

# Heater Replacement Procedure

Oil Diffusion Pump

Model

**ULK-10A**

**ULK-14A**

Components Division,  
ULVAC, Inc.

<http://www.ulvac.co.jp/>

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## **Preface**

We thank you very much for purchasing our product.

This manual describes the rules of the description of this pump heater replacement procedure and information for carrying out replacement according to this manual.

Read this manual first.

- Worker's requirements
- Before replacement of the heater
- Names of components of the pump

## **Worker's requirements**

This pump may be disassembled, reassembled and installed only by a person experienced in disassembly and reassembly of high vacuum pumps.

If you are not experienced in disassembly and reassembly of high vacuum pumps, contact your local ULVAC service station.

## **Before replacement of the heater**

Disassembly of a pump used for exhausting toxic gas or active gas can be dangerous. If a pump was used for exhausting such type of gas, seal it completely simultaneously with removing the pump from the system and request a professional for disassembly and cleaning.

Before starting heater replacement, prepare necessary parts and tools (refer to the list of tools to use, list of major parts and list of replacement parts). Also replace gaskets, which are subject to aging and may be easily damaged during disassembly.

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**1. Parts used**

**1.1. Table of Major Parts**

No.	Description	Quantity	Check
1 .	Heater	1 pc.	<input type="checkbox"/>
2.1	Boiler cover (with terminal box)	1 pc.	<input type="checkbox"/>
2.2	Boiler cover	1 pc.	<input type="checkbox"/>
3	Heater (terminal) cover	1 pc.	<input type="checkbox"/>
4	Heat-resistant heat shrinkable tube 15mm ID × 40mm	2 pcs.	<input type="checkbox"/>
5	Glass wool tube 5mm-dia. × 185mm long (for heater lead wire)	1 pc.	<input type="checkbox"/>
6	Glass wool tube 10mm-dia. × 45mm long (for heater terminal)	2 pcs.	<input type="checkbox"/>
7	Glass fiber tape	0.18 mm thick × 13 mm wide × 300 mm long	<input type="checkbox"/>
8	Heater lead	2 pcs.	<input type="checkbox"/>
9	Heat-transfer-cement	120 g	<input type="checkbox"/>

**1.2. Table of Replacement Parts**

No.	Description	Quantity	Check
1	Heater (see Note)	1 pc.	<input type="checkbox"/>
2	Heat-resistant heat shrinkable tube 15mm ID × 40mm	2 pcs.	<input type="checkbox"/>
3	Heat-transfer-cement	120 g	<input type="checkbox"/>

Note : Use a heater with the wattage and voltage inscribed on the rating plate.

1.3. Bolts used

No.	Description	Quantity	Check
<b>For fixing heater (SUS304)</b>			
1	Allen screw M6 × 25	4 pcs.	<input type="checkbox"/>
2	Hexagon nut M6	7 pcs.	<input type="checkbox"/>
3	Spring washer M6	7 pcs.	<input type="checkbox"/>
4	Plain washer M6	11 pcs.	<input type="checkbox"/>
<b>For heater terminal (SUS304)</b>			
5	Hexagon nut M4	2 pcs	<input type="checkbox"/>
6	Spring washer M4	2 pcs.	<input type="checkbox"/>
7	Plain washer M4	4 pcs.	<input type="checkbox"/>
<b>For fixing the boiler cover (SUS304)</b>			
8	Cross-recessed head machine screw M5 × 10	4 pcs.	<input type="checkbox"/>
9	Cross-recessed head machine screw M5 × 15	1 pc.	<input type="checkbox"/>
10	Spring washer M5	5 pcs.	<input type="checkbox"/>
11	Plain washer M5	5 pcs.	<input type="checkbox"/>
<b>For fixing heater terminal cover</b>			
12	Cross-recessed head machine screw M5 × 10	2 pcs	<input type="checkbox"/>
13	Spring washer M5	2 pcs.	<input type="checkbox"/>
14	Plain washer M5	2 pcs.	<input type="checkbox"/>

1.4. Miscellaneous

No.	Description	Quantity or size		Check
		ULK-10A	ULK-14A	
1	Working fluid ULVOIL D-11 or D-31	800 cc	1,500 cc	<input type="checkbox"/>
2	Intake port gasket (NBR or FPM)	8 mm × 8 mm × 275 mm ID	8 mm × 8 mm × 380 mm ID	<input type="checkbox"/>
3	Exhaust port gasket (NBR or FPM)	4 mm wide × 99 mm ID		<input type="checkbox"/>
4	Molybdenum disulfide (Dow Corning MOLKOT,etc)	Appropriate amount		<input type="checkbox"/>

**2. Tools to use**

**2.1. Table of Working Tools**

No.	Photo	Description	No.	Photo	Description
1		Torque wrench 5 N·m	7		Heat-resistant gloves
2		Spanner 10: 2 pcs. 5 : 1 pc.	8		Protective gloves
3		Philips screwdriver	9		Box 10 mm
4		Shockless hammer	10		Spatula
5		Scraper	11		Pliers (or cutting pliers)
6		Wire brush			

### 3. Removing the Heater

Power Supply wiring <Dismantling>



**WARNING**

- Be sure to cut off the electricity before starting install or dismantling operation.

Cooling water piping<Detaching>



**WARNING**

- Should you remove the Coolant joint immediately after having stopped the Pump, there is a risk that the coolant remained inside the Pump comes to a boil and jets out. Keep flowing the Coolant as far as the Pump temperature cools down.

- The Pump is and remains very hot during and while after having stopped operation. You have a risk of getting burned if a part of the body touched it.

Keep flowing the Coolant as far as the Pump temperature cools down.

- Use a flow meter (HWFM: for example Flow sight) applicable to visually check the Coolant supply source that no water is flowing.

Intake port and exhaust port piping<Dismantling>



**WARNING**

- Take off the piping following the Install Manual of the system.
- Make airtight completely the Pump exhaust outlet with a blank flange.

Transfer



**WARNING**

- You have a risk of giving damage to your back as the load larger than safety standard shall be required to transfer the product.
- Be sure to use the loading machinery (such as mobile crane) to lift up the Pump or load it on the pallet and fix it with Jack and run the Pallet truck for its transfer.

- (1) Move the pump to a place suited to working.
- (2) Before removing the heater, make sure on a surface thermometer or the like that the working fluid temperature has lowered to near ambient temperature.
- (3) Drain working fluid and remove the jet.  
For the disassembly and reassembly of the jet, refer to the instruction manual.
- (4) Protect the flange surface with a closing flange or the like so that the intake port and exhaust port are not damaged when the pump is turned upside down. Here, see to it that the pump interior is not closed.
- (5) Turn the pump upside down to set the boiler cover side in the up position.
- (6) Remove all connecting terminals of the heater connection in the terminal box.
- (7) Remove the heater terminal cover to remove the heater leads.
- (8) Remove the screws that fix the boiler cover to remove the boiler cover.
- (9) Remove the bolts and nuts that are used to fix the heater to remove the heater. If the heater and pump are fixed with heat-transfer-cement, lightly strike them with a shock-absorbing hammer.
- (10) Wear protective gloves and remove heat-transfer-cement from the heater installed surface and the pump using a scraper or wire brush.



This completes removal of the heater.

Disassemble the heater in decreasing order of the numbers in the figure below.  
For reassembly, reverse the order.

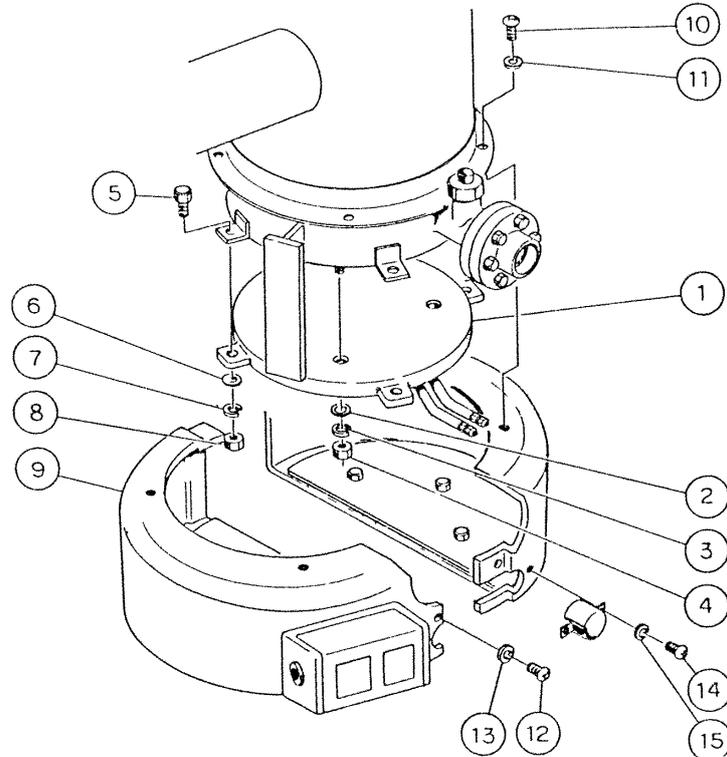


Fig.Removing the heater

#### 4. Installing the Heater

- (1)  Take care against electric shock and burn.

Energize the heater with 100V power to preheat it to 90°C.

Check the temperature on a surface thermometer.

- (2) Take 120 grams of heat-transfer-cement and apply it to the surface on which the heater is installed on the pump side.

Here, apply a uniform coat of heat-transfer-cement about 1 cm inside the end.



- (3)  Take care against electric shock and burn.

Wearing heat-resistant gloves, install the heater that has been preheated to 90°C.

Turn off the power before installing the heater.

Place the heater in a position where it is at approximate middle of the oil filling/draining port and fix the bolts and nuts.

Apply a coat of molybdenum disulfide to bolts and nuts against scuffing.

- (4) Wear heat-resisting gloves and tighten the bolts and nuts for fixing the heater.

The tightening torque is 10 N·m.

- ① First, tighten the 3 bolts and nuts inside with a uniform torque of 10 N·m.
- ② Then tighten the 4 bolts on the outside with a uniform torque of 10 N·m.
- ③ Retighten the 3 bolts inside with increased torque of 10 N·m.
- ④ Finally, retighten the 3 bolts outside with increased torque of 10 N·m.

- (5)  Take care against electric shock and burn

Energize the heater with 100V power to heat it up to 170°C.

Here, check the temperature on the surface thermometer.

- (6)  Take care against electric shock and burn

Heat-transfer-cement will gush out from the 3 nuts inside and heater outer periphery during heating to 170°C. Remove the thermo-element while taking care against burn.



- (7) Turn off the power when the heater has cooled down to 170°C and wait until the heater temperature comes down to ambient.

- (8) Temporarily install the boiler cover when the heater temperature has come down to ambient.

- (9) Adjust the boiler cover and heater terminal positions.  
Adjust the heater terminal position so that it is at the center of the hole of the boiler cover. To adjust the heater terminal position, insert a pipe into the heater terminal and move it



Heater terminal adjustment

- (10) With the boiler cover being assembled temporarily, make sure with a 500V Megger that the insulation resistance between the boiler cover and heater terminal is 10 MΩ or more.  
If not, the heater terminal and the boiler cover may be in contact with each other.

- (11) Remove the boiler cover that has been installed temporarily.  
Wrap glass fiber tape around each of the two heater terminals.



- (12) Cover the heater terminals with glass wool tubes.



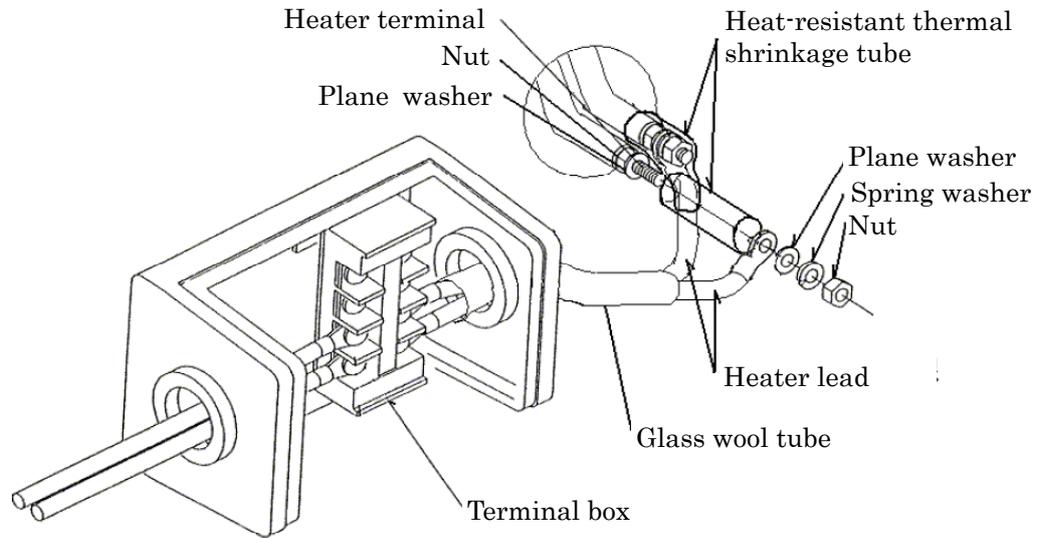
- (13) The side on which the solderless terminal of the heater lead is bent is the heater side.



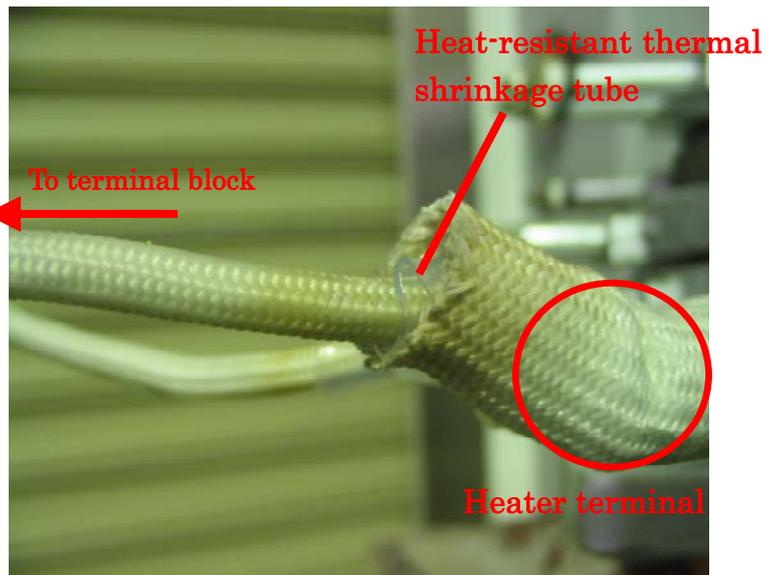
- (14) Attach the bent heater lead to the heater terminal using a spring washer, plain washer and nut so that it is upside (reverse to the oil filling/draining port) when the heater lead is attached.



- (15) Insert the heat-resistant thermal shrinkage tube into the heater terminal. Here, insert the heat-resistant thermal shrinkage tube into the glass wool tube installed by step (11) above.



- (16) Bring the heat-resistant shrinkage tube into intimate contact with the lead with the hot gun, as shown in the photo below.



- (17) Install the boiler cover in position.  
Here, install the boiler cover in such way that the heater terminal is at the center of the hole in the boiler cover.
  
- (18) Make sure that the insulation resistance between the heater terminal and the boiler cover is 10 M $\Omega$  or more on a 500V Megger.  
If not, there is a possibility of the heater terminal not being correctly installed. In that event, install the heater terminal correctly.
  
- (19) Bind the 2 heater leads with a glass wool tube.
  
- (20) Connect the heater lead to the terminal block.
  
- (21) Restore the pump to the original state.

This completes heater replacement.

Before starting the pump, reassemble the jet (refer to the operation manual for the reassembling procedure) and feed lubricating fluid.