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WARNING

THE INSTALLATION SHALL BE MADE BY QUALIFIED INSTALLATION PERSONNEL AND SHOULD CONFORM TO ALL NATIONAL AND LOCAL CODES

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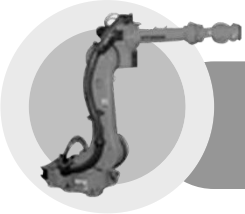

Manipulator Maintenance Manual

YS080 / YS100A / HH050 / HH030L / HH050T

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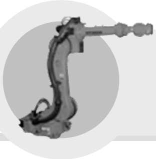

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Safety

1.1. Introduction

The main purpose of this chapter is to describe the safety precautions for users and operators who repair and manipulate the industrial robot.

This manual describes safety precautions for robot manipulator and controller, in complies with the safety regulation of EU Machinery Directive 98/37/EC(2006/42/EC) and US OSHA. And the robot manipulator and controller is manufactured to comply with the safety standards EN ISO 10218-1:2011 and ANSI/NFPA 79:2021.

Every operator, who installs, replaces, adjusts, manipulates, maintains, and repairs, must read thoroughly and fully understand the manipulation and maintenance manual, in particular, the special attention must be paid to the WARNING symbol, the most important marking related to the safety.

Installation, replacement, adjustment, manipulation, maintenance, and repair of robot system must be performed by the personnel who was duly trained for these purposes, following the indicated operating procedure.

This company is planning and carrying out the relevant training such as maintenance, repair, and manipulation for the above operations, so robot users make sure that robot operators should get the relevant training. And make sure that the robot handling work should be carried out only by the operators who completed this training course.

Hyundai Robotics user of industrial robot has responsibility to observe the safety regulation related to robot adopted in corresponding countries and responsibility to design, install and operate safety equipment well in order to protect workers who work at robot system.

In high-risk areas concerning robot systems in which robots, tools, and accessories operate, there must be a method of protection to stop the workers or objects from entering the area according to ANSI/NFPA 79:2021. If a person or object should nevertheless enter the dangerous zone, make sure that the robot system is immediately shut down by emergency stop system. The operators of robot system have a responsibility to take all necessary steps to make correct installation, examination and operation of the relevant safety devices.

The areas for which the robot can be applied and the environment in which it can be used are as follows.

Applicable areas

It is applied to the industrial robot used by installing on the surface of wall or plane (axes addable). It is also appropriate for controlling operation in the dotted section or consecutive section.

Major application is

- Spot welding
- Arc welding
- Cutting
- Handling
- Assembly
- Application such as Sealing
- Palletizing
- Grinding

For the other use than the above emergency application, make a contact with our company to consult on the robot use and possible applications.

Disable environment

Our robot must not be used in a highly explosive environment and the areas contaminated by oil, flammable materials or chemical materials. (Prohibited to be installed and manipulated.)

1.2. Relevant Safety Regulations

The robot is designed as per ISO 10218-1:2011 safety standards for industrial robots, and furthermore in comply with ANSI/NFPA 79:2021 regulations.

1.3. Safety Training

All the personnel who intend to teach, operate or inspect the robot must be trained in an approved robotic operation and safety training course before start-up. The safety training course includes the following details:

- Purpose and functions of safety devices
- Safety procedure to handle the robot
- Performance of robot or the robot system and possible hazards
- Tasks associated with any specific robot applications
- Safety concepts, etc.

1.4. Safety Related Nameplate

1.4.1. Safety Marking

For the purpose of effective safety instructions, the following safety symbols are used in this manual.

Table 1-1 Safety marking

Symbols		**Descriptions**
Warning	⚠	Indicate a highly dangerous situation, meaning that operating or handling in a wrong manner could result in death or serious injury to personnel, or damage to equipment. Attention should be paid to the operation and handling.
Mandatory	❗	Indicate the compulsory measures that should be taken
Prohibited	🛇	Indicate the prohibited actions and/or operations that should not be performed.

1.4.2. Safety Nameplate

Identification plates, warning label and safety symbols are attached to the robot and to the inside and outside of control panel. The designation labels and cable Mark for wire harness between the robot and control panel, and the cables inside/outside of control panel are provided.

All of these plates, labels, symbols and marks constitute safety-relevant parts of the robot and the control panel. They must remain attached to the robot manipulator and control panel at their clearly visible positions all the time for the safety and their full performance.

The painted markings on the floor and signs indicating dangerous zones must be clearly distinguished in form, color, and style from other markings on the machine near the robot system or inside the plant facilities where the robot system is installed.

🛇 **It is forbidden to remove, cover, or paint over by way of spoiling the clearly visible identification plates, warning labels, safety symbols, designation labels and cable marks.**

1.5. Definition of Safety Functions

Emergency Stop Functions – IEC 204-1,10,7

There is one emergency stop button on the controller and teach pendant respectively. If necessary, additional emergency buttons can be connected to the robot's safety chain circuit. The emergency stop function, which overrides all other robot controls, can bring the current operation to a halt by cutting off the power supply to the motors of individual axes. This function will also shut down the power supply to other dangerous functions, which are controlled by the robot, to prevent them from being used.

Safety Stop Function - EN ISO 10218-1:2011

A safety stop circuit needs to be configured, and, through this circuit, each robot should be connected with the safeguards and interlocks. The robot should have a number of electrical input signals which can be used to connect external safety devices, such as safety gates, safety pads, and safety lamps. These signals allow the robot's safety functions to be activated by all equipment, including peripheral equipment and the robot itself.

Speed Limitation Function - EN ISO 10218-1:2011

In a manual mode, the maximum speed of the robot is limited to 250 mm per second.
The speed limitation applies not only to the TCP(Tool Center Point), but to all parts of manual mode robot.
The speed of equipment mounted on the robot should be possibly monitored.

Restricting working Envelope - ANSI/NFPA 79:2021

Operation area of each axis is restricted by soft limit and hardware limit. Axis 1, 2, and 3 can also be restricted by means of mechanical stopper.

Operation Mode Selection - ANSI/NFPA 79:2021

The robot can be operated either in the manual mode or auto mode. In the manual mode, the robot can be operated only by using the teach pendant.

1.6. Installation

1.6.1. Safety Fence

Install safety fence against the possible collision between the robot and workers, so that no worker may approach the robot.

Install safety fence against the possible collision between the robot and workers, so that no worker may approach the robot. When operators or other personnel enter the robot's working envelope by accident, it may cause an accident. Install the safety fence to stop the robot when one, who intends to replace for TIP DRESSING or TIP changing replacement, or to inspect welding equipment, opens the fence gate and approaches the equipment during operation.

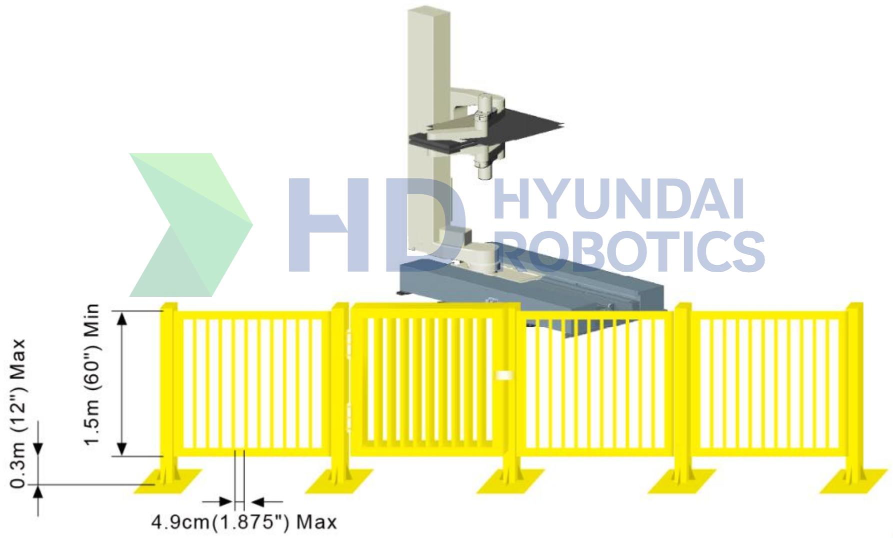


Figure 1.1 Recommended size for safety net and entrance gate (slot type entrance gate)

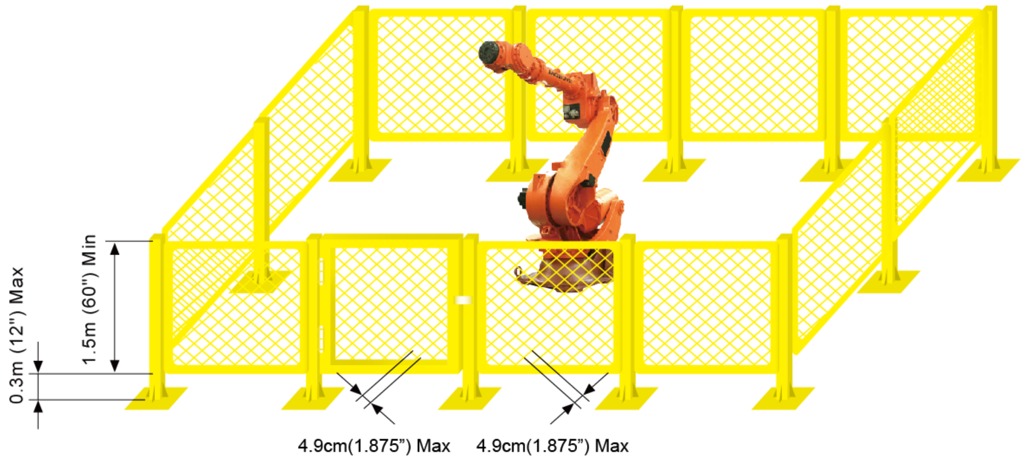


Figure 1.2 Recommended size for safety net and entrance gate (square type entrance gate)

(1) Enough space for safety net should be secured by covering robot operating area so as that workers would not have difficulty in teaching work or repairing work, and the safety net should have solid structure in order that it would not move easily and man cannot enter over easily.

(2) Safety net should be installed by static type in principle, and should not have hazardous parts such as prominence and depression or keen part, etc.

(3) Install the safety fence with an entrance gate, and register the safety plug at the gate so that it does not open unless pulling the plug out. Wiring should be carried out in a way that the robot should be in the operation ready OFF status as well as in the motor OFF status when the safety plug is pulled out or safety net is open.

(4) In order to operate the robot with the safety plug pulled out, wiring should be carried out in a way that will allow the playback to take place at a low speed.

(5) The emergency stop button should be installed at a place where it can be pushed quickly by the operator.

(6) If no safety net is to be installed, devices such as photoelectric switches, and mat switches, should be installed, instead of the safety plug, to cover the overall area within the robot's operation range in a way that the robot can be stopped automatically when a person enters the robot's operation range.

(7) Operation area of robot (hazardous area) should be distinguished by the method like painting on floor.

1.6.2. Placement of Robot & Peripheral Equipment

Please make sure that robot and peripheral equipment should be arranged by following method.

(1) In case of connecting primary power of controller or peripheral devices, please work after checking whether supply power has been deleted. There is a possible danger of electric shock because the high voltage such as 220V and 440V is used as its primary power.

(2) Post a sign [No enter during operation] up the safety fence gate, and inform the operators of its purport.

(3) Arrange such devices as controller, interlock panel, and other manipulation panels to be handled outside of the safety fence.

(4) When installing operation stand, install the emergency stop button on the stand. Make sure that stopping in an emergency situation can be initiated from any place from which the robot is operated.

(5) Make sure that the robot manipulator and the wiring and piping of controller, interlock panel, and timer should not be placed in the way of operator's working range so that they would not be directly stepped on by FORK and LIFT. Otherwise, the operator may suffer electrocution or the wire may suffer disconnection.

(6) Place the controller, interlock panel, and handling stand within the sight of robotic performance. It may cause a major accident to operate the robot while the robot is malfunctioning in an area where the robot’s activity can not be observed, or while the operator is working on it.

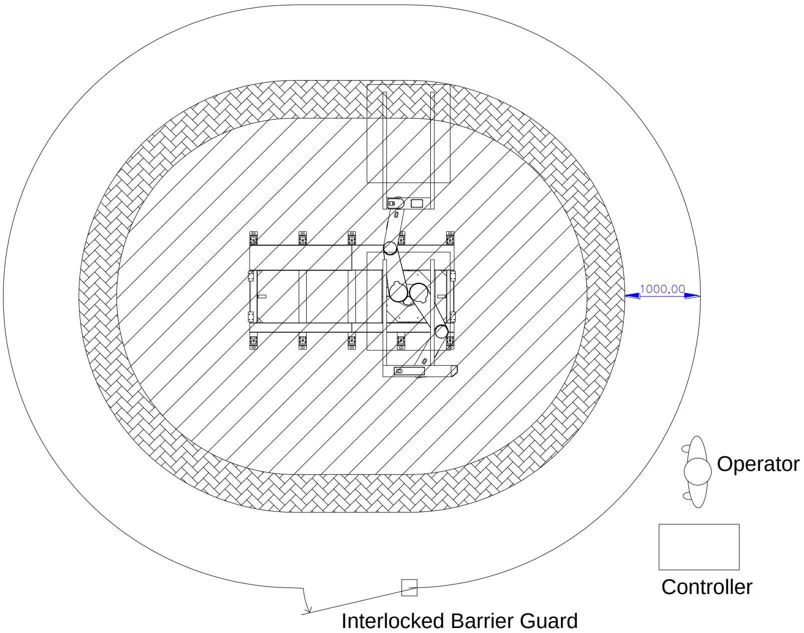
(7) Restrict the robot's working envelope by using the soft limits and the mechanical stopper if the necessary working envelope is narrower than the robot’s workable envelope. When the robot is to move beyond the restricted envelop due to abnormal operation, such as the robot being handled in a wrong way, the robot will be stopped automatically in advance thanks to the function that restricts the workable envelop.

(8) During the welding work, spatter could fall down to workers or the workers could be injured by burning, or fire could break out. Install such devices as a glare shield or a cover in the full sight of robot's working envelope.

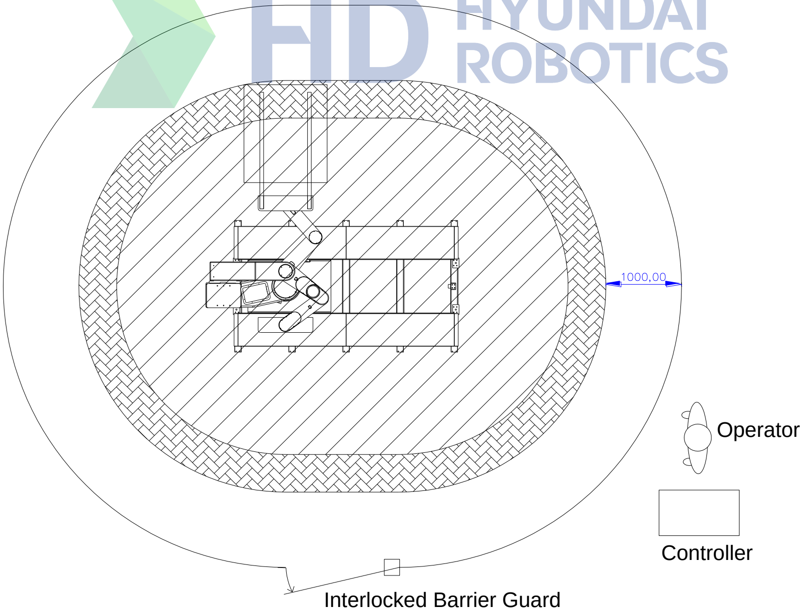
(9) Make sure that the device indicating the robot's running condition, whether automatic or manual mode, can be noticeable even from a slightly distant location. In the case of automatic start-up, a buzzer or a warning lamp will be useful.

(10) Make sure that there is no projecting part in the robot's peripheral equipment. Cover it, if necessary. It usually could cause an accident if the operator comes in touch with it. And it may cause a major accident when the operator tumbles while being astonished at the sudden movement of the robot.

(11) Don't make the system designed to allow the workers to carry the Work in and out using their hands through the safety fence. It could be a cause of accident associated with compressing or amputating.


1000,00
Operator
Controller
Interlocked Barrier Guard

(Cylinder type)


1000,00
Operator
Controller
Interlocked Barrier Guard

(Beam type)

▨ Restricted space
▨▨ Maximum space
▨▨☐ Safeguarded space

Figure 1.3 Arrangement of LCD robot peripheral devices and workers

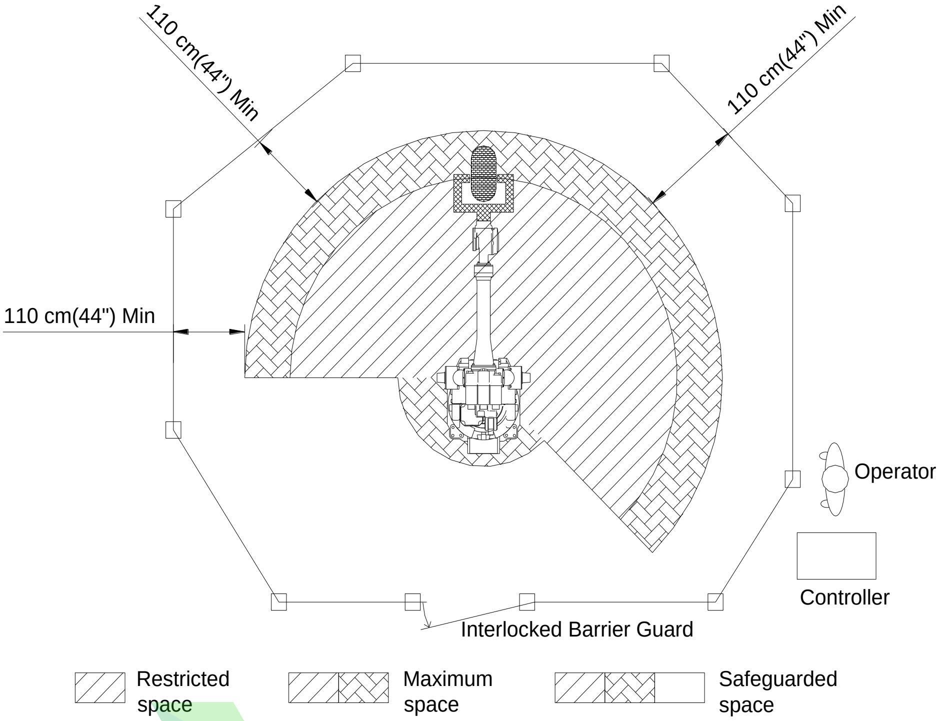

110 cm(44") Min
110 cm(44") Min
110 cm(44") Min
Operator
Controller
Interlocked Barrier Guard
Restricted space
Maximum space
Safeguarded space

Figure 1.4 Arrangement of general robot peripheral devices and workers

1.6.3. Installing the Robot

Please install the robot in accordance with following method surely.

Install the robot as per the planning and layout which has been previously reviewed and studied for its optimized performance and functionality. In case of poor conditions for robot installation, the serious problems can take place, including error of relative position between robot and workpiece during operation, bad performance quality of robot caused by vibration, shortening lifetime, and cause of serious accidents. Thus, pay attention to the following precautions when installing the robot.

General Safety Precautions

(1) Design and install the robot system properly in compliance with laws, regulations, and safety requirements enable in the country where the robot system is installed.

(2) All the workers for the robot system must have the complete knowledge on the information specified in the application and supplementary manual, and proficiently operate and handle the industrial robot.

(3) Installation workers of robot must follow the safety instructions and apply them to the installation when they face any safety problems.

(4) System provider must ensure that all the circuits utilizing safety functions perfectly perform in a safe way.

(5) Install main power supply to be disconnected from outside of the robot's working envelope.

(6) System provider must ensure that all the circuits utilizing emergency stop function perfectly perform in a safe way.

(7) For the immediate emergency stop, install emergency stop button within the accessible distance for the operator.

Technical Safety Precautions

(1) Eliminate any interference with peripheral equipment considering the dimension and working envelope.

(2) Avoid such place for installing which is directly exposed to the sun, extremely humid, contaminated by oil or chemicals, and containing a large amount of metal powder and explosive gas.

(3) Install at the ambient temperature ranged 0~45℃.

(4) Secure sufficient space for the easier disassembly and maintenance.

(5) Install safety fence with a gate, and prohibit any person from entering the robot's working envelope.

(6) Remove any obstacles out of the robot’s working envelope.

(7) Take a special measure, considering thermodynamics of controller, if the robot is installed near the heating elements or places exposed directly to the sun.

(8) Take a special measure if the robot is installed in a place of abundant dust such as metal powder in the air.

(9) Install the robot not to transmit welding electric current. In other word, insulate SPOT GUN with/from the robot’s wrist.

(10) Grounding is very critical in preventing electric shock and malfunction caused by noise, and thus install as following instructions.

① Install an exclusive grounding terminal using class 3 or higher. (For the input voltage of 400V of higher, use special class 3 or higher.)

② Connect grounding line into the grounding bus-bar inside of the control panel.

③ In case of direct grounding on the floor by anchoring, two-point grounding both by robot manipulator and by controller can produce a “ground loop” and contrariwise cause abnormal operation. In this case, connect the grounding line to the base of robot manipulator and disconnect the second grounding point to the controller. If the robot vibrates even after stopping, double-check the grounding status because the possible main causes could be an incomplete grounding or “ground loop”.

④ In the use of internal transgun(GUN), there is a possible danger of dropping because the primary power cable is directly connected to the spot gun. In this case, directly connect the grounding line to the base of robot manipulator in order to prevent any electric shock and protect the control panel, but do not connect it to the controller.

1.6.4. Space for Robot Installation

Install robot after securing sufficient space for maintaining the robot manipulator, controller, and other peripheral equipment. To install the main body and controller, please secure the above mentioned installation area. Install controller outside of the safety fence in order to monitor the robot manipulator and to operate in a safe way.
When installing, be sure to make it easier to perform the maintenance when opening the Controller door. Secure the available space. The specifications of the controller can change according to the type of the controller. (For more details, please refer to the “Maintenance manual”.)

1.7. Safety Operation for Robot Handling

Follow the safety instructions to prevent any accidents. Don't modify nor ignore safety devices or circuits at any time, and be careful of electric shock.
All the normal operations in an automatic mode must be performed outside of the safety fence. Check the robot's working envelope if anyone is inside before operating.

1.7.1. Safety Precautions for Robot Handling

Please observe following countermeasures because safety is very important for the test operation of the robot.

(1) Do not handle the robot other than such personnel as operators handling the robot and other possible operators and supervisors who were designated as whom duly trained in an approved robotic training course and become familiar enough with the proper operation of the safety and robotic functions.

(2) Be sure to wear helmets, goggles, and safety shoes.

(3) Perform the work in pairs. One person must be ready to press the emergency stop button in an emergency while the other must perform his work quickly but carefully within the robot's working envelope. Always check the escape route before working.

(4) Make sure that there is no one in the working envelope when the power source is on.

(5) Operations such as teaching must be performed outside of the robot's working envelope. However, if the operation is performed within the working envelope after stopping the robot, enter the envelope with safety plug or key switch for converting to automatic mode. Make sure that other operators do not change it into automatic mode by accident. Also, pay close attention to the specific direction of robotic movement in case of abnormal operation and malfunction.

(6) Supervisors should follow the instructions below.
   ① Be located at a place where you could take an entire view of robot, and commit yourself to monitoring.
   ② Press the emergency stop button immediately when abnormality is found.
   ③ Anyone is forbidden to be near the operating area other than those who are engaged in the operation.

(7) In a manual mode, the speed of teaching is limited to 250mm/sec.

(8) In teaching, post a sign [Under Teaching].

(9) Operators must pull the safety plug out, and enter the safety fence with the plug.

(10) Do not use any devices causing noise in and around the teaching area.

(11) Handle the teach pendant button, while checking the teaching point with your naked eyes, and do not handle it just relying on your sense.

⚠ (12) It is a repairing part to be prepared for when you buy many sets.

(13) In teaching, check and examine carefully under your feet. In particular, in high teaching for more than 2M, secure a safe zone on which you may step before teaching.

(14) Instructions for any abnormal operations.
① Press immediately the emergency stop button when any abnormal operations are found.
② Be sure to check if the relevant equipment is stopped when checking the abnormality in an emergency stop.
③ In case that the robot stops automatically due to power failure, investigate possible causes and take actions after confirming that the robot completely stops.
④ In case of malfunction of emergency stop devices, immediately disconnect the main power and investigate possible causes to take necessary actions.
⑤ Investigation of the failure must be conducted only by a designated person. For the re-operation after emergency stop, operators must clarify the cause of failure and take necessary actions, and then operate the robot again following the proper procedure.

(15) Write out the operating rules proper to working details and installing location regarding the operation and handling method for the robot, and the necessary actions for robot's any failure. In addition, it is recommended to operate the robot in accordance with the operating rules.

(16) Instructions when the robot stops
Make sure not to approach the robot even when it seems to be stopped. Most accidents occur from a sudden movement of robot which seemed to be stopped when one approaches it. The conditions that the robot stops are as follows.

Table 1-2 State of Robot Stop

No.	State of Robot	Drive Power	Access
1	Pause (Minor failure, Pause switch)	ON	X
2	Emergency stop (Major failure, Emergency stop switch, Safety gate)	OFF	O
3	Input signal standby of peripheral equipment (START INTERLOCK)	ON	X
4	Playback Completion	ON	X
5	Standby	ON	X

Even in the accessible state of robot, be watchful against any possible sudden movement of robot. Make sure to avoid approaching the robot without precautions for emergency under all circumstances.

■ **During temporary halt, the entrance countermeasure same as entrance of teaching work should be considered at the case (nozzle contact, welded part detected, arc error, and so on) of opening entrance gate for simple management against error.**

(17) Clean up any split oil, tools, and impurities in the safety fence after completing robotic operation.

Accidents such as conduction may occur in the working envelope contaminated by oil, or scattered tools on its floor. Make a habit of organizing and cleaning things up.

1.7.2. Safety Precautions for Operating Test

Please observe following countermeasures because safety on robot operation is very important.

In case of operating test, errors in design or teaching and inferiority in manufacturing are possibly seen in the entire system such as teaching program, jig, and sequence. Thus, be more careful and safe in case of operating test. Accidents may occur by these combined causes.

(1) Before handling, check the stop buttons and signal functions to stop the robot such as emergency stop button or stop button. And then, check the abnormality - detective movements. Above all, it is the most critical to check all the stop signals. It would be the most important to stop the robot when any possible accidents are predicted.

(2) In case of operating test, start the robot at low speed(approximately 20%~30%) in the variable speed function, and repeat it more than one cycle to check the movements. If any errors are found, immediately correct them. After then, increase in speed (50% → 75% → 100%) gradually, and repeat more than one cycle respectively to check the movements. Operating at high speed from the very beginning may cause a serious accident.

(3) In case of operating test, it is hard to predict what problems would happen. Do not enter the safety fence during operating test. Unexpected accidents are likely to occur because of its low reliability.

1.7.3. Safety Precautions for Automatic Operation

Please observe following countermeasures because safety on robot automatic operation is very important.

(1) While posting a sign [Do Not Enter During Operation] up the safety fence gate, ask the operators not to enter during operation. If the robot stops, you may enter the safety fence under your full understanding of the situation.

⚠ (2) Be sure to check if any operators are inside of the safety fence when starting the automatic operation. Operating without checking the presence of operators may cause a personal injury.

(3) Before starting the automatic operation, check and confirm that the program number, step number, mode, and starting selection are in the possible state for automatic operation. If starting with the other programs or steps selected, the robot could move in an unpredicted way, and lead to an accident.

(4) Before starting the automatic operation, check if the robot is properly located to get started. Check whether the program number or step number is identical with the location of robot. Even if it's all identical, accidents are still possible to occur due to an abnormal movement when the robot is differently located.

(5) Be prepared to immediately press the emergency stop button when starting the automatic operation. Immediately press the emergency stop button in case of robot's unexpected movements or emergency.

(6) Be sure to detect any abnormalities by checking the route, condition, or sound of robot movement. Sometimes the robot may be abnormally operated including a sudden break down. However, it will show a certain indication before the break down. Understand the robot's normal condition well in order to catch the symptom in advance.

⚠ (7) When any abnormality is detected from the robot, immediately stop and take proper actions on it. Using the robot before any proper actions taken may cause an interruption of produce as well as serious failure leading to a very serious personal injury.

⚠ (8) When checking the robot’s movement after the proper actions taken for the abnormality, do not operate the robot with operators inside of the safety fence. Unexpected accidents are possibly to occur because its low reliability may cause another abnormality.

1.8. Safety Precautions for Access to Safety Fence

Please observe following countermeasures because safety on robot automatic operation is very important.

The robot is very heavy and strong, even at low speeds. When entering the safety fence, one must observe the relevant safety regulations of its pertinent country.
The operators always must be aware of the unexpected movements of robot. Robots are able to move fast shortly after being stopped. The operators should know that the robot is able to move in a different route, without any notice, by means of external signals. Thus, when trying to stop the robot during teaching or operating test, one should be able to stop the robot with a teach pendant or control panel.

When entering the working envelope through the safety gate, you must take the teach pendant with yourself so that other people can not operate the robot. Make sure to post up the control panel a sign indicating the state of robot handling.

People must understand the followings when they are to enter the robot’s working envelope

(1) Do not enter the working envelope other than teaching person.

(2) Operation set-up mode of controller must be a manual mode in the control panel.

(3) Always wear the approved working suite.(Do not wear a loose clothes as you please)

(4) Do not wear gloves when handling controller.

(5) Do not leave innerwear such as underwear, shirts, or necktie out of the working suite.

(6) Do not wear personal accessories such as big earrings, rings, or necklaces.

(7) Make sure to wear safety shoes, helmet, and goggles and if necessary, wear other self-protective outfit such as safety gloves.

(8) Make sure that the emergency stop circuit is working correctly and in its proper function, turns MOTOR OFF when pressing the emergency stop button in the control panel and teach pendant before handling the robot.

(9) Make your posture face-to-face with the robot manipulator when performing your work.

(10) Follow the predetermined working procedure.

(11) Be prepared for emergency exit or safe place considering that the robot may unexpectedly rush at you.

1.9. Safety Precautions for Maintenance and Repair

1.9.1. Safety Precautions for Controller Maintenance and Repair

Please observe following safety countermeasures on repair and check for robot controller.

(1) Maintenance and repair of the robot must be performed by the personnel who was duly trained in the special maintenance training course and has a good knowledge of maintenance.

(2) Perform your work following the maintenance procedures for controller.

(3) Perform your maintenance and repair in a safe way by securing emergency exit or safe place.

(4) Before the daily maintenance, repair, or changing parts, be sure to power down. In addition, post a warning sign [Do Not Input Power] up the primary power so that other operators may not input power by accident.

(5) When changing parts, be sure to use the specified ones.

(6) When you open the door of controller, you should turn off power, and please start working after 3 minutes.

(7) If sufficient illuminance is not secured when you perform maintenance and inspection inside the controller, you should use external lights.

(8) Please do not touch heat radiating plate of servo AMP and recovery resistance because they are very hot.

(9) After completing maintenance, be sure to close the door completely after checking if tools or other things are still remained in the controller.

1.9.2. Safety Precautions for Robot System & Manipulator Maintenance

Please observe following safety countermeasures on repair and check for robot controller.

(1) Refer to the safety precautions for Controller maintenance and repair.

(2) Perform your maintenance and repair for the robot system and manipulator, following the indicated procedures.

(3) Be sure to disconnect the primary power of controller. Post the warning sign [Do not input power] up the primary power to prevent other workers from connecting the power.

(4) Make sure that the Arm is fixed and immovable before maintenance and repair since dropping or moving of the robot's Arm may cause a danger during maintenance and repair. (Refer to the 『Robot manipulator maintenance manual』.)

1.9.3. Necessary Actions after Maintenance and Repair

Please install the robot in accordance with following method surely.

(1) Check if the cables or parts of controller are properly connected.

(2) After maintenance is completed, carefully check that no tools are left around or inside of the controller and manipulator. Make sure that the door is firmly closed.

(3) Do not turn on the power if any problems or critical failures are detected.

(4) Be sure that there is no one within the working envelope, and that you are in a safe place before turning on the power.

(5) Turn on the main circuit breaker on the control panel.

(6) Check the current position and status of robot.

(7) Operate the manipulator at low speed.

1.10. Safety Functions

1.10.1. Operating a Safety Circuit

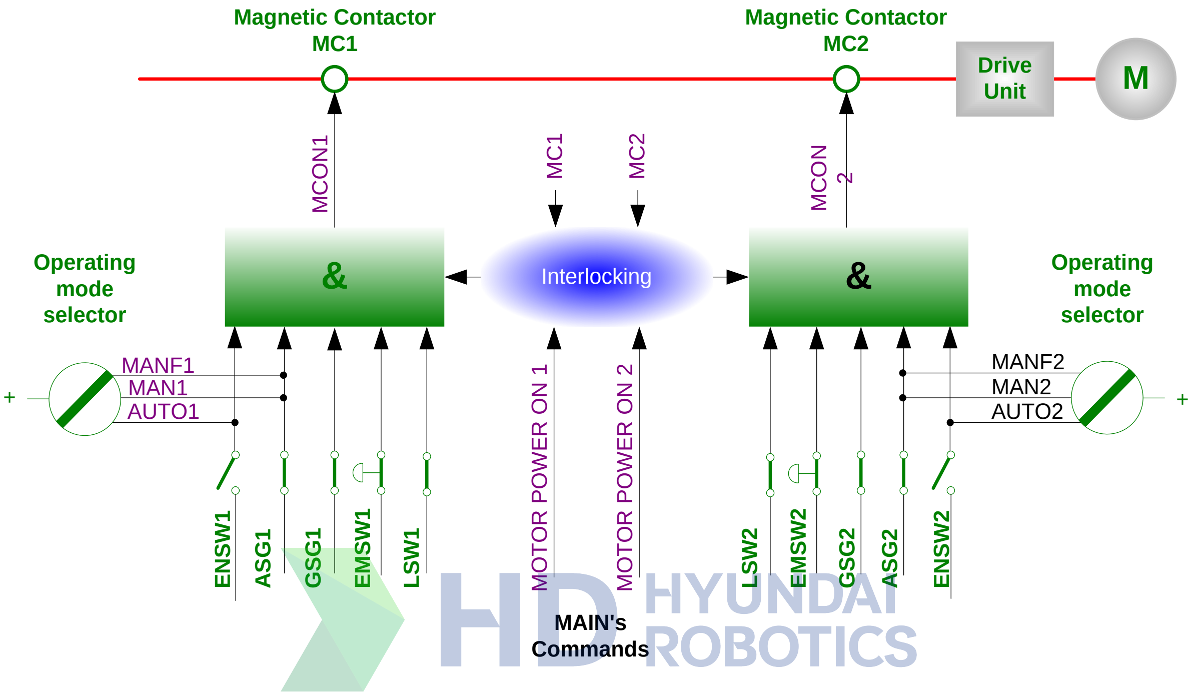

Magnetic Contactor MC1
Magnetic Contactor MC2
Drive Unit
M
MCON1
MC1
MC2
MCON 2
Operating mode selector
&
Interlocking
&
Operating mode selector
MANF1
MAN1
AUTO1
MANF2
MAN2
AUTO2
+
+
ENSW1
ASG1
GSG1
EMSW1
LSW1
MOTOR POWER ON 1
MOTOR POWER ON 2
LSW2
EMSW2
GSG2
ASG2
ENSW2
MAIN's Commands

Figure 1.5 Configuration for safety chain

The robot's safety system is based on a two-channel safety circuit that is continuously monitored. If an error is detected, the power supply to the motors is disconnected and the motor brake is applied. To return the robot to MOTOR ON mode, the switches of two-channel circuit must be connected. If one of the two-channel circuit switches shorts, the contactor of motor will be disconnected leading to the application of brake, and finally the robot will be stopped. Furthermore, when safety circuit is disconnected, the interrupting call will be sent automatically to the controller to find out the possible reason for the interruption.

The safety control circuit of operation is based on dual safety electric circuit in which the controller and MOTOR ON mode are operated interactively. In order to be in MOTOR ON mode, the safety circuit consisted of several switches must be all connected. MOTOR ON mode indicates that drive power is supplied to the motors. If one of the contactors is disconnected, the robot will always return to MOTOR OFF mode.

MOTOR OFF mode indicates that drive power is removed from the robot's motors and the brakes are applied. The status of the switches is displayed on the teach pendant. (Refer to the I/O monitoring screen of "SERVICE" menu, 『Operation manual』.)

Safety circuit

The emergency stop buttons on the controller panel and on the teach pendant and external emergency stop buttons are included in the safety circuit of operation. Users may install the safety devices (safety plug, safety stop device for safe place) which are operated in the AUTO mode. In a manual mode, the signals of these safety devices are ignored. You can connect the general safety stop devices that is active in all operating modes. No one can enter the working envelope in an automatic operation mode due to the unconditional operation of the safety devices (door, safety mat, safety plug etc.). These signals are also generated in a manual mode, but the controller will keep the robot operating while ignoring the robot's teaching. In this case, maximum speed of robot is restricted to 250mm/s. Thus, the purpose of this safety stop function is to secure the safe area around the manipulator while one approaches the robot for maintenance and teaching.

When the robot is stopped with the limit switch, change the robot’s position by operating it with the pendant key at the constant setting mode. (Constant setting mode refers to the state of entry into the menu 『[F2]: System』 menu)

⚠ **The safety circuits must never be by-passed, modified or changed in any way.**

1.10.2. Emergency stop

An emergency stop should be activated when people or equipment is located at the dangerous area. The emergency stop buttons are located both on the control panel and on the teach pendant.
All safety control devices such as emergency stop buttons on the control panel must be located outside the working envelope and easily accessible at any time.

Status of Emergency stop

When the button is pressed, the robot will operate as follows.
Robot stops immediately in any cases.

- Disconnect the servo system power.
- Motor brake is activated.
- Emergency stop message is displayed on screen.

For the emergency stop, the following two methods can operated simultaneously.

(1) Emergency stop for control panel and teach pendant (Basic)

Above the control and teach pendant console.

(2) Emergency stop of external system

External emergency stop device (button etc.) can be connected to the safety electric circuit in accordance with applied standard for the emergency stop circuit.
(Please refer to system board in “basic configuration of controller”) At this time, the emergency stop must be connected to be “Normal On” and it must be check for proper operation during test run.

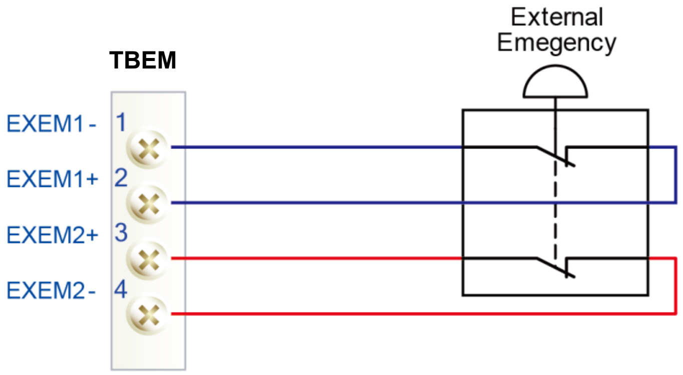


Figure 1.6 Connection with external emergency halt switch through system board terminal block TBEM

1.10.3. Operating Speed

To teach the robot, the operating mode switch must be in a MANUAL mode. Then the maximum speed of robot is limited to 250mm/s.

1.10.4. Connecting the Safety Devices

External safety devices such as light beams, light curtains, safety plug, and safety mats which can be adapted by the system builder execute interlocking the controller by way of connecting with safety circuit within the controller. These devices are used for safety device during execution of normal program in an automatic mode.

1.10.5. Restricting the working Envelope

When the robot is not necessary to reach certain area for specific applications, working envelope of the robot can be limited to secure the sufficient safety working area. This will reduce the damage or loss in case of robot's collision with external safety devices such as safety fence, etc. The movement of axes 1, 2, and 3 of HR, HX, HS and HA can be limited by means of mechanical stopper or electrical limit switches. In this case, the corresponding software limitation parameters must be also changed. If necessary, movement of wrist 3 axes can be restricted, too. Limitation of working envelope for all the axes could be carried out by the user. The robot is delivered to customer as the status of full working envelope setting.

- **Manual mode: Maximum speed is 250mm/s.**
  In a manual mode, by means of worker’s selection, workers may enter the safeguard area.

- **Auto mode: The robot can be operated via remote controller.**
  All safety devices such as safety door, safety mats, etc. are activated.
  No one may enter the safety device area of robot.

1.10.6. Monitoring Function

(1) Motor monitoring function s
Motors are protected against overload by means of onboard sensors.

(2) Voltage Monitoring Function
For the protection of, the servo amp module turns off the power switch when the voltage is too low or too high.

1.11. Safety Related to End Effectors

1.11.1. Gripper

(1) When a gripper is used to grip a workpiece, there should be safety precautions for unexpected dropping of the loaded workpiece.

(2) When any end effectors or devices are installed on the robot arm, use the required size and piece of bolt, and securely fasten as per the required torque using torque wrench. Do not use the bolt which has rust or dirt on its surface.

(3) End effector must be designed and manufactured not to exceed the maximum allowable load at the wrist of robot. Even though power or air supply stops, the gripped workpiece must not be dropped from the gripper. In order to remove any risks and problems which may cause personal injury and/or physical damage, the sharp edge and projecting part of end effector must be made dull and smooth.

1.11.2. Tool / Workpiece

(1) It must be possible to replace tools such as milling cutters in a safe manner. Make sure that safety devices are working correctly until the cutters stop rotating.

(2) Tool must be designed to keep in gripping workpiece securely even though a power failure or a control failure takes place. It must be possible to release workpiece from the gripper in a manual mode.

1.11.3. Pneumatic and Hydraulic Systems

(1) The special safety regulations will apply to pneumatic and hydraulic systems.

(2) Since residual energy of pneumatic and hydraulic systems can be still remaining even after the robot stops, particular care and attention must be paid by users. Internal pressure of equipment must be removed whenever starting the repair work for pneumatic and hydraulic systems.

1.12. Liabilities

The robot system has been built in accordance with the latest technical standards and approved safety rules. Nevertheless, the serious accidents such as death or personal injury still may take place due to the collision between the robot system and peripheral equipment.

The robot system must be used by operator who has a full technical knowledge on its designated use and also pay his close attention to the possible dangers and risks involved in its operation. The use of robot system is subject to compliance with these operating instructions and the operation and maintenance manual supplied together with the robot system. The safety related functions of robot system must not be used for any purposes other than safety.

When you use the robot system for any other or additional purposes than its designated usage, you must review whether it is enable in accordance with design criteria. The manufacturers cannot take any responsibility for any damage or loss which resulted from such misuse or improper use. The users shall have the full responsibility for the risks caused by such misuse or improper use. When you use and operate the robot system for its designated use, you must have a good command of all the information contained at these operating instructions as well as the maintenance manual.

The robot system may not be put into operation until it is ensured that the functional machine or plant into which the robot system has been integrated conforms to the specifications of the EU Machinery Directive 98/37/EC(2006/42/EC) and US OSHA.

The following harmonized standards in particular were taken into account with regard to the safety of the robot system.

- ANSI/RIA R15.06-1999
  Industrial Robots and Robot Systems - Safety Requirements
- ANSI/RIA/ISO 10218-1-2007
  Robots for Industrial Environment - Safety Requirements - Part 1 - Robot
- ISO 11161:2007
  Safety of machinery - Integrated manufacturing systems - Basic requirements
- EN ISO 13849-1:2008
  Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2006)
- EN 60204-1:2006
  Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:2005 (Modified))
- EN ISO 10218-1:2006
  Robots for industrial environments - Safety requirements - Part 1: Robot (ISO 10218-1:2006)

Users must take the full responsibility for any accident caused by their negligence or non-observance of these instructions. The manufacturer will not take any liabilities and responsibilities for any damages or losses caused by the misuse or malfunction of such equipment which is not included in the contract between manufacturer and user and provided by user, or such equipment which is installed around the robot system arbitrarily by the user. User must take the full liabilities and responsibilities for any risks and damages caused by such equipment.

2

Specifications

2.1. Robot Machinery Part

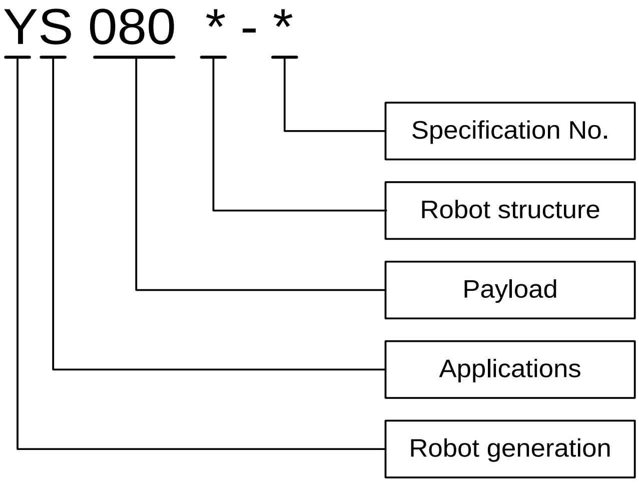

YS 080 * - *
Specification No.
Robot structure
Payload
Applications
Robot generation

Figure 2.1 Robot Machinery Part

2.2. Location of Robot Identification Plate

The model name, serial number, and manufacturing date of robot are written down in the name plate. The name plate is located at the lower part of the main body (left or right) as shown below.

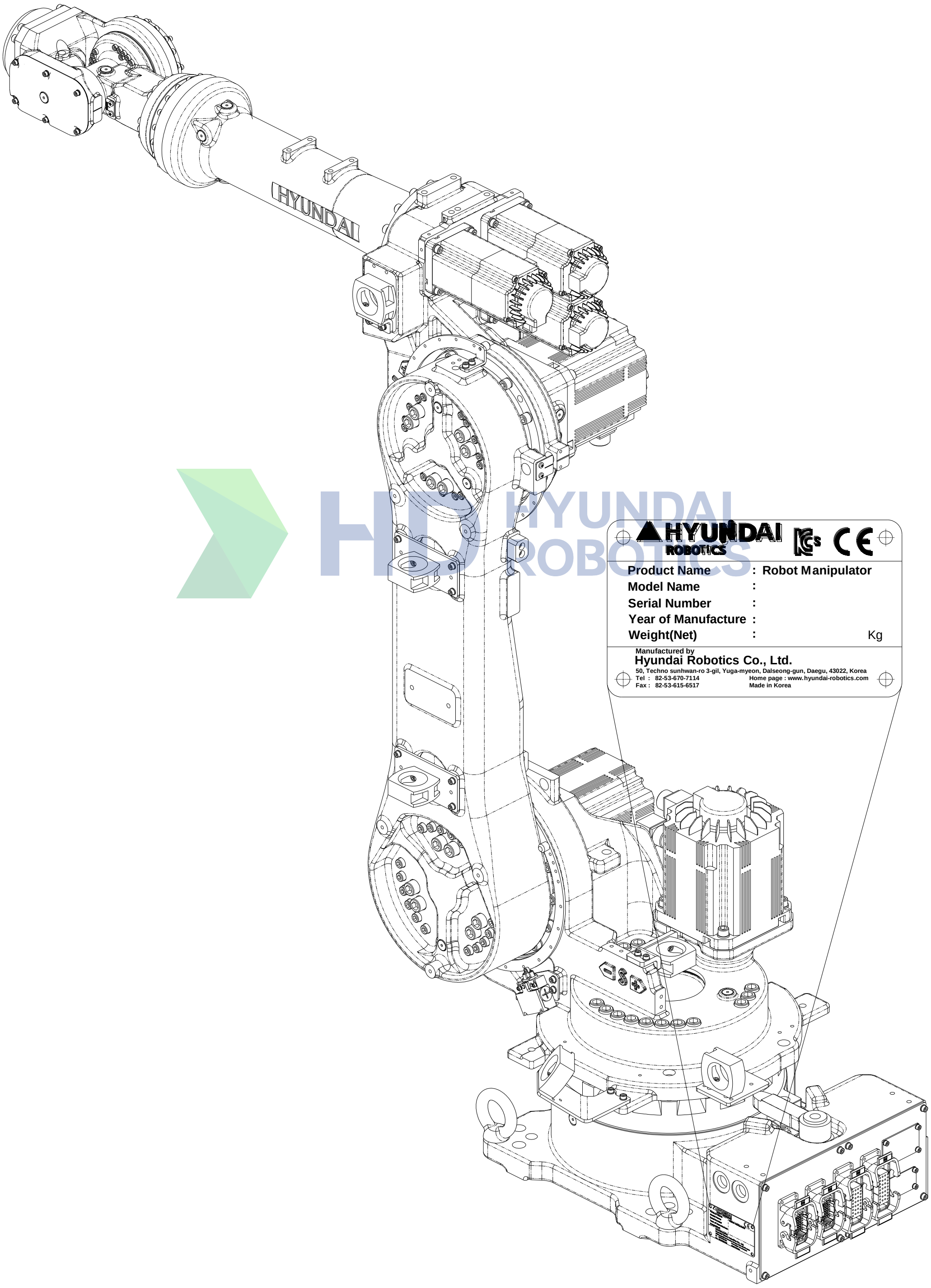

HYUNDAI
HYUNDAI
ROBOTICS
Product Name : Robot Manipulator
Model Name :
Serial Number :
Year of Manufacture :
Weight(Net) : Kg
Manufactured by
Hyundai Robotics Co., Ltd.
50, Techno sunhwan-ro 3-gil, Yuga-myeon, Dalseong-gun, Daegu, 43022, Korea
Tel : 82-53-670-7114
Fax : 82-53-615-6517
Home page : www.hyundai-robotics.com
Made in Korea

Figure 2.2 The location of identification plate

2.3. Basic Specifications

Table 2-1 Basic Specifications for Models: [YS080/YS100A]

Item				Specification	
Robot Model				YS080	YS100A
Construction				Articulated	
Degree of freedom				6	
Drive system				AC servo system	
Max. Working envelope	Arm	S	Swivel	±3.142 rad (±180°)	
		H	For/Backward	-1.134 ~ +2.967 rad (-65° ~ +170°)	-1.134 ~ +3.142 rad (-65° ~ +180°)
		V	Up/downward	-1.396 ~ +3.141 rad (-80° ~ +230°)	-1.396 ~ +3.142 rad (-80° ~ +180°)
	Wrist	R2	Rotation 2	±6.284 rad (±360°)	
		B	Bending	±2.182 rad (±125°)	
		R1	Rotation 1	±6.284 rad (±360°)	
Max. Speed	Arm	S	Swivel	2.967 rad/s (170°/s)	2.618 rad/s (150°/s)
		H	For/Backward	2.444 rad/s (140°/s)	2.094 rad/s (120°/s)
		V	Up/downward	2.793 rad/s (160°/s)	2.443 rad/s (140°/s)
	Wrist	R2	Rotation 2	4.015 rad/s (230°/s)	3.491 rad/s (200°/s)
		B	Bending	4.015 rad/s (230°/s)	3.491 rad/s (200°/s)
		R1	Rotation 1	6.109 rad/s (350°/s)	5.236 rad/s (300°/s)
Load Capacity				784 N (80 kg)	980 N (100 kg)
Wrist Torque		R2	Rotation 2	400 N·m (40.8 kgf·m)	490 N·m (50.0 kgf·m)
		B	Bending	400 N·m (40.8 kgf·m)	490 N·m (50.0 kgf·m)
		R1	Rotation 1	200 N·m (20.4 kgf·m)	245 N·m (25.0 kgf·m)
Accuracy of position repeatability				±0.1 mm	

Item	Specification	
Robot Model	YS080	YS100A
Ambient Temperature	0 ~ 45℃ (273 ~ 318 K)	
Relative humidity	20 ~ 85 %RH	
Robot's Weight	645 kg	
Vibration	0.5G or less	

Table 2-2 Basic Specifications for Models: [HH050/HH030L]

Item				Specification	
Robot Model				HH050	HH030L
Construction				Articulated	
Degree of freedom				6	
Drive system				AC servo system	
Max. Working envelope	Arm	S	Swivel	±3.142 rad (±180°)	
		H	For/Backward	-1.134 ~ +2.967 rad (-65° ~ +170°)	
		V	Up/downward	-1.396 ~ +3.141 rad (-80° ~ +180°)	
	Wrist	R2	Rotation 2	±6.284 rad (±360°)	
		B	Bending	±2.182 rad (±125°)	
		R1	Rotation 1	±6.284 rad (±360°)	
Max. Speed	Arm	S	Swivel	3.054 rad/s (175° /s)	2.618 rad/s (150° /s)
		H	For/Backward	3.054 rad/s (175° /s)	2.444 rad/s (140° /s)
		V	Up/downward	3.054 rad/s (175° /s)	2.618 rad/s (150° /s)
	Wrist	R2	Rotation 2	4.363 rad/s (250° /s)	4.363 rad/s (250° /s)
		B	Bending	4.363 rad/s (250° /s)	4.363 rad/s (250° /s)
		R1	Rotation 1	6.109 rad/s (350° /s)	6.109 rad/s (350° /s)
Load Capacity				490 N (50 kg)	294 N (30 kg)
Wrist Torque		R2	Rotation 2	216 N·m (22.0 kgf·m)	200 N·m (20.4 kgf·m)
		B	Bending	216 N·m (22.0 kgf·m)	200 N·m (20.4 kgf·m)
		R1	Rotation 1	147 N·m (15.0 kgf·m)	100 N·m (10.2 kgf·m)

Item	Specification	
Robot Model	HH050	HH030L
Accuracy of position repeatability	±0.1 mm	
Ambient Temperature	0 ~ 45℃ (273 ~ 318 K)	
Relative humidity	20 ~ 85 %RH	
Robot's Weight	645 kg	650kg
Vibration	0.5G or less	

Table 2-3 Basic Specifications for Models: [HH050T]

Item				Specification
Robot Model				HH050T
Construction				Articulated
Degree of freedom				5
Drive system				AC servo system
Max. Working envelope	Arm	S	Swivel	±3.142 rad (±180°)
		H	For/Backward	-1.134 ~ +2.967 rad (-65° ~ +170°)
		V	Up/downward	-1.396 ~ +3.141 rad (-80° ~ +180°)
	Wrist	R2	Rotation 2	-
		B	Bending	±2.182 rad (±125°)
		R1	Rotation 1	±6.284 rad (±360°)
Max. Speed	Arm	S	Swivel	3.054 rad/s (175°/s)
		H	For/Backward	3.054 rad/s (175°/s)
		V	Up/downward	3.054 rad/s (175°/s)
	Wrist	R2	Rotation 2	-
		B	Bending	4.363 rad/s (250°/s)
		R1	Rotation 1	6.109 rad/s (350°/s)
Load Capacity				490 N (50 kg)
Wrist Torque		R2	Rotation 2	-
		B	Bending	216 N·m (22.0 kgf·m)
		R1	Rotation 1	147 N·m (15.0 kgf·m)

Item	Specification
Robot Model	HH050T
Accuracy of position repeatability	±0.15 mm
Ambient Temperature	0 ~ 45℃ (273 ~ 318 K)
Relative humidity	20 ~ 85 %RH
Robot's Weight	635 kg
Vibration	0.5G or less

2.4. Robot Dimension and Working Envelope

2.4.1. For Hi5

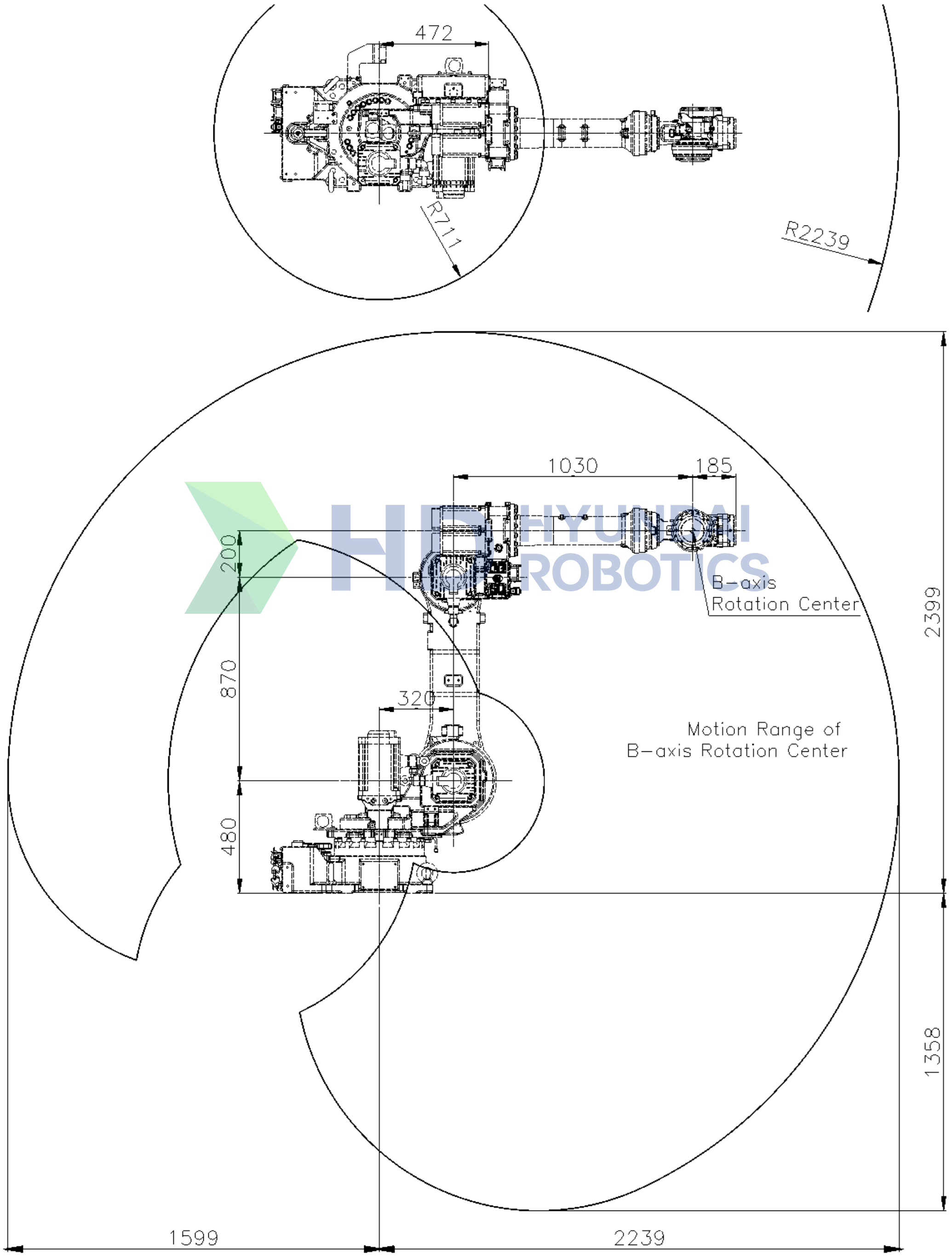

472
R711
R2239
1030
185
200
870
320
480
B-axis
Rotation Center
2399
Motion Range of
B-axis Rotation Center
1358
1599
2239

Figure 2.3 Robot Dimension and Working Envelope: [YS080/YS100A/HH050]

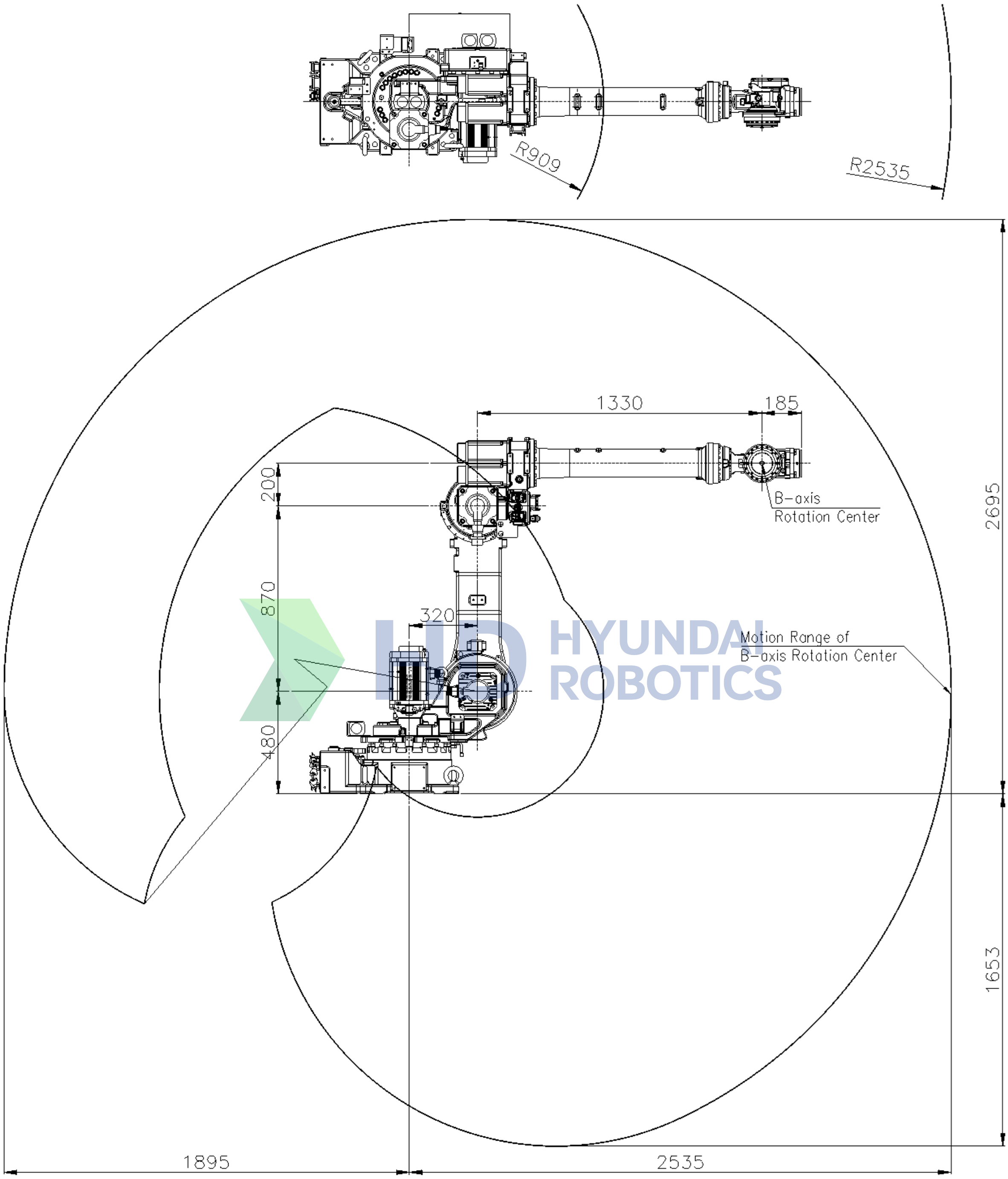

R909
R2535
1330
185
200
870
320
480
B-axis
Rotation Center
Motion Range of
B-axis Rotation Center
2695
1653
1895
2535

Figure 2.4 Robot Dimension and Working Envelope: [HH030L]

2.4.2. For Hi5a

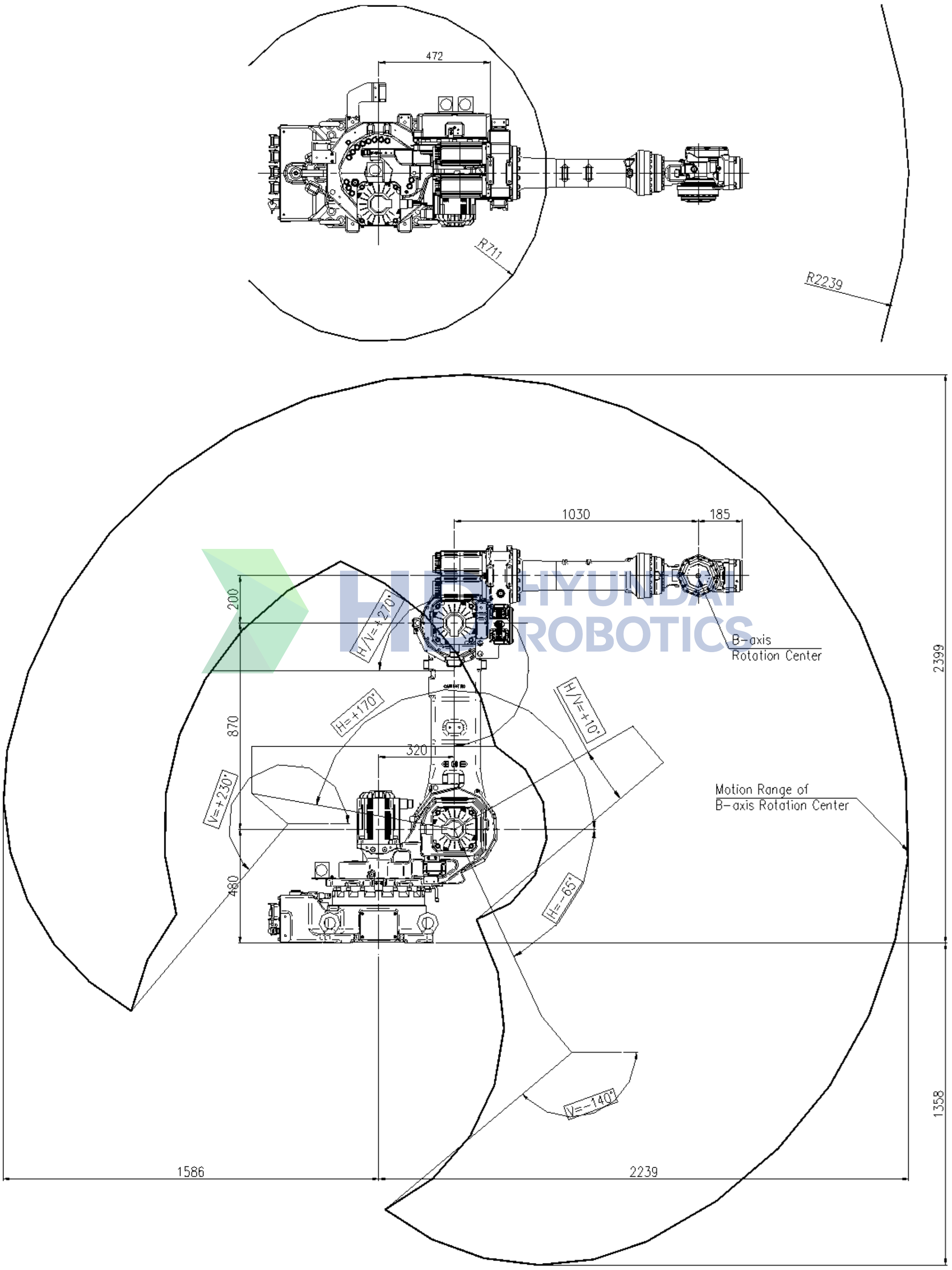

472
R711
R2239
1030
185
200
870
320
480
H/V=+270°
H=+170°
H/V=+10°
V=+230°
H=-65°
V=-140°
B-axis
Rotation Center
Motion Range of
B-axis Rotation Center
2399
1358
1586
2239

Figure 2.5 Robot Dimension and Working Envelope [YS080-11/YS100A-11/HH050-11]

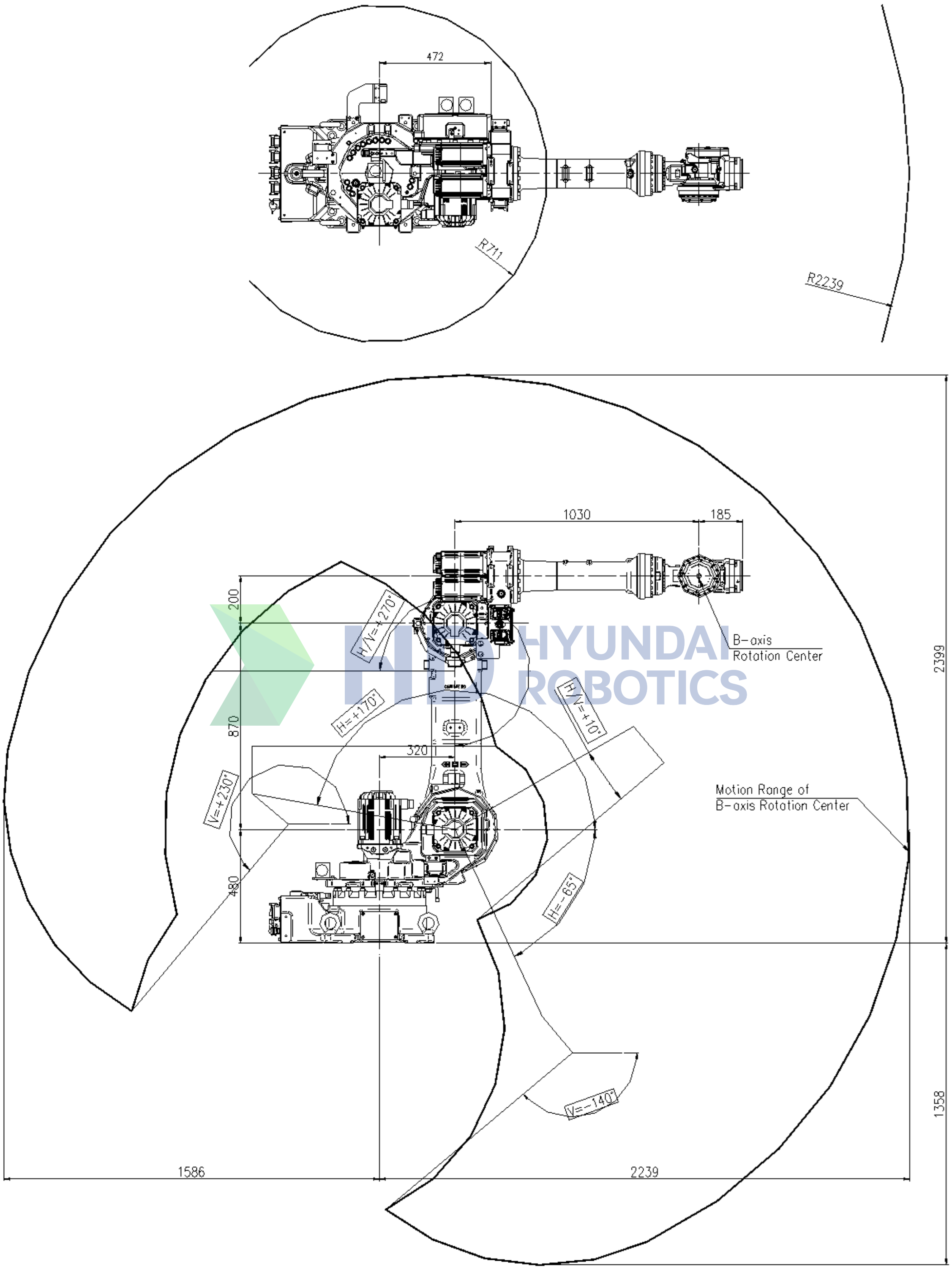

472
R711
R2239
1030
185
200
H/V=+270°
B-axis
Rotation Center
2399
H=+170°
H/V=+10°
870
320
V=+230°
Motion Range of
B-axis Rotation Center
480
H=-65°
V=-140°
1586
2239
1358

Figure 2.6 Robot Dimension and Working Envelope [HH030L-11]

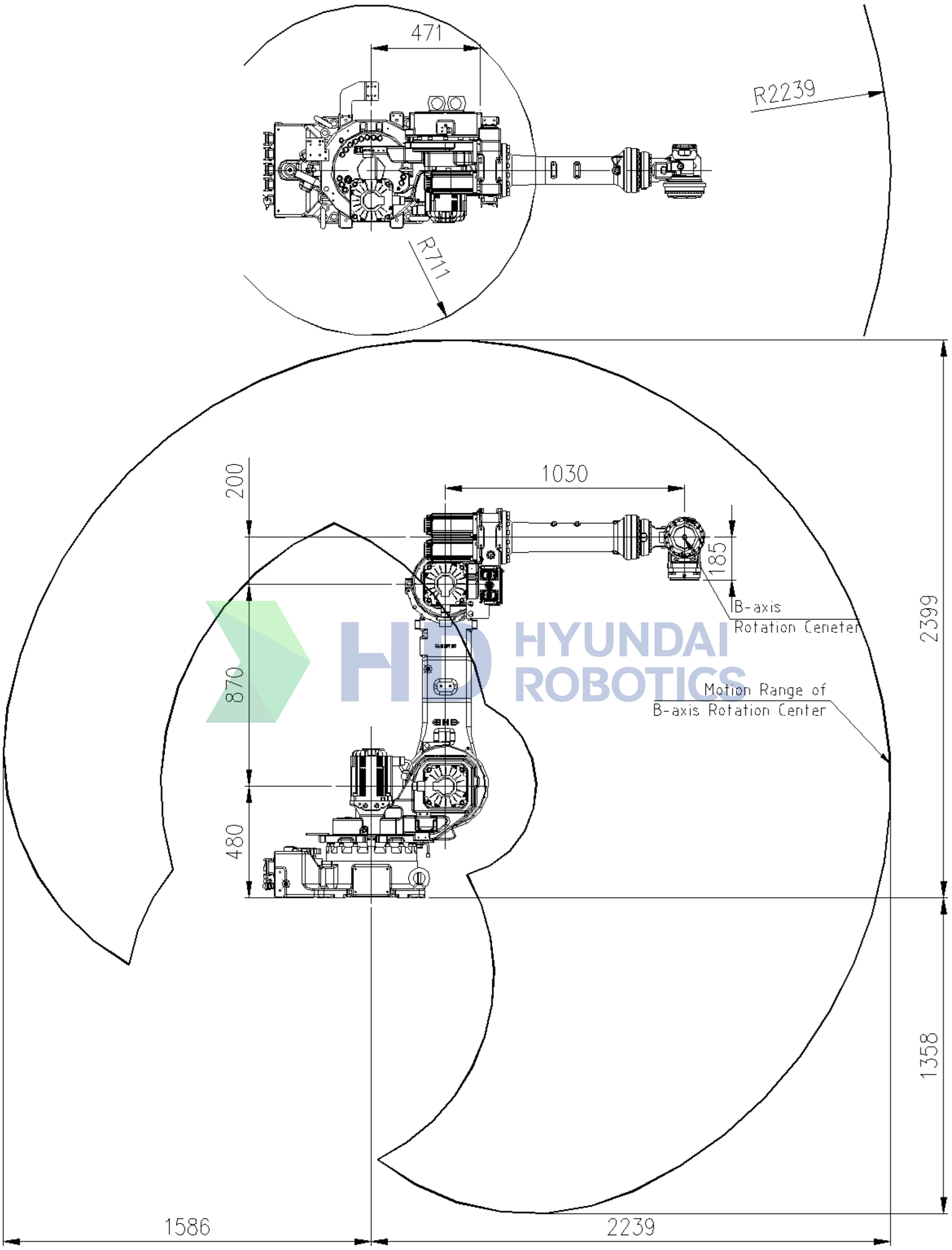

471
R2239
R711
1030
200
185
B-axis
Rotation Ceneter
870
Motion Range of
B-axis Rotation Center
2399
480
1358
1586
2239

Figure 2.7 Robot Dimension and Working Envelope [HH050T-11]

2.5. Axis Identification

Table 2-4 Axis Motion

Axis Name	Operation	Teach Pendant Button	
S	Arm Swivel	LFT(S+)	RHT(S-)
H	Arm Forward and Backward	BWD(H+)	FWD(H-)
V	Arm Upward and Downward	UP(V+)	DOWN(V-)
R2	Wrist Rotation 2	Rx+(R2+)	Rx-(R2-)
B	Wrist Bend	Ry+(B+)	Ry-(B-)
R1	Wrist Rotation 1	Rz+(R1+)	Rz-(R1-)

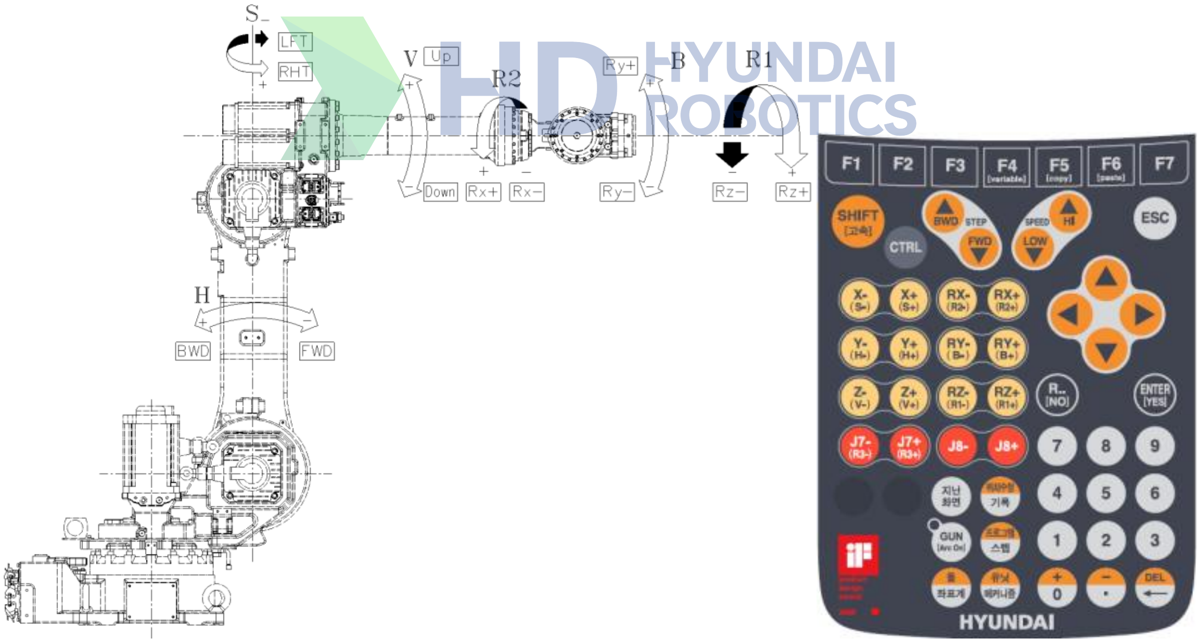

S
LFT
RHT
V
Up
R2
Ry+
B
R1
Down
Rx+
Rx−
Ry−
Rz−
Rz+
H
BWD
FWD
F1
F2
F3
F4
F5
F6
F7
SHIFT
CTRL
BWD
STEP
FWD
SPEED
HI
LOW
ESC
X-(S-)
X+(S+)
RX-(R2-)
RX+(R2+)
Y-(H-)
Y+(H+)
RY-(B-)
RY+(B+)
Z-(V-)
Z+(V+)
RZ-(R1-)
RZ+(R1+)
R..[NO]
ENTER[YES]
J7-(R3-)
J7+(R3+)
J8-
J8+
7
8
9
4
5
6
1
2
3
0
DEL
GUN
HYUNDAI

Figure 2.8 Robot Dimension and Axis [YS080/YS100A/HH050/HH030L] - [HH050T] R2 axis excluded

2.6. Details of Wrist Axis Attachment Surface

When attaching the operating tool to the mechanical interface of robot's wrist flange, fasten it with a bolt at P.C.D. 100.

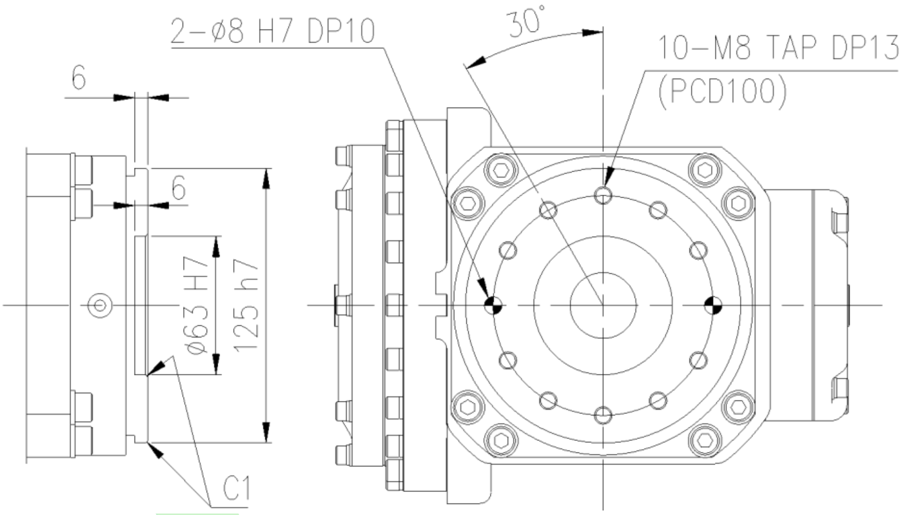

2-ø8 H7 DP10
30°
10-M8 TAP DP13
(PCD100)
6
6
ø63 H7
125 h7
C1

Figure 2.9 Details of Wrist Axis Attachment Surface : [YS080/YS100A/HH050/HH030L/HH050T]

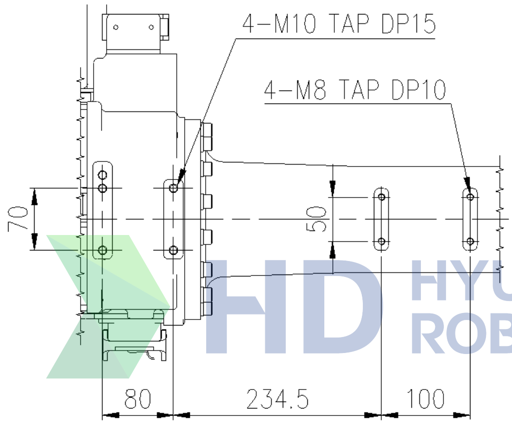
2.7. Details of ARM Frame Attachment Surface

The upper parts of the arm frame and arm pipe of the robots are attached using a tap designed to attach peripheral devices. Within the area marked with ▦, peripheral devices (valves, etc.) shall be attached.

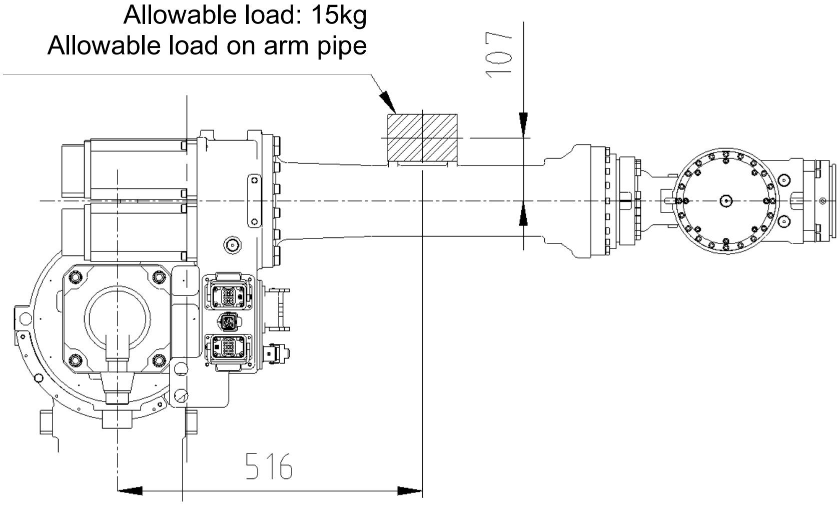
[Attention]

Peripheral devices shall be attached either on the upper part of the arm frame or the upper part of the arm pipe. When attaching, be sure to the center position of gravity should be located within the range marked as ▦.

- Max weight on the ARM PIPE : 15kg

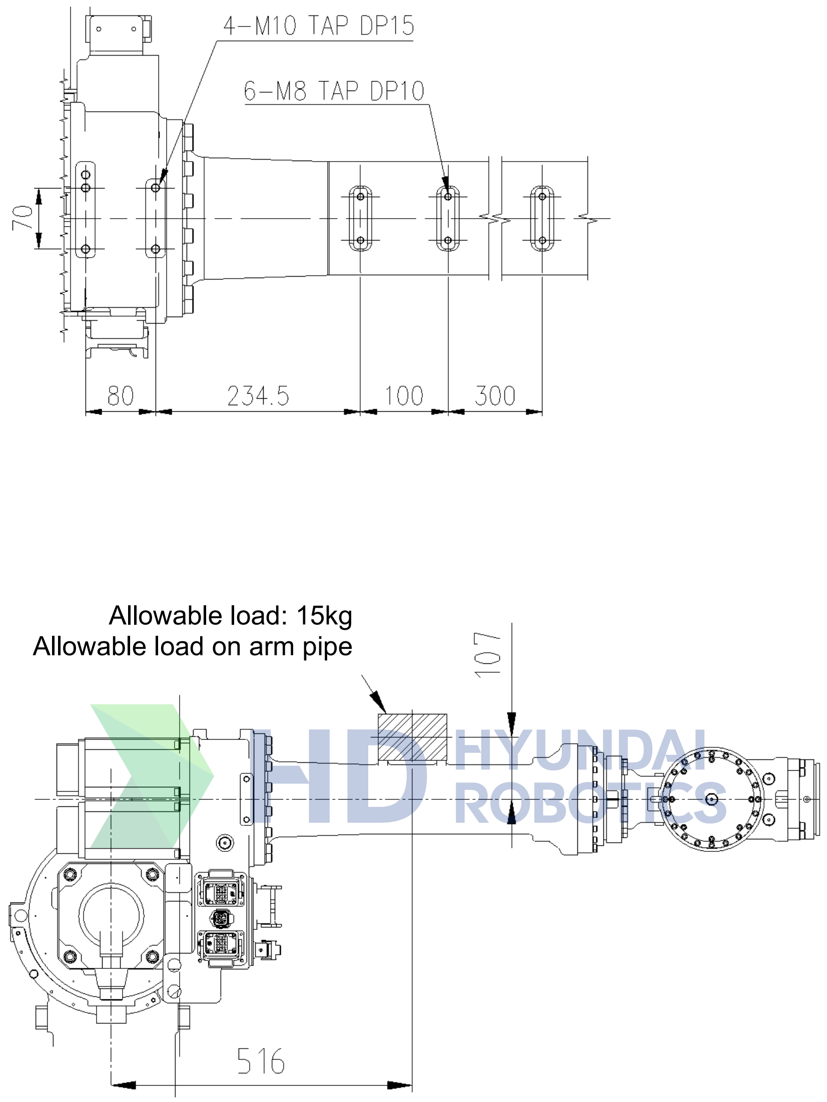


4-M10 TAP DP15
4-M8 TAP DP10
70
50
80
234.5
100



Allowable load: 15kg
Allowable load on arm pipe
107
516

Figure 2.10 Details of Upper ARM FRAME Attachment Surface: [YS080/YS100A/HH050/HH050T]


4-M10 TAP DP15
6-M8 TAP DP10
70
80
234.5
100
300
107
516

Allowable load: 15kg
Allowable load on arm pipe

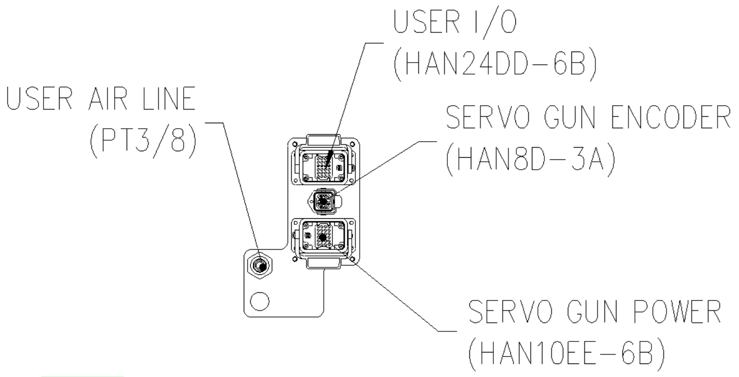
Figure 2.11 Details of Upper ARM FRAME Attachment Surface: [HH030L]

2.8. Application Wiring and Inspection Wiring Diagram

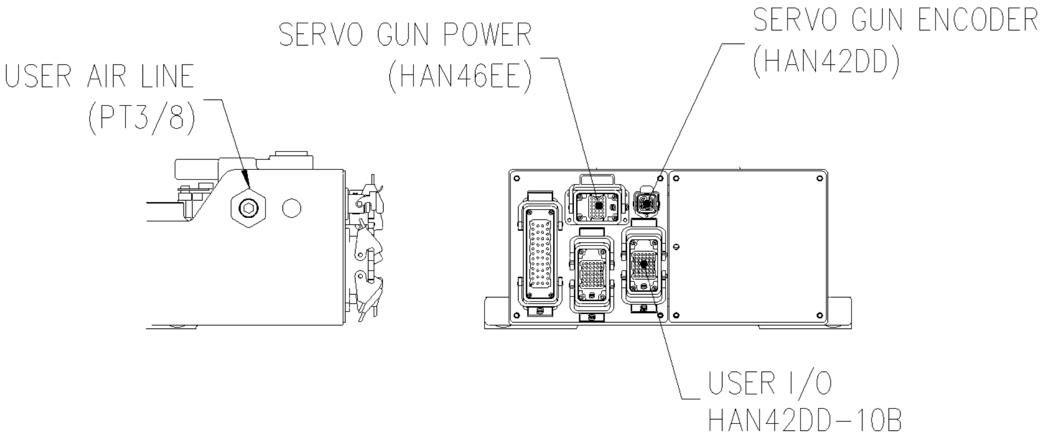
There are air unit and connector to connect the additional equipment to the robot manipulator. Application connectors are indicated as follows.

[Note] Max air pressure of air connection: 5bar (5.1 kgf/cm^2, 72.5 psi)

2.8.1. For Hi5

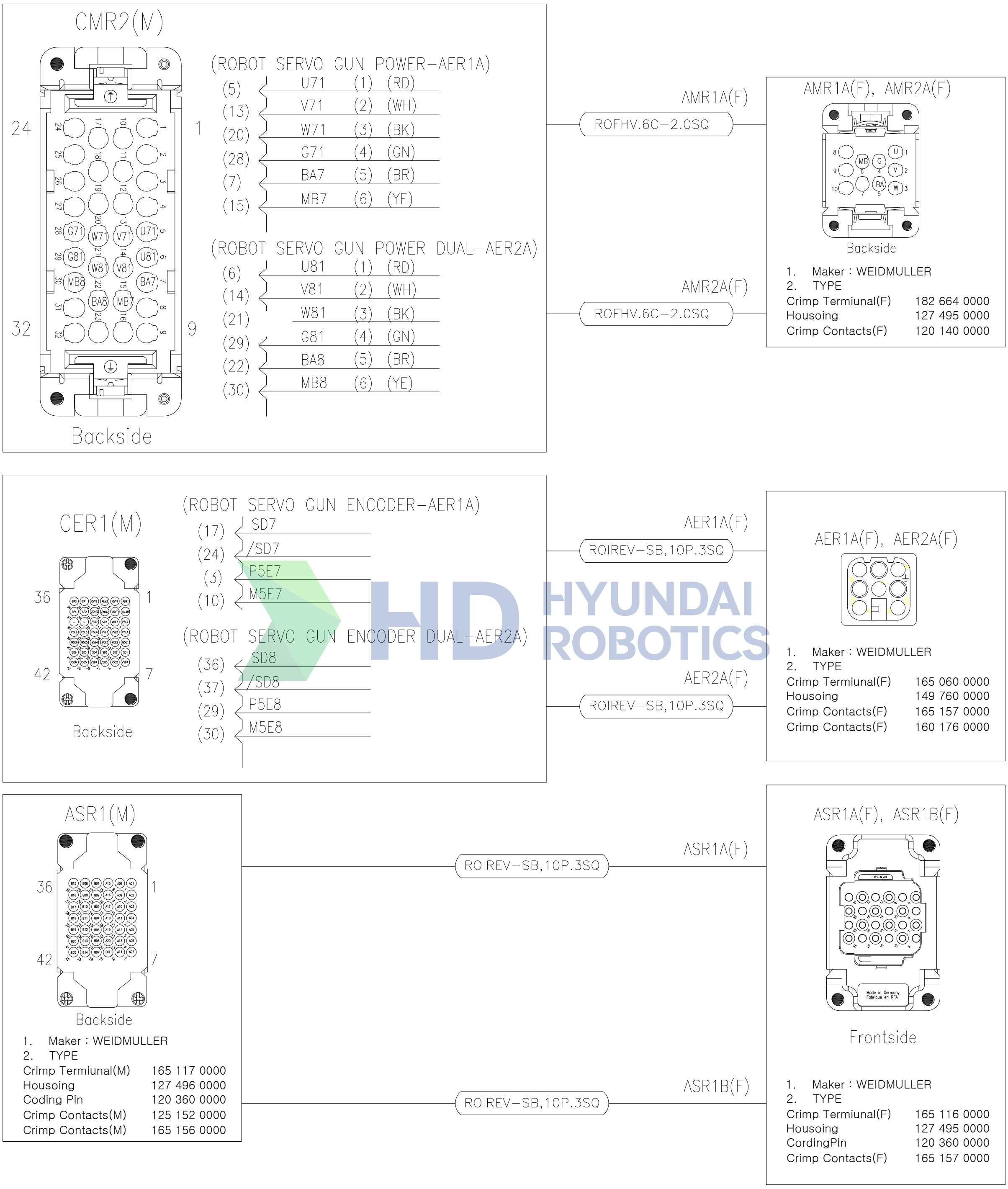

USER I/O
(HAN24DD-6B)
USER AIR LINE
(PT3/8)
SERVO GUN ENCODER
(HAN8D-3A)
SERVO GUN POWER
(HAN10EE-6B)

ARM FRAME PART


SERVO GUN POWER
(HAN46EE)
SERVO GUN ENCODER
(HAN42DD)
USER AIR LINE
(PT3/8)
USER I/O
HAN42DD-10B

BASE BODY PART

Figure 2.12 Application Wiring and Inspection Wiring Diagram: [YS080/YS100A/HH050/HH030L]


CMR2(M)
24
1
32
9
Backside
(ROBOT SERVO GUN POWER–AER1A)
(5) U71 (1) (RD)
(13) V71 (2) (WH)
(20) W71 (3) (BK)
(28) G71 (4) (GN)
(7) BA7 (5) (BR)
(15) MB7 (6) (YE)
(ROBOT SERVO GUN POWER DUAL–AER2A)
(6) U81 (1) (RD)
(14) V81 (2) (WH)
(21) W81 (3) (BK)
(29) G81 (4) (GN)
(22) BA8 (5) (BR)
(30) MB8 (6) (YE)
AMR1A(F)
ROFHV.6C–2.0SQ
AMR2A(F)
ROFHV.6C–2.0SQ
AMR1A(F), AMR2A(F)
Backside
CER1(M)
36
1
42
7
Backside
(ROBOT SERVO GUN ENCODER–AER1A)
(17) SD7
(24) /SD7
(3) P5E7
(10) M5E7
(ROBOT SERVO GUN ENCODER DUAL–AER2A)
(36) SD8
(37) /SD8
(29) P5E8
(30) M5E8
AER1A(F)
ROIREV–SB,10P.3SQ
AER2A(F)
ROIREV–SB,10P.3SQ
AER1A(F), AER2A(F)
ASR1(M)
36
1
42
7
Backside
ASR1A(F)
ROIREV–SB,10P.3SQ
ASR1B(F)
ROIREV–SB,10P.3SQ
ASR1A(F), ASR1B(F)
Frontside

AMR1A(F), AMR2A(F)

1. Maker : WEIDMULLER
2. TYPE

Crimp Termiunal(F)	182 664 0000
Housoing	127 495 0000
Crimp Contacts(F)	120 140 0000

AER1A(F), AER2A(F)

1. Maker : WEIDMULLER
2. TYPE

Crimp Termiunal(F)	165 060 0000
Housoing	149 760 0000
Crimp Contacts(F)	165 157 0000
Crimp Contacts(F)	160 176 0000

ASR1(M)

1. Maker : WEIDMULLER
2. TYPE

Crimp Termiunal(M)	165 117 0000
Housoing	127 496 0000
Coding Pin	120 360 0000
Crimp Contacts(M)	125 152 0000
Crimp Contacts(M)	165 156 0000

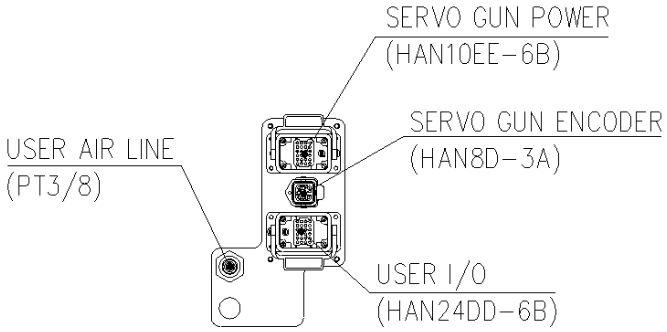
ASR1A(F), ASR1B(F)

1. Maker : WEIDMULLER
2. TYPE

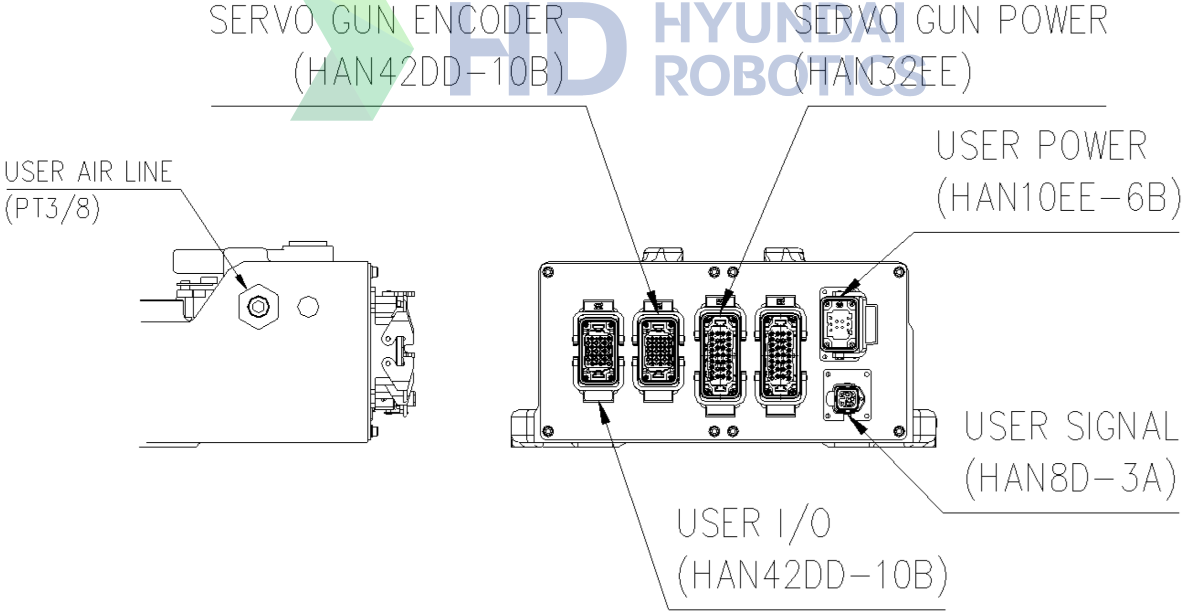
Crimp Termiunal(F)	165 116 0000
Housoing	127 495 0000
CordingPin	120 360 0000
Crimp Contacts(F)	165 157 0000

Figure 2.13 Details of Application Connector: [YS080/YS100A/HH050/HH030L]

2.8.2. For Hi5a


SERVO GUN POWER
(HAN10EE-6B)
SERVO GUN ENCODER
(HAN8D-3A)
USER AIR LINE
(PT3/8)
USER I/O
(HAN24DD-6B)

ARM FRAME PART


SERVO GUN ENCODER
(HAN42DD-10B)
SERVO GUN POWER
(HAN32EE)
USER POWER
(HAN10EE-6B)
USER AIR LINE
(PT3/8)
USER SIGNAL
(HAN8D-3A)
USER I/O
(HAN42DD-10B)

BASE BODY PART

Figure 2.14 Application Wiring and Inspection Wiring Diagram: [YS080-11/YS100A-11/HH050-11/HH030L-11/HH050T-11]

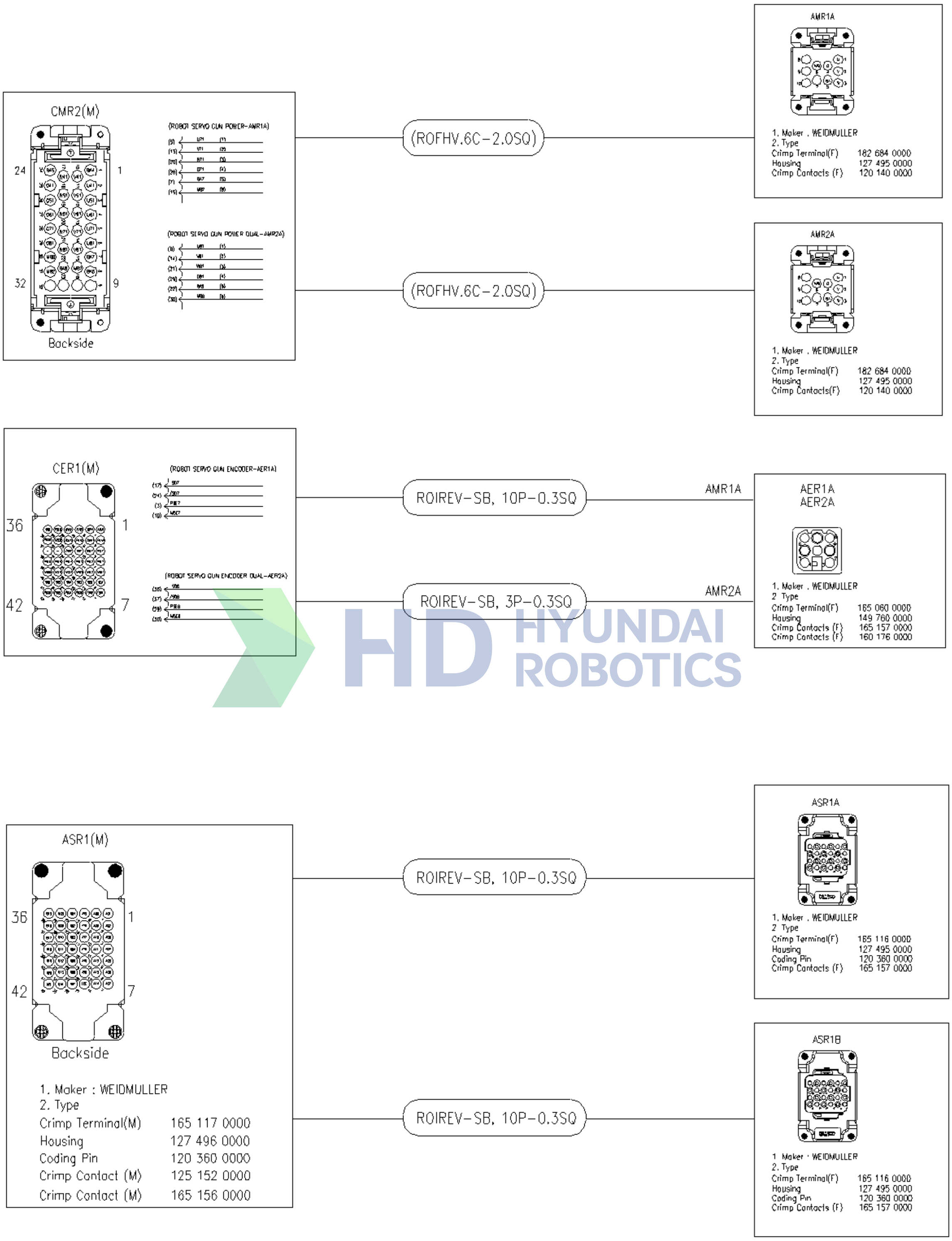

CMR2(M)
24
1
32
9
Backside
(ROBOT SERVO GUN POWER-AMR1A)
(ROBOT SERVO GUN POWER DUAL-AMR2A)
(ROFHV.6C-2.0SQ)
(ROFHV.6C-2.0SQ)
AMR1A
1. Maker . WEIDMULLER
2. Type
Crimp Terminal(F) 182 684 0000
Housing 127 495 0000
Crimp Contacts (F) 120 140 0000
AMR2A
1. Maker . WEIDMULLER
2. Type
Crimp Terminal(F) 182 684 0000
Housing 127 495 0000
Crimp Contacts(F) 120 140 0000
CER1(M)
36
1
42
7
(ROBOT SERVO GUN ENCODER-AER1A)
(ROBOT SERVO GUN ENCODER DUAL-AER2A)
ROIREV-SB, 10P-0.3SQ
ROIREV-SB, 3P-0.3SQ
AMR1A
AMR2A
AER1A
AER2A
1. Maker . WEIDMULLER
2 Type
Crimp Terminal(F) 165 060 0000
Housing 149 760 0000
Crimp Contacts (F) 165 157 0000
Crimp Contacts (F) 160 176 0000
ASR1(M)
36
1
42
7
Backside
1. Maker : WEIDMULLER
2. Type
Crimp Terminal(M) 165 117 0000
Housing 127 496 0000
Coding Pin 120 360 0000
Crimp Contact (M) 125 152 0000
Crimp Contact (M) 165 156 0000
ROIREV-SB, 10P-0.3SQ
ROIREV-SB, 10P-0.3SQ
ASR1A
1. Maker . WEIDMULLER
2 Type
Crimp Terminal(F) 165 116 0000
Housing 127 495 0000
Coding Pin 120 360 0000
Crimp Contacts (F) 165 157 0000
ASR1B
1. Maker · WEIDMULLER
2. Type
Crimp Terminal(F) 165 116 0000
Housing 127 495 0000
Coding Pin 120 360 0000
Crimp Contacts (F) 165 157 0000

Figure 2.15 Details of Application Connector: [YS080-11/YS100A-11/HH050-11/HH030L-11/HH050T-11]

2.9. Restricting the Working Envelope

When installing the robot, take into account that the working envelope can be adjusted freely within the entire working envelope.

Limiting the motion range is useful when:

- During robot operation
- When the robot is likely to collide with another device
- When the length of the application cables or hose pipes are limited

There are three methods to use to limit the motion range of the robot as follows:

- Software limit (applied to the entire axis)
- Limit switch (1-3 axis: optional application)
- Mechanical stopper (1-3 axes)

[Warning]
The mechanical stopper is a physical device. The robot should not exceed the area occupied by the mechanical stopper. The mechanical stopper of a 1-3 axis is fixed. The mechanical stopper with a 4-6 axis is applied only within the software limits.

Once the mechanical stopper is collided with, its strength cannot be guaranteed. Therefore, please ensure it is replaced after impact.

2.9.1. Axis 1(Axis S)

By adding one more mechanical stopper, the working envelope of the 1st axis can be limited. (by 30 °).
If the 1st STOPPER BLOCK and STOPPER are deformed due to a great impact, they must be replaced.

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3

Instructions

3.1. Robot Component Name

The following [Figure 3.1] show and name each component of the robot.

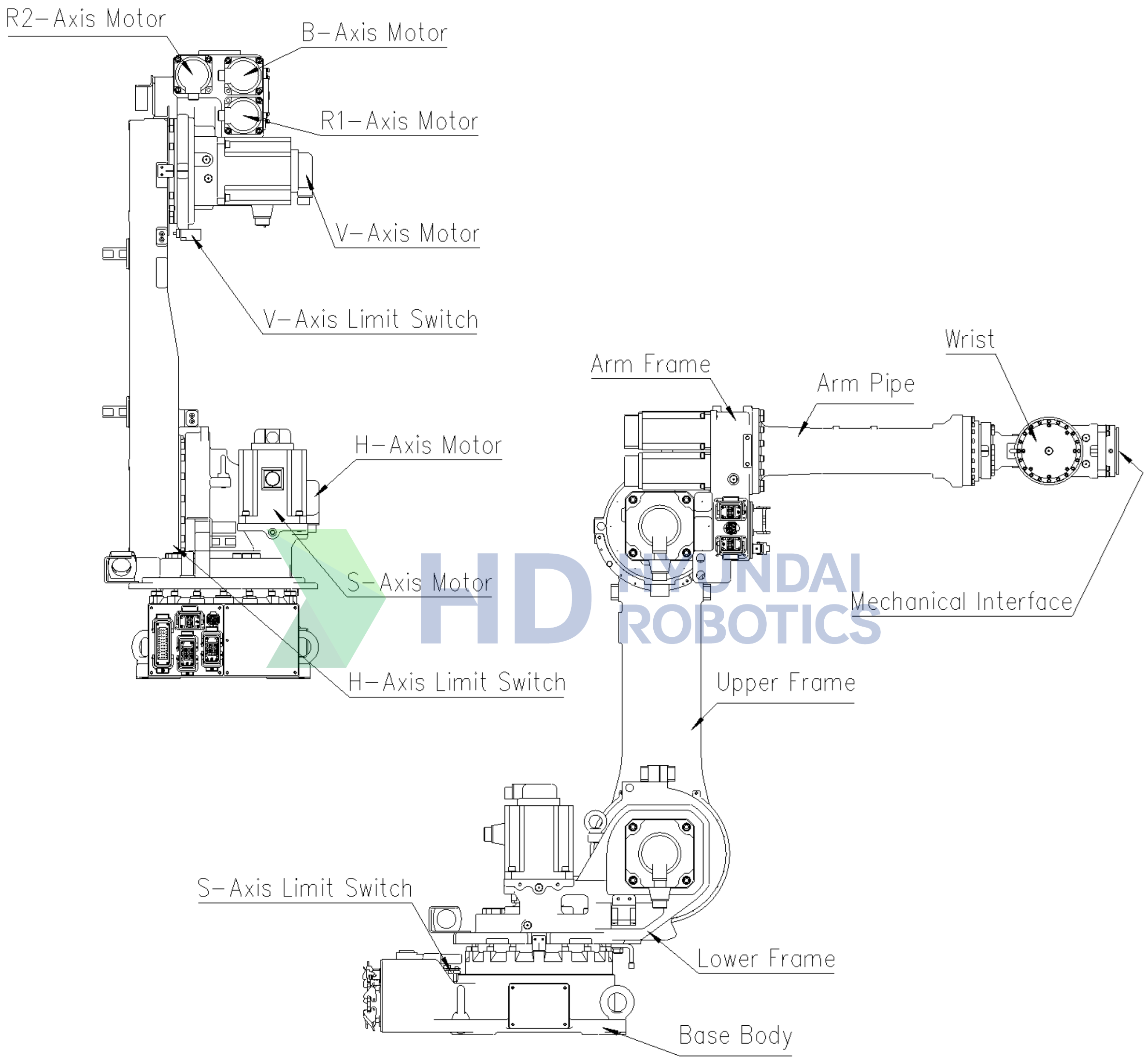
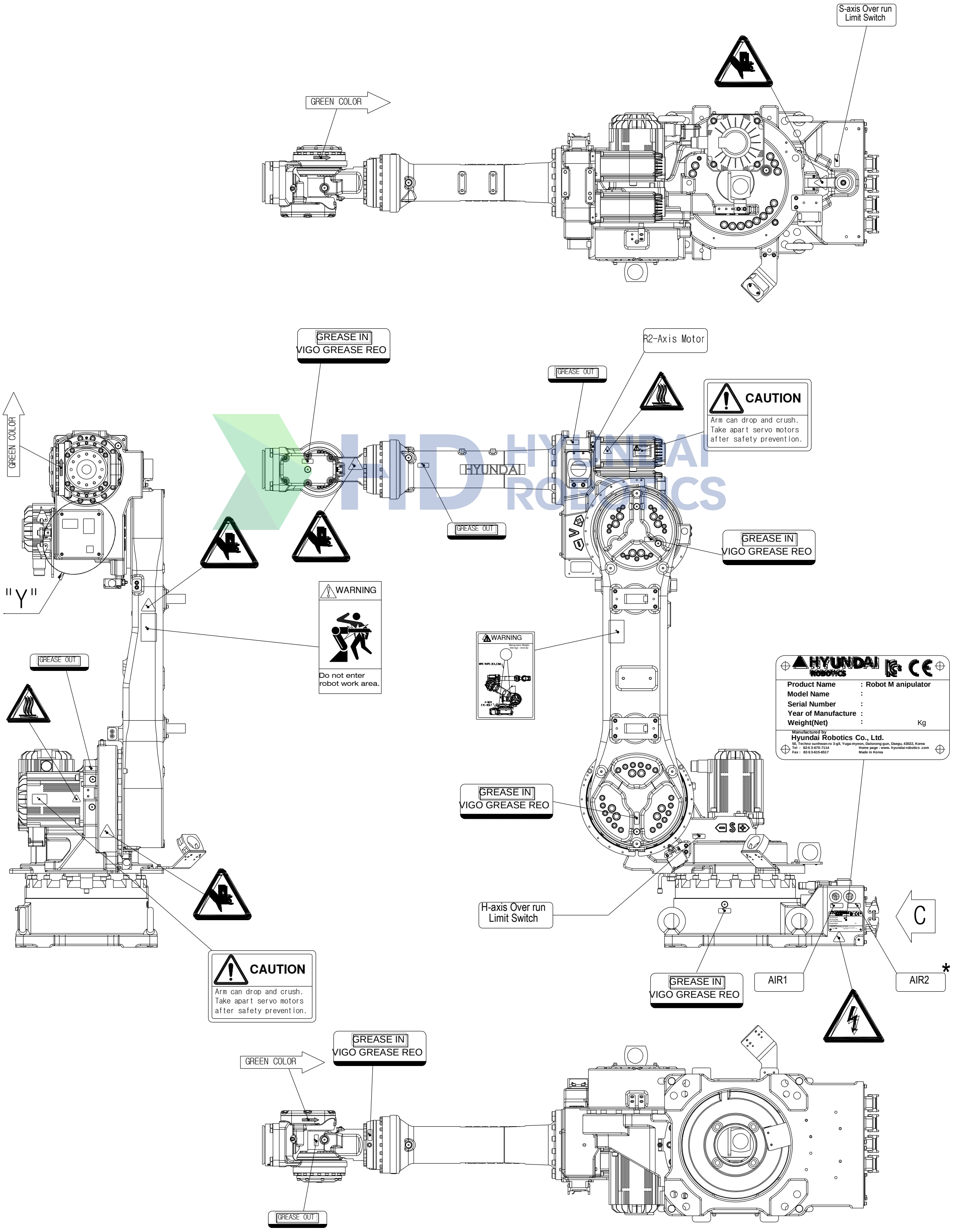

R2-Axis Motor
B-Axis Motor
R1-Axis Motor
V-Axis Motor
V-Axis Limit Switch
H-Axis Motor
S-Axis Motor
H-Axis Limit Switch
Arm Frame
Arm Pipe
Wrist
Mechanical Interface
Upper Frame
S-Axis Limit Switch
Lower Frame
Base Body

Figure 3.1 Name of Robot Components

3.2. Location of Safety Nameplate

In order to prevent any accidents, safety marking plates such as [Figure 3.2] are attached to the robot. Do not remove or replace it unnecessarily.


S-axis Over run Limit Switch
GREEN COLOR
GREASE IN
VIGO GREASE REO
R2-Axis Motor
GREASE OUT
CAUTION
Arm can drop and crush.
Take apart servo motors
after safety prevention.
GREEN COLOR
"Y"
HYUNDAI
GREASE OUT
GREASE IN
VIGO GREASE REO
WARNING
Do not enter robot work area.
WARNING
GREASE OUT
HYUNDAI ROBOTICS
Product Name : Robot M anipulator
Model Name :
Serial Number :
Year of Manufacture :
Weight(Net) : Kg
Manufactured by
Hyundai Robotics Co., Ltd.
50, Techno sunhwan-ro 3-gil, Yuga-myeon, Dalseong-gun, Daegu, 43022, Korea
Tel : 82-53-670-7114
Home page : www. hyundai-robotics .com
Fax : 82-53-615-6517
Made in Korea
GREASE IN
VIGO GREASE REO
H-axis Over run Limit Switch
C
CAUTION
Arm can drop and crush.
Take apart servo motors
after safety prevention.
GREASE IN
VIGO GREASE REO
AIR1
AIR2
*
GREEN COLOR
GREASE IN
VIGO GREASE REO
GREASE OUT

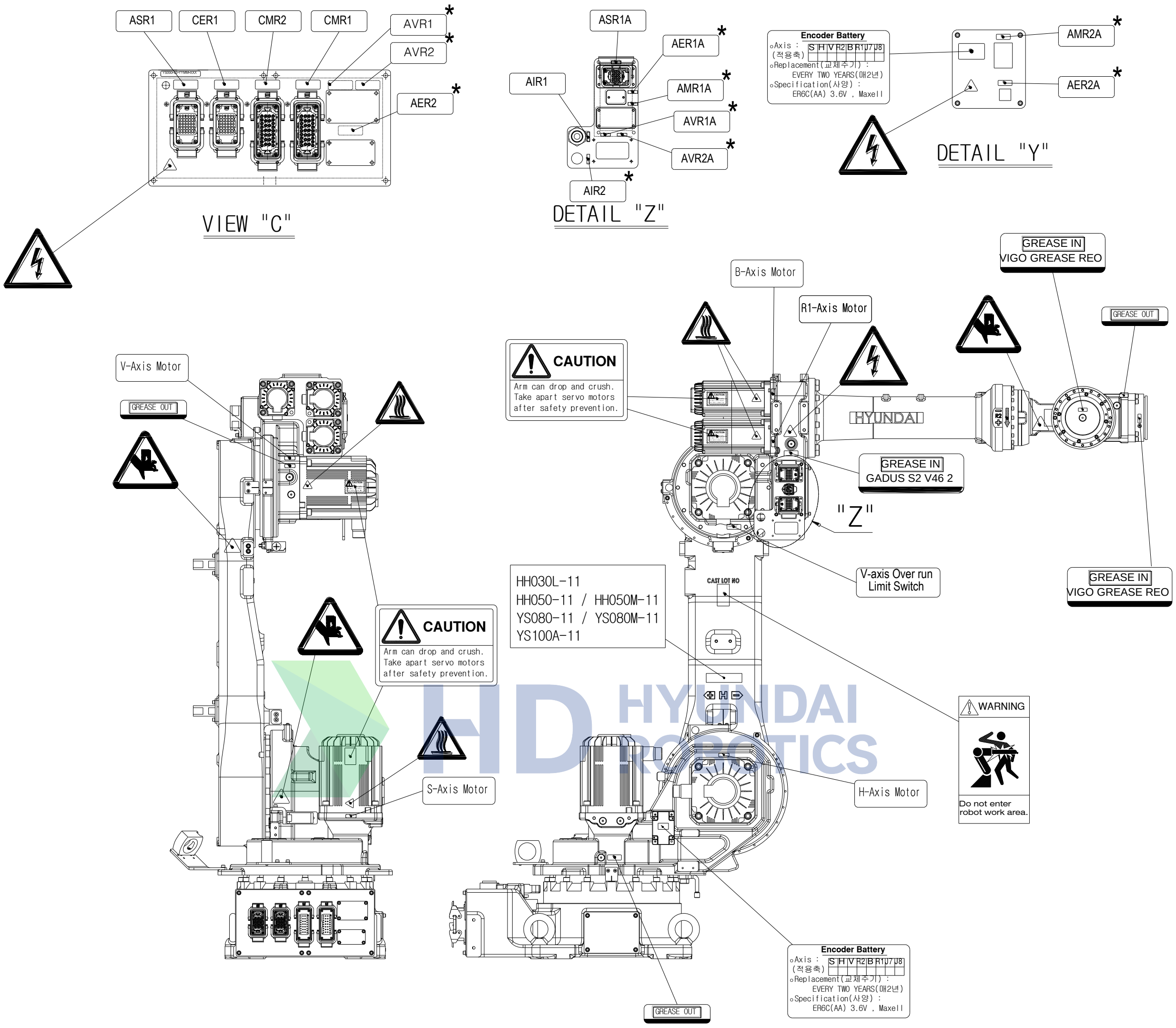

ASR1
CER1
CMR2
CMR1
AVR1 *
AVR2 *
AER2 *
VIEW "C"
ASR1A
AER1A *
AIR1
AMR1A *
AVR1A *
AVR2A *
AIR2 *
DETAIL "Z"
Encoder Battery
○Axis : (적용축) S H V R2 B R1 J7 J8
○Replacement(교체주기) : EVERY TWO YEARS(매2년)
○Specification(사양) : ER6C(AA) 3.6V , Maxell
AMR2A *
AER2A *
DETAIL "Y"
GREASE IN
VIGO GREASE REO
GREASE OUT
B-Axis Motor
R1-Axis Motor
CAUTION
Arm can drop and crush.
Take apart servo motors
after safety prevention.
HYUNDAI
V-Axis Motor
GREASE OUT
GREASE IN
GADUS S2 V46 2
"Z"
V-axis Over run
Limit Switch
GREASE IN
VIGO GREASE REO
HH030L-11
HH050-11 / HH050M-11
YS080-11 / YS080M-11
YS100A-11
CAUTION
Arm can drop and crush.
Take apart servo motors
after safety prevention.
CAST LOT NO
WARNING
Do not enter
robot work area.
S-Axis Motor
H-Axis Motor
Encoder Battery
○Axis : (적용축) S H V R2 B R1 J7 J8
○Replacement(교체주기) : EVERY TWO YEARS(매2년)
○Specification(사양) : ER6C(AA) 3.6V , Maxell
GREASE OUT

Figure 3.2 Location of Safety Nameplate

3.3. How to Transport

3.3.1. Using Crane

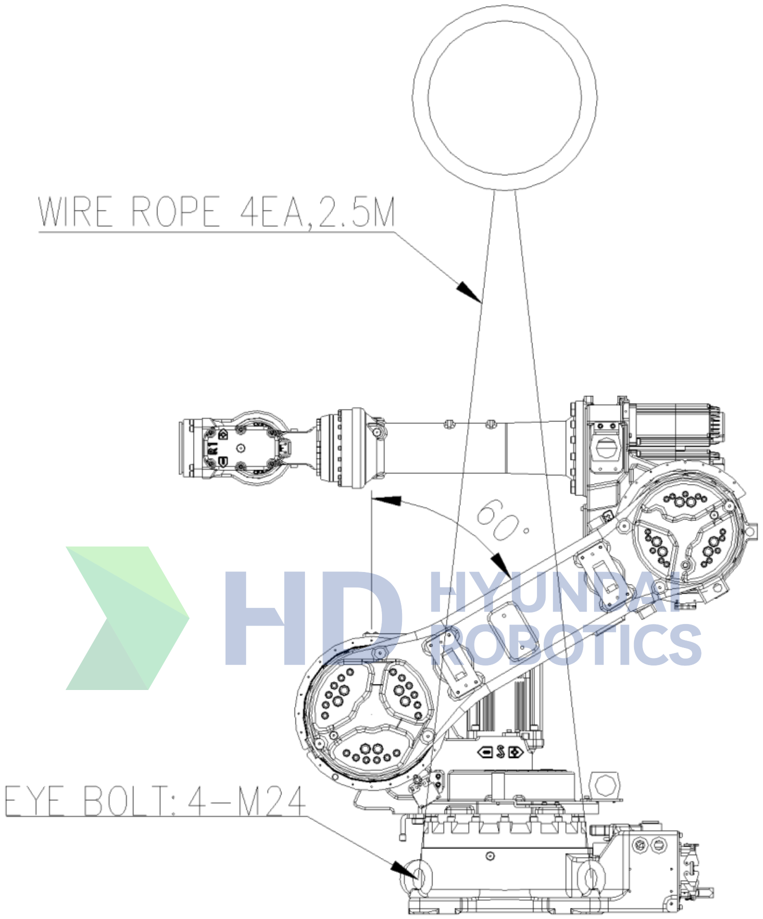


Figure 3.3 How to Transport: Using crane [YS080/YS100A/HH050/HH030L/HH050T]

The following lifting instructions are valid for a "naked" robot. If additional equipment is put on the robot, the center of gravity may change and make lifting dangerous.

⚠

- Never walk under the robot.
- Pose the robot as shown in the Figure.
- Install a 4-M24 eye bolt to the base body.
- Connect a wire rope to the eye bolts.
- Attach the protective hose (50 ㎝) to prevent the damage to the main body of the robot.
- Keep the safety regulations during Lifting process.
- Weight of manipulator : 645kg(YS080/YS100A/HH050), 650kg(HH030L), 635kg(HH050T)
- Minimum crane capacity: 2 tons

3.3.2. Forklift use

A forklift can be used to carry the main body of the robot.

For safety reasons, please pay attention to the following procedures:

- With reference to the pictures provided, use the standard position of each model.
- Fix the robot onto a pallet and insert the forklift fork into the pallet to carry it. The pallet should be strong enough to withstand the weight.
- Carry at a slow speed.
- Follow all safety regulations.

Cautions

- Do not lean against the robot while carrying it.
- Make sure the robot does not collide with the floor while loading and unloading.
- Pay attention to the relevant safety rules while using the forklift truck.

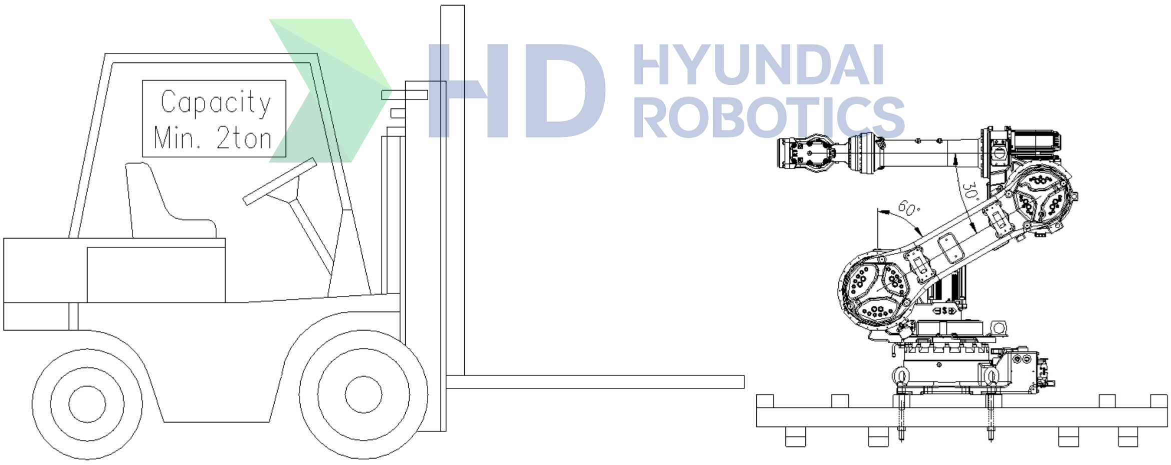


Figure 3.4 How to Transport: Using forklift [YS080/YS100A/HH050/HH030L/HH050T]

3.4. Storage of the robot

To store the robot for non-use, position it as shown in [Figure 3.4].

[Caution]
If not placed as instructed, the robot may fall. For long-term storage, take extra care to ensure that it does not fall.

3.5. How to Install

NOTE:
Before starting to unpack and install the robot, read the safety regulations and other instructions very carefully.

Warning:
The installation shall be made by qualified installation personnel and should conform to all national and local codes.

When unpacking the robot, check if it has been damaged during transporting or unpacking. In addition, strictly keep the following installation instructions because installation method and foundation are very important to maintain a good robot performance.

3.5.1. Operating Conditions

(1) Ambient temperature should range from 0℃ to 45℃.
(2) Ambient humidity should range from 20% to 85% RH, without dew condensation.
(3) Less dust, oil, or moisture.
(4) No flammable, corrosive liquid or GAS.
(5) No impact and shacking.
(6) No electrical noise generator near the robot.
(7) If the robot is not immediately installed, keep it in a dry area at an ambient temperature between -15℃～ and 40℃.

3.5.2. Installation the Robot Manipulator

The base floor to install the robot should be constructed with concrete with a thickness of 300mm or more so that the hardness minimizes dynamic effect to the robot. Repair bumps and cracks on the concrete surface of the floor during installation, and fix the mounting place with M20 Chemical Anchor. And if the thickness of the concrete floor is less than 300mm, it requires an independent base construction that must be reviewed beforehand.
Locate the robot unit on the mounting plate and tightly assemble 8 M20 bolts.

- Bolt: M20*70 (Hardness level: 12.9)
- Flat washer: T = 4mm or above, internal diameter (ID) = 24, hardness of HrC 35
- Assembly torque: 530±20Nm

3.5.3. Accuracy of Installation Surface

The degree of flatness for the four attachment plate surfaces should satisfy the specification. Use a shim, if necessary. The rest of the surface must be flat within ±2mm.

- **Cautions**

  ① The flatness of mounting plate must be within 1.0 mm.
  ② Make four plane figures of a sealed plate of 1.0 mm (±0.5 mm) or less.

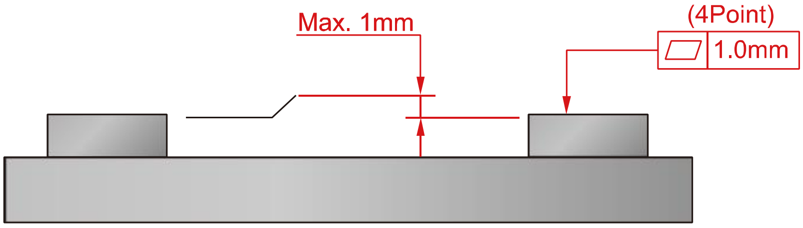


Figure 3.5 Accuracy of Installation surface

3.5.4. Dimension of Installation Surface

Fix the swivel base for robot's installation.
Refer to [Figure 3.6] for the dimension.

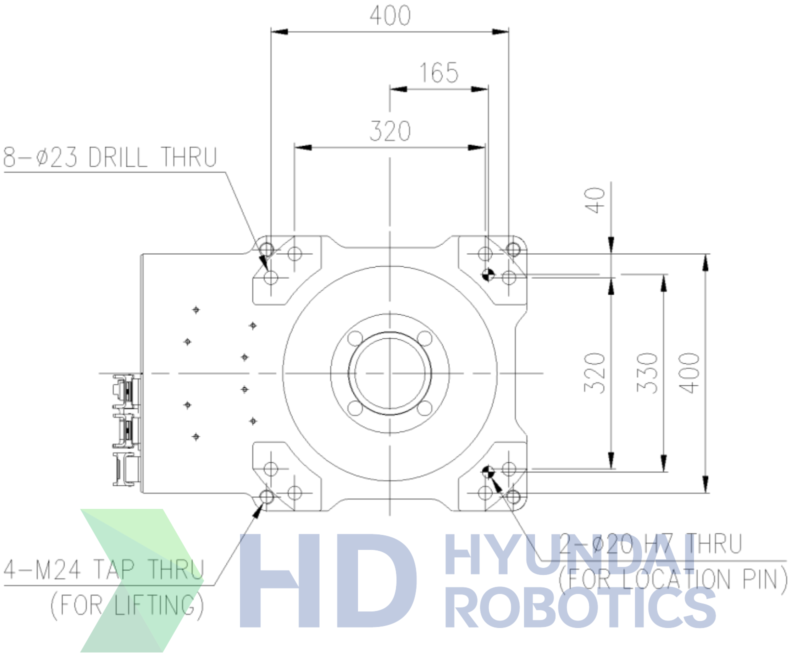

400
165
320
8–ø23 DRILL THRU
40
320
330
400
4–M24 TAP THRU
(FOR LIFTING)
2–ø20 H7 THRU
(FOR LOCATION PIN)

Figure 3.6 Dimension of Robot Installation: [YS080/YS100A/HH050/HH030L/HH050T]

3.5.5. Robot Cable Connection

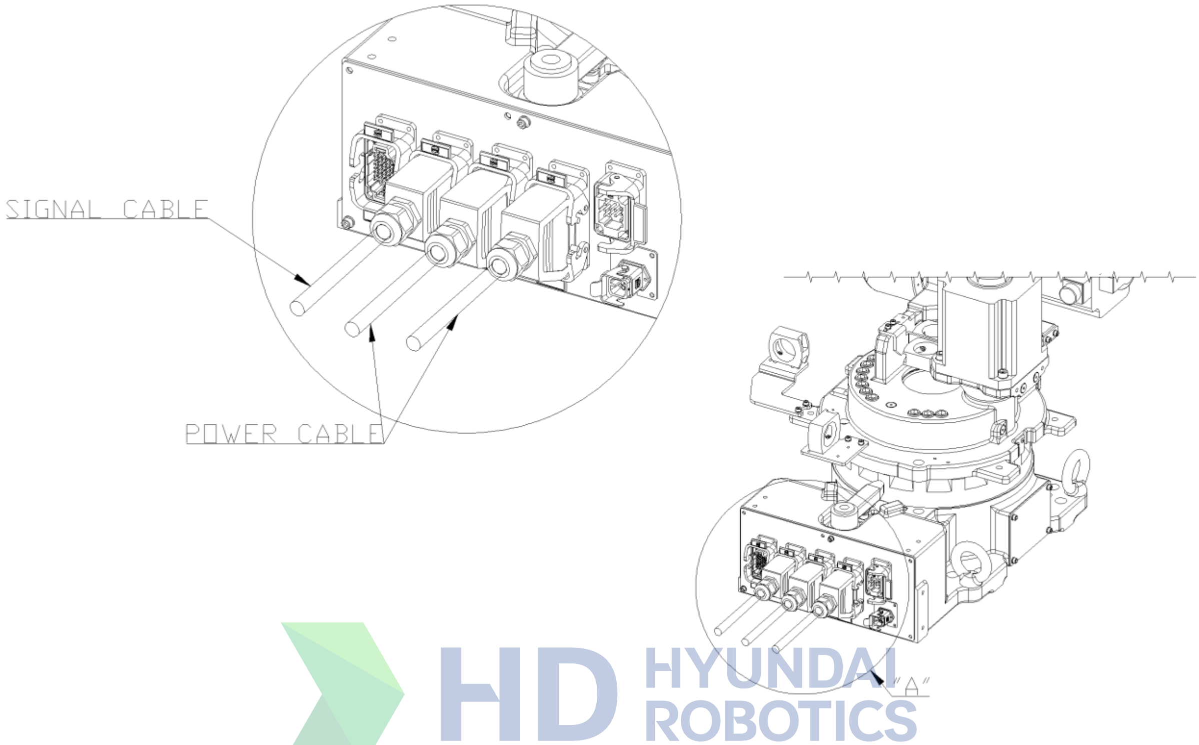


Figure 3.7 Robot Cable Connection

The robot will be connected to the controller with power cables and a signal cable. Connect the cables to the connectors on the rear of the robot base. Connect the ground wire as well.
For the connection of pneumatic pressure cables and option cables, refer to "2.8 Application Wiring and Inspection Wiring Diagram".

Make sure to turn OFF the power of the controller before connecting the cables

3.5.6. Emergency Stop Time & Distance

The following items are the response time and distance for an emergency stop during the max speed operation of each axis (S, H, and V) with the standard load.

Table 3-1 Emergency Stop Time & Distance

Robot Model		S Axis	H Axis	V Axis
YS080	Maximum moving distance [mm]	1,096	1,444	1,036
	Maximum time [s]	0.48	0.72	0.59
YS100A	Maximum moving distance [mm]	1,114	975	970
	Maximum time [s]	0.53	0.57	0.62
H050 HH050T	Maximum moving distance [mm]	1,107	1,634	931
	Maximum time [s]	0.45	0.66	0.47
HH030L	Maximum moving distance [mm]	1,138	1,634	1,020
	Maximum time [s]	0.44	0.70	0.48

3.6. Allowable Load of Wrist Axis

3.6.1. Permitted load torque estimation

The load, which will be applied to the mechanical interface of robot's wrist axis, is restricted by allowable weight, allowable load torque and allowable moment of inertia. The direction of coordinate system used to calculate the load torque and inertia moment is the same with the direction of robot base coordinate system.

- Step 1
  Calculate the location of the weight center from the B axis rotation center (L_X, L_Y, L_Z)
  L_X: Location of weight center in X axis
  L_Y: Location of weight center in Y axis
  L_Z: Location of weight center in Z axis

- Step 2
  Check the location from the center of B and R1 axis to the weight center based on the torque map.

  $$L_B = \sqrt{L_X{}^2 + L_Z{}^2}\ ,\ L_{R1} = \sqrt{L_Y{}^2 + L_Z{}^2}$$

  L_B : Length from B axis rotation center to weight center
  L_{R1} : Length from R1 axis rotation center to weight center

- Step 3
  Calculate the load torque from the calculated distance.

  $$T_B = MgL_B \qquad T_{R1} = MgL_{R1}$$

  T_B: Load torque in the rotational center of axis B
  T_{R1}: Load torque in the rotational center of axis R1
  M: Mass of load
  g: Acceleration of gravity

- Step 4
  Check if the load torque calculated in the step 3 is the same with or smaller than the limit value, on the basis of allowed load torque table.

- Note: If the load mass is similar to the mass on the torque curve below, the torque can be alternatively validated by checking if the distance calculated in the step 2 is distributed in the torque curve, instead of the step 3 and 4. If it is in the torque curve, the calculated load torque is smaller than the allowed load torque but if it is out of the torque curve, the calculated load torque is bigger than the allowed load torque.

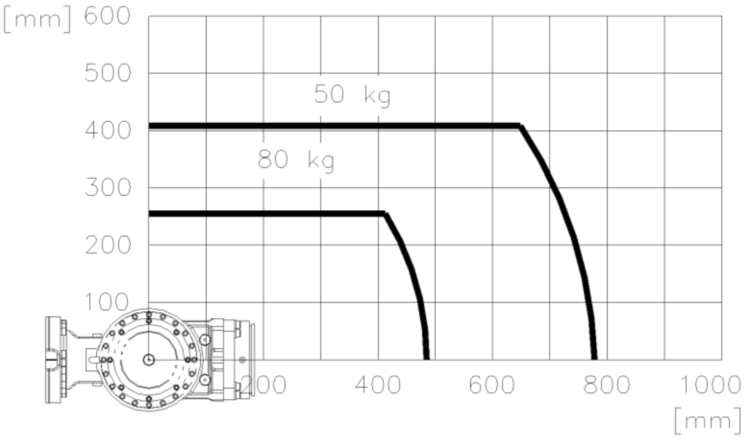


Figure 3.8 Wrist Axis Torque Mapping: [YS080]

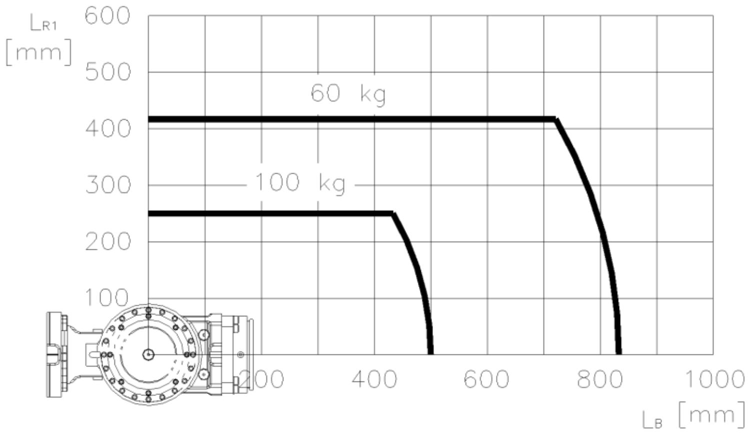


Figure 3.9 Wrist Axis Torque Mapping: [YS100A]

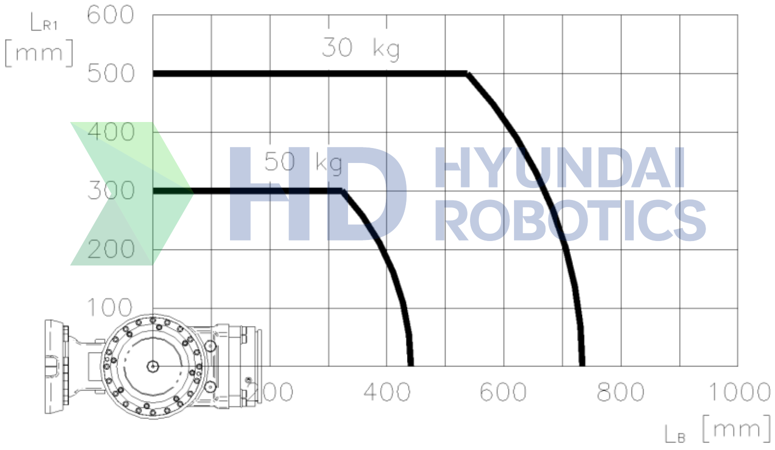


Figure 3.10 Wrist Axis Torque Mapping: [HH050/HH050T]

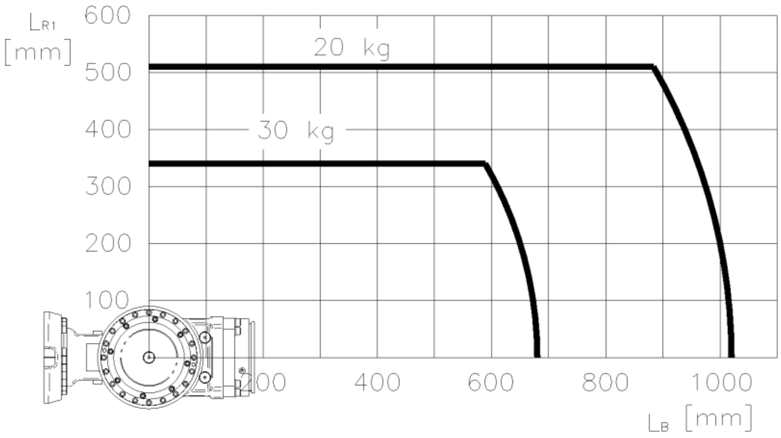


Figure 3.11 Wrist Axis Torque Mapping: [HH030L]

Allowable Load Torque

Table 3-2 Allowable Load Torque

Robot Model	Allowable Load Torque		
	R2 Axis Rotation	B Axis Rotation	R1 Axis Rotation
YS080	Less than 400 N·m(40.8 kgf·m)		200 N·m(20.4 kgf·m)
YS100A	Less than 490 N·m(50.0 kgf·m)		245 N·m(25.0 kgf·m)
HH050	Less than 216 N·m(22.0 kgf·m)		Less than 147 N·m(15.0 kgf·m)
HH030L	Less than 200 N·m(20.4 kgf·m)		Less than 100 N·m(10.2 kgf·m)
HH050T	-	Less than 216 N·m (22.0 kgf·m)	Less than 147 N·m(15.0 kgf·m)

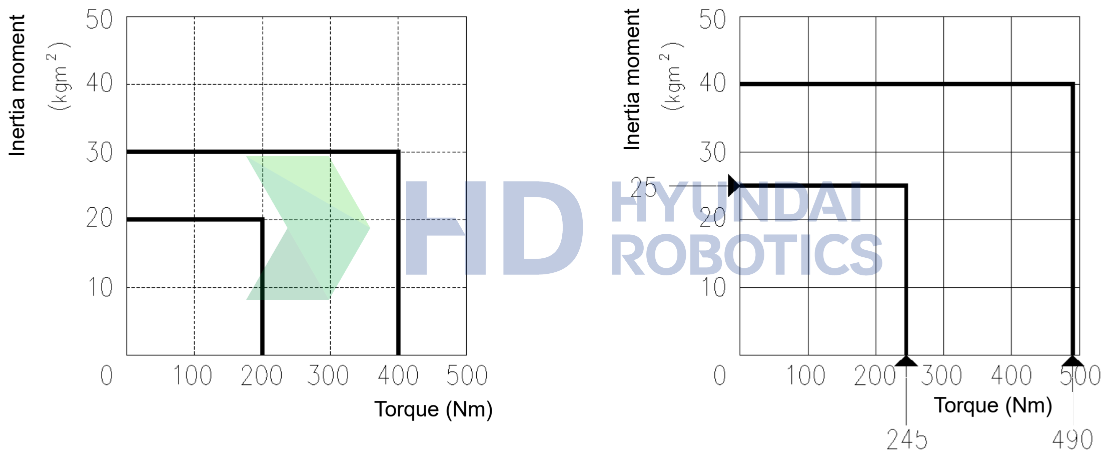
3.6.2. Permitted inertia moment estimation

Loads must be kept below maximum conditions shown in [Figure 3.8] ~ [Figure 3.11].

- Step 1
  Calculate the inertia moment value of the load at each wrist axis center (J_{a4}, J_{a5}, J_{a6})
  J_{a4}- Inertia moment from R2 axis rotation center
  J_{a5}- Inertia moment from B axis rotation center
  J_{a6}- Inertia moment from R1 axis rotation center

- Step 2
  Check if the inertia moment is under the thread according to the permissible inertia moment table.

YS080 Wrist axis load condition **YS100A Wrist axis load condition**



HH050 Wrist axis load condition
HH050T Wrist axis load condition
(R2 axis excluded)

HH030L Wrist axis load condition

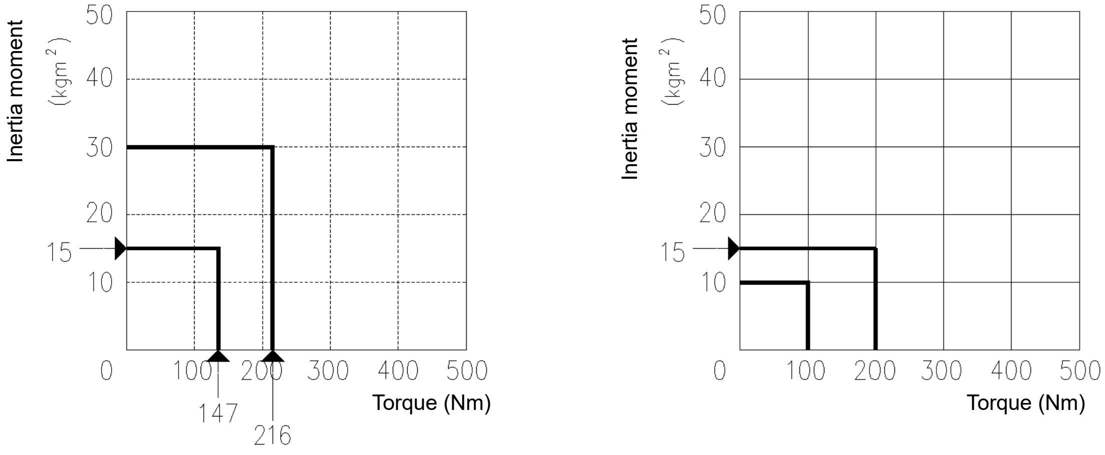


Figure 3.12 Wrist Axis Load Condition: [YS080/YS100A/HH050/HH030L/HH050T]

Allowable Moment of Inertia

Table 3-3 Allowable Moment of Inertia

Robot Model	Allowable Moment of Inertia		
	R2 Axis Rotation	B Axis Rotation	R1 Axis Rotation
YS080	30 kg·m^2 (3.06 kgf·m·s^2)		20 kg·m^2 (2.04 kgf·m·s^2)
YS100A	40 kg·m^2 (4.08 kgf·m·s^2)		25 kg·m^2 (2.55 kgf·m·s^2)
HH050	30 kg·m^2 (2.04 kgf·m·s^2)		15 kg·m^2 (1.53 kgf·m·s^2)
HH030L	15 kg·m^2 (1.53 kgf·m·s^2)		10 kg·m^2 (1.02 kgf·m·s^2)
HH050T	-	30 kg·m^2 (2.04 kgf·m·s^2)	15 kg·m^2 (1.53 kgf·m·s^2)

3.6.3. Example of permitted torque and inertia moment calculation (HS180 Case)

(1) Case #1 Simple 2-D model

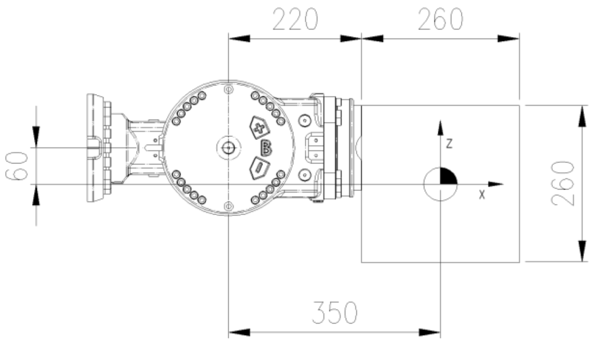


Figure 3.13 2-D load model

M – Load weight
J_{xx} – Inertia moment in X direction from weight center of load
J_{yy} – Inertia moment in Y direction from weight center of load
J_{zz} – Inertia moment in Z direction from weight center of load
J_{a4}- Inertia moment from R2 axis rotation center
J_{a5}- Inertia moment from B axis rotation center
J_{a6}- Inertia moment from R1 axis rotation center

☞ Load condition: Stainless steel with length and width of 260mm and thickness of 260mm (Mass 138.15kg)

① Weight limitation
Load weight: $138.15 \le 180\ \mathrm{kg}$

② Permitted torque limit
Location of B axis weight center L_X = 350mm, L_Y = 0mm, L_Z = -60mm
The distance from the axis B and R1 to the center of gravity can be calculated as follows.
B axis based length $L_B = \sqrt{0.35^2 + 0.06^2} = 0.355\ \mathrm{m}$
R1 axis based length $L_{R1} = 0.06\ \mathrm{m}$
Load torque of axis B $T_B = MgL_B = 49.04\ \mathrm{kgfm} \le 110\ \mathrm{kgfm}$
Load torque of axis R1 $T_{R1} = MgL_{R1} = 8.29\ \mathrm{kgfm} \le 58\ \mathrm{kgfm}$

③ Permitted inertia moment limit
Inertia moment of load from the weight center J_{xx}= 1.56 kgm^2, J_{yy}= 1.56 kgm^2, J_{zz}= 1.56 kgm^2
B axis inertia moment (Ja5)
$$J_{a5} = ML_B^2 + J_{yy} = 138.15 \times 0.355^2 + 1.56 = 18.97 \le 106\ \mathrm{kgm}^2$$
R1 axis inertia moment (Ja6)
$$J_{a6} = ML_{R1}^2 + J_{xx} = 138.15 \times 0.06^2 + 1.56 = 2.06 \le 56\ \mathrm{kgm}^2$$

④ Conclusion
It is safe because the weight, torque and inertia moment all satisfy the limited condition.

(2) Case #2 Complicated 3-D model

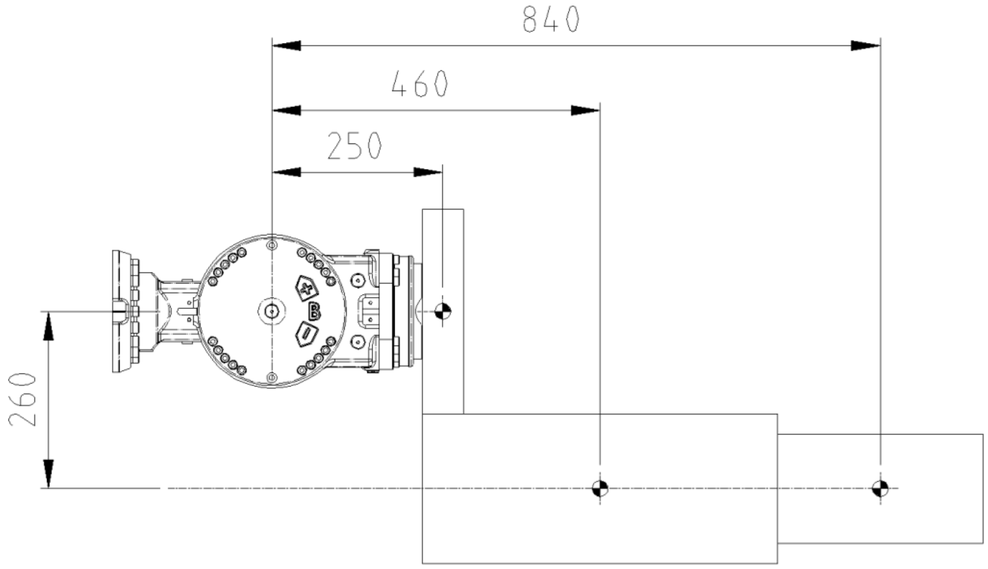


Figure 3.14 3-D load model 2-D shape

Aluminum block shape combination
(σ =0.0027 g/mm^3, : 176.3 kg)

m1 (60×300×300)	14.6kg
m2 (480×440×220)	125.4kg
m3 (280×300×160)	36.3kg

mi - Weight of i block load
LXi - Weight center location in X axis direction of “i” block
LYi - Weight center location in Y axis direction of “i” block
LZi - Weight center location in Z axis direction of “i” block

① Weight limitation

Load weight: $176.3 \ \leq 180 \text{ kg}$

② Permitted torque limit

You can calculate the weight center location for the total load from the B axis rotation center as follows.

$$L_x = \frac{\sum_i m_i L_{xi}}{\sum_i m_i} = \frac{14.6 \times 250 + 125.4 \times 460 + 36.3 \times 840}{176.3} = 520.85 \text{ mm}$$

$L_y = 0 \text{ mm}$ (Symmetric to Y axis)

$$L_z = \frac{\sum_i m_i L_{zi}}{\sum_i m_i} = \frac{14.6 \times 0 + 125.4 \times 260 + 36.3 \times 260}{176.3} = 238.47 \text{ mm}$$

The weight center location for the total load from the B axis rotation center Lx = 520.85mm, Ly = 0mm, L_Z = -238.47mm

Distance from the axis B to center of gravity $L_B = \sqrt{0.521^2 + 0.238^2} = 0.573 \text{ m}$
Distance from the axis R1 to center of gravity $L_{R1} = \sqrt{0.238^2 + 0.0^2} = 0.238 \text{ m}$

Load torque of axis B $T_B = MgL_B = 101.02 \text{ kgfm} \leq 110 \text{ kgfm}$
Load torque of axis R1 $T_{R1} = MgL_{R1} = 41.96 \text{ kgfm} \leq 58 \text{ kgfm}$

x1 y1 z1 - x, y and z direction length of block m1
x2 y2 z2 - x, y and z direction length of block m2
x3 y3 z3 - x, y and z direction length of block m3

LX1, LY1, LZ1 - Weight center location of block m1 from B axis rotation center
LX2, LY2, LZ2 - Weight center location of block m2 from B axis rotation center
LX3, LY3, LZ3 - Weight center location of block m3 from B axis rotation center

Jxx1, Jyy1, Jzz1 - Inertia moment by x, y and z axis from the weight center of block m1
Jxx2, Jyy2, Jzz2 - Inertia moment by x, y and z axis from the weight center of block m2
Jxx3, Jyy3, Jzz3 - Inertia moment by x, y and z axis from the weight center of block m3

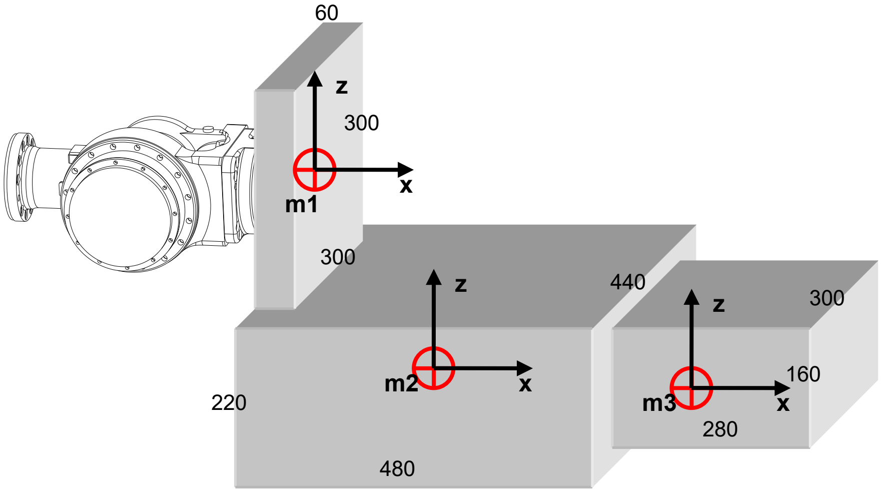

60
z
300
x
m1
300
z
440
z
300
m2
x
160
220
m3
x
280
480

Figure 3.15 3-D load model 3-D shape

③ Permitted inertia moment limit

Table 3-4 Inertia moment from weight center by block

Block weight (kg)	**Weight center (L_X, L_Y, L_Z)**	J_{xx}	J_{yy}	J_{zz}
m_1 (14.6)	(0.25, 0, 0)	0.219 kgm^2	0.114 kgm^2	0.114 kgm^2
m_2 (125.4)	(0.48, 0, -0.26)	2.530 kgm^2	2.915 kgm^2	4.433 kgm^2
m_3 (36.3)	(0.89, 0, -0.26)	0.350 kgm^2	0.314 kgm^2	0.509 kgm^2

B axis inertia moment (J_{a5})

$$J_{a5} = \sum_i [m_i(L_{xi}^2 + L_{zi}^2) + J_{yyi}]$$

$$= [14.6 \times (0.25^2) + 0.114] + [125.4 \times (0.46^2 + 0.26^2) + 2.915]$$
$$+ [36.3 \times (0.85^2 + 0.26^2) + 0.314] = 67.95 \leq 106\ kgm^2$$

R1 axis inertia moment (J_{a6})

$$J_{a6} = \sum_i [m_i(L_{yi}^2 + L_{zi}^2) + J_{xxi}]$$

$$= [14.6 \times (0^2) + 0.219] + [125.4 \times (0.26^2) + 2.530]$$
$$+ [36.3 \times (0.26^2) + 0.350] = 14.03 \leq 56\ kgm^2$$

④ Conclusion

It is safe because the weight, torque and inertia moment all satisfy the limited condition.

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4

Inspection

This chapter provides the instructions for regular inspection and overhaul necessary for the prolonged lifetime of robot performance.

4.1. Inspection Item and Period

Inspection is positively necessary to continue and maintain the high performance of robot for long-term operation.
There are daily inspection and regular inspection. [Table 4-1] shows basic periods for regular inspections, so inspectors should make an inspection according to the indicated periods.
And overhaul every 35,000 operating hours.

The inspection periods have been reviewed for SPOT Welding. In case of high precision work such as handling, it is recommended to inspect at the half intervals of that period as shown in [Table 4-1].
If you have difficulty in understanding the inspection and adjustment methods, please contact the Hyundai Robotics A/S Center (Customer Support).

Table 4-1 Inspection Schedule

Daily Inspection	Daily	MANIPULATOR, MOTOR, REDUCER
Regular Inspection	3months	WIRING, BOLTS, REDUCER
	1 year	LIMIT SWITCH / DOG, BRAKE

4.2. Inspection Item and Period

Table 4-2 Inspection Items and Periods

No.	Inspection Intervals			Inspection Items	Inspection method	Standards	Remark
	Daily	3 months	1 year				
Robot Manipulator and Axes common							
1	○			Cleaning	Examine dirt and dust with naked eyes		
2		○		Inspection wiring	Examine any cable damages Examine cable fixing bracket tightening bolts paint marking with naked eyes Examine any cable cover damages with naked eyes		
3		○		Main bolts	Examine paint marking with naked eyes		
4			○	Limit Switch/ Dog	Check the ON-OFF function of limit switch	Check if the emergency stop lamp is on when the limit switch is ON.	
5	○			Motor	Check the abnormal heating Check the abnormal sound		
6			○	Brake	Check the ON/OFF operation of brake release switch Note) Turn the switch off in a second because the ARM of working axis may be dropped when the brake release switch is on	When the brake release switch is OFF, ARM of End Effect will not be dropped.	
Axis S, H, V							
7	○			Reducer	Check the abnormal sound Check the shaking(vibrating)		
Axis R2, B, R1							
8		○		Reducer	Check the abnormal sound Check the vibrating		
9		○		End Effect tightening bolts	Examine paint marking with naked eyes		

No.	Inspection Intervals			Inspection Items	Inspection method	Standards	Remark
	Daily	3 months	1 year				
10		○		Diversion	there is any diversion by rotating each axis to the right and reverse direction	should not feel diversion by touch	

- If the robot is utilized in adverse condition(such as spot welding, grinding, etc.), perform the inspection more frequently to ensure proper reliability of the robot system
- Inspect all visible cabling, and replace them if damaged.
- Check the mechanical bumper devices for deformation and damage. If the bumper or Dog is bent, replace it immediately.
- Check the tightening torque of main bolts as shown in [Figure 4.1].
- Check the abnormal noise in an automatic or teaching mode in order to ensure the condition of power transmission (such as motor, reducer, etc).

4.3. Inspection of Main External Bolts

The recommended bolt torque is shown in [Figure 4.1].
Apply the appropriate torque, where required, using the torque wrench and place the paint marking where the check-up is completed.

Table 4-3 Inspection part for main bolts

No.	Inspection parts	No.	Inspection parts
1	H-axis reducer seal bolt	6	ARM PIPE seal bolt
2	H-axis motor seal bolt	7	R2-axis reducer seal bolt
3	V-axis reducer seal bolt	8	Wrist assembly seal bolt
4	V-axis motor seal bolt	9	B-axis reducer seal bolt
5	Upper plate of balance spring seal bolt	10	R1-axis reducer seal bolt

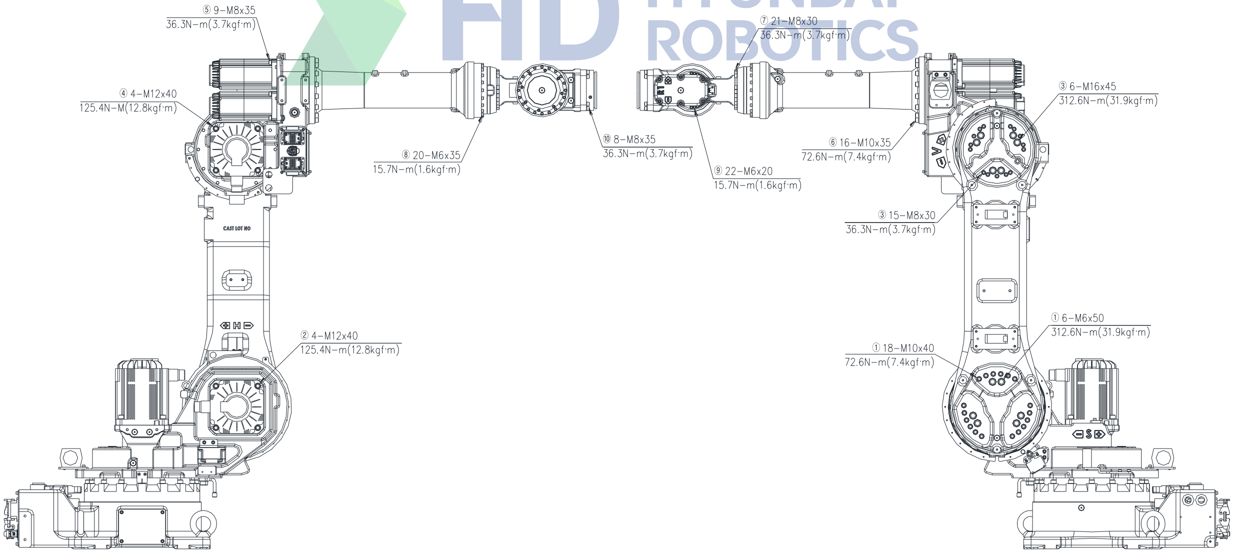
⑤ 9−M8x35
36.3N−m(3.7kgf·m)
④ 4−M12x40
125.4N−M(12.8kgf·m)
⑧ 20−M6x35
15.7N−m(1.6kgf·m)
⑩ 8−M8x35
36.3N−m(3.7kgf·m)
⑦ 21−M8x30
36.3N−m(3.7kgf·m)
⑨ 22−M6x20
15.7N−m(1.6kgf·m)
⑥ 16−M10x35
72.6N−m(7.4kgf·m)
③ 6−M16x45
312.6N−m(31.9kgf·m)
③ 15−M8x30
36.3N−m(3.7kgf·m)
CAST LOT NO
② 4−M12x40
125.4N−m(12.8kgf·m)
① 6−M6x50
312.6N−m(31.9kgf·m)
① 18−M10x40
72.6N−m(7.4kgf·m)

Figure 4.1 Inspection Part for Main Bolts [YS080/YS100A/HH050/HH030L/HH050T]

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5

Maintenance

5.1. Grease replacement & Injecting grease after replacing the reducer

Caution

If the grease is not properly injected, the internal pressure in the injection part may suddenly increase, causing the oil seal damage, oil leakage, and abnormal operation. Abnormal sound may be generated when replacing the current grease with new grease of a different specification, so make sure that different types of grease should not be mixed together. Therefore, you must observe the following items when injecting grease.

(1) Make sure to wear safety glasses before injecting grease and inspection

(2) Before starting to grease, remove the plug from the grease outlet

(3) When loosening a plug, grease and the plug could be discharged. Block the outlet with a thick cloth to prevent injuries caused by discharged grease or plug, and keep a distance away for safety. (Do not look into the grease outlet.)

(4) Whenever possible, avoid using a compressed-air pump, powered by the factory air supply. If the use of a compressed-air pump is unavoidable, restrict the greasing pressure less than 1.5bar(1.5kgf/cm^2)

(5) Use grease only of the specified type. If not, may damage the reducer or lead to other problems

(6) After injecting it, remove the residual pressure from each axis and tighten the plugs according to the given procedure.

Axis	Operation angle (1 Axis /2 Axis /3 Axis)	Operation speed	Operation time
1 Axis ~ 3 Axis	80° /90° /70° or more	50 %	Least 20 min
4 Axis ~ 6 Axis	60° /120° /60° or more	100 %	Least 20 min
Arm Frame Gear Box	60° /120° /60° or more	100 %	Least 20 min

(7) After greasing, confirm that no grease is leaking from the grease outlet and that the grease bath is not pressurized, then re-attach the plug in the grease outlet.

(8) To prevent accidents caused by slipping, completely remove any excess grease from the floor or robot.

(9) When an ambient temperature is more than 35℃, be sure to shorten the period of replenishment in half.

(10) When replacing grease, replace the specified amount and inject new grease as much as the

amount of the discharged grease.

(11) If an abnormal sound is generated from the reducer part during operation after replenishment or replacement of grease, at low temperature, at low speed, or after long-term non-operation, you need to operate the robot while checking the state of the abnormal sound for one or two days. Abnormal sound caused by grease will disappear.

(12) If the grease with a different specification is injected into the reducer part that has been greased already, an abnormal sound may occur. Therefore, do not mix these different types of grease. Please replace Vigo grease with Vigo grease and Eureka grease with Eureka grease.

(13) An abnormal sound may occur even if the existing grease is replaced with the new grease of the same designated specification as the existing grease.

(14) Replacing the grease is not for completely removing the existing grease. A significant amount of existing grease will remain.

■ **Periodic Replacement**

Periodic Replacement

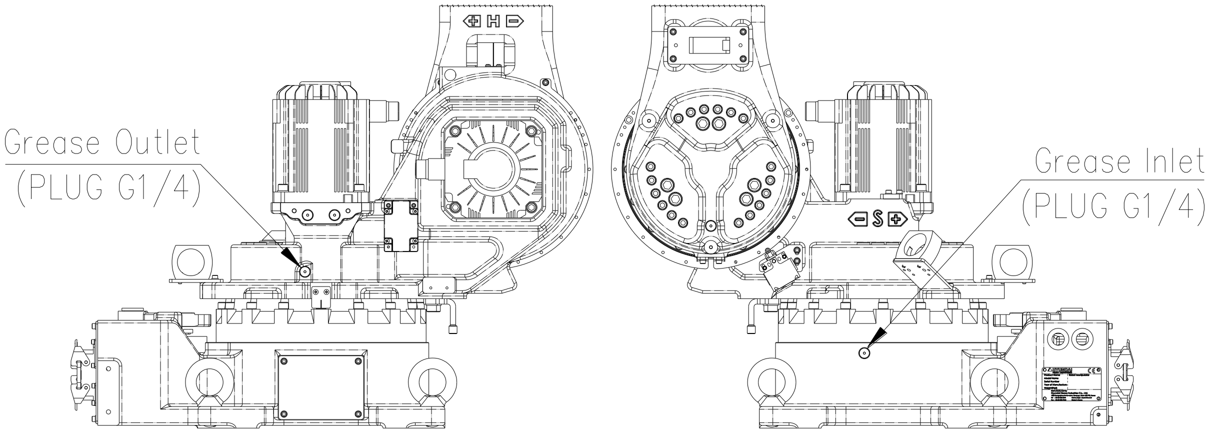
✓ S-axis Reducer, Arm Frame Gear Box : 24,000 hours
✓ Other Reducers : 12,000 hours

If there is still noise in the reducer even after using specified grease, check the state closely for 1-2 days during operation. Generally, the noise will go away.
(The noise will go away if you run the axis at a high speed for 5-10 minutes).
- It can be checked if the abnormal sound will disappear even when the concerned axis is operated at high speed for about 5 to 10 minutes or more.
- When the old grease is discharged as much as possible (about 90% or more) and replaced with new grease, the abnormal grease sound can be minimized. (When the grease is discharged while the axis is rotating at low speed, the grease discharge time can be shortened.)

An abnormal sound usually occur in the following cases:

- During operation after replacement of grease/reducer
- During operation after a long-term non-operation
- During operation at low speed
- During operation at low temperature
- When using unspecified grease
- Mixing grease of different specifications

5.1.1. S-Axis Reducer



Attention

If grease is added without removing the outlet plug, the grease will go inside the motor and may damage it. It is absolutely necessary to remove the plug.

- **Grease Replacement**

(1) Prepare a grease nipple A-PT1/4.

(2) Remove the plug G1/4 of the grease inlet, and fasten the grease nipple A-PT1/4.

(3) Remove the plug G1/4 of the grease outlet.

(4) Inject the grease into the grease inlet using a grease gun.

✓ **Grease type : VIGO GREASE RE0**
✓ **Amount of grease : 2,755cc(2.480g)**

✓ **Grease type : Eureka 114 No.0**
✓ **Amount of grease : 2,755cc(2.314g)**

(5) The grease replacement is complete when new grease appears in the outlet port. The new grease can be distinguished from the old one by color.

(6) Move the S-Axis for a few minutes to eject the old grease and then add grease until the new grease appears in the outlet port.

(7) Discharge excessively fueled grease and residual pressure. (Refer to the discharge procedure below.)

(8) Remove the grease nipple of the inlet and the plug of the air vent, and assemble the inlet plug and air vent set.

- Injecting grease after replacing the reducer.

  (1) Prepare a grease nipple A-PT1/4.

  (2) Remove the plug G1/4 of the grease inlet, and fasten the grease nipple A-PT1/4.

  (3) Remove the plug G1/4 of the grease outlet.

  (4) Inject the grease into the grease inlet using a grease gun.

  (5) The grease replacement is complete when new grease appears in the outlet port.

  (6) Discharge excessively fueled grease and residual pressure. (Refer to the discharge procedure below.)

  (7) Remove the grease nipple of the inlet and the plug of the air vent, and assemble the inlet plug and air vent set.

✓ **Grease type : VIGO GREASE RE0**
✓ **Amount of grease : 3,444cc(3.100g)**

✓ **Grease type : Eureka 114 No.0**
✓ **Amount of grease : 3,444cc(2,893g)**

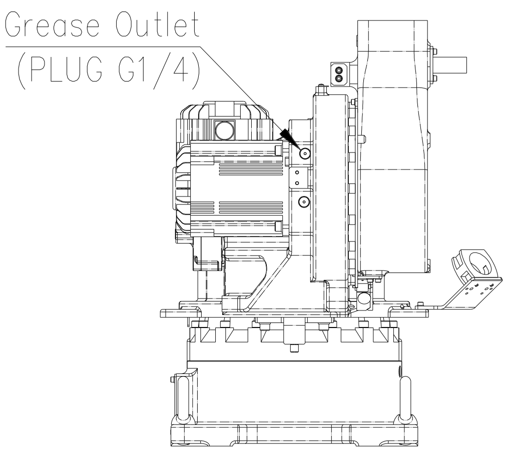
- Procedure in discharging excessively fueled grease and residual pressure after grease replacement and injection

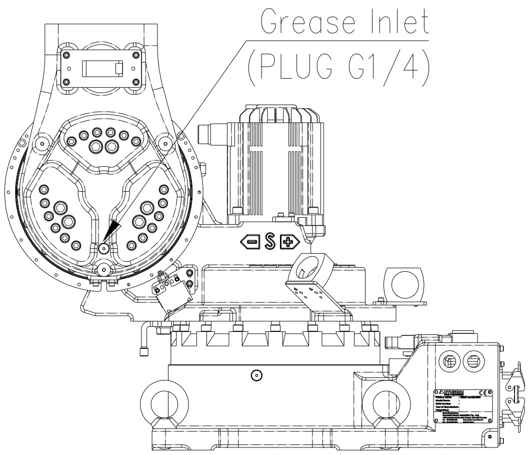
  (1) Attach a grease receiver or a hose to the grease outlet to prevent contamination from discharged grease

  (2) Operate it within a range without surrounding and interference under the following conditions
  ① Operation angle : 80° or more
  ② Operation speed : 50%
  ③ Operation time: 1.5 hours or more
  ④ Work so that the injected amount and the discharged amount are the same. If the discharged amount is less, the residual amount needs to be discharged through the inlet.

  (3) Wipe the outlet port with a cloth and attach the plug

5.1.2. H-Axis Reducer





Attention
If grease is added without removing the outlet plug, it cause damage to the seal of reducer and grease will go inside the motor and may damage it. It is absolutely necessary to remove the plug.

- **Grease Replacement**

(1) Prepare the grease nipple A-PT1/4, and then set the H-axis arm perpendicularly.
(H:90° -Floor Type, H:0° -Shelf Type)

(2) Remove the plug G1/4 of the grease inlet, and fasten the grease nipple A-PT1/4.

(3) Remove the plug G1/4 of the grease outlet.

(4) Inject the grease into the grease inlet using a grease gun.

✓ **Grease type : VIGO GREASE RE0**
✓ **Amount of grease : 1,689cc (1.520g)**

✓ **Grease type : Eureka 114 No.0**
✓ **Amount of grease : 1,689cc (1.418g)**

(5) The grease replacement is complete when new grease appears in the outlet port. The new grease can be distinguished from the old one by color.

(6) Move the H-Axis for a few minutes to eject the old grease and then add grease until the new grease appears in the outlet port.

(7) Discharge excessively fueled grease and residual pressure. (Refer to the discharge procedure below.)

(8) Remove the grease nipple of the inlet and assemble the inlet plug.

- Injecting grease after replacing the reducer.

(1) Prepare the grease nipple A-PT1/4, and then set the H-axis arm perpendicularly.
(H:90° -Floor Type, H:0° -Shelf Type)

(2) Remove the plug G1/4 of the grease inlet, and fasten the grease nipple A-PT1/4.

(3) Remove the plug G1/4 of the grease outlet.

(4) Inject the grease into the grease inlet using a grease gun.

✓ **Grease type : VIGO GREASE RE0**
✓ **Amount of grease : 2,111cc(1.900g)**

✓ **Grease type : Eureka 114 No.0**
✓ **Amount of grease : 2,111cc(1.773g)**

(5) The grease replacement is complete when new grease appears in the outlet port.

(6) Discharge excessively fueled grease and residual pressure. (Refer to the discharge procedure below.)

(7) Remove the grease nipple of the inlet and assemble the inlet plug.

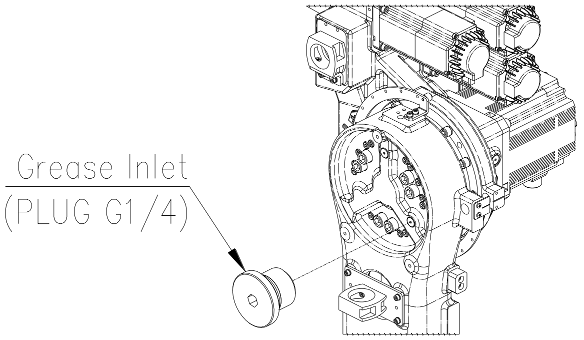
- Procedure in discharging excessively fueled grease and residual pressure after grease replacement and injection.

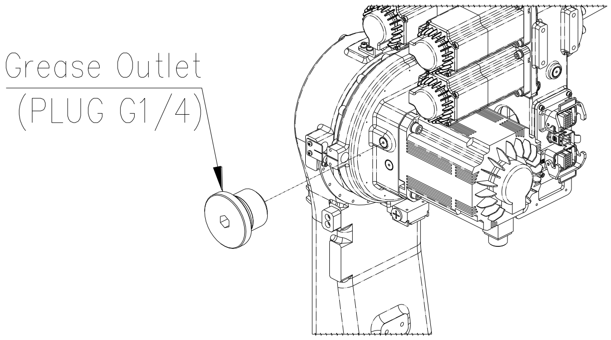
(1) Attach a grease receiver or a hose to the grease outlet to prevent contamination from discharged grease.

(2) Operate it within a range without surrounding and interference under the following conditions.
① Operation angle: 90° or more
② Operation speed: 50%
③ Operation time: 1.5 hours or more
④ Work so that the injected amount and the discharged amount are the same. If the discharged amount is less, the residual amount needs to be discharged through the inlet.

(3) Wipe the outlet port with a cloth and attach the plug.

5.1.3. V-Axis Reducer





Attention

If grease is added without removing the outlet plug, it cause damage to the seal of reducer and grease will go inside the motor and may damage it. It is absolutely necessary to remove the plug.

- **Grease Replacement**

(1) Prepare a grease nipple A-PT1/4 and then make the R2-Axis 0° degree.
(V:0° -Floor Type, V:-90° -Shelf Type)

(2) Remove the plug G1/4 of the grease inlet, and fasten the grease nipple A-PT1/4.

(3) Remove the plug G1/4 of the grease outlet.

(4) Inject the grease into the grease inlet using a grease gun.

- ✓ **Grease type : VIGO GREASE RE0**
- ✓ **Amount of grease : 889cc (800g)**

- ✓ **Grease type : Eureka 114 No.0**
- ✓ **Amount of grease : 889cc (746g)**

(5) The grease replacement is complete when new grease appears in the outlet port. The new grease can be distinguished from the old one by color.

(6) Move the H-Axis for a few minutes to eject the old grease and then add grease until the new grease appears in the outlet port.

(7) Discharge excessively fueled grease and residual pressure. (Refer to the discharge procedure below.)

(8) Remove the grease nipple of the inlet and assemble the inlet plug.

■ Injecting grease after replacing the reducer

(1) Prepare the grease nipple A-PT1/4, and then set the V-axis arm horizontally.
(V:0° -Floor Type, V:-90° -Shelf Type)

(2) Remove the plug G1/4 of the grease inlet, and fasten the grease nipple A-PT1/4.

(3) Remove the plug G1/4 of the grease outlet.

(4) Inject the grease into the grease inlet using a grease gun.

✓ **Grease type : VIGO GREASE RE0**
✓ **Amount of grease : 1,111cc (1.000g)**

✓ **Grease type : Eureka 114 No.0**
✓ **Amount of grease : 1,111cc (933g)**

(5) The grease replacement is complete when new grease appears in the outlet port.

(6) Discharge excessively fueled grease and residual pressure. (Refer to the discharge procedure below.)

(7) Remove the grease nipple of the inlet and assemble the inlet plug.

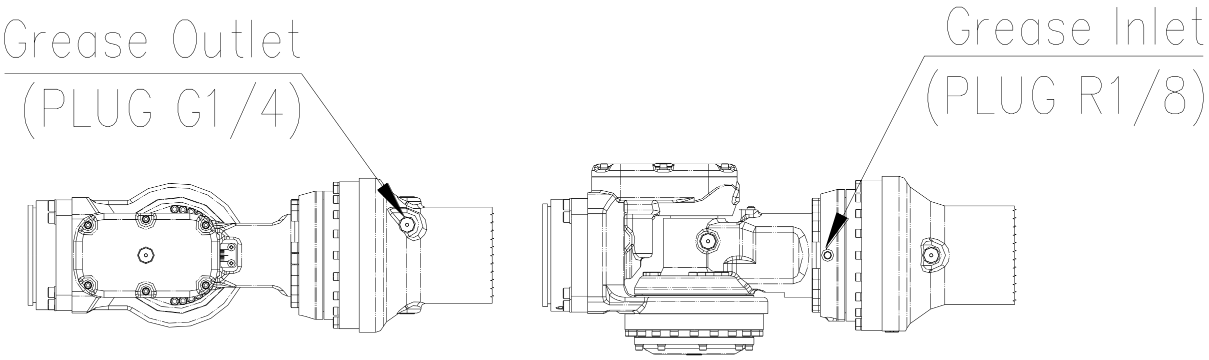
■ Procedure in discharging excessively fueled grease and residual pressure after grease replacement and injection

(1) Attach a grease receiver or a hose to the grease outlet to prevent contamination from discharged grease.

(2) Operate it within a range without surrounding and interference under the following conditions.
① Operation angle: 70° or more
② Operation speed: 50%
③ Operation time: 1.5 hours or more
④ Work so that the injected amount and the discharged amount are the same. If the discharged amount is less, the residual amount needs to be discharged through the inlet.

(3) Wipe the outlet port with a cloth and attach the plug.

5.1.4. R2-Axis Reducer (HH050T - Grease not injected into R2 axis)



Attention

Do not inject excessive grease. The excessive grease would cause an abnormal operation.

- **Grease Replacement**

(1) Prepare a grease nipple A-PT1/8 and then make the R2-Axis 0° degree.

(2) Remove the plug R1/8 of the grease inlet, and fasten the grease nipple A-PT1/8.

(3) Remove the plug G1/4 of the grease outlet.

(4) Inject the grease into the grease inlet using a grease gun.

✓ Grease type : VIGO GREASE RE0
✓ Amount of grease : 586cc(528g)

✓ Grease type : Eureka 114 No.0
✓ Amount of grease : 586cc(493g)

(5) The grease replacement is complete when new grease appears in the outlet port.
The new grease can be distinguished from the old one by color.

(6) Move the R2-Axis for a few minutes to eject the old grease and then add grease until the new grease appears in the outlet port.

(7) Discharge excessively fueled grease and residual pressure. (Refer to the discharge procedure below.)

(8) Remove the grease nipple of the inlet and assemble the inlet plug.

- Injecting grease after replacing the reducer

  (1) Prepare a grease nipple A-PT1/8 and then make the R2-Axis 0° degree.

  (2) Remove the plug R1/8 of the grease inlet, and fasten the grease nipple A-PT1/8.

  (3) Remove the grease outlet plug.

  (4) Inject the grease into the grease inlet using a grease gun.

✓ **Grease type : VIGO GREASE RE0** ✓ **Amount of grease : 733cc (660g)**	✓ **Grease type : Eureka 114 No.0** ✓ **Amount of grease : 733cc (616g)**

  (5) The grease replacement is complete when new grease appears in the outlet port.

  (6) Discharge excessively fueled grease and residual pressure. (Refer to the discharge procedure below.)

  (7) Remove the grease nipple of the inlet and assemble the inlet plug.

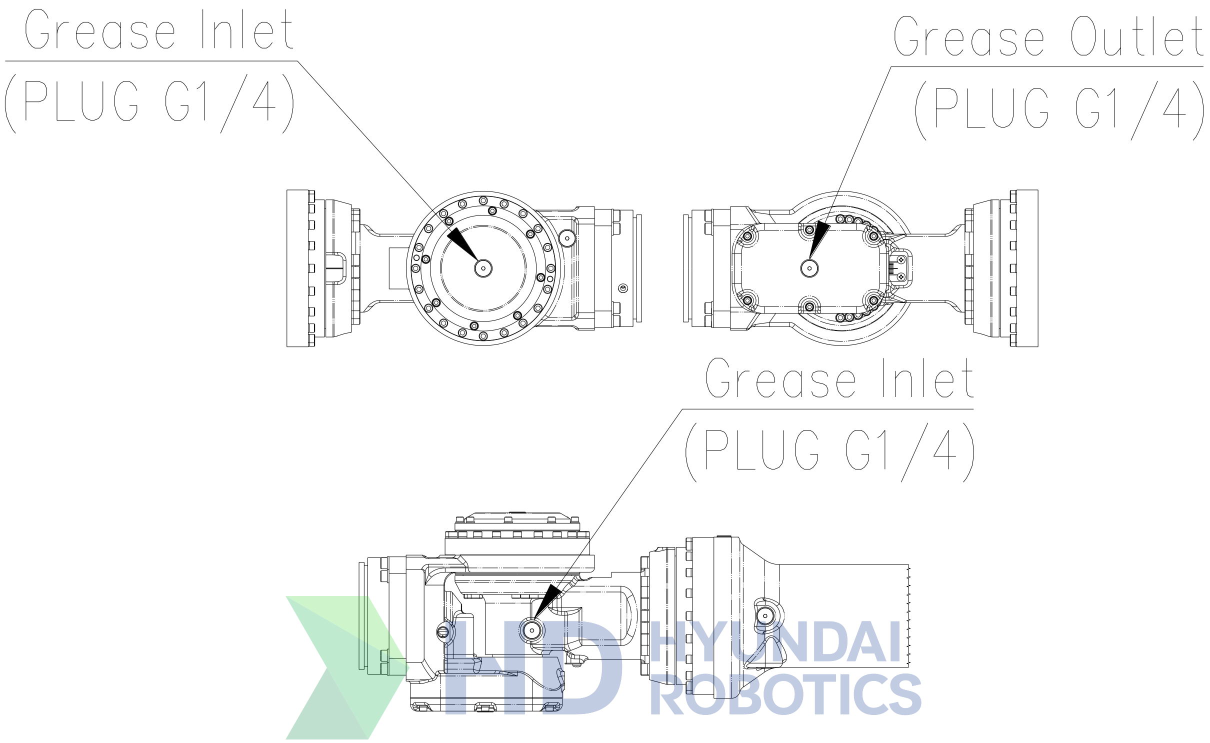
- Procedure in discharging excessively fueled grease and residual pressure after grease replacement and injection

  (1) Attach a grease receiver or a hose to the grease outlet to prevent contamination from discharged grease.

  (2) Operate it within a range without surrounding and interference under the following conditions.
    ① Operation angle: 60° or more
    ② Operation speed: 100%
    ③ Operation time: 1.5 hours or more
    ④ Work so that the injected amount and the discharged amount are the same. If the discharged amount is less, the residual amount needs to be discharged through the inlet.

  (3) Wipe the outlet port with a cloth and attach the plug.

5.1.5. B-Axis Reducer



Attention

Do not inject excessive grease. The excessive grease would cause an abnormal operation.

- Grease Replacement

(1) Prepare a grease nipple (A-PT1/4) and then make the R2, B-Axis 0° degree.

(2) Remove the plug G1/4 of the grease inlet, and fasten the grease nipple A-PT1/4.

(3) Remove the plug G1/4 of the grease outlet.

(4) Inject the grease into the grease inlet using a grease gun.

✓ Grease type : VIGO GREASE RE0
✓ Amount of grease : 205cc (184g)

✓ Grease type : Eureka 114 No.0
✓ Amount of grease : 205cc (172g)

(5) The grease replacement is complete when new grease appears in the outlet port.
The new grease can be distinguished from the old one by color.

(6) Move the R2-Axis for a few minutes to eject the old grease and then add grease until the new grease appears in the outlet port.

(7) Discharge excessively fueled grease and residual pressure. (Refer to the discharge procedure below.)

(8) Remove the grease nipple of the inlet and assemble the inlet plug.

- ■ Injecting grease after replacing the reducer

(1) Prepare a grease nipple (A-PT1/4) and then make the R2, B and R1-Axis 0° degree.

(2) Remove the plug G1/4 of the grease inlet, and fasten the grease nipple A-PT1/4.

(3) Remove the plug G1/4 of the grease outlet.

(4) Inject the grease into the grease inlet using a grease gun.

✓ **Grease type : VIGO GREASE RE0** ✓ **Amount of grease : 256cc (230g)**	✓ **Grease type : Eureka 114 No.0** ✓ **Amount of grease : 256cc (215g)**

(5) The grease replacement is complete when new grease appears in the outlet port.

(6) Discharge excessively fueled grease and residual pressure. (Refer to the discharge procedure below.)

(7) Remove the grease nipple of the inlet and assemble the inlet plug.

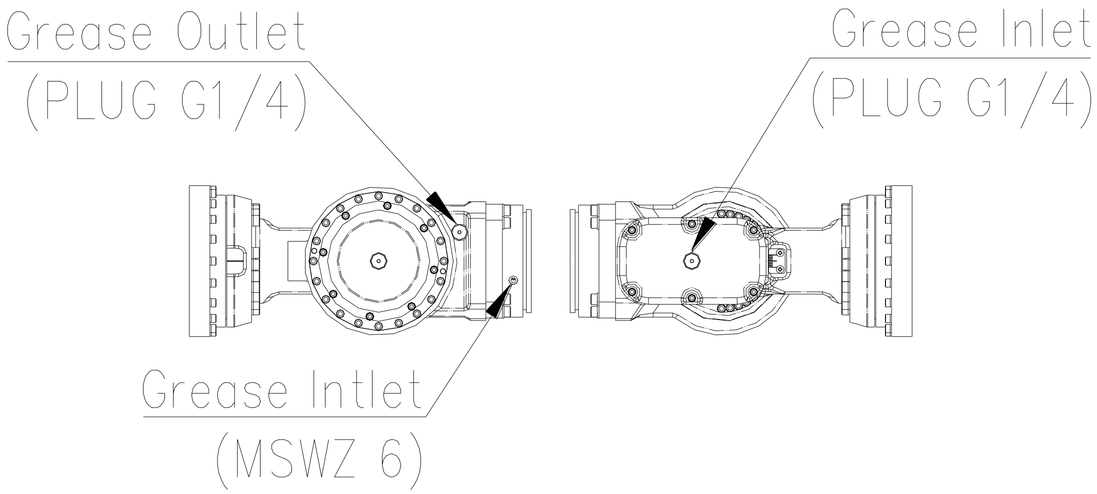
- ■ Procedure in discharging excessively fueled grease and residual pressure after grease replacement and injection

(1) Attach a grease receiver or a hose to the grease outlet to prevent contamination from discharged grease.

(2) Operate it within a range without surrounding and interference under the following conditions.
① Operation angle: 60° or more
② Operation speed: 100%
③ Operation time: Operation time: 1.5 hours or more
④ Work so that the injected amount and the discharged amount are the same. If the discharged amount is less, the residual amount needs to be discharged through the inlet.

(3) Wipe the outlet port with a cloth and attach the plug.

5.1.6. R1-Axis Reducer



Attention

Do not inject excessive grease. The excessive grease would cause an abnormal operation.

- Grease Replacement

(1) Prepare a grease nipple (A-PT1/4) and then make the R2, B and R1-Axis 0° degree.

(2) Remove the plug TR6X6 of the grease inlet, and fasten the grease nipple A-PT1/4.

(3) Remove the plug G1/4 of the grease outlet.

(4) Inject the grease into the grease inlet using a grease gun.

✓ **Grease type : VIGO GREASE RE0**
✓ **Amount of grease : 240cc (216g)**

✓ **Grease type : Eureka 114 No.0**
✓ **Amount of grease : 240cc (202g)**

(5) The grease replacement is complete when new grease appears in the outlet port. The new grease can be distinguished from the old one by color.

(6) Move the R2-Axis for a few minutes to eject the old grease and then add grease until the new grease appears in the outlet port.

(7) Discharge excessively fueled grease and residual pressure. (Refer to the discharge procedure below.)

(8) Remove the grease nipple of the inlet and assemble the inlet plug.

- Injecting grease after replacing the reducer

(1) Prepare a grease nipple (A-PT1/4) and then make the R2, B and R1-Axis 0° degree.

(2) Remove the plug TR6x6 of the grease inlet, and fasten the grease nipple A-PT1/4.

(3) Remove the grease outlet plug.

(4) Inject the grease into the grease inlet using a grease gun.

✓ **Grease type : VIGO GREASE RE0** ✓ **Amount of grease : 300cc (270g)**	✓ **Grease type : Eureka 114 No.0** ✓ **Amount of grease : 300cc (252g)**

(5) The grease replacement is complete when new grease appears in the outlet port.

(6) Discharge excessively fueled grease and residual pressure. (Refer to the discharge procedure below.)

(7) Remove the grease nipple of the inlet and assemble the inlet plug.

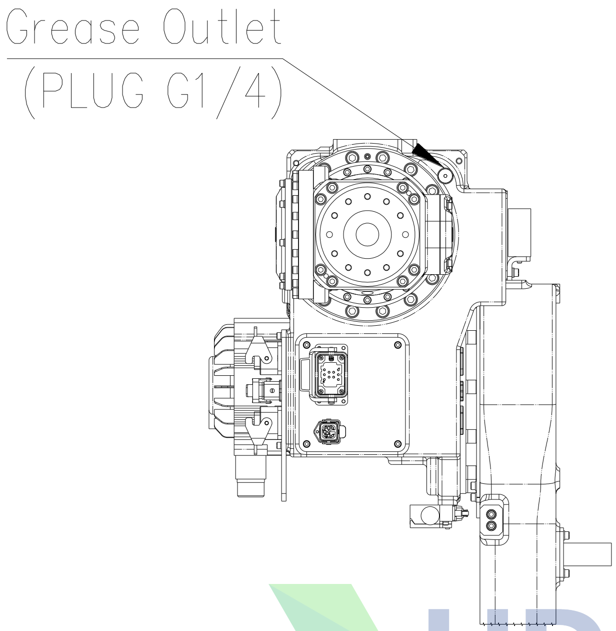
- Procedure in discharging excessively fueled grease and residual pressure after grease replacement and injection

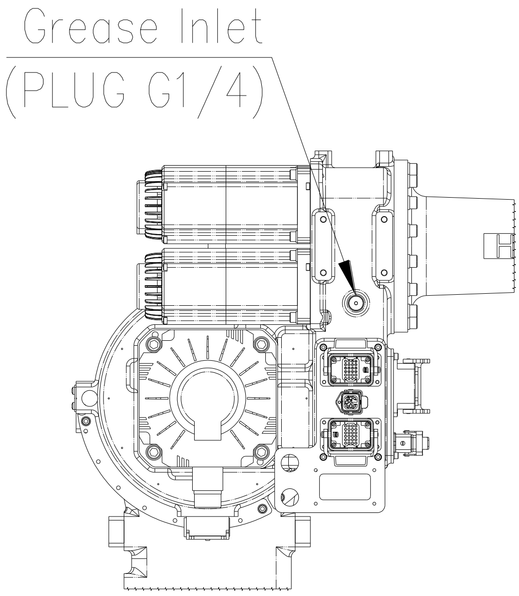
(1) Attach a grease receiver or a hose to the grease outlet to prevent contamination from discharged grease.

(2) Operate it within a range without surrounding and interference under the following conditions.
① Operation angle: 60° or more
② Operation speed: 100%
③ Operation time: 1.5 hours or more
④ Work so that the injected amount and the discharged amount are the same. If the discharged amount is less, the residual amount needs to be discharged through the inlet.

(3) Wipe the outlet port with a cloth and attach the plug.

5.1.7. Arm Frame - Gear Box


Grease Outlet
(PLUG G1/4)


Grease Inlet
(PLUG G1/4)

- Grease Replenishment

  (1) Remove the grease outlet plug.

  (2) Inject the grease into the grease inlet using a grease gun.

  - ✓ **Grease type : GADUS S2 V46 2**
  - ✓ **Amount of grease : 30cc**

  (3) Reinstall the grease plugs with seal tape.

5.2. Battery Replacement

The position data of each axis is preserved by the backup batteries. The batteries need to be replaced every two years. To replace batteries observe the following procedure.

(1) With the power of the control in on condition, press the emergency stop button.

Attention

Replacing the batteries with the power supply turned off causes all current position data to be lost. Therefore, zeroing will be required again.

(2) Separate the cover of the battery location by each axis.

(3) Remove the old battery.

(4) Insert the new battery. Pay attention to the direction.

- ✓ Battery Spec. : ER6V-T1 (AA) 3.6V
- ✓ Manufacturer : TOSHIBA

(5) Install the cover to its original location.

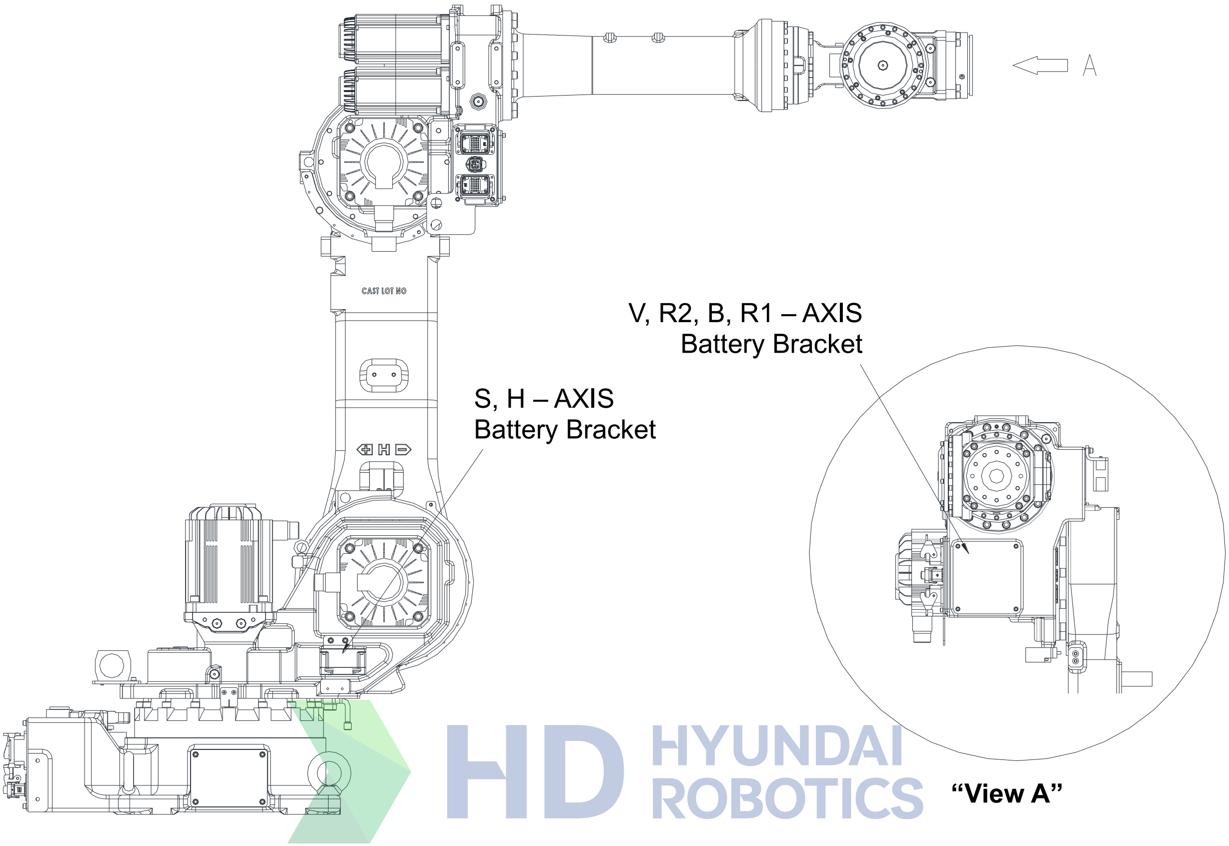

A
V, R2, B, R1 – AXIS
Battery Bracket
S, H – AXIS
Battery Bracket
CAST LOT NO
"View A"

Figure 5.1 Location of Battery Replacement

Attention

- ✓ Do not dispose the batteries. Dispose of the battery with industrial waste according to the laws and other rules in the country where the controller is installed.
- ✓ Do not recharge the batteries, otherwise batteries may result in exploding or overheating.
- ✓ Do not use any batteries other than the recommended one.
- ✓ Change the batteries only with the specified one.
- ✓ Do not short positive and negative terminals of battery.
- ✓ Do not expose batteries to high temperature or flame

5.2.1. Instructions for Battery Storage

(1) Do not keep the batteries at a high temperature and humidity. Keep it in the well-ventilating place without dew condensation.

(2) Keep it in a normal temperature, at relatively constant temperature(20±15℃) and at relative humidity of less than 70%.

(3) Check the battery storage every six months, and manage them with first-in-first-out.

5.3. Internal Wiring

Replacement cycle of internal wiring depends on follows.

- Continuous operation
- Operating speed
- Atmosphere/environment

Inspect on a regular basis, every three months and check any damage on the cables or cable protect spring. If any damage, replace it.

Replace the cable every 16,000 operating hours regardless of working condition.

Attention

- ✓ **As all the wires are flexible type, do not use any wires other than specified one.**
- ✓ **Wiring replacement must be done by unit.**
- ✓ **Do not use any Cable, protective spring, and Hose that have external damage as they may cause future problems.**
- ✓ **When purchasing robot cables, make inquiry of our service office about wiring type.**
- ✓ **Specify the length of wiring for connecting the robot with the controller.**

6

Troubleshooting

6.1. Troubleshooting Procedure

If a failure occurs during robot's operation, but it does not stem from the controller, it must be caused by damage on machine parts. The way to troubleshoot as quick and easy as possible should be to diagnose the problem. In addition, it is necessary to determine which parts cause the problem.

(1) Step 1: Which axis occurs the problem?
First of all, check which axis causes the malfunction. In case that it is hard to detect the problem, check the following possible mechanical defaults.

- Is there any parts making noise?
- Is there any parts generating an overheating?
- Is there any parts have a play or backlash?

(2) Step 2: Which parts have been damaged?
If the abnormal axes are determined, investigate which parts cause trouble. There could be many causes for one phenomenon. Refer to [Table 6-1] for the cause and phenomenon of the trouble.

(3) Step 3: Dealing with malfunction parts
If the malfunction parts are confirmed, conduct relevant repair procedure based on the chapter 『6.3 Diagnostics and Resolutions for Major Parts Failure』. Contact our service office if you have any difficulties in dealing with problems.

6.2. Trouble Symptoms and Possible Causes

As shown in [Table 6-1], there may be many parts as the cause of one phenomenon.
Refer to next page to determine which part is malfunction.

Table 6-1 Trouble phenomenon and cause

Defect parts Trouble phenomenon	Reducer	Brake	Motor	Encoder	Backlash	Grease
Overload [Note 1]	○	○	○			
Displacement	○		○	○		
Abnormal sound occurrence	○	○	○			○ [Note 5]
Noise in operation [Note 2]			○		○	
Staggering at stop [Note 3]			○	○		
Irregular twitching [Note 4]			○	○		
Abnormal deviation			○	○		
Free fall of an axis	○	○				
Overheating	○	○	○	○		○
Incorrect action and out of control movement			○	○		

[Note 1] Overload -------------------- Phenomenon occurring when a load exceeds the rated motor load. In specific, thermal relay of circuit protector is tripped.
[Note 2] Noise in operation -------- Phenomenon which occurs vibration on operation.
[Note 3] Staggering at stop -------- Phenomenon which gives oscillating motion when the robot stops.
[Note 4] Irregular twitching -------- Phenomenon which gives sporadic twitching when the robot is not in motion.
[Note 5] If there is noise from the greased part of reducer at reduced-speed operation, check the state closely for 1-2 days during operation. Generally, the noise will go away.
(The noise will go away if you run the axis at a high speed for 5-10 minutes).

The noise may be caused by following reasons.

1. Operation after greasing or replacing the reducer
2. Operation after long-term storage
3. Operation at a low speed
4. Operation at a low temperature

6.3. Diagnostics and Resolutions for Major Parts Failure

6.3.1. Reducer

Vibration and abnormal sound will be occurred when a reducer is damaged. In this case, it causes overload and abnormal deviation disturbing normal operation. Sometimes overheating may result. The robot may also become completely immovable, or a position offset error may occur.

[Main Axes (S, H, V)]

When turning [ON][OFF] the brake release switch of axis H and axis V, be sure to take necessary precautions to prevent the ARM from dropping, and then switch the brake release [ON][OFF]..

- Diagnostics

① Check out any vibration, abnormal sound or overheating of the reducer when the robot is in operation.
② Check out any play and abrasion in the reducer. And check if any abnormality is felt by hand when shaking 1st ARM back and forth with the brake release switch of axis S [ON].
③ Check if peripheral equipment has been contacted with the robot before the abnormality. (Damage may occur to the reducer due to the contacting impact.)

- Resolution

Replace the reducer. A chain block is needed to lift and hang the robot ARM. Contact our service office for any difficulties.

[Wrist Axes (R2, B, R1)]

When turning [ON][OFF] the brake release switch, be sure to take necessary precautions to prevent the ARM from dropping, and then switch the brake release [ON][OFF].

- Diagnostics

① Check out any vibration, abnormal sound, or overheating of the reducer when the robot is in operation.
② Check out any play in the reducer by shaking the End Effector (such as spot gun and hand devices, etc.) back and forth.
③ Turn motor off, with the brake release switch [ON], and check that the axis can be rotated by hand. If not, the reducer is in bad condition.
④ Check if peripheral equipment has been contacted with the robot before the abnormality. (Damage may occur to the reducer due to the contacting impact)

- Resolution

① Replace the reducer.

② Replace the entire wrist section.
(The replacement of entire wrist should be a quick and reliable resolution as it takes time and necessary equipment for reducer replacement)

6.3.2. Brakes

In case of brakes failure, each axis possibly drops with the motors [OFF]. Or, in reverse, brakes possibly operate even with the motors [ON]. The latter causes overload and noise.

⚠ When intending to operate the entire robot without the motors [ON], operate it with the brake release switch [ON]. Before turning the switch [ON], take necessary precautions to prevent the ARM from dropping as the robot ARM will drop by gravity.

- Diagnostics

  Check if the brake can be heard in operation, by turning the brake release switch [ON] [OFF] alternately with the motors [OFF]. If not heard, the brake cable may be broken. (When operating the brake release switch [ON] [OFF], be careful of ARM dropping. The brake release switch is located on the panel in the controller cabinet door.)

- Resolution

  If cables turn out to be good condition, replace the motor.

6.3.3. Motor

Motor failure causes abnormal operation of robot such as staggering at stop, irregular twitching and noise in operation. Besides, it may cause overheating and abnormal sound.

Check the reducer and fulcrum bearing as well in order to determine which part causes the abnormality. It is because that similar phenomenon is observed when the reducer is damaged.

- Diagnostics

  Check for overheating and abnormal sound. .

- Resolution

  Replace the motor.

6.3.4. Encoder

Position offset, malfunction, and out of control movement as well as staggering at stop, irregular twitching may occur when the Encoder is in bad condition. This case has nothing to do with such phenomena as mechanical abnormal sound, overheating, and vibration

- **Diagnostics**

  ① Check for any encoder data failure.
  ② Use reference pins and blocks to check the positional data is correct at pin position.
  ③ Check for any irregular variations in the encoder data when moving each robot axis.
  ④ Replace the servo amp board, BD542 to check errors.

- **Resolution**

  ① If cabling turns out to be in good condition without any damage, replace the encoder.
  ② If there is no error after replacing the servo amp board BD542, replace the servo amp board.

6.4. Motor Replacement

Warning:

This robot has a brake installed on the motor to maintain the position of the arm and when the motor is disassembled, the arm will fall. To prevent this, hang the arm with the crane or insert a fixating pin to keep the 1st and 2nd arms fixed.

When touching the motor immediately after the robot stops, check the temperature of the motor. The weights of the motor and reducer are as follows. When transporting the motor, be careful.

Axis	S	H	V	R2	B	R1
Weight(kg)	27.2	27.2	27.2	8.2	8.2	8.2
Weight(kg) HH050T	27.2	27.2	27.2	-	8.2	8.2

Warning:

In this work, there is a part performed with the motor [ON]. Therefore, perform the work in pairs. An observer must always be ready to activate an emergency stop. The other performs the work quickly and carefully. An escape route should be determined before starting work.

6.4.1. Necessary Tools and Parts

Table 6-2 Necessary Tools

Tool Name	Axis Name	Part No.(Model)	Remark
Torque wrench (Prepared by user)	S, H, V	M12 Torque wrench(Lock type)	Use torque wrench and extension on the market
	R2, B, R1	M8 Torque wrench (Lock type) M5 Torque wrench (Lock type)	

Table 6-3 Necessary Parts

Part Name	Axis Name	Use or not	Part No.(Model)
Dropping preventive bolt (Optional)	Axis H, V	○	M20×250(Standard)
	Wrist (R2, B, R1)	-	-

(When overhauling the robot, a leveling bulb can be used to focus on the precise starting point. To focus on the precise starting point, please contact us.)

6.4.2. How to Replace Motor

Warning

Because a brake for maintaining the posture of the arm is embedded in the motor of the robot, the arm will fall if the motor is separated. Thus, to prevent falling, there must be safety measures such as hanging the arm using a crane and then inserting fixing bolts to fix arm 1 and arm 2.

(1) Put the controller into TEACH mode and select motors [ON]. When the motors [On] state cannot be obtained, check the respective ARM is firmly fixed while supporting it to prevent dropping. And then begin at step No.4.

(2) The axis requiring motor replacement takes basic posture.

(3) In case of main axes(S, H, V): Refer to [Figure 6.1] and [Figure 6.2].
Insert a supporting bolt to prevent ARM dropping.
In case of wrist axes (R2, B, R1): Set the origin by using SCALES.

(4) Turn the main power [OFF] with the controller power [OFF].

(5) Disconnect the connector from the motor.

(6) Remove attachment bolts of motor and pull the motor out of robot. When removing motors of axis H or V, be sure not to damage the lip of oil seal due to the gear attached to the axis of motor.

(7) Detach the gear from the motor shaft.
Be careful to avoid excessive impact to the motor.

(8) Assemble the gear after lightly applying grease to the shaft.
The bolt used to attach the gear to the shaft should be cleaned and removed of grease before using. Apply Loctite 243 to the screw part of the bolt, and then tighten it using a torque wrench in a regular torque. , Besides, slowly tighten the bolt in a symmetrical order.

(9) Assemble the motor on the robot after applying a small amount of grease to the lip of oil seal and applying a moderate amount of grease to the teeth of gear. When assembly the main axis motor, be sure not to damage the lip of oil seal.

(10) Connect the connector to the motor.

(11) When replacing the axis H or V, replenish the grease as the amount as it lost.

(12) Reset the encoder of the axis whose motor is replaced.

Warning

Before encoder correction, check motor connections, with motors [ON], while pressing the Enable switch for 2~3 seconds.

(13) Perform the encoder calibration about the axis whose motor is replaced. Refer to the chapter [Encoder Calibration] in the controller operating manual.

(14) Remove M20 bolt, a supporting bolt for preventing possible dropping of axis H.

(15) Confirm that there is no error in robot's motion.

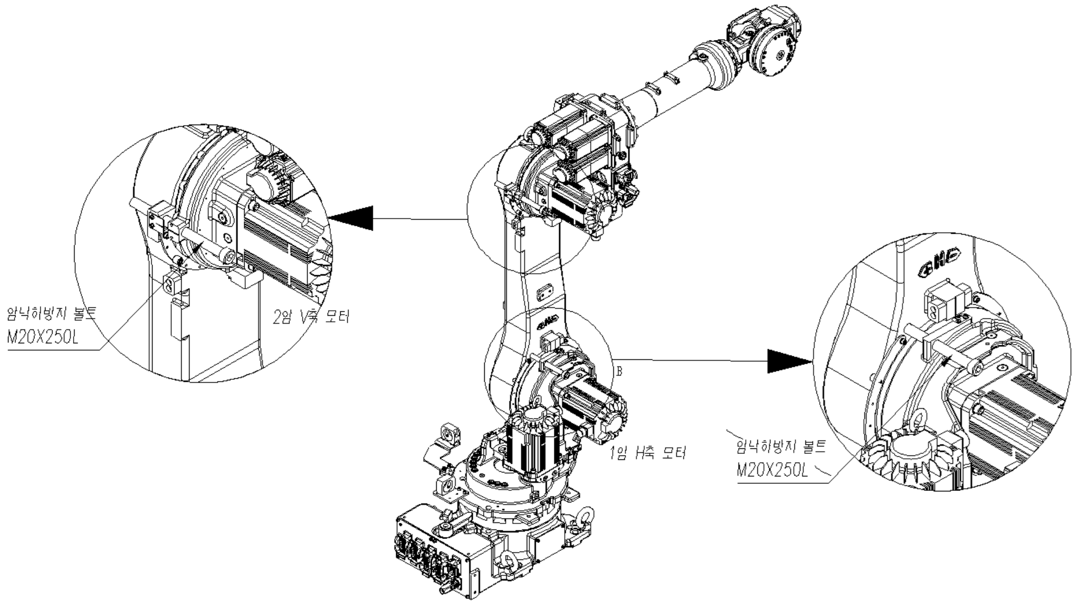

암낙히방지 볼트
M20X250L
2암 V축 모터
B
1암 H축 모터
암낙하방지 볼트
M20X250L

Figure 6.1 Insertion position of Arm 1 (H axis) and Arm 2 (V axis) fixing bolt

6.4.2.1. Motor for main axis (Hi5)

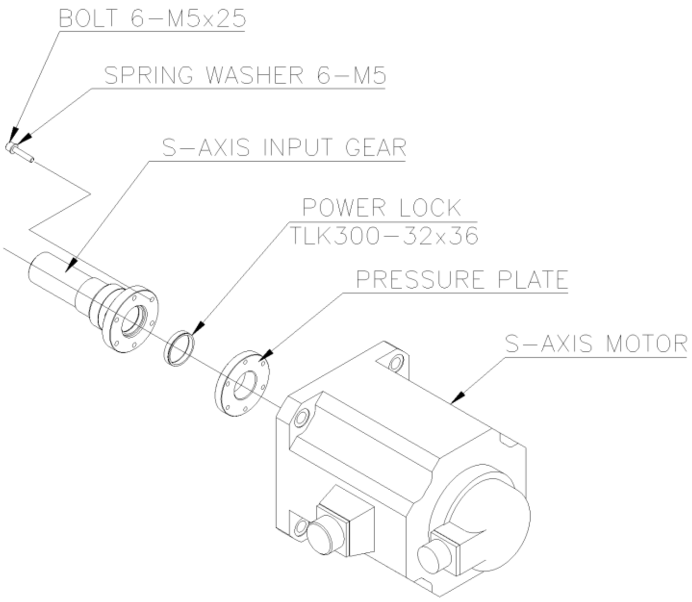

BOLT 6-M5x25
SPRING WASHER 6-M5
S-AXIS INPUT GEAR
POWER LOCK
TLK300-32x36
PRESSURE PLATE
S-AXIS MOTOR

Figure 6.2 Axis S motor assembly

Caution

If the entire upper arm is not completely attached to the mechanical stopper in a gravitational direction when replacing the motor of the V-axis, the upper arm may rotate when the motor is being dismantled.

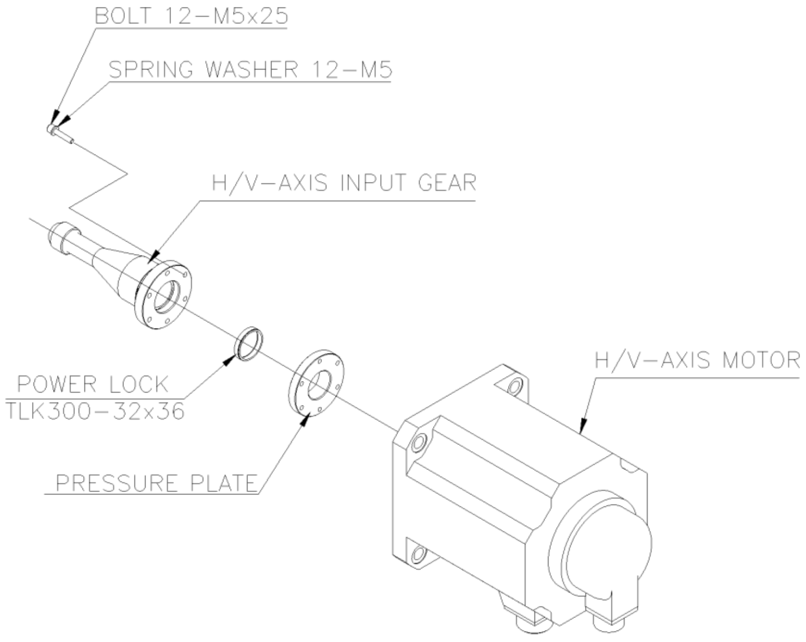

BOLT 12-M5x25
SPRING WASHER 12-M5
H/V-AXIS INPUT GEAR
POWER LOCK
TLK300-32x36
PRESSURE PLATE
H/V-AXIS MOTOR

Figure 6.3 Axis H&V Motor Assembly

6.4.2.2. Motor for main axis (Hi5a)

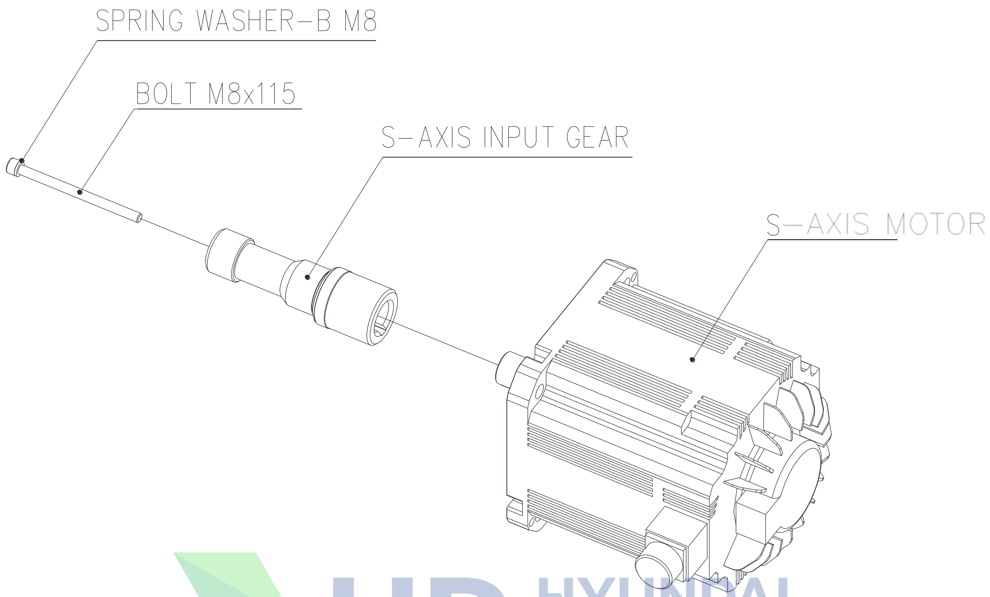

SPRING WASHER-B M8
BOLT M8x115
S-AXIS INPUT GEAR
S-AXIS MOTOR

Figure 6.4 Axis S motor assembly

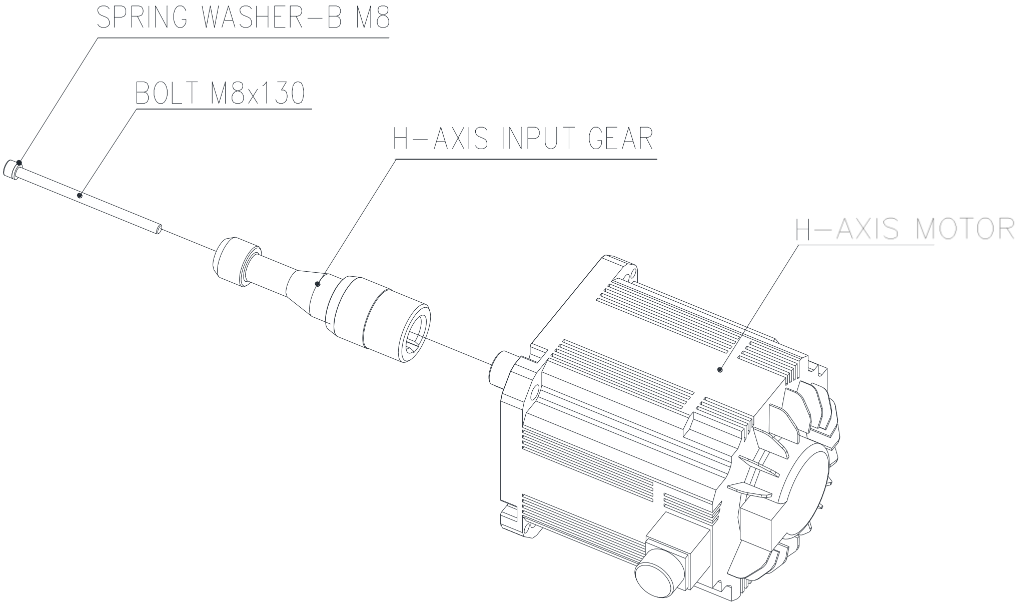

SPRING WASHER-B M8
BOLT M8x130
H-AXIS INPUT GEAR
H-AXIS MOTOR

Figure 6.5 Axis H motor assembly

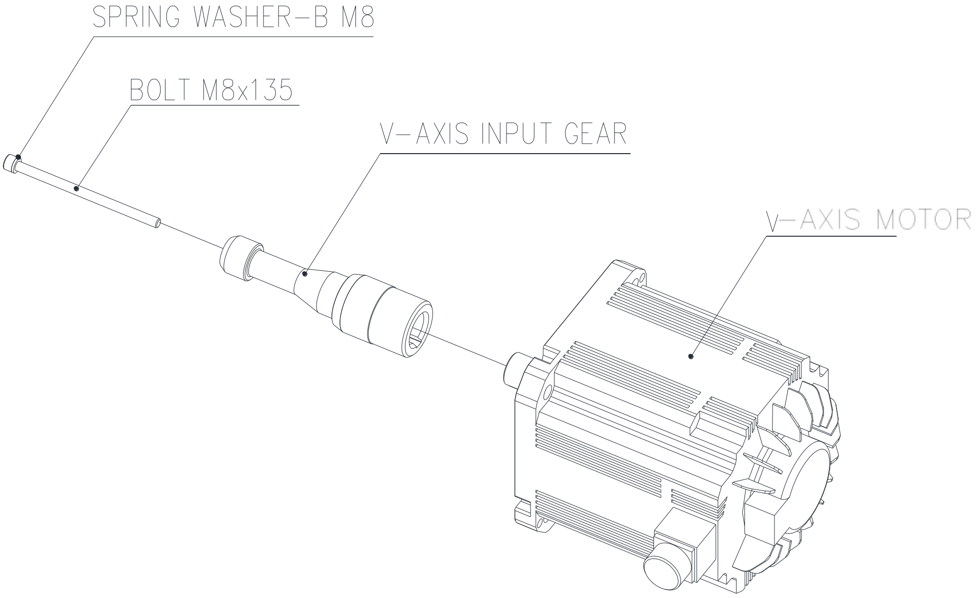

SPRING WASHER-B M8
BOLT M8x135
V-AXIS INPUT GEAR
V-AXIS MOTOR

Figure 6.6 Axis V motor assembly

6.4.2.3. Motor for wrist axis (Hi5/Hi5a)

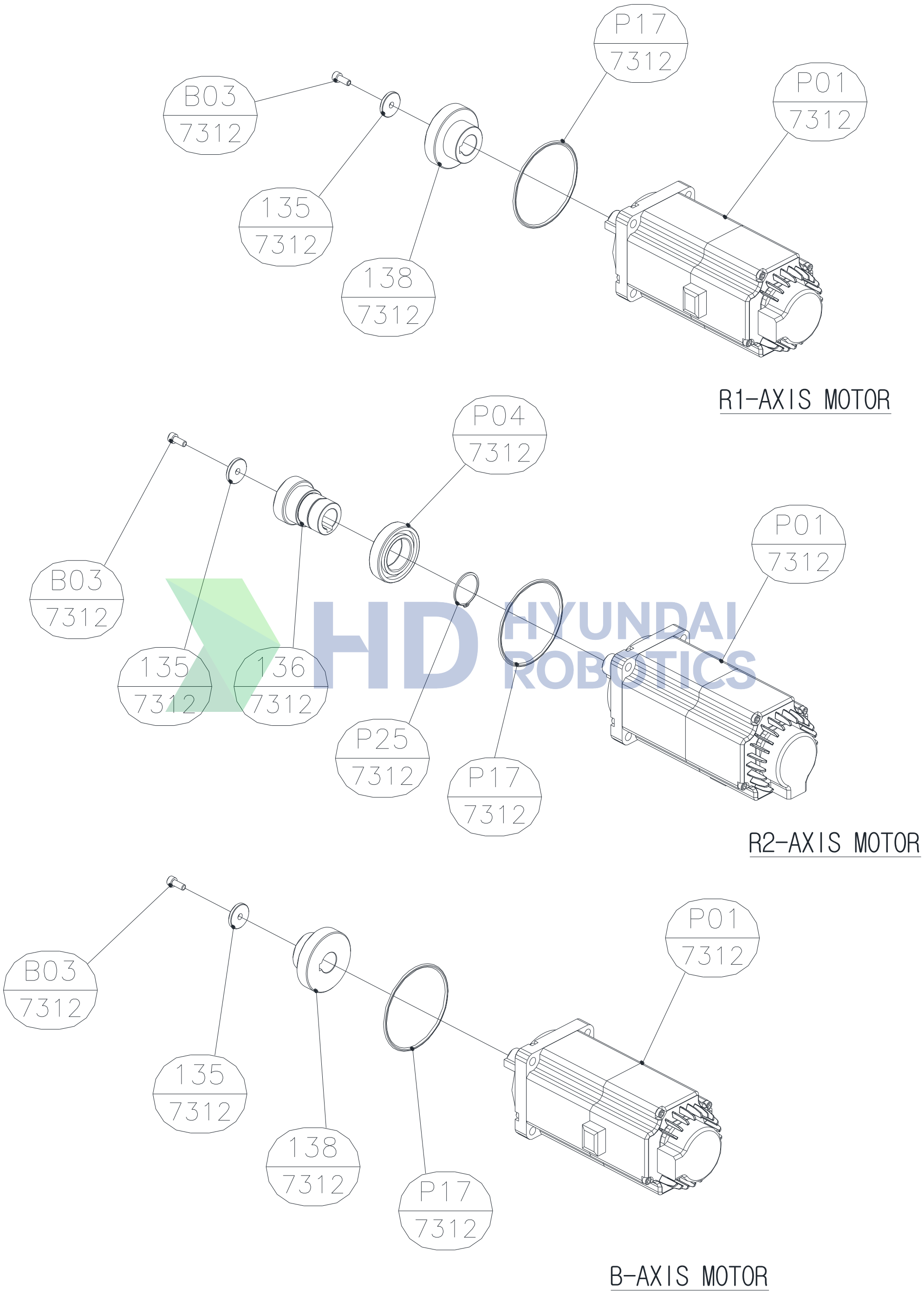

P17
7312
P01
7312
B03
7312
135
7312
138
7312
R1-AXIS MOTOR
P04
7312
P01
7312
B03
7312
135
7312
136
7312
P25
7312
P17
7312
R2-AXIS MOTOR
P01
7312
B03
7312
135
7312
138
7312
P17
7312
B-AXIS MOTOR

Figure 6.7 Wrist Axis Motor Assembly - R2 axis motor excluded (HH050T)

6.5. Encoder Zero Setting

It is necessary to reset the origin when encoder data has been corrupted due to some problems and when the motor is replaced.

A scale is used to decide for the location of the reference position of each axis of the robot.
When the user replaces the motor, set the encoder using the scale to set the zero point of each axis.

⚠ **Warning**

In this work, there is a part performing in the state of motor [ON]. Therefore, this work must be performed in pairs. One must always be ready to activate an emergency stop. The other must perform the work quickly but carefully.
An escape route should be determined before starting work.

6.5.1. Zero Setting

(1) Set the controller to teaching mode and set the robot to standby [ON] condition. If the robot cannot be set to standby [ON] condition due to issues, use the brake cancel switch to set the reference location of the robot.

(2) Move respective axes to the basic posture, then set them by the scale mark.

(3) Reset the Encoder. Refer to 『6.5.2 Encoder Reset』 for the method of encoder reset.

(4) Correct the encoder. Refer to 『Controller Operation Manual』.

(5) Confirm that there is no problem in robot motion.

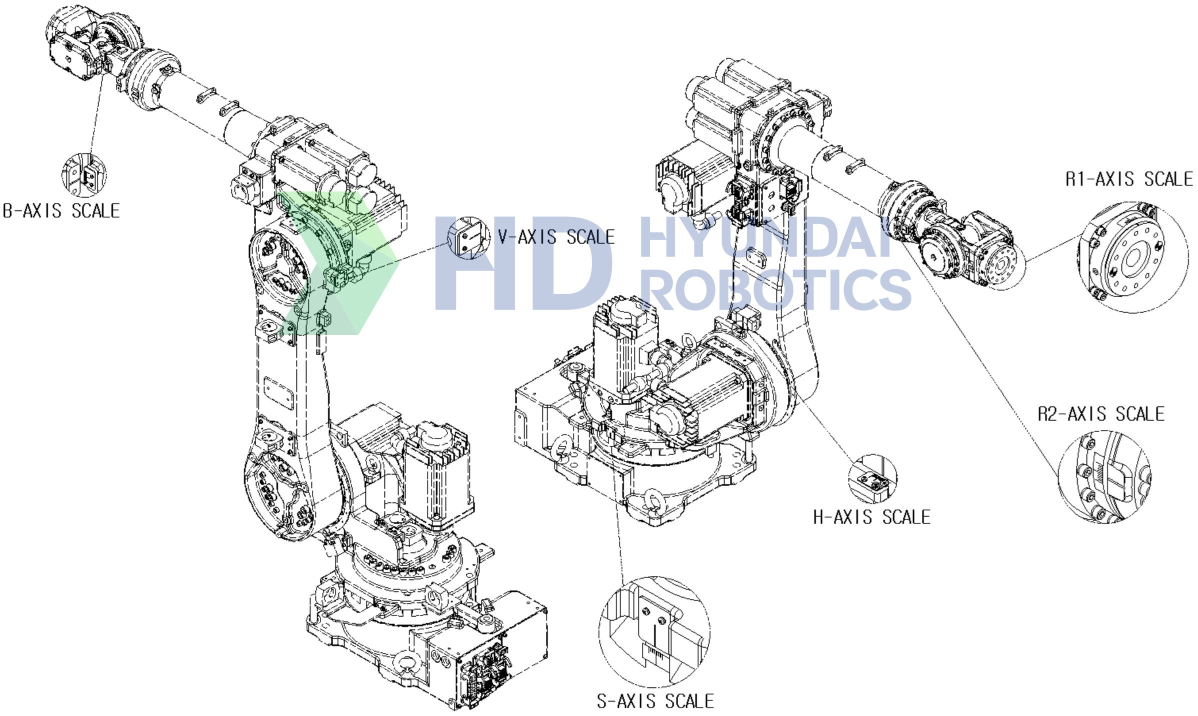
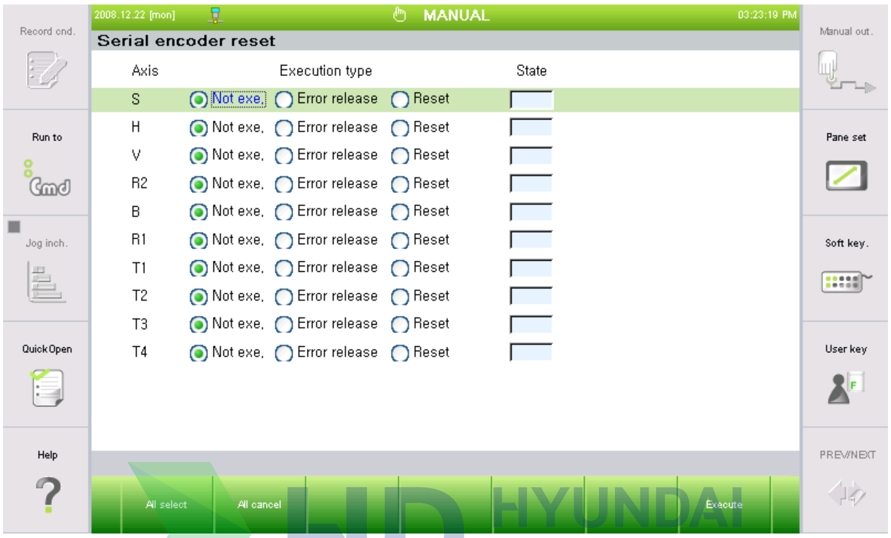

B-AXIS SCALE
V-AXIS SCALE
R1-AXIS SCALE
R2-AXIS SCALE
H-AXIS SCALE
S-AXIS SCALE

Figure 6.8 Method of Zero Setting [YS080/YS100A/HH050/HH030L] - [HH050T - R2 axis excluded]

6.5.2. Encoder Reset

(1) Turn off the motor.

(2) Open the serial encoder reset window. (『[F2]: System』 → 『5: Initialize』 → 『4: Serial encoder reset』)


2008.12.22 [mon]
MANUAL
03:23:19 PM
Record cmd.
Run to
Cmd
Jog inch.
Quick Open
Help
Manual out.
Pane set
Soft key.
User key
PREV/NEXT
All select
All cancel
Execute

Serial encoder reset

Axis	Execution type			State
S	● Not exe.	○ Error release	○ Reset	
H	● Not exe.	○ Error release	○ Reset	
V	● Not exe.	○ Error release	○ Reset	
R2	● Not exe.	○ Error release	○ Reset	
B	● Not exe.	○ Error release	○ Reset	
R1	● Not exe.	○ Error release	○ Reset	
T1	● Not exe.	○ Error release	○ Reset	
T2	● Not exe.	○ Error release	○ Reset	
T3	● Not exe.	○ Error release	○ Reset	
T4	● Not exe.	○ Error release	○ Reset	

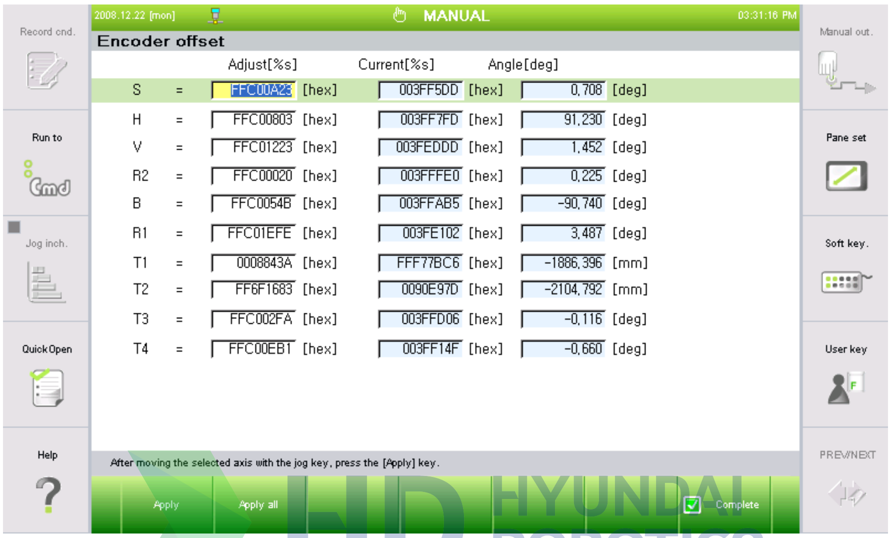
(3) Use keys like [↓], [↑], [SHIFT]+[←][→] to move to a desirable axis, then press the [Execute] key.

(4) After the encoder is reset, please make sure the controller power is turned on.

6.5.3. Encoder offset and Selection

- It is necessary to compensate encoder data for the basic position of each axis.
- Refer to 『Encoder offset』 in the Controller Manual for details.

[Encoder offset Screen]


2008.12.22 [mon]
MANUAL
03:31:16 PM
Record cmd.
Run to
Cmd
Jog inch.
Quick Open
Help
Manual out.
Pane set
Soft key.
User key
PREV/NEXT
Apply
Apply all
Complete

Encoder offset

		Adjust[%s]		Current[%s]		Angle[deg]	
S	=	FFC00A23	[hex]	003FF5DD	[hex]	0,708	[deg]
H	=	FFC00803	[hex]	003FF7FD	[hex]	91,230	[deg]
V	=	FFC01223	[hex]	003FEDDD	[hex]	1,452	[deg]
R2	=	FFC00020	[hex]	003FFFE0	[hex]	0,225	[deg]
B	=	FFC0054B	[hex]	003FFAB5	[hex]	-90,740	[deg]
R1	=	FFC01EFE	[hex]	003FE102	[hex]	3,487	[deg]
T1	=	0008843A	[hex]	FFF77BC6	[hex]	-1886,396	[mm]
T2	=	FF6F1683	[hex]	0090E97D	[hex]	-2104,792	[mm]
T3	=	FFC002FA	[hex]	003FFD06	[hex]	-0,116	[deg]
T4	=	FFC00EB1	[hex]	003FF14F	[hex]	-0,660	[deg]

After moving the selected axis with the jog key, press the [Apply] key.

(1) Select the axis, move the axis to a standard position using the [Axis operation] key, and press the 『[F1]: Apply』 key.

(2) Place the robot’s entire axis as the standard position using the [Axis operation] key and press the 『[F2]: Apply all』 key to carry out encoder offset correction for the entire axis.

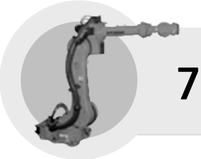
(3) To save the set data, press the 『[F7]: Complete』 key. The [ESC] key will prevent the changes being saved.

Warning

In case of encoder DATA compensation after replacing motor, check if the motor power is on with the power 『ON』.

7

Recommended Spare Parts



The recommended spare parts for robot are as follows. Please check robot serial number and manufacturing date when purchasing, and contact our service office.

[Category]
A : Regular maintenance parts(what is replaced regularly)
B : Essential spare parts (what is of high frequency)
C : Essential component parts
D : Machine parts

Table 7-1 Spare Parts List I

Category	Robot Applied	PLATE No.	Product Name and Specification	Quantity	Remark
A	HH030L HH050/HH050T YS080/YS100A	R7900004400	VIGO GREASE (1CAN=16KG)	1	Common
A	HH030L HH050/HH050T YS080/YS100A	R7900054780	GADUS GREASE (1CAN=15KG)	1	Common
A	HH030L HH050/HH050T YS080/YS100A	R1001-6202-P2	Encoder Battery	6	Common
B	HH030L HH050/HH050T YS080/YS100A	R3135-7112-P01 R3123-7112-P01 R3120-7112-P01	MOTOR	1	S, H and V-axis Common
B	HH030L HH050 YS080/YS100A	R3135-7312-P01 R3123-7312-P01 R3120-7312-P01	MOTOR	3	R2, B and R1-axis Common
B	HH050T	R3123-7312-P01 R3120-7312-P01	MOTOR	2	B and R1-axis Common
B	HH030L HH050/HH050T YS080/YS100A	R3135-7112-P02 R3123-7112-P02 R3120-7112-P02	REDUCER	1	S-Axis
B	HH030L HH050/HH050T YS080/YS100A	R3123-7212-P02	REDUCER	1	H-Axis
B	HH030L HH050/HH050T YS080/YS100A	R3135-7212-P03 R3120-7212-P03	REDUCER	1	H-Axis
B	HH030L HH050/HH050T YS080/YS100A	R3135-7212-P03 R3123-7212-P03 R3120-7212-P03	REDUCER	1	V-Axis
B	HH030L HH050/HH050T YS080/YS100A	R3135-7312-P02 R3123-7312-P02 R3120-7312-P02	REDUCER	1	R2-Axis
B	HH030L HH050/HH050T YS080/YS100A	R3135-7412-P01 R3123-7412-P01 R3120-7412-P01	REDUCER	1	B-Axis

Category	Robot Applied	PLATE No.	Product Name and Specification	Quantity	Remark
B	HH030L HH050/HH050T YS080/YS100A	R3135-7412-P02 R3123-7412-P02 R3120-7412-P02	REDUCER	1	R1-Axis
C	HH030L HH050/HH050T YS080/YS100A	R3135-7412-001 R3123-7412-001 R3120-7412-001	WRIST ASSY	1	WRIST ASSY
C	HH030L HH050/HH050T YS080/YS100A	R3135-7112-112 R3123-7112-112 R3120-7112-112	INPUT GEAR(S)	1	For S-axis Motor
C	HH030L HH050/HH050T YS080/YS100A	R3123-7212-112	INPUT GEAR(H)	1	For H-axis Motor
C	HH030L HH050/HH050T YS080/YS100A	R3135-7212-112 R3120-7212-112	INPUT GEAR(H)	1	For H-axis Motor
C	HH030L HH050/HH050T YS080/YS100A	R3135-7212-111 R3123-7212-111 R3120-7212-111	INPUT GEAR(V)	1	For V-axis Motor
C	HH030L HH050/HH050T YS080/YS100A	R3135-7312-136 R3123-7312-136 R3120-7312-136	R2 SPUR GEAR(INPUT)	1	For R2-axis Motor
C	HH030L HH050/HH050T YS080/YS100A	R3135-7312-138 R3123-7312-138 R3120-7312-138	R1 AND B SPUR GEAR(INPUT)	2	For B/R1-axis Motor
D	HH030L HH050/HH050T YS080/YS100A	R3135-7112-P03 R3123-7112-P03 R3120-7112-P03	BALL BEARING	2	For S-axis Motor
D	HH030L HH050/HH050T YS080/YS100A	R3135-7112-P04 R3123-7112-P04 R3120-7112-P04	OIL SEAL	1	For S-axis Motor
D	HH030L HH050/HH050T YS080/YS100A	R3135-7112-P08 R3123-7112-P08 R3120-7112-P08	O-RING	1	For S-axis Motor
D	HH030L HH050/HH050T YS080/YS100A	R3135-7112-P06 R3123-7112-P06 R3120-7112-P06	O-RING	1	For S-axis reducer (BASE BODY)
D	HH030L HH050/HH050T YS080/YS100A	R3135-7112-P13 R3123-7112-P13 R3120-7112-P13	O-RING	1	For S-axis reducer (LOWER FRAME)
D	HH030L HH050/HH050T YS080/YS100A	R3135-7212-P04 R3123-7212-P04 R3120-7212-P04	OIL SEAL	2	For H/V-axis INPUT GEAR
D	HH030L HH050/HH050T YS080/YS100A	R3135-7212-P06 R3123-7212-P06 R3120-7212-P06	O-RING	2	For H/V-axis Motor

Category	Robot Applied	PLATE No.	Product Name and Specification	Quantity	Remark
D	HH030L HH050/HH050T YS080/YS100A	R3135-7212-P07 R3123-7212-P07 R3120-7212-P07	O-RING	1	For H-axis reducer (LOWER FRAME)
D	HH030L HH050/HH050T YS080/YS100A	R3135-7212-P11 R3123-7212-P11 R3120-7212-P11	O-RING	1	For H-axis reducer (UPPER FRAME)
D	HH030L HH050/HH050T YS080/YS100A	R3135-7212-P10 R3123-7212-P10 R3120-7212-P10	O-RING	1	For V-axis reducer (UPPER FRAME)
D	HH030L HH050/HH050T YS080/YS100A	R3135-7212-P05 R3123-7212-P05 R3120-7212-P05	O-RING	1	For V-axis reducer (ARM FRAME)
D	HH030L HH050/HH050T YS080/YS100A	R3135-7312-P04 R3123-7312-P04 R3120-7312-P04	BALL BEARING	1	For R2-axis Motor
D	HH030L HH050/HH050T YS080/YS100A	R3135-7312-P17 R3123-7312-P17 R3120-7312-P17	O-RING	3	For R2, B and R1-axis Motor
D	HH030L HH050/HH050T YS080/YS100A	R3135-7312-P14 R3123-7312-P14 R3120-7312-P14	O-RING	1	For R2-axis reducer (ARM PIPE)
D	HH030L HH050/HH050T YS080/YS100A	R3135-7312-P15 R3123-7312-P15 R3120-7312-P15	O-RING	1	For R2-axis reducer (WRIST BODY)
D	HH030L HH050/HH050T YS080/YS100A	R3135-7412-P24 R3123-7412-P24 R3120-7412-P24	O-RING	1	For B-axis reducer
D	HH030L HH050/HH050T YS080/YS100A	R3135-7412-P23 R3123-7412-P23 R3120-7412-P23	O-RING	1	For R1-axis reducer

Table 7-2 Spare Parts List Ⅱ

Cate gory	Robot Applied	PLATE No.	Product Name and Specification	Quantity	Remark
D	HH030L HH050 YS080	R3135-7412-P17 R3123-7412-P17 R3120-7412-P17	TAPER BEARING	4	R1-Axis B/G(1)
D	HH030L HH050 YS080	R3135-7412-P12,P18 R3123-7412-P12,P18 R3120-7412-P12,P18	BALL BEARING	1	R1-Axis (B/G) SPLINE SHAFT
D	HH030L HH050 YS080	R3135-7312-P07 R3123-7312-P07 R3120-7312-P07	BALL BEARING	2	ARM FRAME – R1-Axis SHAFT/ R2-Axis SHAFT- B-Axis SHAFT
D	HH030L HH050 YS080	R3135-7312-P10 R3123-7312-P10 R3120-7312-P10	BALL BEARING	1	B-Axis SHAFT– R1-Axis SHAFT (GEAR BOX/B SPUR GEAR)
D	HH030L HH050 YS080	R3135-7312-P05 R3123-7312-P05 R3120-7312-P05	BALL BEARING	1	B-Axis SHAFT – R1-Axis SHAFT (CENTER)
D	HH030L HH050 YS080	R3135-7312-P06 R3123-7312-P06 R3120-7312-P06	BALL BEARING	2	B-Axis SHAFT – R1-Axis SHAFT (WRIST BODY)
D	HH030L HH050 YS080	R3135-7412-P14 R3123-7412-P14 R3120-7412-P14	BALL BEARING	1	R1-Axis SPLINE SHAFT(B/G)
D	HH030L HH050 YS080	R3135-7412-P13,P19 R3123-7412-P13,P19 R3120-7412-P13,P19	BALL BEARING	1	B-Axis GEAR SHAFT
D	HH030L HH050 YS080	R3135-7312-P08 R3123-7312-P08 R3120-7312-P08	BALL BEARING	1	R2-Axis SHAFT- B-Axis SHAFT (GEAR BOX/R2 SPUR GEAR)
D	HH030L HH050 YS080	R3135-7312-P09 R3123-7312-P09 R3120-7312-P09	BALL BEARING	1	ARM PIPE-R2-Axis SHAFT (ARM FRAME)
D	HH030L HH050 YS080	R3135-7312-P03 R3123-7312-P03 R3120-7312-P03	BALL BEARING	1	ARM PIPE-R2-Axis SHAFT (R2-Axis reducer)
D	HH030L HH050 YS080	R3135-7412-P16 R3123-7412-P16 R3120-7412-P16	BALL BEARING	1	R1-Axis MAIN BRG SHAFT
D	HH030L HH050 YS080	R3135-7312-P11 R3123-7312-P11 R3120-7312-P11	OIL SEAL	1	B-Axis SHAFT

Category	Robot Applied	PLATE No.	Product Name and Specification	Quantity	Remark
D	HH030L HH050 YS080	R3135-7312-P12 R3123-7312-P12 R3120-7312-P12	OIL SEAL	1	R2-Axis SHAFT
D	HH030L HH050 YS080	R3135-7312-P13 R3123-7312-P13 R3120-7312-P13	OIL SEAL	1	ARM PIPE
D	HH030L HH050 YS080	R3135-7412-P21 R3123-7412-P21 R3120-7412-P21	OIL SEAL	1	R1-Axis MAIN BRG SHAFT
D	HH030L HH050 YS080	R3135-7112-P05 R3123-7112-P05 R3120-7112-P05	OIL SEAL	1	S-Axis CABLE HOLLOW
D	HH030L HH050 YS080	R3135-7312-P16 R3123-7312-P16 R3120-7312-P16	O-RING	1	ARM PIPE-ARM FRAME
D	HH030L HH050 YS080	R3135-7412-P22 R3123-7412-P22 R3120-7412-P22	O-RING	1	R1-Axis MAIN BRG SHAFT
D	HH030L HH050 YS080	R3135-7112-P07 R3123-7112-P07 R3120-7112-P07	O-RING	1	S-Axis CABLE HOLLOW
D	HH030L HH050 YS080	R1001-6202-P1a	LIMIT SWITCH	1	Option (S-Axis)
D	HH030L HH050 YS080	R1001-6202-P1b	LIMIT SWITCH	2	Option (H/V-Axis)

8

Decommissioning

8.1. Material for each robot part

The robot is made up of several materials as shown in [Table 8-1]. Some of them should be properly arranged and sealed up to eliminate any bad influence on the human body or environment.

Table 8-1 Materials of each part

Parts	Materials
Battery	NiCad or Lithium
Wiring, Motor	Copper
Base body, Lower Frame, Upper Frame etc.	Cast Iron
Brakes, Motors	Samarium Cobalt (or Neodymium)
Wiring, Connectors	Plastic / Rubber
Reduction, Bearings	Oil / Grease
Wrist cover etc.	Aluminum alloy cast

9

Internal Wiring Diagram

Internal wiring is shown in a connection diagram per unit, and thus utilizes it to inspect and replace the wiring.

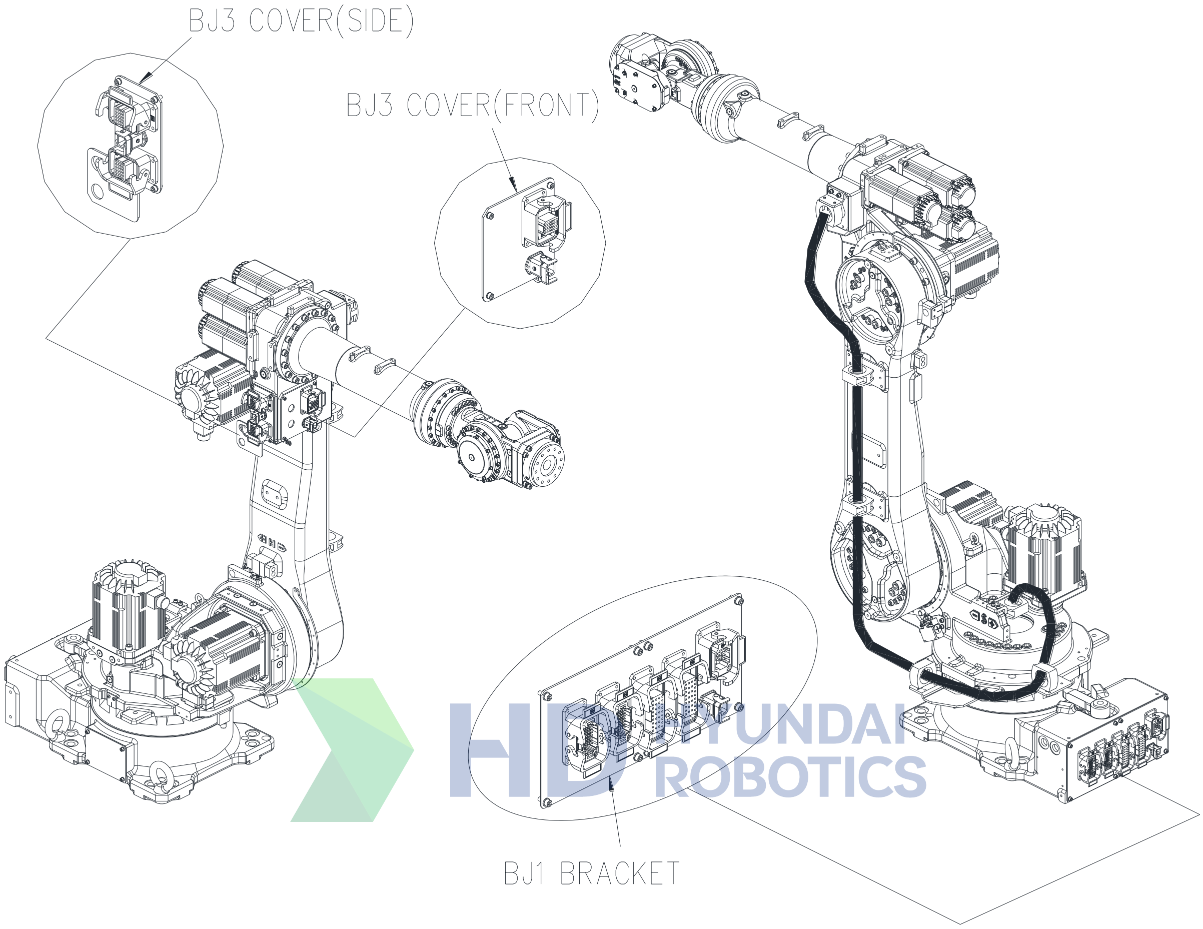

BJ3 COVER(SIDE)
BJ3 COVER(FRONT)
BJ1 BRACKET

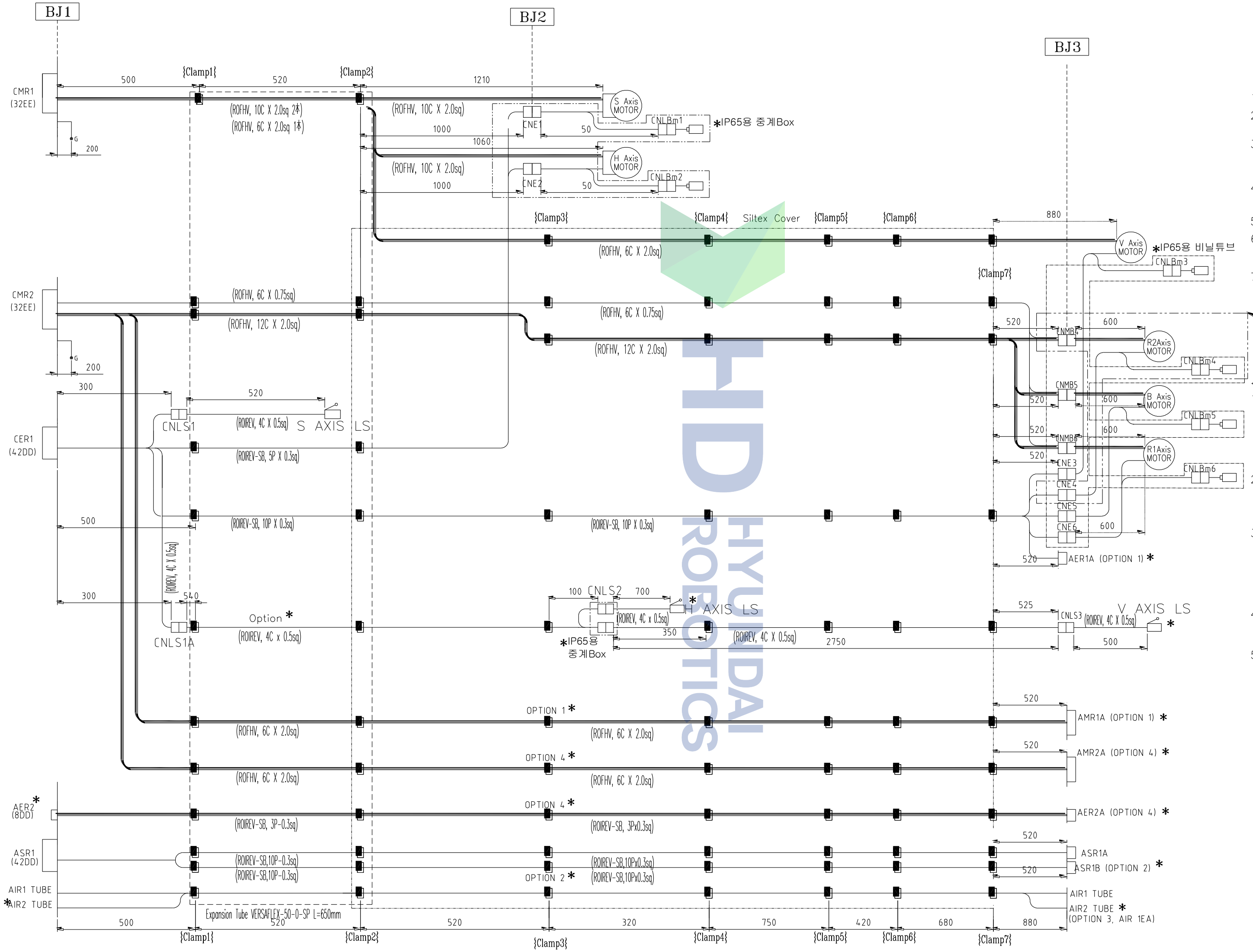
Figure 9.1 Manipulator Configuration

YS / HH Internal wiring diagram

PAGE NO	CONTENTS
1	CABLE BLOCK DIAGRAM
2	MOTOR POWER CABLE CONNECTION FOR S,H,V AXIS
3	MOTOR POWER CABLE CONNECTION FOR R2,B,R1 AXIS
4	MOTOR ENCODER CABLE CONNECTION FOR S,H AXIS
5	MOTOR ENCODER CABLE CONNECTION FOR V,R2,B,R1 AXIS
6	ADD AXIS CABLE CONNECTION
7	USER APPLICATION CONNECTION

▲HYUNDAI ROBOTICS

A3 (420x297mm)


BJ1
BJ2
BJ3
CMR1 (32EE)
CMR2 (32EE)
CER1 (42DD)
AER2 (8DD) *
ASR1 (42DD)
AIR1 TUBE
*AIR2 TUBE
G
200
500
520
1210
300
540
{Clamp1}
{Clamp2}
{Clamp3}
{Clamp4}
{Clamp5}
{Clamp6}
{Clamp7}
Siltex Cover
(ROFHV, 10C X 2.0sq 2本)
(ROFHV, 6C X 2.0sq 1本)
(ROFHV, 10C X 2.0sq)
1000
1060
50
CNE1
CNE2
S Axis MOTOR
H Axis MOTOR
CNLBm1
CNLBm2
*IP65용 중계Box
(ROFHV, 6C X 2.0sq)
(ROFHV, 6C X 0.75sq)
(ROFHV, 12C X 2.0sq)
CNLS1
(ROIREV, 4C X 0.5sq)
S AXIS LS
(ROIREV-SB, 5P X 0.3sq)
(ROIREV-SB, 10P X 0.3sq)
CNLS1A
Option *
(ROIREV, 4C x 0.5sq)
(ROIREV, 4C X 0.5sq)
100
CNLS2
700
350
2750
H AXIS LS
*IP65용 중계Box
OPTION 1 *
OPTION 4 *
OPTION 2 *
(ROIREV-SB, 3P-0.3sq)
(ROIREV-SB, 3Px0.3sq)
(ROIREV-SB,10P-0.3sq)
(ROIREV-SB,10Px0.3sq)
Expansion Tube VERSAFLEX-50-0-SP L=650mm
320
750
420
680
880
V Axis MOTOR
*IP65용 비닐튜브
CNLBm3
CNMB4
CNMB5
CNMB6
CNE3
CNE4
CNE5
CNE6
600
R2Axis MOTOR
B Axis MOTOR
R1Axis MOTOR
CNLBm4
CNLBm5
CNLBm6
AER1A (OPTION 1) *
525
CNLS3
V AXIS LS
AMR1A (OPTION 1) *
AMR2A (OPTION 4) *
AER2A (OPTION 4) *
ASR1A
ASR1B (OPTION 2) *
AIR1 TUBE
AIR2 TUBE *
(OPTION 3, AIR 1EA)

HH020T 기종 제작시 삭제
(핀 작업 없음, 단말 처리)

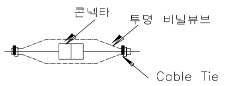
NOTE)

1. ▽ 안전/법규 적합성에 주의
2. 필요 부품 사급후
   CLAMPING 하여 납품할 것.
3. ▮ : CLAMP 부위(브라켓 혹은
   CABLE TIE) 白色
   테이프로 표시 要
4. 치수는 공작, CLAMPING
   후의 참조치수임.
5. ✱:OPTION 사양
6. AIR TUBE COLOR :
   BLACK(FWU-4-12X8 :
   NITTA MOORE)
7. IP65 방수 사양은 옵션임

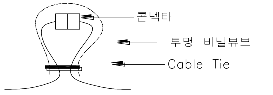
<< IP65 방수 옵션사양 >>

1. IP65 방수 방법
   1) 모터 접속용 Power 콘넥타
      – 방수형 콘넥타 적용
      – 콘넥타 후면부에 방수제(실리콘) 도포
   2) 본체내 엔코더, 신호선 콘넥타 : 비닐튜브 처리
2. ☐ : 투명 비닐튜브 (방수용)
   1) Size : ø90 x 0.1t x 300mm
   2) 수량 : 5EA (A형 : 4 EA, B형 : 1 EA)
3. 비닐튜브 묶음작업
   1) 본체내 기내Cable 조립시 작업함
   2) 비닐튜브로 콘넥타부를 묶음 처리 하고
      콘넥타부가 위쪽에 위치 되도록 함
   3) Power용과 신호용은 동일 묶음 처리 되면 안됨
4. 중계 Box는 Box내부에 물기가 침투되지 않게
   방수처리 할 것
5. 비닐튜브 처리 작업사양

< A형 >

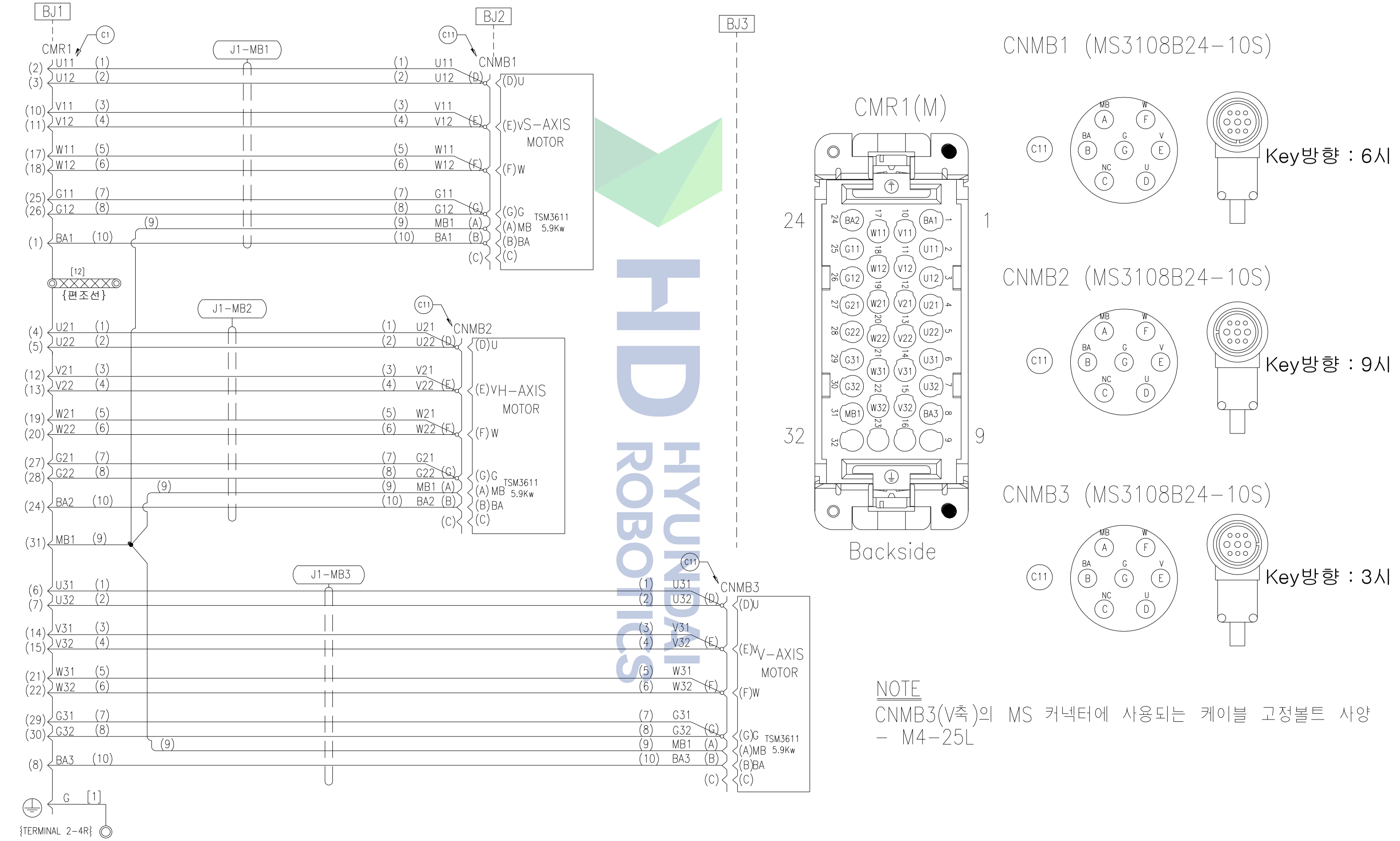

콘넥타
투명 비닐뷰브
Cable Tie

< B형 >


콘넥타
투명 비닐뷰브
Cable Tie

TITLE : CABLE BLOCK DIAGRAM
HYUNDAI ROBOTICS

A3 (420x297mm)

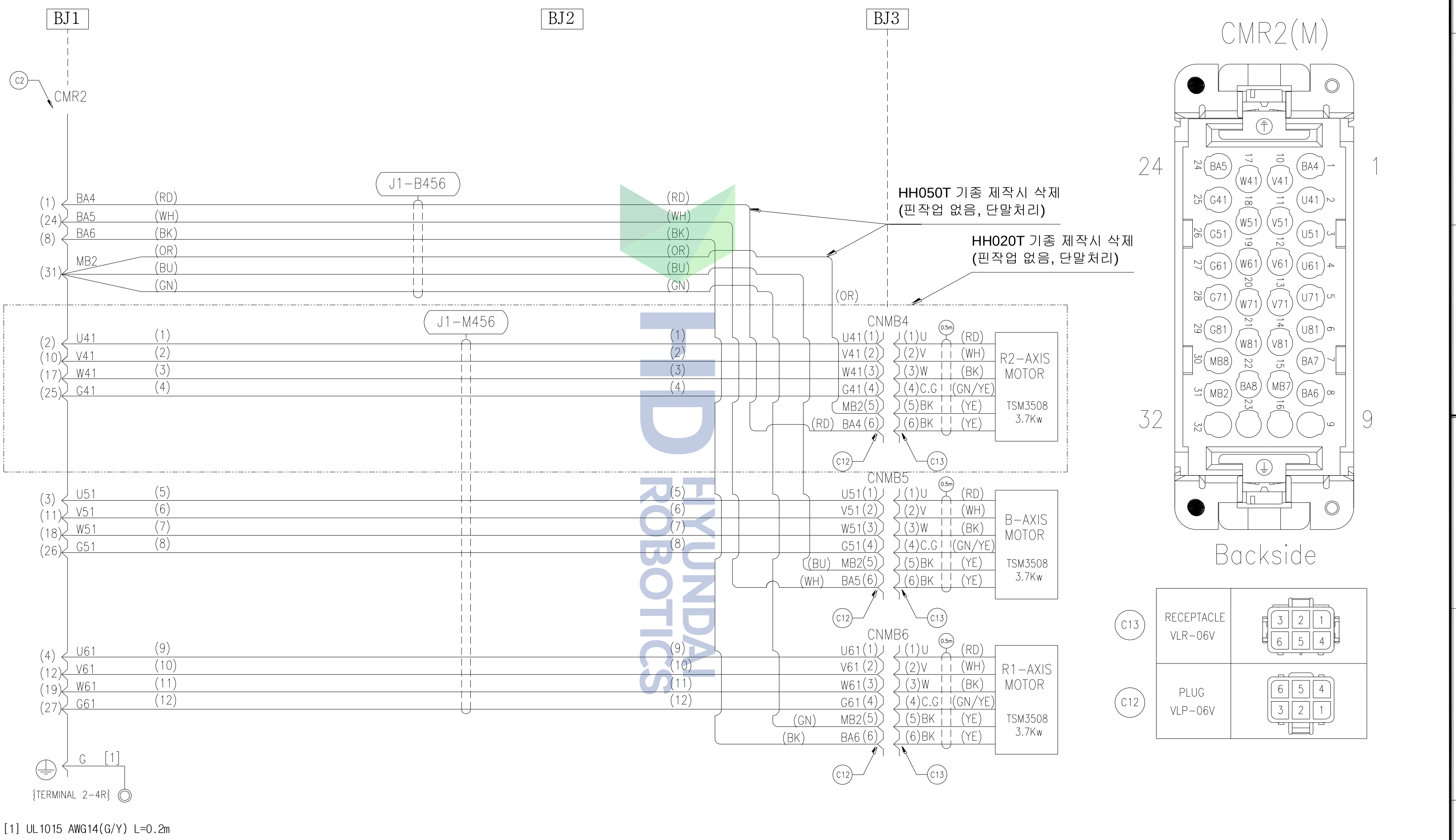

BJ1
CMR1
C1
U11
U12
V11
V12
W11
W12
G11
G12
BA1
J1-MB1
BJ2
C11
CNMB1
(D)U
(E)VS-AXIS MOTOR
(F)W
(G)G
(A)MB
(B)BA
(C)
TSM3611 5.9Kw
MB1
[12]
{편조선}
J1-MB2
CNMB2
U21
U22
V21
V22
W21
W22
G21
G22
BA2
(E)VH-AXIS MOTOR
MB1
J1-MB3
BJ3
CNMB3
U31
U32
V31
V32
W31
W32
G31
G32
BA3
(E)V-AXIS MOTOR
G
[1]
{TERMINAL 2-4R}
CMR1(M)
24
1
32
9
Backside
CNMB1 (MS3108B24-10S)
CNMB2 (MS3108B24-10S)
CNMB3 (MS3108B24-10S)
MB
W
BA
G
V
NC
U
Key방향 : 6시
Key방향 : 9시
Key방향 : 3시

NOTE
CNMB3(V축)의 MS 커넥터에 사용되는 케이블 고정볼트 사양
- M4-25L

[1] UL1015 AWG14(G/Y) L=0.2m
[12] 편조선 8sq L=0.35m

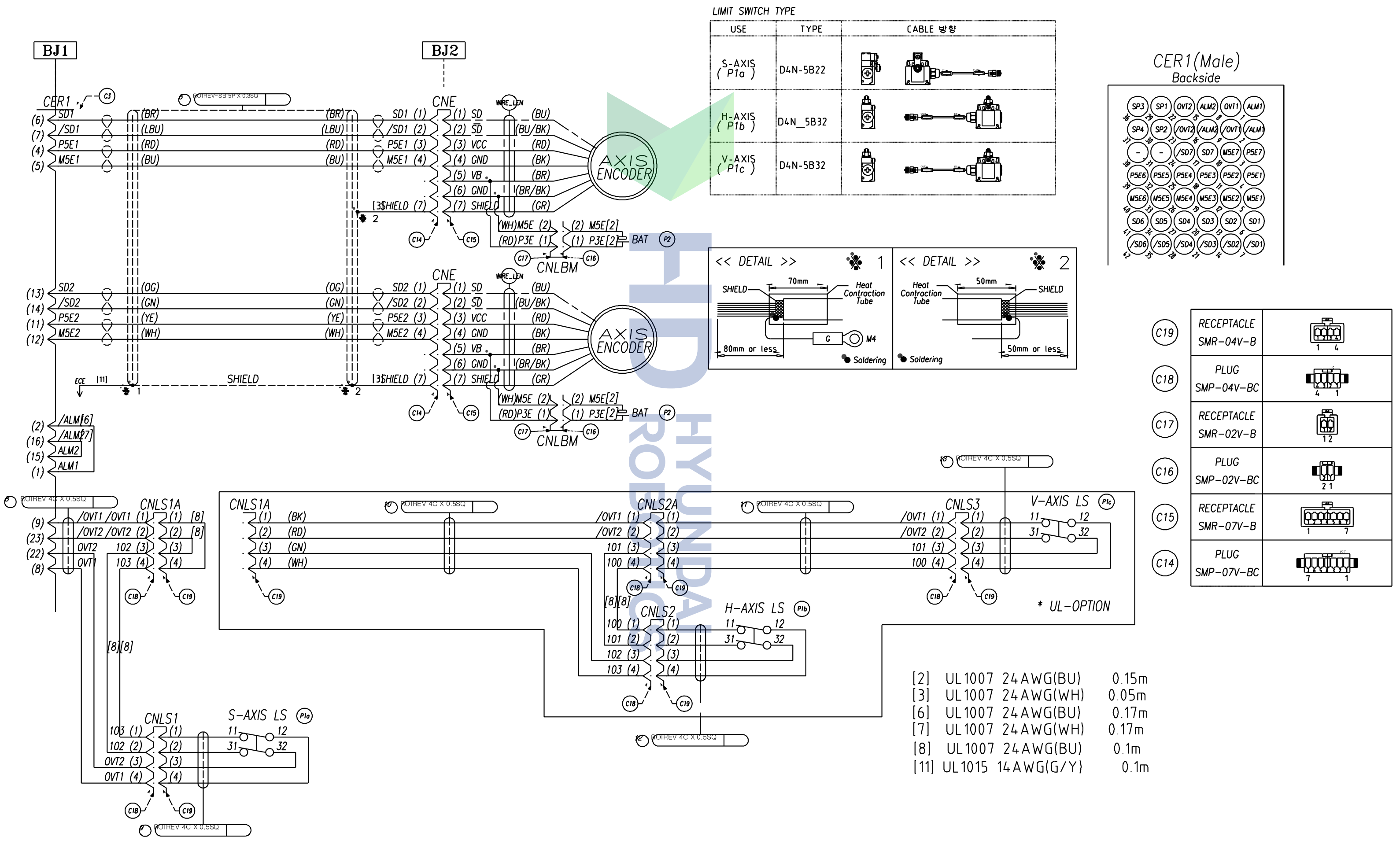
TITLE : MOTOR POWER CABLE CONNECTION FOR S,H,V AXIS
HYUNDAI ROBOTICS

A3 (420x297mm)


BJ1
BJ2
BJ3
C2
CMR2
J1-B456
J1-M456
(1) BA4 (RD)
(24) BA5 (WH)
(8) BA6 (BK)
(31) MB2 (OR) (BU) (GN)
(2) U41 (1)
(10) V41 (2)
(17) W41 (3)
(25) G41 (4)
(3) U51 (5)
(11) V51 (6)
(18) W51 (7)
(26) G51 (8)
(4) U61 (9)
(12) V61 (10)
(19) W61 (11)
(27) G61 (12)
G [1]
{TERMINAL 2-4R}
[1] UL1015 AWG14(G/Y) L=0.2m
HH050T 기종 제작시 삭제
(핀작업 없음, 단말처리)
HH020T 기종 제작시 삭제
(핀작업 없음, 단말처리)
(OR)
CNMB4
U41(1) (1)U (RD)
V41(2) (2)V (WH)
W41(3) (3)W (BK)
G41(4) (4)C.G (GN/YE)
MB2(5) (5)BK (YE)
(RD) BA4(6) (6)BK (YE)
0.5m
R2-AXIS MOTOR
TSM3508 3.7Kw
CNMB5
U51(1) (1)U (RD)
V51(2) (2)V (WH)
W51(3) (3)W (BK)
G51(4) (4)C.G (GN/YE)
(BU) MB2(5) (5)BK (YE)
(WH) BA5(6) (6)BK (YE)
B-AXIS MOTOR
TSM3508 3.7Kw
CNMB6
U61(1) (1)U (RD)
V61(2) (2)V (WH)
W61(3) (3)W (BK)
G61(4) (4)C.G (GN/YE)
(GN) MB2(5) (5)BK (YE)
(BK) BA6(6) (6)BK (YE)
R1-AXIS MOTOR
TSM3508 3.7Kw
C12
C13
CMR2(M)
1 BA4, 2 U41, 3 U51, 4 U61, 5 U71, 6 U81, 7 BA7, 8 BA6, 9
10 V41, 11 V51, 12 V61, 13 V71, 14 V81, 15 MB7, 16
17 W41, 18 W51, 19 W61, 20 W71, 21 W81, 22 BA8, 23
24 BA5, 25 G41, 26 G51, 27 G61, 28 G71, 29 G81, 30 MB8, 31 MB2, 32
Backside
C13 RECEPTACLE VLR-06V
C12 PLUG VLP-06V
A3 (420x297mm)

TITLE : MOTOR POWER CABLE CONNECTION FOR R2,B,R1 AXIS

HYUNDAI ROBOTICS


BJ1
BJ2
CER1
C3
ROIREV-SB 5P X 0.3SQ
(6) SD1
(7) /SD1
(4) P5E1
(5) M5E1
(BR)
(LBU)
(RD)
(BU)
SD1 (1)
/SD1 (2)
P5E1 (3)
M5E1 (4)
[3]SHIELD (7)
CNE
(1) SD
(2) SD
(3) VCC
(4) GND
(5) VB
(6) GND
(7) SHIELD
WIRE_LEN
(BU)
(BU/BK)
(RD)
(BK)
(BR)
(BR/BK)
(GR)
AXIS ENCODER
(WH)M5E (2)
(RD)P3E (1)
(2) M5E[2]
(1) P3E[2]
BAT
P2
C14
C15
C16
C17
CNLBM
(13) SD2
(14) /SD2
(11) P5E2
(12) M5E2
(OG)
(GN)
(YE)
(WH)
SD2 (1)
/SD2 (2)
P5E2 (3)
M5E2 (4)
ECE
[11]
SHIELD
1
2
(2) /ALM[6]
(16) /ALM[7]
(15) ALM2
(1) ALM1
ROIREV 4C X 0.5SQ
(9) /OVT1
(23) /OVT2
(22) OVT2
(8) OVT1
CNLS1A
/OVT1 (1)
/OVT2 (2)
102 (3)
103 (4)
[8]
C18
C19
[8][8]
CNLS1
103 (1)
102 (2)
OVT2 (3)
OVT1 (4)
S-AXIS LS
P1a
11
12
31
32
CNLS1A
(1) (BK)
(2) (RD)
(3) (GN)
(4) (WH)
CNLS2A
/OVT1 (1)
/OVT2 (2)
101 (3)
100 (4)
CNLS2
100 (1)
101 (2)
102 (3)
103 (4)
H-AXIS LS
P1b
CNLS3
/OVT1 (1)
/OVT2 (2)
101 (3)
100 (4)
V-AXIS LS
P1c
* UL-OPTION
<< DETAIL >> 1
SHIELD
70mm
Heat Contraction Tube
80mm or less
G
M4
Soldering
<< DETAIL >> 2
50mm
Heat Contraction Tube
SHIELD
50mm or less
Soldering
CER1(Male)
Backside
SP3 SP1 OVT2 ALM2 OVT1 ALM1
SP4 SP2 /OVT2 /ALM2 /OVT1 /ALM1
- - /SD7 SD7 M5E7 P5E7
P5E6 P5E5 P5E4 P5E3 P5E2 P5E1
M5E6 M5E5 M5E4 M5E3 M5E2 M5E1
SD6 SD5 SD4 SD3 SD2 SD1
/SD6 /SD5 /SD4 /SD3 /SD2 /SD1

LIMIT SWITCH TYPE

USE	TYPE	CABLE 방향
S-AXIS (P1a)	D4N-5B22	
H-AXIS (P1b)	D4N_5B32	
V-AXIS (P1c)	D4N-5B32	

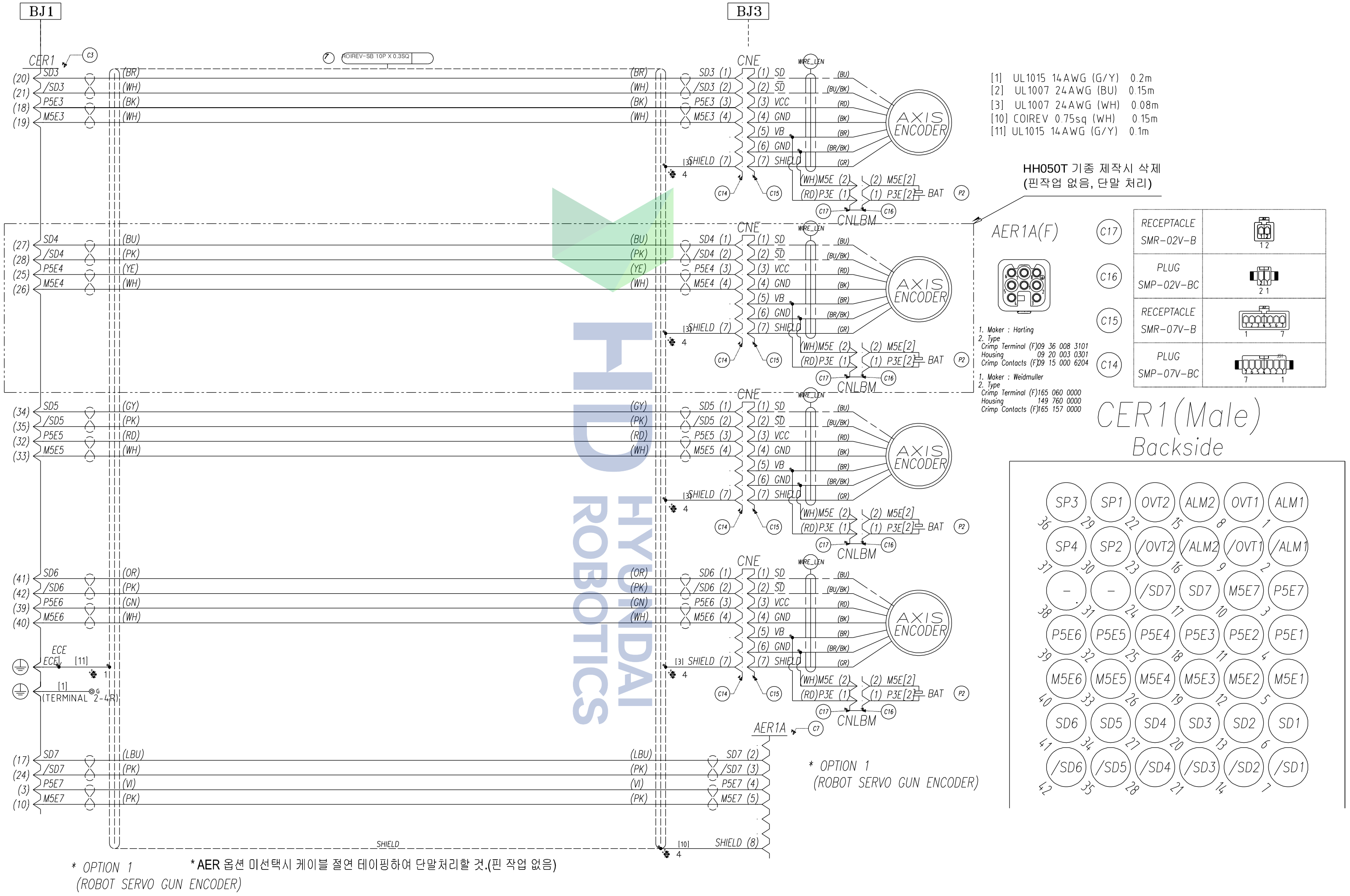
C19	RECEPTACLE SMR-04V-B	1 4
C18	PLUG SMP-04V-BC	4 1
C17	RECEPTACLE SMR-02V-B	1 2
C16	PLUG SMP-02V-BC	2 1
C15	RECEPTACLE SMR-07V-B	1 7
C14	PLUG SMP-07V-BC	7 1

[2]	UL1007	24AWG(BU)	0.15m
[3]	UL1007	24AWG(WH)	0.05m
[6]	UL1007	24AWG(BU)	0.17m
[7]	UL1007	24AWG(WH)	0.17m
[8]	UL1007	24AWG(BU)	0.1m
[11]	UL1015	14AWG(G/Y)	0.1m

TITLE : MOTOR ENCODER CABLE CONNECTION FOR S,H AXIS

HYUNDAI ROBOTICS

A3 (420x297mm)


BJ1
BJ3
CER1
C3
COIREV-SB 10P X 0.3SQ
(20) SD3
(21) /SD3
(18) P5E3
(19) M5E3
(27) SD4
(28) /SD4
(25) P5E4
(26) M5E4
(34) SD5
(35) /SD5
(32) P5E5
(33) M5E5
(41) SD6
(42) /SD6
(39) P5E6
(40) M5E6
ECE
ECE
[11]
[1]
TERMINAL 2-4R
(17) SD7
(24) /SD7
(3) P5E7
(10) M5E7
(BR)
(WH)
(BK)
(BU)
(PK)
(YE)
(GY)
(RD)
(OR)
(GN)
(LBU)
(VI)
SHIELD
CNE
SD3 (1)
/SD3 (2)
P5E3 (3)
M5E3 (4)
SHIELD (7)
(1) SD
(2) SD
(3) VCC
(4) GND
(5) VB
(6) GND
(7) SHIELD
WIRE_LEN
(BU)
(BU/BK)
(RD)
(BK)
(BR)
(BR/BK)
(GR)
AXIS ENCODER
(WH)M5E (2)
(RD)P3E (1)
(2) M5E[2]
(1) P3E[2]
BAT
P2
C14
C15
C16
C17
CNLBM
AER1A
C7
SD7 (2)
/SD7 (3)
P5E7 (4)
M5E7 (5)
SHIELD (8)
[10]
AER1A(F)
1. Maker : Harting
2. Type
Crimp Terminal (F)09 36 008 3101
Housing 09 20 003 0301
Crimp Contacts (F)09 15 000 6204
1. Maker : Weidmuller
2. Type
Crimp Terminal (F)165 060 0000
Housing 149 760 0000
Crimp Contacts (F)165 157 0000
CER1(Male)
Backside
SP3 36
SP1 29
OVT2 22
ALM2 15
OVT1 8
ALM1 1
SP4 37
SP2 30
/OVT2 23
/ALM2 16
/OVT1 9
/ALM1 2
- 38
- 31
/SD7 24
SD7 17
M5E7 10
P5E7 3
P5E6 39
P5E5 32
P5E4 25
P5E3 18
P5E2 11
P5E1 4
M5E6 40
M5E5 33
M5E4 26
M5E3 19
M5E2 12
M5E1 5
SD6 41
SD5 34
SD4 27
SD3 20
SD2 13
SD1 6
/SD6 42
/SD5 35
/SD4 28
/SD3 21
/SD2 14
/SD1 7

[1] UL1015 14AWG (G/Y) 0.2m
[2] UL1007 24AWG (BU) 0.15m
[3] UL1007 24AWG (WH) 0.08m
[10] COIREV 0.75sq (WH) 0.15m
[11] UL1015 14AWG (G/Y) 0.1m

HH050T 기종 제작시 삭제
(핀작업 없음, 단말 처리)

C17	RECEPTACLE SMR-02V-B	1 2
C16	PLUG SMP-02V-BC	2 1
C15	RECEPTACLE SMR-07V-B	1 7
C14	PLUG SMP-07V-BC	7 1

* OPTION 1
(ROBOT SERVO GUN ENCODER)

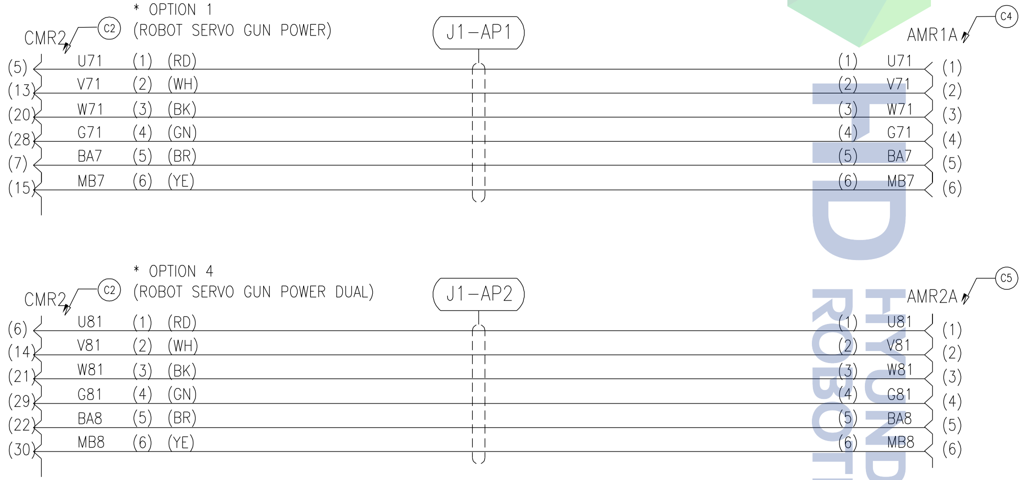
* OPTION 1
(ROBOT SERVO GUN ENCODER)

*AER 옵션 미선택시 케이블 절연 테이핑하여 단말처리할 것.(핀 작업 없음)

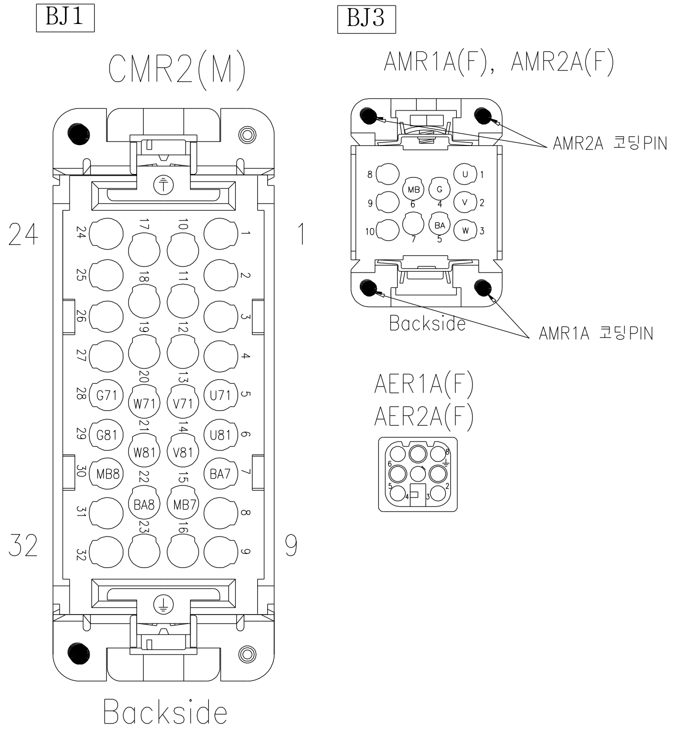
TITLE : MOTOR ENCODER CABLE CONNECTION FOR V,R2,B,R1 AXIS

HYUNDAI ROBOTICS

A3 (420x297mm)


* OPTION 1
(ROBOT SERVO GUN POWER)
CMR2
C2
(5) U71 (1) (RD)
(13) V71 (2) (WH)
(20) W71 (3) (BK)
(28) G71 (4) (GN)
(7) BA7 (5) (BR)
(15) MB7 (6) (YE)
J1-AP1
AMR1A
C4
(1) U71 (1)
(2) V71 (2)
(3) W71 (3)
(4) G71 (4)
(5) BA7 (5)
(6) MB7 (6)
* OPTION 4
(ROBOT SERVO GUN POWER DUAL)
CMR2
C2
(6) U81 (1) (RD)
(14) V81 (2) (WH)
(21) W81 (3) (BK)
(29) G81 (4) (GN)
(22) BA8 (5) (BR)
(30) MB8 (6) (YE)
J1-AP2
AMR2A
C5
(1) U81 (1)
(2) V81 (2)
(3) W81 (3)
(4) G81 (4)
(5) BA8 (5)
(6) MB8 (6)

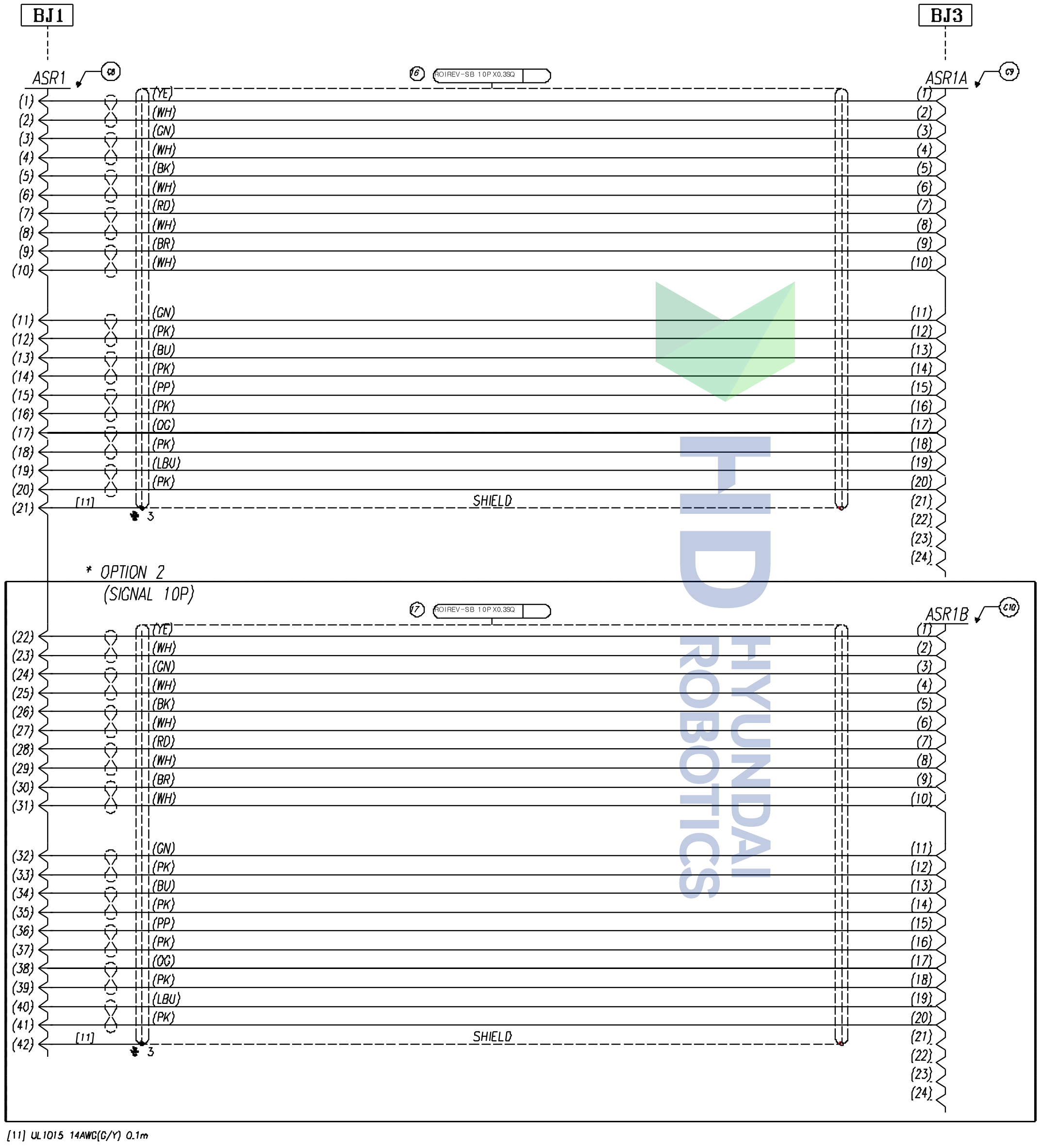
[4] UL1430 COIRV 0.75SQ (WH) L=0.05m
[5] UL1007 16AWG (G/Y) L=0.15m
[10] UL1430 COIRV 0.75SQ (WH) L=0.15m


BJ1
CMR2(M)
1
9
24
32
1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16
17 18 19 20 21 22 23
24 25 26 27 28 29 30 31 32
U71
U81
BA7
V71
V81
MB7
W71
W81
BA8
G71
G81
MB8
Backside
BJ3
AMR1A(F), AMR2A(F)
AMR2A 코딩PIN
AMR1A 코딩PIN
U 1
V 2
W 3
G 4
BA 5
MB 6
7
8
9
10
Backside
AER1A(F)
AER2A(F)
1 2 3 4 5 6 7 8

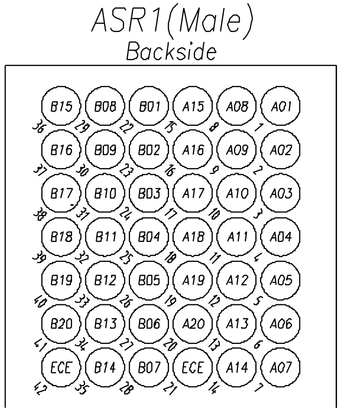
TITLE : ADD AXIS CABLE CONNECTION

HYUNDAI ROBOTICS

A3 (420x297mm)


BJ1
BJ3
ASR1
ASR1A
ASR1B
C8
C9
C10
⑥ ROIREV-SB 10P X0.3SQ
⑦ ROIREV-SB 10P X0.3SQ
(1) (2) (3) (4) (5) (6) (7) (8) (9) (10)
(11) (12) (13) (14) (15) (16) (17) (18) (19) (20) (21)
(22) (23) (24) (25) (26) (27) (28) (29) (30) (31)
(32) (33) (34) (35) (36) (37) (38) (39) (40) (41) (42)
(YE) (WH) (GN) (WH) (BK) (WH) (RD) (WH) (BR) (WH)
(GN) (PK) (BU) (PK) (PP) (PK) (OG) (PK) (LBU) (PK)
SHIELD
[11]
3
(1) … (24)
* OPTION 2
(SIGNAL 10P)

[11] UL1015 14AWG(G/Y) 0.1m

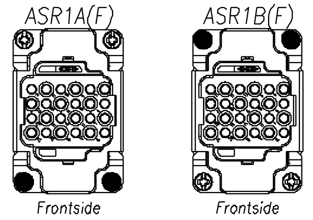

ASR1(Male)
Backside
B15 B08 B01 A15 A08 A01
B16 B09 B02 A16 A09 A02
B17 B10 B03 A17 A10 A03
B18 B11 B04 A18 A11 A04
B19 B12 B05 A19 A12 A05
B20 B13 B06 A20 A13 A06
ECE B14 B07 ECE A14 A07
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42

1. Maker : Harting
2. Type

Crimp Terminal (M)	09 16 042 3001
Housing	09 30 010 0301
Crimp Contacts (M)	09 15 000 6106
Crimp Contacts (M)	09 15 000 6104

3. Maker : Weidmuller
4. Type

Crimp Terminal (M)	165 117 0000
Housing	120 500 0000
Crimp Contacts (M)	165 156 0000
Crimp Contacts (M)	165 152 0000


ASR1A(F)
Frontside
ASR1B(F)
Frontside

ASR1A(F)

1. Maker : Harting
2. Type

Crimp Terminal (F)	09 16 024 3101
Housing	09 30 006 0301
Crimp Contacts (F)	09 15 000 6204

1. Maker : Weidmuller
2. Type

Crimp Terminal (F)	165 116 0000
Housing	120 210 0000
Crimp Contacts (F)	165 157 0000

ASR1B(F)

1. Maker : Harting
2. Type

Crimp Terminal (F)	09 16 024 3101
Housing	09 30 006 0301
Crimp Contacts (F)	09 15 000 6204

1. Maker : Weidmuller
2. Type

Crimp Terminal (F)	165 116 0000
Housing	120 210 0000
Crimp Contacts (F)	165 157 0000

TITLE : USER APPLICATION CONNECTION

HYUNDAI ROBOTICS

A3 (420x297mm)

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