

Instruction Manual

Low Voltage EXT Compound Molecular Pumps:
EXT70H 24V, EXT70Hi 24V*, EXT255H 24V and EXT255Hi 24 V



Description	Item Number
EXT70H/ISO63 24 V	B722-21-991
EXT70H/CF63 24 V	B722-22-991
EXT70H/NW40 24 V	B722-23-991
EXT70H/ISO100 24 V	B722-26-991
EXT255H/ISO100 24 V	B753-01-991
EXT255H/CF100 24 V	B753-02-991
EXT255Hi/ISO100 24 V	B753-03-991
EXT255H/ISO100 24 V (Coarse Inlet Screen)	B753-05-991

* The EXT70Hi 24 V pump is an EXT70H/ISO63 24 V pump with an interstage-port accessory fitted. Refer to the text of this instruction manual for further information.





Declaration of Conformity

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

declare under our sole responsibility that the product(s)

Low voltage EXT Compound Molecular Pumps:

EXT70H/ISO63 24V	B722-21-991
EXT70H/CF63 24V	B722-22-991
EXT70H/NW40 24V	B722-23-991
EXT70H/ISO100 24V	B722-26-991
EXT255H/ISO100 24V	B753-01-991
EXT255H/CF100 24V	B753-02-991
EXT255Hi/ISO100 24V	B753-03-991
EXT255H/ISO100 24V (Coarse Inlet Screen)	B753-05-991

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

EN ISO12100-2: 2003	Safety of machinery. Basic concepts, general principals for design. Technical principals.
EN61010-1: 2001	Safety requirements for electrical equipment for measurement, Control and laboratory use. General requirements.*
EN1012-2: 1997 EN61326: 1997† + A1: 1998 + A2: 2001 (Industrial Location, Class B Emissions) C22.2 No 61010.1-04#	Compressors and vacuum pumps. Safety requirements. Vacuum pumps. Electrical equipment for measurement, control and laboratory use. EMC requirements.
UL61010-1 (2 nd Edition) #	Safety requirements for electrical equipment for measurement, Control and laboratory use, Part 1: General requirements Safety requirements for electrical equipment for measurement, Control and laboratory use, Part 1: General requirements


* The pumps comply with EN61010-1 (2001) when installed in accordance with the instruction manual supplied with the pumps.

† EN61326 Immunity classification is dependent on the controller (see the controller manual for details).

Pumps only comply with the Canadian Standard Authority and Underwriters Laboratory when used with EXDC 24V family of controllers.

following the provisions of:

2006/95/EC	Low Voltage Directive.
2004/108/EC	Electromagnetic Compatibility Directive.
98/37/EC	Machinery Safety Directive.


B. D. Brewster, Technical Manager
Burgess Hill Products

24th October 2007
BURGESS HILL
Date and Place

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

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Associated publications

Publication title

EXDC Turbomolecular pump drive modules

Publication number

D396-40-880

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1 Introduction

1.1 Scope and definitions

This manual provides installation, operation and maintenance instructions for the Edwards EXT70H 24 V, EXT70Hi 24 V, EXT255H 24 V and EXT255Hi 24 V Compound Molecular Pumps. These pumps must be used as specified in this manual. It is not possible to purchase an EXT70Hi 24 V pump; an EXT70Hi 24 V pump is an EXT70H/ISO63 24 V pump fitted with an interstage-port accessory: see [Section 7](#).

The EXT Compound Molecular Pumps are designed for use with a Edwards Turbomolecular Pump Drive Module (abbreviated to EXDC Drive Module in the remainder of this manual). Read this manual and the instruction manual supplied with your EXDC Drive Module before you attempt to install or operate the equipment. The instruction manual supplied with your EXDC Drive Module contains details of how to set up the Module and the logic interface.

Important safety information in this manual is highlighted as WARNING and CAUTION instructions; you must obey these instructions. The use of WARNINGS and CAUTIONS is defined below.



WARNING

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

CAUTION

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

In accordance with the recommendations of EN61010, the following warning symbols may appear on the pump or its accessories:



Warning - refer to accompanying documentation.



Warning - risk of electric shock.



Warning - hot surfaces.



Protective conductor terminal.

The units used throughout this manual conform to the SI international system of units of measurement. Also throughout this manual, wherever flow rates are specified, the abbreviation 'sccm' is used to mean 'standard $\text{cm}^3 \text{min}^{-1}$ ': this is a flow of $1 \text{ cm}^3 \text{min}^{-1}$ at an ambient temperature of 0°C and a pressure of 1013 mbar ($1.013 \times 10^5 \text{ Pa}$).

1.2 General description

The EXT70H 24 V, EXT70Hi 24 V, EXT255H 24 V and EXT255Hi 24 V pumps are compound vacuum pumps that combine a turbomolecular pump and a drag pump on a single shaft. The turbomolecular pump is made from a multi-stage axial-flow turbine which is optimised for operation in molecular flow conditions. The drag pump is designed for operation at higher pressures than conventional turbomolecular pumps.

The angled blades of the turbomolecular pump are machined from a single piece of material. For the blades to be effective, their speed must be close to the thermal velocity of the gas. The rotor of the EXT70H/Hi 24 V therefore rotates at up to 90000 r min⁻¹, and the rotor of the EXT255H/Hi 24 V rotates at up to 60000 r min⁻¹.

Gas from the inlet is compressed through each of the bladed stages of the turbomolecular pump and transferred to the drag pump. In the drag pump stages the gas is further compressed.

The rotating assembly is supported at the inlet end by a frictionless magnetic bearing and by a precision ceramic ball bearing at the outlet end. The ball bearing is lubricated from an oil reservoir and wick mechanism.

The EXT pump is supplied with an inlet-screen fitted in the bore of the inlet-flange. The EXT255Hi 24 V pump is also supplied with an inlet-strainer which fits in the interstage-port. The inlet-screen and inlet-strainer protect the pump against damage which would be caused by debris entering the pump. The inlet-screen also serves to protect the user against injury from the sharp blades in the pump.

The EXT pump has a vent-port for venting the pump and vacuum system to atmospheric pressure. The pump is supplied with a manual vent-valve fitted to the vent-port. As described in [Section 3.4](#), the manual vent-valve can be replaced with a TAV5 or TAV6 solenoid-operated vent-valve (available as an accessory: see [Section 7](#)).

The EXT255H 24 V and EXT255Hi 24 V pumps have a purge-port in the motor and bearing housing chamber. An inert purge gas can be introduced through the purge port in order to protect these parts from corrosion or the bearing lubricant from oxidation. An optional vent-port adaptor and purge restrictor can be fitted to the purge-port to control the flow rate of the purge gas and to filter the gas supply (see [Section 7](#)).

The EXT255Hi 24 V pump has an interstage-port between the turbomolecular and drag stages. If required, an interstage-port accessory can be fitted to an EXT70H/ISO63 24 V pump to upgrade it to an EXT70Hi 24 V pump (see [Section 7](#)). The interstage-port on EXT70Hi 24 V and EXT255Hi 24 V pumps can be used to pump a separate chamber of the vacuum system or to back another turbomolecular pump.

If the EXT70Hi 24 V pump operates with an outlet pressure of less than 5 mbar (500 Pa) and an interstage inlet flow of less than 100 sccm (1.69 mbar l s⁻¹, 169 Pa l s⁻¹) the vacuum performance at the turbomolecular pump-inlet is independent of the interstage operating conditions.

If the EXT255Hi 24 V pump operates with an outlet pressure of less than 5 mbar (500 Pa) and an interstage inlet flow of less than 70 sccm (1.17 mbar l s⁻¹, 117 Pa l s⁻¹), the vacuum performance at the turbomolecular pump-inlet is independent of the interstage operating conditions.

An EXDC 24 V Drive Module is used to control the EXT 24 V pump. The EXDC 24 V Drive Module is fitted directly to the 19-way connector on the pump.

The pump may be cooled using air-cooled or water-cooled optional accessories. Refer to [Section 3](#) for guidance on applications and cooling requirements. Pumps with a Conflat flange are supplied with a water-cooler.

All EXT pumps have thermal sensors to monitor the motor and pump-body temperature.

1.3 Vent options and vent control

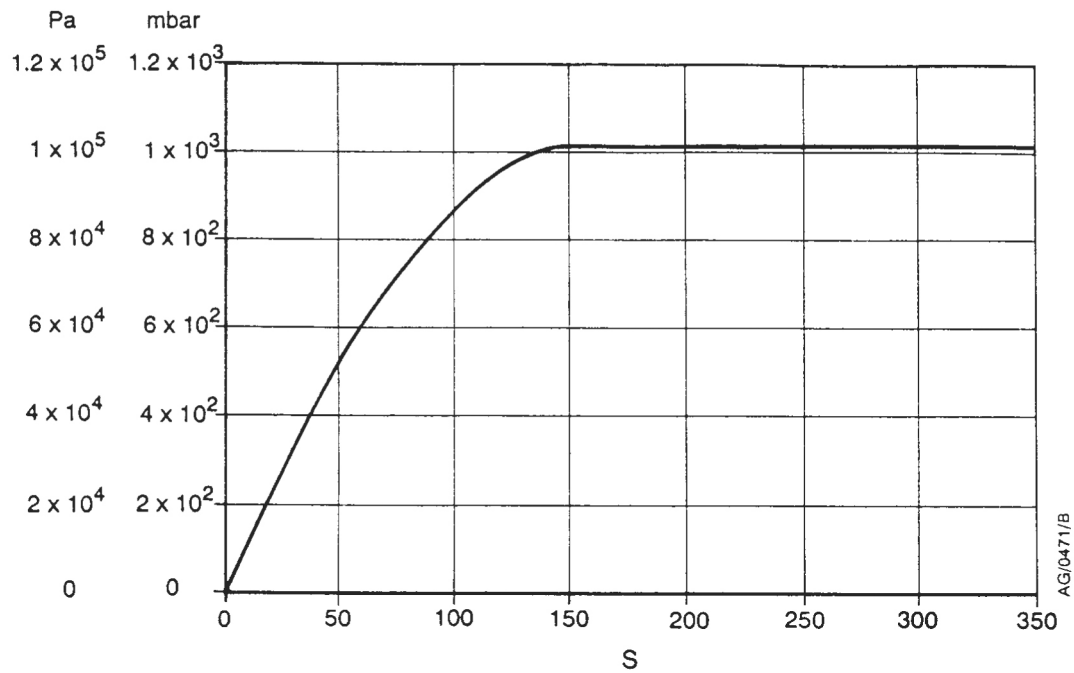
To maintain the cleanliness of the vacuum system, it is recommended that, whenever the pump is switched off, the pump (or vacuum system) is vented when the speed of the EXT pump is between full rotational speed and 50% of full rotational speed. At and above 50% of full rotational speed, the rotor spins fast enough to suppress any backstreaming of hydrocarbon oil from your backing pump.

However, if the pump is vented when it is at full rotational speed and the rate of pressure rise is too high, the pump life may be reduced. It is therefore recommended that either the rate of pressure rise is limited (see [Figure 1](#)), or that the vent-valve is only opened after the EXT pump speed has fallen to 50% of full rotational speed.

The rate of pressure rise cannot be controlled by the manual vent-valve, so if the manual vent-valve is used it must only be opened after the EXT pump speed has fallen to 50% of full rotational speed.

If a TAV vent-valve is used, but the rate of pressure rise cannot be limited, the vent-valve must only be opened after the speed of the EXT pump has fallen to 50% of full rotational speed.

Figure 1 - Maximum allowed rate of pressure rise during venting: pressure against time (with the pump initially at full rotational speed)



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2 Technical data

2.1 General

Performance	See Table 1 and 2
Cooling, noise and electrical data	See Table 1 and 2
Dimensions	See Table 2 and 3
Maximum inlet-flange temperature	100 °C
Maximum magnetic field (EXT255H/Hi)	3.5 mT horizontal field; 7 mT vertical field
Maximum magnetic field (EXT70H/Hi)	5 mT
Installation category	EN61010 part 1, Category 1
Pollution degree	CAN/CSA, UL, EN61010 part 1
Altitude	2000 m
Humidity	10 to 90% non condensing
Electrical supply	24 V d.c.
Equipment type	Fixed equipment, for indoor use only

2.2 Pumping media



WARNING

Vent dangerous gases and gas mixtures safely. Do not expose people to these gases.



WARNING

Do not use EXT pumps to pump explosive gas mixtures as the pumps are not suitable for this purpose.



WARNING

On EXT70Hi 24 V and EXT255Hi 24 V pumps, gas pumped through the interstage-port will mix with gas pumped through the pump-inlet. Ensure that the gases will not react or combine to form dangerous gases and substances.

CAUTION

Do not use an EXT to pump gases containing more than 20% oxygen unless the pump is gas purged. If you do, the lubricant will polymerise and the pump will fail prematurely.

CAUTION

Do not use an EXT to pump mercury vapour and do not allow mercury (for example, from a McLeod gauge) to come into contact with the pump. If you do, the pump rotor may corrode and fail.

Note: Note that concentrations of gases may be modified by the compression of the pump.

2.2.1 Pumps without gas purge

The pumps are designed to pump the following residual gases normally used in high-vacuum systems:

- Air
- Nitrogen
- Carbon dioxide
- Carbon monoxide
- Krypton
- Helium
- Neon
- Argon
- Hydrogen
- Ethane
- Propane
- Butane
- Methane

The pumps may be used to pump oxygen and water vapour, subject to the following conditions:

- Oxygen The oxygen concentration must be less than 20% by volume
- Water vapour You must ensure that vapour does not condense inside the pump; refer to [Section 3.7.3](#).

If you wish to pump a gas not in the list above, contact your supplier for advice. If you do not contact your supplier, you may invalidate the warranty on the pump. The pumps are not suitable for pumping aggressive or corrosive gases.

2.2.2 Pumps with gas purge (EXT255H 24 V and EXT255Hi 24 V only)

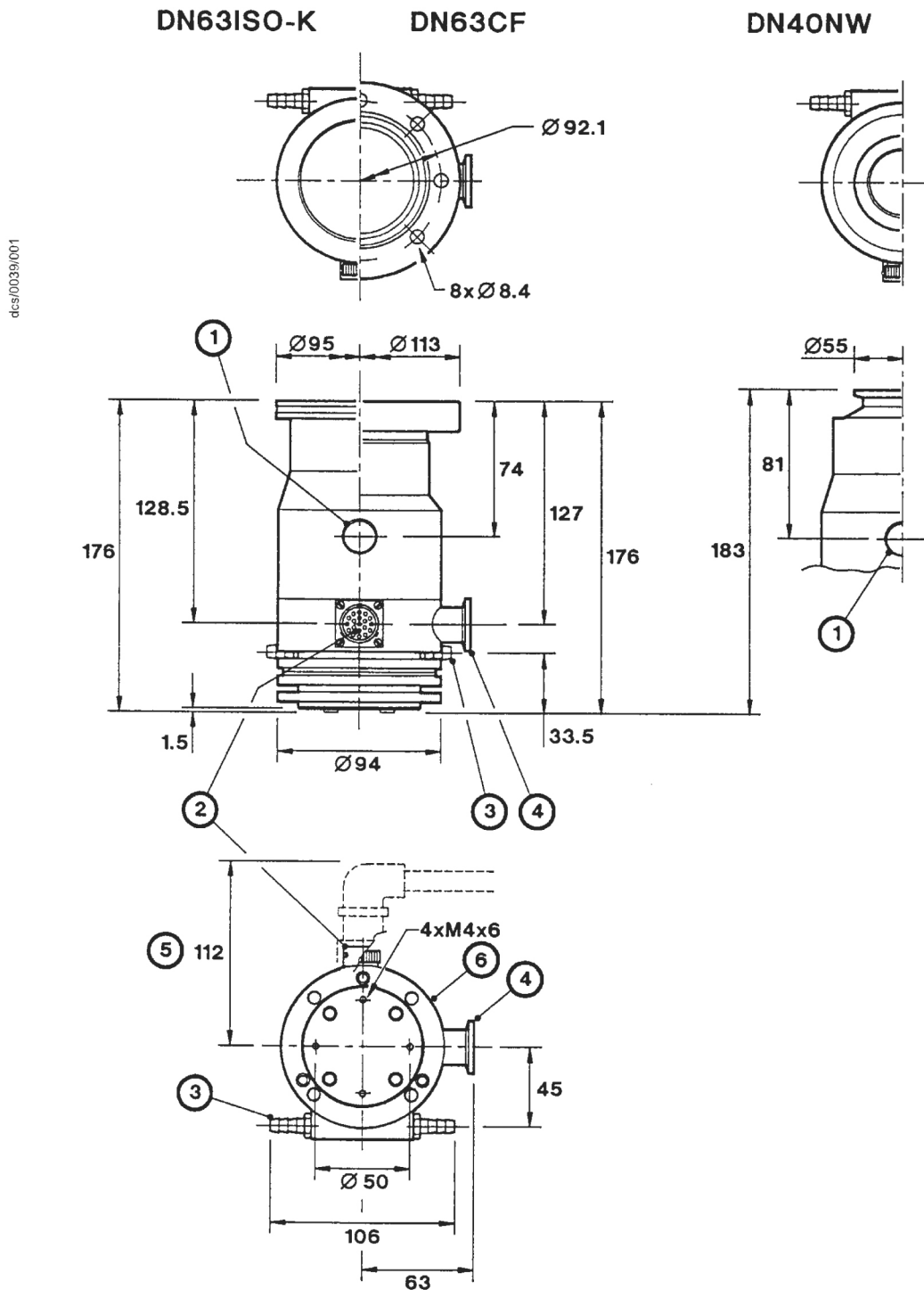
When purged with an inert gas, the pumps can be used to pump oxygen in concentrations above 20% by volume.

2.3 Vent gas specification and vent control data

Although the pump may be vented to atmospheric air, high relative humidity of the air may greatly increase the subsequent pumping time. To reduce pump-down times, vent the pump with dry, clean gases.

Vent gas	Dry air, nitrogen, argon or other inert gases
Maximum dew point at atmospheric pressure	- 22 °C
Maximum size of particulates	1 µm
Maximum concentration of oil	0.1 parts per million
Time for rotational speed to reach 50%	15 s
Maximum allowed rate of pressure rise	See Figure 1

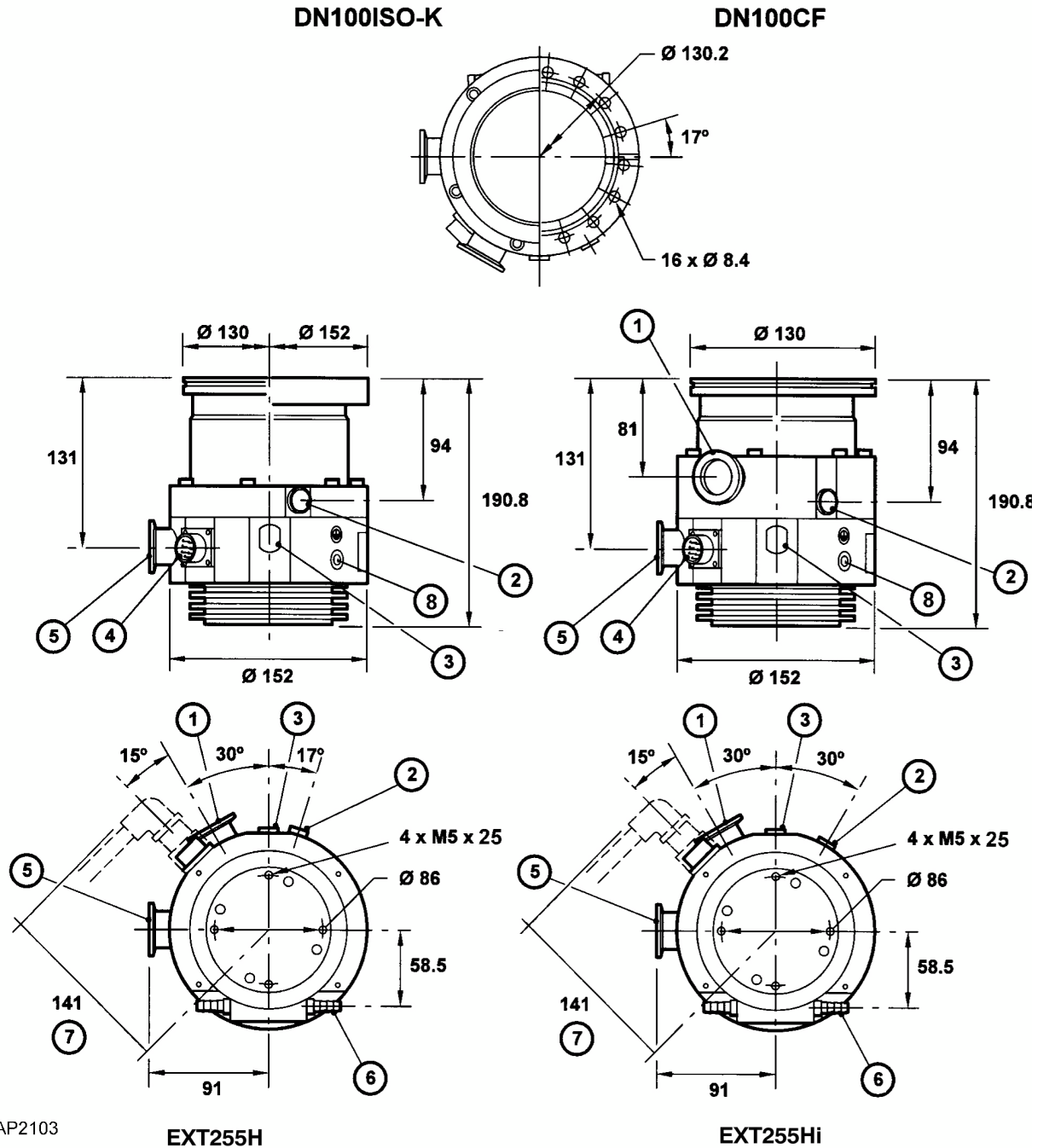
Figure 2 - EXT70H 24 V dimensions (mm)



des/0039/001

- | | |
|--------------------------------|--|
| 1. Vent-valve | 4. Backing-port |
| 2. Electrical supply connector | 5. Allowance for right-angle cable connector |
| 3. Cooling-water connectors | 6. Position of blanked off interstage port
(70H ISO63 only) |

Figure 3 - EXT255H/Hi 24 V dimensions (mm)



- | | |
|--|--|
| 1. Interstage port (EXT 255Hi 24 V only) | 5. Backing-port |
| 2. Vent-valve | 6. Cooling-water connectors |
| 3. Purge-port | 7. Allowance for right-angle cable connector |
| 4. Electrical supply connector | 8. Earth (ground) bonding point |

2.4 Purge gas specification (EXT255H 24 V and EXT255Hi 24 V only)

Purge gas	Dry nitrogen, argon or other inert gases
Maximum dew point at atmospheric pressure	-22 °C
Maximum size of particulates	1 µm
Maximum concentration of oil	0.1 parts per million
Allowable purge gas flow (when required)	20 to 100 sccm (0.33 to 1.67 mbar l s ⁻¹ , 33 to 167 Pa l s ⁻¹)
Recommended purge gas flow	25 sccm (0.42 mbar l s ⁻¹ , 42 Pa l s ⁻¹)
Maximum allowable purge gas supply pressure	2 bar (gauge); 29 psi, 3 x 10 ⁵ Pa

2.5 Cooling-water

The following cooling-water specification corresponds to a typical high-quality drinking water specification. Check with your water supply authority if you are in doubt about the quality of your supply.

Quality	Mechanically clean and optically clear with no deposits or turbidity.
pH value	6.0 to 8.0
Maximum calcium carbonate concentration	75 parts per million
Maximum chloride concentration	100 parts per million
Minimum oxygen concentration	4 parts per million
Minimum water-cooling flow rate (at 15 °C)	15 l h ⁻¹
Water temperature	See Table 1 and 2
Maximum water pressure	5 bar (gauge), 73.5 psig, 6 x 10 ⁵ Pa
Materials exposed to cooling water	Nickel plated brass

2.6 Materials exposed to gases pumped

The following materials and component types are exposed to the gases pumped: aluminium alloys, stainless steels, PEEK (polyether- etherketone) 450G, fluoroelastomer and nitrile 'O'-rings, hydrocarbon lubricant, felt, rare earth magnets, silicon nitride, phenolic resin and carbon- fibre reinforced epoxy resin.

Table 1 - EXT 70H 24 V / EXT 70Hi 24 V technical data

Parameter	EXT70H/ISO63 24 V	EXT70H/ ISO100 24 V	EXT70H/63CF 24 V	EXT70H/NW40 24 V	Notes
Mass	2.8 kg	2.8 kg	4.7 kg	2.8 kg	
Inlet-flange	DN63ISO-K	DN100ISO-K	DN63CF	DN40NW	
Outlet-flange	DN16NW	DN16NW	DN16NW	DN16NW	
Vent-port	1/8 inch BSP	1/8 inch BSP	1/8 inch BSP	1/8 inch BSP	
Interstage-port	DN25NW*	-	-	-	
Purge-flange	-	-	-	-	

Table 1 - EXT 70H 24 V / EXT 70Hi 24 V technical data (continued)

Parameter	EXT70H/ISO63 24 V	EXT70H/ ISO100 24 V	EXT70H/63CF 24 V	EXT70H/NW40 24 V	Notes
Inlet pumping speed					
N ₂ ^{† ‡}	65 l s ⁻¹	71 l s ⁻¹	65 l s ⁻¹	52 l s ⁻¹	Pb < 5 mbar (500Pa), Qi < 100 sccm (1.68 mbar l s ⁻¹ , 168 Pa l s ⁻¹)
He ^{† ‡}	60 l s ⁻¹	62 l s ⁻¹	60 l s ⁻¹	53 l s ⁻¹	Pb < 5 mbar (500 Pa) Qi = 0
H ₂ ^{† ‡}	50 l s ⁻¹	51 l s ⁻¹	50 l s ⁻¹	46 l s ⁻¹	Pb < 2 mbar (200 Pa) Qi = 0
Inlet compression ratio					
N ₂ [‡]	> 1 x 10 ⁸	> 1 x 10 ⁸	> 1 x 10 ⁸	> 1 x 10 ⁸	Pb < 10 mbar (1000 Pa)
He [‡]	4 x 10 ⁵	4 x 10 ⁵	4 x 10 ⁵	4 x 10 ⁵	Pb < 3 mbar (300 Pa)
H ₂ [‡]	3 x 10 ⁴	3 x 10 ⁴	3 x 10 ⁴	3 x 10 ⁴	Pb < 1 mbar (100 Pa)
Interstage pumping speed [†]					
N ₂ [‡]	6 l s ⁻¹	-	-	-	Pb = 5 mbar (500 Pa) Qi = 100 sccm (1.69 mbar l s ⁻¹ , 169 Pa l s ⁻¹) Qp = 0 sccm
Ultimate pressure with rotary vane backing pump: ^{**}	< 5 x 10 ⁻⁹ mbar < 5 x 10 ⁻⁷ Pa	< 5 x 10 ⁻⁹ mbar < 5 x 10 ⁻⁷ Pa	< 5 x 10 ⁻¹⁰ mbar < 5 x 10 ⁻⁸ Pa	< 5 x 10 ⁻⁹ mbar < 5 x 10 ⁻⁷ Pa	
with diaphragm backing pump: ^{††}	< 5 x 10 ⁻⁸ mbar < 5 x 10 ⁻⁶ Pa	< 5 x 10 ⁻⁸ mbar < 5 x 10 ⁻⁶ Pa	< 5 x 10 ⁻⁹ mbar < 5 x 10 ⁻⁷ Pa	< 5 x 10 ⁻⁸ mbar < 5 x 10 ⁻⁶ Pa	
Maximum backing pressure ^{‡‡}					
N ₂	12 mbar 1.2 x 10 ² Pa	12 mbar 1.2 x 10 ² Pa	12 mbar 1.2 x 10 ² Pa	12 mbar 1.2 x 10 ² Pa	
He	8 mbar 8 x 10 ¹ Pa	8 mbar 8 x 10 ¹ Pa	8 mbar 8 x 10 ¹ Pa	8 mbar 8 x 10 ¹ Pa	
H ₂	2.5 mbar 2.5 x 10 ² Pa	2.5 mbar 2.5 x 10 ² Pa	2.5 mbar 2.5 x 10 ² Pa	2.5 mbar 2.5 x 10 ² Pa	
Minimum backing pump displacement	0.6 m ³ h ⁻¹	0.6 m ³ h ⁻¹	0.6 m ³ h ⁻¹	0.6 m ³ h ⁻¹	
Maximum continuous inlet pressure ^{***}					
Nitrogen:					
water cooling (water at 15 °C, 40 °C ambient) ^{***}	2 x 10 ⁻² mbar (2 Pa)	2 x 10 ⁻² mbar (2 Pa)	2 x 10 ⁻² mbar (2 Pa)	2 x 10 ⁻² mbar (2 Pa)	
air cooling at 35 °C ^{***}	1 x 10 ⁻² mbar (1 Pa)	1 x 10 ⁻² mbar (1 Pa)	1 x 10 ⁻² mbar (1 Pa)	1 x 10 ⁻² mbar (1 Pa)	

Table 1 - EXT 70H 24 V / EXT 70Hi 24 V technical data (continued)

Parameter	EXT70H/ISO63 24 V	EXT70H/ ISO100 24 V	EXT70H/63CF 24 V	EXT70H/NW40 24 V	Notes
Argon:					
water cooling at 15 °C ***	9 x 10 ⁻³ mbar 9 x 10 ⁻¹ Pa	9 x 10 ⁻³ mbar 9 x 10 ⁻¹ Pa	9 x 10 ⁻³ mbar 9 x 10 ⁻¹ Pa	9 x 10 ⁻³ mbar 9 x 10 ⁻¹ Pa	
air cooling at 35 °C ***	5 x 10 ⁻³ mbar 5 x 10 ⁻¹ Pa	5 x 10 ⁻³ mbar 5 x 10 ⁻¹ Pa	5 x 10 ⁻³ mbar 5 x 10 ⁻¹ Pa	5 x 10 ⁻³ mbar 5 x 10 ⁻¹ Pa	
Recommended backing pump †††	E2M0.7	E2M0.7	E2M0.7	E2M0.7	
Operating attitude	Vertical and upright through to horizontal ± 2°				
Nominal rotational speed	90000 r min ⁻¹	90000 r min ⁻¹	90000 r min ⁻¹	90000 r min ⁻¹	
Starting time to 90% speed (EXDC80)	≤ 100 sec	≤ 100 sec	≤ 100 sec	≤ 100 sec	
Cooling method:	Forced-air/water				
Ambient air temperature (forced-air cooling)	0 - 35 °C				
Water temperature (water-cooling)	10 - 20 °C				
Noise level (at 1 metre)	<50 dB(A)				
Compatible drive modules	EXDC80 24 V				
EXDC80 24V maximum power input	93 W				

* Optional accessory.

† Pumping speeds are without inlet-screen or inlet-strainer. Inlet-screens and inlet-strainers reduce speed by approximately 10% for ISO63. For ISO100 this reduction is less pronounced.

‡ P_b = backing pressure, Q_i = flow through the interstage-port (EXT70Hi only), Q_p = flow through pump-inlet

** Ultimate pressure 48 hours after bakeout with 2-stage rotary vane backing-pump.

†† Ultimate pressure 48 hours after bakeout with $P_b < 5$ mbar (500 Pa).

‡‡ Inlet pressure has risen to 1 x 10⁻³ mbar (1 x 10⁻¹ Pa).

*** Above this pressure, rotational speed drops below nominal.

††† A larger backing-pump may be required for maximum throughput. A suitable diaphragm pump with ultimate < 5 mbar may also be used.

Table 2 - EXT255H 24 V / EXT255Hi 24 V technical data

Parameter	EXT255H 24V	EXT255Hi 24V	Notes
Mass			
DN100ISO-K inlet flange	5.6 kg	6.0 kg	
DN100CF inlet flange	8.2 kg	N/A	

Table 2 - EXT255H 24 V / EXT255Hi 24 V technical data (continued)

Parameter	EXT255H 24V	EXT255Hi 24V	Notes
Inlet-flange	DN100ISO-K/ DN100CF	DN100ISO-K	
Outlet-flange	DN25NW	DN25NW	
Vent-port	1/8 inch BSP	1/8 inch BSP	
Interstage-port	-	DN25NW	
Purge-flange	DN10NW *	DN10NW *	
Inlet pumping speed			
N ₂ † ‡	220 l s ⁻¹	220 l s ⁻¹	Pb <5 mbar (500 Pa) Qi <70 sccm (1.17 mbar l s ⁻¹ , 117 Pa l s ⁻¹)
He † ‡	230 l s ⁻¹	230 l s ⁻¹	Pb <1 mbar (100 Pa) Qi = 0 sccm
H ₂ † ‡	180 l s ⁻¹	180 l s ⁻¹	Pb <0.5 mbar (50 Pa) Qi = 0 sccm
Inlet compression ratio			
N ₂ † ‡	> 1 x 10 ⁸	> 1 x 10 ⁸	Pb <5 mbar (500 Pa)
He † ‡	4 x 10 ⁵	3 x 10 ⁵	Pb <2 mbar (200 Pa)
H ₂ † ‡	1 x 10 ⁴	1 x 10 ⁴	Pb <1 x 10 ⁻² mbar (1 Pa)
Interstage pumping speed ‡			
N ₂ †	-	10 l s ⁻¹	Pb = 5 mbar (500 Pa) Qi = 240 sccm (4 mbar l s ⁻¹) (400 Pa l s ⁻¹) Qp = 0 sccm
Ultimate pressure with rotary vane backing pump **			
DN100ISOK inlet flange	< 5 x 10 ⁻⁹ mbar < 5 x 10 ⁻⁷ Pa	< 5 x 10 ⁻⁹ mbar < 5 x 10 ⁻⁷ Pa	
DN100CF inlet flange	< 5 x 10 ⁻¹⁰ mbar < 5 x 10 ⁻⁸ Pa		
Ultimate pressure with diaphragm backing pump ††			
DN100ISOK inlet flange	< 5 x 10 ⁻⁸ mbar < 5 x 10 ⁻⁶ Pa	< 5 x 10 ⁻⁸ mbar < 5 x 10 ⁻⁶ Pa	
DN100CF inlet flange	< 5 x 10 ⁻⁹ mbar < 5 x 10 ⁻⁷ Pa		
Maximum backing pressure ††			
N ₂	12 mbar (1200 Pa)	12 mbar (1200 Pa)	
He	9 mbar (900 Pa)	9 mbar (900 Pa)	
H ₂	2.5 mbar (250 Pa)	2.5 mbar (250 Pa)	

Table 2 - EXT255H 24 V / EXT255Hi 24 V technical data (continued)

Parameter	EXT255H 24V	EXT255Hi 24V	Notes
Minimum backing pump displacement	0.6 m ³ h ⁻¹	0.6 m ³ h ⁻¹	
Maximum continuous inlet pressure: ***			
Nitrogen:			
water-cooling (water at 15 °C, ambient 40 °C) ***	5 x 10 ⁻³ mbar 5 x 10 ⁻¹ Pa	5 x 10 ⁻³ mbar 5 x 10 ⁻¹ Pa	
air-cooling at 35 °C ***	5 x 10 ⁻³ mbar 5 x 10 ⁻¹ Pa	5 x 10 ⁻³ mbar 5 x 10 ⁻¹ Pa	
Argon:			
water-cooling (water at 15 °C, ambient 40 °C) ***	3 x 10 ⁻³ mbar 3 x 10 ⁻¹ Pa	3 x 10 ⁻³ mbar 3 x 10 ⁻¹ Pa	
air-cooling at 35 °C ***	2 x 10 ⁻³ mbar 2 x 10 ⁻¹ Pa	2 x 10 ⁻³ mbar 2 x 10 ⁻¹ Pa	
Operating attitude	Vertical and upright through to horizontal ± 2°		
Nominal rotational speed	60000 r min ⁻¹	60000 r min ⁻¹	
Compatible drive modules:	EXDC160 24V, EXDC80 24V		
Maximum power input:			
EXDC80 24 V		93 W	
EXDC160 24 V		187 W	
Starting time to 90% speed (EXDC160 24 V drive module)	< 180 s	< 180 s	
Cooling method	forced air / water	forced air / water	
Ambient air temperature (forced air cooling)	0-35 °C	0-35 °C	
Water temperature (water cooling)	10-20 °C	10-20 °C	
Noise level at 1 meter	50dB(A)		
Recommended backing pump †††	RV3	RV3	

* Not supplied - pump supplied with port blanked.

† Pb = backing pressure, Qj = flow through the interstage-port (EXT255Hi only), Qp = flow through pump-inlet.

‡ Pumping speeds are without inlet-screen or inlet-strainer (EXT255Hi only). Inlet-screens and inlet-strainers reduce speed by approximately 10%.

** Ultimate pressure 48 hours after bakeout with Pb < 10⁻² mbar (1 Pa).

†† Ultimate pressure 48 hours after bakeout with Pb < 5 mbar (500Pa).

‡‡ Inlet pressure has risen to 1 x 10⁻³ mbar (1 x 10⁻¹ Pa).

*** Above this pressure, rotational speed drops below nominal due to thermal limitation of pump and / or control module.

††† A larger backing pump may be required for maximum throughput.

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3 Installation



WARNING

Safely route all vacuum, vent/purge gas and cooling-water pipelines, and all electrical cables and wires, so that people cannot trip over them.

3.1 Unpack and inspect

The pump is packed to prevent damage in transit. Take care when unpacking the pump to avoid excessive shocks which could damage the bearings and reduce the life of the pump. The pump is supplied with the inlet and outlet sealed to prevent entry of dust and vapour. Do not remove these seals until you are ready to install the pump on the vacuum system.

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

Check that the package contains the items listed in [Table 3](#). If any of these items is missing, notify your supplier in writing within three days.

Table 3 - Checklist of items

Qty	Description	Check (✓)
1	EXT turbomolecular pump	<input type="checkbox"/>
1	Inlet seal (trapped 'O' ring Co-Seal or copper compression gasket)	<input type="checkbox"/>
1	Inlet-strainer (EXT255Hi only: fitted in the interstage-port)	<input type="checkbox"/>

If the pump is not to be used immediately, store the pump in suitable conditions as described in [Section 6.1](#).

Do not discard the packing materials; retain them to repack the pump when you return it for service.

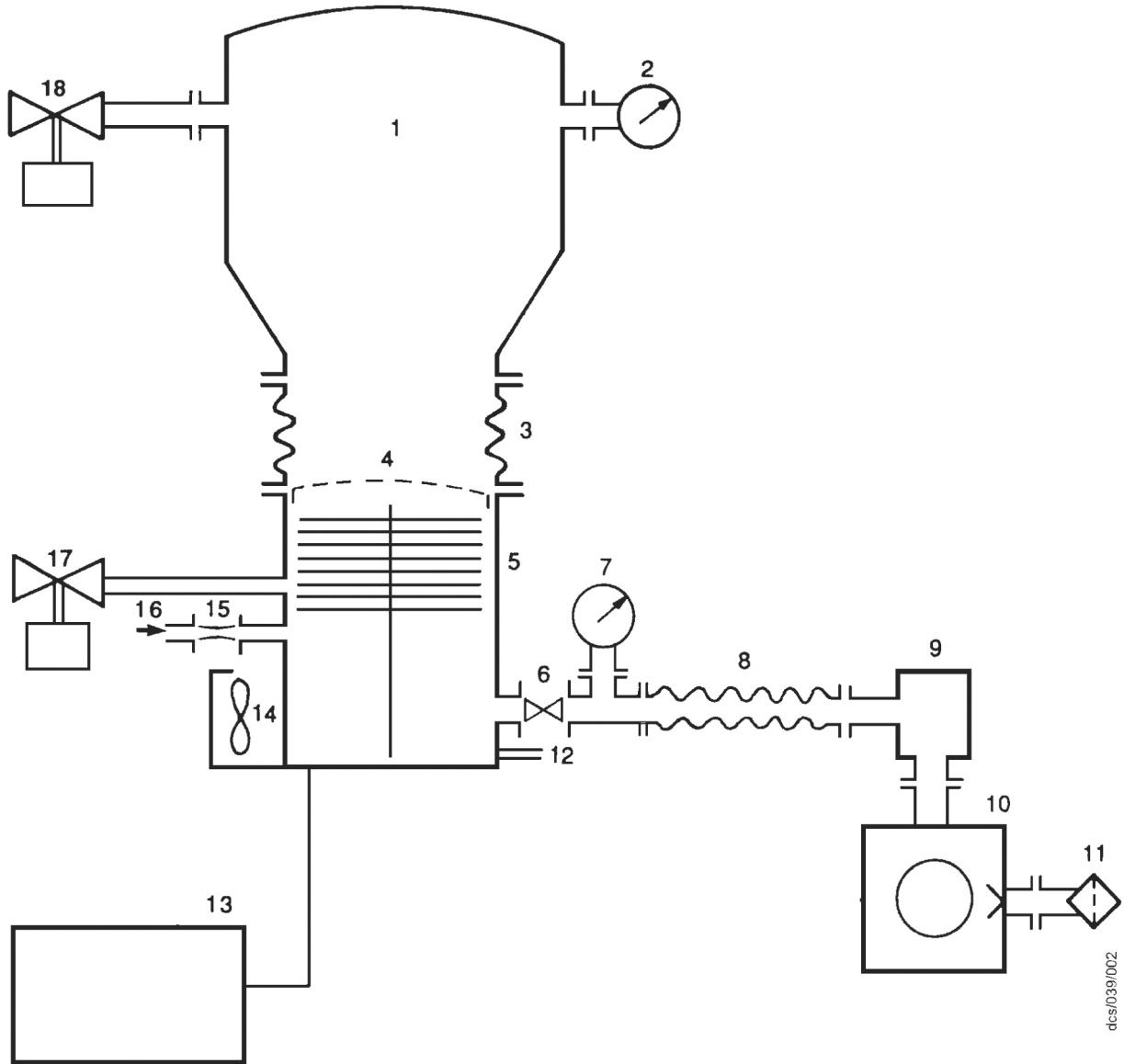
3.2 Typical installation

A typical pumping system with an EXT255H 24V pump is shown in [Figure 4](#). A typical pumping system with an EXT255Hi 24 V pump is shown in [Figure 5](#). When necessary, purge the EXT255H/Hi 24 V pump with inert gas as described in [Section 3.5](#).

Typical pumping systems with an EXT70H 24 V and EXT70Hi 24 V pumps will be as shown in [Figure 4](#) and [5](#), but without the gas purge components (15, 16).

The accessories available for these EXT pumps are detailed in [Section 7](#); the accessories are shown in [Figure 7](#).

Figure 4 - Typical pumping system with an EXT70H or EXT255H pump

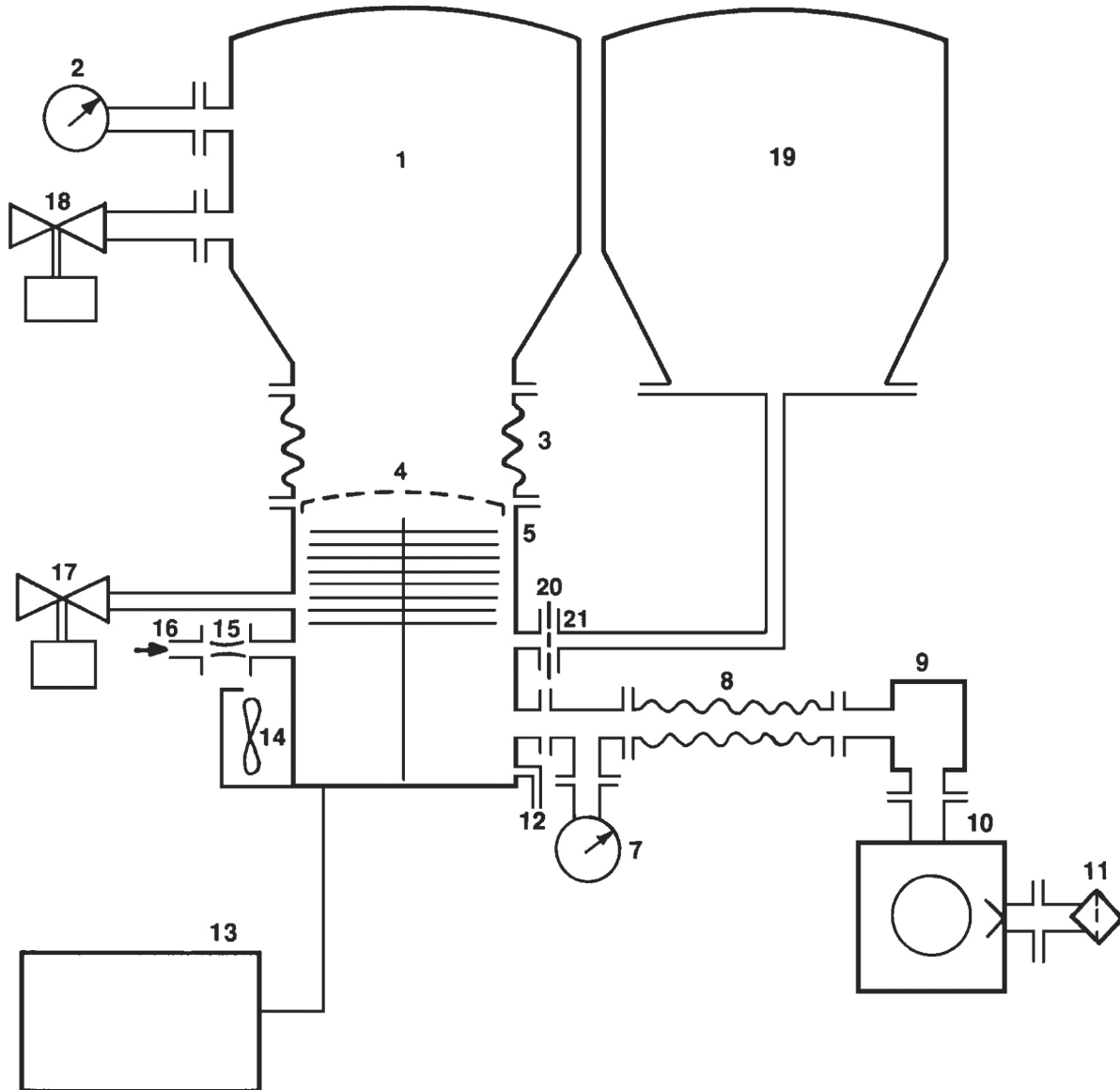


- | | | |
|-----------------------|------------------------------|---|
| 1. Vacuum system | 7. Vacuum gauge | 13. EXDC drive module |
| 2. High-vacuum gauge | 8. Flexible bellows | 14. Air-cooler |
| 3. Vibration isolator | 9. Foreline trap | 15. PRX10 purge restrictor * |
| 4. Inlet-screen | 10. Rotary backing-pump | 16. Regulated purge gas supply * |
| 5. EXT pump | 11. Mist filter | 17. Vent-valve |
| 6. Backing valve | 12. Cooling-water connectors | 18. Alternative position for vent-valve |

* EXT255H only

dcs/039/002

Figure 5 - Typical pumping system with an EXT70Hi or EXT255Hi pump



dcs/0039/003

- | | | |
|-----------------------|------------------------------|---|
| 1. Vacuum chamber 1 | 9. Foreline trap | 16. Regulated purge gas supply * |
| 2. High-vacuum gauge | 10. Rotary backing-pump | 17. Vent-valve |
| 3. Vibration isolator | 11. Mist filter | 18. Alternative position for vent-valve |
| 4. Inlet-screen | 12. Cooling-water connectors | 19. Vacuum chamber 2 |
| 5. EXT pump | 13. EXDC drive module | 20. Inlet-strainer |
| 6. Not used | 14. Air-cooler | 21. Interstage-port |
| 7. Vacuum gauge | 15. PRX10 purge restrictor * | |
| 8. Flexible bellows | | |

* EXT255Hi only

3.3 Connect to the vacuum system



WARNING

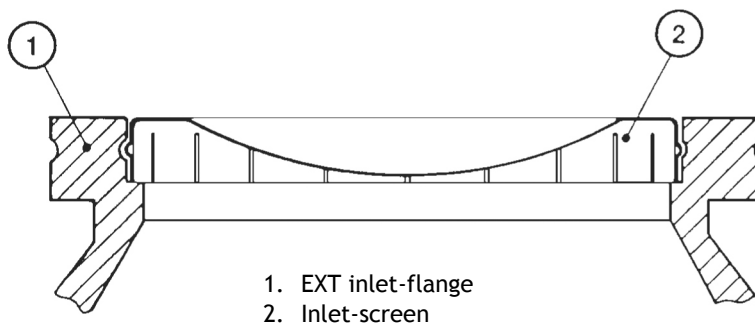
Install the pump in the vacuum system before you connect the EXDC Drive Module. This will ensure that the pump cannot operate and injure people during installation.

3.3.1 Inlet-screen

Do not remove the inlet-screen unless you can be sure that there is no danger that debris can fall into the pump. In order to avoid the danger of injury from the rotor blades, do not remove the inlet-screen until you are ready to mount the pump onto your system. If the screen is removed, the pumping speed will increase by approximately 10%. It is not possible to remove the inlet-screen from a pump with an NW inlet-flange.

To remove the inlet-screen from a pump with an ISO or CF inlet-flange, carefully extract it from the inlet-flange using a bent wire hook. To replace a screen which has been removed, install it as shown in Figure 6, with the Edwards logo uppermost. Ensure that the dimples on the rim of the screen engage in the groove in the pump flange. If necessary, gently bend the tags of the screen outwards to ensure a tight fit.

Figure 6 - Correct installation of the inlet-screen



- 1. EXT inlet-flange
- 2. Inlet-screen

AG/00591A

3.3.2 Mechanical fixing



WARNING

Do not operate the EXT pump until it is securely fixed. If the pump seizes, the stored energy of the rotor can cause rapid movement of the pump, which may cause damage and injury to people.

There are two ways in which the EXT pump can be securely fixed. Ideally, the EXT pump should be securely fixed by its inlet-flange to a rigid, firmly fixed vacuum system: see Section 3.3.4. If this is not possible because of the nature of the vacuum system, the base of the EXT pump must be securely fixed to a firm support: see Section 3.3.3.

3.3.3 Base mounting

Ensure that the base of the pump is securely fixed to a firm support (refer to [Figure 2](#) and [3](#) for the fixing hole details). If the pump supports the weight of the vacuum system, the mass of the vacuum system must be no more than 10 kg for an EXT70H/Hi pump, or no more than 20 kg for an EXT255H/Hi pump.

You must also ensure that your mounting method meets the following requirements, so that the EXT pump will remain secure in the event of a pump seizure:

- The support mounting must be able to withstand a destructive torque of 333 Nm for an EXT70H/Hi pump or 620 Nm for an EXT255H/Hi pump.
- Fit cap-head fixing screws through the tapped fixing-holes in the base of the pump (see [Figure 2](#) and [3](#)): use M4 screws for an EXT70H/Hi pump, and use M5 screws for an EXT255H/Hi pump.
- The fixing screws must comply with ISO 898-1, with a strength class of 12.9 (nominal tensile strength 1200 MPa).
- The fixing screw engagement length must be 6 mm or more.
- Tighten the fixing screws to a torque of 6 Nm (0.61 kgf m) on EXT70H/Hi pumps, and to a torque of 12 Nm (1.22 kgf m) on EXT255H/Hi pumps.

3.3.4 Inlet connection and orientation

The EXT pump can be fixed to the vacuum system by the inlet-flange. The pump can be mounted in any attitude from vertical and upright through to horizontal ($\pm 2^\circ$). If the pump is mounted horizontally and you use a rotary vane pump to back the EXT pump, the backing port must point vertically downwards ($\pm 20^\circ$) to reduce the risk of contamination from the backing pump oil.

Make sure that the pump-inlet and all components fitted to the pump-inlet are clean and dust-free. If the pump-inlet is not kept clean, the pump-down time may be increased.

The inlet-connection of the EXT pump is a CF flange, an ISO flange or an NW flange:

- If the pump has a CF flange, use the copper compression gasket supplied with the pump and use a full complement of bolts to connect the inlet-flange of the pump to the vacuum system.
- If the pump has an ISO flange, use the Edwards trapped 'O' ring supplied with the pump and use a minimum of four claw clamps to connect the inlet-flange of the pump to the vacuum system. Ensure that each claw clamp is tightened to a torque of 10 Nm or more.

Alternatively, use a rotatable collar and the trapped 'O' ring supplied with the pump to connect the inlet-flange of the pump to the vacuum system; use a full complement of bolts with the rotatable collar.

- If the pump has an NW flange, use the Co-Seal supplied with the pump and a suitable NW clamp to connect the inlet-flange of the pump to the vacuum system.

Ensure that no torque or other forces are transmitted to the pump from the vacuum system or the associated pipelines.

If necessary, fit an inlet vibration isolator between the pump-inlet and the vacuum system: refer to [Section 7.4.7](#) for the Item Numbers, and refer to the instruction manual supplied with the vibration isolator for installation details. If you fit a vibration isolator, you must securely fix the base of the EXT pump as described in [Section 3.3.3](#).

Note: *The first time you pump down the system to vacuum, you must re-tighten the bolts which secure the inlet-flange.*

3.3.5 Backing connection

Use suitable vacuum tubing and connectors to connect the NW flange of the backing-port to your backing-pump. If necessary, use flexible pipe or bellows to reduce the transmission of vibration from the backing-pump to the EXT pump.

It is recommended that you use an Edwards EM or RV backing-pump. The minimum size of the backing-pump required is given in [Table 1](#) and [2](#). It may be necessary to use a larger backing-pump if the pump is run at a high inlet pressure or high throughput, or if an EXT255H/Hi 24 V pump is purged with more than 25 sccm ($0.42 \text{ mbar l s}^{-1}$, 42 Pa l s^{-1}) of purge gas.

Do not use the EXT pump with a backing pressure below $1 \times 10^{-4} \text{ mbar}$ ($1 \times 10^{-2} \text{ Pa}$). Lower backing pressures will increase the evaporation rate of the lubricating oil and so will reduce the life of the bearings.

3.3.6 Interstage connection ((EXT70Hi 24 V and EXT255Hi 24 V only)

Use suitable vacuum tube and connectors to connect the interstage-port to the vacuum system or to the outlet flange of another turbomolecular pump (if using the EXT70Hi 24 V or EXT255Hi 24 V pump to back another turbomolecular pump). Leave the inlet-strainer in the interstage-port of the EXT255Hi 24 V pump, unless you are sure that debris cannot be drawn into the interstage-port.

3.4 Vent-valve connection and control

When designing your system and when you install a vent-valve, take note of the information in [Section 1.3](#) and [2.3](#). The EXT pump and vacuum system can be vented by any of the following methods:

- Use the manual vent-valve supplied. Take care not to open the manual vent valve too quickly (see below).
- Use a TAV5 or TAV6 solenoid vent-valve accessory (see [Section 7](#)) in place of the manual vent-valve.
- Use a TAV5 or TAV6 solenoid vent-valve connected to a convenient flange on your vacuum system.
- Use an alternative valve connected to the vacuum system.

If using the manual vent-valve, the vent-valve must be opened only after the EXT pump speed has fallen to 50% of full rotational speed.

If using the TAV5 vent-valve, the pump may only be vented when it is at full speed if the vacuum system has a volume of 5 litres or more. If using the TAV6 vent-valve, the pump may only be vented when it is at full speed if the vacuum system has a volume of 10 litres or more. If the volume of your vacuum system is less than 5 litres (when using a TAV5 vent-valve), or if the volume of your vacuum system is less than 10 litres (when using a TAV6 vent-valve), you can incorporate a suitable vent-restrictor (see [Table 4](#)) and vent the pump when it is at full speed.

If using another vent-valve, ensure that a suitable vent-restrictor is fitted to your vacuum system to limit the rate of pressure rise: refer to [Table 5](#). If you do not fit a suitable vent-restrictor, you must open the vent-valve only after the speed of the EXT pump has fallen to 50% of full rotational speed.

If you connect a vent-valve to your vacuum system, select a point upstream of the EXT pump to prevent backstreaming of oil from the backing pump. Do not connect the vent-valve to the backing pipeline. Connect the inlet of the vent-valve to the vent gas supply (refer to [Section 2.3](#) for the vent gas specification).

Note: *If you use a vent-restrictor, you may find that the time required to vent your vacuum system is unacceptably long. You may be able to reduce the vent time if you use a vent-valve without a vent-restrictor and wait until the pump speed has fallen to 50% of full rotational speed before you open the vent-valve.*

Table 4 - Vent-restrictor orifice diameter (with atmospheric pressure at the inlet of the vent-valve)

Vacuum system volume (l)	Orifice diameter (mm)
< 20	≤ 1.0
< 10	≤ 0.7
< 5	≤ 0.5
< 2	≤ 0.35

3.5 Purge gas connection (EXT255H 24 V and EXT255Hi 24 V only)

3.5.1 Connect the purge gas

To supply a purge gas to the pump, remove the manual purge-valve/plug fitted in the purge-port, fit a vent-port adaptor (see [Section 7.4](#)) to the purge-port and connect the purge gas supply to the vent-port adaptor. The purge gas must comply with the specification given in [Section 2.4](#).

The flow rate of the purge gas must be limited to the allowed range, also specified in [Section 2.4](#). To limit the flow rate, use a flow controller or a pressure regulator and calibrated flow restrictor. The PRX10 purge restrictor accessory (see [Section 7.4](#)) is suitable for this purpose. Adjust the PRX10 as described in the instruction manual supplied with the accessory.

3.5.2 Recommended purge gas flow

The recommended purge gas flow for typical applications is 25 sccm ($0.42 \text{ mbar l s}^{-1}$, 42 Pa l s^{-1}). This flow will protect the pump when pumping oxygen in concentrations above 20% by volume.

3.6 Electrical installation

Always make the electrical connections to the EXT pump after the pump has been installed on your vacuum system.

The EXT pump should be electrically bonded to earth (ground) using the connection provided (see [Section 3.6.2](#)).

3.6.1 EXDC drive module

There are two EXDC drive modules, the EXDC80 24 V and the EXDC160 24V. The EXDC80 24 V drive should be used in conjunction with the EXT70H/Hi 24 V pumps - an EXDC160 should not be used with this family of pumps. It is recommended that the EXT255H/Hi 24 V pumps are driven by the EXDC160 24 V module. However an EXDC80 24 V may be used, although this will result in significantly extended ramp times and reduced performance.

Fit the connector on the EXDC Drive Module directly to the 19-way connector on the EXT pump.

The EXDC Drive Module is designed to allow a pumping system to be configured in a variety of ways. Refer to the EXDC Drive Module instruction manual to complete the electrical installation.

CAUTION

Do not disconnect or connect the EXDC drive module while the pump is rotating. If you do, you may damage the drive module.

3.6.2 Earth (ground) connections

It is recommended that you fit a separate earth (ground) conductor to earth (ground) the EXT pump: use an uninsulated braid or a separate insulated green/yellow conductor, and use the M5 x 10 screw and shakeproof washer supplied (fitted to the earth (ground) hole on the pump) to secure the earth (ground) conductor to the EXT pump.

For external protective earth (ground) systems: the installation should be permanent and use the same earth (ground) system as the EXDC Drive Module; the impedance between the pump-body and the earth (ground) connection point must be $< 0.1 \Omega$.

3.7 Cooling

3.7.1 Introduction

CAUTION

You must ensure that the pump is adequately cooled to prevent damage to the bearing lubricant.

We recommend that wherever possible, you cool the pump by forced-air or water-cooling. You must use water-cooling in any of the following operating conditions:

- Backing pressure > 10 mbar (1000 Pa) and interstage flow > 20 sccm ($0.3 \text{ mbar l s}^{-1}$, 30 Pa l s^{-1}).
- Backing pressure > 8 mbar (800 Pa) and interstage flow > 30 sccm ($0.5 \text{ mbar l s}^{-1}$, 50 Pa l s^{-1}).
- Backing pressure > 5 mbar (500 Pa) and interstage flow > 80 sccm ($1.3 \text{ mbar l s}^{-1}$, 130 Pa l s^{-1}).
- Ambient temperature > 35 °C.
- When using a bakeout band.

In all other operating conditions, forced-air cooling may be used. When using forced-air to cool the pump, ensure that there is an adequate supply of cooling-air to the pump.

However, for light pumping duties, with ambient temperature < 30 °C and inlet-flange temperature < 70 °C, you can use free convection to cool the EXT70H 24 V pump.

During operation, if the temperature of any surface of the pump is higher than 45 °C, the pump is too hot and cooling must be increased.

3.7.2 Forced-air cooling

An air-cooler accessory is available for the EXT pumps (refer to [Section 7](#)). Fit the air-cooler as described in the instruction manual supplied with it. If you wish to use an alternative fan for air-cooling, ensure that the flow rate is above $70 \text{ m}^3 \text{ h}^{-1}$ (40 cfm)

3.7.3 Water-cooling

A water-cooler accessory is available for the EXT pumps (refer to [Section 7.3.4](#)). Fit the water-cooler as described in the instruction manual supplied with it.

The cooling-water supply must comply with the specification given in [Section 2.5](#). Pipes in the water-cooling circuit may become blocked if the cooling-water contains too much calcium carbonate or if it contains particulates which are too large. Corrosion of the water-cooling circuit may occur if there is too little calcium carbonate and oxygen in the water. Good quality drinking water is usually suitable for water-cooling. If in doubt, you must check the quality of your cooling-water supply and, if necessary, provide treatment and filtration.

Connect the cooling-water supply to the water-cooler on the pump as described below. Either of the two riffled connectors on the water-cooler can be used for the water supply or return connections.

1. Push reinforced hose (approximately 6 mm internal diameter) over the ends of the riffled hose connectors on the water-cooler on the pump.
2. Attach the hose with strong hose clips and make sure that they are tightened securely.

Alternatively, unscrew the riffled hose connectors and remove them from the water-cooler and make direct connections to the 1/8 BSP female threaded fittings on the water-cooler.

You must turn off the cooling-water supply when you switch off the pump to prevent condensation of vapours inside the pump.

To remove the pump for maintenance without breaking the cooling-water circuit, unscrew the two M4 cap-head fixing-screws and remove the water-cooler from the pump. Make sure that there is a layer of thermal contact grease on the water-cooler before you refit it to the pump.

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4 Operation

WARNING



Do not operate the pump unless it is connected to your vacuum system. If you do, the pump rotor can cause injury. The pump rotor rotates at very high speeds and you may not be able to see that the pump is rotating. Always ensure the pump has stopped rotating before removing it from the vacuum system.

WARNING



Do not expose any part of your body to vacuum. If you do, you may be injured.

Note: The following sections describe the use of the EXT pump in a basic, manually-controlled pumping system with a manual vent-valve, and with an EXDC drive module. Refer to the EXDC drive module instruction manual for full details of installation and electrical connection.

4.1 Start-up

1. Turn the manual vent-valve clockwise to close it.
2. Turn on the cooling-water supply (if water-cooling is used) or fan (if air cooling is used).
3. Start the backing-pump.
4. Start the EXT pump by supplying power to the EXDC drive module (see EXDC instruction manual).

Note: For large vacuum systems (100 litres or larger) wait until the system pressure reaches 10 mbar (1×10^3 Pa) before supplying power to the EXDC drive module.

5. The pump will then accelerate to normal operating speed. When this has been reached, the green LED on the EXDC will light.

Note: The first time you pump down the system to vacuum, you must re-tighten the bolts which secure the inlet-flange: refer to [Section 3.3.4](#).

4.2 Shut-down

Note: In an emergency only, open the vent-valve quickly to decelerate the pump rotor in the shortest possible time.

1. Switch off the backing-pump and stop the power to the EXDC drive module (see EXDC instruction manual) to switch off the EXT pump.
2. When the EXT pump rotational speed has fallen to below 50% of full rotational speed, you may turn the manual vent-valve anticlockwise to open it. Ensure that the rate of pressure rise does not exceed the allowed rate of pressure rise, otherwise the pump may be damaged: refer to [Section 1.3](#) and [2.3](#).
3. If water-cooling is in use, turn off the cooling-water supply.

4.3 Shut-down due to pump under or over-speed

The EXDC Drive Module monitors the temperature of the EXT pump and the electrical power consumption of the pump. If the EXDC Drive Module detects excessive power consumption or temperature, the rotational speed of the pump motor is reduced until the power and temperature return to normal.

CAUTION

Shut down the EXT pump if its speed falls below 50% of full rotational speed. If you do not, the EXT pump may be damaged.

If the pump speed is reduced to 50% of nominal speed this means that the inlet pressure or pump temperature are too high, or that there is a fault with the pump (for example, the bearings may have failed). If the pump speed falls to below 50% of its full rotational speed you must therefore switch the pump off. Instructions on how to monitor pump speed can be found in the EXDC drive module manual.

The EXDC has an electronic EXT pump speed control system. This control system prevents operation of the EXT pump at over 100% of its normal full rotational speed (as operation above this level reduces bearing operational life). In the unlikely event of a failure of this control circuit the pump may overspeed. If you suspect that your pump may be running at overspeed you should switch it off and consult Edwards or your supplier.

4.4 Bakeout

CAUTION

When baking the EXT pump to above 70 °C at the inlet-flange, the pump must be water-cooled to prevent damage to the bearing lubricant.

If you heat your EXT pump (and your vacuum system), you will speed up the degassing process so that the pump will reach ultimate vacuum in the shortest possible time. If you heat the pump, this will also prevent condensation of vapours inside the pump.

The Edwards BX bakeout band may be used to heat the pump (refer to [Section 7](#)). Fit the band around the pump, just below the inlet-flange. When baking the pump or the system, make sure that the temperature of the inlet-flange does not exceed 100 °C.

When baking vacuum system, if the temperature of the system exceeds 200 °C, you must put a radiation shield between the system and the EXT pump. This radiation shield will reduce the heat radiated onto the pump rotor.

Typically, a bakeout of four hours is long enough to remove water condensation from the pump. However, the bakeout time will depend on the amount of condensation in the pump and the vacuum system, and the ultimate pressure you want to achieve.

5 Maintenance



WARNING

Allow the pump-rotor to stop, then disconnect the EXDC Drive Module from the pump before you remove the pump from your vacuum system for maintenance or fault-finding procedures.

5.1 Introduction

The maintenance operations for the EXT Turbomolecular pumps are described in the following sections. The ISX inlet-screen, the WCX water-cooler, the inlet-strainer and inlet-flange seals are available as spares (refer to [Section 7](#)). Fit the ISX inlet-screen as described in [Section 3.3.1](#). Fit the WCX water-cooler as described in [Section 3.7.3](#).

5.2 Bearing life

When supplied, the pump contains sufficient lubricant to supply the bearings for life. No routine maintenance is therefore required between bearing replacements. The bearings are not user-serviceable. The bearings will need to be replaced when they reach the end of their service life. This is typically more than 20,000 hours, but may be less; this depends on the type of pumping duty on which the pump is used.

When the bearings need replacement, we recommend that you exchange your pump for a factory reconditioned replacement. Alternatively, you can send your pump to an Edwards Service Centre to have the bearings replaced.

When returning EXT pumps to Edwards Service Centres please use the procedure included at the end of this manual. However, the instruction to drain all fluids does not apply to the lubricant in the EXT pump oil-reservoirs.

5.3 Rotor life

The life of the EXT pump rotor is typically 40,000 to 50,000 cycles (of acceleration to full speed, and then deceleration to a stop). The pump rotor is not user-serviceable.

We therefore recommend that you exchange your pump for a factory reconditioned replacement every 20,000 cycles, or 10 years of use, whichever occurs first. Alternatively, you can send your pump to an Edwards Service Centre for a major service (which will include rotor replacement).

When you return EXT pumps to Edwards Service Centres please obey the procedure included at the end of this manual. However, the instruction to drain all fluids does not apply to the lubricant in the EXT pump oil-reservoirs.

5.4 Clean the pump



WARNING

Clean the external surfaces of the EXT pump in a well-ventilated location. When you use cleaning solutions and solvents to clean the pump, observe all precautions specified by the manufacturer. Avoid inhalation of any particulates which may be present in the pump.

CAUTION

Do not attempt to clean any parts of the EXT pump other than the external surfaces. Organic solvents may damage internal pump components. Do not use abrasive materials to clean any part of the pump.

If the inside of the EXT pump is contaminated, it may not be possible to achieve the specified ultimate vacuum, or pump-down time may increase. In these circumstances, you should return the pump to an Edwards Service Centre, where the pump will be dismantled and cleaned. Use the procedure given in the forms at the end of this manual to return the pump.

You can use any organic solvent to clean the external surfaces of the EXT pump. We recommend that you use non-CFC solvents, such as isopropanol or ethanol. Use a cleaning solution which is suitable for the contaminants on the pump surfaces.

For environmental reasons, keep wastage of cleaning solutions and solvents to a minimum.

5.5 Fault finding

Refer to [Table 5](#) for the possible causes of faults and for the recommended actions to rectify faults.

Refer to the fault finding section of the instruction manual supplied with your EXDC Pump Drive Module for further fault finding information.

Table 5 - Fault finding

Symptom	Check	Action
The pump does not rotate.	Check that the electrical supply is on.	If power is supplied and the pump still does not rotate then there is a fault with either the pump or controller - consult Edwards or your supplier.
The pump is not rotating at full speed.	Is the inlet pressure too high?	If so reduce the pumping load or check for a gross leak into the system.
	Is the EXT pump running too hot?	Increase the cooling-water flow or decrease the water temperature or do both. You may need to change from air-cooling to water-cooling. (Refer to Section 2 for maximum inlet pressure and cooling requirements). Check that external heat sources (such as system bakeout heaters) are not excessive.
	Does the rotor rotate freely?	If not the EXT pump-bearings are damaged. Consult Edwards or your supplier.

Table 5 - Fault finding (continued)

Symptom	Check	Action
Ultimate pressure cannot be reached.	<p>Is the pressure limited by water vapour ?</p> <p>Are any of the vacuum gauges contaminated ?</p> <p>Is the pumping speed insufficient (due to poor conductance between the pump and the gauge or too large a chamber) ?</p> <p>Is the interstage inlet pressure > 0.5 mbar (50 Pa) (for the EXT70Hi 24V) or > 0.2 mbar (20 Pa) (for the EXT255Hi 24V) ?</p> <p>Is the backing pressure > 10 mbar (1×10^3 Pa) for the EXT70H/Hi 24V, or > 5 mbar (5×10^2 Pa) for the EXT255H/Hi 24 V ?</p> <p>Is the high-vacuum area of the system contaminated ?</p> <p>Check the rest of your system for leaks and contamination.</p> <p>Remove the pump from the system and test the ultimate pressure of the pump alone (see Section 2 for specification).</p>	<p>Bake the system and pump.</p> <p>If so clean or replace them.</p> <p>Increase the conductance or reduce the volume.</p> <p>If the interstage inlet pressure is too high inlet pressure at the turbomolecular inlet is reduced; ensure that the interstage inlet pressure is < 0.5 mbar (50 Pa) or < 0.2 mbar (20 Pa) as appropriate.</p> <p>If so, the backing pressure is too high. Check for backing pipeline leaks. If the throughput is high you may need a larger backing-pump.</p> <p>If so clean the high-vacuum system.</p> <p>If found clean the contaminated areas and repair the leaks.</p> <p>If poor check the pump for contamination and if necessary return the pump as described in Section 5.4. Leak-check the pump. If the leak rate > 1×10^{-7} mbar l s⁻¹ (1×10^{-5} Pa l s⁻¹) consult Edwards or your supplier.</p>
The EXT is very noisy or there is excessive vibration or both.	<p>Is the pump rotational speed the same as the resonant frequency of the attached system ?</p> <p>Is the vibration being transmitted from the rotary pump ?</p> <p>Is the noise irregular and getting progressively worse ?</p> <p>Is the EXT making a constant high-pitched noise ?</p>	<p>If so change the natural frequency of your system or isolate the pump using flexible bellows.</p> <p>If so fit flexible bellows or a vibration isolator in the backing line.</p> <p>If so a bearing is defective. Consult Edwards or your supplier.</p> <p>If so the rotor is out of balance. Consult Edwards or your supplier.</p>
None of the above.	-	Consult Edwards or your supplier.

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6 Storage and disposal

6.1 Storage

Use the following procedure to store the pump.

1. Place protective covers over the inlet, outlet, interstage (EXT70Hi 24 V and EXT255Hi 24 V only), purge and vent ports.
2. Place the pump in its packing materials. For fastest pump-down when the pump is put back into service, seal the pump inside a plastic bag together with a suitable desiccant.
3. Store the pump in cool, dry conditions until required for use. When required, prepare and install the pump as described in Section 3.
4. Keep the pump upright at all times to prevent the drainage of oil from the bearing reservoir.
5. Avoid long-term storage if possible. When long-term storage is necessary, the pump should be set up and run for at least eight hours every six months.

6.2 Disposal

WARNING



In the unlikely event that the rotor fails, dust may be generated from the carbon fibre reinforced components in the pump. If the rotor has failed:



- Wear the appropriate personal protective equipment (gloves, a dust-proof mask which covers the nose and mouth, an apron or overalls, and safety glasses or goggles) when you handle the pump.



- Ensure that the pump inlet, outlet, and vent-, interstage- and purge-ports are all blanked off/ sealed before you dispose of the EXT pump.

Dispose of the EXT Turbomolecular Pump and any components and accessories safely in accordance with all local and national safety and environmental requirements.

Take particular care with any components which have been contaminated with dangerous process substances.

Take appropriate action to avoid inhalation of any particulates which may be present in the pump.

Do not incinerate the pump. The pump contains phenolic and fluorosilicone materials which can decompose to very dangerous substances when heated to high temperatures.

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7 Service, spares and accessories

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 employ service engineers who have undergone comprehensive Edwards training courses.

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

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

7.2 Service

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

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

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

7.3 Spares

7.3.1 ISX inlet-screen

An inlet-screen is fitted to your pump as supplied to prevent damage from the entry of debris into the pump. The Item Numbers of replacement inlet-screens are given below. Select the inlet-screen according to the pump inlet-flange size. You cannot replace the inlet-screen on a pump with an NW inlet-flange.

Flange size	Inlet-screen	Item Number
DN63ISO-K/DN63CF	ISX63	B580-51-005
DN100ISO-K/DN100CF	ISX100	B580-51-001

7.3.2 Inlet-strainer (EXT255Hi 24V pump only)

The EXT255Hi 24V pump is supplied with an inlet-strainer for the interstage-port. The Item Number of a replacement inlet-strainer is given below.

Flange size	Item Number
DN25ISO-K	A223-05-067

7.3.3 WCX water-cooler

A water-cooler can be fitted to the EXT pump. Please refer to [Section 3](#) to check the suitability of water cooling for a particular application. Pumps with a Conflat flange are supplied with a water-cooler.

Water-cooler	Item Number
WCX500	B736-01-036

7.3.4 Inlet-flange seals

EXT pumps are supplied with an inlet seal. The Item Numbers of replacement seals are given below.

Inlet-flange	Inlet-seal	Item Number
DN63ISO-K	ISO63 trapped 'O' ring (fluoroelastomer)	B271-58-17F
DN40NW	DN40NW Co-Seal (fluoroelastomer)	B271-58-453
DN100ISO-K	ISO100 trapped 'O' ring, fluoroelastomer	B271-58-171
DN63CF	63CF copper compression gasket (pack of 5)	C081-00-003
DN100CF	100CF copper compression gasket (pack of 5)	C082-00-003

7.4 Accessories

7.4.1 Installation

The accessories available for use with the EXT turbomolecular pumps are described in the following Sections. [Figure 7](#) shows how the accessories are fitted to an EXT pump.

7.4.2 EXDC drive modules

There are two EXDC drive modules, the EXDC80 24 V and the EXDC160 24 V. The EXDC80 24V drive should be used in conjunction with the EXT70H/Hi 24 V pumps - an EXDC160 should not be used with this family of pumps. It is recommended that the EXT255H/Hi 24 V pumps are driven by the EXDC160 24 V module. However an EXDC80 24 V may be used, although this will result in significantly extended ramp times and reduced performance.

Drive Module	Item Number
EXDC80 24 V	D396-45-000
EXDC160 24 V	D396-46-000

7.4.3 BX bakeout band

A BX bakeout band accelerates the degassing of the pump to enable it to achieve lower pressures. It may also be used to protect the pump from condensation of contaminants. The bakeout bands are available in 110-120 V or 220-240 V versions.

Pump	Bakeout band	Item Number
EXT70H/Hi 24 V	BX70 (110 V)	B580-52-040
	BX70 (240 V)	B580-52-060
EXT255H/Hi 24 V	BX250 (110 V)	B580-52-041
	BX250 (240 V)	B580-52-061

7.4.4 FL20K foreline trap

The foreline trap minimises oil vapour backstreaming from the backing pump and is recommended where the highest system cleanliness is required.

Foreline trap	Item Number
FL20K	A133-05-000

7.4.5 TAV vent-valve and vent-port adaptor

Two solenoid-operated vent-valves are available for system venting. The valves are 24 V d.c., normally-open. The solenoid-valve is fitted in place of the manual-valve, or alternatively can be fitted with an adaptor (supplied with the valve) and be used with any suitable NW10 flanged port on your vacuum system.

The vent-port adaptor allows the vent-port (or the purge-port, on EXT255H pumps) to be used with any suitable NW10 fitting: see [Figure 7](#), item 7.

Product	Item Number
TAV5 vent-valve	B580-66-010
TAV6 vent-valve	B580-66-020
Vent-port adaptor	B580-66-011

7.4.6 ACX air-cooler

An ACX air-cooler can be fitted to the EXT pump. However, please refer to [Section 3](#) to check the suitability of air-cooling in a particular application.

Pump	Air-cooler	Item Number
EXT70H/Hi 24 V	ACX70	B580-53-050
EXT255H/Hi 24 V	ACX250H	B580-53-160

7.4.7 Vibration isolators

In applications where the small amount of vibration generated by the turbomolecular pump is a problem, a vibration isolator can be fitted. The isolator consists of two special flanges separated by a flexible bellows and a rubber, anti-vibration, outer collar. The isolator required depends on the pump inlet-flange size.

Inlet-flange size	Item Number
DN63ISO-K	B581-15-000
DN63CF	B581-01-000
DN100ISO-K	B581-20-000
DN100CF	B581-05-000

7.4.8 PRX purge-restrictor

The PRX10 is a modified DN10NW centring-ring which filters the purge gas and restricts its flow rate to the recommended flow of 25 sccm. The restrictor is suitable for all EXT pumps fitted with a purge-port.

Note that you must fit a vent-port adaptor (see [Section 7.4.5](#)) to the purge-port on an EXT255H 24V or EXT255Hi 24V pump, in order to connect the purge restrictor to the pump.

Purge-restrictor	Flange size	Item Number
PRX10	NW10	B580-65-001

7.4.9 VRX vent-restrictor

Use a VRX fixed orifice vent-restrictor to restrict the flow of vent gas into the EXT pump. You can fit a VRX vent-restrictor to the inlet of a TAV5 or TAV6 vent-valve or to a PRX10 purge-restrictor. Refer to [Section 3.4](#) for information on the selection of the correct VRX vent-restrictor.

Vent-restrictor	Orifice diameter (mm)	Item Number
VRX10	0.1	B580-66-021
VRX20	0.2	B580-66-022
VRX30	0.3	B580-66-023
VRX50	0.5	B580-66-024
VRX70	0.7	B580-66-025

7.4.10 EXT70H/ISO63 interstage-port accessory kit

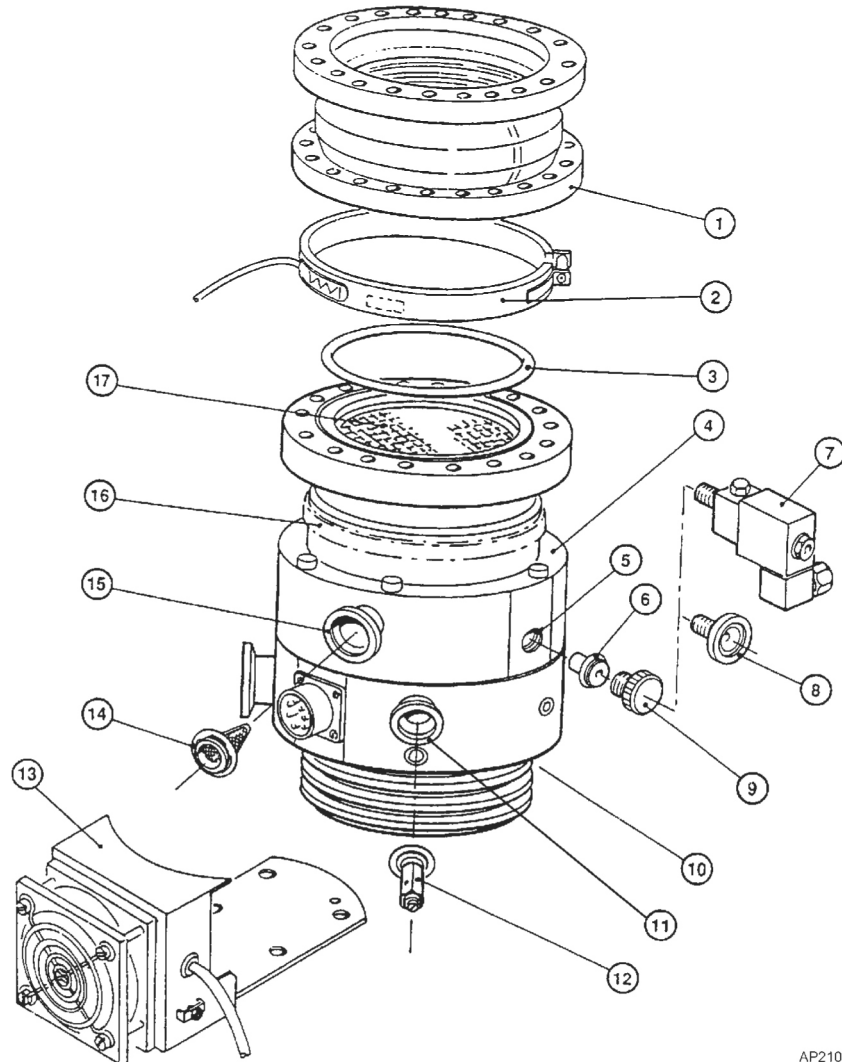
On the EXT70H/ISO63 24 V pump, the interstage-port in the pump-envelope is blanked off. You can remove the blanking cap and fit the interstage-port accessory to upgrade the pump to an EXT70Hi pump, so that you can use the interstage-port of the pump as described in [Section 3.3.4](#).

The accessory kit consists of an 'O' ring and a flange; the flange has an inlet strainer to prevent the entry of debris into the pump. To fit the accessory:

- Use a suitable pin-spanner to remove the blanking plug from the interstage-port. The holes in the blanking plug are 3.2 mm in diameter, and the centres of the holes are 14 mm apart.
- Fit the 'O' ring supplied, then use a 27 mm diameter 'C' spanner to screw the flange into the interstage-port; the holes in the flange accessory are 3.2 mm in diameter.
- Tighten the flange sufficiently, to prevent the flange being loosened by vibration or stress transmitted from pipelines connected to the flange.

Accessory	Item Number
EXT70H/ISO63 interstage-port accessory kit	B580-69-001
Pin-spanner	B279-29-029
27 mm 'C' spanner	B279-29-028

Figure 7 - Installation of optional accessories (and spares): EXT255Hi shown



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- | | | |
|---------------------------------|---|---------------------------------|
| 1. Vibration isolator | 6. VRX vent-restrictor | 11. Vent port adaptor |
| 2. Bakeout band | 7. Solenoid vent-valve | 12. Purge restrictor |
| 3. Inlet-flange seal (supplied) | 8. DN10NW adaptor | 13. Air-cooler |
| 4. EXT255Hi pump | 9. Manual vent-valve (supplied) | 14. Inlet strainer (supplied) * |
| 5. Vent-port | 10. Water-cooler (on opposite side of the pump) | 15. Interstage-port * |
| | | 16. Bakeout band position |
| | | 17. Inlet-screen (supplied) |

* EXT255Hi pump only

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