Y020-00-880
Issue B

Instruction Manual

Pyrophoric Conditioning System

Supplementary Publications

Title	*Publication Number*
Exhaust Check-Valve	*A440-03-880*

BOC EDWARDS

Manor Royal, Crawley, West Sussex, RH10 2LW, UK
Telephone: +44 (0) 1293 528844 Fax: +44 (0) 1293 533453
http://www.bocedwards.com

Declaration of Conformity

We, BOC Edwards,
Manor Royal,
Crawley,
West Sussex RH10 2LW, UK

declare under our sole responsibility that the product(s)

PCS Pyrophoric Conditioning Systems, with Item Numbers in accordance with the following matrix structure:

Y020 - XX - XX0

Model/voltage:
1 'E' model: 230 V, 50 Hz
2 'S' model: 110 V, 60 Hz
3 'J' model: 100 V, 50/60 Hz

Number of inlets:
1 1 inlet
2 2 inlets

Enclosure:
0 No enclosure
1 Cyclone enclosure (for SEMI S2-93A compliance)

Installation options *:
0 None
1 Status display
2 On-line cleaning
3 Inlet pressure monitoring - 1 inlet
4 Inlet pressure monitoring - 2 inlets
5 Options 2 and 3 above
6 Options 2 and 4 above

* The status display is also supplied fitted as standard with installation options 2 to 6.

to which this declaration relates is in conformity with the following standard(s) or other normative document(s)

BSEN61010-1	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.
EN50081-1	Electromagnetic Compatibility, General Emission Standard. Generic Standard Class: Light Industry.
EN50082-2	Electromagnetic Compatibility, General Immunity Standard. Generic Standard Class: Heavy Industry.
UL3101-1	Electrical Equipment for Laboratory Use, Part 1: General Requirements.
C22.2 No. 1010-1-92	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements.
NFPA-79	National Electrical Code - Electrical Safety: Machines.
SEMI S2-93A	Safety Guidelines for Semiconductor Manufacturing Equipment.
SEMI S8-95	Safety Guidelines for Ergonomic/Human Factors Engineering of Semiconductor Manufacturing Equipment.

following the provisions of

73/023/EEC	Low Voltage Directive.
89/336/EEC	Electromagnetic Compatibility Directive.

Stephen E. Ormrod

Dr. S. E. Ormrod, Technical Director

11.11.99, Crawley

Date and Place

BOC EDWARDS

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1 INTRODUCTION

1.1 Scope and definitions

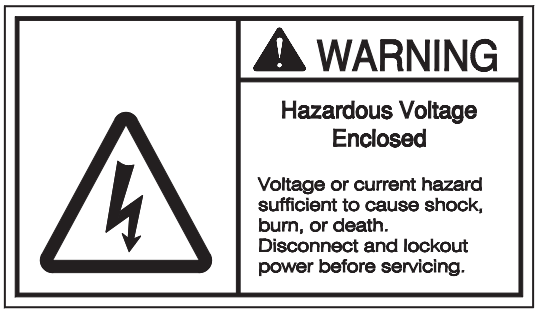
This manual provides installation, operation and maintenance instructions for the BOC Edwards Pyrophoric Conditioning System (abbreviated to PCS in the remainder of this manual). You must use the PCS as specified in this manual.

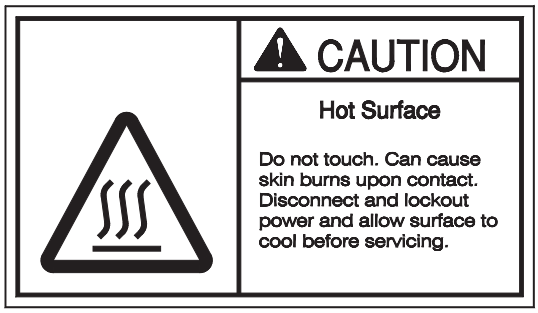
Read this manual before you install and operate the PCS. Important safety information is highlighted as WARNING and CAUTION instructions; you must obey these instructions. The use of WARNINGs and CAUTIONs is defined below.

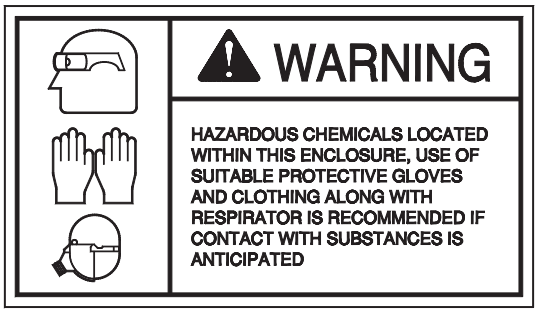
WARNING
Warnings are given where failure to observe the instruction could result in injury or death to people.

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

The following labels and symbol appear on the PCS:







Protective conductor terminal.

The units used throughout this manual conform to the SI international system of units of measurement. Also, the term 'inches.wg' is used to mean 'inches of water (gauge)'.

1.2 Description

The PCS is designed to treat the process exhaust gas streams from one or two dry pumping systems in a process application which uses silane. Single-inlet and dual-inlet PCS models are available: see Section 2.8. The PCS provides protection in the event of a process fault condition, when the exhaust gas stream contains flammable concentrations of silane.

The PCS will ensure that a silane fire or explosion does not occur in your exhaust-extraction system, but cannot ensure silane removal below TLV.

1.3 Applications

You must ensure that the PCS is suitable for use in your application. You must **not** install and use the PCS in an application for which it is not suitable.

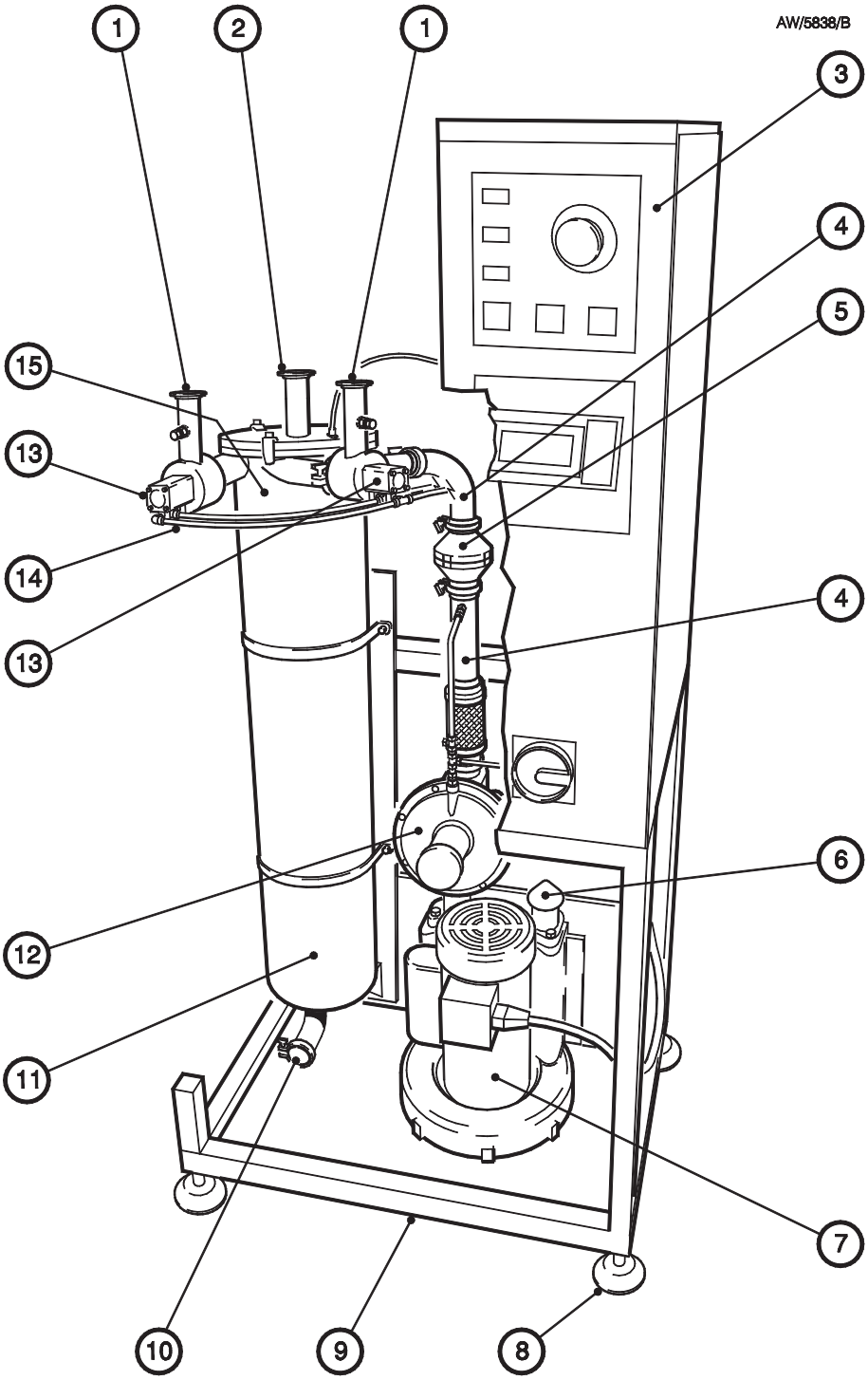
The PCS is suitable for use with the following:

- LPCVD processes including LPCVD Poly, LPCVD Doped Poly, LPCVD Oxide and LPCVD Doped Oxide, from manufacturers including TEL, Kokusai, SVG, Applied Materials and ASM.
- Novellus PECVD Oxide / Nitride.
- Applied Materials Oxide (Undoped TEOS).
- Applied Materials W-CVD.
- VMB's and Gas Cylinder Purge applications.
- Most silane CVD applications

The PCS is **not** suitable for use with the following:

- Any application where ClF_3 is used as a chamber cleaning gas.
- Applications with high hydrogen flows (that is, > 4%).
- W-CVD applications which use C_2F_6 / O_2 cleaning.
- Applied Materials PECVD Nitride (Brown Powder), Polycide, Reduced Pressure EPI and processes which use Remote Microwave Plasma cleaning.
- Novellus W-CVD applications.

If you have any doubt as to the suitability of the PCS for use in your applications, please contact the Exhaust Management Group (see Section 3.2) for advice.



1. Inlets
2. Outlet
3. Control unit
4. Blower air pipeline
5. Check-valve
6. Air inlet
7. Blower
8. Levelling feet
9. Frame
10. Trap cleaning elbow (blanked)
11. Trap
12. Pressure regulator
13. Cleaning actuators
14. Pneumatic pipes
15. Cyclone chamber

Figure 1 - Components of the PCS (dual-inlet PCS shown)

1.4 Principle of operation

Refer to Figure 1. The process exhaust gas enters the PCS at the inlet(s) (1) and flows into the cyclone chamber (15). Each inlet has a self-cleaning mechanism which consists of a spring on a plunger, pneumatically operated by the actuator (13), which operates regularly to dislodge any particulate from the inlet.

The blower (7) draws in ambient air from the inlet (6) and blows this through the blower air pipeline (4), through an orifice and into the cyclone chamber (15). The pressure regulator (12) controls the air pressure, and the check-valve (5) prevents the flow of process gases back into the blower air pipeline.

During normal Process Tool operation, with silane concentration in the process exhaust gas below the BOC Edwards recommended safe dilution level of 1%, the silane will be further diluted by the ambient air blown into the cyclone chamber.

When the silane concentration in the process exhaust gas reaches a level at which pyrophoric reactions may occur, the ambient air blown into the cyclone chamber will react safely with the process exhaust gas, to produce a silicate particulate.

The process exhaust gas flow in conjunction with the air flow from the blower produces a cyclone effect in the cyclone chamber, which causes particulates in the exhaust gas to be deposited in the trap (11) below the cyclone chamber. Diluted / reacted process gas flows out of the outlet (2) and into your exhaust-extraction system.

The operation of the PCS is monitored and controlled by a PLC (Programmable Logic Controller).

1.5 Controls and indicators

Refer to Figure 2. The controls and indicators on the PCS are as follows:

Status display (1)	This is an ordering option / accessory: see Section 1.7.
Electrical supply isolator (2)	Use this to switch the electrical supply to the PCS on and off.
Emergency off switch (3)	Use this to shut down the PCS in an emergency.
Reset button (4)	Use this to reset the PCS after the electrical supply has been switched on, or after an emergency shut down.
Audible alarm (5)	If fitted, this optional accessory (see Section 7.4.1) provides an audible indication that a fault condition exists.
Normal lamp (6)	This green lamp is on whenever the PCS is operating normally.

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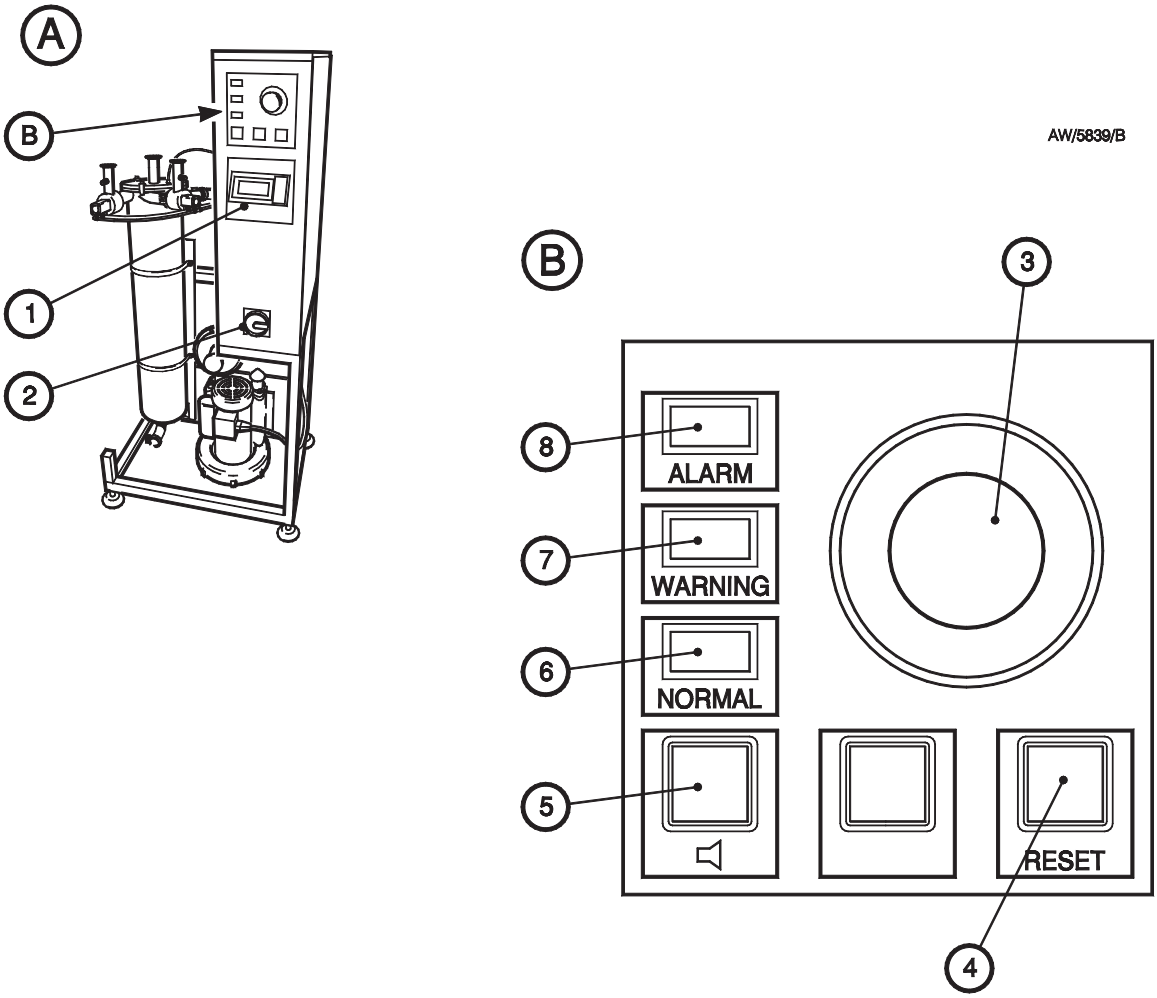


1. Status display *
2. Electrical supply isolator
3. Emergency off switch
4. Reset button
5. Audible alarm *
6. Normal lamp (green)
7. Warning lamp (amber)
8. Alarm lamp (red)
9. Electrical supply isolator (in locked out position)

* Optional accessory

Figure 2 - Controls and indicators

Warning lamp (7) This amber lamp is on whenever a warning condition exists: see Section 1.6.

Alarm lamp (8) This red lamp is on whenever an alarm condition exists: see Section 1.6.

1.6 Equipment interlocks, fault levels and remote fault outputs

Note: If the PCS has ordering options/accessories fitted, there may be additional process interlocks to those specified below: refer to Appendices A3 onwards.

The PCS has one safety critical interlock and two process interlocks, all of which are monitored by the PLC, which is certified to UL standard 991; these interlocks (and the setpoints at which they operate) are shown in Table 1.

The safety critical interlock (PSDL-202) monitors the system pressure by measuring the ambient air flow into the cyclone chamber, and is monitored by the PLC. In the event of low pressure, the PLC will indicate an alarm fault condition.

Each of the safety critical and process interlocks has an associated fault level (alarm or warning); the meanings of the fault levels are as follows:

- Warning This means that a non-serious or transient fault condition exists.
- Alarm This means that a serious fault condition exists.

When a fault condition is detected, the PCS will continue to operate. However, the PCS provides remote fault outputs, which you must connect to your Process Tool (see Section 3.9). When the PLC detects a fault condition, the remote fault outputs will identify the fault level (that is, warning or alarm) to the Process Tool. The Process Tool must take the necessary action for the fault condition (for example, shut down and lock out the Process Tool and the pumping system(s) in the event of an alarm).

In Table 1, note that the 'tag' denotes the label used on the corresponding component in the PCS.

Interlock	Tag	Setpoint	Fault level
Ambient air flow differential low pressure switch	PSDL-202	+3.5 inches.wg	Alarm
Process outlet high temperature switch	TIC-401	100 ^{o}C	Alarm
Nitrogen low pressure switch	PSL-301	3 bar gauge	Warning

Table 1 - Interlocks

1.7 Ordering options and accessories

You can order the PCS with one or more ordering options (see Section 2.8). Refer to Appendices A3 to A6 for full descriptions of these options.

Refer to Section 7.4 for the accessories available for the PCS.

2 TECHNICAL DATA

2.1 Operating and storage conditions

Operating ambient temperature range	5 to 40 ^{o}C
Operating ambient humidity range	30 to 95% RH, non-condensing
Storage ambient temperature range	5 to 40 ^{o}C
Equipment type	Suitable for indoor use only
Installation category	II
Pollution degree	I
Maximum gas flow rate	100 l.min^{-1} for each inlet, 200 l.min^{-1} total for the PCS
Recommended concentration of SiH_4	< 1% in N_2

2.2 Mechanical data

Mass	66 kg
Dimensions	See Figure 3
Maximum tilt angle	12^{o}
Centre of mass	See Figure 3
Mass distribution	See Table 2

2.3 Exhaust-extraction requirements

Maximum flow rate	1200 l.min^{-1} (blower air) + 200 l.min^{-1} (process gas)

Note: The above flow rate is that generated by the blower in the PCS; your exhaust-extraction system must be able to cope with this flow rate.

2.4 Nitrogen supply

Supply pressure	4 to 6 bar gauge, 5 x 10^{5} to 7 x 10^{5} Pa

2.5 Connections

	Size	**Material**
PCS inlet(s)	NW40	Stainless steel
PCS outlet	NW40	Stainless steel
Nitrogen supply connector	$^{1}/_{4}$ inch Swagelok	Brass
Process tool interface connections	Screw terminals inside the control unit (see Section 3.9)	

2.6 Electrical data

	'E' model PCS	'S' model PCS	'J' model PCS
Electrical supply			
Nominal voltage	230 V a.c.	110 V a.c.	100 V a.c.
Phases	1	1	1
Frequency	50 Hz	60 Hz	50/60 Hz
Electrical supply cable conductor size	1.5 mm^2	2.5 mm^2	2.5 mm^2
	16 AWG	14 AWG	14 AWG
Normal load current rating	3.7 A	7.7 A	8.5 A
Circuit breaker CB1 (air blower) rating	4 A	10 A	10 A
Fuse ratings			
FB1 (control unit)	1.6 A	2.5 A	2.5 A
FB2 (24 V control circuit)	1 A	1 A	1 A
Conductor colours			
>100 V	Black	Black	Black
a.c. line neutral	Blue	White	White
24 V a.c.	Red	Red	Red
24 V a.c. return	Red	White	White
24 V d.c. positive	Violet	Violet	Violet
24 V d.c. negative	Brown	Brown	Brown
Signal return	Pink	Pink	Pink
Earth (ground)	Green/ yellow	Green/ yellow	Green/ yellow

	Levelling foot (Figure 3 key)			
	6	**7**	**8**	**9**
Mass	23.4	23.4	9.1	9.1

Table 2 - Mass distribution

1. Outlet
2. Inlet 1
3. Inlet 2 †
4. Centre of mass
5. Control unit
6. Levelling foot
7. Levelling foot
8. Levelling foot
9. Levelling foot
10. Earthquake restraint fixing holes: 10

† Dual-inlet PCS only

Figure 3 - Dimensions (mm): key

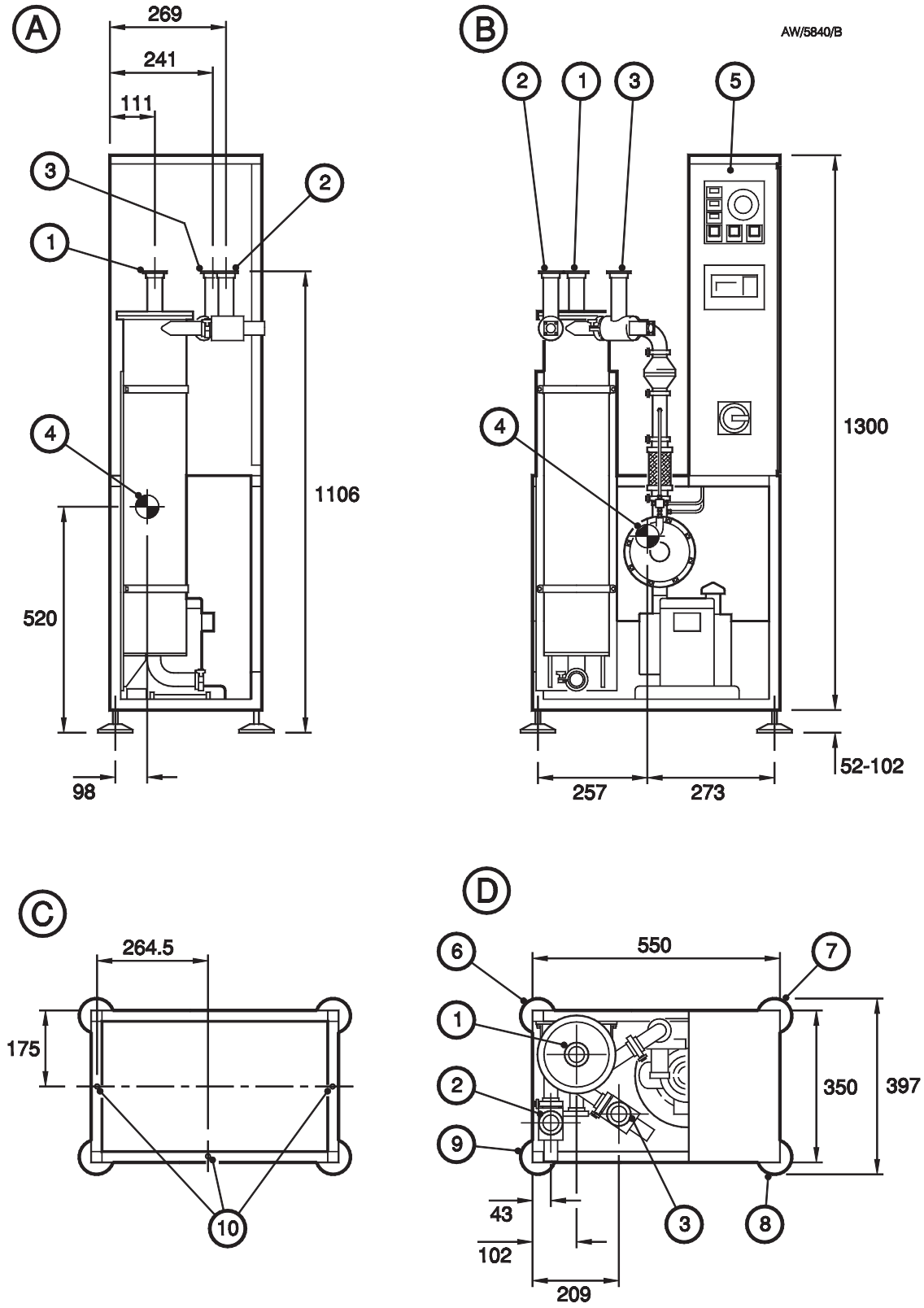


Figure 3 - Dimensions (mm)

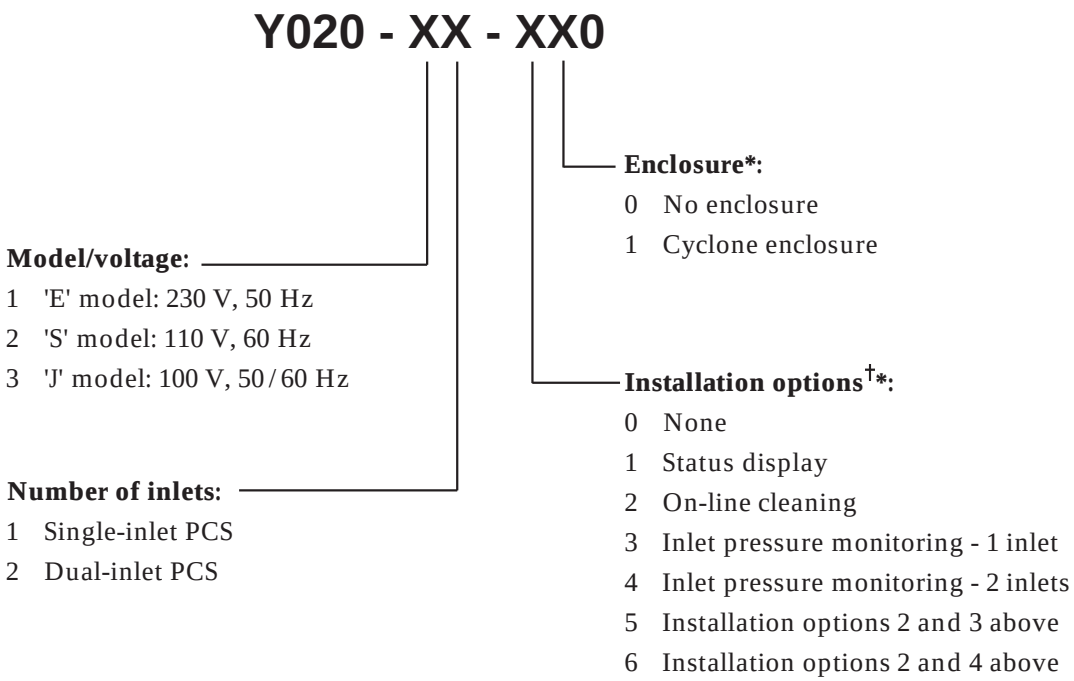
2.7 Manufacturing materials

Materials in contact with the process gases:

- Stainless steel
- Sheathed nickel alloy
- Viton.

2.8 Item Numbers

The Item Number of your PCS depends on the PCS model, the number of inlets, and the ordering options, in accordance with the following matrix structure:



For example, the Item Number for a dual-inlet 'E' model PCS, with an enclosure, and with the corresponding inlet pressure monitoring option is: Y020-12-210.

* The PCS only complies with SEMI S2-93A when the enclosure and the status display are fitted.

† The status display is also provided with installation options 2 to 6.

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 the PCS.
- If the PCS is to be installed on or connected to a Process Tool and/or pumping system(s) which have already been operated:
    - Ensure that you comply with the invasive procedures safety requirements of Section 5.1.3.
    - Ensure that the installation technician is familiar with the safety procedures which relate to the process gases pumped.
- Ensure that the maintenance technician is familiar with the safety procedures which relate to the use of compressed nitrogen.
- Vent and purge the pumping system(s) and ensure that the Process Tool and pumping system(s) are locked out before you start installation: refer to Section 4.3.1.
- Disconnect other components in the process system from the electrical supply, so that they cannot be operated accidentally.
- Leak test the system after installation and seal any leaks found: refer to Section 3.6.

3.2 System design requirements

WARNING

Ensure that the PCS is suitable for use in your application before you install and use the PCS: refer to Section 1.3.

WARNING

Do not install the PCS in a system in which explosive or reactive powders can pass into the exhaust pipelines.

WARNING

If the flow of untreated process gas into your exhaust-extraction system may result in a hazardous situation, you must incorporate suitable safety features in your control system.

CAUTION

The design of your exhaust-extraction system must prevent the drainage of moisture or condensation in the exhaust-extraction pipeline into the PCS. If it does not, the PCS may become blocked or corroded.

Before you install the PCS, ensure that it is suitable for use in your application (see Section 1.3).

Do **not** use the PCS on a system in which explosive or reactive powders can pass into the exhaust pipelines. If necessary, contact the Exhaust Management Group at the following address for advice:

Exhaust Management Group
BOC Edwards
Southfield Trading Estate
Southfield Road
NAILSEA
BS48 1JJ, UK

Phone: +(44) 1275 811200
Fax: +(44) 1275 810256
Email: support.nailsea@edwards.boc.com

Before you start installation, prepare a base for the PCS. The base must be firm and level. Ensure that there is sufficient room to access the PCS for installation and maintenance: in particular, there must be at least 360 mm free space above the cyclone chamber for servicing purposes.

Install the PCS as close as possible to the outlet of the pumping system(s), in order to ensure the immediate conditioning of the process gases. If the pipeline which connects a pumping system to the PCS is long, there will be a large volume of pipeline in which solids can be deposited, corrosion can occur, and flammable exhaust gases may collect.

We recommend that you use NW40 pipelines to connect the pumping systems to the PCS. Refer to Table 3 which shows the gas residence times in pipelines of different diameters.

The exhaust gas from the PCS can be hot, but the thermal capacity of the gas is usually low, so the gas will cool very quickly. The first two meters of the pipeline from the PCS outlet to your exhaust-extraction system must therefore be stainless steel (see Figure 4).

The design of your exhaust-extraction system must prevent the drainage of moisture or condensation in the exhaust-extraction pipeline into the PCS. For example, route the pipeline from the PCS into the top of the exhaust-extraction pipeline, as shown in Figure 4.

You must incorporate safety devices in your control system to switch off the pumping systems if a dangerous pressure rise is detected in the pipelines from the pumping systems to the PCS.

Pipe diameter (mm)	**Pipe length (m) ***					
	3	**4**	**5**	**6**	**7**	**8**
40	18	24	30	36	42	48
50	28	38	47	57	66	75
60	41	54	68	81	95	109
70	55	74	92	111	129	148
80	72	97	121	145	169	193
90	92	122	153	183	214	244
100	113	151	189	226	264	302
110	137	182	228	274	319	365
120	163	217	271	326	380	434
130	191	255	319	382	446	510
140	222	296	369	443	517	591
150	255	339	424	509	594	679
160	290	386	483	579	676	772
170	327	436	545	654	763	872

* The bold lines identify the recommended pipeline lengths and diameter.

Table 3 - Gas residence times (seconds) for different pipeline configurations (with 50 slm gas flow rate)

3.3 Unpack and inspect

WARNING

Do not try to lift the PCS on your own. Refer to Section 2 for the mass of the PCS.

The PCS is supplied on a pallet; use the following procedure to unpack and inspect the PCS:

1. Use a fork-lift or pallet truck to move the PCS (on its pallet) to a location close to its final operating location.

2. Remove any bands and so on which secure the PCS to its pallet.

3. Remove the packaging:

   - Use an appropriate tool to release the spring-clips on the side panels (remove the centre spring-clips last).

   - Remove the front panel.

   - Use an appropriate tool to release the spring-clips on the top panel, then remove the top panel.

4. Get someone to help you lift the PCS off of the pallet. Do not try to lift the PCS on your own.

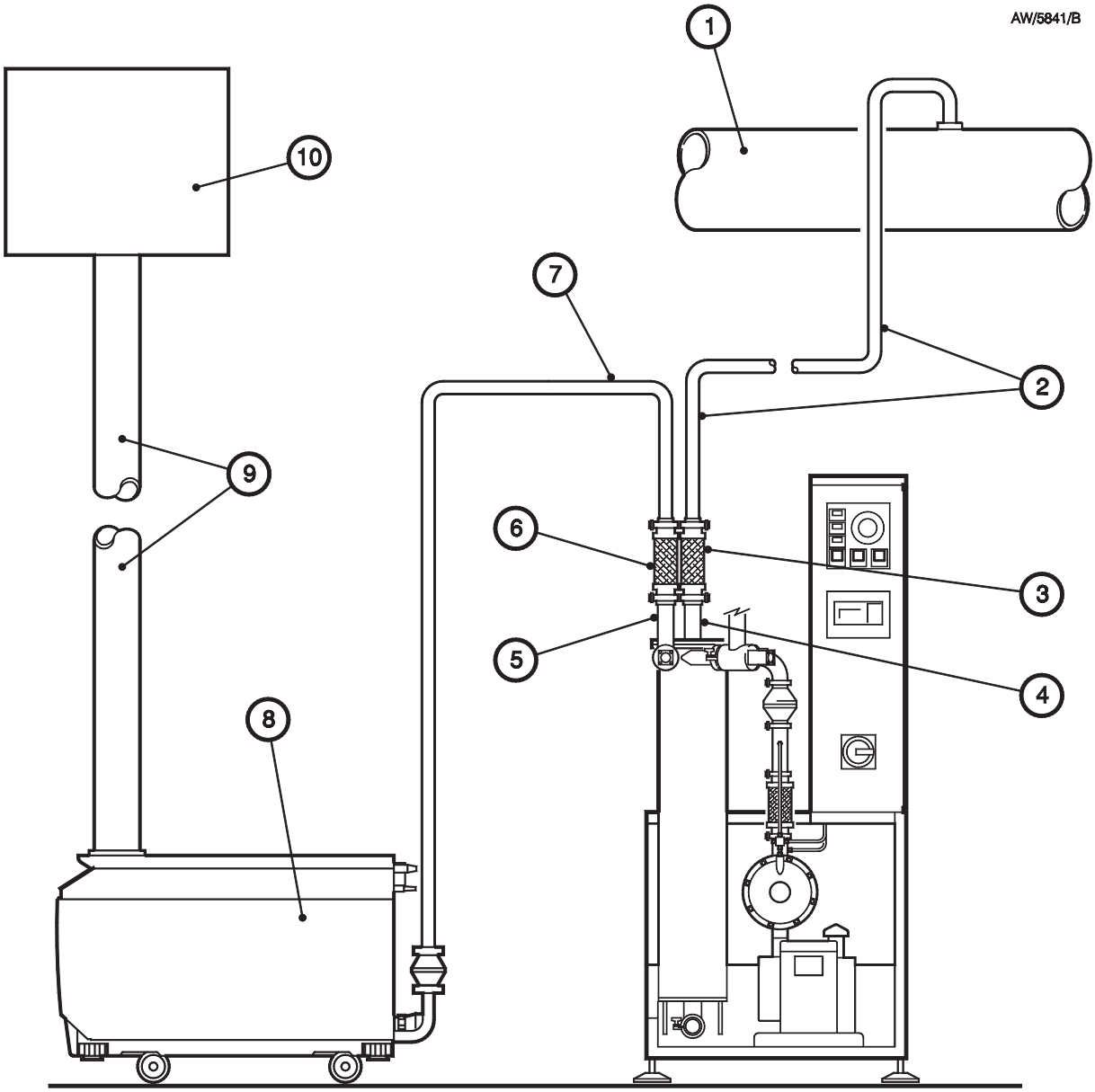
5. Remove all protective coverings and inspect the PCS. If the PCS is damaged, notify your supplier and the carrier in writing within three days; state the Item Number of the PCS, together with your order number and the supplier's invoice number. Retain all packing materials for inspection. Do not install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

6. Check that you have received the items listed in Table 4. If any item is missing, notify your supplier in writing within three days. If the PCS is not to be used immediately, replace any protective covers and store the PCS in suitable conditions, as described in Section 6.1.

Qty	Description	Check (✓)
1	PCS	❑
Fittings kit, which contains the following:		
*	NW40 trapped 'O' rings	❑
*	NW40 clamping rings	❑
6	Spare fuses	❑

* You will receive 2 off of these components with a single-inlet PCS, and you will receive 3 off of these components with a dual-inlet PCS.

Table 4 - Checklist of items



1. Exhaust-extraction system
2. Outlet pipe (rigid)
3. Flexible bellows
4. PCS outlet
5. PCS inlet
6. Flexible bellows
7. Pipeline from pumping system
8. Pumping system
9. Foreline
10. Process chamber

Figure 4 - Typical PCS connection configurations

3.4 Locate the PCS

WARNING

Do not try to lift the PCS on your own. Refer to Section 2 for the mass of the PCS.

1. Get someone to help you lift the PCS and to locate it in its required operating position.

2. Refer to Figure 1. Adjust the levelling feet (8) so that the PCS is level.

3.5 Connect the PCS to your process and exhaust-extraction systems

Use the following procedure to connect the PCS to your process and exhaust-extraction systems. We recommend that you incorporate flexible bellows in the connections (as shown in Figure 4), to prevent the transmission of vibration and to prevent stress on coupling joints.

1. Refer to Figure 1. Use an NW40 trapped 'O' ring and clamping ring supplied to connect the PCS outlet (2) to your exhaust-extraction system.

2. Connect each inlet (1) of the PCS to the outlet of your pumping system: use one of the NW40 trapped 'O' rings and clamping rings supplied for each connection.

3.6 Leak test the installation

WARNING

Leak test the system after installation and seal any leaks found to prevent the leakage of gases from the system and the leakage of air into the system.

Leak test the system after installation and seal any leaks found. Process gases which leak from the system will be dangerous to people.

We recommend that the leak rate is 1×10^{-5} mbar.ls^{-1} (1×10^{-3} Pa.ls^{-1}) or less for the complete system, or 1×10^{-6} mbar.ls^{-1} (1×10^{-4} Pa.ls^{-1}) or less for any individual leak.

If necessary, contact the Exhaust Management Group (at the address given in Section 3.2) for details of leak testing methods.

3.7 Connect the nitrogen supply to the PCS

Notes: Your nitrogen supply must be clean and dry, and must comply with the requirements of Section 2.4.

We recommend that you incorporate an isolation valve in your nitrogen supply pipeline, so that you can shut off the nitrogen supply to the PCS.

Connect your nitrogen supply pipeline to the nitrogen supply connector (Figure 5, item 4) under the control unit: note that the supply connector has Swagelok fittings (refer to Appendix A1).

Do not switch on the nitrogen supply yet.

3.8 Connect the electrical supply to the PCS

WARNING

Ensure that the electrical installation of the PCS conforms with your local and national safety requirements. It must be connected to a suitably fused and protected isolator and a suitable earth (ground) point.

You must connect the electrical supply to the PCS through a suitable isolator; the isolator must be fused (rated as specified in Section 2.6) and earthed (grounded).

Use the following procedure to connect the electrical supply:

1. Refer to Figure 5, detail A. Undo the two catches (2), then open the side door (1) of the control unit.

2. Refer to detail B. Pass a suitable three-core electrical supply cable through the electrical supply cable-gland (3) and into the control unit.

3. Refer to detail C. Route the cable (7) to the electrical supply isolator (6), then connect the ends of the wires in the cable to the isolator as follows (refer to detail D):

    - Connect the end of the earth (ground) wire (9) to the earth (ground) terminal (8).

    - Connect the end of the neutral wire (10) to terminal 8 on the isolator (6).

    - Connect the end of the live wire (11) to terminal 6 on the isolator (6).

4. Tighten the cable-gland strain-relief nut to secure the cable in place.

5. Connect the free end of the electrical supply cable to your electrical supply.

Note: Do not close the door of the control unit. You need to access the inside of the control unit when you connect to your Process Tool in Section 3.9.

3.9 Connect the PCS to your Process Tool

WARNING

You must configure your Process Tool to take the necessary action when a fault condition exists. If you do not, undiluted process gas may flow directly into the exhaust-extraction system, or a blockage may occur.

Note: The procedure below assumes that the side door of the control unit has already been opened in Section 3.8.

You must connect the remote fault outputs to your Process Tool:

- We recommend that you configure your Process Tool to provide a warning indication when the remote fault outputs warning signal is set.
- You **must** configure your Process Tool to shut down and lock out the Process Tool and the pumping systems when the remote fault outputs alarm signal is set: see Section 4.2.

Use the following procedure to connect the remote fault outputs to your Process Tool:

1. Refer to Figure 5, detail B. Pass a suitable cable through the customer interface cable-gland (5) and into the interior of the control unit.

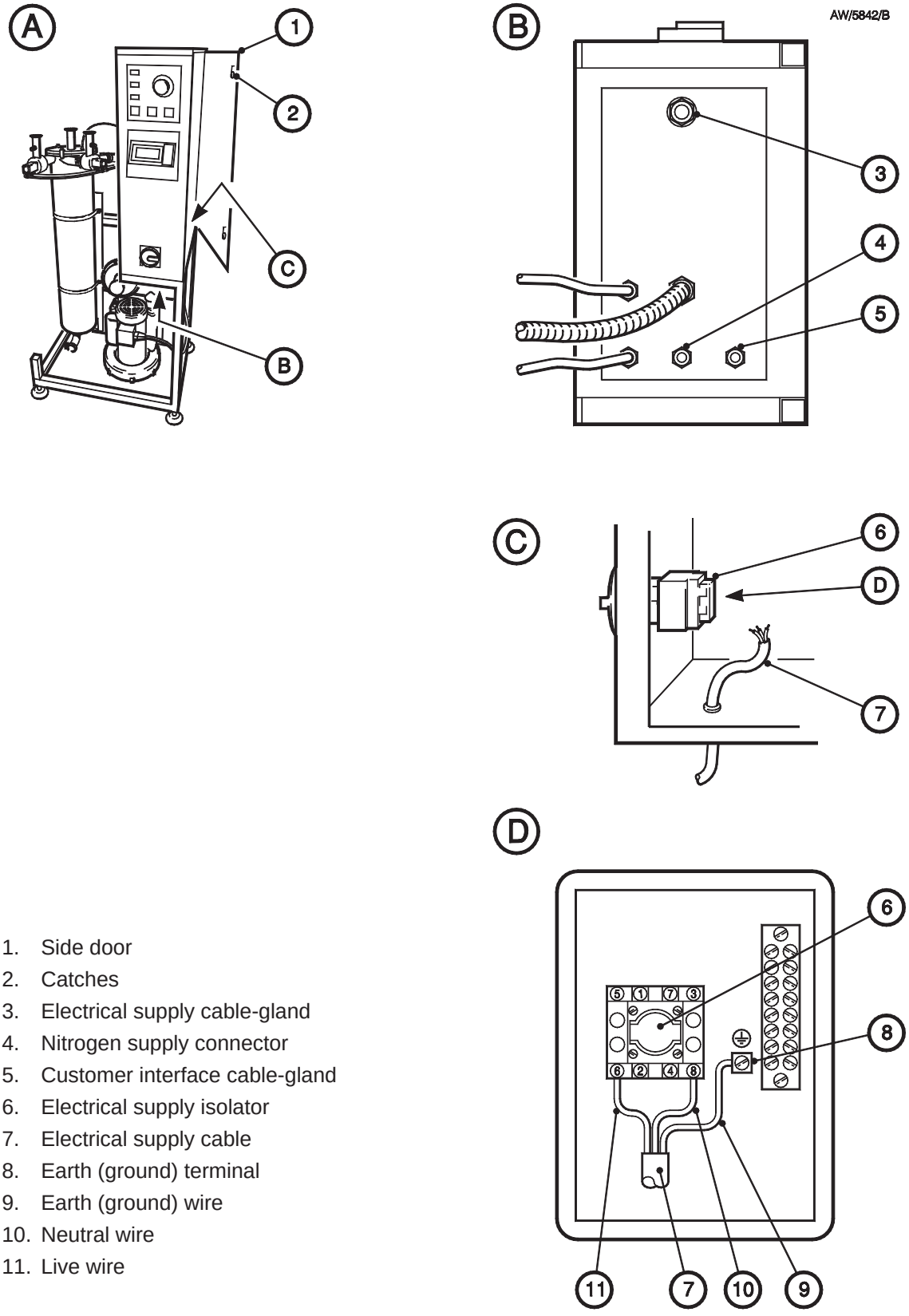
2. Refer to Figure 6, detail B. Route the cable towards the warning and alarm relays (10, 9), then connect the wires in the cable to the required terminals on the bases of the relays as shown in Table 5 (see detail D). Note that both normally open (N/O) and normally closed (N/C) remote fault output signals are available.

3. Refer to Figure 5, detail B. Tighten the strain-relief nut on the customer interface cable-gland (5) to secure the cable.

4. Refer to detail A. Close the side door (1) of the control unit, then engage the two catches (2) to secure the door in place.

Remote fault output signal	Relay (see Figure 6)	Terminals	Use
Warning output	10	C and N/O	Closed when a warning condition exists
		C and N/C	Open when a warning condition exists
Alarm output	9	C and N/O	Closed when an alarm condition exists
		C and N/C	Open when an alarm condition exists

Table 5 - Process Tool remote fault output connections



1. Side door
2. Catches
3. Electrical supply cable-gland
4. Nitrogen supply connector
5. Customer interface cable-gland
6. Electrical supply isolator
7. Electrical supply cable
8. Earth (ground) terminal
9. Earth (ground) wire
10. Neutral wire
11. Live wire

Figure 5 - Services connections

4 OPERATION

Note: In order to minimise PCS down-time, you will need a spare cyclone chamber/trap (refer to Section 7.3) so that you can replace the cyclone chamber/trap when necessary.

4.1 Start-up

1. Ensure that only purge gas is being pumped and that no process gases are being pumped.
2. Refer to Figure 2. Ensure that the electrical supply isolator (2) is in the 'off' position (position 'O').
3. Switch on the nitrogen supply to the PCS.
4. Switch on the external electrical supply to the PCS.
5. Move the electrical supply isolator (2) to the 'on' position (position '|'). The alarm lamp (8) will then go on.
6. Press the reset button (4); after approximately 10 seconds, the blower will start to operate.
7. After approximately a further 30 seconds:
   - If the PCS is operating normally, the alarm lamp (8) will go off and the normal lamp (6) will go on.
   - If a fault condition exists, the alarm lamp (8) will remain on, or the alarm lamp will go off and the warning lamp (7) will go on: refer to Section 4.2.

4.2 Status and fault indications

WARNING

If the alarm lamp goes on, before you shut down the PCS, ensure that the Process Tool and pumping system(s) have been shut down and locked out: refer to Section 4.3.

CAUTION

If the alarm or warning lamp goes on, take the necessary operator action as soon as possible. If you do not, undiluted process gas may flow directly into the exhaust-extraction system, or a blockage may occur.

Note: If your PCS has a status display (Figure 2, item 1), the status display will show messages identifying the status of the PCS and any faults detected: refer to Appendix A3.

Refer to Figure 2. In normal operating conditions, only the normal lamp (6) should be on.

If either of the alarm or warning lamps (8, 7) goes on, you must immediately determine the cause of the fault and rectify the fault. If you do not, undiluted process gas may flow directly into the exhaust-extraction system. Refer to Section 5.9 for fault finding.

Note that if the alarm lamp goes on, this may indicate a silane reaction in the cyclone chamber:

- Do not immediately shut down the PCS as this may result in a more dangerous situation.
- Ensure that the Process Tool and pumping system(s) are shut down and locked out: see Section 4.3.1.
- Shut down the PCS: see Section 4.3.2.
- Replace the cyclone chamber / trap: refer to Section 5.7.

4.3 Normal shut-down

4.3.1 Shut down and lock out the Process Tool and pumping system(s)

WARNING

Before you shut down the PCS, ensure that the Process Tool and pumping system(s) are correctly purged, shut down and locked out. If you do not, undiluted process gas may continue to flow through the PCS and into your exhaust-extraction system, or a blockage may occur.

Before you shut down the PCS, you must ensure that the Process Tool and the pumping system(s) are correctly purged, shut down and locked out.

The operations required are listed below; you must implement suitable procedures to enable these operations to be initiated and carried out safely, and to be notified to other personnel:

- Isolate the process gas supplies from the Process Tool.
- Adequately purge the process chamber with nitrogen.
- Close the process chamber isolation-valve to isolate it from the pumping system(s) and PCS.
- Shut down and lock out the Process Tool.
- Operate inlet purge on the pumping system(s) for at least 15 minutes to purge the pumping system(s), the outlet pipeline and the PCS.
- Shut down and lock out the pumping system(s) and the services supplies to the pumping system(s).

4.3.2 Shut down the PCS

WARNING

Ensure that the PCS has been fully purged before you shut it down. If you do not, process gases will remain in the PCS.

1. Ensure that the Process Tool and pumping system(s) have been correctly shut down and locked out, as described in section 4.3.1.

2. Refer to Figure 2. Move the electrical supply isolator (2) to the 'off' position (position 'O').

3. Switch off the nitrogen supply and the external electrical supply to the PCS.

4.4 Nitrogen and/or electrical supply failure

If the nitrogen supply or electrical supply fails, the PCS will respond to the appropriate safety interlock which operates, and set the appropriate remote fault output signal (see Section 1.6).

4.5 Emergency shut-down

To shut down the PCS in an emergency, press the emergency off switch (Figure 2, item 3).

When you press the emergency off switch, the blower will stop and the PCS will be in an alarm fault condition.

4.6 Restart after emergency shut-down

Note: You must rectify the cause of the shut-down before you restart the PCS.

To restart the PCS after an emergency shut-down:

1. Refer to Figure 2. Turn the electrical supply isolator (2) to the 'off' position (position 'O').

2. Turn the emergency off switch (3) to reset it.

3. Restart the PCS as described in Section 4.1.

5 MAINTENANCE

5.1 Safety

5.1.1 General safety precautions

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 maintain the PCS.
- Ensure that the maintenance technician is familiar with the safety procedures which relate to the use of compressed nitrogen.
- Shut down the PCS before you start work:
  - Ensure that you use the procedure in Section 4.3 (that is, that you shut down and lock out the Process Tool and pumping system(s) before you shut down the PCS), so that the Process Tool and pumping system(s) cannot be operated accidentally.
  - Switch off the PCS nitrogen and electrical supplies before you start work, and lockout the electrical supply (see Section 5.1.2).
- Dispose of components safely: refer to Section 6.2.
- Take care to protect sealing faces from damage, and do not reuse damaged 'O' rings.
- Do not touch or inhale the thermal breakdown products of fluorinated materials which may be present if the PCS has been overheated. These materials are safe in normal use, but can decompose into very dangerous thermal breakdown products if the PCS has been overheated to 260 ^{o}C and above. The PCS may have overheated if it was misused, if it malfunctioned, or if it was in a fire.

  BOC Edwards Material Safety Data Sheets for the fluorinated materials used in the PCS are available on request: contact your supplier or BOC Edwards.

5.1.2 PCS electrical lockout

WARNING

Lockout the PCS from the electrical supply during maintenance or servicing. If you do not, there will be a risk of injury or death by electric shock.

During maintenance or servicing, you must ensure that the PCS is isolated from the electrical supply, so that it cannot be switched on and operated accidentally. The PCS electrical supply isolator has a lockout facility for this purpose: see Figure 2, detail C.

In accordance with OHSA requirements, you must implement a suitable electrical lockout procedure. We recommend that you use the following procedure:

1. Notify all affected persons of the shut-down of the PCS for maintenance or servicing.
2. Identify the person who has locked out the PCS and the reason for the lockout.
3. Record the time, date, purpose and authoriser of the lockout in a log book.
4. Switch off the electrical supply at the lockout location.
5. Securely attach a 'lockout' device to the electrical supply at this location. Use a lock or other device which cannot be readily removed.
6. Display a 'lockout' notice in an easily seen location.

When you want to return the PCS to normal use after maintenance or servicing:

1. Ensure that all tools and other equipment have been removed from the PCS and that the PCS is fully and correctly assembled.
2. Ensure that all appropriate persons are notified that the PCS is to be switched on.
3. Remove the lockout device(s) and switch on the external electrical supply to the PCS.
4. Notify all affected persons that the maintenance or servicing is complete and that the PCS is ready for normal use.
5. Complete the log book to identify when the lockout was removed and when the PCS was switched on again.

5.1.3 Invasive procedures safety requirements

WARNING

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

Before you start to dismantle the PCS, the pumping system outlet pipeline(s) to the PCS, or the outlet pipeline from the PCS to your exhaust-extraction system:

- Place tapes or barriers around the equipment to be worked on, to identify that potentially dangerous operations are to take place, and to prevent access by unauthorised people.
- Ensure that the maintenance technician is familiar with the safety procedures which relate to the process gases used and to the particulates trapped in the PCS.
- Ensure that you have a sufficient number of NW40 trapped 'O' rings, blanking plates and clamps or clamping rings to seal (blank off) the PCS pipelines, the pumping system outlet pipeline(s) to the PCS, and your exhaust-extraction system.
- Ensure that you have a sufficient number of air-tight sacks or bags (of suitable size), to contain components or particulate to be disposed of, or to contain the contaminated cyclone chamber / trap while you move it to the area where you will clean it.

When you dismantle, work on and reassemble the PCS, the pumping system outlet pipeline(s) to the PCS, or the outlet pipeline from the PCS to your exhaust-extraction system:

- Always wear the necessary personal protective equipment: refer to Table 6 (see page 26).
- Disconnect then seal (blank off) exposed pipelines as quickly as possible, to prevent the escape of vapour or particulates from the pipelines into the ambient atmosphere. (In Sections 5.7 and 5.8, the term 'immediately ...' is used to identify this requirement.)
- Take care not to disturb particulate trapped in the PCS or the connecting pipelines. Do not use a brush or compressed air to clean the PCS or the connecting pipelines in its installation location.
- Transport contaminated components inside a suitable air-tight sack, to prevent the escape of particulates into the ambient atmosphere.
- Clean the cyclone trap / chamber in suitable conditions: refer to Section 5.8.
- Safely dispose of particulates and contaminated components: refer to Section 6.2.
- Leak test the system after reassembly: refer to Section 3.6.

Equipment	Requirement
Body protection	Wear overalls or a laboratory apron.
Eye protection	Wear safety glasses as a minimum requirement. (Safety glasses need not be worn if a full-face respiratory mask is worn.)
Foot protection	Always wear steel toe-capped safety shoes.
Head protection	Hard hats may be required. *
Hearing protection	Ear defenders may be required. *
Hand protection	Always wear latex gloves.
Respiratory protection	Ensure that you comply with your local and national requirements. (The exact respiratory protection requirements will depend on the process gases used.)

* These will depend on your installation.

Table 6 - Personal protective equipment requirements for invasive procedures

5.2 Maintenance plan

Note: If your PCS has ordering options/accessories fitted, refer to Appendices A3 onwards for additional maintenance operations that may be required.

The plan shown in Table 7 details the maintenance operations necessary to maintain the PCS in normal operation. Instructions for each operation are given in the section shown. If necessary, adjust the maintenance plan in accordance with your experience.

Operation	Frequency	Refer to Section
Check the nitrogen supply pressure	Monthly	5.3
Inspect the external pipelines and connections	Monthly	5.4
Replace a fuse	When necessary	5.5
Reset the circuit breaker	When necessary	5.6
Replace the cyclone chamber / trap	When necessary	5.7
Clean the cyclone chamber / trap	When required	5.8

Table 7 - Maintenance plan

5.3 Check the nitrogen supply pressure

Regularly check that your nitrogen supply pressure is as specified in Section 2.4.

5.4 Inspect the external pipelines and connections

WARNING

You must comply with the invasive procedure safety requirements of Section 5.1.3 if you dismantle the pumping system outlet pipeline(s), or if you disconnect them from the PCS inlet(s), or if you dismantle or disconnect the pipeline between the PCS outlet and your exhaust-extraction system.

Note: Where possible, we recommend that you identify the cause of any corrosion found and implement any corrective measures to minimise damage to the PCS and connecting pipelines.

1. Inspect the nitrogen supply pipeline and connections; check that they are not damaged or corroded and that they do not leak. Repair or replace any damaged or corroded component and seal any leaks found.

2. Inspect all of the electrical cables and connections; check that they are not damaged and have not overheated. Replace any component which is damaged or which has overheated.

3. Inspect the inlet and outlet pipelines and connections; check that they are not damaged or corroded and that they do not leak. If any component is damaged or corroded, or if any leaks are found, the pipelines must be repaired or replaced: refer to the WARNING above.

5.5 Replace a fuse

Use the following procedure to replace a fuse. Only replace a fuse after you have identified and rectified the fault which caused the fuse failure.

1. Refer to Figure 6, detail A. Undo the two catches (2), then open the side door (1) of the control unit.

2. Refer to detail B. Remove the fuse (13 or 14) which you think has failed, then use a suitable meter to check the electrical continuity of the fuse:

   - If there is no electrical continuity, the fuse has failed: continue at Step 3.

   - If there is electrical continuity across the fuse, the fuse has not failed: refer to Section 5.9 for additional fault finding.

3. Fit a new fuse (13 or 14) of the correct type (see Section 2.6).

4. Refer to detail A. Close the side door (1) of the control unit, then engage the two catches (2) to secure the door in place.

5. Restart the PCS as described in Section 4.1.

If the fuse fails again immediately after you restart the PCS, there may be an electrical fault in the PCS: switch off and isolate the external electrical supply and contact your supplier or BOC Edwards for advice.

5.6 Reset the circuit breaker

Use the following procedure to reset the circuit breaker. Only reset the circuit breaker after you have identified and rectified the fault which caused the circuit breaker to trip.

1. Refer to Figure 6, detail A. Undo the two catches (2), then open the side door (1) of the control unit.

2. Refer to detail B. Move the circuit breaker (4) to the 'on' position (position '|').

3. Refer to detail A. Close the side door (1) of the control unit, then engage the two catches (2) to secure the door in place.

If the circuit breaker trips again immediately after you restart the PCS, there may be an electrical fault in the PCS: switch off and isolate the external electrical supply and contact your supplier or BOC Edwards for advice.

1. Side door
2. Catches
3. PLC
4. Circuit breaker CB1
5. Pressure-switch
6. Pneumatics manifold
7. Nitrogen pressure regulator
8. Nitrogen pressure gauge
9. Alarm relay (RL4)
10. Warning relay (RL3)
11. EMO relay (RL2)
12. Blower relay (RL1)
13. Fuse FB2
14. Fuse FB1
15. Catch
16. Control unit connector
17. Control unit
18. Snap-switch connector
19. Snap-switch cable

Figure 6 - Control unit interior and connections: key

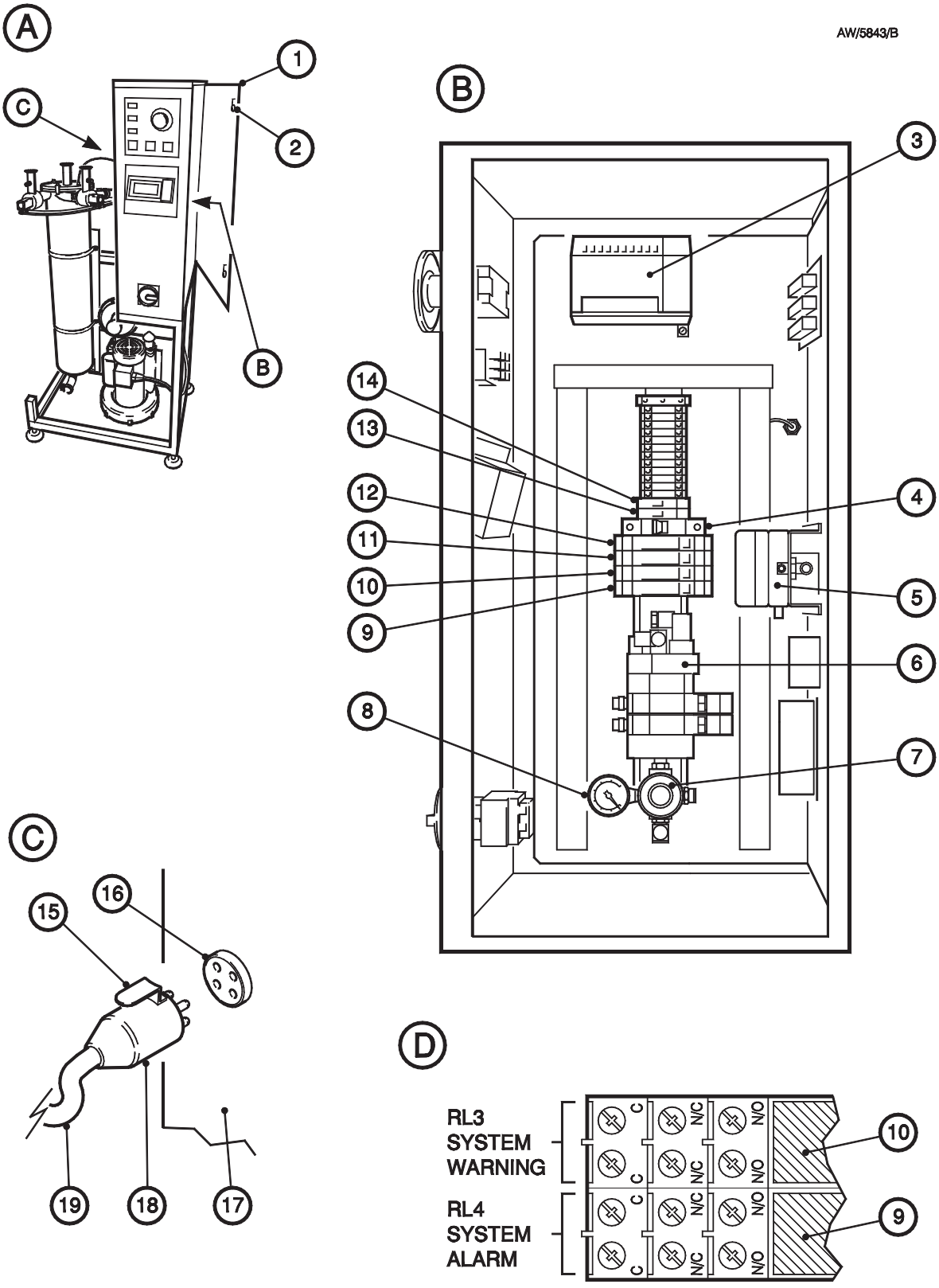


Figure 6 - Control unit interior and connections

5.7 Replace the cyclone chamber/trap

WARNING

You must comply with the invasive procedure safety requirements of Section 5.1.3.

Note: Ensure that a replacement cyclone chamber/trap is available before you start this procedure. The replacement cyclone chamber/trap must be configured in the same way as the chamber/trap that is being replaced; that is, if the chamber/trap currently fitted to the PCS is configured for any ordering options (such as inlet pressure monitoring or on-line cleaning), the replacement chamber/trap must be configured for the same options.

5.7.1 Disconnect the PCS from your process and exhaust-extraction systems

1. Refer to Figure 7, detail A. If you have a single-inlet PCS:

   - Undo and remove the clamping ring and trapped 'O' ring which secures the pumping system outlet pipeline to PCS inlet 1 (17).
   - Immediately fit a clamping ring, trapped 'O' ring and blanking plate to the PCS inlet (17) to seal it.
   - Immediately fit a clamping ring, trapped 'O' ring and blanking plate to the pumping system outlet pipeline to seal it.
   - Continue at Step 3.

2. If you have a dual-inlet PCS:

   - Disconnect and seal PCS inlet 1: refer to Step 1.
   - Undo and remove the clamping ring and trapped 'O' ring which secures the pumping system outlet pipeline to PCS inlet 2 (2).
   - Immediately fit a clamping ring, trapped 'O' ring and blanking plate to the PCS inlet (2) to seal it.
   - Immediately fit a clamping ring, trapped 'O' ring and blanking plate to the pumping system outlet pipeline to seal it.

3. Undo and remove the clamping ring and trapped 'O' ring which secures the PCS outlet (1) to your exhaust-extraction system.

4. Immediately fit a clamping ring, trapped 'O' ring and blanking plate to the PCS outlet (1) to seal it.

5. Fit a clamping ring, trapped 'O' ring and blanking plate to your exhaust-extraction system to seal it.

5.7.2 Remove the cyclone chamber/trap from the PCS

1. Refer to Figure 7, detail A. If you have a single-inlet PCS, disconnect the 5 mm and 6 mm pneumatic pipes (5, 6) from the elbows on the inlet 1 cleaning actuator (16).

   If you have a dual-inlet PCS:

   - Disconnect the 5 mm and 6 mm pneumatic pipes (5, 6) from the elbows on the inlet 1 cleaning actuator (16), and from the 'T' pieces on the inlet 2 cleaning actuator (4).

   - Disconnect the 5 mm and 6 mm pneumatic pipes (5, 6) from the 'T' pieces on the inlet 2 cleaning actuator (4).

2. Refer to Figure 6, detail C. Press down the catch (15), then disconnect the snap-switch connector (18) from the control unit connector (16).

3. Refer to Figure 7, detail A. Loosen the two nuts and washers (12) which secure each bracket (14) to the back-plate (13): do not fully undo and remove the nuts and washers.

4. Undo and remove the clamping ring (10) and trapped 'O' ring (9) which secure the check-valve inlet (8) to the blower air pipeline (11).

5. Immediately turn the cyclone chamber / trap (15) slightly so that you can access the check-valve inlet (8), then fit a clamping ring, trapped 'O' ring and blanking plate to the check-valve inlet to seal it.

6. Immediately fit a clamping ring, trapped 'O' ring and blanking plate to the blower air pipeline (11) to seal it.

7. Support the cyclone chamber / trap (15), fully undo and remove the two nuts and washers (12) which secure each bracket (14) and remove the two brackets, then lift the cyclone chamber / trap off of the PCS frame.

8. Immediately seal the cyclone chamber / trap (15) inside a suitable air-tight bag, and take it to the area where you will clean it.

5.7.3 Fit the replacement cyclone chamber/trap to the PCS

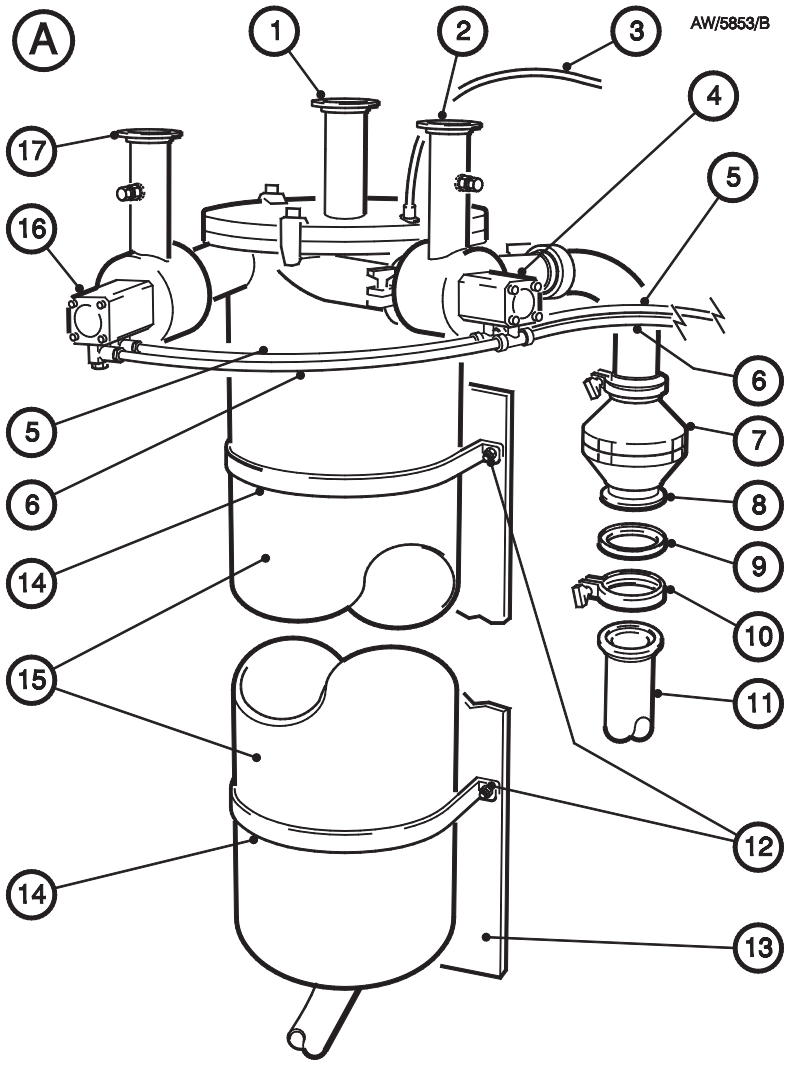
1. Move the replacement cyclone chamber / trap close to the PCS.

2. Refer to Figure 7, detail A. Undo and remove the clamping ring(s), trapped 'O' ring(s) and blanking plate(s) which seal the PCS inlet(s) (17, 2) and the PCS outlet (1) on the cyclone chamber / trap (15).

3. Undo and remove the clamping ring, trapped 'O' ring and blanking plate which seals the check-valve inlet (8), then place the cyclone chamber / trap (15) in position on the PCS frame.

4. Fit the two brackets (14) in place, then fit and tighten by hand the two nuts and washers (12) to loosely secure the brackets to the back-plate (13), to support the cyclone chamber / trap (15) in position.

(Continued on page 34)



1. PCS outlet
2. PCS inlet 2
3. Snap-switch cable
4. Inlet 2 cleaning actuator
5. 5 mm pneumatic pipeline
6. 6 mm pneumatic pipeline
7. Check-valve
8. Check-valve inlet
9. Trapped 'O' ring
10. Clamping ring
11. Blower pipeline
12. Nuts and washers
13. Back-plate
14. Brackets
15. Cyclone chamber/trap
16. Inlet 1 cleaning actuator
17. PCS inlet 1
18. Top-plate
19. Claw clamp
20. Liner
21. 'O' ring
22. Air inlet
23. Trapped 'O' ring
24. Clamping ring
25. Air inlet elbow
26. Clamping ring
27. Trapped 'O' ring
28. Cyclone inlet 2
29. Cyclone inlet 1
30. Pneumatic 'T' pieces
31. Inlet 2 manifold
32. Cleaning spring
33. Clamping ring
34. Trapped 'O' ring
35. Inlet 1 manifold
36. Pneumatic elbows
37. Nut
38. Actuator piston

Figure 7 - Clean the cyclone chamber / trap: sheet 1 of 2

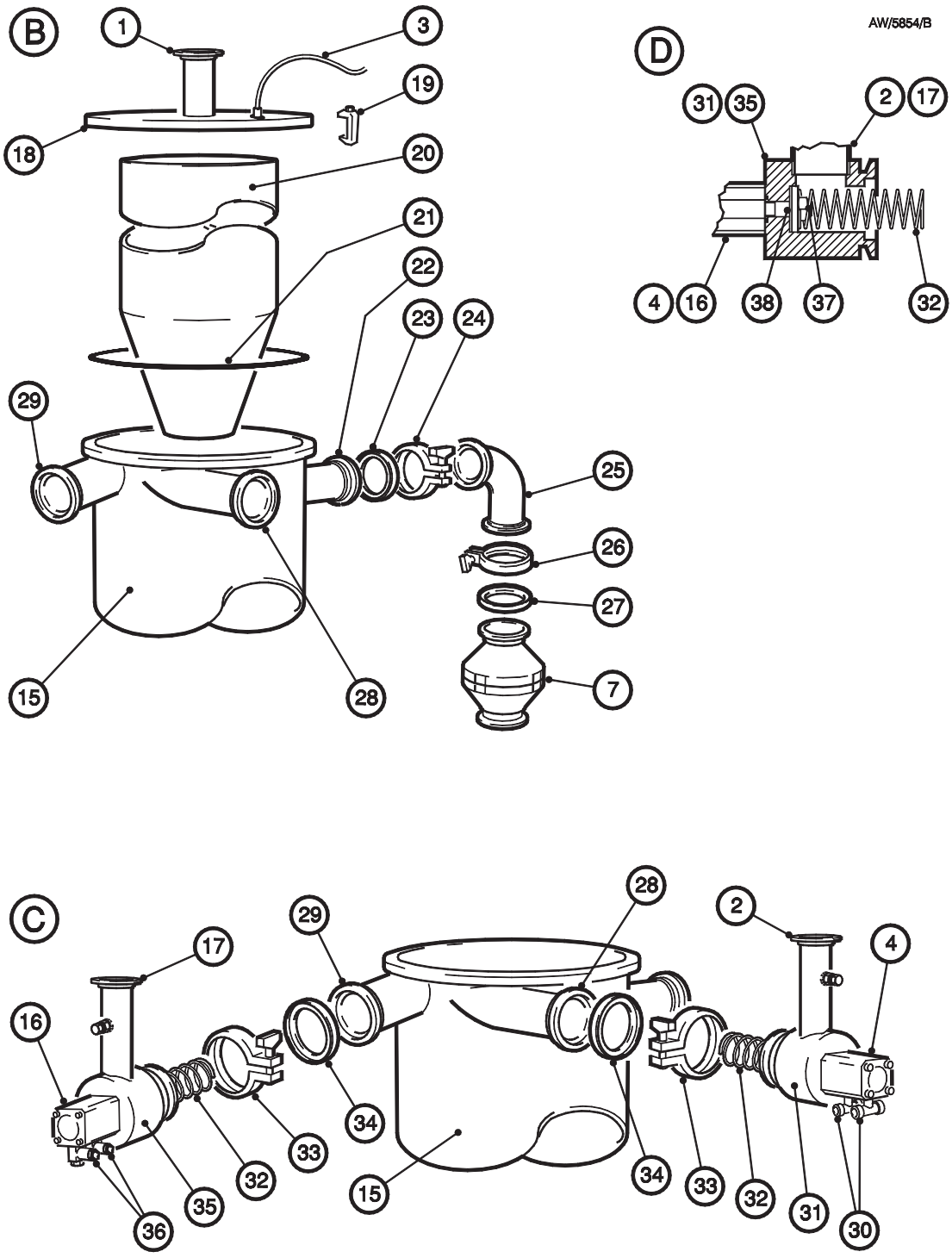


Figure 7 - Clean the cyclone chamber / trap: sheet 2 of 2

5. Undo and remove the clamping ring, trapped 'O' ring and blanking plate which seal the blower air pipeline (11), then immediately use a clamping ring (10) and trapped 'O' ring (9) to secure the check-valve inlet (8) to the blower air pipeline.

6. Fully tighten the two nuts and washers (12) which secure the brackets (14) to the back-plate (13), to fully secure the cyclone chamber / trap (15) to the PCS frame.

7. Refer to Figure 6, detail C. Connect the snap-switch connector (18, on the end of the snap-switch cable, 19) to the control unit connector (16) on the side of the control unit (17): ensure that the snap-switch connector is fully pushed in, so that the catch (15) retains the connector in place.

8. Refer to Figure 7, detail A. If you have a single-inlet PCS, connect the 5 mm and 6 mm pneumatic pipes (5, 6) to the elbows on the inlet 1 cleaning actuator (16).

   If you have a dual-inlet PCS:

   - Connect the 5 mm and 6 mm pneumatic pipes (5, 6) to the 'T' pieces on the inlet 2 cleaning actuator (4).

   - Connect the 5 mm and 6 mm pneumatic pipes (5, 6) to the 'T' pieces on the inlet 2 cleaning actuator (4) and to the elbows on the inlet 1 cleaning actuator (16).

5.7.4 Reconnect the PCS to your process and exhaust-extraction systems

1. Refer to Figure 7, detail A. Remove the clamping ring, trapped 'O' ring and blanking plate which seal your exhaust-extraction system, then immediately use a clamping ring and trapped 'O' ring to connect the PCS outlet (1) to your exhaust-extraction system.

2. If you have a single-inlet PCS:

   - Remove the clamping ring, trapped 'O' ring and blanking plate which seal your pumping system outlet pipeline.

   - Immediately use a clamping ring and trapped 'O' ring to connect the pumping system outlet pipeline to PCS inlet 1 (17), then continue at Step 4.

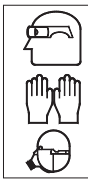
3. If you have a dual-inlet PCS:

   - Connect PCS inlet 1 (17) to the pumping system outlet pipeline: use the method in Step 2.

   - Connect PCS inlet 2 (2) to the pumping system outlet pipeline: use the method in Step 2.

4. The PCS is now ready for operation, as described in Section 4.

5.8 Clean and inspect the cyclone chamber/trap



WARNING

You must comply with the invasive procedure safety requirements of Section 5.1.3.

Note: You will need a check-valve service kit and a new cyclone chamber 'O' ring to clean the cyclone chamber/ trap. Refer to Section 7.3 for the item numbers of these and other spares you may need.

5.8.1 Dismantle the cyclone chamber/trap

1. Refer to Figure 7, detail C. Undo and remove the clamping ring (33) and trapped 'O' ring (34) and disconnect the inlet 1 cleaning actuator and manifold (35) from cyclone inlet 1 (29).

2. If you have a dual-inlet PCS, undo and remove the clamping ring (33) and trapped 'O' ring (34) and disconnect the inlet 2 cleaning actuator and manifold (31) from cyclone inlet 2 (28).

3. Refer to detail A. Undo and remove the clamping ring(s), trapped 'O' ring(s) and blanking plate(s) which seal the PCS inlet(s) (17, 2).

4. Undo and remove the clamping ring, trapped 'O' ring and blanking plate which seal the check-valve inlet (8).

5. Undo and remove the clamping ring, trapped 'O' ring and blanking plate which seal the PCS outlet (1).

6. Refer to detail B. Undo and remove the clamping ring (24) and trapped 'O' ring (23) which secure the air inlet elbow (25) to the cyclone air inlet (22).

7. Undo and remove the clamping ring (26) and trapped 'O' ring (27) which secure the check-valve (7) to the air inlet elbow (25).

8. Undo and remove the claw clamps (19), then remove the top-plate (18) and the 'O' ring (21) from the cyclone chamber / trap (15). Dispose of the 'O' ring: refer to Section 6.2.

9. Remove the liner (20) from the cyclone chamber / trap (15).

10. Refer to Figure 1. Undo and remove the clamping ring, blanking plate and trapped 'O' ring (10) which seal the outlet elbow of the trap (11).

5.8.2 Clean the inlet(s) and the cyclone chamber/trap

WARNING

You must clean the PCS components in a suitable controlled wet bench station.

1. Refer to Figure 7, detail B. Use clean water to wash the liner (20) and the interior surfaces of the top-plate (18), the cyclone chamber / trap (15) and the air inlet elbow (25). Take particular care to wash any deposits out of the air inlet (22) and the cyclone inlet(s) (28, 29) on the cyclone chamber / trap (15).

2. Place the washed components on a clean, dry surface and allow them to dry in ambient conditions.

3. Refer to detail C. Clean any deposits out of the PCS inlet(s) (17, 2), out of the inlet manifold(s) (35, 31) and off of the cleaning spring(s) (32): use a small brush and / or a damp cloth.

5.8.3 Inspect the inlet and cyclone chamber/trap components

Use the following procedure to inspect the inlet(s) and the cyclone chamber / trap:

1. Refer to Figure 7, detail B. Inspect the top-plate (18) and the interior surfaces of the cyclone chamber / trap (15). If the top-plate or cyclone chamber / trap is damaged or corroded, you must replace the cyclone chamber / trap, then continue at Step 10 of Section 5.8.5.

2. Inspect the liner (20); if the liner is damaged or corroded, you must replace it.

3. Inspect the air inlet elbow (25); if the elbow is damaged or corroded, you must replace it.

4. Refer to detail C. Inspect the PCS inlet(s) (17, 2) and the inlet manifold(s) (35, 31). If an inlet or inlet manifold is damaged or corroded, replace the inlet and manifold and continue at Step 5, otherwise continue at Step 7.

5. Remove the two pneumatic connectors (36 or 30) from the cleaning actuator (16 or 4) on the damaged / corroded manifold (35 or 31).

6. Fit the two pneumatic connectors to the cleaning actuator on the new inlet and manifold:

   - The inlet manifold (35) for a single-inlet PCS, or inlet manifold 1 (35) on a dual-inlet PCS, has two pneumatic elbows (36) on the cleaning actuator (16).

   - The inlet manifold (31) for inlet 2 on a dual-inlet PCS has two pneumatic 'T' pieces (30) on the cleaning actuator (4).

   - One of the connectors is a 5 mm connector, the other is a 6 mm connector: the 5 mm connector must be fitted nearest to the manifold (35 or 31).

   - Continue at Section 5.8.4.

7. Inspect the cleaning spring(s) (32). If a cleaning spring is damaged or corroded, you must replace it; use the following method:

    - Refer to detail D. Use a hexagonal key to undo and remove the nut (37), then remove and dispose of the cleaning spring (32).

    - Fit the new cleaning spring (32) in the manifold (35 or 31) and over the end of the threaded stud on the end of the actuator piston (38).

    - Fit and tighten the nut (37) to secure the cleaning spring in place.

5.8.4 Clean and inspect the check-valve

Refer to Figure 7, detail A. Clean and inspect the check-valve (7): refer to the check-valve instruction manual supplied as a supplementary publication.

5.8.5 Reassemble the cyclone chamber/trap

1. Refer to Figure 1. Fit the blanking plate, clamping ring and trapped 'O' ring (10, removed in Section 5.8.1) to the outlet elbow of the trap (11).

2. Refer to Figure 7, detail C. If you have a single-inlet PCS:

    - Use the clamping ring (33) and trapped 'O' ring (34) to secure the inlet 1 manifold (35) to cyclone inlet 1 (29).

    - Fit a clamping ring, trapped 'O' ring and blanking plate to PCS inlet 1 (17) to seal it.

    - Continue at Step 5.

3. If you have a dual-inlet PCS:

    - Refit the inlet 1 manifold and seal PCS inlet 1: refer to Step 2.

    - Use the clamping ring (33) and trapped 'O' ring (34) to secure the inlet 2 manifold (31) to cyclone inlet 2 (28).

    - Fit a clamping ring, trapped 'O' ring and blanking plate to PCS inlet 2 (2) to seal it.

4. Refer to detail B. Fit the liner (20) in the cyclone chamber / trap (15).

5. Fit a new chamber 'O' ring (21) to the 'O' ring groove in the top flange of the cyclone chamber / trap (15), fit the top-plate (18), then fit and tighten the claw clamps (19) to secure the top-plate in position.

6. Use the clamping ring (24) and trapped 'O' ring (23) to secure the air inlet elbow (25) to the cyclone air inlet (22).

(Continued on page 38)

7. Use the clamping ring (26) and trapped 'O' ring (27) to secure the check-valve (7) to the air inlet elbow (25): ensure that the arrow on the check valve points towards the air inlet elbow (refer to the check-valve instruction manual, supplied as a supplementary publication).

8. Refer to detail A. Fit a clamping ring, trapped 'O' ring and blanking plate to the check-valve inlet (8) to seal it.

9. Fit a clamping ring, trapped 'O' ring and blanking plate to the PCS outlet (1) to seal it.

10. Place the cleaned cyclone chamber / trap (15) in a suitable storage area (refer to Section 6.1) until it is required.

5.9 Fault finding

5.9.1 General fault finding

Note: If your PCS has a status display, refer to Appendix A3 for display fault message fault finding.

Refer to Table 8 to identify the possible causes of faults, and the actions necessary to rectify faults. In order to see the PLC indicator LEDs referred to in Table 8 you will have to open the side door of the control unit: refer to Step 1 of Section 5.9.2.

5.9.2 Unexplained shutdowns

If the blower shuts down automatically, or if a fault indication is generated and there is no apparent cause for the shut-down or fault, there may be a failure in the control system. In these circumstances, we recommend that you use the following procedure:

1. Refer to Figure 6, detail A. Undo the catches (2) and open the side door (1) of the control unit.

2. Take note of the states of the indicator LEDs on the PLC (detail B, item 3).

3. Contact your supplier or BOC Edwards for advice: advise them of any fault indications and the states of the PLC LED indicators.

Symptom	Check	Action
All of the status lamps are off.	Has the external electrical supply failed ?	Inspect the external electrical supply and rectify any problem found.
	Is the PLC controller in the incorrect mode ?	Open the control unit door and ensure that the mode switch on the PLC is in the 'term' position.
	Has a fuse failed ?	Inspect the fuses and replace any failed fuse: refer to Section 5.5.
The alarm lamp is on and the blower is not operating.	Has the emergency off switch been pressed ?	Rectify the cause of the shut-down, then reset the emergency off switch and restart the system: refer to Section 4.6.
	Has circuit breaker CB1 tripped ?	Inspect the circuit breaker and reset if necessary: refer to Section 5.6.
	Has fuse FB2 failed ?	Inspect the fuse and replace if necessary: refer to Section 5.5.
The alarm lamp is on and PLC input LED X3 is off.	Has a silane reaction taken place ?	Replace the cyclone chamber / trap (see Section 5.7), then clean and inspect the replaced cyclone chamber / trap: refer to Section 5.8.
		If there is no indication of a reaction in the cyclone chamber / trap, continue fault finding as described below.
	Is the outlet high temperature switch disconnected ?	Ensure that the temperature snap-switch cable is correctly connected to the control unit: refer to Section 5.7.3.
The alarm lamp is on and PLC input LED X1 is off.	Has a silane reaction taken place ?	Replace the cyclone chamber / trap (see Section 5.7), then clean and inspect the replaced cyclone chamber / trap: refer to Section 5.8.
		If there is no indication of a reaction in the cyclone chamber / trap, continue fault finding as described below.

Table 8 - Fault finding

Symptom	Check	Action
The alarm lamp is on and PLC input LED X1 is off. (continued)	Has the blower circuit breaker tripped ?	If the blower is not operating, circuit breaker CB1 may have tripped. Inspect the circuit breaker and reset as necessary: refer to Section 5.6.
	Is air flow into the blower impaired ?	Ensure that the blower inlet is not blocked or obstructed.
	Is there a high back-pressure ?	During extremely high gas flows into the PCS, the resulting back-pressure can cause insufficient air to get into the PCS system. Inspect the gas flow(s) into the PCS and rectify any problem found.
	Is the pressure-switch faulty ?	If you have made the above checks and cannot identify the cause of the fault, the pressure-switch may be faulty: contact your supplier or BOC Edwards.
The warning lamp is on and PLC input LED X2 is off.	Is the nitrogen supply pressure too low ?	Inspect the nitrogen supply and rectify any problem found.
-	-	If you have carried out all of the recommended actions and you still cannot identify the fault, or if you cannot rectify a fault, contact your supplier or BOC Edwards for advice.

Table 8 - Fault finding (continued)

6 STORAGE AND DISPOSAL

6.1 Storage

WARNING

You must comply with the invasive procedure safety requirements of Section 5.1.3 if you dismantle the pumping system outlet pipeline(s), or if you disconnect them from the PCS inlet(s), or if you dismantle or disconnect the pipeline between the PCS outlet and your exhaust-extraction system or if you remove the cyclone chamber / trap and clean it.

Use the following procedure to store the PCS:

1. Shut down the PCS: refer to Section 4.3 and disconnect the PCS from your Process Tool.
2. Disconnect the electrical supply socket from the PCS and disconnect your nitrogen supply pipeline from the PCS.
3. Place protective covers over the nitrogen inlet and the electrical supply socket.
4. If required:
    - Disconnect the PCS inlet(s) from the pumping system(s), disconnect the PCS outlet from your exhaust-extraction system, and seal the pipelines and the PCS inlet(s) and outlet.
    - Remove the cyclone chamber / trap, clean and (if required) refit it: refer to Sections 5.7 and 5.8.
5. Store the PCS in clean, dry conditions until required.
6. When required for use, prepare and install the PCS as described in Section 3.

6.2 Disposal

WARNING

You must safely contain, identify and dispose of contaminated items and particulates removed from the PCS and connecting pipelines.

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

Take particular care with fluoroelastomers which have decomposed as the result of being overheated.

To dispose of contaminated components, contaminated personal protective equipment and particulates removed from the PCS or connecting pipelines:

1. Place the particulate or component inside an air-tight bag or sack and seal it.

2. Place the first bag inside a second air-tight bag, then seal it.

3. Firmly fix / secure a label to the outer waste bag; the label must clearly identify the contents of the bags.

4. Dispose of the bags and their contents in accordance with your local and national safety and environmental procedures.

Note: Bags/sacks which contain contaminated components or particulates, and which are to be transported off-site for disposal must be clearly identified with the nature of their contents.

7 SERVICE, SPARES AND ACCESSORIES

7.1 Introduction

BOC Edwards products and spares are available from BOC Edwards companies in Belgium, Brazil, Canada, China, France, Germany, Israel, Italy, Japan, Korea, Singapore, 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 BOC Edwards training courses.

Order spare parts from your nearest BOC 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 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.

Note: If you need to return the PCS for service or repair:

- *If the PCS has been used, ensure that the inlet(s) and outlet are correctly sealed: refer to Section 5.1.3.*
- *Refit the PCS in its original packaging. If this packaging is no longer available or is damaged, contact your supplier or BOC Edwards to obtain new packaging.*

7.3 Spares

Note: Contact your supplier or BOC Edwards for details of the PCS service exchange policy, which will enable you to replace/return a cyclone chamber/trap.

We recommend that you maintain a stock of the following spares to allow for easy replacement and to minimise PCS down-time:

Spare	Item Number
Cyclone chamber / trap:	
Single-inlet PCS *	Y022-11-001
Dual-inlet PCS *	Y022-11-002
Inlet and manifold *	Y022-11-003
Inlet cleaning spring	A554-02-009
Cyclone chamber liner	Y026-01-025
Air inlet elbow	C105-16-420
Check-valve	A440-03-000
Check-valve service kit	A440-03-820
Cyclone chamber trapped 'O' ring (ISO160)	B271-58-178
NW40 trapped 'O' ring	C105-16-490
NW40 clamping ring	C105-16-401
NW40 blanking plate	C105-16-368

* These items are service exchange kits.

7.4 Accessories

7.4.1 Audible alarm

When fitted, the audible alarm will emit an alarm tone whenever a warning or alarm fault condition exists. If required, you can mute (turn off) the audible alarm.

Accessory	Item Number
Audible alarm	Y021-00-000

7.4.2 Other accessories

The following are also available as ordering options (refer to Appendices A3 and A4). To order these as accessories (for retrofitting to an existing PCS), use the following Item Numbers:

Accessory	Item Number
Status display	Y021-10-100
Cyclone enclosure	Y021-00-300

8 ENGINEERING DIAGRAMS

Figure 8 shows a schematic block diagram of the PCS electrical system and is included to assist in fault finding.

When you look at Figure 8, please note the following:

This symbol identifies a connection to the PCS control system (that is, the PLC).

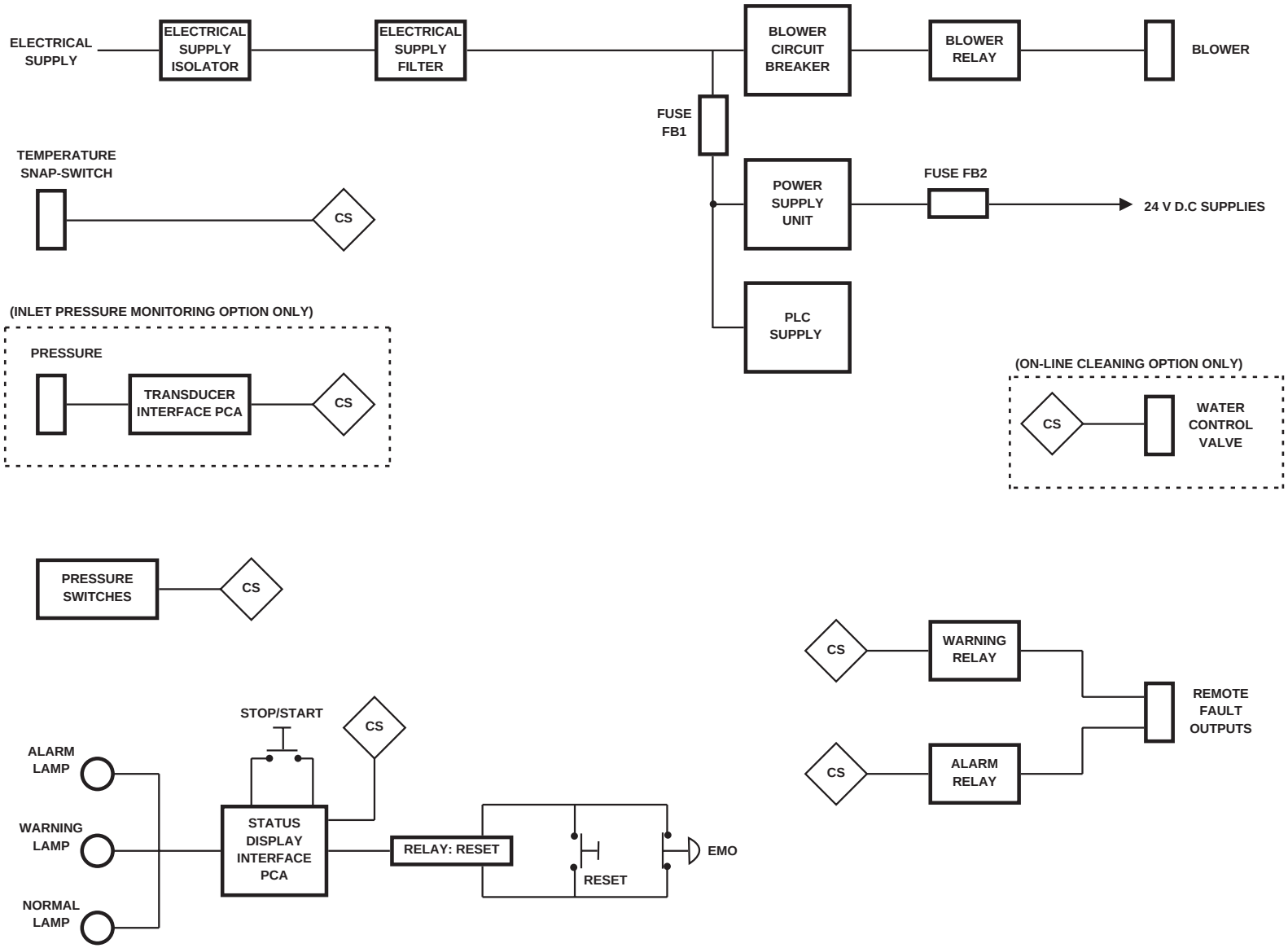


Figure 8 - Schematic electrical diagram of the PCS

APPENDIX

A1 CORRECT USE OF SWAGELOK CONNECTORS

Note: We recommend that you use a second spanner to hold the connector in position when you connect or disconnect a Swagelok connector.

You must know how to correctly fit and tighten Swagelok connectors in order to prevent gas leaks; use the procedures in the following sections.

A1.1 Fit a Swagelok connector

1. Refer to Figure A1-1 detail A. Undo and remove the nut (4) from the Swagelok connector (1). Ensure that the front (tapered) ferrule (2) and the rear ferrule (3) are correctly orientated as shown in detail A, then loosely refit the nut (4) to the connector (1).

2. Refer to detail B. Insert the tube (5) through the nut (4) and into the Swagelok connector (1). Ensure that the tube rests firmly on the shoulder inside the fitting, and that the nut (4) is finger tight.

3. Tighten the nut (4) until you cannot rotate the tube (5). If you cannot turn the tube because of how it is installed, tighten the nut by $^{1}/_{8}$th of a turn.

4. Refer to detail C. Mark the nut (4) at the six o'clock position.

5. Refer to detail D. Hold the body of the connector steady, then turn the nut (4) by $1^{1}/_{4}$ turns (to the nine o'clock position) to fully tighten the connection.

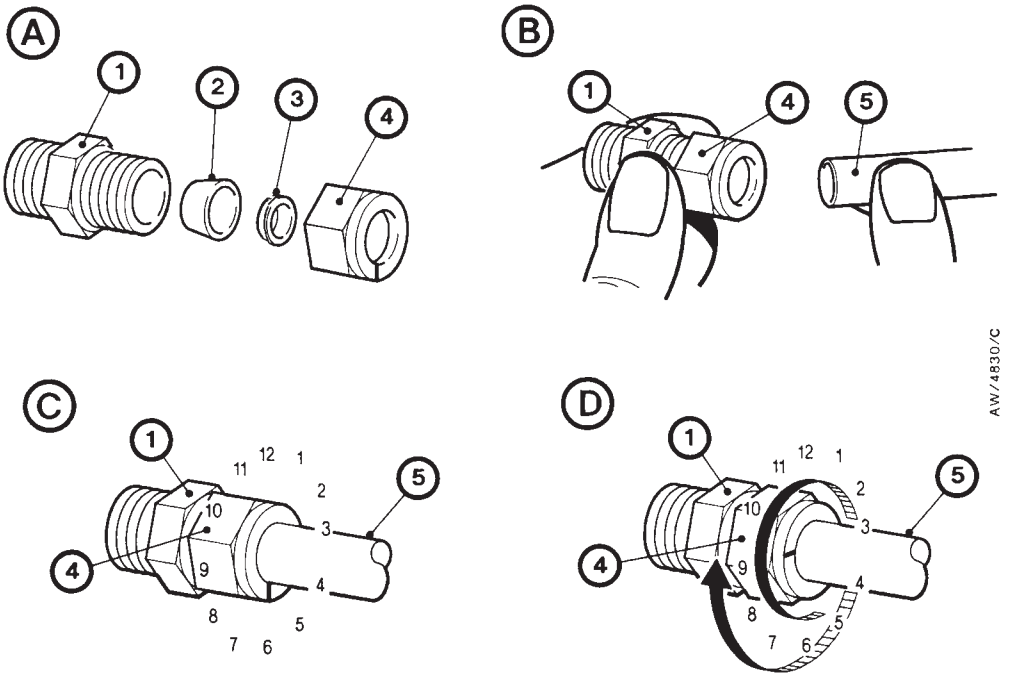
A1.2 Reconnect a Swagelok connector

You can disconnect and reconnect a Swagelok connector many times and still obtain a correct leak-proof seal. Refer to Figure A1-2 detail A which shows a Swagelok connector after you have disconnected it. Use the following procedure to reconnect it:

1. Refer to detail B. Insert the tube (5) with the swaged ferrules (2, 3) into the Swagelok fitting (1), until the front ferrule (2) is fully in the body of the fitting.

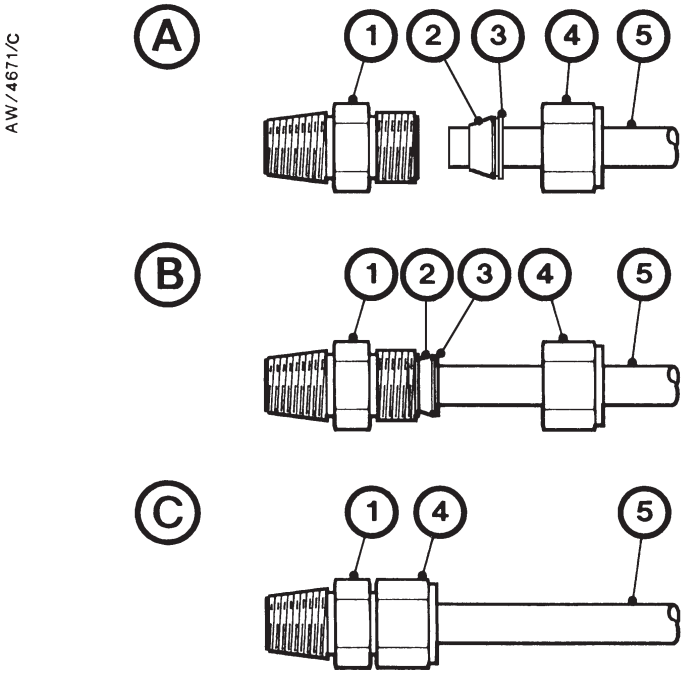
2. Refer to detail C. Tighten the nut (4) by hand.

3. Use a wrench or spanner to turn the nut (4) to its original position (you will feel an increase in resistance when the nut is in its original position), then tighten the nut slightly.



1. Swagelok connector
2. Front (tapered) ferrule
3. Rear ferrule
4, Nut
5. Tube

Figure A1-1 - Fit a swagelok fitting



1. Swagelok connector
2. Front (tapered) ferrule
3. Rear ferrule
4. Nut
5. Tube

Figure A1-2 - Retighten a Swagelok fitting

APPENDIX

A2 CONVERSION TABLES

	$l.min^{-1}$	$ft^3.min^{-1}$	m^3h^{-1}	imp $gal.h^{-1}$	US $gal.h^{-1}$
1 $l.min^{-1}$ =	1	0.0353	0.06	16.67	15.85
1 $ft^3.min^{-1}$ =	28.32	1	1.7	3.734	4.486
1 m^3h^{-1} =	16.67	0.589	1	2.1997	2.642
1 imp $gal.h^{-1}$ =	0.076	0.2678	0.4546	1	1.201
1 US $gal.h^{-1}$ =	0.063	0.2229	0.3785	0.833	1

Table A2-1 - Volumetric flow rate unit conversions

	mm	cm	m	in	ft
1 mm =	1	0.1	0.001	0.0394	3.28×10^{-3}
1 cm =	10	1	0.01	0.3937	3.28×10^{-2}
1 m =	1000	10	1	39.37	3.2808
1 in =	25.4	2.54	0.0254	1	8.33×10^{-2}
1 ft =	304.8	30.48	0.305	12	1

Table A2-2 - Linear unit conversions

Unit/function	**Equivalent/formula**
British Thermal Unit (BTU)	1 BTU = 0.252 kg.Cal
Calorific value: $MJ.m^{-3}$ to kCal	1 kCal = 4.18 x $MJ.m^{-3}$
Centigrade (^oC) to Fahrenheit (^oF)	$^oF = (^9/_5 \times {}^oC) + 32$
Fahrenheit (^oF) to Centigrade (^oC)	$^oC = {}^5/_9 \times (^oF - 32)$

Table A2-3 - Miscellaneous equivalents and formulae

	psi	atm.	inch H_2O	mm H_2O	cm H_2O	oz.inch^{-2}	kg.cm^{-2}	inch Hg	mm Hg (Torr)	cm Hg	mbar	bar	Pa (N.m^{-2})	kPa	MPa
1 psi =	1	0.0681	27.71	703.8	70.38	16	0.0704	2.036	51.715	5.17	68.95	0.0689	6895	6.895	0.0069
1 atm =	14.7	1	407.2	10,343	1,034.3	235.1	1.033	29.92	760	76	1013	1.013	101,325	101.3	0.1013
1 inch H_2O =	0.0361	0.00246	1	25.4	2.54	0.5775	0.00254	0.0735	1.866	0.187	2.488	0.00249	248.8	0.249	0.00025
1 mm H_2O =	0.001421	0.000097	0.0394	1	0.1	0.0227	0.0001	0.00289	0.0735	0.00735	0.098	0.000098	9.8	0.0098	0.00001
1 cm H_2O =	0.01421	0.000967	0.3937	10	1	0.227	0.001	0.0289	0.735	0.0735	0.98	0.00098	98	0.098	0.0001
1 oz.inch^{-2} =	0.0625	0.00425	1.732	43.986	4.4	1	0.0044	0.1273	3.232	0.323	4.31	0.00431	431	0.431	0.00043
1 kg.cm^{-2} =	14.22	0.968	394.1	100,010	1,001	227.6	1	28.96	735.6	73.56	980.7	0.981	98,067	98.07	0.0981
1 inch Hg =	0.4912	0.03342	13.61	345.7	34.57	7.858	0.0345	1	25.4	2.54	33.86	0.0339	3386	3.386	0.00339
1 mm Hg (Torr) =	0.01934	0.001316	0.536	13.61	1.361	0.310	0.00136	0.0394	1	0.1	1.333	0.001333	133.3	0.1333	0.000133
1 cm Hg =	0.1934	0.01316	5.358	136.1	13.61	3.1	0.0136	0.394	10	1	13.33	0.01333	1333	1.333	0.00133
1 mbar =	0.0145	0.000987	0.4012	10.21	1.021	0.2321	0.00102	0.0295	0.75	0.075	1	0.001	100	0.1	0.0001
1 bar =	14.504	0.987	401.9	10,210	1021	232.1	1.02	29.53	750	75	1000	1	100,000	100	0.1
1 Pa (N.m^{-2}) =	0.000145	0.00001	0.00402	0.102	0.0102	0.00232	0.00001	0.000295	0.0075	0.00075	0.01	0.00001	1	0.001	0.000001
1 kPa =	0.14504	0.00987	4.019	102.07	10.207	2.321	0.0102	0.295	7.05	0.75	10	0.01	1,000	1	0.001
1 MPa =	145.04	9.869	4019	102,074	10,207	2321	10.2	295.3	7500	750	10,000	10	1,000,000	1,000	1

Table A2-4 - Pressure unit conversions

APPENDIX

A3 STATUS DISPLAY ORDERING OPTION/ACCESSORY

A3.1 Introduction

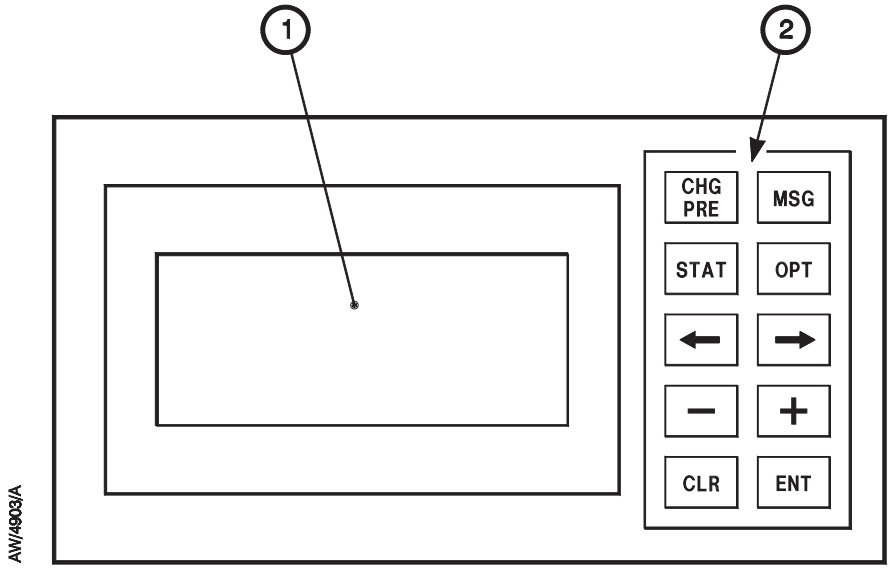
Use the status display to monitor and control the operation of the PCS. If fitted, the location of the status display is shown in Figure 2.

Refer to Figure A3-1:

- The four-line display area (1): shows messages which identify the status of the PCS and messages which identify any fault conditions which have been detected: see Sections A3.3 and A3.4.
- Where necessary (if any ordering options are fitted), the control buttons (2) are used to control the operation of the PCS: refer to Appendices A4 onwards.

A3.2 Technical data

Display type	LCD, back-lit
Number of lines	4
Number of characters per line	16



1. Display area
2. Control buttons

Figure A3-1 - The status display

A3.3 Normal operation

Refer to Figure A3-1. During normal operation:

- The top line of the status (1) display a message which shows the operational status of the PCS. The two messages which can be shown, together with their meanings, are given in Table A3-1.
- The other three lines of the status display may be used to display information associated with ordering options: refer to Appendices A4 onwards.

Message	Meaning
INITIALISING	This is shown on start-up, and indicates that the PCS is initialising. The message will typically be shown for approximately 10 seconds, after which 'SYSTEM OK' will be shown (see below), or a fault message will be shown (see Section A3.4).
SYSTEM OK	This indicates that the PCS is operating normally, with no fault conditions detected.

Table A3-1 - PCS status messages

A3.4 Fault messages

Note: The messages in Table A3-2 are those which can be displayed for a basic PCS. Other fault messages may be shown if your PCS has other ordering options: refer to Appendices A4 onwards.

If a fault condition is detected, a message identifying the fault condition will be shown on the status display.

The fault messages which can be shown are given in Table A3-2. Note that, for ease of reference, these are given in alphabetical order.

Fault message	Check	Action
E525 KEYSWITCH	Is the mode switch on the PLC in the incorrect position ?	Open the control unit door (refer to Section 5.6) and ensure that the mode switch on the PLC (Figure 6, item 3) is in the 'term' position.
PSDL 202 FAULT	Has a silane reaction taken place ?	Replace the cyclone chamber / trap (see Section 5.7), then clean and inspect the replaced cyclone chamber / trap: refer to Section 5.8. If there is no indication of a reaction in the cyclone chamber / trap, continue fault finding as described below.
	Has the blower circuit breaker tripped ?	If the blower is not operating, circuit breaker CB1 may have tripped. Inspect the circuit breaker and reset as necessary: refer to Section 5.6.
	Is air flow into the blower impaired ?	Ensure that the blower inlet is not blocked or obstructed.
	Is the pressure-switch faulty ?	Check the continuity of the pressure-switch output (see Figure 6). If the pressure-switch output is not open circuit, the pressure-switch is faulty and must be replaced: contact your supplier or BOC Edwards.
	Is there a high back-pressure ?	During extremely high gas flows into the PCS, the resulting back- pressure can cause insufficient air to get into the PCS system. Inspect the gas flow(s) into the PCS and rectify any problem found.
PSL 301 N2 FAULT	Is the nitrogen supply pressure too low ?	Inspect your nitrogen supply and rectify any problem found.
TIC 401 FAULT	Has a silane reaction taken place ?	Replace the cyclone chamber / trap (see Section 5.7), then clean and inspect the replaced cyclone chamber / trap: refer to Section 5.8. If there is no indication of a reaction in the cyclone chamber / trap, continue fault finding as described below.
	Is the outlet temperature switch disconnected ?	Ensure that the switch cable is correctly connected to the control unit: refer to Section 5.7.3.

Table A3-2 - Status display fault messages

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APPENDIX

A4 CYCLONE ENCLOSURE ORDERING OPTION/ACCESSORY

A4.1 Description

If you order the PCS with this option, the PCS is supplied with an enclosure fitted. This enclosure provides double containment of the cyclone chamber / trap and the inlet and outlet connections.

Refer to Figure A4-1, detail A, which shows the enclosure installed on the PCS. The enclosure has a hinged front door (4) secured by a catch (3), and a cabinet extraction flange (2), for connection to your cabinet-extraction system.

Refer to detail D. The PCS inlet and outlet pipeline leadthroughs used (25, 27, 22) and the water supply pipe leadthrough (24, if used for the on-line cleaning option: see Appendix A6) are fitted with cover plates (29, shown in detail E), to provide containment of the leadthroughs. A blanking plate will be supplied fitted over any leadthrough which is unused.

The cyclone enclosure can also be supplied as an accessory, which you can retrofit to an existing PCS. The enclosure top-plate can be dismantled into three sections (21, 23, 26) to allow you to easily retrofit the enclosure to an already-installed PCS: refer to Section A4.3.

A4.2 Technical data

Enclosure mass	15 kg
Cabinet extraction	
Extraction flange	Outside 72
Extraction rate required	100 m^3h^{-1}

A4.3 Additional installation requirements: enclosure supplied as an accessory

Note: In the procedures in the following sections, whenever you use a bolt or nut to secure part of the enclosure, you must also use a plain washer and a spring washer.

A4.3.1 Unpack and inspect

If the cyclone enclosure has been supplied as an accessory, use the following procedure to unpack and inspect the accessory:

1. Remove all packing materials and inspect the equipment for damage. If any item is damaged, notify your supplier and the carrier in writing within three days; state the Item Number of the accessory, together with your order number and your supplier's invoice number. Do not install the enclosure if any item is damaged.

2. Check that you have received the items listed in Table A4-1 (see page 56). If any item is missing, notify your supplier in writing within three days.

Qty	Description	Check (✓)
1	Lock-bar	❑
1	Rear panel	❑
1	Side panel	❑
1	Door	❑
1	Top panel assembly	❑
18	Bolts	❑
24	Spring washers	❑
24	Plain washers	❑
6	Nuts	❑

Table A4-1 - Checklist of components for the cyclone enclosure

A4.3.2 Fit the enclosure rear and side panels and front door

1. Refer to Figure A4-1, detail B. Use two bolts (11) to secure the lock-bar (12) to the side of the control unit (10), then use one bolt (13) to secure the bottom of the lock-bar (12) to the PCS frame (14).

2. Fit the rear panel (9) in place on the rear cross-bar of the PCS frame (14), then use two bolts (8) to secure the side of the rear panel to the side of the control unit (10).

3. Use two bolts (15) to secure the bottom of the rear panel (9) to the rear cross-bar of the PCS frame (14).

4. Fit the side panel (6) in place on the side of the PCS frame (14), then use three bolts (16) to secure the rear of the side panel to the rear panel (9) and to the PCS frame (14).

5. Use two bolts (17) to secure the bottom of the side panel (6) to the PCS frame (14).

6. Fit the door (4) in place alongside the side panel (6), then use six nuts to secure the door to the three hinges on the side panel: refer to detail C; the door is secured to each hinge by two nuts (5).

7. Continue to fit the top panel:

   - If you are fitting the enclosure to a PCS which is not already connected to your process and exhaust-extraction systems, continue at Section A4.3.3.

   - If you are fitting the enclosure to a single-inlet PCS which is already connected to your process and exhaust-extraction systems, continue at Section A4.3.4.

   - If you are fitting the enclosure to a dual-inlet PCS which is already connected to your process and exhaust-extraction systems, continue at Section A4.3.5.

A4.3.3 Fit the top panel to an unconnected PCS

1. Refer to Figure A4-1, detail B. Fit the top panel (1) in position on top of the side panel (6) and rear panel (9).

2. Use two bolts (7) to secure the top panel (1) to the side of the control unit (10).

3. Use two bolts (19) to secure the rear panel (9) to the top panel (1).

4. Use two bolts (18) to secure the side panel (6) to the top panel (1).

5. Remove the cover plates from the top panel: refer to Section A4.4.1.

After you have connected the PCS to your process and exhaust-extraction systems (in Section 3.5), continue at Section A4.4.2 to refit the cover plates and to connect the PCS to your cabinet extraction system.

A4.3.4 Fit the top panel to an already connected single-inlet PCS

1. Refer to Figure A4-1, detail E. Undo and remove the four bolts (28) which secure the two cover plates (29) to the inlet 1 leadthrough (detail D, item 27), then remove the cover plates.

2. Undo and remove the four bolts (28) which secure the two cover plates (29) to the outlet leadthrough (detail D, item 22), then remove the two cover plates.

3. Refer to detail D. Undo and remove the bolt (20) which secures the left-hand rear top panel section (21) to the front top panel section (26).

4. Undo and remove the two bolts (20) which secure the left-hand rear top panel section (21) to the right-hand rear top panel section (23), then separate the sections.

5. Place the right-hand rear top panel section (23) and front top panel section (26) in position on the top of the side and rear panels (see detail B), so that your exhaust-extraction pipeline is in the outlet leadthrough half (22), and so that your inlet pipeline is in the inlet 1 leadthrough half (27).

6. Refer to detail B. Fit the two bolts (7) to secure the right-hand rear and front top panel sections to the side of the control unit (10).

7. Refer to detail D. Fit the left-hand rear top panel section (21) in position on the top of the side and rear panels (see detail B), so that your exhaust-extraction pipeline is in the outlet leadthrough half (22), and so that your inlet pipeline is in the inlet 1 leadthrough half (27).

8. Refit the bolt (20) to secure the left-hand rear top panel section (21) to the front top panel section (26).

9. Refit the two bolts (20) to secure the left-hand rear top panel section (21) to the right-hand rear top panel section (23).

10. Continue at Section 4.4.2 to refit the cover plates and to connect the PCS to your cabinet extraction system.

A4.3.5 Fit the top panel to an already connected dual-inlet PCS

1. Refer to Figure A4-1, detail E. Undo and remove the four bolts (28) which secure the two cover plates (29) to the inlet 1 leadthrough (detail D, item 27), then remove the two cover plates.

2. Undo and remove the four bolts (28) which secure the two cover plates (29) to the inlet 2 leadthrough (detail D, item 25), then remove the two cover plates.

3. Undo and remove the four bolts (28) which secure the two cover plates (29) to the outlet leadthrough (detail D, item 22), then remove the two cover plates.

4. Refer to detail D. Undo and remove the bolt (20) which secures the left-hand rear top panel section (21) to the front top panel section (26).

5. Undo and remove the two bolts (20) which secure the left-hand rear top panel section (21) to the right-hand rear top panel section (23), then separate the sections.

6. Undo and remove the two bolts (20) which secure the right-hand top panel section (23) to the front top panel section (26), then separate the two sections.

7. Place the left-hand rear top panel section (21) in position on the top of the rear and side panels (see detail B), so that your exhaust-extraction pipeline is in the outlet leadthrough half (22), and so that your inlet 1 pipeline is in the inlet 1 leadthrough half (27).

8. Refer to detail B. Fit the two bolts (18) to secure the panel to the side panel (6).

9. Refer to detail D. Place the right-hand rear top panel section (23) in position on the top of the rear panel (see detail B), so that your exhaust-extraction pipeline is in the outlet leadthrough half (22), and so that your inlet 2 pipeline is in the inlet 2 leadthrough half (25).

10. Refit the two bolts (20) to secure the left-hand rear top panel section (21) to the right-hand rear top panel section (23).

11. Place the front top panel section (26) in position on the top of the side panel (see detail B), so that your inlet 1 pipeline is in the inlet 1 leadthrough half (27) and your inlet 2 pipeline is in the inlet 2 leadthrough half (25).

12. Fit the bolt (20) to secure the left-hand rear top panel section (21) to the front top panel section (26).

13. Fit the two bolts (20) to secure the right-hand rear top panel section (23) to the front top panel section (26).

14. Refer to detail B. Fit the two bolts (19) to secure the top panel (1) to the rear panel (9).

15. Fit the two bolts (7) to secure the top panel (1) to the side of the control unit (10).

16. Continue at Section A4.4.2 to refit the cover plates and to connect the PCS to your cabinet extraction system.

A4.4 Additional installation requirements: enclosure supplied as an ordering option

Note: In the procedures in the following sections, whenever you use a bolt or nut to secure part of the enclosure, you must also use a plain washer and a spring washer.

A4.4.1 Remove the cover plates

Before you connect the PCS to your process and exhaust-extraction systems (in Section 3.5), remove the cover plates as follows:

1. Refer to Figure A4-1, detail E. Undo and remove the four bolts (28) which secure the two cover plates (29) to the outlet leadthrough (detail D, item 22), then remove the cover plates.

2. Undo and remove the four bolts (28) which secure the two cover plates (29) to the inlet 1 leadthrough (detail D, item 27), then remove the cover plates.

3. If you have a dual-inlet PCS: undo and remove the four bolts (28) which secure the two cover plates (29) to the inlet 2 leadthrough (detail D, item 25), then remove the cover plates.

A4.4.2 Refit the cover plates

After you have connected the PCS to your process and exhaust-extraction systems (in Section 3.5), refit the cover plates, as follows:

1. Refer to Figure A4-1, detail E. Fit the two cover plates (29) to the outlet leadthrough (detail D, item 22), around your exhaust-extraction pipeline: ensure that the two cover plates are in opposite orientations, as shown in detail E.

2. Refit the four bolts (28) to secure the cover plates (29) to the top panel.

3. If you have a single-inlet PCS, continue at Step 6, otherwise continue at Step 4.

4. Fit the two cover plates (29) to the inlet 2 leadthrough (detail D, item 25), around your inlet 2 pipeline: ensure that the two plates are in opposite orientations, as shown in detail E.

5. Refit the four bolts (28) to secure the cover plates (29) to the top panel.

6. Fit the two cover plates (29) to the inlet 1 leadthrough (detail D, item 27), around your inlet 1 pipeline: ensure that the two plates are in opposite orientations, as shown in detail E.

7. Refit the four bolts (28) to secure the cover plates (29) to the top panel.

8. Continue at Section A4.4.3 to connect the PCS to your cabinet extraction system.

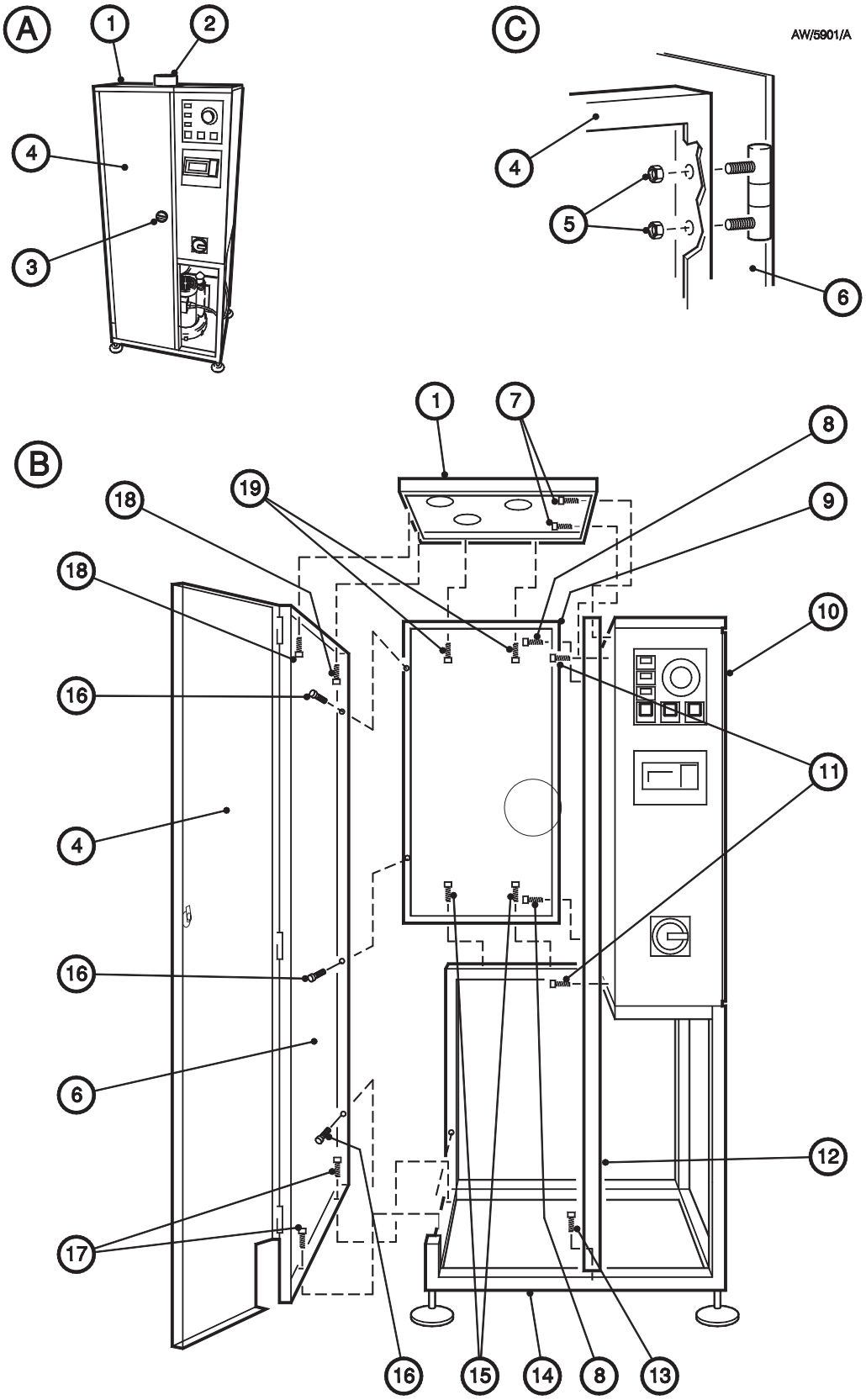
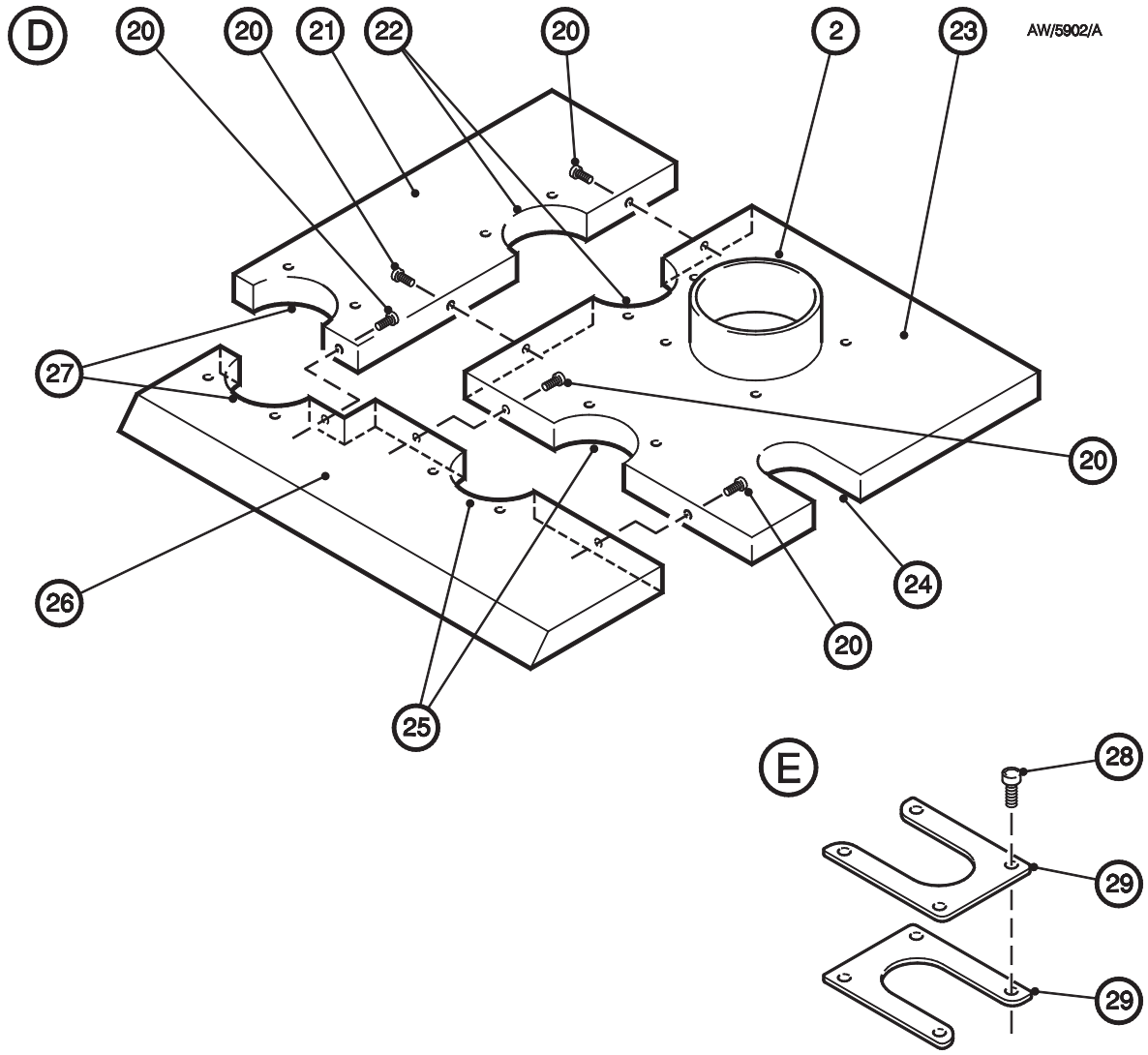


Figure A4-1 - Fit the cyclone chamber enclosure: sheet 1 of 2



1. Top panel
2. Extraction flange
3. Catch
4. Front door
5. Nuts
6. Side panel
7. Bolts (2 off)
8. Bolts (2 off)
9. Rear panel
10. Control unit
11. Bolts (2 off)
12. Lock-bar
13. Bolt
14. Frame
15. Bolts (2 off)
16. Bolts (3 off)
17. Bolts (2 off)
18. Bolts (2 off)
19. Bolts (2 off)
20. Bolts (5 off)
21. Left-hand rear top panel section
22. Outlet leadthrough
23. Right-hand rear top panel section
24. Water pipe leadthrough *
25. Inlet 2 leadthrough
26. Front top panel section
27. Inlet 1 leadthrough
28. Bolts (4 off)
29. Cover plates

* For the on-line cleaning option

Figure A4-1 - Fit the cyclone chamber enclosure: sheet 2 of 2

A4.4.3 Connect the PCS to your cabinet extraction system

WARNING

Ensure that your cabinet extraction system provides the required extraction rate, and cannot be interrupted during operation. If the cabinet extraction system does not operate correctly, the cyclone enclosure will not provide double containment of the cyclone chamber / trap.

Refer to Figure A4-1, detail A. Connect the cabinet extraction flange (2) to your cabinet extraction system.

Incorporate a suitable sample port in your cabinet extraction pipeline approximately 1 metre above the cabinet extraction flange (2). Use this port to sample the air extracted from the enclosure, in order to detect leaks from the PCS or the connecting pipelines.

Your cabinet extraction system must provide the extraction flow rate specified in Section A4.2.

A4.5 Maintenance/service requirements

WARNING

Ensure that your cabinet extraction system is operating and provides the required extraction flow rate before you open the enclosure door to access the PCS cyclone chamber / trap.

Refer to Figure A4-1, detail A. Note that you will need to turn the catch (3) and open the front door (4) of the enclosure in order to access the cyclone chamber / trap for maintenance or service.

Ensure that your cabinet extraction system is operating and providing the correct extraction flow rate before you open the enclosure door.

APPENDIX

A5 INLET PRESSURE MONITORING ORDERING OPTION

A5.1 Introduction

When you order the PCS with this option, the PCS is supplied configured to provide a constantly updated display of the pressure in each PCS inlet; these pressures are shown on the status display. (Note that the status display is provided as part of this ordering option.)

Refer to Figure A5-2, which shows the additional components fitted to the PCS for this ordering option. Each PCS inlet is fitted with a pressure transducer (1, 5), which measures the pressure in the corresponding inlet.

Each pressure transducer is supplied with purge nitrogen from the flexible purge pipe (2), in order to prevent blockage of the transducer by deposits in the process gases, and so to extend the operational life of the transducer.

The outputs of the transducers are connected to the PLC in the control unit. The PLC monitors the inlet pressures, and displays the pressures or generates any appropriate fault messages (refer to Sections A5.3 and A5.4.3).

A5.2 Technical data

Purge nitrogen flow rate (to each pressure transducer) 5 $l.min^{-1}$

A5.3 Normal operation

During normal operation:

- On a single-inlet PCS, the second line of the status display will show the pressure in the PCS inlet.
- On a dual-inlet PCS, the second line of the status display will show the pressure in PCS inlet 1, and the third line of the status display will show the pressure in PCS inlet 2.

Figure A5-1 shows the pressure display format on the status display, where " " specifies a pressure in mbar.

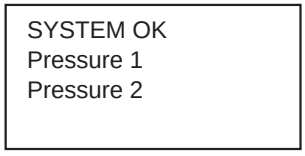


Figure A5-1 - Pressure display format

A5.4 Additional maintenance requirements

A5.4.1 Remove the cyclone chamber/trap from the PCS

If your PCS has the inlet pressure monitoring option, you must disconnect the nitrogen purge pipe and electrical connection(s) before you can remove the cyclone chamber / trap from the PCS.

Before you start the procedure given in Section 5.7.2, carry out the appropriate procedure given below.

Single-inlet PCS

1. Refer to Figure A5-2, detail C. Disconnect the female quick-connector (3) on the nitrogen purge pipe (2) from the male quick-connector (4) connected to the inlet pressure transducer (1).

2. Disconnect the electrical connector (8) on the end of the inlet transducer cable from the electrical connector (9) on the PLC cable.

Dual-inlet PCS

1. Refer to Figure A5-2, detail B. Disconnect the female quick-connector (3) on the nitrogen purge pipe (2) from the male quick-connector (4) connected to the inlet 2 pressure transducer (5).

2. Disconnect the electrical connector (6) on the end of the inlet 2 transducer cable from the electrical connector (7) on the PLC cable.

3. Disconnect the electrical connector (8) on the end of the inlet 1 transducer cable from the electrical connector (9) on the PLC cable.

A5.4.2 Fit the replacement cyclone chamber/trap to the PCS

Note: The replacement cyclone chamber/trap must be configured for the inlet pressure monitoring option.

If your PCS has the inlet pressure monitoring option, you must reconnect the nitrogen purge pipe and electrical connection(s) after you have refitted the cyclone chamber / trap to the PCS.

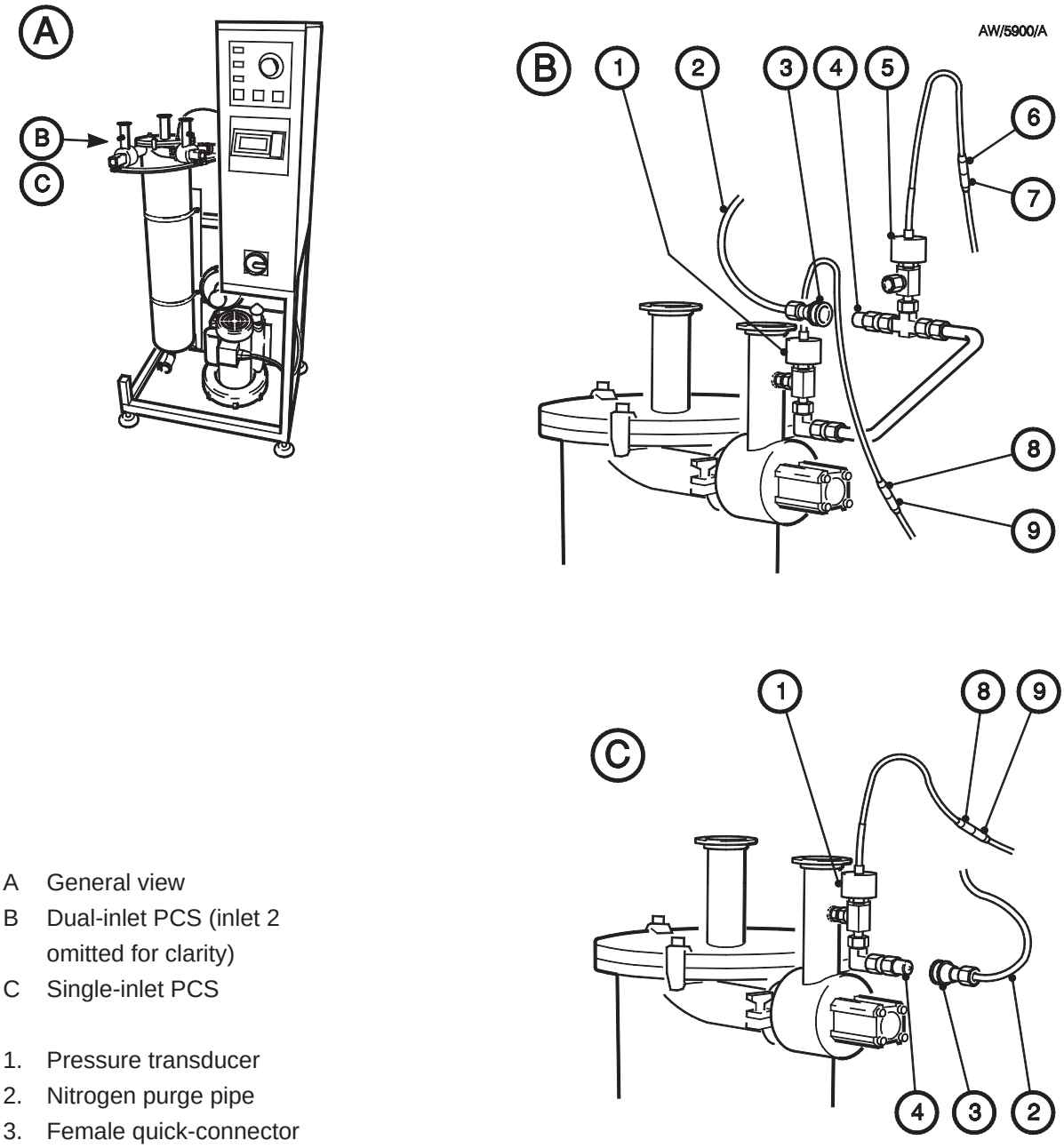
After you have completed the procedure given in Section 5.7.3, carry out the appropriate procedure given below.

Single-inlet PCS

1. Refer to Figure A5-2, detail C. Connect the female quick-connector (3) on the nitrogen purge pipe (2) to the male quick-connector (4) connected to the inlet pressure transducer (1).

2. Connect the electrical connector (8) on the end of the inlet transducer cable to the electrical connector (9) on the PLC cable.

(Continued on page 66)



A General view
B Dual-inlet PCS (inlet 2 omitted for clarity)
C Single-inlet PCS

1. Pressure transducer
2. Nitrogen purge pipe
3. Female quick-connector
4. Male quick-connector
5. Pressure transducer
6. Electrical connector (on inlet 2 transducer cable)
7. Electrical connector (on PLC cable)
8. Electrical connector (on inlet 1 transducer cable)
9. Electrical connector (on PLC cable)

Figure A5-2 - Inlet pressure monitoring components

Dual inlet PCS

Note: The electrical connectors on the transducer cables and PLC cables are marked 'Inlet 1' and 'Inlet 2'. You must connect each transducer cable connector to the corresponding PLC cable connector

1. Refer to Figure A5-2, detail B. Connect the female quick-connector (3) on the nitrogen purge pipe (2) to the male quick-connector (4) connected to the inlet 2 pressure transducer (5).

2. Connect the electrical connector (6) on the end of the inlet 2 transducer cable to the electrical connector (7) on the PLC cable.

3. Connect the electrical connector (8) on the end of the inlet 1 transducer cable to the electrical connector (9) on the PLC cable.

A5.4.3 Additional fault finding

When the inlet pressure monitoring option is fitted, note that the additional fault message given in Table A5-1 can be shown on the status display.

Fault message	Check	Action
PRESSURE WARNING	Is the gas flow into the PCS too high ?	Inspect the gas flow(s) into the PCS and rectify any problem found.
	Is the inlet blocked ?	Replace the cyclone chamber / trap (see Section 5.7), then clean and inspect the replaced cyclone chamber / trap: refer to Section 5.8. If the inlet is blocked, the nitrogen purge to the transducer may be too low: check that the nitrogen purge pipeline is not damaged.
	Is the pressure transducer faulty ?	Inspect the pressure transducer for correct operation and replace if necessary.

Table A5-1 - Inlet pressure monitoring fault message

APPENDIX

A6 ON-LINE CLEANING ORDERING OPTION

A6.1 Introduction

A6.1.1 Description

This ordering option allows you to clean deposits from the cyclone chamber / trap without having to remove the cyclone chamber / trap from the PCS.

Refer to Figure A6-2, which shows a PCS configured with the on-line cleaning option. Note that:

- You must connect a cleaning water supply to the cleaning water inlet (1) during installation (refer to Section A6.3.3).
- The cleaning water supply pipe (7) has a quick-connector (8), so that you can easily disconnect the pipe when you replace the cyclone chamber / trap (refer to section A6.6.1).
- The trap outlet is fitted with a manual drain valve (5) fitted to the trap outlet pipe and a drain tank (Figure A6-5, item 19). You will use the drain tank and drain valve to drain used cleaning water from the cyclone chamber / trap into the drain tank (refer to Section A6.5).

  When cleaning is not in progress, the drain valve can be locked in the closed position (as shown in Figure A6-5, detail D).

Note that the status display is supplied as part of this ordering option.

A6.1.2 Principle of operation

Refer to Figure A6-2. Before you start cleaning, you must open the water isolation valve (2). When cleaning is initiated, the PLC opens the solenoid-valve (3) to enable cleaning water to pass through the supply pipe (6) and the quick connectors and into the spray assembly in the cyclone chamber / trap.

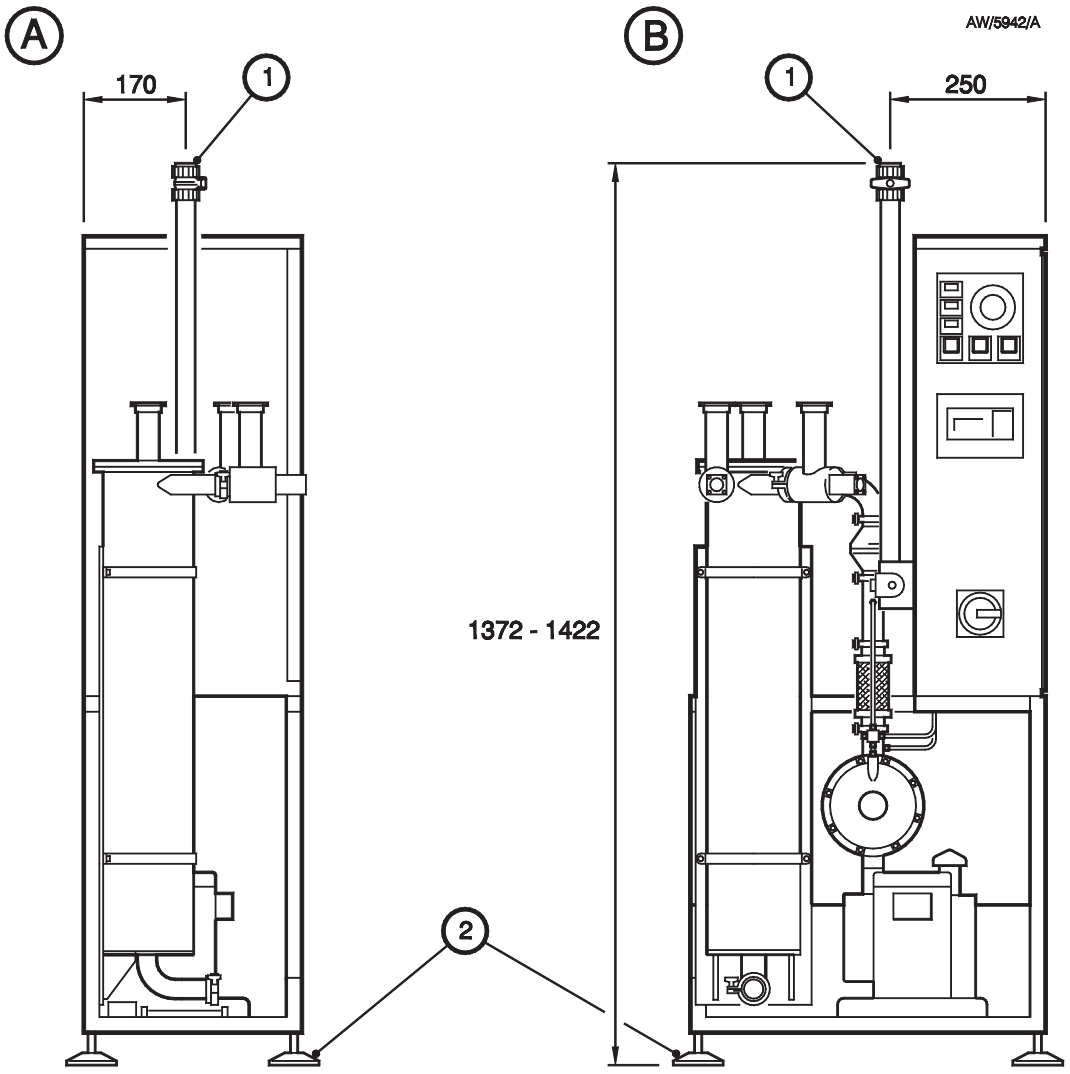
Refer to Figure A6-5, detail C. The cleaning water from the supply pipe enters the spray assembly (5). Streams of cleaning water then spray from the jets (6) around the wall of the cyclone chamber. Particulate on the wall of the cyclone chamber is entrained in the cleaning water, and is carried down the wall of the chamber and into the trap.

After a preset time, the PLC closes the solenoid-valve to isolate the cleaning water supply. You must then connect the drain tank (detail E, item 19) and open the drain valve (10), to allow the cleaning water and the entrained particulate to drain out of the cyclone chamber / trap and into the drain tank.

A second cleaning cycle is then carried out, in order to fully clean the cyclone chamber / trap. You can then dispose of the used cleaning water and entrained particulate in the drain tank.

A6.2 Technical data

Mass (of additional on-line cleaning components)	4 kg
Dimensions (of water inlet)	See Figure A6-1
Cleaning water supply	
Quality	Domestic potable
Calcium content	< 0.1 $mg.l^{-1}$
Pressure	2 to 5 bar gauge (3 x 10^5 to 6 x 10^5 Pa)
Minimum flow rate	5 $l.min^{-1}$
Cleaning water inlet	Suitable for 1 inch outside pipe

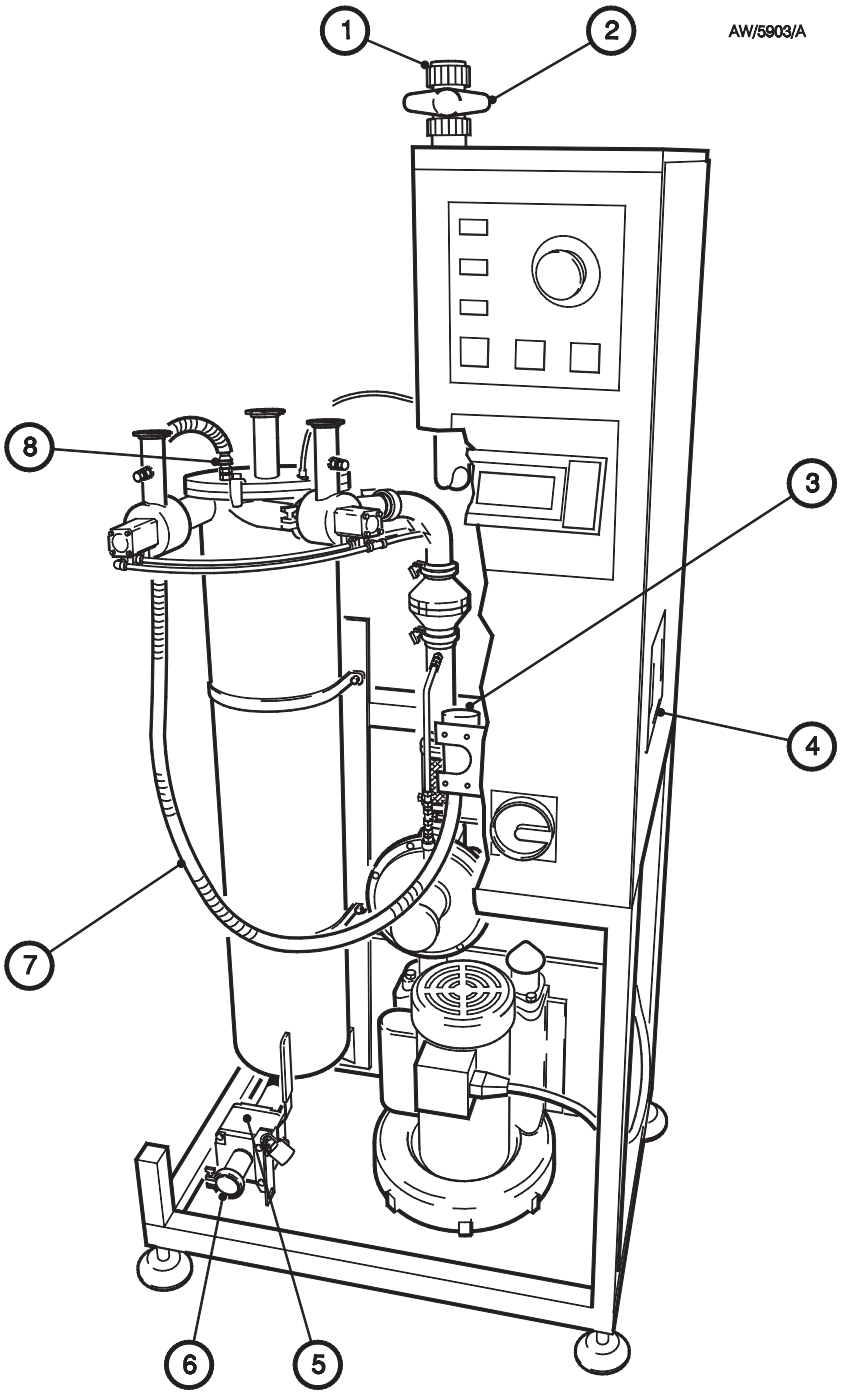


1. Cleaning water inlet
2. Levelling feet

Note: The vertical height to the water inlet (1) is:

- *1372 with the levelling feet (2) fully raised.*
- *1422 with the levelling feet (2) fully lowered.*

Figure A6-1 - Dimensions of water inlet connection (mm)



1. Cleaning water inlet
2. Water isolation valve
3. Solenoid-valve
4. Log card holder
5. Drain valve
6. Drain valve outlet (blanked)
7. Cleaning water supply pipe
8. Quick-connectors

Figure A6-2 - PCS fitted with the on-line cleaning option

A6.3 Installation requirements

A6.3.1 Unpack and inspect

Your PCS will be supplied with the components shown in Figure A6-2 (and a status display) already fitted. You will also receive some additional items (see Table A6-1).

When you unpack and inspect the PCS (in Section 3.3) and refer to the checklist of items in Table 4, ensure that you have also received the additional items listed in Table A6-1.

Qty	Description	Check (✓)
1	Drain tank	❑
1	Elbow fitting (with flexible pipe and flange)	❑
2	Padlock keys	❑
1	Log card	❑

Table A6-1 - Checklist of additional on-line cleaning components

A6.3.2 Place the log card in its storage position

When you order this option, the PCS is supplied with a log card, on which you can record when on-line cleaning of the PCS is carried.

Refer to Figure A6-2. Place the log card in its storage position in the log card holder (4) on the control unit door.

A6.3.3 Connect your water supply to the PCS

Notes: *Your cleaning water supply must meet the requirements of Section A6.2, and your cleaning water supply pipeline must incorporate a suitable filter, to prevent the entry of debris in the supply into the PCS.*

We recommend that you incorporate an isolation valve in your cleaning water supply pipeline, so that you can isolate the supply from the PCS.

After you have connected the nitrogen supply to the PCS (as in Section 3.7), you must connect your cleaning water supply to the PCS; use the following procedure:

1. Refer to Figure A6-2. Ensure that the water isolation valve (2) is in the closed position (that is, at right-angles to the water supply pipe).

2. Connect your water supply pipeline to the cleaning water inlet (1). Do not switch on the cleaning water supply yet.

A6.4 Normal Operation

A6.4.1 Start-up

When you use the procedure in Section 4.1 to start up the PCS, before you switch on the electrical supply isolator (in Step 5):

- Refer to Figure A6-2. Ensure that the water isolation valve (2) is in the closed position (that is, at right-angles to the water supply pipe).
- Ensure that your external cleaning water supply is turned off.

A6.4.2 Status indications

During normal operation, the fourth line of the status display will show the time elapsed since the last on-line cleaning operation was carried out. This time is displayed in the form shown in Figure A6-3, where specifies a digit: the two digits to the left of the decimal point specify the number of days, and the two digits to the right of the decimal point specify the number of hours.

Also, when you carry out on-line cleaning, the status display will show messages which prompt you to carry out specific actions for cleaning: refer to Section A6.5.

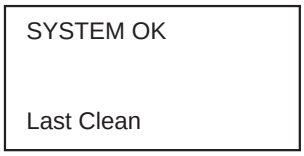


Figure A6-3 - On-line cleaning normal display format

A6.5 On-line cleaning procedure

WARNING

You must comply with the invasive procedure safety requirements of Section 5.1.3 when you connect and disconnect the drain tank, and dispose of the water in the drain tank.

Note: The buttons referenced in the procedures in the following sections are the control buttons on the status display (see Figure A3-1).

A6.5.1 Initiate the cleaning cycle

WARNING

Ensure that process gases cannot enter the PCS during cleaning.

Notes: You cannot carry out on-line cleaning if a PCS warning fault condition exists. When you press the button, if a warning fault condition exists, the status display will show 'Clean Disallowed'.

Figure A6-4 shows a schematic diagram of the status display messages shown, and the buttons that you must press, during the on-line cleaning procedure.

Use the following procedure to initiate cleaning. Ensure that no process gases are being pumped when you start this procedure.

1. Press the button. The status display will then show 'BOCE PCS Online Cleaning Module Hold + / - for 5 seconds'.

2. Press and hold the + and - buttons for at least five seconds. The status display will then show 'Open Water Valve YV501 Then Press + Key'.

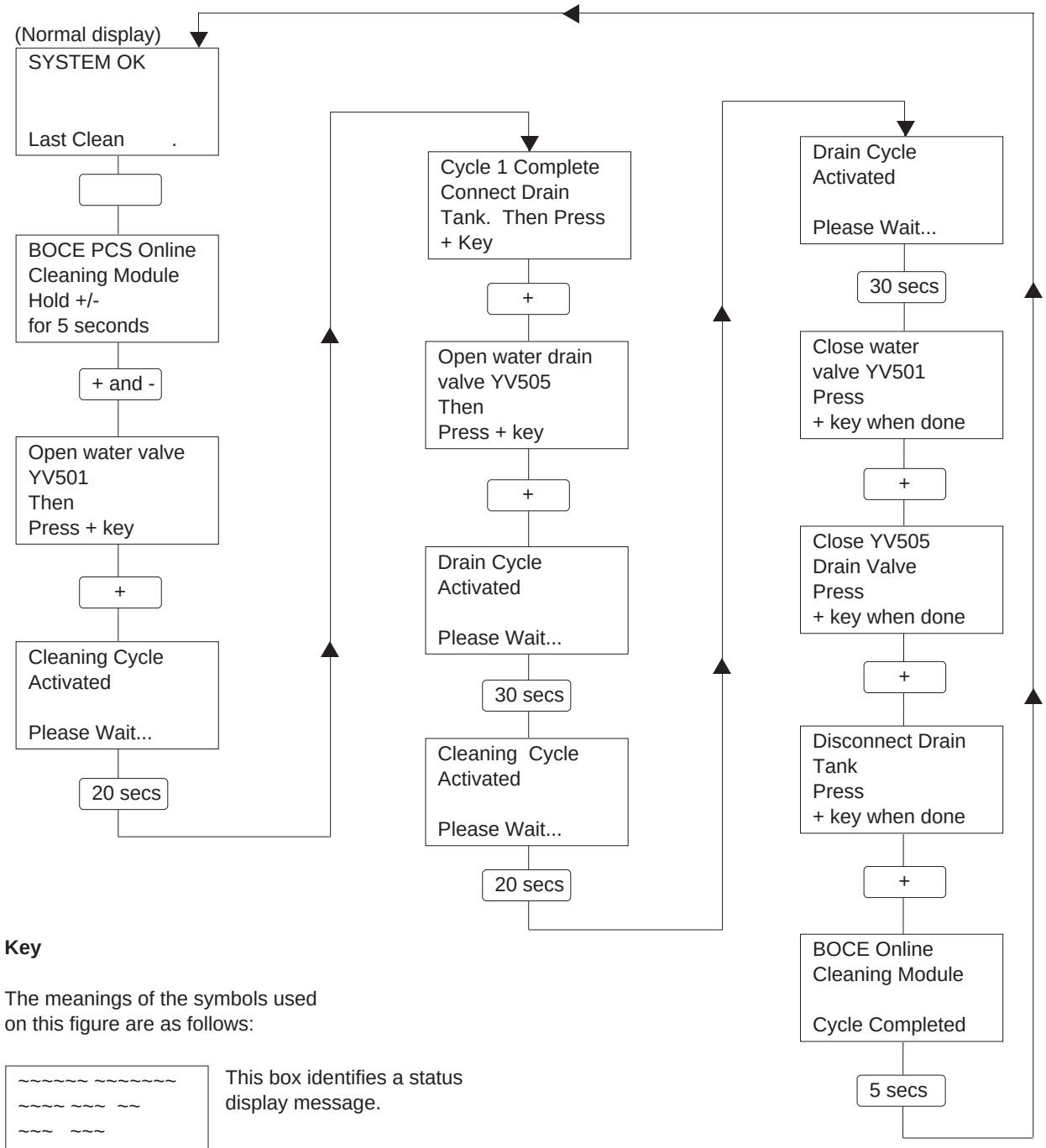
3. Turn on your external cleaning water supply.

4. Refer to Figure A6-2. Move the water isolation valve (2) to the open position (that is, so that it is in-line with the cleaning water supply pipe).

5. Press the + button. The status display will then show 'Cleaning Cycle Activated Please Wait' (this message will scroll on the display), and the solenoid-valve (3) will open to allow cleaning water to flow into the cyclone chamber / trap.

6. When the cleaning cycle has finished, the solenoid-valve (3) will close to isolate the cleaning water supply from the cyclone chamber / trap. The status display will then show 'Cycle 1 Complete Connect Drain Tank Then Press + Key'.

   When this message is shown on the status display, continue at Section A6.5.2.



Key

The meanings of the symbols used on this figure are as follows:

~~ ~~~~~~~ ~~~~ ~~~ ~~ ~~~ ~~~ ~~ ~~~ ~~~~	This box identifies a status display message.
+	This box represents a status display button (or buttons).
XX secs	This box represents a XX second delay (implemented by the PCS control system).

Figure A6-4 - On-line cleaning procedure

A6.5.2 Drain the cleaning water from the cyclone chamber/trap

1. Refer to Figure A6-5, detail D. Undo and remove the clamping ring (13) and trapped 'O' ring (13) and blanking plate (14) which seal the outlet of the drain valve (10).

2. Refer to detail E. Place the drain tank (19) on the floor next to the drain valve (10), remove the cap (18) from the inlet of the drain tank, then fit the elbow assembly (17) to the inlet.

3. Use the clamping ring and trapped 'O' ring (13) to connect the flange (15) on the flexible pipe (16) to the drain valve outlet (20).

4. Press the + button. The status display will then show 'Open Water Drain Valve YV505 Then Press + Key'.

5. Refer to detail D. Use one of the keys supplied to unlock the padlock (9) which secures the locking bar (11) to the bracket (12) and locks the drain valve handle (7) in the closed position, then remove the padlock.

6. Turn the drain valve handle (7) to the open position (so that it is in-line with the drain valve outlet (20) and the trap outlet pipe (8) as shown in detail E), to allow the cleaning water to drain from the cyclone chamber / trap and into the drain tank.

7. Press the + button. The status display will then show 'Drain Cycle Activated Please Wait' (this message will scroll on the display).

8. After a delay of approximately 30 seconds (to allow the cleaning water to fully drain from the cyclone chamber / trap), the solenoid-valve will open again to allow cleaning water to flow into the cyclone chamber / trap, and the status display will show 'Cleaning Cycle Activated Please Wait' (this message will scroll on the display).

9. After approximately 20 seconds, the solenoid-valve will close to isolate the cleaning water supply from the cyclone chamber / trap. The status display will then again show 'Drain Cycle Activated Please Wait' (this message will scroll on the display).

(Continued on page 76)

1. Water supply pipe
2. Female quick-connector
3. Male quick-connector
4. Cyclone chamber top-plate
5. Spray assembly
6. Jets
7. Drain valve handle
8. Trap outlet pipe
9. Padlock
10. Drain valve
11. Locking bar
12. Bracket
13. Clamping ring and trapped 'O' ring
14. Blanking plate
15. Flange
16. Flexible pipe
17. Elbow assembly
18. Cap
19. Drain tank
20. Drain valve outlet

Figure A6-5 - Inspect the spray assembly / drain the cyclone chamber / trap: key

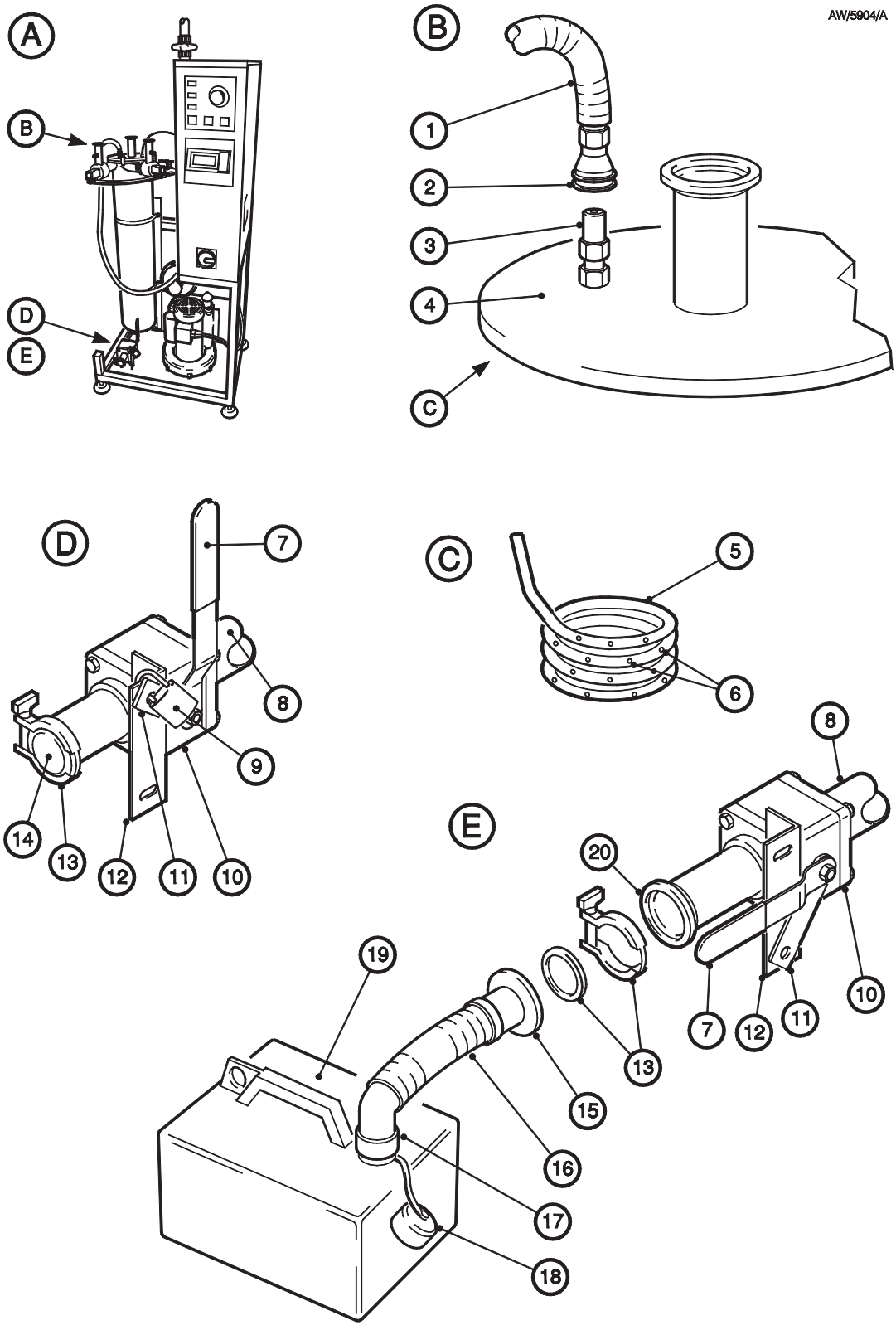


Figure A6-5 - Inspect the spray assembly / drain the cyclone chamber / trap

10. After a delay of approximately 30 seconds (to allow the cleaning water to fully drain from the cyclone chamber / trap), the status display will show 'Close Water Valve YV501 Press + Key when done'.

11. Refer to Figure A6-2. Turn the water isolation valve (2) to the closed position (so that it is at right angles to the water supply pipe), to isolate the cleaning water supply from the PCS.

12. Press the + button. The status display will then show 'Close YV505 Drain Valve Press + Key when done'.

    When this message is shown on the status display, continue at Section A6.5.3.

A6.5.3 Close the drain valve and disconnect the drain tank

1. Refer to Figure A6-5, detail E. Turn the drain valve handle (7) so that it is in the closed position (that is, at right angles to the drain valve outlet (20) and the trap outlet pipe (8), as shown in detail D).

2. Refer to detail D. Fit and lock the padlock (9) to secure the locking bar (11) to the bracket (12), and to secure the drain valve handle (7) in the closed position.

3. Press the + button. The status display will then show 'Disconnect Drain Tank Press + Key when done'.

4. Refer to detail E. Undo and remove the clamping ring and trapped 'O' ring (13) to disconnect the flange (15) on the flexible pipe (16) from the drain valve outlet (20).

5. Refer to detail D. Use the clamping ring and trapped 'O' ring (13) to fit the blanking plate (14) to the drain valve outlet (20).

6. Press the + button. The status display will then show 'BOCE Online Cleaning Module Cycle Complete'. After a few seconds, the status display will then change to show the normal status display format (see Figure A6-3).

7. Switch off your cleaning water supply. You can now continue to use the PCS to treat process gases.

8. Dispose of the water in the drain tank: refer to Section A6.7.

9. Refer to Figure A6-2. Remove the log card from the holder (4), complete the log card, then place it back in the log card holder.

A6.6 Additional maintenance requirements

A6.6.1 Remove the cyclone chamber/trap from the PCS

If your PCS has the on-line cleaning option, you must disconnect the cleaning water supply pipe from the cyclone chamber before you can remove the cyclone chamber / trap from the PCS.

Refer to Figure A6-5, detail B. Before you start the procedure given in Section 5.7.2, do the following:

- Disconnect the female quick-connector (2) on the cleaning water supply pipe (1) from the male quick-connector (3) on the cyclone chamber top-plate (4).

A6.6.2 Fit the replacement cyclone chamber/trap to the PCS

If your PCS has the on-line cleaning option, you must reconnect the cleaning water supply pipe to the cyclone chamber after you have refitted the cyclone chamber / trap from the PCS.

After you have completed the procedure given in Section 5.7.3, do the following:

- Refer to Figure A6-5, detail B. Connect the female quick-connector (2) on the cleaning water supply pipe (1) to the male quick-connector (3) on the cyclone chamber top-plate (4).

A6.6.3 Inspect the water spray assembly

In Section 5.8.3, after Step 1 (in which you inspect the top-plate of the cyclone chamber), you must carry out the following additional steps:

1a. Refer to Figure A6-5, detail C. Inspect the spray assembly (5). If the spray assembly is corroded or cracked, you must replace the cyclone chamber / trap.

1b. If any of the jets (6) are corroded or blocked, you must replace the cyclone chamber / trap.

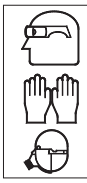
A6.6.4 Additional fault finding

When the on-line cleaning option is fitted, note that the additional fault message given in Table A6-2 can be shown on the status display.

Fault message	Check	Action
Cleaning Disallowed	Is there a fault condition present ?	If a fault condition exists, rectify the cause of the fault, then initiate cleaning again.
	Is there an electrical or control system fault ?	If no fault condition exists, there may be an electrical problem, or the control system may not be operating correctly: contact your supplier or BOC Edwards for advice.

Table A6-2 - On-line cleaning fault message

A6.7 Disposal



WARNING

You must safely dispose of contaminated cleaning water drained from the cyclone chamber / trap.

Dispose of the waste cleaning water drained from the cyclone chamber / trap safely in accordance with all local and national safety and environmental requirements.