



**SYNTEC**  
**TECHNOLOGY CO., LTD.**

## Maintenance Manual (C-series)

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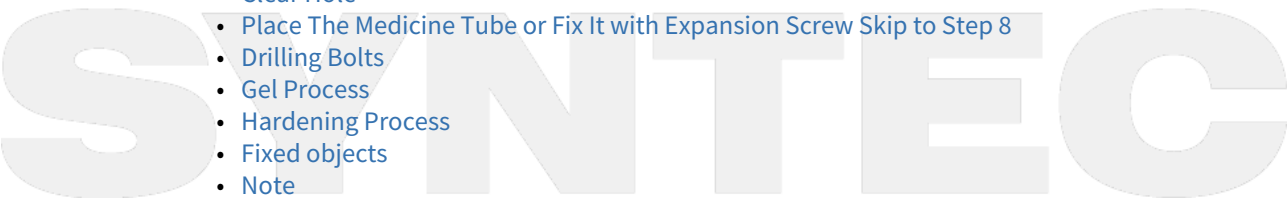


**LEANTEC**  
**INTELLIGENCE**  
聯達智能股份有限公司

联达机器人安装/保养手册

**SYNTEC**

苏州联达自动化设备有限公司  
2019年10月

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# 1 Overview



## Warning

- Maintenance and wiring operations must be done under power off condition, and have a warning sign before performing maintenance.
- It might caused accident such as electric shock, personal injury.



## Cautions

- Maintenance and repair operations need to be done by professionals, else it might caused accident such as electric shock, personal injury.
- Please contact Leantec to perform disassemble and repair works.
- Before changing battery module during maintenance, ensure that the robotic arm already back to home, else the position data will loss and unable to trace it back.

Service and maintenance robot regularly can extend the life of the robot, and must follow the maintenance manual provided by Leantec. The warranty will be voided if failed to do so.

## 1.1 Maintenance Interval and Maintenance Items

Accurate inspection and maintenance items are essential for prevent malfunctions, safety, and enhance the durability of the robot. In order to maintain the efficiency of the robot, it is important to perform maintenance regularly. In addition, the maintenance personnel must prepare the maintenance plan and implement it strictly.

The maintenance and inspection content can be divided to several categories and several stages as shown in table below.

The schedule of maintenance cycle time is according to the time of servo power on.

The maintenance cycle shown in table below is based on the welding robot, it is required to do analysis for other applications. The applications that having high frequency operations such as pick and place are required to shorten the maintenance cycle.

The robot maintenance cycle can be divided to daily, 1000 Hours, 5000 Hours, 12000 Hours, 24000 Hours. Below showed the content for maintenance items.

Maintenance Cycle	Inspection and Maintenance Content	Remarks
Daily	Home position marking	Same as robot home position
	Abnormal noise and vibration	
	Function of motor brake	Listen to the sound of the each motor when the brake is released

Maintenance Cycle	Inspection and Maintenance Content	Remarks
	Oil leaking inspection	Check the installation surface of each reducer
	External visible screws	Fixing screws on robot arm body
1000 Hours	Screw bolt of the robot base	
	External cable	Check the condition of the cable (cleanliness, damage, etc.)
	Remove dust and debris	Especially the ventilation cooling system and electrical box
5000 Hours	Battery replacement of Robot	
	Timing belt	Inspect the timing belt condition (Tension, wears down, etc.)
12000 Hours	Battery replacement of Robot	Replace the battery when battery low voltage alarm pop out during the startup of the system or every year
	Checking internal cable	Port connectivity, Wear of metal contact parts
	Surrounding screws of axis	
	Screws of motor, reducer, etc	
24000 Hours	Internal cable	Replace

## 1.2 Tightening of hexagon socket screws

Hex socket screw is used at the location where required to ensure the strength of the connection. Please follow the torque showed in table below for corresponding screw size during assembly. Please use torque wrench to tighten the screw according to the table below besides specific situation.

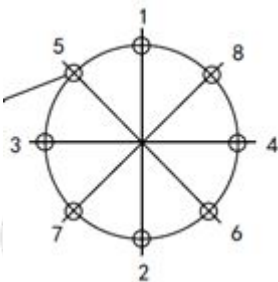
No.	Screw Size	Torque (N•m)
1	M2	0.5

No.	Screw Size	Torque (N•m)
2	M3	2
3	M4	4
4	M5	9
5	M6	15
6	M8	35
7	M10	70
8	M12	125

Refer to table below during the installation of pulley roller.

No.	Screw Size	Torque (N•m)
1	M4	2.0
2	M5	3.9

It is recommended to follow the sequence for tighten hexagon socket screw as shown in figure below. Please do not tighten the screw in one shot, and use torque wrench to tighten the screw for 2-3 times by referring to torque listed in table above.







## 2 Replace Battery

The batteries of the robot are used to record the position data of each axis, hence the batteries are required to replace every 12000 hours. It is allowed user to replace the batteries when battery low voltage alarm is appeared, the position of the robot will loss if the user did not replace the battery as soon as possible.

Procedures of battery replacement:

- Keep the power supply of the robot on, then press the emergency stop button.
- Open battery installation cover and take out the old battery module. (Recommend to use the original battery module)
- Replace it with the new battery module and ensured the batteries are plugged in.
- Tighten the screw of the battery installation cover.

Steps	Old Battery Module	New Battery Module
1		
2		
Part No.	R01-LJ-BATT-01	R01-LJ-BATT-02

### 3 Replace Lubricant Oil

The robot is required to replace the lubricant oil of RV reducer and gear box every 6000 hours. It is recommended to use international standard lubricant oil model: MOLYWHITE RE No.00;

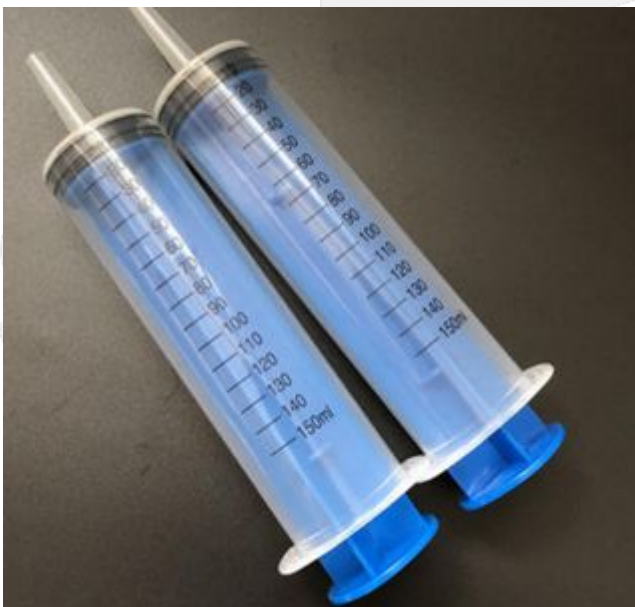


3-1 Figure of Specific Standard

#### Lubricant Oil

### 3.1 Replace RV Reducer Lubricant Oil

The joints of robotic arm that used RV reducer are required to replace lubricant oil regularly. Generally, the 1st, 2nd, and 3rd axis of the robot below 20kg maximum payload are used RV reducer.



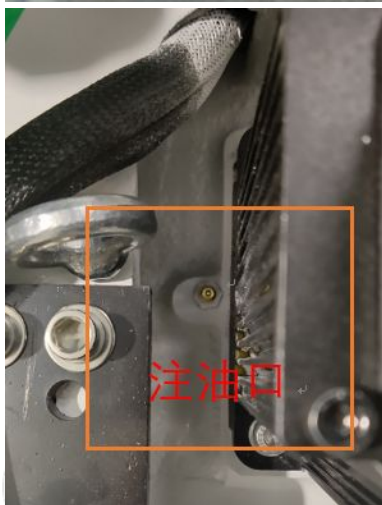
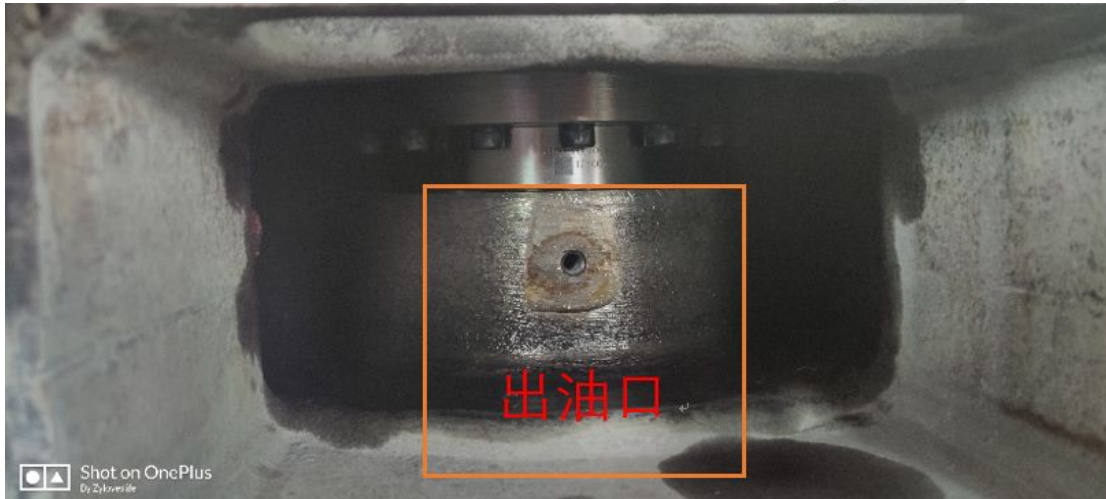


### 3.1-1 Figure of Lubricant Oil Injector

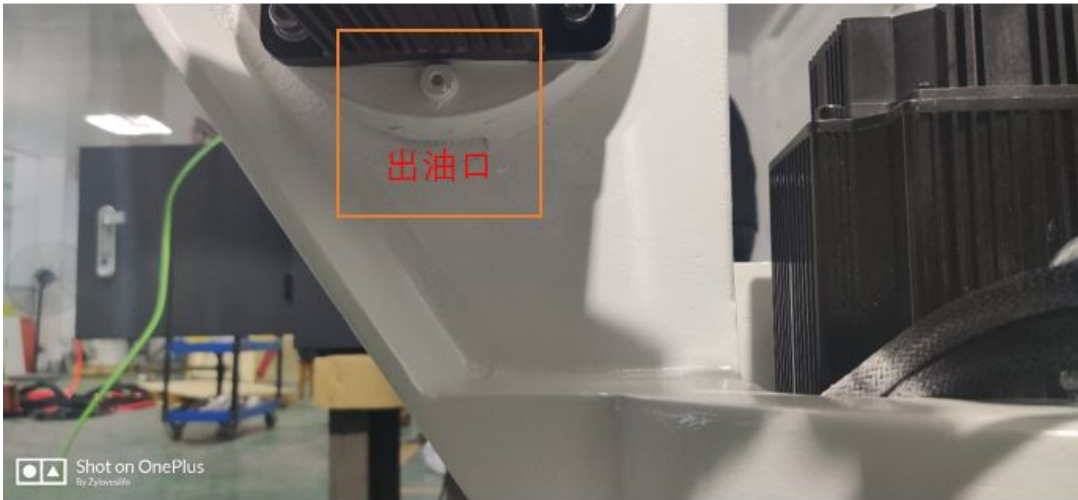
Procedure of Replacing Lubricant Oil:

- Shut down the robot.
- Take off the clogging of the oil inlet and outlet of corresponding joint.
- Inject the lubricant oil from the oil inlet by using oil injector until the oil outlet flowed out the new lubricant oil. Then insert the clogging to the oil inlet and outlet.
- Move the axis that got lubricant oil replacement for a while until the redundant oil flows out.

**Location of oil outlet and inlet of C1 Axis:**



**Location of oil outlet and inlet of C2 Axis:**



**Location of oil outlet and inlet of C3 Axis:**

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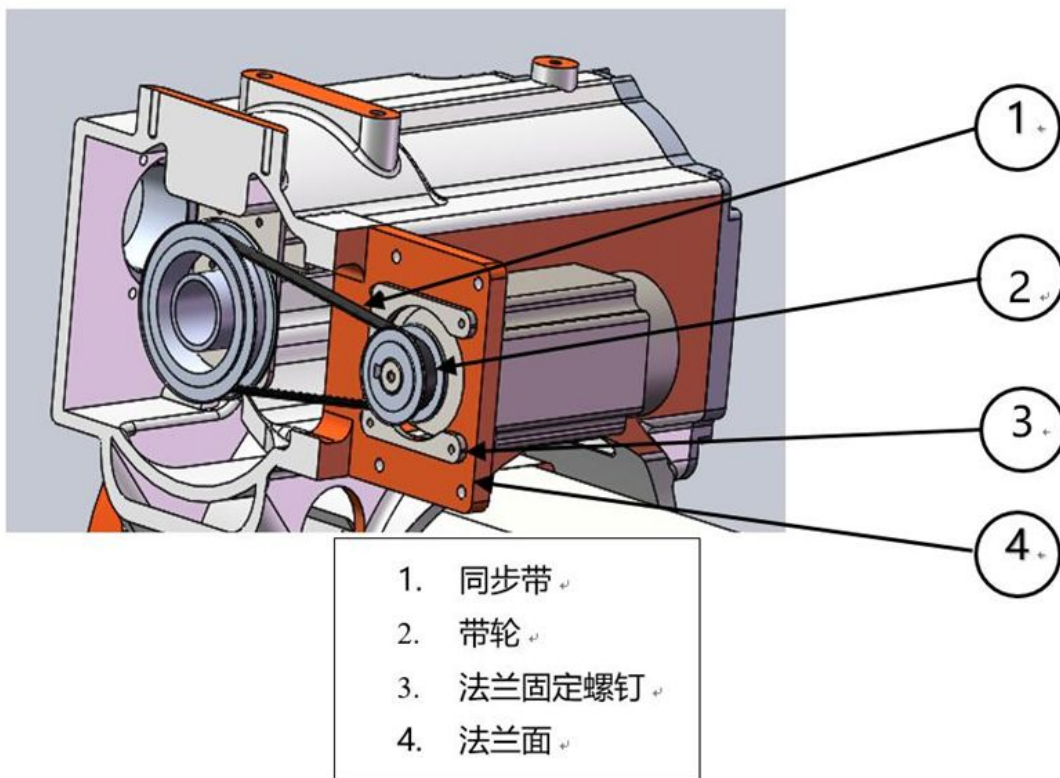
## 4 Inspection of Timing Belt

The harmonic reducer is used in 4th, 5th, and 6th axis of robot below 20kg payload, and moving by using timing belt.

Procedure of timing belt inspection:

- Shut down the robot.
- Open the motor cover of 4th and 5th axis.
- Check the degree of wear of the timing belt and adjust the tightness of the timing belt.
- Install the motor cover of 4th and 5th axis.
- Note: Do not remove the timing belt, which will caused the position loss of the robot.

### 4.1 Figure of Timing Belt of 4th Axis



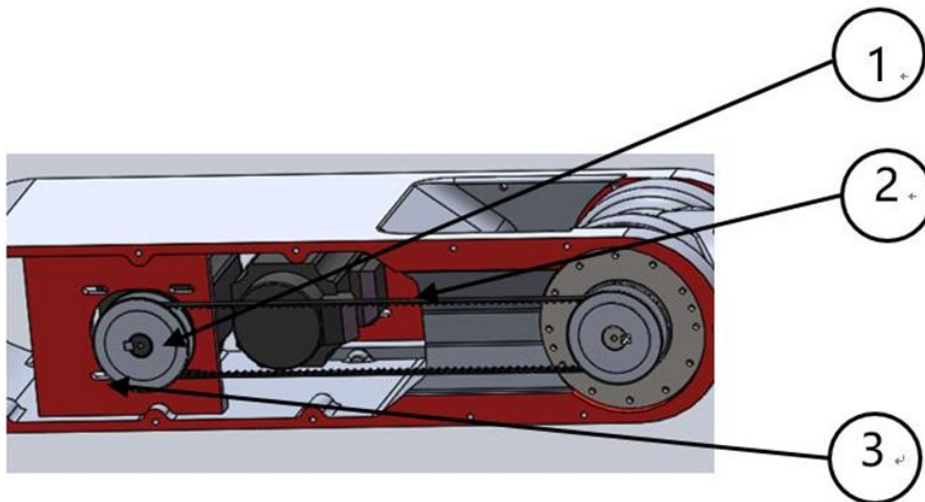
#### 4.1 Figure of Timing Belt of 4th Axis Inspection

1. Timing Belt
2. Pulley Roller
3. Flange Fix Screws
4. Flange Surface

Take off the motor cover of 4th axis and use belt tension meter to measure the tension of the timing belt. The standard tension of the timing belt is between  $45\pm 6\text{N}$  (The tension of the timing belt will reduce to 70% of the standard tension, hence adjust the tension of the timing belt according to 70% of standard tension). If the measured result is not in the tension range, please follow the procedure below to perform timing belt tension adjustment:

- Loosen the flange fixing screws. (4 in total, loosen until the pulley can move freely);
- Adjust the tension of the belt according to the requirement;
- Tighten the flange fixing screws with torque wrench (The torque can refer the table in section 1.2);
- Install the motor cover for 4th axis;
- Please replace the timing belt if wears down as soon as possible, and remastering the home position after replace timing belt.

## 4.2 Figure of Timing Belt of 5th Axis



- |             |
|-------------|
| 1. 带轮 ↵     |
| 2. 同步带 ↵    |
| 3. 法兰固定螺钉 ↵ |

### 4.2 Figure of Timing Belt of 5th Axis Inspection

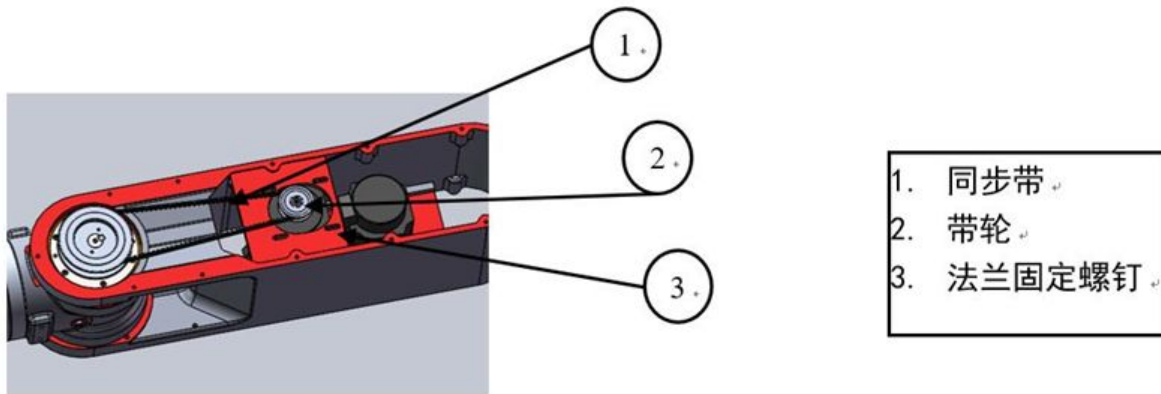
1. Pulley Roller
2. Timing Belt
3. Flange Fixing Screws

Take off the left cover of 5th Axis and use belt tension meter to measure the tension of the timing belt. The standard tension of the timing belt is between  $30\pm 6N$  (The tension of the timing belt will reduce to 70% of the standard tension, hence adjust the tension of the timing belt according to 70% of standard tension). If the measured result is not in the tension range, please follow the procedure below to perform timing belt tension adjustment:

- Loosen the flange fixing screws. (4 in total, loosen until the pulley can move freely);
- Adjust the tension of the belt according to the requirement;
- Tighten the flange fixing screws with torque wrench (The torque can refer the table in section 1.2);
- Install the left cover for 5th axis;
- Please replace the timing belt if wears down as soon as possible, and remastering the home position after replace timing belt.



### 4.3 Figure of Timing Belt of 6th Axis



#### 4.3 Figure of Timing Belt of 6th Axis Inspection

1. Timing Belt
2. Pulley Roller
3. Flange Fixing Screws

Take off the right cover of 5th Axis and use belt tension meter to measure the tension of the timing belt. The standard tension of the timing belt is between  $35\pm 5\text{N}$  (The tension of the timing belt will reduce to 70% of the standard tension, hence adjust the tension of the timing belt according to 70% of standard tension). If the measured result is not in the tension range, please follow the procedure below to perform timing belt tension adjustment:

- Loosen the flange fixing screws. (4 in total, loosen until the pulley can move freely);
- Adjust the tension of the belt according to the requirement;
- Tighten the flange fixing screws with torque wrench (The torque can refer the table in section 1.2);
- Install the right cover for 5th axis;
- Please replace the timing belt if wears down as soon as possible, and remastering the home position after replace timing belt.

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## 5 Troubleshooting

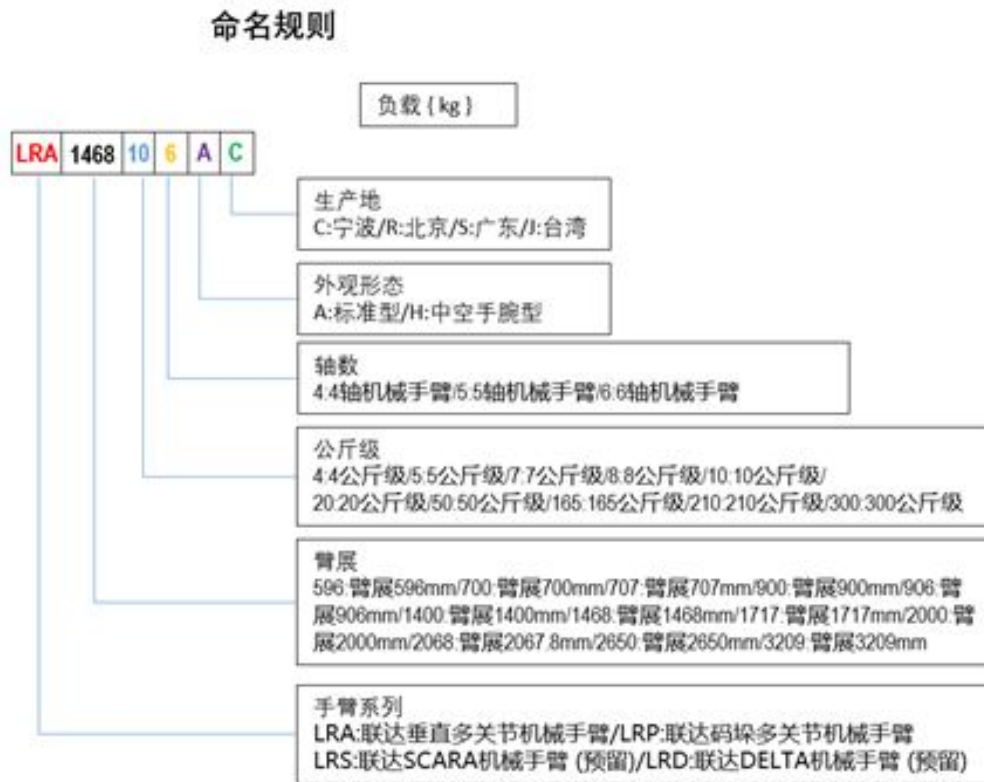
Please stop operating the robot if the robot is faulty and contact the personal who have been trained to perform troubleshooting to figure out the faulty part of the robot. Please contact Syntec if the spare parts are required to replace and do not disassemble the robot.



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## 6 Specification

### 6.1 Model Description



**Figure 6.1-1 Articulated Robotic Arm Naming Rules**

**LRA-1468-10-6-A-C**

| | | | |  
 (1) (2) (3)(4)(5)(6)

**(1) Arm Series:**

1. LRA- Leantec Artic Robot
2. LRP- Leantec Palletizer Robot
3. LRS- Leantec Scara Robot
4. LRD- Leantec Delta Robot

**(2) Arm Max. Reach (in mm)**

**(3) Max. Load Capacity (in kg)**

**(4) Number of Axis**

**(5) Appearance:** A (Standard) ; H (Hollow Wrist Type)

**(6) Manufacture Origin:** C (Ningbo); R (Beijing); S (Guangdong); J (Taiwan)



## 6.2 Robot Model and Corresponding Maximum Load Capacity

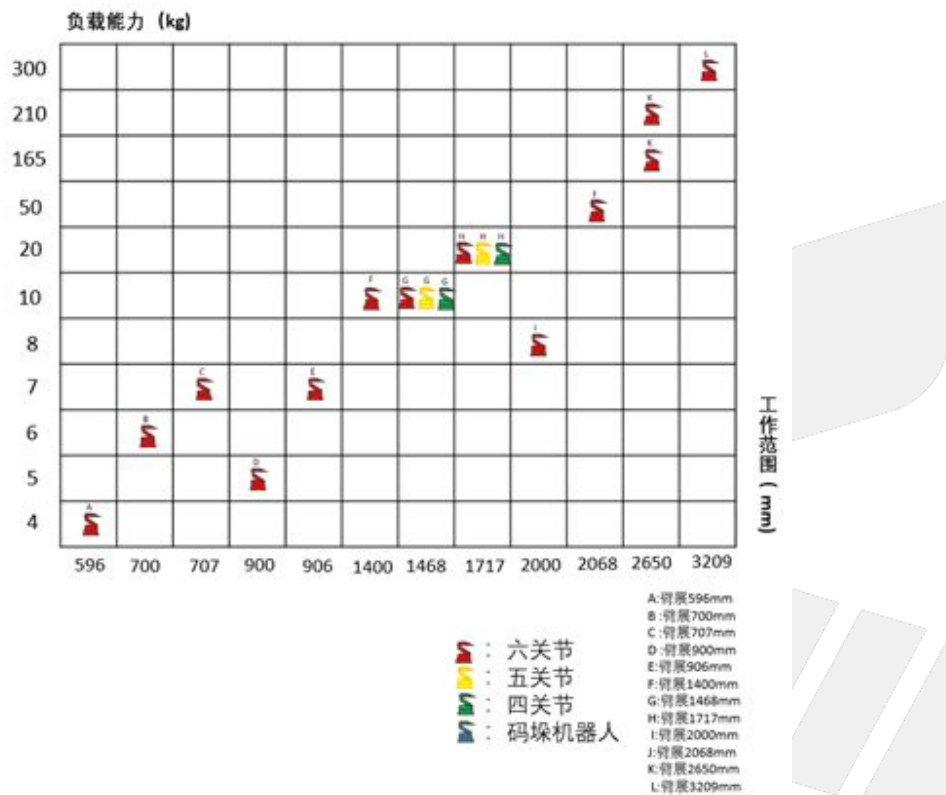


Figure 6.2-2 Load Capacity of Articulated Arm

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## 7 Installation Manual of 10/20KG Robotic Arm

### 7.1 Safety Precautions

- Safety Information

This chapter describes the information for operating the robotic arm safely, hence please read the content in this chapter before operating the robot. The users of LEANTEC industrial robot are required to design and install the safety mechanism and devices that comply with industry safety regulations to protect safety for the individuals.

- Safety Related Description

#### a. Operator:

- Power on or cut off the power supply of the system
- Cycle start or stop the program
- Restore system alarm state

#### b. Programmer:

- Able to perform the job of operator
- Able to teach point for the robotic arm

#### c. Technical Personnel:

- Able to perform the job of programmer
- Able to perform maintenance job

#### d. Programmer and technical personnel are required to receive training from manufacturer

#### e. General considerations



#### Warning

- All operating procedures must be professionally evaluated and based on relevant industrial safety regulations.
- The operator and user of the robot are required to wear Personal Protective Equipment (PPE) before operate the robot.
- Please press the emergency stop button immediately when individual is under dangerous or other emergency situations due to robot arm, and use manual mode to move the robot away from the danger situation slowly.
- The robot arm and the whole system must be under the consideration when considering the safety of the robotic arm. Moreover, it is required to set up fencing or other safety devices when operating the robot arm, and the operator can only operates the robot outside of the fences.
- It is required to set up a safe zone outside of the working range of the robotic arm, and denial unauthorized individual to enter by using appropriate safety devices.
- The drop parts might cause injury to the operator when installing or removing the mechanical parts.
- Ensure that the weight of the workpiece is not more than maximum payload or maximum torque capacity of the robot arm, else it might caused the servo alarm or faulty.
- Any actions of climbing the robot arm is prohibited.
- Adding additional emergency system, which defined by system integrator and comply with ISO 10218-1/-2.



**Caution**

- The personnel of robotic arm installation must proceed the related educational training and permission.
- It is required to follow the instruction of robotic installation in this manual and comply with related industry safety regulations in order to protect individuals.
- Avoid locate the controller electrical box at high voltage or other devices that produced electromagnetic field, as the electromagnetic field could affect the movement of the robotic arm or causing the robot arm faulty.
- Using spare parts from other manufacturer could damage the robotic arm or causing it faulty.
- Be careful of the heat produced by controller and servo motor.
- Do not over bending the power signal line, which could causing unpredictable danger.

f. Considerations during operation



**Warning**

- Programming must be performed outside of the fences. Press the emergency stop button if it is required to enter fencing area.

g. Considerations during maintenance



**Warning**

- Please contact LEANTEC if requires to perform maintenance that not specified by LEANTEC.
- Please contact LEANTEC if requires to change the spare parts that not specified by LEANTEC.
- Perform maintenance regularly, else the life of the robotic arm will be affected or could involved in other unpredictable danger.
- Power off all the power supply before maintenance.
- Maintenance must be performed by authorized personnel, who understand the installation of the system and the other potential risks.
- Avoid other objects enter the robotic arm when changing parts.

h. Considerations when using hydraulic and pneumatic system



**Warning**

- The holding workpiece could drop due to insufficient pressure or gravitation when using hydraulic or pneumatic system.
- Hydraulic and pneumatic system requires to install safety valve for emergency purpose.

i. Considerations of emergency stop button



**Warning**

- At least one of the component of the system (robotic arm or other control devices) could able to perform emergency stop during operation such as emergency stop button.

- Emergency stop button required to locate at the location where can access easily, which can stop the robot immediately.
- The power supply for the servo motor will be cut off from the servo and stop the movement of the robot, and cut off the control system of the robotic arm as well when the performing emergency stop. Release the emergency stop button to make the robot back to ready state.
- Avoid using emergency stop to replace other normal pausing process, to avoid unnecessary wear and tear for the robot arm.

## 7.2 Expected Operation Environment

- LEANTEC industrial robotic arm is suitable for several applications such as pick and place, palletizer, welding. However, it only allows to operate under specific environment as shown in table below.

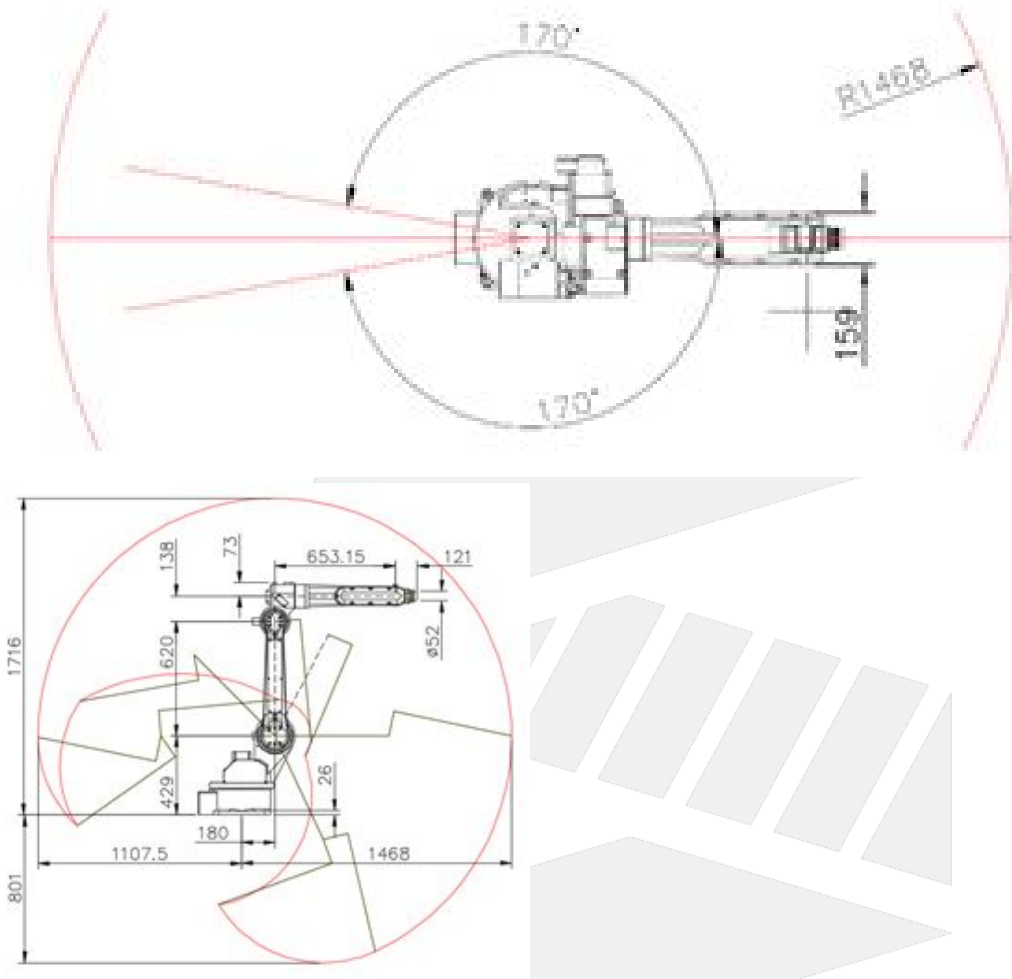
Installation Environment	
Temperature	0~40°C
Humidity	Below 75% R.H
Allowable Height	Altitude below 1000m
Allowable Vibrations	Below 0.5G

- The robot arm is not allow to operate in situations below:
  1. Potential explosive environment.
  2. Corrosive environment.
  3. Flammable environment.
  4. Radiation environment.
  5. Environment without risk assessment.
  6. Used for transportation of human or animals.
  7. Operation outside the allowed usage parameters.

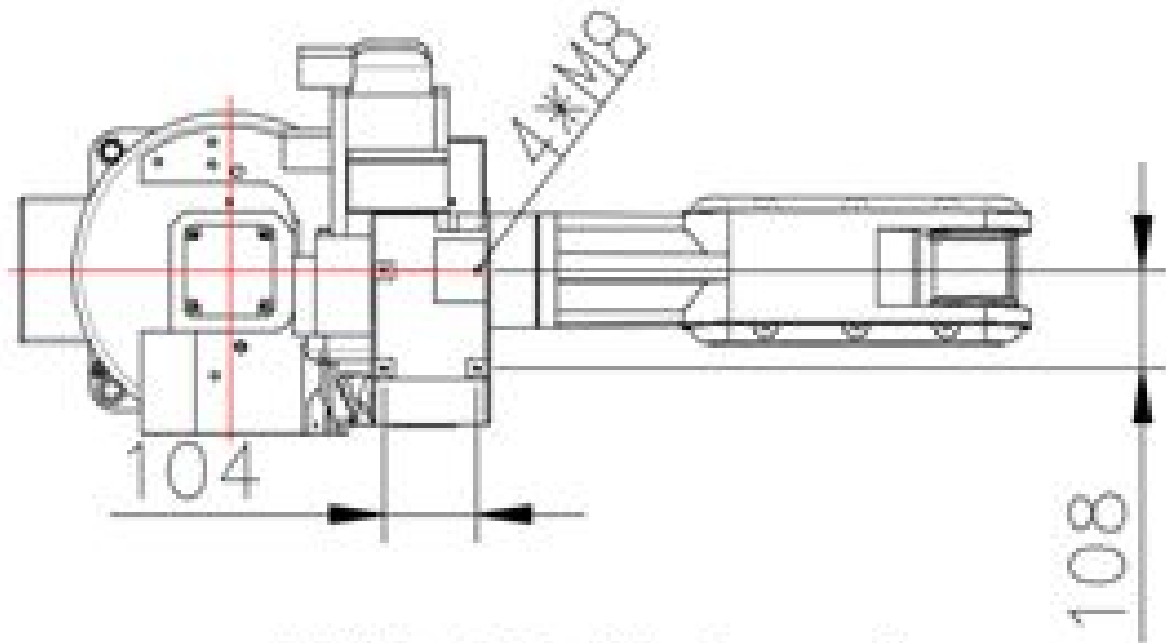
Note: When the arm stops for a long time on a rest day or in near 0°C environment, the movable part will have a large resistance at the beginning of the operation. It is recommended to warm up the machine at a low speed before operation.

## 7.3 Robot Arm Dimension

- Arm size and range of motion



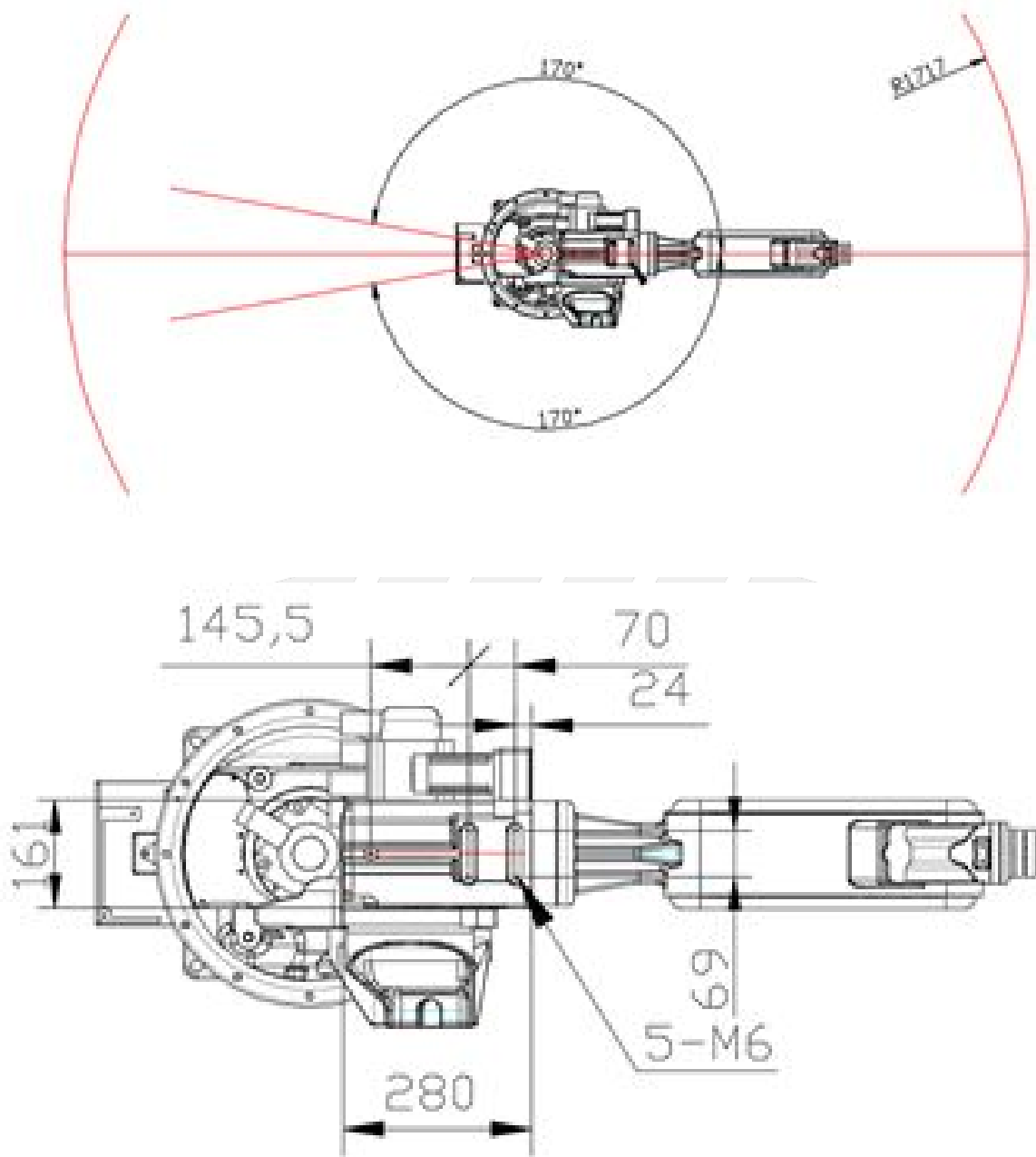
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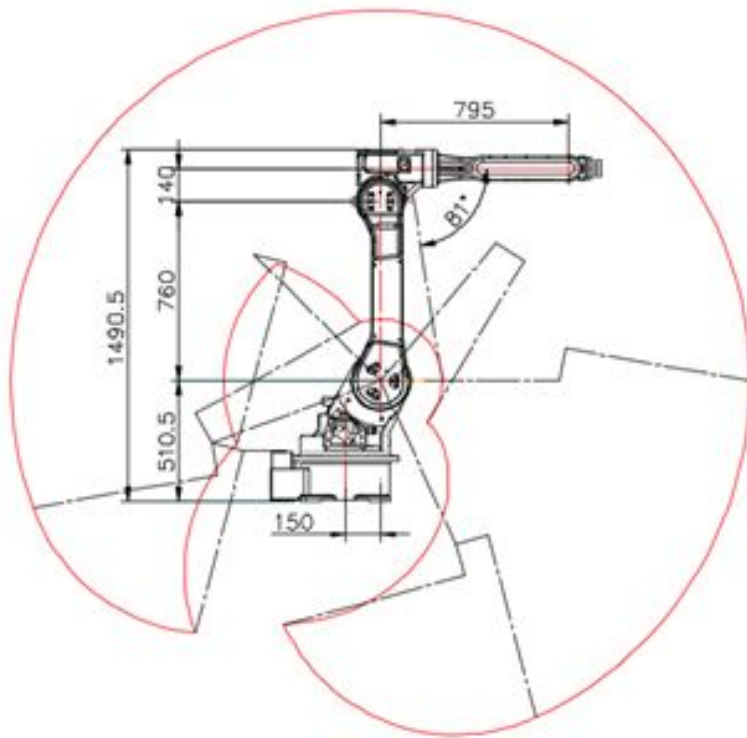
## J4轴辅助安装孔尺寸

Figure 7.3-1 Working Range of LRA1468-10-6A-C

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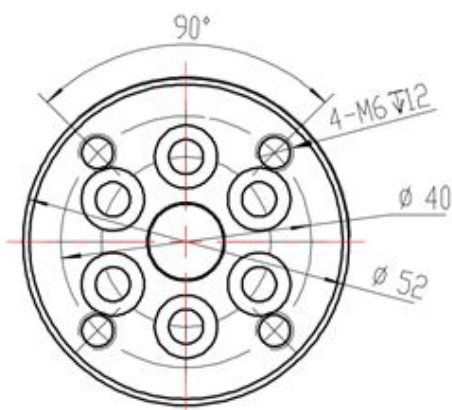


## J4 轴辅助安装尺寸



**Figure 7.3-2 Working Range of LRA1717-20-6A-C**

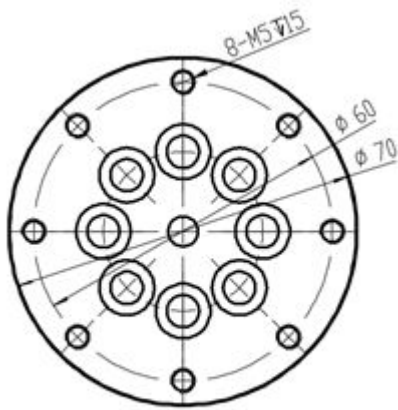
- Arm Flange



末端法兰安装尺寸

**Figure 7.3-3 Arm Flange of LRA1468-10-6A-C**





末端法兰安装尺寸

Figure 7.3-4 Arm Flange of LRA1717-20-6A-C

## 7.4 Standard Drawing of Robot Base

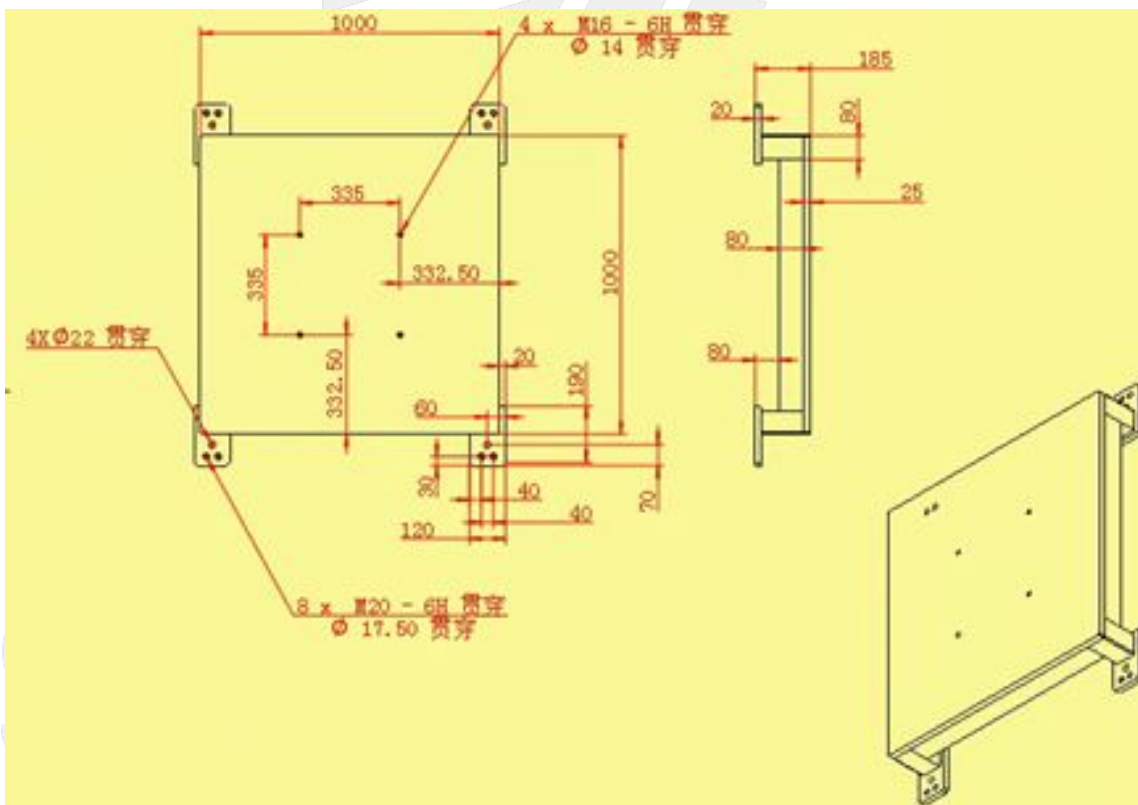


Figure 7.4-1 Station Plate (Common use for 1468 & 1717)

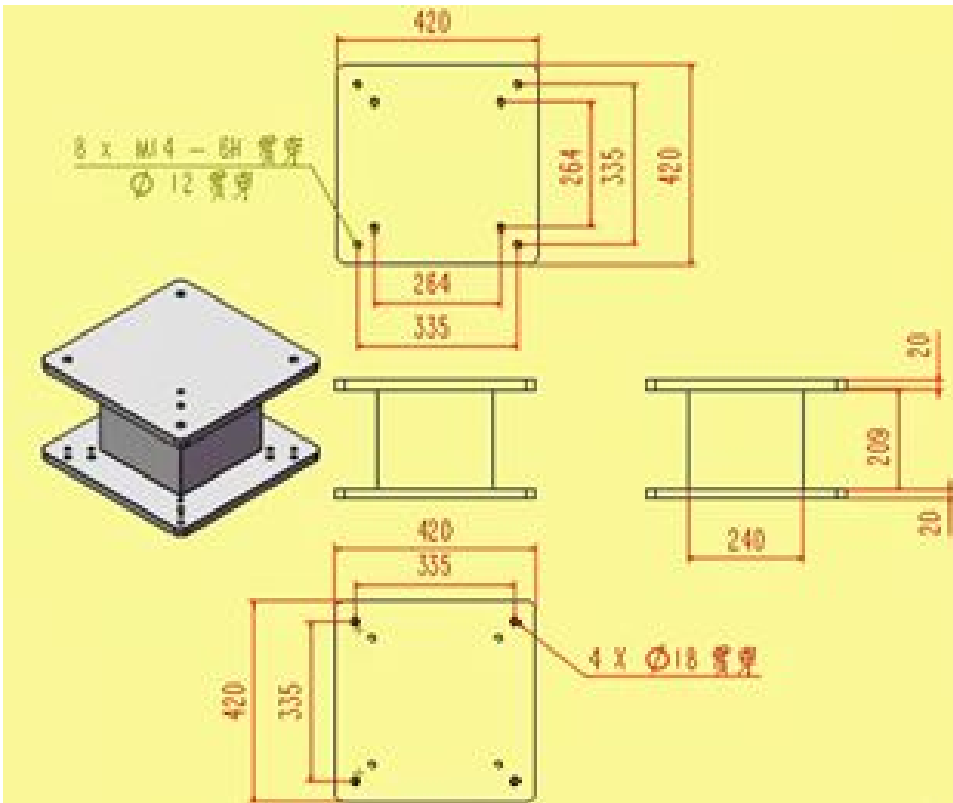






Figure 7.4-2 I-shaped base (Common use for 1468 & 1717)

## 7.5 Sticker Description

Table 7.5-1 Sticker Description on Robotic Arm

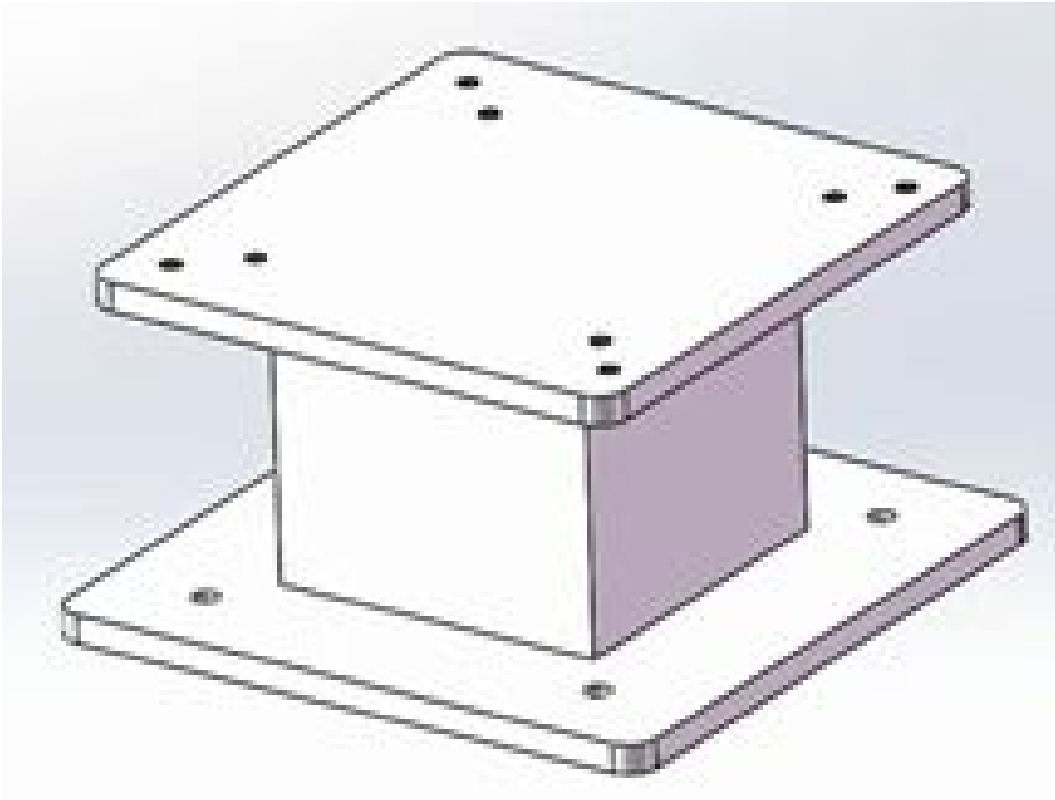
Sticker	Name	Description
	Collision hazard sign	Keep a safe distance when robotic arm is in operation to avoid collision.

Sticker	Name	Description
	<b>Specification label</b>	<b>Label the specifications of the robotic arm and manufacture dates.</b>
	<b>Grounding Sign</b>	<b>Robotic arm must be connected to the ground to prevent electrical shock.</b>
	<b>Electrical Shock Hazard Sign</b>	<b>Robotic arm might have potential electrical shock risks.</b>
	<b>Operate Carefully Sign</b>	<b>Be careful when operating robotic arm, and predict the movement of robotic arm.</b>

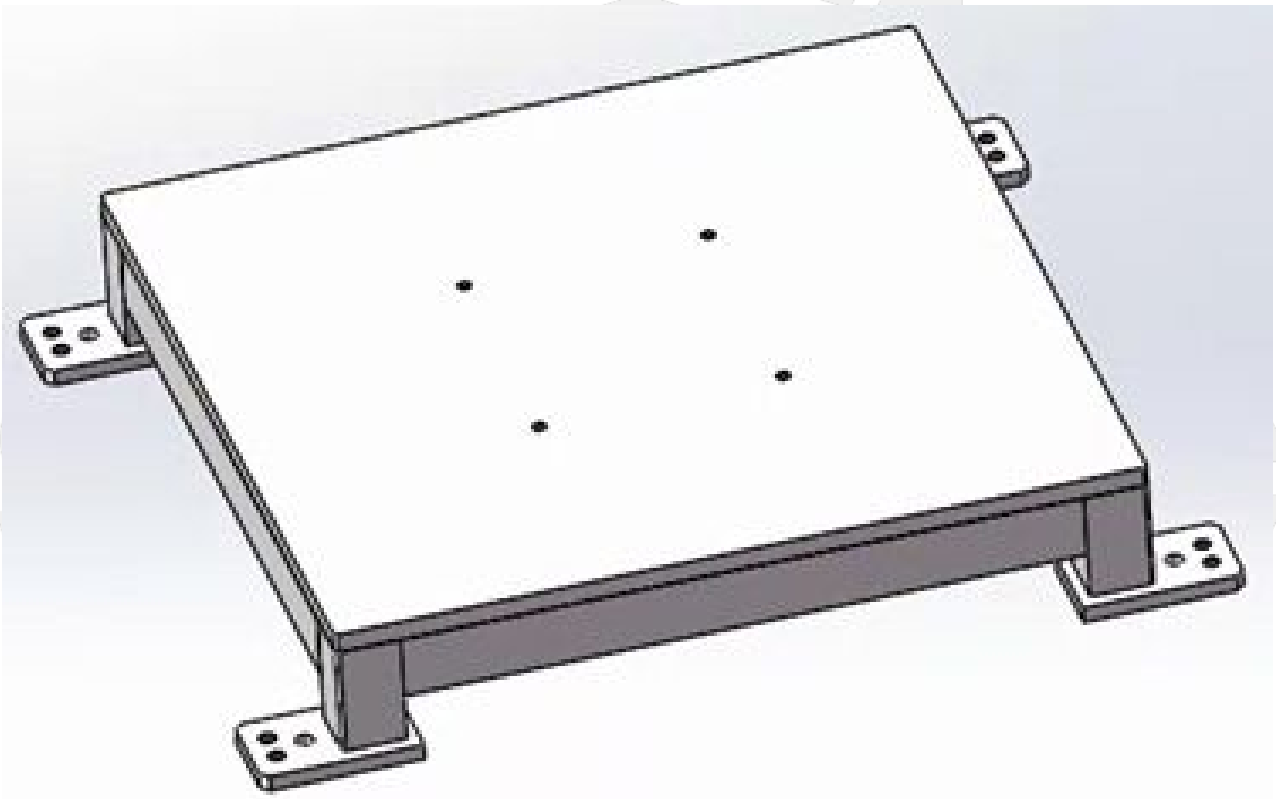
## 7.6 Connection between I-shaped Base and Station Plate

- Robot Base (Common use for 1468 & 1717)

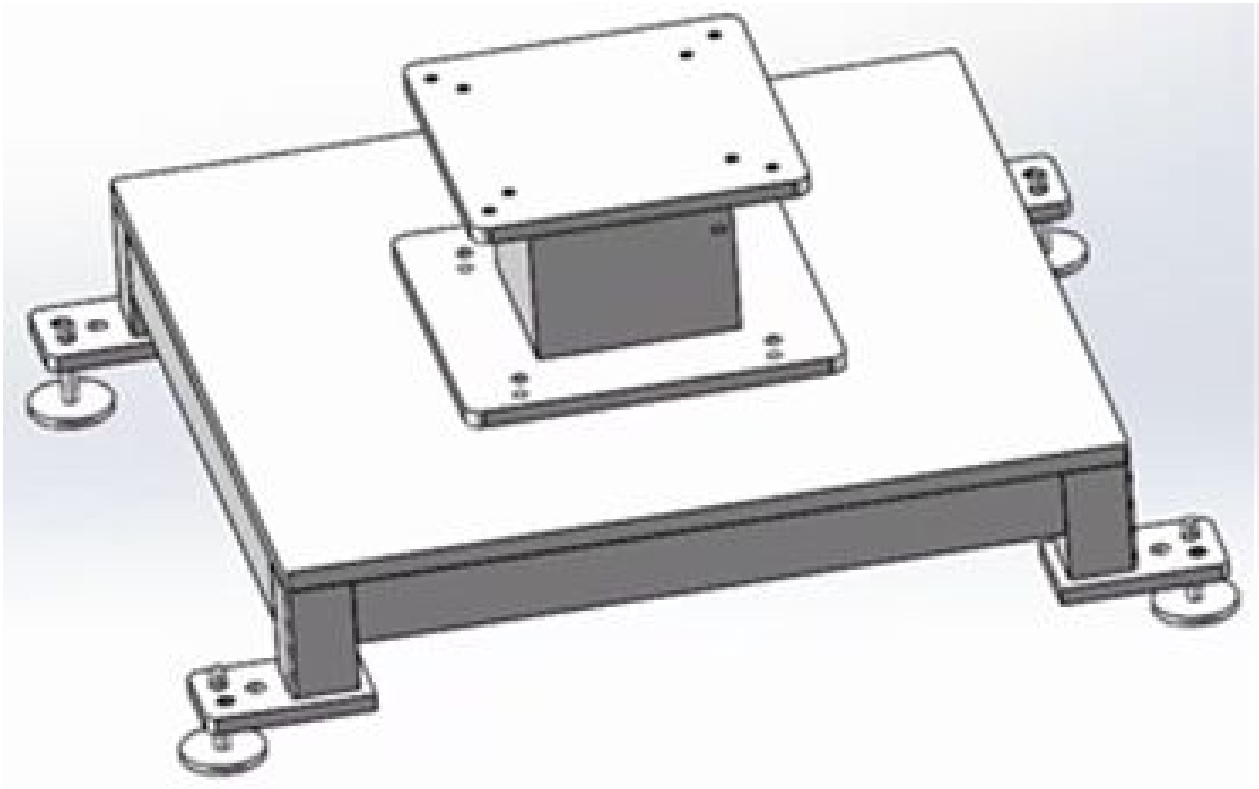
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**Figure 7.6-1 I-shaped Base in 3D**

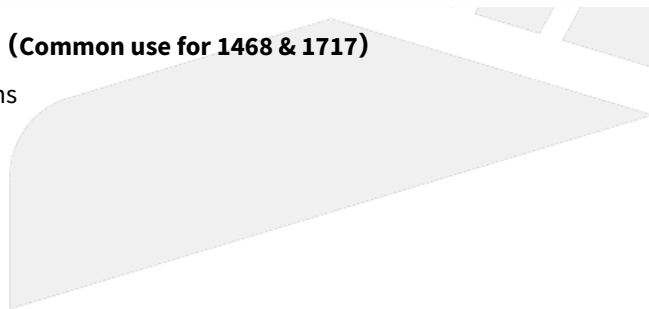


**Figure 7.6-2 Station Plate in 3D**



**Figure 7.6-3 Station Plate (Common use for 1468 & 1717)**

- Keyhole specifications



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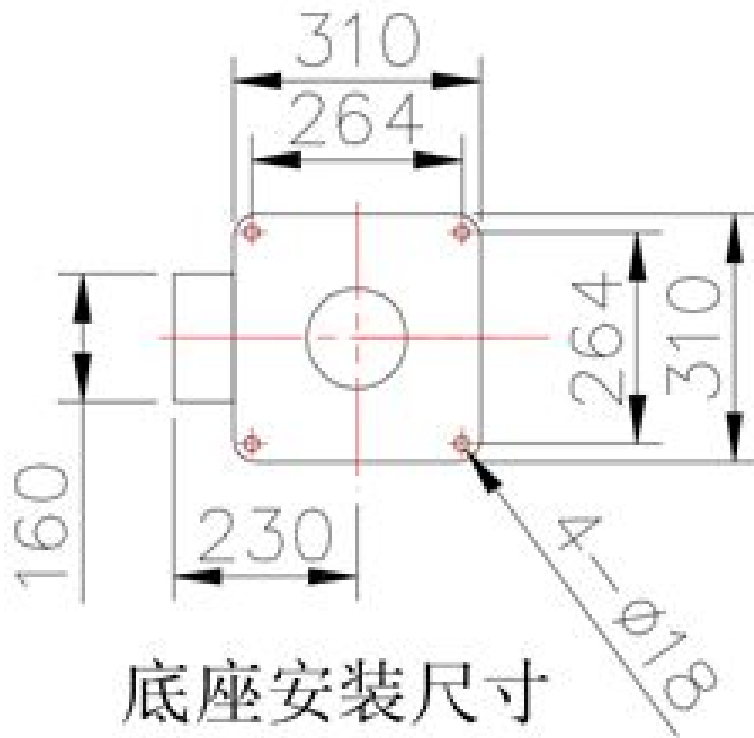
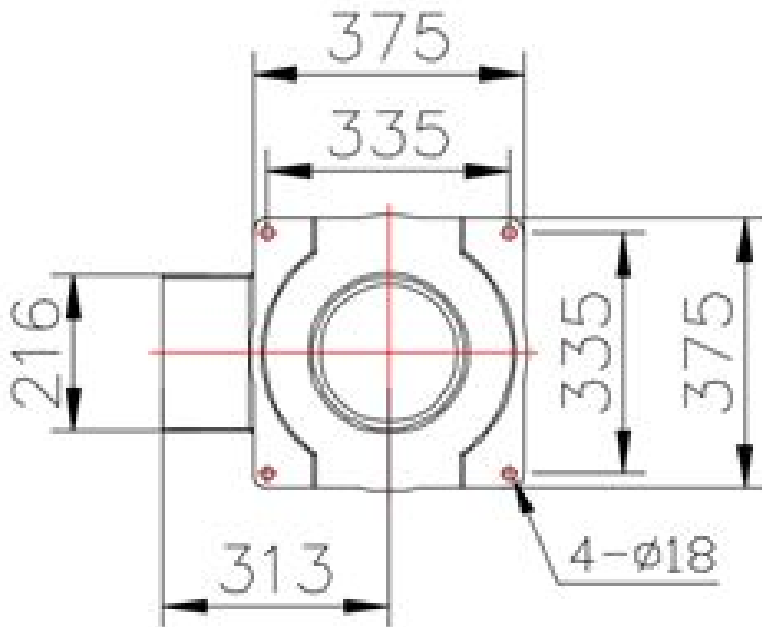


Figure 7.6-4 10KG Articulated robot arm base flange



**Figure 7.6-5 20KG Articulated robot arm base flange**

## 7.7 Connection between I-shaped Based and Ground

By using installation of LRA1468-10-6A-C as example, can apply on LRA1717-20-6A-C as well:

### 7.7.1 Hardware Preparation

**Table 7.7-1 Hardware Preparation**

Category	Name	Quantity
Electrical tools	Electric Drill	1 set
	18 Drilling Bits	1 set
	16 Drilling Bits	1 set
General Tools	Open-end wrench	1 set
	Measurement Tape	1 set
	Spirit Level	1 set
Solution 1: Consumables	M16 Chemical bolt	4 pieces
	M16 Supporting chemical reagents	8 bottles
	M16 Nuts	4 pieces
Solution 2: Consumables	M14 Supporting expansion screws	4 pieces

### 7.7.2 Ground Drilling

According to the design requirements and the drawing, located the position of spacing and margins, then drill the holes on the base layer. The hole diameter and hole depth must meet the design requirements. The mounting hole is generally 2mm larger than the bolt diameter.

**Table 7.7-2 Specification of Drill Hole**

Ancor specifications (mm)	M10	M12	M16	M20	M24
Drilling diameter (mm)	12	14	18	25	28
Drilling Depth (mm)	90	110	125	170	210



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A n c h o r s p e c i f i c a t i o n s ( m m )	M 1 0	M12	M 1 6	M 2 0	M 2 4
B o l t l e n g t h ( m m )	1 3 0	160	1 9 0	2 6 0	3 0 0

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Anchor specifications (mm)	M10	M12	M16	M20	M24
Maximum anchor thickness (mm)	20	25	35	65	65

**Table 7.7-3 Anchor bolt margin and minimum thickness requirements of concrete members**

Anchor specifications	M10	M12	M16	M20	M24
Minimum margin (mm)	45	55	65	85	105
Minimum anchor distance (mm)	45	55	65	85	105
Substrate minimum thickness (mm)	110	130	145	190	230

**Table 7.7-4 Average failure load and design load of single anchor**

Anchor specifications	M10	M12	M16	M20	M24
Breaking Tension (KN) (C30 Concrete)	31.87	45.57	71.58	137.69	186.69
Breaking shear (KN) (C30 concrete)	17.25	29.05	53.43	84.42	114.15
Design tension (KN) (C30 concrete)	10.32	14.76	23.26	44.56	60.90
Design shear force (KN) (C30 concrete)	5.79	9.95	14.40	28.65	45.77

**Table 7.7-5 Setting time**

Temperature in concrete	-5°C~0°C	0°C~10°C	10°C~20°C	20°C以上
Gel time	60min	30min	20min	8min
Hardening time	300min	60min	30min	20min

### 7.7.3 Clear Hole

Use a tool such as an air pressure blower to remove the dust in the hole and keep the hole clean.

### 7.7.4 Place The Medicine Tube or Fix It with Expansion Screw Skip to Step 8

Insert the medicament tube into the clean hole (recommended to insert two medicinal tubes into one hole). The resin can flow like honey under the condition of hand temperature after insert, then the hose can be used.

### 7.7.5 Drilling Bolts

Screw in the screw with an electric drill until the medicine flows out. Electric drills generally use impact drills or hand drills with a drilling speed of 750 rpm. The bolt is screwed in and the medicine tube will be broken at this time. The resin, curing agent and quartz particles are mixed, and the gap between the anchor bolt and the hole wall is filled.

### 7.7.6 Gel Process

Keep the installation tool still, and refer the chemical reaction time in the setting time table.

### 7.7.7 Hardening Process

Remove the installation tool and wait for the agent to harden. The chemical reaction time refer to the setting time table and wait for the agent to harden completely.

### 7.7.8 Fixed objects

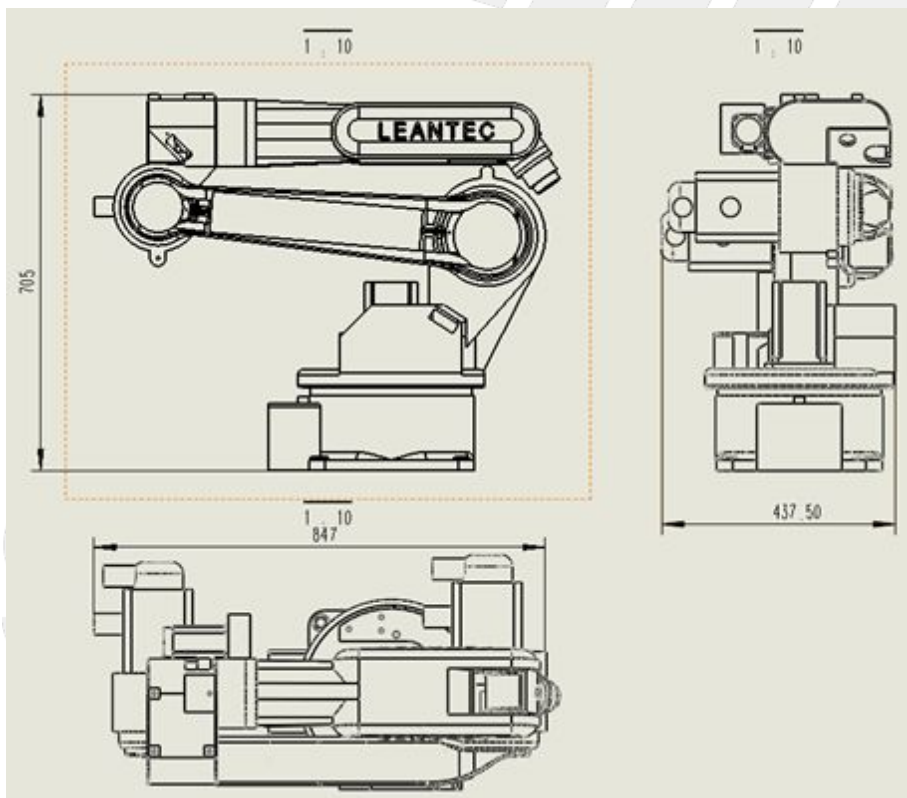
Add washer and hex nut to fix the object.

### 7.7.9 Note

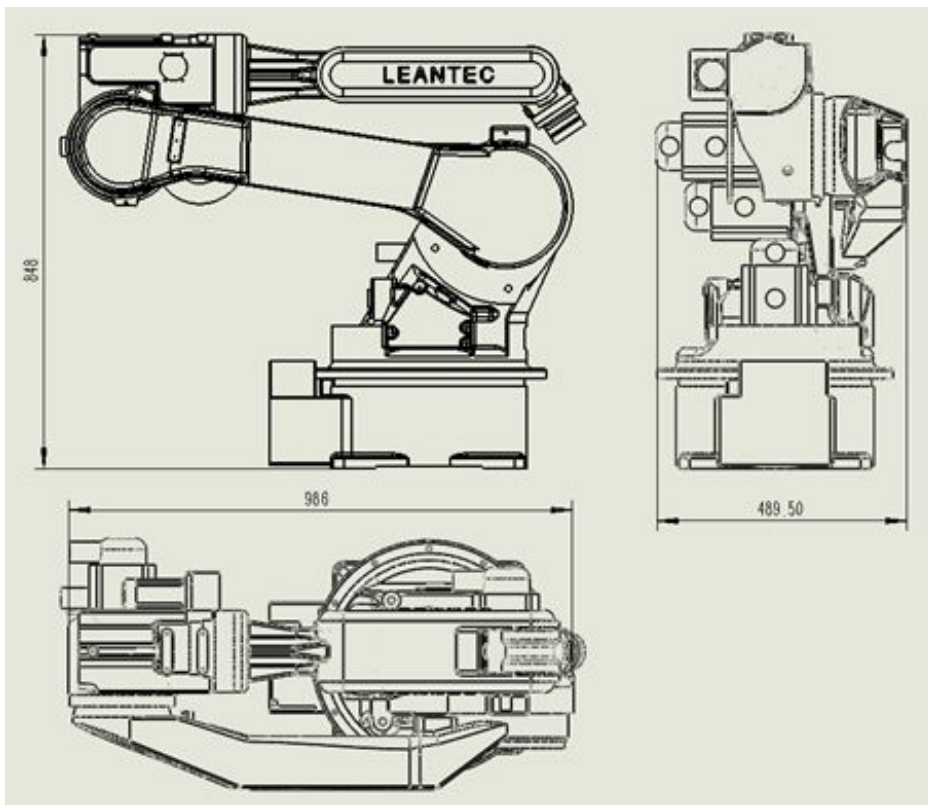
1. The screw must be drilled with an electric drill and cannot be knocked in (in order to make the liquid evenly fill the gap);
2. Before installing the bolts, you must ensure that the holes are clean and there is no water accumulation;
3. The mounting hole is generally 2mm larger than the bolt diameter.

## 7.8 Arm handling method

### 7.8.1 Arm safety posture



**Figure 7.8-1 LRA1468-10-6A-C Articulated Arm Lifting posture**



**Figure 7.8-2 LRA1717-20-6A-C Articulated Arm Lifting posture**

## 7.8.2 Lifting Robotic Arm

Hardware: One forklift or truss, two lifting hooks, one sling;



**Figure 7.8-3 Lifting Hook: 2.0 Tons with non-slip buckles**



3T吊装带  
宽度7.5cm

**Figure 7.8-4 Sling: 3 tons, 2 meters**

### 7.8.3 Lifting Procedure

- a. Check whether the two lifting rings on the joint arm are firm and tighten them clockwise;



**Figure 7.8-5 Lifting ring position**

- b. The lifting ring of the arm is locked with the lifting hook;

Note: Try to avoid direct contact between the hook and the arm, and use a sling to isolate it in order to avoid excessive lifting and scratching the arm.



**Figure 7.8-6 Lifting position**

c. One person carry the sling with both hands, waiting for the forklift to insert;

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**Figure 7.8-7 Forklift preparation**

d. The forklift is approaching, the single tooth is inserted into the sling more than 400mm, and slowly rises. When the sling is tightened, the forklift stops rising. The person who originally carried the sling support the third axis motor to prevent the arm from spinning when the arm just left the base. The forklift start rising slowly till the height is more than 200mm from the installation surface. Then the forklift moves back to an open area to reduce the center of gravity of the arm. The height of the arm is 200mm ~ 300mm from the ground and moves horizontally above the installation position; (The arm needs the support of person to prevent the arm from falling off due to swinging)

e. Move the arm to the top of the mounting base and slowly drop it. The same person assist to mounting hole position then drop arm completely. Use a hexagon wrench to adjust the position mounting holes. Use an M14 screw (add spring washer, washer, length 40mm) and pre-tighten it.

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**Figure 7.8-8 Screw hole position adjustment**

f. Push the arm to adjust the diagonal mounting holes, pre-tighten with M14 screws, then pre-tighten the remaining two mounting holes, and lock the arm mounting holes diagonally.

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**Figure 7.8-9 Bolt fixing**

- g. Insert the aviation plug and lock it;
- h. Connect 220V to the electrical box and grounding.

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