Manual reference: 80 Plus

Oxford Instruments

Plasma Technology

Plasmalab 80 Plus

System Manuals

Volume 1

Operation and Maintenance Manual

This manual, Volume 1 is one of a series for the machine as follows: -

Volume 1	Operation and Maintenance Manual
Volume 2	System Drawings
Volume 3	OEM Manuals

Notes: -

1. Please regard this manual as part of the system.
2. Ensure that any amendment received is incorporated in the text.

Works order number: 17387

Oxford Instruments Plasma Technology
Yatton, Bristol, BS19 4AP
Tel: 01934 833851
Fax: 01934 934918

Issue 3 : January 1996

OXFORD

DECLARATION OF CONFORMITY - CE

Date

199

Responsible person:

Mr J Field, Engineering Director
Oxford Instruments Plasma Technology, North End Yatton, Bristol, BS19 4AP
UK

Machinery:

Directives:

Complies with:
Machinery Directive 89/392/EEC as amended by Directive 91/368/EEC and
EMC Directive 89/336/EEC as amended by Directive 92/31/EEC

Competent body:

TRL EMC Ltd, Long Green, Forthampton, Gloucester, GL19 4QH

Standards applied:

Machinery Directive as expressed by UK Statutory Instrument 1992 No 3073
"The Supply of Machinery (Safety) Regulations 1992"

Electrical Safety of industrial machines EN60204-1:1992

EMC Emission standard BSEN 50081-2:1994

EMC Immunity standard BSEN 50082-2:1995

Signed by

Dr M J Cooke, Technology Manager

QCF 60 ISS 2

Oxford Plasma Technology Goods Return Form

Returns No :

- This form must be completed and a copy sent to Oxford Plasma Technology Service Department by fax or mail before return of any goods to the factory. (Fax No : 01934 - 834918)
- If return to the factory is approved a Returns Authorisation Number will be issued. This should be written in the box provided on this form and the completed form returned with the goods as part of the shipping documentation. ***It must be possible to read this form without opening the packaging containing the goods, therefore the form should not be enclosed within the packaging.***
- All sections below must be completed. If any section does not apply, mark that section "not applicable". If the information requested is not known, mark that section "not known".
- ***Any goods returned to the factory without a copy of this form carrying a Returns Authorisation Number will be considered hazardous and may be disposed of at the sender's expense. Mark the returns number on all packages and supporting shipping documentation.***

Equipment description.	Serial number or identifying marking	
	Original OPT order No :	Date of order :
Reason for return of part/s.	Description of fault/s.	
Chemical names of all materials which have come into contact with the goods.	Precautions which must be taken when handling these materials.	
Nature of hazard(s) presented by contact with these materials.	Action to be taken in the event of human contact or spillage of these materials.	
Details of any decontamination carried out prior to shipping	Levels of residual substances left in or on the returned goods.	
Name and address of person to be contacted in case of query.	Tel No : Ext : Fax No :	

Declaration

Please strike through the section a) or b) which does not apply and sign the declaration.

a) I hereby confirm that the equipment detailed above has not come into contact with any hazardous substance and has been drained of any lubricant.

b) I hereby confirm that the only hazardous materials to which the equipment detailed above has been exposed are listed above and that the following precautions have been taken.

1. The equipment has been drained of any lubricant
2. All ports have been sealed and the equipment has been securely packed and labelled in accordance with Oxford Plasma Technology recommendations (available on request)
3. The carrier has been informed of the nature of the consignment.

Signed. . . . . Date. . . . . .

Name . . . . . Position. . . . . .

OXFORD
lasma Technology

ith End, Yatton
ristol, BS19 4AP
ngland
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ax: (0934) 834918

Date: / /9

QCF 61 iss 1
Sheet 1/1

CERTIFICATE OF ACCEPTANCE

roject number:	Brief description of the system:
ontract number:	
nt serial number/s:	

The equipment supplied has been examined and tested as an assembled system in my presence, and has given satisfactory operational/process results.
I am satisfied with the results that this system has produced and I accept that the technical specifications have been achieved.
Comments:-

Witnessed by: OXFORD Plasma Technology representative

Signature: Date: / /9

Accepted by: Representative of the end user.

Signature: Date: / /9

Original: Customer CC: Service / QA manager

OXFORD
lasma Technology

ith End, Yatton
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QCF 61 iss 1
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Comments:-

Witnessed by: OXFORD Plasma Technology representative

Signature: Date: / /9

Accepted by: Representative of the end user.

Signature: Date: / /9

Original: Customer CC: Service / QA manager

NEW SYSTEM REPORT

Form A

- This report is designed to provide a record of any damage to the packing cases or contents when a new system is delivered. The form consists of 2 part, A & B.
- A copy of this form should be secured to the outside of the packing case which contains the main console cabinet.
- It should be completed by the person responsible for signing the carrier's receipt and unpacking the system.
- When complete, it must be given to the Engineer responsible for the installation.
- Please circle 'yes' or 'no' answers.

1. INITIAL INSPECTION /DAMAGE

1.1 Was there damage to the packing case/s ? If 'yes', please describe. Yes / No

1.2 Had the 'Tiltwatch' indicator on the packing case changed colour to red ? Yes / No
(or otherwise given a warning indication ?)

1.3 Was there evidence of damp / water damage ? If 'yes', please describe. Yes / No

Note : if the answer to 1.1/1.2/ or 1.3 is 'Yes', notify the carrier, the insurance agent and the factory. Take photographs of the damage. DO NOT proceed with the unpacking until authorised by Oxford Instruments Plasma Technology.

1.4 Upon unpacking the machine, was any damage to the system discovered ? Yes /No
If 'yes', please describe.

System Number	Name of Customer	Name of Engineer	Date
Please hand this form to the Engineer responsible for the installation . (for return to the factory)			
Signature of Engineer ;			

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Bristol BS19 4AP, UK
Tel : (01934) 833851
Fax : (01934) 834918
Internet : plasma.technology@oxinst.co.uk

Form B

This form should be completed by the engineer responsible for the installation.
Attach the completed Form A to this form.

2. CONSIGNMENT

2.1 Was the factory packing list enclosed with the machine ? Yes / No

2.2 Was the packing list ticked off and signed by the engineer at the factory ? Yes / No

2.3 Where any items listed on the packing list missing ? Yes / No
If 'yes' please list them by part number and description.

2.4 Where any items listed in the Customers contract missing from the packing list ? Yes / No
If 'yes' please list them by part number and description.

3. OPERATION

3.1 Was the standard of assembly (build quality) of the machine satisfactory ? If 'no', please explain. Yes / No

3.2 Were any faults discovered when the machine was powered up ? Yes / No
If 'yes', please describe. (Include manufacturer, type, part number and serial number if available.)

3.3 Where the manuals clear and comprehensive ? Yes / No
If 'no', please identify the areas of concern.

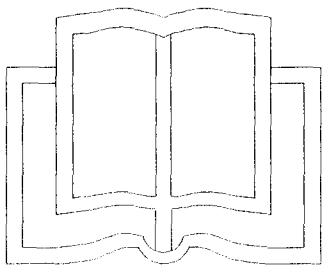
3.4 . Please add any other comments.

Contents

DIAGRAMS

Preface

This manual is the **OPERATION and MAINTENANCE MANUAL**. It provides all the information necessary for the operation and routine maintenance of the system. Certain components within the system are supplied by other manufacturers. These components have their separate manuals which are included, and should be referred to for detailed operation, maintenance and repair information.



Where labels having this symbol appear on the system, the operator / engineer should refer to the relevant manual before proceeding.

Statements of conformity

(A) This system has been designed and built in conformity with the standard EN60 204: Part 1: 1985, 'Electrical equipment of industrial machines'.

(B) This equipment is classified as Class A Group 2 as defined in EN 55011 Clause 4.

1. *Health and Safety*

A l'attention des clients de langue française

Le document hygiène et securité est disponible en fraçais. Vous devez vous assurer que cette version est présente dans ce manual. Si elle est manquante contactez votre representant Oxford Plasma Technology.

Für deutschsprachige Kunden

besteht dieses Kapitel "Health and Safety" unter dem Titel "Sicherheit und Unfallverhütung" auch in deutscher Fassung, die in diesem Hanbuch enthalten sein sollte. Falls diese fehlt, fordern Sie bitte ein Exemplar bei Oxford Instruments Plasma Technology an.

この安全概要 (Health and Safety) に関しましては、日本語版もございますのでマニュアルに含まれてない場合はお問い合わせ下さい。

1. Health and Safety

1.1 Introduction

This section must be read and understood before the system is approached or operated and before any maintenance work is carried out.

Throughout this manual there are **WARNING** and **CAUTION** boxes. These appear as follows:

> WARNING
>
> FAILURE TO COMPLY WITH A SECTION HEADED 'WARNING' MAY RESULT IN DEATH OR SERIOUS INJURY. READ AND BE SURE TO UNDERSTAND ALL THE FOLLOWING INSTRUCTIONS BEFORE WORKING ON THE SYSTEM.

> WARNING
>
> IT IS A REQUIREMENT THAT PROCEDURES AND PRACTICES TAUGHT IN OXFORD PLASMA TECHNOLOGY TRAINING COURSES BE FOLLOWED.

> CAUTION
>
> **Failure to comply with a section headed 'CAUTION' can result in damage to the system.**

Note that sub-sections 1.1 to 1.4 are standardised and may contain warnings which are not relevant to your particular system.

1.2 Hazard Categories

Hazards and associated warnings relevant to Health and Safety which appear in the text of this manual and in this section will fall into the following categories:

a) **Electrical** — The system carries voltages high enough to cause injury or death . Even when the electrical power supply is isolated, electrical energy at dangerous levels is stored by capacitors.

b)	**Electromagnetic Radiation**	Parts of the system produce electromagnetic radiation from audio frequencies to 2.45 GHz. This radiation can have a field strength strong enough to cause death or injury if not properly shielded.
c)	**Light**	Ultra Violet (UV) or Laser light may be emitted in some systems . These can cause permanent damage to the eyes or blindness if not protected by the relevant filters.
d)	**High Temperature**	Some components run at a temperature high enough to cause severe burns.
e)	**Low Temperature**	Components and gases at very low temperatures can cause severe 'burns' if allowed to contact the skin.
f)	**Gas**	Some process gases and cleaning fluid vapour may be toxic, corrosive, carcinogenic or flammable. They may also cause asphyxiation through oxygen deprivation. Gases under pressure can, if applied to the body, enter it and cause death or serious injury.
g)	**Chemicals**	Some etching and deposition compounds are toxic during use, and can leave toxic residues in the system.
h)	**Vacuum**	Chambers or other components under partial vacuum represent stored energy which can cause injury if released carelessly.
i)	**Compressed Air**	Compressed air can enter the body through the skin and cause serious injury. Pneumatically operated system components can be actuated suddenly, even when the system is not operating, causing serious injury.
j)	**Mechanical**	Injury can be caused by heavy components, sprung components, deposition layers under stress, embrittled wire and machinery in motion.
k)	**General**	Various procedures must be studied and followed. These include procedures specific to the system in question and also local and national Health and Safety standards.

1.3 Specific Warnings

1.3.1 Electrical

1.3.1.1 Parts of the system carry high voltages which are capable of causing injury or death. Take great care when carrying out maintenance tasks.

1.3.1.2 Do not operate the system if any of the doors, panels or covers are removed. Parts of the system may still be 'live' even when shut down by a switch, blown fuse or control function.

1.3.1.3 Ensure that all system units are connected to electrical earth (ground). The earth (ground) wire (green/yellow) in the unit's AC power cable must be connected to the system's electrical earth (ground). Do not use extension cables without a protective earth (ground) conductor.

1.3.1.4 During troubleshooting and calibration, the power supplies may need to be connected with live components exposed. **This work must only be carried out by skilled personnel who are aware of the hazards involved.**

1.3.1.5 Ensure that all safety interlocks are tested before the system is used for the first time and at scheduled intervals thereafter. **These tests must be carried out by suitably qualified personnel**

1.3.1.6 Power down the system by opening the main circuit breaker before starting maintenance work.

1.3.1.7 Note that the system POWER OFF button does not isolate the main distribution panel.

1.3.1.8 Inspect the system regularly for damaged components, for example cables, connectors or switches. Any components found damaged must be replaced before continuing to operate the system.

1.3.1.9 Cables must be tested at regular intervals; test immediately if damage is suspected. Refer to the instructions in the maintenance section of this manual.

1.3.1.10 If any water leaks are detected, immediately switch the system off at the main incoming circuit breaker.

1.3.1.11 Although modern electrical equipment incorporates capacitance discharge circuits, the following procedure must be applied after the system has been powered down in preparation for maintenance:

a) Ensure that the system is isolated by opening the main incoming circuit breaker and/or disconnecting the mains input cable.

b) Wait at least five minutes to allow capacitors to discharge.

No servicing is to be carried out unless all personnel involved fully understand the danger of stored electrical energy.

1.3.2 Electromagnetic Radiation

1.3.2.1 Parts of the system produce electromagnetic radiation from audio frequencies to 2.45 GHz. At all frequencies within this range there is a field strength level at which radiation can cause injury. Oxford Instruments Plasma Technology specifies limits for the Electric and Magnetic field strengths within the environment of the system.

The system must be tested to ensure that radiation is within these limits, using suitably calibrated equipment. The tests must be carried out after maintenance involving RF shielding components, and routinely every three months. Refer to the instructions in the maintenance section of this manual.

1.3.2.2 Ensure that all waveguide components, flanges and cables are correctly fitted, secure and undamaged.

1.3.3 Light

1.3.3.1 Laser equipment when handled incorrectly or in a damaged condition can seriously damage eyesight. Read and follow the manufacturer's instructions carefully.

1.3.3.2 Viewports may be constructed from a special glass which absorbs UV (ultra violet) light. They may also be fitted with a metal grid for shielding RF radiation. Replace these items only with the correct parts, and ensure that the ports are correctly reassembled.

1.3.4 High Temperature

1.3.4.1 During operation of the system some components can become dangerously hot. Always allow time for these to cool to a safe temperature before handling them.

1.3.5 Low Temperature

1.3.5.1 Beware of the extreme cold produced in refrigerated or cryogenically cooled systems. Contact with the skin by components at these temperatures can produce 'burns'. Allow the cooling system to reach a safe temperature before attempting any maintenance tasks.

1.3.6 Gases

1.3.6.1 The effluents of all plasma and ion beam systems should be considered toxic.

1.3.6.2 Ensure that effluents are extracted into a safe disposal system. The bore of the extraction pipework must be of a greater internal bore than the pump outlet. Exhaust lines carrying hazardous gases must not be used for any other purpose.

1.3.6.3 Rotary and turbomolecular pumps MUST always be nitrogen ballasted, if this feature is provided on the system. For deposition systems, the oil box of the rotary pump should also be purged. If a flow switch and alarm are needed on any of these lines to ensure safe operation, they must be installed and regularly maintained.

1.3.6.4 If toxic gases are to be used, purge gas extracted from the gas pod should be monitored by a suitable gas detector to give advance warning of any leakage. The entire system must be situated in a purged or extracted environment with a suitable gas detector. An operator respirator must be made available.

If no local guide-lines are available, the regulations contained in U.S. documents UBC 9.911 (1985) and UFC 51 are recommended reading. Guidance is also contained in "The Safe Storage, Handling and Use of Liquid Gases in the Micro-Electronics Industry" BCGA/ECIF COP CP18, ISBN 0260 - 4809, available from BCGA or ECIF.

1.3.6.5 If toxic, flammable or corrosive gases are used, ensure that the main cabinet nitrogen purge inlet is always fitted and that extraction facilities are connected

1.3.6.6 Ensure that the purge exhaust extraction system can withstand corrosion or combustion if necessary.

1.3.6.7 Make regular checks on the vacuum integrity of the gas lines to reduce the risk of sudden leaks.

1.3.6.8 Ensure that the system is completely purged BEFORE maintenance is started and suitably leak tested AFTER maintenance is completed.

1.3.6.9 As far as practicable, shut down gas lines when not in use.

1.3.6.10 Pumps must always be operated in accordance with the manufacturers' manuals and with Oxford Plasma Technology engineers' training courses.

Pumps, when fitted with a nitrogen purging facility, must always be purged during a processing run and for a suitable period after a processing run has finished.

1.3.6.11 Where gas detectors are fitted, their responses should be verified every two weeks (refer to the manufacturer's manuals).

1.3.7 Chemicals

1.3.7.1 Some compounds used in and resulting from deposition and etching processes can be dangerously toxic. These compounds can be deposited as coatings on the inside of the chamber, pipework etc. Therefore, suitable hand and eye protection must be used.

1.3.7.2 Very great care must be taken to ensure that Perfluoro-elastomer (Viton) 'O' rings are not exposed to high temperatures. If overheated, decomposition takes place, producing a highly acidic residue containing hydrofluoric acid (HF).

If there is any evidence that a Viton 'O' ring could have been subjected to temperatures in excess of 300°C the following actions must be carried out:

(a) Consult a competent authority regarding the following items ((b) to (e)).

(b) Wearing suitable protective clothing, remove the 'O' ring and dispose of it in accordance with local Health and Safety regulations.

(c) Wearing suitable protective clothing, thoroughly clean the contaminated area, disposing of any residue in accordance with local Health and Safety regulations.

(d) Fit a new 'O' ring.

(e) Investigate the cause of the overheating and review operating procedures and control systems to prevent a recurrence.

1.3.7.3 Cleaning fluids and the gases given off from them may be toxic. Only use them in a well ventilated area and avoid ingestion.

1.3.7.4 Always use suitable eye and skin protection when handling vacuum pumps and mineral or synthetic oil. Used oils and pumps may be contaminated with dangerous chemicals.

1.3.7.5 Study all relevant Material Safety Data Sheets (MSDS), or their equivalents, before carrying out any maintenance work.

1.3.8 Vacuum

1.3.8.1 Do not enter large vacuum chambers.

1.3.8.2 Process chambers and load locks under vacuum represent stored energy. If released accidentally, this can cause injury. These spaces must be vented to atmospheric pressure before the system is powered down in preparation for maintenance.

1.3.8.3 Handle vacuum capacitors carefully; if knocked or dropped they can implode causing serious injury.

1.3.9 Compressed air

> WARNING
>
> IT IS THE CUSTOMER'S RESPONSIBILITY TO ENSURE THAT ALL PERSONNEL CARRYING OUT MAINTENANCE ON THE ROBOT SYSTEM FULLY UNDERSTAND THE SAFETY ASPECTS DESCRIBED BOTH IN THIS SUB-SECTION (1.3.9) AND IN THE RELEVANT MANUAL TEXT.

1.3.9.1 Never put your hand or any other obstruction in the path of a slit or gate valve blade unless it has been made safe. Retained air pressures can be at dangerous levels. Release the pressure as follows:

a) Power down the system by opening the main circuit breaker.

b) Disconnect the pneumatic supply pipes from the system.

c) Operate and padlock the lock-out valves (if fitted) on the gate valves. This will release all air pressure from both sides of the valve actuators. If lock-out valves are not fitted, disconnect the supply pipe at the point where it connects to the valve.

1.3.10 Mechanical

1.3.10.1 Injury can be caused by attempting to lift heavy components. Always ensure that suitable lifting equipment and assistance, if required, are available when removing or refitting heavy components, e.g. chamber lids, chamber doors or electrodes.

1.3.10.2 Be aware of the weight of racked units, e.g. power supplies. Do not attempt to remove heavy units from their racks unaided.

1.3.10.3 Take care when moving heavy components. Ensure that they remain stable to avoid any risk of toppling.

1.3.10.4 Close chamber doors carefully; ensure that personnel vacate the vicinity of the door and its operating mechanism before it is closed to avoid trapped fingers etc.

1.3.10.5 Handle sprung components under compression or tension carefully, Take suitable precautions, including eye protection, before maintaining small sprung items.

1.3.10.6 Beware of machinery in motion such as robotic arms, substrate lifting mechanisms and shutters. Remember that machinery can start suddenly. Ensure that all safety guards are correctly fitted before use.

1.3.10.7 Beware of deposition layers under stress. Wear eye protection before cleaning surfaces which are coated with layers of material, as particles can be ejected with considerable force.

1.3.10.8 Handle embrittled wire, e.g. filaments, carefully. They can break and become embedded in the skin.

1.3.11 General

1.3.11.1 Ensure that local and national Health and Safety standards are studied and followed.

1.3.11.2 Ensure that all personnel who either operate or maintain this system are experienced and appropriately qualified.

1.3.11.3 Before carrying out any maintenance work, read the relevant manuals supplied by manufacturers of proprietary components.

1.3.11.4 Ensure that the main electrical supply, compressed air, all other gases and the water supply are disconnected before starting maintenance work (Also see sub-section 1.3.9).

1.3.11.5 Consult Oxford Instruments Plasma Technology before making any alterations to the system or changing the process gases.

1.3.11.6 Ensure that all personnel who may be expected to have access to the system during an emergency, such as firemen, paramedics etc. are familiar with the location of the main circuit breakers and valves.

1.3.11.7 Whenever any component is returned to Oxford Instruments Plasma Technology or to any of their agents, it must be accompanied by copies of the Goods Return Form (QCF 60 Iss 2).

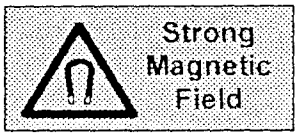
1.3.11.8 Never smoke or eat in the 'clean room' or where gases are stored. In addition to the fire risks and particulate contamination presented by smoking, some chemicals when burnt generate carcinogenic or toxic compounds.

1.4 Warning and advisory labels

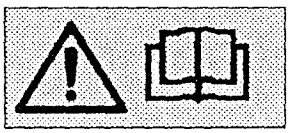
During manufacture, warning and advisory labels are attached to the system to indicate potential hazards and components which should not be operated or maintained without first reading the relevant manual. The labels and their meanings are as follows:

Danger of physical injury from RF radiation or from touching components within the labelled equipment.

Danger of trapping limbs, fingers etc. in the labelled equipment.

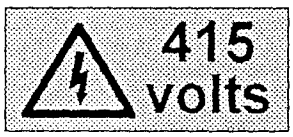


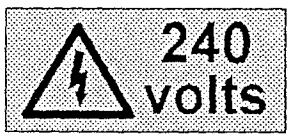
Danger of physical injury from the Strong Magnetic Field generated by the labelled equipment.

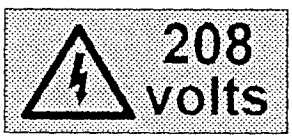


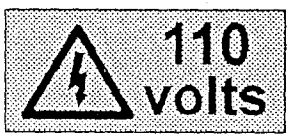
Read the relevant manual before proceeding to operate or maintain the labelled equipment.

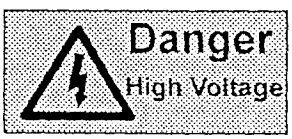
The labels below indicate the presence of high voltages within the labelled equipment. There is a danger of electric shock or burns from touching components within the labelled equipment.











2. Services

2. *Services*

The services requirements for the ***Plasmalab*** 80 Plus are given in two appendices to this manual:

Appendix SS Services Specifications for ***Plasmalab*** and ***Ionfab*** Systems. This document gives generic information and mandatory requirements for all services.

Appendix IDS ***Plasmalab*** 80 Plus Installation Data Sheets. This document gives the information necessary to prepare the environment for the ***Plasmalab*** 80Plus . Services information includes electrical power consumption and cooling water flow rates. References are made to the relevant mandatory services requirements, listed in 'Services Specifications for ***Plasmalab*** and ***Ionfab*** Systems' (see Appendix SS).

3. Description

3. Description

3.1 Introduction

The ***Plasmalab*** 80 Plus is a plasma processing system which can be configured to carry out reactive ion etching (RIE), plasma enhanced chemical vapour deposition (PECVD), plasma etching (PE) or downstream microwave etching/deposition.

A large range of options is available to precisely tailor the system to the customer's requirements.

A stainless steel cabinet with removable access panels encloses the mechanical and electronic components of the system and provides a support for the processing chamber. Rotary vane and Roots type pumps are mounted separately from the main console cabinet.

The chamber lid and integral top electrode are raised and rotated clear of the chamber base and substrate table by a pneumatic hoist mechanism. This provides access to the table for loading and removal of substrates. The hoist is, for safety considerations, operated by pressing two buttons simultaneously.

The cylindrical aluminium chamber has a viewport in its upper section and three ports, for roughing, extraction and pressure gauges, in the base. Gas is supplied to the upper electrode 'shower head' via channels in the two halves of the chamber. Where chamber cooling is required, water cooled plates are fitted to the outer surfaces.

The substrate table (lower electrode) is made of aluminium for temperatures up to 400°C and stainless steel where they may reach 700°C. Water cooling is provided for the tables where RIE/PE processes are used.

3.2 Processes

The chamber arrangements for typical processes are shown in Diagram 3-1 to Diagram 3-4.

The electrodes are powered by a 13.56 MHz RF generator for RIE, PE and PECVD systems. The associated auto-matching tuner unit is positioned close to the driven electrode.

In the case of downstream microwave machines, a 2.45 GHz microwave generator is fitted. Matching is performed by one or more manual tuning stubs in the microwave cavity.

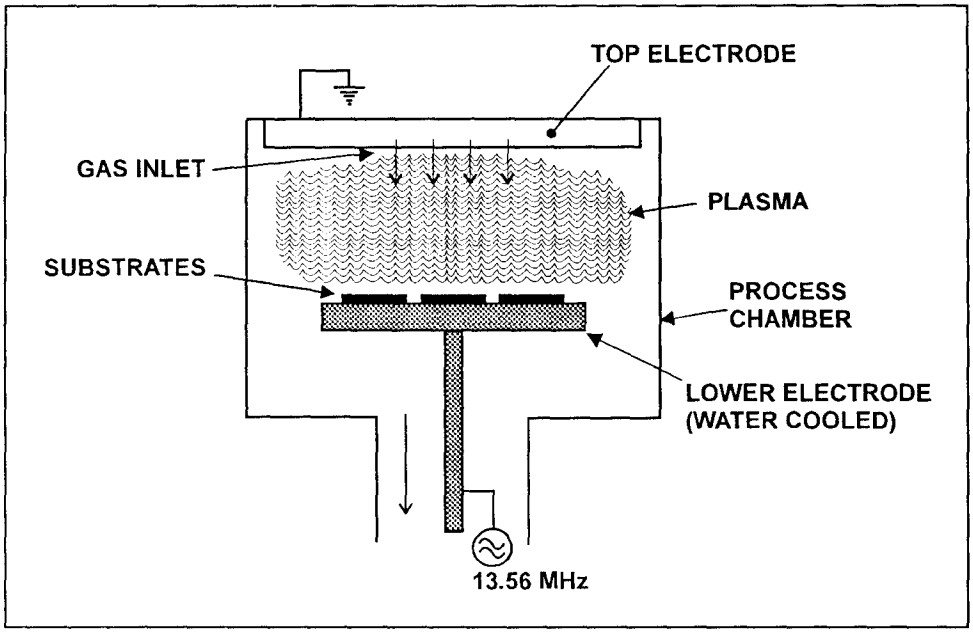


Diagram 3-1: Typical RIE configuration

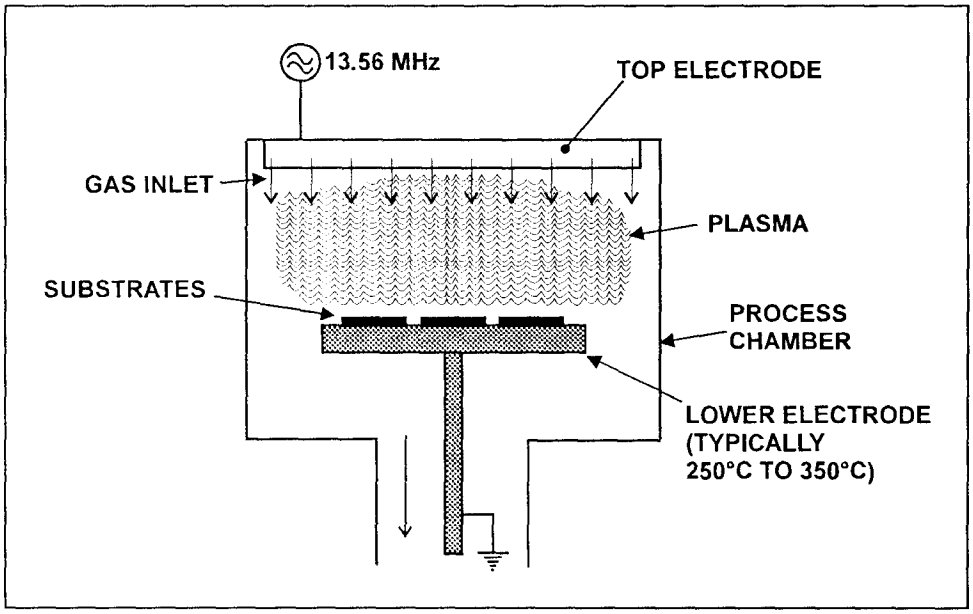


Diagram 3-2: Typical PECVD configuration

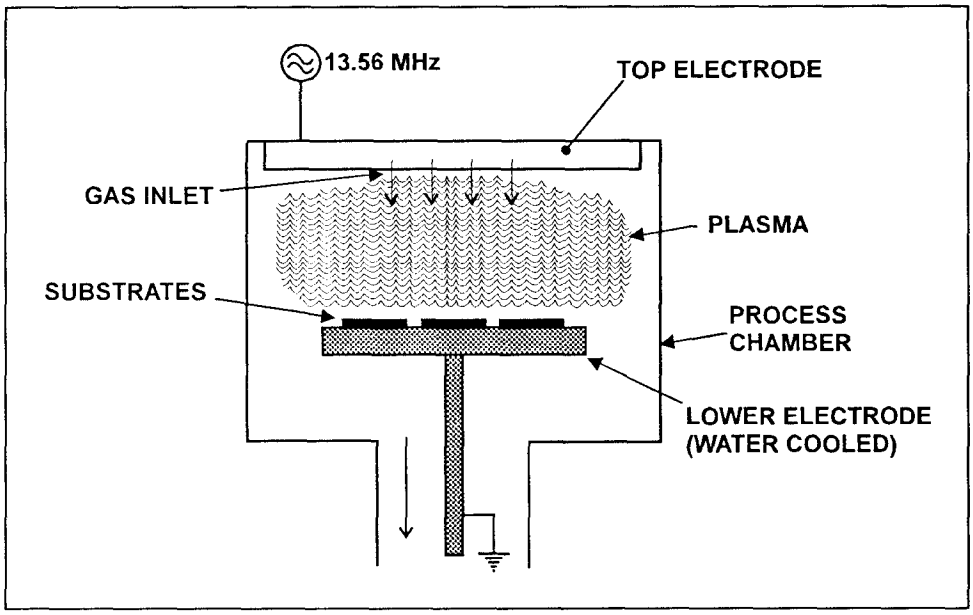


Diagram 3-3: Typical PE configuration

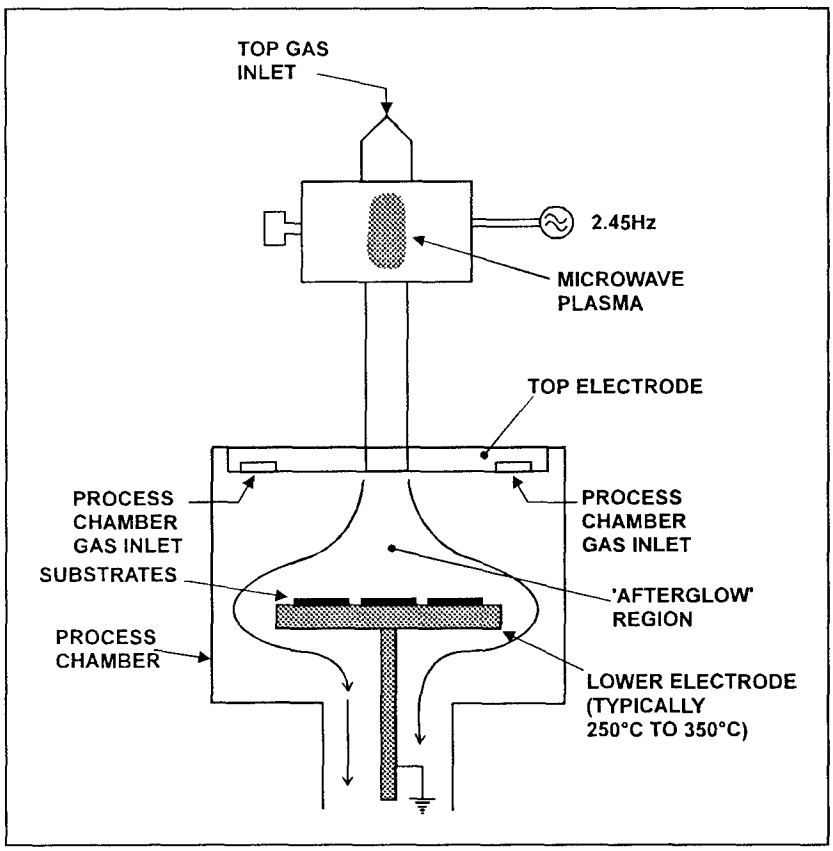


Diagram 3-4: Typical DSμW configuration

3.3 Vacuum systems

Various pumping systems are available. These consist of a rotary vane pump, rotary vane and Roots pump combination or a turbomolecular pump backed by either of the former sets. The gate valves and isolation valves associated with the pumping systems are pneumatically operated.

The process chamber pressure is monitored by a capacitance manometer gauge (1 Torr range for etching or 10 Torr range for deposition). A Penning gauge is added when a turbomolecular pump is fitted.

Pressure control may be achieved by an automatic pressure control (APC) valve.

Typical pumping set options may take the following forms:

3.3.1 Single pump

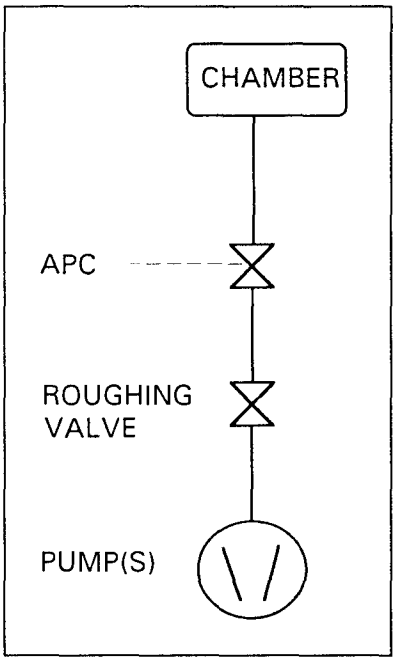


Diagram 3-5: Single pump

In the case of dual chambers sharing the pump, two roughing valves would be required and the APC valve would be re-positioned downstream of them.

3.3.2 Backing pump(s) and turbomolecular pump; process through the turbo pump.

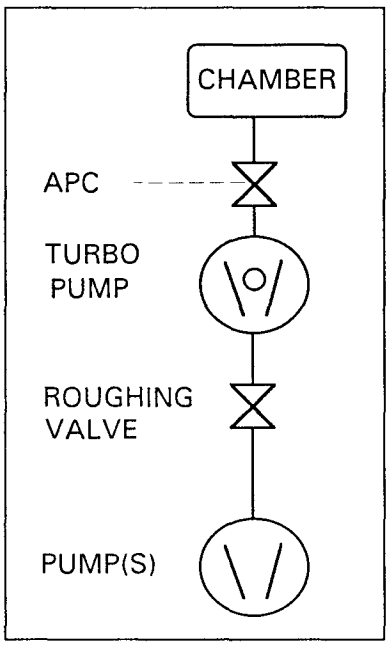


Diagram 3-6: Backing and turbomolecular, turbo process

With this arrangement, the turbo pump must be stopped every time the chamber is vented and pumped. If the backing pump is shared between the two chambers, both will require a roughing valve, APC valve and a controller.

3.3.3 Backing and turbomolecular pumps: process through the turbo pump and pump down by bypassing the turbo.

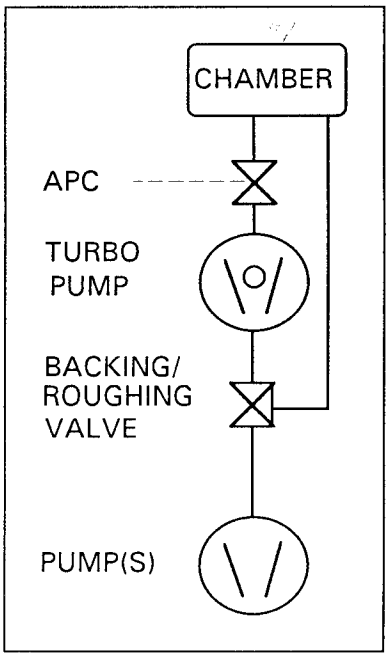


Diagram 3-7: Backing and turbomolecular, turbo process and turbo bypass pump down

With this arrangement, the chamber can be vented and roughed out without stopping the turbo pump.

If the backing pump is shared with a second system, two more valves (or one four-port changeover valve) are positioned between the backing pump and the two systems. Both systems will require an APC valve and controller.

3.3.4 Backing and turbomolecular pumps: process bypassing turbo pump.

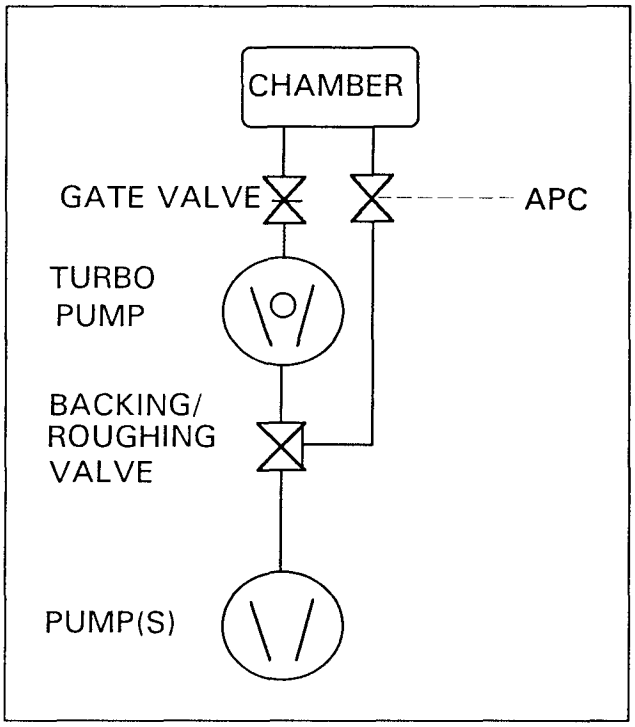


Diagram 3-8: Backing and turbomolecular, process bypassing turbo pump

This arrangement is used if the chamber is to be evacuated thoroughly via the turbo pump, the process gases being flowed directly to the backing pump.

If the backing pump is shared between two chambers, then the APC valve could be shared, positioned immediately before the pump. Additional foreline valves are required to switch between the systems.

3.4 Gas handing

The process gas handling system is enclosed in a stainless steel box mounted remotely from the system cabinet. Gas isolation (shut off) valves are pneumatically operated. The gas flow rates are controlled by individual mass flow controllers (MFCs). The pipework is of stainless steel internally electropolished and orbitally welded. Where a gas line carries toxic gas, a bypass line is provided in parallel with the MFC. Thus if the MFC should become blocked or fail shut, the line may be purged of toxic gas before maintenance work starts. The gas manifold may be constructed so that the gases are split into two groups. Thus two different gas mixes may be supplied to a chamber via separate gas inlets, or one gas mix to each chamber of a dual system.

Where a maximum of four non-toxic gas lines are specified, these may be mounted within the main console cabinet thus dispensing with the need for a separate gas pod.

3.5 System power supply

The Power Distribution Unit is located at the rear of the unit. It houses circuit breakers and transformers (±15 volt DC and 24 volt DC supplies). The main power supply cable gland and sockets for rotary pumps and auxiliary EMO connection are mounted on the unit. Fuses for the 24 volt and ±15 volt supplies are also accessible externally. (Where this is not the case, the fuses are mounted on the power supply boards.)

For details of the Power Distribution Unit see drawing number SE81A15998 in Volume 2.

A 50 mm diameter red 'Emergency Stop' button is mounted on top of the cabinet. When this or any other part of the 24 V DC interlock circuit is broken, it causes the main input power circuit breaker to open, thus shutting down the entire system. See also sub-section 3.6.

WARNING

WHERE THE ROTARY VANE OR ROOTS PUMPS ARE POWERED FROM A MAINS SUPPLY SEPARATE FROM THE 80 PLUS SYSTEM, A SEPARATE 'EMERGENCY OFF' FACILITY MUST BE PROVIDED BY THE CUSTOMER.

3.6 Interlocks

There are two types of interlocks used on the ***Plasmalab*** 80 Plus; hardware and software. In all areas, the hardware interlock will override any software interlock. The hardware interlocks, and their effect on the system components in the case of an interlock becoming open circuit are as follows:

The electrical interlocks are divided into two circuits controlling the power to the system.

1) The mains power connection is made to a system Power Distribution Unit. The Power Distribution Unit will disable all of its power outputs under the following conditions:

   a) If the Emergency Off button is pressed.

   b) If there is an interruption of the power input to the system.

   c) If the Power Distribution Unit external facility interlock sensor link becomes open circuit.

      NOTE: The Power Distribution Unit external facility interlock sensor link enables the interlocks of external sensors, e.g. gas detectors, exhaust scrubbers, etc., to be monitored by the Power Distribution Unit. External interlock contacts connected to this link should be Normally Closed, i.e. faulting to an Open Circuit.

2) The system internal 24V supply, comprises a process line and a chamber line:

The 24V process line, which controls the process gases and plasma power supply units, will be disabled if the Vacuum Safety Switch is open circuit, i.e. Chamber Pressure > 600 mbar.

The 24V chamber line will be disabled under the following conditions, leaving the system controller operational, but disabling all system components which are operated from the PLC.

a) If the Water Flow switch is not closed.

b) If the Chamber top is OPEN.

3. All gases are switched off unless the gas pod door is closed.

Certain gases are mutually exclusive. Refer to the Gas Pod Schematic drawing for your system for details.

Interlock	Emergency Off / Electrical Fail		24V Process line		24V Chamber line	
	Fail	Restore	Fail	Restore	Fail	Restore
System/Controller	OFF	Restart required	ON		ON	
RF Generator	OFF	Powered, NOT active	OFF	Powered, NOT active	OFF	Powered, NOT active
Process Gases	OFF	Powered, NOT active	OFF	Powered, NOT active	OFF	Powered, NOT active
Automatic Pressure Controller Valve	CLOSED	CLOSED	NO CHANGE	NO CHANGE	CLOSED	CLOSED
Pumps	OFF	Pumps must be restarted	NO CHANGE	NO CHANGE	NO CHANGE	NO CHANGE

Table 3-1: Consequences of open circuit interlocks

The other component specific interlocks are incorporated into the software controller, alerting the operator of conditions such as low process gas flow, pump failure, etc.

3.7 Control system

The machine is controlled by a microprocessor based controller module. The controller is provided with an LCD screen to display the various pages such as the **Help Screens** (information for guidance), **Menu Screens** (present a choice of actions) and **Data Screens** (to monitor variables and view or change set points).

The pressure operated switches on the controller are used to change the displayed screen, input data and control the system.

All the switches, except those which comprise the numeric keypad, have status or 'prompt' LED lamps.

The controller does not control any of the pumps. Where a turbomolecular pump is fitted, it is switched on and off from its own rack-mounted controller.

An alternative to the LCD screen and control panel is the PCPlus controller. Although control of the *Plasmalab* 80 Plus using the LCD panel is simple and straightforward, the use of a remote PC terminal with Oxford Plasma Technology's PCPlus software running in the Microsoft Windows™ environment as a host controller has marked advantages. The speed with which process steps and recipes can be changed or created is improved, far more information can be displayed at any one time, and in addition to numerical values, text can be entered.

Other switches are grouped at the top of the 19-inch rack on the 'diagnostics board'. These (where fitted) include:

1) The SYSTEM ON switch
2) The SYSTEM OFF switch
3) Pump No. 1 ON switch (green)
4) Pump No. 1 OFF switch (red)
5) Pump No. 2 ON switch (green)
6) Pump No. 2 OFF switch (red)

3.8 Cryogenic table

When reactive ion etching (RIE) mode processing is used, unwanted chemical etching, the rate of which is dependent upon temperature, may cause undercutting of the mask.

To suppress this effect, the sample should be cooled to temperatures approaching -100°C and below. These low temperatures do not materially reduce the rate of the ion stimulated etching. To achieve these low temperatures, a range of liquid nitrogen cooled tables (lower electrodes) is available.

The liquid nitrogen is fed to the interior of the table where it evaporates and thus cools the table through its latent heat of evaporation capacity. The gaseous nitrogen is piped away to the cabinet exhaust.

The table also incorporates electric resistance heating elements which are used in conjunction with the cooling to give precise temperature control, to cause rapid warm up prior to venting and to heat the table to 200°C for other process modes. The liquid nitrogen flow and the heater elements are both controlled by a common PID controller.

Conduction of heat between the sample and the table is assisted by provision of a pressure controlled supply of helium gas to the centre of the table.

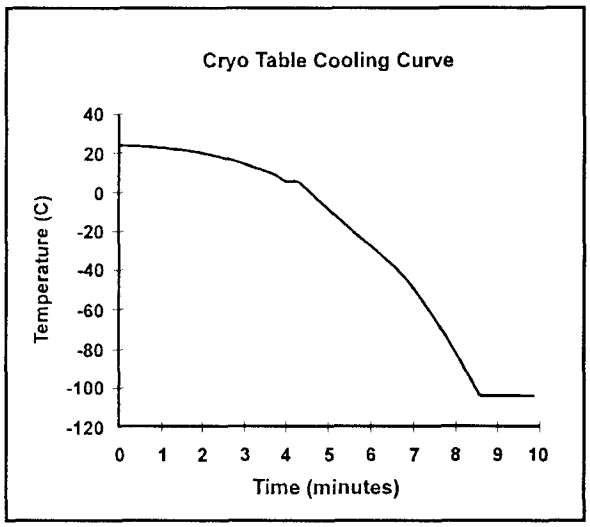


Diagram 3-9: Cryo table cooling curve

For further information please refer to drawings SE81C17751 N2 Cryo/Heated Table and MA81A17329 Assembly of Cryo Table into an 80 Plus machine.

3.8.1 Cryo table specifications

Table Diameter	205mm
Substrate Diameter	up to 200mm
Temperature range (as measured in the RF driven table)	min.-15°C max. +200°C
Heat removal at -150°C	500 Watts
Heating & Cooling Rate cool-down +20°C to-150°C warm-up -150°C to +20°C	 < 15 mins < 10 mins (< 12 mins for 110V operation)
Power consumption	800 Watts
Maximum RF Plasma Power	600 Watts
Temperature uniformity over 200mm control to set-point	 ± 3°C ± 2°C
Coolant Max. consumption rate Normal use	LN_2 11 litres/hour 3 litres/hour with plasma on
Coolant exhaust	Nitrogen gas 8000 litres/hour (max.) 2100 litres/hour (normal use)

3.8.2 Service requirements

LN_2 delivery system pressure flow fitting pressure relief	 2.0 - 2.2 bar 0.5 - 11 litres/hour 1/2" Swagelok relief valve and/or bursting disk
Helium Supply	5 sccm - 1/4" Swagelok

3.9 Table types / options

81-5-01 170mm Ø Aluminium RIE Electrode

170 mm diameter fluid cooled aluminium lower electrode with integral dark space shield and central locator for cover plates.

81-5-02 240mm Ø Aluminium RIE Electrode

240mm diameter fluid cooled aluminium lower electrode with integral dark space shield and central locator for cover plates.

81-5-03 240mm Ø Aluminium Deposition Electrode (400°C)

240mm diameter resistance heated aluminium electrode with temperature control to 400°C. A suitable cover plate (either 81-12-40 or 81-12-40R) is required.

81-5-04 240mm Ø Steel Deposition Electrode (400°C)

240mm diameter resistance heated stainless steel electrode with temperature control to 700°C. (Requires fluid cooled chamber 81-3-12).

81-5-05 200mm Ø Aluminium Refrigerated Electrode for RIE (-60°C)

200mm diameter fluid cooled aluminium electrode with integral dark space shield for RIE with vacuum seals suitable for cooling to -60°C. Operation of the electrode requires a low temperature chiller (item 81-12-20 or equivalent).

81-5-10 Cryo-cooled / Heated Electrode (-150°C to +200°C)

Resistance heated and cryo-cooled electrode with wafer clamping mechanism for wafers up to 200mm Ø (Wafer size must be specified at time of order). Heat transfer is optimised by helium gas flow between the wafer and electrode. A supply of helium gas and liquid nitrogen is required.

81-5-13 240mm Ø Aluminium RF Powerable Deposition Electrode (400°C)

240mm diameter resistance heated aluminium electrode with integral dark space shield and temperature control to 400°C. A suitable cover plate (either 81-12-40 or 81-12-40R) is required.

81-5-14 240mm Ø Stainless Steel RF Powerable Deposition Electrode (700°C)

240mm diameter resistance heated stainless steel electrode with integral dark space shield and temperature control to 700°C. (Requires fluid cooled chamber 81-3-12).

81-5-00/1 Electrode Anodisation

The aluminium electrode surface is anodised for use with corrosive gases such as chlorine.

4. Installation

4. *Installation*

The installation and cabling of this system is the responsibility of Oxford Plasma Technology (unless this has been specifically altered in the sales contract).

If, however it is necessary to move the system at some future date, refer to the Installation Data Sheets in Appendix IDS and the OEM manuals in Volume 3.

Ensure that personnel carrying out the work read Health and Safety in Section 1 of this manual.

WARNING

THE SYSTEM AS A WHOLE AND MANY COMPONENT PARTS OF THE SYSTEM ARE SUFFICIENTLY HEAVY TO CAUSE SERIOUS INJURY IF HANDLED WITHOUT GREAT CARE OR BY UNTRAINED OPERATORS.

ALWAYS USE THE APPROPRIATE LIFTING EQUIPMENT OPERATED BY FULLY TRAINED STAFF.

5. *Operating instructions*

5. *Operating instructions*

CAUTIONS

A) If the system is fitted with a turbomolecular pump, ensure that you read and understand Appendix B.

B) Always ensure that any heater/chiller units provided are switched on when the system is powered up.

5.1 *General description of controller (SMART PLC with LCD panel*)*

The controller is a microprocessor-based device which is provided with an operator control panel having a display and control switches.

Processes can be run in fully automatic mode, using control data (pre-designed recipes) stored in the non-volatile memory. Alternatively, a process can be carried out under manual control.

Up to ten pre-loaded process recipes may be stored in the memory. Each recipe may have up to ten pre-defined steps from a maximum repertoire of nineteen process steps, one clean gas and one vent step.

The various screens or pages which are displayed on the control panel are divided, broadly, into three types. These are:

1) Screens for setting up the steps, recipes, base pressures etc. The information entered via these screens is stored in non-volatile memory, i.e. it is not lost when the machine is powered down.

2) Screens used when a process is being run with the machine in automatic mode.

3) Screens for running the machine manually.

In addition to these 'operational' screens, there are a number of subsidiary or **Help** screens. These screens provide information to guide an operator who is unfamiliar with the 80 Plus system. They provide an explanation of the information which appears on the operational screens and instructions on how to move to the next relevant screen. Note that the only control buttons which may be operated when a **Help** screen is displayed are the HELP, MENU and ABORT buttons.

* If the system is provided with a PCPlus controller (option 81-1-01) terminal, refer to sub-section 5.5 for operating instructions.

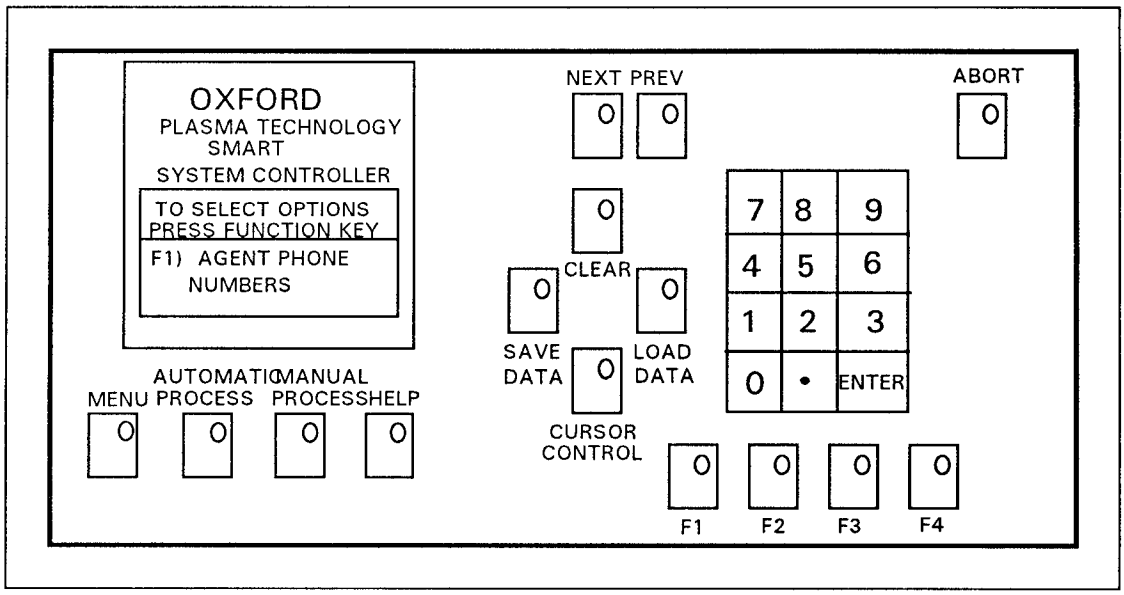


Diagram 5-1: Control panel

5.2 Functional description of the controls

This section describes the use of all the controls available to the operator.

WARNING

1. **IN AN EMERGENCY, ELECTRICAL POWER MAY BE REMOVED FROM THE SYSTEM BY PRESSING THE RED COLOURED EMO (EMERGENCY OFF) BUTTON, LOCATED ON THE TOP LEFT HAND SIDE OF THE CONSOLE CABINET.**

2. **NOTE THAT WHEN THE INCOMING MAINS SAFETY ISOLATOR IS ON, PARTS OF THE SYSTEM ON THE SUPPLY SIDE OF THE MAIN CONTACTOR WILL REMAIN ELECTRICALLY LIVE EVEN THOUGH THE GREEN SYSTEM ON BUTTON ON THE POWER CONTROL PANEL IS EXTINGUISHED.**

5.2.1 Chamber open/close switch and hoist buttons

WARNING

WHEN OPENING OR CLOSING THE PROCESSING CHAMBER, ENSURE THAT PERSONNEL STAND CLEAR OF THE CHAMBER LID AND HOIST ASSEMBLY. WHEN THE COMPRESSED AIR IS FIRST APPLIED TO THE SYSTEM, THE INITIAL CHAMBER LID MOVEMENT WILL BE RAPID UNLESS THE 'HOIST' BUTTONS ARE OPERATED INTERMITTENTLY.

To open the processing chamber, set the **chamber** switch to **open** and press both **hoist** buttons simultaneously. (One button is located at each end of the panel, to reduce the possibility of inadvertent chamber hoist operation.)

To close the processing chamber, set the **chamber** switch to **close** and press the **hoist** buttons simultaneously. It is permissible to stop a movement part way and to resume the movement or to reverse its direction.

5.2.2 Power button (SYSTEM ON)

WARNING

BEFORE OPERATING THE POWER BUTTON, ENSURE THAT ALL EXTERNAL PANELS ARE IN PLACE AND SECURE, AND THAT THE ON-SITE MAINTENANCE LOG HAS BEEN SIGNED OFF, SHOWING THAT THE SYSTEM IS OPERATIONAL.

The power button (labelled SYSTEM CONTROL ON) is located on the left-hand side of the Power Control Panel. This panel is located inside the front cover of the console. Its only function is to switch the system on. Subsequent operation of the button with the machine powered up will have no effect. The button, coloured green, will illuminate to confirm that power is established.

5.2.3 System Off button

This button (labelled SYSTEM CONTROL OFF) is located on the left-hand side of the Power Control Panel. Its only function is to switch the system off.

5.2.4 Pump power buttons

The four pump power buttons (labelled PUMP 1 and PUMP 2) are grouped as two pairs and located on the Power Control Panel.

Each pump is provided with one green ON button and one red OFF button. As with the other power buttons on this panel, they do not toggle.

5.2.5 Emergency Off button

The EMERGENCY OFF (EMO) button is coloured red and is located on the top left hand side of the console. When it is operated by pressing it downwards, all electrical power is removed from the system with the exception of the mains input cable, main contact breaker and associated contactor in the power box.

Note that most of the following buttons on the main operator control panel have 'prompt' LEDs which show when the button may be used.

5.2.6 Function buttons (F1 - F4)

The main purpose of these four function buttons is to provide a means of changing the display screens (see Diagram 5-2 and Diagram 5-3). Either the operational screen itself or the associated **Help** screen will advise which of the four buttons to operate. Note that the choice of function buttons which may be operated is limited to those which have illuminated LED 'prompt' indicators.

5.2.7 Data numeric buttons (0 - 9 and decimal point)

These buttons are used to key in new parameter values and to change the **Process Step** page numbers and the **Recipe** screen numbers.

5.2.8 Enter button

The **Enter** button confirms or enters into a memory file the number which has been keyed into the cursor position.

5.2.9 Cursor control button

The **Cursor Control** button moves the cursor in a pre-determined sequence over those data positions on the screen which can be changed.

5.2.10 Clear button

This button deletes the data over which the cursor is positioned.

5.2.11 Load data button

The **Load Data** button changes the screen display to show the data for the **Step** or **Recipe** number which has been entered.

5.2.12 Save data button

The **Save Data** button enters into the **Step** or **Recipe** memory file the data which is displayed (and where it has been changed, subsequently entered).

5.2.13 Abort button

This button stops any process which is running. The RF, process gases and the table heater are all turned off. The process cannot be started from that point in the sequence of steps.

5.2.14 Next button

This button provides a 'short-cut' between screen displays by bypassing the function key operations which would otherwise be used. It provides a logical sequence for running a process.

5.2.15 Prev (previous) button

This button provides a similar function to the **Next** button, except that it moves in the reverse direction.

5.2.16 Help button

The **Help** button provides supplementary screens giving information to assist the operator's understanding. Subsequent operation of the **Help** button will move to further Help pages and then return to the original operational screen. Note that the only other buttons which are operational while a **Help** screen is displayed are **Menu** and **Abort**.

5.2.17 Menu button

This button displays the main menu screen (see Diagram 5-2)

5.2.18 Automatic process button

This button, which may only be used when the **Automatic Process Run** screen is displayed, initiates the automatic process run using the recipe whose number is displayed.

5.2.19 Manual process button

This button, which may only be used when the **Manual Pressure, Gas or RF Control** screens are displayed, initiates the manual process run using data currently entered in the pumping, process gas or RF control screens.

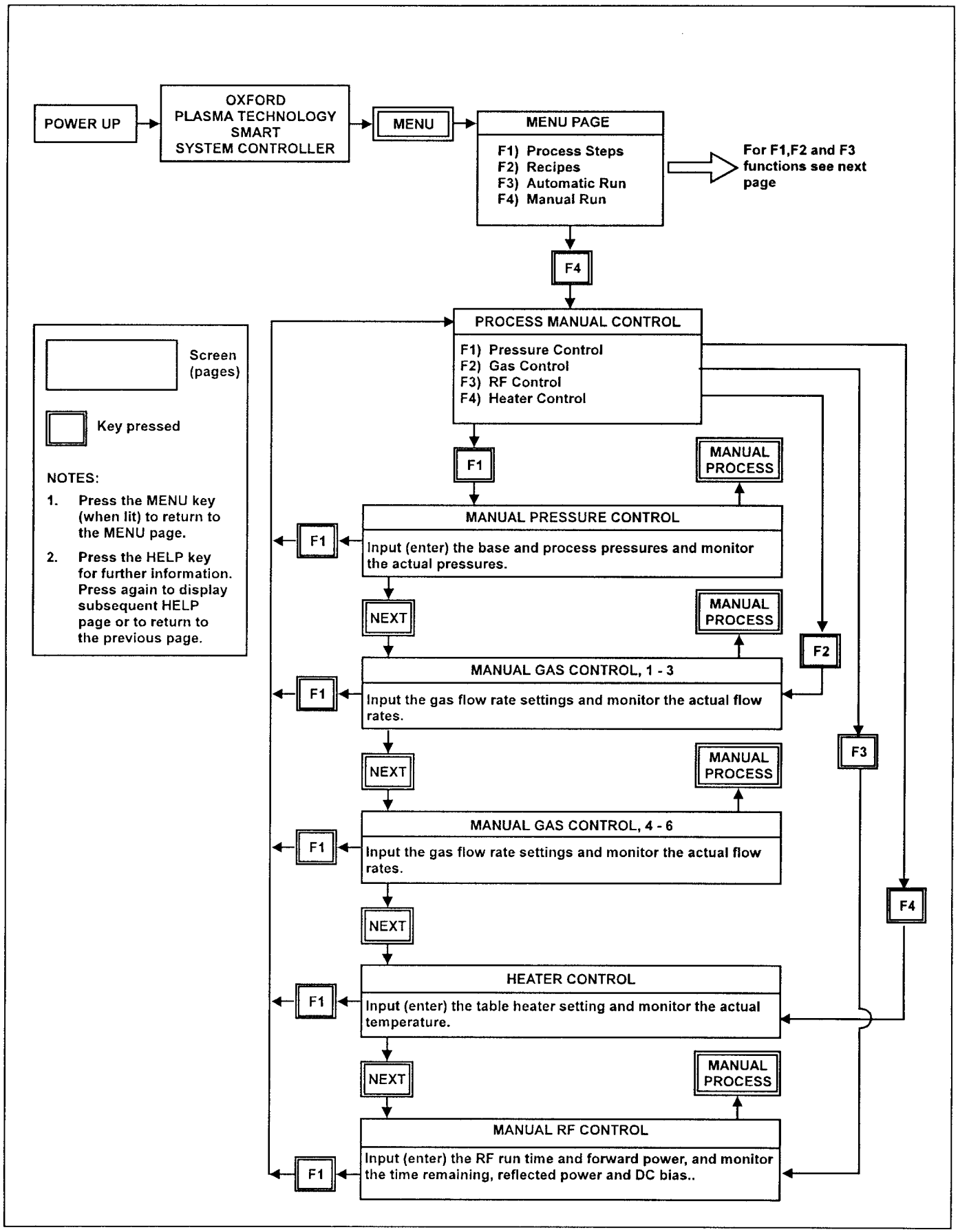


Diagram 5-2: LCD display screen flow chart (Part 1)

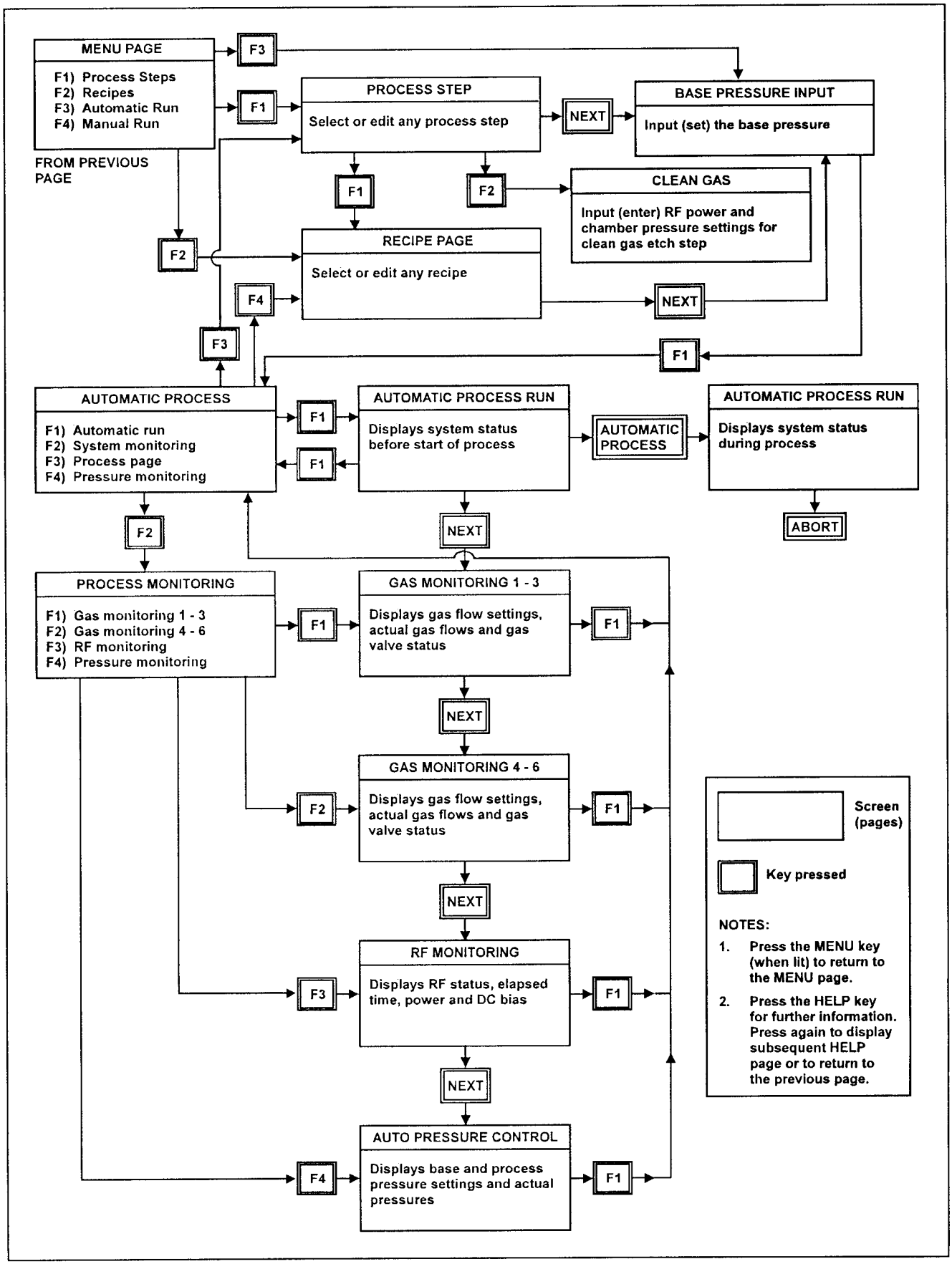


Diagram 5-3: LCD display screen flow chart (Part 2)

5.3 Operating sequences (automatic and manual)

WARNING

READ THE HEALTH AND SAFETY INSTRUCTIONS AT THE BEGINNING OF THIS MANUAL.

This section of the manual consists of an abbreviated set of instructions which describes how to set up or change the individual process steps and the recipes. The process recipes consist of particular mixes and sequences of process steps.

It then goes on to show how to initiate an automatic run or carry out a manual run.

WARNING

BEFORE SWITCHING ON OR OPERATING THE SYSTEM, ENSURE THAT IT IS OPERATIONAL AND HAS BEEN SIGNED OFF AS SUCH IN THE ON-SITE MAINTENANCE LOG.

1) Check that all the external covers are in place and secure.

2) Switch ON the main incoming power safety isolator (mounted adjacent to the machine).

3) Press the green SYSTEM CONTROL ON switch located on the Power Control Panel.

4) Press the green PUMP ON switches. If a turbomolecular pump is fitted, start the pump at the pump controller box. Adjust the bearing purge gas flow at the rotameter on the rear of the machine to 20 sccm.

WARNING

ENSURE THAT PERSONNEL STAND CLEAR OF THE CHAMBER LID / HOIST MECHANISM DURING THE LID OPENING AND CLOSING OPERATIONS.

5) The introductory title page should appear on the control panel display. This will be headed 'OXFORD PLASMA TECHNOLOGY SYSTEM'

5.3 Operating sequences (automatic and manual)

WARNING

READ THE HEALTH AND SAFETY INSTRUCTIONS AT THE BEGINNING OF THIS MANUAL.

This section of the manual consists of an abbreviated set of instructions which describes how to set up or change the individual process steps and the recipes. The process recipes consist of particular mixes and sequences of process steps.

It then goes on to show how to initiate an automatic run or carry out a manual run.

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1) Check that all the external covers are in place and secure.

2) Switch ON the main incoming power safety isolator (mounted adjacent to the machine).

3) Press the green SYSTEM CONTROL ON switch located on the Power Control Panel.

4) Press the green PUMP ON switches. If a turbomolecular pump is fitted, start the pump at the pump controller box. Adjust the bearing purge gas flow at the rotameter on the rear of the machine to 20 sccm.

WARNING

ENSURE THAT PERSONNEL STAND CLEAR OF THE CHAMBER LID / HOIST MECHANISM DURING THE LID OPENING AND CLOSING OPERATIONS.

5) The introductory title page should appear on the control panel display. This will be headed 'OXFORD PLASMA TECHNOLOGY, SMART SYSTEM CONTROLLER'.

Note that whenever the HELP button is illuminated, it may be pressed to display information intended to clarify the previous page, and prompt any action to be taken. Press HELP again to move to continuation pages or to return to the original page.

6) Press function button F1 to display continuation pages. Note that the indicator LEDs on each button illuminate to show which may be operated.

7) Press the MENU button.

5.3.1 Editing the process steps

8) Press F1 to display the process steps. The screen will display the last step number which was accessed.

9) Key in the step number you wish to display and press ENTER.

10) Press LOAD DATA and the existing parameters for that step will be displayed.

11) Press and release the CURSOR CONTROL until it is on the parameter you wish to alter.

12) Key in the parameter value required. Press ENTER.

13) Move the cursor to the next parameter value to be changed and repeat step 12.

14) When all the parameter values are satisfactory, press DATA SAVE.

15) Repeat steps 9 to 14 for all other steps which require alteration or examination.

5.3.2 Editing the recipe pages

16) Press F1 to change to the RECIPE pages.

17) Key in the recipe number you wish to display and press ENTER.

18) Press LOAD DATA, and the existing process step sequence and run times for that recipe number will be displayed.

19) Press and release the CURSOR CONTROL until it is on the STEP or H: M: S (run time) position you wish to change.

20) Key in the required step numbers and values, pressing ENTER after each number.

21) When all the alterations to that page have been made, press DATA SAVE.

22) Repeat steps 17 to 21 for the other recipes as necessary.

Note: Whenever a PROCESS STEP page is displayed, you can change to the RECIPE pages by pressing F1, and vice versa.

23) Press F1 to return to the PROCESS STEP screen.

24) Press F2 to display the CLEAN GAS STEP screen.

25) Change the RF POWER PRESSURE setting in the clean gas step by moving the cursor to the existing value, keying in the new value and pressing ENTER. Press DATA SAVE. Similarly, set the chamber pressure.

Note: A software interlock prevents a CLEAN GAS STEP from being carried out until the chamber has been vented.

5.3.3 Initiating an automatic process

26) Press MENU.

27) Press F3 to select the BASE PRESSURE page. This allows you to set the BASE pressure (the pressure to which the chamber is pumped before the process itself starts) for your particular pumping configuration.

Move the cursor to the base pressure position relevant to the configuration being used and type in the base pressure value required. Note that where the base pressure is achieved via a turbomolecular pump, the value is input in exponential form

28) Press F1 to change to the AUTOMATIC PROCESS page. This is a menu page.

29) Press F1 to change to the AUTOMATIC PROCESS RUN page. This is an information only page. No values can be input and no control is possible except via the AUTOMATIC PROCESS button.

30) Place the sample in the process chamber, set the chamber control to 'CLOSE', and lower the chamber lid by pressing the two HOIST buttons simultaneously.

31) Check that the RECIPE PAGE number corresponds to the particular process recipe you wish to run.

Note that it will be the recipe which was last accessed in steps 17 and 18.

32) Press the AUTOMATIC PROCESS button. Assuming that the chamber lid is down (closed), the pumping down will start.

The progress of the run can be monitored on the AUTOMATIC PROCESS RUN screen.

Note that:

i) The VACUUM YES/NO indicator refers to the status of the vacuum switch. This switch operates during the pump down phase as the pressure approaches the processing pressure. It enables (allows) the start of the RF and the process gases flow. Similarly, it locks them out as the pressure climbs past that level during the vent phase.

ii) The PROCESS STEP number displayed will confirm the progress of the process.

iii) The left hand PRESSURE reading refers to the capacitance manometer (CM) gauge, and the right hand to the Penning gauge reading. Both are in milliTorr units. The CM gauge will give a continuous reading. The Penning gauge is enabled or disabled by a software interlock at a pressure towards the lower limit of the CM gauge.

iv) The TIME display refers to the time remaining for the RF to run (be switched on) and will count down to zero as the process proceeds.

33) Further screens may be displayed as the process runs. They show real time information and together with the AUTOMATIC PROCESS RUN page, allow all the parameters to be monitored as the process proceeds. They are displayed via the PROCESS MONITORING menu page as follows: -

Press F1 and then press F2 to display the PROCESS MONITORING page.

34) Press F1 to display the GAS MONITORING 1 - 3 page. This shows for gas lines number 1, 2 and 3: -

i) The status of the isolation valve
ii) The current flow rate
iii) The set rate.

35) Press NEXT to display the GAS MONITORING 4 - 6 page. This shows information similar to that described in item 34, but for gas lines number 4, 5 and 6.

36) Press NEXT to display the RF MONITORING page.

The information displayed is: -

i) RF POWER ON/OFF.
ii) RF TIME refers to the time remaining for the RF to run, and will count down to zero.
iii) RF FORWARD refers to the forward power.
iv) RF REFLECTED refers to the reflected power.
v) DC BIAS refers to the self bias voltage generated.

37) Press NEXT to display the PRESSURE MONITORING AND AUTO PRESSURE CONTROL page.
The information displayed is: -

i) THROTTLE SHUT/OPEN refers to the APC status.
ii) CHAMBER PRESSURE refers to the current CM and Penning gauge readings.
iii) SET BASE refers to the Penning and CM gauge base pressure settings.
iv) SET PROCESS refers to the CM gauge process pressure settings.

38) The process will stop automatically when the last step in the recipe has been completed.

5.3.4 Manual process

Process parameters for a single recipe step can be executed and altered in real time using the manual process facility.

A manual process is initiated by following steps 39 to 43 below. As soon as the 'MANUAL PROCESS' button is lit and pressed, the machine will pump to the base pressure set and attempt to perform the process currently entered on the manual process control pages.

The pages can be visited and altered at any time before the process ends. Values are altered by moving the cursor where required, typing in new values and pressing ENTER. Values are only executed when the MANUAL PROCESS button is pressed again.

39) This step assumes that the main MENU page is displayed.

Press the F4 button. This will display the PROCESS MANUAL CONTROL page.

40) Press F1 to display the MANUAL PRESSURE CONTROL page.

41) Load the sample and close the chamber lid as described in step 30.

42) The MANUAL PRESSURE CONTROL page allows the base and processing pressures to be set. Note that the MANUAL PROCESS button can be operated when this page is displayed.

43) This page also gives the status of the throttle valve and the current pressure when the process is running.

44) Press NEXT. This will display the MANUAL GAS CONTROL 1 - 3 page*. This page refers to gases 1, 2 and 3.

Move the cursor to the appropriate gas, type in the flow rate setting required, and press ENTER.

This page also shows the gas isolation valves' status and the current gas flow rates when the process is running.

45) Press NEXT to display the MANUAL GAS CONTROL 4 - 6 page. This page serves a similar purpose to the previous page, but for gas lines 4, 5 and 6. Note that the MANUAL PROCESS button can be operated when this page is displayed.

46) Press NEXT to display the HEATER CONTROL page. Type in the required table heater setting and press ENTER.

47) Press NEXT to display the MANUAL RF CONTROL page. Move the cursor to the relevant positions, type in and ENTER the TIME for which the RF power is on and the RF FORWARD power level. Press the MANUAL PROCESS button.

48) To vent the process chamber, Step 20 (which is a dedicated VENT step) must be run in automatic mode as follows:

a) Press the MENU button.

b) Press the F2 button to move to the Recipe page.

c) Key in a recipe number (page number) for a recipe containing Step 20 only. Press ENTER.

d) Press the DATA LOAD button.

e) Press the NEXT button to move to the BASE PRESSURE INPUT page.

f) Press F1 button to select the AUTOMATIC PROCESS page.

g) Press the F1 button to select the AUTOMATIC PROCESS RUN page.

h) Press the AUTOMATIC PROCESS button to vent the chamber.

NOTE: The dedicated step number 20 is pre-loaded in the software. When Step 20 is run, it:

i) Pumps the chamber.

ii) Flows venting gas (N_2) while pumping to purge the chamber.

iii) Pumps the chamber again.

iv) Seals and vents the chamber.

49) To perform an ETCH CLEANING process (see sub-section 6.1.7 for description), Step 21 (which is a dedicated etch cleaning step) must be run in automatic mode.

CAUTION

An ETCH CLEANING process (Step 21) must not be run within a PECVD process. Vent sequence (Step 20) must be run both before the ETCH CLEANING and afterwards. Failure to observe this instruction may result in mixing of the gases and the creation of dust in the system.

Proceed as described in Item 48 (a) to (h) above except that Step 21 should be selected.

5.4 Short form instructions

This section contains a brief set of operating instructions intended for those who need to operate the system in the automatic mode only, using pre-arranged recipes.

> **WARNING**
>
> **BEFORE SWITCHING ON OR OPERATING THE SYSTEM, ENSURE THAT IT IS OPERATIONAL AND HAS BEEN SIGNED OFF AS SUCH IN THE ON-SITE MAINTENANCE LOG.**

1) Check that all the external covers are in place and secure.

2) Switch ON the main incoming power safety isolator (mounted adjacent to the machine).

3) Press the green SYSTEM CONTROL ON switch located on the Power Control Panel.

4) Press the green PUMP ON switches.

> **WARNING**
>
> **ENSURE THAT PERSONNEL STAND CLEAR OF THE CHAMBER LID / HOIST MECHANISM DURING THE LID OPENING AND CLOSING OPERATIONS.**

5) The introductory title page should appear on the control panel display. This will be headed 'OXFORD PLASMA TECHNOLOGY, SMART SYSTEM CONTROLLER'.

Note that whenever the HELP button is illuminated, it may be pressed to display information intended to clarify the previous page, and prompt any action to be taken. Press HELP again to move to continuation pages or to return to the original page.

6) Press the MENU button.

7) Press F2 to change to the RECIPE pages.

8) Key in the recipe number you wish to run in automatic mode and press ENTER.

9) Press LOAD DATA and check that the parameters displayed are satisfactory.

10) Press the NEXT button to change to the BASE PRESSURE INPUT screen.

11) Cursor, key in and ENTER the required pressures for both the CM and Penning gauges.

12) Press F1 to select the AUTOMATIC PROCESS page.

13) Press F1 to select the AUTOMATIC PROCESS RUN page.

14) Set the process chamber control to OPEN and open the chamber lid by pressing the two HOIST buttons simultaneously.

15) Place the sample in the process chamber, set the chamber control to CLOSE and lower the chamber lid by pressing the two HOIST buttons simultaneously.

16) Press the AUTOMATIC PROCESS button to start the process. The progress of the run can be observed on the AUTOMATIC PROCESS RUN page or by pressing F1 to display the monitor pages menu and then F1 to F4 (see diagram 2.2).

5.5 Operation via a remote PC using 'PC plus'

Although control of the 80 Plus using the integral control panel and LCD display is simple and straightforward, the use of a remote PC terminal with Oxford Instruments Plasma Technology ***Windows***™ based software has marked advantages.

The speed with which process steps and recipes may be changed or created is improved, far more information can be displayed at any one time, and, in addition to numerical values, text may be entered.

If you are not familiar with the *Windows* environment, it is recommended that you read chapters 1 and 2 of the Microsoft Windows User's Guide.

5.5.1 Connecting the PC to the 80 Plus

Connect the PC-to-80 Plus console signal cable. (The console socket is located on the Services Panel at the rear of the console and is labelled 'PC Control'.) Making this connection disables process control via the membrane keypad and the liquid crystal display.

5.5.2 Operation using the PC terminal

1) Refer to section 5.3 to check and power up the 80 Plus system.

2) Switch on the PC and its monitor. Note that with the PC connected, the integral LCD display will advise that system control is now via the remote PC terminal. If the 'PC Plus' application has been specified as the 'Windows' shell, it will load automatically when 'Windows' is loaded, otherwise double click on the 'PC Plus' icon.

3) The first page to appear will be the Oxford Instruments Plasma Technology display announcing the PC Process Control software. This will remain while the program is being loaded. When this is complete, the screen will automatically change to the **Access** page. This can be used to give or change the level of control or access which an individual may have. First, however, the operator must log-on by selecting his or her name from the existing **User Name List** (to select, move the cursor arrow using the mouse, and click the left-hand mouse button twice). Then type in and enter the matching password (if any).

4) Click on **Access** and a three choice menu will appear. Access to the **Add** or **Delete User** facilities are limited to the System Manager. Similarly, only they can change another individual's password.

Note: Access to various facilities depends upon the user's status, as follows: -

	1	2	3	4	5	6
Delete/Add users and change passwords	X					
Modify own password	X	X	X	X	X	
Manual control of system	X	X	X	X		
Edit a process	X	X	X		X	
Edit list of parameters logged	X	X	X		X	
Edit material names	X	X		X		
Edit calibration	X	X		X		
Edit tolerances	X	X	X			

where

1 = Systems manager
2 = Systems engineer
3 = Process developer
4 = Maintenance engineer
5 = Process editor
6 = Operator

5) To change an individual's password, click on **Change Password**. An Access Control panel will appear. Select and double click the name of the user due for a password change. Type in the password and Enter.

6) Similarly, users' names may be added and allotted a level of access, or deleted.

7) When your name and level of access (status) appear in the **Current System User** box, click on **Proceed**.

8) The **Master Menu** panel gives access to the five main sectors: -

1) Select
2) Manual
3) Display
4) Edit

NOTES: I) The following descriptions of automatic and manual processing runs are for a typical system configuration, and allowances should be made for any discrepancies.

ii) The *Windows* environment uses various prompts to lead the operator through the operations. For example, the valid selections in a menu will appear emboldened and the appropriate area for data to be typed in will be highlighted.

5.5.2.1 Select - (Automatic run)

Note: Although the PC may be controlling the system automatically in this mode, it will be sending a sequence of commands to the Smart PLC which will be in the manual mode.

9) Click on **Select** to display the **File Selection** box. With both the **Private** and **Public** display options selected ([X]), all the recipes on file will be listed by reference number / name (-------.rec) and description. Recipes which may be run, or run and edited, by any operator, will be listed with only the **Public** option selected. With the **Private** option selected, recipes created by the person who is logged in will be listed.

Click once on the recipe name you wish to run, when it will be highlighted, and then on OK to select it (or click twice in rapid succession on the recipe name).

The **Master Menu** panel will display a Start button.

10) Click on the **Start** button to initiate the automatic process run. The message will change from 'Process Complete', which is displayed when the system is at rest, to a message reflecting the current stage of the process.

5.5.2.2 Manual

11) This mode allows direct control of a single step process in real time.

12) Click on **Manual** and then on **Status**. This window will allow you to click on and enter all the required set point parameters. Note that where there are two values for a parameter, the right hand value is the set point and the left hand, the real time (actual) value. There are coloured indicators between the values (green for 'within tolerance' and yellow for 'out of tolerance'). The running time for the step should be entered in the 'Remaining step time ------- of [ ]" box.

The status of other parts of the system may also be given.

Start (green) and stop (red) buttons are provided to respectively initiate or abort the process.

13) By clicking on **Vacuum**, a graphical representation of the system is displayed. This gives all the real time (actual) values of the various parameters as the process runs.

Set points can be entered by clicking on the appropriate **Info** button. This will display boxes similar to those which are shown on the **Status** page (item 12 above). **Start** and **Stop** buttons are accessed by clicking on the **Auto Info** button.

5.5.2.3 Display

14) Clicking on the **Display** button will provide access to the full range of information available when the system is being operated in the **Automatic** mode. No influence, however, on the running or progress of the process can be made, with the exception of the **Abort** button facility.

15) The **Status page** option, accessed via the **Display** button, is similar to that accessed via the **Manual** button, except that the parameter set points cannot be changed, and both the **Start** and **Stop** buttons are absent.

All the parameter set points and their real time (actual) values are displayed.

16) The **Vacuum page** option, accessed via the **Display** button, is similar to that accessed via the **Manual** button, except that the parameter set points cannot be changed and both the **Start** and **Stop** buttons are absent. All the parameter set points and their real time (actual) values are displayed.

17) The **Process (Process Recipe) page** option displays the recipe which has been selected for the automatic run.

All the steps in the recipe are shown in sequence by type (Action, Data or Sequence), run time and description.

Clicking on any of the steps will display the parameters for that step.

5.5.2.4 Edit

18) The **Edit** button gives access to that sector of the software which deals with the creation or alteration of stored recipes and other information.

The information which can be displayed, created or edited is dependent upon the status of the individual who has logged into the system.

5.5.2.5 Process system recipes

19) The **Process** option deals with Process Recipes. Click on **File** and then **New** to create a recipe or **Open** to edit an existing recipe.

20) To create a new recipe on the **Process Recipe - (Untitled)** page, type in and enter a description. Click on **Datalog Description** and when the **File Selection** window appears, click on the **Datalog** file required and then on **OK** (or double click on the Datalog file).

21) Click on the first step (highlighted in white) to display the **Step editor**. Action steps comprise Process steps, Chamber Vent and Chamber Clean steps.

A Data Step is a Pump down Step and a Sequence Step is a further sub-division of one of the 20 recipe steps into a further 20 steps.

22) Click on the **Step type** box and then on **Data**. Click on **Pump** and then on **Set Data**. Enter the description, base pressure and start type. Click on **OK** twice to copy the step to the recipe 'step one' position.

Note: - File Saver - Having created a new file (a file is any individual collection of data having a reference name or number) or edited an existing file, you may want to save it for future use. To do so, click on **File**. If it is an existing file which you have not altered, simply click on **Save**. If it is a new file or an existing file to which an alteration has been made, click on **Save As**. This will display the **File Saver** window. This allows you to give the file

a new name, or click on an existing file name (in which case, when you click on **OK**, you will be asked if you want to replace (overwrite) the existing file). If the file uses data from another file (imported data), select the option to store it as data, or, more usually, as a reference.

24) Repeat step (23) for other Process steps.

25) Click on **Chamber Clean** and then on **Set Data**. Enter the Description, RF forward power and Step time, and click on **OK**.

26) To edit or change an existing Process Recipe, click on **File** and then on **Open**. Double click on the required recipe name. Editing an existing recipe is similar to creating a new recipe, except that clicking on the **Step Type** (left hand) side of the recipe step line displays the relevant Step Editor, whereas clicking on the **Description** (right hand) side displays the relevant data editing window.

27) If the **Sequence** option is used to create a sub-division of 20 steps for one of the process steps, subsequent editing can be carried out as follows. Click on the left hand side, or step type side, of the recipe step line to display the **Step Editor**. Click on the right hand side, or description side, to display the 20 sub-division steps.

5.5.2.6 Datalog

28) The **Datalog** option allows you to select the various parameters and component status inputs to be logged during a process run.

Enter the description, and double click on the items to be logged.

5.5.2.7 Materials

29) The **Materials** option allows the names of the gases assigned to each of the gas channels to be entered.

5.5.2.8 Calibration

30) The **Calibration** option allows calibration factors and maximum flow rates to be entered. Both these parameters are normally stamped on all mass flow controllers (MFCs) and therefore this information need only be changed when an MFC is replaced.

5.5.2.9 Tolerances

31) The **Tolerances** option allows the levels of deviation from the parameter set points at which warnings are given to be entered.

Both absolute and percentage tolerances may be entered, although it is the greater value of the two which is used.

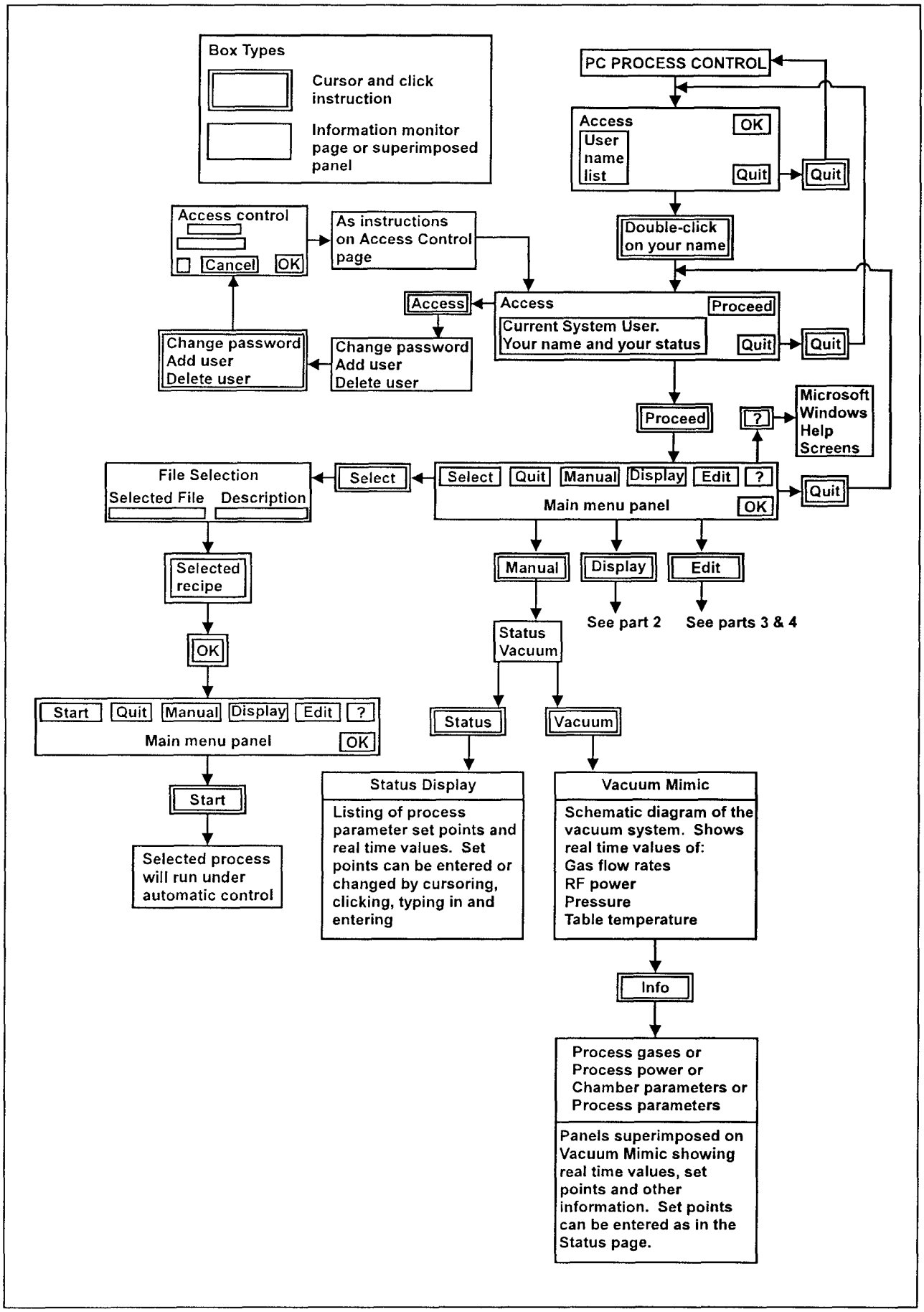

Diagram 5-4: PC process control flowchart (Part 1)

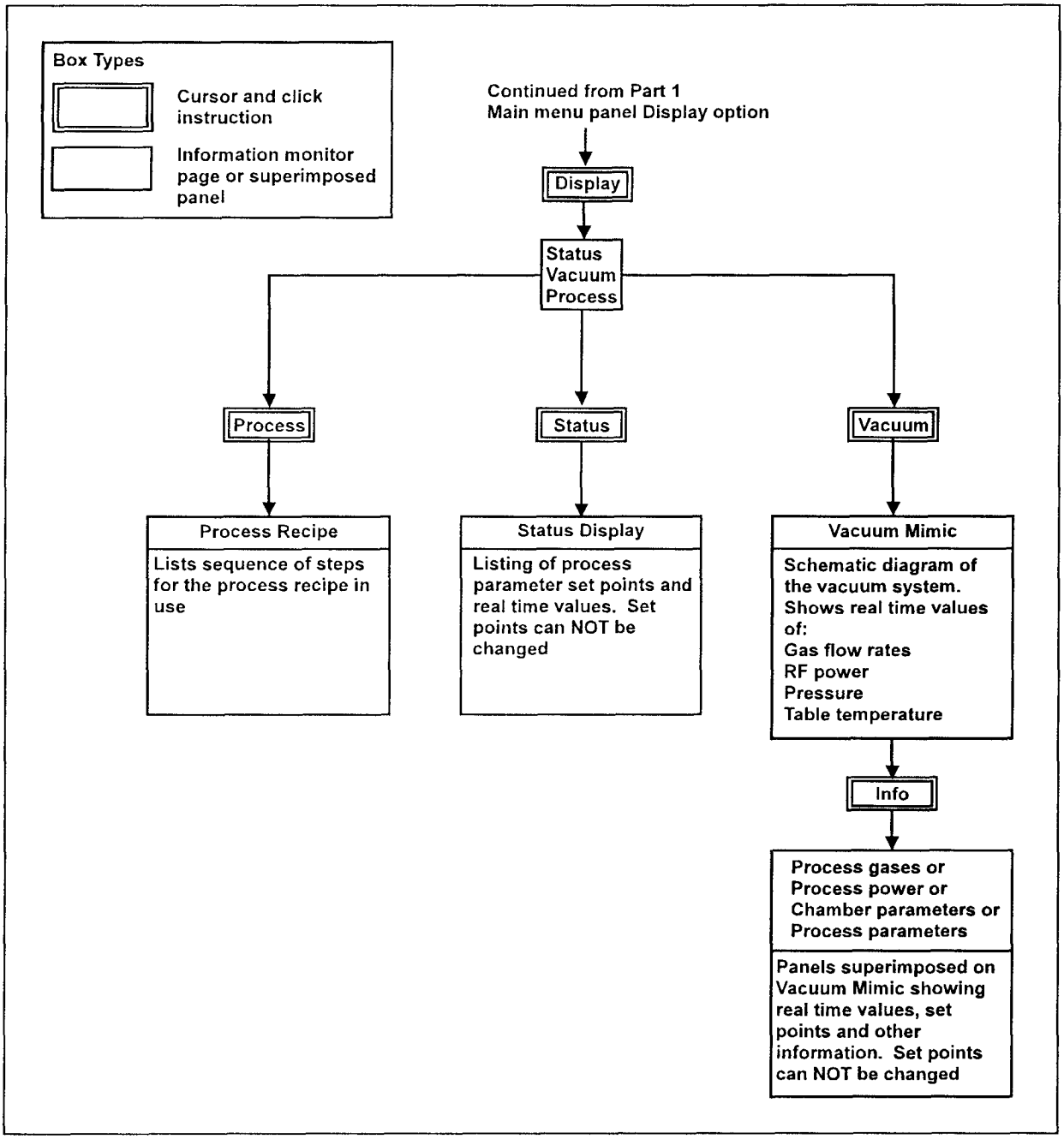

Diagram 5-5: PC Process control flowchart (Part 2)

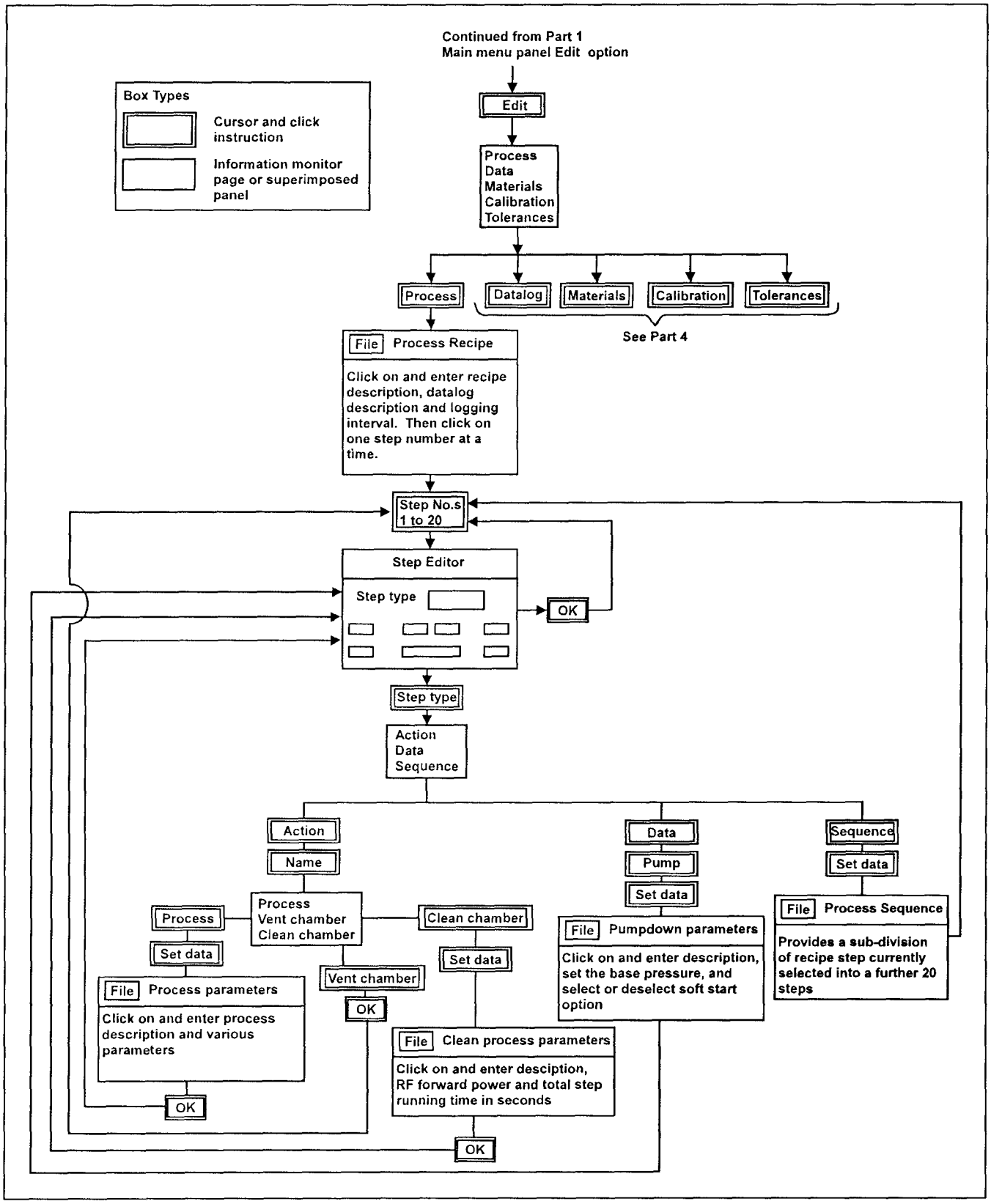

Diagram 5-6: PC Process control flowchart (Part 3)

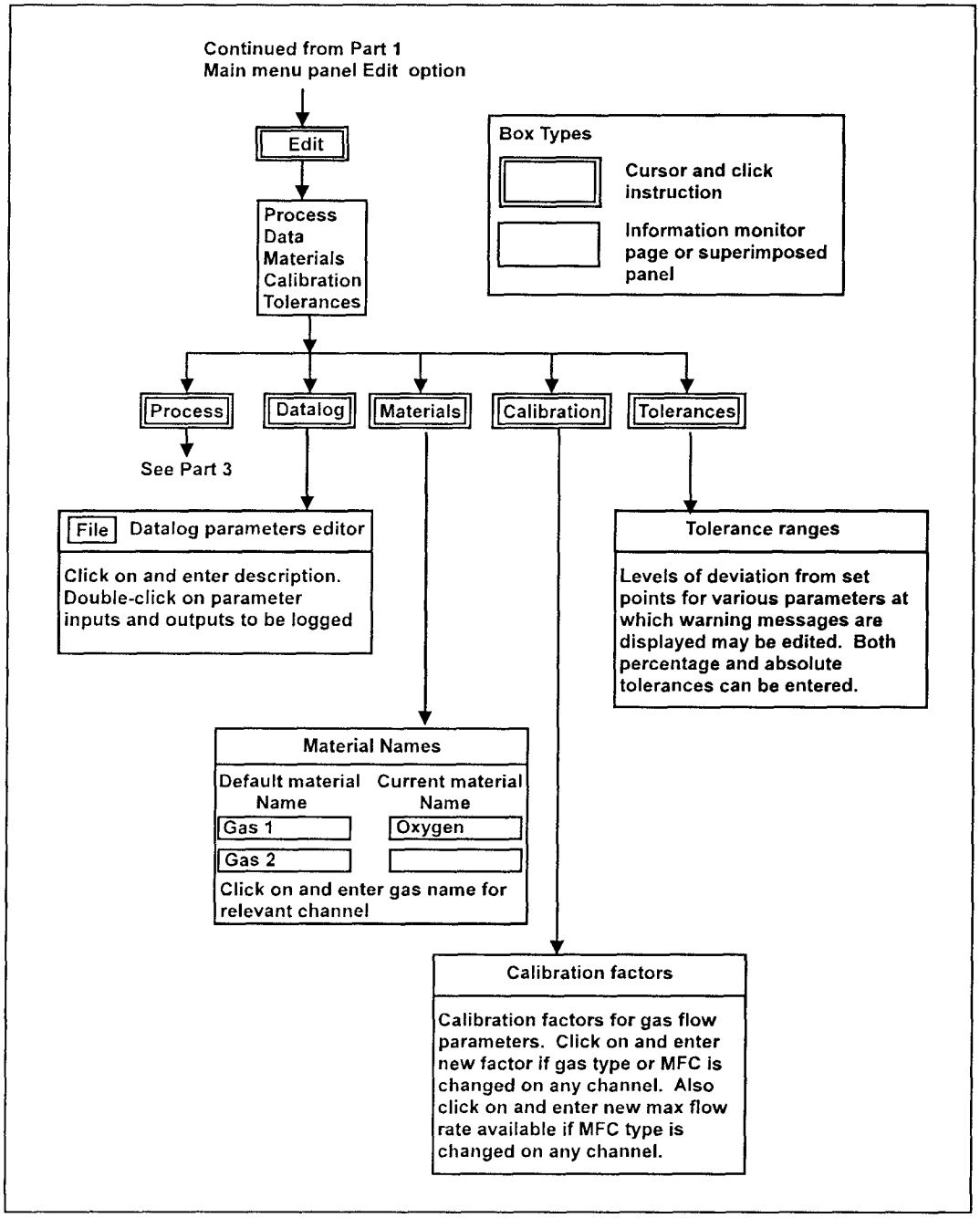

Diagram 5-7: PC Process control flowchart (Part 4)

5.5.3 Screen messages

The following messages may appear on the PLC controller LCD screen:

GAS OUT OF TOLERANCE

This message indicates that a gas flow has been out of tolerance for too long. The RF power is turned off and the timer is paused. Processing will resume automatically if the gas flow regains its set value.

RF FAILURE

This message indicates that the reflected RF power is too high for too long. The controller pauses the process timer, turns off the RF power, and automatically attempts to resume the process after a short delay.

ADJUSTING TEMPERATURE

This message is displayed if the table temperature is outside its tolerance limit. Note that heated tables have a built in delay time after first reaching the set temperature, to allow for any possible overshoot or undershoot.

Other messages can be displayed; their meanings are straightforward:

PUMPING TO BASE PRESSURE

AUTOMATIC PROCESS RUNNING

VENTING CHAMBER

PROCESS ABORTED

PROCESS COMPLETE

5.6 Operator adjustments

5.6.1 Manual adjustment of the ENI MW-5D matching unit

This sub-section is only applicable to systems controlled by a PC.

The following procedure should be used when it is necessary to manually adjust the matching unit or when difficulty is experienced in obtaining an automatic match.

The matching unit can be manually adjusted via a serial interface (COM1) from the PC.

1. Start the Windows Terminal application.

2. From the Settings menu, select the Terminal Emulation option, then select the DEC VT-100 (ANSI) emulation.

3. From the Settings menu, select the Communications option, then select the following parameters:

Baud Rate:	9600 baud
Data Bits:	8
Stop Bits:	1
Parity	None
Flow Control:	None
Connector:	COM1

4. At the keyboard, enter **key1234 <Rtn>**. This action should cause the * prompt to be displayed.

NOTE: A full description of the *commands is listed in the MW-5D operating manual.

CAUTION

When manually adjusting the matching unit, do not use commands other than those listed below without referring to the MW-5D manual or consulting with Oxford Plasma Technology.

Before changing ANY parameter value, make a note of the current value so that it can be returned to in case of difficulty.

5. The following commands are the most likely to be required:

*TAM (Toggle Automatic Control) - this command toggles the matching unit between automatic and manual modes.

*ADJ (Adjust) - only available in manual mode. Follow the on-screen instructions to adjust the capacitor values.

*CAL (Calibration menu) - Use Option 4 from this menu to teach the automatch the matching parameters for a new process.

On exiting from the CAL procedure, note that the matching unit is in manual mode.

The terminal application can be left active when returning to PC Plus, using the Windows Alt + Tab command.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

6. Maintenance

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

6. *Routine maintenance*

Note that this section includes references to optional equipment which may not be fitted to your particular system.

WARNINGS

1. **BEFORE STARTING ANY MAINTENANCE WORK, SWITCH OFF AND LOCK OFF THE MAIN INCOMING CIRCUIT BREAKER.**

2. **ENSURE THAT ONLY FULLY AND APPROPRIATELY QUALIFIED PERSONNEL ARE ALLOWED TO WORK ON THE SYSTEM.**

3. **READ THE HEALTH AND SAFETY SECTION AT THE BEGINNING OF THIS MANUAL.**

6.1 Miscellaneous

WARNING

ISOPROPYL ALCOHOL IS HIGHLY INFLAMMABLE (FLAMMABLE). DO NOT USE IT NEAR A NAKED FLAME OR ENERGISED ELECTRICAL EQUIPMENT.

6.1.1 Weekly

1) Examine the exterior of the machine for damage or signs of overheating and for failed indicator lamps.

2) Examine the service connections of the machine for signs of fluid leaks or loose electrical connectors.

3) Note, in the machine's log book, the time taken for the machine to pump down from atmosphere to a standard pressure. An increase in this time may indicate a leak, a decrease in pumping efficiency, a change in a vacuum gauge or in a vacuum valve.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

6.1.2 Monthly

1) The O-rings should be checked monthly but replaced as and when necessary.

   Replacement O-rings should be constructed of Viton and pre-baked to 150°C to minimise the risk of gas escaping from the chamber. The chamber lid O-ring should not need to be removed unless it leaks. Clean the O-ring *in situ* using a lint-free cloth wetted with Isopropyl Alcohol.

   To change the lid O-ring (use gloves):

   a) Remove the O-ring, being careful not to damage the retaining groove.

   b) Use a lint-free cloth and IPA to clean the O-ring sealing face on the chamber.

   c) The new O-ring, cleaned with IPA, should be inserted with no twists. Stretch the O-ring evenly as it is inserted to avoid local regions of stretching.

2) Monitor the vacuum integrity of the system by pumping thoroughly, isolating the process chamber and noting the rate of pressure rise. An abnormally high value may indicate a leak or heavy contamination of the process chamber. (The chamber can be isolated by closing a sealable APC valve directly from the valve controller, set in local mode. If a non-sealing APC is fitted, the rate of pressure rise can be found during a vent action, with the vent gas line evacuated.)

3) Monitor the backing pump(s)' condition by timing how long it takes to pump from atmosphere to 0.1 Torr (without a turbomolecular pump turned on). An increase in time may indicate deteriorating pump performance.

4) Check the zero setting of the capacitance manometer. A turbo pumped system will have a base pressure well below 0.1 mTorr, so the zero point can be adjusted readily in this case (see manufacturer's data). A Roots / rotary combination should give a base pressure below 1 mTorr, and can be used to set the zero point of a 10 Torr gauge. A rotary pump should give a base pressure below 10 mTorr, so a true zero pressure cannot be set in this case. Either the gauge should be set to the same arbitrary reference level (e.g. 10 mTorr), or it should be set to zero on another vacuum system with a known base pressure, and carefully re-installed in the 80 Plus system.

5) Monitor the performance of each mass flow controller, by noting the system pressure with 10%, 50% and 100% flow set points and the throttle fully open. A change may indicate a deterioration in MFC performance, or a change in pumping speed.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

6.1.3 Three-monthly

1) Heater/chiller unit (Neslab, Polycold, Bettatech, etc.):

   The condenser on the refrigeration circuit should be kept clean enough to allow the free flow of air through it. Dirt may be removed by brushing, vacuum cleaning or with a compressed air blow gun.

2) Closed loop (recirculating) cooling systems:

   Top up with distilled water to which has been added an inhibitor containing dimethylamides, sodium acrylate silicate ester and a copper inhibitor, e.g. **Protex.***

3) Radio frequency and microwave radiation leakage:

   Test the system as detailed in Appendix A "Measurement of radio frequency and microwave emissions.

6.1.4 Annually

1) Replace the filters in the cooling water system.

2) Drain the cooling-water system and replace with distilled water, to which has been added an inhibitor containing dimethylamides, sodium acrylate silicate ester and a copper inhibitor, e.g. **Protex.**

6.1.5 Changing the gas bottles

The operator should be aware that certain process parameters may change as the process gas bottles pressure drops. For example, inert gas bottles which are normally filled to about 3000 psi, should be changed when the pressure drops below 400 psi. The inlet pressure should be 25 - 35 psia.

6.1.6 Etch cleaning

Where the system is used for Plasma Enhanced Chemical Vapour Deposition (PECVD), the manual processing runs should be interspersed with etching processes as an efficient method of cleaning the electrodes and chamber walls.

The etching processes may be optimised to suit particular processing requirements; however, the following recommendations may be used as a starting point.

The etch cleaning should be performed each time the aggregate of the deposition layers reaches 10 microns.

* Note: **Protex** may be obtained from Oxford Instruments Plasma Technology (Part no. TGZ 0007).

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

The etch processes are: -

1) CF_4/O_2 8%, 750 mTorr, 200 W, 30 minutes

2) CF_4/O_2 8%, 150 mTorr, 200 W, 30 minutes

The high pressure process will clean the electrodes and the low pressure process will clean the chamber walls. The two processes should therefore be alternated until the chamber and electrodes are etched clean.

6.2 Process chamber

WARNING

BEFORE ATTEMPTING ANY MAINTENANCE WORK ON THE PROCESS CHAMBER, IT MUST BE SUBJECTED TO AT LEAST TWO VENT CYCLES SUBSEQUENT TO A PROCESSING RUN.

HEATED TABLES MUST BE ALLOWED TO COOL TO ROOM TEMPERATURE BEFORE CLEANING THE CHAMBER WITH SOLVENTS.

CRYOGENICALLY COOLED TABLES MUST BE BROUGHT TO ROOM TEMPERATURE BEFORE MAINTENANCE WORK.

6.2.1 Monthly

1) Visually examine the interior of the chamber for contamination. Any necessary cleaning should be carried out using a lint-free cloth moistened with Isopropyl Alcohol (IPA).

WARNING

ISOPROPYL ALCOHOL IS HIGHLY INFLAMMABLE (FLAMMABLE). DO NOT USE IT NEAR A NAKED FLAME OR ENERGISED ELECTRICAL EQUIPMENT.

2) Examine the exterior of the chamber and its fittings for damage.

3) Examine the lid and seals for any damage or deterioration.

4) Examine the heating/cooling water flow system (outside and inside the machine covers) for signs of leakage.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

5) Purge the process chamber for thirty minutes with dry nitrogen if IPA has been used for cleaning.

6.3 Top electrode (RIE, PE and PECVD)

WARNING

BEFORE ATTEMPTING ANY MAINTENANCE WORK ON THE PROCESS CHAMBER, IT MUST BE SUBJECTED TO AT LEAST TWO VENT CYCLES SUBSEQUENT TO A PROCESSING RUN.

6.3.1 Monthly

1) Visually examine the top electrode for contamination. Any necessary cleaning should be carried out using a lint-free cloth moistened with Isopropyl Alcohol (IPA).

WARNING

ISOPROPYL ALCOHOL IS HIGHLY INFLAMMABLE (FLAMMABLE). DO NOT USE IT NEAR A NAKED FLAME OR ENERGISED ELECTRICAL EQUIPMENT.

2) Examine the top electrode and its integral gas and water fittings for damage. Carefully inspect gas inlet showerhead plates for signs of plasma concentrating in a hole and enlarging the hole.

3) Examine the seal for signs of incipient deterioration.

6.4 Substrate table (lower electrode)

WARNING

BEFORE ATTEMPTING ANY MAINTENANCE WORK ON THE MACHINE, THE PROCESS CHAMBER MUST BE SUBJECTED TO AT LEAST TWO VENT CYCLES SUBSEQUENT TO A PROCESSING RUN.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

6.4.1 Monthly

1) Visually examine the substrate table for contamination. Any necessary cleaning should be carried out using a lint-free cloth soaked in Isopropyl Alcohol (IPA).

WARNING

ISOPROPYL ALCOHOL IS HIGHLY INFLAMMABLE (FLAMMABLE). DO NOT USE IT NEAR A NAKED FLAME OR ENERGISED ELECTRICAL EQUIPMENT.

2) Examine the table and its integral heating and/or cooling systems for signs of damage.

6.5 Vacuum gauges

WARNING

BEFORE ATTEMPTING ANY MAINTENANCE WORK ON THE MACHINE, THE PROCESS CHAMBER MUST BE SUBJECTED TO AT LEAST TWO VENT CYCLES SUBSEQUENT TO A PROCESSING RUN.

6.5.1 Capacitance manometer

6.5.1.1 Six-monthly (or as necessary)

1) Remove the capacitance manometer from the process chamber.

WARNING

ISOPROPYL ALCOHOL IS HIGHLY INFLAMMABLE (FLAMMABLE). DO NOT USE IT NEAR A NAKED FLAME OR ENERGISED ELECTRICAL EQUIPMENT.

2) Carefully pour a measure of Isopropyl Alcohol (IPA) at room temperature into the pressure-measurement cavity. Do not allow IPA to come into contact with electronic components.

3) Agitate the solvent carefully and then pour it out.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

CAUTION

Because the diaphragm in the gauge is thin tensioned metal, it can be destroyed by sudden changes in temperature or by clumsy handling.

4 Re-install the gauge, allowing sufficient time for outgassing of the cavity and diaphragm prior to operation.

NOTE: See manufacturer's literature for calibration adjustments.

6.5.2 Penning gauge

The following applies to an Edwards Active Inverted Magnetron gauge. If a different Penning gauge is fitted, refer to the manufacturer's literature.

WARNING

IF THE ELECTRONICS ARE DISCONNECTED FROM THE BODY TUBE AND THE BODY TUBE IS LEFT CONNECTED TO A VACUUM SYSTEM, THEN IF A PLASMA DISCHARGE IS MAINTAINED IN THE VICINITY OF THE BODY TUBE, THE ANODE AND GUARD RING OF THE BODY TUBE ASSEMBLY MAY BECOME CHARGED UP.

CAUTION

Switch OFF the power supply before removing the gauge from the vacuum system. High voltages exist internally in the gauge. The connecting cable should be removed before attempting to dismantle the gauge.

6.5.2.1 Dismantling the body tube

The body tube assembly can be removed from the gauge by gripping the magnet housing and twisting the body tube flange clockwise to unlock the bayonet fitting. The tube can then be completely withdrawn from the gauge electronics / magnet housing.

The electrode can be removed from the body tube for cleaning / replacement as follows:

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

Using the flat spanner provided with the spares kit, locate the two lugs in the end of the collar and rotate anti-clockwise to completely unscrew. Once the collar is removed, the anode assembly and O-ring can be withdrawn.

The two cathode cups are removed from the flange end of the body tube by releasing the circlip using a pair of circlip pliers. Note the correct orientation of the cups. The cup with the reduced central hole size should be closest to the O-ring end of the body tube.

Re-assembly is the reverse procedure, taking care not to bend the anode, and ensuring that it is centralised in the body tube when tightening the threaded collar.

6.5.2.2 Cleaning

WARNING

ISOPROPYL ALCOHOL IS HIGHLY INFLAMMABLE (FLAMMABLE). DO NOT USE IT NEAR A NAKED FLAME OR ENERGISED ELECTRICAL EQUIPMENT.

The cathode cups, body tube and anode assembly can be cleaned by firstly degreasing in a proprietary degreasing agent, and then thoroughly soaking in a laboratory detergent. After soaking, the parts should be thoroughly rinsed in clean water and then in Isopropyl Alcohol, to remove all traces of water. The parts should be dried thoroughly.

6.6 Gas handling system

WARNING

BEFORE ATTEMPTING ANY MAINTENANCE WORK ON THE GAS HANDLING SYSTEM, ELECTRICALLY ISOLATE THE SYSTEM BY OPENING THE MAIN INCOMING CIRCUIT BREAKER. PROCESS GASES USED MAY BE TOXIC OR INFLAMMABLE (FLAMMABLE). ADOPT THE CORRECT PROCEDURES WITH REGARD TO PURGING BEFORE REMOVING OR LOOSENING COMPONENTS CARRYING THESE GASES. WEAR PROTECTIVE CLOTHING.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

6.6.1 Mass flow controllers

6.6.1.1 Six-monthly

1) Make sure valve has been thoroughly purged before removal.

2) Working in a clean environment, separate the mechanical and the electronic parts of the device.

WARNING

ISOPROPYL ALCOHOL IS HIGHLY INFLAMMABLE (FLAMMABLE). DO NOT USE IT NEAR A NAKED FLAME OR ENERGISED ELECTRICAL EQUIPMENT.

3) Subject the mechanical parts to ultrasonic cleaning for two minutes or soak in a sequence of solutions as follows: -

   a) Approximately 5% HF : 95% H_2O (3 minutes)
   b) Distilled water (3 minutes)
   c) IPA (3 minutes)

4) Blow dry with dry nitrogen or air and reassemble.

5) Purge with nitrogen for 30 minutes after re-fitting.

6) Recalibrate according to the manufacturer's information.

6.6.2 Filters

6.6.2.1 Six-monthly

1) Make sure line has been thoroughly purged before removal.

2) Unscrew union nut and remove assembly.

3) Tap filter element lightly on side with a fibre mallet to loosen and remove element.

4) Fit new element.

5) Re-assemble.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

6.6.3 Pneumatic valves

These valves require no routine maintenance.

6.6.4 Gas lines

6.6.4.1 Weekly

Gas lines and pneumatic lines should be checked for gas tightness. If ferrules are replaced, always use brass nipples on nylon pneumatic lines and stainless steel on gas lines.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

6.7 Pumping system

WARNING

BEFORE ATTEMPTING ANY MAINTENANCE WORK ON THE PUMPING SYSTEM, THE PROCESS CHAMBER MUST BE SUBJECTED TO AT LEAST TWO MANUALLY CONTROLLED VENT CYCLES SUBSEQUENT TO ANY RUN WHERE CORROSIVE, TOXIC OR INFLAMMABLE (FLAMMABLE) PROCESS GASES HAVE BEEN USED. THE SYSTEM MUST THEN BE ELECTRICALLY ISOLATED (SWITCHED OFF).

CAUTION

When changing or topping-up the lubricating oil in a pump, always use oil of the same brand and type. If a change of brand or type is contemplated, refer to Oxford Instruments Plasma Technology for advice.

6.7.1 Exhaust filter with oil feedback and chemical filter

6.7.1.1 Weekly

Inspect the filter differential pressure indicator (if fitted) and change the filter cartridge if necessary. If perfluoropolyether (PFPE) oil is used in the pump, change the filters when the oil becomes cloudy.

WARNING

HAZARDOUS SUBSTANCES MAY ESCAPE FROM THE FILTER AND OIL. TAKE SUITABLE PRECAUTIONS SUCH AS WEARING GLOVES, GOGGLES OR GAS MASK.

6.7.1.2 During an oil change

Always change the filters when the oil is changed. Note that the oil trapped in the filter cartridge housing must also be drained and re-filled.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

6.7.2 Rotary vane pumps

6.7.2.1 Weekly

Inspect the oil level. If the level is low, switch off the system and replenish.

6.7.2.2 Bi-weekly (or at 400 hours operating time)

Inspect the quality of the oil visually, chemically and with regard to its viscosity (see manufacturer's literature) to establish its rate of deterioration for a given process. Once this has been established, the oil should be changed regularly at that frequency, but never less frequently than every 2000 hours. Always change the oil filters when the oil is changed.

Note that PFPE oil should never need changing if used as specified.

CAUTION

Changing from a PFPE oil to a mineral oil or vice versa should only be attempted after reference to the manufacturers. If the oils are allowed to come into contact with each other, they emulsify, with fatal results for the pump.

6.7.2.3 Annually

Remove and clean the wire mesh filters (if fitted) on the intake ports, using a perfluorinated liquid such as Freon when PFPE oil is in use, or Isopropyl alcohol (IPA) when mineral oils (hydrocarbons) are in use.

CAUTION

When replacing filters, do NOT change filter type (filling material) without reference to Oxford Instruments Plasma Technology Ltd.

6.7.3 Turbomolecular pumps

Some turbo pumps now have maintenance-free ceramic type bearings. Refer to the manufacturers' literature relating to the pump fitted to your system for further information.

Where pumps are lubricated by oil, they may require the oil to be replaced after the first 500 hours running time. (See also Appendix B.)

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

6.8 Pump lubricants

CAUTION

When changing or topping-up the lubricating oil in a pump, always use oil of the same brand and type. If a change of brand or type is contemplated, refer to Oxford Instruments Plasma Technology for advice.

6.8.1 General

The lubricating oils used for pumps where the oil comes into contact with the pumped gases, i.e. oil-sealed pumps such as rotary vane types, should be chosen to meet the specific characteristics necessary for the process involved.

The vapour pressure must be low at the temperatures reached at the rubbing surfaces. Viscosity should not vary significantly over the temperature range involved, and the water absorption rate and content must be low.

Lubricating oils generally fall into one of two categories: mineral (hydrocarbon) based oil or synthetic oil such as perfluorinated polyether. The synthetic oils are normally used where they come into contact with strong oxidants such as nitrogen dioxide, oxygen, or one of the halogens.

6.8.2 Perfluorinated polyethers

Perfluorinated polyether (PFPE) lubricants have the following properties:

1) They are stable up to 350^{o}C, i.e. they do not decompose below this temperature.
2) They are chemically inert. They will, however, react with Lewis acids (BCl_3, $AlCl_3$ etc.) at temperatures over 100^{o}C.
3) They do not polymerise under the impact of high-energy radiation.
4) Since they tend not to keep contaminants suspended, pumps using these lubricants must always be fitted with suitable oil filters.
5) They do not 'age' and therefore, if used correctly, need not be replaced during the lifetime of the pump.
6) Any contaminants in the lubricant may be removed by fitting clean filters and letting the pump run for several hours with inert gas ballast, the intake port having been closed.
7) They do not protect metal surfaces against corrosion. Pumps should therefore always be flushed with inert gas. Pumps using PFPE should be allowed to run continuously.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

8) PFPE is incompatible with hydrocarbon oils, i.e. mineral oils, conventional greases and cleaning agents.

   If a pump uses PFPE lubricant only Freon 113 or Frigen 113 may be used as a cleaning agent, and only PFPE grease may be employed.

9) If it should become necessary to change from PFPE to mineral oil lubrication or vice versa, the pump must be completely disassembled, freed of lubricant and fitted with new gaskets and vanes.

10) At temperatures over 350^{o}C, hazardous gaseous decomposition products are formed. Therefore do not smoke in rooms where PFPE is used, and make sure that no tobacco comes into contact with PFPE.

11) When handling PFPE, protective clothing must be used.

12) Do not mix PFPE with used oil. Dispose of them separately.

13) PFPE is normally odourless and colourless. Cloudiness or odour is a sign of contamination.

6.8.3 Hydrocarbon lubricants (mineral oils)

1) Where mineral oils are used, the rate of oil deterioration for a particular pump and process should be established at an early stage, and oil changes based upon this information.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

7. Fault diagnosis

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

7. *Fault diagnosis*

WARNING

1. **BEFORE REMOVING THE EXTERNAL COVERS OF THE SYSTEM, ISOLATE THE SYSTEM ELECTRICALLY BY SWITCHING OFF THE INCOMING MAINS SAFETY ISOLATOR (MOUNTED ADJACENT TO THE MACHINE) .**

2. **READ THE HEALTH AND SAFETY SECTION AT THE FRONT OF THIS MANUAL.**

7.1 General

What may appear to be faults are sometimes simply the failure on the part of the operator to follow the correct procedures. Before spending time, therefore, searching for a failed component, ensure that the pre-power-up check has been carried out (see Section 5) and that all plugs and connectors are secure.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

7.2 Fault symptom chart

Note that the selection of faults given for each symptom may not be exhaustive.

Symptom	Possible Faults and Checks
No Power to system	1) Incoming mains safety isolator (mounted adjacent to the machine) switched off. 2) SYSTEM CONTROL ON button not operated. (Located on front panel). 3) EMERGENCY OFF button not released - twist clockwise to release. (Located on top of machine). 4) External Emergency Off circuit is open circuit. Check that Socket 17 has a shorting plug fitted. (Located at rear of machine). **WARNING** **THE CIRCUIT BREAKERS CB1 TO CB 3 ARE LOCATED WITHIN THE POWER DISTRIBUTION UNIT. DO NOT REMOVE THE COVER OF THIS UNIT UNLESS YOU ARE FULLY TRAINED AND AWARE OF THE RISKS INVOLVED.** 5) Circuit breaker CB1 de-energised. 6) Circuit breaker CB2 de-energised. This CB supplies the 24V dc power supply unit. Check Fuse 3 and the 24V dc power supply unit's output. 7) Circuit breaker CB3 de-energised. This CB supplies the ±15V dc power supply unit. Check FUSES 2 and 3 and the ±15V dc power supply unit's output.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

Symptom	Possible Faults and Checks
Pumps not operating	1) PUMP 1 ON button not operated. (Located on the front panel of the machine). 2) PUMP 2 ON button not operated - applicable to 2-pump systems. (Located on the front panel of the machine). 3) Pump cable not connected. Plug 10 (pump 1) and Plug 9 (pump 2) located at the rear of the machine. **WARNING** **THE CIRCUIT BREAKERS CB12 AND CB 13, AND CONTACTORS K2 AND K3 ARE LOCATED WITHIN THE POWER DISTRIBUTION UNIT. DO NOT REMOVE THE COVER OF THIS UNIT UNLESS YOU ARE FULLY TRAINED AND AWARE OF THE RISKS INVOLVED.** 4) Circuit breaker CB12 (pump 1) and CB13 (pump 2) de-energised. 5) Contactor K2 (pump 1) and K3 (pump 2) de-energised. Refer to the 80 Plus Power Distribution circuit diagram.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

Symptom	Possible Faults and Checks
Excessive time to achieve base pressure of <10 mTorr.	1) Rotary pumps not operating. (See preceding sub-section). 2) Turbo pump not operating (if fitted). Check the status of the Turbo Controller, located on the machine's front panel. Refer to the controller manual. Before running the turbo, confirm water flow and Nitrogen purge to the turbo are connected and that the relevant flows are correct. 3) Roughing valve not operating. Check for correct compressed air supply. 4) APC valve not operating. Check status of APC controller on the machine's front panel. Refer to the controller manual. 5) Leak in chamber or associated pipework. Check all O-rings. Use a leak detector if available. 6) Capacitance Manometer (CM) gauge not operating correctly. Refer to the CM gauge manual.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

Symptom	Possible Faults and Checks
Unable to strike a Plasma	1) Chamber pressure out of correct operating range. Set correct pressure. 2) Gas flows incorrect. Set gas flows. 3) Gas isolation values not operating. Check for correct compressed air supply. 4) RF generator not operating. Check that generator's mains switch is set to ON, and that the AC ON indicator is lit. **NOTE:** RF generator will only switch on when the chamber is below 600 mbar (vacuum switch closed). 5) Is RF generator MAX POWER indicator on? If so, refer to the RF generator manual. 6) Is RF generator OVERHEAT indicator on? If so, refer to the RF generator manual. 7) Is the RF ON indicator on when requesting RF power? If not, contact an Oxford Plasma Technology engineer. 8) Check that the reflected RF power is less than 10% of the forward power. If not, carry out the following checks: (i) Check the cable between the RF generator and the automatch unit. (ii) Check the connection between the automatch and electrode. (iii) RF electrode resistance to chassis should be > 1Mohm, if significantly less, look for a short circuit. (iv) If manual control of the automatch is available, attempt a manual match. If, in a manual match the reflected power can be reduced to less than 10% of forward power, the problem is in the automatch unit - refer to the automatch manual.

8. Glossary

8. *Glossary*

AMU	Abbreviation for Automatch Unit. This is a self-controlling variable capacitor which is connected between an electrode (to which it is normally close-coupled) and the discharge power supply. Its purpose is to shift the voltage and current wave-forms to maximise the power transfer. It also transforms the load impedance to 50Ω.
APC	Abbreviation for Automatic Pressure Controller. Refers to a variable conductance valve which, under the control of a closed loop feedback system, controls the chamber pressure. The controller is a remote electronic module with inputs from a chamber pressure gauge, and from the system master controller.
Backing pump	A pump in series with, and downstream of, the main high vacuum pump. (See also Rotary pump)
Backing valve	The valve which, when open, allows the backing pump to pump gas from the main pump.
Baratron	See CM gauge. *Baratron* is a trade name.
Base pressure	The lowest pressure attainable by a high vacuum pump.
Bayard-Alpert gauge	See Ion gauge
Clean gas	This refers, in fact, to 'cleaning gas'. It is a gas which, when converted to a plasma, removes contamination from the walls of the chamber and from the electrodes.
Cluster	An array of processing chambers around a single load lock chamber housing a substrate handling robot.
CM gauge (Baratron)	Capacitance manometer gauge in which gas pressure deflects a membrane and thus a measured capacitance. Measures absolute pressure down to approximately 10^{-5} Torr. Not affected by corrosive gases. Does not need a correction factor for different types of gas.
Cryo pump (Meissner coil)	These pumps trap gas on a very cold surface. They usually consist of a closed circuit helium refrigeration system. They require periodic regeneration, during which they cannot be used for pumping. Base pressure approximately 10^{-9} Torr.
Driven electrode	The electrode to which the electrical discharge power is applied. The other electrode may be either earthed or at floating potential.

DSμW	An abbreviation for the Downstream Microwave process.
ECR	An abbreviation for the Electron Cyclotron Resonance process.
Electrode	One of two metal plates within the process chamber which form part of the electrical discharge system. The lower electrode is sometimes referred to as the 'table'. They are fabricated from aluminium alloy or stainless steel, and may either be heated by integral electrical resistance elements, or cooled by chilled water pipes.
Foreline	The line immediately downstream of the high-vacuum pump (see Roughing line).
Foreline pump	See Rotary pump
Gas ballast	Inert gas introduced into a port on a rotary pump to improve its ability to pump condensable vapours.
Gas factor	Ion gauges, Pirani gauges, Penning gauges and mass flow controllers need to be adjusted when run on different gases, to prevent them from being inaccurate. This 'gas factor' depends on the gas and also the type of instrument.
Gate valve	A high vacuum valve with a stainless steel shutter having linear motion. It may be used for high vacuum isolation and also for pressure control.
Hivac valve (High vacuum valve)	The valve which isolates the turbo / cryo pump from the process chamber.
ICP	An abbreviation for Induction Coupled Plasma.
Interlock	A safety device (either software or electrically implemented) that allows a piece of apparatus to function only when predetermined conditions are fulfilled.
Ion beam system	This uses an ion source in a vacuum chamber to direct a flux of energetic ions at a substrate in order to etch the surface or uses the ion source to sputter from a target to deposit material on to the substrate.
Ion gauge (Bayard-Alpert gauge)	This gauge uses a glowing cathode to emit electrons. Any positive ions created by collisions with gas molecules are collected on a thin central ion collection wire. The ion current varies with the gas density. Used for checking very low base pressures down to 10^{-10} Torr. It needs to be calibrated to the gases being measured (see Gas factor). The filament lifetime will be limited in reactive gases.

Leak up rate	The rate of increase of pressure, due to leakage and outgassing, in a sealed chamber which has been pumped down to base pressure.
Loadlock	A sealable chamber adjacent to the processing chamber, which allows the specimen to be loaded onto the substrate table without having to vent the processing chamber.
Meissner coil	See Cryo pump
MFC	Short for mass flow controller. This is a closed loop device, which controls the flow rate of piped gases under the control of an analogue signal. It also outputs a measured flow rate analogue signal. It needs to be calibrated to the gases being controlled (see Gas factor).
Micron	Unit of pressure; 10^{-3} Torr. Equivalent to the pressure required to support a column of mercury one micron (length) high.
Micron	Unit of length; 10^{-6} metre.
Millibar	Unit of pressure; $\frac{1}{1000}$ of one atmosphere or bar
Nupro valve	Nupro is a manufacturer of commonly used pneumatically operated gas line valves.
Outgassing	The vaporisation of contaminants from the surfaces of the components exposed to the vacuum.
PE	An abbreviation for the Plasma Etch process.
PECVD	An abbreviation for the Plasma Enhanced Chemical Vapour Deposition process.
Penning gauge	This gauge uses a glow discharge between electrodes and a permanent magnetic field. The ion current varies with the gas density. Used for checking base pressures down to 10^{-8} Torr. It needs to be calibrated to the gases being measured (see Gas factor).
PFPE	An abbreviation for perfluorised polyether lubricating fluid. This synthetic lubricant is used in a highly oxidising environment where mineral (hydrocarbon) oils would deteriorate too rapidly.
Pirani gauge	Senses the thermal conductivity and hence the pressure of a gas by the power required to maintain the temperature of a warm filament. Used to monitor roughing pump pressures down to approximately 10^{-3} Torr. It needs to be calibrated to the gases being measured (see Gas factor).

Plasma	A region of electrons, positive ions and neutral gas particles created between electrodes within which the various etching or deposition processes take place.
Plasma system	This generates a plasma above a substrate in a vacuum chamber and uses the action of the plasma to etch from, or deposit material onto, a substrate.
Platen	The plate which supports the substrate to be processed.
RF	An abbreviation for Radio Frequency, often 13.56 MHz.
RIE	An abbreviation for the Reactive Ion Etching process.
Roots pump (blower)	A pump having rotating lobes which intermesh to give a positive displacement of the pumped gas. The parts of the pump exposed to the pumped gas are usually self-lubricating, i.e. lubricating fluids are unnecessary. Approximate base pressure 1 mTorr.
Rotary pump (backing pump, roughing pump, foreline pump)	Short for Rotary Vane Pump, this consisting of an eccentrically mounted shaft carrying spring-loaded vanes rotating within a cylinder. The vanes are oil sealed. The choice of lubricant depends upon the process. Approximate base pressure 40 mTorr (single stage), 1 mTorr (two stage).
Roughing line	The line between the roughing pump and the chamber.
Roughing pump	A secondary pump which reduces the chamber pressure from atmospheric to a point at which the high vacuum (or main) pump takes over for a further reduction of pressure. (See also rotary pump)
Roughing valve	The valve which, when open, allows the roughing pump to pump gas from the chamber.
Sample	See Substrate
Shower head	A form of top electrode having perforations through which the process gas is introduced into the chamber.
Silane	A process gas, SiH_4, which is commonly used in deposition processes. It is extremely toxic, pyrophoric, and, under certain conditions, explosive.
Slit valve	A two position gate valve used to seal the apertures between chambers.

SMC valve	SMC is the manufacturer of commonly used solenoid operated pneumatic valves. The valves are normally closed, and on receipt of an electrical signal, the pneumatic valve opens. In some cases, the opposite action is used, for example to vent a turbo pump if system power is lost.
Specimen	See substrate
Substrate / wafer / specimen / sample	The item to be processed in the vacuum chamber.
TEOS	Abbreviation for Tetra Ethoxy Silane. TEOS is a liquid at normal temperature and pressure. In gaseous form it is used in PECVD processes. It is a replacement for silane in silicon oxide deposition.
Throttling valve	An adjustable valve.
Torr	Unit of pressure; $\frac{1}{760}$ of one atmosphere or bar.
Turbo pump	Short for turbomolecular pump, this being a multistage axial flow fan rotating at very high speed. Base pressure approximately 10^{-9} Torr.
Wafer	See Substrate
Vent	Introduce high purity nitrogen into a chamber or pump to raise it to atmospheric pressure.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

9. Modification Instructions

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

9. *Modification Instructions*

IMPORTANT: These instructions enable customers to change the processing mode of their machines from RIE to PE or vice versa. Additional system components will be required for the changes. Customers considering these changes should first consult Oxford Plasma Technology.

9.1 Changing the configuration of an 80 Plus system from RIE to PE mode

Notes:

1) The system is normally shipped with the top outer cover and the top inner cover packed separately from the main console.

2) Endpoint detection equipment cannot be used or fitted with the machine configured in the PE mode.

3) The top outer cover cannot be fitted when the machine is configured for use in the PE mode or when endpoint detection equipment is fitted.

WARNING

WHEN THE ENDPOINT DETECTION EQUIPMENT IS NOT FITTED, THE BLANKING CAP MUST BE FITTED TO THE MOUNTING FLANGE ON WHICH THE ENDPOINT DETECTION EQUIPMENT WOULD OTHERWISE BE MOUNTED.

WARNING

WHERE SYSTEMS HAVE USED TOXIC, CORROSIVE OR INFLAMMABLE (FLAMMABLE) GAS, THEY MUST BE THOROUGHLY PURGED BEFORE MAINTENANCE OR RECONFIGURING WORK PROCEEDS.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

The following sequence assumes that the machine is configured in the RIE mode and is to be reconfigured in the PE mode.

Tools needed:

Open-ended spanners (wrenches)
Allen keys
Screwdrivers - Small flat blade, small Posidriv.

1) Purge the process chamber thoroughly if toxic, corrosive or inflammable (flammable) gases have been used.

2) Vent the process chamber to atmospheric pressure. (Leave the chamber in the closed position, i.e. with the lid lowered.)

3) Shut the valves mounted on the compressed gas cylinders.

4) Switch off and lock off the main incoming power switch located on the power supply panel at the rear of the machine.

5) Isolate the compressed air supply by disconnecting it at the services panel located at the rear of the machine.

6) Having electrically isolated the system, wait for about five minutes to ensure that any residual electrical charges have leaked away.

WARNING

WAIT FOR ABOUT FIVE MINUTES AFTER HAVING SWITCHED THE MAIN SWITCH OFF BEFORE PROCEEDING. SHOCKS FROM RESIDUAL ELECTRIC CHARGES CAN BE LETHAL.

7) Turn off the cooling water supply taps.

8) Disconnect the cooling water pipes at a point away from the machine and allow the coolant to drain out. Blowing through with compressed air can assist this. Do not disconnect coolant pipes full of fluid at the rear of the machine to minimise the risk of wetting the electrical controls.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

WARNING

HIGH VOLTAGES ARE USED IN THE SYSTEM. THEY CAN CAUSE DEATH OR INJURY. DO NOT PROCEED WITH THIS WORK UNTIL THE SYSTEM IS ELECTRICALLY ISOLATED.

WARNING

THE TOP ELECTRODE MAY BECOME VERY HOT DURING USE. ALLOW IT TO COOL DOWN TO A COMFORTABLE TEMPERATURE BEFORE HANDLING.

WARNING

THE WEIGHT OF THE TOP ELECTRODE IS ENOUGH TO CAUSE INJURY IF INSUFFICIENT CARE IS TAKEN WHEN REMOVING OR REFITTING IT.

9) Remove the outer top cover, which is secured by two fasteners covered by grommets;

or

Remove all cables where they connect to the endpoint detection equipment.

10) Disconnect the water cooling and process gas unions where they connect to the top electrode.

11) Remove the fasteners holding the top electrode and aluminium spacer ring to the chamber. Lift them clear.

12) Replace the aluminium spacer ring with the PTFE insulating ring and reassemble. Ensure that the blanking cap is fitted to the endpoint detection mounting flange.

13) Connect the process gas to the top electrode. Feed the water pipes through the holes in the inner top RF cover and connect them to the top electrode. Attach the inner top RF cover to the system with the 14 fasteners.

14) Remove the side covers from the main frame to gain access to the AMU.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

15) Remove the RF cover from the terminal plate on the side of the AMU.

16) Remove both terminal nuts and release the cables.

17) Remove the two screws attaching the AMU bracket to the bracket on the pumpdown pipe bracket.

18) Transfer the AMU to the inner top RF cover and secure it to the cover with the ten fasteners.

19) Attach the cable from the RF power supply to the lower of the two terminals on the AMU, and the RF strap attached to the top electrode, to the upper. Check that the RF output strap is not electrically connected to the chassis.

20) Reconnect all the disconnected services at the rear services panel. Turn on the compressed gas cylinders' taps. Turn on the water supply.

21) Fit the terminal plate RF cover to the AMU.

22) Fit all external covers.

WARNING

CHECK THAT NO HIGH VOLTAGE CABLES HAVE BEEN LEFT EXPOSED.

23) Switch the main incoming power switch ON.

WARNING

WHEN OPENING OR CLOSING THE PROCESSING CHAMBER, ENSURE THAT PERSONNEL STAND CLEAR OF THE CHAMBER LID AND HOIST ASSEMBLY. WHEN THE COMPRESSED AIR IS RECONNECTED TO THE SYSTEM, THE INITIAL CHAMBER LID MOVEMENT WILL BE RAPID UNLESS THE 'HOIST' BUTTONS ARE OPERATED INTERMITTENTLY.

24) The system may now be operated as described in Section 5.4.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

WARNING

AT THE EARLIEST OPPORTUNITY, THE SYSTEM MUST BE CHECKED FOR RF RADIATION LEAKAGE, USING A SUITABLE PROBE. (SEE ITEM (25) BELOW.)

25) Test the system for RF leakage as detailed in Appendix A.

9.2 Changing the configuration of an 80 Plus system from PE to RIE mode

Notes:

1) The system is normally shipped with the top outer cover and the top inner cover packed separately from the main console cabinet.

2) The top outer cover cannot be fitted when the machine is configured for use in the PE mode or when the endpoint detection equipment is fitted.

WARNING

WHEN THE ENDPOINT DETECTION EQUIPMENT IS NOT FITTED, THE BLANKING CAP MUST BE FITTED TO THE MOUNTING FLANGE ON WHICH THE ENDPOINT DETECTION EQUIPMENT WOULD OTHERWISE BE MOUNTED.

WARNING

WHERE SYSTEMS HAVE USED TOXIC, CORROSIVE OR INFLAMMABLE (FLAMMABLE) GAS, THEY MUST BE THOROUGHLY PURGED BEFORE MAINTENANCE OR RECONFIGURING WORK PROCEEDS.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

The following sequence assumes that the machine is configured for use in the PE mode and is to be reconfigured in the RIE mode.

Tools needed:

Open-ended spanners (wrenches)
Allen keys
Screwdrivers - Small flat blade, small monochromator.

1) Purge the process chamber thoroughly if toxic, corrosive or inflammable (flammable) gases have been used.

2) Vent the process chamber to atmospheric pressure. (Leave the chamber in the closed position, i.e. with the lid lowered.)

3) Shut the valves mounted on the compressed gas cylinders.

4) Switch off and lock off the main incoming power switch located on the power supply panel at the rear of the machine.

5) Isolate the compressed air supply by disconnecting it at the services panel located at the rear of the machine.

6) Having electrically isolated the system, wait for about five minutes to ensure that any residual electrical charges have leaked away.

WARNING

WAIT FOR ABOUT FIVE MINUTES AFTER HAVING SWITCHED THE MAIN SWITCH OFF BEFORE PROCEEDING. SHOCKS FROM RESIDUAL ELECTRIC CHARGES CAN BE LETHAL.

7) Turn off the cooling water supply.

8) Disconnect the cooling water pipes at a point away from the machine and allow the coolant to drain out. Blowing through with compressed air can assist this. Do not disconnect coolant pipes full of fluid at the rear of the machine to minimise the risk of wetting the electrical controls.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

WARNING

HIGH VOLTAGES ARE USED IN THE SYSTEM. THEY CAN CAUSE DEATH OR INJURY. DO NOT PROCEED WITH THIS WORK UNTIL THE SYSTEM IS ELECTRICALLY ISOLATED.

WARNING

THE TOP ELECTRODE MAY BECOME VERY HOT DURING USE. ALLOW IT TO COOL DOWN TO A COMFORTABLE TEMPERATURE BEFORE HANDLING.

WARNING

THE WEIGHT OF THE TOP ELECTRODE IS ENOUGH TO CAUSE INJURY IF INSUFFICIENT CARE IS TAKEN WHEN REMOVING OR REFITTING IT.

9) Remove the AMU terminal plate RF cover.

10) Disconnect both the RF strap and the cable from the RF power supply.

11) Remove the ten fasteners holding the AMU to the inner top RF cover.

12) Remove the side panels from the main frame to gain access to the lower part of the system.

13) Transfer the AMU to the pumpdown pipe flange and secure it using the two fasteners.

14) Connect the cable from the table to the upper of the two terminals on the AMU, and, after re-routing it, the cable from the RF power supply to the lower.

15) Attach the terminal plate RF cover to the AMU.

16) Release the 14 fasteners securing the RF cover to the system and lift it sufficiently clear to disconnect the water pipes. Remove the RF cover.

17) Disconnect the process gas pipe where it connects to the top electrode.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

18) Remove the fasteners holding the top electrode and PTFE insulator ring to the chamber. Lift them clear.

19) Replace the PTFE ring with the aluminium spacer ring and reassemble.

WARNING

ENSURE THAT, IF THE ENDPOINT DETECTION EQUIPMENT MOUNTING FLANGE IS TO REMAIN UNUSED, IT IS COVERED BY THE FLANGE BLANK.

20) Reconnect the water and process gas pipes.

21) Fit the outer chamber lid cover.

22) Fit all external covers.

23) Reconnect all the disconnected services at the rear services panel. Turn on the compressed gas cylinders' taps. Turn on the water supply.

WARNING

CHECK THAT NO HIGH VOLTAGE CABLES HAVE BEEN LEFT EXPOSED.

24) Switch the main incoming power switch ON.

WARNING

WHEN OPENING OR CLOSING THE PROCESSING CHAMBER, ENSURE THAT PERSONNEL STAND CLEAR OF THE CHAMBER LID AND HOIST ASSEMBLY. WHEN THE COMPRESSED AIR IS RECONNECTED TO THE SYSTEM, THE INITIAL CHAMBER LID MOVEMENT WILL BE RAPID UNLESS THE 'HOIST' BUTTONS ARE OPERATED INTERMITTENTLY.

25) The system may now be operated as described in Section 5.4.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

WARNING

AT THE EARLIEST OPPORTUNITY, THE SYSTEM MUST BE CHECKED FOR RF RADIATION LEAKAGE, USING A SUITABLE PROBE. (SEE ITEM (26) BELOW.)

26) Test the system for RF leakage as detailed in Appendix A.

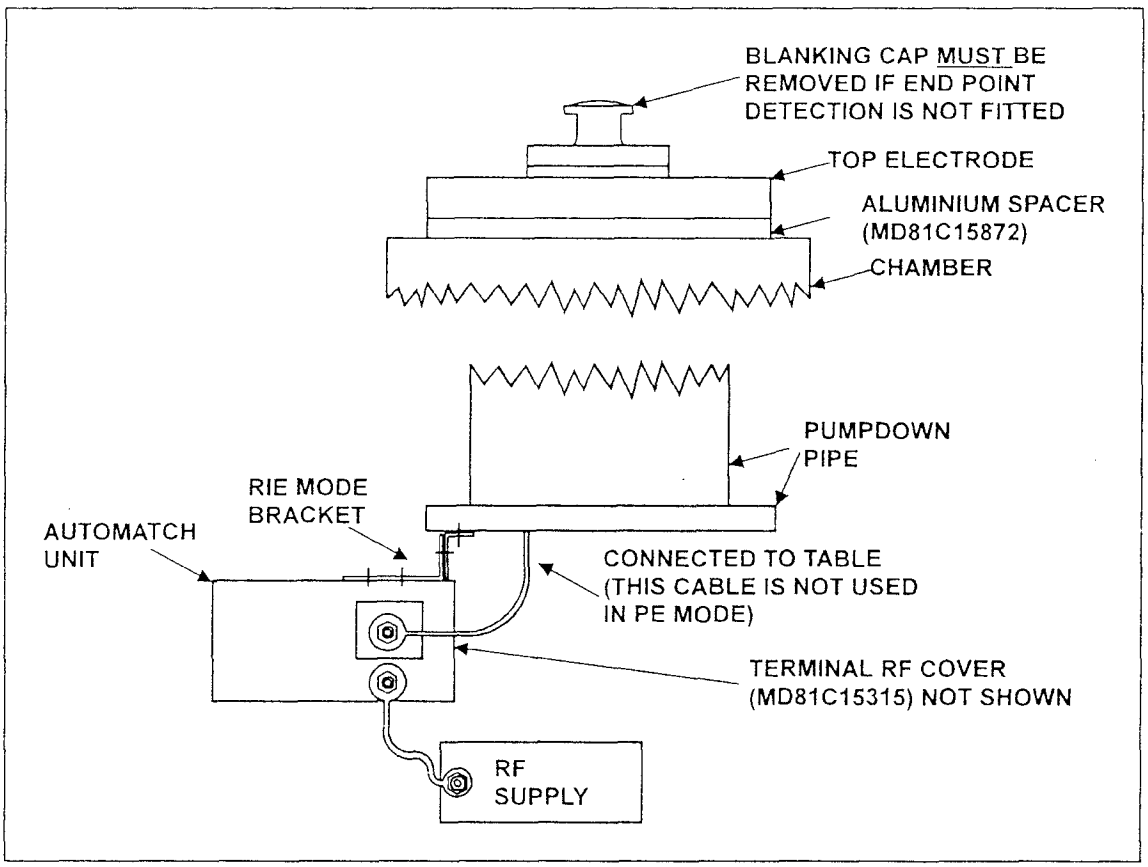

Diagram 9-1: Schematic diagram for RIE mode

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

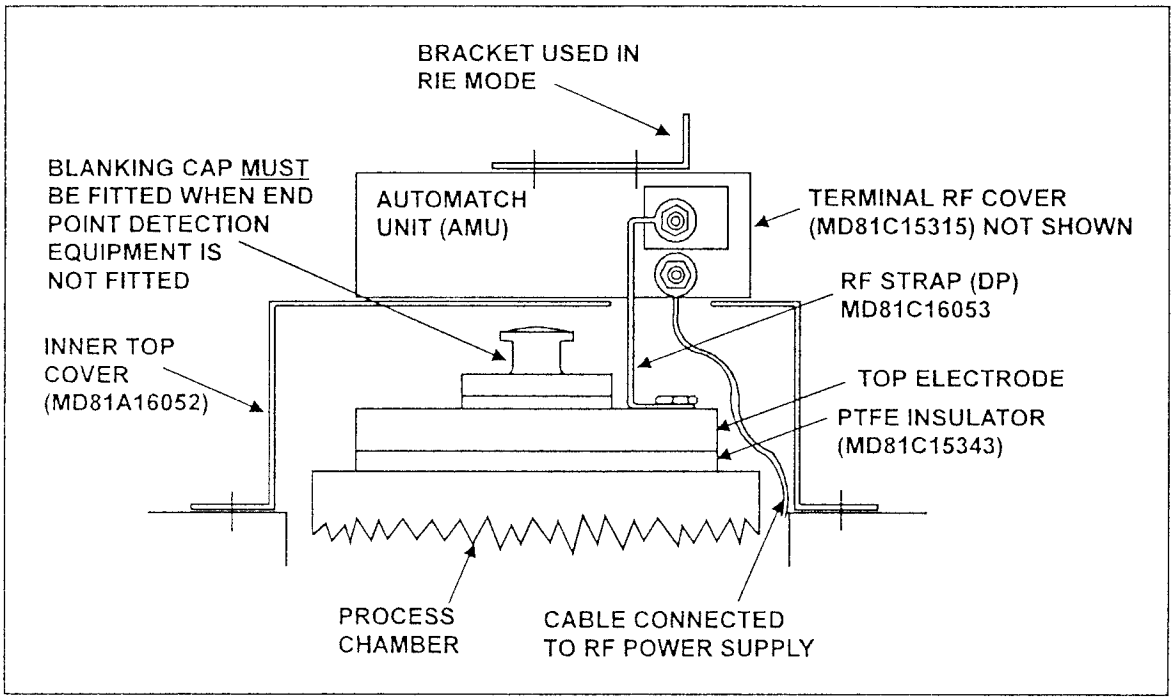

Diagram 9-2: Schematic diagram for PE mode

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

10. Supplementary information

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

10.1 Interface PCB

See drawing number SE81B15961 Revision 2 Chamber A or B Interface PCB (PLC)

This drawing also shows the Comms Link circuits on PCB PC80Z16074. See also drawing number SE81D16073. Connecting the PC signal cable to the 'PC Control' socket at the rear of the Services Panel links pins 6 and 7 on the plug J14. This allows the system to be controlled by the PC via the RS 485. With the PC plug disconnected, control is TTY from the console LCD panel.

The PLC Interface PCB in addition to various output switches and relays, provides an AD596 amplifier for the heater thermocouple inputs and an eight channel multiplexer for an analogue input expansion.

Note that the operation of the *Plasmalab* 80 Plus system via both the console mounted LCD panel or by the remote PC is described in Section 5 of this manual.

10.2 Chamber A to B switching PCB

See drawing number SE81C15937

This PCB holds the thirty-six relays which switch the PLC inputs and outputs to either Chamber A or B interface boards on a dual chamber system.
The manual selector switch mounted on the Slave Chamber console initiates the changeover.

If Chamber A is selected, the input to pin 3 on the 74HC373 i/c goes hi(1) or for Chamber B selection, lo(0). For the i/c outputs (pins 2 and 5) to toggle the 'RF inhibit' input must be hi, turning the associated npn transistor on to send pin 11 lo.

With Chamber A selected, pin 2 will go hi, turning the associated npn transistor Q4 on. This will energise half the relays. The associated pnp transistor Q5 will turn on so that the Chamber A vacstat operation sets the relevant interlock circuit.
Similarly, selecting Chamber B will send pin 3 lo and energise the other relays. Chamber B vacstat will then set its interlock circuit.

The RF changeover vacuum relay will be switched by the npn transistors toggling.

Note that the interlock circuits are set at 24 volts (as opposed to 0 volts) on the Smart PLC 80 Plus systems.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

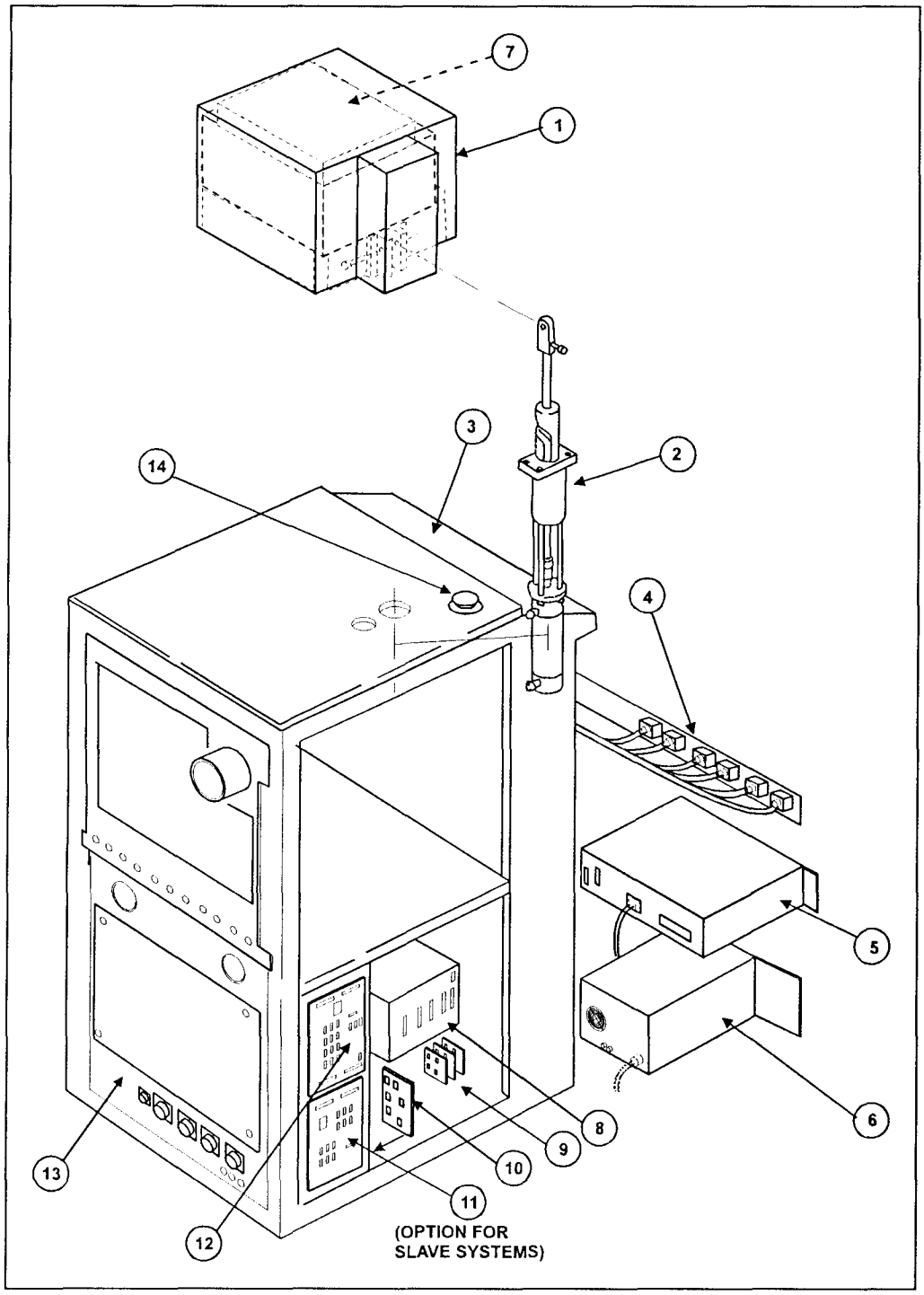

Diagram 10-1: PECVD Master Unit

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

Key to Diagram 10-1 PECVD Master Unit

1. Chamber top cover
2. Hoist assembly
3. B and R liquid crystal display operator panel
4. Pump control panel PCB
5. Automatic Pressure Controller (APC)
6. LF/HF RF Generator
7. Automatic matching unit network (AMU)
8. B and R (Smart) PLC Mini Controller
9. PLC Interface PCB
10. Internally mounted MFCs PCB.
11. Chamber A or B Switching PCB. (option; used for Master/Slave system)
12. Interface PCB
13. Power Box
14. Emergency Stop button (EMO)

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

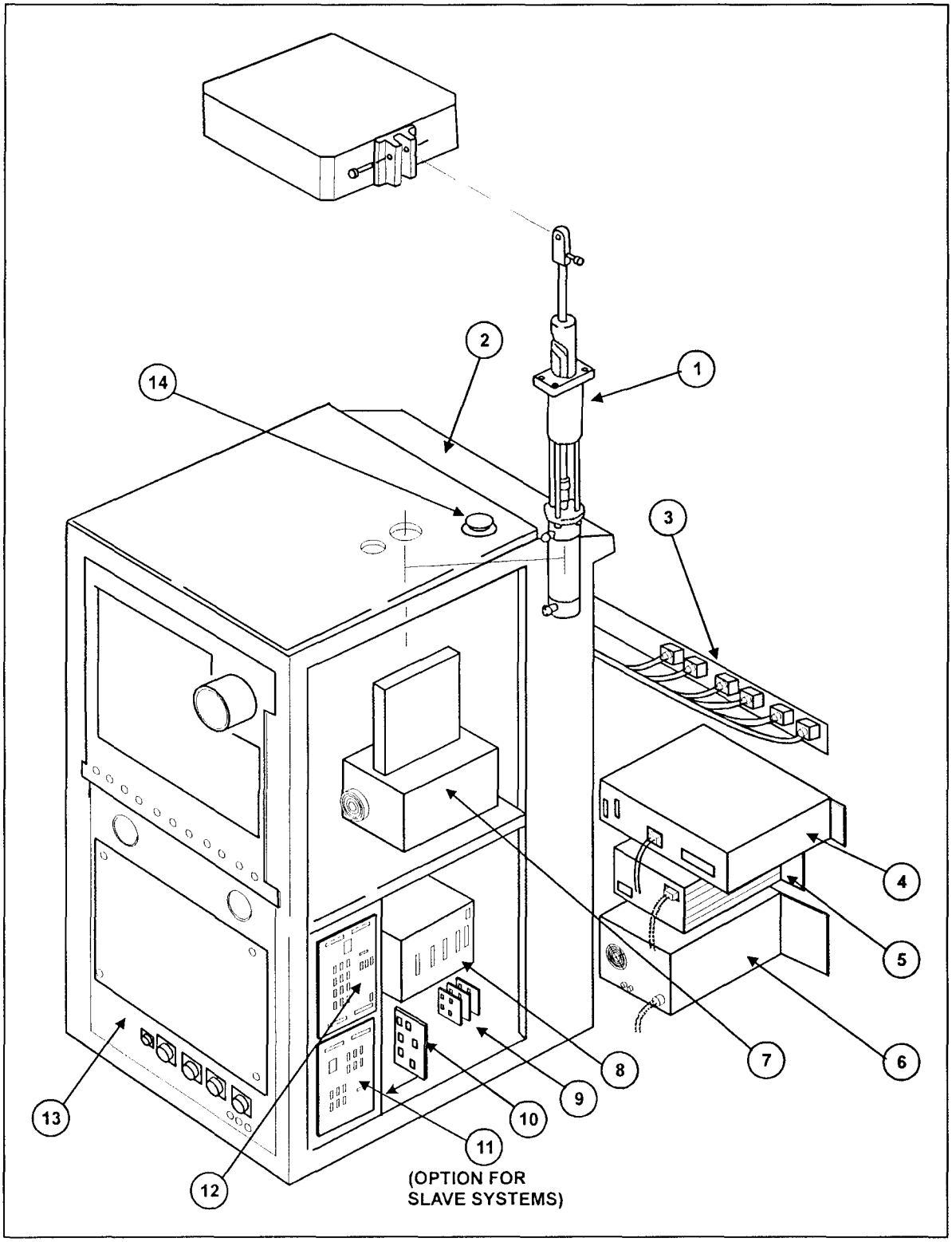

Diagram 10-2: RIE Master Unit

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

Key to Diagram 10-2 RIE Master Unit

1. Hoist assembly
2. B and R Liquid Crystal Display (LCD) Operator Panel
3. Pump Control Panel PCB
4. MKS 625A Automatic Pressure Controller
5. Turbo Pump Controller
6. LF/HF RF Generator
7. Automatic Matching Unit network
8. B and R (Smart) PLC Mini Controller
9. PLC Interface PCB
10. Remote PC control and amplifier PCB
11. Interface PCB (Chamber A or B)
12. Master to Slave switching PCB
13. Power Box
14. Emergency Stop button (EMO)

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

10.3 Gas Pod

See drawing number SE81D15942 Rev 2

The Gas Pod PCB acts as an interface between the Interface PCB (or Switching PCB for a dual chamber system) and the mass flow controllers and the pneumatic gas valve solenoids.

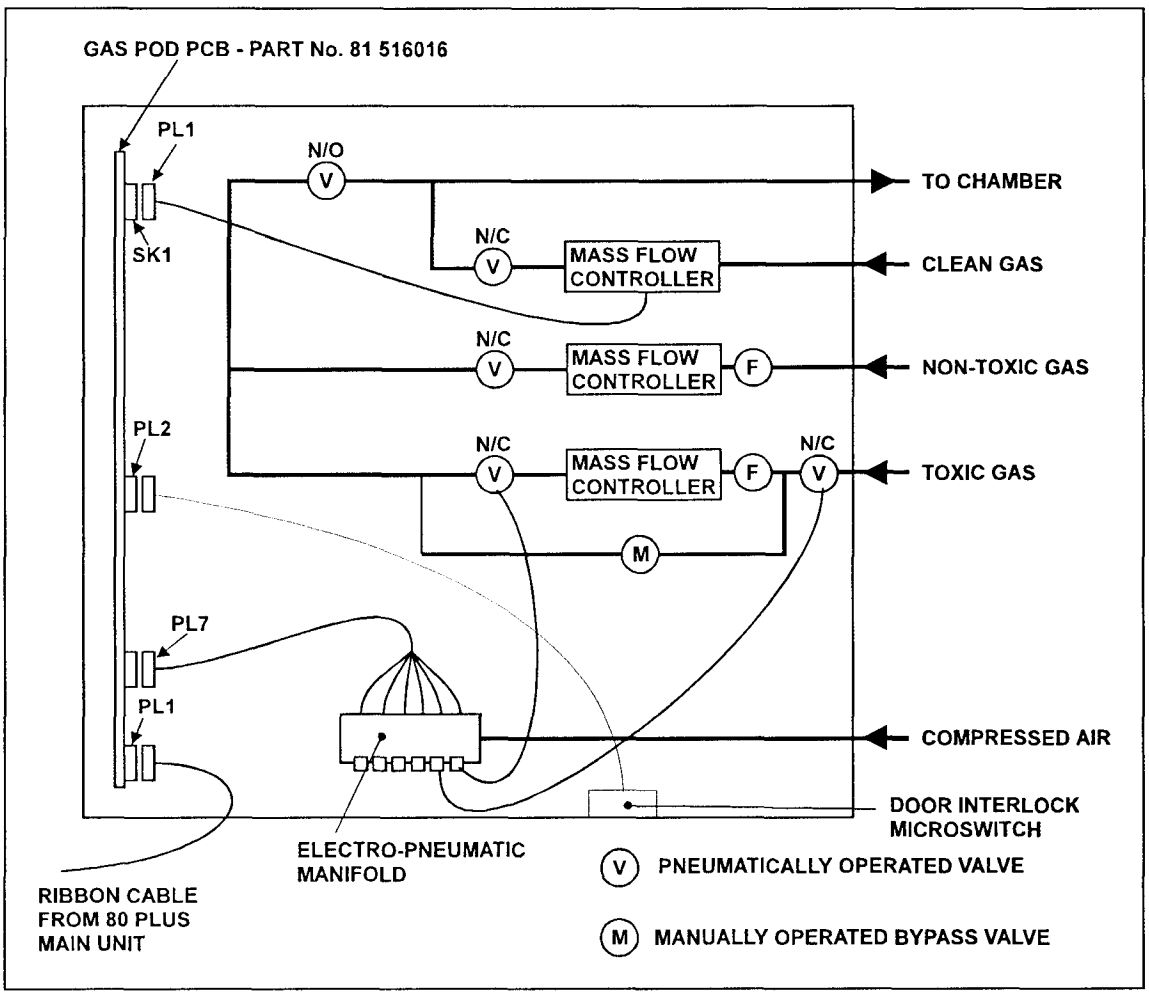

Diagram 10-3: Typical gas pod schematic

Note that where a toxic gas line is installed, both the isolating valves are operated by the same solenoid valve.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

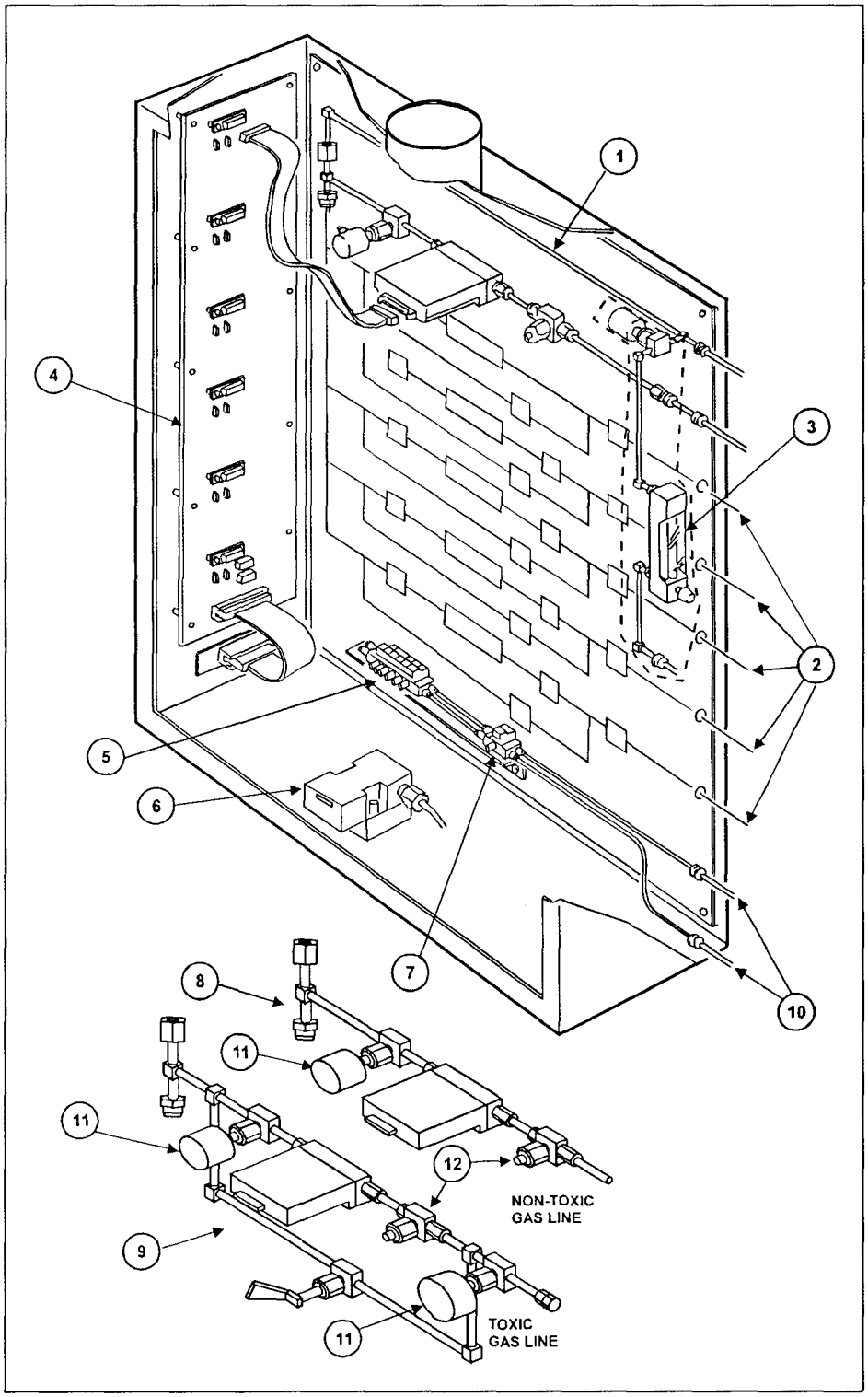

Diagram 10-4: Gas Pod

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

Key to Diagram 10-4 Gas Pod

1. Gas out manifold
2. Gas inlet lines.
3. Clean gas line with needle valve flow rate adjuster
4. Gas pod PCB (Chamber A or B)
5. Six-way SMC pneumatic solenoid valve assembly
6. Door interlock microswitch
7. Single SMC pneumatic solenoid valve
8. Non-toxic gas line
9. Toxic gas line
10. Compressed air inlet and outlet
11. Pneumatically operated isolating valve
12. Filter

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

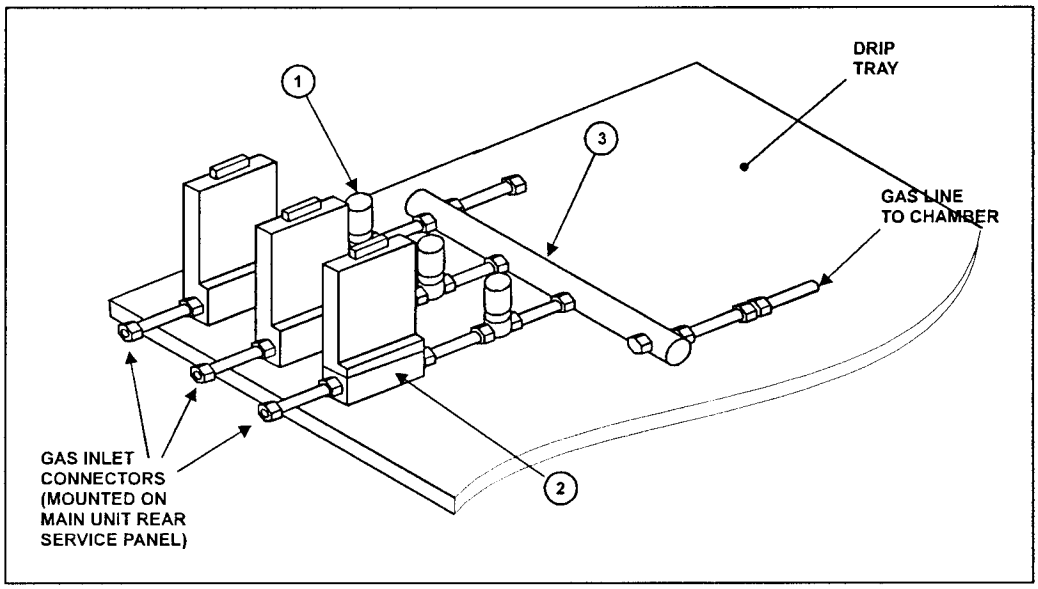

Diagram 10-5: Internal gas lines

Key to Diagram 10-5 - Internal gas lines

1. Peter-Paul 24 volts DC 52Z00140GB
2. Tylan Mass Flow Controller (MFC)
3. Manifold

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

10.4 Water cooling systems

The water cooling system for a typical PECVD machine is shown in Diagram 10-6. The system cools the clamp at the base of the table support column and therefore the adjacent O-ring. The top electrode is cooled by the same circuit and the flow rate is confirmed by a 0.5 litre/minute flow switch. This switch switches off the gases and the RF generators if the flow fails.

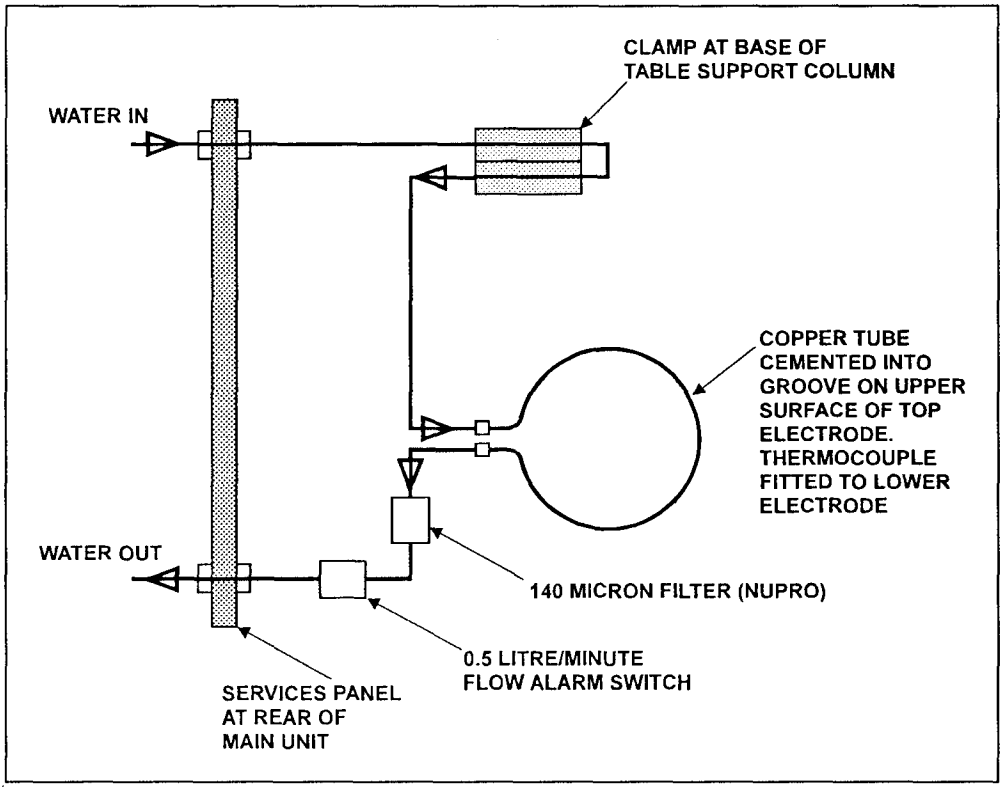

Diagram 10-6: Water cooling for typical PECVD system electrodes

The water cooling system for a typical RIE system is shown in Diagram 10-6. The system is cooled by a simple loop circuit (when a chiller unit is used) or a total loss arrangement fed by mains water. Satisfactory flow rate is confirmed indirectly by a thermocouple in the water flow line downstream from the table.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

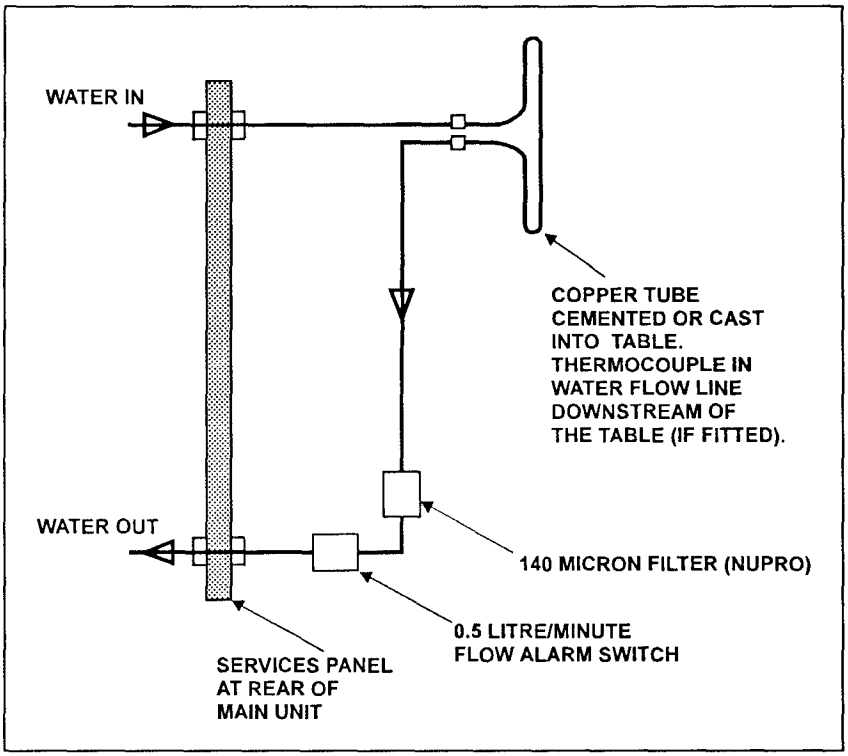

Diagram 10-7: Water cooling for typical RIE system table

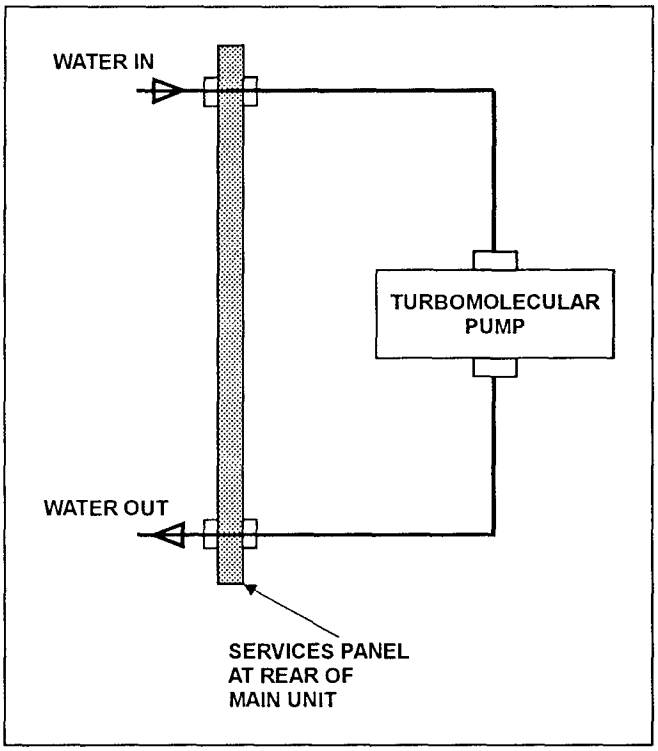

Diagram 10-8: Water cooling for turbomolecular pump

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

10.5 Pneumatic system

The compressed air supply for the pneumatic system enters the machine via the services panel at the rear of the main unit.

A multiple tee unit divides the supply, one branch feeding the various pneumatic valves which are operated under the command of the host controller, the remainder feeding various parts of the chamber lid hoist sub-system.

Both push button controls (one at either end of the main unit control panel) must be operated to achieve a pressure output from the two hand control logic module. This output supplies the two position twist valve mounted on the main unit control panel. One position will raise the hoist, and the other will lower it.

The two outputs from the twist valve feed opposite sides of a spring-centralised pilot valve. With the spool moved in one direction, the pressure supply is routed to one end of the double-acting hoist cylinder, and vice versa. Where the two supplies enter each end of the hoist cylinder, they pass through adjustable flow control valves, which restrict flow in one direction. These slow the operation of the hoist to a suitable rate. A third adjustable flow control valve restricts the main power flow line to the spring centralised pilot valve.

In the case where only one or neither button is operated, there will be no pressure output from the logic module, and therefore no output from the twist valve (whether selected open or close). The spring-centralised pilot valve spool will move to the central position, thus sealing all its ports. This will lock the hoist in its existing position, since no air can enter or leave the hoist cylinder.

Oxford Plasma Technology part numbers: (letters refer to Diagram 10-9)

A)	Push button valves	G/AIR/VLV/800
B)	Two hand control module (PXP-AII)	G/AIR/CTUIOO
C)	Twist valve	G/AIR/VLV/801
D)	Pilot/spring valve (Martonair X3 3607 02)	G/AIR/VLV/802
E)	Flow control valves	G/AIR/REG/800
F)	Double acting cylinder	G/AIR/CYL/800

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

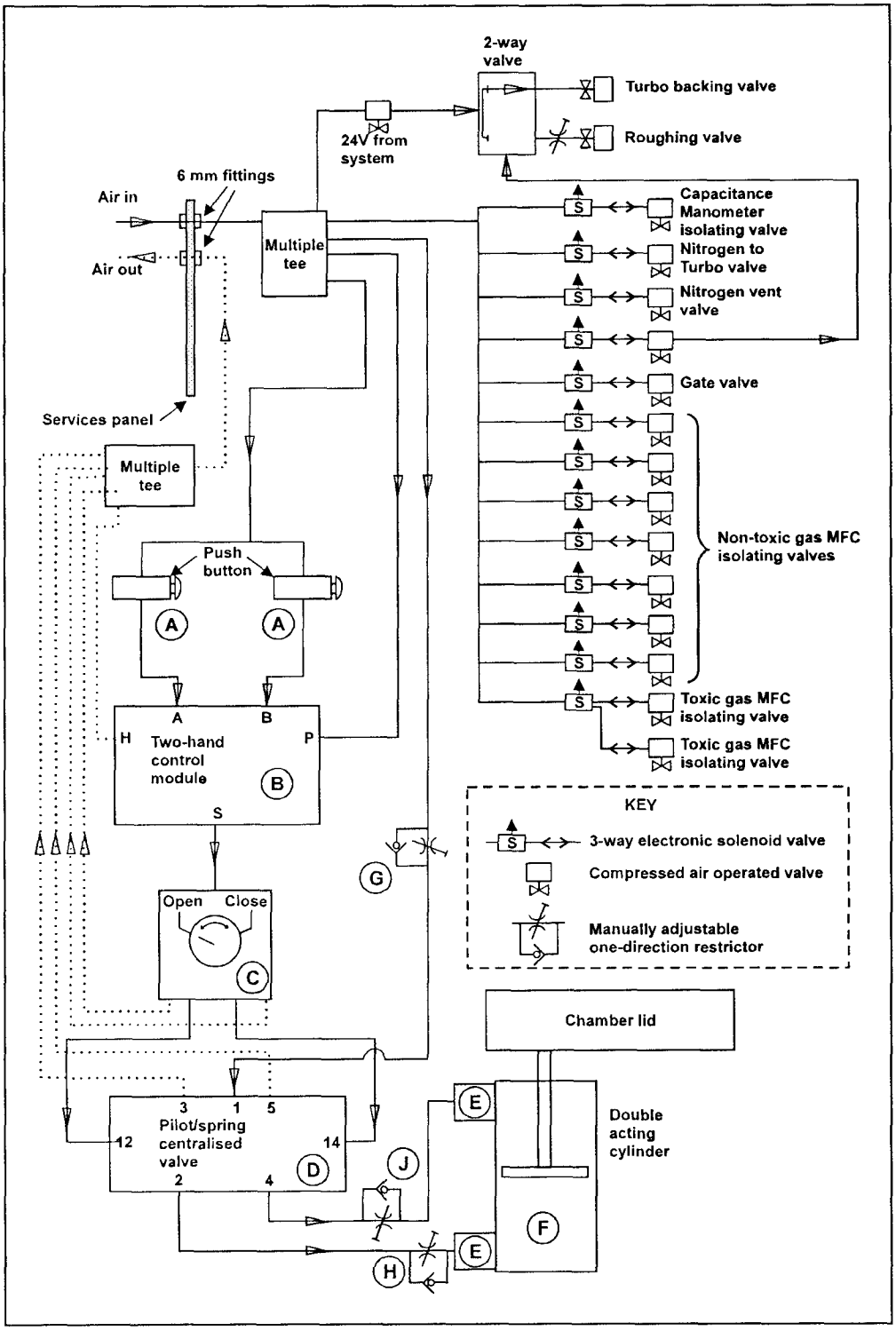

Diagram 10-9: Pneumatic control system schematic

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

10.5.1 Setting up the adjustable flow restrictor valves

The purpose of fitting the three restrictors (G), (H) and (J) (see Diagram 10-9) is to slow the opening and closing of the upper chamber hoist mechanism.

1) Open valves (J) and (H) fully.

2) Close valve (G) and then open it one quarter of a turn.

3) Use the two push buttons on the control panel to alternately open and close the chamber.

4) Gradually open valve (G) to the point where the chamber is moving smoothly but not violently.

5) Gradually close valves (J) and (H) to the point where they start to influence the relevant part of the operation, i.e. close valve (J) until it just begins to slow the closing and (H) until it just begins to slow the opening. Then adjust Valves (J) and (H) so that the chamber opening and closing rates are similar.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

10.6 Chamber disassembly

10.6.1 Disassembly of the upper chamber (RIE)

WARNING

ENSURE THAT THE SYSTEM IS ELECTRICALLY ISOLATED BEFORE REMOVING ANY OF THE EXTERNAL COVERS.

Refer to Diagram 10-14

1) Select chamber close, and operate both hoist buttons to close the chamber lid.

2) Disconnect the main compressed air supply at the rear of the main unit.

3) Power the system down and switch the incoming mains safety isolator OFF and lock it in the OFF position.

4) Remove the two screws (item 1) holding the outer cover of the upper chamber and lift it clear.

5) Remove the four lock nuts on top of the lifting frame and unscrew the four nuts, one turn at a time and in rotation, until they and the four washers can be removed.

6) Remove the nut which secures the lifting frame to the hoist shaft.

7) Remove the four cap head screws and washers which restrain radial movement of the lifting frame relative to the hoist shaft.

8) Remove the lifting frame.

9) Remove the gas inlet pipe (item 3) and associated gas inlet flange (item 4). The upper chamber can now be removed.

Notes:

a) Design modifications incorporated in later systems have the top of the hoist bolted directly to the upper chamber. For these systems, steps 5) to 8) above are not relevant. Simply remove the four screws holding the bracket at the head of the hoist to the upper chamber.

b) During re-assembly, be careful to relocate the tapered spigot in the upper chamber with the corresponding hole in the lower chamber.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

c) Early systems having a lifting frame incorporate a pin in the hoist head bracket to axially locate the bracket relative to the frame.

10.6.2 Disassembly of the lower chamber (RIE)

WARNING

ENSURE THAT THE SYSTEM IS ELECTRICALLY ISOLATED BEFORE REMOVING ANY OF THE EXTERNAL COVERS.

Refer to Diagram 10-15

1) Select chamber open and operate both hoist buttons to open the chamber lid.

2) Disconnect the main compressed air supply at the rear of the main unit.

3) Power the system down and switch the incoming mains safety isolator OFF and lock it in the OFF position.

4) Remove the screws holding vent, gas and vac stat/gauge pipes. In the case of the vac stat/gauge pipe, remove the connecting cables and air supply pipe before lifting clear.

5) Remove the four nuts holding the pumping flange to the pump down pipe, and, being careful to support the weight of the associated gate valve/APC, lift the pipe clear.

6) Remove the electronic modules located directly beneath the pump down pipe.

7) Remove the water cooling pipe, RF cable and thermo-couple cable attachments.

8) Remove the screws holding the water cooled clamp (item 11) and detach.

9) Remove the screws holding the support plate (item 3) and remove it and the PTFE spacer (9).

10) Remove the screws holding the clamping flange (item 3), compression ring (item 4) and table feedthrough (item 2) to the table mounting flange.

11) Remove the table and table column (item 8).

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

12) Whilst supporting the pumpdown pipe, remove the eight screws and washers holding the claw fittings which secure the lower chamber to the pump down pipe, and lift it clear.

13) The lower chamber can now be removed.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

10.6.3 Disassembly of the PECVD upper chamber

WARNING

ENSURE THAT THE SYSTEM IS ELECTRICALLY ISOLATED BEFORE REMOVING ANY OF THE EXTERNAL COVERS.

Refer to Diagram 10-12

1) Select chamber close and operate both hoist buttons to open the chamber lid.

2) Disconnect the main compressed air supply from the services panel at the rear of the main unit.

3) Power the system down and switch the incoming mains safety isolator OFF and lock it in the OFF position.

4) Remove the two screws holding the outer cover of the upper chamber (item 1), and lift clear.

5) Disconnect the water cooling pipes where they attach to the copper tube cemented into the top electrode.

6) Disconnect the two cables (RF and tuner control) where they plug into the remote tuner module mounted on the lifting frame.

7) Remove the screw holding the RF strap (items 6/7) to the top electrode.

8) Remove the four screws holding the remote tuner module to the lifting frame, and lift clear.

9) Remove the four lock nuts on top of the lifting frame, and unscrew the four nuts, one turn at a time and in rotation, until they, and the four washers, can be removed.

10) Remove the nut which secures the lifting frame to the hoist shaft and the four cap head screws which restrain angular movement of the lifting frame relative to the hoist shaft.

11) Remove the lifting frame.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

12) Remove the gas inlet pipe and associated gas inlet flange.

13) The upper chamber can now be removed.

Notes

a) Design modifications incorporated in later systems have the top of the hoist bolted directly to the upper chamber. For these systems, steps 5) to 8) above are not relevant. Simply remove the four screws holding the bracket at the head of the hoist to the upper chamber.

b) During re-assembly, be careful to relocate the tapered spigot in the upper chamber with the corresponding hole in the lower chamber.

c) Early systems having a lifting frame incorporate a pin in the hoist head bracket to axially locate the bracket relative to the frame.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

10.6.4 Disassembly of the PECVD lower chamber

WARNING

ENSURE THAT THE SYSTEM IS ELECTRICALLY ISOLATED BEFORE REMOVING ANY OF THE EXTERNAL COVERS.

Refer to Diagram 10-11

1) Select chamber open and operate both hoist buttons to open the chamber lid.

2) Disconnect the main compressed air supply at the rear of the main unit.

3) Power the system down and switch the incoming mains safety isolator OFF and lock it in the OFF position.

4) Remove the screws holding vent, gas and vac stat/gauge pipes. In the case of the vac stat/gauge pipe, remove the connecting cables and air supply pipe before lifting clear.

5) Remove the nuts holding the pumping flange to the pump down pipe, being careful to support the weight of the associated gate valve/APC, and lift the assembly clear.

6) Disconnect the cooling water pipes from the clamp, the table heater supply cables and the connector plug on the thermocouple lead.

7) Remove the two cap head screws holding the water cooled clamp (item 9) and remove it.

8) Remove the four cap head screws holding the support plate (item 3), and remove it and the PTFE spacer (item 8).

9) Remove the compression ring (item 4) and feedthrough (item 2).

10) Remove the table and table column assembly.

11) Whilst supporting the pump down pipe, remove the screws and washers holding the claw fittings which secure the lower chamber to the pump down pipe, and lift it clear.

12) The lower chamber can now be removed.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

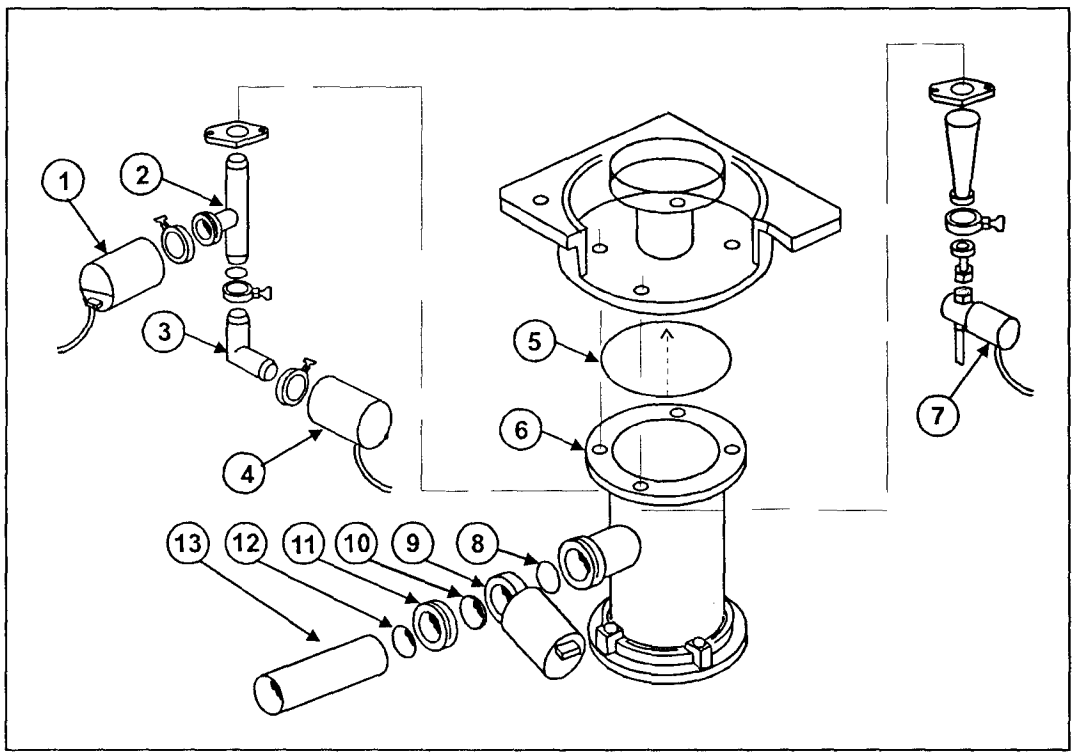

Diagram 10-10: PECVD Vacuum System

Key to Diagram 10-10: PECVD Vacuum System

1. Edwards Vacuum Interlock Switch
2. NW25 Tee
3. NW 25 Elbow
4. 10 Torr range Capacitance Manometer, Tylan CML11
5. Viton O-ring; 5.34 mm x 158.12 mm. BS 362
6. 160 mm to 63 mm reducing Tee
7. Peter-Paul 24 volt DC 52Z00140GB
8. 63 mm Centring ring 32036 - PAZV
9. MKS 653A-60-63-1 sealable APC valve
10. 63 mm centring ring 32036-PAZV
11. Adaptor 65LF
12. 63mm Centring ring 32036-PAZV
13. ISO 63 mm nipple 176 mm or 203 mm long.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

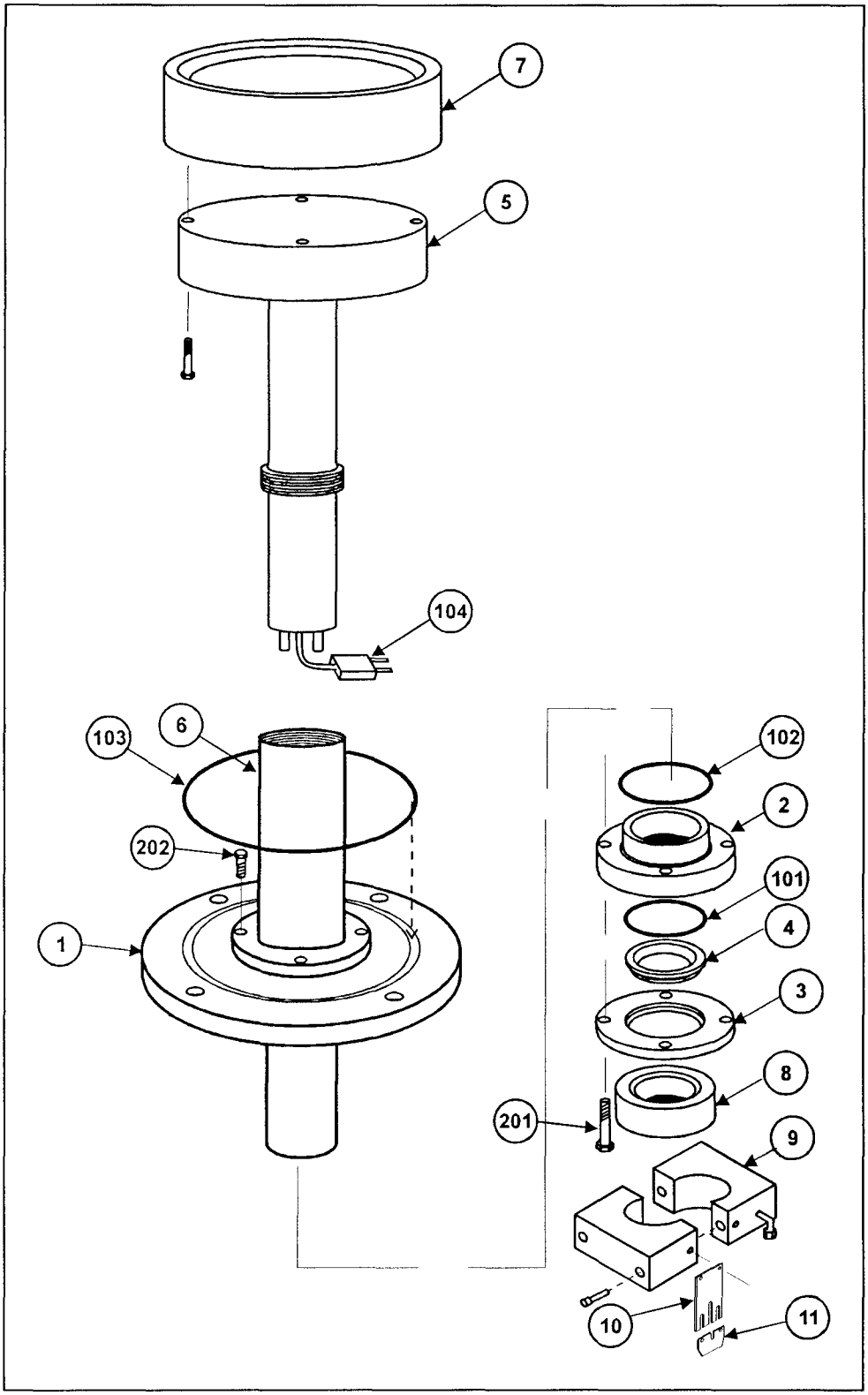

Diagram 10-11: PECVD Lower Electrode (table)

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

Key to Diagram 10-11: PECVD Lower Electrode (table)

1. Table mounting flange
2. Table feed through
3. Clamping flange
4. Compression ring
5. Heating electrode
6. Table support
7. Top plate
8. Spacer
9. Water cooled clamp
10. Thermocouple plate
11. Thermocouple bracket

101. Viton O-ring 2.6 x 66.3
102. Viton O-ring 3.5 x 47.6
103. Viton O-ring 5.34 x 158.12
104. Thermocouple Dual Purpose Probe.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

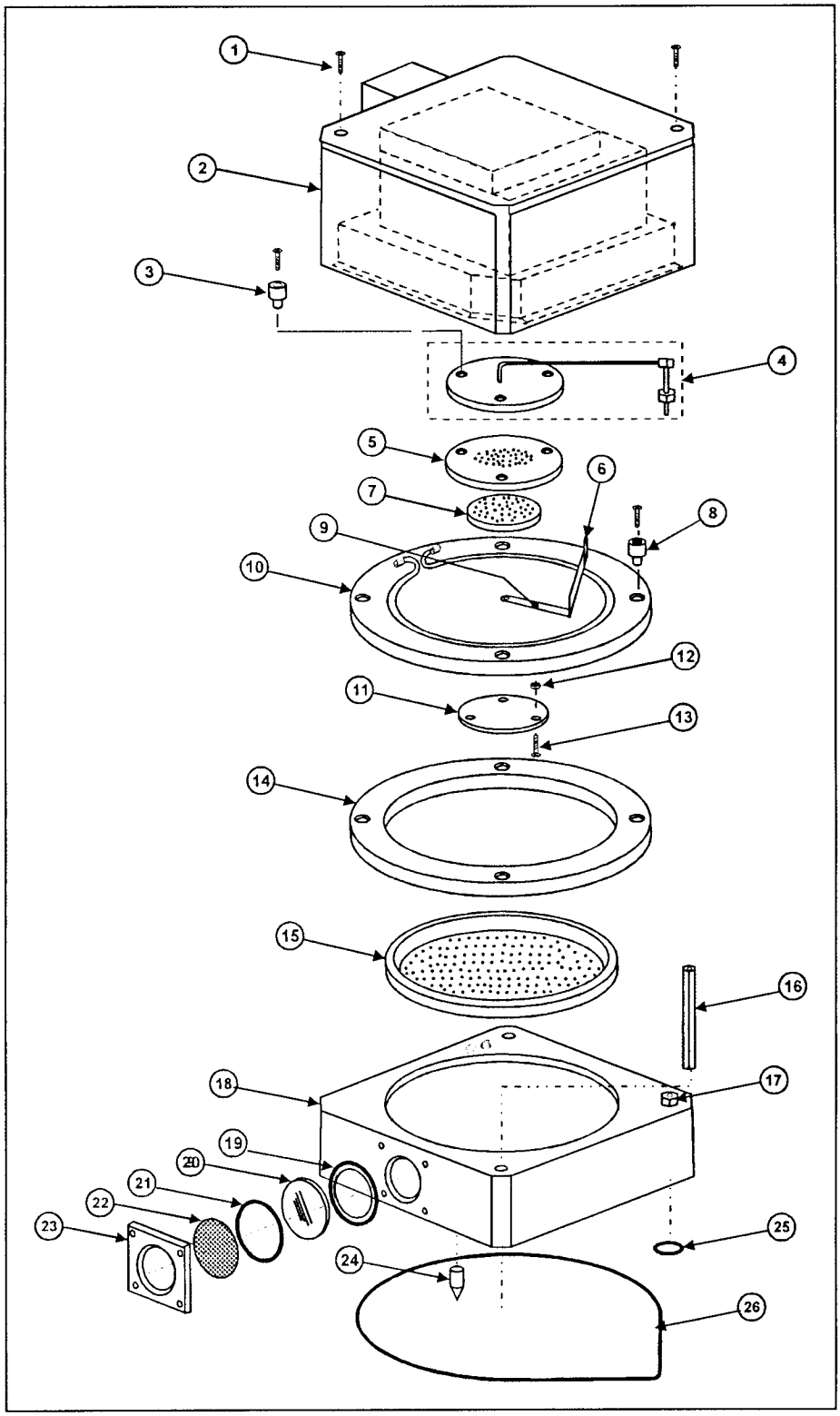

Diagram 10-12: PECVD Chamber Top

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

Key to Diagram 10-12: PECVD Chamber Top

1. Low profile cap and washer and M5 x 10 mm Pan Pozi screw.
2. Chamber top cover
3. Ceramic bush; male number 8
4. Gas inlet kit
5. Isolator disk
6. RF strap
7. Gas distribution plate
8. Insulating cap
9. RF strap
10. Top electrode assembly
11. Gas spreader
12. M3 SS plain washer
13. M3 x 6 mm SS cap head screw
14. Isolator ring
15. Gas inlet plate
16. Pillar
17. 9/16 st 'O' con. SS4 VCR 100032
18. Upper chamber
19. Centring ring
20. Window glass (6 mm Pyrex)
21. Window gasket
22. UV/RF filter
23. Window flange
24. Location pin
25. 3.5 x 20.2 mm Viton O-ring
26. 5.34 x 304.17 Viton O-ring.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

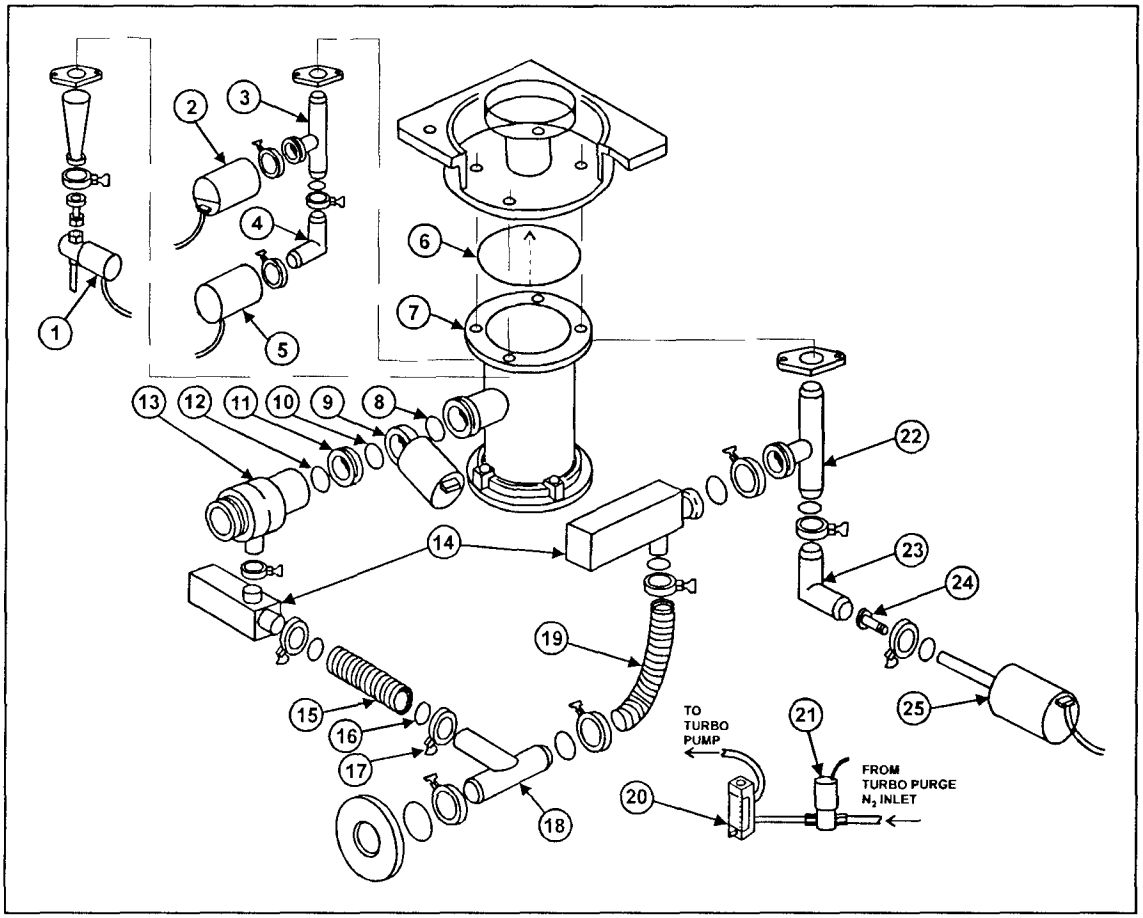

Diagram 10-13: RIE Vacuum System

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

Key to Diagram 10-13: RIE Vacuum System

1. Peter-Paul 24 volts DC 52Z00140GB
2. Edwards vacuum interlock switch
3. NW25 Tee
4. NW25 Elbow
5. Active invert mag gauge AIM-V-NW25 (Penning)
6. 5.34 mm x 158.12 mm Viton BS362
7. 160 - 100 reducing tee
8. 100PF sealing disc 86730
9. 100 mm ISO sealable APC valve
10. 100PF sealing disc 86730
11. Connector B'pump to gate valve
12. 100PF sealing disk 86730
13. LH 361C Turbo 85675 ISO-K
14. PV25PK isolation valve
15. NW25 Flexible pipe 250 mm long
16. NW25 Centring ring
17. NW25 clamp ring
18. NW25 Tee
19. NW25 flexible pipe 500 mm long
20. 50 ccm F65-SHR0-A125-3G (Rotameter)
21. Peter-Paul 24 volt DC 52Z00140GB
22. NW25 Tee
23. NW25 Elbow
24. NW25 to 1/2"Quick disconnect
25. 1 Torr Capacitance Manometer Tylan CDL-01

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

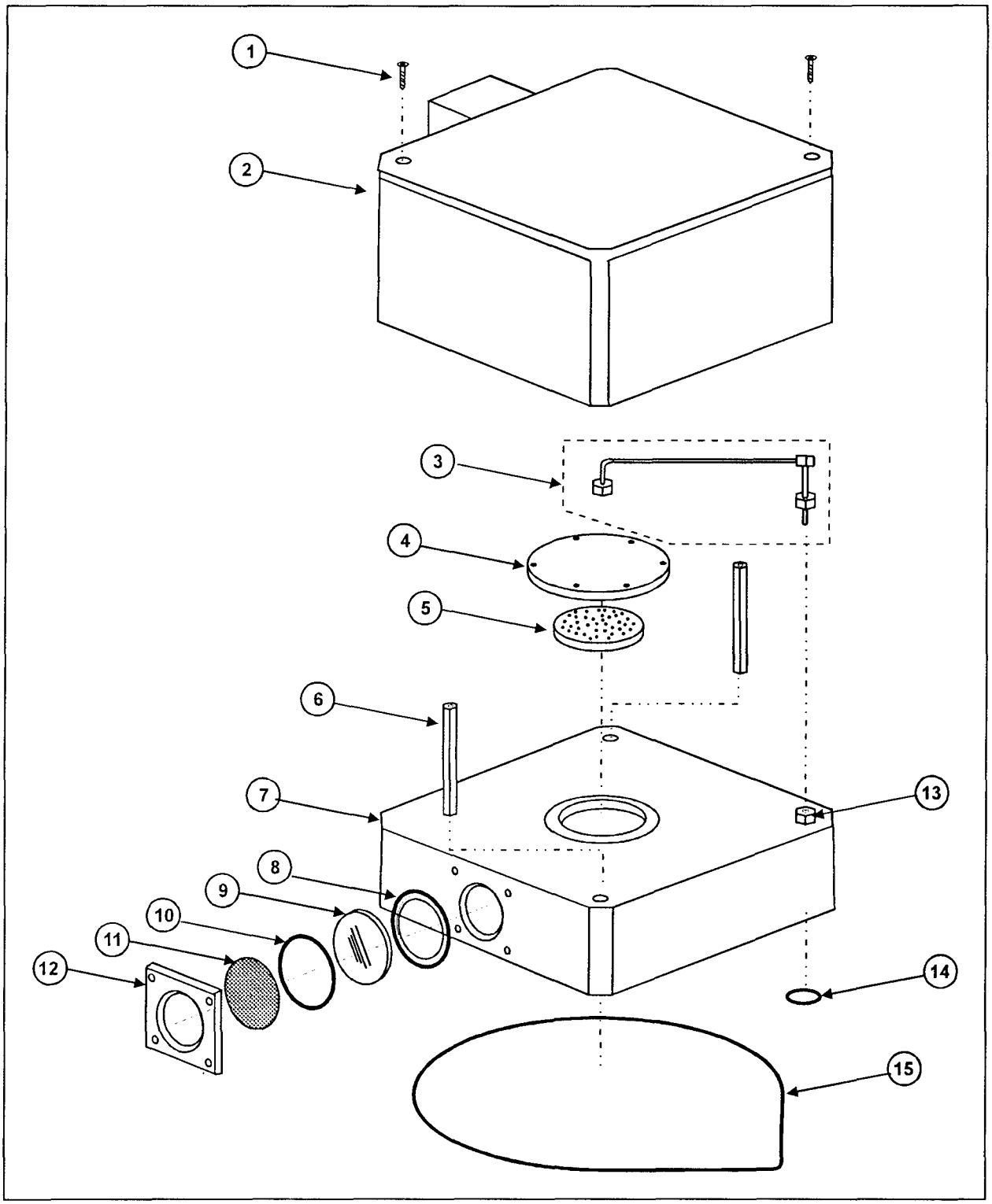

Diagram 10-14: RIE chamber top

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

Key to Diagram 10-14: RIE chamber top

1. Low profile cap and washer, and M5 x Pan Pozi screw
2. Chamber top cover (RIE)
3. RIE gas inlet kit
4. Gas inlet flange (RIE)
5. Gas distributor plate (RIE)
6. Pillar
7. Upper chamber (RIE) externally anodised
8. Centring ring
9. Window glass (6 mm Pyrex)
10. UV/RF filter
11. Window flange (anodised)
12. Window gasket
13. 9/16 'O' con. SS4 VCR100032
14. 3.5 x 20.2 mm O-ring BS211
15. 5.34 x 304.17 O-ring Vit BS 381

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

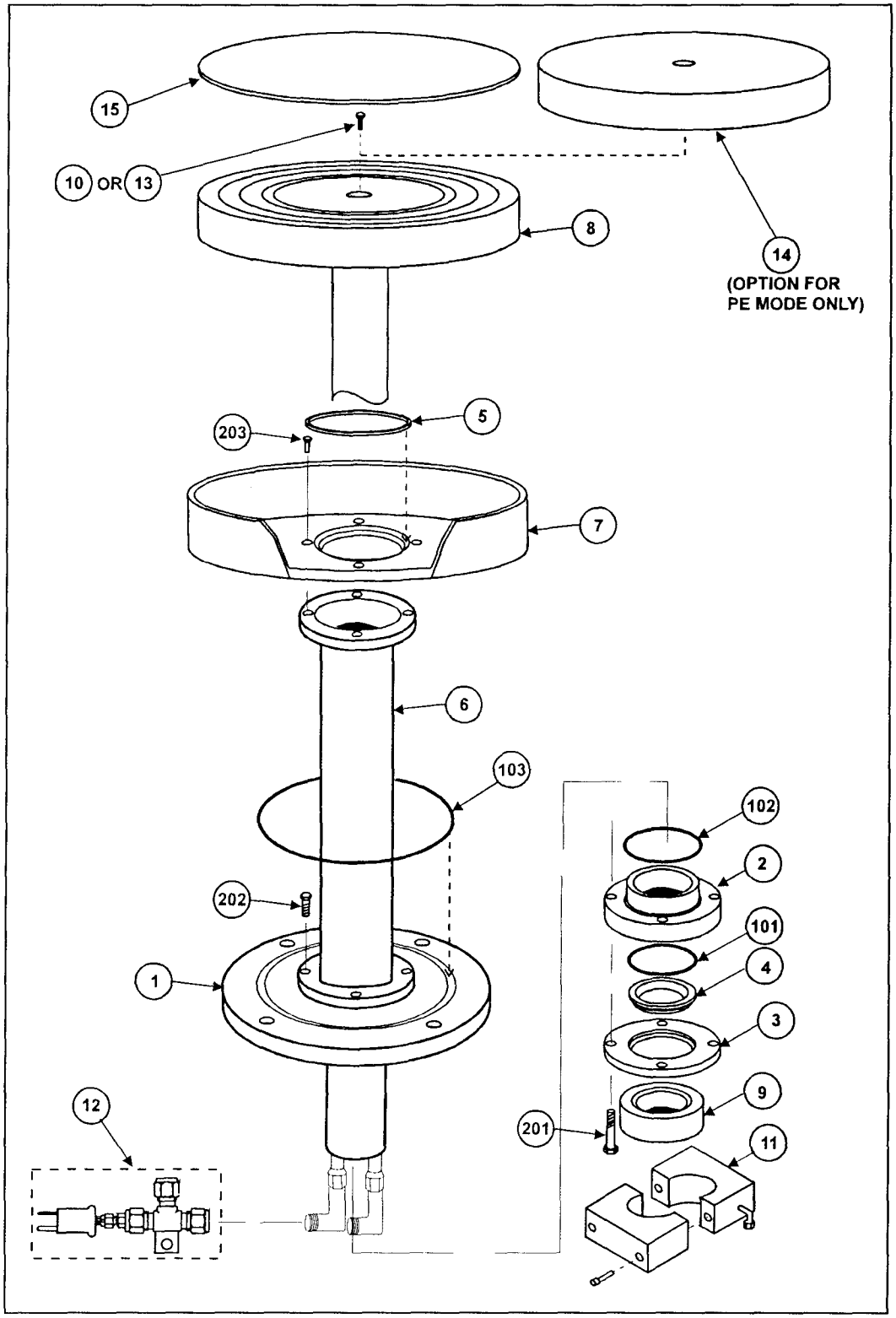

Diagram 10-15: RIE Lower Electrode (Table)

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

Key to Diagram 10-15: RIE Lower Electrode (Table)

1. Table mounting flange
2. Table feedthrough
3. Clamping flange
4. Compression ring
5. Isolator ring (RIE table)
6. Support tube dark space shield
7. Dark space shield
8. RIT table assembly (170 mm diameter)
9. Spacer
10. Threaded plug
11. Water cooled clamp
12. Thermocouple assembly
13. Location spigot

101. 3.5 x 47.6 Viton O-ring BS829
102. 2.6 x 66.3 Viton O-ring BS146
103. 5.34 mm x 158.12 mm Viton O-ring BS 362
201. M6 x 30 mm S/S caphead screw
202. M6 x 16 mm S/S caphead screw
203. M5 x 16 mm S/S csk hd screw

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

10.7 Electrical schematic and production drawings

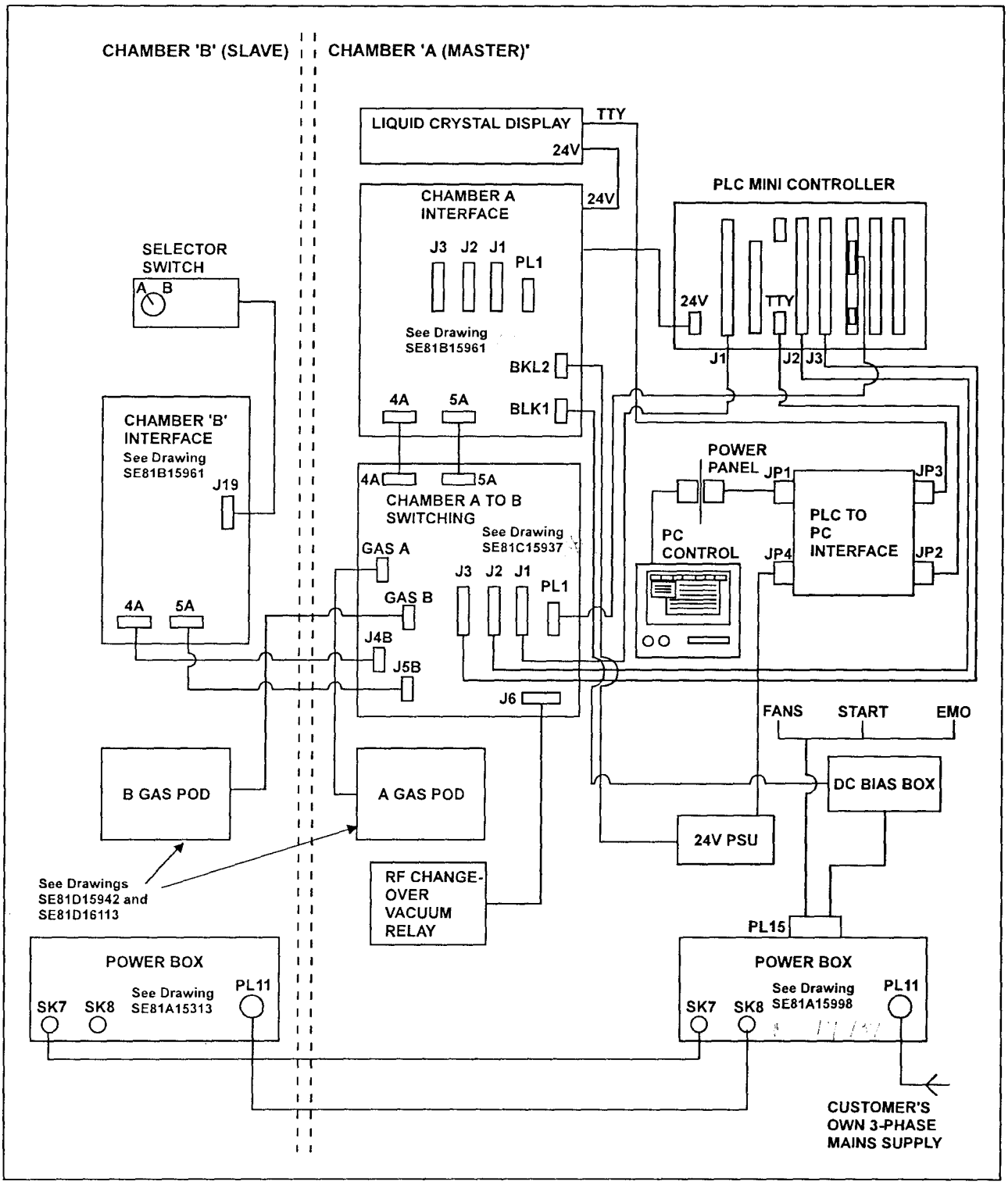

Diagram 10-16: Electrical Schematic 80 Plus (PLC version)

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

Production Drawings

1. SE 81 A 15998 80 Plus Power Dist, and Control (PLC)
2. SE 81 A 15313 80+ Power Box Chamber B
3. SE 81 B 15961 PLC Interface PCB Chamber A or B
4. SE 81 C 15937 Switching PCB Sheet 1
   Sheet 2
5. SE 80 D 15978 PCB for Analogue Boards
6. SE 81 D 16073 Sheet 1 RS 232 to Current Loop Converter
   Sheet 2 ENI Generator Amp. Board 300/500 Watts
7. SE 81 B 15997 Internal Wiring Sheet 1
   Sheet 2
   Sheet 3
   Sheet 4
8. SE 81 D 16113 PLC Gas Pod Looms
9. SE 81 D 15942 PLC Gas Pod PCB
10. MA81B15025 RIE Table/DSS Assy (0240)
11. MA81B15085 Table assy 400°C DP
12. MA81B15275 Hoist Assy
13. MA81C15394 80 Plus earth bonding layout
14. MA81C15398 Thermocouple assy.
15. MA81B15026 RIE Table/DSS Assy.
16. MA81A17329 Assy. of cryo. table into 80 Plus frame.
17. SV81B16135 Gas Pod schematic.
18. MA81A17528 80 Plus DP Biasable Table.

WARNING

BEFORE CARRYING OUT ANY MAINTENANCE, ENSURE THAT SECTION 1 HEALTH AND SAFETY HAS BEEN READ AND UNDERSTOOD.

19. SE81B15294 80 Plus Chamber B internal looms.

20. SE81C 1751 N_2/Cryo Heated Table.

21. SE 00D 17851 Internal Gas Line PCB (MFCs mounted inside the console) Rev 01 17 Nov 1994.

Appendix A Measurement of radio frequency and microwave emissions

Appendix A Measurement of radio frequency and microwave emissions

WARNING

THIS APPENDIX COVERS ALL OF THE CURRENT REQUIREMENTS FOR THE MEASUREMENT OF RADIO FREQUENCY AND MICROWAVE EMISSIONS FOR THE OXFORD INSTRUMENTS PLASMA TECHNOLOGY'S RANGE OF PRODUCTS. ENSURE THAT THE ENTIRE APPENDIX IS READ AND UNDERSTOOD BY ALL INVOLVED PERSONNEL AND THAT THE TESTS RELEVANT TO THE INSTALLED SYSTEM ARE CARRIED OUT AT THE SPECIFIED PERIODICITY.

Scope of testing

Systems which contain RF generators, both Ion Beam and Plasma systems will be tested for the emission of energy prior to shipment. They will also be tested routinely every three months during use, or as required by safety standards at the customer's site, if this is more frequent.

Systems must also be tested after maintenance, if the maintenance has involved RF shielding components such as covers and viewports, or components in the process chamber such as feedthroughs and vacuum gauges.

Systems with RF generators in the frequency range of 0.1 MHz to 27.12 MHz must be tested for emissions by measuring separately both the electric (E) and magnetic (H) field strengths. Either field can be a safety hazard, hence the need to test both.

Systems with microwave frequency generators at 2.45 GHz will only be tested for power, usually by measuring the electric (E) field.

Method of testing

Suitable test meters are the Narda[1] 8512 for 13.56 MHz and 27.12 MHz, and the Holaday[2] 1501 for 2.45 GHz. Equivalent meters from other vendors are acceptable. The test meter MUST have a current calibration certificate. Note that if an alternative meter is used, it should be able to detect the presence of 27.12 MHz as well as13.56 MHz.

[1]The Narda Microwave Corporation, Plainview, New York 11803.
[2]Holaday Industries Inc, 14825 Martin Drive, Eden Prairie, MN 55344.

Testing must be performed on the system in its normal operating configuration, with the usual covers and components in place. The system must be operating at maximum reasonable power, and must be tested both in the presence and the absence of plasma.

The field strength must be measured 50 mm (2 inches) away from the system, at all points that can be reached by hand with the probe (If parts of the system are inaccessible from the ground, a stepladder must be used). The probes of the above meters are designed so that the correct distance is obtained if the head of the probe is touching the system.

Particular attention must be given to viewports, doors and flanges, the automatch unit, and the whole length of waveguides and RF power cables. If viewports are fitted with shutters, then tests must be made with the shutter both open and shut. All cables leaving gauges and other feedthroughs in the process chamber and the pumping system are suspect, and must be checked along their entire length. The pumping system and any separate system racks and power box must also be checked.

It is strongly recommended that the operation of all safety interlocks should be tested at the same time, whenever an RF or Microwave leakage test is performed.

Acceptable exposure standards

Readings must be equal to or less than the levels shown in Table 1 at all points. Exceptions will only be permitted in certain special circumstances. These exceptions will be clearly documented in the system instructions. In all other situations, these standards must be strictly met.

Frequency	Electric Field (E)		Magnetic field (H)	
	V/m	mW/cm^2	A/m	mW/cm^2
0.1 to 1 MHz	614		1.6/f	
13.56 MHz and 27.12 MHz	61	1	0.16	1
2.45 GHz	137	2.5	0.36	2.5

Table 1 - Maximum permitted field strengths

System design

RF and Microwave components such as RF ion sources may be purchased from Oxford Instruments Plasma Technology and fitted to the customer's system. Such an installation requires a system designed to prevent leakage of RF and Microwave emissions, and requires careful testing by the installer before use.

It is not possible to give a full list of necessary safety precautions, and advice should be sought from a competent authority. However, some of the points to be considered are as follows:

(a) The system and all of its assemblies should be very well grounded (earthed), using low impedance straps, and ensuring impedances between power supplies and the chamber of < 0.1 Ohms at 25 A.

(b) Viewports should be shielded with fine conducting mesh to prevent the transmission of RF and Microwave energy, and should be filtered to prevent the transmission of UV light.

(c) Doors and flanges should provide metal-to-metal contact. In case of doubt, and in the case of access doors, the use of copper beryllium finger strips or wire mesh over elastomer core (e.g. Zemrex products from Warth International[3] should be considered. Small flanges in the vacuum system should be joined with metal clamps, not plastic.

(d) All types of electrical feedthrough and vacuum gauges, together with cables leaving them, may need shielding.

(e) Interlocks will need to be wired into the system to ensure safe operation. These will include interlocks with the system access door, the customer's water supply to the RF product, and the system vacuum. The product purchased from Oxford Instruments Plasma Technology will also have interlock switches. These interlocks must all force the disconnection of power from the RF, Microwave and HV power supplies if they are opened. See the product manual for more details.

[3]Warth International Ltd, Charlswood Road, East Grinstead, Sussex, England, RH19 2HH.

Appendix B Operation and maintenance of turbomolecular pumps

WARNING

BEFORE PROCEEDING WITH ANY MAINTENANCE WORK, READ HEALTH AND SAFETY AT THE BEGINNING OF THIS MANUAL.

Appendix B Operation and maintenance of turbomolecular pumps

Please note that premature failure of Turbomolecular Pumps can be caused by failing to observe the following recommendations:

a) Always follow the maintenance and operating instructions contained in the manufacturers' manuals, copies of which are provided within the system manuals. Note that with some types of pump the lubricant should be replaced when the total running time reaches 500 hours.

b) When corrosive process gases are being used always purge the turbo pump with dry nitrogen during a processing run. If the process chamber is to be vented adequate time must first be allowed for the process gases to be pumped away.

c) If corrosive process gases are used in a system with **no gate valve** between the turbo pump and the process chamber and the system is to be left for more than one hour with the turbo pump not running, proceed as follows:

1. Turn off all the manual gas taps on the process gas lines. Also turn off the gas taps on the process gas cylinders.

2. Close the chamber door.

3. Pump the process chamber and turbo pump down to approximately 1×10^{-4} millibars.

4. Vent the process chamber and turbo pump to atmospheric pressure with dry nitrogen. Do not allow the chamber door to open.

5. Repeat Steps 3 and 4 three times.

6. Seal the process chamber and turbo pump.

WARNING

BEFORE PROCEEDING WITH ANY MAINTENANCE WORK, READ HEALTH AND SAFETY AT THE BEGINNING OF THIS MANUAL.

d) If corrosive process gases are used in a system **with a gate valve** between the turbo pump and the process chamber and the system is to be left for more than one hour with the turbo pump not running, proceed as follows:

1. With the exception of the Argon and Nitrogen lines, turn off all the manual gas taps on the process gas lines and also turn off the gas taps on the process gas cylinders.

2. Close the chamber door.

3. Run a 'process' sequence (without any samples loaded) using only Argon or Nitrogen as process gases for at least 10 minutes.

4. Vent the process chamber and vent the turbo pump to atmospheric pressure with dry nitrogen. Do not allow the chamber door to open.

5. Pump the process chamber and the turbo pump down to 1×10^{-4} millibars and then vent them with dry nitrogen.

6. Repeat Step 5 three times.

7. Seal the process chamber and the turbo pump.

Appendix B Operation and maintenance of turbomolecular pumps

WARNING

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c) If corrosive process gases are used in a system with **no gate valve** between the turbo pump and the process chamber and the system is to be left for more than one hour with the turbo pump not running, proceed as follows:

1. Turn off all the manual gas taps on the process gas lines. Also turn off the gas taps on the process gas cylinders.

2. Close the chamber door.

3. Pump the process chamber and turbo pump down to approximately 1×10^{-4} millibars.

4. Vent the process chamber and turbo pump to atmospheric pressure with dry nitrogen. Do not allow the chamber door to open.

5. Repeat Steps 3 and 4 three times.

6. Seal the process chamber and turbo pump.

WARNING

BEFORE PROCEEDING WITH ANY MAINTENANCE WORK, READ HEALTH AND SAFETY AT THE BEGINNING OF THIS MANUAL.

d) If corrosive process gases are used in a system **with a gate valve** between the turbo pump and the process chamber and the system is to be left for more than one hour with the turbo pump not running, proceed as follows:

1. With the exception of the Argon and Nitrogen lines, turn off all the manual gas taps on the process gas lines and also turn off the gas taps on the process gas cylinders.

2. Close the chamber door.

3. Run a 'process' sequence (without any samples loaded) using only Argon or Nitrogen as process gases for at least 10 minutes.

4. Vent the process chamber and vent the turbo pump to atmospheric pressure with dry nitrogen. Do not allow the chamber door to open.

5. Pump the process chamber and the turbo pump down to 1×10^{-4} millibars and then vent them with dry nitrogen.

6. Repeat Step 5 three times.

7. Seal the process chamber and the turbo pump.

Services Specifications

for

Plasmalab and *Ionfab*

Systems

OXFORD

Oxford Instruments
Plasma Technology

Issue 3 : August 1996
Printed 5 October, 1996 09:47

CONTENTS

DIAGRAMS

1. Introduction

This document gives the specifications of the services required for the ***Plasmalab*** and ***Ionfab*** systems. For details of cooling flow rates and electrical supply ratings, see the relevant system installation data sheets.

Customers must ensure that the services as specified are available at the time of delivery to reduce system commissioning time and potential problems.

Unless other arrangements have been made in writing with Plasma Technology, it is a requirement that services meet the following specifications. If they do not meet these specifications then the system warranty and process guarantees may be made invalid.

If you suspect that you may fail to meet ANY of these specifications, please contact Oxford Plasma Technology immediately so that we can discuss the problem with you.

Oxford Plasma Technology conducts a programme of continual product development, and reserves the right to change the design and/or specification of equipment without notice. The details contained in this document were correct at the time of printing but should be confirmed immediately prior to delivery.

WARNING

BEFORE INSTALLING THE SERVICES REQUIRED FOR OXFORD PLASMA TECHNOLOGY SYSTEMS, ENSURE THAT ALL RELEVANT ASPECTS OF HEALTH AND SAFETY ARE FULLY UNDERSTOOD.

HEALTH AND SAFETY GUIDANCE AND INSTRUCTIONS ARE GIVEN IN SECTION 1 OF ALL OUR SYSTEM USER MANUALS. THIS DOCUMENT IS AVAILABLE IN ENGLISH, FRENCH, GERMAN AND JAPANESE.

2. Cooling / Warming water

There are two acceptable methods of applying cooling / warming water to an Oxford Plasma Technology system:

Recirculation

Water is pumped through the system by a dedicated *heater / chiller or heat exchanger. After passing through the system, the temperature of the water is adjusted before recirculating through the system.

* Many customers have a water recirculation facility shared by several systems. This shared facility seldom provides water of suitable quality, and so cannot usually be used for cooling any part of the Oxford Plasma Technology system without the use of a heat exchanger dedicated to the Oxford Plasma Technology system.

Total Loss Cooling Municipal (drinking quality) water is applied to the system from a mains supply, passed through the system to cool it, then fed to a drain for disposal.

Water failing to meet the recirculation or total loss cooling specifications must not be put into the system without close consultation with Oxford Plasma Technology.

In some circumstances, it may be appropriate to use a combination of recirculation cooling and total loss cooling in one system.

It is recommended that the customer uses a dedicated heater/chiller either for the whole system, or at least for the critical components. Note that chillers which cool only can give problems with condensation on chamber components in some environments. This is a particularly important consideration for production systems of the batch-load type. In severe cases they can produce sufficient condensation to damage components such as RF power supplies, ferrofluidic seals and automatch units. Any damage so caused cannot be covered by the system warranty.

Note that if a heater-chiller is used to provide warm water (above 30^{o} C) for heated parts of the system, then items such as the turbopump will need an independent water supply.

Items such as turbopumps can be cooled with total loss cooling, if this is more convenient, and if the water is suitable. If the water is not suitable, then a heat exchanger may be necessary.

2.1 Recirculation water

WARNING

CHILLERS HAVE COMPONENTS WHICH BECOME COLD ENOUGH TO CAUSE SERIOUS INJURY. READ THE MANUFACTURER'S MANUALS BEFORE INSTALLING, OPERATING OR MAINTAINING CHILLERS, AND ENSURE THAT ADEQUATE PROTECTIVE CLOTHING IS WORN.

Recirculation water is used in systems where the user does not wish to consume water at a high rate, or where it is wished to supply water to the system at a constant temperature. This is best achieved by means of a dedicated chiller or heat exchanger attached to the system. Water which is being recirculated MUST have an inhibitor added to prevent corrosion, as such water will inevitably collect corrosive chemicals, and be lacking in the oxygen which protects stainless steel. The installation and water quality must be to the exact specifications listed in sub-section 2.1.1. The recommended basic recirculation installation is shown in Diagram 2-1, note that the total water flow meter and isolation valves are recommended for cooling monitoring and ease of maintenance respectively.

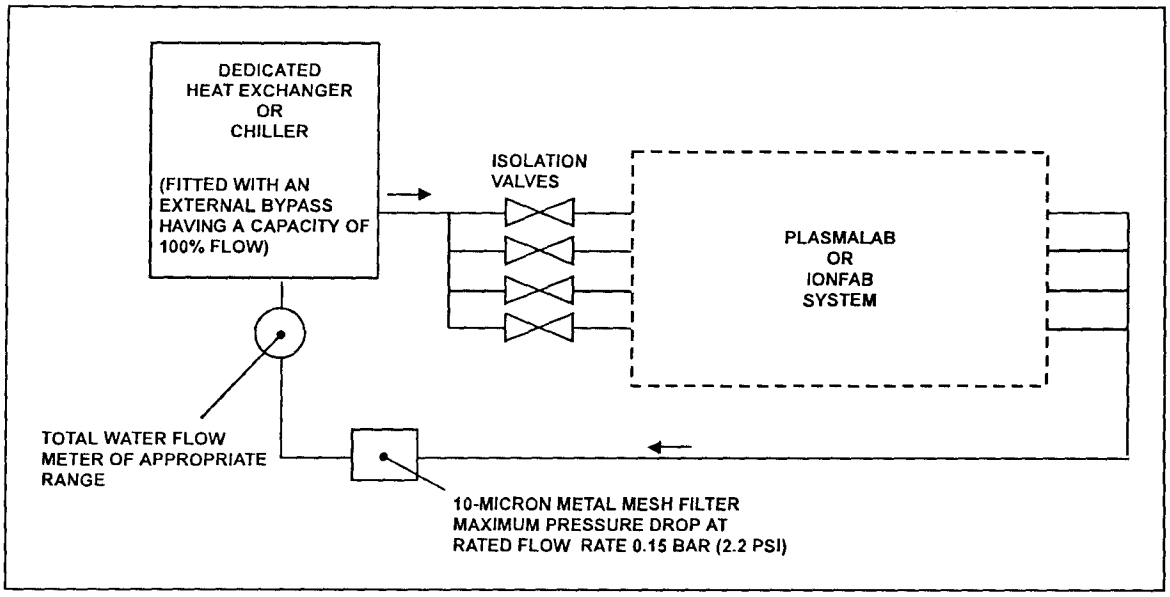

Diagram 2-1: Recommended basic recirculation installation

2.1.1 Mandatory Specifications for recirculated water systems

The water must be kept warm enough to prevent condensation on chamber surfaces and outside system components. This applies to those parts of the system inside the clean room and those parts in a service area. Condensation can damage components such as RF power supplies, ferrofluidic seals and automatch units. Any damage so caused cannot be covered by the system warranty.

Pressure:	**Adjustable 0.7 to 4.2 bar (10 to 60 psi). Chiller / heat exchanger to be fitted with a bypass having a capacity of 100% of rated flow.**
Temperature range	**See system installation data sheets.**
Minimum flows	**See system installation data sheets.**
Cooling capacity	**See system installation data sheets.**
Water:	**Deionised or distilled.**
Inhibitor:	**Protex (Oxford Plasma Technology Part No. for a 400 ml bottle: TGZ0007). Follow inhibitor manufacturer's instructions for concentration and renewal. Typically 200 ml for a heater/chiller dedicated to the system.**
Filtration:	**10 micron metal mesh water filter. Maximum pressure drop 0.15 bar (2.2 psi) at rated flow. For example filter element Balston SMC-100-12-10.**

2.2 Total Loss Cooling

Municipal (drinking) water may be used in total loss cooling of the system in situations where clean water is freely available, but only if the water meets the specification in sub-section 2.2.1. In case of any doubt, obtain the water specification from the water utility company, and consult with Oxford Plasma Technology. It is not practical to use total loss cooling where the water temperature is critical.

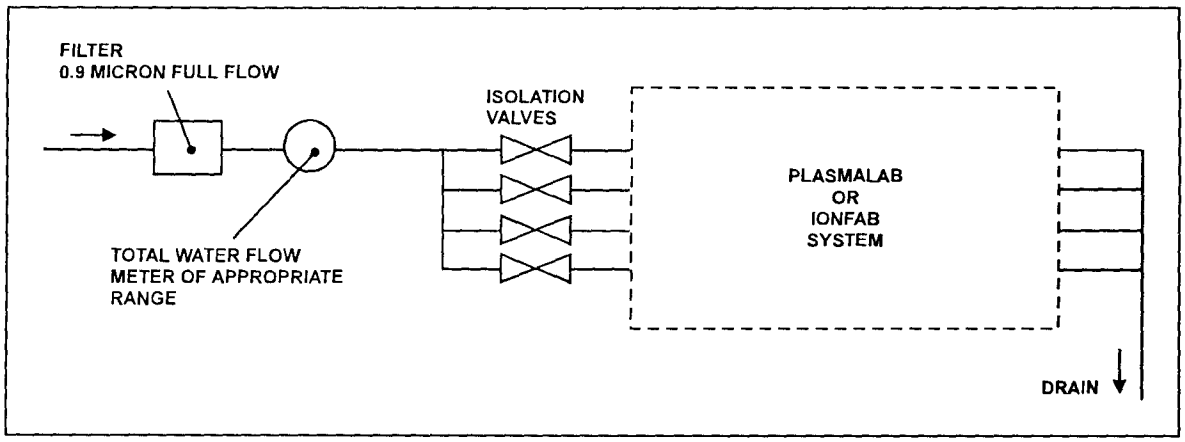

Diagram 2-2: Recommended basic total loss installation

2.2.1 Mandatory Specifications for total loss cooling systems

If total loss cooling with municipal water (drinking quality water) is used in the system or in the pumps, the water quality must meet the following specifications. Note that increased maintenance will be required if this water is used directly in the system as well as in the pumps.

The water must be kept warm enough to prevent condensation on chamber surfaces and outside system components. This applies to those parts of the system inside the clean room and those parts in a service area. Condensation can damage components such as RF power supplies, ferrofluidic seals and automatch units. Any damage so caused cannot be covered by the system warranty.

• **Pressure:**	**4 to 5 bar. Back-pressure from the drain must be less than 1 bar.**
• **Temperature:**	**10°C to 25°C**
• **pH:**	**7 to 8**
• **Oxygen:**	**greater than 4mg/litre**
• **CO_2 and NH_3:**	**less than 10mg/litre**
• **Chloride:**	**less than 100mg/litre**
• **Calcium Carbonate:**	**less than 75mg/litre**
• **Filtration:**	**to 0.9 micron full flow, for example filter element Balston 200-50-50 or 200-95-50.**

3. *Electrical supply*

Classification: For European Community customers who need this information: The systems are classified as Class A, Group 2 as defined in EN 55011 Clause 4.

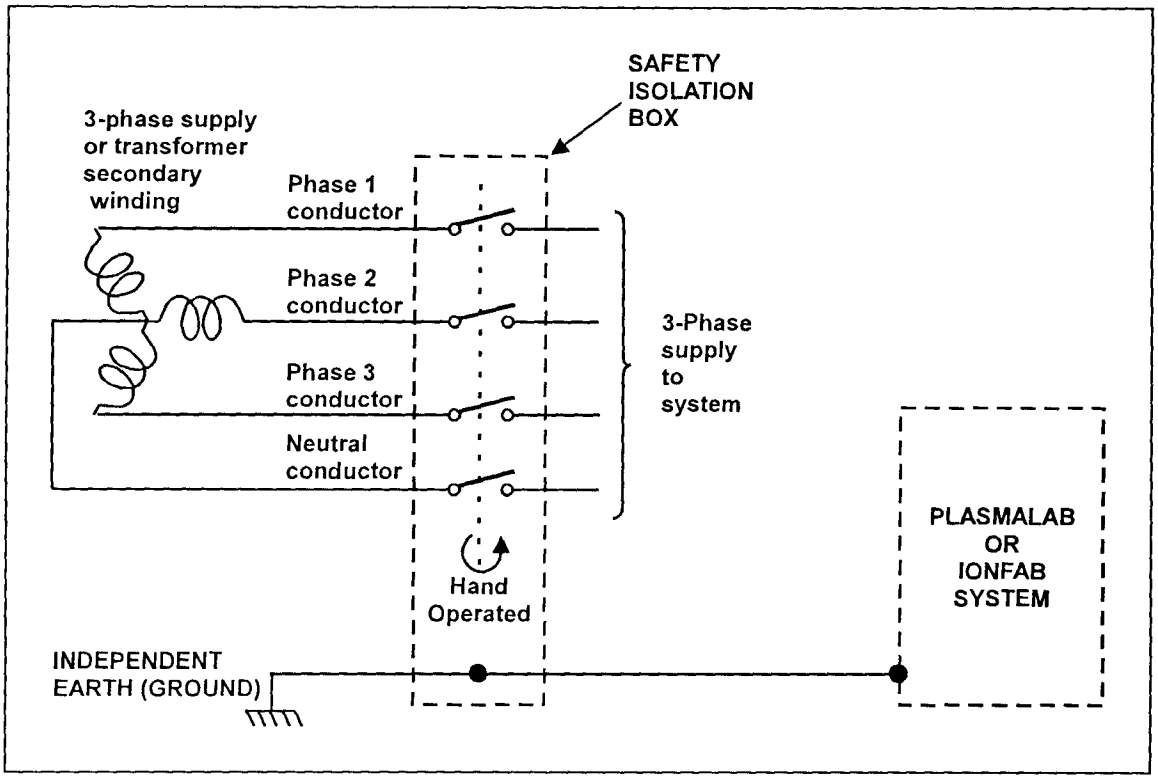

Diagram 3-1: Recommended electrical installation

3.1 *Mandatory Specifications for electrical installations*

• Connection:	In accordance with local regulations via a safety isolation box mounted adjacent to the machine.
• Configuration:	3-phase, star ("Y") with a neutral supply connected to the centre point. An independent earth (ground) is required.
• Maximum Current:	The Maximum Current required by the system is given in the relevant system installation data sheets.
• Voltage & Frequency:	380 -10% to 415V +6% or 208V +/-10% phase-to-phase. Frequency to be 50Hz or 60Hz. Note that voltage and frequency cannot be changed from the values specified at the time of ordering.
• Safety Earthing:	All conducting system components, e.g. chamber, gas pod, equipment racks etc. must be bonded to the main system earth. The earth conductors from all electrically powered equipment, e.g. pumps, RF generators etc. must also be bonded to the main system earth. The system safety earthing must be in accordance with local Electrical Regulations. See Diagram 3-1.

4. Compressed air

A dry and clean compressed air supply at a **minimum pressure** of 6 bar (90 psig) must be fed to a customer-supplied air filter/mist separator/pressure regulator unit mounted adjacent to the machine. A suitable unit is supplied by SMC (part No. AC 2030); other units to the same specification can be used. **Maximum safe pressure** in the customer's feed to the regulator is determined by the regulator used (9.9 bar (148.5 psig) for the SMC unit).

The supply to the system must be monitored by a pressure gauge having a range of 0 to 10 bar (0 to 150 psi). The pressure regulator must be fitted with a stop to prevent a pressure greater than 6 bar from being supplied to the system. The pressure to be used will be set during commissioning of the system.

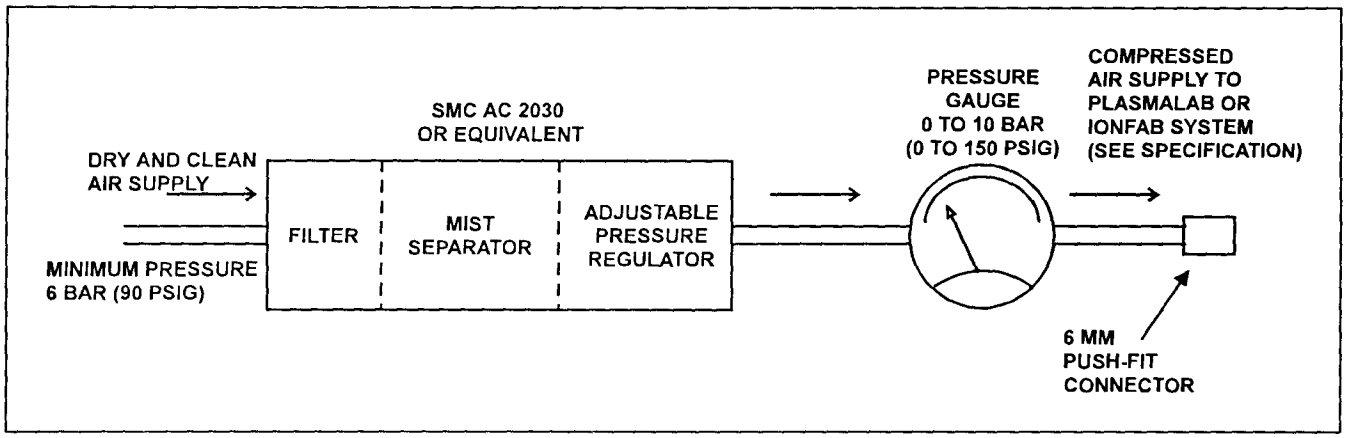

Diagram 4-1: Recommended compressed air supply installation

4.1 Mandatory Specifications for compressed air supplies

• Inlet pressure to filter/mist separator/regulator unit	6 bar (90 psig) minimum.
OUTLET TO SYSTEM:	
• Oil content:	less than 10 ppm
• Maximum Moisture Content:	-3°C (25°F)
• Filtration:	Maximum particle size of 0.3 microns
• Regulator outlet pressure:	Adjustable from 3 bar to 6 bar (45 psig to 90 psig). 6 bar must be the maximum provided.
• Maximum flow rate:	135 litres/minute (5 scfm).
• Pressure monitoring:	0 to 10 bar (0 to 150 psi) pressure gauge.

5. *Nitrogen*

Nitrogen is required to vent and purge process chambers, load locks and pumps.

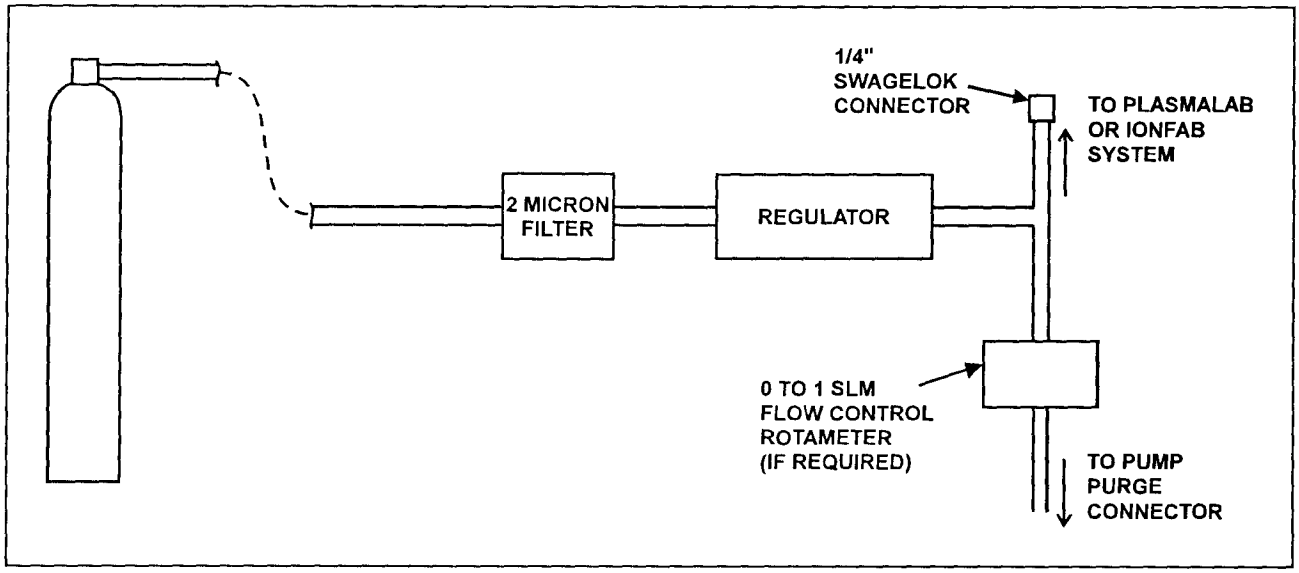

Diagram 5-1: Recommended nitrogen supply installation

Semiconductor grade fittings and pressure regulators, together with electropolished stainless steel tube must be used to ensure that gas quality is not degraded. Purges to turbo pumps are supplied by Oxford Plasma Technology as part of the system. The customer will usually need to fit a purge to the rotary pump. See below.

5.1 *Mandatory specifications for Nitrogen supplies*

• Pipework fittings and pressure regulators:	Semiconductor grade
• Gas handling tubing:	Electropolished stainless steel
• Purity:	At least 99.99% or higher to satisfy process requirements.
• Filtration:	2 micron filter mounted adjacent to the system.
• Regulation:	0.5 to 5 bar (7.5 to 75 psig)
• Minimum pressure at input to system:	3 bar (45 psig)
• Rotary pump purging	

It is the customer's responsibility to ensure that a rotary pump purge connection is fitted and used correctly. This is needed to ensure the protection of the pumping system from the customer's process, and may also be required by local safety regulations. Because customers' requirements vary, components are not supplied automatically by Oxford Plasma Technology. Kits of parts are available if required. Contact Oxford Plasma Technology for further information.

It may be safe to omit this feature on certain systems, such as Ionfab machines running inert gas processes. However, unless the customer has written agreement on this point from Oxford Plasma Technology, any damage caused by the omission cannot be covered by the system warranty.

6. Process gases

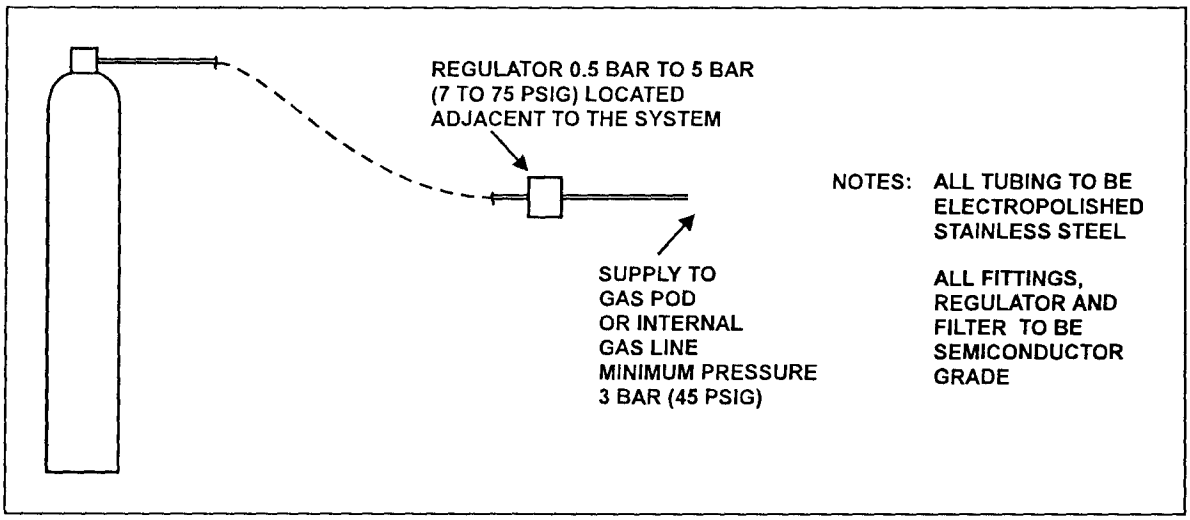

Diagram 6-1: Recommended process gas supply installation

Semiconductor grade fittings and pressure regulators, together with electropolished stainless steel tube must be used to ensure that gas quality is not degraded.

6.1 Mandatory specifications for process gas supplies

• Pipework fittings and pressure regulators:	Semiconductor grade
• Gas handling tubing:	Electropolished stainless steel
• Purity:	At least 99.99% or higher to satisfy process requirements.
• Filtration:	A 2-micron filter is fitted to each gas line supplied as part of the system. For other grades of filter, please consult Oxford Plasma Technology.
• Regulation:	0.5 to 5 bar (7.5 to 75 psig)
• Minimum pressure at input to system:	2 bar (30 psig)

7. Liquid Nitrogen

WARNING

IF LIQUID NITROGEN FACILITIES ARE NOT INSTALLED, OPERATED AND MAINTAINED CORRECTLY, DANGEROUS SITUATIONS CAN RESULT. THESE INTRODUCE RISKS OF:

A) HAZARDOUS PRESSURE BUILD-UP CAUSED BY THE BOIL-OFF OF LIQUID NITROGEN WHICH CAN RESULT IN AN EXPLOSION.

B) PERSONAL INJURY FROM TOUCHING PIPEWORK OR OTHER SYSTEM COMPONENTS CARRYING LIQUID NITROGEN. THIS RISK CAN REMAIN EVEN AFTER VENTING THE CHAMBER.

C) ASPHYXIATION CAUSED BY THE BOILED-OFF LIQUID NITROGEN REPLACING OXYGEN IN THE SYSTEM ENVIRONMENT.

7.1 Mandatory Requirements for Liquid Nitrogen systems

- Ensure that the Liquid Nitrogen installation is carried out in accordance with local safety regulations. This includes the following:

  (a) No part of the Liquid Nitrogen circuit can become blocked with ice or other contaminants.

  (b) Adequate precautions, e.g. pressure relief valves, are fitted to prevent hazardous pressure build-up from boil-off of the Liquid Nitrogen.

  (c) All system components carrying Liquid Nitrogen are adequately insulated, and covered to prevent personnel touching exposed components.

- Ensure that the installation is inspected by a Specialist to confirm that it is safe to use. Inspections must be carried out before the system is commissioned and at regular intervals throughout its life.

- Pipework from the Dewar to the system must be adequately insulated and connected to the system via a $^{3}/_{8}$" Swagelok connector.

8. Extraction

The following mandatory requirements describe the extraction systems recommended by Oxford Plasma Technology. While these recommendations may be regarded as "good practice" they are not a complete definition of the safety standards required when handling toxic, corrosive or otherwise hazardous gases. It is the customer's responsibility to ensure that the installation meets all relevant local safety regulations and Oxford Plasma Technology accepts no responsibility in this respect.

For detailed information about the safety aspects of gas handling and pumping systems, the customer should consult the relevant manufacturer/supplier of the gases and pumps to be used.

8.1 Mandatory requirements for Rotary Pump extraction

The installation must provide a rotary pump exhaust extraction system which matches the rotary pump exhaust and which conforms to local safety standards. In particular specialised equipment such as scrubbers and furnaces may be needed to dispose of hazardous gases. The routing of the pump exhaust line must be arranged so that condensates cannot flow back into the pump.

Note that there is a risk of damage from cross-contamination if rotary pumps share one exhaust system. This applies whether the pumps are on the same system or on different systems. Damage caused by any cross-contamination is not covered by the system warranty.

Care must be taken to route mutually incompatible exhaust gases through separate exhaust ducts. In particular, oxygen enriched exhaust gases should not be mixed with exhausts from mineral oil pumps, otherwise an explosion may occur.

8.2 Mandatory requirements for Gas Pod extraction

The gas pod must be connected to the customer's gas extraction system via a 100 mm diameter pipe collar to provide cabinet extraction with a minimum flow rate of 100 scfm. It is the customer's responsibility to ensure that the gas extraction system, including any necessary gas sensors, meets local safety regulations.

8.3 Mandatory requirements for System Cabinet extraction

The system cabinet, if of an extractable design, must be connected to the customer's laboratory extraction system via a 100 mm diameter pipe collar to provide cabinet extraction with a minimum flow rate of 100 scfm.

8.4 Mandatory requirements for Cryogenic pump extraction

WARNING

ANY CRYOGENIC PUMP WHICH PUMPS HAZARDOUS GASES MUST HAVE A VENT PIPE FITTED TO ITS RELIEF VALVE TO PREVENT THE RELEASE OF GAS INTO THE CLEAN ROOM.

THE PUMPS COLLECT THE PROCESS GASES AND THE GASEOUS RESIDUES DURING OPERATION. THESE GASES ARE RELEASED THROUGH THE RELIEF VALVE DURING PUMP REGENERATION OR IF ELECTRICAL POWER IS LOST.

If a cryogenic pump is used to pump toxic, corrosive, or flammable gases, a written action plan is required. This must be prepared in consultation with Oxford Plasma Technology and other competent bodies. Specialised equipment such as scrubbers and furnaces may be needed to dispose of hazardous gases.

If the pumped gases contain more than 20% oxygen, a vent pipe must be fitted to the cryogenic pump's relief valve. The vent pipe must be routed to a safe place outside of the clean room and conform to local safety standards. The routing of the vent pipe must be arranged so that condensates cannot flow back into the pump.

If a CTI cryogenic pump is used, the vent pipe will have an inside diameter of ½" and must be connected to the relief valve flange via an adapter. A suitable adapter is available from CTI (CTI P/N 8080250K008). Refer to the CTI manual for details.

If a cryogenic pump is used to pump gases containing more than 20% oxygen, the associated roughing pump(s) must be lubricated with a PFPE fluid, e.g. Fomblin or Krytox.

9. Environment

9.1 Mandatory Specifications for the system environment

• **Operating temperature:**	**5°C to 25°C.**
• **Storage temperature:**	**0°C to 50°C.**
• **Maximum humidity:**	**90% See NOTE 1.**
• **Minimum humidity:**	**10% See NOTE 2.**
• **Electrostatic build-up:**	**Low static environment. See NOTE 2.**

NOTE 1: High humidity will have a progressively significant effect on system performance. At humidity greater than 50%, the rate of chamber pump-down after venting the chamber will be affected significantly, and at humidity greater than 65%, the rate of chamber pump-down may not meet system specifications.

NOTE 2: Low humidity will introduce a risk of electrostatic build-up, with subsequent discharge to the system producing a malfunction or damage. The systems are tested to EN60801-2, severity level 3. We recommend the use of an environment which protects against electrostatic build-up, and extra precautions will be necessary at low humidity.

10. Oxford Plasma Technology locations world-wide

Visit us on the Internet - our URL is http://www.oxinst.com/pt/index.html

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Telex : 600105

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Fax : (0611) 764175
e-mail:101455,1566@compuserve.com

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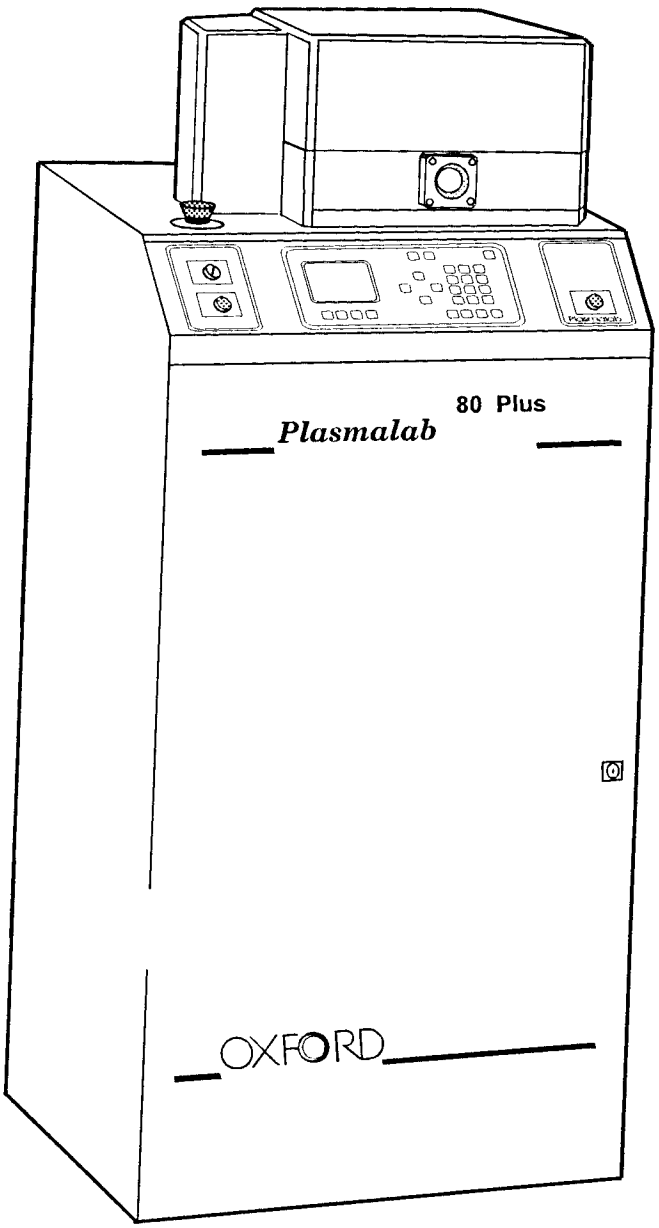
Chiyoda-Ku, Tokyo 102
Tel : (03) 3264 0551
Fax : (03) 3264 0393

Plasmalab 80 Plus

Installation data sheets



OXFORD

Oxford Instruments
Plasma Technology

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Contents

1. Introduction

These specification data sheets give information about the ***Plasmalab*** 80 Plus systems to enable customers to prepare the required environment for the system.

Note that all dimensions shown in these data sheets are typical; precise dimensions depend on the actual equipment fit. All dimensions are given in millimetres unless otherwise stated.

Oxford Plasma Technology conducts a programme of continual product development, and reserves the right to change the design and/or specification of equipment without notice. The details contained in this document were correct at the time of printing but should be confirmed immediately prior to delivery.

2. Installation diagrams

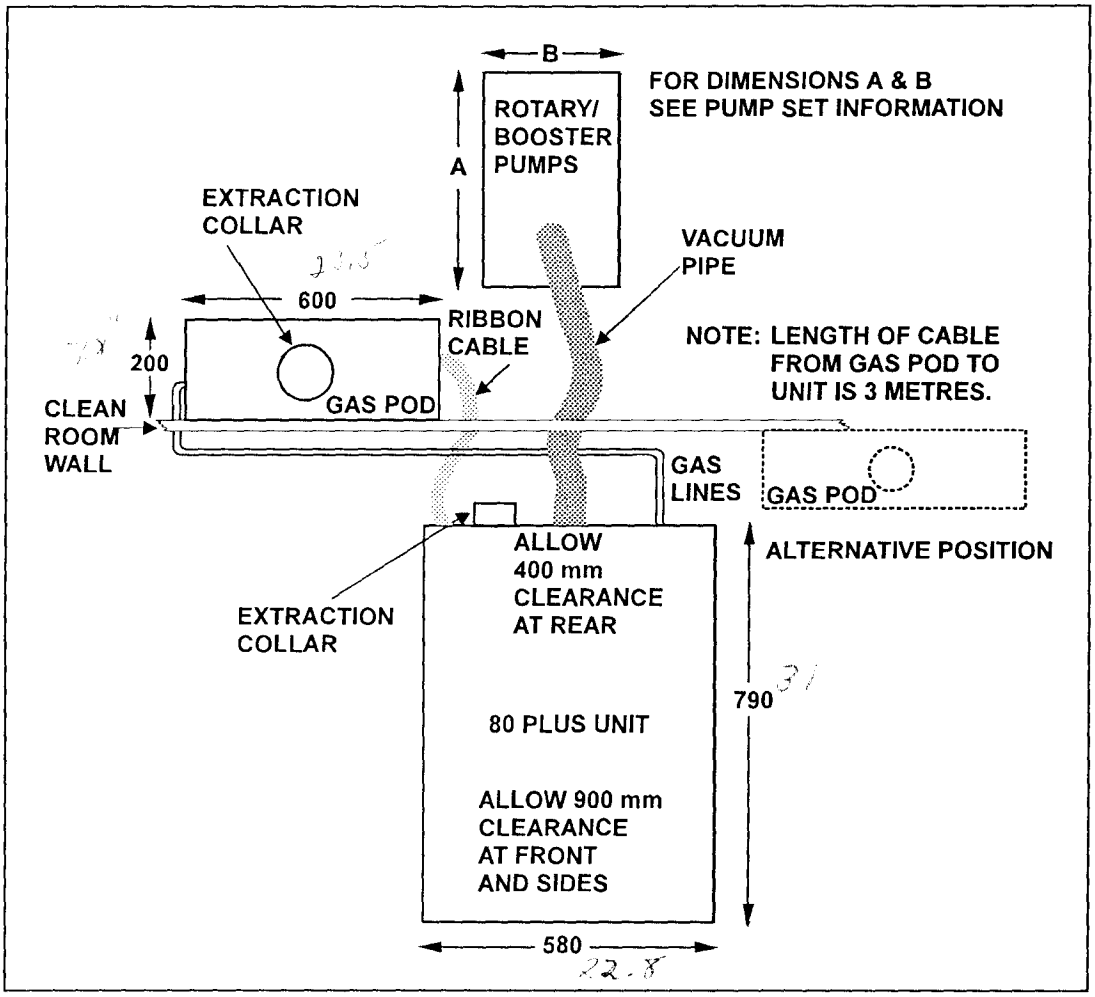

Diagram 2-1: System footprint

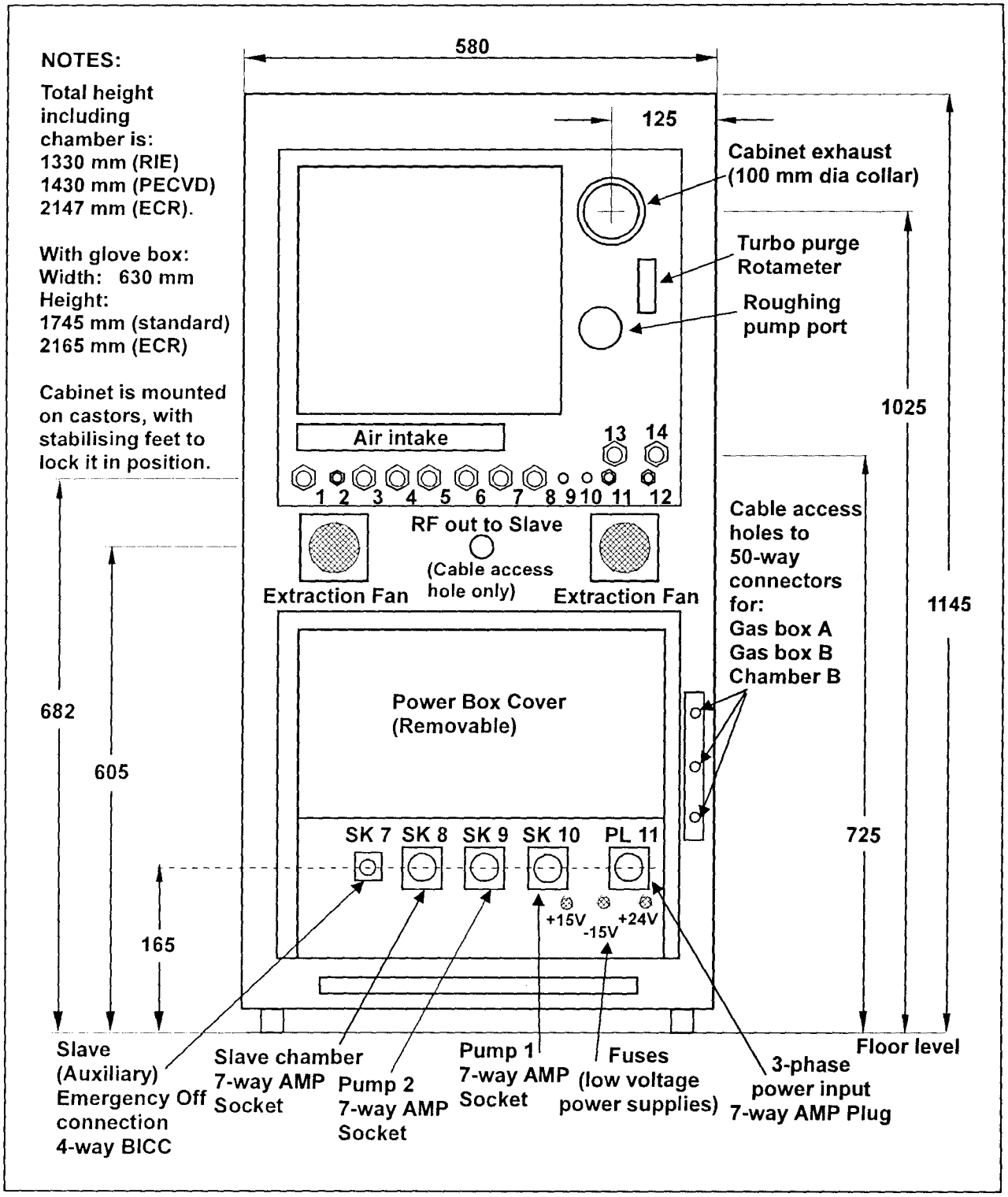

Diagram 2-2: Main unit - rear view

Use	Connection	Fitting
Process gas in from gas pod	1	¼" VCR (Male)
Vent nitrogen	2	¼" Swagelok
Water **IN** (table)	3	¼" Swagelok
Water **OUT** (table)	4	¼" Swagelok
Water **IN** (automatch unit if fitted)	5	¼" Swagelok
Water **OUT** (automatch unit if fitted)	6	¼" Swagelok
For optional equipment	7	¼" Swagelok
Process gas out to slave (if fitted)	8	¼" VCR (Male)
For optional equipment	9*	¼" Swagelok
For optional equipment	10*	¼" Swagelok
Compressed air **IN**	11	4 mm push fit
Compressed air **OUT**	12	4 mm push fit
Water **IN** (Turbo)	13	¼" or 3/8" Swagelok
Water **OUT** (Turbo)	14	¼" or 3/8" Swagelok
*Note that the Cryo Cooling table uses ½" Swagelok for connections 8 & 9.		

Table 1 - Service connections for use with an external Gas Pod

Connection	Use	Fitting
1	Not used	
2	Vent nitrogen	¼" Swagelok
3	Gas 1	¼" Swagelok
4	Gas 2	¼" Swagelok
5	Gas 3	¼" Swagelok
6	Gas 4	¼" Swagelok
7	Water **IN** (table)	¼" Swagelok
8	Water **OUT** (table)	¼" Swagelok
9	Water **IN** (automatch unit if fitted)	¼" Swagelok
10	Water **OUT** (automatch unit if fitted)	¼" Swagelok
11	Compressed air **IN**	4 mm push fit
12	Compressed air **OUT**	4 mm push fit
13	Water **IN** (Turbo)	¼" or 3/8" Swagelok
14	Water **OUT** (Turbo)	¼" or 3/8" Swagelok

Table 2 - Service Connections for use with internal gas lines

CAUTION

To prevent damage to Turbomolecular Pumps, ensure that:

(A) The maintenance and operating instructions given in the manufacturer's manuals are carried out, especially with regard to oil changes and bearing purging.

(B) The bearings are purged continuously whilst the pump is in operation. Purity of Nitrogen or inert gas used must be at least 99.9% or sufficient to satisfy process requirements.

(C) The system must be shut down according to the procedure given in Appendix B of the system Operation and Maintenance manual.

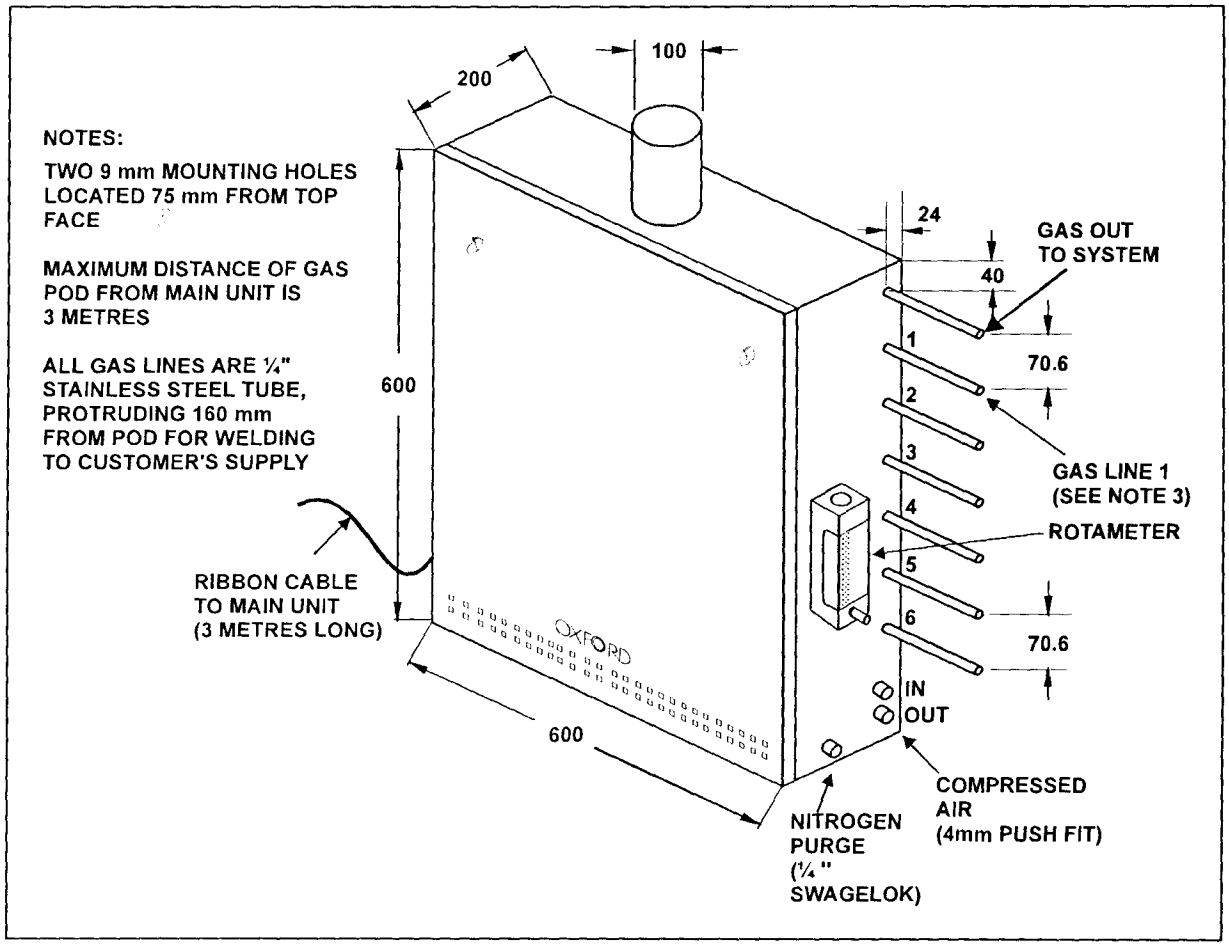

Diagram 2-3: 6-Line gas pod

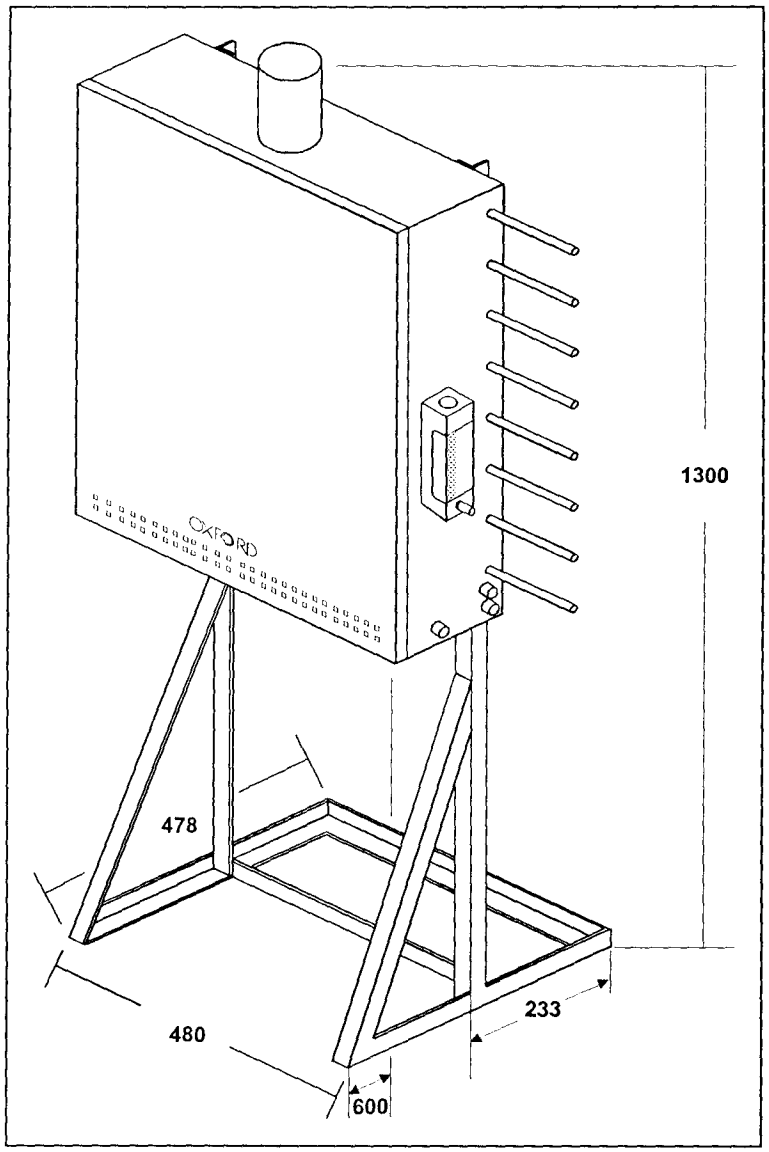

Diagram 2-4: 6-Line gas pod mounted on optional free-standing frame

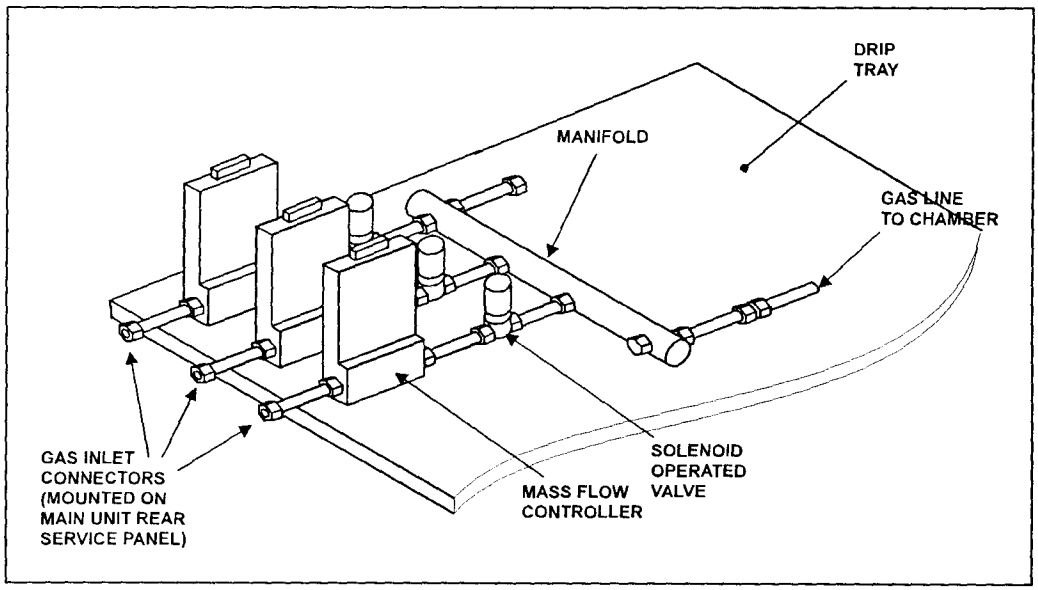

Diagram 2-5: Internal gas lines

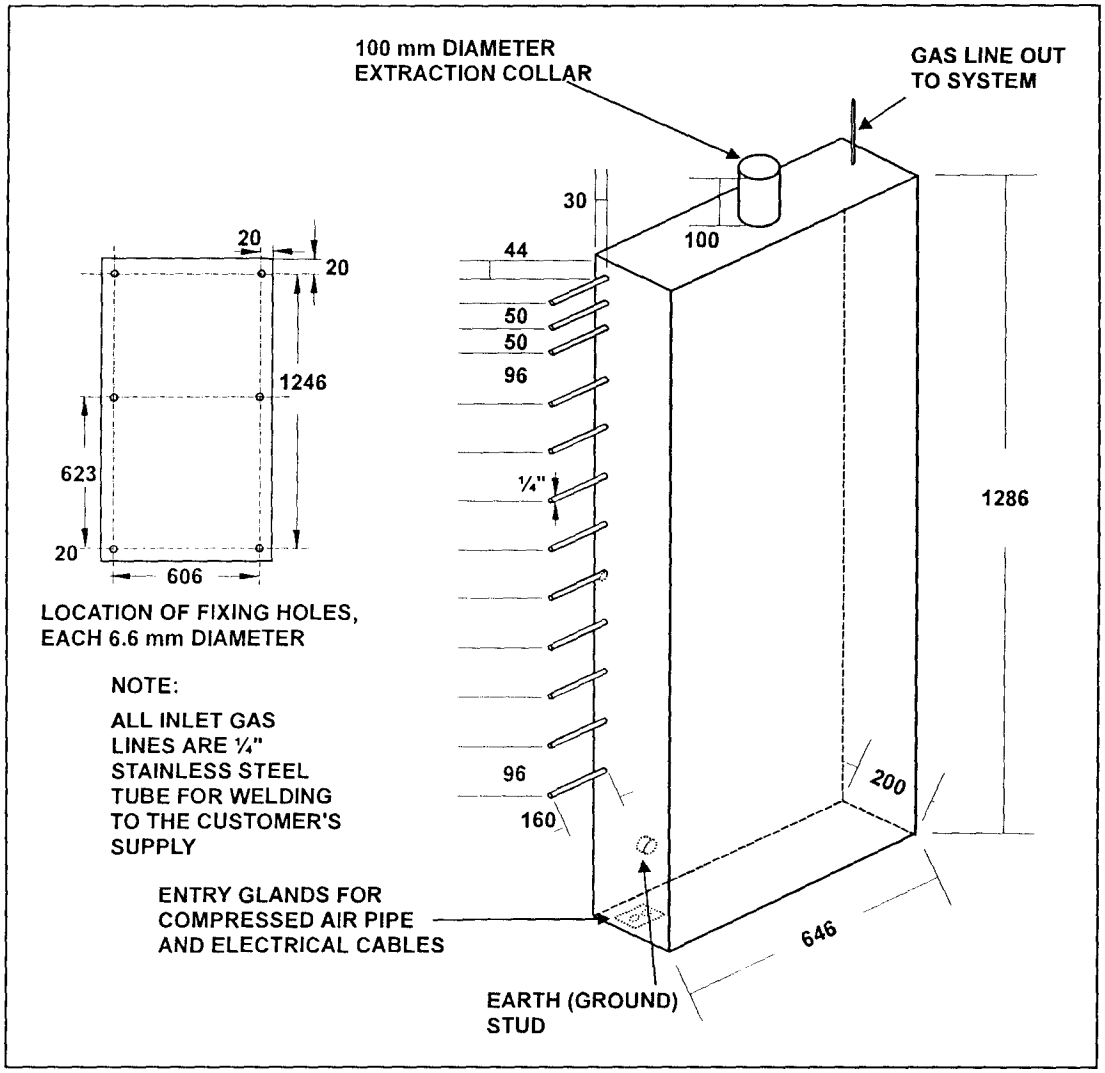

Diagram 2-6: 12-line gas pod

3. *Services*

The following table lists the relevant Mandatory Specifications headings* in the "Services Specifications for ***Plasmalab*** and ***Ionfab*** Systems" document. Water flow rates and electrical supply maximum current requirements are also given.

Service	*Mandatory Specifications Headings	*Plasmalab* 80 Plus requirements
Cooling / warming water	Recirculated water systems and/or Total loss cooling systems	Flow Rates: Chamber: 2 litres/minute minimum Water-cooled RF Generator: 4.5 litres/minute minimum ECR: 6 litres/minute minimum
Electrical Supply	Electrical installations	Peak Power: 25A /phase (415V systems) 50A /phase (208V systems) ECR systems require an additional 30A/phase (415V) or 60A/phase (208V)
Compressed air	Compressed air supplies	
Nitrogen	Nitrogen supplies	
Process gases	Process gas supplies	
Liquid Nitrogen	Liquid Nitrogen systems	
Extraction	Cabinet, Rotary pump and Gas pod	
Environment	System environment	

Table 3 - Services requirements

4. Pump set information

Available pump options	Length mm	Width mm	Height mm	Inlet connection	Outlet connection	Weight kg	Power consumption kW
D16 BCS	549	185	287	KF25	15mm O/D	36	0.75
D25 BCS	612	185	266	KF25	15mm O/D	40	0.90
D40 BCS	665	240	397	KF40	25mm flange	72	1.50
D65 BCS	795	266	430	KF40	25mm flange	105	3.00
WA 251 / D40 BCS	700	300	750	ISO63	25mm flange	133	3.00

5. *Oxford Plasma Technology locations world-wide*

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Oxford Instruments

Plasma Technology

Plasmalab 80 Plus

Illustrated Parts Catalogue

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Contents

Diagrams

Introduction

This Illustrated Parts Catalogue has been prepared to enable the rapid identification of components of the Oxford Plasma Technology ***Plasmalab*** 80 Plus machine.

The catalogue is not a comprehensive list of all machine components, for details of components not included, contact Oxford Plasma Technology (OPT).

Contact your local Oxford Plasma Technology representative for prices; see page 44 of this catalogue for addresses and phone/fax numbers.

The catalogue is divided into two sections:

Section 1 Illustrated Parts Lists giving parts details of the machine's major components and systems. Each Illustrated Parts List comprises a diagram and an associated table of parts.

Section 2 Spare Parts Kits. These are standard spares kits recommended by OPT to enable customers to hold an appropriate stock of spares for scheduled maintenance and repair. For further details, see page 37.

NOTES:

1. Illustrated Parts Lists

Using the Parts Lists

To identify a component:

1. Locate the appropriate section from the contents list.

2. Find the required component on the relevant diagram and note its item number (see note (d) below).

4. Refer to the associated parts list table and find the item number.

5. Note the OPT part number and description.

6. Telephone or fax the part number and description to your local OPT sales office or representative who can quickly locate the part on the spares database. See the last page of this catalogue for OPT locations world-wide.

NOTES:

(a) Where possible, the item number used in the diagrams is the same as that quoted on the OPT Bill of Materials for the assembly. However, in some cases this has not been possible as more than one assembly may be shown in a diagram.

(b) Where an item number appears more than once in a parts list table, this indicates component options: identify the component from the actual machine before selecting the correct option.

(c) Items identified as 'NONE' in the parts list tables are not shown in the diagrams, but their OPT Part Numbers and descriptions are listed to enable identification.

(d) Printed Circuit Boards (PCBs) illustrated within this catalogue are assembled boards which include all integrated circuits and other components. To ensure the correct assembled board is supplied, read the PC number stamped on the PCB. This will read PC81..... ..... Check this with the OPT spares department or include the number with your order.

1.1 RIE machine

1.1.1 Master base unit with SMART controller

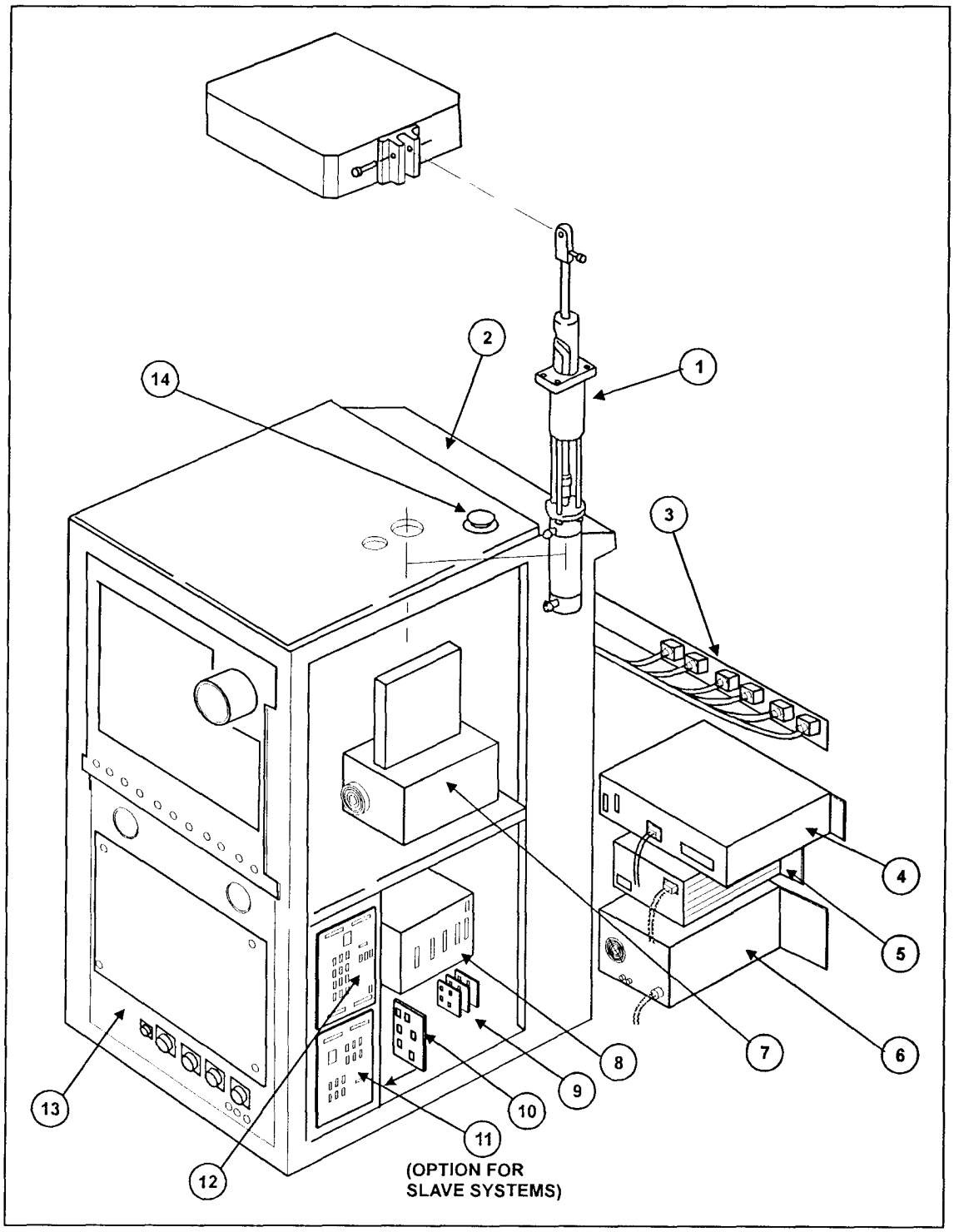

Diagram 1-1 - Master base unit with SMART controller

Item No. in Diagram 1-1	OPT Part No.	Qty	Description
1	MA81B15275	1	HOIST
NONE	G/AIR/VLV/800	2	1/8" BSP 3/2 PUSH BUTTON VALVE
NONE	G/AIR/VLV/801	1	1/8" BSP 5/2 TWIST VALVE
NONE	G/AIR/FIT/110	6	4 x 1/8ML. STD. ELB3109-04-10
NONE	G/AIR/FIT/010	3	4 x 1/8 MALE STUD 3175-04-10
NONE	G/AIR/FIT/015	3	4 x 1/4 MALE STUD 3175-04-13
NONE	G/AIR/FIT/140	2	6 x 1/4ML. STD ELB3109-06-13
NONE	G/AIR/FIT/071	2	MULTIPLE TEE 3304 06 04 (PUSH)
NONE	G/AIR/FIT/416	1	6MM EQUAL TEE 3104-06-00
NONE	G/AIR/FIT/604	5	4MM PLUG 3126-04-00
NONE	G/AIR/FIT/135	2	6 x 1/8ML. STD. ELB3109-06-10
NONE	G/AIR/FIT/445	1	4'Y' PIECE FM/ML3142-04-00
NONE	G/AIR/FIT/546	1	4/6MM. REDUCER 3166-04-06
NONE	R/TUB/NYL/063	1	6MM. O/D. NYLON TUBE, BLUE
NONE	R/TUB/NYL/043	1	4MM. O/D. NYLON TUBE, BLUE
NONE	G/AIR/REG/800	2	6MM x 1/8" BSP FLOW CONTROL
NONE	G/AIR/CTL/100	1	TWO HAND CONTROL MODULE
NONE	G/AIR/VLV/802	1	G1/4 5/3 PILOT SPRING VALVE
NONE	G/AIR/REG/104	1	INLINE FLW REG. AS1001F-04
2	EXP0720	1	B + R LCD OPERATOR PANEL
3	MA81C15410	1	PUMP CONTROL PANEL PCB
4	G/VAC/VLV/622	1	APC CONTROLLER MKS 625A
5	G/VAC/SUN/050	1	TURBO CONTROLLER
6	L/GEN/LF./600	1	LF GENERATOR ENI LPG6A 600W 90-450 KHZ
6	L/GEN/RFG/001	1	AE 600 WATT HF GENERATOR
6	L/GEN/HF./310	1	ENI 300 WATT HF GENERATOR ACE-3XL
6	L/GEN/HF./500	1	ENI 500 WATT HF GENERATOR ACG-5XL
6	L/GEN/RFG/05	1	ENI RF GENERATOR 30W/300W ACG-3XLP
7	L/GEN/AMU/007	1	AMU RF (MW5-D AMU ENI UNIT)
7	L/GEN/AMU/001	1	AMU RF (ATX 600 AMU AE UNIT)
8	EXP0715	1	B + R MINI CONTROLLER + I/O CARD
NONE	EXP0710	1	LITHIUM BATTERY FOR ITEM 9

Table 1-1 Master base unit with SMART controller

Continued on next page

Item No. in Diagram 1-1	OPT Part No.	Qty	Description
9	MA81Z16005	3	PLC INTERFACE PCB
10	MA81Z16453	1	PC CONTROL AND AMP BOARD
11	MA81Z16004	1	CHAMBER A & B SWITCHING PCB
12	MA81Z16000	1	PCB CHAMBER A OR B INTERFACE
13	MA81Z16002	1	POWER BOX CHAMBER A
NONE	EGB2032	1	CONTACTOR 35A 24V DC DILOAM KM
NONE	EGB2000	1	CONTACTOR DIODE MODULE KM
NONE	EGB0050	1	AUX CONTACT TOP 1 x N/C+ 1 X N/O
NONE	EGB3022	3	CONTACTOR 20A 24VDC MIN. KM
NONE	EGT0058	2	O/L RELAY ZE6 4-6A MIN. KM
NONE	EFM1632	1	K.M. SLOW MCB TRIPLE POLE 32A
NONE	EFM1606	2	K.M. SLOW MCB TRIPLE POLE 6A
NONE	EFH2010	3	FUSE HOLDER PANEL MTG 20MM
NONE	EFB2010	3	INS BOOT 20MM FUSE
NONE	EFF2120	3	FUSE 20MM HBC ANTISURET 2A
NONE	EXP0012	1	PSU COUTANT +/-12,15v 110/220V
NONE	EFM1420	1	K.M. SLOW MCB SINGLE POLE 20A
NONE	EXP0502	1	PSU 24VDC 3.6A HSN24-3.6
14	S19/132	1	EMERGENCY STOP BUTTON
NONE	S19/132A	1	CONTACT BLOCK

Table 1-1 (Continued) - Master base unit with SMART controller

NOTES:

1.1.2 Slave console (PC plus) (81-0-41)

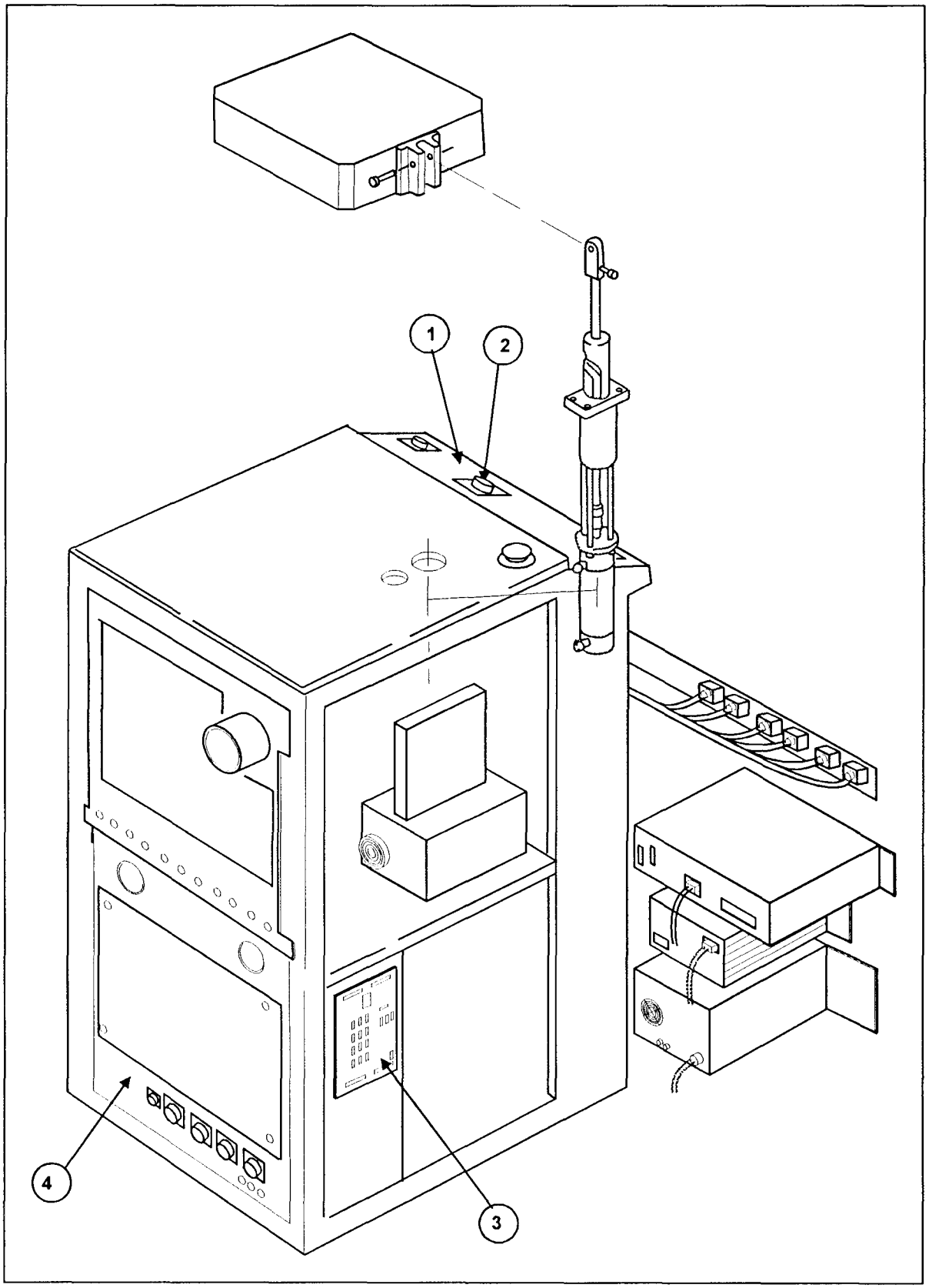

Diagram 1-2 Slave console (PC plus) (81-0-41)

Item No. in Diagram 1-2	OPT Part No.	Qty	Description
1	MD81C15849	1	PANEL SLAVE CONTROL CONSOLE
1	MD81B15261		CONTROL CONSOLE SLAVE (OVERLAY)
2	ESM0400	1	SWITCH BODY (SLAVE CHANGEOVER SWITCH)
NONE	ESM0401	1	SWITCH CONTACT BLOCK (FOR ITEM 2)
3	MA81Z16000		CHAMBER A & B SWITCHING PCB
4	81-0-400	1	POWER BOX
NONE	EFM1616	1	K.M. SLOW MCB TRIPLE POLE 16A
NONE	EFH2010	3	FUSE HOLDER PANEL MTG 20MM
NONE	EFB2010	3	INS BOOT 20MM FUSE
NONE	EFF2110	3	FUSE 20MM HBC ANTISURGET 1A

Table 1-2 Slave console (PC Plus) (81-0-41)

1.1.3 RIE chamber top (standard) (81-3-01)

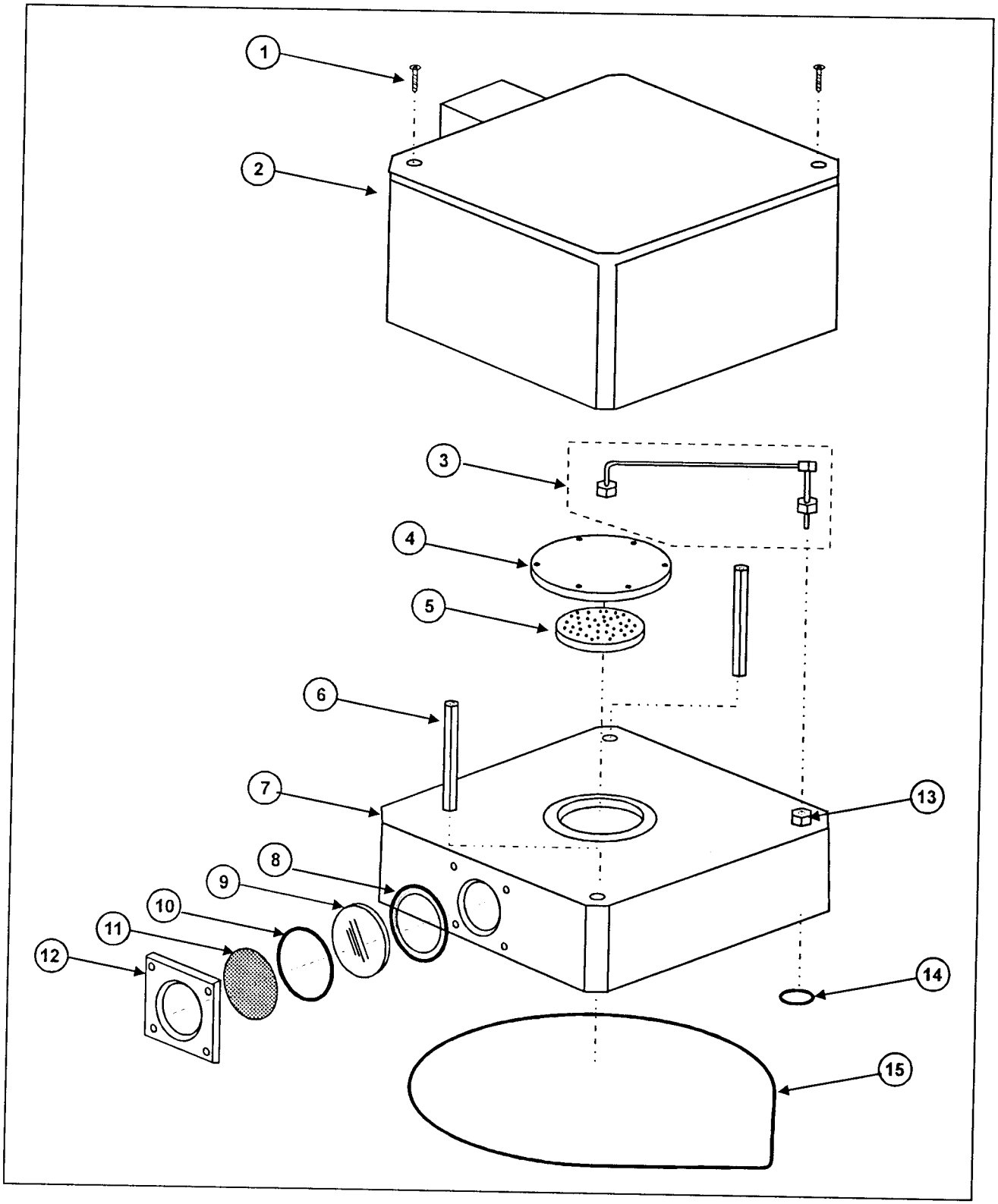

Diagram 1-3 RIE chamber top (standard) (81-3-01)

Item No. in Diagram 1-3	OPT Part No.	Qty	Description
1	G/FIX/SUN/070	2	LOW PROFILE CAP & WASHER
1	G/FIX/S65/510	2	M5x10MM PAN POZI. SCREW
2	MD81A15332	1	CHAMBER TOP COVER (RIE)
3	MA81D14626K	1	RIE GAS INLET KIT
4	MD81D14627	1	GAS INLET FLANGE (RIE)
5	MD81D14213	1	GAS DISTRIBUTOR PLATE (RIE)
6	MD8D15341	2	PILLAR (TOP COVER RIE)
7	MA81A15092	1	UPPER CHAMBER (RIE) EXTERNALLY ANODISED
8*	MA90D13116	1	CENTRING RING
9*	M/0651D/01	1	WINDOW GLASS (6 MM PYREX)
10*	M/4175D/01	1	WINDOW GASKET
11*	MD81D14211	1	UV/RF FILTER
12*	MD81D14027	1	WINDOW FLANGE (ANODISED)
13	G/GAS/FIT/734	1	9/16ST 'O' CON. SS4VCR100032
14	G/SEL/O-V/211	1	3.5 x 20.2MM VITON 'O' RING BS211
15	G/SEL/O-V/381	1	5.34 x 304.17 'O' RING VIT BS 381
* 8 to 12	81-3-101		CHAMBER VIEWPORT KIT

Table 1-3 RIE chamber top (standard) (81-3-01)

NOTE: If you have the combined PE and PECVD option, see Diagram 1-9, page 28.

1.1.4 170 mm RIE table (81-5-01)

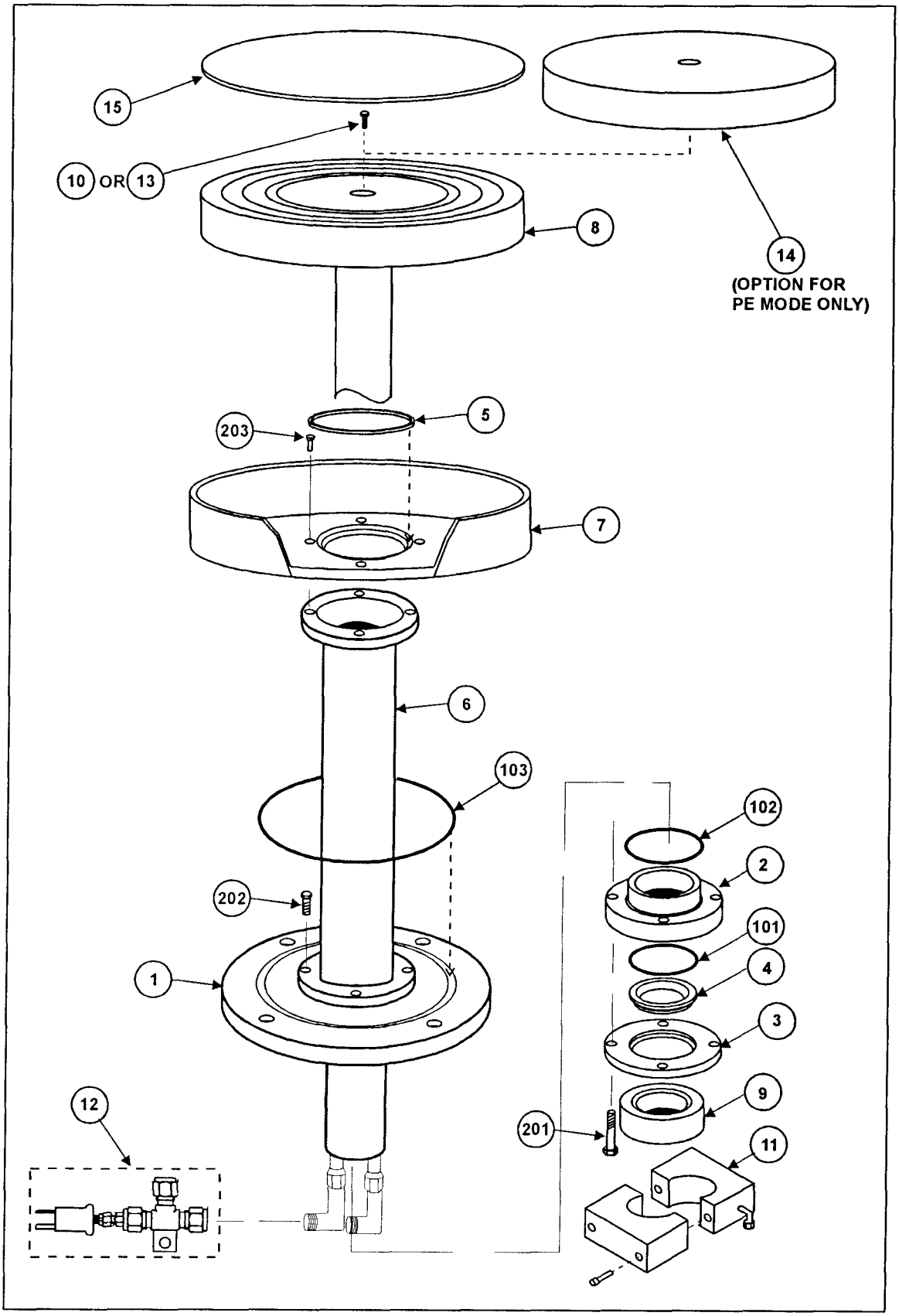

Diagram 1-4 - 170 mm RIE table (81-5-01)

Item No. in Diagram 1-4	OPT Part No.	Qty	Description
1	MD81B14103	1	TABLE MOUNTING FLANGE
2	MD81C14107	1	TABLE FEEDTHROUGH
3	MD81D14109	1	CLAMPING FLANGE
4	MD81D14110	1	COMPRESSION RING
5	MD81D14116	1	ISOLATOR RING (RIE TABLE)
6	MA81B14117	1	SUPPORT TUBE DARK SPACE SHIELD
7	MD81C14115	1	DARK SPACE SHIELD
8	MA81C15014	1	RIE TABLE ASSEMBLY (170 MM DIAMETER)
9	MD81D14111	1	SPACER
10	M/0630D/02	1	THREADED PLUG
11	MD81C14104	1	WATER COOLED CLAMP
12	M/4529D/01	1	THERMOCOUPLE ASSEMBLY
13	M/0629D/01	1	LOCATION SPIGOT
14	MD51C16054	1	TABLE SPACER (PLANAR ETCH) 170 MM
15	----------	1	GRAPHITE OR QUARTZ COVER PLATE
101	G/SEL/O-V/829	1	3.5 x 47.6 VITON 'O' RING BS829
102	G/SEL/O-V/146	1	2.6 x 66.3 VITON 'O' RING BS146
103	G/SEL/O-V/362	1	5.34 MM x 158.12 MM VITON 'O' RING BS 362
201	G/FIX/S32/630	4	M6 x 30 MM S/S CAPHEAD SCREW
202	G/FIX/S32/616	4	M6 x 16 MM S/S CAPHEAD SCREW
203	G/FIX/S54/516	4	M5 x 16 MM S/S CSK HD SCREW

Table 1-4 - 170 mm RIE table (81-5-01)

1.1.5 240 mm RIE table (81-5-02)

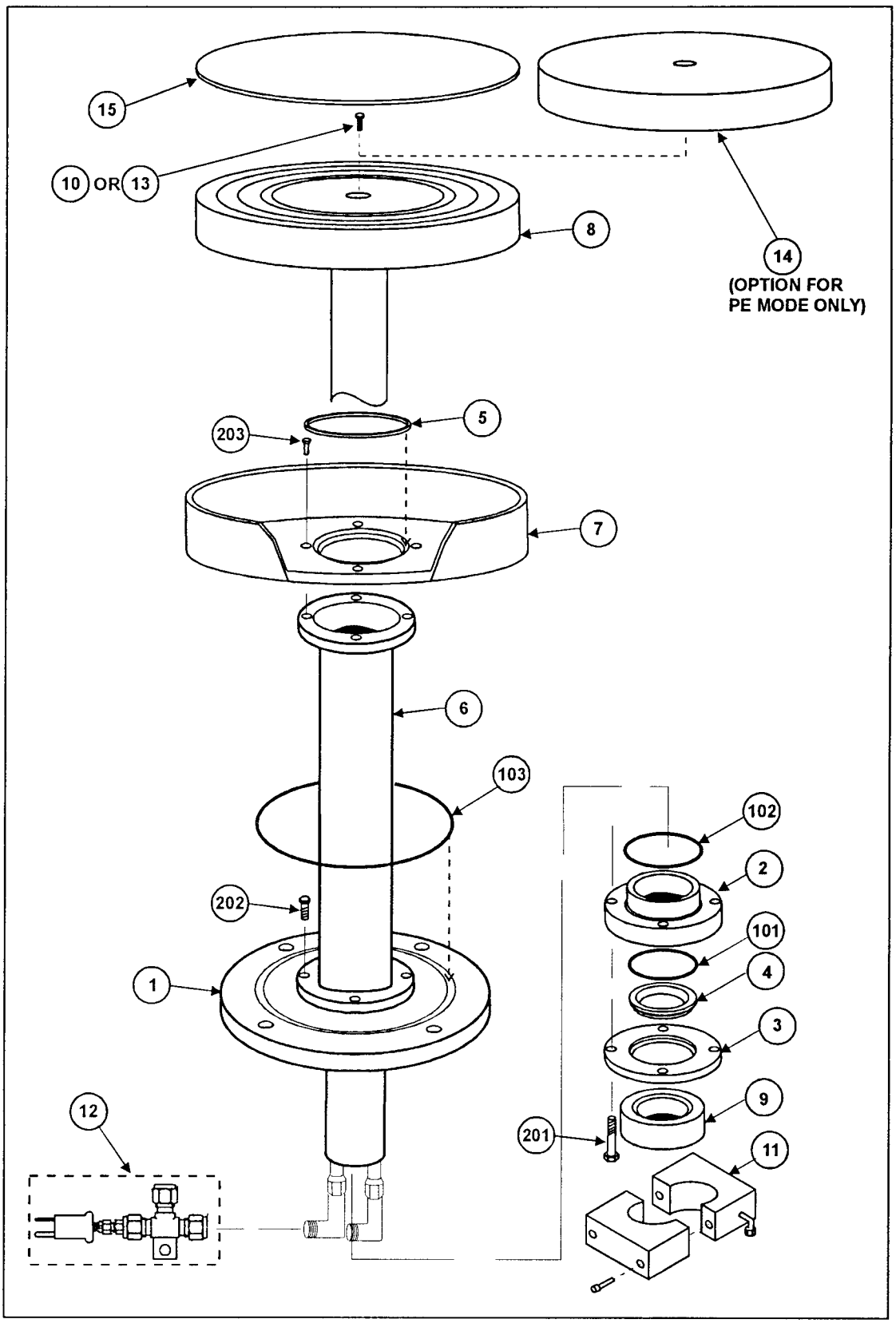

Diagram 1-5 240 mm RIE table (81-5-02)

Item No. in Diagram 1-5	OPT Part No.	Qty	Description
1	MD81B14103	1	TABLE MOUNTING FLANGE
2	MD81C14107	1	TABLE FEEDTHROUGH
3	MD81D14109	1	CLAMPING FLANGE
4	MD81D14110	1	COMPRESSION RING
5	MD81D14116	1	ISOLATOR RING (RIE TABLE)
6	MA81B14117	1	SUPPORT TUBE DARK SPACE SHIELD
7	MD81C14777	1	DARK SPACE SHIELD (240 MM DIAMETER)
8	MA81C15013	1	RIE TABLE ASSEMBLY (240 MM DIAMETER)
9	MD81D14111	1	SPACER
10	M/0630D/02	1	THREADED PLUG
11	MD81C14104	1	WATER COOLED CLAMP
12	M/4529D/01	1	THERMOCOUPLE ASSEMBLY
13	M/0629D/01	1	LOCATION SPIGOT
101	G/SEL/O-V/829	1	3.5 x 47.6 VITON 'O' RING BS829
102	G/SEL/O-V/146	1	2.6 x 66.3 VITON 'O' RING BS146
103	G/SEL/O-V/362	1	5.34 MM x 158.12 MM VITON 'O' RING BS 362
201	G/FIX/S32/630	4	M6 x 30 MM S/S CAPHEAD SCREW
202	G/FIX/S32/616	4	M6 x 16 MM S/S CAPHEAD SCREW
203	G/FIX/S54/516	4	M5 x 16 MM S/S CSK HD SCREW

Table 1-5 240 mm RIE table (81-5-02)

1.1.6 Typical RIE vacuum layout

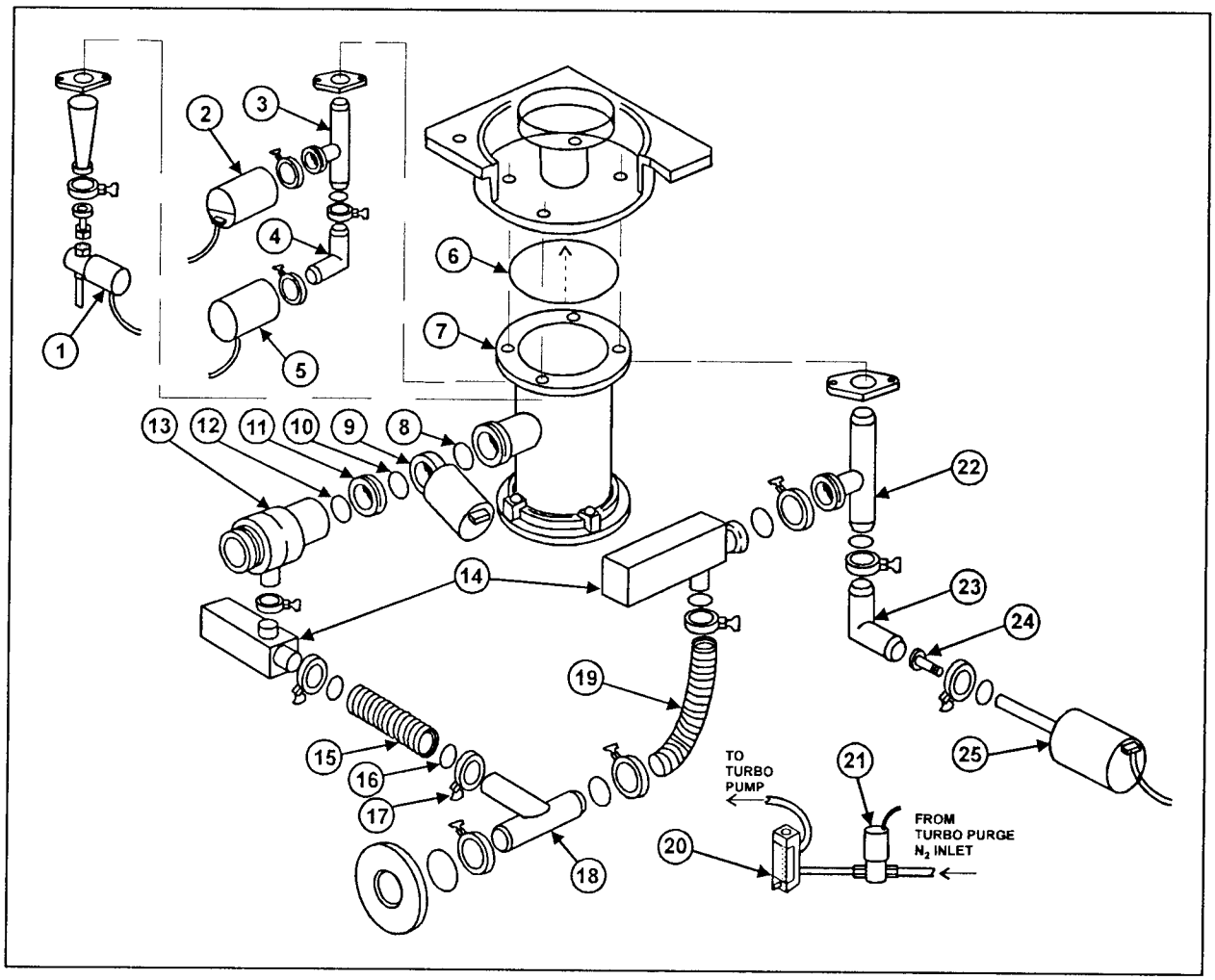

Diagram 1-6 Typical RIE vacuum layout

Item No. in Diagram 1-6	OPT Part No.	Qty	Description
1	G/GAS/VLV/501	2	PETER PAUL 24VDC 52Z00140GB
2	G/VAC/SUN/032	1	EDWARDS VAC INTERLOCK SWITCH
3	G/VAC/FIT/225	1	NW25 TEE
4	G/VAC/FIT/125	1	NW25 ELBOW
5	G/VAC/GGE/004	1	ACT INVERT MAG GGE AIM-V-NW25 (PENNING)
6	G/SEL/O-V/362	1	5.34MM x 158.12MM VITIB BS362
7	G/VAC/FIT/281	1	160 - 100 REDUCING TEE
7	G/VAC/FIT/282	1	160 - 63 REDUCING TEE
8	G/VAC/SEL/475	1	100PF SEALING DISC 86730
8	G/VAC/SEL/063	1	63 MM CENTERING RING 32036-PAZV
9	G/VAC/VLV/668	1	100 MM ISO SEALABLE APC VALVE
9	G/VAC/VLV/669	1	63 MM ISO SEALABLE APC VALVE
10	G/VAC/SEL/475	1	100PF SEALING DISC 86730
10	G/VAC/SEL/063	1	63 MM CENTERING RING 32036-PAZV
11	M/1222B/03	1	CONNECTOR B'PUMP TO GATE VALVE
11	G/VAC/FIT/012	1	DN100/63 ISO-K REDUCER 50 LONG
12	G/VAC/SEL/475	1	100PF SEALING DISC 86730
13	G/VAC/PMP/220	1	LH 361C TURBO 85675 ISO-K
13	G/VAC/PMP/209	1	LH 151C TURBO LEYBOLD 856-35
14	G/VAC/VLV/125	2	PV25PK ISOLATION VALVE
15	G/VAC/FLX/225	1	NW25 FLEXIBLE PIPE 250 MM LONG
16	G/VAC/SEL/025	10	NW25 CENTERING RING
17	G/VAC/CLP/025	10	NW25 CLAMP RING
18	G/VAC/FIT/225	1	NW25 TEE
19	G/VAC/FLX/325	1	NW25 FLEXIBLE PIPE 500 MM LONG
20	G/GAS/ROT/050	1	50 CCM F65-SHR0-A125-3G (ROTAMETER)
21	G/GAS/VLV/501	2	PETER PAUL 24VDC 52Z00140GB
22	G/VAC/FIT/225	1	NW25 TEE
23	G/VAC/FIT/125	1	NW25 ELBOW
24	G/VAC/FIT/015	1	NW25 TO 1/2" QUICK DISCONNECT
25	G/VAC/GGE/401	1	1 T CAPACITANCE MANOMETER TYLAN CDL-01
25	G/VAC/GGE/300	1	10 T CAPACITANCE MANOMETER TYLAN CML11

Table 1-6 Typical RIE vacuum layout

1.2 PECVD machine

1.2.1 Master base unit with SMART controller

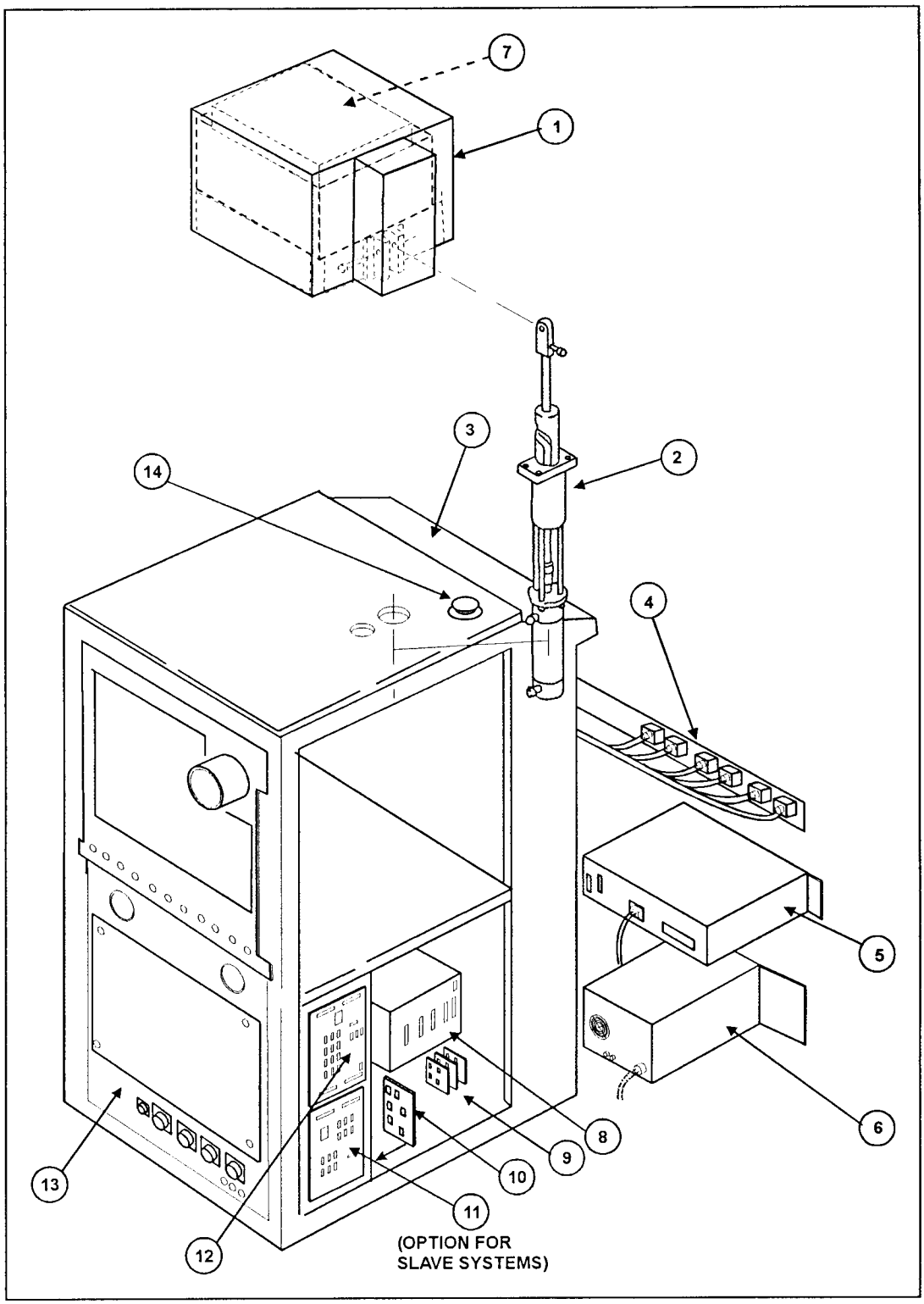

Diagram 1-7 Master base unit with SMART controller

Item No. in Diagram 1-7	OPT Part No.	Qty	Description
1	MD81A16398	1	CHAMBER TOP COVER (DP)
2	MA81B15275	1	HOIST
NONE	G/AIR/VLV/800	2	1/8" BSP 3/2 PUSH BUTTON VALVE
NONE	G/AIR/VLV/801	1	1/8" BSP 5/2 TWIST VALVE
NONE	G/AIR/FIT/110	6	4 x 1/8ML. STD. ELB3109-04-10
NONE	G/AIR/FIT/010	3	4 x 1/8 MALE STUD 3175-04-10
NONE	G/AIR/FIT/015	3	4 x 1/4 MALE STUD 3175-04-13
NONE	G/AIR/FIT/140	2	6 x 1/4ML. STD ELB3109-06-13
NONE	G/AIR/FIT/071	2	MULTIPLE TEE 3304 06 04 (PUSH)
NONE	G/AIR/FIT/416	1	6MM EQUAL TEE 3104-06-00
NONE	G/AIR/FIT/604	5	4MM PLUG 3126-04-00
NONE	G/AIR/FIT/135	2	6 x 1/8ML. STD. ELB3109-06-10
NONE	G/AIR/FIT/445	1	4'Y' PIECE FM/ML3142-04-00
NONE	G/AIR/FIT/546	1	4/6MM. REDUCER 3166-04-06
NONE	R/TUB/NYL/063	1	6MM. O/D. NYLON TUBE, BLUE
NONE	R/TUB/NYL/043	1	4MM. O/D. NYLON TUBE, BLUE
NONE	G/AIR/REG/800	2	6MM x 1/8" BSP FLOW CONTROL
NONE	G/AIR/CTL/100	1	TWO HAND CONTROL MODULE
NONE	G/AIR/VLV/802	1	G1/4 5/3 PILOT SPRING VALVE
NONE	G/AIR/REG/104	1	INLINE FLW REG. AS1001F-04
3	EXP0720	1	B + R LCD OPERATOR PANEL
4	MA81C15410	1	PUMP CONTROL PANEL PCB
5	G/VAC/VLV/622	1	APC CONTROLLER MKS 625A
6	L/GEN/LF/600	1	LF GENERATOR ENI LPG6A 600W 90-450 KHZ
6	L/GEN/RFG/001	1	AE 600 WATT HF GENERATOR
6	L/GEN/HF/310	1	ENI 300 WATT HF GENERATOR ACE-3XL
6	L/GEN/HF/500	1	ENI 500 WATT HF GENERATOR ACG-5XL
6	L/GEN/RFG/05	1	ENI RF GENERATOR 30W/300W ACG-3XLP
7	L/GEN/AMU/007	1	AMU RF (MW5-D AMU ENI UNIT)
7	L/GEN/AMU/001	1	AMU RF (ATX 600 AMU AE UNIT)
8	EXP0715	1	B + R MINI CONTROLLER + I/O CARD
NONE	EXP0710	1	LITHIUM BATTERY FOR ITEM 8

Table 1-7 Master base unit with SMART controller

(Continued on next page)

Item No. in Diagram 1-7	OPT Part No.	Qty	Description
9	MA81Z16005	3	PLC INTERFACE PCB
10	MA81Z16453	1	PC CONTROL AND AMP BOARD
11	MA81Z16004	1	CHAMBER A & B SWITCHING PCB
12	MA81Z16000	1	PCB CHAMBER A OR B INTERFACE
13	MA81Z16002	1	POWER BOX CHAMBER A
NONE	EGB2032	1	CONTACTOR 35A 24V DC DILOAM KM
NONE	EGB2000	1	CONTACTOR DIODE MODULE KM
NONE	EGB0050	1	AUX CONTACT TOP 1 x N/C+ 1 X N/O
NONE	EGB3022	3	CONTACTOR 20A 24VDC MIN. KM
NONE	EGT0058	2	O/L RELAY ZE6 4-6A MIN. KM
NONE	EFM1632	1	K.M. SLOW MCB TRIPLE POLE 32A
NONE	EFM1606	2	K.M. SLOW MCB TRIPLE POLE 6A
NONE	EFH2010	3	FUSE HOLDER PANEL MTG 20MM
NONE	EFB2010	3	INS BOOT 20MM FUSE
NONE	EFF2120	3	FUSE 20MM HBC ANTISURET 2A
NONE	EXP0012	1	PSU COUTANT +/-12,15v 110/220V
NONE	EFM1420	1	K.M. SLOW MCB SINGLE POLE 20A
NONE	EXP0502	1	PSU 24VDC 3.6A HSN24-3.6
14	S19/132	1	EMERGENCY STOP BUTTON
NONE	S19/132A	1	CONTACT BLOCK

Table 1-7 (continued) Master base unit with SMART controller (81-0-06)

NOTES:

1.2.2 Slave console (PC plus) (81-0-41)

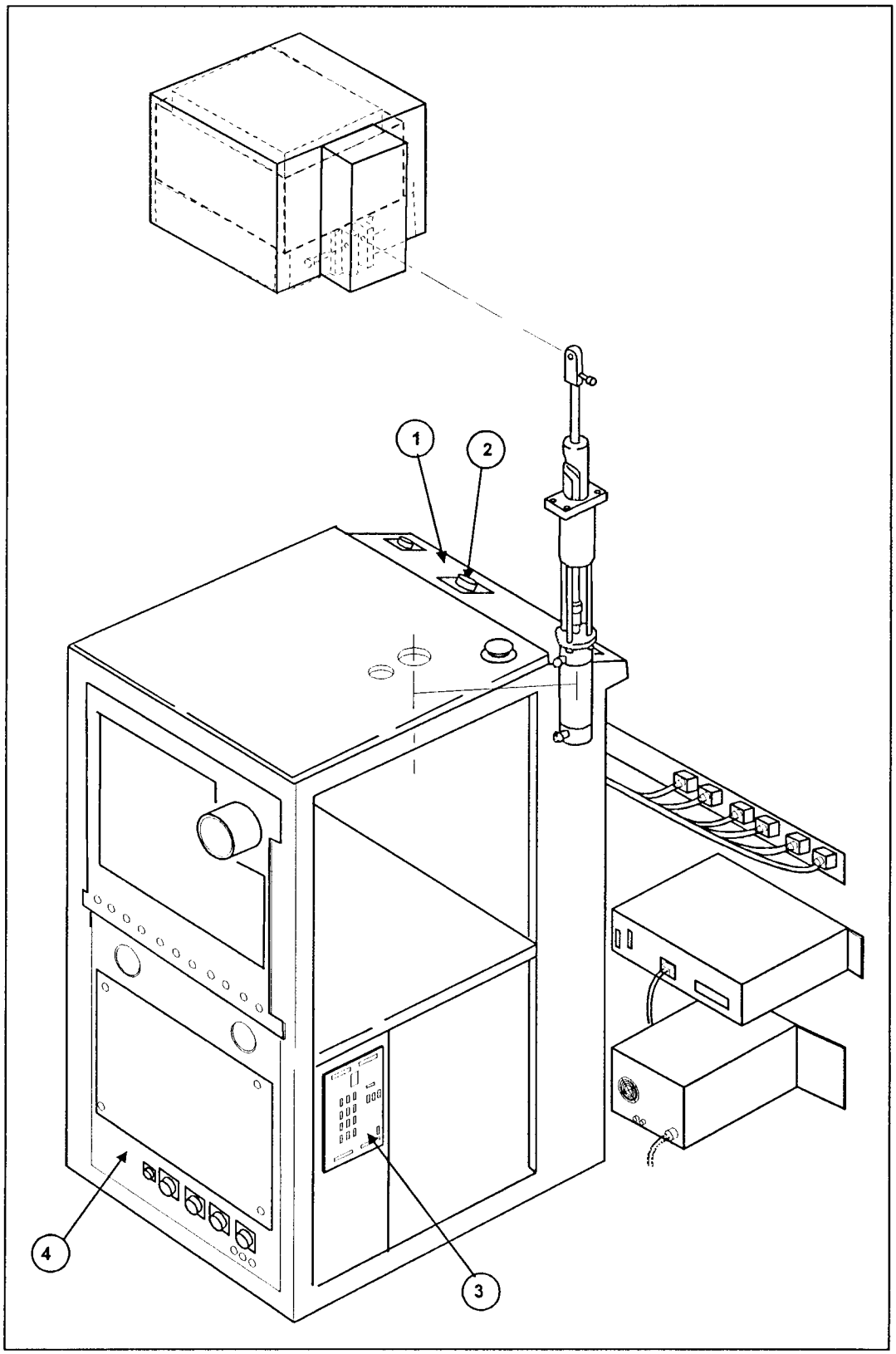

Diagram 1-8 Slave console (PC plus) (81-0-41)

Item No. in Diagram 1-8	OPT Part No.	Qty	Description
1	MD51C15849	1	PANEL SLAVE CONTROL CONSOLE
1	MD81B15261	1	CONTROL CONSOLE SLAVE (OVERLAY)
2	ESM0400	1	SWITCH BODY (SLAVE CHANGEOVER SWITCH)
NONE	ESM0401	1	SWITCH CONTACT BLOCK (FOR ITEM 2)
3	MA81Z16000	1	PCB CHAMBER A OR B INTERFACE
4	81-0-400	1	POWER BOX
NONE	EFM1616	1	K.M. SLOW MCB TRIPLE POLE 16A
NONE	EFH2010	3	FUSE HOLDER PANEL MTG 20MM
NONE	EFB2010	3	INS BOOT 20MM FUSE
NONE	EFF2110	3	FUSE 20MM HBC ANTISURGET 1A

Table 1-8 Slave console (PC Plus) (81-0-41)

1.2.3 Deposition chamber top (81-3-11)

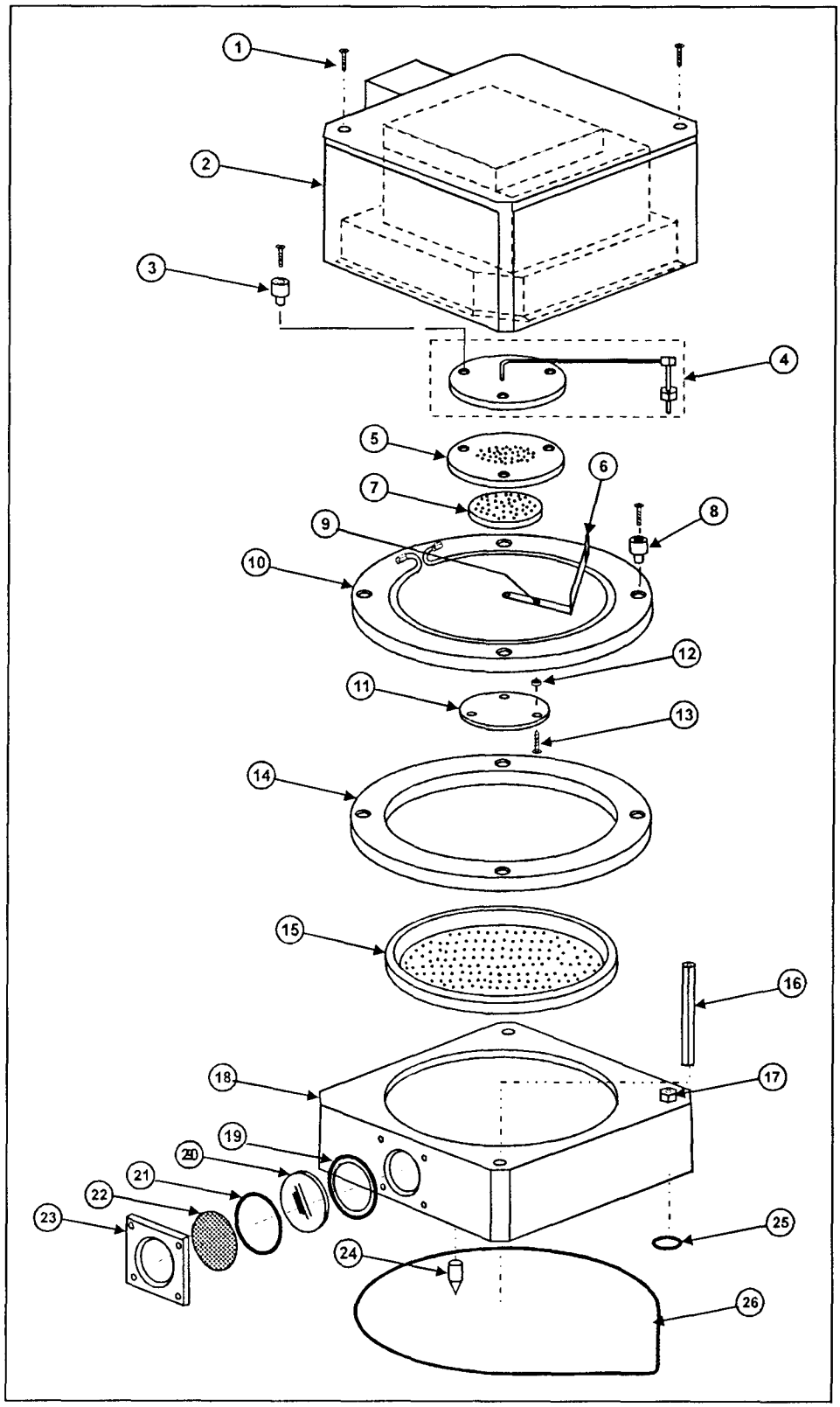

Diagram 1-9 Deposition chamber top (81-3-11)

Item No. in Diagram 1-9	OPT Part No.	Qty	Description
1	G/FIX/SUN/070	2	LOW PROFILE CAP & WASHER
1	G/FIX/S65/510	2	M5x10MM PAN POZI. SCREW
2	MA81A16398	1	CHAMBER TOP COVER (DP)
3	G/SUN/BSH/008	3	CERAMIC BUSH, MALE, NO.8
4	MA81D14623K	1	DP GAS INLET KIT
4	MD81D14624	1	GAS INLET FLANGE
5	MD81D14625	1	ISOLATOR DISK
6	MD81D16500	1	RF STRAP
7	MD81D14206	1	GAS DISTRIBUTOR PLATE
8	MD80D16537	4	INSULATING CAP
9	MD81D16143	1	RF STRAP
10	MA81B15322	1	TOP ELECTRODE ASSY (DP)
11	MD81D14026	1	GAS SPREADER
12	G/FIX/WSH/103	3	M3. S/S. PLAIN WASHER
13	G/FIX/S32/306	3	M3 X 6 MM S/S CAP HD SCW
14	MD81C15343	1	ISOLATOR RING (DP)
14	MD81C15872	1	EARTHING RING (PE CHAMBER)
15	MD81C17353	1	GAS INLET PLATE
16	MD81D16399	2	PILLAR (TOP COVER DP)
17	G/GAS/FIT/734	1	9/16ST 'O' CON. SS4VCR100032
18	MA81A15093	1	UPPER CHAMBER DP EXT. ANODISE
19*	MA90D13116	1	CENTRING RING
20*	M/0651D/01	1	WINDOW GLASS (6 MM PYREX)
21*	M/4175D/01	1	WINDOW GASKET
22*	MD81D14211	1	UV/RF FILTER
23*	MA81D14027	1	WINDOW FLANGE (ANODISED)
24	MD81D15329	1	LOCATION PIN
25	G/SEL/O-V/211	1	3.5 x 20.2 MM VITON 'O' RING BS211
26	G/SEL/O-V/381	1	5.34 x 304.1 7 'O' RING VIT BS 381
*19-23	81-3-101	-	CHAMBER VIEWPORT KIT

Table 1-9 Deposition chamber top (81-3-11)

NOTE: For 81-3-15 both item 14 options, ie isolator ring and earthing ring, are provided.

1.2.4 240 mm 400° C deposition table (81-5-03)

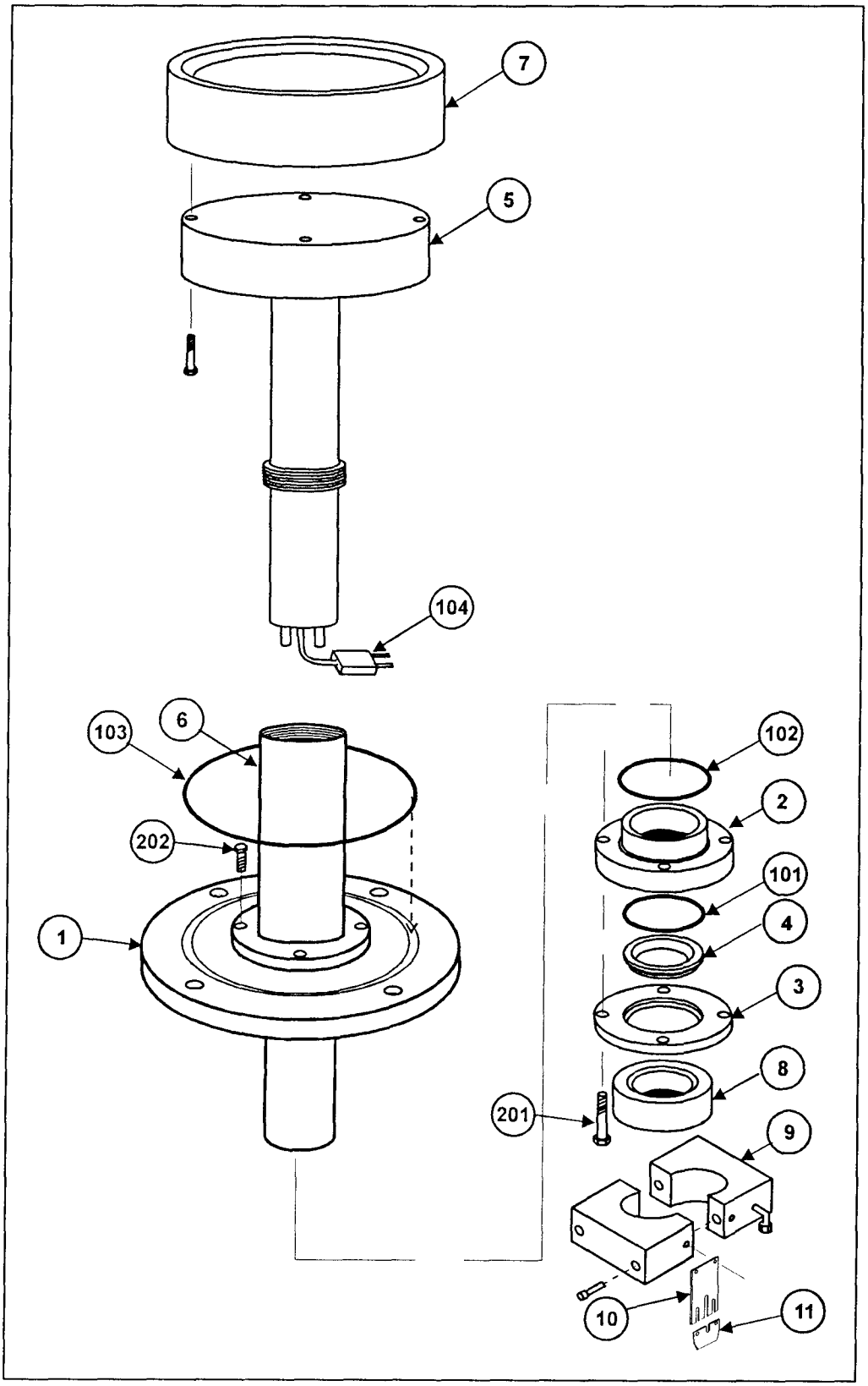

Diagram 1-10 240 mm 400° C deposition table (81-5-03)

Item No. in Diagram 1-10	OPT Part No.	Qty	Description
1	MD81B14103	1	TABLE MOUNTING FLANGE
2	MD81C14107	1	TABLE FEEDTHROUGH
3	MD81D14109	1	CLAMPING FLANGE
4	MD81D14110	1	COMPRESSION RING
5	MA81B15640	1	HEATING ELECTRODE FINAL M/C
6	MD81C14778	1	TABLE SUPPORT (DP)
7	M/0885C/01	1	TOP PLATE, 1x235MM RECESS
8	MD81D14111	1	SPACER
9	MD81C14104	1	WATER COOLED CLAMP
10	MD81D15204	1	PLATE (THERMO SUPPORT)
11	MD81D15205	1	BRACKET (THERMO SUPPORT)
101	G/SEL/O-V/146	1	2.6 x 66.3 VITON 'O'RING BS146
102	G/SEL/O-V/829	1	3.5 x 47.6 VITON 'O'RING BS829
103	G/SEL/O-V/362	1	5.34mm 158.12mm VITON BS362
104	EQT0003	1	T'COUPLE DUAL PROBE SYS 90

Table 1-10 240 mm 400° C table (81-5-03)

1.2.5 63 mm pipework with sealable Automatic Pressure Controller for use with roots / rotary pump

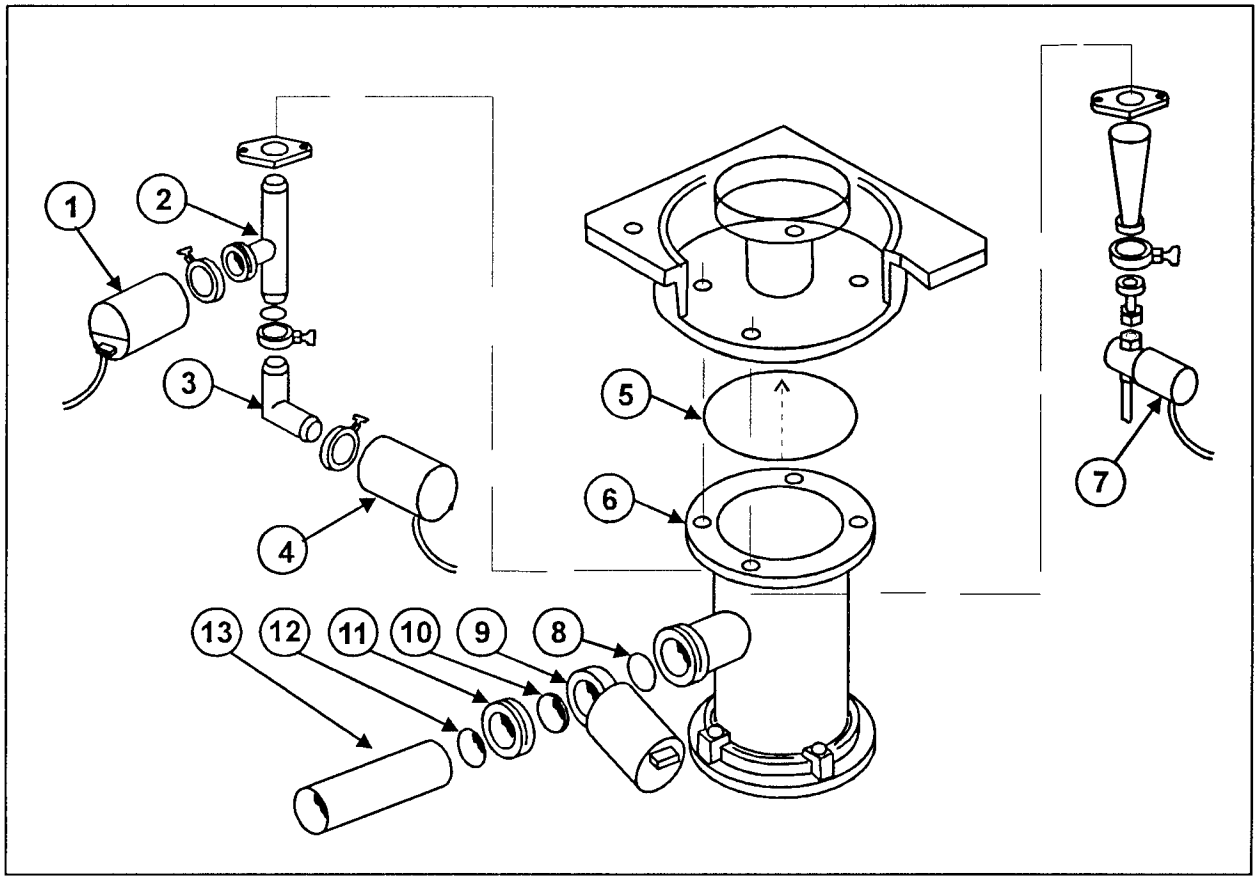

Diagram 1-11 63 mm pipework with sealable Automatic Pressure Controller for use with roots / rotary pump

81-0-03	BASIC VACUUM KIT
81-8-03	63 MM BRANCH SEALABLE APC
81-7-01	80 PLUS 10 TORR CAPACITANCE MANOMETER KIT

Item No. in Diagram 1-11	OPT Part No.	Qty	Description
1	G/VAC/SUN/032	1	EDWARDS VAC INTERLOCK SWITCH
2	G/VAC/FIT/225	1	NW25 TEE
3	G/VAC/FIT/125	1	NW25 ELBOW
4	G/VAC/GGE/300	1	10 T CAPACITANCE MANOMETER TYLAN CML11
5	G/SEL/O-V/362	1	5.34MM x 158.12MM VITION BS362
6	G/VAC/FIT/282	1	160 - 63 REDUCING TEE
7	G/GAS/VLV/501	2	PETER PAUL 24VDC 52Z00140GB
8	G/VAC/SEL/063	1	63 MM CENTERING RING 32036-PAZV
9	G/VAC/VLV/669	1	MKS 653A-60-63-1 SEALABLE APC VALVE
10	G/VAC/SEL/063	1	63 MM CENTERING RING 32036-PAZV
11	M/0377C/02	1	ADAPTER 65LF
12	G/VAC/SEL/063	1	63 MM CENTERING RING 32036-PAZV
13	G/VAC/FIT/062 **OR** G/VAC/FIT/601	1 1	ISO 63 MM NIPPLE 176 MM LONG ISO 63 MM NIPPLE 203 MM LONG

Table 1-11 63 mm pipework with sealable Automatic Pressure Controller for use with roots / rotary pump

1.3 Gas systems

1.3.1 Gas pod (81-9-51)

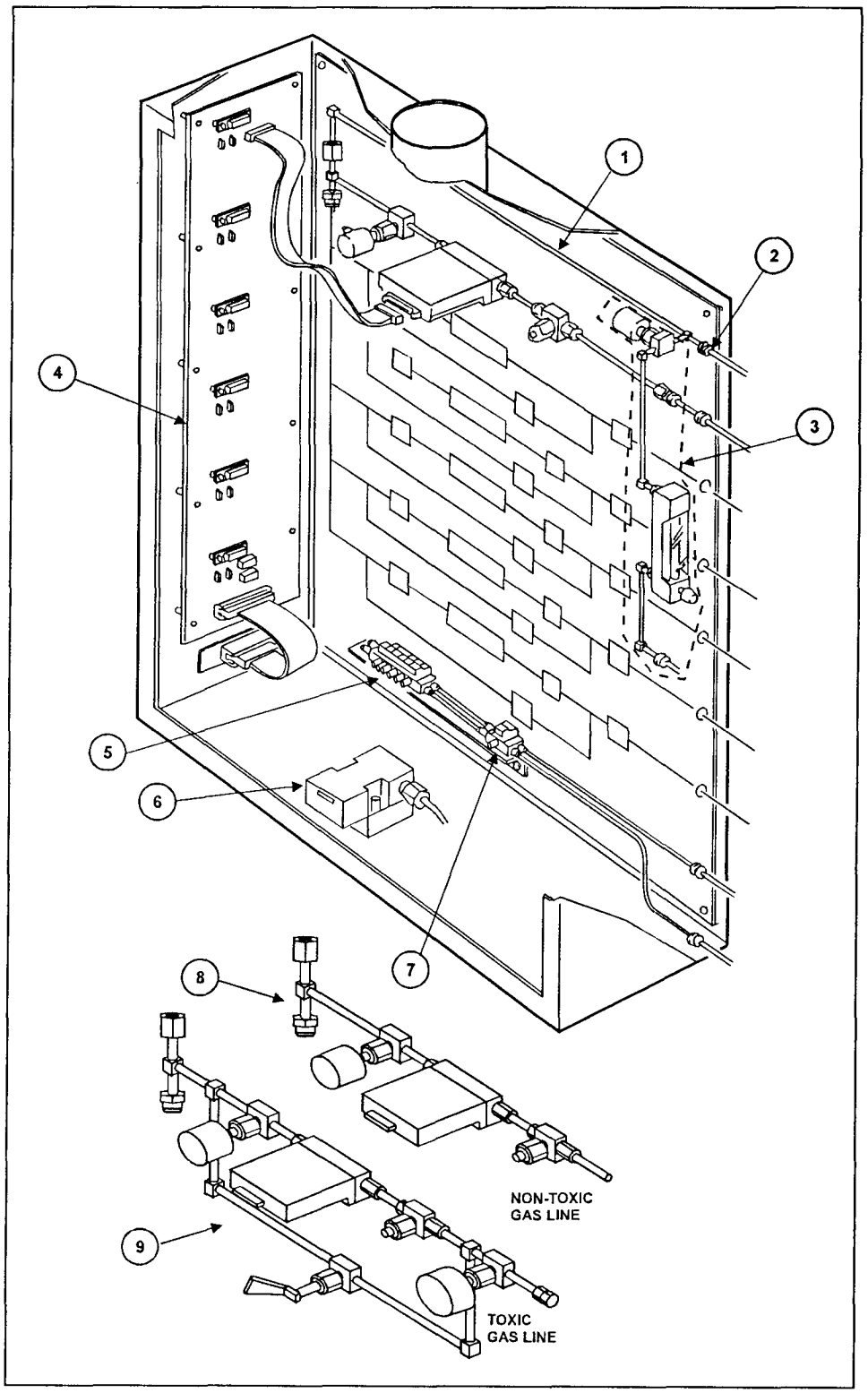

Diagram 1-12 Gas pod (81-9-51)

Item No. in Diagram 1-12	OPT Part No.	Qty	Description
1	MA81D15070	1	MANIFOLD GAS OUT PIPE
2	MA81D14783	1	GAS CONNECTION LINE
3	81-9-07	1	CLEAN GAS LINE
4	MA81Z16003	1	GAS POD CHAMBER A OR B PCB
5	G/AIR/VLV/506	1	6 WAY SMC ASSY. SPASBR06
6	ESZ9102	1	DOOR INTERLOCK MICRO-SW SPDT
7	G/AIR/VLV/501	1	SINGLE SMC ASSY. SPASBR01
8	81-9-11	1	NON-TOXIC GAS LINE
9	81-9-21	1	TOXIC GAS LINE

Table 1-12 Gas pod (81-9-51)

1.3.2 Internal gas lines

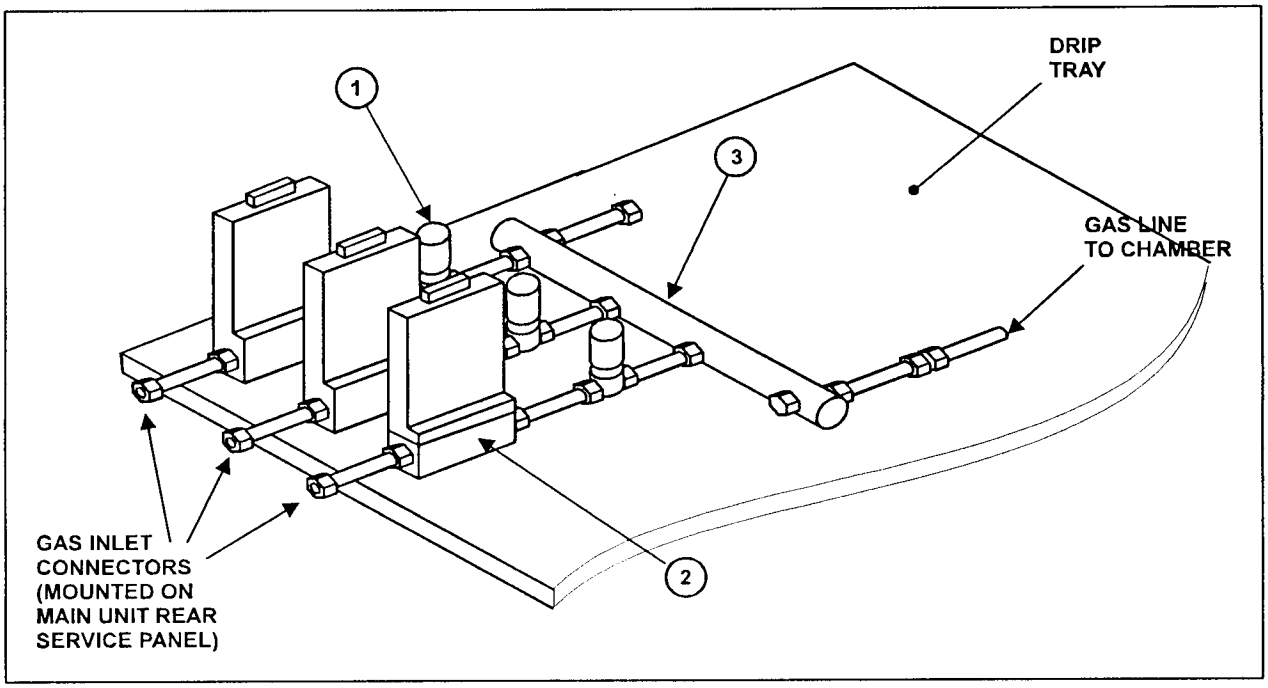

Diagram 1-13 Internal gas lines (option)

Item No. in Diagram 1-13	OPT Part No.	Qty	Description
NONE	PRS-9-11	1	STD NON TOXIC GAS LINE
1	G/GAS/VLV/501	1	PTR. PAUL 24VDC 52Z00140GB
2	M/4251D/01	1	MFC. MTG. PLATE, TYLAN
NONE	PRS-9-51	1	INTERNAL 4 LINE GAS ASSY SMART
3	MD80C11957	1	MANIFOLD
NONE	MA00Z17853	1	INTERNAL GAS LINE PCB ASSY.

Table 1-13 Internal gas lines (option)

2. Spare Parts Kits

Standard spare parts kits

This section covers recommended spare parts kits to enable a customer or agent to select a complete spares kit for the ***Plasmalab*** 80 Plus systems.

NOTES:

1. The ***Plasmalab*** 80 Plus systems are constructed in a modular form and OPT spares kits are put together in the same way. Select a spares kit for each module of the system configuration; for example, Part No (81-0-06S) for the master base, Part No (81-3-01S) for an RIE chamber etc. If you have any questions, please contact our spares department for advice on spares kits for any system configuration.

2. The attached spares kits cover OPT mechanical and electrical modules. These include both other equipment supplier and OPT manufactured recommended parts. For customers where system down time is important major OEM components should be selected as spare parts. These are not included in our standard kits because of the cost and various types of different system configurations. OEM parts such as APC valve, RF generator, AMU, and Turbo pump can be selected from the relevant section of this catalogue.

3. For more information on suitable parts kits for your system please contact our spares department.

2.1 Master base unit spares kits

There are 2 levels of kits for the Master base unit. These are suitable for ***Plasmalab*** 80 Plus systems with SMART controllers.

2.1.1 Master base unit standard spares kit

A kit containing recommended parts for a SMART 80 Plus base module including Power Box PSUs, Contactors / Relays, Hoist Bearings, Cylinder and Lithium Battery for Controller.

Spares kit Part Number 81-0-06S

OPT Part No.	Qty	Description
EGB2032	1	CONTACTOR 35A 24VDC DIL0AM KM
ESZ0010	1	DISCONNECT SW K.M. (200)
EGB2000	1	CONTACTOR DIODE MODULE KM
EGB0050	1	AUX CONTACT TOP 1x N/C+ 1xN/O
EGB3022	1	CONTACTOR 20A 24VDC MIN. KM
EGT0058	1	0/L RELAY ZE6 4-6A MIN. KM
EGT0057	1	O/L RELAY ZE4 2.4-4A MIN. KM
EFM1632	1	K.M. SLOW MCB TRIPLE POLE 32A
EFM1606	1	K.M. SLOW MCB TRIPLE POLE 6A
EFB2010	1	INS BOOT 20mm FUSE
EXP0012	1	PSU COUTANT +/-12, 15V 110/220V
EFM1410	1	K.M. SLOW MCB SINGLE POLE 10A
EFM1402	1	K.M. MCB SINGLE POLESLOW 2A
G/GAS/VLV/501	1	PTR.PAUL 24VDC 52Z00140GB
G/VAC/SEL/025	2	NW25 CENTERING RING
G/VAC/SEL/010	1	NW10 CENT.RING08C10511395
ESR0034	6	RELAY PCB 24VDC 2PC/O 1A PED
G/AIR/CYL/801	1	40MM CYLINDER CDG1N40-125 SMC
G/SUN/BRG/006	1	MCGILL CAMROL CFH-1/2-B
G/SUN/BRG/007	1	RMB THRUST BRG F8-19G
G/AIR/CYL/805	1	SWITCH M/27A/C/2
G/AIR/VLV/800	1	1/8" BSP 3/2 PUSH BUTTON VALVE
G/AIR/VLV/801	1	1/8" BSP 5/2 TWIST VALVE
T20/052	1	THERMOCOUPLE FREE PLUG
G/AIR/VLV/504	1	4 WAY SMC ASSY. SPASBR04
EXP0502	1	PSU 24vDC 3.6A HSN24-3.6
EXP0710	1	BATTERY LITHIUM. 3.6V AA

2.1.2 Master base unit comprehensive spares kit

As previous kit, but in addition includes Hoist complete, SMART Controller Box and OPT Control PCBs. This gives a very good spare parts stock for customers where minimum downtime is important.

Spares kit part number 81-0-06SC

OPT Part No.	Qty	Description
EGB2032	1	CONTACTOR 35A 24VDC DIL0AM KM
ESZ0010	1	DISCONNECT SW K.M. (200)
EGB2000	1	CONTACTOR DIODE MODULE KM
EGB0050	1	AUX CONTACT TOP 1x N/C+ 1xN/O
EGB3022	1	CONTACTOR 20A 24VDC MIN. KM
EGT0058	1	0/L RELAY ZE6 4-6A MIN. KM
EGT0057	1	O/L RELAY ZE4 2.4-4A MIN. KM
EFM1632	1	K.M. SLOW MCB TRIPLE POLE 32A
EFM1606	1	K.M. SLOW MCB TRIPLE POLE 6A
EFB2010	1	INS BOOT 20mm FUSE
EXP0012	1	PSU COUTANT +/-12, 15V 110/220V
EFM1410	1	K.M. SLOW MCB SINGLE POLE 10A
EFM1402	1	K.M. MCB SINGLE POLESLOW 2A
G/GAS/VLV/501	1	PTR.PAUL 24VDC 52Z00140GB
G/VAC/SEL/025	2	NW25 CENTERING RING
G/VAC/SEL/010	1	NW10 CENT.RING08C10511395
ESR0034	6	RELAY PCB 24VDC 2PC/O 1A PED
G/AIR/CYL/801	1	40MM CYLINDER CDG1N40-125 SMC
G/SUN/BRG/006	1	MCGILL CAMROL CFH-1/2-B
G/SUN/BRG/007	1	RMB THRUST BRG F8-19G
G/AIR/CYL/805	1	SWITCH M/27A/C/2
G/AIR/VLV/800	1	1/8" BSP 3/2 PUSH BUTTON VALVE
G/AIR/VLV/801	1	1/8" BSP 5/2 TWIST VALVE
T20/052	1	THERMOCOUPLE FREE PLUG
G/AIR/VLV/504	1	4 WAY SMC ASSY. SPASBR04
EXP0502	1	PSU 24vDC 3.6A HSN24-3.6
EXP0710	1	BATTERY LITHIUM. 3.6V AA
MA81Z16000	1	PCB CHAMBER A OR B INTERFACE
MA81Z16004	1	CHAMBER A&B SWITCHING PCB
EXP0715	1	B&R MINICONT' WITH I/O CARDS.
MA81B15275	1	HOIST ASSY

2.2 Chamber spares kits

2.2.1 RIE chamber spares kit

Spares kit part number 81-3-01S

OPT Part No.	Qty	Description
G/GAS/FIT/734	2	9/16ST 'O' CON. SS4VCR100032
G/GAS/FIT/614	2	1/4 GSKT. RETAIN SS4VCR2GR
G/SEL/O-V/381	1	5.34x304.17 'O' RING VIT BS 381
G/SEL/O-V/315	1	5.3x20mm. VIT 'O' 200-315
G/SEL/O-V/235	1	3.5x79.0mm VITON 'O' RING BS235
G/SEL/O-V/362	1	5.34mm X 158.12mm VITON BS362
G/VAC/SEL/016	1	NW16 CENT. RING S/S
G/VAC/SEL/065	3	65LF CENTERING RING
G/VAC/SUN/032	1	EDWARDS VAC INTERLOCK SWITCH
M/0651D/01	1	WINDOW GLASS (6mm PYREX)
MD81D14211	1	UV/RF FILTER
MA90D13116	1	CENTRING RING
M/4175D/01	1	WINDOW GASKET

2.2.2 Dep chamber spares kit

Also suitable for PE/DP chamber (81-3-15/01)

Spares kit part number 81-3-11S

OPT Part No.	Qty	Description
G/GAS/FIT/734	2	9/16ST 'O' CON. SS4VCR100032
G/GAS/FIT/614	2	1/4 GSKT. RETAIN SS4VCR2GR
G/SEL/O-V/381	1	5.34x304.17 'O' RING VIT BS 381
G/SEL/O-V/315	1	5.3x20mm. VIT 'O' 200-315
G/SEL/O-V/275	2	3.5x266.3mm. VIT 'O' 200-275
G/SEL/O-V/224	2	3.5x44.1MM VITON 'O' RING BS224
G/SUN/BSH/008	7	CERAMIC BUSH, MALE, NO.8
VFZ0011	1	FILTER ST NUPRO 1/4"-1/4"
VGZ0040	1	FLOW ALARM SWITCH 0.5L/MIN
G/GAS/FIT/238	1	1/4x1/4 'O' R.CON.SS40014OR
G/VAC/SUN/032	1	EDWARDS VAC INTERLOCK SWITCH
G/SEL/O-V/362	1	5.34mm X 158.12mm VITON BS362
G/VAC/SEL/065	3	65LF CENTERING RING
G/VAC/SEL/040	2	NW40 CENTERING RING
M/0651D/01	1	WINDOW GLASS (6mm PYREX)
MD81D14211	1	UV/RF FILTER
MA90D13116	1	CENTRING RING
M/4175D/01	1	WINDOW GASKET
MD80D16537	4	INSULATING CAP

2.3 Table spares kits

2.3.1 RIE water cooled table lower electrical table spares kit

Also suitable for ***Plasmalab*** 80 Plus PE system tables.

Spares kit part number 81-5-01S

OPT Part No.	Qty	Description
M/4529D/01	1	THERMO-COUPLE ASSEMBLY
G/SEL/O-V/829	1	3.5 x 47.6 VITON 'O' RING BS829
G/SEL/O-V/146	1	2.6 x 66.3 VITON 'O' RING BS146
G/SEL/O-V/362	1	5.34mm x 158.12mm VITON BS362
T20/011	1	THERMOCOUPLE FREE SOCKET
T20/052	1	THERMOCOUPLE FREE PLUG

2.3.2 DP table lower electrical spares kit

Spares kit part number 81-5-03S

OPT Part No.	Qty	Description
G/SEL/O-V/829	1	3.5 x 47.6 VITON 'O' RING BS829
G/SEL/O-V/146	1	2.6 x 66.3 VITON 'O' RING BS146
G/SEL/O-V/362	1	5.34mm x 158.12mm VITON BS362
EFM1110	1	K.M. FAST MCB SINGLE POLE 10A
EGB3022	1	CONTACTOR 20A 24VDC MIN KM
EQT0003	1	T' COUPLE DUAL PROBE SYS 90
G/SUN/BSH/044	1	CERAMIC INSULATION BUSH
R18/063	1	REL SOLID STATE ZRA 625A

2.5 Consumable spares kits

2.5.1 1-year consumable spares kit

Spares kit part number 81-12-60

OPT Part No.	Qty	Description
EFF2110	10	FUSE 20mm HBC ANTISURGET 1A
G/GAS/FIT/614	10	1/4 GSKT RETAIN SS4VCR2GR
G/SEL/O-V/146	10	2.6 x 66.3 VITON 'O' RING BS146
G/SEL/O-V/224	10	3.5 x 44 .1MM VITON 'O' RING BS224
G/SEL/O-V/235	10	3.5 x 79.0mm VITON 'O' RING BS235
G/SEL/O-V/275	10	3.5 x 266.3mm VIT 'O' 200-275
G/SEL/O-V/314	10	5.34 x 18.42mmVIT 'O' RING BS314
G/SEL/O-V/362	5	5.34 x 158.12mm VITON BS362
G/SEL/O-V/381	5	5.34 x 304.17 'O' RING VIT BS381
G/SEL/O-V/829	10	3.5 x 47.6 VITON 'O' RING BS829
G/VAC/OIL/905	2	SILICONEGREASE 09H02400036

2.5.2 Consumable spares kit

Spares kit part number 81-S-01

OPT Part No.	Qty	Description
G/SEL/O-V/829	1	3.5 x 47.6 VITON 'O' RING BS829
G/SEL/O-V/146	1	2.6 x 66.3 VITON 'O' RING BS146
G/SEL/O-V/362	1	5.34 x 158.12mm VITON BS362
G/SEL/O-V/381	1	5.34 x 304.17 'O' RING VIT BS381
G/SEL/O-V/314	1	5.34 x 18.42mmVIT 'O' RING BS314
G/SEL/O-V/235	1	3.5 x 79.0mm VITON 'O' RING BS235
G/SEL/O-V/275	1	3.5 x 266.3mm VIT 'O' 200-275
G/SEL/O-V/224	1	3.5 x 44 .1MM VITON 'O' RING BS224
G/GAS/FIT/614	4	1/4 GSKT RETAIN SS4VCR2GR
EFF2110	3	FUSE 20mm HBC ANTISURGET 1A