

Instruction Manual

Model 250 Water-Cooled Exhaust Trap

Description

Item Number

Model 250 Water-Cooled Exhaust Trap

A531-14-000

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Associated publications

Publication title	Publication Number
Drystar MKII Dry Pumping System	A302-73-880
Compact Drystar Pumps Models CDP40Si and CDP80Si	A526-43-880
QDP Drystar Vacuum Pumps	A528-40-880
QMKII Dry Pumping System	A529-78-880
Disposable Liners for the Model 250 Water-Cooled Exhaust Trap	A531-15-880

1 INTRODUCTION

1.1 Scope and definitions

This manual provides installation, operation and maintenance instructions for the BOC Edwards Model 250 Water-Cooled Exhaust Trap. You must use the Exhaust Trap as specified in this manual.

Read this manual before you install and operate the Exhaust Trap. 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 Description

1.2.1 General

Refer to Figure 1. The Exhaust Trap cools the exhaust gases from the pump and causes particulates to collect in the Exhaust Trap. This prevents the collection of particulates in the exhaust-system. **The Exhaust Trap is designed for connection to a pump which is used in an LPCVD nitride process using dichlorosilane or hexachlorodisilane and ammonia. The Exhaust Trap is not suitable for connection to a pump which is used in other processes.**

The Exhaust Trap is designed to fit BOC Edwards CDP and QDP dry pumps and Drystar MKI, MKII and QMKII dry pumping systems. Your system must incorporate a pressure switch to shut-down the pump if the exhaust system becomes blocked.

The Exhaust Trap has a main outer body (6) which is mounted on a baseframe (12). You can adjust the height of the trap-body in the baseframe to fit the Exhaust Trap to different pumps. The baseframe has castors (10) for ease of movement of the Exhaust Trap and levelling feet (9) so that you can securely locate the Exhaust Trap in its operating position.

1.2.2 Principle of operation

Refer to Figure 1. The Exhaust Trap inner body (32) is cooled by water which flows through cooling-coils (33) wrapped around the trap-body. After it has passed through the cooling-coils, the water flows upwards through the outside of a cold-finger (21) inside the trap-body and then out of the trap-body through a pipe in the centre of the cold-finger (27).

The exhaust gases from the pump enter the inner body (32) through the Exhaust Trap inlet elbow (8). The cooled inner body then cools the gases and particulates are collected on the following liner components in the inner body:

- Inner and outer liners (20, 31)
- Inlet and outlet end-shields (29, 34)
- Cold-finger liner (30) and cold-finger end-cap (19).

In addition, the trap inlet and outlet (8, 16) are protected by inlet and outlet liners (24, 17).

The exhaust gases then flow out through the Exhaust Trap outlet (16), through the exhaust-silencer (1), if fitted, and into the exhaust-extraction system.

All of the liner components can be easily removed and replaced.

1. Exhaust-silencer (not supplied)	18. Outlet gasket
2. Exhaust-silencer outlet	19. Cold-finger end-cap
3. Clamp	20. Inner liner
4. Trap outlet elbow	21. Cold-finger
5. Thumbwheels	22. Inlet gasket
6. Trap outer body	23. 'O' rings
7. Cooling-water inlet	24. Inlet liner
8. Trap inlet elbow	25. Nuts and washers
9. Levelling foot	26. Inlet insulator
10. Castor (4 off)	27. Cold-finger cooling-water outlet pipe
11. Cooling-water outlet	28. Bottom flange
12. Baseframe	29. Inlet end-shield
13. Lifting-bolt	30. Cold-finger liner
14. 'O' ring	31. Outer liner
15. Top-flange	32. Trap inner body
16. Trap outlet	33. Cooling-coils
17. Outlet liner	34. Outlet end-shield

Figure 1 - Key

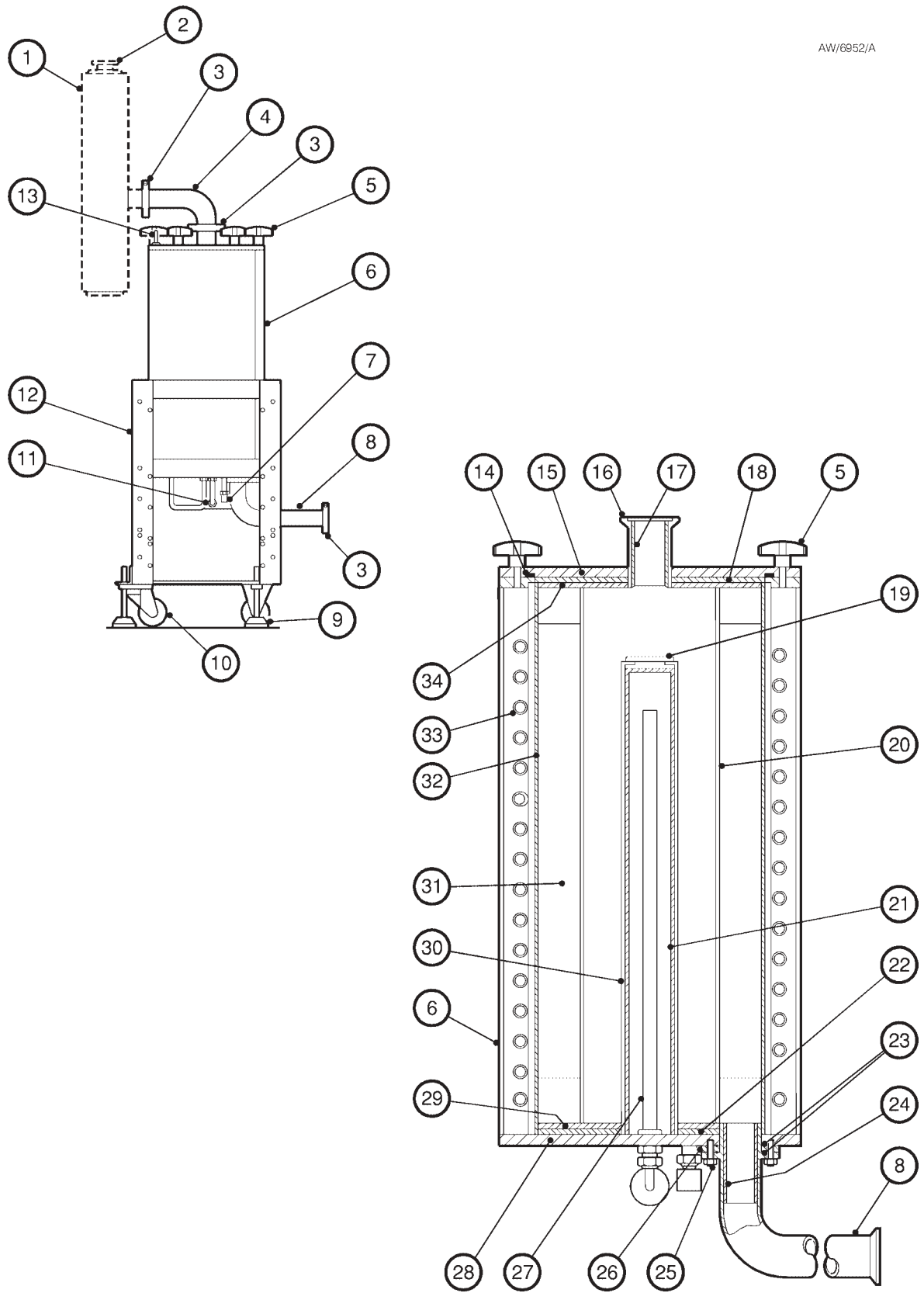


Figure 1 - Components of the Exhaust Trap (with a cross-section of the trap-body)

1.3 Installation options

The baseframe of the Exhaust Trap has mounting holes which allow you to connect the Exhaust Trap to the dry pump in a number of different ways. This manual describes the recommended installation configuration, where the Exhaust Trap is connected directly to the outlet of the dry pump (as shown in Figure 3).

If you wish to install the Exhaust Trap in a different configuration, contact your supplier or BOC Edwards for advice; in particular, note that:

- If you want to connect the Exhaust Trap to the position of the exhaust-silencer outlet on the dry pump, you must use an Exhaust Trap Connection and T.M.S. Kit accessory: refer to Section 7.
- If you want to install the Exhaust Trap in some other location and fit a connecting pipeline between the pump and the Exhaust Trap inlet, you must ensure that the temperature of the connecting pipeline does not fall to below 120 °C. A BOC Edwards Temperature Management System (TMS) of suitable heaters and insulators is available for this purpose.

2 TECHNICAL DATA

2.1 Operating conditions

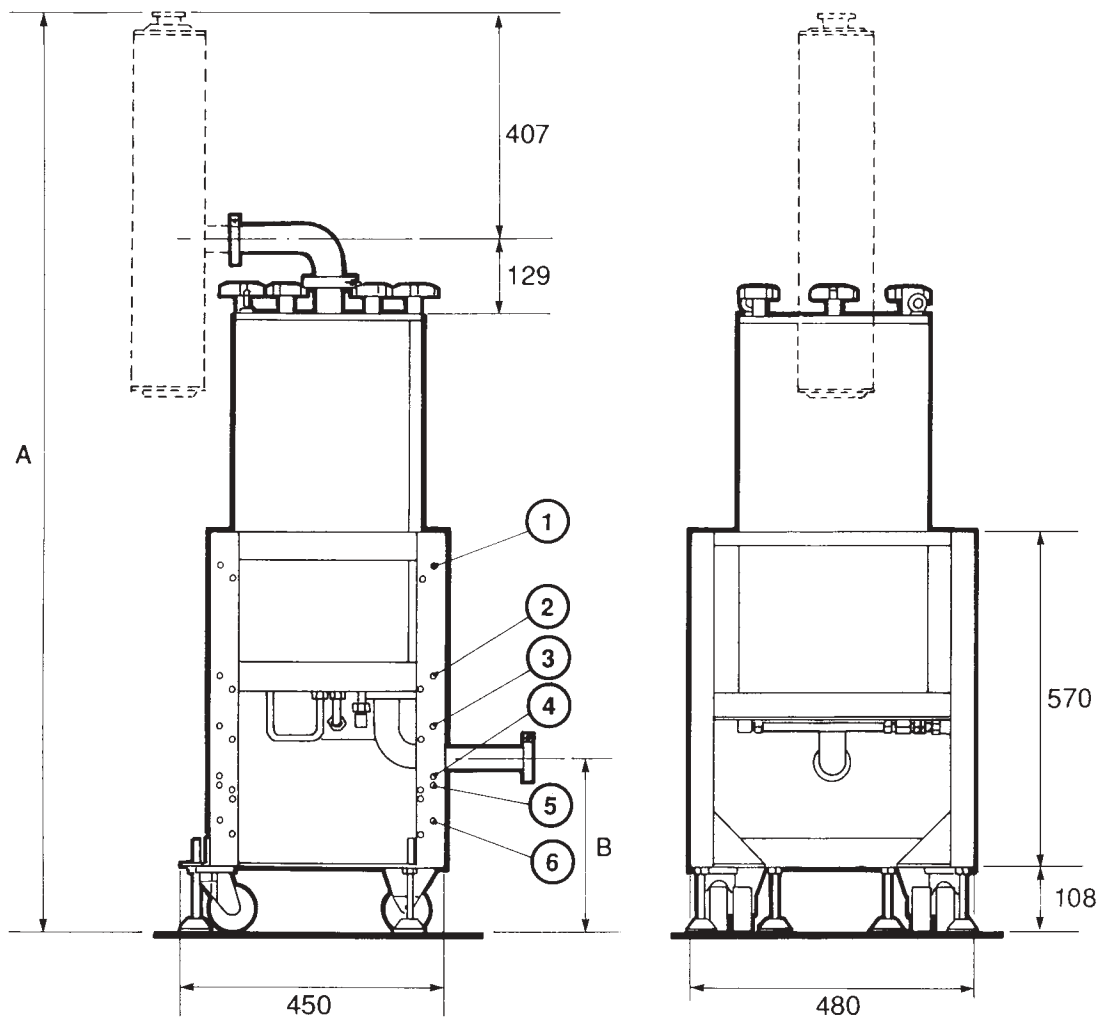
Maximum cooling-water pressure	7 bar gauge (70 Pa)
Minimum cooling-water flow rate	6 l min ⁻¹
Maximum inlet-port pressure	10 bar gauge (100 Pa)
Leak-tightness	1 x 10 ⁻⁶ mbar l s ⁻¹ (1 x 10 ⁻⁴ Pa l s ⁻¹)

2.2 Mechanical data

Dimensions	See Figure 2
Trap inlet	NW40
Trap outlet	NW40
Water-inlet connector	³ / ₈ inch BSP male quick-connect
Water-outlet connector	³ / ₈ inch BSP female quick-connect

2.3 Construction materials

Trap-body	AISI 304L stainless steel
Cooling-water coils	Copper
Liner components	Zinc coated mild steel



AG/0203/B

Mounting hole	Pump/pumping system & installation configuration	A	B
1	Drystar MKII & QMKII, pump outlet	1808	515
2	CDP & QDP, pump outlet	1628	325
3	Drystar MKII & QMKII, exhaust-silencer outlet *	1533	240
4	QDP, exhaust-silencer outlet *	1448	155
5	Drystar MKI, pump outlet and CDP 40/80Ni, exhaust-silencer outlet *	1433	140
6	CDP 40/80i/Ei/Si exhaust-silencer outlet *	1373	80

* Installation configuration not described in this manual: see Section 1.3

Figure 2 - Exhaust Trap dimensions (mm)

3 INSTALLATION

3.1 Safety

WARNING

Obey the safety instructions given below and take note of appropriate precautions. If you do not, you can cause injury to people and damage to equipment.

A suitably trained and supervised technician must install your Exhaust Trap. Obey the safety instructions below when you do installation work, especially when you connect into existing systems. Details of specific safety precautions are given at the appropriate point in the instructions.

- Wear the appropriate safety-clothing when you come into contact with contaminated components
- Vent and purge the pumping system before you start installation work
- Check that all the required components are available and of the correct type before you start work
- Ensure that the installation technician is familiar with the safety procedures which relate to the products handled by the process system
- Disconnect the other components in the process system from the electrical supply so that they cannot be operated accidentally
- Leak-test the system after installation work is complete and seal any leaks found to prevent the leakage of dangerous substances from the system and the leakage of air into the system.

3.2 Unpack and inspect

Remove all protective covers and check the Exhaust Trap.

If the Exhaust Trap is damaged, notify your supplier and the carrier in writing within three days; state your order number and invoice number. Retain all packing materials for inspection. Do not use the Exhaust Trap if it is damaged.

Check that your package contains the items listed in Table 1 below. If any item is missing, notify your supplier within three days.

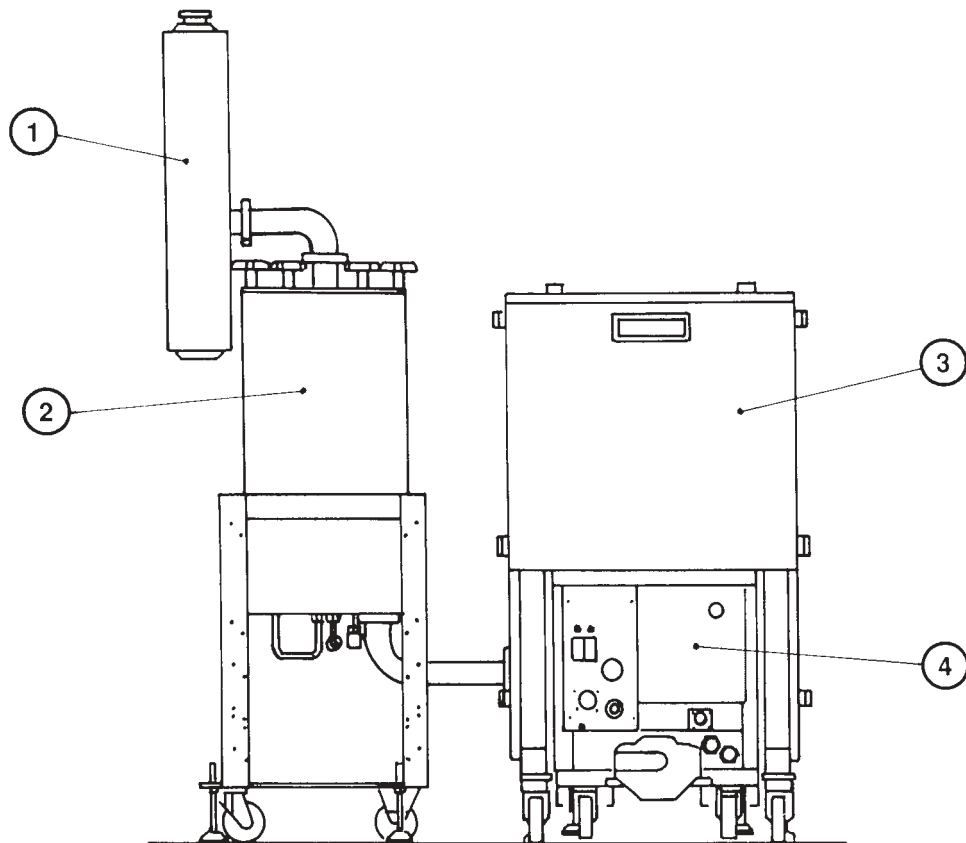
If the Exhaust Trap is not to be used immediately, replace the protective covers. Store the Exhaust Trap in suitable conditions as described in Section 6.1.

Qty	Description	Check (✓)
1	Exhaust Trap	<input type="checkbox"/>
2	Cooling-water quick-release connectors	<input type="checkbox"/>
2	Co-Seal	<input type="checkbox"/>
2	Clamps	<input type="checkbox"/>
1	Pump outlet adaptor	<input type="checkbox"/>
1	Blanking plate	<input type="checkbox"/>
1	Connecting pipe	<input type="checkbox"/>
2	Pipe insulation jackets	<input type="checkbox"/>
2	Elbows	<input type="checkbox"/>

Table 1 - Checklist of components

3.3 Prepare the Exhaust Trap and the dry pump

1. Prepare a suitable base for the Exhaust Trap, in its required operating position (see Figure 3).
2. Ensure a cooling-water supply and an exhaust-extraction system are available for connection to the Exhaust Trap.
3. The Exhaust Trap body is secured to the baseframe by eight M10 bolts, four on the front of the baseframe and four on the back of the baseframe. These bolts pass through the mounting holes in the baseframe (Figure 2, items 1 to 6). Ensure that the bolts are in the correct mounting holes for your installation configuration. If the Exhaust Trap is not configured correctly for your pump:
 - Attach suitable lifting gear to the lifting-bolts on the Exhaust Trap (Figure 1, item 13).
 - Remove the eight bolts which secure the Exhaust Trap to the baseframe.
 - Raise or lower the Exhaust Trap so that the inlet height is configured correctly for your pump, then secure the Exhaust Trap to the baseframe with the eight bolts.
4. Purge then shut down the pumping system. Allow the pump to cool to a safe temperature.
5. Remove the acoustic enclosure (if fitted) on the pump-outlet side of the pump.



1. Exhaust silencer
2. Exhaust Trap
3. QMB Booster Frame Acoustic Enclosure
4. QDP pump

Figure 3 - Exhaust Trap shown installed on a QMB/QDP combination pumping system

3.4 Fit the Exhaust Trap to the dry pump

WARNING

If your application uses hexachlorodisilane, ensure that liquid hexachlorodisilane cannot reach the Exhaust Trap.

WARNING

Use only BOC Edwards barrier shield trapped 'O' rings to seal pipeline connections.

Note: In the following procedure, where necessary refer to the instruction manual(s) supplied with your pump or pumping system.

1. Remove the elbow and the exhaust-silencer from the adaptor on the pump-outlet.
2. Undo the connectors and remove any gas pipelines (for example, exhaust-purge pipeline and gearbox vent pipeline) from the top of the adaptor on the pump-outlet.
3. Fit the pump-outlet adaptor (supplied with the Exhaust Trap) to the pump-outlet. Fit the blanking plate supplied to the bottom of the adaptor.
4. Refit any gas pipelines to the new pump-outlet adaptor; use Loctite 577 to seal the taper threads.
5. Use a clamp and Co-Seal to fit the short connecting pipe supplied to the pump-outlet adaptor.
6. Push the Exhaust Trap on its castors to move it into position next to the outlet of the pump.
7. Use a clamp and Co-Seal to fit the Exhaust Trap inlet to the end of the connecting pipe (fitted in Step 5).
8. Fit the two pipe insulation jackets supplied onto the connecting pipe.
9. Lower the levelling feet (Figure 1, item 9) until the Exhaust Trap is level and does not rest on the castors (10).
10. Connect the Exhaust Trap to your exhaust-extraction system as described in Section 3.5.

3.5 Connect the Exhaust Trap to your exhaust-extraction system

WARNING

Use only BOC Edwards barrier shield trapped 'O' rings to seal pipeline connections.

Note: You can connect your exhaust-extraction system directly to the Exhaust Trap outlet. However, the Exhaust Trap is not designed to act as a silencer and we recommend that you fit an exhaust-silencer to the Exhaust Trap outlet. The Item Number of a suitable exhaust-silencer is given in Section 7.

1. Refer to Figure 1. Use the outlet elbow (4) and the clamps (3) and Co-Seals (supplied with the Exhaust Trap) to fit the exhaust-silencer (1) to the Exhaust Trap outlet as shown in Figure 1.
2. Connect the silencer outlet (2) to your exhaust-extraction system.

3.6 Connect the cooling-water hoses

Use the following procedure to connect the cooling-water supply to the Exhaust Trap; refer to Figure 1.

1. Fit the male and female type quick-release connectors (supplied with the Exhaust Trap) to your cooling-water supply and return hoses with $\frac{3}{8}$ -inch BSP male pipe fittings (which you must supply).
2. Remove the dust-caps from the cooling-water connectors on the Exhaust Trap (7, 11).
3. Connect your water supply hose to the water-inlet connector (7). Connect your water return hose to the water-outlet connector (11).
4. Turn on the cooling-water supply, then check the water hoses, pipelines and connections to ensure that there are no leaks.
5. Turn off the cooling-water supply while you complete the remainder of the installation procedures.

3.7 Install the QDP Exhaust Pressure Module (if necessary)

Your system must incorporate a pressure switch to shut-down the pump if the exhaust system becomes blocked.

BOC Edwards CDP Si pumps and Drystar MKII and QMKII pumping systems incorporate a pressure switch. If you use the Exhaust Trap with a QDP pump, you must fit a QDP Exhaust Pressure Module which is available as an accessory (see Section 7). Fit the QDP Exhaust Pressure Module as described in the instruction manual supplied with the accessory.

If you use the Exhaust Trap with another type of pump, you must ensure that there is a hard-wired interlock upstream of the trap which will shut down the pump in the event of exhaust system blockage.

3.8 Install a nitrogen flow switch

You may require nitrogen purge to ensure that your system is safe. This depends on your process. You must calculate how much nitrogen purge is required for safety and ensure that there is sufficient nitrogen purge flow at all times.

If your system has nitrogen purge, you must incorporate a nitrogen flow switch to shut down the system when nitrogen dilution falls below the safe level.

3.9 Leak-test the system

WARNING

Leak-test the system after installation and maintenance. Seal all detected leaks to prevent the leakage of dangerous substances from the system and leakage of air into the system.

Leak-test the system after you have installed the Exhaust Trap and seal any leaks found. Hazardous substances which leak from the system will be dangerous to people and there will be a danger of explosion if air leaks into the system. Also, if air leaks into the exhaust-system, this will promote the collection of particulates in the exhaust-system.

We recommend that the maximum allowed leak rate is 1×10^{-5} mbar l s⁻¹ (1×10^{-3} Pa l s⁻¹) helium.

4 OPERATION

4.1 Start-up

To operate the Exhaust Trap, do the following before you start the pump:

1. Turn on the cooling-water supply to the Exhaust Trap.
2. Ensure that the cooling-water temperature and flow rate are suitable for your application.
3. Turn on the exhaust-extraction system.

When the pump starts, the flow of water through the Exhaust Trap will cool the exhaust gases and particulates will start to collect in the Exhaust Trap.

4.2 Shut-down

After you switch off the pump, immediately turn off the cooling-water supply to the Exhaust Trap.

5 MAINTENANCE

5.1 Safety

WARNING

You must use the appropriate procedures to shut down the pumping system before you start to maintain the Exhaust Trap. Ensure that the system has been adequately purged with nitrogen to remove any hazardous substances before you shut down the pumping system.

WARNING

The substances accumulated in the Exhaust Trap are likely to be hazardous. Do not allow your skin or eyes to come into contact with these substances. Do not inhale vapours within the Exhaust Trap. Wear gloves, goggles and respiratory protective equipment.

WARNING

Obey the safety instructions given below and take note of appropriate precautions. If you do not, you can cause injury to people and damage to equipment.

- A suitably trained and supervised technician must perform maintenance work
- Allow the pump and the Exhaust Trap to cool to a safe temperature before you start maintenance work.
- Check that all the required parts are available and of the correct type before you start work
- Ensure that the maintenance technician is familiar with the safety procedures which relate to the products pumped and produced.
- Isolate the pump from the electrical supply so that it cannot be operated accidentally.
- Dispose of components and contaminants safely (see Section 6).
- Take care to protect sealing-faces from damage.
- Leak-test the system after maintenance. Seal all detected leaks to prevent the leakage of dangerous substances from the system and leakage of air into the system.

5.2 Maintenance plan

The plan in Table 2 lists the minimum maintenance operations necessary to maintain the Exhaust Trap in normal use.

You may need to clean the Exhaust Trap more frequently, depending on your process conditions. If necessary, adjust the maintenance plan according to your experience.

Operation	Frequency	Refer to Section
Inspect the hoses, pipelines and connections	6 monthly	5.3
Clean the exhaust silencer	6 monthly	5.4
Replace the Exhaust Trap liners	6 monthly	5.5

Table 2 - Maintenance plan

5.3 Inspect hoses, pipelines and connections

1. Check that all cooling-water connections are secure. Inspect all cooling-water hoses, pipelines and connections for corrosion, leaks and damage.
2. Check that all vacuum connections are secure. Inspect all vacuum pipelines for corrosion and damage.

5.4 Clean the exhaust-silencer

Refer to Figure 1.

1. Disconnect the exhaust-silencer outlet (2) from your exhaust-extraction system.
2. Remove the clamp (3) and disconnect the exhaust-silencer inlet from the Exhaust Trap outlet elbow (4). Retain the Co-Seal.
3. Clean the exhaust-silencer as described in the instruction manual supplied with the exhaust-silencer (or with your pump/pumping system).
4. Use the clamp (3) and Co-Seal (removed in Step 2) to connect the exhaust-silencer inlet to the Exhaust Trap outlet elbow (4).
5. Connect the exhaust-silencer outlet (2) to your exhaust-extraction system.

5.5 Replace the Exhaust Trap liners

WARNING

Before you open the Exhaust Trap, ensure that the pressure in the Exhaust Trap is not above atmospheric pressure.

Note: When you replace the Exhaust Trap Liners, you must also replace the inlet insulator and 'O' rings (Figure 1, items 26 and 23).

You cannot clean the Exhaust Trap liners, you must replace them. Replacement Exhaust Trap liners are available as spares (see Section 7).

Replace the Exhaust Trap liners as described in the instruction manual supplied with the Exhaust Trap liners.

6 STORAGE AND DISPOSAL

6.1 Storage

Use the following procedure to store the Exhaust Trap.

1. Shut-down the pump as described in the instruction manual supplied with the pump.
2. Turn off the cooling-water supply to the Exhaust Trap. Place a suitable container under the Exhaust Trap cooling-water connectors (Figure 1, items 7 and 11), then disconnect the cooling-water supply and return hoses from the Exhaust Trap and allow the cooling-water to drain from the Exhaust Trap.
3. Disconnect the Exhaust Trap from the pump and your exhaust-extraction system.
4. Place protective covers over the Exhaust Trap inlet and outlet and the cooling-water connections on the Exhaust Trap.
5. Store the Exhaust Trap in cool, dry conditions until required for use. When required, prepare and install the Exhaust Trap as described in Section 3.

6.2 Disposal

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

Take particular care with components which have been contaminated with dangerous process substances.

7 SERVICE, SPARES AND ACCESSORIES

7.1 Introduction

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

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

- Model and Item Number of your equipment
- Serial number
- Item Number and description of part.

7.2 Service

BOC Edwards products are supported by a world-wide network of BOC Edwards Service Centres. Each Service Centre offers a wide range of options including: equipment decontamination; service exchange; repair; rebuild and testing to factory specifications. Equipment which has been serviced, repaired or rebuilt is returned with a full warranty.

Your local Service Centre can also provide BOC Edwards engineers to support on-site maintenance, service or repair of your equipment.

For more information about service options, contact your nearest Service Centre or other BOC Edwards company.

7.3 Spares

You must only use BOC Edwards recommended spares. The spares available for the Exhaust Trap are as follows:

Spare	Item Number
Replacement trap liners	A531-15-020
Co-Seal	B271-58-058
NW40 clamp	C105-16-401

7.4 Accessories

Accessory	Item Number
QDP Exhaust Pressure Module	A528-06-000
CDP/QDP Exhaust-silencer	A528-19-000
Exhaust Trap Connection and T.M.S. Kit for pump with 250/500 booster	A531-14-060
Exhaust Trap Connection and T.M.S. Kit for pump with 1200 booster	A531-14-065
T.M.S. Controller Unit 220/240V	A550-01-068
T.M.S. Controller Unit 110V	A550-01-069