Product specification
IRB 1600/1660

Product specification

IRB 1600 - 6/1.2
IRB 1600 - 6/1.45
IRB 1600 - 10/1.2
IRB 1600 - 10/1.45
IRB 1660ID - 6/1.55
IRB 1660ID - 4/1.55

IRC5

Document ID: 3HAC023604-001

Revision: AR

Table of contents

This page is intentionally left blank

Overview of this specification

About this product specification

It 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 requirements
- The load diagrams, mounting of extra equipment, the motion and the robot reach
- The specification of variant 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 1600/1660	*3HAC026660-001*
Product specification - Robot user documentation, IRC5 with RobotWare 6	*3HAC052355-001*

Revisions

Revision	Description
3	- Calibration positions and Absolute Accuracy information added in chapter 1.4 - New Inside address for ABB RobotLoad - New wrist, Type A added in chapter 1.5.5 - Figures for customer connections added
D	- Option 287-5 Wash removed

Continues on next page

Overview of this specification

Continued

Revi-sion	Description
E	- New versions IRB 1600ID-4/1.5, IRB 1600-6/x and IRB 1600-8/x added - Changes in Safety/Standards - Directions of forces added - Increased payloads for standard robots - Arc welding options added - Warranty information for load diagrams
F	- Old versions removed and AW offer changed.
G	- Changes for Calibration data - Work range - Explanation of ISO values (new figure and table) - Stopping distance - Changes in chapter Specification of Variants and Options, Track Motion and Process equipment - User documentation on DVD
H	- Added information about mounting equipment on upper arm
J	- General update for 9.1 release
K	- Updated/Corrected Clean Room Class - Option 17/6 removed in Variants and Options
L	- Foundry Plus 2 - Clean Room removed
M	- Text for Standards updated
N	- Information regarding 1-phase power supply
P	- Figure for standard tool flange corrected
Q	- Option 864-1 added
R	- Table for ambient temperature adjusted
S	• Machinery directive updated • ISO value for IRB 1600ID updated • Info regarding tilted IRB 1600ID added • Corrected figure in section *Working range on page 51*.
T	• Minor corrections/update • Missing measures for mounting holes axis 4 added
U	• Minor corrections/update • IRB 1600-8 upgraded to 10 kg • Added mounting holes on the lower arm.
V	• Minor corrections/update
X	• Text for ISO test adjusted • Robot stopping distances and times for category 0 and category 1 stops are moved to a separate document, *Product specification - Robot stopping distances according to ISO 10218-1*
Y	• Text for Foundry Plus updated. • Minor corrections/update
Z	• Minor corrections/update
AA	• Tilting around X-axis added

Continues on next page

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

Revision	Description
AB	• Added a new variant IRB 1600ID - 6/1.55. • Section Track motion with options 1001-1, 1000-5 and 1000-6 removed from manual. • Updated the maximum load values of the robot. See *General on page 22*. • Updated design of extra equipment mounting holes for IRB 1600ID-4/1.5.
AC	• Rename the variant IRB 1600ID - 6/1.55 to IRB 1660ID - 6/1.55. • Updated the manipulator weight of IRB 1660ID - 6/1.55, see *Manipulator weight on page 14*. • Updated the load diagram of IRB 1660ID - 6/1.55 with vertical wrist, see *IRB 1660ID-6/1.55 "Vertical Wrist" (±10º) on page 39*. • Updated robot tool flange dimension drawing of IRB 1660ID - 6/1.55, see *Robot tool flange for IRB 1660ID on page 49*. • Updated the turning radius drawing, see *Turning radius on page 55*.
AD	Published in release R16.2. The following updates are done in this revision: • Added a new variant IRB 1660ID - 4/1.55. • Wall mounting available to IRB 1660ID - X/1.55.
AE	Published in release R17.1. The following updates are done in this revision: • Tilting around X-axis added for IRB 1660ID. • IRB 1600ID removed. • Restriction of load diagram added. • Axis Calibration method added.
AF	Published in release R17.2. The following updates are done in this revision: • Updated list of applicable standards. • TCP acceleration information added
AG	Published in release R18.1. The following updates are done in this revision: • Updated drawing on robot tool flange.
AH	Published in release R18.2. The following updates are done in this revision: • Updated information of holes for mounting of extra equipment for IRB 1600, see *Holes for mounting of extra equipment for IRB 1600 on page 45*. • Removed the phased out options: welding torch package options [878-X], option AristoMig 5000i [1029-14], current/hose set options [1030-X], and feed kit options [1033-X].
AJ	Published in release 19B. The following updates are done in this revision: • Vertical dimensions of IRB 1660ID-X/1.55 and IRB 1600-X/1.2 (1.45) added. See *Technical data on page 14*. • Updated information about *Absolute Accuracy*.
AK	Published in release 19C. The following updates are done in this revision: • Note added about need to calibrate if the robot is other than floor mounted. See *Calibration methods on page 27*.
AL	Published in release R20C. The following updates are done in this revision: • 1037-2 ABB TC96 phase out.
AM	Published in release R20D. The following updates are done in this revision: • Warranty section updated.
AN	Published in release R21D. The following updates are done in this revision: • Text regarding fastener quality is updated. • Removed Axis resolution.
AP	Published in release 22A. The following updates are done in this revision: • Measurement in illustration *Dimensions IRB 1660ID-X/1.55* is changed.

Revi-sion	Description
AQ	Published in release 22B. The following updates are done in this revision: • Updated protection class for *IRB 1660ID-X/1.55*. • Updated holes for mounting of extra equipment for *IRB 1660ID-X/1.55*.
AR	Published in release 23B. The following updates are done in this revision: • Correction regarding WeldGuide options • Added RAL code in manipulator color

1 Description

1.1 Structure

1.1.1 Introduction

Robot family

> A number of new possibilities open up with ABB's IRB 1600 robot. It is available in seven versions, two of which are AW robot variants, IRB 1660ID-6/1.55 and IRB 1660ID-4/1.55 with an compact AW-dressed process upper arm.
>
> The IRB 1600/1660ID family is ideal for Arc Welding, Machine Tending, Material Handling, Gluing and Deburring/Grinding applications.

Software product range

> 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.

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 multitasking, sensor control etc. For a complete description on optional software, see the *Product specification - Controller software IRC5*.

Foundry Plus 2

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 protected robot. The Foundry Plus 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 case rust attach 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 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 liquid and solid contaminants. Among other things all sensitive parts are better protected than the standard offer.

Selected Foundry Plus/Foundry Plus 2 features:

- Improved sealing to prevent penetration into cavities to secure IP67
- Additional protection of cabling and electronics
- Special covers protecting cavities
- Well-proven connectors
- Nickel coated tool flange (Foundry Plus 2)
- Rust preventives on screws, washers and unpainted/machined surfaces

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 2 protection, for example can rust preventive be washed off with wrong cleaning method.

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

Manipulator axes
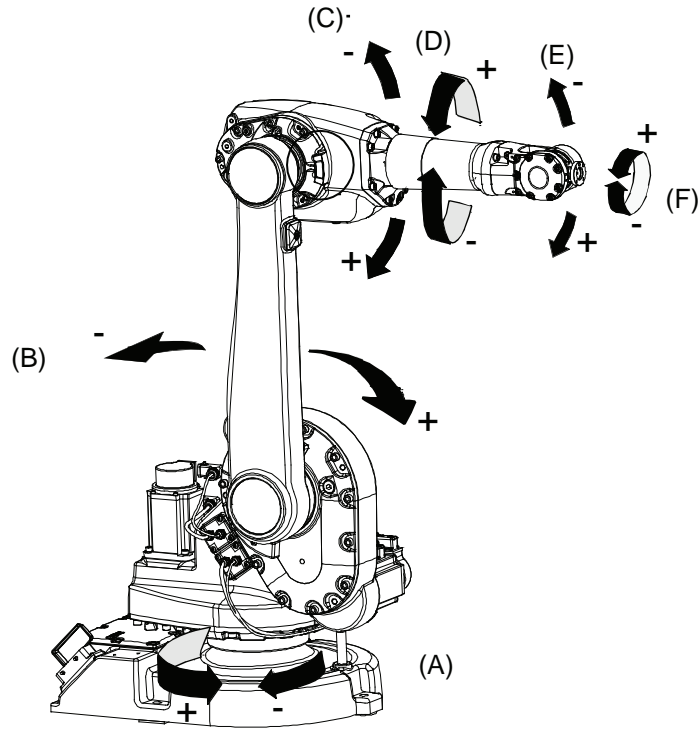
xx1500000244

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

1 Description

1.1.2 Technical data

General

The IRB 1600/1660ID is available in seven versions and they can be mounted on the floor, wall, tilted (up to 55 degrees around the Y-axis or X-axis) or inverted. See *Robot motion on page 51* for limitations.

Robot type	Handling capacity (kg)	Reach (m)
IRB 1600	6 kg	1.2 m
IRB 1600	6 kg	1.45 m
IRB 1600	10 kg	1.2 m
IRB 1600	10 kg	1.45 m
IRB 1660ID	4 kg	1.55 m
IRB 1660ID	6 kg	1.55 m

Airborne noise level

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

Manipulator weight

Robot	Weight
IRB 1600-X/1.2	250 kg
IRB 1600-X/1.45	250 kg
IRB 1660ID-X/1.55	260 kg

Continues on next page

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

Power consumption

Path E1-E2-E3-E4 in the ISO Cube, max.load.

Speed (mm/s)	Power consumption (kW)			
	IRB 1600-X/1.2	IRB 1600-X/1.45	IRB 1660ID-6/1.55	IRB 1660ID-4/1.55
Max.	0.57	0.58	0.62	0.64
1000	0.46	0.47	0.46	0.45
500	0.39	0.42	0.40	0.39
100	0.34	0.39	0.37	0.36
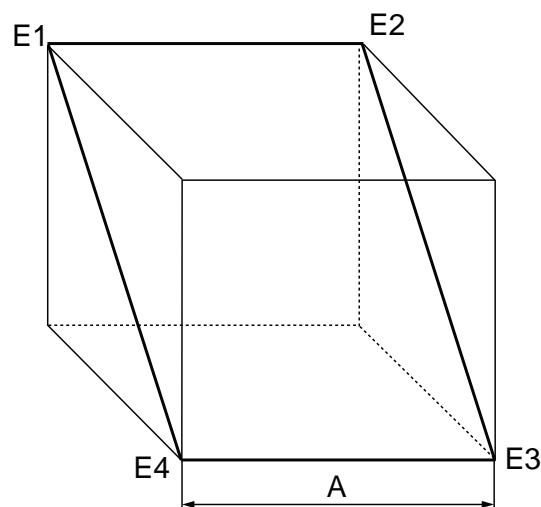
xx1000000101

A	400 mm

Dimensions IRB 1600-X/1.2 (1.45)

252.5
161
215
131 (3x) M8
840
600
65
AN
AN
112 (3x Ø7)
19
1069.5*
1294.5**
475*
700**
486.5
E
E
150
278
242
242
648
A
℄ Axis
A
℄ Axis

*IRB 1600-X/1.2
**IRB 1600-X/1.45

62 M6 (2x) ⩒10
132
(A)
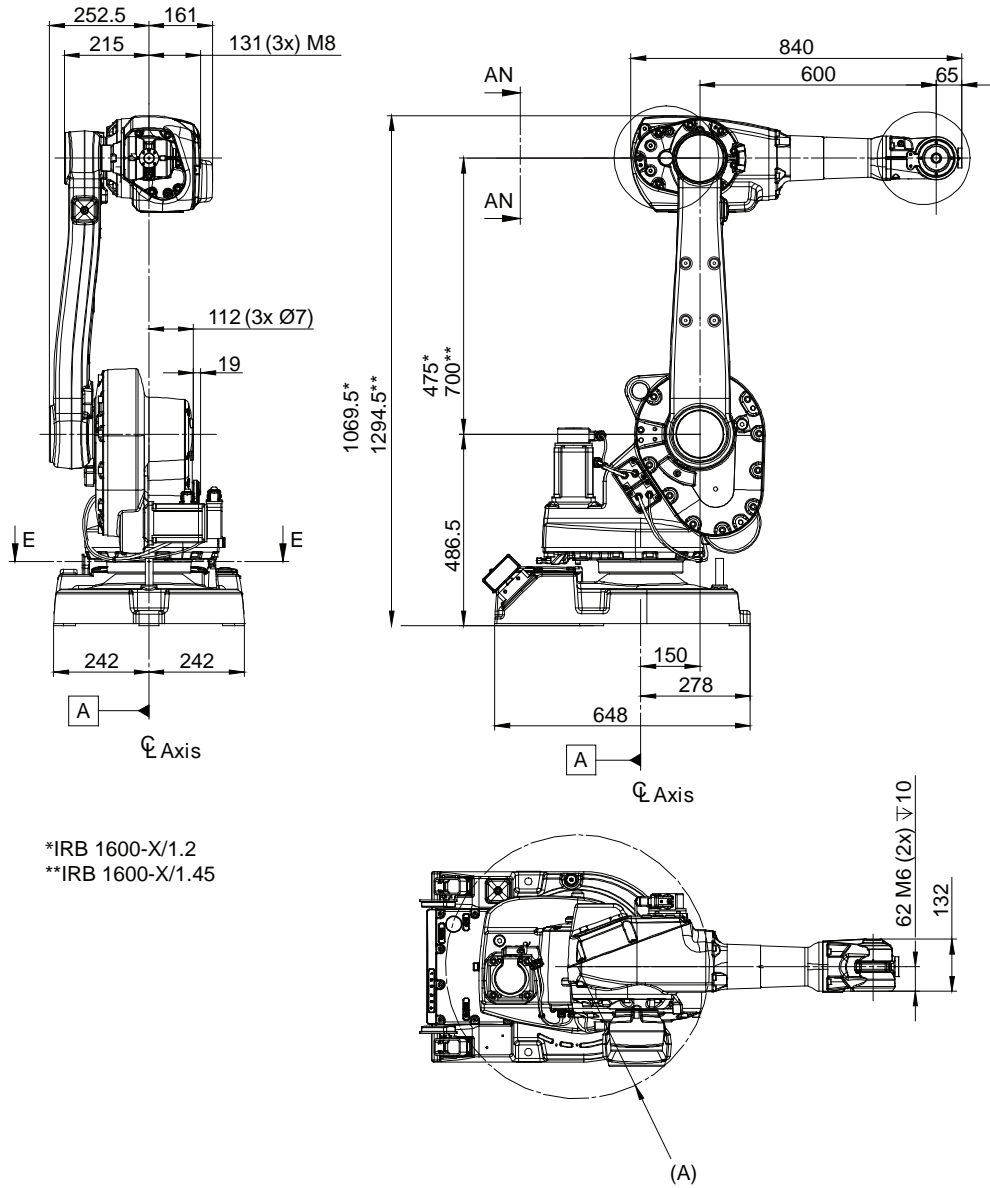
xx1000000972

A	R= 335 mm minimum turning radius

Dimensions IRB 1660ID-X/1.55

xx1500001250

A	R335 Minimum turning radius

1.2 Standards

1.2.1 Applicable standards

> **ℹ️ 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 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 deviations from ISO 10218-1:2011, these are listed in the declaration of incorporation which is part of the product delivery.

Normative standards as referred to from ISO 10218-1

Standard	Description
ISO 9283:1998	Manipulating industrial robots - Performance criteria and related test methods
ISO 10218-2	Robots and robotic devices - Safety requirements for industrial robots - Part 2: Robot systems and integration
ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
ISO 13849-1:2006	Safety of machinery - Safety related parts of control systems - Part 1: General principles for design
ISO 13850	Safety of machinery - Emergency stop - Principles for design
IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements

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

Other standards used in design

Standard	Description
ISO 9787:2013	Robots and robotic devices -- Coordinate systems and motion nomenclatures
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

Continues on next page

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

Standard	Description
ISO 13732-1:2006	Ergonomics of the thermal environment - Part 1
IEC 60974-1:2012 [i]	Arc welding equipment - Part 1: Welding power sources
IEC 60974-10:2014 [i]	Arc welding equipment - Part 10: EMC requirements
ISO 14644-1:2015 [ii]	Classification of air cleanliness
IEC 60529:1989 + A2:2013	Degrees of protection provided by enclosures (IP code)

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

1.3 Installation

1.3.1 Introduction

General

IRB 1600 can be mounted on the floor, wall, tilted (up to 55 degrees around the Y-axis or X-axis, also valid for inverted robot, for more details see *Product manual - IRB 1600/1660*) or inverted. An end effector with max. weight of 6 kg or 10 kg (depending on variant) can be mounted on the tool flange (axis 6). See figure below for wall/tilted mounting position, regarding the X direction of the base coordinate system. See *Robot motion on page 51* for limitations.

IRB 1660ID-X/1.55 can be mounted on the floor or inverted and generally be tilted up to 45 degrees, around the Y-axis or X-axis, with a ±180 degrees working range on axis 1 (at full payload and arm load). It can also be mounted on the wall, with a ±45 degrees working range on axis 1 (at full payload and arm load), a larger working range is possible with a lower load. For IRB 1660ID-6/1.55, an end effector with max. weight of 6 kg can be mounted on the tool flange (axis 6); for IRB 1660ID-4/1.55, an end effector with max. weight of 4 kg can be mounted on the tool flange (axis 6). See *Load diagrams on page 34*.

Extra equipment can be mounted on to the hip and on the upper arm. See *Mounting of equipment on page 44*.

xx1200001354
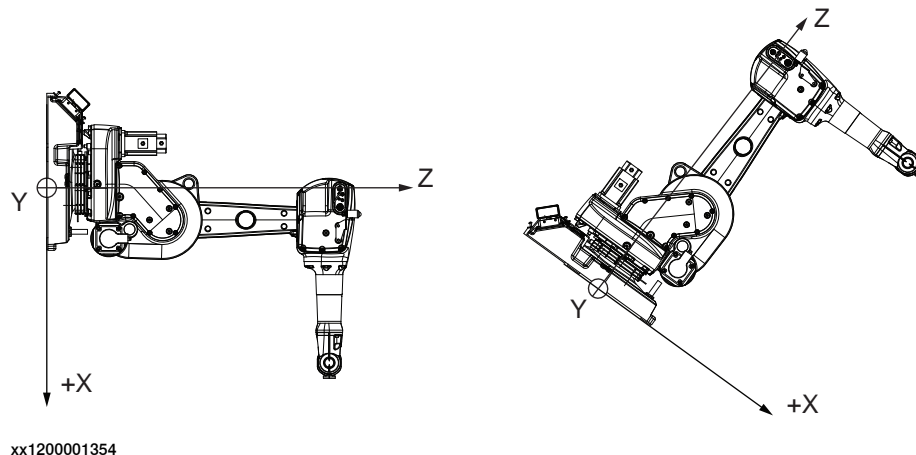
Extra Loads

Extra load, which is included in the load diagrams, can be mounted on the upper arm. An extra load of 15 kg can also be mounted on the frame of axis 1. See *Holes for mounting of extra equipment for IRB 1600 on page 45*.

Working Range

The working range of axes 1-3 of IRB 1600-X/1.2 (1.45) and axes 1-2 of 1660ID can be limited by mechanical stops. Electronic Position Switches can be used on all axes for position indication of the manipulator.

1.3.2 Operating requirements

Protection standards

Robot version	Protection Standard IEC60529
Standard manipulator	IP54
Protection Foundry Plus 2	IP67
IRB 1660ID-X/1.55	IP67 (Axis 4: IP40)

Explosive environments

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

Ambient temperature

Description	Standard/Option	Temperature
Manipulator during operation	Standard	+ 5°C [i] (+ 41°F) to + 45°C (+ 113°F)
For the controller	Standard/Option	See *Product specification - Controller IRC5 with FlexPendant*
Complete robot (incl. controller) 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. 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

General

Maximum load in relation to the base coordinate system. See the following figure.

Floor Mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 1850 N	± 3900 N
Force z	2700 ± 1150 N	2700 ± 2200 N
Torque xy	± 1750 Nm	± 4000 Nm
Torque z	± 855 Nm	± 1500 Nm

Wall Mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 3900 N	± 5300 N
Force z	± 1400 N	± 2800 N
Torque xy	± 2310 Nm	± 3850 Nm
Torque z	± 855 Nm	± 1550 Nm

Suspended

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 1850 N	± 3900 N
Force z	- 2700 ± 1150 N	- 2700 ± 2200 N
Torque xy	± 1750 Nm	± 4000 Nm
Torque z	± 855 Nm	± 1500 Nm

Tilted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 2900 N	± 6000 N
Force z	+ 2100 ± 1700 N	+ 2100 ± 3000 N
Torque xy	± 1700 Nm	± 4300 Nm
Torque z	± 855 Nm	± 1550 Nm

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

Torque$_{xy}$ (M$_{xy}$)

Force$_z$ (F$_z$)

Force$_{xy}$ (F$_{xy}$)

Y

Torque$_z$ (M$_z$)

X

xx1000000894
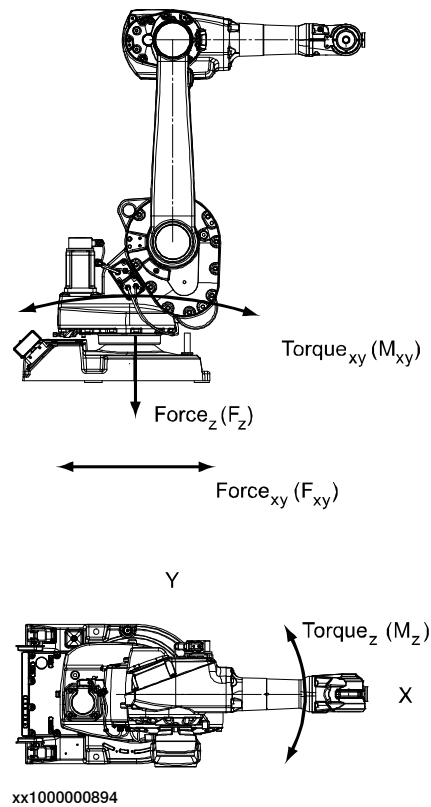
Note regarding M$_{xy}$ and F$_{xy}$

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$_{xy}$).

1 Description

Fastening holes on the robot base
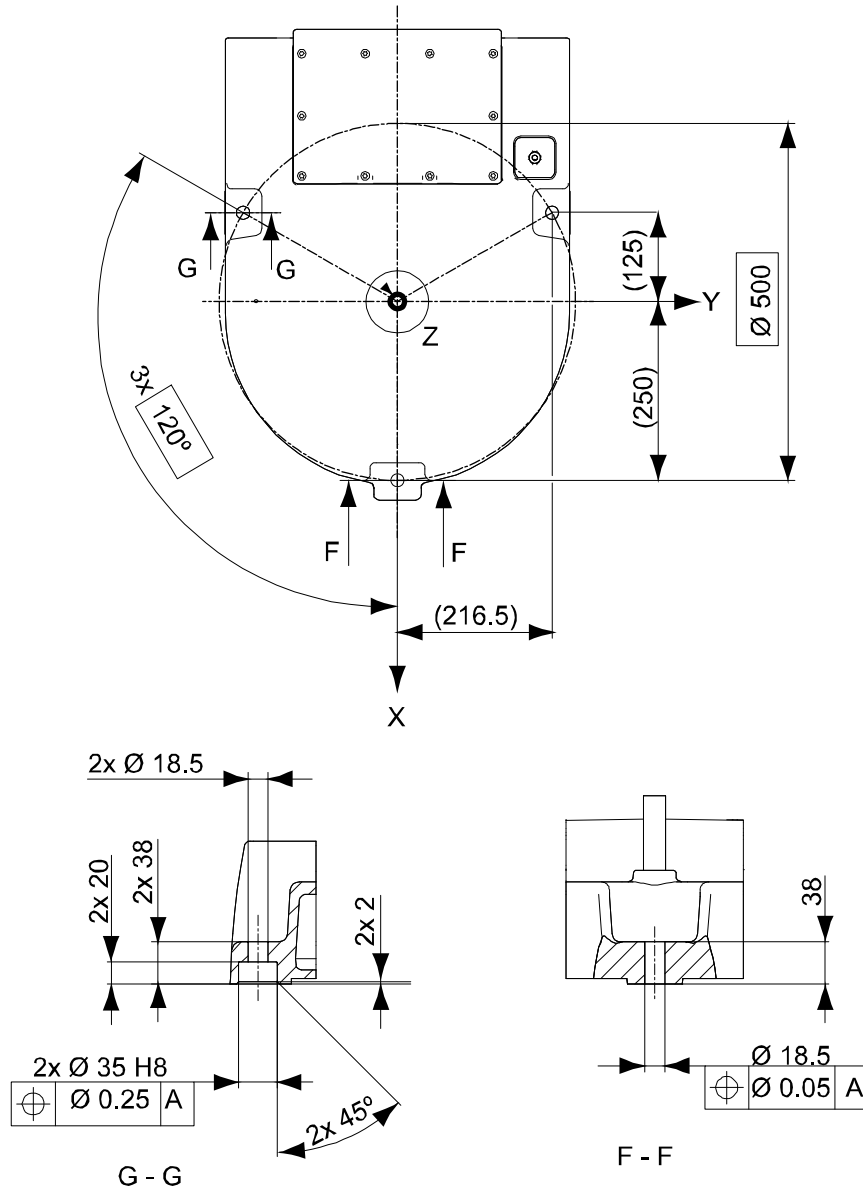
xx1000000895

Attachment bolts, specification

The table below specifies required bolts and washers for securing the robot at installation site.

Specification	Description
Attachment bolts, 3 pcs	M16 x 60 (installation directly on foundation)
	M16 x 70/80 (installation on foundation or base plate, using guiding sleeves)
Washers, 3 pcs	17 x 30 x 3
Quality	Quality 8.8, wall mounted quality 12.9
Tightening torque	200 Nm

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

> **ℹ Note**
>
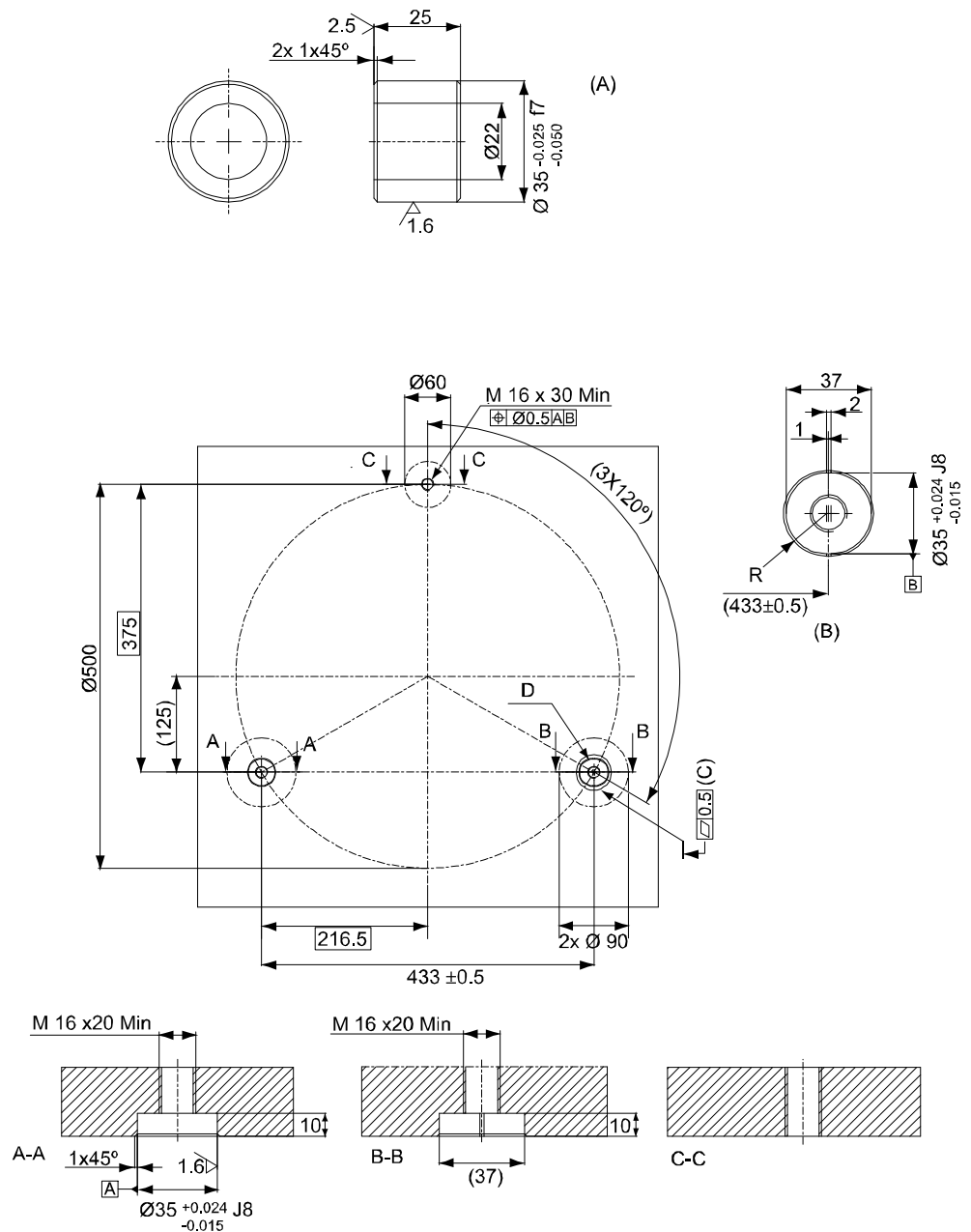> For wall mounted robots, two guide bushings according to the following figure are needed.

> **ℹ Note**
>
> Regarding Abs.Acc. performance, the chosen guide holes according to Figure in the beginning of this chapter are recommended.

Mounting surface and bushings

xx1000000896

1.3.3 Mounting the manipulator
Continued

Position	Description
A	Surface treatment, ISO 2081 Fe/Zn 8 c2, Guide bushing
B	View D
C	3x common zone

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.

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

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.

The original calibration data delivered with the robot is generated when the robot is floor mounted. If the robot is not floor mounted, then the robot accuracy could be affected. The robot needs to be calibrated after it is mounted.

More information is available in the product manual.

Types of calibration

Type of calibration	Description	Calibration method
Standard calibration	The calibrated robot is positioned at calibration position. Standard calibration data is found on the SMB (serial measurement board) or EIB in the robot. 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.	Axis Calibration or Calibration Pendulum [i]
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. 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 (IRC5). 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

Continues on next page

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, 5 and 6.	Wrist Optimization

i   The robot is calibrated by either Calibration Pendulum or Axis Calibration at factory. Always use the same calibration method as used at the factory.

Information about valid calibration method is found on the calibration label or in the calibration menu on the FlexPendant.

If no data is found related to standard calibration, contact the local ABB Service.

Brief description of calibration methods

Calibration Pendulum method

Calibration Pendulum is a standard calibration method for calibration of many of 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.

Axis Calibration method

Axis Calibration is a standard calibration method for calibration of IRB 1600/1660ID. It is the recommended method in order to achieve proper performance.

The following routines are available for the Axis Calibration method:

- Fine calibration
- Update revolution counters
- Reference calibration

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

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

Wrist Optimization method

Wrist Optimization is a method for improving reorientation accuracy for continuous processes like welding and gluing and is a complement to the standard calibration method.

The actual instructions of how to perform the wrist optimization procedure is given on the FlexPendant.

CalibWare - Absolute Accuracy calibration

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

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

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.
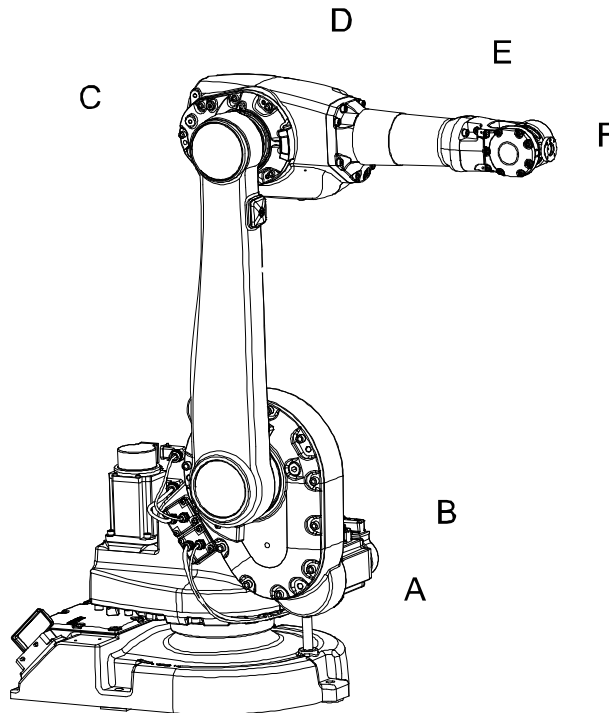
1.4.2 Fine calibration with Calibration Pendulum

General

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

xx1000000891

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.

i	**Note**

The performance data is applicable to the corresponding RobotWare version of the individual robot.

What is included

Every *Absolute Accuracy* robot is delivered with:

- compensation parameters saved in the robot memory
- a birth certificate representing the *Absolute Accuracy* measurement protocol for the calibration and verification sequence.

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

Absolute Accuracy supports floor mounted, wall mounted, and ceiling mounted installations. The compensation parameters that are saved in the robot memory differ depending on which Absolute Accuracy option is selected.

When is *Absolute Accuracy* being used

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

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

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

1.4.3 Absolute Accuracy calibration
Continued

- Linear jogging
- Tool definition (4, 5, 6 point tool definition, room fixed TCP, stationary tool)
- Work object definition

Absolute Accuracy not active

The following are examples of when Absolute Accuracy is not active:

- Any motion function based on a jointtarget (`MoveAbsJ`)
- Independent joint
- Joint based jogging
- Additional axes
- Track motion

> **Note**
>
> In a robot system with, for example, an additional axis or track motion, the Absolute Accuracy is active for the manipulator but not for the additional axis or track motion.

RAPID instructions

There are no RAPID instructions included in this option.

Production data

Typical production data regarding calibration are:

Robot	Positioning accuracy (mm)		
	Average	Max	% Within 1 mm
IRB 1600-6/1.2 0.30 0.65 -6/1.45 -10/1.2 -10/1.45	0.30	0.65	100
IRB 1660ID-6/1.55 -4/1.55	0.30	0.55	100

1.5 Robot load and load diagrams

1.5.1 Introduction

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 - IRC5 with FlexPendant*, 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 pay load inertia, J_0 of 0.012 kgm^2, and an extra load of 15 kg for the IRB 1600-6/x variants, 5 kg for the IRB 1600-10/x variants, 10 kg for IRB 1660ID-6/1.55, 12 kg for IRB 1660ID-4/1.55, 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

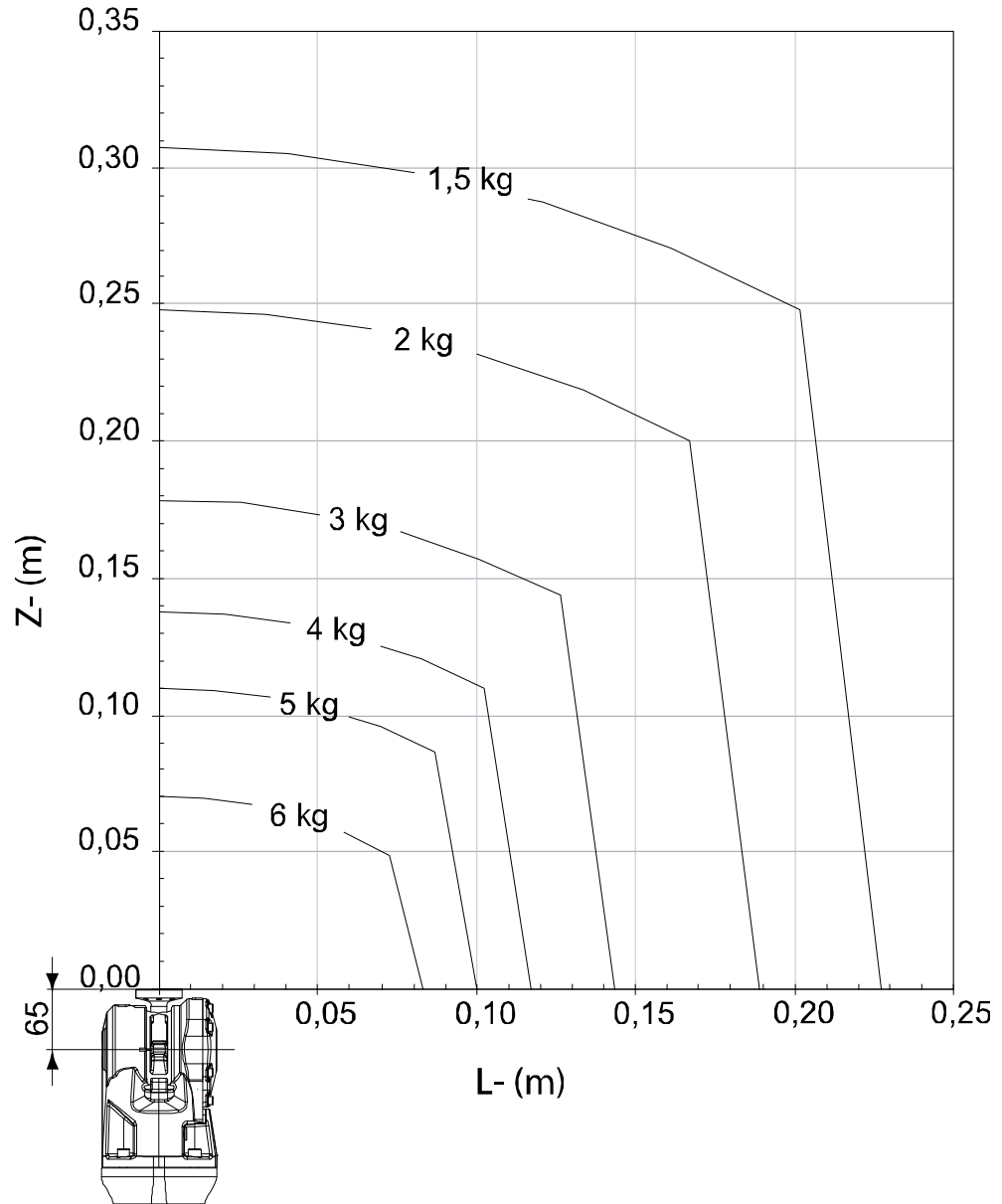To verify a specific load case, use the RobotStudio add-in RobotLoad.

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 1600-6/1.2, IRB 1600-6/1.45

xx1000000899

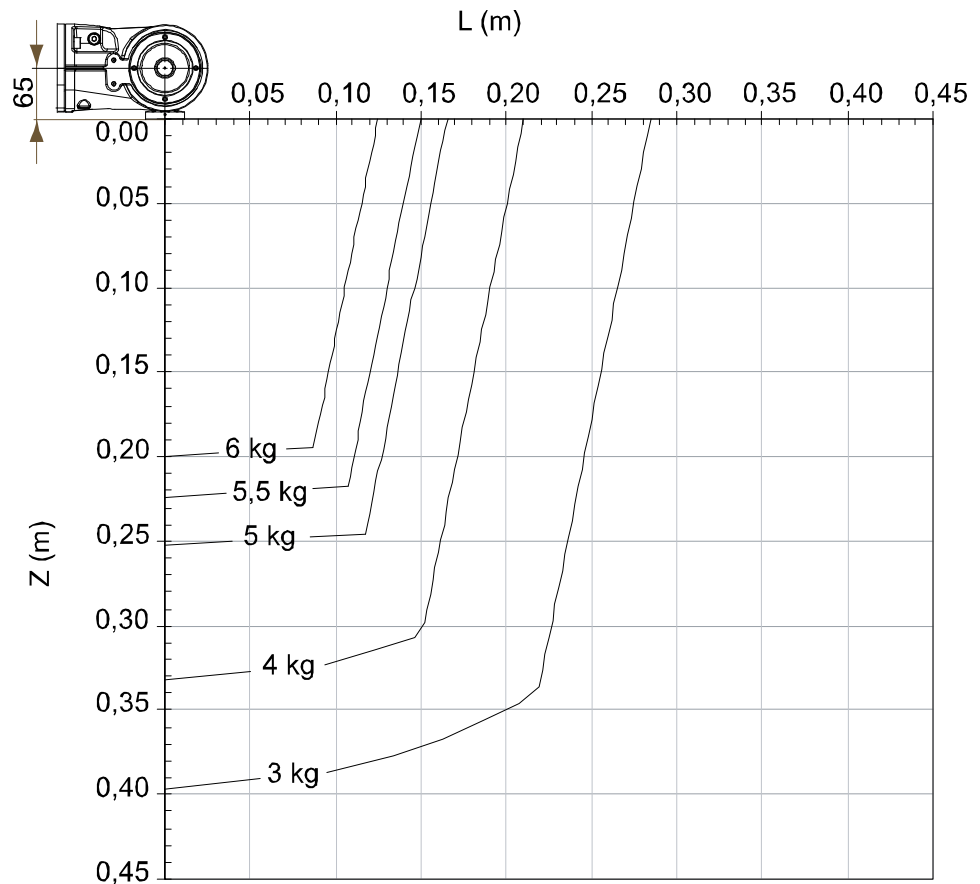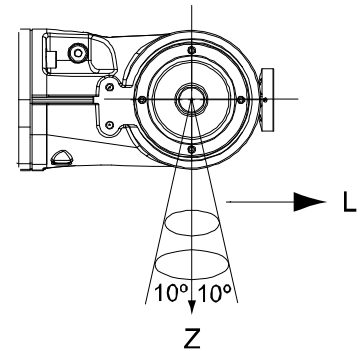**Extra load of 15 kg at the upper arm housing included in the load diagram.**

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

IRB 1600-6/1.2, IRB 1600-6/1.45 "Vertical Wrist" (±10º)

xx1000000901

Extra load of 15 kg at the upper arm housing included in the load diagram.

Description	Values
For wrist down (0° deviation from the vertical line) and no arm loads.	Max load = 13 kg Z_{Max} = 0.057 m L_{Max} = 0.031 m

1 Description

IRB 1600-10/1.2, IRB 1600-10/1.45

xx1200001333

Extra load of 5 kg at the upper arm housing included in the load diagram.

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

IRB 1600-10/1.2, IRB 1600-10/1.45 "Vertical Wrist" (±10º)
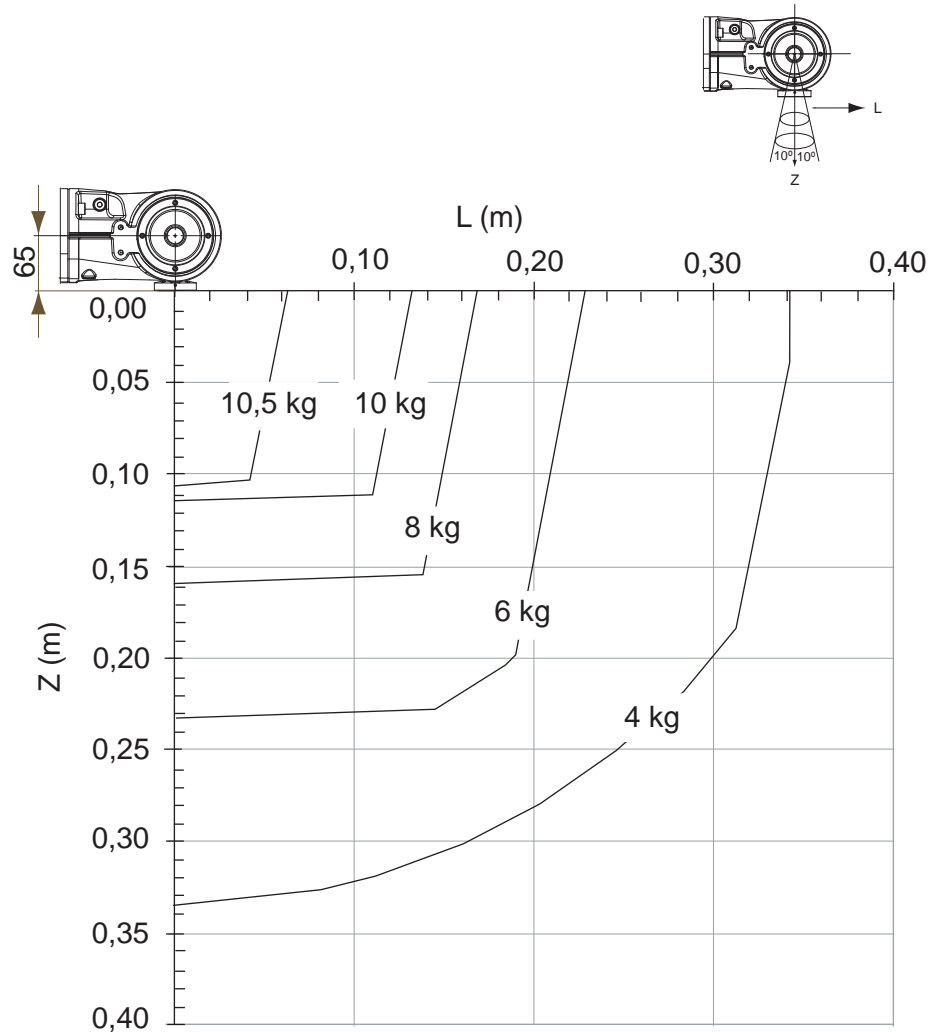
xx1200001334

Extra load of 5 kg at the upper arm housing included in the load diagram.

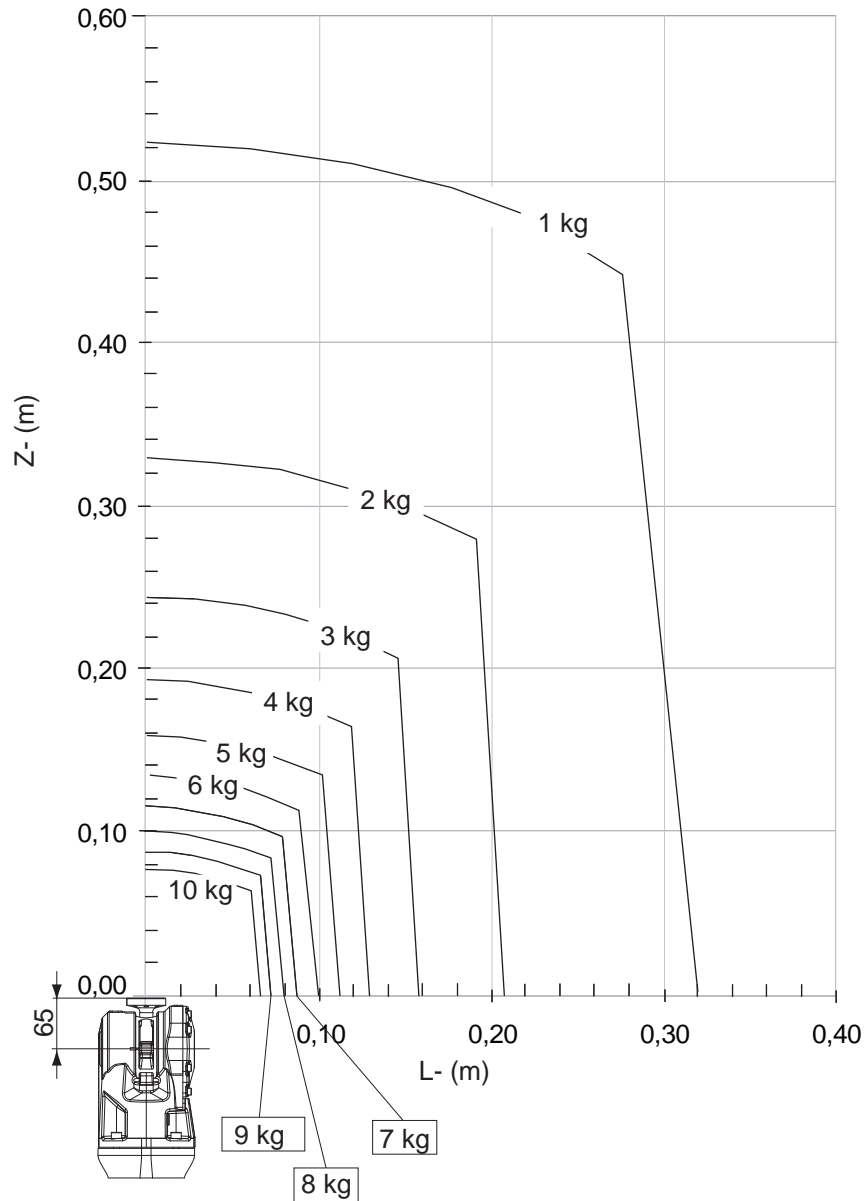| Description	Values
For wrist down (0° deviation from the vertical line) and no arm loads.	Max load = 12 kg ZMax = 0.055 m LMax = 0.017 m

1 Description
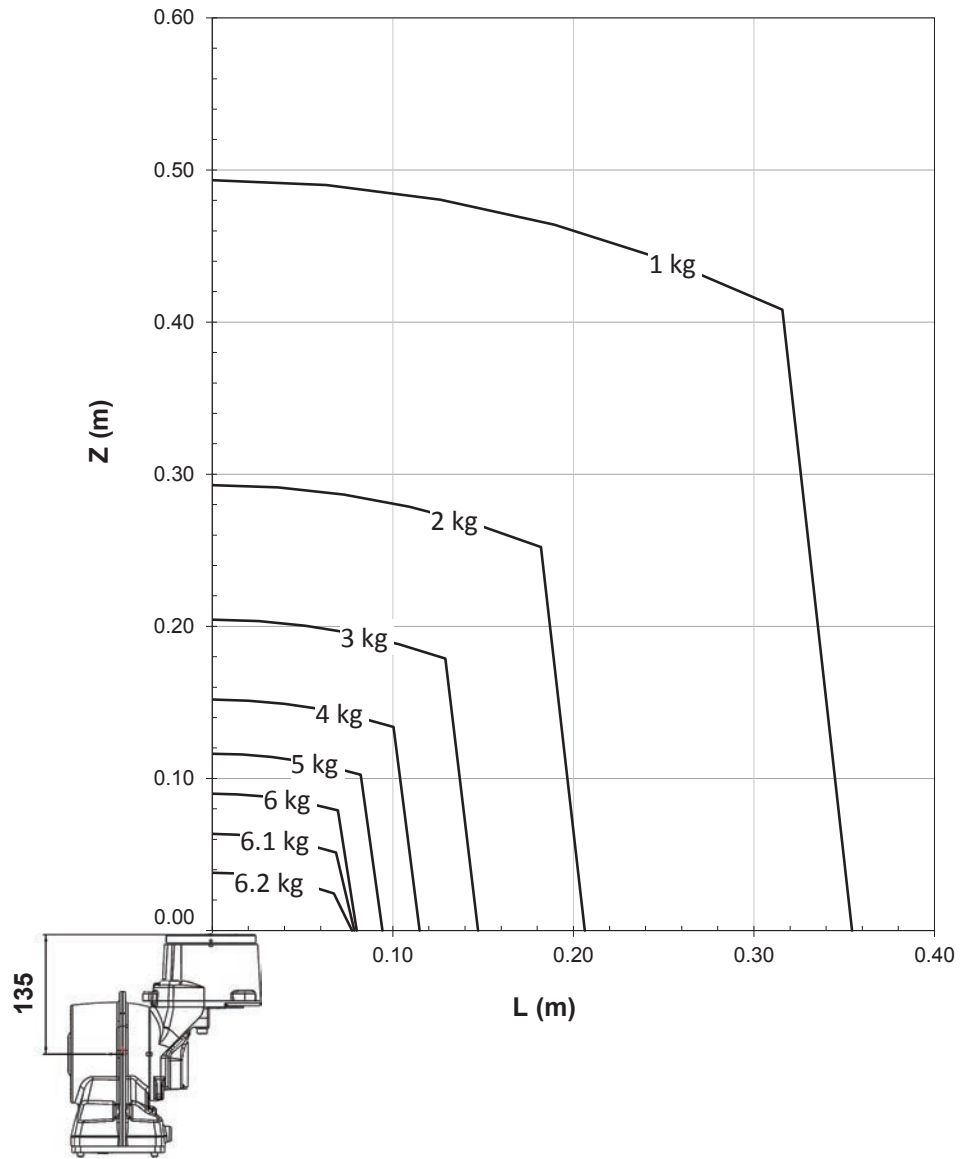
IRB 1660ID-6/1.55

xx1500003069

Extra load of 10 kg at the upper arm housing included in the load diagram.

IRB 1660ID-6/1.55 "Vertical Wrist" (±10º)
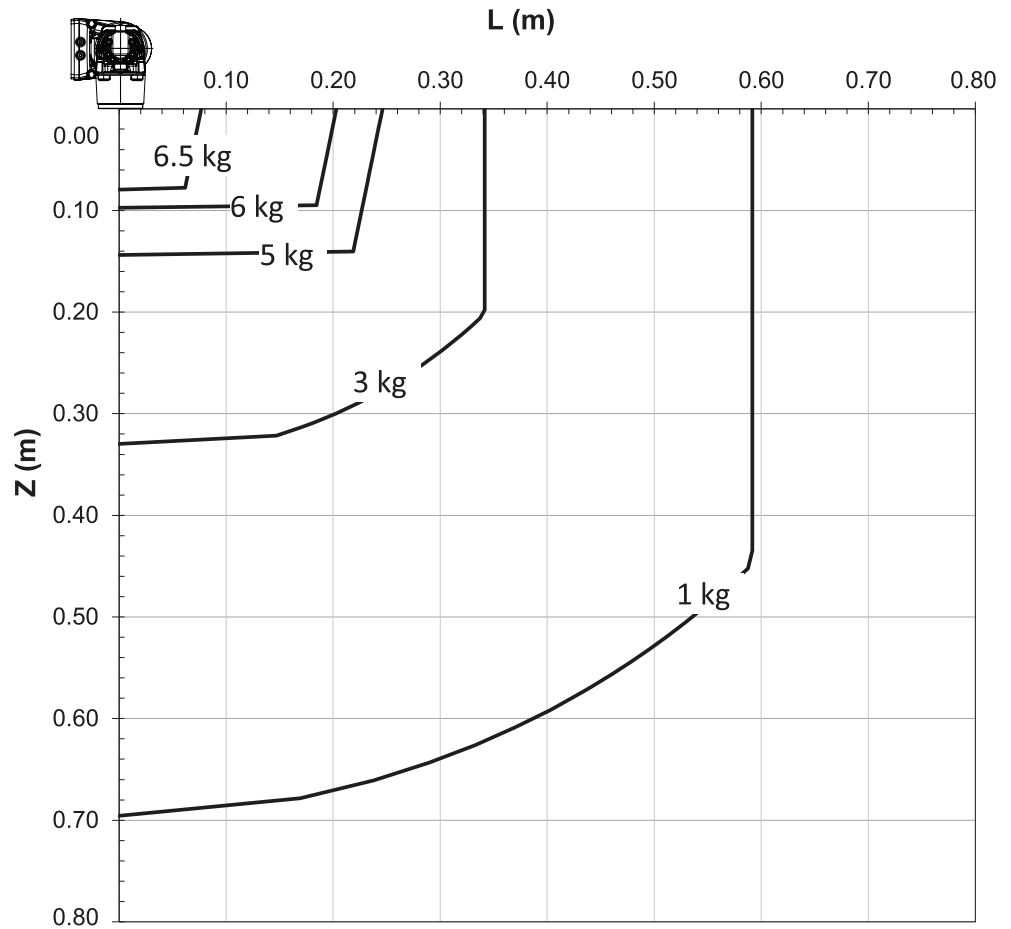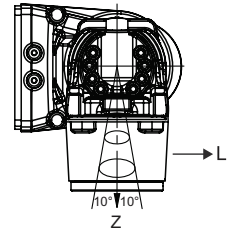
xx1500003070

Extra load of 10 kg at the upper arm housing included in the load diagram.

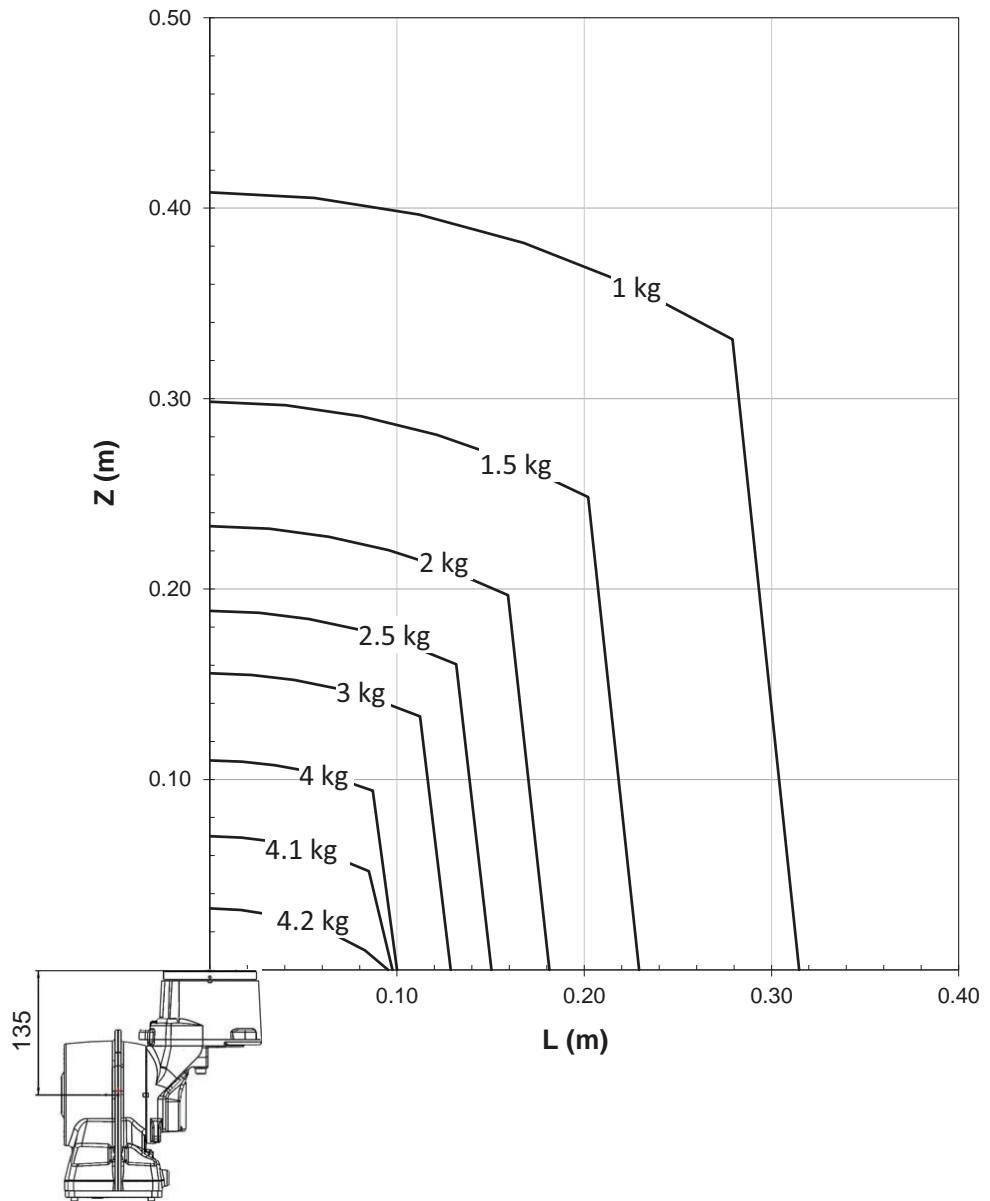| Description	Values
For wrist down (0° deviation from the vertical line) and no arm loads.	Max load = 7 kg Z_{Max} = 0.064 m L_{Max} = 0.100 m

IRB 1660ID-4/1.55

xx1600001188

Extra load of 12 kg at the upper arm housing included in the load diagram.

1.5.3 Maximum load and moment of inertia for full and limited axis 5 (center line down) movement

General

Total load given as: Mass in kg, center of gravity (Z and L) in m and moment of inertia (J_{ox}, J_{oy}, J_{ox}) in kgm^2. L= $\div(X^2 + Y^2)$, see Figure below.

Full movement of Axis 5 (±115º)

Axis	Robot Type	Max. value
5	IRB 1600-6/x	J5 = Mass x $((Z + 0.065)^2 + L^2)$ + max $(J_{ox}, J_{oy}) \leq 0.42$ kgm^2
6	IRB 1600-6/x	J6= Mass x L^2 + $J_{0Z} \leq 0.30$ kgm^2

Axis	Robot Type	Max. value
5	IRB 1600-10/x	J5 = Mass x $((Z + 0.065)^2 + L^2)$ + max $(J_{ox}, J_{oy}) \leq 0.6$ kgm^2
6	IRB 1600-10/x	J6= Mass x L^2 + $J_{0Z} \leq 0.4$ kgm^2

Full movement of Axis 5 (+120º to -120º)

Axis	Robot Type	Max. value
5	IRB 1660ID-6/1.55	J5 = Mass x $((Z + 0.135^2 + L^2)$ + max $(J_{ox}, J_{oy}) \leq 0.70$ kgm^2
6	IRB 1660ID-6/1.55	J6= Mass x L^2 + $J_{oz} \leq 0.36$ kgm^2

Axis	Robot Type	Max. value
5	IRB 1660ID-4/1.55	J5 = Mass x $((Z + 0.135^2 + L^2)$ + max $(J_{ox}, J_{oy}) \leq 0.60$ kgm^2
6	IRB 1660ID-4/1.55	J6= Mass x L^2 + $J_{oz} \leq 0.24$ kgm^2
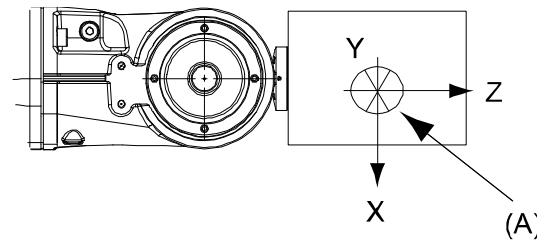
xx1000000903

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.

Limited axis 5, Center line down

Axis	Robot Type	Max. value
5	IRB 1600-6/x	J_5 = Mass x $((Z + 0.065)^2 + L^2)$ + max $(J_{ox}, Joy) \leq 0.55$ kgm^2
5	IRB 1600-10/x	J_5 = Mass x $((Z + 0.065)^2 + L^2)$ + max $(J_{ox}, Joy) \leq 0.65$ kgm^2

Continues on next page

1.5.3 Maximum load and moment of inertia for full and limited axis 5 (center line down) movement
Continued

Axis	Robot Type	Max. value
5	IRB 1660ID-6/1.55	$J_5 = \text{Mass} \times ((Z + 0.135)^2 + L^2) + \max(J_{ox}, J_{oy}) \leq 0.70 \text{ kgm}^2$
6	IRB 1600-6/x	$J_6 = \text{Mass} \times L^2 + J_{0Z} \leq 0.40 \text{ kgm}^2$
6	IRB 1600-10/x	$J_6 = \text{Mass} \times L^2 + J_{0Z} \leq 0.48 \text{ kgm}^2$
6	IRB 1660ID-6/1.55	$J_6 = \text{Mass} \times L^2 + J_{0Z} \leq 0.36 \text{ kgm}^2$
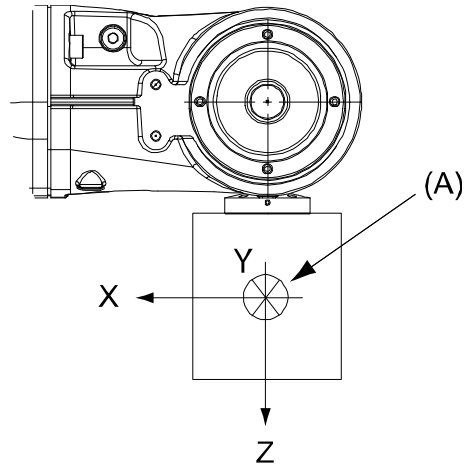
xx1000000904

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 Wrist torque

General

The table below shows the maximum permissible torque due to payload.

> **ℹ 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 1600-6/1.2(1.45)	8.58 Nm	4.91 Nm	5 kg
IRB 1600-10/1.2(1.45)	13.93 Nm	6.47 Nm	10 kg
IRB 1660ID-6/1.55	13.24 Nm	4.71 Nm	6 kg
IRB 1660ID-4/1.55	9.61 Nm	3.92 Nm	4 kg

1.5.5 Mounting of equipment

Load areas

Extra loads can be mounted on the wrist, the upper arm housing, and on the frame. Load areas and permitted loads are shown in graphic below. The center of gravity of the extra load shall be within the marked load areas.
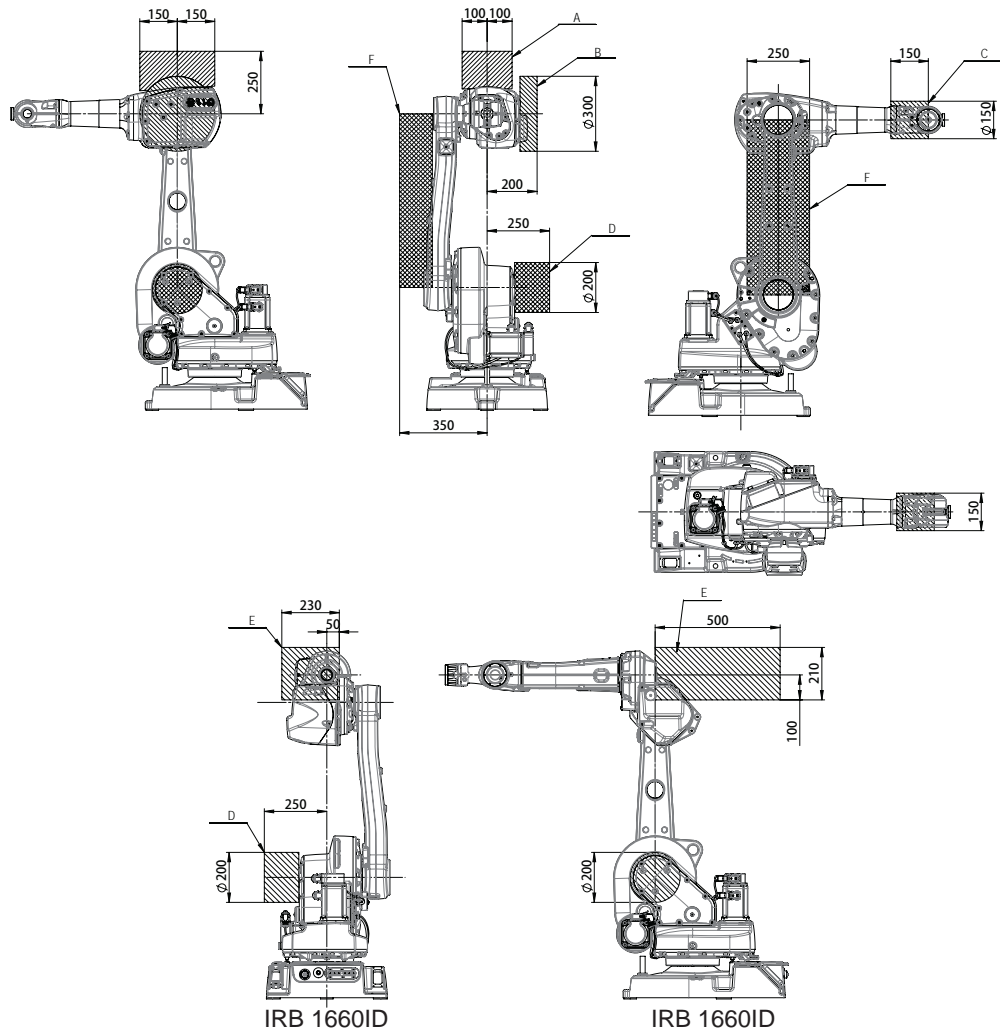
xx1500001249

Robot	Maximum load in load area							
	A	**B**	**C**	**D**	**E**	**F**	**A+B+F**	**E+F**
IRB 1600-6/X	15 kg	5 kg	0.5 kg	15 kg	-	15 kg	15 kg	-
IRB 1600-10/X	5 kg	5 kg	0.5 kg	15 kg	-	5 kg	5 kg	-
IRB 1660ID-6/1.55	-	-	-	15 kg	10 kg	15 kg	-	15 kg
IRB 1660ID-4/1.55	-	-	-	15 kg	12 kg	15 kg	-	15 kg

Continues on next page

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

Holes for mounting of extra equipment for IRB 1600

The robot has holes for mounting extra equipment.
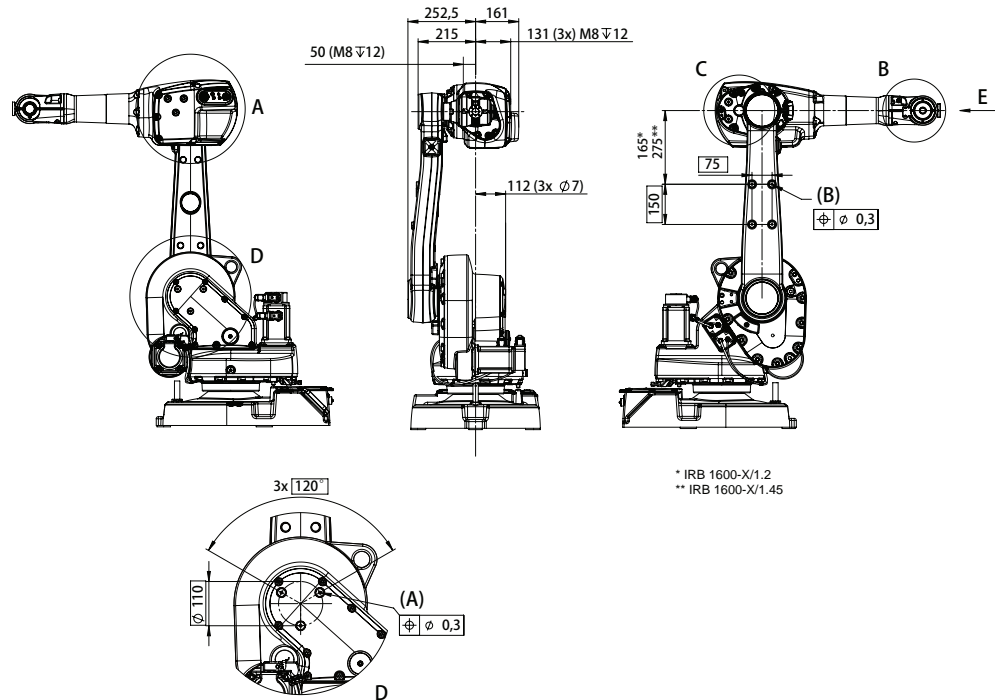
xx1500003258

A	3xΦ7 maximum depth 27, mounting holes for equipment
B	4xM8 depth 12, mounting holes for equipment
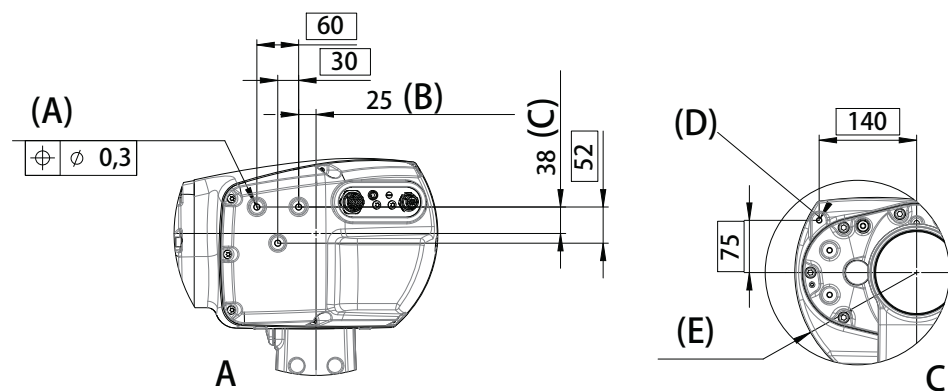
xx1500003262

A	3xM8 depth 12, mounting holes for equipment
B	From center line axis 3
C	From center line axis 4
D	3xM8 depth 16, mounting holes for equipment
E	R175, Axis 3 turning radius

1 Description

1.5.5 Mounting of equipment
Continued

> **ℹ️ Note**
>
> Note! When mounting heavier equipment, for example wire feeders in holes (A), the bracket must be supported in the opposite holes (D).

Design until June 2006
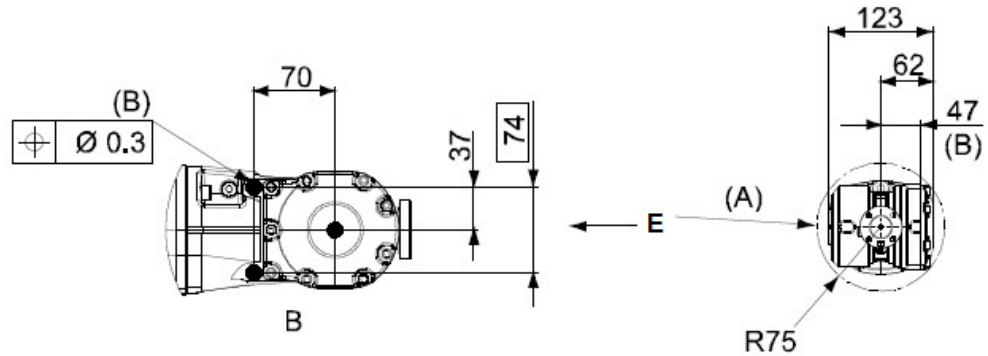
xx1500003259

A	View from E
B	2xM5 depth 7.5, mounting holes for equipment

Design after June 2006, type A
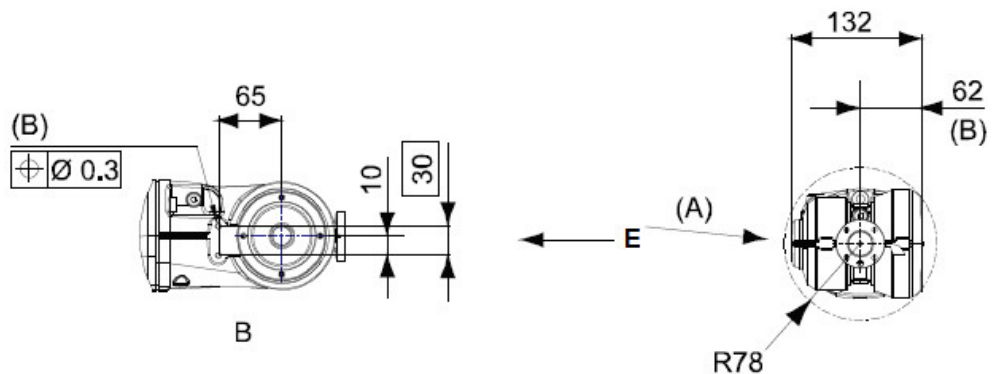
xx1500003260

A	View from E
B	2xM6 depth 10, mounting holes for equipment

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

Holes for mounting of extra equipment for IRB 1660ID

IRB 1660ID-X/1.55
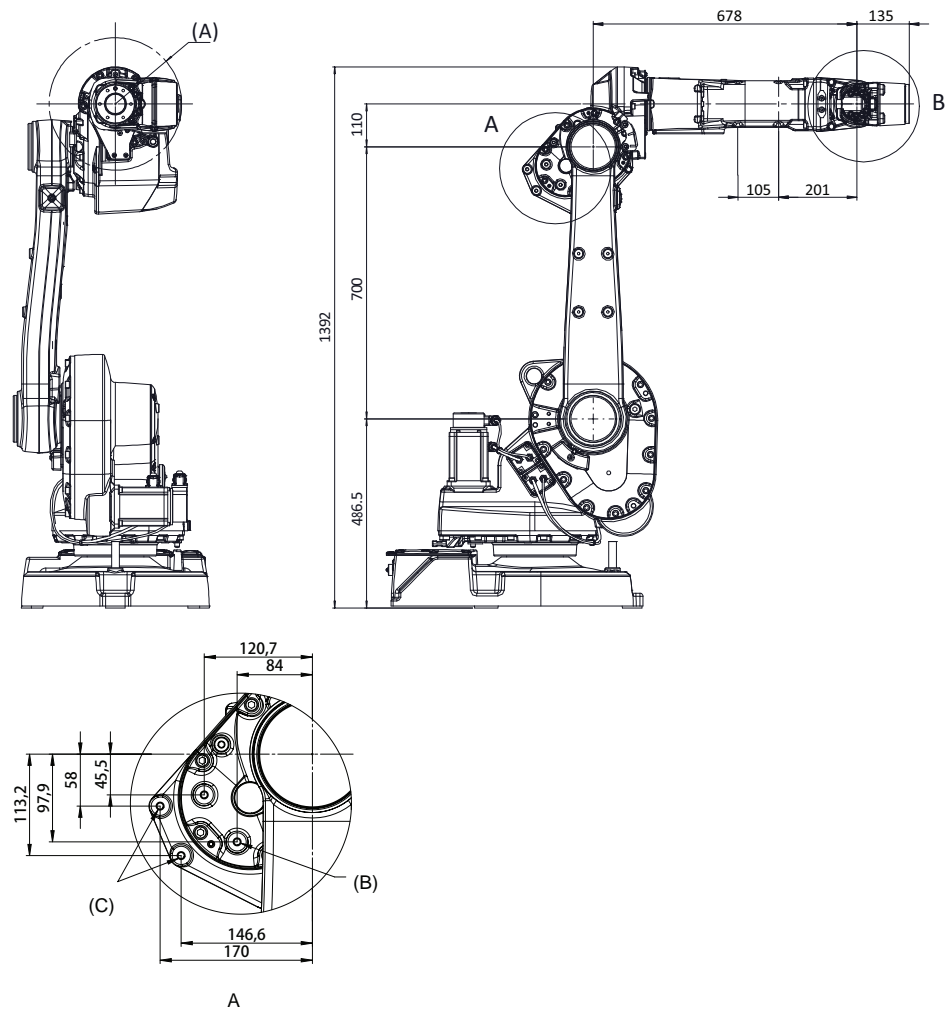
xx1500001253

A	R170.4, smallest circumscribed radius of axis 4
B	2xM8 depth 16, mounting holes for equipment
C	2xM8, mounting holes for equipment

xx1500001251

A	2xM6 depth 12, mounting holes for equipment
B	2xM6 depth 18, mounting holes for equipment

> ℹ️ **Note**
>
> Lower arms among IRB 1600and IRB 1660ID are the same. For holes on the lower arm, see *Holes for mounting of extra equipment for IRB 1600 on page 45*.

Robot tool flange for IRB 1600

xx1000000912

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR
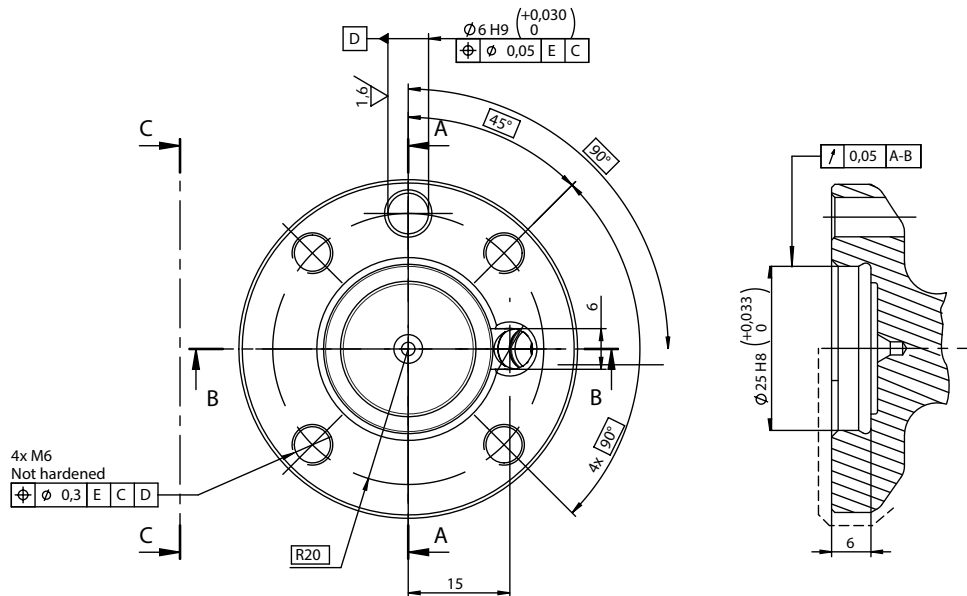
Robot tool flange for IRB 1660ID

IRB 1660ID-X/1.55
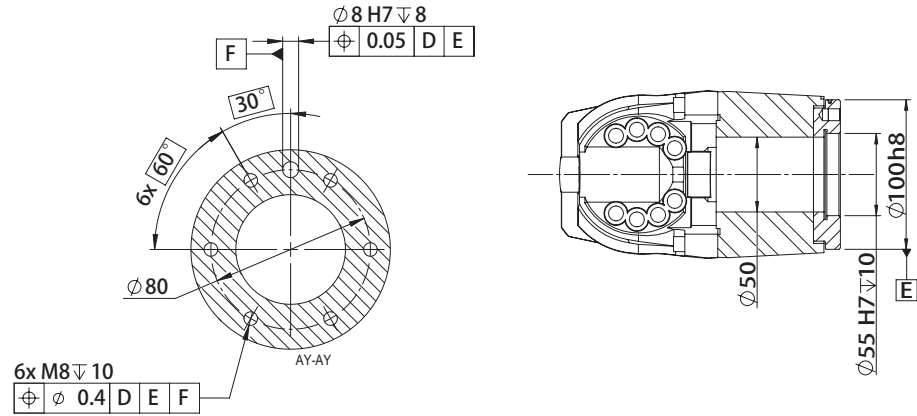
xx1500001254

1.5.6 Maximum TCP acceleration

General

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

Maximum Cartesian design acceleration for nominal loads

Robot type	E-stop Max acceleration at nominal load COG [m/s^2]	Controlled Motion Max acceleration at nominal load COG [m/s^2]
IRB 1600 - 6/1.xx	120	45

> **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 Robot motion

1.6.1 Working range

Range of movement - IRB 1600

Axis	Type of motion	Range of movement 1.2 m reach	Range of movement 1.45 m reach
1	Rotation motion	+180° to -180° [i]	+180° to -180° [i]
2	Arm motion	+110° to -63° +136° to -63° (with axis 1 limited to ±100°)	+120° to -90° +150° to -90° (with axis 1 limited to ±95°)
3	Arm motion	+55° to -235°	+65° to -245°
4	Rotation motion	+200° to -200° default +190 rev. [ii] to -190 rev. maximum [iii]	+200° to -200° default +190 rev. [ii] to -190 rev. maximum [iii]
5	Bend motion	+115° to -115°	+115° to -115°
6	Turn motion	+400° to -400° default +288 rev. [ii] to -288 rev. maximum [iii]	+400° to -400° default +288 rev. [ii] to -288 rev. maximum [iii]

[i]   The working range of axis 1 has the following limitations for wall mounted robots:
- IRB 1600-6/x: ± 20°
- IRB 1600-10/x: ± 60°

If the robot is tilted, the following combinations of tilt angles and axis 1 working ranges are allowed:
- IRB 1600-6/x: axis 1 ± 45° with tilt angles up to 30°
- IRB 1600-10/x: axis 1 ± 180° with tilt angles up to 55°

[ii]   rev. = Revolutions

[iii]   The default working range for axis 4 and axis 6 can be extended by changing parameter values in the software.

Option 610-1 "Independent axis" can be used for resetting the revolution counter after the axis has been rotated (no need for "rewinding" the axis).

Range of movement - IRB 1660ID

Axis	Type of motion	Range of movement 1.55 m reach
1	Rotation motion	+180° to -180° [i]
2	Arm motion	+150° to -90°
3	Arm motion	+79° to -238°
4	Rotation motion	+175° to -175°
5	Bend motion	+120° to -120°
6	Turn motion	+400° to -400° +191 rev. [ii] to -191 rev. maximum [iii]

[i]   The working range of axis 1 has the following limitations for wall mounted robots:
- IRB 1660ID-X/1.55: ±45°

If the robot is tilted, the working range with tilt angles is:
- ± 180° with tilt angles up to 45°

[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).

Continues on next page

Positions at wrist center 1.2 m reach
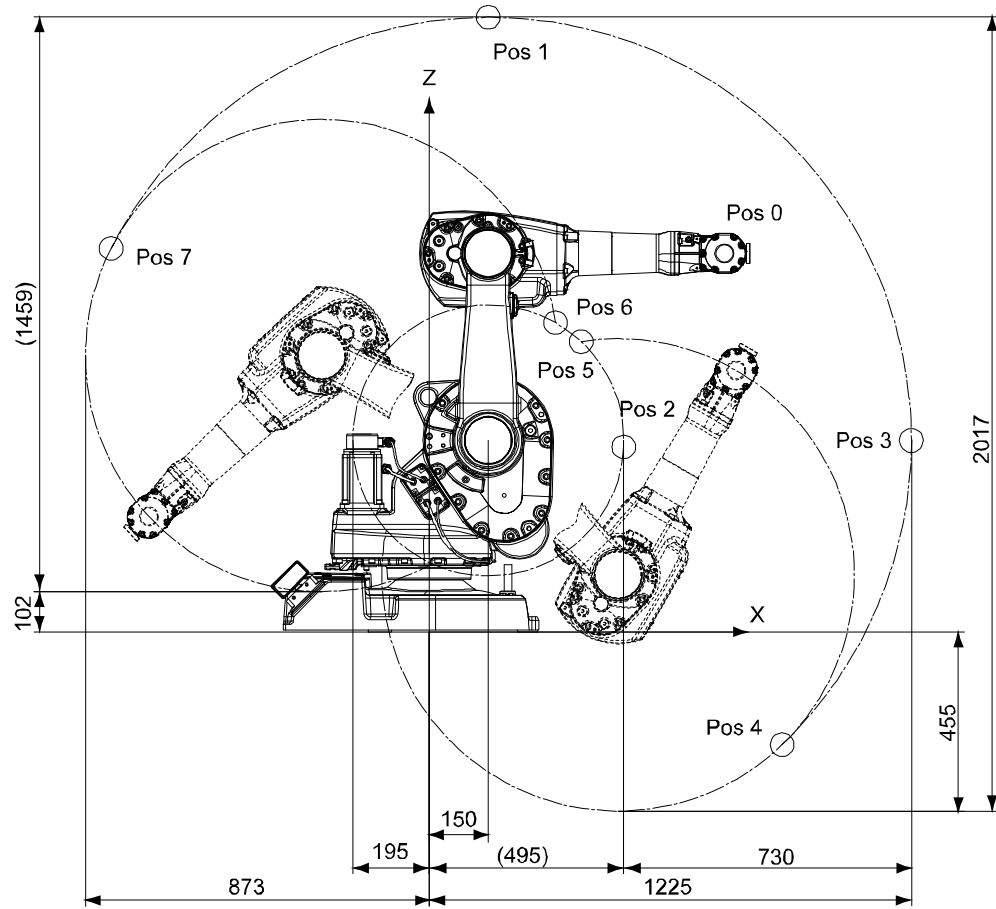
xx1000000914

Position	X (mm)	Z (mm)	Axis 2 angle (degrees)	Axis 3 angle (degrees)
0	750	962	0	0
1	150	1562	0	-90
2	494	470	0	+55
3	1225	487	+90	-90
4	897	-287	+136	-90
5	386	737	+136	-235
6	321	786	-63	+55
7	-808	975	-63	-90

Continues on next page

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

Positions at wrist center 1.45 m reach
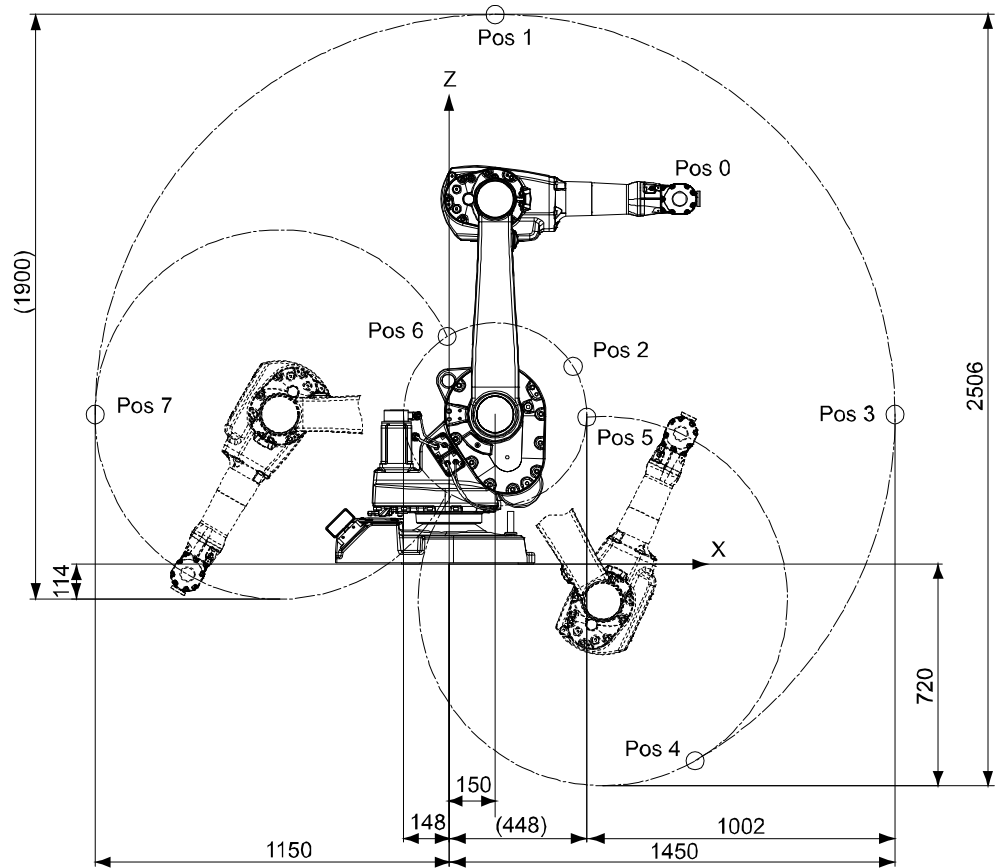
xx1000000915

Position	X (mm)	Z (mm)	Axis 2 angle (degrees)	Axis 3 angle (degrees)
0	750	1187	0	0
1	150	1787	0	-90
2	404	643	0	+65
3	1450	487	+90	-90
4	800	-639	+150	-90
5	448	478	+150	-245
6	-6	740	-90	+65
7	-1150	487	-90	-90

Positions at wrist center IRB 1660ID

IRB 1660ID-X/1.55
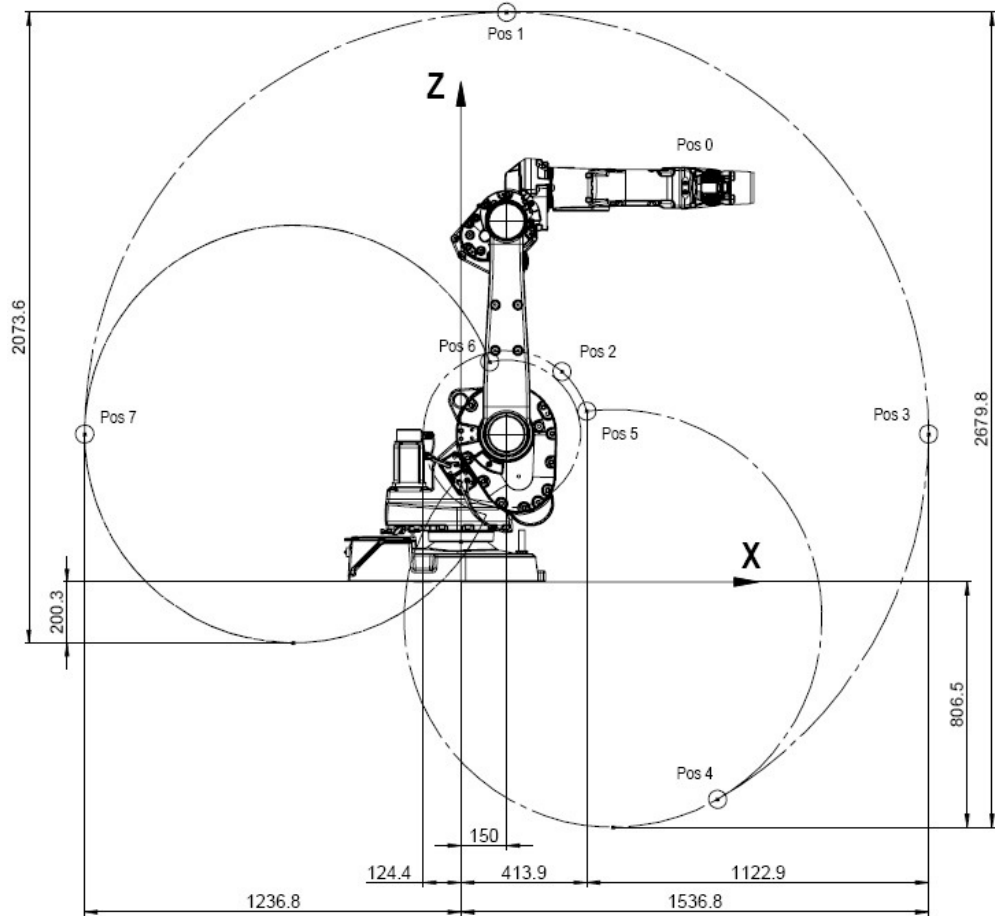
xx1500001246

Position	X (mm)	Z (mm)	Axis 2 angle (de-grees)	Axis 3 angle (de-grees)
0	828	1,296.5	0	0
1	150	1,873.3	0	-81
2	332.2	691.7	0	+79
3	1,536.8	486.5	+90	-81
4	843.4	-714.5	+150	-81
5	413.9	561.7	+150	-238
6	94.6	723.7	-90	+79
7	-1,236.8	486.5	-90	-81

Turning radius

The turning radius for the robot is shown in the figure below. Notice the differences depending on the length of the lower arm.
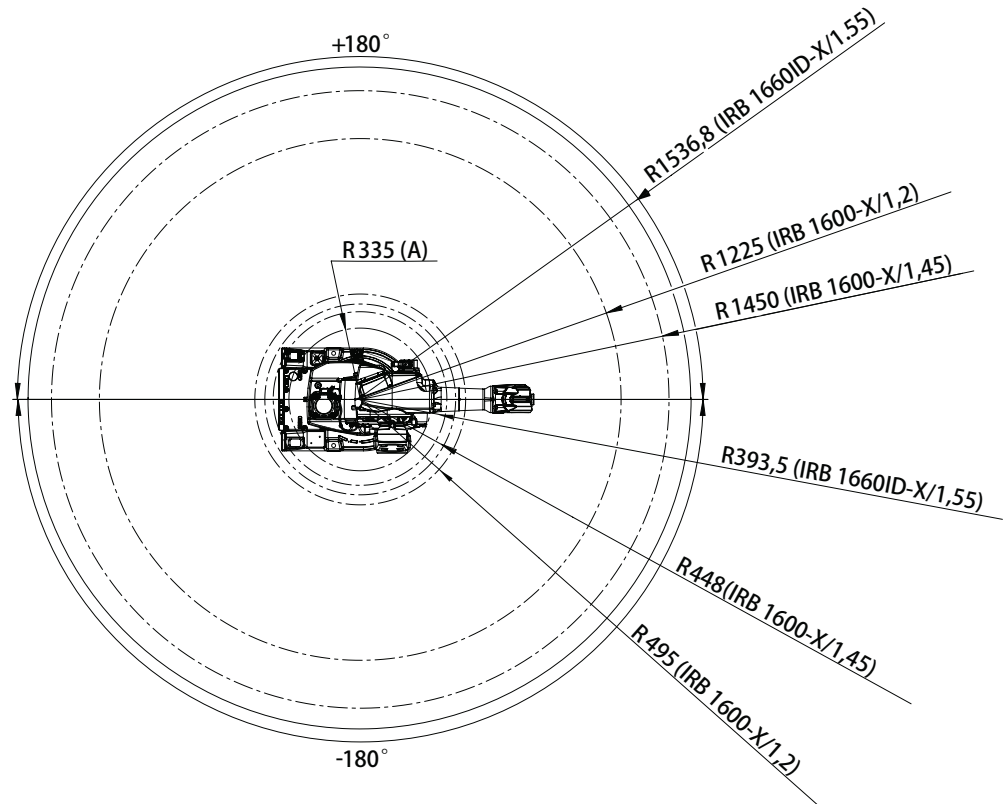
xx1500002817

(A)	Minimum turning radius axis 1 (all models)

1.6.2 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.

xx0800000424

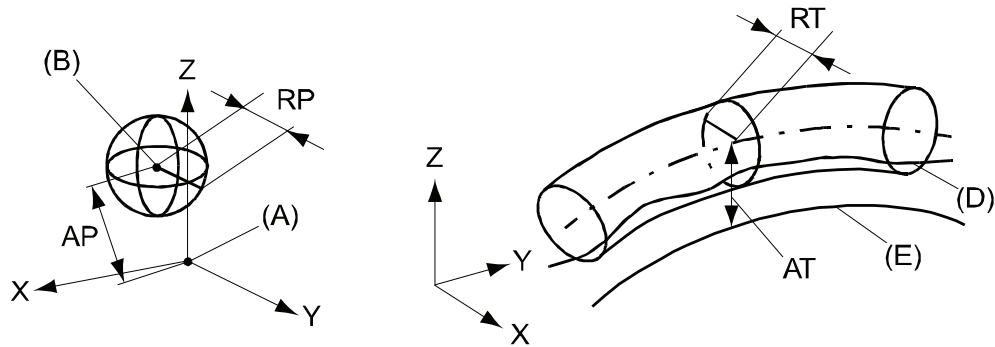| Pos	Description	Pos	Description
A	Programmed position	E	Programmed path
B	Mean position at program execution	D	Actual path at program execution
AP	Mean distance from programmed position	AT	Max deviation from E to average path
RP	Tolerance of position B at repeated positioning	RT	Tolerance of the path at repeated program execution

Description	IRB 1600				IRB 1660ID	
	-6/1.2	-6/1.45	-10/1.2	-10/1.45	-6/1.55	-4/1.55
Pose repeatability, RP (mm)	0.02	0.02	0.02	0.05	0.02	0.02
Pose accuracy, AP[i] (mm)	0.04	0.04	0.01	0.02	0.02	0.03
Linear path repeatability, RT (mm)	0.13	0.19	0.06 [ii]	0.13 [ii]	0.05	0.08
Linear path accuracy, AT (mm)	0.97	1.03	0.20 [ii]	0.26 [ii]	0.25 [ii]	0.23 [ii]
Pose stabilization time, (PSt) to within 0.2 mm of the position (s)	0.11	0.11	0.09	0.09	N/A	N/A

Continues on next page

Description	IRB 1600				IRB 1660ID	
	-6/1.2	-6/1.45	-10/1.2	-10/1.45	-6/1.55	-4/1.55
Pose stabilization time, (PSt) to within 0.1 mm of the position (s)	N/A	N/A	N/A	N/A	0.20	0.13

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.

ii   Measured at a velocity of 250 mm/s.

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

1.6.3 Velocity

3-phase power supply

Axis No.	IRB 1600-6/1.2 IRB 1600-6/1.45	IRB 1600-10/1.2 IRB 1600-10/1.45	IRB 1660ID-6/1.55 IRB 1660ID-4/1.55
1	150°/s	180°/s	180°/s
2	160°/s	180°/s	180°/s
3	170°/s	185°/s	180°/s
4	320°/s	385°/s	320°/s
5	400°/s	400°/s	360°/s
6	460°/s	460°/s	500°/s

1-phase power supply

When the robot uses a single phase power supply, like with Compact controller, the performance regarding max axis speed is reduced, see table below. The reduced top speed can be increased if the power supply minimum voltage is higher than the default setting 187 V (220x0.85). See, "Mains tolerance min", in the Technical reference manual - System Parameters "How to optimize drive system parameters".

Note that the robot acceleration is not affected by the single phase power supply. Thus the cycle time may not be affected at all. To test the cycle RobotStudio can be used. The RobotStudio also allows modification of "Mains tolerance min".

Axis No.	IRB 1600-6/1.2 IRB 1600-6/1.45	IRB 1600-10/1.2 IRB 1600-10/1.45	IRB 1660ID-6/1.55	IRB 1660ID-4/1.55
1	144°/s	144°/s	142°/s	142°/s
2	130°/s	139°/s	141°/s	141°/s
3	153°/s	163°/s	157°/s	157°/s
4	320°/s	376°/s	320°/s	320°/s
5	364°/s	354°/s	329°/s	329°/s
6	460°/s	460°/s	368°/s	371°/s

1.6.4 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*).

1.7 Typical cycle times

General

R12.5

90

400
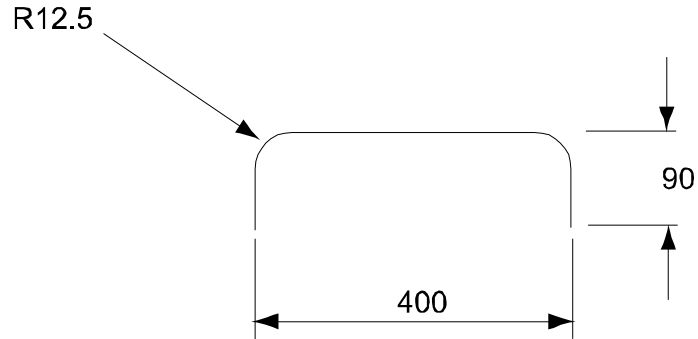
xx1000000917

Approximate cycle times

	IRB 1600-6/x	IRB 1600-10/x
Pay load at wrist down	7 kg	10 kg
Cycle time Packer cycle	0.95 s	1.01 s

1.8 Customer connectors on the robot

General

Customer connections are options, the cables for them are integrated in the robot and the connectors are placed on the upper arm housing.

The customer connections are:

- The standard connections for signals, power and air.
- The integrated wire feed cabling for signals and power.
- The 7-axis connection.

> **ℹ Note**
>
> No customer/application connections are available for IRB 1660ID.

Connections at robot base

The graphics below show the customer connections on the robot base. For description of all connection types see *Connection table on page 62*.
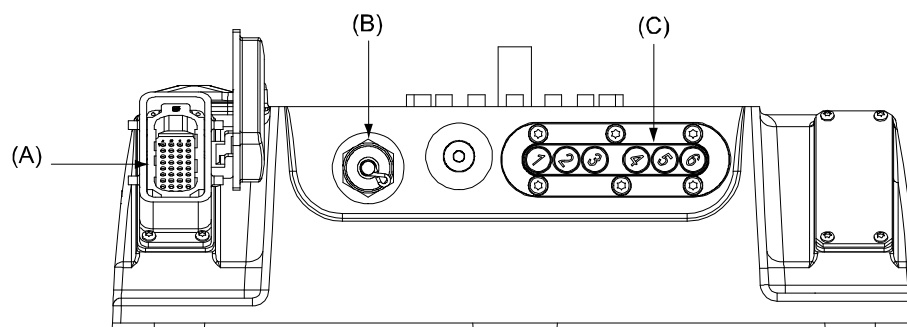
xx1000000918
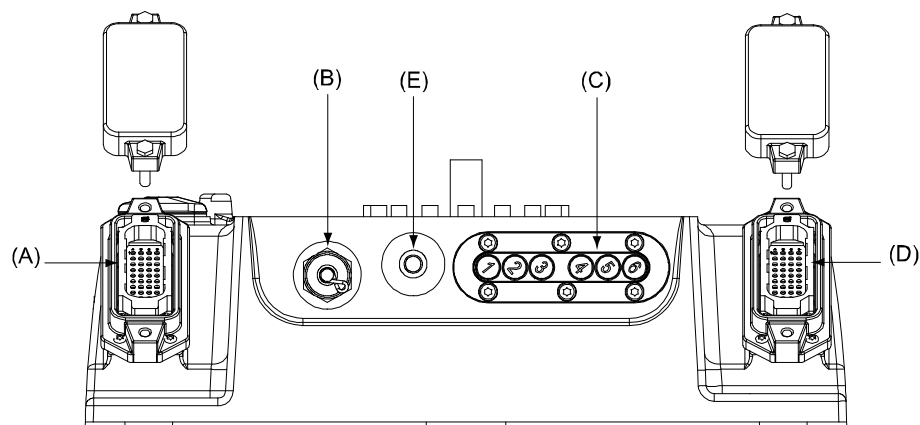
xx1000000919

Continues on next page

xx1000000920

xx1000000921

Connection table

Pos	Connection type	Description
A	R1.MP	Motor power
B	R1.SMB	Serial measurement board signal
C	-	Robot axes brake release buttons
D	R.1 CP/CS	Standard customer power and customer signal
E	R.1Air	Standard air
F	R1.CS	Customer signal for integrated wirefeed interface
G	R1.CP	Customer power for integrated wirefeed interface
H	R1.FB7	Axis 7 connection, 1.5 m cable

Connections on upper arm

No application interface

(C)

(A)

(B)

Standard application interface

(D)

(E)

Integrated wirefeed interface
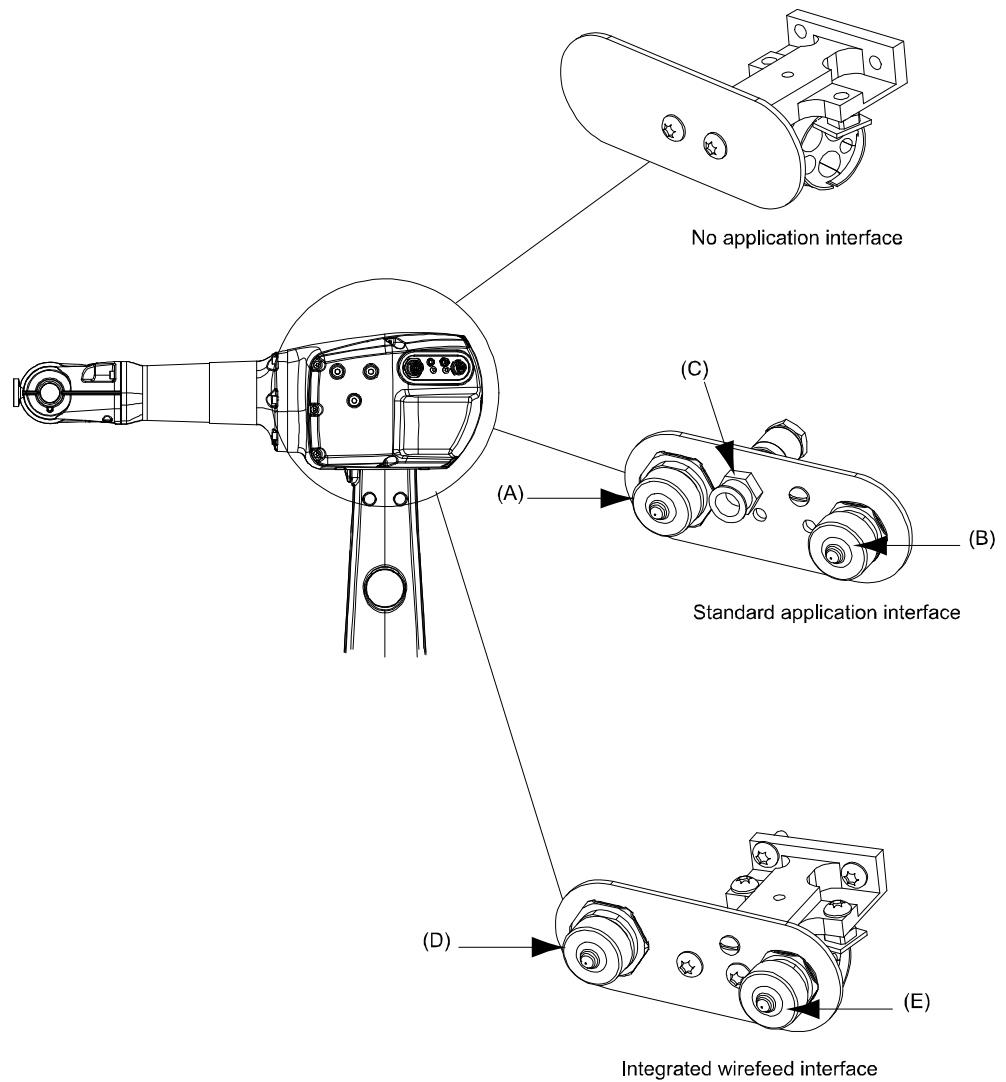
xx1000000922

Pos	Connection type	Description
A	R2.CP	Standard customer power
B	R2.CS	Standard customer signal
C	R2.Air	Standard air
D	R2.CP	Customer power for integrated wirefeed interface
E	R2.CS	Customer signal for integrated wirefeed interface

1.9 Maintenance and trouble shooting

General

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

- Maintenance-free AC motors are used.
- Oil and grease are 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.
- It has a progam memory "battery low" alarm.

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 1600/1660*.

2 Specification of variants and options

2.1 Introduction to variants and options

General

The different variants and options for the IRB 1600/1660ID 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)
435-89	1600	10/1.2
435-90	1600	10/1.45
435-91	1600	6/1.2
435-92	1600	6/1.45
435-133	1660ID	4/1.55
435-134	1660ID	6/1.55

Manipulator color

Option	Color[i]	RAL code[ii]
209-1	ABB orange standard	RAL7032
209-2	ABB white standard	RAL 9003
209-202	ABB Graphite White std Standard color	RAL7035
209-4	Green beige	RAL1000
209-5	Beige	RAL1001
209-6	Sand yellow	RAL1002
209-7	Signal yellow	RAL1003
209-8	Golden yellow	RAL1004
209-9	Honey yellow	RAL1005
209-10	Maize yellow	RAL1006
209-11	Daffodil yellow	RAL1007
209-12	Brown beige	RAL1008
209-13	Lemon yellow	RAL1009

[i] The color of ABB robots is not limited to orange, white or graphite white. Select one of the roughly 200 colors of the RAL CLASSIC scheme. See predefined list of colors with option numbers.

[ii] 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	Name	Description
287-4	Standard	IP 54

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

Option	Name	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 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 case rust attach 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 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/Foundry Plus 2 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 Selected Foundry Plus/Foundry Plus 2 features: The Foundry Plus 2 robot can be cleaned with appropriate washing equipment. Not valid for IRB 1660ID.

Application interface Connected to

Option	Name	Description
16-1	Cabinet[i]	The signals are connected to 12-pole screw terminals, Phoenix MSTB 2.5/12-ST-5.08, to the Control Module. Not together with option 17-6 Integrated wire feed cabling. Not valid for IRB 1660ID.

[i] Note! In a MultiMove application, additional robots have no Control Module. The screw terminal 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.

2 Specification of variants and options

Application interface Connection type

Option	Name	Description	
17-5 [i]	Standard	One Souriau UTOW6 1210 P-H	50 V, 250 mA
		One Souriau UTOW6 1626 P-H	250 V, 2 A
		Signals 23	Max. 8 bar, hose inner diameter 8 mm. R 1/4" at base and upper arm.
		Power 10	
		Air 1	
17-7	No application interface		

[i] Not valid for IRB 1660ID.

Connector kit upper arm

The kit consists of connetor, pins and sockets, fitting connectors in option 17-5.

Option	Name	Description
431-1	Upper arm	Customer Power (CP) and Customer Signals (CS).

Resolver connection, axis 7

A connection for resolver signals axis 7 located on the base.

Option	Description	Remark
864-1	On base	Used together with first additional drive, option 907-1.

Safety lamp

Option	Name	Description
213-1	Safety lamp	It has an orange fixed light, is active in MOTORS ON mode and is std. on an UL/UR approved robot.

Electronic Position Switches (EPS)

Electronic Position Switches (EPS) is an additional safety computer in the controller, with the purpose of providing safe output signals representing the position of robot axes. The output signals are typically connected to cell safety circuitry and/or a safety PLC which takes care of interlocking the robot cell, for example in order to prevent robot and operator to enter a common area simultaneously. See *Application manual - Electronic Position Switches*.

Working range limit

To increase the safety of the robot, the working range of axis 1, 2 and 3 can be restricted.

Option	Name	Description
28-1	Axis 1 Working range limit	One or two mechanical stops for restricting the working range of axis 1. The option includes two stops. See Figure below.

The working range can be restricted freely within the shown scope, depending on where the mechanical stop is installed along the casted groove.
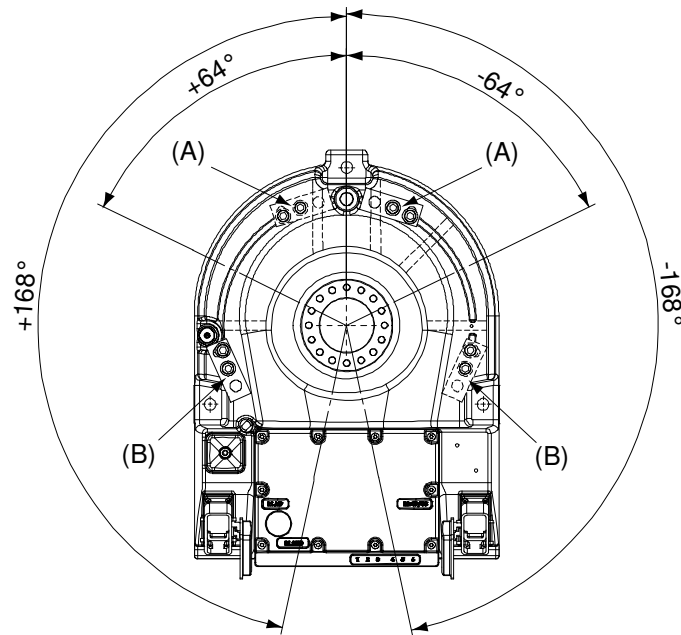
xx1000000958

Pos	Description
A	Mounting position of two additional stops for maximum working area (+/- 168°).
B	Mounting position of two additional stops for maximum working area (+/- 64°).

Continues on next page

Negative directions in axis 1 have extra gravity force (tilted or wall mounted robots)

If the robot is wall mounted or mounted in a tilted position, the additional mechanical stop pin restricts the robot when the axis 1 moves in a positive direction, for example from 0º and upwards to 90º (b).

The stop pin does not manage the extra gravity force that comes from when axis 1 moves in a negative direction, for example from 180º downwards to 90º (a).
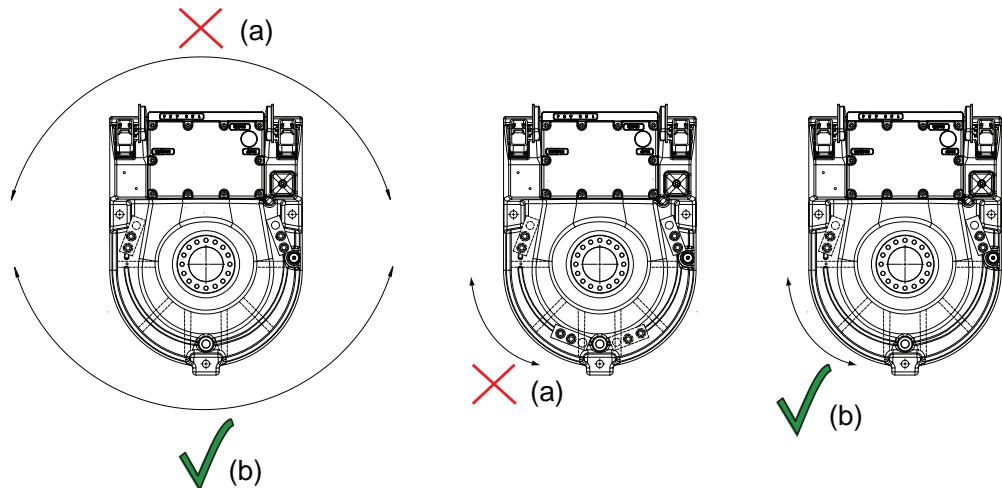
xx1300000180

| (a) | The additional stop pin does not manage the extra gravity force in this restricted working area (for tilted or wall mounted robots). |
| (b) | The additional stop pin manages to restrict this working area (for tilted or wall mounted robots). |
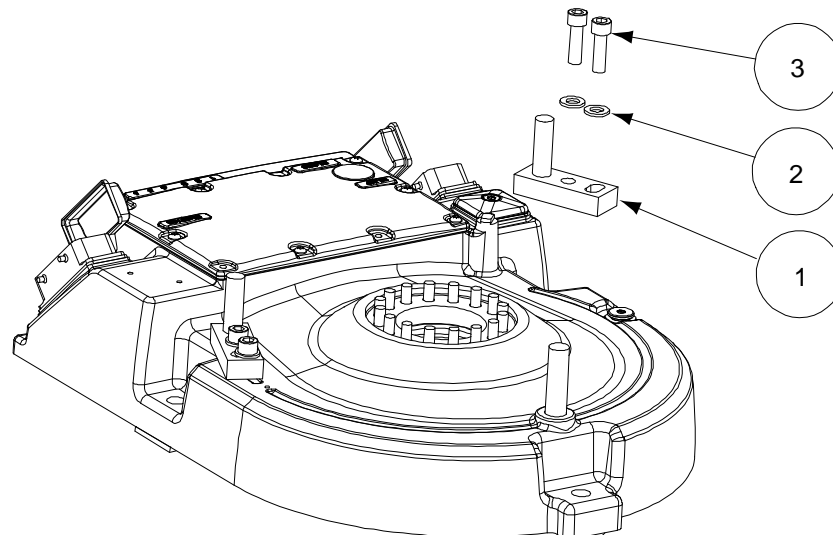
xx1000000957

Pos	Description
1	Mechanical stop (x2)
2	Washers (x4)
3	Screws (x4)

Continues on next page

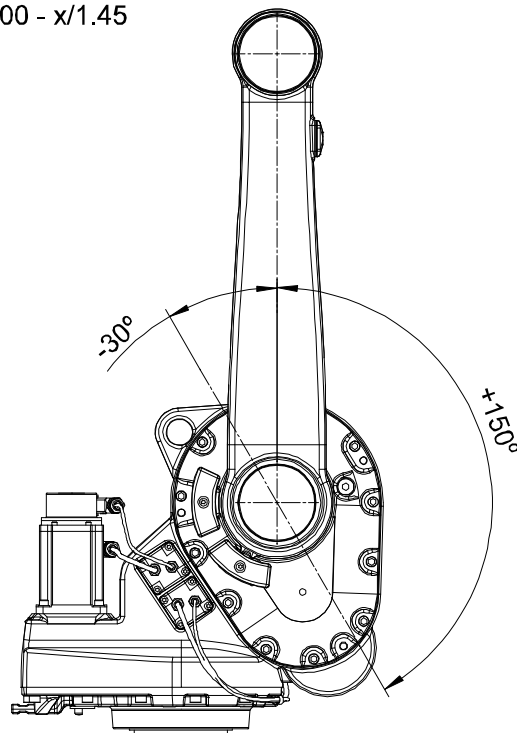| Option	Name	Description
32-1	Axis 2 working range limit	An additional mechanical stop for restricting the working range of axis 2 can be mounted on the frame. The working range can only be restricted backwards as shown in Figure below. Notice the different working range for the different models.

IRB 1600 – x/1.2
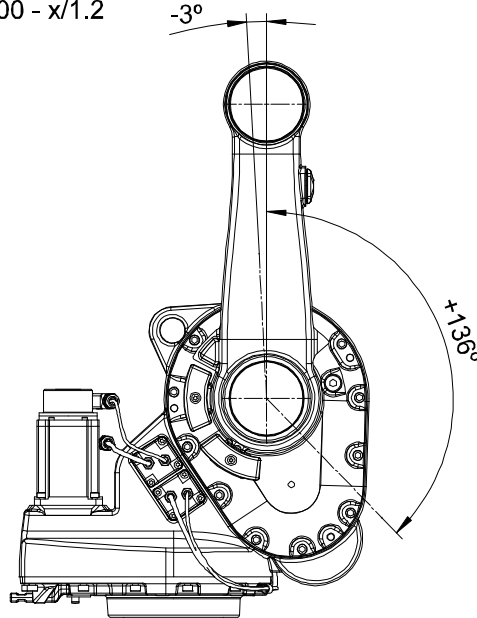
xx0400001289

IRB 1600 – x/1.45

xx0400001290

Continues on next page

Option	Name	Description
34-1 [i]	Axis 3 working range limit	The mechanical stop to restrict the working range within zone A and B for axis 3 can be mounted at the upper arm housing. See Figure 4. Notice the different working range for the different models.

[i] Not valid for IRB 1660ID.

xx0400001283

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

IRB 1600-X/1.45

-245º
-105º
B
(75°)
A
-75°
(65°)
+65°
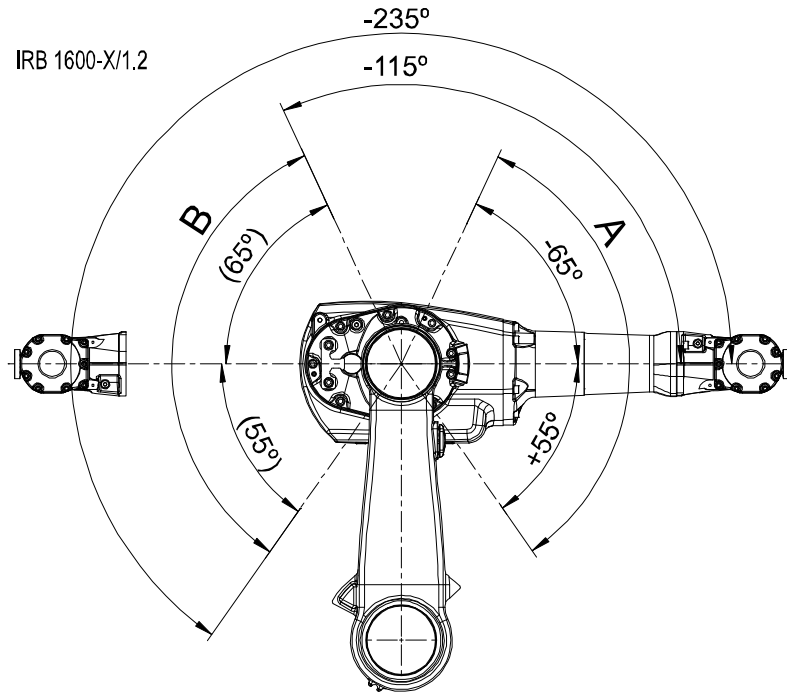
xx0400001284

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 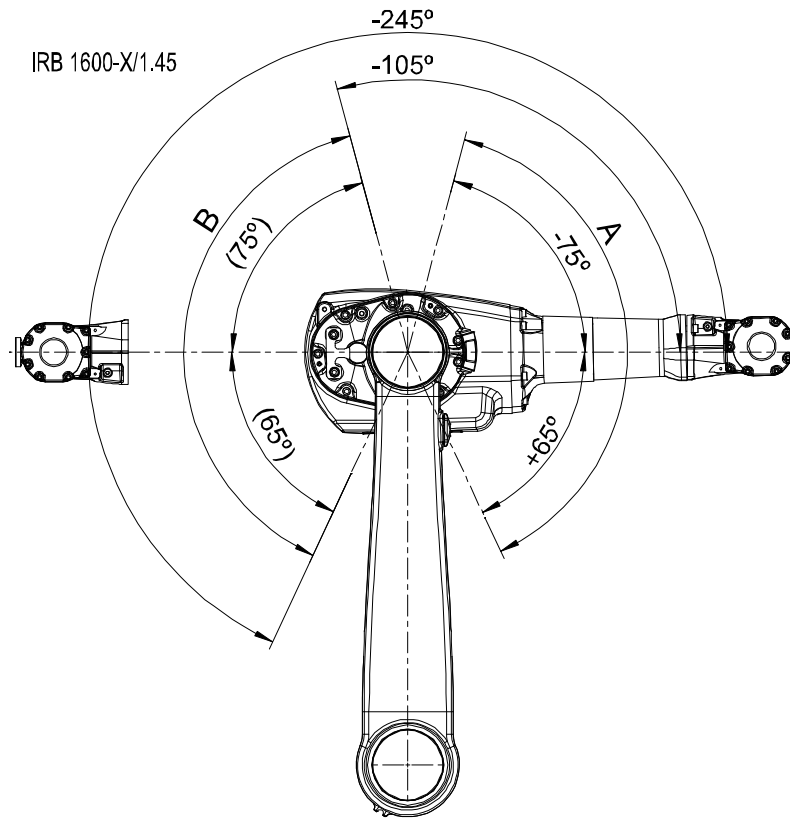is required to have a yearly Preventative Maintenance according to ABB manuals to be performed by ABB. If due to customer restrains no data can be analyzed in the ABB Ability service *Condition Monitoring & Diagnostics* for robots with OmniCore controllers, and ABB has to travel to site, travel expenses are not covered. The Extended Warranty period always starts on the day of warranty expiration. Warranty Conditions apply as defined in the Terms & Conditions.

> **ℹ 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.

Continues on next page

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. ℹ️ **Note** Special conditions are applicable, see *Robotics Warranty Directives*.

2.3 Positioners

General

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

2.4 Floor cables

2.4.1 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

2.4.2 Positioner

Positioner cable 1

Option	Lengths
1067-1	7 m
1067-2	10 m (Standard length)
1067-3	15 m

Positioner cable 2

Option	Lengths
1068-1	7 m
1068-2	10 m (Standard length)
1068-3	15 m

Positioner cable type

Option	Type	Description
1048-1	Flexible	Only available with one or two MTC 250/500/750/2000/5000

Weld return cable

Option	Lengths
1056-1	7 m
1056-2	7 m x 2
1056-3	10 m
1056-4	10 m x 2
1056-5	15 m
1056-6	15 m x 2

Return cable

Option	Type	Description
1057-1	OKC T-connection	Choose quantity, 1-2

2.5 Process

2.5.1 Process

Process module

Option	Type	Description
768-1	Empty cabinet small	See *Product specification - Controller IRC5 with FlexPendant*, see chapter 2.2.1
768-2	Empty cabinet large	See *Product specification - Controller IRC5 with FlexPendant*, chapter 2.2.1

Installation kit

Option	Type	Description
715-1	Installation kit	See *Product specification - Controller IRC5 with FlexPendant*, chapter 2.2.1

WeldGuide IV

Weldguide IV provides tracking functionality by reading the true impedance values close to the arc at 25 kHz then guides the robot to the correct path. Weldguide IV is designed to track difficult welding joint variations resulting from cast components or other pre-process problems.

Option	Type	Description
992-1	Basic	Occupies one slot and one Ethernet port. Digital I/O or AD Combi I/O is needed for WeldGuide functions. Requires options WG Sensor [994-1] or [995-1], and WeldGuide Multipass [815-2]. Not together with option UL/CSA [429-1].
992-2	Advanced	Includes all *Basic* functionality and adaptive fill. This feature allows the robot to adjust to the changes in joint width, the weave stroke will increase or decrease, and the travel speed will be adjusted accordingly. Occupies one slot and one Ethernet port. Digital I/O or AD Combi I/O is needed for WeldGuide functions. Requires options WG Sensor [994-1] or [995-1], and WeldGuide Multipass [815-2]. Not together with option UL/CSA [429-1].
994-1	WG Solid core sensor	
995-1	WG Split core sensor	

2.5.2 Process equipment

Torch service

Option	Type	Description
1037-1	ABB TSC 2013	ABB Torch Service Center. Including: Cleaner, cutter and BullsEye. Occupies I/O signals Dig. 5In/2Out. Requires option Base Dig. 16in/16Out [1541-1].
1037-5	BullsEye	BullsEye stand alone. Requires options RW Arc [633-4], and BullsEye [652-1] or RW Cutting [951-1].

2.5.3 AW Safety options

Working area

Option	Type	Description
1072-1	One working area	
1072-2	Two working areas	

Operator panel

Option	Type	Description
1054-1	Operator panel 1 area	For one working area
1054-2	Operator panel 2 areas	For two working areas.
1054-3	2 x operators panel 2 areas	Two operator panels, one for each working area.

AW Safety interface

Option	Type	Description
1058-1	Safety interface	SIB
1058-2	Active relay	Active relay supervision (open relay).

Gate switch

Option	Type	Description
1060-1	Gate switch	
1060-2	Gate switch/ ext. reset	

Lightbeam

Option	Type	Description
1059-1	Lightbeam	Qty 1 or 2, one working area requires one PC of "two level light beams". Two working areas rerquire two PCs of "two level light beams".

Home position switch

Option	Type	Description
1061-1	Home position switch	Home position switch for IRB 1600/2400, one working area.

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

Station indication

Option	Type	Description
1062-1	Station indication	Station indication for IRB 1600/2400, two working areas.

Pre-reset unit

Option	Type	Description
1063-1	Pre-reset unit	Qty 1 or 2, one working area requires one PC of "Pre-reset". Two working areas require two PCs of "Pre-reset".

Activation unit

Option	Type	Description
1064-1	Activation unit	Qty 1 or 2, one requires one PC of "Activation unit". Two working areas require two PCs of "Activation unit".

Extended EM stop

Option	Type	Description
1065-1	Extended EM stop	Required when using external EM-stop push buttons and when ordering a dual arc system (two welding packages).

2.6 User documentation

User documentation

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

> 💡 **Tip**
>
> All documents can be found via myABB Business Portal, *www.abb.com/myABB*.

Product specification - IRB 1600/1660
3HAC023604-001 Revision: AR

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* and *Product specification - Controller software IRC5*.

Robot peripherals

- Track Motion
- Motor Units

This page is intentionally left blank

Index

ABB

ABB AB
Robotics & Discrete Automation
S-721 68 VÄSTERÅS, Sweden
Telephone +46 10-732 50 00

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