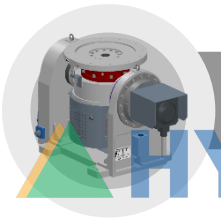
HYUNDAI ROBOTICS

Warning

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

HAP2191201MMEN1



Positioner Main Body Maintenance Manual

HAP2-0500-03

HYUNDAI ROBOTICS

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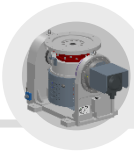

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Specification

1.1. Instrument Part Type of the Positioner

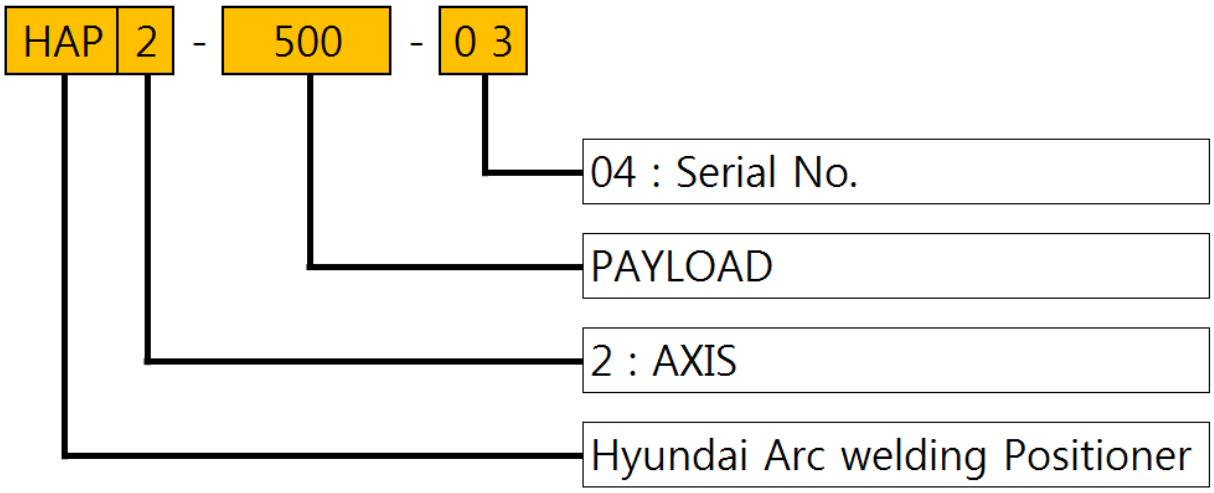


Figure 1.1 Instrument Part Type of the Positioner

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.

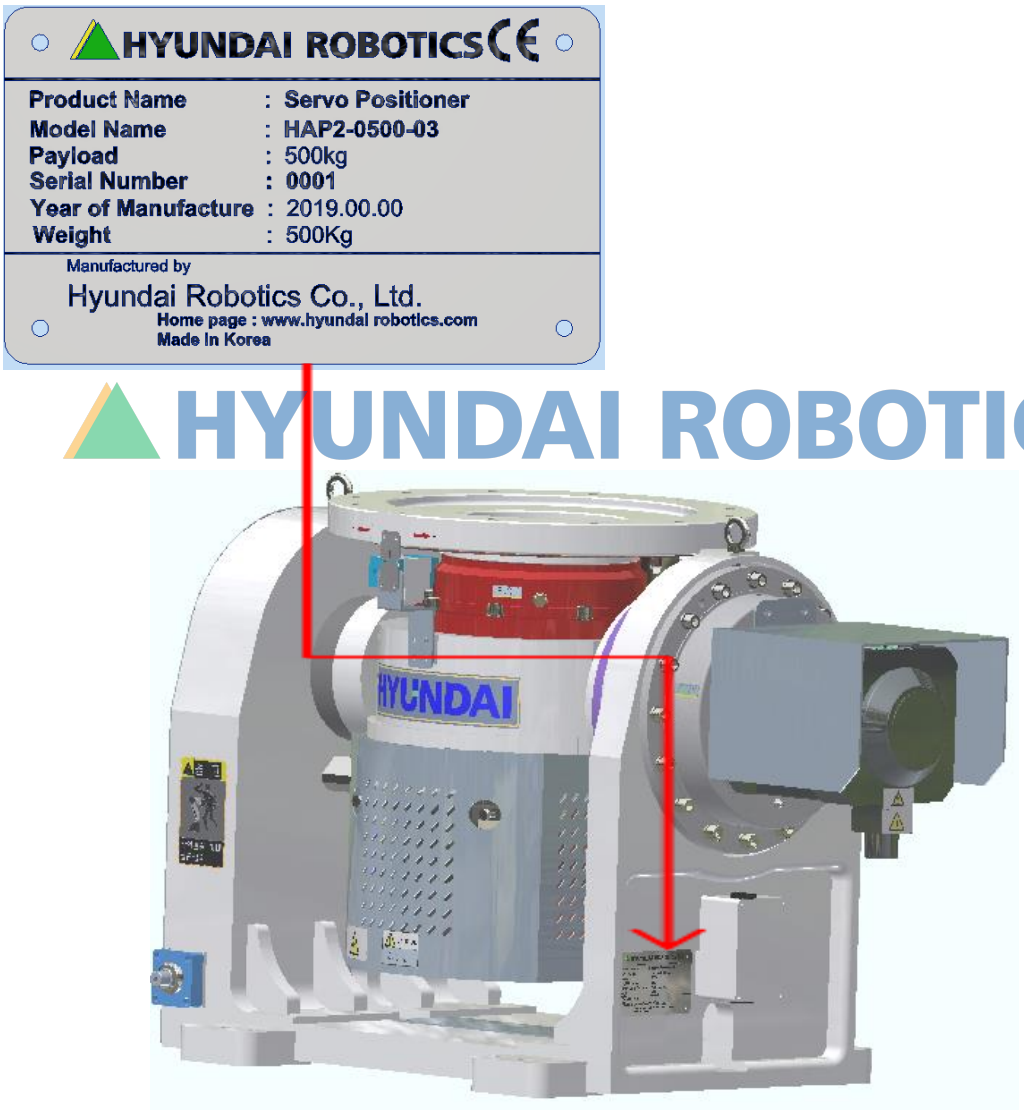
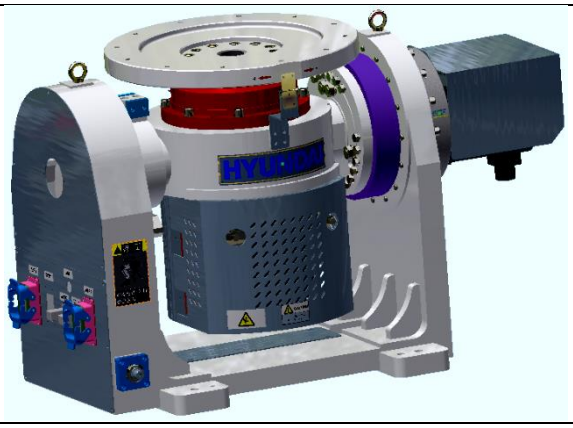


Figure 1.2 Attachment of the Positioner Name Plate

1.3. Basic Specification

Table 1-1 Basic Specification

No.	Item	Unit.	SPECIFICATION	
			Tilting	Rotating
1	MOTOR	Type No.	TSM3611 N7020 E721	TSM3506 N7021 E732
		Capacity	5.9 Kw	2.5 Kw
2	Reducer	Type No.	RV320E3-171	F2CFS-C45-59
		Capacity	171	118
3	Maximum Operation Angle	°	± 135°	±200°
4	Maximum Operation Speed	°/s	70	153
5	Allowable Output Torque	Kgf.m	250	136
6	Allowable Output Inertia	Kg.m²	200	50
7	Repetitive Positioning Accuracy	arcsec	60”	
8	User Connector	-	1. Signal: 40 Cables 2. Air 1 EA: 내경 Φ8 mm (외경 Φ12 mm) 3. Earth Cable	
9	Main Body Weight	Kg	430	
10	Applicable Controller	-	Hi5 ROBOT Controller	
11	Shape	-		

1.4. External Dimensions and Operation Area of the Main Body

1.4.1. External Dimensions and Operation Area of the Main Body

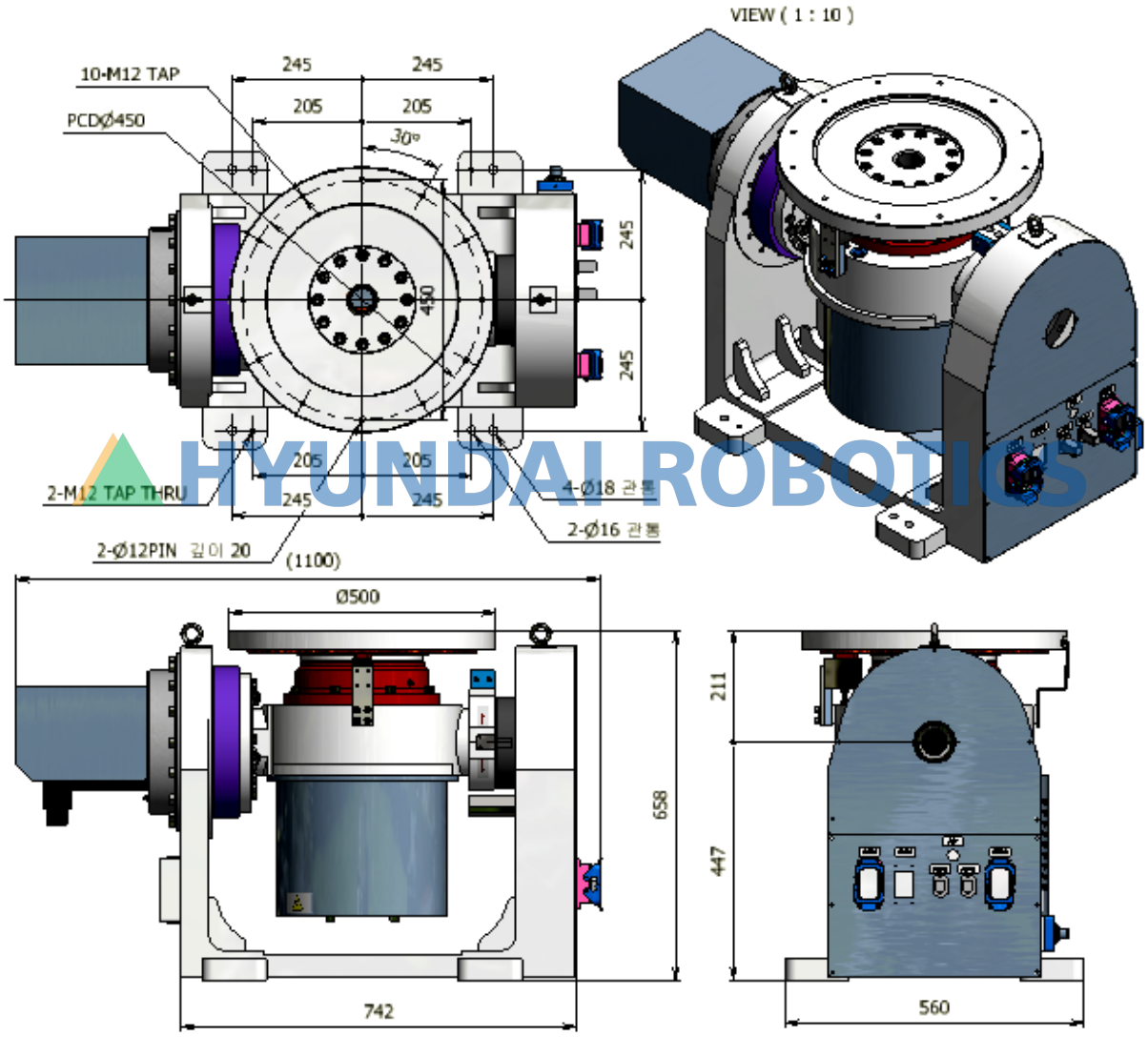


Figure 1.3 External Dimensions and Operation Area of the Main Body

1.4.2. Operation Axis and their names

Table 1-2 Rotation Direction of individual Axis

Axis name	Operation	Teach Pendant Button	
R	Turning	Left(S+)	R
T	Turning	Right(H+)	T

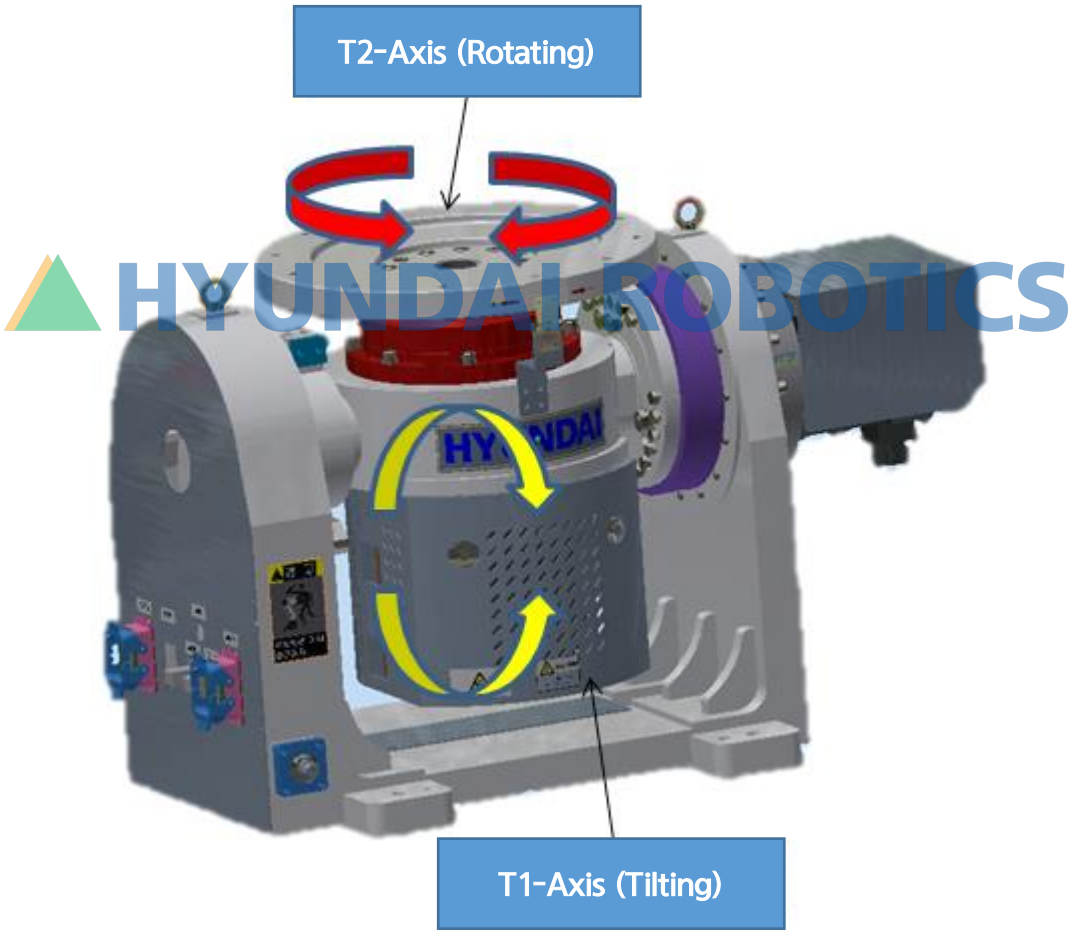


Figure 1.4 Exterior and Operation Axis of the Main Body

1.4.3. Explode-View Drawing of the Two-Axis Positioner

P.C.D 125 bolts should be used to attach a working tool to the flange of the front end of the wrist axis.

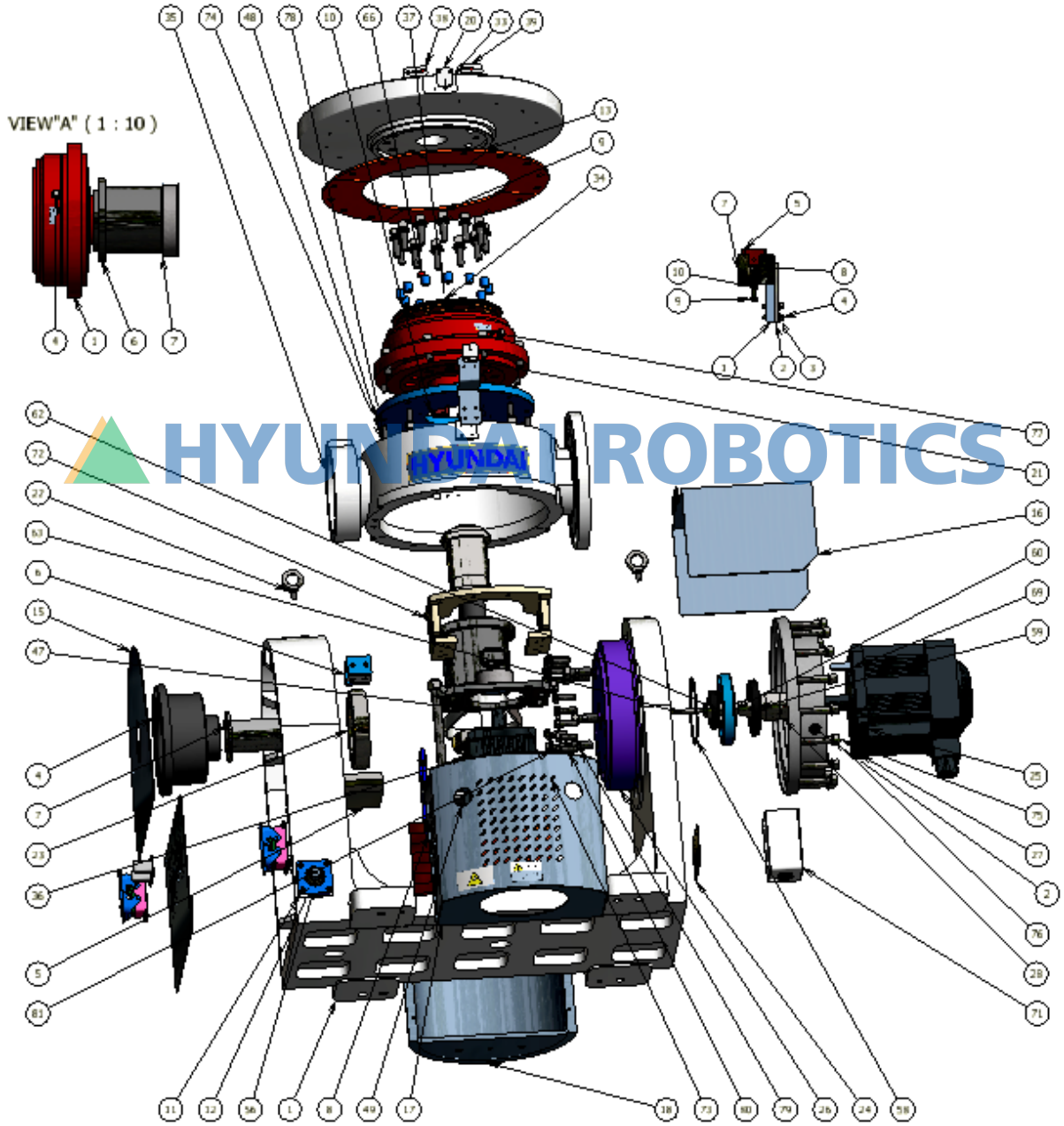


Figure 1.5 2 Exploded-View Drawing of a Two-Axis Positioner

항목	부품 번호	설명
1	HAP2-500D-001	MAIN FRAME
2	HAP2-500D-003	MOTOR BASE
4	HAP2-500D-006	JOINT SHAFT
5	HAP2-500D-008	STOPPER BLOCK
6	HAP2-500D-009	STOPPER
7	HAP2-500D-010	CABLE GUIDE(IN)
8	HAP2-500D-035	CABLE GUIDE SUPPORT
9	HAP2-500D-014	INSULATION BUSH SET
10	SPRING-SWY20.5-30	EARTH BLOCK ASSY
11	HAP2-500D-016	W POWER IN PLATE
12	HAP2-500D-017	W POWER IN SHAFT
13	HAP2-500D-018	EARTH ROUND PLATE
15	HAP2-500D-024	REAR COVER
16	HAP2-500D-025	T-AXIS MOTOR COVER
17	HAP2-500D-026-수정	R-AXIS MOTOR COVER
18	HAP2-500D-031	COUNTER WEIGHT
19	HAP2-500D-027	CABLE COVER
20	HAP2-500D-029	T/R AXIS SCALE
21	HAP2-500D-030	R-AXIS SCALE PLATE
22	KS B 1033 - M10	아이 볼트
23	JIS B 1521 SKF (C) - SKF 6217-2RS1	단열 깊은 그루브 볼 베어링 SKF
24	HAP2-500D-070	IDENTIFICATION PLATE
25	P02-TSM3611N7020E721	TSM3611 N7020E721-SERVO MOTOR(5.9KW-2000RPM)
26	P03-T-AXIS REDUCER(RV320E-201)	감속비 I=201
27	CSN 02 7421 - M10 x 1원추 짧은	직선 볼 머리 윤활 니플 유형 A
28	HAP2-500D-005	T-AXIS INPUT GEAR
31	P09-KS B 2799 - G270-5.7	O-링 하우징 - 설계 기준
33	HAP2-500D-004-수정	MECHANICAL INTERFACE
34	HAP2-500D-012-수정	INSULATION PLATE1
35	HAP2-500D-002-수정	ROTATING FRAME
36	P01-TSM3506N-7021 ASSY-수정	
37	R-AXIS REDUCER-수정안(1축적용타입)	F2CFS-C45-59-CYCLO DRIVE(SUMITOMO)I=59
38	HAP2-500D-071-7	+방향표시계(570파이 공용)
39	HAP2-500D-071-6	-방향표시계(570파이공용)
47	HAP2-500D-045-GUIDE PIPE수정안(1축용길이축소)	GUIDE PIPE(길이축소 수정안)
48	HAP2-500D-033-FLANGE추가	FLANGE
49	HAP2-500D-034-추가	HOSE PIPE SUPPORT PLATE
56	JIS B 1554 - AN 05	홈붙이 둥근 너트
58	P07-G120-3.1	
59	JIS B 2402 - 80 105 13 A	오일 실 - 비스프링, 금속 케이스 GM
60	HAP2-500D-003-1	SEAL COVER
62	JIS B 2402 - 50 72 12 A	오일 실 - 비스프링, 조립 GA
63	KS B 1003 - M 8 x 80	6각머리 태핑 나사
65	HAP2-500D-002-1	CABLE GUIDE
66	HAP2-500D-004-1	CABLE GUIDE
67	JIS B 1354 - A - 6 x 20	평행 핀
68	HAP2-500D-071-4	모터분해주의
69	HAP2-500D-071-9R	BOX COVER
70	CONNECT COVER ASSY	
71	ELECTRIC BOX	BOX COVER
72	HAP2-500D-32-수정	
73	M10x35-12.9	6각 머리 볼트-12.9
74	KS B 1324 - 번호 2 - 10	스프링 잠금 와셔
75	KS B 1003 - M 12 x 70	6각머리 태핑 나사
76	KS B 1324 - 번호 2 - 12	스프링 잠금 와셔
77	KS B 1003 - M 12 x 40	6각머리 태핑 나사
78	KS B 1003 - M 10 x 30	6각머리 태핑 나사
79	M16-50L BOLT-12.9	감속비 I=201
80	KS B 1012 - M 16	6각 너트 및 6각 가는 너트
81	KS B 1324 - 번호 2 - 16	스프링 잠금 와셔

항목	부품 번호	설명
1	P04-R-AXIS REDUCER	CYCLO DRIVE(F2CFS-C45-59)-감속비 I=59
2	JIS B 1521 SKF (E) - SKF 6015-2Z	Z 실드 2개가 있는 단열 깊은볼 베어링 SKF
3	SBHGN A M10 x 1 IS 4009(제I부)	그리스 니플
4	DIN 910 - G 0.25 A	나사 플러그
5	HAP2-500D-011-수정안	SHAFT
6	HAP2-500D-006-BEARING HOUSING수정안	BEARING HOUSING
7	HAP2-500D-042-REDUCER PULLEY수정안	REDUCER PULLEY
항목	부품 번호	설명
1	HAP2-500D-013	INSULATION PLATE1
2	HAP2-500D-015	FLAT WASHER
3	HAP2-500D-022	INSULATION WASHER
4	JIS B 1176 - M6 x 35	원통형 머리 캡 나사
5	HAP2-500D-021	EARTH BRUSH
6	HAP2-500D-020	SPRING PLATE
7	HAP2-500D-019	EARTH BLOCK
8	압축 스프링1	
9	JIS B 1180 - C M8 x 30	6각 머리 볼트
10	JIS B 1181 - A M8	6각 너트 - 스타일1

1.5. Detailed Drawing of the Output Side Attachment Surface

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

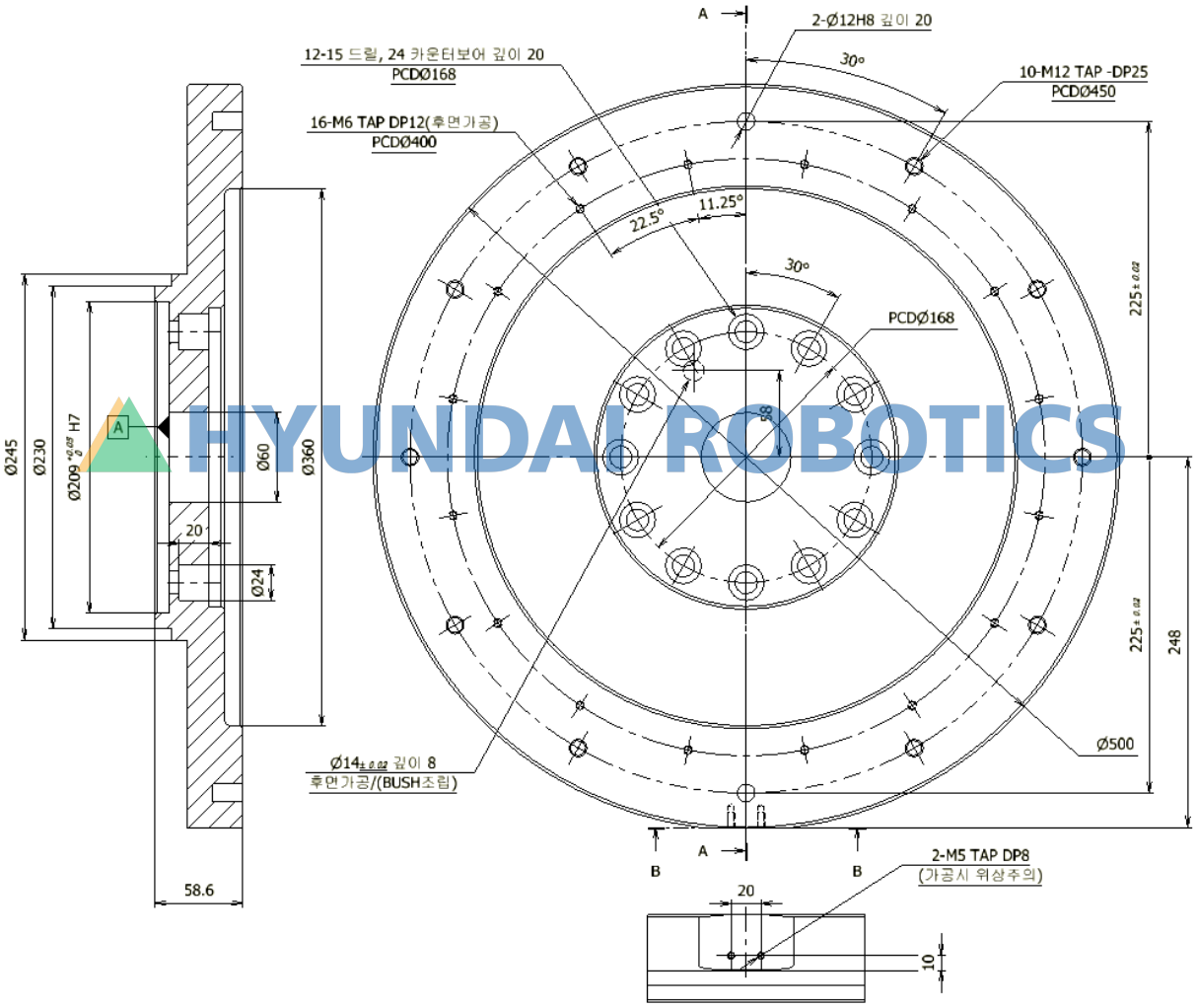
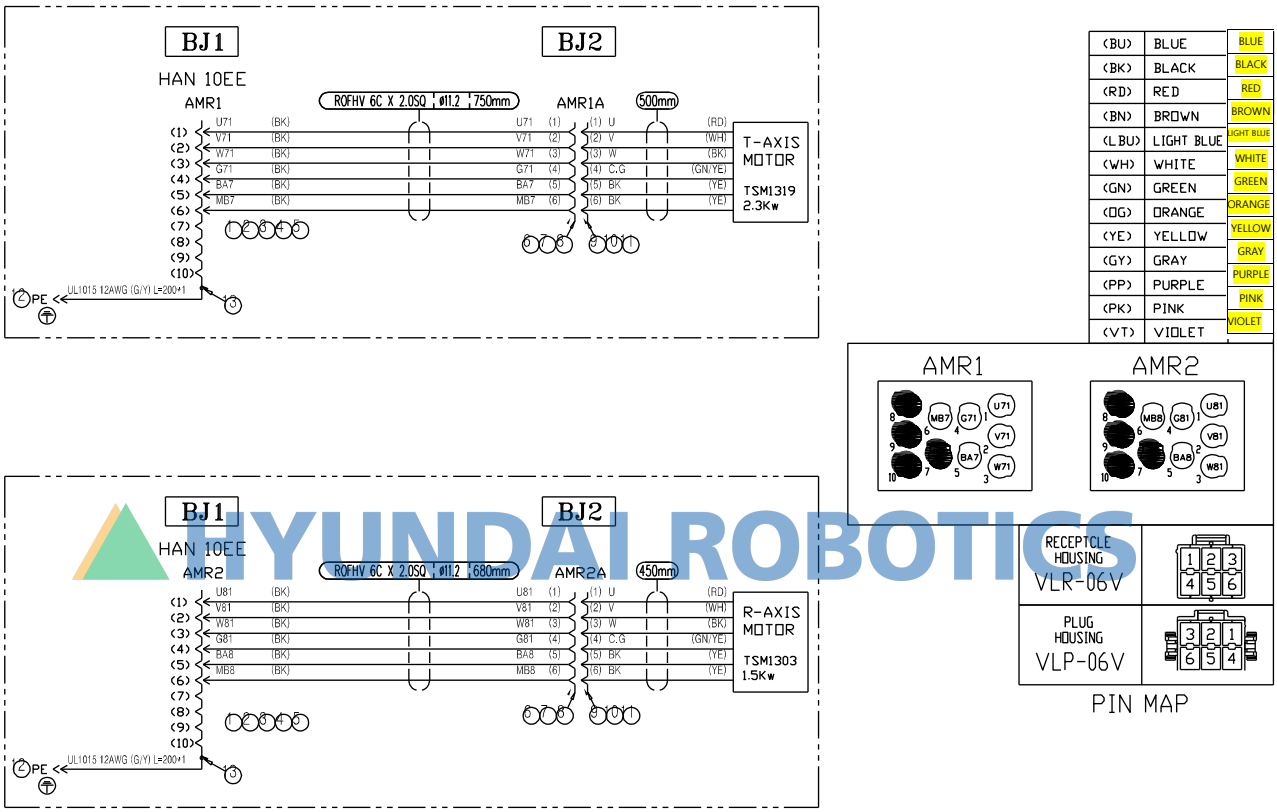
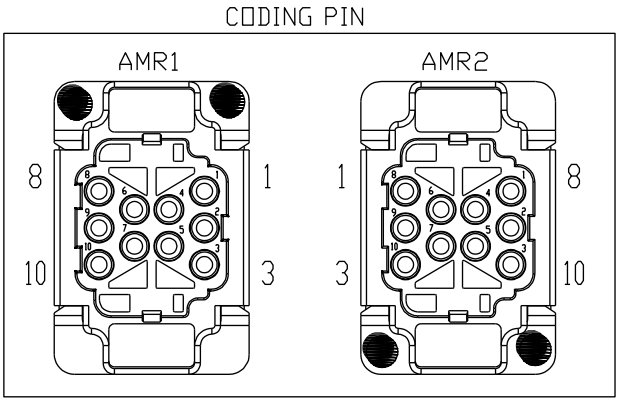


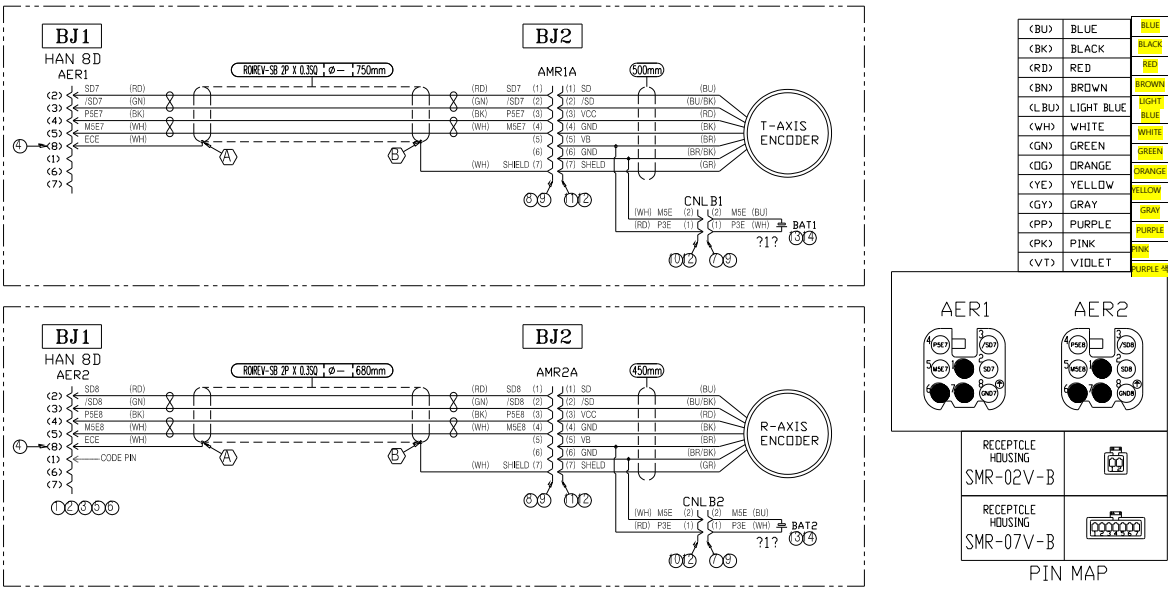
Figure 1.6 Detailed Drawing of the Mechanical interface Attachment Surface

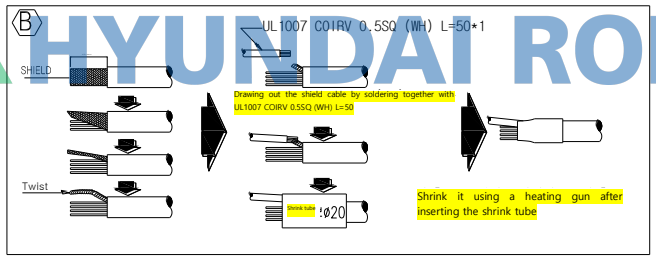
1.6. Wiring and Piping Diagram for Application



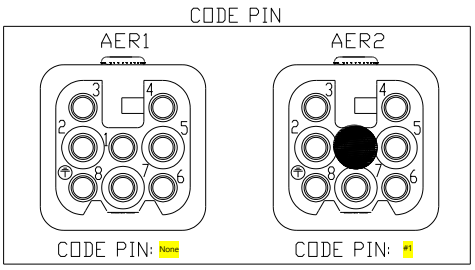


NO	ITEM NO	ITEM NAME	MATERIAL	Q'TY	WT(kg)	REMARK
015		CABLE		400mm		UL1015 12AWG(G/Y)
014		CABLE		1,430mm		ROFHV 6cX2.0sq
013		RING TERMINAL		2		3.5SQ-4R (WIDE TYPE type)
012		RING TERMINAL		2		3.5SQ-5R
011		RETAINER				VLS-03V
010		PIN CONTACT				SVM-61T-P2.0
009		RECEPTACLE HOUSING				VLR-06V
008		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		RORIEV-SB 2P X 0.3SQ
014		BATTERY DISCHARGE PREVENTION CAP		4		3BSQ RUBBER CAP (BK)
013		BATTERY		2		ER-6C 3.6V AA
012		PIN CONTACT				SYM-001T-0.6
011		RECEPTACLE HOUSING				SMR-07V-B
010		RECEPTACLE HOUSING				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 rubber)
005		Code Pin		1		09 33 000 9915
004		Male Contact(0.5SQ)		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

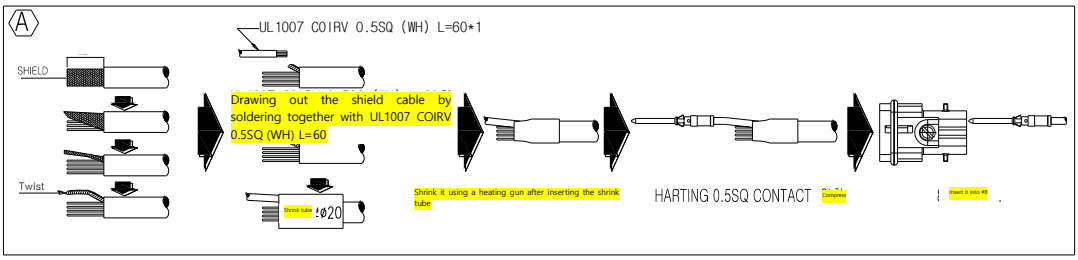


Figure 1.7 Wiring and Piping Diagram for Application

The main body of the positioner has a connector for connecting additional equipment and also an air unit. The following figures show the user application connector.
[Note] Maximum air pressure: 7 bar (7.1 kgf / cm^2, 101 psi)

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.

There are two ways, as shown below, to keep the positioner within the operation area.

- ✓ Software limit (R axis)
- ✓ Mechanical stopper (T axis)

[Caution]
Mechanical stoppers are physical devices. The positioner should not go beyond the mechanical stopper. The mechanical stopper of the T axis is fixed. The software limit is applied only for the R axis.

Mechanical stoppers will deform in one collision and cannot guarantee required strength. Therefore, deformed stoppers must be replaced.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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]

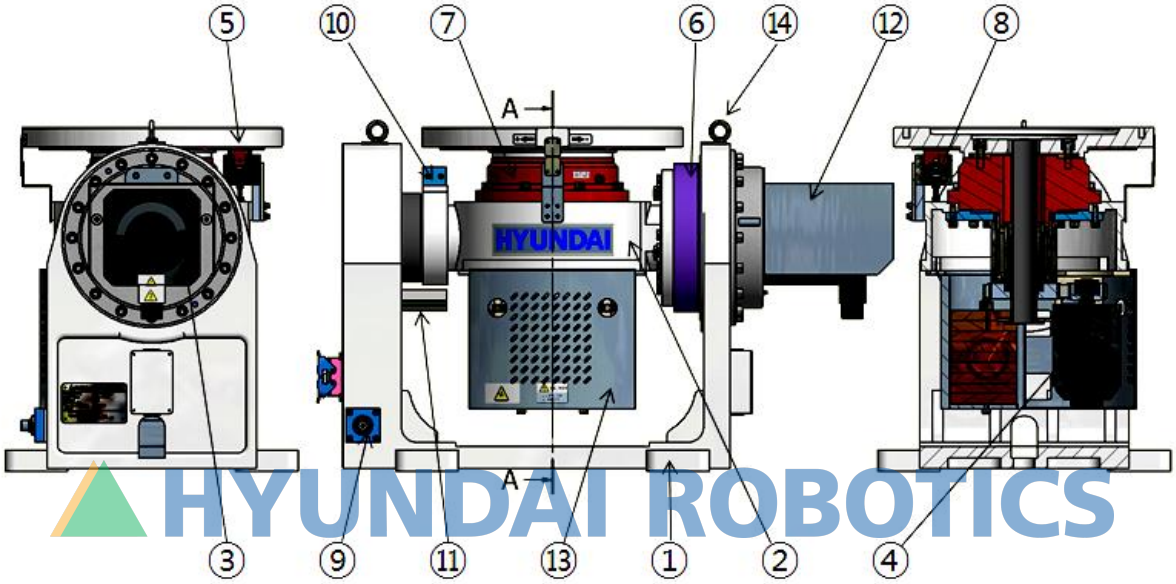


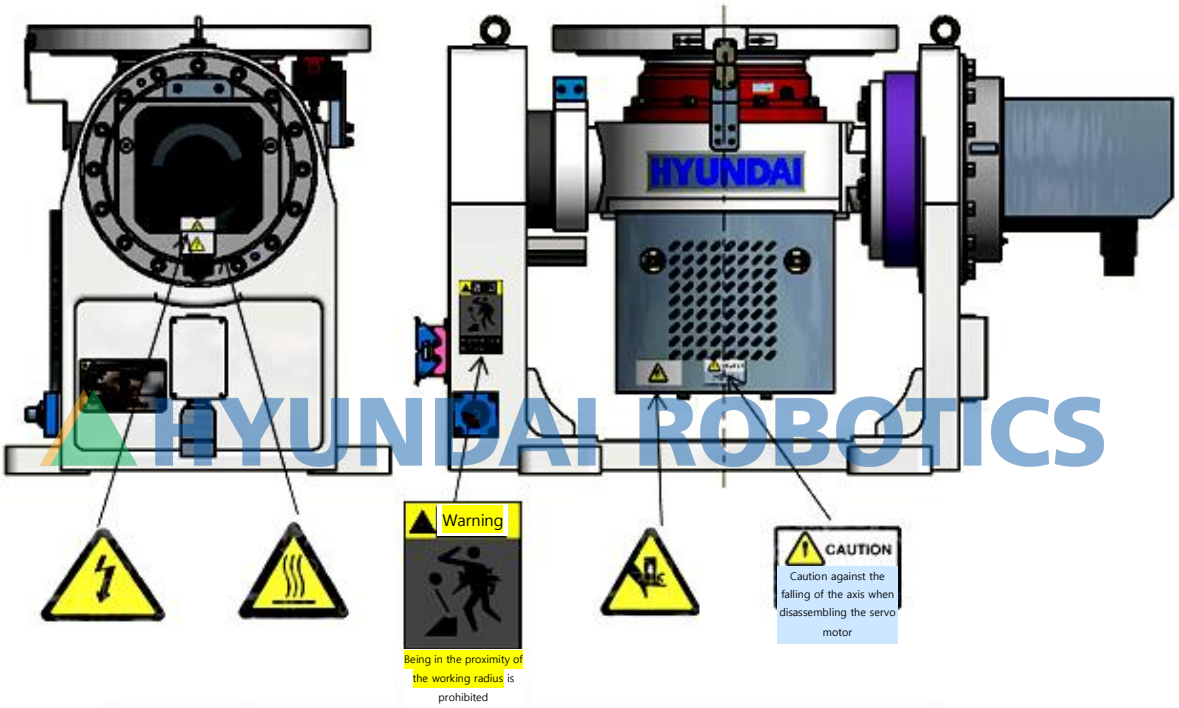
Figure 2.1 The names of individual parts of the main body

Table 2-1 The names of individual parts of the main body

No.	Names of Individual Parts	No.	Names of Individual Parts
1	MAIN FRAME	8	EARTH UNIT
2	ROTATE FRAME	9	EARTH UNIT
3	T AXIS MOTOR	10	STOPPER
4	R AXIS MOTOR	11	STOPPER BLOCK
5	MECHANICAL INTERFACE	12	T AXIS MOTOR COVER
6	T AXIS REDUCER	13	R AXIS MOTOR COVER
7	R AXIS REDUCER	14	EYE BOLT

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.



	No access within working radius
	Crimping attention
	Electric shock
	High temperature caution
	Falling caution

Figure 2.2 Position of the Caution Plates for Safety

2.3. Transport Method

2.3.1. Use of a Crane

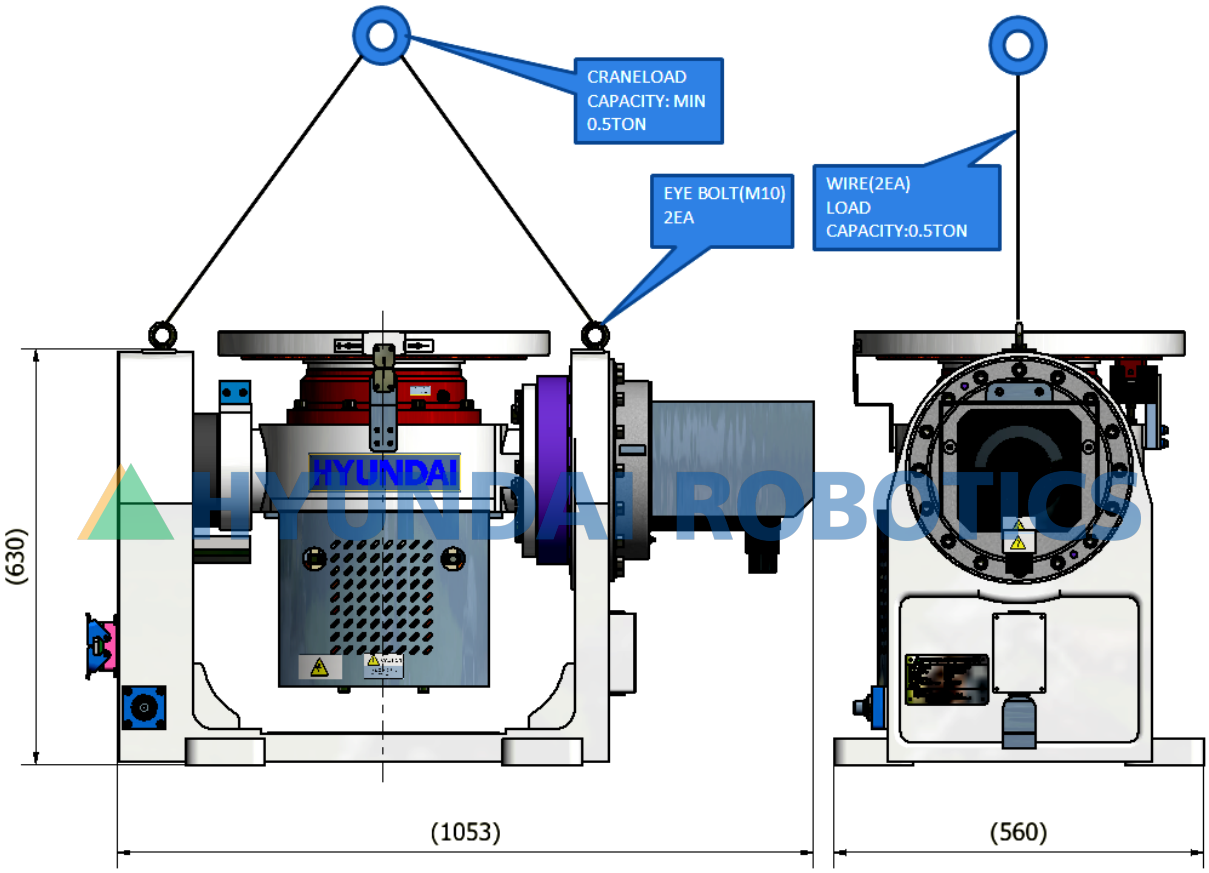


Figure 2.3 Transport Method: Use of a Crane

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.

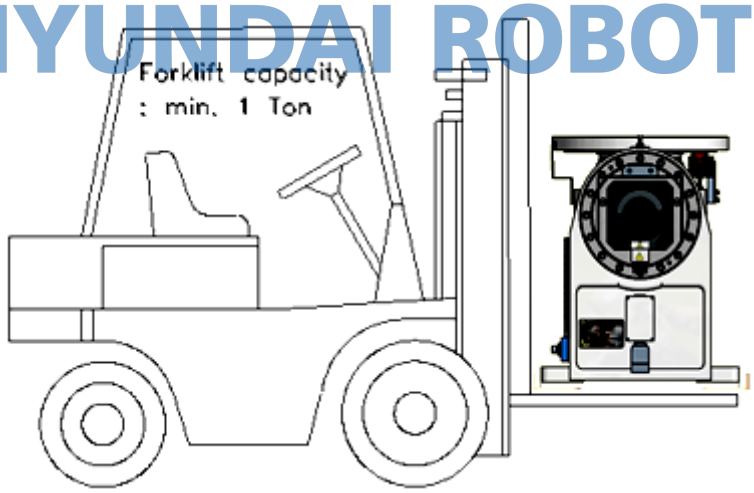


Figure 2.4 Transport Method: Use of a Forklift

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.

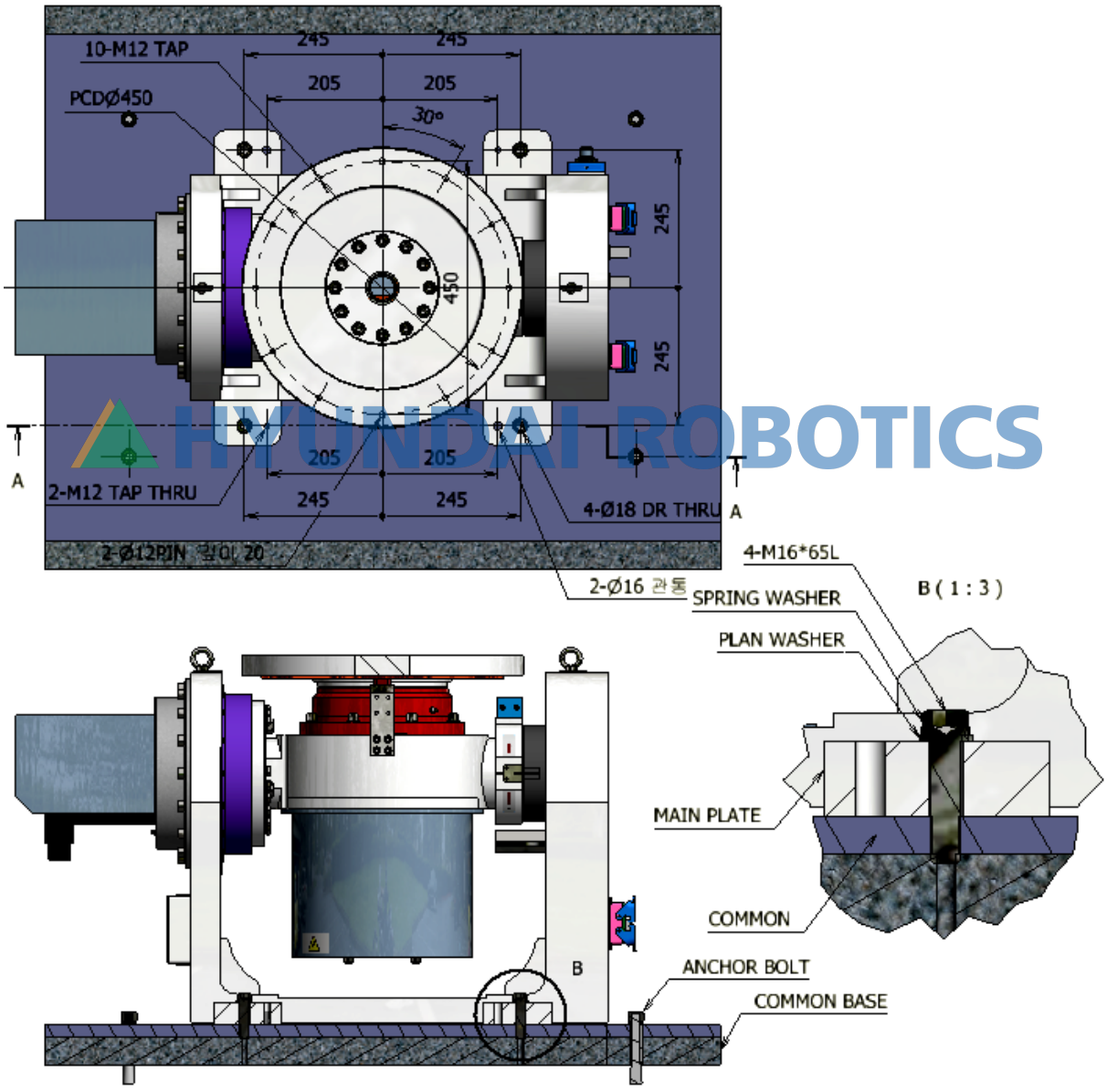


Figure 2.5 Dimensions of the Installation Surface

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).

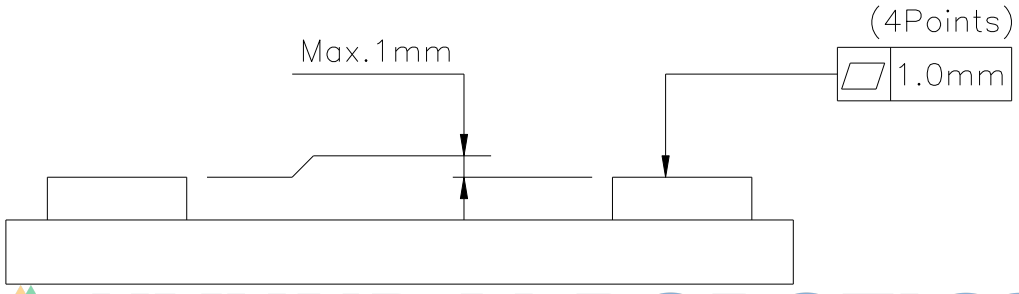


Figure 2.6 Accuracy of the Positioner Installation Surface

2.5. Allowable Load Value

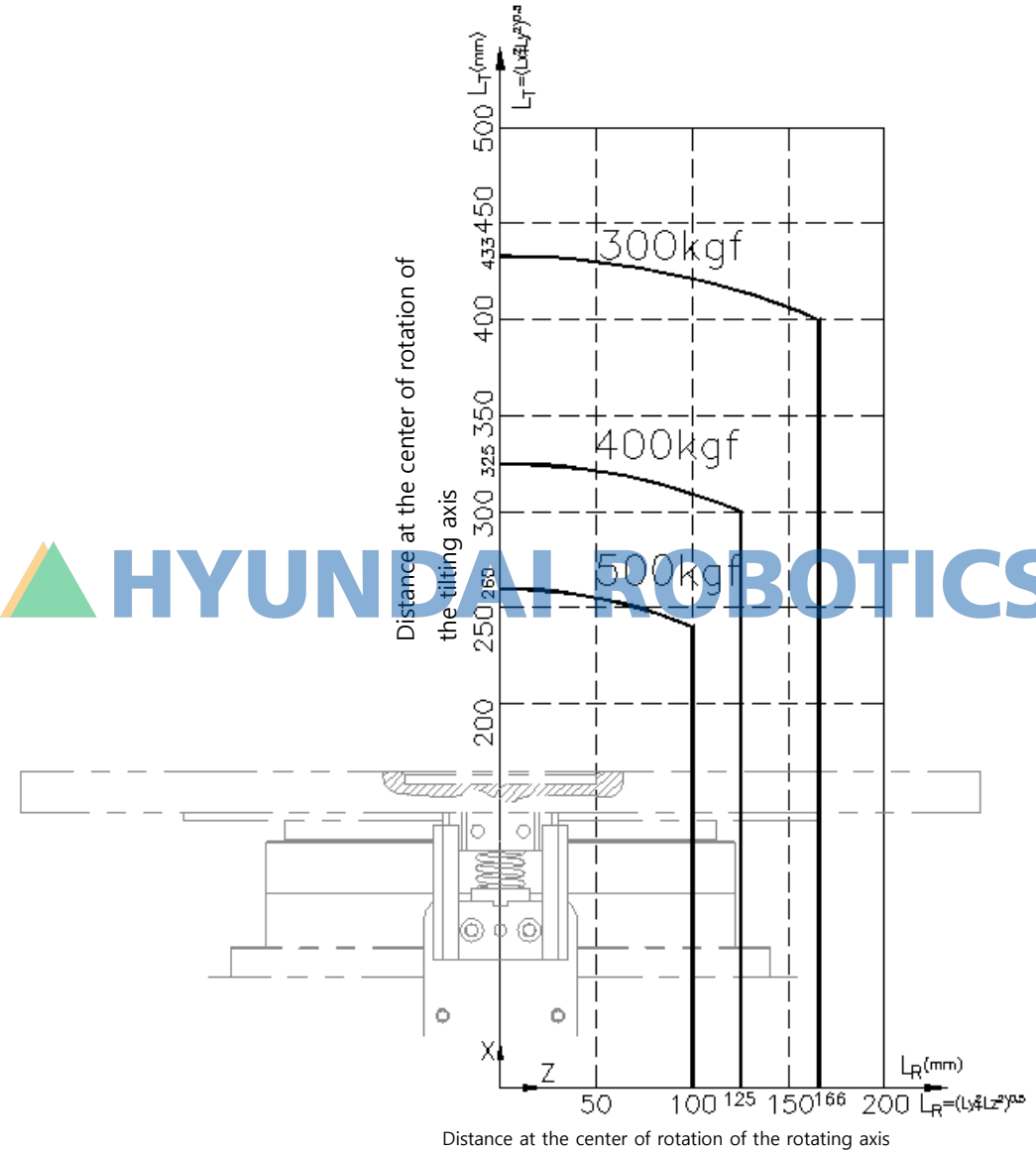


Figure 2.7 R Axis Torque Diagram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3

Inspection

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

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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 4-1].

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 · 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 the abnormal heat generation Checking for the abnormal sound generation		
5	○			Reducer	Checking for the abnormal sound generation 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	7	T axis reducer attachment bolt-1
2	R axis reducer support attachment bolt	8	T axis reducer attachment bolt-2
3	T axis motor cover bolt	9	Stopper attachment bolt
4	T axis motor base attachment bolt	10	Cable guide attachment bolt
5	R axis reducer attachment bolt	11	Stopper block attachment bolt
6	R axis motor BRKT attachment bolt		

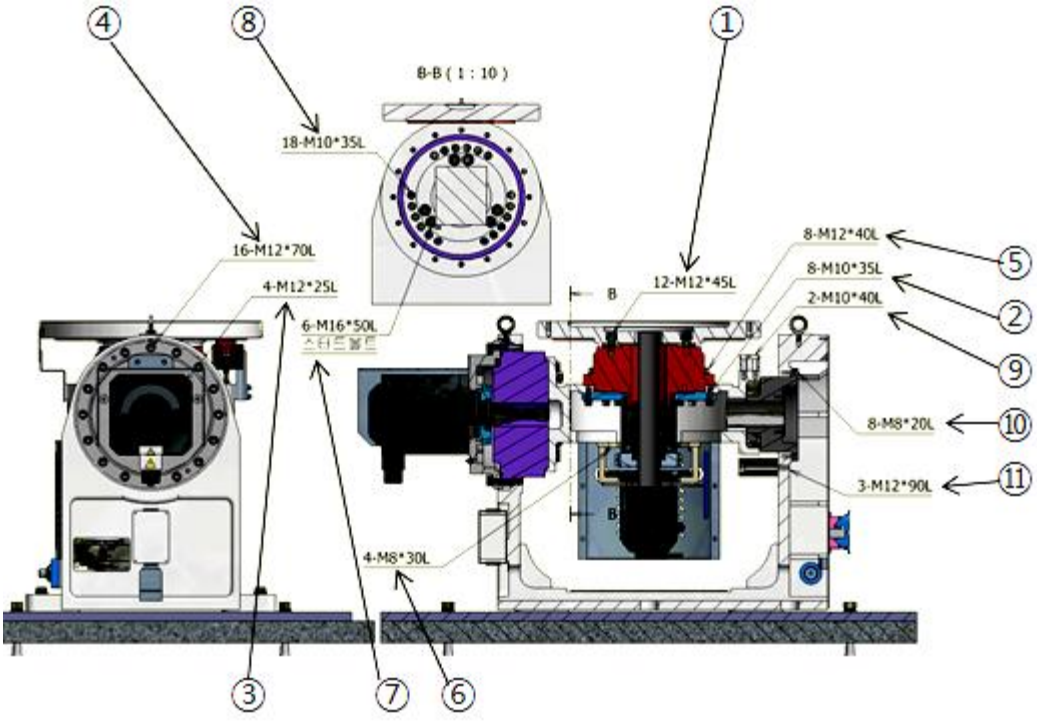

Figure 3.1 Key Bolts to Inspect

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. Injection of Grease for Replenishing/Replacing, and Replacement of Grease

Caution
If the grease is not properly injected, the internal pressure inside the inlet can increase suddenly, causing damage to the oil seal, leakage, and abnormal operation. Therefore, the following procedures must be observed when injecting the grease.

① Must remove the grease outlet plug before injecting the grease.
② If possible, avoid using a compressed air pump driven by the air supplied from the factory, and limit the grease injection pressure to 7 bar (7 kgf / cm^2) or less.
③ Use only the designated grease. Otherwise, damage to the reducer and other problems could occur.
④ After injecting the grease, check whether the grease outlet has any leakage, and check if there is no pressure at the inlet, before fastening the plug.
⑤ Clean the spilled grease on the body of the positioner or on the floor to prevent accidents.
⑥ When using the positioner at an ambient temperature of 40℃ or higher, the grease replenishment and replacement cycle should be reduced in half.

■ Grease replenishment/replacement cycle

Injection cycle

- ✓ Grease replenishment: Every 6,000
- ✓ Grease replacement: Every 12,000

※ The grease replenishment is applicable only to the RV reducer that is used for the tilting axis. The turning axis is a no-oil-injection type; thus, it does not need external oil injection.

4.1.1. T Axis Reducer

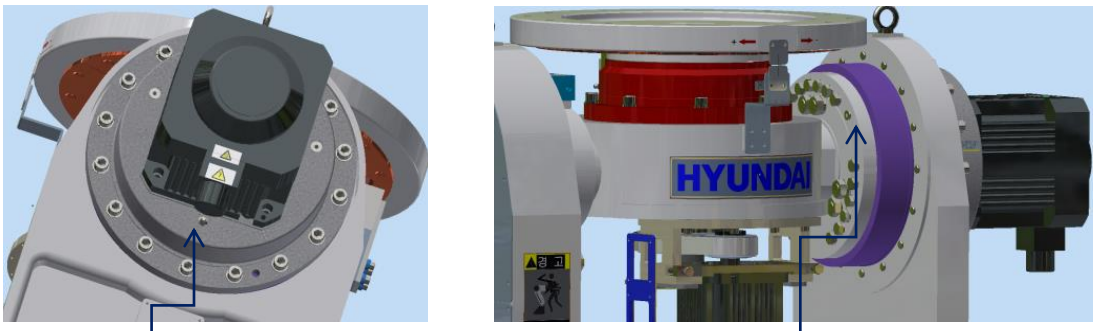

Figure 4.1 Grease Inlet and Outlet

Caution
If you inject the grease without removing the outlet plug, the grease may enter the motor, causing damage. The plug must be removed.

■ Grease replenishment

① Remove the outlet plug.
② Inject the grease through the inlet by using the grease gun.

✓ Grease type: Molywhite RE00
✓ Grease injection amount: 50 cc

③ Clean the outlet with a cloth and assemble the plug wrapped with the seal tape back into its original position.

■ Grease replacement

① Remove the outlet plug.
② Inject the grease through the inlet by using the grease gun.

✓ Grease type: Molywhite RE00
✓ Grease injection amount: 280 cc

③ Insert new grease until it comes out of the outlet. The new grease can be identified by color.
④ Clean the outlet with a cloth and assemble the plug wrapped with the seal tape back into its original position.

4.2. Replacement of Batteries

The position data of each axis is preserved by the backup battery. The battery must be replaced every two years. The following procedures should be followed in replacing the battery.

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 exiting battery.
④ Install the new battery. Be careful about the direction of its installation.

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

⑤ Install the cover back into its original position.

4.2.1. Cautions in Storing the Batteries

① Do not store the batteries in a place with high temperature or high humidity, and keep it in a well-ventilated place to avoid condensation.
② Store the batteries in a place where the temperature stays at the room temperature (20±15℃) and the variation of temperature is low and the relative humidity can be kept at 70% or less.
③ The refence period for storing the batteries should be six months, and batteries should be managed based on the first-in and first-out method.

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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.
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[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 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.
  Before emergency occurs, investigate whether there is any contact with a peripheral system near the positioner.
  ③ (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 an error occurs to 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 noise, 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 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 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	Grease	HHI / MOLY WHITE RE00	2kg	16kg/ CAN	RV reducer
A	Encoder battery	HHI / ER6C (AA) 3.6 V	2EA	2EA	Should be replaced every 2 years regardless of hours of operation
B	AC servo motor	HHI / TSM3506 N7021 E732	1EA	1EA	R axis (2.5 Kw)
B	AC servo motor	HHI / TSM3611 N7020 E721	1EA	1EA	T axis (5.9 Kw)
B	Encoder	HHI / R112504000	2EA	2EA	Common for R and T axes (contact our company for inquiry)
C	T axis reducer	HHI / RV320E3-171	1EA	1EA	T axis
C	R axis reducer	SUMITOMO / F2CFS-C45-59	1 EA	1 EA	R axis
D	O-ring	NOK / G220	2 EA	2 EA	T axis MOTOR

Classification	Part name	Manufacturer	Per unit		Classification
		Specification	Number for use	Number recommended	
E	OIL SEAL	NOK	1 EA	1 EA	T axis
		AC3222A0			
F	BALL BEARING	KBC	1 EA	1 EA	T axis
		6217ZZ			
G	POWER LOCK	DURI	2 EA	2 EA	T axis
		TLK300 22-26			
		G220			


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7

Dismantling

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

Table 7-1 Table of Materials of Individual Parts

Parts	Materials
Battery	NiCad or Lithium
Wiring, Motor	Copper
Brakes, Motors	Samarium Cobalt (or Neodymium)
Wiring, Connectors	Plastic/Rubber
Reducers, 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**

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