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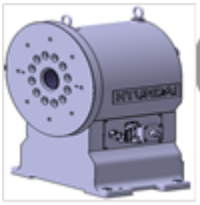
**Warning**

All installation works must be performed by a qualified installer and must comply with applicable laws and regulations.



# Positioner Main Body Maintenance Manual



Applicable model: HAP1-0500-04 (Payload: 500 kg)
HAP1-1000-03 (Payload: 1,000 kg)

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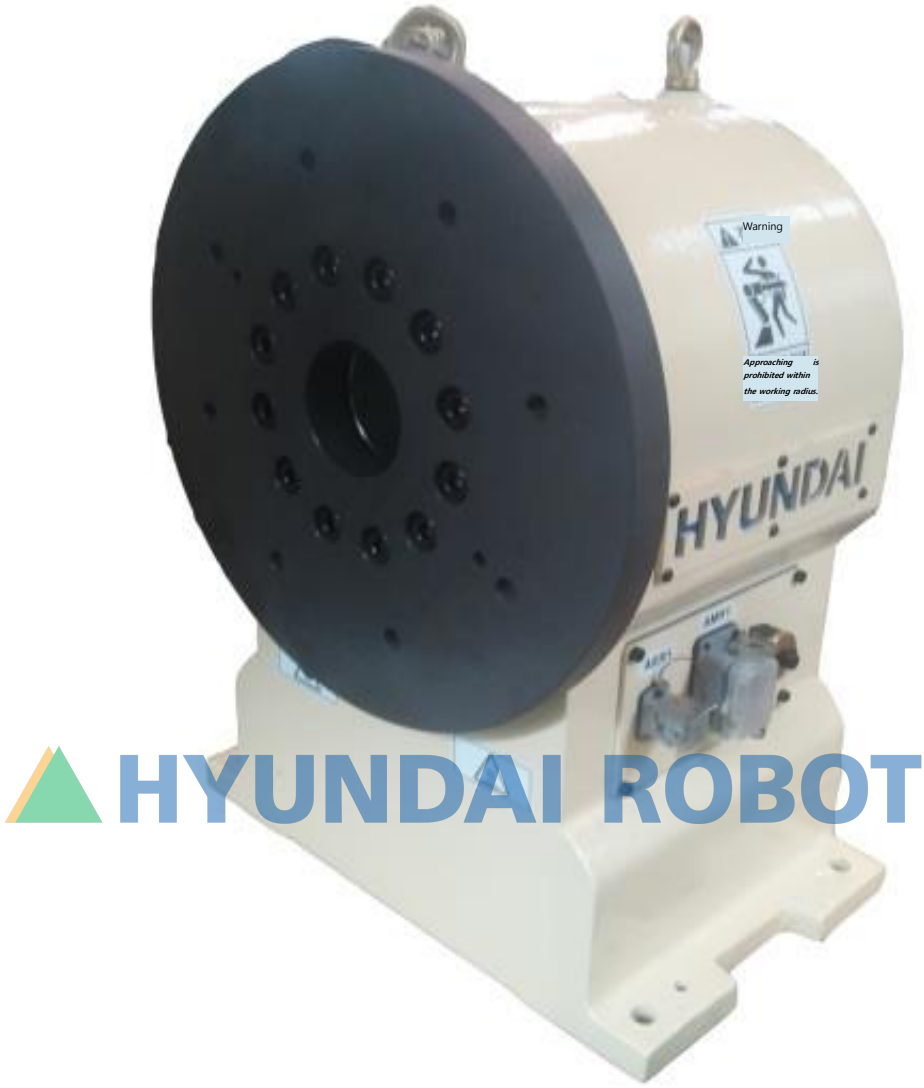




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The manual may be changed without prior notification
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# Specification

## 1.1. Instrument Part Type of the Positioner

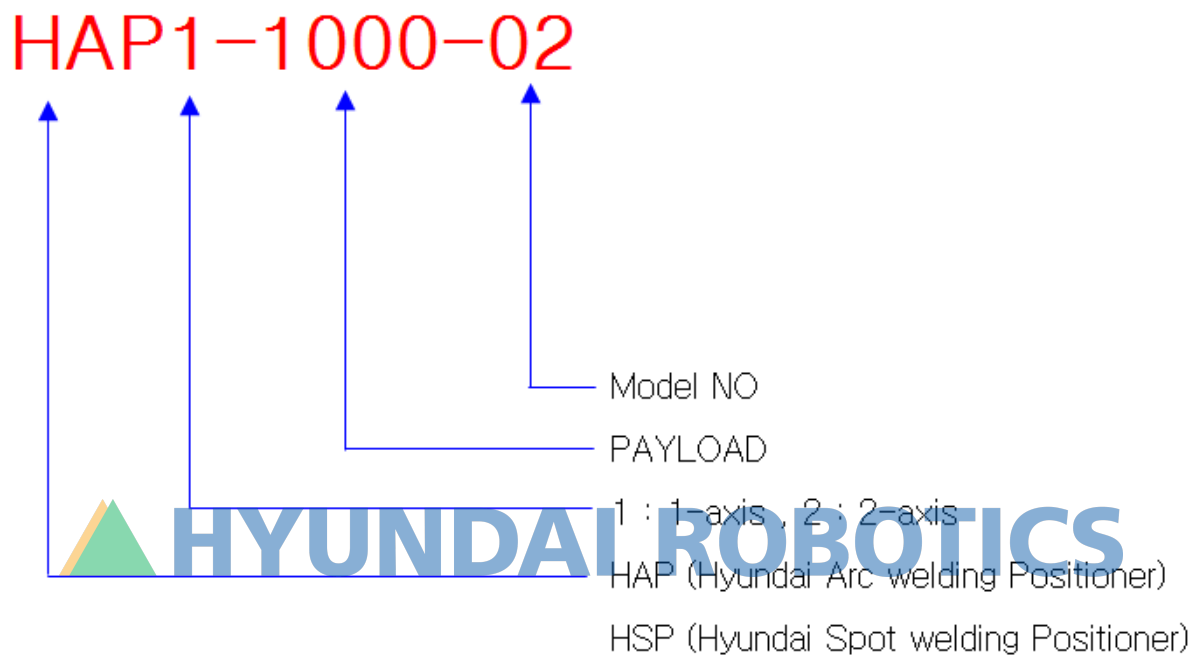





Figure 1.1 Instrument Part Type of the Positioner

## 1.2. Name Plate Position of the Positioner

The nameplate contains the positioner type, serial number, and date of manufacture.
The nameplate is located on the bottom (left) part of the main body, as shown below.

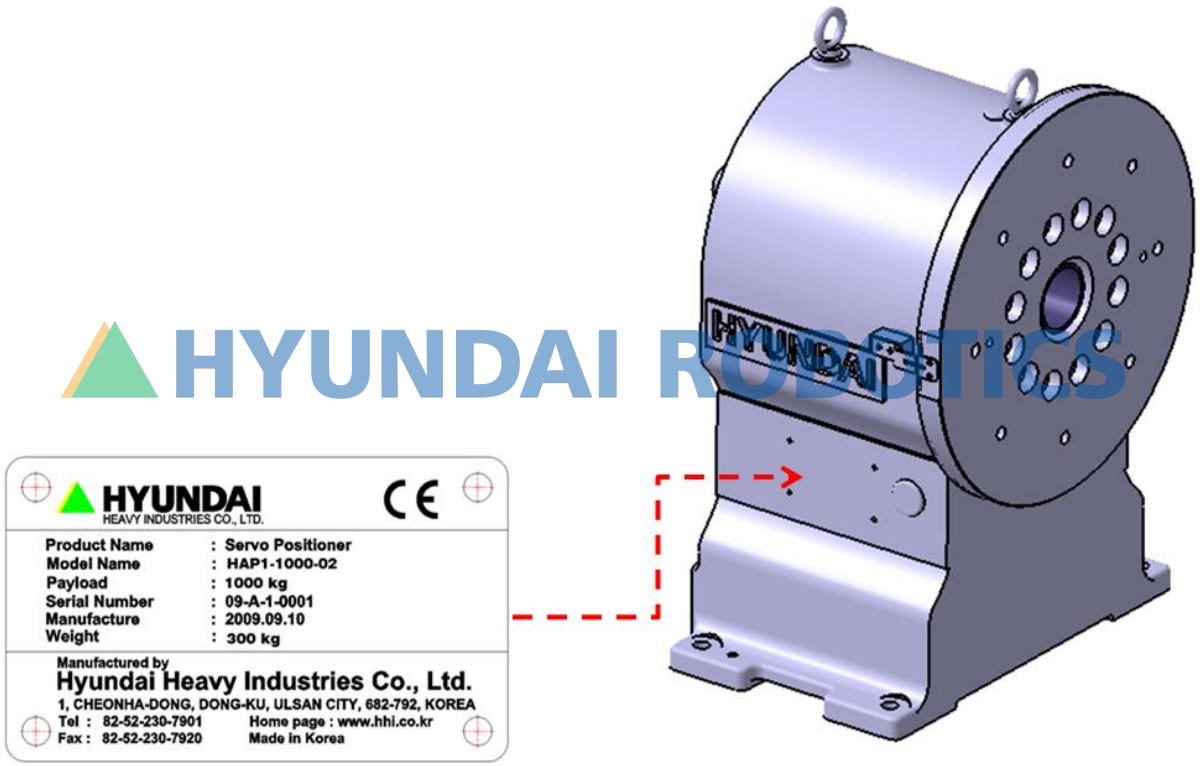
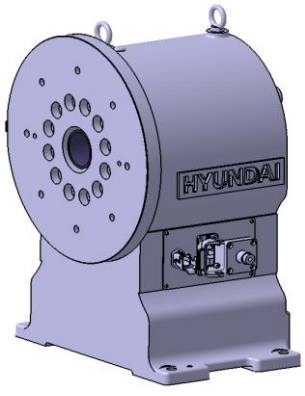





Figure 1.2 Attachment of the Positioner Name Plate

## 1.3. Basic Specification

Table 1-1 Basic Specification

| No. | Item | Unit. | Specification | |
|---|---|---|---|---|
| 1 | ARC Positioner Model | | HAP1-0500-04(500KG) | HAP1-1000-03(1000KG) |
| 2 | Motor | Type No. | TSM3506 N7021 E732 | |
| | | Capacity | 2.5 kW | |
| 3 | Reducer | Type No. | F2CF-C45-59 | F2CF-C55-59 |
| 4 | Maximum Operation Angle | ° | ±360° | |
| 5 | Maximum Operation Speed | °/s | 110 | 75 |
| 6 | Allowable Output Torque | Kgf.m | 500 | 2500 |
| 7 | Allowable Output Inertia | Kg.m² | 50 | 200 |
| 8 | Repetitive Positioning Accuracy | mm | ±0.1mm | |
| 9 | Main Body Weight | - | 200 kg | 300 kg |
| 10 | Applicable Controller | - | Hi5a ROBOT Controller | |
| 11 | Shape | |  |  |

## 1.4. External Dimensions and Operation Area of the Main Body

### 1.4.1. External Dimensions of the Main Body (HAP1-0500-04, 500 kg)

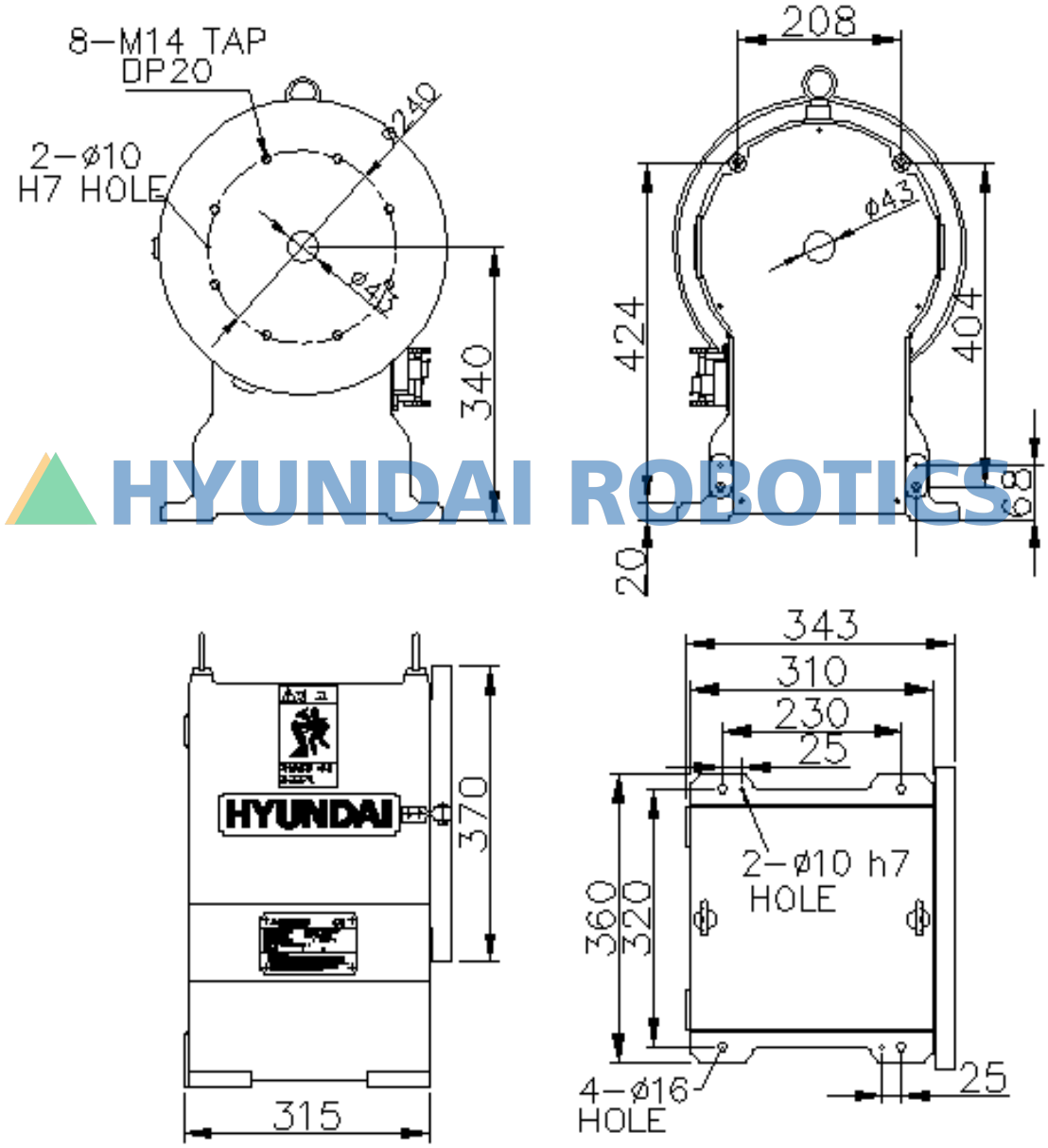





Figure 1.3 External Dimensions of the Main Body

### 1.4.2. External Dimensions of the Main Body (HAP1-1000-03, 1,000 kg)

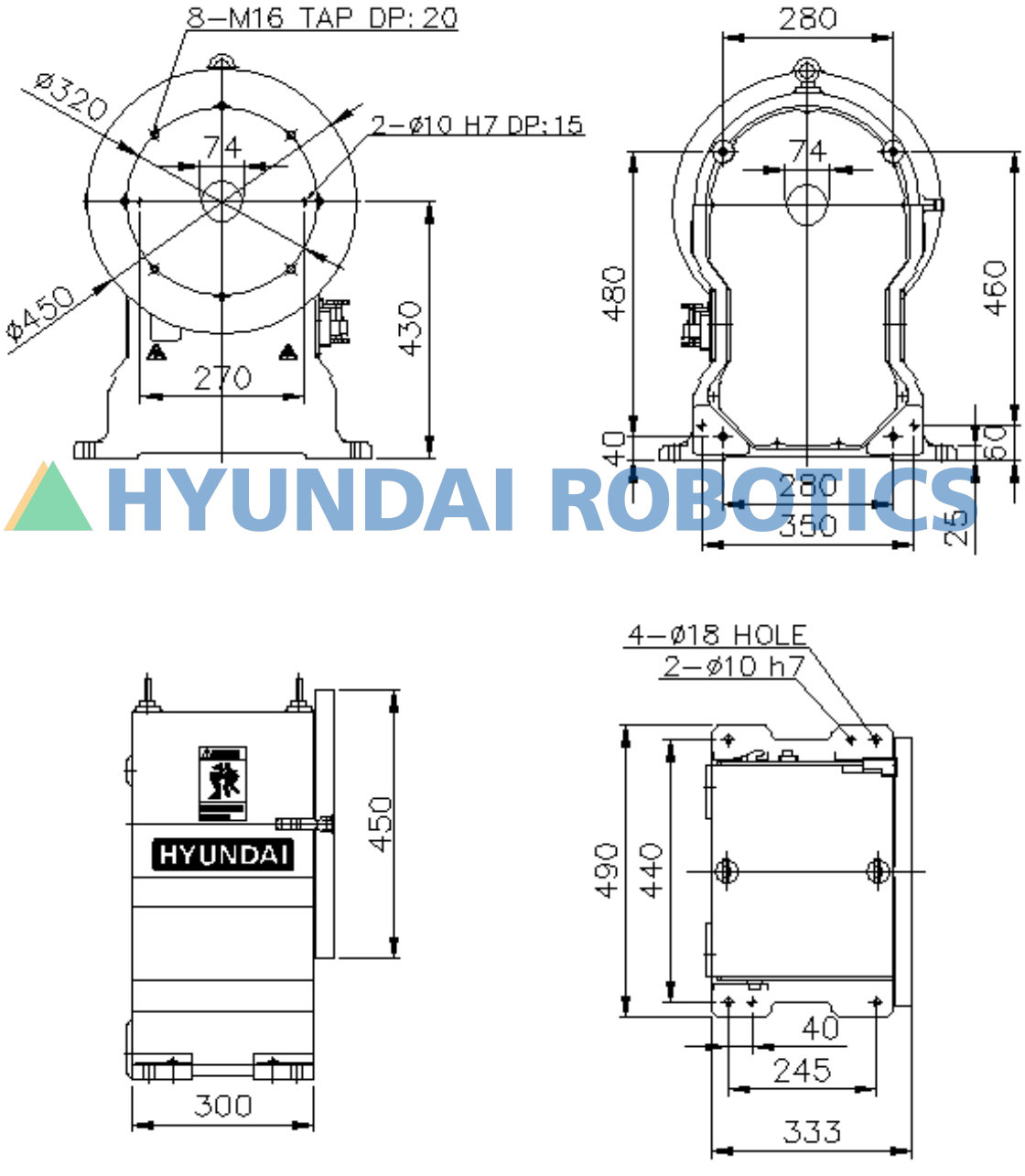





Figure 1.4 External Dimensions of the Main Body

### 1.4.3. Operation Axes and Their Names

Table 1-2 Rotation Direction of Individual Axes

| Operation | Teach Pendant Button | |
|---|---|---|
| Turning | Left (S-) | Right (S+) |

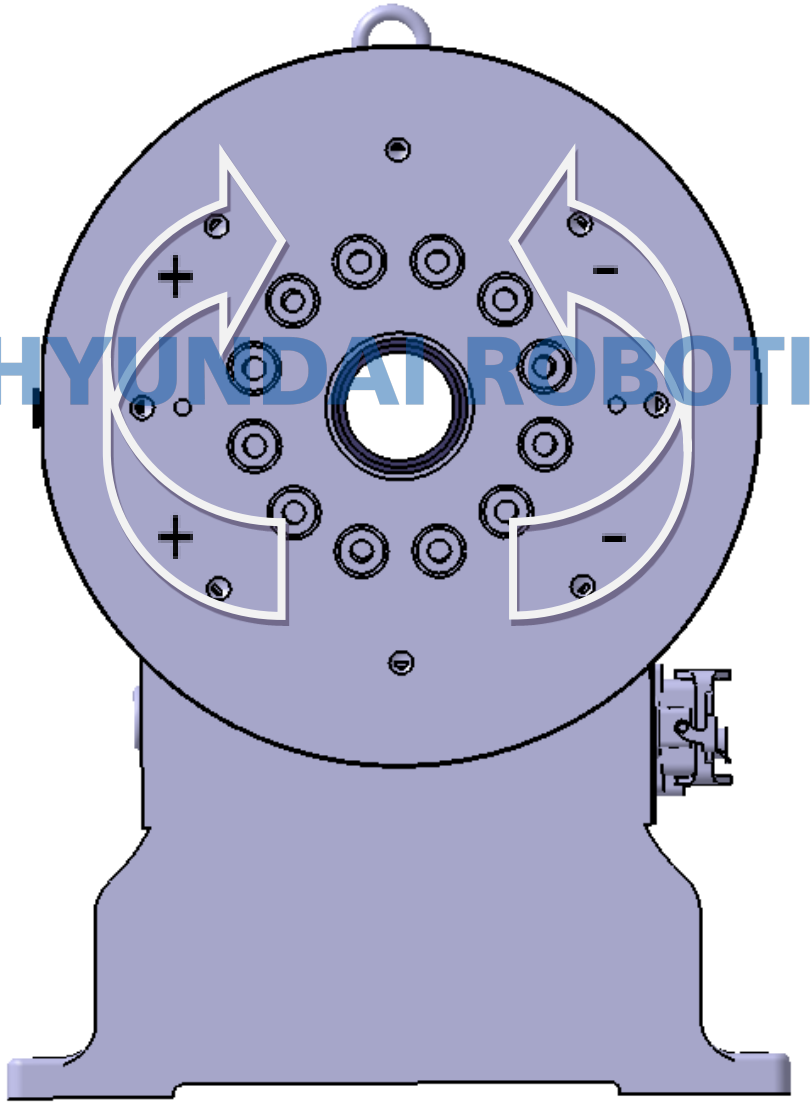





Figure 1.5 Exterior and Operation Axes of the Main Body

## 1.4.4. Explode-View Drawing of the One-Axis Positioner

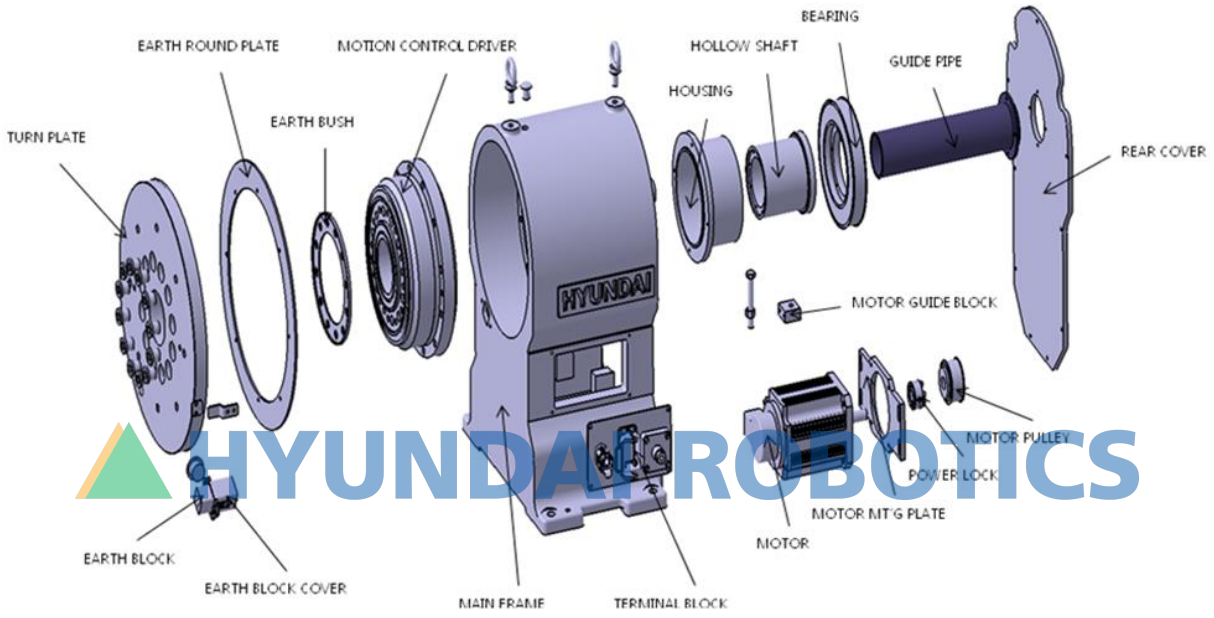





Figure 1.6 Exploded-View Drawing of One-Axis Positioner

## 1.5. Detailed Drawing of the Output Side Attachment Surface (500 kg)

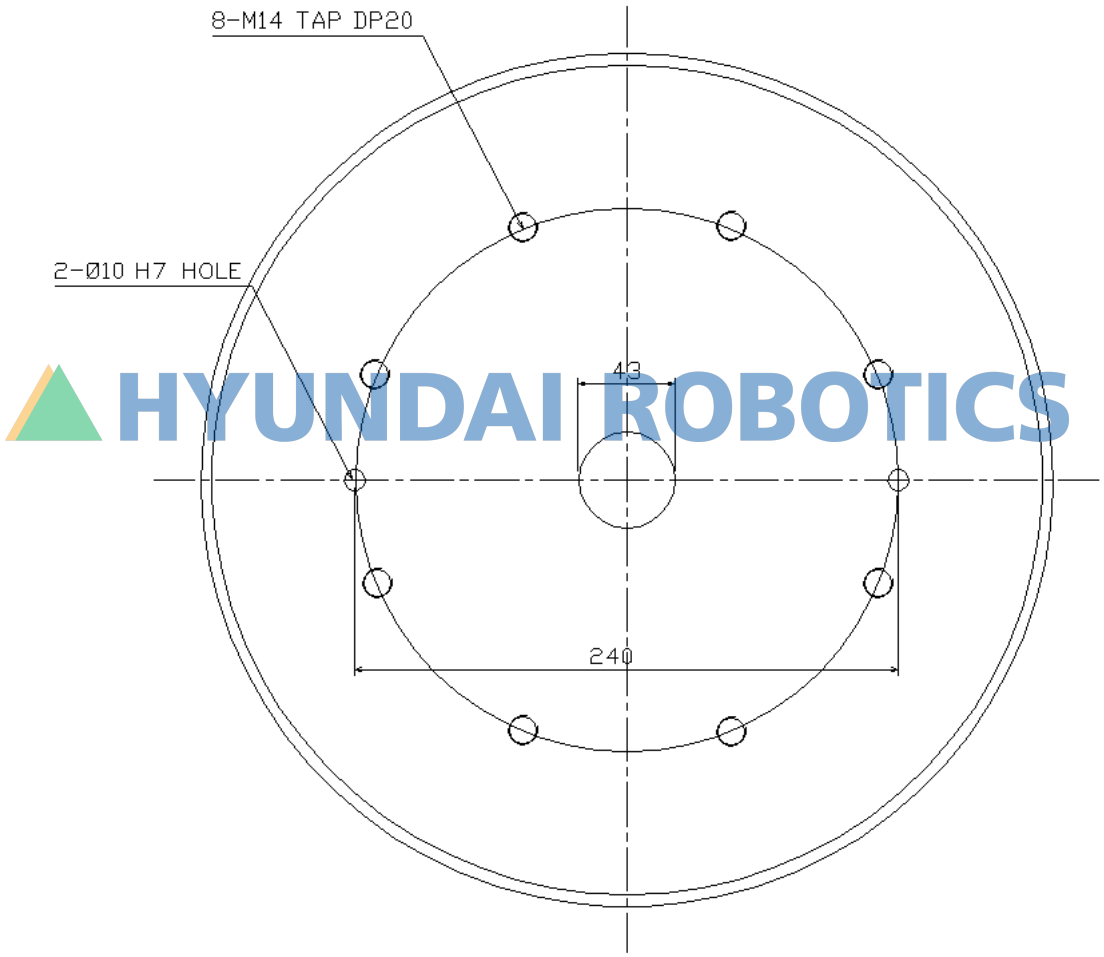





Figure 1.7 Detailed Drawing of the Mechanical Interface Attachment Surface

## 1.6. Detailed Drawing of the Output Side Attachment Surface (1,000 kg)

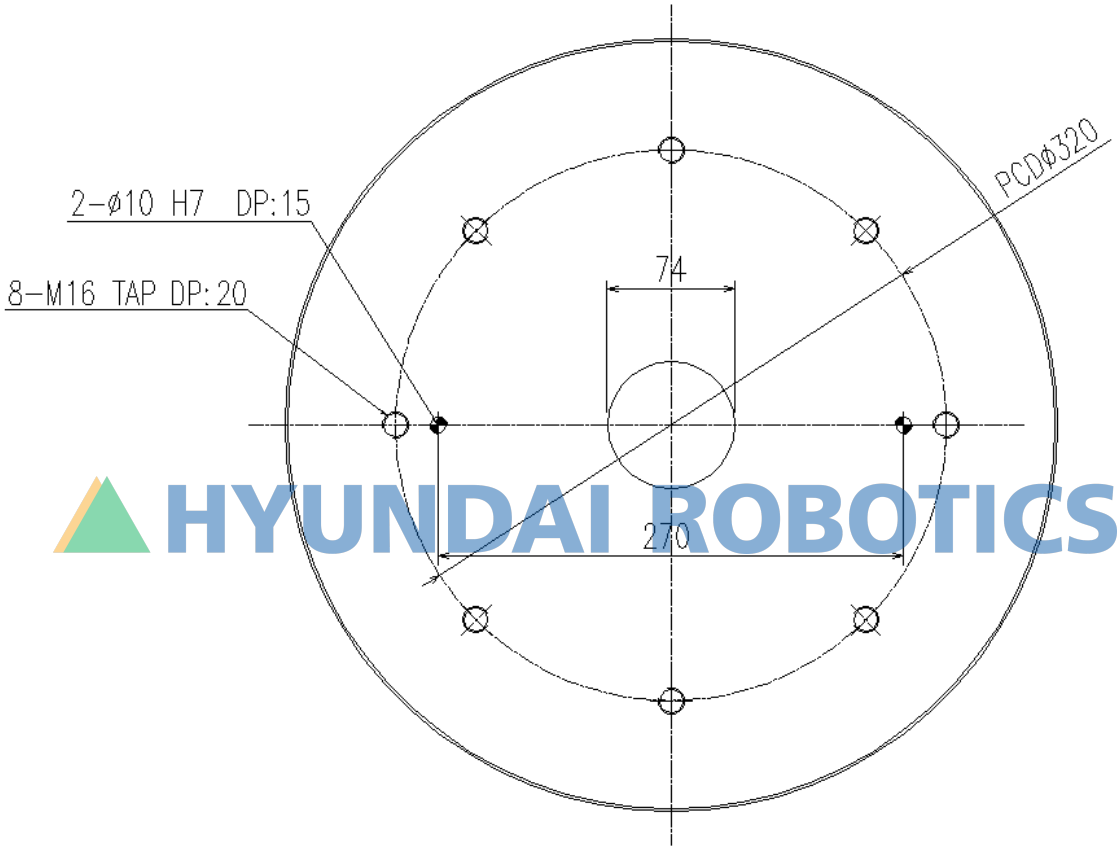





Figure 1.8 Detailed Drawing of the Mechanical Interface Attachment Surface

## 1.7. Restriction of the Operation Range

When installing the positioner, it should be taken into consideration that the operation range can be freely adjusted within the entire operating area.

It will be useful to restrict the operating range in the following environments:

- ✓ When trying to restrict the operation area when the positioner operates;
- ✓ When a collision with a peripheral device could occur; and
- ✓ If the length of the application cable or hose is restricted.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# 2 Precautions in Handling

## 2.1. Names of Individual Parts

The names of individual parts of the main body are shown below in [Figure 2.1].

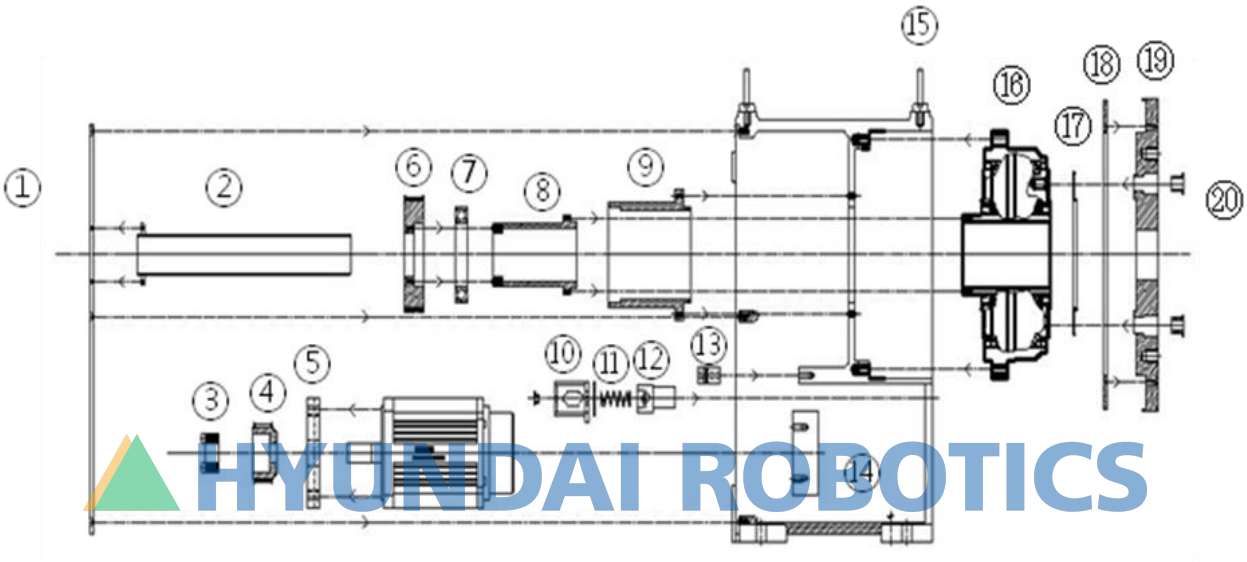




Figure 2.1 Names of Individual Parts of the Main Body

Table 2-1 Names of Individual Parts of the Main Body

| No. | Names of Individual Parts | No. | Names of Individual Parts |
|---|---|---|---|
| 1 | REAR COVER | 11 | SPRING |
| 2 | GUIDE PIPE | 12 | EARTH BLOCK |
| 3 | POWER LOCK | 13 | MOTOR SETTING PLATE |
| 4 | MOTOR PULLEY | 14 | MAIN FRAME |
| 5 | MOTOR MT'G PLATE | 15 | EYE BOLT |
| 6 | REDUCER PULLY | 16 | REDUCER |
| 7 | BEARING | 17 | EARTH PLATE |
| 8 | DESCRIPTION | 18 | EARTH ROUND PLATE |
| 9 | BEARING HOUSING | 19 | TURN PLATE |
| 10 | EARTH BLOCK COVER | 20 | EARTH BUSH |

## 2.2. Position of Precaution Plates for Safety

Caution plates for safety are attached to the main body of the positioner to prevent safety accidents, as shown in [Figure 2.2]. Do not replace or remove them unnecessarily.

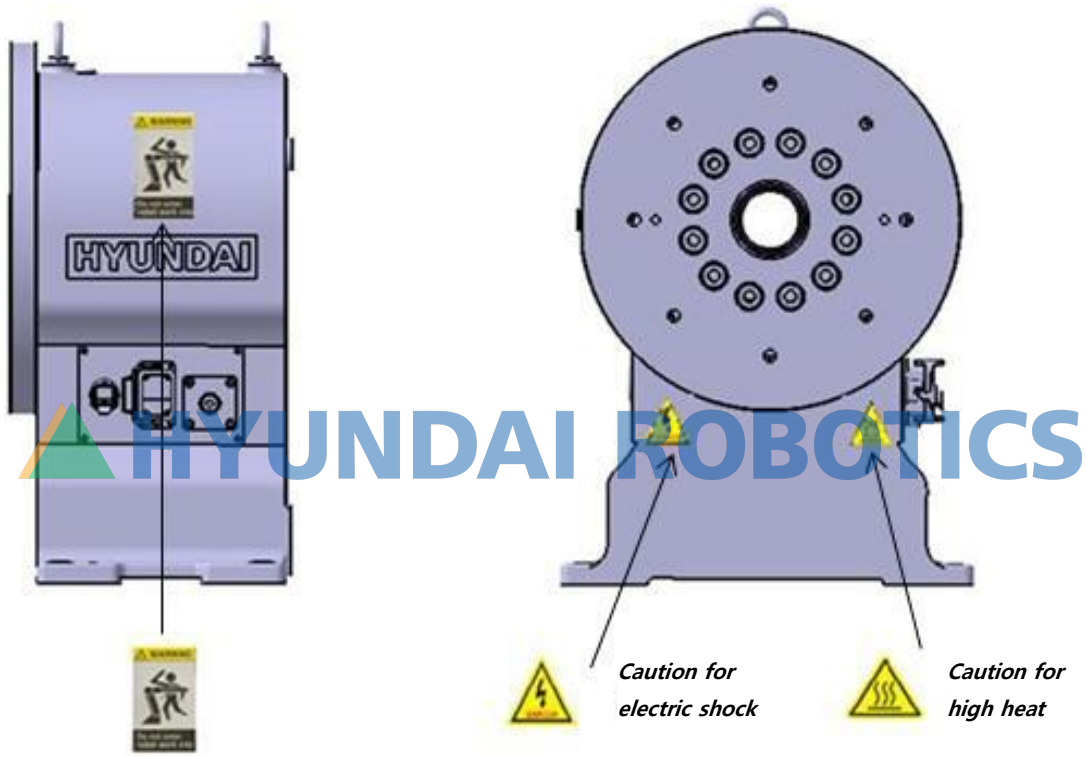




Figure 2.2 Position of the Caution Plates for Safety

## 2.3. Transport Method

### 2.3.1. Use of a Crane

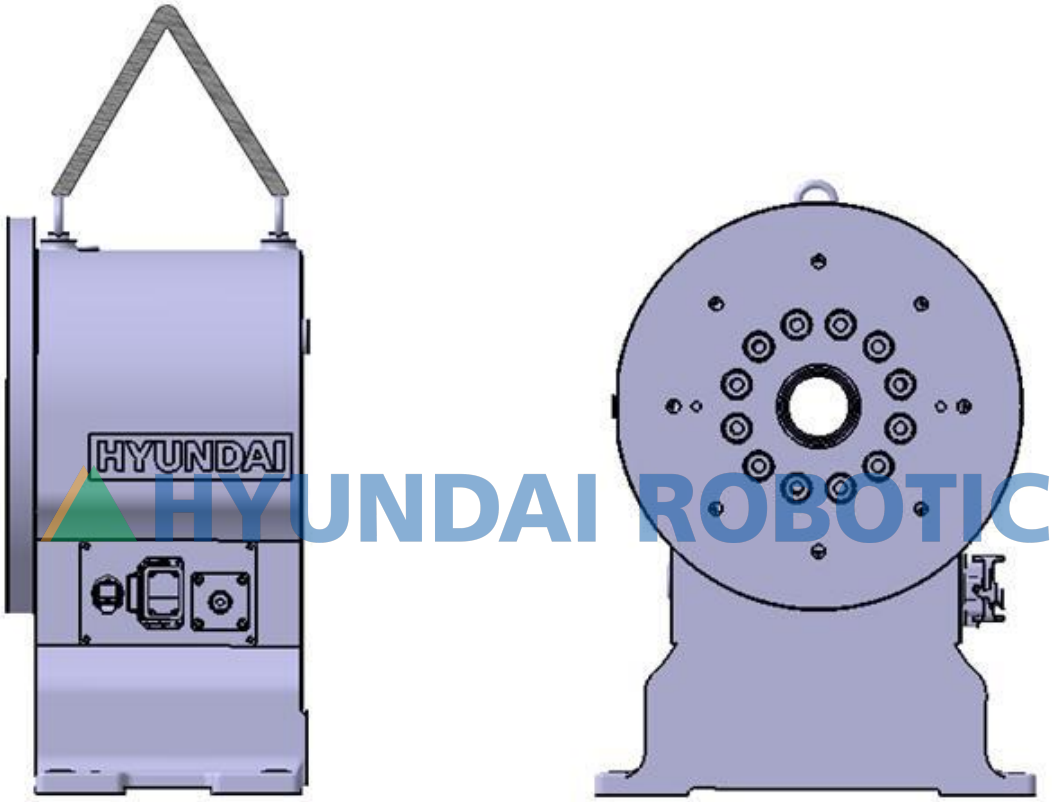




Figure 2.3 Transport Method: Use of a Crane

### 2.3.2. Use of a Forklift

Forklifts can be used to transport the main body of the positioner.

For your safety, please observe the following procedure.

- It is required to secure the basic posture for each model by referring to the following figure.
- Fix the positioner to the pallet using bolts, slide the fork of the forklift into the pallet, and transport it. The pallet must have sufficient rigidity to endure the work.
- Transport at a low speed.
- Observe safety regulations.

**Cautions**

- Do not lean on the main body of the positioner during transportation.
- It is required to ensure that the main body of the positioner does not collide with the floor while loading and unloading it.
- Follow the safety rules when working with the forklift.



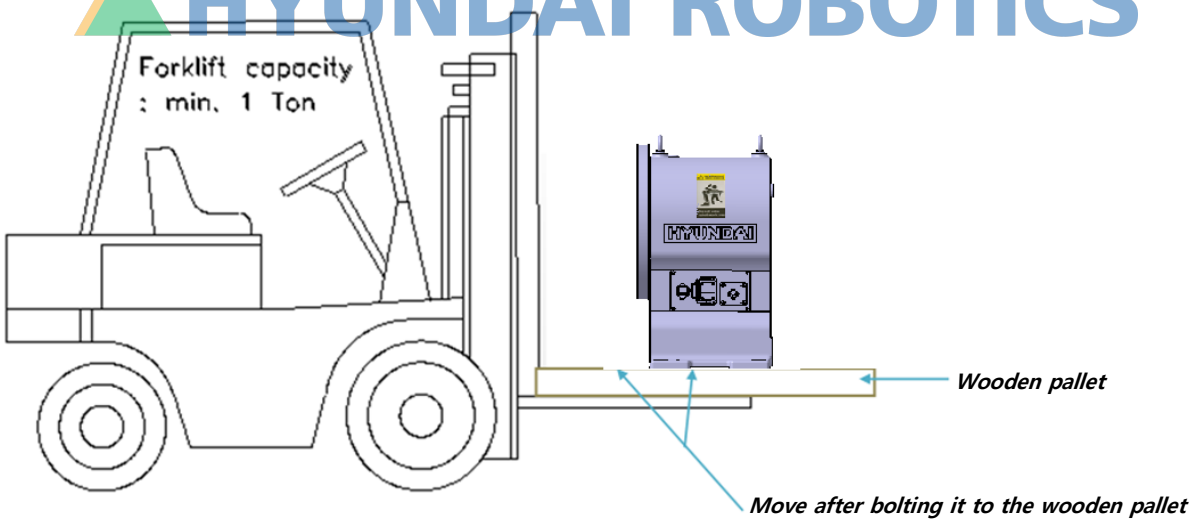


Figure 2.4 Transport Method: Use of a Forklift

## 2.4. Installation Method

**Caution:**
It is required to read the safety regulations and related instructions carefully before unpacking and installing the positioner.

**Warning:**
Installation must be carried out by the installation specialist and must comply with the relevant regulations in your country or region.

When unpacking the package of the positioner, it is required to check whether any damage has occurred during transport or unpacking. In addition, the installation method and foundation for the position are crucial for maintaining the functions, and it is strictly required to observe the following items.

### 2.4.1. Conditions for the Use

(1) The ambient temperature should be in the range of 0° C–45° C.
(2) The ambient humidity should be 20%–85% RH, and there should be no condensation.
(3) There should be a low level of dust, oil, and moisture.
(4) There should be no flammable or corrosive liquids or gas.
(5) No heavy shock or vibration should be applied.
(6) There should be no large source of electrical noise.
(7) If the positioner will not be installed immediately, it is required to keep it in a dry place with a temperature from -15° C to 40° C.



### 2.4.2. Installation of the Main Body of the Positioner

The main body of the positioner should be firmly fixed with four M16 bolts. All four bolts should be used.

- Bolt: M16 Socket head bolt
- Washer: Spring and plain washers
- Fastening torque: 293 Nm

The rigidity of the foundation floor on which the positioner will be installed should be designed to minimize the dynamic influence of the robot.

When the positioner is to be installed on the floor if the concrete thickness of the floor is 200 mm or more, it is required to maintain the floor; if there is any irregularity or crack on the floor first, then fix the mounting plate using anchor bolts. If the concrete thickness of the floor is less than 200 mm, foundation work is required additionally, which means that a prior review should be performed before building the foundation.

### 2.4.3. Accuracy of the Installation Surface

It is required to attach the main body of the positioner by fixing the bottom surface of the turn base. Refer to the figures below for dimensions.

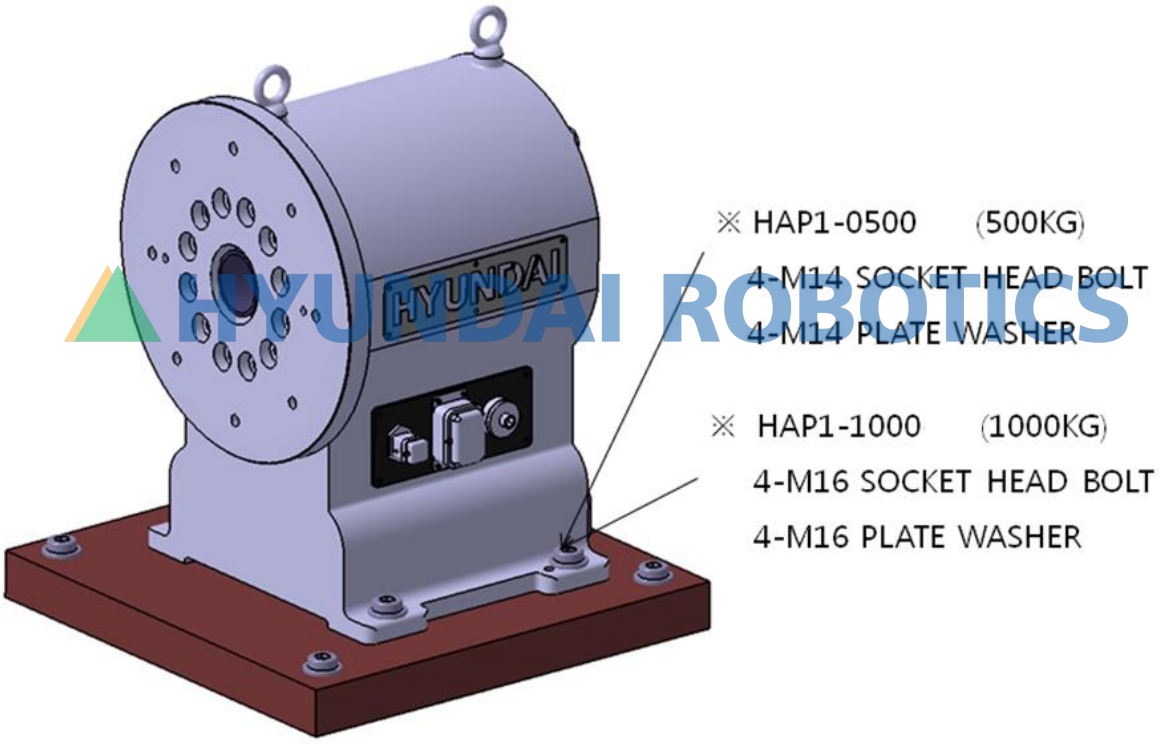




Figure 2.5 Dimensions of the Installation Surface

The flatness of the installation surface of the four plate attachment surfaces of the main body of the positioner should satisfy designated specifications, and shims should be used as necessary. The flatness of the others should be within ±2mm.

■ Precautions

(1) The flatness of the four mounting plates should be within 1.0 mm.
(2) The flatness of the four plate attachment surfaces should be within 1.0 mm (± 0.5 mm).

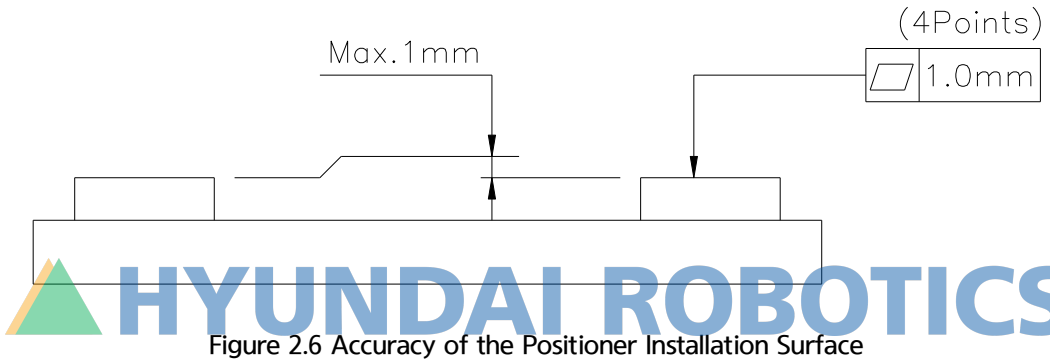




Figure 2.6 Accuracy of the Positioner Installation Surface

# 3
# Inspection

This section describes the periodic inspection, overhaul, adjustment, etc., which are necessary to maintain the performance of the positioner for a long period.

## 3.1. Inspection Items and Cycle

Inspection must be performed to maintain a high performance when the positioner is to be operated for a long duration.

Inspections are divided into daily inspections and regular inspections, and the personnel responsible for inspections must carry out inspections according to the basic inspection cycles, as shown in [Table 3-1].

Overhaul should be carried out every 35,000 operating hours.

The inspection cycle has been reviewed for arc welding. If the inspection and adjustment methods are difficult to understand, please contact our after-sales service center (customer support department) for inquiries.



Table 3-1 Inspection Plan

| Inspections over one year | | | | Inspections over one year | | | |
|---|---|---|---|---|---|---|---|
| Upon 3 months | Upon 6 months | Upon 9 months | Upon 12 months | Upon 3 months | Upon 6 months | Upon 9 months | Upon 12 months |
| Upon 3 months | Upon 6 months | Upon 9 months | Upon 1 year | Upon 1 year and 3 months | Upon 1 year and 6 months | Upon 1 year and 9 months | Upon 2 years |
| Daily inspection | | | | | | | |

## 3.2. Inspection Items and Cycle

Table 3-2 Inspection Items and Cycle

| No. | Inspection cycle | | | Inspection items | Inspection method | Reference | Remarks |
|---|---|---|---|---|---|---|---|
| | Daily | 3 months | 1 year | | | | |
| **Common for the main body and individual axes of the positioner** | | | | | | | |
| 1 | ○ | | | Cleaning of the main body | Visually checking for impurities | | |
| 2 | | ○ | | Inspection of the wiring | · Visually checking for damages to the cables<br>· Visually checking the paint markings of the cable fixing bracket fastening bolts<br>· Visually checking for damages to the cable covers | | |
| 3 | | ○ | | Main bolts | Visually checking the paint markings | | |
| 4 | ○ | | | Motor | Checking for the abnormal heat generation<br>Checking for the abnormal sound generation | | |
| 5 | ○ | | | Reducer | Checking for the abnormal sound generation<br>Checking for the vibration generation | | |



- If the positioner is used under adverse conditions, it is recommended to take a shorter inspection cycle to ensure the performance of the positioner.
- Inspect all visible cables and replace any damaged cables.
- Check the fastening torque of the key bolts in [Table 3-3].
- Check for any abnormal sound in the automatic or teaching mode to check the power transmission system (motor, reducer, etc.) for abnormalities.

## 3.3. Inspection of Key External Bolts

A torque wrench must be used to carry out fastening with a proper torque, and then marking with paint should be performed.

Table 3-3 Key Bolts to Inspect

| No. | Bolts to inspect | No. | Bolts to inspect |
|---|---|---|---|
| 1 | Mechanical interface attachment bolt | 5 | Earth lock cover attachment bolt |
| 2 | Reducer attachment bolt | 6 | Earth bush set screw |
| 3 | Power lock attachment bolt | 7 | Earth block attachment bolt |
| 4 | Motor plate attachment bolt | 8 | Bearing housing attachment bolt |



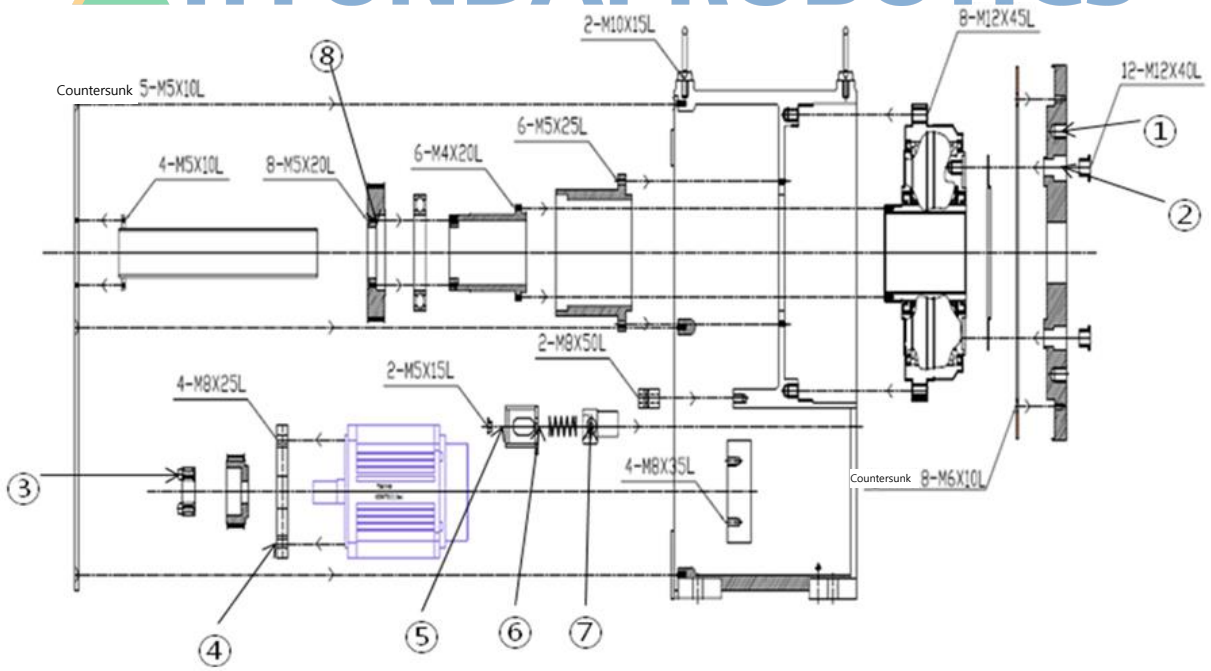


Figure 3.1 Key Bolts to Inspect

## 3.4. Inspection of Wiring in the Main Body

The internal wiring of the main body of the positioner is designed to withstand flexibility. However, if disconnection or short-circuiting occurs caused by damages to or wire breakage, there could be a problem with the robot operation, which requires the user to perform daily inspection surely. In addition, the user must carry out a prior inspection when he/she plans to perform the works within the operation range according to the conditions for a safety inspection.

### 3.4.1. Conditions for Safety Inspection

When planning to carry out works such as the teaching of the positioner within the operation range of the positioner (except for shutting off the driving source of the positioner), the user should check the following items before starting the works. If any abnormality is confirmed, the user should correct it immediately and take other necessary measures.

- Check for any damage to the cover and cable of the external power supply.
- Check for any abnormality with the operation of the main body of the positioner.


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# 4
# Maintenance

## 4.1. Replacement of the Batteries

The position data of each axis is to be preserved using the backup batteries. The batteries should be replaced every two years. It is required to comply with the following procedures in replacing the batteries.

① Press the emergency stop button when the controller power is on.

**Caution**
If you turn off the power and replace the batteries, all current position data will be lost. Therefore, the origin should be reset.

② Remove the cover of the battery at the position of each axis.

③ Remove the existing battery.

④ Install the new battery while being careful about the direction of installing it.

- ✓ Specification: ER6C(AA) 3.6 V
- ✓ Manufacturer: Maxell



⑤ Install the cover back to its original position.

### 4.1.1. Precautions in Storing the Batteries

① Do not store batteries in a place with high temperature or humidity, and keep them in a well-ventilated place to avoid condensation.

② Store batteries at room temperature (20° C ± 15° C) wherein the variation of temperature is low, and the relative humidity can be kept at 70% or less.

③ The reference period for storing batteries should be six months, and they should be managed based on the first-in and first-out method.

# 5

# Troubleshooting

## 5.1. Method of Progressing an Investigation of the Causes of Problems

When an abnormality occurs during the operation of the positioner, and it is not attributable to an abnormality with the controller, it will be a problem because of damages to the mechanical parts. To solve the problem quickly and easily, it is necessary first to identify the phenomenon correctly and determine which part is defective.

(1) First step: Which axis has an abnormality?

First of all, check which axis that shows the abnormal phenomenon. When it is difficult to make a judgment because the abnormality does not appear during the operation, it is required to carry out an investigation as follows.

- Is there any part generating an abnormal sound?
- Is there any part generating an abnormal heat?
- Is there any part with a gap?

(2) Second step: Are there any damaged parts?
If an axis is determined to have an abnormality, it is required to investigate which part is causing the abnormality. There can be several causes of one phenomenon.



(3) Third step: Handling of defective parts
Parts that are determined to be defective should be handled according to the methods described in Section 5.2 Methods for Investigating and Handling Individual Parts. Please contact our service department for items that your company cannot handle.

## 5.2. Methods for Investigating and Handling Individual Parts

### 5.2.1. Reducer

If the reducer is damaged, vibration or abnormal sound will occur. This may cause overloading and an error because of the deviation that interferes with the normal operation and may generate an abnormal sound. As a result, the reducer may not move at all or have a positional deviation.

- Investigation method

  ① Investigate whether there is clearance in bearings by applying force to the output axis.
  ② Investigate whether there is clearance in bearings without a load being applied to the reducer.
  ③ Before any abnormality occurs, investigate whether there is any contact with a peripheral system near the positioner.

- Handling method

  Replace the reducer. Then, you need facilities, such as a chain block, to hang up the output axis frame. If you have any difficulties, please contact our service department.



### 5.2.2. Motor

If any abnormality occurs to the motor, abnormal operation such as shaking when stopping, irregular cycle (pulsation), and vibration during operation will occur. In addition, abnormal heat and sound may occur.

As the phenomena similar to the ones caused by damages to the reducer may occur, investigate the reducer and the bearing part at the same time to determine where the abnormality is caused.

- Investigation method
  Investigate whether there is any abnormal sound or heat generated.

- Handling method
  Replace the motor.


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# 6

# Recommended Spare Parts

The spare parts recommended for the positioner are shown in the table below. When purchasing them, it is required to check the serial number and the date of manufacture on the main body of the positioner, and contact our service department.

[Classification]
A: Parts for regular maintenance (to be replaced regularly)
B: Key spare parts (recommended to be prepared in advance by considering frequent operation)
C: Key components
D: Instrument parts

Table 6-1 Spare Parts List I

| Classification | Part Name | Manufacturer / Specification | Per Unit: Number for use | Per Unit: Number recommended | Remarks |
|---|---|---|---|---|---|
| A | Encoder battery | HHI / ER6C(AA)3.6V | 1 EA | 1 EA | Should be replaced every two years regardless of operational hours |
| B | AC servo motor | HHI / TSM3506 N7021 E732 | 1 EA | 1 EA | 2.5 kW |
| B | Encoder | HHI / R112504000 | 1 EA | 1 EA | |
| B | Reducer | SUMITOMO / F2CF-C45-59 (500 kg) / F2CF-C55-59 (1,000 kg) | 1 EA | 1 EA | |

# 7

# Dismantling

The positioner consists of various materials, as shown in [Table 7-1]. Some parts should be properly sorted out and sealed to prevent adverse effects on the human body or the environment.

Table 7-1 Table of Materials of Individual Parts

| Parts | Materials |
|---|---|
| Battery | NiCad or Lithium |
| Wiring and Motor | Copper |
| Brakes and Motors | Samarium Cobalt (or Neodymium) |
| Wiring and Connectors | Plastic/Rubber |
| Reducers and Bearings | Oil/Grease |

- **Daegu Office (Head Office)**

50, Techno sunhwan-ro 3-gil, yuga, Dalseong-gun, Daegu, 43022, Korea

- **Bundang Office**

42, Dolma-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, 13630, Korea

- **대구 사무소**

(43022) 대구광역시 달성군 유가읍 테크노순환로 3 길 50

- **분당 사무소**

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