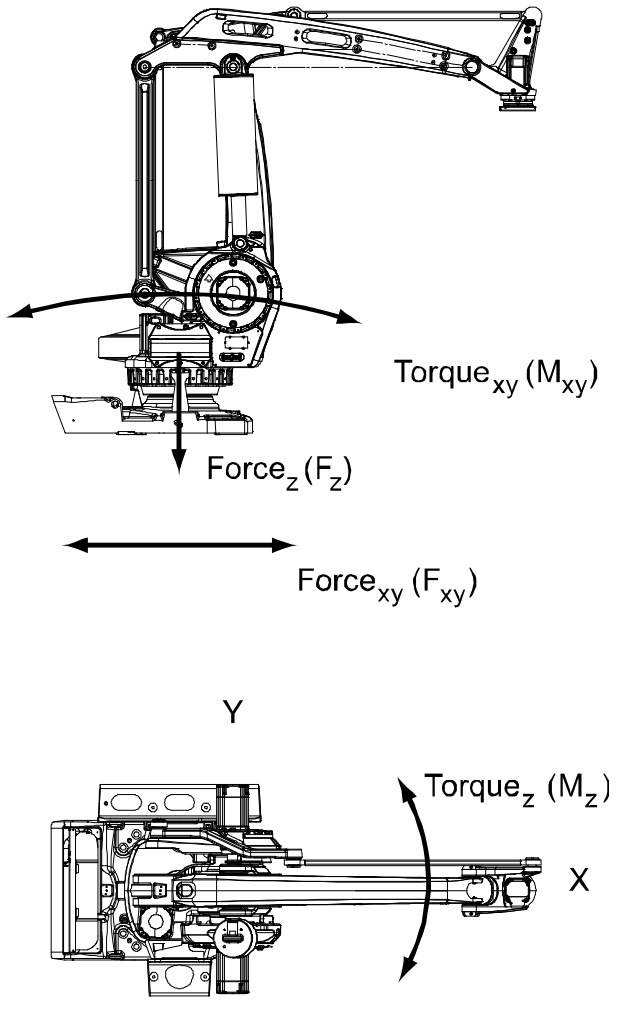
Maximum Load

Maximum load in relation to the base coordinate system.

Floor Mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 8.0 kN	± 11.7 kN
Force z	18.0 ±4.9 kN	18.0 ±8.2 kN
Torque xy	± 23.2 kNm	± 31.2 kNm
Torque z	± 7.7 kNm	± 9.9 kNm

The following figure shows the direction of forces.



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Note regarding M_{xy} and F_{xy}

The bending torque (M_{xy}) can occur in any direction in the XY-plane of the base coordinate system.

The same applies to the transverse force (F_{xy}).

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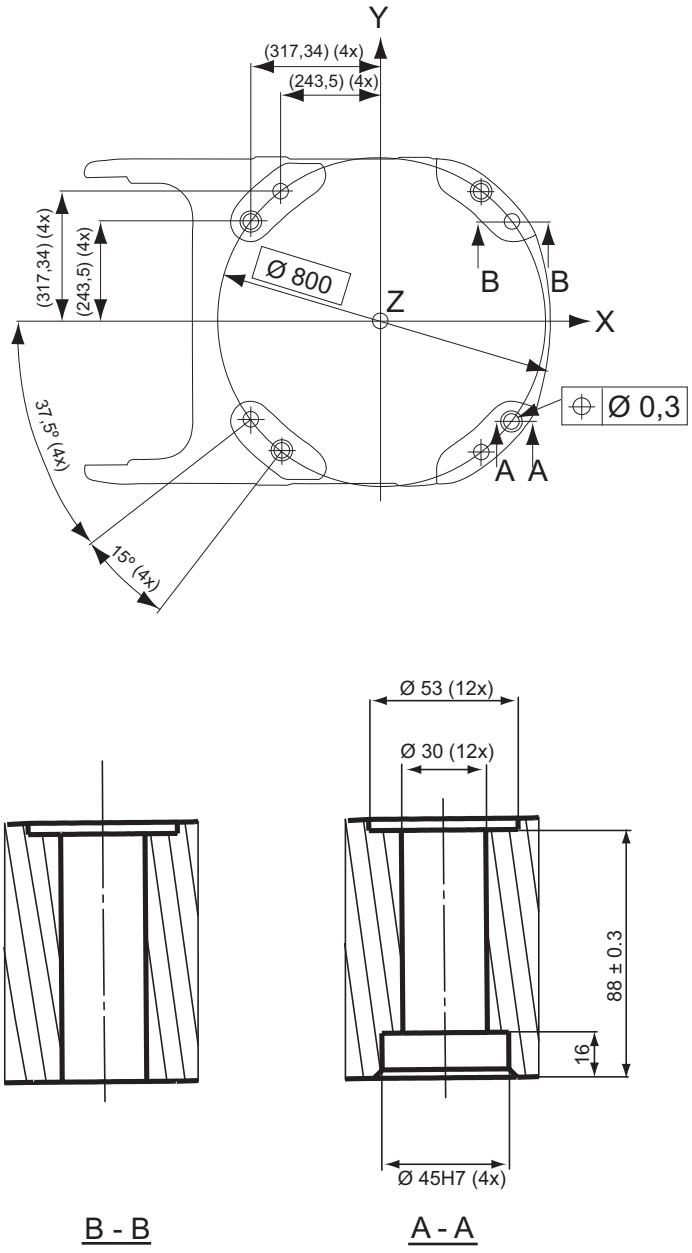
Fastening holes robot base

The following figure shows the hole configuration (dimensions in mm).



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Recommended screws for fastening the manipulator to a base plate:

- M24 x 140 8.8 with 4 mm flat washer. Torque value 725 Nm.

Note

Only two guiding sleeves shall be used. The corresponding holes in the base plate shall be circular and oval according to the following base plate drawing.

Regarding AbsAcc performance, the recommended are the chosen guide holes those are according to the following base plate drawing.

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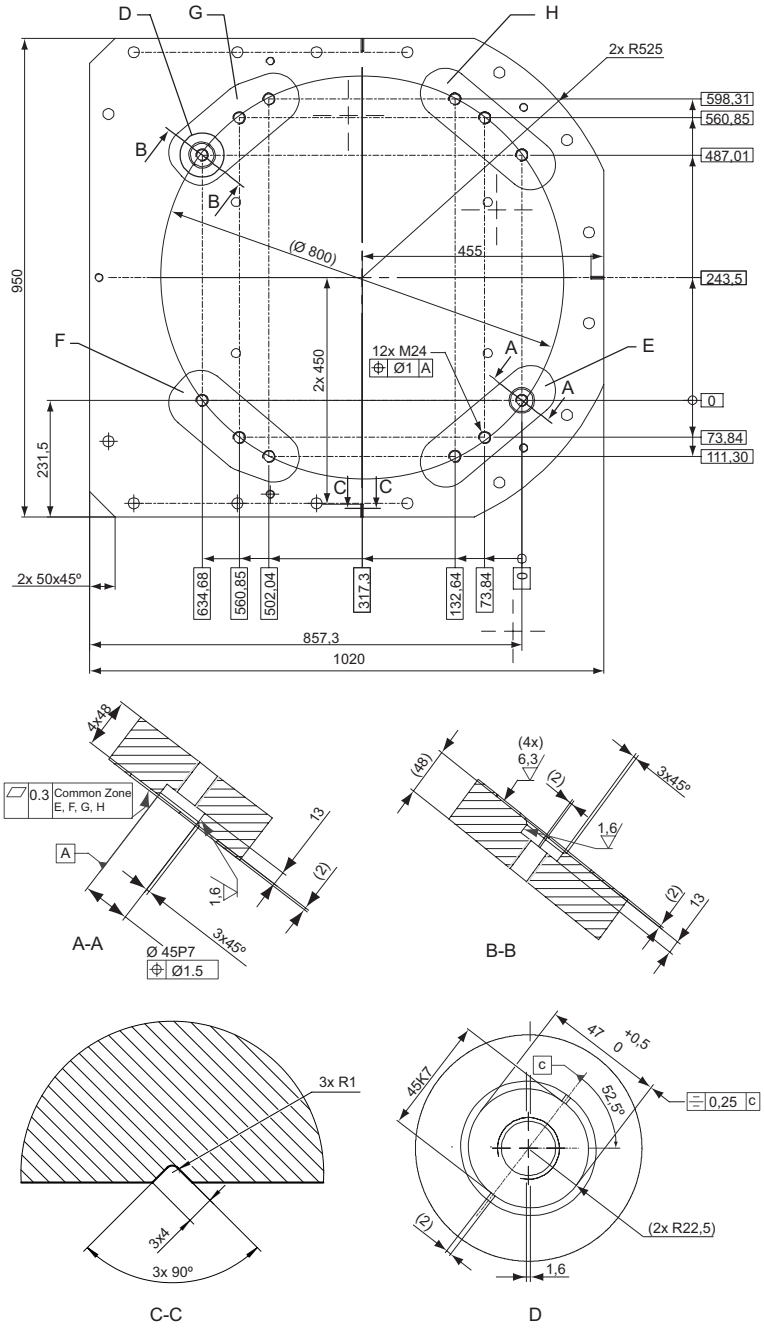
1.3.3 Mounting the manipulator
Continued

Base plate drawing

The following figure shows an example of base plate (dimensions in mm).



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E, F, G, H	Common tolerance zone (accuracy all over the base plate from one contact surface to the other)

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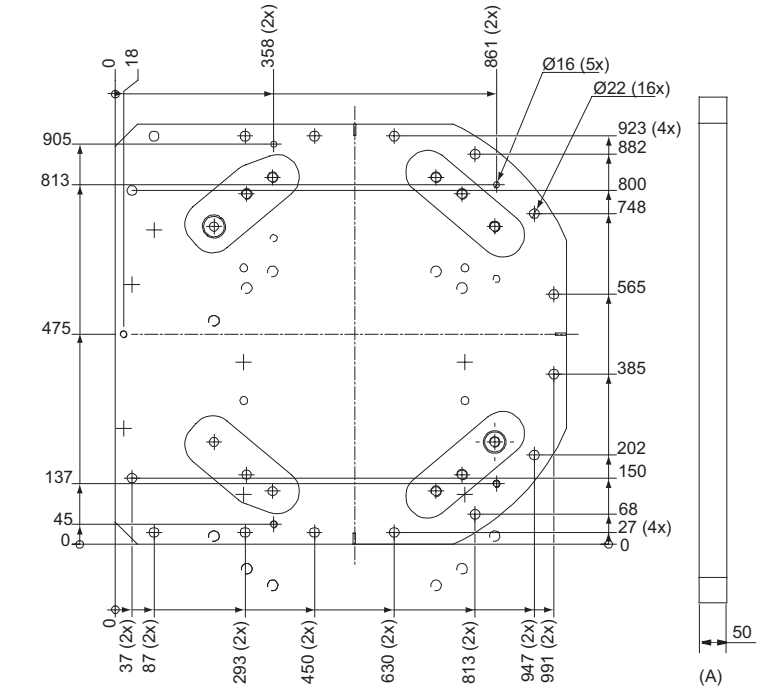

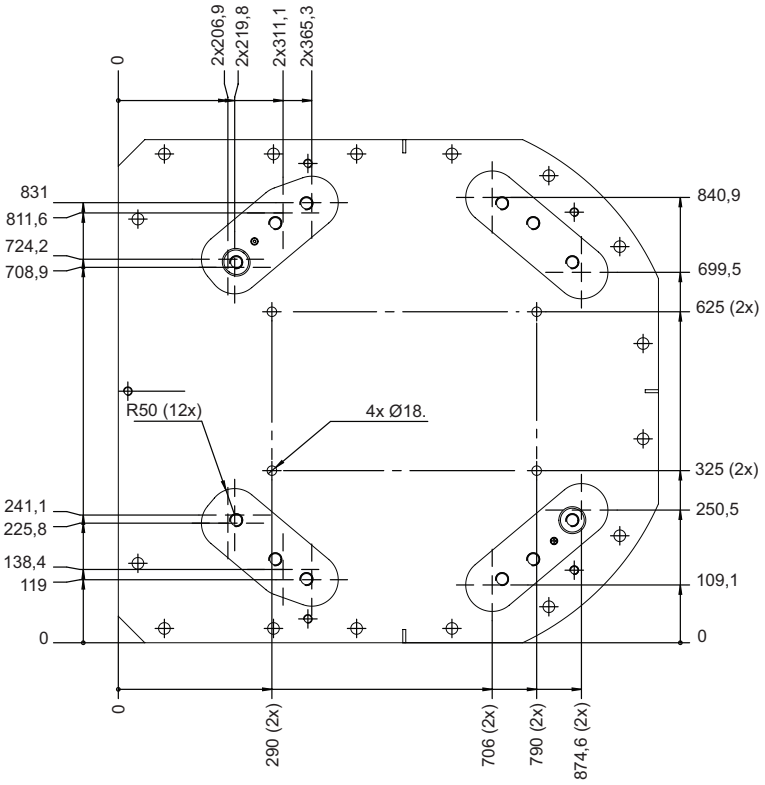

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Pos	Description
A	Color: RAL 9005 Thickness: 80-100 µm

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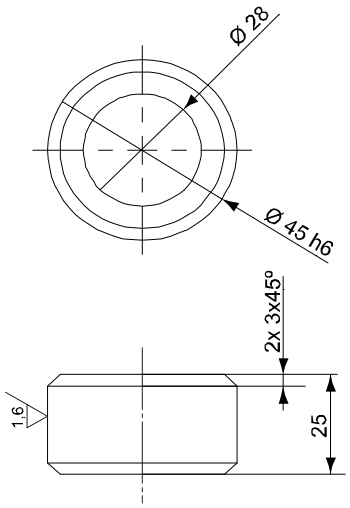
1.3.3 Mounting the manipulator
Continued



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Pos	Description
A	Guide sleeve protected from corrosion

1.4 Calibration

1.4.1 Calibration methods

Overview

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

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

Brief description of calibration methods

Axis Calibration method

Axis Calibration is a standard calibration method for calibration of IRB 660. 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

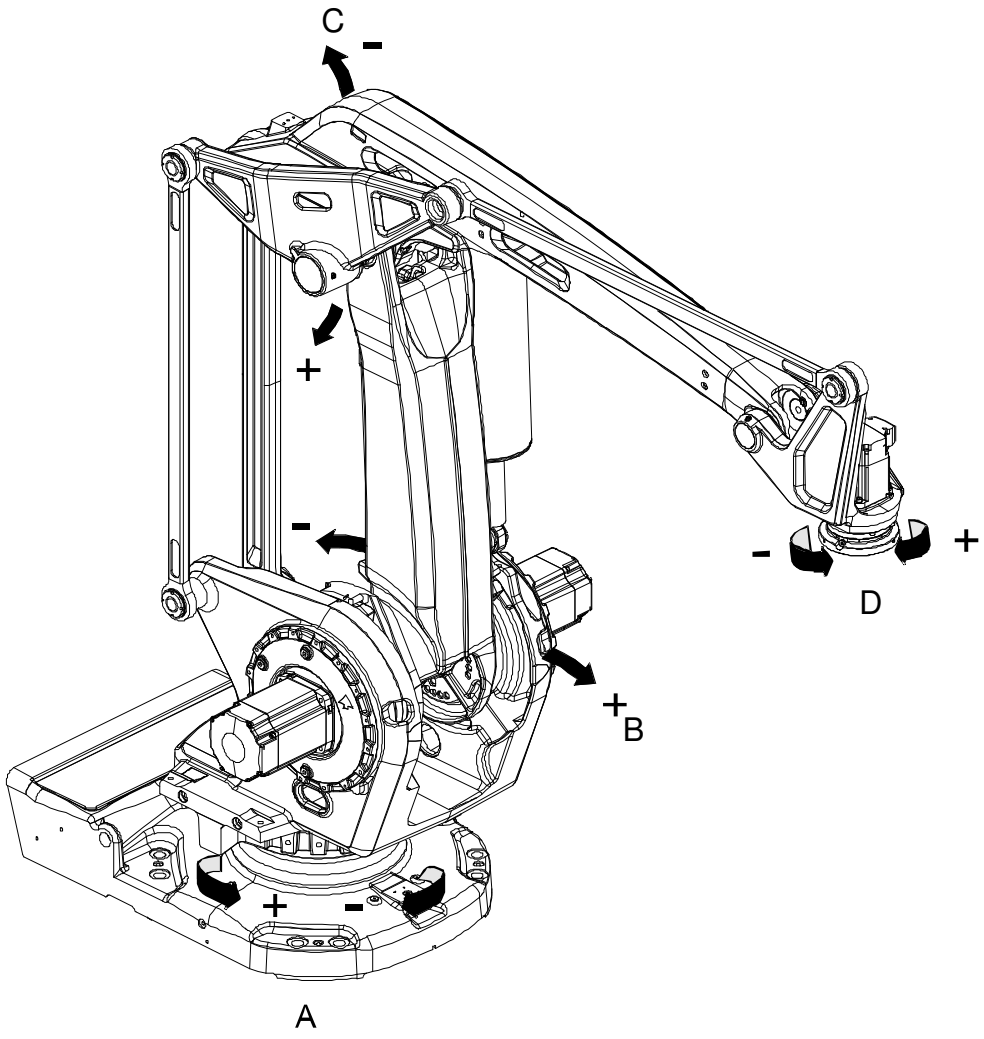
The calibration equipment for Axis Calibration is delivered as a toolkit.

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.

1.4.2 Fine calibration

General

Fine calibration is made using the Axis calibration method. The following figure shows all axes in zero position.



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Position	Description
A	Axis 1
B	Axis 2
C	Axis 3
D	Axis 6

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

Continues on next page

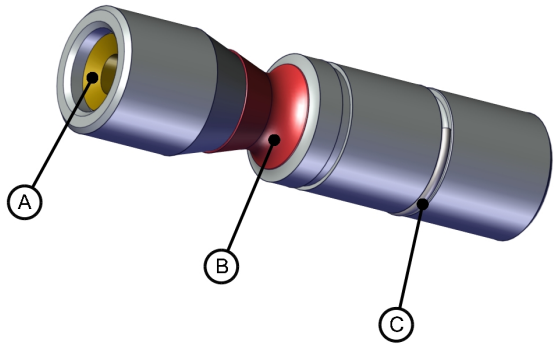
Calibration	Position
Calibration of axis 1	Axis 1 in zero position Axis 2 to 6 in any position

1.4.3 Calibration tools for Axis Calibration

Calibration tools

WARNING

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



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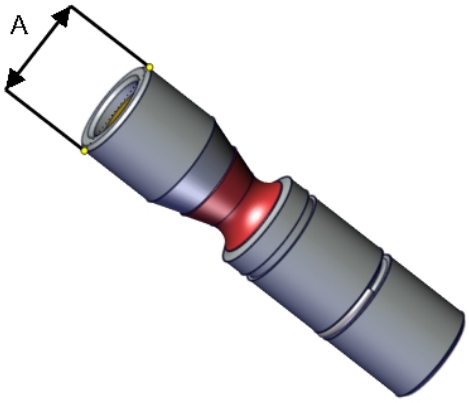
A	Tube insert
B	Plastic protection
C	Steel spring ring



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A	Outer diameter

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

- Outer diameter within Ø12g4 mm, Ø8g4 mm or Ø6g5 mm (depending on calibration tool size).
- Straightness within 0.005 mm.

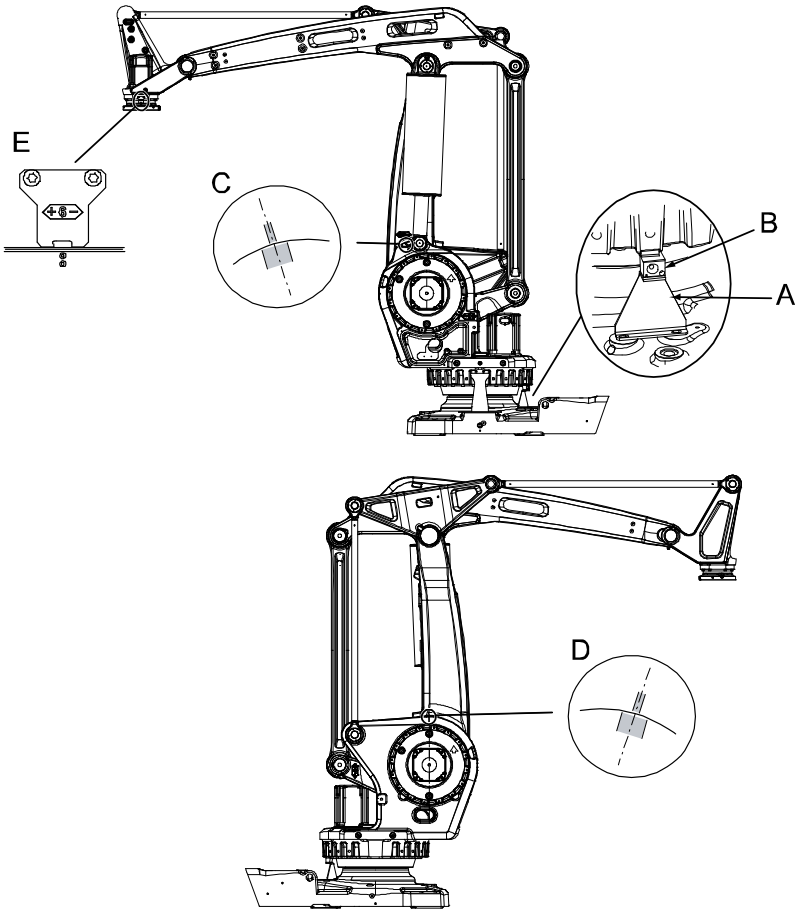
1.4.4 Synchronization marks and axis movement directions

1.4.4.1 Synchronization marks and synchronization position for axes

Introduction

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

Synchronization marks, IRB 660



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A	Synchronization plate, axis 1
B	Synchronization tab on robot
C	Synchronization mark, axis 2
D	Synchronization mark, axis 3
E	Synchronization plate and mark, axis 6

Synchronization marks at axes 2 and 3

The synchronization marks at axes 2, 3 and 6, shown in the figure above, consist of two single marks that should be positioned opposite to one another when the robot is standing in its synchronization position. One of the marks is more narrow than the other and should be positioned within the limits of the wider mark.

1.4.4.2 Calibration movement directions for all axes

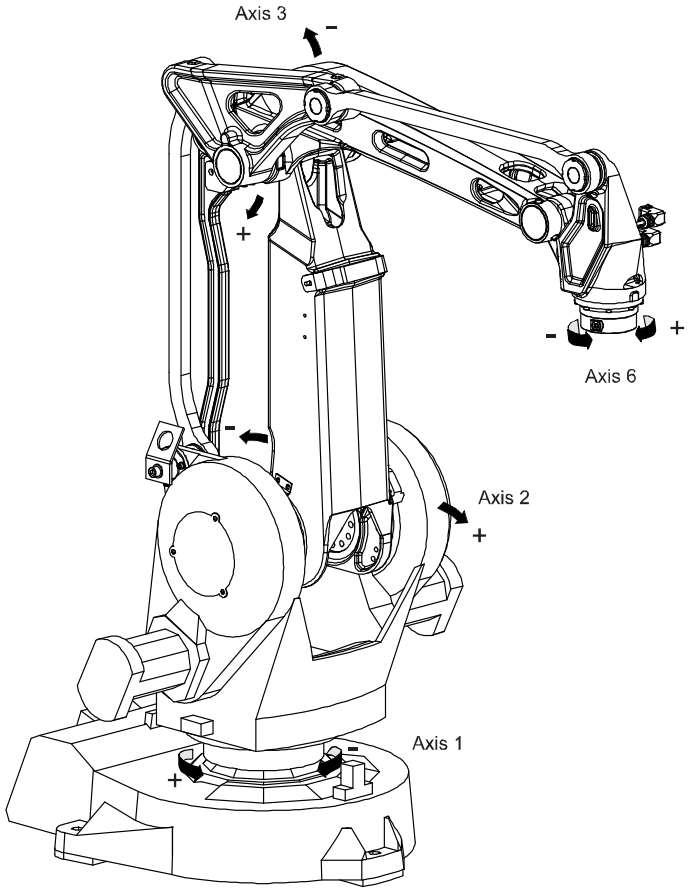
Overview

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

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

Manual movement directions, 4 axes

Note! The graphic shows an IRB 260. The positive direction is the same for all 4-axis robots



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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 15 kgm^2, and an extra load of 50 kg at the upper arm housing.

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

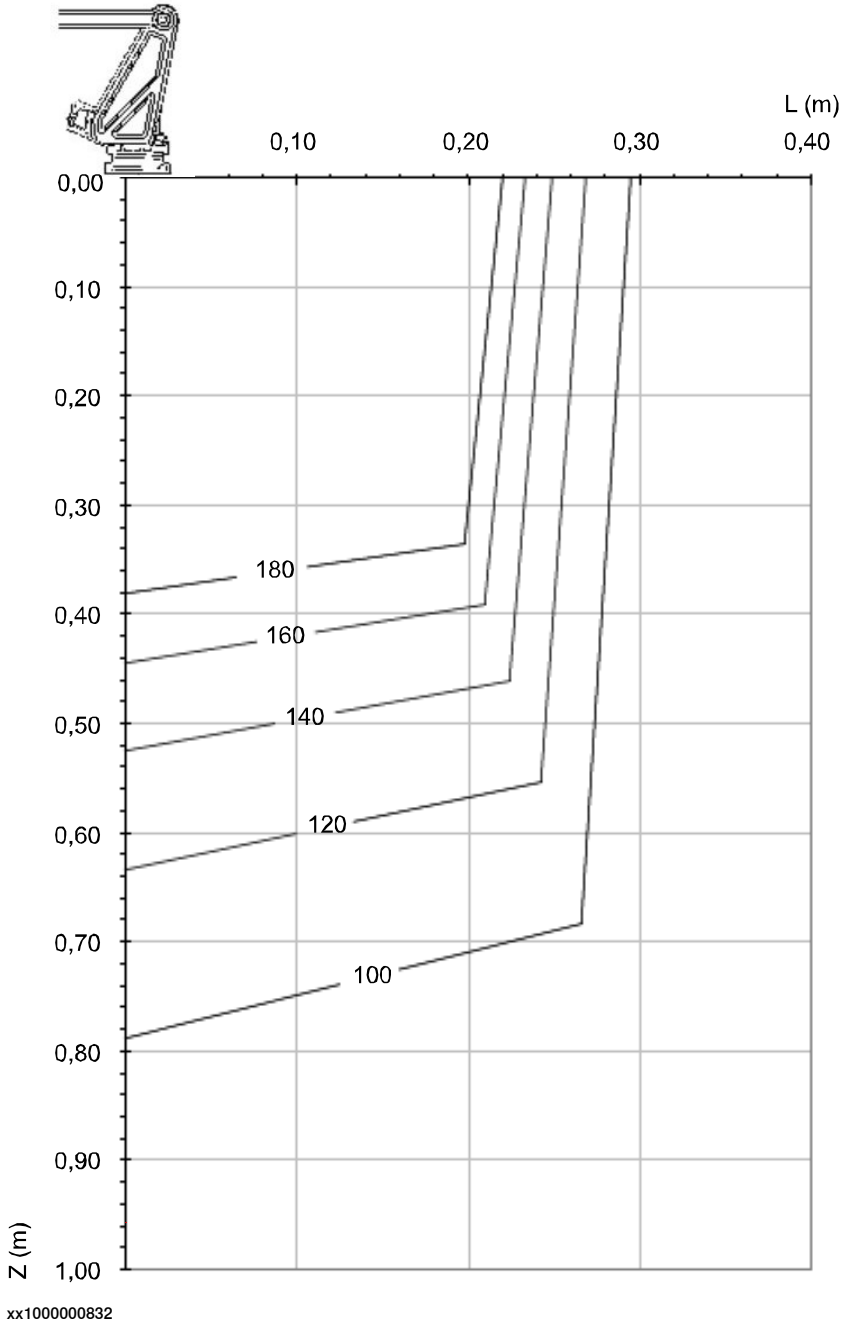
To verify a specific load case, use the RobotStudio add-in RobotLoad.

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.

1.5.2 Load diagrams

IRB 660-180/3.15

The following figures shows the maximum permitted load mounted on the robot tool flange at different positions (center of gravity).



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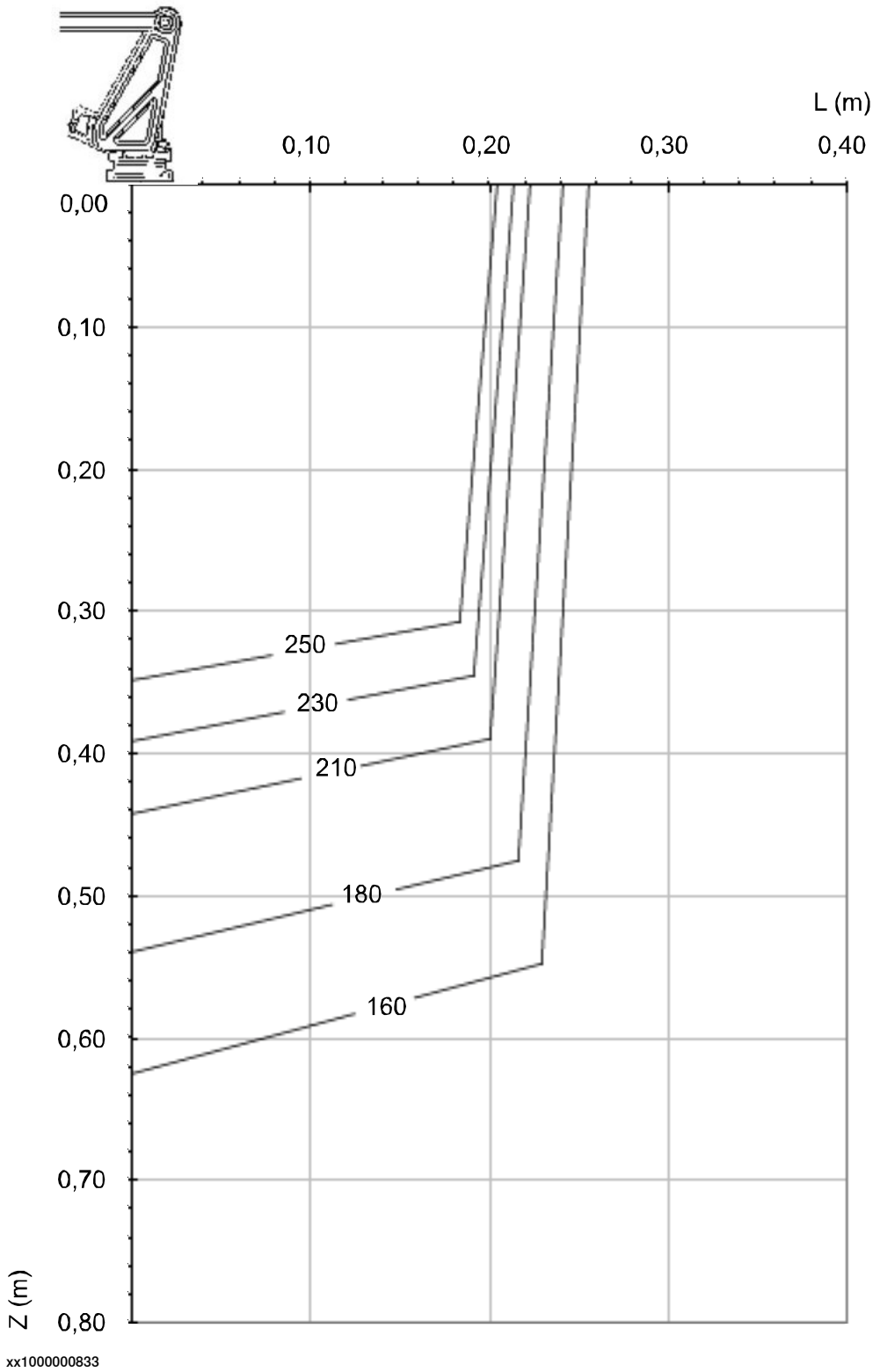
IRB 660-250/3.15

The following figures shows the maximum permitted load mounted on the robot tool flange at different positions (center of gravity).

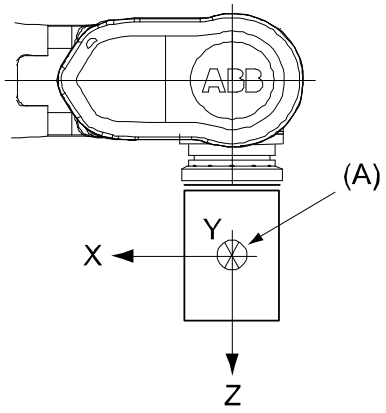


1.5.3 Maximum load and moment of inertia

Overview

Load in kg, Z and L in m and J in kgm^2.

Axis	Maximum moment of inertia
6	Ja6 = Load x L^2 + $J_{0Z} \leq 250$ kgm^2



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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.

1.5.4 Maximum TCP acceleration

General

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

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 660 - 250/3.15	31	18
IRB 660 - 180/3.15	37	24

Note

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

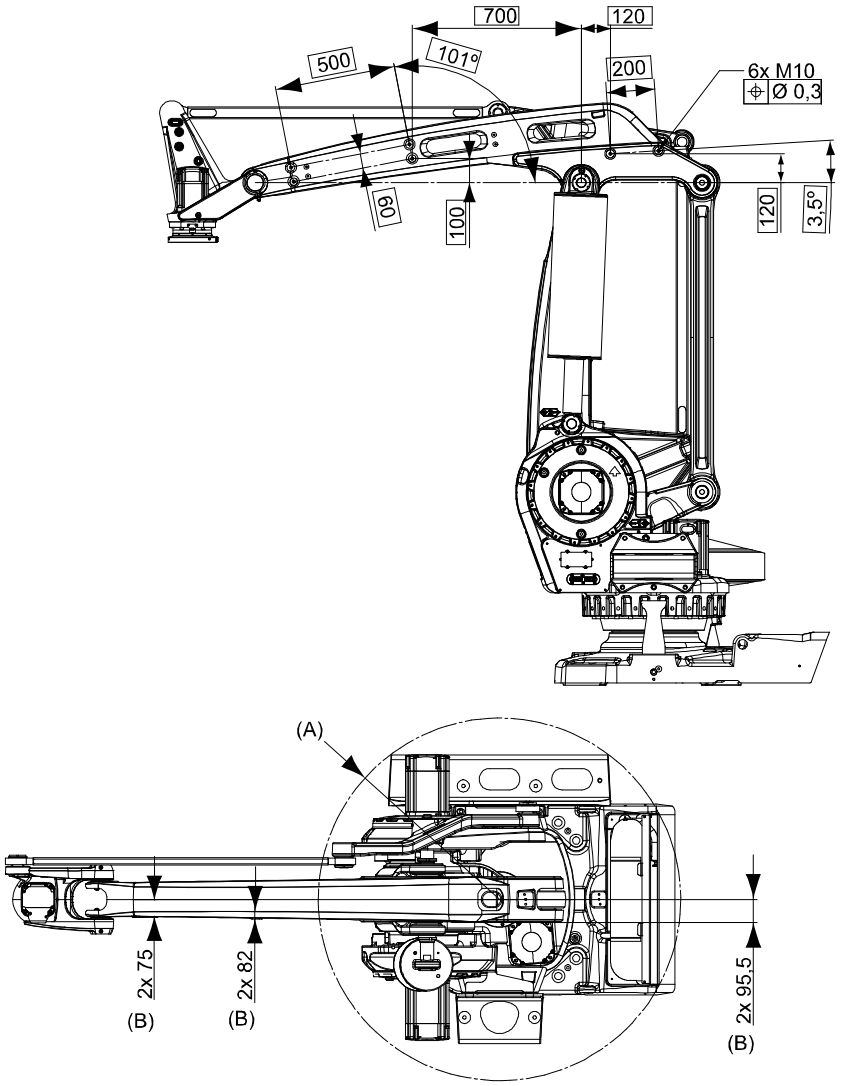
1.6 Mounting of equipment

1.6.1 Overview

General

Extra loads can be mounted on to the upper arm and on to the left side of the frame. Holes and definitions of masses are shown in following figures.

For mounting of an external vacuum hose there are six holes on the upper arm (see the following figure). The maximum weight for the vacuum hose and fastening device is 35kg. When using the holes, the weight of the vacuum hose shall be reduced from the maximum handling capacity, for each variant respectively.



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Position	Description
A	R750 Right fork lift pocket
B	M10 Mounting hole, upper arm

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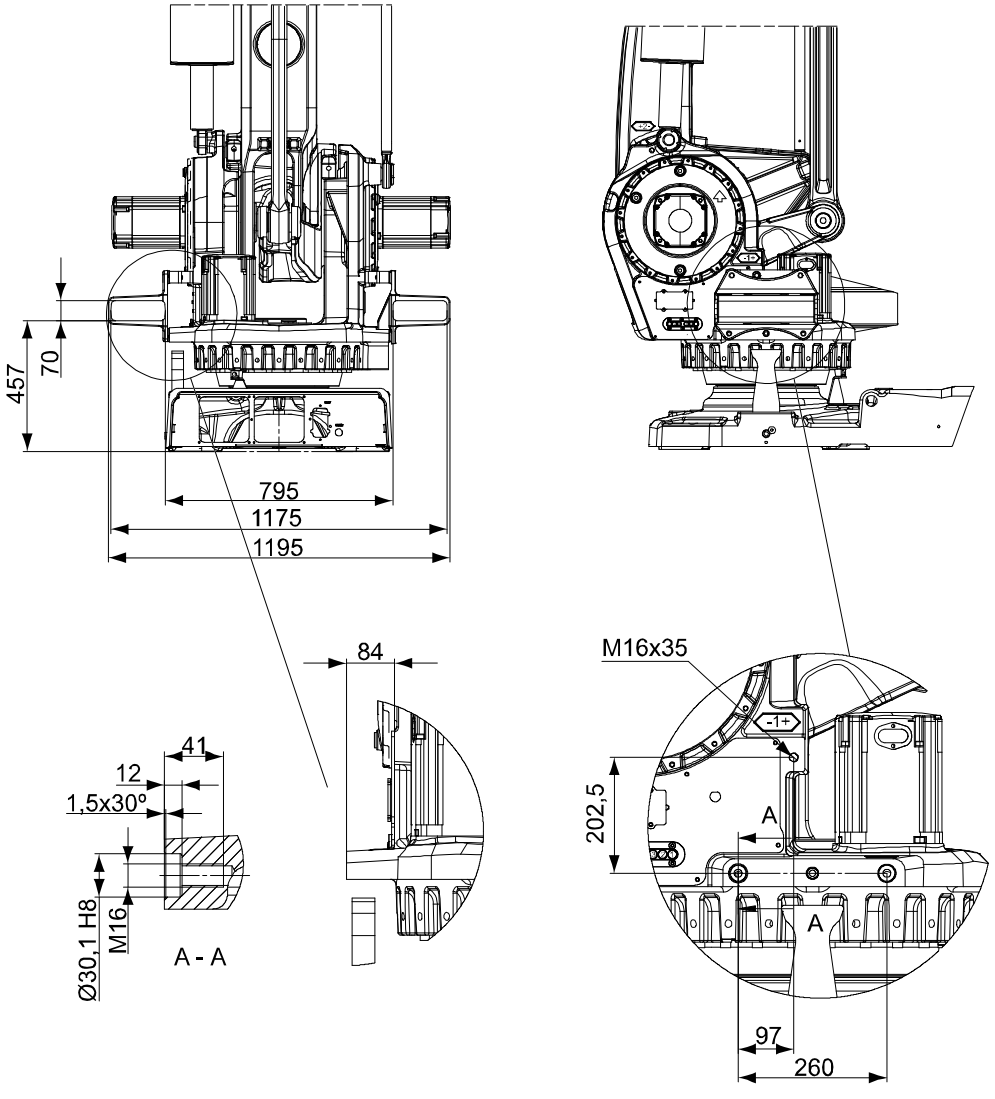
Frame

For mounting of extra load on to the frame there are three holes on the left side (see the following figure). The maximum weight of the extra load is 150kg and the maximum moment of inertia is 120kgm^2.

Description	Value and definition
Permitted extra load on frame	M = 150 kg
Max. moment of inertia for extra load	J_H = 120 kgm^2
Recommended position as shown in the following figure	$J_H = J_{H0} + M \times R^2$ J_{H0} is the moment of inertia (kgm^2) for the extra load. R is the radius (m) from the center of axis1. M is the total mass (kg) of the extra load.



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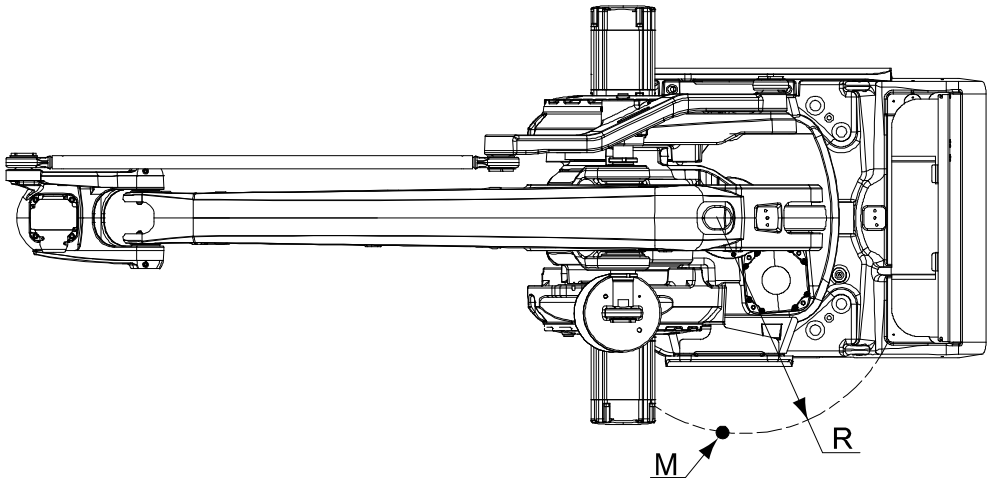
1.6.1 Overview
Continued

The following figure shows the radius for extra load on frame.



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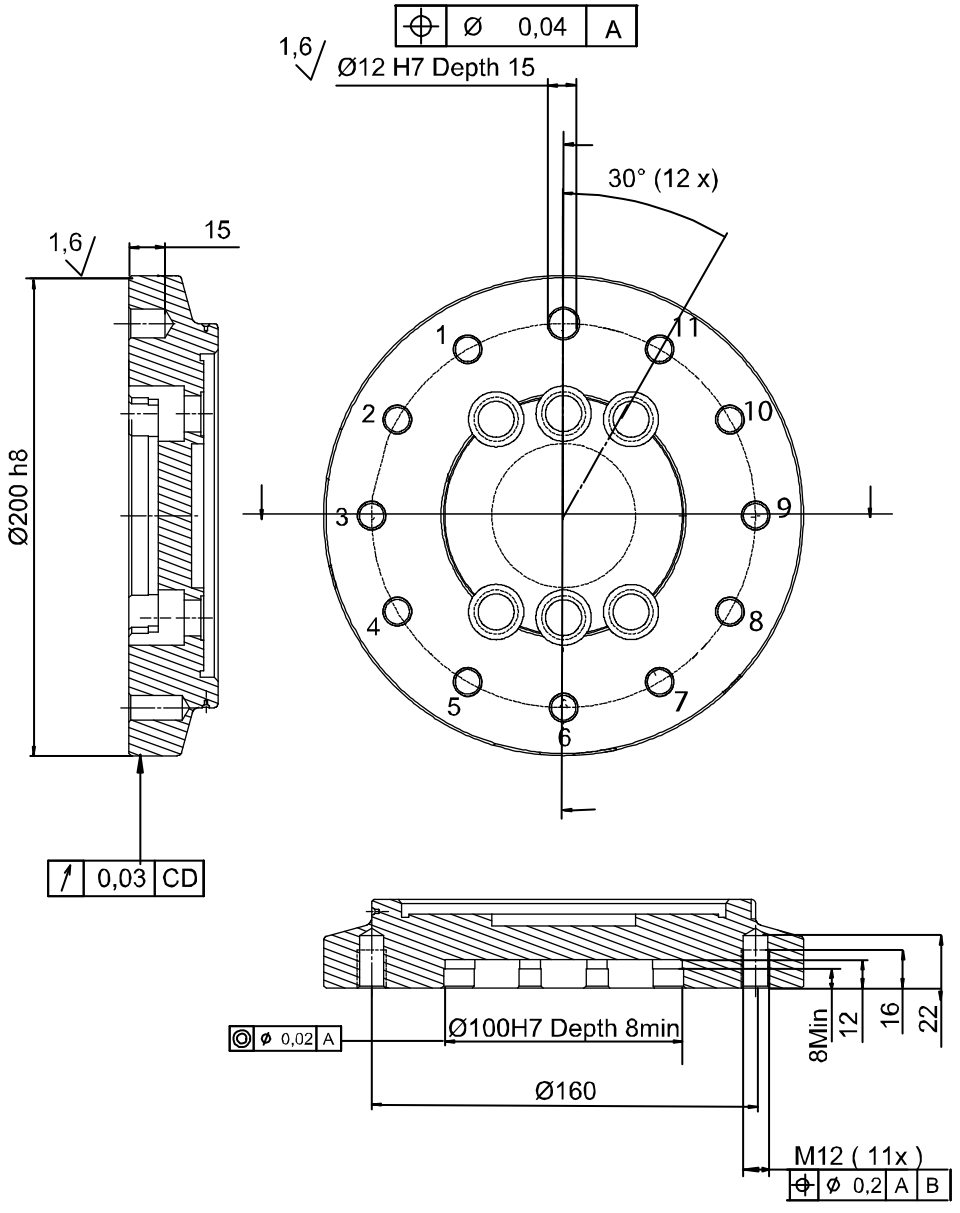
Robot tool flange

The following figure shows the robot tool flange SS-EN ISO 9409-1;2004 (dimensions in mm).



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1.6.1 Overview
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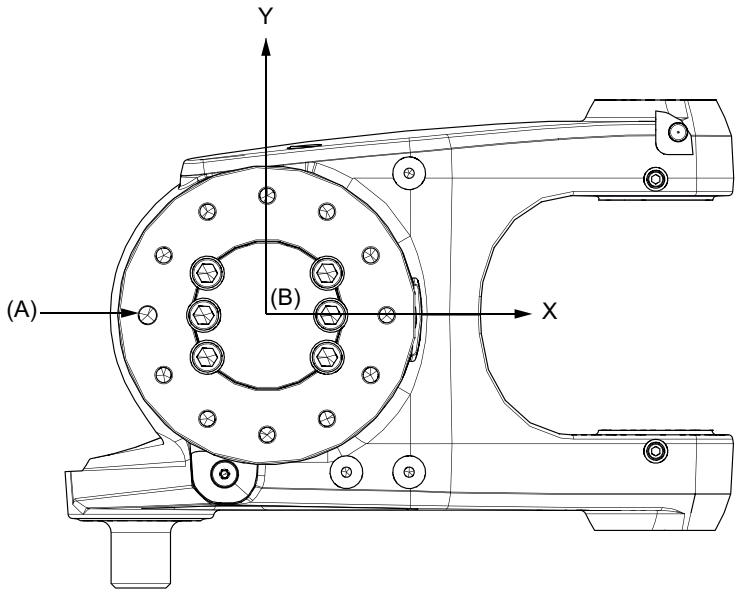

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-	Tool flange in bottom view
A	Locating hole
B	Tool coordinate system

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 Robot motion

1.7.1 Introduction

Type of Motion

Axis	Type of motion	Range of movement	Option
1	Rotation motion	+180° to -180°	+220° to -220°
2	Arm motion	+85° to -42°	
3	Arm motion	+120° to -20°	
6	Turn motion	+300° to -300° (default) +150 revolutions to -150 revolutions Max (see the following note)	

Note

- The default working range for axis 6 can be extended by changing parameter values in the software.

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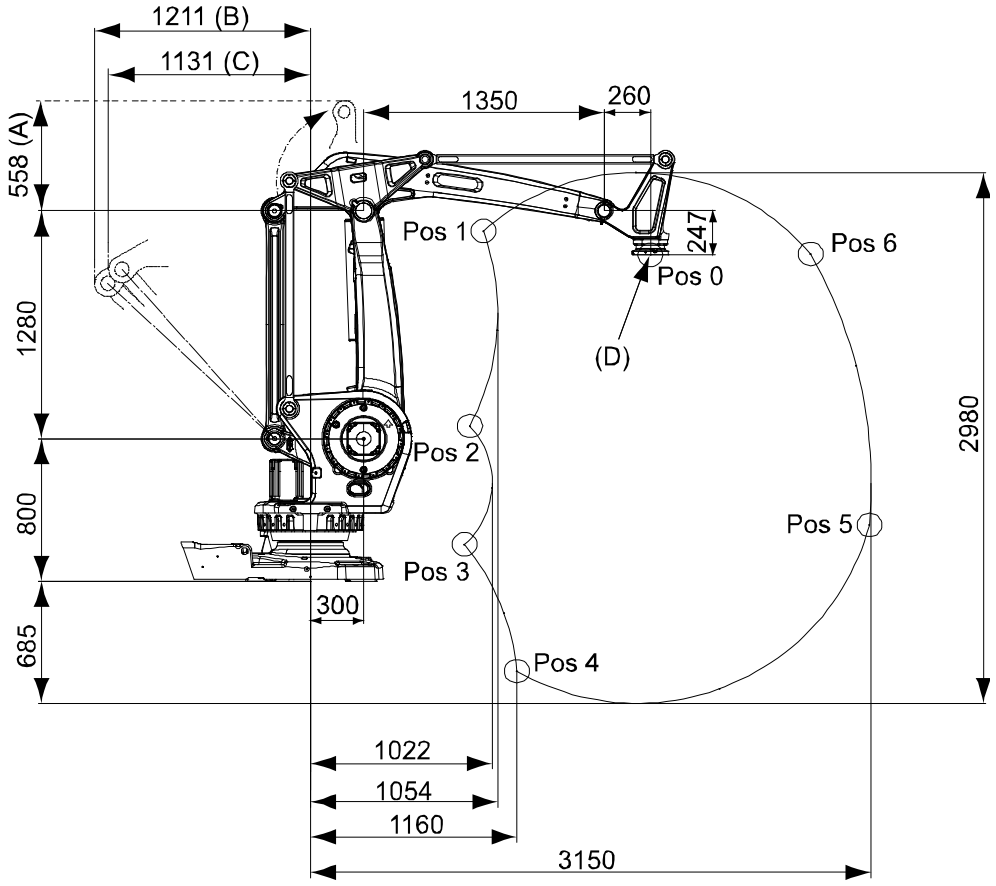
1.7.1 Introduction
Continued

Illustration

The following figure shows the extreme positions of the robot arm specified at the tool flange center (dimensions in mm).



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Position	Description
A	Min. working stop
B	Mechanical stop
C	Max. working stop
D	Tool flange center

Positions at wrist center

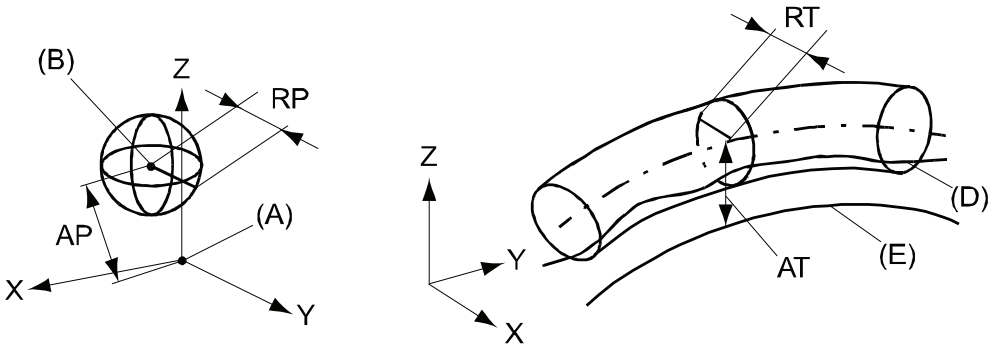
Position number (see preceding figure)	X Position (mm)	Z Position (mm)	Axis2 Angle (degrees)	Axis3 Angle (degrees)
0	1910	1833	0	0
1	972	1966	-42	-20
2	895	870	-42	28
3	866	207	50	120
4	1160	-505	85	120
5	3139	315	85	15
6	2809	1837	50	-20

1.7.2 Performance according to ISO 9283

General

At rated maximum load, maximum offset and 1.6 m/s velocity on the inclined ISO test plane, 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 660-180/3.15	IRB 660-250/3.15
Undirectional pose accuracy, AP[i] (mm)	0.20	0.20
Unidirectional pose repeatability, RP (mm)	0.05	0.05
Linear path repeatability, RT (mm)	0.23	0.17
Linear path accuracy, AT (mm)	2.20	2.13
Pose stabilization time PST (s)	0.17	0.22

[i] AP according to the ISO test above, is the difference between the teached position (position manually modified in the cell) and the average position obtained during program execution.
The above values are the range of average test results from a number of robots.

1.7.3 Velocity

Maximum axis speeds

Axis No.	IRB 660-180/3.15	IRB 660-250/3.15
1	130°/s	95°/s
2	130°/s	95°/s
3	130°/s	95°/s
6	300°/s	240°/s

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

1.7.4 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*).

1.8 Customer connections

1.8.1 Introduction

General

Depending on the choice of options above the DressPack will have different content. The choice of routing will not affect the content. See tables for signal content below.

DressPack, Parallel, bus and air communication

Type	Application	Specification	Connection type	Harting Article No.	Comment
Power (CP)	Utility power	4x0.75mm^2 (5A/250VAC)	3-module Harting, shell size 10B, EE	Female, EE, 8 pin9 140 083 101	1x0.75 mm^2 protective earth
Signals (CS)	Parallel communication	16x AWG24 + 10x AWG24 (50V/1A)	3-module Harting, shell size 10B, HD+EE	Female, HD, 25 pin9 140 253 101	4 quad twisted, 5 screened pair twisted
Signals (CS)		5x2AWG24 (50V/1A)	3-module Harting, shell size 10B, HD	Female, HD, 25 pin9 140 253 101	Sep. Screened
Bus Communication (BUS)	BUS power & BUS utility	2x2 AWG24	3-module Harting, shell size 10B, DD	Female, DD, 12 pin9 140 123 101	
	CANBus	2xAWG26, Z=120 Ohm (1MHz)			
Air (AIR)	Utility air	2x12.7 (1/2") P Nom = 16 bar	Parker Push-lock,1/2" M22x1,5 Brass 24 degree seal		

DressPack, Parallel and Ethernet communication

Type	Application	Specification	Connection type	Supplier Article No.	Comment
Functional Earth (FE)		10mm^2	M8 Cable lug		
Bus communication (BUS)	Ethernet/IP, PROFINET	4x0.4mm^2	M12 PFT Slim Design, 4-poles, D-coded	Male,Harting 21038821425	Ethernet CAT5e 100 Mbit[1].
Power (CP)	Utility power	4x0.75mm^2 (5A/250VAC)	3-module Harting, shell size 10B, EE	Female, EE, 8 pin9 140 083 101	1x0.75mm^2 protective earth
Signals (CS)	Parallel communication	16x AWG24 + 10x AWG24 (50V/1A)	3-module Harting, shell size 10B, HD+EE	Female, HD, 25 pin9 140 253 101	4 quad twisted, 5 screened pair twisted

1 Ethernet with wire colors according to PROFINET standard

Continues on next page

Type	Application	Specification	Connection type	Supplier Article No.	Comment
Air (AIR)	Utility air	2x12.7 (1/2”) P_{Nom} = 16 bar	Parker Push-lock,1/2” M22x1,5 Brass 24 degree seal		

1.9 Maintenance and troubleshooting

1.9.1 Introduction

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 *Product manual - IRB 660*, chapter *Maintenance*.

2 Specification of variants and options

2.1 Introduction to variants and options

General

The different variants and options for the IRB 660 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)
3300-58	660	180	3.15
3300-59	660	250	3.15

Manipulator color

Option	Color	RAL code[i]
209-1	ABB Orange	NCS 2070-Y60R
209-2	ABB White	RAL 9003
209-202	ABB Graphite White **(Standard color)**	RAL 7035
209	RAL code should be specified (ABB none 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 none standard colors.

Protection

Option	Description
3350-670	Base 67,IP67

Note

Base 67 includes IP67, according to standard IEC 60529.

Fork lift device

Option	Type	Description
3318-2	Fork lift on frame	Lifting device on the manipulator for fork-lift handling.

Limited working range

To increase the safety of the robot, the working range of axis 1 can be restricted by extra mechanical stops.

Option	Type	Description
3323-1	Axis 1, 15 degrees	Two stops which allow the working range to be restricted in increments of 15°.
3323-3	Axis 1, 7.5 degrees	Two stops which allow the working range to be restricted in increments of 7.5°.

Continues on next page

Extended work range

Option	Type	Description
3324-1	Axis 1 to ±220°	The option extends the working range on axis 1 from ±180° to ±220°. When the option is used, the mechanical stop can after a risk-assessment be removed. Requires options SafeMove or EPS (Electronic Position Switches).

CAUTION

The option *Extended work range* enables an extension of the working range for axis 1, through a software configuration. With this option installed, the working range can exceed the range limited by the mechanical stop on axis 1. The working range shall be limited through the option SafeMove.

A risk analysis must be done to ensure that no risks remain when using option *Extended work range*, to limit the working range, and before removing the mechanical stops.

For information about the option SafeMove, see *Application manual - Functional safety and SafeMove*.

If the mechanical stop is removed, then the manipulator should have a marking for this, for example, a label. If the robot is delivered with the option *Extended work range*, then such a label is included on delivery.

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]

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.

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Option	Type	Description
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*.

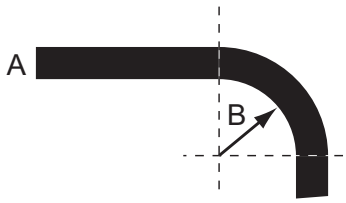
2.3 Floor cables

Manipulator cable - Length

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

Bending radius for static floor cables

The minimum bending radius is 10 times the cable diameter for static floor cables.



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A	Diameter
B	Diameter x10

2.4 Application

DressPack axis 6

Option	Description
3337-12	MH DeviceNet. Includes parallel signals
3337-13	MH EtherNet. Includes parallel signals, Supports ProfiNet, EtherNetIP

Connector kit base

Option	Type	Description
3330-2	CP/CS bus, Proc 1 base	For the Customer Power/Customer Signal connector and one Process connector on the manipulator base. Sockets for bus communication are included.

Connector kit axis 6

Option	Type	Description
3334-2	CP/CS bus, Proc 1 axis6	For the Customer Power/Customer Signal connector and one Process connector on the manipulator axis 6. Sockets for bus communication are included.

Connection of Parallel/CAN DeviceNet communication

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

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

Index

ABB AB
Robotics & Discrete Automation
S-721 68 VÄSTERÅS, Sweden
Telephone +46 (0) 21 344 400

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

ABB Engineering (Shanghai) Ltd.
Robotics & Discrete Automation
No. 4528 Kangxin Highway
PuDong New District
SHANGHAI 201319, China
Telephone: +86 21 6105 6666

ABB Inc.
Robotics & Discrete Automation
1250 Brown Road
Auburn Hills, MI 48326
USA
Telephone: +1 248 391 9000

abb.com/robotics

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