A533-23-880
Issue C Original

Instruction Manual

iF1800 Rapid Loadlock Dry Pumping Systems

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Declaration of Conformity

We, Edwards,
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declare under our sole responsibility, as manufacturer and person within the EU authorised to assemble the technical file, that the product(s)

iF1800 Rapid Load Lock Dry Pumping System:

200/208 V, 50/60 Hz, 3-phase	A533-23-945
440 V, 60 Hz, 3-phase	A533-23-975

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

EN1012-2:1996, A1: 2009	Compressors and Vacuum Pumps. Safety Requirements. Vacuum Pumps
EN61010-1: 2001	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use. General Requirements
EN 61326-1: 2006	Electrical equipment for measurement, control and laboratory Use. EMC requirements. General requirements.
EN60204-1: 2006 + A1: 2009	Safety of machinery. Electrical equipment of machines. General Requirements

and fulfils all the relevant provisions of

2006/42/EC	Machinery Directive
2006/95/EC	Low Voltage Directive
2004/108/EC	Electromagnetic Compatibility (EMC) Directive

Note: This declaration covers all product serial numbers from the date this Declaration was signed onwards.

Sia Abbaszadeh, Chief Technical Officer

9 December 2009

Date and Place

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

iF Dry Pumping System - 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.

Contents

Section Page

dcs/7590/09/07

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

Illustrations

Figure Page

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Tables

Associated publications

Publication title	Publication number
Vacuum pump and vacuum system safety	P400-40-100

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1 INTRODUCTION

1.1 Scope and definitions

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

Read this manual before you install and operate the iF 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^{-1}': this is a flow of 1 l min^{-1} at an ambient temperature of $0^{o}C$ and a pressure of 1013 mbar (1.013×10^{5} 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.

Note: 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 appear on the pump:

Warning - refer to accompanying documentation.

Warning - risk of electric shock.

Warning - hot surfaces.

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Warning -Static sensitive devices

Warning - Heavy object

Warning - Moving parts present

Warning - Use protective equipment

Warning - RF earth (ground)

Warning - Protective earth (ground)

Material Safety Data Sheets for Edwards supplied chemicals can be attained by contacting Edwards.

1.2 The iF System

WARNING

The iF system is intended for use on load-lock chamber applications only. The pump is not configured for process use. Any reference to 'process gas' in the manual refers to clean process gas.

The iF 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 iF1800 system has an FDP200 dry pump with an HMB1800 mechanical booster pump fitted to the inlet of the FDP200 pump. The FDP200 pump is referred to as the FDP pump and the HMB1800 is referred to as the HMB pump throughout the remainder of this manual.

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Both the FDP and HMB pumps have enclosed, water-cooled motors. The iF system is therefore suitable for applications in clean environments where fan cooling of motors is unacceptable.

The iF system has a gas system which introduces purge gas into the FDP pump.

You can manually control the iF system through the Pump Display Terminal: refer to Section 1.11. Alternatively, you can use your process tool or other control equipment to control the operation of the iF system through an Interface Module accessory (refer to Section 8.5.2), or through an iF Communications Module accessory (refer to Section 8.5.1), or you can use the iF Single Pumpset Monitor accessory to control the operation of the iF system (refer to Section 8.5.3). The remainder of this manual describes the use of the Pump Display Terminal to operate the iF system: for use of another accessory to operate the iF system, refer to the instruction manual supplied with the accessory.

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

1.3 Safety

All of the components of the iF system are fitted inside an enclosure. Panels of the enclosure should only be removed for access during maintenance and should at no time be removed by the operator. Potential hazards on the iF system include electricity, hot surfaces, process chemicals, Fomblin oil and nitrogen and water under pressure. Detailed safety information is given in Section 3.1 (Installation), Section 6.1 (maintenance) and Edwards publication number P300-20-000 ‘Vacuum pump and vacuum system safety’.

1.4 The FDP dry pump

The FDP pump is a positive displacement rotary pump in which a pair of matched screw rotors forms, with the casing, a transference space for gas. These rotors, which rotate without metal-to-metal contact are held in correct phase relation by a pair of timing gears. These timing gears and the adjacent bearings are oil lubricated. The bearings at the other end of the shaft are PFPE grease lubricated.

1.5 The FDP gas system

The gas system can be preset to operate in one of two configurations, low gas and high gas. As supplied, the gas system is preset to 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 FDP pump.

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

- Shaft-seals purge: this purge flow is on whenever the FDP pump is on.
- Cooling purge: this purge flow is on whenever the FDP pump is on.
- Dilution purge: this purge flow is on whenever the FDP pump is on.
- Exhaust-purge: this purge flow is only used in high gas configuration. The purge flow is on whenever the FDP pump is on.
- 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 Terminal or by your own control equipment.

Refer to Figure 2 which shows a schematic diagram of the FDP gas system.

The purge flow pressure is controlled by a pressure regulator (24). A mass flow transducer (23) 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 dilution purge flow is switched on and off by the solenoid-valve (15). The inlet-purge, shaft-seals purge and exhaust-purge flows are switched on and off by the solenoid-valves (20, 17 and 22). The dilution / cooling purge solenoid-valve (19) operates in conjunction with the dilution and inlet purge solenoid-valves (15 and 20), to control

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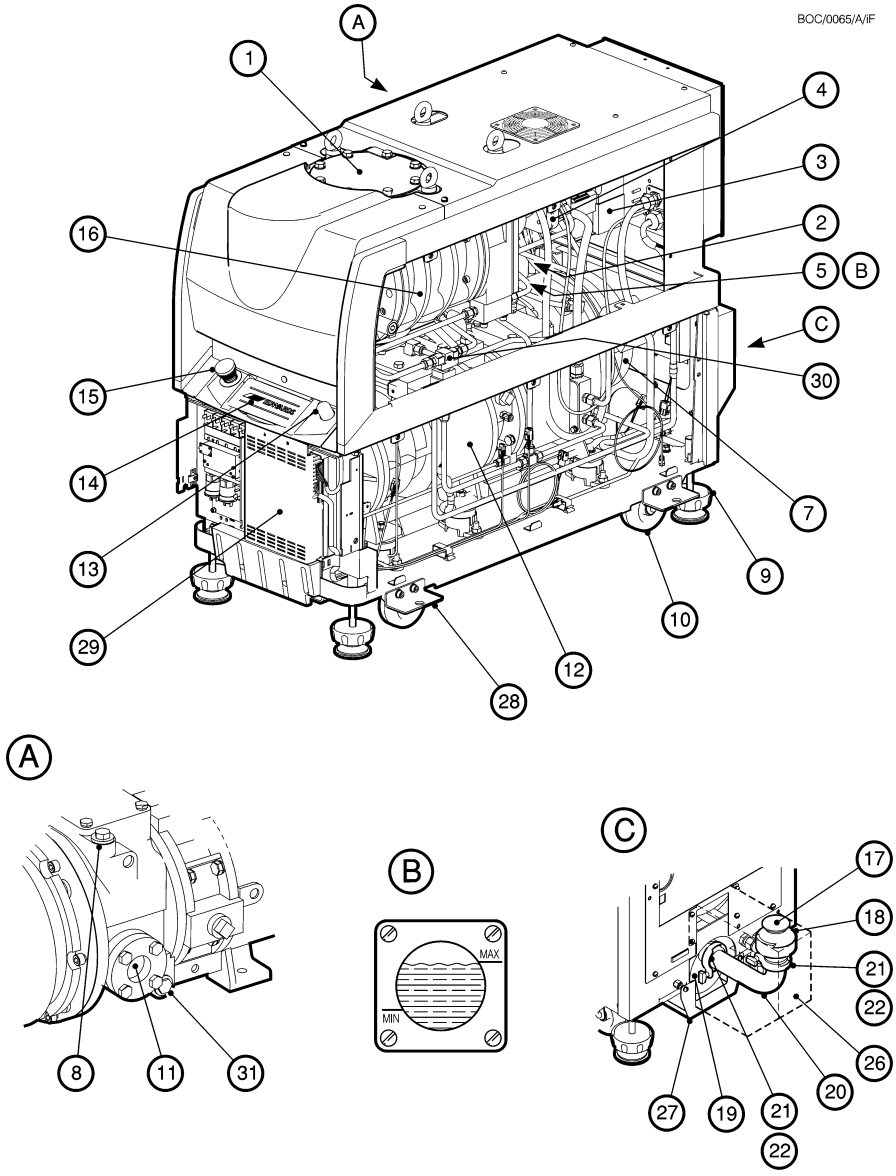
the cooling purge flow when the dilution purge is switched off or the inlet-purge is switched on. Variable restrictors (10 to 14 and 18) limit the purge flow rates.

A pressure transducer (21) monitors the pressure of the shaft-seals purge flow, and another pressure-transducer (7) 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 Terminal.

If there is a pressure rise in the exhaust pipeline, the outputs of the pressure transducer (7) will cause the iF system to be shut down at the appropriate alarm pressure.

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

Figure 1 - The iF system (iF1800 shown without panelwork)



1. Inlet
2. HMB oil filler plug
3. Inverter
4. HMB pump-motor
5. HMB oil-level sight-glass
6. Not used
7. FDP pump-motor
8. FDP oil filler-plug
9. Levelling-foot
10. Castor
11. FDP oil-level sight-glass
12. FDP pump
13. Nitrogen pressure regulator
14. Pump display terminal
15. Emergency stop switch
16. HMB pump
17. Outlet
18. Check-valve
19. Exhaust-silencer
20. Elbow
21. NW40 trapped 'O' ring
22. NW40 clamping ring
23. Not Used
24. Not used
25. Not Used
26. Exhaust enclosure
27. Drip tray
28. Anchor bracket
29. Control module
30. HMB cooling water Solenoid valve
31. FDP Oil Drain Plug

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1.6 The HMB mechanical booster pump

The HMB pump is a positive displacement roots vacuum pump. The pump mechanism is driven by a three-phase electric motor. The HMB pump in the iF1800 system is driven through an electrical inverter, which increases the speed of the motor to 6000 r min^{-1}.

The FDP pump backs the HMB pump:

- The HMB pump in an iF1800 system operates between atmospheric pressure and ultimate vacuum; when you start the FDP pump, the HMB pump starts after 30 seconds.

1.7 Temperature control system

1.7.1 FDP pump temperature control system

The FDP200 employs a direct cooling method, having the water circulating through the pump body such as casing, gear case and bearing case.

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 iF system by connectors at one end (Figure 4, items 2 and 3).

The cooling-water is distributed via the pump cooling circuit to the pump-motor cooling jacket before joining the outlet of the HMB cooling circuit.

A surface temperature sensor is fitted to the pump-body to measure the temperature of the pump-body. The output of the thermocouple is monitored by the iF system, refer to Section 1.9.3.

For safety reasons, a shutdown thermistor is fitted to the pump-motor cooling outlet. It is connected to the relay interlock circuit, and will cause the iF system to shut down if the temperature exceeds 60^{o}C.

A motor protection thermistor and a snap switch are fitted to the pump motor. The thermistor operates at 130^{o}C and the snap switch at 155^{o}C. Both are connected to the relay interlock circuit and will shut down the iF system if the pump motor gets too hot.

1.7.2 HMB pump temperature control system

The headplate and front bearing housing of the HMB pump are directly cooled by water, which flows around these parts of the pump. The solenoid valve in the water system provides cooling to the HMB outlet when required. The pump-motor is cooled by water, which flows through a cooling jacket that surrounds the pump-motor. The pump-motor cooling-water supply and return pipelines are connected to the cooling-water manifold on the FDP pump.

A motor-protection thermistor is fitted to the HMB1800 pump-motor. This thermistor is similar to that fitted to the FDP pump (refer to Section 1.7.1). The thermistor is connected to the relay interlock circuit and will cause the system to be shut down if the pump-motor is too hot.

A temperature sensor probe (Figure 5, item 15) is fitted in the stator of the pump. The output of the sensor is monitored by the iF control system. The output is used to operate the water solenoid valve. It is also used to slow the HMB down if the pump temperatures become too high.

1.8 Exhaust system

The outlet of the FDP pump is connected to an exhaust silencer, which is below the pump. The outlet of the silencer has a check-valve which prevents the suck-back of exhaust vapours after the iF 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 (refer to Section 3.9).

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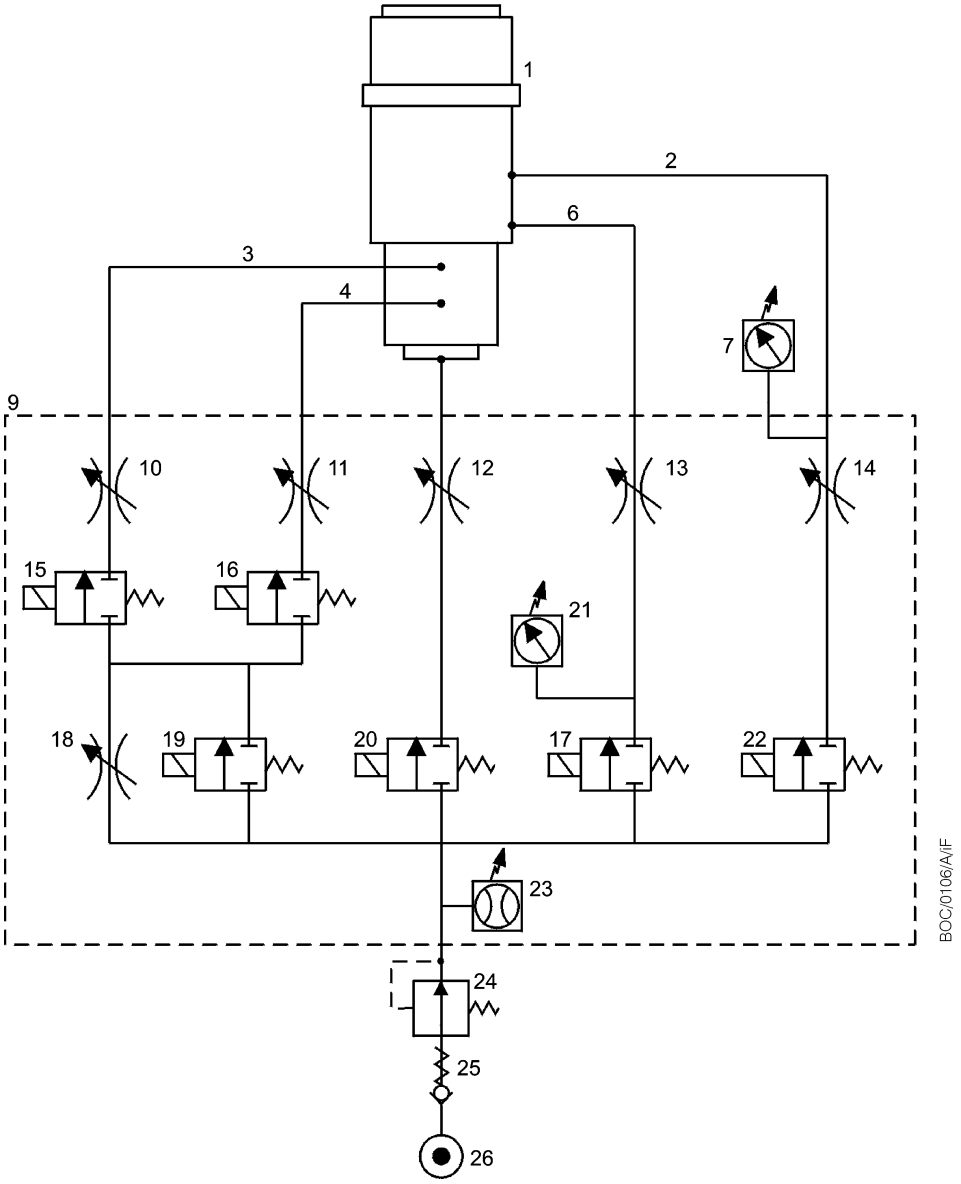
Figure 2 - Scematic diagram of the FPD pump gas system



1. FDP pump
2. Exhaust-purge pipeline
3. 3/4-dilution purge pipeline
4. 2/3-cooling purge pipeline
5. Inlet-purge pipeline
6. Shaft-seals purge pipeline
7. Pressure transducer (exhaust-purge)
8. Pressure-relay (exhaust-purge)
9. Gas Module manifold
10. Variable restrictor (3/4-dilution purge)
11. Variable restrictor (2/3-cooling purge)
12. Variable restrictor (inlet-purge)
13. Variable restrictor (shaft-seals purge)
14. Variable restrictor (exhaust-purge)
15. Solenoid-valve (3/4-dilution purge)
16. Solenoid-valve (2/3-cooling purge)
17. Solenoid-valve (shaft-seals purge)
18. Variable restrictor (dilution purge control)
19. Solenoid-valve (dilution purge control)
20. Solenoid-valve (inlet-purge)
21. Pressure transducer (shaft-seals purge)
22. Solenoid-valve (exhaust-purge)
23. Mass flow transducer
24. Pressure regulator
25. Check-valve
26. Nitrogen supply inlet

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1.9 Electrical system

Refer to Figure 3, which shows a schematic diagram of the electrical and control system of the iF1800 system.

1.9.1 Introduction

The iF system has an Electrics Box (1), Control Module (3), a Gas Module (2) and a Pump Display Terminal (4). The iF1800 system has an inverter (50). Optionally, your iF system may have an iF Interface Module, an iF Communications Module, and other accessories, such as an exhaust temperature sensor (30) and a Pump Display Module (10).

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 (refer to Section 2).

1.9.2 Electrics box

Refer to Figure 3. The external electrical supply (5) is connected to the electrical supply connector (6) on the Electrics Box (1). The Electrics Box provides the electrical supplies to the other Modules in the iF system. The electrical supply to the FDP pump is provided by the Electrics box on the iF1800 system. The inverter (50) provides the electrical supply to the HMB1800 pump in an iF1800 system.

The Electrics Box has contactors for the FDP pump and the HMB pump (on an iF1800 system), pump power and current consumption sensors and short-circuit protection. The Electrics Box has a transformer and fuses for the 24 V control circuits, it also has fuses for the following supplies: iF Tool Interface Module (11) and d.c. electrical supply (47). Three thermal-type, self-resetting fuses in the Electrics Box protect the d.c. electrical supplies to the network.

Refer to Figure 4 detail C. The rear panel of the Electrics Box has the following lamp and connections:

Power on lamp (7): This lamp is on when the electrical supply to the Electrics Box is on.

Tool Interface Module connector (8): Use this to connect an iF Tool Interface Module to the iF system (refer to Section 8.5.2); or to connect an external emergency stop circuit to the iF system (refer to Section 3.14).

LON Interface Connector (9): Use this to connect the iF system to a network.

Electrical supply connector (10): Use this to connect your external electrical supply to the iF system: refer to Section 3.15.2.

Protective earth (ground) stud (11): If required, use this to make additional protective earth (ground) connections: refer to Section 3.15.2.

Exhaust Gas Management interface (12): If required, use this connector to connect the iF system to a Edwards Exhaust Gas Management.

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 iF Interface Module (if fitted).

Refer to detail D. Fuses inside the Electrics Box (16 to 21) protect the internal circuits of the Electrics Box. Note that you cannot change these fuses; a Edwards service engineer must change these fuses.

Refer to detail B. The rear panel of the iF system has the following connections:

Active gauge connector (5): This connector is only available if you have fitted an Active Gauge Connection Kit (refer to Section 8.4.2). Use this to connect the active gauge to the iF system.

RF earth (ground) stud (6): If required, use this to make additional RF earth (ground) connections: refer to Section 3.15.3.

Refer to Figure 5, detail A. The bottom panel of the Electrics Box has the following cables and connectors.

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Electrics and Control Loom (17): This is used to provide power, measurement signals and control signals to the Control Module.

FDP electrical supply cable (18): This is used to connect the electrical supply from the Electrics Box to the FDP pump.

FDP thermistor cable (19): This is used to connect the output of the thermistor in the FDP pump to the Electrics Box.

HMB thermistor cable (21): On an iF1800 system, this is used to connect the output of the thermistor in the HMB pump to the Electrics Box.

HMB electrical supply cable (22): On an iF1800 system, this is used to connect the electrical supply from the Electrics Box to the HMB pump.

1.9.3 Control module

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

- FDP pump-body temperature sensor
- HMB pump temperature sensor
- Exhaust temperature sensor (if fitted)
- Water flow-switch.
- FDP oil level monitor

The Module has a microprocessor which:

- Monitors the status of the system.
- Sends warning and alarm messages (refer to Section 1.11.2) to other Modules connected to the iF system.
- Monitors the control inputs (from the Pump Display Terminal or the Interface Module accessory) and switches the pumps on and off as requested.
- Shuts down the iF system if a sensor reading is outside the specified alarm range: refer to Section 1.11.2.

The Module also communicates with and controls the operation of the Gas Module.

Internal clocks and counters in the module measure the operating time of the iF system and keep count of the number of iF system switch-on / switch-off and process cycles.

1.9.4 Gas Module

The Gas Module communicates with and is controlled by the Control Module. The operation of the nitrogen purge supply solenoid-valves in the Gas Module is described in Section 1.5.

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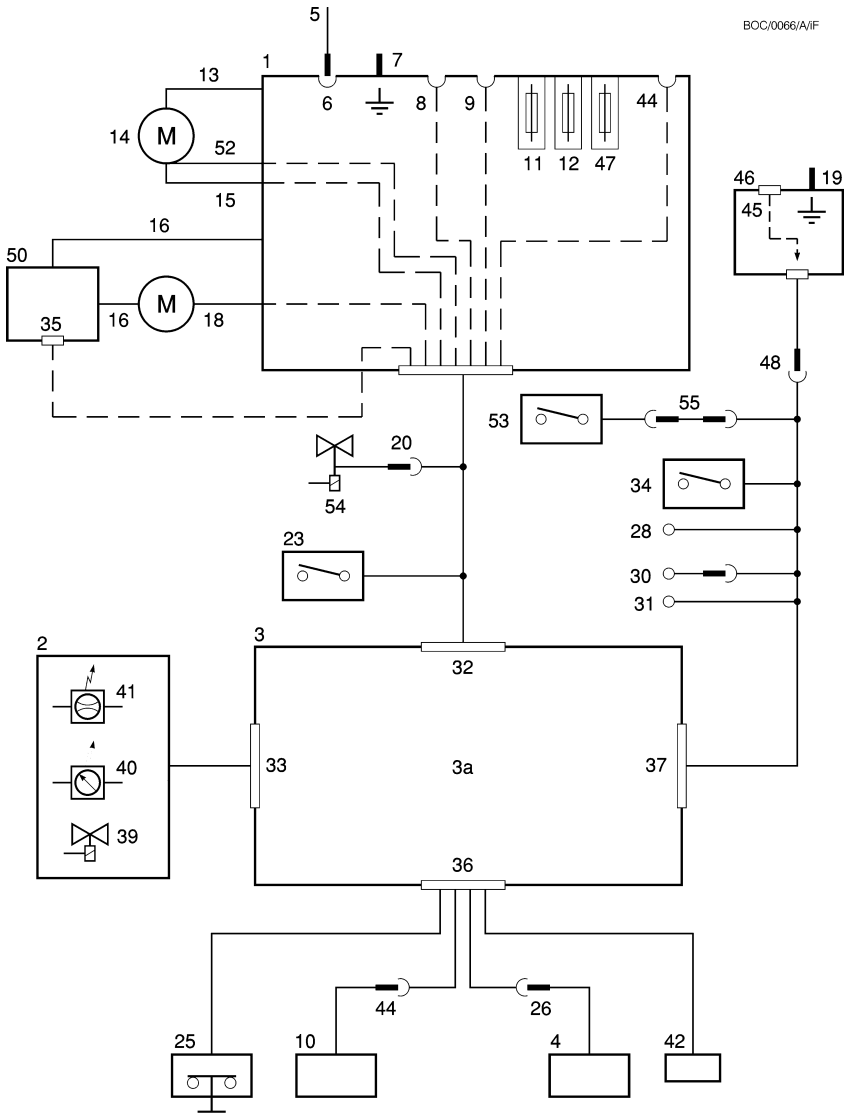
Figure 3 - Schematic diagram of the iF1800 electrical systems



1. Electrics box
2. Gas module
3. Control module
3A. Control SMA
4. Pump display terminal
5. External electrical supply
6. Electrical supply connector
7. Protective earth (ground) stud
8. GRC relay
9. Tool interface module connector
10. Pump display module
11. iF tool interface module fuse holder
12. Emergency stop fuse holder
13. FDP electrical supply
14. FDP motor terminal-box
15. FDP motor thermistor cable
16. HMB electrical supply *
17. HMB motor terminal-box *
18. HMB motor thermistor cable *
19. RF earth (ground) stud
20. Solenoid valve power supply *
21. Not used
22. Not used
23. Pump shutdown thermistor
24. Not used
25. Emergency stop switch
26. RJ12 connector for PDT
27. Cooling-water solenoid valve *
28. HMB temperature sensor *
29. FDP pump-body temperature sensor
30. Exhaust temperature sensor
31. FDP pump-body temperature sensor
32. Control PL3 connector
33. Gas module PL4 connector
34. Water flow-switch
35. RS485
36. Dashboard PL1 connector
37. Sensors PL2 connector
38. Not used
39. Solenoid-valves (6 off)
40. Pressure transducers (2 off)
41. Mass flow transducer
42. Dashboard LEDs
43. Not used
44. 4-way XLR connector for PDM
45. Active gauge connector
46. Lower rear bulkhead panel
47. d.c. electrical supply fuse holder
48. Active gauge cable connector
49. Sensor connector
50. HMB inverter
51. Not used
52. FDP Motor snap switch cable
53. FDP oil level monitor
54. Water valve solenoid
55. FDP oil level monitor loom

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1.10 Controls and indicators

Refer to Figure 6. The controls and indicators on the dashboard of the iF system are as follows:

Emergency stop switch (1): Press this to immediately shut down the iF system in an emergency: refer to Section 5.11.

Pump Display Terminal (2): Use this to control the iF 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 Control Module is on.

Running LED (8): This green LED is on when the iF pumps are operating.

Alarm LED (9): This red LED is on when an alarm condition exists: refer to Section 1.11.2

Warning LED (10): This yellow LED is on when a warning condition exists: refer to Section 1.11.2

1.11 Control functions

1.11.1 Priority of control

The iF system can be controlled by a number of modules: the Pump Display Terminal, an iF Interface Module (refer to Section 8.5.2); or the iF Single Pumpset Monitor (refer to Section 8.5.3). Only one module can have control of the iF system at any one time. That is, once a module has control of the iF system, control requests from another Module are denied.

To allow another Module to control the iF 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 iF 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 iF system. The Module which you want to control the iF system must take control as described above.

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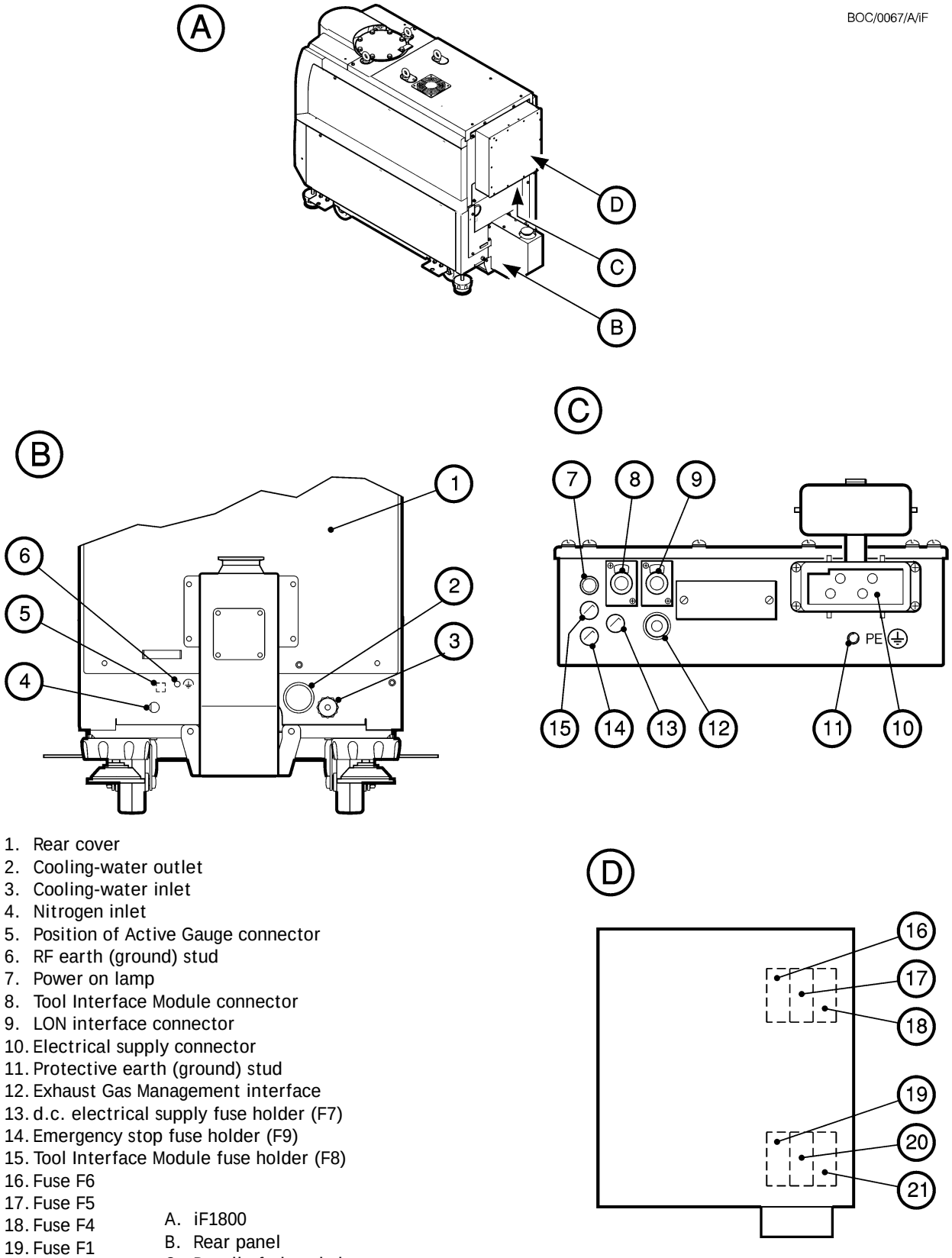
Figure 4 - Services and electrical connections on the rear of the iF system



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. Exhaust Gas Management interface
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

A. iF1800
B. Rear panel
C. Detail of electric box
D. Detail of electric box

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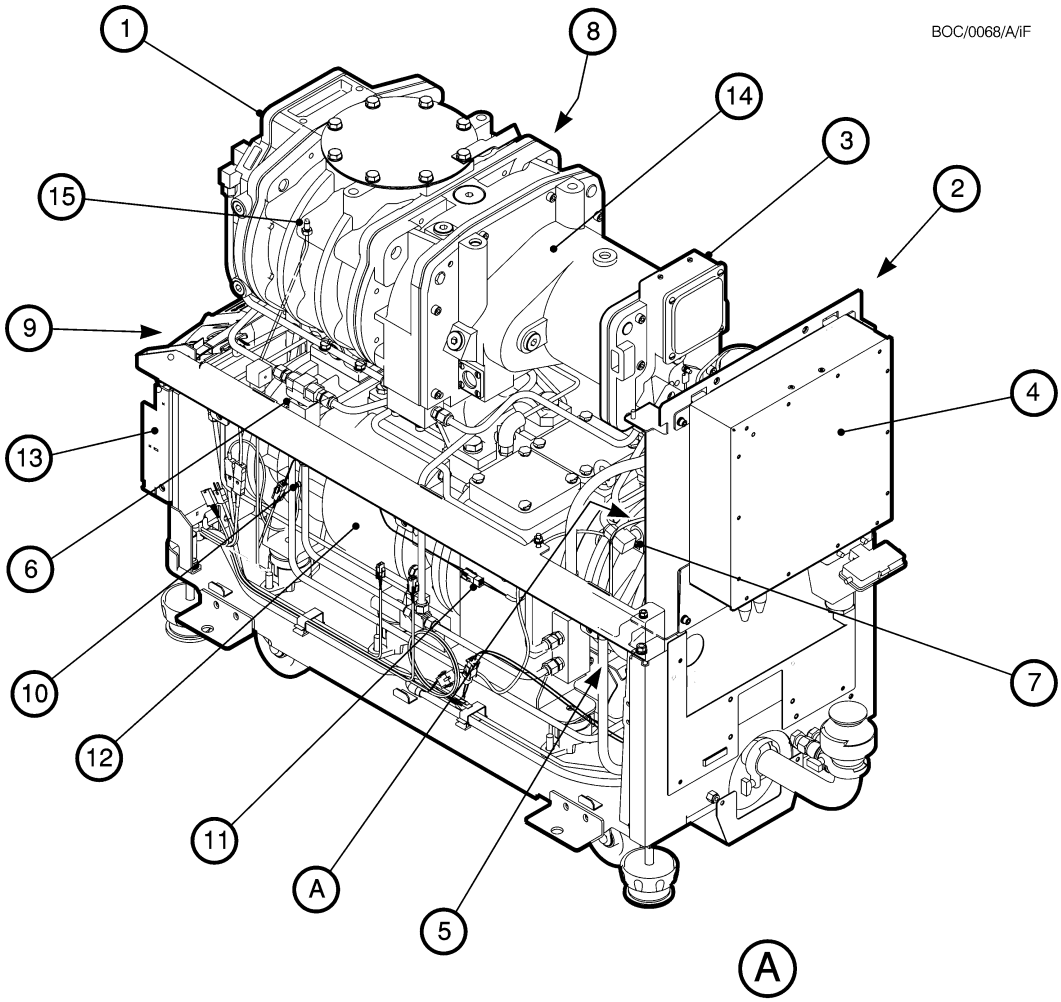
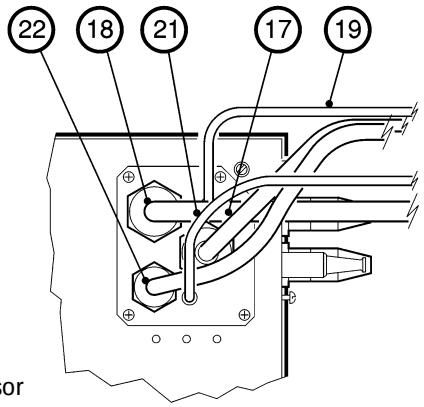
Figure 5 - Electrical components (shown without enclosures for clarity)





A. Electrics Box detail

1. HMB pump
2. Inverter
3. HMB pump-motor terminal-box
4. Electrics Box
5. FDP pump-motor terminal-box
6. Cooling-water solenoid valve
7. FDP pump shut-down thermistor
8. FDP pump water flow-switch
9. Gas Module
10. FDP pump-body temperature sensor
11. FDP oil level monitor cable
12. FDP pump
13. Control Module
14. HMB pump-motor
15. HMB pump temperature sensor
16. Not used
17. Electrics and Control Loom
18. FDP pump electrical supply cable
19. FDP pump-motor thermistor cable
20. Not used
21. HMB pump-motor thermistor cable
22. HMB inverter electrical supply cable

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1.11.2 Setpoints, warning and alarm conditions

Note: Sensors which generate alarm and warning messages are not safety sensors: refer to Section 1.11.3.

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 iF system is abnormal. The iF 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 iF system to prevent damage to the iF system. However, note that for some of the alarm conditions, you may be able to continue to operate the iF system if you have configured the iF system to 'run til crash': refer to Section 5.10.

If an alarm or warning condition exists, an appropriate alarm or warning message is displayed on the Pump Display Terminal and an appropriate alarm or warning indication is sent to other Modules on the network. Refer to Tables 21 and 22 for a full list of the Pump Display Terminal 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.

1.11.3 Safety sensors

The iF system has a number of safety sensors, which are connected to the relay interlock circuit. If any of the safety sensors cause the interlock to operate, the iF system is immediately shut down (EMS - emergency shutdown). Although the pump is shutdown, control and indication power supplies are maintained to safely establish the state of the pump.

Table 1 lists the safety sensors and their shutdown conditions. Locations of the thermal safety sensors is shown in Figure 5.

1.12 Pump Display Terminal

The Pump Display Terminal allows you to manually control the iF system and to display the status of the iF system. Refer to Figure 7 which shows the front panel of the Pump Display Terminal.

Use the On button (1) to switch on the iF system (refer to Section 5.5). The On button has a green LED which is illuminated when the iF system is on. Use the Off button (10) to switch off the iF 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 iF system sensors or internal clocks and counters.

As supplied the first page of Normal display shows FDP pump power consumption and FDP pump body temperature, and the second page shows HMB pump power consumption and HMB 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.

The status LEDs (9) show the current status of the iF system and the Pump Display Terminal.

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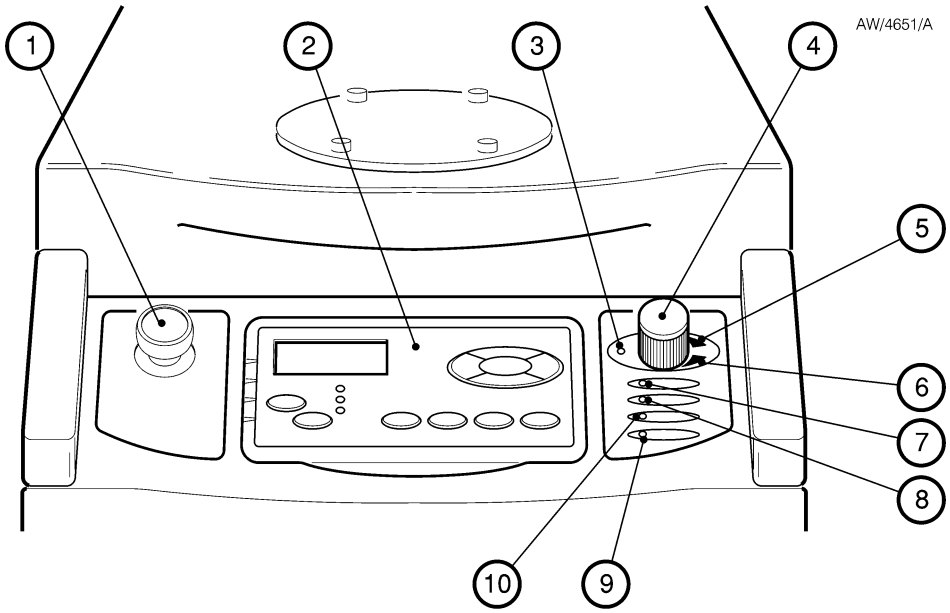
The ALARM and WARNING LEDs flash when the corresponding alarm or warning condition first occurs. When you acknowledge the condition (refer to Section 5.8), the corresponding LED goes on permanently. For most alarms and warnings, if the condition clears (that is, the fault which caused the condition is no longer present), the corresponding LED goes off; refer to Tables 21 and 22 for the warnings and alarms whose LEDs do not automatically reset in this way.

If remote operation in excess of 25m is expected, a Pump Display Module should be used. The functionality of the Pump Display Module is the same as that of the Pump Display Terminal. Refer to Section 8.5.7 for ordering information.

Figure 6 - Controls and indicators on the dashboard



1. Emergency stop switch
2. Pump Display Terminal
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)

1.13 Drip tray

The drip tray is fitted to the bottom of the iF frame (refer to Figure 1) and allows the collection of potentially spilled liquids from the iF system.

1.14 Anchor brackets

The four anchor brackets, which are also used to secure the iF system to a pallet during transit (refer to Figure 14), are fitted to the side of the iF frame.

1.15 Labels

The labels provided warn against potential hazards.

The labels are placed on the iF system to: identify components; state required operating procedures; and warn of residual risks. Figures 8 and 9 show the position and text of these labels.

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1.16 Exhaust Enclosure

The exhaust enclosure fits around the exhaust elbow and check valve (refer to Figure 1), and provides a means of extracting the enclosure in the event of an exhaust leak from the system.

1.17 Accessories

A number of accessories are available to configure the iF system for your specific application. Refer to Section 8 for descriptions of these accessories.

Table 1 - Safety sensors

Safety sensor	Shut-down condition
FDP pump-motor thermistor	When the thermistor in the FDP pump-motor indicates that the temperature of the pump-motor is nominally 130°C
HMB pump-motor thermistor	When the thermistor in the HMB pump-motor indicates that the temperature of the pump-motor is nominally 150°C
FDP pump motor snap switch	When the thermal snap switch operates to indicate the pump motor stator temperature is nominally 155°C
Water system thermistor	When the thermistor indicates that the temperature of the water system is 60°C or higher.
Nitrogen supply pressure source#	When the flow of nitrogen purge gas to the dry pumping system is too low.

Table 2 - Explanation of menu buttons

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 iF system (refer to Section 5.4).
Status	Green	Press this button to select the Status menu. In this menu, you can display the current values of all iF system sensors.
Setup	Green	Press this button to select the Setup menu. In this menu you can: manually control the operation of iF gas purges and gate valves fitted to the vacuum system (and connected to the iF through an iF 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 iF 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.

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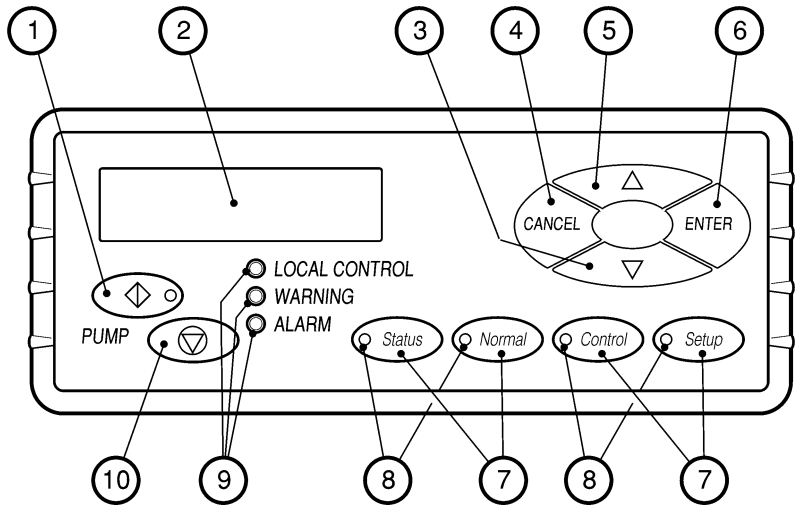
Table 3 - Explanation of LED's

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 Terminal has control of the iF system.

Figure 7 - Controls and indicatorss on the PDT



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

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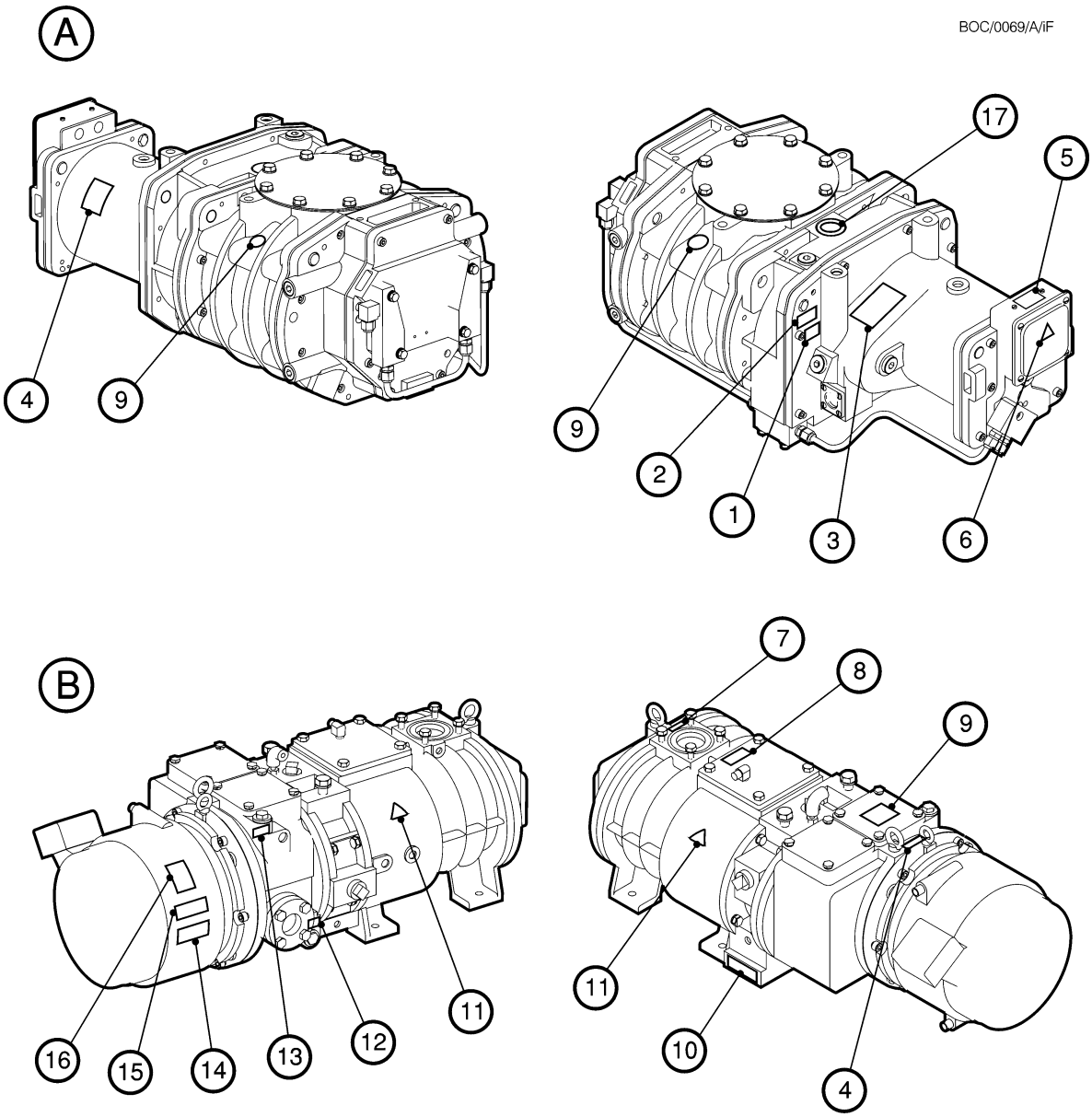
Figure 8 - Label fixing positions on the FDP and HMB



A. HMB
B. FDP

1. Use only Fomblin Drynert 25/6 Oil
2. Caution! Do not overfill with oil
3. HMB Information/Warning! Risk of High Temperature symbol
4. Direction of Rotation Arrow
5. HMB Motor Rating Information
6. Warning! Risk of Electric Shock symbol
7. Suction
8. Caution, High Temp. Keep hand away
9. Use perfluoropolyether oil
10. Delivery
11. Hot surface symbol
12. Oil drain
13. Oil Inlet
14. Thermistor and snap switch information
15. FDP Motor rating
16. General warnings
17. Do not oil symbol

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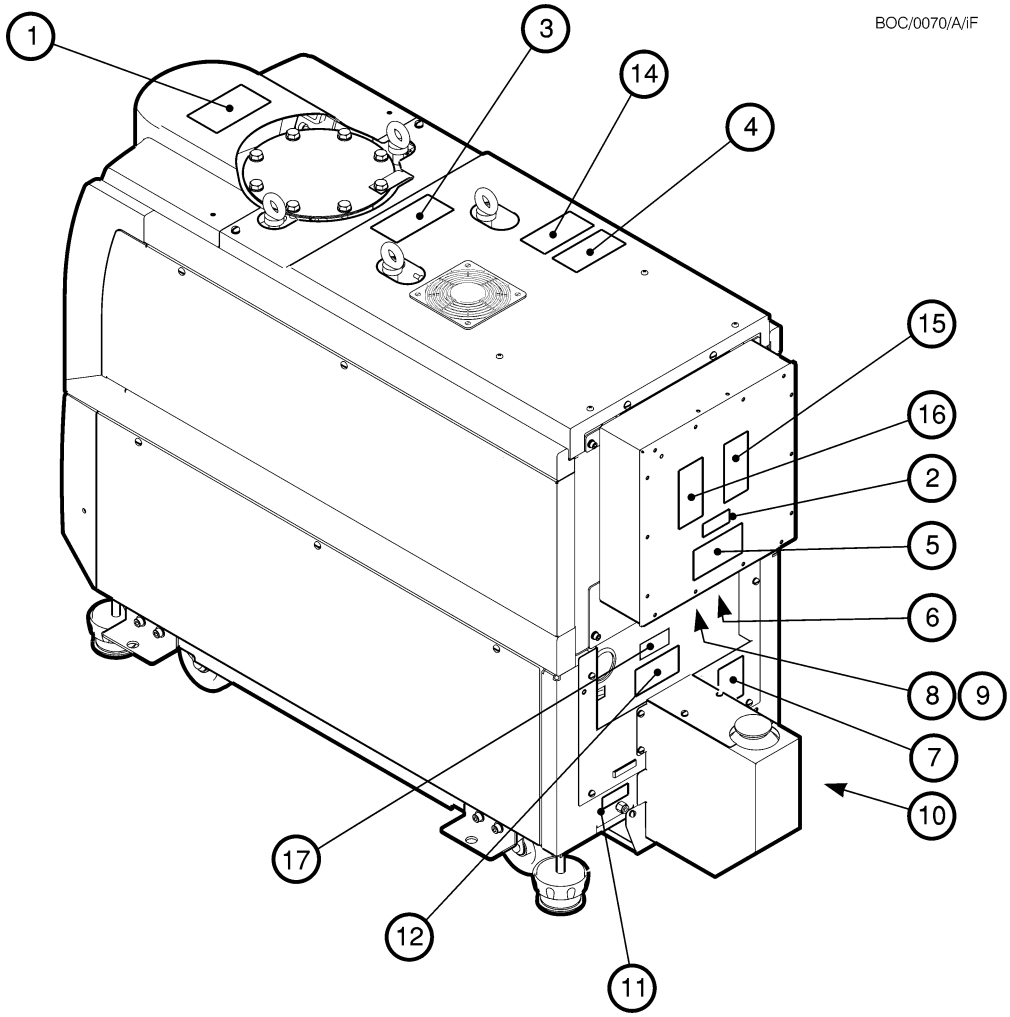
Figure 9 - Label positions on the iF system enclosures



1. Warning! Moving Parts Present
2. Voltage variant
3. Caution! Heavy Object
4. Warning! Hazardous Chemicals Enclosed
5. Warning! Disconnect mains supply before removing Electric Box covers
6. Warning! Risk of Electric Shock
7. System Information/Warning! Risk of High Temperature Symbol
8. Protective Earth symbol
9. External Protective Earth Conductor symbol
10. H_2O < 100 PSIG (< 6.9 bar)
11. N_2 20-100 PSIG (1.4-6.9 bar)
12. Warning! Switch off before disconnecting
13. Not used
14. Caution! Hot Surface
15. This equipment must have a second protective earth. See manual.
16. Set voltage - Do not adjust
17. ETL listing label

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2 Technical Data

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

2.1 General

Dimensions	refer to Figures 10 and 11
Inlet and outlet	refer to Table 4
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 x 10^{-5} mbar l s^{-1} (1 x 10^{-3} Pa l s^{-1})
Exhaust system maximum leak-rate	1 x 10^{-5} mbar l s^{-1} (1 x 10^{-3} Pa l s^{-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)	refer to Table 4
Mass	refer to Table 4
Centre of mass/mass distribution	refer to Figure 12

2.2 Performance

Pumping speed range	refer to Figure 13
Peak pumping speed	refer to Table 4
Ultimate vacuum	refer to Table 4
Maximum inlet pressure	refer to Table 4
Maximum operating time at maximum inlet pressure	refer to Table 4

Table 4 - Technical Data

Parameter	50Hz	60Hz	Units
Typical peak pumping speed	1720	1800	$m^3 h^{-1}$
Typical ultimate vacuum with shaft seals purge only (50 and 60 Hz)	8 x 10^{-4} 0.08	5 x 10^{-4} 0.05	mbar Pa
Maximum inlet pressure (50 and 60 Hz)	Atmospheric Atmospheric	Atmospheric Atmospheric	mbar Pa
Maximum operating time at maximum inlet pressure (50 and 60 Hz)	60	60	Seconds
Inlet connection	ISO160	ISO160	-
Outlet connection	NW40	NW40	-
Mass	585	585	kg
Noise level	<64	<69	dB(A)

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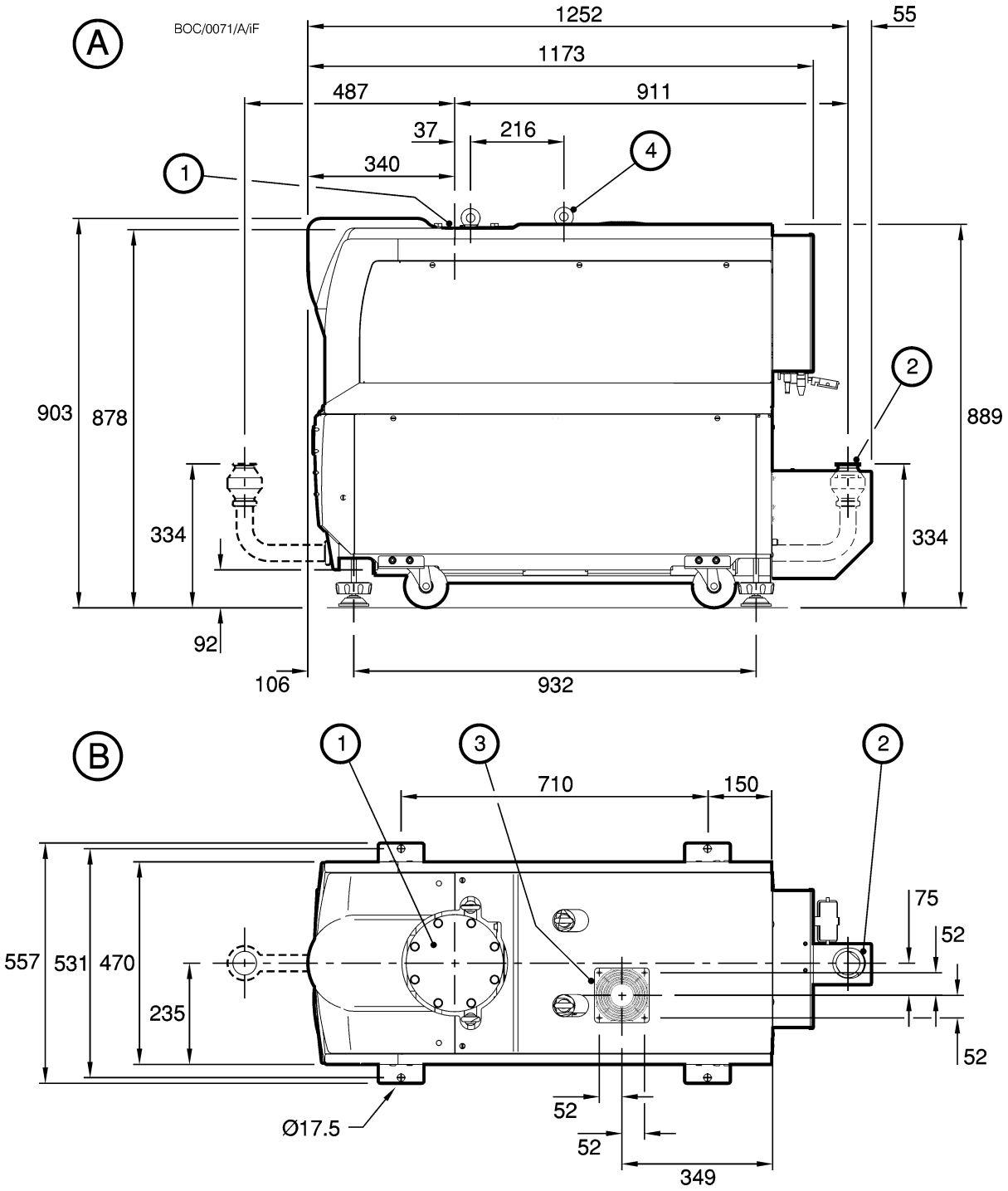
Figure 10 - iF1800 dimensions (mm)



A. Side view
B. Plan view
1. Inlet
2. Outlet (as supplied)
3. Air-extraction port
4. Lifting bolts (all 4 to be used)

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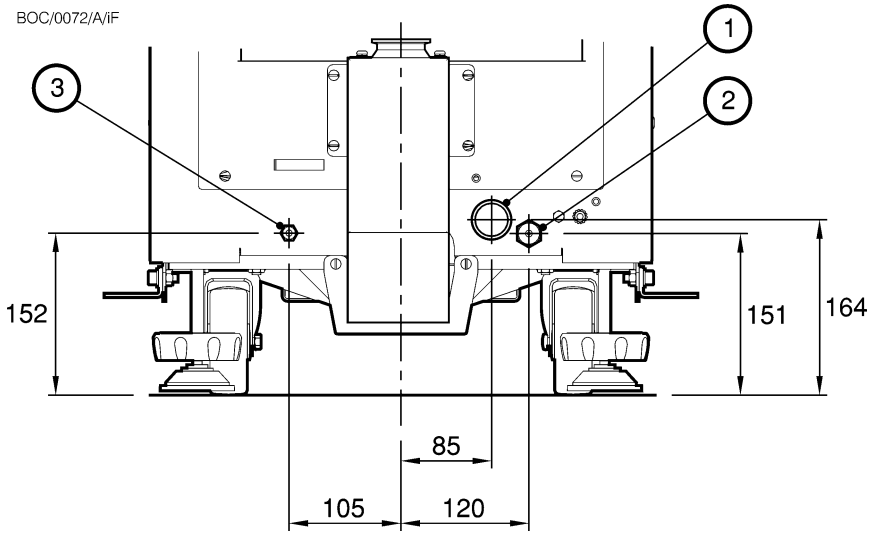
Figure 11 - Services connections dimensions (mm)



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

2.3 Temperature control system

FDP pump shut-down thermistor	
Type	Negative Temperature Coefficient thermistor
"Opening" temperature	60±3 °C
"Closing" temperature	50±4 °C
Thermocouples	K type class 1
FDP and HMB motor-protection thermistor type	Positive temperature coefficient
Reference temperature	HMB 150 °C; FDP 130°C, (snap switch 155±3°C)
Compliant with	IEC 34-11 (BS4999 part III)
Water flow-switch	Closed when system flow > 6 l min^{-1} (HMB flow > 2 l min^{-1})

2.4 Cooling Water Supply

Pumps are supplied with quick release connectors. The water supply should be provided with an isolator.

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

Maximum supply pressure	100 psig (6.9 bar, 6.9 x 10^5 Pa)
Typical pressure differential across supply and return *	
iF1800	20 psi (1.34 bar, 1.34 x 10^5 Pa)
Minimum flow rate required for reliable iF system operation	
iF1800	6 l min^{-1}

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Maximum supply pressure	100 psig (6.9 bar, 6.9 x 10^5 Pa)
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 a flow rate of 6 l min^{-1}.*

2.5 Lubrication

Note: Edwards Material Safety Data Sheets for the oils referenced in the following sections are available on request. (Refer to Section 1.1 for contacts).

2.5.1 FDP pump

End bearings	
Quantity	100 g
Recommended perfluoropolyether oil	Nok Kluber Noxlub KF1920, Fomblin CR6500 or Fomblin CR861
Gearbox	
Oil charge	1.8 litres
Recommended perfluoropolyether oil	Nok Kluber Barrierte J60EP, Fomblin Y14/6

2.5.2 HMB pump

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

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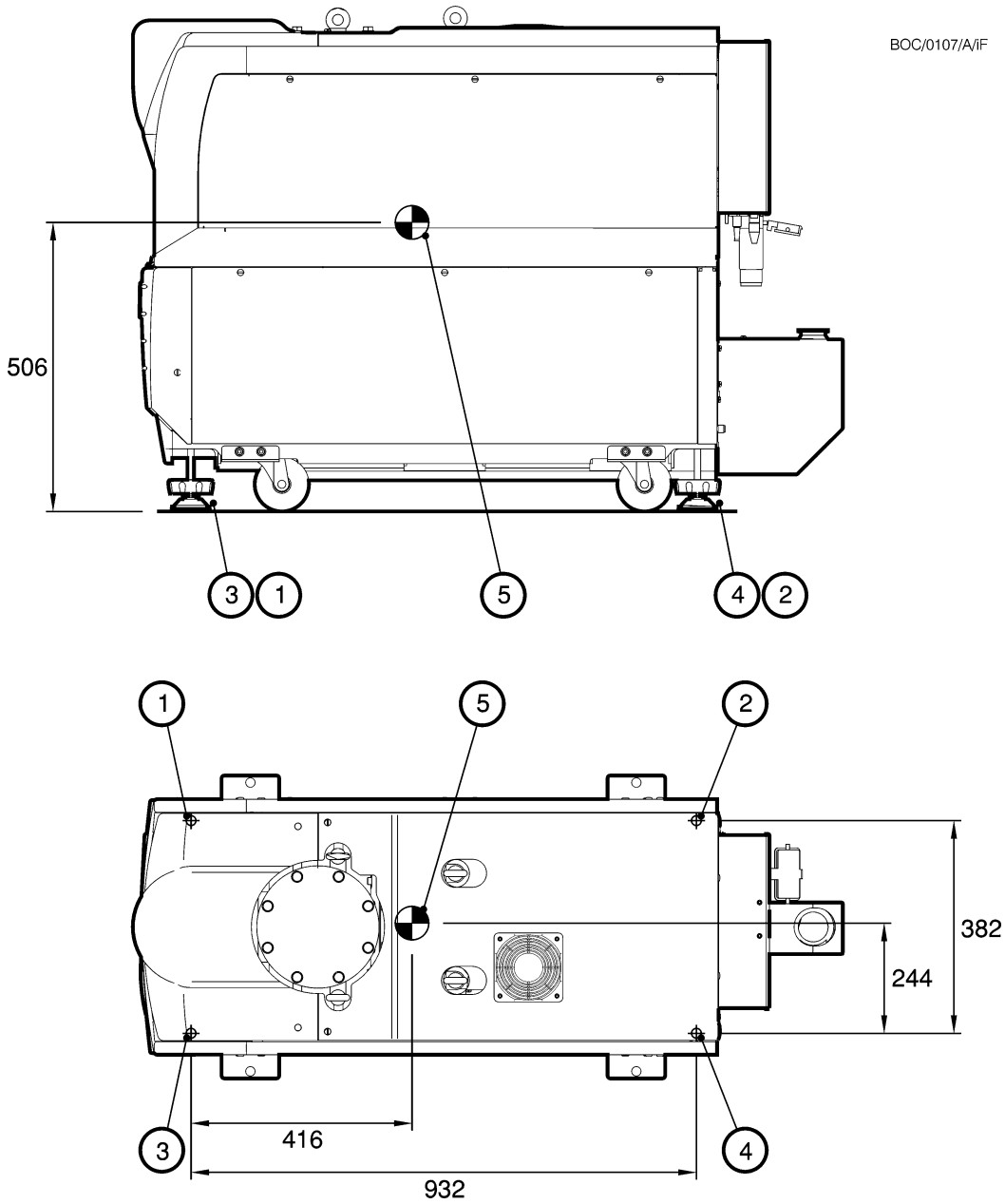
Figure 12 - Centre of mass dimensions (mm) and mass distribution



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**
iF1800	186.3 kg	125.8 kg	140.4 kg	132.5 kg

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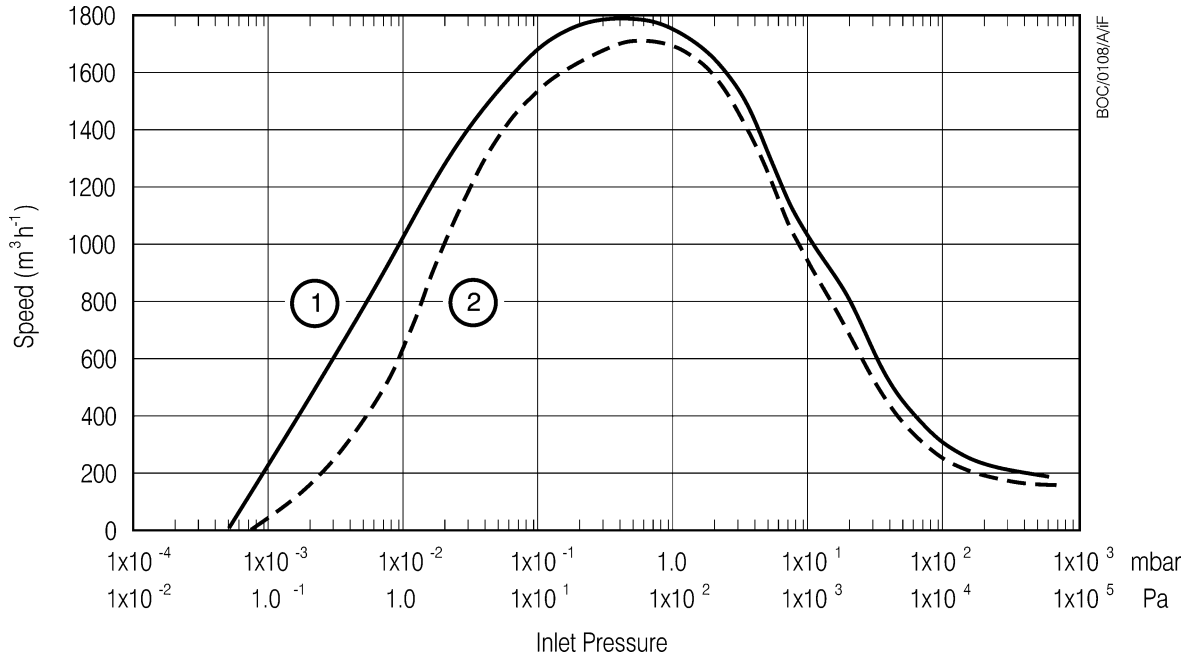
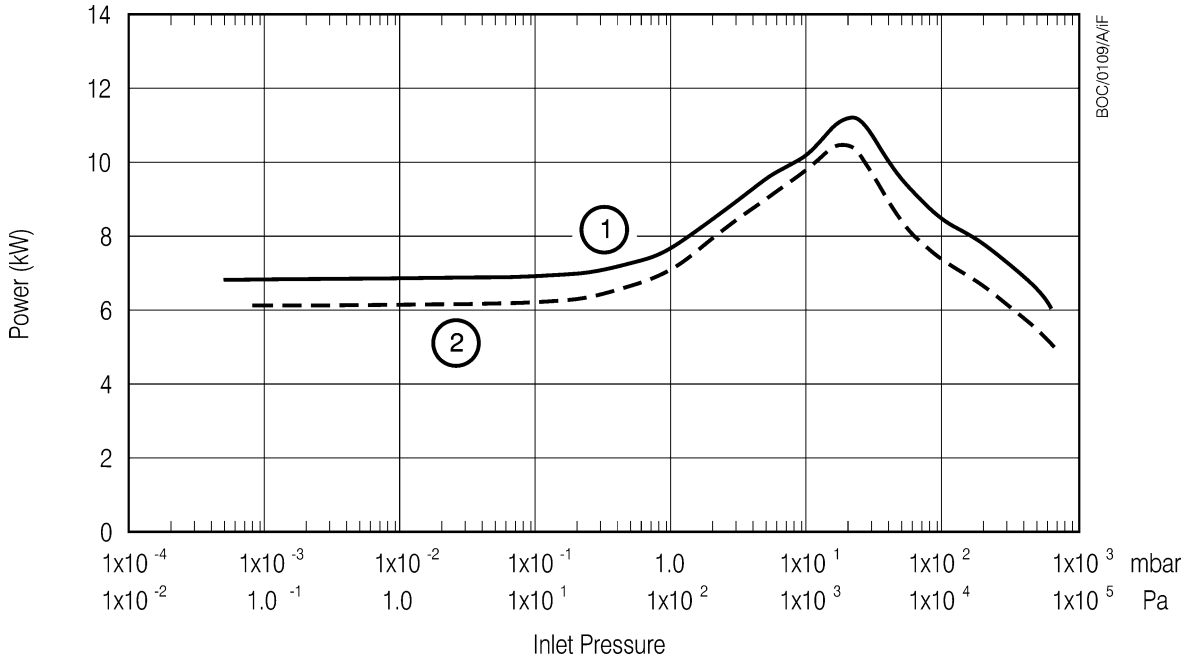
Figure 13 - Typical pumping speed and pump power curves for an iF1800





1. 60Hz
2. 50Hz

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2.6 Electrical data

Electrical supply	
Supply voltage	200-208 V at 50/60 Hz, 3-phase 440 V at 60 Hz, 3-phase
Voltage tolerance	10% (except for 208 V at 50 Hz, which are +6%)
Installation Category	Category 2 (EN61010)
Pollution Category	Category 1 (EN61010)
Full load current ratings	refer to Table 5
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 a.c./d.c., 5 A max
External emergency stop switch	
Rating	24 V a.c., 5 A
Load	700 mA (inductive)

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

Table 5 - Full load current ratings

Supply voltage and frequency		**200-208 V 50 Hz**	**200-208 V 60 Hz**	**440V 60Hz**
FDP	Full load (A)	22.1	21.7	10.1
	Motor rating (kW)	5.5	5.5	5.5
HMB	Full load (A)	14.5	15.4	7.2
	Motor rating (kW)	2.9	3.5	3.5
Maximum input power to iF system (kW)		11.4	12.1	12.1

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2.7 Gas system

The nitrogen supply should be provided with an isolator.

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)
Flow rates (with nitrogen supply capacity of 100 slm)	refer to Table 6
Pressure transducer accuracy	± 0.6 psi (± 4.1×10^{-2} bar, ± 4.1×10^3 Pa) at 6 psig (1.4 bar absolute, 1.4×10^5 Pa)
Flow transducer accuracy	± 3.0 slm (± 5×10^3 Pa l s^{-1})

Table 6 - Nitrogen Purge flow rates: High gas configuration

Purge Flows		Flow Rates	
		slm	Pa l s^{-1}
Typical nitrogen flow rates. (High gas configuration: Factory Set)	Cooling purge	28	4.72×10^4
	Dilution purge*	22	3.71×10^4
	Shaft seals purge	2	3.37×10^3
	Exhaust purge	4	6.75×10^3
	Inlet purge	20	3.37×10^4
	Maximum flow without inlet purge	56	9.45×10^4
	Maximum flow with inlet purge	54	9.11×10^4
Maximum nitrogen flow rates.	Cooling purge	30.5	5.15×10^4
	Dilution purge*	24.5	4.13×10^4
	Shaft seals purge	3	5.06×10^3
	Exhaust purge	5	8.44×10^3
	Inlet purge	22	3.71×10^4
	Maximum flow without inlet purge	63	1.06×10^5
	Maximum flow with inlet purge	60.5	1.02×10^5

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

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2.8 Materials in contact with process gases

Pump, shafts and rotors	-	Cast iron, steel, SG iron
Internal and external shaft-seals		
FDP pump	-	PTFE (polytetrafluoroethylene)
HMB pump	-	PTFE and fluoroelastomer
FDP pump nitrogen pipelines	-	Stainless steel
Gas System components	-	Stainless steel and Viton
FDP rotor coating	-	Molybdenum disulfide; xylene; dioxane;dimthyacetamide and antimony trioxide.

2.9 Fire Safety

The use of combustible materials has been minimised, potential ignition sources have been contained within sealed metal enclosures and engineering controls have been used to avoid ignition or over temperature situations.

2.10 Resource Conservation

Measures have been taken in the design of the iF system to conserve the environment, as advised by ISO14001 - Environmental Management Systems.

- Packaging materials may be recycled
- Lubrication for life has been incorporated into the pump design
- No pump parts require cleaning for maintenance
- Materials used in the manufacture of the pump may be recycled on completion of its useful life.

2.11 Default setpoints

The default setpoints are shown in Tables 7 to 9. 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 7 - Electrics box default setpoints

Parameter	Unit	Default setpoint values			
		Low alarm	Low warning	High warning	High alarm
FDP power consumption	kW	ADJ	0.0	7.0	8.5
HMB power consumption	kW	ADJ	0.0	N/A	N/A

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Table 8 - Electrics module default setpoints

Parameter	Unit	Default setpoint values			
		Low alarm	Low warning	High warning	High alarm
FDP pump temperature	°C	ADJ	ADJ	75	85
FDP motor cooling-water return temperature	°C	ADJ	ADJ	55	ADJ
HMB1800 pump temperature	°C	ADJ	ADJ	165	170
Exhaust gas temperature	°C	ADJ	ADJ	220	ADJ

Table 9 - Gas module default setpoints: High gas configuration

Parameter	Unit	Default Setpoints			
		Low Alarm	Low Warning	High Warning	High Alarm
Dilution purge off	slm	24	28.5	ADJ	ADJ
Dilution purge on	slm	30	35	ADJ	ADJ
Inlet purge on	slm	30	35	ADJ	ADJ
Exhaust pressure	psig	ADJ	ADJ	4.0	7.0
Shaft seals pressure	psig	ADJ	ADJ	12.5	ADJ

Note: Only slm gas flow values are given in the table, because only slm values can be entered in the Pump Display Terminal. To convert slm values to PA ls^{-1}, multiply by (1.013/60) x 10^5.

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2.12 Connections

Inlet and outlet	refer to Table 4
Electrical supply connector	
Type	Harting HAN-K-4/2
Cable outside diameter range	18 to 27 mm
Maximum conductor cross-sectional area	16 mm^2
Pump Display Module connector	XLR type 4-way
Network communications connector	XLR type 4-way
Exhaust Gas Management interface	6-pin DIN [3-Common; 4-Normally Closed; 5-Normally Open]
iF 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
Pump Display Terminal connector	RJ12

* *Connector mating-halves to connect your cooling-water supply and return pipes are supplied with the iF system: refer to Section 3.17.*

2.13 Item Numbers

Table 10 - Item Numbers

Electrical supply	iF1800
440V, 60Hz, 3-phase	A533-23-974
200/208V, 50/60Hz, 3-phase	A533-23-945

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3 INSTALLATION

3.1 Safety

WARNING

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

WARNING

The iF system is introduced for use on Load-lock chamber applications only. The pump is not configured for transfer or process use.

Only Edwards engineers may install the iF pump series. Users can be trained by Edwards to conduct the tasks described in this manual, contact your local service centre or Edwards for more information.

- 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.
- Do not remove the temporary cover or blanking plate from the iF system inlet until you are ready to connect the iF system to your vacuum system. Do not operate the iF system unless the inlet blanking plate is fitted or the iF system is connected to your vacuum system.
- Do not remove the temporary cover or blanking plate from the iF system exhaust until you are ready to connect the iF system to your exhaust-extraction system. Do not operate the iF system unless the exhaust is connected to your exhaust-extraction system.
- Vent and purge the process system (if the iF 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.
- Electrical, nitrogen and water supplies are all potentially hazardous energy sources. Before carrying out any maintenance, the supply of these sources should be locked and tagged out.
- Do not reuse any 'O' ring or 'O' ring assembly and do not allow debris to get into the iF system during installation.
- Pump system includes provision for ventilation extraction and secondary containment of oil and water leaks. Any unintended overflows or spills must be removed immediately to avoid risk of slips.
- Route and secure cables, hoses and pipe-work during installation to avoid possible risk of trips.
- Obey all national and local rules and safety regulations when you install the iF 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 iF system and the sections of this instruction manual which describe those operations are shown in Table 11.

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Table 11 - 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 iF system	3.6
Check the pump oil-level(s)	3.7
iF1800 systems	3.7.2
Install or replace the Pump Display Terminal and optional accessories(if necessary)	3.8
Install the Pump Display Terminal	3.8.1
Install optional accessories	3.8.2
Connect the iF inlet to your vacuum system	3.9
Connect the iF 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 iF system for your electrical supply (if necessary)	3.16.1
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Commission the iF system	3.20
Switch on an iF1800 system	3.20.1

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3.3 Unpack and inspect

WARNING

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

WARNING

Ensure that the maximum angle between paired slings used to lift the iF system is 45°, and that all four lifting bolts are used.

WARNING

Do not exceed the topple angle of 10° when moving the pump.

The iF system is supplied sealed in a foil bag. To prevent contamination of the iF system, before you unpack and inspect the iF 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 iF system to its final operating position.

Use the following procedure to unpack and inspect the iF 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 iF system.
3. Check that you have received the items listed in Table 12. If any of these are missing, notify your supplier within three days.
4. Refer to Figure 14. Remove the nut and washer (2) which secures each of the four anchor brackets (5) to the blocks (4) on the pallet. Retain the nuts and washers for future use.
5. Refer to Figure 15. Use suitable lifting-equipment attached to all four lifting bolts (1) to remove the iF system from its pallet. Do not try to lift the iF system by hand (refer to Table 4 for the mass of the iF system).
6. Inspect the iF system. If the iF system or any other item is damaged, notify your supplier and the carrier in writing within three days; state the Item Number of the iF system together with your order number and your supplier's invoice number. Retain all packing materials for inspection. Do not use the iF system if it is damaged.
7. If the iF system is not to be used immediately, replace the packing materials. Store the iF system in suitable conditions as described in Section 7. If you will use the iF system immediately, continue at Step 8.
8. Refer to Figure 14. If you do not want to use the anchor brackets to prevent inadvertent movement of the iF system (refer to Section 3.5), undo and remove the two cap-head screws and washers (6) which secure each of the four brackets (5) to the sides of the iF system, then remove the brackets. Retain the brackets, cap-head screws and washers for future use.

Table 12 - Checklist of components

Quantity	Description	Check(✓)
1	iF Dry Pumping System	❒
1	Pump Display Terminal	❒
1	Fittings Kit, comprising:	
1	Cooling-water quick-release connectors (pair)	❒
1	NW40 tapped 'O' ring	❒

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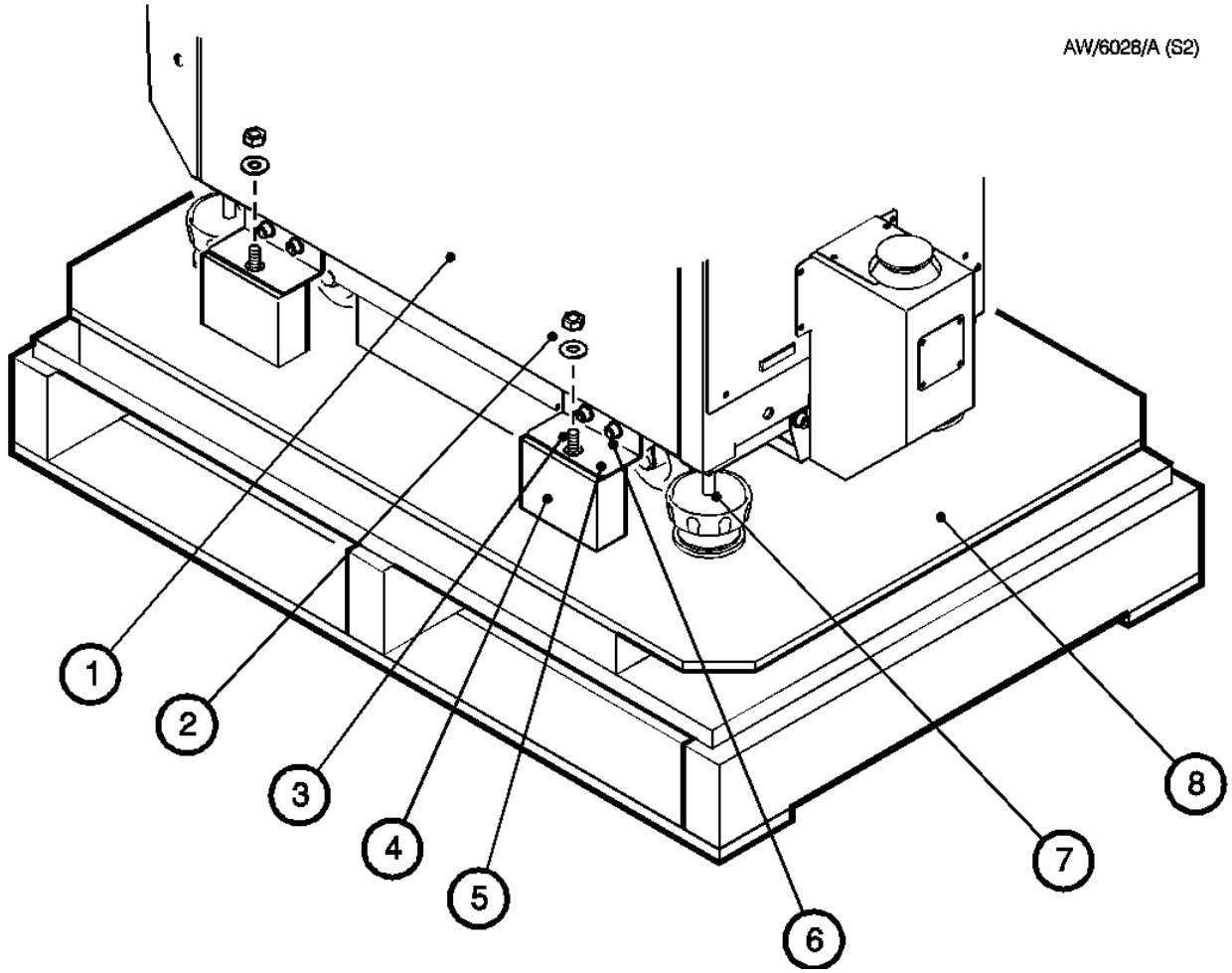
Table 12 - Checklist of components

Quantity	Description	Check(✓)
1	Nw40 clamp	☐
1	Nitrogen pipeline fitting	☐
1	Module connector terminator plug	☐

Figure 14 - Remove the iF system from the pallet



1. iF system
2. Nut and washer
3. Stud
4. Block (4)
5. Anchor bracket (4)
6. Cap-head screw and washer
7. Levelling foot
8. Pallet

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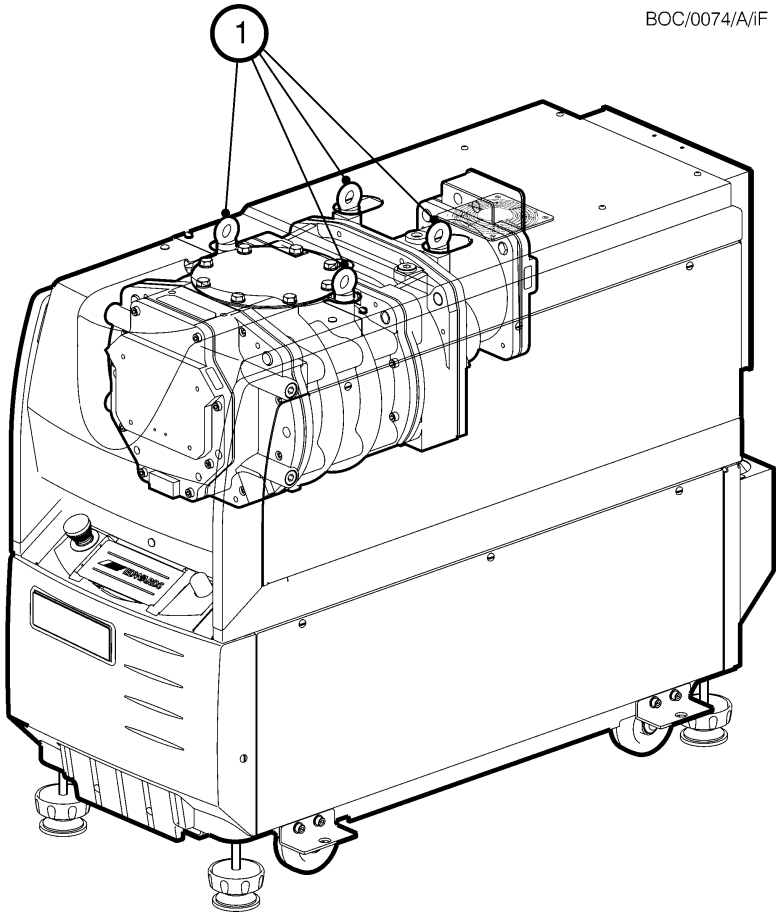
Figure 15 - Lifting bolt positions



1. Four lifting-bolts (use all four when lifting the iF1800)

3.4 Remove the enclosure panels

1. Refer to Figure 16.
2. Remove the HMB left-hand side panel from the iF system:
   - Place your hand against the top of the left-hand side panel (6) to support it and use a flat-head screwdriver to release the 3 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. To remove the HMB right-hand side panel: use the method in Step 2 above.
4. Remove the FDP right-hand and left-hand side panels: use the method in Step 2 above.

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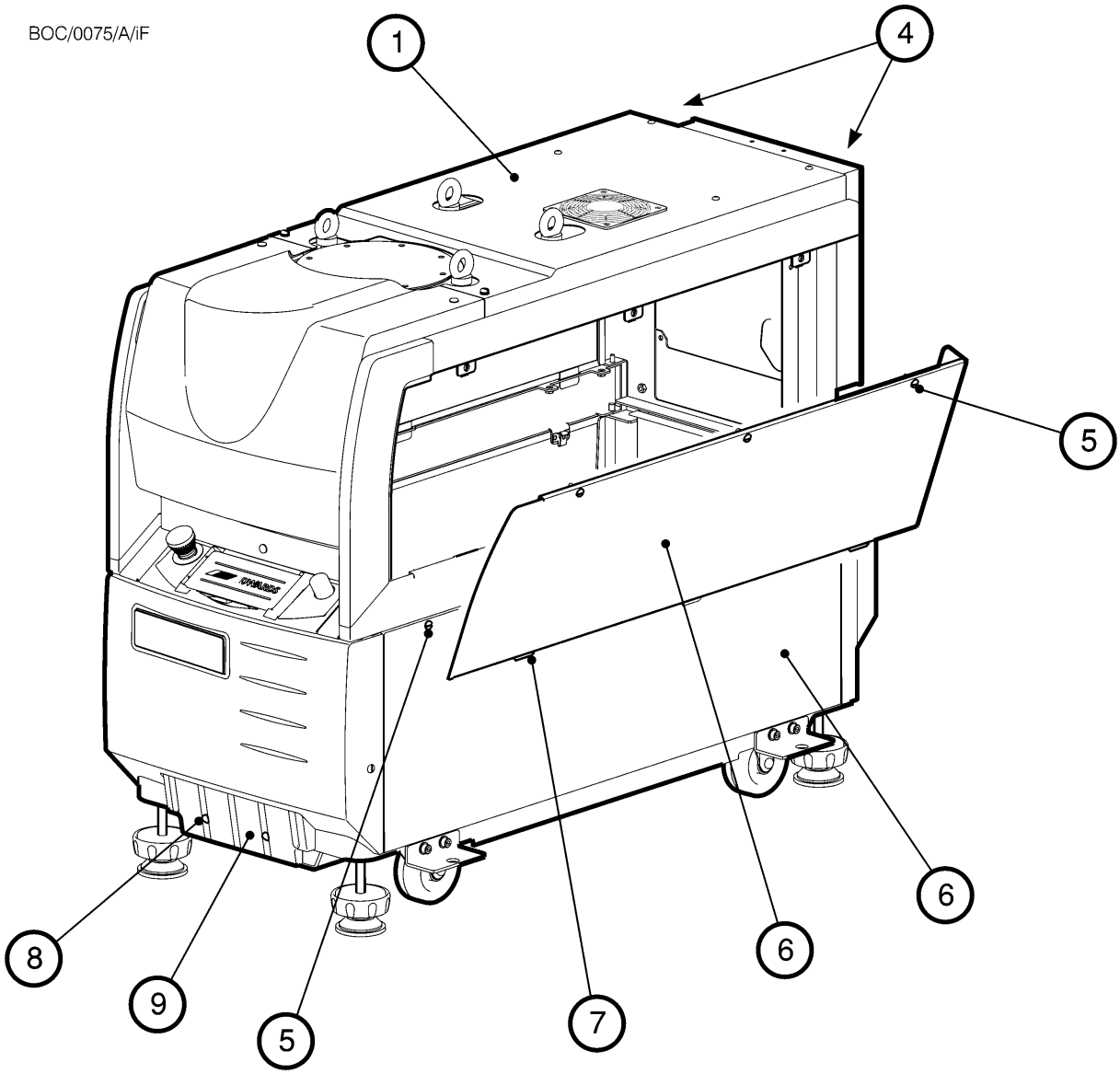
Figure 16 - Remove/refit the enclosure panels



1. Top panel
4. Catches (on rear of item 1)
5. Catches
6. Left-hand side panel
7. Pins
8. Screws (2 off)
9. Skirt cover

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3.5 Locate the iF system

WARNING

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

WARNING

Ensure that the maximum angle between paired slings used to lift the iF system is 45°, and that all four lifting bolts are used.

WARNING

Ensure that the maximum angle between paired slings used to lift the iF system is 45°, and that all four lifting bolts are used.

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

1. Use suitable lifting equipment attached to the lifting bolts to move the iF system close to its final operating position.
2. Wheel the iF system on its castors to move it into its operating position.
3. Adjust the levelling feet to make sure that the iF system is level and is not supported by the castors.

3.6 Check the pump oil level(s)

CAUTION

Ensure that the oil-levels in the FDP pump and the HMB pump are correct. If a pump oil-level is incorrect, pump performance may be affected and the pump may be damaged.

3.6.1 iF1800 Systems

The iF1800 systems are supplied with both the FDP and HMB pumps filled with oil. However, we recommend that you check the FDP and HMB oil-levels as described below.

1. Check the FDP pump oil-level.
2. Refer to Figure 1. Check that the oil-level is between the MAX and MIN marks on the bezel of the HMB 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.

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3.7 Install or replace the Pump Display Terminal and optional accessories (if necessary)

3.7.1 Install the Pump Display Terminal

CAUTION

It is imperative that the Pump Display Terminal is stored in the recess after installation or use. Placing it on a hot surface, such as on top of the enclosure, may adversely affect the long-term reliability of the terminal.

1. Unpack and inspect the Pump Display Terminal.
2. Refer to Figure 17. Remove the blanking panel (1) from the dashboard (2).
3. Fit the connector (4) on the end of the cable (7) to the Pump Display Terminal connector (6) in the recess (5) in the dashboard.

Note: The Pump Display Terminal connector (6) is intended for use by the Pump Display Terminal only, and should not be mistaken for a Portable Personal Computer port.

4. Place the coiled cable (7) in the recess, then place the Pump Display Terminal(8) in position in the recess (5).

3.7.2 Install optional accessories

Accessories are not yet available for iF1800 rapid loadlock dry pumping systems. Please contact your nearest Edwards for more information.

3.8 Connect the iF inlet to your vacuum system

Note: If required (that is, if you will use the iF system in an area subject to high RF (radio frequency) emissions), connect the end of the iF earth (ground) cable to one of the bolts that you use to connect the inlet-flange of the iF system to your process system. refer to Section 3.15.2 for more information.

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

- To get the best pumping speed, ensure that the pipeline which connects the vacuum system to the iF system is the minimum length possible and has an internal diameter not less than the iF system inlet-port.
- 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.
- 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.
- Adequately support vacuum pipelines to prevent the transmission of stress to pipeline coupling-joints.
- On very dusty applications, use a low-impedance inlet-filter to minimise damage to the pump.
- Incorporate a pressure gauge in the inlet pipeline, so that you determine that the iF system operates correctly.
- You must be able to isolate the iF 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 iF system to your vacuum inlet pipeline:

1. Remove the temporary cover or blanking plate from the inlet of the iF system. Retain the nuts, bolts, washers and blanking plate for future use. Retain the temporary cover for future use on non-contaminated pumps only.
2. Use the 'O' ring supplied and suitable nuts, bolts and washers (not supplied) to connect the inlet-flange of the iF system to your vacuum system.

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3.9 Connect the iF exhaust outlet to your exhaust-extraction system

WARNING

Pipe the exhaust to a suitable extraction system.

WARNING

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

CAUTION

Use a catchpot to prevent the drainage of condensate back into the iF system. Condensate that drains back into the iF system could damage the FDP 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 iF system to your exhaust-extraction system: refer to Figure 1.

1. If the check valve (18) is not required on your application:
   - remove the exhaust enclosure (26) by removing the screws connecting to the rear bulkhead cover, drip tray (27) and exhaust enclosure top plate.
   - undo and remove the clamp and ‘O’ ring (22 and 21) which secures the check valve to the elbow (20).
   - retain the check valve for possible future use.
2. If neither the check valve (18) nor elbow (20) is required on your application, or if the elbow is required in a different orientation:
   - remove the exhaust enclosure (26) by removing the screws connecting to the rear bulkhead cover, drip tray (27) and exhaust enclosure top plate.
   - undo, or remove, the clamped ‘O’ ring that secures the elbow to the silencer (19).
   - reposition, or remove, the elbow (retain both elbow and check valve for possible future use if removed).
3. Remove the temporary cover or blanking plate from the exhaust outlet. Retain blanking plate for future use. Retain temporary cover for future use on non-contaminated pumps only. Use the NW40 trapped 'O' ring and clamp supplied to connect the exhaust outlet on the check valve (18), or elbow (20), or silencer (19), to your exhaust extraction system.
4. If the check valve was removed or elbow was removed or re-orientated:
   - refit the exhaust enclosure (if possible) using the screws connecting to the rear bulkhead cover, drip tray and exhaust enclosure top plate.

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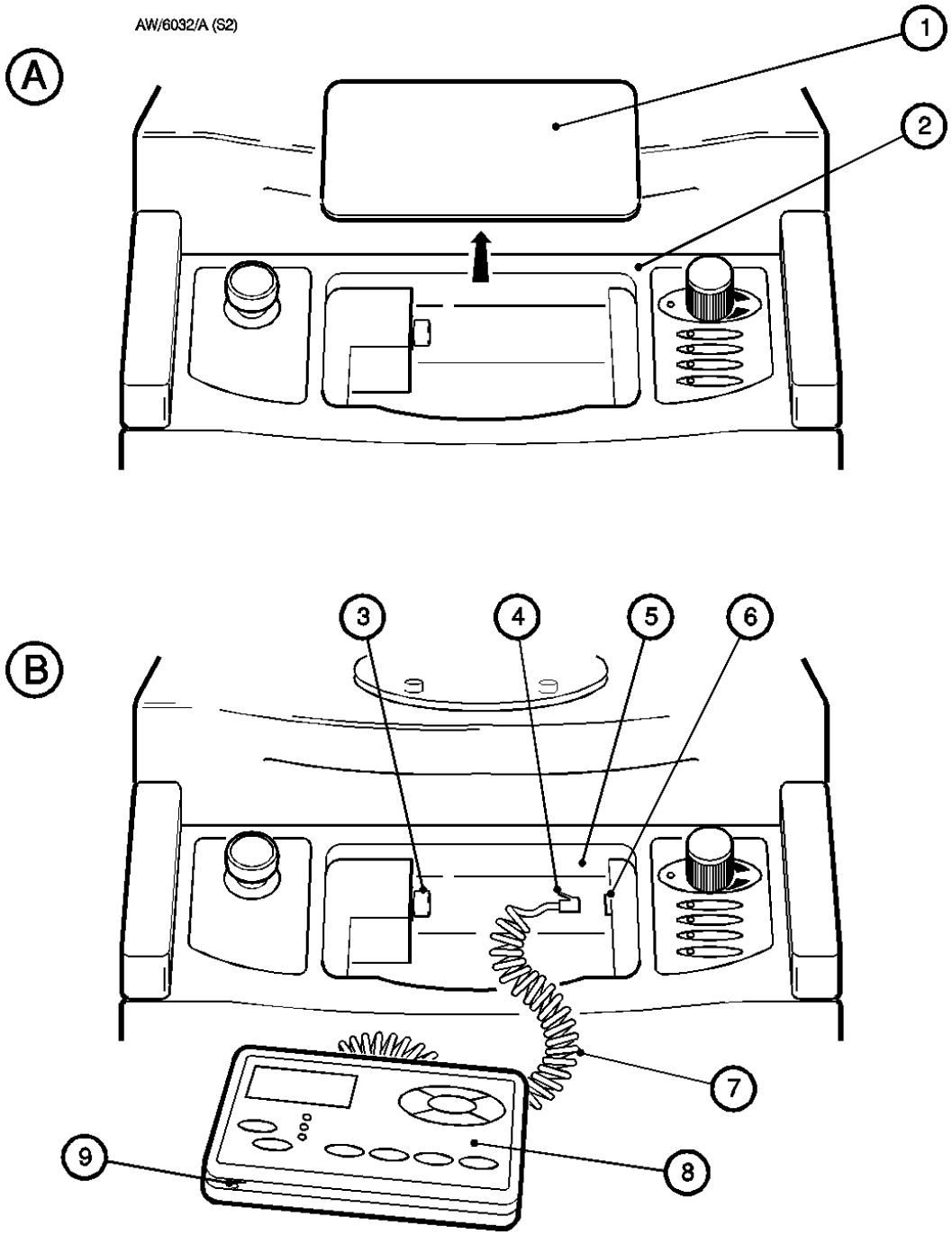
Figure 17 - Fit the pump display terminal



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

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3.10 Connect to your factory extraction system (optional)

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

3.11 Connect the nitrogen supply

WARNING

A release of nitrogen has potential to cause harm by asphyxiation. The nitrogen supply should enable isolation in accordance with SEMI S2-0200 Lockout/Tagout requirements.

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 iF system may be damaged.

Connect your nitrogen supply to the iF system through the nitrogen inlet on the rear of the iF system (Figure 4, item 4).

Use rigid metal supply pipelines (such as stainless steel). We recommend that the nitrogen supply pipeline to the iF 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 Tube fittings in the fitting-kit to connect your nitrogen pipeline to the iF system: use the Tube fittings as described in Section 6.2.

3.12 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 pump down test with helium to leak test the pump. We recommend that the leak rate is $1x10^{-5}$mbar ls^{-1} ($1x10^{-3}$ Pa l s^{-1}) helium or less for the complete system, or $1x10^{-6}$ mbar l s^{-1}($1x10^{-4}$ Pa l s^{-1}) helium or less for any individual leak.

The iF system is supplied with a blanked leak-test port, as shown in Figure 18. To connect to this port:

1. Remove the 3/8 inch BSP blanking plug from the port (3).
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.

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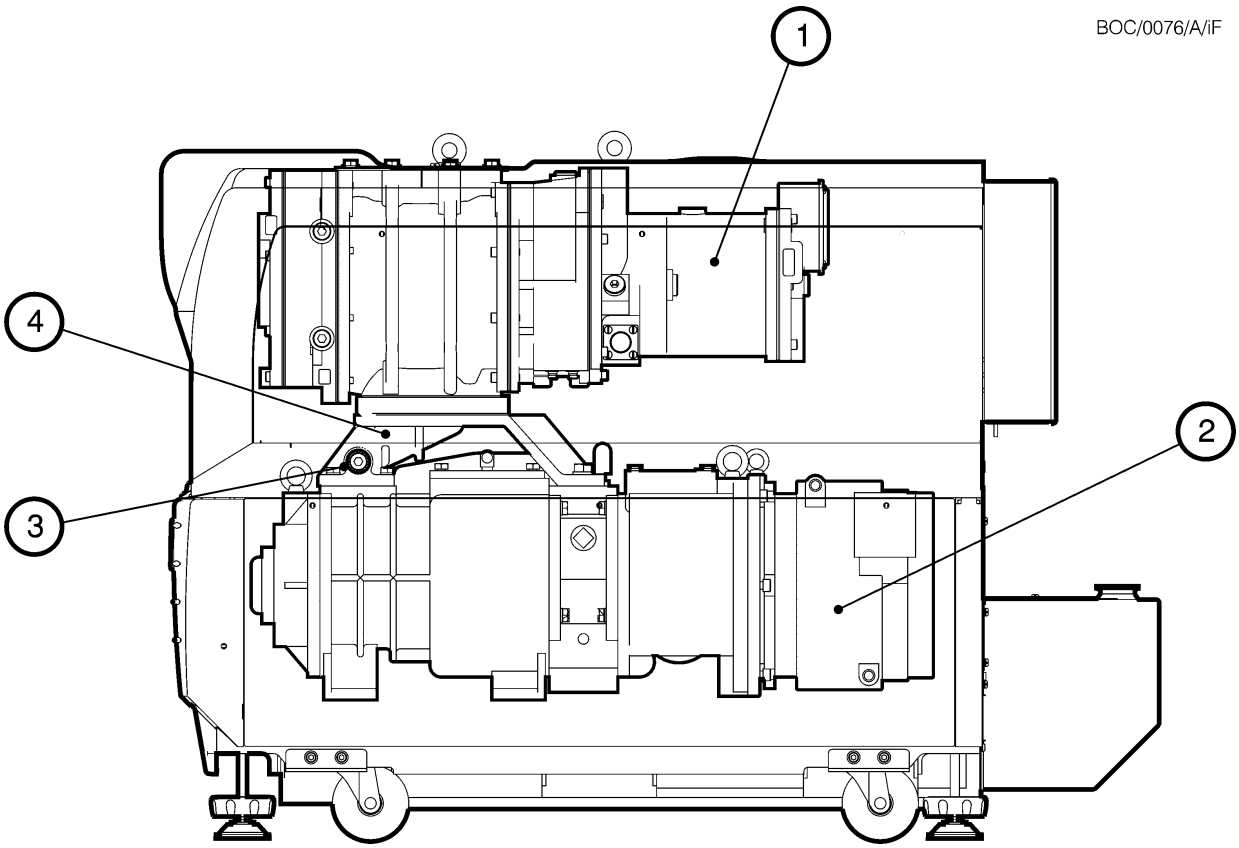
Figure 18 - Leak test port positions



1. HMB pump
2. FDP pump
3. Leak-test port (blanked)
4. Support manifold

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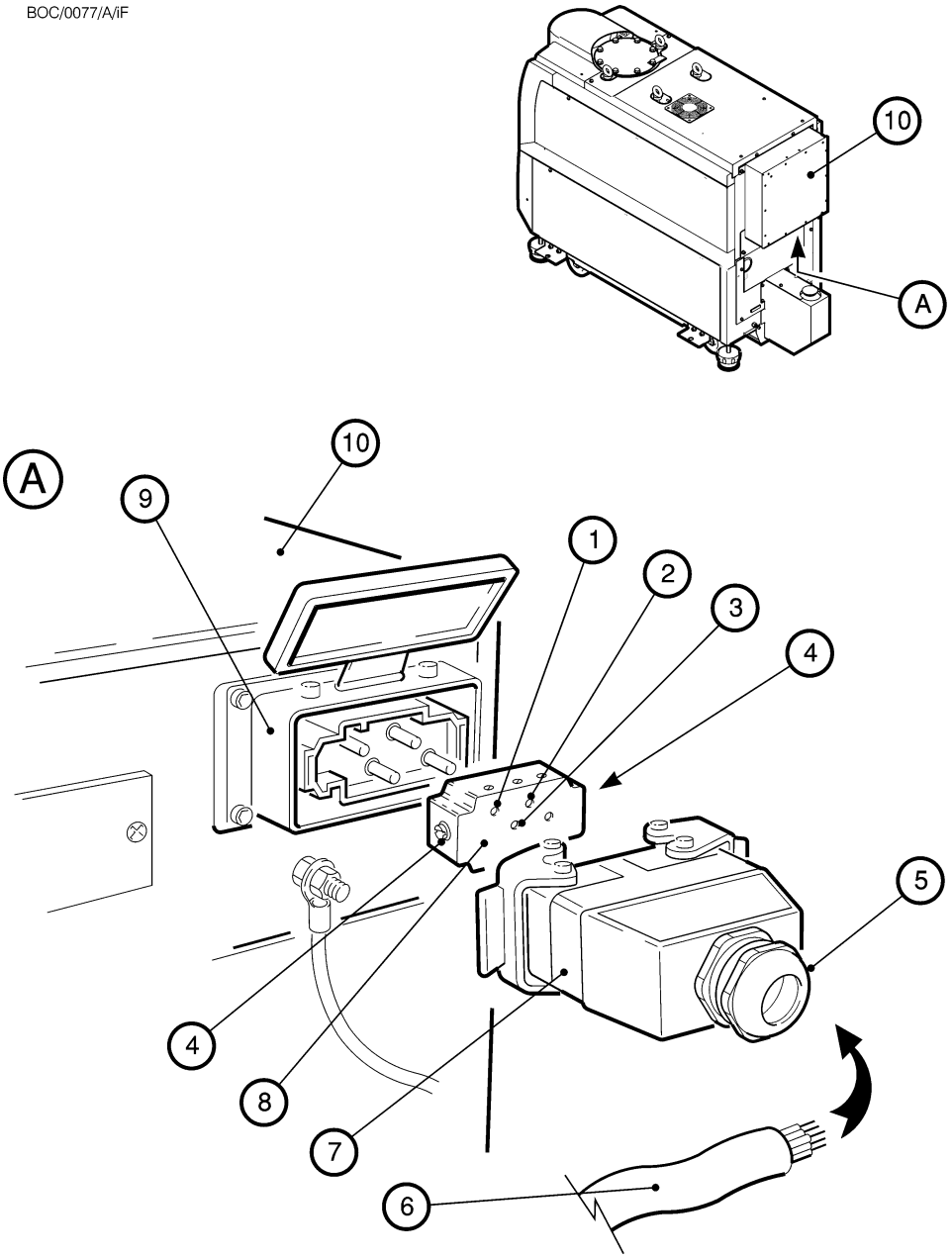
Figure 19 - Connect the electrical supply cable to the connector mating-half



1. Pin 1 (Phase 1)
2. Pin 2 (Phase 2)
3. Pin 3 (Phase 3)
4. Earth (ground) screw
5. Strain releif bush
6. Electrical supply cable
7. Cover
8. Connector block
9. Electrical supply connector
10. Electrics box

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3.13 Install additional safety equipment

WARNING

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

WARNING

Nitrogen Purges are used to cool the FDP pump. Ensure that the system shuts down if the nitrogen supply to the iF system fails.

If the sensors or microprocessor fail, the total flow rate of nitrogen displayed or output by the iF system may be incorrect. If you need to know the total flow rate of nitrogen to the FDP 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 iF system fails, a warning message will be shown on the Pump Display Terminal and will be sent to the Interface Module(s) connected to the iF system. Ensure that your installation is configured so that it remains safe if there is a failure of the nitrogen supply to the iF system.

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

3.14 Connect to your emergency stop circuit (optional)

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

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

1. Remove the link between pins 1 and 2 of the iF Tool Interface Module connector plug supplied.
2. Connect a suitable cable to the plug; Table 13 shows the use of the pins in the plug.
3. Refer to Figure 4. Fit the plug to the iF Tool Interface Module connector (8) on the rear of the iF system.

3.15 Electrical supply and RF earth (ground) connections

3.15.1 Reconfigure the iF system for your electrical supply (if necessary)

CAUTION

The iF system is supplied as either a high volts or a low volts system. A high volts system cannot be reconfigured as a low volts system and vice versa.

If you have a low volts system use the following procedure to ensure that the correct transformer primary tapping is selected before the electrical supply is connected to the iF system.

Refer to Figure 19 (a).

1. Undo screws (5) that connect the cover (4) to the Electrics box (2) and remove the cover.
2. Ensure that the common cable (6) is correctly connected to the common terminal on the terminal block (8).

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3. Ensure that the voltage select cable (7) is connected to the correct voltage terminal of the terminal-block (8) for your electrical supply. Reconfigure if necessary.
4. Refit the cover (4) and secure with the two screws (5).

Table 13 - Pins in the iF 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 Box.
5	24 V a.c. continuous output; maximum current 625 mA
6	0 V return

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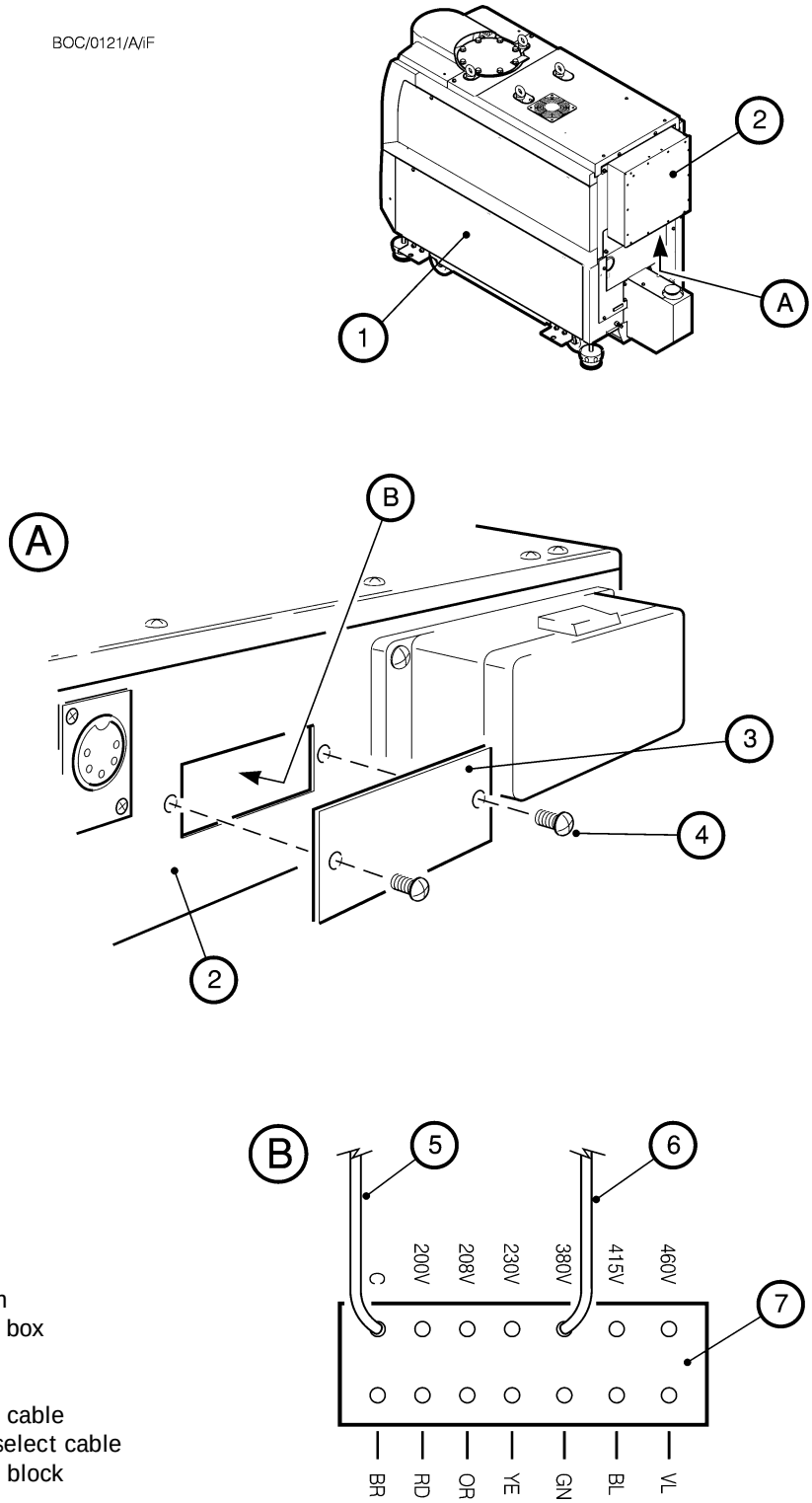
Figure 20 - Reconfigure the iF system for your electrical supply

BOC/0121/A/iF



1. iF system
2. Electrics box
3. Cover
4. Screw
5. Common cable
6. Voltage select cable
7. Terminal block

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3.15.2 Connect the electrical supply to the iF system

WARNING

Connect the iF system to the electrical supply through a suitably rated isolator/connector for your iF system (refer to Section 2 and the notes below).

WARNING

Ensure that the iF 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 iF1800 system, you must fit a second protective earth (ground) conductor (with a cross-section of at least 10mm^2) to the protective earth (ground) stud on the Electrics Box.

Notes: On an iF1800 system, the earth (ground) installation must ensure that there is an equipotential zone around the iF system: the voltage between the protective earth (ground) stud on the iF system and any other conducting surface within 2 metres of the iF system must be < 30 V r.m.s.

If you connect the electrical supply to an iF1800 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). The iF1800 system is for use only with equipment that has no accessible terminals.

Use the following procedure to connect the electrical supply to the iF system. 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 bush on the electrical supply connector mating-half fails, the earth (ground) conductor will be the last conductor to be pulled from the connector.

1. Refer to Figure 19. Remove the connector block (8) from the cover (7) of the mating-half supplied for the electrical supply connector, then pass a suitable cable (6) through the strain relief bush (5) on the cover (7). Refer to Section 2 for suitable cable sizes.
2. Connect the cable phase wires to the pins in the connector block (8) as shown in Table 14.
3. Connect the earth (ground) wire of the cable to one of the two earth (ground) screws (4) on the side of the connector block (8).
4. Refit the cover (7) to the connector block (8), then tighten the strain relief bush (5).
5. Fit the mating-half to the electrical supply connector (9) on the Electrics Box (10).
6. Connect the other end of the electrical supply cable to your electrical supply through a suitable isolator.
7. On iF1800 systems, you must fit a second protective earth (ground) conductor to the protective earth (ground) stud on the Electrics Box (Figure 4, item 11) and connect the other end of this conductor to your factory earth (ground).

3.15.3 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 iF system (Figure 4 item 6). If you will operate the iF 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 iF inlet to one of the bolts that you use to secure the inlet-flange (refer to Section 3.8).
- 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).

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3.16 Refit the enclosure panels

1. Refer to Figure 16. Refit the FDP right hand and left hand side panels the HMB 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 iF system, so that the pins (7) on the frame engage in the slots at the bottom of the panel.
   - 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 3 quarter-swing catches (5).

3.17 Connect the cooling-water hoses

WARNING

Do not leave the cooling-water supply turned on 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.

WARNING

A release of water under pressure constitutes a significant safety hazard. The water supply should be provided with an isolator.

WARNING

Allow the pump to cool down to a safe temperature before disconnecting or isolating the cooling water supply. Failure to do so will result in high pressures being generated in the pump cooling system.

CAUTION

Drain the cooling-water from the iF 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 iF system and damage the pump(s) and/or the cooling-water pipelines.

CAUTION

If cooling water has been interrupted whilst the pump is in operation, do not restore the cooling until the pump has cooled down to a safe temperature. Restoring the cooling water supply whilst the pump is in operation may result in FDP seizure.

Notes: 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 iF 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 iF system.

Table 14 - Pins in the electrical supply connector

Wire	Pin number (Figure 19 key)
Phase 1 (R) Phase 2 (S) Phase 3 (T)	1 2 3

The positions of the cooling-water connectors are shown in Figure 4. Connect the cooling-water supply as follows:

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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.

3.18 Adjust the interstage purge flow rates if necessary

The dilution purge (3/4) flow rate can be adjusted, contact your supplier or Edwards for advice.

3.19 Commission the iF system

WARNING

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

WARNING

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

3.19.1 Switch on an iF1800 system

Note: Operation of the iF system with high inlet pressure may result in shaft-seal pressure warnings (refer to Table 20): the operation of the iF 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 6, 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 iF system.
5. If the iF 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 Terminal):
   - Shut down the iF 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 FDP pump-motor terminal-box and/or the HMB pump-motor terminal-box is incorrectly wired: immediately shut down the iF system, correct the electrical wiring (refer to Section 3.15.1), then repeat this procedure from Step 3 again.

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- If the pressure is decreasing, continue at Step 7.

7. After you have commissioned the iF system:
   - If you want to continue to operate the iF system, refer to Section 5.
   - Otherwise, shut down the system,: refer to Section 5.9.

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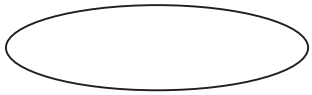
4 Pump display terminal menus and display formats

4.1 Introduction

The menus used and the display messages shown on the Pump Display Terminal are described in the menu diagrams in Figures 21 to 45. The following symbols and conventions are used in the menu diagrams:

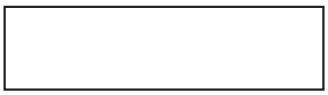
These are flow lines. Arrows on the lines show the direction of flow through a menu.



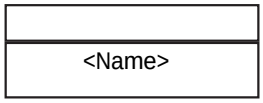
This symbol is used to connect different menus and shows the starting point (or continuation point) of a menu.

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

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



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



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

☞

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

4.2 General operation

When you first switch on the iF system, the normal display is shown: refer to Figure 24. Refer to Figure 20. 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 21 shows this menu control logic.

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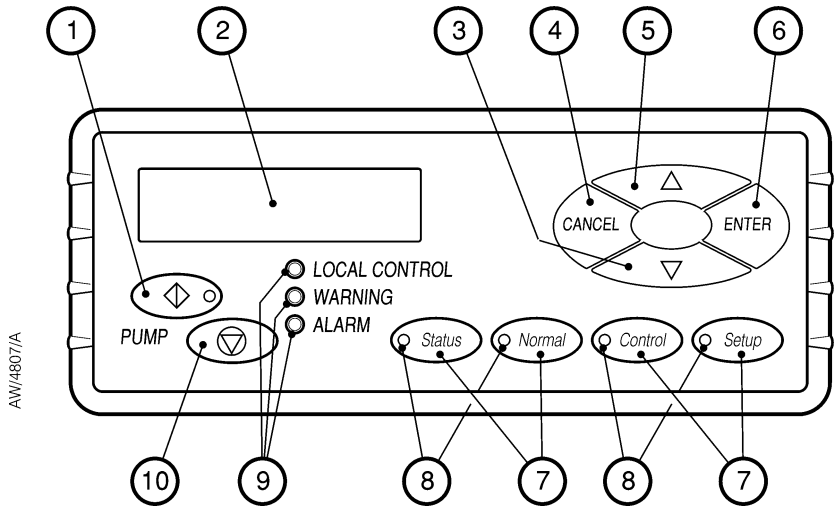
Figure 21 - Front control of the Pump Display Terminal



1. On button
2. Display
3. Down button
4. CANCEL button
5. Up button
6. ENTER button
7. Menu buttons
8. Menu selected LED's
9. Status LED's
10. Off button

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 22 and 23), when you press CANCEL, the menu is exited and the normal display is shown.
- In the Status menu (Figures 25 and 26), when you press CANCEL the display shows the first two status parameters (the defaults are FDP current consumption and power consumption).
- When you change passwords in the Setup and Service menus (Figures 34 and 35) 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 21 to 45, 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 '△' 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 Terminal.

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 iF 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 iF (a Water Flow-Switch). <Status> can be any of the following:

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- 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 iF 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 Terminal 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 iF 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 19. 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 (Figures 25 and 26), if a component is not fitted, 'NP' (not present) is shown in the corresponding display line; an oil monitor is not fitted to the HMB pump, so where Figures 26 and 26 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).

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1. Press the Setup button to enter the Setup menu (Figures 28, 29 and 30).
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 (refer to Figure 32).
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 15 - Menu structure

Menu	Figure
Switch on	35
Switch off	36
Normal	37
Status	38
Control	40
Setup	41
Inlet purge	41
Gas Ballast	42
Gate Valve 1	43
Run Til Crash	44
Units	45
Normal display	46
Service	47
Serial Numbers	49
Zero sensors	50
Gas Valve Control	51
Manual	52
View Status	55
Messages	57
Warning and alarm messages	58

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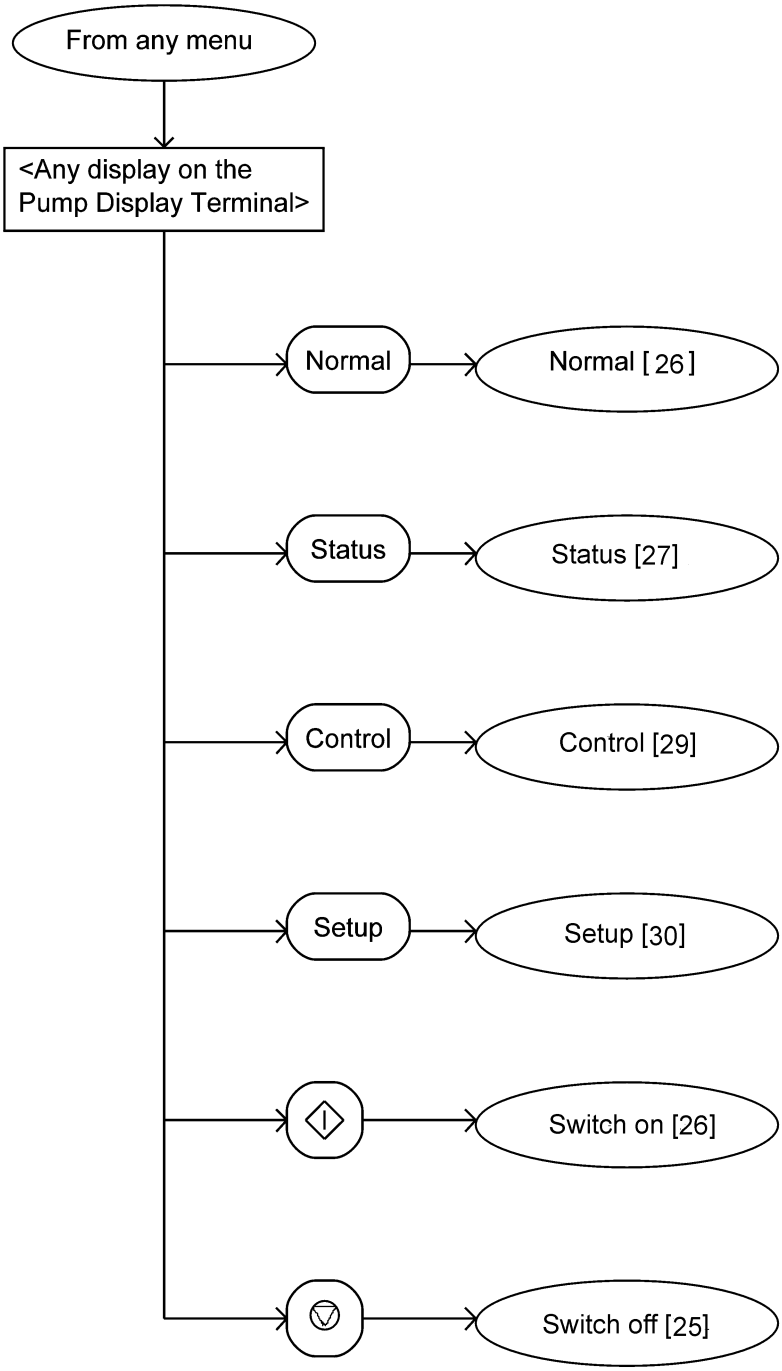
Figure 22 - Menu logic



☞ If the Pump Display Terminal does not have control when you try to switch on or switch off the pumping system, an error message will be displayed: refer to Table 19 .

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Figure 23 - Switch on menu

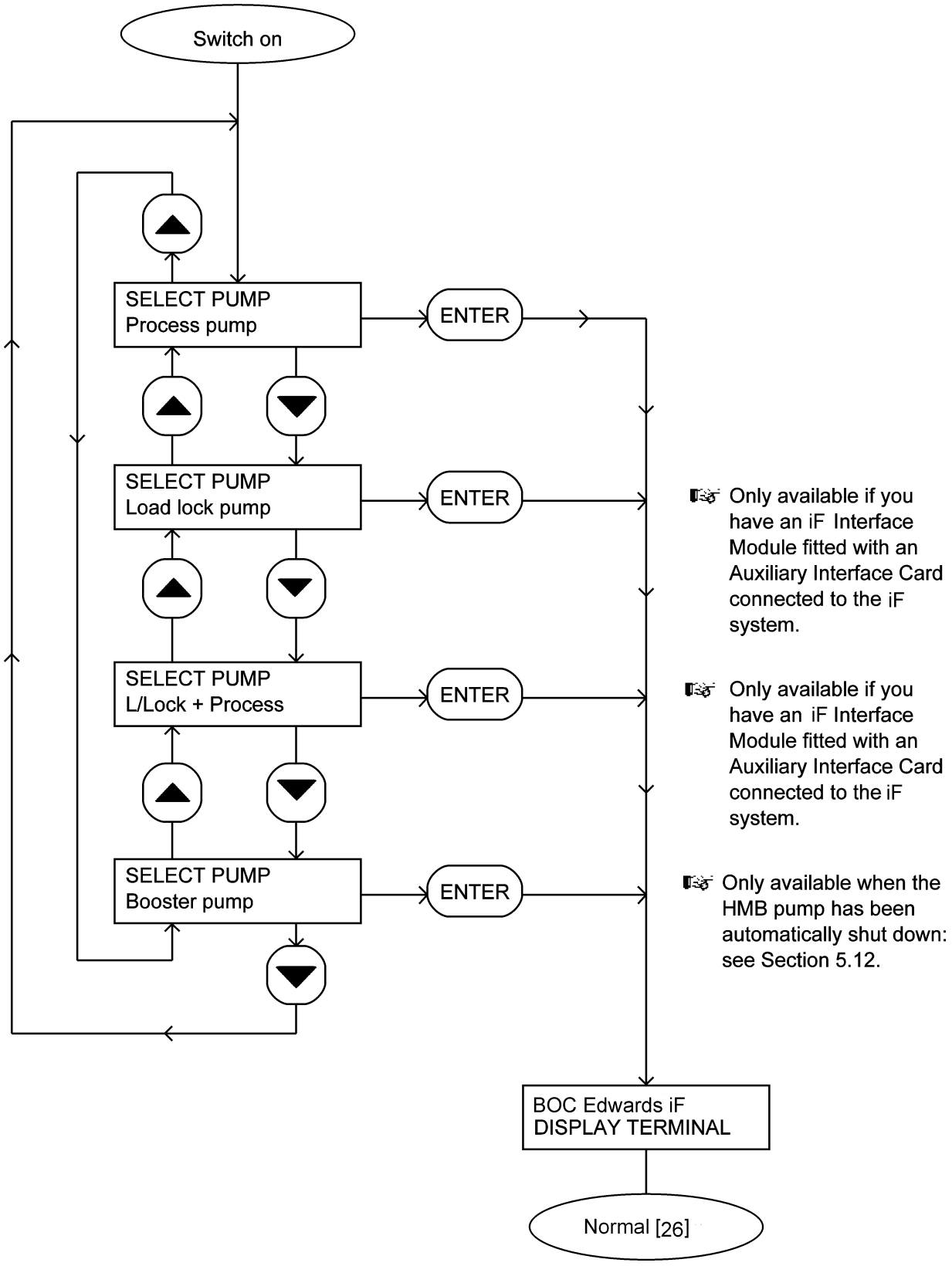

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Figure 24 - Switch off menu

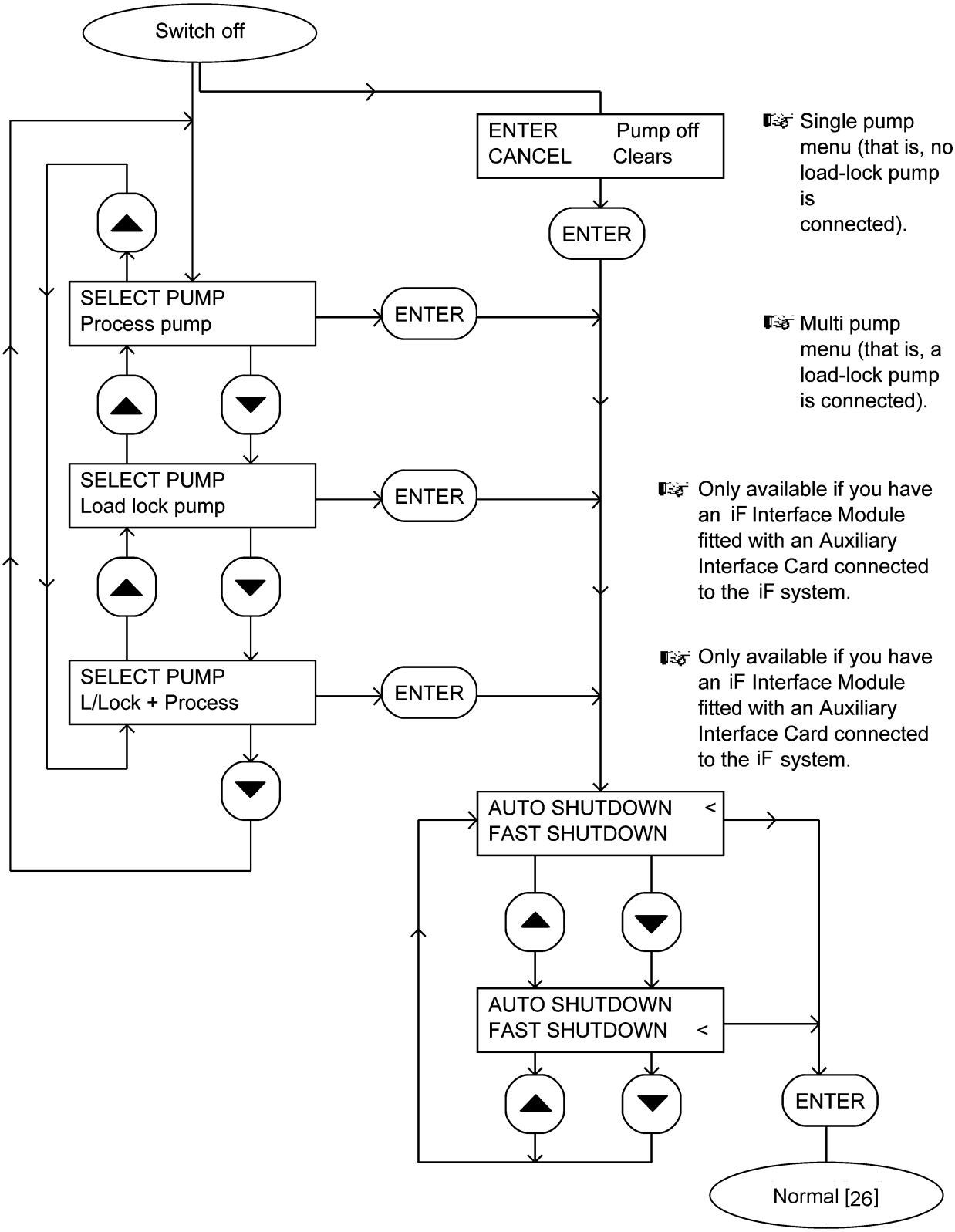

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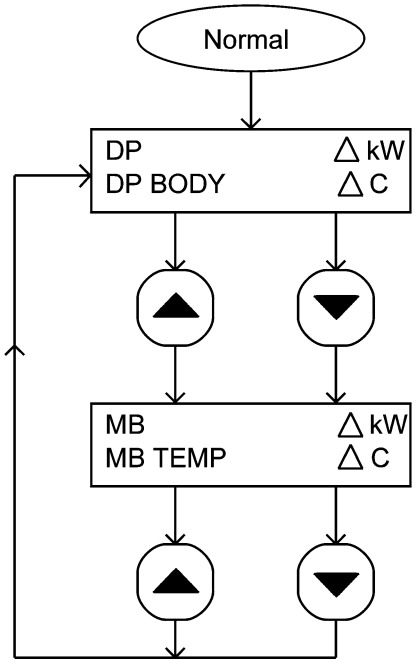
Figure 25 - Normal Menu



☞ 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.

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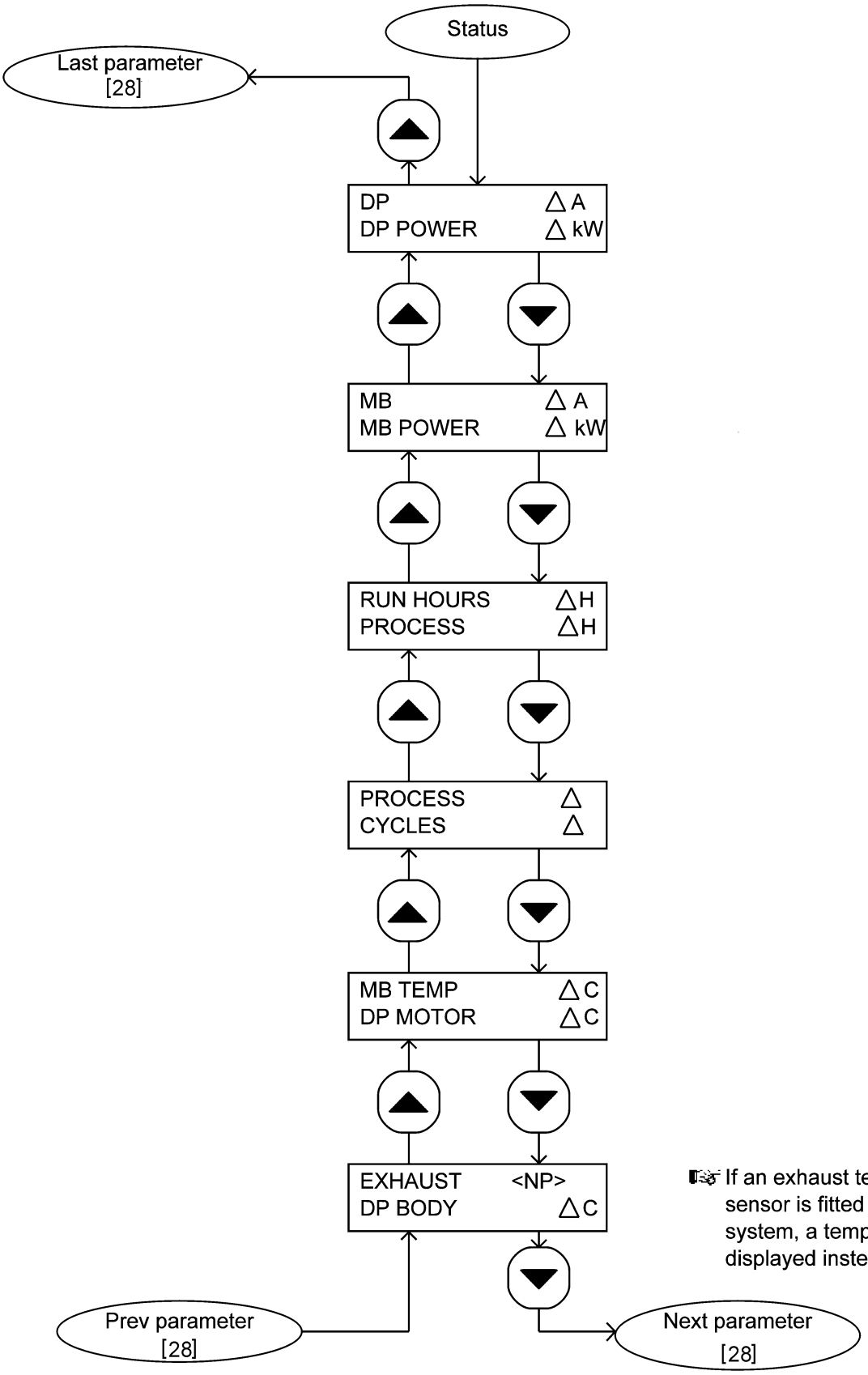
Figure 26 - status menu: sheet 1 of 2



☞ If an exhaust temperature sensor is fitted to the iF system, a temperature will be displayed instead of <NP>.

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Figure 27 - Status menu: sheet 2 of 2

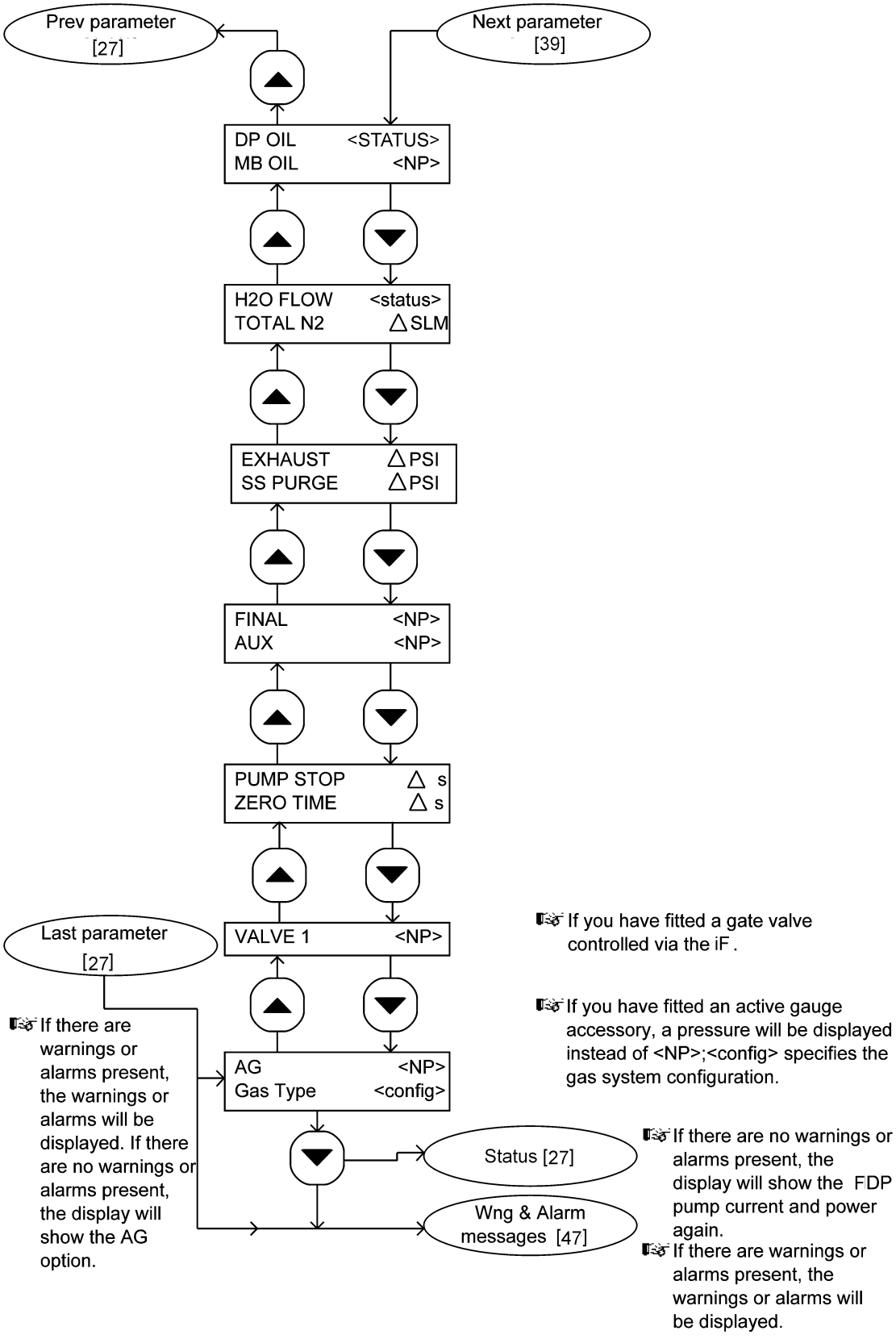

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Figure 28 - Control menu

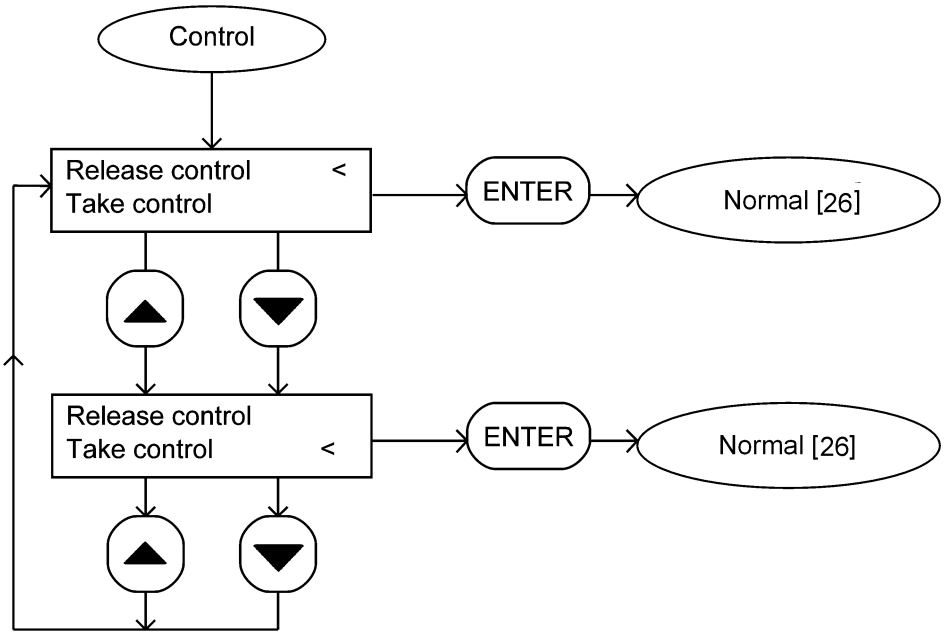

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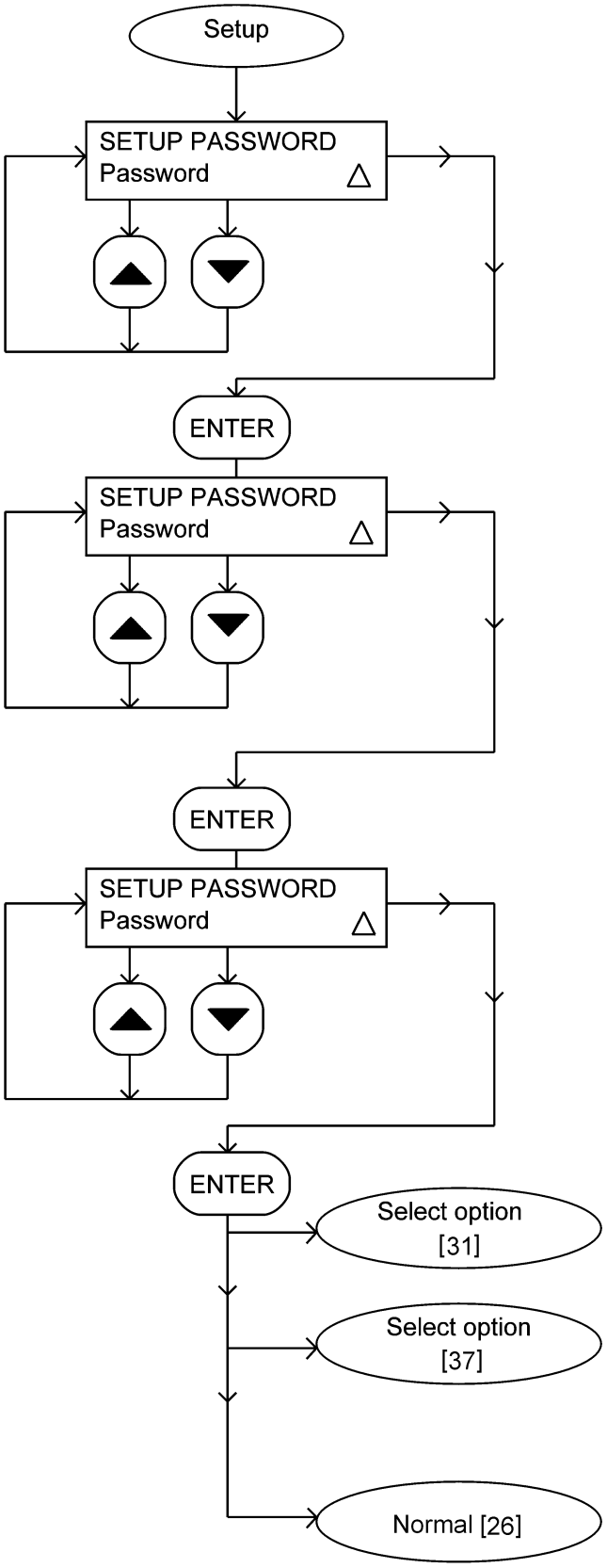
Figure 29 - setup menu: sheet 1 of 3



☞ Use the up and down buttons to increase or decrease the first digit of the password.

Press ENTER when the digit is set correctly.

☞ Use the up and down buttons to increase or decrease the second digit of the password.

Press ENTER when the digit is set correctly.

☞ Use the up and down buttons to increase or decrease the third digit of the password.

Press ENTER when the digit is set correctly.

☞ If the setup password was entered, continue to select the setup menu option.

☞ If the service password was entered, continue to select the service menu option: the service password is only available to BOC Edwards service engineers.

☞ If the password was incorrect, revert to normal display.

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Figure 30 - setup menu: sheet 2 of 3

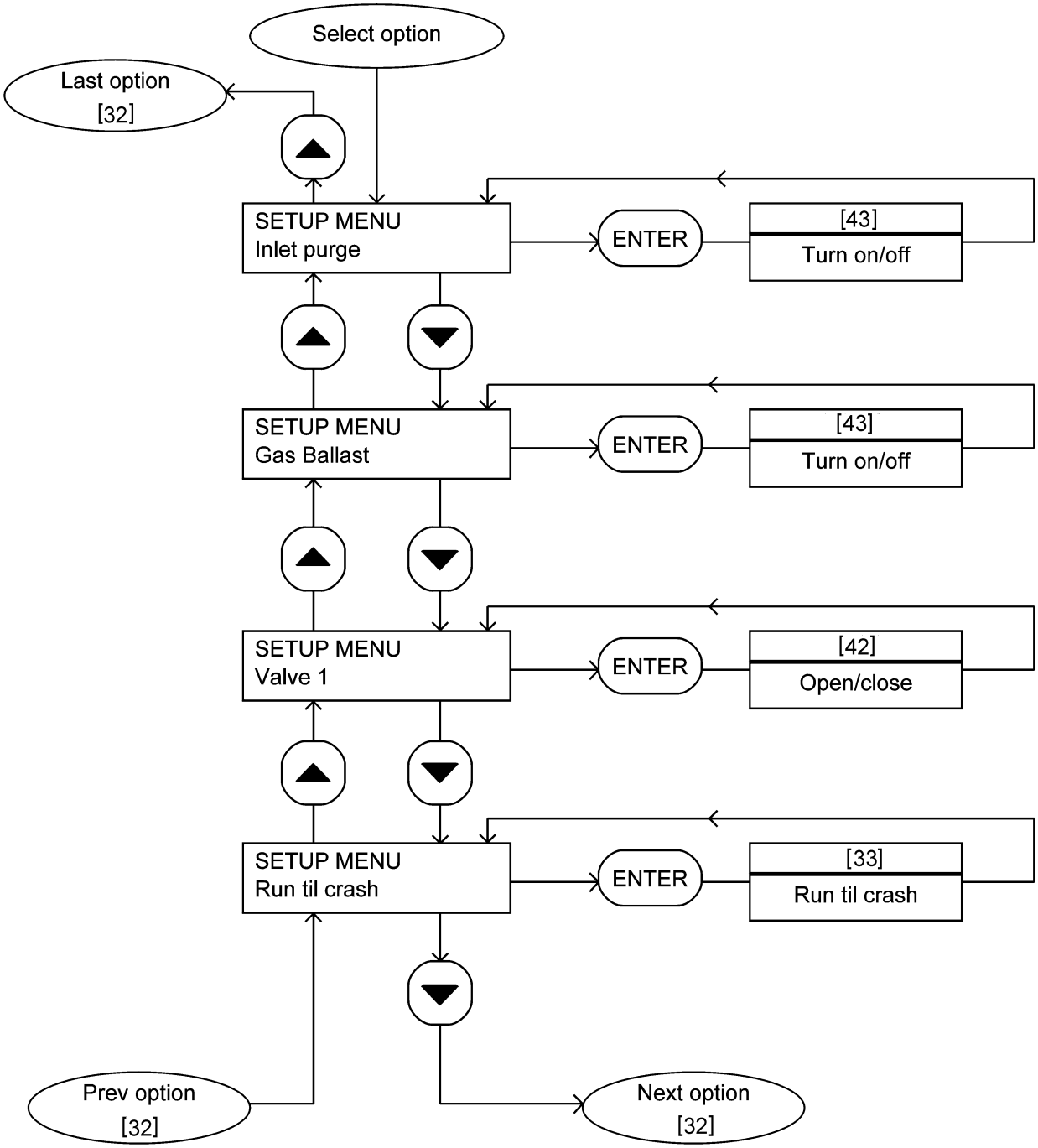

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Figure 31 - setup menu: sheet 3 of 3

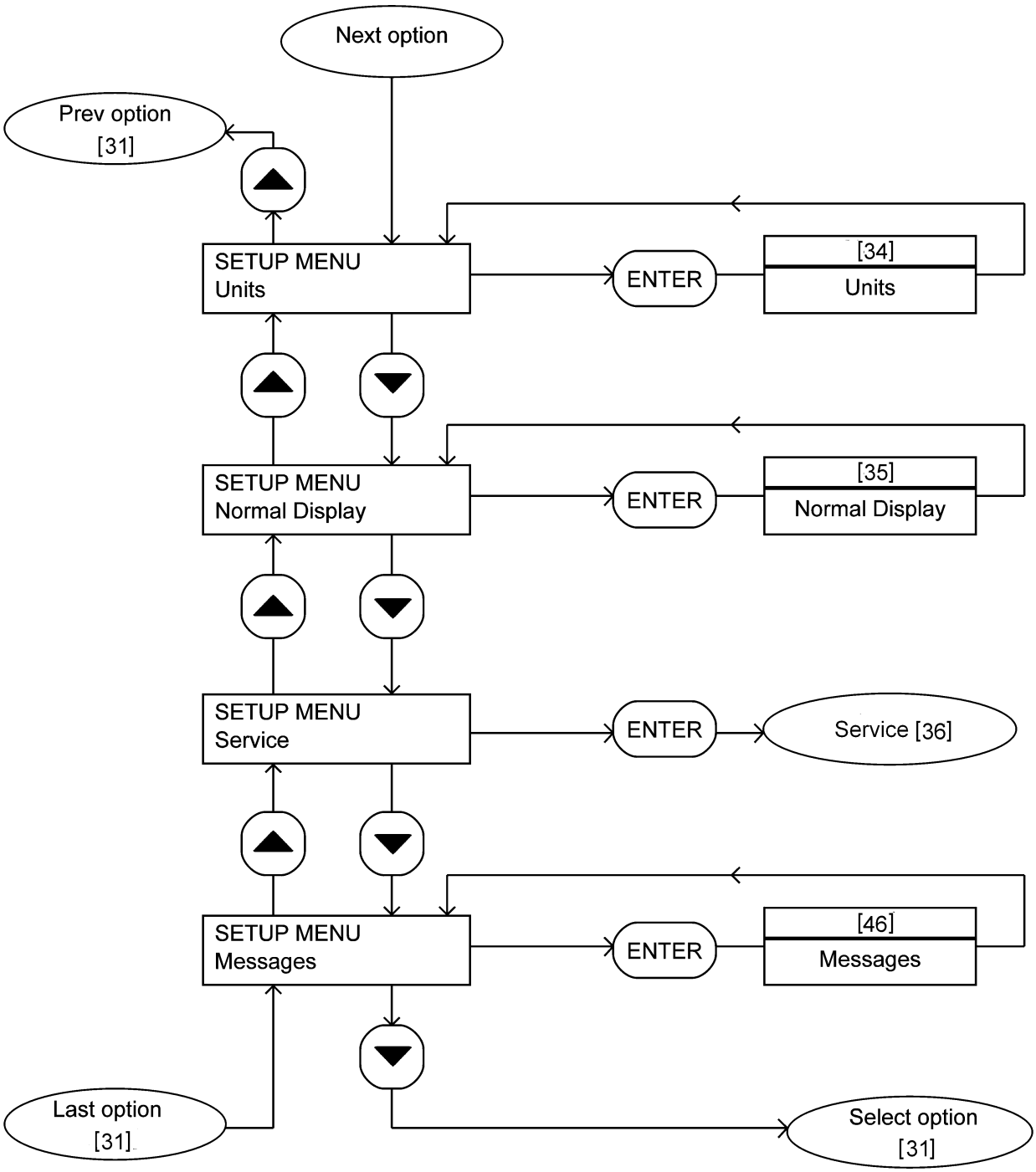

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Figure 32 - Run til crash menu

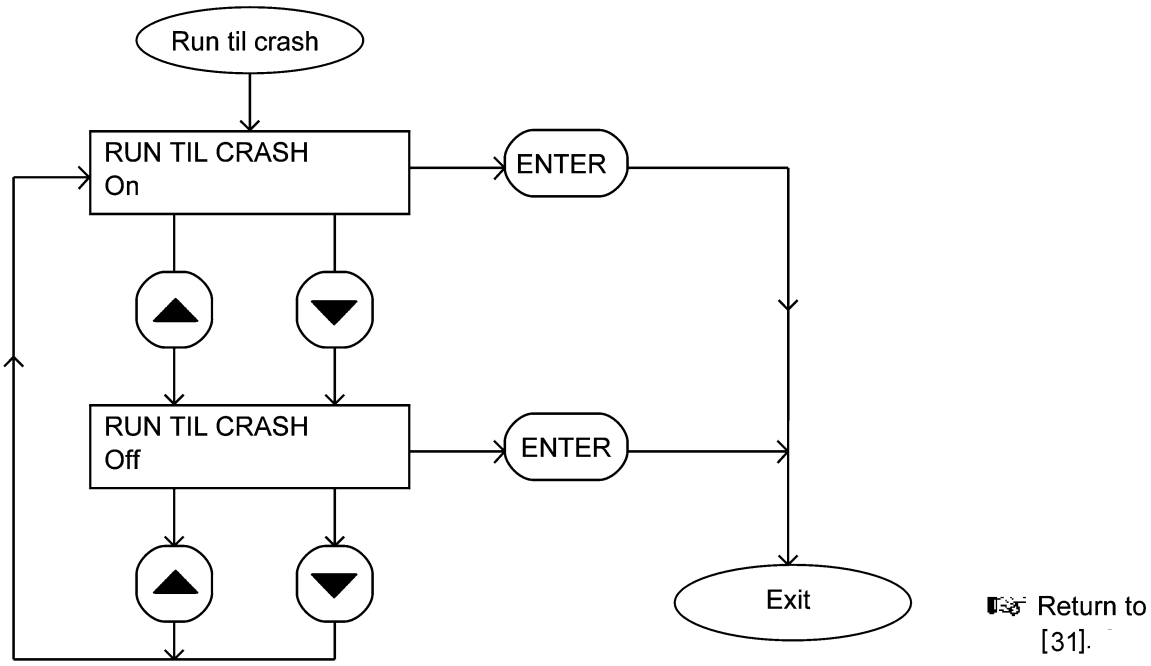

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Figure 33 - Units menu

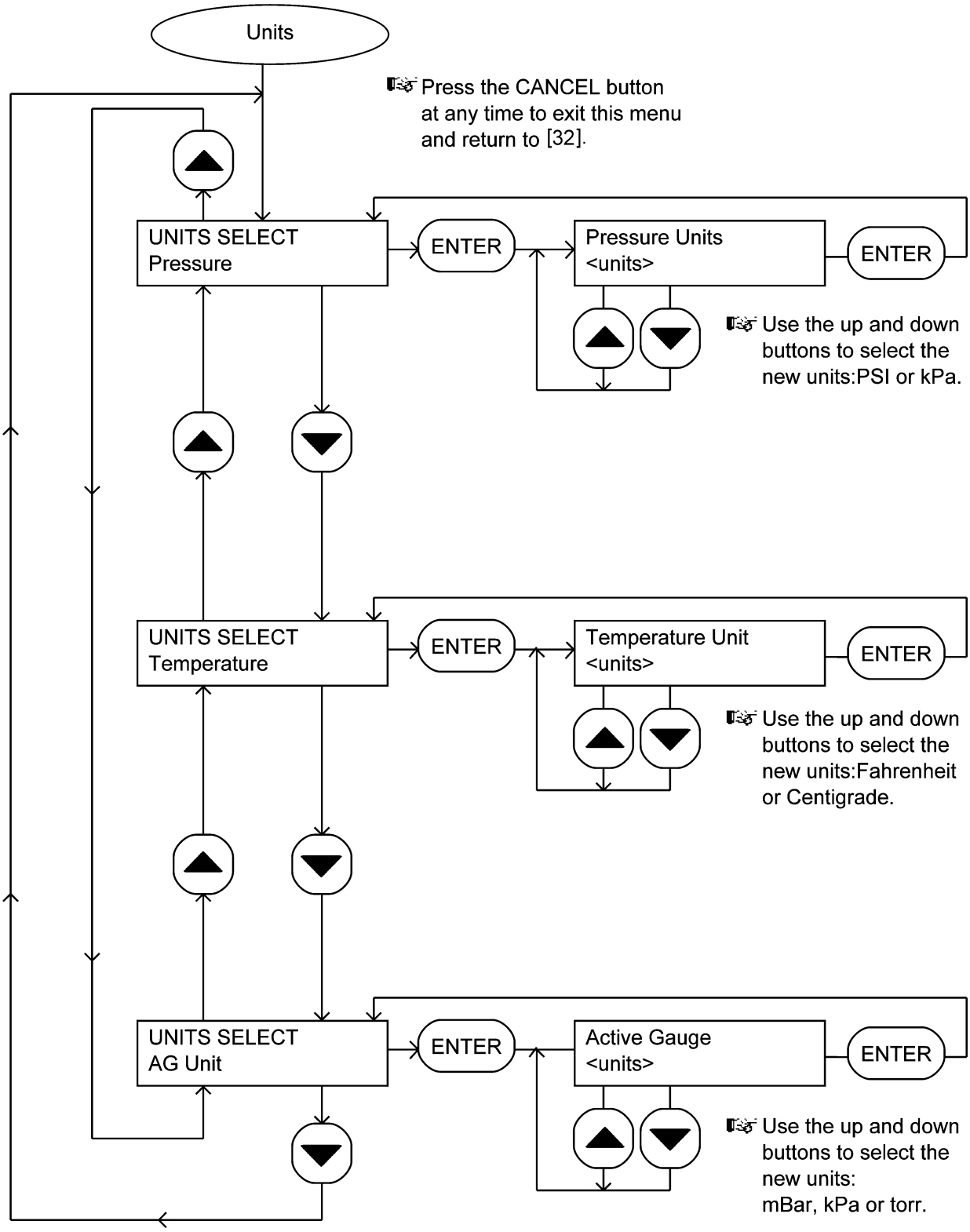

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Figure 34 - Normal display menu

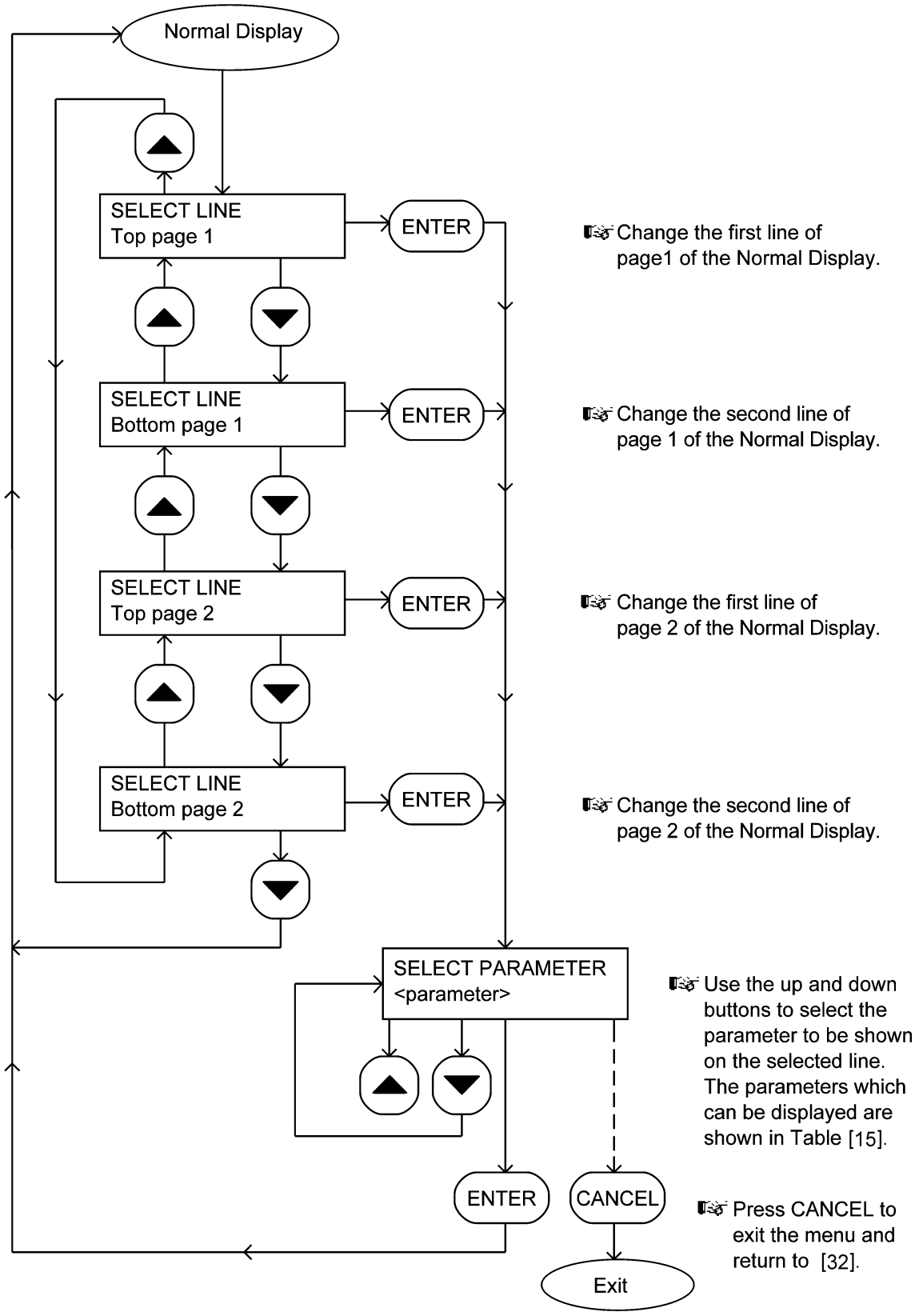

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Figure 35 - Service menu: sheet 1 of 2

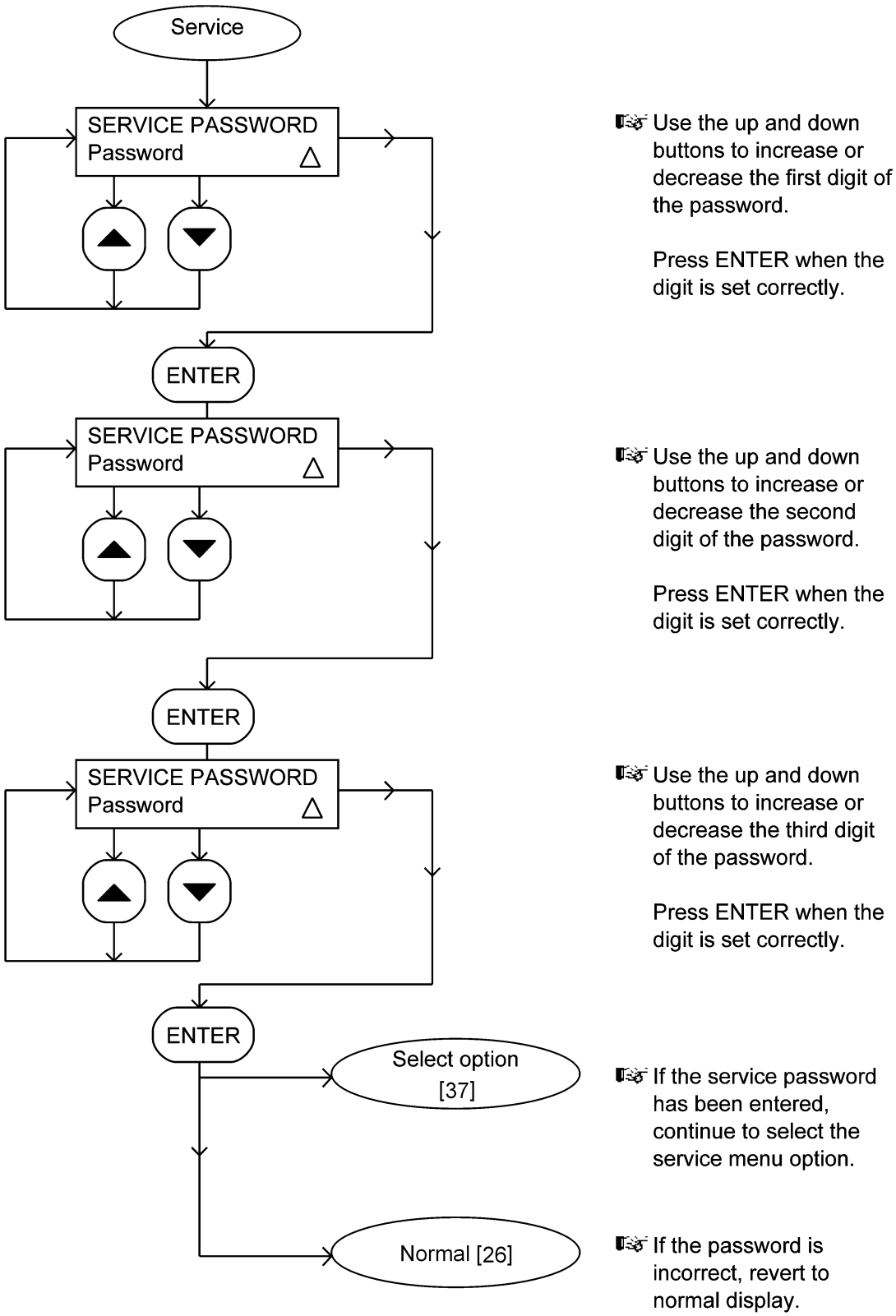

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Figure 36 - Service menu: sheet 2 of 2

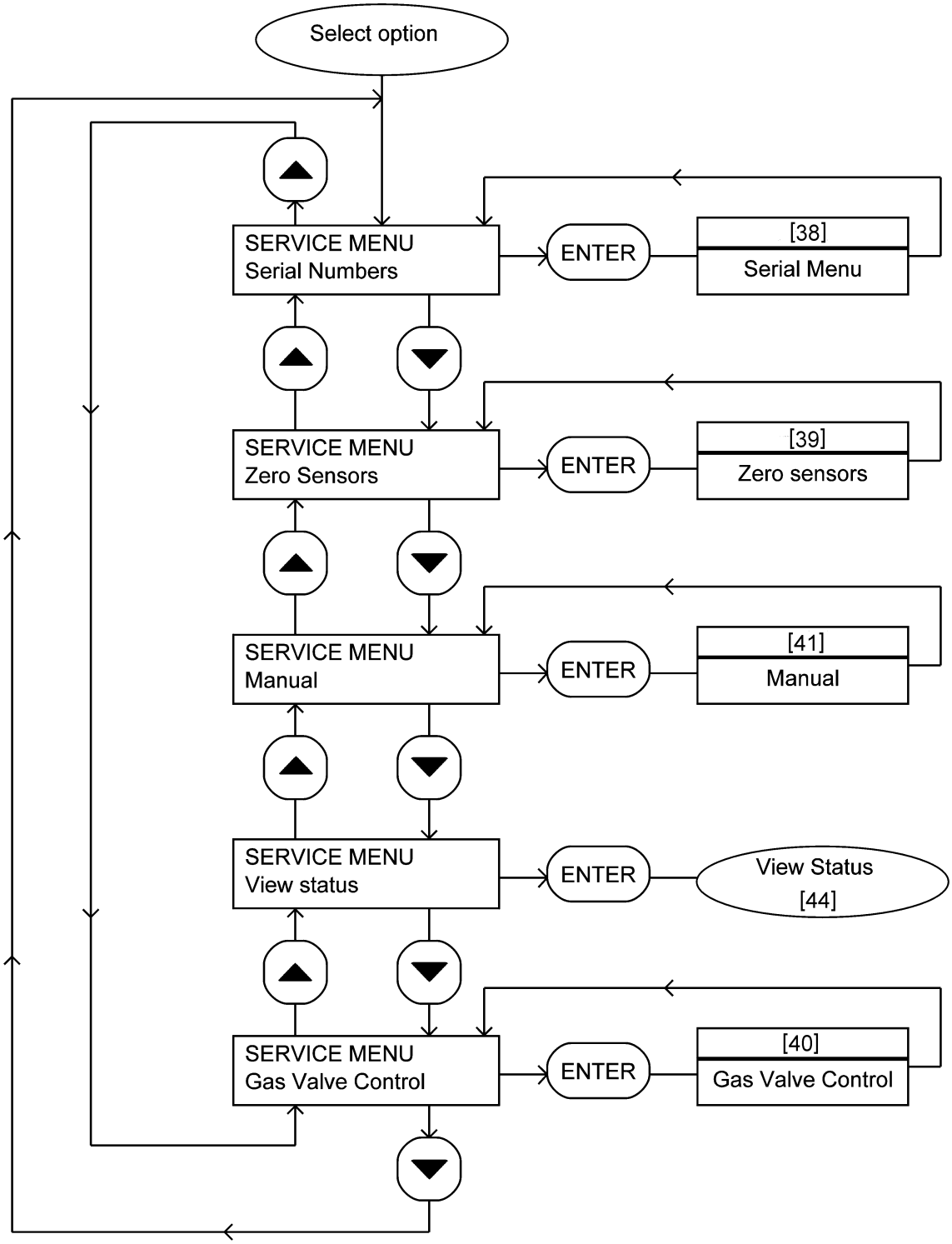

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Figure 37 - Serial menu

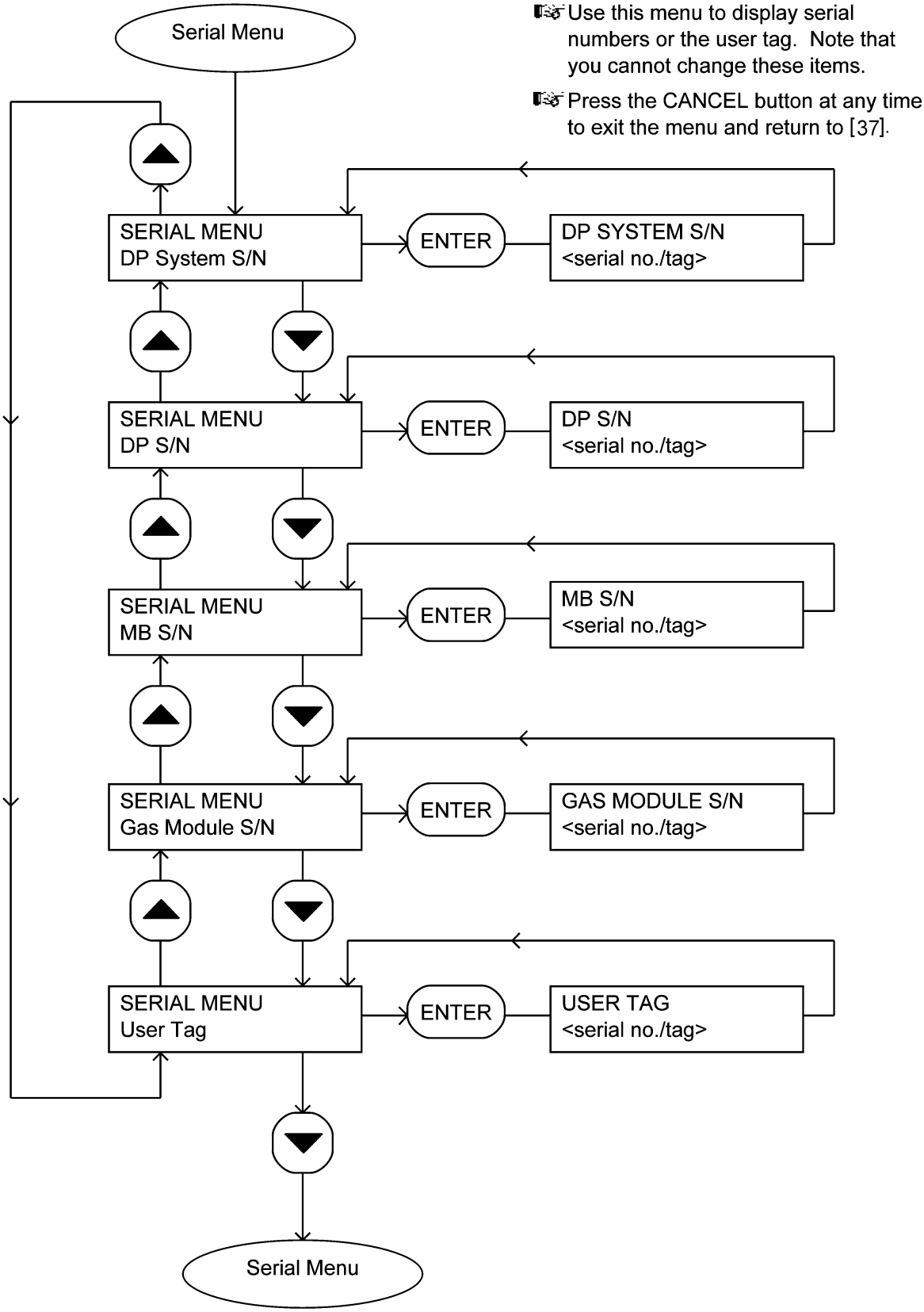

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Figure 38 - Zero sensor menu

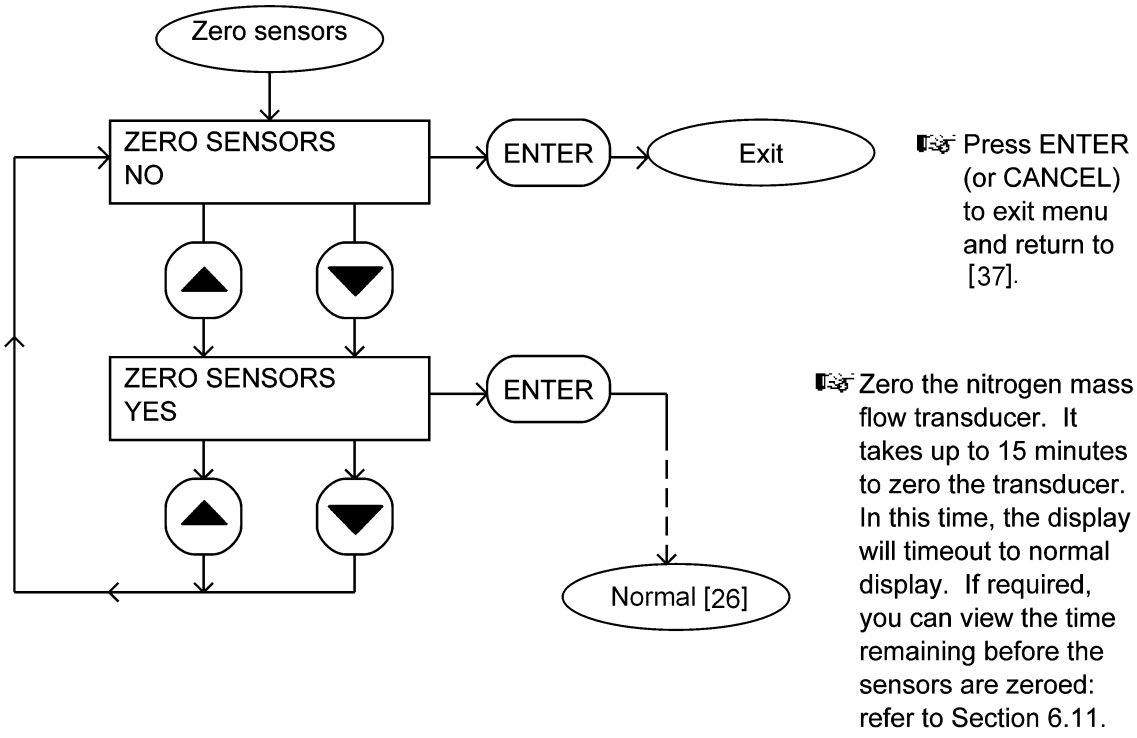

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Figure 39 - Gas valve control menu

Notes: 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.

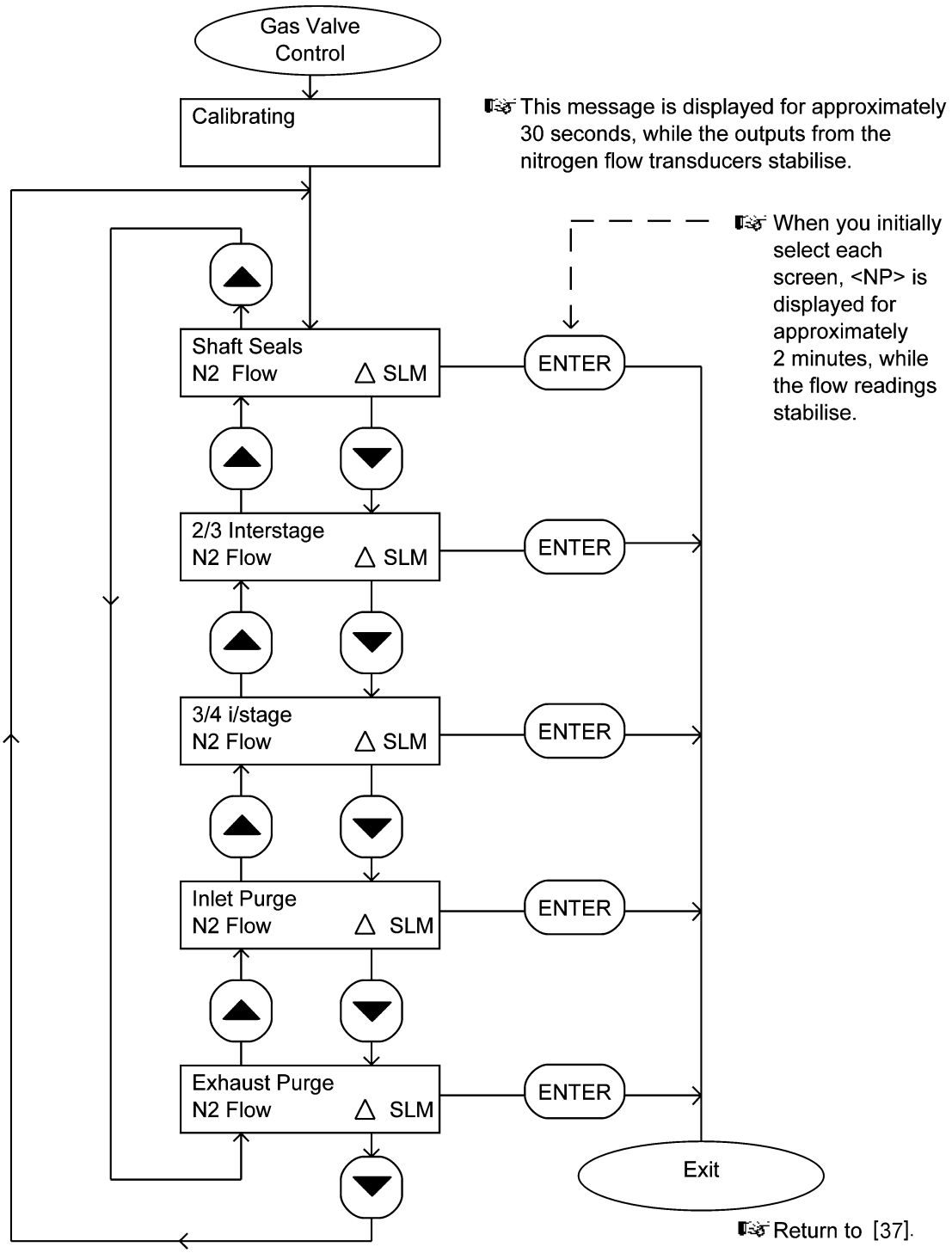

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Figure 40 - manual menu: sheet 1 of 3

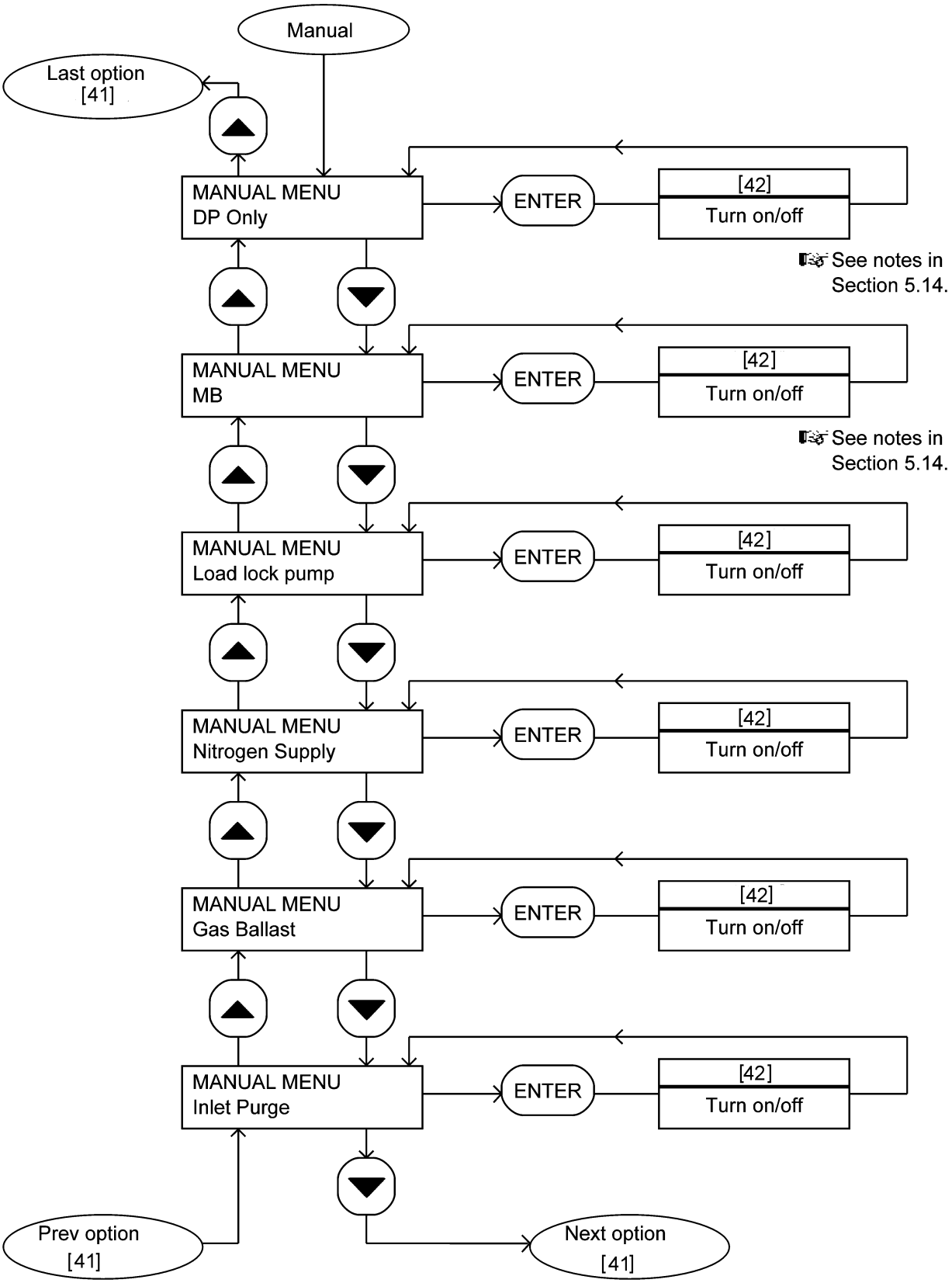

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Figure 41 - Manual menu: sheet 2 of 3

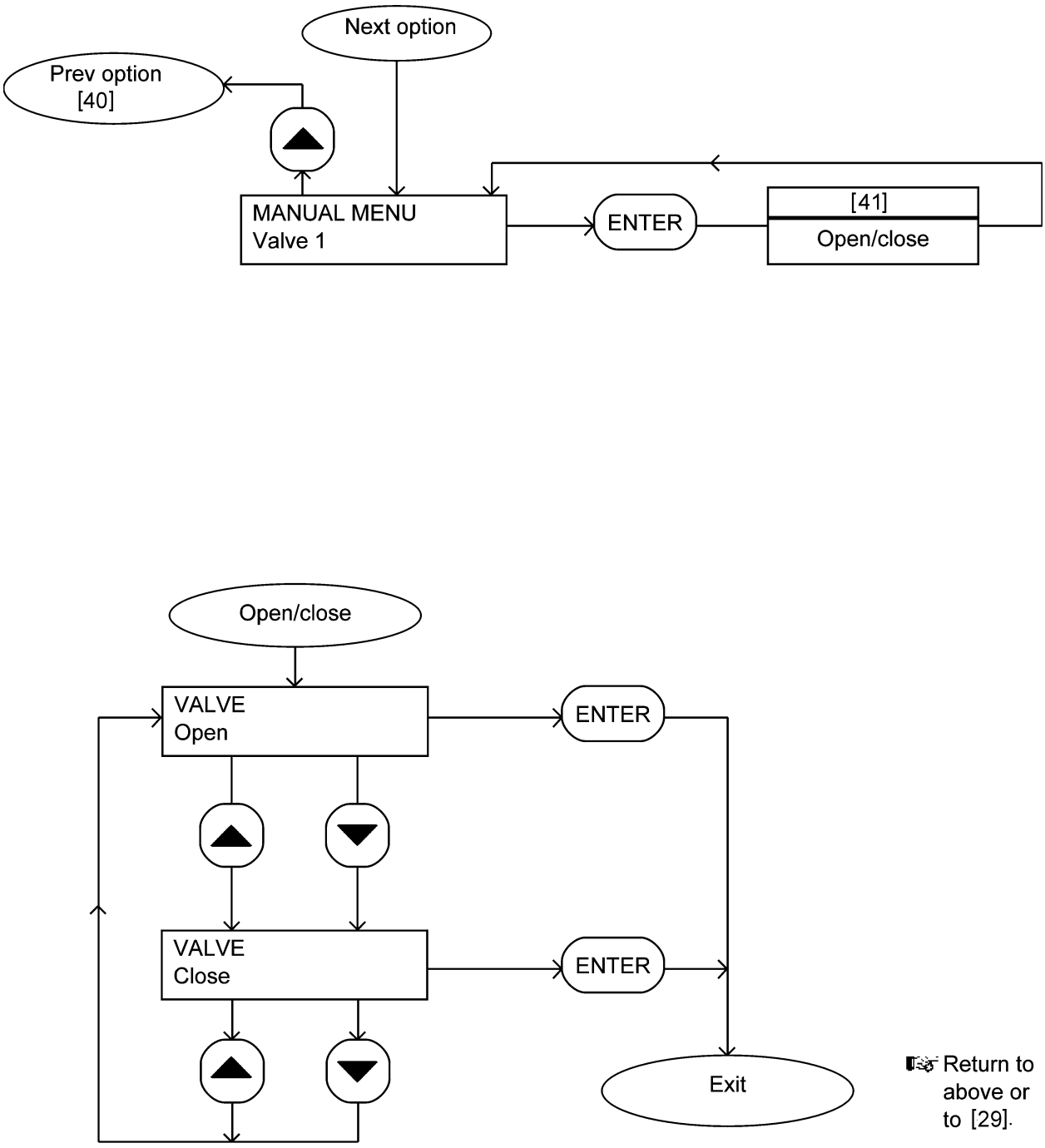

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Figure 42 - Manual menu: sheet 3 of 3

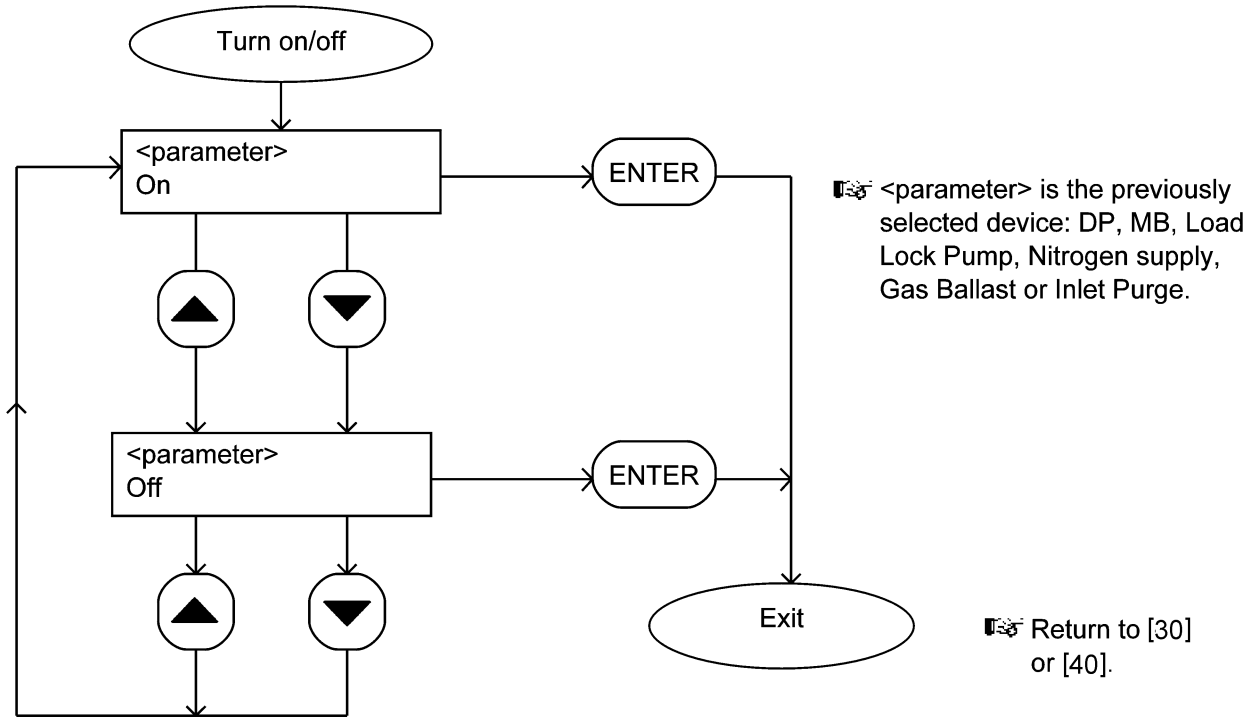

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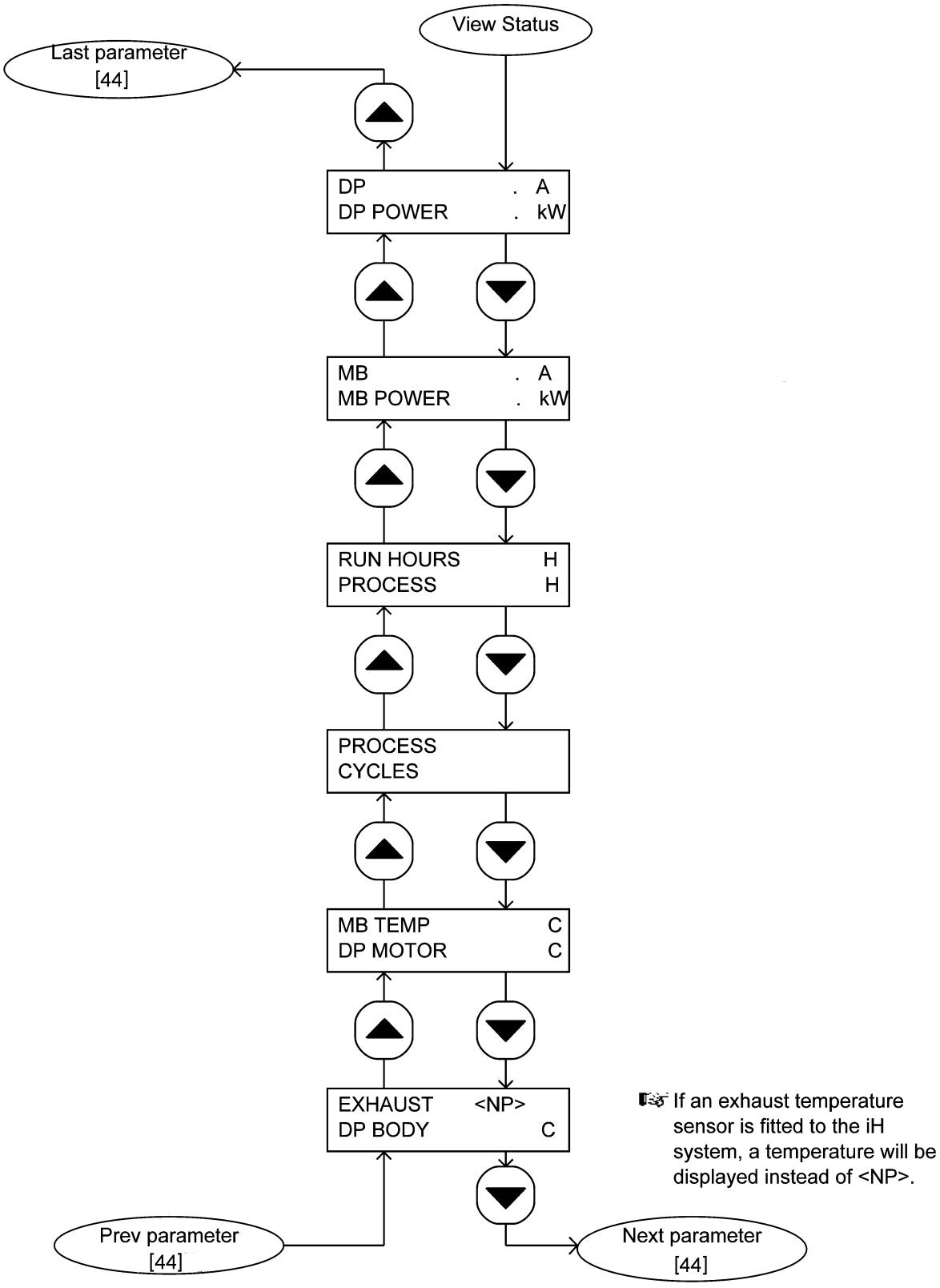
Figure 43 - View status menu: sheet 1 of 2



☞ If an exhaust temperature sensor is fitted to the iH system, a temperature will be displayed instead of <NP>.

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Figure 44 - View status menu: sheet 2 of 2

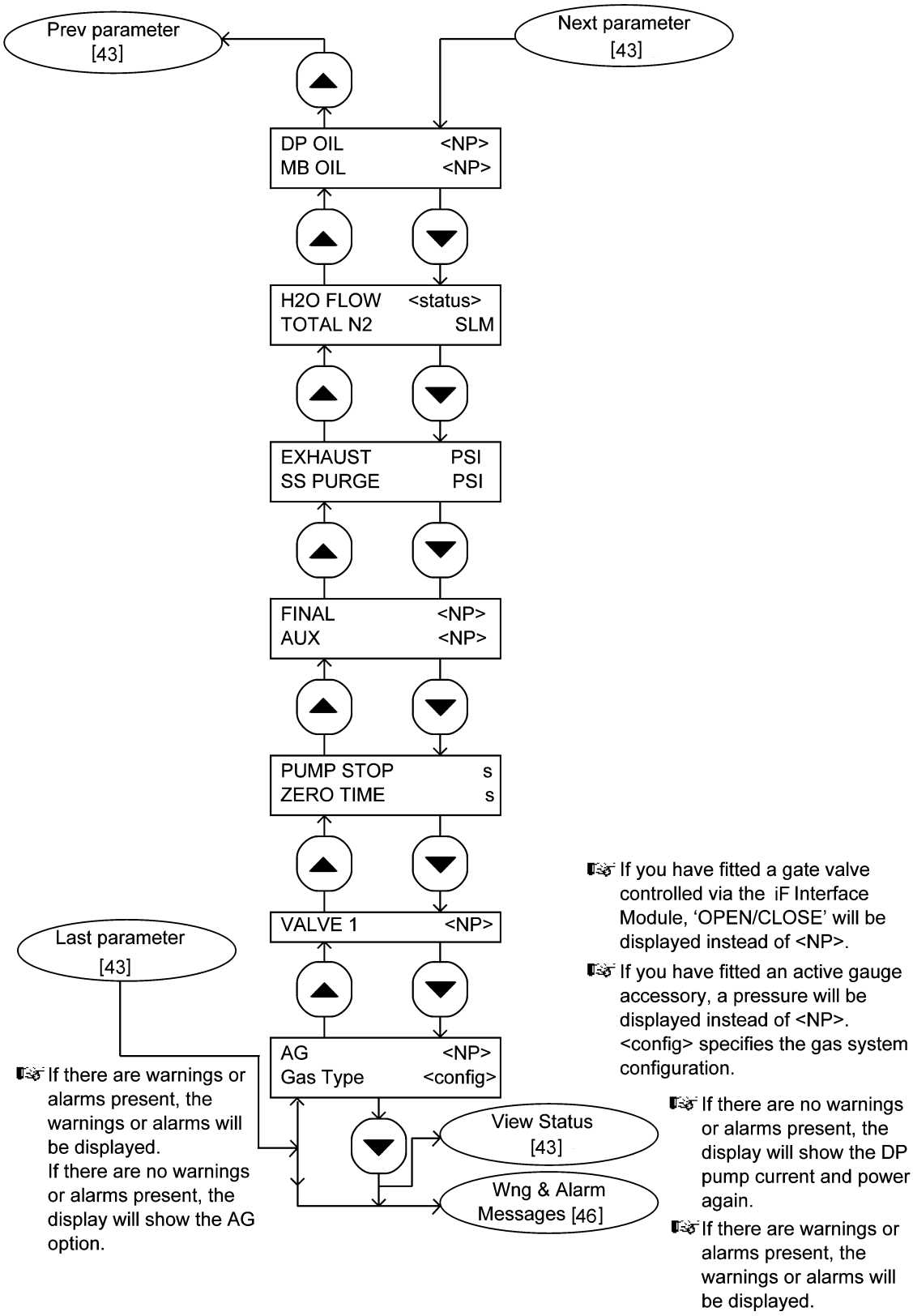

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Figure 45 - Message menu

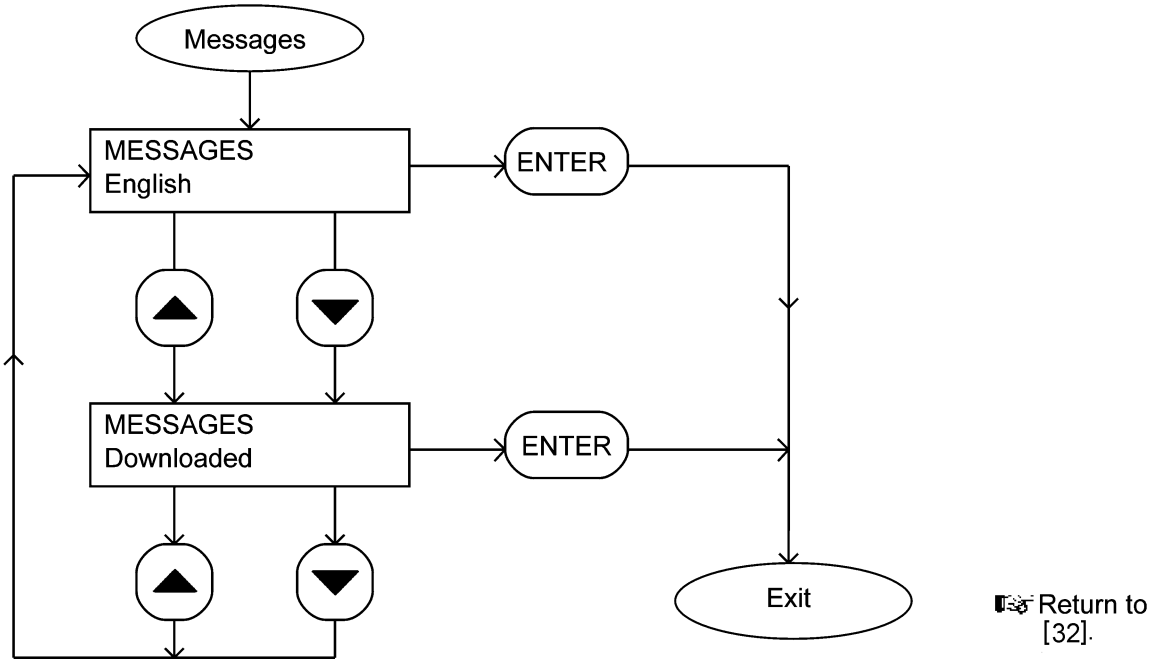

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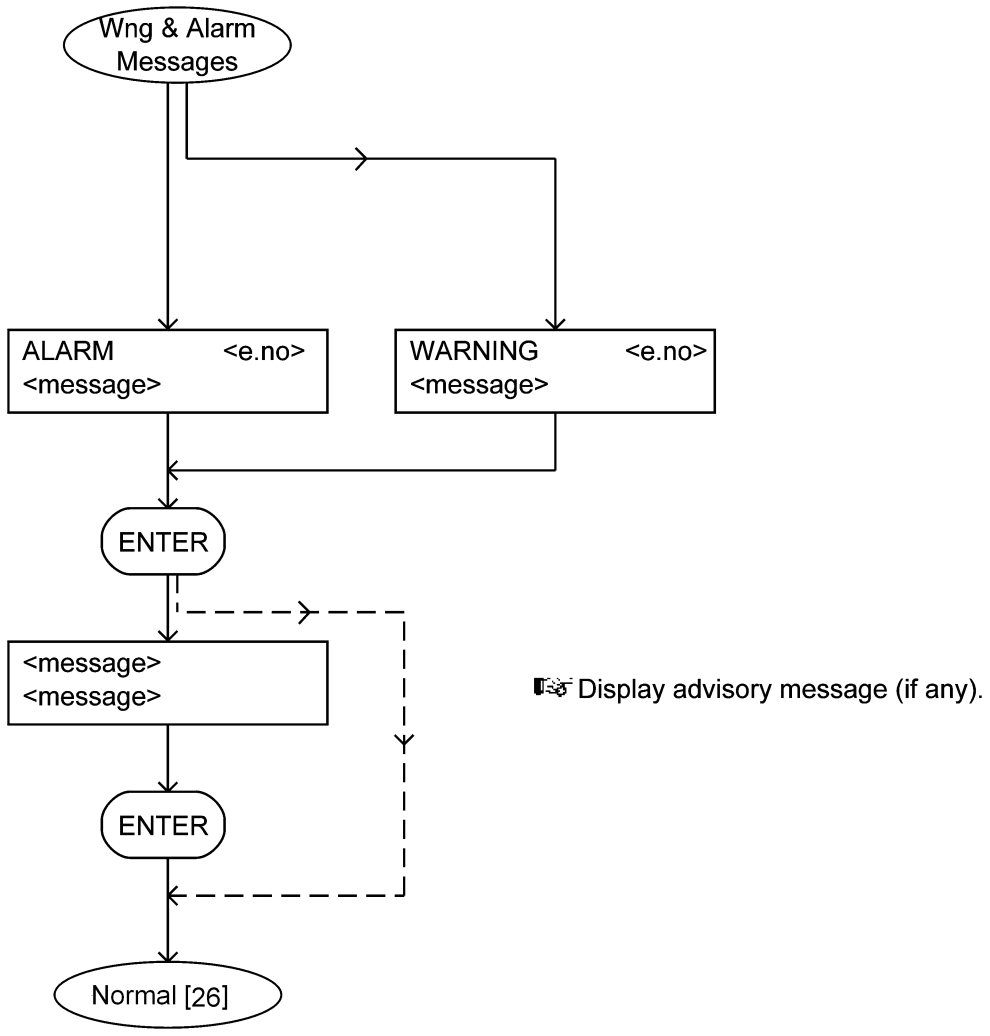
Figure 46 - Warning and alarm messages menu



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5 operation

5.1 Introduction

The following sections describe the use of the Pump Display Terminal to operate the iF system. For a description of the use of an Interface Module or Communications Module accessory to operate the iF 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 iF 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 Terminal. We refer to menus such as 'the Setup/Service/Configuration menu'. Refer to Figure 7 or 20: 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 Terminal menus and buttons before you operate the iF 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 iF system before you can use the Pump Display Terminal.

5.2 Configure the system (optional)

The iF1800 can only be used for loadlock applications. Do not reconfigure the iF1800 for any other applications

If you have a Single Pumpset Monitor connected to the iF system, the Monitor contains three configuration sets which contain preset configuration values (for example setpoints) for the iF system, for high and low nitrogen dilution levels. Table 16 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 iF 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 16 - Configuration store nominal gas flow

Purge Gas Flow	Nominal flow rates (slm)	
	Low Gas Configuration Store	High Gas Configuration Store
Shaft-seals purge	2.0	2.0
Cooling Purge	28.0	28.0
Dilution Purge	-	22.0
Exhaust purge	-	4.0
Total Purge	31.0	56.0

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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 Terminal 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:

- FDP pump power consumption
- FDP pump-body temperature.

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

- HMB pump power consumption
- HMB 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 Terminal display units:

- Pressures shown on the Pump Display Terminal 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 Terminal can be displayed in either ^{o}C or ^{o}F. Use the Setup/Units/Temperature menu to change the temperature display units.
- Pressures measured by an optional Active Gauge connected to the iF system, can be shown on the Pump Display Terminal 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 Terminal to control the operation of the iF system, the Local control LED on the Pump Display Terminal (Figure 7, item 9) must be on. If the LED is not on, use the Control menu to take control. You cannot take control with the PDT if another module already has control.

If you need to use another module (for example, the iF Interface Module) to operate the iF system, the Local control LED on the Pump Display Terminal (Figure 7, item 9) must be off. If the LED is on, use the Control menu to release control.

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

- Take control with the Pump Display Terminal again, then shut down the iF system as described in Section 5.9.
- Take control with another module and use that module to shut down the iF system.
- Use the emergency stop switch, as described in Section 5.11.

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5.5 Start-up

WARNING

Do not operate the iF system with any enclosure panels removed and do not touch any parts of the pump(s) when the iF 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 iF system. If you do not (and for example, maintenance is being performed downstream of the iF system), you could cause injury to people.

Notes: When you use the Pump Display Terminal to start up the iF system, we recommend that you do not disconnect the Terminal from the iF system; if you do, you will not be able to use the Terminal to instantly shut down the iF system: refer to Section 5.4.

Operation of the iF system with high inlet pressure may result in shaft-seal pressure warnings (refer to Table 18): the operation of the iF system will not be affected, and you can ignore these warnings.

Use the following procedure to start up the iF 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 Terminal has control of the iF system: refer to Section 5.4.
4. Refer to Figure 7. Look at the display (2) on the Pump Display Terminal:
   - If there are any warnings or alarms, take the necessary corrective action (refer to Section 6); do not start the iF system.
   - If there are no alarms or warnings displayed, use the Switch On menu to switch on the iF 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 Terminal will start to flash.
- The FDP pump will be switched on.
- The LED on the On button on the Pump Display Terminal will stay permanently on.
- The solenoid-valve(s) in the Gas Module will open to switch on the nitrogen supplies to the FDP pump.
- After the booster start delay, the HMB 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 iF system has been operating for at least four hours, so that the FDP pump is at its correct operating temperature.

You **must** check and adjust the nitrogen pressure when you first use the iF 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.

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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 6. 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 iF system

Notes: 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 17.

5.8 Warning and alarm indications

Notes: Refer to Section 6 for a full list of the warning and alarm messages and their meanings.

Unless you have changed the corresponding setpoints (refer to Section 5.2), nitrogen purge flow and pressure warning conditions will occur if an iF 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 Terminal 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 Terminal 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 (refer to Section 6.16), the display will then change to normal display: refer to Section 5.3.
- If the warning or alarm condition has an advisory message (refer to Section 6.16), 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: refer to Section 5.3.

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5.9 Manual shut-down

WARNING

If you intend to do maintenance on the iF system after you have shut it down and you will not isolate the iF system from the electrical supply, do not disconnect the Pump Display Terminal or release control from the PDT (refer to section 5.4). If you do, the iF system could be started by another module.

Note: Press the Cancel button on the Pump Display Terminal 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 iF system before you select shut-down.

Use the Switch Off menu to shut down the iF 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 iF 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 iF1800 system, the HMB pump is switched off.
- The LED on the On button on the Pump Display Terminal (Figure 7, item 1) starts to flash.
- If not already open, the gas solenoid-valves are opened to switch on the nitrogen purges to the iF system.
- After 15 minutes, the gas solenoid-valves are closed to switch off the nitrogen purges to the FDP pump, and at the same time the FDP pump is switched off.
- The LED on the On button on the Pump Display Terminal goes off.

If you need to shut down the iF 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 iF1800 system, the HMB pump is switched off.
- The gas solenoid-valves are opened to switch on the nitrogen purges to the FDP pump.
- After approximately 30 seconds the gas solenoid-valves are closed to switch off the nitrogen purges to the FDP pump, and at the same time the FDP pump is switched off.
- The LED on the On button on the Pump Display Terminal (Figure 7, 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 iF system equipment.

Notes: The emergency stop button, the emergency stop signal from your control equipment (if fitted) and the safety sensors (refer to Section 1.10.3) will still shut down the iF 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 iF system is disconnected from the electrical supply, or the electrical supply is switched off.

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Normally, if an alarm condition exists, the iF control system will shut-down the iF 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 iF system even if you have selected 'run til crash':

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

On an iF1800 system, the following alarms will cause only the HMB pump to shut down, provided 'run til crash' is not selected:

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

On an iF1800 system, the following alarms will cause only the HMB pump to shut down, whether 'run til crash' is selected or not:

- HMB CURRENT HIGH/LOW * (error numbers 710 and 712).
- HMB THERMISTOR HIGH (error number 912).
- - (error number 701) =.

Table 17 - Status menu sensor reading displays

Sensor data	Units	Notes*
FDP Oil pump current consumption	A	
FDP Oil pump power consumption	kW	
HMB pump current consumption	A	
HMB pump power consumption	kW	
Total running time	hours	Total run-time of the iF system.
Process running time †	hours	Total run-time on process.
Process cycles †	-	Process cycles.
iF cycles	-	The number of times the iF system has been switched on/off.
HMB pump temperature	°C/°F	
FDP pump-motor water manifold surface temperature	°C/°F	
Exhaust temperature ‡	°C/°F	
FDP 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: refer to 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 Valve 1	seconds	
	-	The open/closed state of the gate valve (if an iF 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.

* *NP or NR can also be displayed to identify the status of a sensor: refer to Section 4.7.*

† *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 iF Interface Module.*

‡ *Only available for display if the appropriate optional accessory is fitted to the iF 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.*

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5.11 Emergency stop

Notes: *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 iF system in an emergency, press the emergency stop switch (Figure 6, item 1) on the dashboard. Alternatively, you can operate the emergency stop controls in your own control system if you have connected your emergency stop circuit to the iF system as described in Section 3.14.

When emergency stop is selected:

- The FDP pump (and the HMB pump, on iF1800 systems) is switched off.
- The solenoid-valve(s) in the Gas Module close, to switch off the supply of nitrogen to the FDP pump.
- The Pump Display Terminal will display 'STOP ACTIVATED'.
- The LED on the On button on the Pump Display Terminal (Figure 7, item 1) will go off.

5.12 Restart the HMB pump after automatic pump shut-down

WARNING

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

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

5.13 Restart the iF 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 iF system has automatically shut down because of high FDP pump power (alarms 412 and 512), check that the FDP pump is free to rotate before you restart the iF system.*

If you have used the emergency stop switch on the dashboard to shut down the iF system, you must reset the emergency stop switch before you can restart the iF system. Turn the emergency stop switch to reset it, then restart the iF system as described in Section 5.5. Note that the 'STOP ACTIVATED' alarm message (refer to Table 19) will stay on the Pump Display Terminal until you restart the pumping system.

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

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5.14 Operation of the iF system components

WARNING

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

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.

Notes: The gate valve must be connected to the iF system through an iF Interface Module with an Auxiliary Interface Card.

When you manually start the FDP pump or the HMB 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 HMB pump; that is, you cannot use the menu to manually switch the HMB pump on and off.

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

If necessary (for example, for fault finding purposes), you can control the operation of iF 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 valve (that is open or close the valve).
- Use the Setup/Service/Manual/DP Only menu to control the operation of the FDP pump (that is, switch the FDP pump on and off).

5.15 Operation of the load-lock pump

Note: Operation of the iF system with high inlet pressure may result in shaft-seal pressure warnings (refer to Table 18): the operation of the iF system will not be affected, and you can ignore these warnings.

If you have connected a load-lock pump to the iF 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.

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6 maintenance

6.1 Safety

WARNING

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

WARNING

Allow the pump to cool down to a safe temperature before disconnecting or isolating the cooling water supply. Failure to do so will result in high pressures being generated in the pump cooling system.

WARNING

Hazardous chemicals may be located within the pumps and piping. Use of suitable protective gloves and clothing along with a respirator is recommended if contact with substances is anticipated. Personal protective equipment

WARNING

Particular caution should be exercised when working with Fomblin oil which may have been exposed to temperatures greater than 260°C. Refer to Edwards Material Safety Data Sheets for detailed information.

Only Edwards engineers may maintain the iF pump series. Users can be trained by Edwards to conduct the tasks described in this manual, contact your local service centre or Edwards for more information.

- Safety sensors fitted to the iF system do not require routine maintenance.
- 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.
- Fit a suitable blanking plate on the iF system inlet and your vacuum system as soon as you disconnect the iF system from your vacuum system. Do not operate the iF system unless the inlet blanking plate is fitted or the iF system is connected to your vacuum system.
- Fit a suitable blanking plate on the iF system exhaust and your exhaust-extraction system as soon as you disconnect the iF system from your exhaust-extraction system. Do not operate the iF system unless the exhaust is connected to your exhaust-extraction system.
- Allow the pumps to cool to a safe temperature before you fit lifting bolts or start maintenance work.
- Vent and purge the iF system with nitrogen before you start any maintenance work.
- Isolate the iF 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 iF system is not an electrical isolator.
- Wait for at least four minutes after you have switched off the electrical supply before you touch any electrical component on the iF system.
- Never operate the iF system (even for test purposes) unless a second protective earth (ground) is fitted: refer to Section 3.15.2.
- Recheck the pump rotation direction if the electrical supply has been disconnected.

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- 'O' ring replacement intervals vary depending on your application - your local Edwards office can provide assistance.
- Do not reuse 'O' rings.
- Dispose of components, grease and oil safely (refer to 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 iF system has been overheated to 260 ^{o}C and above. These breakdown products are very dangerous. Fluorinated materials in the iF system may include oils, greases and seals. The iF 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. (refer to Section 1.1 for contact numbers).
- Leak-test the system after maintenance work is complete if you have connected or disconnected any vacuum or exhaust joints; seal any leaks found.
- Wipe up any water or oil spilt during maintenance to avoid possible risk of slips.
- Route and secure cables, hoses and pipe-work during maintenance to avoid possible risk of trips.

6.2 Correct use of tube fittings

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

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

6.2.1 Fit a tube fitting

1. Refer to Figure 46 detail A. Undo and remove the nut (4) from the tube fitting (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 tube fitting (1).
2. Refer to detail B. Insert the tube (5) through the nut (4) and into the tube fitting (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 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 and 1/4 turns (to the nine o'clock position) to fully tighten the connection.

6.2.2 Reconnect a tube fitting

You can disconnect and reconnect a tube fitting many times and still obtain a correct leak-proof seal. Refer to Figure 46 detail A which shows a tube fitting 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 tube 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.

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6.3 Maintenance frequency

The iF 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 iF 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 Tube 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 3.16.

6.5 Check the purge gas flow rates

Use the Service/Gas valve control menu to regularly check the purge gas flow rates against the nominal flow rates shown in Table 16.

6.6 Inspect and clean the exhaust-silencer, 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.

Note: This may require new NW40 trapped O'Rings.

Use the following procedures to dismantle, clean and refit the exhaust system. 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 iF system from your exhaust-extraction pipeline. Dispose of the trapped 'O' ring.
2. Remove the exhaust enclosure (26) by removing the screws connecting to the rear bulkhead cover.
3. Remove the rear cover by removing the screws that secure the rear cover
4. Remove the NW40 clamp and trapped 'O' ring which secures the check-valve (18) to the elbow (20) and remove the check-valve. Dispose of the trapped 'O' ring.

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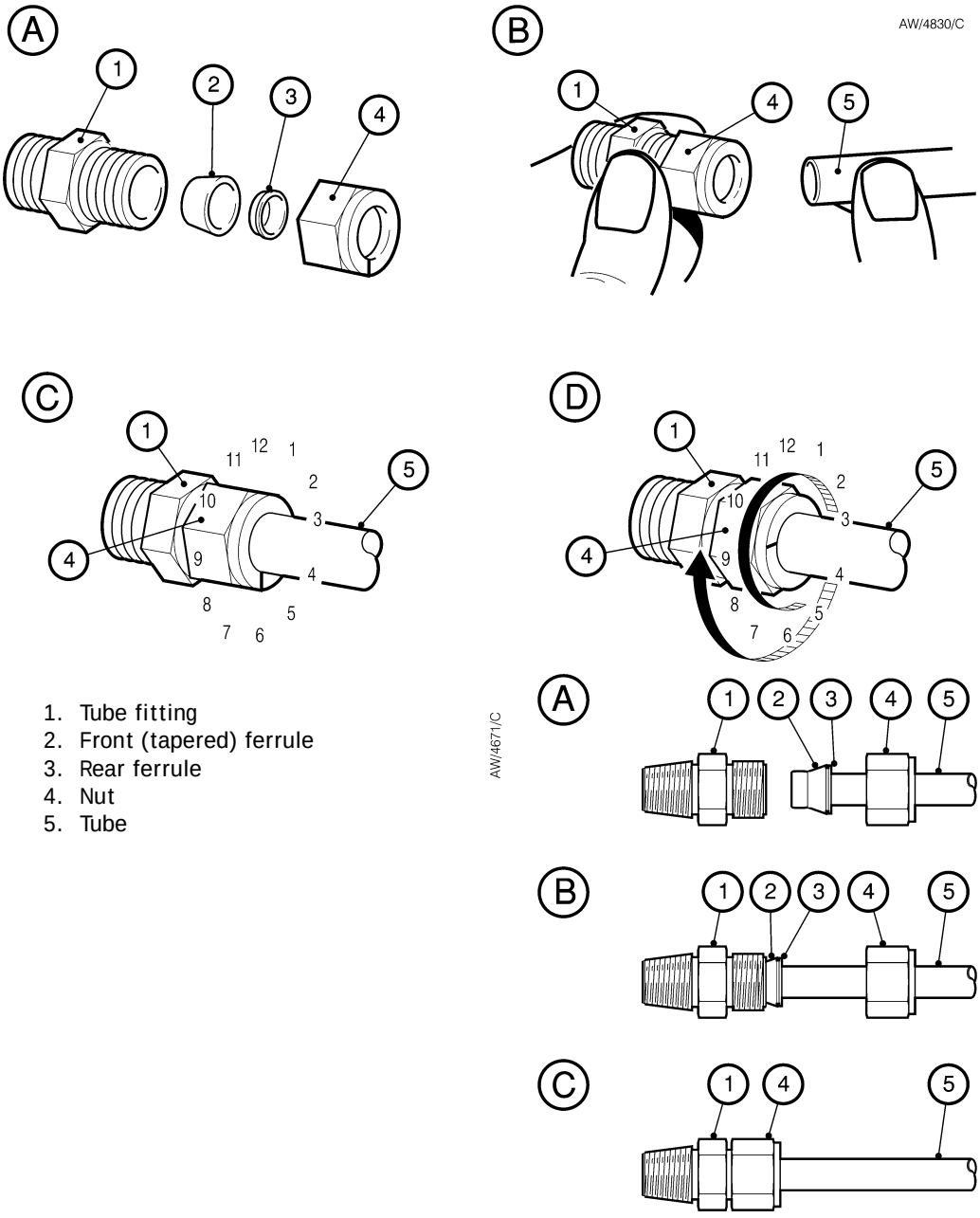
Table 18 - Fit and re-tighten a tube fitting



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

5. Remove the NW40 clamp and trapped 'O' ring which secures the elbow to the exhaust silencer (19). Dispose of the trapped 'O' ring.

6. Inspect the exhaust silencer (19). If you do not need to remove the silencer from the pump to clean it, use a suitable tool (for example a long bottle brush) and a cleaning solution suitable for the deposits to clean the exhaust silencer outlet and continue at Step 7. If you need to remove the exhaust silencer from the pump to clean it, refer to Section 6.6.1.

7. Empty all loose deposits from the elbow, then use a suitable tool (for example a long brush) and a cleaning solution suitable for the deposits to clean the elbow, if necessary.

8. Fit a new NW40 trapped 'O' ring and the NW40 clamp to secure the elbow to the exhaust silencer.

9. If the check valve needs to be cleaned, refer to Section 6.6.2

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10. Refer to Figure 1. Use a new trapped ‘O’ ring and clamp to secure the check-valve (18) to the elbow (20). Ensure that the flow arrow on the check valve (Figure 49, item 7) points away from the elbow towards the exhaust extraction system.
11. Refer to Figure 1. Refit the exhaust enclosure (26) using the screws connecting to the rear bulkhead cover, drip tray (27) and exhaust enclosure top plate.
12. Use a new trapped 'O' ring (not supplied) and the NW40 clamp (removed in Section 6.6.1) to secure the check-valve outlet to the exhaust-extraction system.

6.6.1 Dismantle, Clean and Refit the Exhaust Silencer

Note: This requires a check valve service kit. Refer to Section 8.3.

1. Refer to Figure 1. Remove the screws that secure the drip tray (27) to the iF system. Remove and retain the drip tray.
2. Refer to Figure 48. Undo the bracket (5) that secures the exhaust silencer to the iF system.
3. Remove the NW40 clamp (3) and trapped O’ring (2) that secures the silencer (6) to the manifold (4). Dispose of the trapped O’ring. Remove the silencer from the iF system, retaining the bracket (5).
4. Refer to Figure 47. Remove and retain the six M5 cap head screws (1) and washers (2) that fix the top flange assembly to the silencer body (11).
5. Separate the top flange assembly and body. Remove the O’ring (7) from the O’ring groove (8). Remove the two labels (10) from the side of the silencer. Dispose of the O’ring and labels safely - refer to Section 7.
6. Empty all loose deposits from the silencer body and top flange assembly. Take care not to damage the sealing surfaces on the underside of the top flange assembly, the O’ring groove and the NW40 flanges.
7. Use suitable tools to dislodge any remaining deposits, then wash the silencer body and top flange assembly with steam or water. Finally, bead blast the internals of the silencer. Protect all sealing faces, the drilled and tapped holes during cleaning and bead blasting. If required, use a cleaning solution suitable for the nature of the deposits.
8. Inspect the silencer for internal corrosion. Check that the walls of the silencer body and the top flange plate are not excessively eroded. Inspect the sealing surfaces on the underside of the top flange assembly, the O’ring groove and the NW40 flanges for damage and re-finish if necessary. If the damage to the silencer is excessive, it should be replaced.
9. Check that the O’ring groove is clean. Place the new O’ring (Supplied in the service kit) in the groove.
10. Refit the top flange assembly to the silencer body and fasten using the retained screws and washers. Tighten the screws evenly to a torque of 6.9 to 7.1 Nm. Altering between the screws on the top flange assembly to ensure that the O’ring is evenly compressed.
11. Leak test the silencer, and seal any leaks that are found. Refer to the main pump instruction manual for more information about leak testing. If required, mark the screws with heat resistant security paint after successful leak testing, to show continued integrity of the seal after installation.
12. Refer to Figure 48. Check that the mating surfaces of the exhaust manifold (4) and silencer (6) flanges are not scratched or damaged: If necessary re-finish the surfaces.
13. Affix the new hot surface warning labels (supplied in the service kit) to the sides of the silencer.
14. Insert the silencer into the iF system and loosely fit the bracket assembly (4). Use the new NW40 trapped O’ring (supplied in the service kit) and the NW40 clamp to secure the silencer to the exhaust manifold. Tighten the bracket assembly.
15. Use the cap head screws and washers (retained in step 1) to secure the drip tray to the iF system.
16. Continue at step 7 of Section 6.6.

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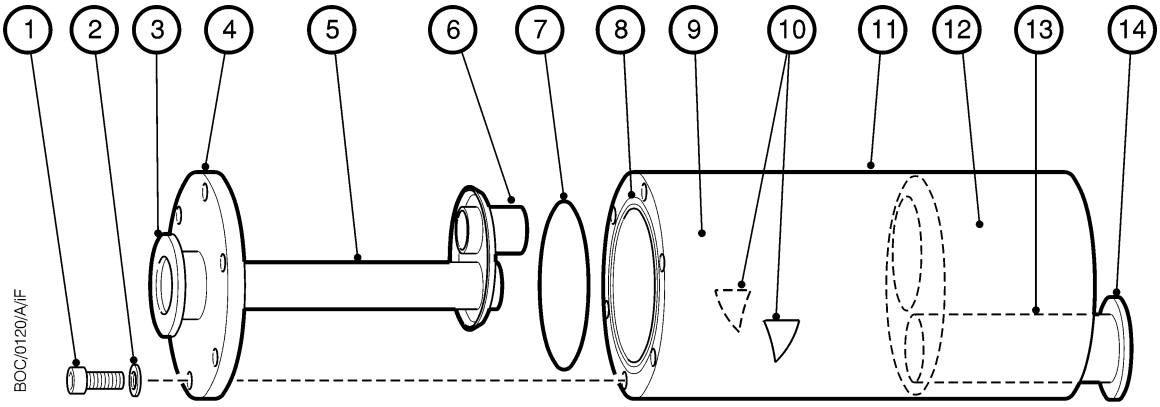
Figure 47 - Dismantle and clean the silencer



1. M5 screw
2. M5 metal washer
3. NW40 inlet flange
4. Top flange assembly
5. Inlet tube
6. Transfer tube
7. O-ring
8. O-ring groove
9. Second stage expansion chamber
10. Hot surface warning labels
11. Body
12. First stage expansion chamber
13. Outlet tube
14. NW40 outlet flange

6.6.2 Clean the check-valve

Note: This requires a check valve service kit. Refer to Section 8.3.

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; re-finish if necessary.
4. Position the new ‘O’ring in its groove in the valve body.
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.

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6.7 Check the HMB 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.

WARNING

The majority of synthetic oils/grease can cause inflammation of the skin (dermatitis). Safety precautions must be taken to prevent prolonged skin contact with these substances. Use of suitable protective gloves and clothing along with respirator is recommended if contact with substances is anticipated.

WARNING

Particular caution should be exercised when working with Fomblin oil that may have been exposed to temperatures greater than 260°C. Refer to Edwards Material Safety Data Sheets for detailed information.

CAUTION

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

CAUTION

Ensure that the oil-level in the HMB 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 a Edwards Service Centre for advice.

Use the following procedure to check the oil-level.

1. Shut down the iF system (refer to Section 5.9) and allow it to cool.
2. Remove the right-hand side enclosure panel from the iF 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 HMB 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 3.16.

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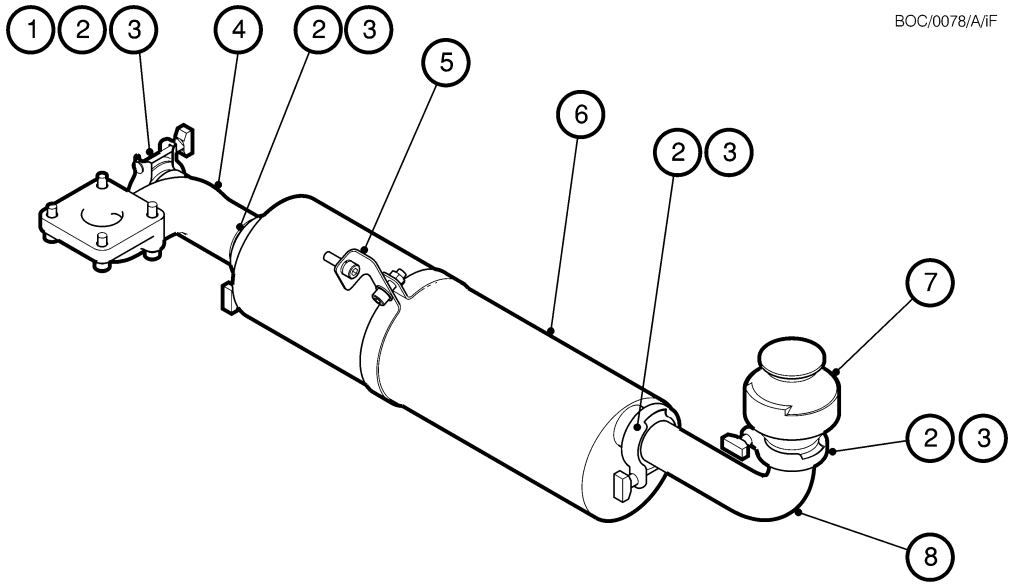
Figure 48 - Removing/cleaning the iF exhaust system



1. NW40 Blank
2. NW40 trapped O-ring
3. NW40 Clamps
4. Exhaust manifold
5. Silencer support bracket
6. Silencer
7. Check valve
8. Elbow

6.8 Check the FDP 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.

WARNING

The majority of synthetic oils/greases can cause inflammation of the skin (dermatitis). Safety precautions must be taken to prevent prolonged skin contact with these substances. Use of suitable protective gloves and clothing along with respirator is recommended if contact with substances is anticipated.

CAUTION

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

CAUTION

Ensure that the oil-level in the FDP 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. An oil-level viewing port is provided on the right hand side panel (viewed from the front of the system). These should be used as an indication only, for an accurate oil-level assessment use the following procedure to check the oil-level.

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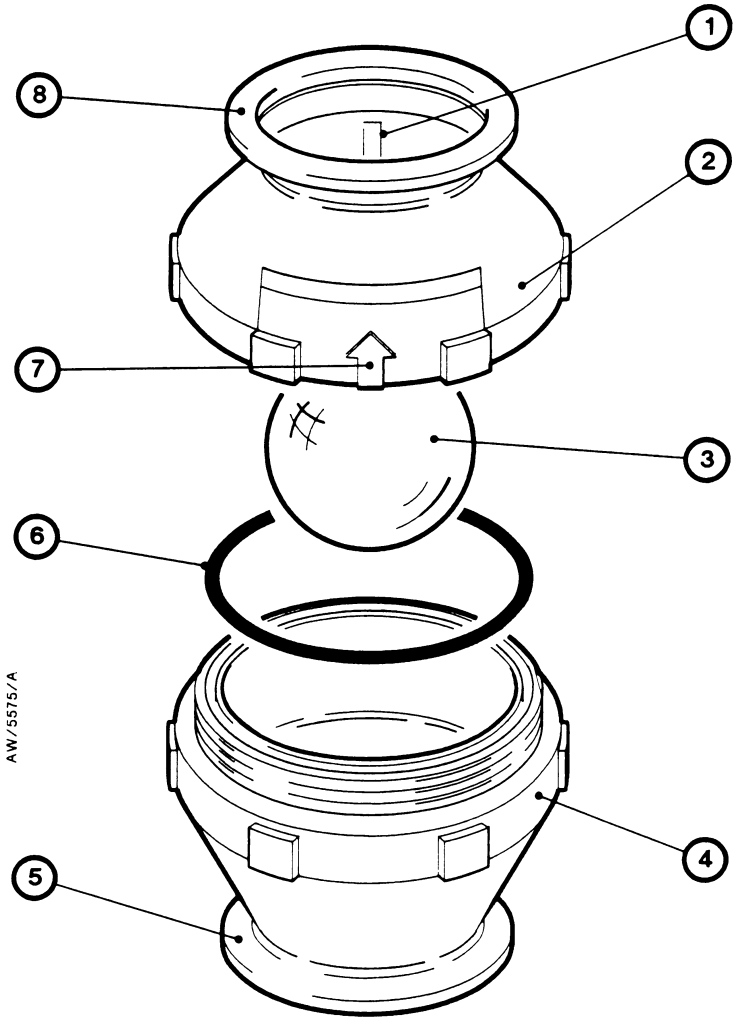
Figure 49 - Clean the exhaust check-valve



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

1. Shut down the iF system (refer to Section 5.9) and allow it to cool.
2. Remove the right-hand side enclosure panel from the iF 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 FDP 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.

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6.9 Change the FDP 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.

WARNING

The majority of synthetic oils/greases can cause inflammation of the skin (dermatitis). Safety precautions must be taken to prevent prolonged skin contact with these substances. Use of suitable protective gloves and clothing along with respirator is recommended if contact with substances is anticipated.

CAUTION

Ensure that the oil-level in the FDP 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 iF system (refer to Section 5.9) and allow it to cool.
2. Remove the right-hand side enclosure panel from the iF system, refer to Section 3.4.
3. Refer to Figure 1. Place a suitable container under the FDP pump and remove the drain plug (31).
4. Allow all the oil to drain from the FDP pump.
5. Dispose of the old 'O' ring on the drain plug (31) and replace it with a new 'O' ring.
6. Refit the drain plug (31).
7. Remove the FDP filler plug (8).
8. 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.
9. Dispose of the old 'O' ring on the filler plug (8) and replace it with a new 'O' ring.
10. Refit the filler plug (8).
11. Refit the right-hand side enclosure panel.

6.10 Change the HMB pump oil

Refer to the warnings and cautions in Section 6.7.

1. Shut down the iF system (refer to Section 5.9) and allow it to cool.
2. Remove the right-hand side enclosure panel from the iF system: refer to Section 3.4.
3. Refer to Figure 1. Remove the HMB 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.

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7. Ensure that the new 'O' ring is correctly positioned on the oil filler-plug (2), then refit the filler-plug to the HMB pump.
8. Refit the right-hand side enclosure panel: refer to Section 3.16.

6.11 Relubricate the FDP rotor bearings

Note: This requires a gas module seals kit.

1. Remove the upper and lower front covers from the iF system by undoing the quarter turn fasteners and retain.
2. Remove the lower side panels from the iF system as described in Section 3.4.
3. Remove the skirt cover by undoing the two M5 cap head screws securing it to the base assembly.
4. Unplug the 'Gas Module' loom from the Control Module. Remove the Gas Module by undoing the three M5 cap head screws connecting it to the front bulkhead.
5. Remove the O'rings from the six gas pipe turrets protruding through the front bulkhead. Dispose of the O'rings in accordance with Section 7.
6. Mark the order of the gas pipe turrets in the slots of the front bulkhead.
7. Unplug the 'Sensors' loom and the 'Electrics box' loom from the control module.
8. Undo and remove the four M10 nuts and washers securing the front bulkhead to the bulkhead strips.
9. Undo and remove the two M10 nuts and washers securing the front bulkhead to the bulkhead strips.
10. Insert a suitable wedge between the top cover and the top of the HMB.
11. Carefully remove the front bulkhead from the iF system, taking care not to damage the looms or the gas pipe turrets.
12. Remove the two bearing covers from the front of the FDP.
13. Use clean, lint free cloth, or a plastic or wooden spatula to remove as much old grease as possible from the covers and bearings. Do not use your fingers for this operation.
14. Inspect the bearings for obvious signs of wear or the presence of debris. If the bearings are worn, return the pump to an Edwards Service Centre for repair.
15. If the bearings are in satisfactory condition, force new PFPE grease (as detailed in Section 2.5.1) into the bearings. Do not over pack the bearings or the pump will run hot.
16. Check the bearing cover O'rings for signs of damage or debris before refitting it onto the bearing covers.
17. Replace the bearing covers onto the pump.
18. Refit the front bulkhead to the iF system, taking care not to damage the looms or the gas pipe turrets.
19. Remove the wedge between the HMB and the top cover.
20. Use the two M10 nuts and washers removed in step 9 to secure the front bulkhead to the bulkhead strips.
21. Use the four M10 nuts and washers removed in step 8 to secure the front bulkhead strips to the base assembly.
22. Plug the 'Sensors' and 'Electrics box' looms back into the Control Module.
23. Coat the new O'rings (supplied with the gas module seals kit) with Fomblin grease and then fit them over the gas pipe turrets.
24. Fit the Gas Module to the front bulkhead and secure it using the M5 cap head screws removed in step 4. Plug the 'Gas Module' loom into the Control Module.
25. Use the two M5 cap head screws removed in step 3 to refit the skirt cover to the base assembly.

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26. Refit the lower side panels to the iF system as described in Section 3.16.

27. Refit the upper and lower front covers to the iF system by tightening the quarter turn fasteners.

6.12 Zero the gas module flow transducer

WARNING

Care must be taken when working on gas module pipe fittings. Nitrogen trapped under pressure in the purge system presents a potential hazard when unscrewing pipe fittings.

Note: The flow transducer is zeroed by the software in the control system; you do not need to physically adjust any part of the iF 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 iF system switched off and your nitrogen supply off and disconnected from the iF 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.

6.13 Adjust the Pump Display Terminal display viewing angle

If the display (Figure 7, item 2) is difficult to see, use the following procedure to adjust the display viewing angle.

1. Refer to Figure 17. Remove the Pump Display Terminal (8) from the recess (5) in the dashboard.
2. Place or hold the Pump Display Terminal in its normal operating orientation.
3. Turn the display adjuster (9) clockwise or anticlockwise until the display is easy to read.
4. Refit the Pump Display Terminal (8) in the recess (5) in the dashboard.
5. If necessary, repeat Steps 1 to 4 until the display is easy to see.

6.14 Replace a fuse

WARNING

Ensure that you replace a fuse with a new fuse of the correct rating. If you do not, the iF system will not be adequately protected and you can damage the iF system or cause injury to people. Do not remove the cover from the electrics box. High voltages exist in the electrics box when it is connected to the electrical supply. There are no spare parts that can be serviced in the electrics box.

Note: You can only change the fuses in fuse holders F7, F8 and F9. A Edwards service engineer must change fuses F1 to F6 in the Electrics Box (refer to Figure 4).

You can only change the low voltage fuses F7 to F9 for the d.c. electrical supply, the iF 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.

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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 Box.
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 Box, then use a flat-bladed screwdriver to turn the fuse holder clockwise by a 1/4 of a turn to secure it in place.

6.15 Replace the Pump Display Terminal

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

1. Refer to Figure 17. Remove the Pump Display Terminal (8) from the recess (5) in the dashboard.
2. Remove the connector (4) on the cable (7) from the terminal connector (6) in the recess of the dashboard.
3. Fit the new Pump Display Terminal as described in Section 3.7.1.

6.16 Relocate the iF system for maintenance

WARNING

Use suitable lifting equipment to move the iF system.

WARNING

Allow the pump to cool down to a safe temperature before disconnecting or isolating the cooling water supply. Failure to do so will result in high pressures being generated in the pump cooling system.

WARNING

System process gases and residue can be highly toxic. Take all necessary precautions when handling components that have, or could have, come into contact with them, including 'O' rings, lubricants, and all exhaust accessories.

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

1. Purge the iF system and shut down the iF system as described in Section 5.9 and allow the iF system to cool down.
2. Refer to Figure 19. Disconnect the mating-half from the electrical supply connector (9) on the Electrics Box.
3. Refer to Figure 4. Switch off your nitrogen and cooling water supplies. Disconnect the nitrogen supply, taking care as any trapped gas under pressure is released. Disconnect the cooling water supply followed by the cooling water return.
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 iF inlet and outlet (1, 17).
5. If necessary, disconnect the iF air-extraction port (refer to Figure 10) from your factory extraction system.

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6. Refer to Figure 1. Adjust the levelling feet (9) so that the iF system rests on the castors (10).
7. Move the iF system to the location where you will do maintenance.
8. If necessary (depending on the maintenance you will do), disconnect any accessories from the iF system.

After maintenance is complete, re-install the iF system as described in Section 3.

6.17 Fault finding

WARNING

Only personnel specially trained to perform electrical maintenance should attempt troubleshooting inside the electrical enclosures. These enclosures contain hazardous voltages and are not operator areas.

CAUTION

If cooling water has been interrupted whilst the pump is in operation, do not restore the cooling until the pump has cooled down to a safe temperature. Restoring the cooling water supply whilst the pump is in operation may result in FDP seizure.

Before performing any maintenance or trouble shooting it is recommended that you follow the lockout/tagout procedures according to the Control of Hazardous Energy (Lockout/Tagout) in Volume 29 of the Code of Federal Regulation (29CFR) Section 1910.147 for the customer supply.

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 iF system.
- FF specifies the fault type: refer to Table 22.

Table 18 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 19 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 18 and 19 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.

6.17.2 Other fault finding

Fault messages will be shown on the Pump Display Terminal to identify that the action you have selected cannot be carried out. The messages which can be displayed and their meanings are shown in Table 20.

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Table 19 - Warning messages

Warning message	Advisory message	Meaning/recommended action
WARNING 101		(a) there is a fault in the Control SMA, or (b) the emergency stop button has been pressed to shut down the iF system, or (c) there has been a transient electrical supply failure (longer than the hold-up time of the iF power supply).
WARNING 113		There is a fault in the ADC (analogue-to-digital convertor) in the Control SMA; the Control SMA must be replaced.
WARNING 209	SEE MANUAL	The electrical supply voltage is too low. Check the electrical supply and the connections to the iF 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 iF system and rectify as necessary.
WARNING 309 DP CURRENT LOW	OPEN CIRCUIT CHECK CONNECTION	The electrical current drawn by the FDP 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 Box may have failed.
WARNING 311 DP CURRENT HIGH	LEAK/DEBRIS SERVICE PUMP	The electrical current drawn by the FDP 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 FDP 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 Box may have failed.
WARNING 411 DP POWER HIGH	LEAK/DEBRIS SERVICE PUMP	The electrical power consumption of the FDP 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 FDP motor thermistor is short circuited. Check the thermistor connections inside the FDP pump motor terminal-box and check the connections between the FDP pump and the Electrics Box.
WARNING 611	SEE MANUAL	There is a phase imbalance in the electrical supply to the FDP pump. Check the electrical supply and the connections to the iF 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 HMB 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 Box may have failed.

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Table 19 - Warning messages

Warning message	Advisory message	Meaning/recommended action
WARNING 711 MB CURRENT HIGH	LEAK/DEBRIS SERVICE PUMP	The electrical current consumption of the HMB 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 809 MB POWER LOW	OPEN CIRCUIT CHECK CONNECTION	The electrical power consumption of the HMB 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 Box may have failed.
WARNING 811 MB POWER HIGH	LEAK/DEBRIS SERVICE PUMP	The electrical power consumption of the HMB 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 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 HMB motor thermistor is short circuited. Check the thermistor connections inside the HMB pump motor terminal-box and check the connections between the HMB pump and the Electrics Box.
WARNING 1011	SEE MANUAL	There is a phase imbalance in the electrical supply to the HMB pump. Check the electrical supply and the connections to the iF 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 FDP 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 iF system has operated for xxxxx hours since it was last serviced. Service the iF system.
WARNING 1601 SERVICE DUE (P)	xxxxx HRS RUN SINCE SERVICE	The iF system has operated for xxxxx hours since it was last serviced. Service the iF system.
WARNING 1801 SERVICE DUE (P)	xxxxx CYCLES SINCE SERVICE	The iF system has been operated for xxxxx process cycles since it was last serviced. Service the iF system.
WARNING 2001 SERVICE DUE (C)	xxxxx CYCLES SINCE SERVICE	The iF system has been operated for xxxxx switch-on/off cycles since it was last serviced. Service the system.
WARNING 3113		There is a fault in the ADC (analogue-to-digital convertor) in the Control SMA; the Control SMA 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 FDP 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.

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Table 19 - Warning messages

Warning message	Advisory message	Meaning/recommended action
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.
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 5113		There is a fault in the ADC (analogue-to-digital convertor) in the Control SMA; the Control SMA must be replaced.
WARNING 5409	SEE MANUAL	The operating temperature of the HMB pump is too low. The cooling water solenoid valve may be stuck in the on position.
WARNING 5411 MB TEMP	SEE MANUAL	The operating temperature of the HMB pump is too high. The cooling water solenoid valve may be stuck in the off position, or the cooling-circuit of the pump may be blocked.
WARNING 5413		Check that the HMB 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 FDP pump-motor is too high. Check the cooling-water connections in the iF 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 HMB 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.

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Table 19 - Warning messages

Warning message	Advisory message	Meaning/recommended action
WARNING 5613		You have configured the iF 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 FDP pump is too low:.
WARNING 5711 DP TEMP HIGH	DP TEMP HIGH SEE MANUAL	The operating temperature of the FDP pump is too high: there may be process debris in the pump or the pump may be damaged.
WARNING 5713		The FDP 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 iF 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.
WARNING 12101		There is a fault in the Tool Interface Card in the iF Interface Module. Refer to the instruction manual supplied with the iF Interface Module.
WARNING 15101		There is a fault in the Auxiliary Interface Card in the iF Interface Module. Refer to the instruction manual supplied with the iF Interface Module.
WARNING 15201		The gate valve connected to the iF Interface Module has failed to close.
WARNING 15301		The gate valve connected to the iF Interface Module has failed to open.
WARNING 17601	SEE MANUAL	The inverter on an iF1800 system has experienced a transient power supply problem, or there is a recoverable fault.
WARNING 17613	SEE MANUAL	There is a fault with the RS485 data link between the inverter drive and the control module. Check that the lead is connected.
WARNING 17701	SEE MANUAL	The HMB pump stator temperature is > 125 ^{o}C, and the HMB pump speed has been reduced to 1200 r min^{-1}. The warning condition will be removed and the HMB pump speed will increase to 6000 r min^{-1} again when the pump stator temperature has fallen to 90 ^{o}C.

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Table 20 - 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 iF 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: refer to Table 19.
ALARM 210		Refer to the recommended actions for error number 209: refer to Table 19.
ALARM 212		Refer to the recommended actions for error number 211: refer to Table 19.
ALARM 310 DP CURRENT LOW	OPEN CIRCUIT CHECK CONNECTION	Refer to the recommended actions for error number 309: refer to Table 19.
ALARM 312 DP CURRENT HIGH	LEAK/DEBRIS SERVICE PUMP	Refer to the recommended actions for error number 311: refer to Table 19.
ALARM 410 DP POWER LOW	OPEN CIRCUIT CHECK CONNECTION	Refer to the recommended actions for error number 409: refer to Table 19.
ALARM 412 DP POWER HIGH	LEAK/DEBRIS SERVICE PUMP	Refer to the recommended actions for error number 411: refer to Table 19.
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: refer to Table 19.
ALARM 710 MB CURRENT LOW	OPEN CIRCUIT CHECK CONNECTION	Refer to the recommended actions for error number 709: refer to Table 19.
ALARM 712 MB CURRENT HIGH	LEAK/DEBRIS SERVICE PUMP	Refer to the recommended actions for error number 711: refer to Table 19.
ALARM 810 MB POWER LOW	OPEN CIRCUIT CHECK CONNECTION	Refer to the recommended actions for error number 809: refer to Table 19.
ALARM 812 MB POWER HIGH	LEAK/DEBRIS SERVICE PUMP	Refer to the recommended actions for error number 811: refer to Table 19.
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: refer to Table 19.
ALARM 1101		(a) the electrical supply is not connected to the FDP pump-motor, or (b) the FDP 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 3.15.2.

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Table 20 - Alarm messages

Alarm message	Advisory message	Meaning/recommended action
ALARM 3912 EXHAUST PRESSURE	EXHAUST BLOCKED SERVICE PUMP	Refer to the recommended actions for error number 3911: refer to Table 19.
ALARM 5412 MB MOTOR TEMP	MOTOR WATER LOW CHECK FILTER	Refer to the recommended actions for error number 5411: refer to Table 19.
ALARM 5512 DP MOTOR TEMP	MOTOR WATER LOW CHECK FILTER	Refer to the recommended actions for error number 5511: refer to Table 19.
ALARM 5610 EXHAUST TEMP LOW	EXHAUST TEMP LOW CHECK EXHAUST	Refer to the recommended actions for error number 5609: refer to Table 19.
ALARM 5710 DP TEMP LOW	TCV SET LOW ADJUST TCV	Refer to the recommended actions for error number 5709: refer to Table 19.
ALARM 5712 DP TEMP HIGH	TCV SET HIGH ADJUST TCV	Refer to the recommended actions for error number 5711: refer to Table 19.
ALARM 17410	SEE MANUAL	The inverter on an iF1800 system has been operating at less than 14 Hz for more than three minutes. There is a mechanical fault (possible a pump rotor has locked): contact your supplier or BOC Edwards for advice.
ALARM 17601	SEE MANUAL	The inverter on an iF1800 system has experienced a significant power supply problem and the HMB pump has been stopped, or the HMB pump in the iF1800 system has stopped because of a mechanical or electrical fault. You must manually restart the HMB pump (refer to section 5.12). If the alarm condition persists after several attempts to restart the HMB pump, contact your supplier or BOC Edwards for advice.

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Table 21 - Fault messages

Message	Meaning
CONTROL failed Press CANCEL	You have requested that the Pump Display Terminal takes control of the iF 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 Terminal takes control of the iF 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 Terminal does not have control of the iF system. Press the CANCEL button, take control and then try again.
PUMP failed to respond (CANCEL)	(a) You have requested that the iF 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 valve (for example, a setpoint) has been requested from the iF system, but the iF system has not been responded. (d) The emergency stop switch has been pressed and released: restart the pumping system.
PUMP RUNNING Press CANCEL	You have requested that the iF 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 iF 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 iF system is switched on and the display does not change to normal display, this means that the Pump Display Terminal cannot correctly communicate with the iF system.
None (the display is blank)	One or both fuses FS6 and FS8 may have tripped. Switch off the electrical supply to the iF system, then switch it on again to reset the fuse(s).

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Table 22 - Fault parameters

Parameter *	Source/cause of error
1	iF system status
2	Electrical supply voltage
3	FDP pump current consumption
4	FDP pump power consumption
5	FDP pump-motor thermistor
6	Phase imbalance in FDP pump current consumption
7	HMB pump current consumption
8	HMB pump power consumption
9	HMB pump-motor thermistor
10	Phase imbalance in HMB pump current consumption
11	FDP pump status
12	HMB pump status
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	Control Module status
53	Active Gauge (optional accessory)
54	HMB pump temperature sensor
55	FDP pump-motor water manifold surface temperature sensor
56	iF exhaust temperature sensor (optional accessory)
57	FDP pump-body thermocouple
70	temperature FDP high vacuum-stage
111	Network Interface Module status (optional accessory)
121	Tool Interface Card status (optional accessory)
151	Auxiliary Interface Card status (optional accessory)
152	Gate Valve Closed status
153	Gate Valve Open status
174	Inverter speed
176	Inverter status
177	HMB pump over-temperature monitor

* *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 23 - 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.*

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7 storage and disposal

7.1 Storage

CAUTION

Drain the cooling-water from the iF 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 iF system and damage the pump(s) and/or the cooling-water pipelines.

Store the iF system as follows:

1. If applicable, ensure that the pumps have been shut down as described in Section 5.9 and disconnect all services, process and exhaust connections.
2. Fit blanking-plates to all vacuum inlets and exhaust outlets. Place protective covers over the iF services connection points.
3. Store the iF system in clean dry conditions until required.
4. When required for use, prepare and install the iF system as described in Section 3 of this manual.

7.2 Disposal

Dispose of the iF 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.

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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
Gas Module Seals Kit	A533-85-800
iF Pump Display Terminal	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
iF Silencer Service Kit	A507-10-000
Teminator plug (4 way)	A532-20-050
Oil filler-plug 'O' ring: pack of 10	H021-06-110
NW40 Trapped O'Ring	C105-16-494

8.3.1 Regrease Spares

Spare	Item Number
BRG Cover O'Ring	A535-99-510
CR861 FombGrease X100qm	H113-50-116

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8.4 Ordering accessories

Note: All of the accessories in Section 8.4.1 to 8.4.2 must be ordered when you order your iF system. The accessories you have ordered will be supplied fitted to your iF system.

8.4.1 Exhaust Temperature Sensor

The Exhaust Temperature Sensor monitors the temperature in the iF exhaust outlet. When fitted, the output of the Sensor is monitored by the iF system. If required, you can configure the iF 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 iF system to monitor the pressure measured by an Active Gauge fitted in the inlet pipeline to the iF system.

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 iF PC Interface Kit if you want to reconfigure the iF system for use with another gauge type (refer to Section 8.5.4).

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

8.5 Other accessories

8.5.1 iF Communications Module

Fit a Communications Module accessory to allow your Process Tool or PC-based software to control and monitor the operation of the iF 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 iF 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
iM Serial Communications Module	D372-32-000
iM Serial and Parallel Communications Module	D372-35-000
iM Parallel Communications Module	D372-36-000

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8.5.2 iF Interface Module

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

The iF 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 iF 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 iF 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 iF system).

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

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

8.5.3 iF Single Pumpset Monitor and iF Fabworks

The iF Single Pumpset Monitor allows you to monitor pump parameters and configure the iF system. The iF Fabworks allows you to network together all of the iF systems in your installation, and to use a PC to centrally monitor the iF systems. Contact your supplier or Edwards if you want to network your iF systems.

8.5.4 iF PC Interface Kits

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

8.5.5 iF Nitrogen Flow Switch

When installed, the Flow Switch enables the iF communications Module to monitor the flow of nitrogen purge gas to the dry pumping system, and shut down the dry pumping system if the flow is too low.

Accessory	Item Number
iF Nitrogen Flow Switch	A532-54-000

8.5.6 iF Pump Display Module

When fitted, the iF Pump Display Module allows the operator to manually control the pump (as with the Pump Display Terminal), but with the option of communicating over distances in excess of 25m.

Accessory	Item Number
iF Pump Display Module	D372-37-000

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8.5.7 iF 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 iF 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

8.5.8 iF Pump Display Terminal Extension Cables

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

Accessory	Item Number
Extension cable (display/interface), 3 m	D372-72-801
Extension cable (display/interface), 5 m	D372-72-802
Extension cable (display/interface), 10 m	D372-72-803
Extension cable (display/interface), 15 m	D372-72-804
Extension cable (display/interface), 25 m	D372-72-805

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