Rotary Vane Pumps
RV3, RV5, RV8 and RV12

INSTRUCTION MANUAL

edwardsvacuum.com

A65201880_AC

Original instructions

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Published: 7/24/2023

Associated publications

Publication title	Publication number
Vacuum pump and vacuum system safety	P40040100

Trademark credit

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

You must use this product as described in this manual. Read the manual before you install, operate, or maintain the product.

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1. Safety and compliance

For safe operation from the start, read these instructions carefully before you install or commission the equipment and keep them safe for future use. Read all the safety instructions in this section and the rest of this manual carefully and make sure that you obey these instructions.

The instruction manual is an important safety document that we often deliver digitally. It is your responsibility to keep the instruction manual available and visible while working with the equipment. Please download the digital version of the instruction manual for use on your device or print it if a device will not be available.

1.1 Definition of Warnings and Cautions

Important safety information is highlighted as warning and caution instructions which are defined as follows. Different symbols are used according to the type of hazard.

WARNING:

If you do not obey a warning, there is a risk of injury or death.

CAUTION:

If you do not obey a caution, there is a risk of minor injury, damage to equipment, related equipment or process.

NOTICE:

Information about properties or instructions for an action which, if ignored, will cause damage to the equipment.

We reserve the right to change the design and the stated data. The illustrations are not binding.

1.2 Safety symbols

The safety symbols on the products show the areas where care and attention is necessary.

The safety symbols that we use on the product or in the product documentation have the following meanings:

	**Warning/Caution** Risk of injury and/or damage to equipment. An appropriate safety instruction must be followed or a potential hazard exists.
	**Warning - Heavy object** Risk of injury or damage to equipment. Identifies a possible hazard from a heavy object.
	**Warning - Dangerous voltage** Risk of injury. Identifies possible sources of hazardous electrical shock.
	**Warning - Hot surfaces** Risk of injury. Identifies a surface capable of inflicting burns through contact.
	**Warning - Use protective equipment** Risk of injury. Use appropriate Personal Protective Equipment (PPE) when performing the task.
	**Warning - Risk of explosion** Risk of injury or damage to equipment. Identifies a situation that could result in an explosion.

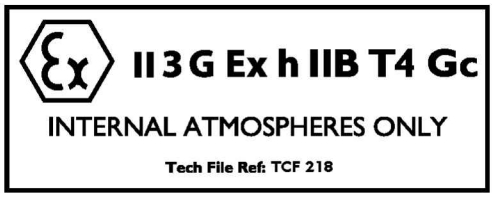
2. Introduction

2.1 Scope and definitions

This manual provides installation, operation and maintenance instructions for the RV3, RV5, RV8 and RV12 Rotary Vane Pumps. The pump must be used as specified in this manual.

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

2.2 Hazardous location implications



This equipment is intended to be installed in a safe non-hazardous area and its design meets the requirements of Group II Category 3 equipment in accordance with EU and UK Legislations concerning equipment and protective systems intended for use in potentially explosive atmospheres.

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 predictable and rare malfunction as defined in the Directive.

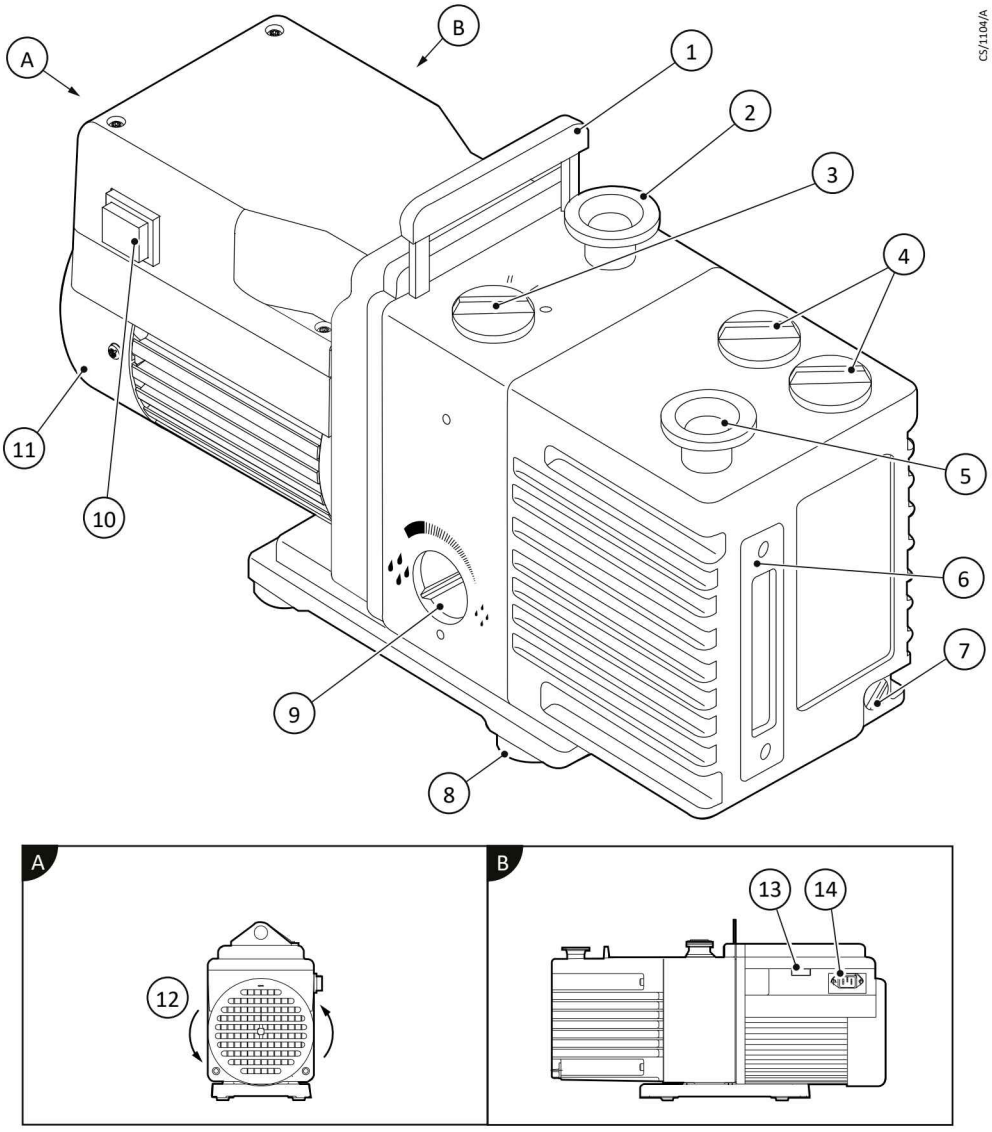
There is no potential source of ignition within the pump during normal operation but there may be potential sources of ignition under conditions of predictable and rare malfunction as defined in the Directive. Accordingly, although the pump is designed to pump flammable materials and mixtures, operating procedures should ensure that under all normal and reasonably predictable 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 while within their explosive limits.

When flammable or pyrophoric materials are present within the equipment:

- Do not allow air to enter the equipment.
- Ensure that the system is leak tight.

For further information, please contact us: refer to our website *www.edwardsvacuum.com* for details of your nearest company.

Figure 1 The RV pump



1. *Lifting handle**
2. *NW25 inlet-port*
3. *Gas-ballast control*
4. *Oil filler-plug*
5. *NW25 outlet-port*
6. *Oil-level sight-glass*
7. *Oil drain-plug*
8. *Rubber feet (4 off)*
9. *Mode selector*
10. *On-off switch†*
11. *Motor fan-cover*
12. *Correct direction of rotation*
13. *Voltage indicator*
14. *Electrical inlet-connector*

** RV3 and RV5 pumps only, a lifting bracket is fitted to RV8 and RV12 pumps.*
† Single-phase pumps only.

Note:

Single-phase RV3/RV5 pump shown.

2.3 Description

The RV rotary vane pump is shown in *Figure: The RV pump*. Refer to *Figure: The RV pump* for item numbers in brackets in the following descriptions. The RV pumps are two-stage, oil-sealed, sliding-vane vacuum pumps. The pump has NW25 inlet (2) and outlet (5)

ports, a gas-ballast control (3) and a mode selector (9). When the pump is switched off, an inlet-valve seals the inlet and prevents the suck-back of air and oil into the vacuum system.

The RV3 and RV5 pumps have a retractable lifting handle (1). The RV8 and the RV12 pumps are fitted with a lifting bracket for use with suitable lifting equipment.

An oil-pump delivers pressurised oil to the vacuum pumping mechanism in the RV pump. The oil level and condition can be inspected in the oil-box through a sight-glass (6). Two oil filler-plugs (4) and an oil drain-plug (7) are provided on the oil-box.

The pump mechanism is driven directly by a single-phase or three-phase electric motor through a flexible motor-coupling. The motor is totally enclosed and is cooled by the motor cooling-fan which directs air along the motor fins. The pumps are cooled by an additional fan attached to the motor-coupling.

Single-phase motors are fitted with an on/off switch (10) and a thermal overload device. When the motor is too hot, the thermal overload device switches off the pump. The thermal overload device has an automatic reset; when the motor cools down, the device resets and (unless suitable control equipment has been incorporated which must be manually reset: see *Connect the pump to the electrical supply* on page 27 and *Connect the pump to the local electrical supply* on page 29), the motor will restart.

As of the end of 2009 improved motors have been fitted to RV pumps. These motors benefit from being fitted with an aluminium terminal box and externally accessible voltage change-over switches. The introduction of these motors has resulted in the range of motors covering all voltage and frequency conditions being reduced from four variants to two. All motors are interchangeable and pump performance is not affected.

The pump is mounted on a base plate on rubber feet (8). Details of suitable vibration isolators and other accessories are provided in *Service and spares* on page 48.

Refer to PFPE-prepared RV pumps refer to *PFPE-prepared RV pumps* on page 54 for additional information if the pump is PFPE-prepared.

2.4 Performance modes and controls

The pump has two controls: the mode selector (9) and the gas-ballast control (3). Six possible combinations of these controls allow for a wide choice of operating characteristics to optimise the performance of the pump for a given application.

2.4.1 Mode selector

Note:

Mode selector operates in a range of approximately 315° (1 and ¾ of turn). Scale above the selector and droplet symbols do not represent the end positions. Droplets size and scale shape guides you that, when turning the selector clockwise the pressurised oil feed is decreased and by turning anti-clockwise it is increased. Physical position of the mode selector flat part in both high vacuum and high throughput is unique for every pump.

The mode selector has two positions, refer to *How to use the pump controls* on page 34 to select these positions. Throughout the rest of this manual, the following convention is used:

- The High Vacuum mode is specified by the ♦ symbol.
- The High Throughput mode is specified by the ♦ symbol.

With the mode selector set to High Vacuum mode ♦, pressurised oil is fed to the low vacuum stage only. In this mode of operation, the pump provides the best possible ultimate vacuum.

With the mode selector set to High Throughput mode ♦, pressurised oil is fed to the high vacuum and low vacuum stages. In this mode of operation, the pump can sustain long-term high inlet pressures.

2.4.2 Gas-ballast control

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

Air can be introduced to the low vacuum stage through the gas-ballast valve. Alternatively, an inert gas such as nitrogen can be supplied through a suitable external valve.

The gas-ballast control has three positions:

- Closed (position ‘0’)
- Low flow (position ‘I’)
- High flow (position ‘II’)

2.5 Construction

The pump-shafts and rotors are made of high-grade cast-iron. The pump-body and oil-box are made from cast-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, silicon, chemically-resistant polymers, nickel and stainless steel.

3. Technical data

3.1 Operating and storage conditions

Table 1 Operating and storage conditions

Parameter	Reference data
Ambient temperature range (operation)	+12 to +40 °C
Ambient temperature range (storage)	–30 to +70 °C
Normal surface temperature of the pump-body*	+50 to +70 °C
Maximum humidity (operation)	90% RH
Maximum altitude (operation)	2000 m
Pollution degree	2
Installation category	II
Area of use	Indoor use

** At ultimate vacuum, with ambient temperature of 20 °C.*

3.2 Performance

3.2.1 General

Note:

In Table: General performance data and Table: Performance data- High Vacuum mode, total pressures have been measured by a capacitance diaphragm gauge on a vacuum chamber without a cold trap, as specified by Pneurop Standard 6602 (1979).

Table 2 General performance data

Parameter	Reference data			
	RV3	RV5	RV8	RV12
High Vacuum mode ♦ performance	See *Table: Performance data- High Vacuum mode*			
High Throughput mode ♦ performance	See *Table: Performance data- High throughput mode*			
Suckback protection	1×10^{-5} mbar l s^{-1}, 1×10^{-3} Pa l s^{-1}			
Maximum initial pressure rise with no gas-ballast flow	1×10^{-1} mbar, 10 Pa			
Maximum displacement: m^3 h^{-1}				
50 Hz electrical supply	3.7	5.8	9.7	14.2
60 Hz electrical supply	4.5	7.0	11.7	17.0
Maximum pumping speed (Pneurop 6602, 1979): m^3 h^{-1}				
50 Hz electrical supply	3.3	5.1	8.5	12.0
60 Hz electrical supply	3.9	6.2	10.0	14.2
Maximum permitted inlet pressure and gas-ballast inlet pressure				
bar gauge	0.5	0.5	0.5	0.5

Parameter	Reference data			
	RV3	RV5	RV8	RV12
Pa	1.5×10^5	1.5×10^5	1.5×10^5	1.5×10^5
Maximum permitted outlet pressure				
bar gauge	0.2	0.2	0.2	0.2
Pa	0.2×10^5	0.2×10^5	0.2×10^5	0.2×10^5

Table 3 Performance data - High vacuum mode - 1

HIGH VACUUM MODE ♦					
Parameter	Units	RV3		RV5	
		1-phase	3-phase	1-phase	3-phase
Gas-ballast control closed (position '0')					
Ultimate total pressure	mbar	2×10^{-3}		2×10^{-3}	
	Pa	2×10^{-1}		2×10^{-1}	
Gas-ballast control low flow (position 'I')					
Ultimate total pressure	mbar	3×10^{-2}		3×10^{-2}	
	Pa	3		3	
Gas-ballast flow	l min^{-1}	5		5	
Maximum water vapour pumping rate	kg h^{-1}	0.06	0.04	0.06	0.04
Maximum water vapour inlet pressure	mbar	27	18	16	11
	Pa	2.7×10^3	1.8×10^3	1.6×10^3	1.1×10^3
Gas-ballast control high flow (position 'II')					
Ultimate total pressure	mbar	1.2×10^{-1}		1×10^{-1}	
	Pa	1.2×10^1		1×10^1	
Gas-ballast flow	l min^{-1}	14		14	
Maximum water vapour pumping rate	kg h^{-1}	0.22	0.12	0.22	0.12
Maximum water vapour inlet pressure	mbar	80	54	50	32
	Pa	8×10^3	5.4×10^3	5×10^3	3.2×10^3

Table 4 Performance data - High vacuum mode - 2

HIGH VACUUM MODE ♦					
Parameter	Units	RV8		RV12	
		1-phase	3-phase	1-phase	3-phase
Gas-ballast control closed (position '0')					
Ultimate total pressure	mbar	2×10^{-3}		2×10^{-3}	
	Pa	2×10^{-1}		2×10^{-1}	
Gas-ballast control low flow (position 'I')					

HIGH VACUUM MODE ♦					
Parameter	**Units**	**RV8**		**RV12**	
		1-phase	**3-phase**	**1-phase**	**3-phase**
Ultimate total pressure	mbar	3×10^{-2}		3×10^{-2}	
	Pa	3		3	
Gas-ballast flow	l min^{-1}	5		5	
Maximum water vapour pumping rate	kg h^{-1}	0.06	0.04	0.06	0.04
Maximum water vapour inlet pressure	mbar	10	7	7	5
	Pa	1×10^{3}	7×10^{2}	7×10^{2}	5×10^{2}
Gas-ballast control high flow (position 'II')					
Ultimate total pressure	mbar	6×10^{-2}		6×10^{-2}	
	Pa	6		6	
Gas-ballast flow	l min^{-1}	16		16	
Maximum water vapour pumping rate	kg h^{-1}	0.22	0.20	0.29	0.25
Maximum water vapour inlet pressure	mbar	38	34	32	28
	Pa	3.8×10^{3}	3.4×10^{3}	3.2×10^{3}	2.8×10^{3}

Table 5 Performance data - High throughput mode - 1

HIGH THROUGHPUT MODE ♦					
Parameter	**Units**	**RV3**		**RV5**	
		1-phase	**3-phase**	**1-phase**	**3-phase**
Gas-ballast control closed (position '0')					
Ultimate total pressure	mbar	3×10^{-2}		3×10^{-2}	
	Pa	3		3	
Gas-ballast control low flow (position 'I')					
Ultimate total pressure	mbar	6×10^{-2}		6×10^{-2}	
	Pa	6		6	
Gas-ballast flow	l min^{-1}	5		5	
Maximum water vapour pumping rate	kg h^{-1}	0.06	0.04	0.06	0.04
Maximum water vapour inlet pressure	mbar	27	18	16	11
	Pa	2.7×10^{3}	1.8×10^{3}	1.6×10^{3}	1.1×10^{3}
Gas-ballast control high flow (position 'II')					
Ultimate total pressure	mbar	1.2×10^{-1}		1×10^{-1}	
	Pa	1.2×10^{1}		1×10^{1}	
Gas-ballast flow	l min^{-1}	14		14	
Maximum water vapour pumping rate	kg h^{-1}	0.22	0.12	0.22	0.12
Maximum water vapour inlet pressure	mbar	80	54	50	32
	Pa	8×10^{3}	5.4×10^{3}	5×10^{3}	3.2×10^{3}

Table 6 Performance data - High throughput mode - 2

HIGH THROUGHPUT MODE					
Parameter	**Units**	**RV8**		**RV12**	
		1-phase	**3-phase**	**1-phase**	**3-phase**
Gas-ballast control closed (position '0')					
Ultimate total pressure	mbar	3×10^{-2}		3×10^{-2}	
	Pa	3		3	
Gas-ballast control low flow (position 'I')					
Ultimate total pressure	mbar	4×10^{-2}		4×10^{-2}	
	Pa	4		4	
Gas-ballast flow	l min^{-1}	5		5	
Maximum water vapour pumping rate	kg h^{-1}	0.06	0.04	0.06	0.04
Maximum water vapour inlet pressure	mbar	10	7	7	5
	Pa	1×10^{3}	7×10^{2}	7×10^{2}	5×10^{2}
Gas-ballast control high flow (position 'II')					
Ultimate total pressure	mbar	6×10^{-2}		6×10^{-2}	
	Pa	6		6	
Gas-ballast flow	l min^{-1}	16		16	
Maximum water vapour pumping rate	kg h^{-1}	0.22	0.20	0.29	0.25
Maximum water vapour inlet pressure	mbar	38	34	32	28
	Pa	3.8×10^{3}	3.4×10^{3}	3.2×10^{3}	2.8×10^{3}

Table 7 Performance characteristics

<table>
<tr><th rowspan="2">MODE SELECTOR POSITION</th><th colspan="6">GAS BALLAST CONTROL</th></tr>
<tr><th colspan="2">Closed (position ‘0’)</th><th colspan="2">Low flow (position ‘I’)</th><th colspan="2">High flow (position ‘II’)</th></tr>
<tr><td rowspan="6">High Vacuum mode</td><td colspan="2">Ultimate total pressure</td><td colspan="2">Ultimate total pressure</td><td colspan="2">Ultimate total pressure</td></tr>
<tr><td>mbar</td><td>Pa</td><td>mbar</td><td>Pa</td><td>mbar</td><td>Pa</td></tr>
<tr><td>2×10^{-3}</td><td>2×10^{-1}</td><td>3×10^{-2}</td><td>3</td><td>1.2×10^{-1} (RV3)
1.0×10^{-1} (RV5)
6×10^{-2} (RV8/12)</td><td>1.2×10^{1} (RV3)
1.0×10^{1} (RV5)
6.0 (RV8/12)</td></tr>
<tr><td colspan="2" rowspan="3">Use for the best ultimate pressure</td><td colspan="2">Maximum water vapour pumping rate</td><td colspan="2">Maximum water vapour pumping rate</td></tr>
<tr><td>1-phase pumps</td><td>3-phase pumps</td><td>1-phase pumps</td><td>3-phase pumps</td></tr>
<tr><td>0.06 kg h^{-1}</td><td>0.04 kg h^{-1}</td><td>0.22 kg h^{-1} (RV3/5/8)
0.29 kg h^{-1} (RV12)</td><td>0.12 kg h^{-1} (RV3/5)
0.20 kg h^{-1} (RV8)
0.25 kg h^{-1} (RV12)</td></tr>
<tr><td rowspan="6">High Throughput mode</td><td colspan="2">Ultimate total pressure</td><td colspan="2">Ultimate total pressure</td><td colspan="2">Ultimate total pressure</td></tr>
<tr><td>mbar</td><td>Pa</td><td>mbar</td><td>Pa</td><td>mbar</td><td>Pa</td></tr>
<tr><td>3×10^{-2}</td><td>3</td><td>6×10^{-2} (RV3/5)
4×10^{-2} (RV8/12)</td><td>6 (RV3/5)
4 (RV8/12)</td><td>1.2×10^{-1} (RV3)
1.0×10^{-1} (RV5)
6×10^{-2} (RV8/12)</td><td>1.2×10^{1} (RV3)
1.0×10^{1} (RV5)
6.0 (RV8/12)</td></tr>
<tr><td colspan="2" rowspan="3">Use for continuous inlet pressure above
50 mbar/5×10^{3} Pa</td><td colspan="2">Maximum water vapour pumping rate</td><td colspan="2">Maximum water vapour pumping rate</td></tr>
<tr><td>1-phase pumps</td><td>3-phase pumps</td><td>1-phase pumps</td><td>3-phase pumps</td></tr>
<tr><td>0.06 kg h^{-1}</td><td>0.04 kg h^{-1}</td><td>0.22 kg h^{-1} (RV3/5/8)
0.29 kg h^{-1} (RV12)</td><td>0.12 kg h^{-1} (RV3/5)
0.20 kg h^{-1} (RV8)
0.25 kg h^{-1} (RV12</td></tr>
</table>

3.2.2 Performance characteristics

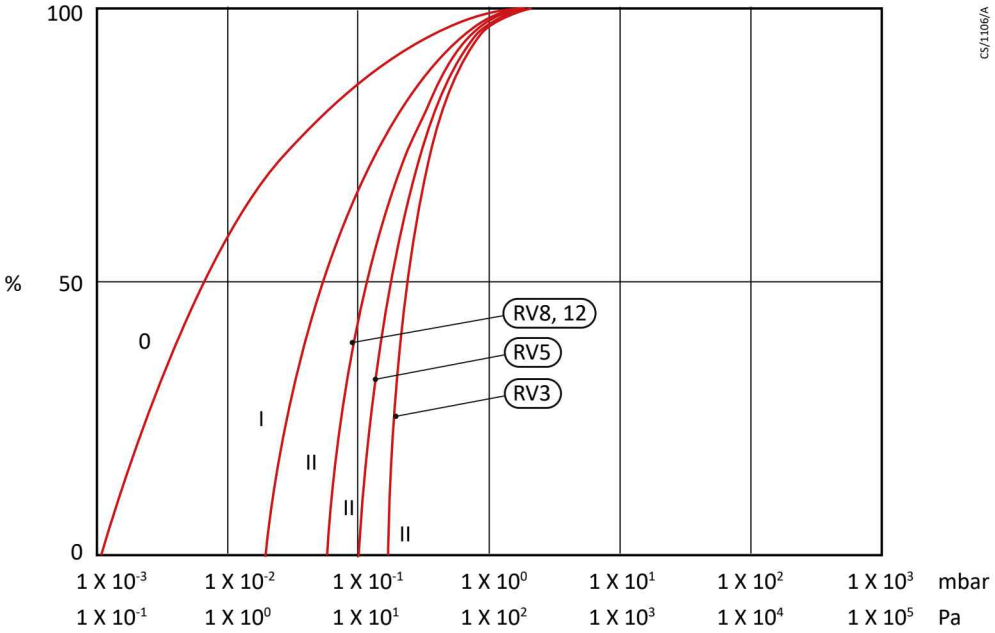
Note:

The performance characteristics described below are for use with hydrocarbon oil.

The positions of the mode selector and the gas-ballast control define the performance characteristics of the pump. These performance characteristics are listed fully in *Table: Performance data- High Vacuum mode* and *Table: Performance data- High throughput mode* .

Table: Performance characteristics gives the ultimate vacuum and maximum water vapour inlet pressure for each of the six possible combinations of control positions. The curves 0, I, and II in *Figure: Performance characteristics in High Vacuum mode (pumping speed against inlet pressure)* show the relationship between inlet pressure and pumping speed for High Vacuum mode ♦.

Figure 2 Performance characteristics in High Vacuum mode (pumping speed against inlet pressure)



3.2.3 Mechanical data

Table 8 Mechanical data

Parameter	RV3	RV5	RV8	RV12
Dimensions	See *Figure: Dimensions (mm)*			
Degree of protection (IEC 34-5: 1981) Single-phase pumps Three-phase pumps	 IP44 IP54			
Maximum tilt angle	10°			
Motor rotational speed 50 Hz electrical supply 60 Hz electrical supply	 1470 r min^{-1} 1760 r min^{-1}			
Maximum mass Pumps with motor, without oil	25.0 kg	25.0 kg	28.0 kg	29.0 kg

3.2.4 Noise and vibration data

Table 9 Noise and vibration data

Parameter	Reference data
Sound pressure*	
Single-phase pumps	48 dBA
Three-phase pumps	50 dBA
Vibration severity†	
Single-phase pumps	Class 1C
Three-phase pumps	Class 1C

** Measured at ultimate vacuum 1 metre from the end of the pump to ISO 11201, High Vacuum mode , 50 Hz operation.*

† Measured at the inlet port to IS0 20816-1.

3.2.5 Lubrication data

Note:

Edwards Material Safety Data sheets for the rotary pump oils are available on request.

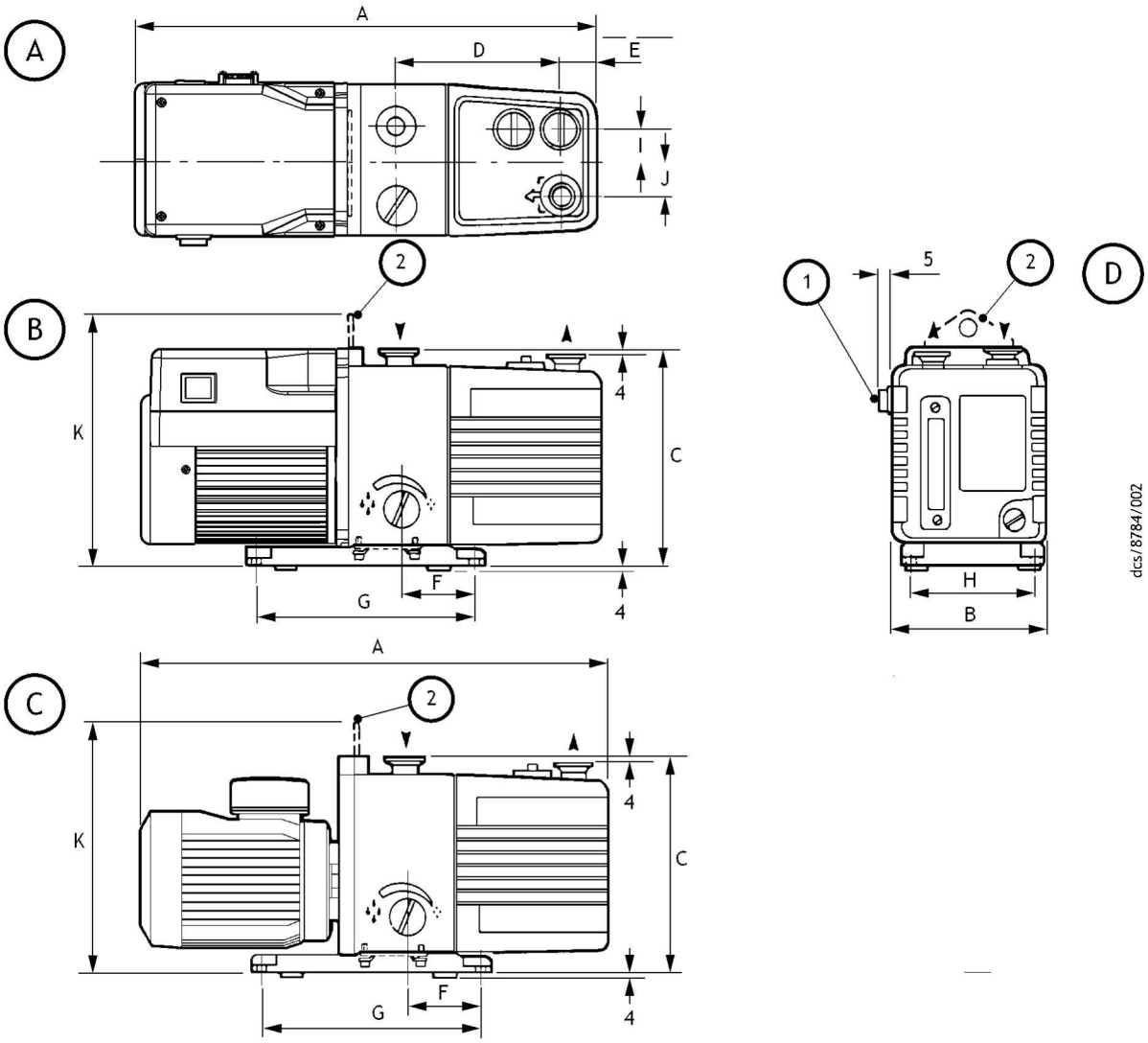
Table 10 Lubrication data

Parameter	Reference data			
	RV3	RV5	RV8	RV12
Recommended oil*				
Hydrocarbon-prepared pumps	Ultragrade 19			
PFPE-prepared pumps	Krytox 1506 or Fomblin 06/6			
Oil capacity				
Maximum	0.70 litres	0.70 litres	0.75 litres	1.00 litres
Minimum	0.42 litres	0.42 litres	0.45 litres	0.65 litres

** To operate the pump when the ambient temperature is outside the limits specified in Operating and storage conditions on page 13, or to optimise the pump performance when pumping condensable vapours, a different oil may be needed.*

3.2.6 Dimension drawing

Figure 3 Dimensions (mm)



A. Top view of single-phase pump
B. Side view of single-phase pump
C. Side view of three-phase pump
D. Front view of single-phase pump

1. On-off switch (single-phase pumps only)
2. Lifting bracket (RV8 and RV12 pumps only. A lifting handle is fitted to RV3 and RV5 pumps.)

Pump	A	B	C	D	E	F	G	H	I	J	K
RV3	430	158	225	127	29	78	230	120	37	32	-
RV5	430	158	225	127	29	78	230	120	37	32	-
RV8	470	158	225	161	35	78	230	120	37	32	261
RV12	490	158	225	181	35	78	230	120	37	32	261

3.2.7 Electrical data: single-phase pumps

Note:

We recommend using regional supply protection of the maximum ratings specified in Table: Electrical data (single-phase pumps with Part Numbers ending in -903 or -906) and Table: Electrical data (single-phase pumps with Part Numbers ending in -904 or -907). Protection of a higher rating must not be used.

The dual-voltage, dual-frequency motor is designed for a single-phase electrical supply and is suitable for 50 Hz or 60 Hz operation. The motor can be manually switched between nominal supply voltages of 110-120 V and 220-240 V (refer to *Check and configure the motor* on page 26). When a cold pump is started, the motor will draw the start-up current shown in *Table: Electrical data (single-phase pumps with Part Numbers ending in -903 or -906)* and *Table: Electrical data (single-phase pumps with Part Numbers ending in -904 or -907)* for up to several seconds. An appropriate rated and pre-approved time-lag fuse must be used to prevent unnecessary fuse failure during pump start-up (in accordance with local and regional electrical codes). Within five minutes, as the oil in the pump warms up, the current drawn will slowly reduce to the full load current specified in *Table: Electrical data (single-phase pumps with Part Numbers ending in -903 or -906)* and *Table: Electrical data (single-phase pumps with Part Numbers ending in -904 or -907)*.

Table 11 Electrical data (single-phase pumps with Part Numbers ending in -903 or -906)

Pump	Nominal supply (V)	Frequency (Hz)	Power (W)	Full load current (A)
RV3, RV5, RV8 and RV12	220-240	50	450	3.4
	230-240	60	550	3.0
	110	50	450	6.8
	115-120	60	550	6.9

Table 12 Electrical data (single-phase pumps with Part Numbers ending in -904 or -907)

Pump	Nominal supply (V)	Frequency (Hz)	Power (W)	Full load current (A)
RV3, RV5, RV8 and RV12	200	50	450	4.2
	200-210	60	550	4.1
	100	50	450	8.3
	100-105	60	550	8.0

Table 13 Recommended regional supply protection

Area	Voltage (V)	Rating (A)
UK	230	5
Europe	230	5
USA	110	13
Japan	100	13

Electrical cables

Recommended cord sets and fuses for regional requirements.

Table 14 Recommended cord sets

Description	Rating	Coupler type	Item number
Cord set assembly, UK	Cable style = H05VV-F, 3 x 1.0 mm^2, 300 V, 70 °C, maximum length of 2.0 metres Plug type = BS1363 UK plug Appliance coupler = IEC60320 style C14 Fuse type = BS1363 10 Amp fuse, to an IEC60320 style	Straight entry	A50505000
Cord set assembly, Europe	Cable style = H05VV-F, 3 x 1.0 mm^2, 300 V, 70 °C, maximum length of 2.0 metres Plug type = European Schuko VDE approved, 16 A 250 V rated with dual earthing contact Appliance coupler = IEC60320 style C14	Straight entry	A50506000
Cord set assembly, USA/Canada (200 - 230 V)	Cable style = SJT, 3 x 14 AWG, 300 V, 90 °C, VW-1 maximum length of 3.0 metres Plug type = NEMA, 6-15P plug Appliance coupler = IEC60320 style C14		N/A

3.2.8 Electrical data: three-phase pumps

For RV3 and RV5 pumps, the dual-voltage, dual-frequency motor is designed for a three-phase electrical supply and is suitable for 50 Hz or 60 Hz operation. The motor can be manually configured for nominal supply voltages of 220-240 V or 380-460 V (refer to *Check and configure the motor* on page 26). Pumps are supplied preset for nominal 380-460 V electric supplies in -905 variant. Variant -925 is preset for 200-230 V electrical supplies.

RV8 and RV12 pumps are supplied with hard wired motor in two variants. High voltage variant -905 must be used at 380-460 V electrical supplies only and the low voltage variant -925 must be used at 200-230 V electrical supplies only. The motor cannot be configured on the customer side.

When a cold pump is started, the motor will draw the start-up current shown in *Table: Electrical data (three-phase pumps with Part Numbers ending in -905 or -925)* for up to 0.5 seconds. The current will then reduce quickly as the motor reaches the rated rotational speed. Within 5 minutes, as the oil and pump warms up, the current drawn

will slowly reduce to a maximum of the full load current specified in *Table: Electrical data (three-phase pumps with Part Numbers ending in -905 or -925)*.

When a warm pump is started, the motor will draw the start-up current shown in *Table: Electrical data (three-phase pumps with Part Numbers ending in -905 or -925)* for up to 0.5 seconds. The current drawn will then immediately fall to the full load current.

Electrical short-circuit and ground-fault protection of the pump will be provided by fitting appropriate pre-approved branch circuit protector or Class CC fuses of the values shown in *Table: Electrical data (three-phase pumps with Part Numbers ending in -905 or -925)* at the point of connection to the supply.

Table 15 Electrical data (three-phase pumps with Part Numbers ending in -905 or -925)

Pump	Nominal supply (V)	Frequency (Hz)	Power (W)	Full load current (A)	Start-up current (A)	Recommended supply protection* (A)
RV3 and RV5 -905 and -925	200	50	250	1.5	10.2	2
	200	60	300	1.7	10.2	2
	230	60	300	1.6	9.0	2
	380	50	250	0.9	6.0	2
	415	50	250	1.0	5.5	2
	460	60	300	0.9	6.0	2
RV8 and RV12 -925	200	50	450	2.7	13.0	4
	208	50	450	2.8	12.5	4
	200	60	550	2.7	13.0	4
	230	60	550	2.6	11.5	4
RV8 and RV12 -905	380	50	450	1.3	7.5	2
	400	50	450	1.3	7.0	2
	415	50	450	1.3	7.0	2
	460	60	550	1.3	6.0	2

** Observe requirements of local and regional electrical codes with respect to supply protection.*

4. Installation

4.1 Safety

WARNING:

Ensure that the installation technician is familiar with the safety procedures which relate to the pump oil and the products handled by the pumping system.

WARNING:

We recommend that a hydrocarbon-prepared RV pump is not used for pumping hazardous substances. PFPE-prepared pumps are suitable for oxygen applications: refer to PFPE-prepared RV pump refer to *PFPE-prepared RV pumps* on page 54.

Obey the safety instructions in this Section and take note of appropriate precautions. If not, injury to people and damage to equipment can result.

Prevent any part of the human body from coming into contact with the vacuum.

Ensure that the RV pump is suitable for the application. If there is any doubt as to the suitability of the RV pump for the application, refer our guidelines on vacuum pump and vacuum system safety or contact us for advice.

A suitably trained and supervised technician must install the RV pump. Obey the safety instructions listed below when installing the pump, especially when connecting the pump into an existing system. Details of specific safety precautions are given at the appropriate point in the instructions.

- Wear the appropriate safety-clothing when coming into contact with contaminated components is anticipated. Dismantle and clean contaminated components inside a fume cupboard.
- Vent and purge the vacuum system before starting installation work.
- Take suitable precautions to avoid the inhalation of oil mist and excessive skin contact with pump-oil, as prolonged exposure can be harmful.
- Disconnect the other components in the pumping system from the electrical supply so that they cannot be operated accidentally.
- Safely route any electrical supply cables to prevent a trip hazard.

4.2 System design considerations

Consider the following points when designing the pumping system:

- We recommend the use of a foreline vacuum isolation valve to allow the pump to warm up before pumping condensable vapours or if a vacuum need to be maintained when the pump is not running.
- Avoid high levels of heat input to the pump from the process gases, otherwise the pump may overheat and seize, and cause the motor thermal overload device to open.

- If using the pump in a high ambient temperature with a high gas throughput, the temperature of the pump-body may exceed 70 °C. We recommend the use of additional guarding to prevent contact with hot surfaces under these conditions.
- Make sure that the exhaust pipeline cannot become restricted. Maximum exhaust pressure is shown in *Table: General performance data*. If an exhaust-isolation valve is fitted, ensure the pump cannot be operated the pump with the valve closed.
- Provide for a purge of inert gas when shutting down the pumping system, to dilute dangerous gases to safe concentrations. A suitable gas ballast adaptor for introduction of purge gas into the pump is available as an accessory (see *Gas-ballast adaptor* on page 51). Contact our Application team for further advice on dilution requirements if required.

4.3 Unpack and inspect

WARNING:

The mass of the RV8 and RV12 pumps is approximately 29 kg.

For the RV8 and RV12 pumps attach the mechanical lifting equipment to the lifting bracket on the pump. Slings do not need to be used to move the RV8 and RV12 pumps.

1. Remove all packing materials and remove the pump from its packing-box.
2. Remove the protective covers from the inlet and outlet-ports and inspect the pump. If the pump is damaged, notify the supplier and the carrier in writing within three days, state the Item Number of the pump together with the order number and the supplier's invoice number. Retain all the 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 the conditions, described in *Storage* on page 47. Refer to *Disposal* on page 47 for disposal of materials.

4.4 Locate the pump

The RV3 and RV5 pumps have a lifting handle enabling the pump to be moved by hand. If using mechanical lifting equipment, do not attach the equipment to the handle; for stability, use slings around the motor and the pump-body.

Provide a firm, level platform for the pump. Locate the pump so that the oil-level sight-glass is visible and the oil filler-plug, oil drain-plug, mode selector and gas-ballast control are accessible.

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

4.5 Fill the pump with oil

WARNING:

A hydrocarbon-prepared pump must not be used to process oxygen in concentrations greater than 25% in volume. As there is a risk of fire or explosion in the oil-box of the pump. PFPE-prepared pumps are available: refer to *PFPE-prepared RV pumps* on page 54.

Fill the pump with oil as described below. Refer to *Lubrication data* on page 19 for the recommended oil. Refer to *Figure: The RV pump* for the item numbers in brackets.

1. Remove one of the oil filler-plugs (4).
2. Pour oil into the pump until the oil-level just reaches the MAX mark on the bezel at the top of the sight-glass (6). If the oil-level goes above the MAX mark, remove the drain-plug (7) and drain the excess oil from the pump.
3. After a few minutes, recheck the oil-level. If the oil-level is now below the MAX mark, pour more oil into the pump.
4. Refit the oil filler-plug. Tighten the plug firmly by hand. Do not overtighten.

4.6 Electrical installation: single-phase pumps

4.6.1 Check and configure the motor

CAUTION:

Ensure that the motor is correctly configured for the local electrical supply. If the pump is operated when the motor is not correctly configured for the electrical supply, the motor will be damaged.

Refer to *Figure: Motor voltage configuration: single-phase pumps* for the item numbers in brackets.

Ensure that the voltage shown on the voltage selector switch (13) in the motor-cover corresponds with the local electrical supply voltage. If it does not, change the configuration of the pump-motor to match the local electrical supply voltage; use the following procedure.

1. Undo the two retaining screws (6) securing the voltage selector switch cover (5).
2. Remove the voltage selector switch cover (5) and toggle the voltage selector switch (3) into the alternate position.
3. Invert the voltage selector switch cover (5) and refit over the voltage selector switch (3).
4. Refit the two retaining screws (6).

4.6.2 Connect the pump to the electrical supply

WARNING:

Ensure that the electrical installation of the RV pump conforms with local and national safety requirements. The pump must be connected to a suitably fused and protected electrical supply with a suitable earth point. For recommended cord sets refer to *Electrical cables* on page 22.

Note:

To prevent automatic restart of the pump-motor if the electrical supply is restored after an electrical supply failure, connect the pump to the electrical supply through suitable control equipment which must be reset manually after an electrical supply failure.

1. Ensure that the on/off switch on the motor (*Figure: Motor voltage configuration: single-phase pumps*, item 4) is in the 'off' position.
2. Insert the moulded IEC connector at the end of the cable into the electrical inlet-connector on the motor (*Figure: Motor voltage configuration: single-phase pumps*, item 2).
3. Connect the plug (if fitted) at the other end of the cable to the electrical supply. If a plug is not fitted, connect the wires in the cable to the correct terminals of the electrical supply.

4.6.3 Check the direction of rotation

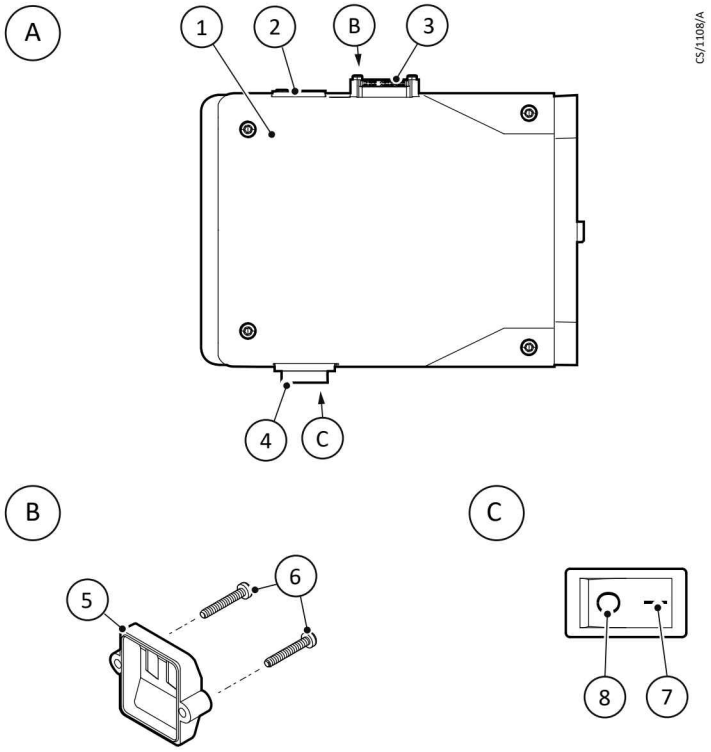
CAUTION:

Ensure that the pump-motor rotates in the correct direction. If it does not, the pump and the vacuum system can become pressurised.

Refer to *Figure: The RV pump* for the item numbers in brackets.

1. Watch the motor cooling-fan through the motor fan-cover (11).
2. Use the on/off switch (10) to switch-on the electrical supply to the motor for a few seconds.
3. Check that the motor cooling-fan rotates in the correct direction (12) shown by the arrow on the motor fan-cover. If the direction of rotation is incorrect, switch off the electrical supply immediately and contact us or the supplier for advice.

Figure 4 Motor voltage configuration: single-phase pumps



A. Top view of motor

B. View of voltage selector switch cover

C. View of On-off switch

1. Terminal box

2. Electrical inlet-connector

3. Voltage selector switch

4. On-off switch

5. Voltage selector switch cover

6. Retaining screws T10 size

7. Position 'I' (on)

8. Position '0' (off)

4.7 Electrical installation: three-phase pumps

4.7.1 Check and configure the motor

CAUTION:

Ensure that the motor is correctly configured for the local electrical supply. If the pump is operated when the motor is not correctly configured for the electrical supply, the motor will be damaged.

1. Remove M4 T20 screws using 1.9 Nm which secure the cover of the motor terminal-box. Remove the cover.
2. Release the dome shaped M16 nut on the cable-gland
3. For RV3 and RV5 only, make sure that the motor is correctly configured for the local electrical supply. If necessary, reconfigure the links *Figure: Three-phase electrical connections: 200-230 V for RV3 and RV5* and *Figure: Three-phase electrical connections: 380-460 V for RV3 and RV5*, item 1) to suit the local electrical supply:
   - For 200-230 V electrical supplies, the links must be configured as shown in *Figure: Three-phase electrical connections: 200-230 V for RV3 and RV5*.

- For 380-460 V electrical supplies, the links must be configured as shown in *Figure: Three-phase electrical connections: 380-460 V for RV3 and RV5*.

4.7.2 Connect the pump to the local electrical supply

WARNING:

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

Note:

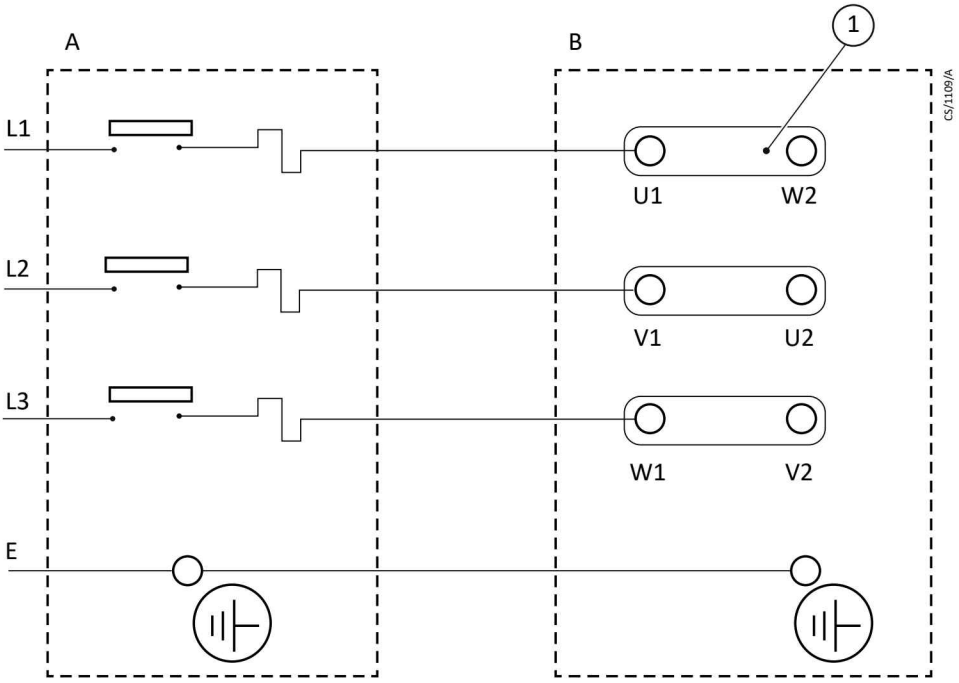
To prevent automatic restart of the pump-motor if the electrical supply is restored after an electrical supply failure, connect the pump to the electrical supply through suitable control equipment which must be reset manually after an electrical supply failure.

The three-phase variants are supplied without the power cord. Recommended cord is 4 wire, 3 phases + PE, cross-section diameter 1.5 mm^2 or 16 AWG. The diameter of the electrical supply cable should be in the range 7 to 11 mm. The cable must conform in size and colour coding with the local and national electrical installation regulations. The temperature rating of the cable must be 70 °C or higher.

We recommend that the electrical supply is connected to the motor through a starter or circuit breaker which has thermal over-current protection which can be adjusted to suit the full load current ratings shown in *Table: Electrical data (three-phase pumps with Part Numbers ending in -905 or -925)*. The fuse ratings in *Table: Electrical data (three-phase pumps with Part Numbers ending in -905 or -925)* are provided for guidance only. The supplier of the thermal over-current protection device may specify different values to ensure correct operation of the fuse and the over-current protection device. Ensure that the fuse used is suitable for the starting currents given in *Table: Electrical data (three-phase pumps with Part Numbers ending in -905 or -925)*.

1. Remove the cover from the motor terminal box by releasing M4 T20 screws using torque 1.9 Nm
2. Release with the 19 mm wrench the dome shaped nut on the M16 cable gland. If the cable gland is released from the motor terminal box, tighten it with 19 mm key to the torque 3.75 Nm.
3. Pass the electrical supply cable through the cable-gland. The diameter of the electrical supply cable should be in the range 7 to 11 mm.
4. Use insulated crimped connectors to connect the wires in the cable to the terminals U1, V1 and W1 and Earth (ground) in the terminal-box as shown in *Figure: Three-phase electrical connections: 200-230 V for RV3 and RV5* and *Figure: Three-phase electrical connections: 380-460 V for RV3 and RV5*. The earth (ground) terminal connection must be tightened to a torque of 1.9 Nm using M4 T20 screw. M4 size terminals U1, V1, W1 to be tightened with 7 mm key to the torque 1.9 Nm.
5. Tighten the dome-shaped nut on the cable-gland until the outer sheath of the cable is firmly gripped. Using a 19 mm wrench this should be tightened to a torque of 2.5 Nm, do not overtighten.
6. Make sure that the cover gasket is correctly positioned, then refit the cover to the terminal-box and secure with the M4 T20 screws to the torque 1.3 Nm.

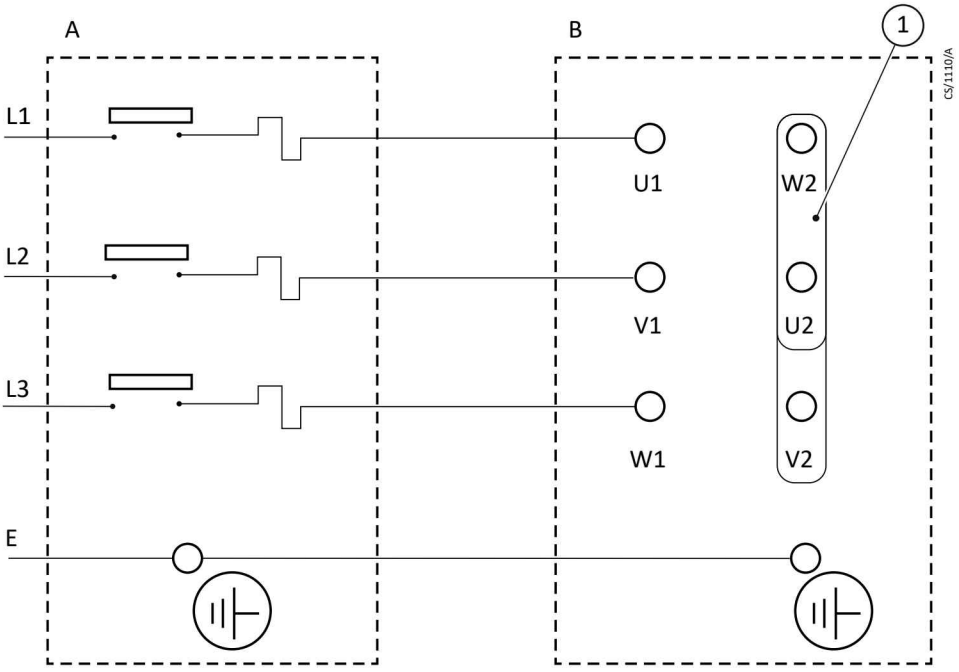
Figure 5 Three-phase electrical connections: 200-230 V for RV3 and RV5



The above three-phase electrical connections are for RV3 and RV5

A. Starter/contactor
B. Motor terminal-box
1. Links

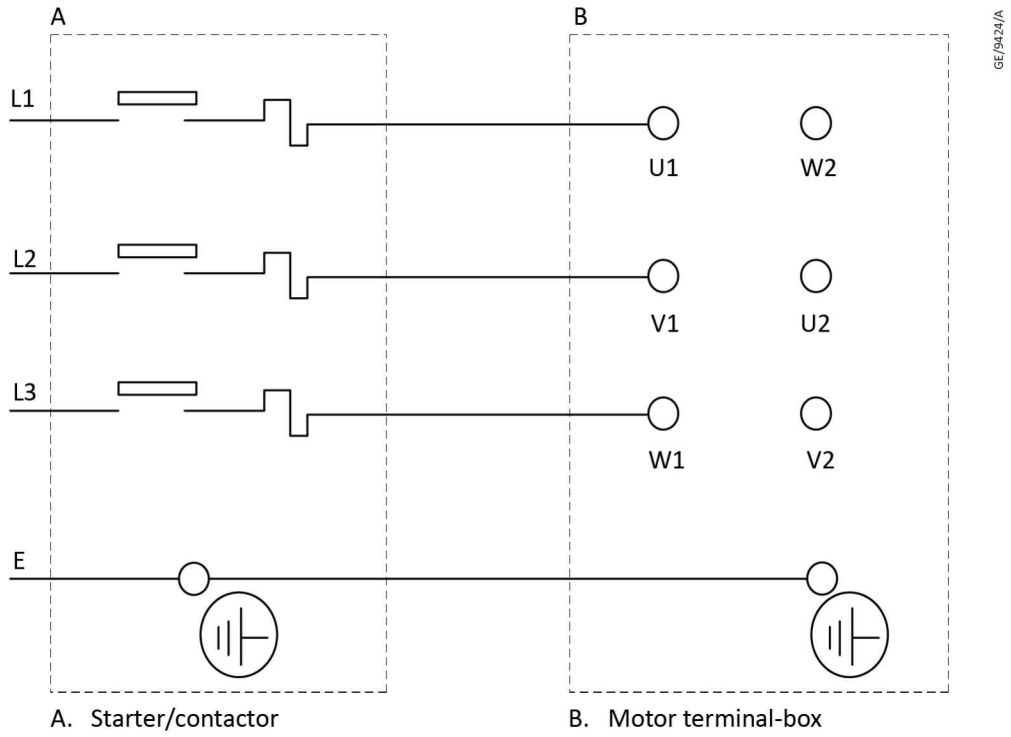
Figure 6 Three-phase electrical connections: 380-460 V for RV3 and RV5



The above three-phase electrical connections are for RV3 and RV5

A. Starter/contactor
B. Motor terminal-box
1. Links

Figure 7 Three-phase electrical connection for RV8 and RV12



4.7.3 Check the direction of rotation

CAUTION:

Ensure that the pump-motor rotates in the correct direction. If it does not, the pump and vacuum system can become pressurised.

1. Refer to *Figure: The RV pump*. Watch the motor cooling-fan through the motor fan-cover (11).
2. Switch-on the electrical supply to the motor for a few seconds.
3. Check that the motor cooling-fan rotates in the correct direction shown by the arrow on the motor mounting plate. If the direction of rotation is incorrect:
   - Switch off the electrical supply immediately.
   - Isolate the pump from the electrical supply.

Remove the terminal-box cover and swap wires L1 and L3: see *Figure: Three-phase electrical connections: 200-230 V for RV3 and RV5* and *Figure: Three-phase electrical connections: 380-460 V for RV3 and RV5*.

- Refit the cover to the terminal-box.

4.8 Inlet and outlet connections

WARNING:

Connect the exhaust to a suitable treatment plant to prevent the discharge of dangerous gases and vapours to the surrounding atmosphere. Use a catchpot to prevent the drainage of contaminated condensate back into the pump.

Before connecting the pump to the vacuum system, fit the centring-ring and inlet-filter (supplied with the pump) to the pump inlet-port (see *Figure: Dimensions (mm)* (item 4)).

Take note of the following information when connecting the pump to the vacuum system. Refer to *Service and spares* on page 48 for details of the accessories mentioned below. Use standard NW25 fittings (not supplied) when connecting the pump.

- For optimum pumping speeds, ensure that the pipeline connected to the pump-inlet is as short as possible and has an internal diameter of 25 mm or larger.
- Support the vacuum pipelines to prevent loading of the coupling-joints.
- If necessary, incorporate flexible bellows in the system pipelines to reduce the transmission of vibration and to prevent loading of coupling-joints. If using flexible bellows, ensure that bellows which have a maximum pressure rating which is greater than the highest pressure that can be generated in the system are used. We recommend using manufacturers flexible bellows.
- Use a suitable inlet trap if pumping condensable vapours or if the pump is to be used for very dusty applications.
- Use a suitable valve to isolate the pump from the vacuum system if pumping condensable vapours or to maintain vacuum when the pump is switched off.
- Ensure that sealing surfaces are clean and scratch-free.

In any of the following circumstances, fitting an oil mist filter to the pump outlet is recommended:

- If using the pump with the gas ballast control open (in position ‘I’ or position ‘II’).
- If operating the pump with an inlet pressure greater than 10 mbar (1×10^3 Pa) for extended periods.
- If the pump is frequently pumped down from atmospheric pressure.

The oil mist filter will trap the oil exhausted from the pump; the oil can be reused if it is not contaminated.

4.9 Leak-test the system

Leak-test the system and seal any leaks found after installing the RV pump, to prevent leakage of substances out of the system and leakage of air into the system.

5. Operation

WARNING:

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

5.1 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 26th February 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 predictable 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 predictable 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.

5.1.1 Flammable materials

WARNING:

Obey the instructions and take note of the precautions given below to ensure that pumped gases do not enter their flammable ranges

When flammable materials are present within the equipment:

- Do not allow air to enter the equipment.
- Ensure that the system is leak tight.
- Use an inert gas purge (for example, a nitrogen purge) to dilute any flammable gases or vapours entering the pump inlet, and/or use an inert gas purge to reduce the concentration of flammable gases or vapours in the pump and in the exhaust pipeline to less than one quarter of the gases' published Lower Explosive Limits (LEL).
- Use an inert gas purge into the pump gas ballast connection to prevent the condensation of flammable vapours within the pump mechanism and exhaust pipeline.

5.1.2 Gas purges

WARNING: INERT GAS SUPPLY

Risk of injury. If using inert gas purges to dilute dangerous gases to a safe level, ensure that the pump is shut down if an inert gas supply fails.

WARNING: FLAMMABLE GAS RANGE

Risk of injury and damage to the equipment. Obey the instructions and take note of any precautions given below to make sure that pumped gases do not enter their flammable ranges.

Switch on the inert gas purge to remove air from the pump and the exhaust pipeline before the process starts. Switch off the purge flow at the end of the process only after any remaining flammable gases or vapours have been purged from the pump and exhaust pipeline.

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 used to supply flammable gases to the process, assume a flow rate for flammable gases that could arise if the mass flow controller is fully open.

Continually measure the inert gas purge flow rate: if the flow rate falls below that required, stop the flow of flammable gases or vapours into the pump.

Note:

We recommend obtaining and reading the Vacuum Pump and Vacuum System Safety manual (publication number P40040100), available from us or the supplier.

5.2 How to use the pump controls

5.2.1 Introduction

Use the mode selector (*Figure: The RV pump*, item 11) and the gas-ballast control (*Figure: The RV pump*, item 5) to optimise the performance of the RV pump for the application. The performance characteristics of the pump with the different control settings are shown in *Table: Performance data- High Vacuum mode* and *Table: Performance data- High throughput mode*. The position of both the mode selector and the gas-ballast control can be changed when the pump is off or when the pump is operating.

5.2.2 Mode selector

Note:

The pump is supplied with High Vacuum mode selected. If High Vacuum mode is selected and the mode selector cannot be turned by hand to select the High Throughput mode, use a suitable tool fitted to the flat part of the mode selector to turn the selector.

The mode selector controls the flow of pressurised oil to the high vacuum stage of the pump (see *Mode selector* on page 11). The can be turned to one of two positions, as follows:

To select the High Vacuum mode , turn the mode selector fully clockwise and tighten by hand. When High Vacuum mode is selected, there is a gap of approximately 3 mm between the mode selector and the inner face of the side panel of the pump. Use this mode:

- to achieve ultimate vacuum
- to pump clean gases
- to pump clean condensable vapours.

To select the High Throughput mode , turn the mode selector fully anticlockwise until it touches the inner face of the side panel of the pump, then gently tighten by hand. Use this mode:

- for long-term operation with high gas throughput
  (that is, inlet pressure > 50 mbar)
- to pump dirty condensable vapours
- to decontaminate the oil.

5.2.3 Gas-ballast control

Use the gas-ballast control to change the amount of air (or inert gas) introduced into the low vacuum stage of the pump (refer to *Gas-ballast control* on page 12). Use of gas-ballast will prevent the condensation of vapours in the pump. The condensates would contaminate the oil. The gas-ballast control can be turned to select one of three positions, as follows:

To select gas-ballast closed, turn the control to position ‘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 oil.

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

- to pump high concentrations of condensable vapours.

When using either low flow or high flow gas-ballast, there will be an increased rate of oil loss from the pump. Where possible, we recommend that low flow gas-ballast (position ‘I’) is selected, rather than high flow gas-ballast (position ‘II’), to minimise the loss of oil.

5.3 Start-up procedure

WARNING:

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

If the oil is contaminated, or if the pump temperature is below 12 °C, or if the electrical supply voltage is more than 10% below the lowest voltage specified on the voltage indicator (*Figure: Motor voltage configuration: single-phase pumps*, item 3), the pump may operate at a reduced speed for a few minutes. On single-phase pumps, if the pump continues to operate at reduced speed, the motor thermal overload device will open and stop the pump. When the motor has cooled, the thermal overload device will reset automatically and the pump will restart.

1. Check that the pump oil-level is between the MAX and MIN marks on the bezel of the oil-level sight-glass; if it is not, refer to *Check the oil-level* on page 40.
2. Turn the mode selector fully clockwise to select High Vacuum mode ♦ or fully anticlockwise to select High Throughput mode ♦, as required (refer to *Check the oil-level* on page 40).
3. Turn the gas-ballast control to position ‘0’, ‘I’ or ‘II’, as required (refer to *Gas-ballast control* on page 35).
4. Switch on the electrical supply to the pump; on single-phase pumps, use the on/off switch.
5. In order to achieve ultimate vacuum, to pump condensable vapours or to decontaminate the pump oil, refer to the procedures in *To achieve ultimate vacuum* on page 36, *To pump condensable vapours* on page 37 and *To decontaminate the oil* on page 37 respectively. Otherwise, open the vacuum system isolation-valve.

5.4 To achieve ultimate vacuum

If the pump does not achieve the performance specified in *Performance* on page 13, make sure that this is not due to the system design before contacting us or the supplier for advice. In particular, the vapour pressure of all materials used in the vacuum system (including pump oil, see below) must be much lower than the specified ultimate vacuum of the pump. Refer to *The pump has failed to achieve the specified performance (has failed to reach ultimate vacuum)* on page 45 for a list of possible causes for failure to achieve the specified performance. Note however that the most common causes are:

- The pressure measurement technique or gauge head is unsuitable or the gauge head is faulty.
- If an oil other than the recommended oil has been used, and the vapour pressure of the oil is higher than the specified ultimate vacuum of the pump.

Use the following procedure to achieve ultimate vacuum:

1. Isolate the RV pump from the vacuum system.
2. Turn the mode selector to select High Throughput mode ♦, set the gas-ballast control to low flow (position ‘I’) and operate the pump for at least 1 hour (or overnight) to thoroughly purge the oil of contaminants.

3. Turn the mode selector to select High Vacuum mode ♦ and close the gas-ballast control (position ‘0’).

Open the vacuum system isolation-valve and pump down to ultimate vacuum.

5.5 To pump condensable vapours

Use gas-ballast (gas-ballast control in position ‘I’ or ‘II’) when there is a high proportion of condensable vapours in the process gases.

1. Close the vacuum system isolation-valve.
2. Turn the mode selector fully clockwise to select High Vacuum mode ♦ or fully anticlockwise to select High Throughput mode ♦, as required (refer to *Mode selector* on page 35).
3. Turn the gas-ballast control to high flow (position ‘II’) and operate the pump for 30 minutes to warm the oil; this will help to prevent vapour condensation in the pump.
4. Set the gas-ballast control to the position required for the application (refer to *Gas-ballast control* on page 35 and the data in *Table: Performance data- High Vacuum mode* and *Table: Performance data- High throughput mode*).
5. Open the vacuum system isolation-valve.

After pumping condensable vapours, decontaminate the oil if necessary: use the procedure in *To decontaminate the oil* on page 37.

5.6 To decontaminate the oil

The oil in the pump should be clear; if the oil is cloudy or discoloured, it is contaminated with process vapours.

1. Look at the condition of the oil in the oil-level sight-glass (*Figure: The RV pump*, item 8). If the oil is cloudy or discoloured, continue with the procedure at Step 2 below.
2. Close the vacuum system isolation-valve.
3. Turn the mode selector fully anticlockwise to select High Throughput mode ♦. Set the gas-ballast control to low flow (position ‘I’).
4. Operate the pump until the oil is clear.

5.7 Unattended operation

The RV pump is designed for unattended operation under the normal operating conditions specified in *Operating and storage conditions* on page 13. However, we recommend checking the pump at regular intervals of not more than 14 days, or more frequently if pumping high volumes of gas or vapour.

On single-phase pumps, the motor is protected by an overload device which isolates the pump from the electrical supply when critical temperature or current levels are exceeded. The overload device resets automatically when the motor has cooled. When checking the pump, make sure that the pump is not going through a repetitive cycle of thermal overload failures and automatic resets. If necessary, change the mode selector to High Throughput mode ♦ and reduce the thermal load from the pumped gases, to prevent overheating of the pump.

5.8 Shut-down

We recommend, as described in the following procedure, decontaminating the oil before shutting down the pump; this will prevent damage to the pump by the contaminates in the oil.

1. Refer to *To decontaminate the oil* on page 37 and decontaminate the oil, as required.
2. Close the vacuum system isolation-valve (if not already closed).
3. Close gas-ballast (set the gas-ballast control to position ‘0’).
4. On single-phase pumps, use the on/off switch to switch off the pump.
5. Switch off the electrical supply to the pump.

6. Maintenance

6.1 Safety information

WARNING:

Allow the pump to cool (so that it is at a safe temperature for skin contact) before starting maintenance work. Make sure the pump is switched off in case the thermal overload device restarts the pump.

WARNING:

Obey the safety instructions given below and take note of appropriate precautions. Failure to do so can cause injury to people and damage to equipment.

- If the pump is PFPE-prepared, refer to *PFPE-prepared RV pumps* on page 54 before maintaining the pump.
- A suitably trained and supervised technician must maintain the pump. Obey local and national safety requirements.
- Ensure that the maintenance technician is familiar with the safety procedures which relate to the pump-oil and the products processed by the pumping system.
- Check that all the required parts are available and of the correct type before starting work.
- Isolate the pump and other components from the electrical supply so that they cannot be operated accidentally.
- Do not reuse O-rings and seals if they are damaged.
- After maintenance is completed, recheck the direction of pump rotation if the electrical supply has been disconnected.
- The pump and the pump-oil will be contaminated with the process chemicals that have been pumped during operation. 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.
- Do not touch or inhale the thermal breakdown products of fluorinated materials which may be present if the pump has been heated to 310 °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 310 °C and above. The pump may have overheated if it was misused, if it malfunctioned, or if it was in a fire. Material Safety Data Sheets for fluorinated materials used in the pump are available on request: contact us or the supplier.
- If necessary, maintain the motor as specified in the manufacturer's information supplied with the motor.

6.2 Maintenance plan

The plan shown in *Table: Maintenance plan* details the routine maintenance operations necessary to maintain RV pumps 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, such as solvents, organic substances and acids; in these circumstances, we recommend replacing the pump seals every year (refer to *Spares* on page 49 for details of available spares). If necessary, adjust the maintenance plan according to prior experience.

When maintaining the RV pump, use our spares and maintenance kits; these contain all of the components necessary to complete maintenance operations successfully. The Item Numbers of the spares and kits are given in *Spares* on page 49.

Table 16 Maintenance plan

Operation	Frequency	Refer to Section
Check the oil-level	Monthly	*Check the oil-level* on page 40
Replace the oil	Every 3000 hours of operation	*Replace the oil* on page 41
Inspect and clean the inlet-filter	Yearly	*Inspect and clean the inlet-filter* on page 41
Inspect and clean the gas-ballast control	Yearly	*Inspect and clean the gas-ballast control* on page 42
Clean the oil-level sight-glass	Yearly	*Clean the oil-level sight-glass* on page 42
Clean the motor fan-cover and enclosure	Yearly	*Clean the motor fan-cover and enclosure* on page 43
Clean and overhaul the pump	Every 15000 hours of operation	*Clean and overhaul the pump* on page 44
Fit new blades	Every 30000 hours of operation	*Fit new blades* on page 44
Test the motor condition	Every 15000 hours of operation	*Test the motor condition* on page 44

6.3 Check the oil-level

Note:

If required, the oil-level can be checked while the pump is operating. The pump must be switched off and the pump and other components in the pumping system isolated from the electrical supply before pouring oil into the pump.

Refer to *Figure: The RV pump* for the items in brackets.

1. Check that the oil-level in the sight-glass (8) is between the MAX and MIN level marks on the bezel of the sight-glass.
2. If the oil-level is near to or below the MIN level mark, remove one of the filler-plugs (6) and pour more oil into the reservoir until the oil reaches the MAX level mark. If the oil-level goes above the MAX mark, remove the drain-plug (9) and drain the excess oil from the pump. Refit the filler-plug.
3. If the oil is contaminated, drain and refill the pump with clean oil as described in *Replace the oil* on page 41.

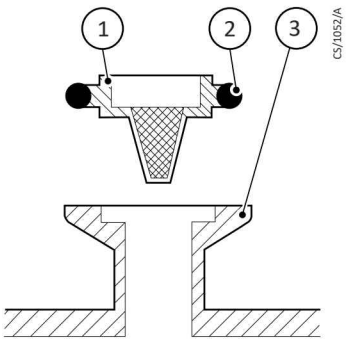
6.4 Replace the oil

1. Refer to *Figure: The RV pump*. Operate the pump for approximately ten minutes to warm the oil, then switch off the pump (this lowers the viscosity of the oil and enables it to be drained from the pump more easily).
2. Isolate the pump from the electrical supply and disconnect it from the vacuum system.
3. Remove one of the oil filler-plugs (4).
4. Place a suitable block under the pump-motor to tilt the pump and place a suitable container under the drain-plug (7). Remove the drain-plug and allow the oil to drain into the container.
5. If the oil drained from the pump is contaminated, pour clean oil into the filler-hole and allow it to drain out of the pump. Repeat this step until the oil reservoir in the pump has been thoroughly cleaned.
6. Refit the drain-plug, remove the block and reconnect the pump to the vacuum system.
7. Fill a suitable container with clean oil and pour the oil into the filler hole until the oil-level reaches the MAX level mark on the bezel of the sight-glass (6).
8. Allow a few minutes for the oil to drain into the pump. If necessary, add more oil. Refit the filler-plug.

6.5 Inspect and clean the inlet-filter

1. Refer to *Figure:Inlet-filter assembly*. Disconnect the vacuum system from the pump inlet-port (3) and remove the centring-ring and filter assembly (1) and the O-ring (2). Inspect the centring-ring and the O-ring. If they are clean, continue at Step 5. If they are not clean, continue at Step 2.
2. Remove the O-ring (2) from the centring-ring and filter assembly (1). Do not allow the O-ring to come into contact with the cleaning solution.
3. Wash the centring-ring and filter 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 filter assembly and the O-ring to the inlet-port. Refit the vacuum system to the pump inlet-port.

Figure 8 Inlet-filter assembly



1. *Centring-ring and filter assembly*
2. *O-ring*
3. *Inlet-port*

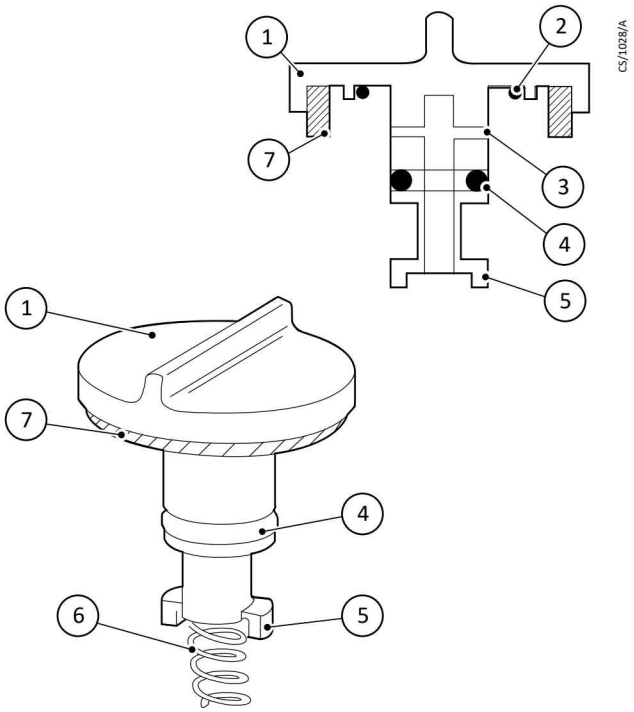
6.6 Inspect and clean the gas-ballast control

Note:

The gas-ballast filter element (Figure:Gas-ballast control assembly, item 7) is retained in its seating with adhesive; do not try to remove it.

1. Refer to *Figure:Gas-ballast control assembly*. Turn the gas-ballast control (1) to the high flow position (position 'II').
2. Push the control down against the compression spring (6) as far as it will go, then turn the control anticlockwise slightly to release the bayonet-lugs (5) and remove the control.
3. If necessary, wipe the control with a clean, dry, lint-free cloth and check that the air-hole (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 turn the control clockwise slightly until the bayonet-lugs engage correctly.
6. Reset the gas-ballast control to the required position.

Figure 9 Gas-ballast control assembly



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

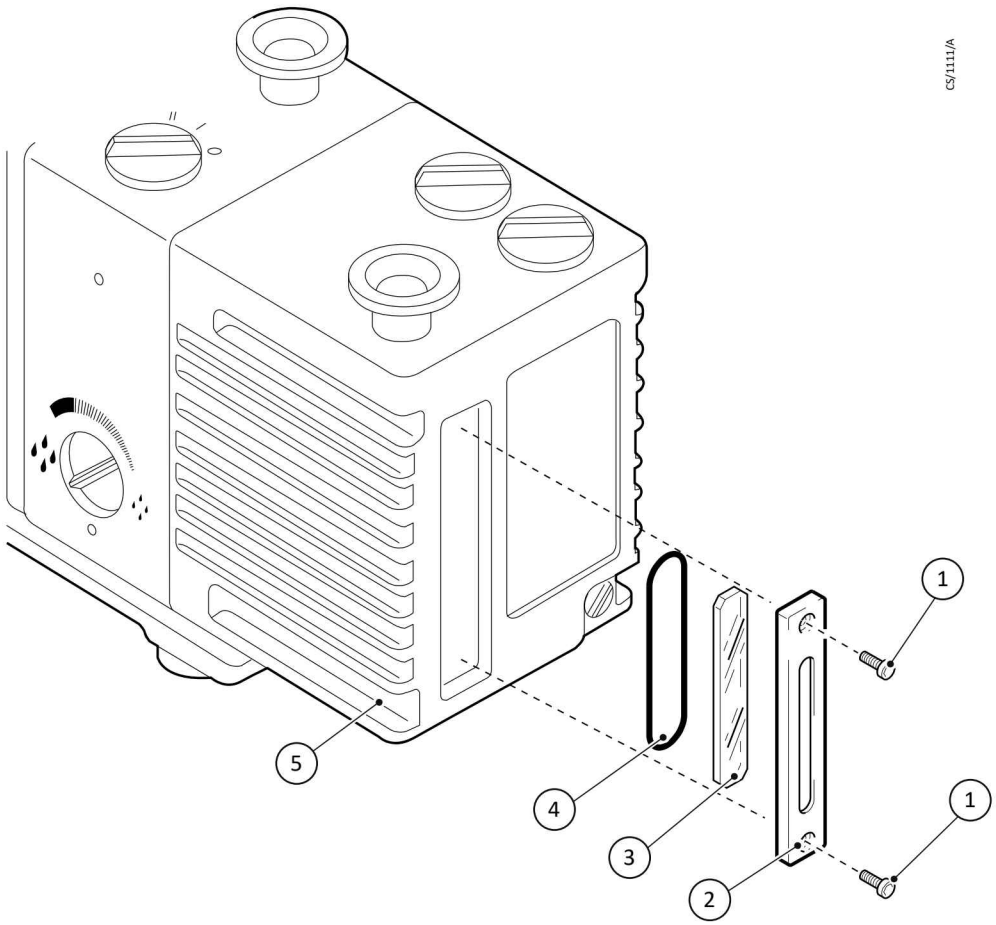
6.7 Clean the oil-level sight-glass

Refer to *Figure: Sight-glass assembly* for the item numbers in brackets.

1. Drain the oil as described in *Replace the oil* on page 41.

2. Undo the two screws (1) and remove the bezel (2), the sight-glass (3) and the O-ring (4) from the oil-box (5).
3. Clean the screws, bezel and sight-glass with a suitable cleaning solution.
4. Wipe the O-ring with a clean, dry, lint-free cloth.
5. Wipe the sight-glass recess in the oil-box with the cloth.
6. Refit the O-ring, sight-glass and bezel and secure with the two screws.
7. Refill the pump with oil as described in *Replace the oil* on page 41.
8. Check that the sight-glass does not leak.

Figure 10 Sight-glass assembly



1. *Screws (2 off M6 x 20)*
2. *Bezel*
3. *Sight-glass*
4. *O-ring*
5. *Oil-box*

6.8 Clean the motor fan-cover and enclosure

If the motor fan-cover and enclosure are not kept clean, the air-flow over the motor 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 and enclosure.

6.9 Clean and overhaul the pump

Clean and overhaul the pump as described in the instructions supplied with the clean and overhaul kit (see *Spares* on page 49).

6.10 Fit new blades

Fit new blades to the pump as described in the instructions supplied with the blade kit (see *Spares* on page 49).

6.11 Test the motor condition

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

The motor of single-phase RV pumps complies with IEC 1010V1. We recommend that, to maintain compliance with IEC 1010-1, the earth continuity is less than 0.1 Ω and the insulation resistance is greater than 10 Ω.

If the motor fails these tests, the motor must be replaced.

7. Fault finding

7.1 Introduction

A list of fault conditions and their possible causes is provided in the following sections to assist in fault-finding. If a fault cannot be rectified using this guide, call our nearest Service Centre for help.

7.2 The pump has failed to start

- The electrical supply fuse has failed.
- The electrical supply voltage does not match that of the motor.
- The outlet pipeline or the outlet-filter (if fitted) is blocked.
- The oil temperature is below 12 °C.
- The oil is too viscous.
- The oil is contaminated.
- The pump has seized after long storage.
- The pump has been left to stand after contaminants have been pumped and has seized.
- The motor is faulty.

7.3 The pump has failed to achieve the specified performance (has failed to reach ultimate vacuum)

- The pressure measurement technique or gauge head is unsuitable or gives an incorrect indication of pressure. For example, a contaminated Pirani gauge can indicate a pressure which is several times higher than the actual pressure in the system.
- The pump has been filled with the wrong type of oil.
- There is a leak in the vacuum system.
- The mode selector and gas-ballast control are set incorrectly.
- The oil-level is below minimum level.
- The oil is contaminated.
- The vacuum fittings are dirty or damaged.
- The inlet-filter is blocked.
- The pump has not warmed up.

7.4 The pump is noisy

- The motor fan-cover is damaged.
- The motor bearings are worn.
- The oil is contaminated with solid particles.

7.5 The pump surface temperature is above 100 °C

Note:

If the inlet pressure is continuously higher than 100 mbar (1 x 10^4 Pa), the surface temperature of the RV12 pump can reach 115 °C when the ambient temperature is 40 °C.

- The ambient temperature is too high.
- The cooling-air supply is insufficient or is too hot.
- The electrical supply voltage is too high.
- The outlet-filter or the outlet pipeline is blocked.
- The oil-level is below minimum level.
- The pump has been filled with the wrong type of oil.
- The oil is contaminated.
- The process gas is too hot or the throughput is too high.

7.6 The vacuum is not fully maintained after the pump is switched off

- The gas-ballast control is open (in position ‘I’ or ‘II’).
- The inlet valve-pad is damaged.
- The inlet valve has not closed.

7.7 The pumping speed is poor

- The connecting pipelines are too small in diameter.
- The connecting pipelines are too long.
- The inlet-filter is blocked.

7.8 There is an external oil leak

- The outer shaft-seal is worn or damaged.
- The oil-box gaskets have deteriorated.
- There is an oil leak from the gas-ballast control.
- There is an oil leak from the drain-plug.
- There is an oil leak from the sight-glass.

8. Storage and disposal

8.1 Storage

CAUTION:

Observe the storage temperature limits stated in *Operating and storage conditions* on page 13. Storage below -30 °C will permanently damage the pump seals.

Note:

If a new pump is to be stored in conditions of high humidity, remove the pump from its cardboard packaging box; dispose of the box (refer to Disposal on page 47).

Use the following procedure to store the pump:

1. Shut-down the pump as described in *Shut-down* on page 38.
2. Disconnect the pump from the electrical supply.
3. Purge the vacuum system and the pump with dry nitrogen and disconnect the pump from the vacuum system.
4. Replace the oil as described in *Replace the oil* on page 41.
5. Place and secure protective covers over the inlet and outlet-ports.
6. Store the pump in cool, dry conditions until required for use. When required, prepare and install the pump as described in *Installation* on page 24. If the pump has been stored for more than a year, before installing the pump it must be cleaned and overhauled as described in the instructions supplied with the clean and overhaul kit.

8.2 Disposal

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.

Do not incinerate fluoroelastomer seals and O-rings.

9. Service and spares

9.1 Introduction

Our products, spares and accessories are available from our 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 our comprehensive training courses.

Order spare parts and accessories from our nearest 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.

9.2 Service

Our products are supported by a world-wide network of our service centre. 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 our 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 company.

9.2.1 Return the equipment or components for service

Before you send your equipment to us for service or for any other reason, you must complete a Declaration of Contamination Form. The form tells us if any substances found in the equipment are hazardous, which is important for the safety of our employees and all other people involved in the service of your equipment. The hazard information also lets us select the correct procedures to service your equipment.

If you are returning equipment note the following:

- If the equipment is configured to suit the application, make a record of the configuration before returning it. All replacement equipment will be supplied with default factory settings.
- Do not return equipment with accessories fitted. Remove all accessories and retain them for future use.
- The instruction in the returns procedure to drain all fluids does not apply to the lubricant in pump oil reservoirs.

Download the latest documents from *edwardsvacuum.com/HSForms/*, follow the procedure in HS1, fill in the electronic HS2 form, print it, sign it, and return the signed copy to us.

NOTICE:

If we do not receive a completed form, your equipment cannot be serviced.

9.3 Spares

See *Table: Spares and maintenance kits* for the spares and maintenance kits available for the RV pumps.

As of the end of 2009 improved motors have been fitted to RV pumps. These motors benefit from being fitted with an aluminium terminal box and externally accessible voltage change over switches. The introduction of these motors has resulted in the range of motors covering all voltage and frequency conditions being reduced from four variants to two. All motors are interchangeable and pump performance is not affected.

Table 17 Spares and maintenance kits

Spare	Item Numbers	
	Hydrocarbon prepared pumps	PFPE prepared pumps
Ultragrade 19 oil, 1 litre	H11025015	-
Ultragrade 19 oil, 4 litres	H11025013	-
Fomblin 06/6 oil, 1 kg	-	H11306019
Fomblin 06/6 oil, 5 kg	-	H11306020
Clean and overhaul kit (Standard)	A65201131	A65201131
Clean and overhaul kit (Nitrile)*	A65201137	-
RV3 Blade kit	A65201130	A65201130
RV5 Blade kit	A65301130	A65301130
RV8 Blade kit	A65401130	A65401130
RV12 Blade kit	A65501130	A65501130
RV3 Cartridge kit	A65201032	A65201032
RV5 Cartridge kit	A65301032	A65301032
RV8 Cartridge kit	A65401032	A65401032
RV12 Cartridge kit	A65501032	A65501032
Inlet-valve kit	A65201036	A65201036
Coupling Element RV 3/5 Pump kit (with coupling element A21071077))	A21071778	A21071778
Coupling Element RV 8/12 Pump kit (with coupling element A21071161))	A21071779	A21071779
Motor starting relay kit†	A50574000	A50574000
Motor starting relay kit (Europe/USA)‡	A07108732	A07108732
Motor starting relay kit (Japan)‡	A07108733	A07108733
Outer shaft seal kit	A65201134	A65201134
Rotor sleeve kit	A65201136	A65209136

Spare	Item Numbers	
	Hydrocarbon prepared pumps	PFPE prepared pumps
Motor kit (Europe/USA) 50/60 Hz, 450/500 W, 1 phase, 110-120/220-240 V	A65299500	A65299500
Motor kit (Japan) 50/60 Hz, 450/500 W, 1 phase, 100-105/200-210 V	A65298500	A65298500
RV3/RV5 Motor kit (Europe/USA/ Japan) 50/60 Hz, 250/300 W, 3 phase, 200-230/380-460 V	A65297000	A65297000
RV8/RV12 Motor kit low voltage 50/60 Hz, 450/550 W, 3 phase, 200-208/200-230 V	A65497035	A65497035
RV8/RV12 Motor kit high voltage 50/60 Hz, 450/550 W, 3 phase 380-415/380-460 V	A65497034	A65497034

**Nitrile clean and overhaul kit is for ammonia application only.*
†For use with motors fitted with a plastic terminal box manufactured before January 2010.
‡For use with motors fitted with an aluminium terminal box manufactured after January 2010.

9.4 Accessories

9.4.1 Introduction

The accessories which can be fitted to the RV pump are shown in *Figure:Accessories*, and their Item Numbers are listed in *Table: Accessory item numbers*.

These accessories are briefly described in Section *Inlet catchpot* on page 51 to *Solenoid operated pipeline valve* on page 52.

Table 18 Accessory item numbers

Accessory	Refer to Section	Item Number
ITO20K Inlet catchpot	*Inlet catchpot* on page 51	A44110000
ITF20K Inlet dust filter	*Inlet dust filter* on page 51	A44215000
ITD20K Inlet desiccant trap	*Inlet desiccant trap* on page 51	A44510000
ITC20K Inlet chemical trap	*Inlet chemical trap* on page 51	A44410000
FL20K Foreline trap	*Foreline trap* on page 51	A13305000
EMF10 Outlet mist filter	*Outlet mist filter* on page 51	A46226000
EMF20 Outlet mist filter	*Outlet mist filter* on page 51	A46229000
Gas-ballast adaptor	*Gas-ballast adaptor* on page 51	A50502000
Oil drain-extension	*Oil drain-extension* on page 52	A50503000
Exhaust nozzle kit	*Exhaust nozzle kit* on page 52	A50509000
Vibration isolators (pack of four)	*Vibration isolators* on page 52	A24801404
EBV20 Solenoid operated gas-ballast valve	*Solenoid operated gas-ballast valve* on page 52	

Accessory	Refer to Section	Item Number
220-240 V 50/60 Hz	-	A50006930
100-120 V 50/60 Hz	-	A50006984
PV25EK Pipeline valve (Aluminium)	*Solenoid operated pipeline valve* on page 52	
220-240 V 50/60 Hz	-	C41301000
110-127 V 50/60 Hz	-	C41303000
PV25EK Pipeline valve (Stainless Steel)	*Solenoid operated pipeline valve* on page 52	
220-240 V 50/60 Hz	-	C41302000
110-127 V 50/60 Hz	-	C41304000
EMF clean application oil drain kit	Refer to Instruction manual A50419880	A50419000
EMF adjustable gas ballast oil drain kit	Refer to Instruction manual A50523880	A50523000

9.4.2 Inlet catchpot

The inlet catchpot traps any liquid droplets and prevents their entry into the pump.

9.4.3 Inlet dust filter

The inlet dust filter protects the pump against abrasive dust.

9.4.4 Inlet desiccant trap

Use a desiccant trap when the pump limited quantities of water vapour at high pumping speeds to a low vapour pressure.

9.4.5 Inlet chemical trap

The inlet chemical trap protects the pump against chemically active gases.

9.4.6 Foreline trap

Use a foreline trap on a clean pumping system to prevent back-migration of pump-oil vapour into the vacuum system.

9.4.7 Outlet mist filter

The outlet mist filter separates and traps oil droplets in the pump outlet to prevent oil mist discharge.

9.4.8 Gas-ballast adaptor

Fit the gas-ballast adaptor in place of the gas-ballast control on the pump. The adaptor allows fitting of a solenoid operated gas-ballast valve or a controlled supply of inert gas to the pump.

9.4.9 Oil drain-extension

Fit the oil drain-extension between the oil drain port on the pump and the oil drain-plug to make the drainage of oil from the pump easier.

9.4.10 Exhaust nozzle kit

The exhaust nozzle replaces the outlet flange. Use the exhaust nozzle to connect the pump outlet to 12 mm internal diameter plastic hose.

9.4.11 Vibration isolators

Vibration isolators reduce vibration and noise when the pump is floor or frame mounted and help to reduce strain when the mounting area is uneven.

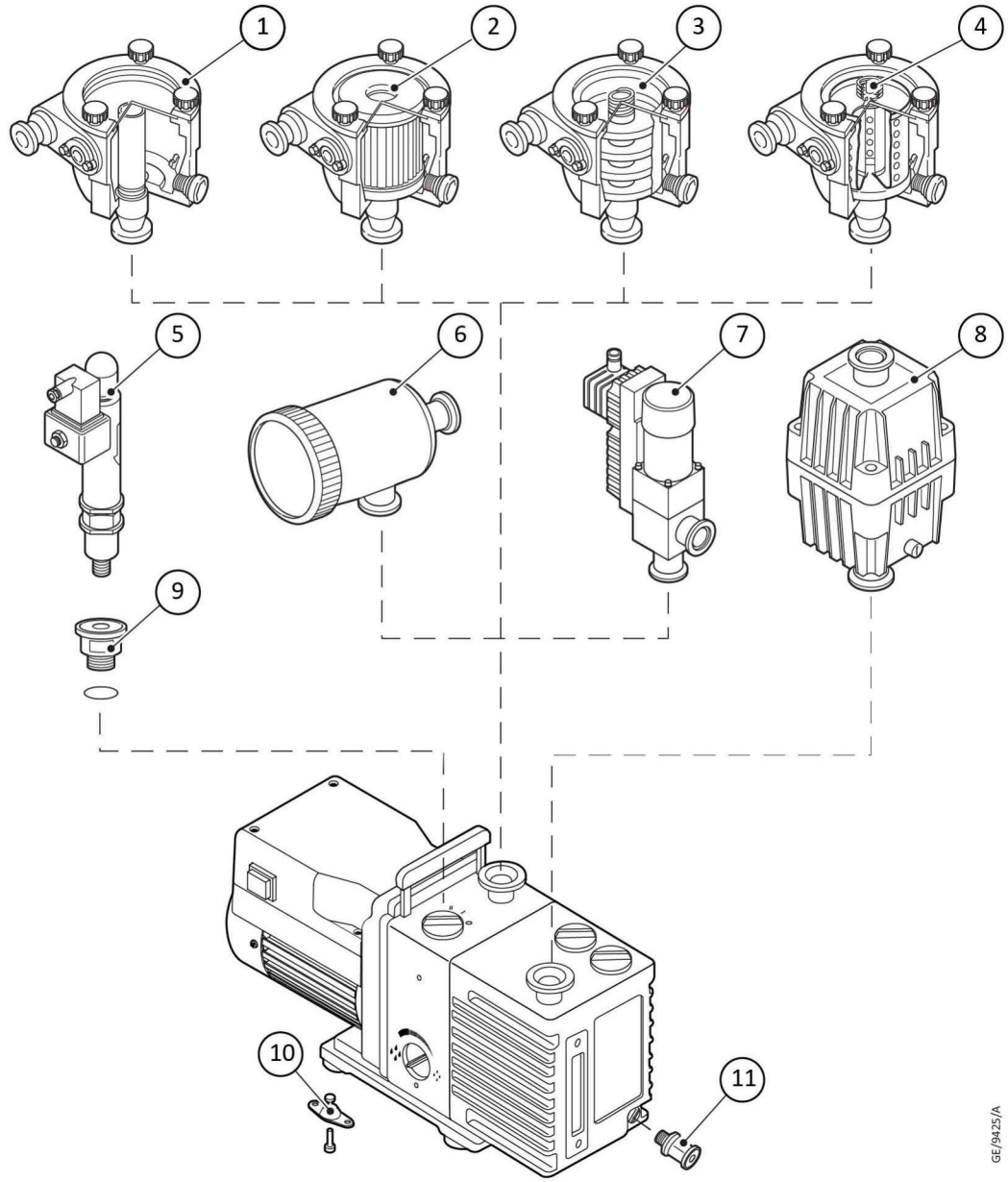
9.4.12 Solenoid operated gas-ballast valve

Fit the gas-ballast valve in place of the built-in gas-ballast control on the pump; the gas-ballast adaptor (see *Gas-ballast adaptor* on page 51) must be fitted with the solenoid operated gas-ballast valve. The valve provides automatic on/off control of the gas-ballast and isolates the gas-ballast inlet when the pump is switched off.

9.4.13 Solenoid operated pipeline valve

Fit the pipeline valve between the vacuum system and the pump-inlet to provide additional system protection when the pump is switched off.

Figure 11 Accessories



1. *Inlet catchpot*
2. *Inlet dust filter*
3. *Inlet desiccant trap*
4. *Inlet chemical trap*
5. *Solenoid operated gas-ballast valve*
6. *Foreline trap*
7. *Solenoid operated pipeline valve*
8. *Outlet mist filter*
9. *Gas-ballast adaptor*
10. *Vibration isolators*
11. *Oil drain-extension*

10. PFPE-prepared RV pumps

10.1 Summary

If a PFPE-prepared RV pump has been ordered, the pump will be supplied prepared for use with recommended PFPE mechanical pump oils, such as Fomblin YVAC 06/6 and Krytox 1506.

PFPE-prepared RV pumps are suitable for pumping high concentrations of oxygen.

Refer to publication P40040100 (Vacuum pump and Vacuum System Safety) before installing and using a PFPE-prepared RV pump.

10.2 Installation

CAUTION:

Never use hydrocarbon lubricants in a PFPE-prepared pump.

When filling the RV pump with oil (as described in *Fill the pump with oil* on page 26), a suitable manufacturers PFPE oil must be used. Do not use a hydrocarbon oil.

10.3 Operation

WARNING:

PFPE-prepared RV pumps are suitable for pumping high concentrations of oxygen, but we recommend that PFPE-prepared RV pumps are not used for the pumping of hazardous materials.

Operation of a PFPE-prepared RV pump is as specified in *Operation* on page 33 but take note of the warning above.

10.4 Maintenance

WARNING:

Obey the safety instructions given below and take note of appropriate precautions. Failure to do so can cause injury to people.

- Take additional care if it is suspected that the pump (and hence the PFPE oil) has overheated.
- Do not touch or inhale the thermal breakdown products of PFPE oil which may be present if the pump has been heated to 260 °C and above. PFPE oils are safe in normal use but can decompose into very dangerous substances if they are heated to 260 °C and above. The pump may have overheated if it was misused, if it malfunctioned, or if it was in a fire. Material Safety Data Sheets for PFPE oils used in the pump are available on request: contact us or the supplier.

Fomblin oil has different properties from other pump oils, therefore:

- If the PFPE-prepared RV pump is filled with Fomblin oil, We recommend you to do regular checks for oil leaks are carried out, particularly around the shaft seals.
- If an oil leak is detected, contact us or the supplier for advice.

P20000540N

EU Declaration of Conformity

This declaration of conformity is issued under the sole responsibility of the manufacturer:

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Innovation Drive
Burgess Hill
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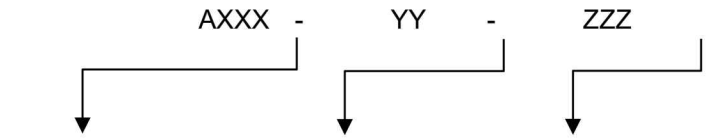
The product specified and listed below



Pump type XXX	Variant YY	Motor description ZZZ
652 = RV3 653 = RV5 654 = RV8 655 = RV12	01 to 99	903 = 220-240V 50/60Hz Single Phase 904 = 200-210V 50/60Hz Single Phase 905 = 200-230/380-460V 50/60Hz Three Phase 906 = 110-120V 50/60Hz Single Phase 907 = 100-105V 50/60Hz Single Phase 925 = 200-230V 50/60Hz Three Phase

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

2006/42/EC	Machinery directive *Note: The safety objectives of the Low Voltage Directive 2014/35/EU were complied with in accordance with Annex 1 No. 1.5.1 of this directive.*
2014/34/EU	ATEX directive on use in potentially explosive atmospheres II 3 G Ex h IIB T4 Gc TCF 218 Only the internal pumping mechanism is classified as ATEX category 3, external parts and motor are not in scope
2011/65/EU	Restriction of certain hazardous substances (RoHS) directive as amended by Delegated Directive (EU) 2015/863

Based on the relevant requirements of harmonised standards:

EN 1012-2:1996 +A1:2009	Compressors and vacuum pumps. Safety requirements. Vacuum pumps
EN 61010-1:2010 *	Safety requirements for electrical equipment for measurement, control and laboratory use. General requirements
** 1-phase pumps only*	*The pumps comply with EN 61010-1 when installed in accordance with the instruction manual supplied with the pumps.*
EN ISO 80079-36:2016	Explosive atmospheres – Part 36: Non-electrical equipment for explosive atmospheres. Basic method and requirements

EN ISO 80079-37:2016	Explosive atmospheres - Part 37: Non-electrical equipment for explosive atmospheres -- Non-electrical type of protection constructional safety ''c'', control of ignition sources ''b'', liquid immersion ''k''

This declaration, based on the requirements of the listed Directives and EN ISO/IEC 17050-1, covers all product serial numbers from this date on: *2022-06-20*

You must retain the signed legal declaration for future reference
This declaration becomes invalid if modifications are made to the product without prior agreement.

Petr Šmérek – Engineering Manager
Scientific Vacuum Division
Lutín, CZ

Jan Večeřa – General Manager
Lutín, CZ

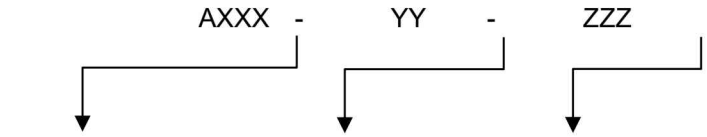
P20000540N

Declaration of Conformity

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

Documentation Officer
documentation@edwardsvacuum.com

This declaration of conformity is issued under the sole responsibility of the manufacturer.



Pump type XXX	Variant YY	Motor description ZZZ
652 = RV3 653 = RV5 654 = RV8 655 = RV12	01 to 99	903 = 220-240V 50/60Hz Single Phase 904 = 200-210V 50/60Hz Single Phase 905 = 200-230/380-460V 50/60Hz Three Phase 906 = 110-120V 50/60Hz Single Phase 907 = 100-105V 50/60Hz Single Phase 925 = 200-230V 50/60Hz Three Phase

The object of the declaration described above is in conformity with relevant statutory requirements:

Supply of Machinery (Safety) Regulations 2008
The objectives of the Electrical Equipment (Safety) Regulations 2016 are governed by Annex 1 1.5.1 of this regulation.

Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016

II 3 G Ex h IIB T4 Gc
TCF 218

Only the internal pumping mechanism is classified as ATEX category 3, external parts and motor are not in scope

Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

Relevant designated standards or technical specifications are as follows:

EN 1012-2:1996 +A1:2009	Compressors and vacuum pumps. Safety requirements. Vacuum pumps
EN 61010-1:2010 *	Safety requirements for electrical equipment for measurement, control and laboratory use. General requirements
* *1-phase pumps only*	*The pumps comply with EN 61010-1 when installed in accordance with the instruction manual supplied with the pumps.*
EN ISO 80079-36:2016	Explosive atmospheres – Part 36: Non-electrical equipment for explosive atmospheres. Basic method and requirements
EN ISO 80079-37:2016	Explosive atmospheres - Part 37: Non-electrical equipment for explosive atmospheres --

Non-electrical type of protection constructional safety ''c'', control of ignition sources ''b'', liquid immersion ''k''

This declaration, based on the requirements of the listed Statutory Instruments and EN ISO/IEC 17050-1, covers all product serial numbers from this date on: *2022-06-20*

You must retain the signed legal declaration for future reference
This declaration becomes invalid if modifications are made to the product without prior agreement.

Signed for and on behalf of Edwards Ltd

Petr Šmérek – Engineering Manager
Scientific Vacuum Division
Lutín, CZ

Jan Večeřa – General Manager
Lutín, CZ

ADDITIONAL LEGISLATION AND COMPLIANCE INFORMATION

RoHS (EU, UK): Material Exemption Information

This product is compliant with the following Exemptions
Annex III:

- 6(c) Copper alloy containing up to 4% **lead** by weight

REACH (EU, UK)

This product is a complex article which is not designed for intentional substance release. To the best of our knowledge the materials used comply with the requirements of REACH. The product manual provides information and instruction to ensure the safe storage, use, maintenance and disposal of the product including any substance based requirements.

Article 33.1 Declaration (EU, UK)

This product contains Candidate List Substances of Very High Concern above 0.1%ww by article as clarified under the 2015 European Court of Justice ruling in case C-106/14.

- Lead (Pb)
  This substance is present in certain brass components.

TSCA PBTs (US)

Regulation of Persistent, Bioaccumulative, and Toxic Chemicals Under TSCA Section 6(h)
The product does not knowingly or intentionally contain substances in contravention with the above requirements.

Additional Applicable Requirements

The product is in scope for and complies with the requirements of the following:

2012/19/EU	Directive on waste electrical and electronic equipment (WEEE)
CSA-C22.2 No.77-2014 #	Motors with inherent overheating protection
CSA-C22.2 No.100-2014 #	Motors and generators
Product is certified to CSA-C22.2 No.61010-1-12	Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements
Product is certified to UL61010-1 3rd Edition	Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements
# 1- phase pumps only	*Canadian Standards Authority and Underwriters Laboratory*

材料成分声明
China Material Content Declaration

部件名称 Part name	有害物质 Hazardous Substances					
	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)
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.

This product has been manufactured under a quality management system certified to ISO 9001:2015

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