Warning

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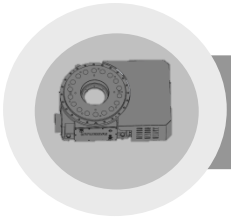
All installation works must be performed by a qualified installer and must comply with applicable laws and regulations.

Hyundai Robotics

HSP125005000200101MMEN1



Positioner Main Body Maintenance Manual

HSP1-2500-04
HSP1-5000-04

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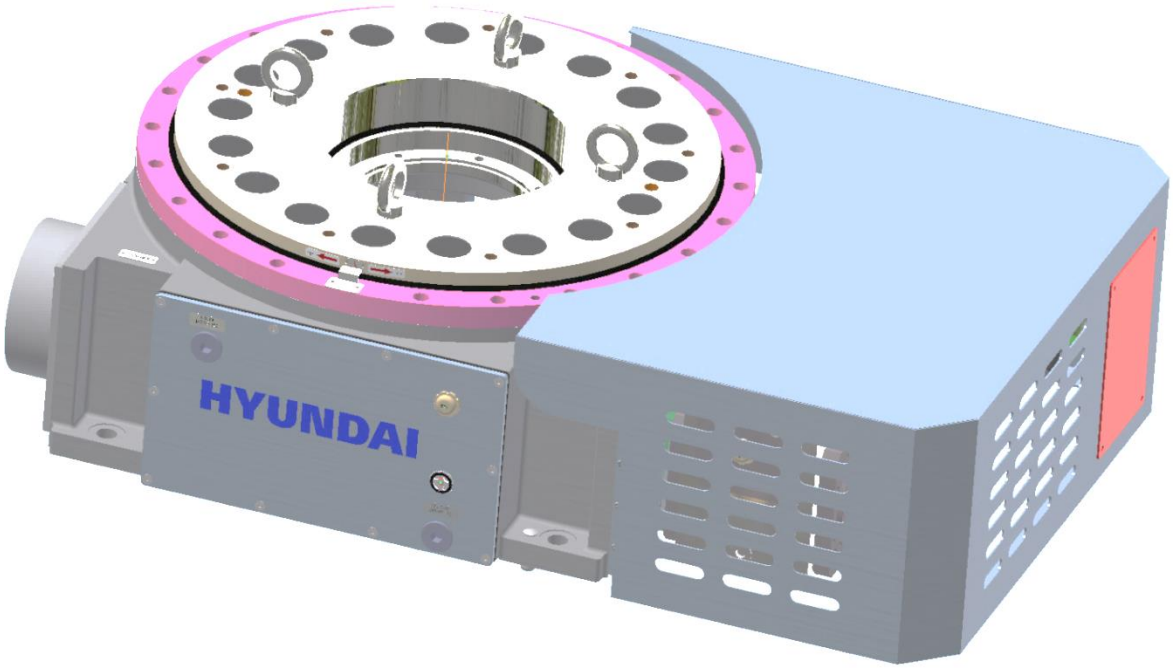

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Printed in Korea – Jan 2020. First Edition


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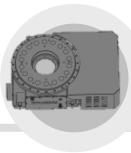

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HYUNDAI ROBOTICS

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Specification

1.1. Instrument Part Type of the Positioner

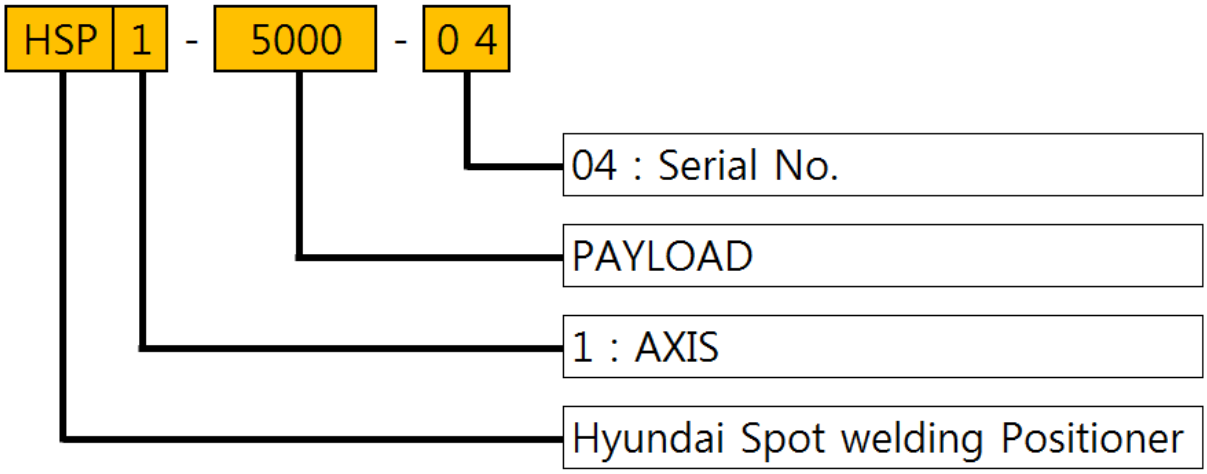


Figure 1.1 Instrument Part Type of the Positioner

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 or right) part of the main body, as shown below.

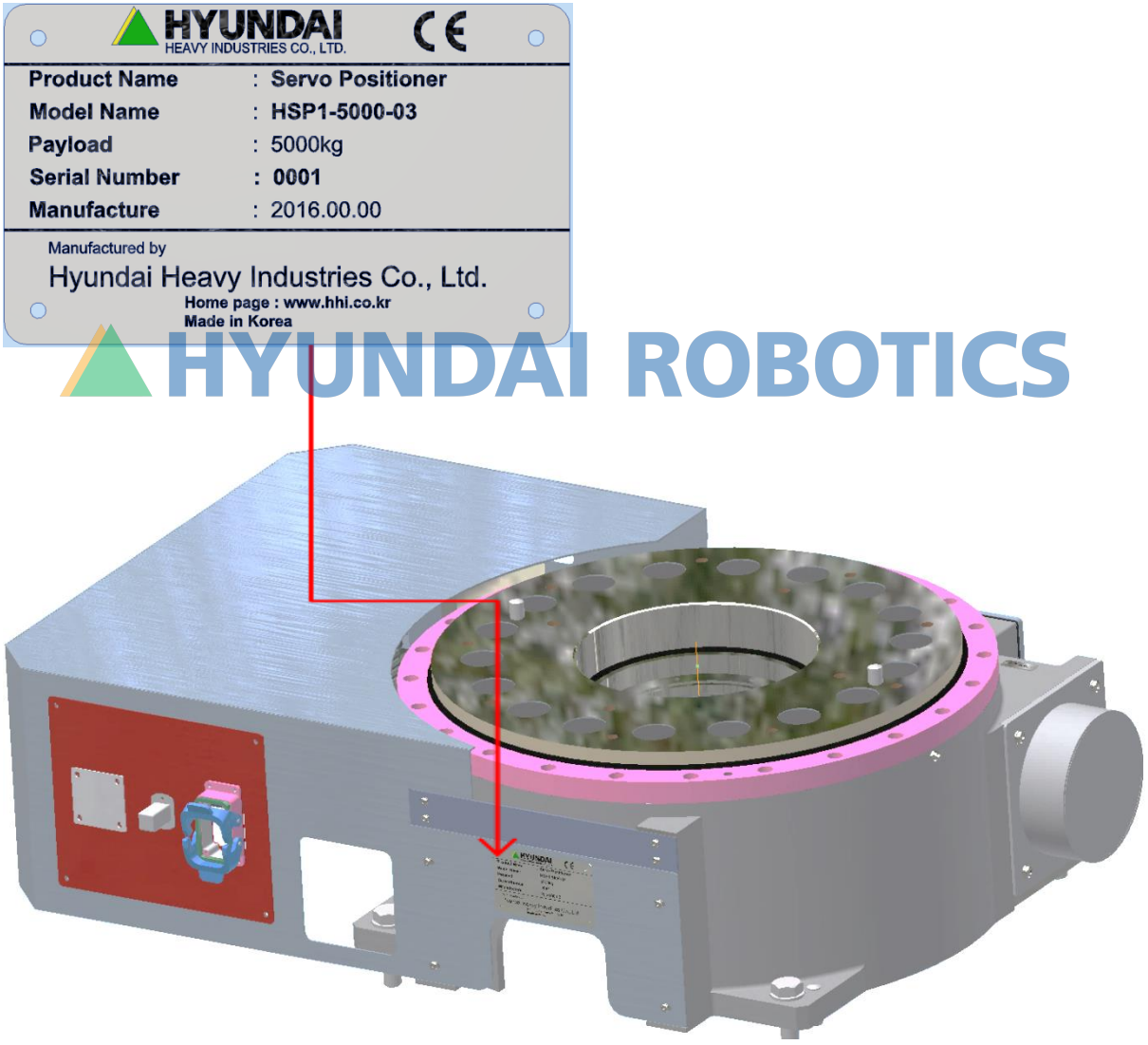
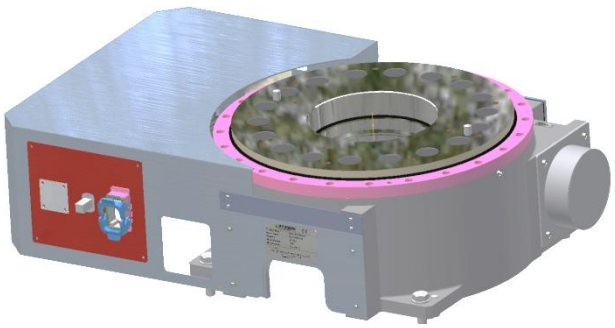


Figure 1.2 Attachment of the Positioner Name Plate

1.3. Basic Specification

Table 1-1 Basic Specification

No.	Item	Unit.	SPECIFICATION	
			2.5Ton	5Ton
1	MOTOR	Type No.	TSM3611N7020 (2.5Ton)	TSM3611N7020 (5Ton)
		Capacity	5.9 Kw	5.9 Kw
2	Reducer	Output Reduction Ratio	I=1:162	I=1:180
3	Maximum Operation Angle	°	± 360	±360
4	Maximum Operation Speed	° /s	74	66
5	Allowable Output Torque	Kgf.m	320	356
6	Allowable Output Inertia	$Kg.m^2$	2,940	6,500
7	Repetitive Positioning Accuracy	arc	Within ± 60 s	
8	Main Body Weight	Kg	400	
9	Applicable Controller	-	Hi5a ROBOT Controller	
10	Shape	-		

1.4. External Dimensions and Operation Area of the Main Body

1.4.1. External Dimensions of the Main Body – Same for 2.5-Ton / 5-Ton Positioners

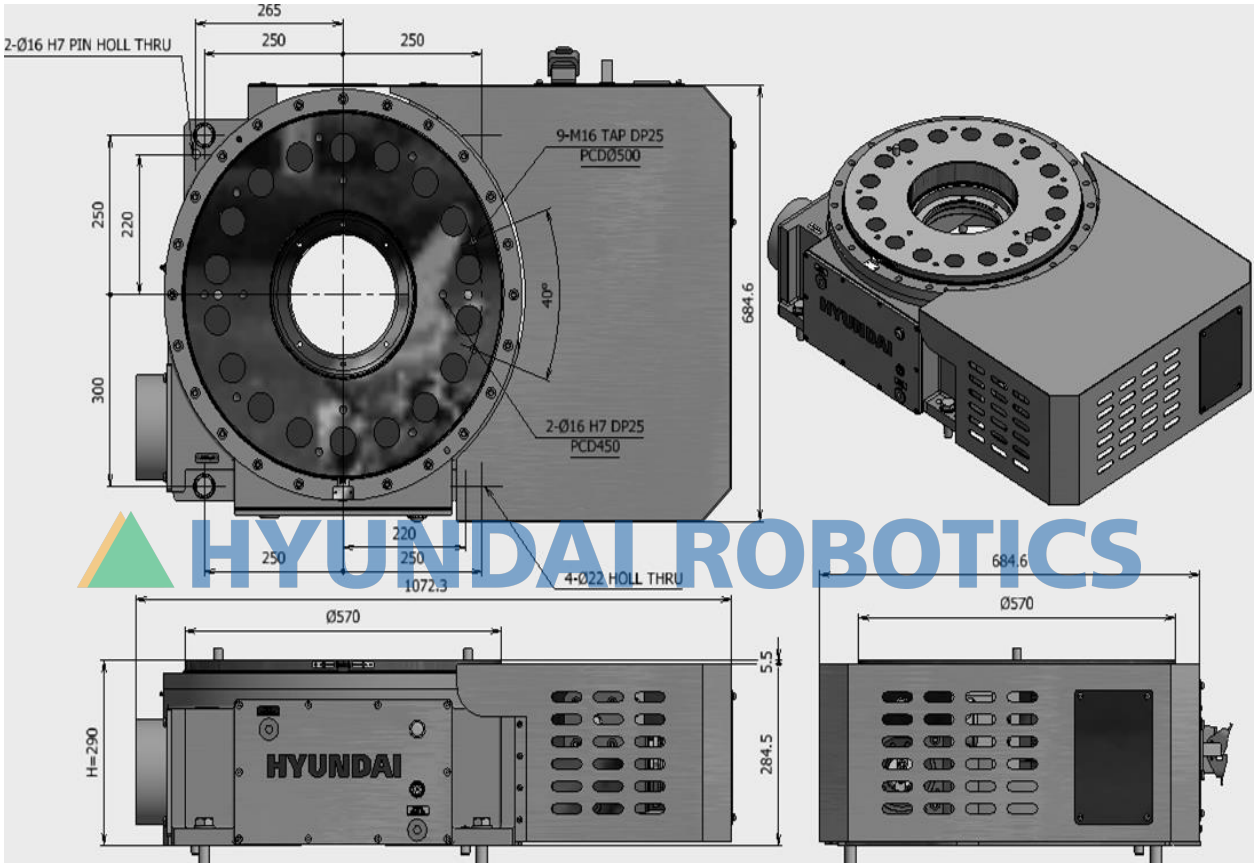


Figure 1.3 External Dimensions of the Main Body

1.4.2. Operation Axes and Their Names

Table 1-2 Rotation Direction of Individual Axes

Axes Name	Operation	Teach Pendant Button	
R	Turning	Left/Right	R

R 축(ROTATING)

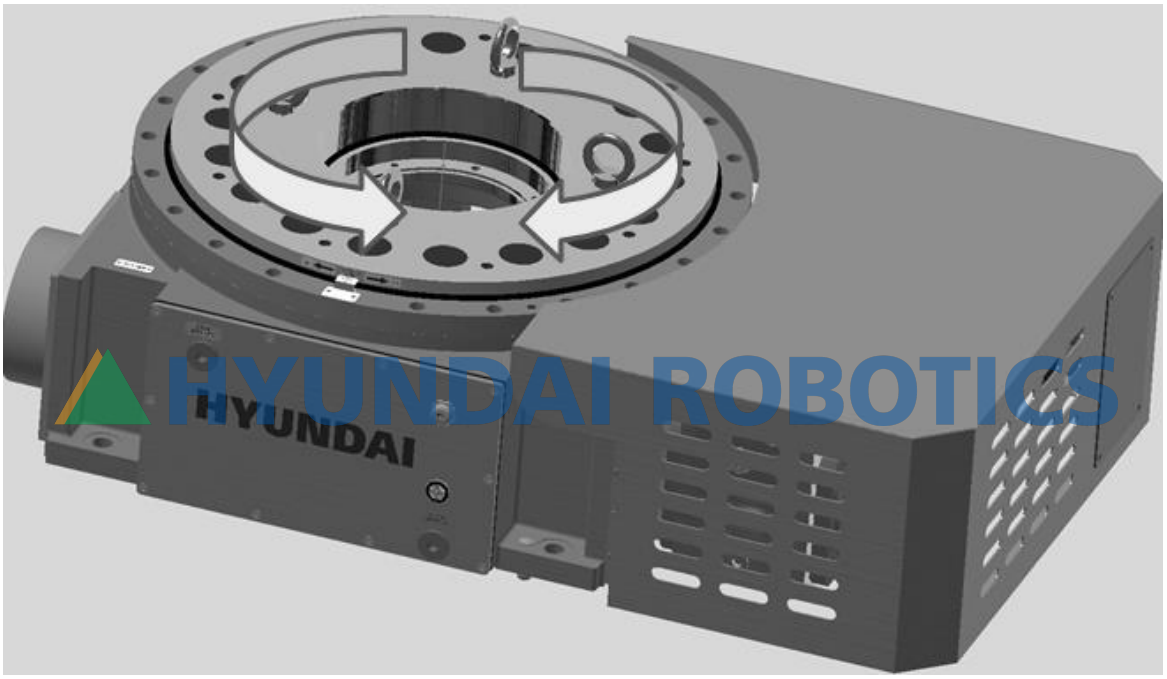


Figure 1.4 Exterior and Operation Axes of the Main Body

1.4.3. Exploded-View Drawing of the 5-Ton Positioner

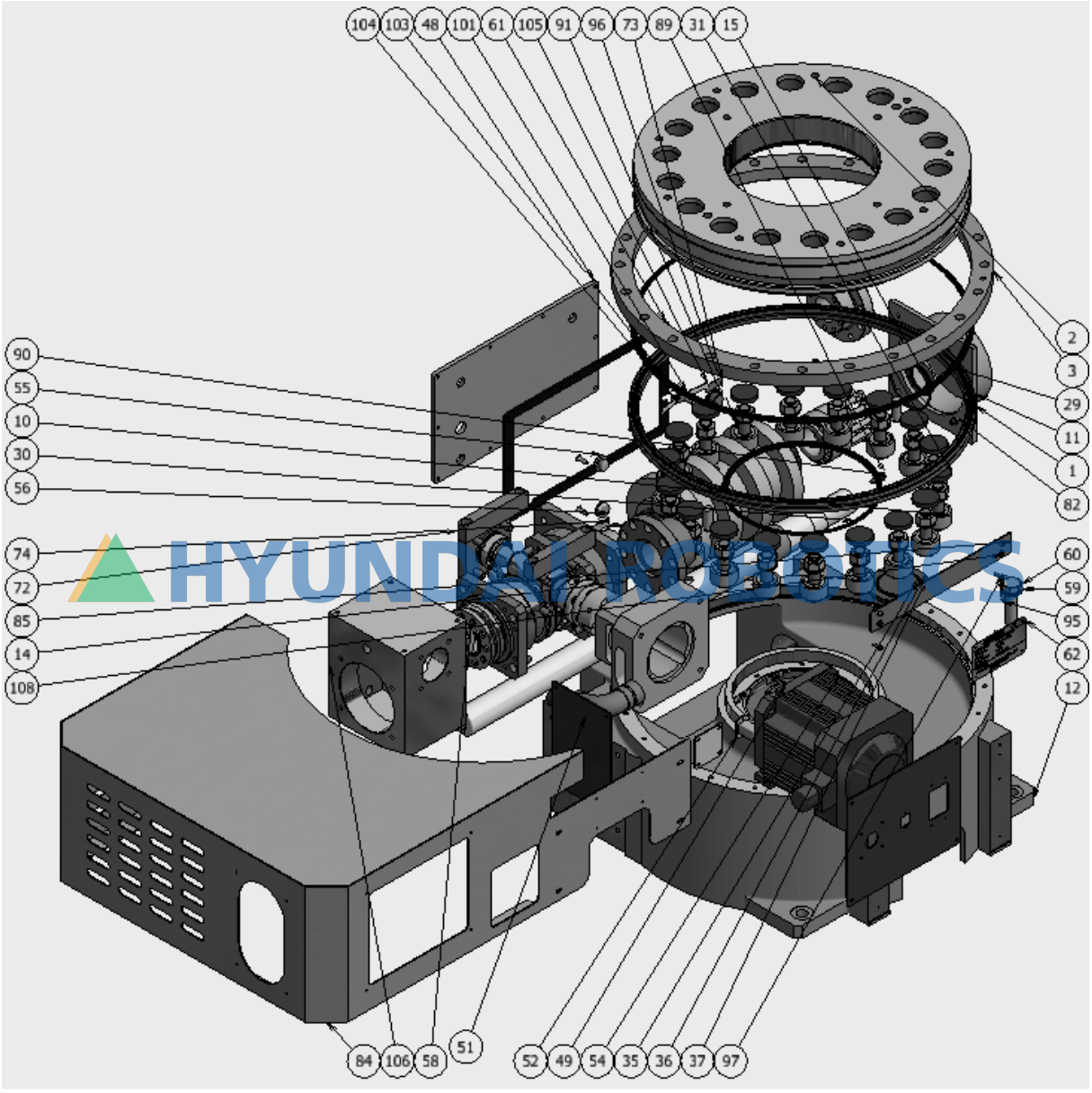


Figure 1.5 Exploded-View Drawing of the 5-Ton Positioner

1.4.4. 5-Ton Positioner Parts List

ITEM	QUANTITY	PART NUMBER	DESCRIPTION
1	1	DJ-BP5025-002-P01	LER5-0570 (WR BEARING-FRANK)
2	1	DP-BP5000-002	ROTARY TABEL(FOR 5 TONS)
3	1	DJ-BP5025-005	PRELOAD FLANGE
10	18	DJ-BP5000-002-A01	NART20VR-PIN TYPE-IKO
11	1	DJ-BP5025-008	PLATE COVER
12	1	DJ-BP5025-001	BOX
14	1	DJ-BP5025-006	REDUCER PLATE
15	1	DJ-BP5025-003	CAM ASSY
29	1	DJ-BP5025-002-P02	UPPER DUST SEAL
30	1	DJ-BP5025-002-P03	INNER DUST SEAL
31	18	DJ-BP5025-002-A01-P04	COVER
35	1	DJ-BP5025-007-P01	G70 O-RING
36	1	DJ-BP5025-007	CAM FOLLOWER COVER
37	4	DJ-BP5025-007-P02	THUM SCREW – M6 X 14
48	1	DJ-BP5025-004	BOX COVER
49	1	DJ-BP5025-P500-01	HOUSING-09 30 010 0301
51	1	DJ-BP5025-P400	TSM3611 N7020-SERVO MOTOR CONNECT
52	1	DJ-BP5025-P600	SERVO CONNECT
54	1	DJ-BP5025-P700	TSM3611 N7020-SERVO MOTOR
55	1	DJ-BP5025-004-P02	DOP-1/2 INCH OIL PLUG-DHC
56	1	DJ-BP5025-004-P03	DCD-25 OIL GAUGE-DHC
58	1	DJ-BP5025-006-02	(REDUCER-SO76 TYPE) KEY
61	1	DJ-BP5025-004-01	NON-ASBESTOS SHEET GASKET(STYLE NO-56KV(SIZE-3Q390-352-226-2t)
62	1	DJ-BP5000-12-03	HSP1-5000F-03-NAME PLATE
72	2	DJ-BP5025-006-3	REDUCER-MC GUIDE
73	1	DJ-BP5025-012-01	OIL IN
74	1	DJ-BP5025-012-02	OIL OUT
82	1	DJ-BP5025-001-P01	GREASE NIPPLE-18
84	1	DJ-BP5025-010	MOTOR COVER
85	1	DJ-BP5025-010-03	AUXILIARY COVER
91	2	DJ-BP5025-004-P01	1/2 INCH-STUD BOLT
92	2	DJ-BP5025-P500-02	HOUSING-09 30 010 0301-1
95	4	DJ-BP5025-001-P02	PIN- 16 x 45
101	1	DJ-BP5025-011-01(570)	RULER-REDUCER BASIC TYPE
103	1	DJ-BP5025-011-04-(570)	GRID-REDUCER TYPE-BASIC TYPE
104	1	DJ-BP5025-011-03(570)	- DIRECTION INDICATOR(570 PIE, COMMON)
105	1	DJ-BP5025-011-02(570)	+ DIRECTION INDICTOR (570 PIE, COMMON)
106	1	REDUCER	SO76-DJ1-2 안-ASSY(I=1/10)
109	1	DJ-BP5025-012-05	FOR 5000kg

1.4.5. Exploded-View Drawing of the 2.5-Ton Positioner

The exploded view below is for the 2.5-ton positioner.

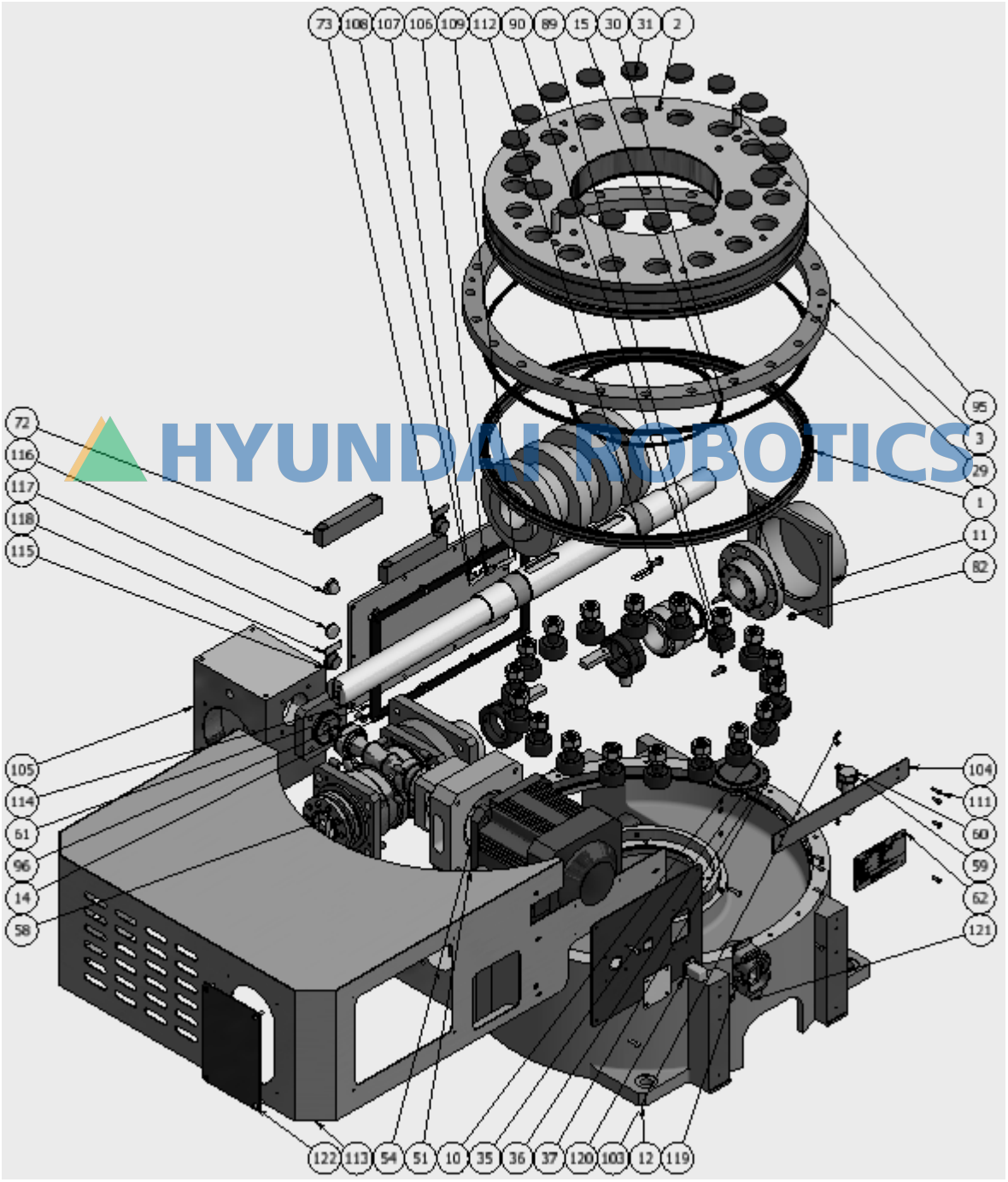


Figure 1.6 Exploded-View Drawing of the 2.5-Ton Positioner

1.4.6. 2.5-Ton Positioner Parts List

ITEM	QUANTITY	PART NUMBER	DESCRIPTION
1	1	DJ-BP5025-002-P01	LER5-0570(WR BEARING-FRANK)
2	1	DJ-BP2500-002	ROTARY TABEL(FOR 2.5-TON POSITIONER)
3	1	DJ-BP5025-005	PRELOAD FLANGE
10	18	DJ-BP2500-002-A01	CF20-IVBUUR-2.5-TON-IKO
11	1	DJ-BP5025-008	PLATE COVER
12	1	DJ-BP5025-001	BOX
14	1	DJ-BP5025-006-(SHINDO REDUCER TYPE)	REDUCER PLATE-SHINDO REDUCER TYPE
15	1	DJ-BP5025-003	CAM ASSY(REFER TO OTHER ASEMBLIES)
29	1	DJ-BP5025-002-P02	UPPER DUST SEAL
30	1	DJ-BP5025-002-P03	INNER DUST SEAL
31	18	DJ-BP5025-002-A01-P04	COVER
35	1	DJ-BP5025-007-P01	G70 O-RING
36	1	DJ-BP5025-007	CAM FOLLOWER COVER
37	4	DJ-BP5025-007-P02	THUMB SCREW – M6 X 14
51	1	DJ-BP5025-P400	TSM3611 N7020-SERVO MOTOR CONNECT
54	1	DJ-BP5025-P100	TSM3611 N7020-SERVO MOTOR
58	1	DJ-BP5025-006-02-(SHINDO REDUCER TYPE)	(SHINDO REDUCER-SO76형)KEY
59	4	DJ-BP5025-001-P04	WASHER – 20x37 x 37 x Finished Circular(1)
60	4	DJ-BP5025-001-P03	HEX BOLT-M20 x75 -2.5(1)
61	1	DJ-BP5025-004-01	ASBESTOS SHEET GASKET(STYLE NO-56KV(SIZE-SQ390-352-226
62	1	DJ-BP2500-012-04	HSP1-2500F-03-NAME PLATE
72	2	DJ-BP5025-006-03-(SHINDO REDUCER TYPE)	SHINDO REDUCER–MC GUIDE
73	1	DJ-BP5025-012-01	OIL IN
82	1	DJ-BP5025-001-P01	GREASE NIPPLE-18
95	4	DJ-BP5025-001-P02	PIN- 16 x 45
104	1	DJ-BP5025-010-03	AUXILIARY COVER
105	1	REDUCER-SHINDO	SO76-DJ1-1 안-ASSY(I=1/9)
106	1	DJ-BP5025-011-01(570)-SHINDO REDUCER TYPE	RULER-SHINDO REDUCER BASIC TYPE
107	1	DJ-BP5025-011-04(570)-SHINDO REDUCER TYPE	GRID-SHINDO REDUCER TYPE-BASIC TYPE
108	1	DJ-BP5025-011-03(570)	- DIRECTION INDICATOR (570 PIE, COMMON)
109	1	DJ-BP5025-011-02(570)	+ DIRECTION INDICATOR(570 PIE, COMMON)
112	1	DJ-BP5025-012-06	FOR 2500kg
113	1	DJ-BP5025-010-SHINDO REDUCER TYPE	MOTOR COVER(SHINDO-REDUCER)
114	1	DJ-BP5025-004	BOX COVER
115	2	DJ-BP5025-004-P01	1/2 INCH-STUD BOLT
116	1	DJ-BP5025-004-P02	DOP-1/2 INCH OIL AUGE-DHC
117	1	DJ-BP5025-004-P03	DCD-25 OIL GAUGE-DHC
118	1	DJ-BP5025-012-02	OIL OUT
119	1	DJ-BP5025-P500-01	HOUSING-09 30 010 0301
120	1	DJ-BP5025-P600	SERVO CONNECT
121	2	DJ-BP5025-P500-02	HOUSING-09 30 010 0301-1

1.5. Detailed Drawing of the Output Side Attachment Surface

The specific types of bolts for individual models should be used to attach a working tool to the mechanical interface of the R axis.

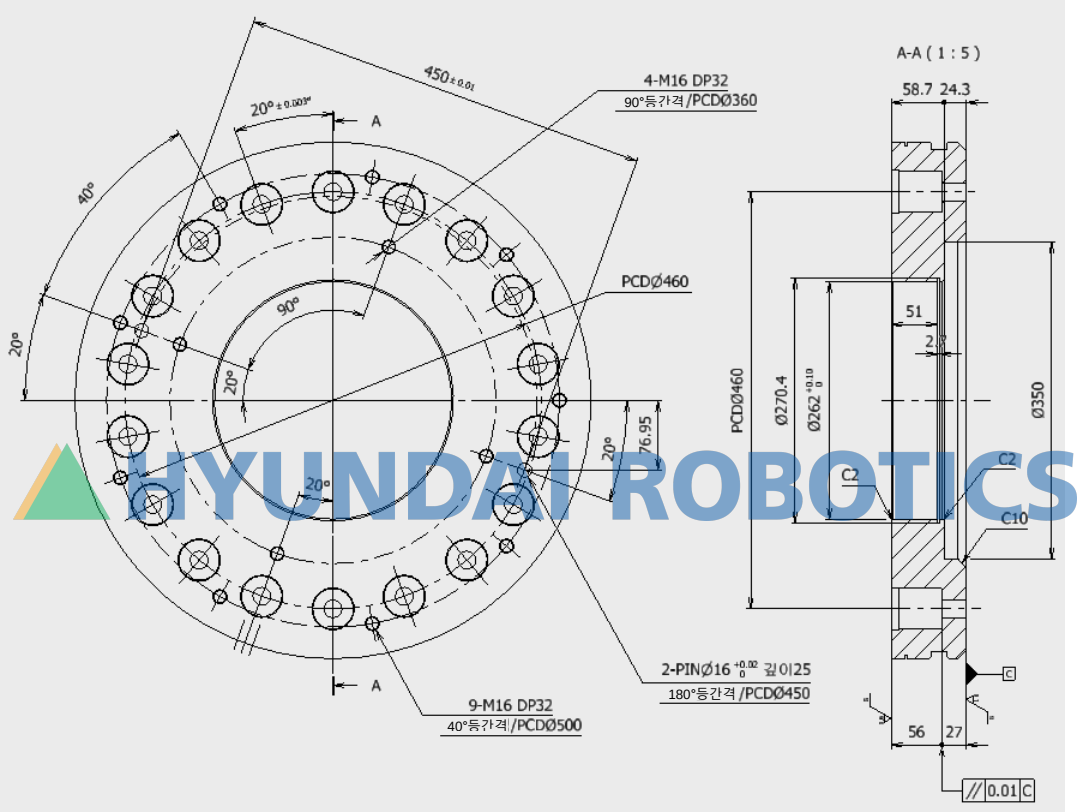
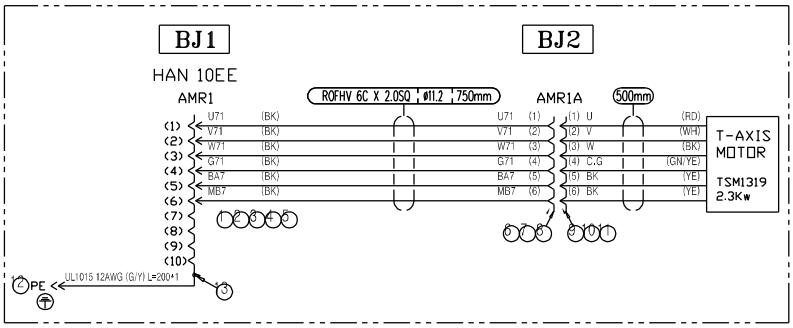
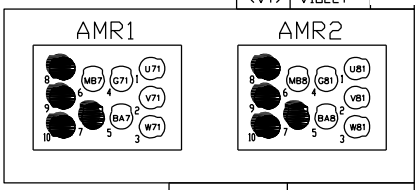


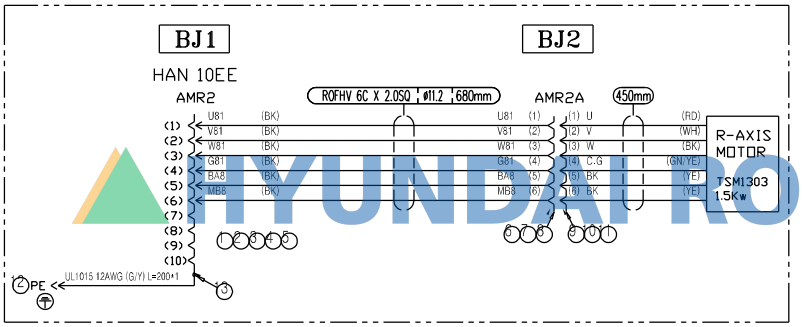
Figure 1.7 Detailed Drawing of the Mechanical Interface Attachment Surface

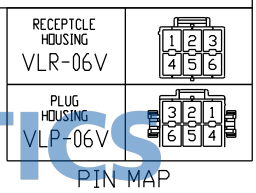
1.6. Wiring and Piping Diagram for Application

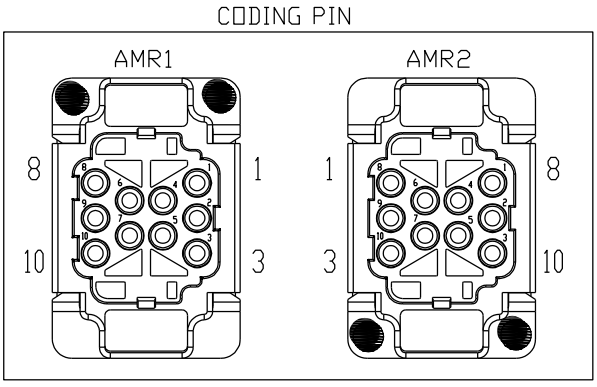


(BU)	BLUE
(BK)	BLACK
(RD)	RED
(BN)	BROWN
(LBU)	LIGHT BLUE
(WH)	WHITE
(GN)	GREEN
(OG)	ORANGE
(YE)	YELLOW
(GY)	GRAY
(PP)	PURPLE
(PK)	PINK
(VT)	VIOLET

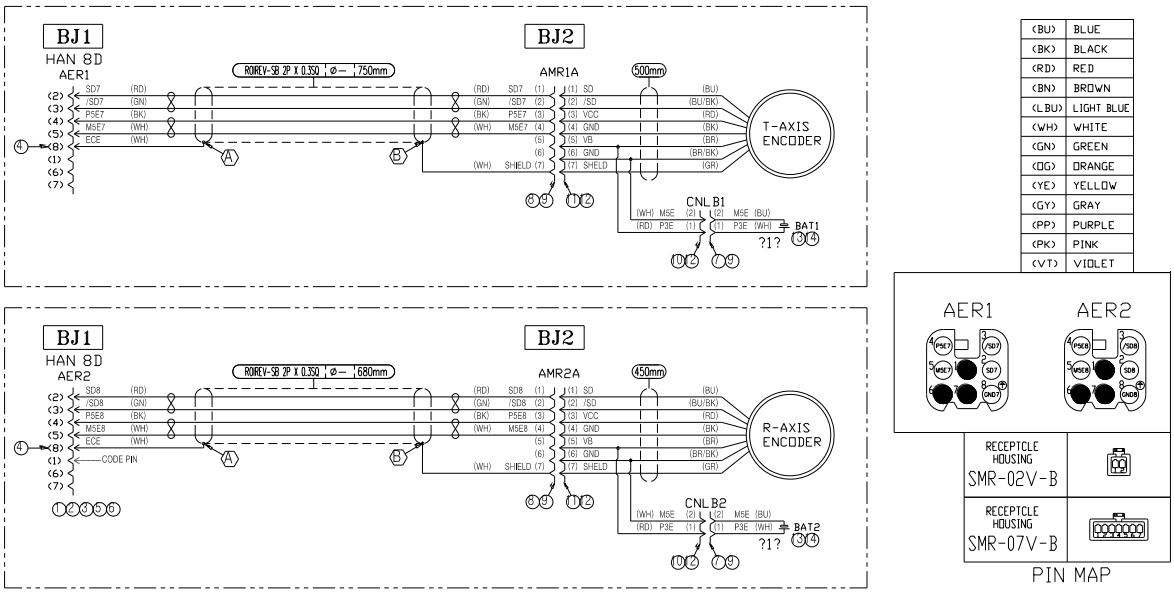


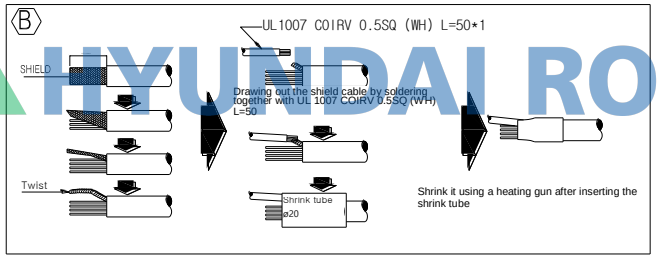






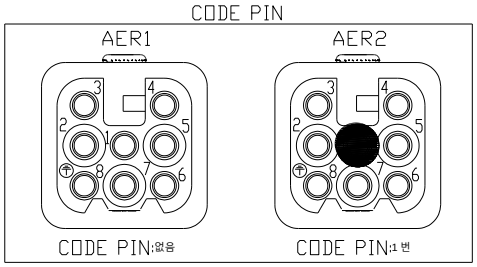
NO	ITEM NO	ITEM NAME	MATERIAL	Q'TY	WT(kg)	REMARK
015		CABLE		400m		UL1015 12AWG(G/Y)
014		CABLE		430mm		ROFHV 6cX2.0sq
013		RING TERMINAL		2		3.5SQ-5R (WIDE TYPE)
012		RING TERMINAL		2		3.5SQ-5R
011		RETAINER		FOR REFERENCE		VLS-03V
010		PIN CONTACT		FOR REFERENCE		SVM-61T-P2.0
009		RECEPTACLE HOUSING		FOR REFERENCE		VLR-06V
008		RETAINER		4		VLS-03V
007		SOCKET CONTACT		12		SVF-61T-P2.0
006		PLUG HOUSING		2		VLP-06V
005		Dust Protection Cover		2		09 30 000 5404
004		Coding Pin		4		09 30 000 9901
003		Male Contact(2.5SQ)		12		09 33 000 6102
002		Housing		2		09 30 006 0301
001		Crimp Terminal(Male)		2		09 32 010 3001





TIP

?1? UL1430 COIRV 0.5SQ (WH) L=150
UL1430 COIRV 0.5SQ (BU) L=150



NO	ITEM NO	ITEM NAME	MATERIAL	Q'TY	WT(kg)	REMARK
019						
018		CABLE		220		UL1007 COIRV 0.5SQ (WH)
017		CABLE		300		UL1430 COIRV 0.5SQ (WH)
016		CABLE		300		UL1430 COIRV 0.5SQ (BU)
015		CABLE		1,430		ROIREV-SB 2P X 0.3SQ
014		BATTERY DISCHARGE PREVENTION CAP		4		38SQ RUBBER CAP (BK)
013		BATTERY		2		ER-6C 3.6V AA
012		PIN CONTACT		FOR REFERENCE		SYM-001T-0.6
011		RECEPTACLE HOUSING		FOR REFERENCE		SMR-07V-B
010		RECEPTACLE HOUSING		FOR REFERENCE		SMR-02V-B
009		SOCKET CONTACT		14		SHF-001T-0.8SS
008		PLUG HOUSING		2		SMP-07V-BC
007		PLUG HOUSING		2		SMP-02V-BC
006		Dust Protection Cover		2		09 20 003 5426 (NO RUNNIBER)
005		Code Pin		1		09 33 000 9915
004		Male Contact(0.3SQ)		2		09 15 000 6103
003		Male Contact(0.14~0.3SQ)		8		09 15 000 6104
002		Housing		2		09 20 003 0301
001		Crimp Terminal(Male)		2		09 36 008 3001

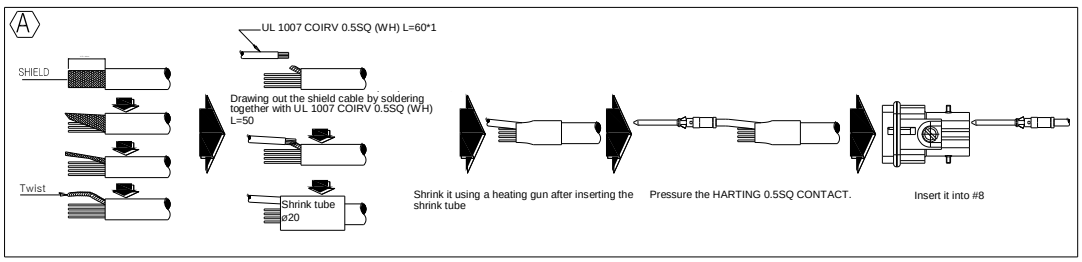


Figure 1.8 Wiring and Piping Diagram for Application

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.

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].

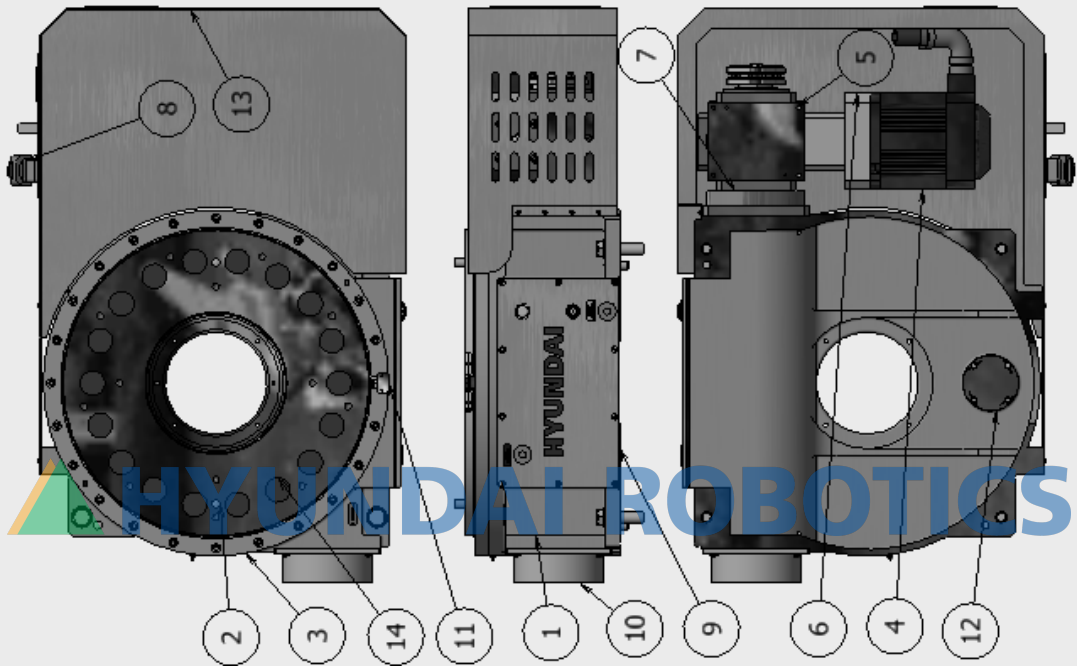


Figure 2.1 Names of Individual Parts of the Main Body

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

No.	Names of Individual Parts	No.	Names of Individual Parts
1	MAIN FRAME BOX	8	ELECTRIC CONNECT UNIT
2	ROTATE TABLE	9	BOX COVER
3	PRELOAD FLANGE	10	PLATE COVER
4	R AXIS MOTOR	11	ORIGIN GAUGE
5	REDUCER	12	BEARING COVER
6	REDUCER CONNECT	13	MOTOR COVER
7	REDUCER PLATE	14	TABLE BEARING COVER

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.

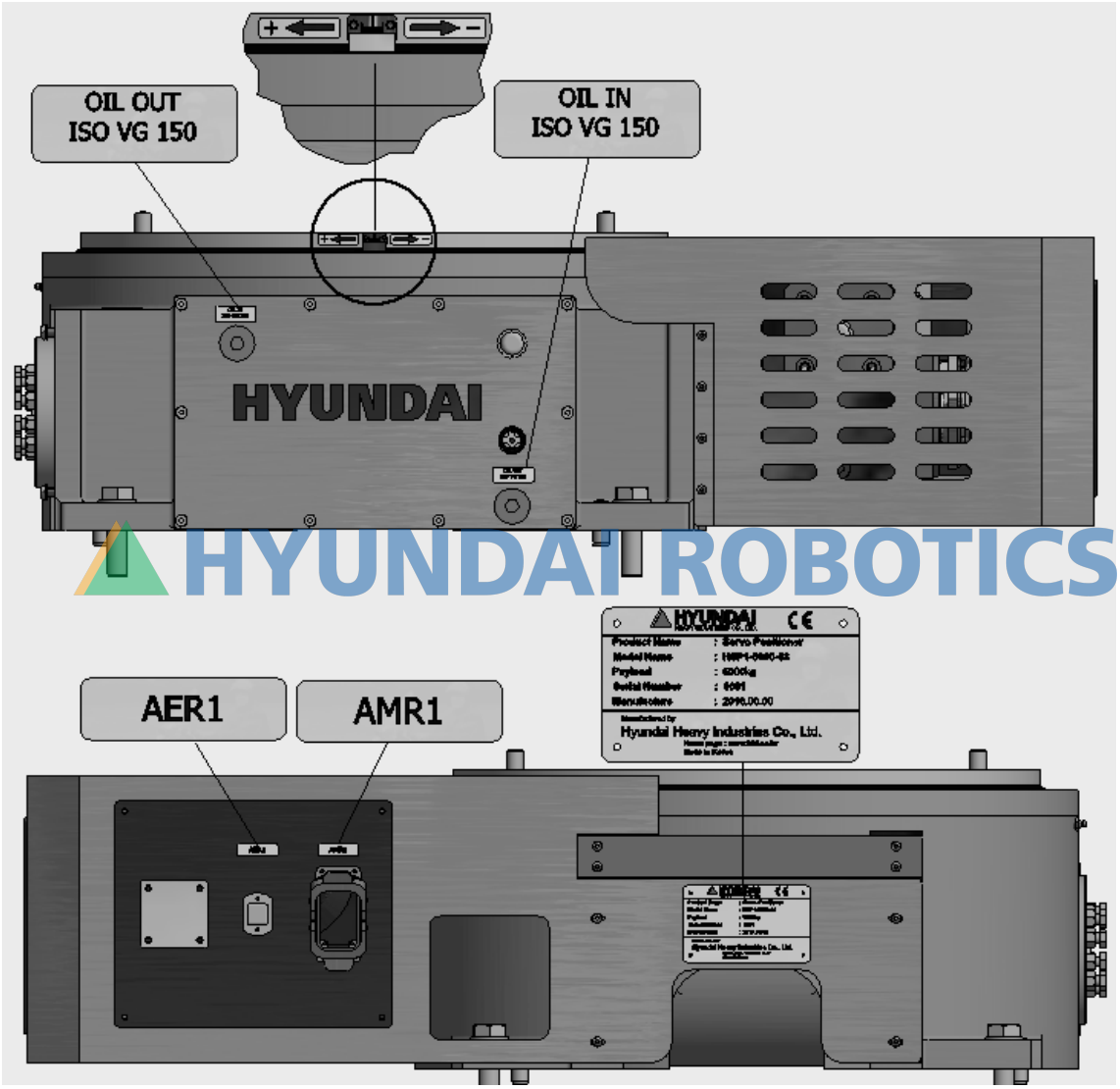


Figure 2.2 Position of the Caution Plates for Safety

2.3. Transport Method

2.3.1. Use of a Crane

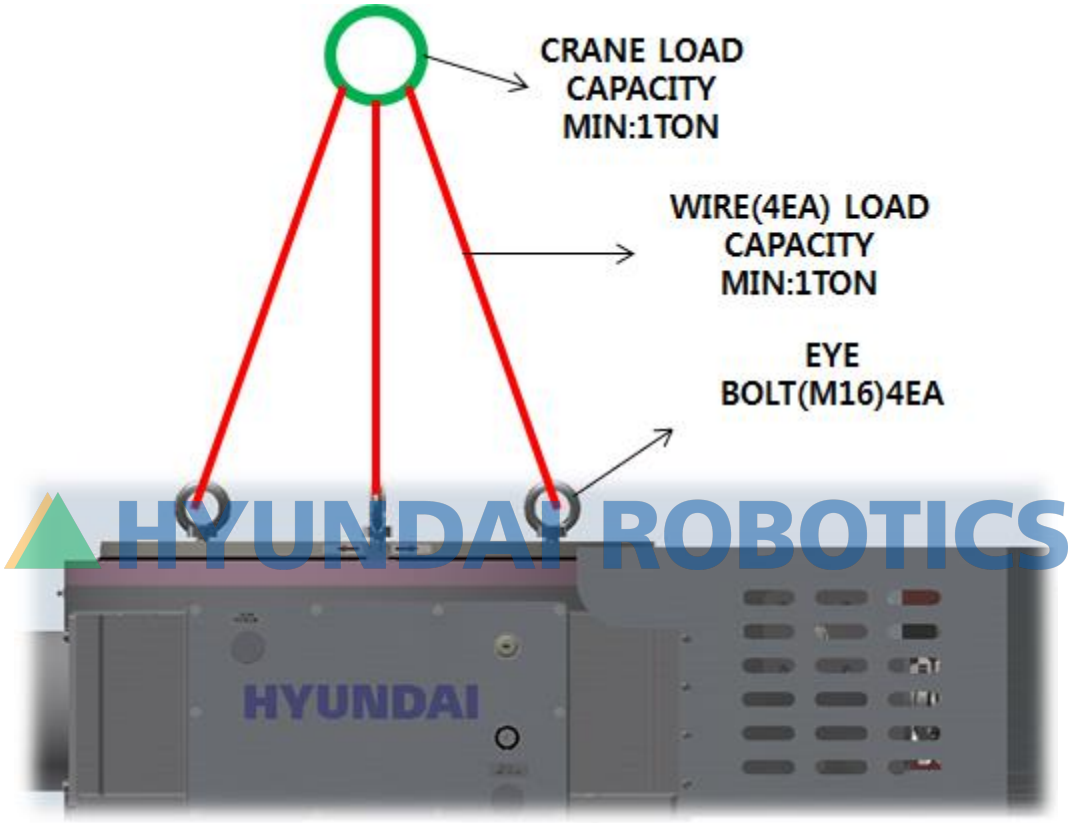


Figure 2.3 Transport Method: Use of a Crane

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.

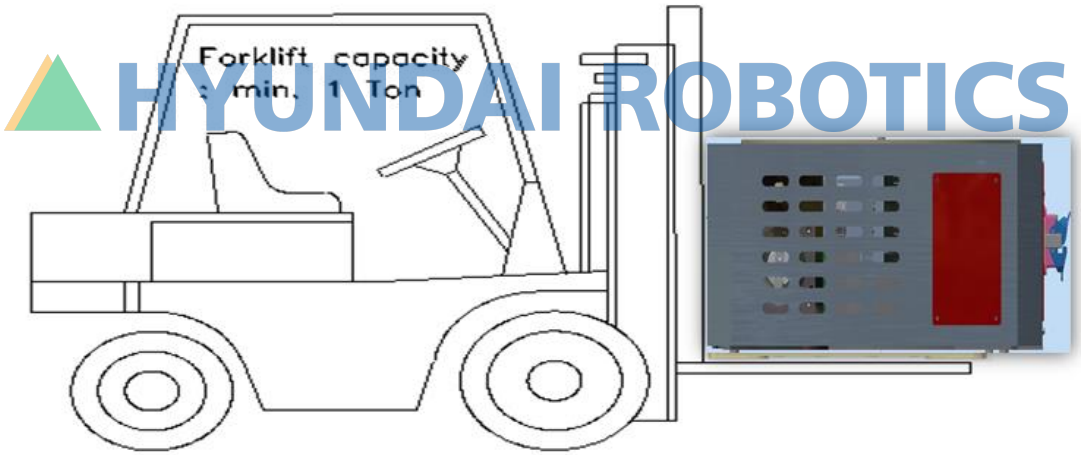


Figure 2.4 Transport Method: Use of a Forklift

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: 552 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.

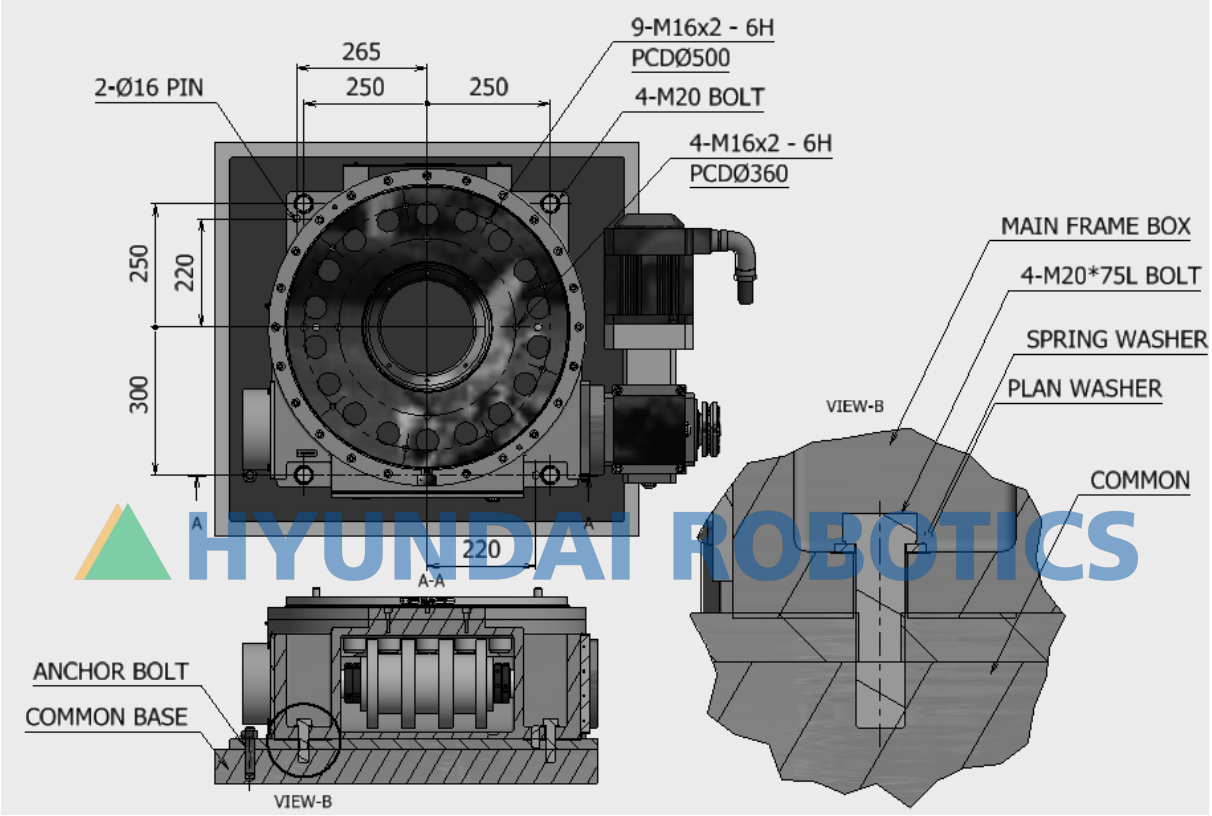


Figure 2.5 Dimensions of the Installation Surface

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).
(3) This positioner should be installed horizontally for use (cannot be installed vertically).

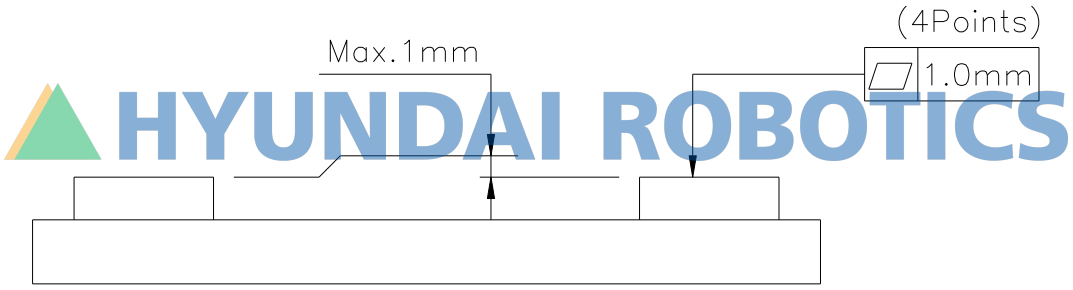


Figure 2.6 Accuracy of the Positioner Installation Surface

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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

The 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 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].
The overhaul should be carried out every 20,000 operating hours.

It is required to refer to the following items. 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, Items, and Cycle

Cycles for Replacing/Replenishing Grease and Oil

Classification	Replenishment Amount	Replenishment Cycle	Replacement Cycle
Barrel cam part (Oil)	-	-	2 years
Worm reducer (Synthetic oil)	20 cc	When oil leakage is found	-
Automatic grease injector	-	-	1 year

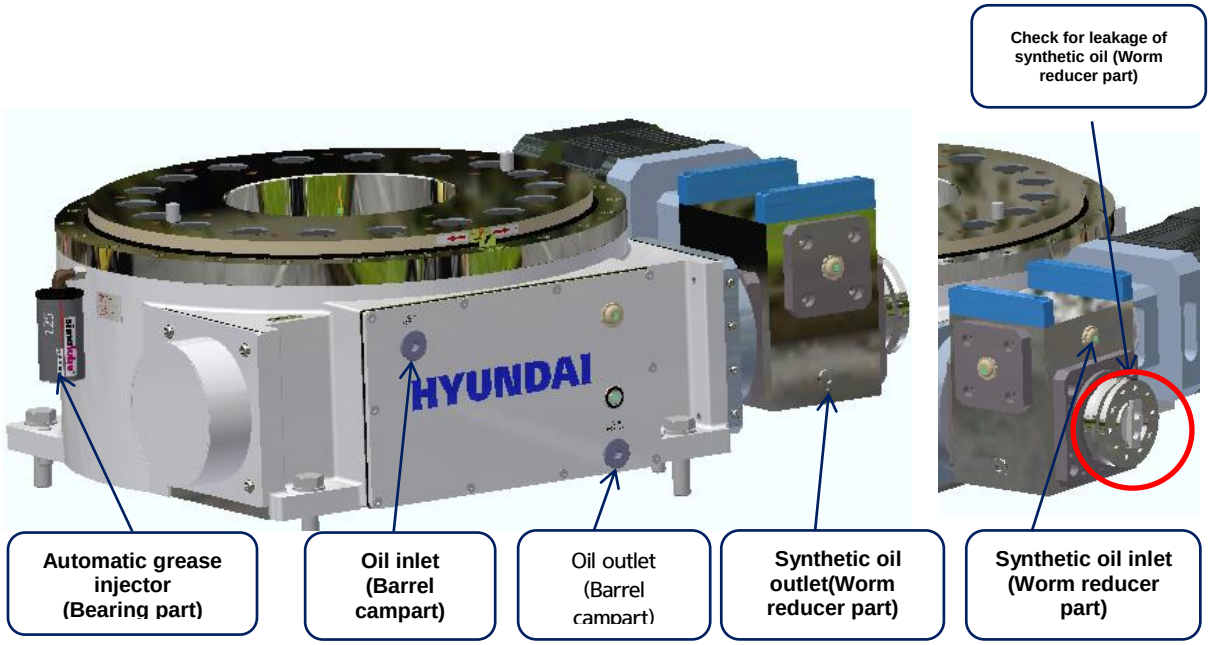

Figure 3.1 Oil Inlet and Outlet

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 · Visually checking the paint markings of the cable fixing bracket fastening bolts ·Visually checking for damages to the cable covers		
3		○		Main bolts	Visually checking the paint markings		
4	○			Motor	Checking for abnormal heat generation Checking for abnormal sound generation		
5	○			Reducer	Checking for abnormal heat generation Checking for abnormal sound 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.

3.2. 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	Preload Flange Attachment Bolt	7	Box Cover Attachment Bolt
2	Plate Cover Attachment Bolt	8	
3	Taper Bearing Flange Attachment Bolt	9	
4	Taper Bearing Pre-Pressure Adjustment Bolt	10	
5	Reducer Plate	11	
6	Taper Bearing Flange Fixing Bolt		

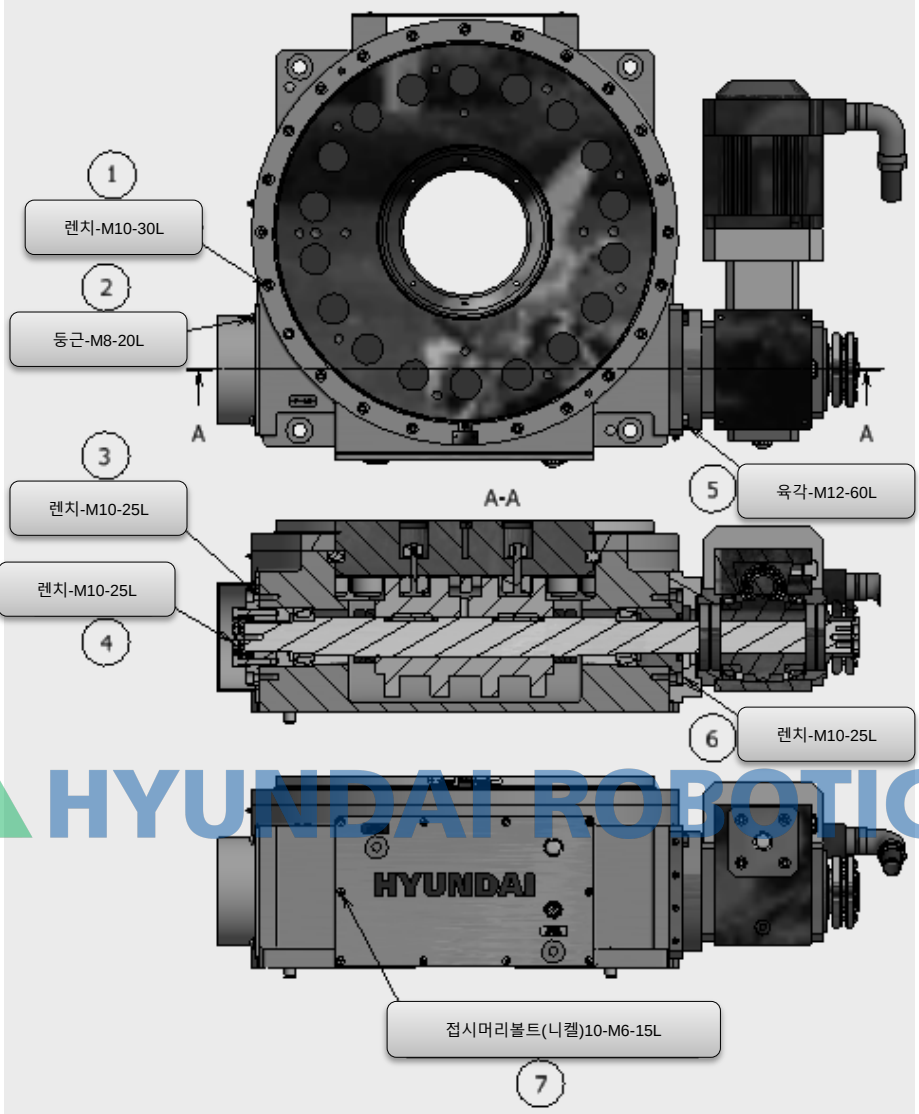

Figure 3.2 Key Bolts to Inspect

3.3. 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.

3.3.1. 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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Maintenance

4.1. Replacement of the Automatic Grease Injector / Injection and Replacement of Oil

Caution

If the oil is not injected correctly, the internal pressure in the inlet could increase suddenly, causing damage to the oil seal, leakage, and abnormal operation. Therefore, the user must comply with the following items when injecting oil.

① The oil outlet plug must be removed before injecting the oil.
② If possible, inject the oil without using a compressed air pump driven by the air supplied from the factory.
③ Use only the designated oil. Otherwise, damage to the reducer and other problems could occur.
④ After injecting the oil, check whether there is any oil leakage at the oil outlet and whether there is any pressure at the inlet.
⑤ Clean the oil spilled on the body or the floor to prevent accidents.
⑥ When the positioner is to be used at an ambient temperature of 40° C or higher, the oil replacement cycle should be reduced by half.

■ Oil replacement cycle and oil injection amount

※ Barrel cam part (Cam gearbox)
- ✓ Oil type: S-OIL Carter EP#150 / ISO VG 150 (Specification)
- ✓ Oil replacement : Every 10,000 hours
- ✓ Oil injection amount: 4 L

※ Worm reducer part (Synthetic oil)
- ✓ Oil type: LD FM220 / ISO VG 220 (Specification)
- ✓ Oil replacement: Every 20,000 hours
- ✓ Oil injection amount: 500 CC
- ✓ Replenish the oil by about 20~30 CC when oil leakage is found.

4.1.1. T Axis Reducer

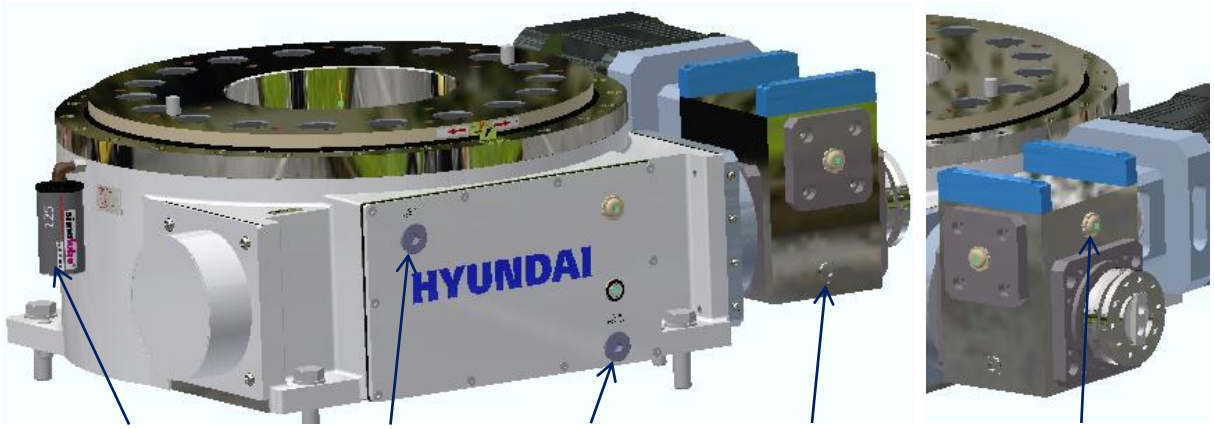

Figure 4.1 Oil Inlet and Outlet

■ Replacement of the automatic grease injector

① Replace the automatic grease injector according to the replacement cycle (every 12 months).
② Replacement method
A. Dismantling: Dismantle it by rotating it counterclockwise without using a tool.
B. Setting: Set the injection cycle to 12 months using the wrench on the bottom of the new grease injector.

C. Installing: Install it by rotating it clockwise.

✓ Grease type: Multipurpose grease
✓ Automatic grease injector type: SIMALUBE 125, SL01
✓ Grease injection amount: 125 cc (Injection cycle 12 months: cc/day 0.08)

Caution
If you inject the oil without removing the outlet plug, the oil may enter the motor, causing damage to the motor. You must remove the plug.

■ Replacement of the oil and synthetic oil

① Remove the outlet plug.
② Inject the oil through the inlet.
③ Inject the new oil until it comes out of the outlet. The new oil can be identified by color.
④ Clean the outlet with a cloth and assemble the plug, which is wrapped with the seal tape, back into its original position.

4.2. 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.

4.2.1. 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.


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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 of 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.

[R axis]

- Investigation method

  ① Investigate whether there is clearance in bearings by applying force to the R axis.
  ② Investigate whether there is clearance in bearings without a load being applied to the reducer.
  ③ Before 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 R axis frame. If you have any difficulties, please contact our service department.

[T axis]

- Investigation method

  ① Investigate whether vibration or abnormal noise occurs and also whether abnormal heat is generated in the reducer part.
  ② Investigate whether there is clearance in the reducer.
  ③ Before an emergency occurs, investigate whether there is any contact with a peripheral system near the positioner.
  ④ (The reducer can be damaged because of an impact from contact)

- Handling method
  Replace the reducer.

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.

5.2.3. Encoder

If there is an error with the encoder, it may cause position deviation, malfunction, runaway, etc., and it may cause shaking during stop and irregular cycles (pulsation). Those problems are not related to the phenomenon of mechanical abnormal sound, heat generation, vibration, etc.

- Investigation method

  ① Check if there is any problem with the encoder data.
  ② Set the customized scale to the reference position, and then investigate whether there is an error with the position data.
  ③ Move each axis of the positioner and investigate whether there is any axis whose data changes irregularly.
  ④ Replace the servo amplifier circuit board BD440, and then investigate whether an error occurs.

- Handling method

  ① Check the wiring and replace the encoder if the wiring is not disconnected.
  ② If the error does not occur when the servo amplifier circuit board BD440 is replaced, it should be replaced.

6

Recommended Spare Parts

The parts recommended as the spare parts for the positioner are as follows. When purchasing them, it is required to check the serial number and manufacture date 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 the high frequency of operation)
C: Key components
D: Instrument parts

Table 6-1 Spare Parts List

Classification	Part Name	Manufacturer / Specification	Per Unit: Number for use	Per Unit: Number recommended	Applicable part
A	AUTO GREASE INJECTOR	SIMALUBE / SIMALUBE 125, SL01	1 EA	1 EA	Should be replaced every one year regardless of hours of operation
A	ENCODER BATTERY	HRC / ER6C (AA) 3.6 V	2 EA	2 EA	Should be replaced every two years regardless of hours of operation
B	AC SEVO MOTOR	HRC / TSM3611N7020	1 EA	1 EA	R AXIS (5.9 Kw)
B	ENCODER	HRC / R112504000	1 EA	1 EA	COMMON FOR 2.5 TON / 5 TON
C	REDUCER	SINDO / S076-DJI (I=1/10)	1 EA	1 EA	FOR 5 TON
C	REDUCER	SINDO / S076-DJI (I=1/9)	1 EA	1 EA	FOR 2.5 TON
E	CAM FOLLOWER BEARING	IKO / CF20-IVBUUR	18 EA	3 EA	FOR 2.5 TON
E	CAM FOLLOWER BEARING	IKO / NART20VR	18 EA	3 EA	FOR 5 TON
F	COUPLING	DURI MITEC / DRW-80C-24K8-28K8	1 EA	2 EA	FOR 2.5 TON / 5 TON
G	BEARING	FRANKE LER5	1 EA	2 EA	COMMON FOR 2.5 TON / 5 TON

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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**

(13630) 경기도 성남시 분당구 돌마로 42 한국과학기술한림원 2 층, 4 층

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