

Arm - RX series I70B family

Characteristics



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CHAPTER 1

DESCRIPTION

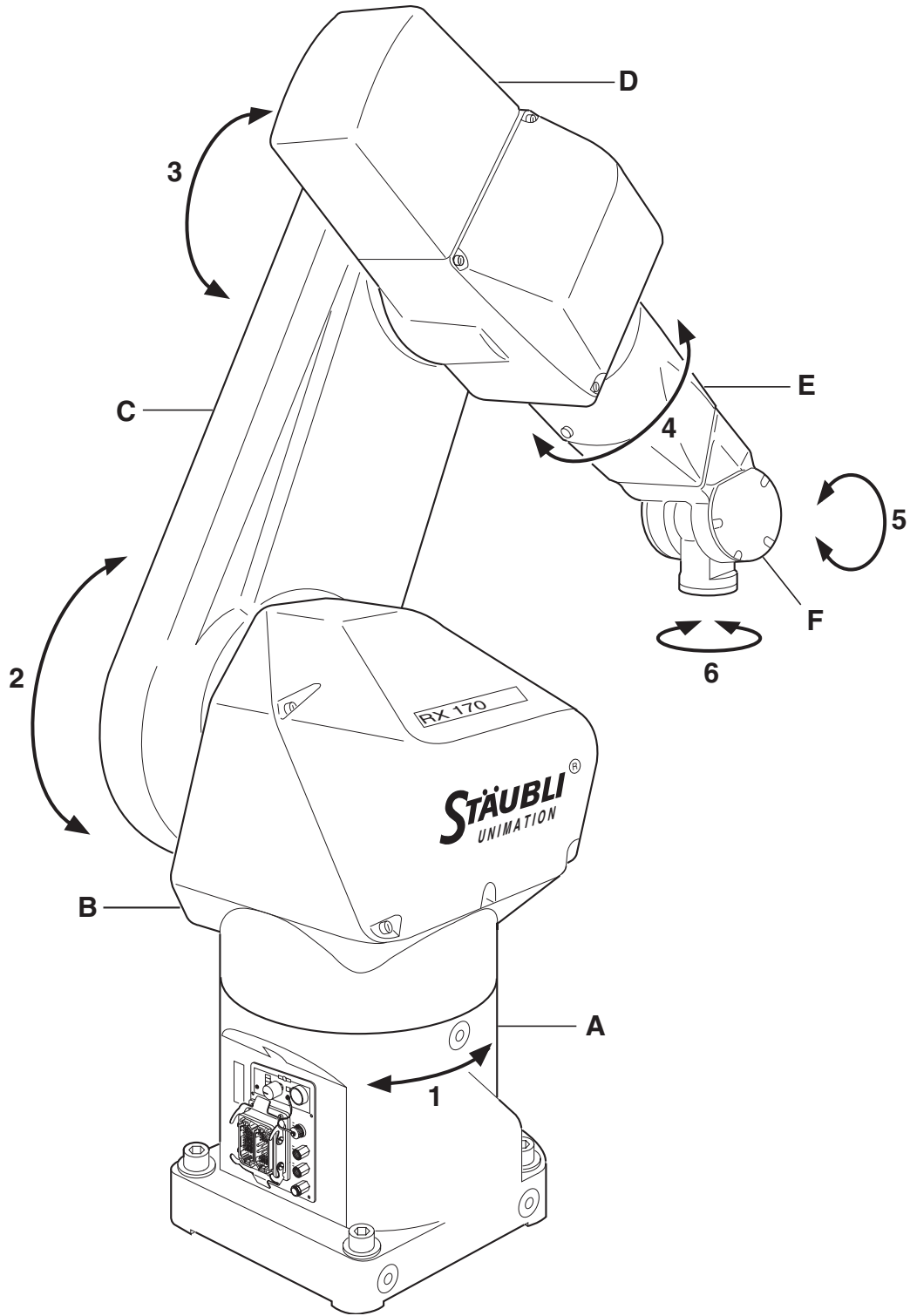


Figure 1.1

1.1. GENERAL PRESENTATION

The arm consists of segments or members interconnected by joints.

Each joint comprises an axis around which two members pivot.

The movements of the robot's joints are generated by brushless motors coupled to resolvers. Each of these motors is equipped with a parking break.

This reliable and robust assembly associated with an innovative counting system allows the absolute position of the robot to be known at all times.

The arm assembly is sufficiently 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 restrictive: for further information, please consult us.

The various elements of the robot's arm are: the base **(A)**, the shoulder **(B)**, the arm **(C)**, the elbow **(D)**, the forearm **(E)** and the wrist **(F)** (**figure 1.1**).

The robot arm assembly thus contains the motorization, brakes, motion transmission mechanisms, cable bundles, pneumatic and electric circuits for the user and the counterbalance system.

Of simple construction, the RX170B arm assembly consists of a rigid and encased structure (protection IP65 to standard NF EN 60529) to protect it against external aggressions. Its design is based on transmission modules: JCS (STÄUBLI Combined Joint) used on joints 1, 2, 3 and 4 (**figure 1.1**).

The wrist consists of joints 5 and 6 (**figure 1.1**).

Arm balance is performed by an integrated spring system. The arm has a built-in spring counterbalance system giving an attractive low weight system.

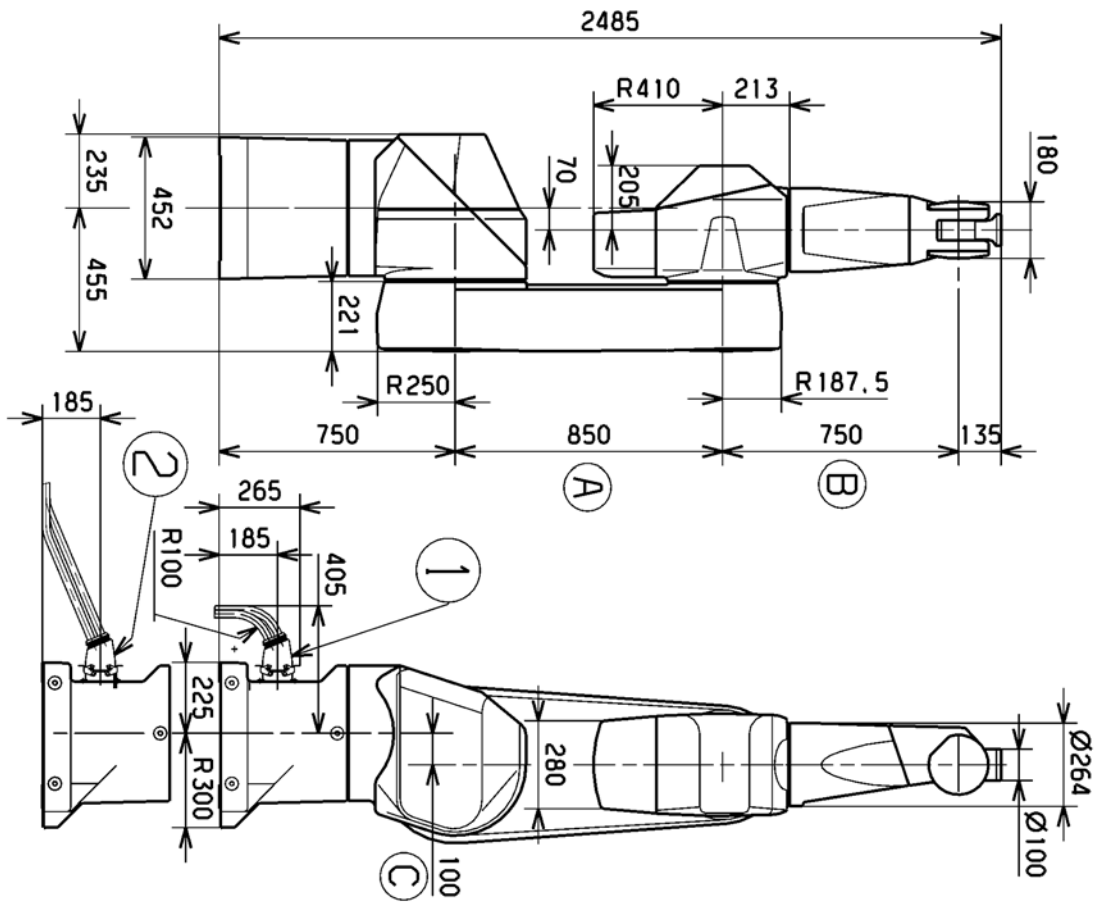


Figure 1.2

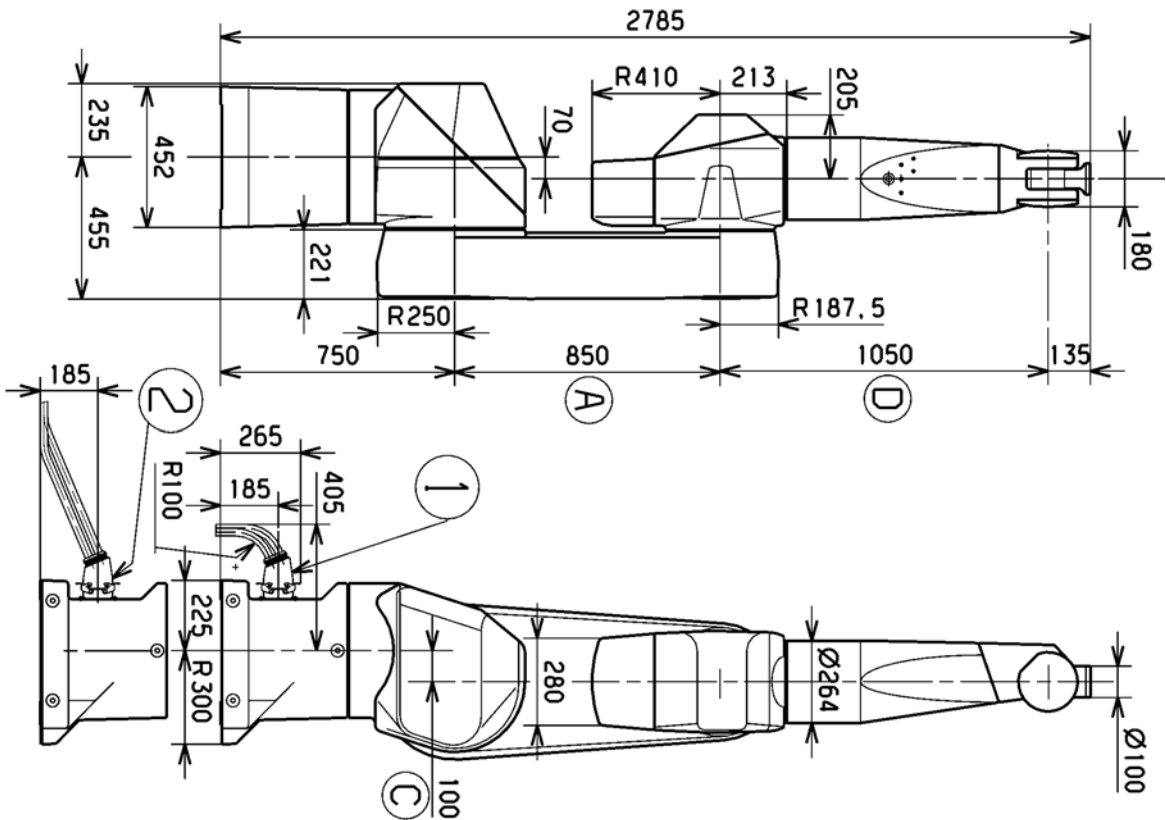


Figure 1.3

1.2. DESIGNATION OF ROBOTS OF THE RX SERIES 170B FAMILY

RX	17	0	B	CR
(1)	(2)	(3)	(4)	(5)

- (1) RX family arm
- (2) Maximum reach between joints 1 and 5 expressed in decimeters:
dimension (A) + dimension (B) + dimension (C)
- (3) Number of active joints:
 - 0 = 6 active joints.
 - 5 = 5 active axes (axis 4 in the 6 axes robot is not motor driven), as the geometry is retained.
- (4) RX family changed to "B".
- (5) Upper case letters to indicate an option.
 - L = extended forearm: dimension (A) + dimension (C) + dimension (D) **(figure 1.3)**.
 - CR = clean room application.
 - HP = heavy load carried.

These letters can be combined.

Example: LCR = extended forearm clean room application.

In the manual, the following terminology is used:

Standard arm: for arm with standard geometry **(figure 1.2)**.

Long arm: for arm with different geometry where forearm is extended **(figure 1.3)**.

5-joint arm: for arm with 5 active joints.

Heavy load arm: Arm that carries a heavy load.

1.3. GENERAL CHARACTERISTICS

1.3.1. OVERALL DIMENSIONS (figures 1.2 and 1.3)

- ① Vertical cable outlet
- ② Horizontal cable outlet

1.3.2. WORK ENVIRONMENT

- Working temperature: + 5°C to + 40°C (according to standard(s) and/or directive(s): NF EN 60 204-1)

CAUTION:

It may be necessary to perform a warm-up cycle before nominal performances are obtained.

- Humidity: 30% to 95% max. non-condensing (according to standard(s) and/or directive(s): NF EN 60 204-1)
- Altitude: 2000 m max
- Vibrations: please consult us

Clean room application: Cleanliness class ISO 5 according to standard 14644-1

1.3.3. WEIGHT

STANDARD ARM	LONG ARM	5-JOINT ARM	LONG 5-JOINT ARM	ARM HP	ARM 5 AXES HP
721 kg	726 kg	706 kg	711 kg	726 kg	711 kg

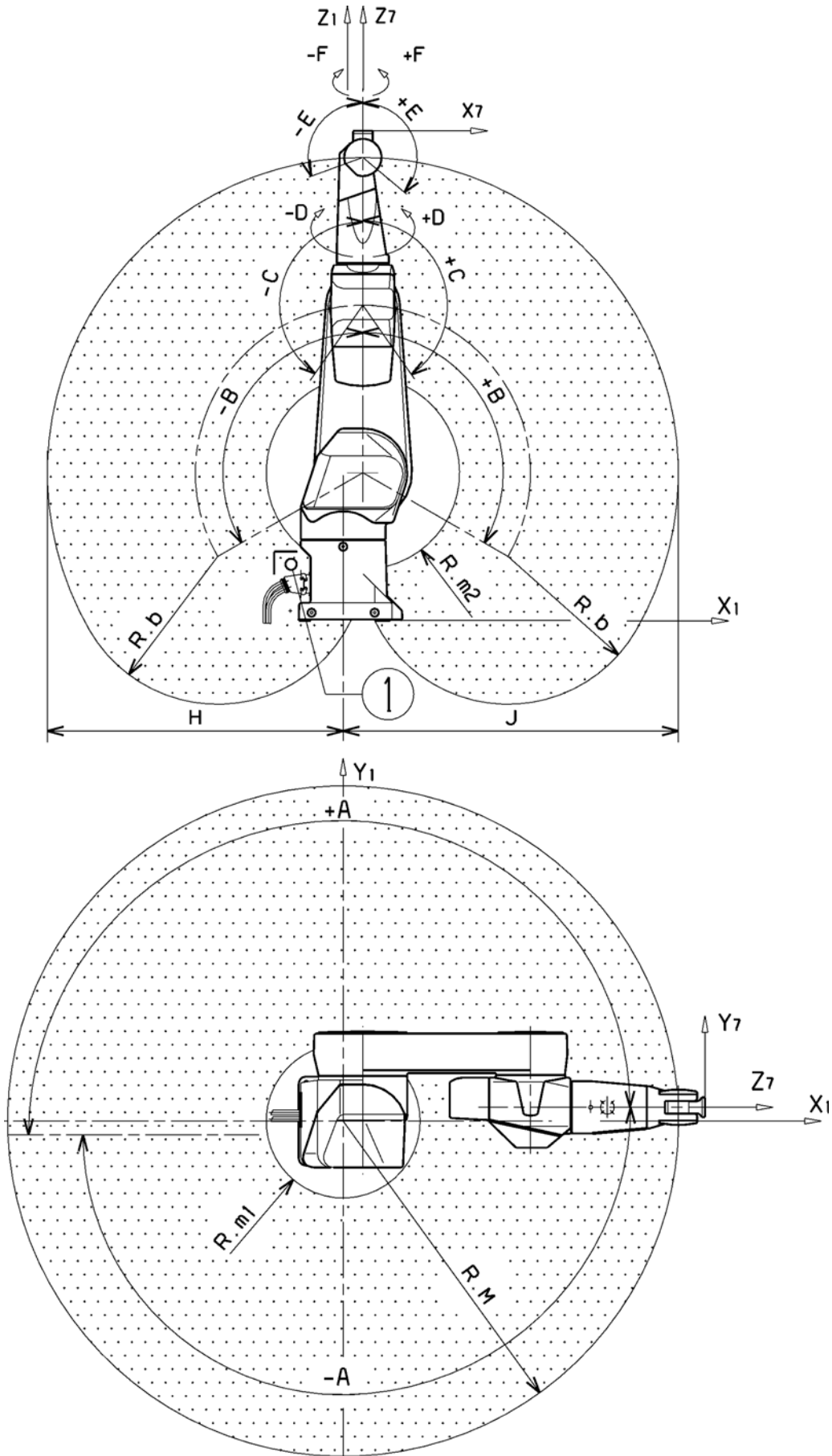


Figure 1.4

1.4. PERFORMANCE

See figure 1.4

① Brake release access area

	STANDARD ARM	LONG ARM	HEAVY LOAD ARM
Work envelope			
R.M max. reach between joints 1 and 5	1701.4 mm	2001.2 mm	1701.4 mm
R.m1 min. reach between joints 1 and 5	390 mm	502 mm	390 mm
R.m2 min. reach between joints 2 and 5	490 mm	602 mm	490 mm
R.b reach between joints 3 and 5	750 mm	1050 mm	750 mm
H	1500 mm	1800 mm	1500 mm
J	1700 mm	2000 mm	1700 mm
Maximum speed at load center of gravity	11.9 m/s	14.6 m/s	5.8 m/s
Repeatability at constant temperature	± 0.04 mm	± 0.05 mm	± 0.04 mm

1.4.1. TORQUE LIMITS

		REFERENCE JOINT		
		JOINT 5 (Z ₆)		JOINT 6 (Z ₇)
STANDARD ARM AND LONG ARM	Static torque (Nm)	129 ⁽¹⁾	93 ⁽²⁾	36
	Peak torque (Nm)	847 ⁽¹⁾	574 ⁽²⁾	273
HEAVY LOAD ARM	Static torque (Nm)	180 ⁽¹⁾	103 ⁽²⁾	77
	Peak torque (Nm)	847 ⁽¹⁾	574 ⁽²⁾	273

(1) if joint 6 torque = 0

(2) for maximum torque on joint 6

1.4.2. AMPLITUDE, SPEED AND RESOLUTION

Joint	STANDARD ARM AND LONG ARM						HEAVY LOAD ARM					
	1	2	3	4 ⁽¹⁾	5	6	1	2	3	4 ⁽¹⁾	5	6
Amplitude (°)	360	240	290	540	240	540 ⁽²⁾	360	240	290	540	240	540 ⁽²⁾
Working range distribution (°)	A ± 180	B ± 120	C ± 145	D ± 270	E +130 -110	F ± 270	A ± 180	B ± 120	C ± 145	D ± 270	E +130 -110	F ± 270
Nominal speed (°/s)	130	115	135	190	200	297	91	57	67	95	100	148
Maximum speed (°/s)	155	130	205	237	243	562 ⁽³⁾	155	130	205	237	151	562 ⁽³⁾
Angular resolution (°·10 ⁻³)	0.568	0.48	0.502	0.87	1.373	1.373	0.568	0.48	0.502	0.87	0.854	1.373

(1) For 5-joint arms, joint 4 is fixed. Joint 5 corresponds to joint 4 and joint 6 to joint 5 of the software.
 (2) Multiturn version available as an option.
 (3) without axis 5 interaction.

Low speed for manual control pendant:

- cartesian mode 250 mm/s
- revolute mode: 10% of nominal speeds

Maximum Cartesian speed:

- 0.8 m/s Heavy load arm
- 1.5 m/s Standard arm and long arm

CAUTION:

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

1.4.3. MODIFICATION OF AMPLITUDES

The arm is installed to obtain maximum angular amplitudes.

The amplitude of the joints can be voluntarily limited by the "software" (see chapter on programming). In addition, on axes 1, 2 and 3, the position of the mechanical travel stops and, where applicable, the electrical stops, can be changed for a number of different positions (for modification, please consult STÄUBLI).

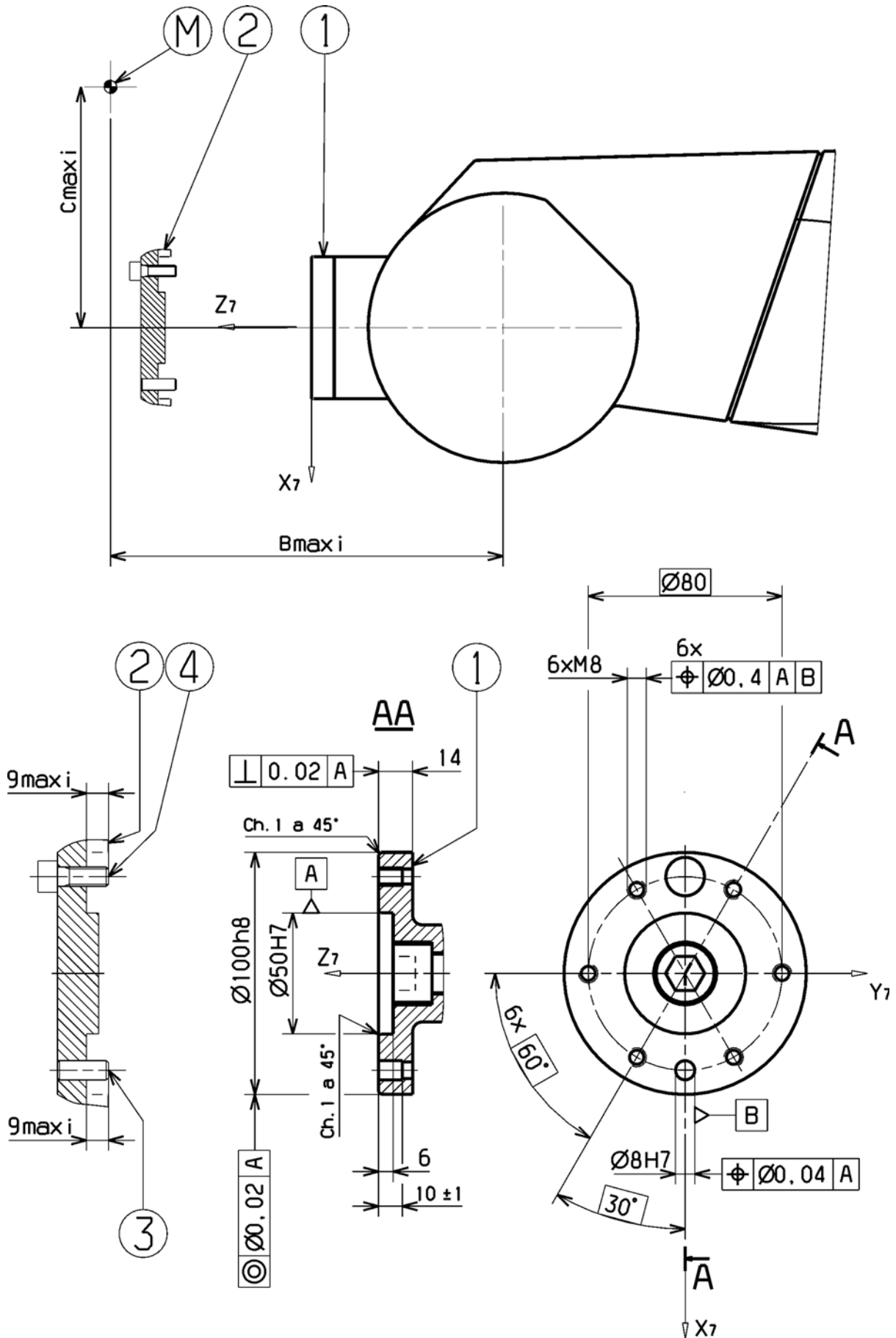


Figure 1.5

1.5. LOAD CAPACITY – MECHANICAL INTERFACE

- ① Mechanical interface
- ② End-effector

The end-effector is not supplied with the robot arm assembly; its design depends on the robot's specific applications. All studies can be undertaken in cooperation with STÄUBLI to obtain optimum performance without exceeding the robot arm assembly load limits. The terminal is fitted on the handle flange and its dimensions are shown in figure 1.5

Attachment by 6 M8 screws item ④ , Class 12-9, torque 42 Nm ± 3 Nm.

Indexing by pin item ③ , diameter 8.

Mechanical interface designation:

ISO 9409 - 1 - A80 as per Standard ISO 9409 - 1 : 1996 (F)

(except the localization of the 6 M8 threaded holes)

CAUTION:

The length of the mounting screws used for the feeler or clamp is restricted so that they do not come through to the back of the mounting flange (figure 1.5).

1.5.1. LOAD CAPACITY

Load characteristics:

Load center of gravity position ⑤	Standard arm	Long arm	Heavy load arm	
B in relation to axis 5	300 mm	350 mm	300 mm	200 mm
C in relation to axis 6	120 mm	150 mm		100 mm

Load capacity	Standard arm	Long arm	Heavy load arm
At nominal speed ⁽¹⁾	30 kg	20 kg	60 kg
At reduced speed ⁽¹⁾		24 kg	
Refer to us if:	Load > 30 kg	Load > 24 kg	Load > 60 kg

(1) In all configurations

	NOMINAL INERTIAS (kg.m ²)			MAXIMAL INERTIAS (kg.m ²) ⁽²⁾		
	Standard arm	Long arm	Heavy load arm	Standard arm	Long arm	Heavy load arm
For joint 5	2.70	2.45	5.40	13.5	12.25	27
For joint 6	0.43	0.45	0.6	2.15	2.25	3

2) under reduced speed and acceleration conditions:

For CS7B: SP60, Acc(8) 50,50.

For CS8: VEL = 60%, Acc = 30%, DEC = 30%.

CAUTION:

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.

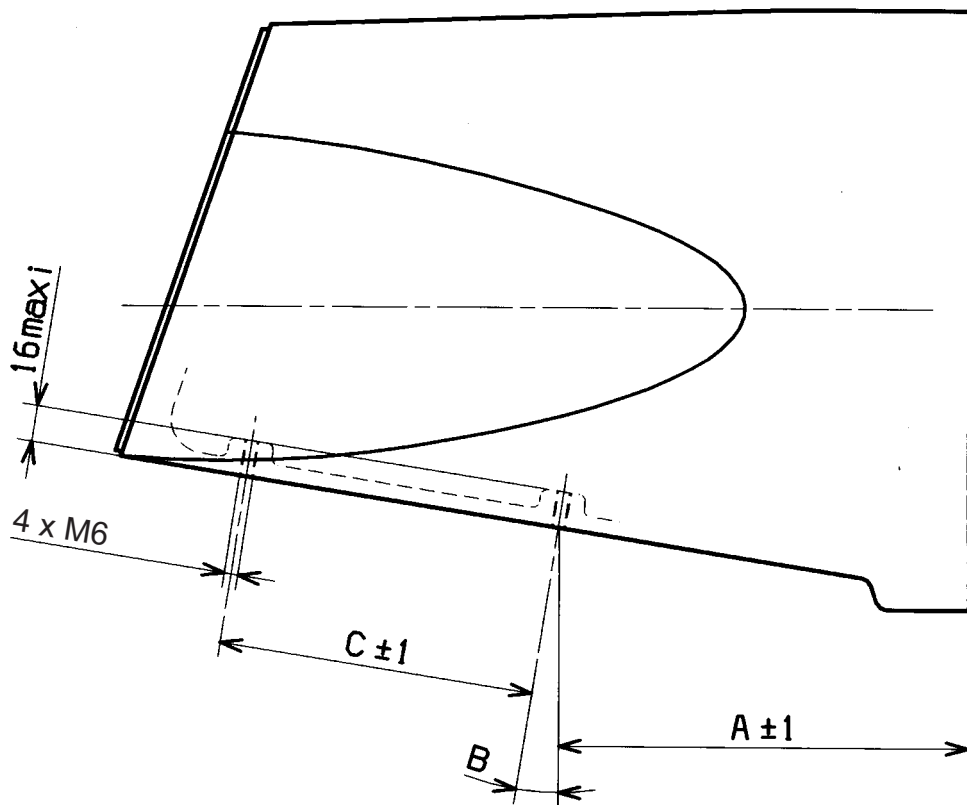
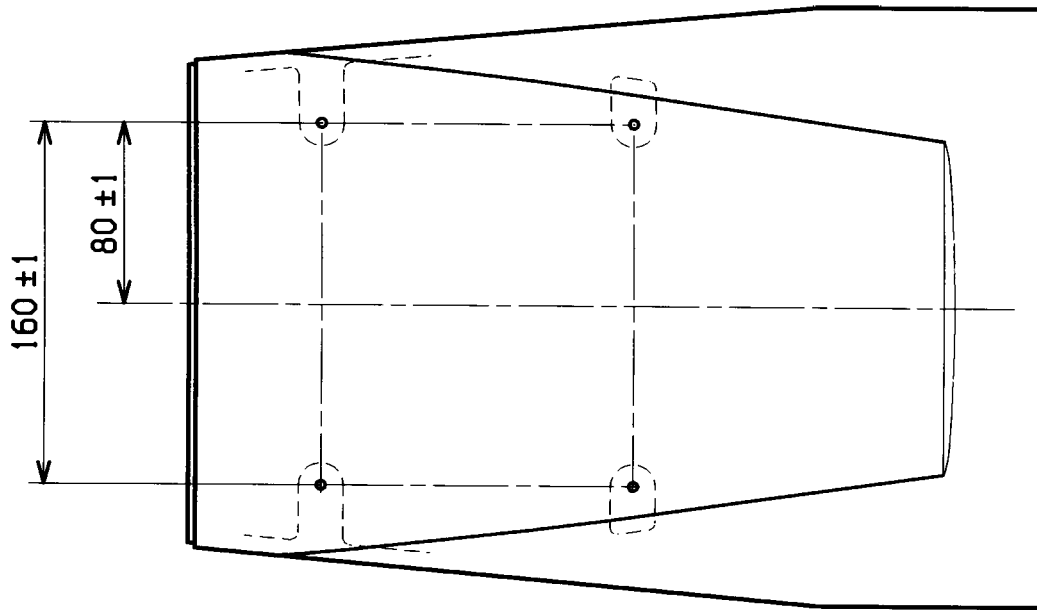


Figure 1.6

1.5.2. ATTACHMENT OF ADDITIONAL LOAD ON FOREARM

Holes to be drilled after removing the handle (see figure 1.6).

DIMENSIONS	STANDARD ARM HP	LONG ARM
A ± 1 mm	182	501.5
B	9°	8.5°
C ± 1 mm	140	120

CAUTION:

The additional load depends on nominal load; in all cases, do not exceed load characteristics.

No chip is allowed in the forearm during drilling.

Ensure sealing if liquids are projected onto the forearm.

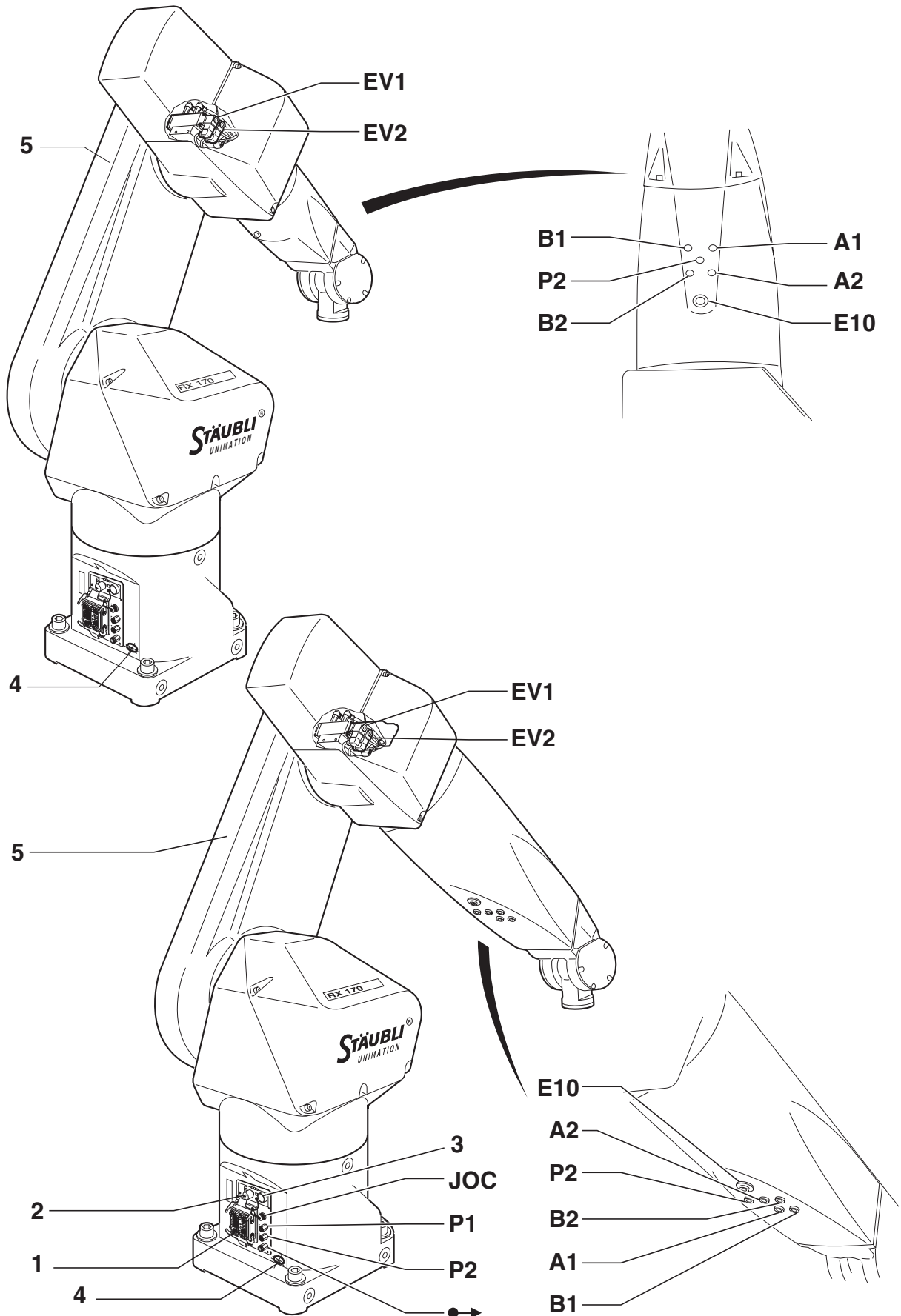


Figure 1.7

1.6. USER CIRCUIT

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. These components are connected by means of removable connectors.

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

The arm also provides a pneumatic hose (**P2**) that directly links the base to the forearm.

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 1.7

- Connector Harding for interconnecting the arm/controller **(1)**.
- R23 connector intended for the user for possible electrical connection of grip (**JOC**).

CAUTION:

When a connector is connected to the Binder E10 socket, there is a collision hazard between it and the arm (5) casing when the forearm is turned by 90°

- Brake release selector **(2)**.
- Brake release pushbutton **(3)**.
- Compressed air network pneumatic (or vacuum) connections **P1** and **P2**.
- Pneumatic (or vacuum) exhaust muffler .
- Arm ground connection **(4)**.

CAUTION:

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.

1.7. RELEASING JOINT BRAKE

The controller must be switched on.

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

CAUTION:

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

Press the brake release pushbutton, the selected joint is totally free. When the pushbutton is released, the brakes will then be engaged and the corresponding joint locked.

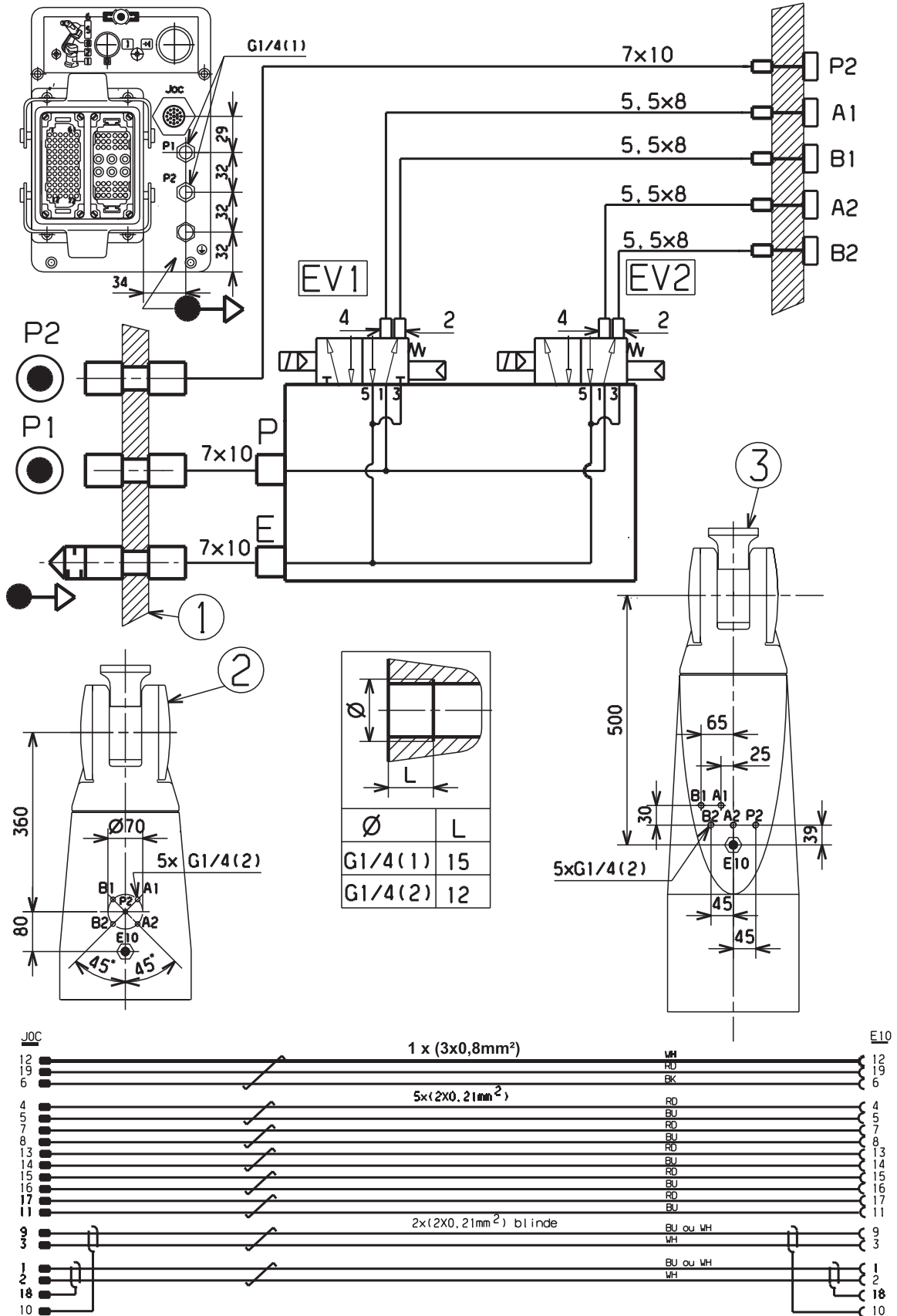


Figure 1.8

1.8. PNEUMATIC AND ELECTRIC CIRCUITS FOR ALL ARMS

1.8.1. PNEUMATIC CIRCUIT

- ① Plate attached to base
- ② Forearm

Solenoid valves (EV1 and EV2):


- 5/2-way monostable.
- Electrically controlled (24 VDC).
- Working pressure: 10 bar.
- Rated flow: 1400 l/min.
- Connector shape B (DIN 43 650).
- Overvoltage protective circuit and indicator diode.

Description (figure 1.8)

- The arm is connected to the compressed air network (6 bars max., lubricated or not) via the base **P1**.

CAUTION:

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 .

1.8.2. ELECTRIC CIRCUIT (figure 1.8)

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 command 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 command 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 - 25 VAC.

Permissible current:

- 3-wire conductor AWG18: 4.5 A per contact.
- Pairs and shielded pairs AWG24: 2 A per contact.

CAUTION:

Do not use the shields as a conductive cable.

- Connection to forearm (**E10**) by R23 elbow male cylindrical connector.
- Connection to base (**JOC**) by R23 straight female cylindrical connector.

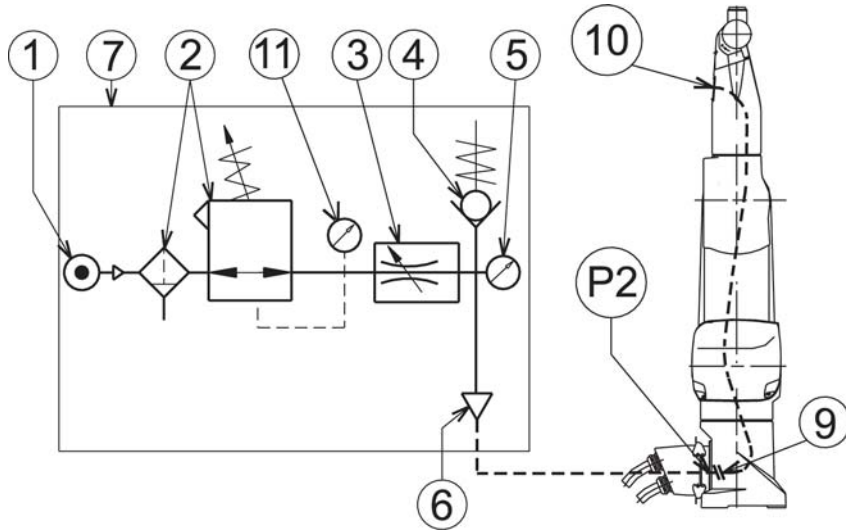


Figure 1.9

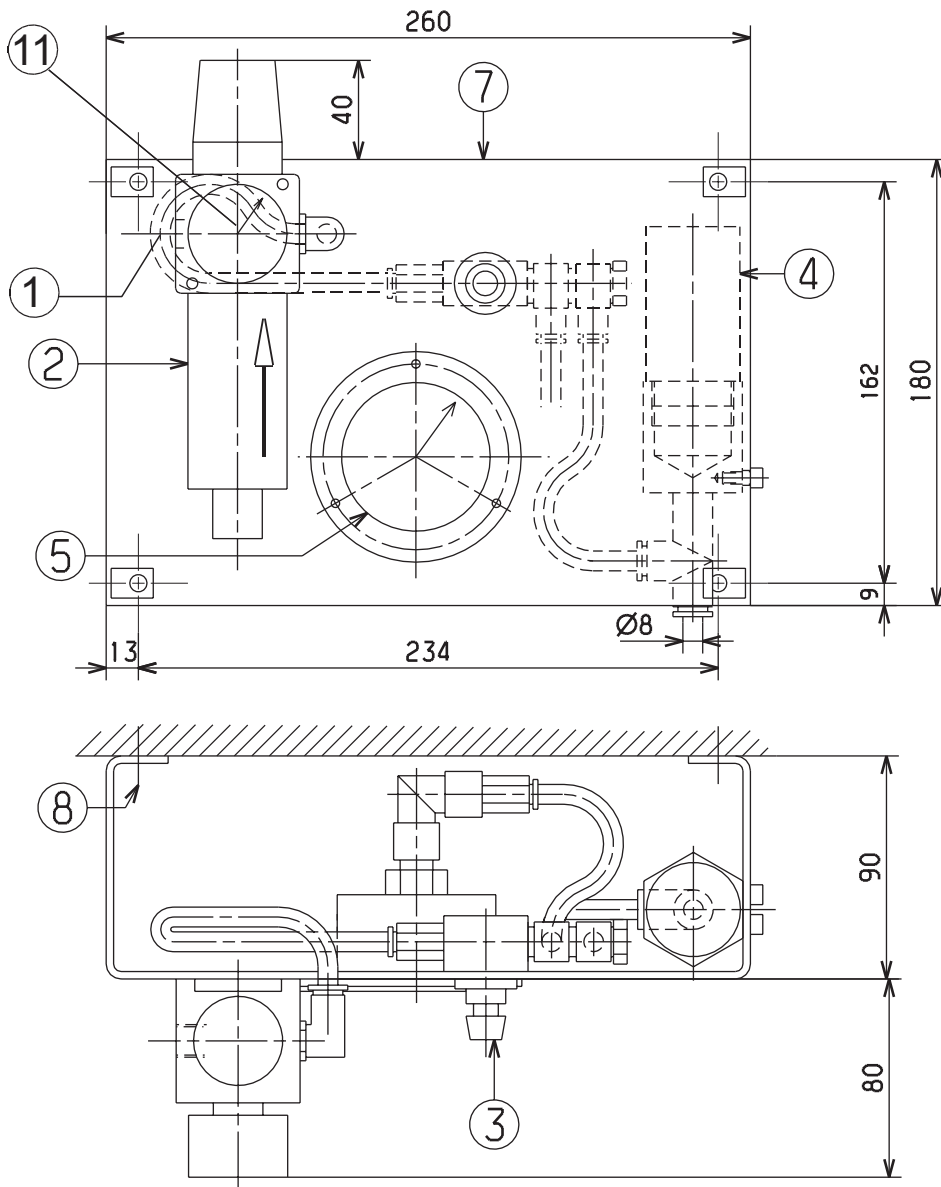


Figure 1.10

1.9. PRESSURIZATION UNIT FOR DUSTY ENVIRONMENTS

1.9.1. PURPOSE

For very severe applications in dusty environment, to maintain the inside of the arm at a pressure greater than the atmospheric pressure to avoid migration of dust.

1.9.2. INSTALLATION

- If the hose **(P2)** between **(9)** and **(10)** is not used, cut the pipe **(P2)** at **(9)** and plug **(P2)** at **(10)**.
- If **(P2)** is used for another function, add a pressure sealed union to the connector mount (black plate at base of arm to which the electrical connector is attached).
- Attach the unit with 4 screws (Ø 6 max.) at item **(8)** (screws not supplied) to a rigid vertical wall in direction shown by arrow; the air inlet **(1)** being to the left of the regulator **(2)**.
- Provide for air inlet at **(1)**, this is a G1/4 tapped hole; the air pressure is 10 bar maximum. Before the pressure arrives at **(1)**, make sure that the regulator **(2)** is completely screwed out and that the valve **(3)** is completely screwed in. Before pressurizing the arm, also make sure that the arm is correctly connected and correctly sealed (covers closed, plugs in hoisting ring tapped hole, pipe connected at **(6)** and at **(9)**, etc.).
- Install a pipe with an outside Ø 8 between the unit (output **6**) and the arm (input **P2**). Provide a male G1/4 union for the pipe with an outside Ø 8. At **(P2)**, the hole is a G1/4 tapped hole for the complete RX range.
- Pressurize the arm.

- 1) Slowly screw in the regulator. First adjust the pressure to 1 bar max. (pressure shown on pressure gage **11**).

Note:

At this stage, the low pressure gage (5) must remain at 0 mbar.

- 2) Very slowly screw out the valve **(3)**; the value on the pressure gage **(5)** must increase progressively. When this value reaches 5 to 10 mbar and remains stable, adjustment is considered as correct.

CAUTION:

An excessive value (above 40 mbars) will make the pressure gage (5) unusable.

- If however the valve **(3)** is completely screwed out and it is impossible to reach 5 mbar, check that:
 - a) the circuit is tight (unit, arm, pipe, etc.)
 - b) the pressure gage **(5)** is not unserviceable (damaged by a pressure greater than 40 mbar).

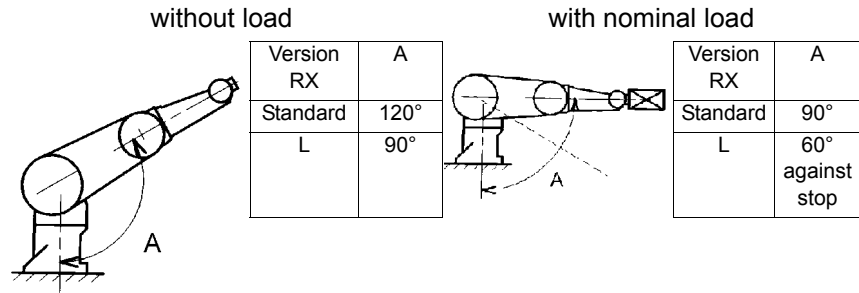
If the 2 points a and b are correct, the pressure can be increased by means of the **(2)** regulator without however exceeding 2 bar.

Note:

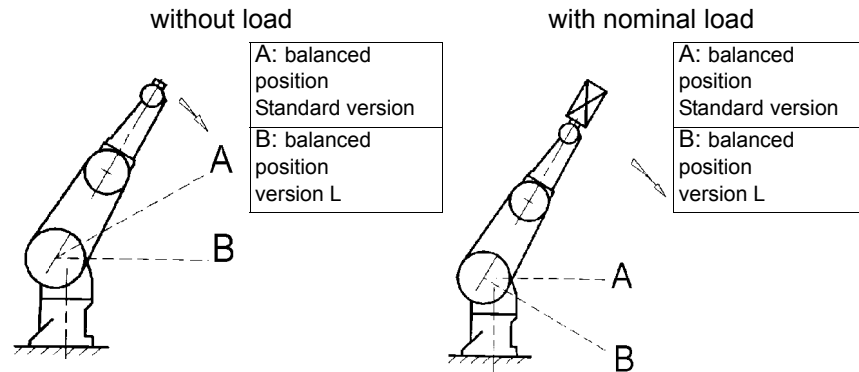
It is preferable for safety reasons (valve 4 opens between 15 and 25 mbars) and consumption reasons to work with minimum pressures (high and low pressures).

FLOOR CONFIGURATION

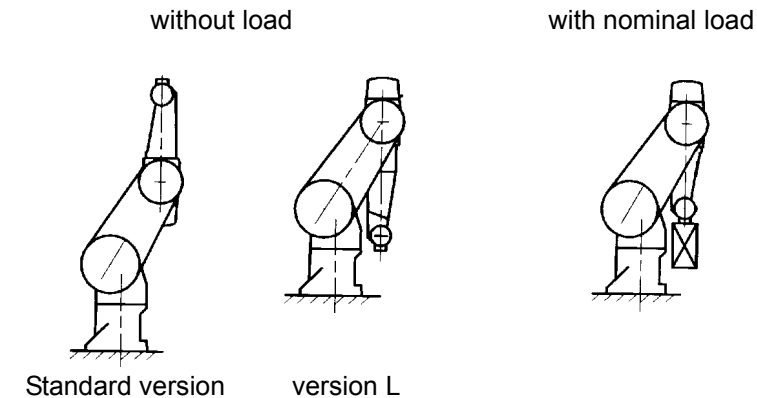
1) Balanced position (joint 2 brake released) is as follows:



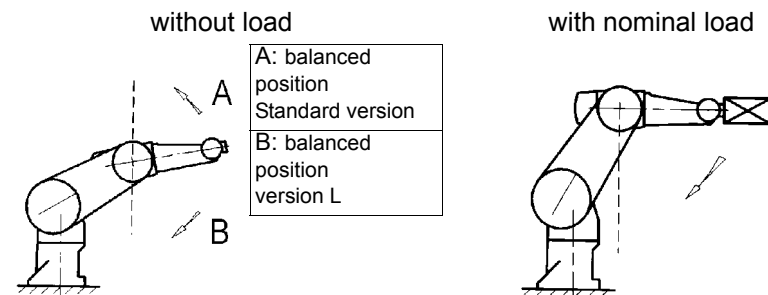
2) When arm is in a position other than balanced position, releasing joint 2 brake causes arm to return to balanced position.



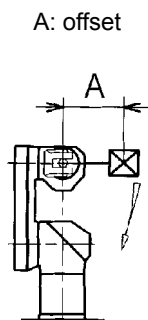
3) Balanced position (joint 3 brake released) is as follows:



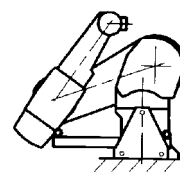
4) When arm is in a position other than balanced position, releasing joint 3 brake causes arm to return to balanced position.



5) Releasing the brake on articulation 4 will cause the load to lower if the load is offset.



6) Warning, before moving the arm, always configure it according to the position below and use the handling accessories.



1.10. SAFETY

The robot arm's energy is that accumulated by the springs.

Indeed, joint 2 is equipped with a spring balance system. Releasing joint 2 discharges the accumulated energy. This energy label is attached on the arm and must remain in place.

The brake release movements are described on the opposite page according to arm configuration (floor or ceiling).

CHAPTER 2

ON-SITE PREPARATION

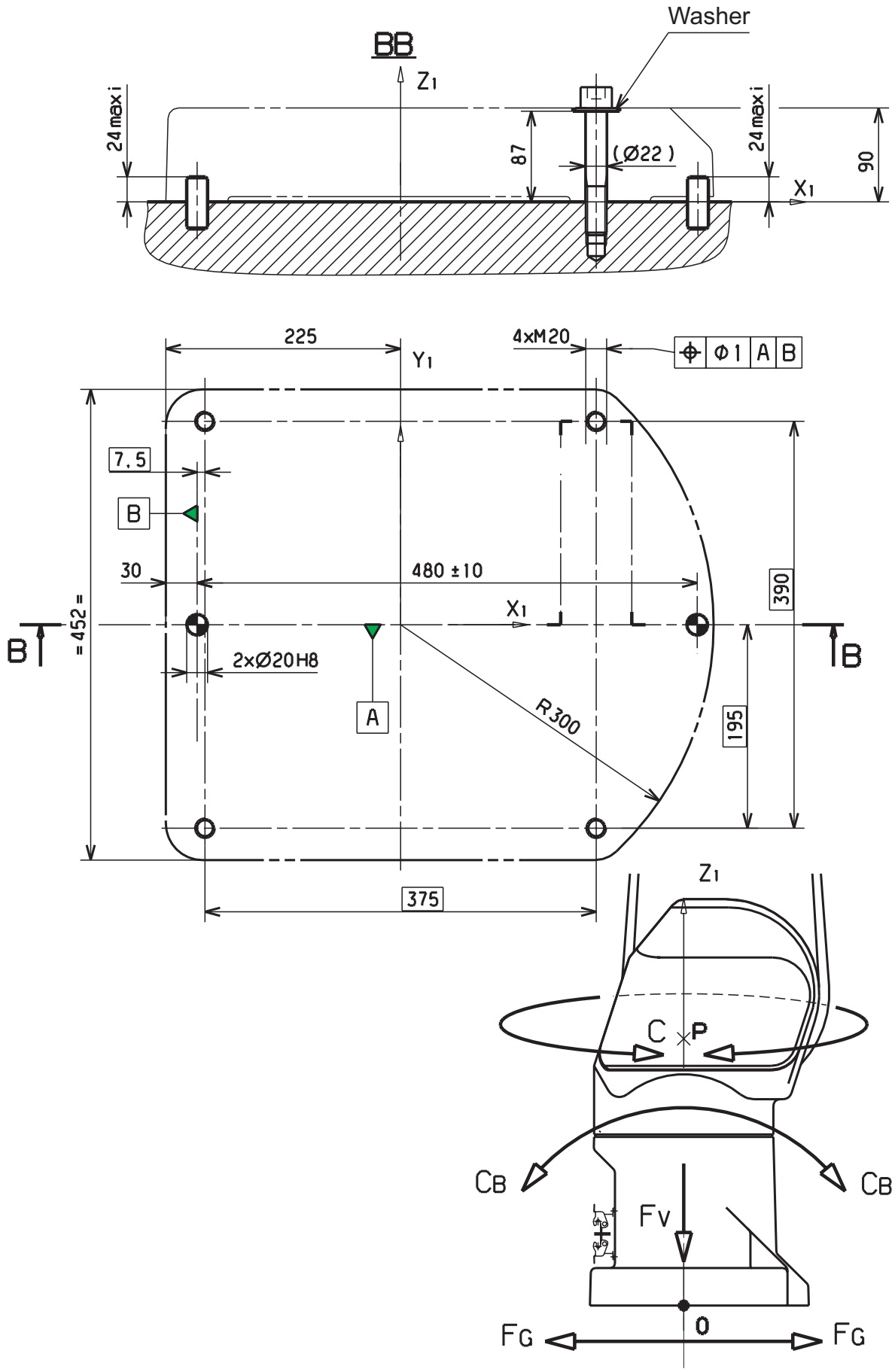


Figure 2.1

2.1. WORKING SPACE

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; power sources shall be available (for electrical power, consult controller characteristics).

	<p>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. International standard: ISO 10218 (1992). French standard: NF EN 775 (1993). European Directive: machine directive CEE 89-392.</p>
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	<p>DANGER: There must be no obstacles within the robot work envelope.</p>
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2.2. ATTACHMENT (figure 2.1)

The robot arm must be installed vertically, with the base downwards. It must be firmly mounted using **4** screws **M20**, class **8.8** or higher, torqued down, as shown in the hole drilling diagram opposite.

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

To dimension the support, take into account the maximum loads generated by the arm in motion at point 0 (**figure 2.1**) which are:

	Standard arm	Long arm	Heavy load arm
F_V	9900 N	9900 N	8700 N
F_G	4700 N	4700 N	2400 N
C_B	8250 N.m	8250 N.m	5700 N.m
C_P	4500 N.m	4500 N.m	2500 N.m

under following load conditions:

	LOAD (kg)	LOAD POSITION (mm)	
		JOINT 5	JOINT 6
Standard arm	30	300	120
Long arm	20	350	150
Heavy load arm	60	300	100

CHAPTER 3

INSTALLATION

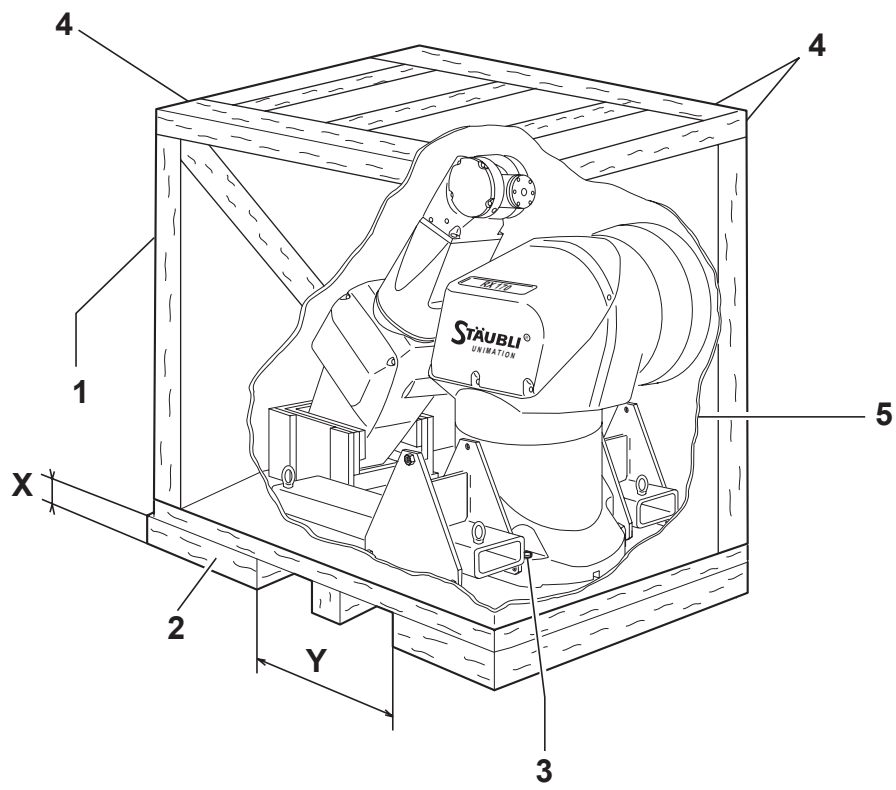


Figure 3.1

3.1. ARM PACKAGING

- Case **(1)**: L x H x P = 1760 x 1700 x 1260 mm
- Gross weight: 890 kg
- Net weight: 730 kg approximately

The arm is mounted on base **(2)** using 4 M20 **(3)** bolts

Transport condition:

- Minimum temperature -20°C
- Maximum temperature +60°C

3.2. HANDLING OF PACKING

By pallet truck under base **(2)**.

- X = 100 mm
- Y = 700 mm

3.3. UNPACKING (figure 3.1)

CAUTION:

The arm is packed in a position that takes up the least amount of space. Carefully comply with the following indications to avoid any accidental arm tipping.

- Move the packing case as near as possible to the installation site.
- Disassemble the case **(1)** by removing screws **(4)**.
- Remove the plastic envelope **(5)**.
- The arm is held down onto the palette **(2)** by 4 M20 **(3)** bolts.
- Two handling components are required to lift the arm. They are each mounted by 3 M16 screws.
- Check that they are correctly attached.

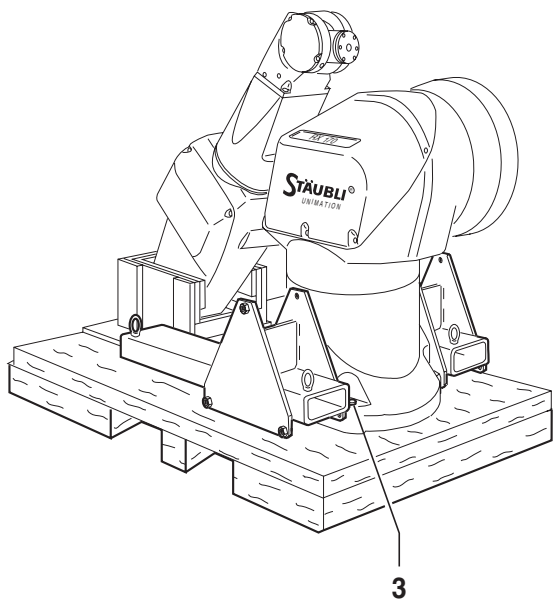


Figure 3.2

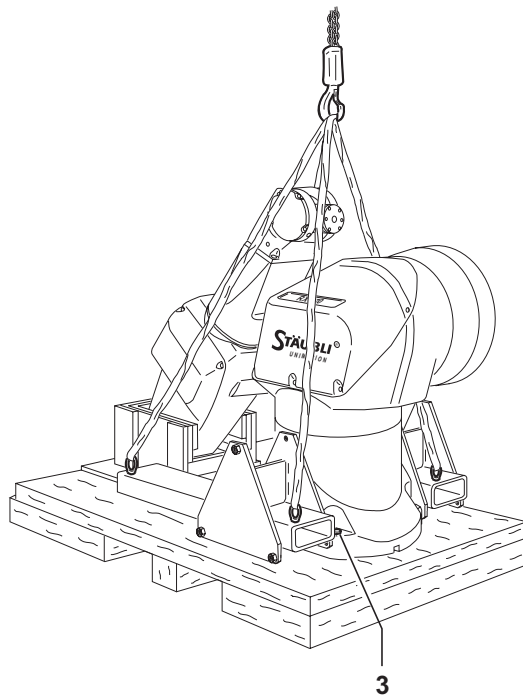


Figure 3.3

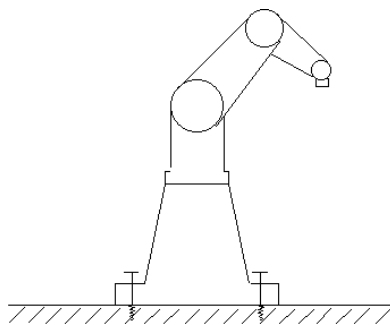
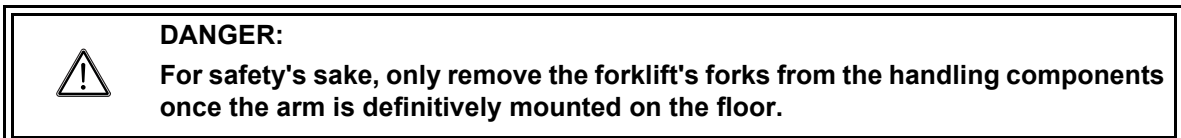


Figure 3.4

3.4. INSTALLATION OF ARM

3.4.1. HANDLE WITH A FORKLIFT TRUCK (figure 3.2)

- Insert the forks into the handling components.
- Remove the 4 M20 (3) bolts from the arm.
- Slowly lift the arm using the forklift.
- Position the arm on the support at its final attachment points.



- Attach the arm (see chapter 2.2).
- Remove the handling components.

3.4.2. HANDLING WITH A HOIST (FIGURE 3.3)

- Fit the slings into the lifting rings on the handling components and keep them slightly taut to avoid letting the arm tip.
- Remove the (3) bolts from the arm.
- Slowly raise the arm using the hoist.
- Position the arm on the support at its final attachment points.



- Attach the arm (see chapter 2.2).
- Remove the handling components.

3.4.3. MOUNTING FLOOR QUALITY (figure 3.4)

The user has to make sure that the mechanical characteristics of the floor and the means of fixture allow to hold up the maximum forces caused by the moving arm (see chapter 2).

