

# Instruction Manual

## XDS46i and XDS46iC Scroll Pumps



Description	Electrical Supply	Item Number
XDS46i Scroll Pump	100-120 V, 200-230 V, 50/60 Hz, - Set to 200-230V	A731-01-983
XDS46iC Scroll Pump	100-120 V, 200-230 V, 50/60 Hz, - Set to 200-230V	A731-06-983

Original Instructions



# Declaration of Conformity

Edwards Ltd,  
Innovation Drive,  
Burgess Hill,  
West Sussex, RH15 9TW, UK

The following products:

XDS35i scroll pump, 100-120 V, 200-230 V, 1 ph, 50/60 Hz, set to high volts	A730-YY-983
XDS35i scroll pump, 100-120 V, 200-230 V, 1 ph, 50/60 Hz, set to low volts	A730-YY-986
XDS35i scroll pump, 100-120 V, 200-230 V, 1 ph, 50/60 Hz	A730-01-983
XDS35i scroll pump no gas ballast, 100-120 V, 200-230 V, 1 ph, 50/60 Hz	A730-05-983
XDS35iC scroll pump, 100-120 V, 200-230 V, 1 ph, 50/60 Hz	A730-06-983
XDS35iE scroll pump enhanced, 100-120 V, 200-230 V, 1 ph, 50/60 Hz	A730-03-983
XDS35iE scroll pump no gas ballast enhanced, 100-120 V, 200-230 V, 1 ph, 50/60 Hz	A730-07-983
XDS35iCE scroll pump enhanced, 100-120 V, 200-230 V, 1 ph, 50/60 Hz	A730-08-983
XDS46i scroll pump, 100-120 V, 200-230 V, 50/60 Hz, single phase	A731-01-983
XDS46iC scroll pump, 100-120 V, 200-230 V, 50/60 Hz, single phase	A731-06-983
XDS100B scroll pump, 100-120V, 200-230V, 50/60Hz, single phase	A732-01-983

where YY is represented by a two digit number between 01 and 99.

Is in conformity with the relevant requirements of European CE legislation:

2006/42/EC	Machinery directive
2014/35/EU	Low voltage directive
2014/30/EU	Electromagnetic compatibility (EMC) directive
2014/34/EU	ATEX directive on use in potentially explosive atmospheres  II 3 G Ex h IIB T4 Gc Internal Atmospheres Only, Tech File ref 209
2011/65/EU	Restriction of certain hazardous substances (RoHS) directive

Based on the relevant requirements of harmonised standards:

EN 1012-2:1996 +A1:2009	Compressors and vacuum pumps. Safety requirements. Vacuum pumps
EN 13463-1:2009	Non-electrical equipment for use in potentially explosive atmospheres. Basic method requirements
EN 13463-5:2011	Non-electrical equipment for use in potentially explosive atmospheres. Protection by constructional safety 'c'
EN 61010-1:2010	Safety requirements for electrical equipment for measurement, control and laboratory use. General requirements
EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements Class A Emissions, Industrial Immunity

The product also complies with the following:

CSA-C22.2 No.61010-1-12	Safety requirements for electrical equipment for measurement, control and laboratory use –Part 1: General requirements
L61010-1 3 <sup>rd</sup> Edition	Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements

This covers all product serial numbers from the date of this declaration onwards.

  
Mr Ian Keech  
Vice President Engineering, High Vacuum Division

22.10.2018, Burgess Hill

Date and Place

## Material Declaration

In accordance with the requirements of the Chinese regulatory requirement on the Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products Order No. 32 (also known as 'China RoHS2') and SJ/T 11364 Marking for the Restricted Use of Hazardous Substances in Electronic and Electrical Products:

### Product Labels

Product	Product Label	Meaning
All pumps in the list below		This product contains hazardous substances in at least one of the homogeneous materials used which are above the limit requirement in GB/T 26572 as detailed in the declaration table below. These parts can safely be used for the environmental protection use period as indicated.

Pump Type	Pump Size
RV Pumps	RV3,5,8,12, E Lab, nRvi
EM Small Pumps	E2M0.7, 1.5, E1M18, E2M18, 28, 30, nE2M40i
nEXT Pumps	nEXT 85, 240, 300, 400, Splitflow
nXDS pumps	nXDS 6, 10, 15, 20
EXT pumps	EXT75DX
XDS pumps	XDS35, 46, 100
Diaphragm	XDD 1, D lab
Turbo Pump Carts	T station, nEXPT, nEXT station

### 材料成分声明 Materials Content Declaration

部件名称 Part name	危险物质					
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr VI)	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
铸铝 Cast Aluminium	X	O	O	O	O	O
铜管管件 Brass pipe Fittings	X	O	O	O	O	O
铜接头 Brass Connectors	X	O	O	O	O	O

O : 表示该有害物质在该部件的所有均质材料中的含量低于 GB/T 26572 标准规定的限量要求。  
O: Indicates that the hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.

X : 表示该有害物质在该部件的至少一种均质材料中的含量超出 GB/T26572 标准规定的限量要求。  
X: Indicates that the hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T26572.

NOTES: These products are EU RoHS compliant, the following Exemptions apply:  
6(b) Lead as an alloying element in aluminium containing up to 0.4% by weight.  
6(c) Copper alloy containing up to 4% lead by weight

### Packaging Information

Pallet	Over-shipper	Protection Pieces	Support Braces
			
Recyclable Natural Wood	Recyclable Cardboard	Recyclable Polypropylene	Recyclable Mild Steel

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

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## Associated publications

Publication title	Publication number
Vacuum Pump and Vacuum System Safety	P400-40-100

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# 1 Introduction

## 1.1 Scope of this manual

This manual provides installation, operation and maintenance instructions for the Edwards XDS46i and XDS46iC scroll pump. The pump must be used as specified in this manual. Read this manual before installing and operating the pump.

Important safety information is highlighted as WARNING and CAUTION instructions; these instructions must be obeyed. 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. The actual symbol shown varies according to the hazard.

### CAUTION

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

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

The following warning labels may be present on the pump and used throughout the product documentation:



Warning - an appropriate safety instruction should be followed or a caution to a potential hazard exists.



Warning - dangerous voltage. Indicates hazards arising from dangerous voltages.



Warning - hot surfaces. To indicate that the marked item can be hot and should not be touched without taking precautions.

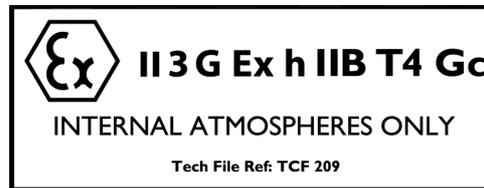


Warning - heavy object. Indicates the potential risk of physical injury and requires suitable lifting equipment to move.



Warning - use protective equipment. Indicates that protective equipment must be used.

## 1.2 ATEX directive implications

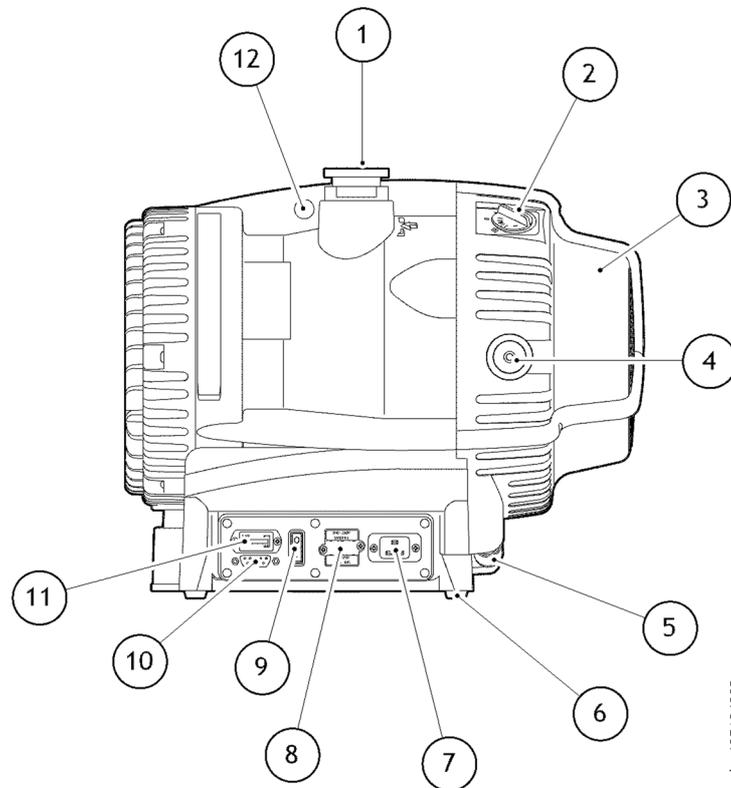


This equipment is designed to meet the requirements of Group II Category 3 equipment in accordance with Directive 2014/34/EU of the European Parliament and the Council of 29th March 2014 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres. (The ATEX Directive)

The ATEX Category 3 applies in respect of potential ignition sources internal to the equipment. An ATEX Category has not been assigned in respect of potential ignition sources on the outside of the equipment as the equipment has not been designed for use where there is an external potentially explosive atmosphere.

There is no potential source of ignition within the pump during normal operation but there may be potential sources of ignition under conditions of foreseeable and rare malfunction as defined in the Directive. Accordingly, although the pump is designed to pump flammable materials and mixtures, operating procedures should ensure that under all normal and reasonably foreseeable conditions, these materials and mixtures are not within explosive limits. Category 3 is considered appropriate for the avoidance of ignition in the case of a rare malfunction which allows flammable materials or mixtures to pass through the pump whilst within their explosive limits.

Figure 1 - XDS46i and XDS46iC scroll pump



dcs/8518/002

- |                        |                                    |
|------------------------|------------------------------------|
| 1. NW40 inlet port     | 7. Electrical connector            |
| 2. Gas ballast control | 8. Voltage changeover switch cover |
| 3. Cooling fan         | 9. Run/Standby switch              |
| 4. NW25 exhaust port   | 10. 15-way connector               |
| 5. Fan connector       | 11. Hour counter                   |
| 6. Rubber feet         | 12. Lifting eye                    |

### 1.3 Description

Refer to [Figure 1](#) for item numbers in brackets in the following descriptions.

The XDS pump is a compact, reliable vacuum pump which is suitable for use on vapour handling processes. It may be used for some pumping applications involving corrosive substances and particulates; for information on pumping flammable gases, please refer to [Section 4.5](#) and contact Edwards for any further assistance.

The body of the pump includes a fixed scroll and an orbiting scroll. The orbiting scroll is controlled by the electric motor through an eccentric cam on the motor drive shaft. The movement of the orbiting scroll, meshed with the fixed scroll, forms successive crescent shaped volumes in the pump. Gas that enters the pump through the inlet is compressed by the movement of the orbiting scroll and swept towards the centre of the fixed scroll. The compressed gas enters the exhaust port near the centre of the stationary scroll and is exhausted from the pump through the outlet.

The XDS is a dry vacuum pump, as all the bearings, with hydrocarbon lubricant, are isolated from the vacuum space.

The pump has an NW40 (item 1) inlet and inlet strainer.

The pump mechanism is driven directly by a three-phase electric motor. The motor is controlled by an inverter, which manages the supply of current to the motor in accordance with operating conditions, and allows the pump to be connected to a single-phase supply. The voltage changeover switch beneath the voltage changeover switch cover (item 8) must be set to the correct position in accordance with the power supply being used, refer to [Section 3.5.2](#).

The pump is optimised for maximum pumping speed at inlet pressures between 1 mbar and 10 mbar (refer to [Figure 2](#)). The pump is not suitable for prolonged operation at inlet pressures above 40 mbar; for pumpdown of large volumes; or for rapid cyclic duty. Such operation may cause the pump to become hot or the inverter to reduce the motor speed. The pump will speed up again after the load is reduced. Maximum rated continuous operating pressure at 40 °C ambient is 12 mbar.

The pump is air-cooled by a fan (item 3) mounted at the opposite end to the motor. The fan will continue to run for one minute after the pump is switched off. The pump incorporates a thermal protection device that will stop the motor in the event of thermal overload, for example, high ambient temperature. The pump will restart after it has cooled down.

## 1.4 Gas ballast control

To pump high vapour loads, gas ballast can be delivered into the pump to prevent condensation of the vapour carried by the pumped gases.

Air can be introduced to the low vacuum stages through the gas ballast control (item 2). Alternatively, an inert gas such as nitrogen can be supplied through a suitable external valve and by using the appropriate adaptor, available as an accessory, refer to [Section 7.3.3](#).

The gas ballast control has three positions:

- Closed (position '0')
- Low flow (position 'I')
- High flow (position 'II')

## 1.5 Construction

The pump scrolls are made of anodised aluminium. The motor housing is aluminium. All surfaces of the pump which are exposed to the pumped gases are free from copper, zinc and cadmium.

Other materials of construction include fluorocarbon elastomer, nitrile, chemically resistant polymers, nickel, stainless steel and a PTFE composite material.

## 2 Technical data



### WARNING

If the pump is operated outside the specified limits, the pump housing may become hot.

### 2.1 Operating and storage conditions

Table 1 - Operating and storage conditions

Ambient temperature range (operation)	+10 °C to +40 °C
Maximum surface temperature of pump body under normal operating conditions and maximum ambient temperature	+40 °C to +65 °C
Maximum humidity (operation)	90% RH
Ambient temperature range (storage)	-30 °C to +70 °C
Pollution	Pollution degree 2
Installation	Installation category II
Altitude restriction	Maximum 2000 m
Area of use	Indoor use

### 2.2 Performance

#### 2.2.1 General

Table 2 - General characteristics

Maximum pumping speed	40 m <sup>3</sup> /h
Maximum permitted continuous inlet pressure	40 mbar
Maximum permitted continuous exhaust pressure	1.2 bara
Maximum permitted gas ballast inlet pressure	1.5 bara
Maximum chamber volume to pump down from atmospheric pressure	100 litres
Maximum chamber volume for cyclic duty - maximum 6 cycles per hour	50 litres
Maximum initial pressure rise with no gas ballast flow	5 mbar l
Suck-back protection	By exhaust valve
Leak tightness	<1 x 10 <sup>-6</sup> mbar l s <sup>-1</sup>
Maximum displacement	60 m <sup>3</sup> /hr
Sound pressure, measured at ultimate vacuum 1 metre from the end of the pump to ISO 3744 and ISO 4871	55.4 ±2.5 dB(A)
Vibration: measured at the inlet port (ISO 3744)	Class 1C...< 4.5 mms <sup>-1</sup> (rms)

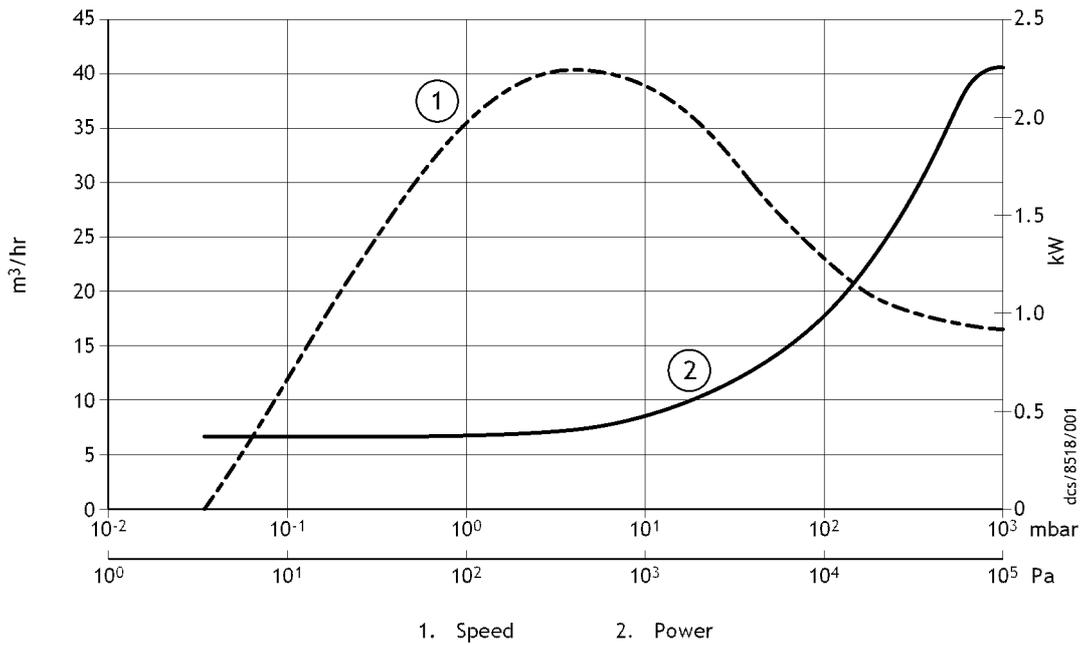
#### 2.2.2 Performance characteristics

The position of the gas ballast control defines the performance characteristics of the pump.

Table 3 - Performance characteristics

Gas ballast control position	Ultimate total pressure (mbar)	Gas ballast flow (l min <sup>-1</sup> )
0	<0.05	-
1	<0.08	3
2	<10.0	12

Figure 2 - Performance characteristics



**Note:** The pump is not suitable for prolonged operation at inlet pressures above 40 mbar. Under such conditions, the inverter may reduce the motor speed.

## 2.3 Mechanical data

### 2.3.1 General

Table 4 - General mechanical data

Overall dimensions (L x W x H)	476 x 333 x 396 mm
Maximum tilt angle	10 degrees
Nominal rotational speed	1750 rpm
Mass	48 kg
Inlet connection	NW40
Outlet connection	NW25
Degree of protection (IEC60529)	IP44

## 2.4 Electrical data

Pumps are supplied set to 200-230 V.

Table 5 - Electrical data

Supply (V)	Phase	Frequency (Hz)	Current (A)
200-230	Single	50/60	6.6
100-120	Single	50/60	10.6

Table 6 - Recommended regional supply protection

Area	Voltage	Rating
UK	230 V	13 A
Europe	230 V	16 A
US	120 V	15 A
Japan	100 V	15 A

### 2.4.1 Electrical cables

Recommended cordsets and fuses for regional requirements.

Table 7 - Recommended cordsets

Description	Rating	Coupler type	Item number
Cordset assembly, UK	Cable style = H05VV-F, 3 x 1.5 mm <sup>2</sup> , 300 V, 70° C, maximum length of 2.5 metres	Straight entry	A50505003
	Plug type = BS1363 UK plug		
	Appliance coupler = IEC60320 style C19	Right angled entry	A50505006
Fuse type = BS1362 13 amp fuse, to an IEC60320 style			
Cordset assembly, Europe	Cable style = H05VV-F, 3 x 1.5 mm <sup>2</sup> , 300 V, 70° C, maximum length of 2.5 metres	Straight entry	A50506003
	Plug type = European Schuko VDE approved, 16 A, 250 V rated with dual earthing contact		
	Appliance coupler = IEC60320 style C19	Right angled entry	A50506006
Cordset assembly, USA/Canada (200-230 V)	Cable style = SJT, 3 x 14 AWG, 300 V, 90 °C, VW-1 maximum length of 3 metres		N/A
	Plug type = NEMA, 6-15P plug		
	Appliance coupler = IEC60320 style C19		

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## 3 Installation

### 3.1 Safety



#### WARNING

Obey the safety instructions in this section and take note of appropriate precautions. Failure to observe these instructions may result in injury to people and damage to equipment.



#### WARNING

Do not expose any part of the human body to vacuum as it can cause injury.



#### WARNING

The pump is not recommended for pumping explosive gases or hazardous substances.



#### WARNING

Use suitable lifting equipment to move the pump. The mass of the pump is approximately 48 kg.



#### WARNING

Take care when moving the pump into position. The pump's weight makes it difficult to slide and movement should only be attempted by two people.

- A suitably trained and supervised technician must install the pump.
- Ensure that the installation technician is familiar with the safety procedures that relate to the products processed by the pump.
- Wear the appropriate safety clothing when coming into contact with contaminated components.
- Dismantle and clean contaminated components inside a fume cupboard.
- Vent and purge the vacuum system before starting installation work.
- Disconnect other components in the pump from the electrical supply so that they cannot be operated accidentally.
- Refer to the Vacuum Pump and Vacuum System Safety manual (publication number P400-40-100) before installing and using the pump to process hazardous or flammable materials.
- Safely route any electrical cables and pipes to prevent a trip hazard.
- Check all required components are available and are of the correct type before starting work.
- Do not reuse O-rings or seals.
- Leak test the system after installation is complete and seal any leaks found to prevent leakage of hazardous substances out of the system and leakage of air into the system.
- Mechanical lifting equipment should be attached to the lifting eye on the pump.
- Loose slings should not be used to lift the pump.

## 3.2 System design considerations



### WARNING

Ensure the exhaust pipeline cannot become blocked. If an exhaust isolation valve is fitted, ensure the pump cannot be operated with the valve closed.

Consider the following points when designing the pumping system:

Edwards recommends the use of a foreline vacuum isolation valve to allow the pump to warm up before pumping condensable vapours or if the vacuum needs to be maintained when the pump is not running.

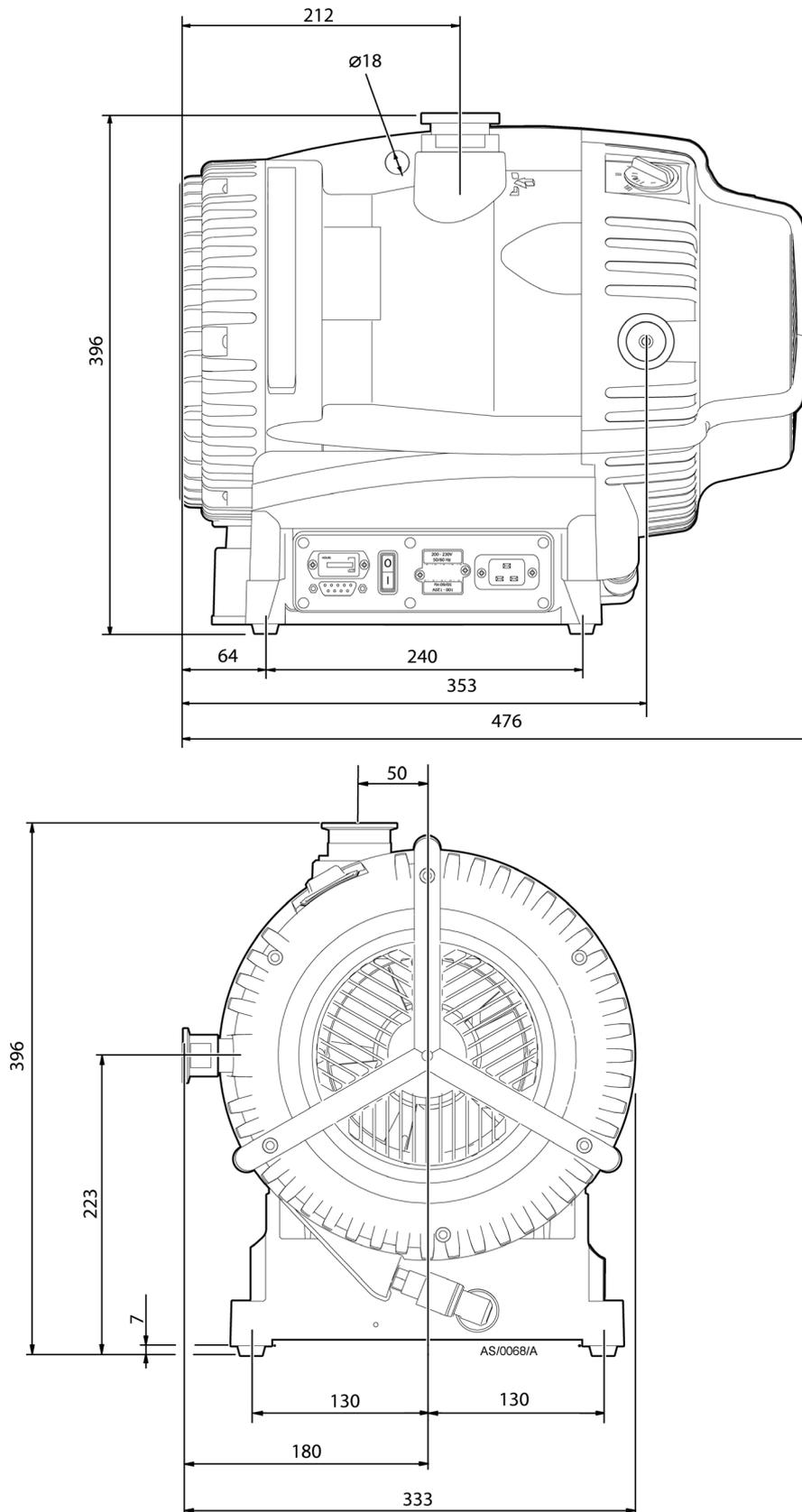
Avoid high levels of heat input into the pump from the process gases, otherwise the pump may overheat, and cause the thermal overload device to open.

If the pump is used in a high ambient temperature with high gas throughput, the pump body temperature may approach 65 °C. Edwards recommends the use of additional guarding to prevent contact with hot surfaces under these conditions.

Ensure the exhaust pipeline cannot become blocked. If an exhaust isolation valve is fitted, ensure the pump cannot be operated with the valve closed. Refer to [Section 3.6](#).

Dilute flammable mixtures to safe concentrations by providing an inert gas dilution purge. Contact the Edwards applications team for further advice on dilution requirements if required and refer to [Section 4.5.2](#).

Figure 3 - Installation drawing



### 3.3 Unpack and inspect



#### WARNING

Use suitable lifting equipment to move the pump. Mechanical lifting equipment should be attached to the lifting eyes; loose slings should not be used. Failure to do so can cause injury to people and damage to the equipment. Refer to [Table 4](#) for the mass of the pump.

Remove all packing materials, remove the pump from its packing box, remove the protective covers from the inlet and outlet ports and inspect the pump.

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

If the pump is not to be used immediately, replace the protective covers. Store the pump in suitable conditions, as described in [Section 6.1](#). Refer to [Section 6.2](#) for disposal of materials.

### 3.4 Locate the pump



#### WARNING

Route and secure cables, hoses and pipework during installation to avoid possible risk of trips.

#### CAUTION

If the pump will be located inside an enclosure, ensure there is adequate ventilation at both ends of the pump, so that the ambient temperature around the pump does not exceed 40 °C. A minimum space of 25 mm between the pump and the enclosure walls is required.

Provide a firm, level platform for the pump. Locate the pump so that the gas ballast control and the Run/Standby switch are accessible.

#### 3.4.1 Mechanical fixing

#### CAUTION

Use the four holes located on each corner of the pump base to secure the pump, if required. Edwards recommends the use of M8 bolts.

### 3.5 Electrical installation

#### 3.5.1 Check and configure the pump

#### CAUTION

Isolate the power supply before changing the voltage. Failure to configure the pump electrical supply correctly can result in damage to the pump.

Ensure that the voltage shown on the voltage indicator (refer to [Figure 1](#), item 8) on the motor cover corresponds with the electrical supply voltage. If not, change the configuration of the pump motor to match the supply voltage using the following procedure.

1. Undo the two screws and lift off the voltage indicator moulding.
2. Rotate the voltage indicator moulding so that the correct voltage is uppermost.
3. Replace the two screws.

### 3.5.2 Connect the pump to the electrical supply



#### WARNING

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



#### WARNING

If using an earth leakage device, for example, an RCD, use a 30 mA rated unit at minimum to avoid tripping during start up.



#### WARNING

The pump will automatically restart after restoration of the power supply following power failure.

For recommended regional supply protection and cordsets, refer to [Section 2.4](#).

## 3.6 Inlet and outlet connections



#### WARNING

If pumping dangerous gases or vapours, connect the exhaust to a suitable treatment plant to prevent the discharge of dangerous gases and vapours to the surrounding atmosphere.



#### WARNING

If pumping for a prolonged period above 100 mbar inlet pressure, use an exhaust silencer (refer to [Section 7.3.2](#)) or connect to an appropriate exhaust line.

Before connecting the pump to the vacuum system, remove the plastic cap from the inlet and the exhaust, and ensure that the inlet strainer is fitted to the pump inlet port. Use appropriate NW40 vacuum fittings for connection to the system.

Take note of the following information when connecting the pump to the vacuum system.

- To minimise noise and exhaust emissions, it is recommended that the pump is connected to an exhaust line or a silencer (refer to [Section 7.3.2](#)).
- For optimum pumping speeds, ensure that the pipeline connected to the pump inlet is as short as possible and has a suitable internal diameter.
- Support the vacuum pipeline to prevent loading of the coupling joints.
- If the pump is operated with the exhaust line blocked, a pressure of 5.5 bar(a) may be generated in the exhaust pipework. Connect the pump using appropriate pipework and fittings.
- If necessary, incorporate flexible bellows in the system pipelines to reduce the transmission of vibration and prevent loading of the coupling joints. If using flexible bellows, ensure the use of bellows that have a

maximum pressure rating which is greater than the highest pressure that can be generated in the system. The use of Edwards bellows is recommended.

- Incorporate an inlet isolation valve in the pipeline between the vacuum system and pump. This will isolate the vacuum system from the pump when it is switched off and prevent the suck-back of process gases and debris into the vacuum system.
- Ensure that the sealing surfaces are clean and scratch-free.

Edwards recommends the use of an exhaust extraction system suitable for use with all process gases being pumped. Ensure that the exhaust extraction system cannot become blocked or obstructed when the pump is operating.

A small amount of tip seal wear dust may collect in the exhaust duct of the pump. The dust may be blown out with the initial burst of air after the pump has been vented. This is quite common and the amount of dust seen will reduce over time.

### 3.7 Leak test the system

Leak test the system and seal any leaks found after installing the pump.

## 4 Operation

### 4.1 Use of gas ballast control

The gas ballast control can be used to optimise the performance of the scroll pump for the application. The performance characteristics of the pump with the different ballast settings are shown in [Table 3](#). The position of the gas ballast control can be changed when the pump is off or operating.

#### 4.1.1 Gas ballast control

Use the gas ballast control to change the amount of air introduced into the final stage of the pump. Use of gas ballast will reduce the condensation of vapours in the pump; the condensates would contaminate the pump. The gas ballast control can be set to select one of three options:

To select no gas ballast, turn the control position to '0'. Use this setting:

- to achieve ultimate vacuum
- to pump dry gases.

To select low flow gas ballast, turn the control to position 'I'. Use this setting:

- to pump low concentrations of condensable vapours
- to decontaminate the pump.

To select high flow gas ballast, turn the control to position 'II'. Use this setting:

- to pump high concentrations of condensable vapours
- to clear excess vapours after processing.

High flow gas ballast 'II' is not intended for long term use as tip seal wear is accelerated. For continuous operation, to dilute condensable vapours for example, gas ballast position 'I' is recommended.

### 4.2 Start up procedure



#### WARNING

Ensure that the system design does not allow the exhaust pipeline to become blocked.

#### CAUTION

A fine dust may be emitted from the exhaust of the scroll pump during start up, particularly when the pump is new or if new tip seals are fitted.

Use the procedure below to start up the pump:

1. Ensure that any vacuum system isolation valve is closed (if fitted).
2. Connect a suitable lead from the power supply to the appliance inlet at the side of the pump.
3. Switch on the electrical supply to the pump, using the Run/Standby switch. Item 9 on [Figure 1](#).
4. With manual operation always use the Run/Standby switch to start and stop the pump. If remote operation is used to control the pump, refer to [Section 4.6](#).
5. Open the vacuum system isolation valve (if fitted).

### 4.3 To achieve ultimate vacuum

In order to achieve the best possible vacuum, the pump should be operated with the gas ballast control on position '0'. However, if the pump, or elements of the vacuum system it is attached to, are new or have been newly fitted, some atmospheric moisture may be present. If atmospheric moisture is present, run the pump with the gas ballast control in position 'I' or 'II' for 20 minutes before switching to position '0'. If moisture is allowed to remain, the performance of the pump will be impaired.

### 4.4 To pump condensable vapours

Select a suitable gas ballast setting (gas ballast control in position 'I' or 'II') when there is a high proportion of condensable vapours in the process gases. This will assist the vapours to pass through the pump without condensing and keep the pump performance from degrading.

### 4.5 Implication of ATEX directive

#### 4.5.1 Flammable/pyrophoric materials

When flammable or pyrophoric materials are present within the equipment:

- Not allow air to enter the equipment.
- Ensure the system is leak tight.
- Dilute any flammable gases or vapours by using an inert purge, for example nitrogen, to the pump inlet and/or gas ballast (if fitted) to reduce the concentration of flammable gases or vapours in the pump and exhaust line to less than one quarter of the published lower explosive limits (LEL).
- Prevent the condensation of flammable vapours within the pump mechanism and exhaust line by using an inert gas purge to the pump gas ballast connection.

#### 4.5.2 Gas purges



#### WARNING

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

The following actions must be taken to ensure that the gas being pumped stays out of the flammable range:

- The inert gas purge should be switched on to remove air from the pump and exhaust before the process starts. The purge flow can be switched off at the end of the process only after any remaining flammable gases or vapours have been purged from the pump and exhaust line.
- If liquids that produce flammable vapours could be present in the pump foreline then the inert gas purge to the pump should be left on all the time this liquid is present. Flammable liquids could be present in the foreline as a result of condensation or may be carried over from the process.
- When calculating the flow rate of inert gas required for dilution, consider the maximum flow rate for the flammable gases/vapours that could occur. For example, if a mass flow controller is being used to supply flammable gases to the process, assume that a flow rate for flammable gases that could arise if the mass flow controller is fully open. The inert gas purge flow rate should be continually measured and if the flow rate falls below that required, then the flow of flammable gases or vapours to the pump must be stopped.

The Vacuum Pump and Vacuum System Safety publication P400-40-100 is available from Edwards or the supplier.

## 4.6 Remote operation using 15-way D connector

It is possible to operate the pump remotely using the 15-way D type connector fitted on the panel at the side of the pump.

The 15-way D connector is insulated to ensure that it remains protected in the event of a single fault condition.

The controls available are as follows:

- Run/Standby
- Run (Runs pump at standard speed 100%)
- Standby (Pump is not running but is ready and awaiting a remote signal for operation)
- Idle (Run pump at 67%)
- Boost (Runs pump at 116%) Intermittent use only (not for continuous operation) See note below for further information on this mode of operation.
- OK Signal

Figure 4 shows which connections to make to enable these functions.

The Run/Standby switch (Figure 1, item 9) should be in the Standby position for remote operation. The idle and boost modes are only available with remote operation.

To completely remove electrical power from the pump, the plug should be removed from the electrical connector (Figure 1, item 7).

**Note:** Boost operation is not recommended for the pump as a permanent operation mode, as increased bearing loads will reduce the life of the pump bearings. Please consult Edwards if the boost mode is intended to be used as the limits of operation are application dependant.

## 4.7 Shut down



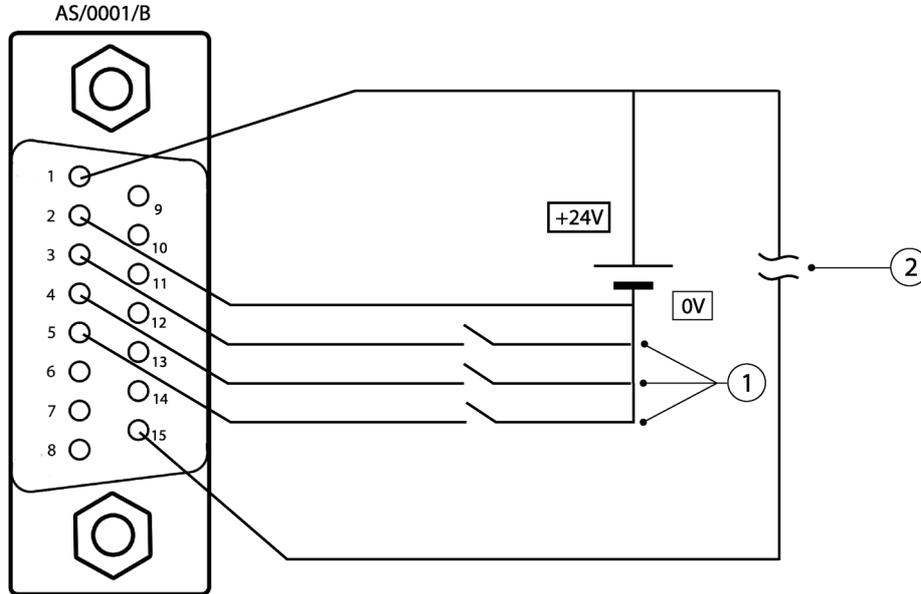
### WARNING

When the pump has been switched off the fan will continue to run for 1 minute.

Use the procedure below to shut down the pump:

1. If shutting the pump down prior to a period of storage, remove any process gases by running on high flow gas ballast for at least one hour.
2. Close any vacuum system isolation valve to prevent suck-back into the vacuum system (where fitted).
3. Switch off the pump. When the pump is switched off the fan will continue to run for 1 minute.
4. Vent the pump by the gas ballast control or valve on the inlet.

Figure 4 - Logic interface schematic



1. Speed control pins 3, 4 and 5  
Maximum current per pin = 7 mA when linked to pin 1 (24 V)
2. Pump healthy signal  
Signal high = normal (maximum permissible current = 100 mA)

Table 8 - Pin status on the logic interface connector

Mode	Speed percentage	Pin 1	Pin 3	Pin 4	Pin 5
Normal	100%	24 V	Link	open	open
Boost	116%	24 V	Link	Link	Link
Idle	67%	24 V	Link	Link	open

The tolerance of the power supply can be  $\pm 10\%$ . Make sure all the unused pins are not connected.

## 5 Maintenance

### 5.1 Safety information



#### WARNING

Obey the safety instructions in this section and take note of appropriate precautions. Failure to observe these instructions may result in injury to people and damage to equipment.



#### WARNING

Wait one minute for capacitor discharge after disconnecting the power supply before working on the pump.



#### WARNING

The pump may be contaminated with the process chemicals that have been pumped during operation. If so, ensure that the pump is decontaminated before maintenance and that adequate precautions are taken to protect people from the effects of dangerous substances if contamination has occurred.



#### WARNING

Allow the pump to cool to ambient temperature before starting any maintenance work.

The pump is designed to require little user maintenance. Observe the following guidelines when carrying out maintenance on the pump:

- A suitably trained and supervised technician must maintain the pump.
- Ensure that the maintenance technician is familiar with the safety procedures that relate to the products processed by the pumping system.
- Wear the appropriate safety clothing when coming into contact with contaminated components.
- Dismantle and clean contaminated components inside a fume cupboard.
- Do not reuse O-rings or seals.
- Isolate the pump and other components from the electrical supply so that they cannot be operated accidentally.
- After maintenance has been completed, re-check the direction of pump rotation if the electrical supply has been disconnected.
- Check all required components are available and are of the correct type before starting work.
- Leak test the system after installation is complete and seal any leaks found to prevent leakage of hazardous substances out of the system and leakage of air into the system.
- Protect sealing faces from damage.
- Do not touch or inhale the thermal breakdown products of fluorinated materials which may be present in the pump if the pump has been heated to 260 °C and above. Fluorinated materials are safe in normal use but can decompose into very dangerous substances (which may include hydrofluoric acid) if they are heated to 260 °C and above. The pump may have overheated if misused or in a fire. Safety Data Sheets for fluorinated materials used in the pump are available on request; contact the supplier or Edwards.

## 5.2 Maintenance plan

The plan shown in Table 9 details the routine maintenance operations necessary to maintain the pump in normal use. Instructions for each operation are given in the section shown.

More frequent maintenance may be required if the pump is used to pump corrosive or abrasive gases and vapours.

Table 9 - Maintenance plan

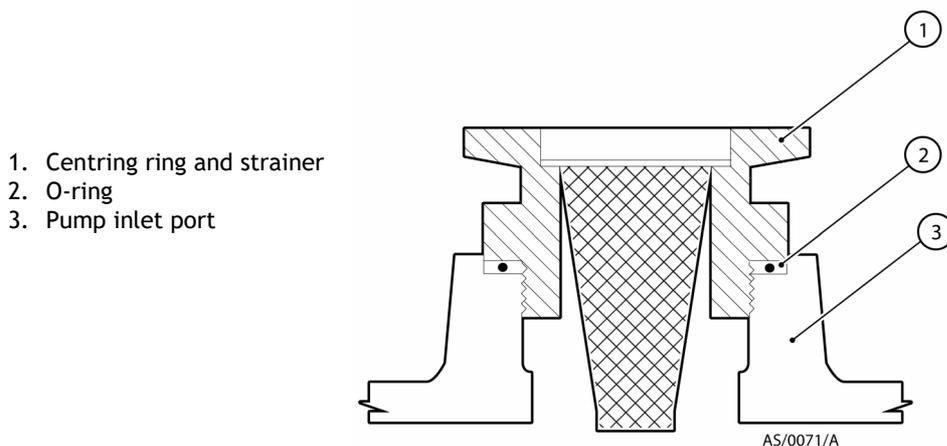
Operation	Frequency	Refer to Section
Inspect and clean inlet strainer	Annually	5.3
Inspect and clean the gas ballast control	Annually	5.4
Clean the external fan cover	Annually	5.5
Replace the tip seal and exhaust valve	Annually or as required	5.6
Test the motor / drive condition	15000 hours	5.7
Replace the bearings	35000 hours	Refer to Edwards

## 5.3 Inspect and clean the inlet strainer

Whenever disconnecting the pump from the vacuum system:

- Remove any debris trapped by the inlet strainer (in the inlet port).
  - Inspect the inlet strainer and if necessary, clean with a cleaning solution suitable for the substances pumped. Refit the inlet strainer before reconnecting the pump to the vacuum system.
1. Refer to Figure 5. Disconnect the vacuum system from the pump inlet port (item 3) and remove the centring ring and strainer assembly (item 1) and the O-ring (item 2). Inspect the centring ring and the O-ring. If clean, continue at Step 5. If not clean, continue at Step 2.
  2. Remove the O-ring (item 2) from the centring ring and strainer assembly (item 1). Do not allow the O-ring to come into contact with the cleaning solution.
  3. Wash the centring ring and strainer assembly in a suitable cleaning solution and allow it to dry.
  4. If necessary, wipe the O-ring with a clean, dry, lint-free cloth.
  5. Refit the centring ring and strainer assembly and the O-ring to the inlet port. Refit the vacuum system to the pump inlet port.

Figure 5 - Inlet strainer assembly

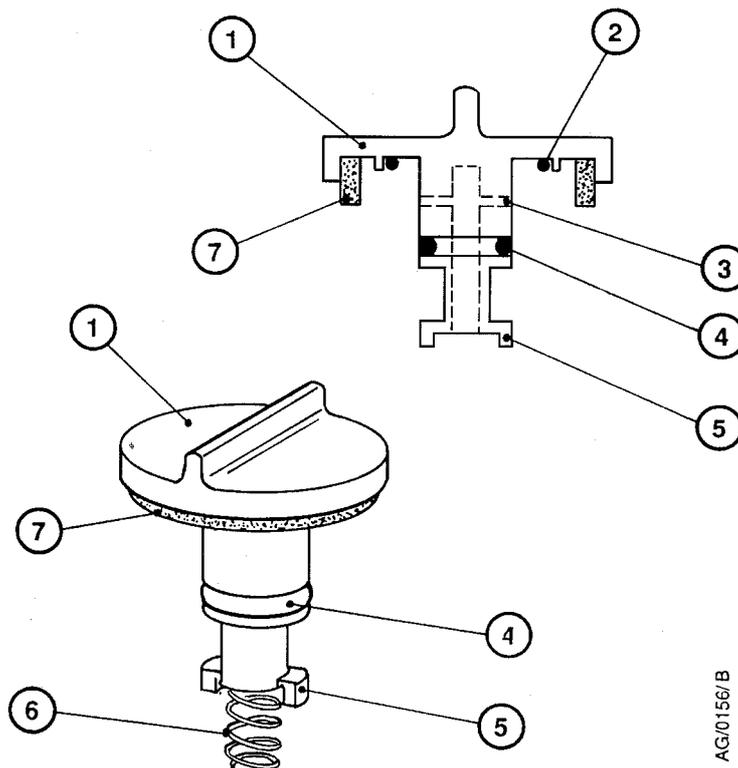


## 5.4 Inspect and clean the gas ballast control

**Note:** The gas ballast filter element (Figure 6, item 7) is retained in its seating with adhesive; do not try to remove it.

1. Refer to Figure 6. Turn the gas ballast control to the high flow position (II).
2. Push the control down against the compression spring (item 6) as far as it will go, then turn the control anti-clockwise slightly to release the bayonet lugs (item 5) and remove the control (item 1).
3. If necessary, wipe the control with a clean, dry, lint-free cloth and check that the air hole (item 3) is not blocked.
4. Refit the control into the gas ballast inlet and ensure that the compression spring locates correctly between the bayonet lugs.
5. Push the control down as far as it will go and then turn the control clockwise slightly until the bayonet lugs engage correctly.
6. Reset the gas ballast control to the required position.

Figure 6 - Gas ballast control assembly



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- |                        |                       |
|------------------------|-----------------------|
| 1. Gas ballast control | 5. Bayonet lugs       |
| 2. O-ring              | 6. Compression spring |
| 3. Air hole            | 7. Filter element     |
| 4. O-ring              |                       |

## 5.5 Clean the external fan cover

If the fan cover is not kept clean, the air flow over the pump can be restricted and the pump may overheat.

1. Switch off the pump and disconnect it from the electrical supply.
2. Use a dry cloth and a soft brush to remove dirt and deposits from the fan cover.

## 5.6 Replace the tip seals

This instruction is applicable to the replacement tip seal kit (contained in minor service kit, refer to [Section 7.3.5](#)) that must be fitted.

## 5.7 Test the motor condition

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### CAUTION

Do not flash test the pump as it may cause damage to the inverter.

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Test the earth continuity and the insulation resistance of the pump motor, in accordance with local regulations for the periodic testing of electrical equipment.

Edwards recommends that the earth continuity is less than 0.1  $\Omega$  and the insulation resistance is greater than 2 M $\Omega$ . (Reference EN61010-1).

If the pump fails these tests, contact Edwards.

## 5.8 Fault finding

### 5.8.1 The pump has failed to start or has stopped

- The electrical supply fuse has blown.
- The electrical supply voltage does not match that for which the inverter input has been configured.
- The inverter drive has not reset after an over temperature event. Disconnect the mains supply and wait for at least one minute and attempt to restart.
- The motor is faulty.
- Fan not working or not connected.
- The ambient temperature is too high.
- The cooling air supply is insufficient or is too hot.
- The process gas is too hot or the throughput is too high.

### 5.8.2 The pump has failed to achieve the required performance

- The pump gas ballast may be selected. To close the gas ballast, turn the control to position '0'. Use this setting in order to achieve the best possible vacuum. If the pump has been used to pump condensable vapours or is to pump a large chamber that has been exposed to atmospheric air (water vapour), it may be necessary to run for at least an hour on high flow gas ballast 'II'.
- If the electrical supply voltage is more than 10% below the lowest voltage specified on the voltage indicator, the pump may operate but yield a degraded vacuum performance.

- There is a leak in the vacuum system.
- The pressure measurement technique or gauge head is unsuitable or gives an incorrect indication of pressure.
- The vacuum fittings are dirty or damaged.
- The inlet strainer is blocked.
- There is a blockage or high pressure in the exhaust line.
- The pump contains traces of process vapours.
- The pump is outside the specified range of operating conditions.
- The gas ballast control (if fitted) is not properly closed.
- The tip seals need replacing.
- The inverter is current limiting the supply.
- The pump is in idle mode.

### 5.8.3 The pump is noisy

- The pump is contaminated with solid particles.
- The bearings are worn.
- Following tip seal replacement, the pump has not been vented and a build up of eroded tip seal dust is reducing running clearances. Refer to [Section 5.6](#) for further information.

### 5.8.4 The pump surface temperature is high

- The ambient temperature is too high.
- The cooling air supply is insufficient or is too hot.
- The process gas is too hot or the maximum continuous operating pressure has been exceeded.

### 5.8.5 The pumping speed is poor or if pump down time is too long

- The connecting pipelines are too small in diameter.
- The connecting pipelines are too long.
- The inlet strainer is blocked.
- There is a leak in the system.
- The inverter is current limiting the supply.
- The pump is in idle mode.

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## 6 Storage and disposal

### 6.1 Storage

Use the following procedure to store the pump:

1. Shut down the pump as described in [Section 4.7](#).
2. Disconnect the pump from the electrical supply.
3. Place and secure protective covers over the inlet and outlet ports.
4. Store the pump in cool, dry conditions until required for use. When required, prepare and install the pump as described in [Section 3](#).

### 6.2 Disposal



#### **WARNING**

Do not incinerate fluoroelastomer or perfluoroelastomer seals, tip seal material or O-rings.

Dispose of the pump and any components removed from it safely in accordance with all local and national safety and environmental requirements.

Take particular care with components and waste oil which have been contaminated with dangerous process substances.

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## 7 Service and spares

### 7.1 Introduction

Edwards products, spares and accessories are available from Edwards companies in Belgium, Brazil, China, France, Germany, Israel, Italy, Japan, Korea, Singapore, 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 the nearest Edwards company or distributor. When ordering, state for each part required:

- Model and Item Number of the equipment.
- Serial number.
- Item number and description of part.

### 7.2 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.

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

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

### 7.3 Accessories

#### 7.3.1 Electrical cables

Electrical cables are available as accessories and should be used to connect the pump to the electrical supply. See [Section 2.4](#) for details.

#### 7.3.2 Silencer

A silencer is available for the pump. The code number for the silencer is A505-97-001. A silencer spares kit, code number A505-97-801 is also available.

#### 7.3.3 Gas ballast adaptor

Fit the gas ballast adaptor in place of the gas ballast control on the pump. The adaptor allows for connecting a controlled supply of inert gas to the pump. Gas ballast adaptor A505-02-000.

#### 7.3.4 Solenoid operated pipeline valves

Fit the pipeline valve between the vacuum system and the pump inlet to provide additional system protection when the pump is switched off. The following valves are available as accessories and are recommended.

Table 10 - Solenoid operated pipeline valves

Product description	Ordering information
PV40EK Valve, 220-240 V 50/60 Hz, Aluminium	C414-01-000
PV40EK Valve, 220-240 V 50/60 Hz, Steel	C414-02-000
PV40EK Valve, 110-127 V 50/60 Hz, Aluminium	C414-03-000
PV40EK Valve, 110-127 V 50/60 Hz, Steel	C414-04-000

### 7.3.5 Tip seal and exhaust valve service kit

This kit contains all the necessary components to replace the tip seals. Tip seals should be replaced as a pair and only simple tools are required. The kit part number is A731-01-801.