

MOTOMAN XRC INSTRUCTION MANUAL MOTOMAN-SP100X, -160, -250

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.



MOTOMAN ROBOTICS EUROPE
A subsidiary of YASKAWA Electric Corporation

MANUAL NO. MRS52060



Reference list

***Operator's manual basic programming
MOTOMAN XRC Maintenance manual***

Revision

990813
First release of this manual

Revision

990924
Version SP100X-160 and SP100X-250 is added.

Revision

000405
Spare part list is added according to YEC rev. 1.



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Safety

NOTES FOR SAFE OPERATION

Read this manual carefully before installation, operation, maintenance or inspection of the MOTOMAN XRC.

In this manual, the Notes for Safe Operation are classified as "WARNING" or "INFORMATION".



WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in minor, moderate or serious injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.

To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as "CAUTION" and "WARNING".



INFORMATION

Always be sure to follow explicitly the items listed under this heading.



This manual explains the various components of the MOTOMAN XRC system and general operations. Read this manual carefully and be sure to understand its contents before handling the MOTOMAN XRC.

General items related to safety are listed in the MOTOMAN XRC Setup Manual. To ensure correct and safe operation, carefully read the Setup Manual before reading this manual.

Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.

The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.



The equipment is manufactured in conformity with the EC Machinery directive, the EMC-directive as well as the LVD-directive.

The equipment is intended to be incorporated into machinery or assembled with other machinery to constitute machinery covered by this directive, and must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of EC's Machinery, EMC and LVD Directive.

Information how to connect to the MOTOMAN XRC is described in the XRC Service Manual.



MOTOMAN is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.



MOTOMAN may modify this model without notice when necessary due to product improvements, modifications or changes in specifications. If such modification is made, the manual will also be revised, see revision information.

If your copy of the manual is damaged or lost, contact a MOTOMAN representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.

MOTOMAN is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.


**Definition of terms used often in this manual**

The MOTOMAN manipulator is the YASKAWA industrial robot product. The manipulator usually consists of the controller, the playback panel, the programming pendant and supply cables. In this manual, the equipment is designated as follows.

Equipment	Manual designation
MOTOMAN XRC Controller	XRC
MOTOMAN XRC Playback panel	P-Panel
MOTOMAN XRC Programming pendant	P-Pendant
Start panel for machinery operation in PLAY-mode	Start panel

**Key operation**

Descriptions of the programming pendant and playback panel keys, buttons and displays are shown as follows:

Equipment	Manual designation
Programming pendant	Character keys The keys which have characters printed on them are denoted with [] ex. [ENTER]
	Symbol keys The keys which have a symbol printed on them are not denoted with [] but depicted with a small picture. ex. page key  The cursor key is an exception and a picture is not shown.
	Axis keys Number keys "Axis keys" and "Number keys" are generic names for the keys for axis operation and number input.
	Keys pressed simultaneously When two keys are to be pressed simultaneously, the keys are shown with a "+" sign between them, ex. [SHIFT]+[COORD]
	Displays The menu displayed in the programming pendant is denoted with " <i>italic</i> " characters. ex. <i>JOB</i>
Playback panel	Buttons Playback panel buttons are enclosed in brackets. ex. [TEACH] on the playback panel



Description of the operation procedure

In the explanation of the operation procedure, the expression "Select •••" means that the cursor is moved to the object item and the SELECT key is pressed.



Teaching

Before operating the robot, check that the servo power is turned off when the emergency stop buttons on the playback panel or programming pendant are pressed.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the robot during emergency. The MOTOMAN XRC should not be used if the emergency stop buttons do not function.

Always set the Teach Lock before entering the robot work envelope to teach a job.

Operator injury can occur if other person reset safety and restart robot in PLAY-mode.

Confirm that no persons are present in the robot work envelope and that you are in a safe location before:

- ✓Turning on the MOTOMAN XRC power.
- ✓Moving the robot with the programming pendant.
- ✓Running check operations.
- ✓Performing automatic operations.

Injury may result if anyone enters the working envelope of the robot during operation. Always press an emergency stop button immediately if there are problems.



Service

Perform the following inspection procedures prior to conducting robot teaching. If problems are found, repair them immediately and be sure that all other necessary processing has been performed.

- ✓Check for problems in robot movement.
- ✓Check for damages to insulation and sheathing of external wires.

Always return the programming pendant to the hook after use.

The programming pendant can be damaged if it is left in the robots work area, on the floor or near fixtures.



Spare parts

MOTOMAN warranty is only valid if original spare parts are used.



Motoman SP100X, -160, -250

This manual covers:

SP100X = YR-SP100-J01

SP100X-160 = YR-SP100-J11

SP100X-250 = YR-SP100-J21

1. Receiving

***Note!***

Confirm that the manipulator and the XRC have the same serial number. Special care must be taken when more than one manipulator is to be installed.

If the numbers do not match, manipulators may not perform as expected and cause injury or damage.

1.1 Checking package contents

When the package arrives, check the contents for the following standard items (Any additional options ordered should be checked as well.):

- ✓ Manipulator (Robot arm)
- ✓ XRC robot controller
- ✓ Programming pendant
- ✓ Motor cable
- ✓ Signal cable

1.2 Checking the serial number

Check that the serial number of the manipulator corresponds to the XRC. The serial number is located on a label as shown below.

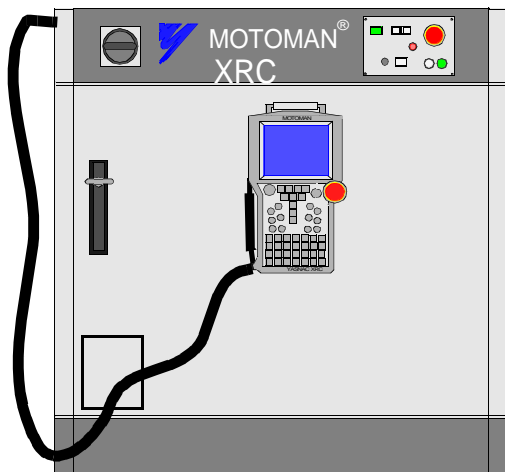
YASNAC XRC	
Type	ERCS - <input type="text"/>
System No:	<input type="text"/>
Power Supply	Peak <input type="text"/> kVA
<input type="text"/>	Average <input type="text"/> kVA
Serial No.	<input type="text"/>
Robot Serial No:	<input type="text"/>
Part No.	<input type="text"/>
Date /signature	<input type="text"/>
Made in Sweden	

Fig.1 Controller and robot identification

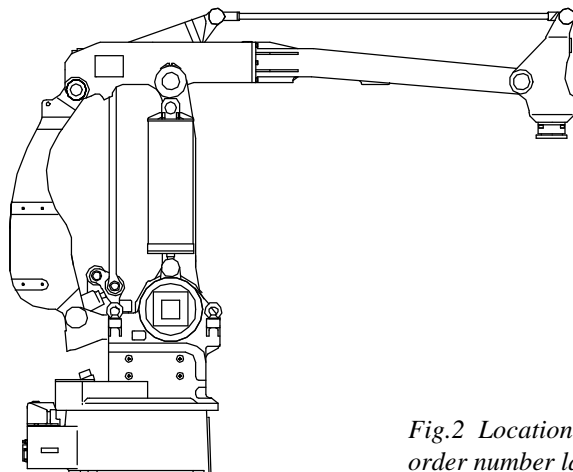
Check serial numbers, there should be same number on both robot and controller.

THE MANIPULATOR AND THE CONTROLLER SHOULD HAVE THE SAME ORDER NUMBER.

ORDER. NO.



(a) XRC (front view)



(b) Manipulator (side view)

Fig.2 Location of order number labels



2. Transporting



Note!

Sling applications and crane or forklift operations must be performed by authorized personnel only.

Failure to observe this caution may result in injury or damage.

Avoid excessive vibration or shock during transporting. The system consists of precision components, so failure to observe this caution may adversely affect performance.

2.1 Transporting method

2.1.A Using the crane

As a rule, when removing the manipulator from the package and moving it, a crane should be used. The manipulator should be lifted using 4-wire ropes threaded through attached eyebolts. Be sure the manipulator is fixed with jigs before transporting and lift it in the posture as shown in the figure "Transporting position". The weight of the MOTOMAN-SP100X is approximately 1750kg, the MOTOMAN-SP100X-160 is 1900kg and the MOTOMAN-SP100X-250 is 1965kg.

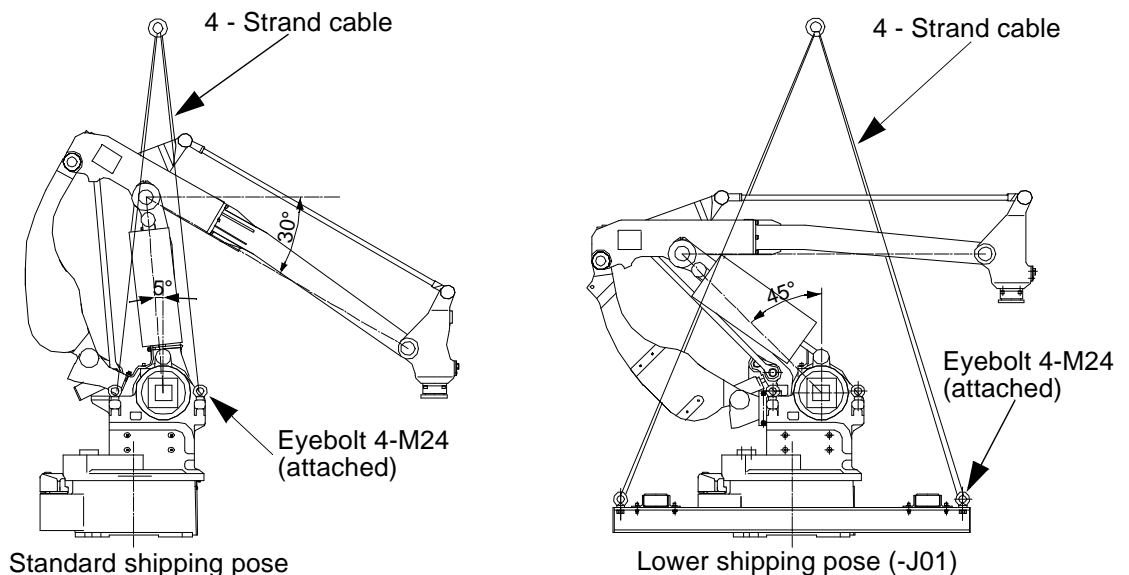


Fig.3 Transporting position



Note!

Check that the eyebolts are securely fastened.

The weight of the manipulator is approximately 2100kg including the shipping bolts and jigs. Use a wire rope strong enough to withstand the weight.

Attached eyebolts are designed to support the manipulator weight. Do not use them for anything other than transporting the manipulator.

Mount the shipping bolts and jigs for transporting the manipulator.

Avoid exerting force on the arm or motor unit when transporting, use caution when using transporting equipment other than a crane or forklift, as injury may occur.

2.2 Shipping bolts and jigs

The manipulator is provided with shipping bolts and jigs at points A, B, C, D, E and F (see figure "Shipping bolts and jigs").

- ✓ The jigs are painted yellow.
- ✓ Number of screws, bolts and nuts are:

For standard lifting position:

- A: 4 × M6 hexagon headed screws .
- B, C: 4 × M12 nuts and studs.
- D: 2 × M12 hexagon socket head cap screws.

For compact lifting position:

- A: 4 × M6 hexagon headed screws.
- B, C: 4 × M12 nuts and studs.
- D: 2 × M12 hexagon socket head cap screws.
- E, F: 8 × M12 hexagon socket head cap screws.

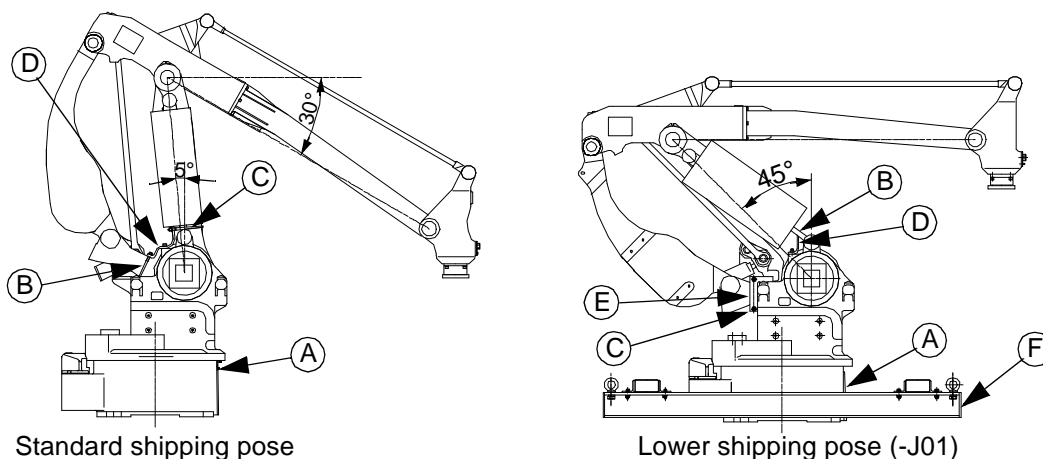


Fig.4 Shipping bolts and jigs



Note!

Before turning on the power, check to be sure that the shipping bolts and jigs have been removed. These shipping bolts and jigs must be stored for future use in the event of moving or carrying the robot.



3. Installation



Note!

Install the safety guards according to CE-marking before taking into service.

Failure to observe this warning may result in injury or damage.

Do not start the manipulator or even turn on the power before it is firmly anchored.

The manipulator may overturn and cause injury or damage.

Do not install or operate a manipulator that is damaged or lacking parts.

Failure to observe this caution may cause injury or damage.

Before turning on the power, check to be sure that the shipping bolts and jigs have been removed.

Failure to observe this caution may result in damage to the driving parts.

Before the installation of the air breezer, be sure that the power supply of MOTOMAN XRC is turned OFF.

Failure to observe this caution may result in electric shock or injury.



3.1 Safety guard installation

To insure safety, be sure to install safety guards according to the EC-directive related to machinery. They prevent unforeseen accidents with personnel and damage to equipment.

Responsibility for safeguarding

The user of a manipulator or robot system shall ensure that safeguards are provided. The means and degree of safeguarding, including any redundancies, shall correspond directly to the type and level of hazard presented by the robot system consistent with the robot application. Example of safetyguardings are barriers, interlock barriers, perimeter guarding, awareness barriers and awareness signals.

3.2 Mounting procedures for manipulator baseplate

The manipulator should be firmly mounted on a baseplate or foundation strong enough to support the robot and withstand repulsion forces during acceleration and deceleration.

Construct a solid foundation with the appropriate thickness to withstand maximum repulsion forces of the manipulator.

During installation, if out of the plane is not right, the manipulator shape may change and its functional ability may be compromised. Out of the plane for installation must be kept at 0.5 mm or less. Mount the baseplate in either of the following ways: 3.2.a or 3.2.b.

Table: Maximum repulsion forces of the manipulator (for SP100X)

Horizontal rotating maximum torque (S-axis moving direction)	34500 Nm (3520 kgfm)
Vertical rotating maximum torque (L-,U-axes moving direction)	52500 Nm (5360 kgfm)



3.2.A When the manipulator and mounting fixture are installed on a common flat steel plate

The common base should be rugged and durable to prevent shifting of the manipulator or the mounting fixture. The thickness of the common base is 50 mm or more and a size of the anchor bolt is M24 or larger are recommended. Place the robot by fastening the plate with the eight M24 (mm) anchor bolts. The plate is tapped for M24 (70mm length) bolts. Tighten the bolts and anchor bolts securely so that they will not work loose during operation. For robot baseplate mounting, see the figure "Mounting the manipulator baseplate".

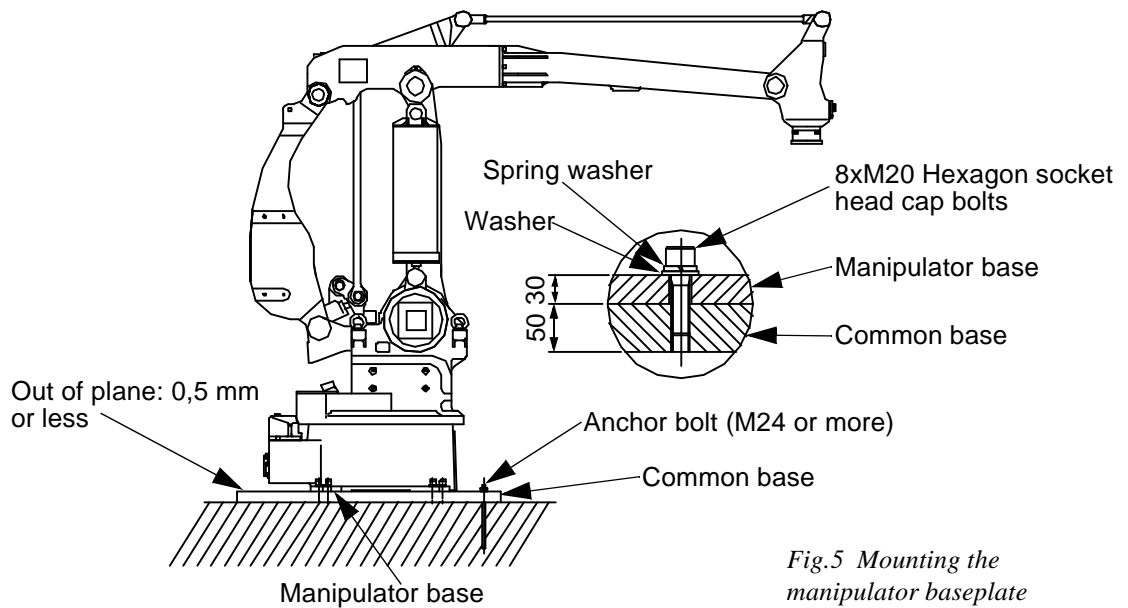
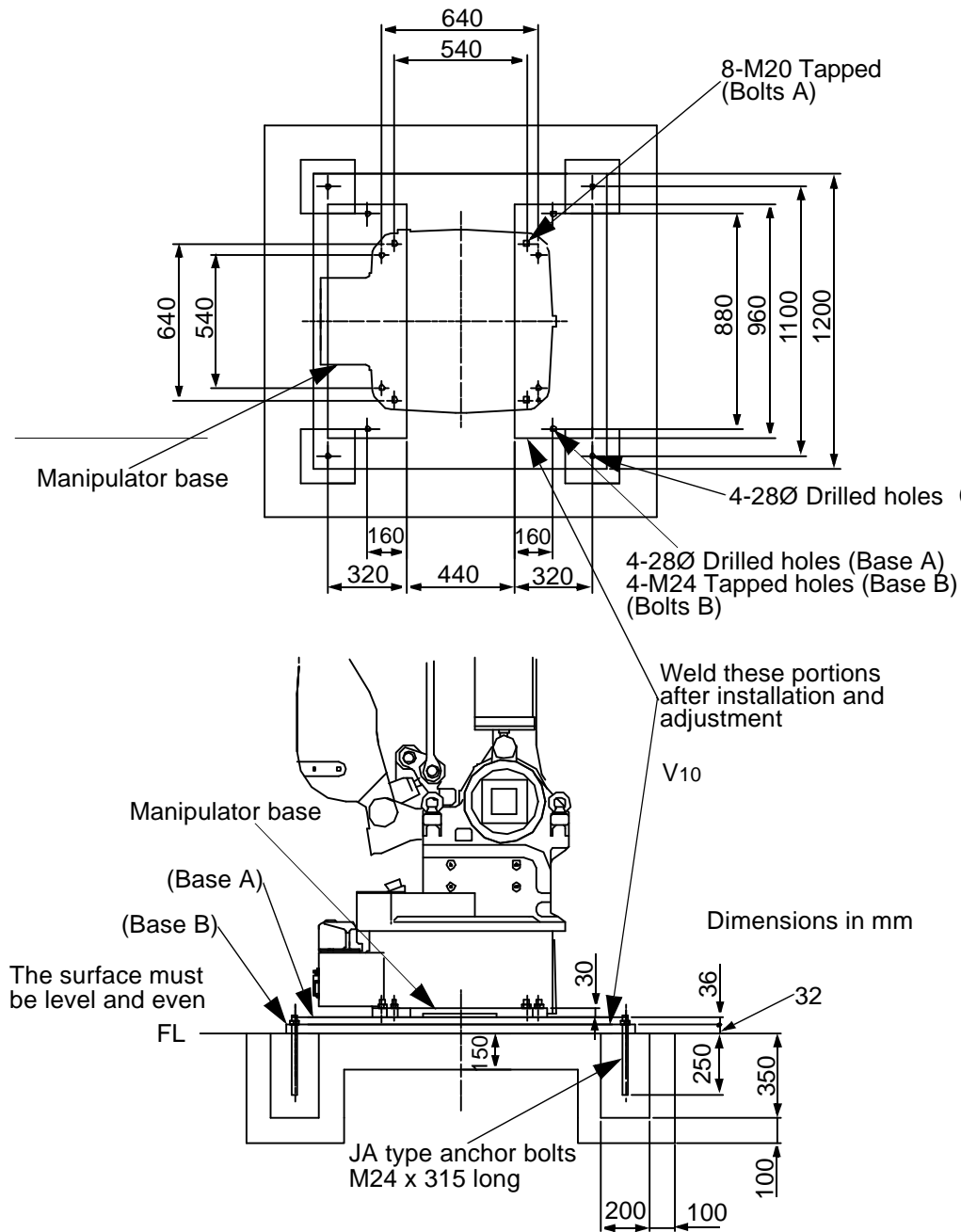


Fig.5 Mounting the manipulator baseplate

3.2.B When the manipulator is mounted directly on the floor

The floor should be strong enough to support the manipulator. Construct a solid foundation with the appropriate thickness to withstand maximum repulsion forces of the manipulator as shown in the table "Maximum repulsion forces of the manipulator". As a rough standard, when there is a concrete thickness (floor) of 200 mm or more, the base of the manipulator can be fixed directly to the floor with M20 anchor bolts. Before mounting the manipulator, however, check that the floor is level and that all cracks, etc. are repaired. Any thickness less than 200 mm is insufficient for mounting, even if the floor is concrete.



Bolts A: 8-M20x70, Spring washer, flat washer
 Bolts B: 4-M24 x 70, Spring washer
 Bolts, Base A and B should be equipped by user.

Fig.6 Affixing the manipulator on the floor



3.3 Location

When the manipulator is installed, it is necessary to satisfy the undermentioned environmental conditions:

- ✓ 0° to 45°C (Ambient temperature).
- ✓ 20 to 80%RH (no moisture).
- ✓ Free from dust, soot or water.
- ✓ Free from corrosive gases, liquid or explosive gases.
- ✓ Free from excessive vibration (less than 0.5G).
- ✓ Free from large electrical noise (plasma).
- ✓ Out of the plane for installation is 0.5 mm or less.





4. Wiring



Note!

Ground resistance must be 100 Ω or less.

Failure to observe this warning may result in fire or electric shock.

Before wiring, make sure to turn the primary power supply off and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)

Failure to observe this warning may result in fire or electric shock.

Wiring must be performed by authorized or certified personnel.

Failure to observe this caution may result in fire or electric shock.

4.1 Grounding

Follow local regulations for grounding line size.



Note!

Do not use this line in common with other ground lines or grounding electrodes for other electric power, motor power, welding devices, etc.

Where metal ducts, metallic conduits or distributing racks are used for cable laying, ground in accordance with Electric Equipment Technical Standards.

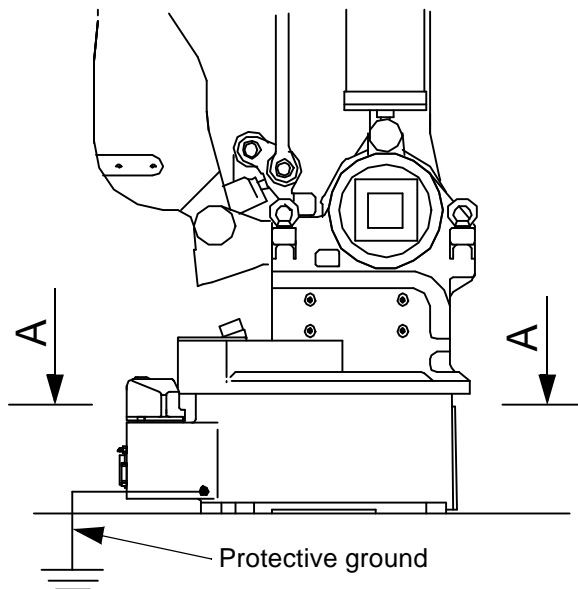
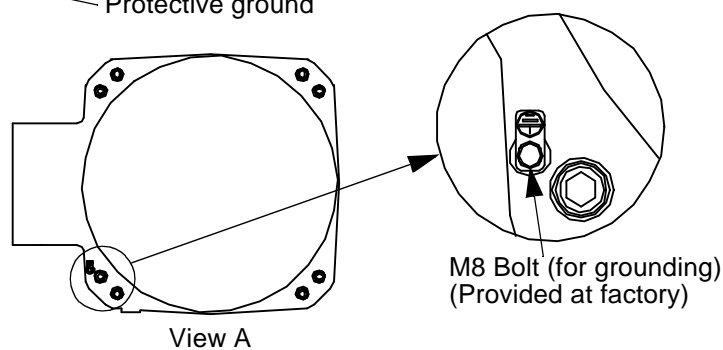


Fig.7 (a) Grounding method



View A

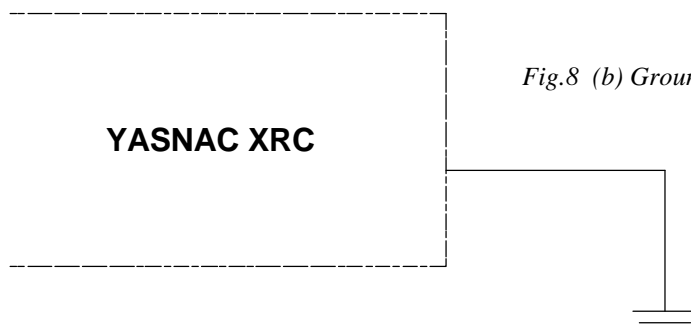


Fig.8 (b) Grounding method



4.2 Cable connection

There are three cables for the power supply (1BC, 2BC and 3BC); a signal cable for detection (1BC) and two power cables (2BC,3BC). Connect these cables to the manipulator base connectors and the XRC.

4.2.A Connection to the manipulator

Before connecting the cables to the manipulator, verify the numbers: 1BC, 2BC, and 3BC on both power supply cables and the manipulator base connectors. When connecting, adjust the cable connector positions to the main key positions of the manipulator and insert cables in the order of 2BC, 3BC and 1BC and then set the lever until hearing a “click”.

4.2.B Connection to the XRC

Connect each cable to the connector. Be sure to verify the numbers on both the cable and connectors before connecting.

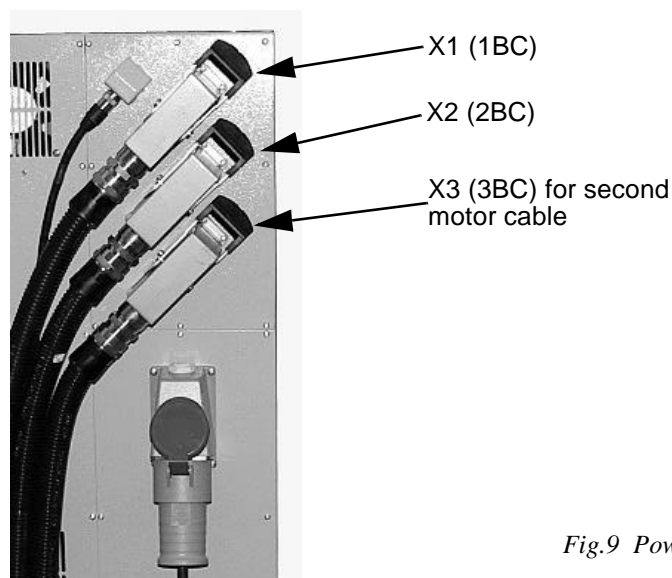


Fig.9 Power cables

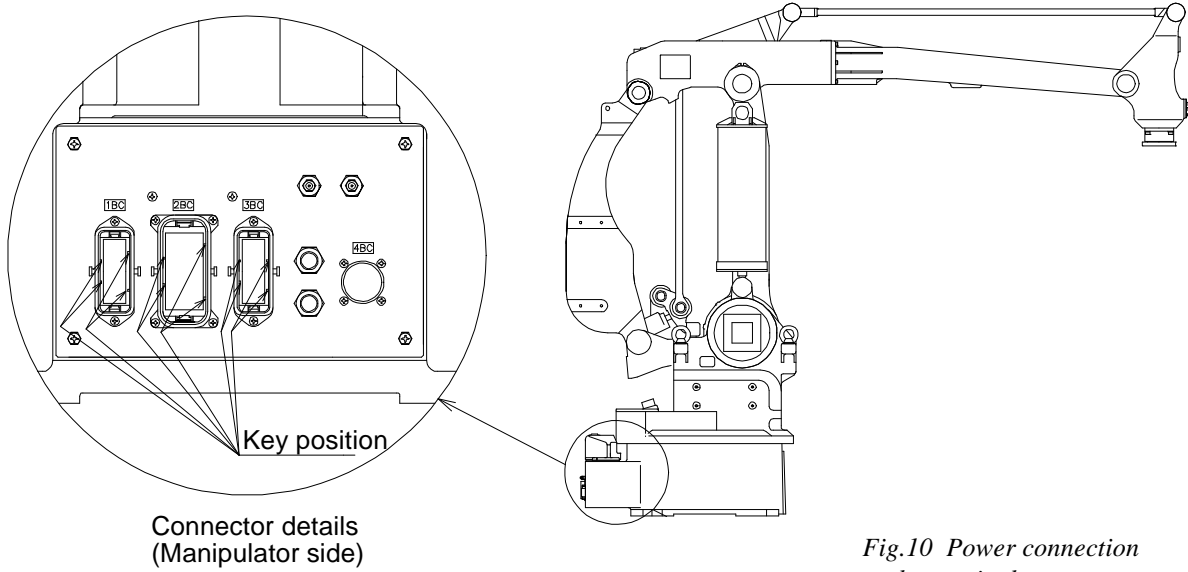


Fig.10 Power connection to the manipulator



5. Basic specifications

5.1 Basic specifications

Table: Basic specifications¹

Item	Model	SP100X	SP100X-160	SP100X-250
Operation mode		Vertically articulated		
Degree of freedom		4		
Payload		100 kg	160 kg	250 kg
Repetitive positioning accuracy ²		±0.5 mm		
Motion range	S-axis (turning)	±180°		
	L-axis (lower arm)	+90°, -45°		
	U-axis (upper arm)	+10°, -90°		
	T-axis (wrist twist)	±350°		
Maximum speed	S-axis	2.44 rad/s, 140°/s	1.48 rad/s, 85°/s	1.31 rad/s, 75°/s
	L-axis	1.83 rad/s, 105°/s	1.66 rad/s, 95°/s	1.04 rad/s, 60°/s
	U-axis	1.83 rad/s, 105°/s	1.66 rad/s, 95°/s	1.04 rad/s, 60°/s
	T-axis	4.19 rad/s, 240°/s	3.40 rad/s, 144°/s	2.88 rad/s, 165°/s
T-axis allowable inertia (GD ² /4)		40 kgm ²		
Mass		1750 kg	1900 kg	1965 kg
Ambient conditions	Temperature	0° to 45°C		
	Humidity	20 to 80% RH (non-condensing)		
	Vibration	Less than 0.5G		
	Others	Free from corrosive gasses or liquids or explosive gasses. Clean and dry. Free from excessive electrical noise (plasma).		
Power capacity		6,5 kVA		

1. SI units are used in this table. However, gravitational unit is used in ().

2. Conformed to ISO9283.

5.2 Part names and working axes

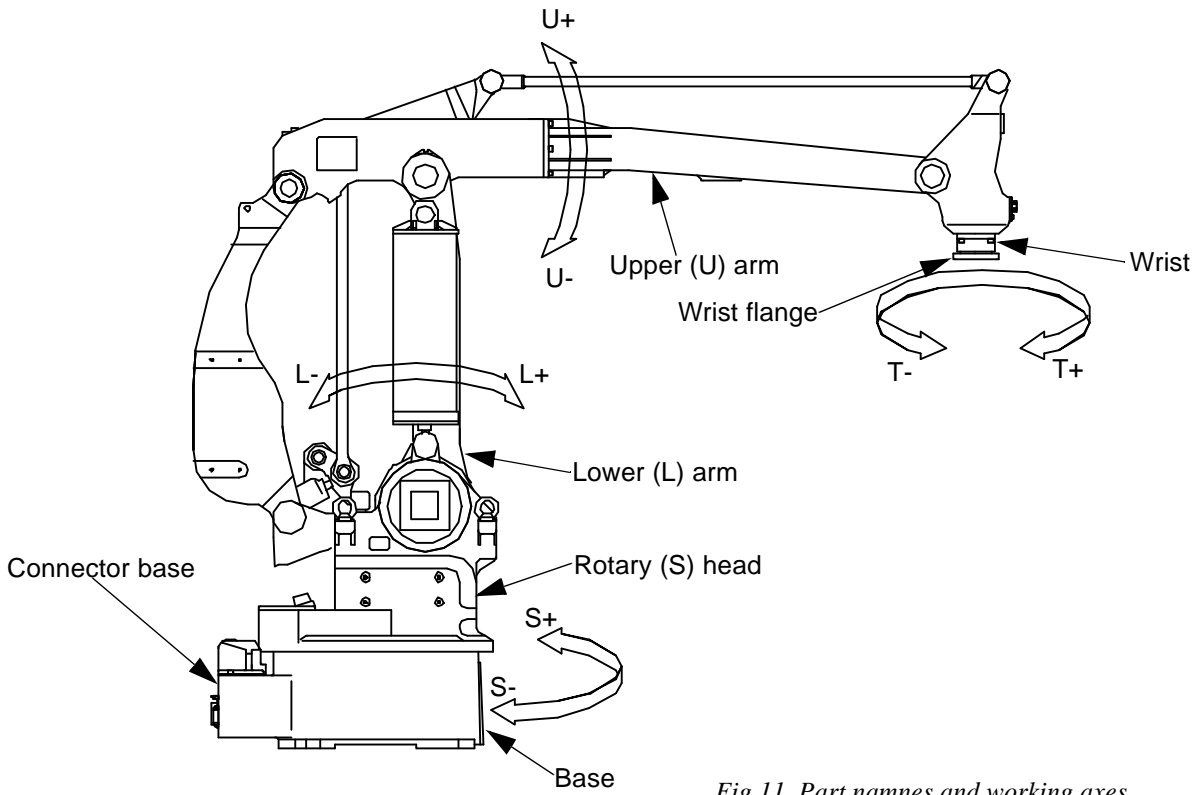


Fig.11 Part names and working axes

5.3 Baseplate dimensions

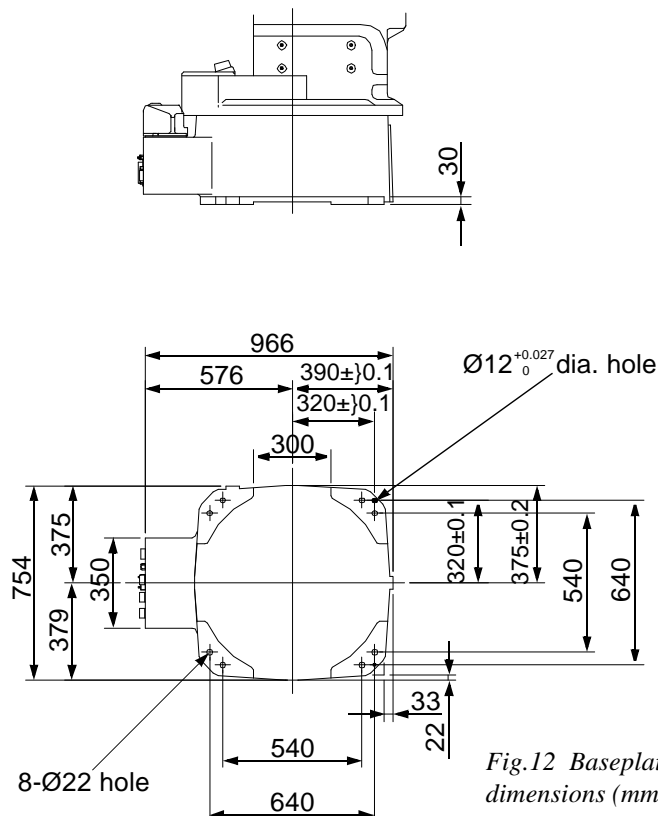


Fig.12 Baseplate dimensions (mm)



5.4 Dimensions and working range

(all types SP100X, SP100X-160 and SP100X-250)

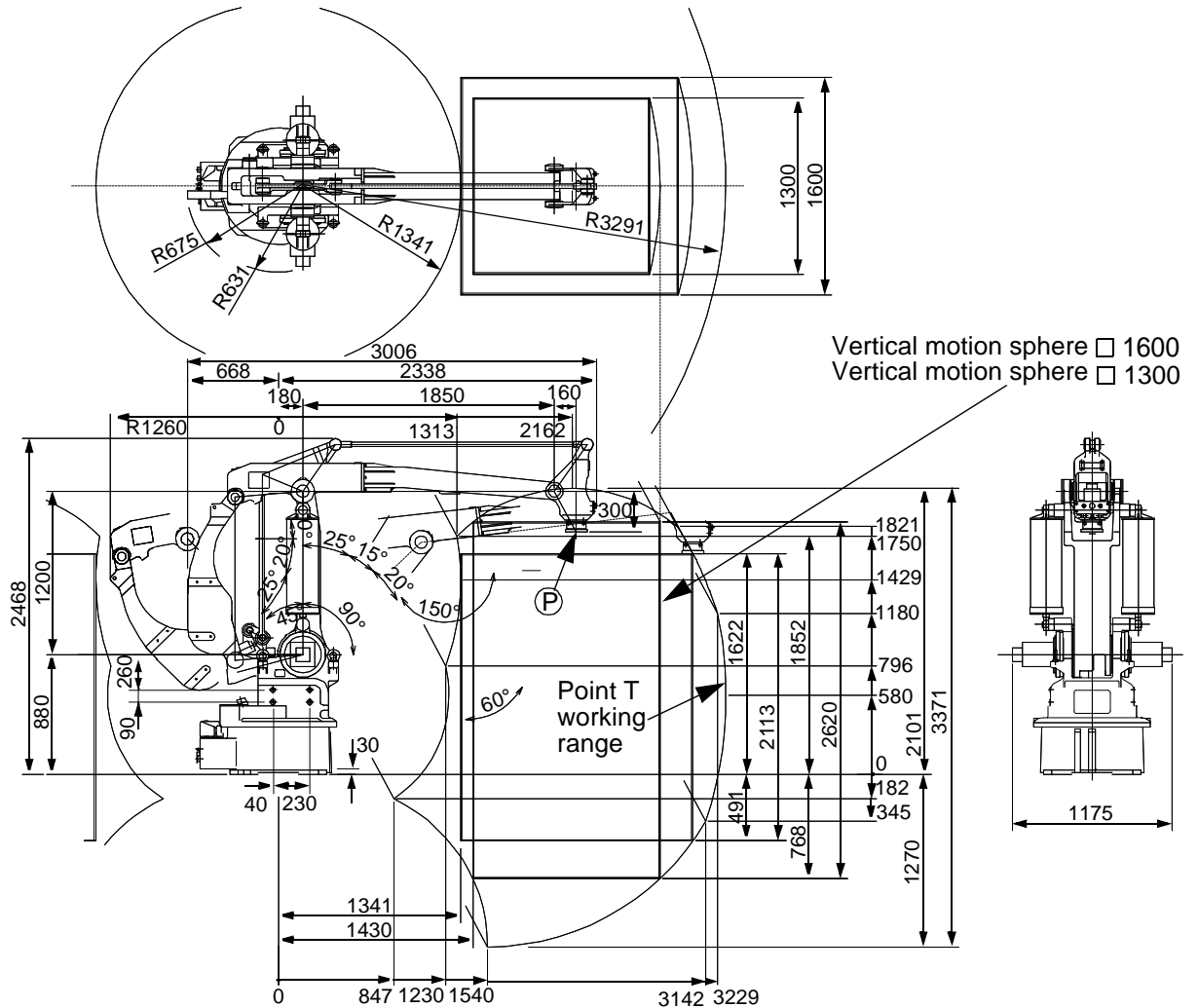


Fig.13 Dimensions and working range



5.5 Alterable working envelope of S-axis mechanical stopper

The working envelopes of S-axis can be altered according to the operating conditions as shown in the table "S-axis working envelope". It alteration is necessary, contact your MOTOMAN representative in advance.

S-axis working envelope

Item	Standard
S-axis working envelope	$\pm 180^\circ$ (Standard)
	$\pm 150^\circ$
	$\pm 120^\circ$
	$\pm 90^\circ$
	$\pm 60^\circ$
	$\pm 30^\circ$



6. Allowable load for wrist axis and wrist flange

6.1 Allowable wrist load

The allowable wrist load for the MOTOMAN-SP100X is 100kg, for the MOTOMAN-SP100X-160 it's 160kg and for the MOTOMAN-SP100X-250 it's 250kg including the weight of the mount / gripper.

The following conditions should be observed.

- ✓ The total inertia (GD2/4) of T-axis should be 40 kgm² or less.
- ✓ The eccentricity of load center measured from T-axis flange rotation center is in the range shown in the figure "Allowable range of mounting dimensions".

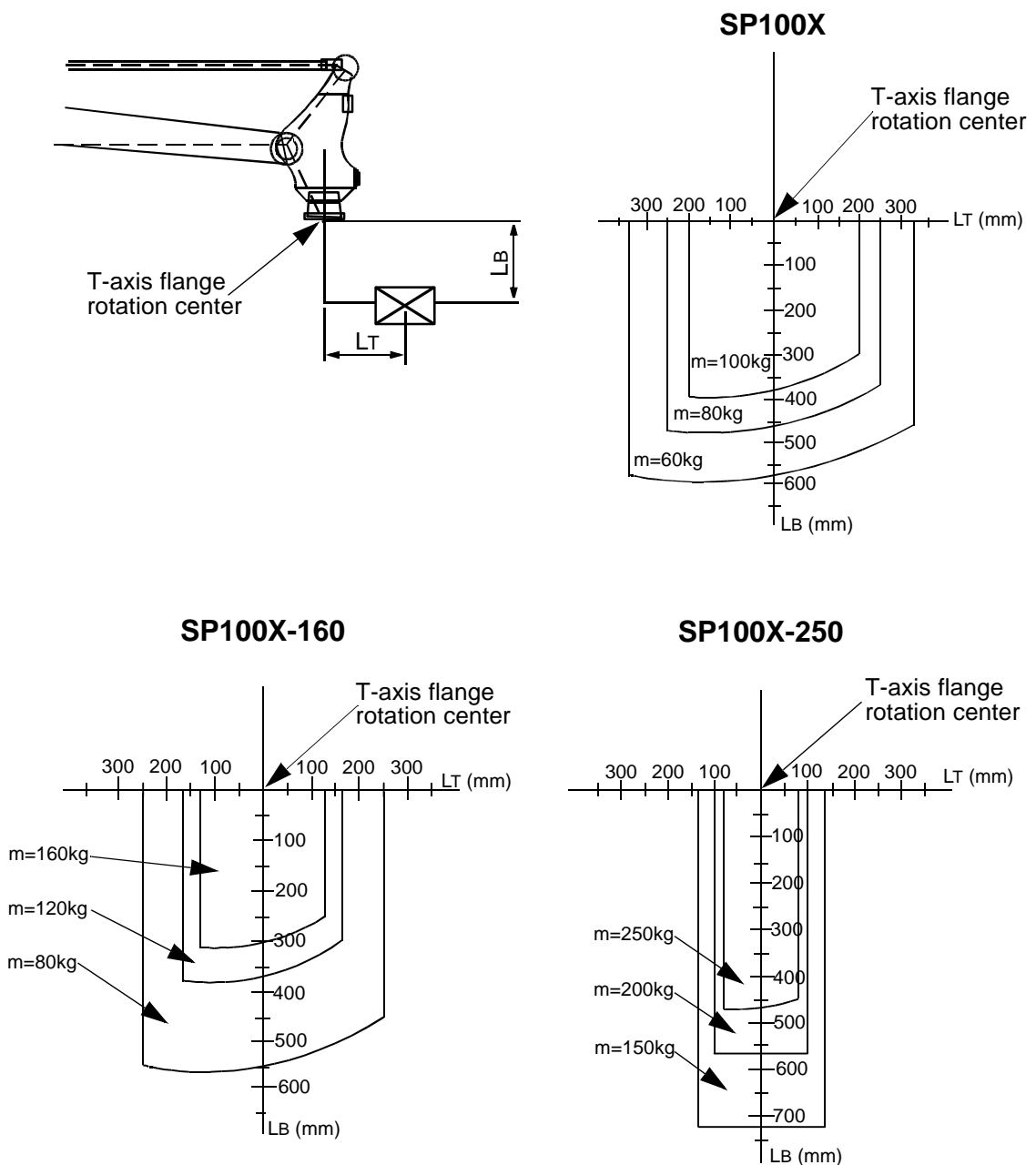


Fig.14 Allowable range of mounting dimensions

6.2 Wrist flange

The wrist flange dimensions are shown in the figure "Wrist flange". In order to see the tram marks, it is recommended that the attachment be mounted inside the fitting. Fitting depth of inside and outside fittings must be 8 mm or less.

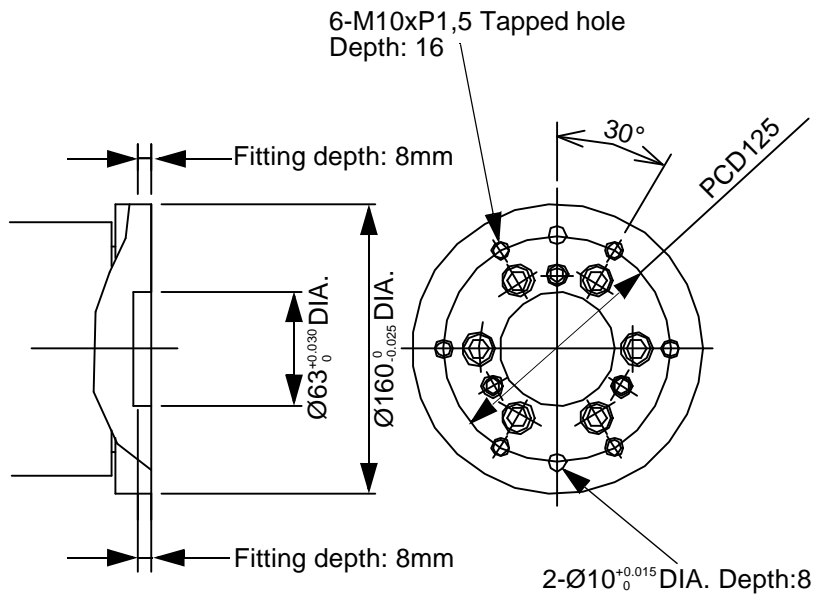


Fig.15 Wrist flange



Note!

Wash off anti-corrosive paint (solid color) on the wrist flange surface with thinner or light oil before mounting the tools.



7. System application

7.1 Mounting equipment

When peripheral equipment is attached to U-axis, the following conditions should be observed.

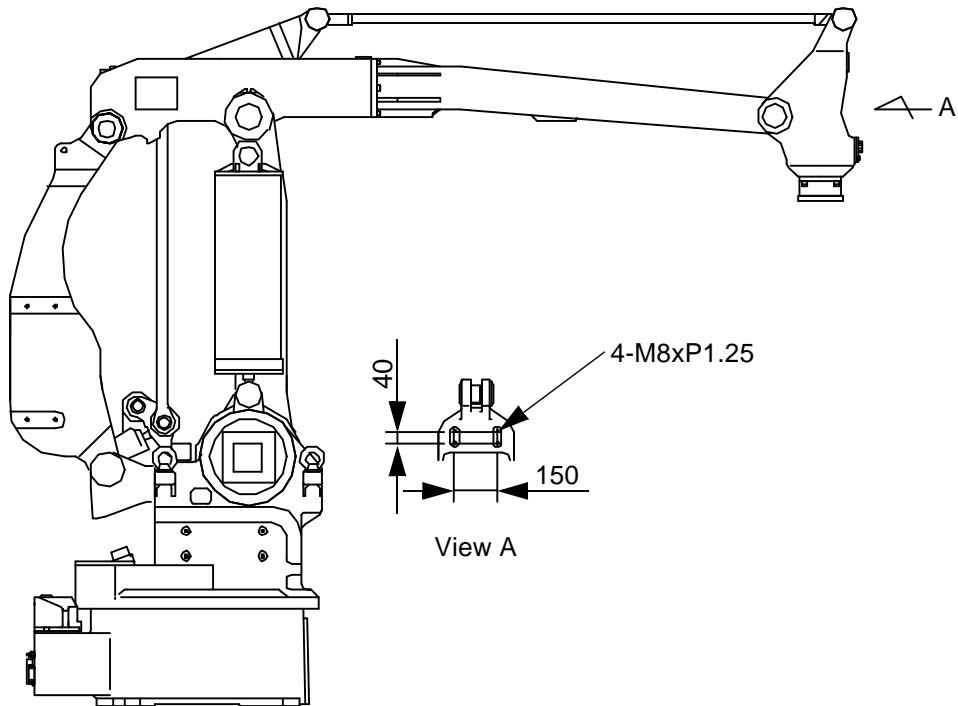


Fig.16 Clamp and tapped holes

Table: Constraint for attaching

Cable processing and valve load	Note
SP100X	100kg max. including wrist load.
SP100X-160	160kg max. including wrist load.
SP100X-250	250kg max. including wrist load.

7.2 Incorporated wire and airduct

Wires and an air line are incorporated into the manipulator for user application. There are 23 wires and 2 air duct rating. The allowable current for wires must be 2.0A or below for each wire. (The total current value for pins 1 to 23 must be 44A or below). The maximum pressure for the air duct is 490 kPa (5kgf/cm²) and its inside diameter is Ø6.5 mm.

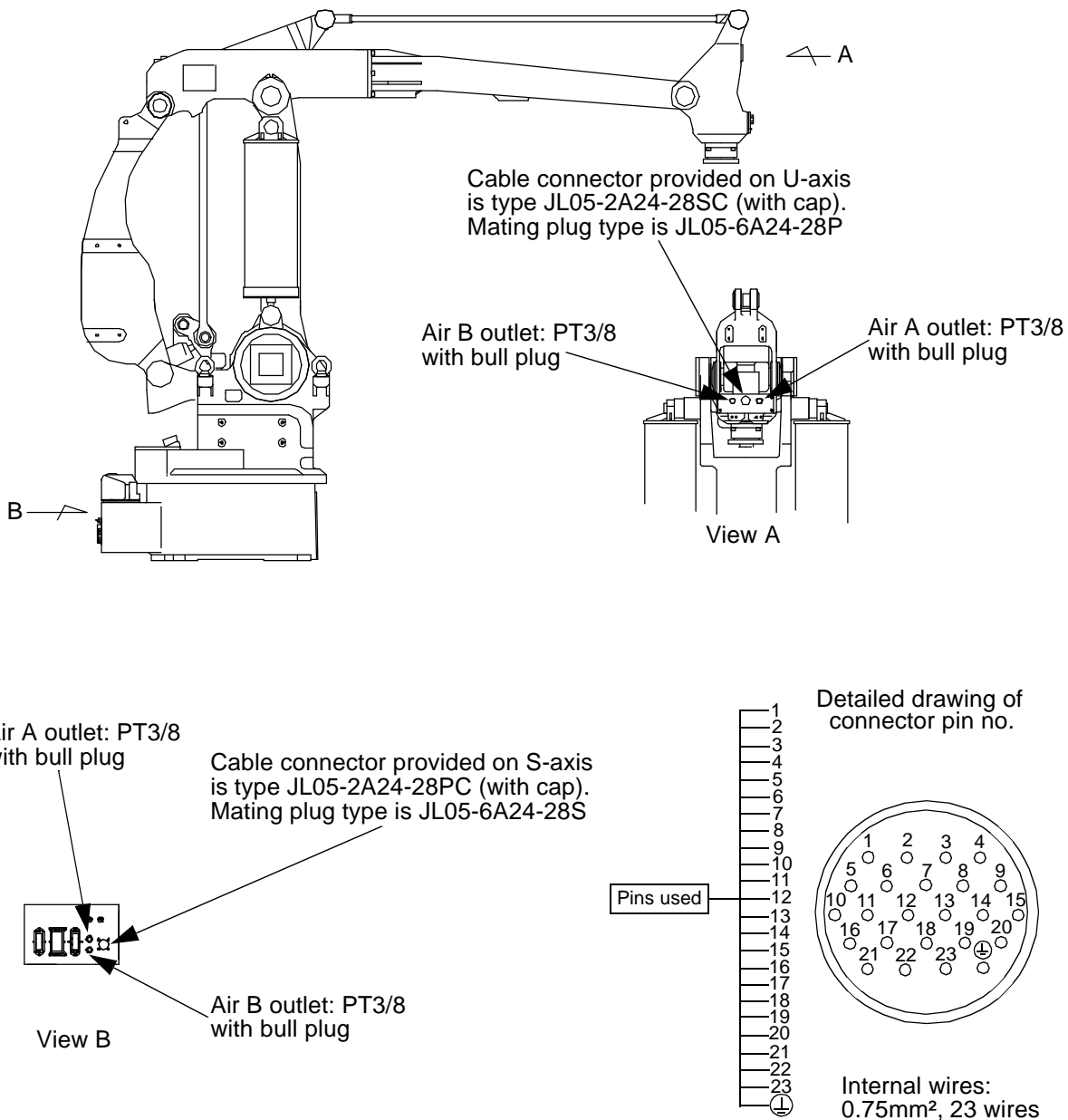


Fig.17 Incorporated wire and airduct

The same pin number (1-23) of two connectors is connected in the lead line of single 0.5mm².



8. Motoman construction

8.1 Limit switch

Limit switch of S-axis limit the working envelope of its axis electrically, by adjusting the position of dog with the limit switch function.

For mechanical limit (mechanical stopper), see chapter "Alterable working envelope of S-axis mechanical stopper".

With the limit switch ON, the power supply of the manipulator is turned OFF and the manipulator makes an emergency stop. For releasing overrun status, refer to Operator's manual.



Note!

When the alteration of working envelope is necessary, contact your MOTOMAN representatives, since modification of position of dog installation and mechanical stopper and value of soft limit should be made for the alteration.

8.2 Position of S-axis limit switch

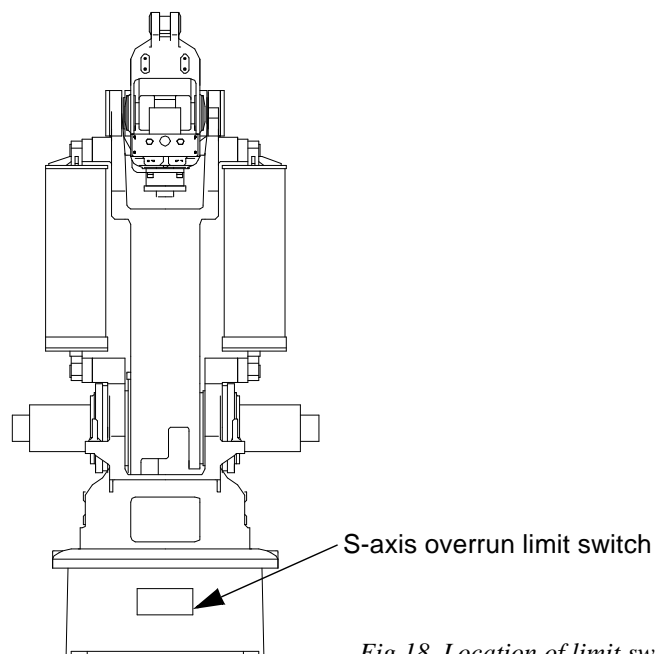


Fig.18 Location of limit switch

8.3 Internal connections

High reliability connectors which can be easily removed are used with each connector part.

For the number and location of connectors, see the figure "Location and numbers of connectors" and the table "List of connector types".

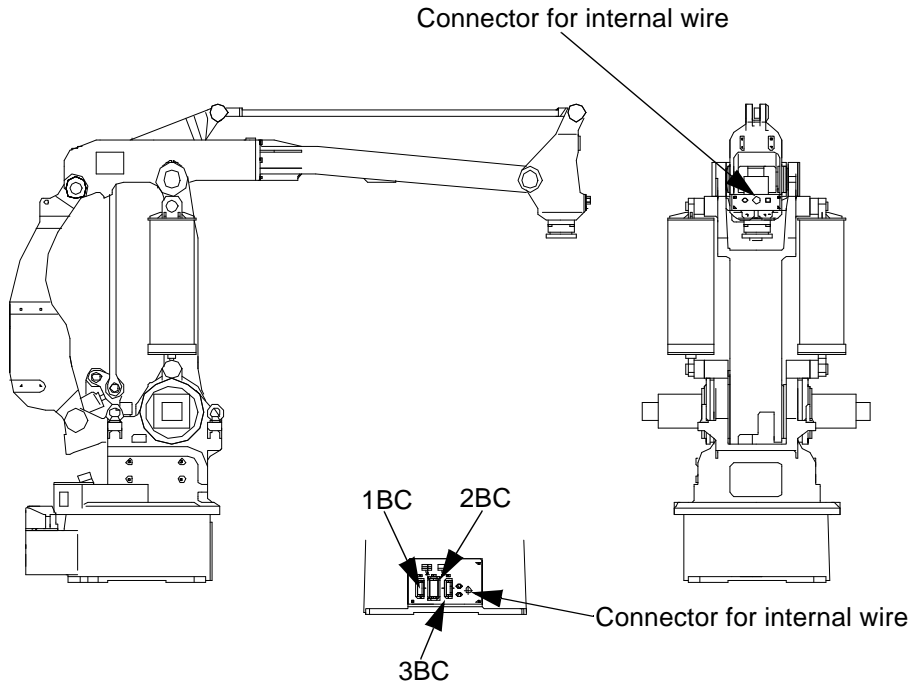


Fig.19 Location and numbers of connectors

List of connector types

Name	Type of connector
Base connector for internal wire	JL05-2A24-28PC (JL05-6A24-28S: Optional)
Wrist base for internal wire	JL05-2A24-28SC (JL05-6A24-28P: Optional)



9. Maintenance and inspection



Note!

Before maintenance or inspection, be sure to turn the main power supply off and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)

Failure to observe this warning may result in electric shock or injury.

Maintenance and inspection must be performed by specified personnel.

Failure to observe this caution may result in electric shock or injury.

For disassembly or repair, contact your Motoman representative.

Do not remove the motor, and do not release the brake.

Failure to observe this caution may result in injury from unexpected turning of the manipulator's arm.

The battery unit must be connected before removing detection connector when maintenance and inspection.

Failure to observe this caution may result in the loss of home position data.

9.1 Inspection schedule

Proper inspections are essential not only to assure that the mechanism will be able to function for a long period, but also to prevent malfunctions and assure safe operation. Inspection intervals are displayed in six levels. Conduct periodical inspections according to the inspection schedule in the table "Inspection items". In the table "Inspection items", the inspection items are classified into three types of operation: operations which can be performed by personnel authorized by the user, operations which can be performed by personnel being trained and operations which can be performed by service company personnel. Only specified personnel are to do inspection work.

**Note!**

The inspection interval must be based on the servo power supply on time.

Since the inspection schedule for MOTOMAN-SP100X is made under the condition that the frequency of operation of each axis is averaged, it is recommended to make inspection in half of the mentioned interval for the axis with higher frequency operations. For sake of safe operations and life of MOTOMAN-SP100X, it is recommended to replace the following parts at the secondary inspection (18000H).

Speed reducer (S-, L-, U- and T-axes)

Cross roller bearings (S- and U-axes)

Oil seals (L-, U- and T-axes motors)

Inspection items

Items ¹	Schedule						Method	Operation	Inspection charge		
	Daily	1000 H Cycle	5000 H Cycle	9000 H Cycle	18000 H	36000 H			Speci- fied person	Licen- see	Service com- pany
1	Tram mark	✓					Visual	Check tram mark accordance and damage at the home position.	✓	✓	✓
2	External lead	✓					Visual	Check for damage and deterioration of leads.	✓	✓	✓
3	Working area and manipulator	✓					Visual	Clean the work area if dust or spatter is present. Check for damage and outside cracks.	✓	✓	✓
4	LU-axes motor	✓					Visual	Check for grease leakage. ^{2, 3}	✓	✓	✓
5	Baseplate mounting bolts		✓				Spanner Wrench	Tighten loose bolts. Replace if necessary.	✓	✓	✓
6	Cover mounting screws		✓				Screw- driver, Wrench	Tighten loose bolts. Replace if necessary.	✓	✓	✓
7	Base connectors		✓				Manual	Check for loose connectors.	✓	✓	✓
8	LU-axes connectors		✓				Manual	Check for loose connectors.	✓	✓	✓



Inspection items

Items ¹	Schedule						Method	Operation	Inspection charge			
	Daily	1000 H Cycle	5000 H Cycle	9000 H Cycle	18000 H	36000 H			Speci-fied person	Licen-see	Service com-pany	
9	Connectors in S-head			✓				Manual	Check for loose connectors.	✓	✓	✓
10	L-axis balancer			✓				Grease gun Visual	Supply grease. ⁴ Check for loose nut and shaft.		✓	✓
11	S-axis limit switch dog			✓				Screw-driver, wrench, multi-meter	Check for stain, damage and looseness. Tighten and check the dog movement.		✓	✓
12	Wire harness in manipulator (SLU-axes leads)(T-axis leads)				✓			Visual Multi-meter	Check for conduction between the main connector of base and intermediate connector with manually shaking the wire. Check for wear of protective spring. ⁵		✓	✓
						✓			Replace ⁶			✓
13	Wire harness in manipulator (T-axis leads)				✓			Visual Multi-meter	Check conduction between terminals. Check for wear of protective spring. apply grease. ⁵		✓	✓
						✓			Replace ⁶			✓
14	Link				✓			Visual Manual	Move L- and U-axes back and forth, up and down to check for looseness of gearing. Supply grease. ⁴		✓	✓
15	Battery unit in manipulator						✓	Screw-driver	Replace the battery unit when the battery alarm occurs or the manipulator drove for 36000H.		✓	✓
16	S-axis speed reducer			✓				Grease gun	Check for malfunction. (Replace if necessary.) Supply grease ⁴ (5000H cycle). Replace grease ⁴ . (9000H cycle).		✓	✓



Inspection items

Items ¹	Schedule						Method	Operation	Inspection charge		
	Daily	1000 H Cycle	5000 H Cycle	9000 H Cycle	18000 H	36000 H			Specified person	Licence	Service company
17 L- and U-axes speed reducer			✓				Grease gun	Check for malfunction. (Replace if necessary.) Supply grease ⁴ (5000H cycle). Replace grease ⁴ (9000H cycle).		✓	✓
18 T-axis speed reducer			✓				Grease gun	Check for malfunction. (Replace if necessary.) Supply grease ⁴ (5000H cycle). Replace grease ⁴ (9000H cycle).		✓	✓
19 Bearings			✓				Grease gun	Supply grease Replace grease ^{4, 2}		✓	✓
20 Motor cooling fan			✓				Visual	Check for malfunction and damage.	✓	✓	✓
21 Overhaul					✓						✓

1. Inspection no. correspond to the numbers in the figure "Inspection parts and inspection numbers" .
2. For S-axis cross roller bearing, supply grease every 5000H but in 1 year.
3. The occurrence of a grease leakage indicates the possibility that grease has seeped into the motor. This can cause a motor breakdown. Contact your Motoman representative.
4. For the grease, refer to the table "Inspection parts and grease used" .
5. When checking for conduction with multimeter, connect the battery to "BAT" and "OBT" of connectors on the motor side for each axis, and then remove connectors on detector side for each axis from the motor. Otherwise, the home position may be lost. (Refer to "Notes for maintenance")
6. Wire harness in manipulator to be replaced at 18000H inspection.

Since replacement of grease of motor bearings is not possible, replace bearings by necessity. Life of bearing grease is approx. 30000 hours.

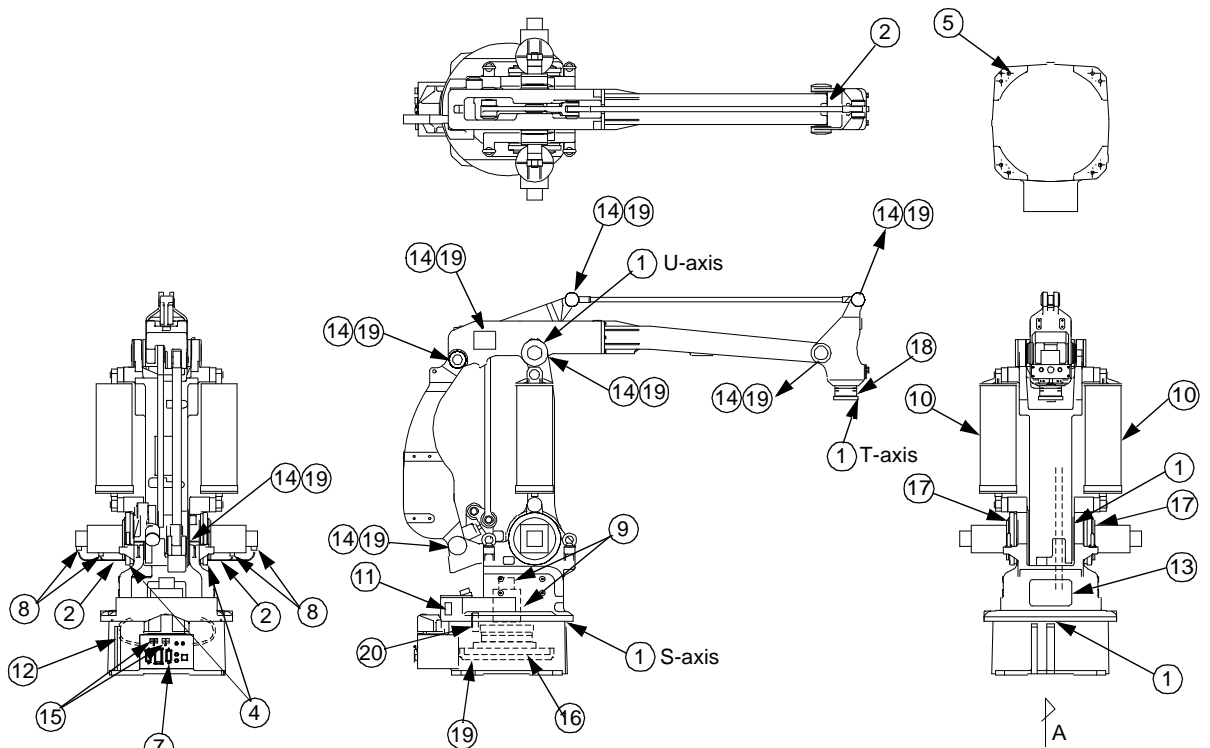


Fig.20 Inspection parts and inspection numbers

Inspection parts and grease used

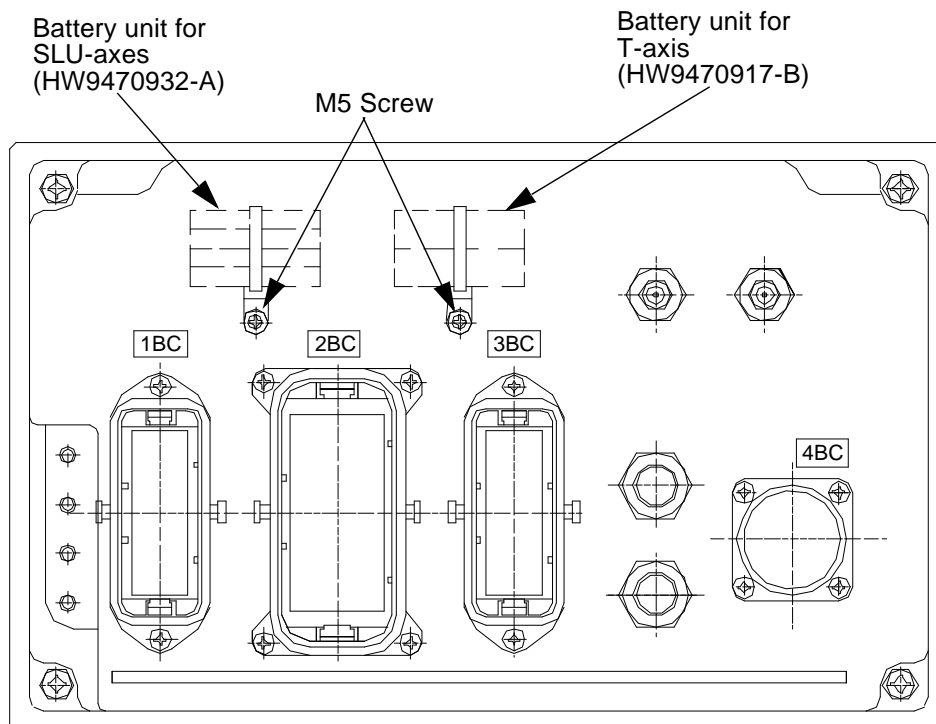
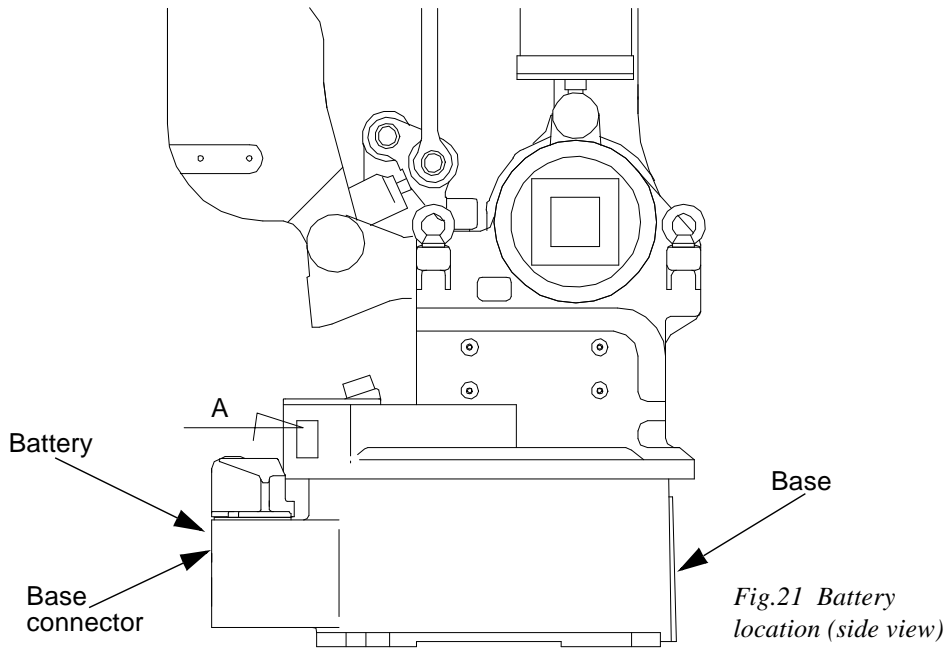
No.	Grease used	Inspected parts
12, 13	Multemp PS2A	Protective spring
16, 17, 18	Molywhite RE No. 00	S-, L-, U- and T-axes speed reducers
10, 19	Alvania EP Grease 2	L-axis balancer and bearings

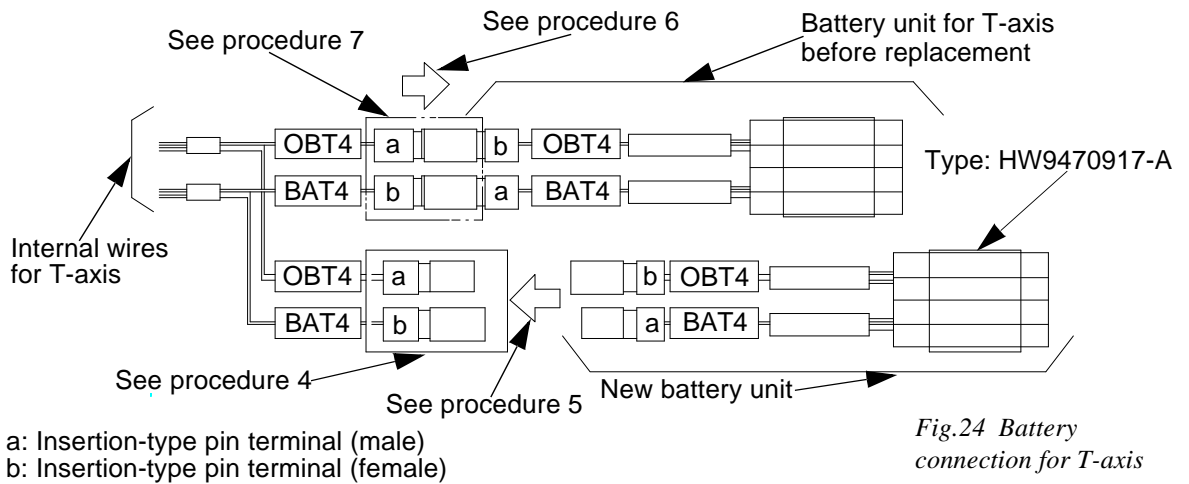
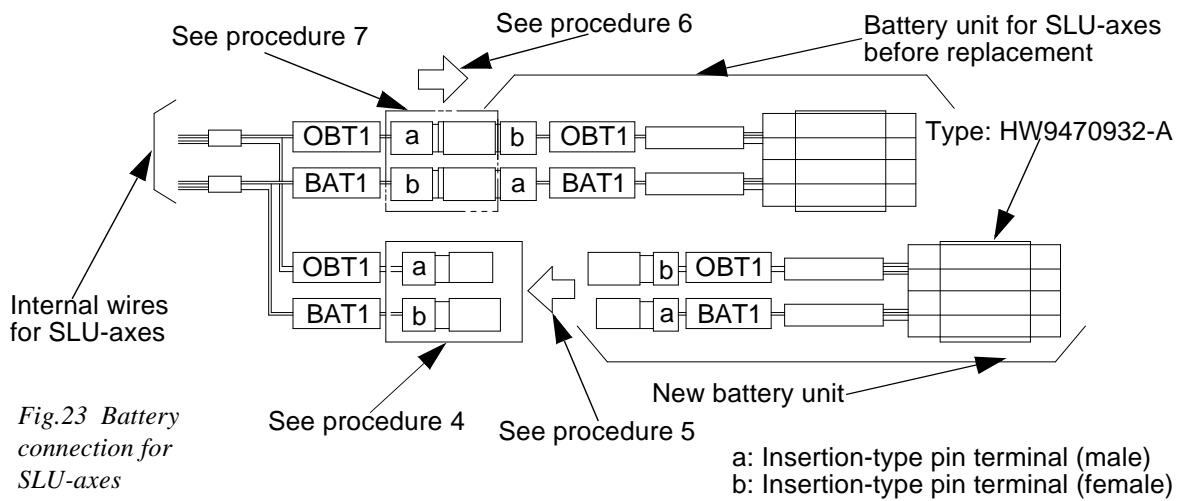
The numbers in the above table correspond to the numbers in the table "Inspection items".

9.2 Notes on maintenance procedures

9.2.A Battery unit replacement

If a battery alarm occurs in the XRC, replace the battery according to the following procedure:





- a) Turn the XRC main power supply off.
- b) Remove the connector base and grease tube from the union.
- c) Remove the battery unit mounting screw on the support.
- d) Remove the plastic tape (insulation tape) protecting the connection part of the battery unit in the manipulator.
- e) Connect the new battery.
- f) Remove the old battery.
- g) Protect the connection part of the battery unit in the manipulator with plastic tape (insulation tape).
- h) Mount the battery unit with the screw, connect the grease tube to the union and then mount the connector base.



Note!

Remove the old battery unit after connecting the new one so that the encoder absolute data does not disappear.

Do not pinch the cable when the base connector is installed.

9.2.B Grease replenishment/replacement for S-axis speed reducer

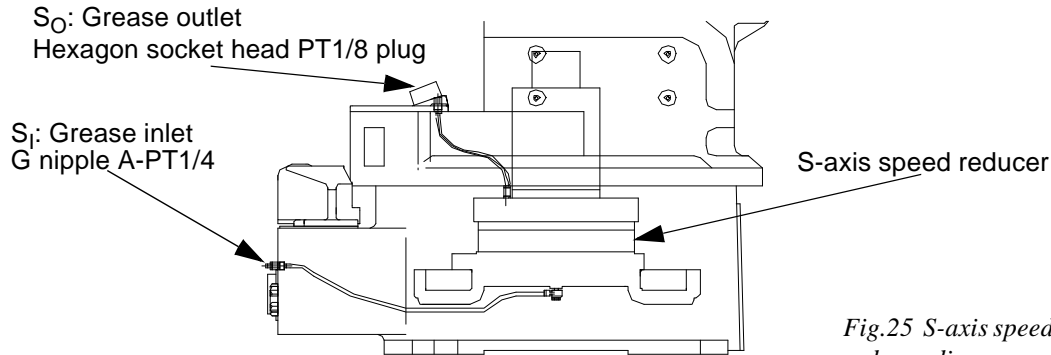


Fig.25 S-axis speed reducer diagram

■ Grease replenishment (for S-axis)

- Remove the S_o exhaust plug.
- Inject the grease into the S_i grease inlet using a grease gun.

<p>Grease type: Molywhite RE No.00 Amount of grease: 300cc (600cc for 1st supply)</p>

- Move the S-axis for 30 minutes to discharge the extra grease.
- Wipe S_o exhaust port with a cloth and reinstall the plug.

■ Grease replacement (for S-axis)

- Remove the S_o exhaust plug.
- Inject the grease into the S_i grease inlet using a grease gun.

<p>Grease type: Molywhite RE No.00 Amount of grease: 1400cc</p>

- The grease replacement is complete when new grease appears in the S_o exhaust port. The new grease can be distinguished from the old grease by color.
- Move the S-axis for 30 minutes to discharge the extra grease.
- Wipe the S_o exhaust port with a cloth and reinstall the plug.



Note!

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

If the plug is installed when the grease is being exhausted, the grease will go inside the motor and may damage it.



9.2.C Grease replenishment/replacement for L-axis speed reducer

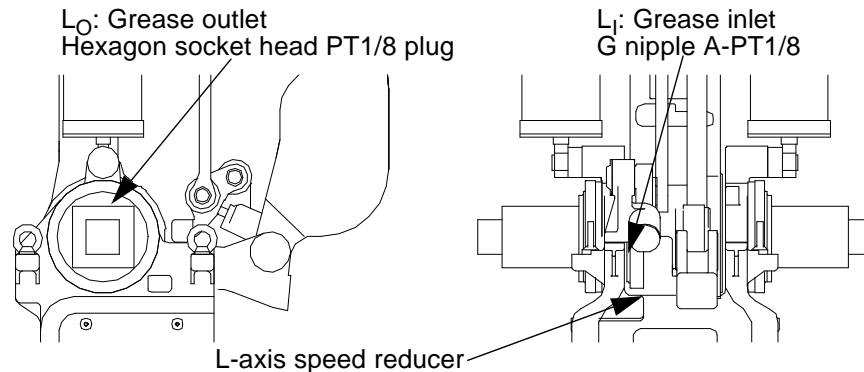


Fig.26 L-axis speed reducer diagram

■ Grease replenishment (for L-axis)

- Remove the L_O exhaust plugs.
- Inject grease into the L_I grease inlet using a grease gun.

Grease type: Molywhite RE No.00
Amount of grease: L_I 180cc
L_I: (360cc for 1st supply)

- Move the L-axis for 30 minutes to discharge the excess grease.
- Wipe the L_O exhaust plugs with a cloth and reinstall the plugs. (Spread the Modifier silicon Caulk on the screw of the plug.)

■ Grease replacement (for L-axis)

- Remove the L_O exhaust plugs.
- Inject grease into the L_I grease inlets using a grease gun.

Grease type: Molywhite RE No.00
Amount of grease: approx. 800cc

- The grease replacement is complete when new grease appears in the L_O exhaust ports. The new grease can be distinguished from the old grease by color.
- Move the L-axis for 30 minutes to discharge the excess grease.
- Wipe the L_O exhaust plugs with a cloth and reinstall the plugs.



Note!

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

If the plug is installed when the grease is being exhausted, the grease will go inside the motor and may damage it.

9.2.D Grease replenishment/replacement for U-axis speed reducer

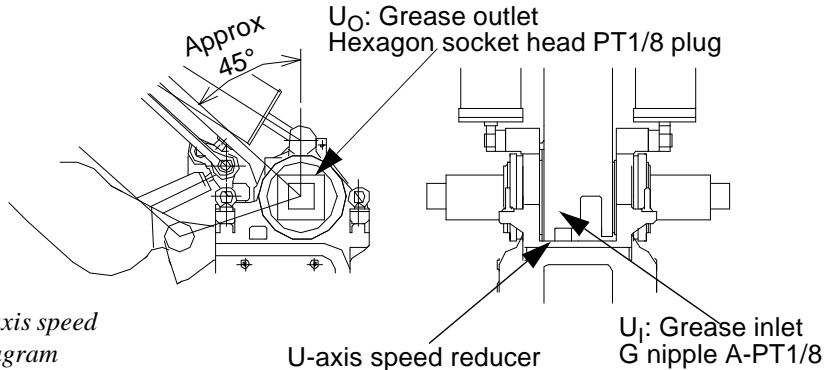


Fig.27 U-axis speed reducer diagram

■ Grease replenishment (for U-axis)

- Remove the U_O exhaust plugs.
- Inject grease into the U_I grease inlet using a grease gun.

Grease type: Molywhite RE No.00
Amount of grease: 180cc
(360cc for 1st supply)

- Move the U-axis for 30 minutes to discharge the excess grease.
- Wipe the U_O exhaust plugs with a cloth and reinstall the plugs.

■ Grease replacement (for U-axis)

- Remove the U_O exhaust plugs.
- Inject grease into the U_I grease inlet using a grease gun.

Grease type: Molywhite RE No.00
Amount of grease: approx. 800cc

- The grease replacement is complete when new grease appears in the U_O exhaust ports. The new grease can be distinguished from the old grease by color.
- Move the U-axis for 30 minutes to discharge the excess grease.
- Wipe the U_O exhaust plugs with a cloth and reinstall the plugs.



Note!

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

If the plug is installed when the grease is being exhausted, the grease will go inside the motor and may damage it.



9.2.E Grease replenishment/replacement for T-axis speed reducer and gear

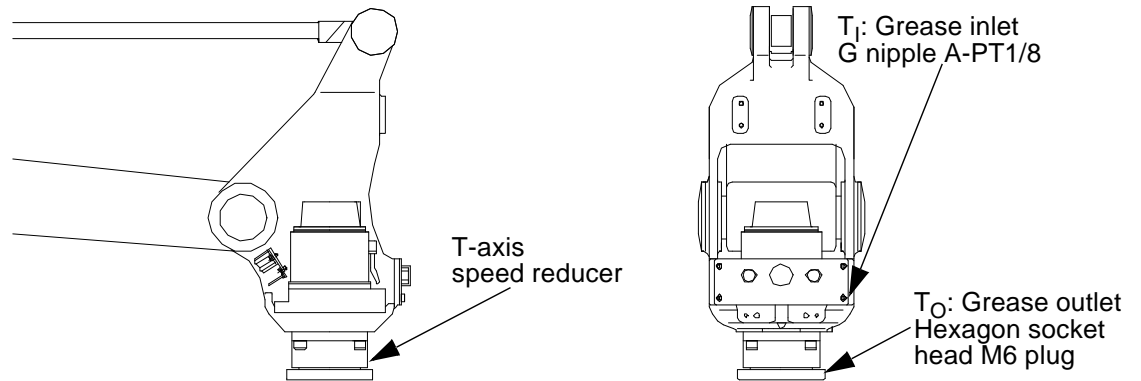


Fig.28 T-axis speed reducer and gear diagram

■ Grease replenishment (for T-axis)

- Remove the T₀ exhaust plugs.
- Inject grease into the T₁ grease inlet using a grease gun.

Grease type: Molywhite RE No.00
Amount of grease: 50cc
(100cc for 1st supply)

- Move the T-axis for 30 minutes to discharge the excess grease.
- Wipe the T₀ exhaust plugs with a cloth and reinstall the plugs.

■ Grease replacement (for T-axis)

- Remove the T₀ exhaust plugs.
- Inject grease into the T₁ grease inlet using a grease gun.

Grease type: Molywhite RE No.00
Amount of grease: approx. 250cc

- The grease replacement is completed when new grease appears from the T₀ exhaust port. The new grease is distinguished from the old grease by color.
- Move the T-axis for 30 minutes to discharge the excess grease.
- Wipe the T₀ exhaust plugs with a cloth and reinstall the plugs.



Note!

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

If the plug is installed when the grease is being exhausted, the grease will go inside the motor and may damage it.

9.2.F Grease replenishment for S-axis cross roller bearing

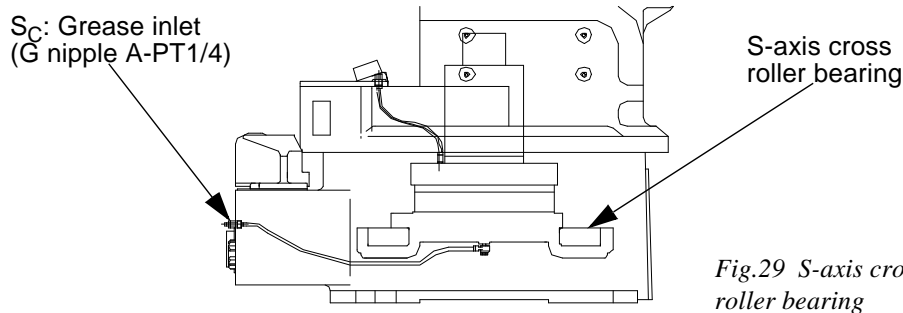


Fig.29 S-axis cross roller bearing

- a) Inject grease into the S_C grease inlet using a grease gun. (Refer to the figure "S-axis cross roller bearing").

<p>Grease type: Alvania EP grease 2 Amount of grease: 100cc</p>

9.2.G Grease replenishment L-axis cross roller bearing

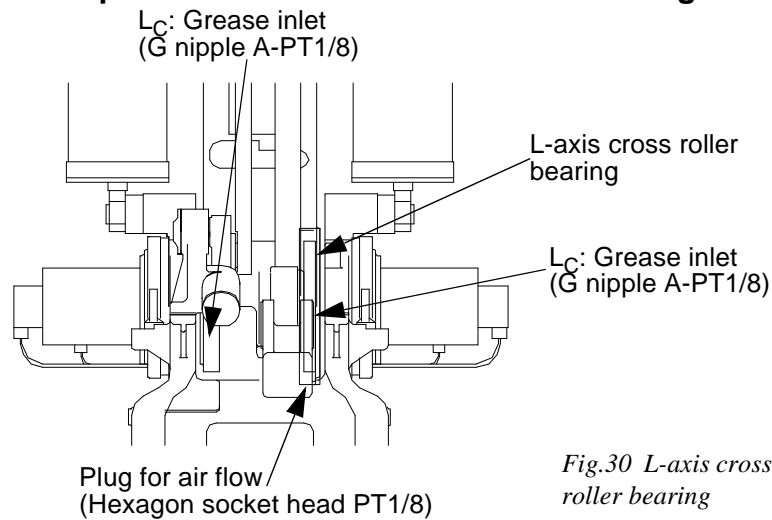


Fig.30 L-axis cross roller bearing

- a) Remove the plugs for air flow.
b) Inject grease into L_C grease inlet by using a grease gun.

<p>Grease type: Alvania EP grease 2 Amount of grease: 60cc</p>
--

- c) Reinstall the plug.



Note!
Plug are used for air flow. Do not inject excessive grease.



9.2.H Grease replenishment for link parts

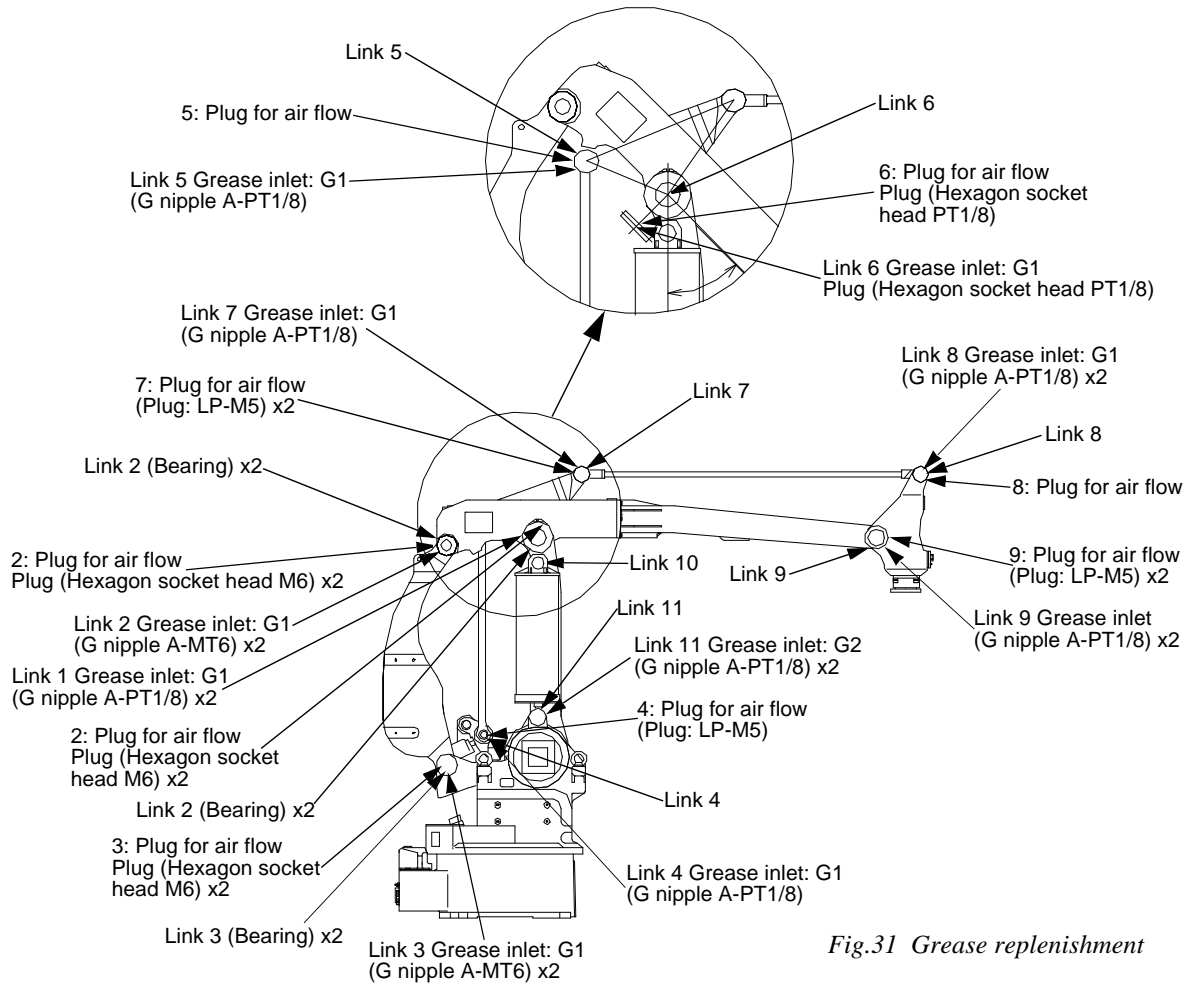


Fig.31 Grease replenishment

- Remove 15 plugs for air flow at the links 1 to 9. (There are no plugs for air flow at the links 10 to 11).
- Inject grease into 19 G1 grease inlets by using a grease gun.
- Reinstall plug for air flow.

Grease type: Alvania EP grease 2
 Amount of grease: 6cc for the links 1, 2, 3 and 6 (12cc for the 1st supply)
 12cc for the links 4, 5 and 9 (24cc for the 1st supply)
 3cc for the links 7 and 8 (6cc for the 1st supply)
 5cc for the links 10 and 11



Note!
Plugs are used for air flow. Do not inject excessive grease.



9.2.I Notes for maintenance

Remove the old battery unit after connecting the new one so that the encoder absolute data does not disappear.

■ **Battery unit connection for S-, L- and U-axes motors**

The connector for the battery unit connection is attached to the main body of the S-, L- and U-axes motors. Connect the battery unit according to the following procedure.

- a) Remove the cap attached to the battery backup connector of the motor.
- b) Connect the battery unit connection cable (HW9470945-A) for the motor with the battery backup connector of the motor.
- c) Connect the S-, L- and U-axes battery unit (HW9470932-A) with the battery unit connection cable (HW9470945-A) for the motor. (Under such a condition, remove the encoder connector and do the maintenance check work.)
- d) Confirm all connectors connection after the maintenance check ends and remove the battery unit connection cable for the motor and the battery unit.
- e) Install the cap attached to the battery backup connector of the motor.

■ **Battery unit connection for T-axis motors**

The connector (insertion-type pin terminal) for the battery backup is installed in the end point of the cable for the encoder of the T-axis motors (BAT and OBT are marked). Connect the battery unit according to the following procedure.

- a) Connect battery unit (HW9470917-A) for the T-axis with the the battery backup connector (BAT and OBT are marked) located in the end point of the cable for the encoder. (Under such a condition, remove the encoder connector and do the maintenance check work.)
- b) Confirm all connectors connection after the maintenance check ends and remove the battery unit.



Note!

Do not remove the battery unit in the base connector.

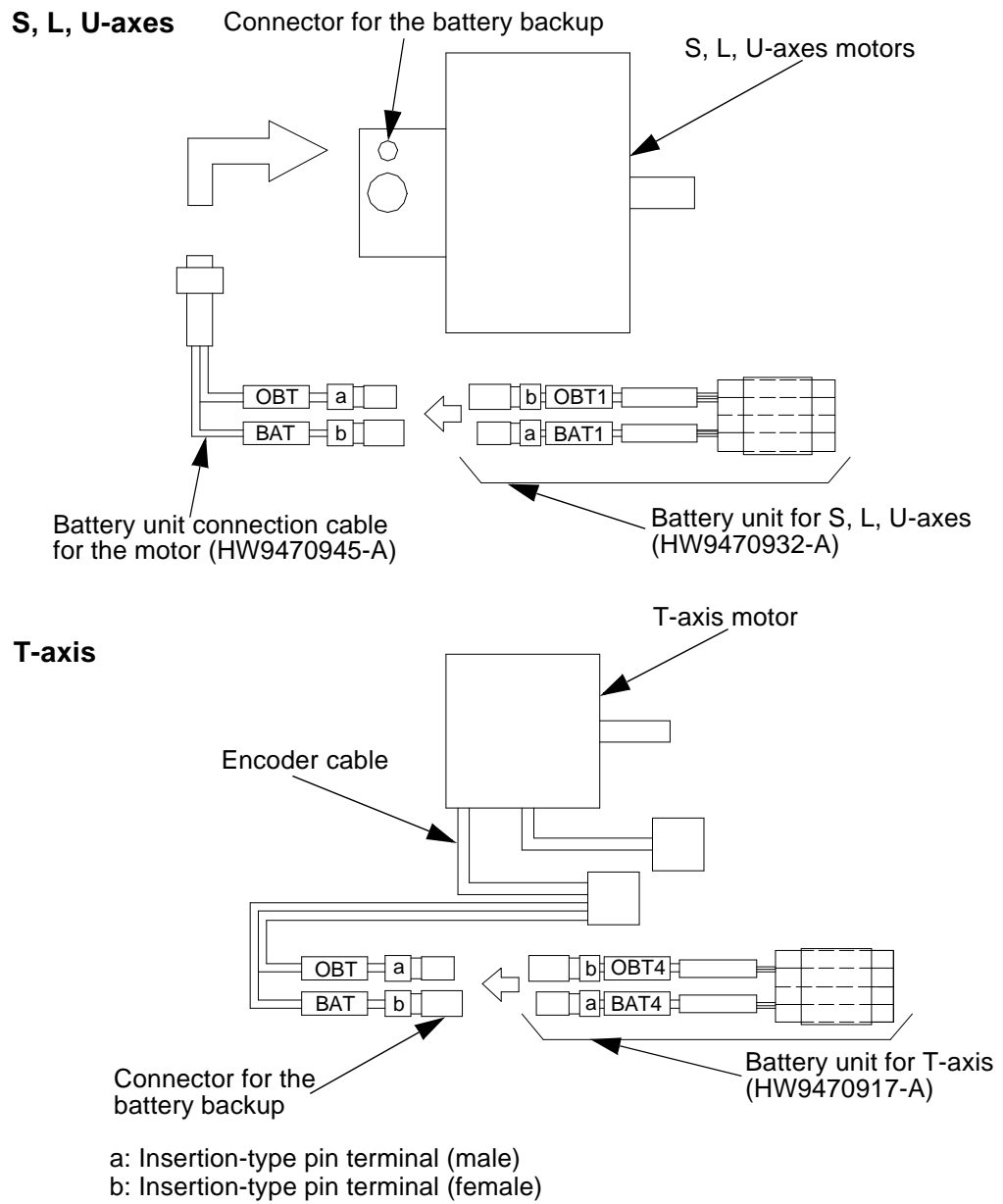


Fig.32 Battery unit connection





10. Recommended spare parts

It is recommended that the following parts and components be kept in stock as spare parts for the Motoman-SP100X. The spare parts list for the Motoman-SP100X is shown below. Product performance can not be guaranteed when using spare parts from any company other than Motoman. The spare parts are ranked as follows:

- ✓ Rank A: Expendable and frequently replaced parts.
- ✓ Rank B: Parts for which replacement may be necessary as a result of frequent operation.
- ✓ Rank C: Drive unit



Note!

To replace parts in rank B or rank C, contact your Motoman representative.

Spare Parts for the Motoman-SP100X (all types)

Rank	Parts No.	Name	Type	Manufacturer	Qty	Qty per Unit	Remarks
A	1	Grease	Molywhite RE No. 00	Yaskawa Electric Corporation	16kg	-	For all axes speed reducers
	2	Grease	Alvania EP Grease 2	Showa Oil Co.,Ltd.	16kg	-	For L-axis balancer,bearing
	3	Grease	Multemp PS2A	Kyodo.Oil Co.,Ltd.	2.5kg	-	For protective spring
	4	Battery unit	HW9470932-A	Yaskawa Electric Corporation	1	1	For SLU-axes
	5	Battery unit	HW9470917-A	Yaskawa Electric Corporation	1	1	For T-axis
B	6	S-axis speed reducer	HW9381220-A	Yaskawa Electric Corporation	1	1	
	7	L-and U-axes speed reducer	HW9381021-A	Yaskawa Electric Corporation	1	2	
	8	T-axis speed reducer	HW9381221-A	Yaskawa Electric Corporation	1	1	
	9	S-axis cross roller bearing	HW9381222-A	Yaskawa Electric Corporation	1	1	
	10	L-axis cross roller bearing	HW9482144-A	Yaskawa Electric Corporation	1	1	



Spare Parts for the Motoman-SP100X (all types)

Rank	Parts No.	Name	Type	Manufacturer	Qty	Qty per Unit	Remarks
C	11	Internal wires for S-axis	HW9171627-A	Yaskawa Electric Corporation	1	1	Base connector leads
	12	Internal wires for U-axis	HW9271158-A	Yaskawa Electric Corporation	1	1	Standard
			HW9271104-A				Lead terminal treatment completion (-J01)
	13	AC Servomotor for S-,L-,U-axes	HW9381261-A	Yaskawa Electric Corporation	1	3	
	14	AC Servomotor for T-axis	HW9381363-A	Yaskawa Electric Corporation	1	1	Standard
HW9371104-A			Lead terminal treatment completion(-J01)				
15	Motor cooling fan	HW9370631-D	Yaskawa Electric Corporation	1	1		



11. Rebuilding SP100X to SP160X/SP250X

■ Rebuild to SP160X

- a) Add on counterweight No. 1 (Motoman P/N No. xxxxxxxx)
- b) Change parameters to (SP100X-J11)

■ Rebuild to SP250X

- a) Add on counterweight No. 1 (Motoman P/N No. xxxxxxxx)
- b) Add on counterweight No. 2 (Motoman P/N No. 357077)
- c) Add on S-axis flywheel kit (Motoman P/N No. xxxxxxxx)
- d) Change parameters to (SP100X-J21)
- e) Confirm S-axis encoder data

11.1 Add on flywheel

■ General

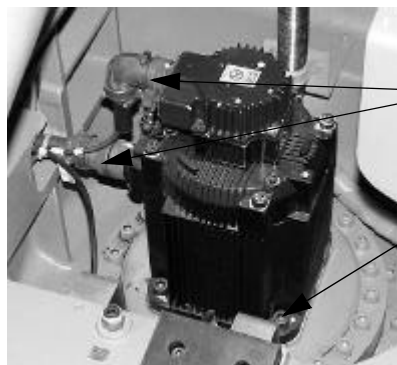
Check all necessary parts

Check all necessary tools (dynamometric wrench).

Use sealing compound type; *LOCTITE Master Gasket 574*

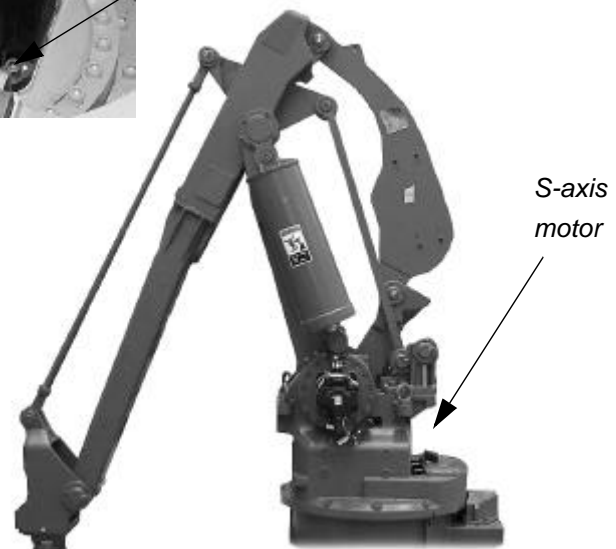
■ Dismount the S-axis motor

- a) Put robot in position like the picture to get access to the S-axis motor.
- b) Disconnect the XRC controller from the power supply.
- c) Remove signal and power connections.
- d) Undo the four bolts fixing the motor to the chassie.



Remove power and signal cables

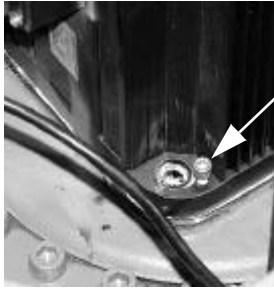
Remove the four bolts



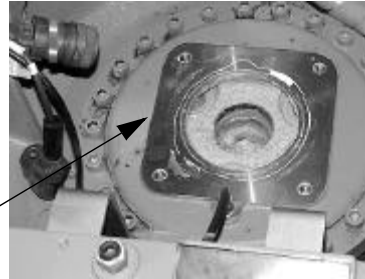
S-axis motor



- e) Use two M6x40 bolts to press the motor apart from the S-axis chassis. Otherwise, it may be difficult to lift the motor up, due to the sealing compound



Extra bolt M6x40 for separation



Chassie after motor is removed

- f) Put eyebolts in the threaded holes on the top of the motor and use some sort of lifting device to remove the motor from chassis.
 g) Put the motor on a workbench.
 h) Remove the clips, blocking the gear wheel.



- i) Remove the bolt holding the gear wheel.
 j) Take away all grease using a piece of cloth. Don't use any solvent.



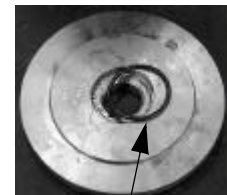
■ **Mounting the flywheel**

- k) Add sealing compound to the flange of the servo motor.



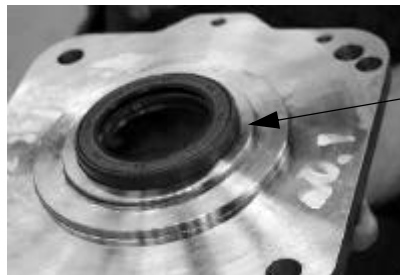


- l) Mount the first part of the distance to the motor flange. See to that the holes match the motor flange.
- m) Put the O-ring in the groove (which is turned against the motor flange).
- n) Put the flywheel onto the motor shaft. It may be necessary to adjust the key by using a rubber mallet.



O-ring

- o) Mount the rubber sealing in the second part of the distance (flywheel cover). It may be necessary to use a rubber mallet to get it in place.



Sealing to be in line with the flange

- p) Put sealing compound to the second part of the distance.

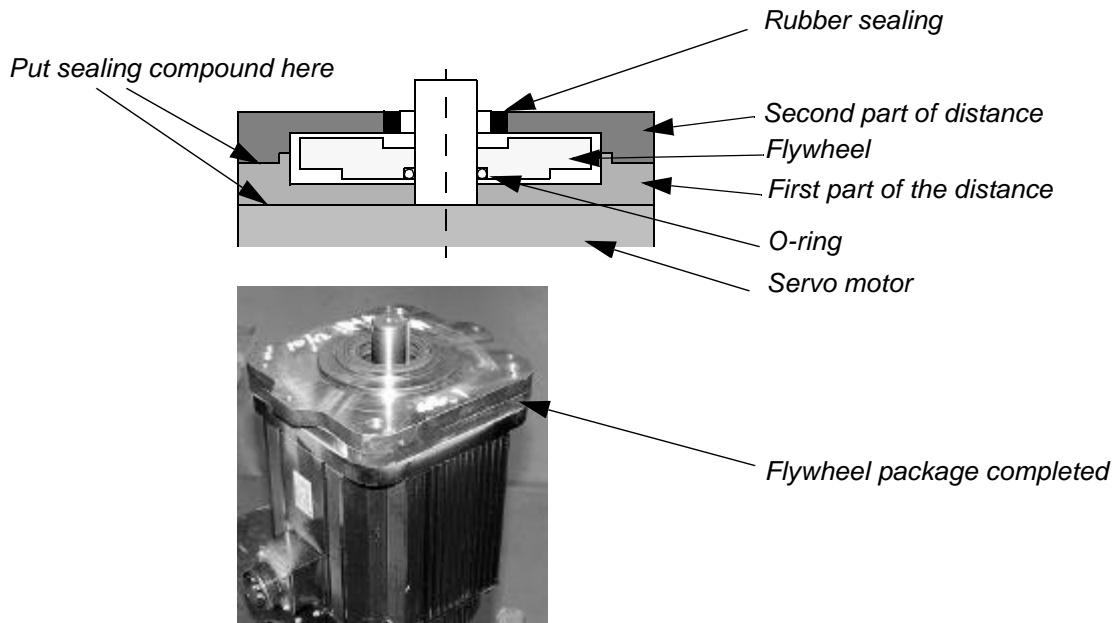


Note

No grease or oil should be added to the flywheel area.

- q) Put the second part of the distance on top of the package. See to that the holes match with the motor flange.
- r) Fix the motor package together by means of the two bolts.





■ Add gear wheel and put the motor back

- s) Add on the new gear wheel package.
- t) Tighten the new longer bolt in the center of the gear wheel.

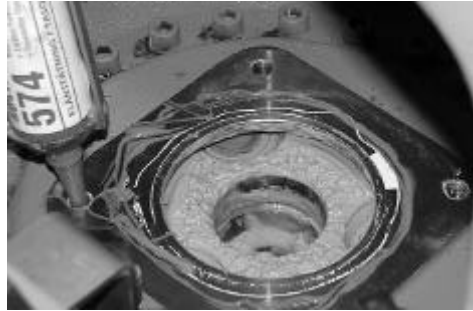


- u) Put the safety clips back.





- v) Add sealing compound on the flange of the chassis.
- w) Don't forget to put sealing compound on the motor bolts as well. (The bolts goes right through the chassis).



- x) Put the motor back. It may be a little bit tricky to get the gears in mesh. Turn the motor slightly forth and back to get in mesh.
- y) Tighten the four motor bolts (torque =14.5 Nm). Size of bolts is = M12x70. Longer bolts **must not be used**, otherwise they will interfere with the reduction gear underneath.
- z) Put the power and signal cables back.

**Note**

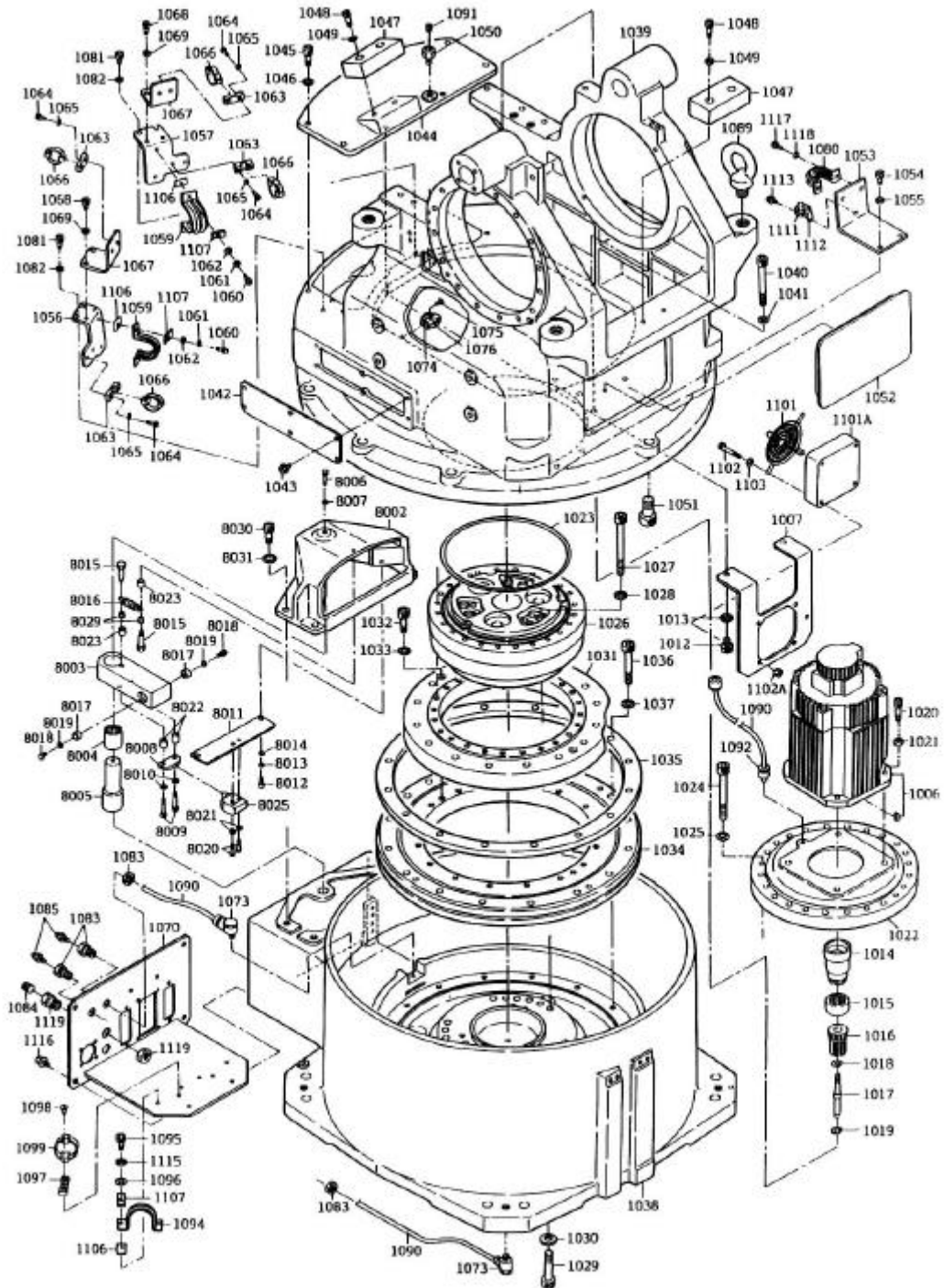
After the S-axis motor and the gear wheel has been put apart, the encoder data may have changed. Always confirm/set "0"-position of the encoder before taking robot into service.





12. Parts list

12.1 S-axis driving unit





No.	Name	DWG no.	Pcs
1006	AC servo motor	HW9381261-A	1
1007	Support	HW9301983-A	1
1012	Socket screw	M8 × 16	2
1013	Spring washer	2H-8	2
1014	Shaft	HW9381068-A	1
1015	Shaft	HW9481343-A	1
1016	Gear	HW9481878-A	1
1017	Bolt	HW9481363-A	1
1018	Spring washer	2H-8	1
1019	C stopper	STW-12	1
1020	Socket screw	M12 × 35	4
1021	Spring washer	2H-12	4
1022	M base	HW9200826-1	1
1023	O ring	ARP568-276	1
1024	Socket screw	M12 × 115	24
1025	Spring washer	2H-12	24
1026	RV reduction gear	HW9381220-A	1
1027	Socket screw	M16 × 140	6
1028	Spring washer	2H-16	6
1029	Socket screw	M14 × 65	18
1030	Washer	M14	18
1031	Base plate	HW9301763-1	1
1032	Socket screw	M10 × 40	2
1033	Spring washer	2H-10	2
1034	Cross roller bearing	HW9381222-A	1
1035	B cover	HW9301768-1	1
1036	Socket screw	M12 × 80	16
1037	Spring washer	2H-12	16
1038	Base	HW9100830-1	1
1039	S head	HW9100831-1	1
1040	Socket screw	M12 × 100	16
1041	Spring washer	2H-12	16
1042	Cover	HW9404291-1	2
1043	APS bolt	M6 × 12	12
1044	Cover	HW9301767-1	1
1045	Socket screw	M6 × 25	5
1046	Spring washer	2H-6	5
1047	Stopper	HW9481239-A	2



No.	Name	DWG no.	Pcs
1048	Socket screw	M8 × 25	4
1049	Spring washer	2H-8	4
1050	Union	KQE8-03	1
1051	Socket screw	M24 × 40	1
1052	Cover	HW9380618-A	1
1053	Plate	HW9404525-1	1
1054	Socket screw	M8 × 16	2
1055	Spring washer	2H-8	2
1056	Plate	HW9302489-1	1
1057	Plate	HW9302489-2	1
1059	Saddle	CD-42	2
1060	Socket screw	M5 × 16	4
1061	Spring Washer	2H-5	4
1062	Washer	M5	4
1063	Plate	HW9403595-1	4
1064	Socket screw	M4 × 16	8
1065	Spring washer	2H-4	8
1066	Insulok' tie	T50L	4
1067	Plate	HW9404647-1	2
1068	Socket screw	M6 × 16	4
1069	Spring washer	2H-6	4
1070	C base	HW9302445-A	1
1073	Union	PH8-01	2
1074	Clamp	TM3S25	2
1075	Screw	M6 × 12	2
1076	Insulok' tie	T30L	3
1080	Saddle	CD-28	1
1081	Socket screw	M6 × 12	1
1082	Spring washer	2H-6	1
1083	Union	KQE8-02	2
1084	Plug	PT3/8	2
1085	Grease nipple	A-PT1/4	2
1089	I bolt	M24	4
1090	Tube	NB-0860-1	3
1091	Plug	PT1/8	1
1092	Union	POC8-01	1
1094	Saddle	CD-42	2
1095	Socket screw	M5 × 20	4
1096	Washer	M5	4

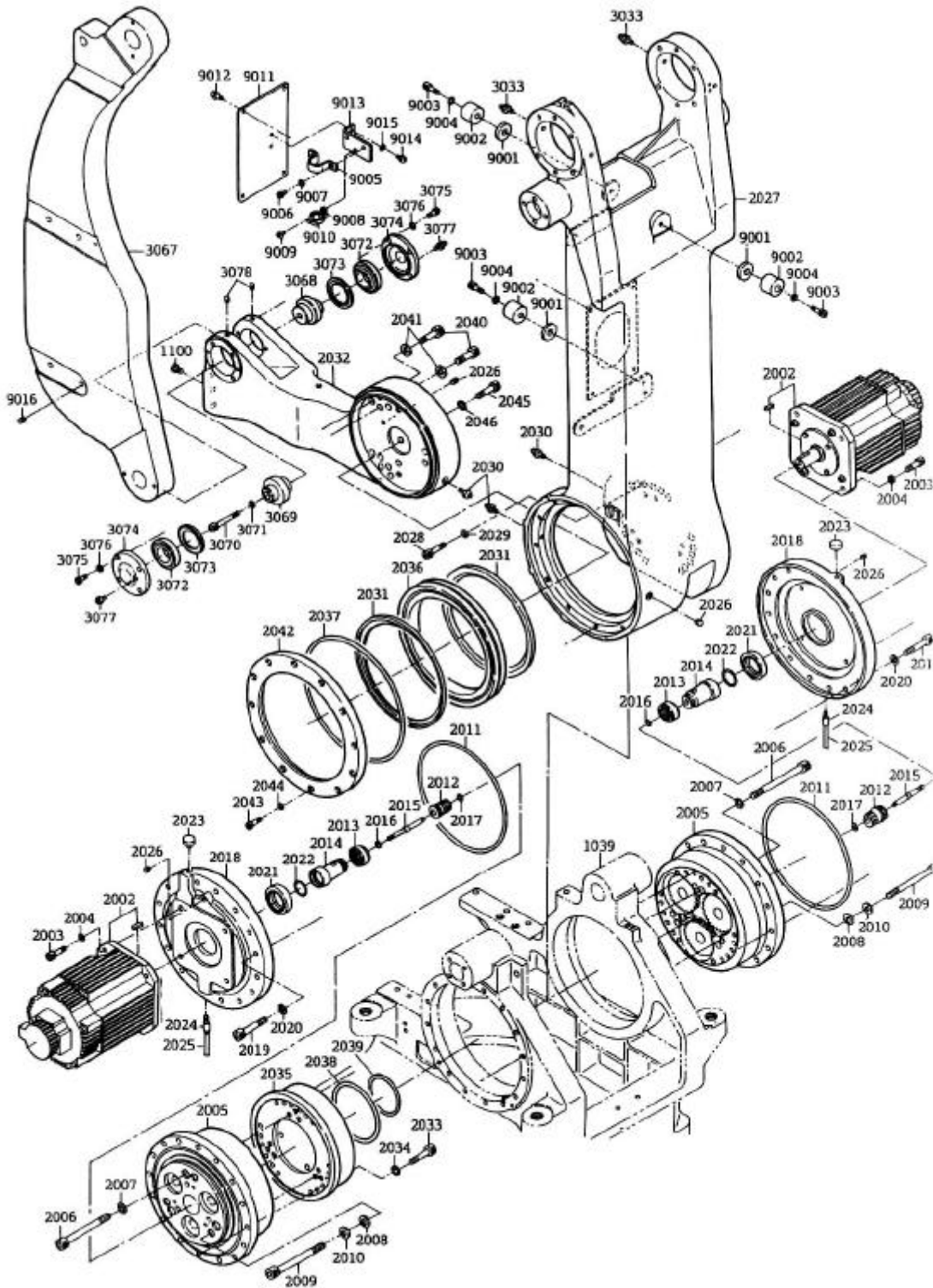


No.	Name	DWG no.	Pcs
1097	Plate	HW9403595-1	2
1098	Screw	M4 × 12	4
1099	Insulok' tie	T120S	2
1101	Fan cover	A-30F	1
1101A	Fan	HW9480687-A	1
1102	Round head screw	M3 × 45	4
1102A	Nut	M3	4
1103	Washer	M3	4
1106	Spacer	HW9404759-1	8
1107	Plate	HW9404760-1	8
1111	Insulok' tie	T30L	1
1112	Clamp	TAI-S10	1
1113	APS bolt	M5 × 12	1
1115	Spring washer	2H-5	4
1116	APS bolt	M6 × 12	4
1117	Socket screw	M5 × 12	2
1118	Spring washer	2H-5	2
1119	Union	KQE10-03	2
8002	Case	HW9100750-1	1
8003	Stopper	HW9403955-1	1
8004	Bearing	TLAW3038Z	1
8005	Shaft	HW9403956-1	1
8006	Socket screw	M6 × 25	1
8007	Spring washer	2H-6	1
8008	Dog	HW9403958-1	1
8009	Socket screw	M6 × 30	2
8010	Spring washer	2H-6	2
8011	Plate	HW9403957-1	1
8012	Socket screw	M6 × 15	2
8013	Spring washer	2H-6	2
8014	Washer	M6	2
8015	Bolt	MSB8-25	2
8016	Spring	AWT16-65	1
8017	Stopper	HW9403962-1	2
8018	Socket screw	M4 × 10	2
8019	Spring washer	2H-4	2
8020	Round head screw	M4 × 25	2
8021	Washer	M4	2
8022	Collar	HW9403961-1	2



No.	Name	DWG no.	Pcs
8023	Collar	HW9403959-1	2
8025	Limit switch	SHL-02255-MR-1.0	1
8029	Oiless collar	LFF-0806	2
8030	Socket screw	M16 × 40	4
8031	Spring washer	2H-16	4

12.2 L- and U-axis driving unit





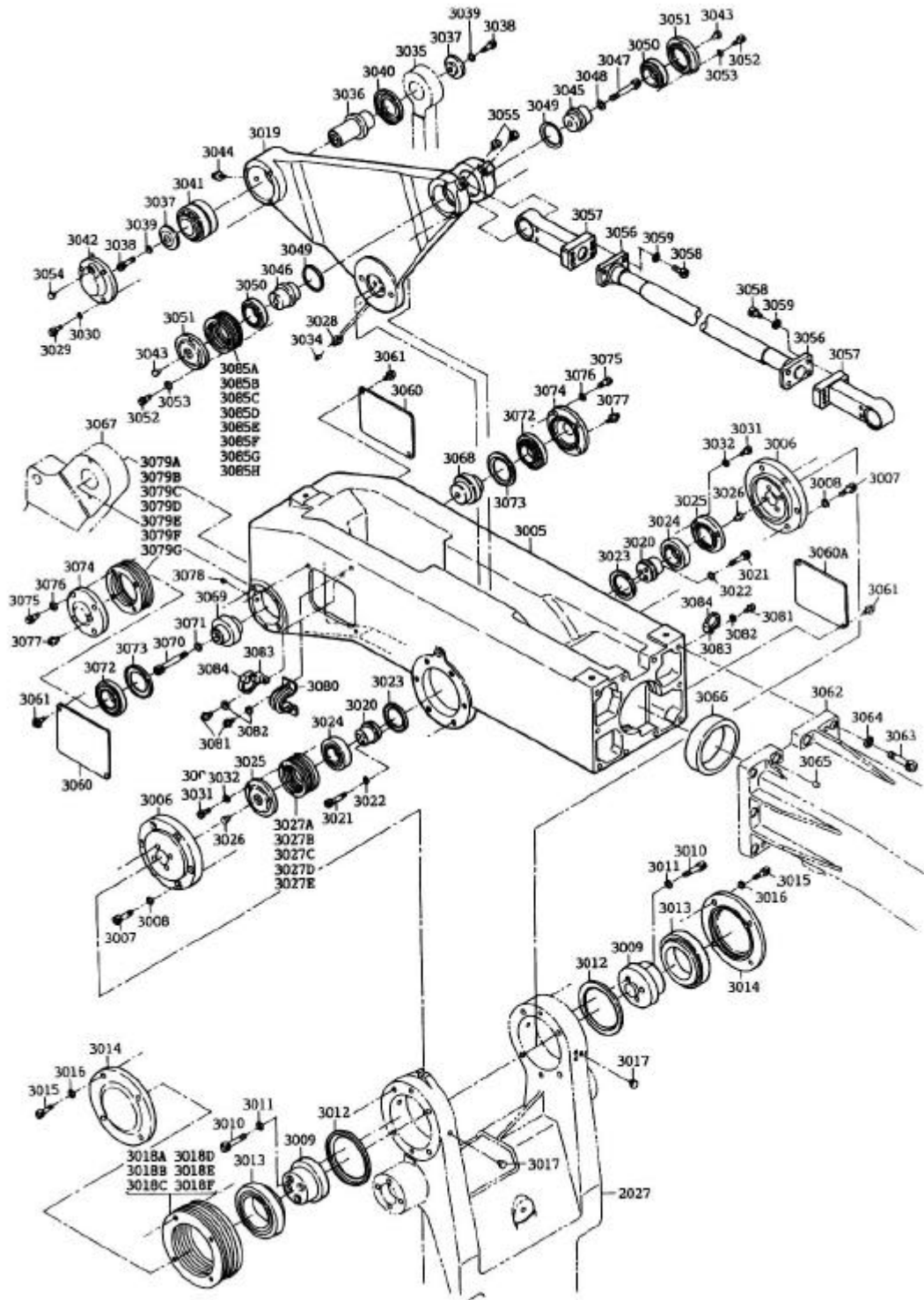
No.	Name	DWG no.	Pcs
1039	S head	HW9100831-1	1
1100	Plug	MP0625	4
2002	Motor	HW9381261-A	2
2003	Socket screw	M12 × 35	8
2004	Spring washer	2H-12	8
2005	Reduction gear	HW9381021-A	2
2006	Socket screw	M6 × 140	6
2007	Spring washer	2H-6	6
2008	Washer	HW9403870-1	6
2009	Socket screw	M6 × 140	6
2010	Washer	GT-SH M5	6
2011	O ring	G270	2
2012	Gear	HW9481362-A	2
2013	Shaft	HW9481343-A	2
2014	Shaft	HW9381068-A	2
2015	Bolt	HW9481363-A	2
2016	Spring washer	2H-6	2
2017	C type clip	STW-12	2
2018	M base	HW9200827-1	2
2019	Socket screw	M12 × 70	32
2020	Spring washer	2H-12	32
2021	Oil seal	Y507212.5	2
2022	O ring	G40	2
2023	Air breezer	EZ0094-AO	2
2024	Union	TSH6-01M	2
2025	Tube	UB-0640-0.1C	2
2026	Plug	PT1/8	5
2027	L arm	HW9100832-1	1
2028	Socket screw	M10 × 45	18
2029	Spring washer	2H-10	18
2030	Grease nipple	A-PT1/8	3
2031	Oil seal	VB 265 280 7	2
2032	Link B	HW9200772-1	1
2033	Socket screw	M10 × 60	18
2034	Spring washer	2H-10	18
2035	Shaft	HW9301309-1	1
2036	Cross roller bearing	HW9482144-A	1
2037	O ring	GS310	1



No.	Name	DWG no.	Pcs
2038	O ring	G145	1
2039	O ring	G90	1
2040	Socket screw	M14 × 50	15
2041	Washer	GT-SH M14	15
2042	B cover	HW9301736-1	1
2043	Socket screw	M8 × 25	12
2044	Spring washer	2H-8	12
2045	Socket screw	M10 × 45	1
2046	Spring washer	2H-10	1
3033	Grease nipple	A-PT1/8	2
3066	Collar	HW9404482-1	2
3067	Link A	HW9100794-1	1
3068	Shaft	HW9403572-1	2
3069	Shaft	HW9403574-1	2
3070	Socket screw	M12 × 70	2
3071	Spring washer	2H-12	2
3072	Bearing	HR30203J	4
3073	Oil seal	AG3151EO	4
3074	B cover	HW9403570-1	4
3075	Socket screw	M6 × 20	16
3076	Spring washer	2H-6	16
3077	Grease nipple	A-MT6 × 1	4
3078	Plug	PT1/8	4
9001	Washer	HW9405676-1	3
9002	Stopper	HW9481240-A	3
9003	Socket screw	M8 × 35	3
9004	Spring washer	2H-8	3
9005	Saddle	CD-28	1
9006	Socket screw	M5 × 12	2
9007	Spring washer	2H-5	2
9008	Clamp	TAI-10	1
9009	APS bolt	M5 × 12	1
9010	Insulok' tie	T30L	1
9011	Cover	HW9404371-1	1
9012	APS bolt	M6 × 12	4
9013	Plate	HW9404485-1	1
9014	Socket screw	M5 × 12	2
9015	Spring washer	2H-5	2
9016	Plug	62PP050BG14	8



12.3 U-axis link unit





No.	Name	DWG no.	Pcs
2027	L arm	HW9100832-1	1
3005	Casing	HW9100833-1	1
3006	Shaft	HW9301766-1	2
3007	Socket screw	M10 × 30	12
3008	Spring washer	2H-10	12
3009	Shaft	HW9403571-1	2
3010	Socket screw	M10 × 45	8
3011	Spring washer	2H-10	8
3012	Oil seal	AG4059E0	2
3013	Bearing	HR32016XJ	2
3014	B cover	HW9301405-1	2
3015	Socket screw	M10 × 25	8
3016	Spring washer	2H-10	8
3017	Plug	PT1/8	2
3018A	Shim	HW9403656-1	1
3018B	Shim	HW9403656-2	1
3018C	Shim	HW9403656-3	1
3018D	Shim	HW9403656-4	1
3018E	Shim	HW9403656-5	1
3018F	Shim	HW9403656-6	1
3019	Link D	HW9200825-1	1
3020	Shaft	HW9403773-1	2
3021	Socket screw	M6 × 35	6
3022	Spring washer	2H-6	6
3023	Oil seal	AF2835EO	2
3024	Bearing	32008JR	2
3025	B cover	HW9404985-1	2
3026	Plug	LP-M5	2
3027A	Shim	HW9404985-1	1
3027B	Shim	HW9404985-2	1
3027C	Shim	HW9404985-4	1
3027D	Shim	HW9404985-5	1
3027E	Shim	HW9404985-6	1
3028	Grease nipple	A-PT1/8	1
3029	Socket screw	M6 × 20	3
3030	Spring washer	2H-6	3
3031	Socket screw	M5 × 16	6
3032	Spring washer	2H-5	6



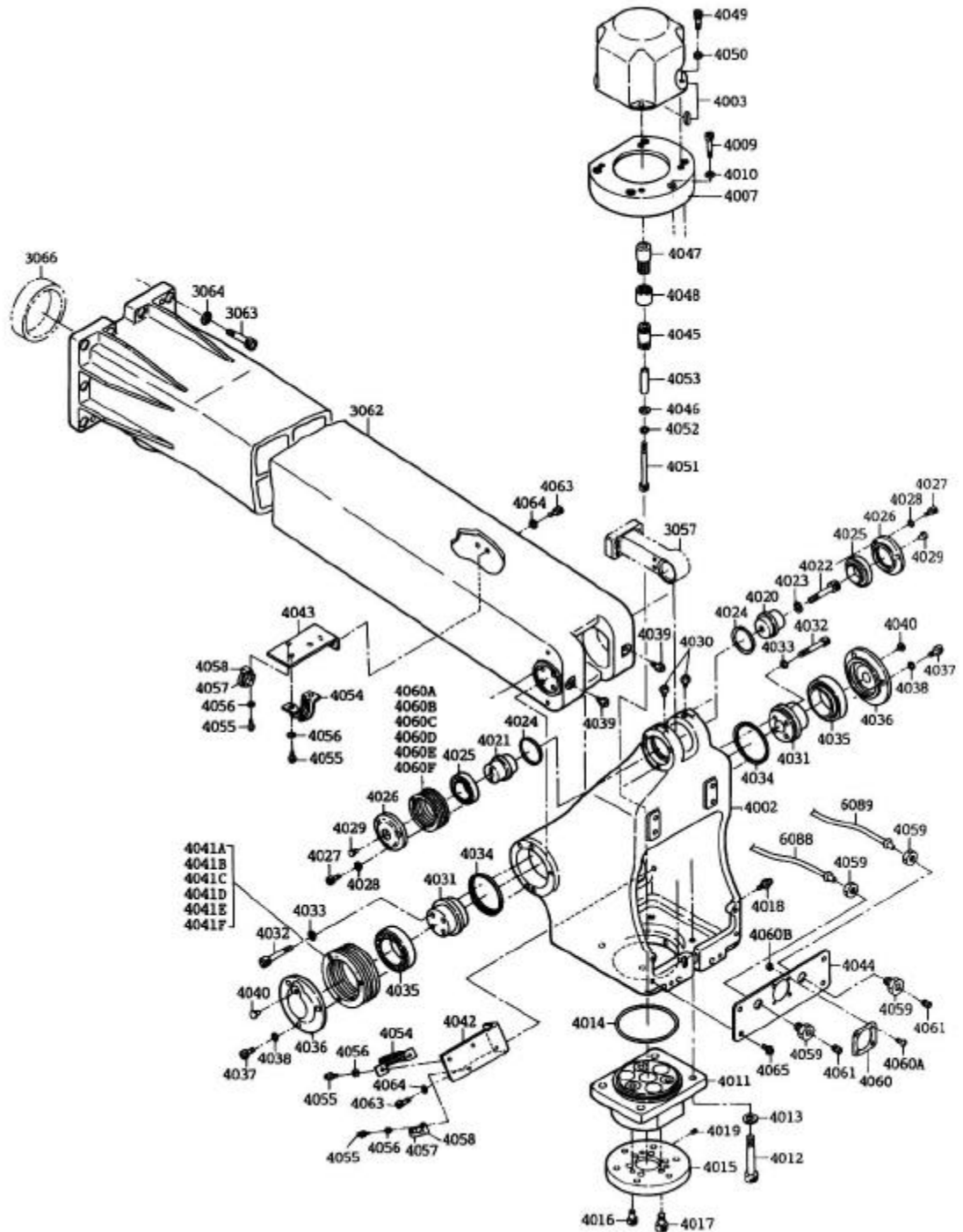
No.	Name	DWG no.	Pcs
3033	Grease nipple	A-PT1/8	2
3034	Plug	PT1/8	1
3035	Link C	HW9301769-2	1
3036	Shaft	HW9301654-1	1
3037	Washer	HW9404205-1	2
3038	Socket screw	M10 × 25	2
3039	Spring washer	2H-10	2
3040	Oil seal	AG3217A4	1
3041	Bearing	HW9481646-A	1
3042	B cover	HW9404361-1	1
3043	Plug	LP-M5	2
3044	Grease nipple	A-PT1/8	1
3045	Shaft	HW9404484-1	1
3046	Shaft	HW9404480-1	1
3047	Socket screw	M12 × 60	1
3048	Spring washer	2H-12	1
3049	Oil seal	AG2835EO	2
3050	Bearing	32008JR	2
3051	B cover	HW9404985-1	2
3052	Socket screw	M5 × 16	6
3053	Spring washer	2H-5	6
3054	Plug	LP-M5	1
3055	Grease nipple	A-PT1/8	2
3056	Shaft	HW9302106-A	1
3057	Frange	HW9302107-A	2
3058	Socket screw	M8 × 20	8
3059	Spring washer	2H-8	8
3060	Cover	HW9404483-1	2
3060A	Cover	HW9404892-1	1
3061	APS bolt	M5 × 10	6
3062	U arm	HW9100834-1	1
3063	Socket screw	M12 × 50	10
3064	Spring washer	2H-12	10
3065	Pin	MSTH6-30	1
3066	Collar	HW9404482-1	1
3067	Link A	HW9100794-1	1
3068	Shaft	HW9403572-1	2
3069	Shaft	HW9403574-1	2
3070	Socket screw	M12 × 70	2



No.	Name	DWG no.	Pcs
3071	Spring washer	2H-12	2
3072	Bearing	HR30208J	4
3073	Oil seal	AG3151EO	4
3074	B cover	HW9403570-1	4
3075	Socket screw	M6 × 20	16
3076	Spring washer	2H-6	16
3077	Grease nipple	A-MT6 × 1	4
3078	Plug	PT1/8	4
3079A	Shim	HW9403657-1	1
3079B	Shim	HW9403657-2	1
3079C	Shim	HW9403657-3	1
3079D	Shim	HW9403657-4	1
3079E	Shim	HW9403657-5	1
3079F	Shim	HW9403657-6	1
3079G	Shim	HW9403657-7	1
3080	Saddle	CD-28	1
3081	APS bolt	M5 × 8	4
3082	Washer	M5	4
3083	Clamp	TAI-S10	2
3084	Insulok' tie	T50R	2
3085A	Shim	HW9404548-1	1
3085B	Shim	HW9404548-2	1
3085C	Shim	HW9404548-3	1
3085D	Shim	HW9404548-4	1
3085E	Shim	HW9404548-5	1
3085F	Shim	HW9404548-6	1
3085G	Shim	HW9404548-7	1
3085H	Shim	HW9404548-8	1



12.4 Wrist unit





No.	Name	DWG no.	Pcs
3056	Flange	HW9302107-A	1
3062	U arm	HW9100834-1	1
3063	Socket screw	M12 × 50	10
3064	Spring washer	2H-12	10
3066	Collar	HW9404482-1	1
4002	Wrist base	HW9100767-1	1
4003	AC servo motor	HW9381363-A	1
4007	M base	HW9302444-1	1
4009	Socket screw	M8 × 40	2
4010	Spring washer	2H-8	2
4011	RV reduction gear	HW9381221-A	1
4012	Socket screw	M14 × 85	4
4013	Washer	GT-SH M14	4
4014	O ring	S132	1
4015	Flange	HW9301425-1	1
4016	Socket screw	M8 × 20	3
4017	Socket screw	M12 × 25	6
4018	Grease nipple	A-PT1/8	1
4019	H set screw	M6 × 10	1
4020	Shaft	HW9404484-1	1
4021	Shaft	HW9404480-1	1
4022	Socket screw	M12 × 60	1
4023	Spring washer	2H-12	1
4024	Oil seal	AG2835EO	2
4025	Bearing	32008JR	2
4026	B cover	HW9404985-1	2
4027	Socket screw	M5 × 16	6
4028	Spring washer	2H-5	6
4029	Plug	LP-M5	2
4030	Grease nipple	A-PT1/8	2
4031	Shaft	HW9404245-1	2
4032	Socket screw	M8 × 60	8
4033	Spring washer	2H-8	8
4034	Oil seal	AG3584AO	2
4035	Bearing	HR32012XJ	2
4036	B cover	HW9404383-1	2
4037	Socket screw	M8 × 20	6
4038	Spring washer	2H-8	6

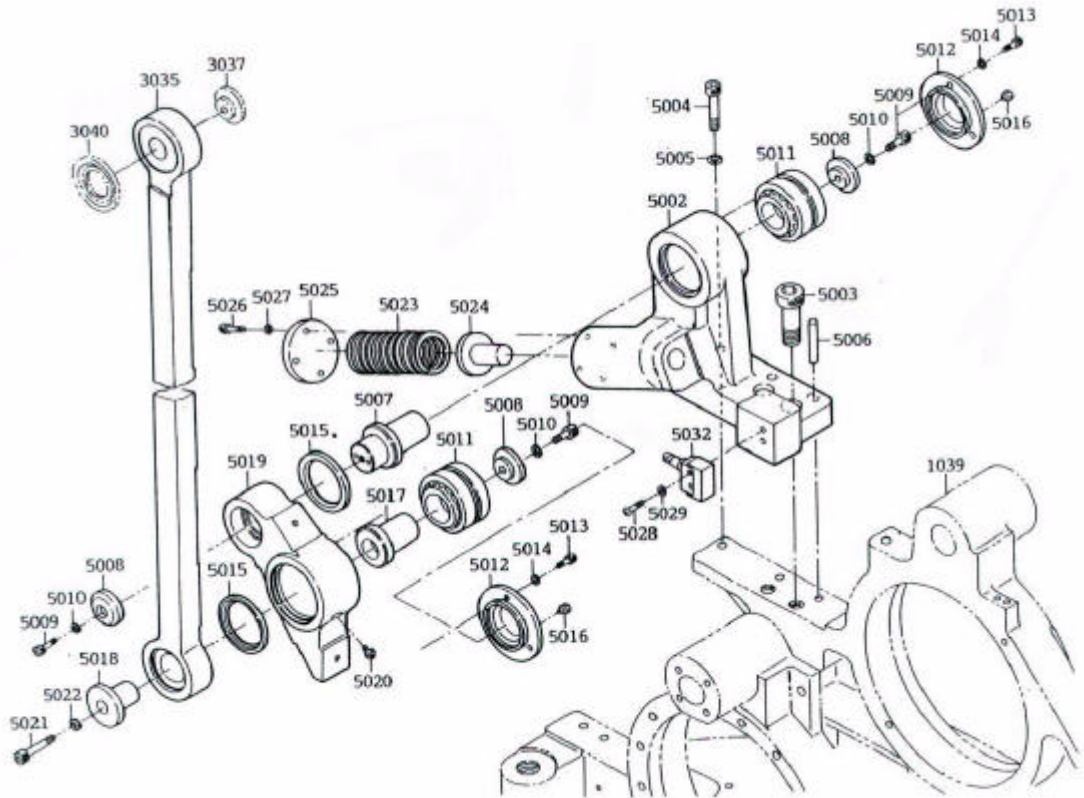


No.	Name	DWG no.	Pcs
4039	Grease nipple	A-PT1/8	2
4040	Plug	LP-M5	2
4041A	Shim	HW9404261-1	1
4041B	Shim	HW9404261-2	1
4041C	Shim	HW9404261-3	1
4041D	Shim	HW9404261-4	1
4041E	Shim	HW9404261-5	1
4041F	Shim	HW9404261-6	1
4042	Plate	HW9404522-1	1
4043	Plate	HW9404523-1	1
4044	Plate	HW9404527-1	1
4045	Gear	HW9481952-A	1
4046	Washer	HW9404651-1	1
4047	Shaft	HW9481951-A	1
4048	Shaft	HW9481950-A	1
4049	Socket screw	M8 × 30	4
4050	Spring washer	2H-8	4
4051	Socket screw	M6 × 100	1
4052	Spring washer	2H-6	1
4053	Pipe	HW9404650-1	1
4054	Saddle	CD-28	2
4055	APS bolt	M5 × 8	6
4056	Washer	M5	6
4057	Insulok' tie	T50R	2
4058	Clamp	TAI-S10	2
4059	Union	KQE10-03	2
4060	Gasket	HW9481087-E	1
4060A	Round head screw	M3 × 12	4
4060B	Nut	M3	4
4061	Plug	PT3/8	2
4062A	Shim	HW9404548-1	1
4062B	Shim	HW9404548-2	1
4062C	Shim	HW9404548-3	1
4062D	Shim	HW9404548-4	1
4062E	Shim	HW9404548-5	1
4062F	Shim	HW9404548-6	1
4063	Socket screw	M5 × 20	4
4064	Spring washer	2H-8	4
4065	APS bolt	M5 × 12	4



No.	Name	DWG no.	Pcs
6088	Air hose	TU1065BU	1
6089	Air hose	TU1065B	1

12.5 Shock sensor unit

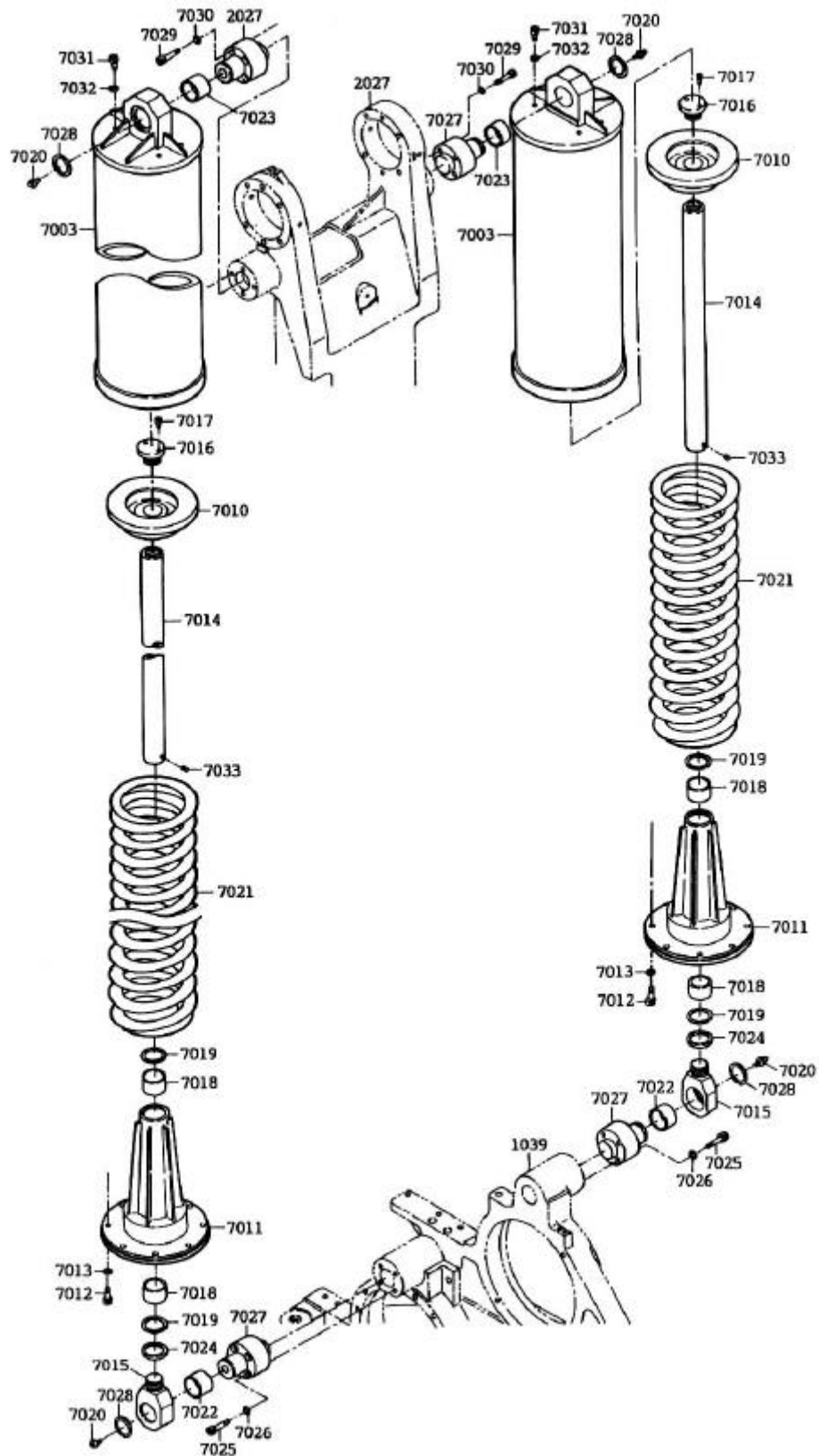




No.	Name	DWG no.	Pcs
1039	S head	HW9100831	1
3035	Link C	HW9301769-2	1
3037	Washer	HW9404205-1	2
3040	Oil seal	AG3217A4	1
5002	base block	HW9100825-1	1
5003	Socket screw	M24 × 60	2
5004	Socket screw	M12 × 60	1
5005	Spring washer	2H-12	1
5006	Pin	MSTM12-60	2
5007	Shaft	HW9301654-1	1
5008	Washer	HW9404205-1	3
5009	Socket screw	M10 × 25	3
5010	Spring washer	2H-10	3
5011	Bearing	HW9481646-A	2
5012	B cover	HW9404361-1	2
5013	Socket screw	M6 × 20	6
5014	Spring washer	2H-6	6
5015	Oil seal	AG3217A4	2
5016	Plug	LP-M5	2
5017	Shaft	HW9404476-1	1
5018	Shaft	HW9404479-1	1
5019	Link	HW9100835-1	1
5020	Grease nipple	A-PT1/8	2
5021	Socket screw	M10 × 50	1
5022	Spring washer	2H-10	1
5023	Spring	TH60X150	1
5024	Pin	HW9404477-1	1
5025	Cover	HW9404478-1	1
5026	Socket screw	M8 × 30	4
5027	Spring washer	2H-8	4
5028	Round head screw	M4 × 25	2
5029	Washer	M4	2
5032	Limit switch	SHL-Q2255 MR 1.0	1

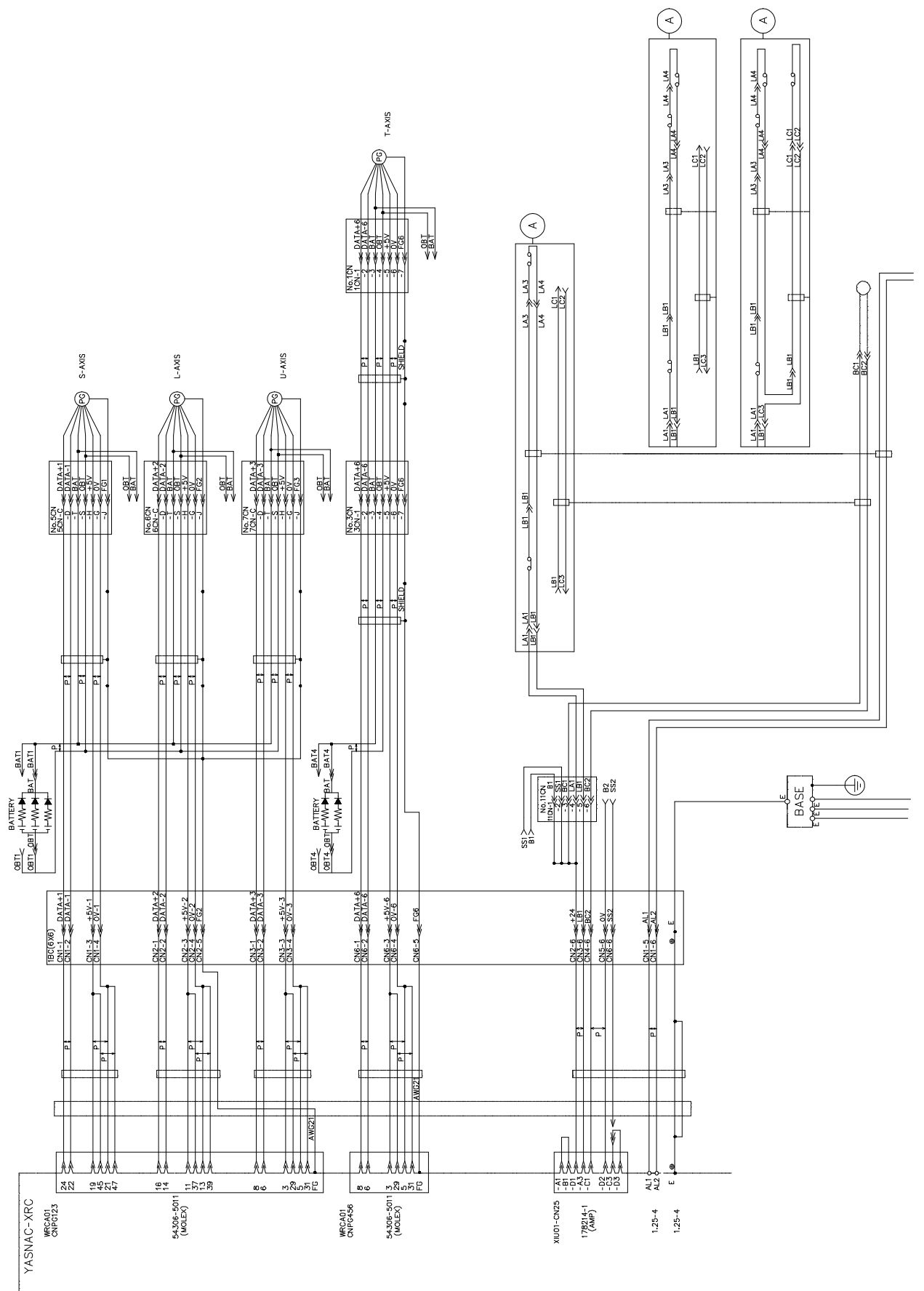


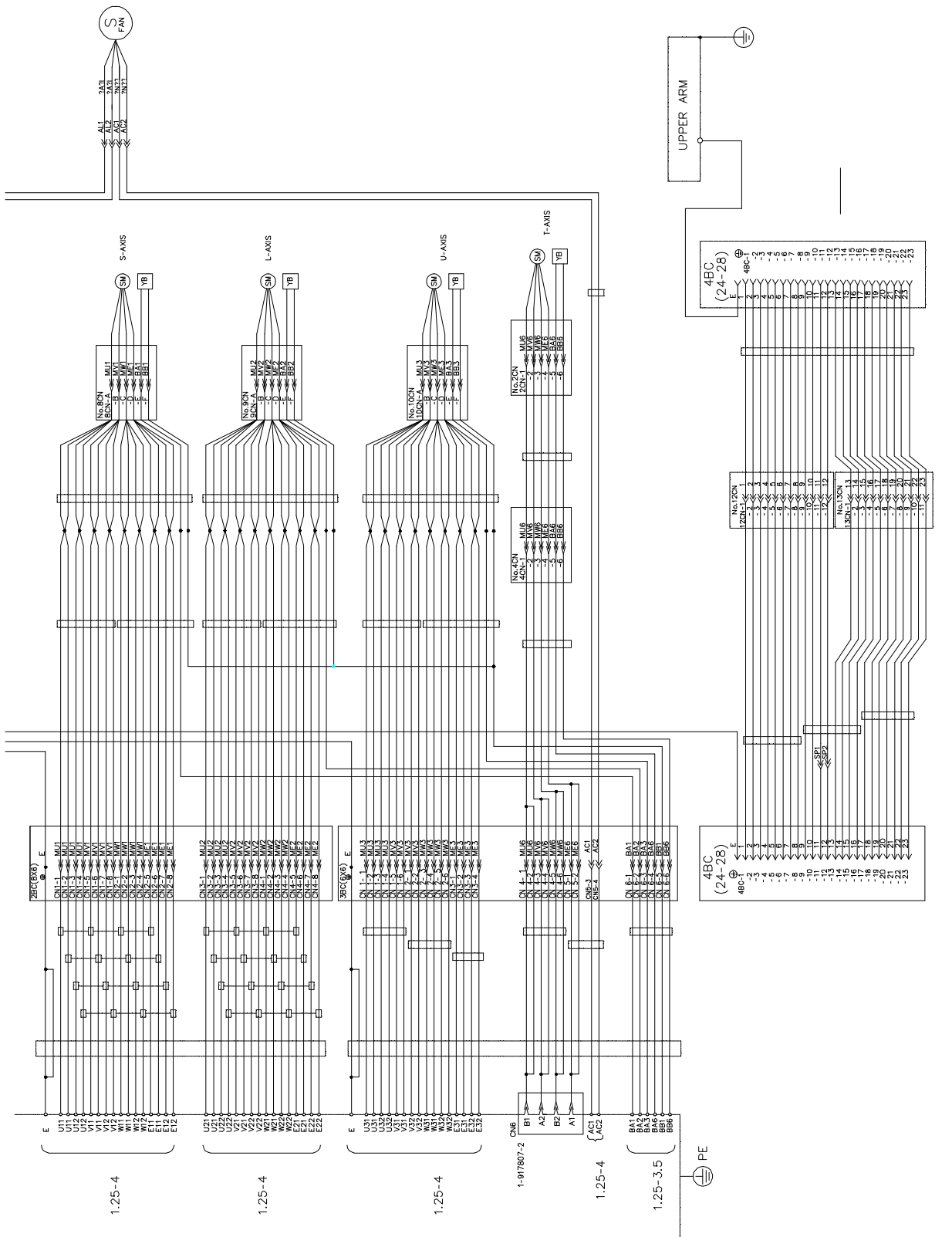
12.6 L- and U-axis balancer unit





No.	Name	DWG no.	Pcs
1039	S head	HW9100831-1	1
2027	L arm	HW9100832-1	1
7003	Case	HW9100867-A	2
7010	Flange	HW9404655-1	2
7011	Flange	HW9200854-1	2
7012	Socket screw	M8 × 25	16
7013	Spring washer	2H-8	16
7014	Rod	HW9301831-2	2
7015	Clevis	HW9404620-1	2
7016	Flange	HW9404619-1	2
7017	Socket screw	M5 × 12	4
7018	Oiless collar	HW9481226-A	4
7019	C stopper	IRTW-55	4
7020	Grease nipple	MT6 × 1	4
7021	Spring	HW9481955-A	2
7022	Oiless collar	HW9481226-A	2
7023	Oiless collar	HW9482010-A	2
7024	Dust seal	FD2633AO	2
7025	Socket screw	M10 × 45	8
7026	Spring washer	2H-10	8
7027	Shaft	HW9301416-1	4
7028	C stopper	STW-45	4
7029	Socket screw	M10 × 45	8
7030	Spring washer	2H-10	8
7031	Socket screw	M8 × 15	8
7032	Spring washer	2H-8	8
7033	Magic screw	M6 × 8	2





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