Instruction Manual

IPUP E100 (v2.1)

Description	*Electrical supply*	*BOC Edward's part number*	*Applied Material's part number*
IPUP E100L	*208 V 50/60 Hz*	*A535-72-945*	*0190-04184*
IPUP E100Li	*208 V 50/60 Hz*	*A535-76-945*	
IPUP E100L (Hardwire)	*208 V 50/60 Hz*	*A535-73-945*	*3620-00176*

ETL LISTED US 2002519

SEMI S2-0200

CE 98/37/EC 89/336/EEC 73/023/EEC

BOC EDWARDS

CONTENTS

Section	Title	Page
1	INTRODUCTION	1
1.1	Scope and definitions	1
1.2	The IPUP E100	2
1.2.1	The IPUP E100Li	2
1.2.2	The IPUP E100L (Hardwire)	2
1.3	IPUP E100 features	2
1.4	Temperature control system	2
1.5	Priority of control	7
1.6	Warning and alarm conditions	7
1.6.1	Pump protection sensors	7
1.7	Pump display terminal (PDT) accessory	7
2	TECHNICAL DATA	11
2.1	Technical information	11
2.2	Weight distribution	12
2.3	Lubrication	12
2.4	Materials in contact with pumped gases	12
2.5	System schematics	16
2.5.1	Electrical system	16
2.5.2	Water cooling system	17
2.6	Part numbers	18
2.7	Declaration of conformity	19
2.8	Certificate of compliance (IPUP E100L)	20
2.9	Certificate of compliance (IPUP E100Li)	21
2.10	Certificate of compliance (IPUP E100L Hardwire)	22
3	INSTALLATION	23
3.1	Safety	23
3.2	Installation checklist	23
3.3	Unpack and inspect	24
3.4	Securing the IPUP E100 pump	24
3.5	Using the stacking bolts	25
3.6	Inlet connection	26
3.7	Exhaust connection	26
3.8	Interstage connection (Li only)	27
3.9	Leak test the system	27
3.10	Connect the cooling-water supply	28
3.11	Connect to your emergency stop circuit	28
3.12	Connect the electrical supply (IPUP E100L and IPUP E100Li only)	29

djd/0203

CONTENTS (continued)

Section	Title	Page
3.13	Connect the electrical supply (IPUP E100L (Hardwire) only)	29
3.14	Connecting the smart pump interface, SPI	31
3.15	Pump display terminal, PDT	31
3.16	Lubrication	31
4	PUMP DISPLAY TERMINAL (PDT) MENUS AND DISPLAY FORMATS	33
4.1	Introduction	33
4.2	General operation	34
4.3	The CANCEL button	34
4.4	Display text and variable text	34
4.5	Wrap-around	35
4.6	Timeout	35
4.7	Menu structure	35
4.8	Example	35
5	OPERATION	55
5.1	Introduction	55
5.2	Start-up	55
5.3	Status indicators	55
5.4	Manual shut-down	55
5.5	Unplanned shutdown and alarms	56
6	MAINTENANCE	57
6.1	Maintenance plan	57
6.2	Inspect the pipelines and connections	57
6.3	Cleaning the pump	58
6.4	Service the IPUP E100 pump	58
6.5	Warning and alarm message fault finding	59
6.6	Other fault finding	59
7	STORAGE AND DISPOSAL	61
7.1	Storage	61
7.2	Disposal	61
	INDEX	63
	RETURN OF BOC EDWARDS EQUIPMENT	

ILLUSTRATIONS

Figure	Title	Page
1	IPUP E100L	1
2	IPUP E100L	4
3	IPUP E100Li	5
4	IPUP E100L (Hardwire)	6
5	Front panel of the pump display terminal	8
6	Weight distribution of IPUP E100	12
7	Dimensions of pump IPUP E100L	13
8	Dimensions of pump IPUP E100Li	14
9	Dimensions of pump IPUP E100L (Hardwire)	15
10	Electrical system - schematic	16
11	Water functional diagram	17
12	Handle	25
13	Stacking bolts	25
14	Connection box	30
15	Connection box (cover removed)	30
16	SPI Connections	32
17	PDT Menu logic	37
18	Switch on Menu	38
19	Switch off menu	39
20	Normal Menu	40
21	Status Menu	41
22	Control menu	42
23	Setup menu (sheet 1 of 3)	43
24	Setup menu (sheet 2 of 3)	44
25	Setup menu (sheet 3 of 3)	45
26	PDT, turn on/off menu	46
27	PDT, pump type menu	47
28	PDT, shut down mode menu	48
29	PDT, units menu	49
30	PDT, adjust pressure menu	50
31	PDT, adjust temperature menu	50
32	PDT, adjust speed menu	51
33	PDT, select line menu	52
34	PDT, clear incerter alarms	53
35	PDT, software version menu	53

TABLES

Table	Title	Page
1	Controls and connections	3
2	Technical Information	11
3	Materials in contact with pumped gases	12
4	IPUP E100 Pump Part Numbers	18
5	Installation Checklist	23
6	Pump Display Terminal (PDT)/menu structure	36
7	LED's	55
8	Maintenance plan	57
9	Warning and alarm error codes	58

1 INTRODUCTION

1.1 Scope and definitions

Figure 1 - IPUP E100L

This manual provides installation, operation and maintenance instructions for the IPUP E100L, the IPUP E100Li and the IPUP E100L (Hardwire). These are the BOC Edwards Load Lock, and Load Lock Interstage IPUP Dry Pumping Systems. Refer to Figures 2, 3 and 4 for views of the pumps. You must use the IPUP E100L, the IPUP E100Li and the IPUP E100L (Hardwire) as specified in this manual.

The IPUP E100L, the IPUP E100Li and the IPUP E100L (Hardwire) will be referred to generically as the IPUP E100 from this point forwards unless specifically stated.

Read this manual before you install and operate the IPUP E100. Important safety information is highlighted as WARNING and CAUTION instructions; you must obey these instructions. The use of WARNINGS and CAUTIONS is defined below.

WARNING

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

CAUTION

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

Throughout this manual, page, figure and table numbers are sequential.

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

The following warning labels appear on the pump:

Warning - risk of electric shock.

Warning - hot surfaces.

Warning - heavy object.

Warning - moving parts present.

1.2 The IPUP E100

The IPUP E100 has been jointly developed by BOC Edwards and Applied Materials to meet all of the IPUP requirements for 'plug and play' interfaces.

The IPUP E100 pump is designed for chambers such as loadlock, transfer, PVD and all clean chambers using nitrogen or inert gases.

The IPUP E100 operates at pressures between atmospheric and ultimate vacuum with no lubricating or sealing fluid in the pumping chamber. This ensures a clean pumping system without back-migration of oil into the system being evacuated.

The IPUP E100 has an enclosed, water-cooled motor. The IPUP E100 is therefore suitable for applications in clean environments where fan cooling is unacceptable.

The IPUP E100 is a high vacuum pump capable of exhausting to atmosphere. The pump design employs two intermeshing screws running at super-synchronous speed. There are no contacting rotor and stator parts within the pumping mechanism.

Refer to Figure 2 for front and rear views of the IPUP E100L. The identification key for the components is given in Table 1.

1.2.1 The IPUP E100Li

The IPUP E100Li pump is also designed for all clean chambers using nitrogen or inert gas. The IPUP E100Li has a secondary inlet port, the interstage port, which is designed for differentially pumping clean volumes using nitrogen or inert gas.

Refer to Figure 3 for front and rear views of the IPUP E100Li. The identification key for the components is given in Table 1.

1.2.2 The IPUP E100L (Hardwire)

The IPUP E100L (Hardwire) provides the same functionality as the IPUP E100L, however, it provides an alternative method of connection for the mains supply from the tool.

The Amphenol connector (Figure 2, item 10), on the IPUP E100L has been replaced with a connection box that incorporates ring lug fixings for the three phases and earth. This allows the IPUP E100L (Hardwire) to be permanently 'hardwired' on installation. The cable clamp (Figure 2, item 9), has also been removed on the hardwire variant.

Refer to Figure 4 for views of the IPUP E100L (Hardwire). The identification key for the components is given in Table 1.

1.3 IPUP E100 features

The IPUP E100 contains no high vacuum bearings that could otherwise cause contamination issues in the chamber or process. The IPUP E100 contains a unique pumping mechanism; a tapered screw. This provides the high particulate handling capacity of a screw pump with a low power consumption without having to use exhaust restrictors. Whilst having a peak pumping speed in excess of 100 m^3/hr, the displacement per revolution is quite small thereby making the overall mechanism small, reducing footprint and saving space.

1.4 Temperature control system

The IPUP E100 has an integrated water cooling circuit.

The cooling water supply and return pipelines are connected to the pump by quick fit connectors. Refer to Figures 2 and 3 (items 3 and 4).

Item	Control/Connector Identification	Functions
1	Top Panel	
2	Inlet	Pumped gas inlet connection
3	Water in	Cooling water supply connection
4	Water out	Cooling water return connection
5	Exhaust	Exhausted gas outlet connection
6	Comms 3	Smart pump interface connector (SPI)
7	PE	Protective earth stud
8	Jacking bolts	
9	Cable clamp (L and Li only)	Mains supply cable clamp
10	Mains supply (L and Li only)	Mains supply connection
11	Transportation wheels	
12	Pump display terminal (PDT)	Manual control terminal
13	Seismic anchor locators	
14	Docking station anchoring points	
15	Lifting eyes	
16	I/O	Mains switch
17	Comms 1	PDT connector
18	Comms 2	Network connector
19	LEDs	
	Green	Power
	Green	Running
	Amber	Warning
	Red	Alarm
20	Interstage (Li only)	Interstage gas inlet connection
21	Connection box (L (Hardwire) only)	Mains supply connection

Table 1 - Controls and connections

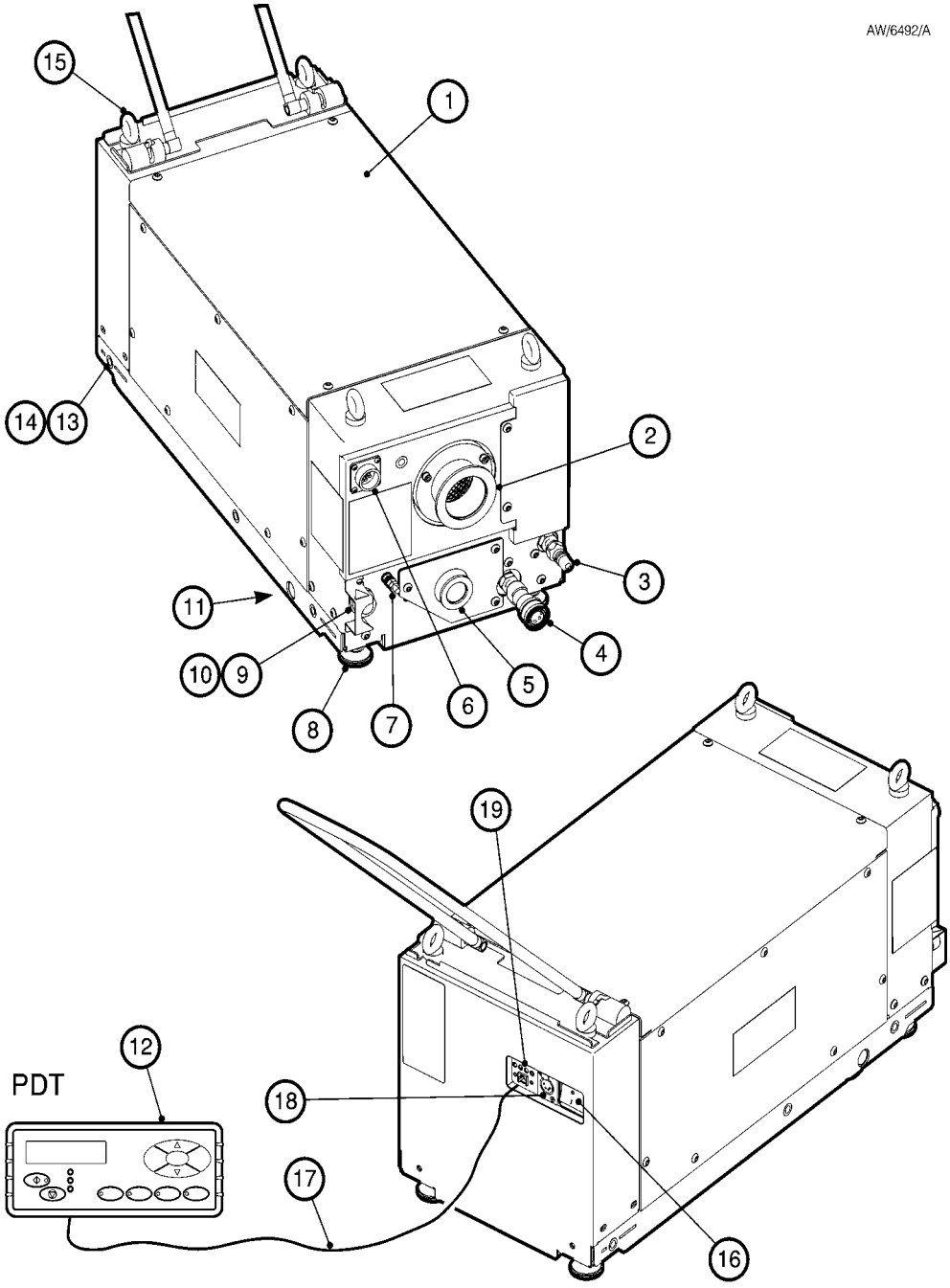


Figure 2 - IPUP E100L

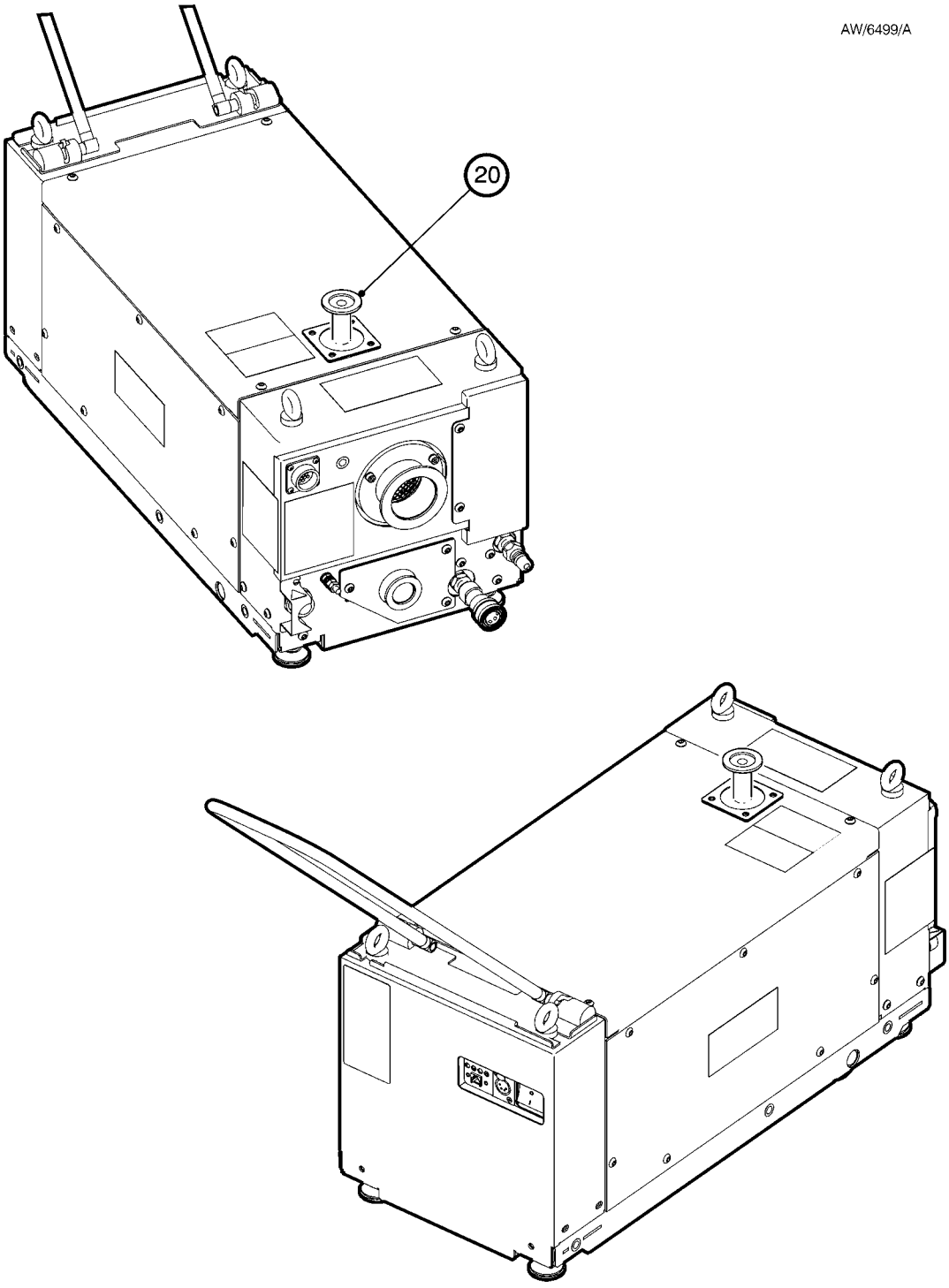


Figure 3 - IPUP E100Li

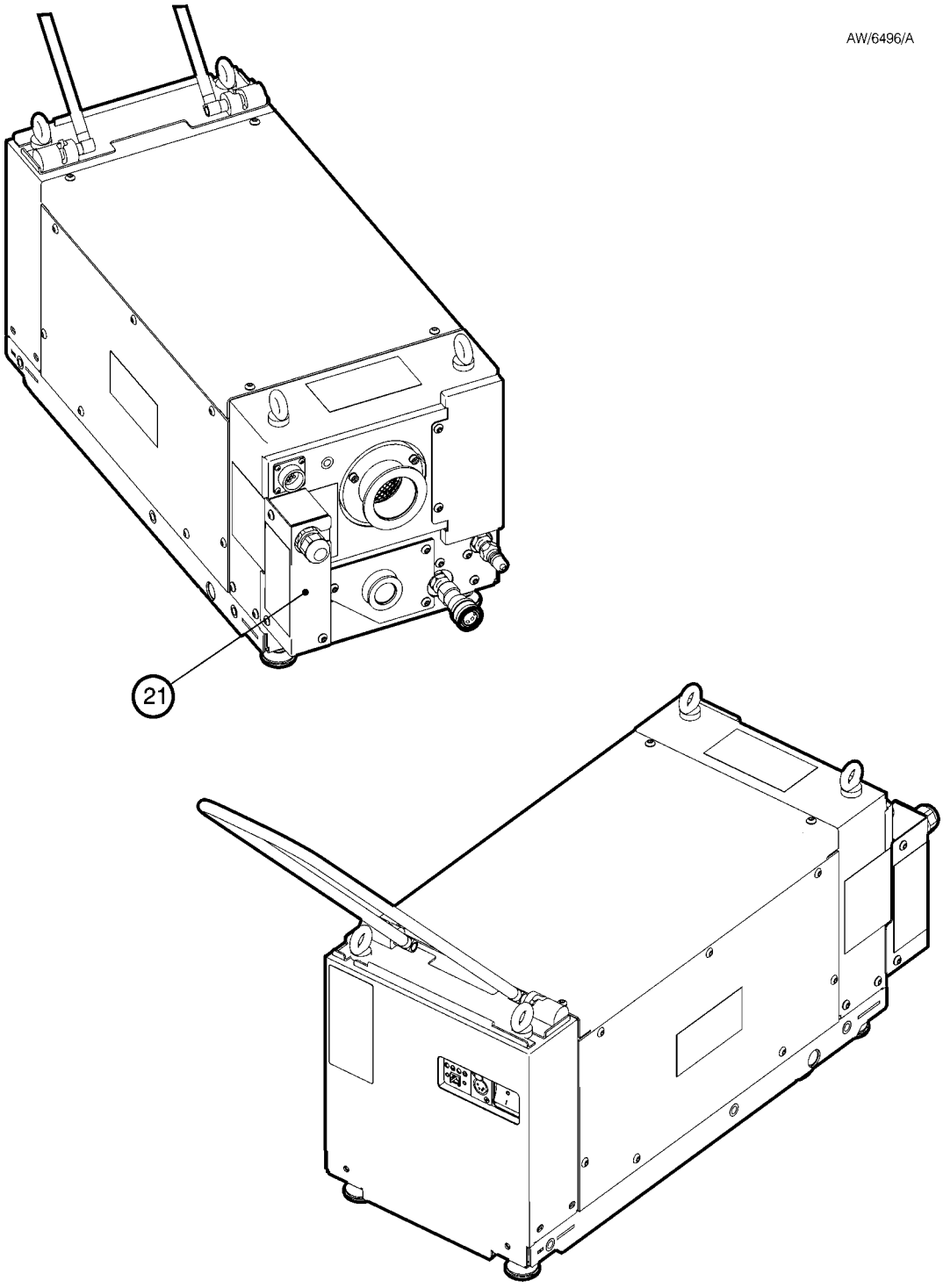


Figure 4 - IPUP E100L (Hardwire)

Water conditions must conform to those specified in Table 1.

1.5 Priority of control

The IPUP E100 system can be controlled by the pump display terminal (PDT) or the Smart Pump Interface (SPI) from the tool. Only one of these can have control of the IPUP E100 system at any time. That is, once one of these has control of the IPUP E100 system, control requests from the other are denied. To allow the tool interface to switch the IPUP E100 pump on, the PDT must 'release' control if it currently has control (refer to Figure 22, Section 4).

1.6 Warning and alarm conditions

The IPUP E100 system monitors sensors to see if a warning or alarm condition exists.

A warning condition indicates that some aspect of the IPUP E100 system is abnormal.

An alarm condition indicates that a serious fault has been detected by the IPUP E100 system.

If an alarm or warning condition exists, an appropriate alarm or warning message is displayed on the PDT (if fitted). Refer to Table 8, Section 6 for a full list of warning and alarm messages.

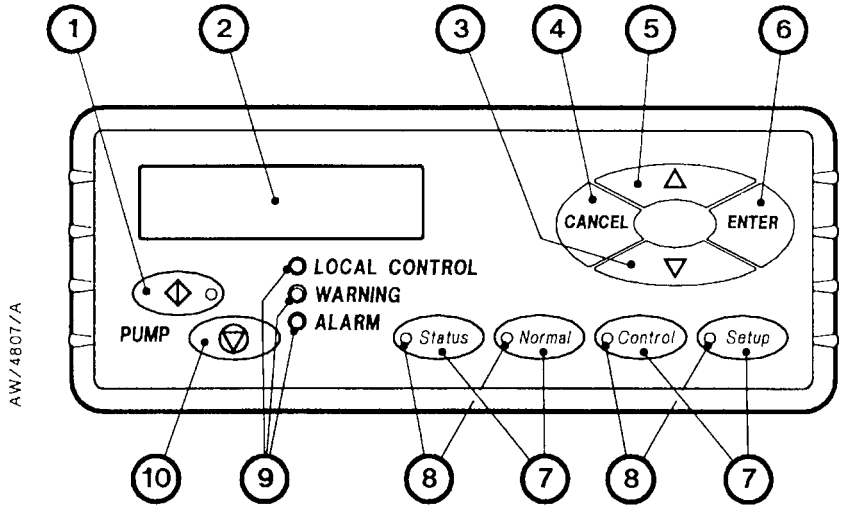
1.6.1 Pump protection sensors

The IPUP E100 has three pump protection sensors which are used to generate warnings and alarms. The warnings and alarms are triggered at different setpoints and will send signals to the LEDs on the front of the pump, the PDT and the SPI. The inverter also has internal protection which can generate warnings and alarms. The decision on whether or not to shutdown the pump has been left with the tool.

1.7 Pump display terminal (PDT) accessory

The PDT allows manual control of the IPUP E100 pump and also displays the pump status. Refer to Figure 5 which shows the front panel of the pump display terminal.

Use the On button (Figure 5, item 1) to switch on the IPUP E100 system. The On button has a LED which is on when the IPUP E100 system is on. Use the Off button (Figure 5, item 10) to switch off the system.



1. On button
2. Display
3. Down button
4. CANCEL button
5. Up button
6. ENTER button
7. Menu buttons Status, Normal, Control, Setup
8. Menu selected LEDs
9. Status LEDs Local Control, Warning, Alarm
10. Off button

Figure 5 - Front panel of the pump display terminal

The display (Figure 5, item 2) shows two lines of text; each line is 16 characters long. In normal operation, the Normal display is shown; the Normal display has two pages, and each has two lines. Each page of the Normal display shows the status of one or more IPUP E100 system sensors or internal clocks and counters. As supplied, the first page of Normal display shows the pump serial number and pump current. It is possible to change the information shown on the Normal display.

At any time, press one of the four menu buttons (Figure 5, item 7) to select a new menu. Then use the up (Figure 5, item 5), down (Figure 5, item 3), ENTER (Figure 5, item 6) and CANCEL (Figure 5, item 4) buttons to move through the menu. The appropriate menu selected LED (Figure 5, item 8) is on when the corresponding menu is in use.

Use the menu (Figure 5, item 7), up (Figure 5, item 5), down (Figure 5, item 3), CANCEL (Figure 5, item 4) and ENTER (Figure 5, item 6) buttons as described below. Refer to Section 4 for a full definition of the menu structures and the display formats.

Status: Press this button to select the Status menu. This menu displays the current values of all IPUP E100 system sensors.

Normal: Press this button to select the Normal display.

Control: Press this button to select the Control menu, then take control or release control of the pumping system (refer to Section 4).

Setup: Press this button to select the Setup menu. In this menu it is possible to: manually change the operation of the gas purge, change the shutdown mode and change other display parameters (such as the pressure units used when pressures are displayed). The Setup menu also allows selection of the Service menu. In this menu, it is possible to change service information (such as pumping system and pump serial number).

Enter (6): Use this button to select a currently displayed menu option or to enter a currently displayed parameter.

Cancel (4): Use this button to cancel the currently displayed menu or option and return to the previous menu or option.

Up (5)/Down (3): Use these buttons to move up or down menu options or to increase or decrease a displayed parameter.

The status LEDs (Figure 5, item 9) show the current status of the IPUP E100 system and the Pump Display Terminal.

Alarm: This LED shows when an alarm condition exists.

Warning: This LED shows when a warning condition exists.

Local control: This LED is on when the Pump Display Terminal has control of the IPUP E100 system.

The ALARM and WARNING LEDs flash when the corresponding alarm or warning condition first occurs. When acknowledging the condition, the corresponding LED goes on permanently. For most alarms and warnings, if the condition clears (that is, the fault which caused the condition is no longer present), the corresponding LED goes off; refer to Table 9 for the alarms and warnings whose LEDs do not automatically reset this way.

This page intentionally blank.

2 TECHNICAL DATA

2.1 Technical information

Type	Characteristic	Value	Units
General	Dimensions	Refer to Figures 2, 3 and 4	
	Jacking feet diameter	37	mm
	Mass	112	kg
	Ambient operating temperature range	5 to 50	°C
	Maximum humidity	90% up to 15 °C, decreasing to 70% in 20 °C ambient, 40% in 30 °C ambient and 20% in 40 °C ambient	%RH
	Sound level	<56	dBA
	Vibration level at inlet and exhaust	<1.5	mm/s
Performance	Peak pumping speed	105	m^3/hr
	Ultimate	$5x10^{-3}$ (3.75×10^{-3} torr)	mbar
	Peak pumping speed, interstage (Li only)	35 (see note)	m^3/hr
	Ultimate, interstage (Li only)	1 (see note)	mbar
	Maximum leak rate	$1x10^{-5}$ (7.5×10^{-6} torr l s^{-1})	mbar l s^{-1}
Electrical	Supply voltage 3PH	208 V 50/60 Hz	V
	Maximum nominal power	2.8	kW
	Nominal power at ultimate	2.2	kW
	Recommended fuse/isolator rating	16 A fuse maximum and multipole isolator with minimum contact gap of 3 mm. The mains disconnect device AIC (Amperes Interrupt Capacity) must be rated to at least 10,000A.	
	Installation (overvoltage) category	class II	
Water cooling system	Maximum supply pressure	100	psig
	Minimum supply pressure	35	psig
	Minimum pressure differential across supply and return	35	psi
	Nominal water consumption	1.7	l/min
	Maximum supply temperature	25	°C
	Minimum supply temperature	15	°C
	Maximum particle size	0.03	mm^2
Lubrication	Lubrication oil (Fomblin 16/6)	0.485	kg
Connectors	Pump inlet flange	NW50	
	Pump exhaust flange	NW25	

Table 2 - Technical Information

Type	Characteristic	Value	Units
Connectors (continued)	Pump interstage flange (Li only)	NW25	
	Water supply	Hanson 72 Series Stainless Steel ¼" BSP quick connect.	
	Water return	Hanson 72 Series Stainless Steel ¼" BSP quick connect.	
	Mains supply (L and Li only)	Amphenol type C-16 3 phase and earth	
	Mains Supply (L (Hardwire) only)	M5 studs (Mains supply cable must use M5 insulation sleeved, crimped ring-lugs and have an overall outer diameter between 9 and 17mm).	
	Comms 1 (PDT)	Flair 623K /Adam Tech MTJP623K60*A type RJ12 connector. Double insulated.	
	Comms 2 (Network)	Lane Electronics/Neutrik NC4FP1B type XLR connector. Double insulated.	
	Comms 3 (SPI)	RS/AMP 206036-1 type connector. Double insulated.	

Table 2 - Technical Information

Note: Figures for interstage are dependent upon inlet conditions.

2.2 Weight distribution

The weight distribution and location of the centre of gravity of the IPUP E100 is shown on Figure 6.

The centre of gravity is 179 mm from the floor when the pump rests on its wheels.

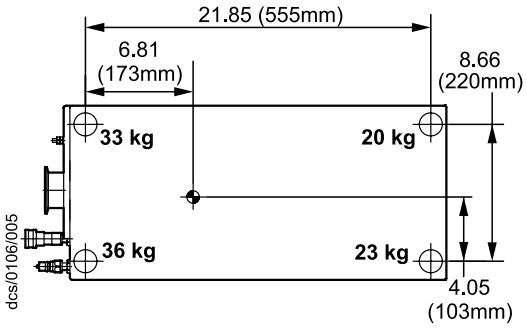


Figure 6 - Weight distribution of IPUP E100

2.3 Lubrication

The IPUP E100 has been filled with a charge of oil at the factory. It is not necessary to add oil.

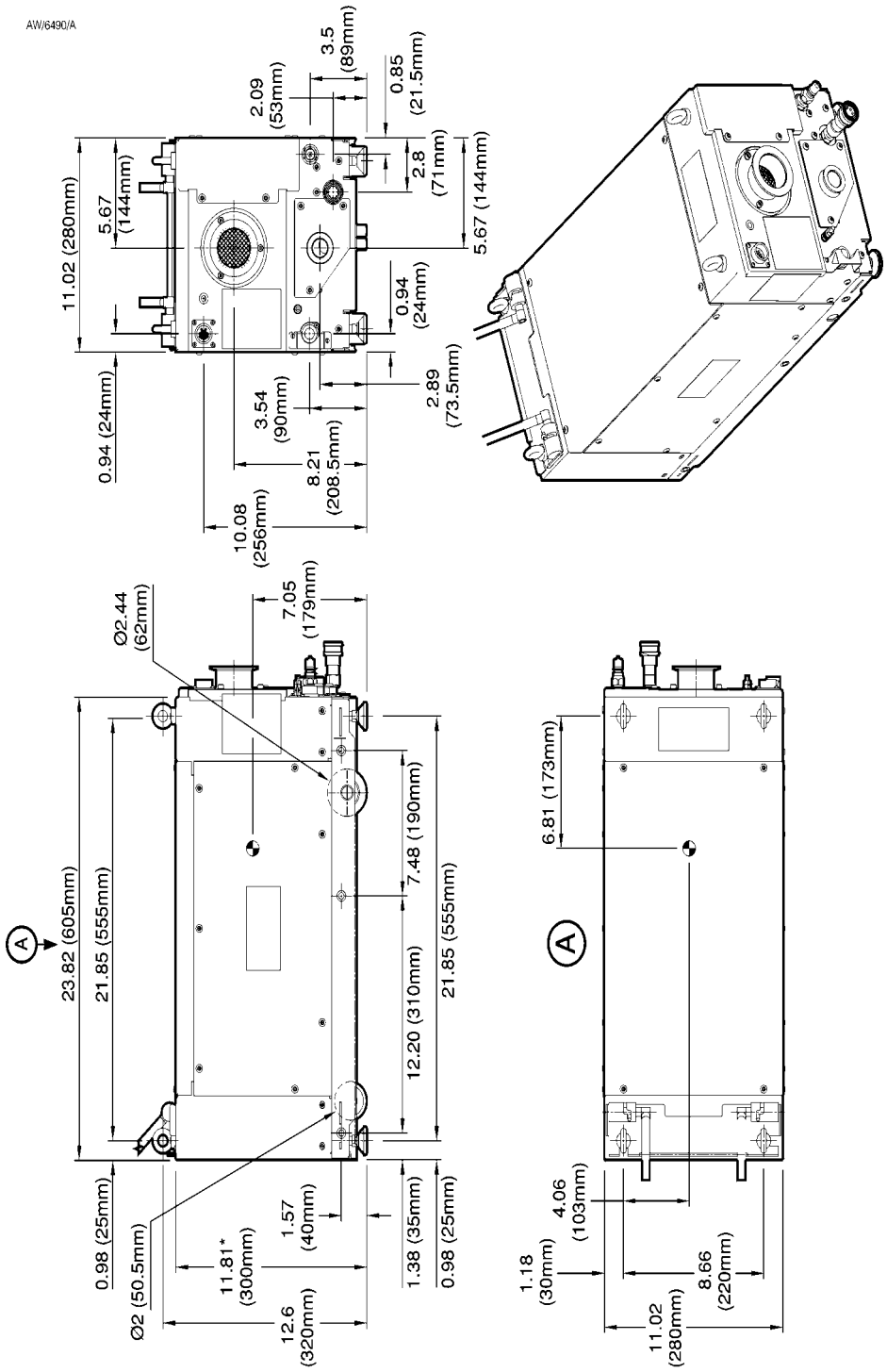
Note: BOC Edwards Material and Safety Data sheet for the oil referred to in the following sections are available on request.

Recommended Oil — Fomblin 16/6
MSDS No. P120-01-015

2.4 Materials in contact with pumped gases

Material	IPUP E100
Cast Iron	✓
SG Iron	✓
Viton	✓
Stainless Steel	✓
Carbon Steel	✓

Table 3 - Materials in contact with pumped gases



* Height of stacked pumps 23.62 (600mm)

Figure 7 - Dimensions of pump IPUP E100L

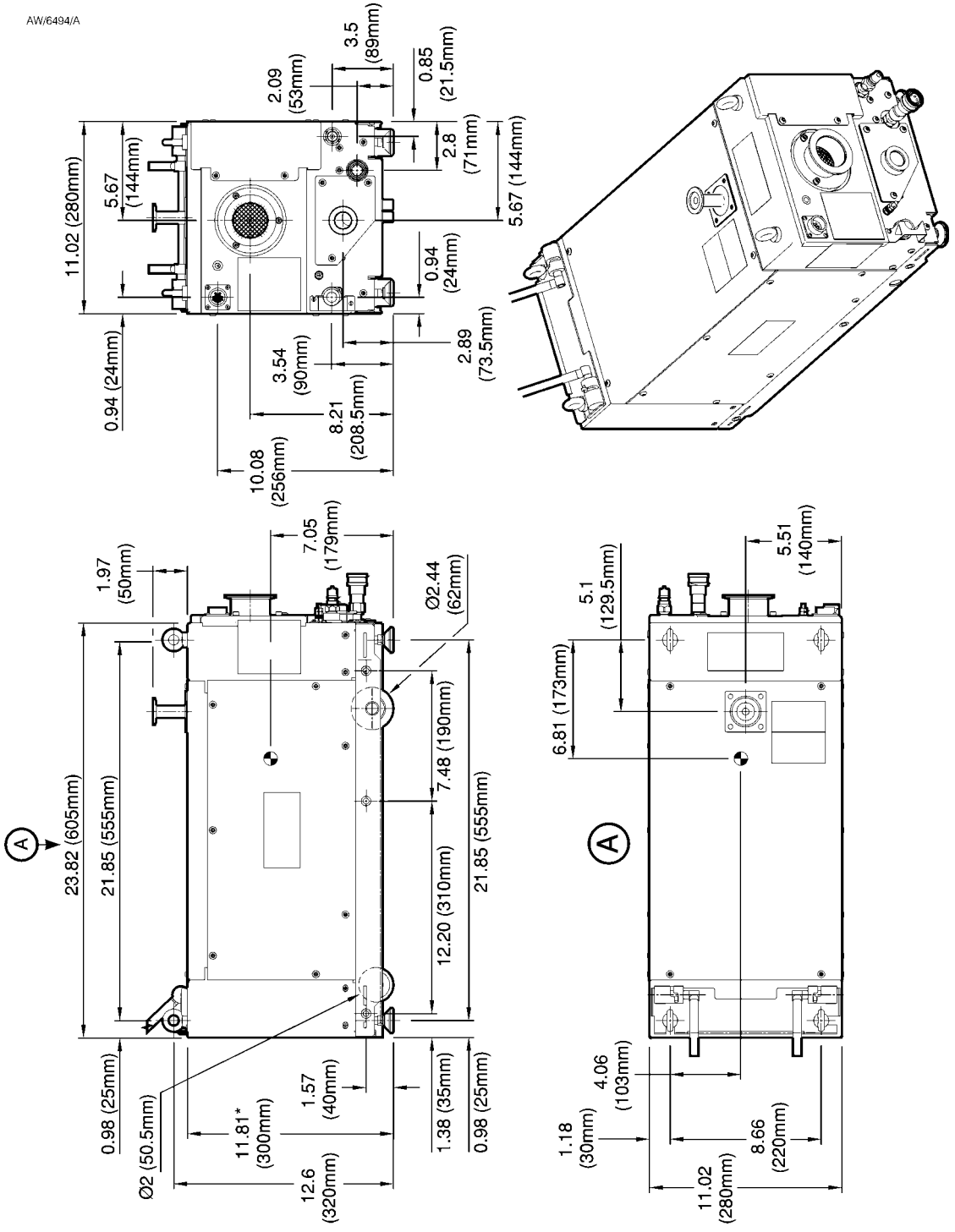


Figure 8 - Dimensions of pump IPUP E100Li

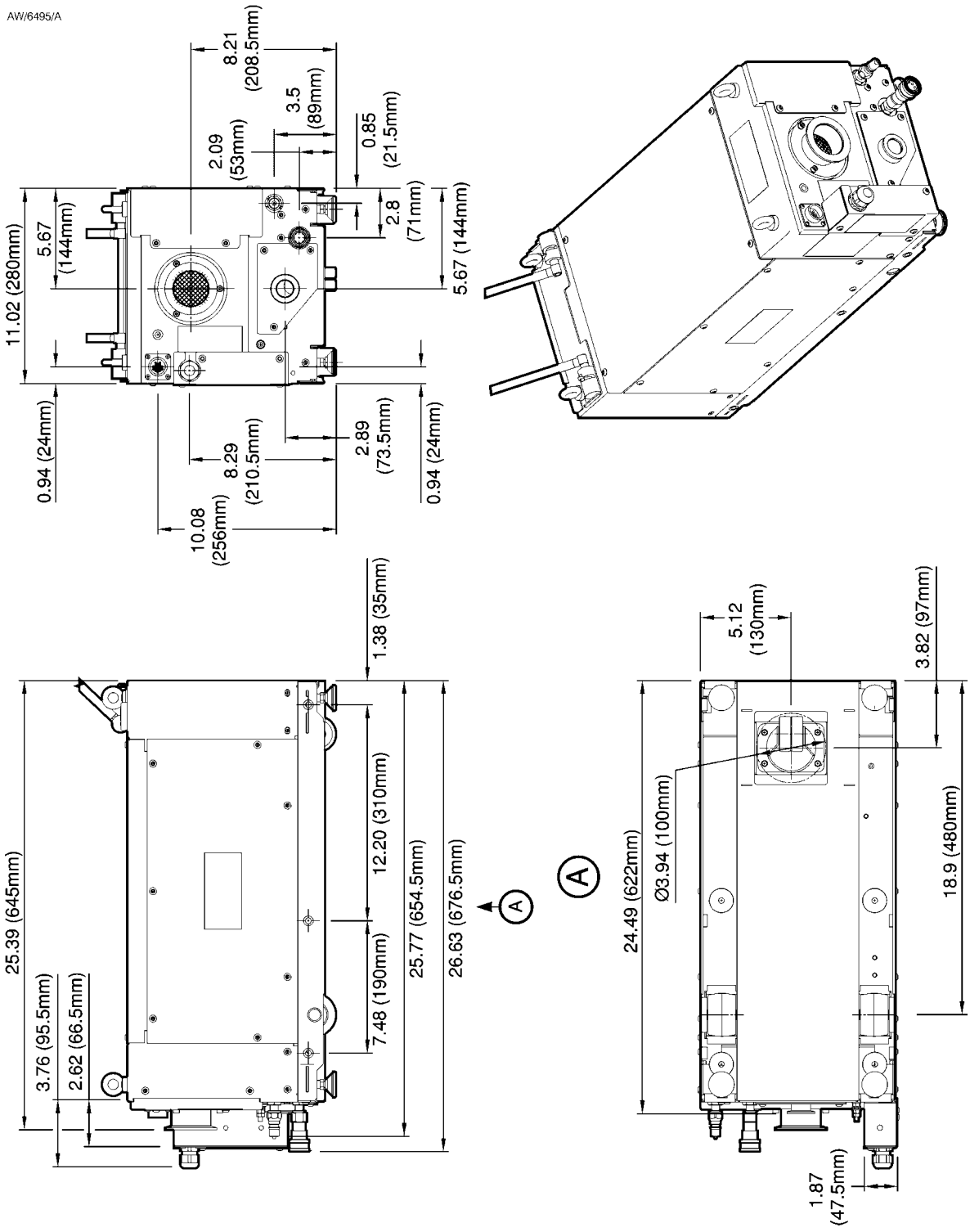


Figure 9 - Dimensions of pump IPUP E100L (Hardwire)

2.5 System schematics

2.5.1 Electrical system

Refer to Figure 10, below for details of the electrical system.

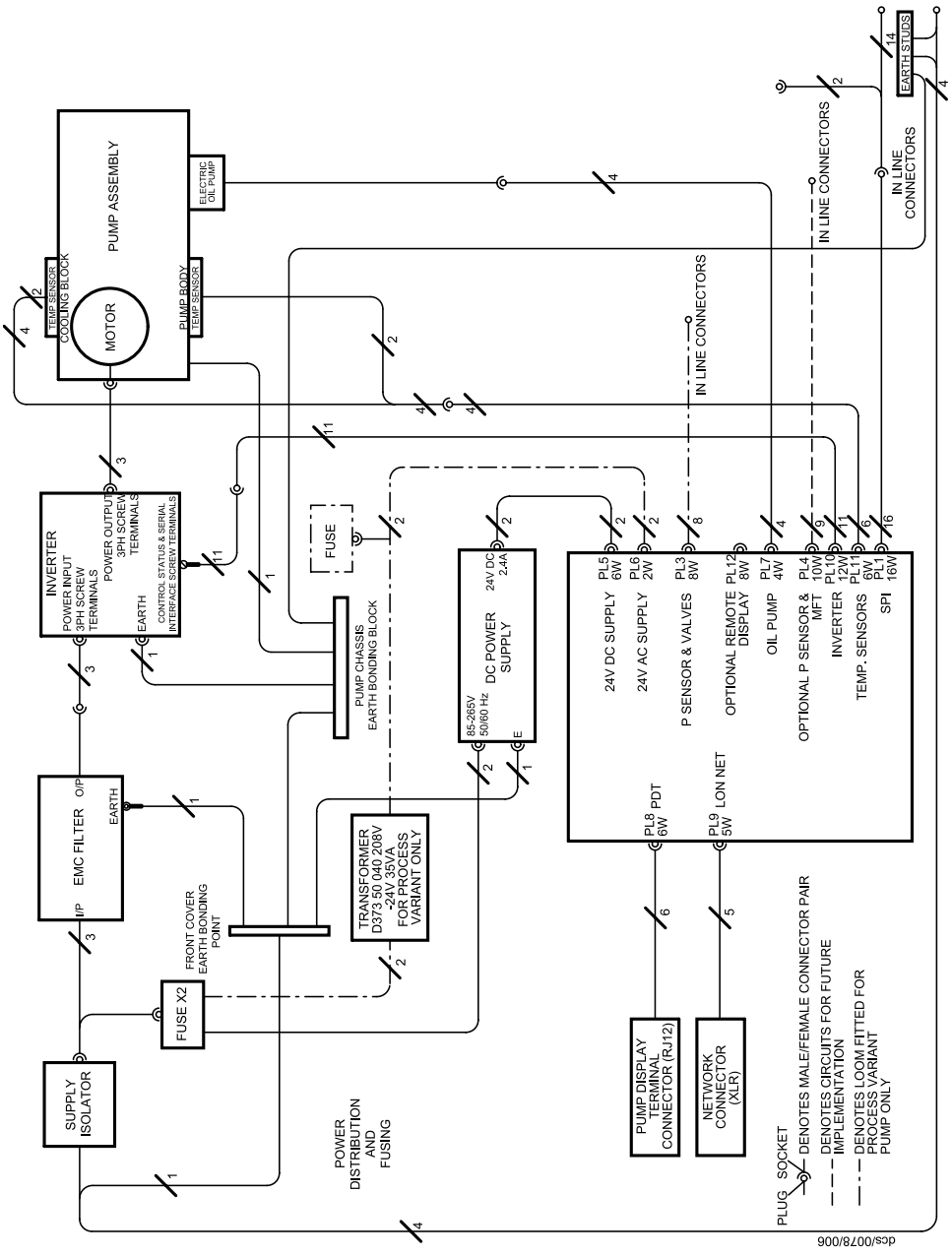


Figure 10 - Electrical system - schematic

2.5.2 Water cooling system

Refer to Figure 11, below for details of the water system.

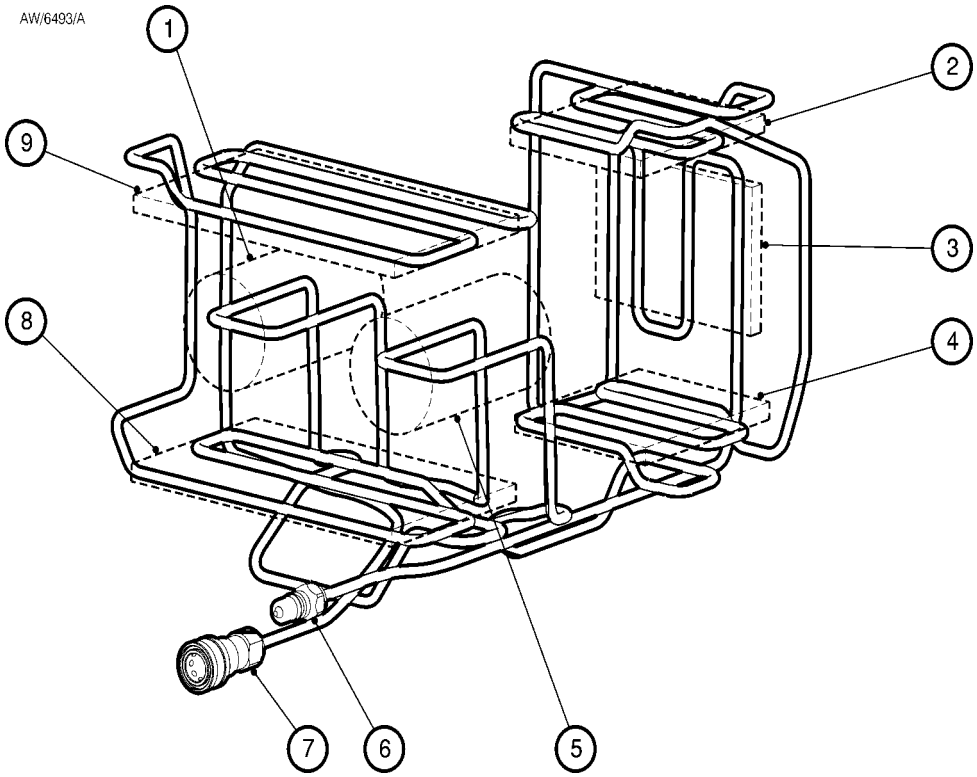


Figure 11 - Water functional diagram

2.6 Part numbers

Table 4 identifies the IPUP E100L, IPUP E100Li, IPUP E100L (Hardwire) and the IPUP E100Li (Hardwire) pumps and gives associated part numbers for ancillary equipment.

Model	Part Number	Applied Materials Part Number
Edwards IPUP E100L / Clean Duty / Mains supply cable (Amphenol) / Pump display terminal (PDT) / Instruction Manual / Stacking bolts (x2) / Handle / 208 V 50/60 Hz system	A535-72-945	0190-04184
Edwards IPUP E100Li / Clean Duty / Interstage Option / Mains supply cable (Amphenol) / Pump display terminal (PDT) / Instruction Manual / Stacking bolts (x2) / Handle / 208 V 50/60 Hz system	A535-76-945	
Edwards IPUP E100L (Hardwire) / Clean Duty / Hardwire Option / Mains supply cable (Marineco) / Pump display terminal (PDT) / Instruction Manual / Stacking bolts (x2) / Handle / 208 V 50/60 Hz system	A535-73-945	3620-00176
Pump display terminal (PDT)	D372-72-800	
Handle	A535-62-190	
Mains supply cable (Amphenol)	D373-50-067	
Stacking bolts set (x4)	A535-72-082	
Instruction Manual	A535-72-880	

Table 4 - IPUP E100 Pump Part Numbers

2.7 Declaration of conformity

Declaration of Conformity

We, BOC Edwards,
Manor Royal,
Crawley,
West Sussex RH10 9LW, UK

declare under our sole responsibility that the product(s)

IPUP E100L	208 V 50/60 Hz	A535-72-945
IPUP E100Li	208 V 50/60 Hz	A535-76-945
IPUP E100L (Hardwire)	208 V 50/60 Hz	A535-73-945

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

EN61326 (Industrial environment, Class A Emissions)	Electrical Equipment for Measurement, Control and Laboratory Use – EMC Requirements.
EN61010-1	Electrical Safety; Machines.
EN 1012-2	Compressors and Vacuum Pumps – Safety Requirements Part 2 - Vacuum Pumps.
SEMI S2-0200	Environmental Health and Safety Guidelines for Semiconductor Manufacturing Equipment.
UL3101	Electrical Equipment for Laboratory Use; Part 1 General Requirements (1st Edition 1993) Control Number: 2002519

following the provisions of

73/023/EEC	Low Voltage Directive.
89/336/EEC	Electromagnetic Compatibility Directive.
98/37/EC	Machinery Safety Directive.

Dr. J. D. Watson, Senior Technical Manager
Vacuum Equipment and Exhaust Management Product Divisions

Date and Place

This product has been manufactured under a quality system registered to ISO9001

BOC EDWARDS

P900-77-000 Issue A 2B01-010

2.8 Certificate of compliance (IPUP E100L)

Global Semiconductor Safety Services

CERTIFICATE OF COMPLIANCE

To SEMI S2-0200 and S8-0999 Guidelines

January 19, 2001

Company Name & Location:	BOC Edwards Manor Royal, Crawley, West Sussex, UK
Place of Manufacturing:	Burgess Hill, Sussex
Document Number:	200395LF
Date of Report:	January 19, 2001
Product Description:	Loadlock Dry Pump
Investigated in accordance with:	SEMI S2-0200 / S8-0999
Model:	IPUP E100L

Andrew Giles, Technical Manger

Pavol Breder, Technical Manager

2.9 Certificate of compliance (IPUP E100Li)

Global Semiconductor Safety Services

CERTIFICATE OF COMPLIANCE

To SEMI S2-0200 and S9-0999 Guidelines

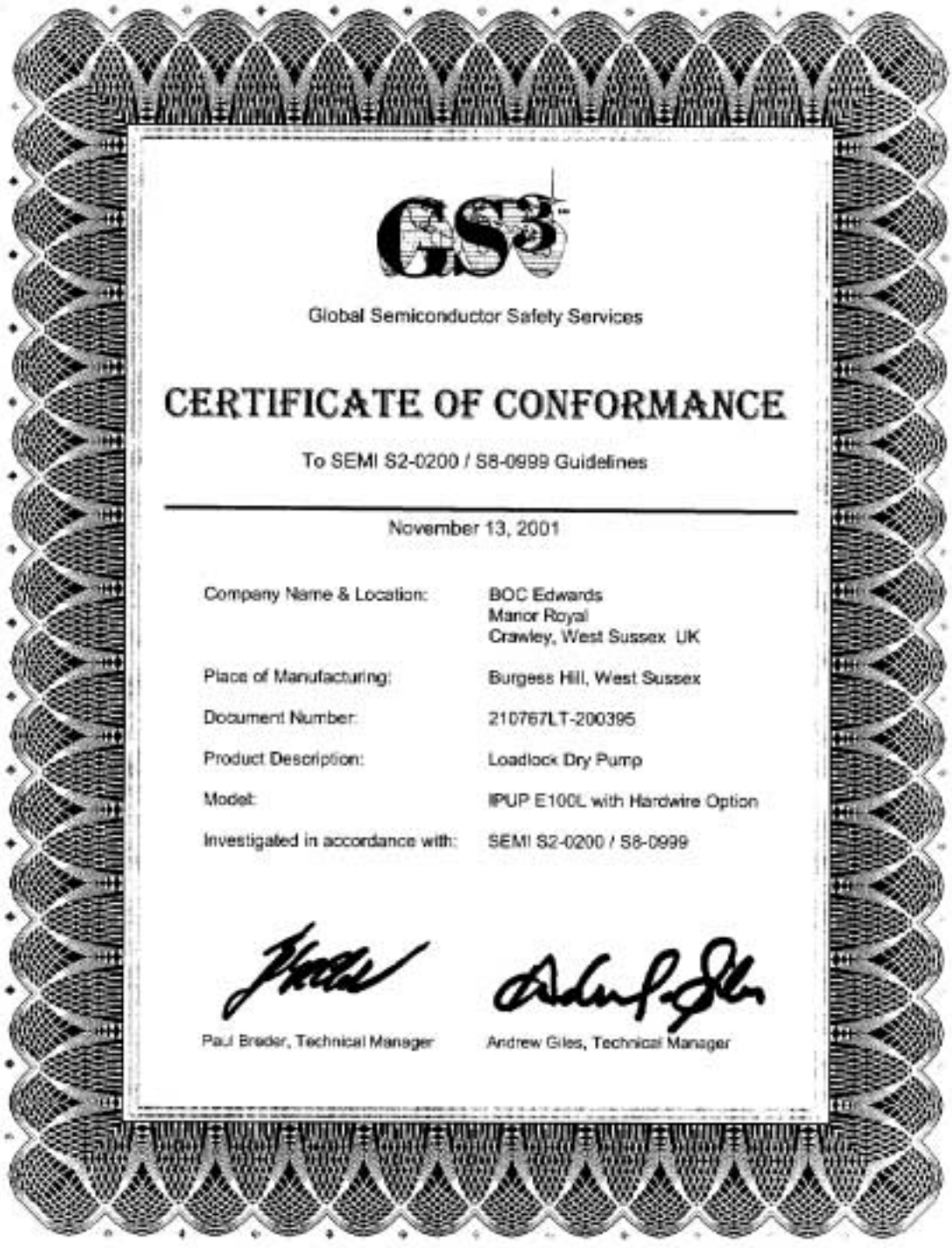
February 22, 2001

Company Name & Location:	BOC Edwards Manor Royal, Crawley, West Sussex, UK
Place of Manufacturing:	Burgess Hill, Sussex
Document Number:	200395LiF
Date of Report:	February 22, 2001
Product Description:	Loadlock Dry Pump
Investigated in accordance with:	SEMI S2-0200 / S8-0999
Model:	IPUP E100Li

Andrew Giles, Technical Manger

Pavol Breder, Technical Manager

2.10 Certificate of compliance (IPUP E100L Hardwire)



Global Semiconductor Safety Services

CERTIFICATE OF CONFORMANCE

To SEMI S2-0200 / S8-0999 Guidelines

November 13, 2001

Company Name & Location:	BOC Edwards Manor Royal Crawley, West Sussex UK
Place of Manufacturing:	Burgess Hill, West Sussex
Document Number:	210767LT-200395
Product Description:	Loadlock Dry Pump
Model:	IPUP E100L with Hardwire Option
Investigated in accordance with:	SEMI S2-0200 / S8-0999

Paul Brader, Technical Manager

Andrew Giles, Technical Manager

3 INSTALLATION

3.1 Safety

WARNING

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

Do not use the pump in a manner not specified by this instruction manual.

CAUTION

Maintain relative humidity levels specified in Table 1 to avoid condensation on the water cooling circuit.

- A suitably trained and supervised technician must install the IPUP E100.
- Ensure that you comply with all local and national safety requirements during installation.
- Ensure that the IPUP E100 pump is suitable for your application. The IPUP E100 is designed for semiconductor load lock, transfer or PVD system pumping applications, or clean general vacuum applications. Contact BOC Edwards or your supplier if you wish to use the IPUP E100 on any other application.

Further details are available from the BOC Edwards publication 'Vacuum pump and vacuum system safety', part no. P300-20-200.

3.2 Installation checklist

The operations required to install the IPUP E100 and the sections of this manual which describe those operations are shown in Table 5.

Installation Operation	Section
Unpack and inspect	3.3
Securing the IPUP E100	3.4
Using the stacking bolts	3.5
Inlet connection	3.6
Exhaust connection	3.7
Interstage connection (Li only)	3.8
Leak test the system	3.9
Connect the cooling-water supply	3.10
Connect to your emergency stop circuit	3.11
Connect the electrical supply (IPUP E100L and IPUP E100Li only)	3.12
Connect the electrical supply (IPUP E100L (Hardwire) only)	3.13
Connect the Smart Pump Interface, SPI	3.14
Pump display terminal, PDT	3.15
Lubrication	3.16

Table 5 - Installation Checklist

3.3 Unpack and inspect

WARNING

Heavy object. Can cause muscle strain or back injury. Use suitable lifting equipment to move the pump.

WARNING

Ensure that the maximum angle between paired slings used to lift the pump is less than 90°.

WARNING

Ensure that Metric M12 eyebolts are fitted to the IPUP E100 as per Figure 2 when lifting the pump.

WARNING

Ensure that the top panel is fitted and that all enclosure fasteners are in place and securely fastened before lifting the pump (Figure 2, Item 1).

1. Remove any protective packaging and covers from the pump along with the four M10 nuts, washers and L-shaped transport brackets that attach the pump to the pallet.
2. Use suitable lifting-equipment attached to the lifting eyes (Figure 2, item 15) to remove the IPUP E100 from its packaging. Refer to Table 2 for pump mass.
3. Inspect the pump. If the pump is damaged notify your supplier and the carrier in writing within three days; state the Serial Number of the IPUP E100 pump together with your order number and your supplier's invoice number. Retain all packing materials for inspection. Do not use the pump if it is damaged.

Note: A 'tip and tell' indicator is fitted to the IPUP E100 pump packaging to indicate any damage or mis-handling during shipment. If the indicator shows that the pump has been tilted or mis-handled during shipment, ensure that you inspect the pump carefully for damage.

4. If the IPUP E100 pump is not to be used immediately, replace the packing materials. Store the pump in suitable conditions as described in Section 7.

3.4 Securing the IPUP E100 pump

WARNING

Heavy object. Can cause muscle strain or back injury. Use suitable lifting equipment to move the pump.

1. Use suitable lifting equipment attached to the eyebolts to move the pump into its required operating position.

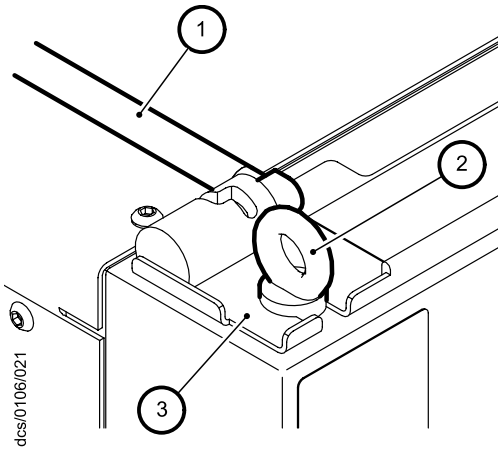
CAUTION

Do not use the handle to lift or carry the pump. The handle is for manoeuvring the pump only.

2. The IPUP E100 can be manoeuvred on a flat surface using the inbuilt wheels and the handle provided.

CAUTION

Ensure handle is properly secured to the pump using the two eyebolts as shown in Figure 12.



1. Handle (lowered)
2. Eyebolt
3. Retaining plate

Figure 12 - Handle

3. Secure the IPUP E100 using the M10 fixing holes provided (Figure 2, Items 13 and 14).

CAUTION

If the docking station is not being used to secure the pump, the pump must be raised up on its four jacking feet.

3.5 Using the stacking bolts

WARNING

Do not stack pumps more than 2 high.

WARNING

Do not stack on top of an IPUP E100Li.

To use the stacking bolts:

1. Remove the four eyebolts and replace with the lower section of the stacking bolt, which has a single through hole. Ensure that the lower section of the stacking bolt is screwed fully into the eyebolt hole (Figure 2, Item 15).
2. Remove the four jacking feet from the second pump and replace with the upper section of the stacking bolt, which has multiple through holes to aid alignment.
3. Crane the second pump onto the top of the first pump, ensuring that the two sections of the four stacking bolts mate.

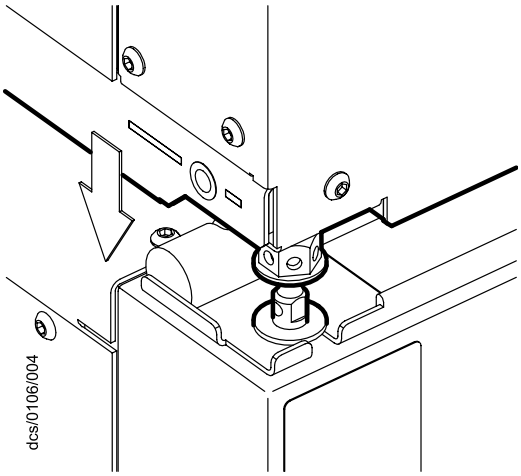


Figure 13 - Stacking bolts

4. Adjust the height of the upper section of the stacking bolt until the through holes in stacking bolt assembly line up.
5. Use the retaining pin and R-clip provided to secure the two sections of the stacking bolt together.

CAUTION

Ensure that all four stacking bolts are used when stacking the IPUP E100. Ensure that the stacking bolt assembly is secured with the retaining pins and R-clip.

3.6 Inlet connection

WARNING

Moving parts present. Can result in serious injury to hands or fingers if placed in the machine. Disconnect and lockout the power before servicing.

Remove the plastic blanking cap from the inlet (Figure 2, item 2), then use a suitable clamp and seal to connect the inlet to your vacuum chamber. Take note of the following when connecting the inlet to your vacuum chamber:

- To get the best pumping speed, ensure that the pipeline which connects the vacuum chamber to the pump is as short as possible and has an internal diameter not less than the pump inlet (NW50).
- Use a flexible connection in the pipeline from the vacuum chamber to the pump to reduce vibration and stress in the system pipelines. Ensure that it has a pressure rating compatible with the highest pressure that can be generated within the system.
- Ensure that you are able to isolate the pump from the atmosphere and from your vacuum chamber if you have pumped or produced dangerous substances.
- Do not allow debris to get into the pump during installation. Ensure that debris cannot get into the pump during operation.
- If necessary, contact BOC Edwards or your supplier for advice on inlet isolation-valves or other components suitable for your application and system design.

3.7 Exhaust connection

WARNING

Pipe the exhaust to a suitable treatment plant to prevent the discharge of dangerous gases or vapors to the surrounding atmosphere.

CAUTION

Install an outlet catchpot to prevent the drainage of condensate back into the pump. If you do not, condensate which drains back into the pump may damage the pump.

Note: If your exhaust extraction system is unrestricted, and so cannot be sealed for leak test purposes, you must leak test the system (refer to Section 3.9) before you connect the pump outlet.

Remove the blanking cap from the outlet (Figure 2, item 5), then use a suitable clamp and seal to connect the outlet to your exhaust pipeline. Take note of the following when connecting the outlet to your exhaust extraction system:

- Do not operate the pump if the pipeline is restricted or blocked as the pump will not operate correctly and may be damaged.

- Incorporate flexible, braided bellows in the exhaust pipeline to reduce the transmission of vibration and to prevent the loading of coupling-joints. When using flexible bellows, ensure that the bellows have a maximum pressure rating which is greater than the highest pressure that can be generated in the system, and can withstand the maximum temperatures that can be generated by the process conditions.
- The exhaust pipeline must be a minimum diameter of NW25 throughout.

3.8 Interstage connection (Li only)

WARNING

Moving parts present. Can result in serious injury to hands or fingers if placed in the machine. Disconnect and lockout the power before servicing.

Remove the plastic blanking cap from the inlet (Figure 3, item 20), then use a suitable clamp and seal to connect the inlet to your process system. Take note of the following when connecting the inlet to your process system:

- To get the best pumping speed, ensure that the pipeline which connects the process system to the pump is as short as possible and has an internal diameter not less than the pump inlet (NW25).
- Use a flexible connection in the pipeline from the process system to the pump to reduce vibration and stress in the system pipelines. Ensure that it has a pressure rating compatible with the highest pressure that can be generated within the system.
- Ensure that you are able to isolate the pump from the atmosphere and from your process system if you have pumped or produced dangerous substances.
- Do not allow debris to get into the pump during installation. Ensure that debris cannot get into the pump during operation.
- If necessary, contact BOC Edwards or your supplier for advice on inlet isolation-valves or other components suitable for your application and system design.

3.9 Leak test the system

WARNING

Leak test the system and seal any leaks found to prevent the leakage of dangerous substances out of the system and leakage of air into the system.

Note: If your exhaust extraction system is unrestricted, and so cannot be sealed for leak test purposes, you must leak test the system before you connect to the pump outlet.

Leak test the system, then seal any leaks found. Substances which leak from the system may be dangerous, and there may be a danger of explosion if air leaks into the system.

As supplied, the leak rate of the IPUP E100 pump is tested to better than 1×10^{-5} mbar l s^{-1}. The required leak rate for your system will depend on your safety and process requirements.

3.10 Connect the cooling-water supply

Connect the cooling-water supply as follows (refer to Table2 for water supply conditions):

1. Fit a suitable female quick-release connector to your cooling-water supply pipeline (details of the connector on the IPUP E100 are given in Table 2).
2. Fit a suitable male quick-release connector to your cooling-water return pipeline (details of the connector on the IPUP E100 are given in Table 2).
3. Fit the male quick-release connector on your cooling-water return pipeline to the cooling-water outlet (Figure 2, Item 4).
4. Fit the female quick-release connector on your cooling-water supply pipeline to the cooling-water inlet (Figure 2, Item 3).
5. Turn on the cooling-water supply.
6. Inspect the water hoses, pipelines and connections to ensure that there are no leaks.
7. Turn off the water supply whilst you complete the remainder of the installation procedure.

Take note of the following when you connect the cooling-water supply and return pipelines:

- Route and secure cables, hoses and pipe-work neatly during installation to avoid possible risk of trips.
- Wipe up any water spilt during installation to avoid possible risk of slips.
- If you need to connect more than one IPUP E100 pump to the water supply, you must connect them in parallel and not in series.
- We recommend that you incorporate a suitable ball-type flow indicator in your water return pipeline, to provide a visual indication of cooling water through the IPUP E100 pump.
- We recommend that you incorporate a suitable filter in the water supply pipeline, if the water supply contains particulates. (For the cooling-water supply specification, refer to Table 2).
- To prevent damage to the pump in the event of cooling-water supply failure, we recommend that you incorporate a suitable flow-switch in the cooling-water return pipelines. You can connect the outputs of the flow-switch to your control equipment to shut down the pump if the cooling-water flow through the pump gets too low.

CAUTION

Drain the cooling water from the IPUP E100 if you intend to transport or store the pump where the cooling water could freeze, to avoid internal damage to the pump.

3.11 Connect to your emergency stop circuit

The pump must be connected to an emergency stop facility. The operation of the emergency stop function should immediately disconnect power from the pump when the emergency stop control is operated. Returning the emergency stop control to its normal operating position should not result in power being re-applied to the pump; a separate start or reset control should be used for this.

The emergency stop control must be compliant with [IEC 60947-5-1]. (This should be a red self latching mushroom push button on a yellow background.)

3.12 Connect the electrical supply (IPUP E100L and IPUP E100Li only)

WARNING

Do not use the mains supply connector or mains switch, Figure 2, Items 10 and 16, to isolate the power.

WARNING

Connect the electrical supply to the IPUP E100 pump through a suitable fuse/ isolator rated as specified in Table 2.

The pump must be fused and isolated close to the pump and marked as the disconnection device for the equipment.

WARNING

Ensure that the cable clamp (Figure 2, Item 9) is fastened around the connector using the fixing supplied before the power is connected.

WARNING

Do not operate the IPUP E100 unless it is correctly earthed (grounded).

Note: If you connect the electrical supply to the IPUP E100 pump through ELCB relays, they must be suitable for the protection of equipment with a d.c. component in the fault current, and suitable for short-duration switch-on surges, and for high leakage currents (for example, type B, according to prEN50178).

The IPUP E100 pump is supplied with a mains cable. Use the following procedure to connect the pump to the electrical supply:

1. Use a suitable earth (ground) cable to connect the protective earth (ground) stud (Figure 2, item 7) on the IPUP E100 to a suitable earth (ground) point on the system. The cable rating should be consistent with the system earthing policy.
2. Connect the earth (ground) ring lug on the mains supply cable to supply earth from the tool.
3. Connect the three phases ring lugs on the mains supply cable to the supply from the tool.
4. Screw the mains supply connector into the mating connector on the pump (Figure 2, item 10).
5. Lock the cable clamp (Figure 2, item 9) around the mated mains supply connectors using the fixing provided.

3.13 Connect the electrical supply (IPUP E100L (Hardwire) only)

WARNING

Do not use the mains supply connection box, mains supply connector or mains switch (Figure 2, Item 10 or Figure 4, item 21) to isolate the power.

WARNING

Connect the electrical supply to the IPUP E100 pump through a suitable fuse/ isolator rated as specified in Table 2.

The pump must be fused and isolated close to the pump and marked as the disconnection device for the equipment.

WARNING

Ensure that the connection box cover (Figure 14, Item 3) is securely fastened onto the connection box (Figure 14, item 1) using the fixings supplied, before the power is connected.

WARNING

Do not operate the IPUP E100 unless it is correctly earthed (grounded).

Note: If the electrical supply to the IPUP E100 pump is connected through ELCB relays, they must be suitable for the protection of equipment with a d.c. component in the fault current, and suitable for short-duration switch-on surges, and for high leakage current (for example Type B, according to prEN50178).

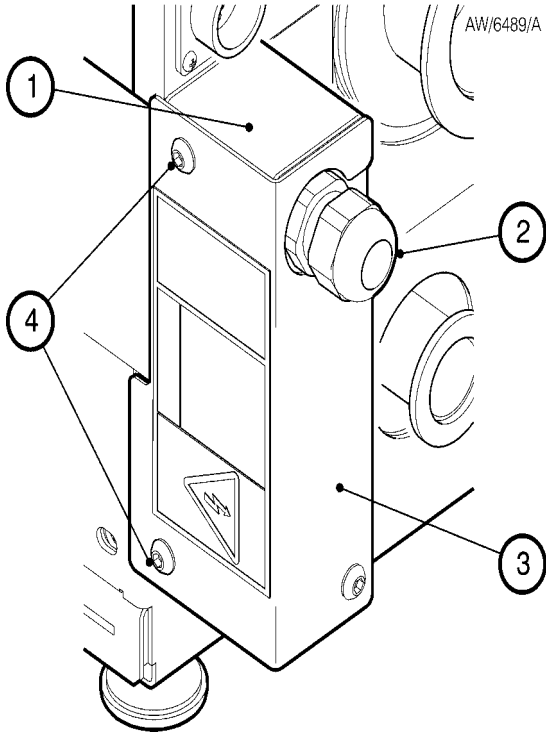


Figure 14 - Connection box

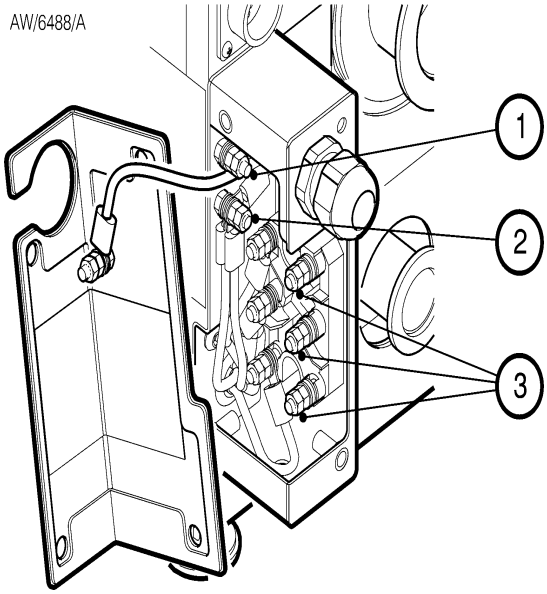


Figure 15 - Connection box (cover removed)

The IPUP E100 hardwire variant is supplied with a connection box and mains cable. Use the following procedure to connect the mains cable to the connection box as required.

CAUTION

The cable rating for the incoming mains supply from the tool must be consistent with the pump ratings given in Table 2.

1. Use a suitable earth (ground) cable to connect the protective earth (ground) stud (Figure 2, item 7) on the IPUP E100 to a suitable earth (ground) point on the system. The cable rating should be consistent with the system earthing policy.
2. Remove the cover (Figure 14, item3) from the connection box by removing the four fixings.

3. Pass the incoming mains cable from the tool through the cable gland (Figure 16, item 2), allowing sufficient length inside the connection box to remove any strain from the wiring.

4. Connect the earth (ground) ring lug on the incoming mains supply cable to the earth stud on the connection box (Figure 17, item 1).

CAUTION

Do not disconnect the pump earth stud (Figure x, item x) or the connection box cover earth stud (Figure 17, item 1).

CAUTION

The earth lead on the incoming mains supply cable from the tool must be longer than any of the three phase wires to ensure that the earth wire would be the last to break, should the cable be forcibly pulled through the cable gland.

CAUTION

Ensure that the mains supply cable is terminated at the connection box with M5 insulation sleeved ring lugs.

5. Connect the three phase ring lugs on the incoming mains supply cable from the tool to the three studs (Figure 17, item 2). Remove the two upper nuts and the washer, fit the ring lug and refit the washer and two nuts. (The connections are not phase dependant).

CAUTION

Ensure that the nuts are sufficiently tight so that they will not unfasten accidentally.

6. Tighten the cable gland (Figure 16, item 2).

7. Refit the connection box cover using the four fasteners supplied, by passing the mains supply cable from the tool through the cut-out in the connection box cover.

3.14 Connecting the smart pump interface, SPI

WARNING

SPI signals are for control only and should not be used for safety purposes.

CAUTION

Control defaults to the SPI should the power be removed.

Note: All control connectors are protected by double or reinforced insulation from becoming hazardous live.

Connect the Smart Pump Interface Cable to the Comms 3 port (Figure 2, item 6) (Cable not supplied). The pin-out is shown in Figure 16.

3.15 Pump display terminal, PDT

If required, the IPUP E100 can be run manually through the PDT. Connect the PDT to the Comms 1 port (Figure 2, item 17) as required.

3.16 Lubrication

The IPUP E100 is given a charge of oil before it leaves the factory. There is no requirement to modify the oil level.

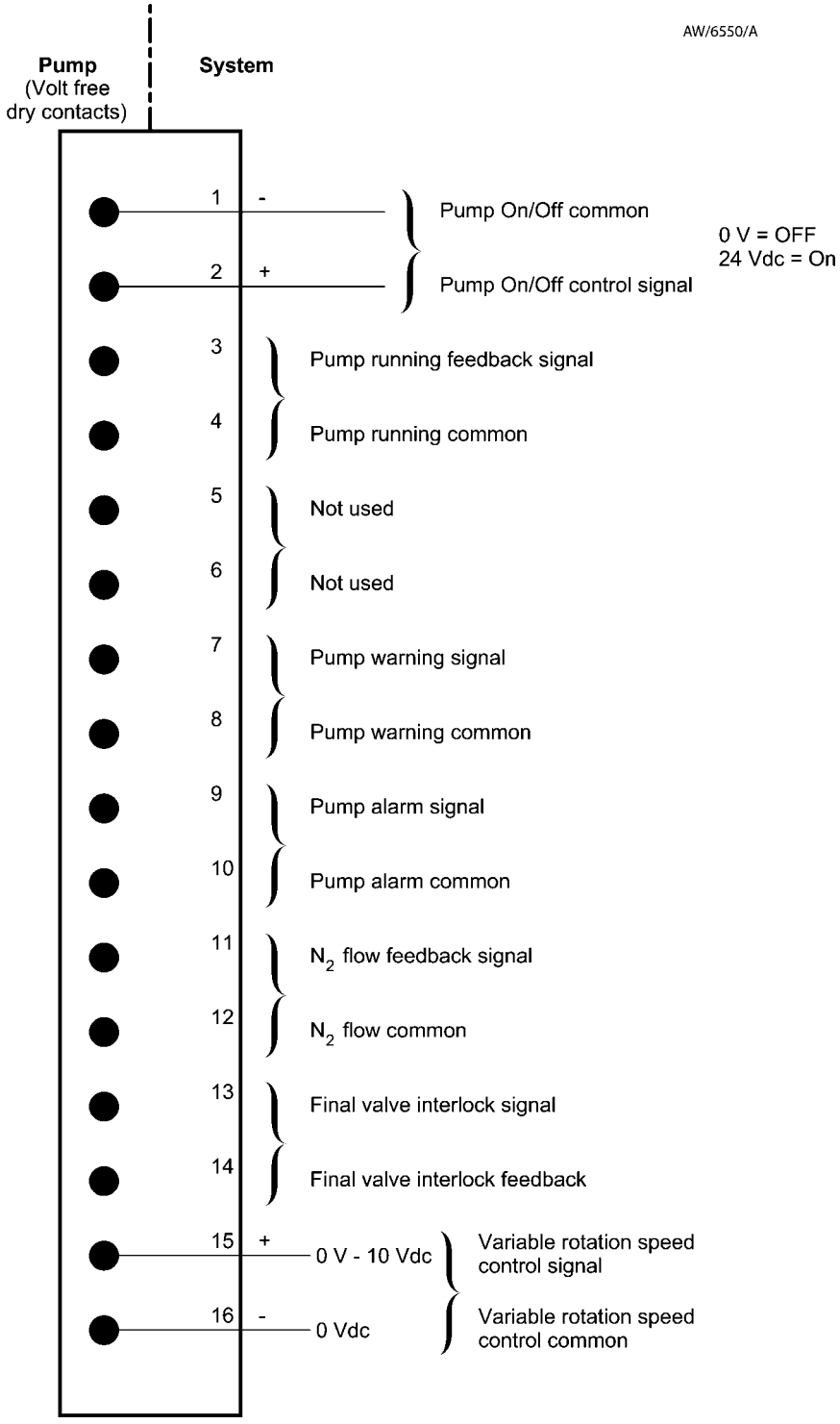


Figure 16 - SPI Connections

4 PUMP DISPLAY TERMINAL (PDT) MENUS AND DISPLAY FORMATS

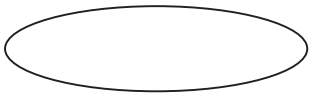
4.1 Introduction

The PDT front panel showing the display and the control buttons are shown in Figure 5.

The menu structure is shown in Table 6. Note that if a particular system component or accessory is not fitted, the corresponding menu option is shown as 'NP' (not present).

Menus used and the display messages shown on the Pump Display Terminal (PDT) are described in the menu diagrams in Figures 17 to 35. The following symbols and conventions are used in the menu diagrams:

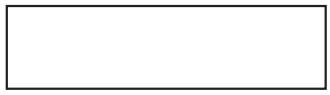
These are flow lines. Arrows on the lines show the direction of flow through a menu.



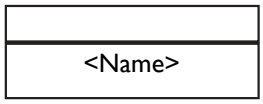
This symbol is used to connect different menus and shows the starting point (or continuation point) of a menu.

This symbol is used for the ENTER and CANCEL buttons and the four menu buttons: Normal, Status, Control and Setup.

This symbol is used for the up (s) and down (t) buttons and for the on (⏻) and off (⏻) buttons.



This symbol is used for the two-line display on the PDT.



This symbol is a submenu box; a submenu is a series of menu steps which are used in a number of different menus or used in different parts of one menu. Completion of the menu returns to the previous menu.

☞

This symbol shows additional text which is not part of the menu, but which further describes the operation of the menu.

4.2 General operation

When you first switch on the IPUP E100 system, the Normal display is shown: see Figure 20. You can then press the On or Off button, or any of the four menu buttons to exit the current menu and enter the corresponding new menu. Figure 22 shows this menu control logic.

4.3 The CANCEL button

You can press the CANCEL button at any time during menu operation. For this reason, we have not shown the use of the CANCEL button on all of the menu diagrams, but we have shown specific uses where there is no other obvious way to cancel the current menu option and enter the previous menu option. In general, when you press the CANCEL button, the current menu option is cancelled and the previous menu option is displayed. Other specific uses of the CANCEL button are as follows:

- In the Switch On and Switch Off menus (Figures 18 and 19), when you press CANCEL, the menu is exited and the normal display is shown.
- In the Status menu (Figure 21), when you press CANCEL the display shows the first two status parameters (the defaults are IPUP E100 current consumption and power consumption).
- When you enter the password for the setup menu (Figure 23), if you press CANCEL, before you enter the value, the menu moves back to entry of the previous digit of the password.

4.4 Display text and variable text

In the menu diagrams in Figures 17 to 35, text shown without chevron brackets in the two-line display symbol is the actual text that will be shown on the display. In this text, the 'Δ' symbol is used to show where a digit will be shown; the value of the digit depends on the sensor data or information you enter into the PDT.

Text enclosed in chevron brackets (for example, <status>) defines variable text; what is shown on the display depends on the menu or the IPUP E100 system and data entered by the user. The following variable text markers are used on the menu diagrams:

<status>

Text message giving status of the selected parameter.

<serial number>

This specifies the serial number. The serial number is a number which you can use to identify the IPUP E100 system in the installation.

<parameter>

This is a previously selected parameter or menu option.

<message>

This specifies a warning, alarm or advisory message.

4.5 Wrap-around

When you use the up and down buttons to change a digit or character on the display, the digit or character will 'wrap-around' between its minimum and maximum values. For example, when you enter a password digit, if the digit is '0' and you press the down button, the digit will change to '9'; if the digit is '9' and you press the up button, the digit will change to '0'.

4.6 Timeout

As supplied, after you have entered a menu (other than the Normal menu), if you do not press a button for five minutes, the Pump Display Terminal will automatically exit the current menu and enter the Normal menu. This facility (known as timeout) is available so that if the setup menu is entered and then IPUP E100 system is accidentally left unattended for a specified time, the menu is exited to prevent unauthorized use of the menu options.

4.7 Menu structure

The PDT front panel showing the display and the control buttons are shown in Figure 5.

The menu structure is shown in Table 6. Note that if a particular system component or accessory is not fitted, the corresponding menu option is shown as 'NP' (not present).

4.8 Example

Here is an example of how to interpret the menu diagrams. The following procedure describes how to change the units displayed for pressures (you can select kPa or psi).

1. Press the Setup button to enter the Setup menu (Figure 23).
2. Use the up and down buttons to change the first digit of the setup password to the correct value, then press the ENTER button.
3. Use the up and down buttons to change the second digit of the setup password to the correct value, then press the ENTER button.
4. Use the up and down buttons to change the third digit of the setup password to the correct value, then press the ENTER button.
5. If you have entered the correct password, the display will then show 'SETUP MENU' on the top line and 'N_2 Purge' on the bottom line.
6. Press the down button four times or press the up button five times; the display will then show 'SETUP MENU' on the top line and 'Units' on the bottom line.
7. Press the ENTER button; the display will then show 'UNITS SELECT' on the top line and 'PRESSURE' on the bottom line (see Figure 23).
8. Press the ENTER button; the display will then show 'PRESSURE UNITS' on the top line and the currently selected pressure units on the bottom line.
9. Press the up or down buttons to change the units displayed to the required units, then press the ENTER button. Pressures will now be displayed in the units you selected.

Menu	Figure
Switch on	18
Switch off	19
Normal (default)	20
Status	21
Control	22
Setup (1 of 3)	23
PDT, turn on/off menu	26
PDT, Pump type menu	27
PDT, Shutdown mode menu	28
PDT, Units menu	29
PDT, Adjust pressure menu	30
PDT, Adjust temperature menu	31
PDT, adjust speed menu	32
PDT, Select line menu	33
PDT, Clear inverter alarms	34
PDT, Software version	35

Table 6 - Pump Display Terminal (PDT)/menu structure

* Read only parameters.

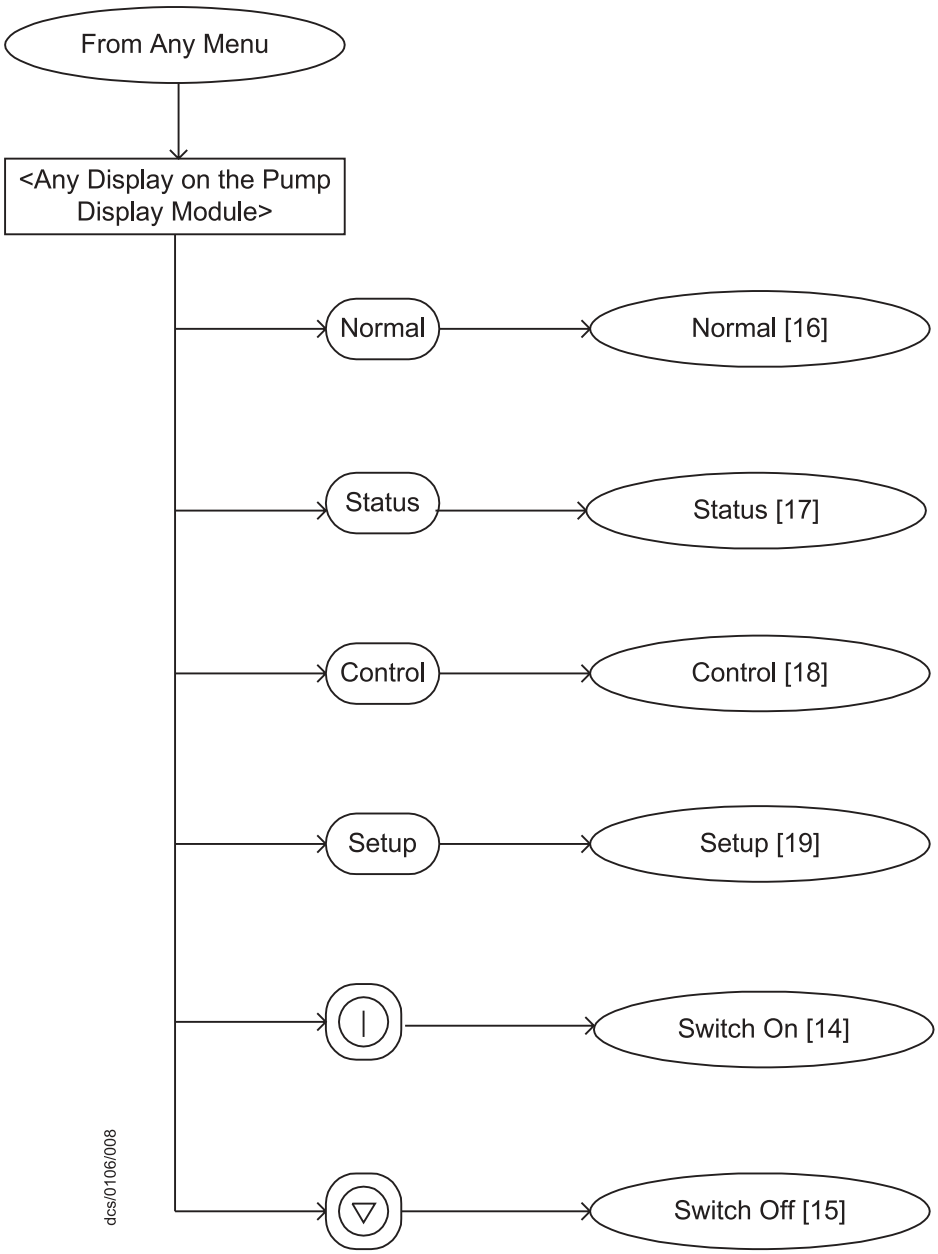
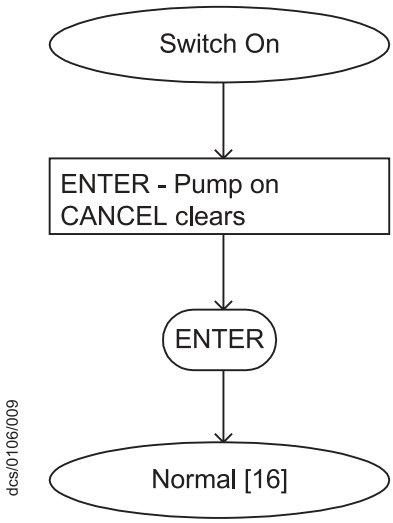


Figure 17 - PDT Menu logic



Local control is required before the pump can be switched on.

Figure 18 - Switch on Menu

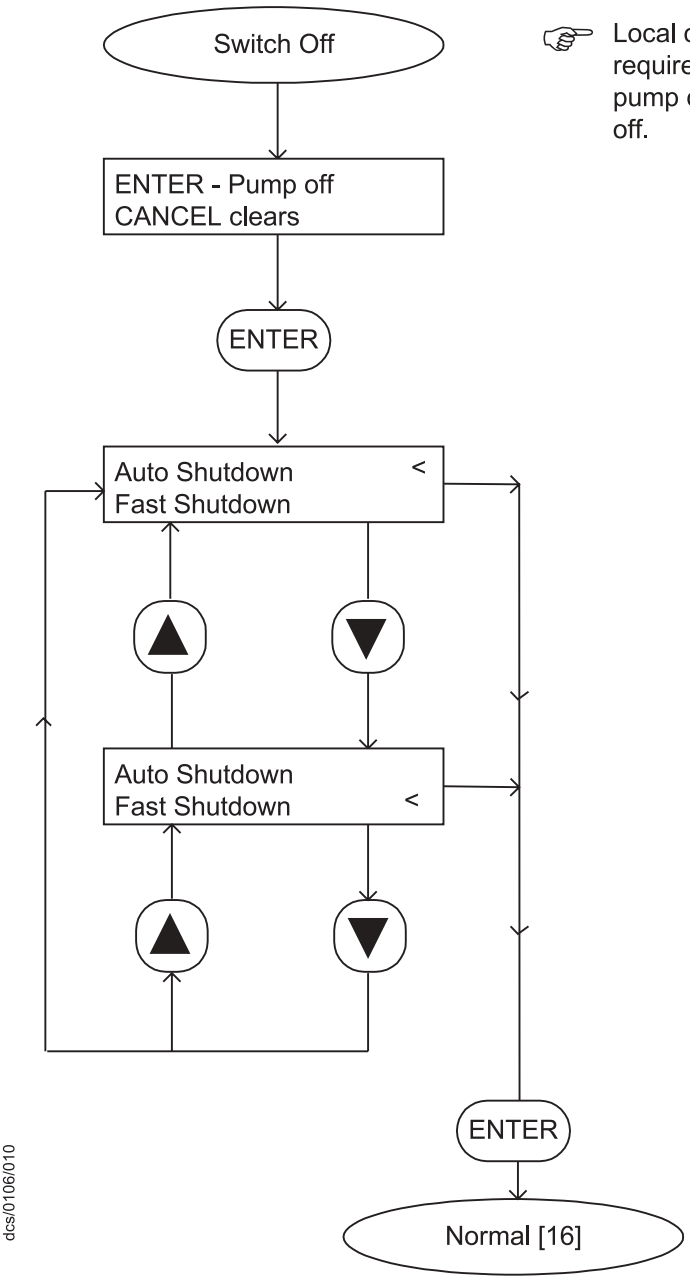
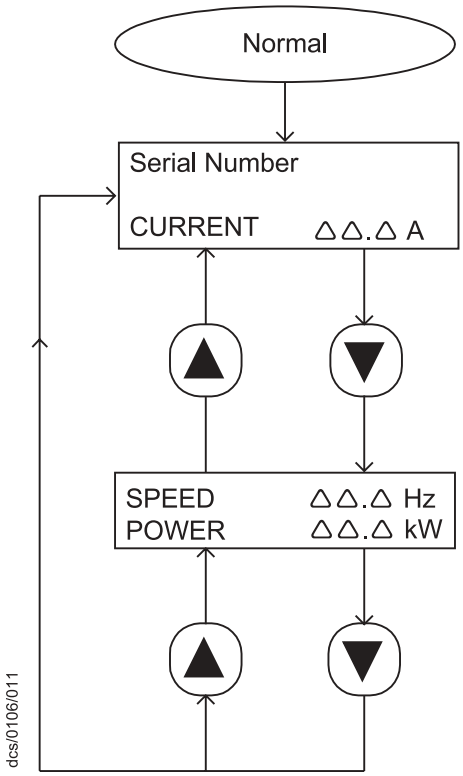


Figure 19 - Switch off menu



To change the values being displayed revert to [19].

Figure 20 - Normal Menu

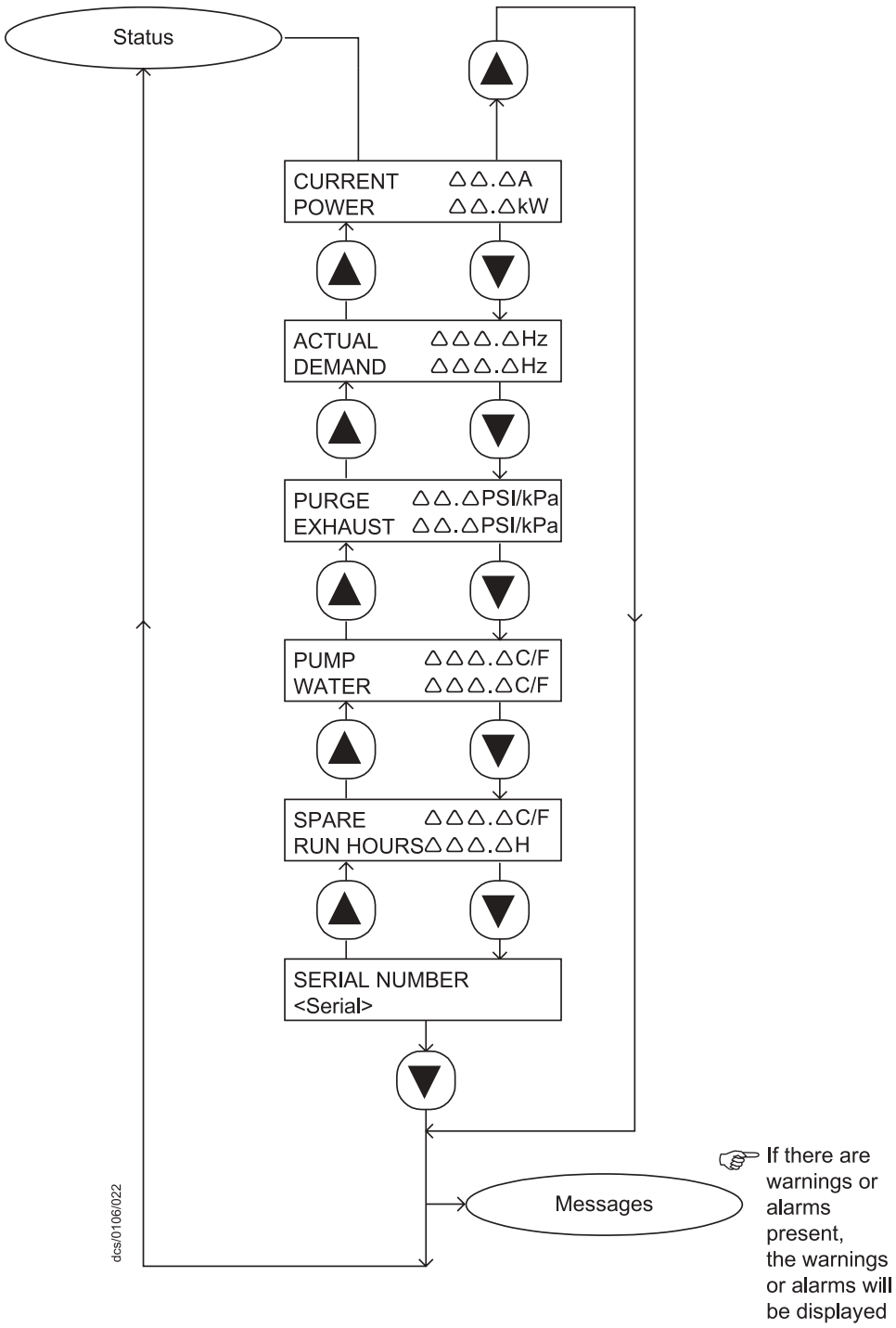


Figure 21 - Status Menu

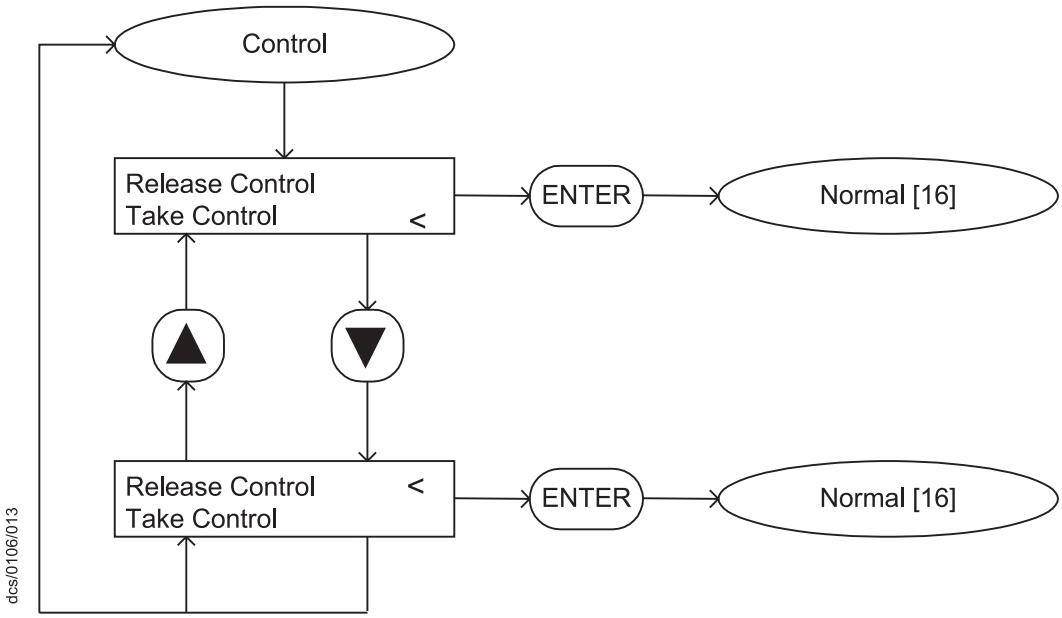


Figure 22 - Control menu

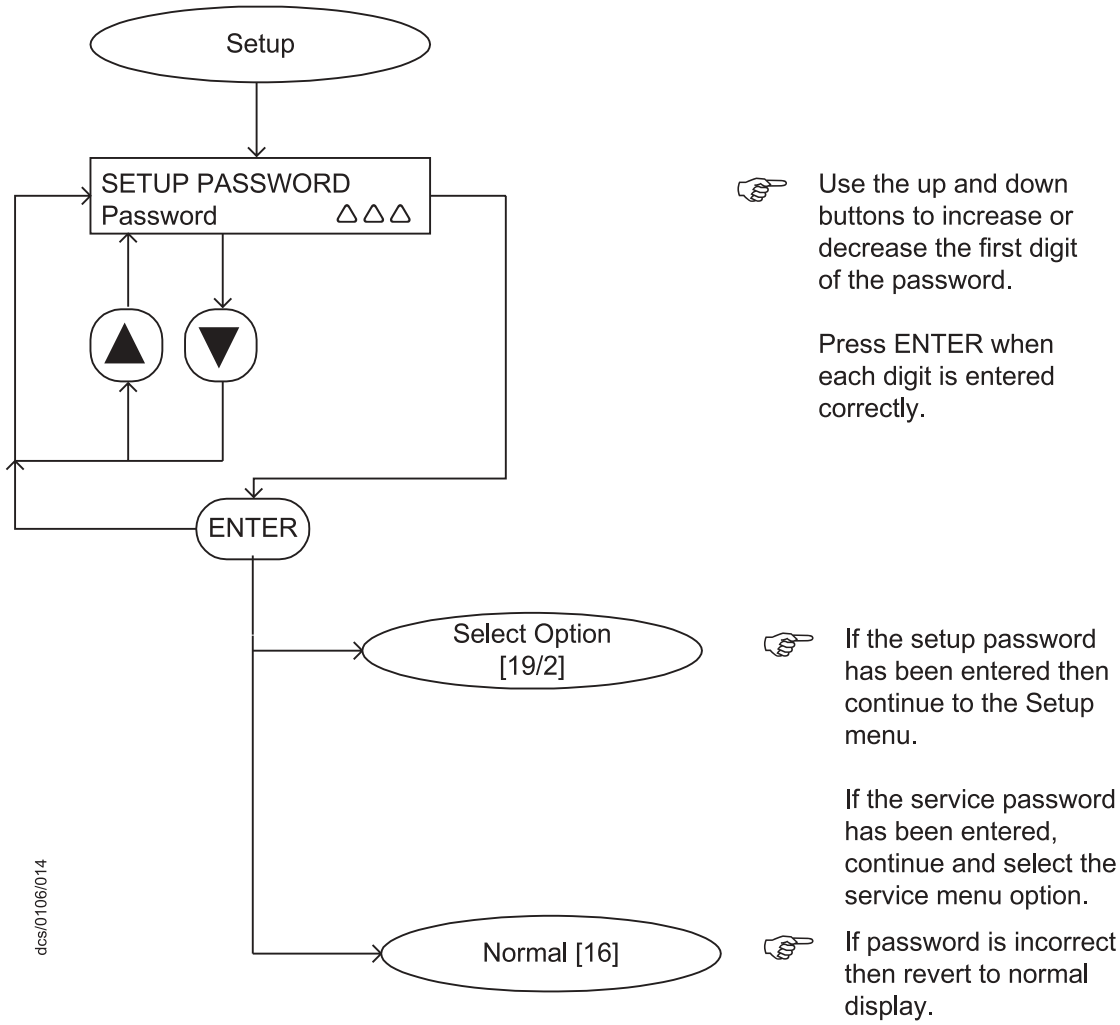


Figure 23 - Setup menu (sheet 1 of 3)

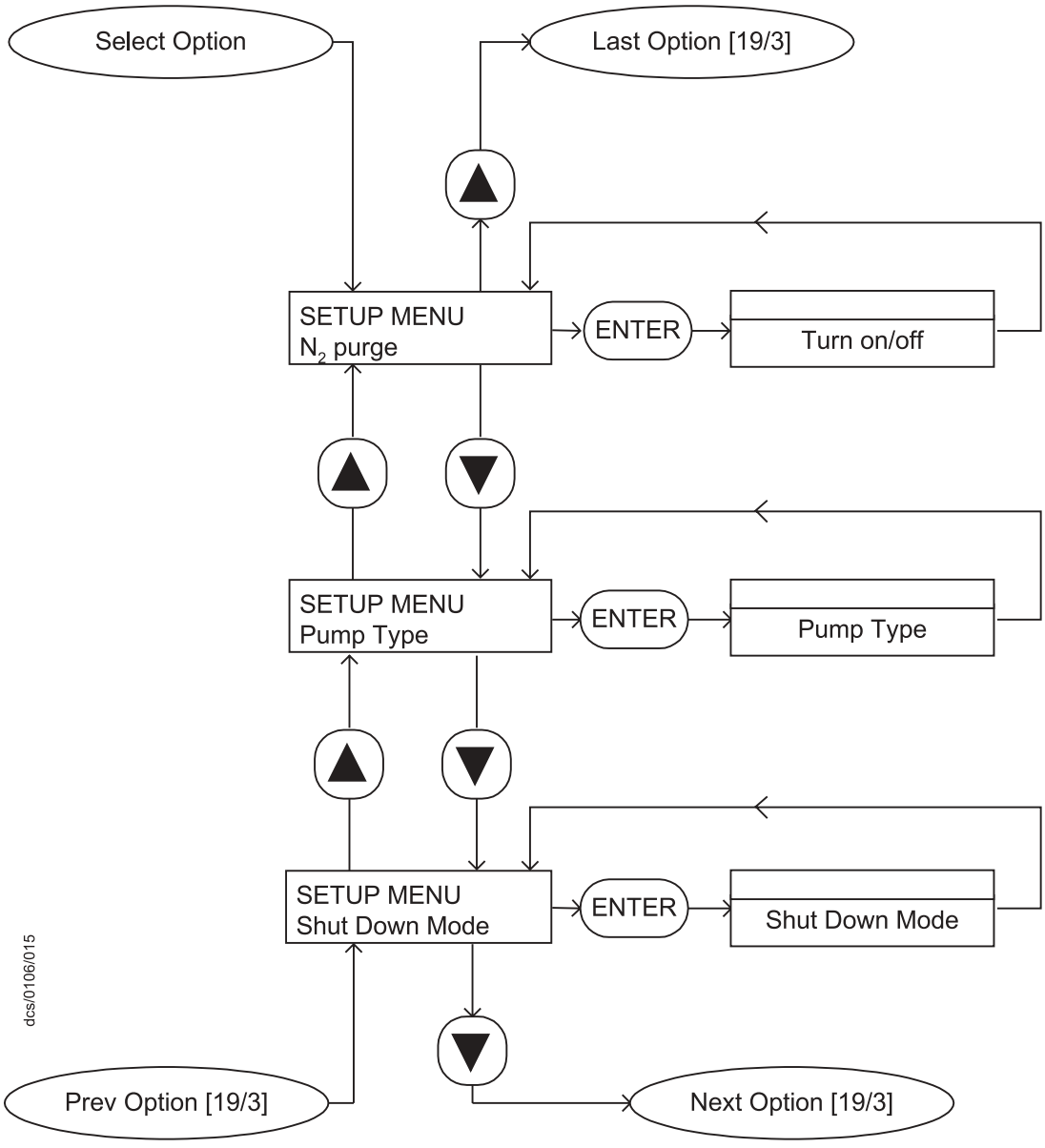


Figure 24 - Setup menu (sheet 2 of 3)

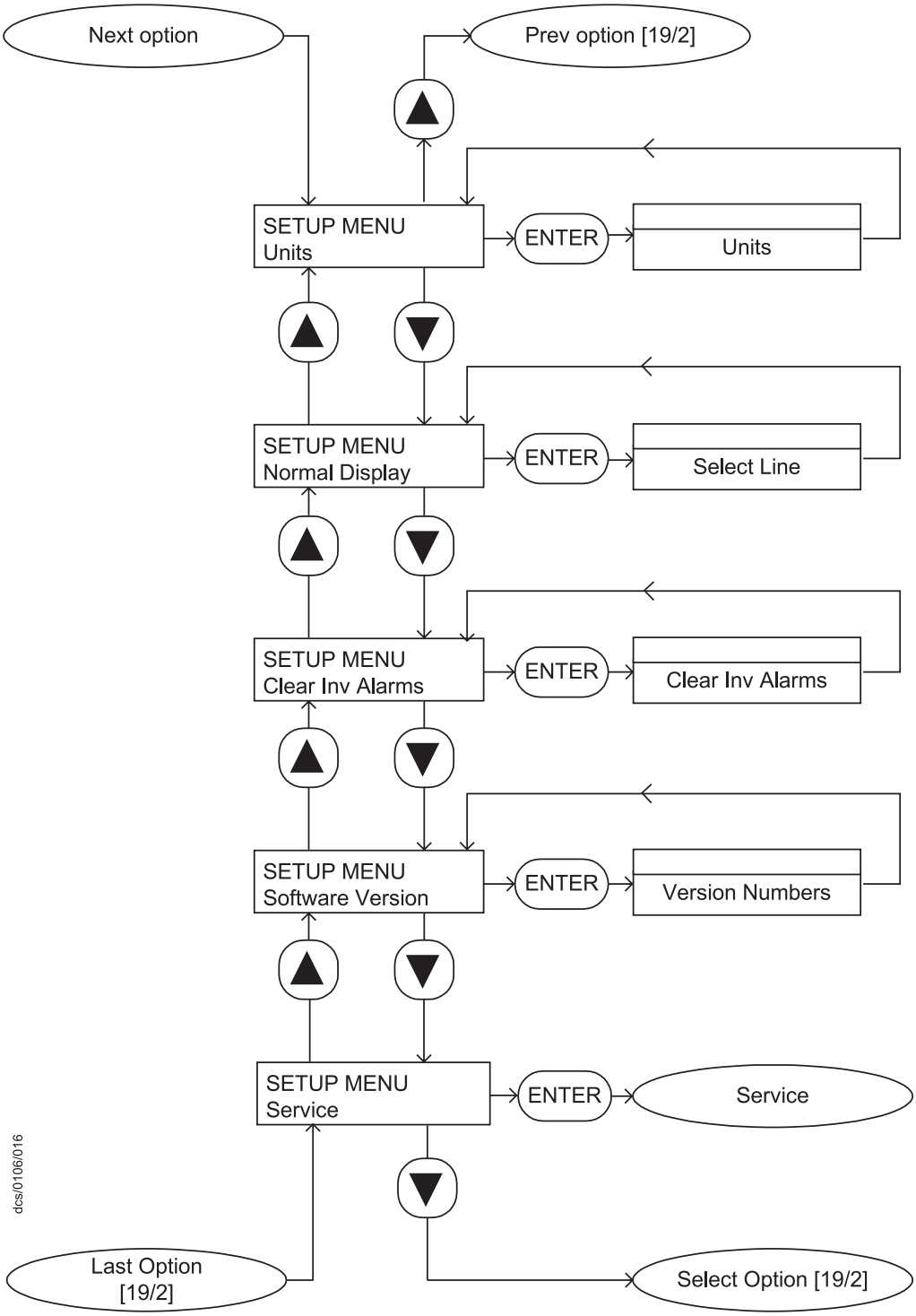


Figure 25 - Setup menu (sheet 3 of 3)

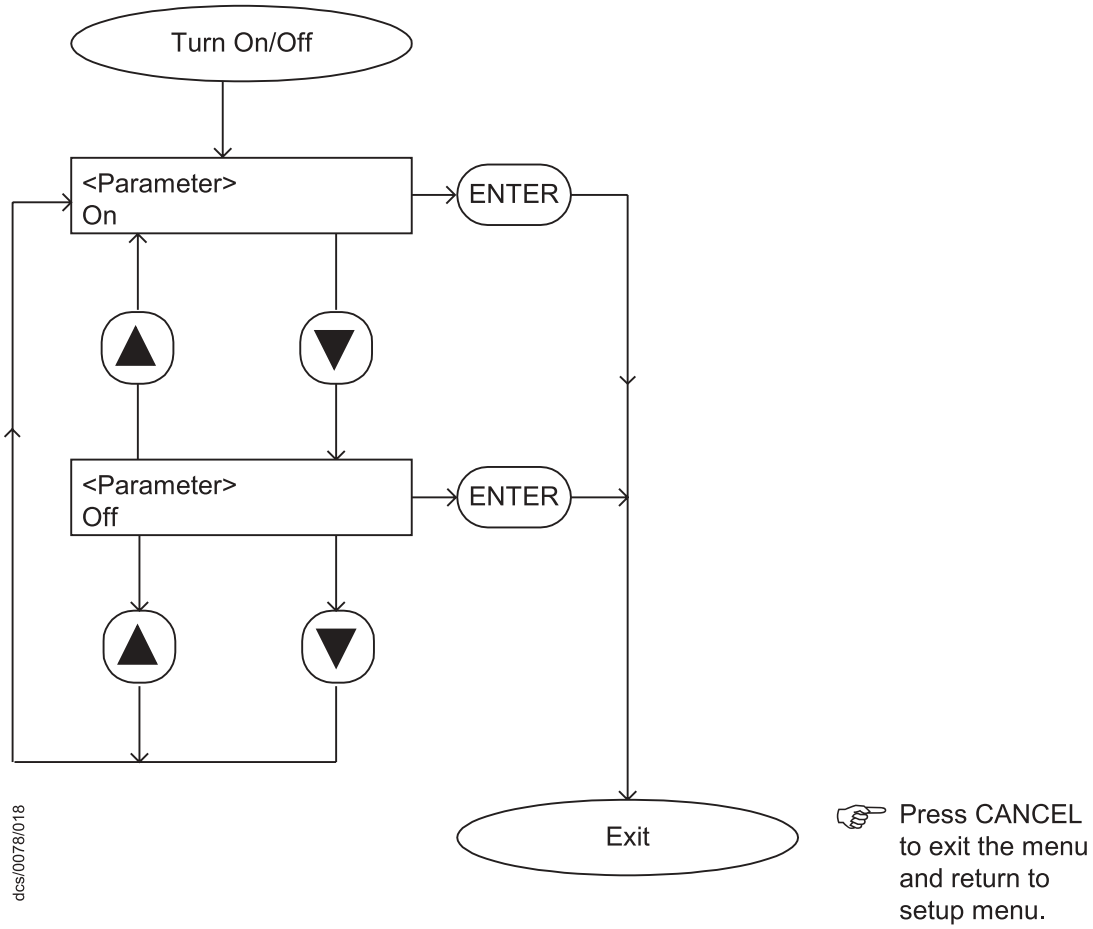


Figure 26 - PDT, turn on/off menu

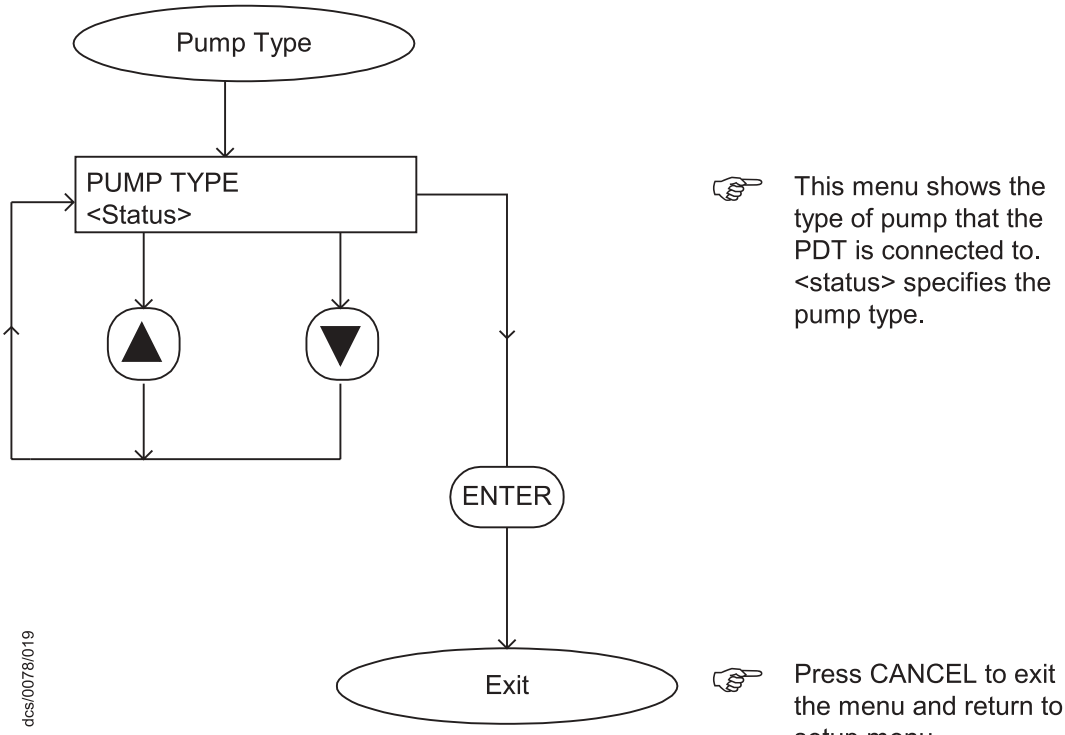


Figure 27 - PDT, pump type menu

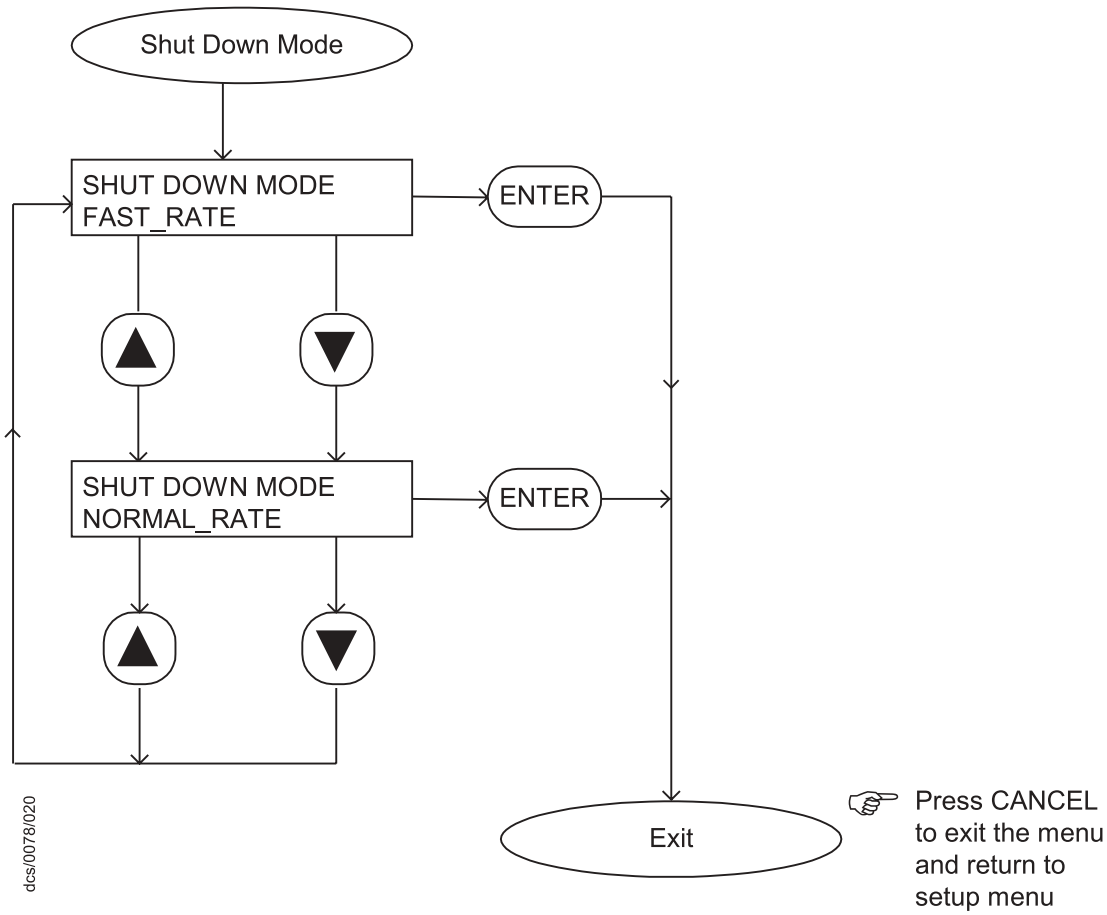


Figure 28 - PDT, shut down mode menu

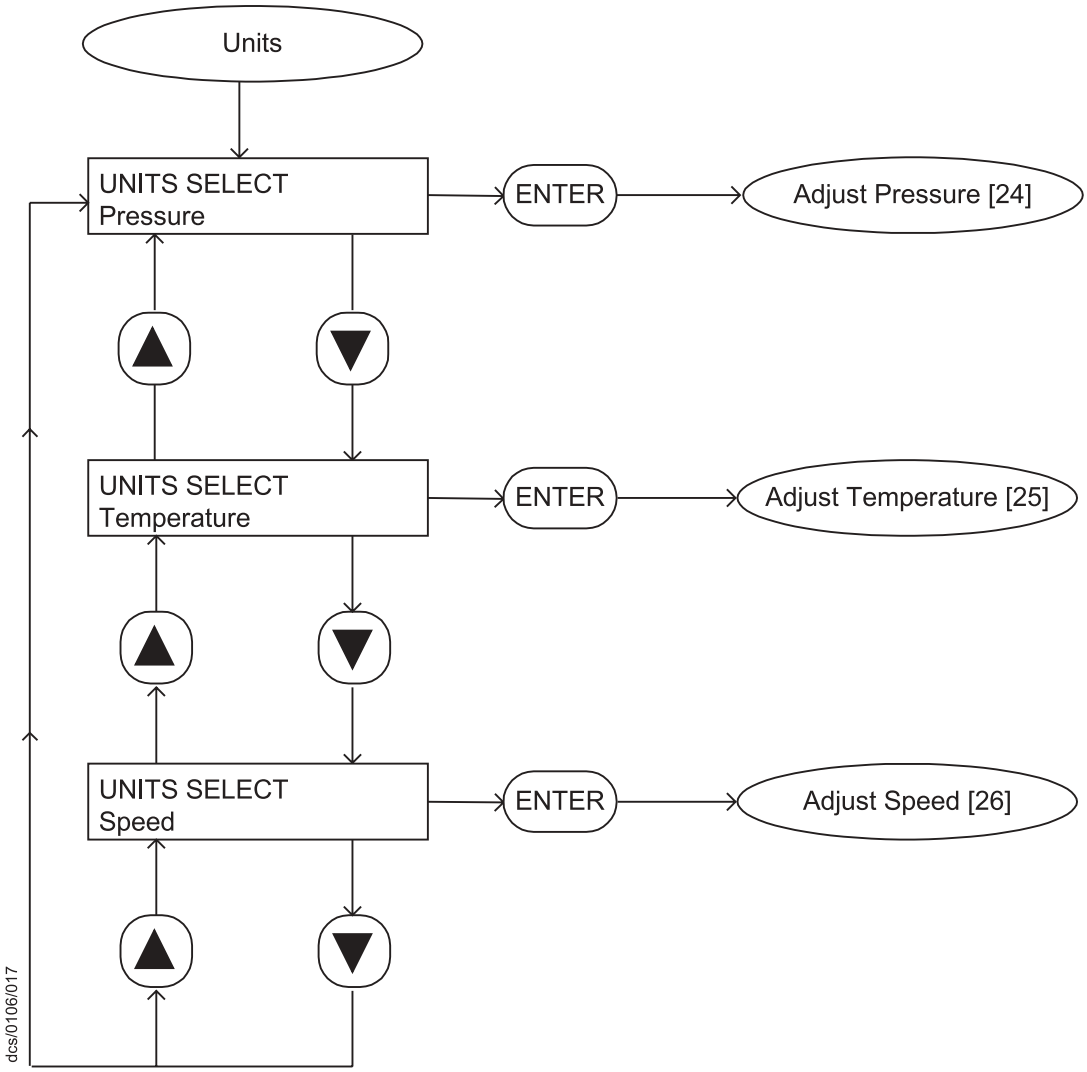


Figure 29 - PDT, units menu

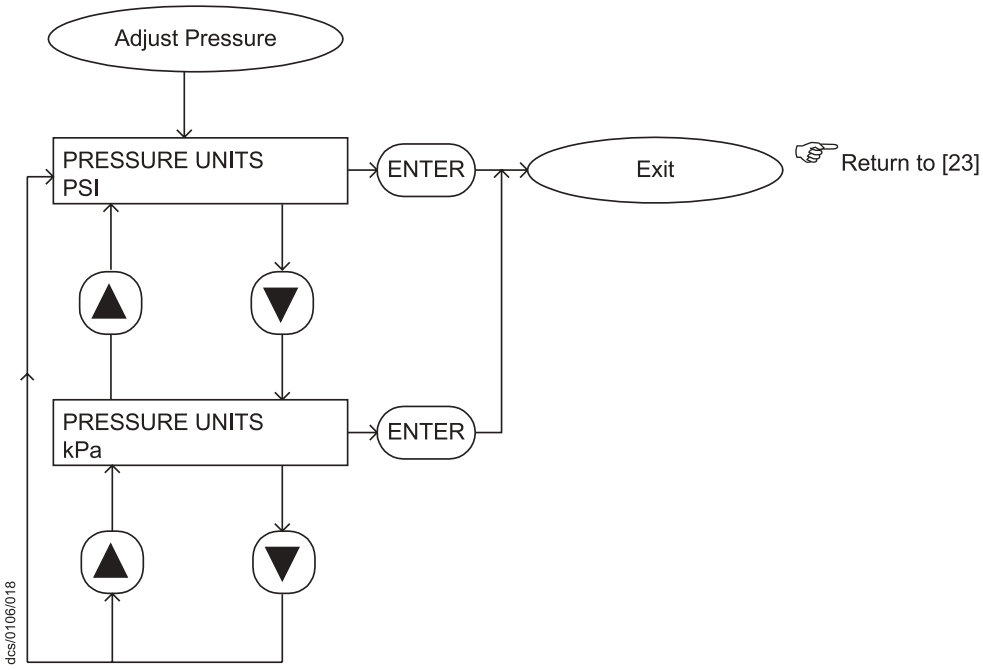


Figure 30 - PDT, adjust pressure menu

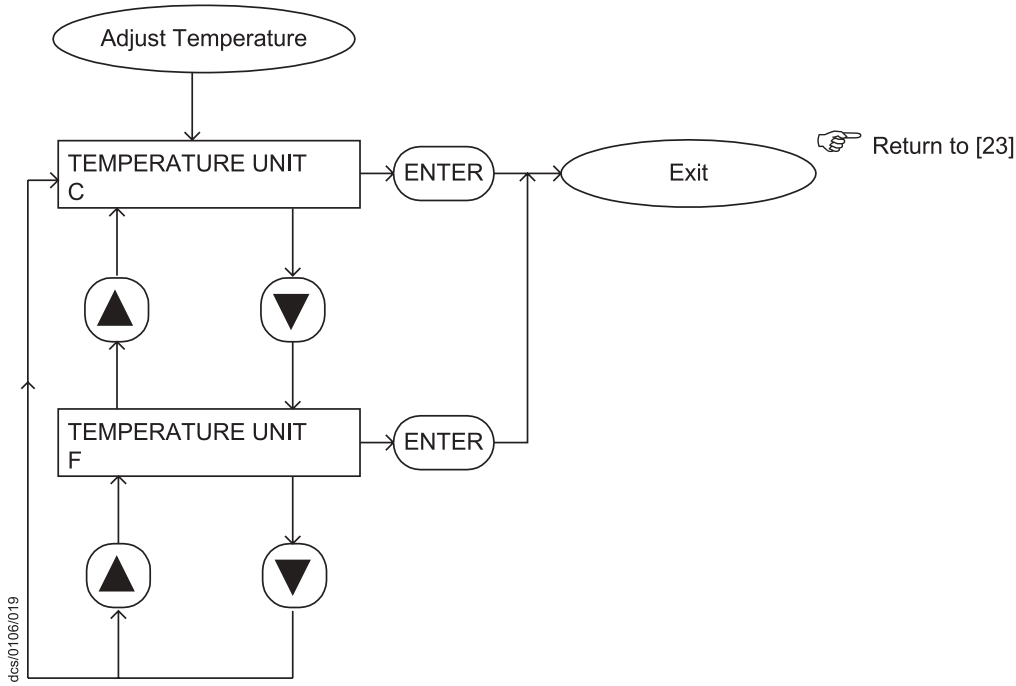


Figure 31 - PDT, adjust temperature menu

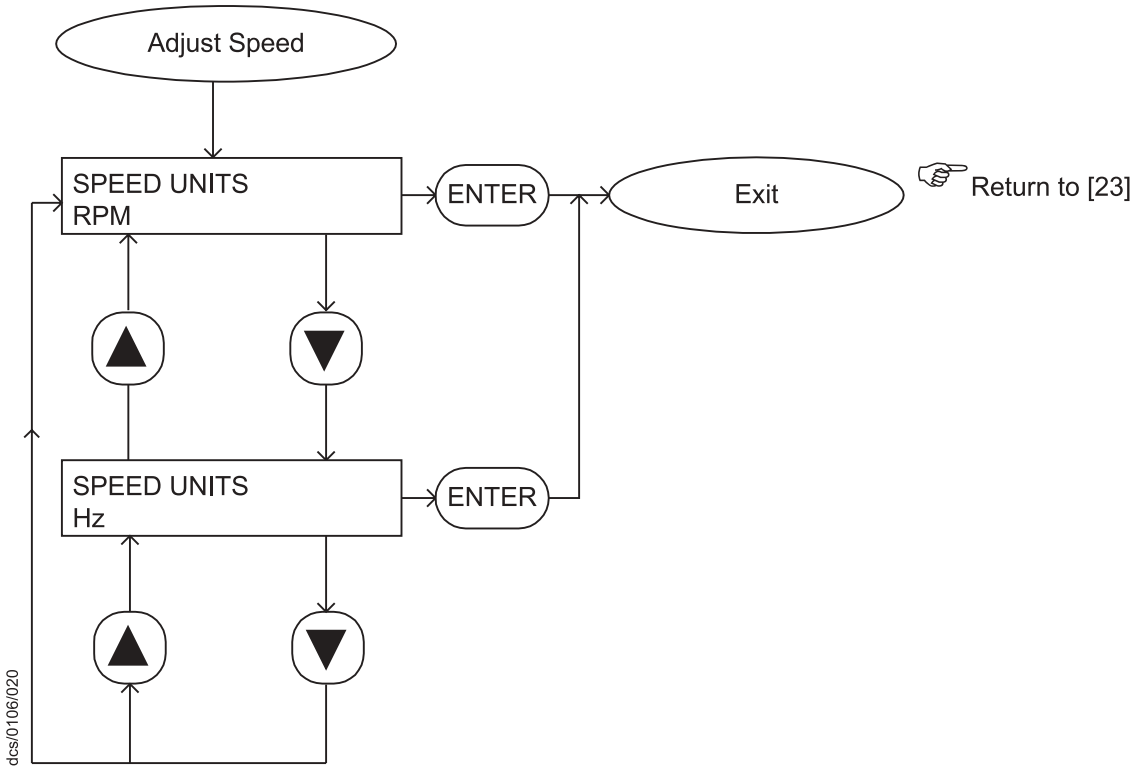


Figure 32 - PDT, adjust speed menu

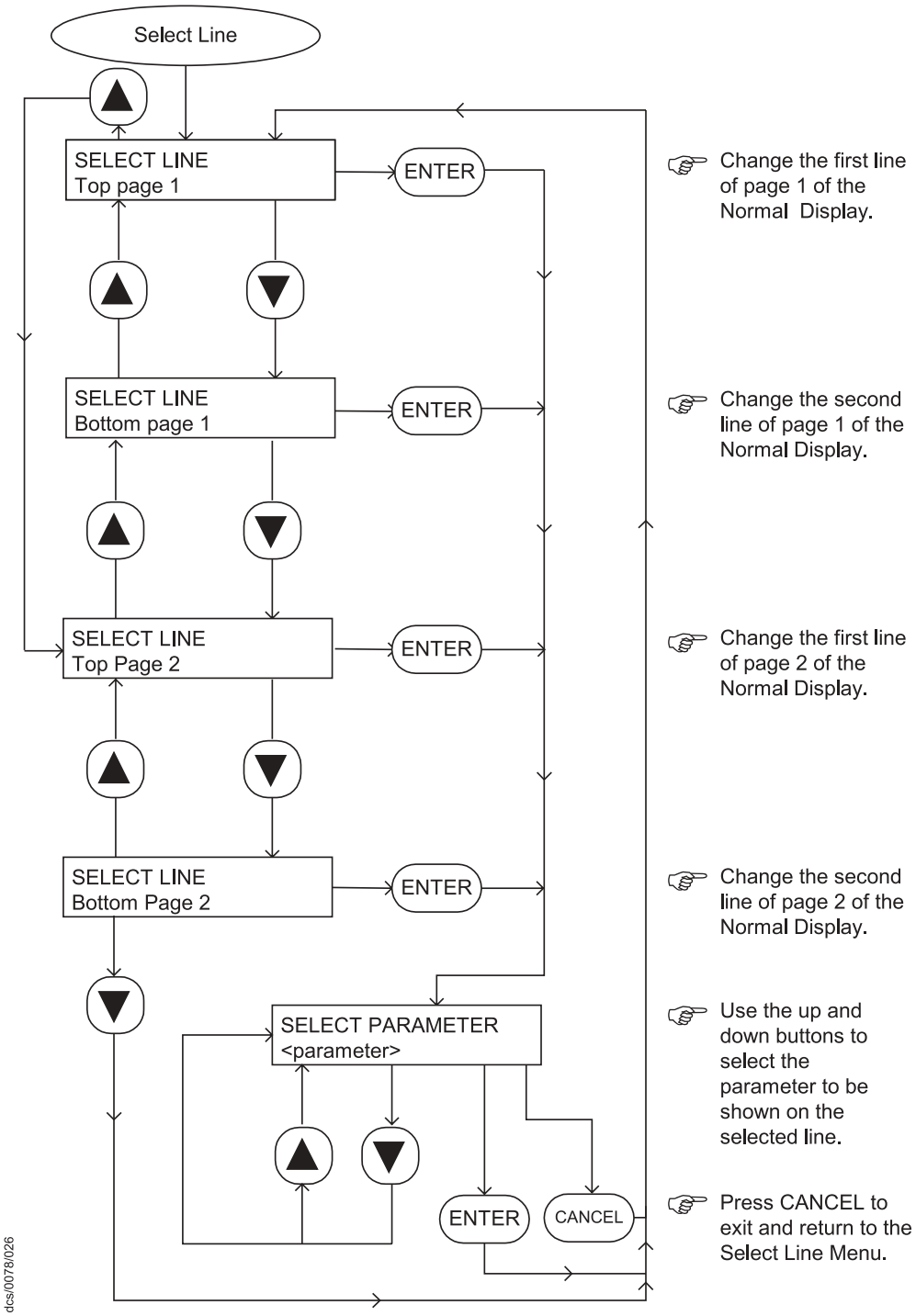
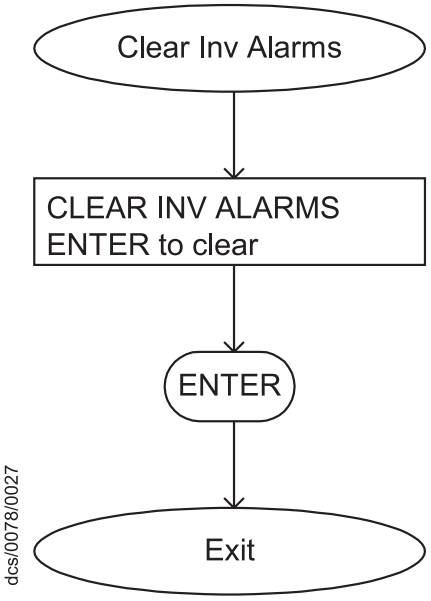


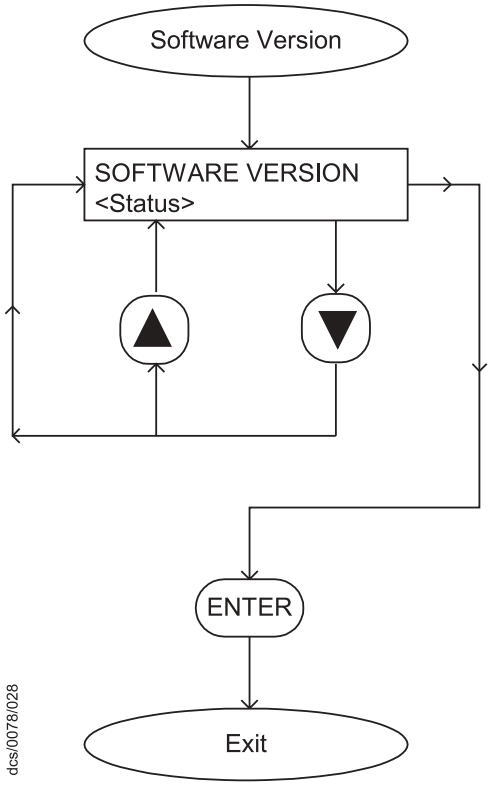
Figure 33 - PDT, select line menu



Press CANCEL if you do not wish to clear inverter alarms.

Return to setup menu.

Figure 34 - PDT, clear incerter alarms



<status> displays the software version numbers.

Press ENTER to return to setup menu.

Figure 35 - PDT, software version menu

This page intentionally blank.

5 OPERATION

5.1 Introduction

The IPUP E100 has been designed to be as easy to operate as possible. Once started, the IPUP E100 requires little or no manual intervention.

5.2 Start-up

WARNING

Hot surface. Inlet and exhaust temperatures can exceed 65° C during pump operation.

WARNING

Hot surface. Interstage temperature (Li only) can exceed 65° C during pump operation.

CAUTION

Do not operate the pump if the pipeline is restricted or blocked as the pump will not operate correctly and may be damaged.

CAUTION

If the electrical supply to the IPUP E100 fails for up to one second, the pump will continue to run once the power is returned.

1. Switch on the cooling-water supply and check that there are no leaks. If there are any leaks, switch off the cooling-water supply, seal the leaks, then switch on the cooling-water supply and check for leaks again. Repeat this process until the system is leak tight.
2. Switch on the electrical supply to position 'I' using the mains supply switch (Figure 2, item 16), and check that the Power LED (Figure 2, item 19) goes on; if the Power LED does not go on, refer to Section 3.12.
3. Check that the exhaust-extraction system is not restricted, and that any valves in the exhaust-extraction system are open.
4. Use your control equipment to set the pump start/ stop signal to the interface connector and check that the Run LED (Figure 2, item 19) goes on. If the Run LED does not go on, or if the pump running status output remains open, refer to Section ?.

5.3 Status indicators

The LEDs on the front of the pump indicate:

Color	Indication
Green	Power on
Green	Pump running
Amber	Warning
Red	Alarm

Table 7 - LED's

5.4 Manual shut-down

WARNING

Do not remove the inlet connections until the pump has been allowed to stop rotating and the power has been isolated. The pump can take up to three minutes to completely stop.

The pump can be shutdown using either the SPI or the PDT.

For the SPI:

1. Use your control equipment to reset the pump start/ stop signal to the interface connector (refer to Figure 16 for SPI connections). The Run LED (Figure 2, item 19) will then go off, and the pump running status output signal will open.
2. If the pump is not going to be required for some time, switch off the electrical supply and the cooling-water supply.

For the PDT:

The shutdown mode is defaulted to fast (immediate operation). A 'normal' shutdown can be selected using the PDT which introduces a nitrogen purge cycle.

5.5 Unplanned shutdown and alarms

The IPUP E100 is fitted with a number of pump protection sensors that will give warnings and alarms. Refer to Section 1.6.1. The decision on whether or not to shutdown the pump is left with the tool.

If, however, the inverter running signal is not received for >20 seconds whilst the pump should be running, the pump will shut down and will post a 7001 alarm. Refer to Section 6 for a full listing of warnings and alarms.

If the IPUP E100 pump has an unplanned shutdown, ensure that the cause of the shutdown is identified and rectified before restarting. If you are in any doubt, please call a BOC Edwards service engineer.

6 MAINTENANCE

WARNING

Hot surface. Inlet and exhaust temperatures can exceed 65° C during pump operation. Allow to cool before servicing the pump.

WARNING

Hot surface. Interstage temperature (Li only) can exceed 65° C during pump operation. Allow to cool before servicing the pump.

WARNING

There are no user serviceable parts within the IPUP E100. There is no requirement to remove the covers from the pump during normal operation. Removing the covers could cause injury to people or damage to equipment.

WARNING

Ensure that the power has been locked out/tagged out before removing the connection box cover (Figure 16, item 3). The pump drive electronics contain capacitors that can store a charge. Do not remove the connection box cover until 4 minutes after the power has been disconnected.

WARNING

Lockout/tagout process delivery to the pump before the pump is disconnected from the system.

It is recommended that all maintenance and service operations are done by qualified BOC Edwards Service Personnel.

6.1 Maintenance plan

The plan shown in Table 8 details the maintenance operations we recommend to maintain the IPUP E100 pump in normal operation. Instructions for each operation are given in the section shown.

6.2 Inspect the pipelines and connections

1. Inspect all cooling-water pipelines and connections; check that they are not corroded or damaged. Replace any of the pipelines and connections that are corroded or damaged. Check that all cooling-water connections are secure. Tighten any connections that are loose.
2. Inspect all electrical cables; check that they are not damaged and have not overheated. Replace any cables that are damaged or have overheated. Check that all electrical connections are secure. Tighten any connections that are loose.
3. Inspect all process and exhaust pipelines; check that they are not corroded or damaged. Replace any pipelines that are corroded or damaged. Check that all process and exhaust connections are secure. Tighten any connections that are loose.

Operation	Frequency	Refer to Section
Inspect the pipelines and connections	Monthly	6.2
Cleaning the pump	Monthly	6.3
Service the IPUP E100 pump	3 yearly	6.4

Table 8 - Maintenance plan

6.3 Cleaning the pump

CAUTION

Do not use cleaning materials based on strong alkalis, aggressive or chlorinated solvents.

CAUTION

Do not use cleaning materials containing abrasives.

Inspect the pump monthly and, if necessary, wipe the outside clean with a soft lint free cloth and a proprietary cleaning material based on demineralized water and, isopropanol or mild detergents.

6.4 Service the IPUP E100 pump

We recommend that the IPUP E100 is given a major service every five years. Major service is outside the scope of this manual and must be done by qualified BOC Edwards Service personnel: Please contact your supplier or BOC Edwards to arrange a major service.

Object responsible	Message on PDT	Cause
IPUP E100 node (1)	'Warning 101 power interrupt'	< 1 sec brownout
IPUP E100 node (1)	'Alarm 101 power interrupt'	>1 sec brownout
IPUP E100 node (1)	'Warning 113 PCA fault'	I/O fault reading PICs
Run time to service (15)	'Warning 1501, service due'	after 43830 hrs (5 years running)
Inverter running Input (70)	'Alarm 7001, inverter stopped'	If inverter running signal not received for > 20 seconds whilst the pump should be running.
Oil Pressure (219)	'Warning 21909, oil pressure low'	Insufficient oil pressure
Oil Pressure (219)	'Alarm 21910, oil pressure low'	Insufficient oil pressure
Spare temperature (54)	'Warning 5413, spare temperature sensor missing	(When fitted) spare temperature sensor open circuit/missing
Cooling block temperature (55)	'Warning 5511, cooling block temperature high'	Cooling block temperature > 80 °C
Cooling block temperature (55)	'Alarm 5512, cooling block temperature high'	Cooling block temperature > 100 °C
Cooling block temperature (55)	'Warning 5513, cooling block temperature sensor missing'	Cooling block temperature sensor open circuit/missing
Pump temperature (57)	'Warning 5711, pump temperature high'	Pump temperature > 140 °C
Pump temperature (57)	'Alarm 5712, pump temperature high'	Pump temperature > 150 °C
Pump temperature (57)	'Warning 5709, pump temperature low'	Pump temperature < 90 °C
Pump temperature (57)	'Warning 5713, pump temperature sensor missing'	Pump temperature sensor open circuit/ missing

Table 9 - Warning and alarm error codes

Object responsible	Message on PDT	Cause
Exhaust pressure (39)	'Warning 3911, exhaust pressure high'	(When fitted) exhaust pressure high (> 5 psi)
Exhaust pressure (39)	'Alarm 3912, exhaust pressure high'	(When fitted) exhaust pressure high (> 8 psi)
Exhaust pressure (39)	'Warning 3913, exhaust pressure sensor missing'	(When fitted) exhaust pressure sensor open circuit or missing
N_2 flow switch (61)	'Warning 6101, N2 flow low'	N_2 flow switch indicates low N_2 flow rate
Inverter status (176)	'Warning 17601, inverter fault'	Inverter indicates warning condition across serial link
Inverter status (176)	'Alarm 17601, inverter fault'	Inverter indicates fault trip condition across serial link
Inverter status (176)	'Warning 17613, inverter fault'	Fault in serial communications with the inverter

Table 9 - Warning and alarm error codes

6.5 Warning and alarm message fault finding

When a warning or alarm message is generated, it is displayed on the PDT. Each new warning or alarm is accepted by pressing 'ENTER'. You can scroll through all of the active warnings and alarms in the PDT status menu, refer to Section 4.

The first line of a message specifies the fault condition (warning or alarm) and shows the error number. With respect to Table 7 error numbers are of the form PFF, where:

- FF specifies the fault type and are the last two digits of the code given in the 'message on PDT'.
- P is a one, two or three digit number and specifies the fault parameter as shown in brackets in the 'object responsible' column.

Table 9 shows the alarm and warning messages, the advisory text and the meaning of the error.

6.6 Other fault finding

Fault messages will be shown on the Pump Display Terminal to identify that the action you have selected cannot be carried out.

This page intentionally blank.

7 STORAGE AND DISPOSAL

WARNING

Lockout/tagout process delivery to the pump before the pump is disconnected from the system.

7.1 Storage

Store the pump as follows:

1. Ensure that the IPUP E100 has been shut down as described in Section 5, then disconnect the pump from the electrical supply.
2. Allow the pump to cool for approximately 30 minutes before disconnecting the water to the pump. Drain the water from the cooling circuit. Place a suitable container under the water outlet connector connection (Figure 2, item 4) and connect a spare ¼" BSP Quick Connector along with a short length of hose for a drain. Fit an airline (maximum pressure 100 psi) to a second spare ¼" BSP Quick Connector and connect it to the pump water inlet connector connection (Figure 2, item 3). Blow the water out of the cooling circuit then remove the drain fittings.
3. Disconnect the pump inlet (Figure 2, item 2), pump outlet (Figure 2, item 5) and pump interstage (Figure 3, item 20) (Li only) from the system.
4. Fit blanking caps to the pump inlet (Figure 2, item 2), pump outlet (Figure 2, item 5) and pump interstage (Figure 3, item 20) (Li only).
5. Store the pump in clean dry conditions until required.
6. When required for use, prepare and install the pump as described in Section 3 of this manual.

7.2 Disposal

Dispose of the IPUP E100 pump and any components safely in accordance with all local and national safety and environmental requirements.

Take particular care with the following:

- Fluoroelastomers which may have decomposed as the result of being subjected to high temperatures.
- Components which have been contaminated with dangerous process substances.

This page intentionally blank.

Numerics

11769
H6 Heading 4
3.12 Pump display terminal, PDT 31

C

Certificate of compliance (IPUP E100L) 20
Certificate of compliance (IPUP E100Li) 21, 22
Cleaning the pump 58
Connecting the smart pump interface, SPI 31

D

Declaration of conformity 19
Disposal 61

E

Electrical system 16
Emergency stop 28
Exhaust connection 26

F

Fault finding 59

I

Inlet connection 26
Installation 23
Installation checklist 23
Interstage port 2
Introduction 1
IPUP E100 features 2

L

Leak test the system 27
Lubrication 12

M

Maintenance 57
Manual shut-down 55
Materials in contact with pumped gases 12

O

Operation 55

P

Part numbers 18
Priority of control 7
Pump display terminal (PDT) accessory 7
Pump protection sensors 7

R

Recommended oil 12

S

Safety 23
Scope and definitions 1
Start-up 55
Status indicators 55
Storage 61
System schematics 16

T

Technical data 11
Temperature control system 2
The IPUP E100 2

U

Unpack and inspect 24
Unplanned shutdown 56

W

Warning and alarm conditions 7
Water cooling system 17
Weight distribution 12

Return of Edwards Equipment - Procedure **(Form HS1)**

Introduction

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

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

Guidelines

Take note of the following guidelines:

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

PROCEDURE

Use the following procedure:

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

Return of Edwards Equipment - Declaration **(Form HS2)**

Return Authorisation Number:

You must:
Know about all of the substances which have been used and produced in the equipment before you complete this Declaration

- Read the Procedure (HS1) on the previous page before you attempt to complete this Declaration
- Contact your supplier to obtain a Return Authorisation Number and to obtain advice if you have any questions
- Send this form to your supplier before you return your equipment

SECTION 1: EQUIPMENT

Equipment r

Serial Nu

Has the equipment been used, tested or operated?

FOR SEMICONDUCTOR APPLICATIONS ONLY :

Tool Reference Nu

Process

Failure

SECTION 2: SUBSTANCES IN CONTACT WITH THE EQUIPMENT

Are any of the substances used or produced in the equipment

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

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

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

- Decontaminate the equipment
- Provide proof of decontamination

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

SECTION 3: LIST OF SUBSTANCES IN CONTACT WITH THE EQUIPMENT

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

SECTION 4: RETURN INFORMATION

Reason for return and symptoms of malfunc

If you have a warranty claim:

SECTION 5: DECLARATION

Print your name: Print your job

Print your organisation:

Print your address:

Telephone number: Date of equipment deli

I have made reasonable enquiry and I have supplied accurate information in this Declaration. I have not withheld any information.

Corporate Headquarters

BOC Edwards

Manor Royal
Crawley
West Sussex, RH10 2LW
UNITED KINGDOM
☎+(44) 1293 528844 Fax: +(44) 1293 533453

Asia Headquarters

BOC Edwards (Asia)

2605 Shun Tak Centre, West Wing
200 Connaught Road Central
Hong Kong S.A.R
☎+(852) 2796 9111 Fax: +(852) 2796 9095
☎CHINA Shanghai +(86) 21 5899 0272
☎CHINA Tianjin +(86) 22 2834 1981
☎TAIWAN, R.O.C. Toufen +(886) (0)37 611422
Fax: +(886) (0)37 611401
☎SOUTH EAST ASIA Singapore +(65) 546 8408
Fax: +(65) 546 8407

Europe Headquarters

BOC Edwards

Manor Royal
Crawley
West Sussex, RH10 2LW
UNITED KINGDOM
☎+(44) 1293 528844 Fax: +(44) 1293 533453
☎UK Guildford+(44) 1483 579857
Fax: +(44) 1483 505211
☎UK Cumbernauld +(44) 1236 730575
☎BELGIUM Brussels +(32) 2 363 00 30
Fax: +(32) 2 363 00 64
☎FRANCE Paris +(33) 1 47 98 24 01
Fax: +(33) 1 47 98 44 54
☎GERMANY Munich +(49) 89 99 19 18 0
Fax: +(49) 89 99 19 18 99
☎ITALY Milan +(39) 2 48 4471
Fax: +(39) 2 48 401638
☎ISRAEL Qiryat Gat +(972) 7 681 0633

Japan Headquarters

BOC Edwards

Shuwa Shiba Park Building A-3F
2-4-1 Shibakoen, Minato-ku
Tokyo, 105-0011
JAPAN
☎Tel: +(81) (0) 3 5470 6530 Fax: +(81) (0) 3 5470 6521
☎OSAKA +(81) (0) 6 6384 7052
Fax: +(81) (0) 6 6384 7504
☎KYUSHU +(81) (0) 96 326 7300
Fax: +(81) (0) 96 326 7302
☎SENDAI +(81) (0) 22 373 8525
Fax: +(81) (0) 22 373 9636
Electronic Gases
☎OSAKA +(81) 3 3434 6789
Fax: +(81) 3 5472 8728

Korea Headquarters

Songwon Edwards Ltd

625-7 Upsong-dong
Chunan City
Chungchong Nam-do
KOREA
☎+(82) 417 554 7070 Fax: +(82) 417 554 7300
☎SEOUL +(82) 2 501 7070

Americas
USA Headquarters

BOC Edwards

One Edwards Park
301 Ballardvale Street
Wilmington, MA 01887
USA
☎+(1) 978 658 5410 Fax: +(1) 978 658 7969
☎TOLL FREE (USA only): 800 848 9800
☎ARIZONA Tempe +(1) 602 777 7007
Fax: +(1) 602 777 2202
☎ARIZONA Phoenix +(1) 602 777 7007
Fax: +(1) 602 777 2244
☎CALIFORNIA Santa Clara +(1) 408 496 1177
Fax: +(1) 408 496 1188
☎TEXAS Austin +(1) 512 491 6622
Fax: +(1) 512 389 3890
☎TEXAS Richardson +(1) 972 669 9386
Fax: +(1) 972 669 8054
☎BRAZIL Sao Paulo +(55) 11 8580377
Fax: +(55) 11 2652766

BOC EDWARDS
http://www.bocedwards.com

1	Controls and connections	3
2	Technical Information	11
3	Materials in contact with pumped gases	12
4	IPUP E100 Pump Part Numbers	18
5	Installation Checklist	23
6	Pump Display Terminal (PDT)/menu structure	36
7	LED's	55
8	Maintenance plan	57
9	Warning and alarm error codes	58

1	IPUP E100L	1
2	IPUP E100L	4
3	IPUP E100Li	5
4	IPUP E100L (Hardwire)	6
5	Front panel of the pump display terminal	8
6	Weight distribution of IPUP E100	12
7	Dimensions of pump IPUP E100L	13
8	Dimensions of pump IPUP E100Li	14
9	Dimensions of pump IPUP E100L (Hardwire)	15
10	Electrical system - schematic	16
11	Water functional diagram	17
12	Handle	25
13	Stacking bolts	25
14	Connection box	30
15	Connection box (cover removed)	30
16	SPI Connections	32
17	PDT Menu logic	37
18	Switch on Menu	38
19	Switch off menu	39
20	Normal Menu	40
21	Status Menu	41
22	Control menu	42
23	Setup menu (sheet 1 of 3)	43
24	Setup menu (sheet 2 of 3)	44
25	Setup menu (sheet 3 of 3)	45
26	PDT, turn on/off menu	46
27	PDT, pump type menu	47
28	PDT, shut down mode menu	48
29	PDT, units menu	49
30	PDT, adjust pressure menu	50
31	PDT, adjust temperature menu	50
32	PDT, adjust speed menu	51
33	PDT, select line menu	52
34	PDT, clear incerter alarms	53
35	PDT, software version menu	53

1	INTRODUCTION	1
1.1	Scope and definitions	1
1.2	The IPUP E100	2
1.2.1	The IPUP E100Li	2
1.2.2	The IPUP E100L (Hardwire)	2
1.3	IPUP E100 features	2
1.4	Temperature control system	2
1.5	Priority of control	7
1.6	Warning and alarm conditions	7
1.6.1	Pump protection sensors	7
1.7	Pump display terminal (PDT) accessory	7
2	TECHNICAL DATA	11
2.1	Technical information	11
2.2	Weight distribution	12
2.3	Lubrication	12
2.4	Materials in contact with pumped gases	12
2.5	System schematics	16
2.5.1	Electrical system	16
2.5.2	Water cooling system	17
2.6	Part numbers	18
2.7	Declaration of conformity	19
2.8	Certificate of compliance (IPUP E100L)	20
2.9	Certificate of compliance (IPUP E100Li)	21
2.10	Certificate of compliance (IPUP E100L Hardwire)	22
3	INSTALLATION	23
3.1	Safety	23
3.2	Installation checklist	23
3.3	Unpack and inspect	24
3.4	Securing the IPUP E100 pump	24
3.5	Using the stacking bolts	25
3.6	Inlet connection	26
3.7	Exhaust connection	26
3.8	Interstage connection (Li only)	27
3.9	Leak test the system	27
3.10	Connect the cooling-water supply	28
3.11	Connect to your emergency stop circuit	28
3.12	Connect the electrical supply (IPUP E100L and IPUP E100Li only)	29
3.13	Connect the electrical supply (IPUP E100L (Hardwire) only)	29

3.14	3.14 Connecting the smart pump interface, SPI	31
3.15	3.15 Pump display terminal, PDT	31
3.16	3.16 Lubrication	31
4	PUMP DISPLAY TERMINAL (PDT) MENUS AND DISPLAY FORMATS33	
4.1	Introduction	33
4.2	General operation	34
4.3	The CANCEL button	34
4.4	Display text and variable text	34
4.5	Wrap-around	35
4.6	Timeout	35
4.7	Menu structure	35
4.8	Example	35
5	OPERATION	55
5.1	Introduction	55
5.2	Start-up	55
5.3	Status indicators	55
5.4	Manual shut-down	55
5.5	Unplanned shutdown and alarms	56
6	MAINTENANCE	57
6.1	Maintenance plan	57
6.2	Inspect the pipelines and connections	57
6.3	Cleaning the pump	58
6.4	Service the IPUP E100 pump	58
6.5	Warning and alarm message fault finding	59
6.6	Other fault finding	59
7	STORAGE AND DISPOSAL	61
7.1	Storage	61
7.2	Disposal	61