

## Arm - RX series 160 family

### Instruction manual



A "readme.pdf" document may be delivered on the robot DVD. It contains the documentation addenda and errata.

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# 1 - INTRODUCTION

## 1.1 - FOREWORD

M0000242.1

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Electrical drawings provided in this manual are for information only. The reference for robot electrical drawings is provided in a separate manual. The photos are used to make the document easier to understand, they cannot be construed as being of a contractual nature.

Please report errors and omissions to the Stäubli Robotics Customer Support contact for your country, that can be found at:

- <http://www.staubli.com/en/contacts/division/robotics/>

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### 1.1.1 - OBJECTIVE OF THIS MANUAL

M0000548.1

The objective of this manual is to provide information concerning the installation, operation, and maintenance of Stäubli RX160. It provides help for people working on the equipment, for reference purposes only. Stäubli recommends attending training courses for easier understanding of this manual, better use and robot maintenance.

## 1.1.2 - SPECIAL MESSAGES CONCERNING SAFETY, DANGERS, CAUTIONS AND INFORMATION

M0000549.1

In this document, there are several icons for important warnings.  
These warnings are as follows (by decreasing order of importance):



### DANGER

Instructions drawing the reader's attention to the risks of accidents that could lead to serious bodily harm if the steps shown are not complied with. In general, this type of indication describes the potential danger, its possible effects and the necessary steps to reduce the danger. It is essential to comply with the instructions to ensure personal safety.



### SAFETY

Instructions drawing the reader's attention that they are responsible if the steps shown are not complied with. It is essential to comply with the instructions to maintain the robot safety level.



Instructions directing the reader's attention to the risks of material damage or failure if the steps shown are not complied with. It is essential to comply with these instructions to ensure equipment reliability and performance levels.



Supplies further information, or underlines a point or an important procedure. This information must be memorized to make it easier to apply and ensure correct sequencing of the operations described.



### ESD

This symbol is a reminder of the possible consequences of touching electrostatically sensitive components (see chapter 1.3.4.2).

## 1.2 - DEFINITIONS AND GLOSSARY

M0000594.1

In this manual, a specific vocabulary is used according to our products. This chapter allows an easier general understanding.

People in contact with the product are designated by different names:

**Person:** General term identifying all individuals likely to come close to the Stäubli machine.

**Staff:** Identifies people specifically employed and trained to install, operate, and service the Stäubli machine.

**User:** Refers to people or the company responsible for operating the Stäubli machine.

**Operator:** Refers to the person who starts or stops the robot, or controls its operation.

**Integrator:** Refers to people or the company responsible for the design and manufacture of the robot cell.

## 1.3 - SAFETY

### 1.3.1 - SAFETY REGULATIONS

M0000550.1

#### Intended use

A robot is not a ready-to-use product. It is a "partly completed machinery" designed to be integrated in a "machine": the robot cell. This machine as a whole shall be compliant to the applicable safety regulations before it can be operated.

The Stäubli robot is designed for industrial applications, where the operator is safely separated from a moving robot with protective devices. Temporary proximity between the operator and the robot is possible for collaborative operation, or for tuning and maintenance tasks, with additional risks that shall be handled by the integrator.

## European regulations

In the European Union, the applicable safety regulations for a machine are defined by the Machinery Directive 2006/42/EC. This directive specifies that a risk assessment shall be carried out in order to determine the health and safety requirements which apply to the machinery. The machinery must then be designed and constructed taking into account the results of the risk assessment. The directive defines essential health and safety requirements that are mandatory.

International standards have been developed to provide a framework for the correct application of the Machinery Directive. The Machinery Directive, and harmonized standards list, can be found at <http://eur-lex.europa.eu>. For robot integration, application of the specifications of the EN ISO 10218-2:2011 standard on the basis of the integrator risk assessment confers a presumption of conformity with the essential health and safety requirements of the Machinery Directive covered by the standard.

The Machinery Directive defines the procedures to evaluate the machinery conformity. For completed machinery, the CE mark accompanied by the EC conformity declaration confers presumption of compliance with the Directive. For partly completed machinery, the incorporation declaration defines the essential health and safety requirements and other applicable Directives that are satisfied.

The robot is delivered with its incorporation declaration. An electronic copy including several translations is available on the robot DVD. It can also be requested from the Stäubli Customer Support contact.

The robot incorporation declaration is based on the applicable requirements implementation of the following harmonized standards:

- |                                          |                                                                                 |
|------------------------------------------|---------------------------------------------------------------------------------|
| ■ EN ISO 10218-1:2011                    | Robots and robotic devices - Safety requirements for industrial robots - Part 1 |
| ■ EN ISO 13849-1:2015                    | Safety of machinery - Safety-related parts of control systems - Part 1          |
| ■ EN 60204-1:2006 and EN 60204-1/A1:2009 | Safety of machinery - Electrical equipment                                      |
| ■ EN 61000-6-4:2007 / A1:2011            | Electromagnetic compatibility - Generic emissions standard                      |
| ■ EN 61000-6-2:2005                      | Electromagnetic compatibility - Generic immunity standard                       |

In the United States, there are no standardized Occupational Safety and Health Administration regulatory standards for robots. However, standard ANSI/RIA R15.06-2012 is referenced as the standard applicable to robot systems. That standard is harmonized to make it basically identical to standards ISO 10218-1:2011 and ISO 10218-2:2011, in the same way as standard CAN/CSA-Z434-03 (R2013) for Canada. These ISO standards for industrial robots have also been adopted in Korea.

Each country can draw up further safety standards, and implement specific local rules. For example, the UL standard for robots and robot equipment UL 1740 sets out further requirements covering the robot and electrical safety.

For the UL version, the robot system has been evaluated to meet the following standards:

- |                        |                                                                                          |
|------------------------|------------------------------------------------------------------------------------------|
| ■ Standard UL 1740     | Robots and Robotics Equipment                                                            |
| ■ Standard RIA15-06    | American National Standard for Industrial Robots and Robot Systems. Safety Requirements. |
| ■ Standard CSA Z434-03 | Industrial Robots and Robot Systems. General Safety Requirements.                        |
| ■ Standard NFPA 79     | Electrical standard for industrial machinery                                             |
| ■ Standard NFPA 70     | National Electrical Code                                                                 |

For relative information about REACH 1907/2006 regulation (CE) consult the following internet address: <https://www.staubli.com/en/robotics-reach/>

### 1.3.2 - SAFETY DIRECTIVES CONCERNING TO THE WORK ENVIRONMENT

#### 1.3.2.1 - Analysis of safety around the machine

M0000142.1

Safety must be taken into account for the machine from the design and development stage on.

Before planning the installation of the machine, it is necessary to study the following points:

- Plan the safety strategies that reduce risks to an acceptable level.
- Define the tasks required for the foreseeable applications and assess the access and/or approach requirements.
- Identify the sources of risks including the failures and the failure modes associated with each of the tasks. The risks can involve:
  - the cell itself
  - its association with other items of equipment
  - the interactions between people and the cell.
- Assess and estimate the risks stemming from cell operation:
  - programming risks
  - operating risks
  - risks during use
  - maintenance risks for the machine.
- Select the protective methods:
  - use of protective devices
  - installation of signalling means
  - compliance with safe working procedures.

These points are taken from the standards applicable to robots.



This list is not exhaustive. Above all, it is necessary to comply with the standards in force in your country.

#### 1.3.2.2 - Rules concerning the robot's work area

M0000143.1

The controlled area or isolation area in which the robot moves must be determined using protective devices (protective elements).



Protective elements are devices protecting people from a dangerous area. See the standards currently in force concerning safety for industrial handling equipment.



#### **DANGER**

At the time of an emergency stop, the final position of the arm can never be determined precisely because of the kinetic energy involved. It is thus necessary to make sure that no persons or obstructions are present in the robot's work area when the arm is powered up.

### 1.3.3 - SAFETY DIRECTIVES CONCERNING TO STAFF PROTECTION

M0000204.1

Stäubli robots work with computer controlled mechanisms, capable of moving at high speed and exerting considerable force. Like all robots and most industrial equipment, they must be operated with great care by the user of the machine. All staff using Stäubli robots must be familiar with the warnings and recommendations given in this manual. The safety rules, warning, notes and recommendations provided in this safety chapter are only one part of the over all safety instructions. Other information is provided throughout the manual.

It is prohibited to modify a robot without a written agreement from Stäubli.

**1.3.3.1 - Mechanical and electrical dangers**

This sign, applied on different parts of the robot, indicates that there is a potential electrical danger and that only qualified service personnel may install or service the robot system.

**DANGER**

- Only qualified service personnel may install or service the robot system.
- Ensure compliance with all local and national safety and electrical codes for the installation and operation of the robot system.
- Disconnect all the electrical and pneumatic power supplies before carrying out any work on the controller or the arm.
- Lockout and tagout equipment before servicing.

To disconnect the robot from the power supply, set the general isolating switch of the controller to the "0" position.

To prevent inadvertent during the service operation, the main switch must be locked in 0 position using a padlock whose key is to be kept by the person carrying out the service operation. The locked status must be shown by a sign. For example, put a "Do not operate" sign in place.

Before powering up the system, make sure that all the electrical protection systems have been fitted and that there is no risk of electric shocks.



When the main switch is set to 0, voltage remains present between the input terminals (mains supply filter) and the main switch input.

**DANGER**

Each time the arm is powered on, keep one hand close to the "Emergency stop" button in order to be able to press it as quickly as possible in the event of a problem.

- For UL robots: When arm is powered-on, a light on the arm is on to indicate there is a potential danger. This light is also on when manual brake release is performed (on axis 1 on RX and TX robots, on axis 3 on Scara robots).
- Do not connect or disconnect components while the unit is under power. The connection between the controller and the robot arm can only be made if the controller has been switched off.
- Remove part or tool loaded on robot during maintenance operations.
- If unusual sounds or vibrations are noted on the robot arm, especially following a shock or some other incident, it is necessary to inspect the tool and gripper fastenings carefully and make diagnoses at low speed.



- If a crash of the arm occurs, all safety components involved in the safety have to be checked carefully to verify they are still operating and not damaged: hard stop devices on the arm, electrical limit switches, calibration of the robot. Don't hesitate to call Stäubli service for any doubt.
- Each time a calibration, adjustment or recovery procedure is done, the calibration of the arm has to be controlled carefully to verify that the robot is able to move in its expected angular range and not more. This verification has to be done at slow speed.

**DANGER**

All people are prohibited from remaining in the isolation area in which the robot arm operates. Certain robot working modes such as the "brake release" mode can lead to unforeseeable arm movements.

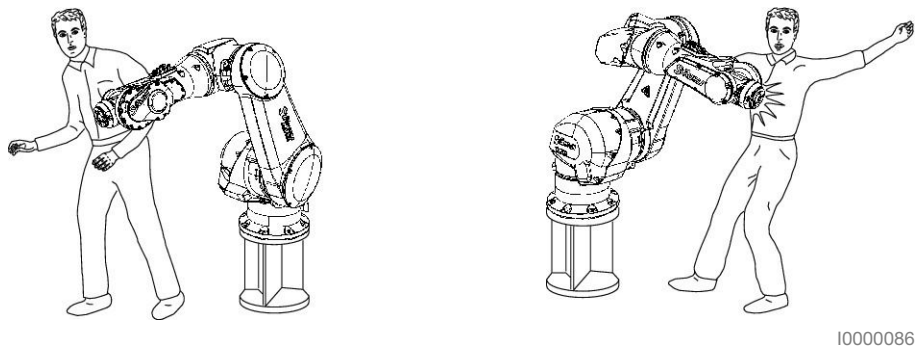


Figure 1.1

Following maintenance work, whether it involves mechanical, electrical, pneumatic or software operations, it is advisable to make sure that the robot functions correctly, first at low speed while the person stays outside the cell, and then under the normal conditions of use. In particular, make sure that all the protective and safety systems are correctly in place, and that calibration of the robot is correct.

### 1.3.3.2 - Machine safety devices

M0000546.1

The safety devices must form an integral part of the design and installation of the machine. Operator training and compliance with the operating procedures constitute a major element in setting up the safety devices and systems.

Stäubli robots feature various interfaces that help the user to develop safety systems and devices for the machine. These functions include the emergency stop circuits, the digital input/output lines, and the display system for error and warning messages (see the "Integration" chapter in the controller instruction manual). When the system is used without the SP2, these messages/warnings can only be consulted via the application program.

### 1.3.4 - SAFETY DIRECTIVES CONCERNING TO PROTECTION OF THE EQUIPMENT

M0000208.1



#### **DANGER**

To ensure reliability and precision in the robot's movements, the machine environment must comply with the levels of electrical disturbance set out in the safety standards.

#### 1.3.4.1 - Connections

M0000203.1

- Before connecting the controller to the power supply, make sure that its nominal voltage does indeed correspond to the network voltage.
- When connecting the controller, use a cable whose cross-section corresponds to the power rating shown on the manufacturer's plate.
- Before removing or inserting an electronic component, switch off arm power and then switch off controller power and comply with the procedure.
- Take care to avoid blocking the air inlets and outlets for the controller airflow path.
- Never use the emergency stop to power down the arm under normal conditions of use.

#### 1.3.4.2 - Information on electrostatic discharges

M0000207.1

What is an electrostatic discharge?

Everyone has felt the effects of static electricity on their clothes or when they touch a metal object, without being aware of the damage that can be done to electronic components by static electricity.

Our desire to integrate the notions of quality and reliability in our products makes it necessary to prevent electrostatic discharges from causing damage to them. This means that all the staff and login users must be informed.

## Storage of a charge

An electric charge is created simply by combining a conductor, a dielectric and the ground (lowest reference potential, usually the ground in the case of an electrostatic charge).

Example: People, printed circuits, integrated circuits, components, conducting mats when separated from the ground by a dielectric.

## Electrostatic discharges or ESD

Most people have experienced ESD by receiving an electric shock when walking on a carpet and touching a doorknob or when getting out of a car.

In most cases, the following is true:

- To feel an ESD, a charge of at least 3 500 V is required.
- To hear one, a charge of at least 5 000 V is required.
- To see a spark, a charge of at least 10 000 V is required.

This shows that it is possible to develop charges of over 10 000 V before noticing an electrostatic discharge!

## Risks created by an electrostatic discharge

A high ESD voltage (several thousand volts) creates danger for electronic components. A semi-conductor must be handled carefully to prevent destruction by ESD. It is estimated that ESD destroy only 10% of the components that they effect. The other 90% of components fall into the "deteriorated" category. A component may be damaged with simply 25% of the voltage required to destroy it.

These hidden faults can lead to problems that appear several days, weeks or even months after the incident. Components may also undergo a change in their operating characteristics. Initial tests are successfully passed but an intermittent error occurs under vibration or temperature constraints. The same components will pass the "on/off" test successfully, as carried out during repairs, but the problem will reappear again once on site.

## Typical ESD voltages

| Source                     | Low relative humidity<br>10 - 20% | Average relative humidity<br>40% | High relative humidity<br>65 - 90% |
|----------------------------|-----------------------------------|----------------------------------|------------------------------------|
| Walking on carpet          | 35 kV                             | 15 kV                            | 1.5 kV                             |
| Walking on vinyl           | 12 kV                             | 5 kV                             | 0.3 kV                             |
| Working at the workstation | 6 kV                              | 2.5 kV                           | 0.1 kV                             |
| Plastified instructions    | 7 kV                              | 2.6 kV                           | 0.6 kV                             |
| Polyethylene bags          | 20 kV                             | 2 kV                             | 1.2 kV                             |
| Cellular polyurethane      | 18 kV                             | 11 kV                            | 1.5 kV                             |

## Charge sources

- Work surfaces
- Packaging
- Floors
- Handling
- Chairs
- Assembly
- Carriages
- Cleaning
- Clothes
- Repairing

## Parts sensitive to static charges

- Electronic cards
- Power supplies
- Encoders
- etc

### 1.3.4.3 - Prevention of damage due to electrostatic discharges

M0000547.1

It is essential to guard against electrostatic discharges during an intervention concerning electronic components, subassemblies and complete systems.

Elimination of the danger due to ESD requires a combined team effort. By complying with the following instructions, the user can substantially reduce the potential damage caused by ESD and ensure long-term reliability for the robot:

- Inform the staff of the risks stemming from ESD.
- Know the critical zones sensitive to ESD.
- Know the rules and procedures to deal with ESD.
- Always carry components and boards in a tray to protect them from electrostatic charges.
- Always ground yourself before working on a workstation.
- Keep non-conducting equipment (static charge generators) away from components and boards.
- Use tools providing protection from ESD.

## Stäubli workstation

To handle electronic cards, Stäubli workstations are given a grounded coating that dissipates static electricity.

## Work zones

An antistatic bracelet is required to handle boards or electronic components.

Remove objects that generate static electrical charges from the work area.

Printed circuits, boards and electronic components must be kept in antistatic bags.

## Antistatic wrist strap

The wrist straps are supplied as part of the standard equipment for the robot.



Use an antistatic wrist strap and mat connected to the frame of the controller or to the frame of the arm and the ground during all handling of electronic boards or electrical components.

### 1.3.5 - ARM SAFETY DEVICES

M0003539.1

The axis range limitation systems using software or electric switches do not meet the safety performance levels required under standard ISO 10218-1 for control systems linked to safety. They may be used to protect the equipment and not for functional safety in the cell.

#### 1.3.5.1 - Overview of the safety devices

M0000170.1

The arm features the following safety devices:

| Device                  | Paragraph                                                        |
|-------------------------|------------------------------------------------------------------|
| Axis limitation devices | 2.12.8 "Axis range limitation"<br>4.5.4 "Modification of ranges" |

### 1.3.5.2 - Residual risks

Whatever the safety functions implemented, there are some residual risks due to the type of machine:

|                                          |                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Adequate safety performance level</b> | A Category 3 PLd safety function is usually adequate for a temporary protection of the operator. A permanent protection of the operator may require a higher performance of the safety function. The required safety performance level can only be determined by an application-specific risk analysis.                                                     |
| <b>Faultless conditions</b>              | The robot must only be operated in faultless conditions. Some safety functions require specific conditions of use to guaranty their integrity. It is recommended to keep records of all safety related actions on the robot and on the cell in a "safety book" or the like. Special care must be taken during maintenance and restarting phases.            |
| <b>Adequate conditions of use</b>        | Safe operation in the cell does not rely only on the safety functions of the robot. Refer to the instruction manuals of arm and controller for robot conditions of use. These recommendations do not prevent from a detailed risk analysis related to the specificities of the cell. Special care must be taken during installation and maintenance phases. |
| <b>Risk signaling</b>                    | ISO 10218-1, 5.7.3 recommends that "wherever possible, the manual mode of operation shall be performed with all persons outside the safeguarded space".                                                                                                                                                                                                     |
|                                          | The arm must be secured before any operation under its mechanical parts, in manual mode, maintenance, or when using the manual brake release function.                                                                                                                                                                                                      |
|                                          | Before operating near the robot it must be assured that the brakes are operational.                                                                                                                                                                                                                                                                         |
|                                          | Risks of impingement between the moving robot and the cell environment.                                                                                                                                                                                                                                                                                     |
|                                          | Risks of contact with moving edges or hot parts of the robot, even at low speed.                                                                                                                                                                                                                                                                            |
|                                          | Risks of potentially dangerous situations (falling part when opening the gripper, command of other moving parts in the cell...) due to the activation of output signals.                                                                                                                                                                                    |
|                                          | Risks of reduced attention to other hazards in the cell (steps, other moving parts, sharp edges...) when paying attention to the robot.                                                                                                                                                                                                                     |
|                                          | Risk of a sudden operator reaction to an unexpected robot movement, even at low speed (incorrect command for an operation, major joint movement caused by a small movement of the tool centre, untoward program command).                                                                                                                                   |
|                                          | Risks of crushing during arm lifting or movement, or release of a joint brake.                                                                                                                                                                                                                                                                              |



## 2 - DESCRIPTION

### 2.1 - IDENTIFICATION

M0000243.1

**Robots are manufactured by**

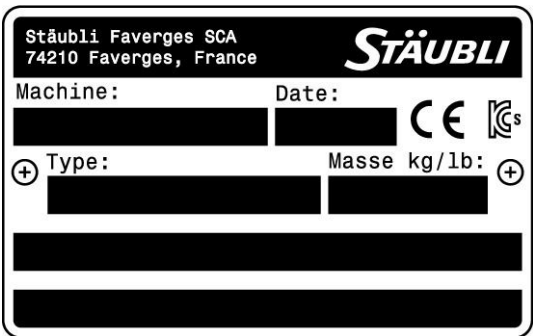
Stäubli Faverges SCA

Place Robert Stäubli

74210 Faverges France

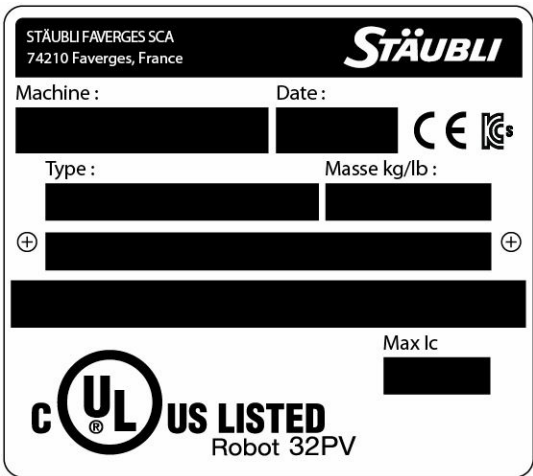
They are identified by a plate attached to the controller and to the arm.

Example:



I0000124

**Figure 2.1 : Standard version**



I0000014

**Figure 2.2 : UL version**

The CE mark placed on the identification plate refers to the "Electromagnetic Compatibility" directive.



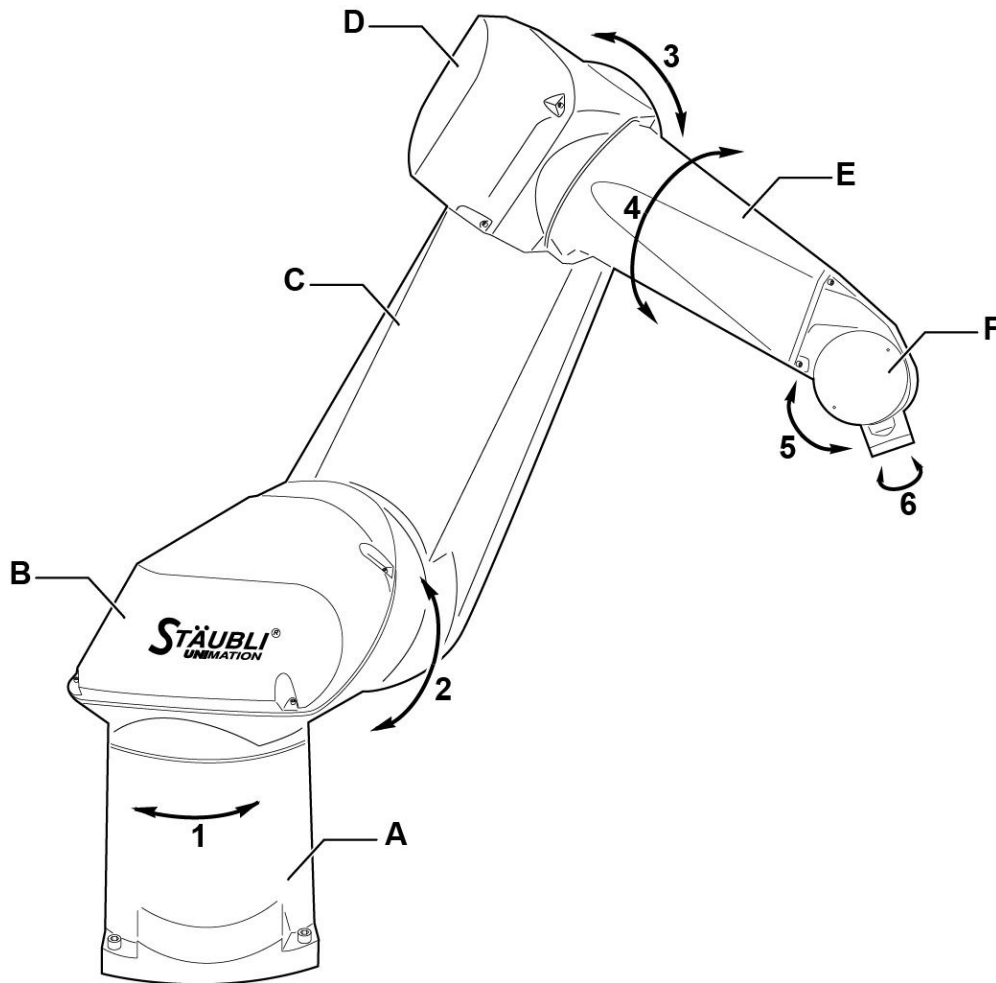
#### **SAFETY**

The manufacturer's identification plate must remain present and legible throughout the robot service life.

Whenever requesting information, ordering spare parts, or requesting intervention, please state the type and serial number of the machine concerned, as shown on the identification plate.

## 2.2 - GENERAL PRESENTATION

M0000189.1



I0002370

Figure 2.3

Figure 2.4

The arm consists of links interconnected by joints. The various elements of the robot's arm are: the base **(A)**, the shoulder **(B)**, the inner link **(C)**, the elbow **(D)**, the forearm **(E)** and the wrist **(F)**.

The arm joint movements are generated by brushless servomotors coupled to encoders. Each of these motors is equipped with a parking brake.

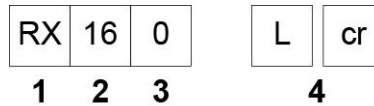
This reliable, robust assembly is linked to an innovative counting system that provides data concerning the absolute position of the robot at all times.

The arm assembly is flexible and is able to perform a great variety of applications.

Example: Handling of loads, assembly, process, application of adhesive beads, control/check and clean room applications. This list is not exhaustive: for further information, please consult us.

## 2.3 - DESIGNATION OF ROBOTS OF THE RX SERIES 160 HD FAMILY

M0003530.1



I0003732

| Item | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | RX family arm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 2    | Maximum working radius between axis 2 and axis 5 on the standard version, expressed in decimetres:<br><br>dimension (A) + dimension (B) + dimension (C) (figure 2.6).                                                                                                                                                                                                                                                                                                                                            |
| 3    | Number of active axes:<br><ul style="list-style-type: none"> <li>■ 0 = 6 active axes.</li> <li>■ 5 = 5 active axis, geometry being conserved.</li> </ul>                                                                                                                                                                                                                                                                                                                                                         |
| 4    | Letters to indicate an option.<br>Example:<br><ul style="list-style-type: none"> <li>■ L = extended forearm: dimension (A) + dimension (C) + dimension (D) (figure 2.7).</li> <li>■ HD = heavy duty wrist.</li> <li>■ cr = cleanroom application.</li> <li>■ he = wet environment application.</li> <li>■ steri = application in a bio-contaminated environment.</li> <li>■ These letters can be combined.</li> </ul> <p style="margin-left: 20px;">Example: L cr = extended forearm clean room application.</p> |

**Figure 2.5**

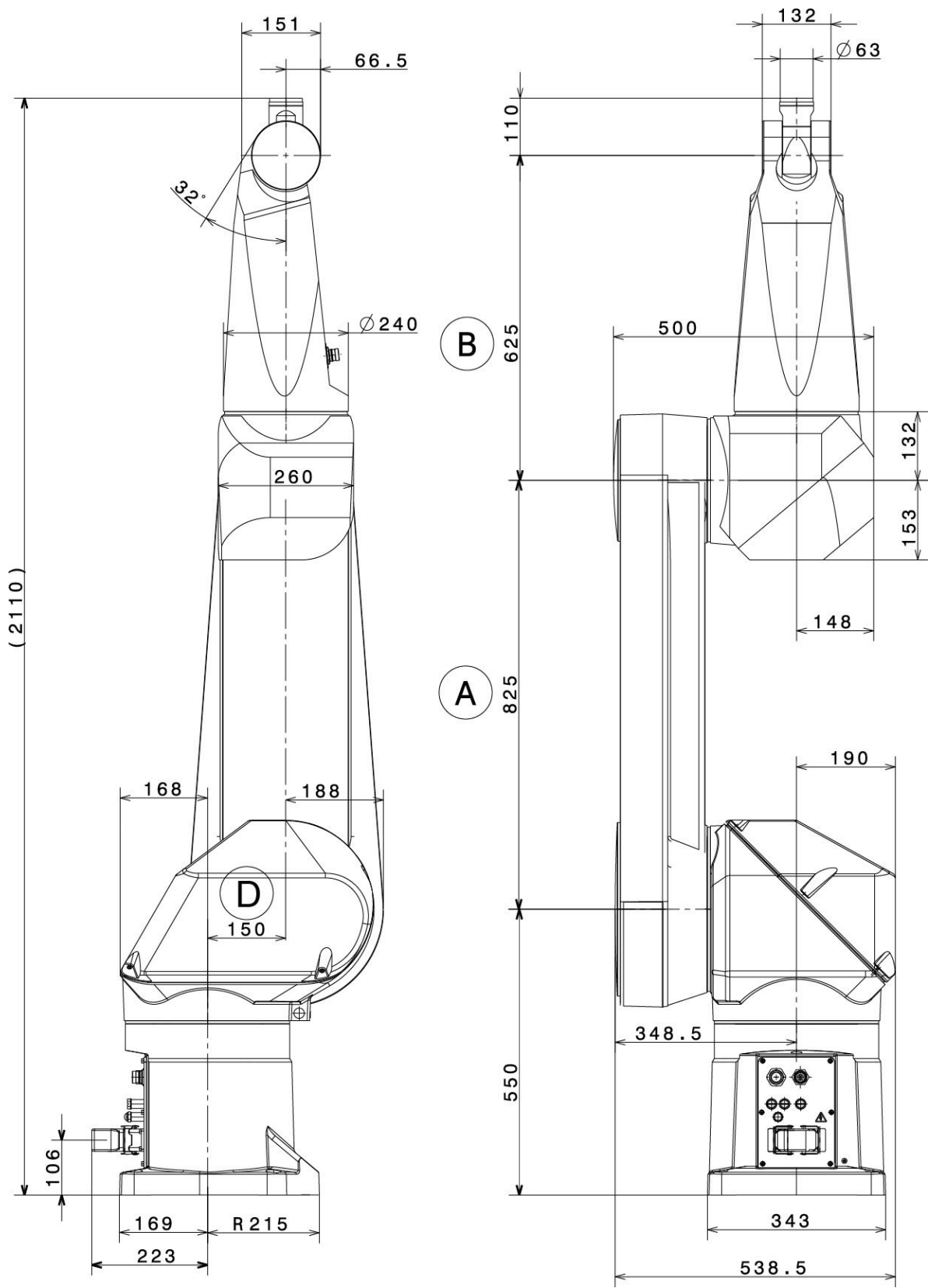
In the manual, the following terminology is used:

- Standard arm: arm with standard geometry.
  - Horizontal cable outlet (see figure 2.6).
  - Vertical cable outlet (see figure 2.9).
- L arm: for arm with different geometry where forearm is extended.
  - Horizontal cable outlet (see figure 2.7).
  - Vertical cable outlet (see figure 2.10).
- Standard arm, HD option: Standard geometry arm with heavy duty wrist.
  - Horizontal cable outlet (see figure 2.8).
  - Vertical cable outlet (see figure 2.11).
- 5-axis arm: for arm with 5 active axis.

2.4 - GENERAL CHARACTERISTICS

2.4.1 - OVERALL DIMENSIONS

M0003501.1



I0002683

Figure 2.6 : (RX160) - Standard arm, horizontal cable outlet

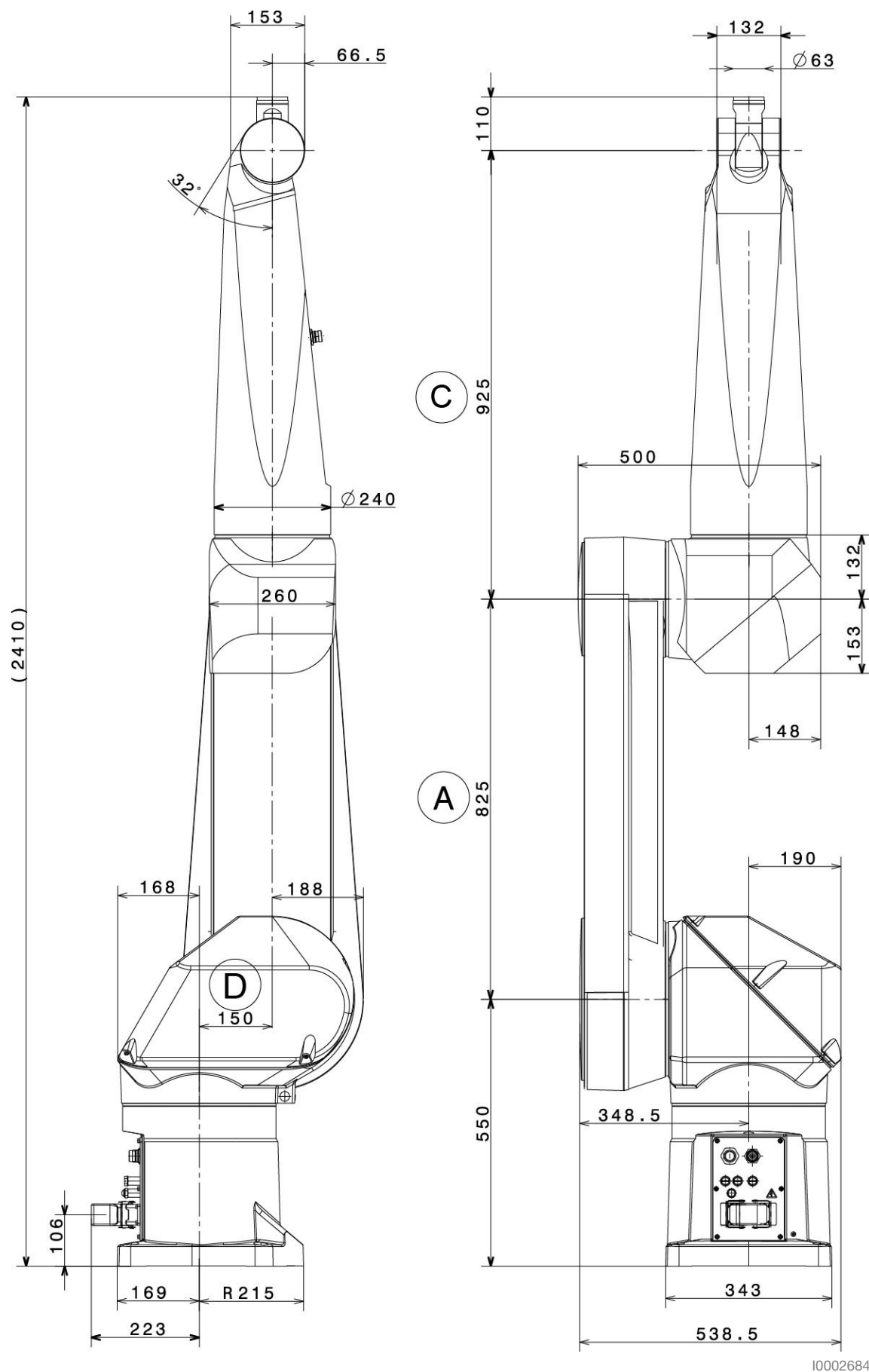
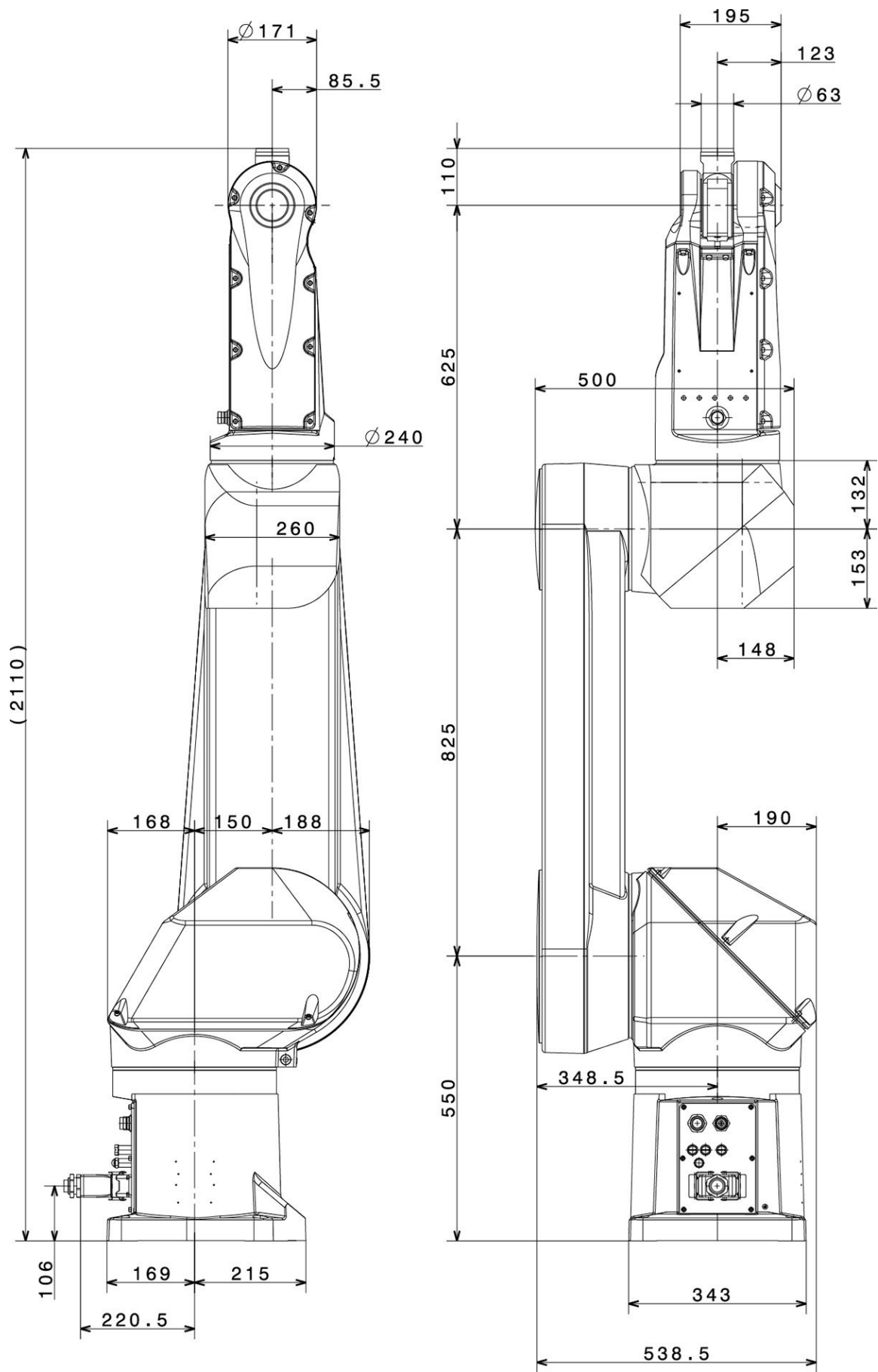
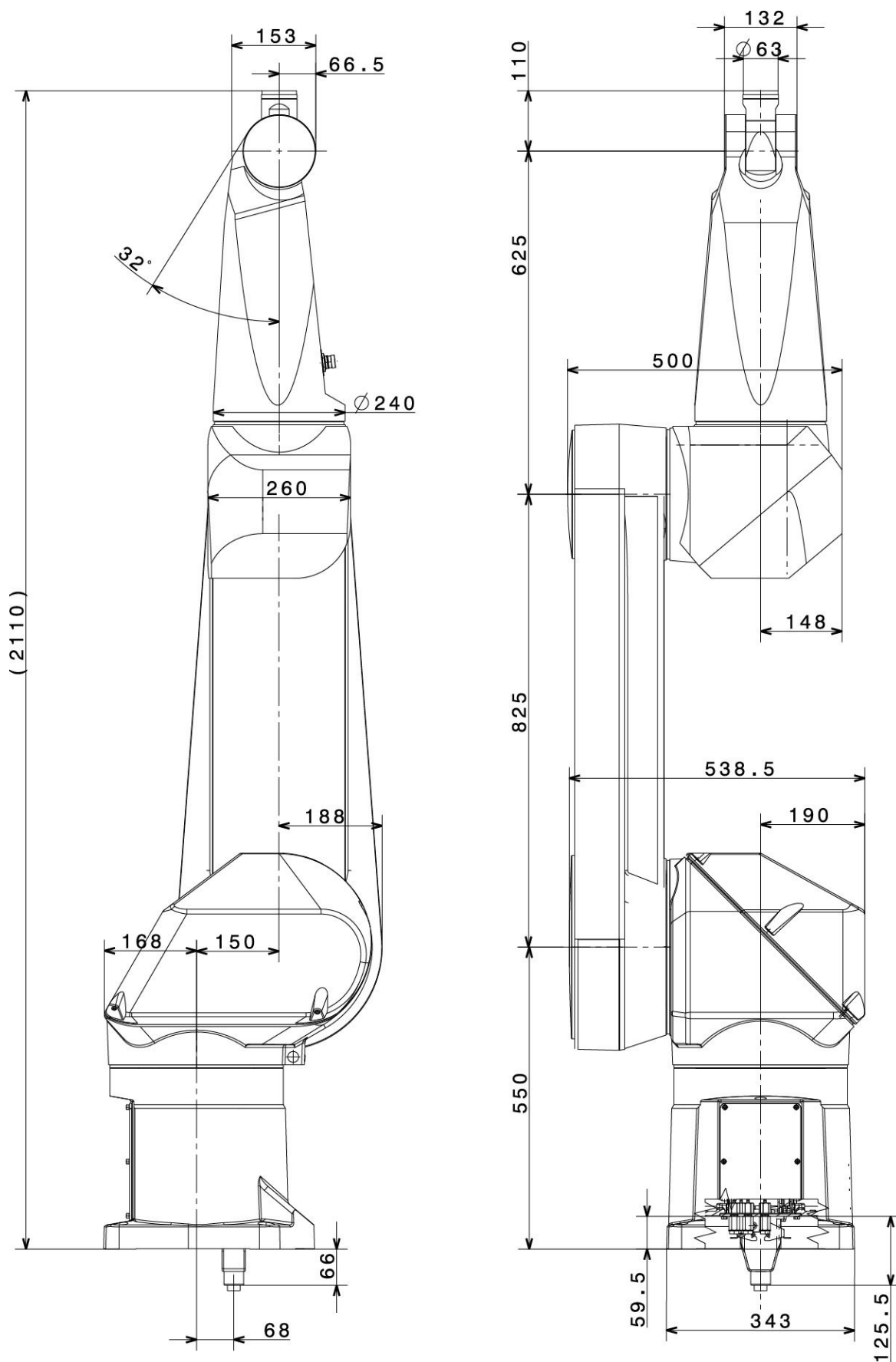


Figure 2.7 : (RX160L) - Long arm, horizontal cable outlet



I0003230

Figure 2.8 : (RX160 HD) - Standard arm, HD option, horizontal cable outlet



10002686

Figure 2.9 : (RX160) - Standard arm with vertical cable outlet

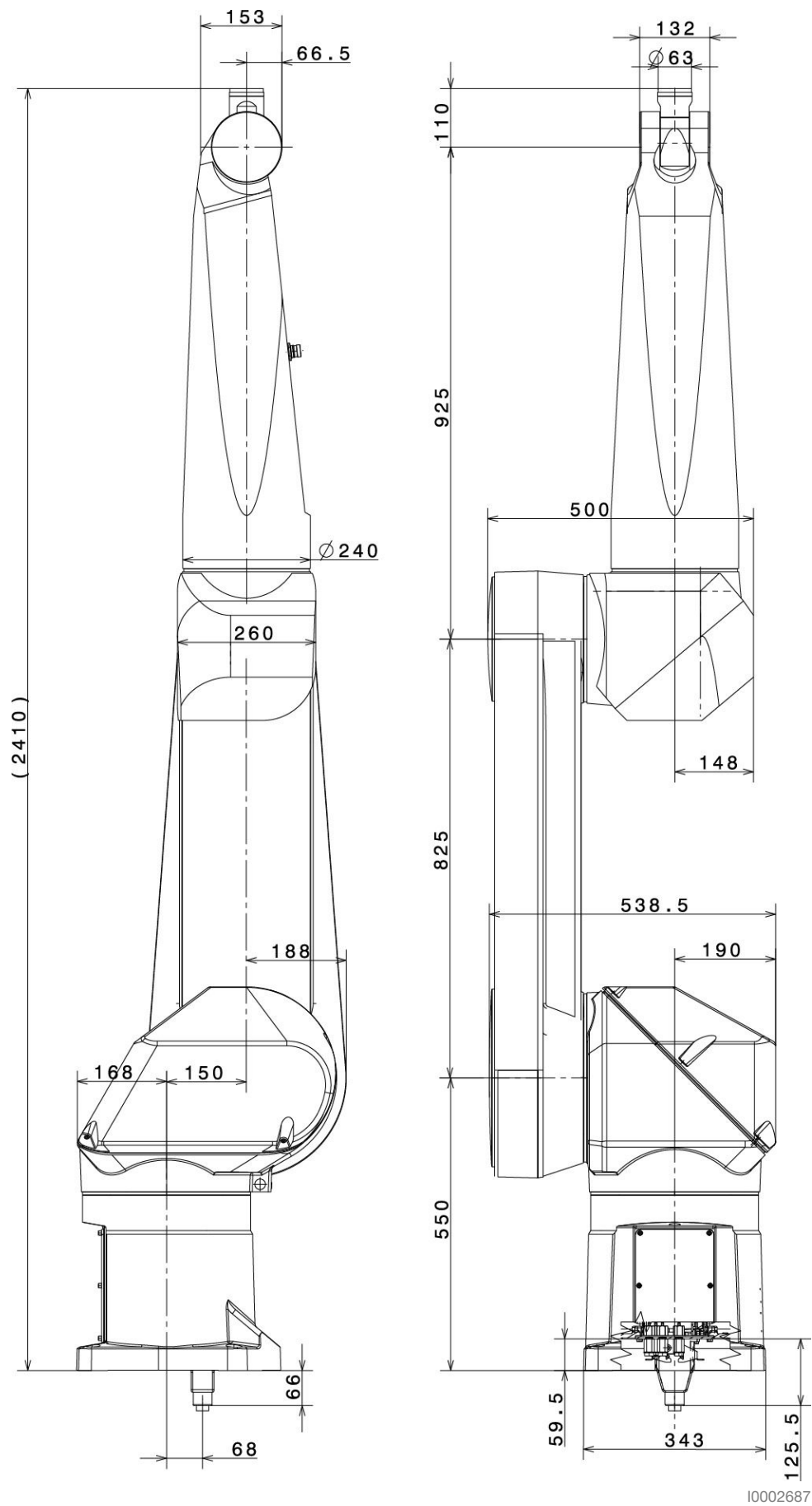
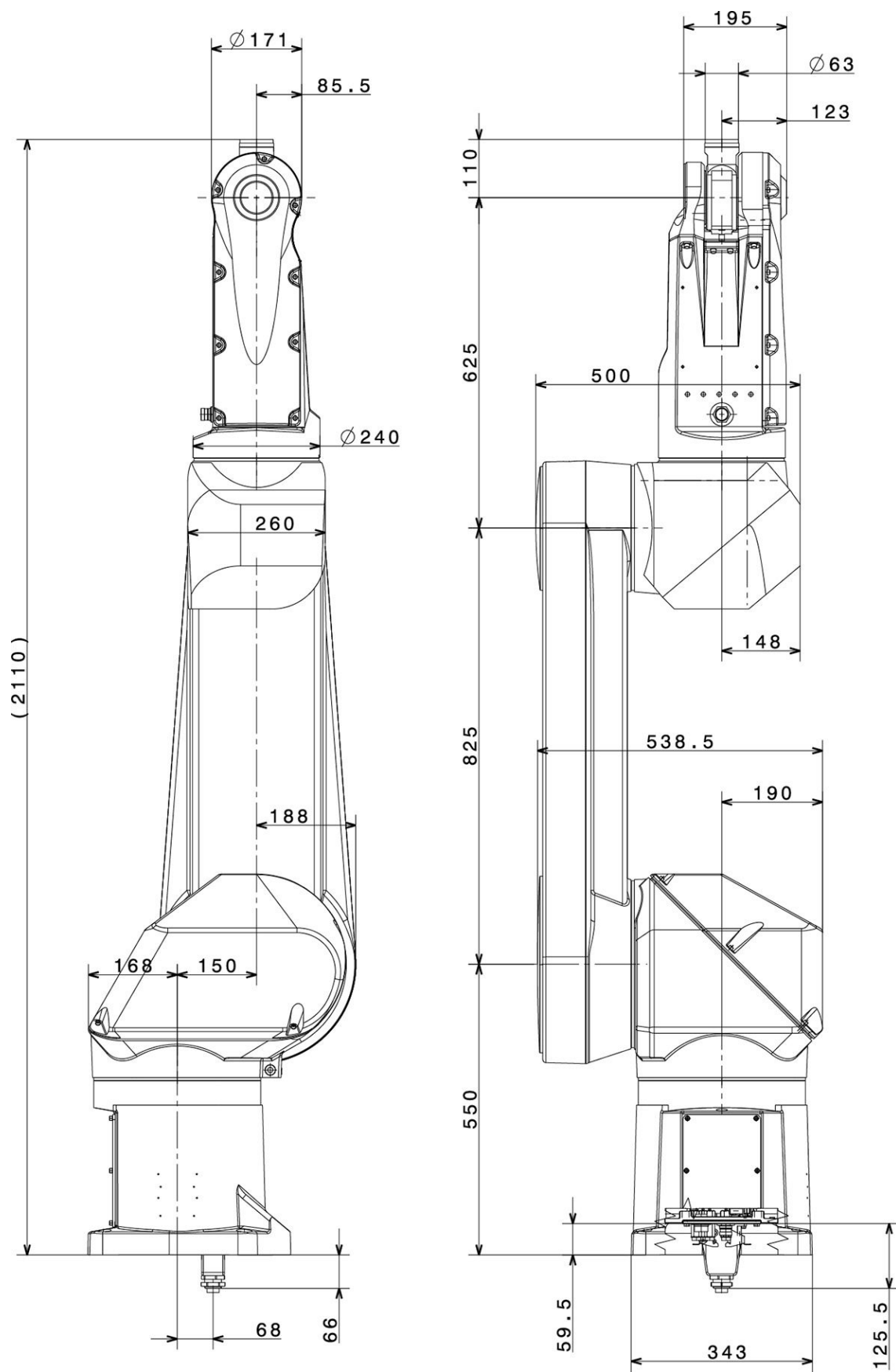


Figure 2.10 : (RX160L) - Long arm with vertical cable outlet



I0003231

Figure 2.11 : (RX160 HD) - Standard arm, HD option, vertical cable outlet

## 2.4.2 - WORK ENVIRONMENT

M0000155.1

- Working temperature: + 5°C to + 40°C.



It may be necessary to perform a warm-up cycle before nominal performances are obtained. A high ambient temperature may lead to limitations in the robot's dynamic performance levels.

- Humidity: 30% to 95% max. non-condensing.
- Altitude: 2000 m max
- Vibrations: Please consult us.
- IP65 arm protection and IP67 wrist protection ratings with the electric or blanking plugs inserted.



If the robot is used in an area exposed to dust or splattering with liquids, it is highly advisable to use the Stäubli pressurization unit described in chapter 2.10. Stäubli could decline its warranty if the arm is pressurized by a system which doesn't provide the same characteristics.



Any damage due to failure to comply with the recommendations inherent to the environments below lies outside the scope of the guarantee.

### Clean room application:

- CR: Cleanliness class ISO 4 in accordance with standard ISO 14644-1.
- The robot can be cleaned with wipes wetted with isopropyl alcohol diluted with 30 % of water (IPA 70).

### Additional information for humid environment application (HE):



It is necessary to use a pressurization system (as described in chapter 2.10) on robots in wet environments (HE).

- Limits of application:
  - $4,5 < \text{pH} < 8,5$ .
  - Resistance to salt spray: 300 hours in accordance with standard NS EN 60068-2-11.
  - Use of chlorinated products for cleaning is prohibited.
  - The arm must be pressurized with the Stäubli pressurization system described in chapter 2.10. Stäubli could decline its warranty if the arm is pressurized by a system which doesn't provide the same characteristics. The pressurization system must be protected from the humid environment (HE).



A separate Stäubli pressurization system is needed for each robot.

- The following elements are not qualified for a humid environment (HE) and they must be protected from that environment:
  - The threaded fasteners on the wrist mechanical interface.
  - The threaded fasteners on the robot.
  - The underside of the base.
  - The forearm electrical connection.
  - The interconnect plate.
  - The equipment on the plate.

This protection is to be provided by the customer, and are their responsibility. The guarantee does not cover any damage occurring there.
- In the event of use of an optional mechanical hard stop system, depending on the environment, the system may show limited chemical resistance. Regularly inspect the system to check that it is in good condition (see also chapter 4.5.4). In the event of deterioration, the system can be replaced. It should be noted that because of its complex shape, the mechanical limit stop system makes the robot arm more difficult to clean and disinfect.
- Vertical cable outlet: **Standard configuration**
  - See also chapter 3.2 for the particular aspects concerning HE robot installation.

- Horizontal cable outlet: **Option only**
  - See also chapter 3.2 for the particular aspects concerning HE robot installation.

#### Bio-contaminated environment application (Stericlean):

- Limits of application:
  - $4,5 < \text{pH} < 8,5$
  - Resistance to salt spray: 300 hours in accordance with standard NS EN 60068-2-11.
  - Bio-decontamination with hydrogen peroxide on a wipe (concentration 35%) or in vapor phase.
  - Use of chlorinated products for cleaning is prohibited.
  - The threaded fasteners on the wrist's mechanical interface, the threaded fasteners on the robot, the underside of the base, the socket holder plate and the equipment fitted on it, are not qualified for a bio-contaminated (Stericlean) environment, so they must be protected from that environment. This protection is to be provided by the customer, and are their responsibility. The guarantee does not cover any damage occurring there.
  - In the event of use of an optional mechanical hard stop system, depending on the environment, the system may show limited chemical resistance. Regularly inspect the system to check that it is in good condition (see also chapter 4.5.4). In the event of deterioration, the system can be replaced. It should be noted that because of its complex shape, the mechanical limit stop system makes the robot arm more difficult to clean and disinfect.
  - The robot can be cleaned with wipes wetted with isopropyl alcohol diluted with 30 % of water (IPA 70).
  - There must not be any pressure difference between the inside of the robot and the exterior environment of the robot.
- Vertical cable outlets only:
  - See also chapter 3.2 for the particular aspects concerning steri robot installation.

#### 2.4.3 - WEIGHT

M0003500.1

| Standard arm      | Standard arm, HD option | L arm           |
|-------------------|-------------------------|-----------------|
| 248 kg (546.7 lb) | 250 kg (551 lb)         | 250 kg (551 lb) |

#### 2.4.4 - CLEANING AND DISINFECTING RECOMMENDATIONS

M0000190.1

##### Stäubli standard, CR, SCR external robot surfaces external robot surfaces

- Unpainted metal parts:
  - Use wipes wetted with product recommended in the following compatibility chart.
- Painted metal parts or plastic parts:
  - Use wipes soaked with a neutral pH aqueous soap solution (For example, use a product listed in the following compatibility chart).
  - Rinse with wipe wetted with clean water.
  - Dry with wipes.

The interval between two cleaning or disinfecting actions depends on robot dirtiness (Typical periodicity: 1 week).

##### Stäubli HE external robot surfaces (Humid environment application):

- Use an aqueous product having a pH between 4.5 to 8.5 (For example, use a product listed in the following compatibility chart).
- Rinse with clean water.
- Dry with wipes.

### **Stäubli Stericlean external robot surfaces (Bio-contaminated environment application):**

- Use an aqueous product having a pH between 4.5 to 8.5 (For example, use a product listed in the following compatibility chart).
- Rinse with clean water.
- Dry with wipes.

or

- Use other products recommended in the following compatibility chart (e.g. IPA 70, hydrogen peroxide 35% on a wipe or in vapor phase) without any water rinse.

The interval between two cleaning or disinfecting actions depends on robot dirtiness (Typical periodicity: End of every production).



Information given herein shall not relieve you from checking the cleanliness of the robot after the cleaning and disinfecting process. Stäubli shall not be liable for any damage arising because of persistence of residue after the cleaning process described herein.



Use of chlorinated products for cleaning or disinfecting is prohibited. Use of any other cleaning or disinfecting product than those specified may damage robot external surfaces. In such case it is recommended to cover the robot by a protective covering.



In case of cleaning or disinfecting process with liquid splash or low pressure liquid jet, the robot arm has to be pressurized (see instruction manual).



Nevertheless, the repetitive mechanical action of wiping may damage the brightness of the paint.

In case of cleaning or disinfecting agents being out of specification, please consult Stäubli.

| Type of product                      |                          |                                | Disinfectant                                                        |              |                                                 |                                 | Cleaner                                                             |         |                                 |
|--------------------------------------|--------------------------|--------------------------------|---------------------------------------------------------------------|--------------|-------------------------------------------------|---------------------------------|---------------------------------------------------------------------|---------|---------------------------------|
| pH                                   |                          |                                | Neutral                                                             | Neutral      | 2 to 4                                          | -                               | 8.5                                                                 | Neutral | -                               |
| Cleaner or disinfecting product name |                          |                                | P3 alcodes                                                          | P3 topax 990 | hydrogen peroxide H <sub>2</sub> O <sub>2</sub> | 70% Iso-propyl alcohol (IPA 70) | P3 aquanta tin                                                      | ELPON   | 70% Iso-propyl alcohol (IPA 70) |
| Manufacturer                         |                          |                                | ECOLAB<br><a href="http://www.ecolab.com">http://www.ecolab.com</a> |              |                                                 |                                 | ECOLAB<br><a href="http://www.ecolab.com">http://www.ecolab.com</a> |         |                                 |
| Concentration                        |                          |                                | 100%                                                                | 3%           | 35% on a wipe or vapor phase                    | 100%                            | 0.2%                                                                | 3%      | 100%                            |
| Robot version                        | Standard                 | Unpainted parts                | √*                                                                  | No           | No                                              | √*                              | No                                                                  | No      | √*                              |
|                                      |                          | Painted parts or plastic parts | No**                                                                | √            | No                                              | No**                            | √                                                                   | √       | No**                            |
|                                      | SCR & CR                 | Unpainted parts                | √*                                                                  | No           | No                                              | √*                              | No                                                                  | No      | √*                              |
|                                      |                          | Painted parts                  | √                                                                   | √            | No                                              | √                               | √                                                                   | √       | √                               |
|                                      | HE                       | Unpainted parts                | √                                                                   | √            | √*                                              | √                               | √                                                                   | √       | √                               |
|                                      |                          | Painted parts                  | No**                                                                | √            | No                                              | No**                            | √                                                                   | √       | No**                            |
|                                      | Stericlean               | Unpainted parts                | √                                                                   | √            | √                                               | √                               | √                                                                   | √       | √                               |
|                                      |                          | Painted parts                  | √                                                                   | √            | √                                               | √                               | √                                                                   | √       | √                               |
|                                      | Usable for food industry |                                | √                                                                   | √            | √                                               | √                               | √                                                                   | √       | √                               |

Please contact the product manufacturer to define cleaning or disinfected process.

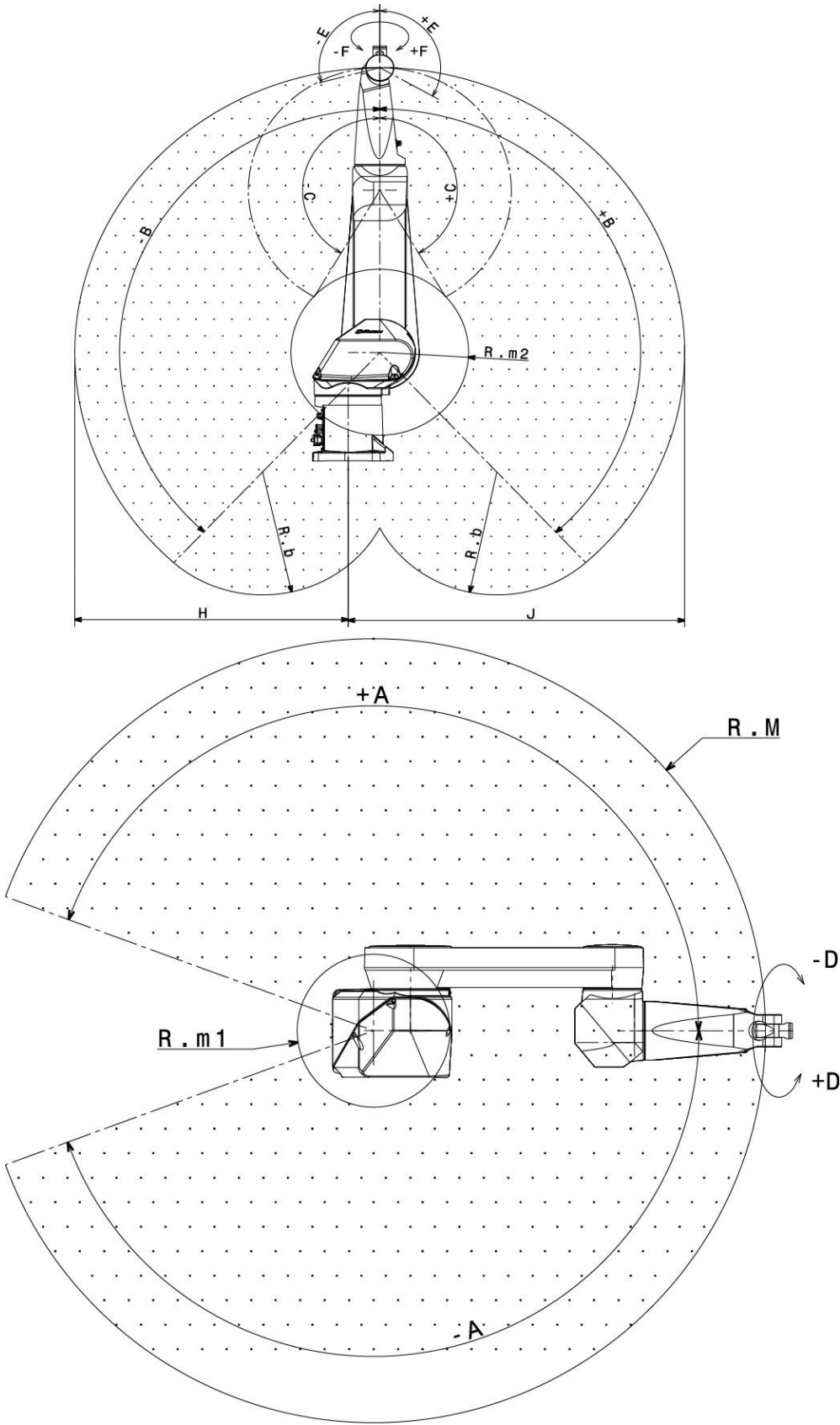


\*: Use only wipes wetted with the product.

\*\*· For painted part, it is also possible to use this product with a soft action of wiping and without too long application. Nevertheless, the repetitive mechanical action of wiping may damage the brightness of the paint.

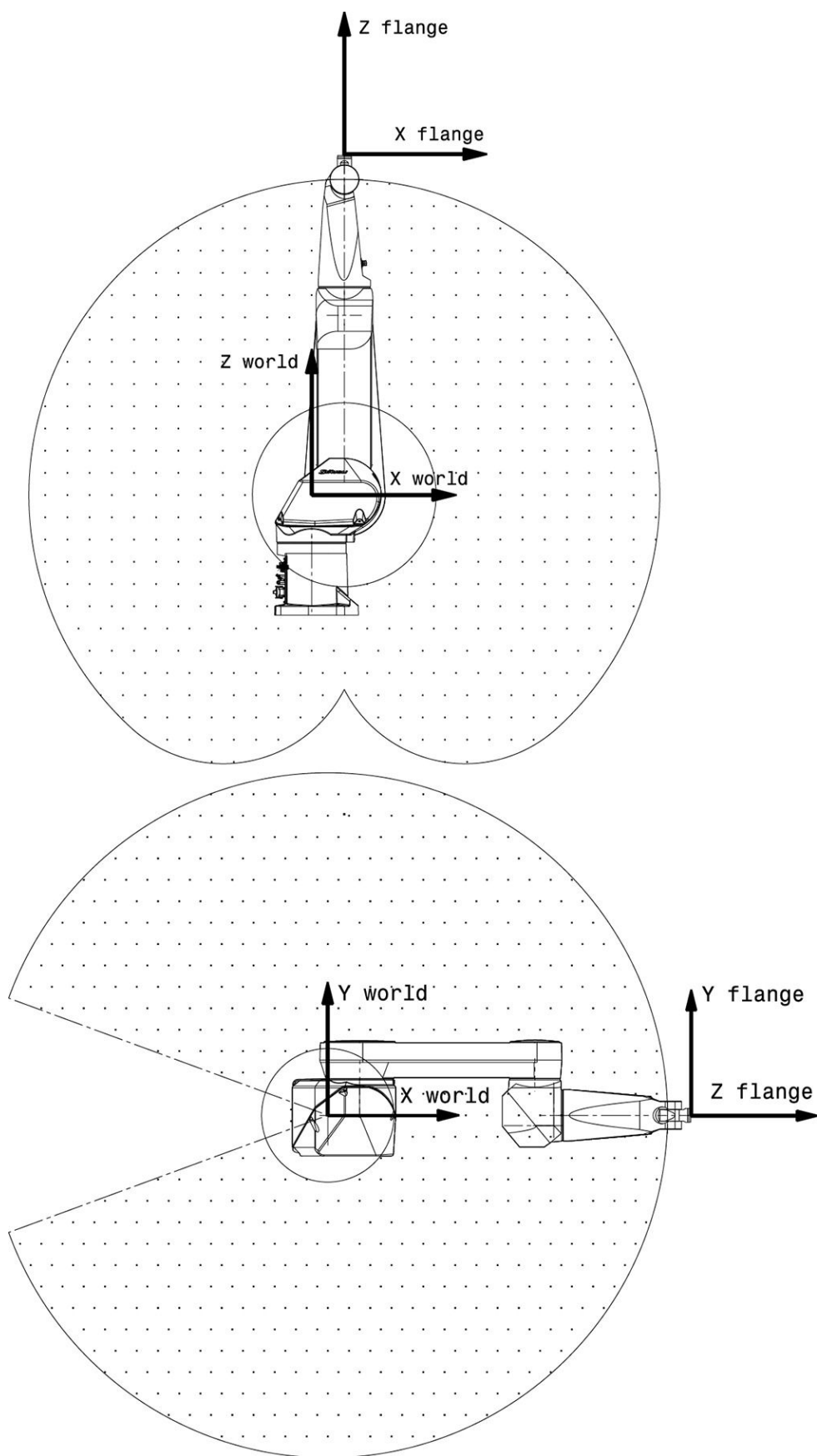
2.5 - PERFORMANCE

M0003525.1



I0002991

Figure 2.12



I0002992

**Figure 2.13**

|                                                   | Standard arm<br>Standard arm, HD option | L arm     |
|---------------------------------------------------|-----------------------------------------|-----------|
| Working space:                                    |                                         |           |
| R.M max. reach between axis 1 and 5               | 1600 mm                                 | 1900 mm   |
| R.m1 min. reach between axis 1 and 5              | 312 mm                                  | 462 mm    |
| R.m2 min. reach between axis 2 and 5              | 422 mm                                  | 463 mm    |
| R.b reach between axis 3 and 5                    | 625 mm                                  | 925 mm    |
| H                                                 | 1300 mm                                 | 1600 mm   |
| J                                                 | 1600 mm                                 | 1900 mm   |
| Maximum speed at load center of gravity           | 10.3 m/s                                | 12.3 m/s  |
| Placing Repeatability in accordance with ISO 9283 | ± 0.05 mm                               | ± 0.05 mm |

### 2.5.1 - RANGE, SPEED AND RESOLUTION

M0003526.1

| Standard arm<br>L arm                    |         |                    |         |         |                  |                    |
|------------------------------------------|---------|--------------------|---------|---------|------------------|--------------------|
| Axis                                     | 1       | 2                  | 3       | 4       | 5                | 6                  |
| Range (°)                                | 320     | 275 <sup>(1)</sup> | 300     | 540     | 225              | 540 <sup>(2)</sup> |
| Working range distribution (°)           | A ± 160 | B ± 137.5          | C ± 150 | D ± 270 | E<br>+120 ; -105 | F ± 270            |
| Nominal speed (°/s)                      | 165     | 150                | 190     | 295     | 260              | 440                |
| Maximum speed (°/s) <sup>(3)</sup>       | 200     | 200                | 255     | 315     | 360              | 870                |
| Angular resolution (°.10 <sup>-3</sup> ) | 0.042   | 0.042              | 0.054   | 0.062   | 0.12             | 0.17               |

- (1) Installation of an optional mechanical stop on axis 1 entails a limitation of the angular range for axis 2: + 137,5°: -103°.
- (2) Can be configured by software up to ±18 000°. See the "Software configuration" chapter in the "Controller" documentation. Can be configured as a "continuous" axis under the continuousAxis license.
- (3) Maximum speed for reduced conditions of load and inertia.

Low speed in manual mode: 250 mm/s at tool centre point and 45 °/s on each axis.

| Standard arm, HD option                  |         |                    |         |         |         |                    |
|------------------------------------------|---------|--------------------|---------|---------|---------|--------------------|
| Axis                                     | 1       | 2                  | 3       | 4       | 5       | 6                  |
| Range (°)                                | 320     | 275 <sup>(1)</sup> | 300     | 540     | 240     | 540 <sup>(2)</sup> |
| Working range distribution (°)           | A ± 160 | B ± 137.5          | C ± 150 | D ± 270 | E ± 120 | F ± 270            |
| Nominal speed (°/s)                      | 165     | 150                | 190     | 295     | 260     | 440                |
| Maximum speed (°/s) <sup>(3)</sup>       | 200     | 200                | 255     | 315     | 360     | 870                |
| Angular resolution (°.10 <sup>-3</sup> ) | 0.042   | 0.042              | 0.054   | 0.062   | 0.12    | 0.17               |

- (1) Installation of an optional mechanical stop on axis 1 entails a limitation of the angular range for axis 2: + 137,5°: -103°.
- (2) Can be configured by software up to ±18 000°. See the "Software configuration" chapter in the "Controller" documentation. Can be configured as a "continuous" axis under the continuousAxis license.
- (3) Maximum speed for reduced conditions of load and inertia.

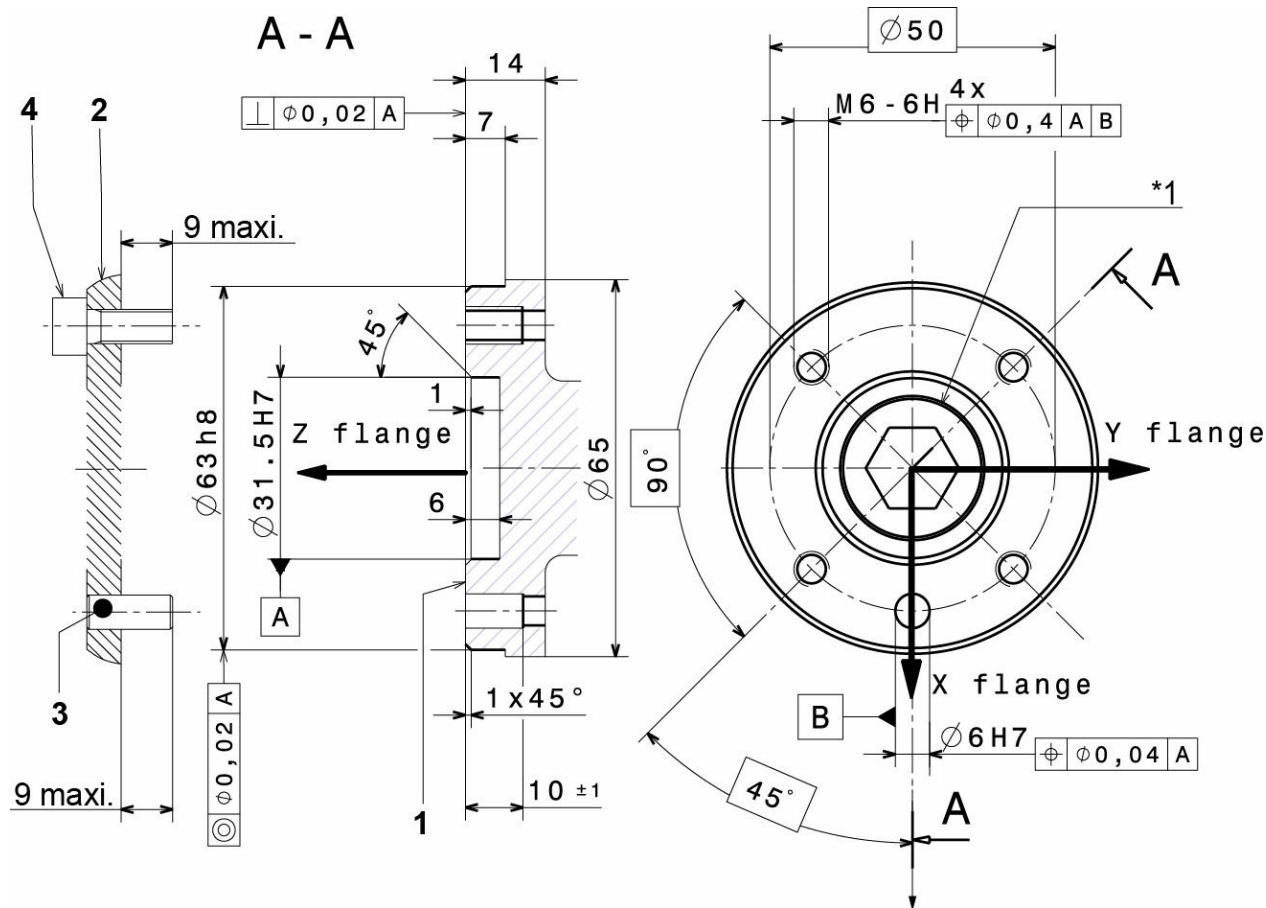
Low speed in manual mode: 250 mm/s at tool centre point and 45 °/s on each axis.



In some arm configurations, the maximum joint speeds can be reached only if payloads and inertias are reduced.

2.6 - LOAD CAPACITY - MECHANICAL INTERFACE

M0003482.1



I0003785

\*1: M6 screws: To protect from the humid or bio-contaminated environment.

| Item | Description          |
|------|----------------------|
| 1    | Mechanical interface |
| 2    | End-effector         |

Figure 2.14

The end-effector is not supplied with the robot arm assembly; its design depends on the robot's specific applications. The end-effector design should be sufficient rigid to avoid affecting robot performance levels. All studies can be undertaken in cooperation with Stäubli to obtain optimum performance without exceeding the robot arm assembly load limits.

The end-effector is installed on the mechanical interface of the wrist, the dimensions of which are given on figure 2.14:

- Attachment by 4 M6 screws frame (4), Class 12-9, torque 16.7 Nm ± 1.2 Nm.
- Indexing by pin frame (3), diameter 6.

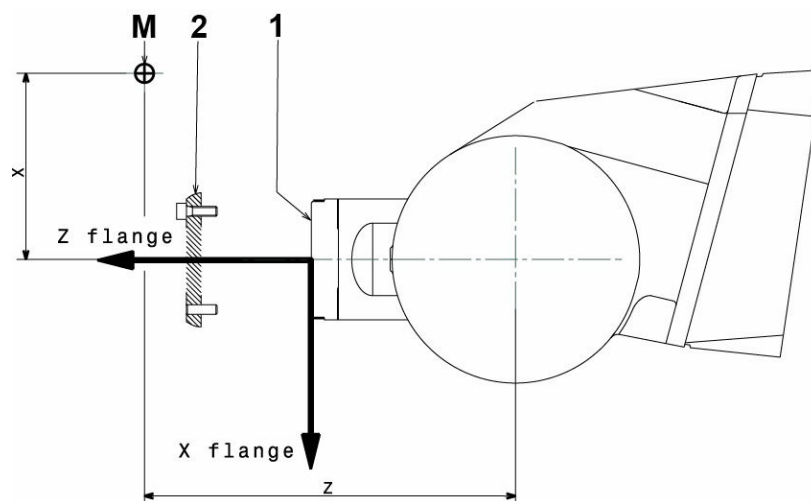
Mechanical interface designation:

- NF EN ISO 9409-1-50-4-M6 - A50 as per Standard ISO 9409 - 1 : 2004 (F) (Standard and L arms) (except the localization of the 4 M6 threaded holes).



Length of end-effector attaching screws is limited to avoid all interference with the wrist (figure 2.14).

## 2.6.1 - LOAD CAPACITY



I0003749

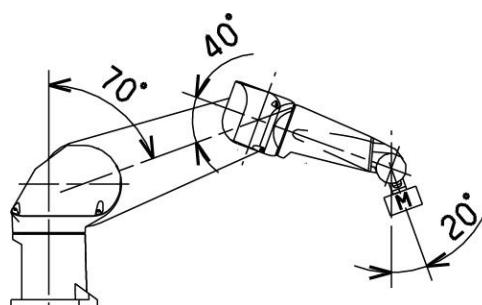
| Item | Description          |
|------|----------------------|
| M    | Center of gravity    |
| 1    | Mechanical interface |
| 2    | End-effector         |

Figure 2.15

| Load capacity                                          | X   | Z   | Standard arm<br>Standard arm, HD option | L arm           |
|--------------------------------------------------------|-----|-----|-----------------------------------------|-----------------|
|                                                        | mm  | mm  |                                         |                 |
| At nominal speed                                       | 100 | 200 | 20 kg (44.1 lb)                         | 14 kg (30.8 lb) |
| At reduced speed <sup>(1)</sup>                        | 100 | 200 | 30 kg (66.1 lb)                         | 20 kg (44.1 lb) |
| Maximum load capacity (see figure 2.16) <sup>(2)</sup> | 100 | 200 | 34 kg (74.9 lb)                         | 28 kg (61.7 lb) |

(1) In all configurations and taking maximum inertia into account. See the table below.

(2) Limiting load for which the maximum arm extension cannot exceed that shown in figure 2.16.



I0002368

Figure 2.16

|                 | Nominal inertias (kg.m <sup>2</sup> )   |       | Maximal inertias (kg.m <sup>2</sup> ) <sup>(3)</sup> |       |
|-----------------|-----------------------------------------|-------|------------------------------------------------------|-------|
|                 | Standard arm<br>Standard arm, HD option | L arm | Standard arm<br>Standard arm, HD option              | L arm |
| For axis 5 (I5) | 0.8                                     | 0.56  | 4                                                    | 2.8   |

|                 | Nominal inertias (kg.m <sup>2</sup> )   |       | Maximal inertias (kg.m <sup>2</sup> ) <sup>(3)</sup> |       |
|-----------------|-----------------------------------------|-------|------------------------------------------------------|-------|
|                 | Standard arm<br>Standard arm, HD option | L arm | Standard arm<br>Standard arm, HD option              | L arm |
| For axis 6 (I6) | 0.2                                     | 0.14  | 1                                                    | 0.7   |

(3) Under reduced speed and acceleration conditions:

Generally: VEL = 60%, ACC = 30%, DEC = 30% (consult us).



The nominal values can be exceeded to a certain extent but imply a limitation to the speed and the acceleration of the arm. If these limits are to be exceeded, please consult Stäubli.



The maximum levels of inertia cannot be used simultaneously on axes 5 and 6. In all cases, the following two conditions must be complied with:

- I5 load + I6 load < I5 max.
- I6 load < I6 max.

## 2.6.2 - MAXIMUM TORQUE

M0003520.1

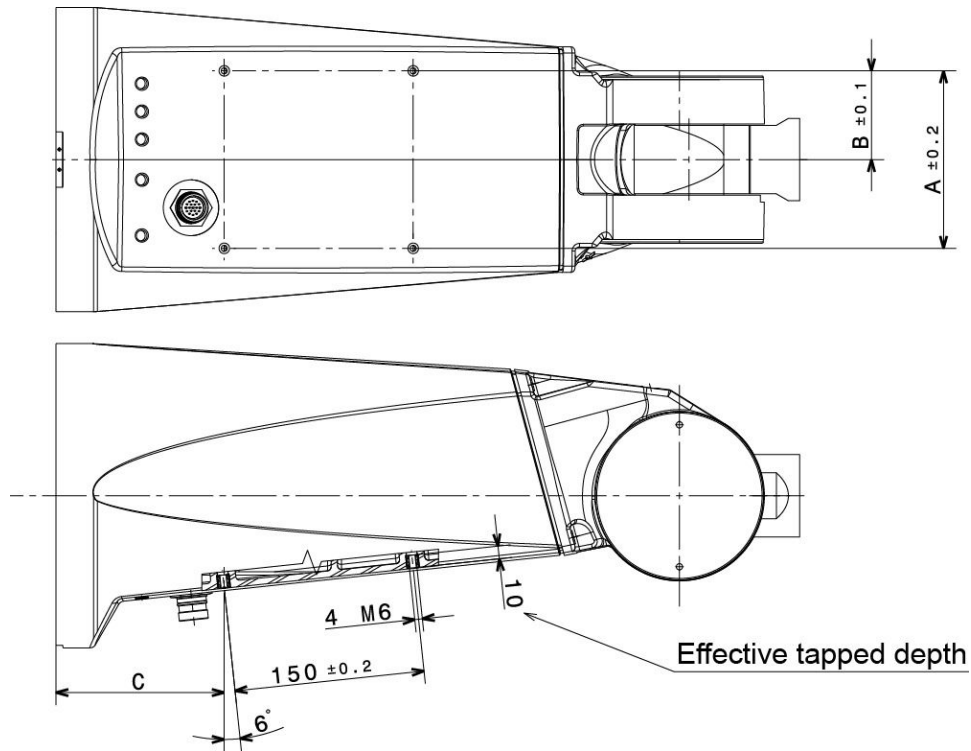
|                               | Reference axis |        |        |        |                          |                       |        |
|-------------------------------|----------------|--------|--------|--------|--------------------------|-----------------------|--------|
| Static torques                | Axis 1         | Axis 2 | Axis 3 | Axis 4 | Axis 5                   |                       | Axis 6 |
|                               |                |        |        |        | Without torque / joint 6 | With torque / joint 6 |        |
| RX160 / RX160L                | 692            | 574    | 242    | 58     | 58                       | 29                    | 29     |
| Standard RX160 with HD option | 692            | 574    | 242    | 58     | 150                      | 121                   | 29     |



These torques are available for a load carried equal to 0 kg.

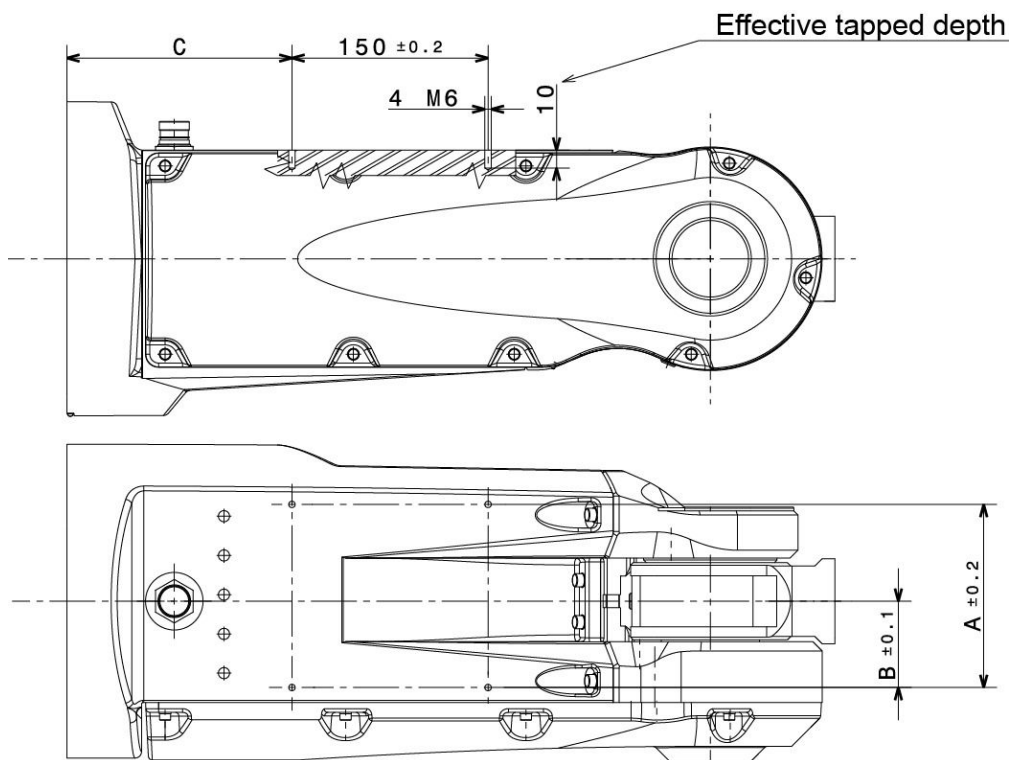
## 2.6.3 - ATTACHMENT OF ADDITIONAL LOAD ON FOREARM

M0003519.1



I0003232

Figure 2.17 : Standard arm / L arm



I0003750

Figure 2.18 : Standard arm, HD option

An additional load can be attached to the forearm using 4 M6 screws; maximum torque is 12 Nm.  
Position of tapped holes: See figures 2.17 and 2.18.

| Dimensions | Standard arm | L arm | Standard arm, HD option |
|------------|--------------|-------|-------------------------|
| A          | 140          | 110   | 140                     |
| B          | 70           | 55    | 66                      |
| C          | 133          | 185   | 172                     |

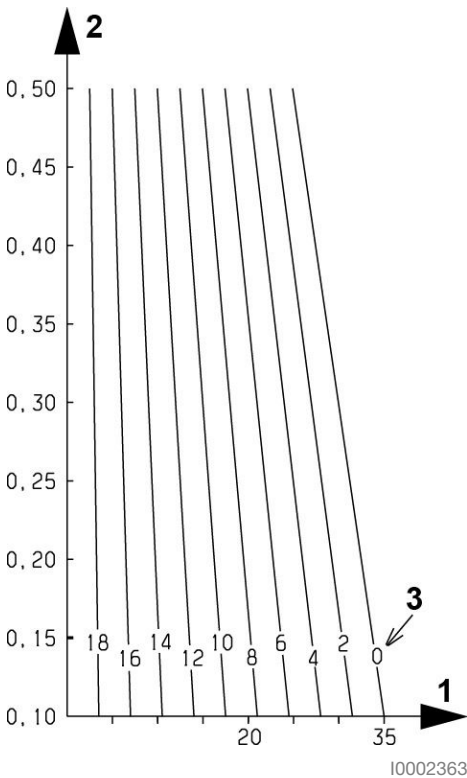


The additional load depends on nominal load (see next page). In all cases, do not exceed load characteristics.

2.6.4 - ADDITIONAL LOAD DIAGRAMS

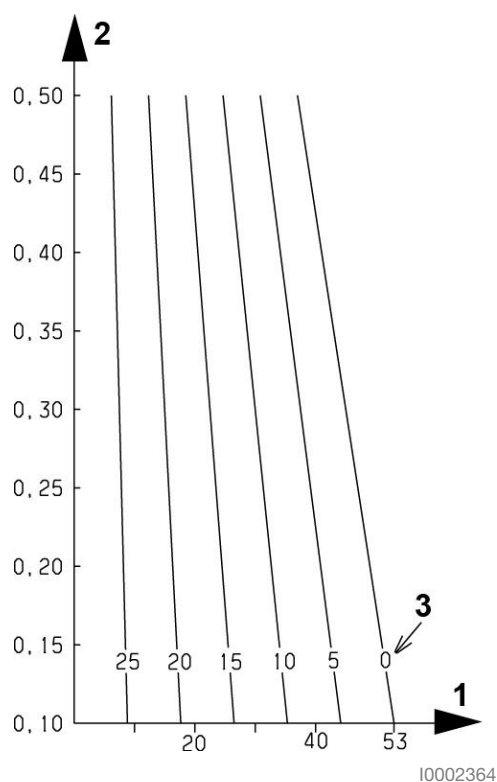
M0003502.1

These diagrams can be used to determine the additional load which can be attached to the forearm depending on its center of gravity position from joint 3 and the load attached to the mechanical interface of the wrist.



| Item | Description                                                                                                                                                                    |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Additional load (kg).                                                                                                                                                          |
| 2    | Additional load center of gravity position (m) from centerline of joint 3.<br>The additional load center of gravity position is at 0.20 m max. from the centerline of joint 4. |
| 3    | Load attached to the mechanical interface of the wrist.<br>200 mm with respect to joint 5 and 100 mm with respect to joint 6.                                                  |

Figure 2.19 : For standard RX160 and standard RX160 with HD option

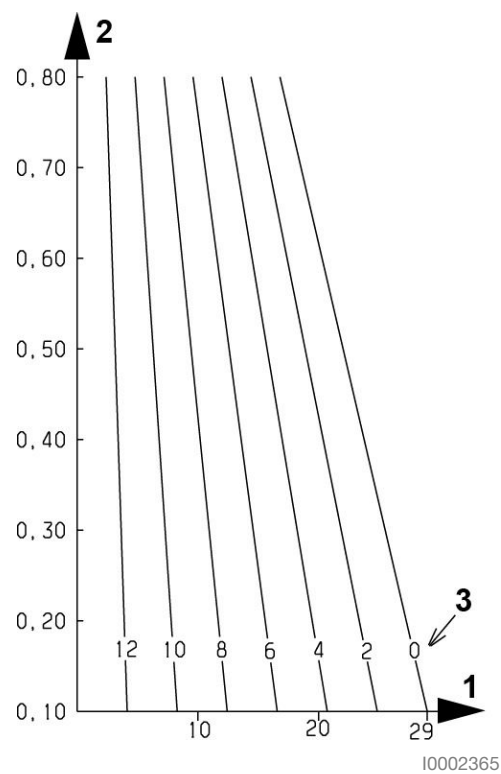


| Item | Description                                                                                                                                                                    |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Additional load (kg).                                                                                                                                                          |
| 2    | Additional load center of gravity position (m) from centerline of joint 3.<br>The additional load center of gravity position is at 0.20 m max. from the centerline of joint 4. |
| 3    | Load attached to the mechanical interface of the wrist.<br>200 mm with respect to joint 5 and 100 mm with respect to joint 6.                                                  |

**Figure 2.20 : For standard RX160 and standard RX160 with HD option at reduced speeds <sup>(1)</sup>**

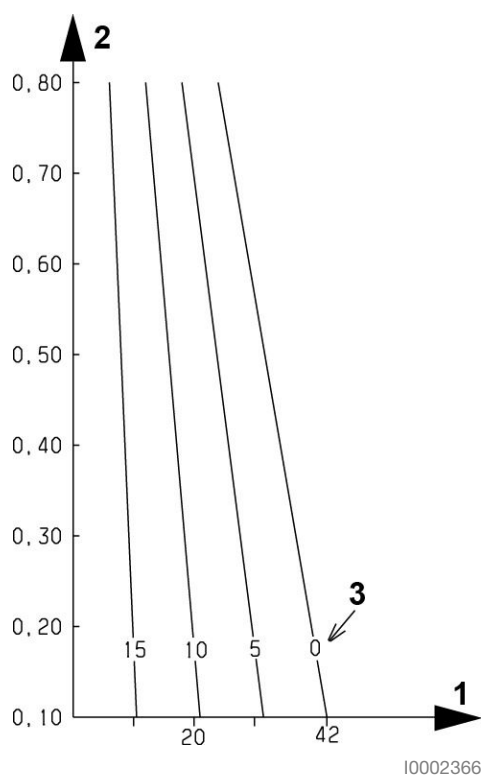
<sup>(1)</sup>: Reduced speeds:

For CS8C: VEL = 60%, ACC = 30%, DEC = 30%.



| Item | Description                                                                                                                                                                    |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Additional load (kg).                                                                                                                                                          |
| 2    | Additional load center of gravity position (m) from centerline of joint 3.<br>The additional load center of gravity position is at 0.20 m max. from the centerline of joint 4. |
| 3    | Load attached to the mechanical interface of the wrist.<br>200 mm with respect to joint 5 and 100 mm with respect to joint 6.                                                  |

Figure 2.21 : For RX160 with L arm



| Item | Description                                                                                                                                                                    |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Additional load (kg).                                                                                                                                                          |
| 2    | Additional load center of gravity position (m) from centerline of joint 3.<br>The additional load center of gravity position is at 0.20 m max. from the centerline of joint 4. |
| 3    | Load attached to the mechanical interface of the wrist.<br>200 mm with respect to joint 5 and 100 mm with respect to joint 6.                                                  |

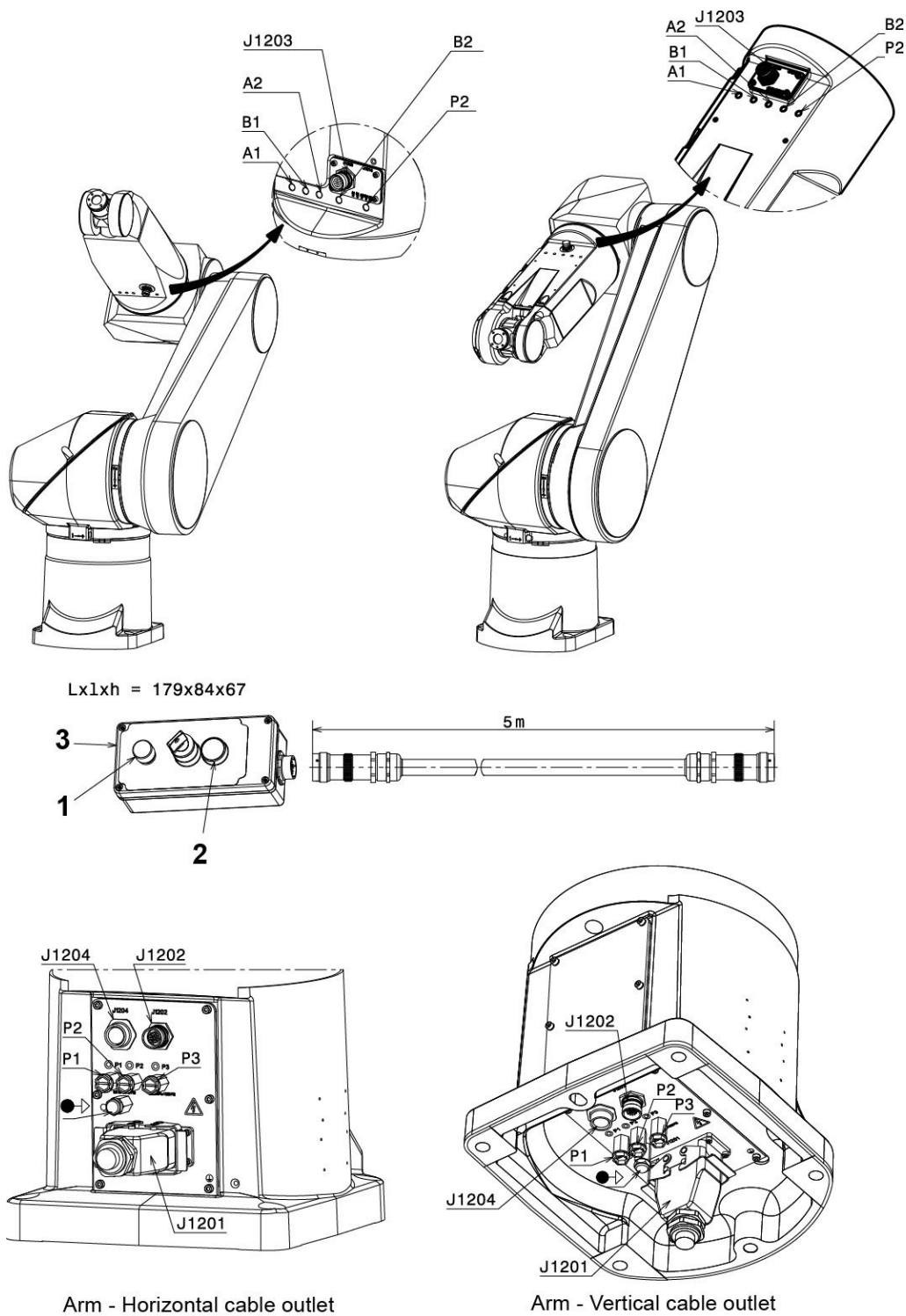
**Figure 2.22 : For RX160 with an L arm at reduced speeds <sup>(1)</sup>**

<sup>(1)</sup>: Reduced speeds:

For CS8C: VEL = 60%, ACC = 30%, DEC = 30%.

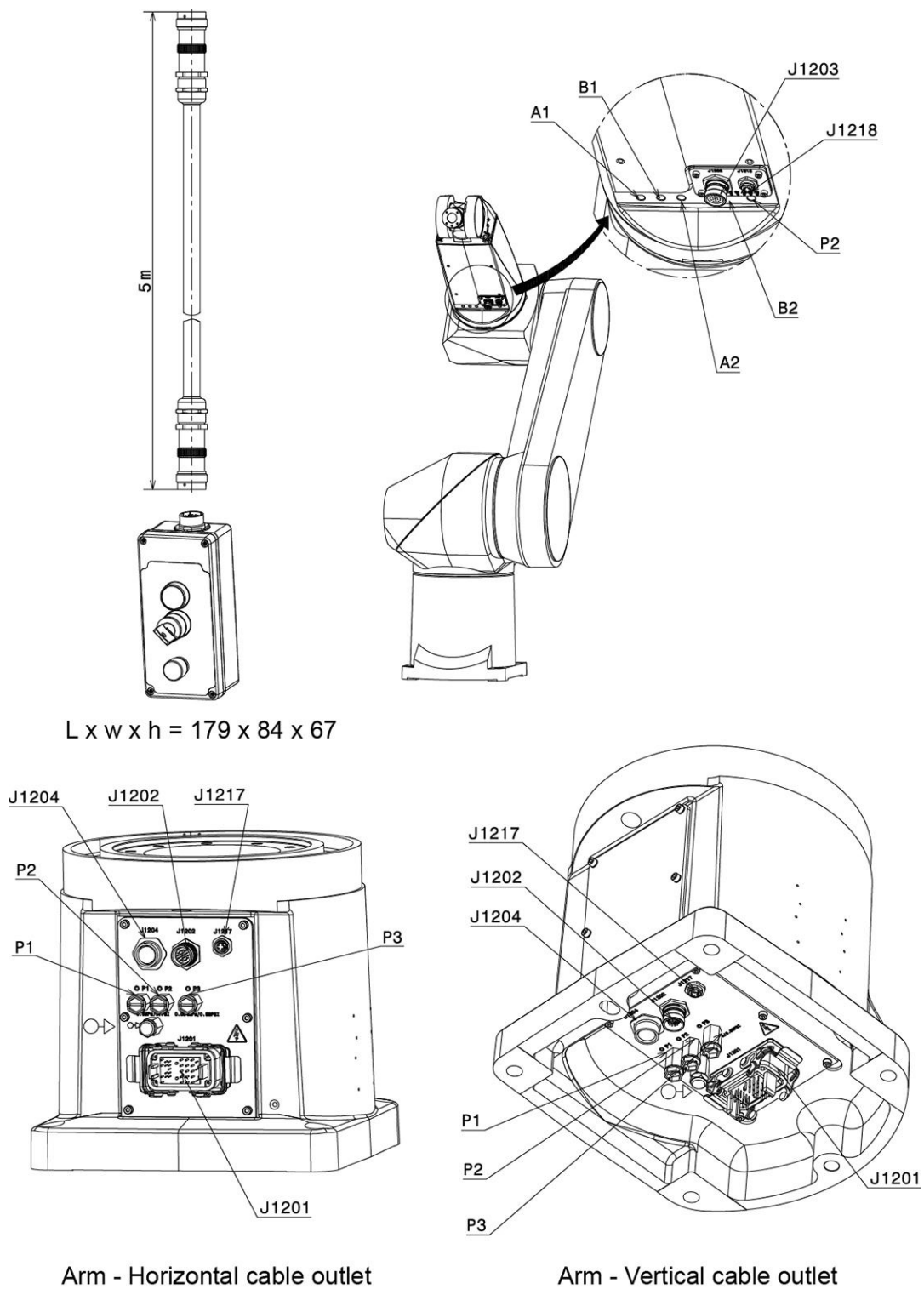
2.7 - USER CIRCUIT

M0003483.1



I0003233

Figure 2.23



I0003751

Figure 2.24

The electric wiring of the arm is assembled into a harness including several cables supplying the motors (power, brakes, resolvers), the solenoid valves, the limit switches and user connector. The links to these components are made via detachable connectors.

The harness also includes pneumatic hoses which supply air to the solenoid valves ((**EV1**) and (**EV2**)).

The robot also has a pressure source (**P2**) close to the tool clamp.

The outlets of the solenoid valves (**EV1**) and (**EV2**) are on the forearm:

- (**A1**) and (**B1**) for solenoid valve (**EV1**).
- (**A2**) and (**B2**) for solenoid valve (**EV2**).

The wiring is inside the structure and routed through the centre of the joints. It is connected to the arm base on a plate which includes several electrical and pneumatic components such as: Figures 2.23 and 2.24.

Arm with a horizontal or vertical cable outlet:

- Arm / controller (**J1201**) interconnection socket.
  - Arm with a single user connector:
    - R23 connector intended for the user for possible electrical connection of gripper (**J1202**).
  - Arm with two user connectors:
    - Socket (**J1202**) for electrical connection of the tool by the user where applicable.
    - Socket (**J1217**) for a Cat 5e Ethernet link or an electrical connection for the gripper.
- Socket (**J1204**) for connection of the remote box releasing the brakes.
- Pneumatic connections to the (**P1**) and (**P2**) compressed air networks.
- Connection for creating overpressure in the (**P3**) arm.



The overpressure must never exceed 50 mbar (0.73 psi).

- Remote brake release box (**3**).
- Brake release selector (**1**).
- Brake release pushbutton (**2**).
- Pneumatic exhaust muffler (**E**).



Do not add wires or cables to arm wiring as this may cause premature wear of the arm electrical wiring and lead to loss of the warranty.

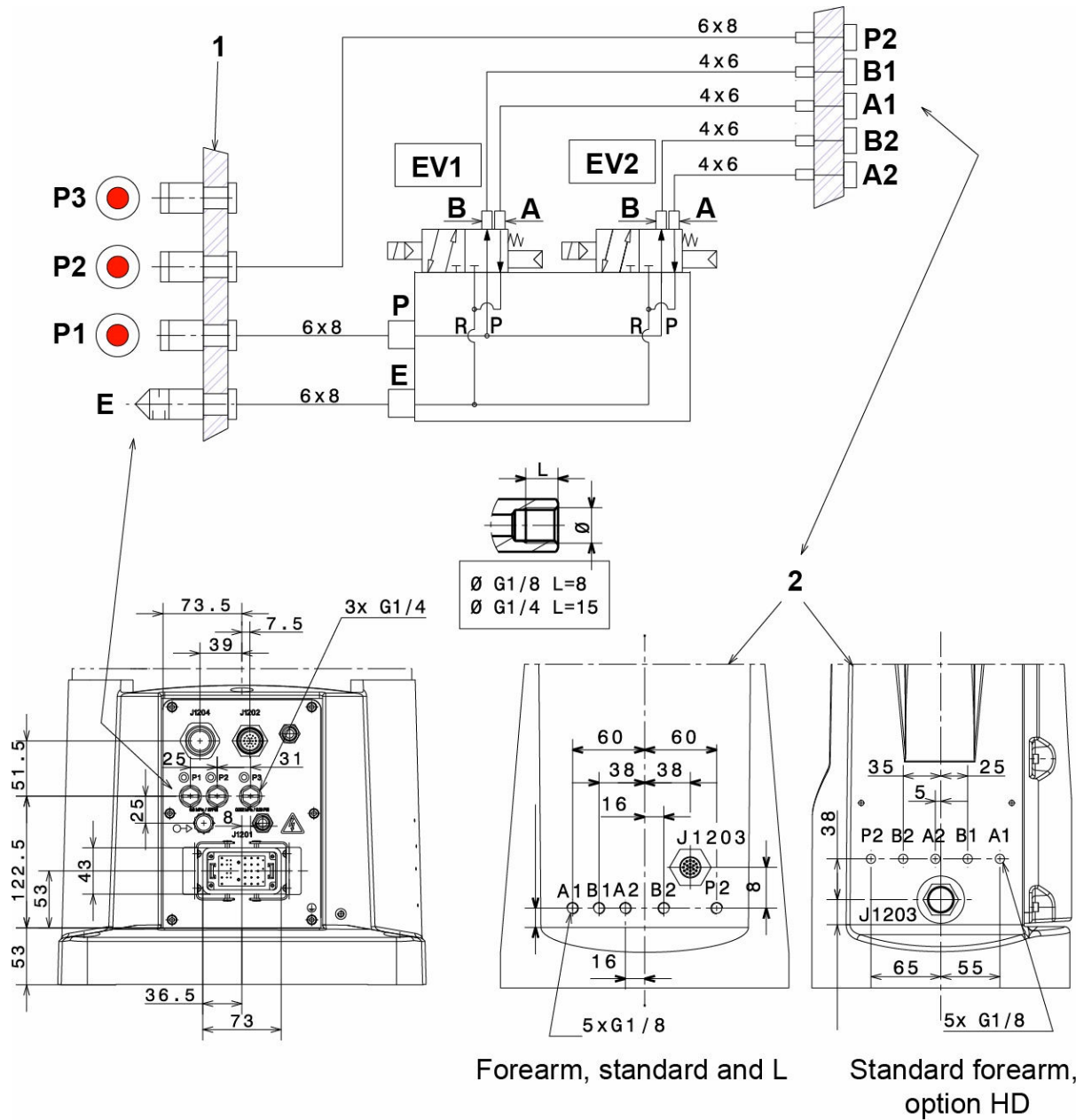
## 2.8 - PNEUMATIC AND ELECTRIC SYSTEMS (EXCEPT FOR CLEAN ROOM APPLICATION)

M0003557.1



Check in the application that the gripper is designed to hold the load with the accelerations programmed, and in the event of an electrical power or air supply failure.

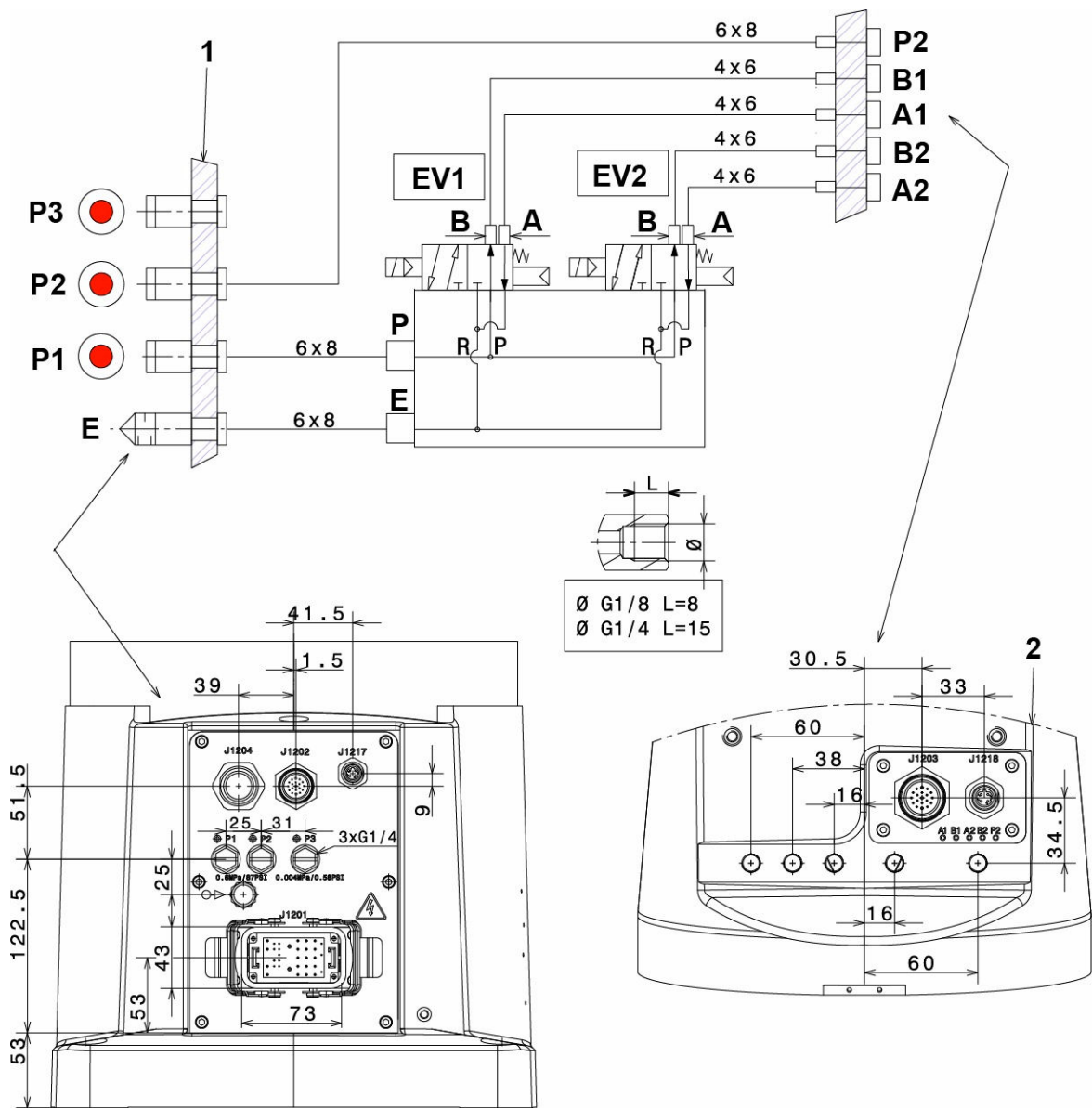
## 2.8.1 - PNEUMATIC CIRCUIT



| Item | Description            |
|------|------------------------|
| 1    | Plate attached to base |
| 2    | Forearm                |

Figure 2.25 : Horizontal cable outlet

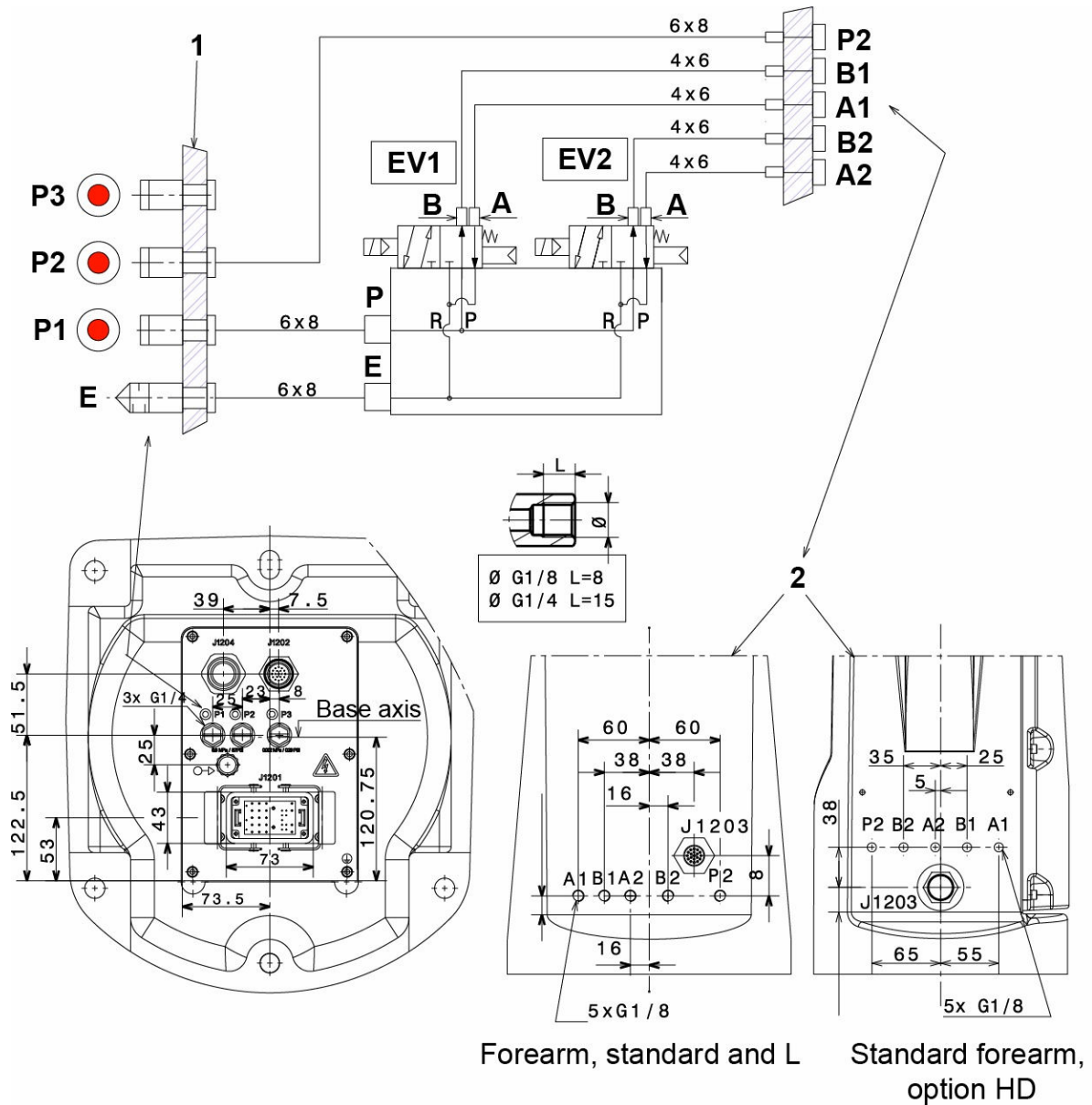
10003234



I0003510

| Item | Description            |
|------|------------------------|
| 1    | Plate attached to base |
| 2    | Forearm                |

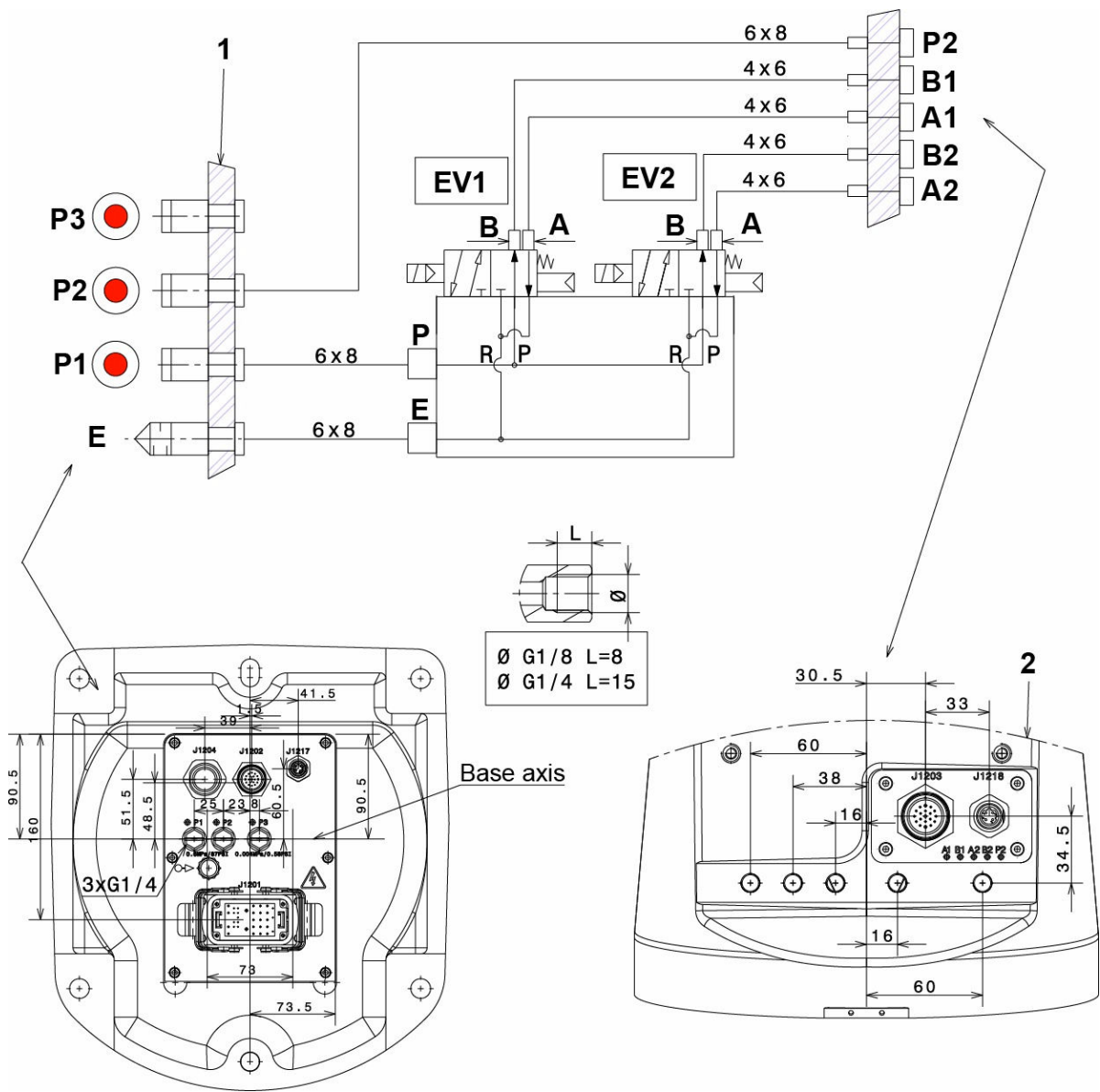
Figure 2.26 : Horizontal cable outlet



10003235

| Item | Description            |
|------|------------------------|
| 1    | Plate attached to base |
| 2    | Forearm                |

**Figure 2.27 : Vertical cable outlet**



I0003511

| Item | Description            |
|------|------------------------|
| 1    | Plate attached to base |
| 2    | Forearm                |

Figure 2.28 : Vertical cable outlet

Solenoid valves (EV1 and EV2):

- 5/2-way monostable.
- Electrically controlled (24 VDC).
- Working pressure: 1.5 to 7 bar (21.75 to 100 psi).
- Flow coefficient Kv = 8.6.
- Clip-on connector.
- Overvoltage protective circuit and indicator diode.

**Description:**

- The arm is connected to the compressed air network (7 bar max., lubricated or not) via the base **(P1)**.



The air must be filtered by a 10 µm filter.

- There is a direct line between the base and the forearm **(P2)**.
- The centralized solenoid valve exhaust is directed to the base and through a muffler **(E)**.



It is preferable to use double-acting actuators: a single-acting actuator (with a weak return spring) may be triggered in an untimely way by the air exhaust from the second valve manifold.

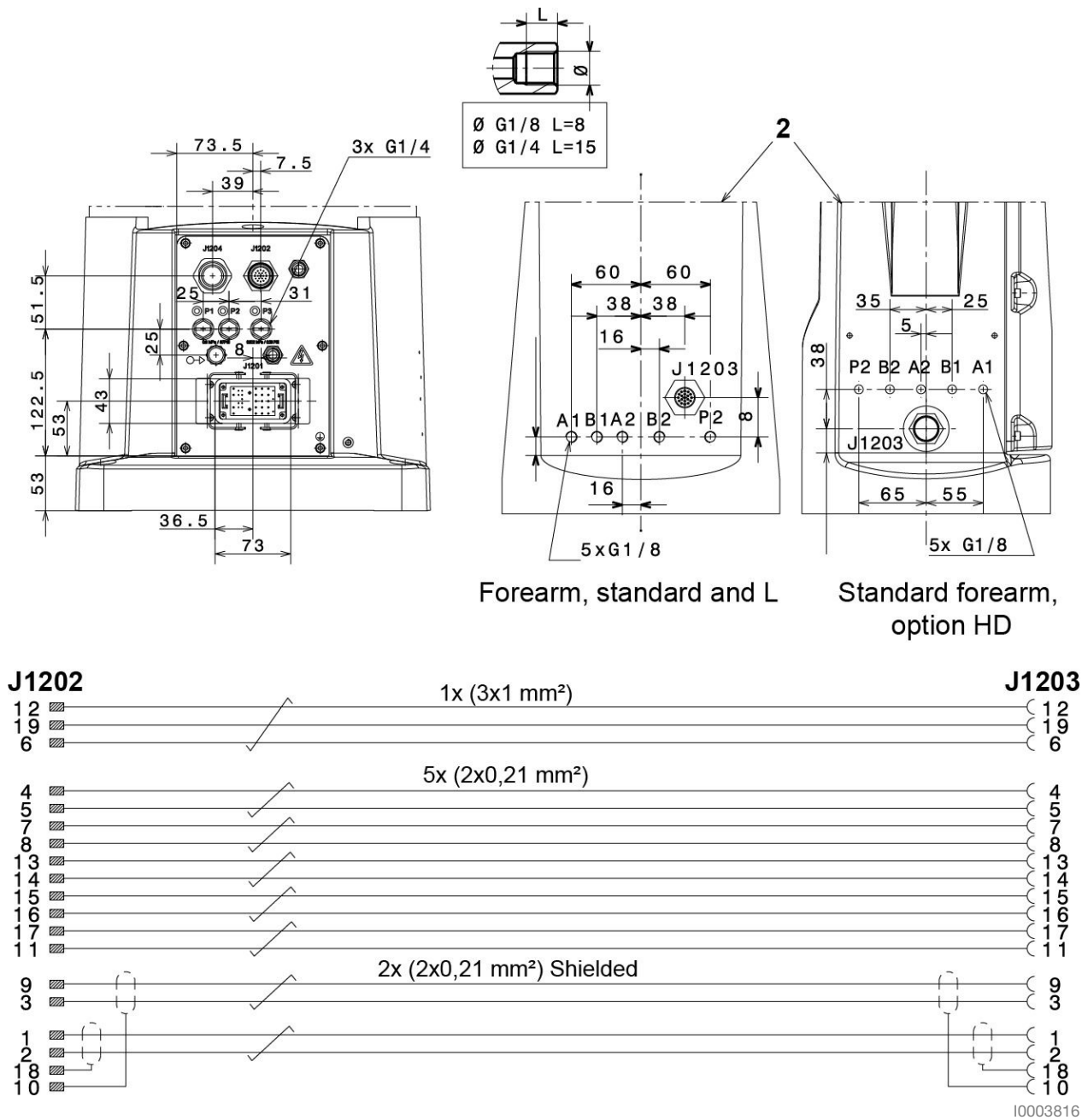
- An orifice **(P3)** is provided to connect the pressurization system, if used, to the base of the robot.



Do not use this orifice for other purposes.

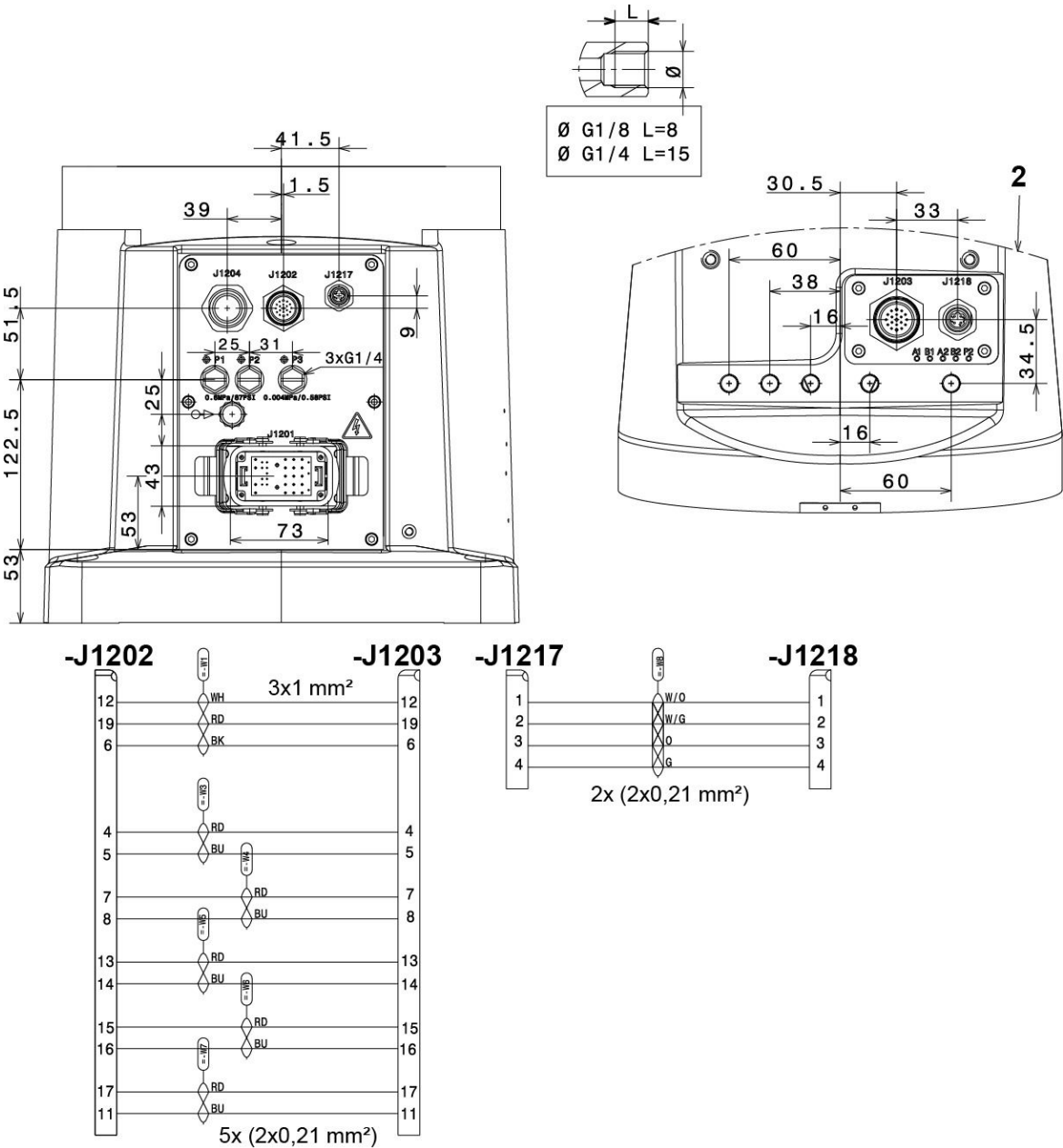
2.8.2 - ELECTRIC CIRCUIT

M0003558.1



| Item | Description |
|------|-------------|
| 2    | Forearm     |

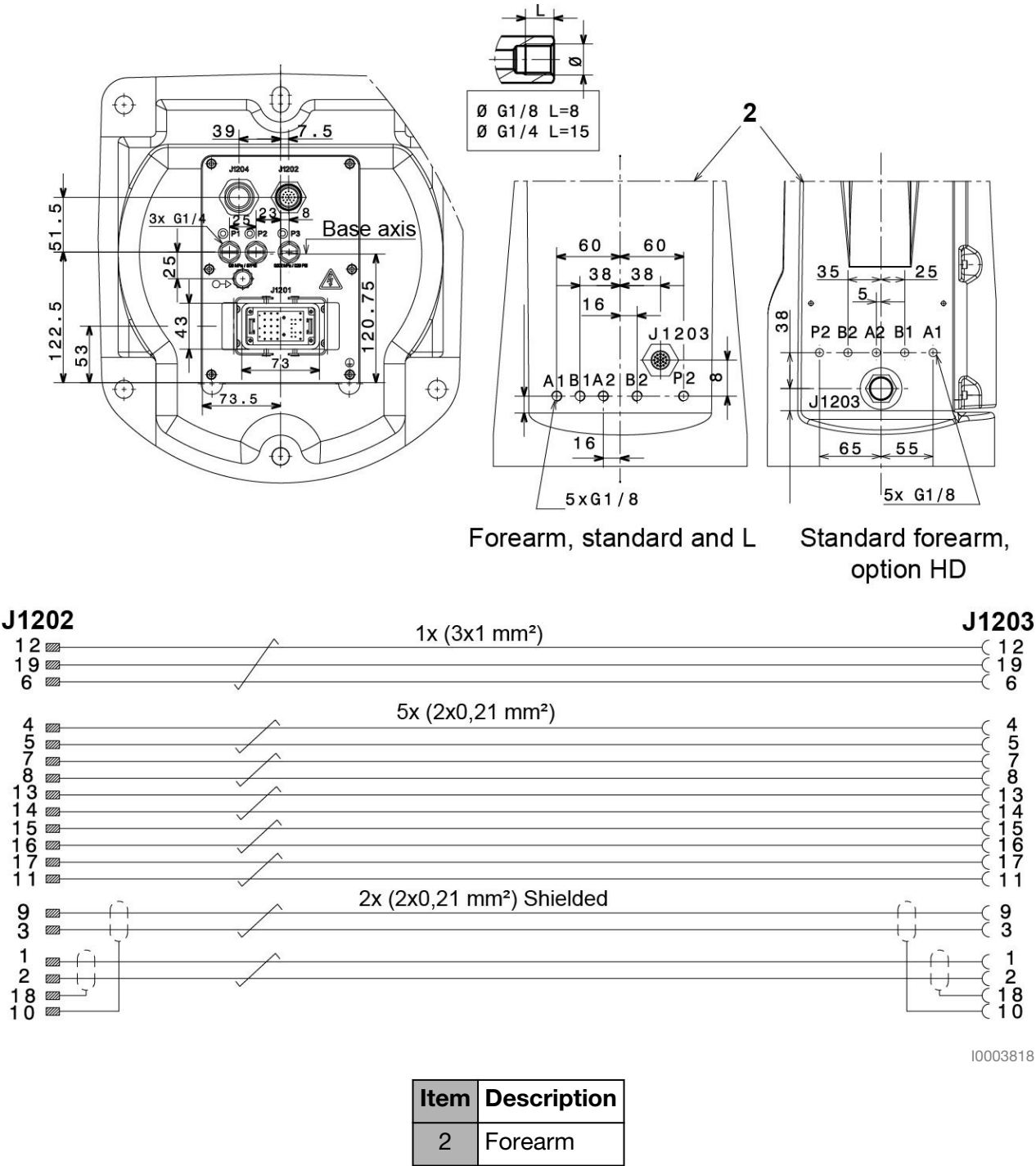
Figure 2.29 : Horizontal cable outlet



I0003817

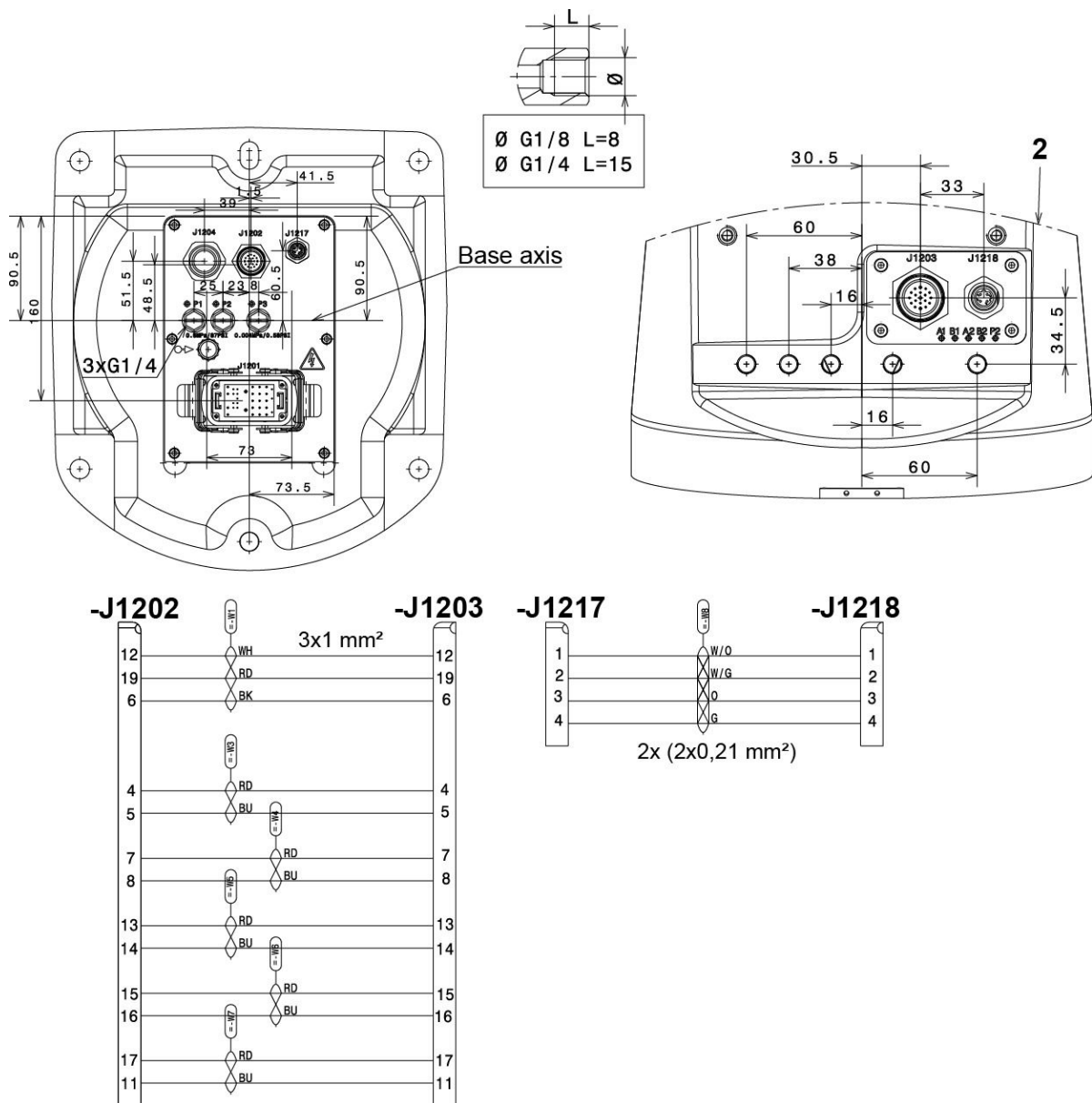
| Item | Description |
|------|-------------|
| 2    | Forearm     |

Figure 2.30 : Horizontal cable outlet



I0003818

Figure 2.31 : Vertical cable outlet



10003819

| Item | Description |
|------|-------------|
| 2    | Forearm     |

Figure 2.32 : Vertical cable outlet

### Arm with a single user connector (figures 2.29 and 2.31)

The electrical circuit consists of:

- A male 19-contact socket at the bottom of the arm.
- A female 19-contact socket on the forearm.

These 19 contacts include 3 power contacts and 16 signal contacts:

- The 3 power contacts in each socket are connected by a 3-wire conductor with cross-section AWG18 (contacts 6-12-19).
- The 16 signal contacts in each socket are connected in the following way:
  - 2 shielded twisted pairs, cross-section AWG24 connecting contacts 3-9-10 and 1-2-18 in each socket.
  - 5 twisted pairs, cross-section AWG24 for the other contacts.

Supply voltage: 60 VDC.

Permissible current:

- 3-wire conductor AWG18: 4.5 A per contact.
- Pairs and shielded pairs AWG24: 2 A per contact.
- Connection to forearm (**J1203**) by R23 elbow male cylindrical connector.
- Connection to base (**J1202**) by R23 straight female cylindrical connector.

### Arm with two user connectors (figures 2.30 and 2.32)

The electrical circuit consists of:

- A 19-contact fixed male connector with only 13 conductors connected and a 4-contact fixed male connector (M12 coding D ethernet) at the base of the arm.
- A 19-contact fixed female connector with only 13 conductors connected and a 4-contact fixed female connector (M12 coding D ethernet) on the forearm.

These 13 contacts include 3 power contacts and 10 signal contacts:

- The 3 power contacts in each socket are connected by a 3-wire conductor with cross-section AWG18 (contacts 6-12-19).
- The 10 signal contacts in each fixed connector are linked by 5 twisted pairs with cross-section AWG24.

The 4 contacts are connected via a twin shielded pair AWG24 Ethernet cable.

Supply voltage: 60 VDC (19-contact connector) and 50 VDC (Ethernet socket).

Permissible current:

- 3-wire conductor AWG18: 4.5 A per contact.
- Pairs and shielded pairs AWG24: 2 A per contact.
- Connection on forearm (**J1203**) and (**J1218**) via an angle male cylindrical connector.
- Connection on the base (**J1202**) and (**J1217**) via a female cylindrical connector.



Do not use the shields as a conductive cable.

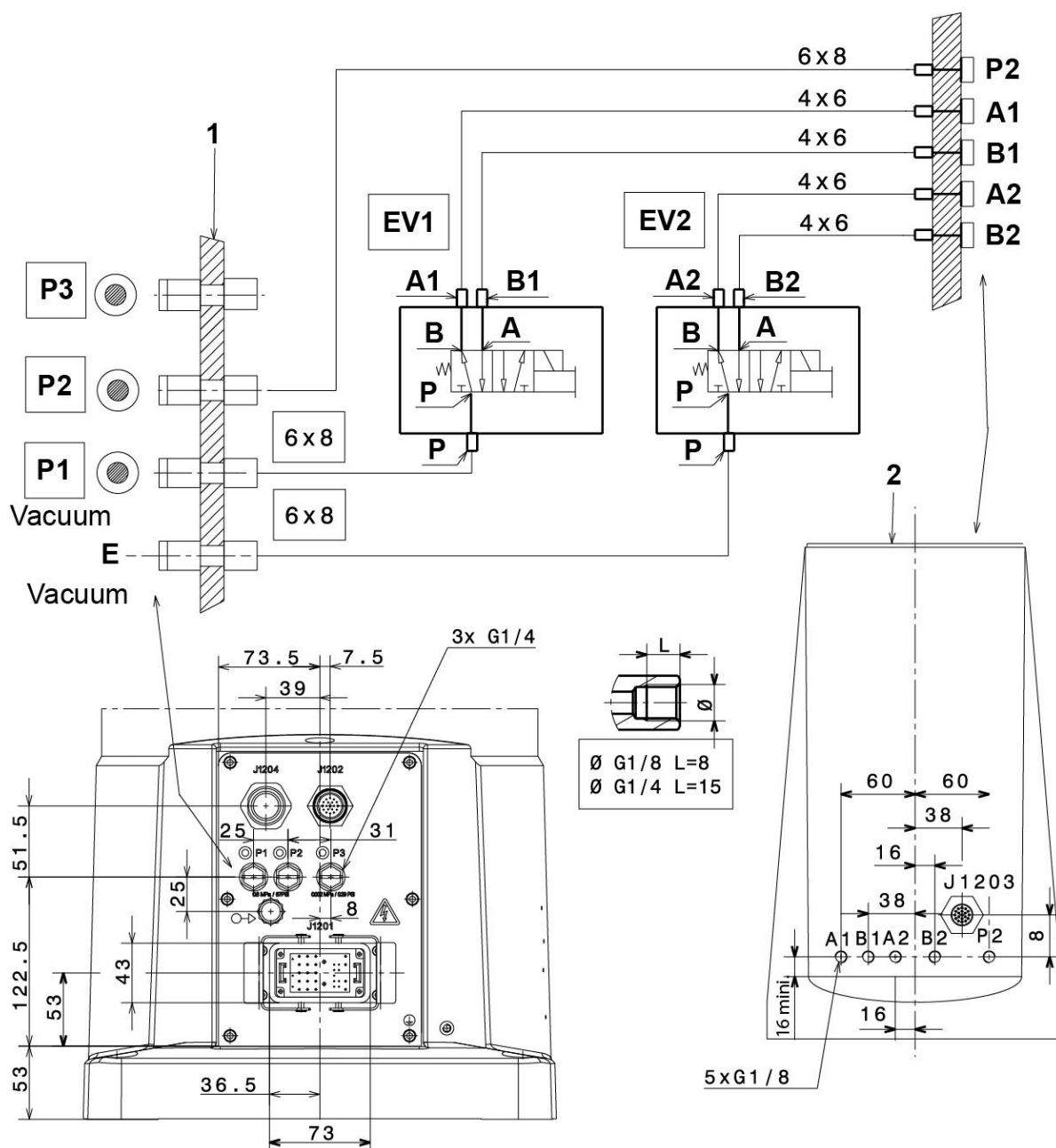
## 2.9 - PNEUMATIC AND ELECTRIC CIRCUITS CLEAN ROOM APPLICATION

M0003559.1



Check in the application that the gripper is designed to hold the load with the accelerations programmed, and in the event of an electrical power or air supply failure.

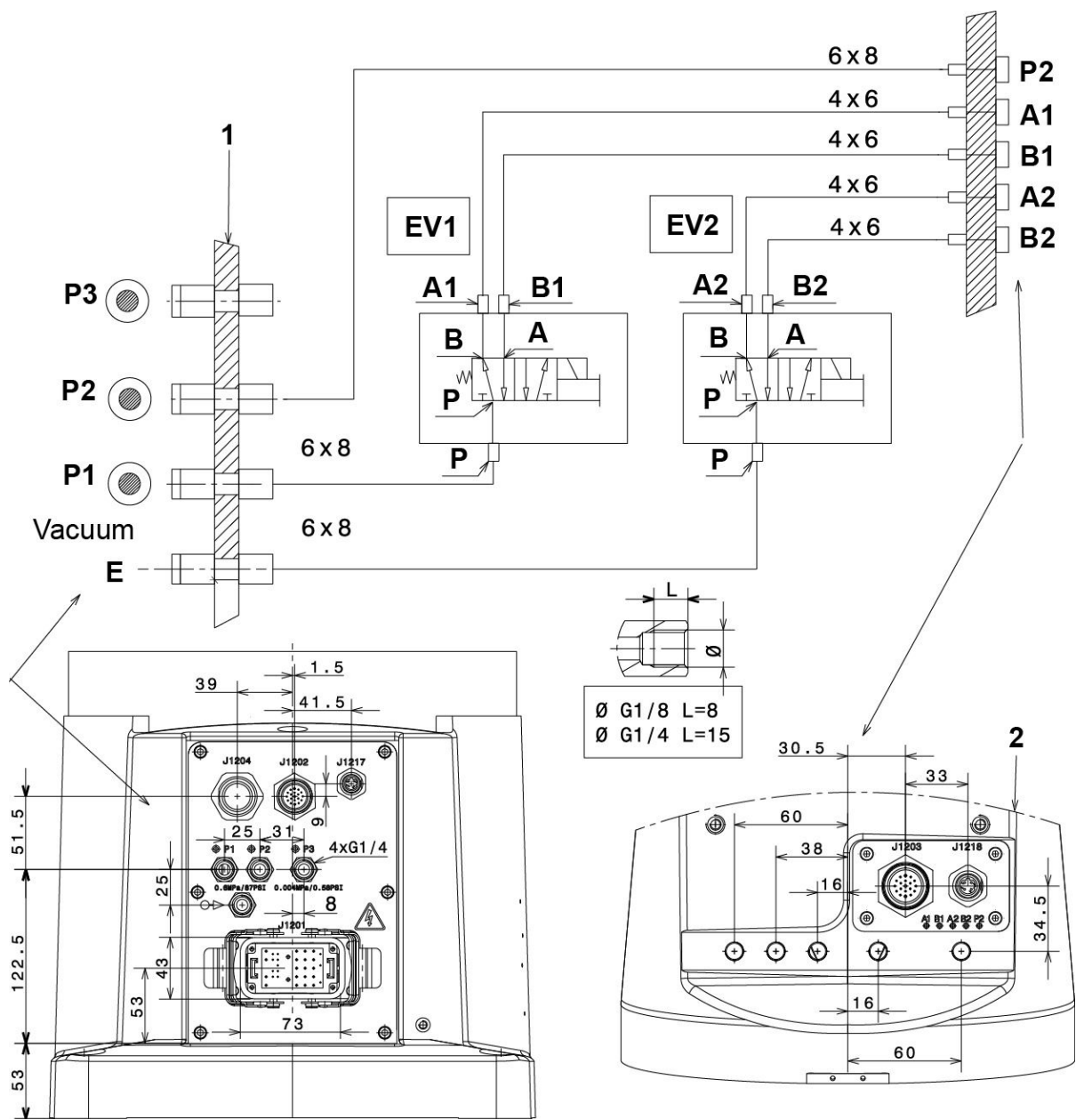
## 2.9.1 - PNEUMATIC CIRCUIT



10002685

| Item | Description            |
|------|------------------------|
| 1    | Plate attached to base |
| 2    | Forearm                |

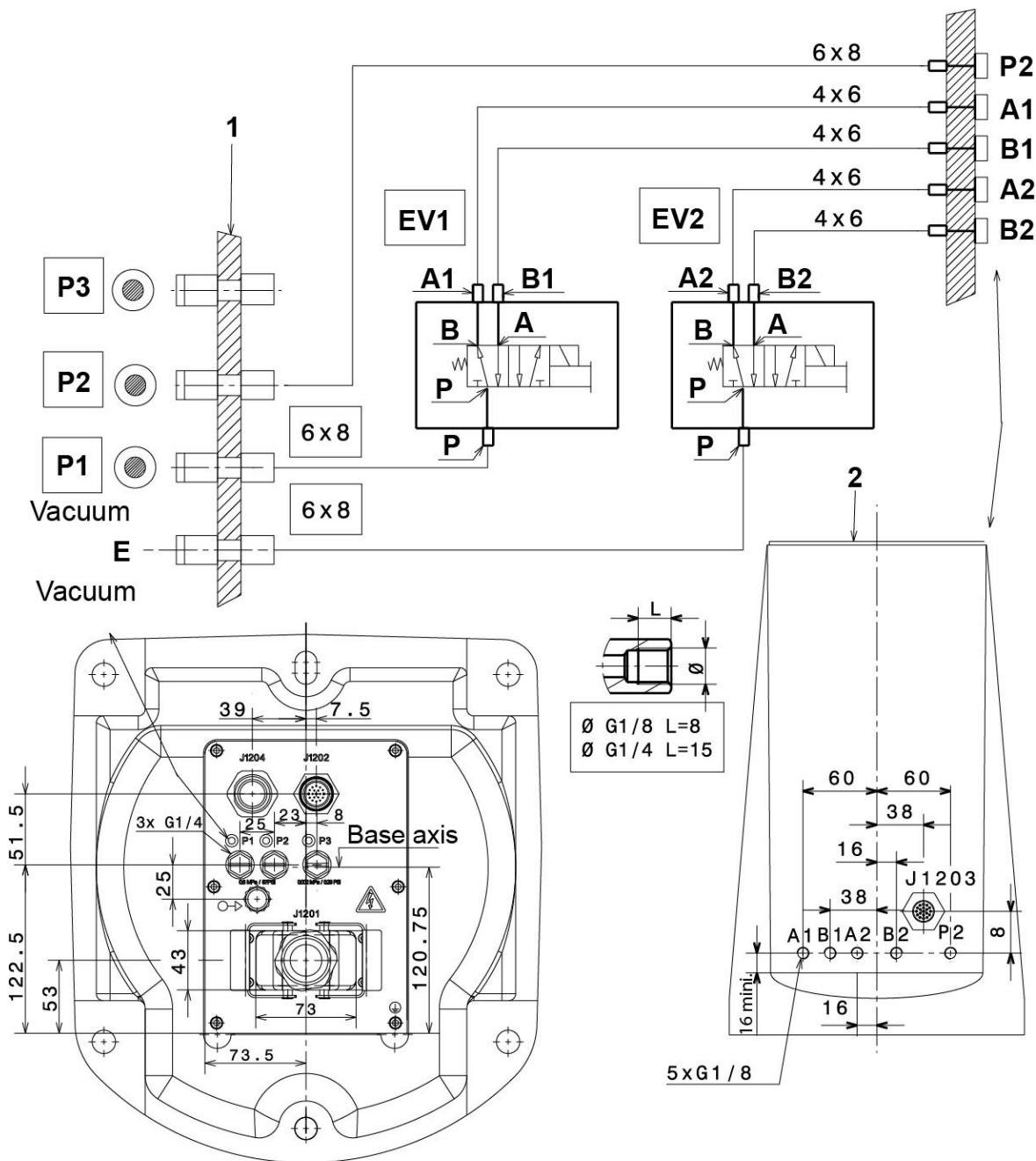
Figure 2.33 : Horizontal cable outlet



10003512

| Item | Description            |
|------|------------------------|
| 1    | Plate attached to base |
| 2    | Forearm                |

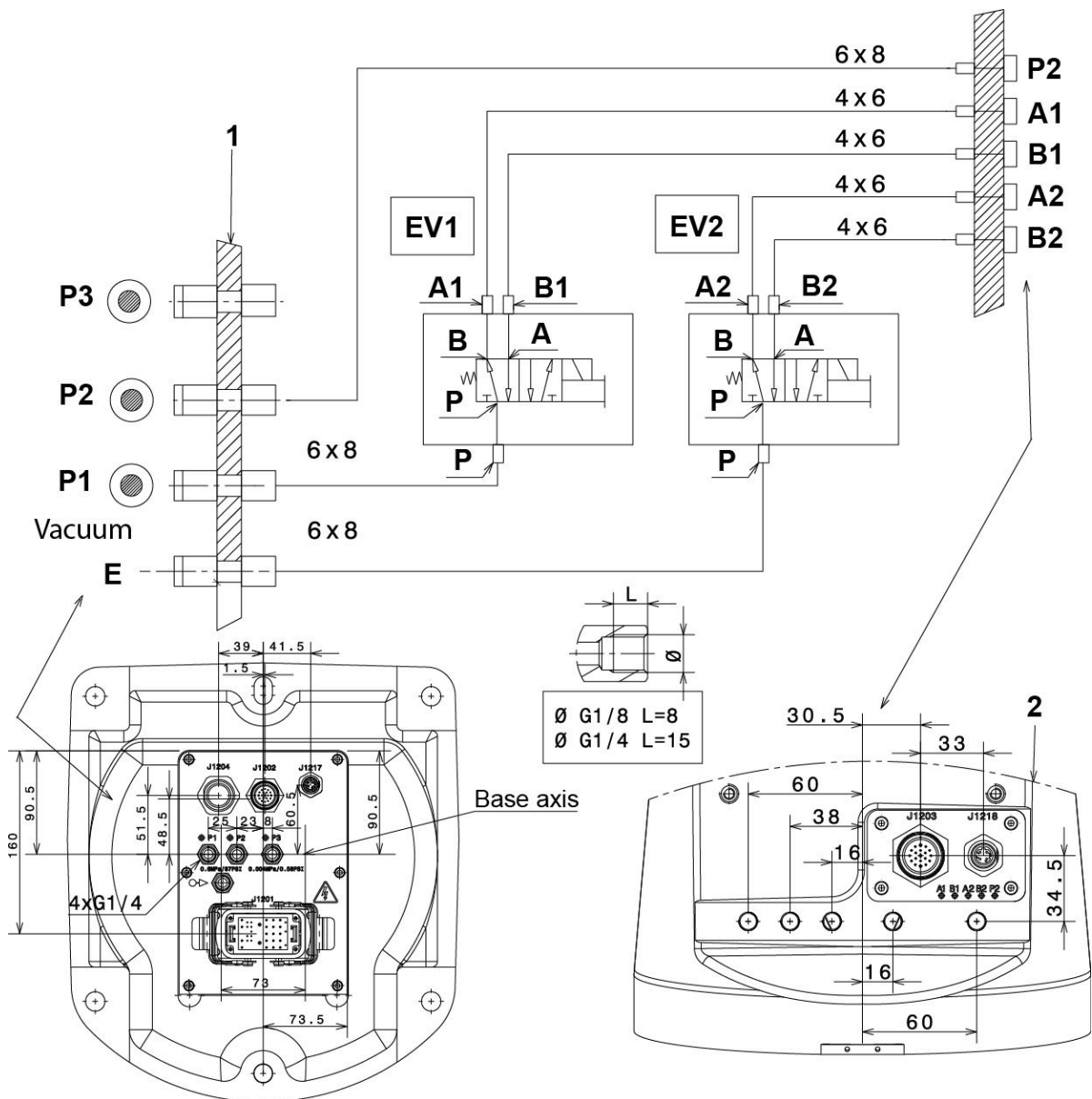
Figure 2.34 : Horizontal cable outlet



I0002688

| Item | Description            |
|------|------------------------|
| 1    | Plate attached to base |
| 2    | Forearm                |

Figure 2.35 : Vertical cable outlet



I0003513

| Item | Description            |
|------|------------------------|
| 1    | Plate attached to base |
| 2    | Forearm                |

Figure 2.36 : Vertical cable outlet

**Solenoid valves (EV1 and EV2):**

- 5/2-way monostable.
- Electrically controlled (24 VDC).
- Max. working pressure: vacuum only  $\approx$  -0.8 bar (11.6 psi).
- Flow coefficient  $K_v = 5.72$ .
- Clip-on connector.

**Description:**

- The arm is connected to the vacuum source via the base ((P1) and (E)).
- There is a direct line between the base and the forearm (P2).
- Max. working pressure: vacuum only.

- There is no exhaust to the outside of the arm for the solenoid valves controlling the vacuum circuit.  
Cleanliness of air must be equivalent to 5 µm filtered air.

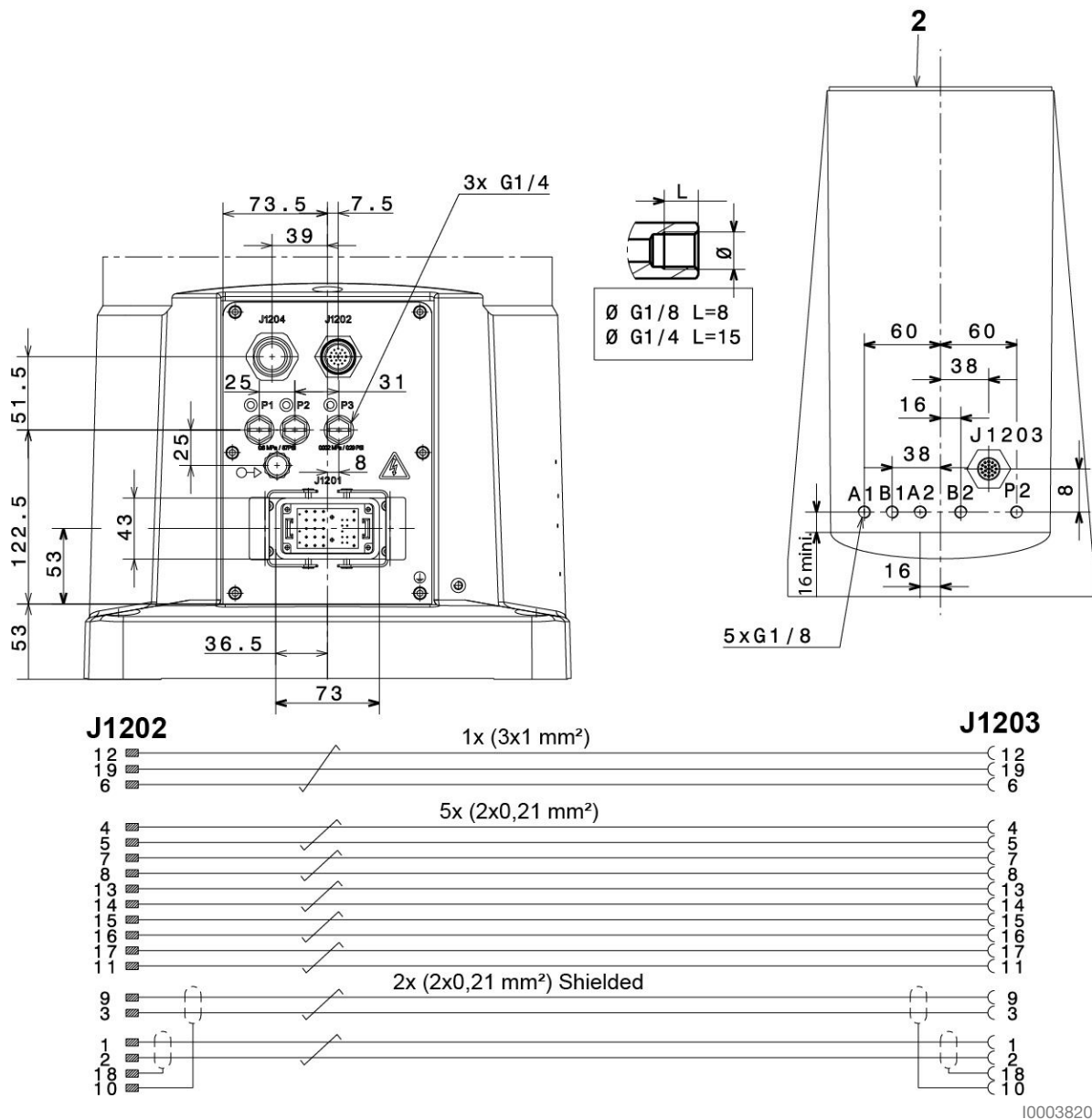


- An orifice (**P3**) is provided to connect the pressurization system, if used, to the base of the robot.  
Do not use this orifice for other purposes.



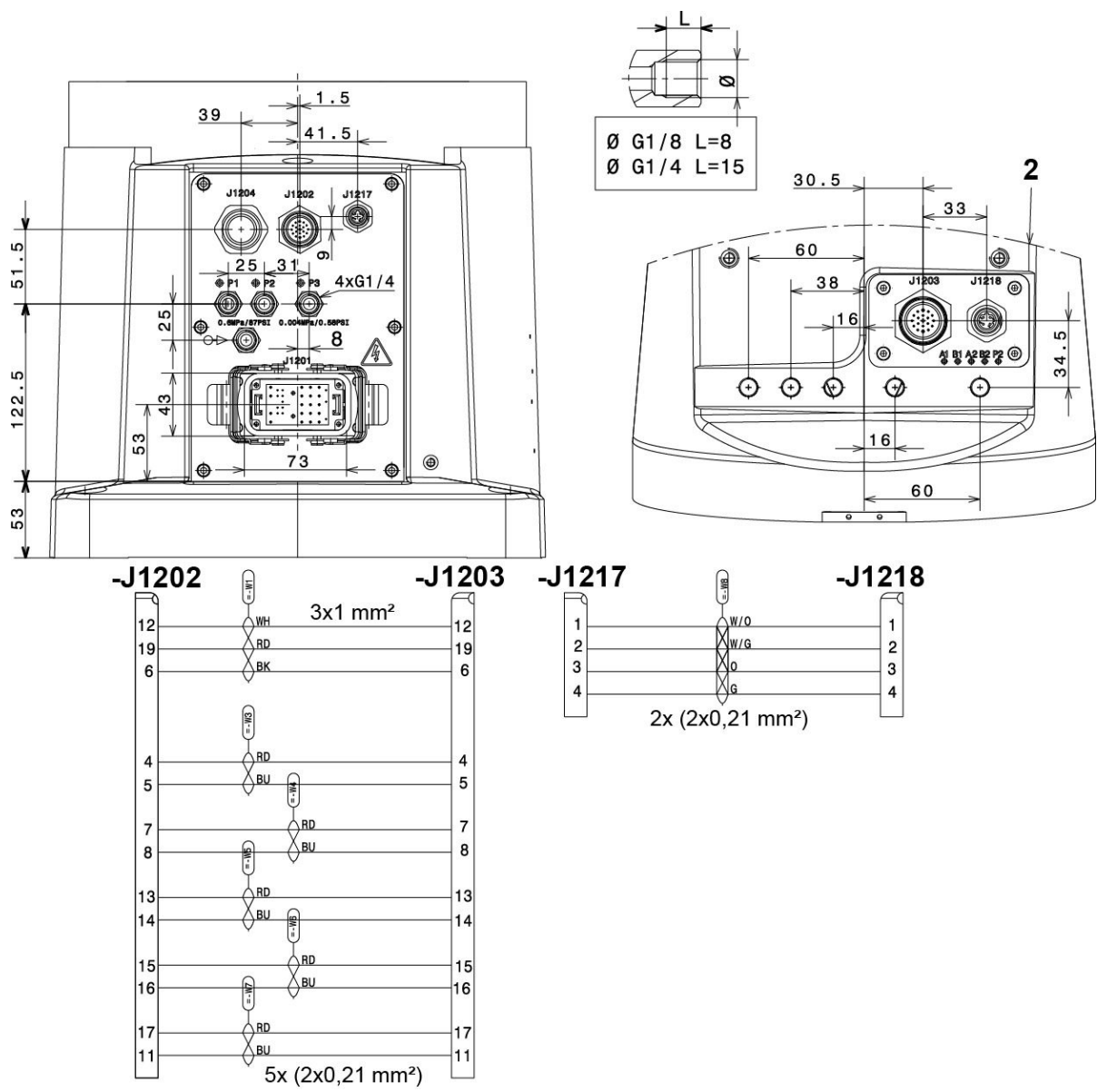
## 2.9.2 - ELECTRIC CIRCUIT

M0004440.1



| Item | Description |
|------|-------------|
| 2    | Forearm     |

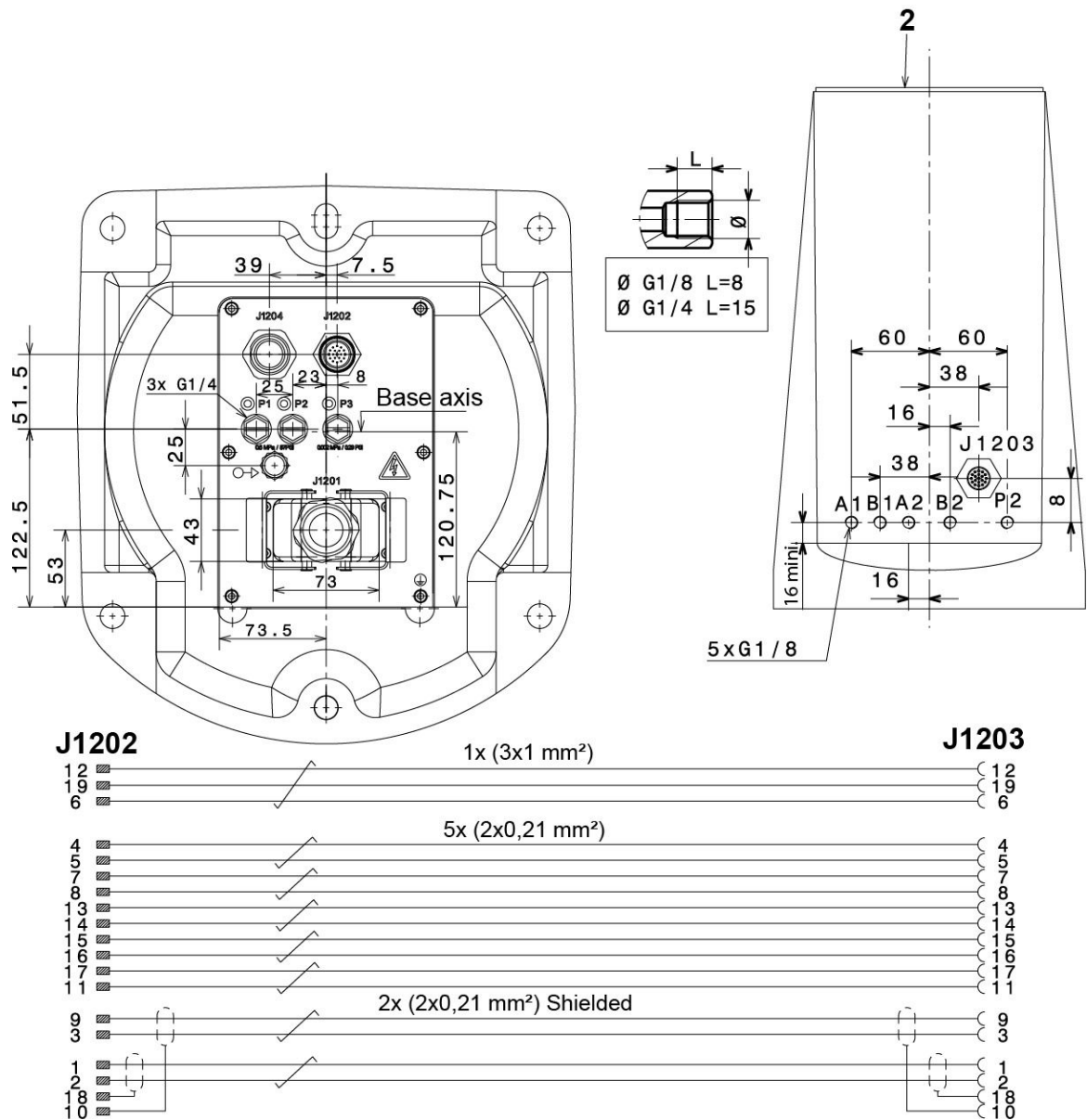
Figure 2.37 : Horizontal cable outlet



I0003821

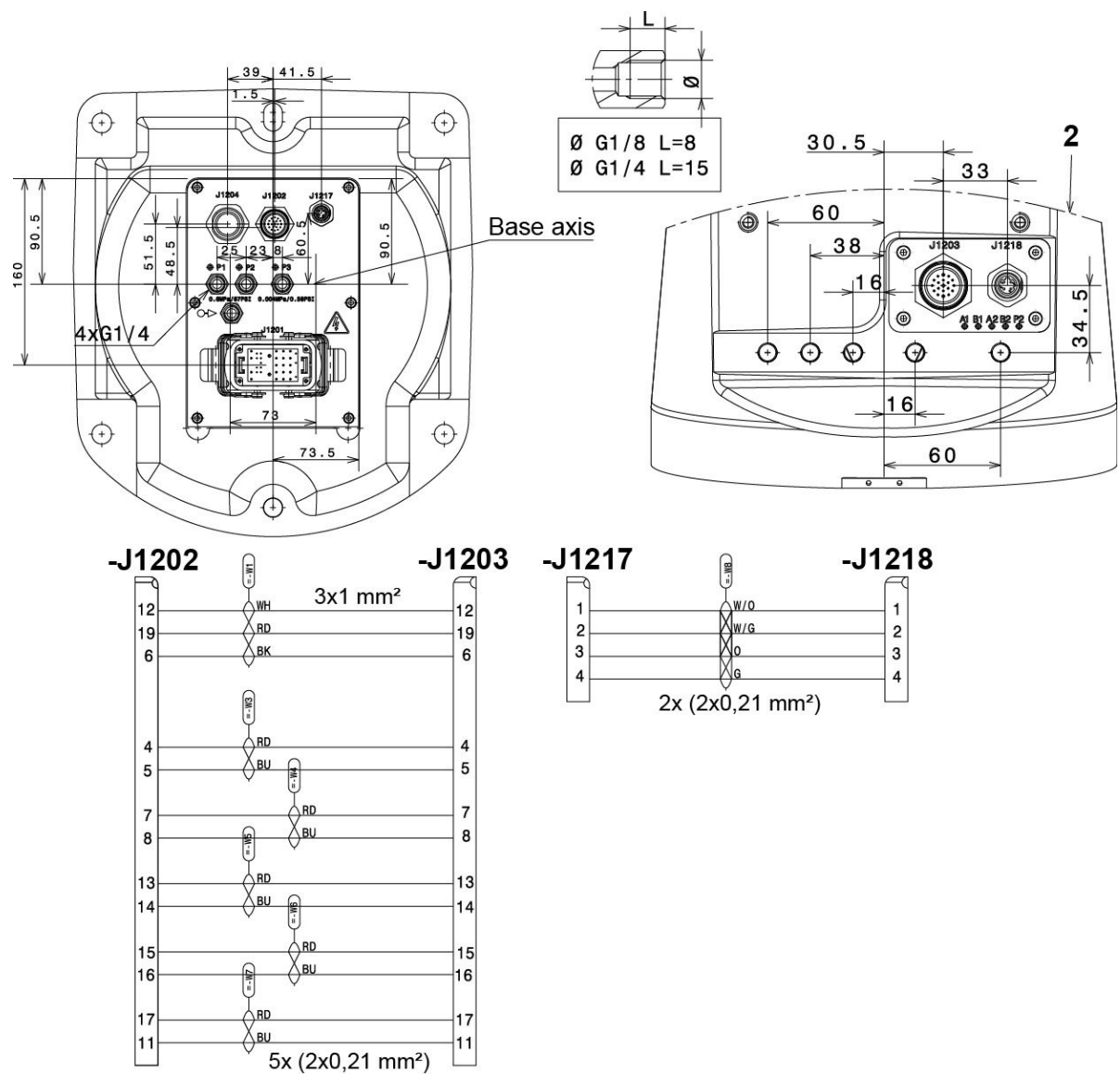
| Item | Description |
|------|-------------|
| 2    | Forearm     |

Figure 2.38 : Horizontal cable outlet



10003822

Figure 2.39 : Vertical cable outlet



10003823

| Item | Description |
|------|-------------|
| 2    | Forearm     |

Figure 2.40 : Vertical cable outlet

Arm with a single user connector (figures 2.37 and 2.39)

The electrical circuit consists of:

- A male 19-contact socket at the bottom of the arm.
- A female 19-contact socket on the forearm.

These 19 contacts include 3 power contacts and 16 signal contacts:

- The 3 power contacts in each socket are connected by a 3-wire conductor with cross-section AWG18 (contacts 6-12-19).
- The 16 signal contacts in each socket are connected in the following way:
  - 2 shielded twisted pairs, cross-section AWG24 connecting contacts 3-9-10 and 1-2-18 in each socket.
  - 5 twisted pairs, cross-section AWG24 for the other contacts.

Supply voltage: 60 VDC.

Permissible current:

- 3-wire conductor AWG18: 4.5 A per contact.
- Pairs and shielded pairs AWG24: 2 A per contact.
- Connection to forearm (**J1203**) by R23 elbow male cylindrical connector.
- Connection to base (**J1202**) by R23 straight female cylindrical connector.

### Arm with two user connectors (figures 2.38 and 2.40)

The electrical circuit consists of:

- A 19-contact fixed male connector with only 13 conductors connected and a 4-contact fixed male connector (M12 coding D ethernet) at the base of the arm.
- A 19-contact fixed female connector with only 13 conductors connected and a 4-contact fixed female connector (M12 coding D ethernet) on the forearm.

These 13 contacts include 3 power contacts and 10 signal contacts:

- The 3 power contacts in each socket are connected by a 3-wire conductor with cross-section AWG18 (contacts 6-12-19).
- The 10 signal contacts in each fixed connector are linked by 5 twisted pairs with cross-section AWG24.

The 4 contacts are connected via a twin shielded pair AWG24 Ethernet cable.

Supply voltage: 60 VDC (19-contact connector) and 50 VDC (Ethernet socket).

Permissible current:

- 3-wire conductor AWG18: 4.5 A per contact.
- Pairs and shielded pairs AWG24: 2 A per contact.
- Connection on forearm (**J1203**) and (**J1218**) via an angle male cylindrical connector.
- Connection on the base (**J1202**) and (**J1217**) via a female cylindrical connector.



Do not use the shields as a conductive cable.

## 2.10 - PRESSURIZATION SYSTEM

### 2.10.1 - PURPOSE

M0000151.1

For applications with dusty conditions or with spattered liquids, the purpose of this option is to prevent dust or liquids from getting into the arm by keeping its internal pressure above atmospheric pressure.



The overpressure must never exceed 50 mbar (0.73 psi).



A separate pressurization system is needed for each robot. The arm must be pressurized using a Stäubli pressurization system. Stäubli could decline its warranty if the arm is pressurized by a pressurization system which doesn't provide the same characteristics.



The Stäubli pressurization system is designed for installation outside the areas exposed to dust or spattering with liquids. If that is not possible, protect the pressurization system from its environment.

### 2.10.2 - INSTALLATION OF THE PRESSURIZATION SYSTEM (OPTION)

M0000588.1

Available on the DVD, in a specific pressurization system manual, if option is chosen.

## 2.11 - RELEASING JOINT BRAKE

M0003550.1



Make sure that the arm and load relevant to this joint are suitably supported.

The controller must be connected to the power supply.

Place the brake release selector in position corresponding to the joint to be released.

When the brake release pushbutton is pressed, the brake on the selected joint is released and the motor is short circuited through the amplifier to reduce the speed at which the arm drops due to gravity.



- In the event of an amplifier failure, the arm falling speed limitation created by the amplifier may not be operational. In this case, the axis is completely free and it may fall faster than usual.
- During the controller start-up (boot) phase, the axis braking mechanism via the amplifiers is not always operational. All arm movement is prohibited during controller start-up, as this could affect its calibration.



### **DANGER**

A movement during the controller start-up phase can affect the variable drive calibration mechanism. In that case, it is necessary to restart the controller to ensure correct robot operation.



### **DANGER**

The tables below show the possible arm movements upon the release of a brake. Arm can fall because of gravity when brake is released. The arm may be raised by the counterbalance system when the brake on joint 2 is released.



### **DANGER**

When a brake is released, short-circuiting of the motor, and the counterbalance system on joint 2, are the only elements that limit the speed of the movement.



The brake on a joint can be released if the robot has to be moved manually, e.g. to free an item of equipment or a person blocked in the cell.

**1) Balanced position (joint 2 brake released) is as follows:**

| Floor configuration                |                    | Ceiling configuration |                    |
|------------------------------------|--------------------|-----------------------|--------------------|
| without load:                      | with nominal load: | without load:         | with nominal load: |
|                                    |                    |                       |                    |
| Rotating joint 3 modifies angle A: |                    |                       |                    |
|                                    |                    |                       |                    |

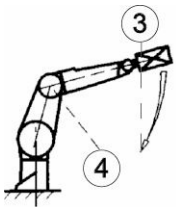
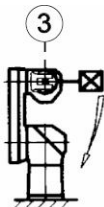
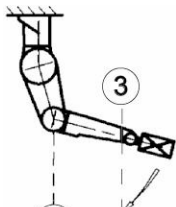
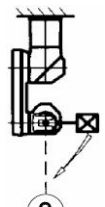
| Item | Description  |
|------|--------------|
| 1    | against stop |

**2) When arm is in a position other than balanced position, releasing joint 2 brake causes arm to return to balanced position:**

| Floor configuration |                    | Ceiling configuration |                    |
|---------------------|--------------------|-----------------------|--------------------|
| without load:       | with nominal load: | without load:         | with nominal load: |
|                     |                    |                       |                    |

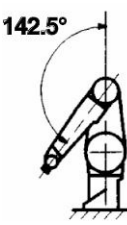
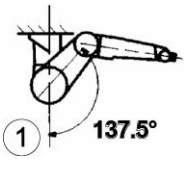
| Item | Description       | Item | Description |
|------|-------------------|------|-------------|
| 1    | against stop      | 3    | vertical    |
| 2    | balanced position |      |             |

3) Releasing brakes of joints 3, 4, 5 and 6 (standard arm) or joints 3, 4 and 5 (5 axis arm) causes arm to move down whether loaded or not:

| Floor configuration                                                                                                   |                                                                                                                | Ceiling configuration                                                                                                 |                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>■ Joints 3 and 5 (standard arm)</li><li>■ Joints 3 and 4 (5 axis arm)</li></ul> | <ul style="list-style-type: none"><li>■ Joints 4 and 6 (standard arm)</li><li>■ Joint 5 (5 axis arm)</li></ul> | <ul style="list-style-type: none"><li>■ Joints 3 and 5 (standard arm)</li><li>■ Joints 3 and 4 (5 axis arm)</li></ul> | <ul style="list-style-type: none"><li>■ Joints 4 and 6 (standard arm)</li><li>■ Joint 5 (5 axis arm)</li></ul> |
|                                      |                               |                                     |                             |

| Item | Description        |
|------|--------------------|
| 3    | vertical           |
| 4    | position of axis 3 |

4) Before all operations on arm (especially for removal), springs must be released and arm placed in following position:

| Floor configuration                                                                 | Ceiling configuration                                                                 |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |

| Item | Description  |
|------|--------------|
| 1    | against stop |

## 2.12 - SAFETY

### 2.12.1 - RISK SIGNALING

M0000130.1

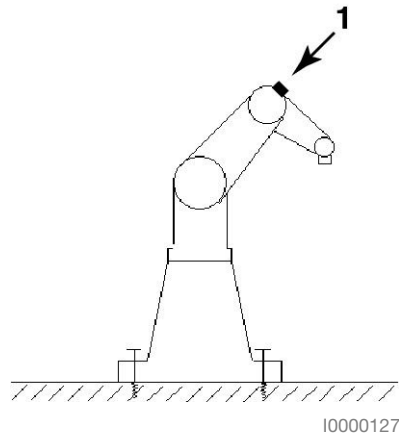


Figure 2.41

For the UL version, a yellow "power on" indicator light **(1)** is placed on the robot arm to show that it is powered up, that movements are possible, and that it could constitute a hazard for the operator.



- Whenever possible, the manual operating mode should be activated while all people are outside the protected area.
- When it is necessary to operate in manual mode inside the cell, the operator must keep in mind the inherent residual risks. Typical residual risks inside the cell are listed in chapter 1.3.5.2.

### 2.12.2 - BALANCING SYSTEM

M0003542.1

The robot arm energy is that accumulated by the springs.

This is because joint 2 is fitted with a spring counterbalance system. The joint brake can be released to reduce the energy accumulated (see chapter 2.11). Specific tools must be used to fully release the energy accumulated by the springs, for certain maintenance or scrapping operations. You must consult Stäubli.



Depending on the arm configuration, the movements due to brake release are shown in the tables in section 2.11.



#### **DANGER**

When a brake is released, short-circuiting the motor is the only way of limiting the fall speed (see chapter 2.11).

### 2.12.3 - STOPPING TIMES AND ANGLES

#### 2.12.3.1 - Stop conditions

M0000156.1

Definition of stop categories (according to EN 60204-1):

Category 0: Immediate power off on motors and brakes activation.

Category 1: Controlled stop with arm power maintained followed by arm power off and brakes activation.

The stopping category applied by the controller depends on the situation (see the controller instruction manual).

2.12.3.2 - Category 1 stop

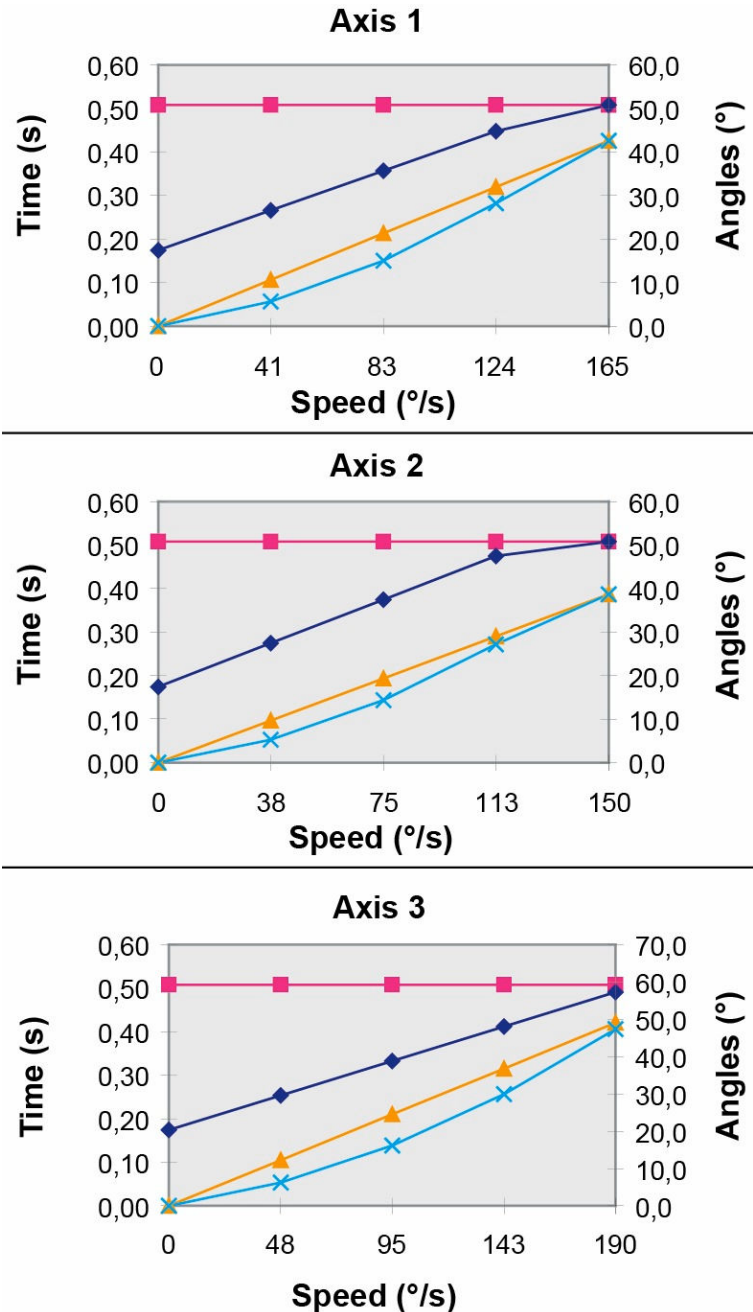
M0003523.1

These are stops on a trajectory that do not depend on the load.



- The stopping times and angles change with the deceleration parameter for the movement descriptor (see the "Type mdesc" paragraph in the VAL 3 reference manual).
- The maximum value curves correspond to extreme cases, such as high speed and low deceleration levels.
- If deceleration is more than 100 %, the stop times and angles are less than those shown in the graphs.

Standard arm/Standard arm, HD option/L arm



I0002722

| Item | Description             | Item | Description              |
|------|-------------------------|------|--------------------------|
|      | Maximum guaranteed time |      | Maximum guaranteed angle |
|      | Time decel 100%         |      | Angle decel 100%         |

Figure 2.42

### 2.12.3.3 - Category 0 stop

M0000173.1

Mains power failures and envelope errors are some of the typical common faults.

The stopping times and angles are about the same order of magnitude as category 1 stops, but the stops are made axis by axis and not on a trajectory.

### 2.12.3.4 - Exceptional fault stop

M0003545.1

In the event of an exceptional fault (such as certain amplifier failures), the faulty axis is only stopped by the brakes. The other axes then apply a category 0 stop.

The stopping times and distances for the faulty axis are measured with the arm extended, at nominal load and nominal speed.

|                                        | Stopping distance (axis degrees) |        |        | Stopping time (seconds) |        |        |
|----------------------------------------|----------------------------------|--------|--------|-------------------------|--------|--------|
|                                        | Axis 1                           | Axis 2 | Axis 3 | Axis 1                  | Axis 2 | Axis 3 |
| Standard arm / Standard arm, HD option | 65                               | 90     | 30     | 0.74                    | 1.1    | 0.31   |
| L arm                                  | 65                               | 85     | 34     | 0.75                    | 1.05   | 0.37   |

### 2.12.4 - MAXIMUM ENERGY GENERATED BY THE ROBOT IN THE EVENT OF AN IMPACT

M0003556.1

This energy is calculated with the arm fully extended, with the nominal load and at the nominal speed.

|                                        | Maximum energy |
|----------------------------------------|----------------|
| Standard arm / Standard arm, HD option | 1248 J         |
| L arm                                  | 1275 J         |

### 2.12.5 - NOISE LEVEL

M0003555.1

The noise level generated by the robot depends on the conditions of use. In the event of use of several axes at nominal speed and nominal load, the noise level measured at a height of 1.60 m and a distance of 1 m from the maximum work range can reach 80 dBA.

Precautions corresponding to the noise level generated must be taken concerning the workstation, such as placing warning signs, providing hearing protection, etc.

|                                                  | Noise level |
|--------------------------------------------------|-------------|
| Standard arm<br>Standard arm, HD option<br>L arm | 80 dBA      |

### 2.12.6 - OUTSIDE TEMPERATURE OF THE ARM

M0000149.1



#### **DANGER**

The temperature at the surface of the arm can reach 80°C (176°F) under severe operating conditions.

### 2.12.7 - ACCELERATIONS, DECELERATIONS

M0000131.1

The robot is capable of strong accelerations and decelerations. Check in the application that:

- The robot hand and the tool are correctly sized and firmly fixed in place. A gripper that is not rigid enough considerably reduces dynamic arm performance and precision levels.
- The gripper is designed to hold the load with programmed accelerations and in the event of an electrical power or air failure affecting it.
- The arm is correctly attached (see chapter 3.2).

### 2.12.8 - AXIS RANGE LIMITATION

M0000180.1

The arm is mounted in a way that provides the maximum angular amplitudes defined in chapter 2.5.1.

Axis range can be limited, depending on the axes:

- by software.
- by range limiter on some axes internal mechanical and/or electric stop.
- by an optional adjustable mechanical stop (on some axes).

The mechanical limiters should never be reached during normal robot use (the range limits are controlled by software).



However, if the mechanical range limiters are hit, the fixed and mobile parts must be replaced (consult the Stäubli services).



Only the optional mechanical stops meet the safety requirements specified by the ISO 10218-1 standard to establish a restricted space around the robot. The range limitation system using software limits, electric limiters or internal mechanical limiters must only be used to protect the equipment and not to provide functional safety in the cell.

It is possible to deliberately limit joint range by 'software' (see the chapter covering the software configuration of the controller).

Range modifications via limiters and adjustable mechanical stops are defined in chapter 2.12.8.

## 3 - ON-SITE PREPARATION

### 3.1 - WORKING SPACE

M0000138.1

The user is responsible for performing all preparatory work required to complete the on-site installation of the robot. Working space must be sufficient, installation surface appropriate; the power supplies must be available (for the electric power supplies, see the controller characteristics).



To enable all maintenance operations to be carried out, it is essential to provide easy access to the robot (e.g. removable safety barriers, etc.) and anchoring points for easy handling of the arms, especially those whose weight exceeds 70 kg / 154 lb.



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**DANGER**

The arm's working area must be surrounded by a closed safety enclosure in compliance with the country's safety legislation preventing personnel accessing the dangerous area.

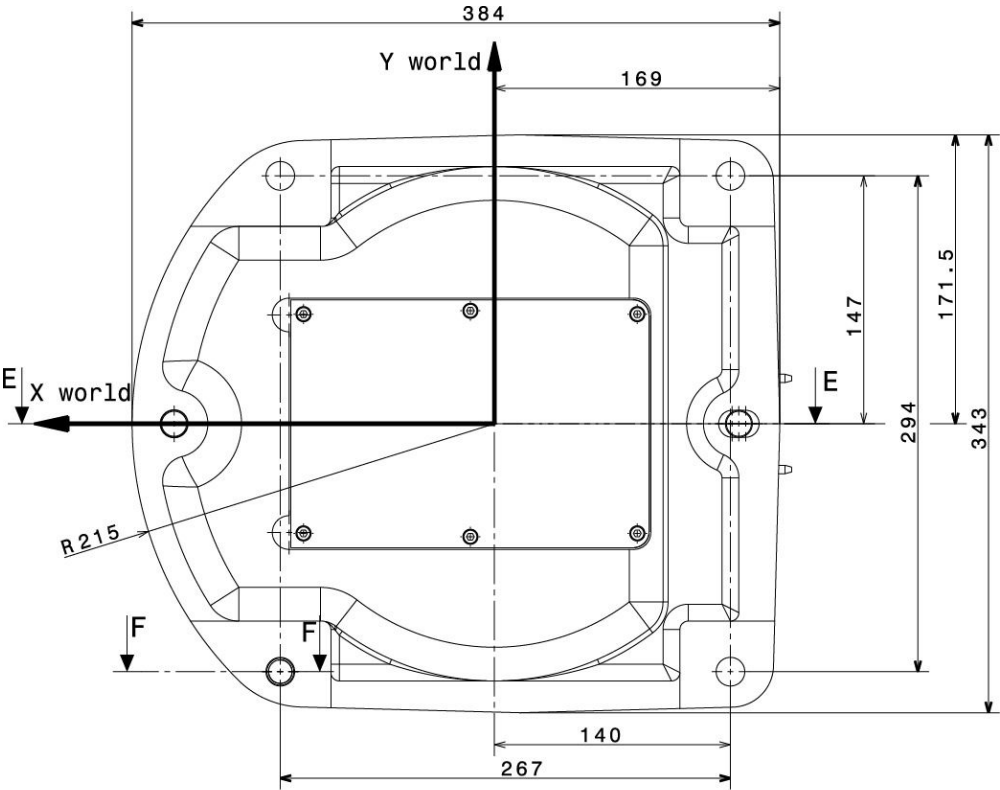


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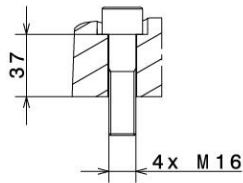
There must be no obstacles within the robot work envelope.

3.2 - ATTACHMENT

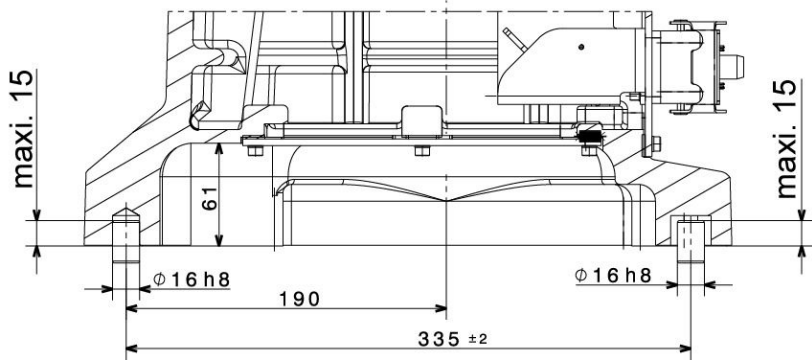
M0003518.1



SECTIONAL VIEW F-F

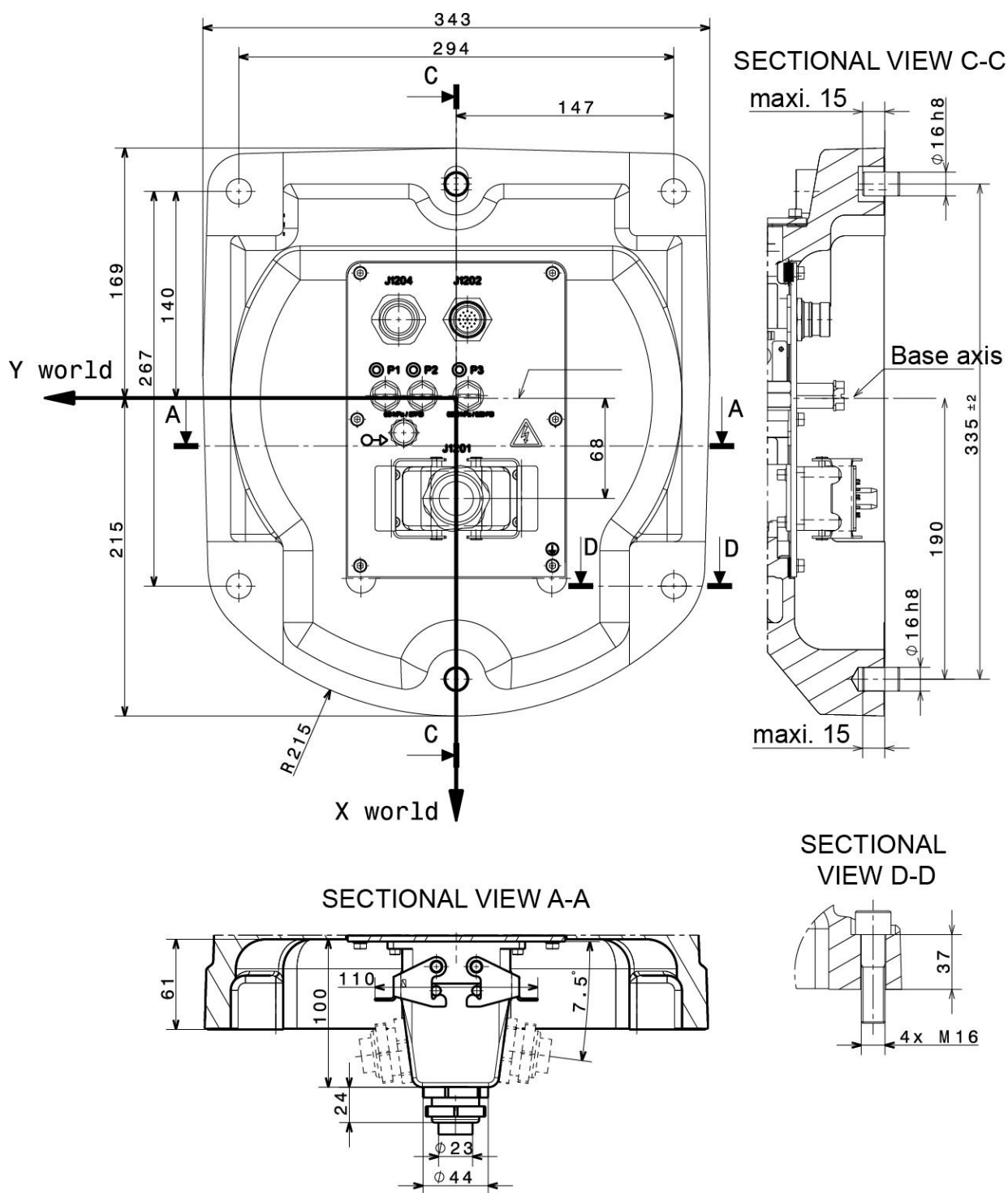


SECTIONAL VIEW E-E



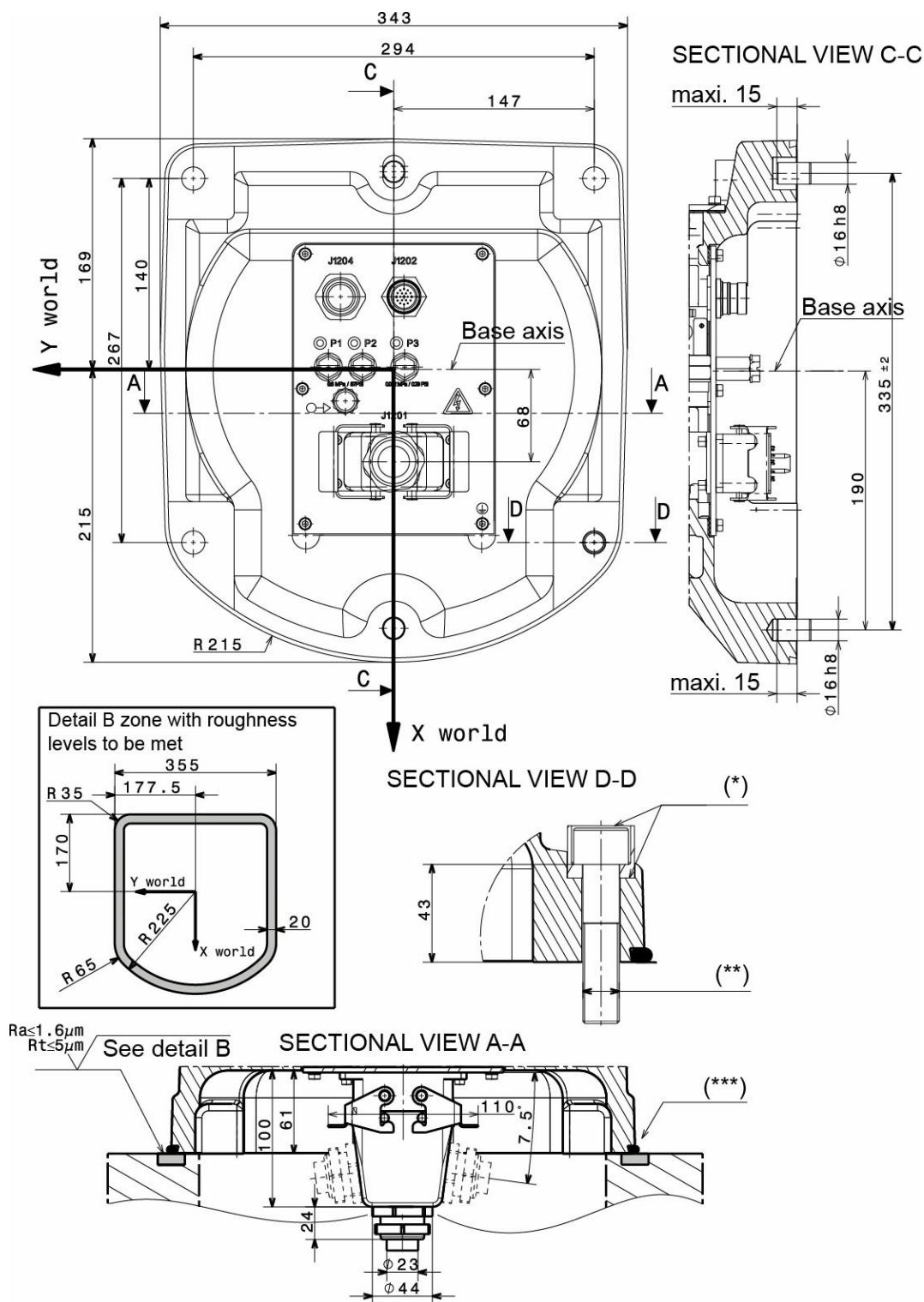
I0002995

Figure 3.1 : Horizontal cable outlet



10002996

Figure 3.2 : Vertical cable outlet



10002997

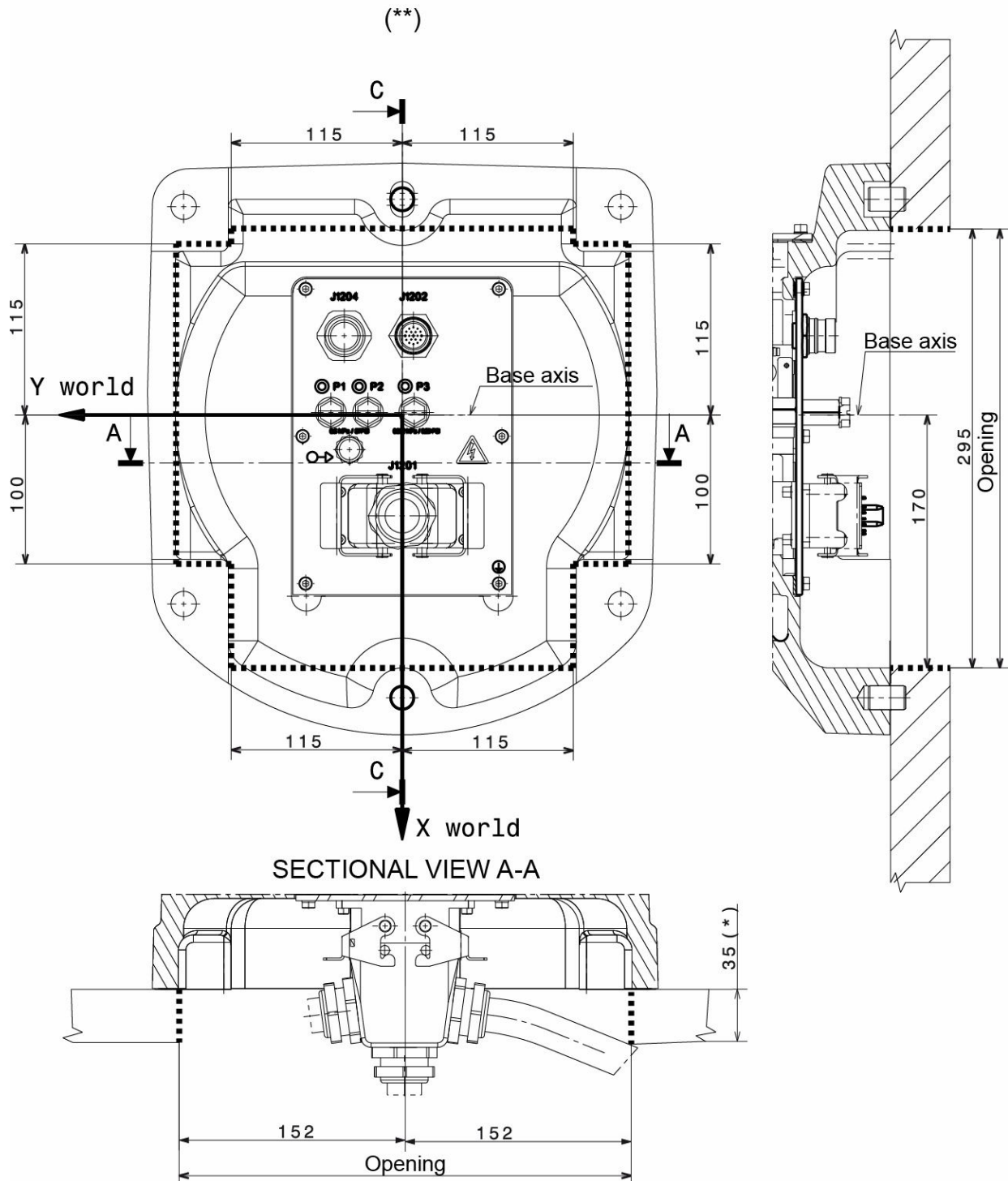
(\*): Cover the spot facings and screw heads with mastic + Insert mastic under the washers.

(\*\*): 4 CHC M16 screws, class 12-9.

(\*\*\*): O-ring around the edge Ø6.99.

**Figure 3.3 : Vertical cable outlet with sealing between the base inner face and the holder provided by a static seal (version he, steri)**

## SECTIONAL VIEW C-C



I0003521

(\*): Limit the height in the event of a side outlet.

(\*\*): Opening size for the connecting the fittings and to allow disassemble the socket holder plate.

**Figure 3.4 : Passage to be cut out in the robot holder for a "Vertical cable outlet"**

The robot arm can be installed vertically, base downwards (floor-mounted version) or base upwards (ceiling-mounted version). In all cases, it must be securely attached by 4 class 12.9 M16 hex. socket head screws.



Particular aspects of the applications in a "wet environment" (he) or a "bio-contaminated environment" (steri) (figure 3.3):

Reminder (see also chapter 2.4.2):

The threaded fasteners on the wrist's mechanical interface, the threaded fasteners on the robot, the underside of the base, the socket holder plate and the equipment fitted on it, are not qualified for a wet environment (he) or a bio-contaminated environment (steri), so they must be protected from these environments.

This protection is to be provided by the customer, and are their responsibility. The guarantee does not cover any damage occurring there.

- Base / holder interface made waterproof with the exterior seal supplied:
  - The surface of the holder on which the robot base is fixed must have surface characteristics that provide static sealing.
  - Lubricate and fit the exterior seal.
  - The underside of the base must be protected from the humid or bio-contaminated environment.
- Protection of the screws holding the robot in place to prevent liquid infiltration and corrosion:
  - When fitting the washers and fixing screws, insert mastic between the washers and the robot base.
  - Fill the spot facings and the socket (Chc) heads of the robot fixing screws with mastic (Loctite Terostat 92) or equivalent.
- Protection of the power socket holder plate and the equipment fitted on it:
  - Protect the complete element from the humid or bio-contaminated environment.
- Replacing the lifting ring:
  - Remove the ring. Fit the plug with its O-ring instead.
- Protection of the threaded fasteners on the robot wrist interface:
  - The end-effector must be assembled with (Loctite Terostat 92) or equivalent mastic to protect the threaded fasteners on the robot wrist's interface from the wet or bio-contaminated environment.



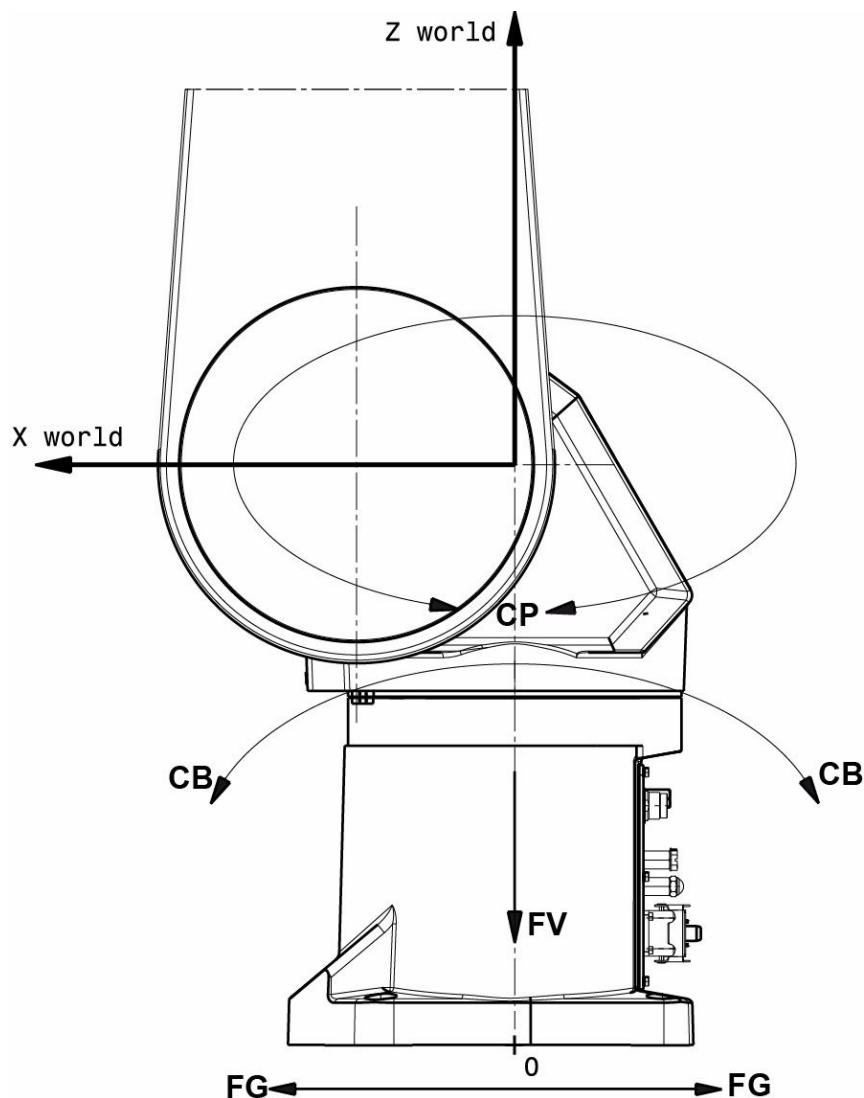
For the "vertical cable outlet" version, it is important to leave as large an opening as possible in the supporting surface for the robot, without exceeding the measurements shown in the diagram (figure 3.4), to facilitate access to the connections during installation and maintenance work.



It is necessary to configure the controller to suit the robot installation. To do so, see the "Software configuration" chapter in the controller instruction manual.

Attachment surface shall be flat and metallic. A deformable support will greatly reduce robot performance in speed and accuracy.

- To dimension the support, take into account the maximum loads generated by the arm in motion at point 0 which are (see figure 3.5):
  - $F_V = 4067 \text{ N}$
  - $F_G = 2456 \text{ N}$
  - $C_B = 3706 \text{ Nm}$
  - $C_P = 2012 \text{ Nm}$



I0002994

Figure 3.5

Under following load conditions:

|                                         | Load |      | Load position |      |        |      |
|-----------------------------------------|------|------|---------------|------|--------|------|
|                                         |      |      | Axis 5        |      | Axis 6 |      |
|                                         | kg   | lb   | mm            | inch | mm     | inch |
| Standard arm<br>Standard arm, HD option | 20   | 44.1 | 200           | 7.87 | 100    | 3.94 |
| L arm                                   | 14   | 30.8 | 200           | 7.87 | 100    | 3.94 |

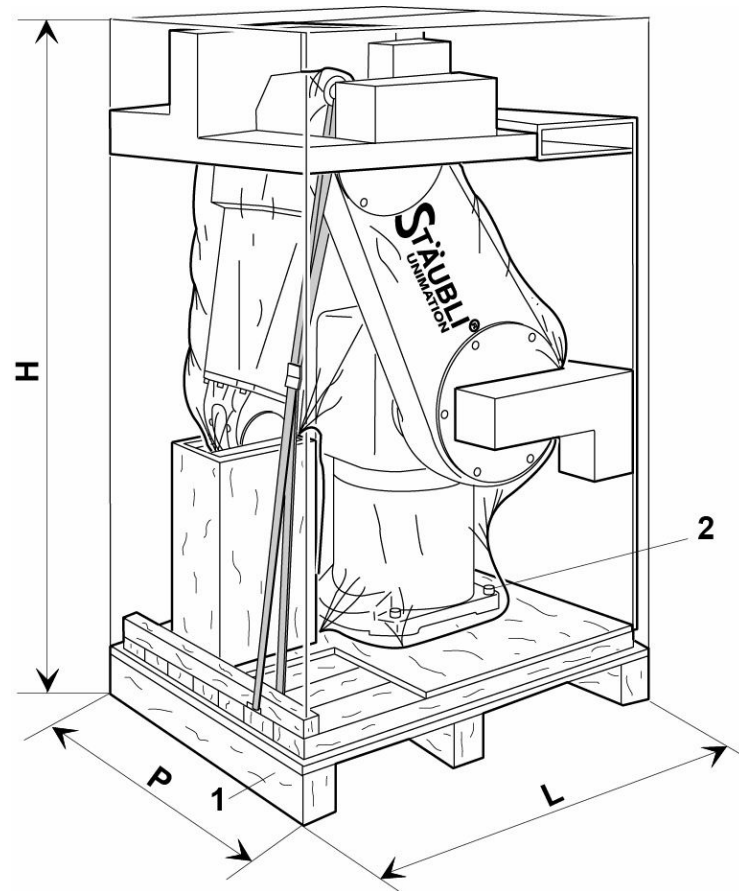
The user can accurately position the robot by means of two 16h8 diameter centering pins (not supplied).



## 4 - STORAGE, TRANSPORT AND INSTALLATION

### 4.1 - ARM PACKAGING

M0003528.1



I0002226

Figure 4.1

#### Packaging position of the arm:

|                                                  | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 |
|--------------------------------------------------|--------|--------|--------|--------|--------|--------|
| Standard arm<br>Standard arm, HD option<br>L arm | +15°   | -40°   | -130°  | +180°  | +10°   | -0°    |

#### Standard packaging:

|                                           | Standard arm                               | Standard arm, HD option                    | L arm                                      |
|-------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|
| L x H x D (mm)<br>[in]                    | 1200 x 1580 x 1000<br>[47.2 x 62.2 x 39.4] | 1200 x 1580 x 1000<br>[47.2 x 62.2 x 39.4] | 1200 x 1580 x 1000<br>[47.2 x 62.2 x 39.4] |
| Gross weight (kg)<br>[lb] (approximately) | 318<br>[701.1]                             | 309<br>[681.2]                             | 325<br>[716.5]                             |

International packaging:

|                                           | Standard arm                               | Standard arm, HD option                    | L arm                                      |
|-------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|
| L x H x D (mm)<br>[in]                    | 1300 x 1580 x 1000<br>[51.2 x 62.2 x 39.4] | 1300 x 1580 x 1000<br>[51.2 x 62.2 x 39.4] | 1290 x 1570 x 1000<br>[50.8 x 61.8 x 39.4] |
| Gross weight (kg)<br>[lb] (approximately) | 337<br>[743]                               | 326<br>[718.7]                             | 393<br>[866.4]                             |

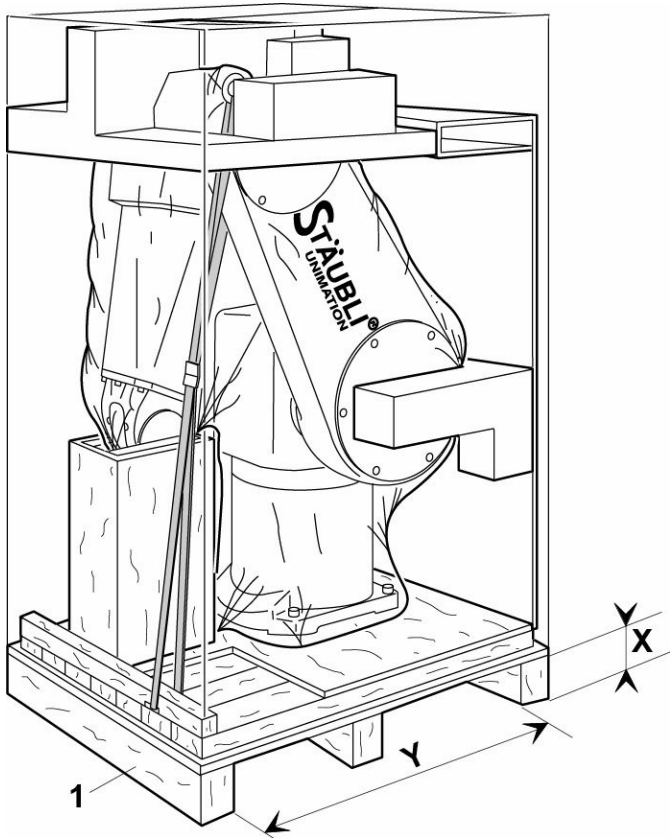
The arm is packed in the vertical position. It is attached to the pallet **(1)** by 4 M16 bolts **(2)**.

Conditions of storage and transport:

- Temperature for storage and transport: -20°C to +60°C.

4.2 - HANDLING OF PACKING

M0004431.1



I0003838

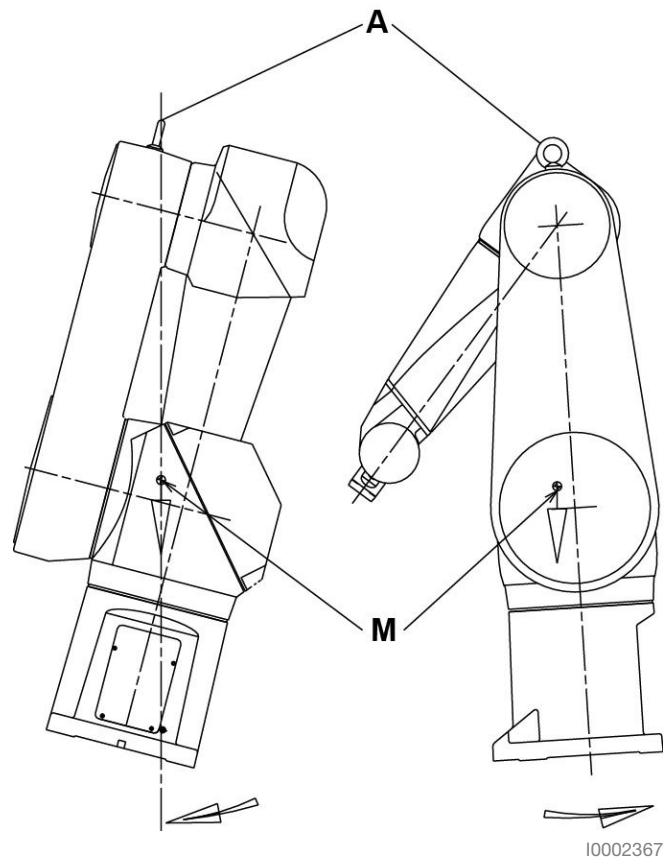
Figure 4.2

By pallet truck under base **(1)**.

- X = 100 mm [3.94 in]
- Y = 1040 mm [41 in]

## 4.3 - UNPACKING AND INSTALLATION OF THE STANDARD ARM

M0003552.1



| Item | Description       |
|------|-------------------|
| A    | Attachment point  |
| M    | Center of gravity |

Figure 4.3

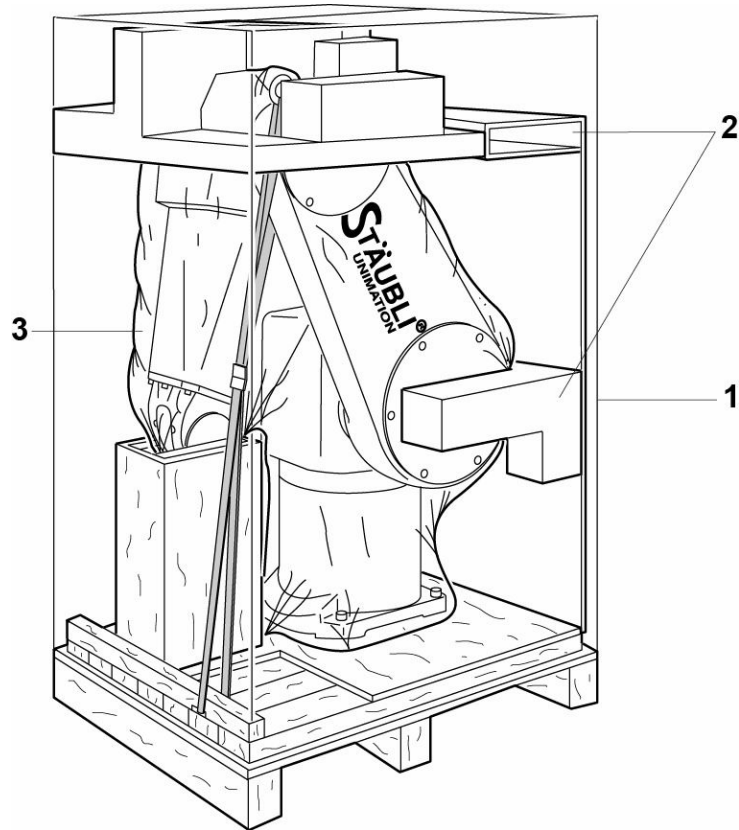
**DANGER**

In compliance with the "Machines" Directive 2006/42/CE, the tapped hole M20 for the lifting eye bolt **(5)** used to handle the robot is defined in accordance with standard ISO 262.



The slings and lifting eye bolts used to lift the robot must comply with the Machine Directive in Europe or with the rules in force for other countries.

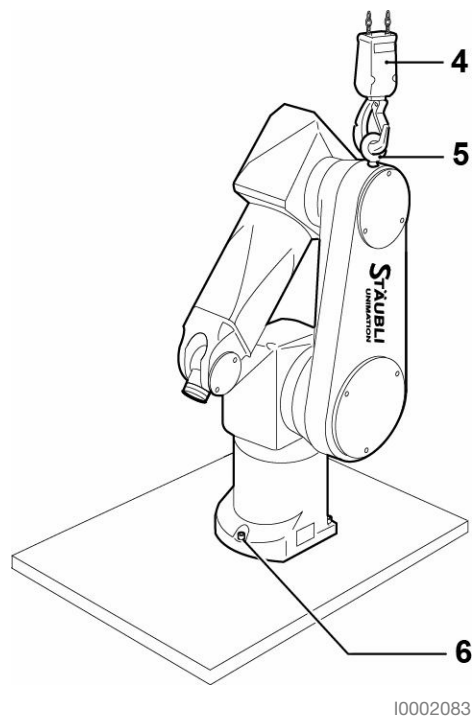
- Move the packing case as near as possible to the installation site.



I0003839

**Figure 4.4**

- Remove the cardboard packaging **(1)**, remove the packing material **(2)** and the plastic cover **(3)**.

**Figure 4.5**

- Pass the hook **(4)** of the hoist through the hoisting ring **(5)** and hold slightly tensioned to stop the arm from tipping.
- Remove the **(6)** bolts from the arm.
- Slowly raise the arm using the hoist.



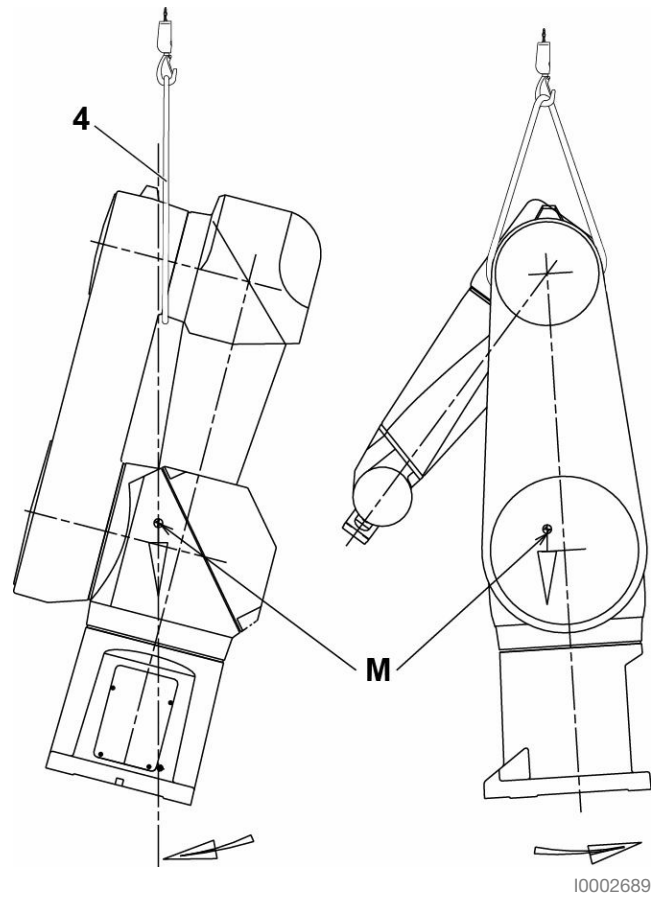
The robot will swing when raised and moved (figures 4.3 and 4.5).



For ceiling-mounted version robots (balance springs of joint 2 released), do not rotate joint 2.

4.4 - UNPACKING AND INSTALLATION OF THE UL VERSION ARM

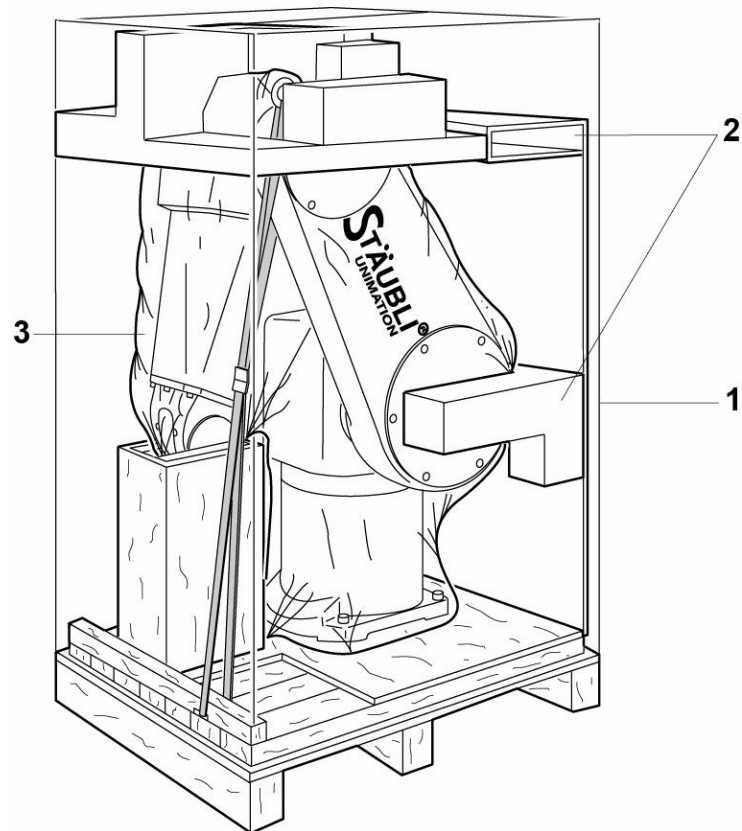
M0003553.1



| Item | Description       |
|------|-------------------|
| M    | Center of gravity |

Figure 4.6

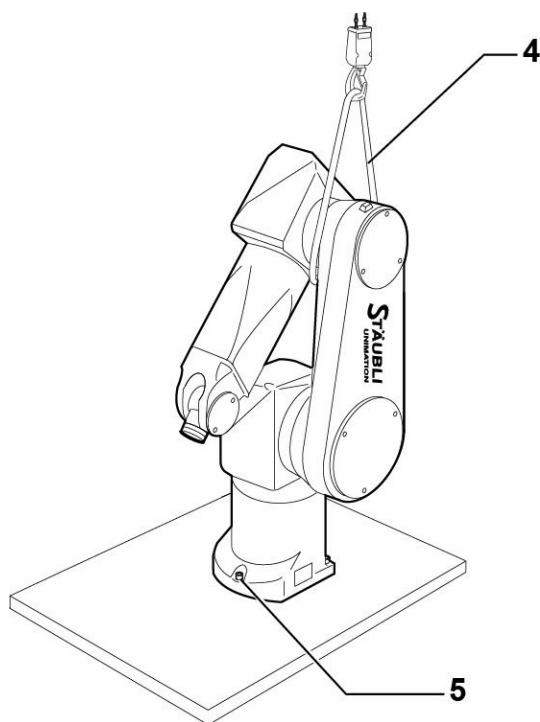
- Move the packing case as near as possible to the installation site.



I0003839

**Figure 4.7**

- Remove the cardboard packaging **(1)**, remove the packing material **(2)** and the plastic cover **(3)**.



10002690

Figure 4.8

- Put the fabric sling **(4)** around the joint 3 as shown in the figure and take up any slack to prevent the arm from tilting.



500 kg (1102 lb) fabric sling.

- Remove the **(5)** bolts from the arm.
- Slowly raise the arm using the hoist.



The robot will swing when raised and moved (figures 4.6 and 4.8).



For ceiling-mounted version robots (balance springs of joint 2 released), do not rotate joint 2.

## 4.5 - INSTALLATION OF ARM

M0003506.1

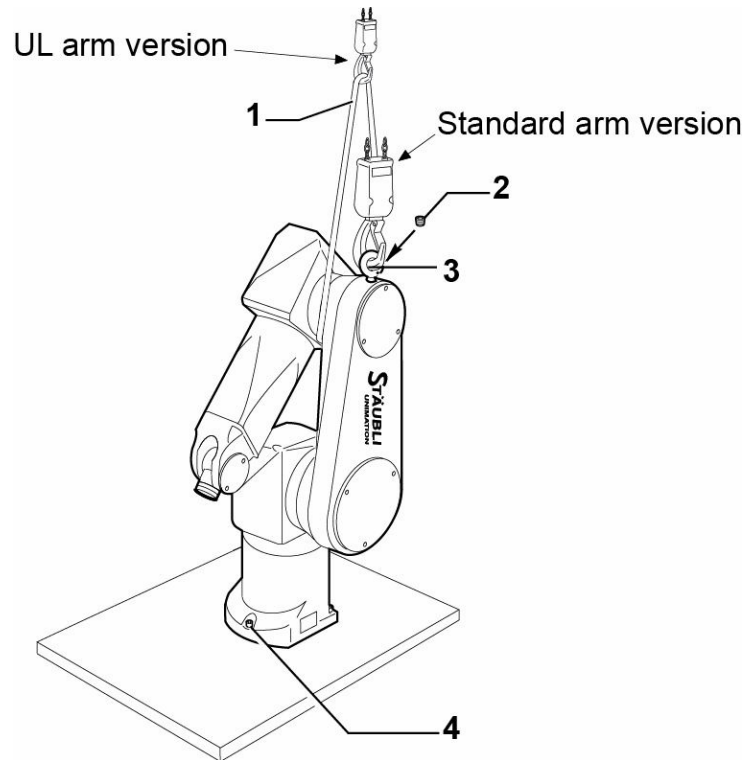


The arm can be attached with the base downwards (floor-mounted version) or with base upwards (ceiling-mounted version). Caution: the balance system is installed in the factory for one OR the other of these versions. Transformation from a floor-mounted version to a ceiling-mounted version entails mechanical work on the balance system and corresponding controller configuration (see chapter 4.6).



Throughout all handling and installation operations concerning the arm, it is essential to keep the protection on the main connector at the foot of the robot in place at all times to avoid damaging and soiling the electrical and optical contacts.

### 4.5.1 - INSTALLATION OF ARM ON FLOOR



I0002465

**Figure 4.9**

- Position the arm on the support at its final attachment points.
- Attach the arm with 4 class 12.9 M16 hex. socket head screws **(4)**, tightened to  $325 \text{ Nm} \pm 23 \text{ Nm}$ .
- Unscrew the hoisting ring **(3)** and install the plug **(2)**.
- Remove the sling **(1)** (version UL).

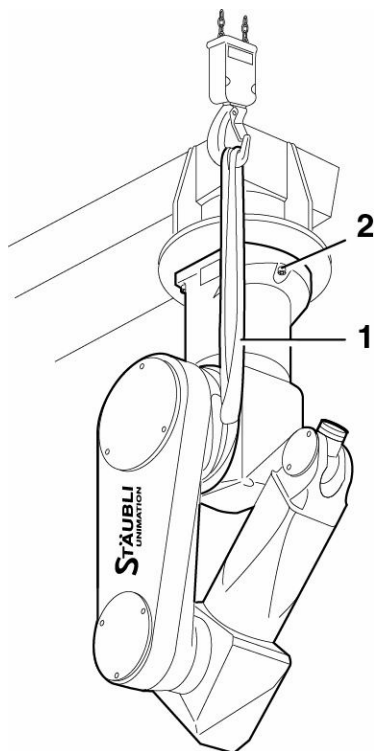


#### **DANGER**

For safety reasons, keep the sling slightly tensioned until the arm is securely attached to the floor.

## 4.5.2 - INSTALLATION OF ARM ON CEILING

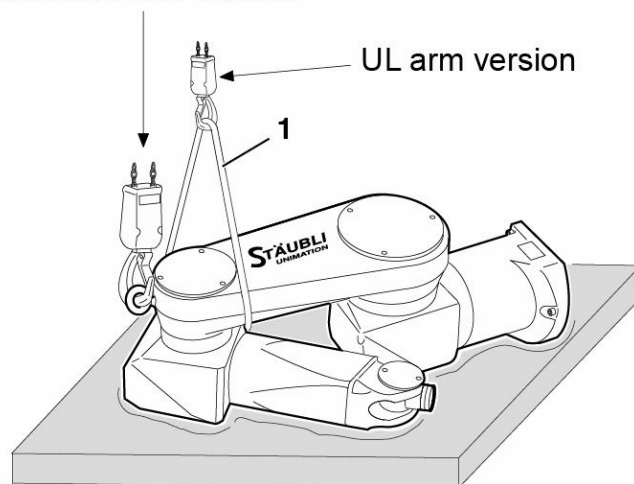
M0003527.1



I0002084

Figure 4.10

Standard arm version



I0002466

Figure 4.11



Do not rotate joint 2.

Carefully lay down the arm on a flexible support as shown on figure 4.11.

- Using the lifting ring (Standard version).
- Using the sling (version UL).

Place the fabric sling (1) around joint 2 as shown on figure 4.10.



500 kg (1102 lb) fabric sling.

- Position the arm on the support at its final attachment points.
- Attach the arm with 4 class 12.9 M16 hex. socket head screws **(2)**, tightened to  $325 \text{ Nm} \pm 23 \text{ Nm}$ .
- Tension the springs for robots delivered in ceiling-mounted version using the tool supplied with the robot (see chapter 4.6).



### DANGER

For safety reasons, hold the sling slightly tensioned until arm is securely attached to the ceiling.

## 4.5.3 - MOUNTING FLOOR QUALITY

M0000101.1

The user must make sure that the mechanical characteristics of the floor (or the supporting structure) and the fastening systems are able to bear the maximum forces placed on them by the arm when it is moving (see chapter 3).



The height of the robot support can strongly influence the forces on the floor.

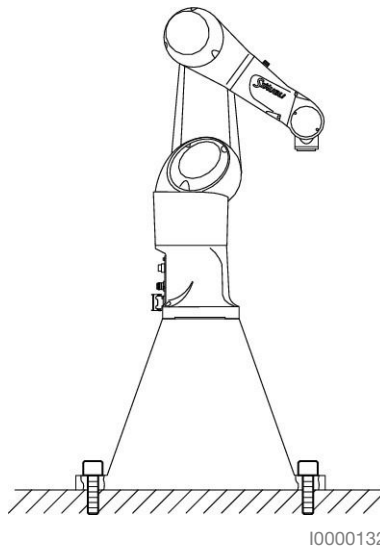


Figure 4.12

## 4.5.4 - MODIFICATION OF RANGES

M0000176.1

The arm is mounted in a way that provides the maximum angular amplitudes defined in chapter 2.5.1.

Axis range can be limited, depending on the axes:

- by software.
- by range limiter on some axes internal mechanical and/or electric stop.
- by an optional adjustable mechanical stop (on some axes).

The mechanical limiters should never be reached during normal robot use (the range limits are controlled by software).



However, if the mechanical range limiters are hit, the fixed and mobile parts must be replaced (consult the Stäubli services).



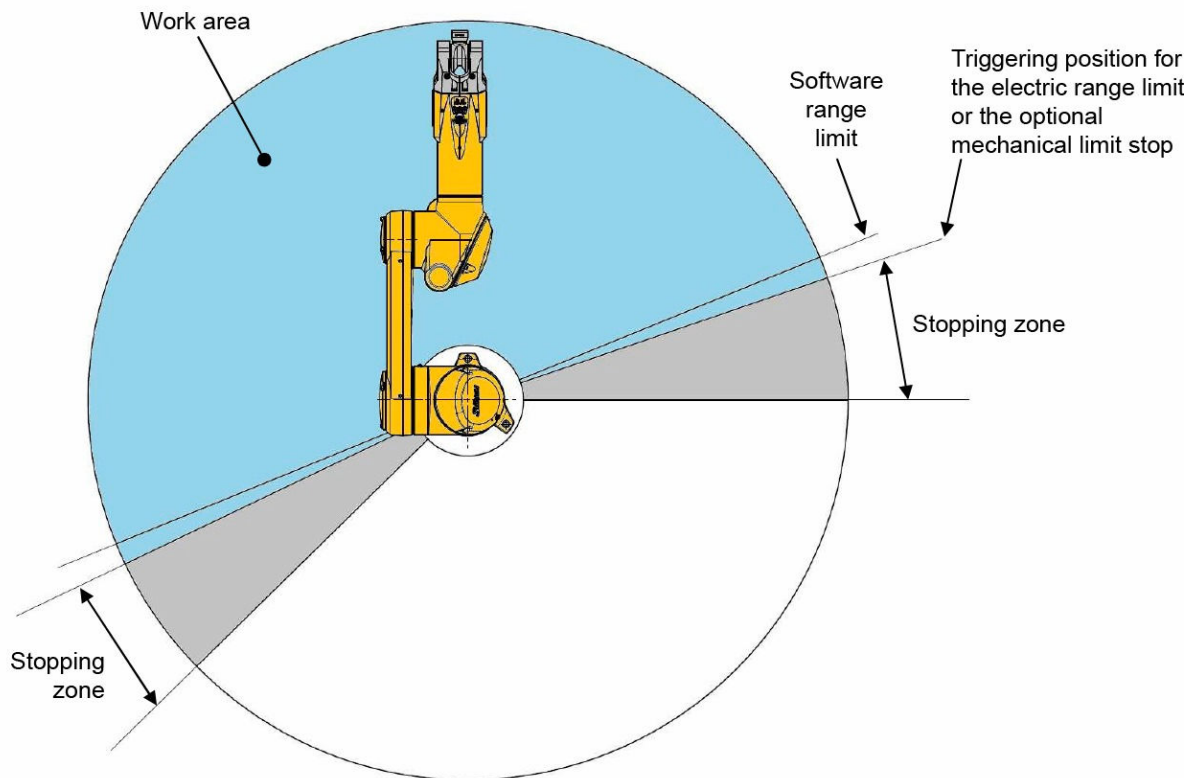
Only the optional mechanical stops meet the safety requirements specified by the ISO 10218-1 standard to establish a restricted space around the robot. The range limitation system using software limits, electric limiters or internal mechanical limiters must only be used to protect the equipment and not to provide functional safety in the cell.

It is possible to deliberately limit joint range by 'software' (see the chapter covering the software configuration of the controller).

#### 4.5.4.1 - Taking stopping zones into account

M0000184.1

Joint range limitation by an electric or mechanical system must take the stopping distances into account:



I0000130

Figure 4.13

- Work area: Angular range within which the robot moves during normal operation. It is possible to deliberately limit the range of the articulations using software (see the chapter on controller software configuration), and also using optional adjustable mechanical stops (see chapter 4.5.4.2).
- Stopping zone (abnormal operating zone): Maximum angle necessary to stop the robot. In the event of use of the optional adjustable mechanical limit stop system, the stopping angle depends on the violence of the impact (its maximum value is 15°). The stopping angle for an electric limit switch is defined in paragraph 2.12.3.3 (Category 0 stop).



#### DANGER

After changing a software range limit, check at low speed that the axis is able to move through the planned angular range, but no further.



In the event of use of optional adjustable mechanical limit stops, check that they are correctly placed as compared with the desired limitations, and then define the software range limit at least 2.5° smaller.

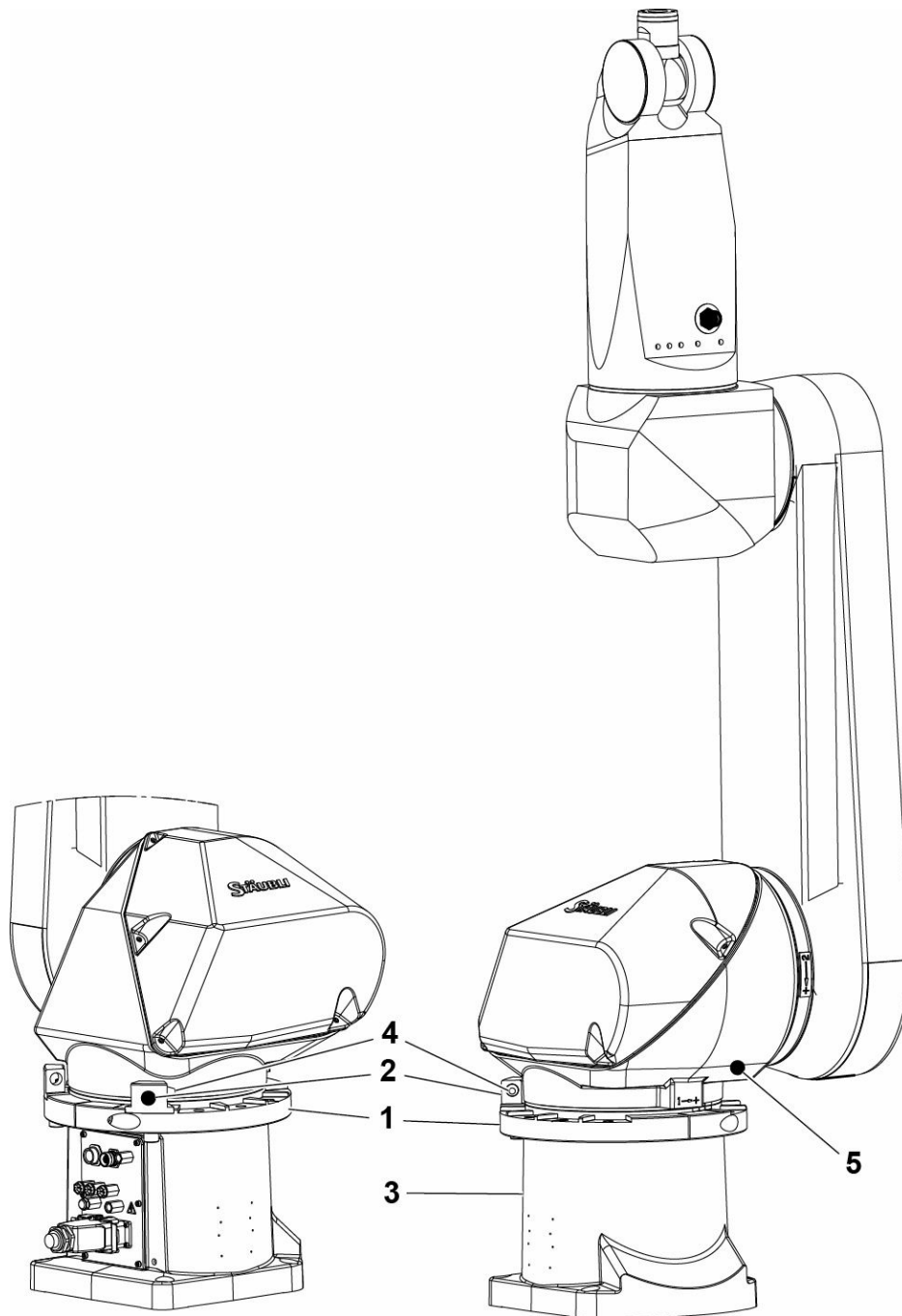
#### 4.5.4.2 - Axis 1

M0003535.1

##### Factory settings:

- No mechanical stops are fitted.
- The software range limit is set at  $\pm 160^\circ$ .
- The electric range limit is set at  $\pm 163.5^\circ$ .
- The mechanical range limit stop is set at  $\pm 165^\circ$ .

## Optional mechanical limit stop



10002748

**Figure 4.14**

The optional mechanical limit stop system is able to stop the robot at nominal load and nominal speed. It is sized to absorb the kinetic energy of the axis.

### Description:

- The optional mechanical limit stop system is made up of a two-part ring **(1)** on which one or two adjustable limit stops **(2)** can be placed to limit the working range of axis 1.
- The ring is fitted on the robot base **(3)**.
- One limit stop is attached to the robot shoulder **(5)**.
- The amplitude of the working range is modified by fitting one or two adjustable limit stops as shown in the tables below that set out the amplitudes, and in figure 4.16.

Installation of the optional mechanical limit stop:

- 1) Fit the holding ring **(1)** on the robot base **(3)**, resting against the shoulder.
- 2) Align the mark on the holding ring with the axis mark.

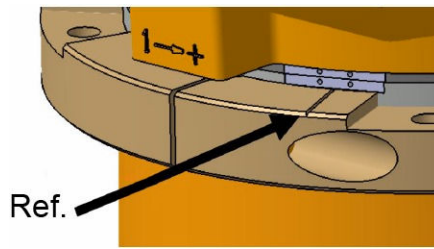


Figure 4.15

- 3) Tighten the two screws supplied (CHc M16 x 60, class 12-9, protected by Deltaprotekt treatment) holding the ring **(1)** in place, to a torque of 171 Nm.
- 4) Position the two adjustable limit stops **(2)** as shown in figure 4.14 and in the amplitude modifications table below.
- 5) Fix the two limit stops **(2)** using the screws supplied (CHc M16 x 50, class 12-9, protected by Deltaprotekt treatment) tightened to a torque of 171 Nm.
- 6) Check operation at low speed.



### DANGER

The system performance levels are only guaranteed in the case of correct assembly (compliance with the required torque values, etc.), with clean, grease free parts. Any failure to comply with the instructions can result in poor functioning of the mechanical stop system and risks for the user.



### DANGER

What should be done if the robot is stopped by an optional mechanical hard stop ?

- 1) Check transmission: Place arm on reference mark. If there is an offset, contact Stäubli.
- 2) Check that the robot has not suffered any visible damage.
- 3) Check that there is no unusual noise or backlash on the various axes during brake release and in manual mode.
- 4) Put the ring back in place if it has slipped. Follow the points concerned in the installation procedure.
- 5) Replace the resilient pad that absorbed the impact (Reference: D60020100).
- 6) Check operation at low speed.



### DANGER

If any ring damage or slippage is noted (or in the event of doubt following an impact or a suspected impact), consult the Stäubli Customer Support for an arm diagnostic.

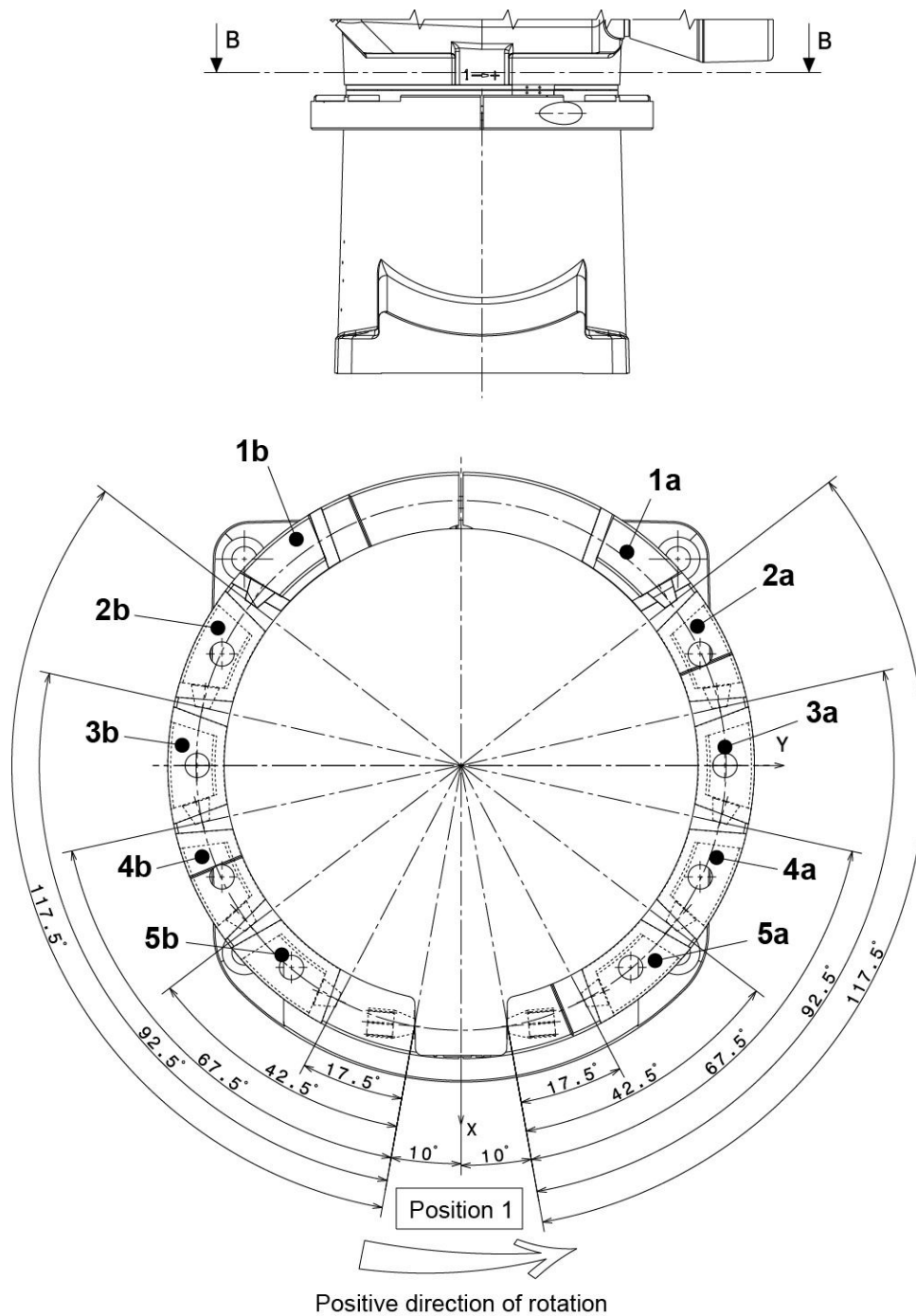


### DANGER

Installation of optional mechanical limit stops on axis 1 results in a working range limitation on axis 2: +137,5°: -103°.

Check the following points at least once a year:

- No visible damage.
- Tightening torque  $171 \pm 3.5$  Nm for the two screws holding the ring **(1)** in place.
- No slippage for the ring **(1)**. Check this by making sure that the mark on the holding ring remains aligned with the axis mark.



I0002749

**Figure 4.16**

Example:

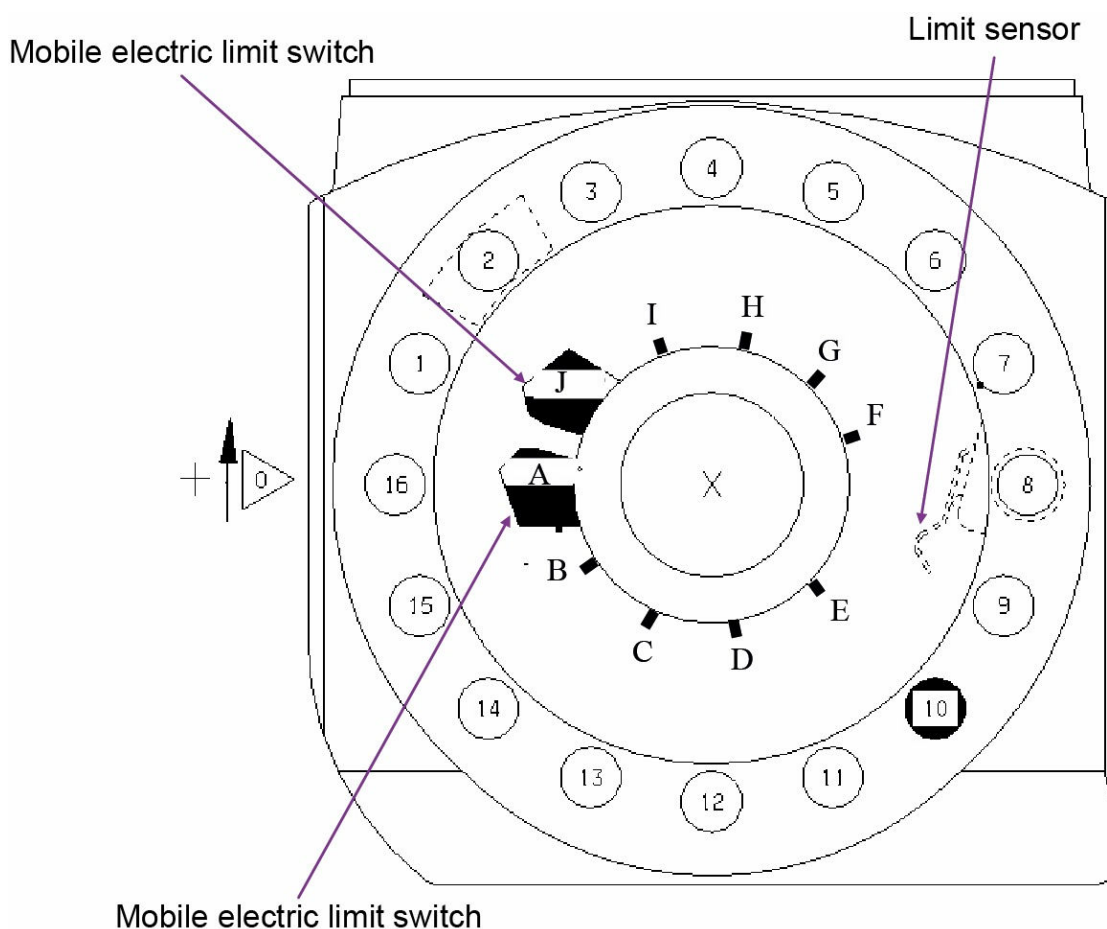
- Limit stop adjustable in position "1a":
  - Mechanical limitation at  $117.5^\circ$  in the positive direction and  $160^\circ$  in the negative direction.
- One hard stop in position "1a" and another in position "1b":
  - Mechanical limitation at  $117.5^\circ$  in the positive and negative directions.
- Further reduction in steps of  $25^\circ$  if positions 2 to 4 are used.

**Arrays defining the ranges of the optional mechanical limit stop:**

Usual cases:

|    | 1a    |        | 2a   |        | 3a   |        | 4a   |        | 5a   |        |
|----|-------|--------|------|--------|------|--------|------|--------|------|--------|
| 1b | 117,5 | -117,5 | 92,5 | -117,5 | 67,5 | -117,5 | 42,5 | -117,5 | 17,5 | -117,5 |
| 2b | 117,5 | -92,5  | 92,5 | -92,5  | 67,5 | -92,5  | 42,5 | -92,5  | 17,5 | -92,5  |
| 3b | 117,5 | -67,5  | 92,5 | -67,5  | 67,5 | -67,5  | 42,5 | -67,5  | 17,5 | -67,5  |
| 4b | 117,5 | -42,5  | 92,5 | -42,5  | 67,5 | -42,5  | 42,5 | -42,5  | 17,5 | -42,5  |
| 5b | 117,5 | -17,5  | 92,5 | -17,5  | 67,5 | -17,5  | 42,5 | -17,5  | 17,5 | -17,5  |

Safety: See chapter 2.12

**Changing ranges:**

I0003034

**Figure 4.17 : View of the inside of the base**

The electrical range limits can be reduced by moving the mobile electric limit switches among the positions from A to J.

The limit switches are located inside the robot base. This means that it is necessary to unscrew the socket holder plate. Do not pull on the harness.

Remark: Release the harness in the shoulder to increase the slack length available.

| Positions             | A       | B     | C     | D    | E    | F   | G   | H    | I    | J      |
|-----------------------|---------|-------|-------|------|------|-----|-----|------|------|--------|
| Electric range limits | -163.5° | -133° | -100° | -67° | -34° | 34° | 67° | 100° | 133° | 163.5° |

Safety: See chapter 2.12.8

#### 4.5.4.3 - Axis 2

##### Factory settings:

- The software range limit is set at  $\pm 137.5^\circ$ .
- The electric range limit is set at  $\pm 140^\circ$ .
- The mechanical range limit stop is set at  $\pm 142.5^\circ$ .

##### Changing ranges:

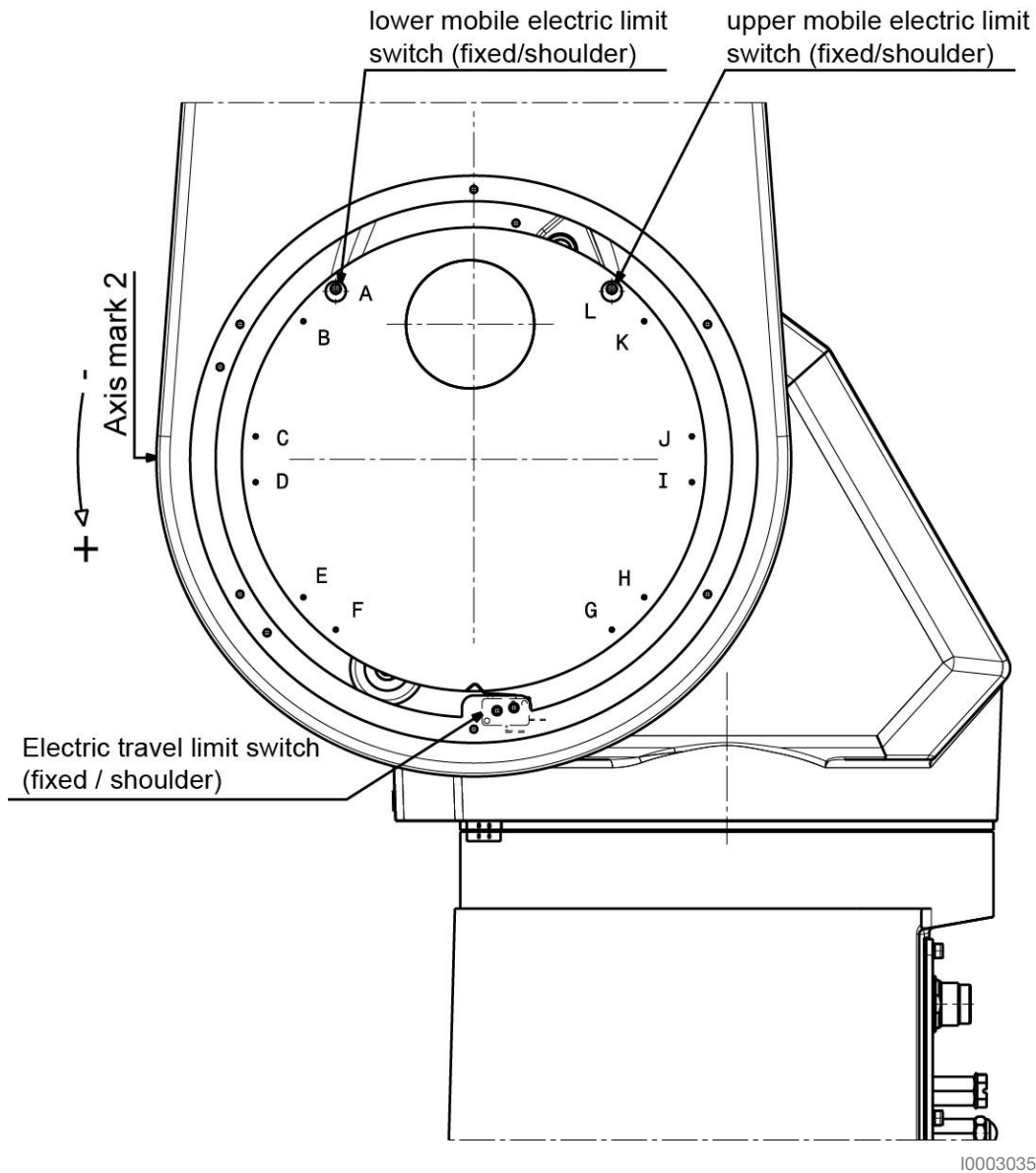


Figure 4.18

The electrical range limits can be reduced by moving the mobile electric limit switches among the positions from A to L.

The limiters are located inside the robot arm; they are fixed on the separating plate. When the axis is on the factory mark, they are under the spring holder. Turn axis 2 to remove them.

| Positions             | A     | B     | C    | D    | E    | F    | G   | H   | I   | J   | K    | L    |
|-----------------------|-------|-------|------|------|------|------|-----|-----|-----|-----|------|------|
| Electric range limits | -140° | -128° | -95° | -83° | -50° | -38° | 38° | 50° | 83° | 95° | 128° | 140° |

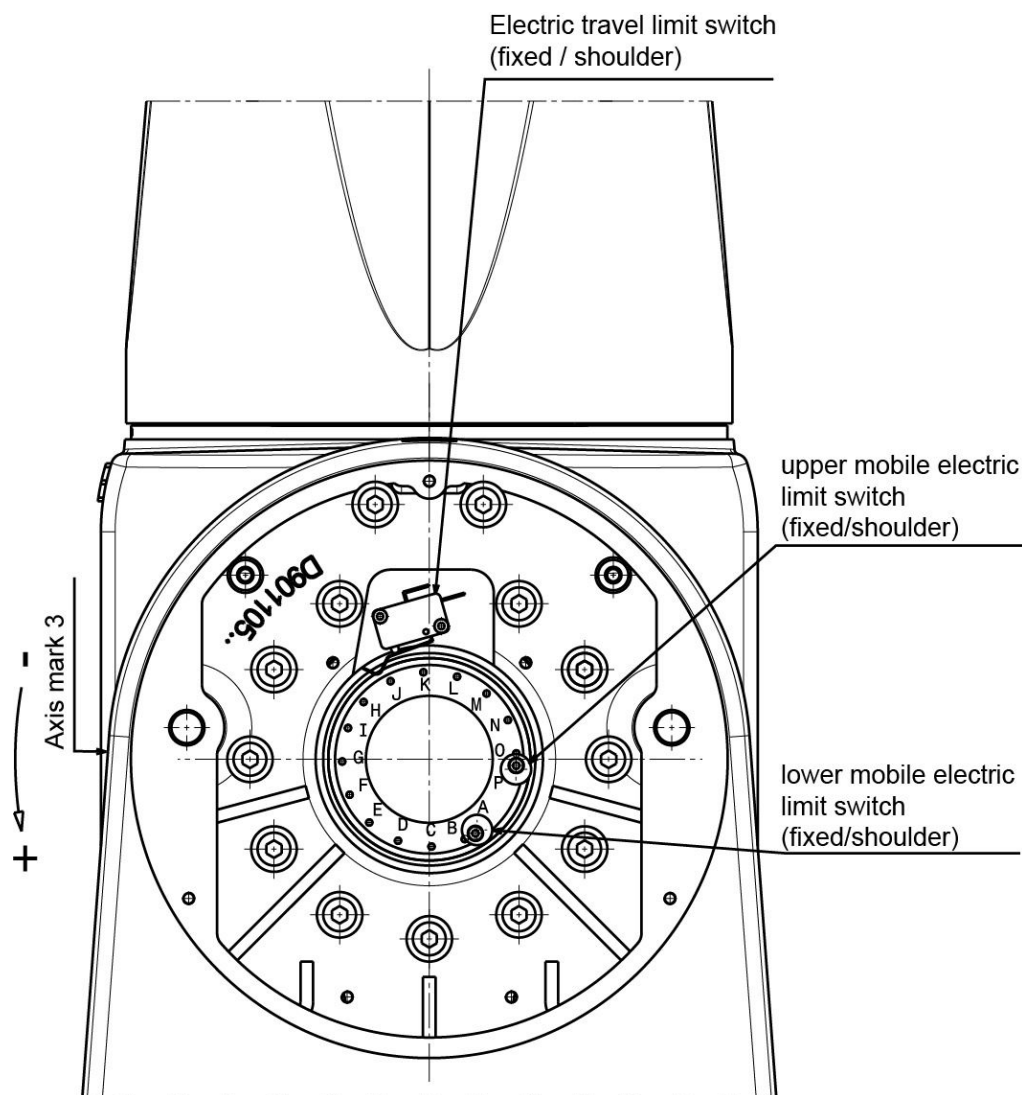
Safety: See chapter [2.12.8](#)

## 4.5.4.4 - Axis 3

M0004133.1

**Factory settings:**

- The software range limit is set at  $\pm 150^\circ$ .
- The electric range limit is set at  $\pm 152^\circ$ .
- The mechanical range limit stop is set at  $\pm 153.5^\circ$ .

**Changing ranges:**

I0003036

**Figure 4.19**

The electrical range limits can be reduced by moving the mobile electric limit switches among the positions from A to P.

Take the cover off axis 3; the limit switches are fixed on the sleeve.

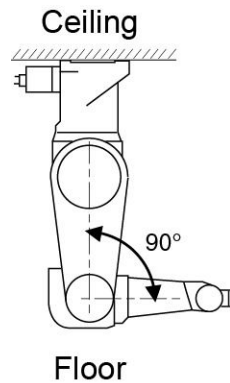
| Positions             | A            | B            | C              | D           | E             | F           | G             | H          |
|-----------------------|--------------|--------------|----------------|-------------|---------------|-------------|---------------|------------|
| Electric range limits | $-152^\circ$ | $-144^\circ$ | $-121.5^\circ$ | $-99^\circ$ | $-76.5^\circ$ | $-54^\circ$ | $-31.5^\circ$ | $-9^\circ$ |

| Positions             | I         | J            | K          | L             | M          | N             | O           | P           |
|-----------------------|-----------|--------------|------------|---------------|------------|---------------|-------------|-------------|
| Electric range limits | $9^\circ$ | $31.5^\circ$ | $54^\circ$ | $-76.5^\circ$ | $99^\circ$ | $121.5^\circ$ | $144^\circ$ | $152^\circ$ |

Safety: See chapter [2.12.8](#)

## 4.6 - INSTALLATION BALANCING SPRINGS FOR CEILING-MOUNTED VERSION ROBOTS

M0003554.1

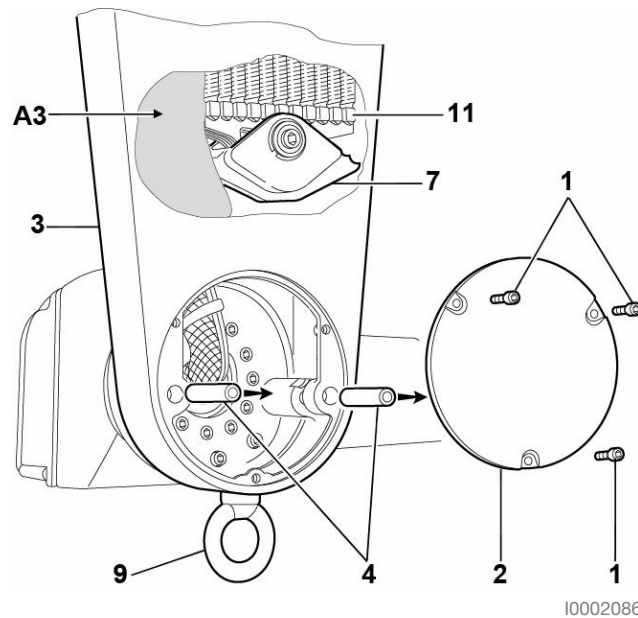


I0002085

Figure 4.20



The robot must be attached to the ceiling. Do not rotate joint 2.



I0002086

Figure 4.21

- Remove hoisting ring **(9)** from the arm.
- Unscrew the M5 screws **(1)** attaching cover **(2)**.
- Remove cover **(2)** from arm **(3)**.
- Remove the 2 pins **(4)** from arm **(3)**.
- Remove foam **(A3)** wedging beam **(7)** against arm **(3)**.
- Check that beam **(7)** and its springs **(11)** are not jammed in arm **(3)**.
- Place the robot in position (figure 4.20).

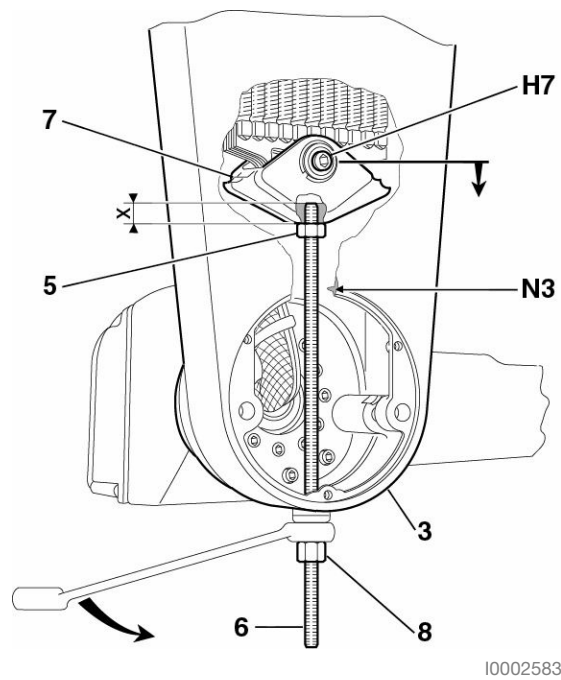


Figure 4.22

- Unscrew the M12 nut **(5)** from the M12 threaded rod **(6)**.
- Insert threaded rod **(6)** into arm **(3)** (polyamide washer in contact with arm).
- Screw nut **(5)** onto threaded rod **(6)**.
- Screw the end of threaded rod **(6)** into beam **(7)**. Grip length  $X = 15 \text{ mm} \pm 1 \text{ mm}$ .
- Tighten nut **(5)** against beam **(7)**.
- Using an 18 mm wrench (not supplied), tighten nut **(8)** until the pin holes of beam **(7)** coincide and pass beyond ( $\pm 1 \text{ mm}$ ) those on the arm.

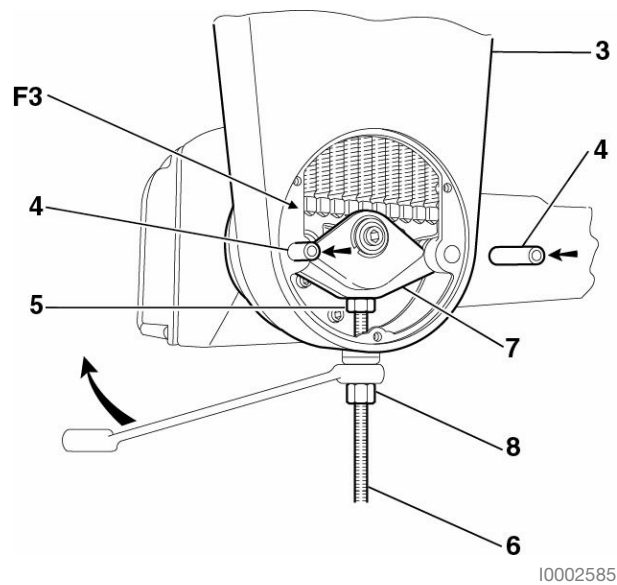


Figure 4.23

- When the beam (7) is in position, insert the pins (4) in the arm (3) (pin threads on the outside). The pins must be inside face (F3) of arm (3).
- Unscrew nut (8) so that beam (7) bears on pins (4).
- Unlock nut (5).
- Unscrew threaded rod (6).
- Unscrew the M12 nut (5) from the M12 threaded rod (6).
- Remove threaded rod (6) from the arm.

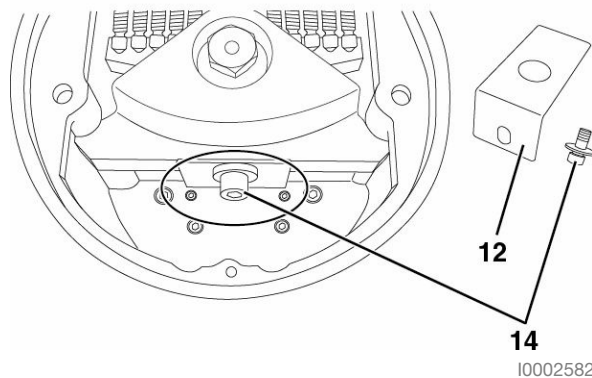


Figure 4.24

- Put the plate (12) in place.
- Tighten the M12 screw (14) with its washer (tightening torque 20 to 30 Nm).

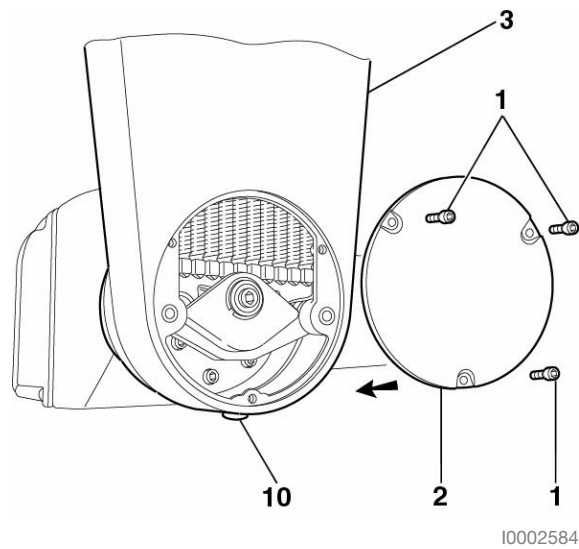


Figure 4.25

- Install cover **(2)** on arm **(3)**.
- Tighten the 3 screws **(1)**.
- Install plug **(10)** in arm **(3)**.



It is necessary to configure the controller for a ceiling arm version. To do so, see the "Software configuration" chapter in the controller instruction manual.

## 5 - INTERNAL VARIATIONS BETWEEN VARIOUS TYPES OF ARMS

### 5.1 - PURPOSE OF THIS CHAPTER

M0003485.1

This chapter shows the internal differences between a standard arm and a clean room arm at axle 1, 2, 3 and 4 levels.

These variations concern the type of solenoid valves and their locations.

Two solenoid valves are placed at joints 3 and 4 in the standard arms.

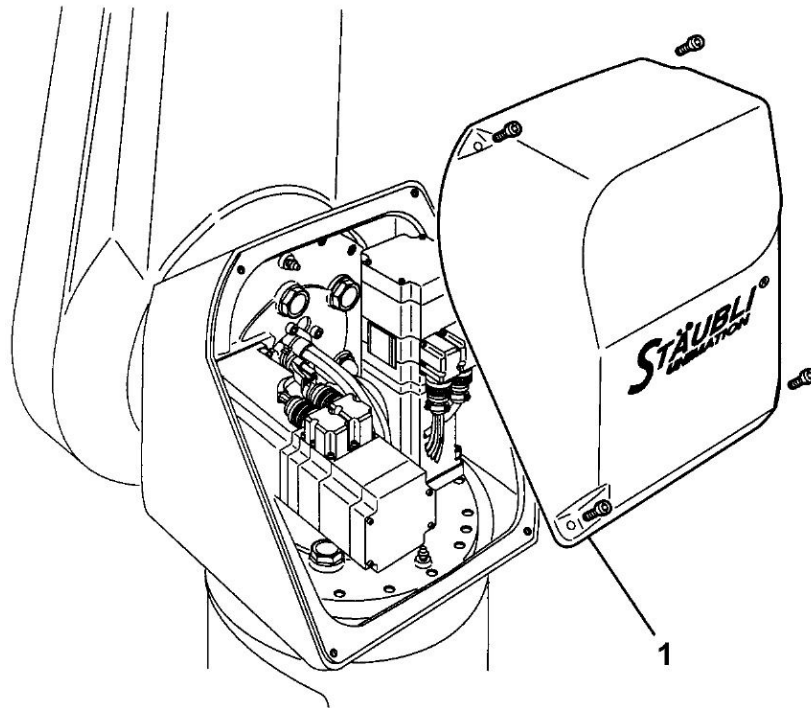
For space reasons, one solenoid valve is attached to joints 3 and 4 and the other to joint 1 on the clean room arms.

These variations are detailed on the following pages.

Only the views of the standard version are shown in the following paragraphs.

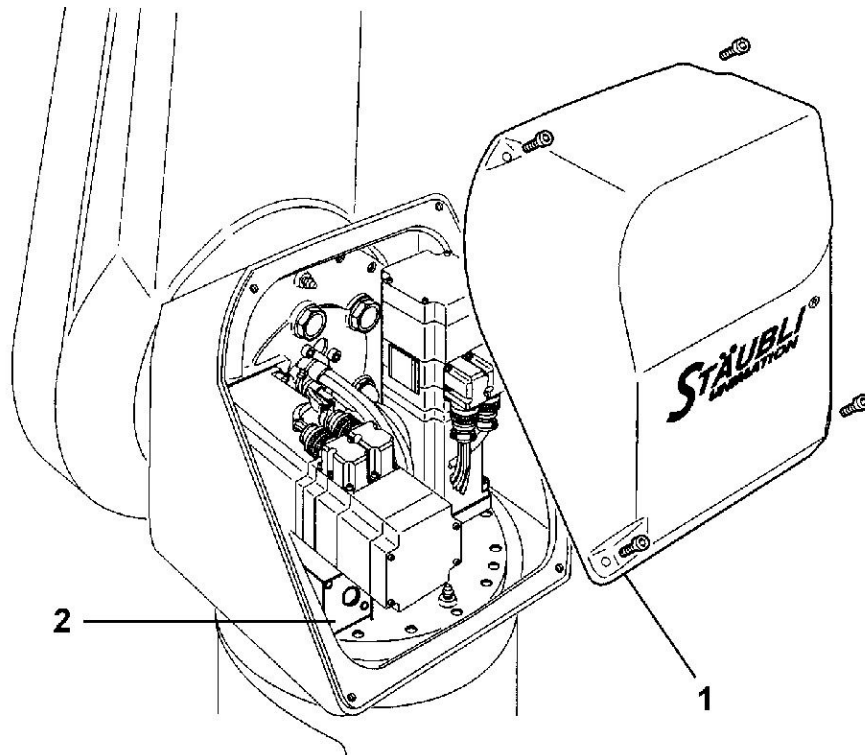
### 5.2 - JOINTS 1 AND 2

M0003490.1



I0002382

Figure 5.1 : Joints 1 and 2 standard arm



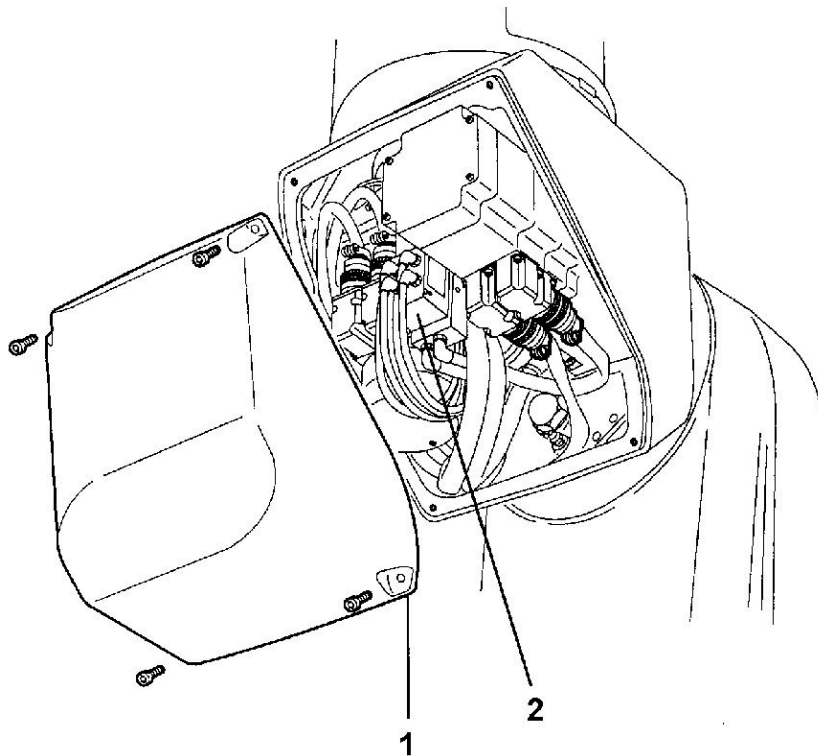
I0001048

**Figure 5.2 : Joints 1 and 2 clean room arm**

On the clean room arm, solenoid valve **(2)** is visible (bottom left) when cover **(1)** is removed.

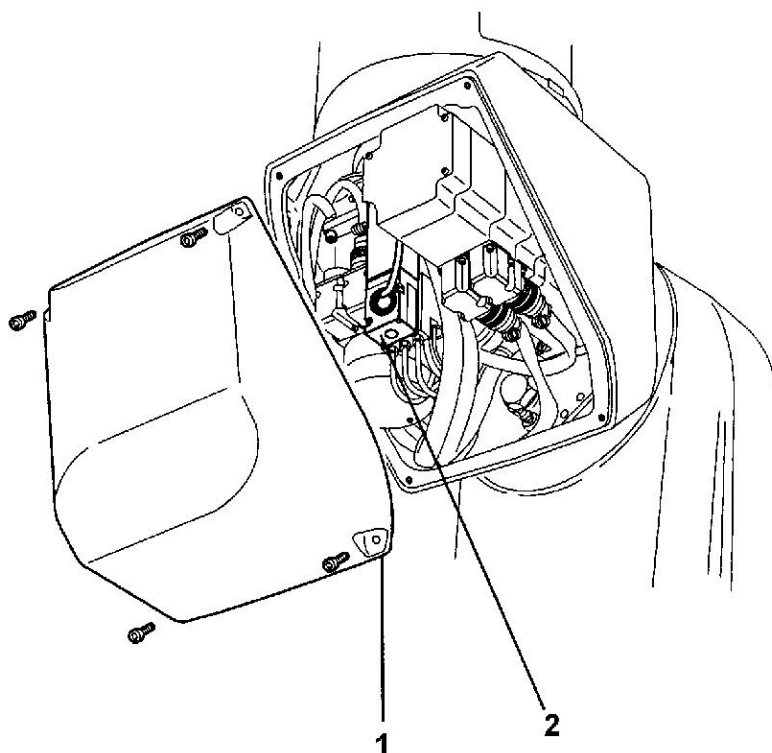
### 5.3 - JOINTS 3 AND 4

M0003491.1



I0001049

**Figure 5.3 : Joints 3 and 4 standard arm**



I0001050

**Figure 5.4 : Joints 3 and 4 clean room arm**

After removing cover **(1)**, the two solenoid valves **(2)** of the standard arm are replaced by a single solenoid valve **(2)** on the clean room arm.



## 6 - PREVENTIVE MAINTENANCE

### 6.1 - RULES TO BE APPLIED FOR MAINTENANCE

M0000160.1

- To keep the arm performance at an optimal level the arm requires preventive maintenance.



#### **DANGER**

Poor maintenance can lead to premature wear, or even cause safety hazards for production or maintenance operators.

- All maintenance operations must be carried out solely by personnel who have undergone the appropriate training provided by Stäubli.



#### **SAFETY**

The maintenance technician must be informed of the hazards linked to the robot environment, and especially the risks of concurrent activity on the machine during maintenance.



To ensure a correct seal, it is essential to replace the seal each time a cover is removed (see chapter 6.5).



An inappropriate application may cause premature wear of the flat seal.



The wrist straps are supplied as part of the standard equipment for the robot. Use an electrostatic wrist strap and an antistatic mat connected to the frame of the controller or to the frame of the arm and the ground during all handling of electronic boards or electrical components.



#### **Particular case of HE and Stericlean robots**

- In the event of damage to paintwork (HE or Stericlean arm), it is essential to touch up the paintwork as soon as possible, to protect the part concerned from corrosion (see chapter 6.7).
- We strongly recommend contacting the Stäubli after-sales services to ensure that the repairs are carried out correctly.
- In the event of damage, any failure to comply with these instructions can affect the product's technical characteristics, and hence bring into question Stäubli liability as to guarantee.



#### **SAFETY**

For restarting after any maintenance operation:

- Make sure that the maintenance procedure was followed until its end.
- Check that the connections of the arm have been restored.
- Stay away from the arm during the functional tests.



#### **DANGER**

Read the general safety precautions before carrying out any maintenance operation (see chapter 1.3). The system must be disconnected from the power supply while maintenance operations are carried out on the robot: the master switch on the cell controller **MUST** be set to OFF.



#### **SAFETY**

Make sure that the arm and the load are suitably supported during all work on the robot arm.

## 6.2 - DEFINING THE LEVELS OF INTERVENTION

M0000193.1

Level 1: Operations that can be carried out by a maintenance technician without specific Stäubli training.

Level 2: Operations that can be carried out by a maintenance technician who has undergone specific Stäubli training. The documentation corresponding to these operations will be provided during the training.

Level 3: Operations that must be carried out by the Stäubli Customer Support.



### DANGER

Failure to comply with the levels of intervention can lead to incorrect operation of the robot and entail risks for the user and the machine environment.

## 6.3 - MAINTENANCE FREQUENCY

M0004429.1

| RX160<br>Preventive maintenance                                                     | See chapter | Intervention levels | Periodicity           |      |         |             |              |              |              |              |              |              |
|-------------------------------------------------------------------------------------|-------------|---------------------|-----------------------|------|---------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|
|                                                                                     |             |                     | Every (first reached) |      |         |             |              |              |              |              |              |              |
|                                                                                     |             |                     | Month                 | Year | 5 years | 7 500 hours | 10 000 hours | 15 000 hours | 20 000 hours | 30 000 hours | 40 000 hours | 60 000 hours |
| Safety                                                                              |             |                     |                       |      |         |             |              |              |              |              |              |              |
| ■ Mechanical hard stops (option): Visual check, change if necessary                 |             | 1                   | ◇                     |      |         |             |              |              |              |              |              |              |
| ■ Remote brake release (option): Check operation, replace if necessary              | 2.11        | 1                   | ◇                     |      |         |             |              |              |              |              |              |              |
| ■ Brake: Check brake operation                                                      |             | 2                   |                       | ◇    |         |             |              |              |              |              |              |              |
| ■ Brake: Replace if necessary                                                       |             | 2                   |                       |      |         |             |              |              |              |              |              |              |
| ■ Fastenings (base, tool interface flange, etc.): Check tightness and for corrosion |             | 1                   | ◇                     |      |         |             |              |              |              |              |              |              |
| ■ Power light (option): Check, change if necessary                                  | 2.12.1      | 1                   | ◇                     |      |         |             |              |              |              |              |              |              |
| ■ Check continuity of the protection circuit                                        |             | 2                   |                       | ◇    |         |             |              |              |              |              |              |              |
| General state of the arm                                                            |             |                     |                       |      |         |             |              |              |              |              |              |              |
| ■ External: Visual check for corrosion and collision damage                         |             | 1                   | ●                     |      |         |             |              |              |              |              |              |              |
| ■ Painted parts: Visual check, touch up the paintwork if it has been damaged        | 6.7         | 1                   | Δ                     | ●    |         |             |              |              |              |              |              |              |

| RX160<br>Preventive maintenance                                       | See chapter | Intervention levels | Periodicity           |      |         |             |              |              |              |              |              |              |
|-----------------------------------------------------------------------|-------------|---------------------|-----------------------|------|---------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|
|                                                                       |             |                     | Every (first reached) |      |         |             |              |              |              |              |              |              |
|                                                                       |             |                     | Month                 | Year | 5 years | 7 500 hours | 10 000 hours | 15 000 hours | 20 000 hours | 30 000 hours | 40 000 hours | 60 000 hours |
| Gear boxes: Axis 1 to 4 for standard arm, axis 5 for HD arm (option)  |             |                     |                       |      |         |             |              |              |              |              |              |              |
| ■ Oil level: Check                                                    | 6.8         | 1                   |                       | ●    |         |             |              |              |              |              |              |              |
| ■ Operation (backlash, hard spots)                                    |             | 2                   |                       | ●    |         |             |              |              |              |              |              |              |
| ■ Oil change                                                          |             | 2                   |                       |      | ●<br>H1 | ●<br>H1     | ●<br>H1      | ○            | ●            |              |              |              |
| ■ Replacement                                                         |             | 3                   |                       |      |         |             |              | ●<br>H1      |              | ○<br>H1      |              | ●            |
| Gear boxes: Axis 5 and 6 for standard arm, axis 6 for HD arm (option) |             |                     |                       |      |         |             |              |              |              |              |              |              |
| ■ Oil level: Check                                                    | 6.8         | 1                   |                       | ●    |         |             |              |              |              |              |              |              |
| ■ Operation (backlash, hard spots)                                    |             | 2                   |                       | ●    |         |             |              |              |              |              |              |              |
| ■ Oil change                                                          |             | 2                   |                       |      | ●       |             | ○            |              | ●            |              |              |              |
| ■ Replacement (wrist for standard arm)                                |             | 2                   |                       |      |         |             |              |              | ○            |              | ●            |              |
| ■ Replacement (axis 6 for HD arm)                                     |             | 3                   |                       |      |         |             |              |              | ○            |              | ●            |              |
| Belt transmission for HD arm (option)                                 |             |                     |                       |      |         |             |              |              |              |              |              |              |
| ■ Visual inspection of belt and pulleys                               |             | 1                   |                       | ●    |         |             |              |              |              |              |              |              |
| ■ Belt replacement                                                    |             | 2                   |                       |      | ●       |             | ●            |              |              |              |              |              |
| Sealing                                                               |             |                     |                       |      |         |             |              |              |              |              |              |              |
| ■ Lip seals: Visual check of seepage                                  |             | 1                   | Δ                     | ●    |         |             |              |              |              |              |              |              |
| ■ Lip seals: Replacement                                              |             | 3                   |                       |      |         |             |              |              | Δ            |              | ●            |              |
| ■ Covers, interconnect plate: Visual check                            |             | 1                   | Δ                     | ●    |         |             |              |              |              |              |              |              |
| ■ Covers, interconnect plate flat seals: Replacement                  | 6.5         | 1                   |                       | Δ    | ●       |             |              |              | ●            |              |              |              |
| ■ Pressurization system (option): Check operating pressure on dial    | 2.10        | 1                   | ●                     |      |         |             |              |              |              |              |              |              |

| RX160<br>Preventive maintenance                                                                                  | See chapter | Intervention levels | Periodicity           |      |         |             |              |              |              |              |              |              |
|------------------------------------------------------------------------------------------------------------------|-------------|---------------------|-----------------------|------|---------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|
|                                                                                                                  |             |                     | Every (first reached) |      |         |             |              |              |              |              |              |              |
|                                                                                                                  |             |                     | Month                 | Year | 5 years | 7 500 hours | 10 000 hours | 15 000 hours | 20 000 hours | 30 000 hours | 40 000 hours | 60 000 hours |
| Electrical and pneumatic harness                                                                                 |             |                     |                       |      |         |             |              |              |              |              |              |              |
| ■ Visual check of the harness and connectors, condition of the fixings (covers removed)                          |             | 1                   |                       | ●    |         |             |              |              |              |              |              |              |
| ■ Harness lubrication                                                                                            |             | 2                   |                       | ●    |         |             | ●            |              |              |              |              |              |
| ■ Harness replacement                                                                                            |             | 3                   |                       |      |         |             | ○            |              | ●            |              |              |              |
| ■ Solenoid valves (option): Check operation. Replace if necessary<br>Typical lifetime: 47 000 000 cycles at 5 Hz |             | 1                   | ◇                     |      |         |             |              |              |              |              |              |              |
| Balancing system                                                                                                 |             |                     |                       |      |         |             |              |              |              |              |              |              |
| ■ Visual check                                                                                                   |             | 1                   |                       | ●    |         |             |              |              |              |              |              |              |
| ■ Eccentric spring bearings: Lubricate                                                                           |             | 2                   |                       | ●    |         |             |              |              |              |              |              |              |
| ■ Spring bearings (opposite to eccentric unit): Replacement                                                      |             | 2                   |                       |      |         |             |              |              |              |              | ○            |              |
| ■ Springs: Replacement                                                                                           |             | 2                   |                       |      |         |             |              |              |              |              | ●            |              |
| ■ Eccentric unit: Replacement                                                                                    |             | 3                   |                       |      |         |             |              |              |              |              | ●            |              |

◇: Recommended periodicity: To be adapted in the light of the risk analysis for the application.

●: Typical periodicity ("Standard maintenance" level from OptimizeLab).

○: Recommended typical periodicity for heavy duty applications ("Adapted maintenance" level from OptimizeLab). Consult the Stäubli Customer Support.

Δ: Recommended typical periodicity for applications in harsh environments (such as damp environments) or clean environments (such as CRs). Consult the Stäubli Customer Support.

H1: Typical periodicity ("Standard maintenance" level from OptimizeLab) for joint lubricated with H1 oil, if different from standard preventive maintenance periodicity (if not mentioned, use standard periodicity).

H1: Recommended typical periodicity for heavy duty applications ("Adapted maintenance" level from OptimizeLab), for joint lubricated with H1 oil. Consult the Stäubli Customer Support.

## 6.4 - COVER LOCATIONS AND REMOVAL



M5 screws on the outer covers: Tightening torque = 5.7 Nm.



To ensure a correct seal, it is essential to replace the seal each time a cover is removed.



### Tools required:

- 4 mm Allen key.



### Recommended tools:

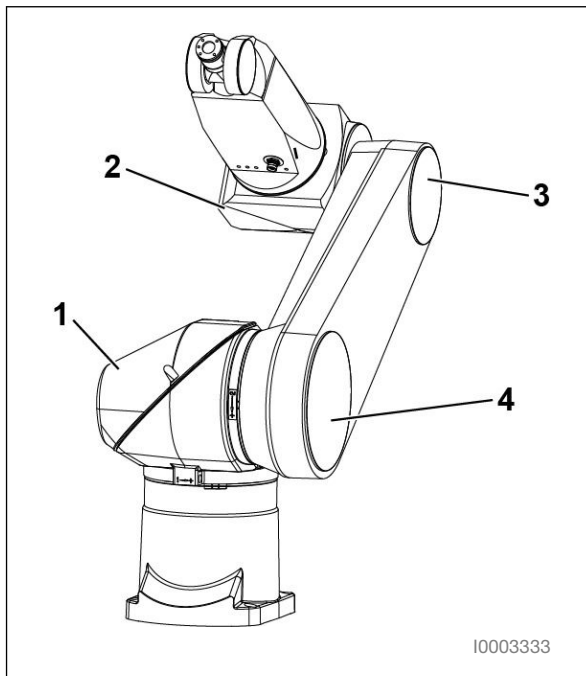
- Torque wrench.

### Initial position:

- Not applicable.

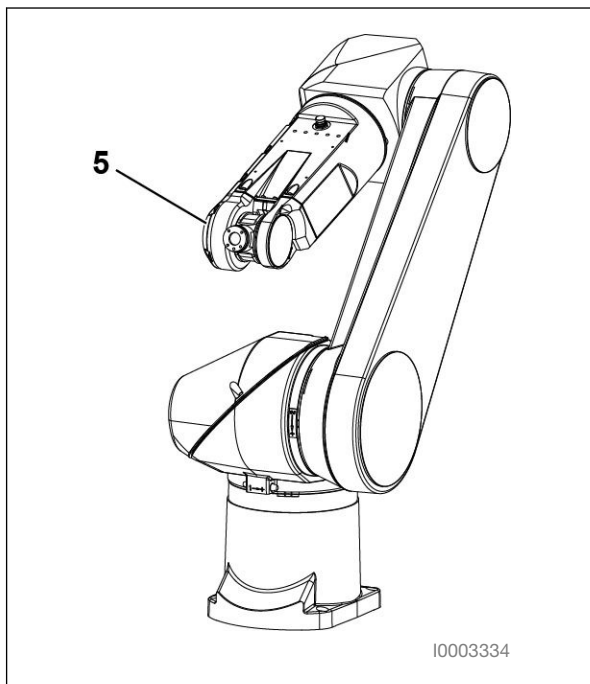


### Procedure:



### RX160/160L/160 HD:

- (1): Shoulder cover and M5 fixing screws.
- (2): Elbow cover and M5 fastening screws.
- (3): Arm cover on spring tension access side and M5 fastening screws.
- (4): Arm cover on counter balance cam grease fitting access side and M5 fastening screws.

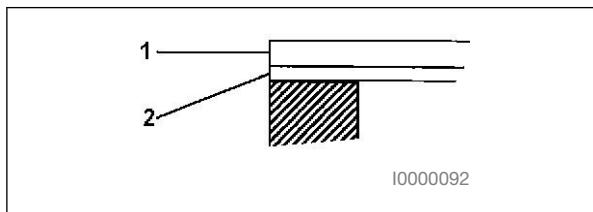


#### RX160 HD:

- **(5):** Axis 5 motor cover and M5 fastening screws.

## 6.5 - PROCEDURE FOR REPLACING THE FLAT SEAL

M0000161.1



#### The flat seal is made up of 2 sections:

- A section made of foam **(1)**,
- An adhesive section **(2)**.

### 6.5.1 - REMOVING THE SEAL

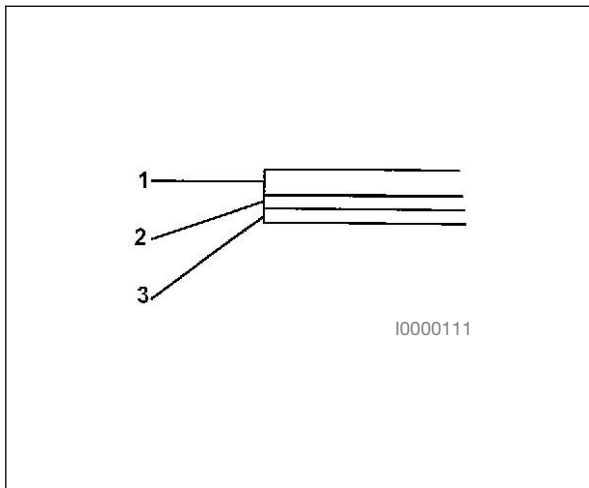
M0000162.1



- To remove the flat seal, peel off a corner of the seal and pull it towards you. If the adhesive section **(2)** remains stuck to the cover, use "C" fluid (ethyl acetate) to remove it.
- Clean the surface, remove all paint and all other particles present on the surface, without scratching it.
- Clean the whole surface using "C" fluid (ethyl acetate).

### 6.5.2 - FITTING A NEW SEAL

M0000163.1



#### The new seal is made up of 3 sections:

- A section made of foam **(1)**,
- An adhesive section **(2)**,
- A protective paper covering the adhesive **(3)**.
- Remove the cut-out sections such as screw holes.
- Present the seal. Line the contour of the seal up with that of the surface.
- Apply the new seal to the surface. Remove a corner of the protective paper covering, apply that part to the surface, and then continue to remove the paper and put the seal into contact with the surface.

## 6.6 - VISUAL CHECK OF THE GENERAL STATE OF THE ARM

M0003567.1

### HE and STERI arms.

Check that nothing is damaging or affecting the outside elements. If this is not the case, it is essential to contact the Stäubli after-sales services.

## 6.7 - PAINT TOUCH-UP PROCEDURE FOR HE AND STERICLEAN ROBOTS

M0000196.1

To protect the surfaces of painted parts from the environment, it is essential to make all necessary touch-ups in the event of scratches.

A paint touch-up kit is available. To order one, contact the Stäubli Customer Support.

The kit includes the paint and the procedure to be followed to carry out the touch-up work.



In the event of damage to the paintwork, failure to comply with these instructions may lead to deterioration in the product's technical characteristics and bring into question Stäubli liability concerning warranty.

## 6.8 - CHECKING OIL LEVELS

M0000110.1



The greasing and lubrication work is carried out by Stäubli in the factory. At the time of delivery, the robot is ready for use.

### 6.8.1 - GENERAL INFORMATION

M0000563.1

The robot requires very little maintenance, but lubrication and the inspections listed below must be carried out at regular intervals to ensure its efficiency over time.



#### DANGER

Read the general safety precautions before carrying out any maintenance operation (see chapter 1.3). The system must be disconnected from the power supply while maintenance operations are carried out on the robot: the master switch on the cell controller **MUST** be set to OFF.



It is advisable to carry out regular, precise preventive maintenance to ensure that the robot keeps its original operating characteristics over long periods.

**6.8.1.1 - Lubricate**

M0000565.1

The type and quantity of lubricant for each lubrication sequence are listed in the table in chapter 7.



Too much or too little oil can prevent the robot from operating correctly.

**6.8.1.2 - Precautions for use of lubricants**

M0000564.1

**SAFETY**

During assembly in the Stäubli factory, the robot is filled up with lubricants that are free of substances harmful to health; however, in some cases, repeated and prolonged exposure to the product can cause skin irritation, or sickness if swallowed.

**DANGER**

In the event of contact with the eyes or the skin, wash the affected areas with plenty of water; if irritation persists, consult a doctor. In the event of swallowing, do not provoke vomiting or administer any products orally; consult a doctor as soon as possible.

**6.8.2 - CHECKING OIL LEVELS**

M0003585.1



Too much or too little oil can prevent the robot from operating correctly.

## 6.8.2.1 - Arm in floor-mounted position



Too much or too little oil can prevent the robot from operating correctly.

**Tools required:**

- 5 mm Allen key.

**Recommended tools:**

- Torque wrench.

**Initial position:**

- Covers removed.

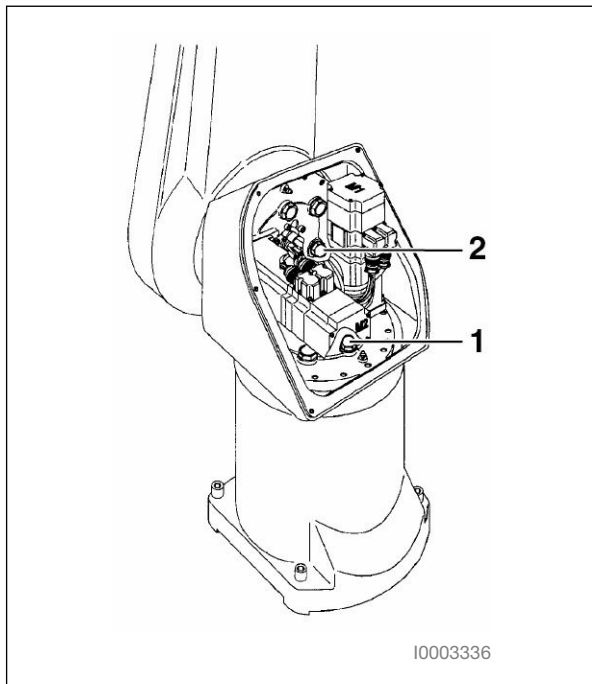
Arm joint positions for oil level checks:

|                                          | Position |         |         |         |            |
|------------------------------------------|----------|---------|---------|---------|------------|
| Check                                    | Joint 1  | Joint 2 | Joint 3 | Joint 4 | Joints 5/6 |
| Joint 1                                  | -        | 0°      | 0°      | 0°      | 0°         |
| Joint 2                                  |          |         |         |         |            |
| Joint 3                                  |          |         | - 40°   |         |            |
| Joint 4                                  |          |         | - 100°  |         |            |
| Joints 5/6<br>(standard arm/L arm)       |          |         | + 105°  |         |            |
| Joint 5<br>(standard arm with HD option) | -        | 0°      | + 120°  | 0°      | 0°         |
| Joint 6<br>(standard arm with HD option) | -        | 0°      | + 112°  | + 180°  | 0°         |

When the robot is in the position shown above, the oil levels to be complied with are as listed below.

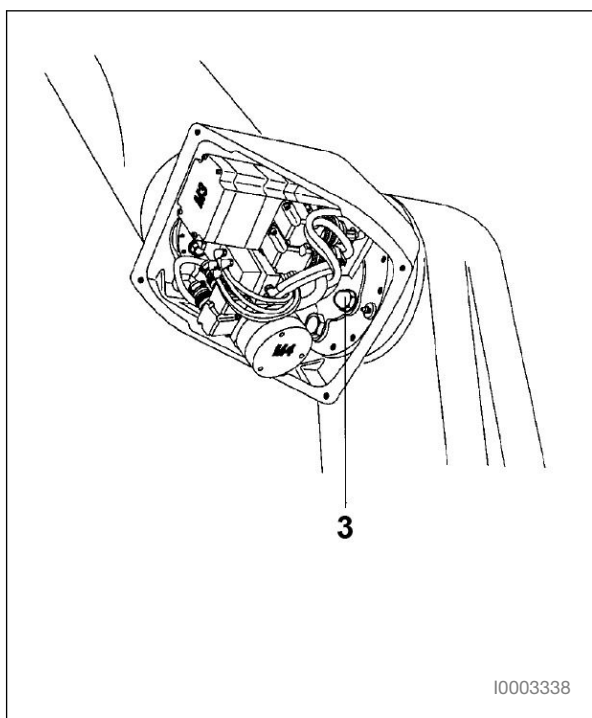


## Procedure:

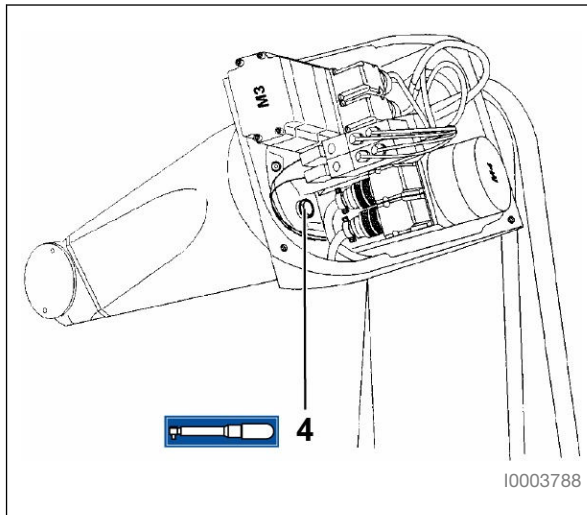


### Standard and L arms:

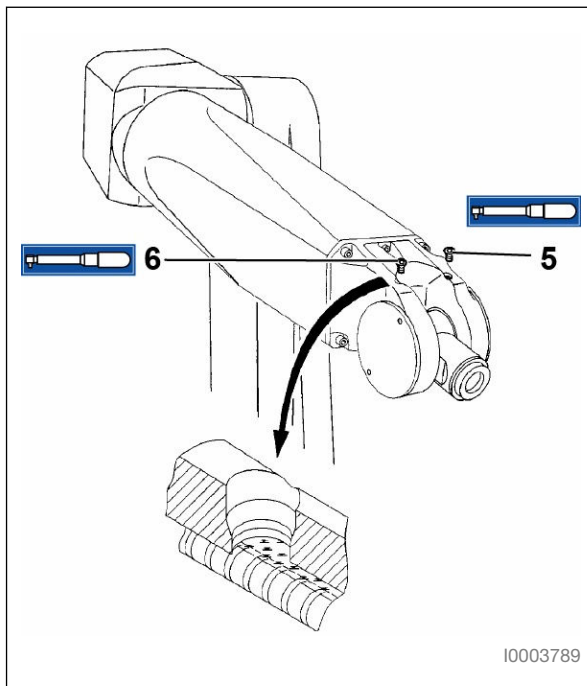
- Joint 1:
  - Oil level flush with lower edge of toothed wheel visible via indicator **(1)**.
- Joint 2:
  - The oil level is in the center of the sight glass **(2)**  $\pm 2$  mm.



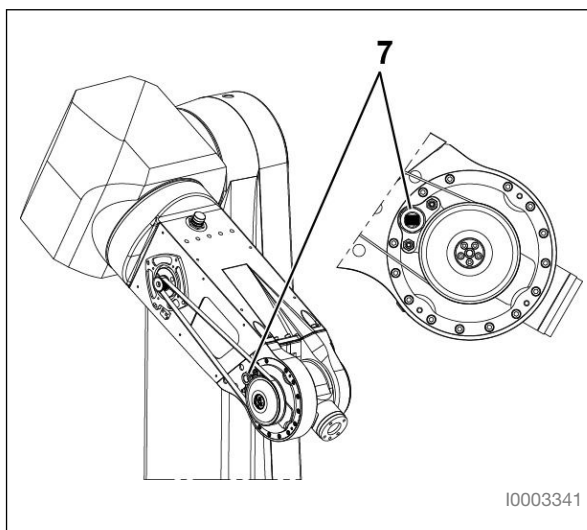
- Joint 3:
  - The oil level is in the center of the sight glass **(3)**  $\pm 2$  mm.



- Joint 4:
  - The oil level coincides with the base of hole  $\varnothing 5.5$  after removing cap (4).
  - Tighten the plug (4) to a torque of 15 Nm.

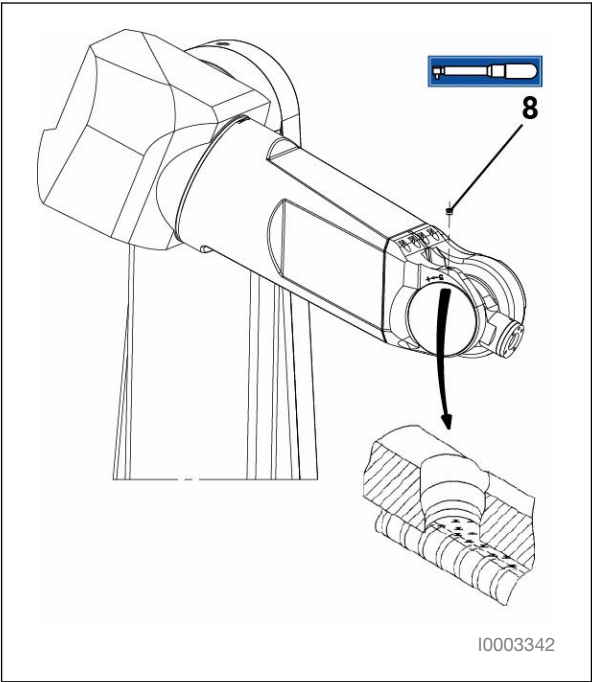


- Joints 5 and 6:
  - The oil level must touch the thread root of the worm screws (plugs removed) (5) and (6).
  - Tighten the plugs (5), (6) to a torque of 4 Nm.



#### Standard arm, HD option:

- Joint 5:
  - The oil level coincides with the centre of the sight glass (7).



- Joint 6:
  - The oil level is flush with the bottom of the worm screw thread (plug removed) **(8)**.
  - Tighten the plug **(8)** to a torque of 4 Nm.

6.8.2.2 - Arm in ceiling-mounted position

M0004423.1



Too much or too little oil can prevent the robot from operating correctly.



**Tools required:**

- 5 mm Allen key.



**Recommended tools:**

- Torque wrench.

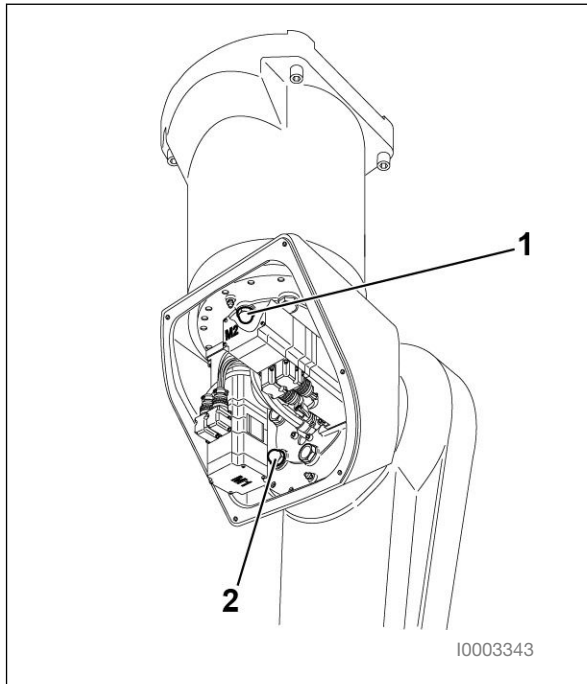
**Initial position:**

- Covers removed.

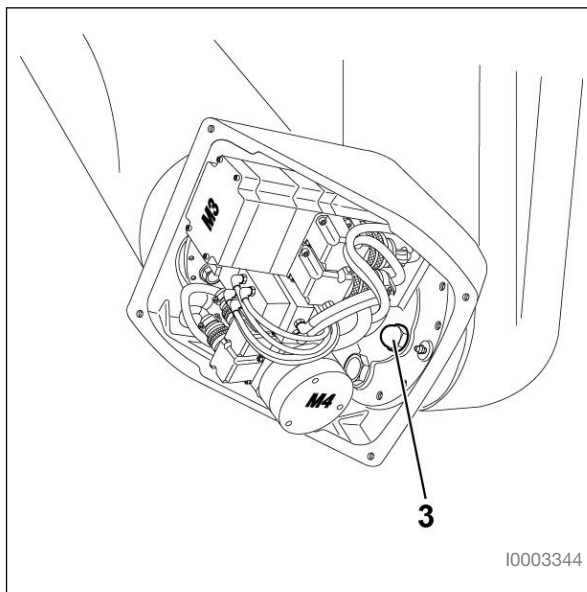
Arm joint positions for oil level checks:

|                                          | Position |         |         |         |            |
|------------------------------------------|----------|---------|---------|---------|------------|
| Check                                    | Joint 1  | Joint 2 | Joint 3 | Joint 4 | Joints 5/6 |
| Joint 1                                  | -        | 0°      | 0°      | 0°      | 0°         |
| Joint 2                                  |          |         |         |         |            |
| Joint 3                                  |          |         | + 140°  |         |            |
| Joint 4                                  |          |         | + 80°   |         |            |
| Joints 5/6<br>(Standard arm/L arm)       |          |         | - 75°   |         |            |
| Joint 5<br>(standard arm with HD option) | -        | 0°      | - 60°   | 0°      | 0°         |
| Joint 6<br>(standard arm with HD option) | -        | 0°      | - 68°   | + 180°  | 0°         |

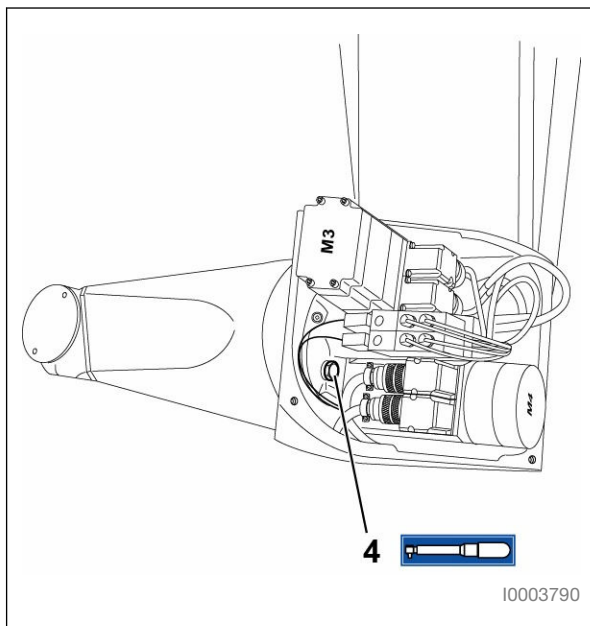
When the robot is in the position shown above, the oil levels to be complied with are as listed below.

**Procedure:****Standard and L arms:**

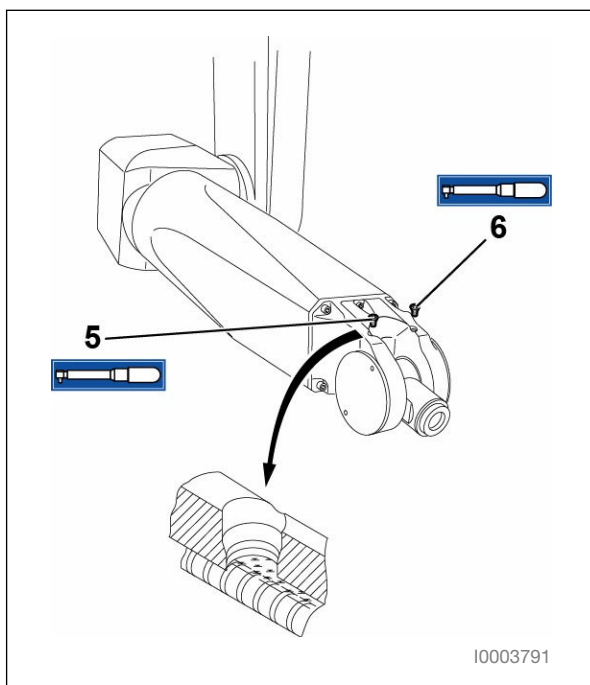
- Joint 1:
  - The indicator is filled with oil **(1)**.
- Joint 2:
  - The sight glass **(2)** is almost full, level between 0 and -2 mm from the upper edge.



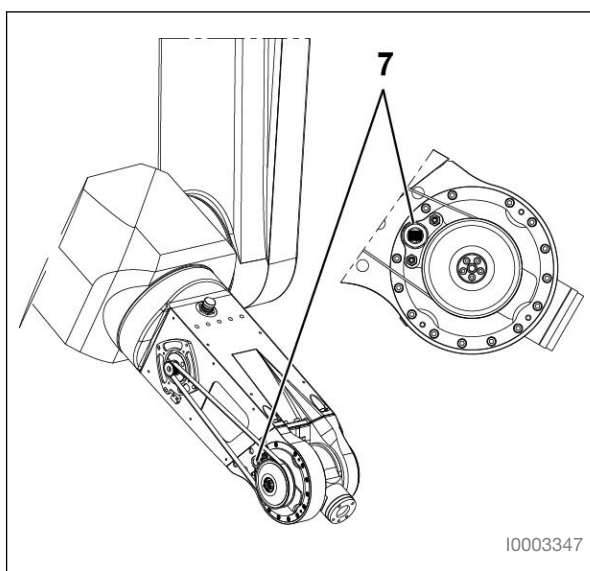
- Joint 3:
  - The sight glass **(3)** is almost full, level between 0 and -2 mm from the upper edge.



- Joint 4:
  - The oil level coincides with the base of hole Ø5.5 after removing cap **(4)**.
  - Tighten the plug **(4)** to a torque of 15 Nm.

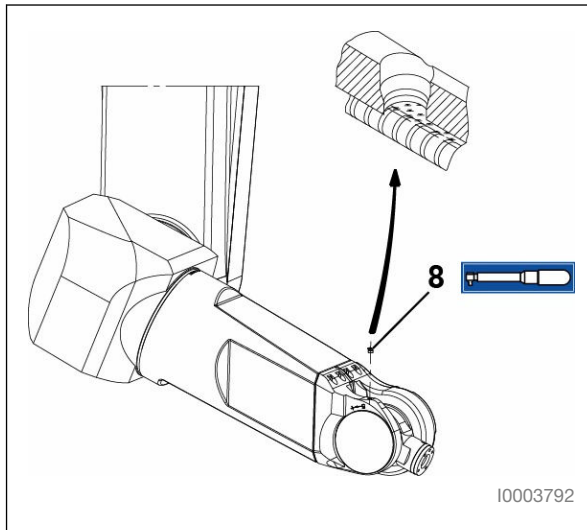


- Joints 5 and 6:
  - The oil level must touch the thread root of the worm screws (plugs removed) (5) and (6).
  - Tighten the plugs **(5)**, **(6)** to a torque of 4 Nm.



#### Standard arm, HD option:

- Joint 5:
  - The oil level coincides with the centre of the sight glass **(7)**.



- Joint 6:
  - The oil level is flush with the bottom of the worm screw thread (plug removed) (8).
  - Tighten the plug (8) to a torque of 4 Nm.

## 6.9 - CHECKING THE TOOTHED BELT ON JOINT 5 (STANDARD ARM WITH HD OPTION)

M0004424.1



### Tools required:

- Not applicable.



### Recommended tools:

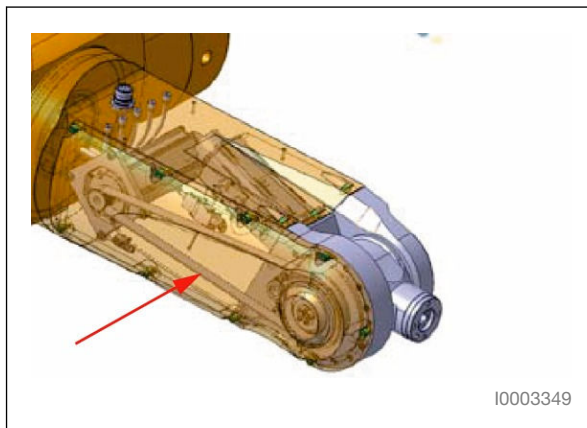
- Not applicable.

### Initial position:

- Forearm cover removed.



### Procedure:



- Check the condition of the belt without removing it (do not force or twist the belt).
- Replace the belt if necessary (Consult Stäubli).

## 6.10 - REPLACING A SOLENOID VALVE BLOCK ASSEMBLY

M0003576.1



Make sure that the arm and the load are suitably supported during all work on the robot arm. The air supply must be cut off. Make sure the cut-off does not make the load fall.

## 6.10.1 - STANDARD ARM/STANDARD ARM, HD OPTION

M0004425.1

**Tools required:**

- Flat-bladed screwdriver.

**Recommended tools:**

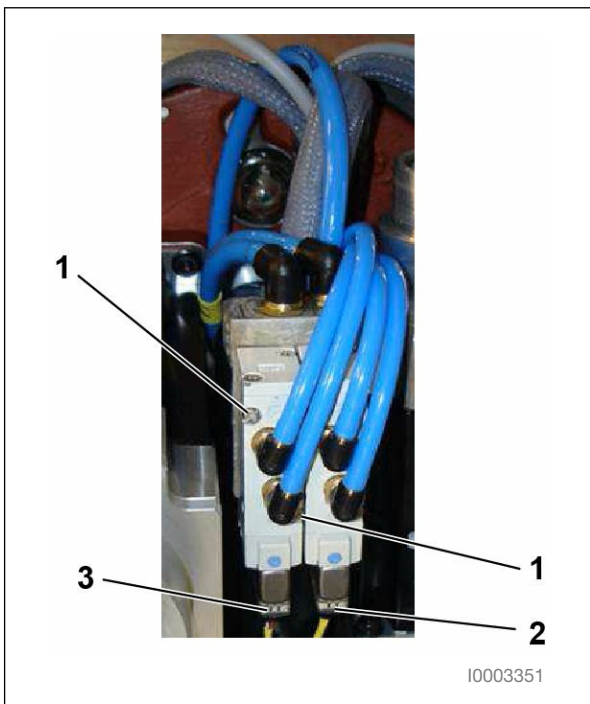
- Not applicable.

**Initial position:**

- Elbow cover removed.

**Procedure:****Elbow:**

- Removal:
  - Remove the following parts if necessary:
    - The connector air outlets.
    - Connectors J8A **(2)** and J8B **(3)**.
  - Remove the 2 screws **(1)**.
  - Remove the solenoid valve block.
- Refitting:
  - Replace the solenoid valve block and its flat seal.
  - Execute the assembly operations in reverse order.



## 6.10.2 - CLEAN ROOM APPLICATION



### Tools required:

- 2.5 and 5 mm hex keys.



### Recommended tools:

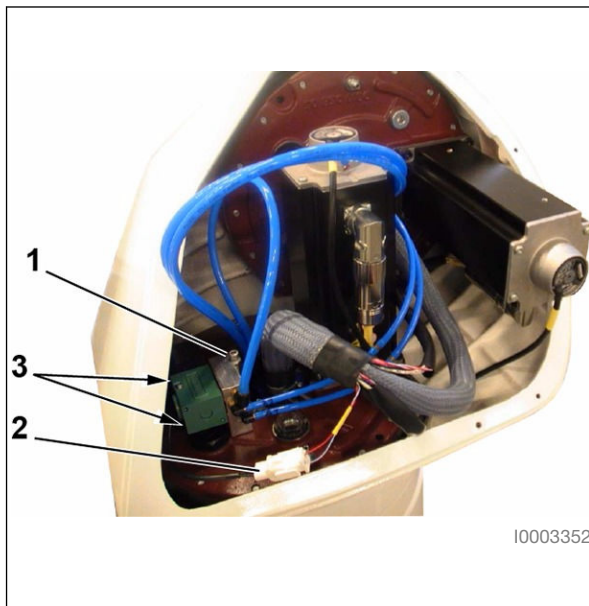
- Not applicable.

### Initial position:

- Shoulder cover removed.
- Elbow cover removed.

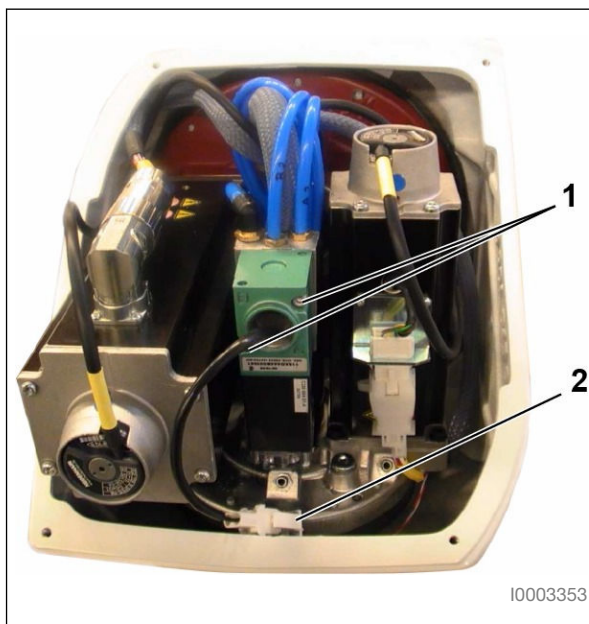


### Procedure:



#### Shoulder:

- Removal:
  - Remove the connector J1V (2).
  - Remove the screw (1).
  - Remove the solenoid valve block and holder unit.
  - Remove the 2 fixing screws (3) holding the solenoid valve block in place.
  - Remove the solenoid valve block.
- Refitting:
  - Replace the solenoid valve block and its flat seal.
  - Execute the assembly operations in reverse order.



#### Elbow:

- Removal:
  - Remove the connector J2V (2).
  - Remove the 2 screws (1).
  - Remove the solenoid valve block.
- Refitting:
  - Replace the solenoid valve block and its flat seal.
  - Execute the assembly operations in reverse order.

## 6.11 - RECOMMENDED CHECKS AFTER A ROBOT COLLISION

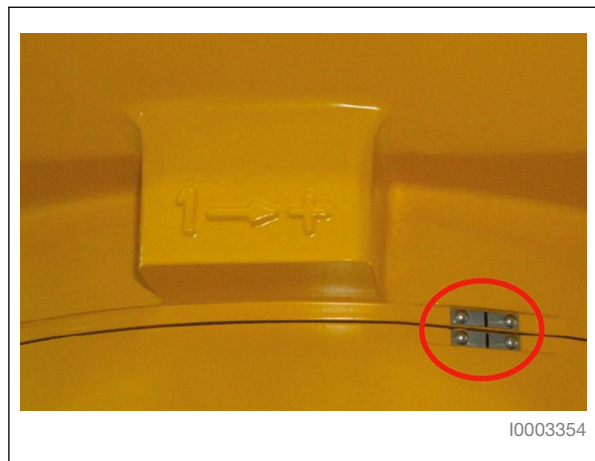
M0003580.1

In the event of a handling or programming error, a robot movement may result in a crash. To make sure the collision has not affected the robot's internal mechanical elements, check the alignment of the marks calibrated during assembly at Stäubli prior to dispatch of the arm or the references determined by the customer (RefBras, RefCellule).

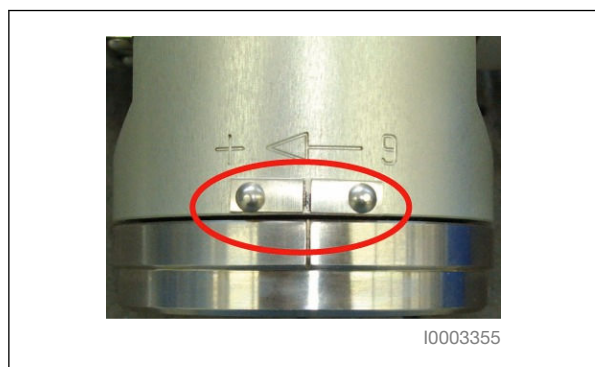


Before making any such checks, make sure you can do so in full safety by ensuring that the movement speed is set to a suitable level (we recommend 25% of the nominal speed).

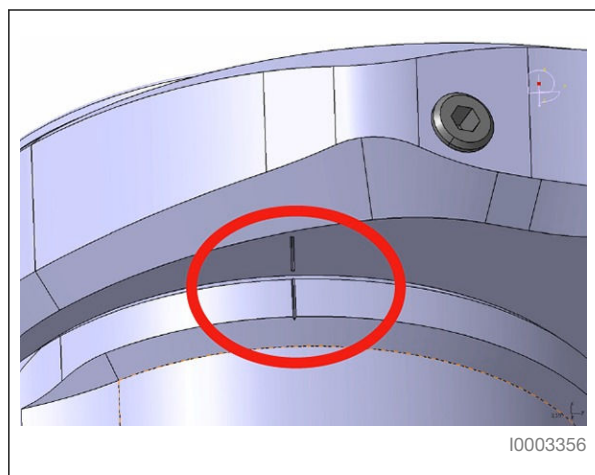
In the event of an offset, carry out an adjustment procedure.



Type of "Factory marks" for axes 1, 2, 3 and 4 (marks lined up) on standard arm and standard arm with HD option.



Type of "Factory marks" for axes 5 and 6 (engravings and marks lined up) on standard arm.



Type of "Factory marks" for axes 5 and 6 (engravings lined up) on standard arm with HD option.

# 7 - RECOMMENDED LUBRICANTS AND SPARE PARTS

## 7.1 - RECOMMENDED LUBRICANTS AND SPARE PARTS

M0004427.1



To ensure correct operation of the robot, it is essential to use original Stäubli parts when making repairs.

Type of lubricants and approximate quantities (the quantities are given for information purposes only, please refer to the oil level):

Standard RX160 arm:

|              | Standard lubricant        | H1 option                 | Quantity |
|--------------|---------------------------|---------------------------|----------|
| Axis 1       | ROBOLUB 68-S              | ROBOLUB 100-H1            | 750 ml   |
| Axis 2       | ROBOLUB 68-S              | ROBOLUB 100-H1            | 270 ml   |
| Axis 3       | ROBOLUB 68-S              | ROBOLUB 100-H1            | 110 ml   |
| Axis 4       | ROBOLUB 68-S              | ROBOLUB 100-H1            | 80 ml    |
| Axis 5       | ROBOLUB 1000-H1           | ROBOLUB 1000-H1           | 450 ml   |
| Axis 6       |                           |                           |          |
| Harness      | MOBIL MOBILITH SHC PM 460 | MOBIL MOBILITH SHC PM 460 | -        |
| Cam bearings | SHELL GADUS S5 T460       | SHELL GADUS S5 T460       | -        |

Standard RX160 arm with HD option:

|              | Standard lubricant        | H1 option             | Quantity |
|--------------|---------------------------|-----------------------|----------|
| Axis 1       | ROBOLUB 68-S              | -                     | 750 ml   |
| Axis 2       | ROBOLUB 68-S              | -                     | 270 ml   |
| Axis 3       | ROBOLUB 68-S              | -                     | 110 ml   |
| Axis 4       | ROBOLUB 68-S              | -                     | 80 ml    |
| Axis 5       | ROBOLUB 150-S             | -                     | 200 ml   |
| Axis 6       | KLÜBER GH6-1500           | -                     | 350 ml   |
| Harness      | MOBIL MOBILITH SHC PM 460 | -                     | -        |
| Cam bearings | SHELL GADUS S5 T460       | -                     | -        |
| Belt         | LUPROTEC PTFE PROFLON     | LUPROTEC PTFE PROFLON | -        |

Recommended spare parts:

- Solenoid valve and its flat seal.
- Cover seal kit.
- Paint kit.

