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Edwards High Vacuum International

NOTICE OF NEW OR UP-ISSUED PRODUCT MANUAL RELEASE

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NEW / UP-ISSUED PRODUCT MANUAL INFORMATION

New manual number and issue: F105-01-880 Issue D
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Product Item Numbers: F105-01-000, -03-
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EXISTING STOCK / MASTERS

Action of existing stock: Production: use as defined by the ECD. All others: destroy.
Action for existing masters: Crawley: archive. All others: return to Literature Storekeeper at Crawley.

COMMENT

The manual has been changed to reflect that we now recommend the use of RV pumps with the Micromodulyo.

SUPPLY COPIES OF THIS MANUAL WITH A BLACK, HEATED-TAPE SEAL ON THE LEFT-HAND EDGE.

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XPS R310

F105-01-880
Issue D

Instruction Manual

Micromodulyo 1.5K Freeze Dryer

Description	*Item Number*
Micromodulyo 1.5K Freeze Dryer, single voltage (220/240 V, 50 Hz, 1-phase)	*F105-01-000*
Micromodulyo 1.5K Freeze Dryer, dual voltage (90/110 V, 50 Hz, 1-phase, 90-127 V, 60 Hz, 1-phase)	*F105-03-000*

EDWARDS

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1 INTRODUCTION

1.1 Scope and definitions

This manual provides installation, operation and maintenance instructions for the Edwards Micromodulyo 1.5K Freeze Dryer. You must use the Micromodulyo as specified in this manual.

Read this manual before you install and operate the Micromodulyo. Important safety information is highlighted as WARNING and CAUTION instructions; you must obey these instructions. The use of WARNINGS and CAUTIONS is defined below.

> WARNING
>
> Warnings are given where failure to observe the instruction could result in injury or death to people.

> CAUTION
>
> Cautions are given where failure to observe the instruction could result in damage to the equipment, associated equipment and process.

The units used throughout this manual conform to the SI international system of units of measurement.

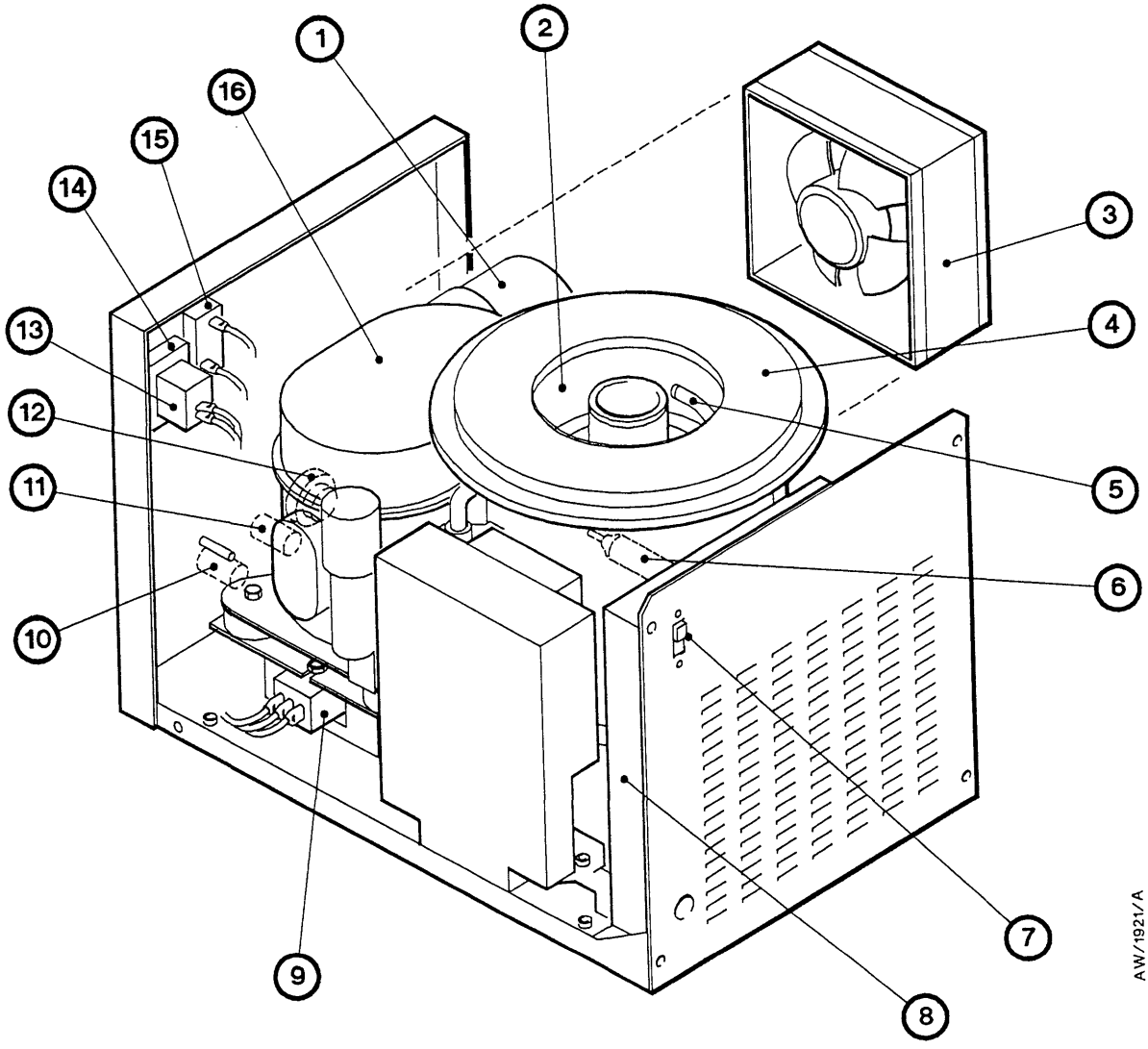
1.2 General description

1.2.1 Micromodulyo 1.5K

The Micromodulyo is the ice condenser section of a freeze drying system. It is a low-cost unit suitable for freeze drying biological and pharmaceutical preparations in a laboratory. The Micromodulyo only requires the attachment of a suitable vacuum pump and a drying accessory to form a complete freeze drying system. The Micromodulyo is also suitable for use on other vacuum duties, including evaporation and distillation processes.

The Micromodulyo has a condenser chamber, a refrigeration system and a temperature indicator. These components are all housed in a steel cabinet which is designed for bench-top use. The components are described in the following sections (see Figure 1 for the locations of components).

When used with suitable accessories, the Micromodulyo can be used to freeze dry materials in bulk trays, round-bottomed flasks, vials or ampoules. Alternatively, the Micromodulyo can be used as a low-temperature vapour trap (or cold trap) that may be attached to an existing evaporation facility. A number of accessories are available from Edwards, these include drying accessories and glassware. Refer to Section 7 for a full list of Edwards accessories.



1. Electrical supply transformer *
2. Condenser chamber
3. Cooling-fan
4. Accessory-flange
5. Cooling-coil
6. Filter-dryer
7. Voltage selector switch *
8. Refrigerant condenser
9. Thermostat
10. Vacuum pump connector
11. Drain-outlet
12. Drain-valve
13. Thermal magnetic circuit breaker
14. On/off switch
15. Operating Temperature lamp
16. Compressor

* Dual voltage Micromodulyo only

Figure 1 - Micromodulyo components

Two models of the Micromodulyo are available : a single voltage model and a dual voltage model. Refer to Section 2 for the electrical supplies required for the two models.

1.2.2 The condenser chamber

The condenser chamber (2) is capable of trapping 1.5 litres of ice. It contains a cooling-coil (5) which condenses water vapour, to form ice. The temperature of the cooling-coil (5) under normal operating conditions with no load applied is -50° C.

A 225 mm diameter accessory-flange (4), which is compatible with the Modulyo small flange accessory range, is at the top of the condenser chamber. The large top opening allows easy inspection, cleaning and defrosting of the condenser coils and enables high vacuum-pumping rates to be attained.

A valved drain-pipe runs from the base of the condenser chamber to the drain-outlet (11) on the front of the Micromodulyo. This drain-pipe is used to drain liquid condensate from the chamber and to admit air into the system.

A vacuum pipeline connects the chamber to a vacuum pump connector (10) on the front panel of the Micromodulyo. You can connect a suitable two-stage vacuum pump to this connector to evacuate the condenser chamber.

1.2.3 Baffle-tube

A baffle-tube is supplied with the Micromodulyo. The baffle-tube can be installed inside the condenser chamber to ensure an open path for vapour flow within the condenser chamber. This results in an improved distribution of ice.

We recommend that you fit the baffle-tube inside the condenser chamber whenever a load capacity of 1 litre (or more) of condensate will be collected.

1.2.4 Control panel and connections

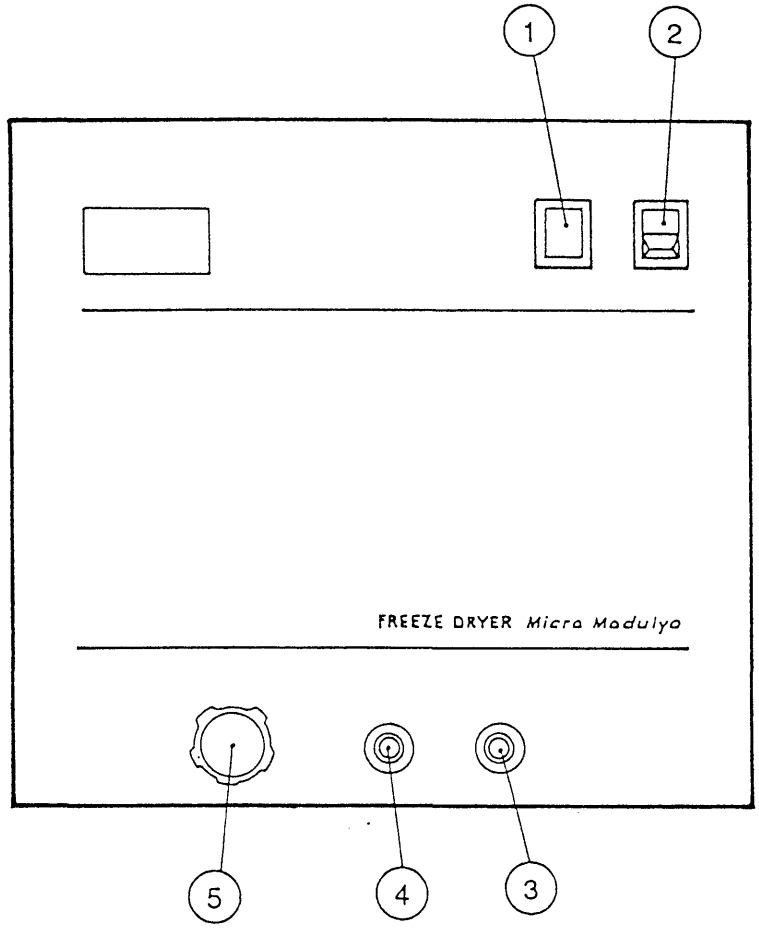
The controls and connection points of the Micromodulyo are all positioned on the front panel. The use of the controls and connections is described in Table 1.

Control/connection	Use
On/Off switch	This is a rocker-action switch (position 'O' = off, position '1' = on).
Operating Temperature lamp	This green lamp goes on when the Micromodulyo has reached its operating temperature of -50 °C.
Drain-valve	When closed, this valve isolates the condenser chamber from the drain-outlet. When open, this valve is used to admit air into the vacuum system and also to drain water from the condenser chamber after defrosting.

Table 1 - Micromodulyo controls and connections

Control/connection	Use
Drain-outlet	This outlet is used to drain water from the Micro-modulyo during defrosting of the condenser chamber and cooling-coil. The outlet is also used to admit air into the vacuum system.
Vacuum pump connector	Use this to connect your vacuum pump to the Micromodulyo.

Table 1 - Micromodulyo controls and connections (continued)



1. Operating Temperature lamp
2. On/Off switch
3. Vacuum pump connector
4. Drain-outlet
5. Drain-valve

Figure 2 - Micromodulyo front panel

1.2.5 Protection devices

The Micromodulyo is protected by a thermal magnetic circuit-breaker which is integral with the On/Off switch on the front panel. The switch resets every time the Micromodulyo is switched off and every time the circuit breaker trips.

The electrical supply to the Micromodulyo must be suitably fused (refer to Section 3).

1.3 Applications

1.3.1 Introduction

If you want to use the Micromodulyo as a freeze dryer, you must connect it to a two-stage vacuum pump and fit a drying accessory. When you use the Micromodulyo as part of a freeze drying system, we recommend that you keep accurate records of all operating parameters (that is : load, drying times, and so forth). This data will help you to determine the optimum cycle for efficient operation with various products.

Some factors which affect the freeze drying process are described in the following sections.

1.3.2 The freezing process

You must pre-freeze the product to be freeze dried before you place it in (or on) the drying accessory. The thickness of the ice (and hence the product) will affect the length of time needed to dry a given sample. In general, the thickness should be less than 10 mm. A range of product containers is available from Edwards. These include the containers shown in Table 2.

Container	Method of freezing
Bulk tray	Use a cabinet freezer to freeze the bulk tray. The maximum recommended depth is 10 mm.
Vials	Use a cabinet freezer to freeze the vials. The maximum recommended depth of fill is 10 mm.
Ampoules	Pre-freeze in a cabinet freezer or use an Edwards spin-freeze accessory to dry the ampoules.
Flasks	Use an Edwards pre-freeze bath to shell-freeze to a maximum thickness of 10 mm.

Table 2 - Product containers

1.3.3 The drying process

When the condenser has reached a temperature of -50 °C, the Operating Temperature lamp goes on and the vacuum pump can be switched on (see Section 4). The pressure in the condenser chamber then starts to drop, producing the conditions necessary for freeze drying to occur.

The time required to dry a product varies and is determined by a number of factors; these include the type of product, its mass and thickness, the type of container used, the temperatures of the product and the condenser and the system performance.

Freeze drying requires an input of heat energy to the product to change the ice into water vapour. When using the Micromodulyo, this energy may be absorbed solely from the surroundings or, alternatively, a heated accessory may be used to supplement this heat input. If you use a heated accessory, the accessory should not be switched on until the pressure in the condenser chamber has stabilised.

When deciding on the quantity of heat input required, or when trying to optimise the drying cycle for a particular product, it is important to observe the physical appearance of the product whenever possible during the drying process. If the product has been correctly frozen, it will usually appear to be uniform in colour and compact. If the product is uneven in colour, or if signs of boiling are visible, then the product may have been incorrectly frozen or may have undergone some physical change, possibly from the application of too much heat.

A wide range of factors has to be considered when trying to optimise the drying cycle for a given product. To assist in this optimisation, we therefore recommend that you take note of the rate of change of both temperature and pressure within the condenser chamber during the drying freeze drying process.

1.3.4 Vapour trapping

When the Micromodulyo is used as a vapour trap (for example, in gel drying applications), its function is significantly different to that when it is used in freeze drying applications. In vapour trapping applications, the Micromodulyo acts solely to protect the rotary pump; in freeze drying applications, it actually pumps the water vapour from the product.

In vapour trapping applications, it is often necessary to limit the vapour flow from the system to the Micromodulyo by fitting a restrictor between the vapour source and the Micromodulyo. The size of restrictor required is dependent on the system.

2 TECHNICAL DATA

2.1 General

Dimensions (mm)	
Height	310
Width	332
Depth	440
Accessory-flange diameter	225
Mass	27.5 kg
Enclosure rating (BS 5490)	IP 22
Ambient operating temperature range	5 to 24 °C
Maximum ambient storage temperature	50 °C
Condenser	
Ice capacity (in 12 hours)	1.0 kg
Maximum ice capacity	1.5 kg
Operating temperature	-50 °C
Instrumentation	
On/Off switch	Rocker switch with integral thermal magnetic circuit breaker (see Section 2.3)
Operating Temperature lamp	Remote sensing thermostat

2.2 Refrigeration system data

Compressor type	$^1/_4$-hp hermetic unit
Compressor model	L'Unité Hermetique CAE 2417Z
Displacement	11.3 cc
Refrigerant condenser type	Cantardo - STN 7121
Refrigerant type	ISCEON 69L (R403a)
Refrigerant charge	96 ± 3 g
Evaporator	2.5 metres, $^3/_8$-inch (stainless steel)
Normal suction line pressure	0.7 bar (absolute)
Expansion device	Capillary tube

2.3 Electrical data

Electrical supply	
Single voltage model	220/240 V, 50 Hz, 1-phase
Dual voltage model	90/110 V, 50 Hz, 1-phase
	90/127 V, 60 Hz, 1-phase
Power rating	350 W
Protection	
Internal	Thermal magnetic circuit-breaker, rated at 8 A
External	10 A fuse

2.4 Construction details

2.4.1 Legislation and standards

The Micromodulyo has been designed in compliance with the following legislation and standards :

- C-P 3-0502-202 (1985-11) IBM Non-Product Equipment Design.
- ESCHLE (1986) Electrical Safety Code for Hospital Laboratory Equipment
- BS 5490 : 1977 Specification for the classification of degrees of protection provided by enclosures

2.4.2 Construction materials

Item	**Material**
Cabinet	Steel
Condenser chamber	Stainless steel
Vacuum pipeline	Stainless steel
Baffle-tube	Nylon

2.5 Vacuum pump requirements

For freeze drying, your vacuum pump must meet the following specification :

Type of pump	Two-stage, oil-sealed rotary pump
Ultimate pressure	5×10^{-2} mbar (or better)
Pumping rate	30 $l.min^{-1}$ or more.

Your vacuum pump must also have a gas-ballast facility to prevent water build up in the pump.

3 INSTALLATION

3.1 Unpack and inspect

Remove all packing materials and inspect the Micromodulyo.

If the Micromodulyo is damaged, notify your supplier and the carrier in writing within three days; state the Item Number of the Micromodulyo together with your order number and your supplier's invoice number. Retain all packing materials for inspection. Do not use the Micromodulyo if it is damaged.

Check that your package contains the items listed in Table 3 below. If any of these items is missing, notify your supplier in writing within three days.

Qty	Description	Check (✓)
1	Micromodulyo 1.5K Freeze Dryer	❑
1	Baffle-tube	❑
1	Vacuum pump connection kit	❑

Table 3 - Checklist of components

If the Micromodulyo is not to be used immediately, replace the protective covers. Store the Micromodulyo in suitable conditions as described in Section 6.

3.2 Locate the Micromodulyo

The Micromodulyo is designed for use on a laboratory bench-top. Locate the Micromodulyo in its required operating position, within convenient access to a suitable electrical supply.

We recommend that you leave an air-gap of at least 200 mm between all four sides of the Micromodulyo and any wall or obstruction. If you do not leave a sufficient air-gap, poor cooling of the Micromodulyo may result in poor performance.

When you locate the Micromodulyo, you should also consider ease of access for maintenance and repair work, when you will need to remove the cover of the Micromodulyo (see Figure 5).

3.3 Make the electrical connections

3.3.1 Connect the electrical supply

> WARNING
>
> Ensure that the electrical installation of the Micromodulyo conforms with your local and national safety requirements. It must be connected to a suitably fused and protected electrical supply and a suitable earth point.

1. Make sure that the Micromodulyo is suitable for use with your electrical supply voltage and frequency.

2. The Micromodulyo is supplied with a two-metre length of 3-core electrical supply cable. Connect the cable to the electrical supply as shown in Table 4 below.

3. Connect a 10 A fuse at the electrical supply outlet to protect the Micromodulyo.

Core	Electrical supply connection
Brown	Live or Line 1
Blue	Neutral or Line 2
Green/yellow	Earth (ground)

Table 4 - Electrical supply cable connections

3.3.2 Adjust the voltage selector switch (dual voltage Micromodulyo only)

> CAUTION
>
> You must correctly set the voltage selector switch when you install the dual voltage Micromodulyo.

The dual voltage version of the Micromodulyo has an electrical supply voltage selector switch located on the rear of the Micromodulyo (Figure 1, item 7).

Ensure that the switch is in the correct position for your electrical supply; the voltage positions are clearly marked.

3.4 Connect the vacuum pump

3.4.1 General

> WARNING
>
> If you intend to freeze dry products which contain sodium azide, make sure that your vacuum pump and pipeline are suitable for freeze drying these products. If they are not suitable, there is a severe risk of explosion.

> CAUTION
>
> You must use a two-stage vacuum pump with the Micromodulyo. If you do not, the pump will have a very short working life.

Connect your vacuum pump to the vacuum pump connector marked 'VAC' on the front of the Micromodulyo (see Figure 3). The connector is suitable for use with a 10 mm inside diameter pipeline.

If necessary, use an Edwards model RV3 vacuum pump with the Micromodulyo. This pump is suitable for freeze drying products which contain sodium azides (see Section 4.1). To connect an Edwards RV3 pump to the Micromodulyo, refer to Section 3.4.2.

If you do not use an Edwards vacuum pump, it must meet the requirements specified in Section 2.5. To connect another type of pump to the Micromodulyo, refer to the instruction manual supplied with the pump.

3.4.2 Connect an Edwards RV3 pump to the Micromodulyo

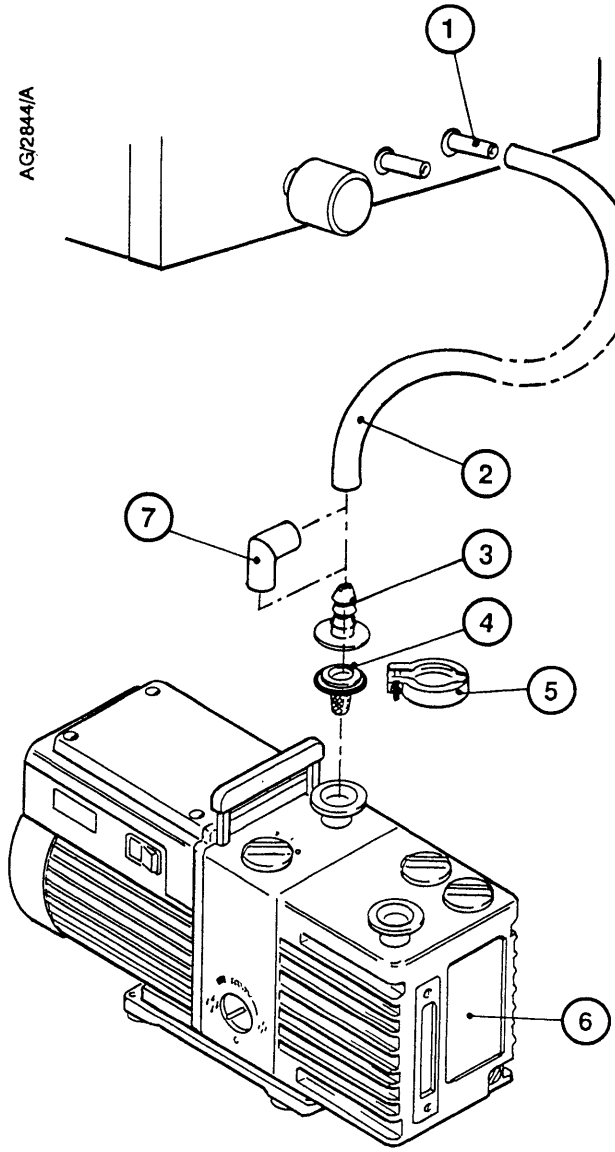
To connect an Edwards RV3 vacuum pump to the Micromodulyo, refer to Figure 6 and use the following procedure.

1. Remove the vacuum pump connection kit from its packing material. The kit contains a nozzle connector, swing clamp, vacuum pipeline and a right-angle adaptor.

2. Fit the centring-ring and inlet filter (4) to the pump inlet-port, then use the swing clamp (5) to secure the nozzle connector (3) to the inlet-port.

3. If required, fit the right angle adaptor (7) to the nozzle connector (3). Push one end of the vacuum pipeline (2) onto the nozzle connector (3) or into the right-angle adaptor (7), if fitted.

4. Push the other end of the vacuum pipeline (2) onto the vacuum pump connector marked 'VAC' (1) on the front panel of the Micromodulyo.



1. Vacuum pump connector ('VAC')
2. Vacuum pipeline
3. Nozzle connector
4. Centring-ring and inlet filter *
5. Swing clamp
6. RV3 pump
7. Right-angle adaptor

* Supplied with the RV3 pump

Figure 3 - Connect the RV3 vacuum pump

3.4.3 Pump outlet safety

Fit an oil mist filter or pipe the exhaust gases of the vacuum pump to a suitable treatment plant.

An Edwards EMF Oil Mist Filter is available as an accessory and can be fitted to trap oil mist exhausted from the pump.

3.5 Test after installation

> CAUTION
>
> Do not attempt to use the Micromodulyo if it fails the installation test. If you do, poor performance may result in the loss of the product being freeze dried.

When you have installed the Micromodulyo, use the following procedure to test that the Micromodulyo works correctly.

1. Switch on the electrical supply.
2. Move the On/Off switch to the 'on' (1) position.
3. Watch the cooling-fan through the grill on the side of the Micromodulyo. If the fan rotates, then it is operating correctly: continue at Step 4. If the fan does not rotate, continue at Step 6 below.
4. Check that the compressor operates. If it operates, you will hear a low hum: continue at Step 5. If you cannot hear the compressor, continue at Step 6 below.
5. Leave the Micromodulyo on for approximately 30 minutes, then check that the Operating Temperature lamp is on. If the lamp is on, the Micromodulyo is ready for use (refer to Section 4). If the Operating Temperature lamp is not on, continue at Step 6 below.
6. If any of the checks in Steps 3 to 5 above fail, switch the Micromodulyo off and disconnect the electrical supply. Contact your supplier for advice. Do not attempt to use the Micromodulyo.

4 OPERATION

4.1 Safety

> WARNING
>
> If you intend to freeze dry products which contain sodium azide, make sure that your vacuum pump and pipeline are suitable for freeze drying these products. If they are not suitable, there is a severe risk of explosion.

Sodium azide is sometimes used as a stabilizing agent in freeze drying processes. Sodium Azide is toxic and, when dry, is highly explosive.

If you freeze dry a product which contains sodium azide, a chemical reaction can occur in the presence of heavy metals such as copper, lead, zinc and cadmium. The result of this reaction is the formation of metallic azides which are highly unstable and explosive.

The Micromodulyo contains no heavy metals and is suitable for freeze drying products which contain sodium azide. Edwards pumps are also suitable for this purpose (see Section 7).

However, if you do not use an Edwards pump, your vacuum pump and vacuum pipeline may not be suitable for freeze drying products containing sodium azide. Check with your vacuum pump's manufacturer to determine its suitability if you intend to freeze dry products containing sodium azide.

4.2 Sequence of operation

Operation of the Micromodulyo can involve a number of different steps, as shown in Table 5 below.

Operation step	Refer to Section
Prepare the Micromodulyo	4.3
Fit the product container and any other necessary accessory	4.4
Load the product(s)	-
Pre-cool the Micromodulyo	4.5
Dry the product	4.6
Shut down	4.7

Table 5 - Sequence of operation

Before freeze drying a product, you must always prepare the Micromodulyo as described in Section 4.3. Always dry the product and shut down the Micromodulyo as described in Sections 4.6 and 4.7.

However, the order in which the remaining three steps are carried out is dependent on the type of product container or other accessory being used and the type of product to be freeze dried. In some circumstances you will need to pre-cool the Micromodulyo with the accessory-flange open to atmosphere; in other circumstances, you fit the product container, then pre-cool the Micromodulyo and then load the product to be freeze dried.

If the correct sequence of operations to follow is not clear to you, refer to the instruction manual supplied with the product container or other accessory which you will use.

4.3 Prepare the Micromodulyo

Note : Use only mild detergents to clean the condenser chamber, accessories and connecting pipeline. Some of the Edwards accessories are made from acrylic materials and must not be cleaned with organic solvents.

Before you first use the Micromodulyo, and between freeze drying cycles, prepare the Micromodulyo, as follows :

1. Remove any water left in the bottom of the condenser chamber by opening the drain-valve (that is, by turning it anticlockwise). When the chamber is completely drained, close the valve by turning it fully clockwise.

2. If acidic or corrosive products have been processed, flush through the condenser chamber and drain-line with clean water.

3. Make sure that the condenser chamber is dry.

4. Make sure that the Micromodulyo is clean, particularly the accessory-flange. If the flange is not clean, you will not get a good vacuum seal and the performance of the Micromodulyo will be poor.

5. Check the vacuum connection on the front of the Micromodulyo. Check the connection at the vacuum pump.

6. If a load of more than 1 litre of ice will be condensed in the Micromodulyo, we recommend that you fit the baffle-tube. Refer to Figure 7 and fit the baffle-tube by placing it over the drain-outlet in the centre of the condenser chamber; the cut-outs in the tube must be at the bottom.

   If you do not fit the baffle-tube, the vacuum pump connection may become blocked with ice; this may cause a loss of vacuum and the product may melt.

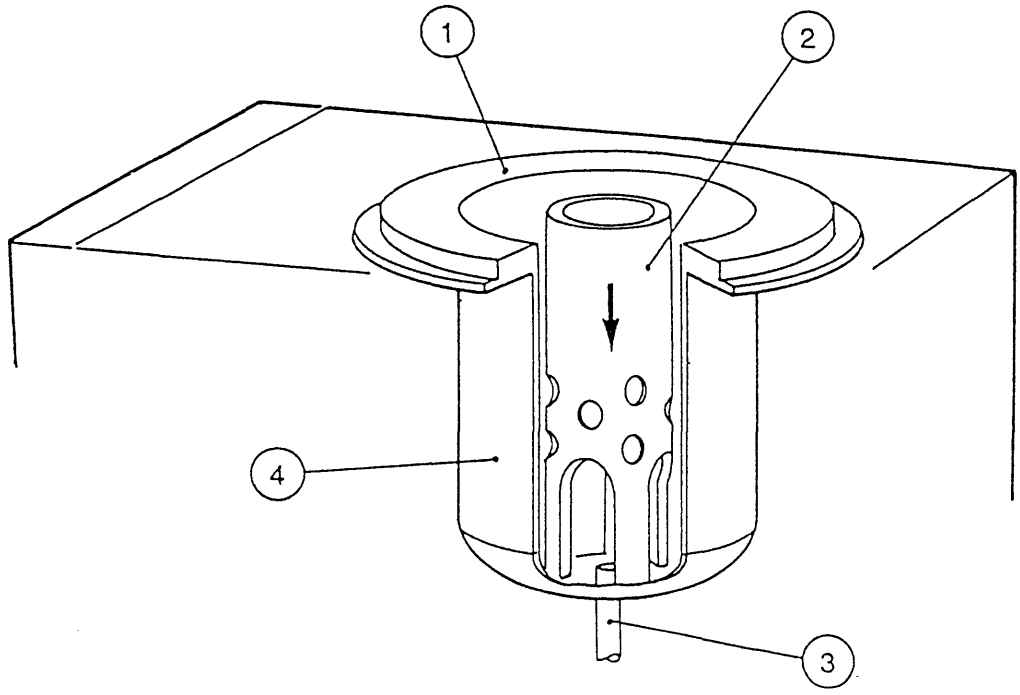
7. Select a suitable drying accessory for the product. Wipe clean the sealing-ring of the accessory and check the sealing-ring for damage; if it is damaged, fit a new sealing-ring.

   The accessory sealing-ring should not need lubricating, but if it is excessively dry, apply a light wipe of high vacuum grease.

4.4 Fit the product container and other accessories

A drying accessory may be connected to the Micromodulyo accessory-flange (see Figure 6).

The flange has a diameter of 225 mm and accessories have a rubber sealing-ring to seal the accessory to the flange. Once positioned, the weight of the accessory is sufficient to produce an airtight seal under vacuum conditions.



1. Accessory-flange
2. Baffle-tube
3. Drain-outlet
4. Condenser chamber

Figure 4 - Fit the Baffle Tube

4.5 Pre-cool the Micromodulyo

> WARNING
>
> Do not touch any part of the condenser chamber during or immediately after the cooling process. The condenser chamber is at a very low temperature and can cause tissue damage.

Pre-cool the Micromodulyo condenser chamber as follows :

1. Make sure that the Micromodulyo is connected to the electrical supply, then use the On / Off switch to switch on the Micromodulyo.
2. Leave the Micromodulyo on until the Operating Temperature lamp goes on.
3. Wait a further five minutes.

4.6 Drying

> CAUTION
>
> Use gas-ballast on the vacuum pump when drying. If you do not, water may condense in the pump.

1. Turn the gas-ballast valve on the pump so that it is about half open.
2. Switch the pump on.

Take note of the following when freeze drying products :

- When a load is first applied to the Micromodulyo, the Operating Temperature lamp may go off for a few minutes. This is because the evaporation rate from the product is initially high.

  If the lamp does not go on again within a few minutes, the Micromodulyo is overloaded. Reduce the amount of product in the freeze drying system to prevent the product from melting or, if using the Micromodulyo as a vapour trap, restrict the flow of vapour to the Micromodulyo.

- If you wish to dry a number of flasks, first attach one flask, then evacuate the flask. If the Operating Temperature lamp goes off, wait until it is on again, then attach and evacuate the remaining flasks in the same way.

  If you use this procedure, you can identify any flasks that leak. This procedure also prevents rapid pressure increases, which might cause flasks to fall off of the drying accessory.

- If there appears to be a leak, check that the drain-valve is fully closed and that all seals are clean. If the Micromodulyo continues to leak, contact your supplier or Edwards.

4.7 Shut down

> CAUTION
>
> If you use a manifold assembly, do not admit air into the Micromodulyo through the drain-valve until all flasks have been removed, otherwise the flasks may fall off of the manifolds.

Look at the appearance of the product and consult data gathered from previous freeze drying operations (refer to Sections 1.3.2 and 1.3.3) to determine when the freeze drying process has finished.

Once the process has finished, shut down the Micromodulyo as follows :

1. If you use a manifold accessory, use the manifold valves to vent each flask in turn. Remove and seal each flask.
2. Switch the vacuum pump off.
3. If you use other accessories, slowly open the drain-valve to admit air to the system.
4. Remove the product when the pressure in the system has reached atmospheric pressure.
5. Switch off the Micromodulyo.
6. Remove the drying accessory.

4.8 Defrosting

> WARNING
>
> Do not touch any part of the condenser chamber during or immediately after the cooling process. The condenser chamber is at a very low temperature and can cause tissue damage.

> WARNING
>
> Do not pour water at a temperature greater than 50 °C into the ice condenser when it is cold. This may result in a dangerous rise in pressure in the refrigeration system.

Defrost the Micromodulyo by leaving it to defrost at ambient temperature. Make sure that the water is drained from the condenser chamber before you switch the Micromodulyo on again. This method takes up to five hours to complete, depending on the ambient temperature.

Alternatively, you can pour warm water into the ice condenser to speed up the defrosting process. This method is useful if you wish to use the Micromodulyo again immediately. Use the following procedure.

1. Remove the drying accessory from the accessory-flange.
2. Close the drain-valve.
3. Pour warm water, at a maximum temperature of 50 °C, into the condenser chamber. Do not fill the chamber above the level of the vacuum pipeline outlet.
4. Wait for a few minutes to allow the ice to melt.
5. Fully open the drain-valve and allow the water to drain out of the condenser chamber.
6. Remove the baffle-tube (if fitted). Clean and dry both the baffle-tube and the inside of the condenser chamber.

Prepare the Micromodulyo for the next operational cycle as described in Section 4.3.

4.9 Operation with no load

If you operate the Micromodulyo with no load for several hours, the internal components of the Micromodulyo get very cold. Atmospheric water vapour will then condense onto the cold surfaces and may drip out of the bottom of the Micromodulyo. You may therefore see puddles of water under the Micromodulyo, which give the impression that water is leaking from the condenser chamber.

If you see water dripping out of the Micromodulyo, inspect the condenser chamber: if there is ice in the chamber, the water is probably not leaking fom the chamber, but is dripping from the cold surfaces inside the Micromodulyo. Always check this carefully before you contact your supplier or Edwards for advice.

To avoid this problem, we recommend that you shut-down the Micromodulyo if you will not use it for three or four hours. This is particularly important if the use the Micromodulyo in a high humidity environment.

5 MAINTENANCE

5.1 Introduction

Note : You must obey the maintenance procedures defined in the instruction manuals supplied with your accessories and vacuum pump.

The Micromodulyo is designed to require no user maintenance and contains no user serviceable parts. The preparation procedures of Section 4.3 are sufficient to maintain the Micromodulyo in serviceable condition.

The following sections describe possible problems and their possible solutions and are intended as a guide to the user and to qualified service engineers. Some of the solutions can be carried out by the user, but others (which are clearly identified) must be carried out only by approved Edwards service engineers.

5.2 Electrical fault finding

Note: The On/off switch has an integral thermal magnetic circuit breaker, which automatically resets when switched off.

If an electrical fault is suspected, use Table 6 below to identify the possible causes and actions to cure the fault. If the fault persists after carrying out the recommended action, contact your supplier or Edwards before you use the Micromodulyo again.

Symptom	Check	Action
The On/Off switch is on but there is no electrical supply to any components.	Has the thermal magnetic circuit-breaker tripped ?	If so, identify and rectify the cause of the problem.
	Has the external fuse in the electrical supply failed ?	If so, identify and rectify the cause of the problem, then replace the fuse. If not, call a qualified service engineer.

Table 6 - Electrical fault finding

5.3 Refrigeration faults

5.3.1 Safety

WARNING
Obey the safety instructions given below and take note of appropriate precautions.

The refrigerant used in the Micromodulyo is heavier than air and is an asphyxiant by the displacement of oxygen.

If a refrigerant leak is suspected, place the Micromodulyo in a well-ventilated area. Do not allow naked flames or smoking near the Micromodulyo, as products of combustion of the refrigerant include dangerous fluorides and chlorides.

If refrigerant vapour is inhaled, summon medical help immediately. Take the victim to a well-ventilated, uncontaminated area; If the victim's breathing is weak or has stopped, apply artificial ventilation, preferably using an oxygen resuscitator. Do **not** use adrenalin or other cardiac stimulants.

At normal atmospheric pressure, the refrigerant will evaporate at -40 °C. Contact with skin or eyes can cause cold burns. If contact has taken place, seek medical help immediately and carry out the following : Remove clothing from the affected area; Carefully irrigate the affected area with tepid water for at least 15 minutes; Apply a sterile dressing and treat the wound as you would a heat burn.

5.3.2 Repeat the installation test

If you suspect that there is a fault in the refrigeration system in the Micromodulyo, then :

1. Defrost the condenser chamber (refer to the defrosting instructions given in Section 4.8).
2. Repeat the installation tests of Section 3.5. Note the results at each step and then contact an Edwards Service Centre.

5.3.3 Fault diagnosis

Some possible causes of refrigeration faults, together with suggested solutions, are shown in Table 7.

If other symptoms occur, or the cause of a fault cannot be identified, contact Edwards or your supplier.

Symptom	Check	Action
The compressor does not start.	Is the electrical supply voltage too low ?	Use an alternative electrical supply. Remove any extension leads which can cause small voltage drops.
	Is the voltage selector switch in the correct position (dual voltage Micromodulyo only) ?	Ensure that the voltage selector switch is in the correct position: refer to Section 3.3.2.
The compressor starts but the temperature does not reach -50 °C.	Is there sufficient ventilation ?	If not, relocate the Micro-modulyo. There must be no restrictions to air-flow to the sides and rear of the Micro-modulyo.
The Operating Temperature lamp goes off during drying and stays off for more than 20 minutes.	Is the load on the Micromodulyo too high ?	Reduce the amount of product being freeze dried or restrict the vapour load to the Micro-modulyo.

Table 7 - Refrigeration fault finding

5.4 Poor vacuum performance

The vacuum system on the Micromodulyo is unlikely to cause problems during normal use. If you suspect a leak in the vacuum system, use the following procedure.

1. Defrost the condenser chamber (see Section 4.8), then thoroughly dry and clean the chamber (see Section 4.3).

2. Fit the accessory with the smallest volume or blank off the accessory-flange.

   A blanking-flange fitted with a vacuum gauge will help you to monitor pumping progress; alternatively, you can fit a vacuum gauge in the vacuum pipeline.

3. Make sure that your vacuum pump is connected and that the quality of the pump oil is satisfactory (refer to the instruction manual supplied with your pump).

4. Close the drain-valve then switch on your vacuum pump and fully open the gas-ballast valve.

5. Leave the system on for approximately 12 hours.

If there is no leak but the system is contaminated, the previous procedure will purge the system of the contaminant. If the ultimate pressure is still poor, carry out the following :

1. Check that all seals are clean and free from damage.

2. Check that there is no leak in the vacuum pipeline between the pump and the Micromodulyo.

3. Check that the vacuum pump works correctly. If possible, use another pump.

4. Isolate the Micromodulyo from the electrical supply.

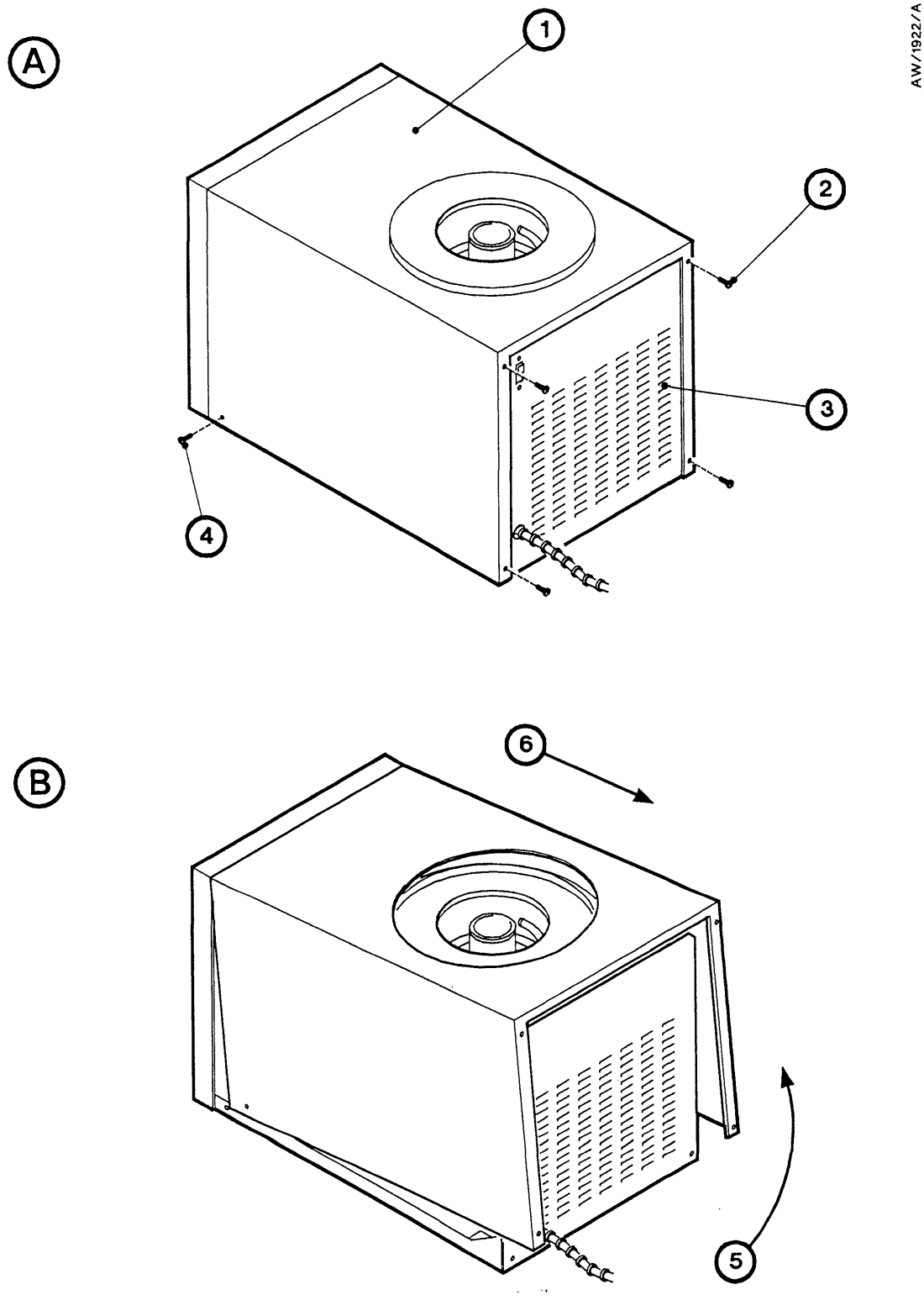
5. Refer to Figure 5, detail A. Undo and remove the four screws (2) which secure the cover (1) to the rear panel (3) and undo and remove the two screws (4) which secure the cover (1) to the side of the Micromodulyo.

6. Refer to Figure 5, detail B. Lift up the rear of the cover (as shown by arrow 5), then pull the cover backwards (as shown by arrow 6) to remove it.

7. Check all internal vacuum connections, including the vacuum pipeline, the drain-valve and the drain-valve connection.

If you still cannot determine the cause of the problem, contact Edwards or your supplier for advice.

After fault finding, refit the cover: use the reverse procedure of Steps 5 and 6 above.



1. Cover
2. Screws (4 off)
3. Rear panel
4. Screws (2 off)
5. Lift the cover
6. Pull off the cover

Figure 5 - Remove the cover

6 STORAGE AND DISPOSAL

6.1 Storage

Store the Micromodulyo as follows :

1. If applicable, ensure that the Micromodulyo has been shut down as described in Section 4.7.
2. Disconnect the electrical supply and vacuum connections and clean the Micromodulyo (see Section 4.3).
3. Replace any protective covers supplied with the Micromodulyo.
4. Store the Micromodulyo in clean dry conditions until required.
5. When required for use, prepare and install the Micromodulyo as described in Section 3 of this manual.

6.2 Disposal

Dispose of the Micromodulyo and any components safely in accordance with all local and national safety and environmental requirements.

7 SPARES AND ACCESSORIES

7.1 Introduction

Edwards products, spares and accessories are available from Edwards companies in Belgium, Brazil, Canada, France, Germany, Hong Kong, Italy, Japan, Korea, Switzerland, United Kingdom, U.S.A, and a world wide network of distributors. The majority of these centres employ Service Engineers who have undergone comprehensive Edwards training courses.

Order spare parts and accessories from your nearest Edwards company or distributor. When you order, please state for each part required:

- Model and Item Number of your equipment
- Serial number (if any)
- Item Number and description of part.

7.2 Accessories

7.2.1 Drying accessories

Accessory	Item Number
8-port column manifold	F056-56-000
Bell jar	F029-60-000
Stoppering shelf unit	F056-23-000
Heater kit for stoppering shelf unit	F056-55-000
Spin freezer 96 (220 V)	F056-37-000
Spin freezer 96 (110 V)	F056-38-000
Secondary drying manifold	F029-64-000
Cold trap adaptor	F056-60-000

7.2.2 Glassware

Accessory		Item Number
Vials	2 ml (approximately 1000 off)	H014-30-008
	5 ml (approximately 100 off)	H014-30-048
	10 ml (approximately 100 off)	H014-30-042
	20 ml (approximately 94 off)	H014-30-043
Ampoules	0.5 ml (approximately 1000 off)	H014-30-081
	2.5 ml (approximately 500 off)	H014-30-092
	5.0 ml (approximately 200 off)	H014-30-083
Wide-mouth flasks	1000 ml	F056-57-000
	500 ml	F056-50-000
	250 ml	F056-58-000

7.2.3 Sealing accessories

Accessory		Item Number
Stoppers	13 mm (1000 off)	H014-30-121
	20 mm (1000 off)	H014-30-122
Caps	13 mm (1000 off)	H014-30-161
	20 mm (1000 off)	H014-30-162
	Wide-mouth flasks (all)	F056-59-000
Ampoule constrictor		F041-01-000

7.2.4 Vacuum pumps and accessories

A range of vacuum pumps suitable for use with the Micromodulyo is available from Edwards. These pumps are also suitable for freeze drying products which contain sodium azide. Vacuum pump accessories such as oil mist filters are also available. Please contact Edwards or your supplier to discuss your vacuum pump requirements.

Return of Edwards Equipment - Procedure (Form HS1)

Introduction

Before you return your equipment you must warn your supplier if the substances you used (and produced) in the equipment can be dangerous. You must do this to comply with health and safety at work laws.

You must complete the Declaration (HS2) on the next page and send it to your supplier before you dispatch the equipment. If you do not, your supplier will assume that the equipment is dangerous and he will refuse to accept it. If the Declaration is not completed correctly, there may be a delay in processing your equipment.

Guidelines

Take note of the following guidelines:

- Your equipment is '**uncontaminated** ' if it has not been used or if it has only been used with substances that are not dangerous. Your equipment is '**contaminated** ' if it has been used with any dangerous substances.
- If your equipment has been used with radioactive substances, you must decontaminate it before you return it to your supplier. You must send independent proof of decontamination (for example a certificate of analysis) to your supplier with the Declaration (HS2). Phone your supplier for advice.
- We recommend that contaminated equipment is transported in vehicles where the driver does not share the same air space as the equipment.

PROCEDURE

Use the following procedure:

1. Contact your supplier and obtain a Return Authorisation Number for your equipment.
2. Turn to the next page(s), photocopy and then complete the Declaration (HS2).
3. Remove all traces of dangerous gases: pass an inert gas through the equipment and any accessories which will be returned to your supplier. Drain all fluids and lubricants from the equipment and its accessories.
4. Disconnect all accessories from the equipment. Safely dispose of the filter elements from any oil mist filters.
5. Seal up all of the equipment's inlets and outlets (including those where accessories were attached). You may seal the inlets and outlets with blanking flanges or heavy gauge PVC tape.
6. Seal contaminated equipment in a thick polythene bag. If you do not have a polythene bag large enough to contain the equipment, you can use a thick polythene sheet.
7. If your equipment is a large pump (or any other large piece of equipment), strap the equipment and its accessories to a wooden pallet. Preferably, the pallet should be no larger than 510mm x 915mm (20" x 35"); contact your supplier if you cannot meet this requirement.
8. If your equipment is too small to be strapped to a pallet, pack it in a suitable strong box.
9. If the equipment is contaminated, label the pallet (or box) in accordance with laws covering the transport of dangerous substances.
10. Fax or post a copy of the Declaration (HS2) to your supplier. The Declaration must arrive before the equipment.
11. Give a copy of the Declaration to the carrier. You must tell the carrier if the equipment is contaminated.
12. Seal the original Declaration in a suitable envelope; attach the envelope securely to the outside of the equipment package. **WRITE YOUR RETURN AUTHORISATION NUMBER CLEARLY ON THE OUTSIDE OF THE ENVELOPE OR ON THE OUTSIDE OF THE EQUIPMENT PACKAGE.**

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Return of Edwards Equipment - Declaration (Form HS2)

Return Authorisation Number:

You must:

- Know about all of the substances which have been used and produced in the equipment before you complete this Declaration
- Read the Procedure (HS1) on the previous page before you attempt to complete this Declaration
- Contact your supplier to obtain a Return Authorisation Number and to obtain advice if you have any questions
- Send this form to your supplier before you return your equipment

SECTION 1 : EQUIPMENT

Equipment model _____

Serial Number _____

Has the equipment been used, tested or operated?

yes ❑ Go to Section 2 no ❑ Go to Section 4

FOR SEMICONDUCTOR APPLICATIONS ONLY :

Tool Reference Number _____

Process _____

Failure Date _____

Serial Number of Replacement Pump _____

SECTION 2 : SUBSTANCES IN CONTACT WITH THE EQUIPMENT

Are any of the substances used or produced in the equipment

- Radioactive yes ❑ no ❑
- Biologically active yes ❑ no ❑
- Dangerous to human health and safety? yes ❑ no ❑

If you have answered 'no' to all of these questions, go to Section 4.

Your supplier will not accept delivery of any equipment that is contaminated with radioactive substances, unless you:

- Decontaminate the equipment
- Provide proof of decontamination

YOU MUST CONTACT YOUR SUPPLIER FOR ADVICE BEFORE YOU RETURN SUCH EQUIPMENT

SECTION 3 : LIST OF SUBSTANCES IN CONTACT WITH THE EQUIPMENT

Substance name	Chemical symbol	Precautions required (for example, use protective gloves, etc.)	Action required after spillage or human contact
1			
2			
3			
4			
5			
6			

SECTION 4 : RETURN INFORMATION

Reason for return and symptoms of malfunction: _____

_____

If you have a warranty claim:

- who did you buy the equipment from ? _____
- give the supplier's invoice number _____

SECTION 5 : DECLARATION

Print your name: _____ Print your job title: _____

Print your organisation: _____

Print your address: _____

_____

Telephone number: _____ Date of equipment delivery: _____

I have made reasonable enquiry and I have supplied accurate information in this Declaration. I have not withheld any information. I have followed the Return of Edwards Equipment Procedure (HS1) on the previous page.

Signed: _____ Date: _____

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