SERVICE

Service

Our Expertise is in understanding how to get the most from your Edwards product, using the know-how we have gathered from supporting our global installed base of over 750,000 Edwards Vacuum Pumps and 8,500 Edwards Exhaust Management Systems. Your Advantage is in being able to optimise your total cost of ownership (TCO), to improve product and process yield, and to minimise your environmental impact. Whether the repair of a single unit, or a proactive programme of managing and optimising all Edwards product across your facility, Expert Advantage offers a choice for you.

- Product upgrades and optimisation
- Product repair and overhaul
- Product exchange
- Replacement parts, kits and tooling
- On-site support
- Service contracts and agreements
- Operation, maintenance and service training
- Certified Product sales

Upgrades and Optimisation

Take advantage of Edwards' latest technology and know-how by upgrading or optimising your existing equipment. We offer cost effective upgrade of most Edwards and other branded equipment, allowing you to benefit from enhanced performance, energy efficiency, and greatly improved cost of ownership. Through CIP driven optimisation programmes, we use our know-how developed from our global installed base to help you enhance your process and product yield, and realise Total Cost of Ownership (TCO) improvements.

- Innovative products and upgrades to reduce carbon footprint and optimise environmental strategy
- Simple single equipment retrofit kits to full facility-wide turnkey programmes with high return on investment
- Technology upgrades, system tuning and optimisation for product and process yield improvements
- Sophisticated modelling and simulation, validated against our global knowledge base
- Remote diagnostics and prognostic condition monitoring with FabWorks-iMS for TCO optimisation

Product Repair and Overhaul

When products require more than just routine maintenance and you want the confidence afforded by the quality and standard of repair only the OEM can guarantee, then choose from our range of product repair and overhaul services. Edwards offers fixed price servicing for swift response and simple budgeting, or a flexible pricing structure for maximum cost control.

Product Exchange

If process uptime is critical, or it is simply not convenient to perform repair or maintenance work on site, the Edwards Service Exchange Programme offers rapid product replacement from a comprehensive global inventory (for common pump variants and subject to availability). Products are rebuilt and tested to factory derived standards by factory trained technicians and are backed up by a comprehensive 1 year warranty.

Replacement Parts, Kits and Tooling

Genuine Edwards Replacement Parts are produced to the same quality standards as our new products. They always meet the latest product standards and will minimise your maintenance time by helping you get the job done right the first time. To simplify your job we offer many kits/sets tailored to your Edwards product needs for periodic and repair maintenance. Use Genuine Edwards Replacement Parts kits and your maintenance team will start work with the materials they need to get the job done: save time, reduce your supply chain cost, extend the life of your product and enjoy years of trouble free operation. With distribution centres globally located, Edwards can meet your needs for availability of our Genuine Replacement Parts.

Certified Products

Edwards Certified Products are pre-owned units, refurbished in our OEM remanufacturing factories by our skilled technicians using genuine Edwards' spare parts only. Certified products offer a cost effective and carbon friendly option to acquire additional vacuum and abatement equipment.
Certified products are provided with all the accessories required to install your product straight out of the box. Typical installation accessories include electrical connectors, water connectors, inlet and exhaust o-rings as well as full instructions for installation and usage. Edwards Certified Products are available globally through our extensive service and logistics Network. Due to the rapidly changing nature of the used equipment market please contact Edwards in the first instance to ensure product availability before ordering.

Onsite Services

Highly skilled Edwards teams, supporting End-users, OEMs and Systems Integrators alike worldwide, work in partnership with you, at your site; from simple single visits to integrated multi-site teams, resolving breakdowns, providing continuous improvement, optimising equipment uptime and yield, and reducing your site management costs. Options include:

- Product installation and commissioning, operator training
- Scheduled monitoring, preventative and predictive maintenance, breakdown support
- Upgrades providing improved performance and efficiency
- Logistics management to optimise availability and supply chain
- Emergency hotline and service support, including availability outside of normal working hours
- Local, regional and global agreements, flexible and integrated with your support network

Service Contracts and Agreements

Tailored Contracts, ideal for larger installations, bring together any combination of our service product range into one package, whether for a single turnkey activity or longer term equipment maintenance, management and optimisation programmes focussed on reducing total cost of ownership. For smaller installations, or those under the cost control of multiple managers, Edwards provides standard fixed price contracts for simple budgeting and cost management.

Operation, Maintenance and Service Training

Avoid unplanned downtime with correct operation and maintenance by taking advantage of professional advice over the phone, or dedicated onsite training for your technicians and operators.

Local Support from a Global Company

We understand the importance of local support. Edwards has a number of major service facilities located throughout the world, backed up by an extensive team of engineers and technicians to provide the support you need. From Edwards you can expect a local, rapid response and great value service, delivered by the experts.

Consistent and Reliable Standards Wherever You Are

We develop or manufacture the training, processes, tooling and parts used throughout our service network at the factories where we develop and manufacture our products. This is why our service team is always ready to deliver quality support. As you would expect from a responsible, global company, we operate under ISO9001 and ISO14001 accreditation.

Edwards support extends across our complete range of products.

Global Support from Edwards

Our worldwide network of around 1000 service personnel is easily and simply accessed through your local Edwards Office.

www.edwardsvacuum.com/service

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Guide to Pump Selection and Pipe Installation

Our experienced applications team are trained to provide expert advice on specifying the correct pumping system. Please contact your local Edwards office for further details.

Rotary Pump Speed and Pump-Down Time Calculations

To estimate the pump speed you need to reach a given system pressure, P:

$S = (F \times V)/t$ (1)

To estimate the time to pump-down your system to a given pressure, P:

$t = (F \times V)/S$ (2)

where t is the pump-down time

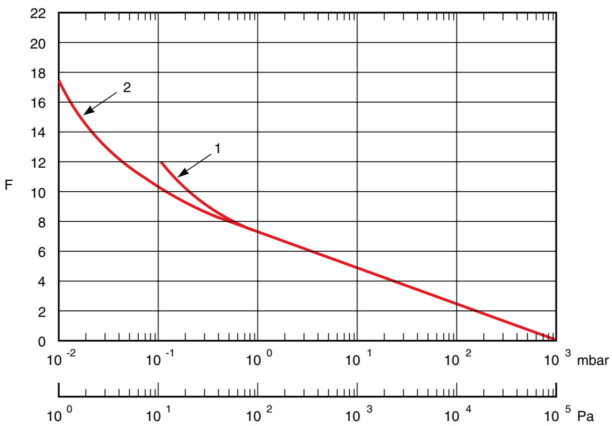
F is the pump-down factor at pressure P

V is the volume of the vacuum system

S is the speed of the rotary pump

Read F from Figure 1. t, V and S must be in consistent units: for example, t in hours, V in cubic metres (m3) and S in cubic metres per hour (m^3h^{-1}).

Speed and Power Curves



1 One-stage rotary pump

2 Two-stage rotary pump or pump combination

Figure 1 – Pump-down factor, F, as a function of system pressure, mbar

F applies a correction for the change in the speed of rotary pumps as the inlet pressure decreases. But F does not include a correction for the effect of conductance of inter-connecting pipes (refer to the section below if you want to apply this correction). These calculations apply to clean and leak tight vacuum systems. It is difficult to extend these curves to below 0.1 mbar, because the effect of system design and out-gassing become increasingly important at lower pressures. For example, you have a 0.06 m3 (60 l) vacuum system that you must evacuate to 1 mbar in 0.05 hr (3 minutes). From Figure 1, at 1 mbar F = 7.

$S = (F \times V)/t = (7 \times 0.06)/0.05 = 8.4\ m^3h^{-1}$

So, you require a pump with a minimum speed of 8.4 m^3h^{-1} and an ultimate vacuum well below 1 mbar. Edwards RV8 pump is suitable for this application.

Effect of the Conductance of Connection Pipes

Resistance to flow of gases and vapours through pipes can significantly affect the size of pump you require or the pump-down time you can achieve with a given pump. If you know the dimensions of the pipes in your system, you can correct the speed and pumpdown time calculations. The conductance of 1 m lengths of pipes of various diameters is shown in Figure 2. Please note these limitations for the data in this graph. The data shown in the dotted portions of the curves applies only to low velocity, viscous, laminar flow in long pipes (where the length of the pipe is typically many 100 times the pipe diameter). This data does not apply to turbulent flow (when the pipe conductance may be significantly reduced) or to compressed gases (such as gases in short pipes or subject to high speed flows). If your calculations are for short pipes (where the length of the pipe is typically < 100 times the pipe diameter), or for pipe diameters and pressures shown by the dotted portions of the curves in Figure 2, please refer to Wutz1 or Dushman2, or contact Edwards for advice.

Speed and Power Curves

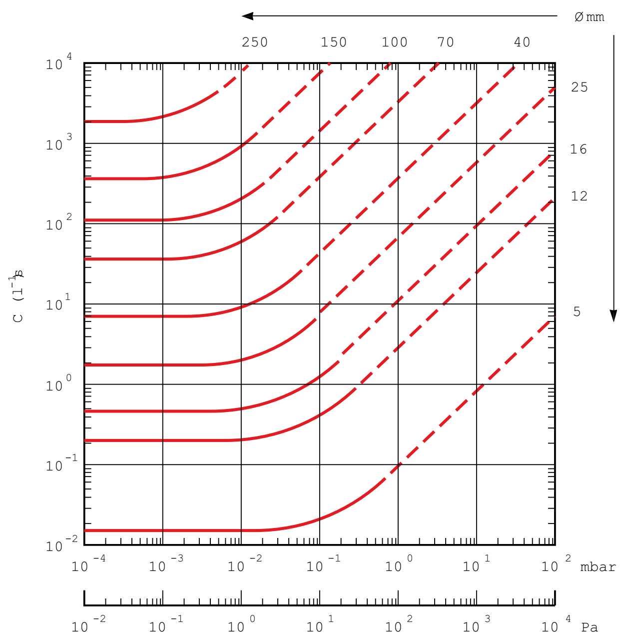


Figure 2 – *Conductance of 1 m of round pipe, for air at 20 °C (the data shown in the dotted portions of the curves is for low velocity, viscous, laminar flow in long pipes)*

The conductance of a pipe at a given pressure is:

Cp = C/l

where Cp is the conductance of the pipe

C is the conductance per metre, read from Figure 2l is the length of the pipe in metres.

Then, you can use the value for Cp to correct the pumping speed at the end of the pipe when it is connected to the pump inlet; use this equation:

1/Sp = (1/S) + (1/Cp) or Sp = (Cp × S)/(Cp + S) (3)

where Sp is the pumping speed at the end of the pipe S is the speed of the pump. Use a similar procedure to make an approximate correction to the pump-down time calculation. First, read the value of C at the required system pressure from Figure 2, and calculate Cp for your pipe at that pressure. Then use the pump speed, S, and Cp in equation (3) to calculate the corrected speed, Sp. Use this value of Sp in equation (2) to estimate the pump-down time, t. If you use a narrow pipe between the pump and the process chamber, this restricts the effective pumping speed. It is usually more economical to use a wider or shorter pipe and a smaller pump, than to restrict the pumping speed of a larger pump. You should aim at the effective pumping speed to be 80% or more of the pump's speed. You can use equation (3) and the graph in Figure 2 to select the minimum size of the pipe you need. For example, you need a pumping speed of 150 m^3h^{-1} at 1.0 mbar in your process chamber, and the pump must be 6 m away from the chamber. The E2M175 (135 m^3h^{-1} at 1 mbar) is too small for this application, even without losses in the pipelines. So, consider the E2M275 pump which has a pump speed of 230 m^3h^{-1}. Use equation (3) to calculate the minimum conductance of the connecting pipe: Cp = (S × Sp)/(S – Sp) = (230 × 150)/(230 – 150) = 430 m^3h^{-1} The conductance per metre is then 430 × 6 = 2580 m^3h^{-1}. In Figure 2, the nearest larger diameter pipe that has a conductance of 2580 m^3h^{-1} or more at 1.0 mbar is 70 mm. Conveniently, this is the same diameter as the inlet of the E2M275 pump.

Maximum Pipe Length for Increase in Pump-Down Time of < 20%

Table 1 gives a quick guide to the maximum length of pipe you can use to connect the pump to your vacuum system, if you want the conductance of the pipe to contribute no more than 20% to the pumpdown time.

In our calculations, we assumed that the pipes and fittings used correspond to the size of the inlet port. That is, for example, that NW25 pipes and fittings are used for the RV pumps. If you use smaller pipes and fittings, the pump-down times will be increased significantly.

Pump Model	Pump Inlet	Inlet Ø (mm)	Maximum Pipe Length (m), for Pump-Down to			
			1 mbar		0.1 mbar	
			50 Hz	60 Hz	50 Hz	60 Hz
Speedivac 2	¼ inch BSP	12	4	3.5	-	-
E2M0.7	NW10	10	6	5	0.7	0.6
E2M1, E2M1.5	NW10	10	3	2.5	0.3	0.3
RV3	NW25	25	50	45	7	6
RV5	NW25	25	35	30	4.5	3.5
RV8	NW25	25	22	19	3	2
RV12	NW25	25	16	14	2	1.5
E1M18, E2M18	NW25	25	11	9	1.5	1
E2M28	NW25	25	8	6.5	1	0.8
E2M40	ISO40	40	26	24	2.5	2
E2M80	ISO40	40	16	13	1.5	1
E2M175	ISO63	70	31	28	4	3.5
E2M275	ISO63	70	25	21	3.5	2.5

Table 1 – Maximum pipe lengths, for an increase in pump-down time of < 20%

How to Choose a Rotary Pump to Back a Vapour Pump

We recommend that you use two-stage rotary pumps (such as the RV5 or the E2M18 pumps) to back vapour pumps. When a vapour pump operates at its maximum specified throughput, the backing pressure must not be higher than 0.5 times the critical backing pressure. Note that the maximum throughput of most vapour pumps is calculated at 1×10^{-2} mbar: the maximum throughput of vapour booster pumps is calculated at 1 mbar. Use this equation to calculate the required rotary pump speed:

$$S > tm/(0.5 \times Pcb)$$

where S is the speed of the rotary pump
tm is the maximum throughput of the vapour pump
Pcb is the critical backing pressure of the vapour pump.

For example, at 1×10^{-2} mbar and a corresponding speed of 60 ls^{-1} , the maximum throughput of the Diffstak 100/300 pump is $60 \times 10^{-2} = 0.6$ mbar ls^{-1}. The critical backing pressure of this pump with Santovac® 5 fluid is 0.6 mbar. So, the required rotary pump speed is:

$$S > 0.6/(0.5 \times 0.6) = 2\ ls^{-1} \sim 8\ m^3h^{-1}$$

The nearest larger, two-stage rotary pump suitable for this application with no correction for pipe conductance effects) is the RV8. If the maximum throughput for your system is lower than the pump's specified maximum throughput, you may be able to use a smaller rotary pump: please contact Edwards for advice. You must now check that the rotary pump you have selected can pump-down your vacuum system from atmospheric pressure to the critical backing pressure in an acceptable time. If it cannot, you may need to choose a larger rotary pump.

How to Choose a Rotary Pump to Back a Turbomolecular Pump

We recommend that you use two-stage rotary pumps (such as the RV5 or the E2M18 pumps) or scroll pumps to back turbomolecular pumps. The size of the rotary pump you need depends on the maximum backing pressure and the speed of the turbomolecular pump at your required system pressure:

S > (St × P)/(0.5 × Pmb)

where S is the speed of the rotary pump

St is the speed of the turbomolecular pump, at your required system pressure P

Pmb is the maximum backing pressure of the turbomolecular pump.

For conventional turbomolecular pumps, the maximum backing pressure is typically 0.1 mbar: for compound turbomolecular pumps, it is about 5 mbar. For example, you require a system pressure of 1 × 10^{-4} mbar with a conventional 200 ls^{-1} turbomolecular pump. The required rotary pump speed is:

S > (200 × 10-4)/(0.5 × 0.1) = 0.4 l s-1 ~ 1.44 m^3h^{-1}

So, you need a rotary pump with a speed, at 0.1 mbar, of 1.44 m^3h^{-1}. The nearest larger, two-stage, rotary pump suitable for this application (with no corrections for pipe conductance affects) is the RV3. You must now check that the rotary pump you have selected can pump-down your vacuum system from atmospheric pressure to the critical backing pressure in an acceptable time. If it cannot, you may need to choose a larger pump. This is particularly important if you use a compound turbomolecular pump: the higher maximum backing pressure of these pumps mean that you can use a smaller backing pump. Note that, in all applications you will achieve a lower ultimate pressure (lower P) if you use a larger backing pump. If you want to pump hydrogen or helium, these calculations may not apply: please contact Edwards for advice.

Effect of the Pipe Between the Secondary Pump and the Rotary Pump

As we discussed above, the conductance of the pipe between the rotary pump and the secondary pump can reduce the effective pumping speed. This may mean that the critical backing pressure of the secondary pump is exceeded, even though the unrestricted speed of the rotary pump is adequate. If you know the bore and length of the pipe between the rotary pump and the secondary pump, you can use equation (3) and the data in Figure 2 to calculate the pumping speed at the end of the pipe. Then, match this corrected speed to the maximum throughput of the secondary pump.

Alternatively, in Table 2, we give a quick guide to the maximum length of pipe you can use between the rotary and secondary pumps, if you want the reduction in pump speed at 0.5 m pipes and fittings are used for the RV pumps. If you use smaller pipes and fittings, you must use shorter pipes.

Pump Model	Pump Inlet	Inlet Ø (mm)	Maximum Pipe Length (m)	
			50 Hz	60 Hz
Speedivac 2	¼ inch BSP	12	0.8	0.8
E2M0.7	NW10	10	0.7	0.7
E2M1, E2M1.5	NW10	10	0.4	0.4
RV3	NW25	25	7	6
RV5	NW25	25	4	3.5
RV8	NW25	25	2.5	2
RV12	NW25	25	1.5	1.5
E1M18, E2M18	NW25	25	1	1
E2M28	NW25	25	0.8	0.7
E2M40	ISO40	40	3.5	3.5
E2M80	ISO40	40	2	1.5
E2M175	ISO63	70	7	7
E2M275	ISO63	70	4.5	4.5

Table 1 – Maximum pipe lengths, for an increase in pump-down time of < 20%

Conversions

Pressure Units

	mbar	bar	Torr	Pa (Nm^{-2})	atm	lbf inch^{-2}
1 mbar =	1	1 x 10^{-3}	0.75	10^{2}	9.87 x 10^{-4}	1.45 x 10^{-2}
1 bar =	10^{3}	1	7.5 x 10^{2}	1 x 10^{5}	0.987	14.5
1 Torr =	1.33	1.33 x 10^{-3}	1	1.33 x 10^{2}	1.32 x 10^{-3}	1.93 x 10^{-2}
1 Pa (Nm^{-2}) =	0.01	1 x 10^{-5}	7.5 x 10^{-3}	1	9.87 x 10^{-6}	1.45 x 10^{-4}
1 atm =	1.01 x 10^{3}	1.01	7.6 x 10^{2}	1.01 x 10^{5}	1	14.7
1 lbf inch^{-2} =	68.9	6.89 x 10^{-2}	51.71	6.89 x 10^{3}	6.80 x 10^{-2}	1
1 kgf cm^{-2} =	9.81 x 10^{2}	0.98	7.36 x 10^{2}	9.81 x 10^{4}	0.97	14.2
1 inch Hg =	33.9	3.39 x 10^{-2}	25.4	3.39 x 10^{3}	3.34 x 10^{-2}	0.49
1 mm Hg =	1.33	1.33 x 10^{-3}	1	1.33 x 10^{2}	1.32 x 10^{-3}	1.93 x 10^{-2}
1 inch H_2O =	2.49	2.49 x 10^{-3}	1.87	2.49 x 10^{2}	2.46 x 10^{-3}	3.61 x 10^{-2}
1 mm H_2O =	9.81 x 10^{-2}	9.81 x 10^{-5}	7.36 x 10^{-2}	9.81	9.68 x 10^{-5}	1.42 x 10^{-3}

	kgf cm^{-2}	inch Hg	mm Hg	inch H2O	mm H2O
1 mbar =	1.02 x 10^{-3}	2.95 x 10^{-2}	0.75	0.40	10.2
1 bar =	1.02	29.53	7.5 x 10^{2}	4.01 x 10^{2}	1.02 x 10^{4}
1 Torr =	1.36 x 10^{-3}	3.94 x 10^{-2}	1	0.54	13.6
1 Pa (Nm^{-2}) =	1.02 x 10^{-5}	2.95 x 10^{-4}	7.5 x 10^{-3}	4.01 x 10^{-3}	0.10^{2}
1 atm =	1.03	29.92	7.6 x 10^{2}	4.07 x 10^{2}	1.03 x 10^{4}
1 lbf inch^{-2} =	7.03 x 10^{-2}	2.04	51.71	27.68	7.03 x 10^{2}
1 kgf cm^{-2} =	1	28.96	7.36 x 10^{-2}	3.94 x 10^{2}	1 x 10^{4}
1 inch Hg =	3.45 x 10^{-2}	1	25.4	13.6	3.45 x 10^{2}
1 mm Hg =	1.36 x 10^{-3}	3.94 x 10^{-2}	1	0.54	13.60
1 inch H_2O =	2.54 x 10^{-3}	7.36 x 10^{-2}	1.87	1	25.4
1 mm H_2O =	10^{-4}	2.90 x 10^{-3}	7.36 x 10^{-2}	3.94 x 10^{-2}	1

Note also: 1 dyn cm^{-2} (barye) = 0.1 Pa (Nm^{-2}) = 10^{-3} mbar

Leak Rate Units

	mbar ls^{-1}	Torr ls^{-1}	atm cm^{3} s^{-1}	lusec	atm ft^{3}min^{-1}
1 mbar ls^{-1} =	1	0.75	0.99	7.5 x 10^{2}	2.09 x 10^{-3}
1 Torr ls^{-1} =	1.33	1	1.32 x 10^{3}	103	2.79 x 10^{-3}
1 atm cm^{3} s^{-1} =	1.01	0.76	1	7.6 x 10^{2}	2.12 x 10^{-3}
1 lusec =	1.33 x 10^{-3}	1 x 10^{-3}	1.32 x 10^{-3}	1	2.79 x 10^{-6}
1 atm ft^{3}min-^{1} =	4.78 x 10^{2}	3.59 x 10^{2}	4.72 x 10^{2}	3.59 x 10^{5}	1

Pumping Speed Units

	ls^{-1}	l min^{-1}	ft^{3}min^{-1}	m^{3}h^{-1}
1 ls^{-1} =	1	60	2.119	3.60
1 l min^{-1} =	0.017	1	0.035	0.06
1 ft^{3}min^{-1} =	0.472	28.317	1	1.699
1 m^{3}h^{-1} =	0.278	16.667	0.589	1

Material Safety Data Sheets

The following data sheets are available on request

P110-11-000 Mechanical pump oil - Supergrade
P110-20-100 Oil Apiezon® AP303
P120-01-000 Mechanical pump oil – 45
P120-01-005 Mechanical pump oil – TW
P120-01-010 Mechanical pump oil – Ultragrade 15, 19, 20, 70
P120-01-030 Drynert 25/6, gear box lubricant
P120-01-050 Synfilm GT Oil
P120-02-000 Oil – Apiezon® A, AP201, B, BW, C & G
P120-02-005 Oil – Apiezon® J & K
P120-02-010 Oil – Apiezon® AP301
P120-02-015 Diffusion pump fluid – DC702, 704EU & 705
P120-02-025 Diffusion pump fluid – Edwards L9
P120-03-000 Grease – Fomblin® (AR555)
P120-03-005 Grease – Krytox® series 240 & LVP fluorinated greases
P120-03-010 Grease – Apiezon® H & T
P120-03-015 Grease – Apiezon® L & M
P120-03-025 Grease – Apiezon® AP101
P120-03-030 Grease – Apiezon® AP100
P120-03-035 Grease – Silicone high vacuum
P120-03-040 Fomblin® CR 861
P120-03-045 DEFRIC COAT D1-C
P120-03-050 DEFRIC COAT D1-C solvent
P120-04-000 Wax – Apiezon® W & W40
P120-04-005 Wax – Sealing compound Apiezon® Q
P120-04-015 O-rings – Viton®
P120-04-020 O-rings – Nitrile & rubber vacuum
P120-04-025 O-rings – Kalrez®
P120-04-030 Indium metal seals
P120-04-035 O Rings - Fluoroelastomer (VAT)
P120-05-000 GS battery
P120-05-005 Grease – Asonic GHY72
P120-06-000 Coolant – Edwards Drystar® 2
P120-06-005 Coolant – HT110
P120-07-000 Refrigerant – Edwards chiller (SUVA HP62)
P120-08-000 GRC cartridges – C150Y/C150R/C150JV/C150W/ CM10Y
P120-08-005 End point detector fluid
P120-08-010 Pipe insulation jackets
P120-08-015 Thermal processing/conditioning system TPU-TCS
P120-08-020 GRC cartridges – C150A/C7150A
P120-08-025 GRC cartridges – C250Y
P120-09-000 Alumina grade A (activated alumina)
P120-09-005 Activated charcoal AC35
P120-09-010 Rotary pump blade material – CX2
P120-09-020 Rotary pump blade material – GE21
P120-09-025 Polytetrafluoroethylene PTFE
P120-10-000 Leak detection/ion gauge filaments
P120-11-010 V Lube B
P120-11-020 V Lube F US version
P120-11-025 V Lube F European version
P120-11-030 V Lube G
P120-11-040 V Lube H
P120-11-080 Heat transfer fluid
P120-11-100 Sealant – silicone liquid gasket
P120-11-110 Cartridge grease - Shell Darina® EP grease 2
P120-20-010 1-Methoxy-2-Propanol
P120-20-020 Emarald lacquer
P120-20-030 Emarald primer
P120-20-040 Isopropanol anhydrous
P120-20-050 Potassium hydroxide solution
P120-20-060 Visioncoat 2000
P120-20-070 Visioncoat 2000 solvent
P120-20-080 Optical 10L fluid
P120-20-090 Super II fluid
P120-20-100 Hexid fluid
P120-20-110 In-situ hydrophobic monomer
P120-20-130 Exchange carbon
P120-20-140 Exchange resin
P120-20-160 Zirconium
P120-30-010 XDS black tip seal dust
P120-30-015 XDS light brown tip seal dust
P120-40-020 Sodium fluoride
P120-40-060 Aquareus ion exchange resin
P120-70-005 Rotary pump blade material -F43
P120-70-010 Rotary pump blade material -F32

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Notice - Dimensions

Although every care has been taken in the preparation of dimensional drawings no responsibility can be taken for customers' work processed from this catalogue. Unless otherwise stated all dimensions are in mm (inches).

Notice - Accessories

Accessories are occasionally included in illustrations and dimension drawings for clarity or convenience. In general this is indicated on the drawing or in the adjacent text but in the case of doubt, please verify the status of such components before ordering.

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Certificate numbers:
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FM32104, FM59924 and FS23443.

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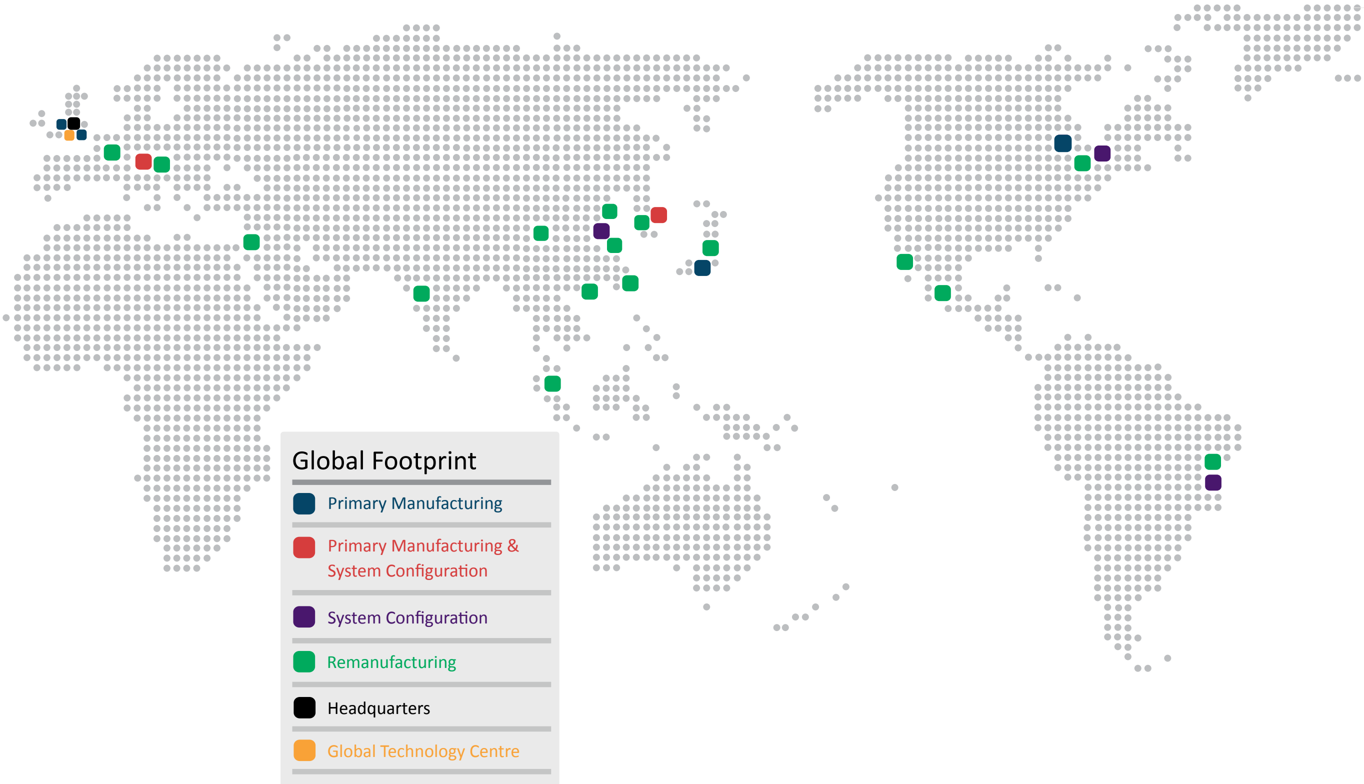

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