

Instruction Manual

iH Dry Pumping Systems



This page has been intentionally left blank.

iH Dry Pumping Systems - Setup Password

The setup password for this equipment is preset as follows:

SETUP PASSWORD: 202

You can remove this sheet from the instruction manual and retain it in a safe place to prevent unauthorised access to the setup menus in the iH system

This page has been intentionally left blank.

Contents

Section	Page
1	Introduction 1
1.1	Scope and definitions 1
1.2	The iH system 2
1.3	The HCDP dry pump 2
1.4	The HCDP gas system 4
1.5	The HCMB mechanical booster pump (iH600/iH1000 only) 6
1.6	Temperature control system 7
1.6.1	HCDP pump temperature control system 7
1.6.2	HCMB pump temperature control system (iH600/iH1000 only) 7
1.7	Exhaust system 9
1.8	Electrical system 9
1.8.1	Introduction 15
1.8.2	Electrics and Pump Control Module 15
1.8.3	Sensor Monitoring and Gas Control Module 16
1.8.4	Gas Module 16
1.9	Controls and indicators 16
1.10	Control functions 17
1.10.1	Priority of control 17
1.10.2	Setpoints, warning and alarm conditions 17
1.10.3	Safety sensors 18
1.10.4	Exhaust pressure relay 18
1.11	Pump Display Module 18
1.12	Accessories 20
2	Technical Data 21
2.1	General 21
2.2	Performance 21
2.3	Temperature control system 22
2.4	Cooling-water supply 26
2.5	Lubrication 30
2.5.1	HCDP pump 30
2.5.2	HCMB pump (iH600/iH1000 only) 30
2.6	Electrical data 31
2.7	Gas system 32
2.8	Materials in contact with process gases 33
2.9	Default setpoints 33
2.10	Connections 34
2.11	Item Numbers 34
3	Installation 35
3.1	Safety 35
3.2	Installation checklist 35
3.3	Unpack and inspect 36
3.4	Remove the enclosure panels 38
3.5	Reconfigure the nitrogen and/or water connections (if required) 41
3.6	Locate the iH system 41
3.7	Check the pump oil-level(s) 42
3.7.1	iH80 systems 42
3.7.2	iH600/iH1000 systems 42
3.8	Install or replace the Pump Display Module and optional accessories (if necessary) 42
3.8.1	Install the Pump Display Module 42
3.8.2	Install optional accessories 42

3.9	Connect the iH inlet to your vacuum system	44
3.10	Connect the iH exhaust outlet to your exhaust-extraction system	44
3.11	Connect to your factory extraction system (optional)	45
3.12	Connect the nitrogen supply	45
3.13	Leak test the system	45
3.14	Install additional safety equipment (optional)	47
3.15	Connect to your emergency stop circuit (optional)	47
3.16	Electrical supply and RF earth (ground) connections	48
3.16.1	Reconfigure the iH system for your electrical supply (if necessary)	48
3.16.2	Reconfigure the pump(s) for your electrical supply (if necessary)	48
3.16.3	Connect the electrical supply to the iH system	51
3.16.4	Connect an additional RF earth (optional)	53
3.17	Refit the enclosure panels	53
3.18	Connect the cooling-water hoses	54
3.19	Adjust the interstage purge flow rates if necessary	55
3.20	Commission the iH system	55
3.20.1	Switch on an iH80/iH1000 system	55
3.20.2	Configure and switch on an iH600 system	56
4	Pump Display Module Menus and Display Formats	59
4.1	Introduction	59
4.2	General operation	59
4.3	The CANCEL button	60
4.4	Display text and variable text	60
4.5	Wrap-around	61
4.6	Timeout	61
4.7	Menu structure	61
4.8	Example	62
5	Operation	89
5.1	Introduction	89
5.2	Configure the system (optional)	89
5.3	Change the display format	90
5.3.1	Change the normal display	90
5.3.2	Change the display units	90
5.4	Take and release control	90
5.5	Start-up	91
5.6	Check the nitrogen pressure and adjust if necessary	91
5.7	Monitor the status of the iH system	92
5.8	Warning and alarm indications	92
5.9	Manual shut-down	93
5.10	Automatic shut-down	94
5.11	Emergency stop	95
5.12	Restart the HCMB pump after automatic pump shut-down (iH600/iH1000 only)	95
5.13	Restart the iH system after an emergency stop or automatic shut-down	95
5.14	Operation of the iH system components	96
5.15	Operation of the load-lock pump	96
6	Maintenance	97
6.1	Safety	97
6.2	Correct use of Swagelok connectors	97
6.2.1	Fit a Swagelok connector	98
6.2.2	Reconnect a Swagelok connector	98
6.3	Maintenance frequency	98
6.4	Inspect the connections, pipelines, cables and fittings	98
6.5	Check the purge gas flow rates	100
6.6	Inspect and clean the exhaust-pipe, elbow and check-valve	100
6.6.1	Dismantle, clean and refit the exhaust-pipe and elbow	100

6.6.2	Clean and refit the check-valve (if fitted)	101
6.7	Check the HCMB pump oil-level (iH600/iH1000 only)	101
6.8	Check the HCDP pump oil-level	102
6.9	Change the HCDP pump oil	103
6.10	Change the HCMB pump oil (iH600/iH1000 only)	104
6.11	Zero the gas module flow transducer	104
6.12	Adjust the Pump Display Module display viewing angle	104
6.13	Replace a fuse	105
6.14	Replace the Pump Display Module	105
6.15	Relocate the iH system for maintenance	105
6.16	Check for free rotation of the HCDP pump	106
6.17	Fault finding	108
6.17.1	Warning and alarm message fault finding	108
6.17.2	Other fault finding	108
7	Storage and Disposal	117
7.1	Storage	117
7.2	Disposal	117
8	Service, Spares and Accessories	119
8.1	Introduction	119
8.2	Service	119
8.3	Spares	119
8.4	Ordering accessories	119
8.4.1	Exhaust Temperature Sensor	120
8.4.2	Active gauge connection kit	120
8.4.3	iH600 Pressure Control Kit	120
8.4.4	iH Enclosure Extraction Fan Kit	120
8.5	Other accessories	121
8.5.1	iH Pump Display Module Extension Cables	121
8.5.2	iH Communications Module	121
8.5.3	iH Interface Modules	121
8.5.4	iH Central Monitoring System	121
8.5.5	iH PC Interface Kits	122
8.5.6	iH Alternative Connections Kits	122
8.5.7	TMS (Temperature Management System) accessories	122

For return of equipment, complete the HS Forms at the end of this manual.

Illustrations

Figure

Page

1	The iH system (iH600/iH1000 shown, with side panels removed)	3
2	Schematic diagram of the HCDP pump gas system	5
3	Controls and indicators on the front panel	6
4	Services and electrical connections on the rear of the iH system	8
5	Electrical components: key	9
6	Schematic diagram of the iH80/iH600 electrical systems: key	11
7	Schematic diagram of the iH1000 electrical system: key	13
8	Front panel of the Pump Display Module	19
9	iH80 dimensions (mm)	23
10	iH600 dimensions (mm)	24
11	iH1000 dimensions (mm)	25
12	Services connections dimensions (mm)	26
13	Centres of mass dimensions (mm) and mass distribution	27
14	Typical pumping speeds for iH80/iH1000: pumping speed against pressure	28
15	Typical pumping speeds for iH600: pumping speed against pressure	28
16	iH80 pump power curves: electrical power input against inlet pressure	29
17	iH600 pump power curves: electrical power input against inlet pressure	29
18	iH1000 pump power curves: electrical power input against inlet pressure	30
19	Remove the iH system from the pallet	38
20	Lifting bolt positions	39
21	Remove/refit the enclosure panels	40
22	Remove the vibration isolator transit brackets	41
23	Fit the Pump Display Module	43
24	Leak-test port positions	46
25	Reconfigure the iH system for your electrical supply (iH80/iH600 only)	49
26	Reconfigure the pump-motor terminal-boxes (iH80/iH600 only)	50
27	Connect the electrical supply cable to the connector mating-half	52
28	Front panel of the Pump Display Module	60
29	Menu logic	63
30	Switch on menu	64
31	Switch off menu	65
32	Normal menu	66
33	Status menu sheet 1 of 2	67
34	Control menu	69
35	Setup menu sheet 1 of 3	70
36	Run til crash menu	73
37	Units menu	74
38	Normal display menu	75
39	Service menu sheet 1 of 2	76
40	Serial menu	78
41	Zero sensors menu	79
42	Gas valve control menu	80
43	Manual menu sheet 1 of 3	81
44	View status menu sheet 1 of 2	84
45	Message menu	86
46	Warning and alarm messages menu	87
47	Fit a tube fitting	99
48	Re-tighten a tube fitting	99
49	Clean the exhaust check-valve	102
50	Try to turn the HCDP pump	107

Tables

Table	Page
1 Safety sensors	18
2 Technical data	22
3 Full load current ratings	31
4 Nitrogen purge flow rates: high gas configuration	32
5 Electrics and Pump Control Module default setpoints	33
6 Sensor Monitoring Module default setpoints	33
7 Gas Module default setpoints: high gas configuration	34
8 Installation Checklist	36
9 Checklist of components	37
10 Pins in the iH Tool Interface Module connector plug	47
11 Pins in the electrical supply connector	53
12 Menu structure	62
13 Configuration store nominal gas flows	89
14 Status menu sensor reading displays	93
15 Warning messages	108
16 Alarm messages	112
17 Fault messages	113
18 Fault parameters	114
19 Fault types	115

This page has been intentionally left blank.

1 Introduction

1.1 Scope and definitions

This manual provides installation, operation and maintenance instructions for the Edwards iH Dry Pumping Systems. You must use the iH systems as specified in this manual.

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



WARNING

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

CAUTION

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

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. Also, throughout this manual, wherever nitrogen flow rates are specified, the abbreviation 'slm' is used to mean 'standard l min': this is a flow of 1 l min⁻¹ at an ambient temperature of 0 °C and a pressure of 1013 mbar (1.013 x 10⁵ Pa).

Note: The content of this manual may change from time to time without notice. Edwards accepts no liability for any errors that may appear in this manual nor does it make any expressed or implied warranties regarding the content. So far as is reasonably practicable Edwards has ensured that its products have been designed and constructed so as to be safe and without risks when properly installed and used in accordance with Edwards operating instructions. Edwards accepts no liability for loss of profit, loss of market or any other indirect or consequential loss whatsoever.

Product warranty and limit of liability are dealt with in Edwards standard terms and conditions of sale or negotiated contract under which this document is supplied.

The following IEC warning labels may appear on the iH system:



Warning - refer to accompanying documentation.



Warning - heavy object.



Warning - risk of electric shock.



Warning - moving parts present



Warning - hot surfaces.



RF earth (ground)



Warning - static sensitive devices.



Protective earth (ground)



Warning - use protective equipment.

Material Safety Data Sheets for Edwards supplied chemicals can be attained by contacting: UK +44 (0) 1293 528844; France +331 (1) 47 98 24 01; Germany +49 (0) 6421 8030, or; USA (transportation emergency) +1 800-424-9300 (other inquiries) +1 800-848-9800.

1.2 The iH system

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

The iH80 system has an HCDP80 dry pump; the iH600 system has an HCDP80 dry pump, with an HCMB600 mechanical booster pump fitted to the inlet of the HCDP80 pump; the iH1000 system has an HCDP80 dry pump, with an HCMB1000 mechanical booster pump fitted to the inlet of the HCDP80 pump. The HCDP80 pump is referred to as the HCDP pump and the HCMB600 and HCMB1000 pumps are referred to as the HCMB pumps throughout the remainder of this manual.

Both the HCDP and HCMB pumps have enclosed, water-cooled motors. The iH system is therefore suitable for applications in clean environments where fan cooling is unacceptable.

The iH system has a gas system which introduces purge gas into the HCDP pump. This gas system is suitable for use on harsh duty processes. If you use the iH system on light or medium duty processes, you can use the economiser gas mode to reduce the consumption of purge nitrogen by the pumping system.

You can manually control the iH system through the Pump Display Module: see [Section 1.11](#). Alternatively, you can use your process tool or other control equipment to control the operation of the iH system through an Interface Module accessory (refer to [Section 8.5.3](#)), or through an iH Communications Module accessory (see [Section 8.5.2](#)), or you can use the iH Single Pumpset Monitor accessory to control the operation of the iH system (refer to [Section 8.5.4](#)). The remainder of this manual describes the use of the Pump Display Module to operate the iH system: for use of another accessory to operate the iH system, refer to the instruction manual supplied with the accessory.

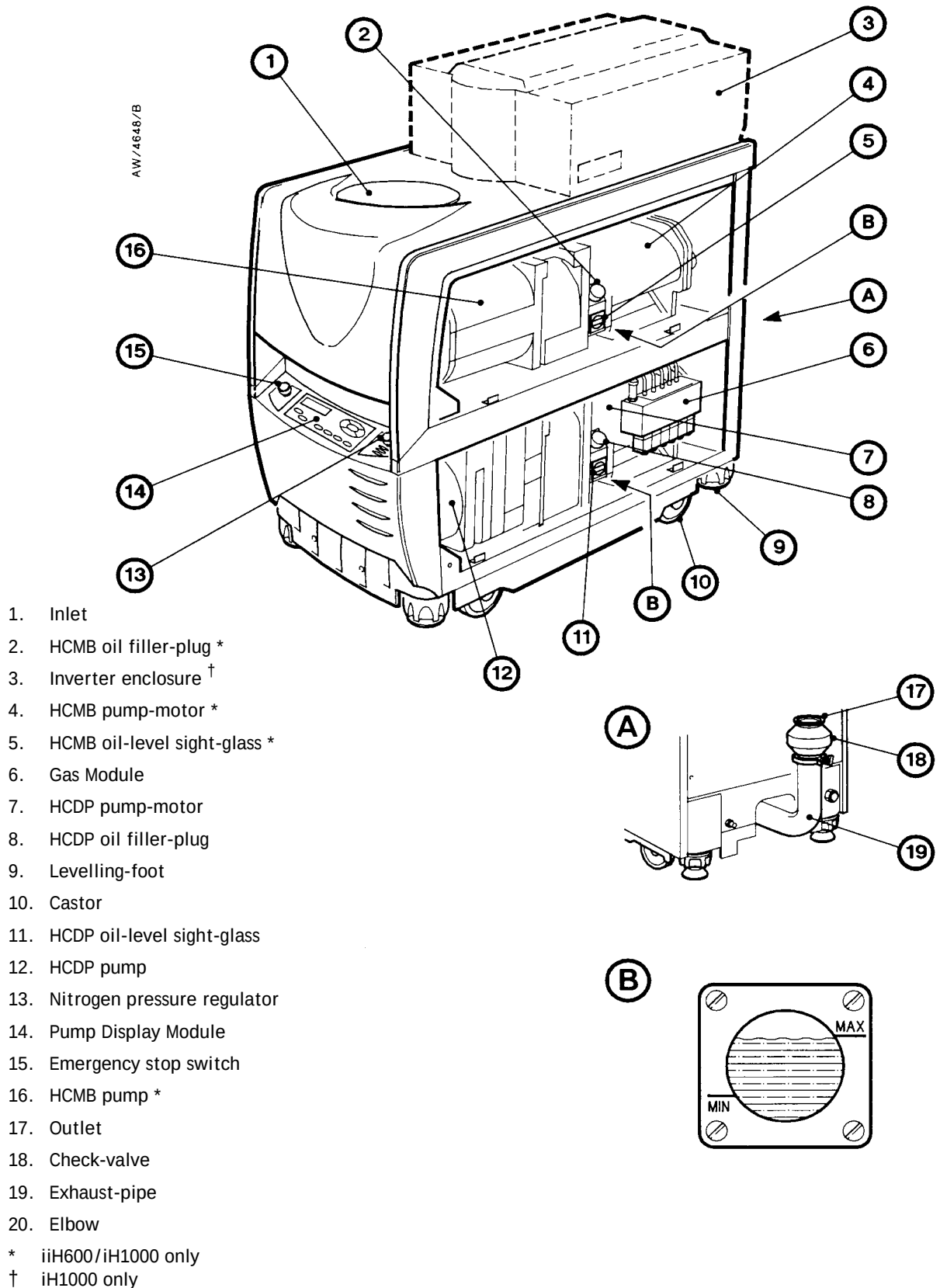
All of the components of the iH system are fitted inside an enclosure. Panels of the enclosure can be removed for access to the pumps during maintenance.

The components of the iH system are described in the following sections.

1.3 The HCDP dry pump

The HCDP pump is a five-stage, positive displacement rotary pump in which pairs of intermeshing rotors (of different profiles mounted on common shafts) are held in correct phase relation by a pair of timing-gears. The timing-gears and the adjacent deep-groove ball-bearings, are oil lubricated.

Figure 1 - The iH system (iH600/iH1000 shown, with side panels removed)



1.4 The HCDP gas system

The HCDP pump has a gas system which is suitable for use in harsh processes, such as ion implanters, PECVD (Plasma Enhanced Chemical Vapour Deposition), LPCVD nitride, LPCVD TEOS and Silicides. The gas system is also suitable for use in light or medium duty processes.

The gas system can be preset to operate in any one of the following four configurations: low gas; medium gas; medium gas and exhaust; high gas. As supplied, the gas system is preset for the high gas configuration. To change the gas system configuration, refer to [Section 5.2](#).

The gas system has supply pipelines and components (such as valves), a Gas Module with a distribution manifold, gas purge controls and sensors, and pipelines which deliver purge nitrogen to the purge points on the HCDP pump.

The gas system provides the following purge flows to the HCDP pump:

- Shaft-seals purge: this purge flow is on whenever the HCDP pump is on.
- 2/3-interstage purge and 3/4-interstage purge: these purge flows are either both on or both off. The purge flows can be switched on or off by use of the Pump Display Module or by your own control equipment.
- Exhaust-purge: this purge flow is on whenever the HCDP pump is on and the gas system is either in the high gas configuration, or in the medium gas and exhaust configuration.
- Inlet-purge: this purge flow is only used in high gas configuration. The purge flow can be switched on or off by use of the Pump Display Module or by your own control equipment.

Refer to [Figure 2](#) which shows a schematic diagram of the iH gas system.

The purge flow pressure is controlled by a pressure regulator (26). A mass flow transducer (25) measures the total flow of purge gas to the pump purge points. A check-valve (27) prevents the flow of process gases back into your nitrogen supply pipeline.

The 3/4-interstage purge and 2/3-interstage purge flows are switched on and off by the solenoid-valves (17 and 18). The inlet-purge, shaft-seals purge and exhaust-purge flows are switched on and off by the solenoid-valves (22, 19 and 24). The 2/3-interstage and 3/4-interstage purges solenoid-valve (21) operates in conjunction with the inlet-purge solenoid-valve (22), to provide reduced interstage purge flow when inlet-purge is switched on.

Variable restrictors (12 to 16 and 20) limit the purge flow rates.

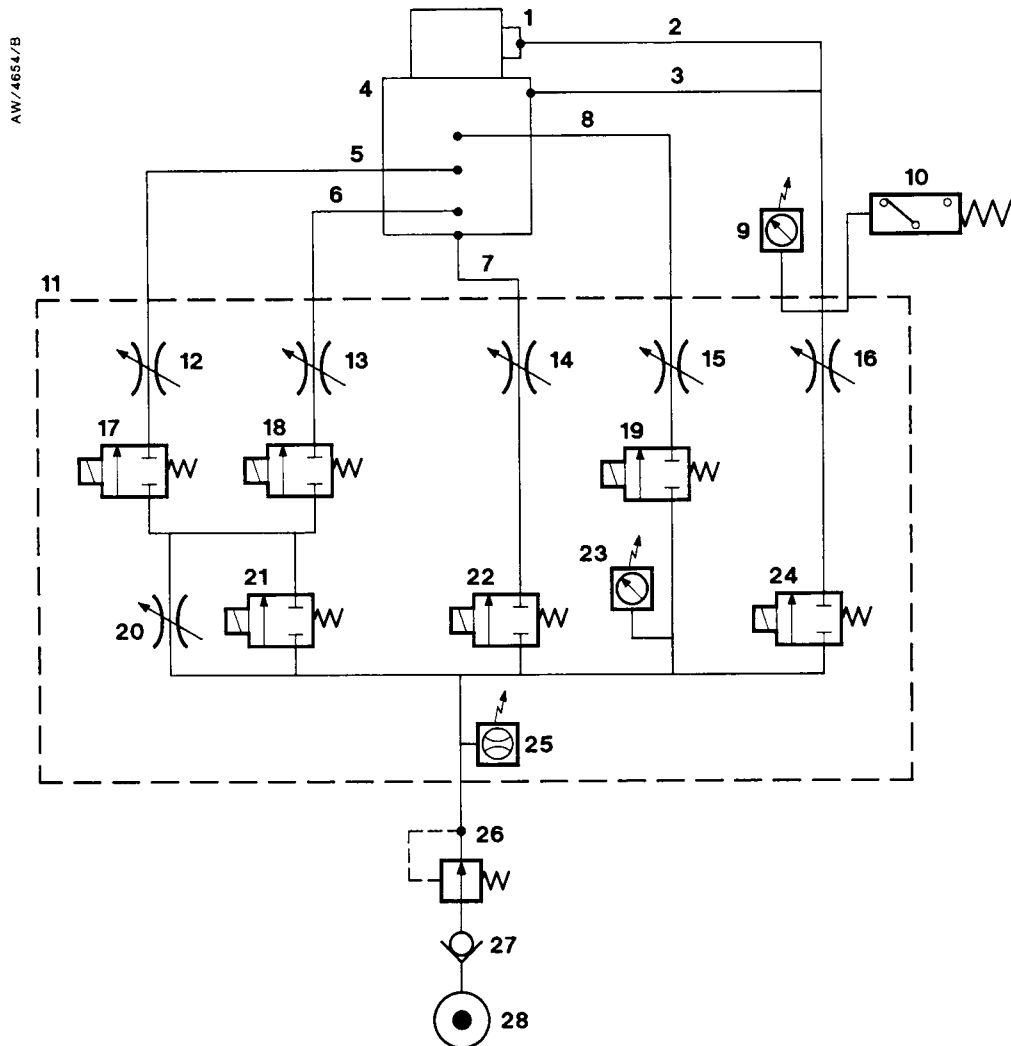
A pressure transducer (23) monitors the pressure of the shaft-seals purge flow, and another pressure-transducer (9) monitors the pressure in the exhaust pipeline. The outputs of the pressure transducers are used to display the shaft-seals purge and exhaust pressures on the Pump Display Module.

A pressure relay (10) also monitors the pressure in the exhaust pipeline. The outputs of the pressure relay are connected directly into the emergency stop circuit of the iH system: see [Section 1.10.4](#).

If there is a slow rate of pressure rise in the exhaust pipeline (for example, caused by a blockage formed due to process debris), the outputs of the pressure transducer (9) will cause the iH system to be shut down at the appropriate alarm pressure. If the pressure in the exhaust pipeline rises rapidly, the pressure rise may be faster than the response time of the exhaust-purge pressure transducer. In this case, the exhaust pressure relay (10) will cause the iH system to be shut down. A rapid pressure rise in the exhaust pipeline may be caused, for example, by the closure of a valve in the exhaust pipeline close to the iH exhaust outlet.

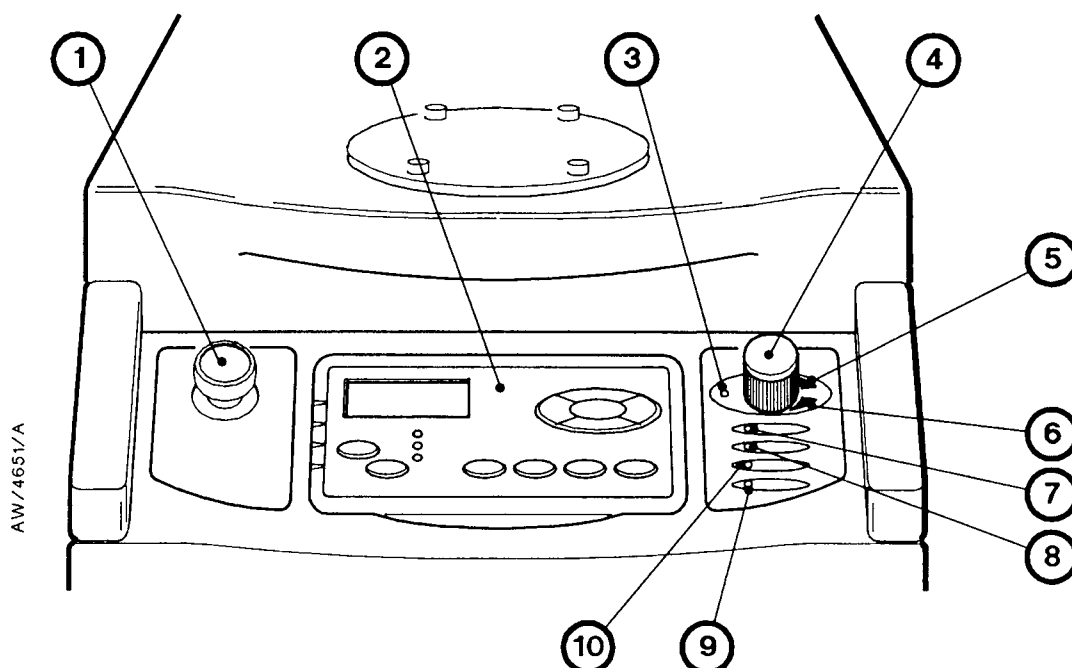
The front panel has three pressure status LEDs ([Figure 3](#), items 3, 5 and 6). These LEDs show whether the nitrogen supply pressure is too high, too low or is in the acceptable range: refer to [Section 5.6](#).

Figure 2 - Schematic diagram of the HCDP pump gas system



- | | |
|--|---|
| 1. Two-way gearbox vent-valve | 15. Variable restrictor (shaft-seals purge) |
| 2. Gearbox vent pipeline | 16. Variable restrictor (exhaust-purge) |
| 3. Exhaust-purge pipeline | 17. Solenoid-valve (3/4-interstage purge) |
| 4. HCDP pump | 18. Solenoid-valve (2/3-interstage purge) |
| 5. 3/4-interstage purge pipeline | 19. Solenoid-valve (shaft-seals purge) |
| 6. 2/3-interstage purge pipeline | 20. Variable restrictor (2/3 and 3/4-interstage purges) |
| 7. Inlet-purge pipeline | 21. Solenoid-valve (2/3 and 3/4-interstage purges) |
| 8. Shaft-seals purge pipeline | 22. Solenoid-valve (inlet-purge) |
| 9. Pressure transducer (exhaust-purge) | 23. Pressure transducer (shaft-seals purge) |
| 10. Pressure-relay (exhaust-purge) | 24. Solenoid-valve (exhaust-purge) |
| 11. Gas Module manifold | 25. Mass flow transducer |
| 12. Variable restrictor (3/4-interstage purge) | 26. Pressure regulator |
| 13. Variable restrictor (2/3-interstage purge) | 27. Check-valve |
| 14. Variable restrictor (inlet-purge) | 28. Nitrogen supply inlet |

Figure 3 - Controls and indicators on the front panel



1. Emergency stop switch
2. Pump Display Module
3. Shaft-seals purge pressure warning LED (yellow)
4. Nitrogen pressure regulator
5. Shaft-seals purge pressure high LED (green)
6. Shaft-seals purge pressure low LED (green)
7. Power OK LED (green)
8. Running LED (green)
9. Alarm LED (red)
10. Warning LED (yellow)

1.5 The HCMB mechanical booster pump (iH600/iH1000 only)

The HCMB pump is a positive displacement Roots vacuum pump. The pump mechanism is driven directly by a three-phase electric motor. The HCMB1000 pump in the iH1000 system is driven through an electrical inverter, which increases the speed of the motor to 6000 r.min⁻¹.

The HCMB pump is backed by the HCDP pump:

- The HCMB600 pump in an iH600 system operates at inlet pressures of 5 mbar (5×10^2 Pa) and below; when you start the HCDP pump, the iH system delays the start of the HCMB pump for a preset time, to allow the HCDP pump to reduce the pressure in the process system to below the maximum inlet pressure for the HCMB pump.
- The HCMB pump in an iH1000 system operates between atmospheric pressure and ultimate vacuum; when you start the HCDP pump, the HCMB pump is also started.

1.6 Temperature control system

1.6.1 HCDP pump temperature control system

The headplate and the fourth stage of the HCDP pump have a direct cooling system in which water flows around these parts of the pump. All other stages of the pump are air-cooled by natural convection and radiation.

The pump-motor is cooled by water which flows through a cooling jacket which surrounds the motor. The cooling-water supply and return pipelines are connected to the iH system by connectors on the end of the iH system (Figure 4, items 2 and 3).

The cooling-water manifolds on the pump distribute the cooling-water to the pump cooling circuit and to the pump-motor cooling circuit (and to the HCMB pump-motor cooling circuit, on an iH600 system).

A surface temperature sensor (Figure 5, item 11) is fitted to the pump-body to measure the temperature of the pump-body. The output of the thermocouple is monitored by the iH system: see Section 1.8.3.

For safety reasons, a thermal snap-switch is fitted to the pump-motor manifold block. The snap-switch opens at 60 °C. The output of the snap-switch is connected to the internal emergency stop circuit (see Section 1.10.3) and will shut down the iH system if the snap-switch has operated and the normal temperature monitoring system has not already shut down the iH system.

A motor-protection thermistor is fitted to the pump-motor. This thermistor is a solid-state device which has an electrical resistance of less than 750 W at normal pump-motor operational temperature. When the pump-motor is too hot, the electrical resistance rises quickly to 4000 W or more. The thermistor is connected to the emergency stop circuit to shut down the iH system if the pump-motor is too hot.

A surface temperature sensor (Figure 5, item 6) is fitted to the pump-motor water manifold. The output of the sensor is monitored by the iH system and is used to provide a warning of cooling system failure.

A water flow-switch is fitted in the pump-motor water manifold. The output of the flow-switch is monitored by the iH system and provides an indication of low water flow through the pump.

1.6.2 HCMB pump temperature control system (iH600/iH1000 only)

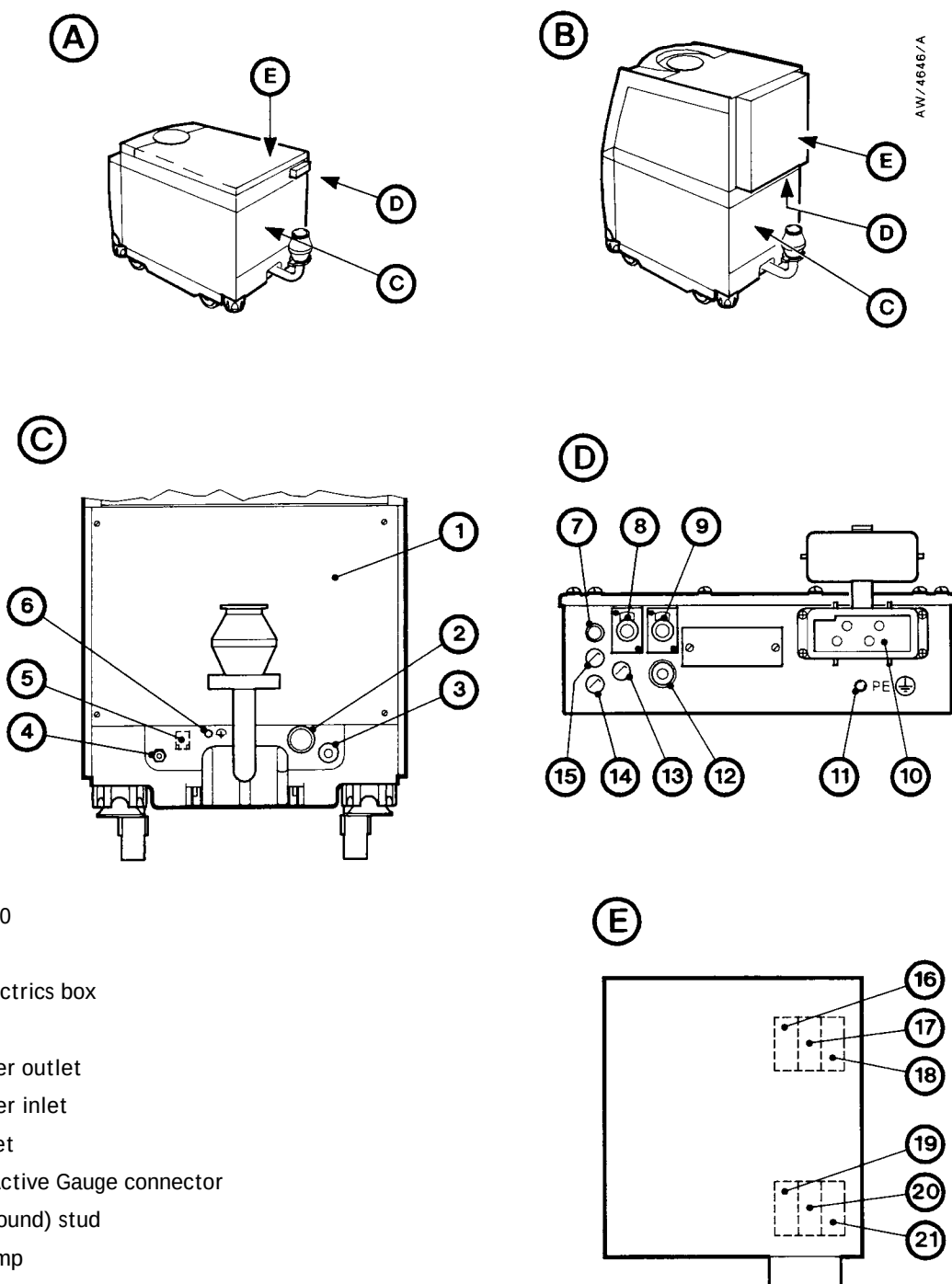
The HCMB600 pump in an iH600 system is cooled by ambient air. The pump-motor is cooled by water which flows through a cooling jacket which surrounds the pump-motor. The pump-motor cooling-water supply and return pipelines are connected to the cooling-water manifold on the HCDP pump.

The headplate of the HCMB1000 pump in an iH1000 system is directly cooled by water which flows around this part of the pump. The pump-motor is cooled by water which flows through a cooling jacket which surrounds the pump-motor. The headplate and pump-motor cooling-water supply and return pipelines are connected to the cooling-water manifold on the HCDP pump.

A motor-protection thermistor is fitted to the HCMB600 and HCMB1000 pump-motors. This thermistor is identical to that fitted to the HCDP pump (see Section 1.6.1). The thermistor is connected to the emergency stop circuit to shut down the iH system if the pump-motor is too hot.

A temperature sensor probe (Figure 5, item 14) is fitted in the stator of the pump. The output of the sensor is monitored by the iH system: on the iH600, the output is used to provide a warning that the pump has been operating at maximum inlet pressure for longer than the specified time (see Table 2) and is overheating; on the iH1000 system, the output is used to control the speed of the HCMB pump, to prevent overheating at high inlet pressures.

Figure 4 - Services and electrical connections on the rear of the iH system



A iH80

B iH600/iH1000

C Rear panel

D, E Detail of Electrics box

1. Rear cover

2. Cooling-water outlet

3. Cooling-water inlet

4. Nitrogen inlet

5. Position of Active Gauge connector

6. RF earth (ground) stud

7. Power on lamp

8. Tool Interface Module connector

9. LON interface connector

10. Electrical supply connector

11. Protective earth (ground) stud

12. GRC relay connector

13. d.c. electrical supply fuse holder (F7)

14. Emergency stop fuse holder (F9)

15. Tool Interface Module fuse holder (F8)

16. Fuse F6

17. Fuse F5

18. Fuse F4

19. Fuse F1

20. Fuse F2

21. Fuse F3

1.7 Exhaust system

The outlet of the HCDP pump is connected to an exhaust-pipe, which is below the pump. The outlet also has a port which allows gearbox vent gases to join the main exhaust stream (see [Figure 2](#)).

The final stage of the HCDP pump is a positive displacement Roots stage, which attenuates the gas pressure pulses from the claw stages in the pump. This pump configuration reduces pump-induced resonance in your exhaust-extraction system and removes the need for an exhaust silencer.

The outlet of the exhaust pipe has a check-valve which prevents the suck-back of exhaust vapours after the iH system is shut down. The check-valve also provides additional attenuation of the pulses in the exhaust pressure. If required, you can remove the check-valve for your specific process (see [Section 3.10](#)); for example, when you use the iH system on LPCVD and need to connect the exhaust pipe directly to an exhaust treatment system (such as an Edwards GRC).

You can fit an exhaust temperature sensor accessory to the end of the exhaust pipe (between the exhaust pipe and the check-valve, if fitted): see [Section 8.4.2](#). When fitted, the output of the sensor is monitored by the iH system and is used to provide an indication of exhaust gas temperature.

1.8 Electrical system

Refer to [Figures 6 and 7](#) which show schematic diagrams of the electrical and control systems of the iH80, iH600 and iH1000 systems.

Figure 5 - Electrical components: key

- | | |
|--|---|
| A. iH80 Electrics and Pump Control Module detail | |
| B. iH600/iH1000 Electrics and Pump Control Module detail | |
| 1. HCMB pump * | 12. HCDP pump |
| 2. Inverter enclosure ▲ | 13. Sensor Monitoring and Gas Control Module |
| 3. HCMB pump-motor terminal-box * | 14. HCMB pump motor * |
| 4. iH600 Electrics and Pump Control Module | 15. HCMB pump temperature sensor * |
| 5. HCDP pump-motor terminal-box | 16. SLTA card ▲ |
| 6. HCDP pump-motor water manifold temperature sensor | 17. Internal EMS/Gas Module electrical supply cable |
| 7. HCDP pump thermal snap-switch | 18. HCDP pump electrical supply cable |
| 8. HCDP pump water flow-switch | 19. HCDP pump-motor thermistor cable |
| 9. Gas Module | 20. LON network cable |
| 10. iH80 Electrics and Pump Control Module | 21. HCMB pump-motor thermistor cable * |
| 11. HCDP pump-body temperature sensor | 22. HCMB pump electrical supply cable (iH600) *
or inverter electrical supply cable (iH1000) ▲ |
| * iH600/iH1000 only | |
| ▲ iH1000 only | |

Figure 5 - Electrical components (shown without enclosure for clarity)

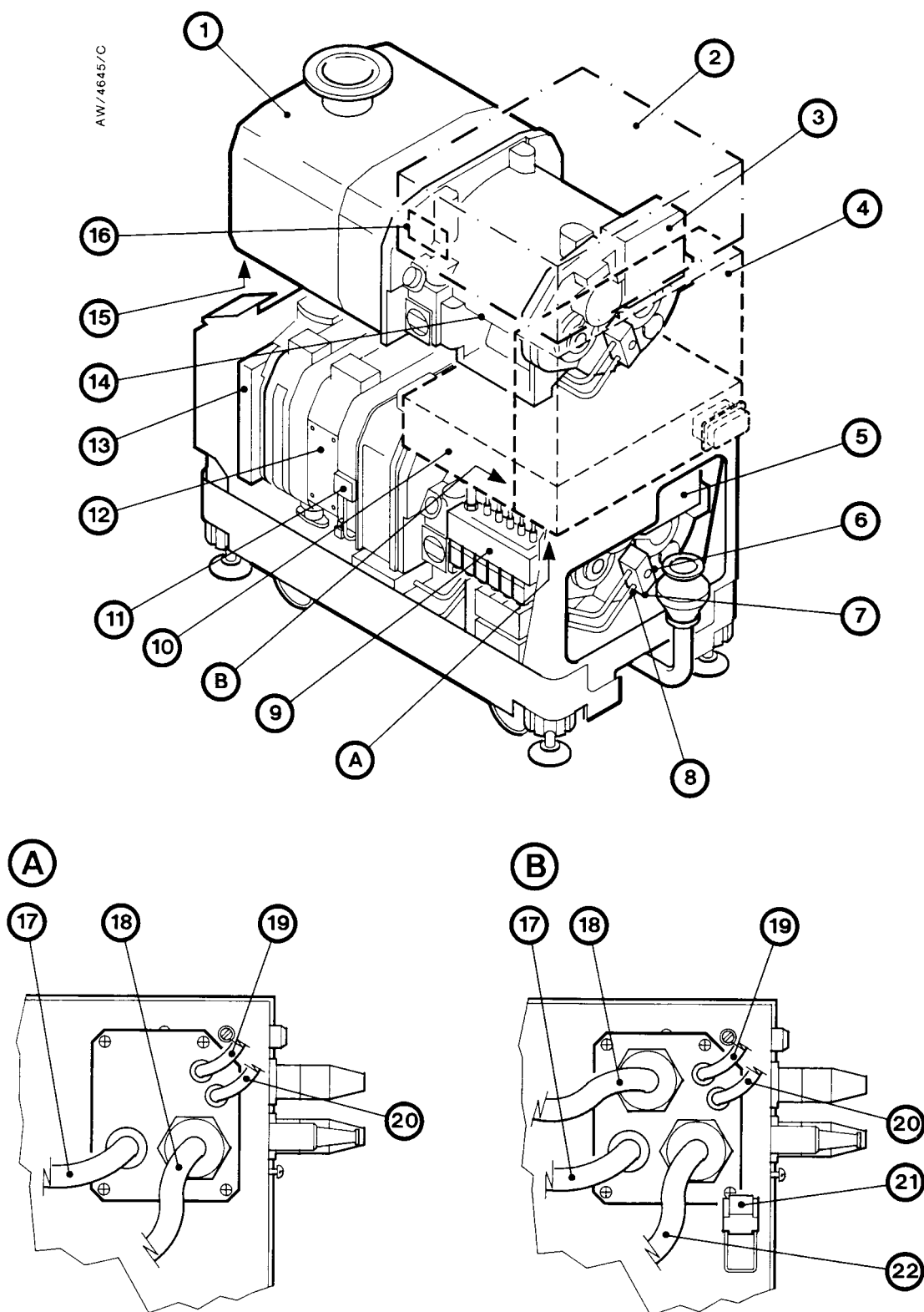


Figure 6 - Schematic diagram of the iH80/iH600 electrical systems: key

- | | |
|--|---|
| 1. Electrics and Pump Control Module | 25. Emergency stop switch |
| 2. Gas Module | 26. Not used |
| 3. Sensor Monitoring & Gas Control Module | 27. Gas solenoid-valves electrical supply |
| 3A. Sensor monitoring PCA | 28. HCMB temperature sensor [†] |
| 3B. Gas control PCA | 29. HCDP pump-motor water manifold surface temperature sensor |
| 4. Pump Display Module | 30. Exhaust temperature sensor * |
| 5. External electrical supply | 31. HCDP pump-body temperature sensor |
| 6. Electrical supply connector | 32. Not used |
| 7. Protective earth (ground) stud | 33. Not used |
| 8. GRC relay connector | 34. Water flow-switch |
| 9. Tool Interface Module connector | 35. LON connector |
| 10. Control PCA | 36. Not used |
| 11. iH Tool Interface Module fuse holder | 37. Not used |
| 12. Emergency stop fuse holder | 38. 25-way 'D' type connector |
| 13. HCDP electrical supply | 39. Solenoid-valves (6 off) |
| 14. HCDP motor terminal-box | 40. Pressure transducers (2 off) |
| 15. HCDP motor thermistor cable | 41. Mass flow transducer |
| 16. HCMB electrical supply [†] | 42. Front panel LEDs |
| 17. HCMB motor terminal-box [†] | 43. Front panel 10-way connector |
| 18. HCMB motor thermistor cable [†] | 44. 4-way XLR connector for PDM |
| 19. RF earth (ground) stud | 45. Active Gauge connector * |
| 20. Cooling-fan connector | 46. Rear panel |
| 21. Internal emergency stop loop | 47. d.c. electrical supply fuse holder |
| 22. Pressure-relay | 48. Active gauge cable connector |
| 23. Pump shut-down thermal snap-switch | 49. Sensor connector |
| 24. Not used | |
- * Optional accessory
[†] iH600 only

Figure 6 - Schematic diagram of the iH80/iH600 electrical systems

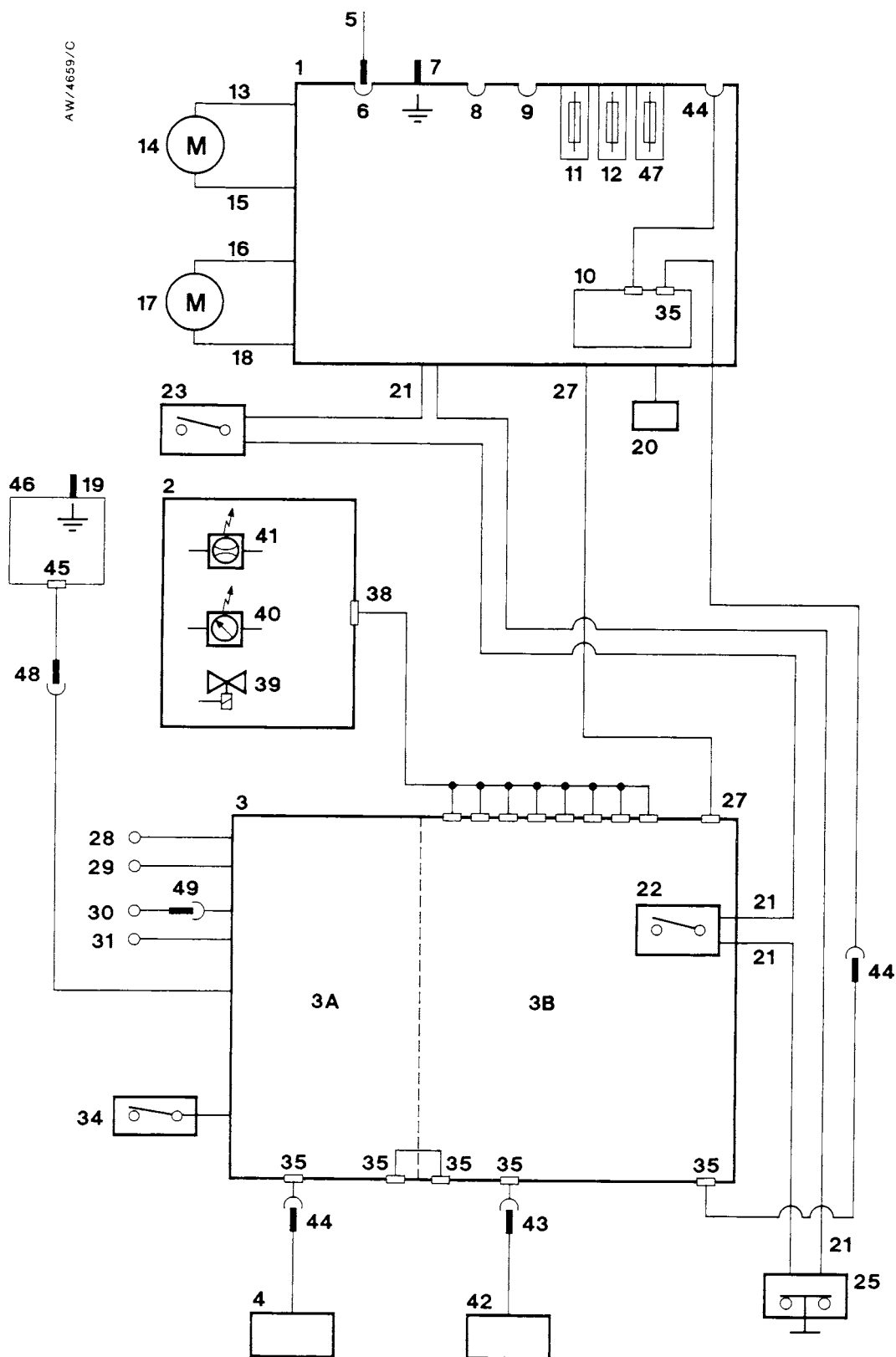
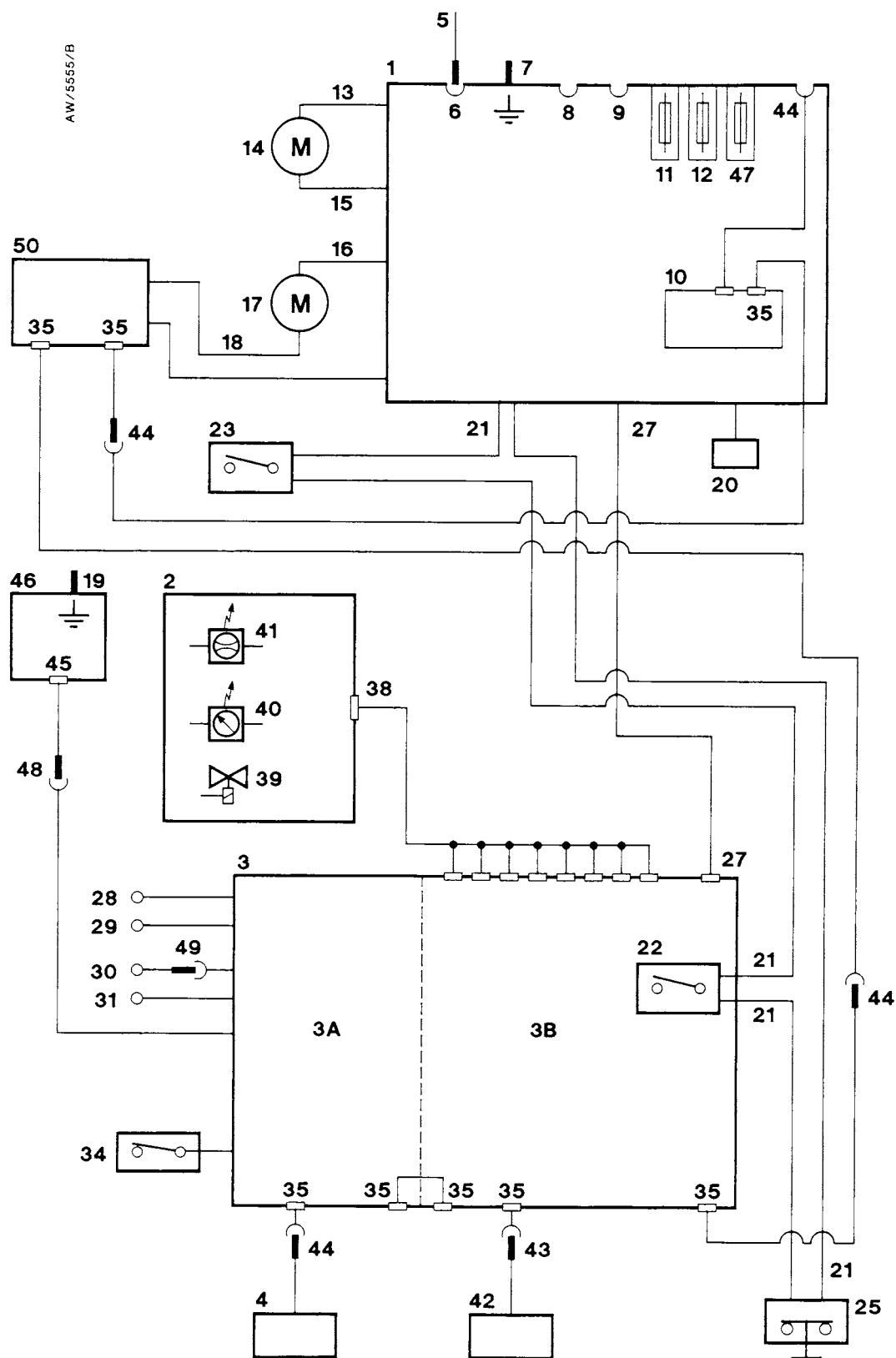


Figure 7 - Schematic diagram of the iH1000 electrical system: key

- | | |
|--|---|
| 1. Electrics and Pump Control Module | 25. Emergency stop switch |
| 2. Gas Module | 26. Not used |
| 3. Sensor Monitoring & Gas Control Module | 27. Gas solenoid-valves electrical supply |
| 3A. Sensor monitoring PCA | 28. HCMB temperature sensor [†] |
| 3B. Gas control PCA | 29. HCDP pump-motor water manifold surface temperature sensor |
| 4. Pump Display Module | 30. Exhaust temperature sensor * |
| 5. External electrical supply | 31. HCDP pump-body temperature sensor |
| 6. Electrical supply connector | 32. Not used |
| 7. Protective earth (ground) stud | 33. Not used |
| 8. GRC relay connector | 34. Water flow-switch |
| 9. Tool Interface Module connector | 35. LON connector |
| 10. Control PCA | 36. Not used |
| 11. iH Tool Interface Module fuse holder | 37. Not used |
| 12. Emergency stop fuse holder | 38. 25-way 'D' type connector |
| 13. HCDP electrical supply | 39. Solenoid-valves (6 off) |
| 14. HCDP motor terminal-box | 40. Pressure transducers (2 off) |
| 15. HCDP motor thermistor cable | 41. Mass flow transducer |
| 16. HCMB electrical supply [†] | 42. Front panel LEDs |
| 17. HCMB motor terminal-box [†] | 43. Front panel 10-way connector |
| 18. HCMB motor thermistor cable [†] | 44. 4-way XLR connector for PDM |
| 19. RF earth (ground) stud | 45. Active Gauge connector * |
| 20. Cooling-fan connector | 46. Rear panel |
| 21. Internal emergency stop loop | 47. d.c. electrical supply fuse holder |
| 22. Pressure-relay | 48. Active gauge cable connector |
| 23. Pump shut-down thermal snap-switch | 49. Sensor connector |
| 24. Not used | 50. Inverter |
- * Optional accessory
[†] iH600 only

Figure 7 - Schematic diagram of the iH1000 electrical system



1.8.1 Introduction

The iH system has an Electrics and Pump Control Module (1), a Sensor Monitoring and Gas Control Module (3), a Gas Module (2) and a Pump Display Module (4). The iH1000 system also has an inverter (50). Optionally, your iH system may have an iH Interface Module, an iH Communications Module, an HCMB pump and other accessories, such as an exhaust temperature sensor.

All of these Modules communicate through a serial data network. Each Module on the network has a microprocessor, which controls the network communications and also contains the default setpoints for the sensors in or connected to the Modules (see [Section 2](#)).

1.8.2 Electrics and Pump Control Module

Note: *The operation of a safety sensor and the operation of the exhaust pressure relay will have the same effect as the operation of the emergency stop switch: see [Sections 1.10.3](#) and [1.10.4](#).*

Refer to [Figures 6](#) and [7](#). The external electrical supply (5) is connected to the electrical supply connector (6) on the Electrics and Pump Control Module (1). The Electrics and Pump Control Module switches the electrical supplies to the HCDP pump and to the HCMB600 pump (on an iH600 system) and monitors the operation of the pump(s). The Module also provides the electrical supplies to the other Modules in the iH system. The electrical supply to the HCMB1000 pump in an iH1000 system is provided by the inverter (50).

The Module has contactors for the HCDP pump and the HCMB pump (on an iH600/iH1000 system), pump power and current consumption sensors and short-circuit protection. Internal clocks and counters in the Module measure the operating time of the iH system and keep count of the number of iH system switch-on/switch-off and process cycles. The Module also has a transformer and fuses for the 24 V control circuits and fuses for the following supplies: iH Interface Module (11), emergency stop circuit (12) and d.c. electrical supply (47). Three thermal-type, self-resetting fuses in the Electrics and Pump Control Module protect the d.c. electrical supplies to the network.

Refer to [Figure 4](#) detail D. The rear panel of the Electrics and Pump Control Module has the following lamp and connections:

Power on lamp (7)	This lamp is on when the electrical supply to the Electrics and Pump Control Module is on.
Tool Interface Module connector (8)	Use this to connect an iH Tool Interface Module to the iH system, or to connect an external emergency stop circuit to the iH system (see Section 3.15).
LON Interface Connector (9)	Use this to connect the iH system to a network.
Electrical supply connector (10)	Use this to connect your external electrical supply to the iH system: refer to Section 3.16.3 .
Protective earth (ground) stud (11)	If required, use this to make additional protective earth (ground) connections: refer to Section 3.16.3 .
GRC relay connector (12)	If required, use this connector to connect the iH system to an Edwards GRC.
Fuse holder F7 (13)	This fuse protects the d.c. electrical supply.
Fuse holder F9 (14)	This fuse protects the emergency stop circuit.
Fuse holder F8 (15)	This fuse protects the iH Interface Module (if fitted).

Refer to detail E. Fuses inside the Module (16 to 21) protect the internal circuits of the Module. Note that you cannot change these fuses; an Edwards service engineer must change these fuses.

Refer to detail C. The rear panel of the iH system has the following connections:

Active gauge connector (5)	This connector is only available if you have fitted an Active Gauge Connection Kit (see Section 8.4.3). Use this to connect the active gauge to the iH system.
RF earth (ground) stud (6)	If required, use this to make additional RF earth (ground) connections: refer to Section 3.16.4 .

Refer to [Figure 5](#), detail A or B. The bottom panel of the Electrics and Pump Control Module has the following cables and connectors:

Internal EMS/Gas Module electrical supply cable (17)	This is used to connect the Module to the iH internal emergency stop circuit, and to provide the electrical supply to the Gas Module.
HCDP electrical supply cable (18)	This is used to connect the electrical supply from the Electrics and Pump Control Module to the HCDP pump.
HCDP thermistor cable (19)	This is used to connect the output of the thermistor in the HCDP pump to the Module.
LON network cable (20)	This is used to connect the Module to the Sensor Monitoring and Gas Control Module.
HCMB thermistor cable (21)	On an iH600/iH1000 system, this is used to connect the output of the thermistor in the HCMB pump to the Electrics and Pump Control Module.
HCMB electrical supply cable (22)	On an iH600/iH1000 system, this is used to connect the electrical supply from the Electrics and Pump Control Module to the HCMB pump.

1.8.3 Sensor Monitoring and Gas Control Module

This Module communicates with the Gas Module, the Pump Display Module and the optional Interface Module accessories. The following sensors are connected to the Sensor Monitoring and Gas Control Module:

- HCDP pump-body and pump-motor water manifold temperature sensors
- HCMB pump temperature sensor (iH600/iH1000 systems only)
- Exhaust temperature sensor (if fitted)
- Water flow-switch.

The Module has a microprocessor which:

- Monitors the status of the system.
- Sends warning and alarm messages (see [Section 1.10.2](#)) to other Modules connected to the iH system.
- Monitors the control inputs (from the Pump Display Module or the Interface Module accessory) and switches the pumps on and off as requested.
- Shuts down the iH system if a sensor reading is outside the specified alarm range: see [Section 1.10.2](#). (Note that the safety sensors and the exhaust pressure relay can also shut down the iH system; these sensors are not connected to the microprocessor: see [Sections 1.10.3](#) and [1.10.4](#).)

The Module also communicates with and controls the operation of the Gas Module and the nitrogen supply solenoid valve.

1.8.4 Gas Module

The Gas Module communicates with and is controlled by the Sensor Monitoring and Gas Control Module. The operation of the nitrogen purge supply solenoid-valves in the Gas Module is described in [Section 1.4](#).

1.9 Controls and indicators

Refer to [Figure 3](#). The controls and indicators on the front panel of the iH system are as follows:

Emergency stop switch (1)	Press this to immediately shut down the iH system in an emergency: refer to Section 5.11 .
Pump Display Module (2)	Use this to control the iH system: refer to Section 1.11 .

Shaft-seal purge pressure warning LED (3)	This yellow LED is on when the shaft-seals purge nitrogen pressure is too high or too low.
Nitrogen supply pressure regulator (4)	Use this to adjust the nitrogen supply pressure.
Shaft-seal purge pressure high and low LEDs (5, 6)	These green LEDs are both on when the shaft-seals purge nitrogen pressure is acceptable. The pressure high LED (5) is off when the pressure is too low, and the pressure low LED (6) is off when the pressure is too high.
Power OK LED (7)	This green LED is on when the 24 V electrical supply to the Gas Control Module is on.
Running LED (8)	This green LED is on when the iH pumps are operating.
Alarm LED (9)	This red LED is on when an alarm condition exists: see Section 1.10 .
Warning LED (10)	This yellow LED is on when a warning condition exists: see Section 1.10 .

1.10 Control functions

1.10.1 Priority of control

The iH system can be controlled by a number of modules: the Pump Display Module (see [Section 1.11](#)); an iH Interface Module (see [Section 8.5.3](#)); or the iH Single Pumpset Monitor (see [Section 8.5.4](#)). Only one module can have control of the iH system at any one time. That is, once a module has control of the iH system, control requests from another Module are denied.

To allow another Module to control the iH system:

- The Module which currently has control must 'release' control (that is, you must send the appropriate message on the network or press the appropriate button to release control).
- Any Module which requires control must then 'take' control (that is, you must send the appropriate message to the iH system or press the appropriate button to take control).

Note that when you first switch-on the electrical supply, no Module will initially have control of the iH system. The Module which you want to control the iH system must take control as described above.

1.10.2 Setpoints, warning and alarm conditions

Note: Sensors which generate alarm and warning messages are not safety sensors: see [Section 1.10.3](#).

Each Module which monitors sensors has a microprocessor. Each monitored sensor (except for switch-type sensors, such as the oil monitors, which have only two output states: error or no error) has four associated setpoints. The setpoints are: the low warning setpoint, the high warning setpoint, the low alarm setpoint and the high alarm setpoint. The microprocessor compares the sensor data to the setpoints to determine if an alarm or warning condition exists:

- If the sensor data is below the low warning setpoint or above the high warning setpoint, a warning condition exists. A warning condition means that some aspect of the operation of the iH system is abnormal. The iH system will continue to operate.
- If the sensor data is below the low alarm setpoint or above the high alarm setpoint, an alarm condition exists. An alarm condition means there is a serious fault which results in the shut-down of the iH system to prevent damage to the iH system. However, note that for some of the alarm conditions, you may be able to continue to operate the iH system if you have configured the iH system to 'run til crash': see [Section 5.10](#).

If an alarm or warning condition exists, an appropriate alarm or warning message is displayed on the Pump Display Module and an appropriate alarm or warning indication is sent to other Modules on the network. Refer to [Section 6](#) for a full list of the Pump Display Module warning and alarm messages.

You can use the default setpoints or you can use a Single Pumpset Monitor to adjust the setpoints to suit your application: refer to [Section 5.2](#). Refer to [Section 2](#) for the default setpoints.

1.10.3 Safety sensors

Note: The operation of a safety sensor will have the same effect as the operation of the emergency stop switch described in [Section 1.9](#).

The iH system has a number of safety sensors connected to the internal emergency stop circuit in the Electrics and Pump Control Module. If any of the safety sensors operate, the iH system is immediately shut down. [Table 1](#) shows the safety sensors and the shut-down conditions.

Table 1 - Safety sensors

Safety sensor	Shut-down condition
HCDP pump-motor thermistor	When the thermistor in the HCDP pump- motor indicates that the temperature of the pump-motor is nominally 150 °C.
HCMB pump-motor thermistor *	When the thermistor in the HCMB pump- motor indicates that the temperature of the pump-motor is nominally 150 °C.
HCDP pump shut-down thermistor	When the thermal snap-switch operates to indicate that the temperature of the HCDP pump-motor manifold is 60 °C or higher.

* iH600/iH1000 only.

1.10.4 Exhaust pressure relay

Note: The operation of the exhaust pressure relay will have the same effect as the operation of the emergency stop switch described in [Section 1.9](#).

The exhaust pressure relay is connected to the internal emergency stop circuit in the Electrics and Pump Control Module. When the pressure-relay operates to indicate that the pressure in the exhaust pipeline is 9 psig or higher, the iH system is immediately shut down.

1.11 Pump Display Module

The Pump Display Module allows you to manually control the iH system and to display the status of the iH system. Refer to [Figure 8](#) which shows the front panel of the Pump Display Module.

Use the On button (1) to switch on the iH system (refer to [Section 5.5](#)). The On button has a green LED which is on when the iH system is on. Use the Off button (10) to switch off the iH system (refer to [Section 5.9](#)).

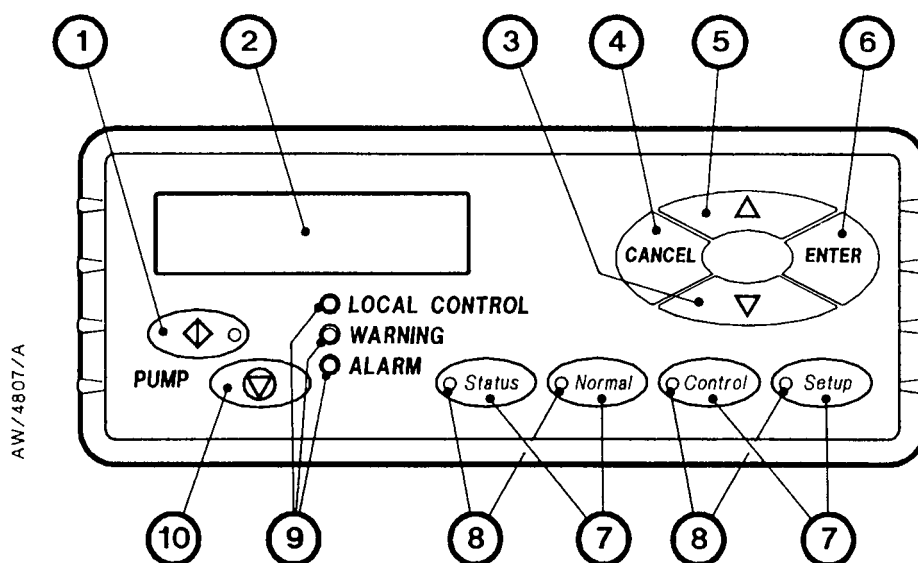
The display (2) shows two lines of text; each line is 16 characters long. In normal operation, the Normal display is shown; the Normal display has two pages, and each page has two lines. Each page of the Normal display shows the current status of one or more iH system sensors or internal clocks and counters.

As supplied the first page of Normal display shows HCDP pump power consumption and HCDP pump body temperature, and the second page shows HCMB pump power consumption and HCMB pump-motor temperature. You can change the information shown on the Normal display: refer to [Section 5.3](#).

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

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

Figure 8 - Front panel of the Pump Display Module



- | | |
|------------------|-----------------------|
| 1. On button | 6. ENTER button |
| 2. Display | 7. Menu buttons |
| 3. Down button | 8. Menu selected LEDs |
| 4. CANCEL button | 9. Status LEDs |
| 5. Up button | 10. Off Button |

Button	LED colour	Button use
Normal	Green	Press this button to select the Normal display (see above).
Control	Green	Press this button to select the Control menu. You can then take control or release control of the iH system (see Section 5.4).
Status	Green	Press this button to select the Status menu. In this menu, you can display the current values of all iH system sensors.
Setup	Green	Press this button to select the Setup menu. In this menu you can: manually control the operation of iH gas purges and gate valves fitted to the vacuum system (and connected to the iH through an iH Interface Module with an Auxiliary Interface Card); select 'Run til Crash'; change other display parameters (such as the pressure units used when pressures are displayed and the timeout time). The Setup menu also allows you to select the Service menu; in this menu, you can zero the Gas Module flow transducer and manually operate the components of the iH system.
ENTER	-	Use this button to select a currently displayed menu option or to enter a currently displayed parameter.
CANCEL	-	Use this button to cancel the currently displayed menu or option and return to the previous menu or option.
Up/down	-	Use these buttons to move up or down menu options or to increase or decrease a displayed parameter.

The status LEDs (9) show the current status of the iH system and the Pump Display Module:

LED	LED colour	Meaning
ALARM	Red	This LED shows when an alarm condition exists.
WARNING	Amber	This LED shows when a warning condition exists.
LOCAL CONTROL	Green	This LED is on when the Pump Display Module has control of the iH system.

The ALARM and WARNING LEDs flash when the corresponding alarm or warning condition first occurs. When you acknowledge the condition (refer to [Section 5.8](#)), 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; see Tables [15](#) and [16](#) for the warnings and alarms whose LEDs do not automatically reset in this way.

1.12 Accessories

A number of accessories are available to configure the iH system for your specific application. Refer to [Section 8](#) for descriptions of these accessories.

2 Technical Data

Note: Unless otherwise specified, data in the following sections applies to all models of iH system.

2.1 General

Dimensions	See Figures 9 and 12
Inlet and outlet	See Table 2
Warm-up time to nominal pumping performance	15 min
Minimum warm-up time to process gas pumping	4 hours
Vacuum system maximum leak-rate	$1 \times 10^{-5} \text{ mbar ls}^{-1}$ ($1 \times 10^{-3} \text{ Pa ls}^{-1}$)
Exhaust system maximum leak-rate	$1 \times 10^{-5} \text{ mbar ls}^{-1}$ ($1 \times 10^{-3} \text{ Pa ls}^{-1}$)
Ambient operating temperature range	5 to 40 °C
Maximum ambient operating humidity	90% RH
Noise level measured at 1 m from the pump (with enclosure panels fitted)	See Table 2
Mass	See Table 2
Centre of mass/mass distribution	See Figure 5

2.2 Performance

Pumping speed range	See Figures 14 and 15
Power curves	See Figures 14 and 15
Peak pumping speed	See Table 2
Ultimate vacuum	See Table 2
Maximum pressure differential between HCMB inlet and outlet *	See Table 2
Maximum inlet pressure *	See Table 2
Maximum operating time at maximum inlet pressure *	See Table 2

* iH600/iH1000 systems only

Table 2 - Technical data

Parameter		Units	iH80	iH600	iH1000
Typical peak pumping speed	50 Hz	m ³ h ⁻¹	86	518	950
	60 Hz	m ³ h ⁻¹	103	600	1000
Typical ultimate vacuum with shaft-seals purge only	50 Hz	mbar Pa	3 × 10 ⁻² 3	2 × 10 ⁻³ 2 × 10 ⁻¹	1.3 × 10 ⁻³ 0.13
	60 Hz	mbar Pa	1 × 10 ⁻² 1	7 × 10 ⁻⁴ 7 × 10 ⁻²	6 × 10 ⁻⁴ 6 × 10 ⁻⁴
Maximum pressure differential across HCMB pump *	50 Hz	mbar Pa	- -	90 9 × 10 ³	90 9 × 10 ³
	60 Hz	mbar Pa	- -	90 9 × 10 ³	90 9 × 10 ³
Maximum inlet pressure	50 Hz	mbar Pa	-	See Figure 15 See Figure 15	See Figure 14 See Figure 14
	60 Hz	mbar Pa	-	See Figure 15 See Figure 15	See Figure 14 See Figure 14
Maximum operating time at maximum inlet pressure	50 Hz	hour	-	1	Continuous
	60 Hz	hour	-	1	Continuous
Inlet connection		-	ISO63 bolted	ISO100 bolted	ISO100 bolted
Outlet connection		-	NW40	NW40	NW40
Mass		kg	240	405	420
Noise level †		dB(A)	< 64	< 67	<69

* H600/iH1000 only.

† Measured at 1 metre from the pump, with enclosure panels fitted.

2.3 Temperature control system

HCDP pump shut-down thermistor

“Opening” temperature

60 ± 3 °C

“Closing” temperature

50 ± 4 °C

Thermocouples

K type class 1

HCDP and HCMB motor-protection thermistors

Type

Positive temperature coefficient

Reference temperature

150 °C

Compliant with

IEC 34-11 (BS4999 part III)

Water flow-switch

Closed when flow ≥ 2 l min⁻¹ (iH80)

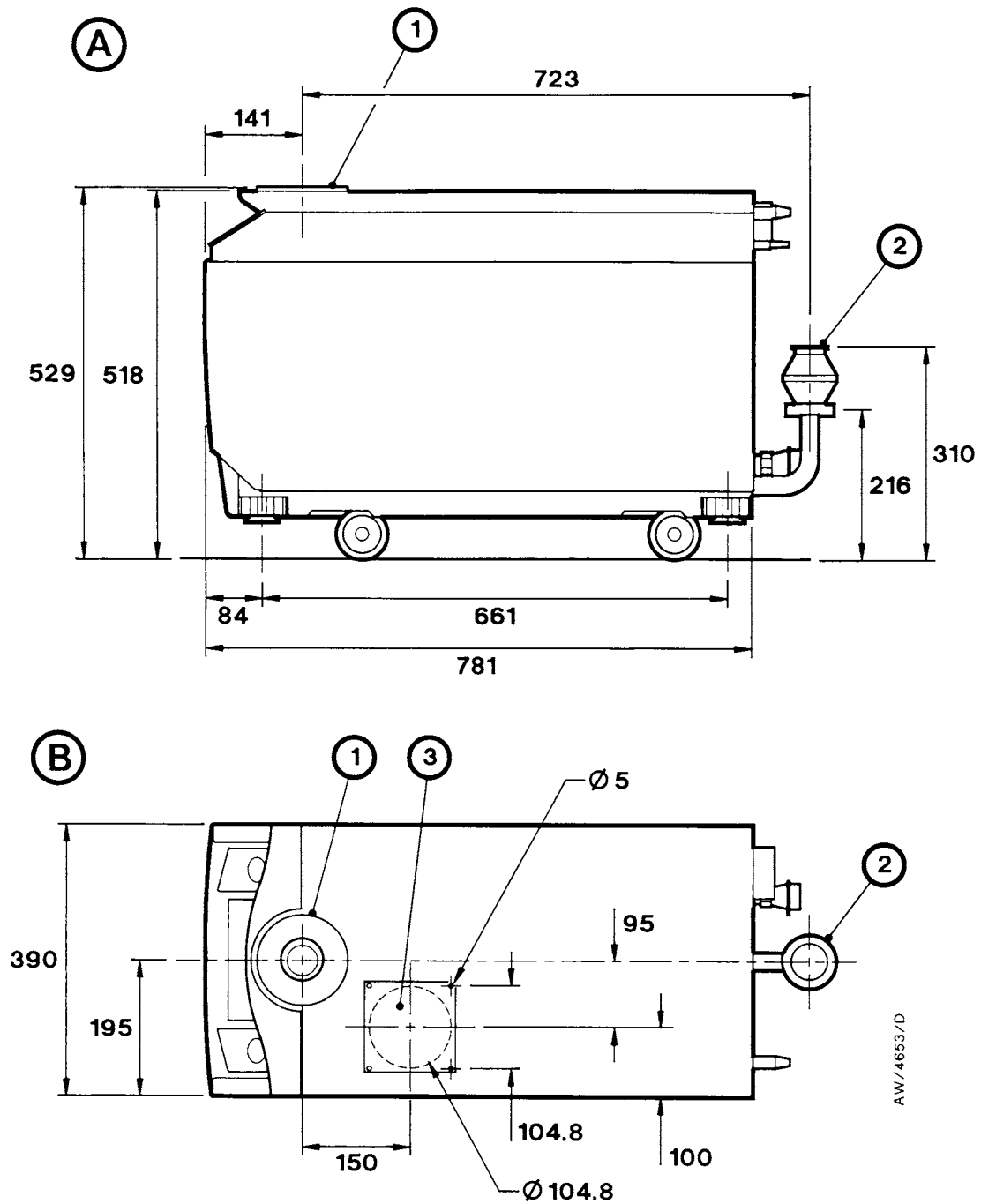
iH80/iH600

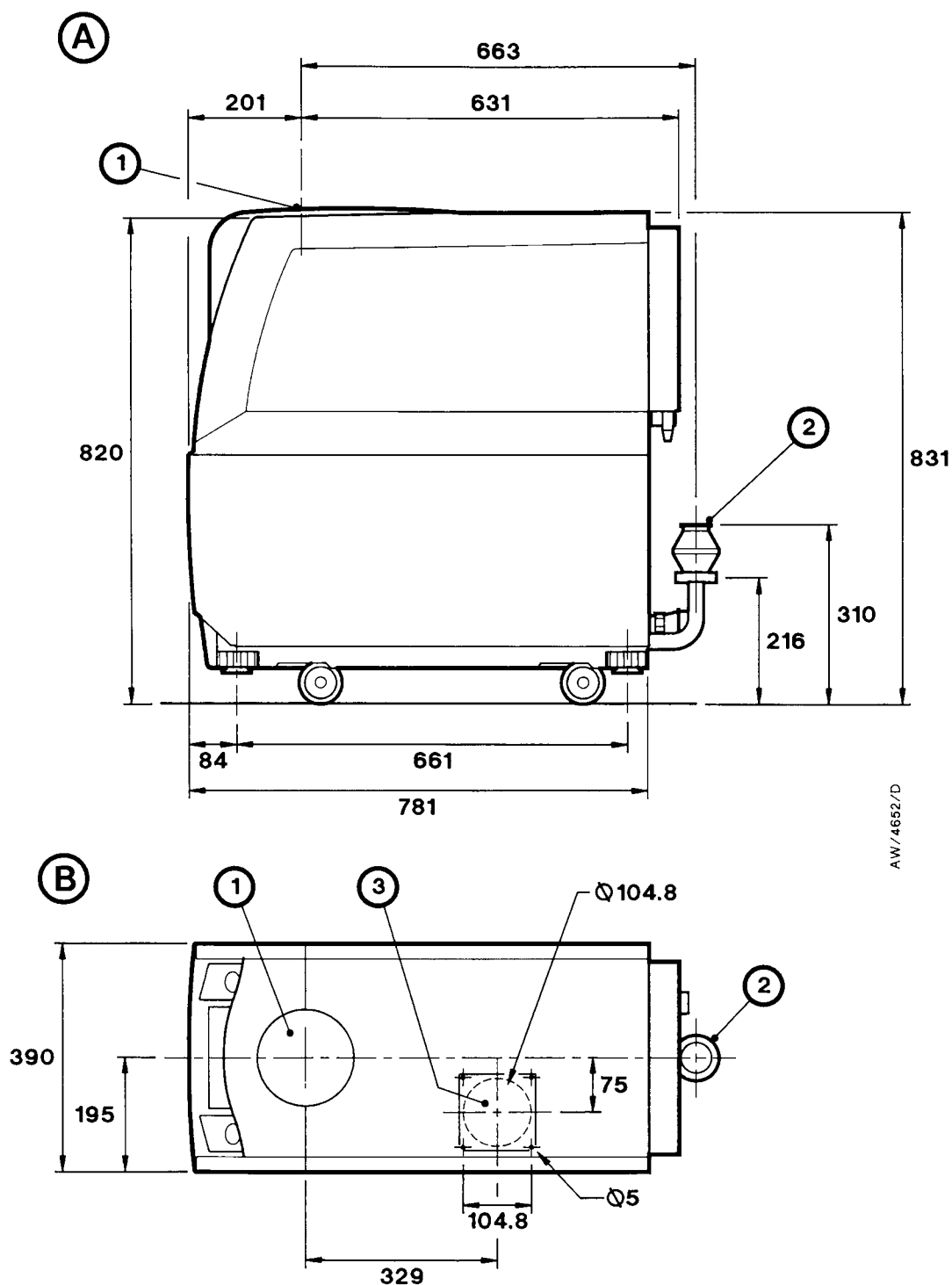
Closed when flow ≥ 4 l min⁻¹

iH1000

Closed when flow ≥ 4 l min⁻¹

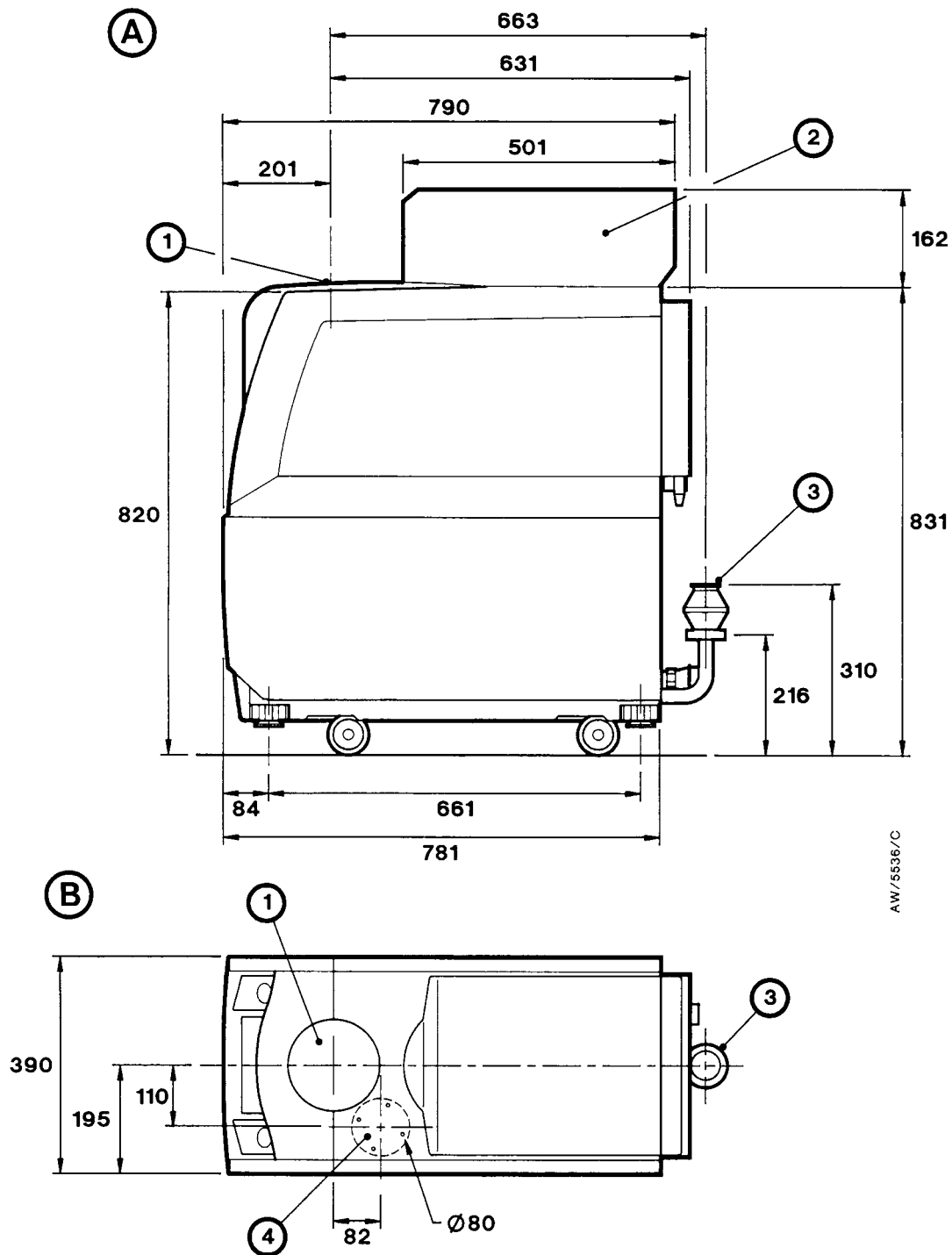
Figure 9 - iH80 dimensions (mm)





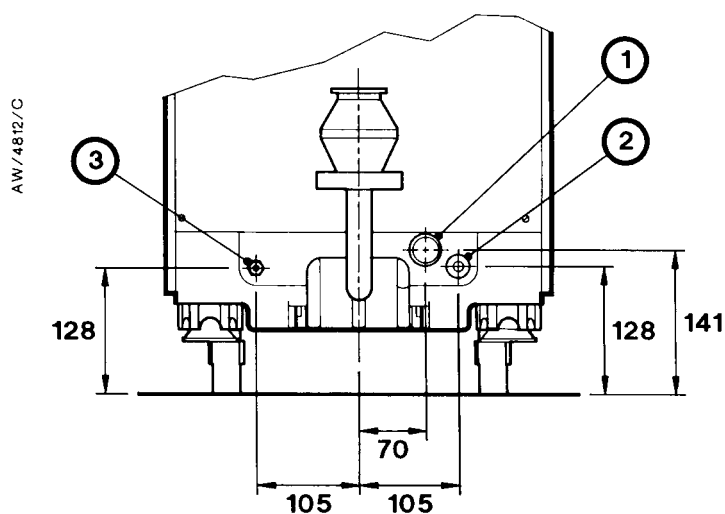
- | | | | |
|----|-----------|----|----------------------|
| A. | Side View | 1. | Inlet |
| B. | Plan View | 2. | Outlet (as supplied) |
| | | 3. | Air-extraction port |

Figure 11 - iH1000 dimensions (mm)



- | | |
|--------------|------------------------|
| A. Side View | 1. Inlet |
| B. Plan View | 2. Inverter enclosure |
| | 3. Outlet |
| | 4. Air-extraction port |

Figure 12 - Services connections dimensions (mm)



1. Cooling-water outlet
2. Cooling-water inlet
3. Nitrogen inlet

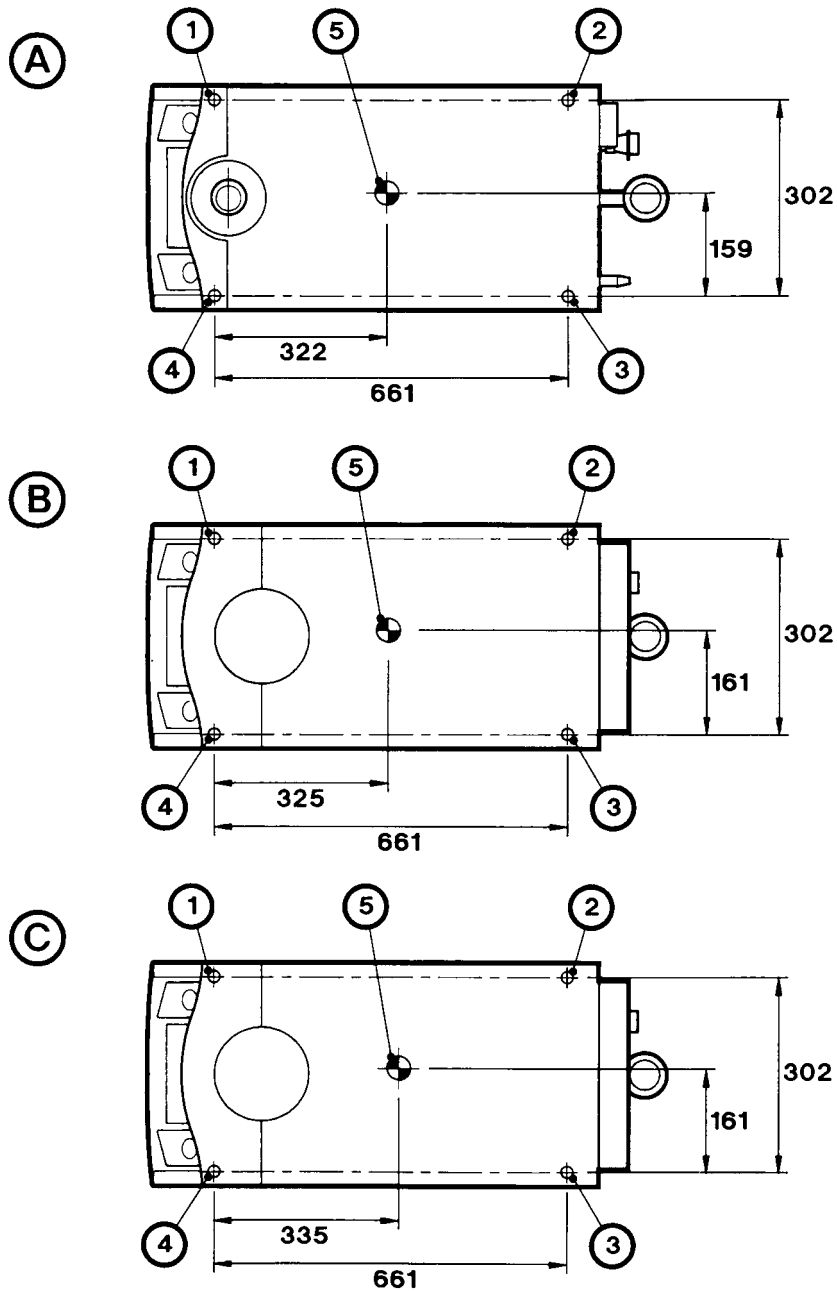
2.4 Cooling-water supply

Note: Use treated water or non-corrosive industrial water to cool the iH system.

Maximum supply pressure	100 psig (6.9 bar, 6.9×10^5 Pa)
Typical pressure differential across supply and return *	
iH80/iH600	15 psi (1.03 bar, 1.03×10^5 Pa)
iH1000	15 psi (1.03 bar, 1.03×10^5 Pa)
Minimum flow rate required for reliable iH system operation	
iH80/iH600	2 l min ⁻¹
iH1000	4 l min ⁻¹
Typical heat removed from iH system at peak operating speed	
iH80	2.5 kW
iH600	3.2 kW
iH1000	3.2 kW
Maximum particle size in supply	0.03 mm ²
Water supply quality	
Acidity	6.5 to 8.0
Hardness	< 100 ppm
Resistivity	> 1 kΩ cm ⁻¹
Solids (turbidity)	< 100 ppm

* With cooling-water supply temperature of 20 °C and flow rate of 3 l min⁻¹.

Figure 13 - Centres of mass dimensions (mm) and mass distribution

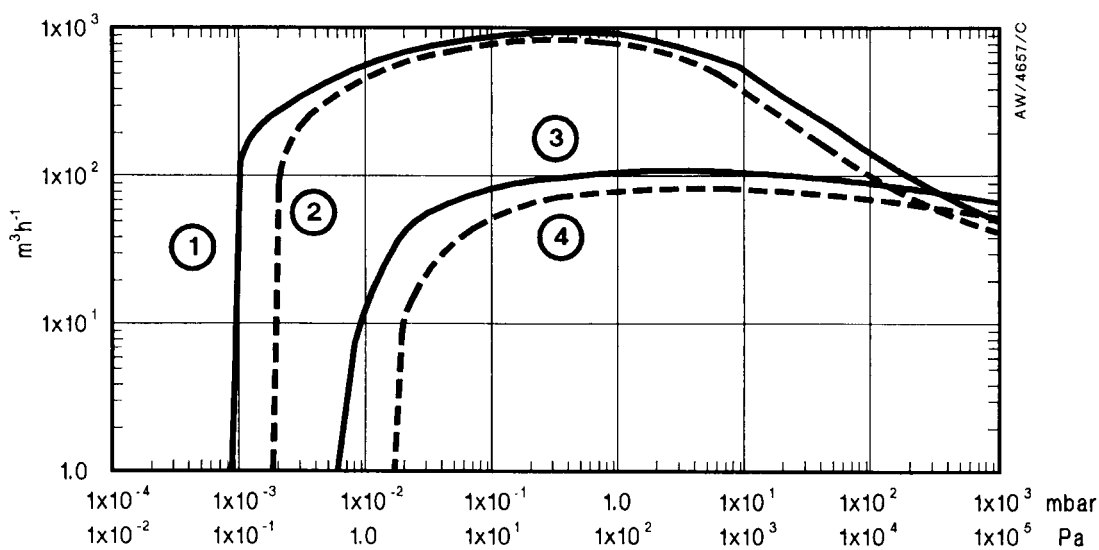


AW/4816/B

- A iH80
B iH600
C iH1000
1. Levelling-foot
2. Levelling-foot
3. Levelling-foot
4. Levelling-foot
5. Centre of mass

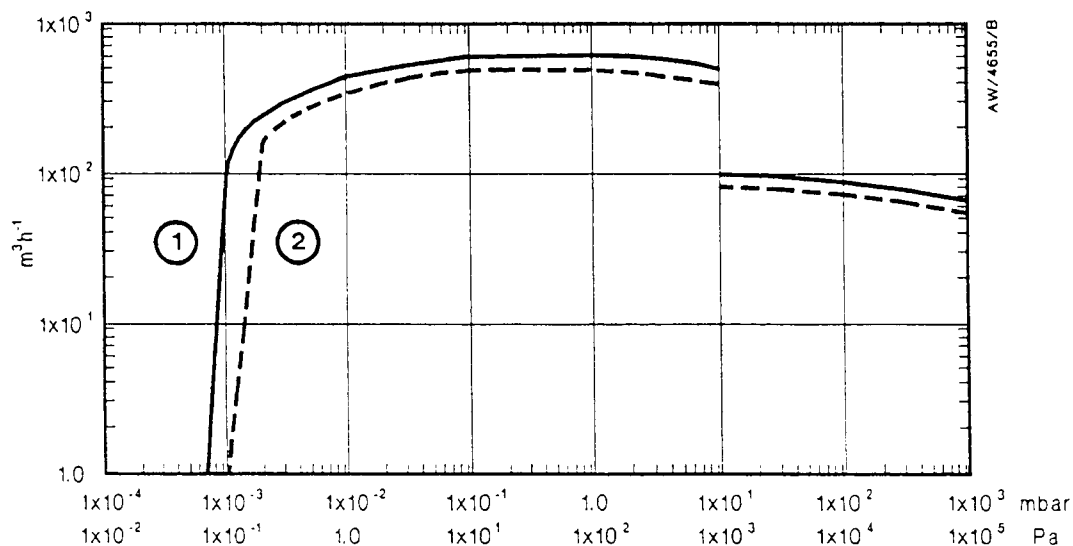
	Mass distribution on levelling feet			
	1	2	3	4
iH80	75 kg	66 kg	51 kg	48 kg
iH600	149 kg	67 kg	132 kg	57 kg
iH1000	89 kg	135 kg	78 kg	118 kg

Figure 14 - Typical pumping speeds for iH80/iH1000: pumping speed against pressure



- | | |
|------------------|----------------|
| 1. iH1000, 60 Hz | 3. iH80, 60 Hz |
| 2. iH1000, 50 Hz | 4. iH80, 50 Hz |

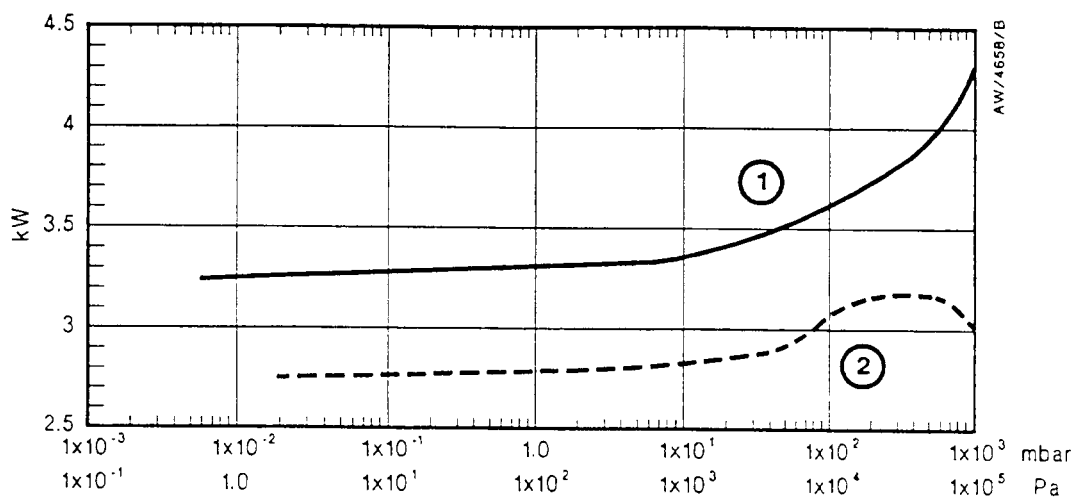
Figure 15 - Typical pumping speeds for iH600: pumping speed against pressure



1. 60 Hz
2. 50 Hz

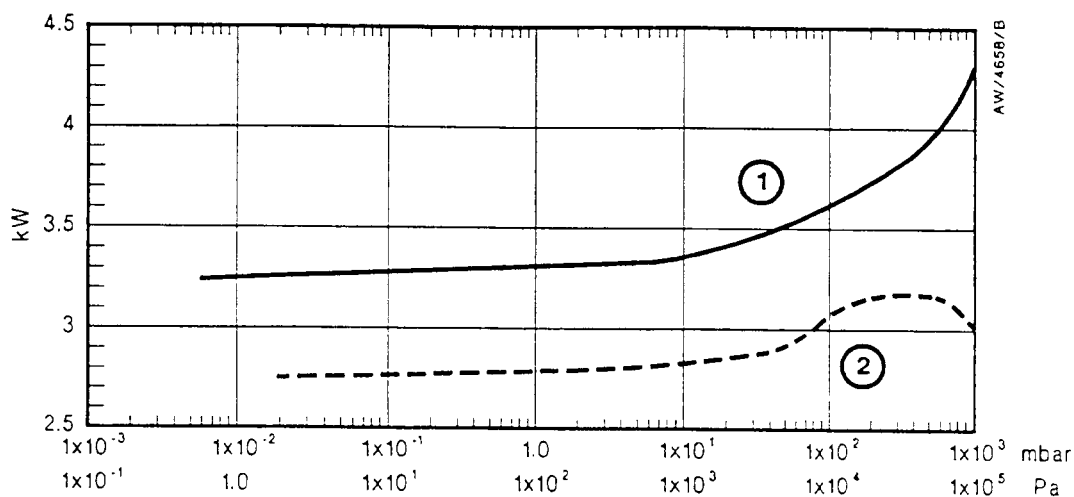
Note: The discontinuity at inlet pressure of 10 mbar (1×10^3 Pa) indicates where the HCMB600 pump is automatically switched off: refer to [Section 5.10](#).

Figure 16 - iH80 pump power curves: electrical power input against inlet pressure



1. 60 Hz
2. 50 Hz

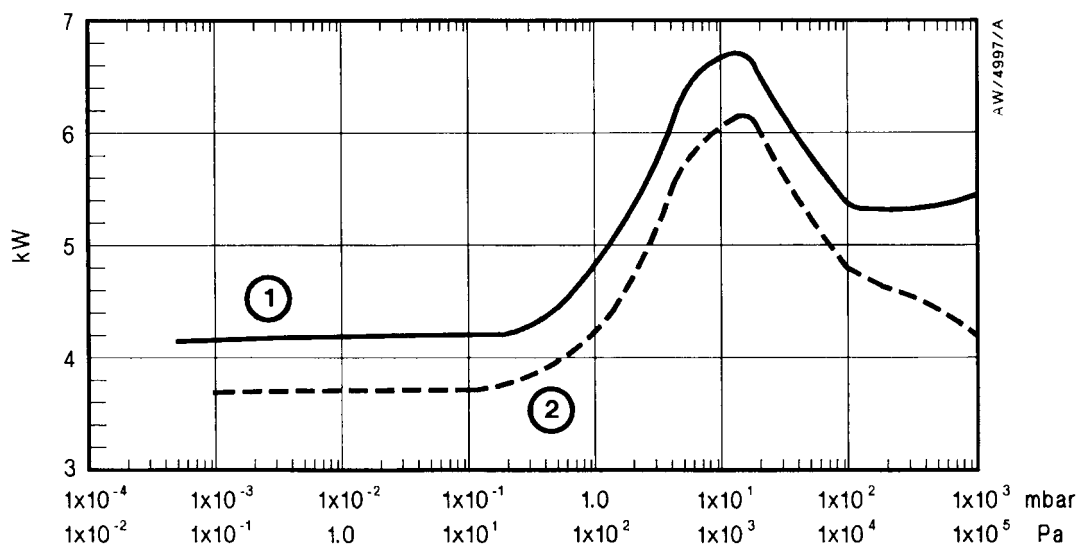
Figure 17 - iH600 pump power curves: electrical power input against inlet pressure



1. 60 Hz
2. 50 Hz

Note: The discontinuity at inlet pressure of 10 mbar (1×10^3 Pa) indicates where the HCMB600 pump is automatically switched off: refer to [Section 5.10](#).

Figure 18 - iH1000 pump power curves: electrical power input against inlet pressure



1. 60 Hz
2. 50 Hz

2.5 Lubrication

Note: Edwards Material Safety Data Sheets for the oils referenced in the following sections are available on request.

2.5.1 HCDP pump

Gearbox

Oil charge	0.7 litres (typical)
Grade of oil	SAE 40
ISO viscosity grade	150
Recommended perfluoropolyether oils	Fomblin 25/6, Krytox 1525, Drynert 25/6

2.5.2 HCMB pump (iH600/iH1000 only)

Gearbox

Oil charge	0.73 litres (iH600) 0.78 litres (iH1000)
Grade of oil	SAE 40
ISO viscosity grade	150
Recommended perfluoropolyether oils	Fomblin 25/6, Krytox 1525, Drynert 25/6

2.6 Electrical data

Electrical supply

Supply voltage	200-208/380-415 V at 50 Hz, 3-phase 200-208/230/460 V at 60 Hz, 3-phase
Voltage tolerance	±10% (except for 208 V and 415 V at 50 Hz, which are +6% and -10%)

Full load current ratings

See [Table 3](#)

Fuse types and ratings

F1 †	30 A, 600 V, Class J
F2 †	30 A, 600 V, Class J
F3 †	30 A, 600 V, Class J
F4 †	20 A, 600 V, Class J
F5 †	20 A, 600 V, Class J
F6 †	20 A, 600 V, Class J
F7	1.6 A, 250 V
F8	1.6 A, 250 V
F9	3.15 A, 250 V

Emergency stop switch rating

24 V ac/dc, 5 A max

External emergency stop switch

Rating	24 V ac, 5 A
Load	700 mA (inductive)

† These fuse rating are included for information only. You cannot change these fuses; an Edwards service engineer must change these fuses

Table 3 - Full load current ratings

		Supply voltage and frequency ®				
		200-208 V 50 Hz	200-208 V 60 Hz	230 V 60 Hz	380-415 V 50 Hz	460 V 60 Hz
iH80	Full load (A)	14	14.6	14.4	7.0	7.2
	HCDP motor rating (kW)	2.9	3.5	3.5	2.9	3.5
	Maximum power input to pump motor (kW)	4.03	4.73	4.73	4.03	4.73
iH600	Full load (A)	24.8	26.0	25.2	12.5	12.6
	HCMB motor rating (kW)	2.2	2.6	2.6	2.2	2.6
	Maximum power input to both pump motors (kW)	7.09	8.29	8.29	7.09	8.29
iH1000	Full load (A)	24.8	26.0	25.2	12.5	12.6
	HCMB motor rating (kW)	2.2	2.6	2.6	2.2	2.6
	Maximum power input to both pump motors (kW)	7.09	8.29	8.29	7.09	8.29

2.7 Gas system

Note: Once you have connected your nitrogen supply and adjusted the nitrogen supply pressure, for optimum performance of the pressure regulator, we recommend that the stability of your nitrogen supply is such that the supply pressure remains within ± 20 psi of the adjusted pressure.

Nitrogen supply pressure range	20 to 100 psig (2.4 to 7.9 bar absolute, 2.4×10^5 to 7.9×10^5 Pa)
Nitrogen supply quality	Clean, dry, particles $< 0.01\mu\text{m}$
Flow rates (with nitrogen supply capacity of 100 slm)	See Table 4
Pressure transducer accuracy	± 0.6 psi ($\pm 4.1 \times 10^{-2}$ bar, $\pm 4.1 \times 10^3$ Pa) at 6 psig (1.4 bar absolute, 1.4×10^5 Pa)
Pressure relay operating pressure	9 ± 0.6 psi ($1.48 \pm 4 \times 10^{-2}$ bar absolute, $1.48 \times 10^5 \pm 4 \times 10^3$ Pa) rising
Flow transducer accuracy	± 3.0 slm ($\pm 5 \times 10^3$ Pa ls^{-1})

Table 4 - Nitrogen purge flow rates: high gas configuration

Purge flows		Flow rates	
		slm	Pa ls^{-1}
Typical nitrogen flow rates (high gas configuration: factory set)	2/3-interstage purge *	5	8.44×10^3
	3/4-interstage purge *	30	5.06×10^4
	Shaft-seals purge	4	6.76×10^3
	Exhaust-purge	5	8.44×10^3
	Maximum total flow without inlet-purge	44	7.44×10^4
	Inlet-purge	25	4.22×10^4
	Maximum total flow with inlet-purge	44	7.44×10^4
Maximum nitrogen flow rates	2/3-interstage purge *	10	1.69×10^4
	3/4-interstage purge *	30	5.06×10^4
	Shaft-seals purge	10	1.69×10^4
	Exhaust-purge	10	1.69×10^4
	Maximum total flow without inlet-purge	60	1.01×10^5
	Inlet-purge	30	5.06×10^4
	Maximum total flow with inlet-purge	60	1.01×10^5

* With inlet purge off. When inlet purge is on, these flow rates will be lower.

2.8 Materials in contact with process gases

Pump, shafts and rotors	Cast iron, steel, SG iron
Internal and external shaft-seals	
HCDP pump	PTFE (polytetrafluoroethylene)
HCMB pump (iH600/iH1000 only)	PTFE and fluoroelastomer
HCDP pump nitrogen pipelines	Stainless steel
Gas module nitrogen components (pipelines, manifolds, valves, pressure transducers and Brass, stainless steel, aluminium, so forth)	Brass, stainless steel, aluminium, Viton, zinc alloy, cast iron, nickel

2.9 Default setpoints

The default setpoints are shown in Tables 5 to 7. Where there is an 'ADJ' (adjust) entry in these tables, this specifies that the setpoints are usually not used and the default setpoint is preset so that no warning or alarm condition could result from sensor readings. If required you can adjust these 'ADJ' setpoints for your application, so that suitable warnings and alarms can be generated: refer to [Section 5.2](#).

Table 5 - Electrics and Pump Control Module default setpoints

Parameter	Unit	Default setpoint values			
		Low alarm	Low warning	High warning	High alarm
HCDP power consumption	kW	ADJ	0.0	4.0	4.7
HCMB power consumption	kW	ADJ	0.0	2.9	3.6

Table 6 - Sensor Monitoring Module default setpoints

Parameter	Unit	Default setpoint values			
		Low alarm	Low warning	High warning	High alarm
HCDP pump temperature	°C	ADJ	ADJ	168	177
HCDP motor cooling-water return temperature	°C	ADJ	ADJ	45	ADJ
HCMB600 pump temperature	°C	ADJ	ADJ	115	125
HCMB1000 pump temperature	°C	ADJ	ADJ	165	170
Exhaust gas temperature	°C	ADJ	ADJ	220	ADJ

Table 7 - Gas Module default setpoints: high gas configuration

Parameter		Unit †	Default setpoint values			
			Low alarm	Low warning	High warning	High alarm
Total nitrogen flow (high gas configuration: factory set)	Shaft-seals purge on, Exhaust-purge on, 2/3-interstage purge off, 3/4-interstage purge off, Inlet-purge off	slm	ADJ	3	18	ADJ
	Shaft-seal purge on, Exhaust-purge on, 2/3-interstage purge on, 3/4-interstage purge on, Inlet-purge off	slm	ADJ	38.0	59.4	ADJ
	Shaft-seal purge on, Exhaust-purge on, 2/3-interstage purge on, 3/4-interstage purge on, Inlet-purge on	slm	ADJ	38.0	60.0	ADJ
Exhaust pressure		psig	ADJ	ADJ	5.0	8.0
Shaft-seals purge pressure		psig	ADJ	ADJ	12.5	ADJ

† Only slm gas flow values are given in the table, because only slm values can be entered in the Pump Display Module. To convert slm values to Pa ls⁻¹, multiply by (1.013 / 60) x 10⁵.

2.10 Connections

Inlet and outlet

See [Table 2](#)

Electrical supply connector

Type

Harting HAN-K-4/2

Cable outside diameter range

18 to 27 mm

Maximum conductor cross-sectional area

16 mm²

Pump Display Module connector

XLR type 4-way

Network communications connector

XLR type 4-way

GRC relay connector

6-pin DIN

iH Tool Interface Module connector

XLR type 6-way

Nitrogen supply connector

1/4 inch Tube fitting

Water inlet connector *

3/8 inch BSP male quick-disconnect

Water outlet connector *

3/8 inch BSP female quick-disconnect

Active gauge connector

SCC68 socket

* Connector mating-halves to connect your cooling-water supply and return pipes are supplied with the iH system: refer to [Section 3.18](#).

2.11 Item Numbers

Electrical Supply

460V, 60Hz, 3-phase

iH80

A533-81-908

iH600

A533-82-908

iH1000

A533-83-908

200/208V, 50/60Hz, 3-phase

A533-81-945

A533-82-945

A533-83-945

380/415V, 50Hz, 3-phase

A533-81-946

A533-82-946

A533-83-946

230V, 60Hz, 3-phase

A533-81-947

A533-82-947

A533-83-947

3 Installation

3.1 Safety



WARNING

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

- A suitably trained and supervised technician must install the iH system.
- Ensure that the installation technician is familiar with the safety procedures which relate to the products pumped. Wear the appropriate safety-clothing when you come into contact with contaminated components. Dismantle and clean contaminated components inside a fume-cupboard.
- Vent and purge the process system (if the iH system is to replace an existing pumping system) with nitrogen for 15 minutes before you start installation work.
- Disconnect the other components in the process system from the electrical supply so that they cannot be operated accidentally.
- Do not reuse 'O' rings and 'O' ring assemblies, and do not allow debris to get into the iH system during installation.
- Obey all national and local rules and safety regulations when you install the iH system.
- Consult Edwards publication P300-20-000 (Vacuum Pump and Vacuum System Safety) before you pump hazardous materials. This publication is available on request: contact your supplier or Edwards.

3.2 Installation checklist

The operations required to install the iH system and the sections of this instruction manual which describe those operations are shown in [Table 8](#).

Table 8 - Installation Checklist

Installation operation	Section
Unpack and inspect	3.3
Remove the enclosure panels	3.4
Reconfigure the nitrogen and water connections (if required)	3.5
Locate the iH system	3.6
Check the pump oil-level(s)	3.7
iH80 systems	3.7.1
iH600/iH1000 systems	3.7.2
Install or replace the Pump Display Module and optional accessories (if necessary)	3.8
Install the Pump Display Module	3.8.1
Install optional accessories	3.8.2
Connect the iH inlet to your vacuum system	3.9
Connect the iH exhaust outlet to your exhaust extraction system	3.10
Connect to your factory extraction system (optional)	3.11
Connect the nitrogen supply	3.12
Leak test the system	3.13
Install additional safety equipment (optional)	3.14
Connect to your emergency stop circuit (optional)	3.15
Electrical supply and RF earth (ground) connections	3.16
Reconfigure the iH system for your electrical supply (if necessary)	3.16.1
Reconfigure the pump(s) for your electrical supply (if necessary)	3.16.2
Connect the electrical supply to the iH system	3.16.3
Connect an additional RF earth (optional)	3.16.4
Refit the enclosure panels	3.17
Connect the cooling-water pipelines	3.18
Adjust the interstage purge flow rates if necessary	3.19
Commission the iH system	3.20
Switch on an iH80/iH1000 system	3.20.1
Configure and switch on an iH600 system	3.20.2

3.3 Unpack and inspect



WARNING

You must use suitable lifting equipment to move the iH system. It is too heavy to lift by hand.



WARNING

Ensure that the maximum angle between paired slings used to lift the iH system is 45°.

The iH system is supplied sealed in a foil bag. To prevent contamination of the iH system, before you unpack and inspect the iH system we recommend that you move the pallet as close as possible to the clean area in which you will install the system. Remove the foil bag carefully; use the bag as a dust cover while you wheel the iH system to its final operating position.

Use the following procedure to unpack and inspect the iH system.

1. Place the pallet in a convenient position with a fork-lift truck or a pallet truck.
2. Remove the staples which secure the cardboard box to the pallet, then remove the cardboard box. Open the top of the foil bag which encloses the iH system.

3. If you have an iH600 or iH1000 system, remove the four screws which secure the wooden stabiliser to the HCMB pump-inlet, remove the stabiliser, then refit the four screws to the HCMB pump-inlet blanking plate. Retain the stabiliser for future use.
4. Refer to [Figure 19](#). Remove the nut and washer (2) which secures each of the four brackets (5) to the blocks (4) on the pallet. Retain the nuts and washers for future use.
5. If you have an iH1000 system:
 - Refer to [Figure 21](#). Undo the four screws which secure the inverter rear cover (3) and remove the cover.
 - Refer to [Figure 20](#), detail B. Use a hexagonal key to undo and remove the two cap-head screws (2) which secure the inverter enclosure (3) to the frame.
 - Lift up the front of the inverter enclosure (3), disconnect the support rod (5) from the catch under the inverter, and fit the end of the support rod to the frame as shown.
 - Refer to [Figure 21](#). Slide forward and lift out the top panel (1); continue at Step 7.
6. Refer to [Figure 21](#). If you have an iH80 or iH600 system, use a flat-bladed screwdriver to undo the two quarter-turn catches (4) on the end of the top panel (1), pull the panel back (towards the outlet), then remove the top panel from the iH system.
7. Refer to [Figure 20](#). If you have an iH600 or iH1000 system, remove the three lifting-bolts from the lifting-bolt holder (4), then fit the lifting-bolts (1) to the top of the HCMB pump in the positions shown in detail B.
8. Refer to [Figure 20](#) detail A or B. Use suitable lifting-equipment attached to the lifting bolts (1) to remove the iH system from its pallet. Do not try to lift the iH system by hand (see [Section 2](#) for the mass of the iH system).
9. Inspect the iH system. If the iH system or any other item is damaged, notify your supplier and the carrier in writing within three days; state the Item Number of the iH system together with your order number and your supplier's invoice number. Retain all packing materials for inspection. Do not use the iH system if it is damaged.
10. If the iH system is not to be used immediately, replace the packing materials. Store the iH system in suitable conditions as described in [Section 7](#). If you will use the iH system immediately, continue at Step 11.
11. Refer to [Figure 19](#). If you do not want to fit restraints to prevent inadvertent movement of the iH system (see [Section 3.6](#)), undo and remove the two nuts and washers (6) which secure each of the four brackets (5) to the sides of the iH system, then remove the brackets. Retain the brackets, nuts and washers for future use.

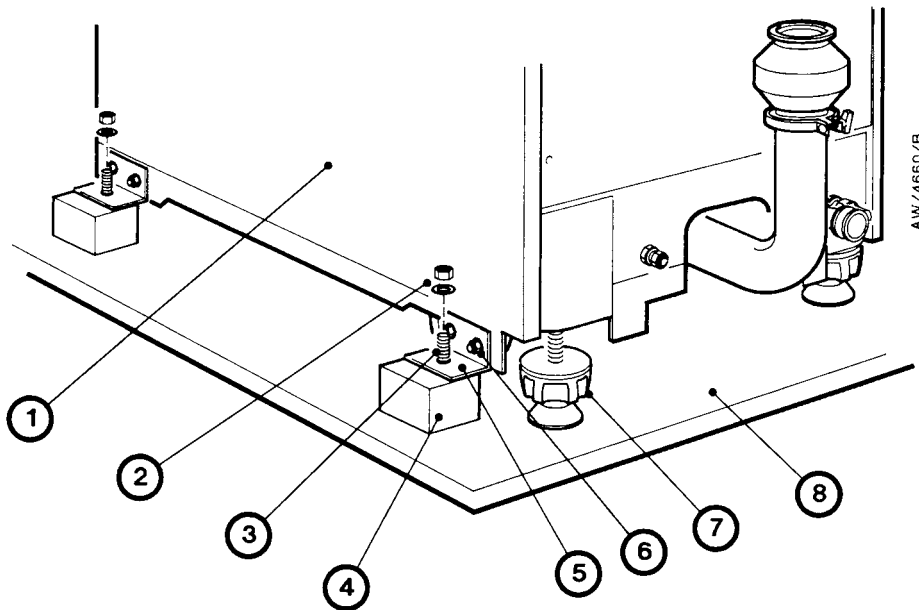
Table 9 - Checklist of components

Quantity	Description	Check(✓)
1	iH Dry Pumping System	☐
1	Pump Display Module	☐
1	Fittings -kit, which contains the following	
1	Inlet 'O' ring [†]	☐
1	Cooling-water quick-release connectors (pair)	☐
1	NW40 tapped 'O' ring	☐
1	Nw40 clamp	☐
1	Nitrogen pipeline fitting	☐
1	Module connector terminator plug	☐
1	Emergency stop switch guard *	☐
1	Electrical supply connector kit	☐

* If required, fit this over the emergency stop switch to prevent inadvertent operation of the switch.

[†] Supplied with the iH80 only.

Figure 19 - Remove the iH system from the pallet



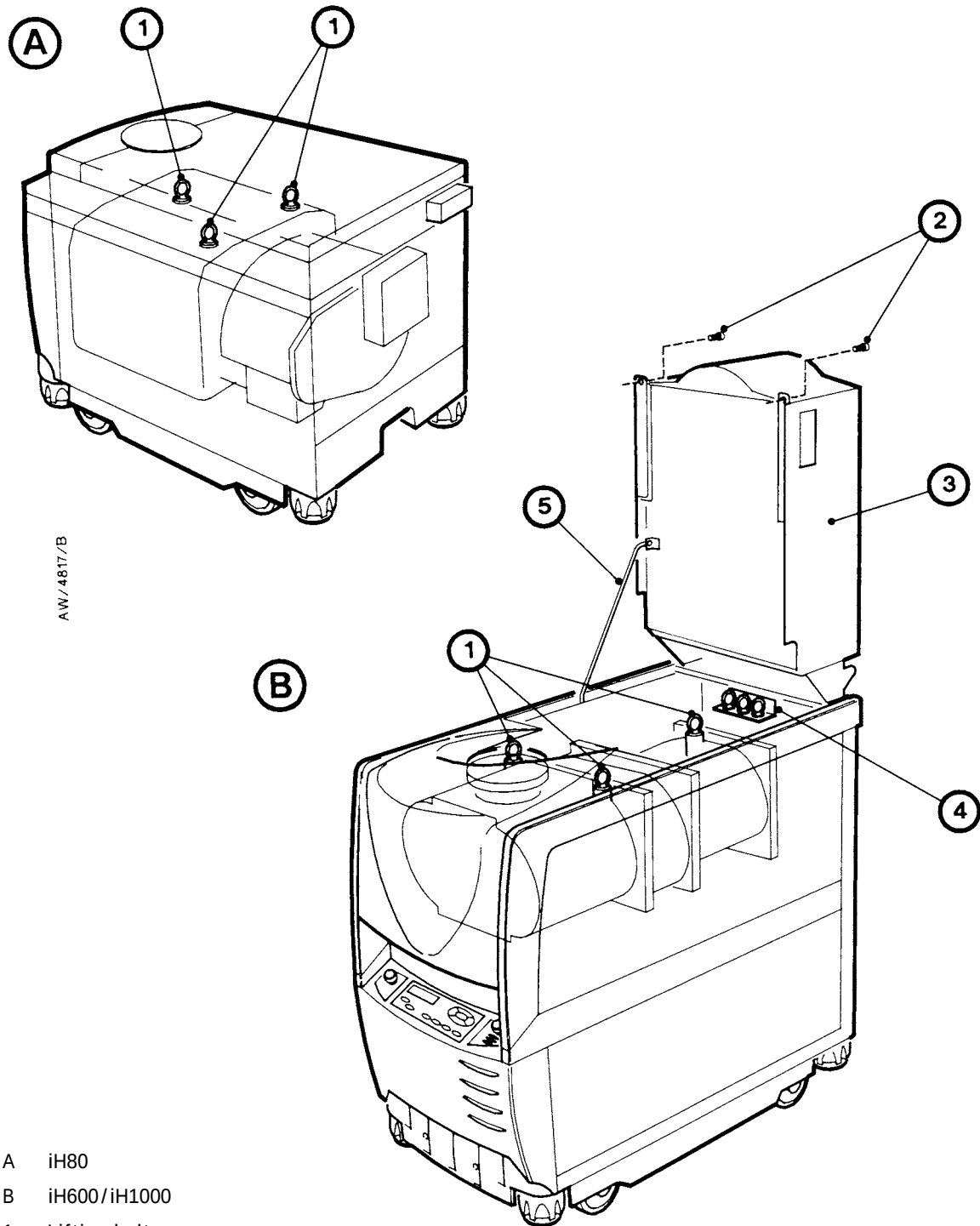
- | | |
|-------------------|-------------------|
| 1. iH system | 5. Bracket |
| 2. Nut and washer | 6. Nut and washer |
| 3. Stud | 7. Levelling foot |
| 4. Block | 8. Pallet |

3.4 Remove the enclosure panels

Note: Some of the components in [Table 9](#) are supplied packed in a plastic bag, inside the enclosure. When you remove the enclosure panels, make sure that these components do not fall out.

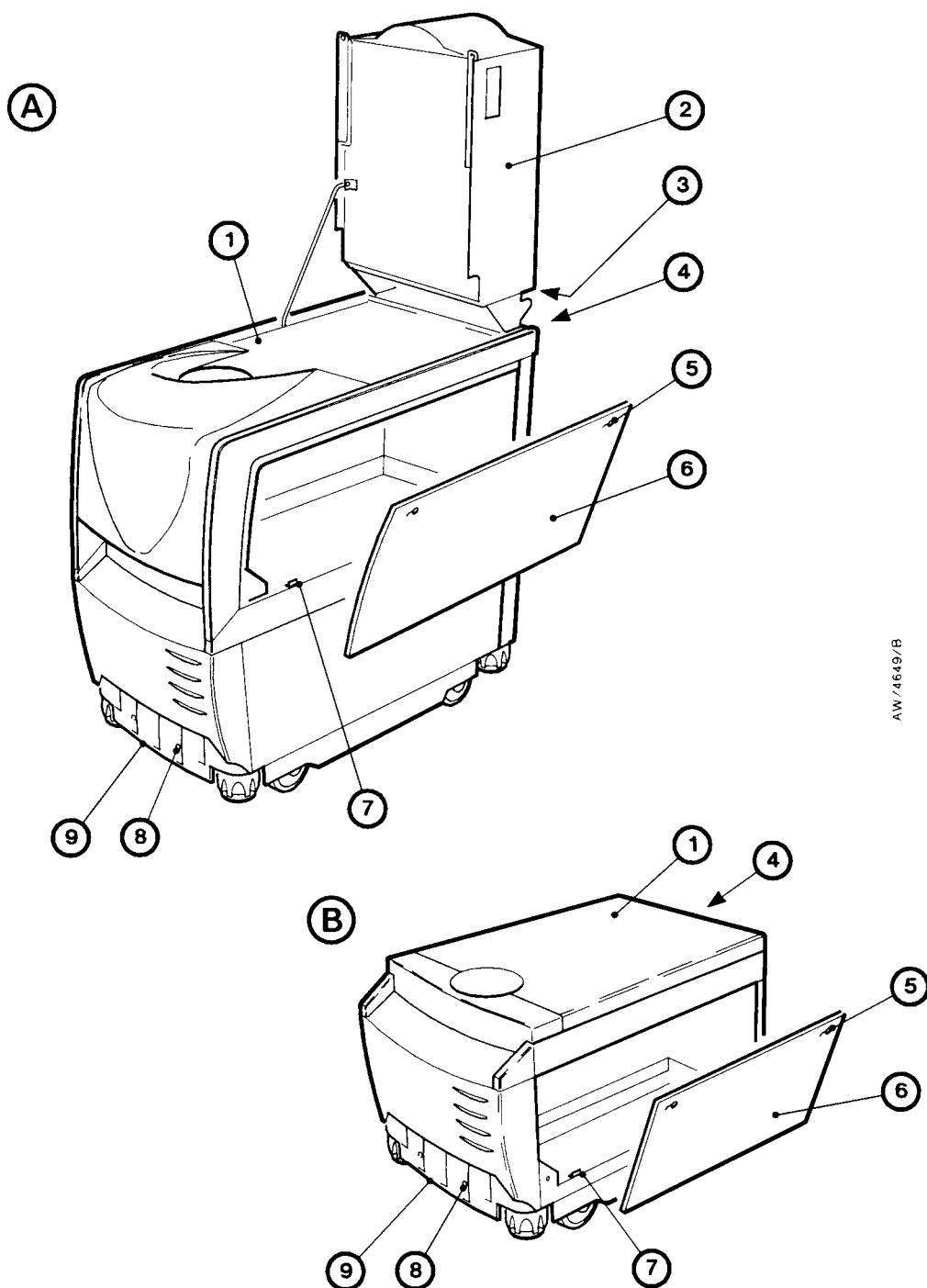
1. Refer to [Figure 21](#). If you have an iH80, continue at Step 4, otherwise continue at Step 2.
2. Refer to detail A. Remove the HCMB right-hand side panel from the iH system:
 - Place your hand against the top of the right-hand side panel (6) to support it and use a flat-head screwdriver to release the two quarter-turn catches (5).
 - Swing the top of the panel out slightly and lift out the panel so that the slots in the bottom of the panel disengage from the pins (7) on the frame.
 - Fully remove the panel and place it in a safe location.
3. Remove the HCMB left-hand side panel: use the method in Step 2 above.
4. Refer to detail B. Remove the HCDP right-hand and left-hand side panels: use the method in Step 2 above.
5. Take out any components packed in bags inside the enclosure, then check that you have received the items listed in [Table 9](#). If any of these items is missing, notify your supplier in writing within three days.

Figure 20 - Lifting bolt positions



- A iH80
- B iH600/iH1000
- 1. Lifting-bolts
- 2. Screws
- 3. Inverter enclosure (iH1000 only)
- 4. Lifting-bolt holder
- 5. Support rod

Figure 21 - Remove/refit the enclosure panels



- | | | | |
|---|--------------|--|--------------------------|
| A | iH600/iH1000 | 1. Top panel | 6. Right-hand side panel |
| B | iH80 | 2. Inverter enclosure (iH1000 only) | 7. Pins |
| | | 3. Inverter rear cover (on rear of item 2) | 8. Screws (2 off) |
| | | 4. Catches (on rear of item 1) | 9. Lower cover |
| | | 5. Catches | |

3.5 Reconfigure the nitrogen and/or water connections (if required)

6. As supplied, the nitrogen and cooling-water connections are at the rear of the iH system (as shown in [Figure 4](#)). If required, you can reconfigure the iH system so that the nitrogen and/or cooling-water connections are at the front of the iH system.
7. You will need an Alternative Nitrogen and Cooling-Water Connections Kit if you want to reconfigure the nitrogen and/or cooling-water connections (see [Section 8](#)). Reconfigure the connections as described in the instruction manual supplied with the kit.

3.6 Locate the iH system



WARNING

You must use suitable lifting equipment to move the iH system. It is too heavy to lift by hand.



WARNING

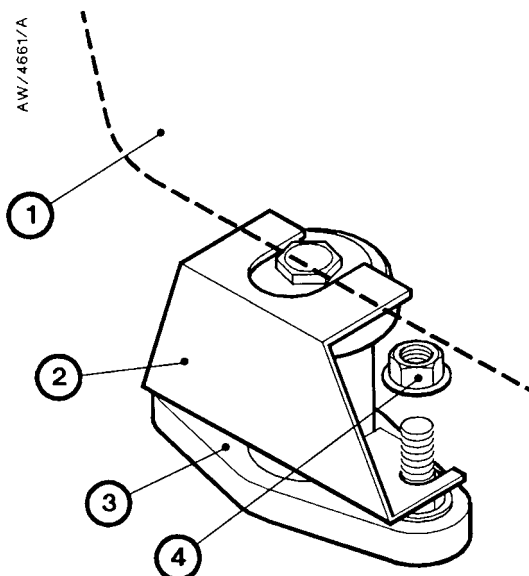
Ensure that the maximum angle between paired slings used to lift the iH system is 60°.

Use the following procedure to locate the iH system in its operating position. The iH system must be located on a firm, level surface.

1. Use suitable lifting equipment attached to the lifting bolts to move the iH system close to its final operating position.
2. Refer to [Figure 22](#). Remove the nuts and washers (4) which secure the four transit brackets (2) to the vibration isolators (3), then remove the transit brackets (2).
3. Wheel the iH system on its castors to move it into its operating position.
4. Adjust the levelling feet to make sure that the iH system is level and is not supported by the castors.

Figure 22 - Remove the vibration isolator transit brackets

1. H system
2. Transit bracket
3. Vibration isolator
4. Nut and washer



3.7 Check the pump oil-level(s)

CAUTION

Ensure that the oil-levels in the HCDP pump and the HCMB pump (in an iH600 system) are correct. If a pump oil-level is incorrect, pump performance may be affected and the pump may be damaged.

3.7.1 iH80 systems

The iH80 system is supplied with the HCDP pump filled with oil. However, we recommend that you check the oil-level before you operate the iH system; use the method described below.

Refer to [Figure 1](#). Check that the oil-level is between the MAX and MIN marks on the bezel of the HCDP oil-level sight-glass (10):

- If the oil-level is above the MAX mark, drain excess oil from the pump as described in [Section 6.9](#) until the oil-level is correct.
- If the oil-level is below the MIN mark, fill the pump with oil until the oil-level is correct, as described in [Section 6.8](#).

3.7.2 iH600/iH1000 systems

The iH600 and iH1000 systems are supplied with both the HCDP and HCMB pumps filled with oil. However, we recommend that you check the HCDP and HCMB oil-levels as described below.

1. Check the HCDP pump oil-level: refer to [Section 3.7.1](#).
2. Refer to [Figure 1](#). Check that the oil-level is between the MAX and MIN marks on the bezel of the HCMB oil-level sight-glass (5):
 - If the oil-level is above the MAX mark, drain excess oil from the pump as described in [Section 6.10](#) until the oil-level is correct.
 - If the oil-level is below the MIN mark, fill the pump with oil until the oil-level is correct, as described in [Section 6.10](#).

3.8 Install or replace the Pump Display Module and optional accessories (if necessary)

3.8.1 Install the Pump Display Module

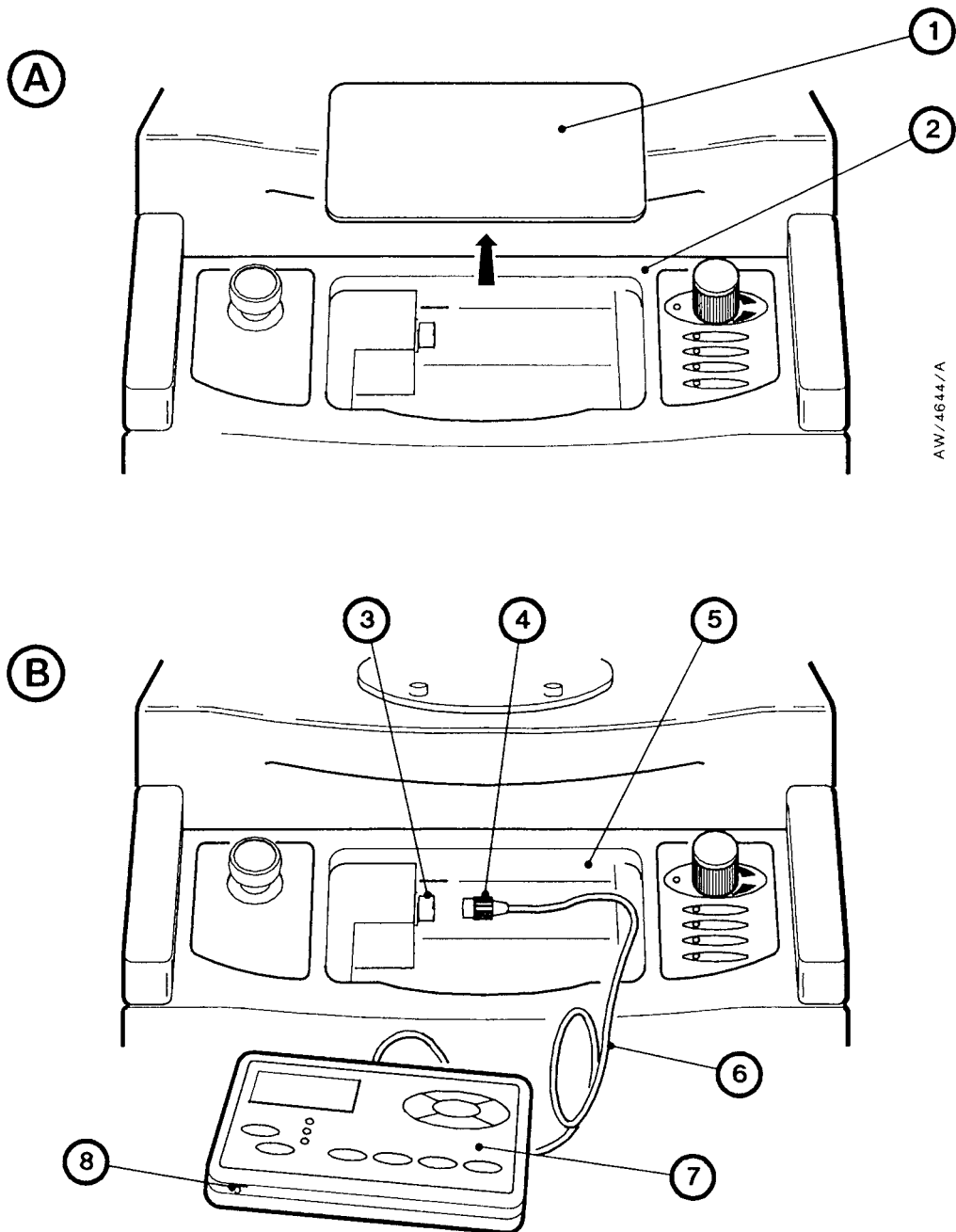
1. Unpack and inspect the Pump Display Module.
2. Refer to [Figure 23](#). Remove the blanking panel (1) from the front panel (2).
3. Fit the connector (4) on the end of the cable (6) to the module connector (3) in the recess (5) in the front panel.
4. Place the coiled cable (6) in the recess, then place the Pump Display Module (7) in position in the recess (5).

3.8.2 Install optional accessories

Note: Some accessories can only be factory fitted (see [Section 8](#)): you will have ordered these accessories when you ordered your iH system, and the accessories will be supplied fitted to your iH system.

Install optional accessories (listed in [Section 8](#)) as described in the instructions supplied with the accessory.

Figure 23 - Fit the Pump Display Module



AW/4644/A

- | | | | |
|----|-------------------------------|----|------------------------|
| A | Remove the blanking panel | 4. | Connector |
| B | Fit the Pump Display Module | 5. | Recess |
| 1. | Blanking panel | 6. | Cable |
| 2. | Dashboard | 7. | Pump Display Module |
| 3. | Pump Display Module connector | 8. | Viewing angle adjuster |

3.9 Connect the iH inlet to your vacuum system

Note: If required (that is, if you will use the iH system in an area subject to high RF (radio frequency) emissions), connect the end of the iH earth (ground) cable to one of the bolts that you use to connect the inlet-flange of the iH system to your process system. See [Section 3.16.4](#) for more information.

When you connect your iH system to your vacuum system, take note of the following:

1. To get the best pumping speed, ensure that the pipeline which connects the vacuum system to the iH system is the minimum length possible and has an internal diameter not less than the iH system inlet-port.
2. Ensure that all components in the vacuum pipeline have a maximum pressure rating which is greater than the highest pressure that can be generated in your system.
3. Incorporate flexible pipelines in the vacuum pipeline to reduce the transmission of vibration and to prevent loading of coupling-joints. We recommend that you use Edwards braided flexible pipelines.
4. Adequately support vacuum pipelines to prevent the transmission of stress to pipeline coupling-joints.
5. On very dusty applications, use a low-impedance inlet-filter to minimise damage to the pump.
6. Incorporate a pressure gauge in the inlet pipeline, so that you determine that the iH system operates correctly and (on iH600 systems) so that you can determine the correct booster start delay (see [Section 3.20.2](#)). You can fit an Active Gauge Connection Kit accessory (see [Section 8.4.3](#)) or an iH600 Pressure Control Kit accessory (see [Section 8.4.4](#)) for this purpose.
7. You must be able to isolate the iH system inlet from the atmosphere and from your vacuum system if you have pumped or produced corrosive chemicals.

Use the following procedure to connect the inlet of the iH system to your vacuum inlet pipeline:

1. If fitted, remove the blanking plate from the inlet of the iH system. Retain the nuts, bolts and washers which secured the blanking plate for future use.
2. Use the 'O' ring supplied and suitable nuts, bolts and washers (not supplied) to connect the inlet-flange of the iH system to your vacuum system.

3.10 Connect the iH exhaust outlet to your exhaust-extraction system



WARNING

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



WARNING

Do not operate the iH system with the exhaust pipeline blocked. If the exhaust pipeline is blocked, the iH system can generate exhaust pipeline pressures up to 7 bar (7×10^5 Pa).

CAUTION

Use a catchpot to prevent the drainage of condensate back into the iH system. Condensate which drains back into the iH system could damage the HCDP pump.

When you connect to your exhaust-extraction system, take note of the following:

- Ensure that all components in the exhaust pipeline have a maximum pressure rating which is greater than the highest pressure that can be generated in your system.

- Incorporate flexible pipelines in the exhaust pipeline to reduce the transmission of vibration and to prevent loading of coupling-joints. We recommend that you use Edwards braided flexible pipelines.
- You must be able to isolate the exhaust-outlet from the atmosphere if you have pumped or produced corrosive chemicals.
- Adequately support exhaust pipelines to prevent the transmission of stress to pipeline coupling-joints.

Use the following procedure to connect the iH exhaust outlet to your exhaust-extraction system:

1. Refer to [Figure 1](#). If the check-valve (18) is not required on your application, undo and remove the clamp and 'O' ring which secures the check-valve to the exhaust-pipe (19) and remove the check-valve. Retain the check-valve for possible future use.
2. Use the NW40 trapped 'O' ring and clamp supplied to connect the exhaust outlet on the check-valve (or the outlet on the exhaust-pipe, 19) to your exhaust-extraction system.

3.11 Connect to your factory extraction system (optional)

As supplied, the temperature control system fitted is sufficient to maintain the iH system at the correct operating temperature; you do not need to connect an air-extraction system to the iH system. However, if required you can connect your factory extraction system to the air-extraction port on the top of the iH system (see Figures 9 to 11). Note that the iH system is supplied with a finger-guard fitted over the air-extraction port.

3.12 Connect the nitrogen supply

CAUTION

Ensure that your nitrogen supply conforms to the requirements given in [Section 2](#). If it does not, the flow sensors may not operate correctly, the gas pipelines may become blocked or the iH system may be damaged.

Connect your nitrogen supply to the iH system through the nitrogen inlet on the rear of the iH system ([Figure 4](#), item 4).

Use rigid metal supply pipelines (such as stainless steel). We recommend that the nitrogen supply pipeline to the iH system has an outside diameter of 1/4 inch, and that the pipeline is designed and constructed so that large pressure drops are not introduced into the nitrogen supply.

Use the Swagelok connectors in the fitting-kit to connect your nitrogen pipeline to the iH system: use the Swagelok connectors as described in [Section 6.2](#).

3.13 Leak test the system



WARNING

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

Note: If you need further information on leak testing, contact your supplier or Edwards for advice.

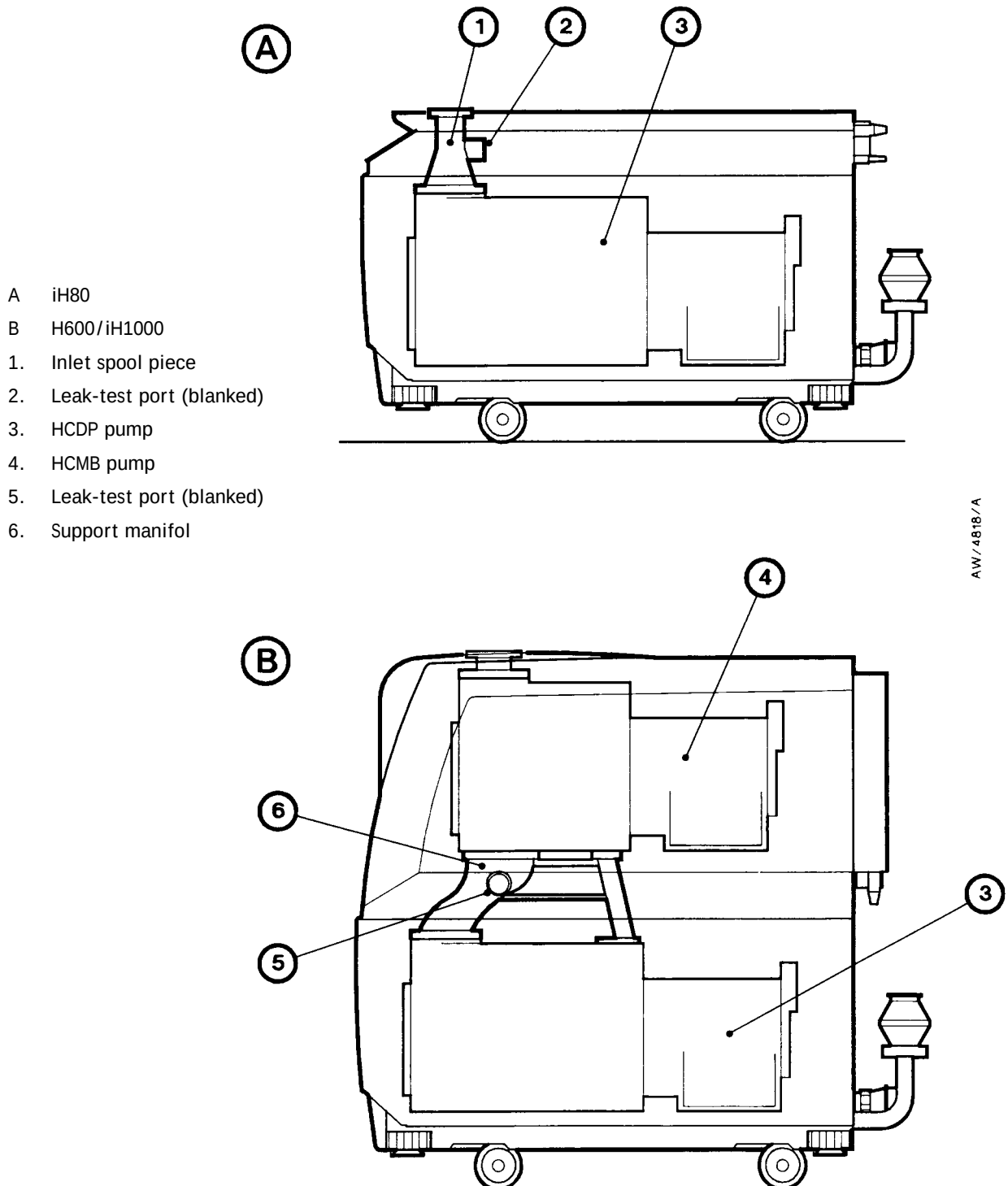
Leak-test the system after installation and seal any leaks found. Dangerous substances which leak from the system will be dangerous to people and there may be a danger of explosion if air leaks into the system.

Use a pump down test with helium to leak test the pump. We recommend that the leak rate is 1×10^{-5} mbar.l.s⁻¹ (1×10^{-3} Pa.l.s⁻¹) helium or less for the complete system, or 1×10^{-6} mbar.l.s⁻¹ (1×10^{-4} Pa.l.s⁻¹) helium or less for any individual leak.

The iH system is supplied with a blanked leak-test port, as shown in [Figure 24](#). To connect to this port:

1. Refer to Figure 24. Remove the 3/8 inch BSP blanking plug from the port (2 or 5).
2. Fit a suitable NW25 klein adaptor and 'O' ring and (if required) an elbow to the port, then connect your leak test equipment to the adaptor or elbow.

Figure 24 - Leak-test port positions



3.14 Install additional safety equipment (optional)



WARNING

If your Process Tool/control system needs to know the total flow rate of nitrogen to the iH system for safety reasons, install suitable measurement equipment in the nitrogen supply pipeline.



WARNING

If you use the nitrogen purges to dilute dangerous gases to a safe level, ensure that the system shuts down if the nitrogen supply to the iH system fails.

If the sensors or microprocessor fail, the total flow rate of nitrogen displayed or output by the iH system may be incorrect. If you need to know the total flow rate of nitrogen to the HCDP pump for safety reasons, you should therefore fit suitable measurement equipment in the nitrogen supply pipeline. If you fit a rotameter, ensure that it is suitable for use with nitrogen and that it is correctly calibrated.

If the nitrogen supply to the iH system fails, a warning message will be shown on the Pump Display Module and will be sent to the Interface Module(s) connected to the iH system. Ensure that your installation is configured so that it remains safe if there is a failure of the nitrogen supply to the iH system.

If an alarm condition is detected (and the iH system is not configured to 'run til crash': see [Section 5.10](#)) the iH system will shut down automatically. You must ensure that your installation remains safe if the iH system shuts down automatically.

3.15 Connect to your emergency stop circuit (optional)

Note: If you do not connect to your own control equipment, you must fit the iH Tool Interface Module plug supplied to the iH Tool Interface Module connector on the rear of the iH system ([Figure 4](#), item 8). If you do not, you will not be able to operate the iH system.

If required, you can connect your own control equipment to the iH system to shut down the iH system in an emergency. Use the following procedure

1. Remove the link between pins 1 and 2 of the iH Tool Interface Module connector plug supplied.
2. Connect a suitable cable to the plug; [Table 10](#) shows the use of the pins in the plug.
3. Refer to [Figure 4](#). Fit the plug to the iH Tool Interface Module connector (8) on the rear of the iH system.

Table 10 - Pins in the iH Tool Interface Module connector plug

Pin(s)	Use
1 and 2	Linked as supplied. Remove the link and connect these pins to your normally-closed, isolated external emergency stop circuit.
3 and 4	Isolated auxiliary contacts of the emergency stop switch on the Electrics and Pump Control Module.
5	24 V a.c. continuous output; maximum current 625 mA
6	0 V return

3.16 Electrical supply and RF earth (ground) connections

3.16.1 Reconfigure the iH system for your electrical supply (if necessary)

CAUTION

iH1000 systems are supplied already configured for your electrical supply. If you have an iH1000 system, do not try to reconfigure the iH system. If you do, you may damage the iH system.

Note: You cannot reconfigure an iH1000 system. If you want to use an iH1000 system with a different electrical supply to that specified on the rating plate (Figure 26, item 1), contact your supplier or Edwards.

Your iH system will be supplied correctly configured for your electrical supply; the Item Number of the iH system (shown on the rating plate: Figure 26, item 1) specifies how the system is configured: refer to Section 2.11.

If you want to use an iH80 or iH600 system with a different electrical supply, ensure that the correct transformer primary tapping is selected before you connect the electrical supply to the iH system; refer to Figure 25 and use the following procedure:

1. Undo the screws (5) which secure the cover (4) to the Electrics and Pump Control Module (2) and remove the cover.
2. Ensure that the common cable (6) is correctly connected to the common terminal on the terminal-block (8).
3. Ensure that the voltage select cable (7) is connected to the correct voltage terminal of the terminal-block (8) for your electrical supply.
4. Refit the cover (4) and secure with the two screws (5).

3.16.2 Reconfigure the pump(s) for your electrical supply (if necessary)

CAUTION

iH1000 systems are supplied already configured for your electrical supply. If you have an iH1000 system, do not try to reconfigure the pumps. If you do, you may damage the iH system.

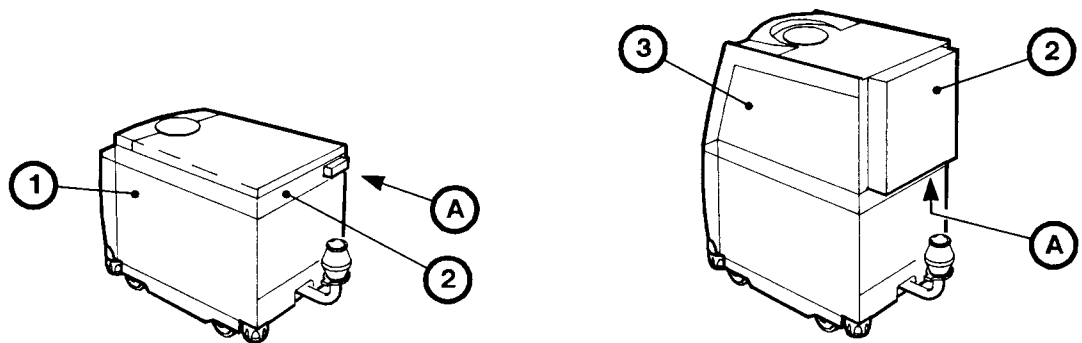
Note: You cannot reconfigure an iH1000 system. If you want to use an iH1000 system with a different electrical supply to that specified on the rating plate (Figure 26, item 1), contact your supplier or Edwards.

Your iH system will be supplied correctly configured for your electrical supply; the Item Number of the iH system (shown on the rating plate: Figure 26, item 1) specifies how the system is configured: refer to Section 2.11.

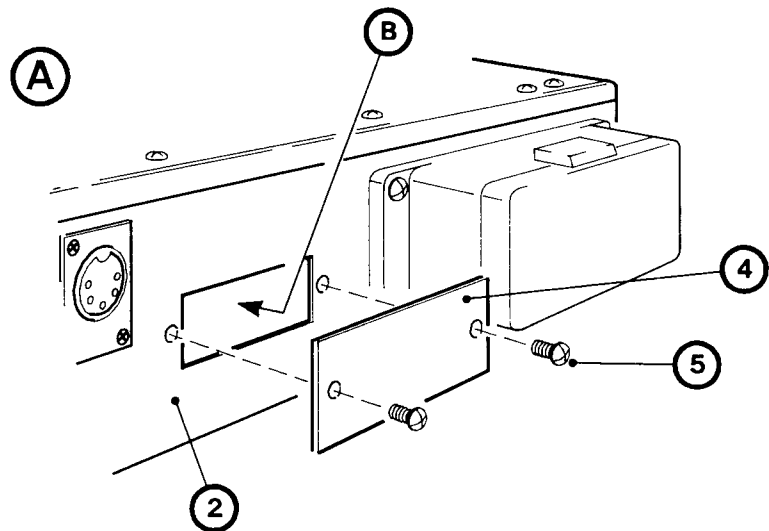
If you want to use an iH80 or iH600 system with a different electrical supply, use the following procedure:

1. Refer to Figure 26 detail A. Undo and remove the six screws (5) which secure the blanking plate (4) over the HCDP pump-motor, and remove the blanking plate.
2. Undo and remove the four screws (3) which secure the cover (2) to the HCDP pump-motor terminal-box.
3. Look at the links in the terminal-box (8):
 - For high voltage operation (380-415 V at 50 Hz or 460 V at 60 Hz), ensure that the links (9) are in the positions shown in detail C.
 - For low voltage operation (200-208 V at 50 Hz or 200-230 V at 60 Hz), ensure that the links (9) are in the positions shown in detail D.
4. Refer to detail A. Refit the cover (2) to the HCDP pump-motor terminal-box and secure with the four screws (3).
5. Refit the blanking plate (4) and secure with the six screws (5).

Figure 25 - Reconfigure the iH system for your electrical supply (iH80/iH600 only)



AW/4650/A



1. iH80 system
2. Electrics and Pump Control Module
3. iH600 system
4. Cover
5. Screw
6. Common cable
7. Voltage select cable
8. Terminal-block

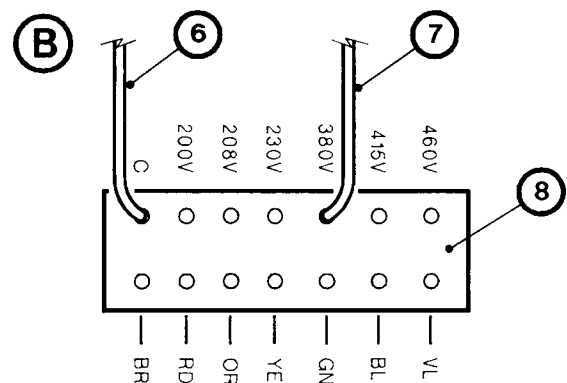
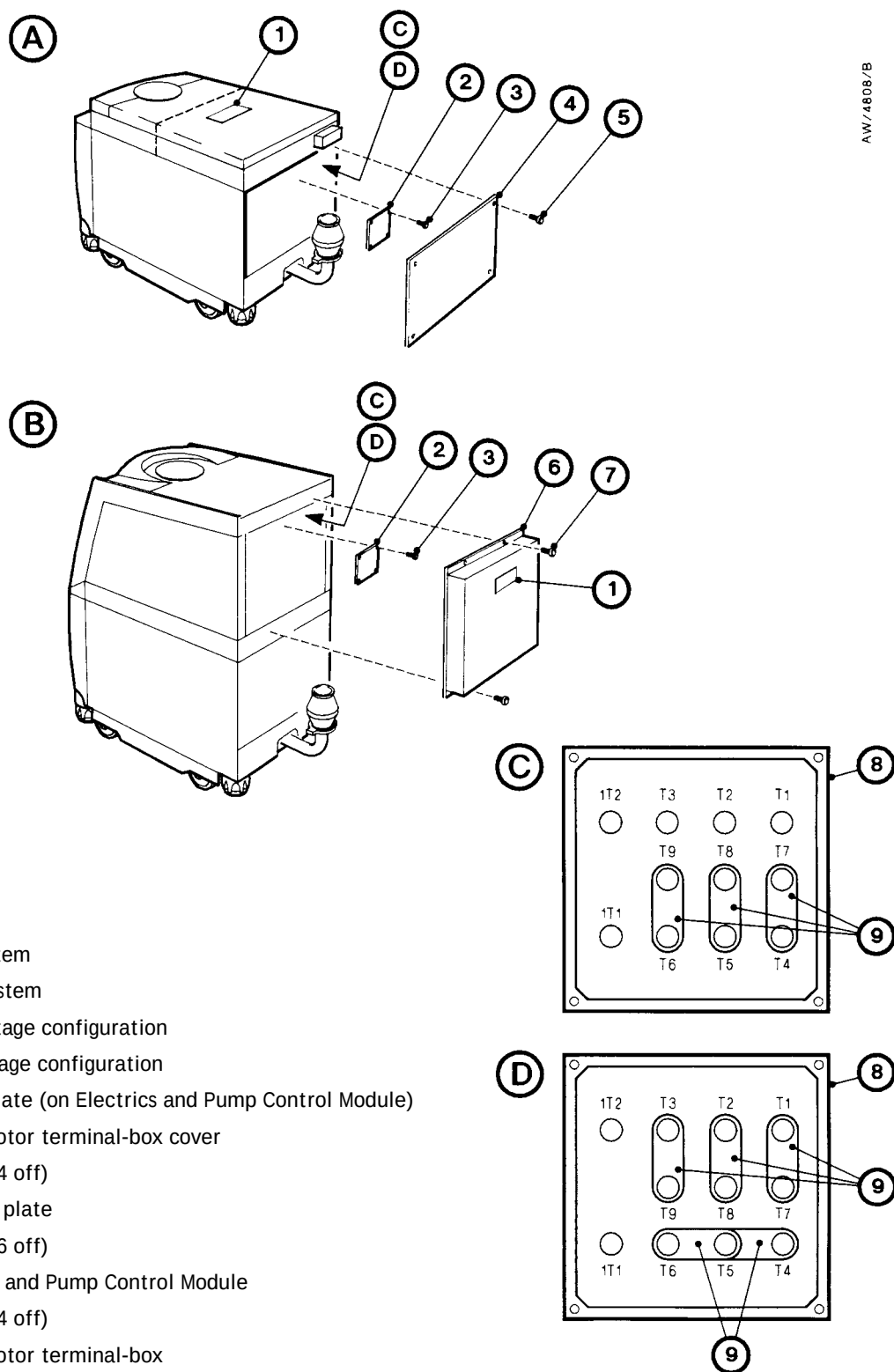


Figure 26 - Reconfigure the pump-motor terminal-boxes (iH80/iH600 only)



6. If you have an iH600, continue at Step 7, otherwise continue at [Section 3.16.3](#).
7. Refer to detail B. Undo and remove the four screws (7) which secure the Electrics and Pump Control Module (6) to the rear of the iH system, then carefully lower and support the Module. Ensure that you do not disconnect, break or damage any of the cables connected to the Module.
8. Undo and remove the four screws (3) which secure the cover (2) to the HCMB pump-motor terminal-box, then remove the cover (through the access hole in the rear cover-plate).
9. Look at the links in the terminal-box (8):
 - For high voltage operation (380-415 V at 50 Hz or 460 V at 60 Hz), ensure that the links (9) are in the positions shown in detail C.
 - For low voltage operation (200-208 V at 50 Hz or 200-230 V at 60 Hz), ensure that the links (9) are in the positions shown in detail D.
10. Refit the cover (2) to the pump-motor terminal-box and secure with the four screws (3).
11. Refit the Electrics and Pump Control Module (6) to the rear of the iH system and secure with the four screws (7): ensure that you do not trap any of the cables connected to the Module.

3.16.3 Connect the electrical supply to the iH system



WARNING

Connect the iH system to the electrical supply through a suitably rated isolator/contactor for your iH system (refer to [Section 2](#) and the Notes below).



WARNING

Ensure that the iH system and your electrical supply cable are suitably protected against earth (ground) faults and that the earth (ground) conductor of the electrical supply cable is longer than the phase conductors in the connector. On an iH1000 system, you must fit a second protective earth (ground) conductor (with a cross-section of at least 10 mm²) to the protective earth (ground) stud on the Electrics Box.

CAUTION

This is an industrial (class A) product as defined by EN 61326. To ensure compliance with European Electromagnetic Compatibility (EMC) requirements for harmonics and flicker, please note that it is not intended for use in domestic buildings, or in properties directly connected to a electricity supply network which also supplies domestic buildings.

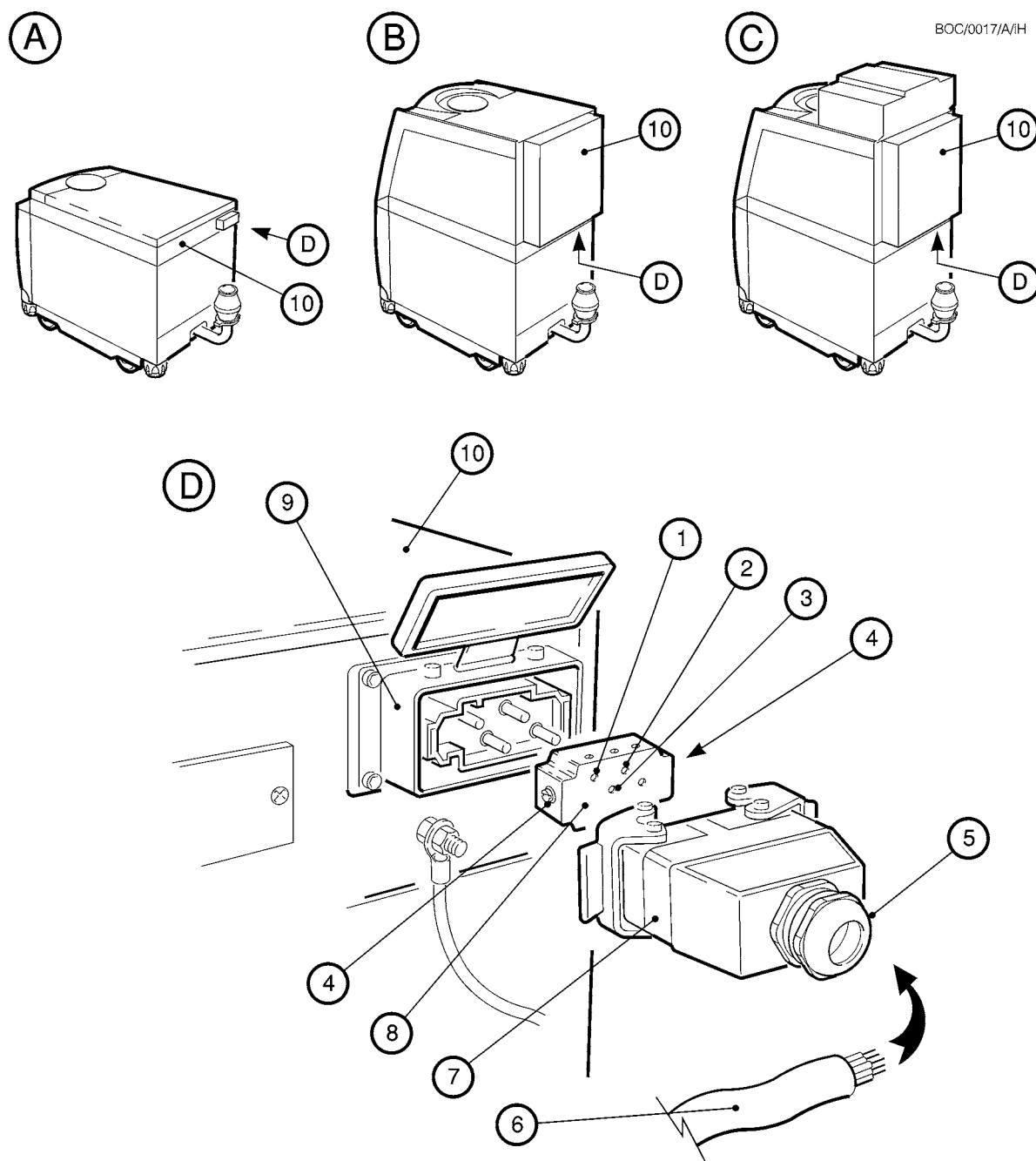
Note: On an iH1000 system, the earth (ground) installation must ensure that there is an equipotential zone around the iH system: the voltage between the protective earth (ground) stud on the iH system and any other conducting surface within 2 metres of the iH system must be < 30 V r.m.s.

If you connect the electrical supply to an iH1000 system 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).

Use the following procedure to connect the electrical supply to the iH system.

Refer to [Figure 27](#). The electrical connector kit supplied with the iH system comprises a connector hood (7), a connector block (8), a cable-gland body and five seal inserts of different sizes. The cable-gland body and the seal inserts are supplied together in a single bag. You must select and use the correct size of seal insert for your electrical supply cable; that is you must use the seal insert that will only just fit onto the cable. If you use a larger size of seal insert, it will not adequately grip the cable, and it may allow moisture to penetrate into the interior of the connector assembly.

Figure 27 - Connect the electrical supply cable to the connector mating-half



- | | | | |
|----|-------------------------|-----|-----------------------------------|
| A | iH80 | | |
| B | iH600 | | |
| C | iH1000 | | |
| 1. | Pin 1 (phase 1) | 6. | Electrical supply cable |
| 2. | Pin 2 (phase 2) | 7. | Hood |
| 3. | Pin 3 (phase 3) | 8. | Connector block |
| 4. | Earth (ground) screw | 9. | Electrical supply connector |
| 5. | Cable-gland locking nut | 10. | Electrics and Pump Control Module |

When you make your electrical supply cable, ensure that the earth (ground) conductor is longer than the phase conductors. This will ensure that if the cable is accidentally dragged and the strain relief on the electrical supply connector mating-half cable-gland fails, the earth (ground) conductor will be the last conductor to be pulled from the connector.

1. Refer to [Figure 27](#). Remove the connector block (8) from the hood (7) of the mating-half electrical supply connector.
2. Remove the locking nut (5) from the cable-gland and pass the end of your electrical supply cable (6) through the nut.
3. Select the most suitable size of seal insert (see above), then pass the end of your electrical supply cable (6) through the seal insert, with the knurled face of the insert towards the end of the cable.
4. Fit the cable-gland body to the hood (7). Ensure that it is securely fitted, then push the end of the electrical supply cable (6) through the cable-gland body and push the seal insert fully into the cable-gland body.
5. Screw the locking nut (5) onto the cable-gland, but do not fully tighten it yet.
6. Connect the cable phase conductors to the pins in the connector block (8) as shown in [Table 11](#).
7. Connect the earth (ground) conductor of the cable to one of the two earth (ground) screws (4) on the side of the connector block (8).
8. Refit the connector block (8) into the hood (7), then tighten the locking nut (5) on the cable-gland.
9. Fit the mating-half assembly to the electrical supply connector (9) on the Electrics and Pump Control Module.
10. Connect the other end of the electrical supply cable to your electrical supply through a suitable isolator.
11. On iH1000 systems, you must fit a second protective earth (ground) conductor to the protective earth (ground) stud on the Electrics and Pump Control Module ([Figure 4](#), item 11) and connect the other end of this conductor to your factory earth (ground).

On iH80 and iH600 systems, we recommend that you fit a second protective earth (ground) conductor..

Table 11 - Pins in the electrical supply connector

Wire	Pin number (Figure 27 key)
Phase 1 (R)	1
Phase 2 (S)	2
Phase 3 (T)	3

3.16.4 Connect an additional RF earth (optional)

An earth (ground) cable is connected to the rear of the M6 RF earth (ground) stud on the rear panel of the iH system ([Figure 4](#), item 6). If you will operate the iH system in an area subject to high RF (radio frequency) emissions, in accordance with good RF installation practise, we recommend that you:

- Use a star washer to connect the end of the earth (ground) cable connected to the iH inlet to one of the bolts that you use to secure the inlet-flange (see [Section 3.9](#)).
- Connect an additional earth (ground) cable to the M6 RF earth (ground) stud. You must use a suitable low-impedance cable (for example, use braided cable).

3.17 Refit the enclosure panels

1. Refer to [Figure 21](#), detail A (iH600/iH1000) or detail B (iH80). Refit the top panel:
 - Place the front of the top panel (1) on the top of the iH system.

- Lower the rear of the panel so that it is horizontal, then slide it forward (towards the iH inlet) until it is fully in place.
 - On an iH80 or iH600 system, use a flat-bladed screwdriver to secure the two quarter-turn catches (4) on the end of the top panel.
2. Refer to detail B. Refit the HCDP right-hand and left-hand side panels (and, on iH600 and iH1000 systems, the HCMB right-hand and left-hand side panels); use the following method for each side panel:
 - Hold the panel (6) and fit it to the side of the iH system, so that the pins (7) on the frame engage in the slots in the bottom of the panel (6).
 - Lower the panel fully down, then swing the top of the panel into place against the frame.
 - Use a flat-bladed screwdriver to secure the two quarter-swing catches (5).
 3. If you have an iH1000 system:
 - Refer to [Figure 20](#). Support the inverter enclosure (3), then disconnect the support rod (5) from the frame and fit it into the catch under the inverter enclosure.
 - Lower the inverter enclosure (3) onto the pump frame.
 - Use a hexagonal key to refit the two cap-head screws (2) to secure the inverter enclosure (3) to the pump frame.
 - Refer to [Figure 21](#). Refit the inverter rear cover (3) and secure with the four screws.

3.18 Connect the cooling-water hoses



WARNING

Do not leave the cooling-water supply turned on until after you complete the electrical installation of the pump. If you do, condensation may form inside the motor terminal-box and there may be a risk of electric shock.

CAUTION

Drain the cooling-water from the iH system, if you will transport or store it in conditions where the cooling-water could freeze. If you do not, cooling-water may freeze in the iH system and damage the pump(s) and/or the cooling-water pipelines.

Note: For optimum water-cooling, ensure that your cooling-water supply and return hoses are free of restrictions which would reduce the cooling-water flow rate. If you need to connect more than one iH system to the water supply, you must connect them in parallel and not in series.

For minimum water consumption, regulate the cooling-water flow to the iH system.

The positions of the cooling-water connectors are shown in [Figure 4](#). Connect the cooling-water supply as follows:

1. Use 3/8 inch BSP male pipe fittings (which you must supply) to fit the female quick-release connector to the cooling-water supply hose and to fit the male quick-release connector to the cooling-water return hose.
2. Refer to [Figure 4](#). Remove the dust-caps from the cooling-water inlet and outlet (2, 3).
3. Connect your water return hose to the cooling-water outlet (2) and connect your water supply hose to the cooling-water inlet (3).
4. Turn on the cooling-water supply.
5. Inspect the water hoses, pipelines and connections and check that there are no leaks.

6. Turn off the water supply while you complete the remainder of the installation procedures.

3.19 Adjust the interstage purge flow rates if necessary

The 2/3-interstage purge and 3/4-interstage purge flow rates are preset for correct operation. If necessary, these purge flow rates can be adjusted: contact your supplier or Edwards for advice.

3.20 Commission the iH system



WARNING

Do not operate the iH system with the exhaust pipeline blocked. If the exhaust pipeline is blocked, the iH system can generate exhaust pipeline pressures up to 7 bar (7×10^5 Pa).



WARNING

Do not operate the iH system with any enclosure panels removed and do not touch any parts of the pump(s) when the iH system is on. Surfaces of the pump(s) are very hot and can cause injury to people.

3.20.1 Switch on an iH80/iH1000 system

Note: Operation of the iH system with high inlet pressure may result in shaft-seal pressure warnings (refer to [Table 15](#)): the operation of the iH system will not be affected, and you can ignore these warnings.

1. Switch on the external electrical supply and check that the power ok LED ([Figure 3](#), item 7) goes on. If the LED does not go on, refer to [Section 6](#) to determine the cause of the fault.
2. Switch on the cooling-water and nitrogen supplies.
3. Ensure that the exhaust-extraction system is not blocked (for example, that valves in the exhaust-extraction system are open).
4. Ensure that all openings to atmospheric pressure in the foreline vacuum system are closed, then switch on the iH system.
5. If the iH system starts and continues to operate, continue at Step 6. If a warning or alarm condition is indicated (for example, a warning or alarm message is shown on the Pump Display Module):
 - Shut down the iH system: refer to [Section 5.9](#).
 - Refer to [Section 6](#) to determine the cause of the fault and to rectify the fault.
6. Look at the pressure gauge in your inlet pipeline:
 - If the pressure is increasing, the HCDP pump-motor terminal-box (and/or if you have an iH1000 system, the HCMB pump-motor terminal-box) is incorrectly wired: immediately shut down the iH system, correct the electrical wiring (refer to [Section 3.16.2](#)), then repeat this procedure from Step 3 again.
 - If the pressure is decreasing, continue at Step 7.
7. After you have commissioned the iH system:
 - If you want to continue to operate the iH system, refer to [Section 5](#).
 - Otherwise, shut down the system,: refer to [Section 5.9](#).

3.20.2 Configure and switch on an iH600 system

CAUTION

Ensure that the booster start delay is correctly adjusted for your installation. If it is not, you may damage the iH when you start it up.

CAUTION

You can only switch on and configure an iH600 system if you have a Single Pumpset Monitor (SPM.) connected to the iH system. If you do not have SPM., do not use the following procedure; contact your supplier or Edwards for advice.

CAUTION

Do not operate an iH600 system with the maximum inlet pressure for longer than the maximum time specified in [Table 2](#). If you do, the HCMB pump may overheat.

Note: You will need a stop-watch to do the following procedure, which assumes that you are familiar with the operation of the SPM; where necessary, refer to the manual supplied with the SPM.

You can only adjust the iH booster start delay up to a maximum of 255 seconds. If your required delay is longer than 255 seconds, you must fit an iH600 Pressure Control Kit accessory: refer to [Section 8.4.4](#).

Operation of the iH system with high inlet pressure may result in shaft-seal pressure warnings (refer to [Table 15](#)): the operation of the iH system will not be affected, and you can ignore these warnings.

When you switch on an iH600 system, the HCDP pump starts immediately, but there is a delay before the HCMB pump is started. This ensures that the vacuum system and vacuum inlet pipelines are partially evacuated by the HCDP pump, so that the maximum inlet pressure for the HCMB pump is not exceeded (see [Section 2](#)). As supplied, this delay (the booster start delay) between HCDP pump switch-on and HCMB pump switch-on is preset to 30 seconds.

You must use the following procedure to determine whether the booster start delay is suitable for your installation.

1. Switch on the external electrical supply and check that the power ok LED ([Figure 3](#) item 7) goes on. If the LED does not go on, refer to [Section 6](#) to determine the cause of the fault.
2. Logon to the SPM.
3. Use the SPM to:
 - Upload the configuration set from the iH system, and store it with a suitable file name (for example, "iH600").
 - Edit the configuration to identify that an HCMB pump is not fitted, and save the new edited configuration set with a suitable new file name (for example, "iH80/600").
 - Download the edited configuration set to the iH system.
4. Switch on the cooling-water and nitrogen supplies.
5. Ensure that the exhaust-extraction system is not blocked (for example, that valves in the exhaust-extraction system are open).
6. Ensure that all openings to atmospheric pressure in the foreline vacuum system are closed, then switch on the iH system and simultaneously start the stop-watch.
7. If the iH system starts and continues to operate, continue at Step 8. If a warning or alarm condition is indicated (for example, a warning or alarm message is displayed on the SPM or shown on the Pump Display Module):
 - Shut down the iH system: refer to [Section 5.9](#).

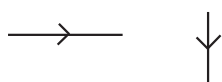
- Refer to [Section 6](#) to determine the cause of the fault and to rectify the fault, then repeat this procedure from Step 7.
8. Look at the pressure gauge in your inlet pipeline:
 - If the pressure is increasing, the HCDP pump-motor terminal-box is incorrectly wired: immediately shut down the iH system, correct the electrical wiring (refer to [Section 3.16.2](#)), then repeat this procedure from Step 7 again.
 - If the pressure is decreasing, leave the iH system to operate and take note of the time taken to pump down to 5 mbar (5×10^2 Pa), then continue at Step 9.
 9. Stop the iH system and isolate it from the electrical supply.
 10. Add 10% to the time noted in Step 8, to give the required booster start delay for your installation.
 11. If the required booster start delay is less than or equal to 30 seconds, continue at Step 13.
 12. If the required booster start delay is greater than 30 seconds, use the SPM to edit and save the original configuration set uploaded from the iH (the set saved as, for example, "iH600"): set the BOOSTER START DELAY to the required booster start delay time.
 13. Use the SPM to download the original configuration set (with file name, for example, of "iH600") to the iH system.
 14. Start up the iH system again and at the same time start the stop-watch. Watch the pressure gauge in your inlet pipeline. The HCDP pump will start and the pressure will start to reduce. After the booster start delay time, the HCMB pump will start (at an inlet pressure of approximately 5 mbar, 5×10^2 Pa):
 - If the pressure increases or does not decrease any further when the HCMB pump starts, the HCMB pump-motor terminal-box is incorrectly wired: immediately shut down the iH system, correct the electrical wiring (refer to [Section 3.16.2](#)), then repeat this procedure from this step (Step 14) again.
 - If the pressure continues to decrease after the HCMB pump starts, continue at Step 15.
 15. After you have commissioned the iH system:
 - If you want to continue to operate the iH system, refer to [Section 5](#).
 - Otherwise, shut down the system: refer to [Section 5.9](#).

This page has been intentionally left blank.

4 Pump Display Module Menus and Display Formats

4.1 Introduction

The menus used and the display messages shown on the Pump Display Module are described in the menu diagrams in Figures 29 to 46. 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. The symbol is shown with the menu name and, where applicable, a reference of the form [x/y]. This reference specifies that the menu continues on (or is continued from) a menu shown on sheet y of Figure x. The sheet reference (/y) is omitted where it is not necessary.



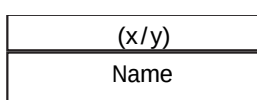
This symbol is used for the ENTER and CANCEL buttons and the four menu buttons: Normal, Status, Control and Setup.



This symbol is used for the up (▲) and down (▼) buttons and for the on (◀) and off (▶) buttons.



This symbol is used for the two-line display on the Pump Display Module. With the exception of variable text (see [Section 4.4](#)), the text shown in the symbol is the text that will be shown on the display.



This symbol is a subroutine box and is used to represent a 'subroutine call'; a subroutine is a series of menu steps which are used in a number of different menus or used in different parts of one menu. The [x/y] reference (used as described above) shows where the subroutine is expanded.

In a menu which 'calls' a subroutine, where a menu flow line meets the left hand side of a subroutine box, this means that flow continues at the start connector (identified by <name>) of the subroutine. At the 'exit' connector of the subroutine, flow continues in the (calling) menu along the flow line to the right of the subroutine box.



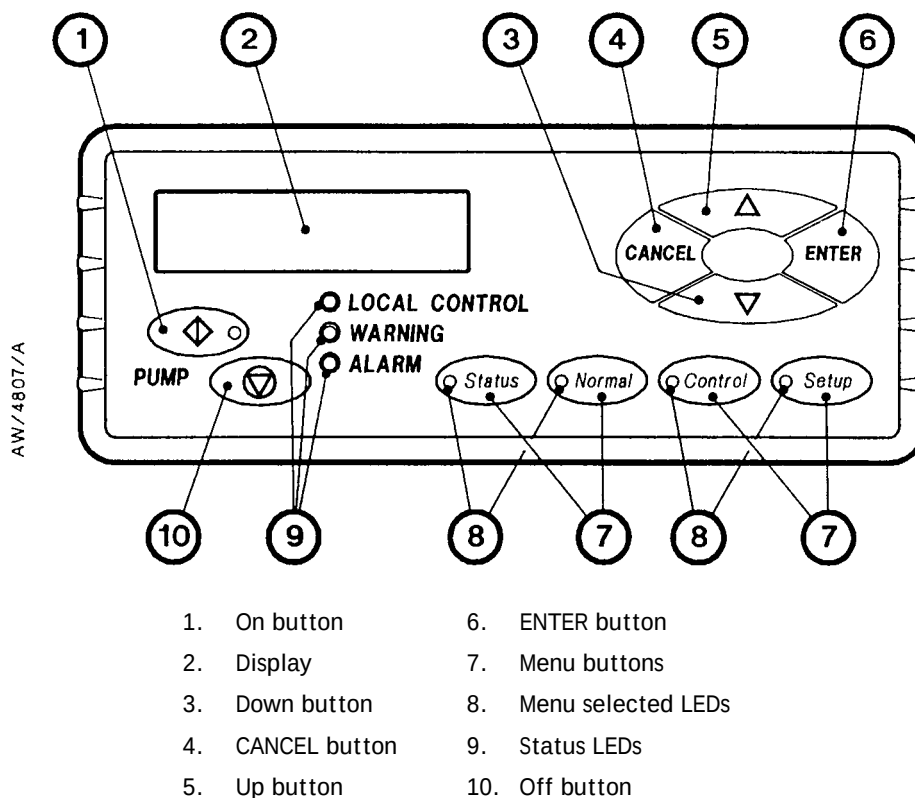
This symbol shows additional text which is not part of the menu, but which further describes the operation of the menu.

4.2 General operation

When you first switch on the iH system, the normal display is shown: see [Figure 32](#). Refer to [Figure 28](#). You can then press the On or Off button (1 or 10) or any of the four menu buttons (7) to enter the corresponding menu. Then,

regardless of the current menu and display status, when you press any of these buttons, you exit the current menu and enter the corresponding new menu. Figure 29 shows this menu control logic.

Figure 28 - Front panel of the Pump Display Module



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 30 and 31), when you press CANCEL, the menu is exited and the normal display is shown.
- In the Status menu (Figure 33), when you press CANCEL the display shows the first two status parameters (the defaults are HCDP current consumption and power consumption).
- When you change passwords in the Setup and Service menus (Figures 35 and 40) and before you press the ENTER button, if you press CANCEL, the menu moves back to entry of the first digit of the password or serial number.

4.4 Display text and variable text

In the menu diagrams in Figures 19 to 46, 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 'D' 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 Pump Display Module.

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

<status>	This specifies the status of a sensor in the iH (a Water Flow-Switch). <Status> can be any of the following: • OK indicates that the status is acceptable. • CHECK or LOW indicates that the reading from the sensor is low. • NP (not present) indicates that the sensor is not fitted. • NR (not reading) indicates that the sensor is disconnected, faulty or not switched on.
<serial no./Tag>	This specifies a serial number or the user tag. The user tag is a number which you can use to identify the iH system in the installation.
<parameter>	This is a previously selected parameter or menu option.
<message>	This specifies a warning, alarm or advisory message.
<e.no>	This specifies an error number: refer to Section 6 .
<units>	This specifies setpoint units, for example kW or slm.
<config>	This specifies the gas system configuration and can be any of the following: "low", "medium", "med+exh", or "high".

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 Module will automatically exit the current menu and enter the Normal menu. This facility (known as timeout) is available so that if the setup or service menu is entered and then the iH system is accidentally left unattended for a specified time, the menu is exited to prevent unauthorised use of the menu options.

4.7 Menu structure

The menu structure is shown in [Table 12](#). Note that if a particular system component or accessory is not fitted, the corresponding menu option or parameter is not shown or is shown as 'NP' (not present). For example, in the Status menu ([Figure 33](#)), if a component is not fitted, 'NP' (not present) is shown in the corresponding display line; an oil monitor is not fitted to the HCMB pump, so where [Figure 33](#) shows the 'MB OIL' status display, the actual display line will be 'MB OIL NP'.

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 35](#)).
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 'Inlet Purge' on the bottom line.
6. Press the down button six 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 38](#)).
8. Press the ENTER button; the display will then show 'Pressure' 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.

Table 12 - Menu structure

Menu	Figure
Switch on	30
Switch off	31
Normal	32
Status	33
Control	34
Setup	35
Inlet purge	35
Gas Ballast	35
Gate Valve 1	35
Run Til Crash	36
Units	37
Normal display	38
Service	39
Serial Numbers	40
Zero sensors	41
Gas Valve Control	42
Manual	43
View Status	44
Messages	45
Warning and alarm messages	46

Figure 29 - Menu logic

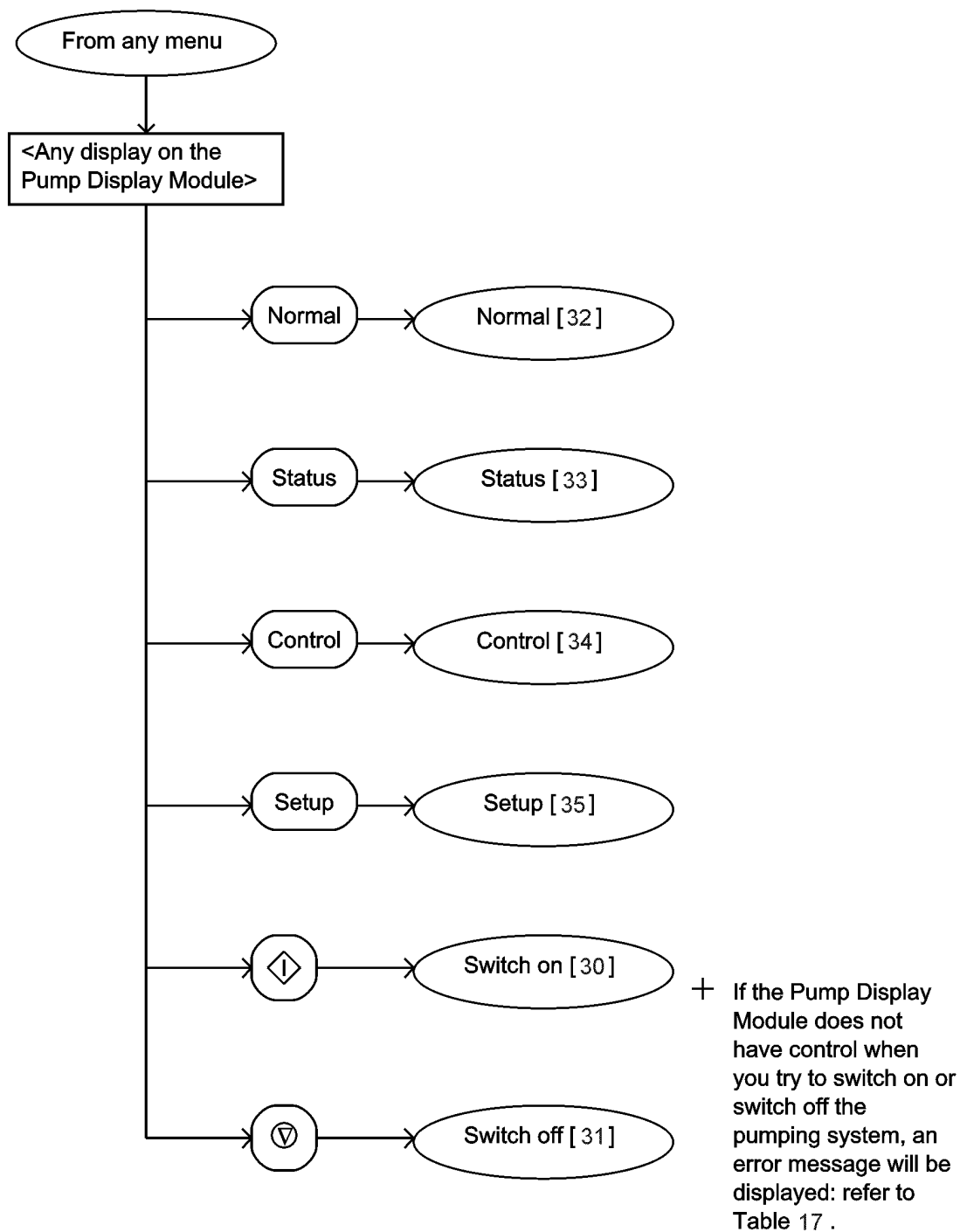


Figure 30 - Switch on menu

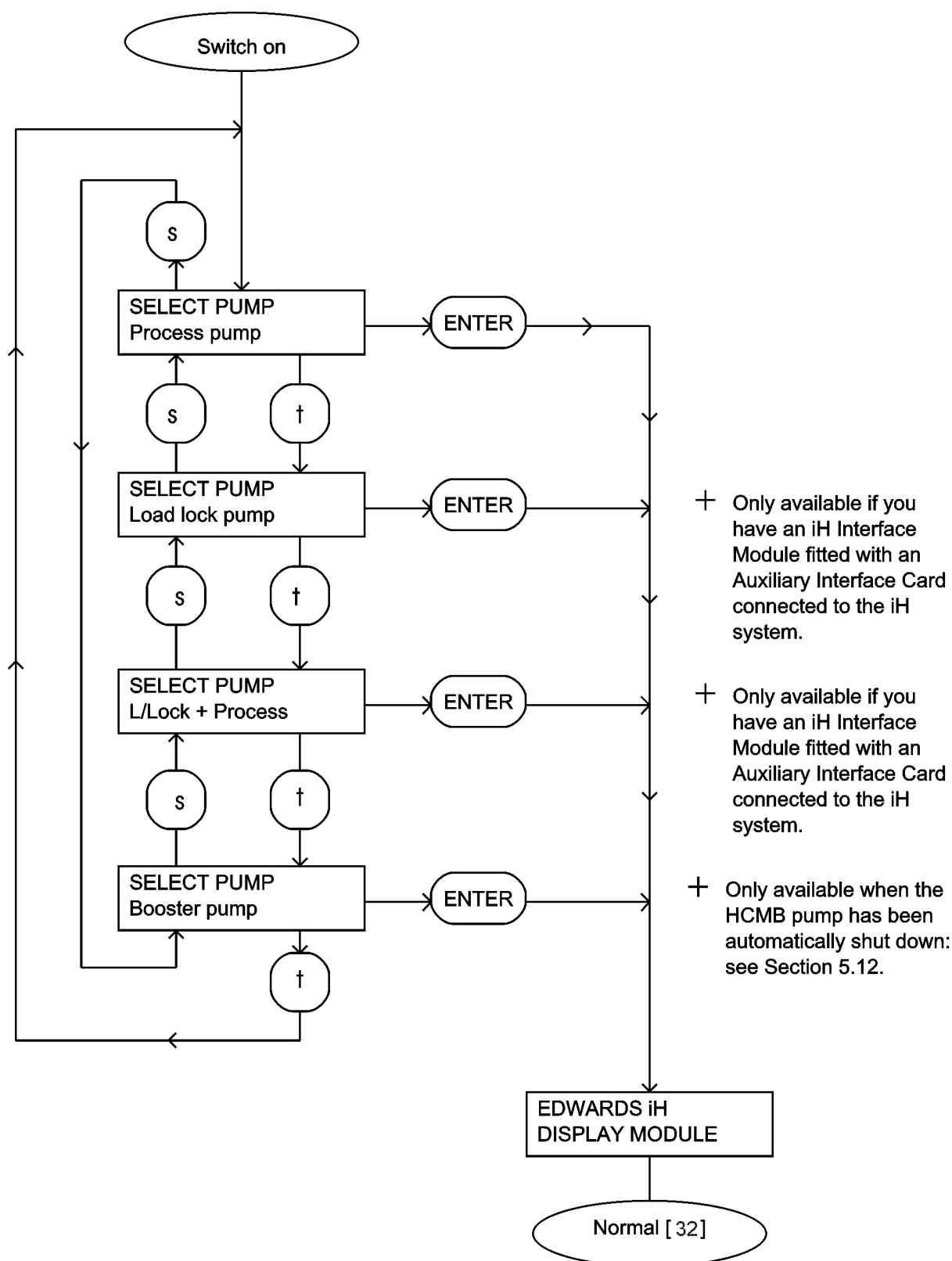


Figure 31 - Switch off menu

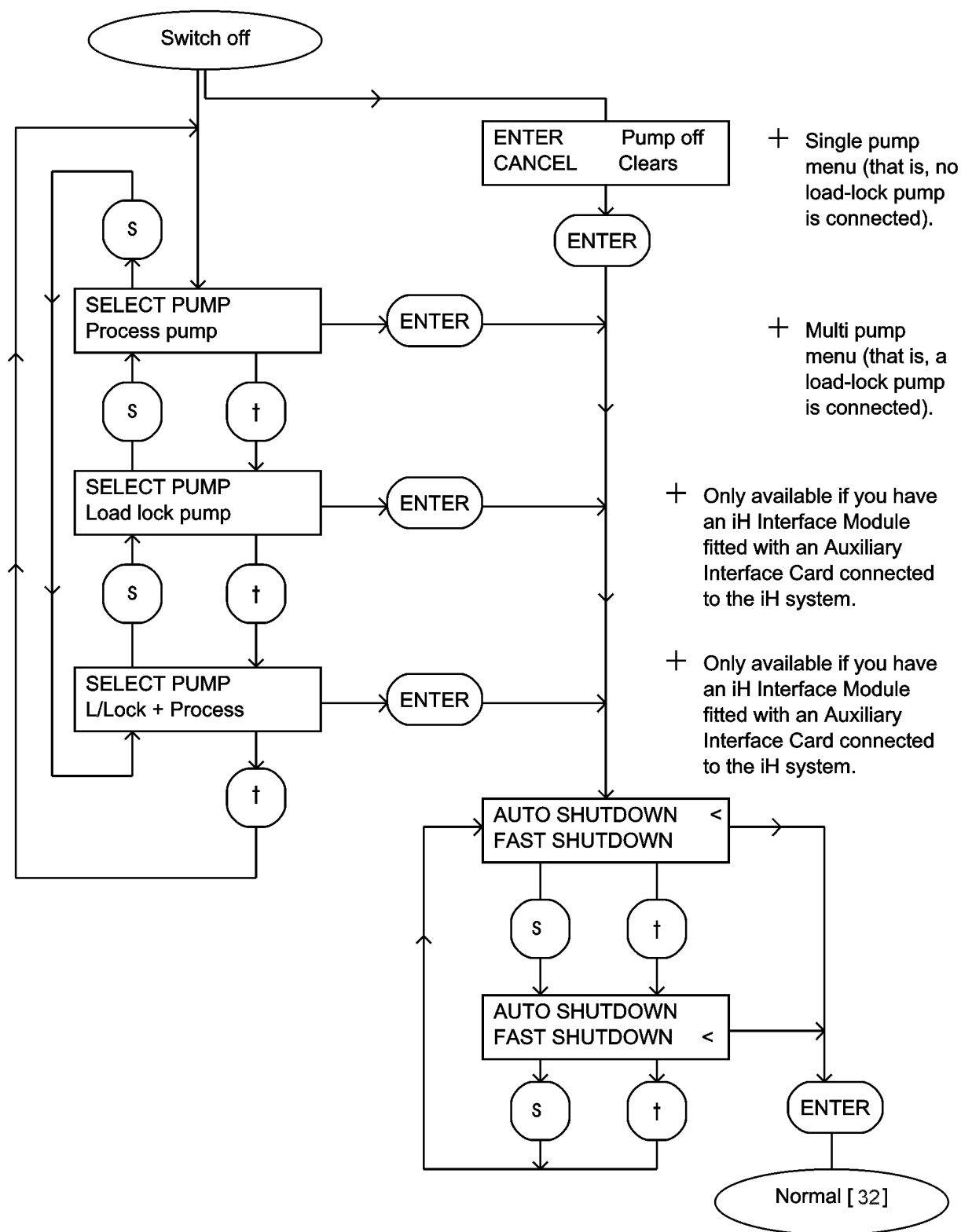
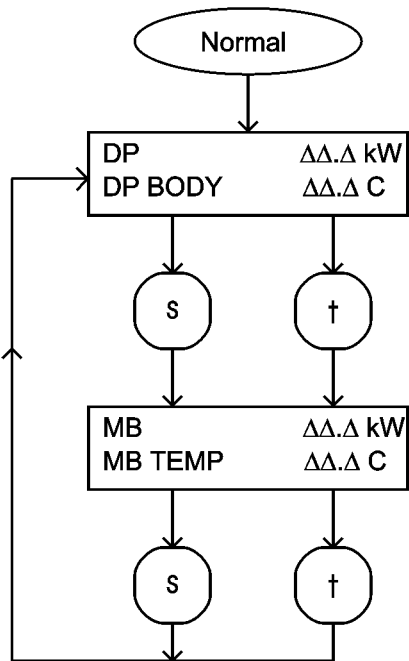


Figure 32 - Normal menu



+ First page of the normal display

+ Second page of the normal display

+ To change the information shown on the two pages, refer to Section 5.

```

graph TD
    Status([Status]) --> DP[DP<br/>DP POWER<br/>ΔΔ.Δ A<br/>ΔΔ.Δ kW]
    DP -- s --> Last([Last parameter<br/>[ 33/2 ]])
    DP -- † --> MB[MB<br/>MB POWER<br/>ΔΔ.Δ A<br/>ΔΔ.Δ kW]
    MB -- s --> Run[ RUN HOURS<br/>PROCESS<br/>ΔΔΔ H]
    MB -- † --> Proc[PROCESS<br/>CYCLES<br/>ΔΔΔ]
    Proc -- s --> Temp[MB TEMP<br/>DP MOTOR<br/>ΔΔΔ.Δ C<br/>ΔΔΔ.Δ C]
    Proc -- † --> Exhaust[EXHAUST<br/>DP BODY<br/><NP><br/>ΔΔΔ.Δ C]
    Exhaust -- s --> Prev([Prev parameter<br/>[ 33/2 ]])
    Exhaust -- † --> Next([Next parameter<br/>[ 33/2 ]])

```

+ On iH80 systems, some parameters may be shown in inches.
 + On iH80 systems, some parameters may be shown in inches.
 + If an exhaust sensor is fitted to the system, a temperature sensor may be displayed in inches.

Figure 33 - Status menu sheet 2 of 2

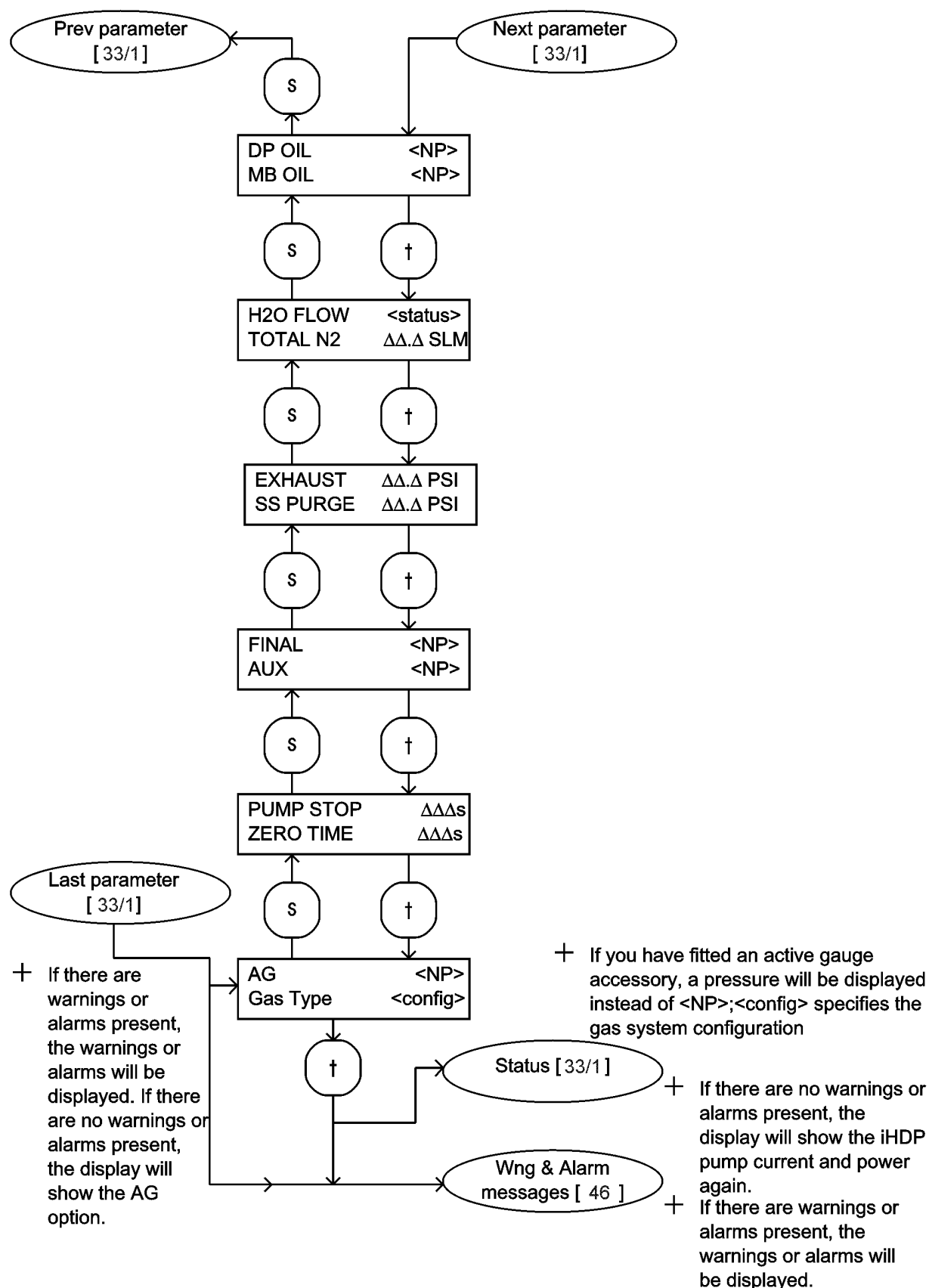


Figure 34 - Control menu

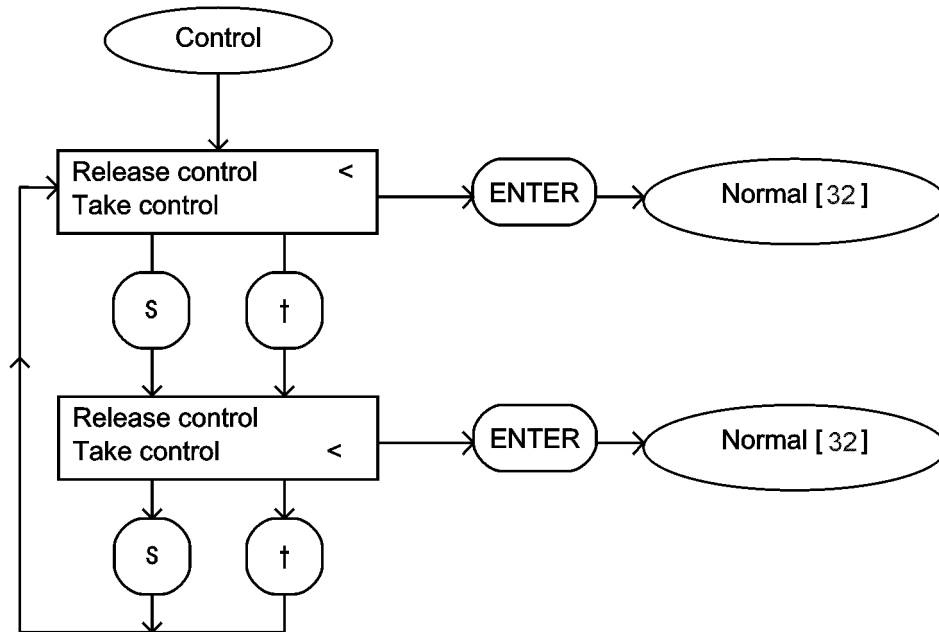


Figure 35 - Setup menu sheet 1 of 3

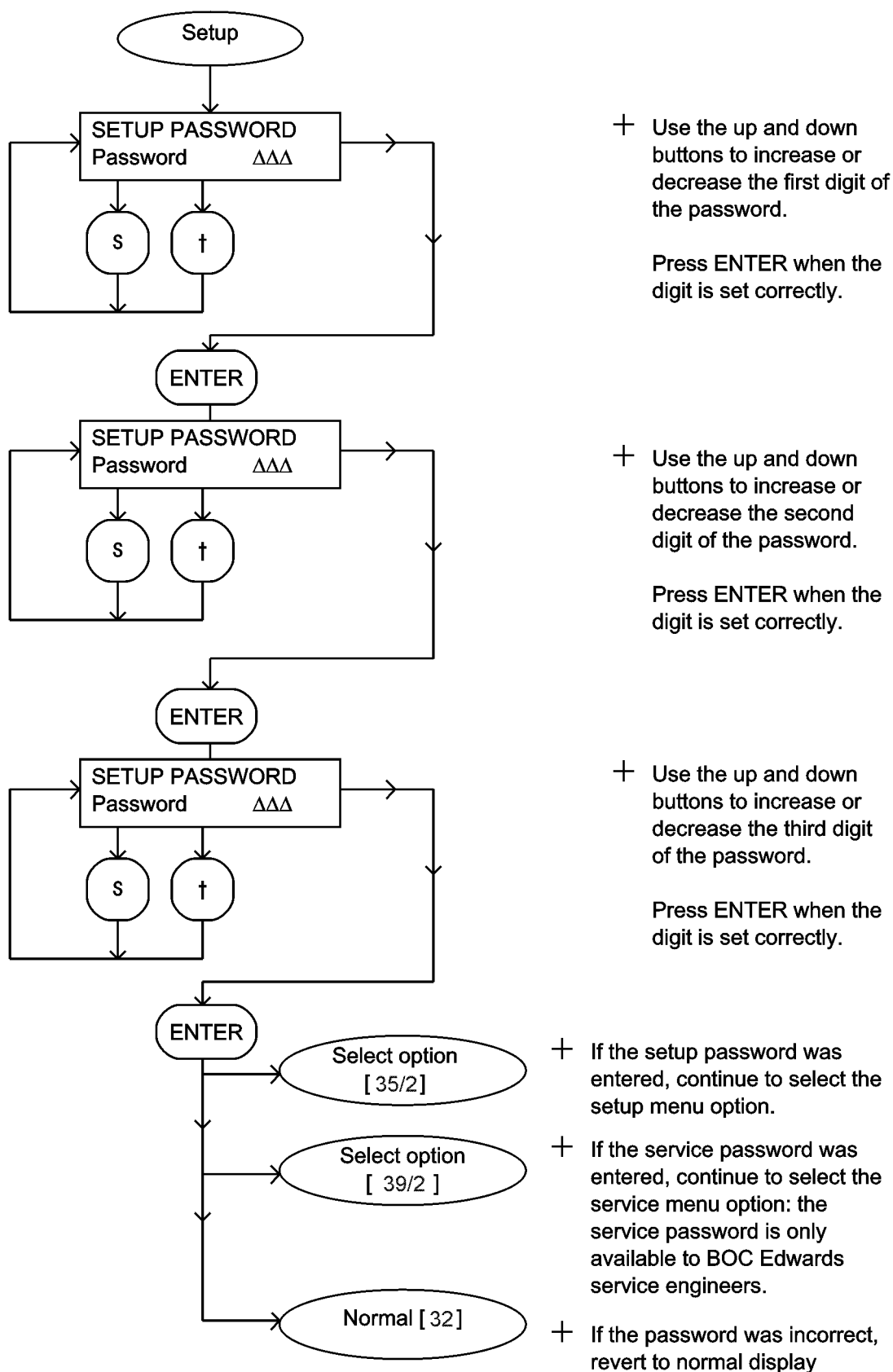


Figure 35 - Setup menu sheet 2 of 3

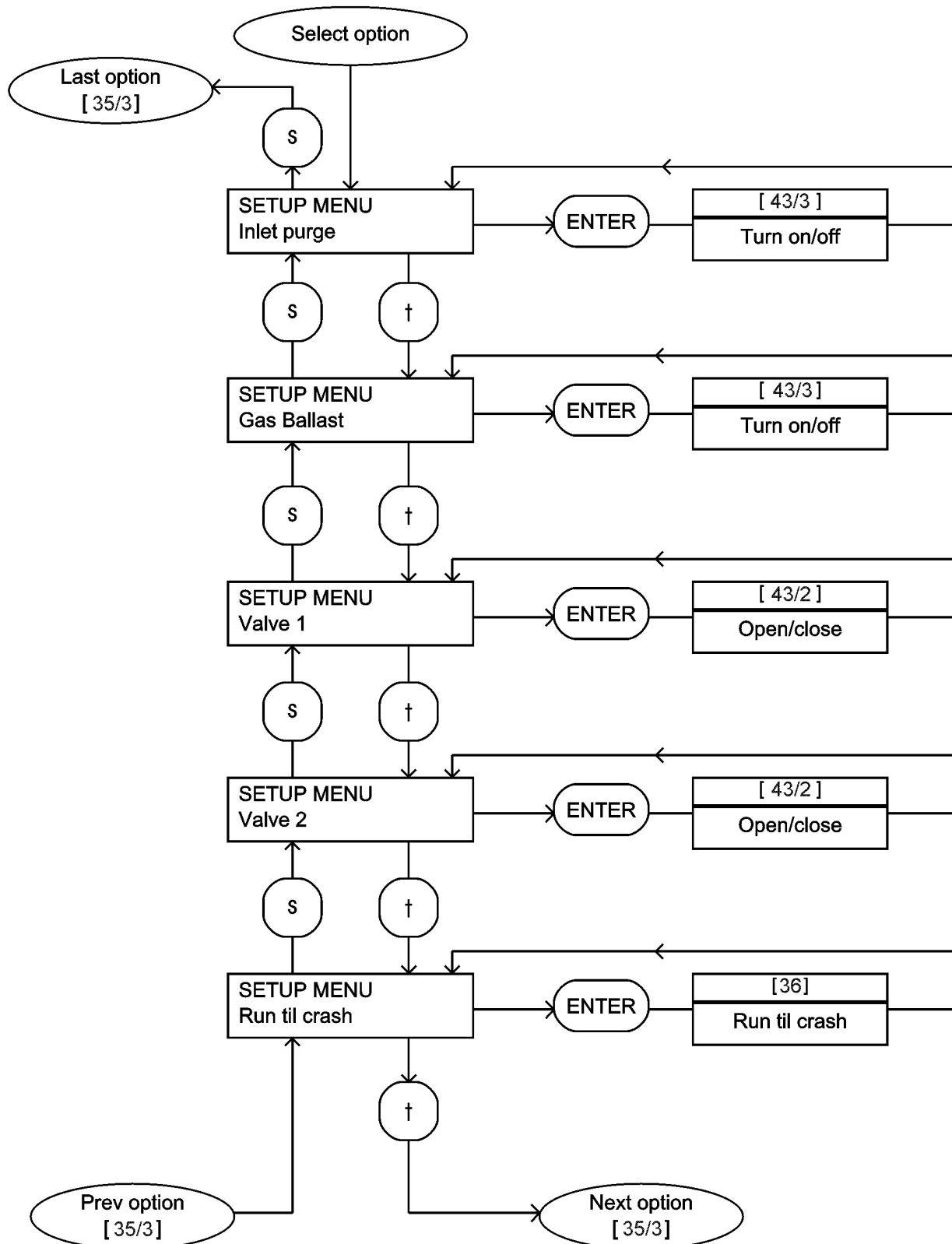


Figure 35 - Setup menu sheet 3 of 3

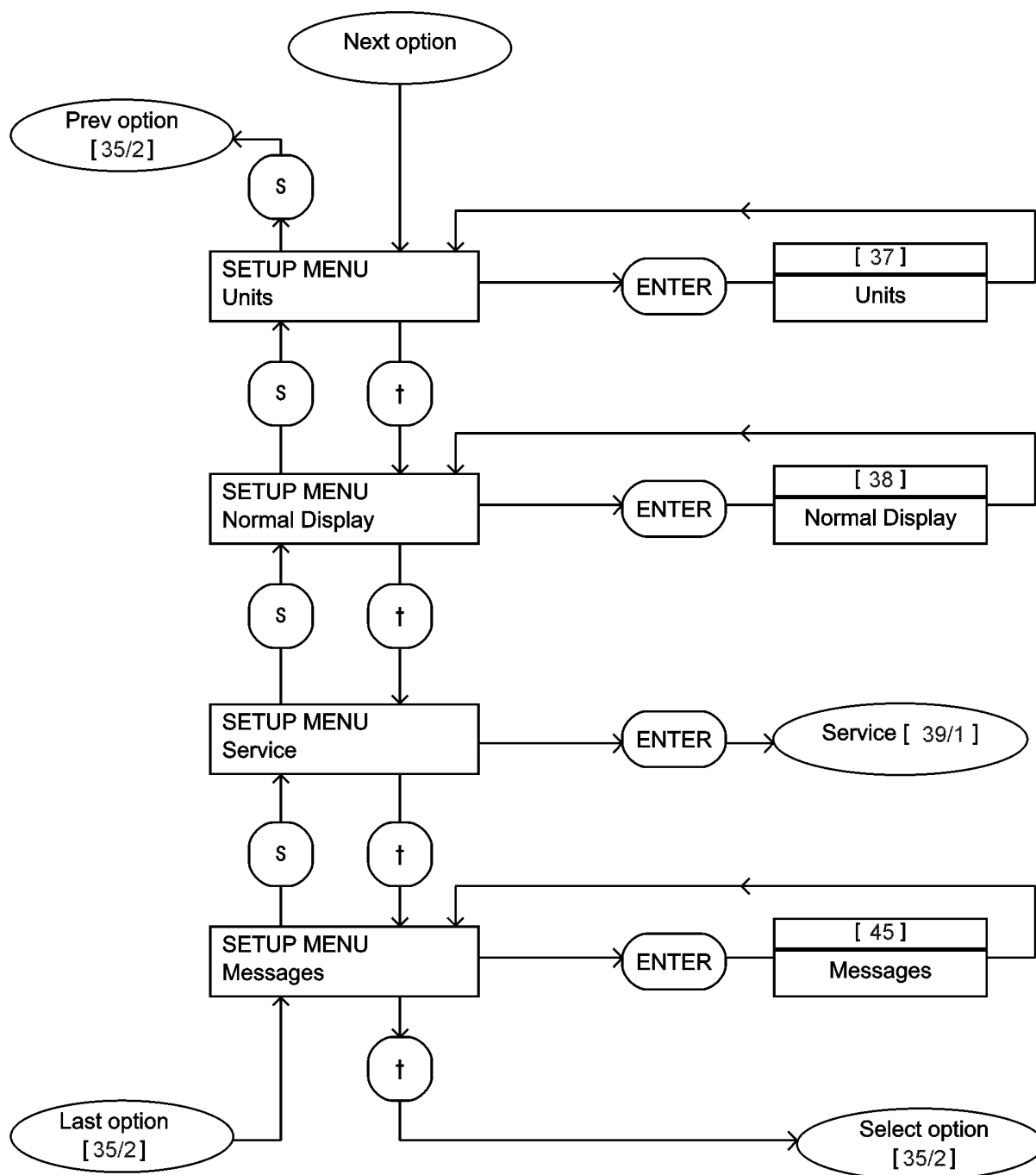


Figure 36 - Run til crash menu

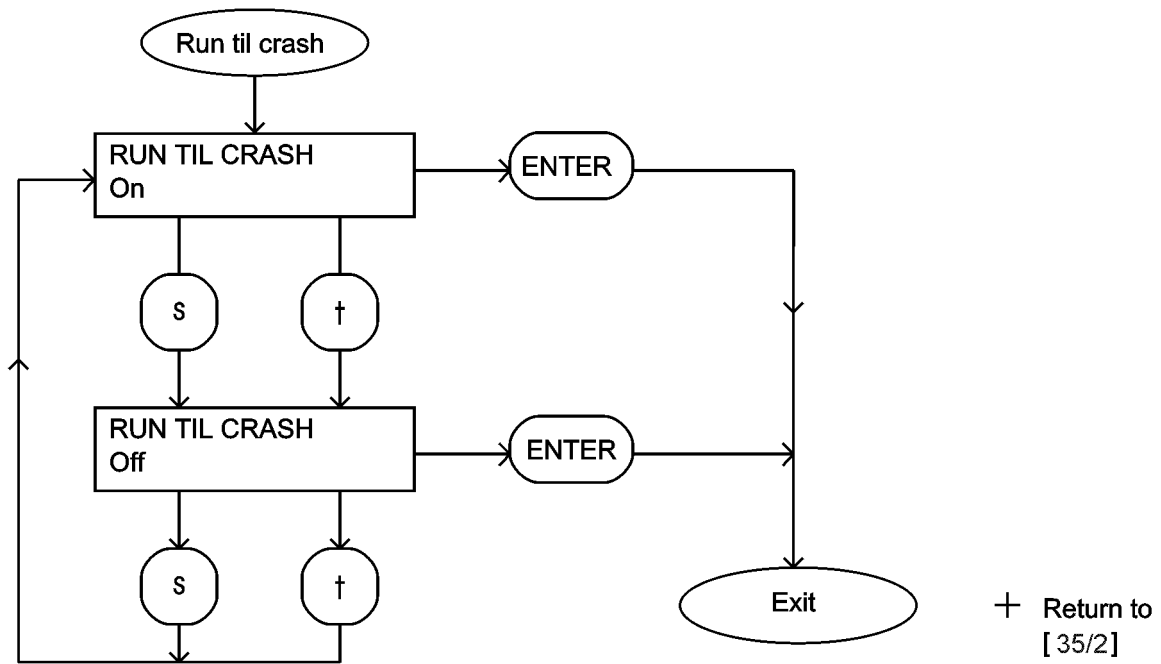


Figure 37 - Units menu

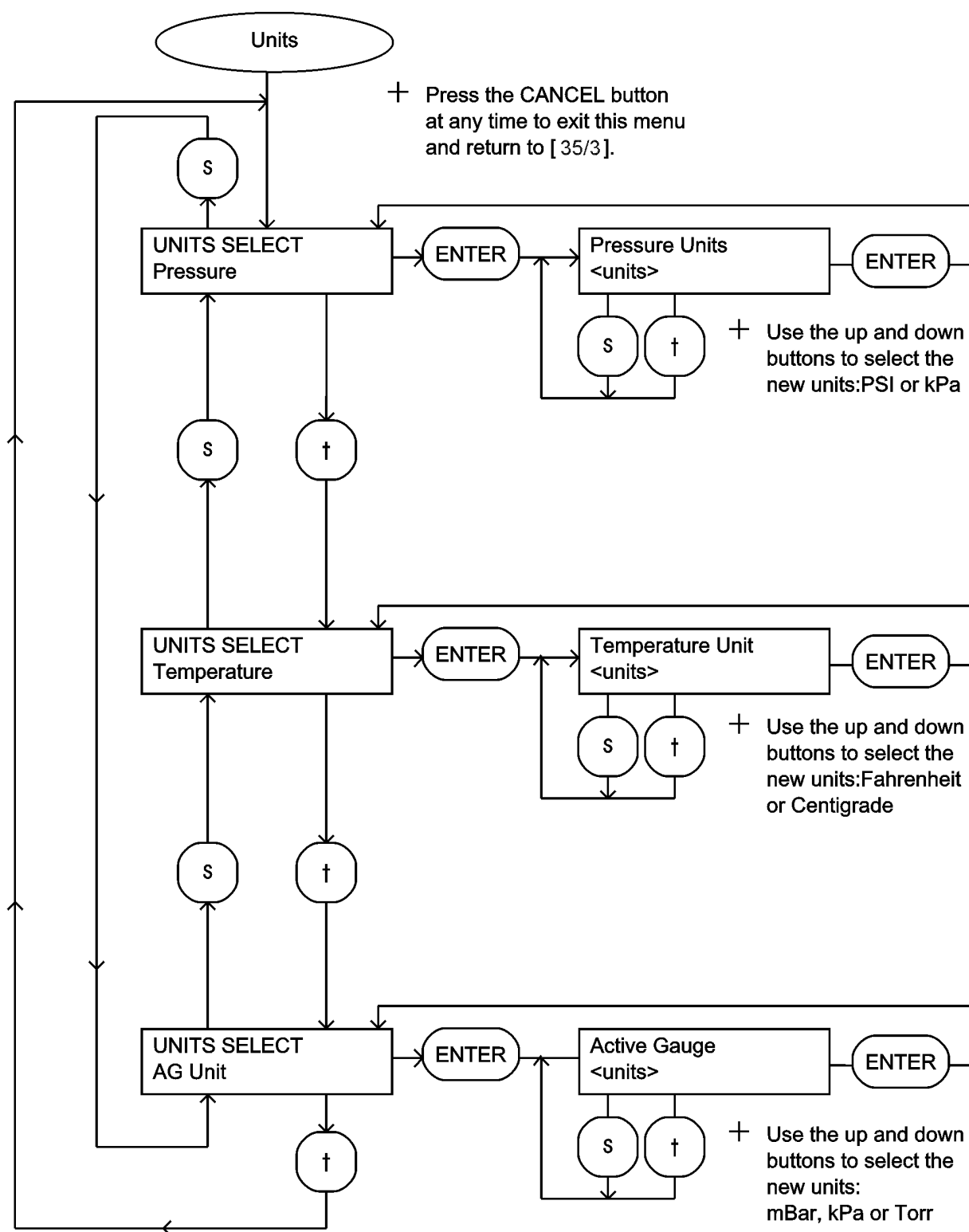


Figure 38 - Normal display menu

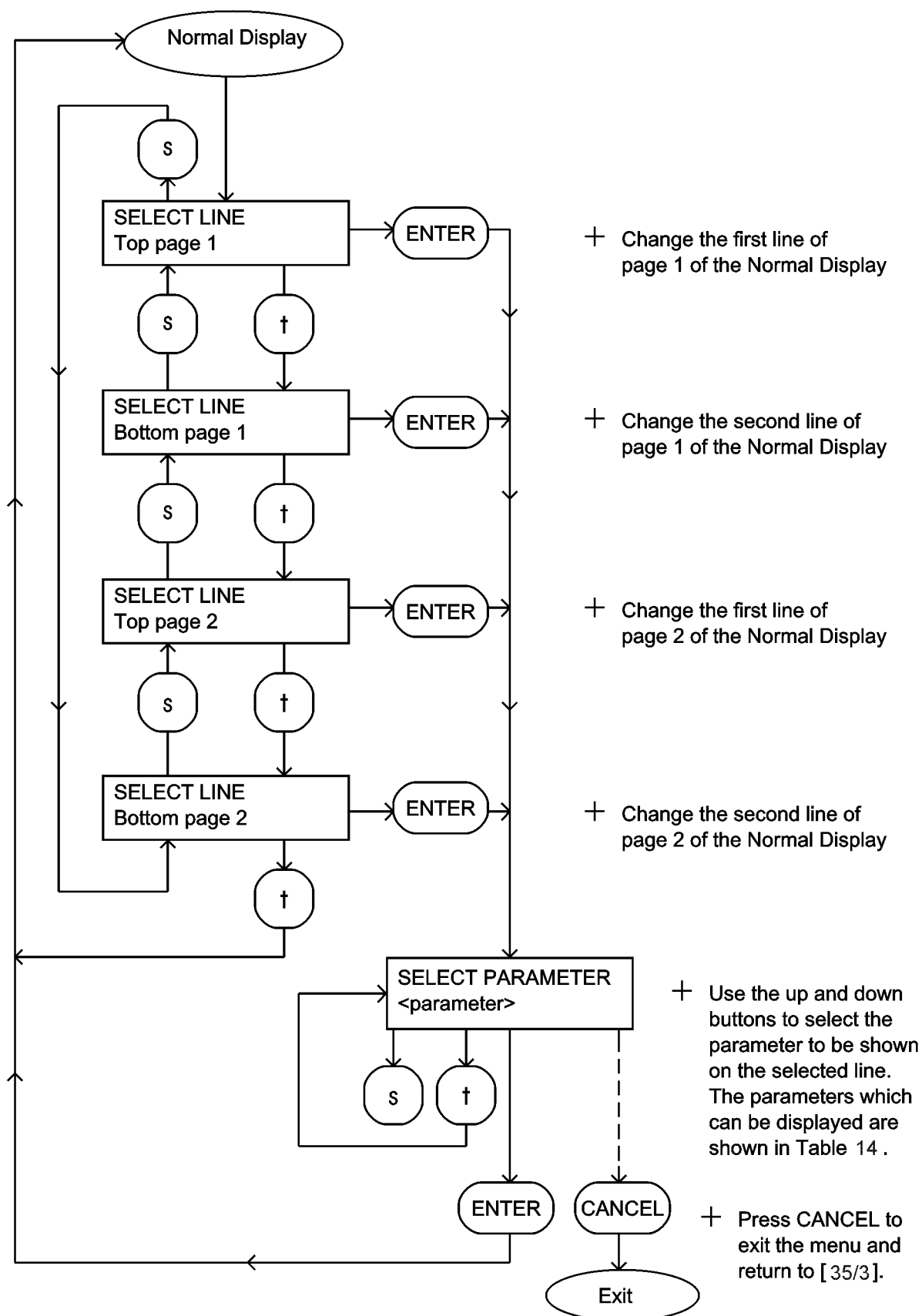


Figure 39 - Service menu sheet 1 of 2

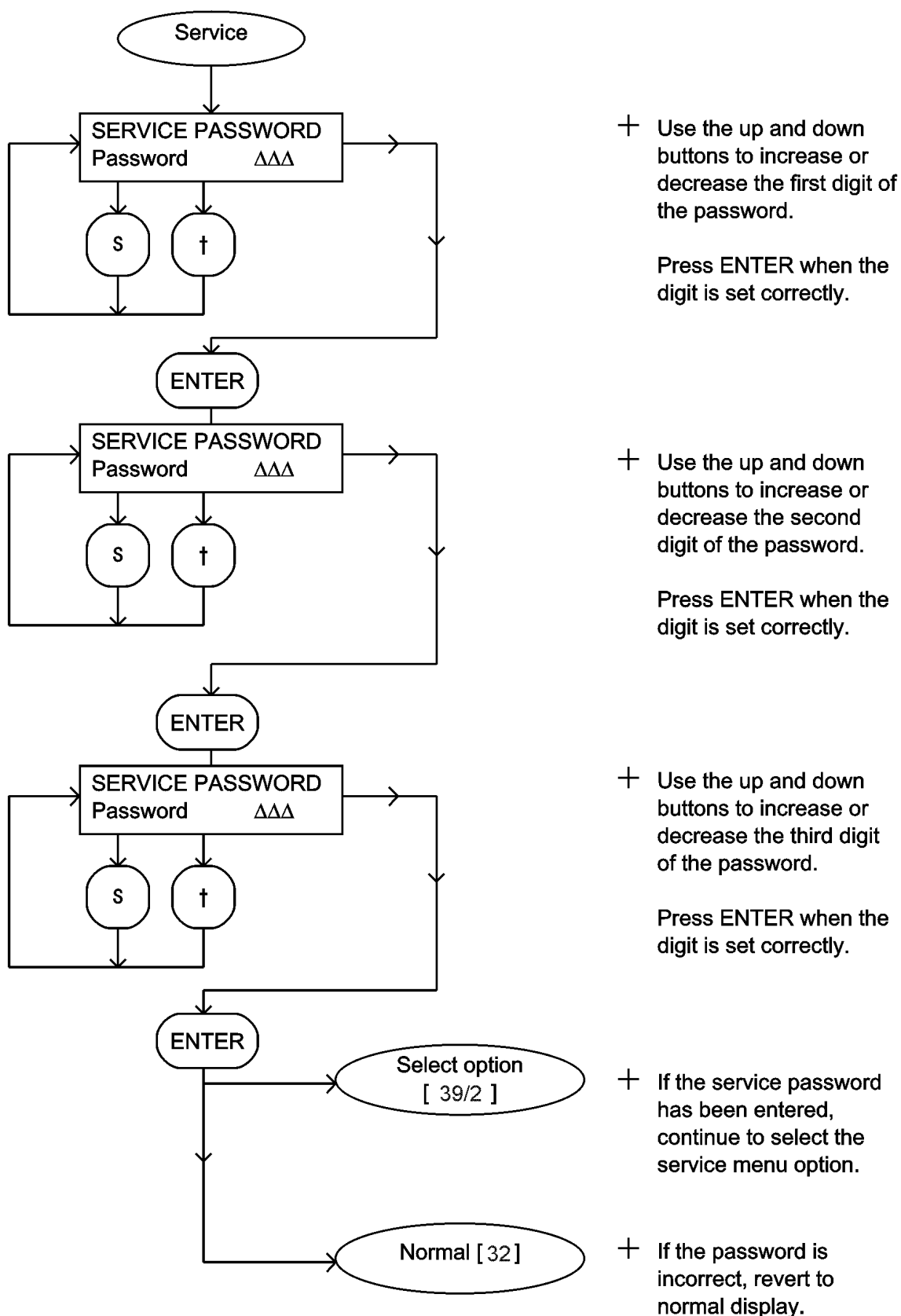


Figure 39 - Service menu sheet 2 of 2

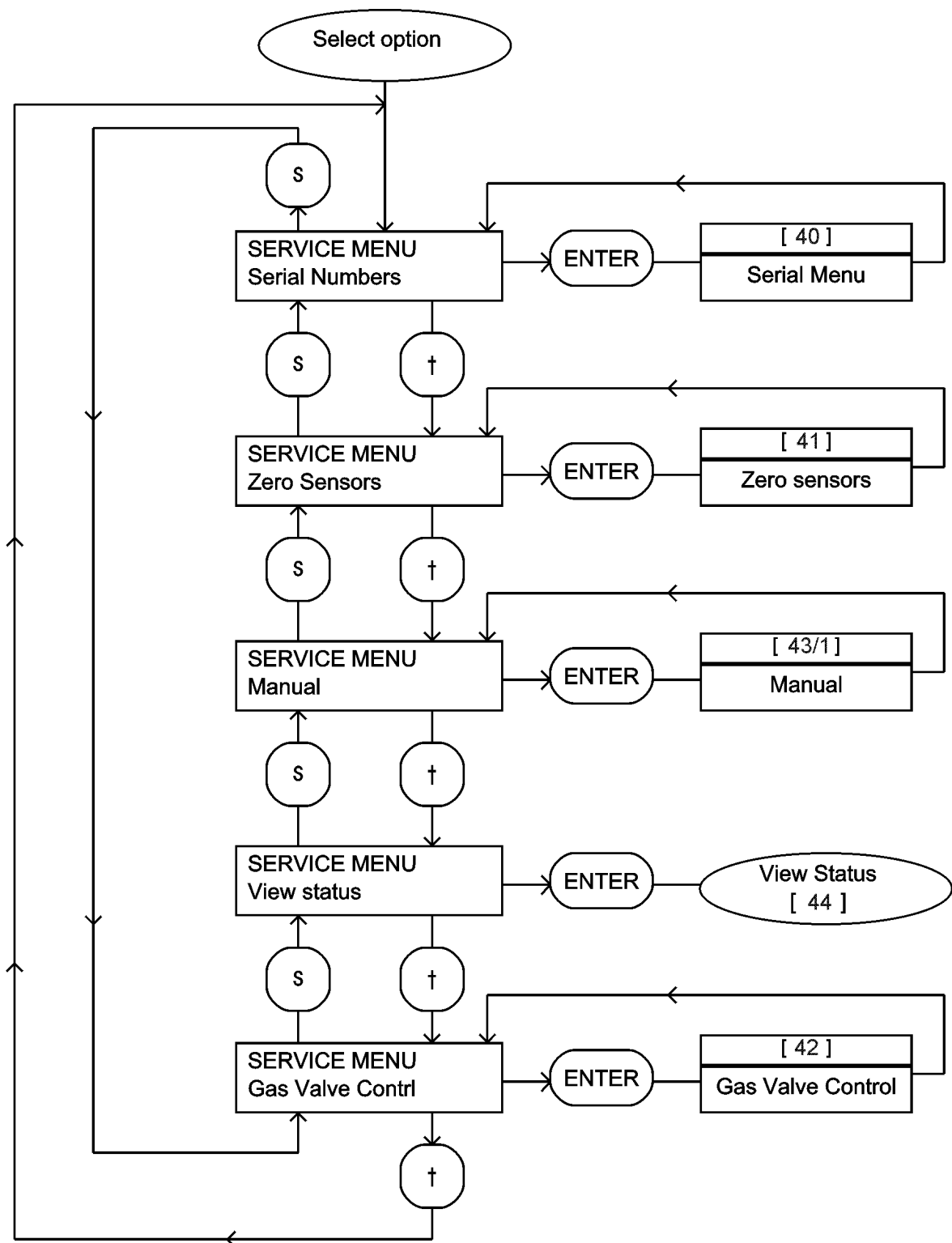


Figure 40 - Serial menu

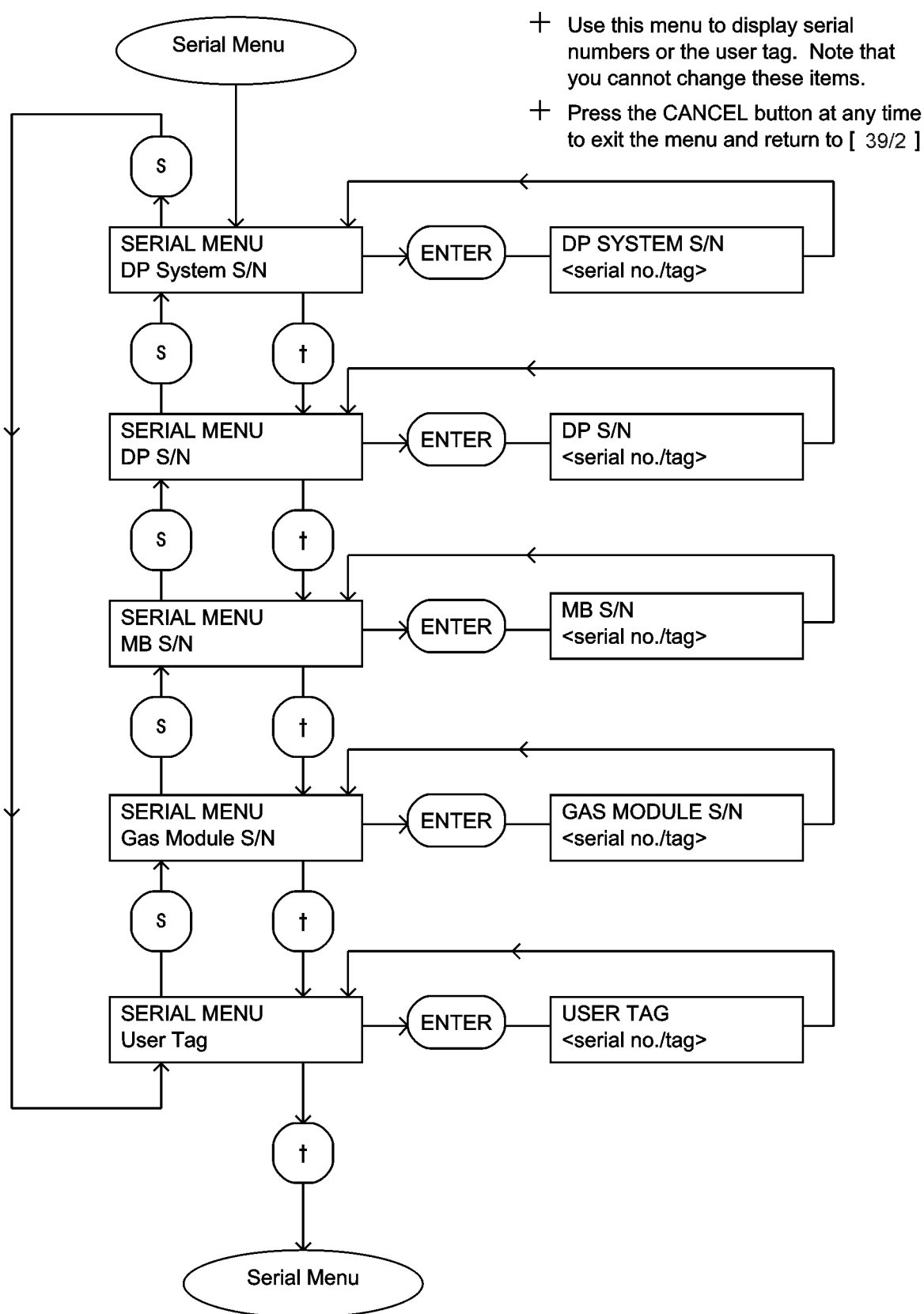
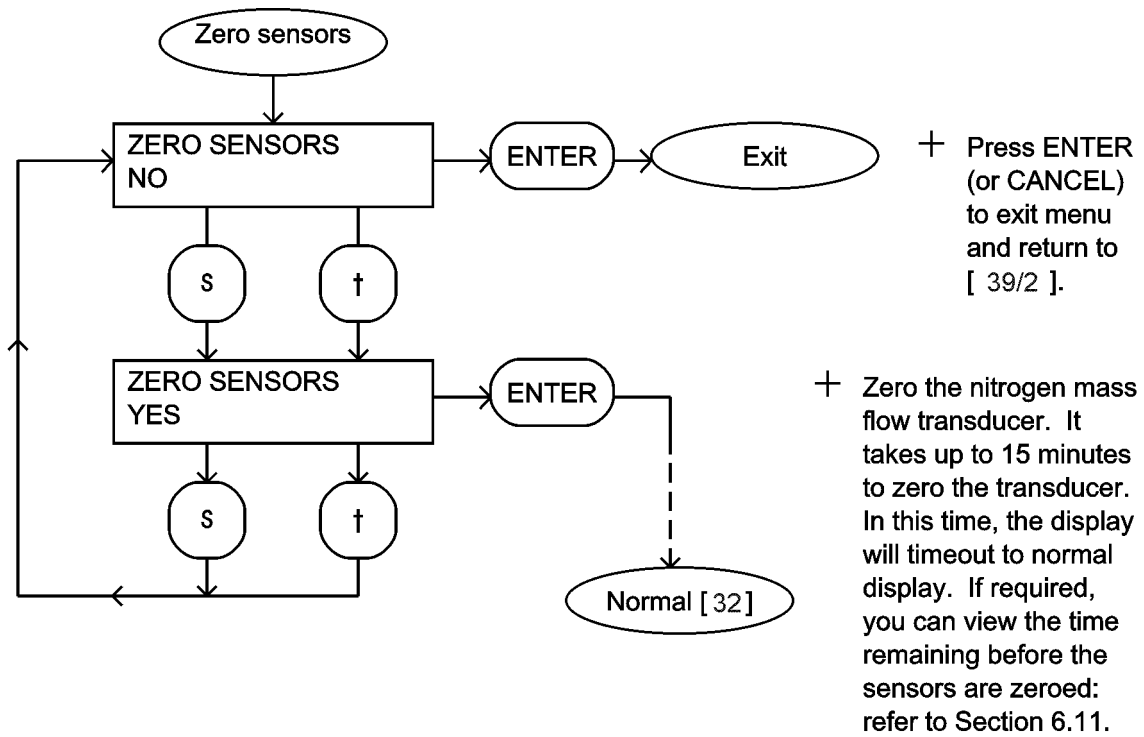


Figure 41 - Zero sensors menu



Note: You should only use this menu if you have been suitably trained by Edwards Service Personnel. If necessary, contact Edwards or your supplier to arrange suitable training.

The actual values displayed depend on the build standard of your system (as identified by its serial number). Contact Edwards if you are unsure what values should be displayed for your system

Figure 42 - Gas valve control menu

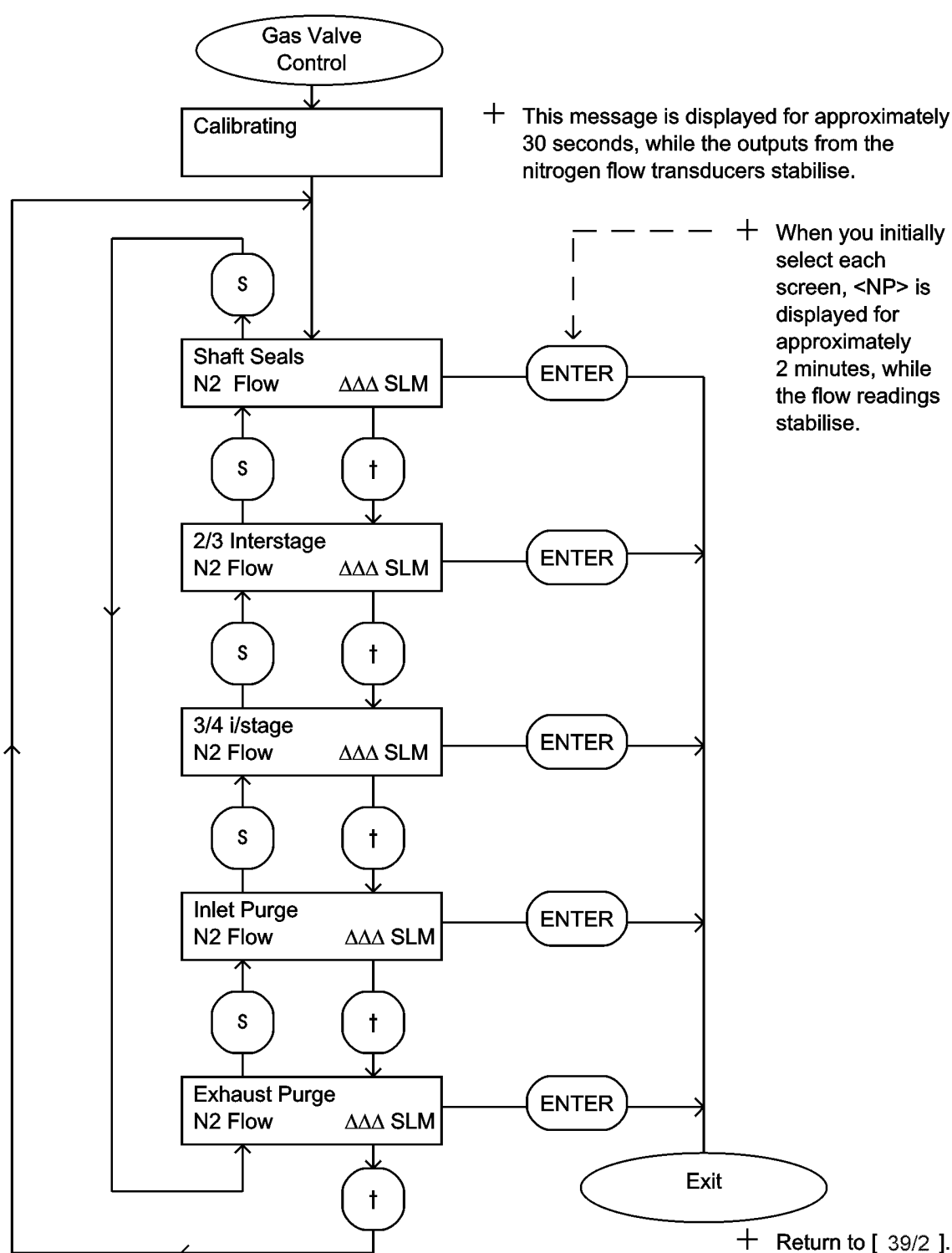


Figure 43 - Manual menu sheet 1 of 3

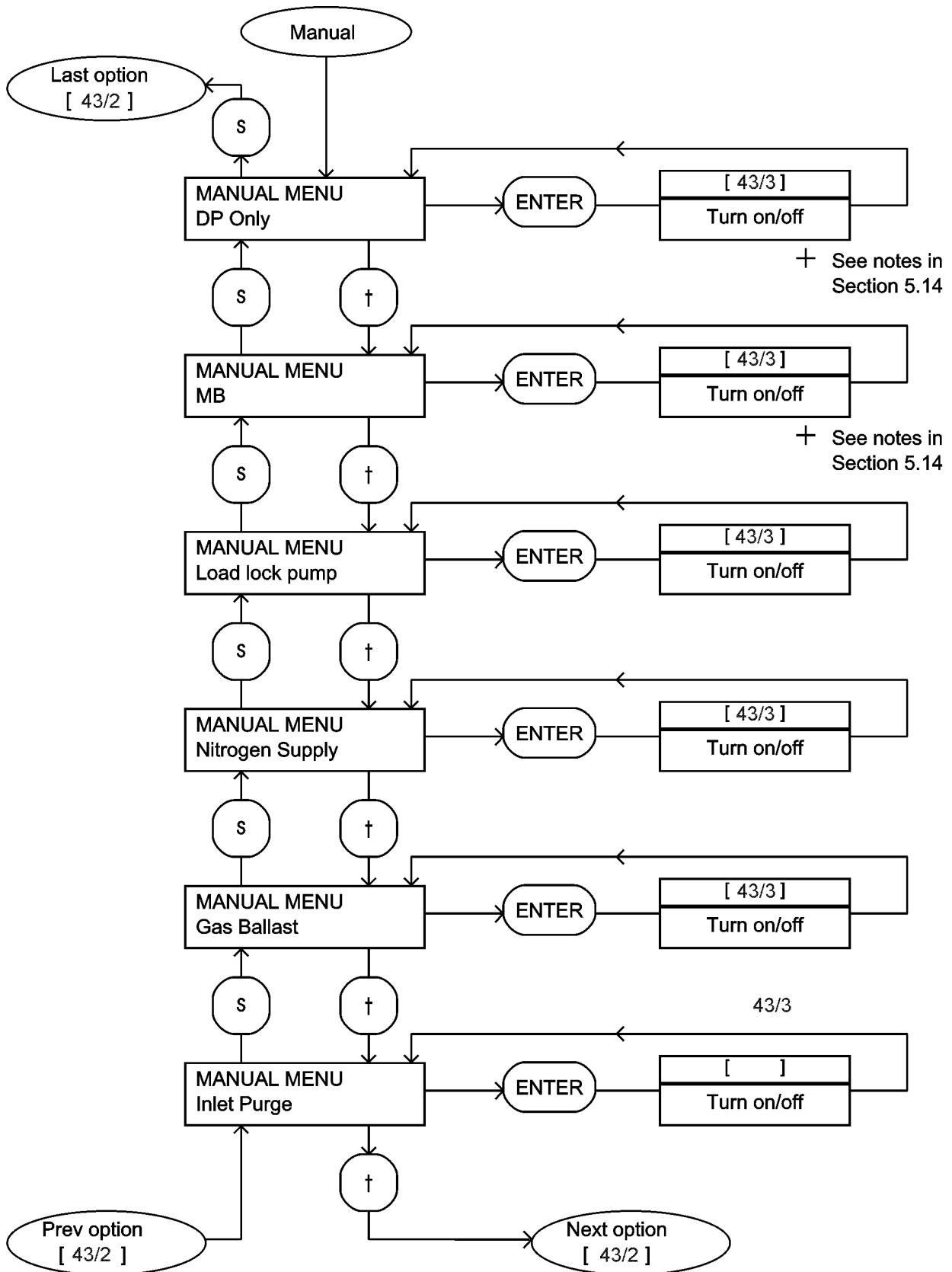


Figure 43 - Manual menu sheet 2 of 3

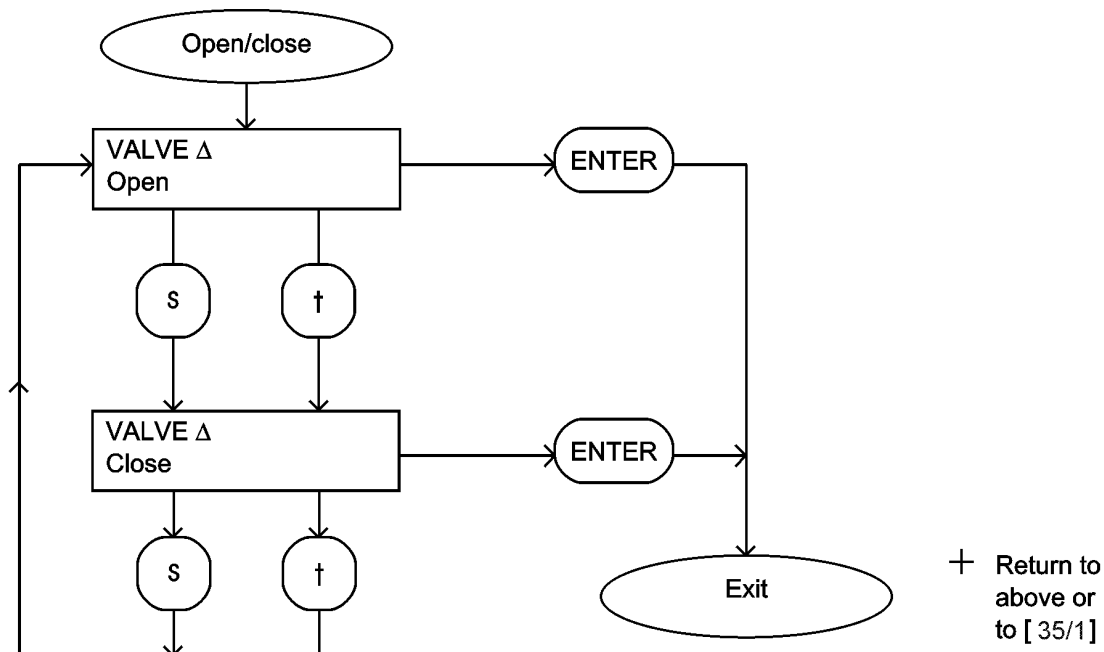
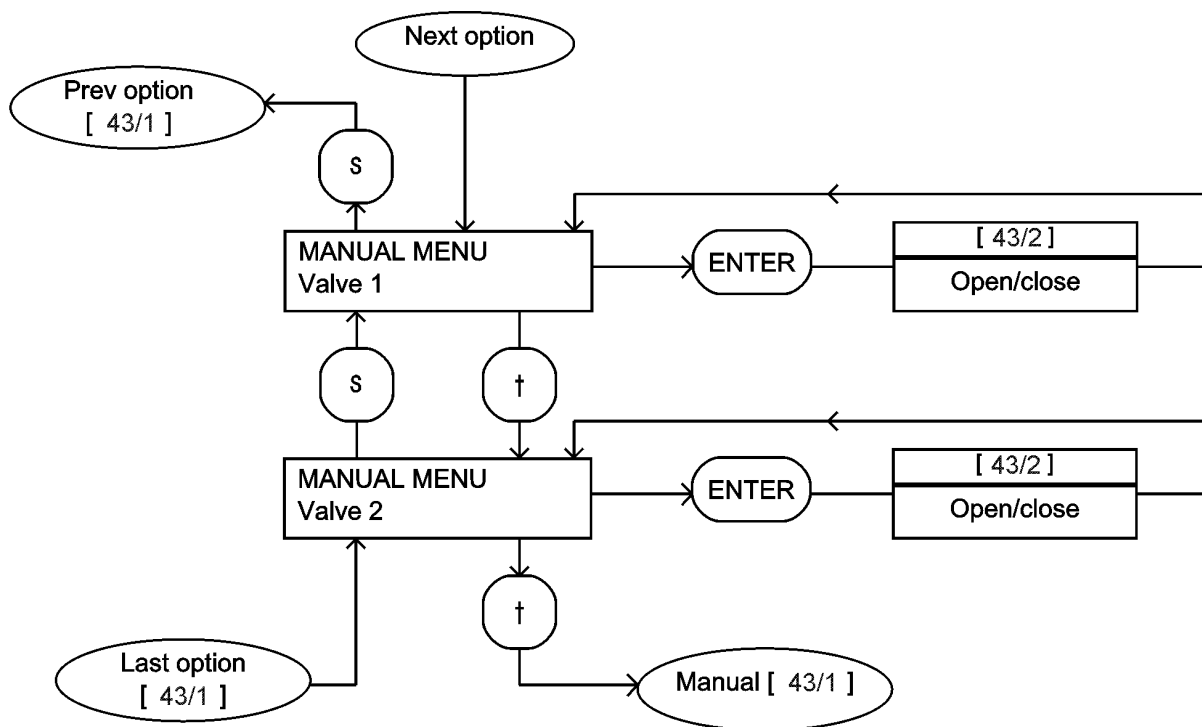


Figure 43 - Manual menu sheet 3 of 3

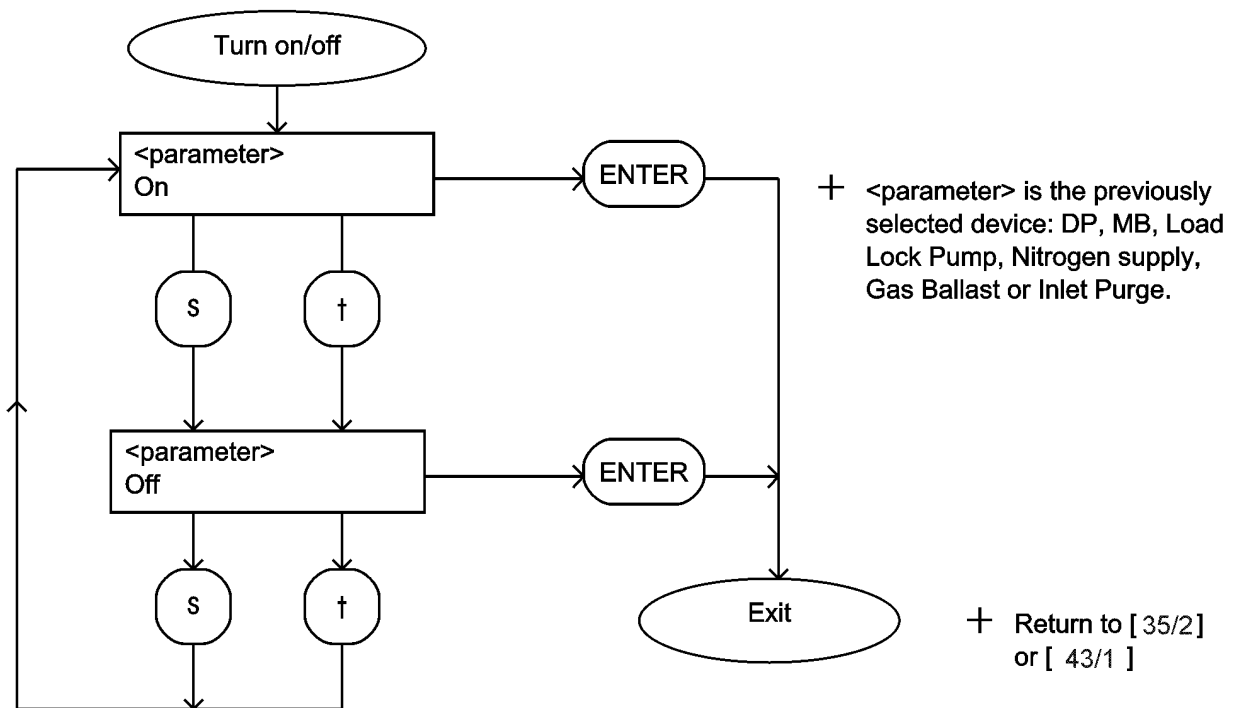


Figure 44 - View status menu sheet 1 of 2

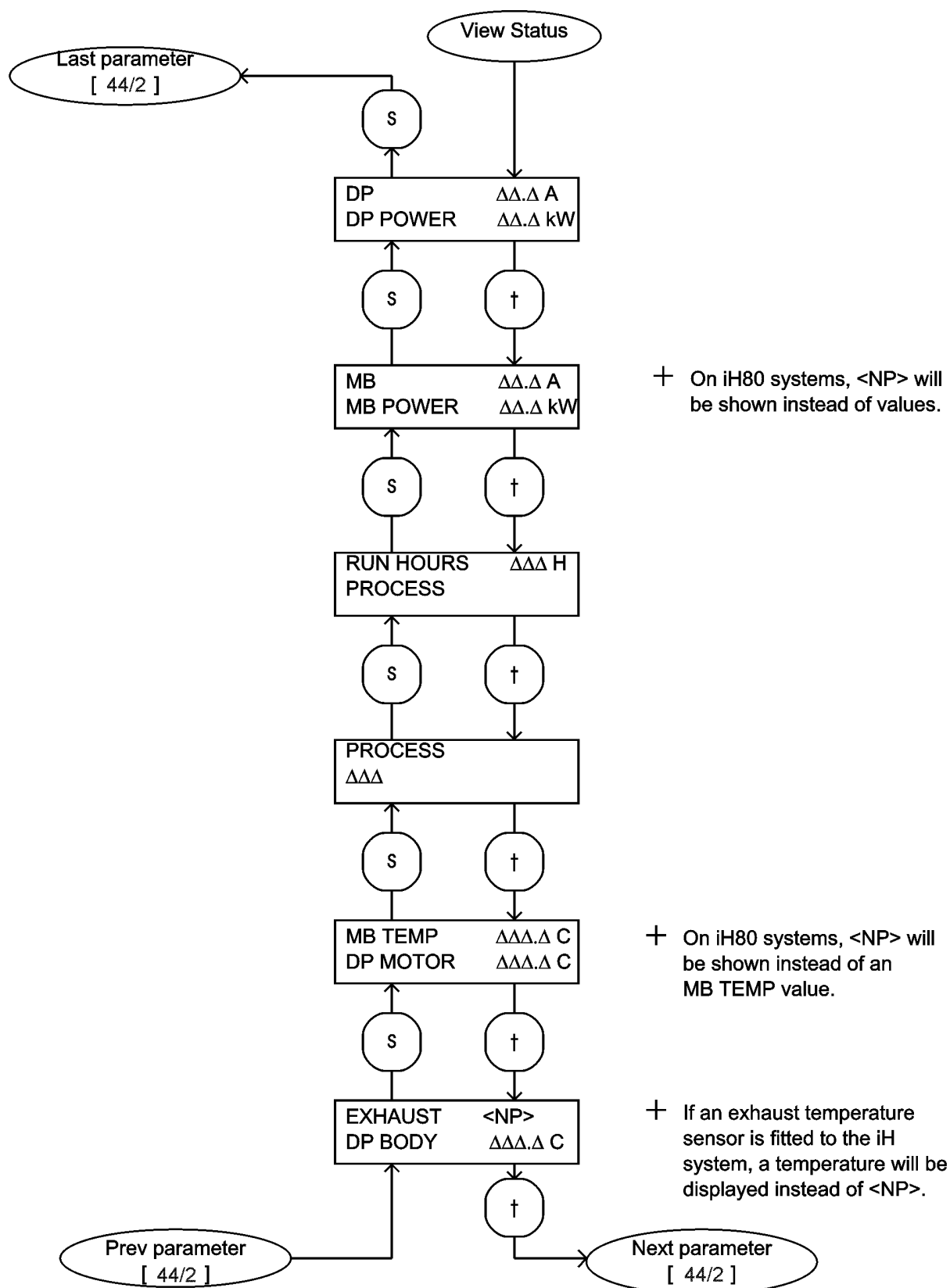


Figure 44 - View status menu sheet 2 of 2

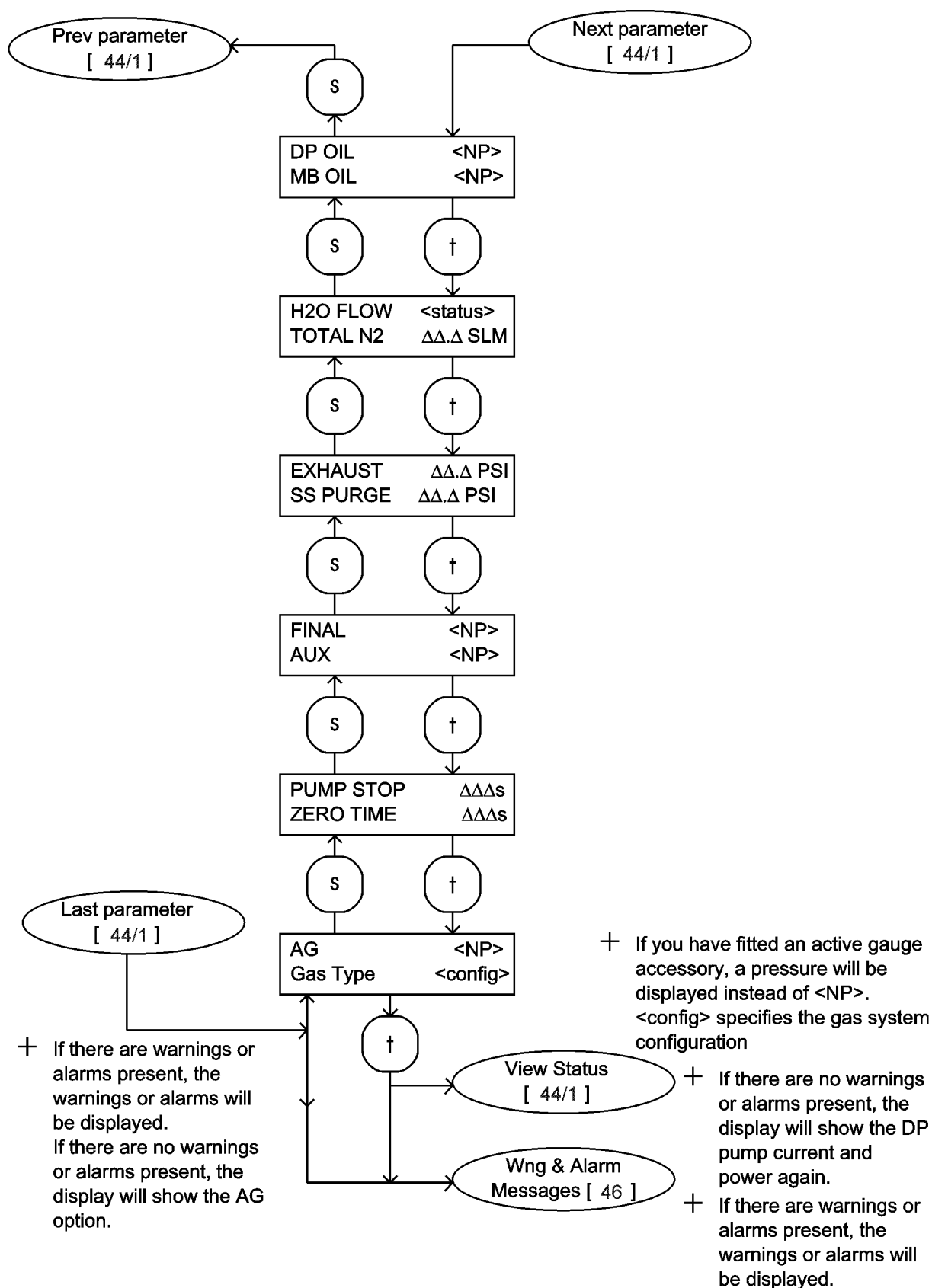


Figure 45 - Message menu

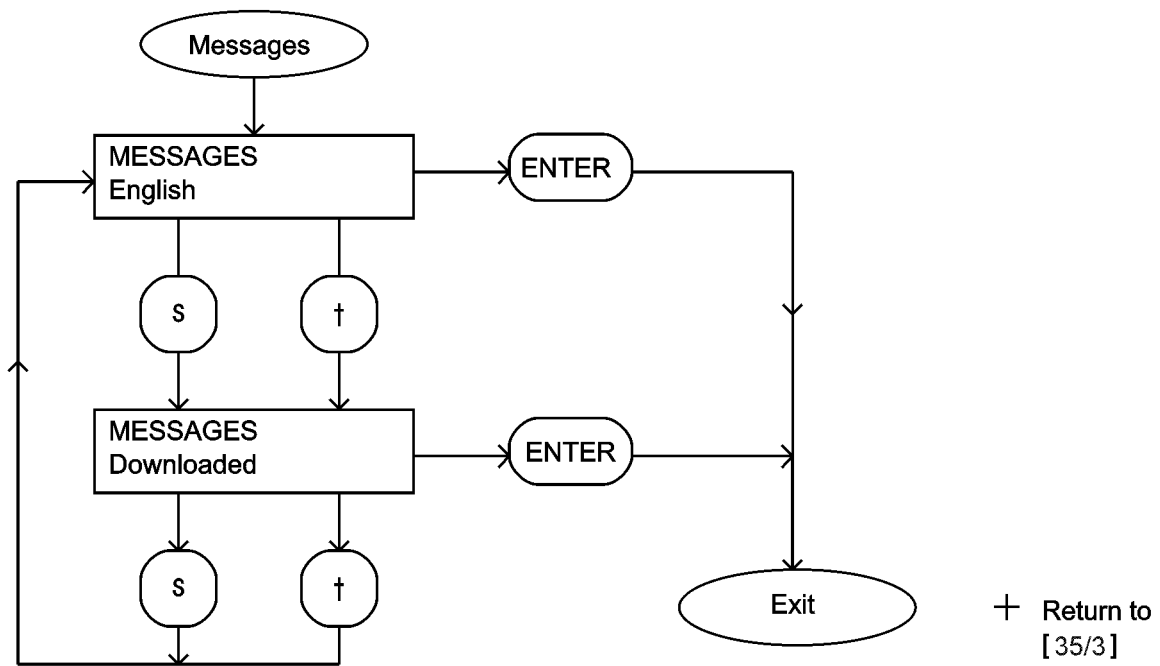
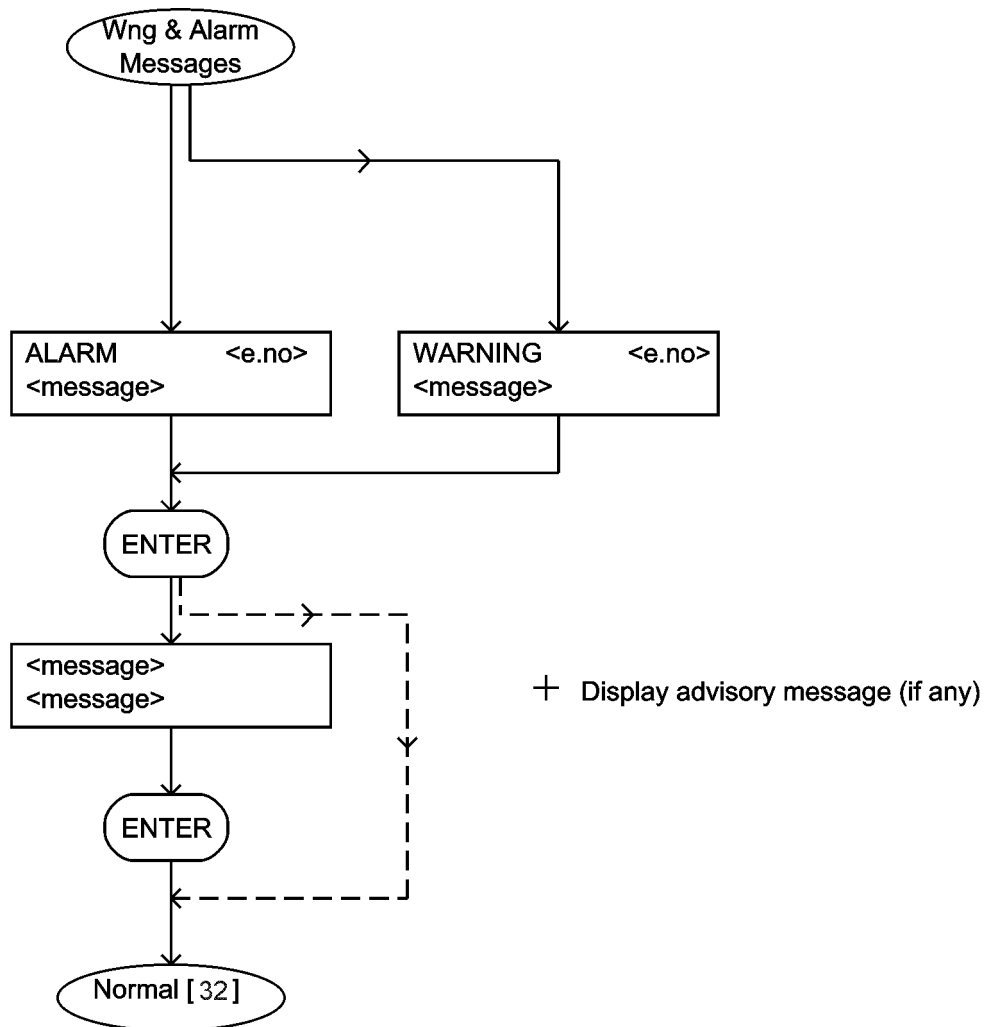


Figure 46 - Warning and alarm messages menu



This page has been intentionally left blank.

5 Operation

5.1 Introduction

The following sections describe the use of the Pump Display Module to operate the iH system. For a description of the use of an Interface Module or Communications Module accessory to operate the iH system, refer to the instruction manual supplied with the Module. For a description of the operation of the load-lock pump (if you have connected the iH system to the load-lock pump through an Interface Module), refer to [Section 5.15](#).

The following sections summarise the use of the menus in the Pump Display Module. We refer to menus such as 'the Setup/Service/Configuration menu'. Refer to [Figure 8](#) or [28](#): this means that you:

- Press the Setup button (7) to select the Setup menu.
- Use the up and down buttons (5, 3) to show the Service option and press ENTER (6) to select the Service menu.
- Use the up and down buttons (5, 3) to show the Configuration option and press ENTER (6) to select the Configuration menu.

We recommend that you fully understand the use of the Pump Display Module menus and buttons before you operate the iH system. Refer to [Section 4](#) which fully defines the menus, the use of the buttons and the display formats.

Note that you must switch on the electrical supply to the iH system before you can use the Pump Display Module.

5.2 Configure the system (optional)

CAUTION

Ensure that you use the correct configuration setpoints for your application. If you do not, the iH system may be damaged during operation.

Note: If you download a configuration set to the iH system, an Edwards engineer must adjust the variable restrictors in the gas system (see [Section 1.4](#)) to suit the application. Contact your nearest Edwards Service Centre to arrange this.

If you have a Single Pumpset Monitor connected to the iH system, the Monitor contains three configuration sets which contain preset configuration values (for example setpoints) for the iH system, for light, medium and process duty applications. [Table 13](#) shows the nominal flow rates associated with each of these configuration stores.

You can use the Single Pumpset Monitor to download one of these configuration sets to the iH system. Ensure that you use the correct configuration set for your application; contact your supplier or Edwards for advice before you download a configuration set.

Table 13 - Configuration store nominal gas flows

Purge gas flow	Nominal flow rates (slm)			
	Low gas configuration store	Medium gas configuration store	Medium gas + exhaust configuration store	High gas configuration store
Shaft-seals purge	4	4	4	4
2/3-interstage purge	-	10	10	5
3/4-interstage purge	-	10	10	30
Exhaust-purge	-	-	5	5
Total purge	4	14	19	44

5.3 Change the display format

5.3.1 Change the normal display

During normal operation (or whenever the Normal menu is selected), the Pump Display Module will show the first page of the normal display. The normal display has two pages and each page can show the readings of one or more sensors or internal clocks or counters. As supplied, the information shown on the first page is:

- HCDP pump power consumption
- HCDP pump-body temperature.

If you press the up or down button, the Pump Display Module will then show the second page of normal display; as supplied, the information shown on the second page is:

- HCMB pump power consumption
- HCMB pump temperature.

If required, you can use the Setup/Normal display menu to change the information shown on the two normal display pages.

5.3.2 Change the display units

If required, you can change the Pump Display Module display units:

- Pressures shown on the Pump Display Module can be displayed in either kPa or psi. Use the Setup/Units/Pressure menu to change the pressure display units.
- Temperatures shown on the Pump Display Module can be displayed in either °C or °F. Use the Setup/Units/Temperature menu to change the temperature display units.
- Pressures measured by an optional Active Gauge connected to the iH system, can be shown on the Pump Display Module in either mbar, kPa or Torr. Use the Setup/Units/AG menu to change the Active Gauge pressure display units.

5.4 Take and release control

To use the Pump Display Module to control the operation of the iH system, the Local control LED on the Pump Display Module ([Figure 8](#), item 9) must be on. If the LED is not on, use the Control menu to take control. You cannot take control with the PDM if another module already has control.

If you need to use another module (for example, the iH Interface Module) to operate the iH system, the Local control LED on the Pump Display Module ([Figure 28](#), item 9) must be off. If the LED is on, use the Control menu to release control.

If you use the Pump Display Module to start up the iH system and you then disconnect the Module from the iH for 150 seconds or more, the iH system will automatically assume that the Pump Display Module has released control; you will then have to use one of the following methods to shut down the iH system:

- Take control with the Pump Display Module again, then shut down the iH system as described in [Section 5.9](#).
- Take control with another module and use that module to shut down the iH system.
- Use the emergency stop switch, as described in [Section 5.11](#).

5.5 Start-up



WARNING

Do not operate the iH system with any enclosure panels removed and do not touch any parts of the pump(s) when the iH system is on. Surfaces of the pump(s) are very hot and can cause injury to people.



WARNING

Ensure that it is safe to start the iH system. If you do not (and for example, maintenance is being performed downstream of the iH system), you could cause injury to people.

Note: When you use the Pump Display Module to start up the iH system, we recommend that you do not disconnect the Module from the iH system; if you do, you will not be able to use the Module to instantly shut down the iH system: see [Section 5.4](#).

Operation of the iH system with high inlet pressure may result in shaft-seal pressure warnings (refer to [Table 15](#)): the operation of the iH system will not be affected, and you can ignore these warnings.

Use the following procedure to start up the iH system:

1. Switch on the cooling-water supply, the nitrogen supply and the external electrical supply (if not already on).
2. Ensure that the exhaust-extraction system is not blocked and that valves in the exhaust-extraction system are open.
3. Ensure that the Pump Display Module has control of the iH system: refer to [Section 5.4](#).
4. Refer to [Figure 28](#). Look at the display (2) on the Pump Display Module:
 - If there are any warnings or alarms, take the necessary corrective action (refer to [Section 6](#)); do not start the iH system.
 - If there are no alarms or warnings displayed, use the Switch On menu to switch on the iH system.

When you switch on, the following actions will occur (with a small time delay between each action):

- The LED on the On button on the Pump Display Module will start to flash.
- The HCDP pump will be switched on.
- The LED on the On button on the Pump Display Module will stay permanently on.
- The solenoid-valve(s) in the Gas Module will open to switch on the nitrogen supplies to the HCDP pump.
- On iH600/iH1000 systems, after the booster start delay, the HCMB pump will be switched on.

5.6 Check the nitrogen pressure and adjust if necessary

Note: You must only check and adjust the nitrogen pressure after the iH system has been operating for at least four hours, so that the HCDP pump is at its correct operating temperature.

You must check and adjust the nitrogen pressure when you first use the iH system. Thereafter, we recommend that you regularly check and adjust the nitrogen pressure, to ensure optimum shaft-seals performance and to maximise the life of the shaft-seals.

When you need to adjust the nitrogen pressure:

- Turn the pressure regulator clockwise to increase the pressure.
- Turn the pressure regulator anticlockwise to decrease the pressure.

Use the following procedure to check and adjust the nitrogen pressure:

1. Use the Setup/Inlet Purge menu to turn off inlet-purge.
2. Use the Setup/Gas ballast menu to turn on gas-ballast.
3. Refer to [Figure 3](#). If the pressure low LED (6) and the pressure high LED (5) are both on and the pressure warning LED (3) is off, the nitrogen pressure is correct, otherwise continue at Step 4.
4. Pull up the top of the pressure regulator (4) to unlock it.
5. Adjust the pressure regulator (4) until the pressure high and pressure low LEDs (5, 6) are both on and the pressure warning LED (3) is off. Alternatively, use the Status/SS purge menu to display the nitrogen flow, and adjust the pressure regulator (4) until a pressure of 6.0 psi is displayed.
6. Push down the top of the pressure regulator (4) to lock it.

5.7 Monitor the status of the iH system

Note: If you have selected the Status menu and then do not press any button for five minutes, the display will change to the Normal display: refer to [Section 5.3](#).

If a sensor is not fitted, the corresponding display line will show 'NP' (not present).

Use the Status menu or the Setup/Service/View Status menu to display sensor readings and the values of internal clocks and counters. The information that can be displayed (up to two items of information at a time) is shown in [Table 14](#).

5.8 Warning and alarm indications

Note: Refer to [Section 6](#) for a full list of the warning and alarm messages and their meanings.

Unless you have changed the corresponding setpoints (see [Section 5.2](#)), nitrogen purge flow and pressure warning conditions will occur if an iH80 system is operated for extended periods with the inlet pressure close to atmospheric pressure.

If a warning or alarm condition exists:

- The top line of the display on the Pump Display Module will change to 'WARNING' or 'ALARM', together with an error number.
- The bottom line of the display will show the warning or alarm message or (for some errors) will be blank.
- The warning or alarm LED on the Pump Display Module will flash.

To acknowledge the warning or alarm, press the ENTER button. If the warning or alarm condition has cleared, the warning or alarm LED will go off. If the warning or alarm condition is still present:

- The warning or alarm LED will stay on.
- If the warning or alarm condition does not have an advisory message (see [Section 6.17](#)), the display will then change to normal display: see [Section 5.3](#).
- If the warning or alarm condition has an advisory message (see [Section 6.17](#)), the display will show two lines which describe a simple check which you can make to identify the cause of the fault and to rectify the fault. When you have read the message, press the ENTER button again; the display will then change to normal display: see [Section 5.3](#).

Table 14 - Status menu sensor reading displays

Sensor data	Units	Notes ▼
HCDP pump current consumption	A	
HCDP pump power consumption	kW	
HCMB pump current consumption *	A	
HCMB pump power consumption *	kW	
Total running time	hours	Total run-time of the iH system.
Process running time †	hours	Total run-time on process.
Process cycles †	-	Process cycles.
iH cycles	-	The number of times the iH system has been switched on/off.
HCMB pump temperature *	°C/°F	
HCDP pump-motor water manifold surface temperature	°C/°F	
Exhaust temperature ▲	°C/°F	
HCDP pump body temperature	°C/°F	
Water flow	-	OK indicates the cooling-water flow is acceptable; CHECK indicates that the flow is too low, or that the water flow-switch is faulty or disconnected: see Section 6 .
Total nitrogen flow	slm	Total nitrogen flow rate through the Gas Module.
Exhaust pressure	kPa/psi	
Shaft-seals purge pressure	kPa/psi	
Pump stop time	seconds	
Pump zero time	seconds-	
Valve 1*		The open/closed state of the gate valve (if an iH interface controlling a gate valve is fitted).
Active gauge pressure ▲	mbar/kPa/Torr	
Gas system configuration	-	"low", "medium", "med+exh" or "high".
Warning/alarm messages #	-	Refer to Section 6 for a list of the messages.

* iH600/iH1000 only.

† These display items require signals from the process tool to indicate when the process is on and off, hence these items are only available if you have an iH Interface Module.

▲ Only available for display if the appropriate optional accessory is fitted to the iH system.

These messages cannot be manually selected to be displayed on the Normal display, but will be automatically displayed on the Normal display when a warning or alarm condition exists.

▼ NP or NR can also be displayed to identify the status of a sensor: refer to [Section 4.4](#).

5.9 Manual shut-down



WARNING

If you intend to do maintenance on the iH system after you have shut it down and you will not isolate the iH system from the electrical supply, do not disconnect the Pump Display Module or release control from the Pump Display Module (see [Section 5.4](#)) If you do, the iH system could be started by another Module.

Note: Press the Cancel button on the Pump Display Module to cancel a shut-down request. The purge time for the Auto shut-down option is preset to 15 minutes as supplied. This purge time can be configured for your application.

Ensure that it is safe to shut down the iH system before you select shut-down.

Use the Switch Off menu to shut down the iH system. Note that the menu has two shut-down options: Fast and Auto. We recommend that you use the Auto shut-down option. This ensures that the iH system is purged with nitrogen for 15 minutes before it is shut down.

When you select Auto shut-down, the following actions will occur (with a small time delay between each action):

- On an iH600 or iH1000 system, the HCMB pump is switched off.
- The LED on the On button on the Pump Display Module (Figure 8, item 1) starts to flash.
- If not already open, the gas solenoid-valves are opened to switch on the nitrogen purges to the iH system.
- After 15 minutes, the gas solenoid-valves are closed to switch off the nitrogen purges to the HCDP pump, and at the same time the HCDP pump is switched off.
- The LED on the On button on the Pump Display Module goes off.

If you need to shut down the iH system quickly, use the Fast shut-down option. When you select Fast shut-down, the following actions will occur (with a small time delay between each action):

- On an iH600 or iH1000 system, the HCMB pump is switched off.
- The gas solenoid-valves are opened to switch on the nitrogen purges to the HCDP pump.
- After approximately 15 seconds (for an iH80/iH600 system) or approximately 30 seconds (for an iH1000 system), the gas solenoid-valves are closed to switch off the nitrogen purges to the HCDP pump, and at the same time the HCDP pump is switched off.
- The LED on the On button on the Pump Display Module (Figure 8, item 1) goes off.

5.10 Automatic shut-down

CAUTION

If you select 'Run til crash', the pump(s) can be damaged and you may invalidate any warranties on the iH system equipment.

Note: The emergency stop button, the emergency stop signal from your control equipment (if fitted) and the safety sensors (see Section 1.10.3) will still shut down the iH system, even if you have selected 'Run til crash'.

Use the Setup/Run Til Crash menu to select 'run til crash'.

'Run til crash' is automatically reset to 'off' when the iH system is disconnected from the electrical supply, or the electrical supply is switched off.

Normally, if an alarm condition exists, the Electrics and Pump Control Module will shut-down the iH system. If required, you can request 'run til crash' operation. In this mode of operation, most alarm conditions will be ignored and the pump(s) will continue to operate. Note however that for safety reasons the following alarms will shut down the iH system even if you have selected 'run til crash':

- HCDP CURRENT HIGH/LOW (error numbers 310 and 312).
- HCDP THERMISTOR HIGH (error number 512).
- EXHAUST PRESSURE (error number 3912).

On an iH600 or iH1000 system, the following alarms will cause only the HCMB pump to shut down, provided 'run til crash' is not selected:

- HCMB POWER HIGH/LOW (error numbers 810 and 812).
- HCMB PHASE IMBALANCE (error number 1012).

On an iH600 or iH1000 system, the following alarms will cause only the HCMB pump to shut down, whether 'run til crash' is selected or not:

- HCMB CURRENT HIGH/LOW * (error numbers 710 and 712).

- HCMB THERMISTOR HIGH (error number 912).
- - (error number 701) [†].

5.11 Emergency stop

Note: The emergency stop switch is not an electrical isolator.

The use of emergency stop will not automatically shut down the load lock pump (if fitted); you must shut down the load lock pump separately.

To shut down the iH system in an emergency, press the emergency stop switch (Figure 3, item 1) on the front panel. Alternatively, you can operate the emergency stop controls in your own control system if you have connected your emergency stop circuit to the iH system as described in Section 3.15.

When emergency stop is selected:

- The HCDP pump (and the HCMB pump, on iH600 and iH1000 systems) is switched off.
- The solenoid-valve(s) in the Gas Module close, to switch off the supply of nitrogen to the HCDP pump.
- The Pump Display Module will display 'STOP ACTIVATED'.
- The LED on the On button on the Pump Display Module (Figure 8, item 1) will go off.

5.12 Restart the HCMB pump after automatic pump shut-down (iH600/iH1000 only)

If the HCMB pump has been automatically shut down due to an alarm (see Section 5.10), use the Switch On/Booster Pump menu to restart the HCMB pump after the alarm condition has cleared.

5.13 Restart the iH system after an emergency stop or automatic shut-down



WARNING

If a pump is automatically shut-down, ensure that it is safe to restart before restarting the pump.

Note: If the iH system has automatically shut down because of high HCDP pump power (alarms 412 and 512), check that the HCDP pump is free to rotate before you restart the iH system: refer to Section 6.17.

If you have used the emergency stop switch on the front panel to shut down the iH system, you must reset the emergency stop switch before you can restart the iH system. Turn the emergency stop switch to reset it, then restart the iH system as described in Section 5.5. Note that the 'STOP ACTIVATED' alarm message (see Table 16) will stay on the Pump Display Module until you restart the pumping system.

If the iH system has been automatically shut down because of an alarm condition, the alarm condition must be rectified before you can restart the iH system. For example, if the iH system has been shut down because the HCDP pump-body is too hot, the pump-body must be allowed to cool before you can restart the iH system. Restart the iH system as described in Section 5.5.

5.14 Operation of the iH system components



WARNING

Ensure that it is safe to start the iH system. If you do not (and for example, maintenance is being performed on components downstream of the iH system), you could cause injury to people.

CAUTION

On an iH600 system, do not operate the HCMB pump unless the HCDP pump is on and has been operating for longer than the booster start delay. If you do, you may damage the iH system

CAUTION

Ensure that you do not over-pressurise the vacuum system if you switch on the purge gas flow when the pump(s) are not on.

Note: The gate valves must be connected to the iH system through an iH Interface Module with an Auxiliary Interface Card.

When you manually start the HCDP pump or (on an iH600 or iH1000 system) the HCMB pump, the pump will only operate for 10 seconds and will then automatically be switched off again.

Although you can select and use the Setup/Service/Manual/MB menu, this will have no effect on the HCMB pump; that is, you cannot use the menu to manually switch the HCMB pump on and off.

In normal operating conditions, the components of the iH system are operated automatically.

If necessary (for example, for fault finding purposes), you can control the operation of iH system components separately:

- Use the Setup/Service/Manual/Gas Module menu to control the operation of the Gas Module (that is, turn the nitrogen supply, gas-ballast and inlet-purge flows on and off).
- Use the Setup/Service/Manual/Valve menu to control the operation of the gate valves (that is open or close the valves).
- Use the Setup/Service/Manual/DP Only menu to control the operation of the HCDP pump (that is, switch the HCDP pump on and off).

5.15 Operation of the load-lock pump

Note: Operation of the iH system with high inlet pressure may result in shaft-seal pressure warnings (refer to Table 15): the operation of the iH system will not be affected, and you can ignore these warnings.

If you have connected a load-lock pump to the iH system through an Interface Module, you can use the following menus to control the operation of the load-lock pump:

- Switch On.
- Switch Off.
- Setup/Service/Manual/Load lock pump.

6 Maintenance

6.1 Safety



WARNING

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

- A suitably trained and supervised technician must maintain the iH system.
- Ensure that the maintenance technician is familiar with the safety procedures which relate to the products pumped. Wear the appropriate safety-clothing when you come into contact with contaminated components. Dismantle and clean contaminated components inside a fume-cupboard.
- Allow the pumps to cool to a safe temperature before you start maintenance work.
- Vent and purge the iH system with nitrogen before you start any maintenance work.
- Isolate the iH system and other components in the process system from the electrical supply so that they can not be operated accidentally. Note that the emergency stop switch on the iH system is not an electrical isolator.
- On an iH1000 system:
 - Wait for at least four minutes after you have switched off the electrical supply before you touch any electrical component on the iH system.
 - Never operate the iH system (even for test purposes) unless a second protective earth (ground) is fitted: refer to [Section 3.16.3](#).
- Recheck the pump rotation direction if the electrical supply has been disconnected.
- Do not reuse 'O' rings or 'O' ring assemblies.
- 'O' ring replacement intervals will vary depending on your application: contact Edwards for advice.
- Dispose of components, grease and oil safely (see [Section 7.2](#)).
- Take care to protect sealing-faces from damage.
- Do not touch or inhale the thermal breakdown products of fluorinated materials which may be present if the iH system has been overheated to 260 °C and above. These breakdown products are very dangerous. Fluorinated materials in the iH system may include oils, greases and seals. The iH system may have overheated if it was misused, if it malfunctioned or if it was in a fire. Edwards Material Safety Data Sheets for fluorinated materials used in the pump are available on request: contact your supplier or Edwards.
- Leak-test the system after maintenance work is complete if you have connected or disconnected any vacuum or exhaust joints; seal any leaks found.

6.2 Correct use of Swagelok connectors

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

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

6.2.1 Fit a Swagelok connector

1. Refer to [Figure 47](#) detail A. Undo and remove the nut (4) from the Swagelok connector (1). Ensure that the front (tapered) ferrule (2) and the rear ferrule (3) are correctly orientated as shown in detail A, then loosely refit the nut (4) to the connector (1).
2. Refer to detail B. Insert the tube (5) through the nut (4) and into the Swagelok connector (1). Ensure that the tube rests firmly on the shoulder inside the fitting, and that the nut (4) is finger tight.
3. Tighten the nut (4) until you cannot rotate the tube (5). If you cannot turn the tube because of how it is installed, tighten the nut by 1/8 th of a turn.
4. Refer to detail C. Mark the nut (4) at the six o'clock position.
5. Refer to detail D. Hold the body of the connector steady, then turn the nut (4) by 1 1/4 turns (to the nine o'clock position) to fully tighten the connection.

6.2.2 Reconnect a Swagelok connector

You can disconnect and reconnect a Swagelok connector many times and still obtain a correct leak-proof seal. Refer to [Figure 48](#) detail A which shows a Swagelok connector after you have disconnected it. Use the following procedure to reconnect it:

1. Refer to detail B. Insert the tube (5) with the swaged ferrules (2, 3) into the Swagelok fitting (1), until the front ferrule (2) is fully in the body of the fitting.
2. Refer to detail C. Tighten the nut (4) by hand.
3. Use a wrench or spanner to turn the nut (4) to its original position (you will feel an increase in resistance when the nut is in its original position), then tighten the nut slightly.

6.3 Maintenance frequency

The iH system requires little user maintenance. The maintenance operations you can carry out are described in the following sections. The frequency of maintenance operations depends on your process. Adjust the frequency of maintenance operations according to your experience.

When you maintain the iH system, use Edwards maintenance and service kits. These contain all of the necessary seals and other components necessary to complete maintenance operations successfully.

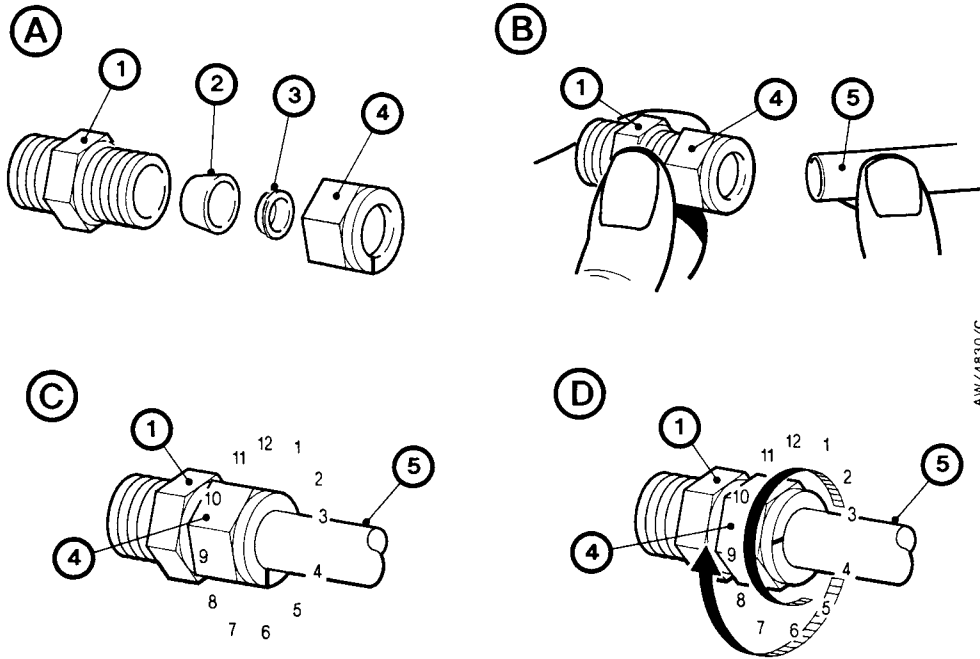
6.4 Inspect the connections, pipelines, cables and fittings

Note: Refer to [Section 6.2](#) if you have to connect, disconnect or tighten Swagelok fittings.

1. Remove the enclosure side and top panels: refer to [Section 3.4](#).
2. Check that all the cooling-water connections are secure; tighten any loose connections. Inspect all cooling-water pipelines, hoses and connections and check that they are not corroded or damaged and do not leak; repair or replace any pipelines, hoses and connections that are corroded or damaged, or which leak.
3. Check that all the nitrogen connections are secure; tighten any loose connections. Inspect all nitrogen pipelines and connections and check that they are not corroded or damaged and do not leak; repair or replace any pipelines and connections that are corroded or damaged, or which leak.
4. Check that all electrical connections are secure; tighten any loose connections. Inspect all electrical cables and connectors for damage; replace any cables and connectors that are damaged.
5. Check that all process and exhaust connections are secure; tighten any loose connections. Inspect all process and exhaust pipelines and fittings and check that they are not corroded or damaged; replace any pipelines or fittings that are corroded or damaged.

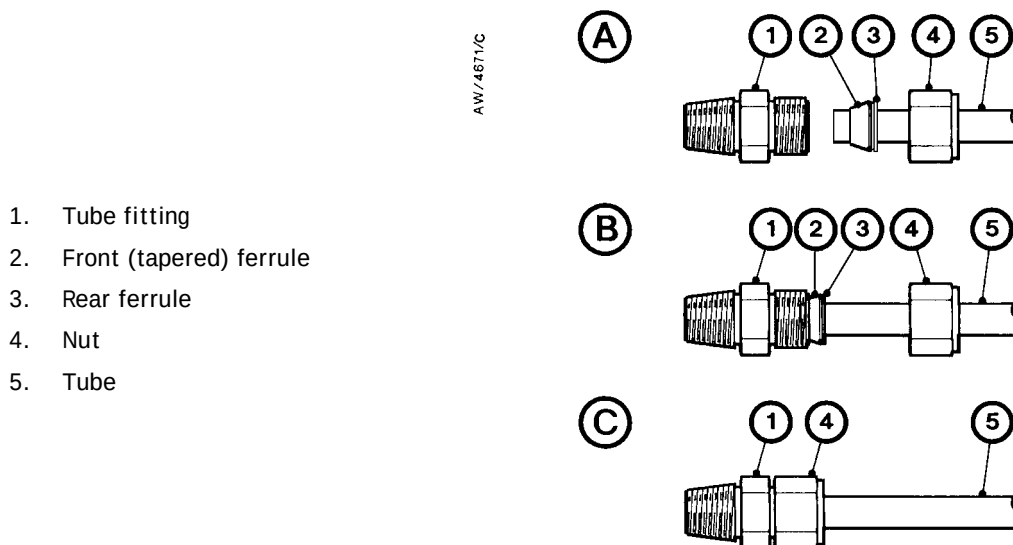
6. Refit the enclosure side and top panels: refer to [Section 3.17](#).

Figure 47 - Fit a tube fitting



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

Figure 48 - Re-tighten a tube fitting



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

6.5 Check the purge gas flow rates

Use the Service/Gas valve contrl menu to regularly check the purge gas flow rates against the nominal flow rates shown in [Table 13](#).

6.6 Inspect and clean the exhaust-pipe, elbow and check-valve



WARNING

The substances that accumulate in the exhaust-pipe, elbow and check-valve can be dangerous. Do not allow these substances to come into contact with your skin or eyes. Do not inhale the vapours from these substances. Fit blanking caps to the inlet and outlet flanges when you move the exhaust-pipe, elbow or check-valve around your workplace.

6.6.1 Dismantle, clean and refit the exhaust-pipe and elbow

Use the following procedure to dismantle, clean and refit the exhaust-pipe and elbow. Refer to [Figure 1](#).

1. Remove the NW40 clamp and trapped 'O' ring on the outlet flange of the check-valve (18) to disconnect the iH system from your exhaust-extraction pipeline. Dispose of the trapped 'O' ring.
2. Remove the NW40 clamp and trapped 'O' ring which secures the check-valve (18) to the exhaust-pipe (19) and remove the check-valve. Dispose of the trapped 'O' ring.
3. Inspect the exhaust-pipe (19). If you do not need to remove the exhaust-pipe from the pump to clean it, continue at Step 12. If you need to remove the exhaust-pipe from the pump to clean it, continue at Step 4.
4. Undo and remove the bolt which secures the exhaust-pipe bracket to the iH system.
5. Use a hexagonal key to remove the four M8 cap-head screws and washers which secure the exhaust pipe (19) to the HCDP pump, then remove the metal 'O' ring and the exhaust-pipe from the HCDP pump. Dispose of the 'O' metal ring.
6. Empty all loose deposits from the exhaust-pipe (19), then use a suitable tool (for example, a long bottle-brush) and a cleaning solution suitable for the deposits to clean the exhaust-pipe.
7. Check that the mating surfaces of the HCDP pump outlet and the inlet flange on the exhaust pipe (19) are not scratched or damaged: if necessary refinish the surfaces.
8. Apply a light wipe of vacuum grease to a new metal 'O' ring (available as a spare: see [Section 8.3](#)), then fit the 'O' ring to the 'O' ring groove on the flange on the exhaust-pipe (19).
9. Use the screws and washers (retained in Step 5) to secure the flange to the HCDP pump outlet and tighten by hand; ensure that the 'O' ring remains correctly in place.
10. Use a spanner to alternately and evenly tighten the four screws to a torque of 30 Nm.
11. Use the bolt (removed in Step 4) to secure the bracket on the exhaust pipe (19) to the iH system.
12. Continue at [Section 6.6.2](#) to clean and refit the check-valve.

6.6.2 Clean and refit the check-valve (if fitted)

1. Refer to [Figure 49](#). Unscrew the two halves (2, 4) of the check-valve body (if necessary, use a strap wrench, then remove the fluoroelastomer ball (3) and the 'O' ring (6).
2. Use a cleaning solution suitable for the deposits to clean the valve body and the fluoroelastomer ball. If necessary, replace the fluoroelastomer ball.
3. Inspect the 'O' ring groove and the flange sealing-faces for damage; refinish if necessary.
4. Apply a light wipe of vacuum grease to the 'O' ring (6), then position the 'O' ring in its groove in the valve body (4).
5. Ensure that the fluoroelastomer ball (3) is correctly positioned in the valve body, then screw the two halves of the valve body (2, 4) together.
6. Refer to [Figure 1](#). Apply a light wipe of vacuum grease to a new trapped 'O' ring, then use the trapped 'O' ring and clamp (removed in [Section 6.6.1](#)) to secure the check-valve (18) to the exhaust pipe (19). Ensure that the flow arrow on the check-valve ([Figure 49](#), item 7) points away from the exhaust pipe towards the exhaust-extraction system.
7. Apply a light wipe of vacuum grease to a new NW40 trapped 'O' ring, then use the trapped 'O' ring and the NW40 clamp (removed in [Section 6.6.1](#)) to secure the check-valve outlet to the exhaust-extraction system.

6.7 Check the HCMB pump oil-level (iH600/iH1000 only)



WARNING

Do not remove the oil filler-plug while the pump is operating. If you do, hot oil may be ejected from the pump.

CAUTION

Do not check the oil-level when the iH system is operating. The correct oil-level may not be shown when the pump is operating.

CAUTION

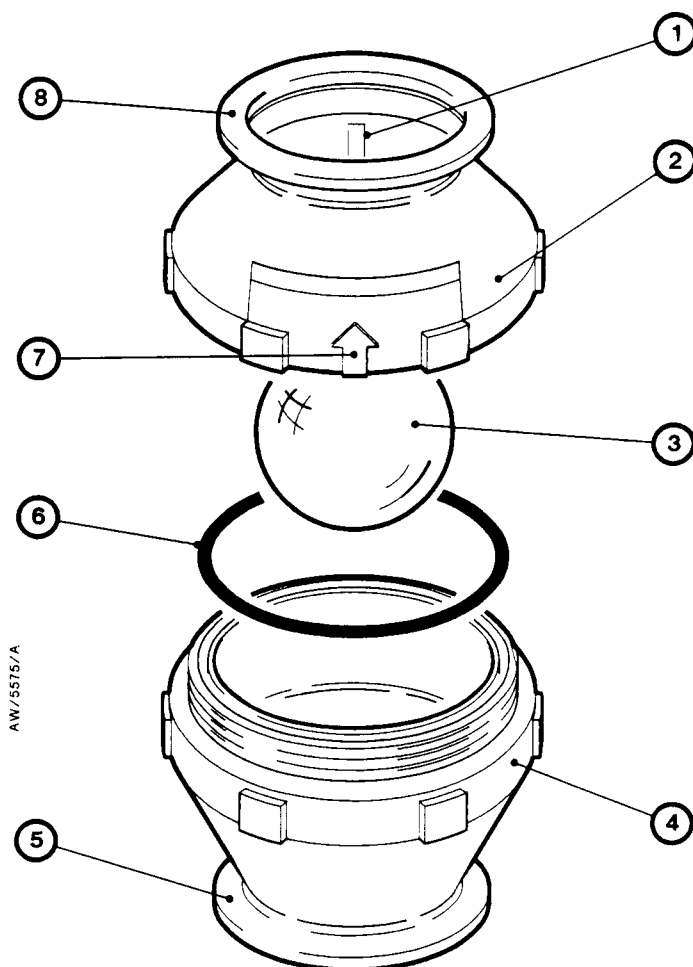
Ensure that the oil-level in the HCMB pump is correct. If the pump oil-level is incorrect, pump performance may be affected and the pump may be damaged.

Note: If there is a significant loss of oil from the pump, the shaft-seals may have failed. You cannot replace the shaft-seal. Contact your supplier or an Edwards Service Centre for advice.

You must check the oil-level every three months. Use the following procedure to check the oil-level.

1. Shut down the iH system (refer to [Section 5.9](#)) and allow it to cool.
2. Remove the right-hand side enclosure panel from the iH system: refer to [Section 3.4](#).
3. Refer to [Figure 1](#). Check that the oil-level is between the MAX and MIN marks on the bezel of the HCMB oil-level sight-glass (5):
 - If the oil-level is above the MAX mark, drain excess oil from the pump as described in [Section 6.10](#) until the oil-level is correct.
 - If the oil-level is below the MIN mark, fill the pump with oil until the oil-level is correct, as described in [Section 6.10](#).
4. Refit the right-hand side enclosure panel: refer to [Section 3.17](#).

Figure 49 - Clean the exhaust check-valve



- | | |
|-------------------------|-------------------------|
| 1. Spider leg | 5. Inlet-flange |
| 2. Valve body (female) | 6. 'O' ring |
| 3. Fluoroelastomer ball | 7. Flow direction arrow |
| 4. Valve body (male) | 8. Outlet-flange |

6.8 Check the HCDP pump oil-level



WARNING

Do not remove the oil filler-plug while the pump is operating. If you do, hot oil may be ejected from the pump.

CAUTION

Do not check the oil-level when the iH system is operating. The correct oil-level may not be shown when the pump is operating.

CAUTION

Ensure that the oil-level in the HCDP pump is correct. If the pump oil-level is incorrect, pump performance may be affected and the pump may be damaged.

You must check the oil-level every three months. Use the following procedure to check the oil-level.

1. Shut down the iH system (refer to [Section 5.9](#)) and allow it to cool.
2. Remove the right-hand side enclosure panel from the iH system: refer to [Section 3.4](#).
3. Refer to [Figure 1](#). Check that the oil-level is between the MAX and MIN marks on the bezel of the HCDP oil-level sight-glass (11):
 - If the oil-level is above the MAX mark, drain excess oil from the pump as described in [Section 6.9](#) until the oil-level is correct.
 - If the oil-level is below the MIN mark, fill the pump with oil until the oil-level is correct, as described in [Section 6.9](#).
4. Refit the right-hand side enclosure panel: refer to [Section 3.17](#).

6.9 Change the HCDP pump oil



WARNING

Do not remove the oil filler-plug while the pump is operating. If you do, hot oil may be ejected from the pump.

CAUTION

Ensure that the oil-level in the HCDP pump is correct. If the pump oil-level is incorrect, pump performance may be affected and the pump may be damaged.

1. Shut down the iH system (refer to [Section 5.9](#)) and allow it to cool.
2. Remove the right-hand side enclosure panel from the iH system: refer to [Section 3.4](#).
3. Refer to [Figure 1](#). Remove the HCDP oil filler-plug (8).
4. Use a suitable pump or syringe to suck the oil out of the pump.
5. Dispose of the old 'O' ring on the oil filler-plug (8) and replace it with a new 'O' ring (available as a spare: refer to [Section 8.3](#)).
6. Fill the pump through the filler hole with the correct grade and quantity of oil. Allow the oil to drain into the pump, then check the oil-level on the sight-glass: refer to [Section 6.8](#).
7. Ensure that the new 'O' ring is correctly positioned on the oil filler-plug (8), then refit the filler-plug to the HCDP pump.
8. Refit the right-hand side enclosure panel: refer to [Section 3.17](#).

6.10 Change the HCMB pump oil (iH600/iH1000 only)



WARNING

Do not remove the oil filler-plug while the pump is operating. If you do, hot oil may be ejected from the pump.

CAUTION

Ensure that the oil-level in the HCDB pump is correct. If the pump oil-level is incorrect, pump performance may be affected and the pump may be damaged.

1. Shut down the iH system (refer to [Section 5.9](#)) and allow it to cool.
2. Remove the right-hand side enclosure panel from the iH system: refer to [Section 3.4](#).
3. Refer to [Figure 1](#). Remove the HCMB oil filler-plug (2).
4. Use a suitable pump or syringe to suck the oil out of the pump.
5. Dispose of the old 'O' ring on the oil filler-plug (2) and replace it with a new 'O' ring (available as a spare: refer to [Section 8.3](#)).
6. Fill the pump through the filler hole with the correct grade and quantity of oil. Allow the oil to drain into the pump, then check the oil-level on the sight-glass: refer to [Section 6.7](#).
7. Ensure that the new 'O' ring is correctly positioned on the oil filler-plug (2), then refit the filler-plug to the HCMB pump.
8. Refit the right-hand side enclosure panel: refer to [Section 3.17](#).

6.11 Zero the gas module flow transducer

Note: The flow transducer is zeroed by the software in the control system; you do not need to physically adjust any part of the iH system..

The accuracy of the mass flow transducer in the Gas Module may drift slightly and we recommend that it is 'zeroed' (that is, calibrated for zero gas flow) once a year.

You must zero the transducer with the electrical supply on, the iH system switched off and your nitrogen supply off and disconnected from the iH system. This ensures that the transducer is correctly zeroed when there is no nitrogen flow (if you zero the transducer with the nitrogen supply connected, small nitrogen leaks through the solenoid-valves could affect the calibration).

Use the Setup/Service/Zero Sensors menu to start to zero the transducer, then use the Status menu to display the gas flows; the gas flow displayed will be zero when the transducer has been correctly zeroed. Note that it will take approximately 15 minutes to zero the transducer; if required, you can use the Status/Zero time menu to view the time remaining before the transducer is zeroed.

6.12 Adjust the Pump Display Module display viewing angle

If the display ([Figure 8](#), item 2) is difficult to see, use the following procedure to adjust the display viewing angle.

1. Refer to [Figure 23](#). Remove the Pump Display Module (7) from the recess (5) in the front panel.
2. Place or hold the Pump Display Module in its normal operating orientation.
3. Turn the display adjuster (8) clockwise or anticlockwise until the display is easy to read.

4. Refit the Pump Display Module (7) in the recess (5) in the front panel.
5. If necessary, repeat Steps 1 to 4 until the display is easy to see.

6.13 Replace a fuse



WARNING

Ensure that you replace a fuse with a new fuse of the correct rating. If you do not, the iH system will not be adequately protected and you can damage the iH system or cause injury to people.

Note: You can only change the fuses in fuse holders F7, F8 and F9. An Edwards service engineer must change fuses F1 to F6 in the Electrics and Pump Control Module (see [Figure 4](#)).

You can only change the low voltage fuses F7 to F9 for the d.c. electrical supply, the iH Interface Module and the emergency stop circuit. If any of the internal fuses F1 to F6 have failed, you must contact your supplier or Edwards for advice. Only change a fuse if you have identified and rectified the cause of the failure.

To change a fuse, refer to [Figure 4](#) and use the following procedure. If the fuse immediately fails when you replace it, there may be an electrical fault: contact your supplier or Edwards for advice.

1. Use a flat-bladed screwdriver to undo the fuse holder (13, 14 or 15) by a 1/4 of a turn, then remove the fuse holder from the Electrics and Pump Control Module.
2. Remove the failed fuse from the fuse holder.
3. Fit a new fuse of the correct rating in the fuse holder. Refer to [Section 2](#) for the fuse ratings.
4. Refit the fuse holder in the Electrics and Pump Control Module, then use a flat-bladed screwdriver to turn the fuse holder clockwise by a 1/4 of a turn to secure it in place.

6.14 Replace the Pump Display Module

Use the following procedure to replace the Pump Display Module. Note that you do not need to switch off the iH system to replace the Pump Display Module.

1. Refer to [Figure 23](#). Remove the Pump Display Module (7) from the recess (5) in the front panel.
2. Remove the connector (4) on the cable (6) from the module connector (3) in the recess of the front panel.
3. Fit the new Pump Display Module as described in [Section 3.8.1](#).

6.15 Relocate the iH system for maintenance



WARNING

Use suitable lifting equipment to move the iH system.

If you want to remove the iH system from its operating location and move it to another location where you will do maintenance, use the following procedure.

1. Purge the iH system and shut down the iH system as described in [Section 5.9](#) and allow the iH system to cool down.
2. Refer to [Figure 27](#). Disconnect the mating-half from the electrical supply connector (9) on the Electrics and Pump Control Module.

3. Refer to [Figure 4](#). Switch off your nitrogen and cooling-water supplies, then disconnect the nitrogen supply pipeline from the nitrogen inlet (4) and disconnect the cooling-water supply and return pipelines from the cooling-water inlet and outlet (3, 2).
4. Refer to [Figure 1](#). Disconnect the inlet (1) from your vacuum system and disconnect the outlet (17) from your exhaust-extraction system. Fit blanking caps to your vacuum and exhaust-extraction pipelines and to the iH inlet and outlet (1, 17).
5. If necessary, disconnect the iH air-extraction port (see Figures 9 to 11) from your factory extraction system.
6. Refer to [Figure 1](#). Adjust the levelling feet (9) so that the iH system rests on the castors (10).
7. Refer to [Figure 22](#). If necessary (that is, if you will use lifting equipment to move the iH system), refit the four transit brackets to the vibration isolators: refit each transit bracket (2) to the vibration isolator (3), then refit the nuts and washers (4) to secure the transit brackets in place.
8. Move the iH system to the location where you will do maintenance.
9. If necessary (depending on the maintenance you will do), disconnect any accessories from the iH system.

After maintenance is complete, re-install the iH system as described in [Section 3](#).

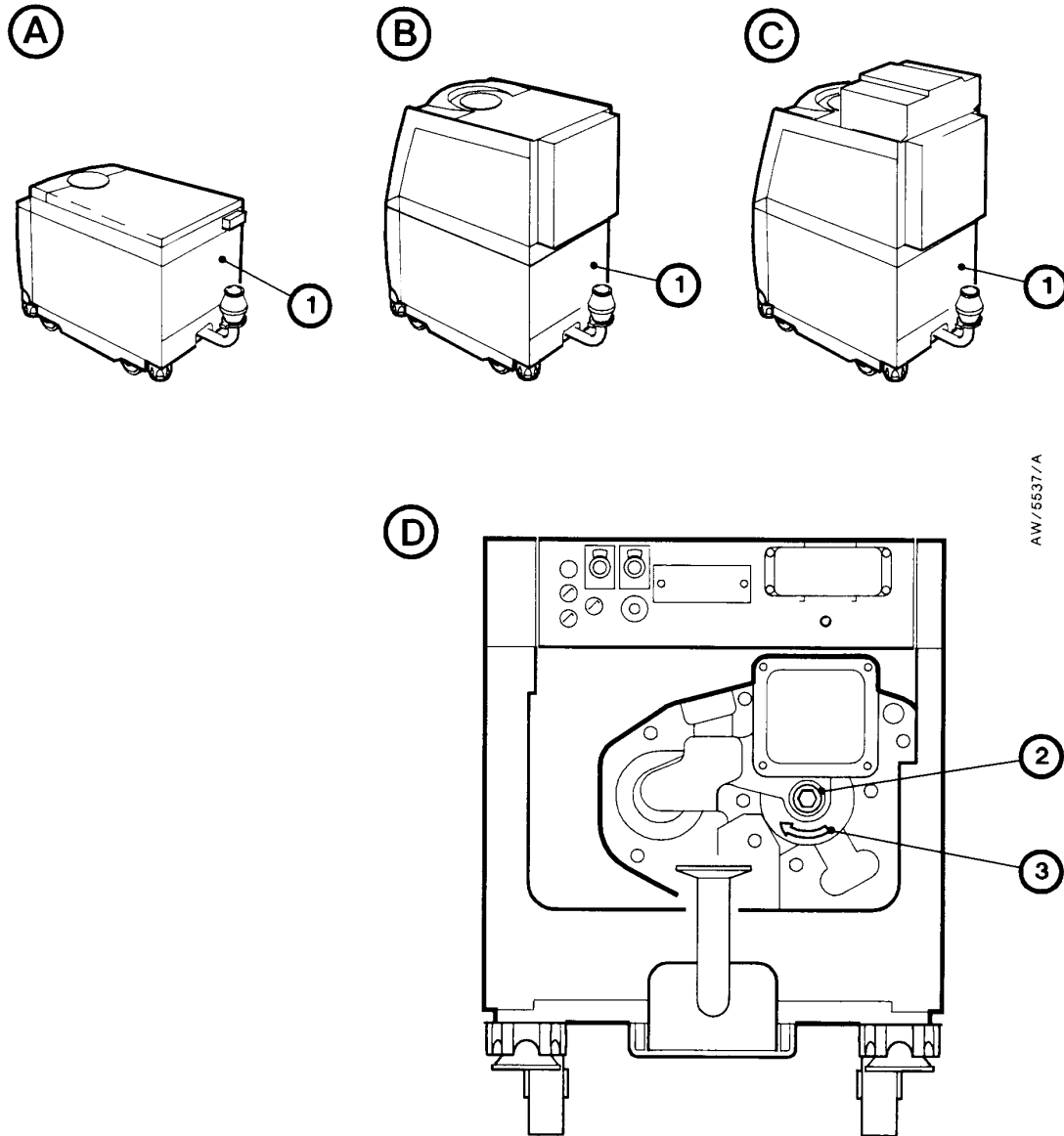
6.16 Check for free rotation of the HCDP pump

If the iH has automatically shut down because of excessive HCDP pump-motor power (that is, alarms 412 or 512 are displayed), use the following procedure to check that the pump is free to rotate before you restart the iH system:

1. Refer to [Figure 27](#). Disconnect the mating-half from the electrical supply connector (9) on the Electrics and Pump Control Module.
2. Refer to [Figure 4](#). Undo and remove the four screws which secure the rear cover (1), then remove the cover.
3. Refer to [Figure 50](#). Use a 100 mm A/F hexagonal key to remove the 3/8 BSP plug and 'O' ring (2) from the motor shaft.
4. Fit the hexagonal key to the end of the motor shaft and try to turn the shaft clockwise (in the direction shown by the arrow, 3):
 - If the shaft is free to turn, remove the hexagonal key and continue at Step 5.
 - If the shaft is not free to turn, contact your supplier or Edwards: do not try to restart the iH system.
5. Refit the plug and 'O' ring (2) to the motor shaft.
6. Refer to [Figure 4](#). Refit the rear cover (1) and secure with the four screws.
7. Refer to [Figure 27](#). Refit the mating-half to the electrical supply connector (9) on the Electrics and Pump Control Module.

You can now restart the iH system: refer to [Section 5.13](#).

Figure 50 - Try to turn the HCDP pump



- | | | | |
|---|--------|----|-------------------------------------|
| A | iH80 | 1. | Rear cover |
| B | iH600 | 2. | Plug and 'O' ring: 3/8 BSP |
| C | iH1000 | 3. | Correct direction of rotation arrow |

6.17 Fault finding

6.17.1 Warning and alarm message fault finding

When a warning or alarm message is generated, you can display the message and (for some of the messages) two lines of text (the advisory message) which identify possible checks you can make to identify the cause of the fault and to rectify the fault.

The first line of a message specifies the fault condition (warning or alarm) and shows the error number. Error numbers are of the form PFF, PPFF or PPPFF, where:

- P, PP, or PPP specifies the fault parameter associated with the alarm or warning: refer to [Table 18](#). Note that [Table 18](#) defines all of the possible sources; some of these may not be fitted to your iH system (for example, the HCDP and HCMB pump oil monitors).
- FF specifies the fault type: refer to [Table 19](#).

Table 6-1 shows all of the warning messages, the corresponding lines of advisory text (if any) and the meaning of the error/recommended actions. The warning messages are given in error number order in this table.

Table 6-2 shows all of the alarm messages, the corresponding lines of advisory text (if any) and the meaning of the error/recommended actions. The alarm messages are given in error number order in this table.

Note that [Tables 15](#) and [16](#) show all of the possible warning and alarm messages, however some of these messages may not be displayed: this depends on how you have adjusted the setpoints. For example, warning 5801 (DP OIL LOW) may not appear if you have configured the system not to display the warning.

6.17.2 Other fault finding

Fault messages will be shown on the Pump Display Module to identify that the action you have selected cannot be carried out. The messages which can be displayed and their meanings are shown in [Table 17](#).

Table 15 - Warning messages

Warning message	Advisory message	Meaning/recommended action
WARNING 101		(a) there is a fault in the Sensor Monitoring and Gas Control Module PCA, or (b) a module or sensor which should be fitted is not fitted or is disconnected, or (c) the emergency stop button has been pressed (or a safety sensor has operated or your external emergency stop switch has been operated) to shut down the iH system, or (d) there has been a transient electrical supply failure (longer than the hold-up time of the iH power supply), or (e) the wrong gas module is fitted for the current iH configuration.
WARNING 113		There is a fault in the ADC (analogue-to-digital convertor) in the Sensor Monitoring and Gas Control Module; the ADC must be replaced.
WARNING 209	SEE MANUAL	The electrical supply voltage is too low. Check the electrical supply and the connections to the iH system and rectify as necessary.
WARNING 211	SEE MANUAL	The electrical supply voltage is too high. Check the electrical supply and the connections to the iH system and rectify as necessary.

Table 15 - Warning messages

Warning message	Advisory message	Meaning/recommended action
WARNING 309 DP CURRENT LOW	OPEN CIRCUIT CHECK CONNECTION	The electrical current drawn by the HCDP pump is less than normal. Check that the electrical connections are correct and rectify as necessary. If the electrical connections are correct, a fuse in the Electrics and Pump Control Module may have failed or the gearbox coupling may have failed.
WARNING 311 DP CURRENT HIGH	LEAK/DEBRIS SERVICE PUMP	The electrical current drawn by the HCDP pump is higher than normal. There may be a leak in the system or process debris in the pump, or the pump motor may have failed. Inspect the pipelines and service the pump.
WARNING 409 DP POWER LOW	OPEN CIRCUIT CHECK CONNECTION	The electrical power consumption of the HCDP pump is less than normal. Check that the electrical connections are correct and rectify as necessary. If the electrical connections are correct, a fuse in the Electrics and Pump Control Module may have failed or the gearbox coupling may have failed.
WARNING 411 DP POWER HIGH	LEAK/DEBRIS SERVICE PUMP	The electrical power consumption of the HCDP pump is higher than normal. There may be a leak in the system or process debris in the pump, or the pump motor may have failed. Inspect the pipelines and service the pump.
WARNING 412 DP POWER HIGH	LEAK/DEBRIS SERVICE PUMP	Refer to the recommended actions for error number 411 in this table.
WARNING 509	SEE MANUAL	The HCDP motor thermistor is short circuited. Check the thermistor connections inside the HCDP pump motor terminal-box and check the connections between the HCDP pump and the Electrics and Pump Control Module.
WARNING 611	SEE MANUAL	There is a phase imbalance in the electrical supply to the HCDP pump. Check the electrical supply and the connections to the iH system. If the electrical supply and connections are correct, the pump motor may be faulty.
WARNING 709 MB CURRENT LOW	OPEN CIRCUIT CHECK CONNECTION	The electrical current drawn by the HCMB pump is lower than normal. Check that the electrical connections are correct and rectify as necessary. If the electrical connections are correct, a fuse in the Electrics and Pump Control Module may have failed or the gearbox coupling may have failed or the coupling-cover oil-level may be too low.
WARNING 711 MB CURRENT HIGH	LEAK/DEBRIS SERVICE PUMP	The electrical current consumption of the HCMB pump is higher than normal. There may be a leak in the system or process debris in the pump, or the pump motor may have failed or the coupling-cover oil-level may be too low. Inspect the pipelines and service the pump.
WARNING 809 MB POWER LOW	OPEN CIRCUIT CHECK CONNECTION	The electrical power consumption of the HCMB pump is lower than normal. Check that the electrical connections are correct and rectify as necessary. If the electrical connections are correct, a fuse in the Electrics and Pump Control Module may have failed.
WARNING 811 MB POWER HIGH	LEAK/DEBRIS SERVICE PUMP	The electrical power consumption of the HCMB pump is higher than normal. There may be a leak in the system or process debris in the pump or the pump motor may have failed. Inspect the pipelines and service the pump.

Table 15 - Warning messages

Warning message	Advisory message	Meaning/recommended action
WARNING 812 MB POWER HIGH	LEAK/DEBRIS SERVICE PUMP	Refer to the recommended actions for error number 811 in this table.
WARNING 909	SEE MANUAL	The HCMB motor thermistor is short circuited. Check the thermistor connections inside the HCMB pump motor terminal-box and check the connections between the HCMB pump and the Electrics and Pump Control Module.
WARNING 1011	SEE MANUAL	There is a phase imbalance in the electrical supply to the HCMB pump. Check the electrical supply and the connections to the iH system. If the electrical supply and connections are correct, the pump motor may be faulty.
WARNING 1201		When started, no electrical current was drawn by the HCDP pump. Check whether the pump motor is open circuit. If not, the current sensor may have failed.
WARNING 1401 SERVICE DUE (R)	xxxxx HRS RUN SINCE SERVICE	The iH system has operated for xxxxx hours since it was last serviced. Service the iH system.
WARNING 1601 SERVICE DUE (P)	xxxxx HRS RUN SINCE SERVICE	The iH system has operated for xxxxx hours since it was last serviced. Service the iH system.
WARNING 1801 SERVICE DUE (P)	xxxxx CYCLES SINCE SERVICE	The iH system has been operated for xxxxx process cycles since it was last serviced. Service the iH system.
WARNING 2001 SERVICE DUE (C)	xxxxx CYCLES SINCE SERVICE	The iH system has been operated for xxxxx switch-on/off cycles since it was last serviced. Service the system.
WARNING 3101		The Gas Module PCA may be disconnected. If the wiring connections are correct the PCA may be faulty.
WARNING 3113		There is a fault in the ADC (analogue-to- digital convertor) in the gas module; the ADC must be replaced.
WARNING 3501		(a) the gas module mass flow transducer has drifted outside the valid range allowed for zeroing, or (b) you cannot zero the transducer because the nitrogen purge is switched on or the HCDP pump is on.
WARNING 3509 TOTAL N2 FLOW LO	FLOW LOW CHECK GAS MODULE	The total nitrogen flow is too low. There may be a fault in the Gas Module.
WARNING 3511 TOTAL N2 FLOW HI	FLOW HIGH CHECK GAS MODULE	The total nitrogen flow is too high. There may be a fault in the Gas Module.
WARNING 3911 EXHAUST PRESSURE	EXHAUST BLOCKED SERVICE PUMP	The pressure in the exhaust pipeline is too high. There may be process debris or condensation in the exhaust pipeline, or a valve in the pipeline may be shut. You may have too many pumping systems connected to the exhaust pipeline.
WARNING 3913		The exhaust pressure transducer is not fitted, or is disconnected or has failed. Check and rectify as necessary.
WARNING 4009 SS PURGE LOW	ADJUST REGULATOR INCREASE PRESS.	The shaft-seals purge pressure is too low. Check that the nitrogen supply is as specified in Section 2 and that you have correctly adjusted the pressure: refer to Section 5.6 .
WARNING 4010 SS PURGE LOW	PRESSURE LOW ADJUST REGULATOR	Refer to the recommended actions for error number 4009 in this table.
WARNING 4011 SS PURGE HIGH	PRESSURE HIGH CHECK GAS MODULE	The shaft-seals purge pressure is too high. Check that you have correctly adjusted the pressure: refer to Section 5.6 . If you cannot correctly adjust the pressure, the regulator may be faulty.

Table 15 - Warning messages

Warning message	Advisory message	Meaning/recommended action
WARNING 4012 SS PURGE HIGH	PRESSURE HIGH CHECK GAS MODULE	Refer to the recommended actions for error number 4011 in this table.
WARNING 4013		The shaft-seals pressure transducer is not fitted, or is disconnected or has failed. Check and rectify as necessary.
WARNING 5101		The Sensor Monitoring Module may be disconnected. If the wiring connections are correct, the PCA may be faulty.
WARNING 5113		There is a fault in the ADC (analogue-to- digital convertor) in the Sensor Monitoring Module; the ADC must be replaced.
WARNING 5411 MB TEMP		The temperature of the HCMB pump is too high. Check the pumping system inlet pressure; has the pumping system been operating with inlet pressure > 5 mbar (5×10^2 Pa) for 1 hour or more. If the maximum inlet pressure has not been exceeded, or if the pumping system has not been operated at the maximum inlet pressure for longer than the specified time, the cooling-circuit of the pump maybe blocked.
WARNING 5413		Check that the HCMB pump temperature sensor is fitted and is correctly connected. If the sensor is correctly fitted and connected, it may have failed. Check the operation of the sensor and replace it if it has failed.
WARNING 5511 DP MOTOR TEMP	MOTOR WATER LOW CHECK WATER	The temperature of the HCDP pump- motor is too high. Check the cooling-water connections in the iH system and check that the cooling-water supply is on and is as specified in Section 2 . If the connections and supply are correct, the cooling-circuit of the pump maybe blocked.
WARNING 5513		The HCMB pump-motor surface temperature sensor is not fitted, or is disconnected or has failed.
WARNING 5609 EXHAUST TEMP LOW	EXHAUST TEMP LOW CHECK EXHAUST	The temperature of the exhaust is too low for the process.
WARNING 5613		You have configured the iH to have an exhaust temperature sensor fitted, but the sensor is not fitted, or is disconnected or has failed. Check and rectify as necessary.
WARNING 5709 DP TEMP LOW	DP TEMP LOW SEE MANUAL	The operating temperature of the HCDP pump is too low.
WARNING 5711 DP TEMP HIGH	DP TEMP HIGH SEE MANUAL	The operating temperature of the HCDP pump is too high: there may be process debris in the pump or the pump may be damaged.
WARNING 5713		The HCDP pump-body temperature sensor is not fitted, or is disconnected or has failed. Check and rectify as necessary.
WARNING 6001 WATER FLOW LOW	CHECK COOLING WATER SUPPLY	The flow of cooling-water through the iH system is too low. Refer to the recommended actions for error number 5411.
WARNING 11101		There is a fault in the NIM (Network Interface Module): refer to the instruction manual supplied with the NIM.

Table 15 - Warning messages

Warning message	Advisory message	Meaning/recommended action
WARNING 12101		There is a fault in the Tool Interface Card in the iH Interface Module. Refer to the instruction manual supplied with the iH Interface Module.
WARNING 15101		There is a fault in the Auxiliary Interface Card in the iH Interface Module. Refer to the instruction manual supplied with the iH Interface Module.
WARNING 17601	SEE MANUAL	The inverter on an iH1000 system has experienced a transient power supply problem, or there is a recoverable fault.
WARNING 17701	SEE MANUAL	The HCMB pump stator temperature is $> 165^{\circ}\text{C}$, and the HCMB pump speed has been reduced to 1200 r.min^{-1} . The warning condition will be removed and the HCMB pump speed will increase to 6000 r.min^{-1} again when the pump stator temperature has fallen to 150°C .

Table 16 - Alarm messages

Alarm message	Advisory message	Meaning/recommended action
ALARM 101 STOP ACTIVATED		The emergency stop switch has been pressed or a safety sensor connected to the emergency stop circuit has operated (or your remote emergency off circuit has operated) to shut down the iH system. Note that the message will remain on the display until you restart the pumping system.
ALARM 101		Refer to the recommended actions for error number 101: see Table 15 .
ALARM 210		Refer to the recommended actions for error number 209: see Table 15 .
ALARM 212		Refer to the recommended actions for error number 211: see Table 15 .
ALARM 310 DP CURRENT LOW	OPEN CIRCUIT CHECK CONNECTION	Refer to the recommended actions for error number 309: see Table 15 .
ALARM 312 DP CURRENT HIGH	LEAK/DEBRIS SERVICE PUMP	Refer to the recommended actions for error number 311: see Table 15 .
ALARM 410 DP POWER LOW	OPEN CIRCUIT CHECK CONNECTION	Refer to the recommended actions for error number 409: see Table 15 .
ALARM 412 DP POWER HIGH	LEAK/DEBRIS SERVICE PUMP	Refer to the recommended actions for error number 411: see Table 15 .
ALARM 512		The pump-motor has tripped out because the motor windings are too hot: either the cooling-system has failed or the motor overloaded. Either of these faults should have been identified before shut-down, so either there are two separate faults (for example, cooling-water supply failure and thermocouple circuit failure) or the thermistor circuit has failed: contact your supplier or Edwards.
ALARM 612		Refer to the recommended actions for error number 611: see Table 15 .
ALARM 710 MB CURRENT LOW	OPEN CIRCUIT CHECK CONNECTION	Refer to the recommended actions for error number 709: see Table 15 .

Table 16 - Alarm messages

Alarm message	Advisory message	Meaning/recommended action
ALARM 712 MB CURRENT HIGH	LEAK/DEBRIS SERVICE PUMP	Refer to the recommended actions for error number 711: see Table 15 .
ALARM 810 MB POWER LOW	OPEN CIRCUIT CHECK CONNECTION	Refer to the recommended actions for error number 809: see Table 15 .
ALARM 812 MB POWER HIGH	LEAK/DEBRIS SERVICE PUMP	Refer to the recommended actions for error number 811: see Table 15 .
ALARM 912		Refer to the recommended actions for error number 512 in this table.
ALARM 1012		Refer to the recommended actions for error number 1011: see Table 15 .
ALARM 1101		(a) the electrical supply is not connected to the HCDP pump-motor, or (b) the HCDP pump has started, but has then immediately stopped again, because the phase sequence of the electrical supply to the pump is incorrect: reverse two of the phases in the electrical supply connector: refer to Section 3.16.3).
ALARM 3912 EXHAUST PRESSURE	EXHAUST BLOCKED SERVICE PUMP	Refer to the recommended actions for error number 3911: see Table 15 .
ALARM 5412 MB MOTOR TEMP	MOTOR WATER LOW CHECK FILTER	Refer to the recommended actions for error number 5411: see Table 15 .
ALARM 5512 DP MOTOR TEMP	MOTOR WATER LOW CHECK FILTER	Refer to the recommended actions for error number 5511: see Table 15 .
ALARM 5610 EXHAUST TEMP LOW	EXHAUST TEMP LOW CHECK EXHAUST	Refer to the recommended actions for error number 5609: see Table 15 .
ALARM 5710 DP TEMP LOW	TCV SET LOW ADJUST TCV	Refer to the recommended actions for error number 5709: see Table 15 .
ALARM 5712 DP TEMP HIGH	TCV SET HIGH ADJUST TCV	Refer to the recommended actions for error number 5711: see Table 15 .
ALARM 17410	SEE MANUAL	The inverter on an iH1000 system has been operating at less than 7 kHz for more than three minutes. There is a mechanical fault (possible a pump rotor has locked): contact your supplier or Edwards for advice.
ALARM 17601	SEE MANUAL	The inverter on an iH1000 system has experienced a significant power supply problem and the HCMB pump has been stopped, or the HCMB pump in the iH1000 system has stopped because of a mechanical or electrical fault. You must manually restart the HCMB pump (refer to Section 5.12). If the alarm condition persists after several attempts to restart the HCMB pump, contact your supplier or Edwards for advice.

Table 17 - Fault messages

Message	Meaning
CONTROL failed Press CANCEL	You have requested that the Pump Display Module takes control of the iH system, but the attempt to take control has failed. Press the CANCEL button to return to normal display.
CONTROL REMOTE Press CANCEL	(a) You have requested that the Pump Display Module takes control of the iH system, but another module still has control. Press the CANCEL button to return to normal display, release control from the module which currently has control and then try again. (b) You have requested some action, but the Pump Display Module does not have control of the iH system. Press the CANCEL button, take control and then try again.
PUMP failed to respond (CANCEL)	(a) You have requested that the iH system is switched on or off, but the pump(s) has failed to start or stop: press the CANCEL button to cancel the request, identify and rectify the cause for the failure of the pump(s) to start or stop, then try again. (b) You have tried to open or close one of the gate valves (if fitted), but the valve has failed to respond. Identify and rectify the cause for the failure of the valve to open or close, then try again. (c) A value (for example, a setpoint) has been requested from the iH system, but the iH system has not responded. (d) The emergency stop switch has been pressed and released: restart the pumping system.
PUMP RUNNING Press CANCEL	You have requested that the iH system is switched on, but it is already on. Press the CANCEL button to return to normal display.
PUMP STOPPED Press CANCEL	You have requested that the iH system is switched off, but it is already off. Press the CANCEL button to return to normal display.
EDWARDS DISPLAY MODULE	If this message is displayed when the iH system is switched on and the display does not change to normal display, this means that the Pump Display Module cannot correctly communicate with the iH system.
None (the display is blank)	One or both of fuses FS6 and FS8 may have tripped. Switch off the electrical supply to the iH system, then switch it on again to reset the fuse(s).

Table 18 - Fault parameters

Parameter [†]	Source/cause of error
1	iH system status
2	Electrical supply voltage
3	HCDP pump current consumption
4	HCDP pump power consumption
5	HCDP pump-motor thermistor
6	Phase imbalance in HCDP pump current consumption
7	HCMB pump current consumption
8	HCMB pump power consumption
9	HCMB pump-motor thermistor
10	Phase imbalance in HCMB pump current consumption
11	HCDP pump status
12	HCMB pump status

Table 18 - Fault parameters

Parameter [†]	Source/cause of error
14	Total run hours (since last service)
16	Total run hours (on process, since last service)
18	Process cycles (since last service)
20	Switch-on/off cycles (since last service)
31	Gas Module status
35	Gas Module flow transducer: total nitrogen purge flow
39	Exhaust pressure sensor
40	Shaft-seals purge pressure transducer
51	Electronics Module status
53	Active Gauge (optional accessory)
54	HCMB pump temperature sensor
55	HCDP pump-motor water manifold surface temperature sensor
56	iH exhaust temperature sensor (optional accessory)
57	HCDP pump-body thermocouple
111	Network Interface Module status (optional accessory)
121	Tool Interface Card status (optional accessory)
151	Auxiliary Interface Card status (optional accessory)
176	Inverter status (iH1000 only)
177	HCMB pump over-temperature monitor (iH1000 only)

[†] First digit of a three-digit error number, first two digits of a four-digit error number, or first three digits of a five-digit error number.

Table 19 - Fault types

Fault type [▲]	Meaning
01	Digital alarm condition *
09	Low warning condition
10	Low alarm condition
11	High warning condition
12	High alarm condition
13	Device error [†]

[▲] Last two digits of the error number.

* For example, the gas module flow transducer has drifted outside the valid range allowed for zeroing.

[†] For example, sensor is not fitted, or is disconnected.

This page has been intentionally left blank.

7 Storage and Disposal

7.1 Storage

CAUTION

Drain the cooling-water from the iH system, if you will transport or store it in conditions where the cooling-water could freeze. If you do not, the cooling-water may freeze in the iH system and damage the pump(s) and/or the cooling-water pipelines.

Store the iH system as follows:

1. If applicable, ensure that the pumps have been shut down as described in [Section 5.8](#) and disconnect all services, process and exhaust connections.
2. Fit blanking-plates to all vacuum inlets and exhaust outlets. Place protective covers over the iH services connection points.
3. Store the iH system in clean dry conditions until required.
4. When required for use, prepare and install the iH system as described in [Section 3](#) of this manual.

7.2 Disposal

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

Pump system materials suitable for recycling include cast iron, steel, SG iron, PTFE, stainless steel, brass, aluminium, zinc alloy, nickel, mild steel, ABS.

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 has been intentionally left blank.

8 Service, Spares and Accessories

8.1 Introduction

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

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

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

8.2 Service

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

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

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

8.3 Spares

Spare	Item Number
iH Pump Display Module	D372-72-800
Krytox 1525 oil (1 kg)	H113-09-018
Fomblin 25/6 oil (1 kg)	H113-12-019
Drynert 25/6 oil (1 kg)	H113-12-021
Exhaust check-valve servicing kit	A440-03-820
iH Tool Interface Module connector plug	A532-20-050
Exhaust-pipe (with metal 'O' ring)	A505-52-000
Metal 'O' ring (for HCDP outlet to exhaust-pipe connection): pack of 10	H021-15-001
Oil filler-plug 'O' ring: pack of 10	H021-06-110

8.4 Ordering accessories

Note: All of the accessories in Section 8.4.1 to 8.4.4 must be ordered when you order your iH system. The accessories you have ordered will be supplied fitted to your iH system.

8.4.1 Exhaust Temperature Sensor

The Exhaust Temperature Sensor monitors the temperature in the iH exhaust outlet. When fitted, the output of the Sensor is monitored by the iH system. If required, you can configure the iH system to generate a warning if the exhaust temperature is too low or too high.

Accessory	Item Number
Exhaust Temperature Sensor	A532-07-000

8.4.2 Active gauge connection kit

The Active Gauge Connection Kit allows the iH system to monitor the pressure measured by an Active Gauge fitted in the inlet pipeline to the iH system. Note that the Active Gauge Connection Kit cannot be fitted if you have ordered an iH Pressure Control Kit: see [Section 8.4.3](#).

The Connection Kit is suitable for use with any of the following Edwards Active Gauges:

- ATC-M Active Thermocouple Gauge
- ASG (1000 mbar) Active Strain Gauge
- APG-MP Active Pirani Gauge
- APG-L Active Pirani Gauge (Heated)
- Barocel Capacitance Manometers (10 to 1000 mbar or torr).

When supplied, the Active Gauge Connection Kit is configured for use with an APG-MP Active Pirani Gauge. You will need to fit an iH PC Interface Kit if you want to reconfigure the iH system for use with another gauge type (see [Section 8.5.5](#)).

Accessory	Item Number
Active Gauge Connection Kit	D372-41-000

8.4.3 iH600 Pressure Control Kit

The iH600 Pressure Control Kit can be fitted to an iH600 system, to enable the HCMB pump to be automatically started at a preset inlet pressure. Note that the Active Gauge Connection Kit accessory (see [Section 8.4.2](#)) cannot be fitted if you have ordered an iH Pressure Control Kit.

Accessory	Item Number
iH Pressure Control Kit	A505-40-000

8.4.4 iH Enclosure Extraction Fan Kit

When fitted, an iH Enclosure Extraction Fan Kit provides air-extraction of the iH enclosure at a rate of $2.8 \text{ m}^3 \text{ min}^{-1}$ (100 cfm). The Kit is suitable for both iH80 and iH600 systems.

Accessory	Item Number
iH Enclosure Extraction Fan Kit	A505-39-000

8.5 Other accessories

8.5.1 iH Pump Display Module Extension Cables

If required, you can use an extension cable to allow you to use the Pump Display Module further away from the iH system.

Accessory	Item Number
Extension cable (display/interface), 3 m	D372-07-591
Extension cable (display/interface), 5 m	D372-07-592
Extension cable (display/interface), 10 m	D372-07-595
Extension cable (display/interface), 15 m	D372-07-596
Extension cable (display/interface), 25 m	D372-07-597

8.5.2 iH Communications Module

Fit a Communications Module accessory to allow your Process Tool or PC-based software to control and monitor the operation of the iH system through a serial port or through a parallel port, with a small number of digital lines:

- Serial port communications use the RS232C communications protocol.
- Parallel port communications implement a sub-set of the iH Tool Interface Module communications. A single digital control input is used to turn the pump(s) on and off, and four digital outputs provide pump(s) on, warning and alarm status outputs.

Accessory	Item Number
iH Serial Communications Module	D372-32-000
iH Serial and Parallel Communications Module	D372-35-000
iH Parallel Communications Module	D372-36-000

8.5.3 iH Interface Modules

The iH Interface Module allows you to control the operation of the iH system through your Process Tool or other control equipment.

The iH Interface Module can be fitted with one or more Tool Interface Card and/or one or more Auxiliary Interface Card.

The Tool Interface Card allows you to control and monitor the status of the iH system through your process tool or other control equipment. The Tool Interface Card has a setpoints store. The setpoints store can be preset to contain sensor setpoints suitable for a particular process or application (that is, the combination of the iH system configuration, process chemistry and user's production pattern). If you have a Tool Interface Card fitted, you can use the application recipe at any time (instead of the default setpoints in the iH system).

The Auxiliary Interface Card allows you to control the operation of other equipment (such as inlet and outlet isolation-valves) connected to the iH system.

Contact your supplier or Edwards if you want to order iH Interface Modules

8.5.4 iH Central Monitoring System

The iH Central Monitoring System allows you to network together all of the iH systems in your installation, and to use a PC to centrally monitor the iH systems. Contact your supplier or Edwards if you want to network your iH systems.

8.5.5 iH PC Interface Kits

The iH PC Interface Kit allows you to directly connect the iH system to a laptop PC or to a desktop PC and to use the PC to switch the iH system on and off, and to monitor the status of the iH system. The Kit is supplied with all necessary cables and with the iH Single Equipment Monitor software.

Accessory	Item Number
Desktop PC Interface Kit	D372-18-100
Laptop PC Interface Kit (USA)	D372-18-200
Laptop PC Interface Kit (Europe)	D372-18-300
Laptop PC Interface Kit (UK)	D372-18-400
Laptop PC Interface Kit (Japan)	D372-18-500
PCMCIA Laptop PC Interface Kit	D372-17-000

8.5.6 iH Alternative Connections Kits

Use this kit to reconfigure the iH system to use the alternative nitrogen inlet and/or cooling-water inlet and outlet connection positions (see [Section 3.5](#)).

Accessory	Item Number
Alternative Nitrogen and Cooling-Water Connections Kit	A505-34-000

8.5.7 TMS (Temperature Management System) accessories

If necessary for your application, fit TMS accessories to maintain the temperature in the iH exhaust pipeline, to prevent deposition in the pipeline.

Accessory	Item Number
iH Pump Heated Exhaust Kit	A550-01-190
Controller iH/iQ Heated Exhausts, 110 V	A550-01-192
Controller iH/iQ Heated Exhausts, 208 V	A550-01-193
Controller iH/iQ Heated Exhausts, 240 V	A550-01-194