ROBOTICS

Product specification

IRB 1510

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Product specification

IRB 1510

OmniCore

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Revision: B

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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 - OmniCore C line	*3HAC065034-001*
Product manual - IRB 1510	*3HAC087870-001*
Product manual - OmniCore C30 Type A	*3HAC089064-001*
Product manual - OmniCore C90XT Type A	*3HAC089065-001*

Revisions

Revision	Description
A	First edition.
B	Published in release 24C. The following updates are done in this revision: • Added support for OmniCore C90XT Type A controller. • Added mains cable options [3203].

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1 Description

1.1 Structure

1.1.1 Introduction

Robot family

The IRB 1510 is a 6-axis industrial robot, designed specifically for manufacturing industries that use flexible robot-based automation. The robot has an open structure that is specially adapted for flexible use, and can communicate extensively with external systems.

Operating system

The robot is equipped with the OmniCore C line 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*.

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.

Safety

Safety standards valid for complete robot, manipulator and controller.

Additional functionality

For additional functionality, the robot can be equipped with optional software for application support - for example gluing and welding, communication features - network communication - and advanced functions such as multitasking, sensor control etc. For a complete description on optional software, see *Product specification - OmniCore C line*.

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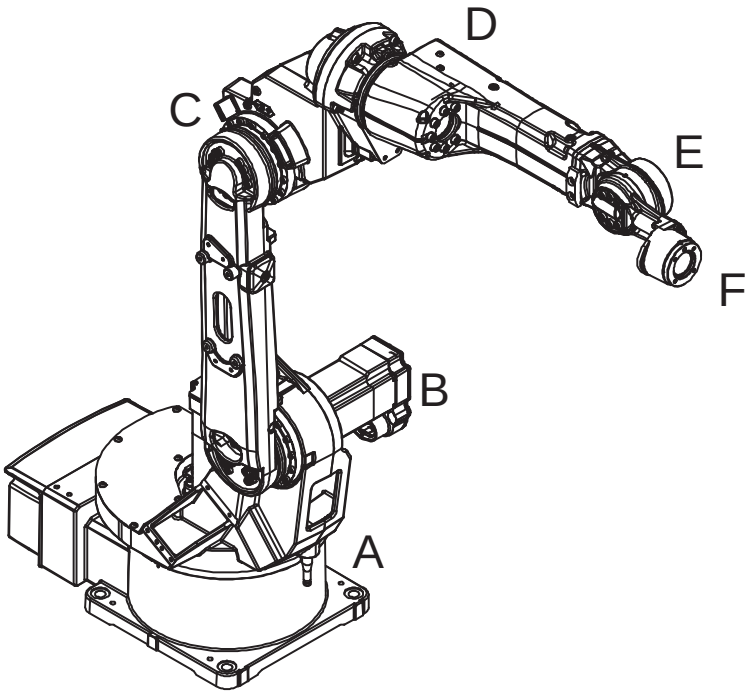
1.1.1 Introduction
Continued

Manipulator axes



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

1.1.2 Different robot variants

General

The IRB 1510 is available in one variant and can only be mounted on the floor or inverted (no tilting allowed around X-axis or Y-axis). See *Robot motion on page 32* for limitations.

Robot	Handling capacity (kg)	Reach (m)
IRB 1510ID	4 kg	1.5 m

Manipulator weight

Robot	Weight
IRB 1510ID-4/1.5	170 kg

Other technical data

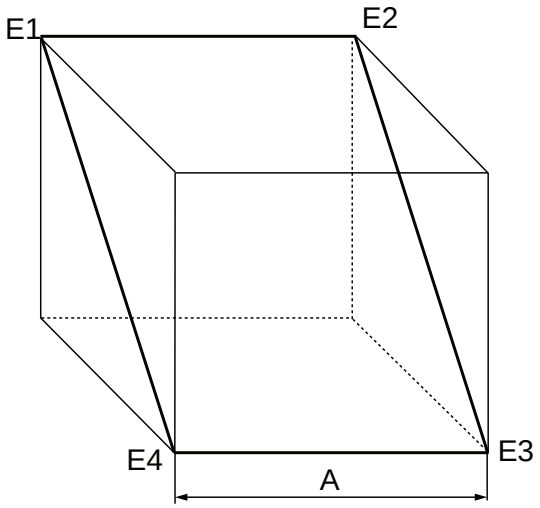
Data	Description	Note
Airborne noise level	The sound pressure level outside the working space	< 70 dB (A) Leq (acc. to Machinery directive 2006/42/EG)

Power consumption

Type of movement	Power consumption (kW) (all variants)
ISO Cube Max. velocity	0.46

Robot in calibration position	All variants (kW)
Brakes engaged	0.10
Brakes disengaged	0.23

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



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Pos	
A	400 mm

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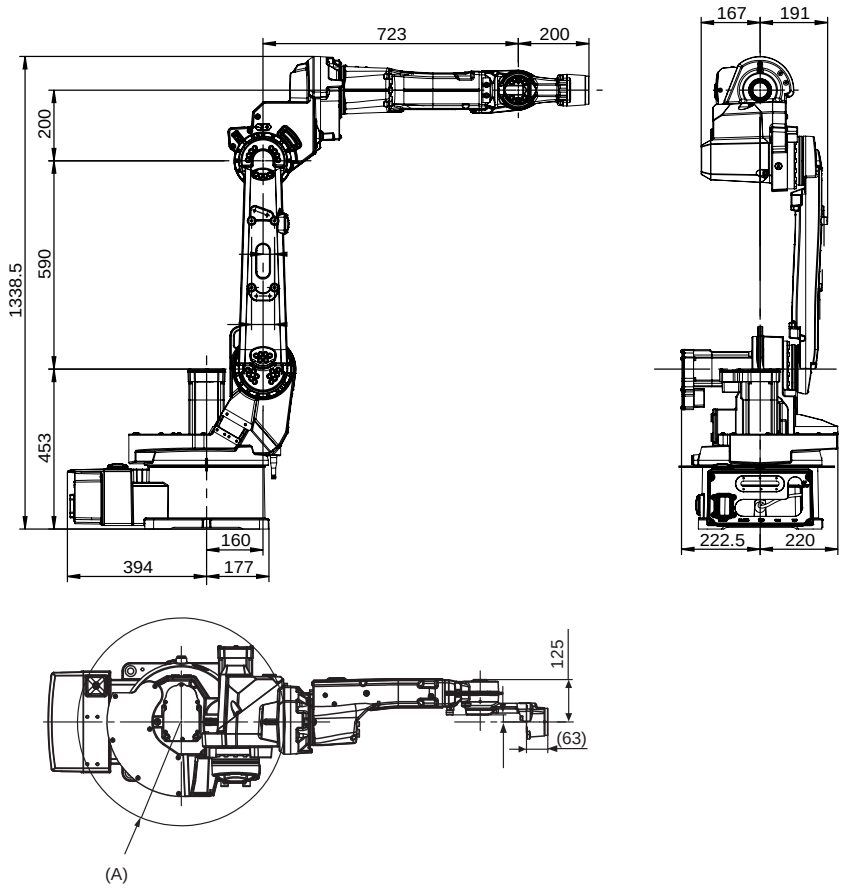
1.1.2 Different robot variants
Continued

Dimensions IRB 1510ID-4/1.5



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Pos	Description
A	Minimum turning radius R=307 mm

1.2 Applicable standards

General

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

Robot standards

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

Other standards used in design

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

1.3 Installation

1.3.1 Introduction

General

IRB 1510ID-4/1.5 can only be mounted on the floor or inverted (no tilting allowed around X-axis or Y-axis). An end effector with max. weight of 4 kg including payload, can be mounted on the tool flange. See *Robot load and diagrams on page 22*.

Extra equipment can be mounted on the upper arm. See *Mounting of equipment on page 28*.

Extra loads

Extra load, which is included in the load diagrams, can be mounted on the upper arm. See *Robot load and diagrams on page 22*.

Working range

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
IRB 1510ID-4/1.5	IP 40

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

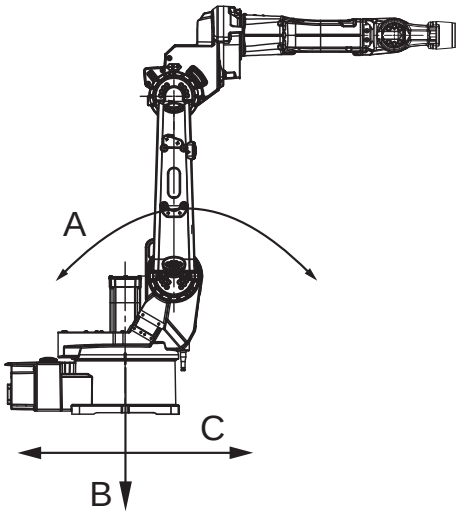
Maximum load in relation to the base coordination system. See Figure below.

Floor Mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 1900 N	± 4300 N
Force z	1850 ±900 N	1850 ±2350 N
Torque xy	± 1550 Nm	± 3900 Nm
Torque z	± 390 Nm	± 1200 Nm

Suspended

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 1900 N	± 4250 N
Force z	- 1850 ±750 N	-1850 ±2350 N
Torque xy	± 1550 Nm	± 3900 Nm
Torque z	± 390 Nm	± 1200 Nm



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Pos	Description
A	$Torque_{xy}$ (T_{xy})
B	$Force_{z}$ (F_{z})
C	$Force_{xy}$ (F_{xy})

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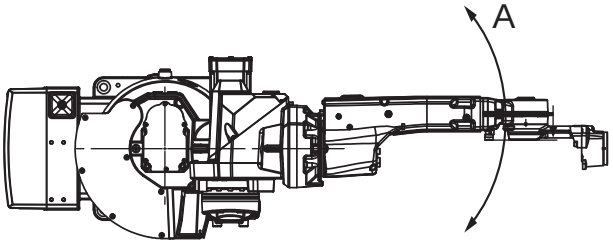

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Pos	Description
A	$Torque_z$ (T_z)

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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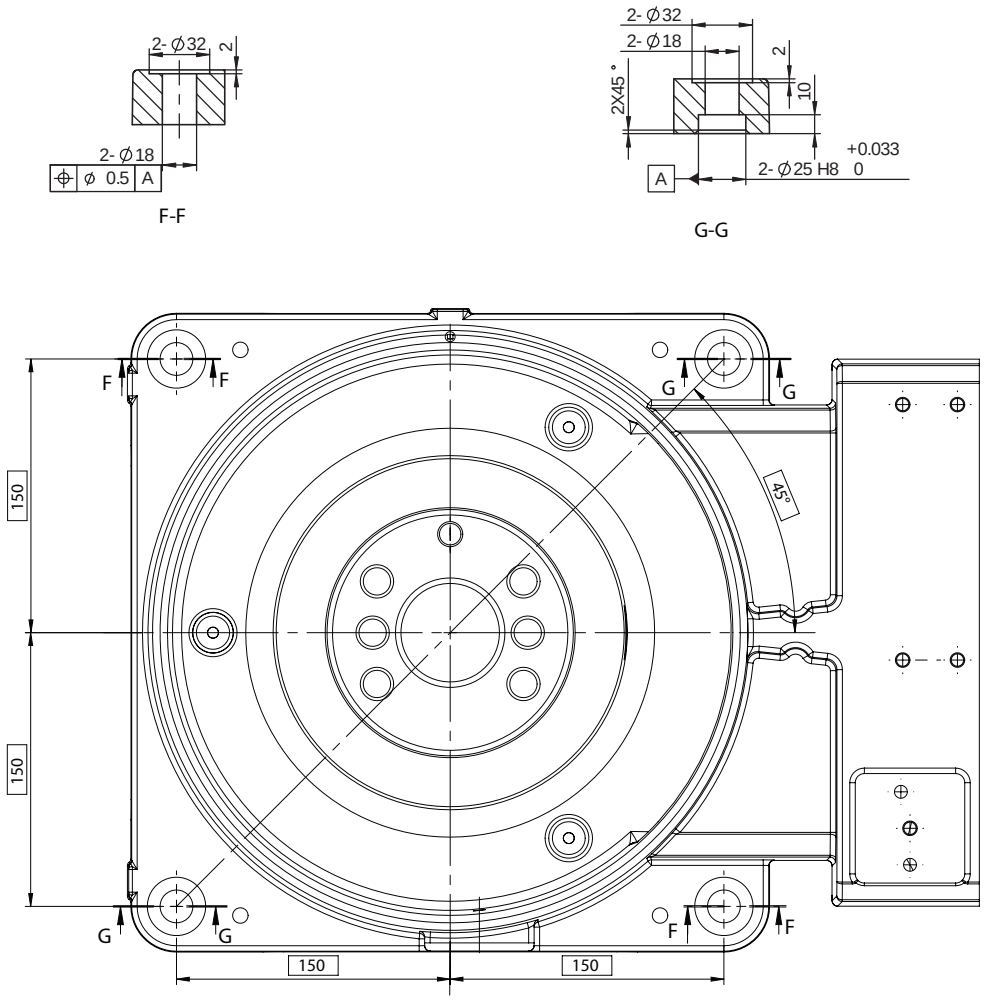
1.3.3 Mounting the manipulator
Continued

Fastening holes robot base



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Attachment bolts, specification

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

Specification	Description
Attachment bolts, 4 pcs	M16 x 60 (installation directly on foundation) M16 x 70/80 (installation on foundation or base plate, using guiding sleeves)
Washers, 4 pcs	17 x 30 x 3
Quality	Quality 8.8
Tightening torque	200 Nm

1.4 Calibration and reference

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.	Calibration Pendulum
Absolute accuracy calibration (optional)	Based on standard calibration, and besides positioning the robot at synchronization position, the Absolute accuracy calibration also compensates for: • Mechanical tolerances in the robot structure • Deflection due to load Absolute accuracy calibration focuses on positioning accuracy in the Cartesian coordinate system for the robot. Absolute accuracy calibration data is found on the serial measurement board (SMB) or other robot memory. A robot calibrated with Absolute accuracy has the option information printed on its name plate (OmniCore). To regain 100% Absolute accuracy performance, the robot must be recalibrated for absolute accuracy after repair or maintenance that affects the mechanical structure.	CalibWare
Optimization	Optimization of TCP reorientation performance. The purpose is to improve reorientation accuracy for continuous processes like welding and gluing. Wrist optimization will update standard calibration data for axes 4 and 5. **Note** For advanced users, it is also possible to use the do the wrist optimization using the RAPID instruction `WristOpt`, see *Technical reference manual - RAPID Instructions, Functions and Data types*. This instruction is only available for OmniCore robots.	Wrist Optimization

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1.4.1 Calibration methods
Continued

Brief description of calibration methods

Calibration Pendulum method

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

Two different routines are available for the Calibration Pendulum method:

- Calibration Pendulum II
- Reference calibration

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

Wrist Optimization method

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

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

CalibWare - Absolute Accuracy calibration

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

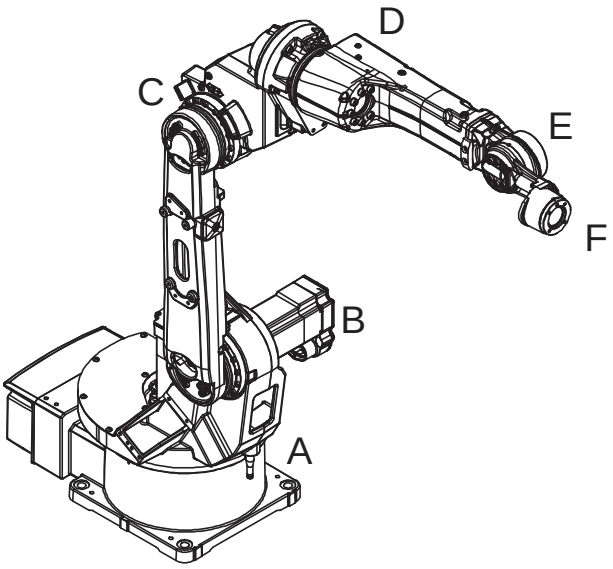
If a service operation is done to a robot with the option Absolute Accuracy, a new absolute accuracy calibration is required in order to establish full performance. For most cases after replacements that do not include taking apart the robot structure, standard calibration is sufficient.

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

1.4.2 Fine calibration

General

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



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

Calibration

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

1.5 Robot load and 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 - 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 pay load inertia, J_0 of 0.012 kgm^2, and an extra load of 10 kg (hose package included) 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.

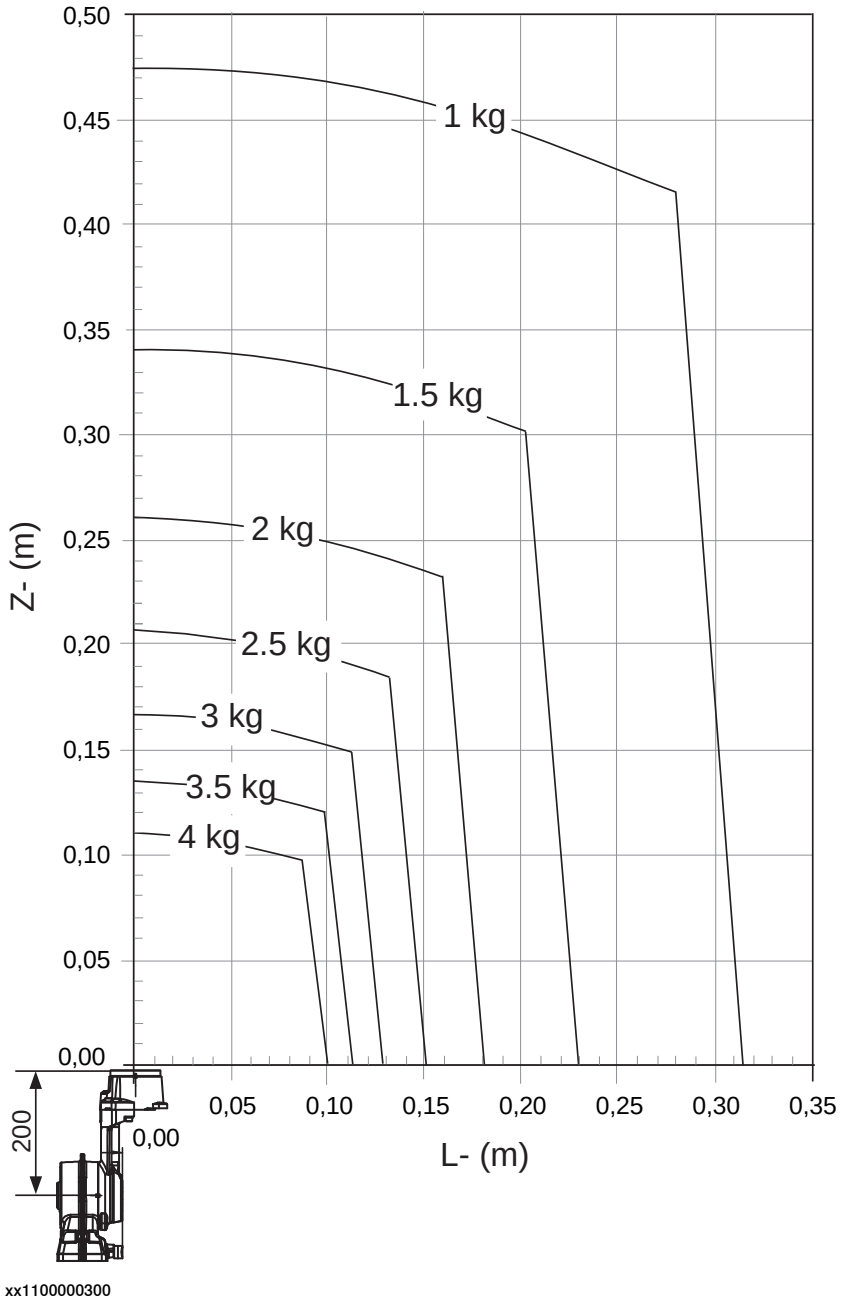
Control of load case with RobotLoad

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 1510ID-4/1.5



Extra load of 10 kg (hose package included) at the upper arm housing included in the load diagram.

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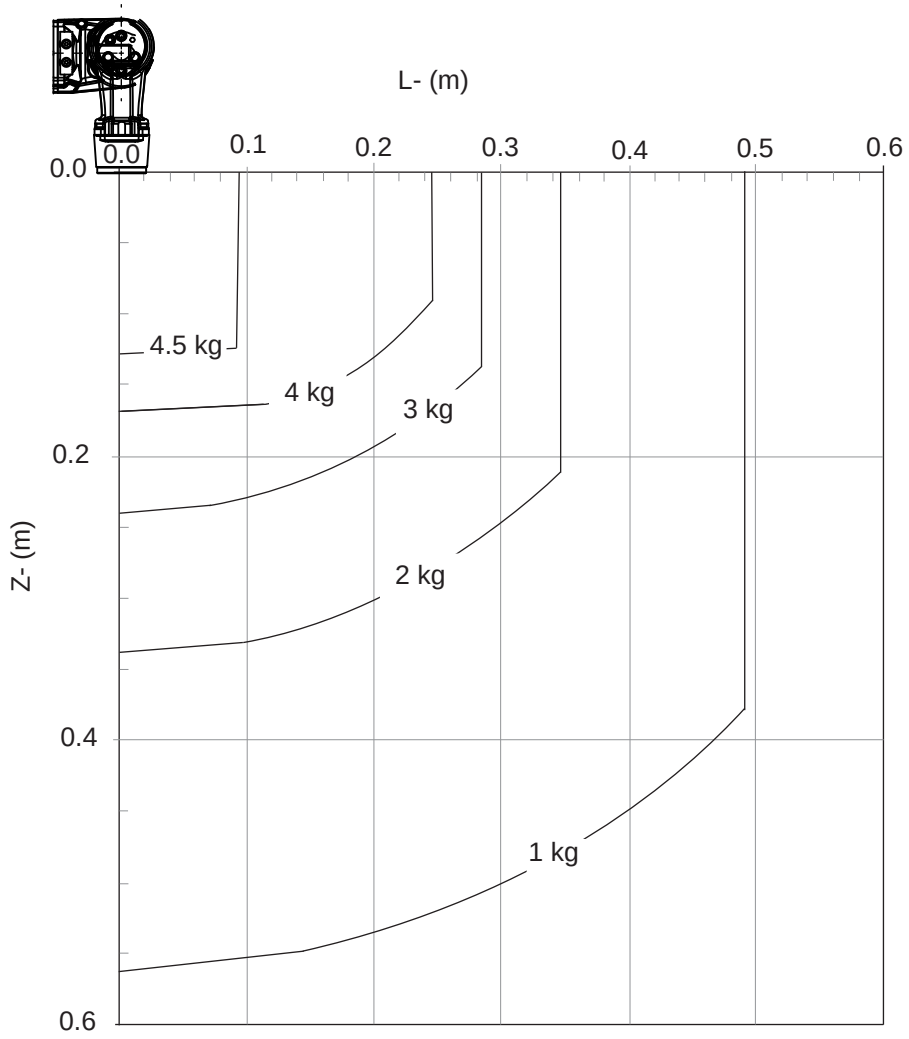
1.5.2 Load diagrams
Continued

IRB 1510ID-4/1.5 "Vertical Wrist" (±10º)



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Extra load of 10 kg (hose package included) at the upper arm housing included in the load diagram.

For wrist down (turning disk faced downwards) with ±10º deviation from vertical line.

	Description
Max load	4.5 kg
Z_{max}	0.128 m
L_{max}	0.093 m

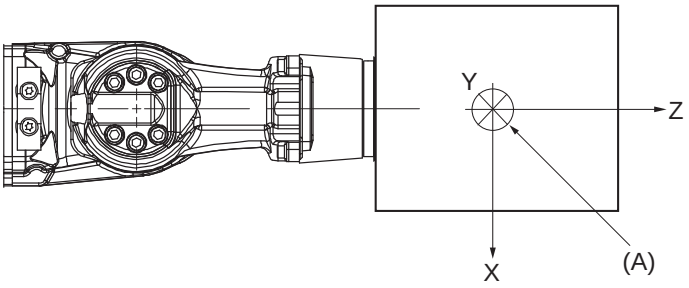
1.5.3 Maximum load and moment of inertia for full and limited axis (center line down) movement

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= sqr($X^2 + Y^2$), see Figure below.

Full movement of axis 5 (+135º to -135º)

Axis	Robot type	Max. value
5	IRB 1510ID-4/1.5	J5 = Mass x (($Z + 0.200^2 + L^2$) + max (J_{ox}, J_{oy}) ≤ 0.58 kgm^2
6	IRB 1510ID-4/1.5	J6= Mass x L^2 + J_{0Z} ≤ 0.24 kgm^2



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Pos	Description
A	Center of gravity

	Description
J_{ox}, J_{oy}, J_{0Z}	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 1510ID-4/1.5	J5 = Mass x (($Z + 0.200^2 + L^2$) + max (J_{ox}, J_{oy}) ≤ 0.58 kgm^2
6	IRB 1510ID-4/1.5	J6= Mass x L^2 + J_{0Z} ≤ 0.24 kgm^2

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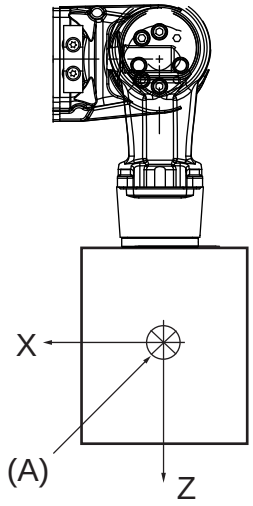
1.5.3 Maximum load and moment of inertia for full and limited axis (center line down) movement
Continued



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Pos	Description
A	Center of gravity

	Description
J_{ox}, J_{oy}, J_{0Z}	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.

Note

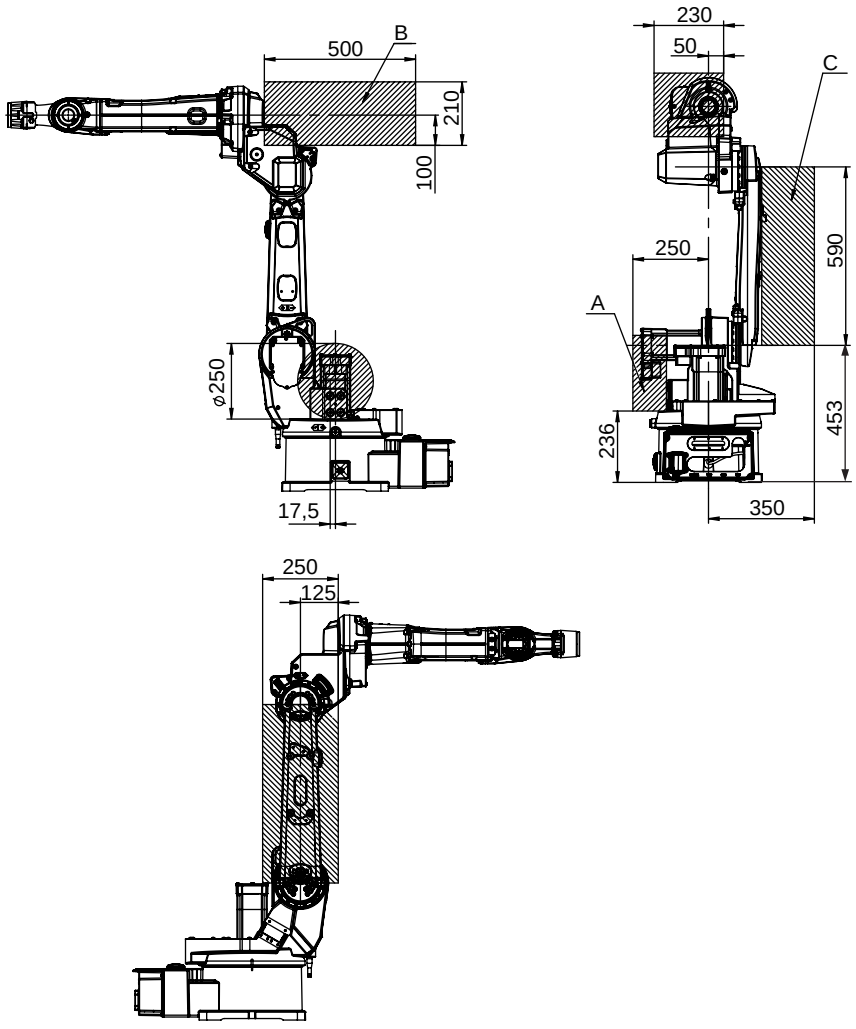
The wrist torque values are for reference only, and should not be used for calculating permitted load offset (position of center of gravity) within the load diagram, since those also are limited by main axes torques as well as dynamic loads. Furthermore, arm loads will influence the permitted load diagram. 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 1510ID-4/1.5	12.2 Nm	3.9 Nm	4 kg

1.6 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.



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Load area Robot	Max. load			
	A	B	C	B+C
IRB 1510ID-4/1.5	20 kg	10 kg	15 kg	25 kg

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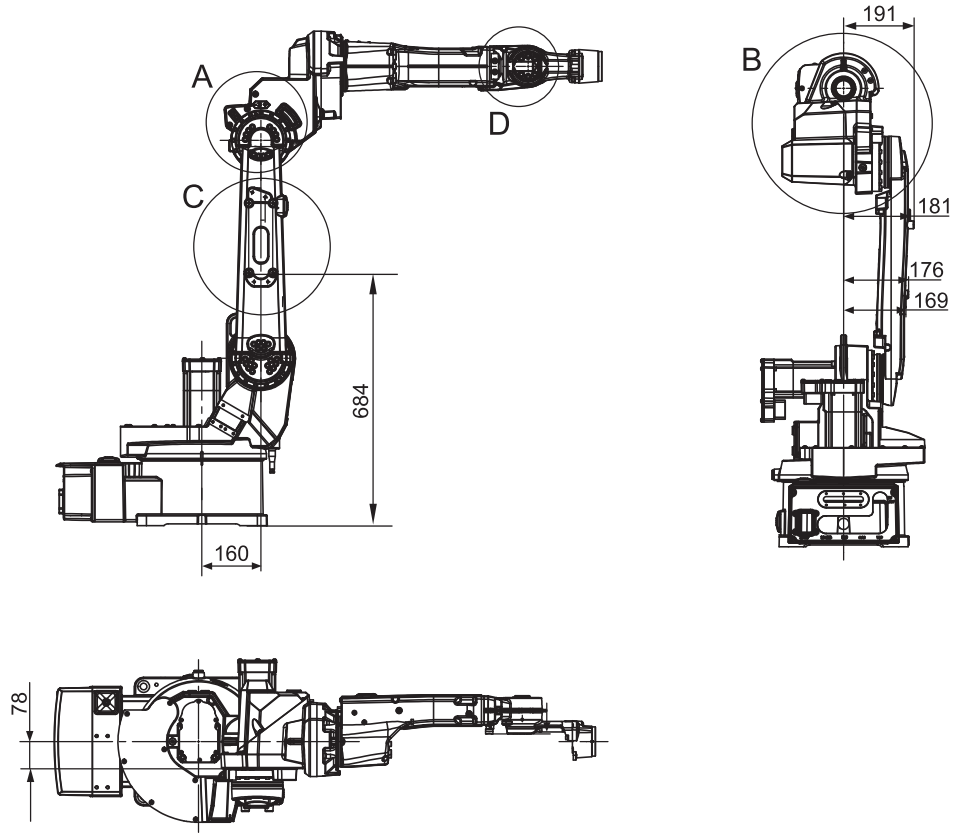
Holes for mounting of extra equipment

The robot has holes for mounting extra equipment.



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1.6 Mounting of equipment

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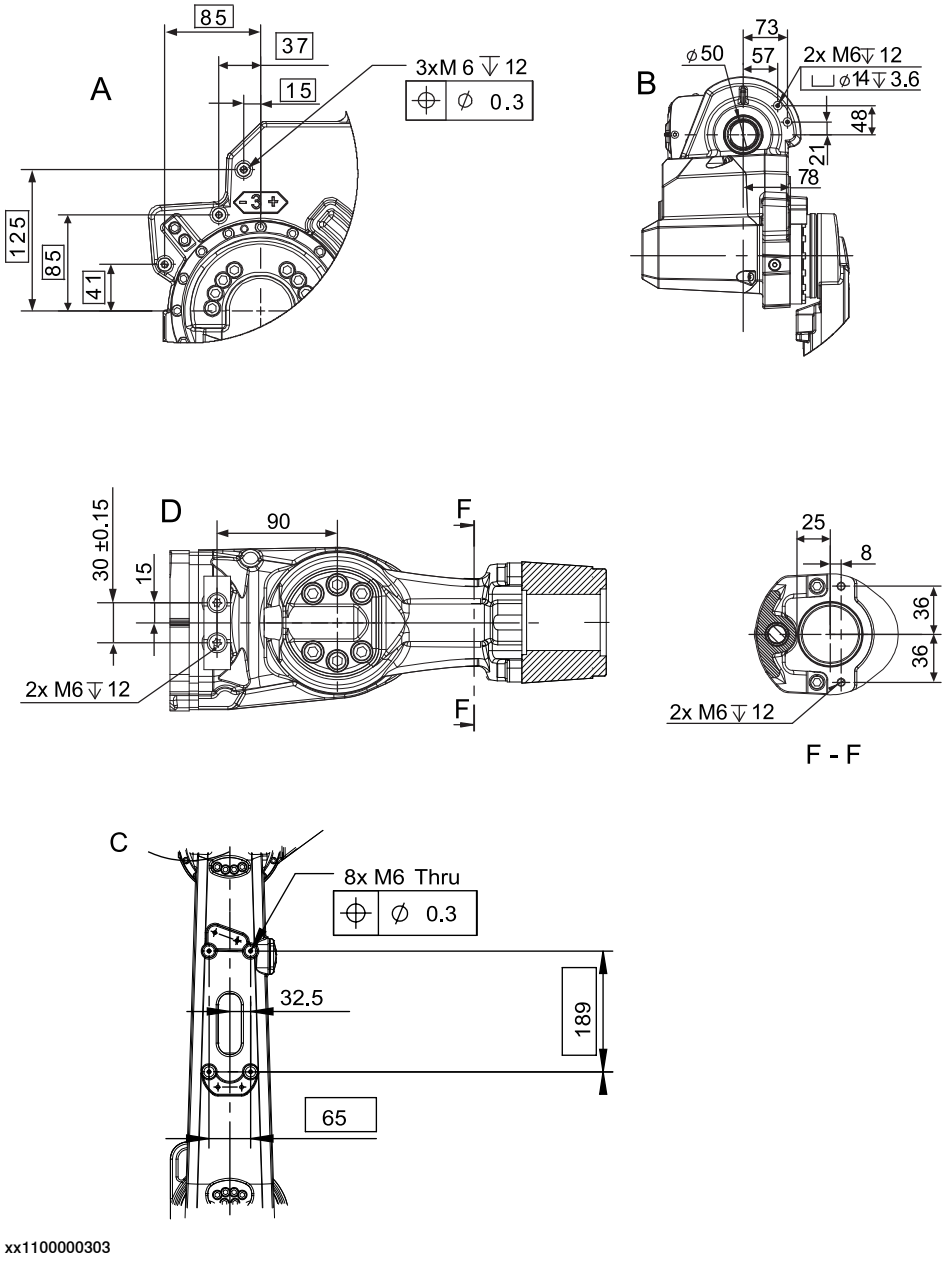

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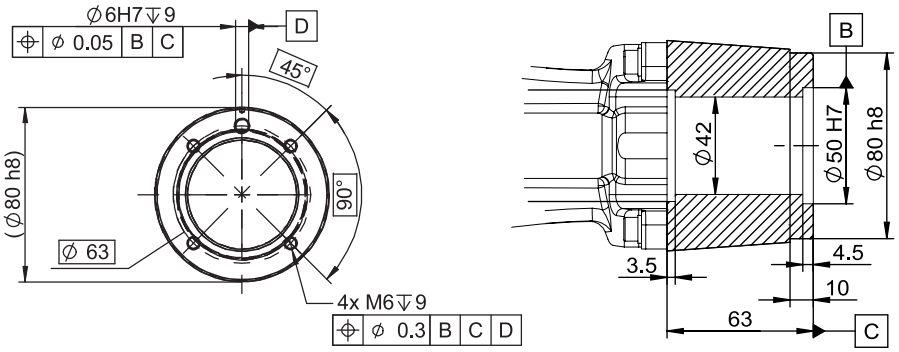
Robot tool flange



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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

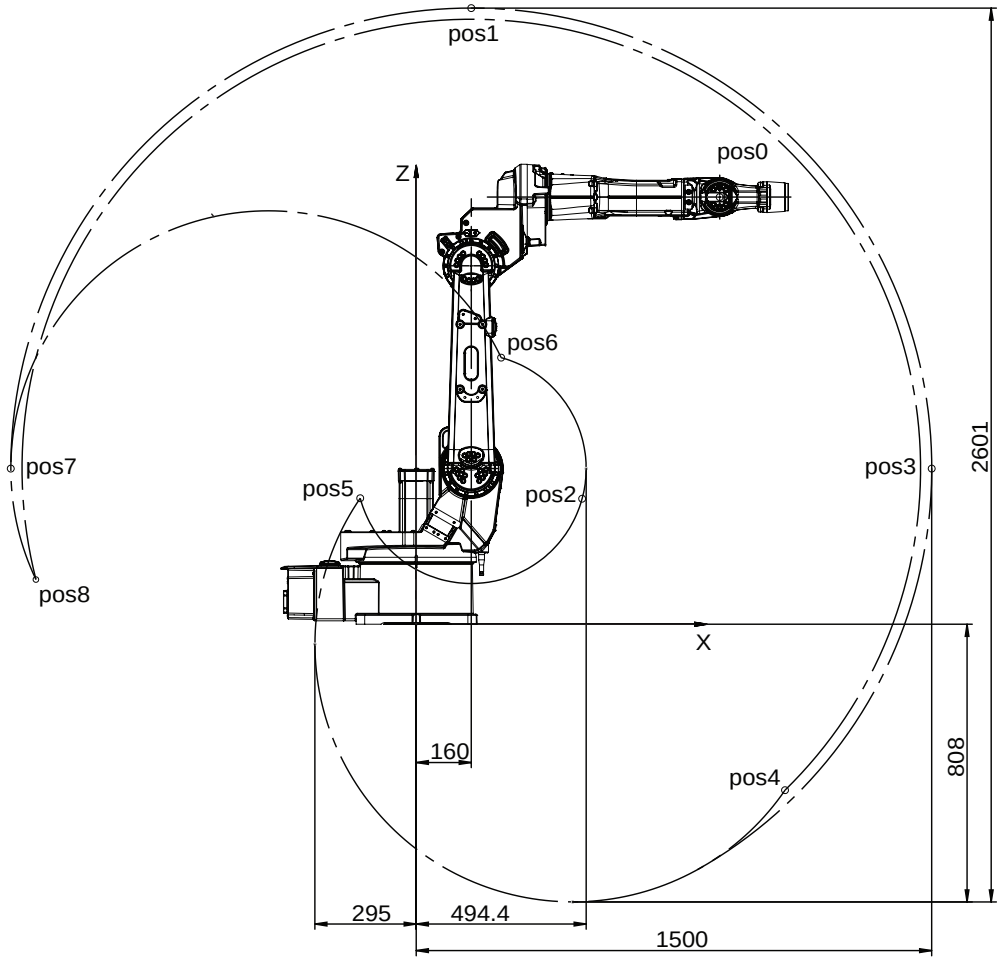
1.7.1 Introduction

IRB 1510ID-4/1.5

Axis	Type of motion	Range of movement
1	Rotation motion	+170° to -170°
2	Arm motion	+150° to -90°
3	Arm motion	+80° to -100°
4	Rotation motion	+155° to -155°
5	Bend motion	+135° to -135°
6	Turn motion	+200° to -200°

Positions at wrist center IRB 1510ID-4/1.5

Working range with extra mechanical stop on axis 3.



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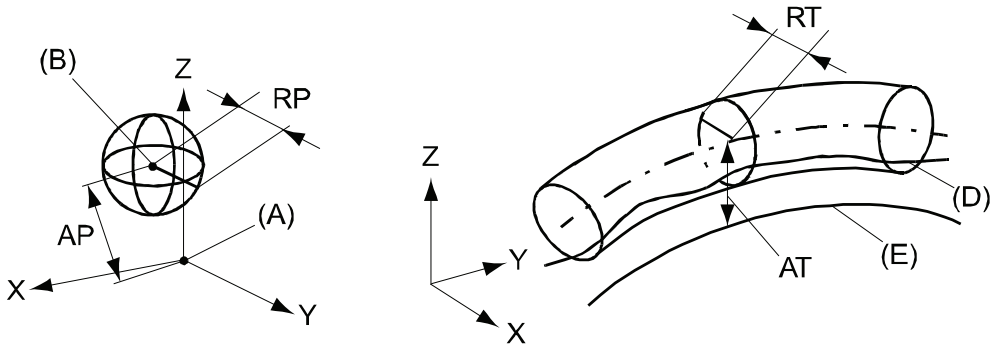
Pos No. see Figure above	X Position (mm)	Z Position (mm)	Axis 2 Angle (degrees)	Axis 3 Angle (degrees)
Pos 0	883	1243	0	0
Pos 1	160	1793	0	-74,5
Pos 2	483	365	0	+80
Pos 3	1500	453	+90	-74,5
Pos 4	1073	-483	+150	-100
Pos 5	-163	367	+150	+80
Pos 6	247	776	-90	+80
Pos 7	-1180	453	-90	-74,5
Pos 8	-1107	130	-90	-100

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 1510ID-4/1.5
Pose repeatability, RP (mm)	0.05
Pose accuracy, AP[i] (mm)	0.05
Linear path repeatability, RT (mm)	0.35
Linear path accuracy, AT (mm)	1.3
Pose stabilization time, (PSt) to within 0.2 mm of the position (s)	0.1

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 speed

Axis No.	IRB 1510ID-4/1.5
1	130°/s
2	140°/s
3	140°/s
4	320°/s
5	380°/s
6	460°/s

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

Note

No customer/application connections available for IRB 1510ID-4/1.5.

1.9 Maintenance and troubleshooting

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 1510.

2 Specification of variants and options

2.1 Introduction to variants and options

General

The different variants and options for the IRB 1510 are described in the following sections. The same option numbers are used here as in the specification form.

The variants and options related to the robot controller are described in the product specification for the controller.

2.2 Manipulator

Manipulator variant

Option	IRB Type	Handling capacity (kg)/Reach (m)
3300-113	1510ID	4/1.5

Manipulator color

Option	Name	Description
209-202	ABB Graphite White standard	Standard color

Manipulator protection

Option	Name	Description
3350-400	Base 40	IP40

Mounting position

Option	Name	Description
3317-1	Inverted	

Resolver connection 7th axis

Option	Description
3322-1	On base

2.3 Floor cables

Manipulator cable length

Option	Lengths
3200-2	7 m
3200-3	15 m

Mains cable

Option	Cable	Description
3203-1	EU mains cable, 3 m	Cable assembly with CEE7/VII line-side plug
3203-2	UK mains cable, 3 m	Cable assembly with BS1363 line-side plug, 5A fused
3203-5	CN mains cable, 3 m	Cable assembly with CPCS-CCC line-side plug
3203-6	AU mains cable, 3 m	Cable assembly with AS/NZs 3112 line-side plug
3203-7	All regions cable, 5 m	Cable assembly without line-side plug

Tip

The mains cable requires 3000-130 OmniCore C30.

2.4 Warranty

Warranty

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

Note

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

Option	Type	Description
438-1	Standard warranty	Standard warranty is 12 months from *Customer Delivery Date* or latest 18 months after *Factory Shipment Date*, whichever occurs first. Warranty terms and conditions apply.
438-2	Standard warranty + 12 months	Standard warranty extended with 12 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-4	Standard warranty + 18 months	Standard warranty extended with 18 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-5	Standard warranty + 24 months	Standard warranty extended with 24 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-6	Standard warranty + 6 months	Standard warranty extended with 6 months from end date of the standard warranty. Warranty terms and conditions apply.
438-7	Standard warranty + 30 months	Standard warranty extended with 30 months from end date of the standard warranty. Warranty terms and conditions apply.
438-8	Stock warranty	Maximum 6 months postponed start of standard warranty, starting from factory shipment date. Note that no claims will be accepted for warranties that occurred before the end of stock warranty. Standard warranty commences automatically after 6 months from *Factory Shipment Date* or from activation date of standard warranty in WebConfig. **Note** Special conditions are applicable, see *Robotics Warranty Directives*.

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