ROBOTICS

Product specification

IRB 6650S

Trace back information:
Workspace 24C version a5
Checked in 2024-09-17
Skribenta version 5.5.019

Product specification

IRB 6650S-90/3.9
IRB 6650S-125/3.5
IRB 6650S-200/3.0

IRC5

Document ID: 3HAC030822-001

Revision: AD

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Original instructions.

Table of contents

Overview of this product specification

About this product specification

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

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

The specification covers the manipulator using the IRC5 controller.

Usage

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

The specification is intended for:

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

References

Reference	Document ID
Product manual - IRB 6650S	*3HAC020993-001*
Product manual - DressPack IRB 6650S	*3HAC055424-001*
Product specification - Controller IRC5 IRC5 with main computer DSQC1000.	*3HAC047400-001*
Product specification - Controller software IRC5 IRC5 with main computer DSQC1000 and RobotWare 6.	*3HAC050945-001*
Product specification - Robot user documentation, IRC5 with RobotWare 6	*3HAC052355-001*

Revisions

Revision	Description
-	- New Product Specification.
A	- Changes for Calibration data - Work range - Explanation of ISO values (new figure and table) - Stopping distance - User documentation on DVD
B	- General update for 9.1 release
C	- Foundry Plus 2

Continues on next page

Continued

Revision	Description
D	- Updated Foundry Plus 2 text - ISO-Cube
E	- Text for Standards updated - New document structure
F	- Minor corrections and information added
G	• Table for ambient temperature adjusted • Minor corrections
H	• Machinery directive updated • General corrections
J	• Base plate drawing updated • Drawing for reference holes updated • Minor corrections/update
K	• Minor corrections/update
L	• Minor corrections/update
M	• 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*
N	• Text for Foundry Plus updated. • Minor corrections/update
P	• Minor corrections/update
Q	• DressPack LeanID added • Section "SpotWelding cabinet" updated.
R	• Warranty information for DressPack added
S	Phrase *The values for IRB 6650S-90/3.9 are not yet available* is changed to *The values for IRB 6650S-90/3.9 are not available*, in section *Performance according to ISO 9283 on page 63*
T	Published in release R17.1. The following updates are done in this revision: • Restriction of load diagram added.
U	Published in release R17.2. The following updates are done in this revision: • Updated list of applicable standards. • TCP acceleration information added. • Delete option 828-1, 828-2, 768-3 and 782-1 as they were all phased out.
V	Published in release R18.2. The following updates are made in this revision: • New dimensions added on illustration, see *Mounting of hip load on page 55*.
X	Published in release 19C The following updates are made in this revision: • Graphics for DressPack changed. See *Interface descriptions for DressPack on page 82*. • Updated information about *Absolute Accuracy*.
Y	Published in release 20A. The following updates are done in this revision: • M8 cable lug description added in DressPack section.

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Revision	Description
Z	Published in release 20D. The following updates are done in this revision: • Warranty section updated.
AA	Published in release 21C. The following updates are done in this revision: • Text regarding fastener quality is updated. • Removed Axis resolution. • Updated information about the option *Extended working range*. • Removed options (SpotPack phase out)782-13 Bosch MFDC ProfiNet, 858-1 Bosch Adaptive control, 788-1 Forced air cooling, 789-1 Earth fault protection unit, 790-1 Contactor for weld power, 791-1 Weld power cable, 7 m, 791-2 Weld power cable, 15 m, 809-1 process cable to stationary gun, 7 m, 809-2 process cable to stationary gun, 15 m, 792-1 Type S, 792-2 Type HS, 793-1 Second water return, 797-1 7m, 797-2 15m, 797-3 22m, 797-4 30m.
AB	Published in release 23B. The following updates are done in this revision: • Updated data for power consumption. • Added RAL code in manipulator color introduction. • Updated pose repeatability for 90 kg variant.
AC	Published in release 23C. The following updates are done in this revision: • Corrections done in the DressPack connector kits, see *Connector kits on page 129*.
AD	Published in release 24C. The following updates are done in this revision: • Corrected the section *Technical data on page 21*.

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1 Description

1.1 Structure

1.1.1 Introduction

Robot family

The IRB 6650S is ideal for process applications, regardless of industry and offers a unique working envelope. Typical areas can be Material Handling and Machine Tending.

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.

Protection type Foundry Plus 2

Robots with the option Foundry Plus 2 are designed for harsh environments where the robot is exposed to sprays of coolants, lubricants and metal spits that are typical for die casting applications or other similar applications.

Typical applications are spraying insertion and part extraction of die-casting machines, handling in sand casting and gravity casting, etc. (Please refer to Foundry Prime robots for washing applications or other similar applications). Special care must be taken in regard to operational and maintenance requirements for applications in foundry are as well as in other applications areas. Please contact ABB Robotics Sales organization if in doubt regarding specific application feasibility for the Foundry Plus 2 protected robot.

The robot is painted with two-component epoxy on top of a primer for corrosion protection. To further improve the corrosion protection additional rust preventive

Continues on next page

1.1.1 Introduction
Continued

are applied to exposed and crucial areas, e.g. has the tool flange a special preventive coating. Although, continuous splashing of water or other similar rust formation fluids may cause rust attach on the robots unpainted areas, joints, or other unprotected surfaces. Under these circumstances it is recommended to add rust inhibitor to the fluid or take other measures to prevent potential rust formation on the mentioned.

The entire robot is IP67 compliant according to IEC 60529 - from base to wrist, which means that the electrical compartments are sealed against water and solid contaminants. Among other things all sensitive parts are better protected than the standard offer.

Selected Foundry Plus 2 features:

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

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

Available robot variants

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

See *Specification of variants and options on page 135* for robot versions and other options not selectable together with Foundry Plus 2.

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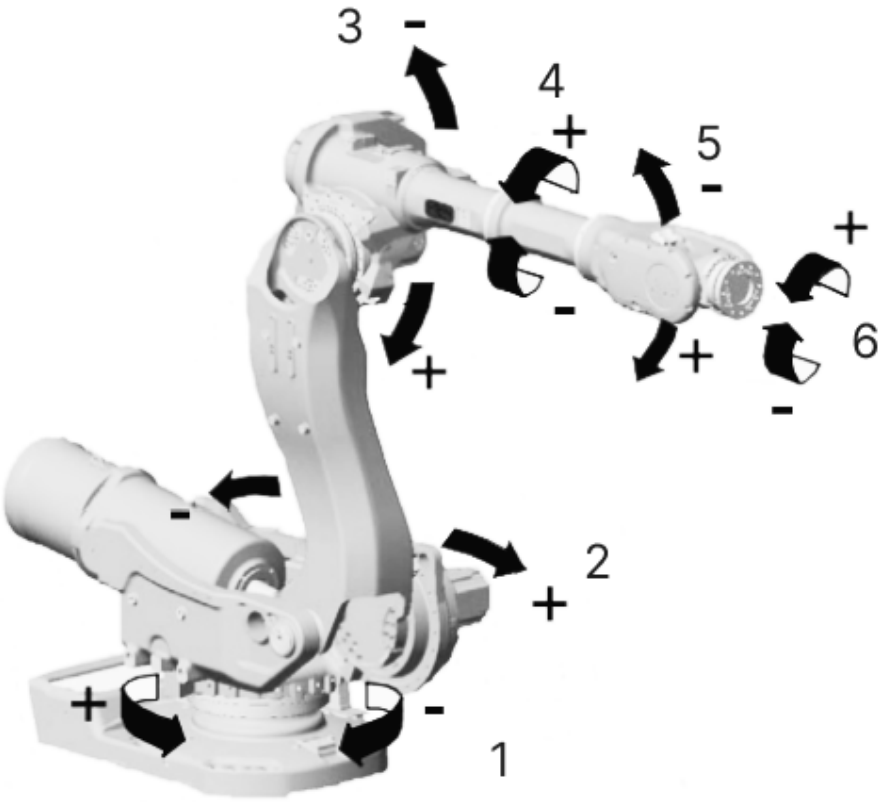
Axis movement



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1.1.2 Different robot variants

G0eneral

The IRB 6650S is available in the following variants.

Standard

Robot	Handling capacity	Handling capacity for LeanID	Reach
IRB 6650S	90 kg	-	3.9 m
IRB 6650S	125 kg	100 kg	3.5 m
IRB 6650S	200 kg	190 kg	3.0 m

Note

If option *780-4 LeanID* is selected, the payload will decrease as stated above, for detailed information see *Load diagrams on page 39*.

1.1.3 Technical data

Mounting options

Handling capacity (kg)/ Reach (m)

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

Manipulator weight

Robot type	Weight[i]
IRB 6650S-90/3.9	2275 kg
IRB 6650S-125/3.5	2250 kg
IRB 6650S-200/3.0	2250 kg

i Without DressPack

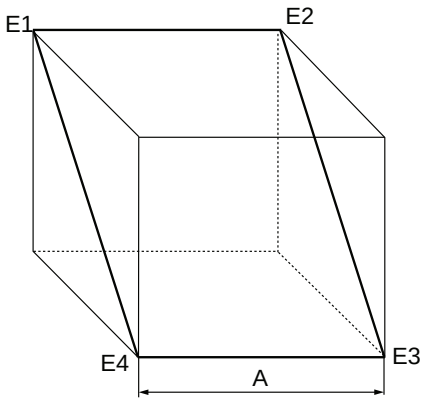
Other technical data

Data	Description	Note
Airborne noise level	The sound pressure level outside the working space.	< 73 dB (A) Leq (acc. to Machinery directive 2006/42/EG)

Power consumption at max speed (vmax)

Type of Movement	IRB 6650S
ISO Cube	2.7 kW

Robot in calibration position	IRB 6650S
Brakes engaged	0.19 kW
Brakes disengaged	1.07 kW



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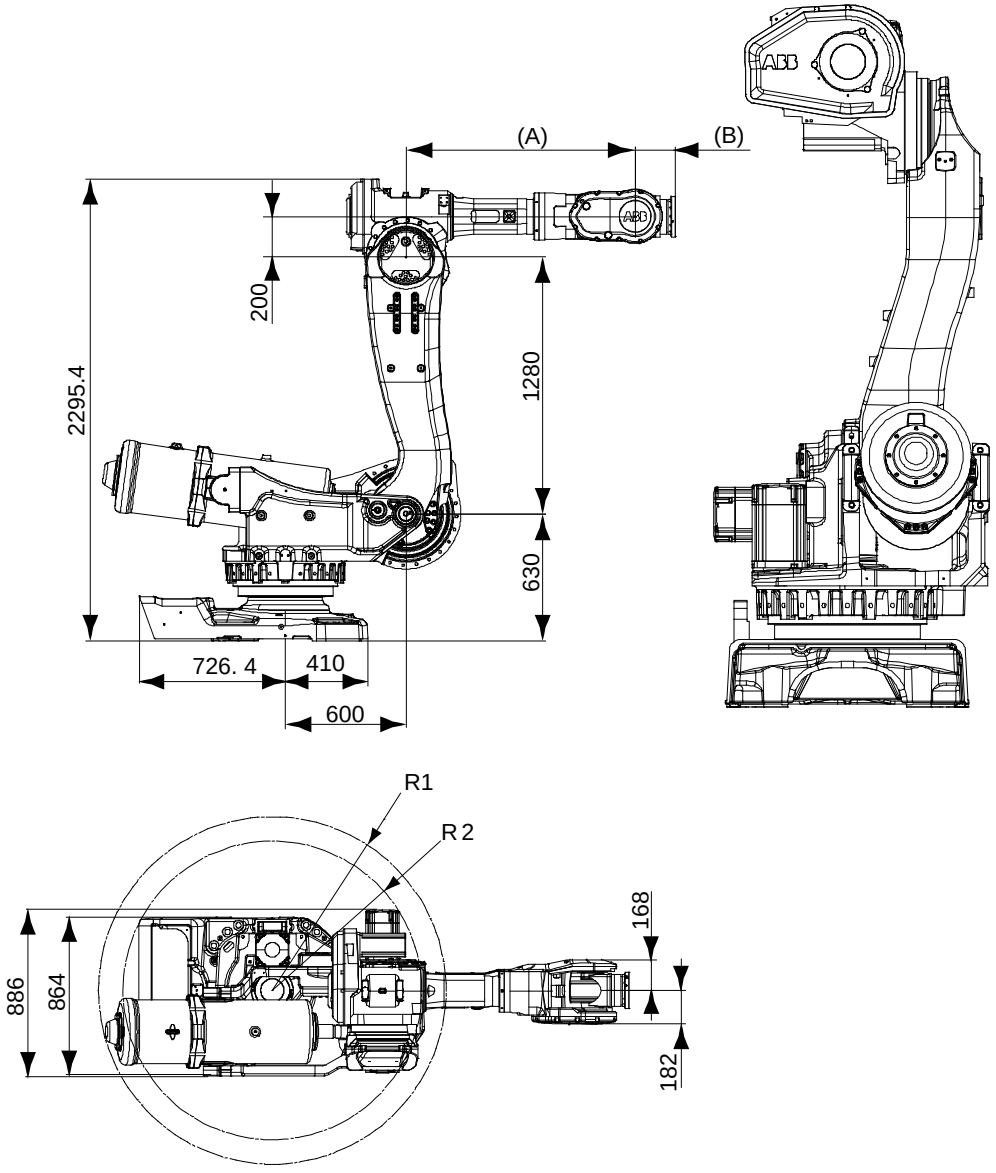
1.1.3 Technical data
Continued

Pos	Description
A	1,000 mm

Dimensions of IRB 6650S



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Robot variant	A	B
IRB 6650S-90/3.9	2,042 mm	-
IRB 6650S-125/3.5	1,592 mm	200 mm for standard and 349 mm for LeanID
IRB 6650S-200/3.0	1,142 mm	200 mm for standard and 349 mm LeanID

Pos	Description
R1	R 960 (Rear side, Balancing device)

Continues on next page

Pos	Description
R2	R 813 (Front side, Motor axis 2)

1.2 Standards

1.2.1 Applicable standards

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

General

The product is designed in accordance with 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	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

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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

All versions of IRB 6650S are designed for floor mounting (no tilting allowed around X-axis or Y-axis). Depending on the robot version, an end effector with max. weight of 90 to 200 kg including payload, can be mounted on the mounting flange (axis 6). See *Load diagrams on page 39* for IRB 6650S generation robots.

Extra Loads

Extra load (valve packages, transformers) of 50 kg, which is included in the load diagrams, can be mounted on the upper arm. An extra load of 500 kg can also be mounted on the frame of axis 1. See *Mounting equipment on page 53* on IRB 6650S.

Working Range

The working range of axes 1-3 can be limited by mechanical stops.

Explosive environments

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

1.3.2 Technical data

Weight, robot

The table shows the weight of the robot.

The weight does not include the weight of the DressPack.

Robot model	Weight
IRB 6650S	2275 kg

Note

The weight does not include tools and other equipment fitted on the robot.

The weight does not include the weight of the DressPack.

Mounting positions

The table shows valid mounting options for the manipulator.

Mounting option	Installation angle	Note
Floor mounted	0° i	

i A tilt of up to 5° does not affect the payload or reach, but it can have a negative impact on performance and lifetime. The actual value must be set in the system parameters.

Note

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

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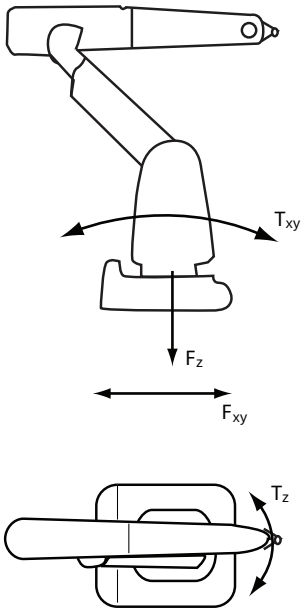
Loads on foundation, robot

The illustration shows the directions of the robots stress forces.

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



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

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

Note

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

WARNING

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

Floor mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 10.6 kN	± 20.9 kN
Force z	28.2 ± 7.7 kN	28.2 ± 16.4 kN
Torque xy	± 28.2 kNm ± 31 kNm[i]	± 50.5 kNm ± 55.6 kNm[i]

Continues on next page

Force	Endurance load (in operation)	Max. load (emergency stop)
Torque z	± 7.9 kNm	± 13.6 kNm

i When using base spacers (option).

Requirements, foundation

The table shows the requirements for the foundation where the weight of the installed robot is included:

Requirement	Value	Note
Flatness of foundation surface	0.3 mm	Flat foundations give better repeatability of the resolver calibration compared to original settings on delivery from ABB. The value for levelness aims at the circumstance of the anchoring points in the robot base. In order to compensate for an uneven surface, the robot can be recalibrated during installation. If resolver/encoder calibration is changed this will influence the absolute accuracy.
Minimum resonance frequency	22 Hz **Note** It may affect the manipulator lifetime to have a lower resonance frequency than recommended.	The value is recommended for optimal performance. Due to foundation stiffness, consider robot mass including equipment. i For information about compensating for foundation flexibility, see the application manual of the controller software, section *Motion Process Mode*.

i The minimum resonance frequency given should be interpreted as the frequency of the robot mass/inertia, robot assumed stiff, when a foundation translational/torsional elasticity is added, i.e., the stiffness of the pedestal where the robot is mounted. The minimum resonance frequency should not be interpreted as the resonance frequency of the building, floor etc. For example, if the equivalent mass of the floor is very high, it will not affect robot movement, even if the frequency is well below the stated frequency. The robot should be mounted as rigid as possibly to the floor.

Disturbances from other machinery will affect the robot and the tool accuracy. The robot has resonance frequencies in the region 10 – 20 Hz and disturbances in this region will be amplified, although somewhat damped by the servo control. This might be a problem, depending on the requirements from the applications. If this is a problem, the robot needs to be isolated from the environment.

Storage conditions, robot

The table shows the allowed storage conditions for the robot:

Parameter	Value
Minimum ambient temperature	-25° C
Maximum ambient temperature	+55° C
Maximum ambient temperature (less than 24 hrs)	+70° C
Maximum ambient humidity	95% at constant temperature (gaseous only)

Operating conditions, robot

The table shows the allowed operating conditions for the robot:

Parameter	Value
Minimum ambient temperature	+5°

Continues on next page

1.3.2 Technical data
Continued

Parameter	Value
Maximum ambient temperature	+50 °C
Maximum ambient humidity	Max. 95% at constant temperature.

Protection classes, robot

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

Protection type	Protection class[i]
Manipulator, protection type Standard	IP 67
Manipulator, protection type Foundry Plus	IP 67

[i] According to IEC 60529.

1.3.3 Mounting the manipulator

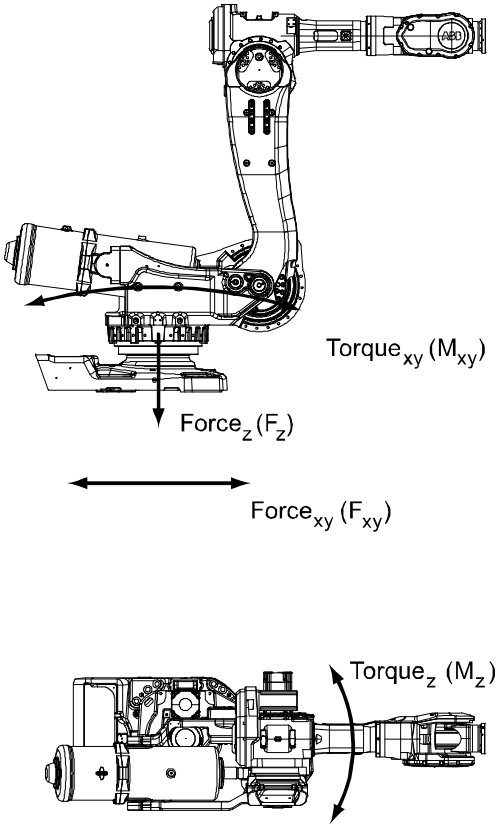
Maximum Load

Maximum load in relation to the base coordinate system.

Floor Mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	± 10.6 kN	± 20.9 kN
Force z	28.2 ± 7.7 kN	28.2 ± 16.4 kN
Torque xy	± 28.2 kNm ± 31 kNm[i]	± 50.5 kNm ± 55.6 kNm[i]
Torque z	± 7.9 kNm	± 13.6 kNm

i When using base spacers (option).



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Note regarding Mxy and Fxy

The bending torque (Mxy) can occur in any direction in the XY-plane of the base coordinate system.

The same applies to the transverse force (Fxy).

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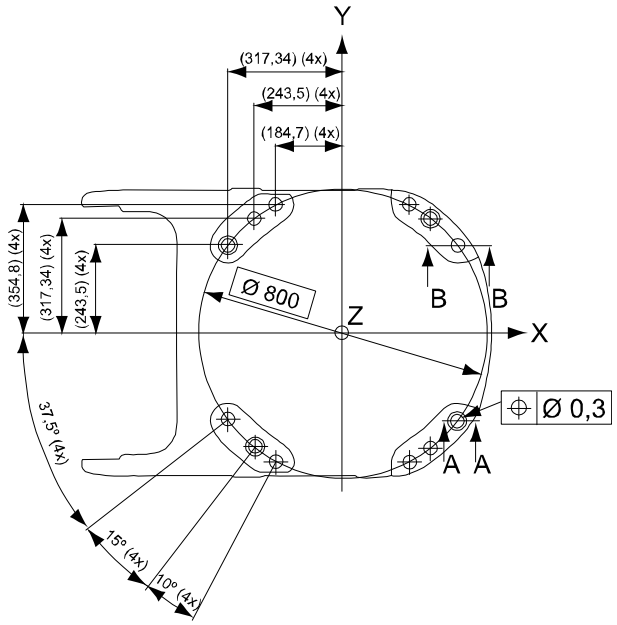
1.3.3 Mounting the manipulator
Continued

Fastening holes robot base - for IRB 6650S



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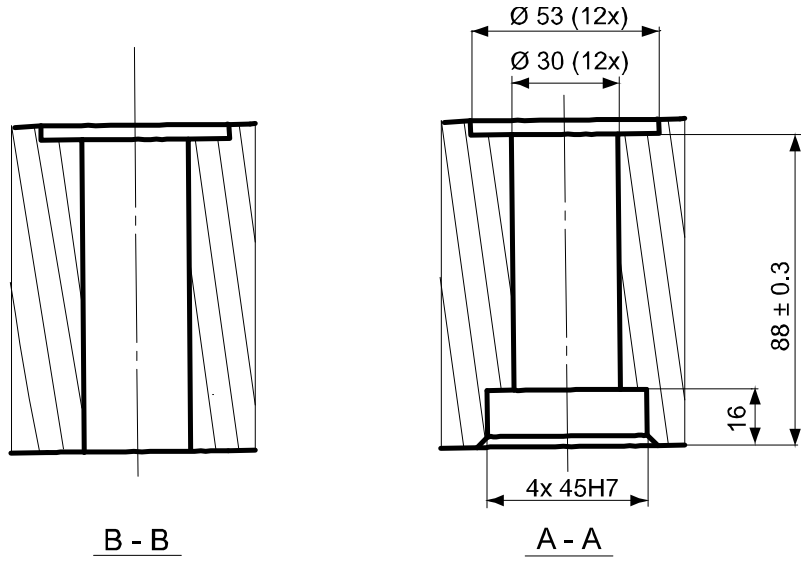

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Recommended srews for fastening the manipulator to the base	M24 x 140 8.8 with 4 mm flat washer
Torque value	725 Nm

Note

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

Regarding AbsAcc performance, the chosen guide holes according to Figures below are recommended.

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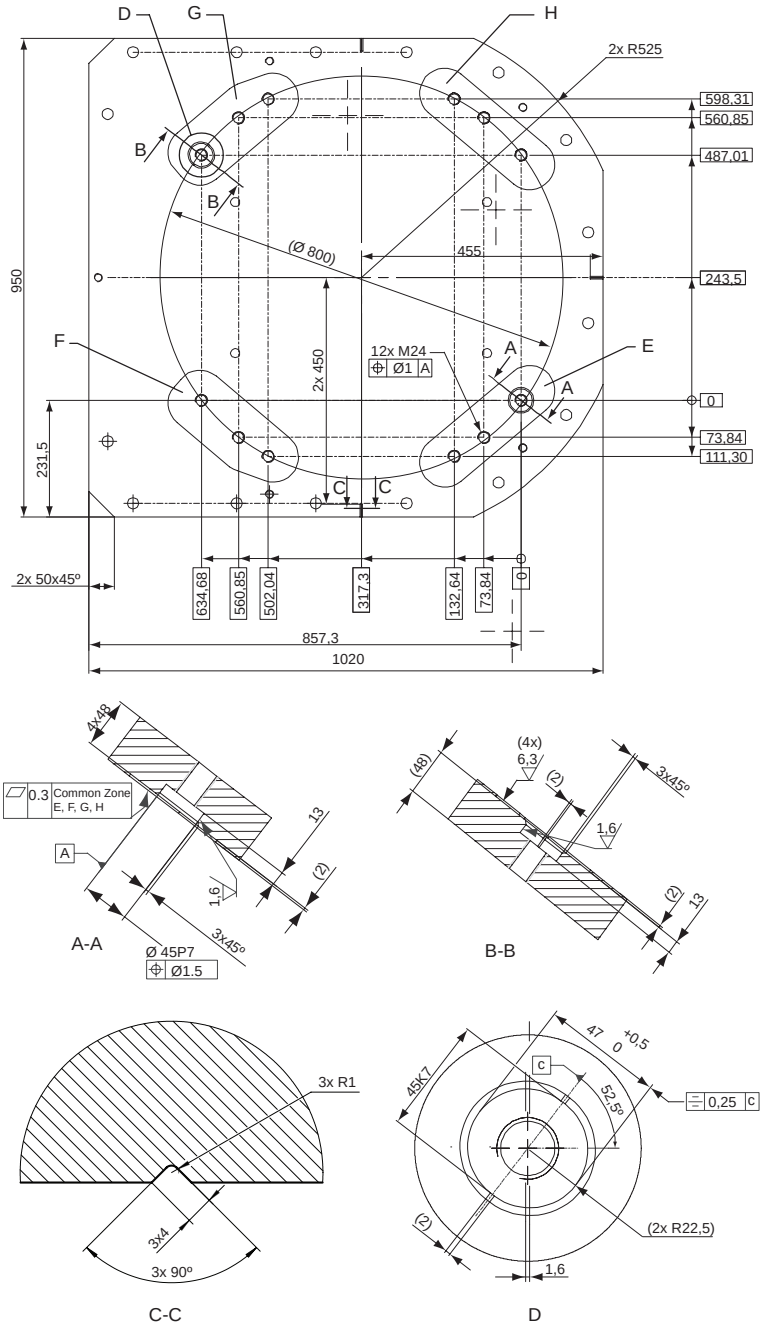
Base plate drawing

The following figure shows the option base plate (dimensions in mm).



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

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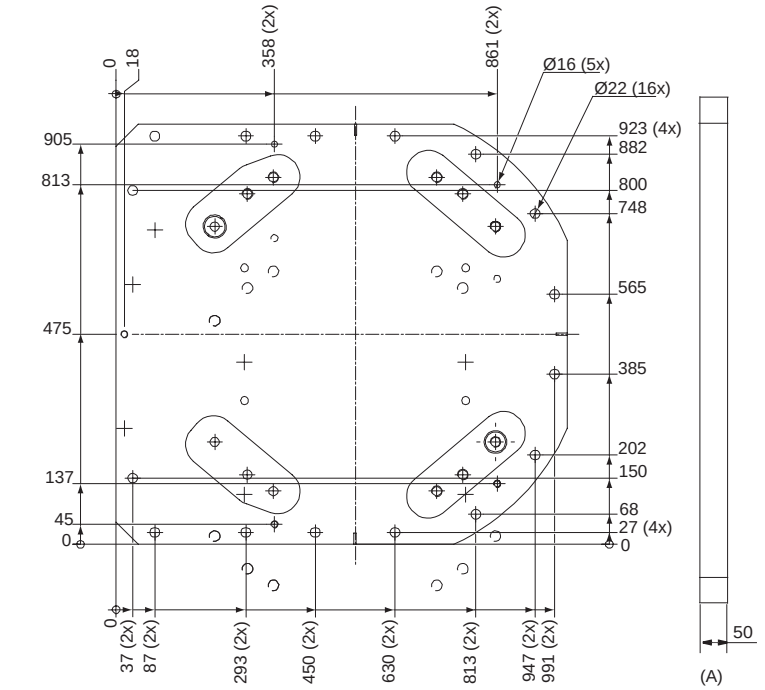
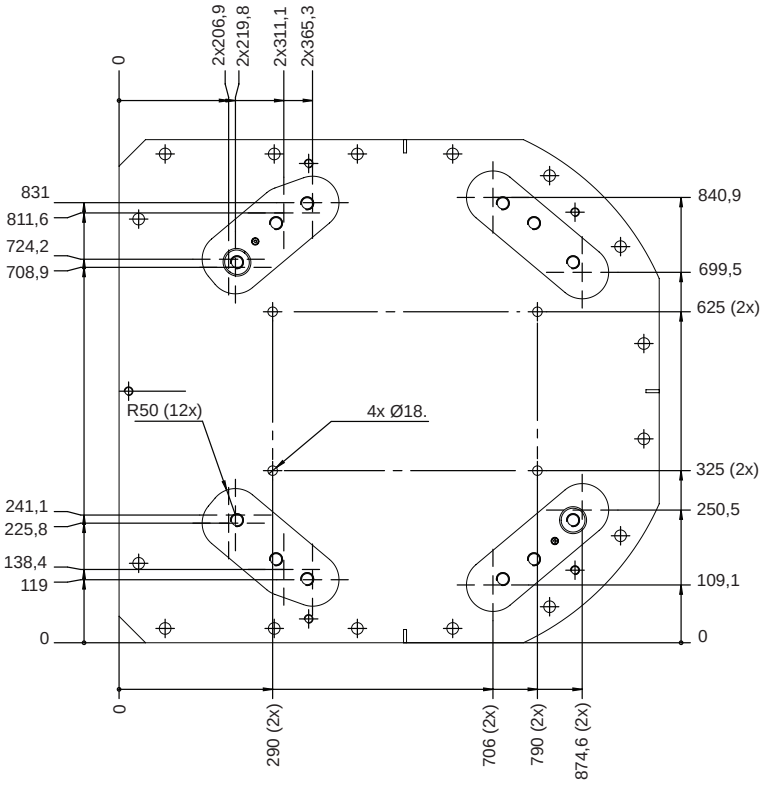
1.3.3 Mounting the manipulator

Continued





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

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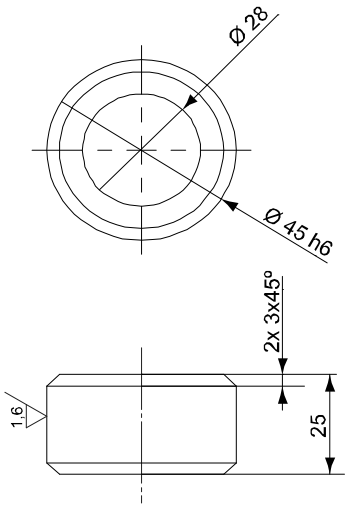

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Pos	Description
A	Guide sleeve protected from corrosion

1.4 Calibration and references

1.4.1 Calibration methods

Overview

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

More information is available in the product manual.

Types of calibration

Type of calibration	Description	Calibration method
Standard calibration	The calibrated robot is positioned at calibration position. Standard calibration data is found on the SMB (serial measurement board) or EIB in the robot.	Axis Calibration Levelmeter calibration (alternative method)
Absolute accuracy calibration (optional)	Based on standard calibration, and besides positioning the robot at synchronization position, the Absolute accuracy calibration also compensates for: • Mechanical tolerances in the robot structure • Deflection due to load Absolute accuracy calibration focuses on positioning accuracy in the Cartesian coordinate system for the robot. Absolute accuracy calibration data is found on the serial measurement board (SMB) or other robot memory. For IRC5 robots, 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
Optimization	Optimization of TCP reorientation performance. The purpose is to improve reorientation accuracy for continuous processes like welding and gluing. Wrist optimization will update standard calibration data for axes 4 and 5.	Wrist Optimization

Continues on next page

Brief description of calibration methods

Axis Calibration method

Axis Calibration is a standard calibration method for calibration of IRB 6650S. 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*.

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.

1.4.2.1 Synchronization marks and synchronization position for axes

1.4.2 Synchronization marks and axis movement directions

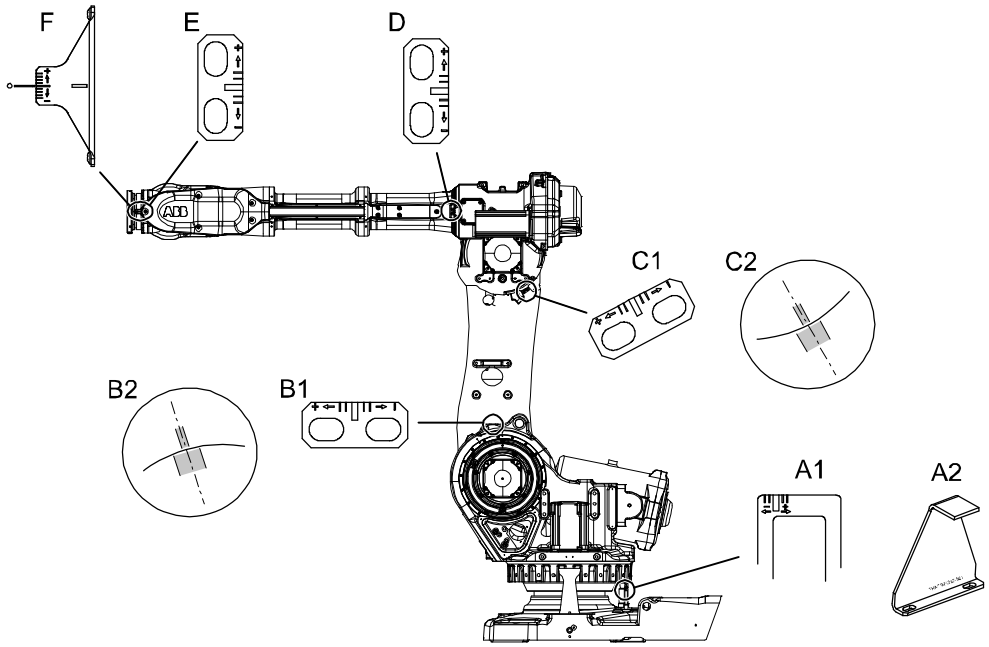
1.4.2.1 Synchronization marks and synchronization position for axes

Introduction

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

Synchronization marks, IRB 6650S

The figure shows IRB 6600, but the scales and their positions are the same.



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A1	Synchronization mark, axis 1 (early design)
A2	Synchronization mark, axis 1 (later design)
B1	Synchronization mark, axis 2 (early design)
B2	Synchronization mark, axis 2 (later design)
C1	Synchronization mark, axis 3 (early design)
C2	Synchronization mark, axis 3 (later design)
D	Synchronization mark, axis 4
E	Synchronization mark, axis 5
F	Synchronization mark, axis 6

Synchronization marks at axes 2 and 3

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

1.4.2.2 Calibration movement directions for all axes

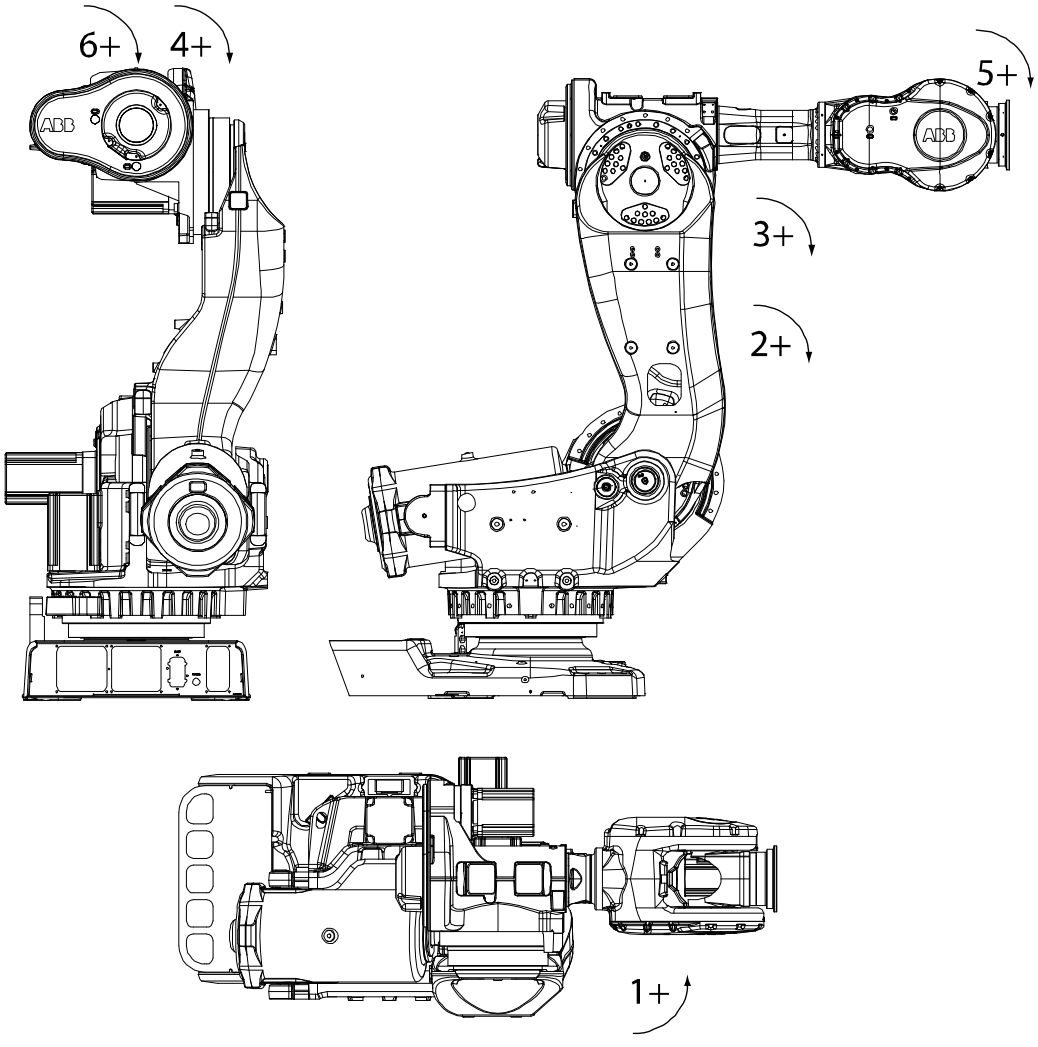
Overview

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

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

Manual movement directions, 6 axes

Note! The graphic shows an IRB 7600. The positive direction is the same for all 6-axis robots, except the positive direction of axis 3 for IRB 6400R, which is in the opposite direction!



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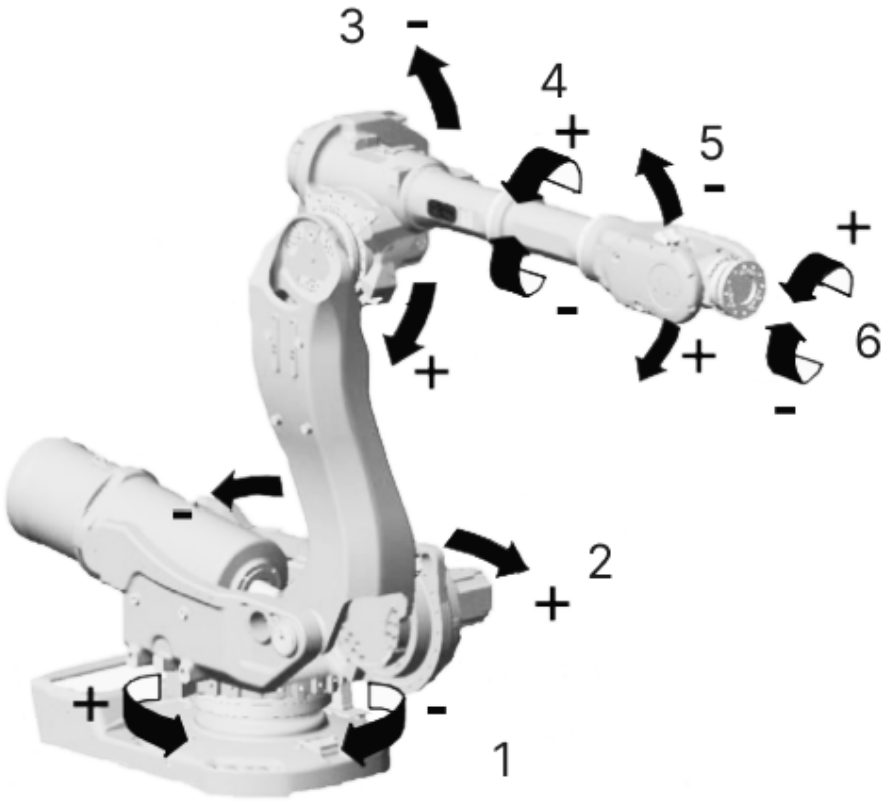
1.4.3 Fine calibration

General

Fine calibration is made using the Calibration Pendulum, see *Operating manual - Calibration Pendulum* or Axis calibration, see *Product manual - IRB 6650S*.



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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

1.4.4 Absolute Accuracy calibration

Purpose

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

Here are some examples of when this accuracy is important:

- Exchangeability of robots
- Offline programming with no or minimum touch-up
- Online programming with accurate movement and reorientation of tool
- Programming with accurate offset movement in relation to eg. vision system or offset programming
- Re-use of programs between applications

The option *Absolute Accuracy* is integrated in the controller algorithms and does not need external equipment or calculation.

Note

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

Note

Singularities might appear in slightly different positions on a real robot compared to RobotStudio, where *Absolute Accuracy* is off compared to the real controller.

What is included

Every *Absolute Accuracy* robot is delivered with:

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

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

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

When is *Absolute Accuracy* being used

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

Continues on next page

1.4.4 Absolute Accuracy calibration
Continued

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

Absolute Accuracy active

Absolute Accuracy will be active in the following cases:

- Any motion function based on robtargets (e.g. `MoveL`) and ModPos on robtargets
- Reorientation jogging
- Linear jogging
- Tool definition (4, 5, 6 point tool definition, room fixed TCP, stationary tool)
- Work object definition

Absolute Accuracy not active

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

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

Note

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

RAPID instructions

There are no RAPID instructions included in this option.

Production data

Typical production data regarding calibration are:

Robot	Positioning accuracy (mm)		
	Average	Max	% Within 1 mm
IRB 6650S-125/3.50 IRB 6650S-200/3.00	0.50	1.20	97
IRB 6650S-90/3.9	a	a	a

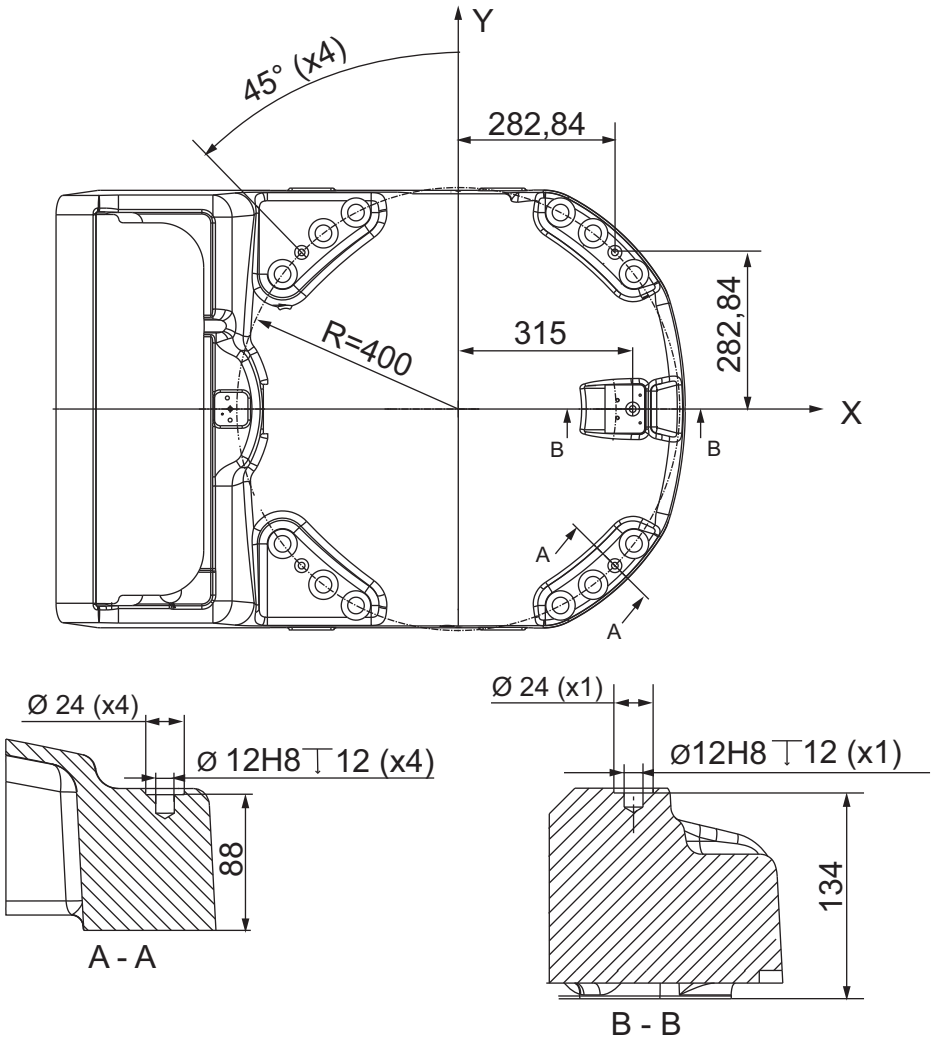
a. For detailed data and data missing in the table, please contact ABB for more information.

1.4.5 Robot references

Base

The holes shown in figure below are used for measuring the robot position when integrated in a production cell.

The holes are not available for option Foundry Plus.



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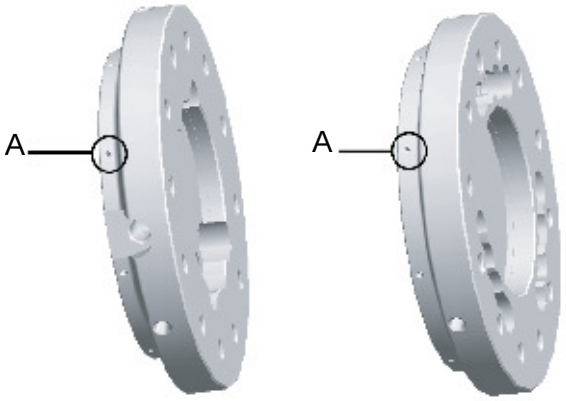
1.4.5 Robot references
Continued



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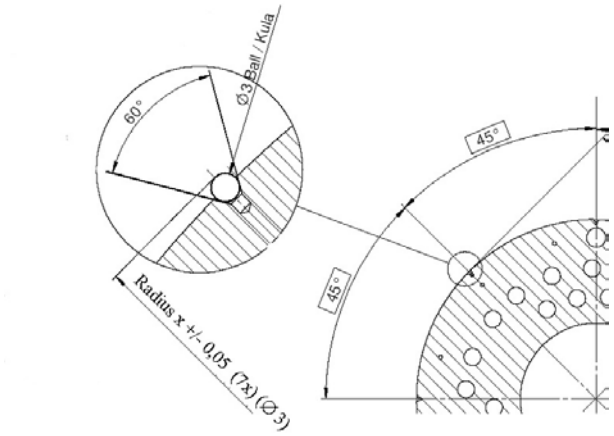

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Robot	Radius X (mm) for references on tool flange
IRB 6650S-90/3.90 IRB 6650S-125/3.50 IRB 6650S-200/3.00	R=87,5

1.5 Load diagrams

1.5.1 Introduction to Load diagrams

Information

WARNING

It is very important to always define correct actual load data and correct payload of the robot. Incorrect definitions of load data can result in overloading of the robot.

If incorrect load data is used, and/or if loads outside the load diagram are used, the following parts can be damaged due to overload:

- motors
- gearboxes
- mechanical structure

WARNING

In RobotWare, the service routine LoadIdentify can be used to determine correct load parameters. The routine automatically defines the tool and the load.

See *Operating manual - 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 payload inertia, J_0 of 15 kgm^2, and an extra load of 50 kg at the upper arm housing.

At different moment of inertia the load diagram will be changed. For robots that are allowed tilted, wall or inverted mounted, the load diagrams as given are valid and thus it is also possible to use RobotLoad within those tilt and axis limits.

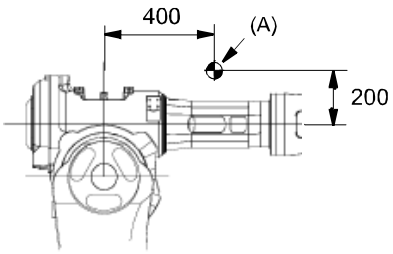
Continues on next page

1.5.1 Introduction to Load diagrams
Continued

Control of load case with RobotLoad

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

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



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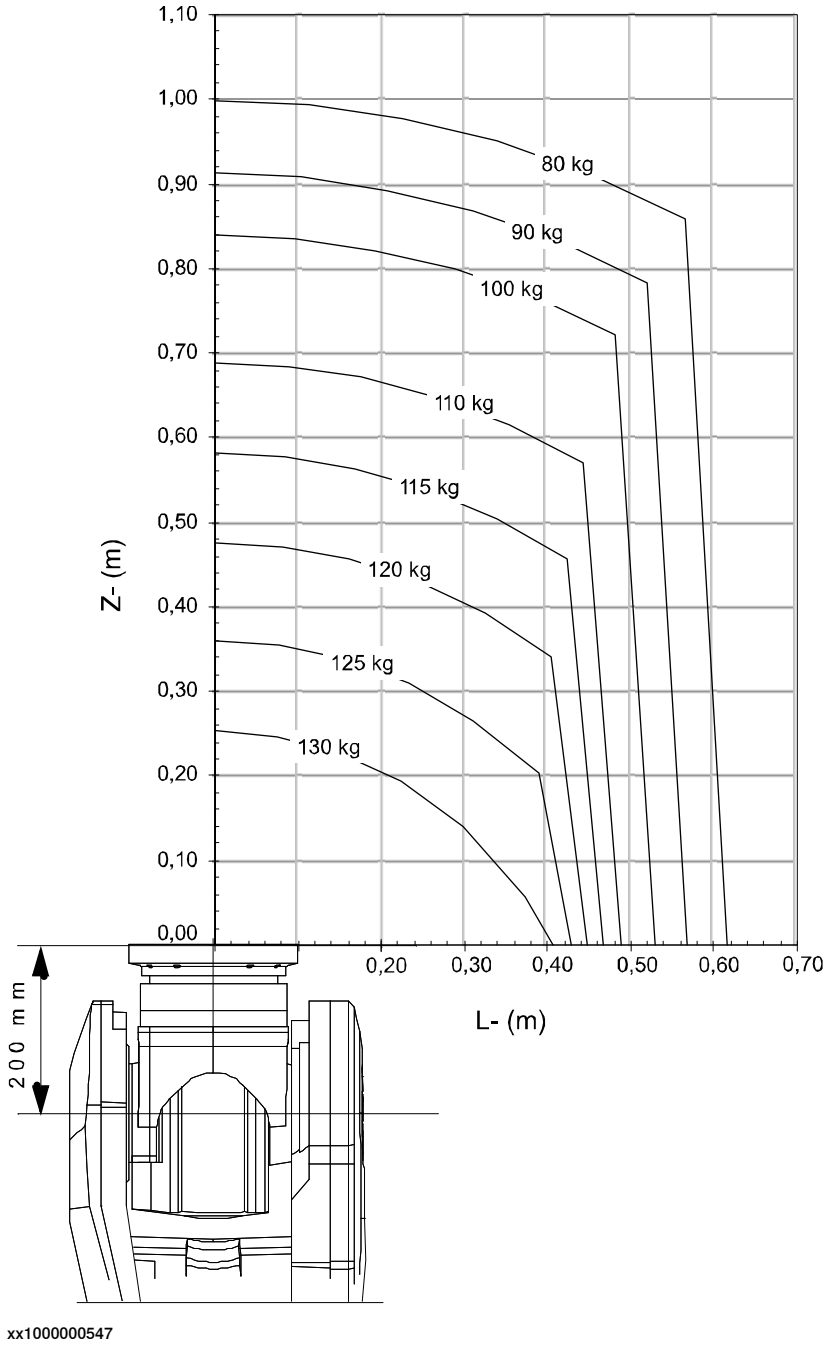
Pos	Description
A	Center of gravity 50 kg

1.5.2 Load diagrams

IRB 6650S-125/3.5



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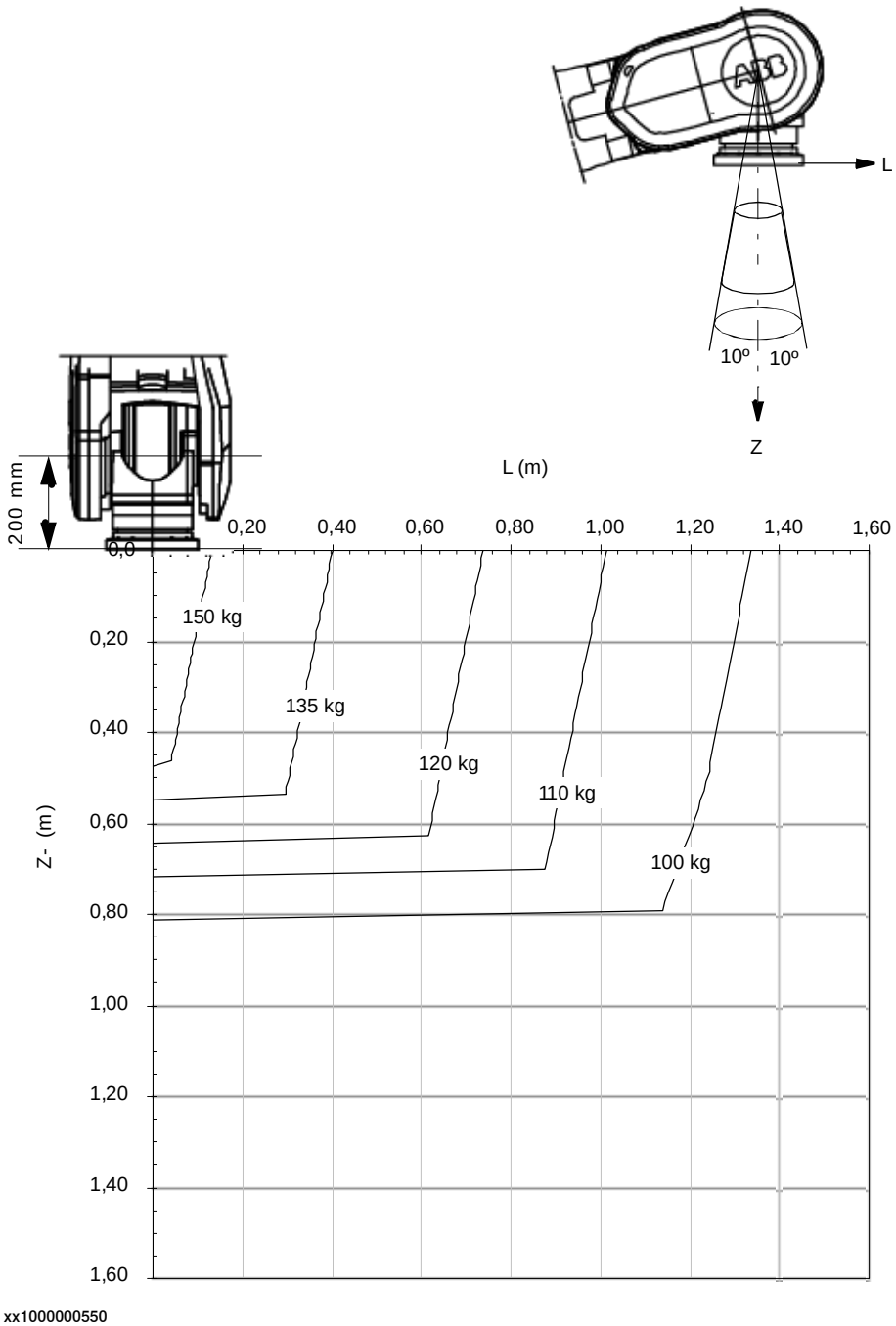
1.5.2 Load diagrams
Continued

IRB 6650S-125/3.5 “Vertical Wrist” (±10°)



xx1000000550

For wrist down (0° deviation from the vertical line).

	Description
Max load	150 kg
Z_{max}	0,462 m
L_{max}	0,156 m

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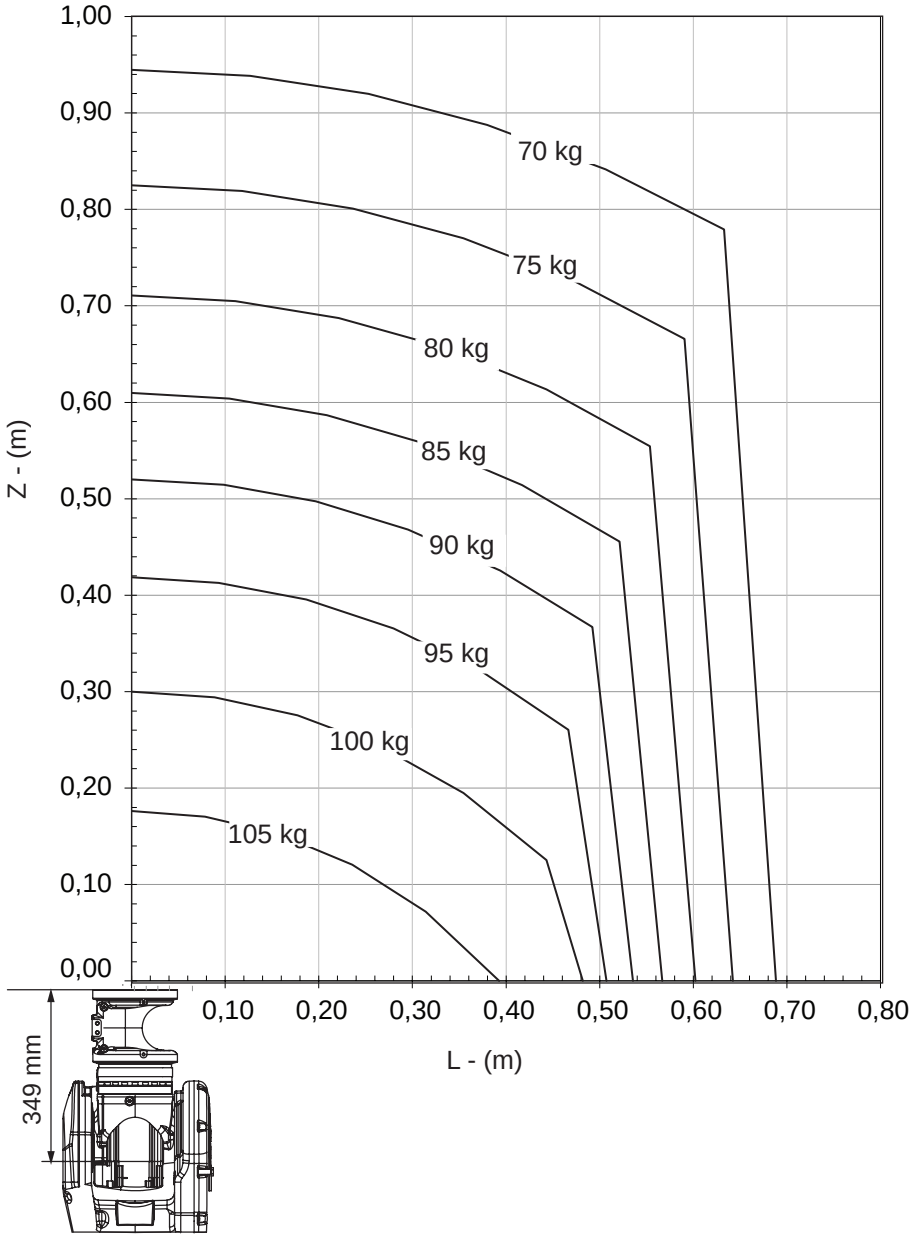
IRB 6650S-125/3.5 LeanID, with option 780-4



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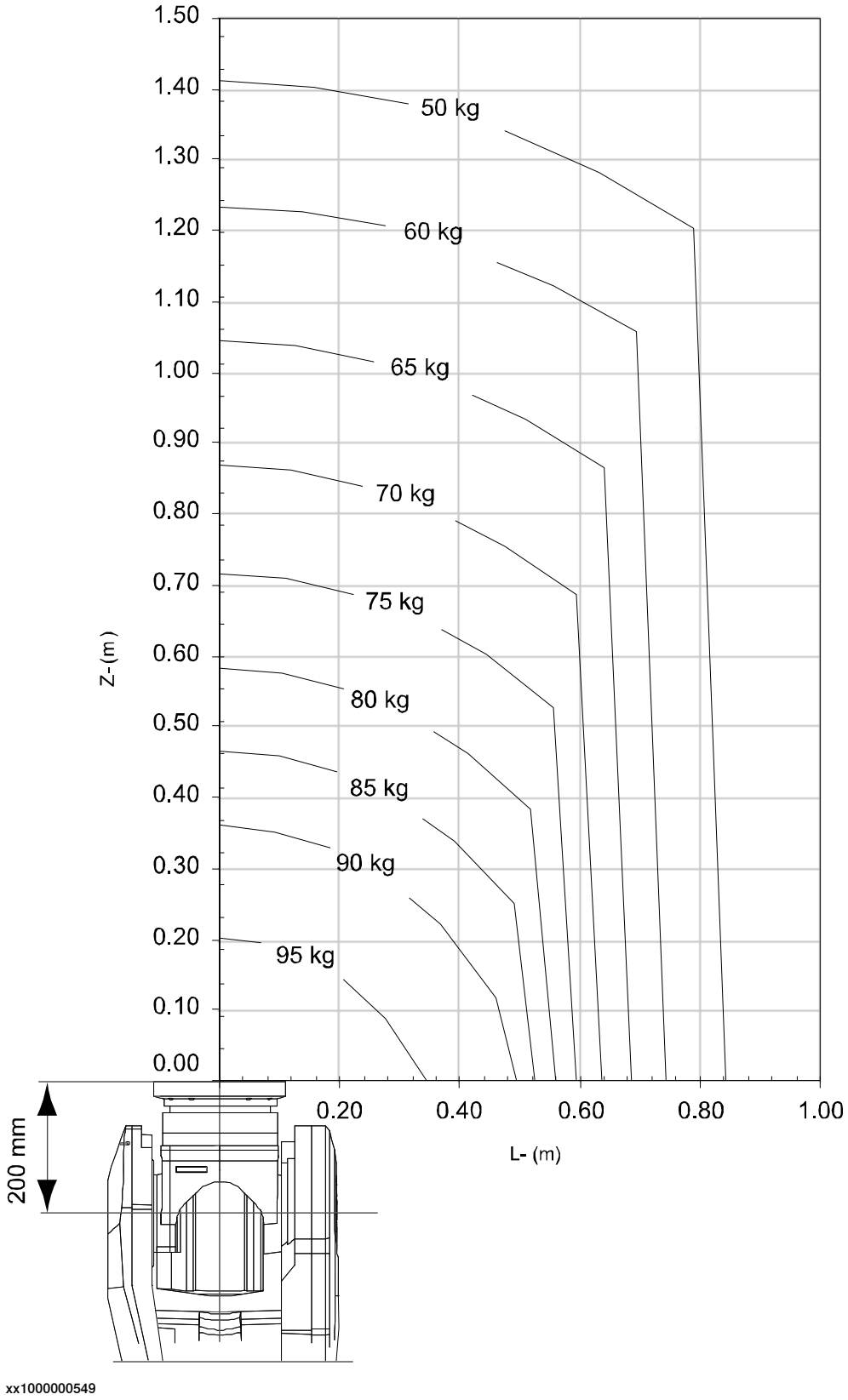
1.5.2 Load diagrams
Continued

IRB 6650S-90/3.9



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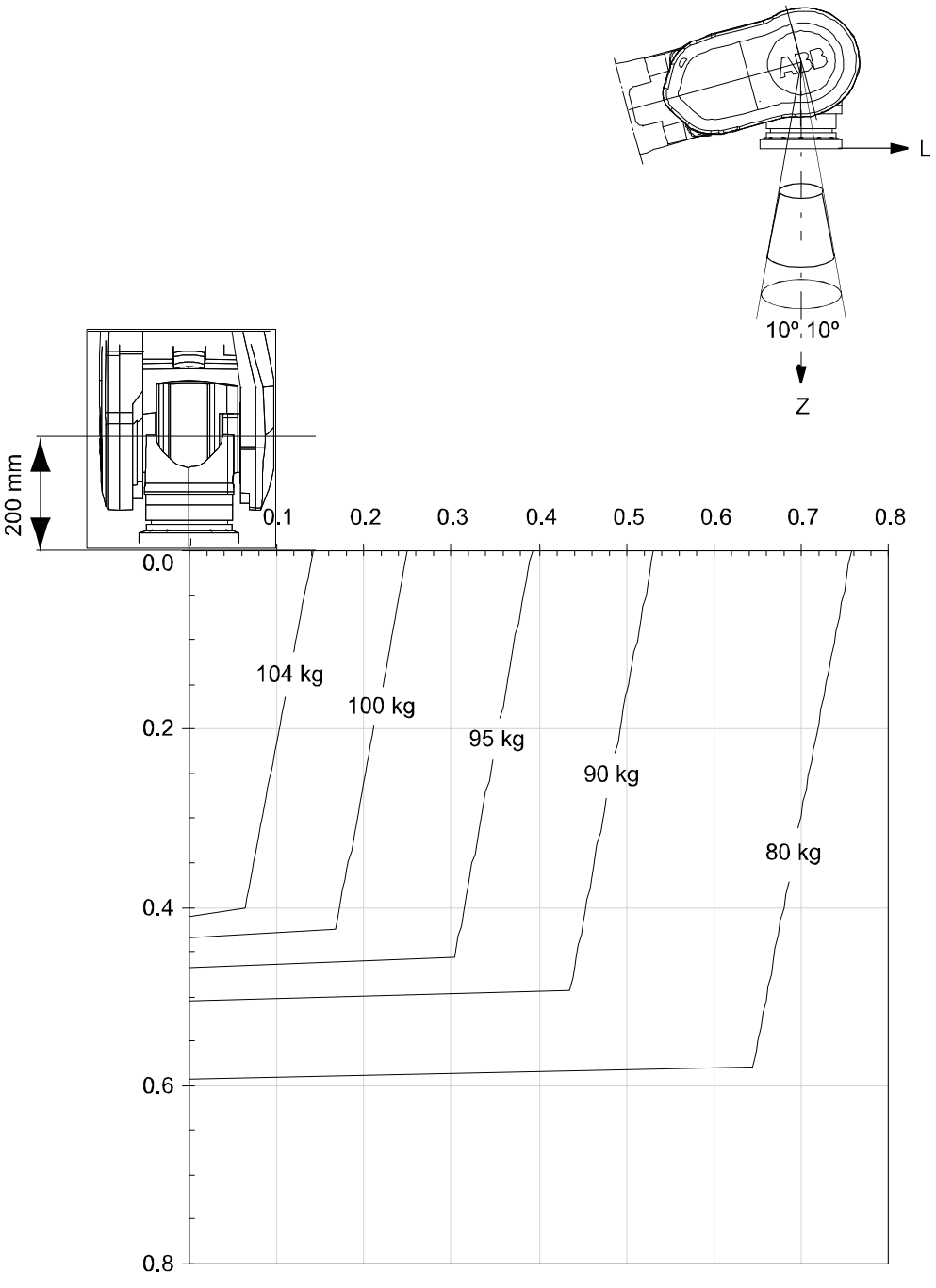
IRB 6650S-90/3.9 “Vertical Wrist” (±10o)



xx1000000551

For wrist down (0° deviation from the vertical line).

	Description
Max load	107 kg
Z_{max}	0,2 m
L_{max}	0.1 m

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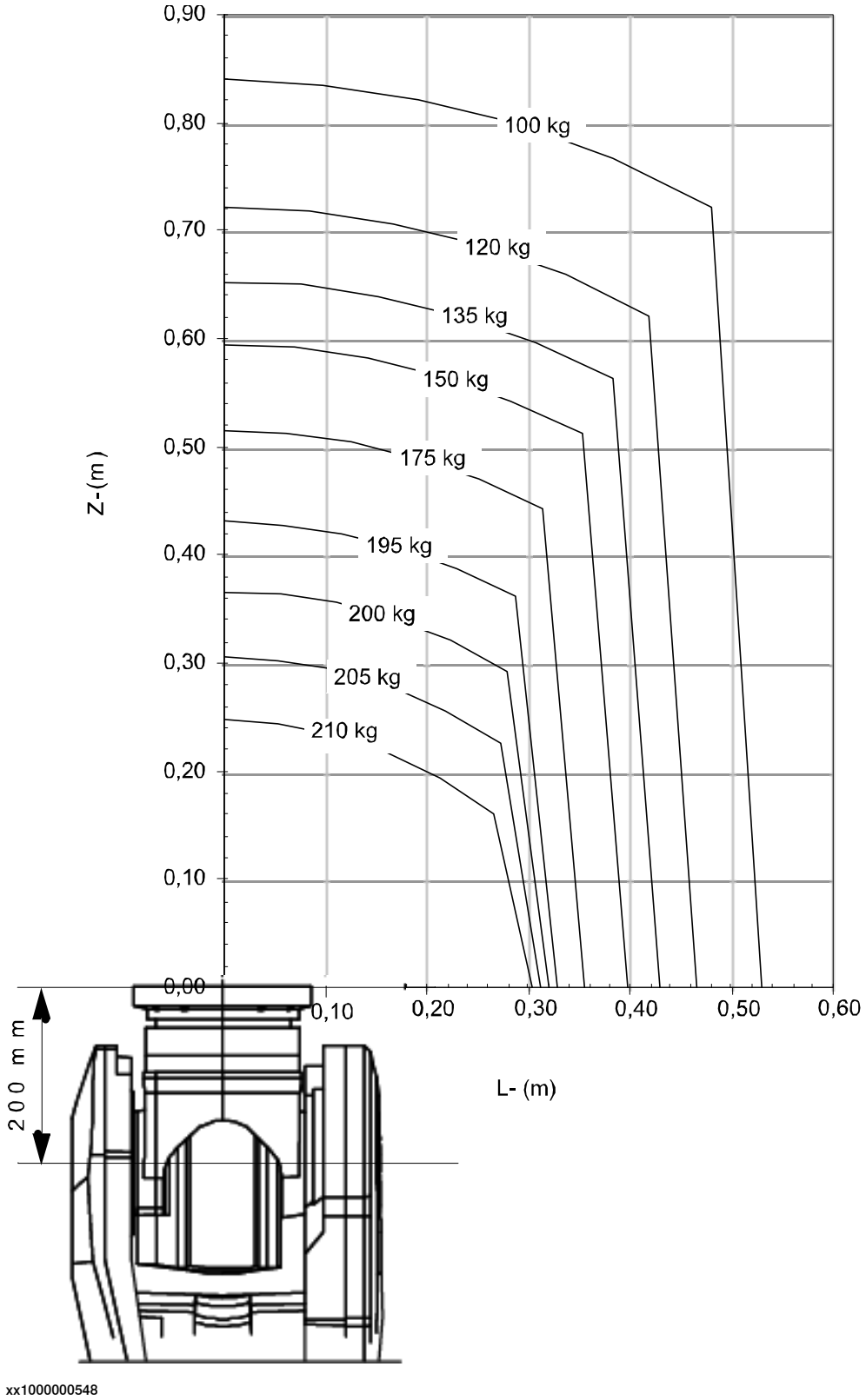
1.5.2 Load diagrams
Continued

IRB 6650S-200/3.0



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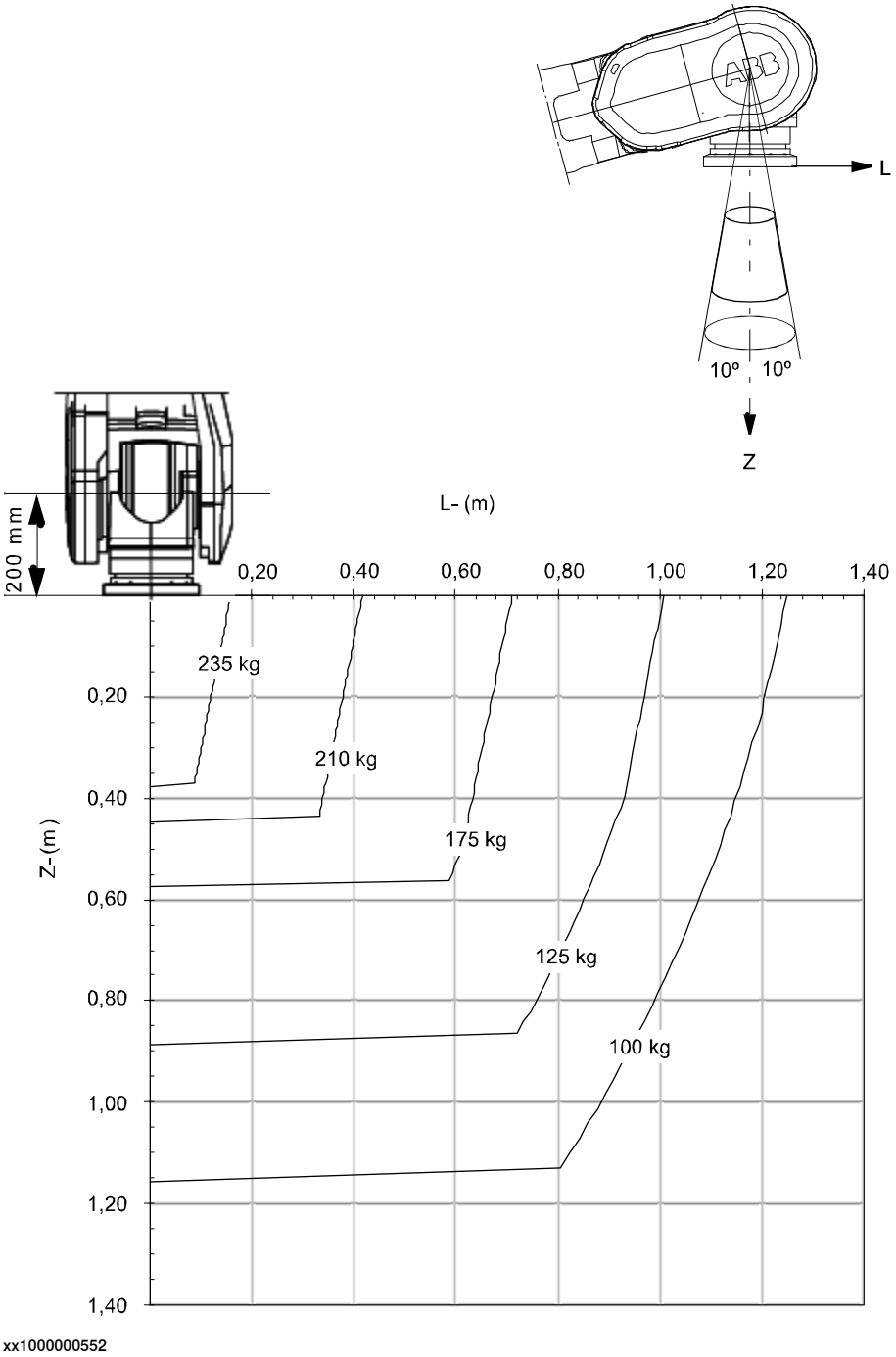
IRB 6650S-200/3.0“ Vertical Wrist” (±10°)



xx1000000552

For wrist down (0° deviation from the vertical line).

	Description
Max load	245 kg
Z_{max}	0,345 m
L_{max}	0,098 m

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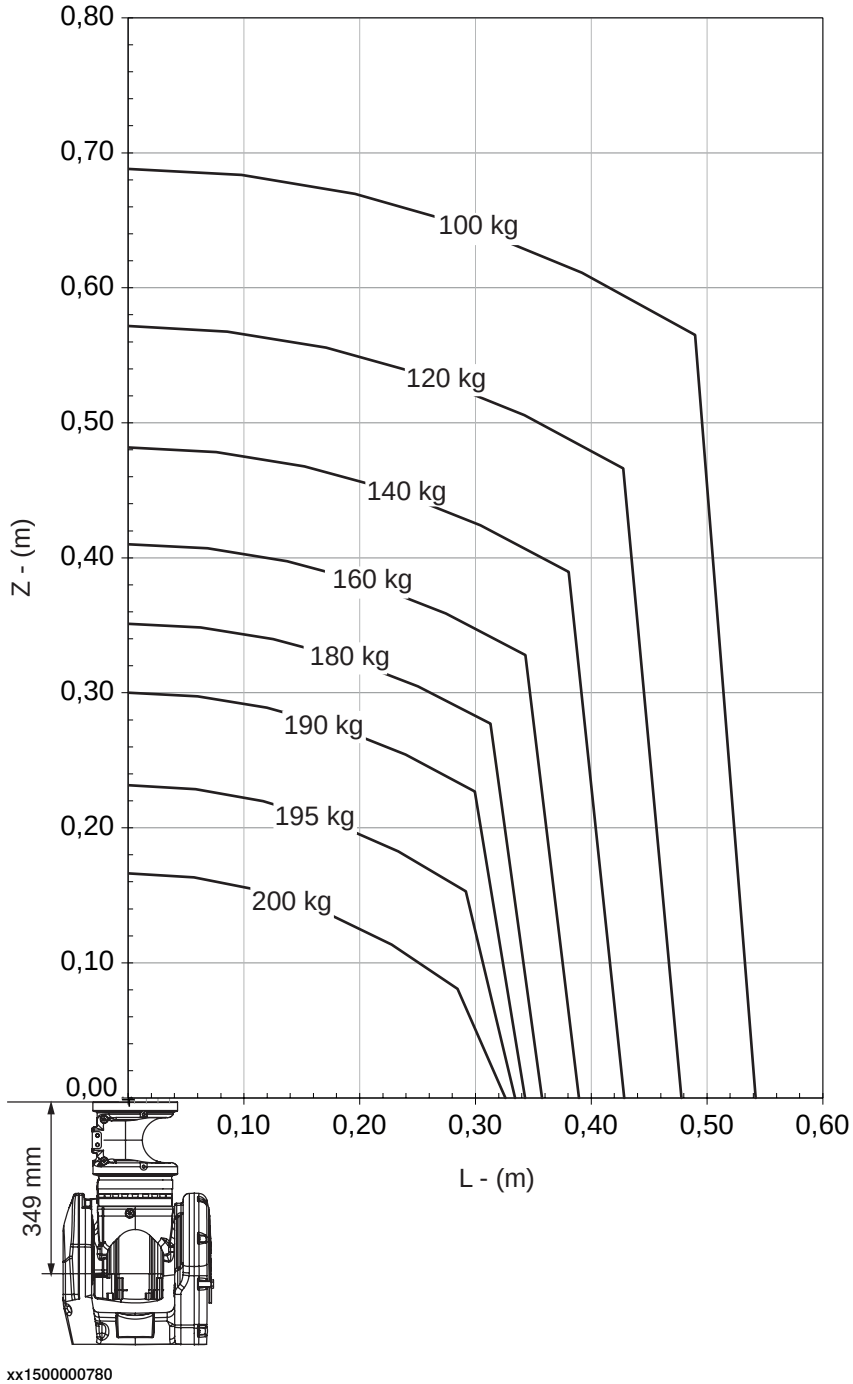
1.5.2 Load diagrams
Continued

IRB 6650S-200/3.0 LeanID, with option 780-4



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

Note

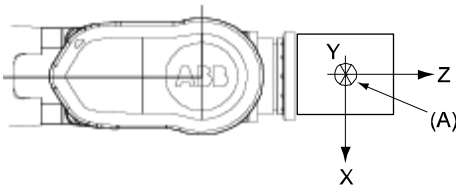
Note

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

Full movement of axis 5 (±120°)

Axis	Robot Type	Maximum moment of inertia
5	125/3.5, 200/3.0 and 90/3.9	Ja5 = Load x $((Z + 0{,}200^{i})^2 + L^2)$ + max (J_{0x}, J_{0y}) ≤ 250 kgm^2
6	125/3.5, 200/3.0 and 90/3.9	Ja6 = Load x L^2 + J0Z ≤ 185 kgm^2

i For LeanID=0,349 m (option 780-4)



xx0900000774

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	Maximum moment of inertia
5	125/3.5, 200/3.0 and 90/3.9	Ja5 = Load x $((Z + 0{,}200^{i})^2 + L^2)$ + max (J_{0x}, J_{0y}) ≤ 275kgm^2
6	125/3.5, 200/3.0 and 90/3.9	Ja6 = Load x L^2 + J_{0Z} ≤ 250 kgm^2

i For LeanID=0,349 m (option 780-4)

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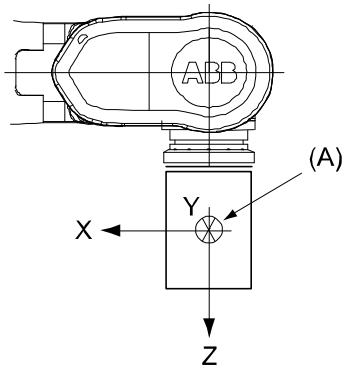
1.5.3 Maximum load and moment of inertia for full and limited axis 5 (center line down) movement
Continued



xx0900000775

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.

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 6650S-200/3.0	1,264 Nm	625 Nm	192 kg
IRB 6650S-125/3.5	1,037 Nm	526 Nm	105 kg
IRB 6650S-90/3.9	495 Nm	438 Nm	60 kg

1.5.5 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 6650S - 200/3.0	53	21
IRB 6650S - 125/3.5	60	25
IRB 6650S - 90/3.9	48	31

Note

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

1.6 Mounting equipment

1.6.1 Introduction

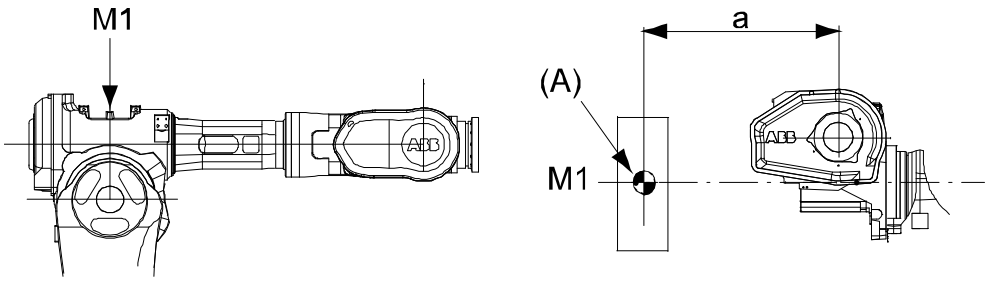
General

Extra loads can be mounted on the upper arm housing, the lower arm, and on the frame. Definitions of distances and masses are shown in the next two Figures. The robot is supplied with holes for mounting extra equipment (see Figure in next chapter). Maximum allowed arm load depends on center of gravity of arm load and robot payload.

Upper arm

Allowed extra load on upper arm housing plus the maximum handling weight(see Figure below):

M1 ≤ 50 kg with distance a ≤ 500 mm, center of gravity in axis 3 extension.



xx1000000495

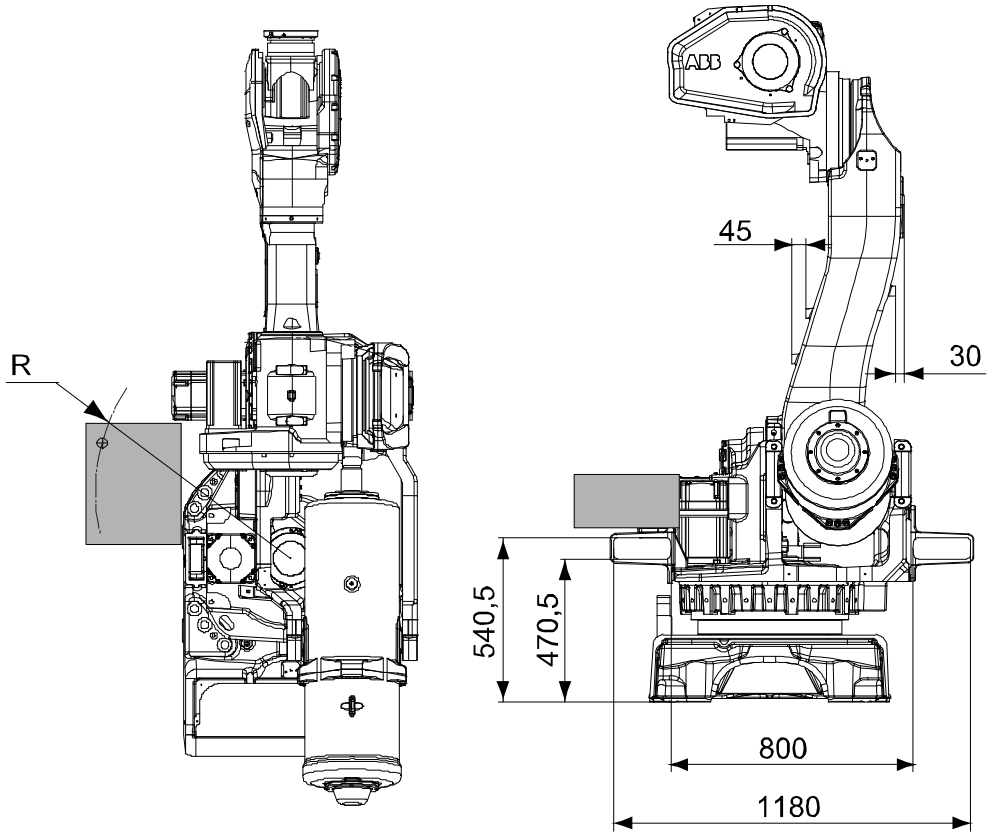
Pos	Description
A	Mass center

Continues on next page

1.6.1 Introduction
Continued

Frame (Hip Load)

	Description
Permitted extra load on frame	J_H = 200 kgm^2
Recommended position (see Figure below)	$J_H = J_{H0} + M4 \times R^2$ where: J_{H0} is the moment of inertia of the equipment R is the radius (m) from the center of axis 1 M4 is the total mass (kg) of the equipment including bracket and harness (≤ 500 kg)



xx1000000496

Pos	Description
A	View from above
B	View from the rear

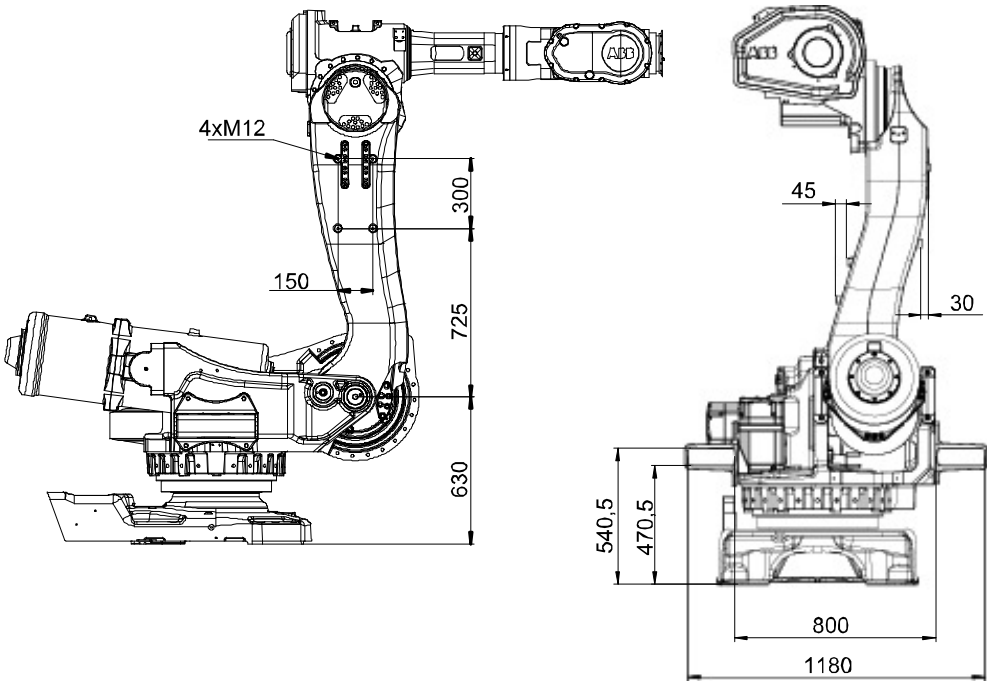
1.6.2 Mounting of hip load

General

The extra load can be mounted on the frame. Holes for mounting see next two Figures. When mounting on the frame all four holes (2x2, Ø 16) on one side must be used.

If loads exceeding 50 kg is required on lower arm, use the calculation program ABB RobotLoad, please contact your local ABB organization.

6650S



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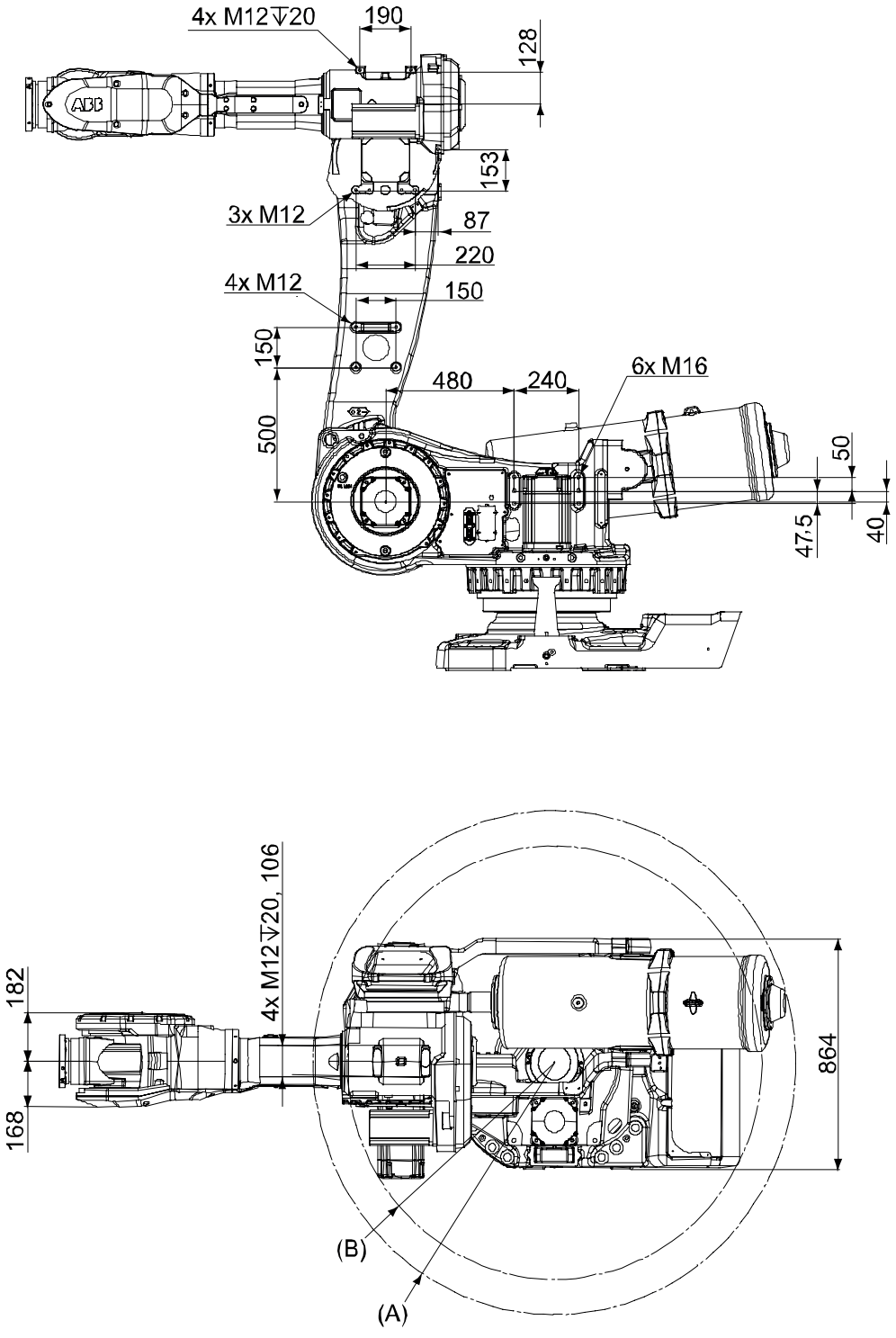
1.6.2 Mounting of hip load
Continued



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Pos	Description
A	R 946 (Rear side, Balancing device)
B	R 813 (Front side, Motor axis 2)

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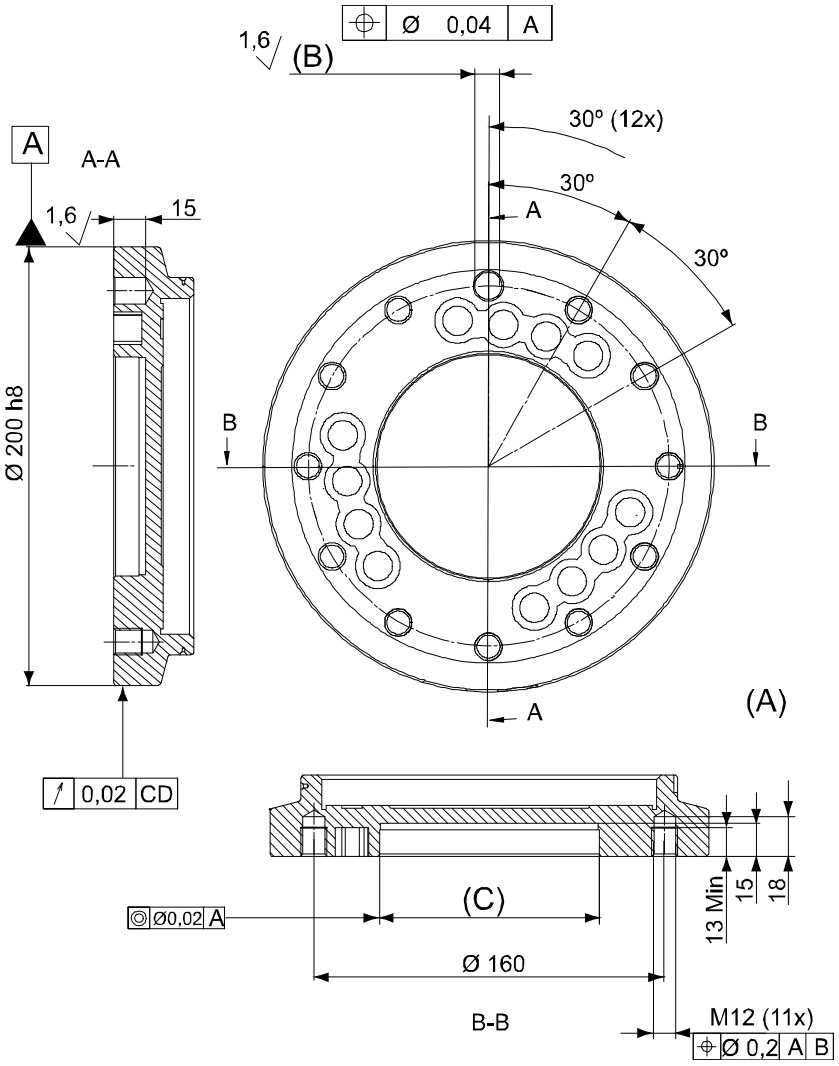
Tool flange also valid for LeanID.



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Pos	Description
A	Minimum thread length for screws in M12-hole is 9 mm.
B	Ø 12 H7 Depth 15
C	Ø 100 H7 Depth 8 min

Fastener quality

When fitting tools on the tool flange, only use screws with quality 12.9. For other equipment use suitable screws and tightening torque for your application.

1.7 Maintenance and troubleshooting

1.7.1 Introduction

General

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

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

Maintenance

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

1.8 Robot motion

1.8.1 Introduction

Type of Motion

Axis	Type of motion	Range of movement, IRB 6650S
1	Rotation Motion	+ 180° to - 180° + 220° to - 220° (option)
2	Arm motion	+ 160° to - 40°
3	Arm motion	+ 70° to - 180°
4	Wrist motion	+ 300° to - 300°
5	Bend motion	+ 120° to - 120°
6	Turn motion	+ 360° to - 360° default ± 96 Rev[i] Max.[ii]

i Rev. = Revolutions

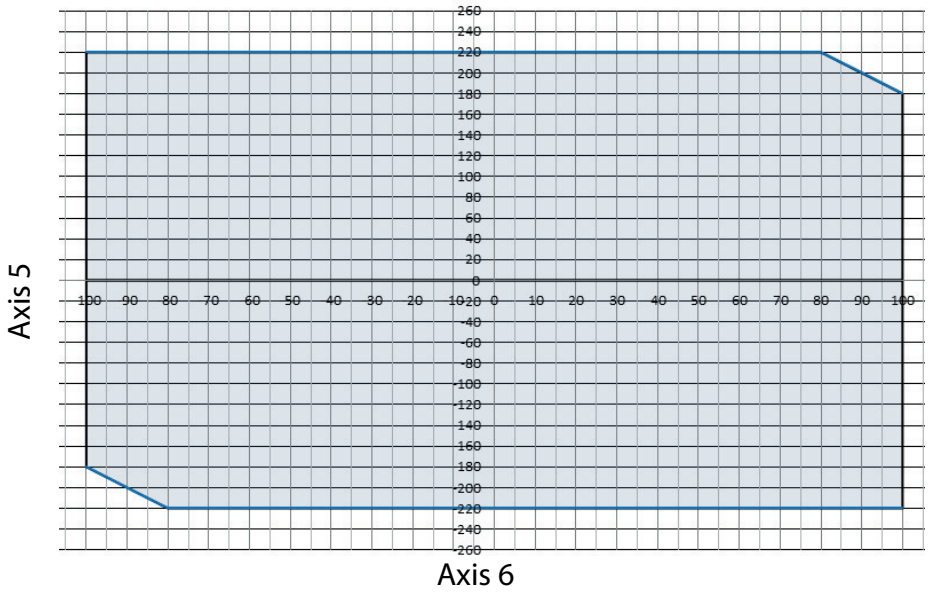
ii The default working range for axis 6 can be extended by changing parameter values in the software. (option 780-4)Option 610-1 “Independent axis” can be used for resetting the revolution counter after the axis has been rotated (no need for “rewinding” the axis).

Note

Note! For limitation of range of motion in combination with DressPack see *Introduction on page 59*.

Working range axis 5 and 6 for LID variants (option 780-4)

Allowed working area for axis 6 related to axis 5 position is shown in the figure below.



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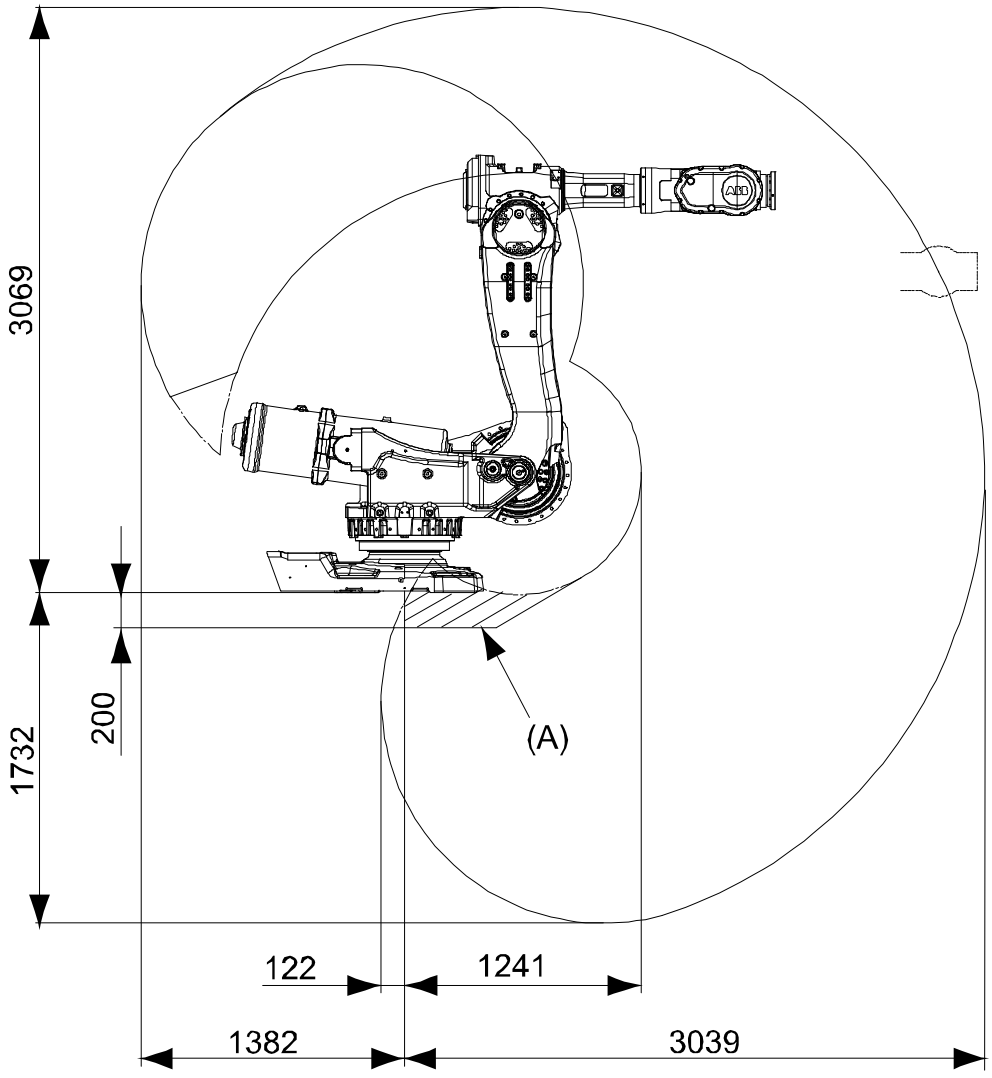
1.8.1 Introduction
Continued

Robot variant	Handling capacity (kg)	Reach (m)
IRB 6650S-200/3.0	200	3.0



xx1000000500

Pos	Description
A	Marked area not available under the robot base.

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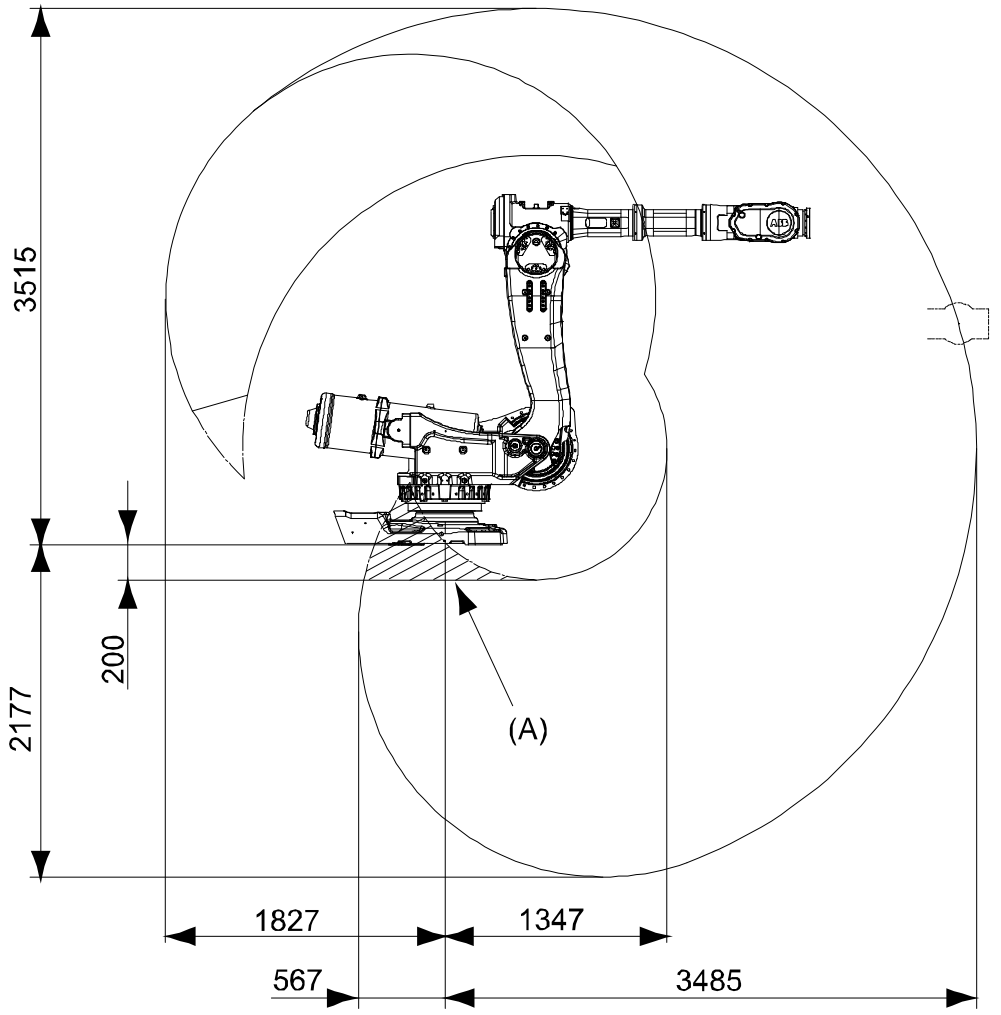
Robot variant	Handling capacity (kg)	Reach (m)
IRB 6650S-125/3.5	125	3.5



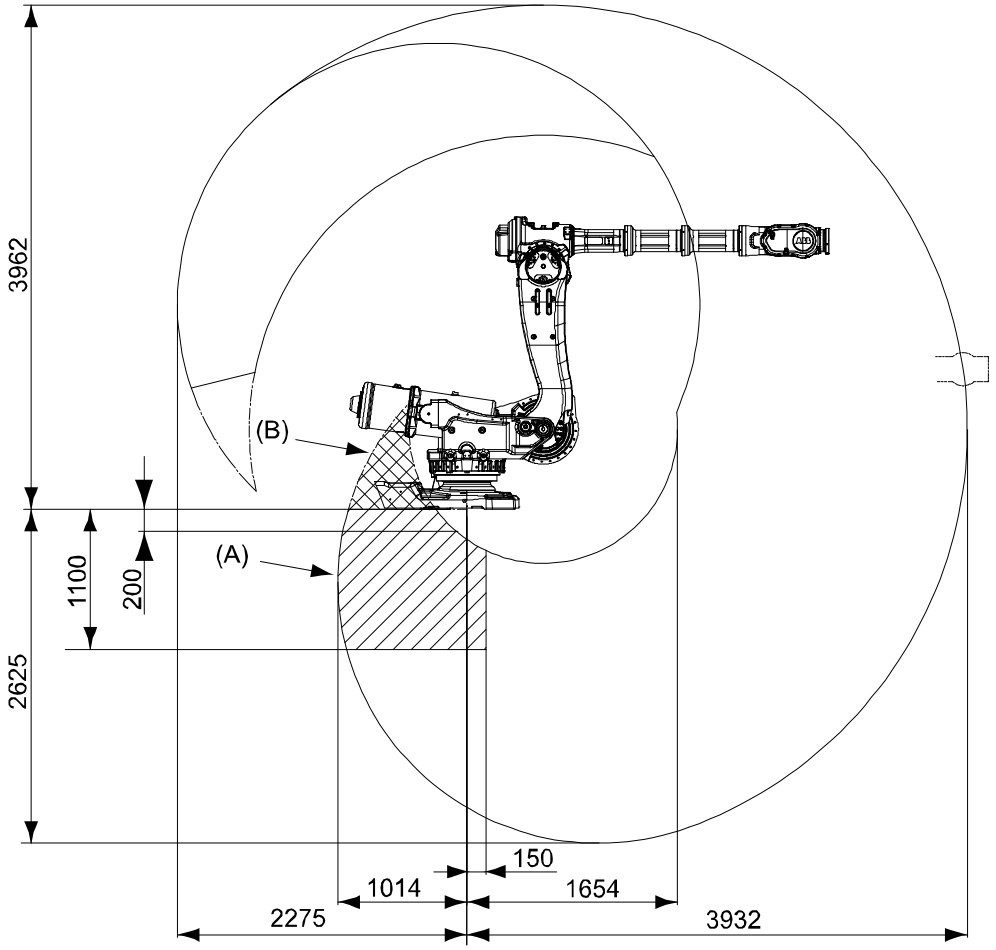
xx1000000502

Pos	Description
A	Marked area not available under the robot base.

Continues on next page

1.8.1 Introduction
Continued

Robot variant	Handling capacity (kg)	Reach (m)
IRB 6650S-90/3.9	90	3.9



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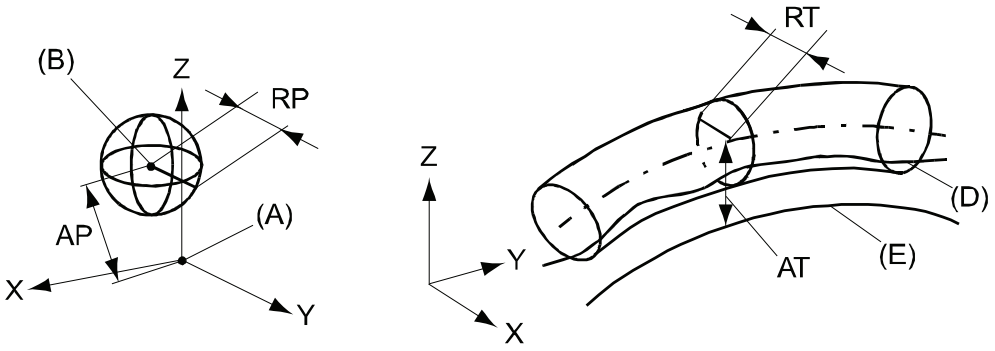
Pos	Description
A and B	Marked area, max. payload 50 kg
B	Marked area not available under the robot base

1.8.2 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

IRB 6650S	125/3.5	200/3.0	90/3.9
Pose accuracy, AP [a] (mm)	0.16	0.13	[b]
Pose repeatability, RP (mm)	0.13	0.14	0.13
Pose stabilization time, PSt (s) within 0.4 mm of the position	0.33	0.18	[b]
Path accuracy, AT (mm)	2.58	2.98	[b]
Path repeatability, RT(mm)	0.90	0.70	[b]

a. 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.

b. The values for IRB 6650S-90/3.9 are not available.

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

1.8.3 Velocity

Maximum axis speeds

Robot Type	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
IRB 6650S-90/3.9	100°/s	90°/s	90°/s	150°/s	120°/s	235°/s
IRB 6650S-125/3.5	110°/s	90°/s	90°/s	150°/s	120°/s	235°/s
IRB 6650S-200/3.0	100°/s	90°/s	90°/s	150°/s	120°/s	190°/s

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

1.8.4 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*).

1.9 Cooling fan for axis 1 and 2 motor

1.9.1 Introduction

Option 87-1, 88-1

To be used to avoid overheating of motors and gears in applications with intensive motion (high average speed and /or high average torque and/or short wait time) of axis 1 and/or axis 2.

Valid protection for cooling fan is IP54. Fan failure stops the robot. The option is not allowed to select when the robot is placed on a track motion, IRBT.

To determine the use of cooling fans for axis 1 and/or axis 2 motor use the “Gearbox Heat Prediction Tool” in RobotStudio. Reliable facts for the decision of need for fan or not will be achieved by entering the ambient temperature for a specific cycle. Please contact your local ABB organization.

1.10 Servo gun

1.10.1 Introduction

General

The robot can be supplied with hardware and software for control of the following configurations:

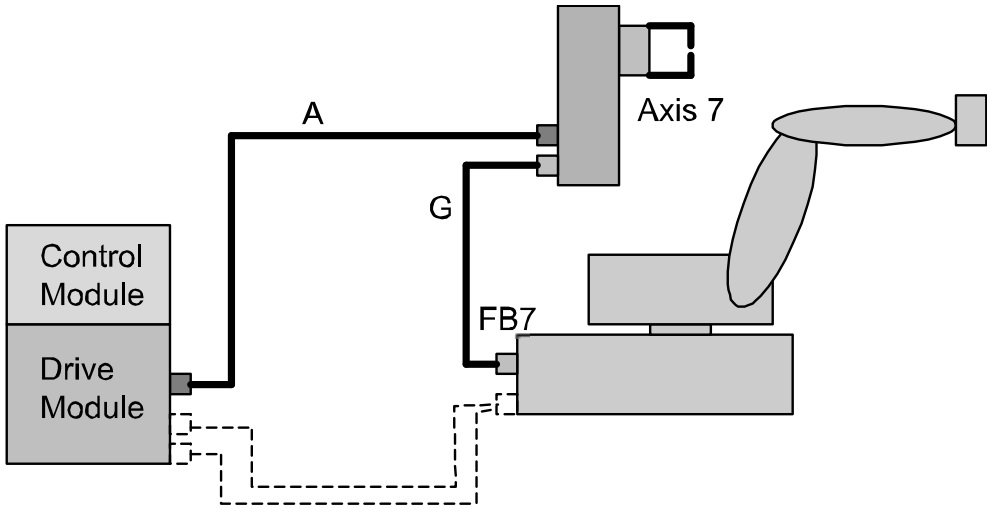
- Stationary Gun
- Robot Gun
- Robot Gun and Track Motion
- Track motion

The specific parts related to the servo motor control for electrical welding guns and for track motion configurations are shown in the conceptual pictures below. The major parts and required options are also stated in the configurations lists below each picture.

The cables for control of the basic robot are shown in the pictures with dotted lines.

1.10.2 Stationary Gun

General



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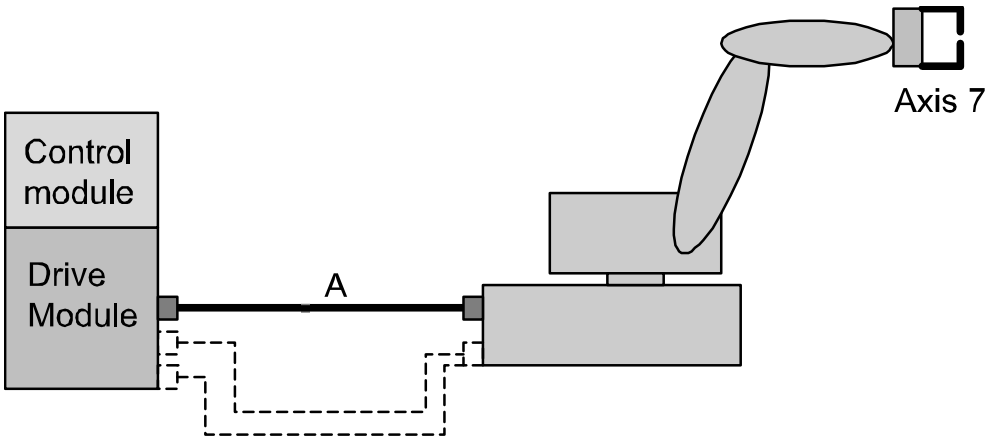
Options

Options according to the table below are required to complete the delivery. For further details on each option see the corresponding product specification.

Option	Description	Product specification
785-5	Stationary gun. This option includes: Cable G (7 m length) for resolver signals from robot base (FB7) to stationary gun/axis 7.	
770-4	First additional drive. Drive unit for 7th axis with corresponding cables assembled inside Drive Module.	*Product specification - Controller IRC5*
786-1,-2,-3,-4	Connection to first drive. Cable A (7-30 m) between Drive Module and stationary gun/axis 7 for servo drive power.	
635-3, -4 or -5	Spot Servo, Spot Servo Multiple Guns or Spot Servo Equalizing.	*Product specification - Controller software IRC5*

1.10.3 Robot Gun

General



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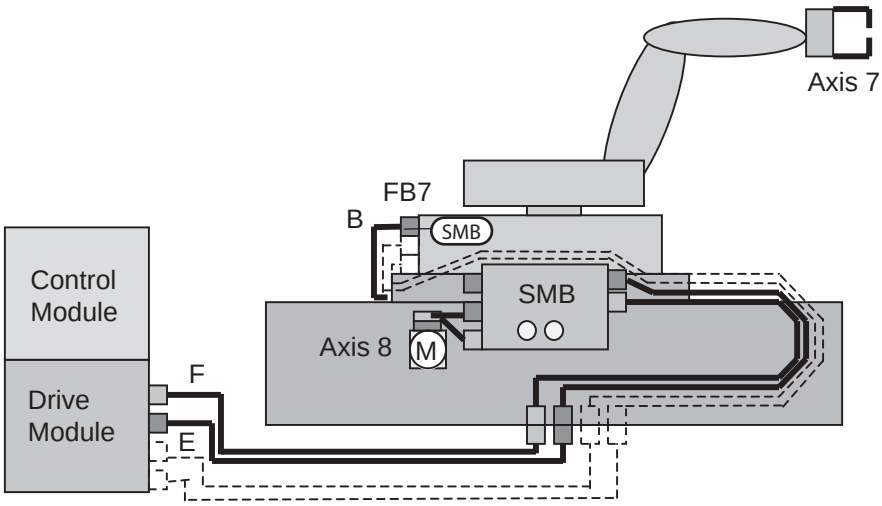
Options

Options according to the table below are required to complete the delivery. For further details on each option see the corresponding product specification.

Option	Description	Product specification
785-1	Robot gun. This option includes: Cables within manipulator for servo power signals (servo gun/axis 7).	
770-4	First additional drive. Drive unit for 7th axis with corresponding cables assembled inside Drive Module.	*Product specification - Controller IRC5*
786-1,-2,-3,-4	Connection to first drive. Cable A (7-30 m) between Drive Module and robot base for servo drive power.	
635-3, -4 or -5	Spot Servo, Spot Servo Multiple Guns or Spot Servo Equalizing.	*Product specification - Controller software IRC5*

1.10.4 Robot Gun and Track Motion IRBT 6004

General



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Options

Options according to the table below are required to complete the delivery. For further details on each option see the corresponding product specification.

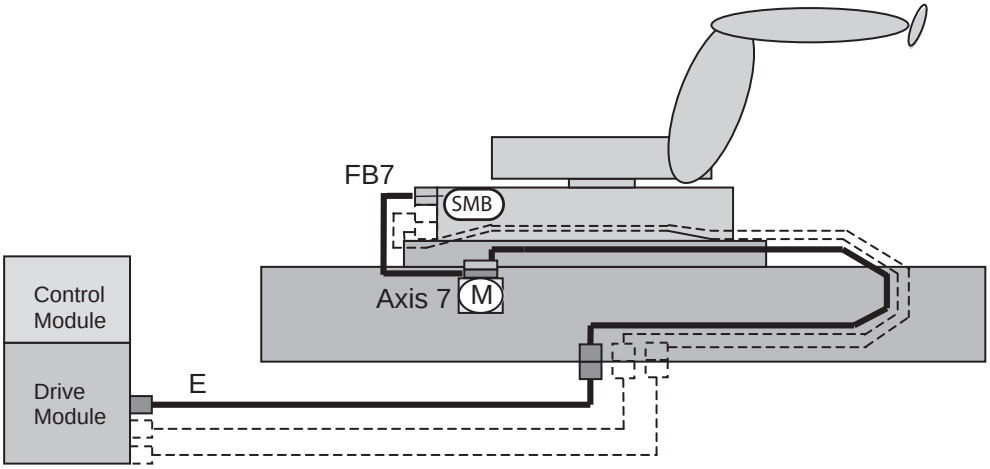
Option	Description	Product specification
785-1+1002-2 [i]	Robot Gun - Track Motion. This option includes:Cables within manipulator for servo power signals (servo gun/axis 7).	Track motionIRBT 6004 + IRB 6600
Track motion delivery includes	Serial measurement box (SMB2, Split box) for distribution of servo power to axis 8. The box is placed on the track motion. Cables from serial measurement box to track motion. Cable B for servo power (1,5 m length).Connection to first and second drive. Cable E and F (7-22 m) between Drive Module and serial measurement box for dual servo drive power/resolver signals.	Track motionIRBT 6004/IRBT 7004
907-1	First additional drive. Drive unit for 7th axis with corresponding cables assembled inside Drive Module.	Controller IRC5 with FlexPendant
907-1	Second additional drive. Drive unit for 8th axis with corresponding cables assembled inside Drive Module.	Controller IRC5 with FlexPendant
635-3, -4 or -5	Spot Servo, Spot Servo Multiple Guns or Spot Servo Equalizing.	Controller software IRC5
864-1	Resolver connection, axis 7, on base (FB7).	

[i] To specify robot on track equipped with servo gun. Option 1002-2 from specification form for Track Motion.

1.10.5 Track Motion IRBT 6004

General

The robot can be supplied with a Track Motion, see Product specification - IRBT 6004. For configuration and specification of hardware see Figure below.



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Options

Options according to the table below are required to complete the delivery. For further details on each option see the corresponding product specification.

Option	Description	Product specification
Track motion delivery includes	Serial measurement (SMB) in manipulator is used, together with option 864-1, FB7 for signals to axis 7/Track motion. Cable E for between Drive Module and track motion servo for drive power.	IRBT 6004/IRBT 7004
907-1	First additional drive. Drive unit for 7th axis with corresponding cables assembled inside Drive Module.	
864-1	Resolver connection, axis 7, on base (FB7).	

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2 DressPack

2.1 Introduction

2.1.1 General

DressPack

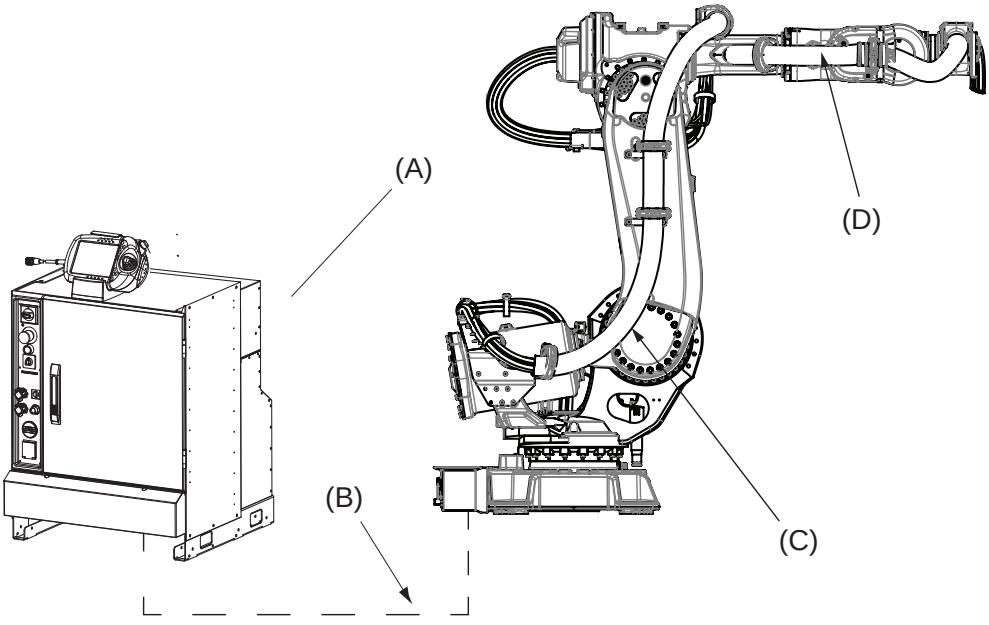
Includes options for Upper arm, Lower arm and Floor pos C, D, see Figure below. These are described separately below but are designed as a complete package for various applications.

The DressPack for the floor contains customer signals.

The DressPack for upper and lower arm contains process cable packages including signals, process media (water and/or air) and power feeding (for Spot Welding power) for customer use.

Necessary supports and brackets are also included.

The routing of the process cable package on the robot is available in different configurations.



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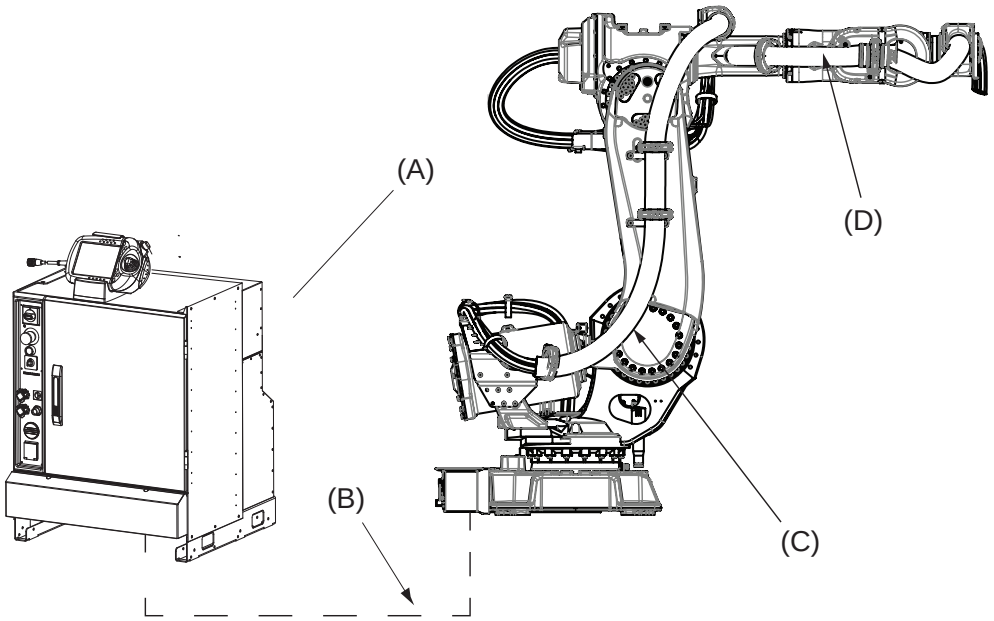
2.1.1 General
Continued

Spot welding

The package supplies the transformer gun/gripper with necessary media, such as compressed air, cooling water and electrical power. It includes the above described DressPack and software.



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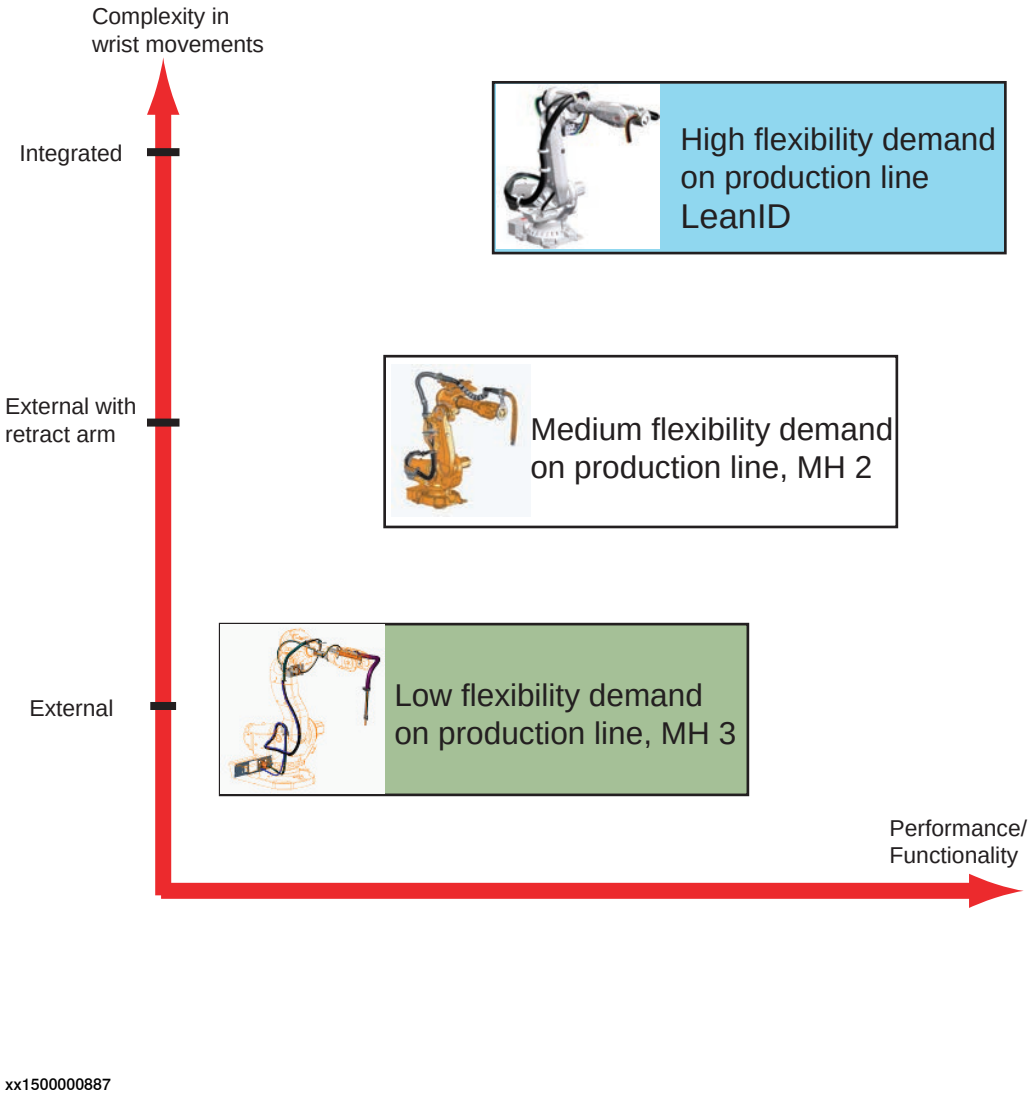
Pos	Description
A	Robot controller, (including 7th axis drive for servo gun)
B	DressPack, Floor
C	DressPack, Lower arm
D	DressPack, Upper arm

2.1.2 Product range

DressPack solutions for different user's needs

The robot can be equipped with the well integrated cable and hose packages in the DressPack option. The DressPack is designed in close conjunction with the development of the manipulator and is therefore well synchronized with the robot.

As there is a big span between different user's need of flexibility, depending of the complexity of the operation/wrist movements, there are three major levels of dress pack solutions available, see Figure below.



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2.1.2 Product range
Continued

External with retract arm

This type of dress pack is recommended for production where there are limited complexity in wrist movements. This normally occurs when there are not to many different products running in the same production cell.

Available option are 798-2 and 780-2 for both material handling/spot welding.

Integrated

This type of dress pack is intended for a production where there are many complex wrist movements and the need for flexibility in changing products is high.

Available options are 798-3 and 780-4 for material handling/spot welding, the LeanID concept.

External

This type of dress pack is recommended where there are less complexity in wrist movements. This normally occurs when there are not many different products running in the production cell. This package requires more individual adjustment to optimize towards robot program at set up.

Available options are 798-3 and 780-3 for material handling.

2.1.3 Limitations of robot movements

General

When using DressPack options on the upper arm the robot movements will be limited. The position of bracket installed on axis 6 must be taken in consideration when optimizing the possible robot movements.

- The axis 5 working range is limited to +/- 110 degrees due to the axis 6 bracket attachment (when applicable).
- In bending backwards positions there are limitations due to inteference with manipulator or Water and Air unit (if such is mounted).

Note

For more detailed information, contact your local ABB office.

Restrictions for LeanID, option 780-4

Limitation for axis 5 and 6 depends on how the dresspack is assembled at the tool and how adjustment has been done.

Axis	Working range
Axis 5	+100° to -100°
Axis 6	+220° to -220°

2.1.4 Impact on DressPack lifetime

General

There are some robot movements/positions that shall be avoided in the robot production program. This to improve the lifetime significantly of external upper arm DressPack and wear parts, for example, protection hose, hose reinforcement, and protective sleeves.

- The axis 5 movement is not allowed to press the DressPack against the robot upper arm.
- Combined rotation of the wrist axes must be limited so that the DressPack is not wrapped hard against the upper arm.

See the product manual for more detailed information and recommended adjustments.

2.1.5 Chapter structure

General

The Chapters for DressPack are structured in the following way.

The DressPack can be delivered in five versions developed for two different applications. Each type is described under separate chapter.

Chapter	Option	Description
2.2	DressPack	DressPack includes general description DressPack with common information.

Material Handling application / DressPack

Chapter	Option	Description
2.3	Type H	DressPack for Material Handling.

Spot Welding application / DressPack

Chapter	Option	Description
2.4	Type S	DressPack for pneumatic transformer guns carried by the robot manipulator.
2.5	HS	DressPack for handling the part against pneumatic transformer guns stationary mounted.
2.6	Type Se	DressPack for electrical servo driven transformer guns carried by the robot manipulator.
2.7	Type HSe	DressPack for handling the part against electrical servo driven transformer guns stationary mounted.

Connector Kits

Chapter	Option	Description
2.8	Connector kits	Includes general description of Connector kits for DressPack.

2.2 DressPack

2.2.1 Introduction

Available DressPack configurations for Material Handling

The table below shows the different DressPack configurations available for Material Handling.

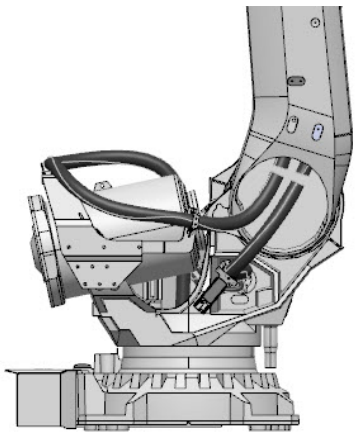
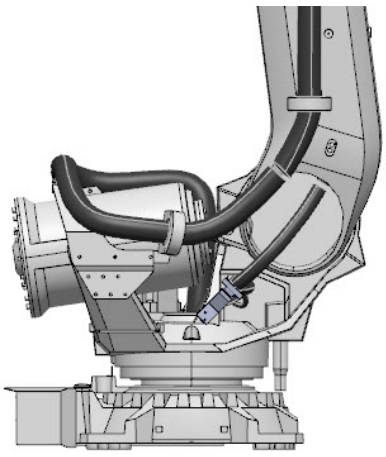
	Lower arm	Upper arm
Option 778-1 Material Handling	Option 798-3, Base to axis 3 Internal routing in lower arm	Option 780-3, Axis 3 to 6 External routing
		Option 780-4, Axis 3 to axis 6 (LeanID) Internal routing

Available DressPack configurations for Spot Welding

The table below shows the different DressPack configurations available for Spot Welding.

	Lower arm	Upper arm
Option 778-2 Spot Welding	Option 798-3 Base to axis 3	Option 780-4 Int. Axis 3 to 6 (LeanID) Internal routing
	Option 798-2 Base to axis 2	Option 780-2 Ext. Axis 2 to axis 6 External routing

Lower arm

	
Internal routing in lower arm Option 778-1 (Material handling) Option 798-3, Base to axis 3 Option 3325-11/12/13/14/15, Base to axis 3	External routing Option 798-3, Base to axis 3 Option 3325-11/12/13/14/15, Base to axis 3

2.2.2 Built-in features for upper arm DressPack

External

Material handling (option 780-3):

- Internal routing through the rear part of the upper arm.
- Protection hose can easily be replaced if damaged.
- One version for all IRB 6650S variants.
- Adjustment for optimal hose/cable lengths.
- Easy exchange of DressPack

External with retract arm

Spot welding and Material handling (option 780-2):

- Adjustable bracket axis 6 with position marking.
- Adjustable retracting force to optimize the system depending on cycle and hose package.

Internal

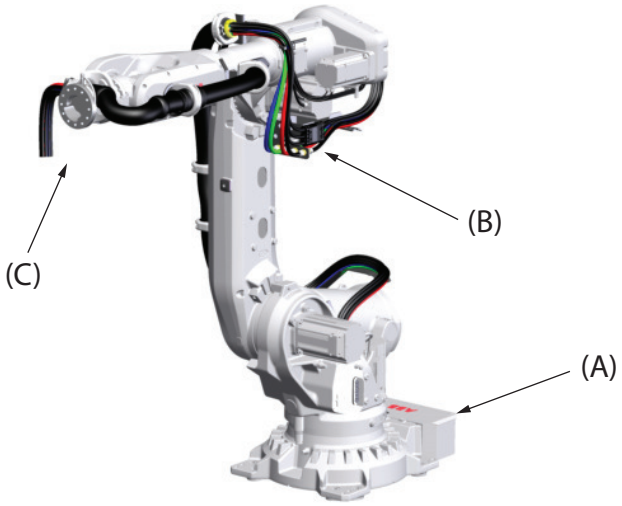
Spot welding and Material handling (option 780-4):

- Partly internal routing through the upper arm.
- Suitable for complex movements.
- High demands for flexibility and accessibility.
- Longer life time
- Predictable movements
- Easy exchange of DressPack

2.2.3 Interface descriptions for DressPack

General

Below is an overview showing the different DressPack options connection points, and their locations. For detailed information see the circuit diagram, and product manual for the manipulator.



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Pos	Location	Description	Options
A	Base	FB7, CP/CS/CBUS/Ethernet	864-1, 798-3
B	Axis 3	CP/CS/CBUS/Ethernet	798-3
C	Axis 6	CP/CS/CBUS/Ethernet, WELD	780-3, 780-4

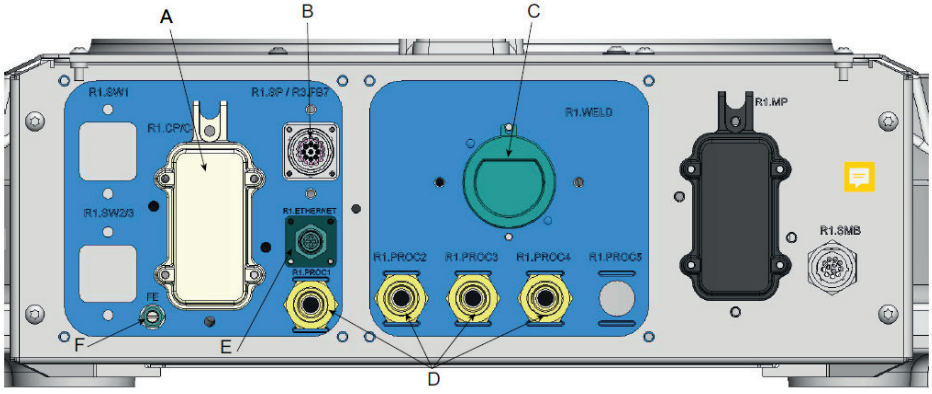
Base

Material handling (option 798-3), see figure below:

- Included are: A, one D (Proc 1).

Spot welding (option 798-3), see figure below:

- Included are: A, B (if applicable), C, D (Proc 1-4) and E, F (if applicable).



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For corresponding parts of the tool, see *Connector kits on page 129*.

Pos	Description
A	R1.CP/CS
B	R1.SP (spot welding servo gun) or FB7 (resolver connection)
C	R1.WELD 3x35mm^2 (spot welding)
D	R1.PROC 1 (material handling/spot welding 1/2", M22x1.5, 24 degree seal) R1.PROC 2 - 4 (spot welding 1/2", M22x1.5, 24 degree seal)
E	R1.ETHERNET (M12 connector, when EtherNet communication is selected)
F	FE (functional earth, when EtherNet communication is selected)

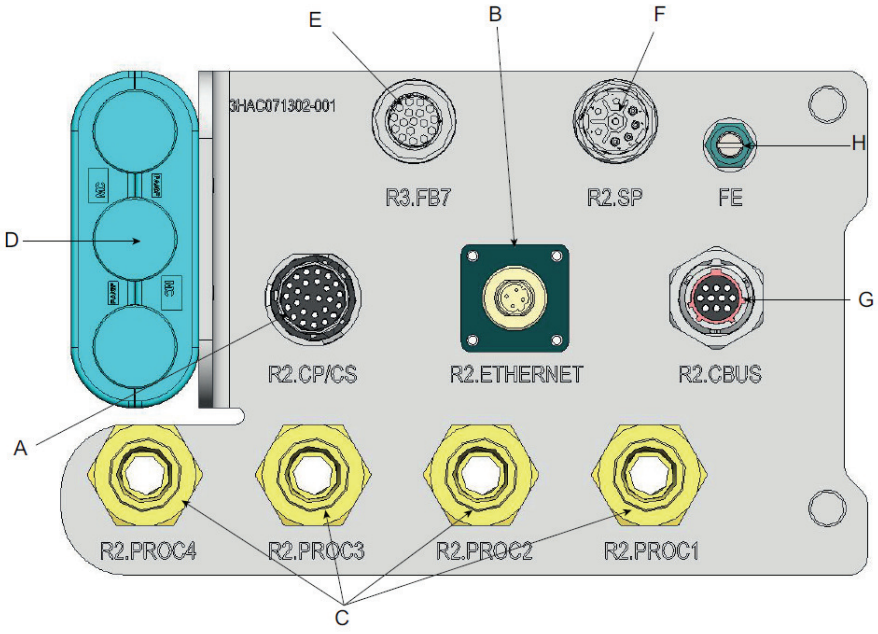
Axis 3

Material Handling (option 798-3), see figure below:

- Included are: A and one C (Proc 1).

Spot welding (option 798-3), see figure below:

- Included are: A, D, B/E/F/G/H (if applicable) and C (Proc 1-4).



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For corresponding parts of the tool, see *Connector kits on page 129*.

Pos	Description
A	R2.CP/CS
B	R2.ETHERNET (M12 connector, when EtherNet communication is selected)
C	R2.PROC 1 (material handling 1/2", M22x1.5, 24 degree seal) R2.PROC 2-4 (spot welding 1/2", M22x1.5, 24 degree seal)
D	R2.WELD 3x35mm^2 (spot welding)
E	R2.FB7
F	R2.SP (spot welding servo gun)

Continues on next page

2.2.3 Interface descriptions for DressPack
Continued

Pos	Description
G	R2.CBUS (UTOW connector when DeviceNet communication is selected)
H	FE (functional earth, when EtherNet communication is selected)

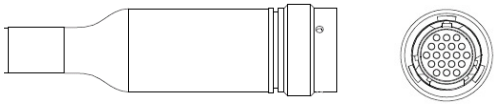
Axis 6

External

Material handling (option 780-3), see figure below:

- Hose and cable free length, min. 1,000 mm
- Air hose ends with free end.

The cable ends with a connector, the main parts are described in the list below (for corresponding parts of the tool, see *Connector kits on page 129*):



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Material handling connector

Material handling (option 780-3), see figure below:

- Cable free length, min. 1,000 mm
- Signals are connected with an M12 connector.

The different main parts within the connector are described in the list below, both with name and Harting article number (for corresponding parts of the tool, see within the Harting product offer).

Name	Harting article
PIN connector, R3.ETHERNET	21 03 881 1405
PIN	61 03 000 0094

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Material handling connector (LeanID)

Material handling/spot welding option 780-4 (LeanID), see figure below:

- Hose and cable free length, min. 1,160 mm
- Hoses and weld power cable (only for spot welding) end with free end.

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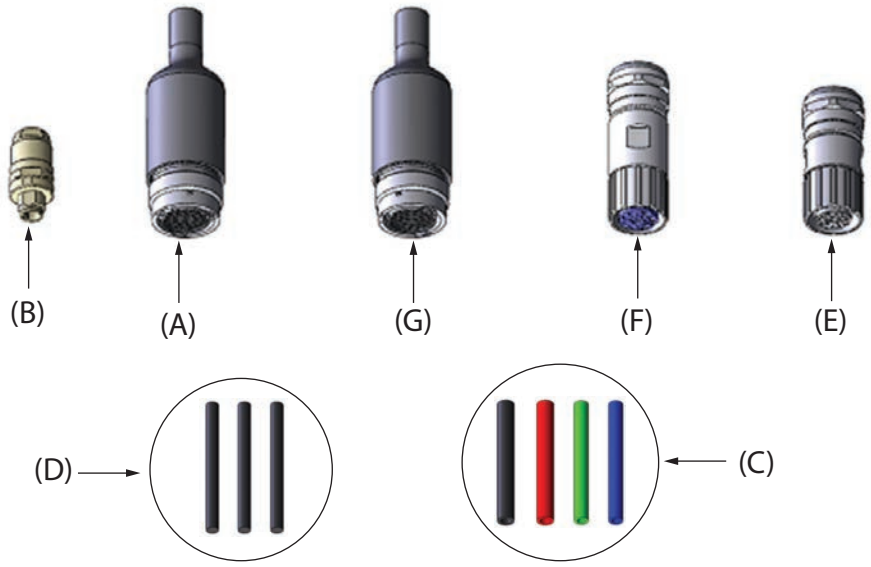
The cable ends with connectors, for corresponding parts of the tool, see *Connector kits on page 129* and within the UTOW product offer.



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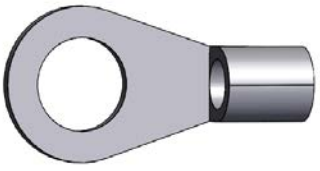
Pos	Description
A	R3.CP/CS (UTOW connector 26p) Customer signals and power
B	R3.ETHERNET (M12 connector) EtherNet signals (when EtherNet communication is selected)
C	R3.PROC 1-2 (1/2", free end) R3.PROC 2-4 (3/8", free end) Media hoses
D	R3.WELD 3x25mm^2 (free end) Spot Welding power
E	R3.FB7 (M23 connector 17p) Servo motor feedback (when Spot Welding Servo gun is selected)
F	R3.SP (M23 connector 8p) Servo motor power (when Spot Welding Servo gun is selected)
G	R3.CBUS (UTOW connector 10p) BUS signals (when Profibus or DeviceNet communication is selected)

- FE (M8 cable lug) Functional Earth 10 mm^2 (when Parallel and Ethernet communication is selected)



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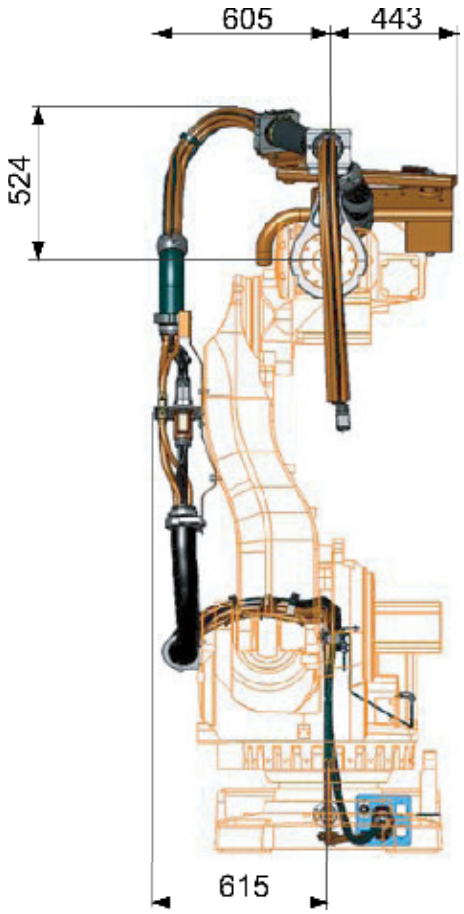
2.2.4 Dimensions

General

Dimensions are shown in Figures below.



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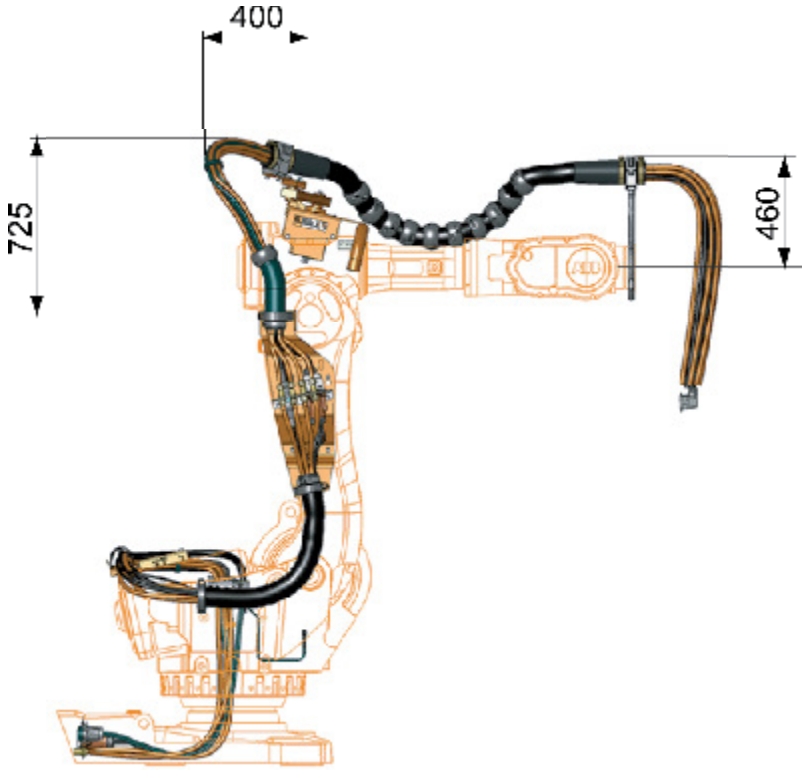

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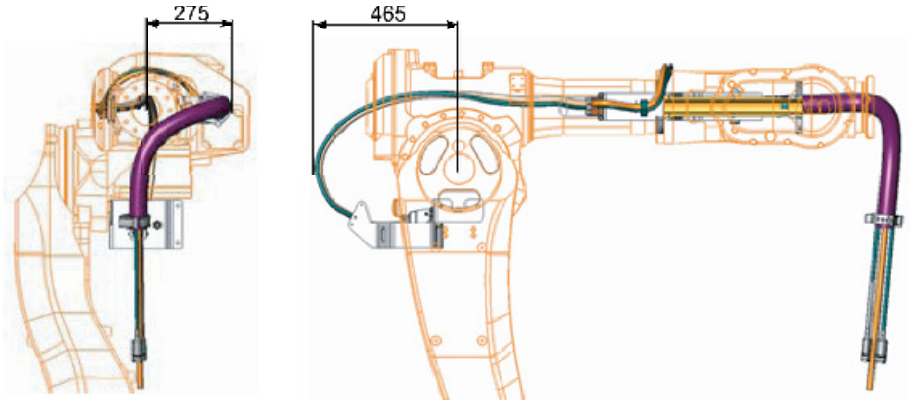

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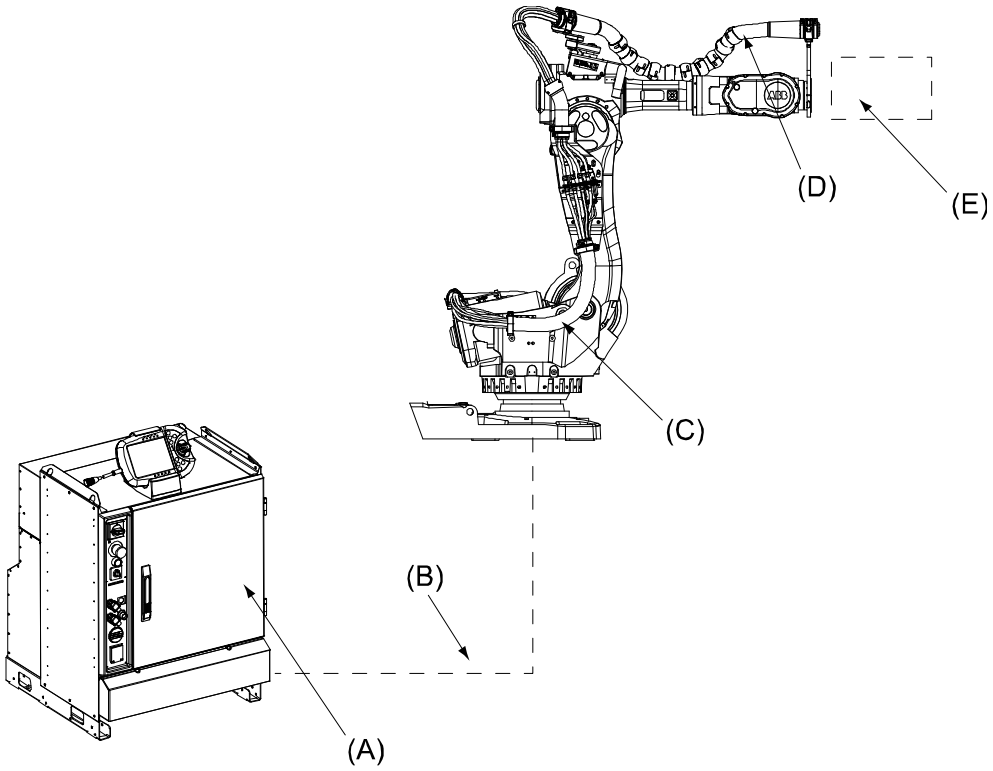
2.3 Type H

2.3.1 Introduction

General

DressPack Type H is designed for material handling (MH) applications. The included modules are shown in following figure.



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Pos	Name
A	Robot controller
B	DressPack, Floor
C	DressPack, Lower arm
D	DressPack, Upper arm
E	Robot Gripper

Available configurations with linked option numbers are described below.

Continues on next page

Option description

Option	Type	Description
16-1	Connection to cabinet	Floor cables and connections inside the I/O section for the DressPack are chosen. The length and configuration of the floor harness is specified under the options below. Option 94-1,-2,-3,-4 for parallel communication. Option 90-2,-3,-4,-5 for parallel communication and field bus communication with Can/DeviceNet. Option 92-2,-3 for parallel communication and field bus communication with Profibus.
455-1	Parallel communication	Offers the signal cables needed for parallel communication in lower and upper arm DressPack. To be combined with option 94-1,-2,-3,-4,-5.
455-4	Parallel and Bus communication	Offers the signal cables needed for the combination of parallel and bus communication in lower and upper arm DressPack. To be combined with option 90-2,-3,-4,-5 or 92-2,-3.
455-8	Parallel and Ethernet	Offers the signal cables needed for the Ethernet communication in combination in lower and upper arm DressPack. To be combined with option 859-1,-2,-3,-4. Requires selection of option 94-X.

The available alternatives and allowed combinations are shown in the schematic table below.

Application Interface connected to Option 16-1, Cabinet	Option 455-1, Parallel communication	Option 94-1,-2,-3,-4 Cable length, Parallel communication	Option 778-1, Material handling
	Option 455-4, Parallel and bus communication	Option 90-2,-3,-4,-5 Option 92,2,-3 Cable length, Parallel and bus communication	
	Option 455-8, Parallel and Ethernet communication	Option 859-1, -2, -3, -4 Cable length, Ethernet communication	

	Lower arm	Upper arm
Option 778-1, Material Handling	Option 798-3, Base to axis 3	Option 780-3, Axis 3 to 6 External routing
		Option 780-4, Axis 3 to 6 Internal routing
	Option 798-2, Base to axis 2	Option 780-2, Axis 2 to 6 External routing

2.3.2 Configuration result for Type H

General

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

DressPack Type H. Parallel communication

- Option 16-1 with Connection to cabinet
- (Option 94-1,-2,-3,-4 to specify cable length)
- Option 455-1. Parallel communication
- Option 778-1. Material Handling
- Option 798-2 or Option 798-3. Internal routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-3 or 780-4 (and option 798-3). External/Internal routing

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, Axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms [a]
Protective earth		1	0.5 mm^2	250 VAC [b]
Customer Signals (CS)				
Signals twisted pair	20	20 (10x2) [b]	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Media				
Air (PROC 1)		1	12.5 mm inner diameter	Max. air pressure 16 bar/230 PSI

a. For option 780-3 50 VAC / 60 VDC.

b. For option 780-3 8 signals instead of 20.

DressPack Type H. Parallel and field bus communication, Can/DeviceNet

- Option 16-1 with Connection to cabinet
- (Option 90-2,-3,-4,-5 to specify cable length)
- Option 455-4. Parallel and bus communication
- Option 778-1. Material Handling
- Option 798-2 or Option 798-3 Internal routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-3 or 780-4 (and option 798-3). External/Internal routing

Continues on next page

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, Axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms[a]
Protective earth		1	0.5 mm^2	250 VACb
Customer Signals (CS)				
Signals twisted pair	20	20 (10x2)[b]	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Customer bus (CBus)				
Bus signals	At bus board	2	0.14 mm^2	Can/DeviceNet spec
Bus signals	At bus board	2	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair	6	6(3x2)	0.14 mm^2	50 V DC, 1 A rms
Media				
Air (PROC 1)		1	12.5 mm inner diameter	Max. air pressure 16 bar/230 PSI

a. For option 780-3 50 VAC / 60 VDC.

b. For option 780-2 8 signals instead of 20.

DressPack Type H. Parallel and field bus communication, Profibus

- Option 16-1 with Connection to cabinet
- (Option 92-2,-3 to specify cable length)
- Option 455-4. Parallel and bus communication
- Option 778-1. Material Handling
- Option 798-2 or Option 798-3. Internal routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Optiion 780-3 or 780-4 (and Option 798-3). External/Internal routing

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, Axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms[a]
Protective earth		1	0.5 mm^2	250 VACb
Customer Signals (CS)				
Signals twisted pair	22	22(11x2)[b]	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms

Continues on next page

2.3.2 Configuration result for Type H
Continued

Type	At terminals in cabinet	At connection point. Base, Axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer bus (CBus)				
Bus signals	At bus board	4	0.14 mm^2	Profibus 12 Mbit/s spec
Signals twisted pair	6	6 (3x2)	0.14 mm^2	50 V DC, 1 A rms
Media				
Air (PROC 1)		1	12.5 mm inner diameter	Max. air pressure 16 bar/230 PSI

a. For option 780-3 50 VAC / 60VDC.

b. For option 780-3 8 singals instead of 22.

DressPack Type H, Parallel and field bus communication, Ethernet

- Option 16-1 with Connection to cabinet
- (Option 859-1,-2, -3, -4 to specify cable length)
- (Option 94-1, -2, -3, -4 to specify cable length)
- Option 455-8. Parallel and Ethernet communication
- Option 778-1. Material Handling
- Option 798-2 or Option 798-3. Internal routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-3 or 780-4 (and option 798-3). External/Internal routing.

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, Axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms [i]
Protective earth		1	0.5 mm^2	250 VACa
Customer Signals (CS)				
Signals twisted pair	20	20(10x2) [ii]	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Customer bus (Ethernet)				
Bus signals	4	4	0.4 mm^2	Ethernet CAT 5e, 100 Mbit [iii]
Media				
Air (PROC 1)		1	12.5 mm inner diameter	Max. air pressure 16 bar/230 PSI

i For option 780-3 50 VAC / 60 VDC.
ii For option 780-3 8 signals instead of 20.

Continues on next page

iii Ethernet with wire colors according to PROFINET standard, M12-connectors.

Summary Type H

The following options are required to form a complete DressPack Type H:

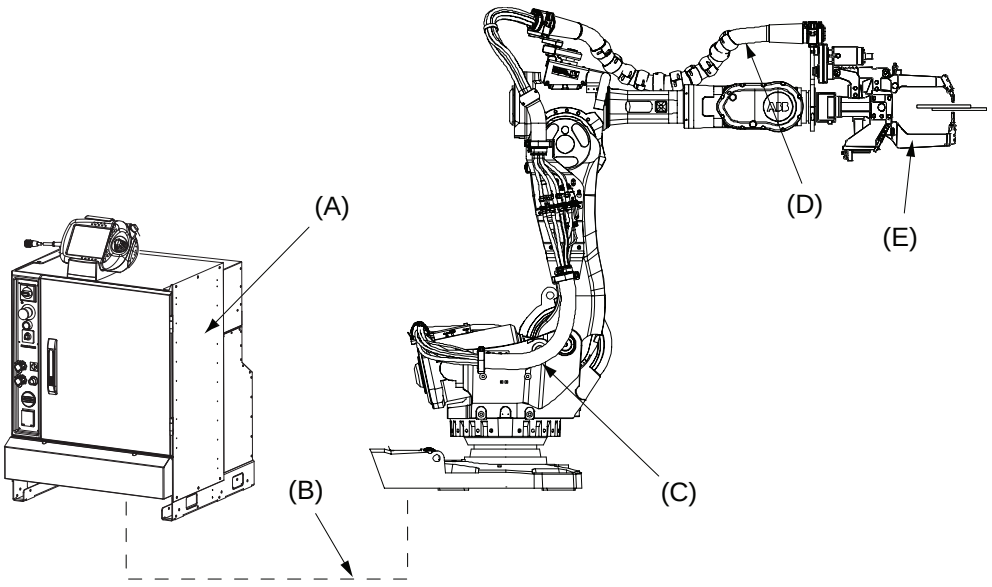
- Option 16-1. Connection to cabinet, (Cable length and communication type to be stated)
- Option 455-1, 455-4. Parallel or Parallel and Bus communication
- (Communication type to be stated)
- Option 778-1. Material Handling
- Option 798-2 or Option 798-3. Internal routing, DressPack Lower arm
- (Routing type to be stated)
- Option 780-2. External routing Axis 2 to 6, option 780-3, -4 External routing Axis 3 to 6, DressPack Upper arm (Routing type to be stated)

2.4 Type S

2.4.1 Introduction

General

DressPack Type S is designed for spot welding applications with robot held pneumatic gun. Included modules are shown in Figure below. Available configurations with linked option numbers are described below.



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Pos	Name
A	Robot controller
B	DressPack, Floor
C	DressPack, Lower arm
D	DressPack, Upper arm
E	Pneumatic gun

Available configurations and allowed combinations with linked option numbers are described below.

Option description

Option	Type	Description
16-1	Connection to cabinet	Floor cables and connections inside the I/O section for the DressPack are chosen. The length and configuration of the floor harness is specified under the options below. Option 94-1,-2,-3,-4 for parallel communication Option 90-2,-3,-4,-5 for parallel communication and field bus communication with Can/DeviceNet Option 92-2,-3 for parallel communication and field bus communication with Profibus

Continues on next page

Option	Type	Description
455-1	Parallel communication	Offers the signal cables needed for parallel communication in lower and upper arm DressPack. To be combined with option 94-1,-2,-3,-4.
455-4	Parallel and Bus communication	Offers the signal cables needed for the combination of parallel and bus communication in combination in lower and upper arm DressPack. To be combined with option 90-2,-3,-4,-5 or 92-2,-3.
455-8	Parallel and Ethernet	Offers the signal cables needed for the Ethernet communication in combination in lower and upper arm DressPack. To be combined with option 859-1,-2,-3,-4. Requires selection of option 94-X.

The available alternatives and allowed combinations are shown in the schematic table below.

Application Interface connected to Option 16-1	Option 455-1, Parallel communication	Option 94-1,-2,-3,-4 Cable length, Parallel and Bus communication	Option 778-2, Spot Welding
	Option 455-1, Parallel and Bus communication	Option 90-2,-3,-4,-5 Option 92-2,-3 Cable length, Parallel and Bus communication	
	Option 455-8, Parallel and Ethernet communication	Option 859-1, -2, -3, -4 Cable length, Ethernet communication	

	Lower arm	Upper arm
Option 778-2, Spot Welding	Option 798-2, Base to axis 2 External routing	Option 780-2, Axis 2 to 6 External routing
	Option 798-3, Base to axis 3 External routing	Option 780-4, Axis 3 to 6 Internal routing

2.4.2 Configuration result for Type S

General

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

DressPack Type S. Parallel communication

- Option 16-1 with Connection to cabinet
- (Option 94-1,-2,-3,-4 to specify cable length)
- Option 455-1. Parallel communication
- Option 778-2. Spot Welding
- Option 798-2. External routing, DressPack Lower arm
- Option 798-3. External routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-4 (and Option 798-3). Internal routing.

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms
Protective earth		1	0.5 mm^2	250 VAC
Customer Signals (CS)				
Signals twisted pair	20	20 (10x2)	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Media				
Water/Air (PROC 1-4)		4	12.5 mm inner diameter [i]	Max. air pressure 16 bar/ 230 PSI Max. water pressure 10 bar/ 145 PSI
Welding power (WELD)				
Lower and Upper arm		2	35 mm^2 [ii]	600 VAC, 150 A rms at 20 °C (68 °F)
Protective earth (Lower and Upper arm)		1		

i For LeanID 2x1/2" + 2x3/8", only upper arm
ii For LeanID upper arm 25 mm^2, only upper arm, 135 A rms

Continues on next page

DressPack Type S. Parallel and field bus communication, Can/DeviceNet

- Option 16-1 with Connection to cabinet
- (Option 90-2,-3,-4,-5 to specify cable length)
- Option 455-4. Parallel and bus communication
- Option 778-2. Spot Welding
- Option 798-2. External routing, DressPack Lower arm
- Option 798-3. External routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-4 (and Option 798-3). Internal routing.

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms
Protective earth		1	1 mm^2	250 VAC
Customer signals (CS)				
Signals twisted pair	20	20 (10x2)	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Customer bus (CBus)				
Bus signals	At bus board	2	0.14 mm^2	Can/DeviceNet spec
Bus signals	At bus board	2	0.23 mm^2	50 V DC, 1 A rms
Signals twisted pair	6	6 (3x2)	0.14 mm^2	50 V DC, 1 A rms
Media				
Water/Air (PROC 1-4)		4	12.5 mm inner diameter [i]	Max. air pressure 16 bar/230 PSI Max. water pressure 10 bar/145 PSI.
Welding power (WELD)				
Lower and Upper arm		2	35 mm^2 [ii]	600 VAC, 150 A rms at 20 °C (68 °F)
Protective earth (Lower and Upper arm)		1		

i For LeanID 2x1/2" + 2x3/8", only upper arm
ii For LeanID upper arm 25 mm^2, only upper arm, 135 A rms

Continues on next page

2.4.2 Configuration result for Type S
Continued

DressPack Type S. Parallel and field bus communication, Profibus

- Option 16-1 with Connection to cabinet
- (Option 92-2,-3 to specify cable length)
- Option 455-4. Parallel and bus communication
- Option 778-2. Spot Welding
- Option 798-2. External routing, DressPack Lower arm
- Option 798-3. External routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-4 (and Option 798-3). Internal routing.

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms
Protective earth		1	0.5 mm^2	250 VAC
Customer signals (CS)				
Signals twisted pair	22	22 (11x2)	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Customer bus (CBus)				
Bus signals	At bus board	4	0.14 mm^2	Profibus 12 Mbit/s spec
Signals twisted pair	6	6 (3x2)	0.14 mm^2	50 V DC, 1 A rms
Media				
Water/Air (PROC 1-4)		4	12.5 mm inner diameter[i]	Max. air pressure 16 bar/230 PSI Max. water pressure 10 bar/145 PSI.
Welding power (WELD)				
Lower and Upper arm		2	35 mm^2 [ii]	600 VAC, 150 A rms at 20 °C (68 °F)
Protective earth (Lower and Upper arm)		1		

i For LeanID 2x1/2" + 2x3/8", only upper arm
ii For LeanID upper arm 25 mm^2, only upper arm, 135 A rms

Continues on next page

DressPack Type S. Parallel and field bus communication, Ethernet

- Option 16-1 with Connection to cabinet
- (Option 859-1,-2, -3, -4 to specify cable length)
- (Option 94-1, -2, -3, -4 to specfiy cable length)
- Option 455-8. Parallel and Ethernet communication
- Option 778-2. Spot Welding
- Option 798-2. External routing, DressPack Lower arm
- Option 798-3. External routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-4 (and Option 798-3). Internal routing.

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms
Protective earth		1	0.5 mm^2	250 VAC
Customer signals (CS)				
Signals twisted pair	202	20 (10x2)	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Customer bus (Ethernet)				
Bus signals	4	4	0.4 mm^2	Ethernet CAT 5e, 100 Mbit [i]
Media				
Water/Air (PROC 1-4)		4	12.5 mm inner diameter [ii]	Max. air pressure 16 bar/230 PSI Max. water pressure 10 bar/145 PSI.
Welding power (WELD)				
Lower and Upper arm		2	35 mm^2 [iii]	600 VAC, 150 A rms at 20°C (68°F)
Protective earth (Lower and Upper arm)		1		

[i] Ethernet with wire colors according to PROFINET standard, M12-connectors.
[ii] For LeanID 2x1/2" + 2x3/8", only upper arm
[iii] For LeanID upper arm 25 mm^2, only upper arm, 135 A rms

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2.4.2 Configuration result for Type S
Continued

Required general options for Type S

To enable the Spot welding function package IRB 6650S to perform as intended, general standard robot options are required. These standard options are further described under other chapters and are also mentioned in this chapter.

- Option 716-1. 1 pc. Digital 24 VDC I/O 16 inputs/ 16 outputs
- Option 727-1. 24V 8 Amps power supply
- Option 635-1. Spot. Software option for pneumatic guns

2.4.3 Summary Type S

General

The following options are the minimum required to form a complete Spot welding function Type S:

DressPack

- Option 16-1. Connection to cabinet, (Cable length and communication type to be stated)
- Option 455-1, 455-4. Parallel or Parallel and Bus communication (Communication type to be stated)
- Option 778-2. Spot Welding
- Option 798-2 or 798-3. DressPack Lower arm
- Option 780-2 or 780-4. DressPack Upper arm (Routing type to be stated)

General options

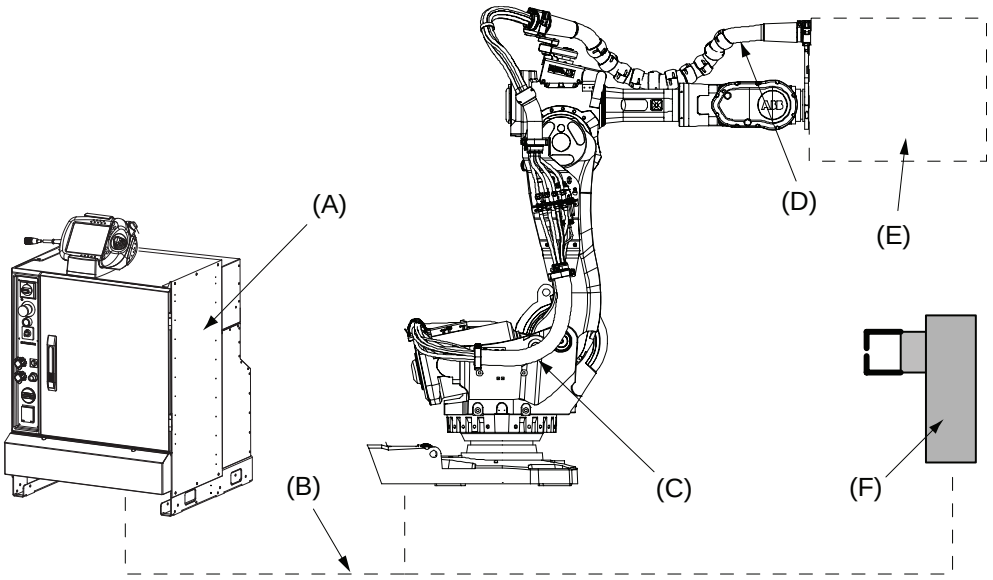
- Option 716-1. 1 pc. Digital 24 VDC I/O 16 inputs/ 16 outputs
- Option 727-1. 24V 8 Amps power supply
- Option 635-1. Spot

2.5 Type HS

2.5.1 Introduction

General

DressPack Type HS is designed for handling against a stationary mounted spot welding pneumatic gun. Included main modules are shown in Figure below. Available configurations with linked option numbers are described below starting at the DressPack.



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Pos	Name
A	Robot controller
B	DressPack, Floor
C	DressPack, Lower arm
D	DressPack, Upper arm
E	Robot Gripper
F	Stationary gun

Available configurations with linked option numbers are described below.

Option description

Option	Type	Description
16-1	Connection to cabinet	Floor cables and connections inside the I/O section for the DressPack are chosen. The length and configuration of the floor harness is specified under the options below. Option 94-1,-2,-3,-4 for parallel communication. Option 90-2,-3,-4,-5 for parallel communication and field bus communication with Can/DeviceNet. Option 92-2,-3 for parallel communication and field bus communication with Profibus.

Continues on next page

Option	Type	Description
455-1	Parallel communication	Offers the signal cables needed for parallel communication in lower and upper arm DressPack. To be combined with option 94-1,-2,-3,-4,-5.
455-4	Parallel and Bus communication	Offers the signal cables needed for the combination of parallel and bus communication in lower and upper arm DressPack. To be combined with option 90-2,-3,-4,-5 or 92-2,-3.
455-8	Parallel and Ethernet	Offers the signal cables needed for the Ethernet communication in combination in lower and upper arm DressPack. To be combined with option 859-1,-2,-3,-4. Requires selection of option 94-X.

The available alternatives and allowed combinations are shown in the schematic table below.

Application Interface connected to Option 16-1, Cabinet	Option 455-1, Parallel communication	Option 94-1, -2, -3, -4 Cable length, Parallel communication	Option 778-1, Material Handling
	Option 455-4, Parallel and bus communication	Option 90-2, -3, -4, -5 Option 92-2,-3 Cable length, Parallel and bus communication	
	Option 455-8, Parallel and Ethernet communication	Option 859-1, -2, -3, -4 Cable length, Ethernet communication	

Continued

	Lower arm	Upper arm
Option 778-1 Material Handling	Option 798-3, Base to axis 3	Option 780-3, Axis 3 to 6 External routing
		Option 780-4, Axis 3 to 6 Internal routing
	Option 798-2, Base t o axis 2	Option 780-2, Axis 2 to 6 External routing

2.5.2 Configuration result for Type HS

General

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

DressPack Type HS. Parallel communication

- Option 16-1 with Connection to cabinet
- (Option 94-1,-2,-3,-4 to specify cable length)
- Option 455-1. Parallel communication
- Option 778-1. Material Handling
- Option 798-2 or Option 798-3. Internal routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-3, -4 (and Option 798-3). External routing, DressPack Upper arm

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, Axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+21 [a]	0.5 mm^2	250 VAC, 5 A rms [b]
Protective earth			0.5 mm^2	250 VACa
Customer Signals (CS)				
Signals twisted pair	20	20(10x2) [c]	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Media				
Air (PROC 1)		1	12.5 mm inner diameter	Max. air pressure 16 bar/230 PSI

a. Not included in option 780-3.

b. For option 780-3 50 VAC / 60VAC.

c. For option 780-3 8 signals instead of 20.

Continues on next page

DressPack Type HS. Parallel and field bus communication, Can/DeviceNet

- Option 16-1 with Connection to cabinet
- (Option 90-1,-2,-3,-4 to specify cable length)
- Option 455-4. Parallel and bus communication
- Option 778-1. Material Handling
- Option 798-2 or Option 798-3. Internal routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-3, -4 (and Option 798-3). External routing, DressPack Upper arm

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, Axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms[b]
Protective earth		1[a]	0.5 mm^2	250 VACa
Customer Signals (CS)				
Signals twisted pair	208	20 (10x2)[c]	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded		8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Customer bus (CBus)				
Bus signals	At bus board	2	0.14 mm^2	Can/DeviceNet spec
Bus signals	At bus board	2	0.23 mm^2	50 V DC, 1 A rms50 V DC, 1 A rms
Signals twisted pair	6	6(3x2)	0.14 mm^2	
Media				
Air (PROC 1)		1	12.5 mm inner diameter	Max. air pressure 16 bar/230 PSI

a. Not included in option 780-3.

b. For option 780-3 50 VAC / 60 VAC.

c.For option 780-3 8 signals instead of 20.

Continues on next page

2.5.2 Configuration result for Type HS
Continued

DressPack Type HS. Parallel and field bus communication, Profibus

- Option 16-1 with Connection to cabinet
- (Option 92-1,-2,-3 to specify cable length)
- Option 455-4. Parallel and bus communication
- Option 778-1. Material Handling
- Option 798-2 or Option 798-3. Internal routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-3, -4 (and Option 798-3). External routing, DressPack Upper arm

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, Axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms [b]
Protective earth		1 [a]	0.5 mm^2	250 VACa
Customer Signals (CS)				
Signals twisted pair	22	22(11x2) [c]	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Customer bus (CBus)				
Bus signals	At bus board	4	0.14 mm^2	Profibus 12 Mbit/s spec
Signals twisted pair	6	6 (3x2)	0.14 mm^2	50 V DC, 1 A rms
Media				
Air (PROC 1)		1	12.5 mm inner diameter	Max. air pressure 16 bar/230 PSI

a. Not included in option 780-3.

b. For option 780-3 50 VAC / 60 VDC.

c. For option 780-3 8 signals instead of 22.

Continues on next page

DressPack Type HS. Parallel and field bus communication, Ethernet

- Option 16-1 with Connection to cabinet
- (Option 859-1,-2,-3, -4 to specify cable length)
- (Option 94-1, -2, -3, -4 to specify cable length)
- Option 455-8. Parallel and Ethernet communication
- Option 778-1. Material Handling
- Option 798-2 or Option 798-3. Internal routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-3, -4 (and Option 798-3). External routing, DressPack Upper arm

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, Axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms [i]
Protective earth		1	0.5 mm^2	250 VACa
Customer Signals (CS)				
Signals twisted pair	20	20(10x2) [ii]	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Customer bus (Ethernet)				
Bus signals	4	4	0.4 mm^2	Ethernet CAT 5e, 100 Mbit [iii]
Media				
Air (PROC 1)		1	12.5 mm inner diameter	Max. air pressure 16 bar/230 PSI

i For option 780-3 50 VAC / 60 VDC.
ii For option 780-3 8 signals instead of 20.
iii Ethernet with wire colors according to PROFINET standard, M12-connectors.

Continues on next page

2.5.2 Configuration result for Type HS
Continued

Required general options for Type HS

To enable the Spot welding function package IRB 6650S to perform as intended, general standard robot options are required. These standard options are further described under other chapters and are also mentioned in this chapter.

- Option 716-1. 1 pc. Digital 24 VDC I/O 16 inputs/ 16 outputs
- Option 727-1. 24V 8 Amps power supply
- Option 635-1. Spot. Software option for pneumatic guns.

2.5.3 Summary Type HS

General

The following options are the minimum required to form a complete Spot welding function Type HS:

DressPack

- Option 16-1. Connection to cabinet, (Cable length and communication type to be stated)
- Option 455-1, 455-4. Parallel or Parallel and Bus communication (Communication type to be stated)
- Option 798-2 or Option 798-3. Internal routing, DressPack Lower arm (Routing type to be stated)
- Option 780-2, 780-3, 780-4. External routing, DressPack Upper arm (Routing type to be stated)

General options

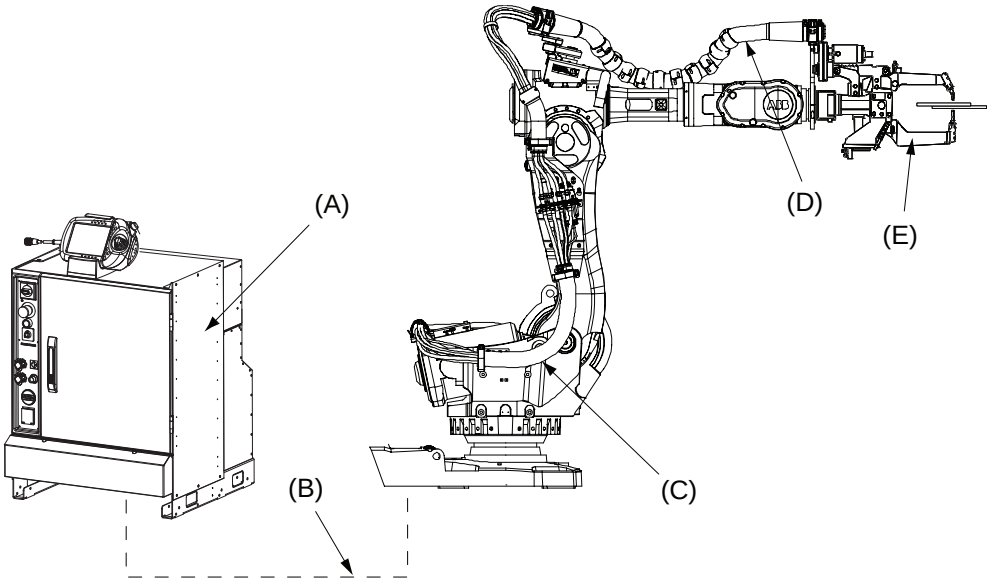
- Option 716-1. 1 pc. Digital 24 VDC I/O 16 inputs/ 16 outputs
- Option 727-1. 24V 8 Amps power supply
- Option 635-1. Spot

2.6 Type Se

2.6.1 Introduction

General

DressPack Type Se is designed for spot welding application with robot handled servo-controlled tool (electrical gun). Included modules are shown in Figure below. Available configurations with linked option numbers are described below.



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Pos	Name
A	Robot controller (including 7th axis drive)
B	DressPack, Floor
C	DressPack, Lower arm
D	DressPack, Upper arm
E	Servo gun

Available configurations with linked option numbers are described below. To achieve the specific servo motor connections within the DressPack option 785-1 Robot gun must also to be chosen. See *Robot Gun on page 69*.

Option description

Option	Type	Description
16-1	Connection to cabinet	Floor cables and connections inside the I/O section for the DressPack are chosen. The length and configuration of the floor harness is specified under the options below. Option 94-1,-2,-3,-4 for parallel communication Option 90-2,-3,-4,-5 for parallel communication and field bus communication with Can/DeviceNet Option 92-2,-3 for parallel communication and field bus communication with Profibus

Continues on next page

Option	Type	Description
455-1	Parallel communication	Offers the signal cables needed for parallel communication in lower and upper arm DressPack. To be combined with option 94-1,-2,-3,-4.
455-4	Parallel and Bus communication	Offers the signal cables needed for the combination of parallel and bus communication in combination in lower and upper arm DressPack. To be combined with option 90-2,-3,-4,-5 or 92-2,-3.
455-8	Parallel and Ethernet	Offers the signal cables needed for the Ethernet communication in combination in lower and upper arm DressPack. To be combined with option 859-1,-2,-3,-4. Requires selection of option 94-X.

The available alternatives and allowed combinations are shown in the schematic table below.

Application Interface connected to Option 16-1, Cabinet	Option 455-1, Parallel communication	Option 94-1,-2,-3,-4 Cable length, Parallel communication	Option 778-2 Spot Welding
	Option 455, Parallel and Bus communication	Option 90-2,-3,-4,-5 Option 92-2,-3 Cable length, Parallel and Bus communication	
	Option 455-8, Parallel and Ethernet communication	Option 859-1, -2, -3, -4 Cable length, Ethernet communication	

	Lower arm	Upper arm
Option 778-2, Spot Welding	Option 798-2, Base to axis 2 External routing	Option 780-2, Axis 2 to 6 External routing
	Option 798-3, Base to axis 3 External routing	Option 780-4, Axis 3 to 6 (LeanID) Internal routing

2.6.2 Configuration result for Type Se

General

Depending on the choice of options above (combined with option 785-1 Robot gun) the DressPack will have different content. The choice of routing will not affect the content. See tables for signal content below.

DressPack Type Se. Parallel communication

- Option 16-1 with Connection to cabinet
- (Option 94-1,-2,-3,-4 to specify cable length)
- Option 455-1. Parallel communication
- Option 778-2 .Spot Welding
- Option 798-2. External routing, DressPack Lower arm
- Option 798-3. External routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-4 (and Option 798-3). Internal routing

The table below shows the available type of wires/media.

Type Se	At terminals in cabinet	At connection point. Base, axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms
Protective earth		1	0.5 mm^2	250 VAC
Customer Signals (CS)				
Signals twisted pair	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	4 (2x2)	0.24 mm^2	50 V DC, 1 A rms
Servo motor signals				
Servo motor power	At drive	3	1.5 mm^2	600 VAC, 12 A rms
Protective earth	At drive	1	1.5 mm^2	600 VAC
Signals twisted pair for resolver	-	6	0.23 mm^2	50 V DC, 1 A rms
Brake	-	2	0.23 mm^2	50 V DC, 1 A rms
Temperature control/PTC	-	2	0.23 mm^2	50 V DC, 1 A rms
Media				
Water/Air (PROC 1-4)		4	12.5 mm inner diameter[i]	Max. air pressure 16 bar/ 230 PSI. Max. water pressure 10 bar/ 145 PSI
Welding power (WELD)				

Continues on next page

Type Se	At terminals in cabinet	At connection point. Base, axis 2/3 or axis 6	Cable/part area	Allowed capacity
Lower and Upper arm		2	35 mm^2 [ii]	600 VAC, 150 A rms at 20°C (68°F)
Protective earth (Lower and Upper arm)		1		

[i] For LeanID 2x1/2" + 2x3/8", only upper arm
[ii] For LeanID upper arm 25 mm^2, only upper arm, 135 A rms

Continues on next page

2.6.2 Configuration result for Type Se
Continued

DressPack Type Se. Parallel and field bus communication, Can/DeviceNet

- Option 16-1 with Connection to cabinet
- (Option 90-2,-3, -5, -5 to specify cable length)
- Option 455-4. Parallel and bus communication
- Option 778-2. Spot Welding
- Option 798-2. External routing, DressPack Lower arm
- Option 798-3. External routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-4 (and Option 798-3). Internal routing

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms
Protective earth		1	0.5 mm^2	250 VAC
Customer signals (CS)				
Signals twisted pair	14	14 (7x2)	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	4	4 (2x2)	0.24 mm^2	50 V DC, 1 A rms
Customer bus (CBus)				
Bus signals	At bus board	2	0.14 mm^2	Can/DeviceNet spec
Bus signals	At bus board	2	0.23 mm^2	50 V DC, 1 A rms
Signals twisted pair	6	6 (3x2)	0.14 mm^2	50 V DC, 1 A rms
Servo motor signals				
Servo motor power	At drive	3	1.5 mm^2	600 VAC, 12 A rms
Protective earth	At drive	1	1.5 mm^2	600 VAC
Signals twisted pair for resolver	-	6[a]	0.23 mm^2	50 V DC, 1 A rms
Brake	-	2	0.23 mm^2	50 V DC, 1 A rms
Temperature control/PTC	-	2	0.23 mm^2	50 V DC, 1 A rms
Media				
Water/Air (PROC 1-4)		4	12.5 mm inner diameter[i]	Max. air pressure 16 bar/230 PSI. Max. water pressure 10 bar/145 PSI.
Welding power (WELD)				
Lower and Upper arm		2	35 mm^2 [ii]	600 VAC, 150 A rms at 20 °C (68 °F)
Protective earth (Lower and Upper arm)		1		

[i] For LeanID 2x1/2" + 2x3/8", only upper arm

Continues on next page

ii For LeanID upper arm 25 mm^2, only upper arm, 135 A rms

a. Interface only at axis 3 or axis 6.

Continues on next page

2.6.2 Configuration result for Type Se
Continued

DressPack Type Se. Parallel and field bus communication, Profibus

- Option 16-1 with Connection to cabinet
- (Option 92-2,-3 to specify cable length)
- Option 455-4. Parallel and bus communication
- Option 778-2. Spot Welding
- Option 798-2. External routing, DressPack Lower arm
- Option 798-3. External routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-4 (and Option 798-3). Internal routing

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	1+1	1+1	0.5 mm^2	250 VAC, 5 A rms
Protective earth		1	0.5 mm^2	250 VAC
Customer signals (CS)				
Signals twisted pair	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	4	4 (2x2)	0.24 mm^2	50 V DC, 1 A rms
Customer bus (CBus)				
Bus signals	At bus board	4	0.14 mm^2	Profibus 12 Mbit/s spec
Signals twisted pair	6	6 (3x2)	0.14 mm^2	50 V DC, 1 A rms
Servo motor signals				
Servo motor power	At drive	3	1.5 mm^2	600 VAC, 12 A rms
Protective earth	At drive	1	1.5 mm^2	600 VAC
Signals twisted pair for resolver	-	6[a]	0.23 mm^2	50 V DC, 1 A rms
Brake	-	2	0.23 mm^2	50 V DC, 1 A rms
Temperature control/PTC	-	2	0.23 mm^2	50 V DC, 1 A rms
Media				
Water/Air (PROC 1-4)		4	12.5 mm inner diameter[i]	Max. air pressure 16 bar/230 PSI. Max. water pressure 10 bar/145 PSI.
Welding power (WELD)				
Lower and Upper arm		2	35 mm^2 [ii]	600 VAC, 150 A rms at 20 °C (68 °F)
Protective earth (Lower and Upper arm)		1		

i For LeanID 2x1/2" + 2x3/8", only upper arm
ii For LeanID upper arm 25 mm^2, only upper arm, 135 A rms

Continues on next page

a. Interface only at axis 3 or axis 6.

Continues on next page

2.6.2 Configuration result for Type Se
Continued

DressPack Type Se. Parallel and field bus communication, Ethernet

- Option 16-1 with Connection to cabinet
- (Option 859-1, -2,-3, -4 to specify cable length)
- (Option 94-1, -2, -3, -4 to specify cable length)
- Option 455-8. Parallel and Ethernet communication
- Option 778-2. Spot Welding
- Option 798-2. External routing, DressPack Lower arm
- Option 798-3. External routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-4 (and Option 798-3). Internal routing

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms
Protective earth		1	0.5 mm^2	250 VAC
Customer signals (CS)				
Signals twisted pair	20	20 (10x2)	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Customer bus (Ethernet)				
Bus signals	4	4	0.4 mm^2	Ethernet CAT 5e, 100 Mbit [i]
Servo motor signals				
Servo motor power	At drive	3	1.5 mm^2	600 VAC, 12 A rms
Protective earth	At drive	1	1.5 mm^2	600 VAC
Signals twisted pair for resolver	-	6 [ii]	0.23 mm^2	50 V DC, 1 A rms
Brake	-	2	0.23 mm^2	50 V DC, 1 A rms
Temperature control/PTC	-	2	0.23 mm^2	50 V DC, 1 A rms
Media				
Water/Air (PROC 1-4)		4	12.5 mm inner diameter [iii]	Max. air pressure 16 bar/230 PSI. Max. water pressure 10 bar/145 PSI.
Welding power (WELD)				
Lower and Upper arm		2	35 mm^2 [iv]	600 VAC, 150 A rms at 20 °C (68 °F)
Protective earth (Lower and Upper arm)		1		

[i] Ethernet with wire colors according to PROFINET standard, M12-connectors.
[ii] Interface only at axis 3 or axis 6.

Continues on next page

iii For LeanID 2x1/2" + 2x3/8", only upper arm
iv For LeanID upper arm 25 mm^2, only upper arm, 135 A rms

Required general options for Type Se

To enable the Spot welding function package IRB 6650S to perform as intended, general standard robot options are required. These standard options are further described under other chapters and are also mentioned in this chapter.

- Option 716-1. 1 pc. Digital 24 VDC I/O 16 inputs/ 16 outputs
- Option 727-1. 24V 8 Amps power supply

Required options for servo gun

To enable the spot welding function package 6650S to run with a servo controlled gun, some additional (additional to those described in previous section "Required general options for Type Se") servo drive options are required. These standard options are described under other chapters and are also mentioned below in this chapter.

- Option 770-4. First additional drive, W Drive
- Option 864-1. Resolver connection, axis 7
- Option 785-1. Robot Gun
- Option 786-1,-2,-3,-4. Connection to first drive (cable length to be stated)
- Option 635-3. Spot Servo. Software option for servo controlled guns.
- (Software option 635-4 and option 635-5 could also be used)

Also option 630-1, Servo tool change, should be added if servo gun tool change is required.

2.6.3 Summary Type Se

General

The following options are the minimum required to form a complete Spot welding function Type Se.

DressPack

- Option 16-1. Connection to cabinet, (Cable length and communication type to be stated)
- Option 455-1, 455-4. Parallel or Parallel and Bus communication (Communication type to be stated)
- Option 778-2. Spot Welding
- Option 798-2. External routing, DressPack Lower arm (Routing type to be stated)
- Option 780-2. External routing, DressPack Upper arm (Routing type to be stated)

Note

See *Robot Gun on page 69* for further drive details.

General options

- Option 716-1. 1 pc. Digital 24 VDC I/O 16 inputs/ 16 outputs
- Option 727-1. 24V 8 Amps power supply

Required options for servo gun

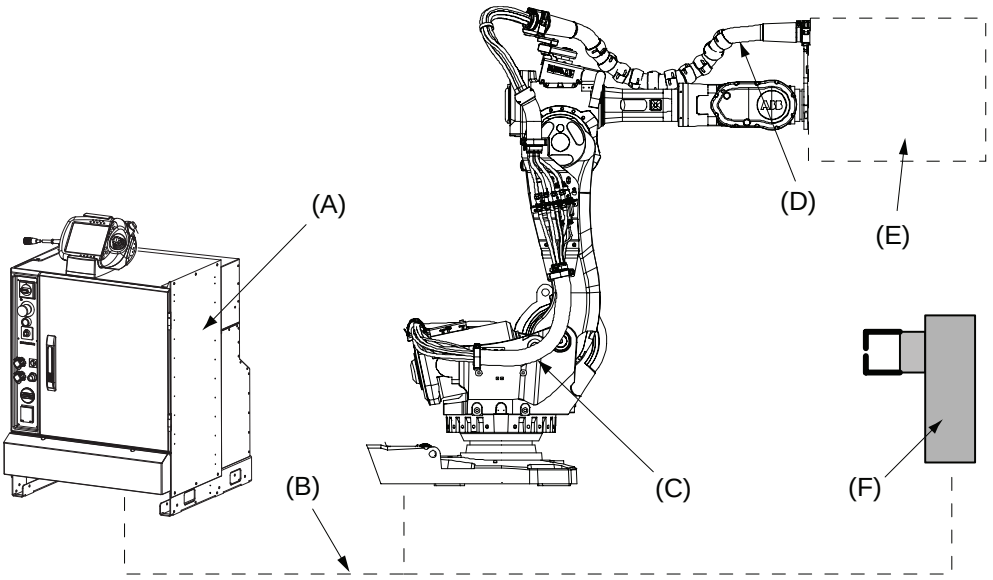
- Option 770-4. First additional drive, W Drive
- Option 785-1. Robot Gun
- Option 786-1,-2,-3,-4. Connection to first drive (cable length to be stated)
- Option 635-3. Spot Servo

2.7 Type HSe

2.7.1 Introduction

General

DressPack Type HSe is designed for handling against a stationary mounted spot welding servo controlled tool (electrical gun). Included main modules are shown in Figure below. Available configurations with linked option numbers are described below with starting with the DressPack.



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Pos	Name
A	Robot controller (incl. 7 th axis drive)
B	DressPack, Floor
C	DressPack, Lower arm
D	DressPack, Upper arm
E	Robot Gripper
F	Stationary gun with axis 7

Available configurations with linked option numbers are described below.

Option description

Option	Type	Description
16-1	Connection to cabinet	Floor cables and connections inside the I/O section for the DressPack are chosen. The length and configuration of the floor harness is specified under the options below. Option 94-1,-2,-3,-4 for parallel communication. Option 90-2,-3,-4,-5 for parallel communication and field bus communication with Can/DeviceNet. Option 92-2,-3 for parallel communication and field bus communication with Profibus.

Continues on next page

2.7.1 Introduction
Continued

Option	Type	Description
455-1	Parallel communication	Offers the signal cables needed for parallel communication in lower and upper arm DressPack. To be combined with option 94-1,-2,-3,-4,-5.
455-4	Parallel and Bus communication	Offers the signal cables needed for the combination of parallel and bus communication in lower and upper arm DressPack. To be combined with option 90-2,-3,-4,-5 or 92-2,-3.
455-8	Parallel and Ethernet	Offers the signal cables needed for the Ethernet communication in combination in lower and upper arm DressPack. To be combined with option 859-1,-2,-3,-4. Requires selection of option 94-X.

The available alternatives and allowed combinations are shown in the schematic table below.

Application Interface connected to Option 16-1, Cabinet	Option 455-1, Parallel communication	Option 94-1,-2,-3,-4 Cable length, Parallel communicaiton	Option 778-1, Material Handling
	Option 455-4, Parallel and bus communication	Option 90-2,-3,-4,-5 Option 92-2,-3 Cable length, Parallel and bus communication	
	Option 455-8, Parallel and Ethernet communication	Option 859-1, -2, -3, -4 Cable length, Ethernet communication	

Continued

	Lower arm	Upper arm
Option 778-1, Material Handling	Option 798-3, Base to axis 3	Option 780-3, -4, Axis 3 to 6 External routing
	Option 798-2, Base to axis 2	Option 780-2, Axis 2 to 6 External routing

2.7.2 Configuration result for Type HSe

General

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

DressPack Type HSe. Parallel communication

- Option 16-1 with Connection to cabinet
- (Option 94-1,-2,-3,-4 to specify cable length)
- Option 455-1. Parallel communication
- Option 778-1 Material Handling
- Option 798-2 or Option 798-3. Internal routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-3, -4 (and Option 798-3). External routing, DressPack Upper arm

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, Axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms[b]
Protective earth		1[a]	0.5 mm^2	250 VACa
Customer Signals (CS)				
Signals twisted pair	20	20 (10x2)[c]	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Media				
Air (PROC 1)		1	12.5 mm inner diameter	Max. air pressure 16 bar/230 PSI

a. Not included in option 780-3.

b. For option 780-3 50 VAC / 60 VDC.

c. For option 780-3 8 signals instead of 20.

Continues on next page

2.7.2 Configuration result for Type HSe
Continued

DressPack Type HSe. Parallel and field bus communication, Can/DeviceNet

- Option 16-1 with Connection to cabinet
- (Option 90-1,-2,-3,-4 to specify cable length)
- Option 455-4. Parallel and bus communication
- Option 778-1. Material Handling
- Option 798-2 or Option 798-3. Internal routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-3, -4 (and Option 798-3). External routing, DressPack Upper arm

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At Connection point. Base, Axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms [b]
Protective earth		1 [a]	0.5 mm^2	250 VAC [a]
Customer Signals (CS)				
Signals twisted pair	20	20 (10x2) [c]	0.23 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.23 mm^2	50 V DC, 1 A rms
Customer bus (CBus)				
Bus signals	At bus board	2	0.14 mm^2	Can/DeviceNet spec
Bus signals	At bus board	2	0.23 mm^2	50 V DC, 1 A rms
Signals twisted pair	6	6(3x2)	0.14 mm^2	50 V DC, 1 A rms
Media				
Air (PROC 1)		1	12.5 mm inner diameter	Max. air pressure 16 bar/230 PSI

a. Not included in option 780-3.

b. For option 780-3 50 VAC / 60 VAC.

c. For option 780-3 8 signals instaed of 20.

Continues on next page

DressPack Type HSe. Parallel and field bus communication, Profibus

- Option 16-1 with Connection to cabinet
- (Option 92-1,-2 to specify cable length)
- Option 455-4. Parallel and bus communication
- Option 778-1. Material Handling
- Option 798-2 or Option 798-3. Internal routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-3, -4 (and Option 798-3). External routing, DressPack Upper arm

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, Axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms [b]
Protective earth		1 [a]	0.5 mm^2	250 VAC [a]
Customer Signals (CS)				
Signals twisted pair	22	22 (11x2) [c]	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Customer bus (CBus)				
Bus signals	At bus board	4	0.14 mm^2	Profibus 12 Mbit/s spec
Signals twisted pair	6	6 (3x2)	0.14 mm^2	50 V DC, 1 A rms
Media				
Air (PROC 1)		1	12.5 mm inner diameter	Max. air pressure 16 bar/230 PSI

a. Not included in option 780-3.

b. For option 780-3 50 VAC / 60 VDC.

c. For option 780-3 8 signals instead of 22.

Continues on next page

2.7.2 Configuration result for Type HSe
Continued

DressPack Type HSe. Parallel and field bus communication, Ethernet

- Option 16-1 with Connection to cabinet
- (Option 859-1,-2, -3, -.4 to specify cable length)
- (Option 94-1, -2, -3, -4 to specify cable length)
- Option 455-8. Parallel and bus communication
- Option 778-1. Material Handling
- Option 798-2 or Option 798-3. Internal routing, DressPack Lower arm

One of the options:

- Option 780-2 (and Option 798-2). External routing with retract arm
- Option 780-3, -4 (and Option 798-3). External routing, DressPack Upper arm

The table below shows the available type of wires/media.

Type	At terminals in cabinet	At connection point. Base, Axis 2/3 or axis 6	Cable/part area	Allowed capacity
Customer Power (CP)				
Utility Power	2+2	2+2	0.5 mm^2	250 VAC, 5 A rms [i]
Protective earth		1	0.5 mm^2	250 VAC [a]
Customer Signals (CS)				
Signals twisted pair	20	20 (10x2) [ii]	0.24 mm^2	50 V DC, 1 A rms
Signals twisted pair and separate shielded	8	8 (4x2)	0.24 mm^2	50 V DC, 1 A rms
Customer bus (Ethernet)				
Bus signals	4	4	0.4 mm^2	Ethernet CAT 5e, 100 Mbit [iii]
Media				
Air (PROC 1)		1	12.5 mm inner diameter	Max. air pressure 16 bar/230 PSI

i For option 780-3 50 VAC / 60 VDC.
ii For option 780-3 8 signals instead of 20.
iii Ethernet with wire colors according to PROFINET standard, M12-connectors.

Continues on next page

Required general options for Type HSe

To enable the Spot welding function package IRB 6650S to perform as intended, general standard robot options are required. These standard options are further described under other chapters and are also mentioned in this chapter.

- Option 716-1. 1 pc. Digital 24 VDC I/O 16 inputs/ 16 outputs
- Option 727-1. 24V 8 Amps power supply

Required options for servo gun

To enable the Spot welding function package 6650S to run with a servo controlled gun, some additional (additional to those described in previous section "Required general options for Type Se") servo drive options are required. These standard options are described under other chapters and are also mentioned below in this chapter.

- Option 770-4. First additional drive, W Drive
- Option 864-1. Resolver connection, axis 7
- Option 785-5. Stationary gun
- Option 786-1,-2,-3,-4. Connection to first drive (cable length to be stated)
- Option 635-3. Spot Servo. Software option for servo controlled guns.
- (Software option 635-5 could also be used)

Also option 630-1, Servo tool change, should be used if servo gun tool change is required.

2.7.3 Summary Type HSe

DressPack

The following options are the minimum required to form a complete Spot welding function Type HSe:

- Option 16-1. Connection to cabinet, (Cable length and communication type to be stated)
- Option 455-1, 455-4. Parallel or Parallel and Bus communication (Communication type to be stated)
- Option 778-1. Material Handling
- Option 798-2 or Option 798-3. Internal routing, DressPack Lower arm (Routing type to be stated)
- Option 780-2, 780-3, 780-4. External routing, DressPack Upper arm (Routing type to be stated)

General options

- Option 716-1. 1 pc. Digital 24 VDC I/O 16 inputs/ 16 outputs
- Option 727-1. 24V 8 Amps power supply

Required options for servo gun

- Option 770-4. First additional drive, W Drive
- Option 785-5. Stationary gun
- Option 786-1. Connection to first drive (other lengths available)
- Option 635-3. Spot Servo. Software option for servo controlled guns

2.8 Connector kits

General

For detailed information on connection location see *Interface descriptions for DressPack on page 82*.

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

xx1300000223

Continues on next page

2.8.1 Base - Connector kits

Available options

		DressPack options	Resolver conn., axis 7	Description
Option	Name	798-3	864-1	
459-1	CP/CS, Proc 1 on base	X		
453-1	FB 7		X	

Note

Ethernet and Servo power connection kits not available.

Option CP/CS, Proc 1 on base - 459-1

R1. CP/CS and Proc 1 on base for option 798-3.

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

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

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

Option FB7 - 453-1

R3. FB 7 on base for option 864-1

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

- Connector with:

1 pcs Multiple connector (pin)	UTOW
1 pcs Adapter	8 pin
8 pcs Pin	For 0.13 - 0.25 mm^2

Continues on next page

Assembly Accessories to complete connector	
Assembly instruction	

2.8.2 Axis 3 - Connector kits

Available options

		DressPack options	Description
Option	Name	798-3	
458-1	CP/CS, CBUS/SP/SS, Proc 1 axis 3	X	UTOW

Option CP/CS/CBus/SP/SS, Proc 1 axis 3 - 458-1

CP/CS/CBus/SP/SS, Proc 1 axis 3 on tool side for option 780-3 and 780-4.

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

This must be assembled by the customer.

The kit contains:

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

CP/CS	
1 pcs UTOW Pin connector 26p, bayonet	UTOW61626PH, Shell size 16
26 pcs Pin	RM18W3K, 0.5-0.82 mm^2
CBUS	
1 pcs UTOW Pin connector 10p, bayonet	UTOW61210PH, Shell size 12
10 pcs Pin	RM18W3K, 0.5-0.82 mm^2
Ethernet	
1 pcs Pin connector M12	Harting 21 03 881 1405
4 pcs Pin	Harting 09670005576, 0.13-0.33 mm^2
SP (Servo Power)	
1 pc Straight connector M23 8p	
4 pcs Crimp pin 1 mm	AWG 24-17
4 pcs Crimp pin 2 mm	AWG 18-14
SS (Servo Signal)	
1 pcs Straight connector M23 17p	
17 pcs Pin	AWG 28-20
Assembly Accessories to complete connector	
Assembly instruction	

2.8.3 Axis 6 - Connector kits

Available options

				Description
Option	Name	780-3 (MH)	780-4 (LeanID)	
543-1	CP/CS/CBUS/SP/SS Proc 1 axis 6	X	X	UTOW
452-1	Weld Proc 1-4 axis 6		X	MC, Separate conductors

Option CP/CS/CBus, Proc 1 axis 6 - 543-1

CP/CS/CBus/SP/SS, Proc 1 axis 6 on tool side for option 780-3 and 780-4.

This kit offers a kit with connectors to be mounted at toolside of axis 6.

This must be assembled by the customer.

The kit contains:

- 1 Hose fitting (swivel nut adapter (1/2", M22x1.5 Brass, 24 degree seal))
- Connector with:

CP/CS	
1 pcs UTOW Pin connector 26p, bulkhead	UTOW71626PH05, Shell size 16
26 pcs Pin	RM18W3K, 0.5-0.82 mm^2
CBUS	
1 pcs UTOW Pin connector 10p, bulkhead	UTOW71210PH05, Shell size 12
10 pcs Pin	RM18W3K, 0.5-0.82 mm^2
Ethernet	
1 pcs Socket connector M12	Harting 21 03 881 2425
4 pcs Socket	Harting 09670005476, 0.13-0.33 mm^2
SP (Servo Power)	
1 pcs Bulkhead contact M23	
4 pcs Crimp pin 1 mm	AWG 24-17
4 pcs Crimp pin 2 mm	AWG 18-14
SS (Servo Signal)	
1 pcs Bulkhead contact M23	
17 pcs Pin	AWG 28-20
Assembly Accessories to complete connector	
Assembly instruction	

Option Weld, Proc 1-4 axis 6 - 452-1

Weld and Proc 1-4 axis 6 on manipulator side for option 780-4

The process cable package from axis 6 ends with free end for media and for weld power cable. The option 452-1 offers a kit for connectors. This must be assembled by the customer when hoses and power cable has been cut to required length.

Continues on next page

2.8.3 Axis 6 - Connector kits
Continued

The kit contains:

- 4 Hose fittings (Swivel Nut adapter, (2 x ½", M22x1.5) and (2x 3/8", M16x1.5))
- 1 Multi contact connector (Female) type including:
-

1 pc Welding connector	3x25 mm^2
1 pc Cable gland	Diameter 24-28 mm
1 pc End housing	0.21-0.93 mm^2
1 pcs Reducing coupling	PG36/PG29
Assembly Accessories to complete connector	
Assembly instruction	

3 Specification of variants and options

3.1 Introduction to variants and options

General

The different variants and options for the IRB 6650S 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.

3.2 Manipulator

Variants

Option	IRB Type	Handling capacity (kg)/Reach (m)
435-69	6650S	90/3.9
435-50	6650S	125/3.5
435-51	6650S	200/3.0

Manipulator color

Option	Color	RAL code[i]
209-1	ABB orange standard Standard color with protection option 287-3 Foundry Plus	RAL 7032
209-202	ABB Graphite White std Standard color with protection option 287-4 Standard	RAL 7035
209	RAL code should be specified (ABB non-standard colors)	

i The colors can differ depending on supplier and the material on which the paint is applied.

Note

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

Protection types

Option	Protection type	Note
287-4	Standard	IP 67
287-3	Foundry Plus 2	See *Protection type Foundry Plus 2 on page 11* for a complete description of protection type Foundry Plus 2.

3.3 Equipment

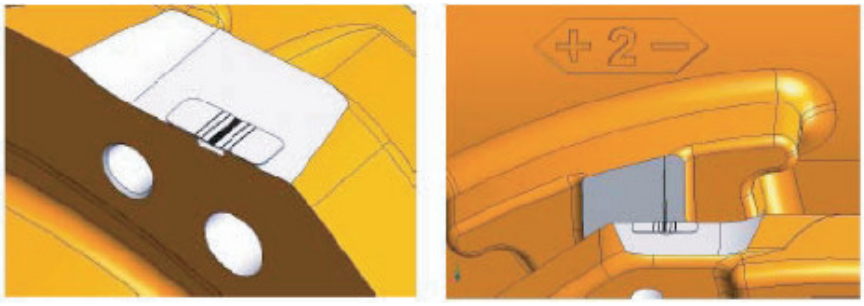
General

Option	Type	Description
213-1	Safety lamp	A safety lamp with an orange fixed light can be mounted on the manipulator. The lamp is active in MOTORS ON mode. The safety lamp is required on a UL/UR approved robot.
159-1	Fork lift device	Lifting device on the manipulator for fork-lift handling. Note. When Cooling Fan for axis 1 motor unit is used, this must be disassembled in order to use fork lift device.
37-1	Base plate	Can be used for IRB 6650S and IRB 7600. See *Installation on page 20*, for dimension drawing.
87-1	Cooling fan for axis 1 motor (IP 54)	Cannot be combined with Cooling fan for axis 2 motor option 88-1. For in use recommendations see *Cooling fan for axis 1 and 2 motor on page 66*. Not for protection Foundry Plus. Not together with track motion.
88-1	Cooling fan for axis 2 motor (IP 54)	For in use recommendations see *Cooling fan for axis 1 and 2 motor on page 66*. Not for protection Foundry Plus. Not together with track motion.
430-1	Upper arm covers	See Figure in *Upper arm covers on page 139*. Included in protection Foundry Plus.
804-1	Labels for synchronization markings	For a more accurate marking of the synchronization position of the robot. Assembly instructions are included. See Figures for Synchronize lables, axis 2 - 6.

Synchronize lables

The option contains synchronize lables for each axis.

Synchronize lables for Axis 2



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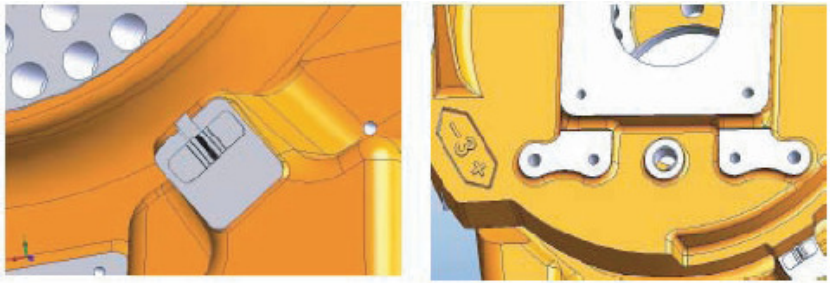
3.3 Equipment
Continued

Synchronize lables for Axis 3



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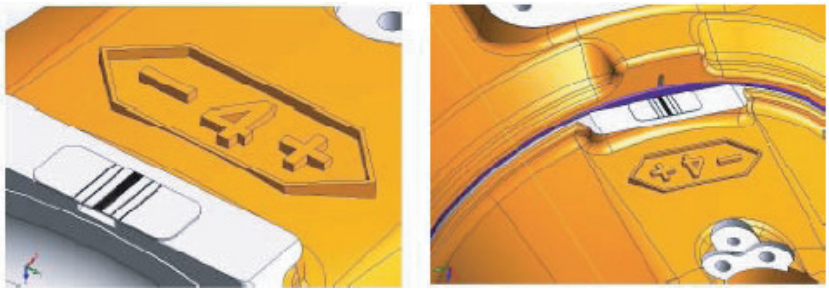
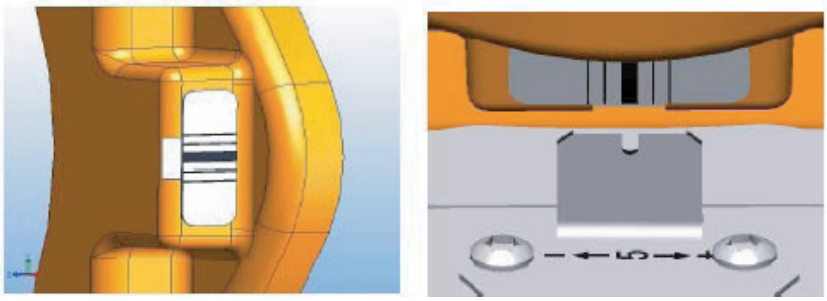
Synchronize lables for Axis 4



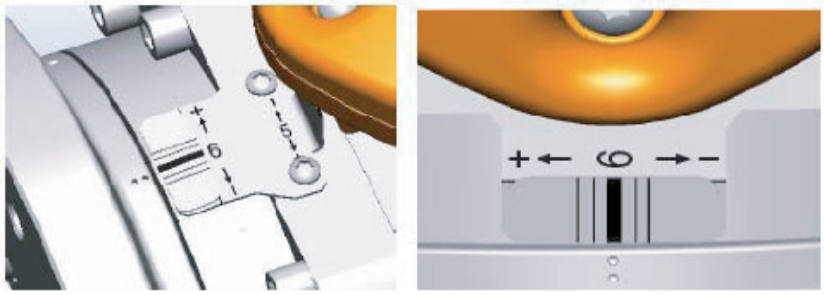
xx1000000526

Synchronize lables for Axis 5



xx1000000527

Synchronize lables for Axis 6



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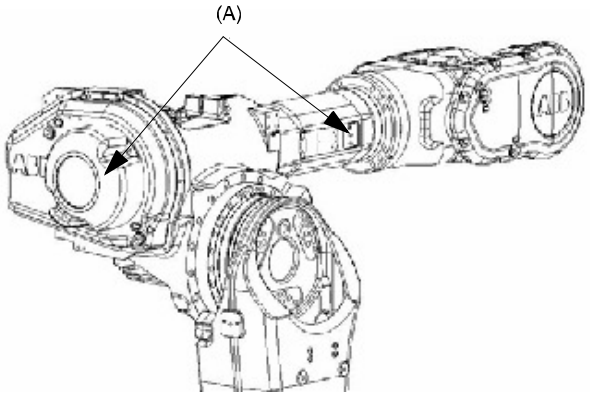
Resolver connection, axis 7

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

Upper arm covers



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Pos	Description
A	Option 430-1

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*.

Foundry Plus Cable Guard

The manipulator cables are equipped with an additional protection of aluminized leather against e.g. aluminium spitz and flashes and chips from machining. Process cable for material handling from base to axis 3, option 798-3 has the same protection

Option	Description	Remark
908-1	Foundry Plus Cable Guard	For extra protection of cables. Requires option 287-3 Foundry Plus.

Working Range Limit

To increase the safety of the robot, the working range of axes 1, 2 and 3 can be restricted by extra mechanical stops.

Option	Type	Description
29-1	Axis 1,15 degrees	Two stops which allow the working range to be restricted in increments of 15°.
29-2	Axis 1, 7.5 degrees	Two stops which allow the working range to be restricted in increments of 7,5°.

Continues on next page

Option	Type	Description
32-1	Axis 2	Six stops which allow the working range to be restricted in increments of 15° at both end positions. Each stop decreases the motion by 15°.
34-1	Axis 3	Six stops which allow the working range to be restricted in increments of 20° at both end positions. Each stop decreases the motion by 20°.

Extended work range

Option	Type	Description
561-1	Extended work range axis 1	To extend the working range on axis 1 from ± 180° to ± 220°. When the option is used the mechanical stop shall be removed. Requires options SafeMove or EPS (Electronic Position Switches).

CAUTION

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

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

For information about the option SafeMove, see *Application manual - Functional safety and SafeMove2*.

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

Standard calibration method

Option	Type	Description
1999-1	Axis calibration	Preferred standard calibration method. Robust, high performance axis calibration using only mechanical calibration stops and software.
1999-2	Calibration Pendulum	Previous standard calibration method only to be used in special cases if customers would like to harmonize calibration with already installed base.

Note

The calibration methods are not interchangeable.

3.4 Floor cables

Manipulator cable length

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

3.5 Process DressPack

Connection to

Option	Connection to	Description
16-1	Cabinet	The signals CP/CS are connected to 12-pole screw terminals, Phoenix MSTB 2.5/12-ST-5.08, in the controller. The cable between R1.CP/CS and the controller is supplied. For information about the limited number of signals available, see *Type H on page 88* to *Type S on page 94*

Communication

Option	Type	Description
455-1	Parallel communication	Includes customer power CP, customer signals CS.
455-4	Parallel and bus communication	Includes CP, customer signals and CAN/DeviceNet or Profibus for process cable package.
455-8	Parallel and Ethernet communication	Includes CP, customer signals and PROFINET or Ethernet/IP for process cable package

3.6 DressPack Floor

Connection to Parallel/CAN DeviceNet/Profibus/Ethernet

Following information specifies the cable length for Parallel/CANDeviceNet/Profibus for connection to cabinet.

Option	Lengths	Description
94-1/90-2/92-2/859-1	7 m	
94-2/90-3/92-3/859-2	15 m	
90-4/92-4/859-3	22 m	
94-4/90-5/92-5/859-4	30 m	

3.7 DressPack Lower and Upper arm

DressPack process configuration

Note

For more information about the process cable packages, see 1.2 DressPack.

Option	Description	Note
778-1	Material Handling	Includes signals and one air hose.
778-2	Spot Welding	Includes signals, weld power cable, one air hose and three media hoses.

DressPack lower arm

Option	Description	Note
798-2	Routing from base to axis 2	
798-3	Routing from base to axis 3	

DressPack upper arm

Option	Description	Note
780-2	External routing from axis 2 to axis 6	Requires option 798-2.
780-3	External routing from axis 3 to axis 6	Requires option 778-1 and 798-3.
780-4	Internal routing from axis 3 to axis 6	Requires option 798-3.

Note

If option 780-4, LeanID, is selected the payload will decrease, for detailed information see Load diagrams.

3.8 Connection kits

General

The connectors fit to the connectors at the manipulator base, axis 2/3 and 6 respectively.

Content

The kit consists of connectors, pins and sockets. For technical description, see *Connector kits on page 129*.

Option	Type	Description
459-1	R1.CP/CS and PROC1	For the Customer Power/Customer Signal connector and one Process connector on the manipulator base. Sockets for bus communication are included.
453-1	R3.FB7	For the 7-axis connector on the manipulator base.
458-1	R2.CP/CS and PROC1	For the Customer Power/Customer Signal connector and one Process connector at axis 2/3. Pins for bus communication are included.
452-1	WELD and PROC1-4 axis 6	Weld connector and four Process connectors at axis 6, the manipulator side.
543-1	CP/CS/BUS, PROC1 axis 6	Connector for customer power/customer signal/customer bus at axis 6 tool side.

3.9 Servo Gun

Content

For technical description see *Servo gun on page 67*.

Option	Lengths
785-1	For robot handled Servo Gun.
785-5	For Stationary Servo Gun.

Connection to first drive

Following information specifies the cable length for Connection to first drive. For further information see *Servo gun on page 67*.

Option	Lengths
786-1	7 m
786-2	15 m
786-3	22 m
786-4	30 m

3.10 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*.

Continues on next page

Warranty for DressPack

Note

Option 780-2 upper arm DressPack SW/MH2 is not covered by the warranty.

Note

Option 780-3 upper arm DressPack MH3 is not covered by the warranty.

Note

Option 780-4 DressPack LeanID is covered by the warranty.

3.11 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*.

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4 Accessories

4.1 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

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