Product Specification

Industrial Robot

3HAC 13491-1/M2000/Rev. 3
IRB 7600 - 500/2.3
IRB 7600 - 400/2.55
IRB 7600 - 150/3.5

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1 Description

1.1 Structure

A new world of possibilities opens up with ABB's new Power Robot family. It comes in three versions, 500 kg, 400 kg, and 150 kg handling capacities.
The IRB 7600 is ideal for heavy-weight applications, regardless of industry. Typical areas can be handling of heavy fixtures, turning car bodies, lifting engines, handling heavy parts, loading and unloading of machine cells, alternatively handling large and heavy pallet layers.

There is more to this benchmark product than sheer power. 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 the robot itself. When handling payloads of 500 kg, it is clear that safety features are vital in protecting the new investment.

There are a large number of process options for spot welding and material handling integrated in the robot. For a complete description of process options for spot welding see the Product Specification SpotPack.

The robot is equipped with the operating system BaseWare OS. BaseWare OS controls every aspect of the robot, like motion control, development and execution of application programs, communication etc. See Product Specification S4Cplus.

For additional functionality, the robot can be equipped with optional software for application support - for example spot welding, communication features - network communication - and advanced functions such as multi-tasking, sensor control, etc. For a complete description on optional software, see the Product Specification RobotWare Options.

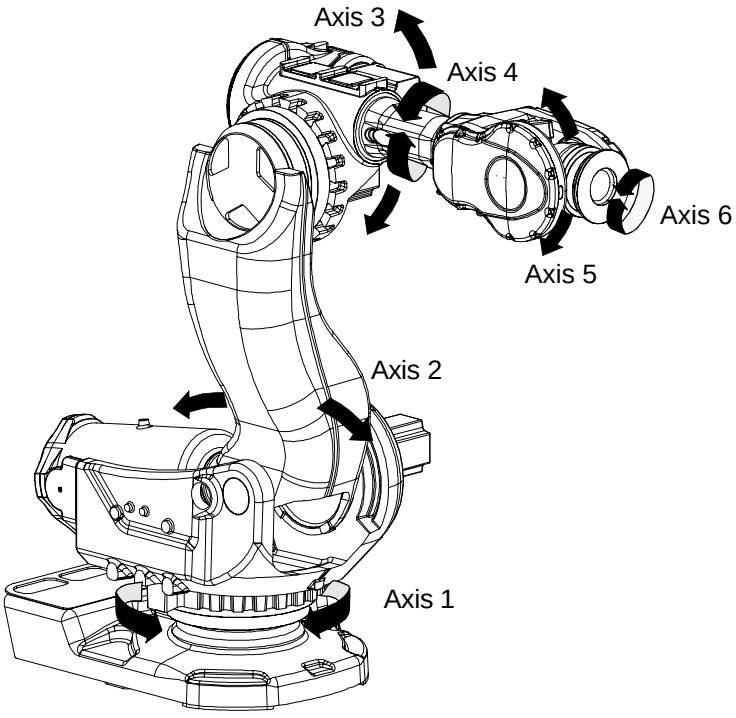


Figure 1 The IRB 7600 manipulator has 6 axes.

Different robot versions

The IRB 7600 is available in three versions. The following different robot types are available:

Standard:

IRB 7600 - 500 kg / 2.3 m
IRB 7600 - 400 kg / 2.55 m
IRB 7600 - 150 kg / 3.5 m

Definition of version designation

IRB 7600 Mounting - Handling capacity / Reach

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

Manipulator weight IRB 7600-500/2.32490 kg
IRB 7600-400/2.552500 kg
IRB 7600-150/3.52530 kg

Airborne noise level:

The sound pressure level outside the working space	≤ 73 dB (A) Leq (acc. to Machinery directive 98/37/EEC)

Power consumption at maximum load:

ISO Cube	3.4 kW
Normal robot movements	5.8 kW

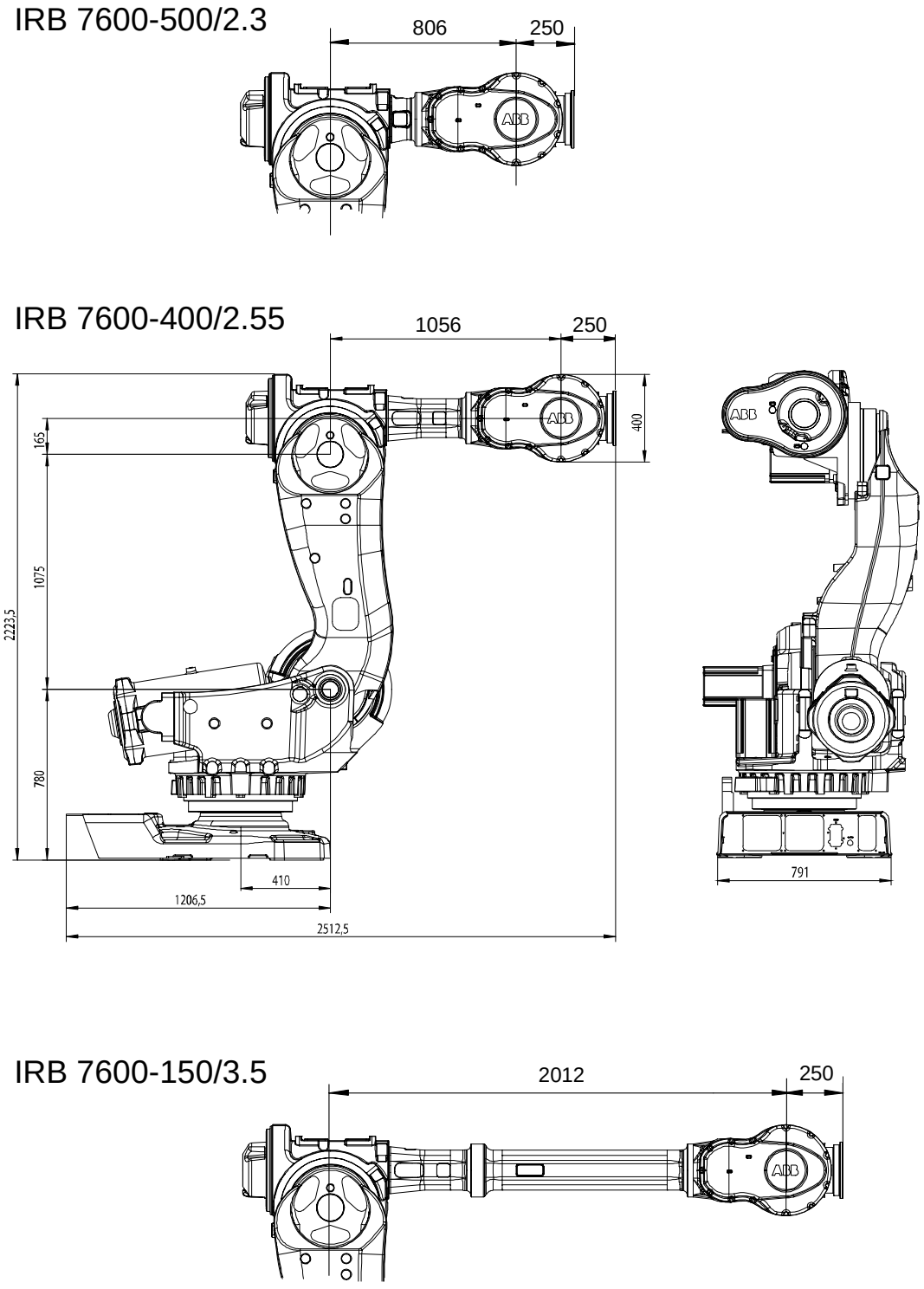


Figure 2 View of the manipulator from the side and rear (dimensions in mm). Allow 200 mm for cables behind the manipulator foot.

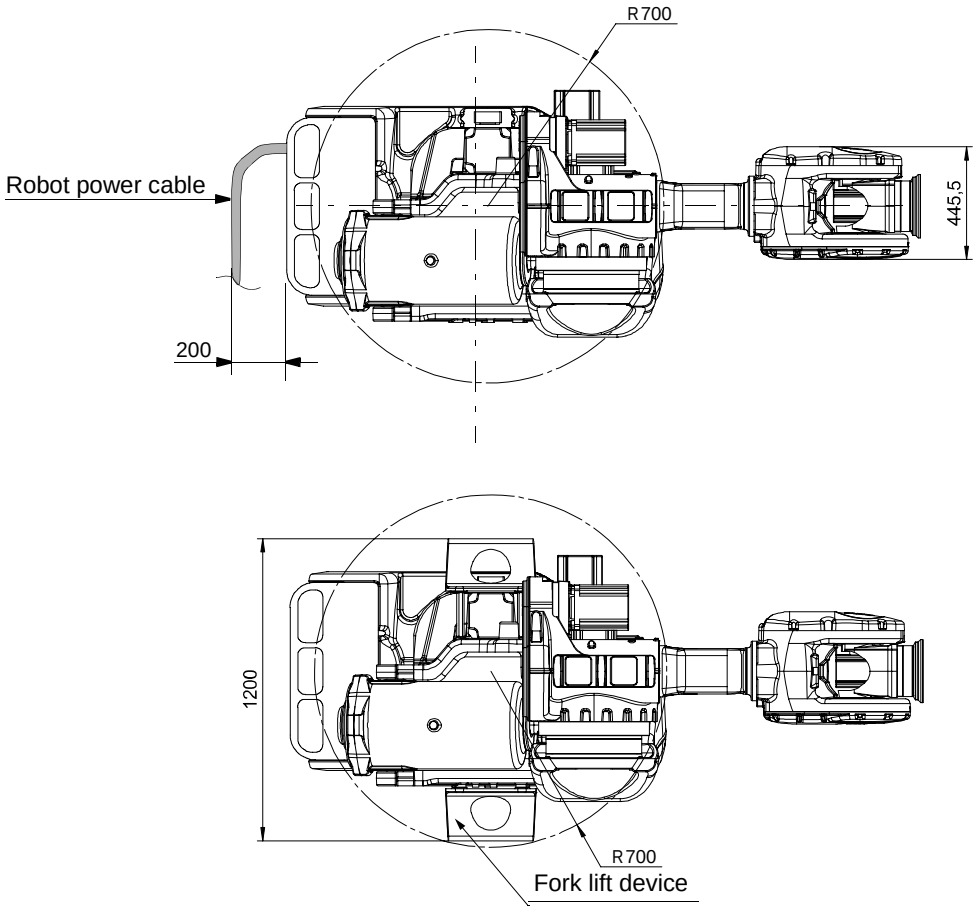


Figure 3 View of the manipulator from above (dimensions in mm)

1.2 Safety/Standards

The robot conforms to the following standards:

EN 292-1	Safety of machinery, terminology
EN 292-2	Safety of machinery, technical specifications
EN 954-1	Safety of machinery, safety related parts of control systems
EN 60204	Electrical equipment of industrial machines
IEC 204-1	Electrical equipment of industrial machines
ISO 10218, EN 775	Manipulating industrial robots, safety
ANSI/RIA 15.06/1999	Industrial robots, safety requirements
ISO 9787	Manipulating industrial robots, coordinate systems and motions
IEC 529	Degrees of protection provided by enclosures
EN 50081-2	EMC, Generic emission
EN 61000-6-2	EMC, Generic immunity
ANSI/UL 1740-1996 (option)	Standard for Industrial Robots and Robotic Equipment
CAN/CSA Z 434-94 (option)	Industrial Robots and Robot Systems - General Safety Requirements

The robot complies fully with the health and safety standards specified in the EEC's Machinery Directives.

The Power Robot Generation is designed with a unique combination of robot power and control system intelligence.

The Service Information System (SIS)
The service information system gathers information about the robot's usage and by that determines how hard the robot has been used. The usage is characterised by the speed, the rotation angles and the load of every axis.
With this data collection, the service interval of every individual robot of this generation can be predicted, optimising and planning ahead service activities. The collection data is available via the teach pendant or the network link to the robot.

The Power Robot Generation is designed with absolute safety in mind. It is dedicated to actively or passively avoid collisions and offers the highest level of safety to the operators and the machines as well as the surrounding and attached equipment. These features are presented in the active and passive safety system.

The Active Safety System

The active safety system includes those software features that maintain the accuracy of the robot's path and those that actively avoid collisions which can occur if the robot leaves the programmed path accidentally or if an obstacle is put into the robot's path.

The Active Brake System (ABS)
All robots run with an active brake system that supports the robots to maintain the programmed path even in an emergency situation.
The ABS is active during all stop modes, braking the robot to a stop with the power of the servo drive system along the programmed path. After a specific time the mechanical brakes are activated ensuring a safe stop.
The stopping process is in accordance with a class 1 stop. The maximal applicable torque on the most loaded axis determines the stopping distance.
In case of a failure of the drive system or a power interruption, a class 0 stop turns out.
While programming the robot in manual mode, the enabling device has a class 0 stop.
ES and GS have still a class 1 stop.

The Self Tuning Performance (STP)
The Power Robot Generation is designed to run at different load configurations, many of which occur within the same program and cycle.
The robot's installed electrical power can thus be exploited to lift heavy loads, create a high axis force or accelerate quickly without changing the configuration of the robot.
Consequently the robot can run in a "power mode" or a "speed mode" which can be measured in the respective cycle time of one and the same program but with different tool loads. This feature is based on QuickMove™.
The respective change in cycle time can be measured by running the robot in NoMotion-Execution with different loads or with simulation tools, like RobotStudio.

The Electronically Stabilised Path (ESP)
The load and inertia of the tool have a significant effect on the path performance of a robot. The Power Robot Generation is equipped with a system to electronically stabilise the robot's path in order to achieve the best path performance.
As the path performance as such is measured in a combination of speed and path accurac, the user can choose himself the optimal configuration by applying the parameter "WorldAccLim" which can limit the linear acceleration along a programmed path.
This has an influence while accelerating and braking and consequently stabilises the path during all motion operations with a compromise of the best cycle time. This feature is secured through TrueMove™.

Over-speed protection
The speed of the robot is monitored by two independent computers.

Restricting the working space
The movement of each axis can be restricted using software limits.

As options there are safeguarded space stops for connection of limit switches to restrict the working space.
Axes 1-3 can also be restricted by means of mechanical stops.

Collision detection (option)
In case an unexpected mechanical disturbance occurs, like a collision, electrode sticking, etc., the robot will detect the collision, stop on the path and slightly back off from its stop position, releasing tension in the tool.

The Passive Safety System

The Power Robot Generation has a dedicated passive safety system that by hardware construction and dedicated solutions is designed to avoid collisions with surrounding equipment. It integrates the robot system into the surrounding equipment safely.

Compact robot arm design
The shape of the lower and upper arm system is compact, avoiding interference into the working envelope of the robot.
The lower arm is shaped inward, giving more space under the upper arm to re-orientate large parts and leaving more working space while reaching over equipment in front of the robot.
The rear side of the upper arm is compact, with no components projecting over the edge of the robot base even when the robot is moved into the home position.

Moveable mechanical limitation of main axes (option)
All main axes can be equipped with moveable mechanical stops, limiting the working range of every axis individually. The mechanical stops are designed to withstand a collision even under full load.

Zone switches on main axes (option)
All main axes can be equipped with zone switches. The double circuitry to the cam switches is designed to offer personal safety according to the respective standards.

The Internal Safety Concept

The internal safety concept of the Power Robot Generation is based on a two-channel circuit that is monitored continuously. If any component fails, the electrical power supplied to the motors shuts off and the brakes engage.

Safety category 3
Malfunction of a single component, such as a sticking relay, will be detected at the next MOTOR OFF/MOTOR ON operation. MOTOR ON is then prevented and the faulty section is indicated. This complies with category 3 of EN 954-1, Safety of machinery - safety related parts of control systems - Part 1.

Selecting the operating mode
The robot can be operated either manually or automatically. In manual mode, the robot can only be operated via the teach pendant, i.e. not by any external equipment.

Reduced speed
In manual mode, the speed is limited to a maximum of 250 mm/s (600 inch/min.). The speed limitation applies not only to the TCP (Tool Centre Point), but to all parts of the robot. It is also possible to monitor the speed of equipment mounted on the robot.

Three position enabling device
The enabling device on the teach pendant must be used to move the robot when in manual mode. The enabling device consists of a switch with three positions, meaning that all robot movements stop when either the enabling device is pushed fully in, or when it is released completely. This makes the robot safer to operate.

Safe manual movement
The robot is moved using a joystick instead of the operator having to look at the teach pendant to find the right key.

Emergency stop
There is one emergency stop push button on the controller and another on the teach pendant. Additional emergency stop buttons can be connected to the robot’s safety chain circuit.

Safeguarded space stop

The robot has a number of electrical inputs which can be used to connect external safety equipment, such as safety gates and light curtains. This allows the robot's safety functions to be activated both by peripheral equipment and by the robot itself.

Delayed safeguarded space stop
A delayed stop gives a smooth stop. The robot stops in the same way as at a normal program stop with no deviation from the programmed path. After approx. 1 second the power supplied to the motors is shut off.

Hold-to-run control
"Hold-to-run" means that you must depress the start button in order to move the robot. When the button is released the robot will stop. The hold-to-run function makes program testing safer.

Fire safety
Both the manipulator and control system comply with UL's (Underwriters Laboratory) tough requirements for fire safety.

Safety lamp (option)
As an option, the robot can be equipped with a safety lamp mounted on the manipulator. This is activated when the motors are in the MOTORS ON state.

1.3 Installation

All versions of IRB 7600 are designed for floor mounting. Depending on the robot version, an end effector with max. weight of 150 to 500 kg including payload, can be mounted on the mounting flange (axis 6). See Load diagrams for IRB 7600 generation robots from page 16 to page 21.

Extra loads (valve packages, transformers) can be mounted on the upper arm with a maximum weight of 50 kg. On all versions an extra load of 500 kg can also be mounted on the frame of axis 1. Holes for mounting extra equipment on page 24.

The working range of axes 1-3 can be limited by mechanical stops. Position switches can be supplied on axes 1-3 for position indication of the manipulator.

External Mains Transformer

The robot system requires a 475 VAC power supply. Therefore an external transformer will be included when a mains voltage other than 475V is selected.

Operating requirements

Protection standards

Standard and Foundry	Manipulator	IP67

Explosive environments

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

Ambient temperature

Manipulator during operation		+5°C (41°F) to +50°C (122°F)
For the controller:	Standard	+45°C (113°F)
	Option	+52°C (126°F)

Complete robot during transportation and storage,	-25°C (13°F) to +55°C (131°F)
for short periods (not exceeding 24 hours)up to	+70°C (158°F)

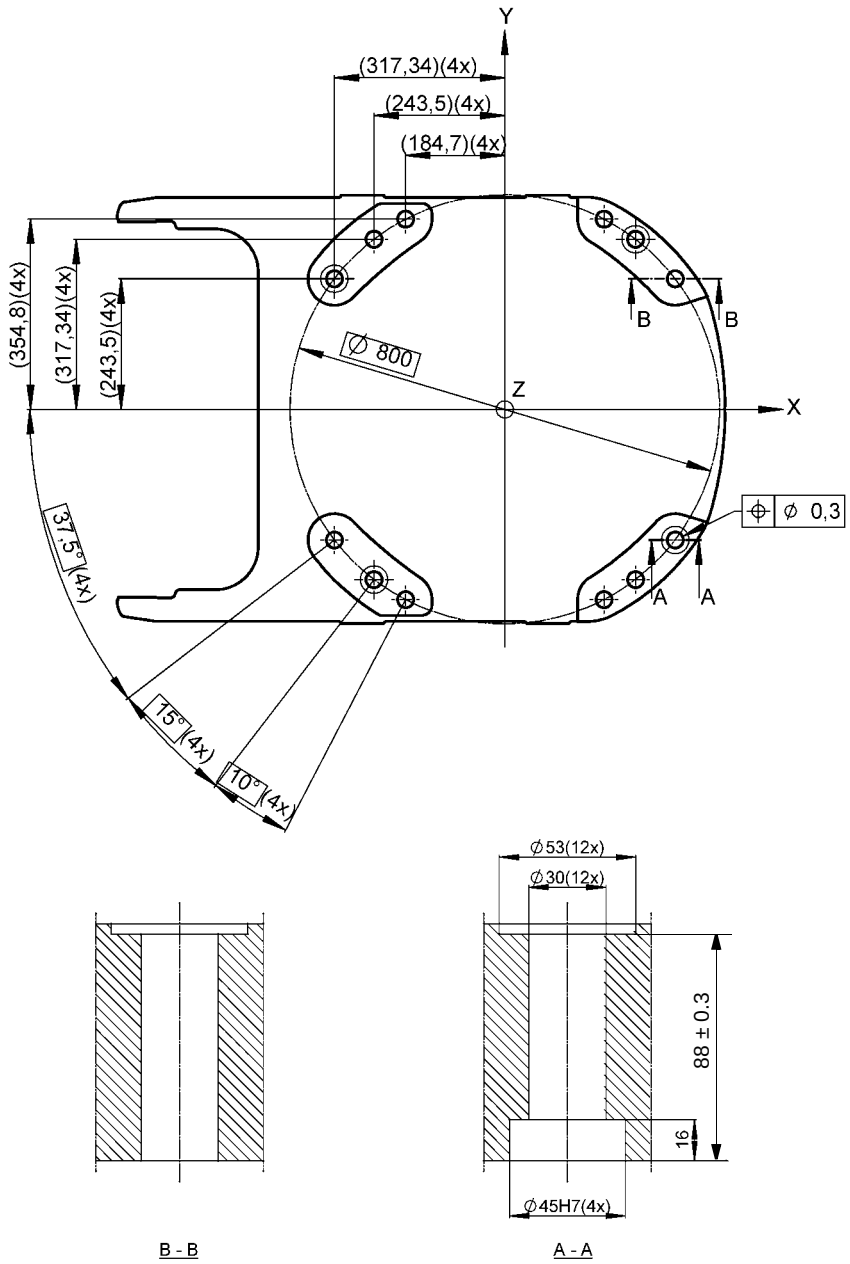
Relative humidity

Complete robot during transportation and storage	Max. 95% at constant temperature
Complete robot during operation	Max. 95% at constant temperature

Mounting the manipulator

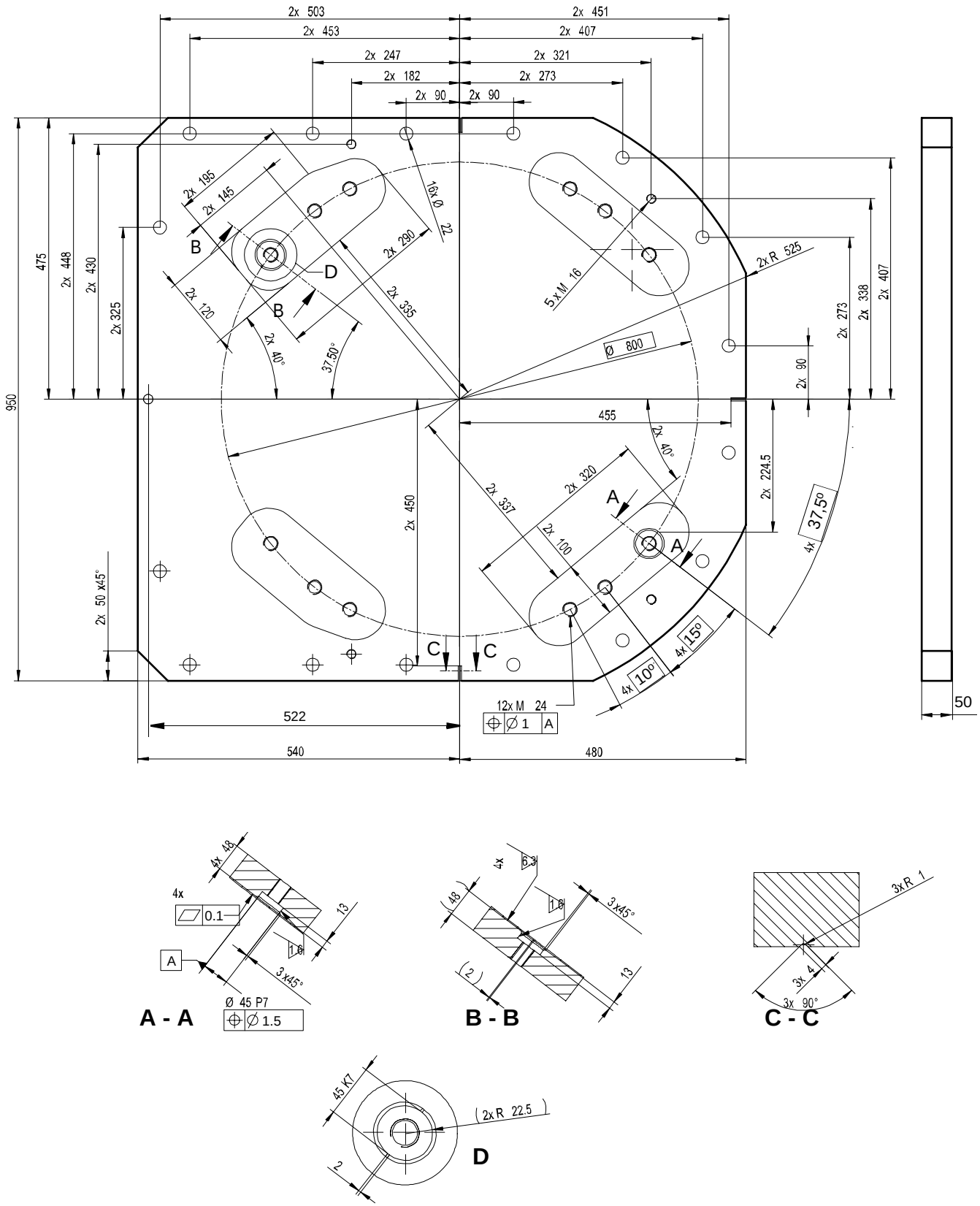
Maximum load in relation to the base coordinate system.

	Endurance load in operation	**Max. load at emergency stop**
Force xy	±14000 N	±31000 N
Force z	32000 ±10000 N	39000 ±16000 N
Torque xy	±42000 Nm	±72000 Nm
Torque z	±11000 Nm	±19500 Nm



Recommended screws for fastening
the manipulator to a base plate: M24 x 120 8.8 with 4 mm flat washer
Torque value 775 Nm

Figure 4 Hole configuration (dimensions in mm).



Two guiding pins required, dimensions see Figure 6

Figure 5 Option Base plate (dimensions in mm).

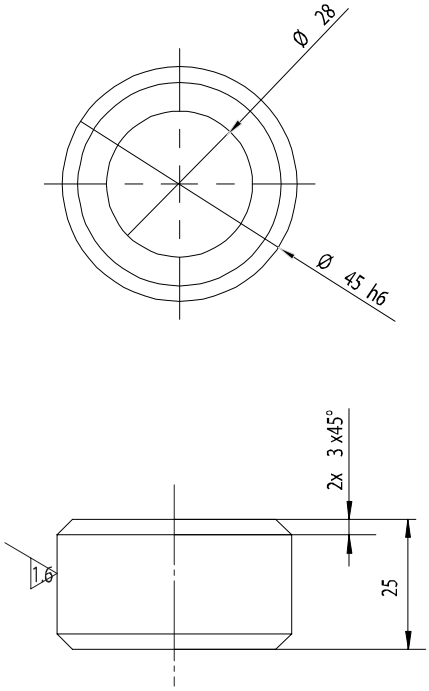


Figure 6 Guide sleeves (dimensions in mm).

1.4 Load diagrams

The load diagrams include a nominal payload inertia, J_0 of 35 kgm^2, and an extra load of 50 kg at the upper arm housing, see Figure 7.

At different arm load, payload and moment of inertia, the load diagram will be changed.

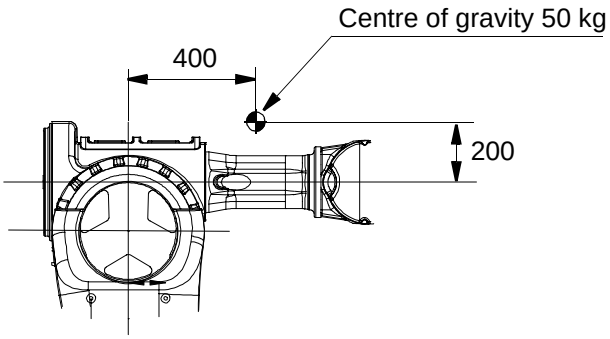


Figure 7 Centre of gravity for 50 kg extra load at arm housing (dimensions i mm).

Load diagram for IRB 7600-500/2.3

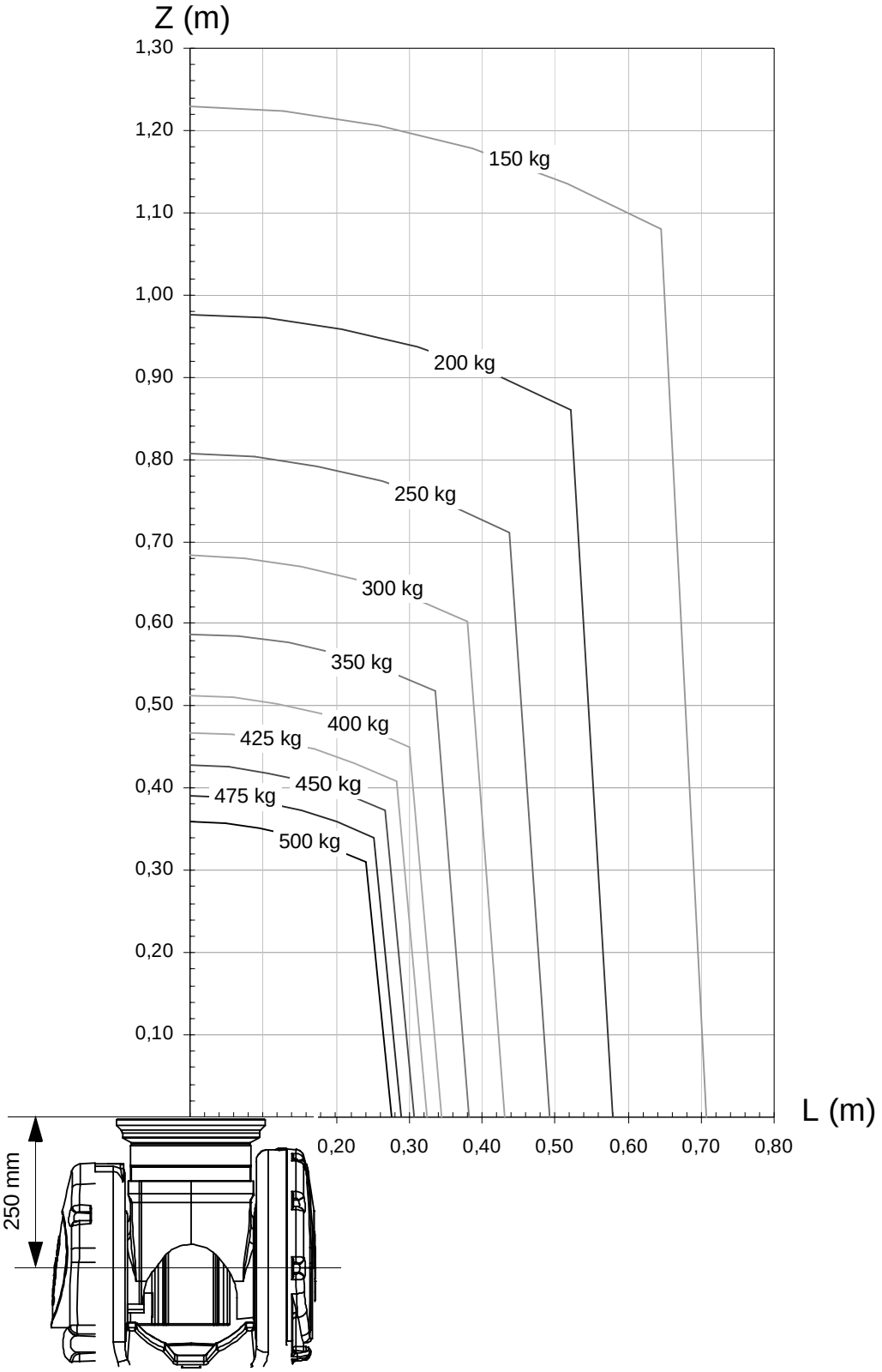


Figure 8 Maximum permitted load mounted on the robot tool flange at different positions (centre of gravity).

Load diagram for IRB 7600-500/2.3 “Vertical Wrist” (±10^{o})

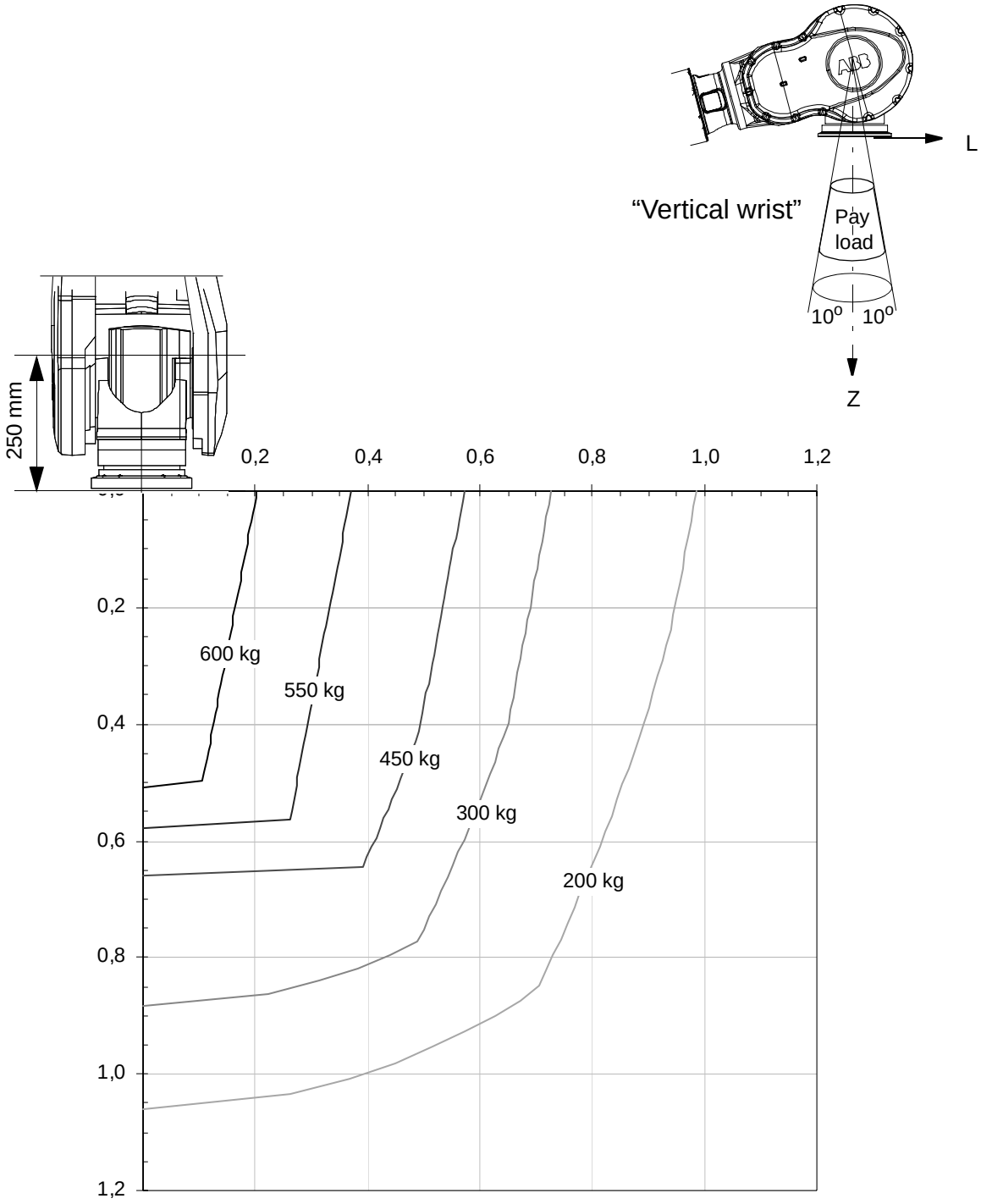


Figure 9 Maximum permitted load mounted on the robot tool flange at different positions (centre of gravity) at “Vertical Wrist” (±10^{o}), J_0 =35 kgm^2.

For wrist down (0^{o} deviation from the vertical line).
Max load = 650kg, Z_{max} = 0,439m and L_{max} = 0,096m

Load diagram for IRB 7600-400/2.55

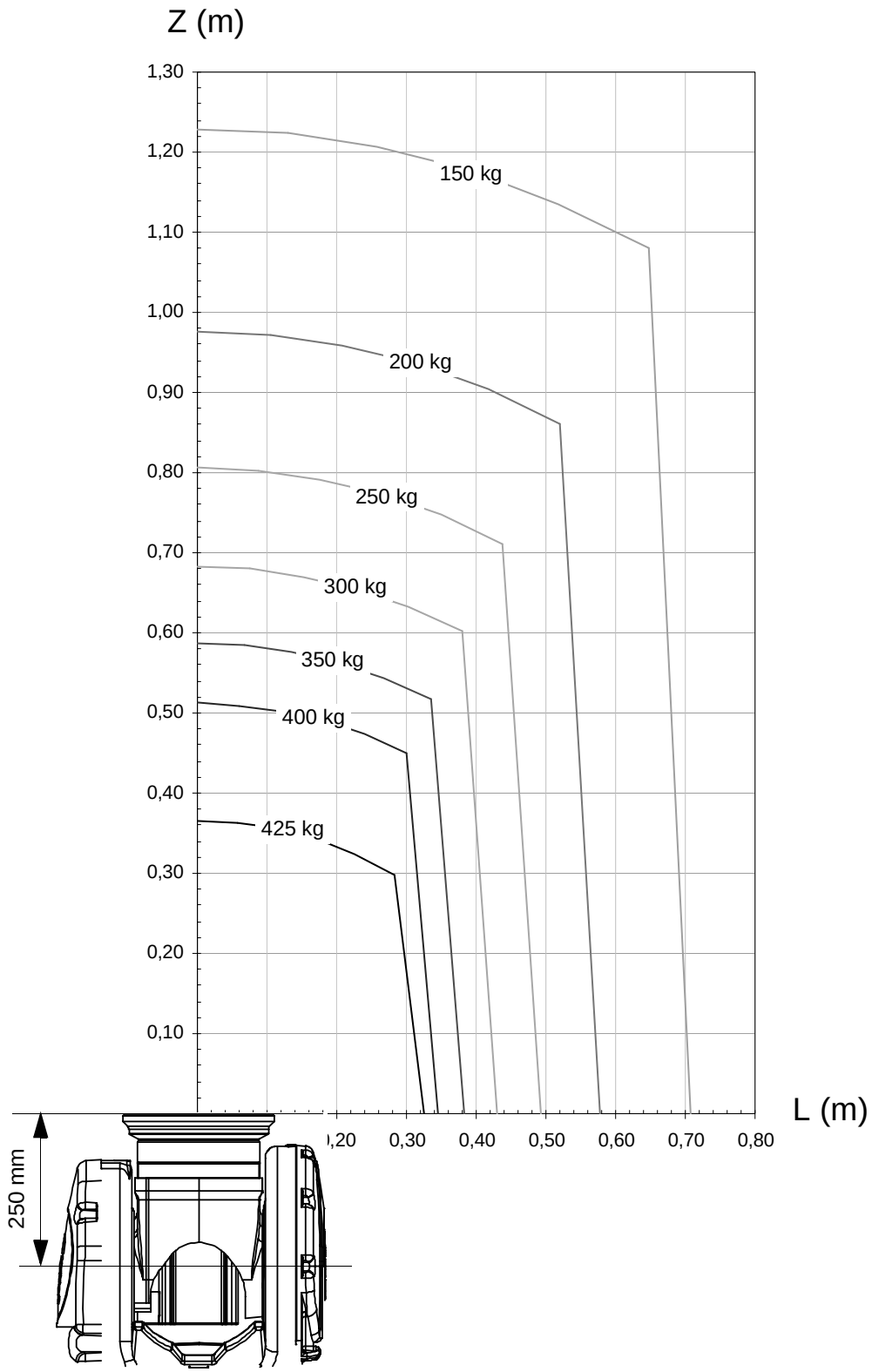


Figure 10 Maximum permitted load mounted on the robot tool flange at different positions (centre of gravity).

Load diagram for IRB 7600-400/2.55 “Vertical Wrist” ($\pm 10^{o}$)

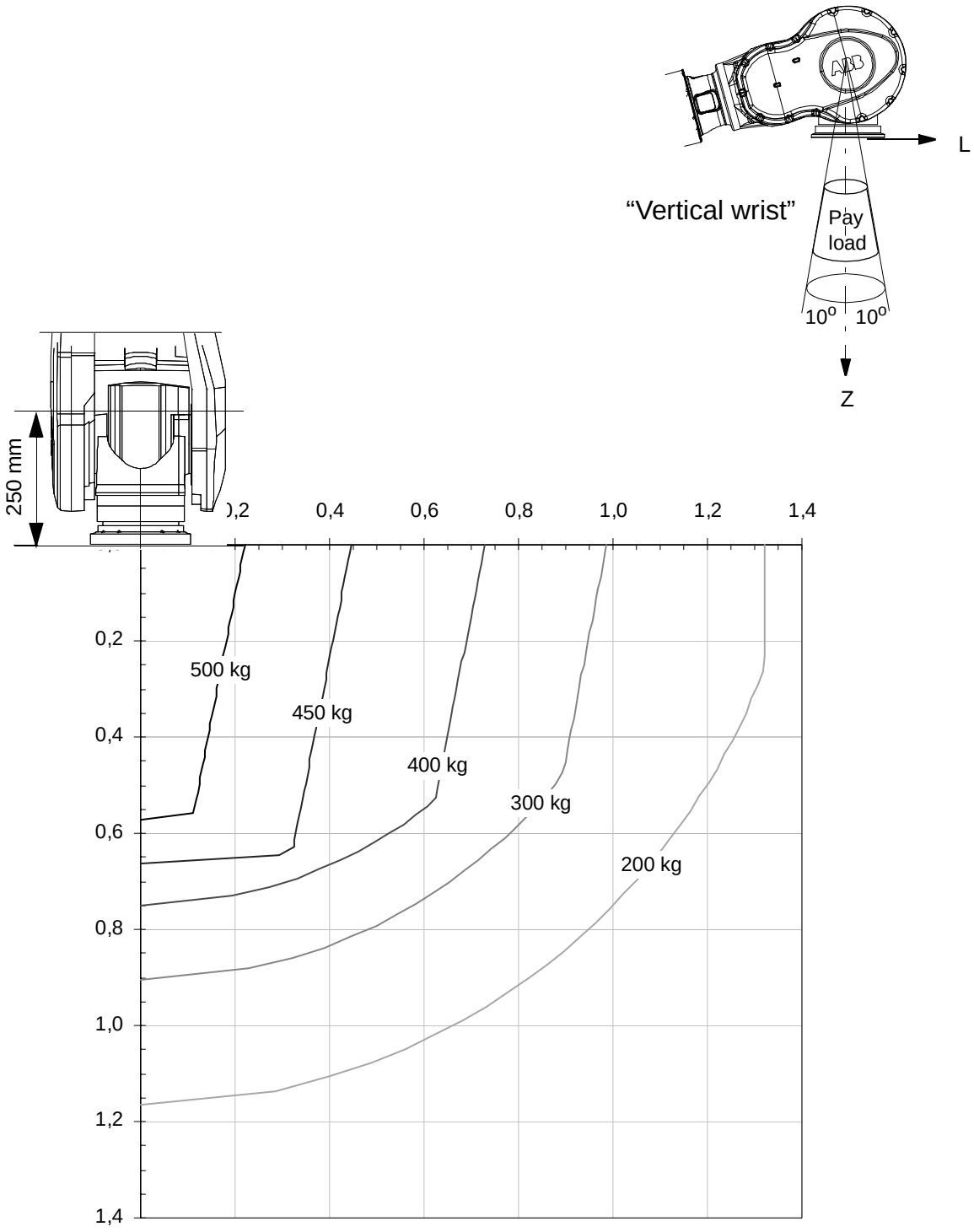


Figure 11 Maximum permitted load mounted on the robot tool flange at different positions (centre of gravity) at “Vertical Wrist” ($\pm 10^{o}$), J_0 =35 kgm^2.

For wrist down (0^{o} deviation from the vertical line).
Max load = 540 kg, Z_{max} = 0,498m and L_{max} = 0,103m

Load diagram for IRB 7600-150/3.5

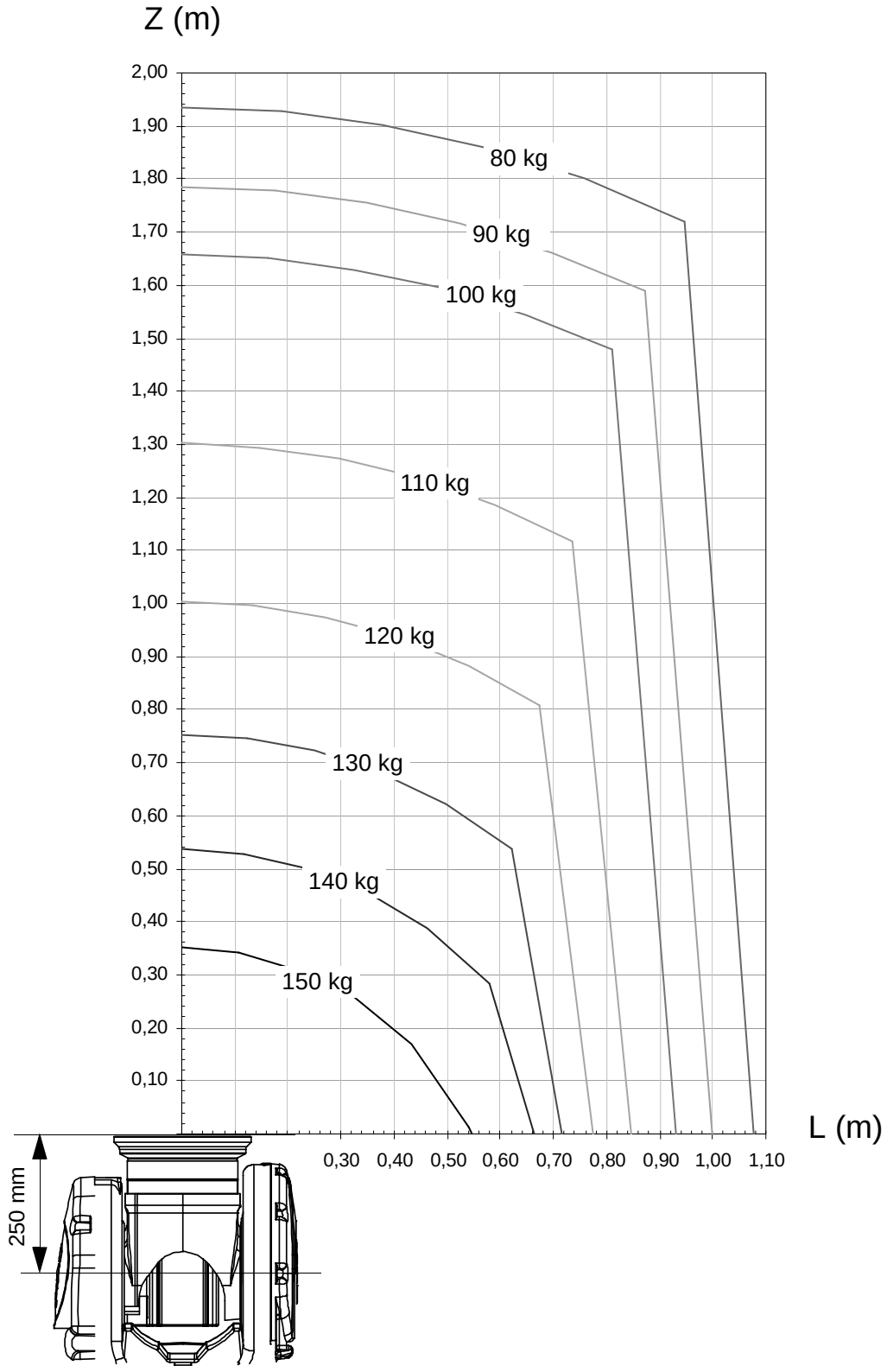


Figure 12 Maximum permitted load mounted on the robot tool flange at different positions (centre of gravity).

Load diagram for IRB 7600-150/3.5 “Vertical Wrist” (±10^{o})

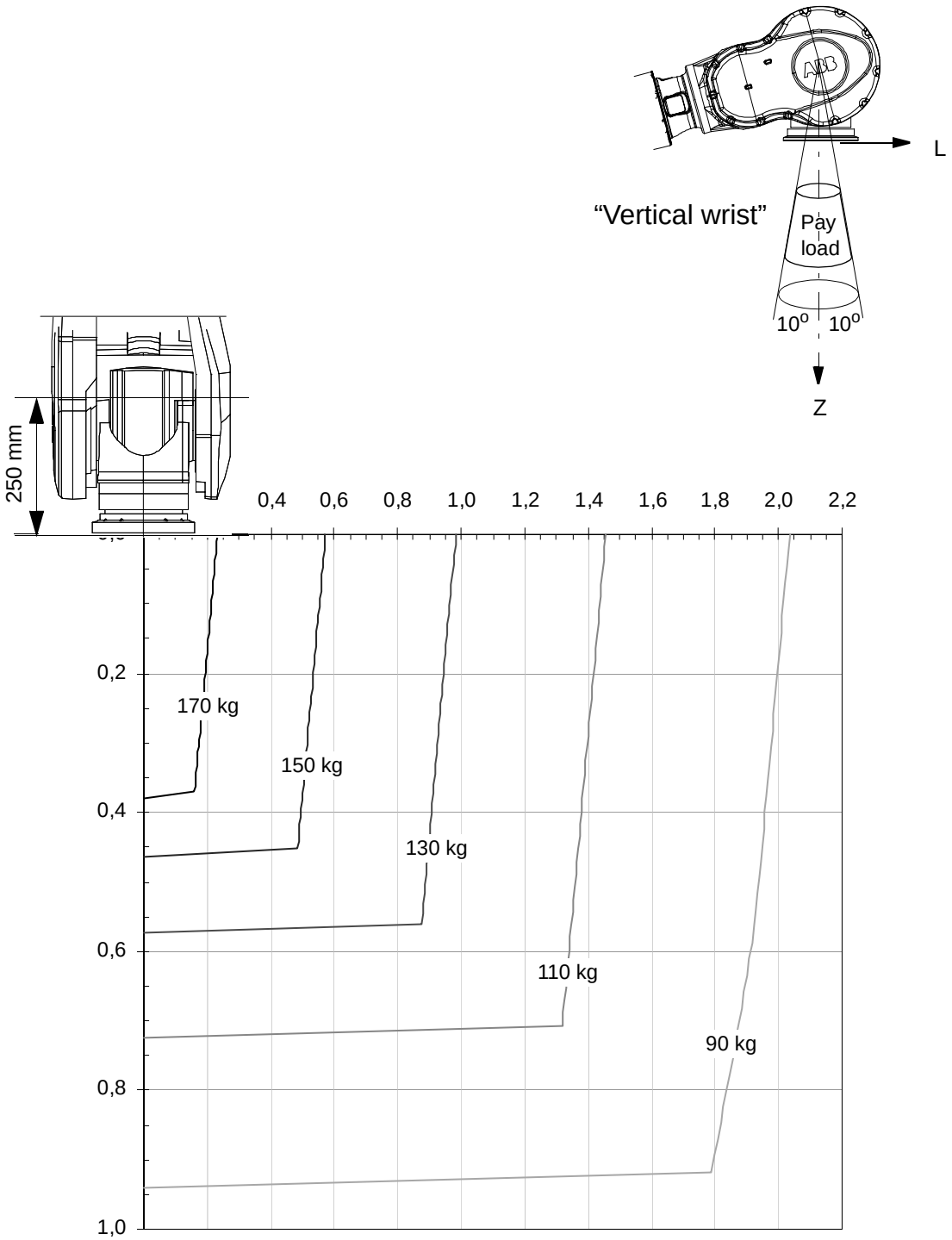


Figure 13 Maximum permitted load mounted on the robot tool flange at different positions (centre of gravity) at “Vertical Wrist” (±10^{o}), J_0 =35 kgm^2.

For wrist down (0^{o} deviation from the vertical line).
Max load = 180kg, Z_{max} = 0,337m and L_{max} = 0,126m

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

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

Full movement of axis 5 (±120°):

Axis 5
Maximum moment of inertia:
$Ja5 = Mass \bullet ((Z+0.250)^2 + L^2) + \max J_{0L} \leq 500\ kgm^2$

Axis 6
Maximum moment of inertia:
$Ja6 = Mass \bullet L^2 + J_{0Z} \leq 315\ kgm^2$

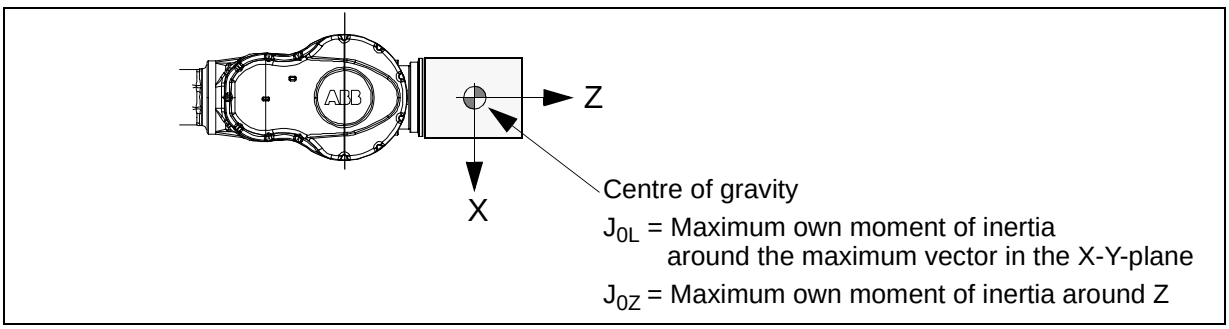


Figure 14 Own moment of inertia.

Limited axis 5, centre line down:

Axis 5
Maximum moment of inertia:
$Ja5 = Load \bullet ((Z+0.250)^2 + L^2) + J_{0L} \leq 550\ kgm^2$

Axis 6
Maximum moment of inertia:
$Ja6 = Load \bullet L^2 + J_{0Z} \leq 500\ kgm^2$

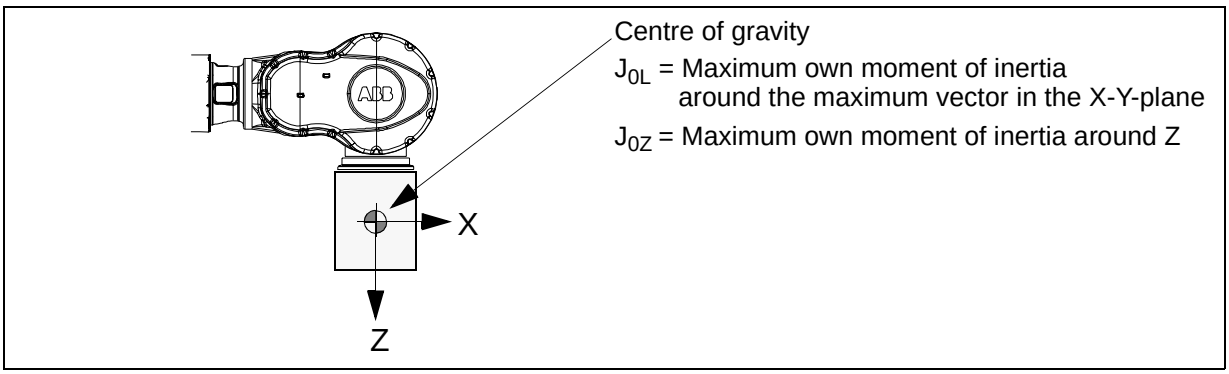


Figure 15 Moment of inertia when axis 5 centre line down.

Mounting equipment

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 Figure 16 and Figure 17.
The robot is supplied with holes for mounting extra equipment (see Figure 18).
Maximum permitted arm load depends on centre of gravity of arm load and robot payload.

Upper arm

Permitted extra load on upper arm housing plus the maximum handling weight (See Figure 16):
M1 ≤50 kg with distance a ≤500 mm, centre of gravity in axis 3 extension.

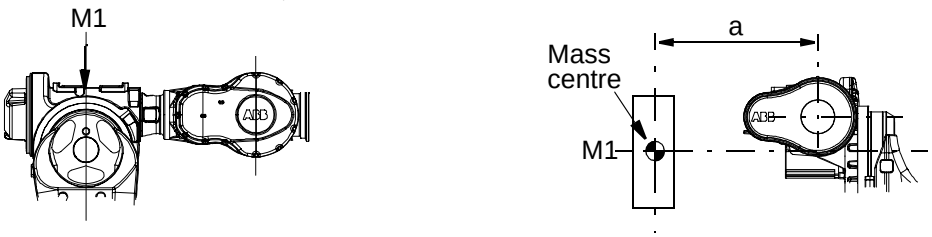


Figure 16 Permitted extra load on upper arm.

Frame (Hip Load)

Permitted extra load on frame is J_H = 200 kgm^2.
Recommended position (see Figure 17).
$J_H = J_{H0} + M4 \bullet R^2$

where J_{H0} is the moment of inertia of the equipment
R is the radius (m) from the centre of axis 1
M4 is the total mass (kg) of the equipment including bracket and harness (≤500 kg)

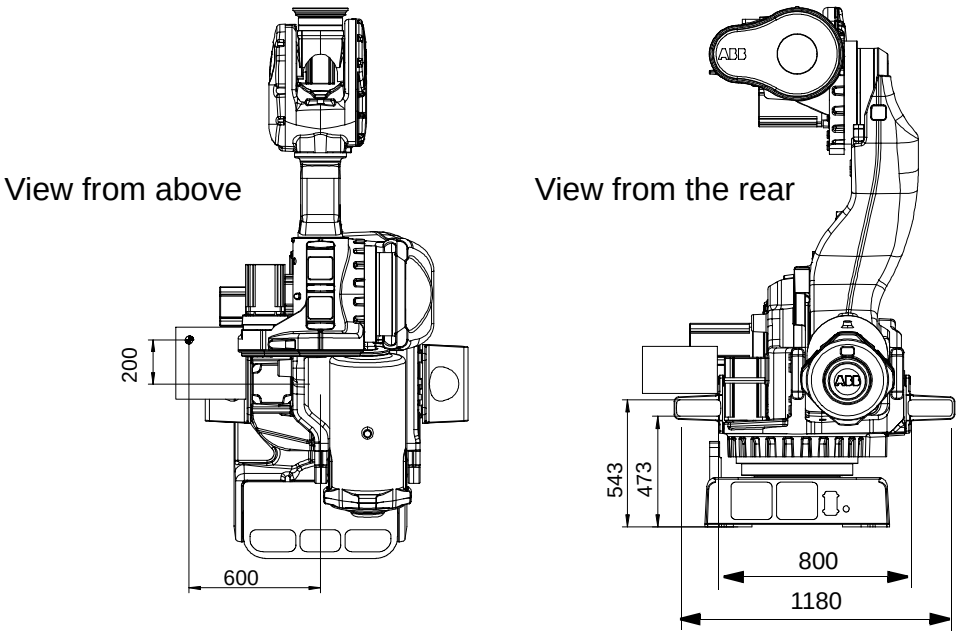


Figure 17 Extra load on the frame of IRB 7600 (dimensions in mm).

Mounting of hip load

The extra load can be mounted on the frame. Holes for mounting see Figure 20.
When mounting on the frame all the four holes (2x2, ∅16) on one side must be used.

Holes for mounting extra equipment

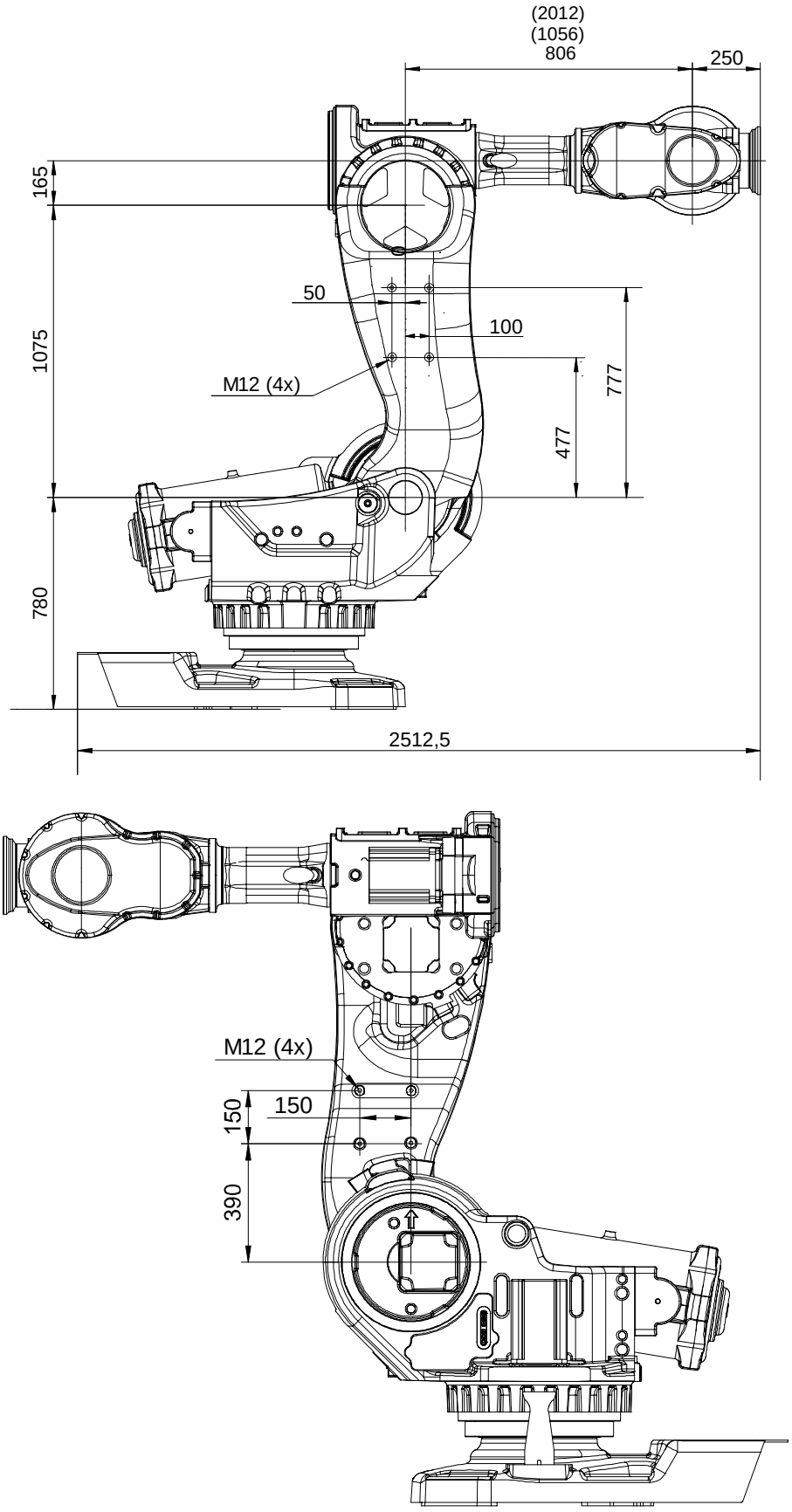


Figure 18 Holes for mounting extra equipment on the upper and the lower arm (dimensions in mm).

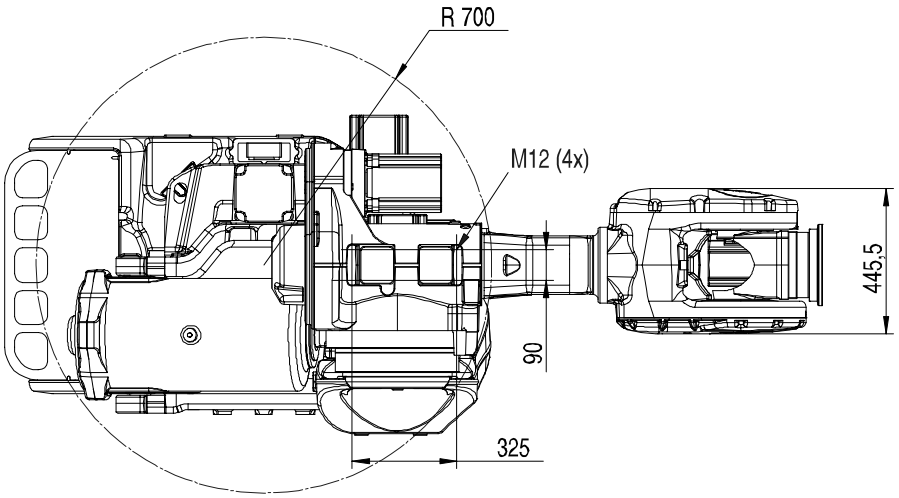


Figure 19 Holes for mounting of extra load on the upper arm (dimensions in mm).

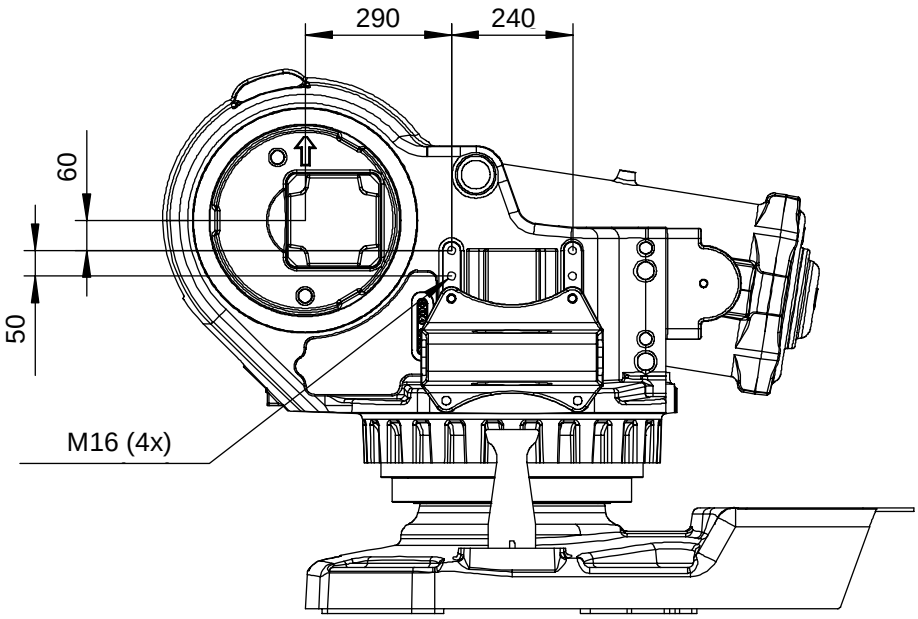


Figure 20 Holes for mounting of extra load on the frame, and for mounting of fork lift device (dimensions in mm).

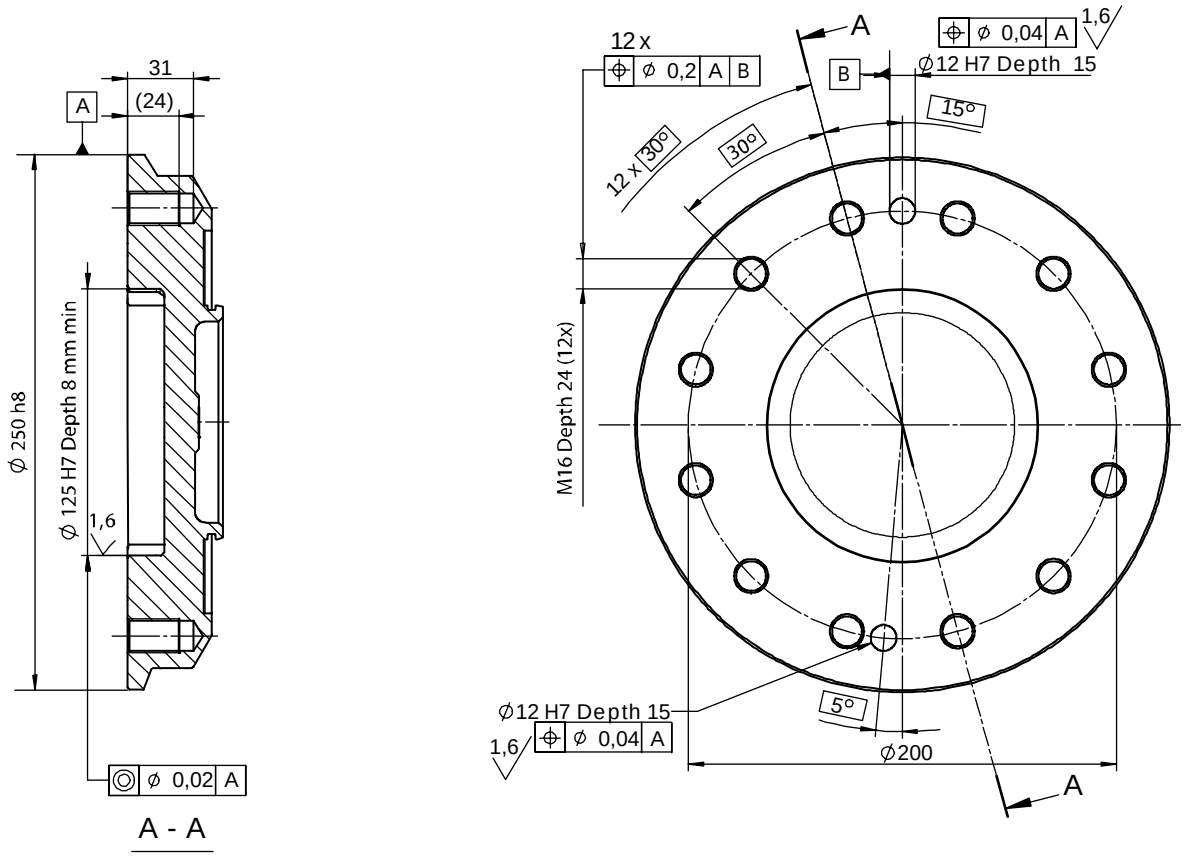


Figure 21 The mechanical interface; mounting flange (dimensions in mm).

1.5 Maintenance and Troubleshooting

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

- Maintenance-free AC motors are used.
- Liquid grease or 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.

The following maintenance is required:

- Changing filter for the transformer/drive unit cooling every year.
- Changing batteries every third year.

The maintenance intervals depend on the use of the robot. For detailed information on maintenance procedures, see Maintenance section in the Product Manual.

1.6 Robot Motion

Type of motion		Range of movement
Axis 1	Rotation motion	+180°to-180°
Axis 2	Arm motion	+85°to-60°
Axis 3	Arm motion	+60°to-180°
Axis 4	Wrist motion	+300°to-300°
Axis 5	Bend motion	+100°to-100°
Axis 6	Turn motion	+300°to -300°

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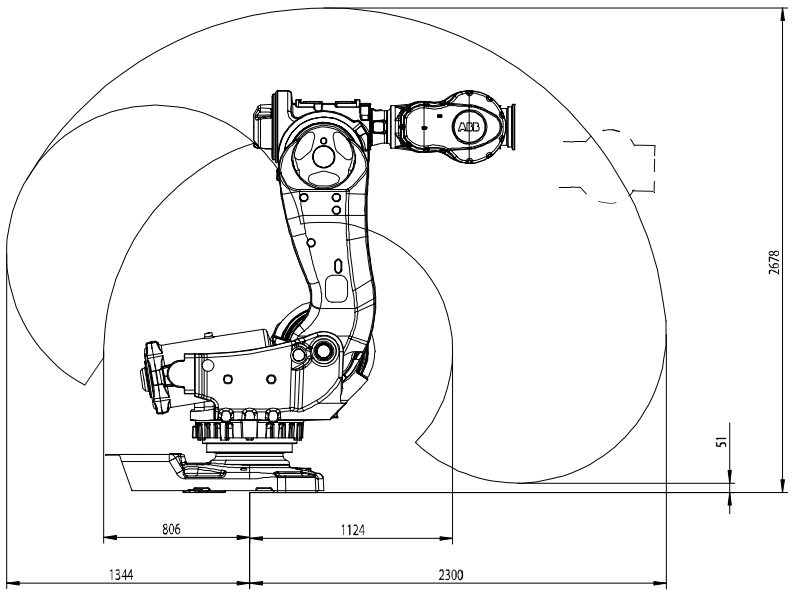

Figure 22 The extreme positions of the robot arm specified at the wrist centre (dimensions in mm).

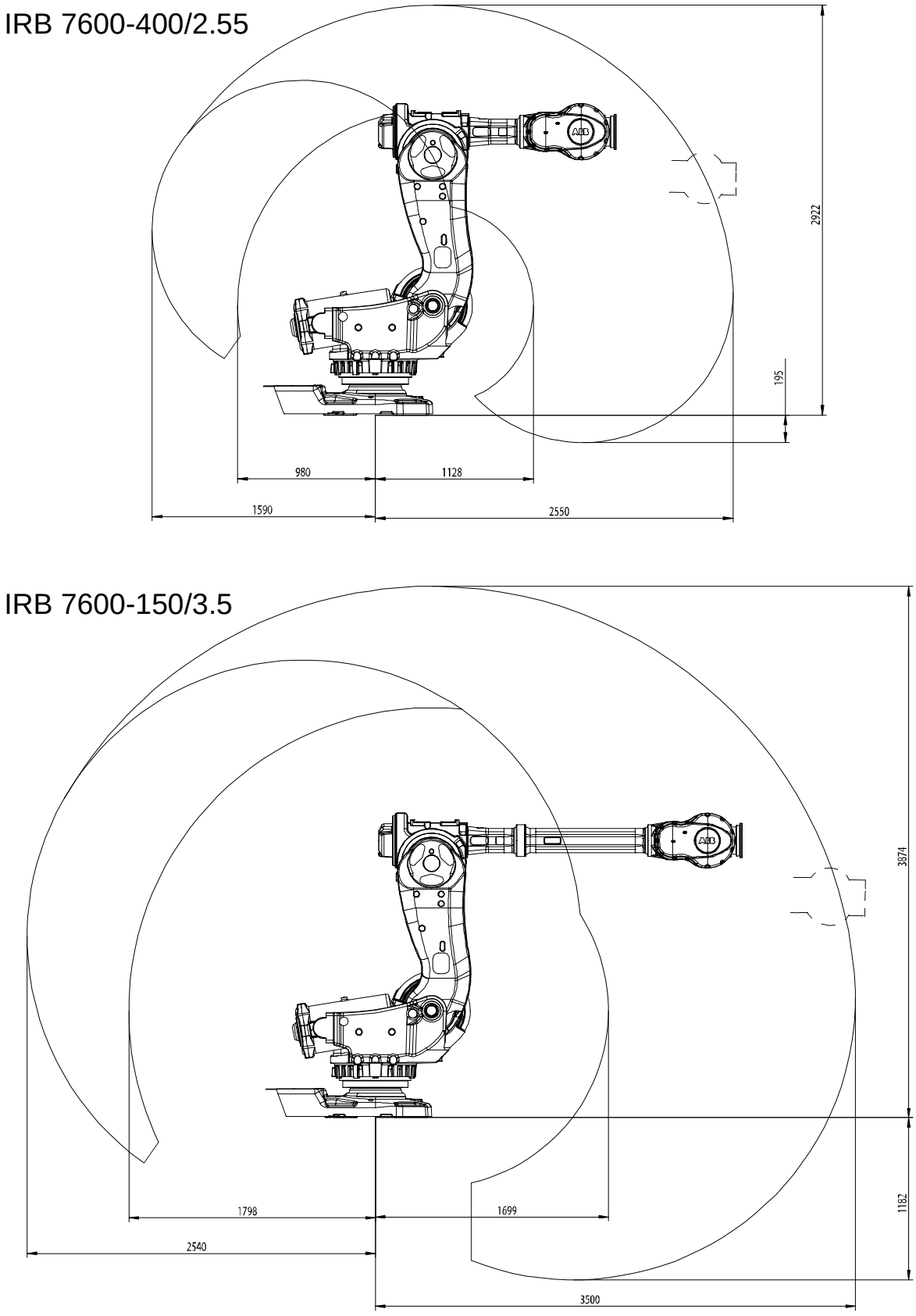

Figure 23 The extreme positions of the robot arm specified at the wrist centre (dimensions in mm).

Velocity

Maximum axis speeds.

IRB 7600	**-400/2.55**	**-500/2.3**	**-150/3.5**
Axis no.			
1	75°/s	75°/s	100°/s
2	60°/s	60°/s	60°/s
3	60°/s	60°/s	60°/s
4	100°/s	100°/s	100°/s
5	100°/s	100°/s	100°/s
6	160°/s	160°/s	160°/s

Accuracy according to ISO 9283

Position accuracy: 0.10 mm (IRB 7600-400/2.55)
Position repeatability: 0.19 mm (IRB 7600-400/2.55)
Path repeatability: 1.27 mm (IRB 7600-400/2.55)

1.7 Cooling fan for axis 1-3 motor (options 113-115)

A motor of the robot needs a fan to avoid overheating if the average speed over time exceeds the value given in Table 1. The maximum allowed average speed is depending on the load.

The average speed can be calculated with the following formula:

$$\text{Average speed} = \frac{\text{Total axis movement, number of degrees, in one cycle}}{\text{360 x cycle time (minutes) incl. waiting time}}$$

The maximum allowed average speed depends on the ambient temperature according to Table 1 and can be interpolated linearly between 40-50^{o}C.
IP 54 for cooling fan.

Table 1

Variant	**Maximum ambient temp. (^{o}C)**	**Maximum average speed axis 1 (rpm)**	**Maximum average speed axis 2 (rpm)**	**Maximum average speed axis 3 (rpm)**
IRB 7600-500/2.3	40 50	7.6 - 9.9 5.4 - 7.0	2.2 - 2.4 1.4 - 1.5	2.9 - 3.8 1.2 - 1.6
IRB 7600-400/2.55	40 50	7.6 - 9.9 5.4 - 7.0	2.2 - 2.4 1.4 - 1.5	2.9 - 3.8 1.2 - 1.6
IRB 7600-150/3.5	40 50	5.0 - 6.5 4.1 - 5.3	2.5 - 2.8 1.3 - 1.4	3.7 - 4.8 2.2 - 2.9

1.8 DressPack for Material Handling

DressPack options

Dress Pack options include options for Upper arm harness, Lower arm harness and Floor harness. These are described separately below but are designed and meant to be seen as a complete package for either Material handling or Spot welding application.

The **Upper Arm Harness** consists of a process cable package and supports, clamps, brackets, and a retractor arm. The process cable package contains special designed cables and hoses that have been long term tested. The cables and hoses are partly placed in a protective hose to extend the lifetime.

The Upper Arm Harness is designed to follow the robot arm movements and minimise damages to the harness or the manipulator. The interface to the lower arm harness is located well protected below the motor for axis 3.

The complete harness is tested and proven to be well suited for both spot welding applications and other applications with the same type of movements and very high requirements. The cable and hose package has a 1000-mm free length at axis 6 for connection to a robot tool. A tension arm unit keeps hose package in the right position for the robot arm movement approved for the DressPack. An arm protection will prevent wearing on the protective hose and on the robot itself. Please note that when the robot is operating, some multiply axis movement might end up with an overstraining of the hose package. These movements must be avoided.

For more information see the Installation and Maintenance Manual.

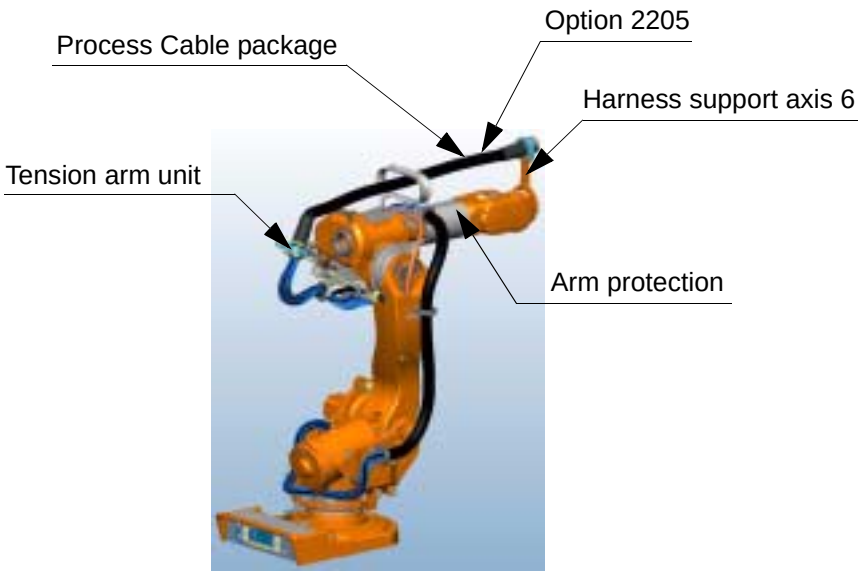

Figure 24 Mechanical equipment upper arm harness.

Note. The upper arm harness specification is based on the selection of lower arm harness.

The **Lower Arm Harness** consists of a process cable package and supports, clamps and brackets. The process cable package, containing special designed cables and hoses, has been long term tested.

The process cable package is routed along the lower arm to minimize space required and to give no limitation in the robot working envelope. The cables and hoses are partly placed in a protective hose to extend the lifetime.

The lower arm harness is connected to the upper arm harness at the connection point under the axis 3 motor. The interface plate at the manipulator base is the place where the floor harness and the process media are connected.

The **Floor Harness** consists of signal cables for customer signals. The floor harness is connected to the lower arm harness at the interface plate at the manipulator base and to the left side of the control cabinet. The signal connection inside the control cabinet depends on chosen options. As example bus option and parallel option mean different connections.

The cables and hose which are used to form the DressPack for the Material Handling application has the following specification and capacity:

Table 2

Type	Pcs	Area	Allowed capacity
Customer Power (CP) Utility Power Protective Earth	 2+2 1	 0,5 mm^2 1,0 mm^2	 500 VAC, 5 A rms 500 VAC
Customer Signals (CS) Signals twisted pair Signals twisted pair and separate shielded	 19 4	 0,23 mm^2 0,23 mm^2	 50 VAC/DC, 1 A rms 50 VAC/DC, 1 A rms
Customer Bus (CBus) Bus signals Bus signals Bus signals Bus utility signals	 2 2 4 4	 0,18 mm^2 0,18 mm^2 0,18 mm^2 0,23 mm^2	 Profibus 12 Mbit/s spec* Can/DeviceNet spec* Interbus spec* 50 VAC/DC, 1 A rms
Media Air (PROC 1)	 1	 12,5 mm inner diameter	 Max. pressure 16 bar / 230 PSI

* Quad twisted under separate screen. Can also be used for very sensitive signals

Process cable package

For material handling the DressPack can be chosen in different configurations, where details of the signals and media are added.

Option 056 Connection to manipulator

No floor cables for the DressPack are chosen. The connector at the base for interfacing is specified in the installation and maintenance manual. Terminal connections could be found in the circuit diagrams.

Option 057 Connection to cabinet

Floor cables for the DressPack are chosen. The number of cables and cable type depends on chosen options. The length of the process cable package at the floor is specified under the options below:

- Option 675-678 for parallel communication
- Option 660-663 for bus communication with CANDeviceNet
- Option 665-668 for bus communication with Profibus
- Option 670-673 for bus communication with Interbus

The connection inside the cabinet depends on communication type.

- If parallel communication is chosen, signals are found at terminals inside the cabinet (XT5.1, XT5.2 and XT6)
- If bus communication is chosen, signals are both routed to valid bus card. The remaining are found at terminals inside the cabinet (XT5.1, XT5.2 and XT6).

Communication

Option 2063 Parallel communication

The process cable package has been chosen for parallel communication. The number as well as the type of signals are defined under Material handling application, Option 2204, 2205.

Option 2064 Bus communication

The process cable package has been chosen for bus communication. This alternative includes both the signals for the bus communication as well as some parallel signals. The number as well as the type of signals are defined under Material handling application, Option 2204, 2205. The type of bus is defined by the choice of floor cabling (see also option 057)

Option 2204 Material Handling axis 1 to axis 3

The Lower arm harness for the Material Handling has been chosen. This includes the process cable package as well as brackets, connectors etc. to form a complete dressing package from manipulator base to connectors on axis 3. Depending on the choice above the process cable package will have different content. See tables below.

For all process cable packages some of the content are common. These common parts for Material Handling application are shown in Table 3 below. Unique parts for different option combinations are shown in Table 4, Table 5 and Table 6. These tables are valid for option 2204 and 2205.

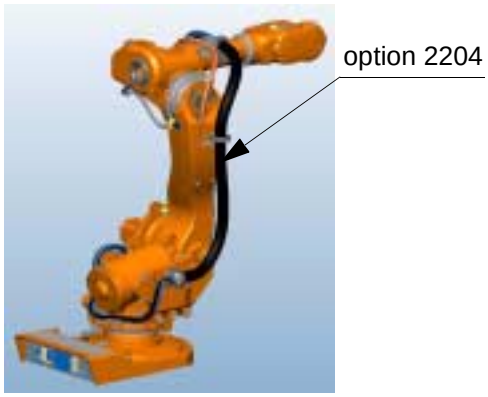

Figure 25 Material Handling from foot to axis 3

Table for Common content Material Handling (with option 2063/2064)

Table 3

Type	Pieces at Connection point	Note	Allowed capacity
Media			
Air (PROC 1)	1	12,5 m inner diameter	Max pressure 16 bar / 230 PSI

Table for Material Handling with option 2063

Table 4

Type	Pieces at Terminal*	Pieces at Connection point**	Allowed capacity
Customer Power (CP) Utility Power Protective earth	 2+2 1	 2+2 1	 500 VAC, 5 A rms 500 VAC
Customer Signals (CS) Signals twisted pair Signals twisted pair and separate shielded	 19 4	 19 4	 50 VAC, 5 A rms 50 VAC, 5 A rms

* Terminals inside the cabinet if option 057 is chosen
** At manipulator base or axis 3 interface (or axis 6 under option 2205)

Table for Material Handling with option 2064 and Can/DeviceNet

Table 5

Type	Pieces at Terminal*	Pieces at Connection point**	Allowed capacity
Customer Power (CP)			
Utility Power	2+2	2+2	500 VAC, 5 A rms
Protective earth	1	1	500 VAC
Customer Bus (CBus)			
Bus signals		2	Can/DeviceNet spec
Bus signals		2	50 VAC, 1 A rms
Signals twisted pair	4	4	50 VAC, 1 A rms
Utility signals	4	4	50 VAC, 1 A rms

* Terminals inside the cabinet if option 057 is chosen
** At manipulator base or axis 3 interface (or axis 6 under option 2205)

Table for Material Handling with option 2064 and Interbus

Table 6

Type	Pieces at Terminal*	Pieces at Connection point**	Allowed capacity
Customer Power (CP)			
Utility Power	2+2	2+2	500 VAC, 5 A rms
Protective earth	1	1	500 VAC
Customer Bus (CBus)			
Bus signals		4	Interbus spec
Bus signals		1	50 VAC, 1 A rms
Signals twisted pair	4	4	50 VAC, 1 A rms
Utility signals	3	3	50 VAC, 1 A rms

* Terminals inside the cabinet if option 057 is chosen
** At manipulator base or axis 3 interface (or axis 6 under option 2205)

Option 2205 Material Handling axis 3 to axis 6

The Upper arm harness for the Material Handling has been chosen. This includes the process cable package as well as brackets, connectors etc. to form a complete dressing package from interface at axis 3 to the connectors at axis 6. Depending on the earlier choice (see option 2204) the process cable package will have different content.
For content see Table 3, Table 4, Table 5 and Table 6. See also Figure 24.

The connector type at the manipulator base, at axis 3 and axis 6 is specified in the installation and maintenance manual.

2 Specification of Variants and Options

The different variants and options for the IRB 7600 are described below.
The same numbers are used here as in the Specification form. For controller options, see Product Specification S4Cplus, for software options, see Product Specification RobotWare Options, and for SpotPack options, see Product Specification SpotPack.

1 MANIPULATOR

VARIANTS

021 IRB 7600-150/3.5
024 IRB 7600-400/2.55
025 IRB 7600-500/2.3

Manipulator colour

330 Standard
The manipulator is painted in ABB orange.

352 Ral code
Colours according to RAL-codes. Not available for Foundry.

Protection

035 Standard (IP 67)

036 Foundry
Robot adapted for foundry or other harsh environments.
The robot has the FoundryPlus protection which means that the whole manipulator is IP67 classified and steam washable. An excellent corrosion protection is obtained by a special coating. The connectors are designed for severe environment, and bearings, gears and other sensitive parts are highly protected.
Only available colour is ABB orange Foundry.

PROCESS CABLE PACKAGE

For more information see chapter 1.8 DressPack for Material Handling.
Regarding DressPack for spot welding see Product Specification SpotPack.

2204 Material Handling from foot to axis 3
Requires Communication Parallel or Bus option 2063/2064.
See Figure 25, and chapter1.8 DressPack for Material Handling and Table 2 - Table 6.

2205 Material Handling from axis 3 to axis 6
Requires Material Handling from foot to axis 3 option 2204 and Communication Parallel or Bus option 2063/2064.
See Figure 25, and chapter1.8 DressPack for Material Handling and Table 2 - Table 6.

Communication

2063 Parallel
Includes customer power CP, customer signals CS and Air for MH-process cable package.

2064 Bus
Includes CP, Air and CAN/DeviceNet, Interbus or Profibus for MH-process cable package.

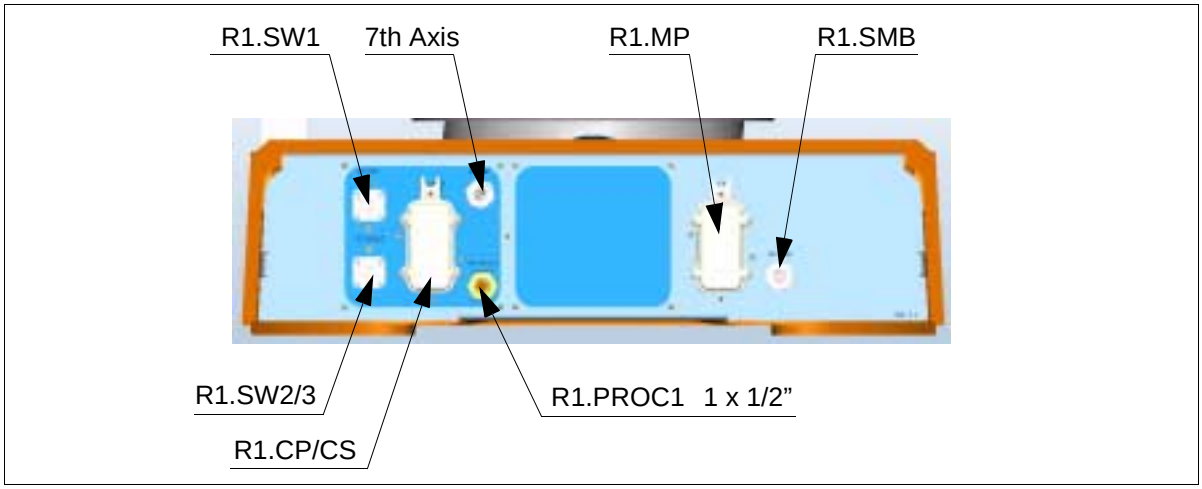

Figure 26 Location of MH connections on the foot.

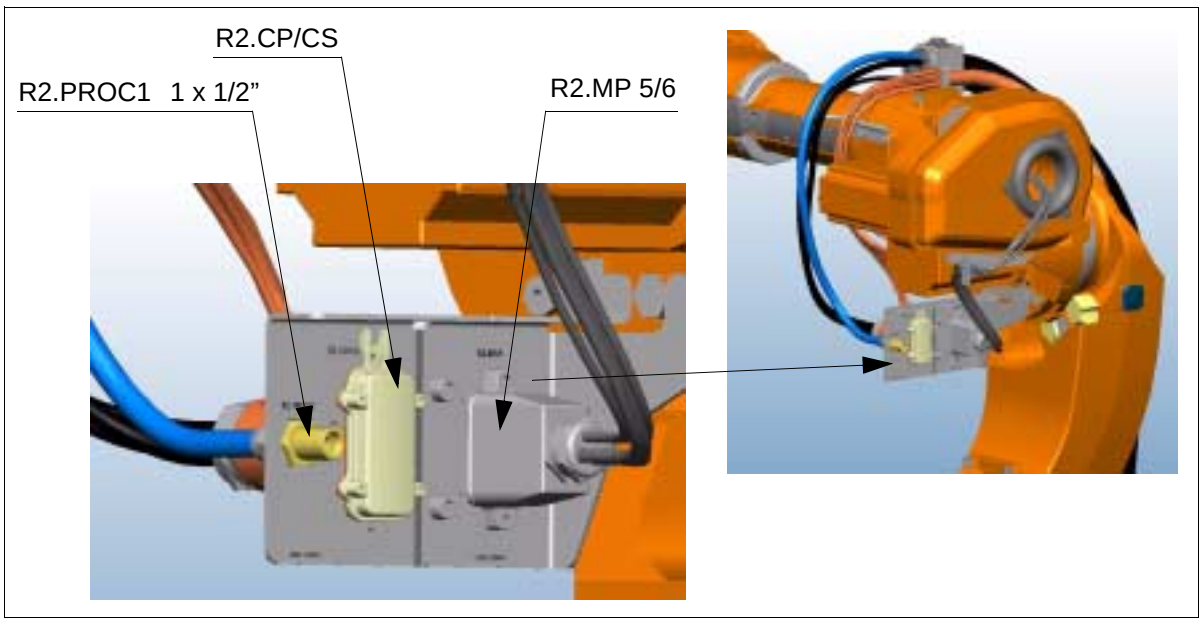

Figure 27 Location of MH connections on axis 3.

Connection to

056 Manipulator
The signals are connected directly to the manipulator base to one heavy duty industrial housing with a Harting modular connector R1.CP/CS, see Figure 26.
The cables from the manipulator base are not supplied.

057 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 DressPack options on page 31.

Connection to cabinet (Cable lengths)

Parallel/CANDeviceNet/Interbus/Profibus

675/660/670/665 7m
676/661/671/666 15m
678/663/673/668 30m

EQUIPMENT

691 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.

092 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.

087 Base plate
See chapter 1.3 Installation, for dimension drawing.

091 Brake release cover
A cover for the break release buttons.

113 Cooling fan for axis 1 motor (IP 54)
Cannot be combined with Cooling fan for axis 2 motor option 114.
For in use recommendations see 1.7 Cooling fan for axis 1-3 motor (options 113-115).
See Figure 28.
Not for protection Foundry.

114 Cooling fan for axis 2 motor (IP 54)
For in use recommendations see 1.7 Cooling fan for axis 1-3 motor (options 113-115).
Not for protection Foundry.

115 Cooling fan for axis 3 motor (IP 54)
For in use recommendations see 1.7 Cooling fan for axis 1-3 motor (options 113-115).
See Figure 28.
Not for protection Foundry.

088 Upper arm covers
See Figure 29.

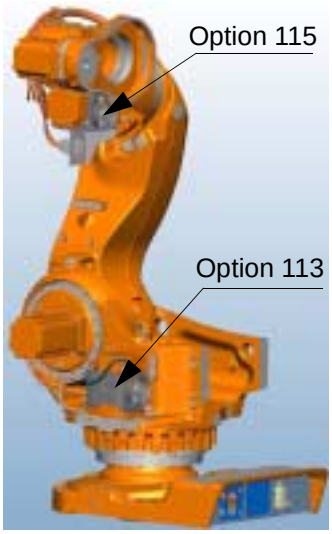

Figure 28 Cooling fan for axis 1 motor and axis 3 motor.

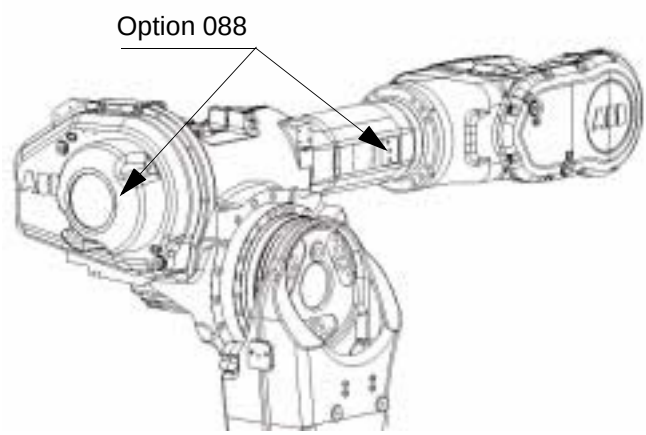

Figure 29 Upper arm covers.

1300 Axis 1 cover
A leather cover around the cables in the central hole at axis 1.

1301 Piston cover
A leather bellow for the balancing cylinder piston.

POSITION SWITCHES

Position switches indicating the position of the three main axes. Rails with separate adjustable cams are attached to the manipulator. The cams, which have to be adapted to the switch function by the user, can be mounted in any position in the working range for each switch. No machining operation of the cams is necessary for the adaptation, simple hand tools can be used.

For axis 1, there are three redundant position zones available, each with two independent

switches and cams. For axes 2 and 3, two redundant position zones are available, each with two independent switches and cams.

For axis 1 it is possible to mount a second set of position switches, doubling the number of redundant zones to six.
Each position zone consists of two switches mechanically operated by separate cams. Each switch has one normally open and one normally closed contact. See Product Specification S4Cplus.
The design and components fulfil the demands to be used as safety switches.
These options may require external safety arrangements, e.g. light curtains, photocells or contact mats.

The switches can be connected either to the manipulator base (R1.SW1 and R1.SW2/3, see Figure 26), or to the controller. In the controller the signals are connected to screw terminal XT8 Phoenix MSTB 2.5/12-ST-5.08.
Switch type Balluff Multiple position switches BNS, according to EN 60947-5-1 and EN 60947-5-2.

Connection to

075 Manipulator
Connection on the manipulator base with one/two FCI Sealok 32-pin connector.

076 Cabinet
Connected to 12-pole screw terminals, Phoenix MSTB 2.5/12-ST-5.08, in the controller. Position switch cables are included.

Position switches axis 1

071 Three redundant position zones are available, each with two independent switches and cams.

Connection of signals axis 1 (cable lengths)

078 7m
079 15m
081 30m

072 Position switches axis 2
Two redundant position zones are available, each with two independent switches and cams.

073 Position switches axis 3
Two redundant position zones are available, each with two independent switches and cams.

Connection of signals axes 2 and 3 (cable lengths)

083 7m
084 15m
086 30m

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.

Axis 1

061 Four stops which allow the working range to be restricted in increments of 7,5°.

062 Two stops which allow the working range to be restricted in increments of 15°.

063 **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°.

064 **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°.

3 Accessories

There is a range of tools and equipment available, specially designed for the robot.

Basic software and software options for robot and PC

For more information, see Product Specification S4Cplus, and Product Specification RobotWare Options.

Robot Peripherals

- Track Motion
- Tool System
- Motor Units
- Spot welding system for transformer gun

Tools

Brake release box
Includes six brake release buttons and 24V battery unit which can be connected to R1.BU on the manipulator frame. The brake release box can be ordered from ABB Automation Technology Products AB, Robotics, department S.

Calibration Cube
This calibration tool can be ordered from ABB Automation Technology Products AB, Robotics, department S.

4 Index