MELFA Robots

Industrial Robot

Standard Specifications Manual

RH-6SDH/12SDH/18SDH
CR1D-7**/CR2D-7**/
CR3D-7** Controller)

Art. no. BFP-A8658
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Version C

⚠ Safety Precautions

Always read the following precautions and the separate "Safety Manual" before starting use of the robot to learn the required measures to be taken.

⚠ CAUTION

All teaching work must be carried out by an operator who has received special training. (This also applies to maintenance work with the power source turned ON.)
Enforcement of safety training

⚠ CAUTION

For teaching work, prepare a work plan related to the methods and procedures of operating the robot, and to the measures to be taken when an error occurs or when restarting. Carry out work following this plan. (This also applies to maintenance work with the power source turned ON.)
Preparation of work plan

⚠ WARNING

Prepare a device that allows operation to be stopped immediately during teaching work. (This also applies to maintenance work with the power source turned ON.)
Setting of emergency stop switch

⚠ CAUTION

During teaching work, place a sign indicating that teaching work is in progress on the start switch, etc. (This also applies to maintenance work with the power source turned ON.)
Indication of teaching work in progress

⚠ WARNING

Provide a fence or enclosure during operation to prevent contact of the operator and robot.
Installation of safety fence

⚠ CAUTION

Establish a set signaling method to the related operators for starting work, and follow this method.
Signaling of operation start

⚠ CAUTION

As a principle turn the power OFF during maintenance work. Place a sign indicating that maintenance work is in progress on the start switch, etc.
Indication of maintenance work in progress

⚠ CAUTION

Before starting work, inspect the robot, emergency stop switch and other related devices, etc., and confirm that there are no errors.
Inspection before starting work

The points of the precautions given in the separate "Safety Manual" are given below.
Refer to the actual "Safety Manual" for details.

⚠CAUTION Use the robot within the environment given in the specifications. Failure to do so could lead to a drop or reliability or faults. (Temperature, humidity, atmosphere, noise environment, etc.)

⚠CAUTION Transport the robot with the designated transportation posture. Transporting the robot in a non-designated posture could lead to personal injuries or faults from dropping.

⚠CAUTION Always use the robot installed on a secure table. Use in an instable posture could lead to positional deviation and vibration.

⚠CAUTION Wire the cable as far away from noise sources as possible. If placed near a noise source, positional deviation or malfunction could occur.

⚠CAUTION Do not apply excessive force on the connector or excessively bend the cable. Failure to observe this could lead to contact defects or wire breakage.

⚠CAUTION Make sure that the workpiece weight, including the hand, does not exceed the rated load or tolerable torque. Exceeding these values could lead to alarms or faults.

⚠WARNING Securely install the hand and tool, and securely grasp the workpiece. Failure to observe this could lead to personal injuries or damage if the object comes off or flies off during operation.

⚠WARNING Securely ground the robot and controller. Failure to observe this could lead to malfunctioning by noise or to electric shock accidents.

⚠CAUTION Indicate the operation state during robot operation. Failure to indicate the state could lead to operators approaching the robot or to incorrect operation.

⚠WARNING When carrying out teaching work in the robot's movement range, always secure the priority right for the robot control. Failure to observe this could lead to personal injuries or damage if the robot is started with external commands.

⚠CAUTION Keep the jog speed as low as possible, and always watch the robot. Failure to do so could lead to interference with the workpiece or peripheral devices.

⚠CAUTION After editing the program, always confirm the operation with step operation before starting automatic operation. Failure to do so could lead to interference with peripheral devices because of programming mistakes, etc.

⚠CAUTION Make sure that if the safety fence entrance door is opened during automatic operation, the door is locked or that the robot will automatically stop. Failure to do so could lead to personal injuries.

⚠CAUTION Never carry out modifications based on personal judgments, or use non-designated maintenance parts.
Failure to observe this could lead to faults or failures.

⚠WARNING When the robot arm has to be moved by hand from an external area, do not place hands or fingers in the openings. Failure to observe this could lead to hands or fingers catching depending on the posture.

⚠ CAUTION

Do not stop the robot or apply emergency stop by turning the robot controller's main power OFF. If the robot controller main power is turned OFF during automatic operation, the robot accuracy could be adversely affected. Moreover, it may interfere with the peripheral device by drop or move by inertia of the arm.

⚠ CAUTION

Do not turn off the main power to the robot controller while rewriting the internal information of the robot controller such as the program or parameters. If the main power to the robot controller is turned off while in automatic operation or rewriting the program or parameters, the internal information of the robot controller may be damaged.

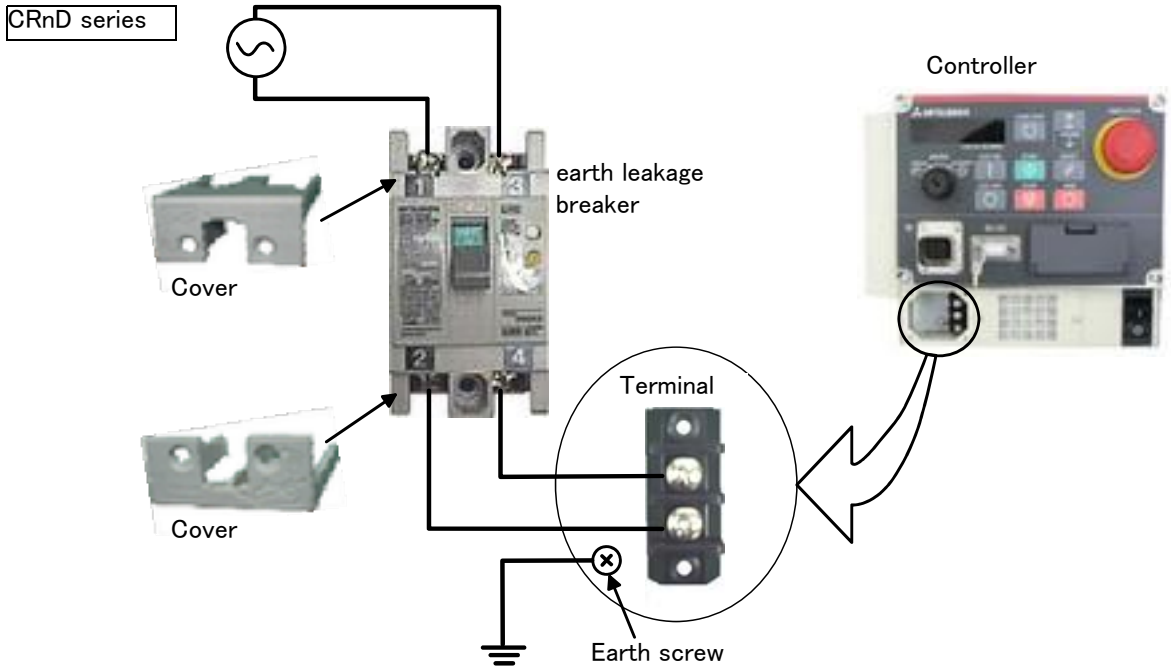
⚠ CAUTION

Security of operation and the maintenance of marketing of USB equipment cannot be done at our company. Care fully because the commercial item may not fit the problem of affinity with our equipment, and the FA environment (temperature, the noise, etc.). When using it, measures against the noise, such as measures against EMI and the addition of the ferrite core, may be necessary. Please fully confirm of operation of the customer

C.Notes of the basic component are shown. （CR1D-700 series）

⚠ CAUTION

Please install the earth leakage breaker in the primary side supply power supply of the controller because of leakage protection.



■ Revision history

Date of print	Specifications No.	Details of revisions
2008-06-30	BFP-A8658	・First print.
2008-11-10	BFP-A8658-A	・The example of filter installation to the servo amplifier for addition axes was added. ・CE Marking specification was added.
2008-12-18	BFP-A8658-B	・Difference of connector assignment of of sink and source type of parallel I/O interface/ unit were added.
2009-02-10	BFP-A8658-C	・EC Declaration of Conformity were added.

■ Introduction

The RH-6SDH/12SDH/18SDH series offers small-size industrial robots developed using Mitsubishi's latest technol-ogy. They are especially designed to handle and assemble mechanical parts. They are Mitsubishi's answer to the customer's need to achieve a compact manufacturing facility capable of highly flexible production, as necessitated by the diffusion of high-density product groups and the shorter product life cycles that have become common-place in recent years.

However, to comply with the target application, a work system having a well-balanced robot arm, peripheral devices or robot and hand section must be structured.
When creating these standard specifications, we have edited them so that the Mitsubishi robot's characteristics and specifications can be easily understood by users considering the implementation of robots.
However, if there are any unclear points, please contact your nearest Mitsubishi branch or dealer.
Mitsubishi hopes that you will consider these standard specifications and use our robots.

The controller differ corresponding to the specification of robot. Please refer to "1.2 Model type combination of robot" on page 2 or "1.3 CE marking specifications" on page 3 .
Note that in this specification document the specifications related to the robot arm is described "2 Robot arm" on page 8 , the specifications related to the controller"3 Controller" on page 35 , and software functions and a command list "4 Software" on page 158 separately.

This document has indicated the specification of the following types robot.

*RH-6SDH series
*RH-12SDH series
*RH-18SDH series

Contents

Contents

1 General configuration

1.1 Structural equipment

Structural equipment consists of the following types.

1.1.1 Standard structural equipment

The following items are enclosed as a standard.

(1) Robot arm
(2) Controller
(3) Machine cable
(4) Robot arm installation bolts
(5) Earth leakage breaker(CR1D-700 only)
(6) Arm fixing bolts
(7) Safety manual, Instruction manual, CD-ROM (Instruction manual)
(8) Guarantee card

1.1.2 Shipping special specifications

Part of the standard structural equipment is changed at the time of factory shipment. Consequently, kindly confirm the delivery date.

To make changes to the specifications after shipment, service work must be performed at the work site or the robot must be returned for service.

1.1.3 Options

Installation is possible after shipment. Customer needs to perform the installation work.

1.1.4 Maintenance parts

Consumable parts and spare parts for maintenance use.

For items not listed, contact the dealer where you made your purchase.

1.2 Model type combination of robot

The robot has decided the type corresponding to load, arm length, and environment specification. Please select the robot matched with the use.

1.2.1 How to identify the robot model

RH-◇◇SDH □□ △△ ○ -SMxx

(a) (b) (c) (d) (e)

(a). RH- ◇◇ SDH.....Indicates the RH-6SDH/12SDH/18SDH series
◇◇ : Indicates the maximum load capacity.

(b). □□ .....Indicates the arm length.
Ex.)
55: 550mm, 70: 700mm, 85: 850mm

(c). △△ .....Indicates the arm length.
Ex.)
30: 300mm stroke, 35: 350mm stroke

(d). ○ .....Indicates environment specification.
Ex.)
Blank: Standard specifications
C: Clean specifications
M: Oilmist specifications

(e). -SMxx.....Indicates a special model
[1] -S**M**** Indicates a specification with protection specification controller.
[2] -S**xx** Indicates a special model number.

1.2.2 Combination of the robot arm and the controller

Table 1-1 : Combination of the robot arm and the controller

Protection specification	Robot arm	Arm length (mm)	J3-axis stroke (mm)	Controller[Note1)]
RH-6SDH series				
General-purpose environment	RH-6SDH3520	350	200	CR1D-761
	RH-6SDH4520	450		
	RH-6SDH5520	550		
Clean spesifications	RH-6SDH3517C	350	170	
	RH-6SDH4517C	450		
	RH-6SDH5517C	550		
Oil mist specifications	RH-6SDH3517M	350		
	RH-6SDH4517M	450		
	RH-6SDH5517M	550		
RH-12SDH series				
General-purpose environment	RH-12SDH5535	550	350	CR2D-741
	RH-12SDH7035	700		
	RH-12SDH8535	850		
Clean spesifications	RH-12SDH5530C	550	300	
	RH-12SDH7030C	700		
	RH-12SDH8530C	850		
Oil mist specifications	RH-12SDH5530M	550		
	RH-12SDH7030M	700		
	RH-12SDH8530M	850		
RH-18SDH series				
General-purpose environment	RH-18SDH8535	850	350	CR2D-751
Clean spesifications	RH-18SDH8530C		300	
Oil mist specifications	RH-18SDH8530M			

Note1)When you use by adverse environment, please use the protection specification controller.
RH-6SDH series .....: The controller protection box is attached. (IP54)
(Ex. : RH-6SDH3520-SM)
RH-12SDH/18SDH series .....: Protection specification controller : CR3D-700M(IP54)
(Ex. : RH-12SDH5535-SM6)

1.3 CE marking specifications

The RH-6SDH/12SDH/18SDH series provides models with CE marking specifications as well,

Table 1-2 : Robot models with CE marking specifications

Robot type	Controller	External signal logic	Language setting
RH-6SDH*-S312	CR2D-761	Source type	English (ENG)
RH-12SDH*-S12	CR2D-741		
RH-18SDH*-S12	CR2D-751		

1.4 Indirect export

If you intend to export robots bought from us, the display language can be changed into English by change of the parameter (LNG).

1.5 Instruction manuals

The instruction manuals supplied with the shipment are provided in electronic form in a CD-ROM, except for the Safety Manual. This CD-ROM (electronic manual) includes instruction manuals in both Japanese and English versions. Please note that the instruction manuals are the same for both language settings.

1.6 Contents of the structural equipment

1.6.1 Robot arm

The list of structural equipment is shown in Fig. 1-1.

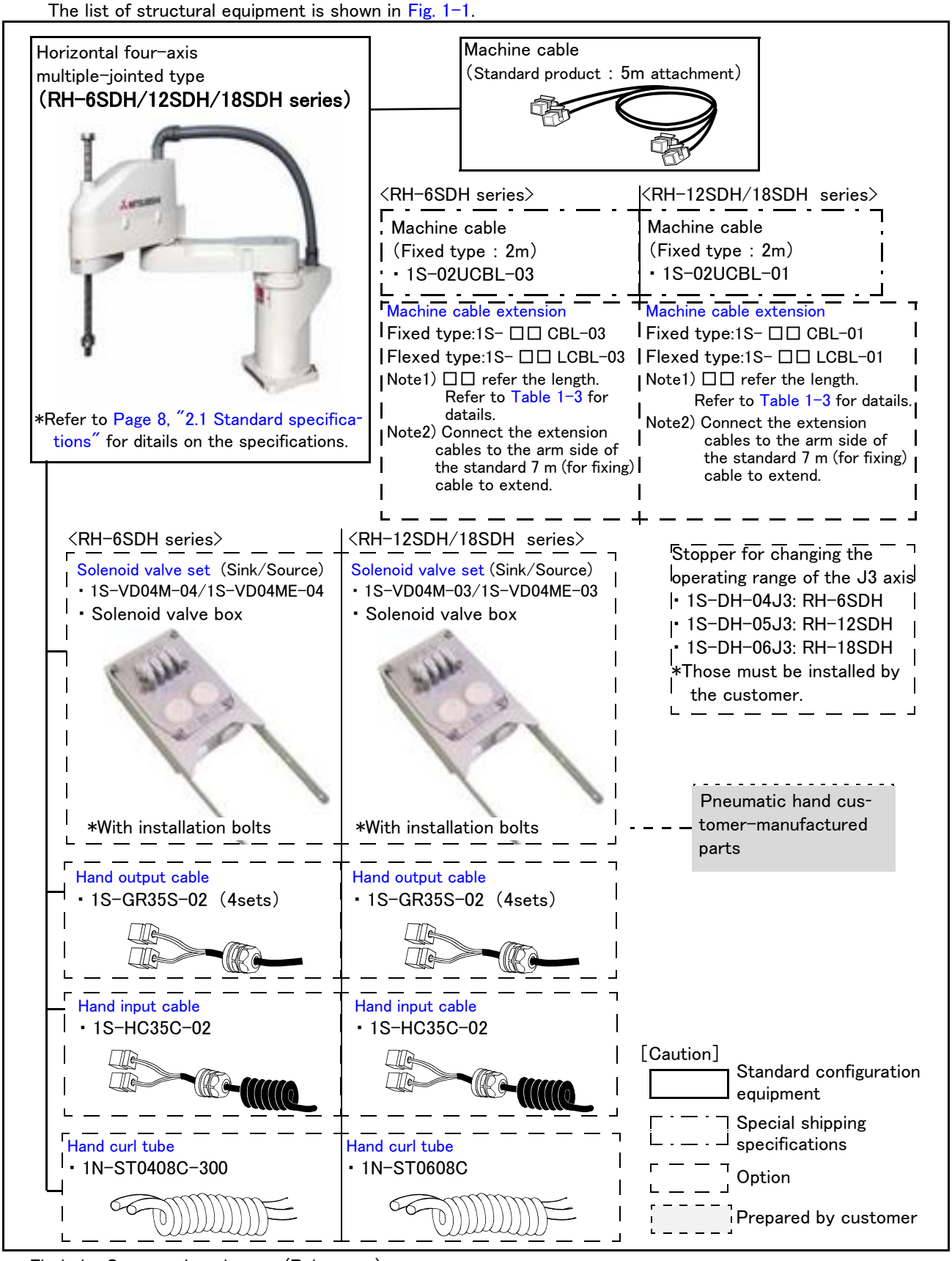


Fig.1-1 : Structural equipment (Robot arm)

1.6.2 Controller

The devices shown below can be installed on the controller.
The controllers that can be connected differ depending on the specification of the robot.

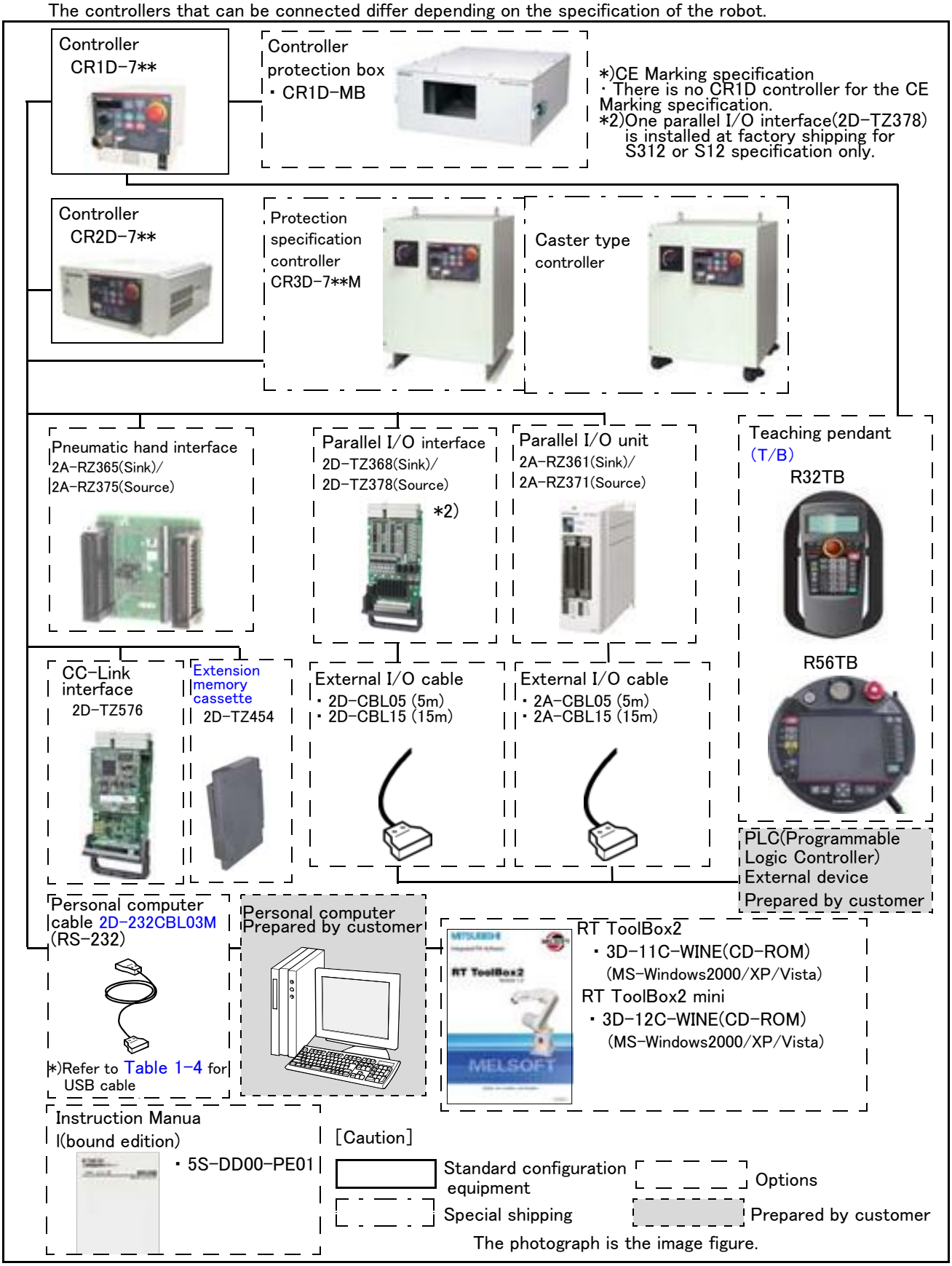


Fig.1-2 : Structural equipment

1.7 Contents of the Option equipment and special specification

A list of all Optional equipments and special specifications are shown below.

Table 1-3 : The list of Option equipment and special specification

Item	Type	Specifications	Classification Note1)	Descripsion
Machine cable(Replaced with shorter cable)	1S-02UCBL-03	RH-6SDH for fixing (Two sets for power and signal)	○·□	2m(A 2 m cable is supplied instead of the 5 m cable that is supplied as standard)
	1S-02UCBL-01	RH-12SDH/18SDH for fixing (Two sets for power and signal)	○·□	
Extended machine cable	1S- □□ CBL-03	RH-6SDH for fixing (Two sets for power and signal)	○	5、10、15m
	1D- □□ LCBL-03	RH-6SDH for bending (Two sets for power and signal)	○	
	1S- □□ CBL-01	RH-12SDH/18SDH for fixing (Two sets for power and signal)	○	
	1D- □□ LCBL-01	RH-12SDH/18SDH for bending (Two sets for power and signal)	○	
Solenoid valve set	1S-VD04M-04/ 1S-VD04ME-04	RH-6SDH 4 set (Sink type)/(Source type)	○	
	1S-VD04M-03/ 1S-VD04ME-03	RH-12SDH, RH-18SDH 4 set (Sink type)/(Source type)	○	
Hand output cable	1S-GR35S-02	Robot side connector. One terminal is not treated.	○	The cable is connected to the hand output connector by the customer.
Hand input cable	1S-HC35C-02	Robot side connector. One terminal is not treated.	○	The cable is connected to the sensor by the customer.
Hand curl tube	1E-ST0408C-300	For solenoid valve 4set.:Φ4x8	○	Curl type air tube 1E-ST0408C-300: RH-6SDH ｼﾘｰｽﾞ用 1N-ST0608C: RH-12SDH/18SDH ｼﾘｰｽﾞ用
	1N-ST0608C	For solenoid valve 4set.:Φ4x8	○	
Teaching pendant	R32TB	Cable length 7m	○	With 3-position deadman switch
	R32TB-15	Cable length 15m	○	
	R56TB	Cable length 7m	○	
	R56TB-15	Cable length 15m	○	
Pneumatic hand interface	2A-RZ365	DO: 8 point(Sink type)	○	It is necessary when the hand output signal of the robot arm is used.
	2A-RZ375	DO: 8 point(Source type)	○	
Parallel I/O Interface	2D-TZ368	DO: 32 point (Sink type)/ DI : 32 point (Sink type) Insulated type output signal (100mA/point)	○	The card type external input-and-output. Interface.Install to the slot of controller.
	2D-TZ378	DO: 32 point (Source type)/ DI : 32 point (Source type) Insulated type output signal (100mA/point)	○Note2)	
External I/O cable (For Parallel I/O Interface)	2D-CBL05	5m	○	Use to connect the external peripheral device to the parallel input/output interface.
	2D-CBL15	15m	○	
Parallel I/O Unit	2A-RZ361	DO: 32 point (Sink type)/ DI : 32 point (Sink type)	○	The unit for expansion the external input/output. Electrical isolated Type (100mA/Point)
	2A-RZ371	DO: 32 point (Source type)/ DI : 32 point (Source type)	○	
External I/O cable (For Parallel I/O Unit)	2A-CBL05	5m	○	Use to connect the external peripheral device to the parallel input/output unit
	2A-CBL15	15m	○	
Personal computer cable Note3)	2D-232CBL03M	RS-232C cable 3m for PC-AT compatible model	○	
RT ToolBox2 (Personal computer Support software)	3D-11C-WINE	CD-ROM	○	MS-Windows2000/XP/Vista (With the simulation function)
RT ToolBox2 mini (Personal computer Support software mini)	3D-12C-WINE	CD-ROM	○	MS-Windows2000/XP/Vista
CC-Link interface	2D-TZ576	Local station (The local station alone is supported.)	○	for MELSEC PLC with CC-Link connection.
Extended memory cassette	2D-TZ454	Teaching point number: 50,800 Steps number: 50,800 Program number: 512	○	The battery backup function is provided. The value combined with the standard
Controller protection box Note4)	CR1D-MB	IP54	□	The controller protection box is used to protect the controller from an oil mist or other operating environment
Instruction Manual	5S-DD00-PE01	RH-6SDH/12SDH/18SDH series	○	A set of the instructions manual bookbinding editions

Note1)In the classification column, ○ refers to an option,and □ to a Shipping special specifications.
Note2)One 2D-TZ378(Source type) is installed for CE Marking specification at shipping. (Only S312 or S12 specification)

Note3)The recommendation products of the USB cable are shown in Table 1-3.
Note4)This is provided as standard for the specification with the controller protection box. Use this option to protect the controller from the oil mist when the controller will be installed in the environment such as the oil mist. This option only applies to the CR1D-7** controller.

[Reference]:The recommendation products of the USB cable are shown below.

Table 1-4 : Recommendation article of the USB cable

Name	Type	Maker
USB cable (USB A type-USB B type)	USB2-30	ELECOM CO., LTD.
	AU230	BUFFALO KOKUYO SUPPLY INC.
USB cable (USB A type-USB mini B type)	KU-AMB530	SANWA SUPPLY INC.
	USB-M53	ELECOM CO., LTD.
	GT09-C20USB-5P	MITSUBISHI ELECTRIC SYSTEM & SERVICE CO., LTD.
	MR-J3USBCBL3M	MITSUBISHI ELECTRIC CO., LTD.
USB adapter (USB B type-USB mini B type)	AD-USBBFTM5M	ELECOM CO., LTD.

⚠Caution Be careful to the USB cable to apply neither the static electricity nor the noise. Failure to observe this could lead to malfunc-tioning .

⚠Caution Security of operation and the maintenance of marketing of USB equipment cannot be done at our company. Care fully because the commercial item may not fit the problem of affinity with our equipment, and the FA environment (temperature, the noise, etc.). When using it, measures against the noise, such as measures against EMI and the addition of the ferrite core, may be necessary. Please fully confirm of operation of the customer

2 Robot arm
2.1 Standard specifications

2.1.1 RH-6SDH sereis

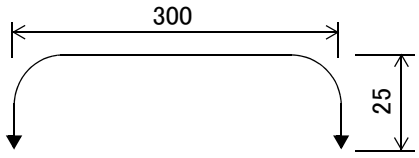
Table 2-1 : Tab Standard specifications of robot (Standard Specification)

Item		Unit	Specifications		
Type			RH-6SDH3520	RH-6SDH4520	RH-6SDH5520
Environment			Standard specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute encoder		
Motor capacity	J1	W	400		
	J2	W	100		
	J3 (Z)	W	100		
	J4 (θ axis)	W	100		
Brake			J1, J2, J4 : no brake J3 : with brake		
Arm length	No. 1 arm	mm	125	225	325
	No. 2 arm	mm	225		
Max.reach radius(No. 1+ No. 2)		mm	350	450	550
Operating range	J1	deg	254(± 127)		
	J2	deg	274(± 137)	290(± 145)	
	J3 (Z)	mm	200(97 to 297)		
	J4 (θ axis)	deg	720(± 360)		
Speed of motion	J1	deg/s	375		
	J2	deg/s	612		
	J3 (Z)	mm/s	1,177		
	J4 (θ axis)	deg/s	2,411		
Maximum horizontal composite speed Note1)		mm/s	6,473<4,694>	7,128<5,349>	7,782(6,003)
Cycle time Note2)		sec	0.45	0.46	0.47
Load (Including hand)	Rating	kg	2		
	Maximum		6		
Allowable moment load	Rating	kg・m^2	0.01		
	Maximum		0.04		
Pose repeatability Note3)	X-Y direction	mm	± 0.02		
	J3 (Z)	mm	± 0.01		
	J4 (θ axis)	deg	± 0.02		
Ambient temperature		℃	0 to 40		
Mass		k	20	21	
Tool wiring Note4)			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6 × 2		
Supply pressure		MPa	0.5 ± 10% (		
Protection specification Note5)			IP20		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1)The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note2)Values of the operation below at rated load capacity.

・The cycle time may increase when the positioning accuracy or other criterion of a work is required, or depending on the position of operation.



Note3)The pose repeatability details are given in Page 6, "2.2.1 Pose repeatability".

Note4)The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note5)The protection specification details are given in Page 26, "2.2.4 Protection specifications and working environment".

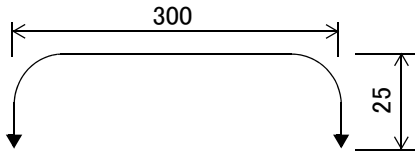
Table 2-2 : Tab Standard specifications of robot (Clean Specification)

Item		Unit	Specifications		
Type			RH-6SDH3517C	RH-6SDH4517C	RH-6SDH5517C
Environment			Clean specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute encoder		
Motor capacity	J1	W	400		
	J2	W	100		
	J3 (Z)	W	100		
	J4 (θ axis)	W	100		
Brake			J1, J2, J4 : no brake J3 : with brake		
Arm length	No. 1 arm	mm	125	225	325
	No. 2 arm	mm	225		
Max.reach radius(No. 1+ No. 2)		mm	350	450	550
Operating range	J1	deg	254(± 127)		
	J2	deg	274(± 137)	290(± 145)	
	J3 (Z)	mm	170(97 to 267)		
	J4 (θ axis)	deg	720(± 360)		
Speed of motion	J1	deg/s	375		
	J2	deg/s	612		
	J3 (Z)	mm/s	1,177		
	J4 (θ axis)	deg/s	2,411		
Maximum horizontal composite speed Note1)		mm/s	6,473<4,694>	7,128<5,349>	7,782<6,003>
Cycle time Note2)		sec	0.45	0.46	0.47
Load (Including hand)	Rating	kg	2		
	Maximum		6		
Allowable moment load	Rating	kg・m^2	0.01		
	Maximum		0.04		
Pose repeatability Note3)	X-Y direction	mm	± 0.02		
	J3 (Z)	mm	± 0.01		
	J4 (θ axis)	deg	± 0.02		
Ambient temperature		℃	0 to 40		
Mass		kg	20	21	
Tool wiring Note4)			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6 × 2		
Supply pressure		MPa	0.5 ± 10%		
Degree of cleanliness Note5)			10(0.3 μ m)		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1)The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note2)Values of the operation below at rated load capacity.

・The cycle time may increase when the positioning accuracy or other criterion of a work is required, or depending on the position of operation.



Note3)The pose repeatability details are given in Page 6, "2.2.1 Pose repeatability".

Note4)The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note5)The details of the clean specifications are described in Page 28, "2.2.5 Clean specifications". Protection of the cleanness of the robot is required if the down flow in a clean room is 0.3 m/s or more and robot internal suction is 60 NL/min. A ϕ8 joint is prepared at the base rear part for suction.

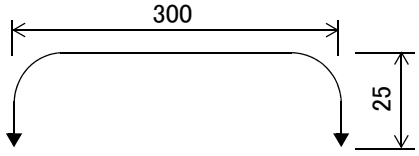
Table 2-3 : Tab Standard specifications of robot (Oil mist Specification)

Item		Unit	Specifications		
Type			RH-6SDH3517M	RH-6SDH4517M	RH-6SDH5517M
Environment			Oil mist specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute encoder		
Motor capacity	J1	W	400		
	J2	W	100		
	J3 (Z)	W	100		
	J4 (θ axis)	W	100		
Brake			J1, J2, J4 : no brake J3 : with brake		
Arm length	No. 1 arm	mm	125	225	325
	No. 2 arm	mm	225		
Max.reach radius(No. 1+ No. 2)		mm	350	450	550
Operating range	J1	deg	254(± 127)		
	J2	deg	274(± 137)	290(± 145)	
	J3 (Z)	mm	170(97 to 267)		
	J4 (θ axis)	deg	720(± 360)		
Speed of motion	J1	deg/s	375		
	J2	deg/s	612		
	J3 (Z)	mm/s	1,177		
	J4 (θ axis)	deg/s	2,411		
Maximum horizontal composite speed Note1)		mm/s	6,473<4,694>	7,128<5,349>	7,782<6,003>
Cycle time Note2)		sec	0.45	0.46	0.47
Load (Including hand)	Rating	kg	2		
	Maximum	kg	6		
Allowable moment load	Rating	kg・m^2	0.01		
	Maximum		0.04		
Pose repeatability Note3)	X-Y direction	mm	± 0.02		
	J3 (Z)	mm	± 0.01		
	J4 (θ axis)	deg	± 0.02		
Ambient temperature		℃	0 to 40		
Mass		kg	20	21	
Tool wiring Note4)			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6 × 2		
Supply pressure		MPa	0.5 ± 10%		
Protection specification Note5) Note6)			IP54		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1)The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note2)Values of the operation below at rated load capacity.

・The cycle time may increase when the positioning accuracy or other criterion of a work is required, or depending on the position of operation.



Note3)The pose repeatability details are given in Page 6, "2.2.1 Pose repeatability".

Note4)The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note5)The protection specification details are given in Page 26, "2.2.4 Protection specifications and working environment".

Note6) If you intend to use the controller in oil mist or similar environments, use the controller protection box (CR1B-MB) to protect the controller from the operation environment. A robot equipped with the controller protection box as standard is available(indicated with "-SM" on type).

2.1.2 RH-12SDH sereis

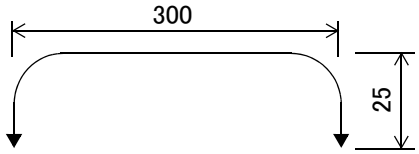
Table 2-4 : Tab Standard specifications of robot (Standard Specification)

Item		Unit	Specifications		
Type			RH-12SDH5535	RH-12SDH7035	RH-12SDH8535
Environment			Standard specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute encoder		
Motor capacity	J1	W	750		
	J2	W	400		
	J3 (Z)	W	200		
	J4 (θ axis)	W	100		
Brake			J1, J2, J4 : no brake J3 : with brake		
Arm length	No. 1 arm	mm	225	375	525
	No. 2 arm	mm	325		
Max.reach radius(No. 1+ No. 2)		mm	550	700	850
Operating range	J1	deg	280(± 140)		
	J2	deg	290(± 145)		306(± 153)
	J3 (Z)	mm	350(-10 to 340)		
	J4 (θ axis)	deg	720(± 360)		
Speed of motion	J1	deg/s	360		288
	J2	deg/s	412.5		
	J3 (Z)	mm/s	1,300		
	J4 (θ axis)	deg/s	1,500		
Maximum horizontal composite speed Note1)		mm/s	10,555<5,796>	11,498<6,738>	11,221<6,612>
Cycle time Note2)		sec	0.43	0.44	0.46
Load (Including hand)	Rating	kg	2		
	Maximum	kg	12		
Allowable moment load	Rating	kg・m^2	0.02		
	Maximum		0.1		
Pose repeatability Note3)	X-Y direction	mm	± 0.02	± 0.025	
	J3 (Z)	mm	± 0.01(± 3^{-5})		
	J4 (θ axis)	deg	± 0.03		
Ambient temperature		℃	0 to 40		
Mass		kg	41	43	45
Tool wiring Note4)			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6 × 2		
Supply pressure		MPa	0.5 ± 10%		
Protection specification Note5)			IP20		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1)The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note2)Values of the operation below at rated load capacity.

・The cycle time may increase when the positioning accuracy or other criterion of a work is required, or depending on the position of operation.



Note3)The pose repeatability details are given in Page 6, "2.2.1 Pose repeatability".

Note4)The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note5)The protection specification details are given in Page 26, "2.2.4 Protection specifications and working environment".

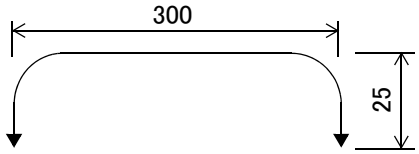
Table 2-5 : Tab Standard specifications of robot (Clean Specification)

Item		Unit	Specifications		
Type			RH-12SDH5530C	RH-12SDH7030C	RH-12SDH8530C
Environment			Clean specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute encoder		
Motor capacity	J1	W	750		
	J2	W	400		
	J3 (Z)	W	200		
	J4 (θ axis)	W	100		
Brake			J1, J2, J4 : no brake J3 : with brake		
Arm length	No. 1 arm	mm	225	375	525
	No. 2 arm	mm	325		
Max.reach radius(No. 1+ No. 2)		mm	550	700	850
Operating range	J1	deg	280(± 140)		
	J2	deg	290(± 145)		306(± 153)
	J3 (Z)	mm	300(-10 to 290)		
	J4 (θ axis)	deg	720(± 360)		
Speed of motion	J1	deg/s	360		288
	J2	deg/s	412.5		
	J3 (Z)	mm/s	1,300		
	J4 (θ axis)	deg/s	1,500		
Maximum horizontal composite speed Note1)		mm/s	10,555<5,796>	11,498<6,738>	11,221<6,612>
Cycle time Note2)		sec	0.43	0.44	0.46
Load (Including hand)	Rating	kg	2		
	Maximum	kg	12		
Allowable moment load	Rating	kg・m^2	0.02		
	Maximum		0.1		
Pose repeatability Note3)	X-Y direction	mm	± 0.02	± 0.025	
	J3 (Z)	mm	± 0.01		
	J4 (θ axis)	deg	± 0.03		
Ambient temperature		℃	0 to 40		
Mass		kg	41	43	45
Tool wiring Note4)			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6 × 2		
Supply pressure		MPa	0.5 ± 10%		
Degree of cleanliness Note5)			10(0.3 μ m)		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1)The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note2)Values of the operation below at rated load capacity.

・The cycle time may increase when the positioning accuracy or other criterion of a work is required, or depending on the position of operation.



Note3)The pose repeatability details are given in Page 6, "2.2.1 Pose repeatability".

Note4)The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note5)The details of the clean specifications are described in Page 28, "2.2.5 Clean specifications" To secure cleanliness, a clean room down flow of 0.3 m/s or more and an internal robot suction of 60 NL/min are required. A coupling of ϕ8 is provided in the rear of the base for suction.

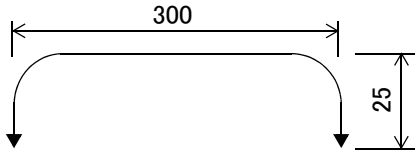
Table 2-6 : Tab Standard specifications of robot (Oil mist Specification)

Item		Unit	Specifications		
Type			RH-12SDH5530M	RH-12SDH7030M	RH-12SDH8530M
Environment			Oil mist specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute encoder		
Motor capacity	J1	W	750		
	J2	W	400		
	J3 (Z)	W	200		
	J4 (θ axis)	W	100		
Brake			J1, J2, J4 : no brake J3 : with brake		
Arm length	No. 1 arm	mm	225	375	525
	No. 2 arm	mm	325		
Max.reach radius(No. 1+ No. 2)		mm	550	700	850
Operating range	J1	deg	280(± 140)		
	J2	deg	290(± 145)		306(± 153)
	J3 (Z)	mm	300(-10 to 290)		
	J4 (θ axis)	deg	720(± 360)		
Speed of motion	J1	deg/s	360		288
	J2	deg/s	412.5		
	J3 (Z)	mm/s	1,300		
	J4 (θ axis)	deg/s	1,500		
Maximum horizontal composite speed Note1)		mm/s	10,555<5,796>	11,498<6,738>	11,221<6,612>
Cycle time Note2)		sec	0.43	0.44	0.46
Load (Including hand)	Rating	kg	2		
	Maximum		12		
Allowable moment load	Rating	kg・m^2	0.02		
	Maximum		0.1		
Pose repeatability Note3)	X-Y direction	mm	± 0.02	± 0.025	
	J3 (Z)	mm	± 0.01		
	J4 (θ axis)	deg	± 0.03		
Ambient temperature		℃	0 to 40		
Mass		kg	41	43	45
Tool wiring Note4)			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6 × 2		
Supply pressure		MPa	0.5 ± 10%		
Protection specification Note5) Note6)			IP54		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1)The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note2)Values of the operation below at rated load capacity.

・The cycle time may increase when the positioning accuracy or other criterion of a work is required, or depending on the position of operation.



Note3)The pose repeatability details are given in Page 6, "2.2.1 Pose repeatability".

Note4)The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note5)The protection specification details are given in Page 26, "2.2.4 Protection specifications and working environment".

Note6) When using the controller in an oil mist environment, etc., select the oil mist compatible controller specifications (indicated with "-SM" on type). The CR3-535M controller, compatible with an oil mist environment, is available as factory-shipped special specifications.

2.1.3 RH-18SDH series

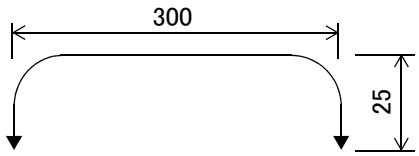
Table 2-7 : Tab Standard specifications of robot

Item		Unit	Specifications		
Type			RH-18SDH8535	RH-18SDH8530C	RH-18SDH8530M
Environment			Standard specification	Clean specification	Oil mist specification
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute encoder		
Motor capacity	J1	W	750		
	J2	W	400		
	J3 (Z)	W	400		
	J4 (θ axis)	W	100		
Brake			J1, J2 : no brake J3, J4 : with brake		
Arm length	No. 1 arm	mm	525		
	No. 2 arm	mm	325		
Max.reach radius(No. 1+ No. 2)		mm	850		
Operating range	J1	deg	280(± 140)		
	J2	deg	306(± 153)		
	J3 (Z)	mm	350(-10 to 340)	300(-10 to 290)	
	J4 (θ axis)	deg	720(± 360)		
Speed of motion	J1	deg/s	288		
	J2	deg/s	412.5		
	J3 (Z)	mm/s	1,200		
	J4 (θ axis)	deg/s	1,500		
Maximum horizontal composite speed Note1)		mm/s	11,221 <6,612>		
Cycle time Note2)		sec	0.53		
Load (Including hand)	Rating	kg	5		
	Maximum		18		
Allowable moment load	Rating	kg・m^2	0.02		
	Maximum		0.2		
Pose repeatability Note3)	X-Y direction	mm	± 0.025		
	J3 (Z)	mm	± 0.01		
	J4 (θ axis)	deg	± 0.03		
Ambient temperature		℃	0 to 40		
Mass		kg	47		
Tool wiring Note4)			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6 × 2		
Supply pressure		MPa	0.5 ± 10%		
Protection specification Note5) Note6)			IP20	—	IP54
Degree of cleanliness Note7)			—	10(0.3 μ m)	—
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1)The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note2)Values of the operation below at rated load capacity.

・The cycle time may increase when the positioning accuracy or other criterion of a work is required, or depending on the position of operation.



Note3)The pose repeatability details are given in Page 6, "2.2.1 Pose repeatability".

Note4)The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note5)The protection specification details are given in Page 26, "2.2.4 Protection specifications and working environment".

Note6) When using the controller in an oil mist environment, etc., select the oil mist compatible controller specifications (indicated with "-SM" on type). The CR3-535M controller, compatible with an oil mist environment, is available as factory-shipped special specifications.

Note7)The details of the clean specifications are described in Page 28, "2.2.5 Clean specifications" To secure cleanliness, a clean room down flow of 0.3 m/s or more and an internal robot suction of 60 NL/min are required. A coupling of ϕ8 is provided in the rear of the base for suction.

2.2 Definition of specifications

The accuracy of pose repeatability mentioned in catalogs and in the specification manual is defined as follows.

2.2.1 Pose repeatability

For this robot, the pose repeatability is given in accordance with JIS 8432 (Pose repeatability). Note that the value is based on 100 measurements (although 30 measurements are required according to JIS).

[Caution] The specified "pose repeatability" is not guaranteed to be satisfied under the following conditions.

[1] Operation pattern factors
1) When an operation that approaches from different directions and orientations are included in relation to the teaching position during repeated operations
2) When the speed at teaching and the speed at execution are different

[2] Load fluctuation factor
1) When work is present/absent in repeated operations

[3] Disturbance factor during operation
1) Even if approaching from the same direction and orientation to the teaching position, when the power is turned OFF or a stop operation is performed halfway

[4] Temperature factors
1) When the operating environment temperature changes
2) When accuracy is required before and after a warm-up operation

[5] Factors due to differences in accuracy definition
1) When accuracy is required between a position set by a numeric value in the robot's internal coordinate system and a position within the actual space
2) When accuracy is required between a position generated by the pallet function Note1) and a position within the actual space

Note1)
The pallet function is a function that teaches only the position of the work used as reference (3 to 4 points) and obtains the remaining positions by calculations, for an operation that arranges works orderly or for an operation that unloads orderly arranged works. By using this function, for example, in the case of an operation that arranges works on grid points of 100 x 100, by teaching only three points of four corners, the remaining grid points are automatically generated; thus, it is not necessary to teach all 10,000 points. For more information about the pallet function, refer to the separate volume, "Instruction Manual/Detailed Explanation of Functions and Operations."

2.2.2 Rated load (mass capacity)

The robot's mass capacity is expressed solely in terms of mass, but even for tools and works of similar mass, eccentric loads will have some restrictions When designing the tooling or when selecting a robot, consider the following issues.

(1) The tooling should have the value less or equal than the smaller of the tolerable inertia and the tolerable moment found in Page 8, "2.1 Standard specifications".

(2) Fig. 2-1, Fig. 2-2 and Fig. 2-3 shows the distribution dimensions for the center of gravity in the case where the volume of the load is relatively small. Use this figure as a reference when designing the tooling.

[CAUTION]The mass capacity and the allowable moment of inertia are significantly affected by the operating speed and operating posture of the robot. Even when these values are within the allowable range described above, an overload or overcurrent alarm may occur. In such cases, the acceleration/deceleration time settings, operating speed and/or operating posture must be adjusted.

[CAUTION]The overhang amount of the load, such as the mass capacity and the allowable moment of inertia defined in this section, are dynamic limit values determined by the capacity of the motor that drives axes or the capacity of the speed reducer. Therefore, it does not guarantee the accuracy on all areas of tooling. Guaranteed accuracy is measured from the center point of the mechanical interface surface. Please note that if the point of operation is kept away from the flange surface by long and low-rigid tooling, the positioning accuracy may deteriorate or may cause vibration.
Note that the allowable offset value (Z direction) from the lower edge of the shaft to the position of center of gravity is 100 mm.

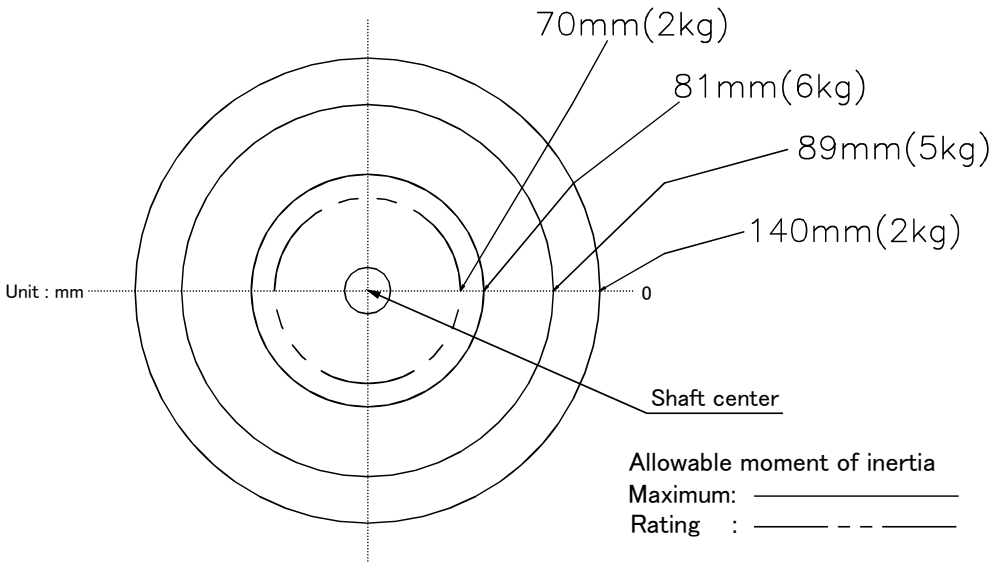


Fig.2-1 : Position of center of gravity for loads (for loads with comparatively small volume): RH-6SDH series

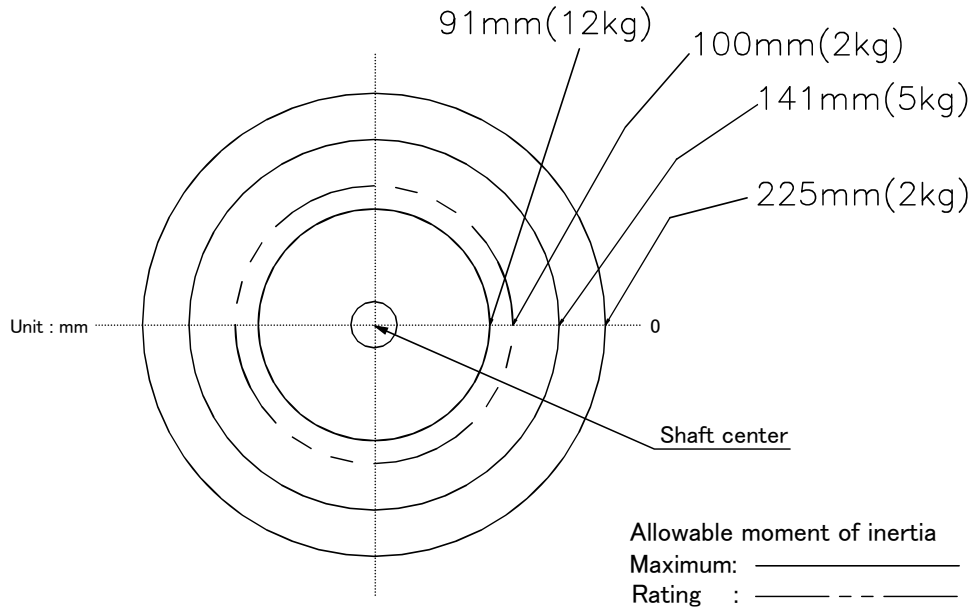


Fig.2-2 : Position of center of gravity for loads (for loads with comparatively small volume): RH-12SDH series

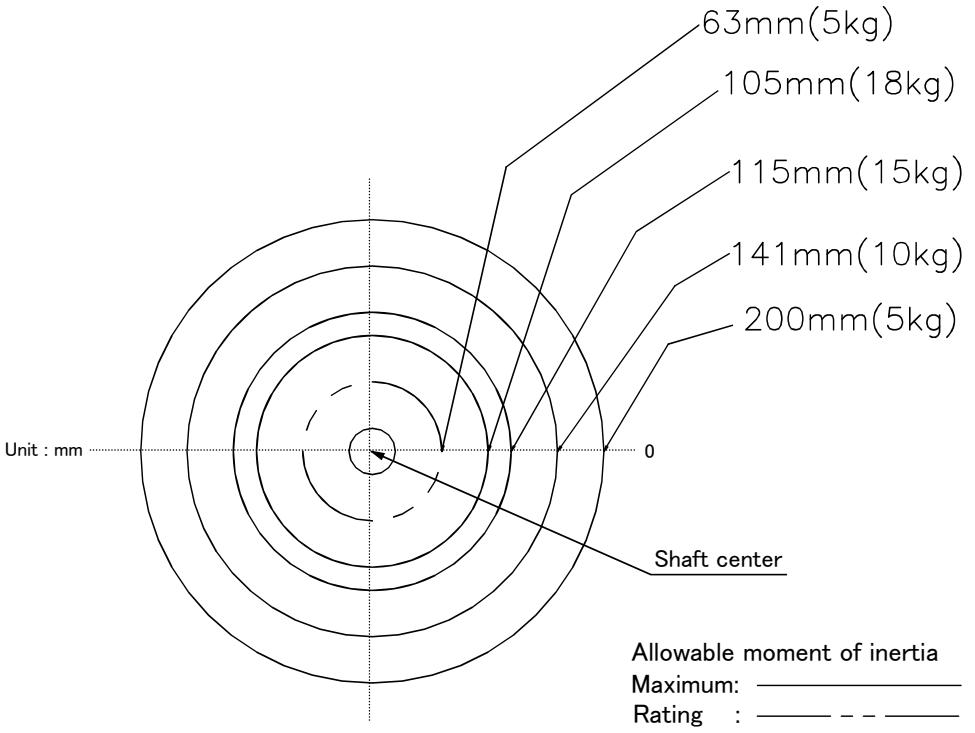


Fig.2-3 : Position of center of gravity for loads (for loads with comparatively small volume): RH-18SDH series

2.2.3 Relationships Among Mass Capacity, Speed, and Acceleration/Deceleration Speed

This robot automatically sets the optimum acceleration and deceleration speeds and maximum speed, according to the load capacity and size that have been set, and operates using these automatically set speeds.
To achieve that, it is necessary to correctly set the actual load data (mass and size of hand and work) to be used. However, vibration, overheating and errors such as excessive margin of error and overload may occur,depending on the robot operation pattern or ambient temperature. In such a case, change the setting value to the +20% range. If a setting is performed in such a way that it falls below the mounted load, the life span of the mechanism elements used in the robot may be shortened. In the case of a work requiring a high degree of accuracy, set up the load correctly and use the robot by lowering the ratios of the acceleration and deceleration speeds.

(1) Setting Load Capacity and Size (Hand Conditions)

Set up the capacity and size of the hand with the "HNDDAT*" parameter (optimum acceleration/deceleration setting parameter), and set up the capacity and size of the work with the "WRKDAT*" parameter. Numbers 0 to 8 can be used for the asterisk (*) part. Designate the "HNDDAT*" and "WRKDAT*" parameters to be used using the "LOADSET" command in a program.
For more details, refer to the separate "Instruction Manual/Detailed Explanation of Functions and Operations."
It is the same meaning as "LOADSET 0.0" if not using the "LOADSET".

<Factor default settings>

	Hand mass kg	size X mm	size Y mm	size Z mm	center-of-gravity position X mm	center-of-gravity position Y mm	center-of-gravity position Z mm
RH-6SDH series							
HNDDAT*	6.0	99.0	99.0	76.0	0.0	0.0	38.0
WRKDAT*	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RH-12SDH series							
HNDDAT*	12.0(26.5)	225.0(0.74)	225.0(0.74)	30.0(0.10)	0.0	0.0	15.0(0.05)
WRKDAT*	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RH-18SDH series							
HNDDAT*	18.0(39.7)	258.0(0.85)	258.0(0.85)	34.0(0.11)	0.0	0.0	17.0(0.06)
WRKDAT*	0.0	0.0	0.0	0.0	0.0	0.0	0.0

(2) Relationship Between Mass Capacity and Speed

A function to optimize the maximum speed of each axis according to the setting value of the load capacity will be activated (Refer to Fig. 2-4). However, this function does not work with the setting of 2kg (5kg in the case of RH-18SDH85 sereis) or lighter load mass. When the setting of the load mass is changed to 2kg (5kg in the case of RH-18SDH85 sereis) or heavier, the maximum speed is compensated according to the load mass.

[CAUTION] Depending on the operation pattern, the speed and/or acceleration/deceleration at the front edge may not be parallel with the speed and the rate of change of acceleration/deceleration specified in a program.

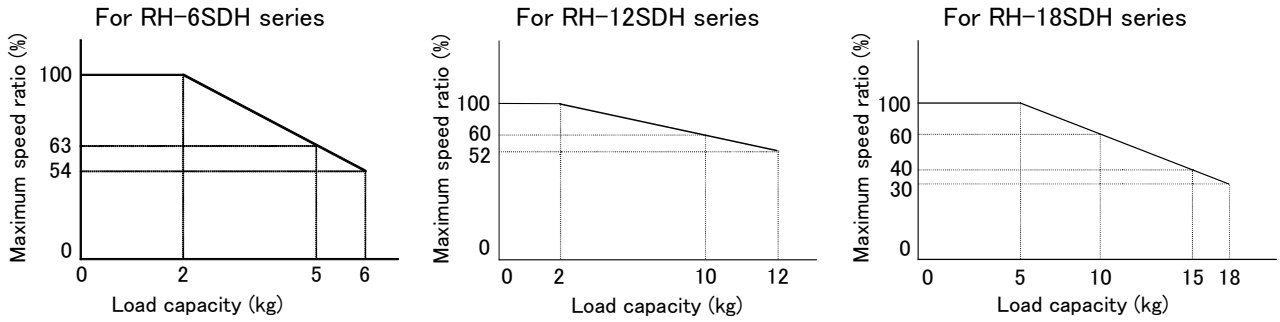
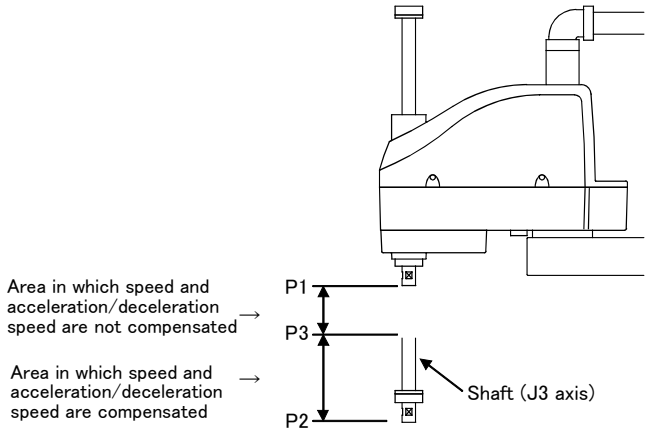


Fig.2-4 : Automatic compensation of speed

(3) Relationship Between Height of Shaft (J3 Axis) and Acceleration/Deceleration Speed

A function to optimize the acceleration/deceleration speed according to the height of the shaft (Refer to Fig. 2-6) will be activated. This function is invalid if the shaft (axis J3) operates at a position above P3 in Fig. 2-5. Acceleration/deceleration is compensated for at a position below P3 in Fig. 2-5 if the position of the center of gravity of the load is located at the front edge of the shaft.



	Upper stroke edge P1(mm)	Lower stroke edge P2(mm)	Position P3(mm)
RH-6SDH***	297	-23	247(Position 50 mm below the upper stroke edge.)
RH-12SDH***	340	-10	248(Position 92 mm below the upper stroke edge.)
RH-18SDH***	340	-10	320(Position 20 mm below the upper stroke edge.)

Fig.2-5 : Area in which acceleration/deceleration speed is compensated

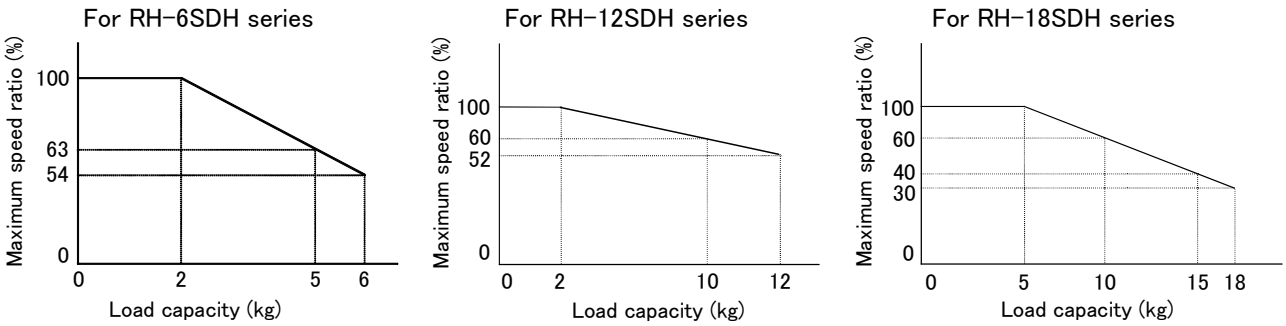


Fig.2-6 : Automatic compensation of acceleration/deceleration speed

(4) Time to reach the position repeatability (only for RH-12SDH/18SDH series)

When using this robot, the time to reach the position repeatability may be prolonged due to the effect of residual vibration at the time of stopping. If this happens, take the following measures:

1) Change the operation position of the Z axis to the location near the top as much as possible.
2) Increase the operation speed prior to stopping.
3) When positioning the work near the bottom edge of the Z axis, if no effectiveness is achieved in step <2> above, perform operation <1> (robot path: O -> A -> C). In the case of operation 2 (robot path: O -> B -> C), residual vibration may occur. (Refer to Fig. 2-7.)

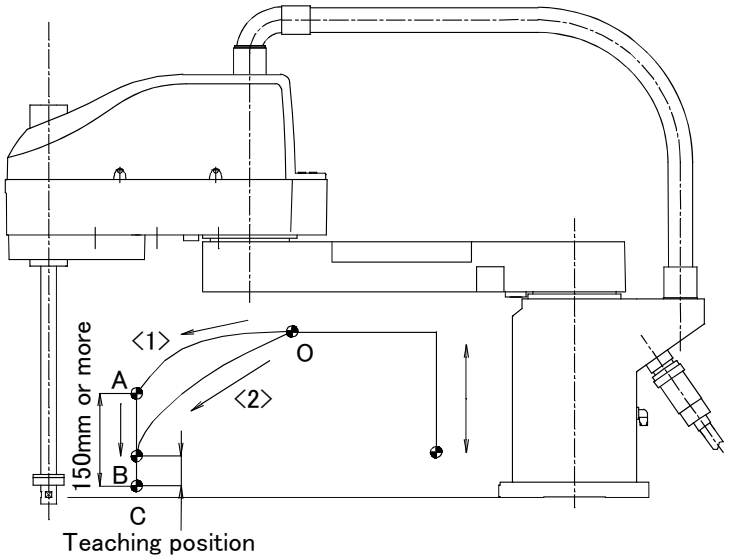


Fig.2-7 : Recommended path when positioning at the bottom edge of the Z axis

2.2.4 Protection specifications and working environment

(1) Types of protection specifications

The robot arm has protection specifications that comply with the IEC Standards. The protection specifications and applicable fields are shown in Table 2-8.
Even oil mist environment can be used in addition to the general environment.

Table 2-8 : Protection specifications and applicable fields

Type	Protection specifications (IEC Standards value)	Classification	Applicable field	Remarks
RH-6SDH series				
RH-6SDH 3520 RH-6SDH 4520 RH-6SDH 5520	Robot arm : IP20 Controller : IP20	General environment specifications	General assembly Slightly dusty environment	
RH-6SDH 3517M RH-6SDH 4517M RH-6SDH 5517M	Robot arm : IP54 Controller : IP20	Oil mist specifications	Machine tool (cutting) Machine shop with heavy oil mist Dusty work shop	Note that if the cutting machine contains abrasive materials, the machine line will be shortened.
RH-6SDH 3517M-SM Note1) RH-6SDH 4517M-SM RH-6SDH 5517M-SM	Robot arm : IP54 Controller : IP54			
RH-12SDH series				
RH-12SDH 5535 RH-12SDH 7035 RH-12SDH 8535	Robot arm : IP20 Controller : IP20	General environment specifications	General assembly Slightly dusty environment	
RH-12SDH 5530M RH-12SDH 7030M RH-12SDH 8530M	Robot arm : IP54 Controller : IP20	Oil mist specifications	Machine tool (cutting) Machine shop with heavy oil mist Dusty work shop	Note that if the cutting machine contains abrasive materials, the machine line will be shortened.
RH-12SDH 5530M-SM Note2) RH-12SDH 7030M-SM RH-12SDH 8530M-SM	Robot arm : IP54 Controller : IP54			
RH-18SDH series				
RH-18SDH 8535	Robot arm : IP20 Controller : IP20	General environment specifications	General assembly Slightly dusty environment	
RH-18SDH 8530M	Robot arm : IP54 Controller : IP20	Oil mist specifications	Machine tool (cutting) Machine shop with heavy oil mist Dusty work shop	Note that if the cutting machine contains abrasive materials, the machine line will be shortened.
RH-18SDH 8530M-SM Note2)	Robot arm : IP54 Controller : IP54			

Note1) The "-SM" specification (specification with the controller protection box) comes with the controller protection box (CR1D-MB) as standard.
Note2) Replaced with the CR3D-7**M controller in the case of the "-SM" specification (controller specification with countermeasure against oil mist).

⚠ CAUTION Use the controller protection box (CR1D-MB) to protect the controller from the environment when the CR1D-7xx controller will be used in the environment such as the oil mist shown in the Table 2-8. A robot equipped with the controller protection box as standard is available.

The IEC IP symbols define the degree of protection against solids and fluids, and do not indicate a protective structure against the entry of oil or water.

The evaluation regarding oil mist specifications has been confirmed with Mitsubishi's standard testing methods using the cutting oils shown in Table 2-9.

Table 2-9 : Tested cutting oil for oil mist specifications

Name	Maker	Relevant JIS	Main characteristics	Application
Emulcut FA-800	Kyodo Yushi Co., Ltd	Class A1 No. 2	Water soluble cutting oil ・Base oil..... 50-60% ・Surfactant and rust inhibitor..... 30-40% ・Additives..... 5% or less ・Water ..... The rest	Water soluble cutting oil Emulcut

【Information】
・The IEC IP20
It indicates the protective structure that prevents an iron ball 12 $^{+0.05}_{0}$mm diameter, which is being pressed with the power of 3.1 kg ± 10%, from going through the opening in the outer sheath of the supplied equipment.

・The IEC IP54

The IEC IP54 standard refers to protection structure designed to prevent any harmful effects by fresh water scattering vertically onto the testing equipment in a radius of 180 degrees from a distance of 300 to 500 mm, with 10 ± 0.5 liters of water every minute, at a water pressure of 80 to 100kPa, covering the entire area of the robot with the exception of the installation section at 1 ㎡ per minute, for a total of 5 minutes or more.

・The IEC IP65

Protection against water infiltration as specified in IP65 indicates a protective structure that is not harmfully affected when 12.5 ± 5% liters of water is supplied from a test device at a position approx. 3m away in various directions and a water pressure of 30kPa at the nozzle section. The water is filled one minute per $1m^2$ of test device surface area for a total of three minutes.

(2) About the use with the bad environment

This robot has protection methods that conform to IEC's standards (splashproof type). Recommended usage conditions.

The protection specifications robot has protection methods that conform to IEC's IP54 standards (splashproof type). It has protection structure designed to prevent harmful effects caused by splashing water coming from various directions, as the robot is operating.

Recommended usage conditions

1) The robot is designed for use in combination with machining device.
2) Please examine cutting oil referring to Table 2-9 used by a standard examination of our company.
3) Take measures so that the robot will not be exposed to water, oil and/or chips for a long period of time.
4) Protection performance can be improved by pressurizing the inside of the robot arm. Since the joint (AIR PURGE) of phi 8 is prepared at the rear of the base section, please supply the dry air for pressurization from from this joint. The specification of the dry air for pressurization is shown in Table 2-10.

Table 2-10 : Specification of the dry air for pressurization

Item	Dew point	Pressure
Specification	The atmospheric pressure dew point is -20 degree or less.	0 to 0.01MPa

The warranty is invalid for any faults that occur when the robot is used under the following conditions.

Also, if the cover and/or other parts are damaged by interferences caused by the peripheral devices and the robot, the protection specification (seal performance, etc.) may be degraded. Therefore, please pay extra attention when handling the robot.

Refer to Page 173, "6.2 Working environment".

1) In surroundings that generate inflammable gases or corrosive gasses.
2) Atmosphere used excluding cutting oil shown in Table 2-9.
3) Environment where the robot is exposed to water, oil and/or chips for a long period of time.
4) In surroundings where chips fall directly on the robot.In surroundings where the minimum diameter of chips is less than 0.5mm.
5) Mist atmosphere exceeding the specification.
6) Pressurization by the dry air exceeding the specification of Table 2-10

2.2.5 Clean specifications

(1) Types of clean specifications

The robot arm with clean specification is made by order. Please check the delivery schedule.

Table 2-11 : Clean specifications

Type	Degree of cleanliness	Internal suction	Remarks
RH-6SDH 3517C RH-6SDH 4517C RH-6SDH 5517C	10(0.3 μm)	Internal suction	Internal suction: 60 NL/min *Prepare the above suction by customer.
RH-12SDH 5530C RH-12SDH 7030C RH-12SDH 8530C			
RH-18SDH8530C			

Table 2-12 : Specifications of vacuum generation valve

Type	Maker	Air pressure
MEDT 14	KONEGAI CORPORATION	0.2 to 0.6 MPa

■ Precautions for use

1) When using a device that moves or rotates the robot arm, the down flow may not be secured because of the air flow. In this case, the degree of cleanliness cannot be ensured.
2) A Φ8 coupling is provided in the base section of the robot arm for suction inside the robot arm. When using the robot, connect this coupling with the vacuum generating valve and vacuum pump (furnished by the customer).
   * Install the vacuum generating valve downstream of the downflow or install a filter in the exhaust air section so that the exhaust air from the vacuum generating valve does not affect cleanness.
   Recommended filter: Exhaust filter EF300-02, Koganei Corporation
   * If any vacuum pump is prepared by the customer, assure on the vacuum side flow rate 30 liters/min.(ANR) or more .
3) When using the Mitsubishi standard option solenoid valve set, use the spare piping (Φ6 pneumatic hose) of the primary piping to exhaust the air.
   If the exhaust leaks into the robot arm, the degree of cleanliness could be affected.

2.3 Names of each part of the robot

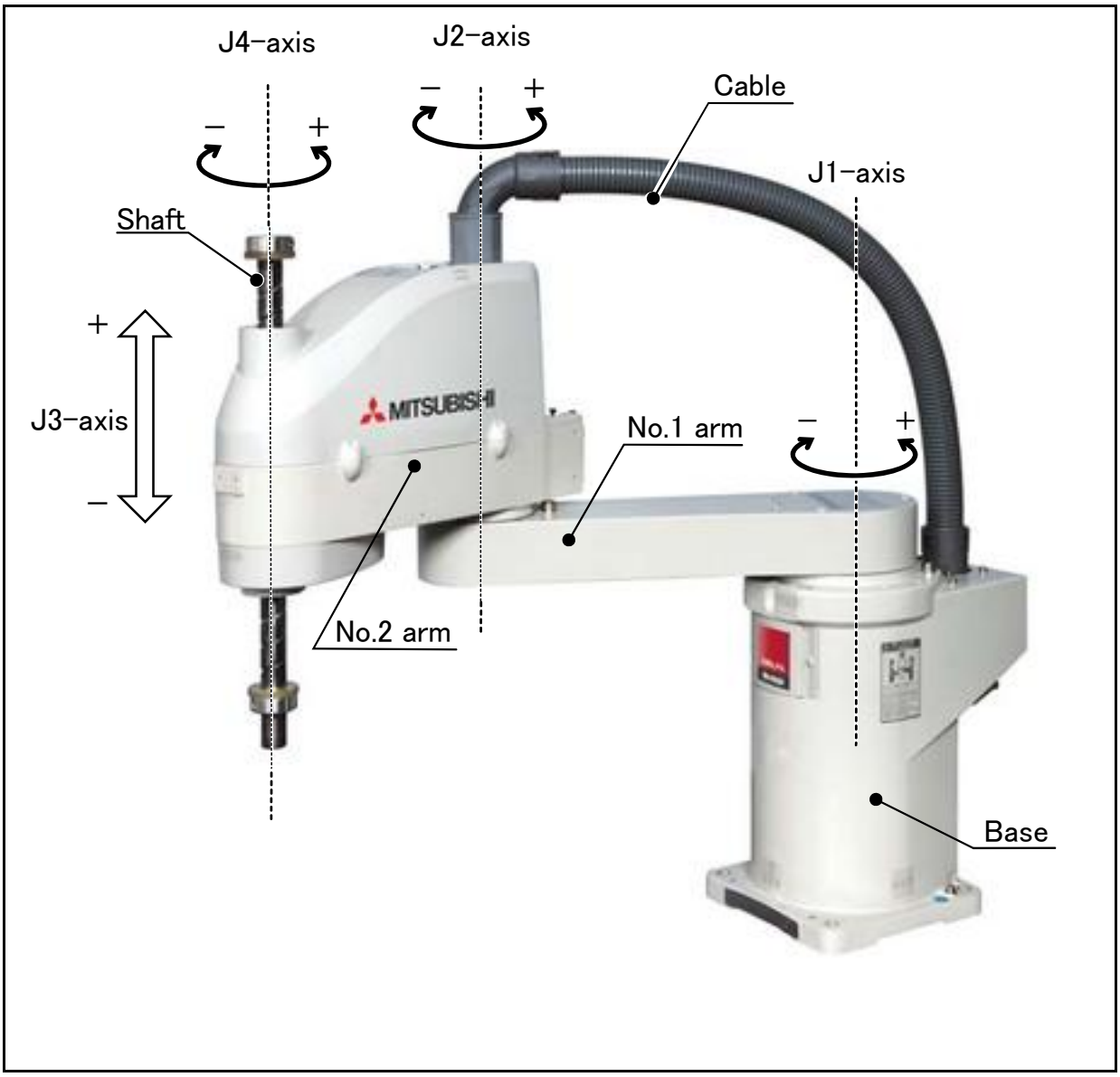
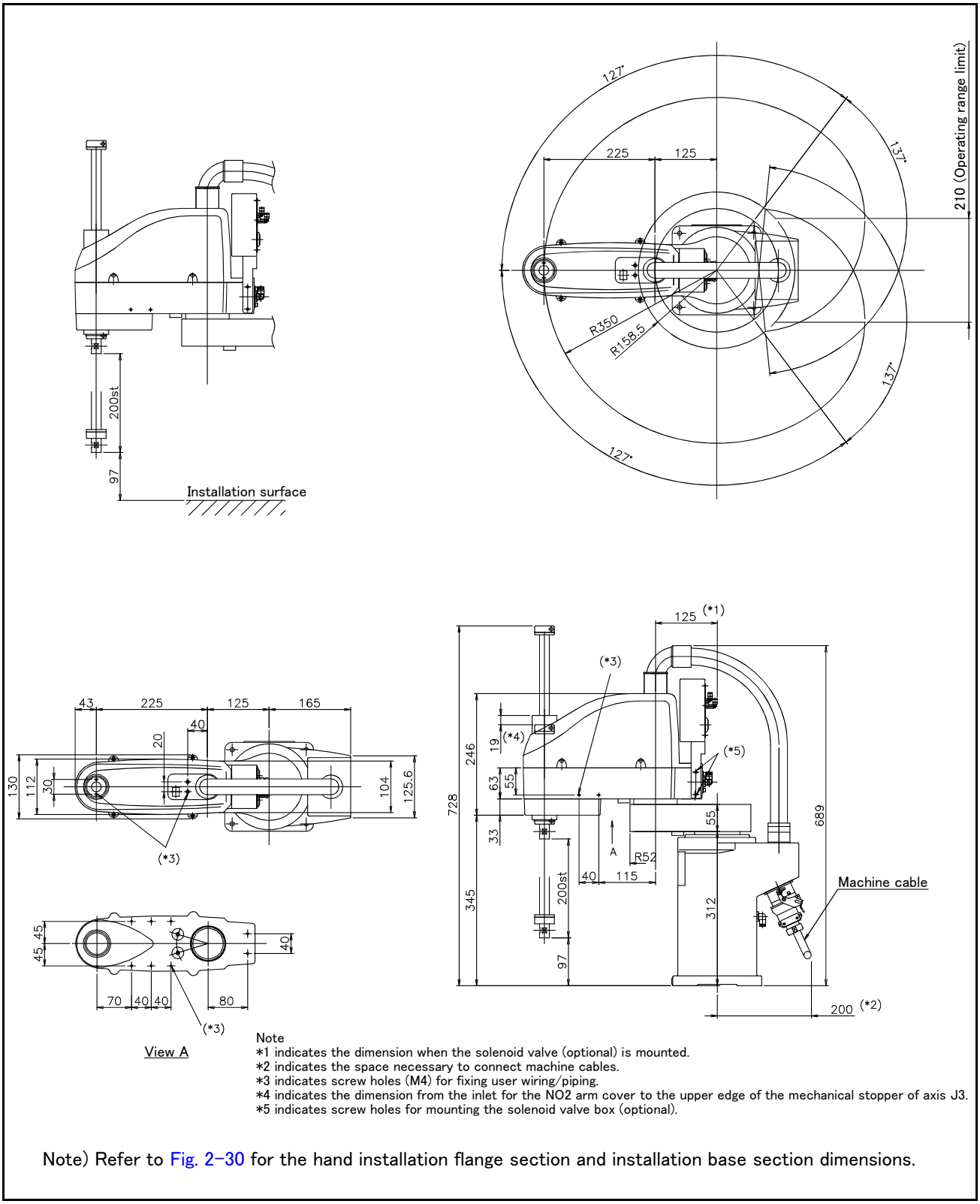


Fig.2-8 : Names of each part of the robot

2.4 Outside dimensions・Operating range diagram

2.4.1 Outside dimensions・Operating range diagram (RH-6SDH series)

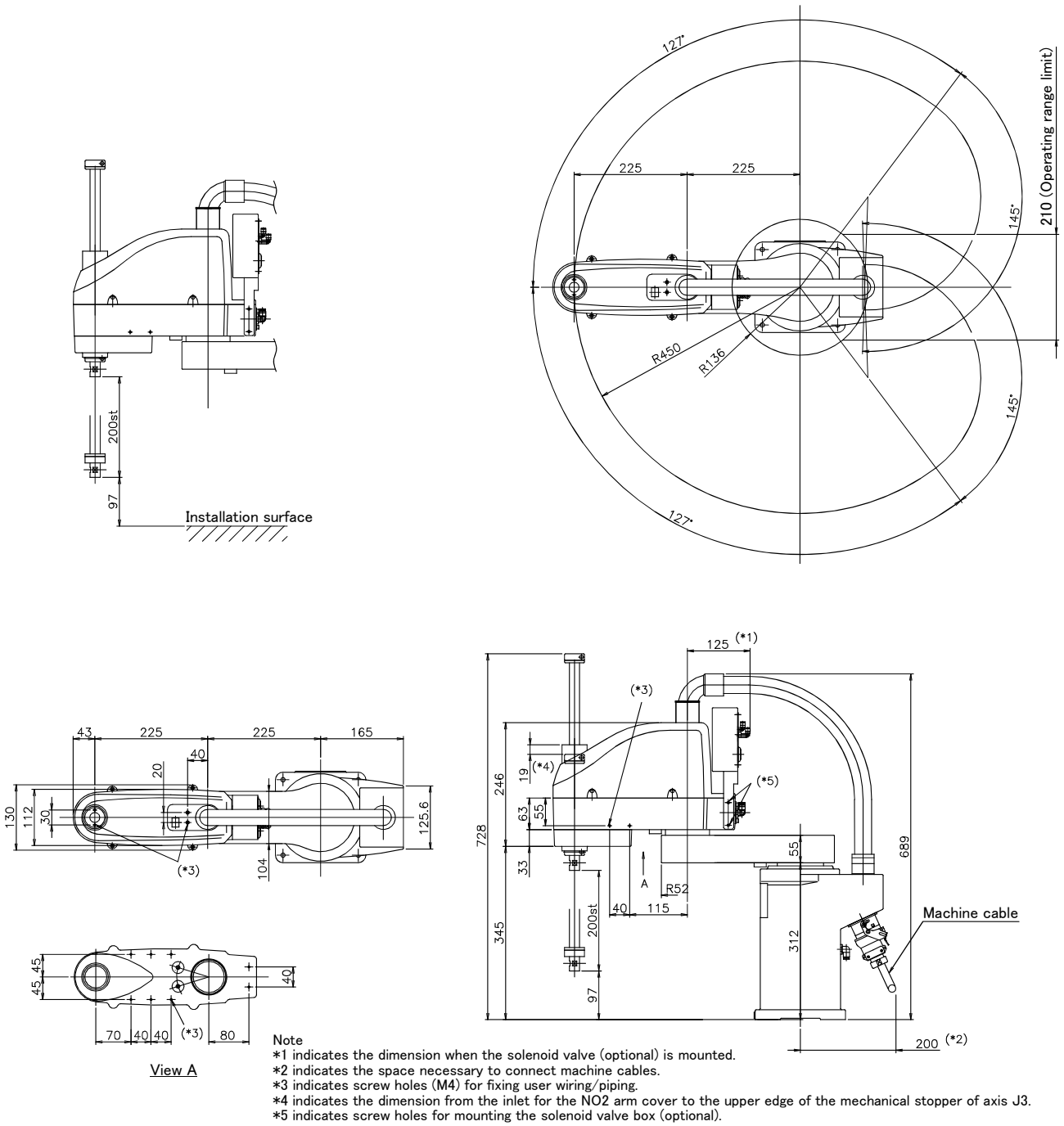
(1) Srandard Specification



Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates the dimension from the inlet for the NO2 arm cover to the upper edge of the mechanical stopper of axis J3.
*5 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

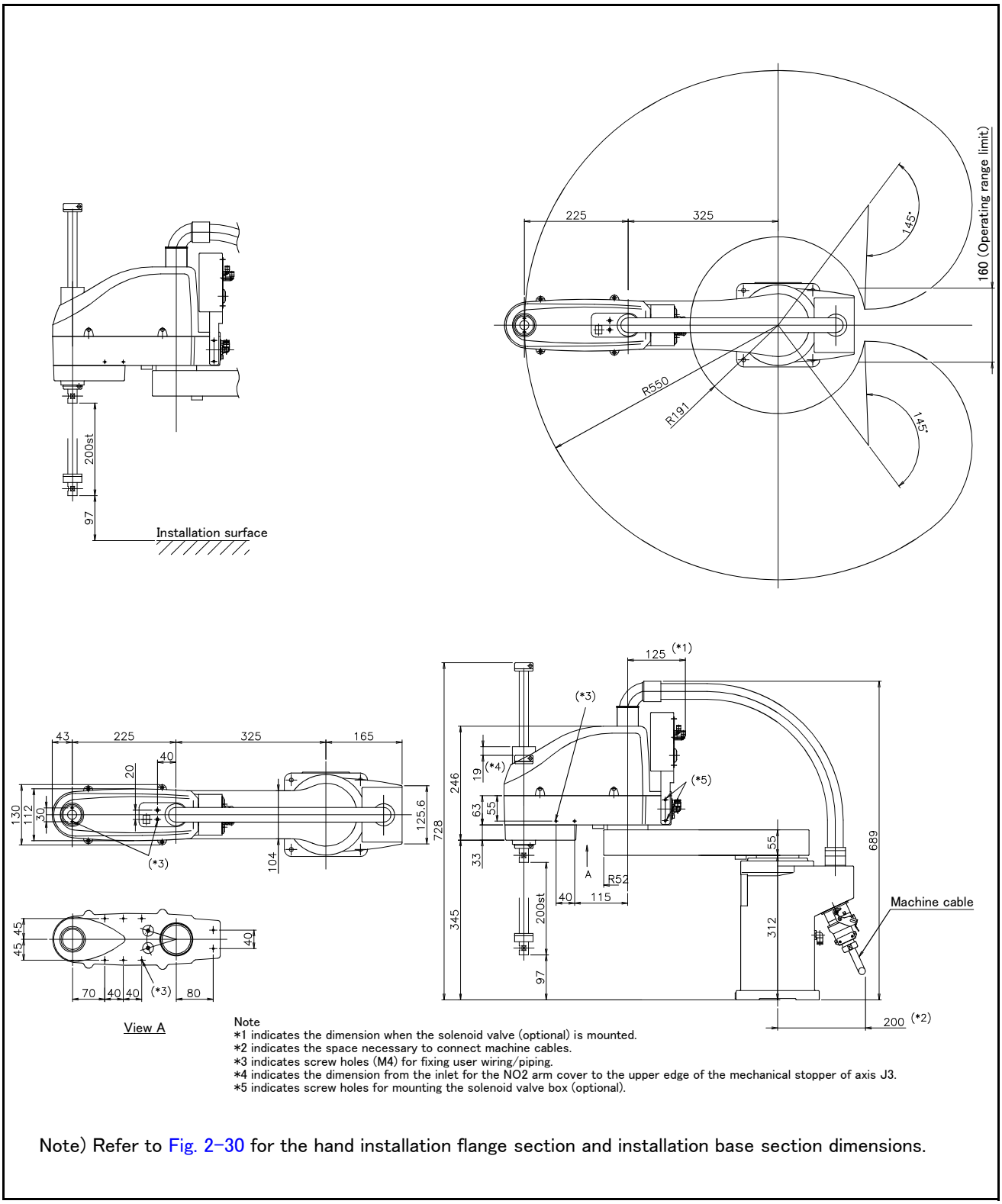
Fig.2-9 : Outside dimensions, Operating range diagram of RH-6SDH3520



Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates the dimension from the inlet for the NO2 arm cover to the upper edge of the mechanical stopper of axis J3.
*5 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

Fig.2-10 : Outside dimensions, Operating range diagram of RH-6SDH4520

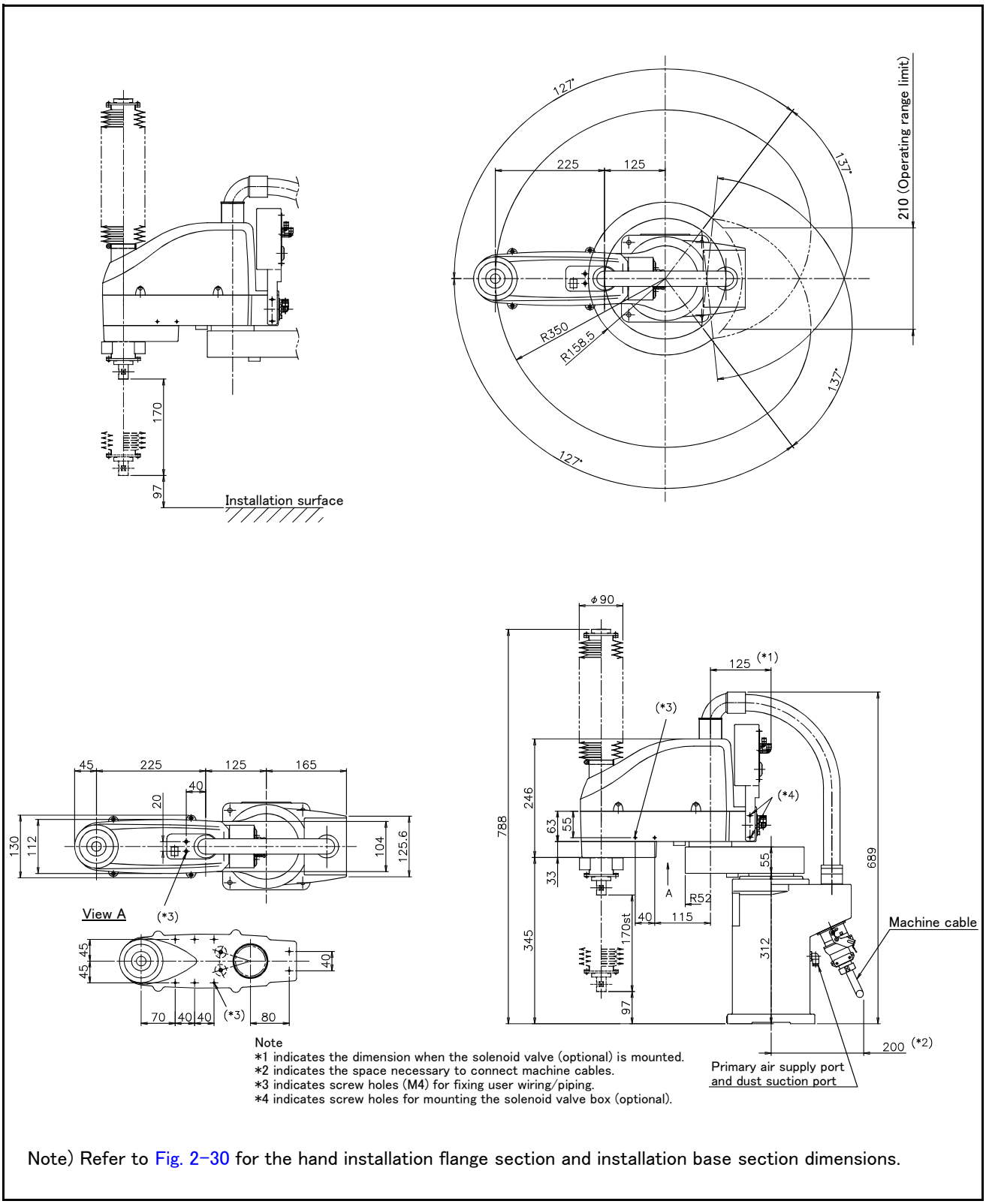


Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates the dimension from the inlet for the NO2 arm cover to the upper edge of the mechanical stopper of axis J3.
*5 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

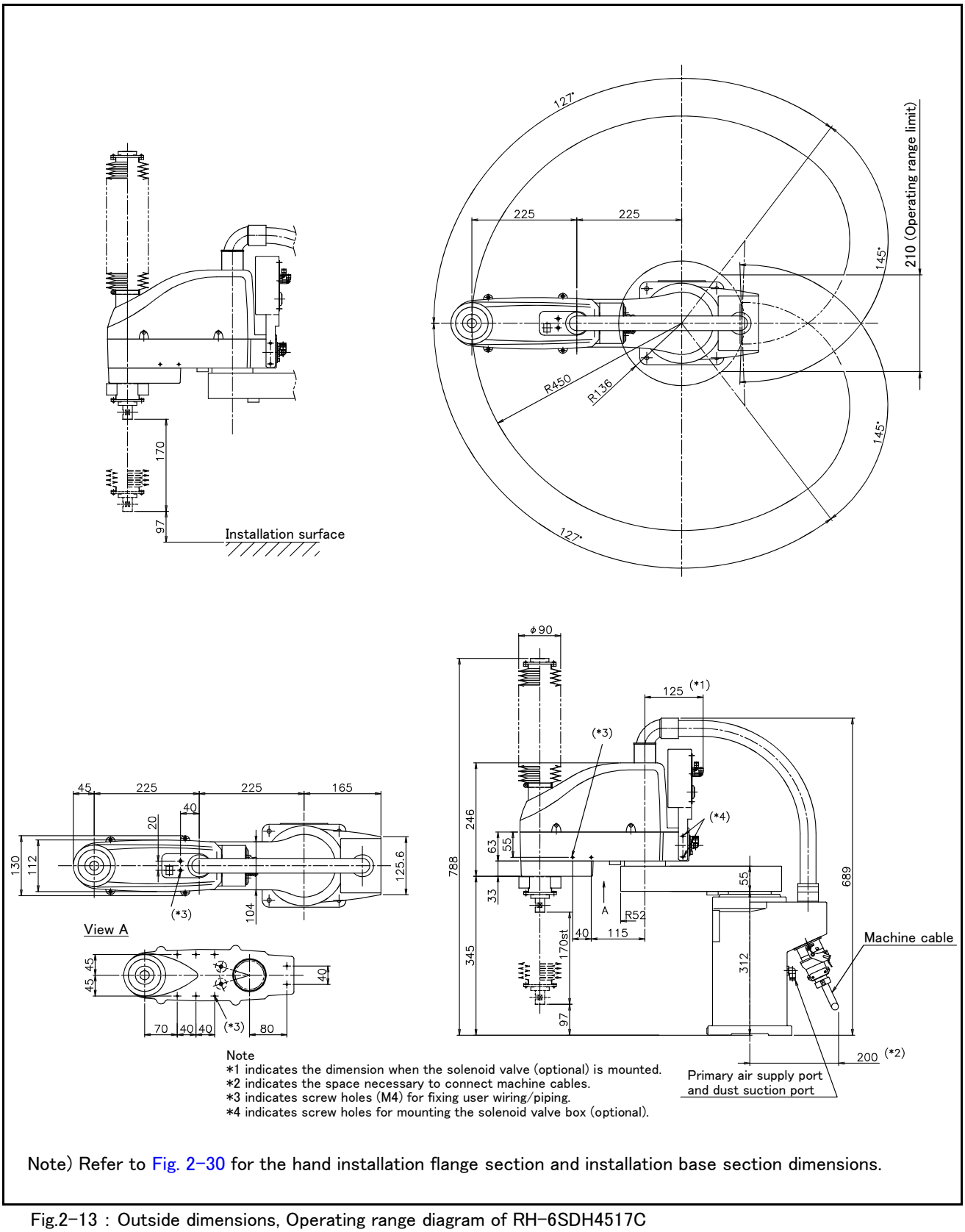
Fig.2-11 : Outside dimensions, Operating range diagram of RH-6SDH5520

(2) Clean Specification



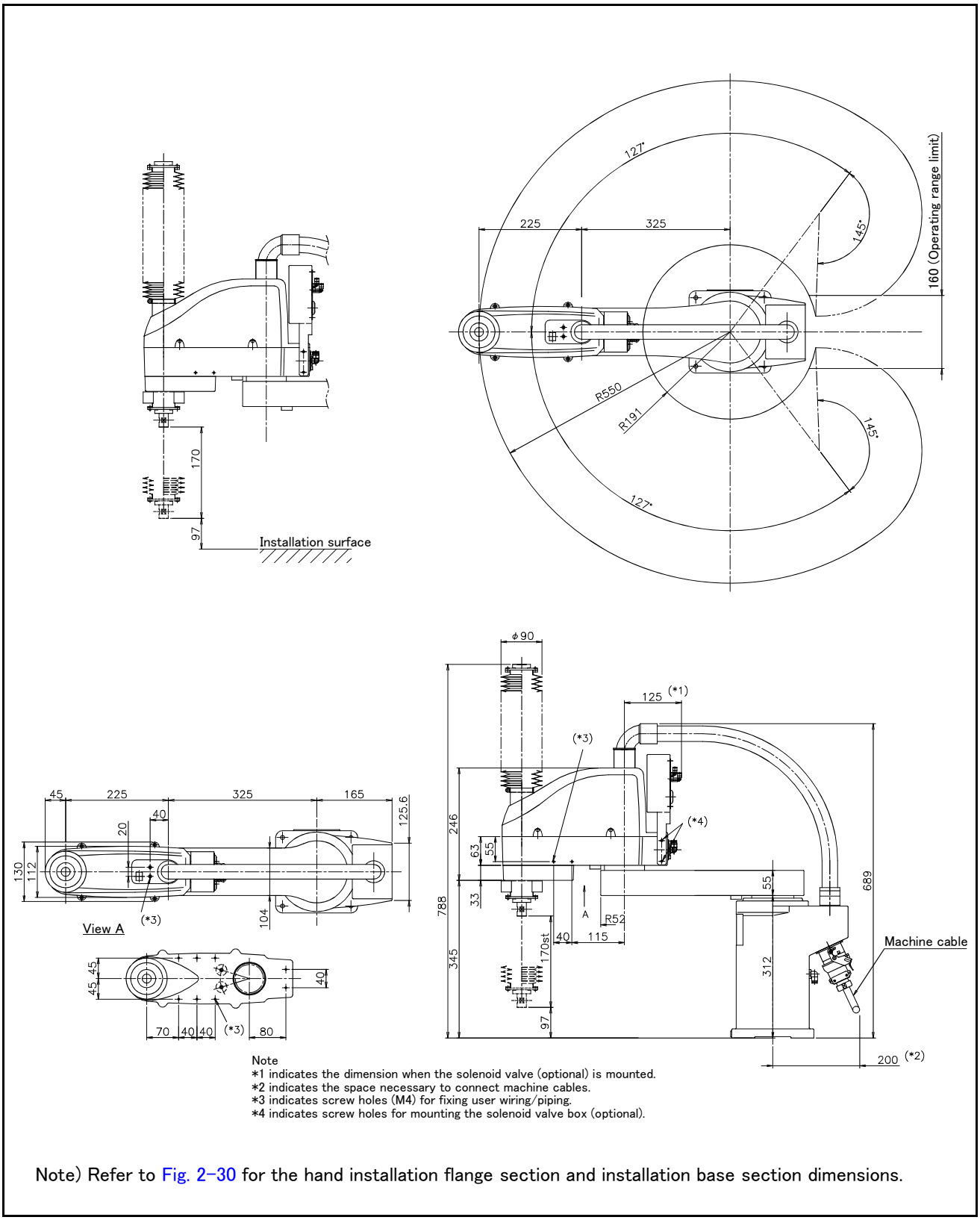
Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

Fig.2-12 : Outside dimensions, Operating range diagram of RH-6SDH3517C



Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

Fig.2-13 : Outside dimensions, Operating range diagram of RH-6SDH4517C

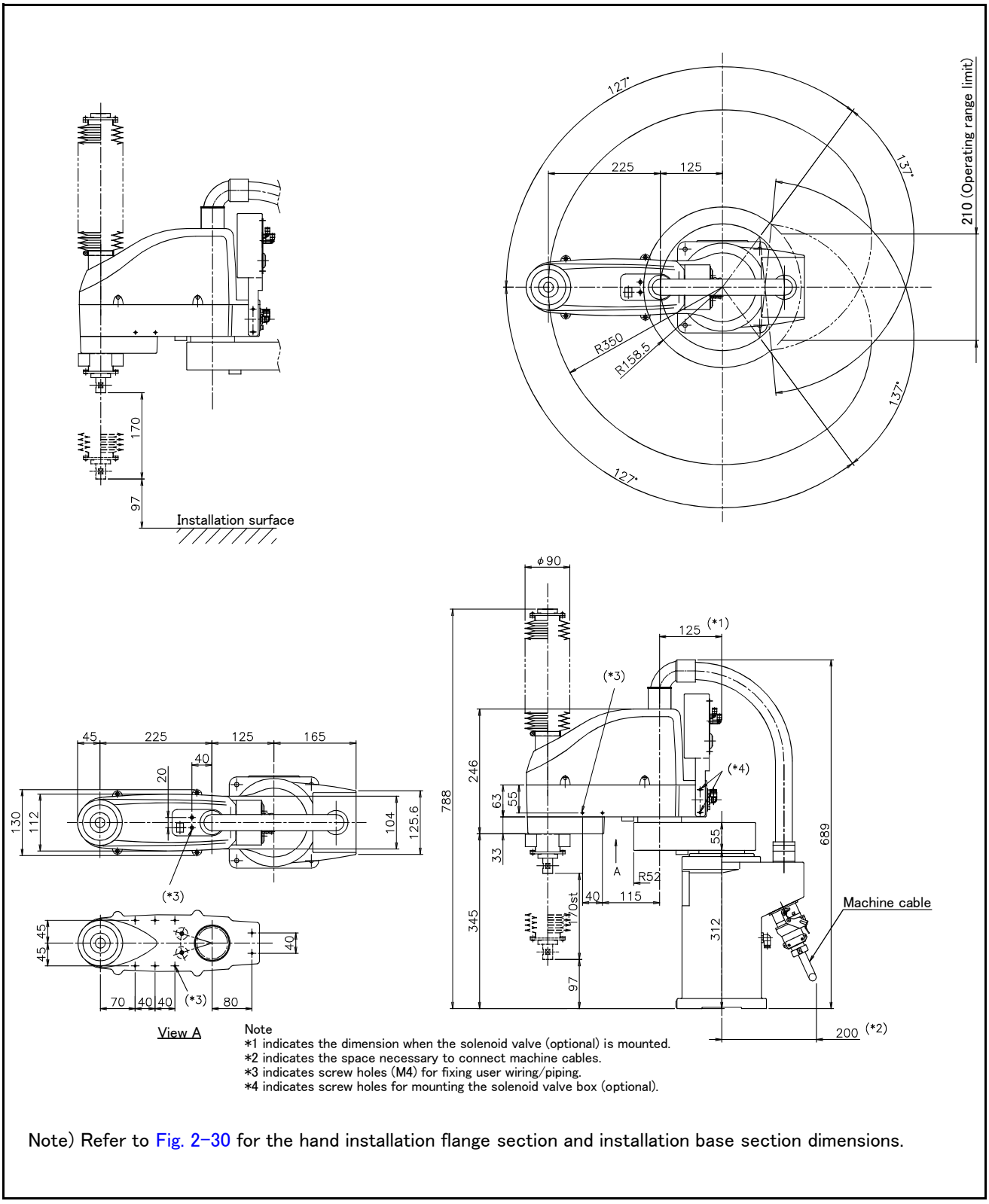


Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

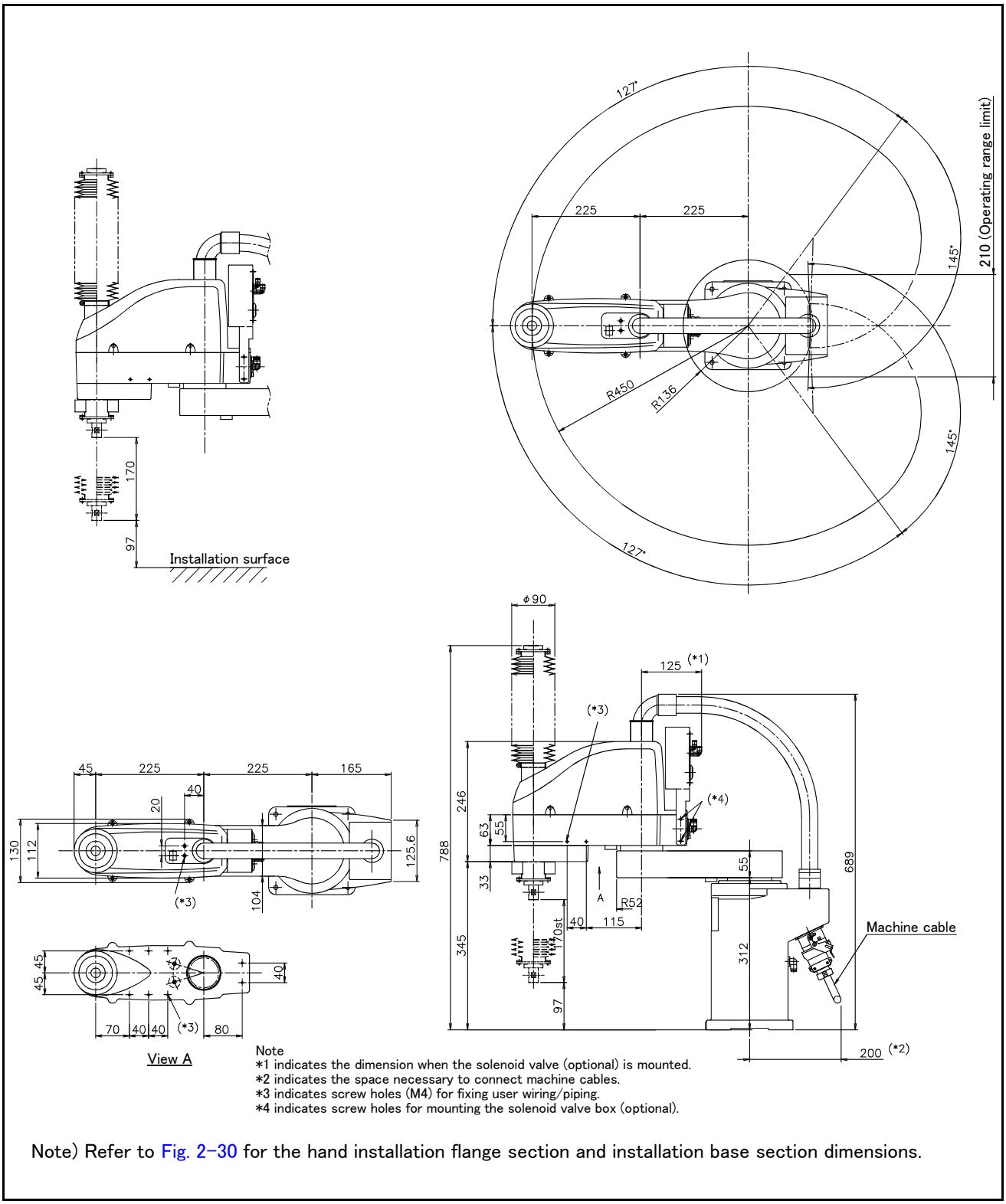
Fig.2-14 : Outside dimensions, Operating range diagram of RH-6SDH5517C

(3) Oil mist Specification



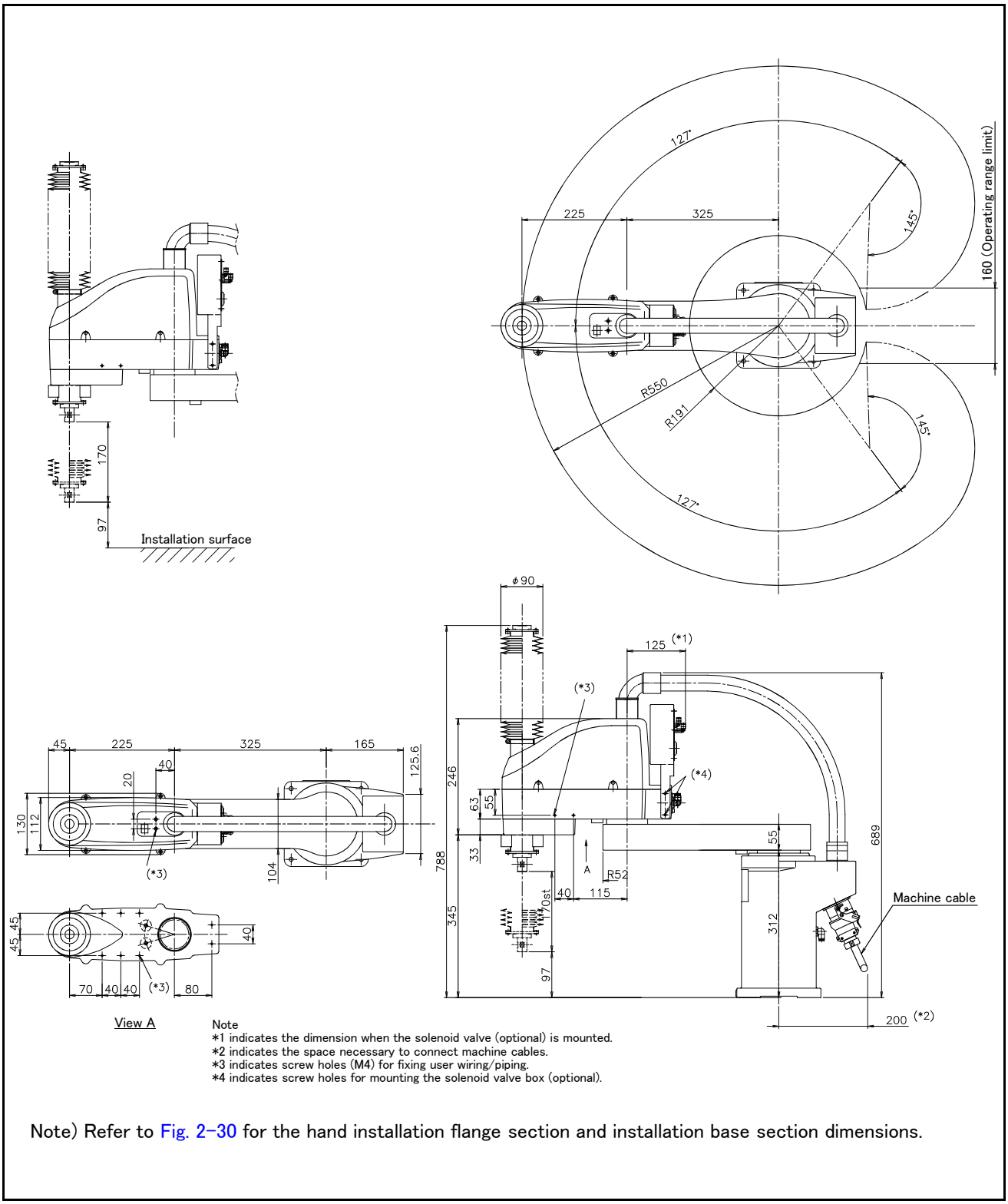
Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

Fig.2-15 : Outside dimensions, Operating range diagram of RH-6SDH3517M



Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

Fig.2-16 : Outside dimensions, Operating range diagram of RH-6SDH4517M

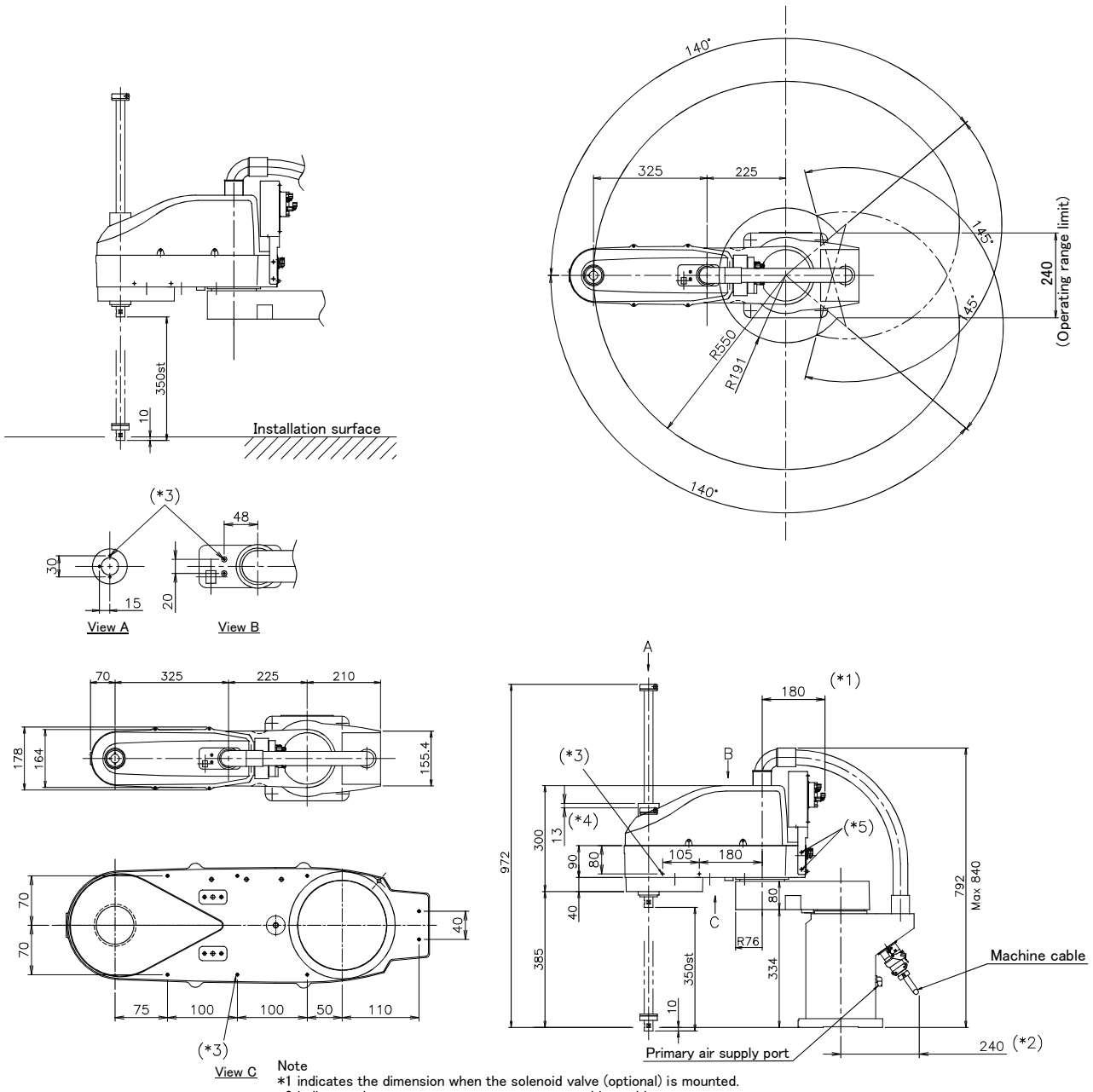


Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

Fig.2-17 : Outside dimensions, Operating range diagram of RH-6SDH5517M

2.4.2 Outside dimensions・Operating range diagram of RH-12SDH series

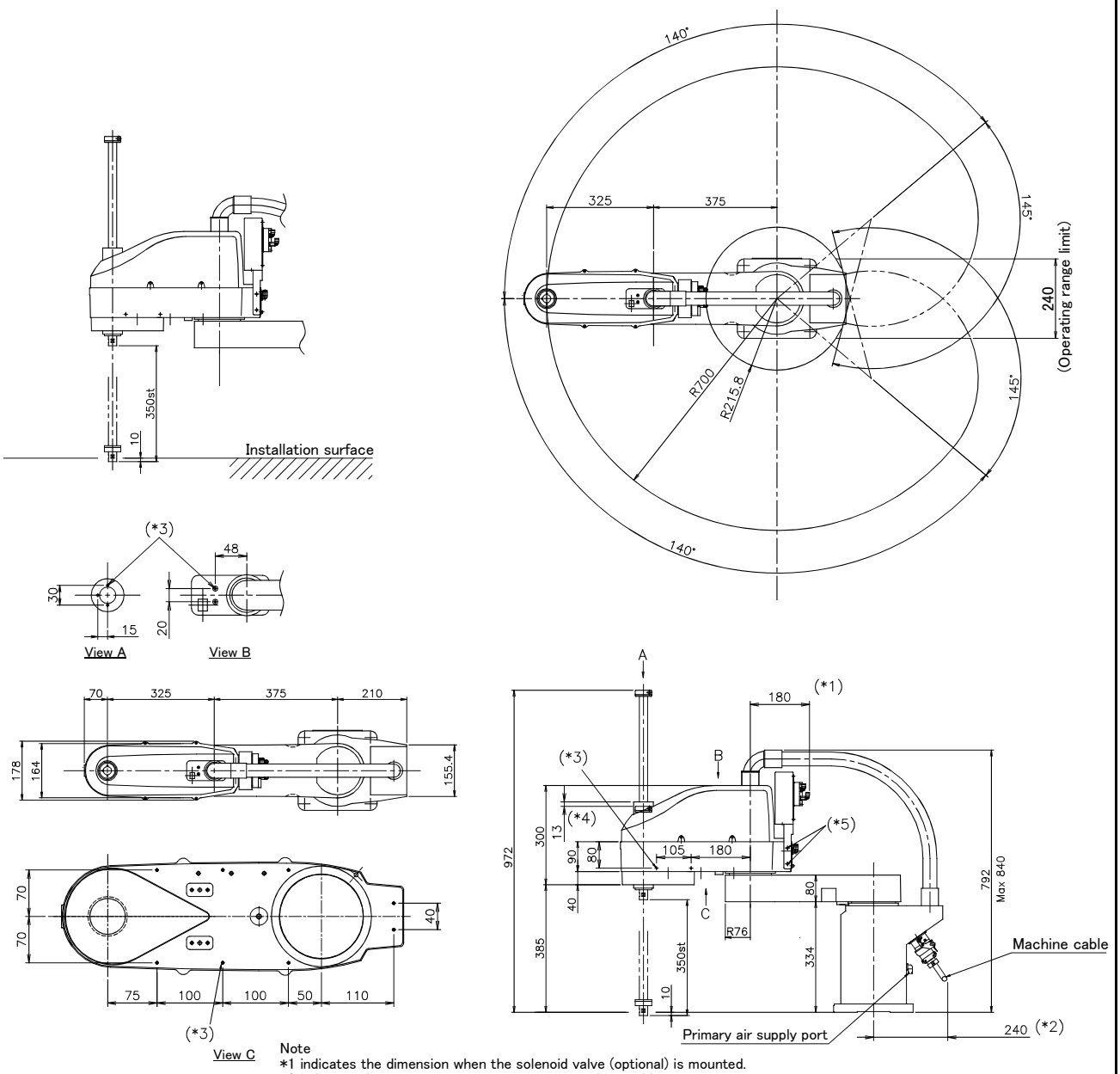
(1) Srandard Specification



Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates the dimension from the inlet for the NO2 arm cover to the upper edge of the mechanical stopper of axis J3.
*5 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

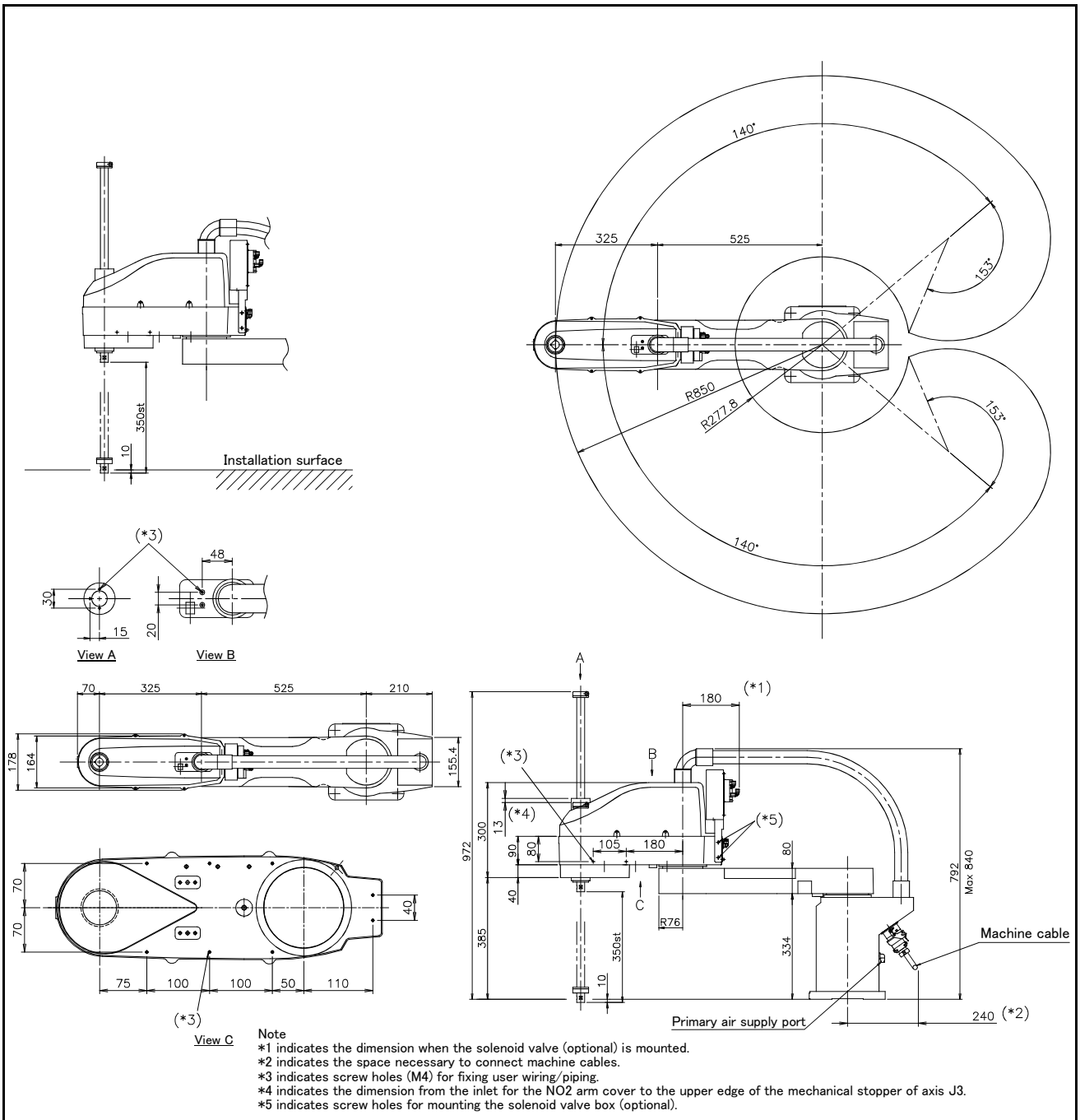
Fig.2-18 : Outside dimensions, Operating range diagram of RH-12SDH5535



Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates the dimension from the inlet for the NO2 arm cover to the upper edge of the mechanical stopper of axis J3.
*5 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

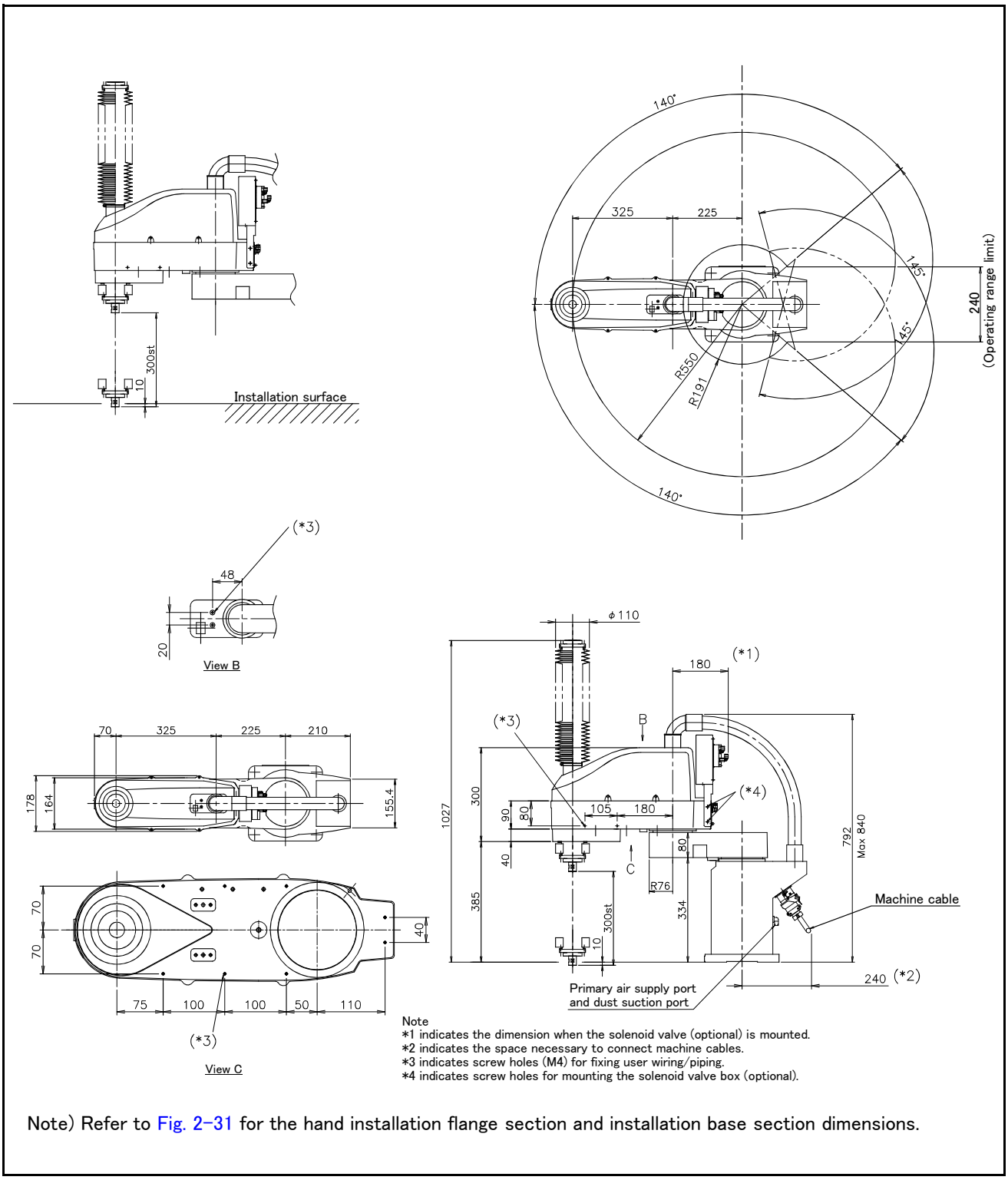
Fig.2-19 : Outside dimensions, Operating range diagram of RH-12SDH7035



Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

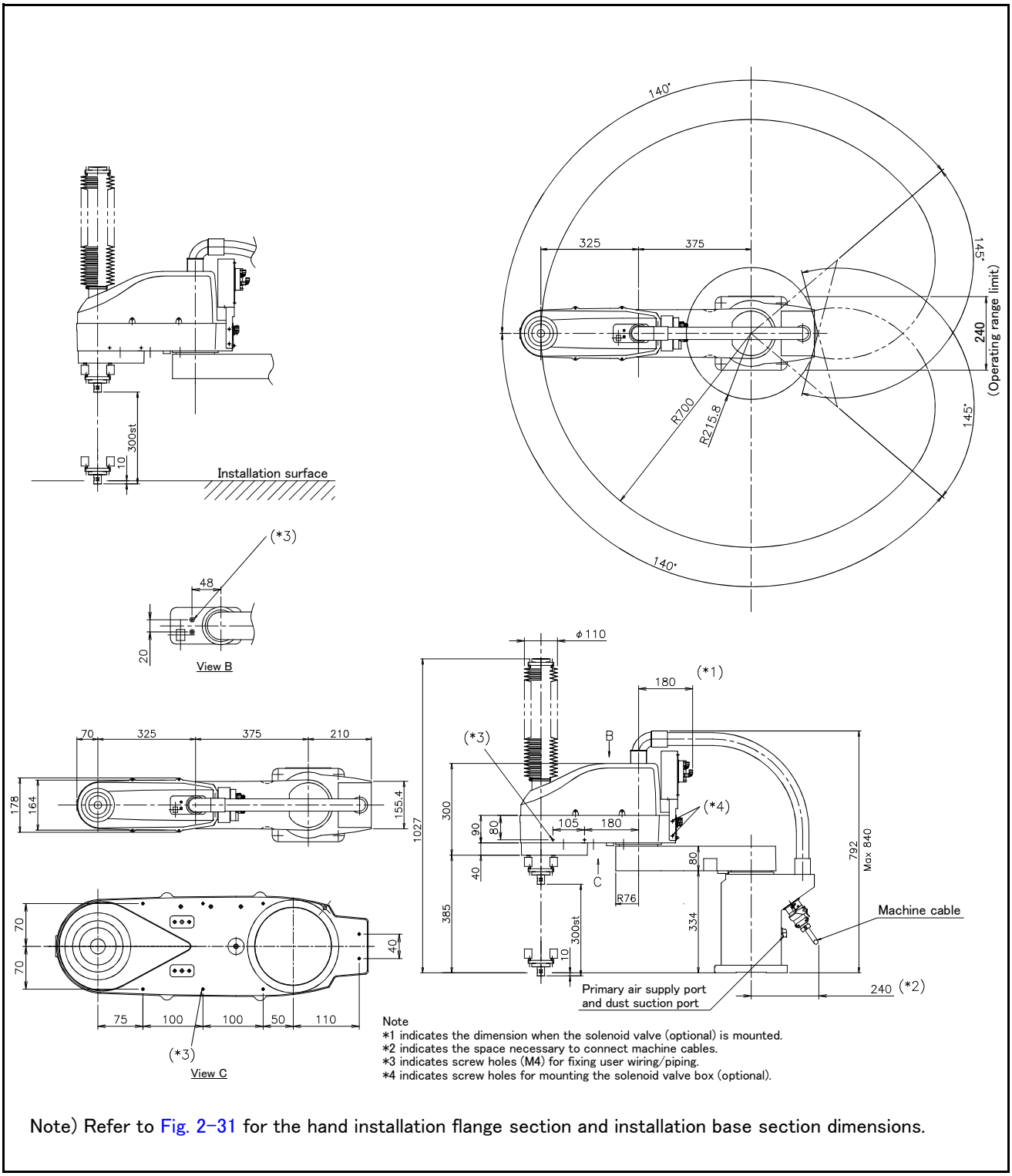
Fig.2-20 : Outside dimensions, Operating range diagram of RH-12SDH8535

(2) Clean Specification



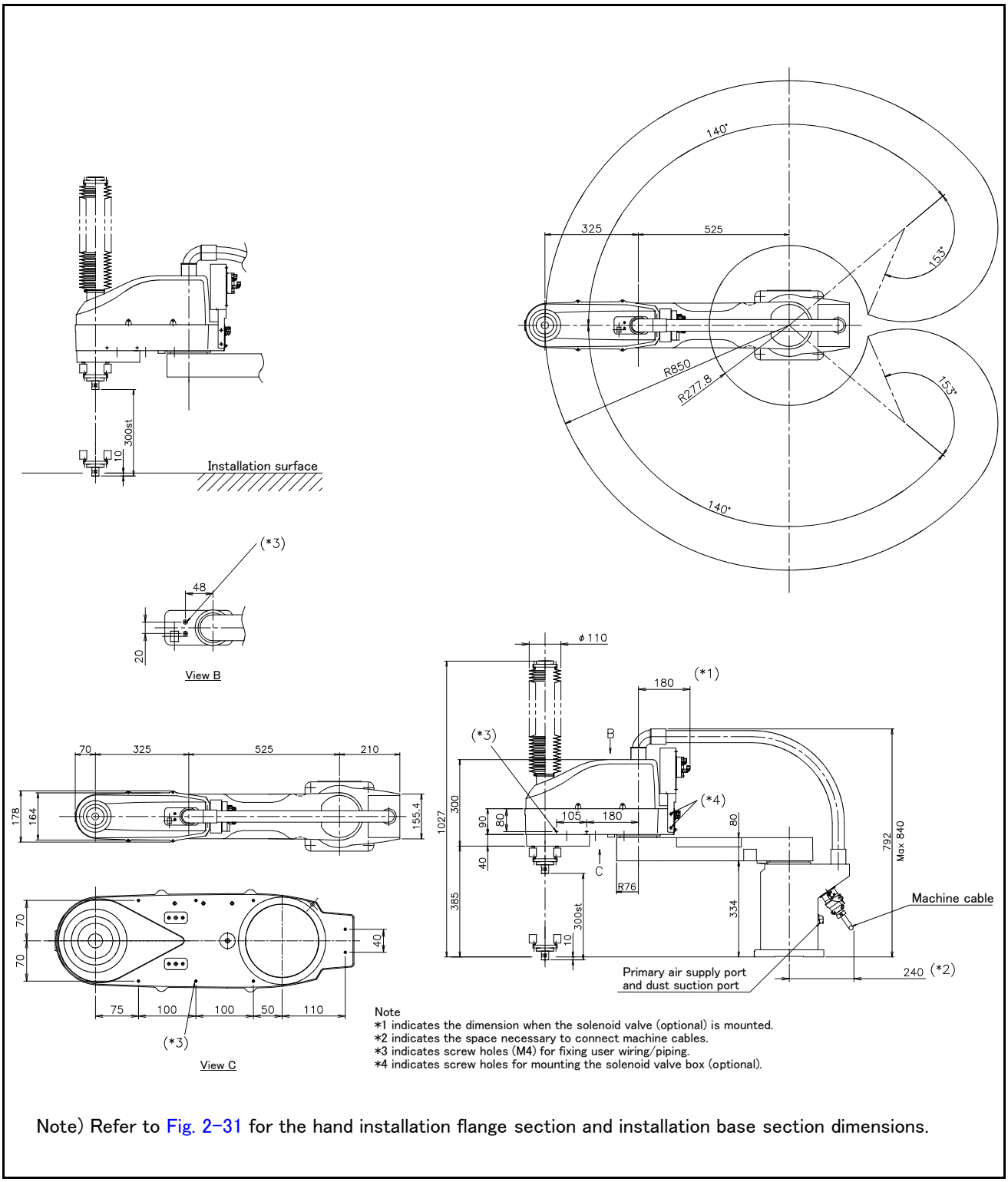
Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

Fig.2-21 : Outside dimensions, Operating range diagram of RH-12SDH5530C



Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

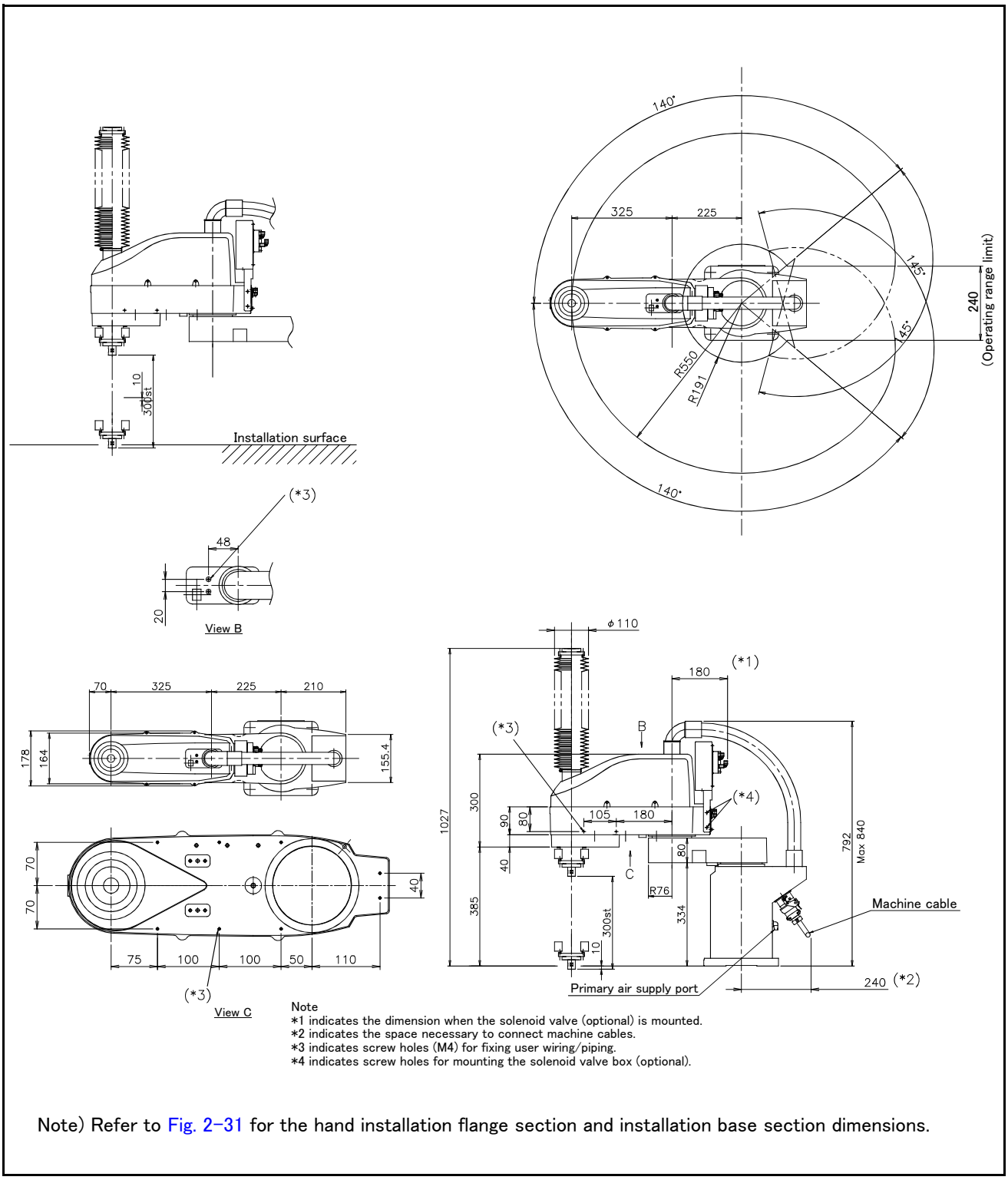
Fig.2-22 : Outside dimensions, Operating range diagram of RH-12SDH7030C



Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

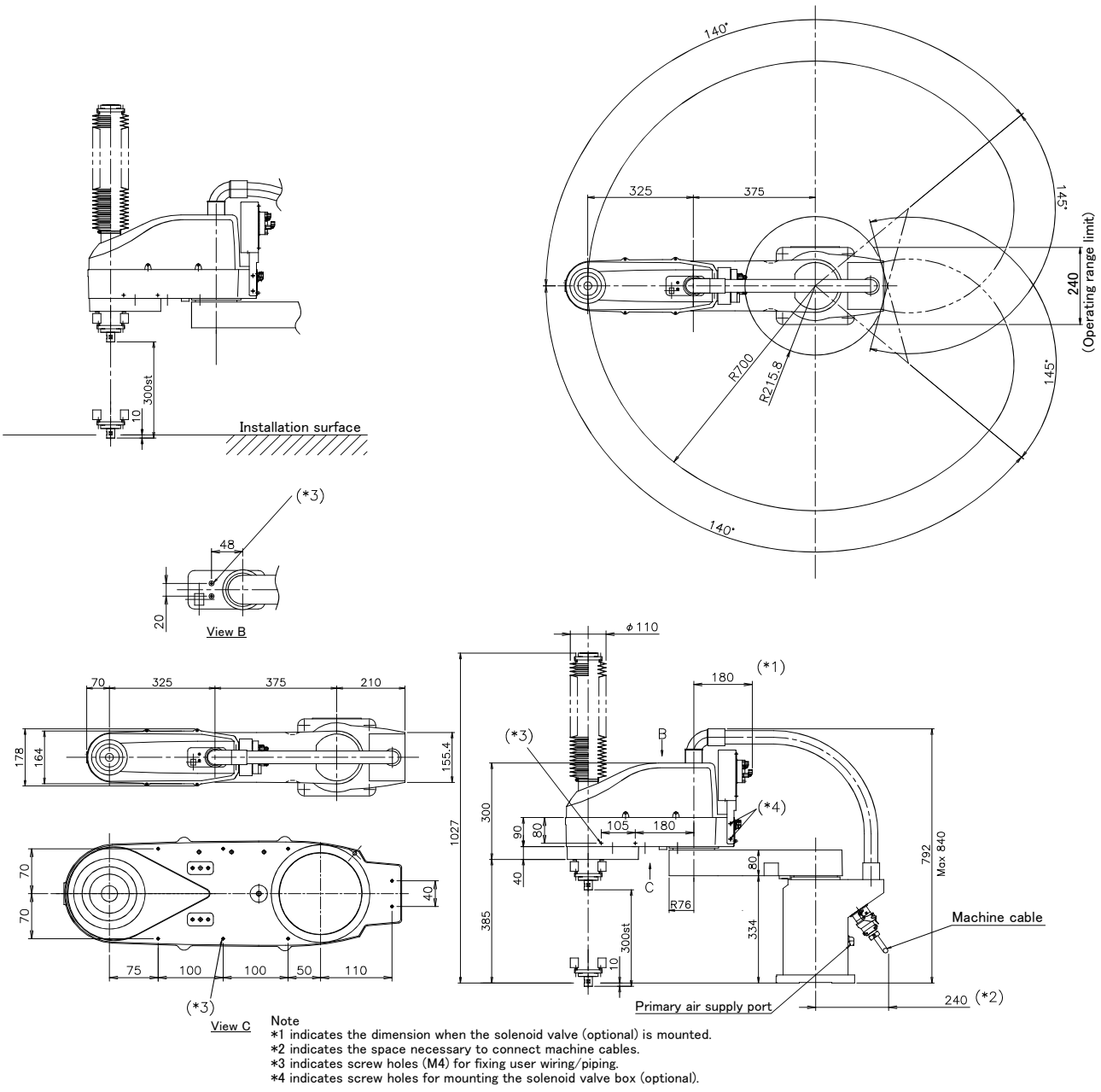
Fig.2-23 : Outside dimensions, Operating range diagram of RH-12SDH8530C

(3) Oil mist Specification



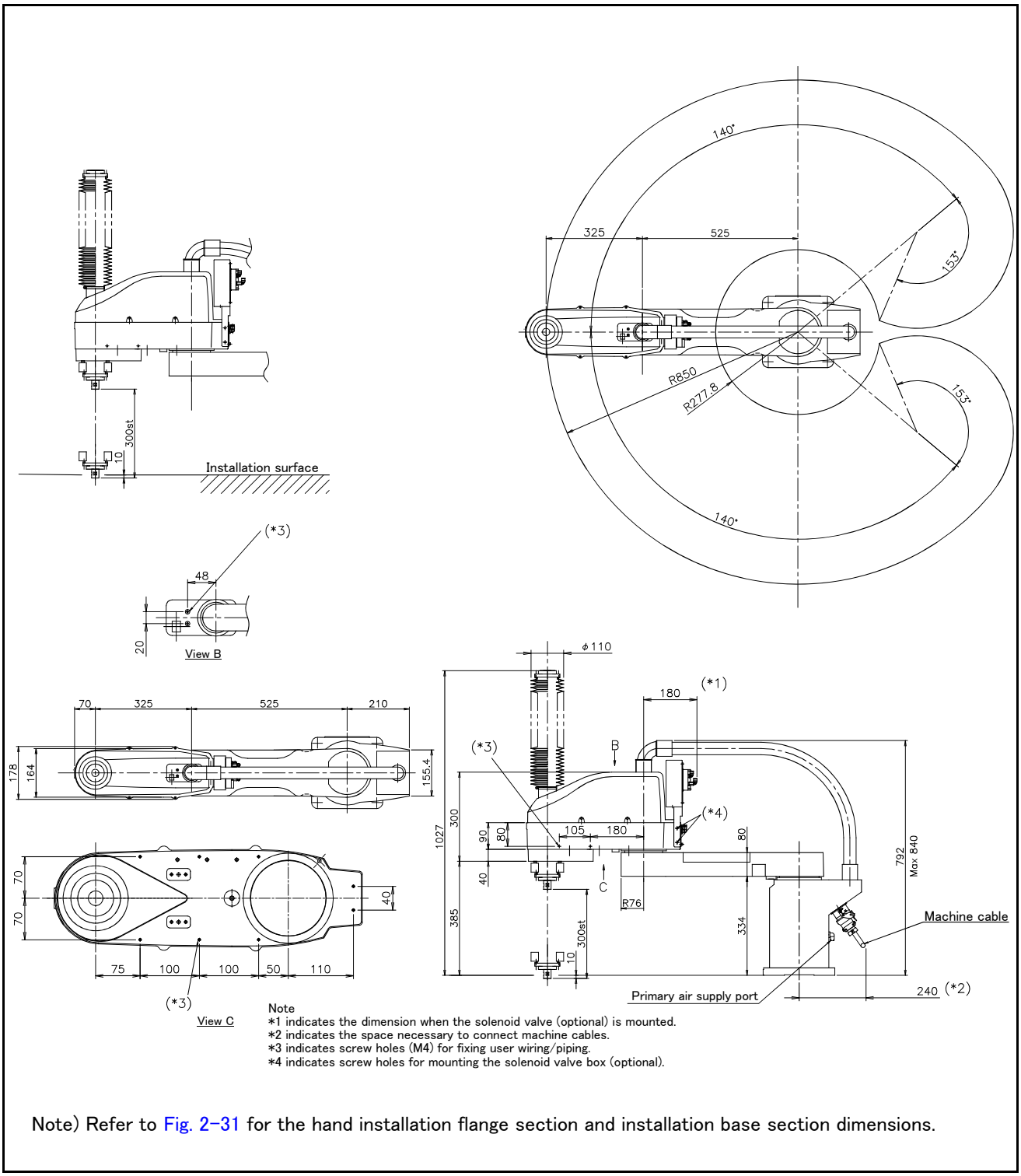
Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

Fig.2-24 : Outside dimensions, Operating range diagram of RH-12SDH5530M



Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

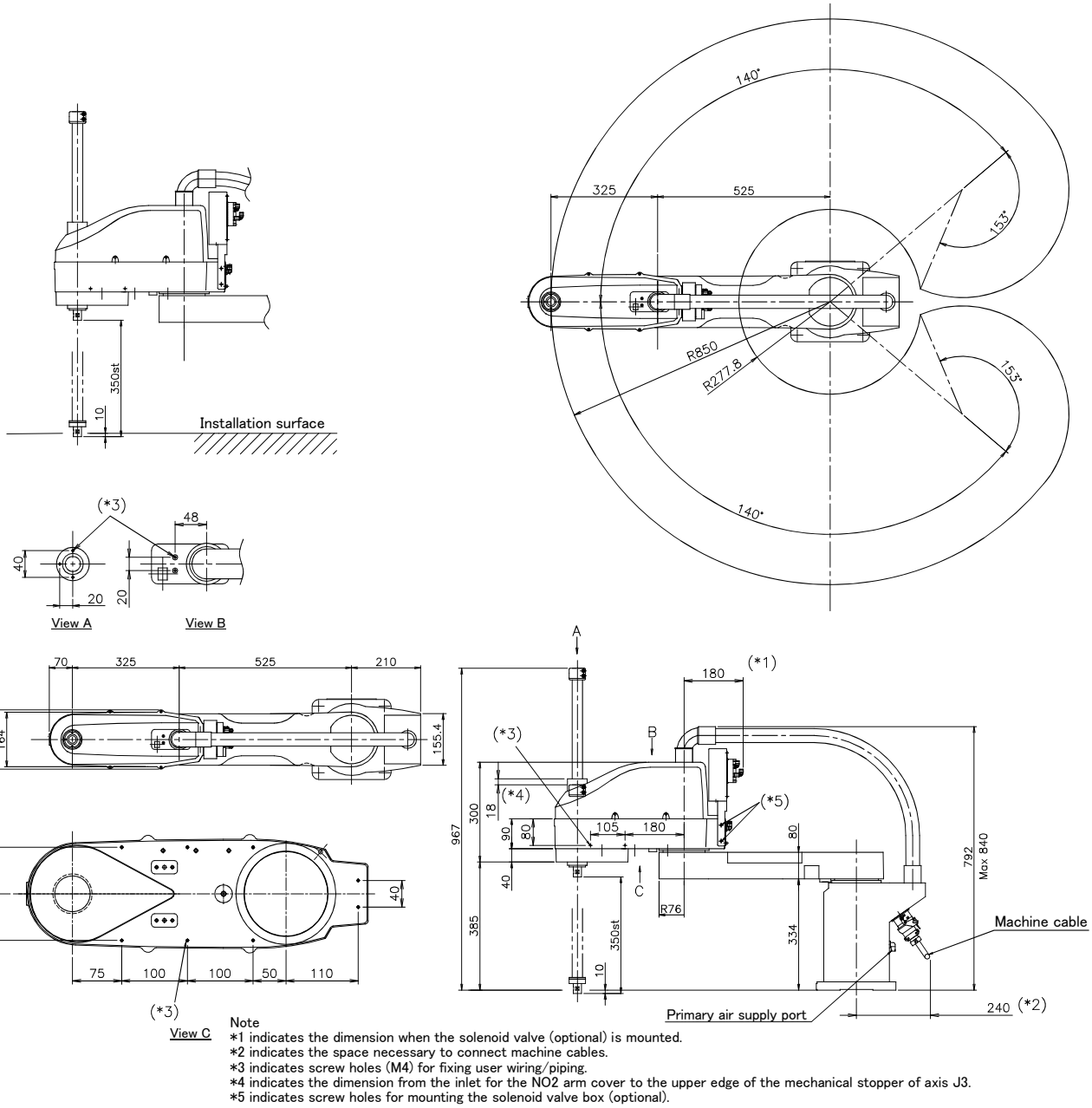
Fig.2-25 : Outside dimensions, Operating range diagram of RH-12SDH7030M



Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

Fig.2-26 : Outside dimensions, Operating range diagram of RH-12SDH8530M

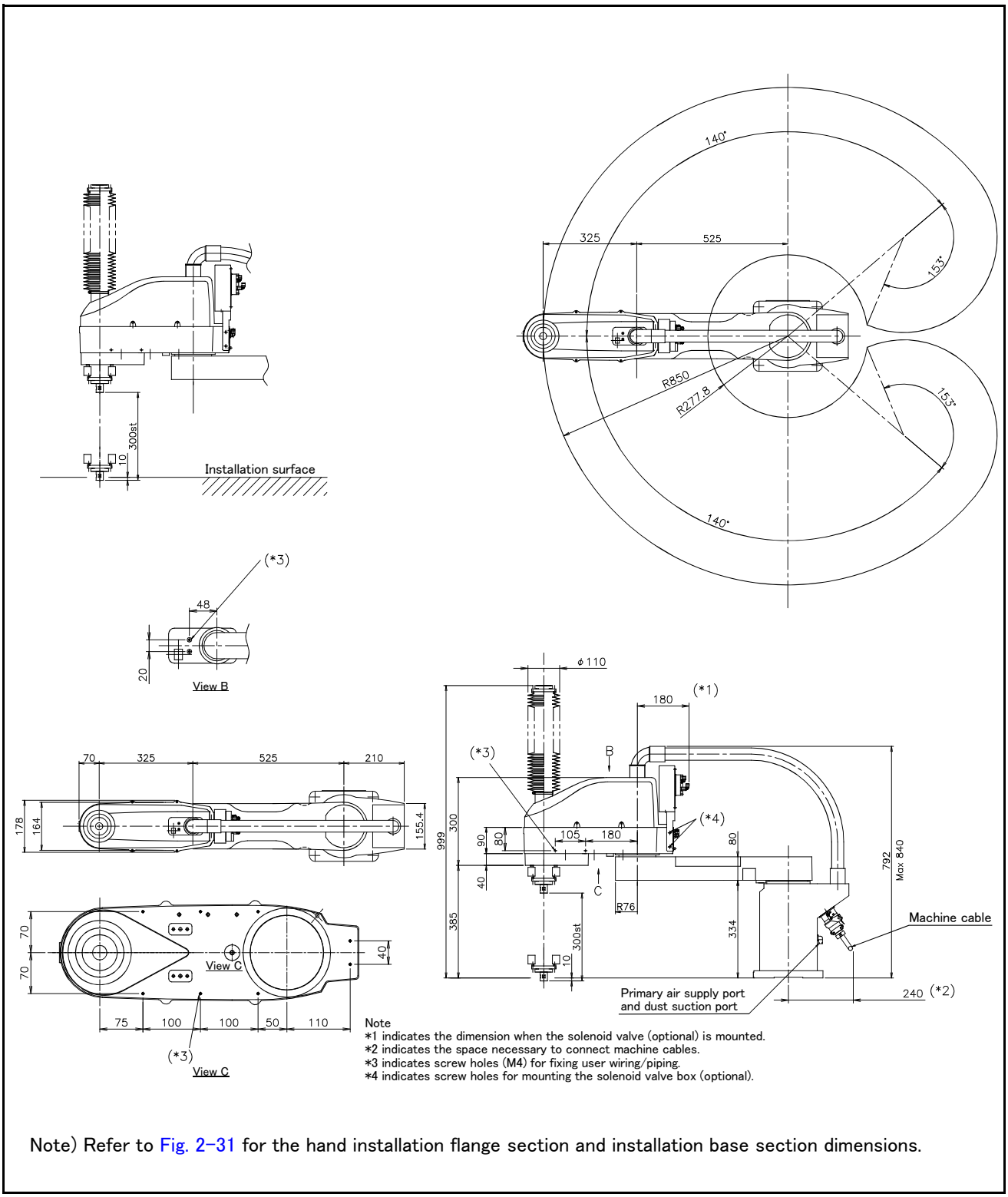
2.4.3 Outside dimensions・Operating range diagram of RH-18SDH series
(1) Srandard Specification



Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

Fig.2-27 : Outside dimensions, Operating range diagram of RH-18SDH8535

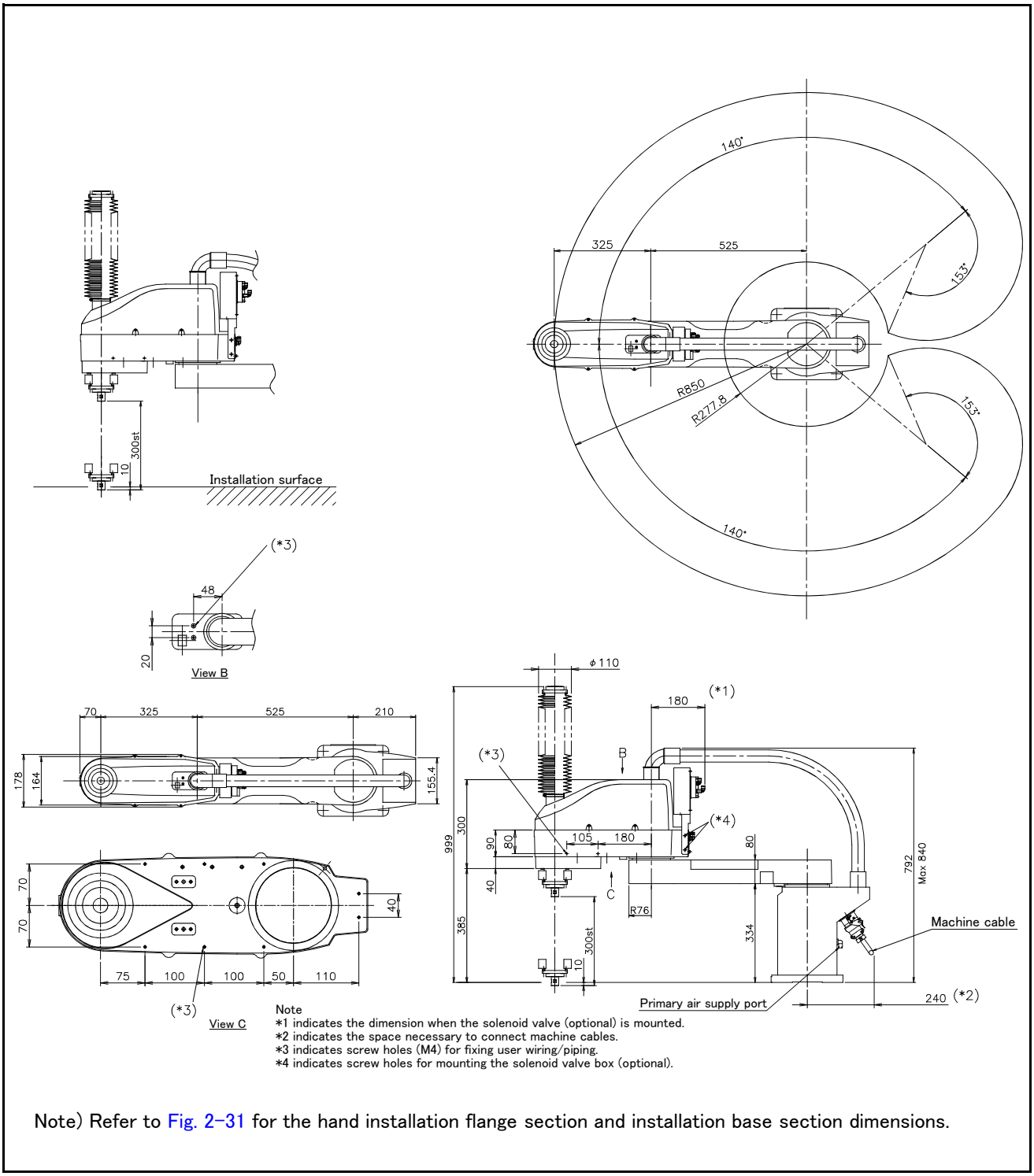
(2) Clean Specification



Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

Fig.2-28 : Outside dimensions, Operating range diagram of RH-18SDH8530C

(3) Oil mist Specification

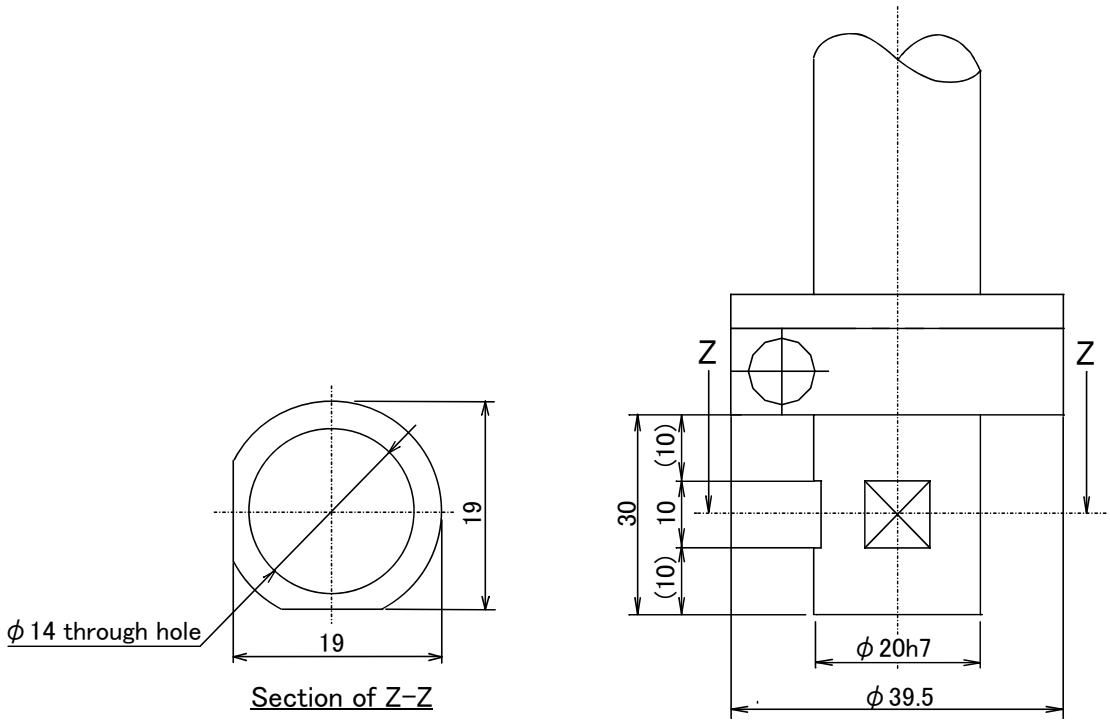


Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

Fig.2-29 : Outside dimensions, Operating range diagram of RH-18SDH8530M

2.4.4 Mechanical interface and Installation surface

(1) Mechanical interface and Installation surface of RH-6SDH sereis



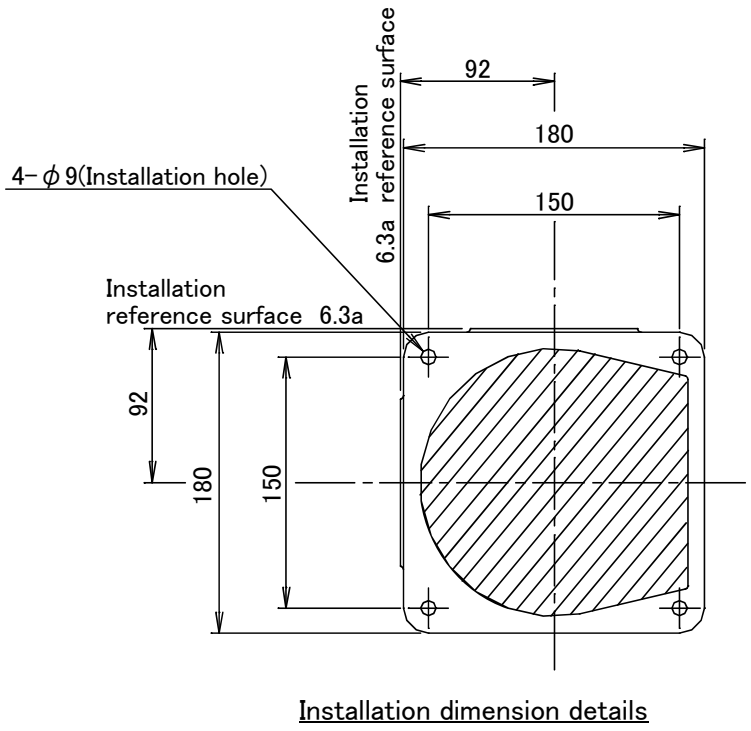
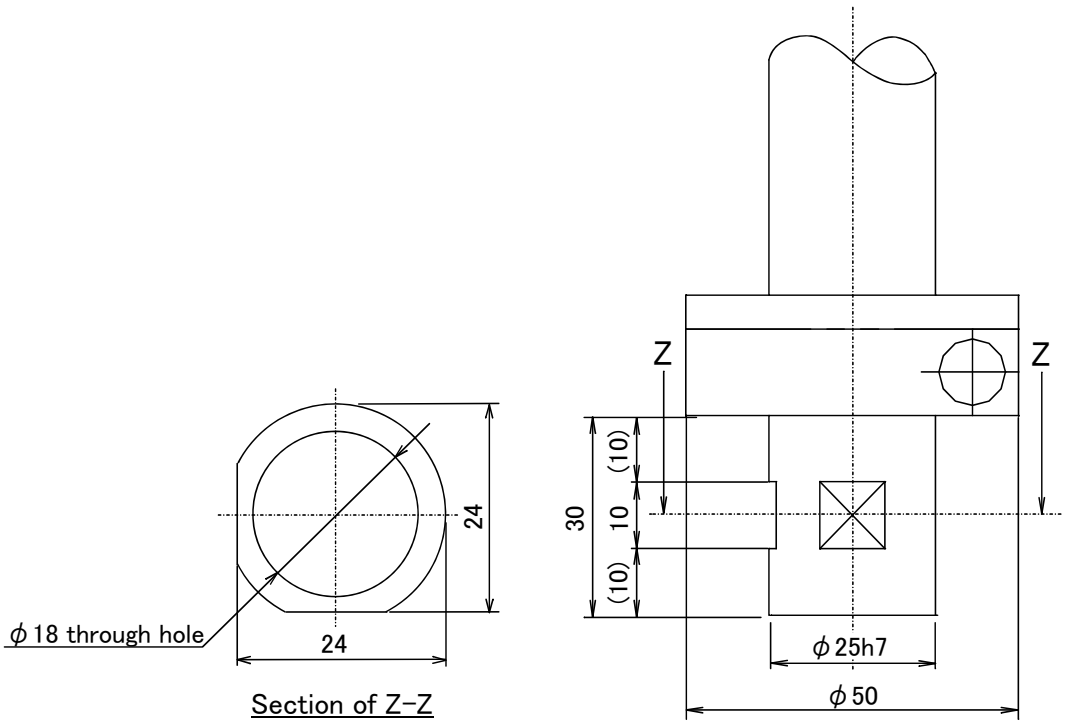


Fig.2-30 : Mechanical interface and Installation surface of RH-6SDH series

(2) Mechanical interface and Installation surface of RH-12SDH/18SDH series



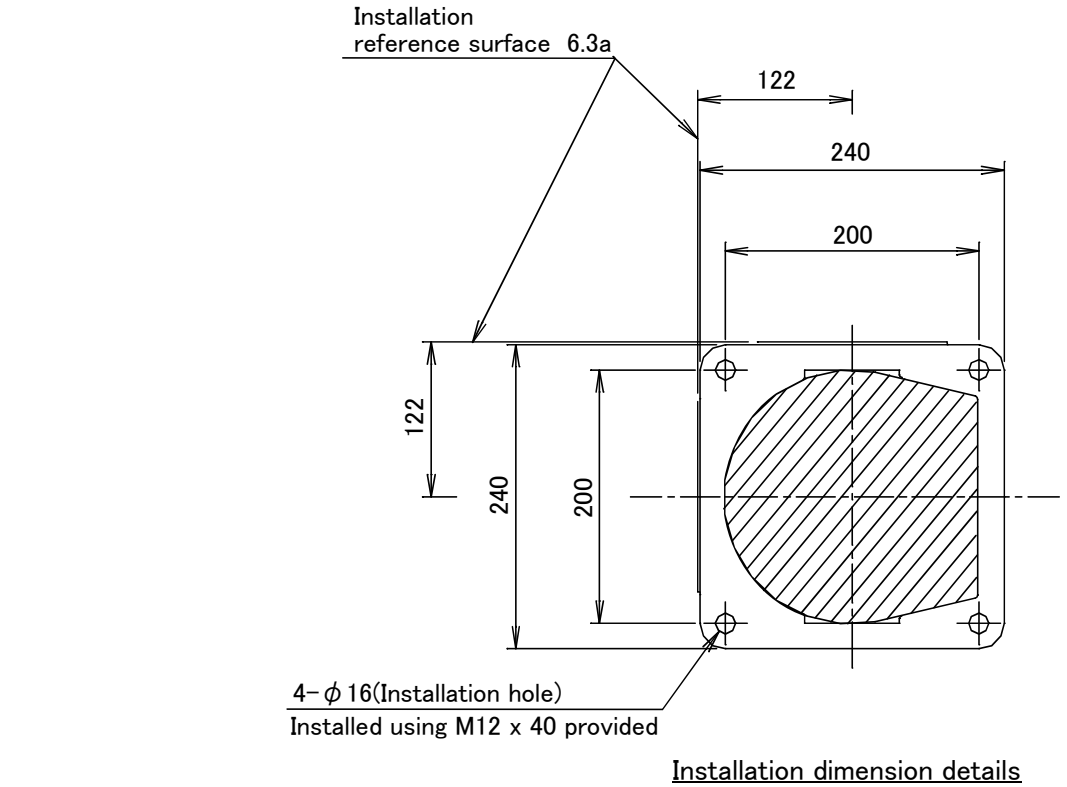


Fig.2-31 : Mechanical interface and Installation surface of RH-12SDH/18SDH series

2.4.5 Change the operating range

The operating ranges of both the J1, J2 and J3 axes can be limited. Change the mechanical stopper and the operating range to be set inside of that area.

If the operating range must be limited for example, to avoid interference with peripheral devices or to ensure safety--set up the operating range as shown below.

(1) Operating range changeable angle

The operating range must be set up at angels indicated by Table 2-13.

Table 2-13 : Operating range changeable angle

Axis	Type	Direction	Standard	Changeable angle				
RH-6SDH series								
J1	RH-6SDH35*/45*/55*	+ side	+127 deg.	+90 deg.	+60 deg.	+30 deg.	0 deg.	Any one point shown at the left
		Mechanical stopper angle	+130 deg.	+95 deg.	+65 deg.	+35 deg.	+5 deg.	
		Mechanical stopper position	P11	P12	P13	P14	P15	
		- side	-127 deg.	-90 deg.	-60 deg.	-30 deg.	0 deg.	Any one point shown at the left
		Mechanical stopper angle	-130 deg.	-95 deg.	-65 deg.	-35 deg.	-5 deg.	
		Mechanical stopper position	N11	N12	N13	N14	N15	
J2	RH-6SDH35*	+ side	+137 deg.	+117 deg.	+97 deg.	—	—	Any one point shown at the left
		Mechanical stopper angle	+139 deg.	+119 deg.	+99 deg.			
		Mechanical stopper position	P21	P22	P23			
		- side	-137 deg.	-117 deg.	-97 deg.	—	—	Any one point shown at the left
		Mechanical stopper angle	-139 deg.	-119 deg.	-99 deg.			
		Mechanical stopper position	N21	N22	N23			
	RH-6SDH45*/55*	+ side	+145 deg.	+125 deg.	+105 deg.	—	—	Any one point shown at the left
		Mechanical stopper angle	+147 deg.	+127 deg.	+107 deg.			
		Mechanical stopper position	P21	P22	P23			
		- side	-145 deg.	-125 deg.	-105 deg.	—	—	Any one point shown at the left
		Mechanical stopper angle	-147 deg.	-127 deg.	-107 deg.			
		Mechanical stopper position	N21	N22	N23			
J3	Standard specifications	+ side	+297	Change is impossible.				
		- side	+97	+115 to+ 257mm				
	Clean, oil-mist specifications	+ side	+267	Change is impossible.				
		- side	+97	+115 to+ 227mm				
RH-12SDH/18SDH series								
J1	RH-12SDH55*/70*/85* RH-18SDH85*	+ side	+140 deg.	+105 deg.	+75 deg.	+45 deg.	+15 deg.	Any one point shown at the left
		Mechanical stopper angle	+143 deg.	+110 deg.	+80 deg.	+50 deg.	+20 deg.	
		Mechanical stopper position	P11	P12	P13	P14	P15	
		- side	-140 deg.	-105 deg.	-75 deg.	-45 deg.	-15 deg.	Any one point shown at the left
		Mechanical stopper angle	-143 deg.	-110 deg.	-80 deg.	-50 deg.	-20 deg.	
		Mechanical stopper position	N11	N12	N13	N14	N15	
J2	RH-12SDH55*/70*	+ side	+145 deg.	+125 deg.	—	—	—	Any one point shown at the left
		Mechanical stopper angle	+150 deg.	+130 deg.				
		Mechanical stopper position	P21	P22				
		- side	-145 deg.	-125 deg.	—	—	—	Any one point shown at the left
		Mechanical stopper angle	-150 deg.	-130 deg.				
		Mechanical stopper position	N21	N22				
	RH-12SDH85* RH-18SDH85*	+ side	+153 deg.	+125 deg.	—	—	—	Any one point shown at the left
		Mechanical stopper angle	+155 deg.	+130 deg.				
		Mechanical stopper position	P21	P22				
		- side	-153 deg.	-125 deg.	—	—	—	Any one point shown at the left
		Mechanical stopper angle	-155 deg.	-130 deg.				
		Mechanical stopper position	N21	N22				
J3	RH-12SDH standard specifications	+ side	+290	Change is impossible.				
		- side	-10	+115 to+ 305mm				
	RH-12SDH clean, oil-mist specifications	+ side	+290	Change is impossible.				
		- side	-10	+115 to+ 255mm				

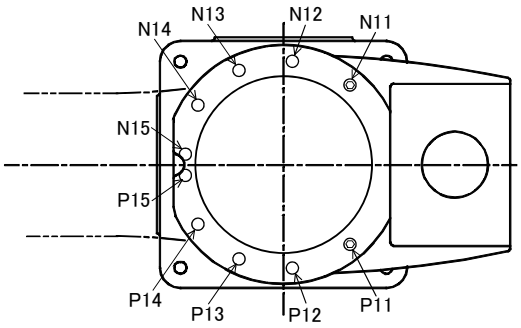
Axis	Type	Direction	Standard	Changeable angle
J3	RH-18SDH standard specifications	+ side	+340	Change is impossible.
		− side	−10	+115 to+ 285mm
	RH-18SDH clean, oil-mist specifications	+ side	+290	Change is impossible.
		− side	−10	+115 to+ 235mm

Note1) The * symbols next to the robot types indicate the up/down stroke length, environment specification, specification with controller protection box (RH-6SDH series) or controller specification with countermeasure against oil mist (RH-12SDH/18SDH series). In this case, it is possible to change the movement ranges shown in Table 2-13 for any model.

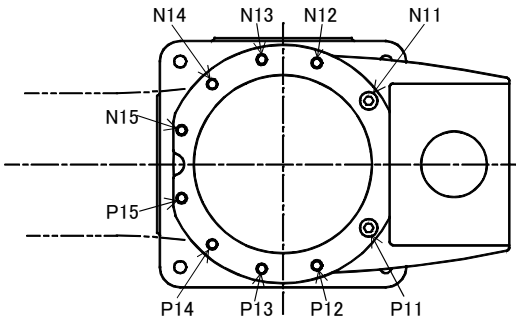
Note2) The changeable angle shown in Table 2-13 indicates the operation range by the software.
The mechanical stopper angle in the table shows the limit angle by the mechanical stopper. Use caution when laying out the robot during the designing stage.

Note3) The changeable angle can be set independently on the + side and − side.

Note4) Refer to Fig. 2-32 and Fig. 2-33 for mechanical stopper position. The J3 axis makes the mechanical stopper slide.

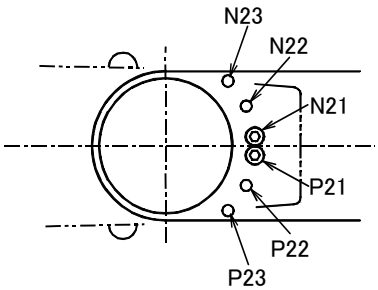


*Hexagon socket bolt = M8 x 16
For RH-6SDH series

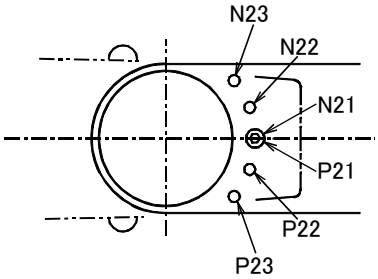


*Hexagon socket bolt = M12 x 25
For RH-12SDH/18SDH series

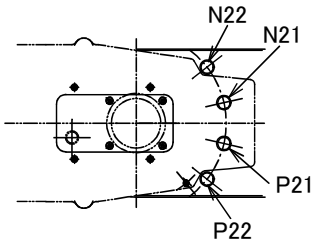
Fig.2-32 : Mechanical stopper position (J1 axis)



*Hexagon socket bolt = M8 x 16
For RH-6SDH35* series



*Hexagon socket bolt = M8 x 16
For RH-6SDH45*/55* series



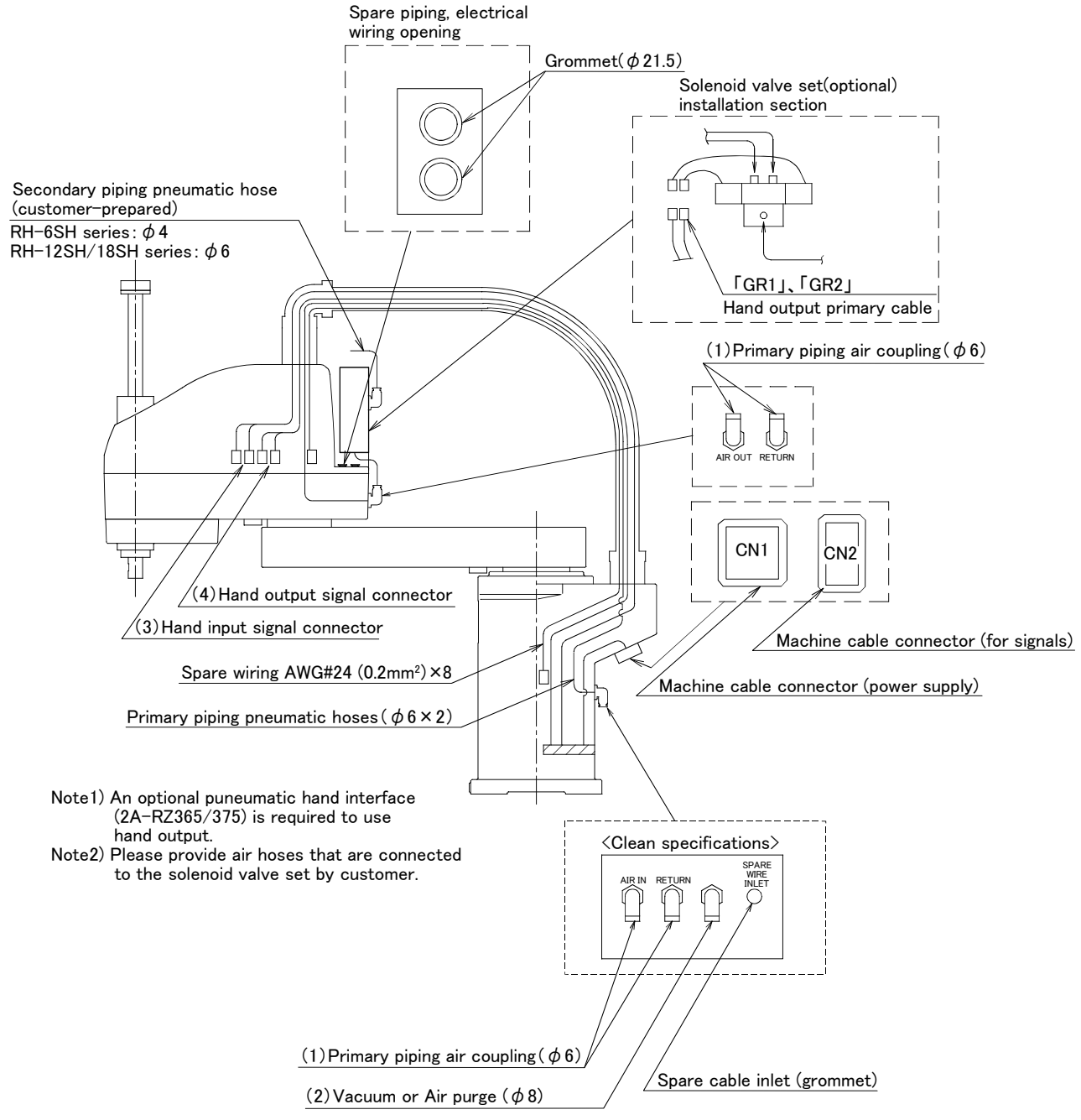
*Hexagon socket bolt = M8 x 16
For RH-12SDH/18SDH series

Fig.2-33 : Mechanical stopper position (J2 axis)

2.5 Tooling

2.5.1 Wiring and piping for hand

Shows the wiring and piping configuration for a standard-equipped hand.



Connector and pneumatic coupling

No	Name	Qty.	Robot side (Robot arm side)		Counter side (customer-prepared)		Manufacturer
			Connectors, couplings	Connector pins	Connector	Connector pins	
(1)	Coupling	4	UKBL6	—	—	—	Koganei Corporation
(2)	Cou pling Note1)	1	UKBL8	—	—	—	Koganei Corporation
(3)	Connector	2	1-1717834-3	1318108-1	1-1318115-3	1318112-1	Tyco Electronics AMP
(4)	Connector	2	1-1717834-4	1318108-1	1-1318115-4	1318112-1	Tyco Electronics AMP

Note1) For air purge or dust suction .

Fig.2-34 : Wiring and piping for hand

2.5.2 Internal air piping

(1) Standard type

1) The robot has two φ6 x 4 urethane hoses from the pneumatic entrance on the base section to the shoulder cover.
2) One hose is the primary piping for the pneumatic equipment. The remaining pipe is used for air exhaust.
3) The pneumatic inlet in the base section has a φ6 pneumatic coupling bridge.
4) Refer to Page 67, "(2) Solenoid valve set" for details on the electronic valve set (optional).
5) Protection performance can be improved by pressurizing the inside of the robot arm. Since the joint (AIR PURGE) of phi 8 is prepared at the rear of the base section, please supply the dry air for pressurization from this joint. Refer to Page 21, "2.2.4 Protection specifications and working environment" for the details of dry air.

(2) Clean type

1) The clean type basically includes the same piping as the standard type.
2) With the clean specification, a φ8 coupling is provided in the base section for suction inside the machine. For use, connect it to the suction port of the vacuum pump or the coupling on the "VACUUM" side of the vacuum generating valve. Moreover, to clean the exhaust from the vacuum pump or vacuum generator, use the exhaust filter (prepared by the customer).
3) Refer to Page 23, "2.2.5 Clean specifications" for details of the vacuum for suction.
4) Use clean air as the air supplied to the vacuum generator.

2.5.3 Internal wiring for the hand check input cable

1) The hand output primary cable extends from the connector PCB of the base section to the inside of the forearm. (AWG#24(0.2mm^2)x 2 : 8 cables) The cable terminals have connector bridges for eight hand inputs. The connector names are HC1 and HC2. The terminal section is connected to the connector in the fore-arm section.
2) The hand check signal of the pneumatic hand is input by connecting this connector.
To extend the wiring to the outside of the arm, a separate cable (optional "hand input cable "1S-HC25C-02" IP65 is recommended) is required.

2.5.4 Internal wiring for the hand check input cable

1) The hand output primary cable extends from the connector PCB of the base section to the inside of the forearm. (AWG#24(0.2mm^2)x 2 : 8 cables) The cable terminals have connector bridges for eight hand inputs. The connector names are HC1 and HC2. The terminal section is connected to the connector in the fore-arm section.
2) The hand check signal of the pneumatic hand is input by connecting this connector.
To extend the wiring to the outside of the arm, a separate cable (optional "hand input cable "1S-HC35C-02 " IP65 is recommended) is required.

2.5.5 Spare Wiring

(1) Standard type

As spare wiring, four pairs of AWG#24(0.2mm^2) cab tire cables (total of eight cores) are preinstalled between the base section and the No.2 arm rear section. The connector is attached to both ends. Customer can be use. Refer to the separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" for details.
Both ends of the wire terminals are unprocessed. Use them under the following circumstances:

- For folding as the hand output cable when installing the solenoid valve in outside the robot.
- For when installing six or more hand I/O points for the sensor in the hand section
(Connects to the parallel I/O general purpose input.)

Reference) Pin assignment of the connector, and the matching connector

Pin assignment

Pin	Color
A1	Red
A2	Brown
A3	Breen
A4	Brack
B1	Orange
B2	White
B3	Yellow
B4	Blue

Robot side connector

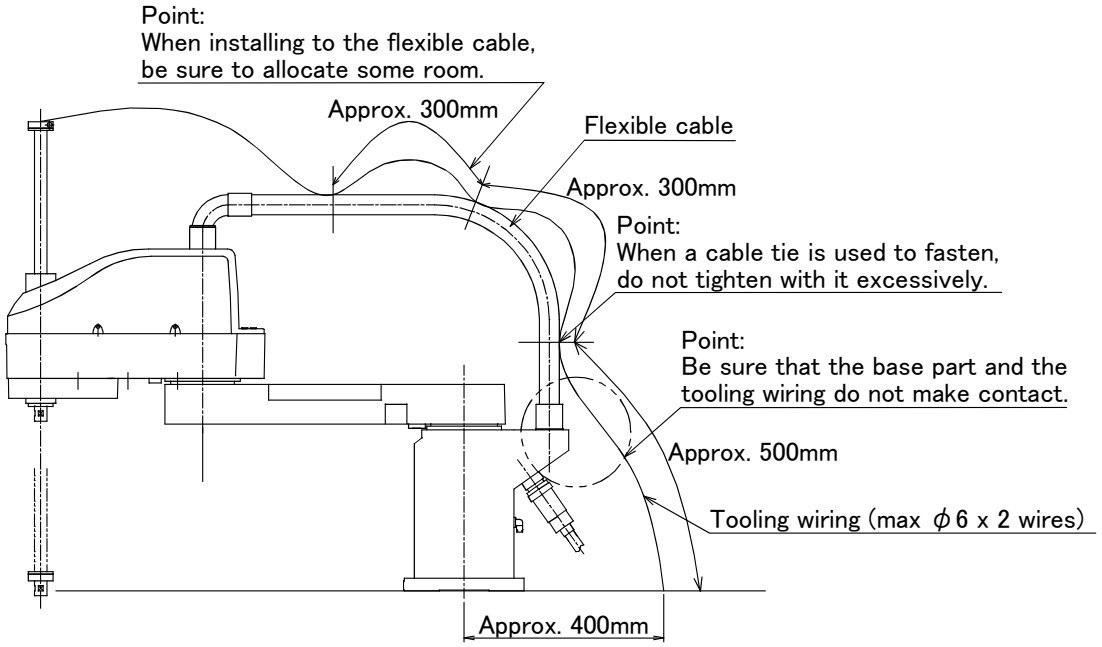
Connection place	Connector	Contactor	Maker
Base portion	2-1318115-4	-	Tyco Electronics AMP K.K.
Fore arm portion	2-1717834-4	-	

Other party connector (recommendation)

Connection place	Connector	Contactor	Maker
Base portion	2-1717834-4	1318108-1	Tyco Electronics AMP K.K.
Fore arm portion	2-1318115-4	1318112-1	

2.5.6 Precautions for piping to the flexible cable

If the piping of the hand is performed to the flexible cable of this robot, be sure to perform wiring and piping by following the precautions listed below so that they will not interfere with the functionality of the flexible cable.



If many hand cables are installed to the flexible cable and depending on the manner of installation, excessive force may be applied to the flexible cable and the life span of the flexible cable may be shortened and also the mounting nuts of the flexible cable may come loose.

2.5.7 About the Installation of Tooling Wiring and Piping (Examples of Wiring and Piping)

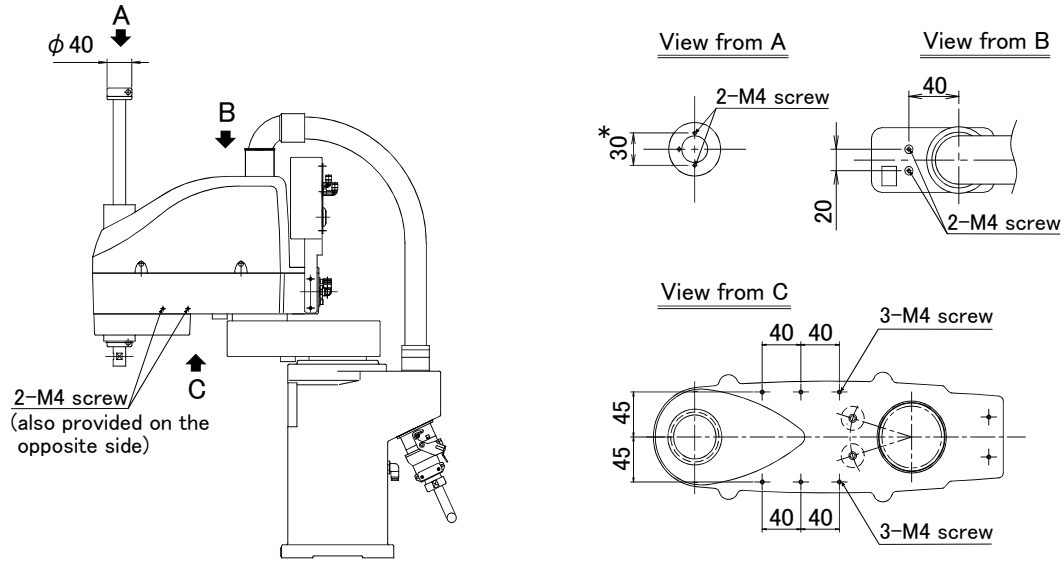
The customer is required to provide tooling wiring, piping and metal fixtures.

Screw holes are provided on the robot arm for the installation of tooling wiring, piping and metal fixtures. (Refer to the Table 2-35, Table 2-36 and Table 2-37.)

The length of wiring and piping and the installation position on the robot must be adjusted according to the work to be done by the robot. Please use the following example as reference. Pay extra attention to the precautions and interfering points described in the example during the adjustment.

- A hand input cable and a hand curl cable are available as optional accessories for your convenience.
- After performing wiring and piping to the robot, operate the robot at low speed to make sure that each part does not interfere with the robot arm and the peripheral devices. (Interfering points and precautions are indicated in the example.)
- Please be aware that dust may be generated from friction if wires and pipes come into contact with the robot arm when using it according to the clean specifications.

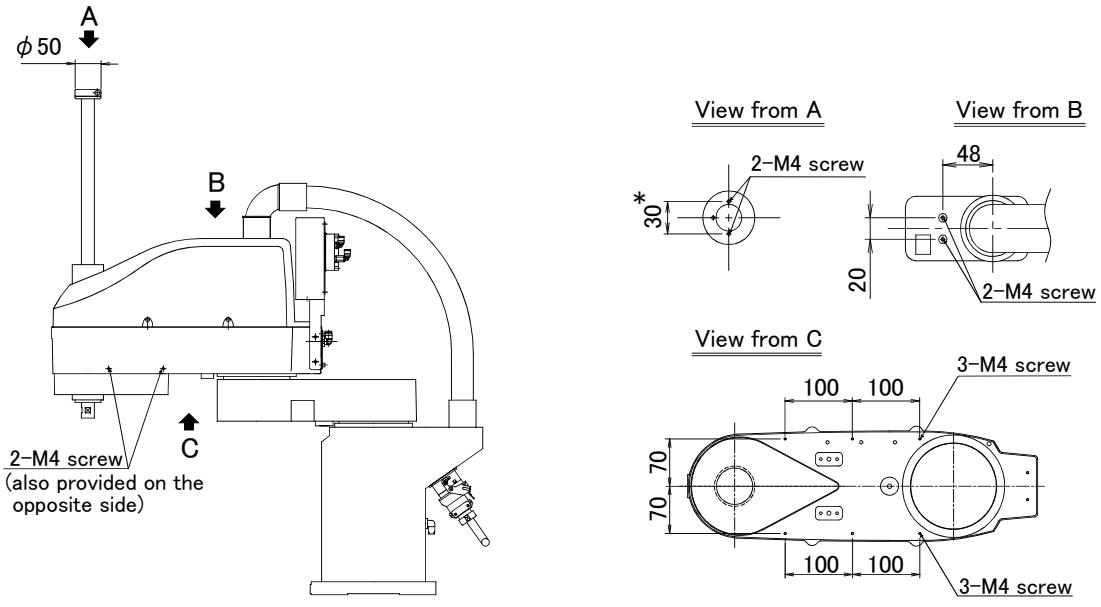
RH-6SDH series



* The dimension is 33 mm for the clean/oil mist specifications.

Fig.2-35 : Location of screw holes for fixing wiring/piping(RH-6SDH series)

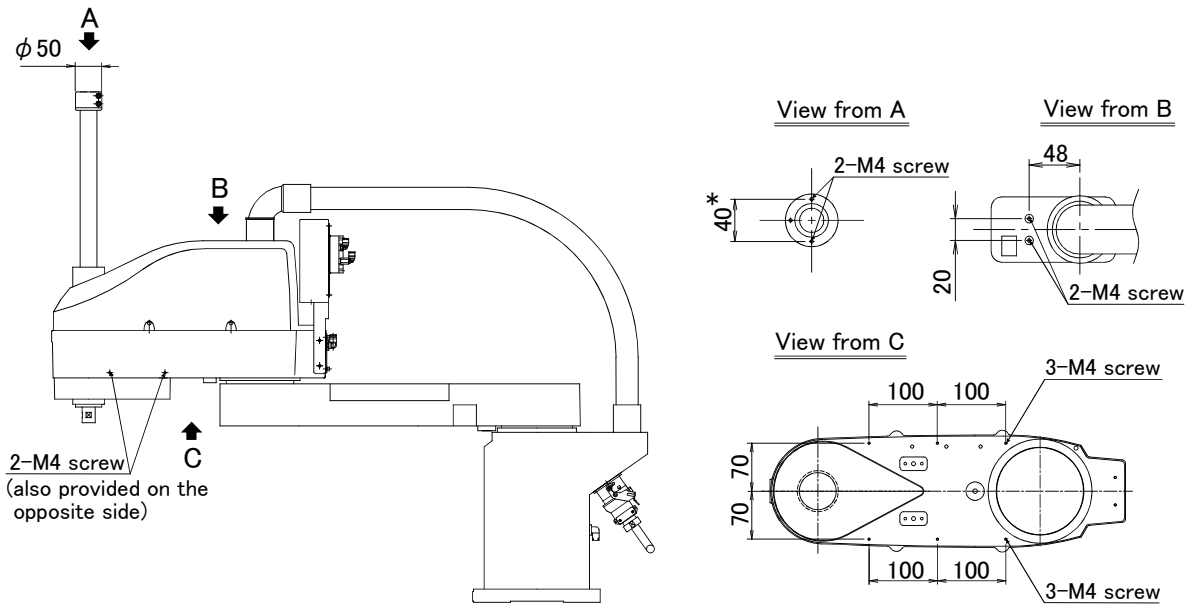
RH-12SDH series



* The dimension is 33 mm for the clean/oil mist specifications.

Fig.2-36 : Location of screw holes for fixing wiring/piping(RH-12SDH series)

RH-18SDH series



* The dimension is 33 mm for the clean/oil mist specifications.

Fig.2-37 : Location of screw holes for fixing wiring/piping(RH-18SDH series)

(1) Example of wiring and piping <1>

This method is effective when the rotation of the hand is small (within ± 90 deg.) and provides easy maintenance of the robot arm as well as during the replacement of wiring and piping.

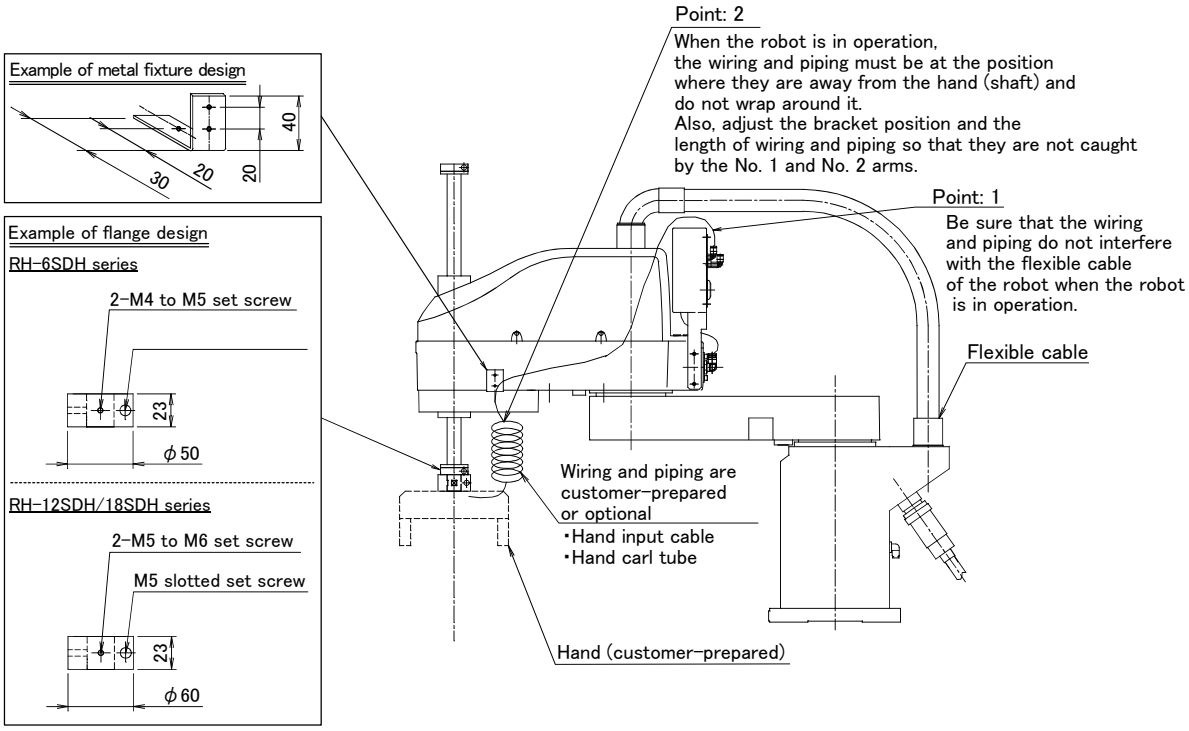


Fig.2-38 : Example of wiring and piping <1>

(2) Wiring and piping example <2>

If wiring and piping are fed through the hollow section of the shaft, the wiring and piping to the hand can be streamlined.

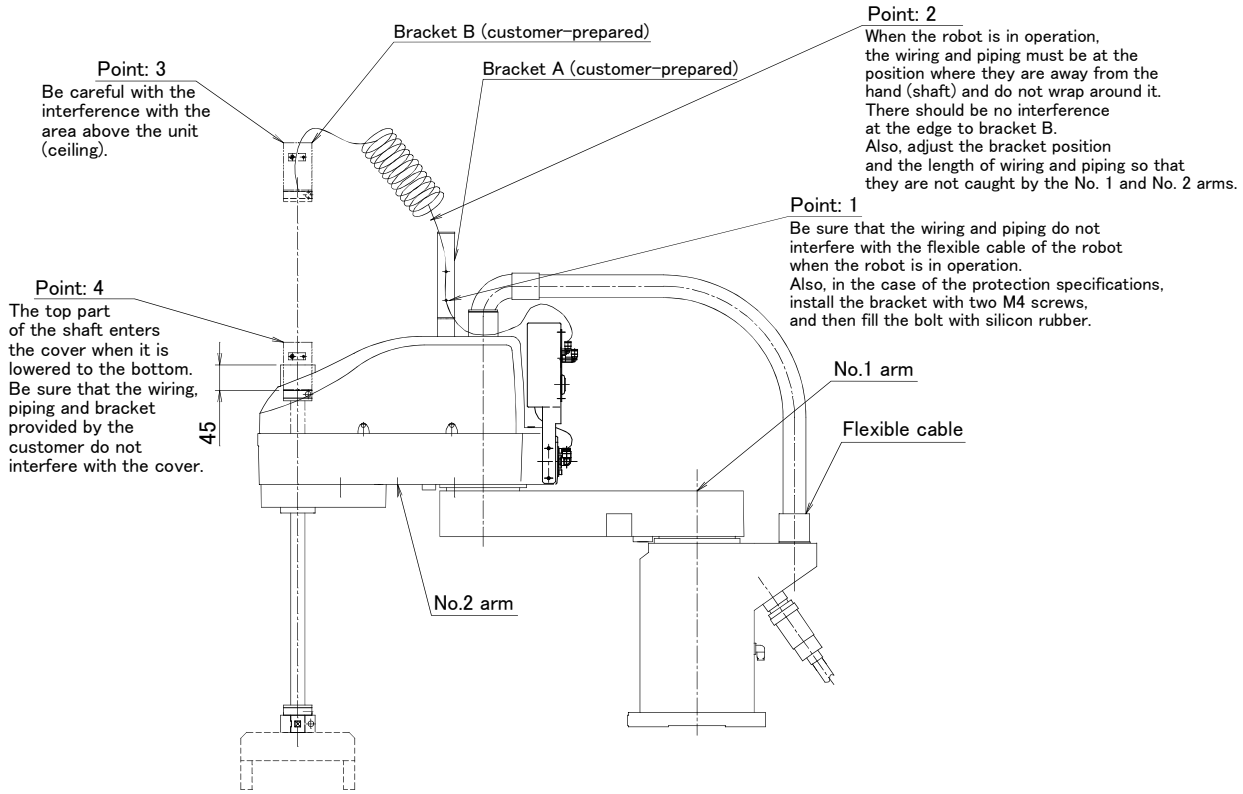
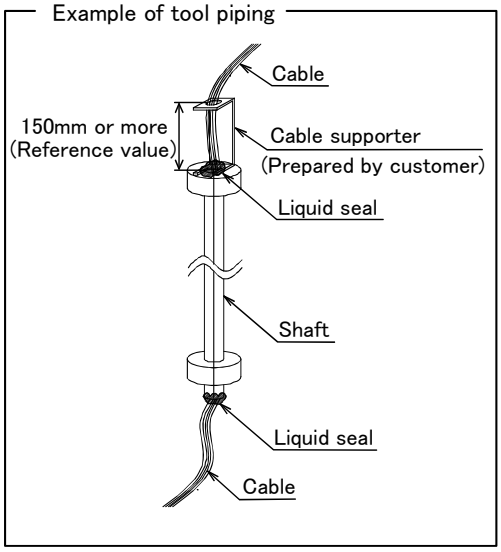
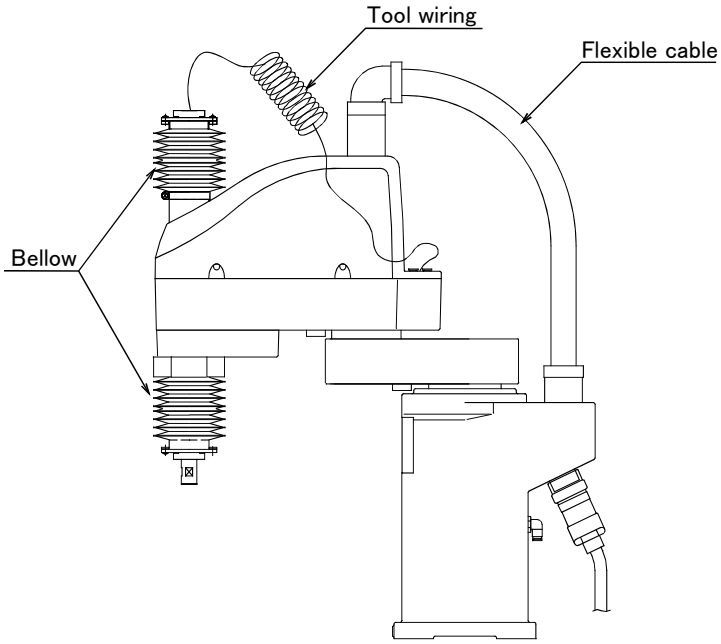


Fig.2-39 : Example of wiring and piping <2>

(3) Precautions for the oil mist specification and clean specification

- Bellows are attached to the tips so confirm not interfering in the tooling wiring, piping, and the flexible tube.
- Please use wiring materials that are sufficiently flexible. Furthermore, please perform the wiring in such a way that the bending radii of the selection tube and wires will not become less than the minimum values allowed while the robot is operating.





(4) Precautions for the clean specification

The top and bottom parts of the through hole of the tip shaft are taped at shipment.
Perform the following actions as necessary in order to ensure that the robot is sufficiently clean during the operation:

1) When the through hole of the shaft is not used
   - Keep the tip shaft taped while the robot is in use.

2) When the through hole of the shaft is used for wiring.
   - Peel the tape of the tip shaft off and perform the necessary wiring. Once the wiring is completed, seal the tip shaft using liquid seal in order to avoid accumulation of dust.
   - Perform the wiring in such a way that the wires around the area below the tip shaft will not get into contact with other parts while the robot is operating.

2.5.8 iring and piping system diagram for hand

Shows the wiring and piping configuration for a standard-equipped hand.

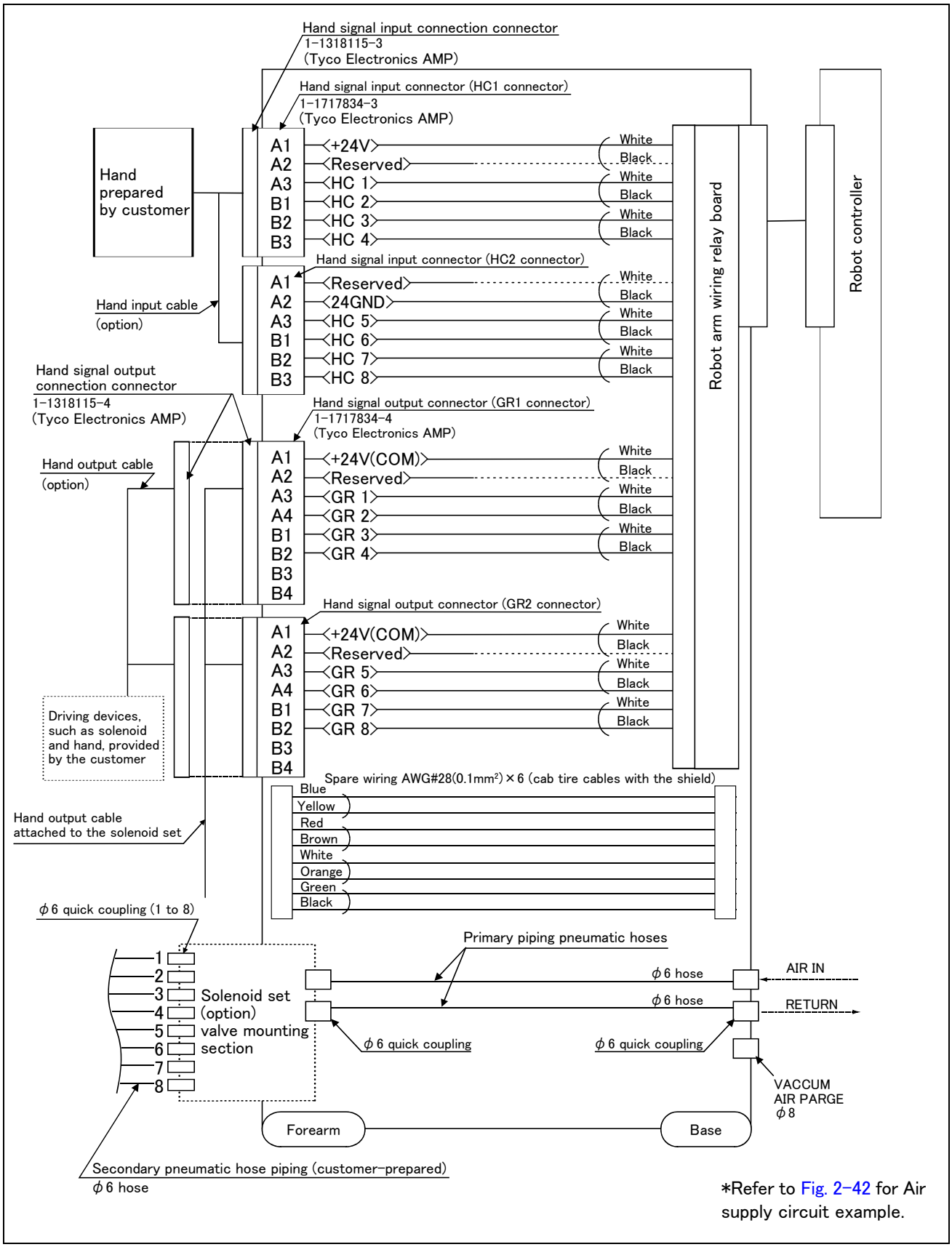


Fig.2-40 : Wiring and piping system diagram for hand and example the solenoid valve installation(Sink type)

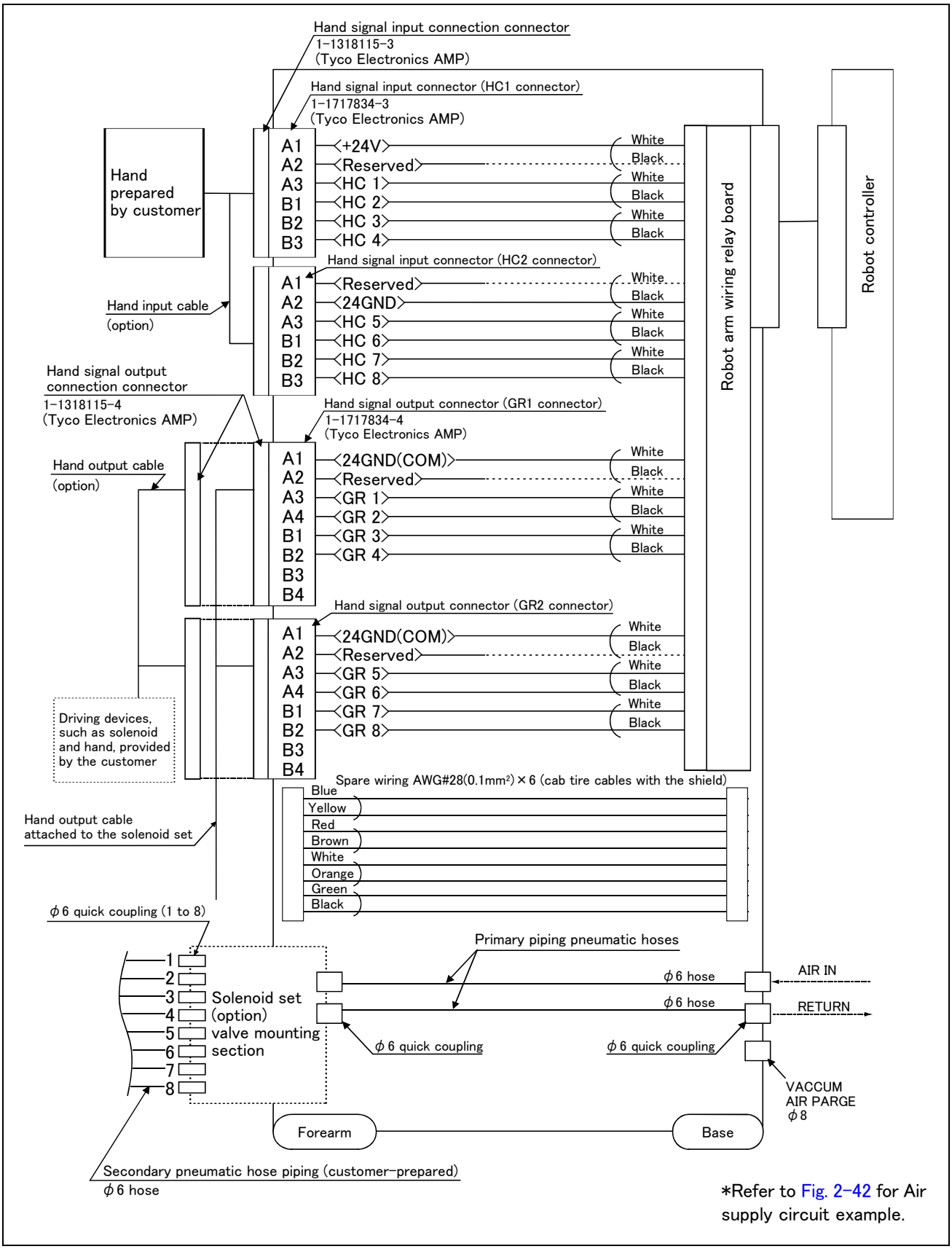


Fig.2-41 : Wiring and piping system diagram for hand and example the solenoid valve installation(Source type)

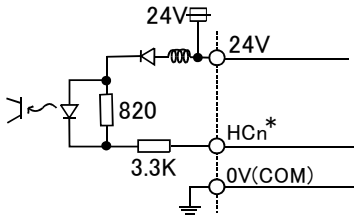
2.5.9 Electrical specifications of hand input/output

Table 2-14 : Electrical specifications of input circuit

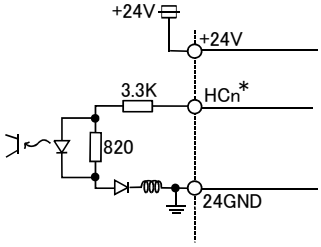
Item		Specifications
Type		DC input
No. of input points		8
Insulation method		Photo-coupler insulation
Rated input voltage		12VDC/24VDC
Rated input current		Approx. 3mA/approx. 7mA
Working voltage range		DC10.2 to 26.4V(ripple rate within 5%)
ON voltage/ON current		8VDC or more/2mA or more
OFF voltage/OFF current		4VDC or less/1mA or less
Input resistance		Approx. 3.3kΩ
Response time	OFF-ON	10ms or less(DC24V)
	ON-OFF	10ms or less(DC24V)

Internal circuit

<Sink type>



<Source type>



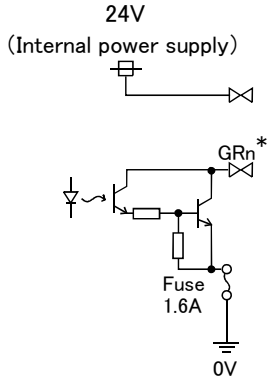
* HCn = HC1 ~ HC8

Table 2-15 : Electrical specifications of output circuit

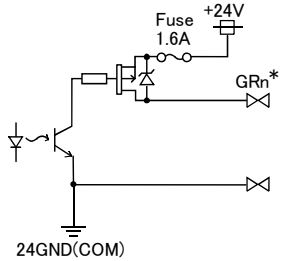
Item		Specification
Type		Transistor output
No. of output points		8
Insulation method		Photo coupler insulation
Rated load voltage		DC24V
Rated load voltage range		DC21.6 to 26.4VDC
Max. current load		0.1A/ 1 point (100%)
Current leak with power OFF		0.1mA or less
Maximum voltage drop with power ON		DC0.9V(TYP.)
Response time	OFF-ON	2ms or less (hardware response time)
	ON-OFF	2 ms or less (resistance load) (hardware response time)
Fuse rating		1.6A (each one common) Cannot be exchanged

Internal circuit

<Sink type>



<Source type>



* GRn = GR1 ~ GR8

Note) An optional air hand interface (2A-RZ365/2A-RZ375) is required to use hand output.

2.5.10 Air supply circuit example for the hand

Fig. 2-42 shows an example of pneumatic supply circuitry for the hand.

(1) Place diodes parallel to the solenoid coil.

(2) When the factory pneumatic pressure drops, as a result of the hand clamp strength weakening, there can be damage to the work. To prevent it, install a pressure switch to the source of the air as shown in Fig. 2-42 and use the circuit described so that the robot stops when pressure drops. Use a hand with a spring-pressure clamp, or a mechanical lock-type hand, that can be used in cases where the pressure switch becomes damaged.

(3) The optional hand and solenoid valve are of an oilless type. If they are used, don't use any lubricator.

(4) Supply clean air to the vacuum generation valve when you use clean type robot.

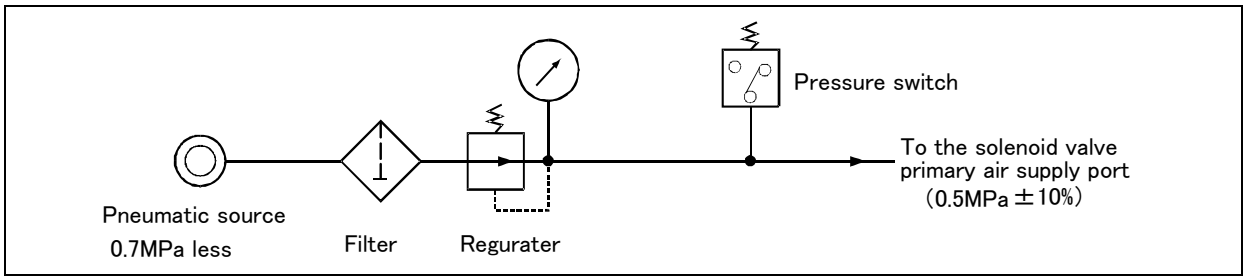


Fig.2-42 : Air supply circuit example for the hand

2.6 Shipping special specifications, options, and maintenance parts

2.6.1 Shipping special specifications

■ What are sipping special specifications?

Shipping special specifications are changed at the time of shipment from the factory. Consequently, customer need to confirm the delivery date.

To make changes to the specifications after shipment, service work must be performed at the work site or the robot must be returned for service.

■ How to order

(1) Confirm beforehand when the factory special specifications can be shipped, because they may not be immediately available.

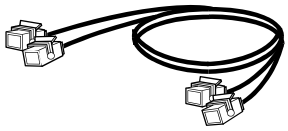
(2) Order before the factory shipping date.

(3) Specified method …… Specify the part name, model, and robot model type.

(1) Machine cable

■ Order type: RH-6SDH series ..... ● Fixed type1S-02UCBL-03 (2m)
RH-12SDH/18SDH series ..... ● Fixed type1S-02UCBL-01 (2m)

■ Outline



This cable is exchanged for the machine cable (5 m for fixed type) that was supplied as standard to shorten the distance between the controller and the robot arm.

■ Configuration

Table 2-16 : Configuration equipments and types

Part name			Type	Qty.	Qty.
RH-6SDH series					
	Fixed	Set of signal and power cables	1S-02UCBL-03	1set	2m
		Motor signal cable	BKO-FA0741H02	(1 cable)	
		Motor power cable	BKO-FA0768H02	(1 cable)	
RH-12SDH/18SDH series					
	Fixed	Set of signal and power cables	1S-02UCBL-01	1set	2m
		Motor signal cable	BKO-FA0741H02	(1 cable)	
		Motor power cable	BKO-FA0739H02	(1 cable)	

Note) Standard 5 m (for fixed type) is not attached.

[Caution] Orders made after purchasing a robot are treated as purchases of optional equipment. In this case, the machine cable (5 m for fixed type) that was supplied as standard is not reclaimed.
Please keep it in storage.

2.7 Options

■ What are options?

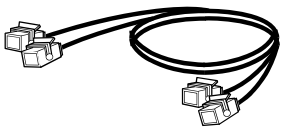
There are a variety of options for the robot designed to make the setting up process easier for customer needs. customer installation is required for the options. Options come in two types: ″set options″ and ″single options″.

1. Set options .....A combination of single options and parts that together, from a set for serving some purpose.
2. Single options .....That are configured from the fewest number of required units of a part. Please choose customer's purpose additionally.

(1) Machine cable extension

■ Order type : RH-6SDH series ..... ● Fixed type 1S- ☐☐ CBL-03
● Flexed type 1S- ☐☐ LCBL-03
RH-12SDH/18SDH series ..... ● Fixed type 1S- ☐☐ CBL-01
● Flexed type 1S- ☐☐ LCBL-01
Note) The numbers in the boxes ☐☐ refer the length.

■ Outline



This cable is exchanged for the machine cable (5 m) that was supplied as standard to extend the distance between the controller and the robot arm.
A fixed type and flexible type are available.
Exchanges after shipment will be charged (for packaging, shipping costs).
The fixing and flexible types are both configured of the motor signal cable and motor power cable.

■ Configuration

Table 2-17 : Configuration equipments and types

Part name		Type	Qty.		Remarks
			Fixed	Flexed	
RH-6SDH series					
Fixed	Set of signal and power cables	1S- ☐☐ CBL-03	1 set	–	5m, 10m, or 15m each
	Motor signal cable	1S- ☐☐ CBL(S)-01	(1 cable)	–	
	Motor power cable	1S- ☐☐ CBL(P)-02	(1 cable)	–	
Flexed	Set of signal and power cables	1S- ☐☐ LCBL-03	–	1 set	5m, 10m, or 15m each
	Motor signal cable	1S- ☐☐ LCBL(S)-01	–	(1 cable)	
	Motor power cable	1S- ☐☐ LCBL(P)-02	–	(1 cable)	
Nylon clamp		NK-14N	–	2 pcs.	for motor signal cable
Nylon clamp		NK-18N	–	2 pcs.	for motor power cable
Silicon rubber			–	4 pcs.	
RH-12SDH/18SDH series					
Fixed	Set of signal and power cables	1S- ☐☐ CBL-01	1 set	–	5m, 10m, or 15m each
	Motor signal cable	1S- ☐☐ CBL(S)-01	(1 cable)	–	
	Motor power cable	1S- ☐☐ CBL(P)-01	(1 cable)	–	
Flexed	Set of signal and power cables	1S- ☐☐ LCBL-01	–	1 set	5m, 10m, or 15m each
	Motor signal cable	1S- ☐☐ LCBL(S)-01	–	(1 cable)	
	Motor power cable	1S- ☐☐ LCBL(P)-01	–	(1 cable)	
Nylon clamp		NK-14N	–	2 pcs.	for motor signal cable
Nylon clamp		NK-18N	–	2 pcs.	for motor power cable
Silicon rubber			–	4 pcs.	

The numbers in the boxes ☐☐ refer the length.

■ Specifications

The specifications for the fixed type cables are the same as those for standard cables.
Shows usage conditions for flexed type cables in Table 2-18.

Table 2-18 : Conditions for the flexed type cables

Item		Specifications
Minimum flexed radius		100R or more
Cable bare, etc., occupation rate		50% or less
Maximum movement speed		2000mm/s or less
Guidance of life count		7.5 million times
Environmental proof		Oil-proof specification sheath (for silicon grease, cable sliding lubricant type)
Cable configuration	Motor signal cable	φ6.5 x 5, φ8.5 x 1 and φ1.7 x 1
	Motor power cable	φ6.5 x 10: RH-6SDH φ8.9 x 3 and φ6.5 x 6: RH-12SDH/18SDH

[Caution] The guidance of life count may greatly differ according to the usage state (items related to Table 2-18 and to the amount of silicon grease applied in the cable conduit.
[Caution] This option can be installed on clean-type, but its cleanliness is not under warranty.

■ Cable configuration

The configuration of the flexible cable is shown in Table 2-19. Refer to this table when selecting the cable bare.

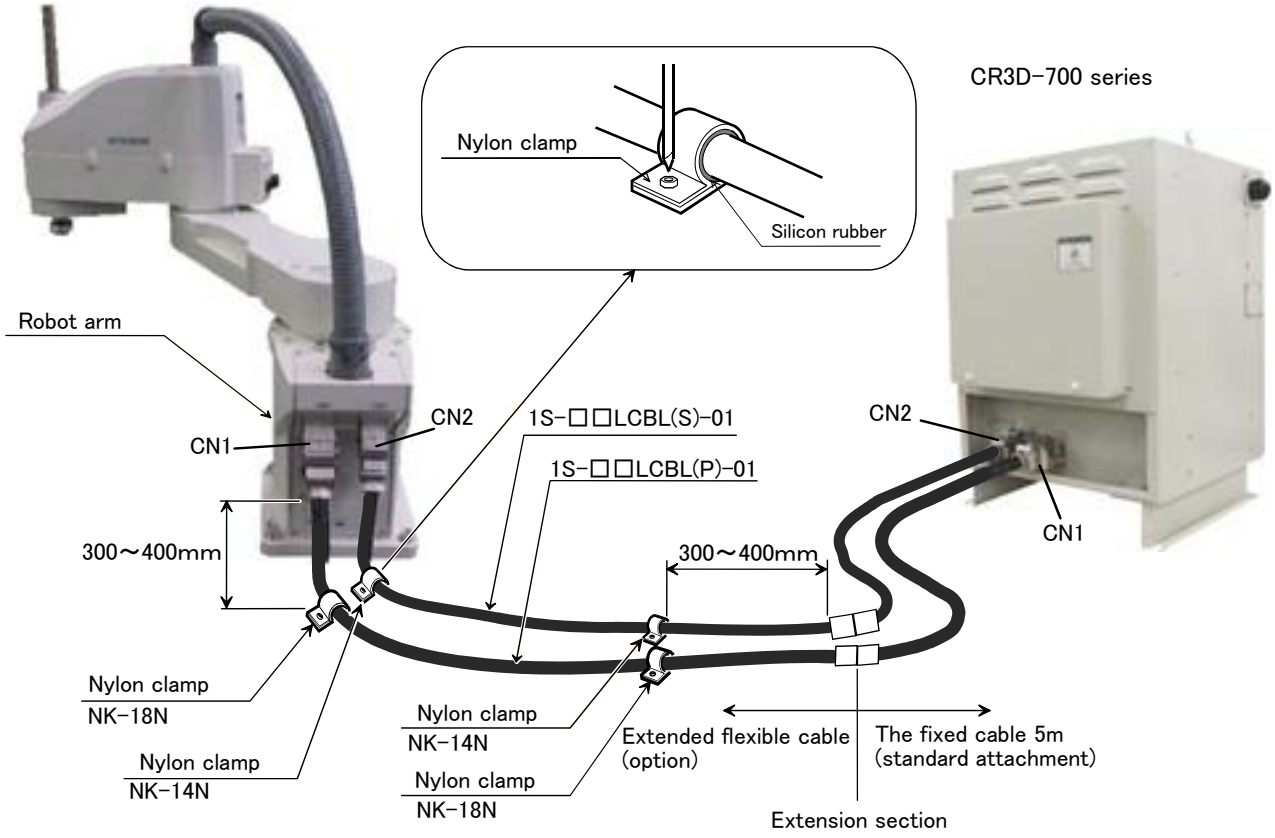
Table 2-19 : Cable configuration

Item	Motor signal cable 1S- □□ LCBL(S)-01			Motor power cable 1S- □□ LCBL(P)-01	
No. of cores	AWG#24(0.2mm^2)-4P	AWG#24(0.2mm^2)-7P	AWG#18(0.75mm^2)	AWG#16(1.25mm^2)-4C	AWG#18(0.75mm^2)-4C
Finish dimensions	Approx. ϕ6mm	Approx. ϕ8.5mm	Approx. ϕ1.7mm	Approx. ϕ8.9mm	Approx. ϕ6.5mm
No.of cables used	5 cables	1 cable	1 cable	3 cable	6 cable
No. in total	7 cables			9 cables	

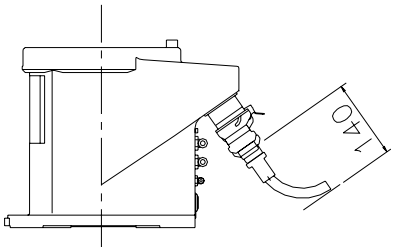
■ Fixing the flexible cable

(1) Connect the connector to the robot arm .

(2) Wind the silicon rubber around the cable at a position 300 to 400 mm from the side of robot arm and extension section as shown in Fig. 2-43, and fix with the nylon clamp to protect the cable from external stress.



⚠ CAUTION Cover the extension terminal area with the cover etc. so that it may not be easily touched to the latch lever.



The cable shall bend and size shall be 140mm or more.

CR1D-700 series

CR2D-700 series

Fig.2-43 : Fixing the flexible cable

(2) Solenoid valve set

■ Order type : Four sets : 1S-VD04M-04(Sink type)/1S-VD04ME-04(Source type): RH-6SDQH series
Four sets : 1S-VD04M-03(Sink type)/1S-VD04ME-03(Source type) RH-12SDQH/18SDQH series

■ Outline

The solenoid valve set is an option that is used for controlling toolings when various toolings, such as the hand, are installed at the end of the arm.
This solenoid valve set has a hand output cable attached to the solenoid valve. Also, for easy installation of this electromaagnetic set onto the robot, it comes equipped with a manifold, couplings, silencers, among other things.
When using the robot arm's hand output signal, the pneumatic hand interface option must be installed on the separate controller.

■ Configuration

Table 2-20 : Configuration equipment

Part name	Type	Q'ty	Remark
RH-6SDH series			
Solenoid valve set (4 sets)	1S-VD04M-04/ 1S-VD04ME-04	Either one pc.	M4 x 8 Four screws (Installation screws)
RH-12SDH/18SDH series			
Solenoid valve set (4 sets)	1S-VD04M-03/ 1S-VD04ME-03	Either one pc.	M4 x 8 Four screws (Installation screws)

■ Specifications

Table 2-21 : Valve specifications

Item	Specifications
Number of positions	2
Port	5 Note1)
Valve function	Double solenoid
Operating fluid	Clean air Note2)
Operating method	Internal pilot method
Effective sectional area (CV value)	0.64mm
Oiling	Unnecessary
Operating pressure range	0.1 to 0.7MPa
Guaranteed proof of pressure	1.0MPa or more
Response time	22msec or less (at 0.5 MPa)
Max. operating frequency	5c/s
Ambient temperature	−5 to 50 ℃ (However, there must be no condensation.)

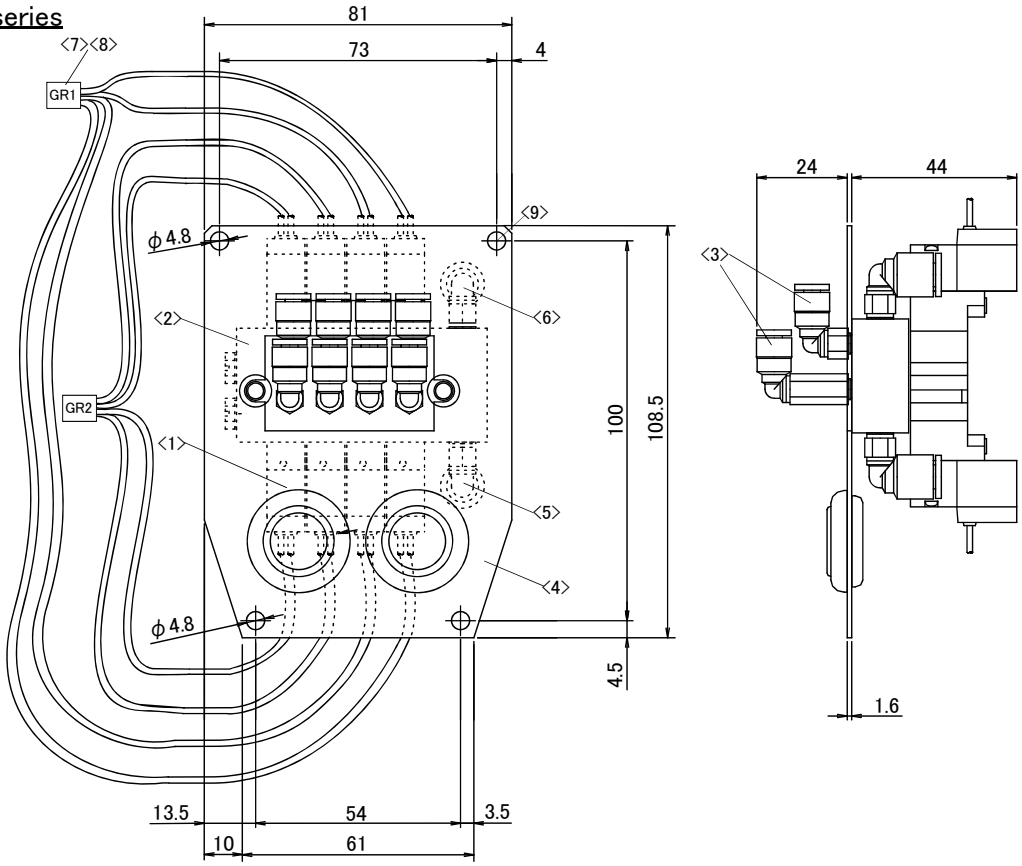
Note1) Couplings of unused solenoid valves must be blocked with plugs. If they are not blocked, supplied air will blow out from the couplings, lowering the air pressure of the solenoid valves being used and making them nonfunctional
(recommended plugs: KQ2P-04 plugs made by SMC).

⚠ CAUTION Note2) The air to be provided must be clean, i.e., filtered with a mist separator or air filter. Failing to do so may lead to malfunctions.

Table 2-22 : Solenoid specifications

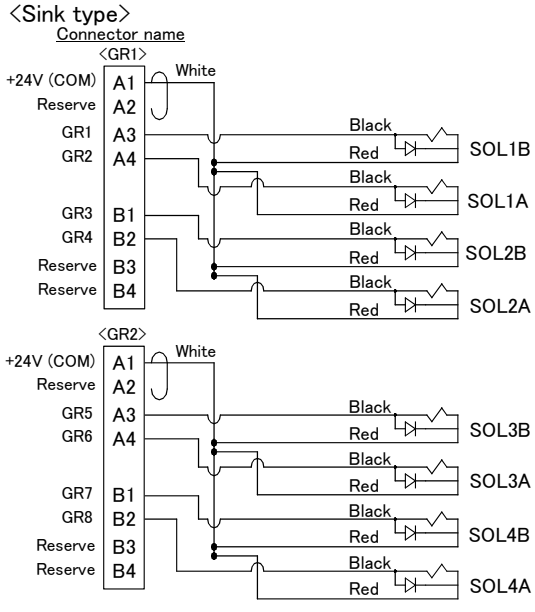
Item	Specifications
Coil rated voltage	DC24V ± 10%
Power consumption	0.55W
Voltage protection circuit with power surge protection	Diode

RH-6SDH series



Part no.	Part name	Qty.	Specifications
<1>	Solenoid valve	4	
<2>	Manifold block	1	
<3>	Quick coupling	8	φ4
<4>	Block plate	1	
<5>	Quick coupling	1	φ6
<6>	Quick coupling	1	φ6
<7>	Connector	2	1-1318115-4
<8>	Contact	12	1318112-1
<9>	Installation screw	4	M4 × 8

<Sink type>



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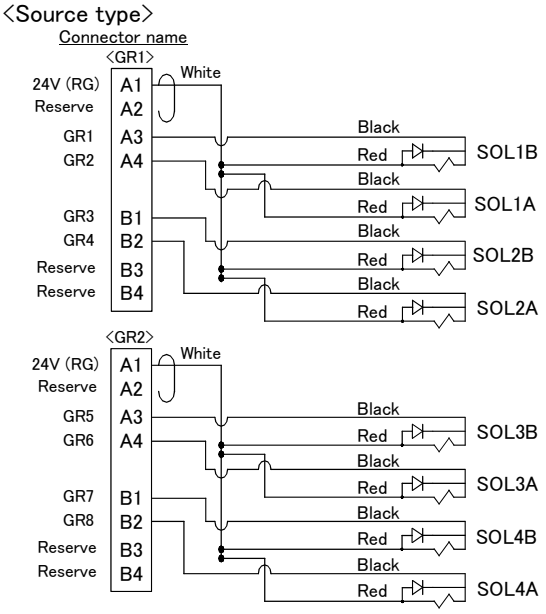


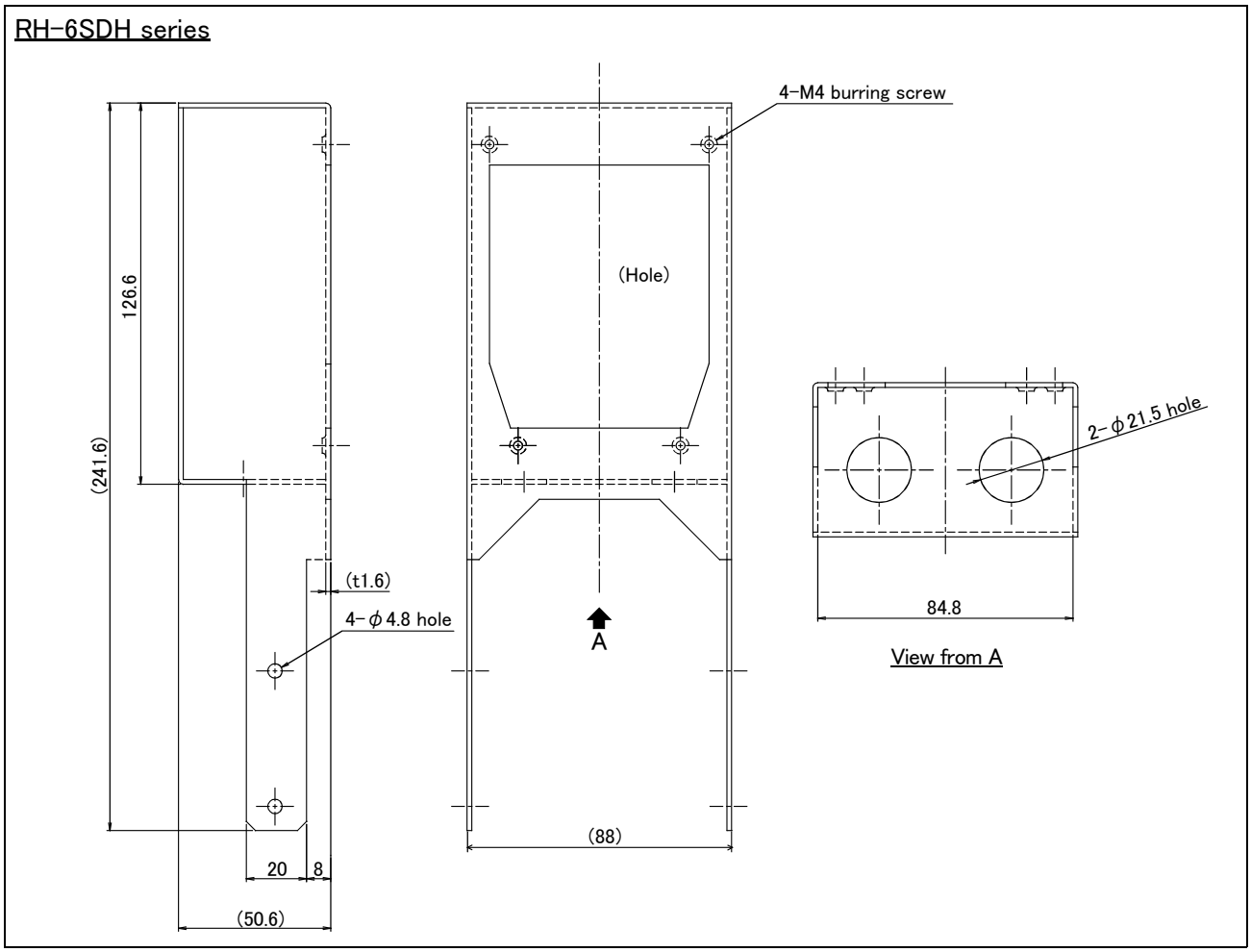
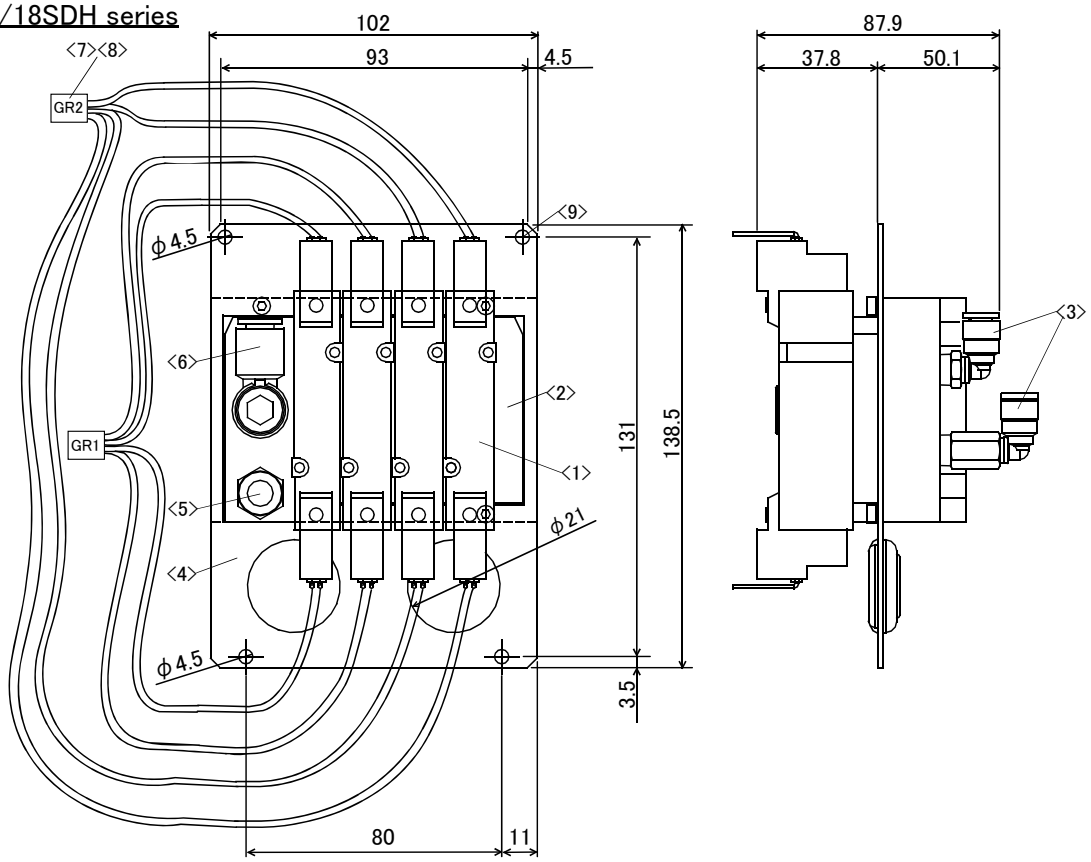


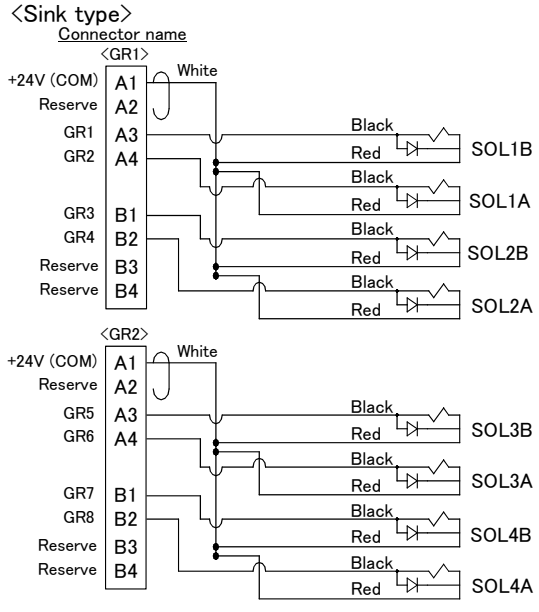
Fig.2-44 : Outside dimensions of solenoid valve box (RH-6SDH series)

RH-12SDH/18SDH series

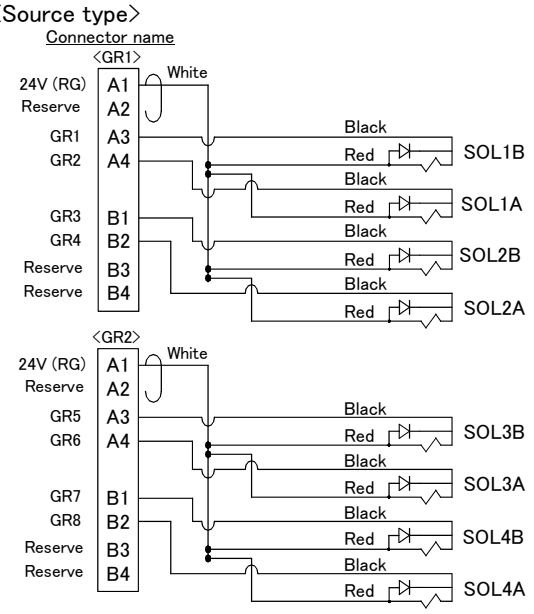


Part no.	Part name	Qty.	Specifications
<1>	Solenoid valve	4	
<2>	Manifold block	1	
<3>	Quick coupling	8	φ4
<4>	Block plate	1	
<5>	Quick coupling	1	φ6
<6>	Quick coupling	1	φ6
<7>	Connector	2	1-1318115-4
<8>	Contact	12	1318112-1
<9>	Installation screw	4	M4 × 8

<Sink type>



<Source type>



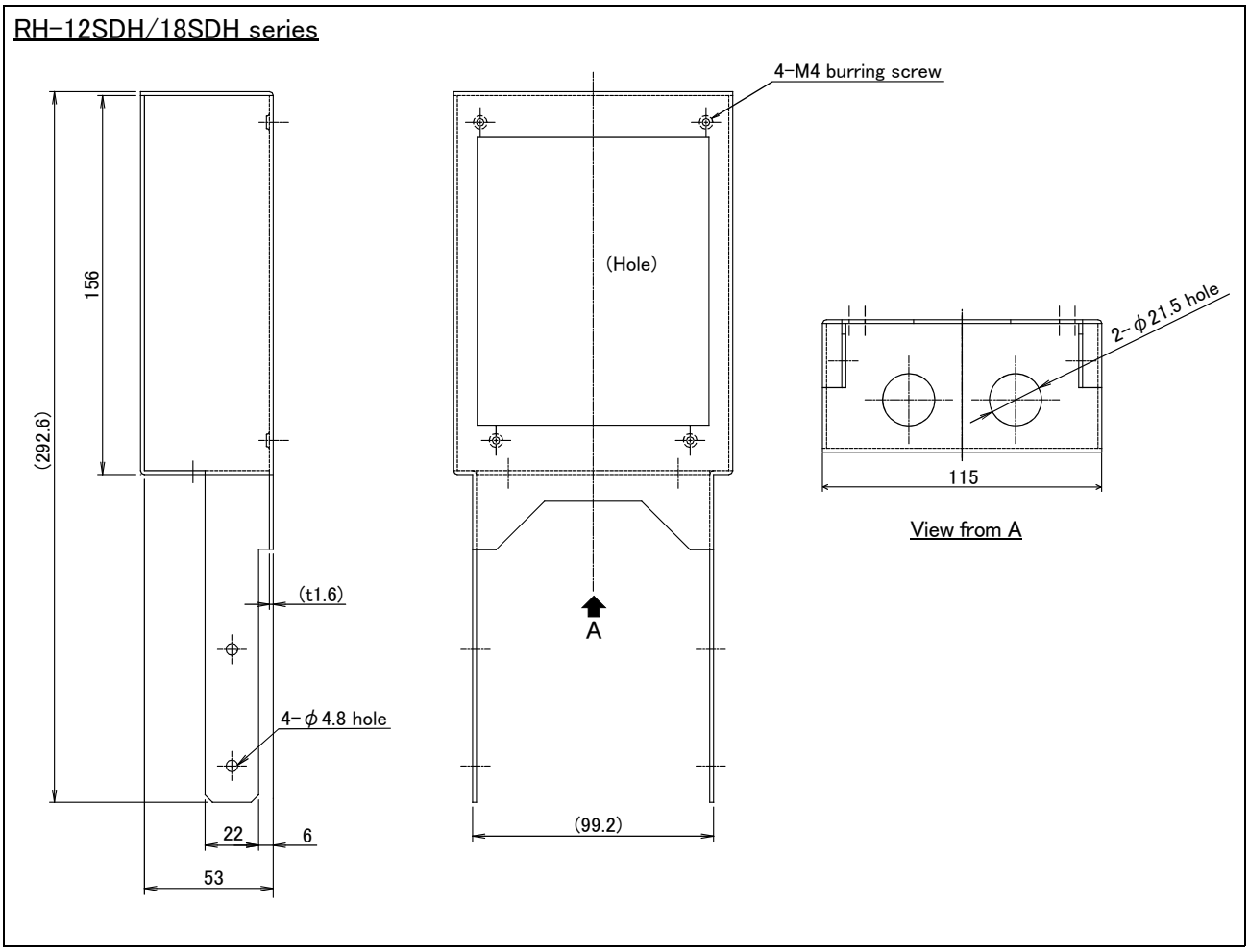
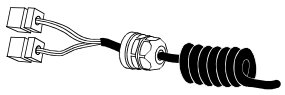


Fig.2-45 : Outside dimensions of solenoid valve box (RH-12SDH/18SDH series)

(3) Hand input cable

■ Order type: 1S-HC35C-02

■ Outline



The hand input cable is used for customer-designed pneumatic hands.
It is necessary to use this to receive the hand's open/close confirmation signals and grasping confirmation signals, at the controller.
One end of the cable connects to the connector for hand input signals, which is in the wrist section of the hand. The other end of the cable connects to the sensor inside the hand customer designed.

■ Configuration

Table 2-23 : Configuration equipment

Part name	Type	Qty.	Remarks
Hand input cable	1S-HC35C-02	1 cable	

■ Specifications

Table 2-24 : Specifications

Item	Specifications	Remarks
Size x cable core	AWG#24 (0.2mm^2) × 12	One-sided connector, one-sided cable bridging
Total length	1300mm (Including the curl section, which is 350mmlong)	

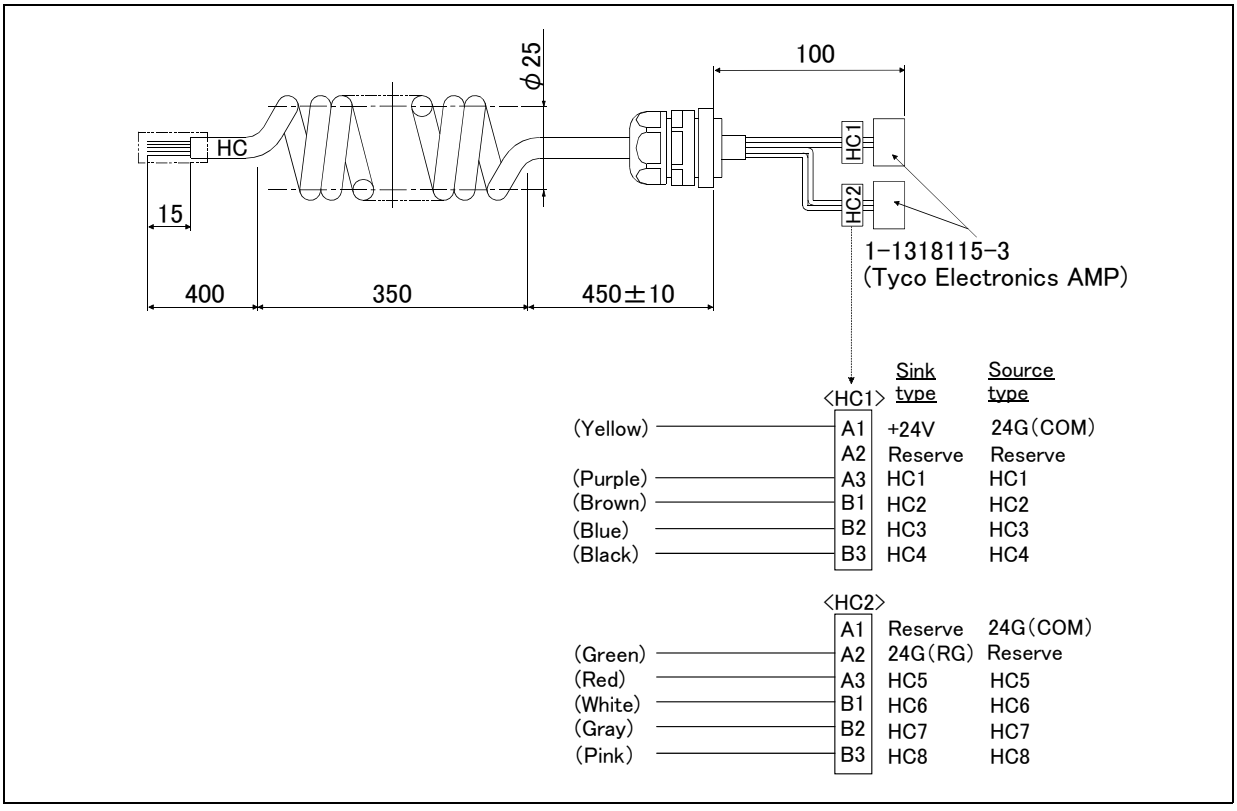


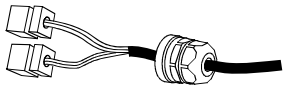
Fig.2-46 : Outside dimensional drawing and pin assignment

[Caution] This option can be installed on clean-type, but its cleanliness is not under warranty.

(4) Hand output cable

■ Order type: 1S-GR35S-02

■ Outline



The hand output cable (solenoid valve connection cable) is an option that is used when an solenoid valve other than one of the solenoid valve set options, is used. One end of the cable has a connector that connects to the input terminal inside the robot. The other end of the cable is connected.

■ Configuration

Table 2-25 : Configuration equipment

Part name	Type	Qty.	Remarks
Hand output cable	1S-GR35S-02	1 cable	

■ Specifications

Table 2-26 : Specifications

Item	Specifications	Remarks
Size x Cable core	AWG#24(0.2mm^2) x 12 cores	One side connector and one side cable connection
Total length	450mm	

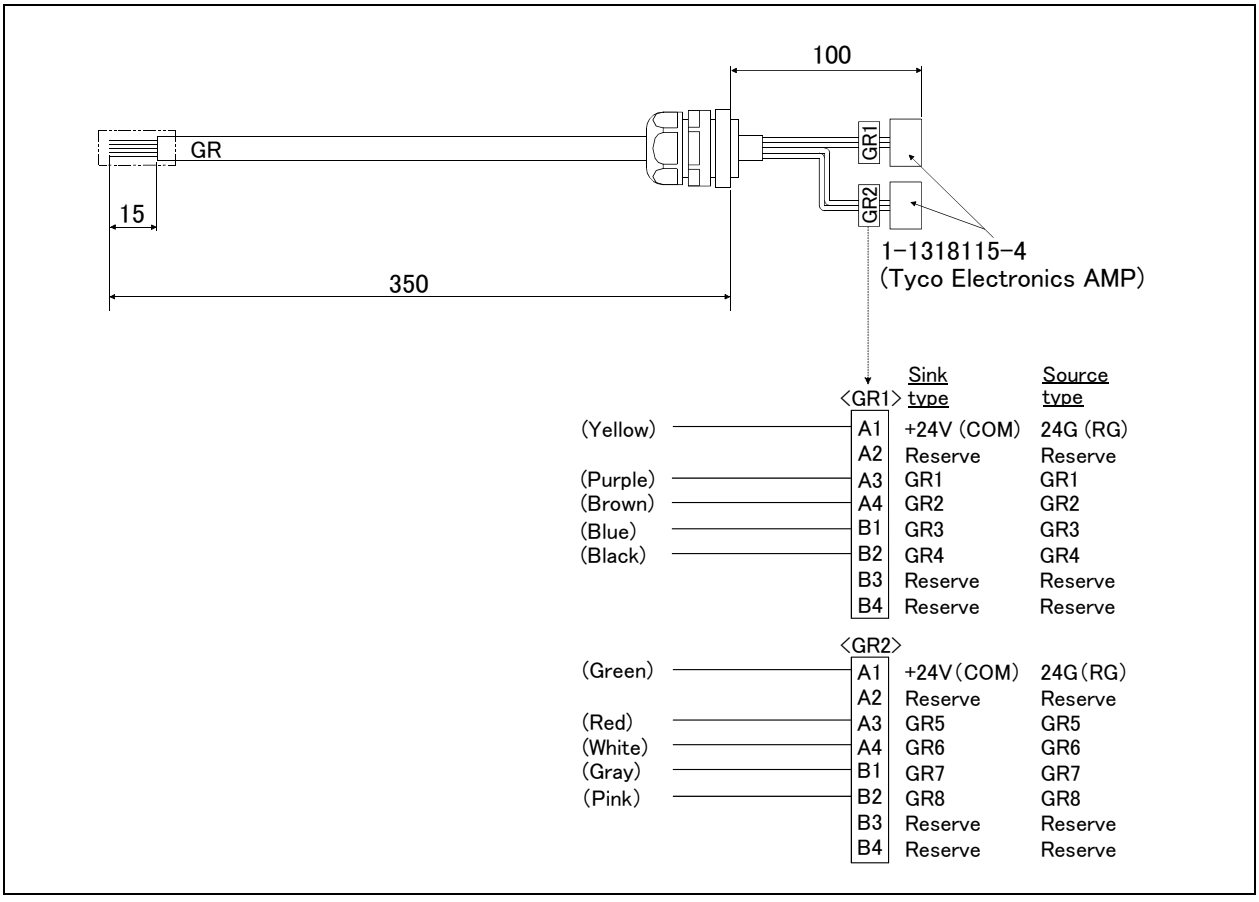
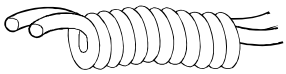


Fig.2-47 : Outline dimensional drawing and pin assignment

(5) Hand curl tube

■ Order type: RH-6SDH series..... 1E-ST0408C-300
RH-12SDH/18SDH series..... 1N-ST0608C

■ Outline



The hand curl tube is a curl tube for the pneumatic hand.

■ Configuration

Table 2-27 : Configuration equipment

Part name	Type	Qty.	Remarks
RH-6SDH series			
Hand curl tube (Four set: 8 pcs.)	1E-ST0408C-300	1 pc.	Φ4 tube, 8pcs
RH-12SDH/18SDH series			
Hand curl tube (Four set: 8 pcs.)	1N-ST0608C	1 pc.	Φ6 tube, 8pcs

■ Specifications

This option can be installed on clean-type, but its cleanliness is not under warranty.

Table 2-28 : Specifications

Item	Specifications	
	RH-6SDH series	RH-12SDH/18SDH series
Material	Urethane	Urethane
Size	Outside diameter: Φ4 x Inside diameterΦ2.5	Outside diameter: Φ6 x Inside diameterΦ4

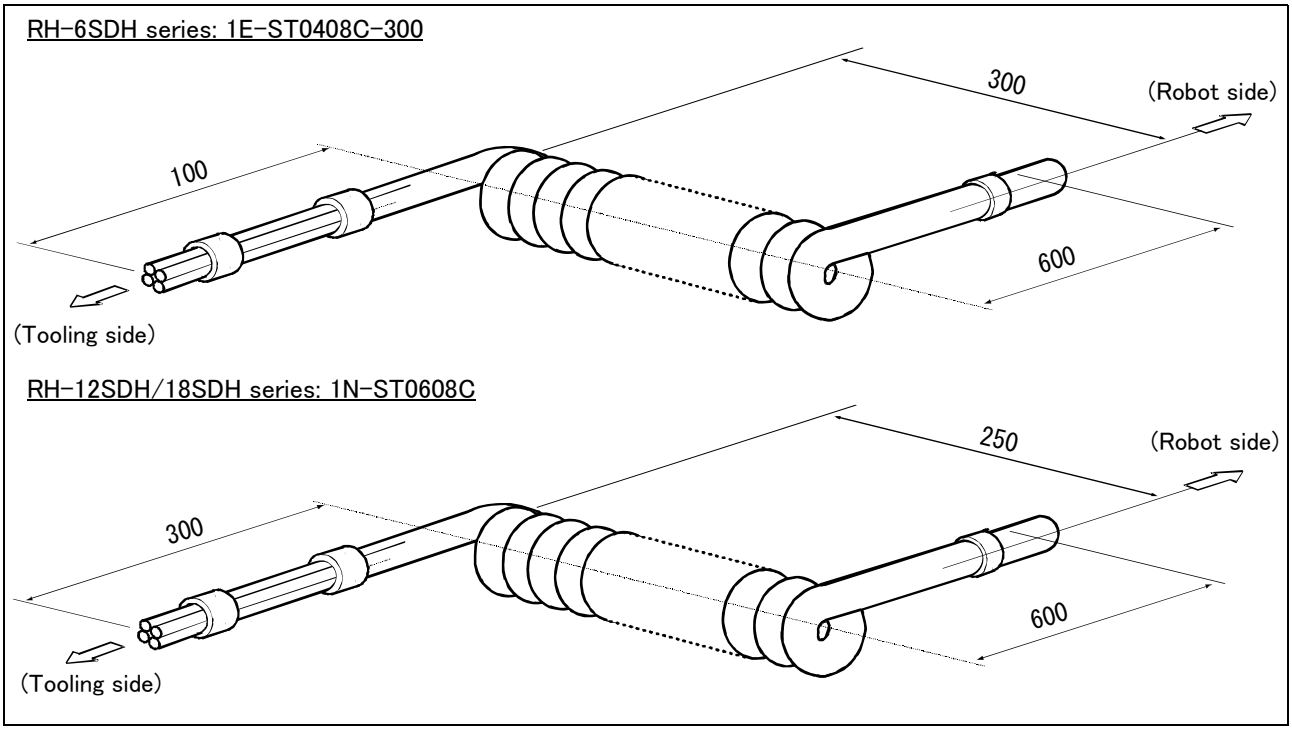


Fig.2-48 : Outline dimensional drawing

[Caution] This option can be installed on clean-type, but its cleanliness is not under warranty.

2.8 Maintenance parts

The consumable parts used in the robot arm are shown in Table 2-29. Purchase these parts from the designated maker or dealer when required. Some Mitsubishi-designated parts differ from the maker's standard parts. Thus, confirm the part name, robot arm and controller serial No. and purchase the parts from the dealer.

Table 2-29 : Consumable part list

No.	Part name	Type Note1)	Usage place	Qty.	Supplier
1	Grrase	SK-1A	Reduction gears of each axis	As needed	Mitsubishi Electric
2		Marutenpu PS No.2	Shaft	As needed	
3	Lithium battery	A6BAT	Rear section of the base	4	
RH-6SDH series					
4	Timing belt		J3 axis	1	Mitsubishi Electric
5			J4 axis motor side	1	
6			J4 axis shaft side	1	
RH-12SDH/18SDH series					
7	Timing belt		J3 axis	1	Mitsubishi Electric
8			J4 axis motor side	1	
9			J4 axis shaft side	1	

Note1)Confirm the robot arm serial No., and contact the dealer or service branch of Mitsubishi Electric Co., for the type.

3 Controller

3.1 Standard specifications

3.1.1 Standard specifications

Table 3-1 : Standard specifications of controller (CR1D-700 series)

Item		Unit	Specification	Remarks
Type			CR1D-761	RH-6SDHseries[Note1)]
Number of control axis			Simultaneously 4	
Memory capacity	Programmed positions and No. of steps	point step	13,000 26,000	
	Number of programs		256	
Robot language			MELFA-BASIC Ⅴ or MELFA-BASIC Ⅳ[Note2)]	
Teaching method			Pose teaching method ,MDI method	
External input and output	input and output	point	0/0	Max. 256/256 by option
	Dedicated input/output	point	Assigned with general-purpose input/output	
	Special stop input	point	1	
	Hand open/close input/output	point	Input 8 point/Output 0 point	Up to 8 output points can be added as an option[Note3)]
	Emergency stop input	point	1	Dual emergency line
	Door switch input	point	1	Dual door switch line
	Enabling device input	point	1	Dual enabling switch line
	Emergency stop output	point	1	
	Mode output	point	1	
	Robot error output	point	1	
	Addition axis synchronization	point	1	
Interface	RS-232C	port	1	For expansion such as the personal cpmputer, Vision sensor
	Ethernet	port	1: For T/B, 1: For customers	10BASE-T/100BASE-Tx
	USB		1	Ver. 2.0 Only device function
	Hand dedicated slot	slot	1	Dedicated for pneumatic hand inter-face
	Option slot	slot	3	
	Additional axis interface	Channel	1	SSCNET Ⅲ
Power source	Input voltage range	V	1-phase, AC180 to 253	[Note4)]
	Power capacity	KVA	1.0	Does not include rush current [Note5)]
Outline dimensions		mm	240(W) x 290(D) x 200(H)	Excluding protrusions
Mass		kg(lb)	Approx. 9(19.8)	
Construction			Self-contained floor type, Opened type	IP20 [Note6)]
Operating temperature range		deg.	0 to 40	
Ambient humidity		%RH	45 to 85	Without dew drops
Grounding		Ω	100 or less	D class grounding earth[Note7)]
Paint color			Light gray	Munsell 0.08GY7.64/0.81

Note1)In case of CE specification, the controller is the CR2D-700 series.

Note2) The program of MELFA-BASICIV can be used by MELFA-BASICV, if program is converted by RT ToolBox2 (option).

Note3) It is when an pneumatic hand interface (2A-RZ365/2A-RZ375) is installed.

Note4) Please use the controller with an input power supply voltage fluctuation rate of 10% or less.

Note5) The power capacity is the rating value for normal operation. The power capacity does not include the rush current when the power is turned ON. The power capacity is a guideline and the actual operation is affected by the input power voltage.

Note6) This controller is a general environment specification. If the controller used in the clean environment, install to the place which does not have effect to cleanness.

Note7) The robot must be grounded by the customer.

Table 3-2 : Standard specifications of controller (CR2D-700 series)

Item		Unit	Specification	Remarks
Type			CR2D-761/CR2D-741/CR2D-751	RH-6SDH series : CR2D-761 Note1) RH-12SDH series : CR2D-741 RH-18SDH series : CR2D-751
Number of control axis			Simultaneously 4	
Memory capacity	Programmed positions and No. of steps	point step	13,000 26,000	
	Number of programs		256	
Robot language			MELFA-BASIC Ⅴ or MELFA-BASIC Ⅳ Note2)	
Teaching method			Pose teaching method ,MDI method	
External input and output	input and output	point	0/0 Note3)	Max. 256/256 by option
	Dedicated input/output	point	Assigned with general-purpose input/output	
	Special stop input	point	1	
	Hand open/close input/output	point	Input 8 point/Output 0 point	Up to 8 output points can be added as an option Note4)
	Emergency stop input	point	1	Dual emergency line
	Door switch input	point	1	Dual door switch line
	Enabling device input	point	1	Dual enabling switch line
	Emergency stop output	point	1	
	Mode output	point	1	
	Robot error output	point	1	
	Addition axis synchronization	point	1	
Interface	RS-232C	port	1	For expansion such as the personal cpmputer, Vision sensor
	Ethernet	port	1: For T/B, 1: For customers	10BASE-T/100BASE-Tx
	USB		1	Ver. 2.0 Only device function
	Hand dedicated slot	slot	1	Dedicated for pneumatic hand interface
	Option slot	slot	3	
	Additional axis interface	Channel	1	SSCNET Ⅲ
Power source	Input voltage range	V	1-phase, AC180 to 253	Note5)
	Power capacity	KVA	2.0	Does not include rush current Note6)
Outline dimensions		mm	470(W) x 400(D) x 200(H)	Excluding protrusions
Mass		kg(lb)	Approx. 21(46)	
Construction			Self-contained floor type, Opened type	IP20 Note7)
Operating temperature range		deg.	0 to 40	
Ambient humidity		%RH	45 to 85	Without dew drops
Grounding		Ω	100 or less	D class grounding earth Note8)
Paint color			Light gray	Munsell 0.08GY7.64/0.81

Note1)This controller is the standard of CE specification.

Note2) The program of MELFA-BASICIV can be used by MELFA-BASICV, if program is converted by RT ToolBox2 (option).

Note3)The 32/32 points can be use for S312 specification only. (One parallel I/O interface(2D-TZ378) is installed at factory shipping)

Note4) It is when an pneumatic hand interface (2A-RZ365/2A-RZ375) is installed.

Note5) Please use the controller with an input power supply voltage fluctuation rate of 10% or less.

Note6) The power capacity is the rating value for normal operation. The power capacity does not include the rush current when the power is turned ON. The power capacity is a guideline and the actual operation is affected by the input power voltage. The power consumption in the specific operation pattern with the RH-12SDH/18SDH series is approx. 0.6kw. The peak value at the robot's maximum speed is 2.72 kW.

Note7) This controller is a general environment specification. For use in an oil-mist environment or in an environment with excess dust, use the CR3D-7**M controller instead.
Please contact to dealer, if you need the controller of protection specification of CE specification.

Note8) The robot must be grounded by the customer.

Table 3-3 : Standard specifications of controller (CR3D-700 series)

Item		Unit	Specification	Remarks
Type			CR3D-741M/CR3D-751M	RH-12SDH-SM series:CR3D-741M RH-18SDH-SM series:CR3D-751M[Note1)]
Number of control axis			Simultaneously 4	
Memory capacity	Programmed positions and No. of steps	point step	13,000 26,000	
	Number of programs		256	
Robot language			MELFA-BASIC Ⅴ or MELFA-BASIC Ⅳ[Note2)]	
Teaching method			Pose teaching method ,MDI method	
External input and output	input and output	point	0/0 [Note3)]	Max. 256/256 by option
	Dedicated input/output	point	Assigned with general-purpose input/output	
	Special stop input	point	1	
	Hand open/close input/output	point	Input 8 point/Output 0 point	Up to 8 output points can be added as an option[Note4)]
	Emergency stop input	point	1	Dual emergency line
	Door switch input	point	1	Dual door switch line
	Enabling device input	point	1	Dual enabling switch line
	Emergency stop output	point	1	
	Mode output	point	1	
	Robot error output	point	1	
	Addition axis synchronization	point	1	
Interface	RS-232C	port	1	For expansion such as the personal cpmputer, Vision sensor
	Ethernet	port	1: For T/B, 1: For customers	10BASE-T/100BASE-Tx
	USB		1	Ver. 2.0 Only device function
	Hand dedicated slot	slot	1	Dedicated for pneumatic hand interface
	Option slot	slot	3	
	Additional axis interface	Channel	1	SSCNET Ⅲ
Power source	Input voltage range	V	3-phase, AC180 to 253 for standard 3-phase, AC360 to 480 for CE Marking	[Note5)]
	Power capacity	KVA	3.0	Does not include rush current [Note6) Note7)]
Outline dimensions		mm	450(W)x440(D)x625(H)	Excluding protrusions[Note8)]
Mass		kg(lb)	Approx. 60(132)	
Construction			Self-contained floor type, Closed type (IP54)	
Operating temperature range		deg.	0 to 40	
Ambient humidity		%RH	45 to 85	Without dew drops
Grounding		Ω	100 or less	D class grounding earth[Note9)]
Paint color			Light gray	Munsell 0.08GY7.64/0.81

Note1)Please contact to dealer, if you need the controller of CE specification.

Note2)The program of MELFA-BASICIV can be used by MELFA-BASICV, if program is converted by RT ToolBox2 (option).

Note3)The 32/32 points can be use for S312 and S12 specification only. (One parallel I/O interface(2D-TZ378) is installed at factory shipping)

Note4) It is when an pnveumatic hand interface (2A-RZ365/2A-RZ375) is installed.

Note5) Please use the controller with an input power supply voltage fluctuation rate of 10% or less.

Note6) The power capacity is the rating value for normal operation. The power capacity does not include the rush current when the power is turned ON. The power capacity is a guideline and the actual operation is affected by the input power voltage. The power consumption in the specific operation pattern with the series is approx. 0.64kW. The peak value at the robot's maximum speed is 2.72 kW.

Note7)If the earth leakage breaker is installed in the primary side power supply circuit of the controller, please select the earth leakage breaker of the specification of the amperage rating 20A and 10mA of sensed current. (The leak current of the controller is set to about 7.5mA)

The short circuit breaker should use the following.

*Operate by the current leakage under the commercial frequency domain (50-60Hz).

If sensitive to the high frequency ingredient, it will become the cause in which below the maximum leak current value carries out the trip.

Note8)Becomes 615(H) at the caster specification.

Note9) The robot must be grounded by the customer.

3.1.2 Protection specifications and operating supply

A protection method complying with the IEC Standard CR1D-7**/CR2D-7**: IP20(Opened type), CR3D-7**M: IP54(Closed type) is adopted for the controller.

The IEC IP symbols refer only to the degree of protection between the solid and the fluids, and don't indicated that any special protection has been constructed for the prevention against oil and water.

【Information】
<CR1D-7**/CR2D-7** controller>
・The IEC IP20
It indicates the protective structure that prevents an iron ball 12 $^{+0.05}_{0}$mm diameter, which is being pressed with the power of 3.1 kg ± 10%, from going through the opening in the outer sheath of the supplied equipment.

<CR3D-7**M controller>
・The IEC IP54
The IEC IP54 standard refers to protection structure designed to prevent any harmful effects by fresh water scattering vertically onto the testing equipment in a radius of 180 degrees from a distance of 300 to 500 mm, with 10 ± 0.5 liters of water every minute, at a water pressure of 80 to 100kPa , covering the entire area of the robot with the exception of the installation section at 1 ㎡ per minute, for a total of 5 minutes or more.

Refer to the section Page 91, "6.2 Working environment" for details on the working environment.

⚠ CAUTION If the robot is used in an oil mist environment, use the optional contorller protection box (CR1D-MB) to protect the CR1D controller from the oil mist environment for RH-6SDH series.

3.2 Names of each part

＜ CR1D-700 series ＞

＜ Operating panel ＞

⑯
(Right side)

①

＜ CR2D-700 series ＞
(The standard of CE specification)

⑯
(Rear side)

①

＜ CR3D-700 series ＞

⑯

①

＜ Operating panel ＞

＜ Operating panel ＞

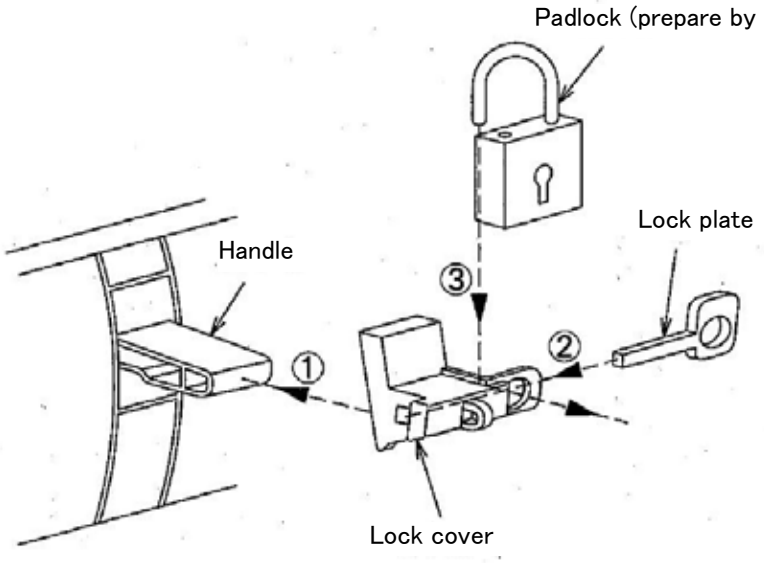
Fig.3-1 : Names of controller parts

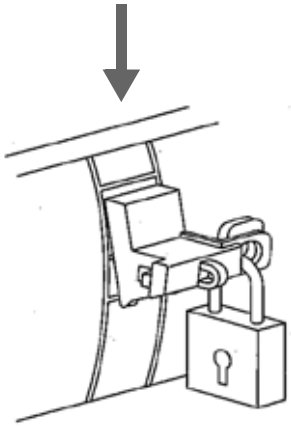
① POWER switch [Note 1)] ..... This turns the control power ON/OFF. (With earth leakage breaker function)
② START button..... This executes the program and operates the robot. The program is run continuously.
③ STOP button ..... This stops the robot immediately. The servo does not turn OFF.
④ RESET button ..... This resets the error. This also resets the program's halted state and resets the program.
⑤ Emergency stop switch..... This stops the robot in an emergency state. The servo turns OFF.

⑥ CHNGDISP button..... This changes the details displayed on the display panel in the order of "Override" → "Program No." → "Line No.".
⑦ END button..... This stops the program being executed at the last line or END statement.
⑧ SVO.ON button..... This turns ON the servo power. (The servo turns ON.)
⑨ SVO.OFF button..... This turns OFF the servo power. (The servo turns OFF.)
⑩ STATUS NUMBER
(display panel)..... The alarm No., program No., override value (%), etc., are displayed.
⑪ T/B connection connector ..... This is a dedicated connector for connecting the T/B. When not using T/B, connect the attached dummy connector.
⑫ MODE key switch..... This changes the robot's operation mode.
AUTOMATIC.....operations from the controller or external equipment are valid. Operations for which the operation mode must be at the external device or T/B are not possible. It is necessary to set the parameter for the rights of operation to connection between the operation panel and external equipment. For details, please refer to "INSTRUCTION MANUAL/Detailed explanations of functions and operations" of the separate volume.
MANUAL.....When the T/B is valid, only operations from the T/B are valid. Operations for which the operation mode must be at the external device or controller are not possible.
⑬ UP/DOWN button..... This scrolls up or down the details displayed on the "STATUS. NUMBER" display panel.
⑭ Interface cover .....USB interface and battery are mounted.
⑮ RS-232 connector..... This is an RS-232C specification connector for connecting the personal computer.
⑯ Power cable leading out..... Lead out the power cable.

Note 1) The operation lock of the power switch (CR2D-700/CR3D-700 series controller)
The power switch has the operation lock function. It is the mechanism in which the mistaken power supply ON is prevented with the padlock etc. at the time of the maintenance of the robot system etc. Prepare lock devices, such as the padlock, by the customer.
The usage of lock function is shown in the following.

＜ CR2D-700 ＞





⚠CAUTION

Please use the robot, in the condition that the key of the padlock is removed. There is a possibility of touching the electric charging part.

Do not operate the trip test by the trip button in the state of the power switch locked at OFF position.

The lock cover is installed strongly. Pull up strongly and remove.

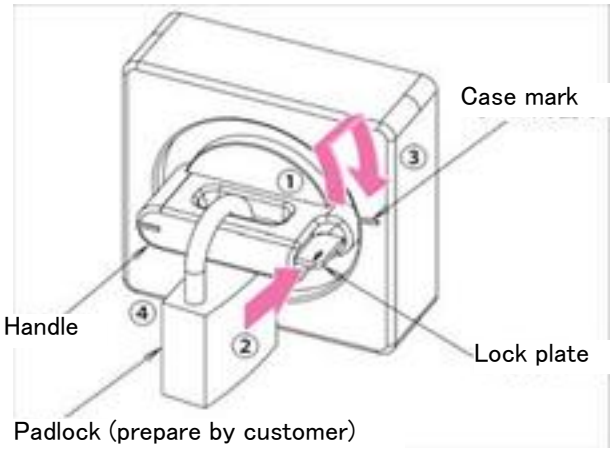
The lock device which can be used

Dimension of the padlock

Dimension (mm(ft))		
A	B	C
25	14	4

Fig.3-2 : operation lock of the power switch(CR2D)

＜ CR3D-700 ＞



Usage of lock function

① Turn the handle in the reset direction until the mark of the lock plate and the case is in agreement.
② Push in the lock plate.
③ Return the handle to the OFF position, with the lock plate pushed.
④ Lock the hole of the center of the handle with the padlock.

The lock device which can be used

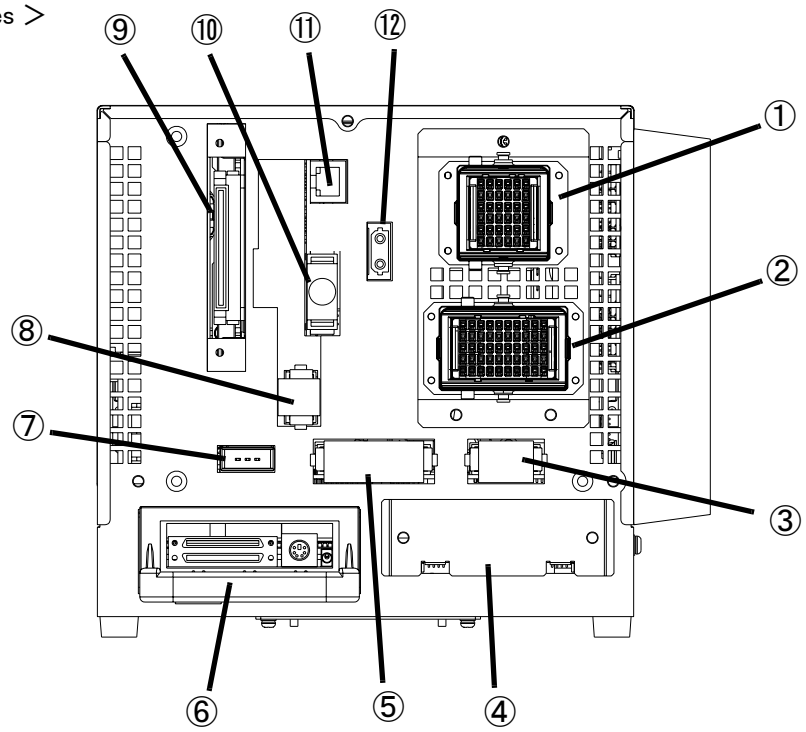
Dimension of the padlock

Dimension (mm(ft))		
A	B	C
35(0.11)	19(0.06)	5(0.016)
40(0.13)	22(0.072) or 23(0.075)	5.5(0.018)

C dimension: Maximum 8mm can be installed.

Fig.3-3 : operation lock of the power switch(CR3D-700)

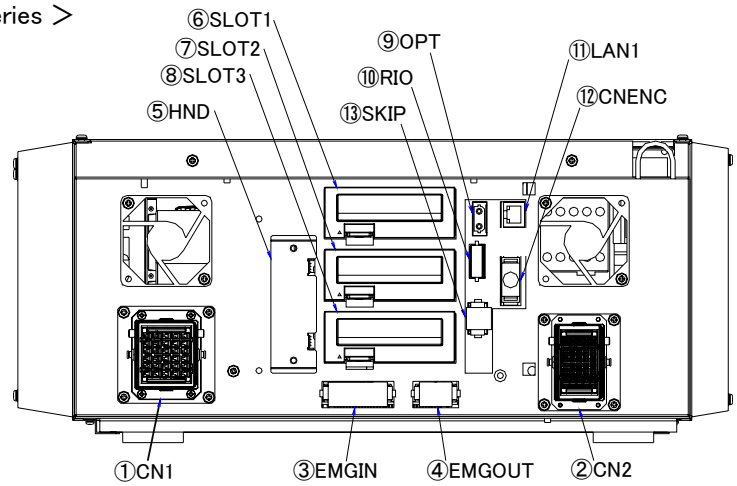
＜ CR1D-700 series ＞



① Machine cable connector (motor power)(CN1).....Connects to the robot arm base. (CN1 connector)
② Machine cable connector (motor signal)(CN2).....Connects to the robot arm base. (CN2 connector)
③ Emergency stop output(EMGOUT).....The robot's error condition is outputted.
④ Hand slot(HND)..... Install the pneumatic hand interface optional.
⑤ Emergency stop input(EMGIN).....Connect the emergency stop switch to the robot.
⑥ Option slot(SLOT1)..... Install the interface optional.
⑦ Extension parallel input/output unit connection connector(RIO)
Connect the extension parallel input/output unit.
⑧ Special stop input(SKIP).....stops the robot immediately.
⑨ Expansion memory cassette(MEMORY CASSETTE) ....Install the memory cassette optional.
⑩ Tracking interface(CNENC).....Connect the encoder cable, if it uses the tracking function.
⑪ Ethernet interface(LAN1).....Connect the Ethernet cable.
*In the CE Marking specification, Please use Ethernet interface by installing the line noise filter and the ferrite core to the Ethernet cable. The line noise filter and the ferrite core are attachments.
Refer to Page 88, "Fig.3-8 : Installation to the Ethernet cable of ferrite core and filter (CE Marking)" for detail.
⑫ Addition axis connection connector(OPT).....Connect the cable for addition axis control.

Fig.3-4 : Names of each part (Rear side CR1D-700 series)

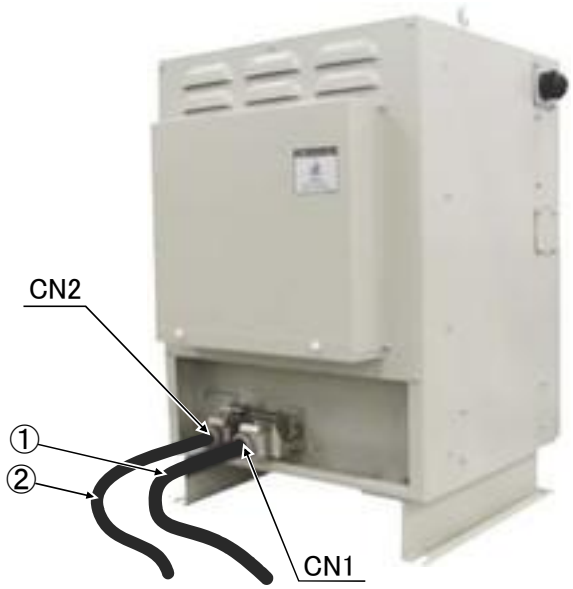
< CR2D-700 series >



① Machine cable connector (motor power)(CN1) .....Connects to the robot arm base. (CN1 connector)
② Machine cable connector (motor signal)(CN2) .....Connects to the robot arm base. (CN2 connector)
③ Emergency stop input(EMGIN) .....Connect the emergency stop switch to the robot.
④ Emergency stop output(EMGOUT).....The robot's error condition is outputted.
⑤ Hand slot(HND) ..... Install the pneumatic hand interface optional.
⑥⑦⑧ Option slot(SLOT1, SLOT2, SLOT3)..... Install the interface optional.
⑨ Addition axis connection connector(OPT).....Connect the cable for addition axis control.
⑩ Extension parallel input/output unit connection connector(RIO)
Connect the extension parallel input/output unit.
⑪ Ethernet interface(LAN1) .....Connect the Ethernet cable.
*In the CE Marking specification, Please use Ethernet interface by installing the line noise filter and the ferrite core to the Ethernet cable. The line noise filter and the ferrite core are attachments.
Refer to Page 88, "Fig.3-8 : Installation to the Ethernet cable of ferrite core and filter (CE Marking)" for detail.
⑫ Tracking interface(CNENC) .....Connect the encoder cable, if it uses the tracking function.
⑬ Special stop input(SKIP).....stops the robot immediately.

Fig.3-5 : Names of each part (Rear side CR2D-700 series)

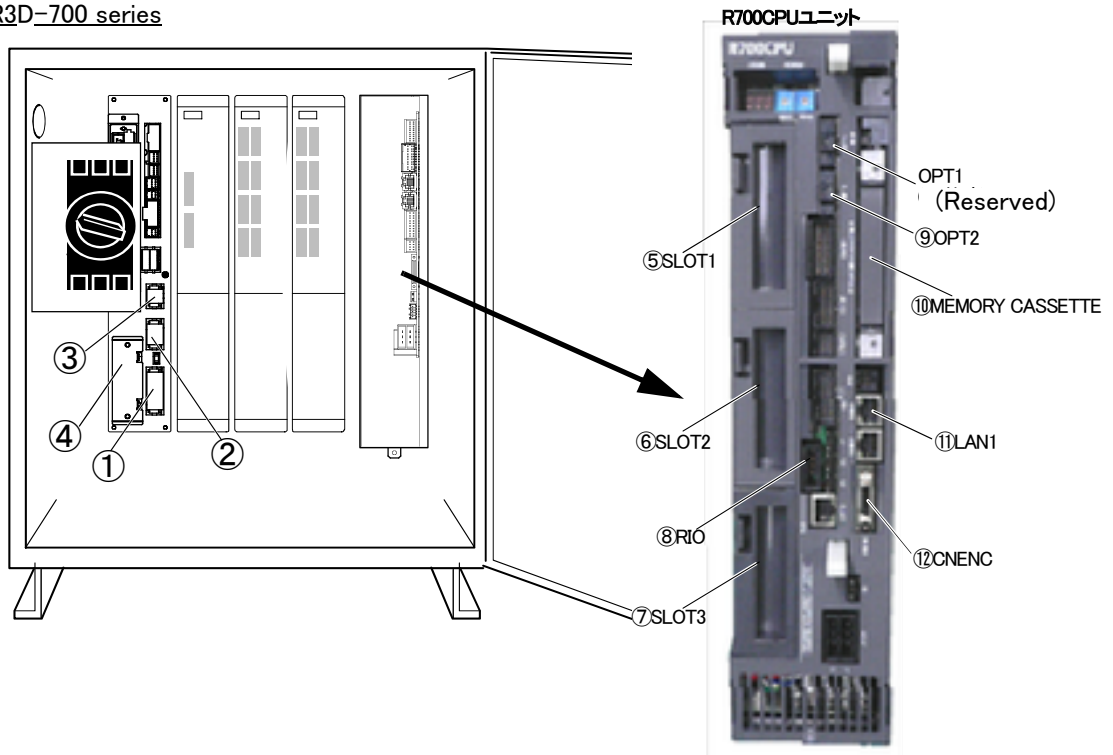
＜ CR3D-700 series ＞



① Machine cable connector (motor power)(CN1)..... Connects to the robot arm base. (CN1 connector)
② Machine cable connector (motor signal)(CN2)..... Connects to the robot arm base. (CN2 connector)

Fig.3-6 : Names of each part (Rear side CR3D-700 series)

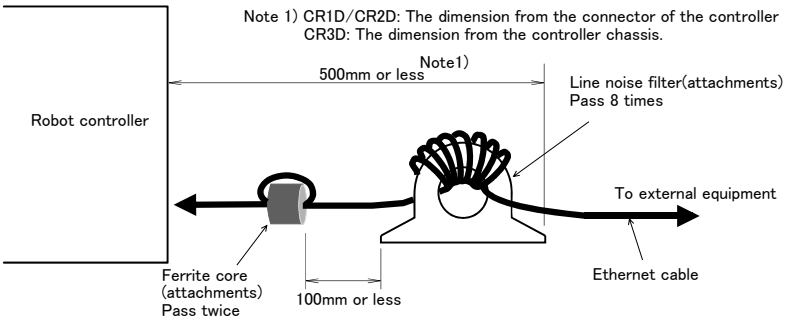
CR3D-700 series

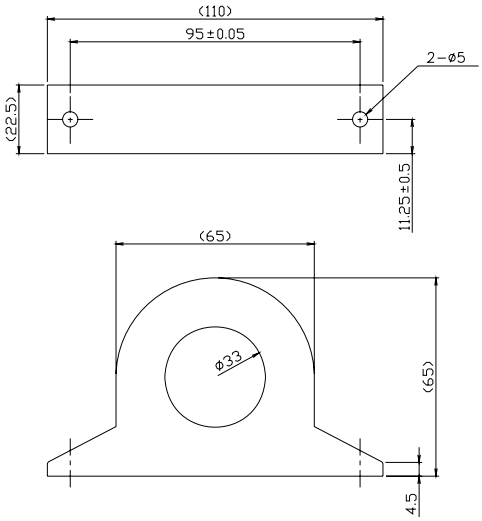


① Emergency stop input(EMGIN)..... Connect the emergency stop switch to the robot.
② Emergency stop output(EMGOUT)..... The robot's error condition is outputted.
③ Special stop input(SKIP)..... stops the robot immediately.
④ Hand slot(HND)..... Install the pneumatic hand interface optional.
⑤⑥⑦ Option slot(SLOT1, SLOT2, SLOT3)..... Install the interface optional.
⑧ Extension parallel input/output unit connection connector(RIO)
Connect the extension parallel input/output unit.
⑨ Battery connection connector(BAT)..... Connect the battery
⑩ Addition axis connection connector(OPT)..... Connect the cable for addition axis control.
⑪ Expansion memory cassette(MEMORY CASSETTE).... Install the memory cassette optional.
⑫ Ethernet interface(LAN1)..... Connect the Ethernet cable.
*In the CE Marking specification, Please use Ethernet interface by installing the line noise filter and the ferrite core to the Ethernet cable. The line noise filter and the ferrite core are attachments.
Refer to Page 88, "Fig.3-8: Installation to the Ethernet cable of ferrite core and filter (CE Marking)" for detail.
⑬ Tracking interface(CNENC)..... Connect the encoder cable, if it uses the tracking function.

Fig.3-7 : Names of each part (interior CR3D-700 series)

The installation conditions of the ferrite core and the line noise filter





Outside dimension of the line noise filter

Fig.3-8 : Installation to the Ethernet cable of ferrite core and filter (CE Marking)

3.3 Outside dimensions/Installation dimensions

3.3.1 Outside dimensions

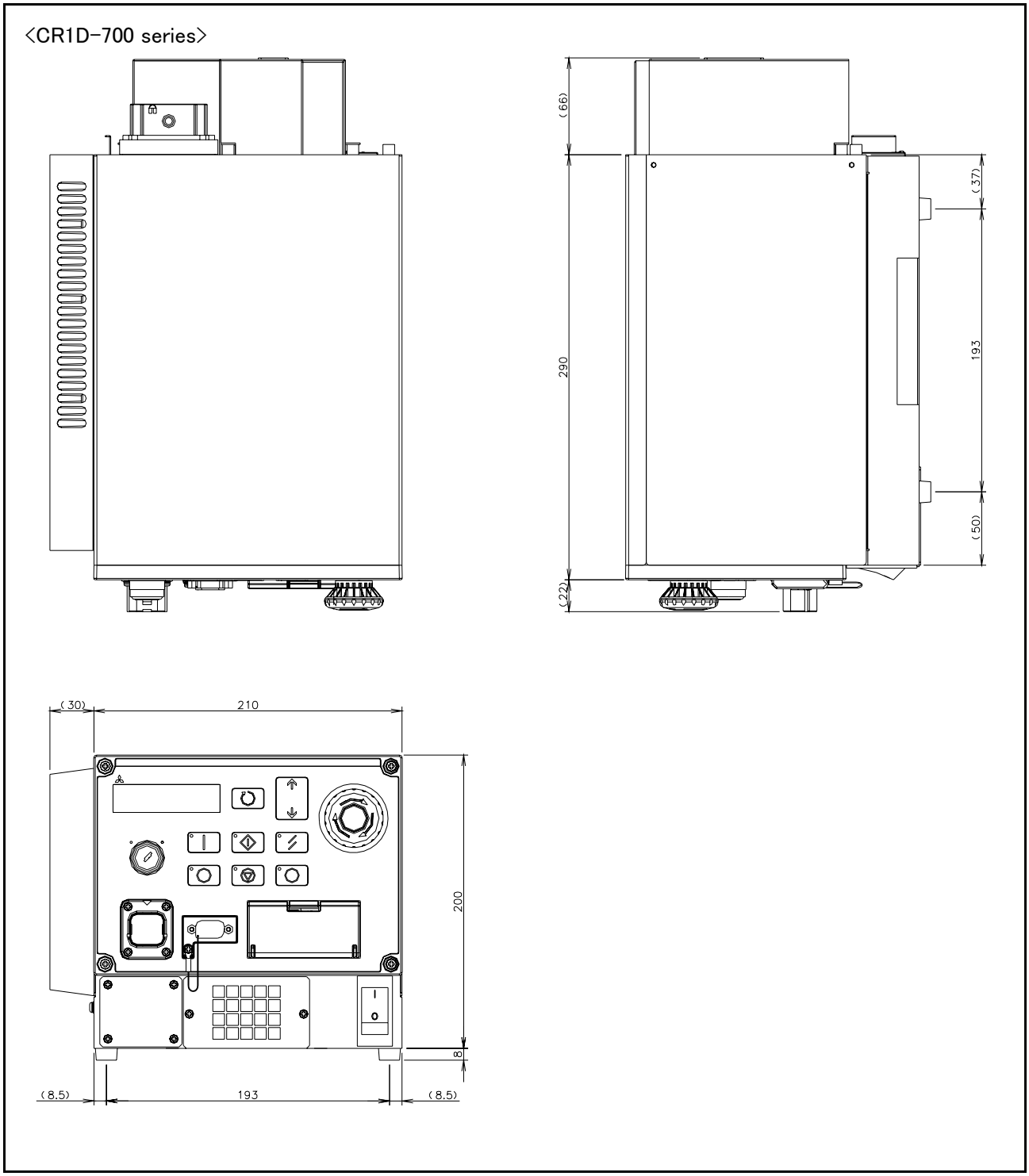


Fig.3-9 : Outside dimensions of controller (CR1D-700)

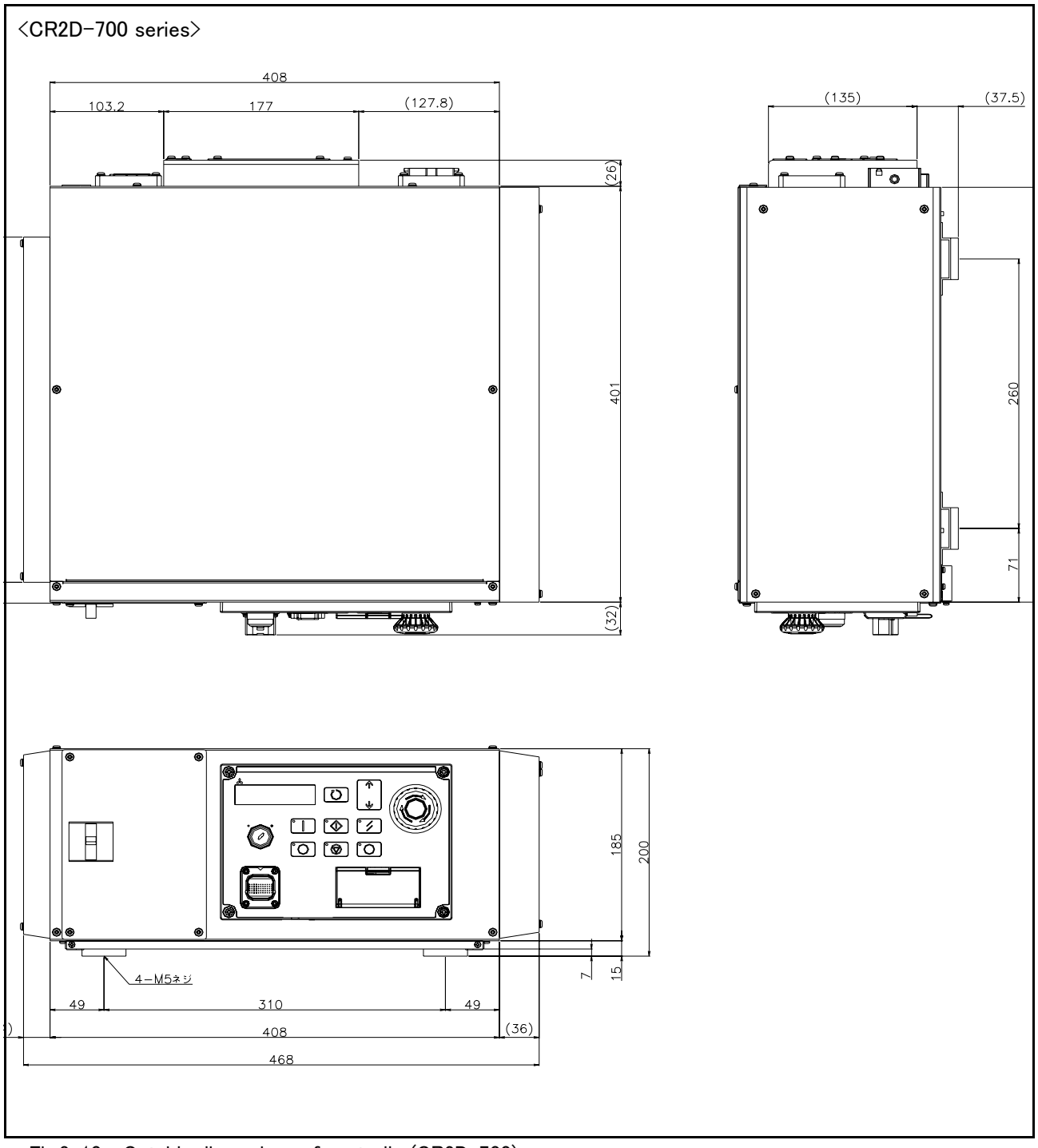


Fig.3-10 : Outside dimensions of controller(CR2D-700)

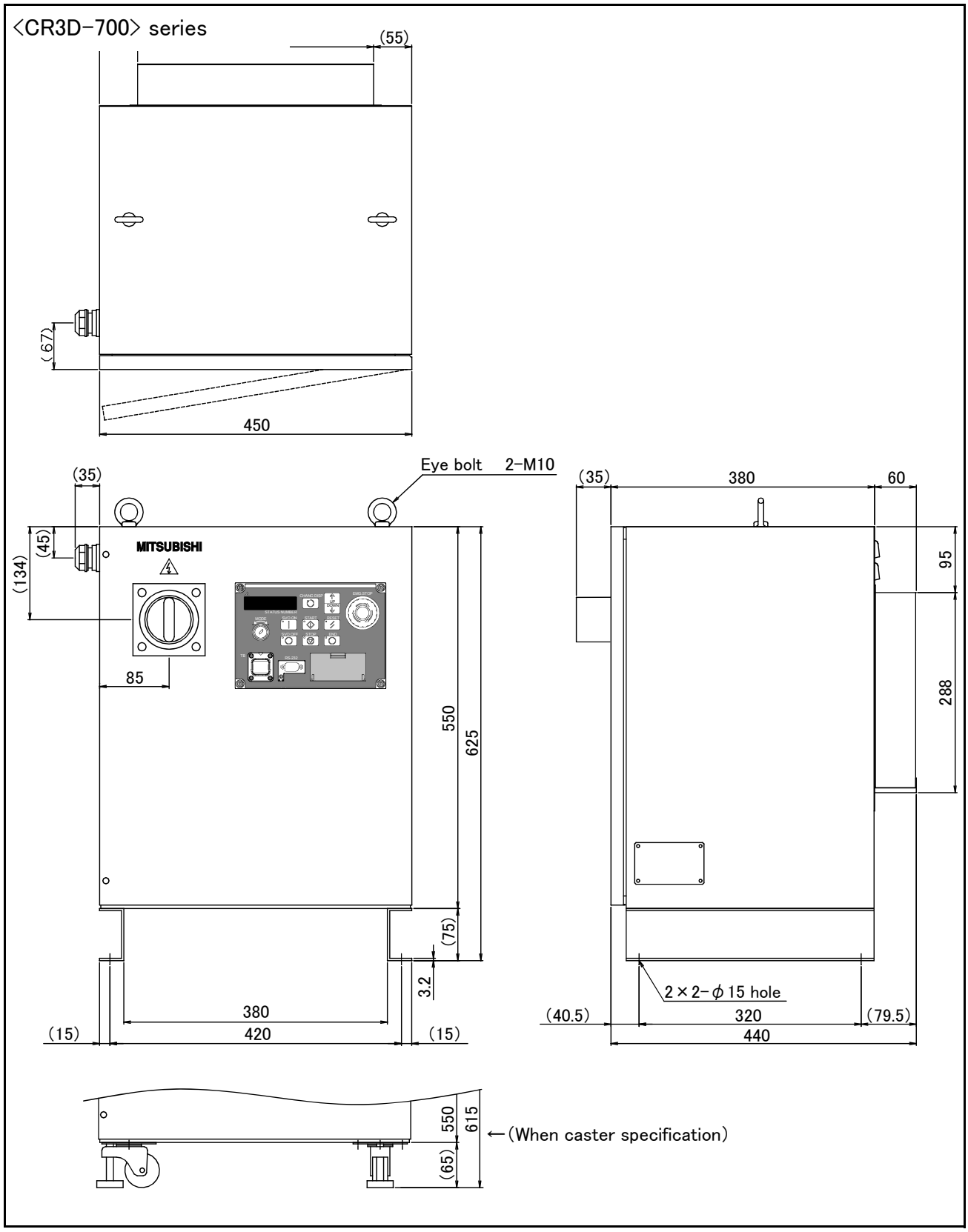


Fig.3-11 : Outside dimensions of controller(CR3D-700)