Simple *and* friendly

Kawasaki

**Kawasaki Robot
BXP/BTP Series**

Installation and Connection Manual

R o b o t

Kawasaki Heavy Industries, Ltd.

Preface

This manual explains the installation and connection procedures for the Kawasaki Robot BXP/BTP Series.

Be sure to fully understand the content of this manual and pay attention to the safety items in this manual and the separate "Safety Manual" when performing an operation. Note that this manual only provides descriptions of the installation and connection procedures for the arm. Also see the "Installation and Connection Manual" for the controller. For arc-welding robots, also consult the "Installation and Connection Manual" for the Arc Welding Application.

Again, do not perform any kind of work until you fully understand all of the contents of this manual. Also, Kawasaki is not responsible for damages or problems that occur as a result of performing work after referring to specific pages only.

────────────── [**NOTE**] ──────────────

The explanations in this manual are applicable to the following robots.
BXP110S, BXP110L, BXP135X, BXP165N, BXP165L, BXP210L,
BTP165L, BTP210L

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1. This manual does not guarantee the operation of the system with which the robot is used. Accordingly, Kawasaki is not responsible for any accidents, damages, and/or problems relating to industrial property rights as a result of using the system.
2. It is recommended that all personnel assigned for activation of operation, teaching, maintenance or inspection of the robot attend the necessary education/training course(s) prepared by Kawasaki, before assuming their responsibilities.
3. Kawasaki reserves the right to change, revise, or update this manual without prior notice.
4. This manual may not, in whole or in part, be reprinted or copied without the prior written consent of Kawasaki.
5. Store this manual with care and keep it available for use at any time. If the robot is reinstalled or moved to a different site or sold off to a different user, attach this manual to the robot without fail. In the event that the manual is lost or damaged, contact Kawasaki.

Symbols

The items that require special attention in this manual are designated with the following symbols.

Ensure proper and safe operation of the robot and prevent physical injury or property damage by complying with the safety matters given in the boxes with these symbols.

> ⚠ **DANGER**
>
> **Failure to comply with indicated matters can result in imminent injury or death.**

> ⚠ **WARNING**
>
> **Failure to comply with indicated matters may possibly lead to injury or death.**

> ⚠ **CAUTION**
>
> **Failure to comply with indicated matters may lead to physical injury and/or mechanical damage.**

> ───── **[NOTE]** ─────
>
> Denotes precautions regarding robot specification, operation and maintenance.

> ⚠ **WARNING**
>
> 1. **The accuracy and effectiveness of the diagrams, procedures, and detailed explanations given in this manual cannot be confirmed with absolute certainty. Therefore, should any unexplained questions or problems with work arise, please contact your nearest Kawasaki.**
> 2. **Safety related contents described in this manual apply to the specific matters described and not to all robot work. They are not applicable to other general items or other matters. In order to perform all work safely, read and fully understand the "Safety Manual," all pertinent laws, regulations, and related materials, as well as all the safety explanations in each chapter, and prepare safety measures suitable for actual work.**

Table of Contents

1   Precautions

1.1   Precautions During Transportation, Installation, and Storage

When transporting the Kawasaki Robot to the installation location, observe the following precautions for transportation, installation, and storage.

⚠ **WARNING**

1. **When transporting the robot by crane or forklift, never allow a person to support it.**
2. **During transportation, never allow a person to ride on the robot, and never allow a person to get under it when it is suspended.**
3. **Before starting installation, be sure to turn OFF the controller power and external power switches, and after clearly displaying that "inspection and maintenance is in progress," lock out and tag out the external power switch so that an operator or third party does not accidentally turn ON the power, causing an unexpected situation such as electric shock.**
4. **When operating the robot, be sure to confirm safety points and absence of problems regarding robot installation before turning the motor power ON, and moving the robot arm to the designated position. Take care not to approach the arm and become accidentally caught when doing so. After setting the arm to the desired position, turn OFF the controller power and external power again as mentioned above, clearly indicate that "inspection and maintenance is in progress," and lock out and tag out the external power switch before starting work.**

⚠ **CAUTION**

1. **The robot is made of precision parts. Be careful not to subject it to impact or shock during transport.**
2. **When transporting the robot, clear away obstructions, etc. in advance so that it can be transported safely to the installation location.**
3. **Please pay attention to the following points when transporting or storing the robot.**
    (1) **Maintain an ambient temperature within the -10°C to 60°C range.**
    (2) **Maintain a relative humidity within the 35% to 85% RH range (without any condensation).**
    (3) **Avoid large vibrations or shocks.**

1.2 Robot Arm Installation Environment

Install the robot arm in a location that satisfies the following conditions.

1. For floor-standing installation, the location must be capable of maintaining a horizontal surface within ±5°.
2. The floor and frame must have adequate hardness.
3. The location must be able to maintain flatness so that excess force is not exerted on the installed part.
   (If flatness cannot be ensured, adjust with a liner. Flatness of setting surface: under 0.3)
4. The ambient operating temperature must be between 0°C and 45°C.
   (Starting in low temperatures increases the viscosity of grease and oil, which can lead to deviation errors and excess loads. In such cases, move the robot at low speeds before operating.)
5. Relative humidity must be 35% to 85% RH. In addition, there must not be any condensation.
6. Altitude: up to 1,000 meters above mean sea level
7. The location must have little dirt, dust, oil, smoke or water, etc.
8. The location must have no flammable or corrosive fluids or gases.
9. The location must not be subject to large vibrations. (0.5 G or less)
10. The location must be well protected against electrical noise.
11. The location must safeguard a space that is larger than the robot arm's motion range.
    (1) Install a safety fence around the robot, and make sure that it does not interfere with surrounding equipment, even when the arm has tools or workpieces mounted and is extended to its maximum motion range.
    (2) Minimize the number of entrance gates in the safety fence (only one is best) and equip the entrance gate with a safety plug. Enter and exit the fence from here.
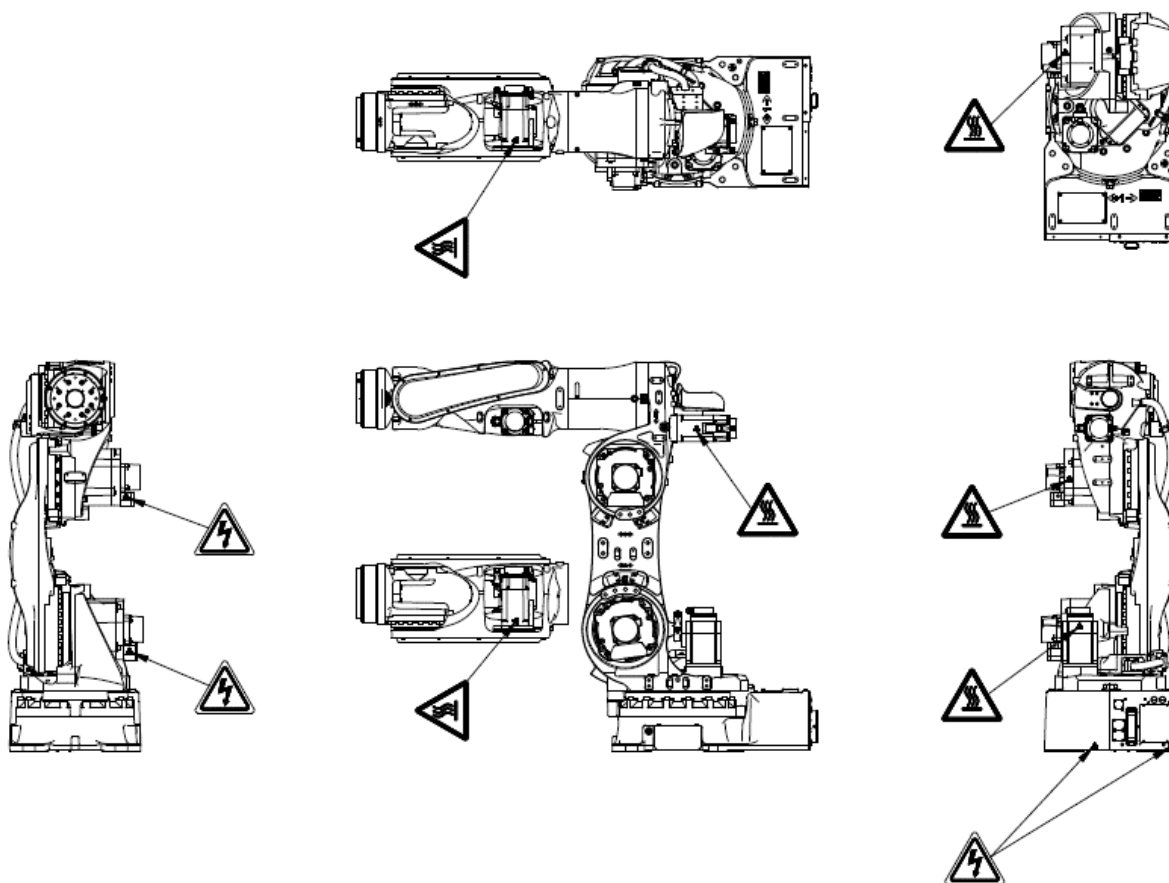   (3) For details concerning safety fences, observe the ISO 10218 requirements.
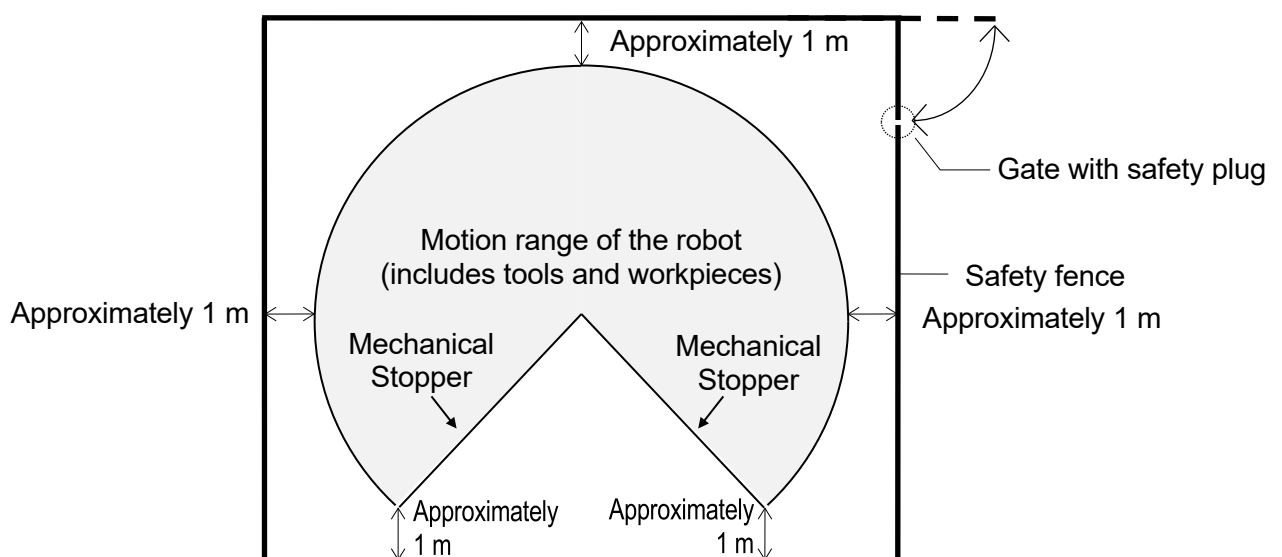
1.3   Residual Risk When Operating

⚠   **WARNING**
Pay attention to the residual risk areas described in the figures below during operation.

■**High-temperature and electric shock danger areas (BXP110S)**

⚠ **High-temperature danger areas**

⚠ **Electric shock danger areas**

■ **High temperature and electric shock danger areas**
   (BXP110L, BXP165N, BXP165L, BXP210L)

⚠ **High-temperature danger areas**
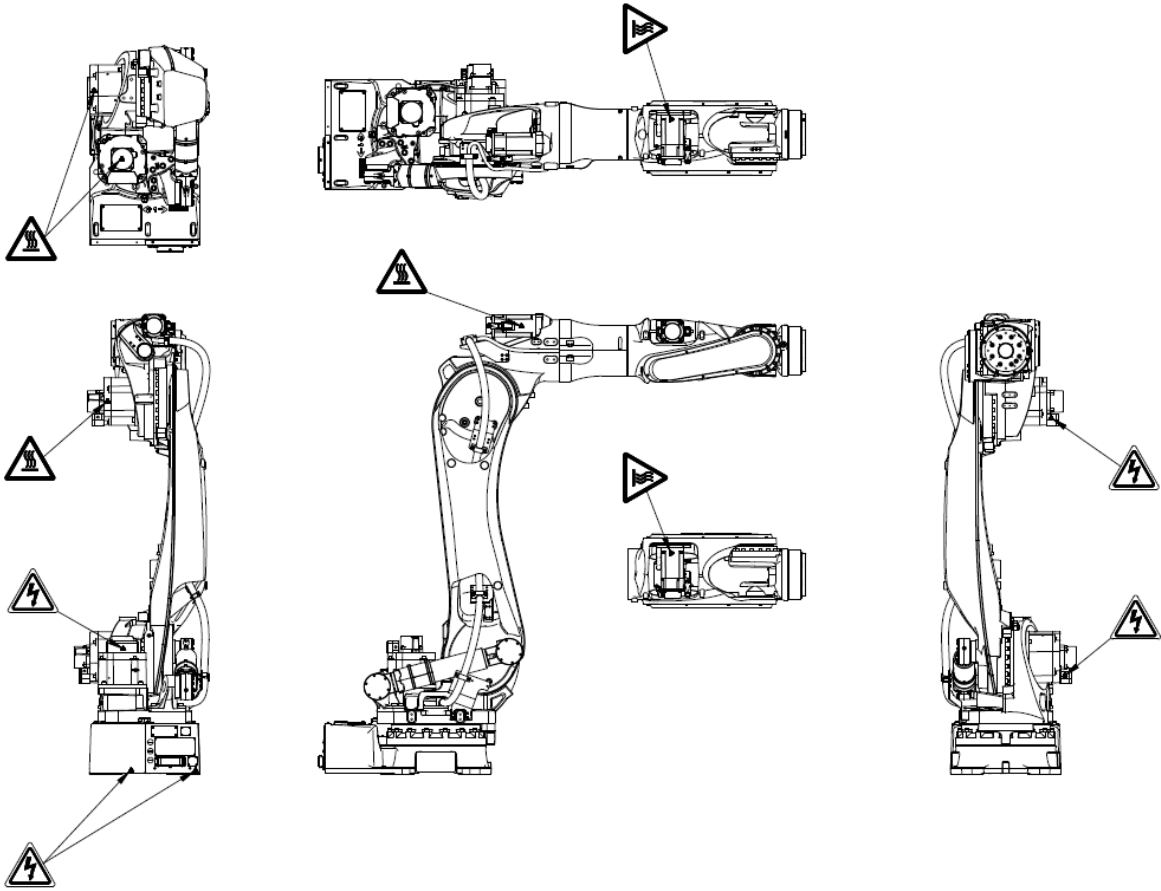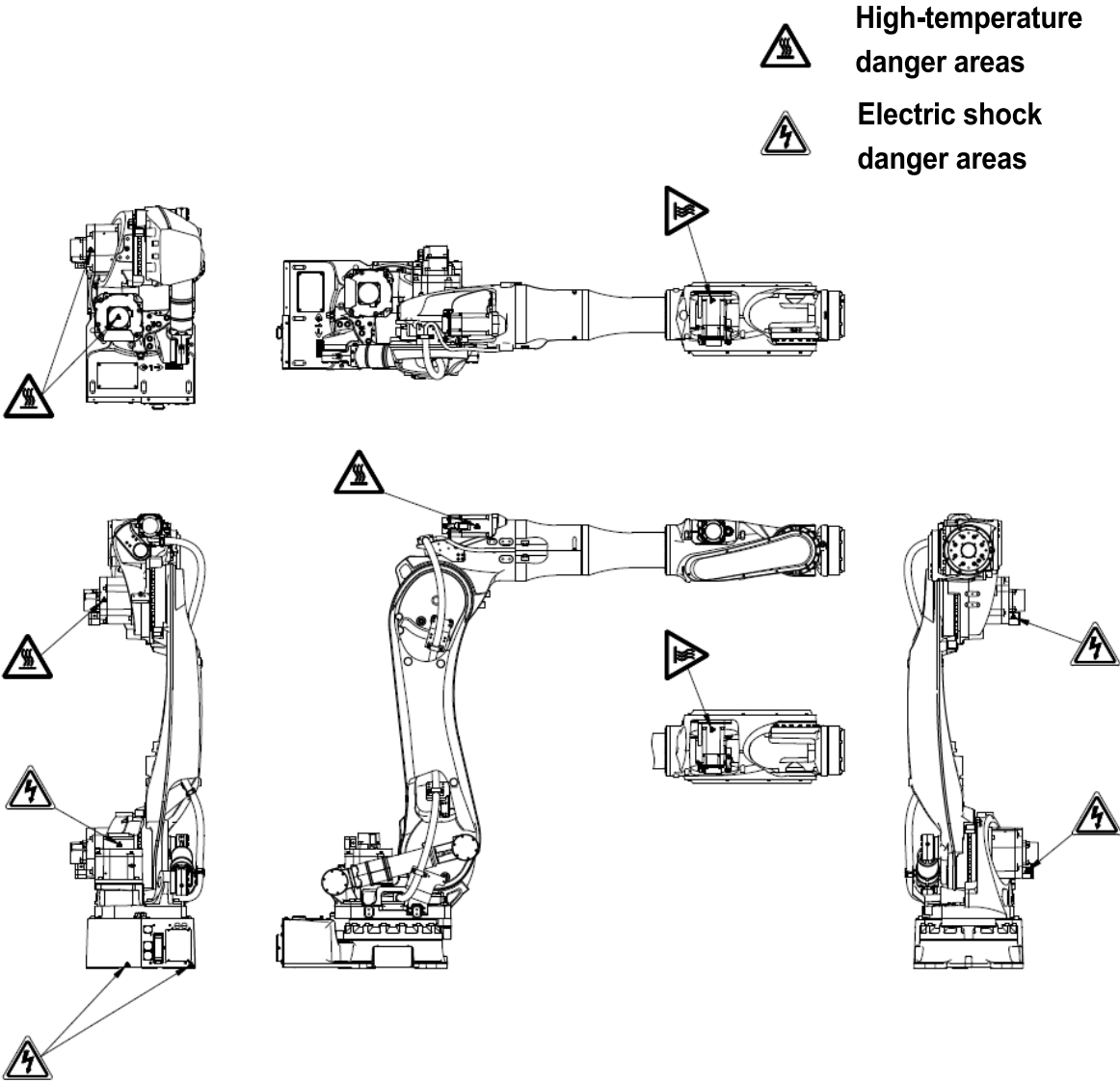
⚠ **Electric shock danger areas**

■ High-temperature and electric shock danger areas (BXP135X)

High-temperature danger areas

Electric shock danger areas

■**High-temperature and electric shock danger areas (BTP165L, BTP210L)**

High-temperature danger areas

Electric shock danger areas

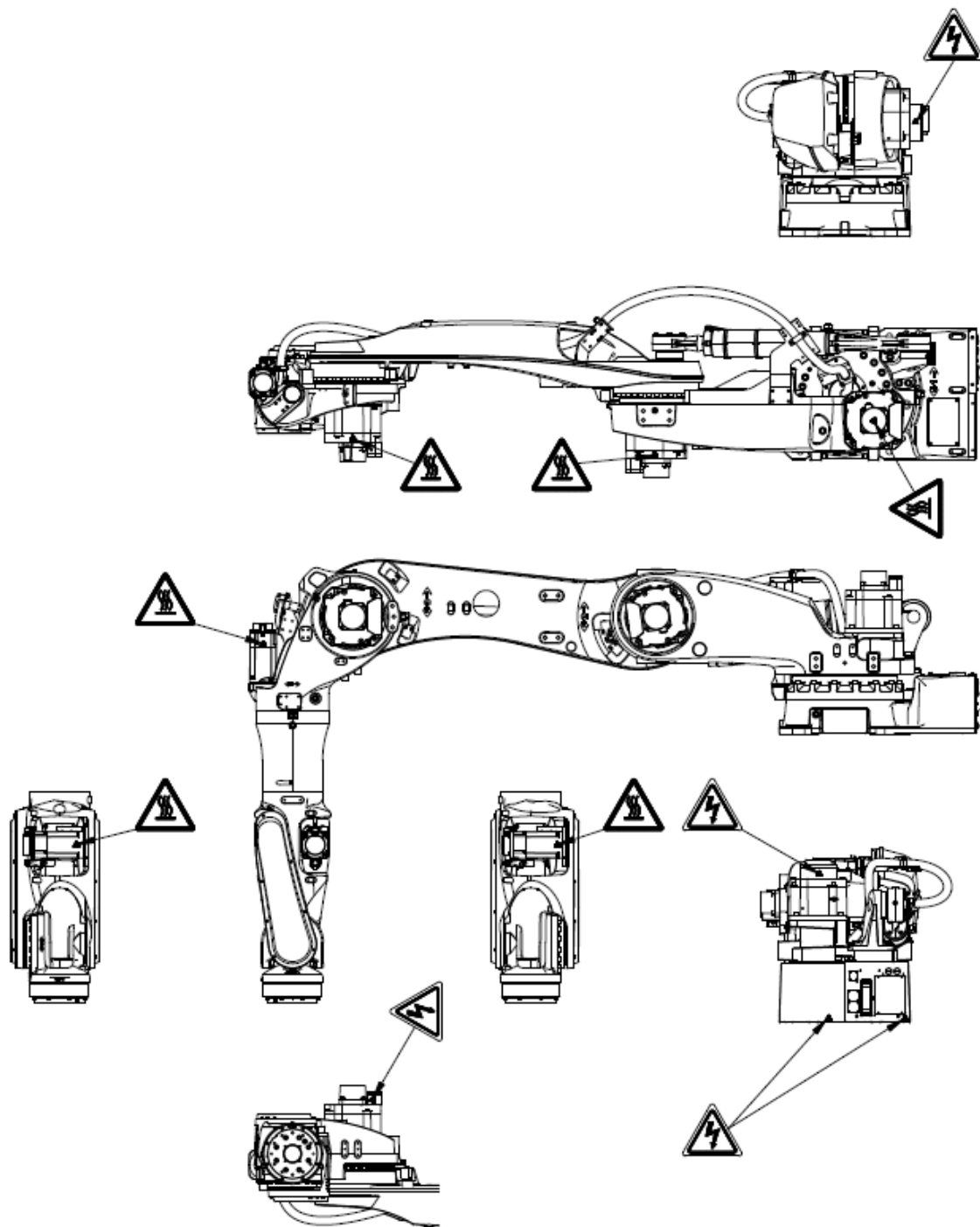■Catching danger areas (BXP110S)

◯ **Catching danger areas**
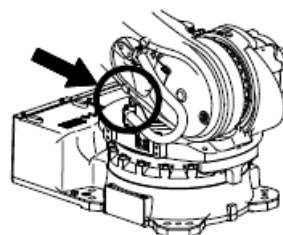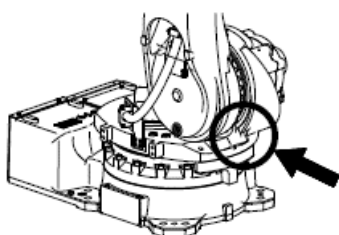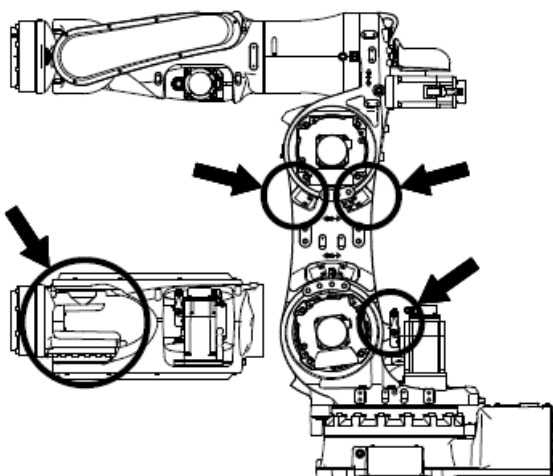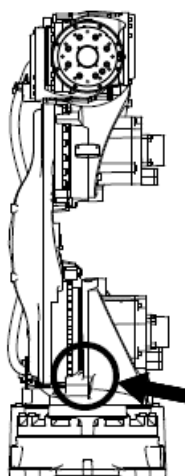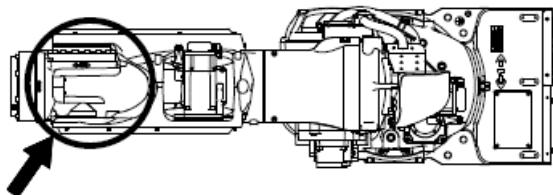
■ **Catching danger areas (BXP110L, BXP165N, BXP165L, BXP210L)**

◯ **Catching danger areas**

■Catching danger areas (BXP135X)

◯ **Catching danger areas**
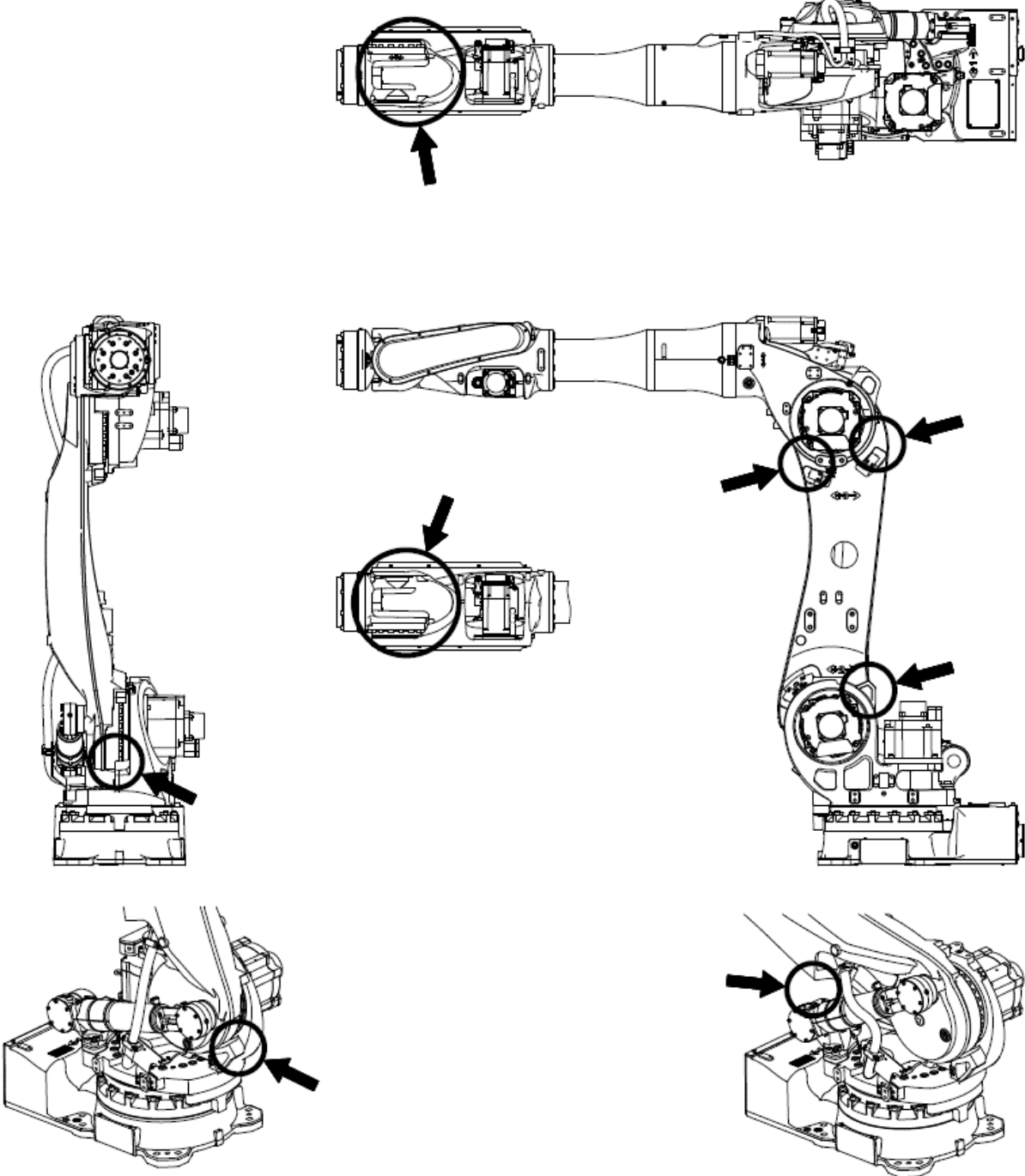
■Catching danger areas (BTP165L, BTP210L)

◯ **Catching danger areas**
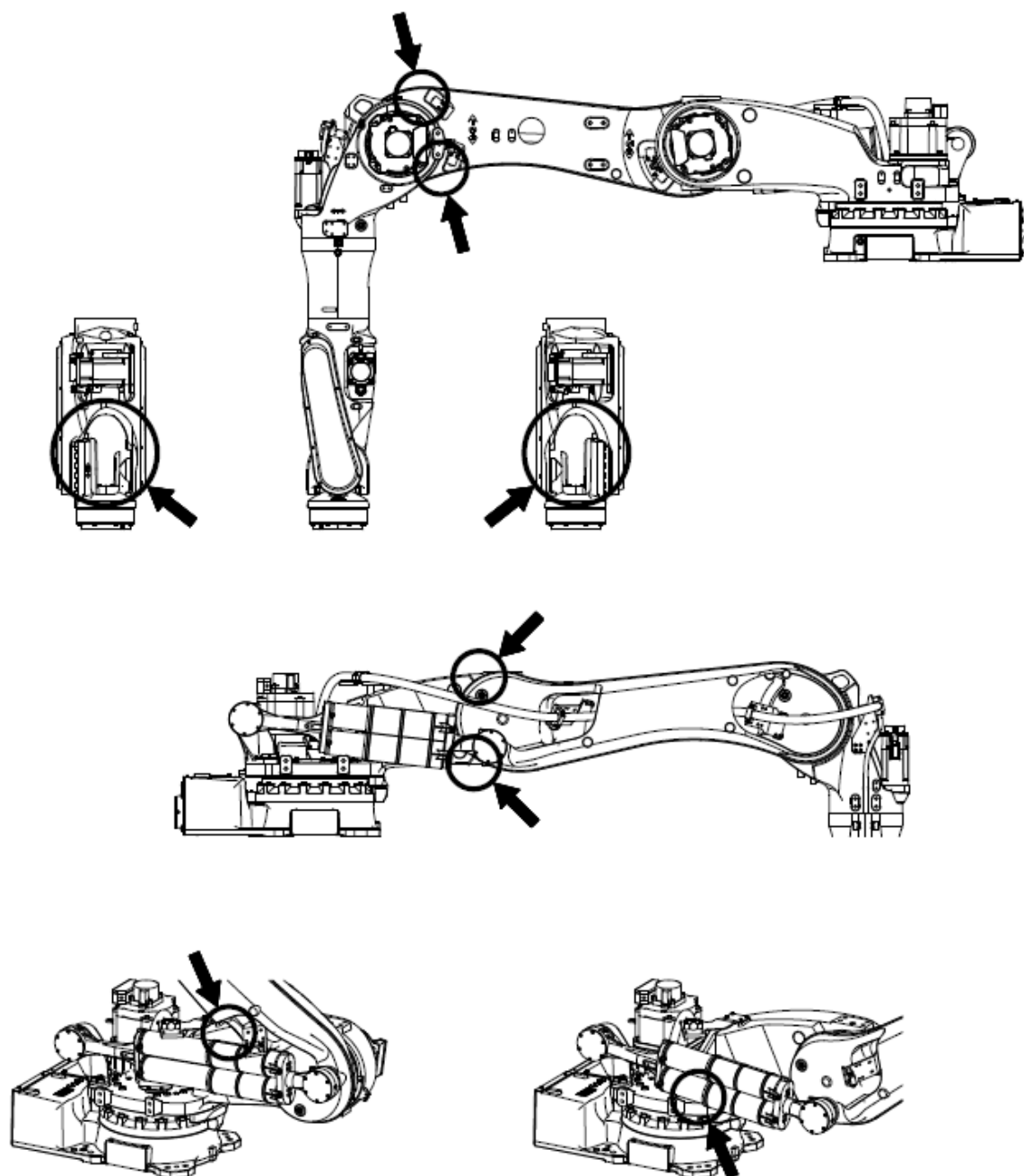
2 Arm Installation and Connection Work Flow

The work flow described here is for the robot arm only. See the controller's "Installation and Connection Manual" for more information regarding the controller.

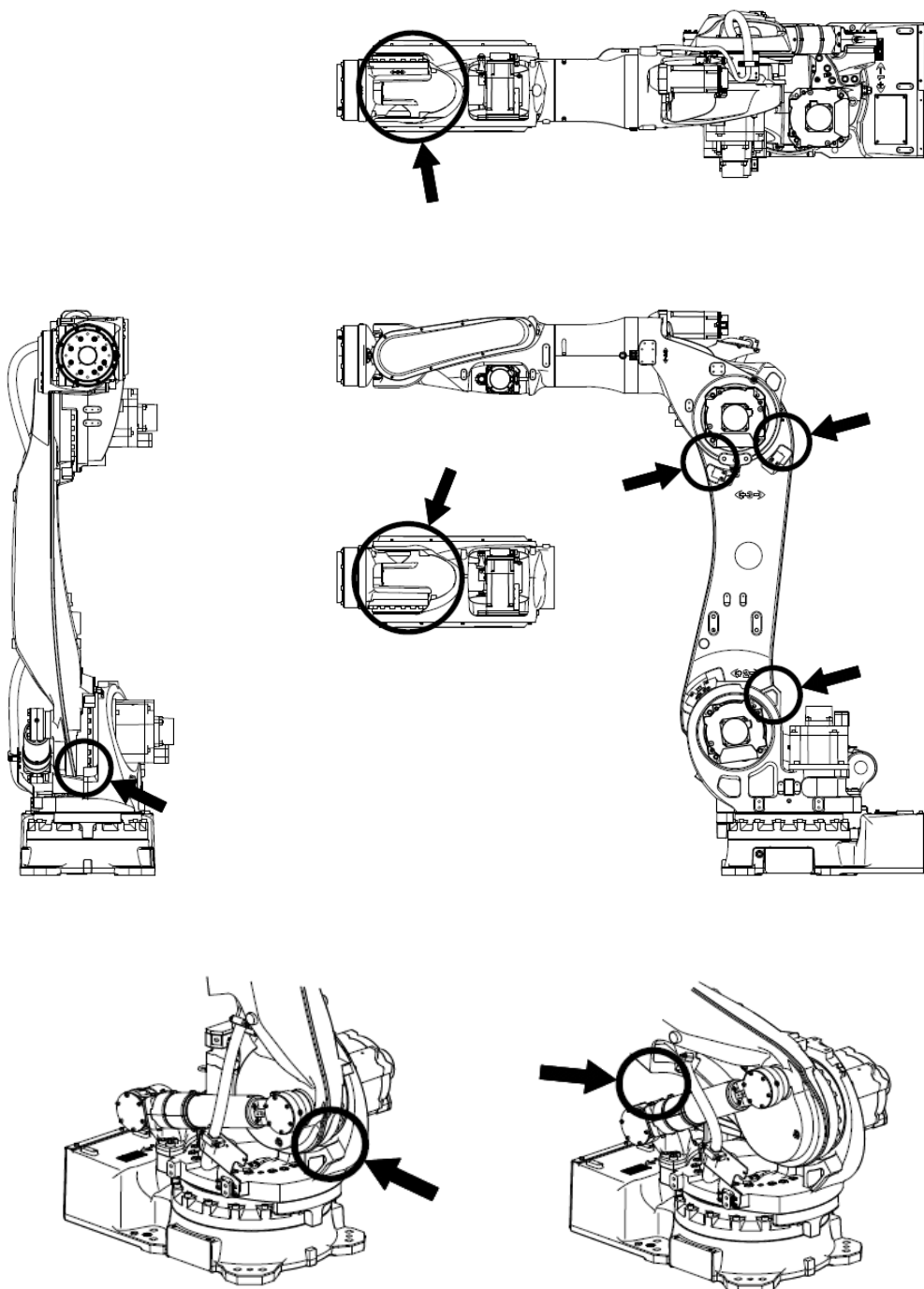| Preparation | Study installation location and motion range | ◀ | See "3 Motion Range and Specifications." |
	Study and preparation of surface for installation	◀	See "5 Base Installation Dimensions," "6 Reactive Forces on Installation Area During Operation," and "7 Installation."
Actual Operation	Robot arm transportation	◀	See "4 Transportation Methods."
	Robot arm installation	◀	See "5 Base Installation Dimensions," "6 Reactive Forces on Installation Area During Operation," and "7 Installation."
	Installation of tools	◀	See "8 Installation of Tools."
Work Using the Controller	Connection to controller	◁	See the controller's "Installation and Connection Manual."
	Arm operational check Tool operational check	◁	See the "Operation Manual."
	Check all other functions	◁	See the "Operation Manual."
	Installation complete		

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3   Motion Range and Specifications

3.1   Determination of Safety Fence Installation Location from Motion Range
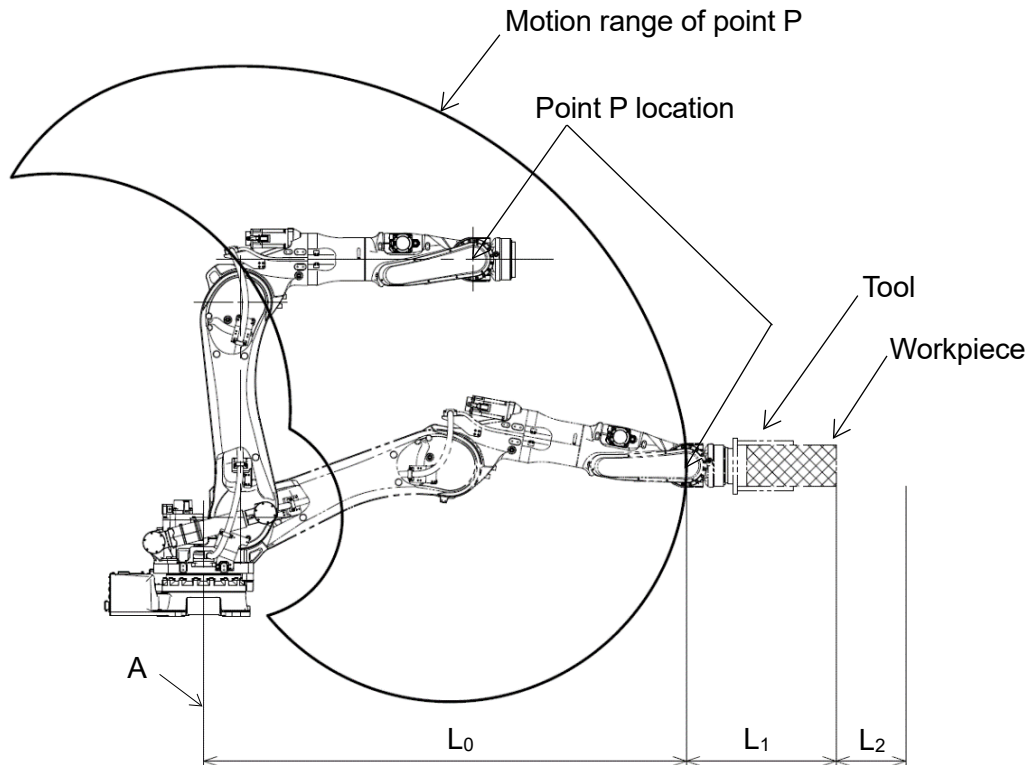
The motion range of the robot described below is represented by the motion range of point P in the figure. Therefore, as shown in the figure below, the safety fence needs to be ensured outside the circle whose radius is $L_0+L_1+L_2$, where L_0 is the length from the center line of the arm (point A shown in the figure), L_1 is the total length from the wrist flange to the outer edge of the largest workpiece held by any tool, and L_2 is the safety margin. For the length of L_0, see "3.2 Motion Range and Specifications."
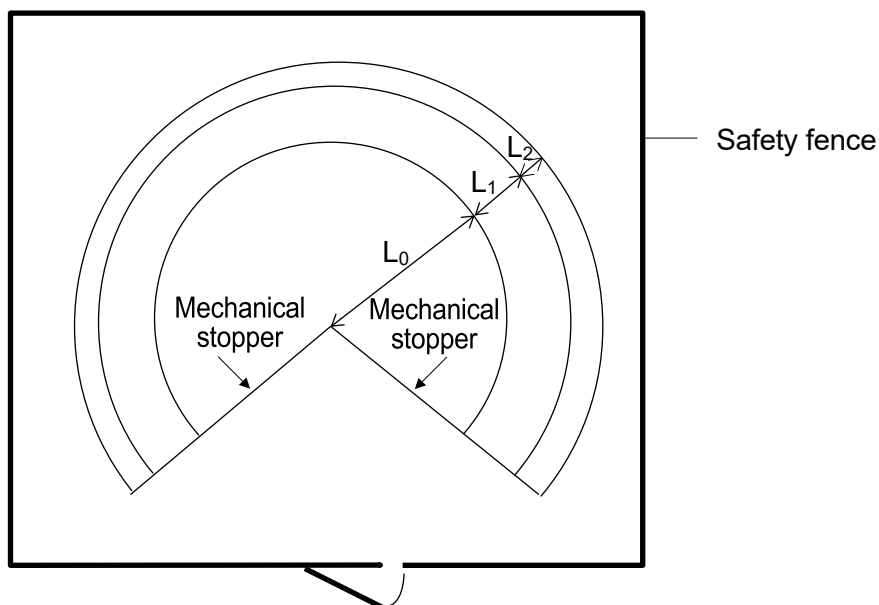
3.2   Motion Range and Specifications

■BXP110S
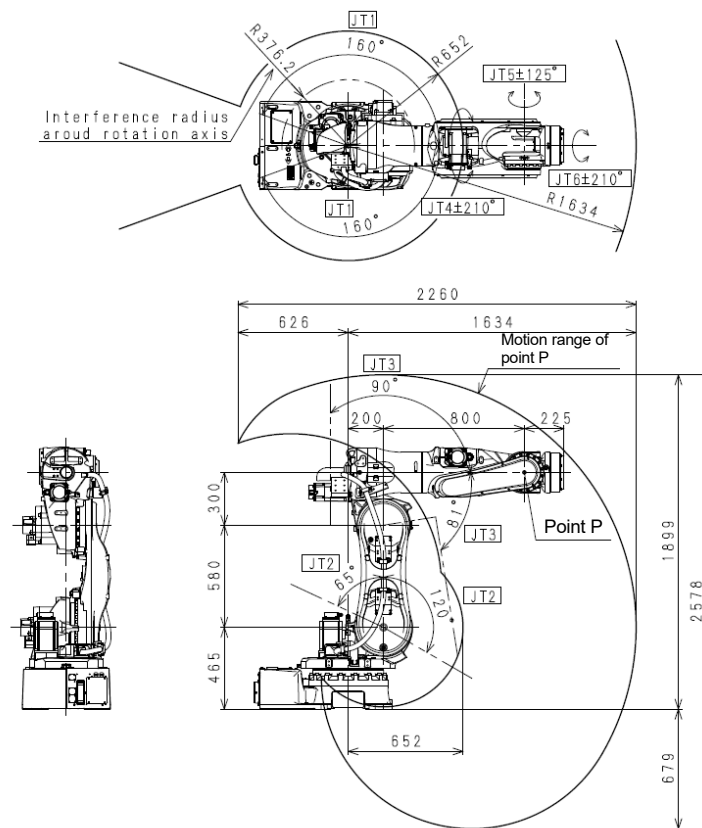
Model	Vertically articulated robot		
Degree of freedom of motion	6		
Motion range and speed	JT	Motion range	Maximum speed
	1	±160°	140°/s
	2	+120° to −65°	130°/s
	3	+90° to −81°	170°/s
	4	±210°	220°/s
	5	±125°	185°/s
	6	±210°	300°/s
Maximum payload	110 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	855 N·m	90 kg·m^2
	5	855 N·m	90 kg·m^2
	6	445 N·m	50 kg·m^2
Repeated positional accuracy	±0.06 mm		
Mass	700 kg		
Acoustic noise	<80 dB (A)[*1]		

*1   Measurement conditions
  • Robot tightly fixed to a flat floor surface
  • Point 4,600 mm from the center of JT1 axis

Noise level varies situationally.

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■BXP110L

Model	Vertically articulated robot		
Degrees of freedom of motion	6		
Motion range and speed	JT	Motion range	Maximum speed
	1	±160°	140°/s
	2	+76° to −60°	130°/s
	3	+90° to −75°	135°/s
	4	±210°	220°/s
	5	±125°	200°/s
	6	±210°	300°/s
Maximum payload	110 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	855 N·m	90 kg·m^2
	5	855 N·m	90 kg·m^2
	6	445 N·m	50 kg·m^2
Repeated positional accuracy	±0.06 mm		
Mass	870 kg		
Acoustic noise	< 80 dB (A)[*1]		

*1 Measurement conditions
   • Robot tightly fixed to a flat floor surface
   • Point 4,600 mm from the center of JT1 axis

⎧ Noise level varies
⎨ situationally.
⎩
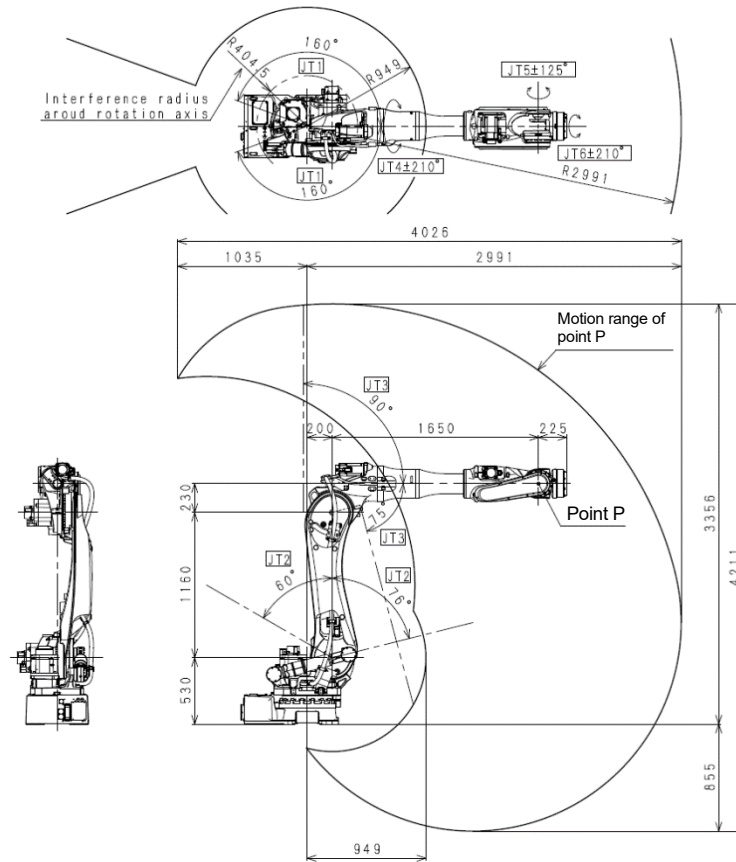
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■BXP135X

Model	Vertically articulated robot		
Degrees of freedom of motion	6		
Motion range and speed	JT	Motion range	Maximum speed
	1	±160°	140°/s
	2	+76° to -60°	105°/s
	3	+90° to -75°	140°/s
	4	±210°	220°/s
	5	±125°	200°/s
	6	±210°	300°/s
Maximum payload	135 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	855 N·m	90 kg·m²
	5	855 N·m	90 kg·m²
	6	445 N·m	50 kg·m²
Repeated positional accuracy	±0.06 mm		
Mass	880 kg		
Acoustic noise	< 80 dB (A)[*1]		

*1 Measurement conditions
 • Robot tightly fixed to a flat floor surface
 • Point 4,600 mm from the center of JT1 axis
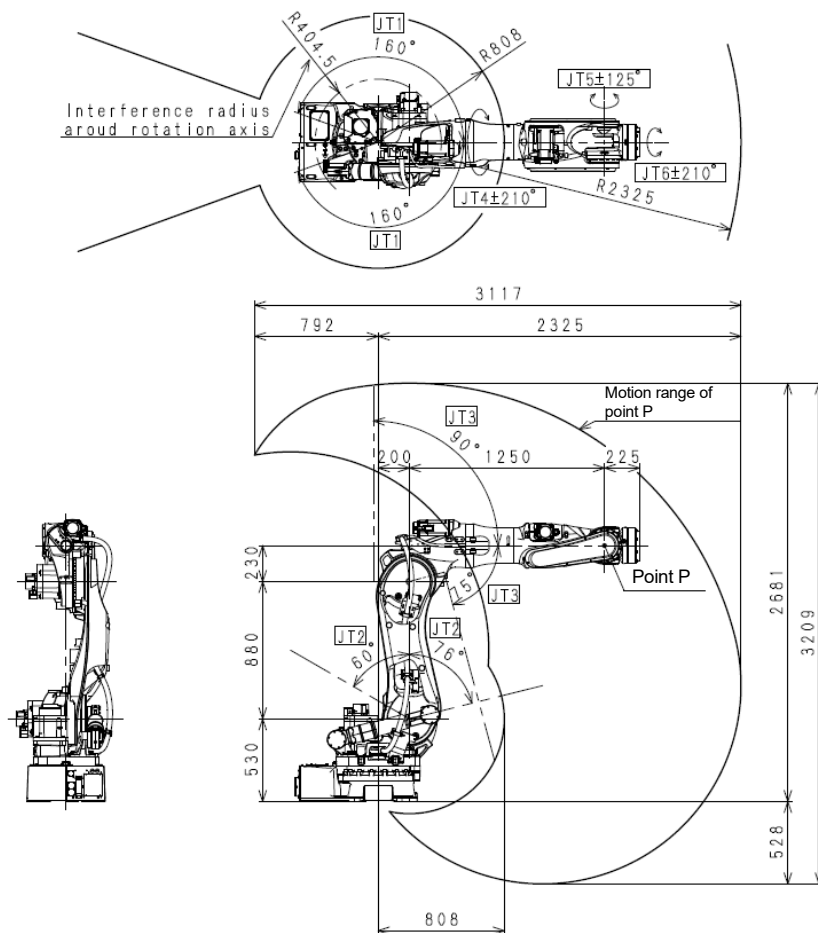
Noise level varies situationally.

■**BXP165N**

Model	Vertically articulated robot		
Degrees of freedom of motion	6		
Motion range and speed	JT	Motion range	Maximum speed
	1	±160°	140°/s
	2	+76° to -60°	130°/s
	3	+90° to -75°	135°/s
	4	±210°	190°/s
	5	±125°	180°/s
	6	±210°	300°/s
Maximum payload	165 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	940 N·m	105 kg·m^2
	5	940 N·m	105 kg·m^2
	6	510 N·m	50 kg·m^2
Repeated positional accuracy	±0.06 mm		
Mass	855 kg		
Acoustic noise	< 80 dB (A)[1]		

*1 Measurement conditions
- Robot tightly fixed to a flat floor surface
- Point 4,300 mm from the center of JT1 axis
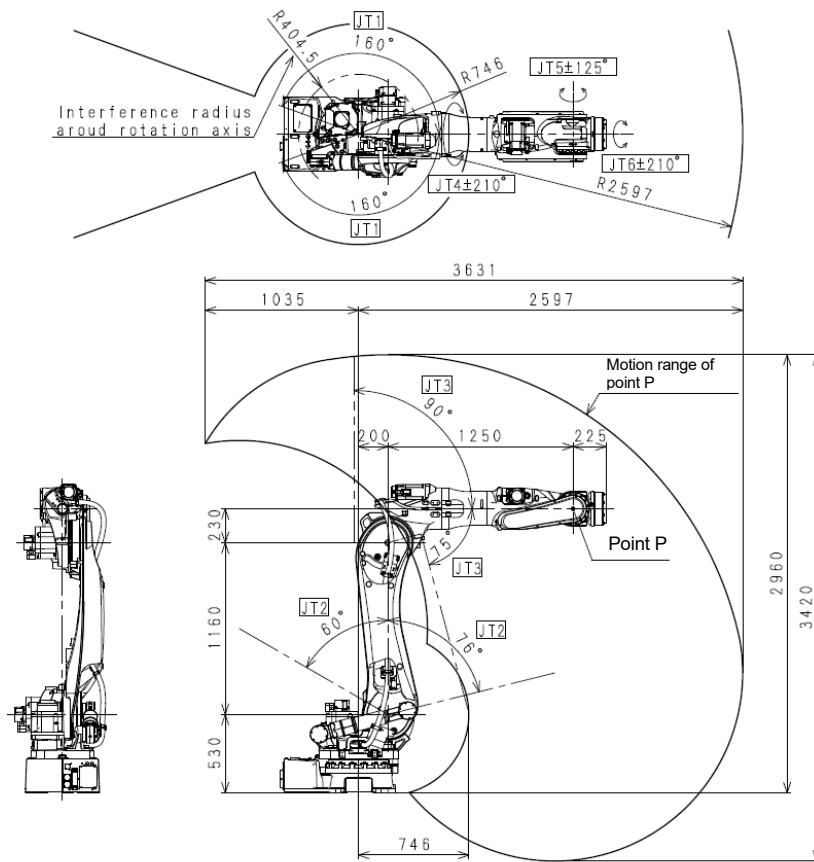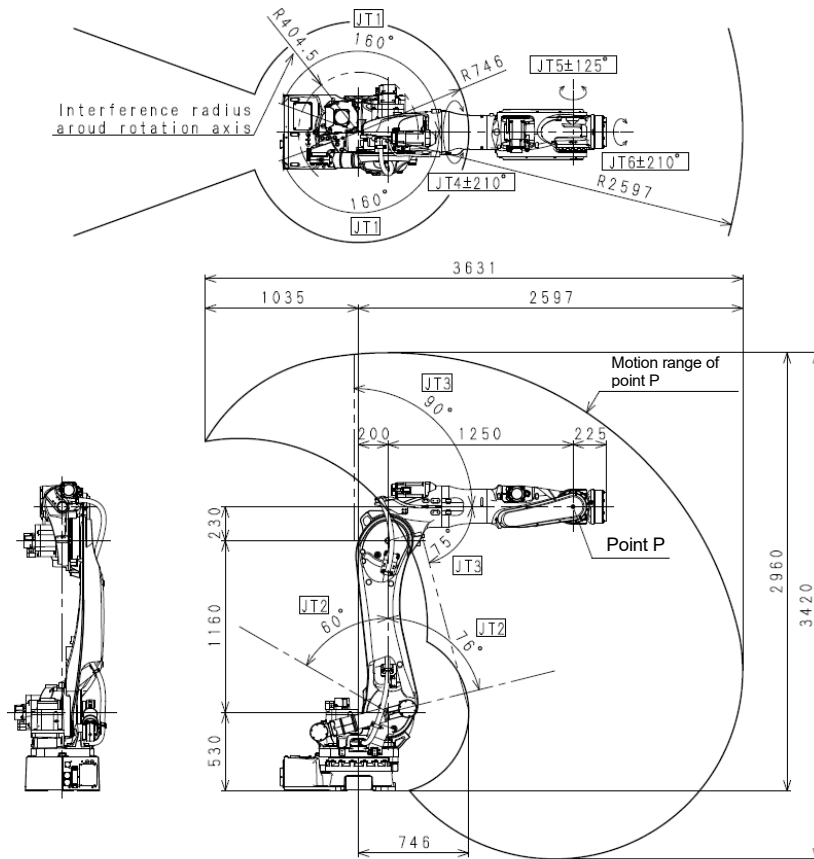
Noise level varies situationally.

■BXP165L

Model	Vertically articulated robot		
Degrees of freedom of motion	6		
Motion range and speed	JT	Motion range	Maximum speed
	1	±160°	140°/s
	2	+76° to -60°	115°/s
	3	+90° to -75°	130°/s
	4	±210°	190°/s
	5	±125°	180°/s
	6	±210°	290°/s
Maximum payload	165 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	960 N·m	105 kg·m^2
	5	960 N·m	105 kg·m^2
	6	520 N·m	50 kg·m^2
Repeated positional accuracy	±0.06 mm		
Mass	870 kg		
Acoustic noise	< 80 dB (A)[*1]		

*1   Measurement conditions
  • Robot tightly fixed to a flat floor surface
  • Point 4,600 mm from the center of JT1 axis

⎧ Noise level varies
⎨ situationally.
⎩

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■BXP210L

Model	Vertically articulated robot		
Degrees of freedom of motion	6		
Motion range and speed	JT	Motion range	Maximum speed
	1	±160°	140°/s
	2	+76° to -60°	105°/s
	3	+90° to -75°	115°/s
	4	±210°	140°/s
	5	±125°	135°/s
	6	±210°	240°/s
Maximum payload	210 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	1,380 N·m	205 kg·m^2
	5	1,380 N·m	205 kg·m^2
	6	600 N·m	160 kg·m^2
Repeated positional accuracy	±0.06 mm		
Mass	870 kg		
Acoustic noise	< 80 dB (A)[1]		

*1 Measurement conditions
- Robot tightly fixed to a flat floor surface
- Point 4,600 mm from the center of JT1 axis
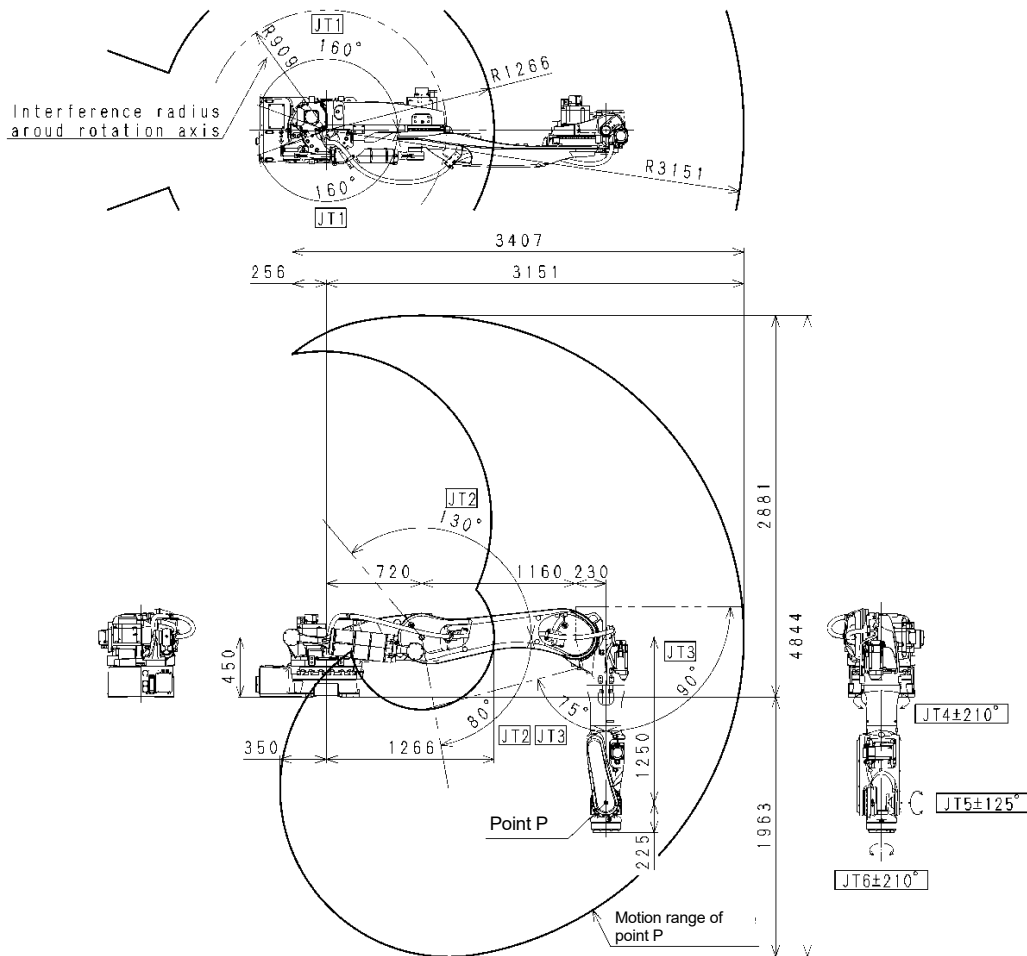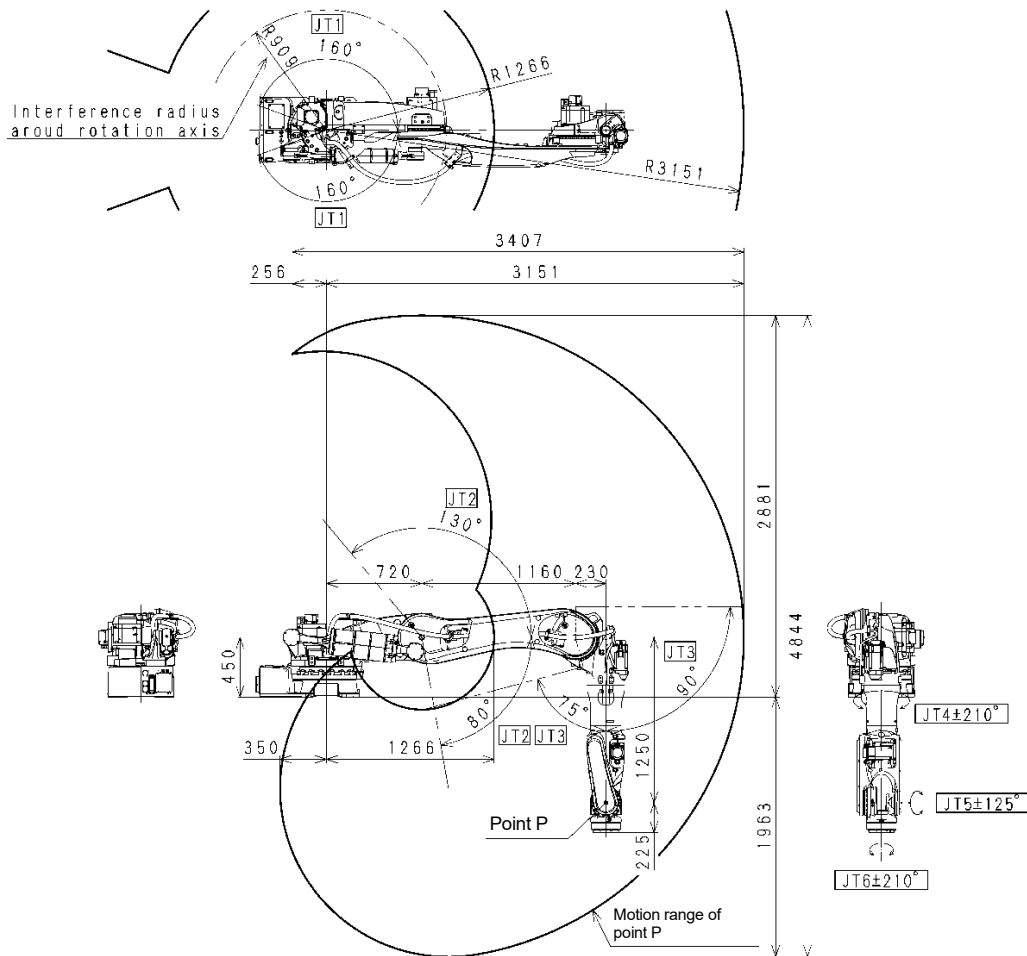
Noise level varies situationally.

■BTP165L

Model	Vertically articulated robot		
Degrees of freedom of motion	6		
Motion range and speed	JT	Motion range	Maximum speed
	1	±160°	125°/s
	2	+80° to -130°	115°/s
	3	+90° to -75°	130°/s
	4	±210°	190°/s
	5	±125°	180°/s
	6	±210°	290°/s
Maximum payload	165 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	960 N·m	105 kg·m^2
	5	960 N·m	105 kg·m^2
	6	520 N·m	50 kg·m^2
Repeated positional accuracy	±0.08 mm		
Mass	1,030 kg		
Acoustic noise	< 80 dB (A)[*1]		

*1 Measurement conditions
   • Robot tightly fixed to a flat floor surface
   • Point 5,200 mm from the center of JT1 axis

(Noise level varies situationally.)

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■**BTP210L**

| Model	Vertically articulated robot		
Degrees of freedom of motion	6		
Motion range and speed	JT	Motion range	Maximum speed
	1	±160°	115°/s
	2	+80° to -130°	90°/s
	3	+90° to -75°	115°/s
	4	±210°	140°/s
	5	±125°	135°/s
	6	±210°	240°/s
Maximum payload	210 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	1,380 N·m	205 kg·m^2
	5	1,380 N·m	205 kg·m^2
	6	600 N·m	160 kg·m^2
Repeated positional accuracy	±0.08 mm		
Mass	1,030 kg		
Acoustic noise	< 80 dB (A)[1]		

*1   Measurement conditions
  • Robot tightly fixed to a flat floor surface
  • Point 5,200 mm from the center of JT1 axis

(Noise level varies situationally.)

3.3   Mechanical Stoppers

Mechanical stoppers are installed at the points shown in the figure below at JT1, JT2, and JT3 of the base axes.

JT3 stopper part

JT3 stopper
part

JT2 stopper
part

JT1 stopper part
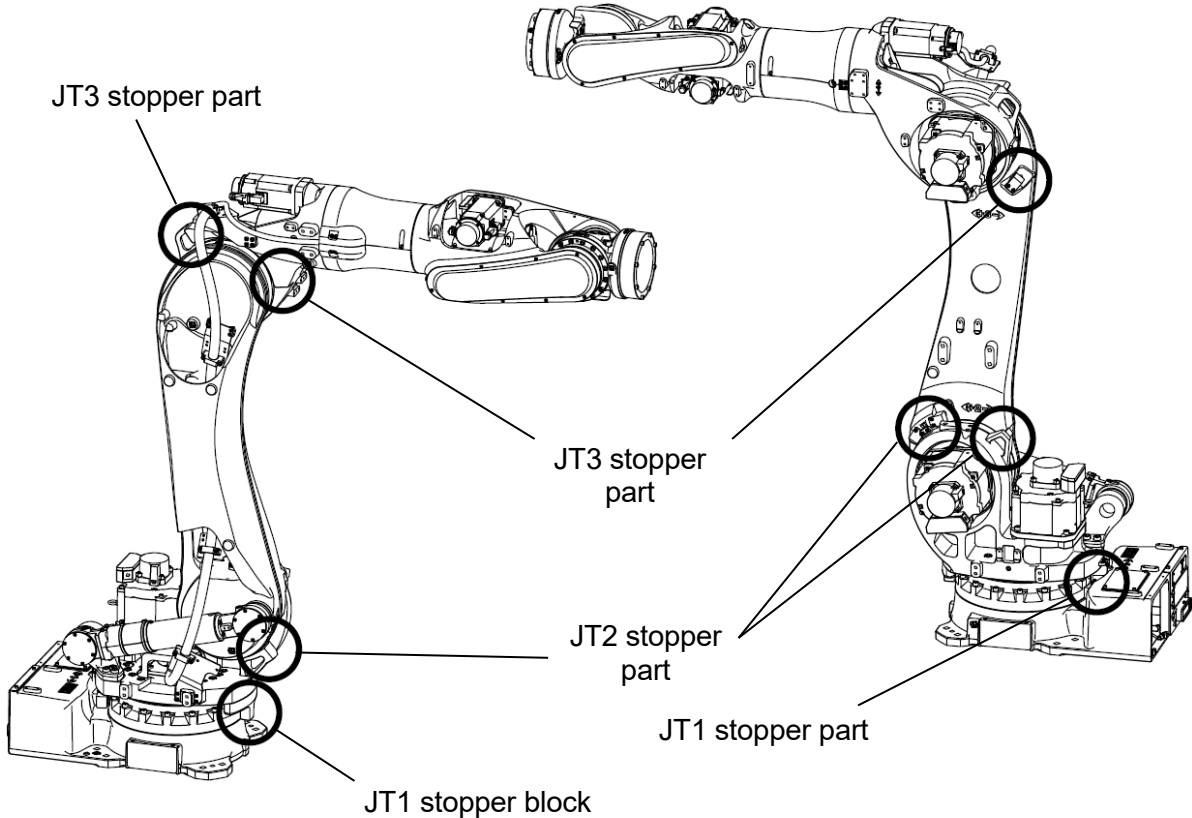
JT1 stopper block

3.3.1   JT1 Stopper Block

■Standard stopper block mounting

The motion range for the standard stopper is 160° to the positive (+) side and 160° to the negative (−) side.

Standard stopper block

160°   160°

A

A

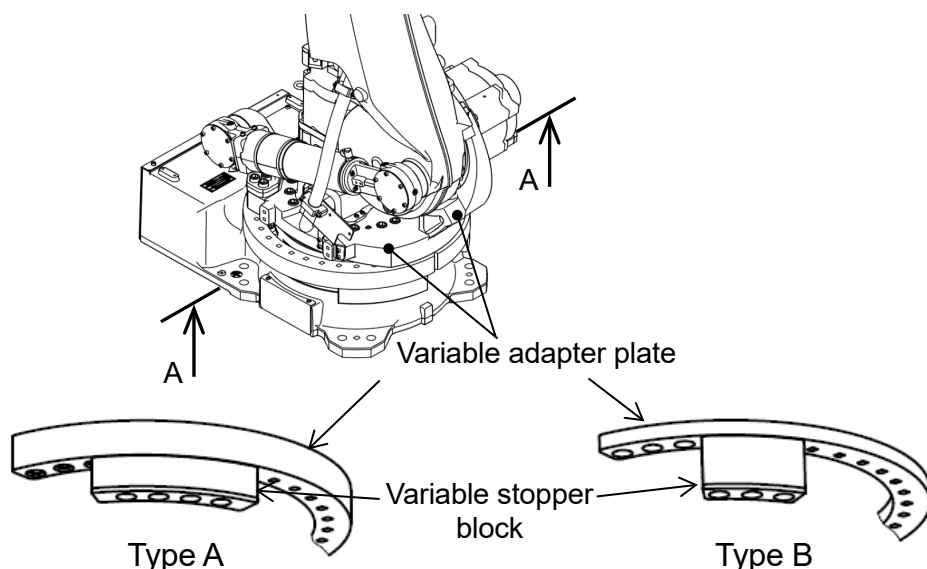View A-A
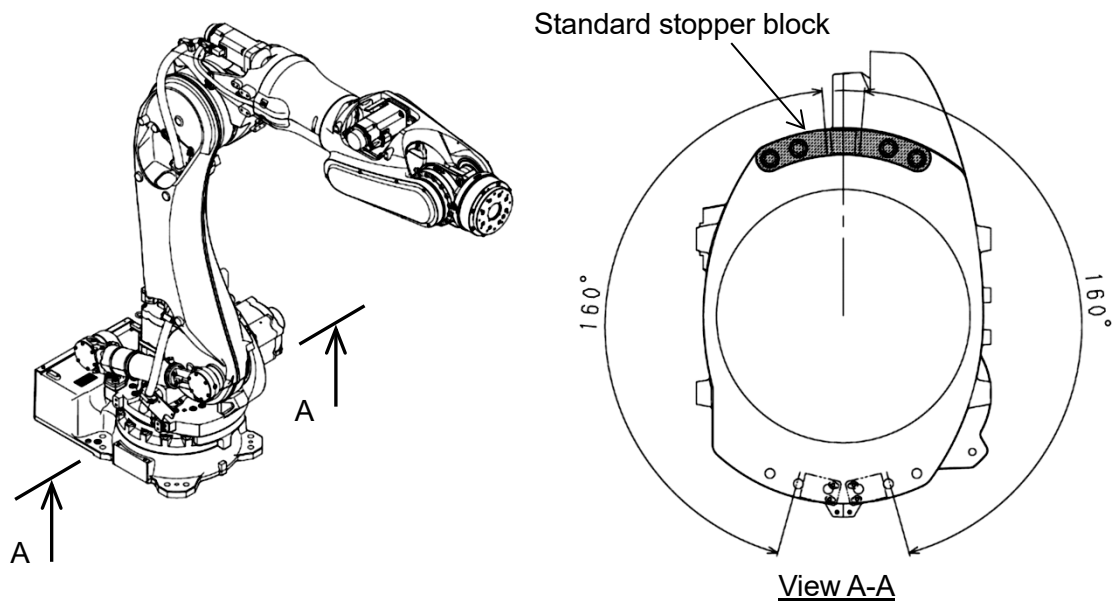
■Variable stopper block mounting

By mounting a variable adapter plate, the mounting position of the variable stopper block can be changed in increments of 10°.

It is also possible to reduce the motion range by mounting two stopper blocks. Variable stopper blocks are available as an option.

Variable adapter plates and variable stopper blocks are available in two types each.

Type	Block	Plate
A	4 installation holes	Thickness 50 mm
B	3 installation holes	Thickness 21 mm

Note   Do not mount the different types of plate and block. Otherwise, the variable stopper will not function properly.
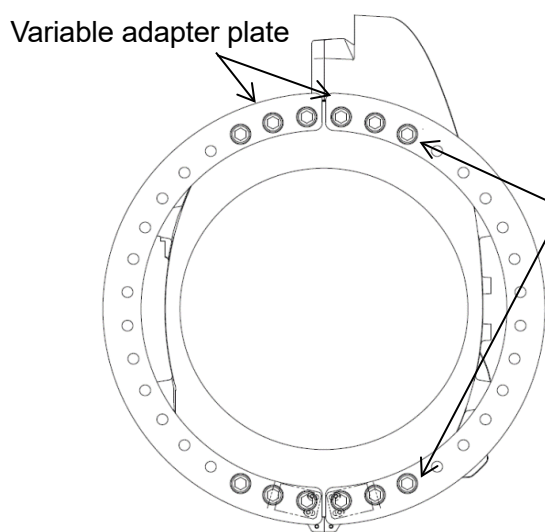
Type A   Type B

・Type A
Hexagon socket head bolt:
M16×55 (12 bolts)

・Type B
Hexagon socket head bolt:
M16×30 (12 bolts)
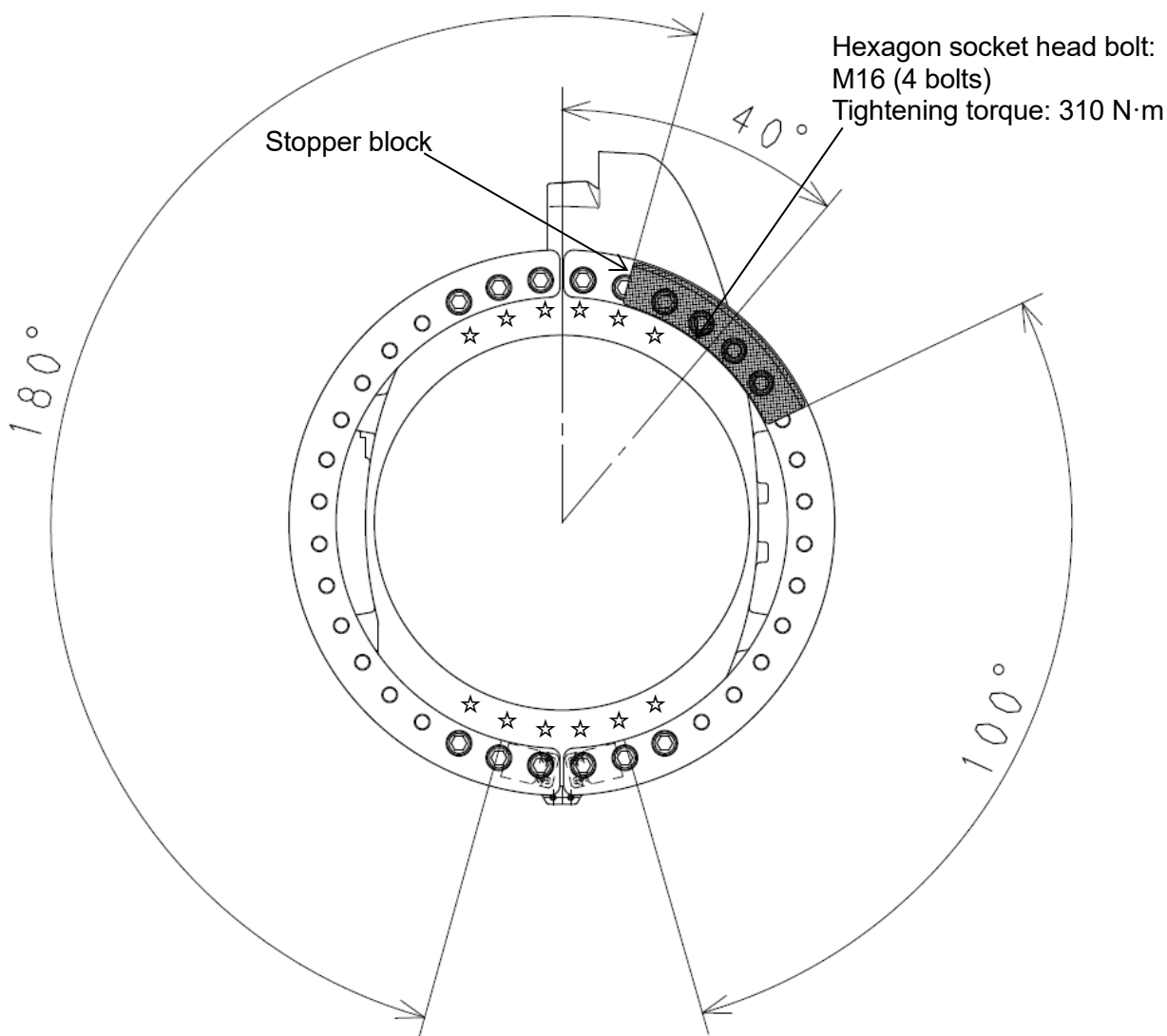
Tightening torque: 310 N·m
(Same in type A and B)

View A-A

■When using a single stopper block (Type A)

The motion range that can be adjusted by changing the stopper block mounting position is limited to up to 180° on both the positive (+) side and the negative (–) sides due to harness treatment and control restrictions. However, the total combined motion range on both sides is 280°.

If a stopper block is mounted as shown in the figure below, the motion range is 180° for the positive (+) side and 100° for the negative (−) side.

The stopper block is secured with M16×55 hexagon socket head bolts (four bolts). The fixings marked with a "☆" also secure the variable adapter plate, so M16×100 hexagon socket head bolts should be used.
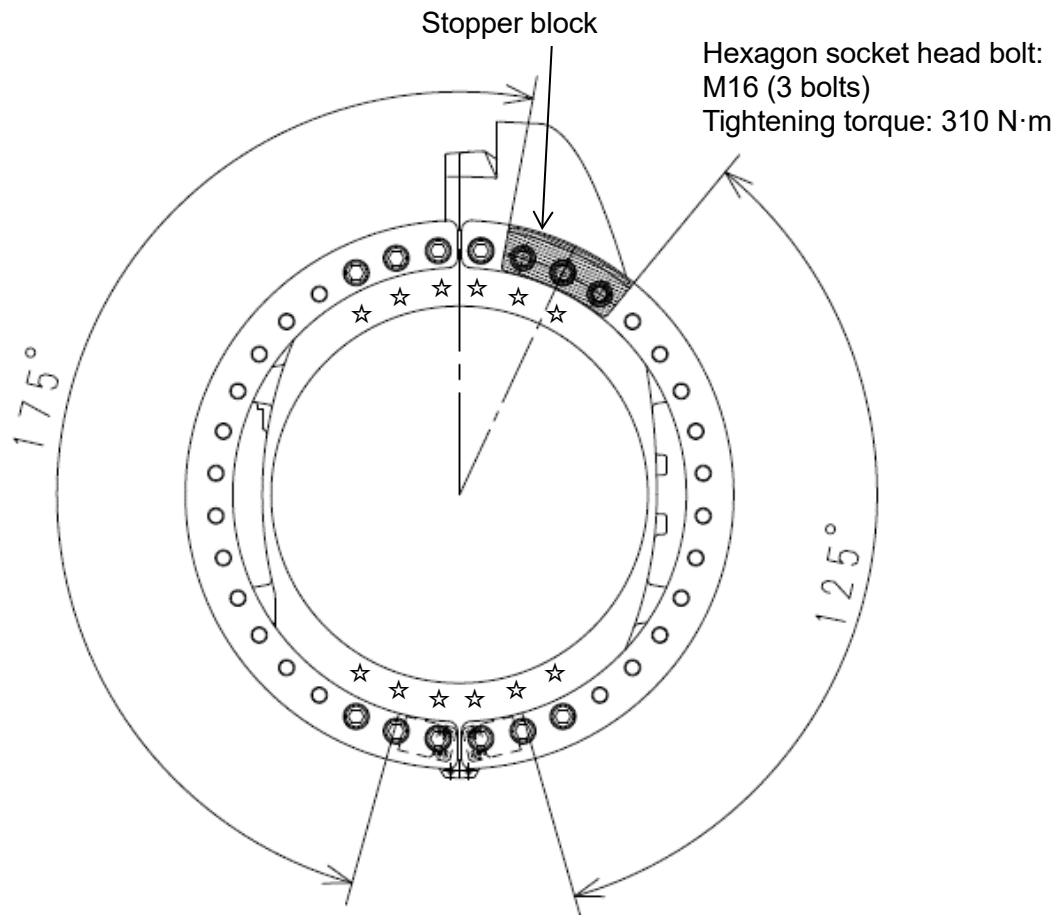
■When using a single stopper block (Type B)

The motion range that can be adjusted by changing the stopper block mounting position is limited to up to 180° on both the positive (+) side and the negative (–) sides due to harness treatment and control restrictions. (Possible range to set: 5° to 175°) However, the total combined motion range on both sides is 300°.

If a stopper block is mounted as shown in the figure below, the motion range is 175° for the positive (+) side and 125° for the negative (−) side.

The stopper block is secured with M16×75 hexagon socket head bolts (three bolts). The fixings marked with a "☆" also secure the variable adapter plate, so M16×100 hexagon socket head bolts should be used.
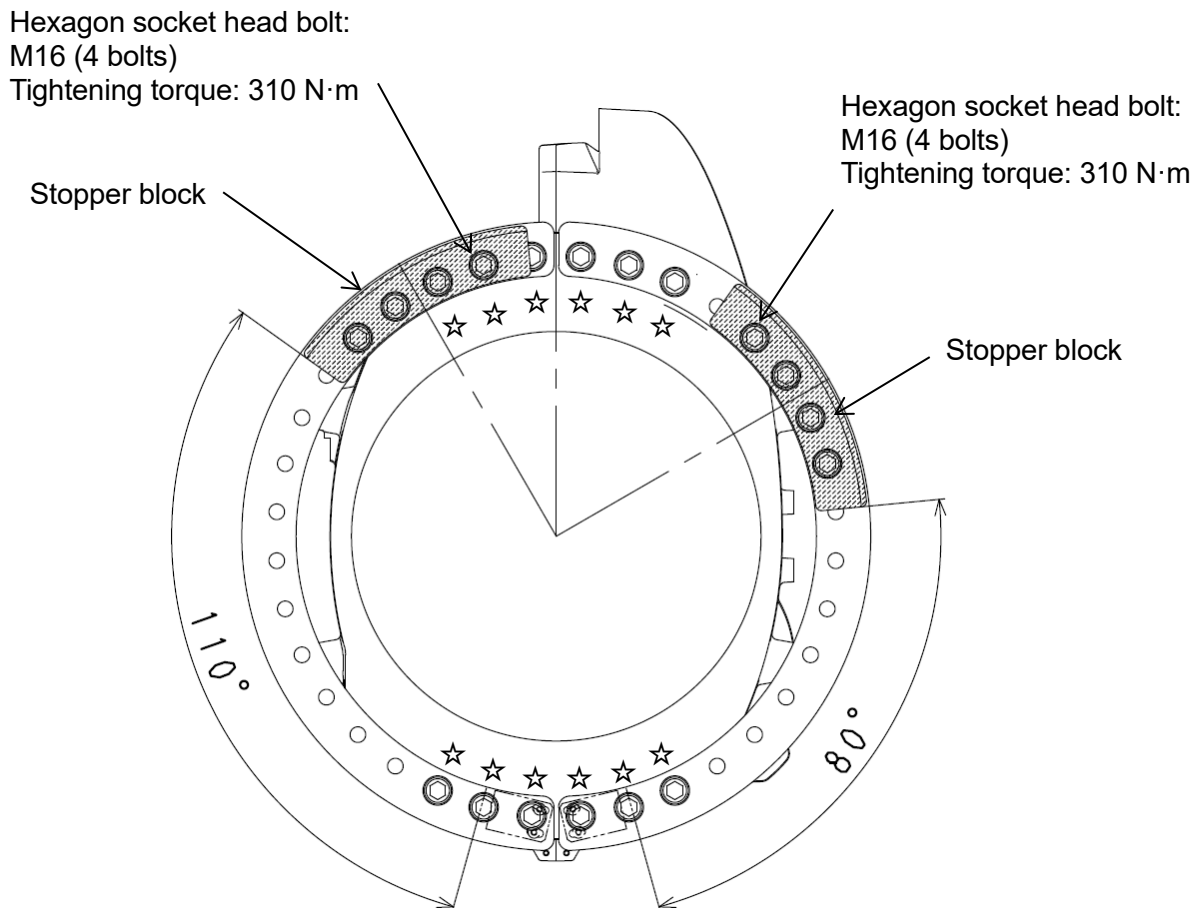
■When using two stopper blocks (Type A)

The motion range that can be adjusted by changing the stopper block mounting position is limited to up to 180° on both the positive (+) side and the negative (–) sides due to harness treatment and control restrictions. However, the total combined motion range of both sides can be adjusted between 10° and 230°.

If stopper blocks are mounted as shown in the figure below, the motion range is 110° for the positive (+) side and 80° for the negative (−) side.

The stopper blocks are secured with M16×55 hexagon socket head bolts (four bolts each). The fixings marked with a "☆" also secure the variable adapter plate, so M16×100 hexagon socket head bolts should be used.

Hexagon socket head bolt:
M16 (4 bolts)
Tightening torque: 310 N·m

Stopper block

Hexagon socket head bolt:
M16 (4 bolts)
Tightening torque: 310 N·m

Stopper block

110°

80°

■When using two stopper blocks (Type B)

The motion range that can be adjusted by changing the stopper block mounting position is limited to up to 180° on both the positive (+) side and the negative (–) sides due to harness treatment and control restrictions. (Possible range to set: 5° to 175°) However, the total combined motion range of both sides can be adjusted between 10° and 270°.

If stopper blocks are mounted as shown in the figure below, the motion range is 115° for the positive (+) side and 75° for the negative (−) side.

The stopper blocks are secured with M16×75 hexagon socket head bolts (three bolts each). The fixings marked with a "☆" also secure the variable adapter plate, so M16×100 hexagon socket head bolts should be used.
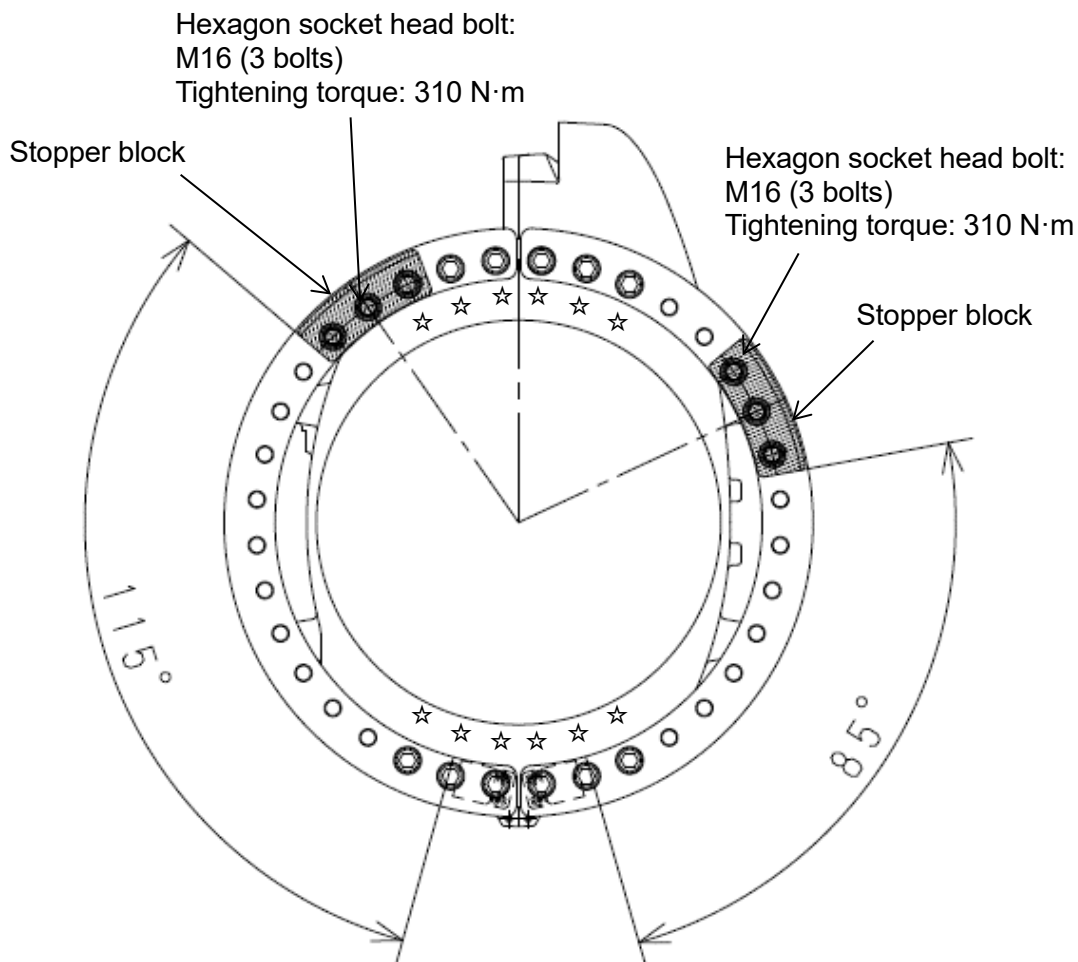
4   Transportation Methods
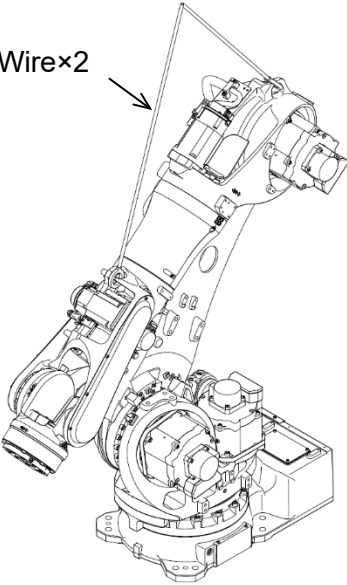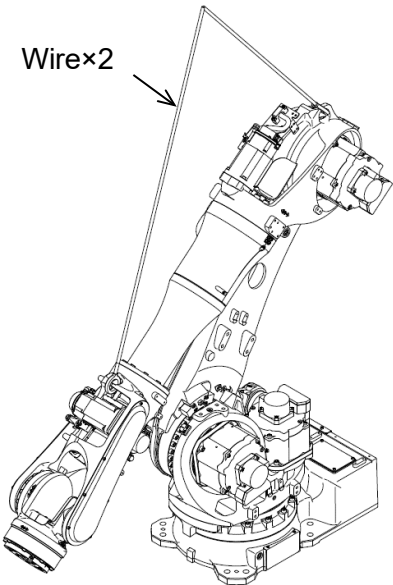
4.1   Wire Sling Suspension

Attach hooks (Manufacturer: TAIYO, Product name: V-hook, Nominal load: 1.25 tons) to the arm in the two locations shown in the figure below, and hoist the arm with wires.
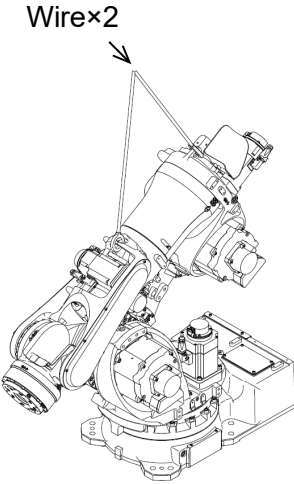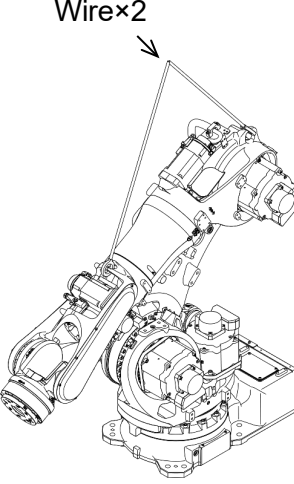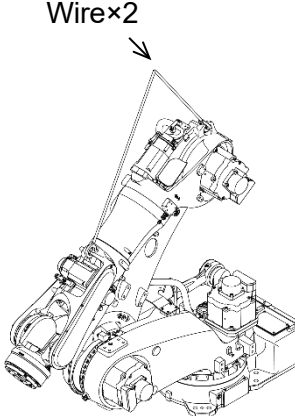
> ⚠ **WARNING**
>
> **There is a risk the robot will fall if suspended via methods other than those prescribed.**

> ⚠ **CAUTION**
>
> **When suspending the robot, care is required as it may tip forward or back depending on its posture or installed options. If the robot is suspended while at an angle, shocks may result in swinging or damage; wires may catch on the harness or piping; and external parts may cause interference resulting in damage.**

Model	BXP110L, BXP165L, BXP210L	BXP135X
Suspended posture	Wire×2	Wire×2

Hoisting posture	JT1	0°
	JT2	-35°
	JT3	-75°
	JT4	0°
	JT5	0°
	JT6	0°

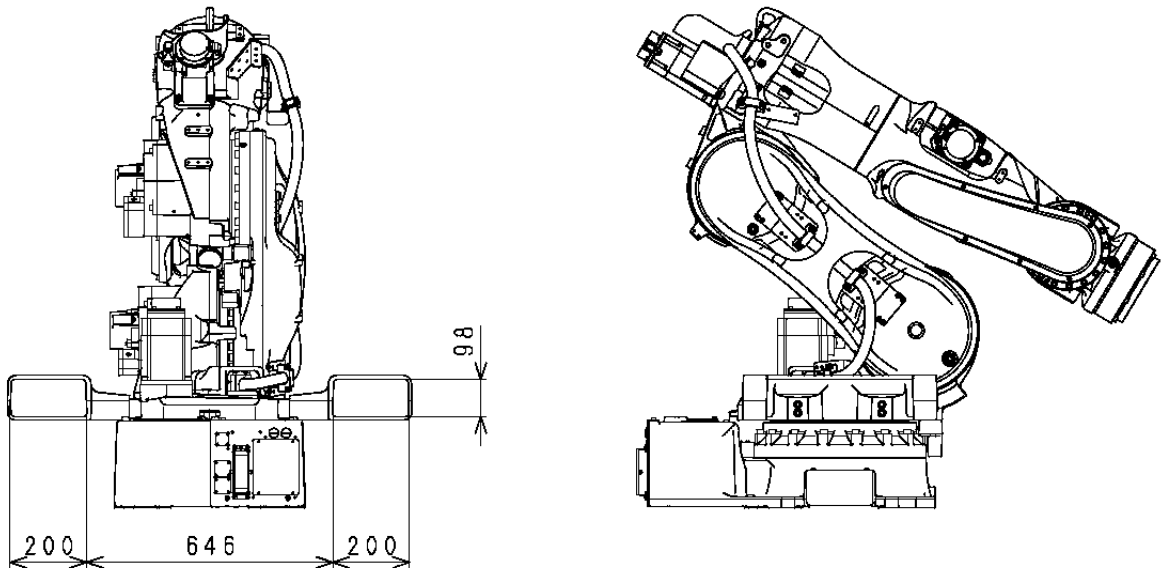| Model		BXP110S	BXP165N	BTP165L, BTP210L
Suspended posture		Wire×2	Wire×2	Wire×2
Hoisting posture	**JT1**	0°	0°	0°
	JT2	-50°	-45°	-130°
	JT3	-81°	-75°	-75°
	JT4	0°	0°	0°
	JT5	0°	0°	0°
	JT6	0°	0°	0°

4.2　Forklift

Mount a forklift lifting jig to the arm and transport it as shown in the figure below.

> ⚠ **CAUTION**
>
> 1. **Always check that the forklift forks are sufficiently engaged with the lifting jig.**
> 2. **When transporting, be careful not to overbalance and tip the forklift on sloping ground or uneven road surfaces.**
> 3. **After transport is completed, remove the lifting jig from the robot arm.**

■**BXP110S**

Hexagon socket head bolt:
M12×50 (8 bolts)
Tightening torque: 98 N·m

Forklift lifting jig
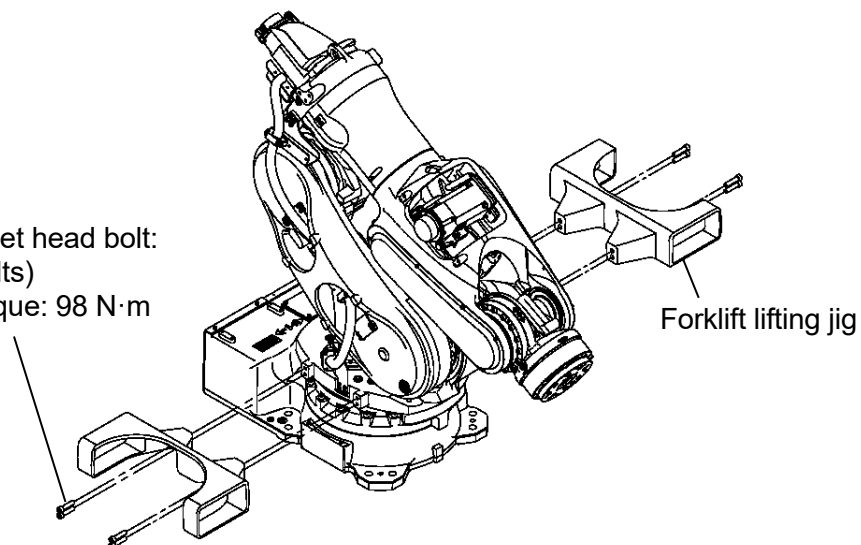
■BXP110L, BXP165N, BPX165L, BXP210L

98

200   646   200

Hexagon socket head bolt:
M12×50 (8 bolts)
Tightening torque: 98 N·m
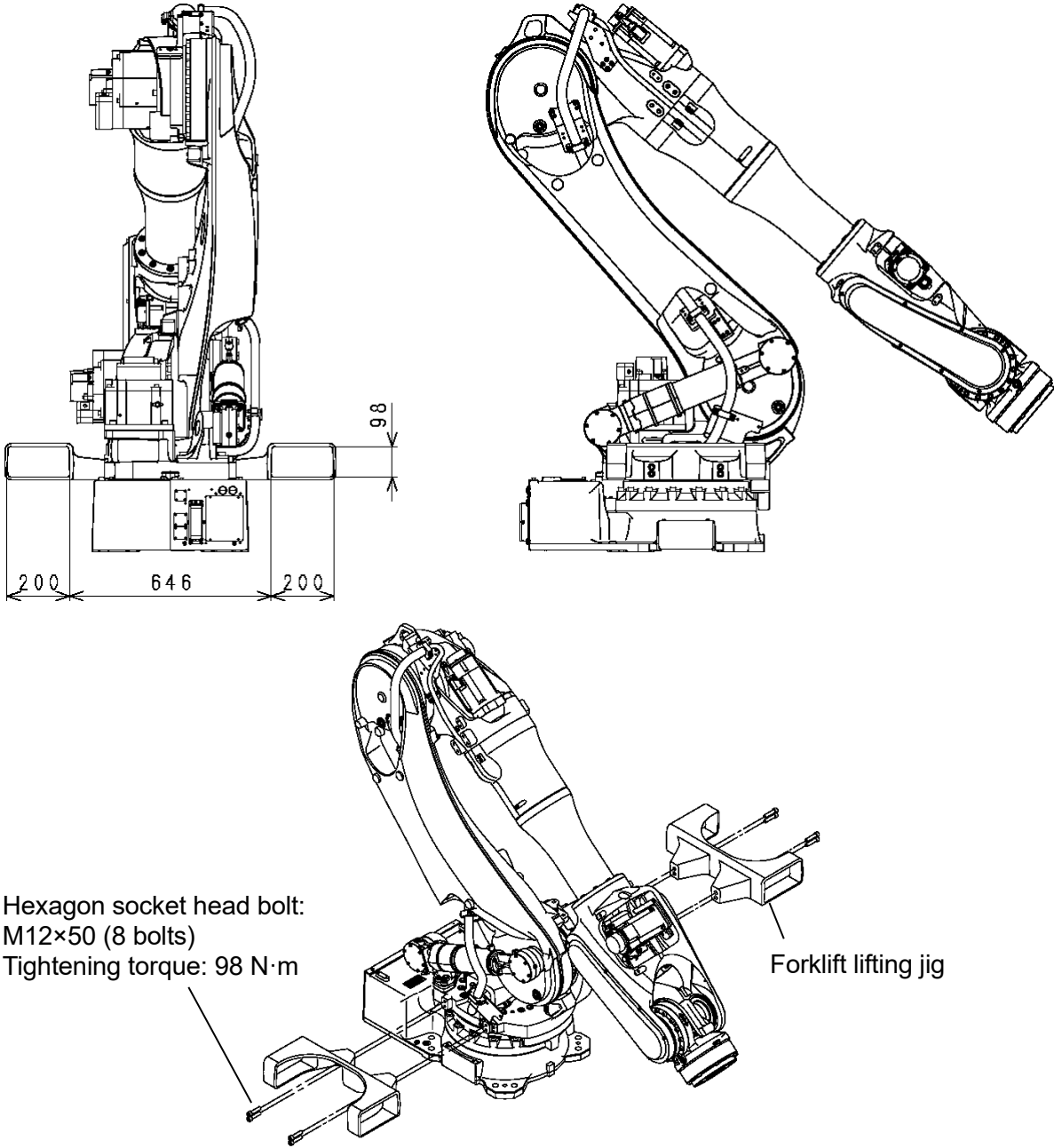
Forklift lifting jig

■**BXP135X**

98

200   646   200

Hexagon socket head bolt:
M12×50 (8 bolts)
Tightening torque: 98 N·m

Forklift lifting jig
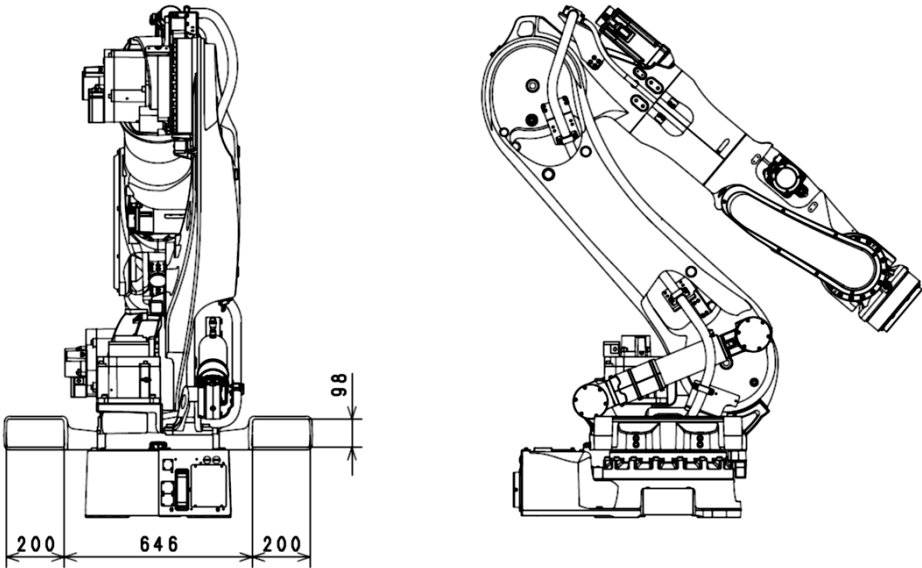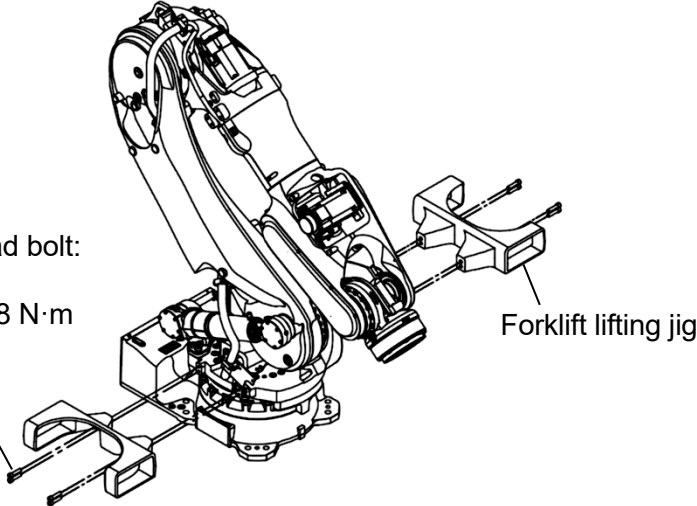
■BTP165L, BTP210L
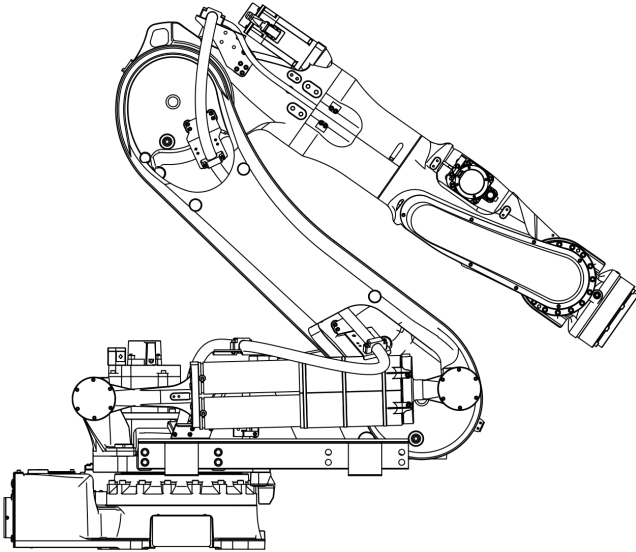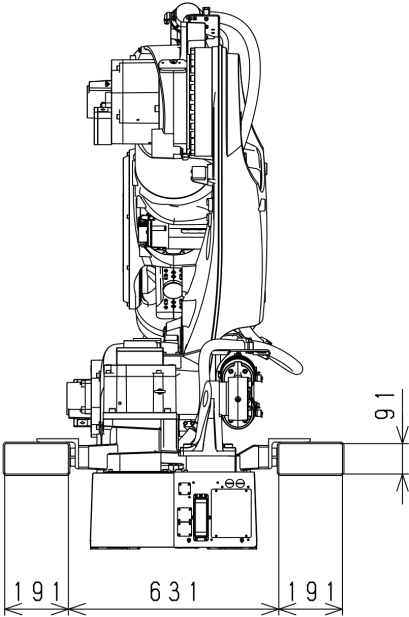
Hexagon socket head bolt:
M16x65 (8 bolts)
Tightening torque: 235.2 N·m

Forklift lifting jig

5   Base Installation Dimensions

Use the bolt holes and fix with high tensile bolts during base installation.

Model	BXP110S, BXP110L, BXP135X, BXP165N, BXP165L, BXP210L, BTP165L, BTP210L
Dimensions of the installed part	
Cross-section figure of the installed part	
Bolt holes	8-ø22
High tensile bolts	8-M20 Material: SCM435 Hardness category: 10.9 or more
Tightening torque	431 N·m
Installation surface angle	±5° or less

6   Reactive Forces on Installation Area During Operation

The reactive forces acting on the installation surface during robot operation are shown in the table below. These forces should be taken into consideration during installation.

| Model	BXP110S	BXP165N	BXP110L, BXP135X, BXP165L, BXP210L	BTP165L, BTP210L
M (tipping moment)	27,000 N·m	33,400 N·m	35,000 N·m	40,400 N·m
T (rotational torque)	10,000 N·m	13,000 N·m	15,000 N·m	21,700 N·m

For details of M and T, refer to the following chapter.

7   Installation

7.1   Installing the Base Directly on the Floor

As shown in the figure below, embed a steel plate with a thickness of at least 35 mm into the
concrete floor, or fix with anchors.
Secure the steel plate firmly enough to withstand counterforce from the robot.
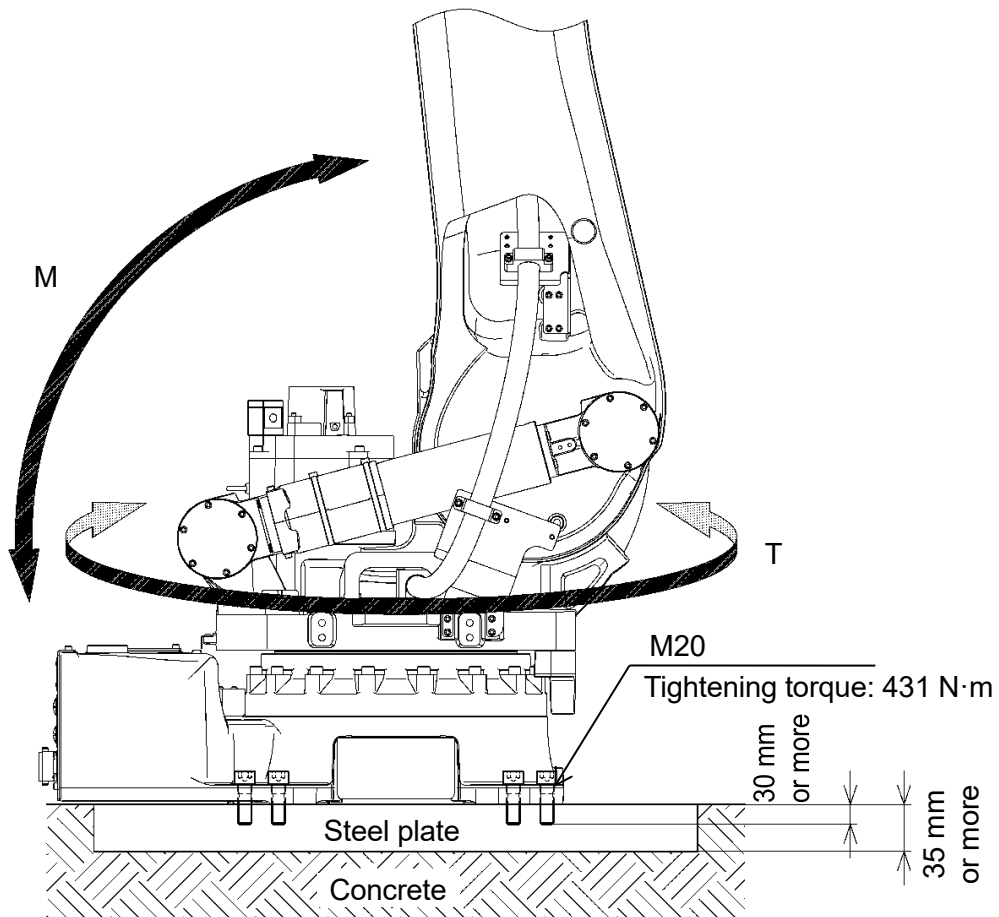
8 Mounting of Tools

> ⚠ **WARNING**
>
> **When mounting a tool, be sure to turn OFF the controller power and external power, and after clearly displaying that "inspection and maintenance is in progress," lock out and tag out the external power so that an operator or third party does not accidentally turn ON the power, causing an unexpected situation such as electric shock.**

8.1 Wrist Tip (Flange Surface) Dimensions

Pin hole   Tapped hole

φ160
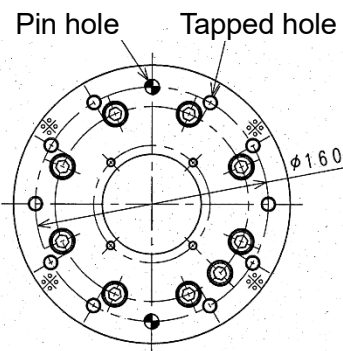
The tip of the robot arm features a flange for mounting tools. Fixing bolts should be bolted through to the tapped holes machined as ⌀160 circumferentially into the flange, as shown in the left figure. Also, use the pin holes to determine tool locations.

8.2 Passing Cables or Hoses Through the Wrist Center

12

φ98

Clamp external diameter   Clamp
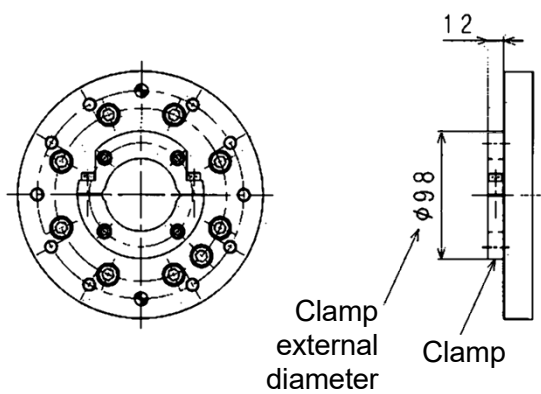
When passing cables or hoses through the center of the wrist, a clamp is mounted to the wrist flange surface as shown in the figure to the left. Provide a hole of ⌀100 to the flange on the tool side, or use adapter plate (option) or adapter bracket (option).

Adapter bracket   12

Pin hole   Tapped hole

φ125

φ98
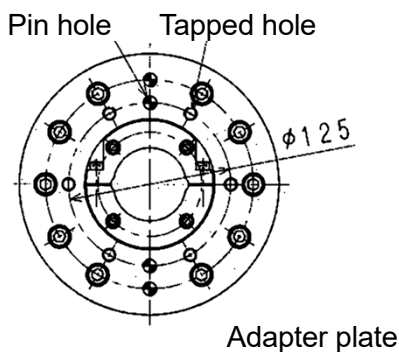
Adapter plate

Clamp external diameter   Clamp

37
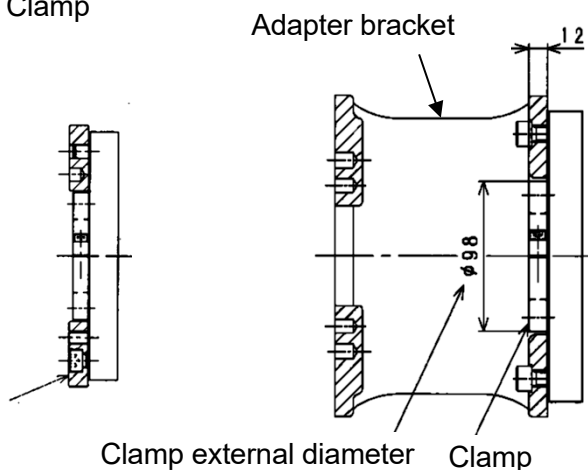
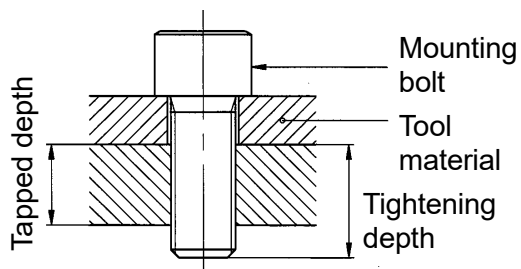## 8.3 Mounting Bolt Specifications

Mounting bolt
Tool material
Tightening depth
Tapped depth

Select mounting bolts of sufficient length according to the thickness of the tool in use, such that they reach the rated tightening depth. Additionally, use high tensile bolts, and tighten to the specified torque.

> ⚠ **CAUTION**
>
> **If the tightening depth is above the rated value, then the mounting bolts will bottom out and the tool may not be secured.**

	Standard flange	Optional flange (adapter plate)
Model	BXP/BTP series	BXP/BTP series
Tapped hole	6-M10	6-M10
⌀D	⌀160	⌀125
Pin hole	2-⌀10H7, depth 12	2-⌀10H7, depth 14
Tapped depth	19 mm	20 mm
Tightening depth	13 to 14 mm	13 to 14 mm
High tensile bolts	SCM435, 10.9 or more	SCM435, 10.9 or more
Tightening torque	56.84 N·m	56.84 N·m

	Optional flange (adapter bracket)		
Model	BXP/BTP series		
Tapped hole	10-M10	6-M10[*1]	6-M10[*1]
⌀D	⌀92	⌀125	⌀160
Pin hole	2-⌀9H7, depth 12	2-⌀10H7, depth 12	2-⌀10H7, depth 12
Tapped depth	12 mm through-hole	12 mm through-hole	12 mm through-hole
Tightening depth	13 to 18 mm	13 to 18 mm	13 to 18 mm
High tensile bolts	SCM435, 10.9 or more	SCM435, 10.9 or more	SCM435, 10.9 or more
Tightening torque	56.84 N·m	56.84 N·m	56.84 N·m

*2 Tapped holes marked with "☆" in the figure below need not be used.
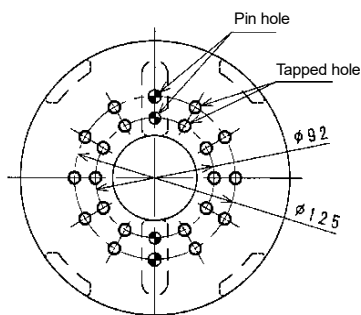
Standard flange
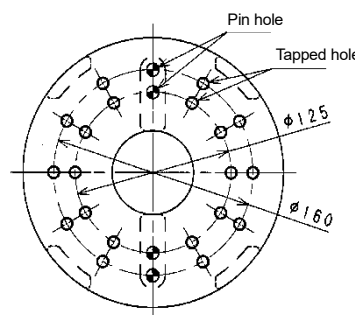
Optional flange
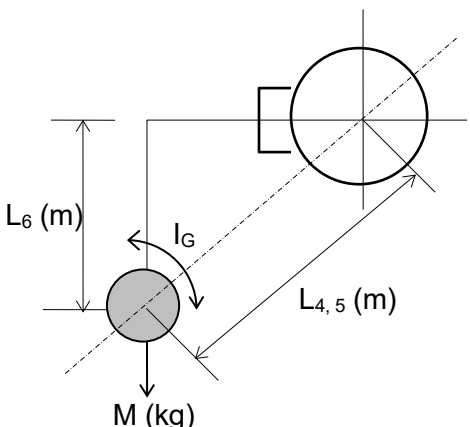
8.4   Load Capacity

The load mass capacity of the robot, including tool mass, is fixed for each robot type. Additionally, strictly observe the restrictions for load torque and load moment of inertia around each wrist axis (JT4, JT5, JT6) as shown below.

> ⚠ **CAUTION**
>
> **If a load above the specified range is applied to the robot, this can result in deteriorated operational functionality or service life. Load mass includes all tool masses such as any hands, tool changers, and spot weld guns. If an amount other than the rated load will be applied, consult with Kawasaki.**

The load torque and moment of inertia can be calculated using the following formula.

Calculation formula

Load mass (including tool): $M \leq M_{max}$ (kg)

Load torque: $T = 9.8 \cdot M \cdot L$ (N·m)

Load moment of inertia: $I = M \cdot L^2 + I_G$ (kg·m^2)

M_{max}:   Maximum load mass: See section 3.2.

L: Distance from center of axis rotation to load center of gravity (Units: m) (See diagram)

- $L_{4,5}$: Distance from JT4 (5) center of rotation to load center of gravity
- L_6:   Distance from JT6 center of rotation to load center of gravity
- I_G: Moment of inertia around the center of gravity (Units: kg·m^2)

When calculating with the load divided between multiple locations (for example, tool and workpiece, etc.), use the total combined values as the load torque and moment of inertia.

Strictly adhere to the following restrictions regarding load of the wrist part.

1.   Keep the load mass, including the tool mass, at or below the following values.

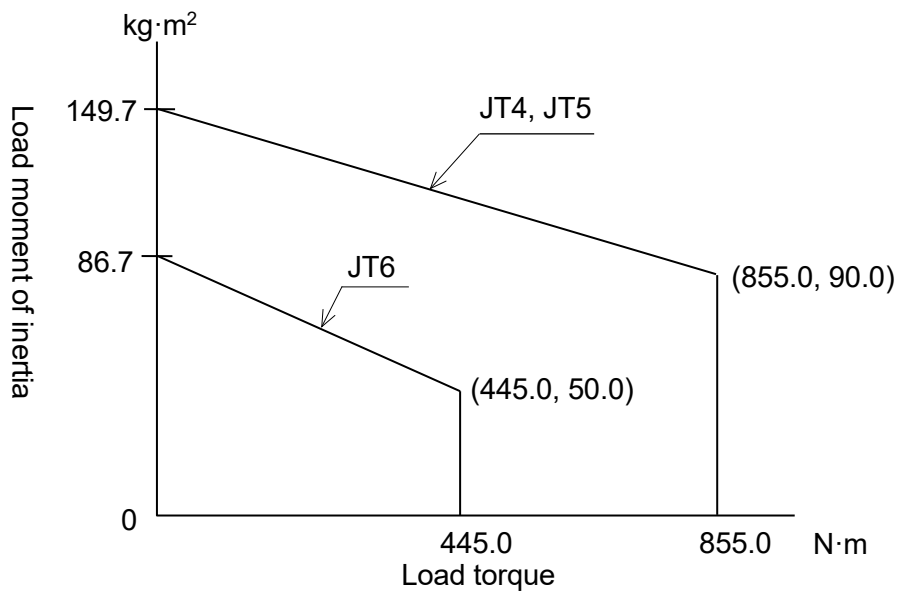| Model	Load mass
BXP110L, BXP110S	110 kg
BXP135X	135 kg
BXP165N, BXP165L, BTP165L	165 kg
BXP210L, BTP210L	210 kg

2. There are restrictions for the load torque and load moment of inertia around each wrist axis (JT4, JT5, JT6).

Keep the load torque and load moment of inertia around each axis within the allowable ranges shown in the figure below.

> ⚠ **CAUTION**
>
> **After tool installation, always make sure to set the load via auxiliary function 0304. Operating the robot with incorrect settings may cause vibrations in motion, degradation of movement performance, and shortening of robot service life.**

BXP110L, BXP110S

kg·m²

Load moment of inertia

149.7 — JT4, JT5

86.7 — JT6

(855.0, 90.0)

(445.0, 50.0)

0

445.0   855.0   N·m

Load torque

BXP135X

kg·m²

Load moment of inertia

187.98 — JT4, JT5

89.23 — JT6

(855.0, 90.0)

(445.0, 50.0)

0

445.0   855.0   N·m

Load torque

40

BXP165N

kg·m²

Load moment of inertia

239.64

162.98

JT4, JT5

JT6

(940.0, 105.0)

(510.0, 50.0)

0

510.0

940.0

N·m

Load torque

BXP165L, BTP165L

kg·m²

Load moment of inertia

242.51

169.18

JT4, JT5

JT6

(960.0, 105.0)

(520.0, 50.0)

0

520.0

960.0

N·m

Load torque

BXP210L, BTP210L

kg·m²

Load moment of inertia

492.5 ——— JT4, JT5

354.22 ——

JT6

(1,380.0, 205.0)

(600.0, 160.0)

0

600.0   1,380.0   N·m
Load torque

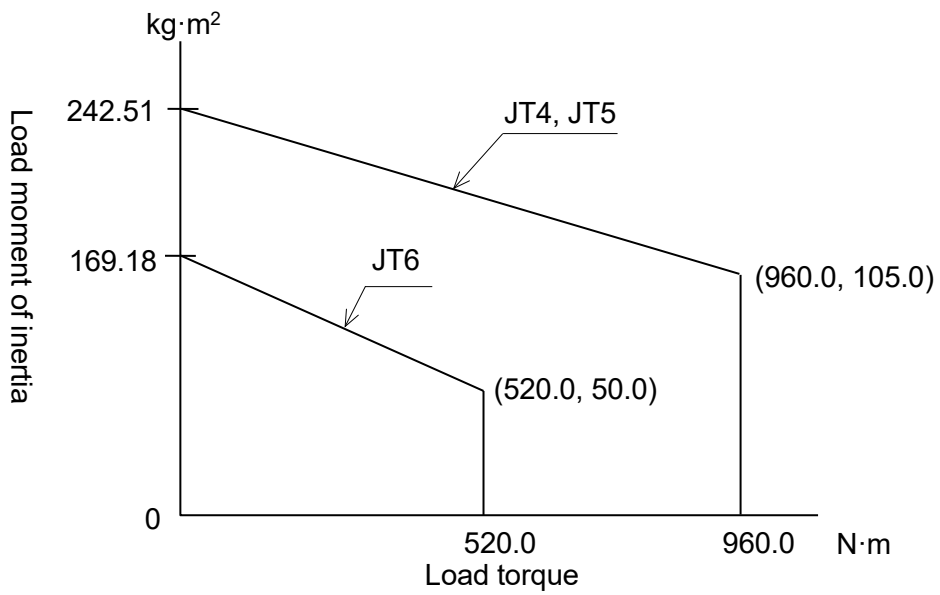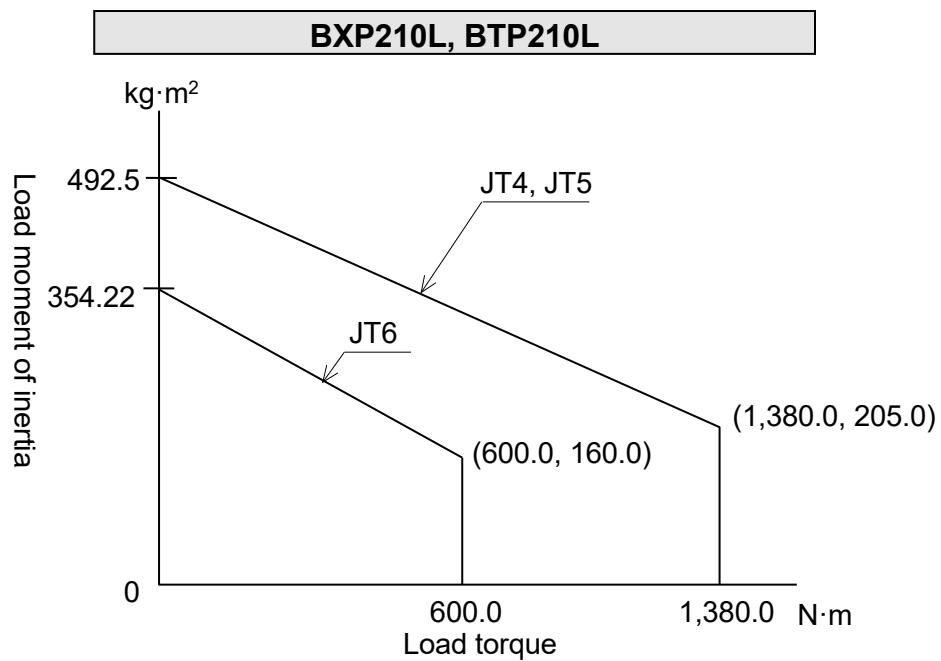# 9 Mounting of External Devices

9.1 Service Tapped Hole Positions

Service tapped holes, shown in the figure below, are provided on each part of the robot arm for mounting external devices, wiring brackets, arm-fixing jigs, etc.

> ⚠ **CAUTION**
>
> **Perform a thorough operation check to confirm that mounted external devices, brackets, and fixing jigs for arm do not interfere with peripheral equipment or the robot arm itself.**

■**BXP110S**

Cross section A-A   Section C detail   Section D detail

■BXP110L, BXP135X, BXP165N, BXP165L, BXP210L

3–M16 depth 32

3×2–M6 depth 12

2×2–M6 depth 12

6–M8 depth 16

2–M8 depth 16

3–M16 depth 32

2×2–M16 depth 32

2×2–M6 depth 12

2×2–M12 depth 24

Cross section A-A

■BTP165L, BTP210L

View A
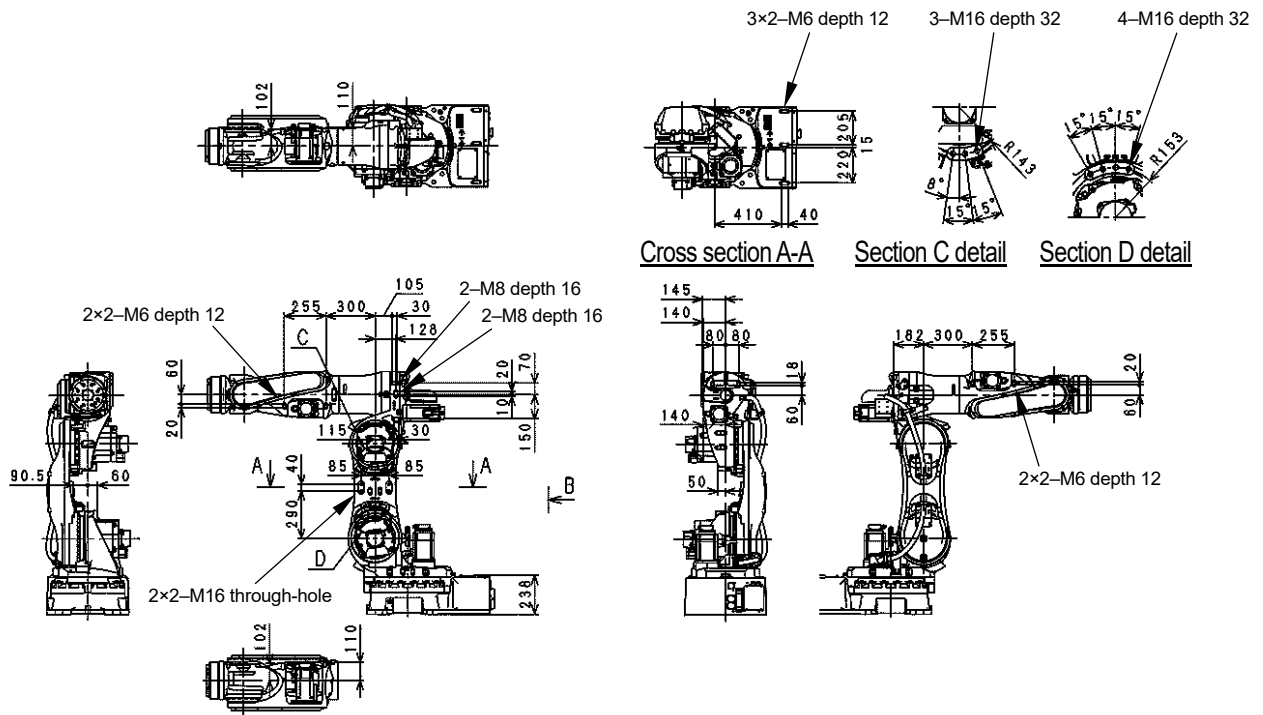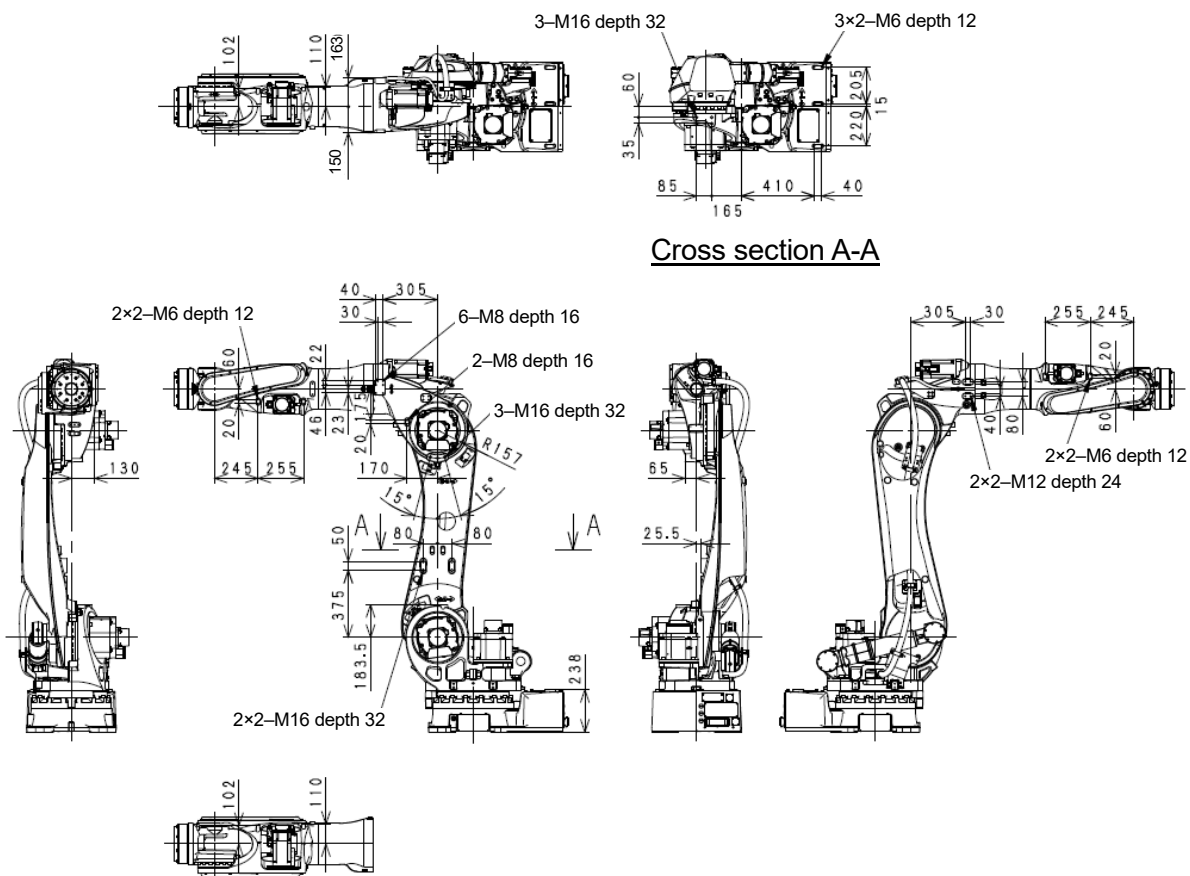
9.2 Calculation of External Device Load Capacity

The mass load capacity of the robot is fixed for each model. Additionally, strictly observe the restrictions as follows for the allowable load on the arm.

> ⚠ **CAUTION**
>
> **If a load above the specified range is applied to the robot, this can result in deteriorated operational functionality or service life. If an amount other than the rated load will be applied, consult with Kawasaki.**

For both JT2 and JT3, limit the total load torque on the wrist tip and arm so as not to exceed the maximum allowable load torque. The load torque can be calculated using the formula below.

Calculation formula
BXP110S, BXP110L, BXP135X, BXP165N, BXP165L, BXP210L, BTP165L, BTP210L

- JT3: $W(L_3+l_w) + W_3 \cdot l_3 \leq W_{max.}(L_3+L_W)$
- JT2: $W(L_2+L_3+l_w) + W_3(L_2+l_3) \leq W_{max.}(L_2+L_3+L_W)$

W_{max}: Maximum allowable load [kg]

W: Load on wrist tip [kg]

W_3: Total load on upper arm [kg]

l_w: Position of wrist load center of gravity [mm]

l_3: Position of center of gravity of total load on upper arm [mm]

Use the values shown in the table below for the calculation.

	L_1 [mm]	L_2 [mm]	L_3 [mm]	L_w [mm]	W_{max} [kg]
BXP110S	200	580	855	1,063	110
BXP110L	200	1,126	1,271	793	110
BXP135X	200	1,126	1,666	646	135
BXP165N	200	854	1,271	581	165
BXP165L	200	1,126	1,271	680	165
BXP210L	200	1,126	1,271	670	210
BTP165L	720	1,160	1,271	680	165
BTP210L	720	1,160	1,271	670	210

However, ensure that the value of W_3 satisfies the following inequality.

$W (L_1+L_2+L_3+l_w) + W_3 (L_1+L_2+l_3) \leq W_{max} (L_1+L_2+L_3+L_W)$

> ⚠ **CAUTION**
>
> **When shipped, W_3, W, l_3, and l_w are the default settings. When using the robot for the first time, or when changing the load mass or load center of gravity position, be sure to set W_3, W, l_3, and l_w using the auxiliary functions 0304 and 0404. Operating the robot with incorrect settings may cause vibrations in motion, degradation of movement performance, and shortening of robot service life.**

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