

Intravenous Infusion Lines

Enhancing Patient Safety During IV Therapy



Drug Compatible



Filtration



Protection

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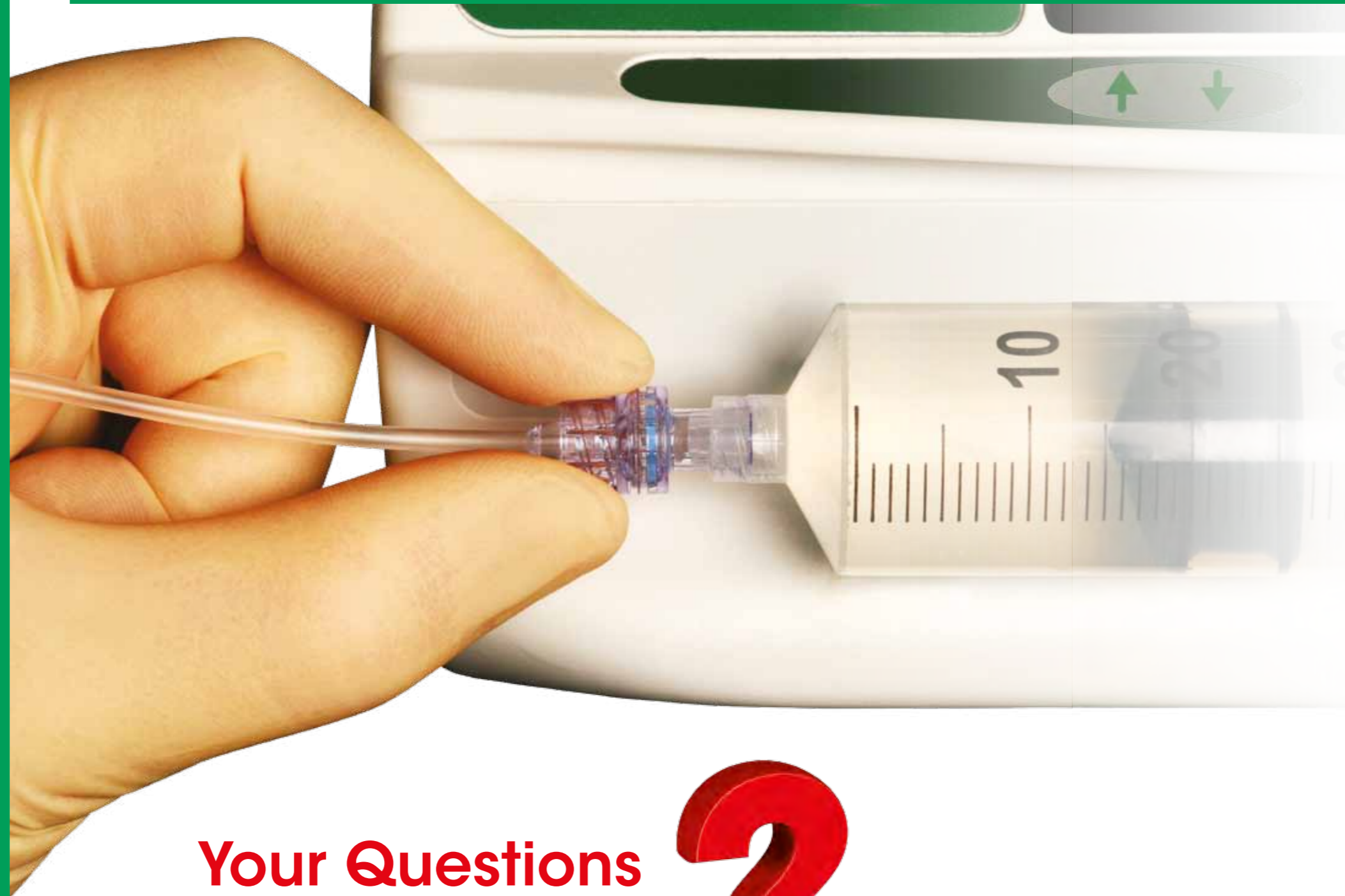
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Key to product features

Feature	Benefit	Key
ASV	Minimises the risk of downloading	■
ARV	Minimises the risk of backtracking	■
Clamp	For security during medication changes	■
PE-lined	Drug compatible fluid pathway	■
Side port with ARV	Allows simultaneous bolus dose administration or secondary infusion	■
Amber tubing	To protect light sensitive drugs	■
Filter	0.22µm 96hr endotoxin retentive for enhanced safety	■
Side port with ARV & Bionector	Allows safe bolus dose administration	■
Coiled line	Gives patient freedom of movement	■
Colour coded clips	For arterial or venous identification	■
PVC	Flexible tubing	■
Stopcock	3-way stopcock for multiple access points	
Dual-end	For universal use	
Detachable Line	For easy connection of infusions	



Your Questions Answered!

If you have any further questions on infusion line management, contact us on **01285 657051**



Since manufacturing the first drug-compatible Lectrocath over 45 years ago, Vygon has continued to focus on developing infusion lines which enhance patient safety during the administration of IV therapies.

Some of the safety issues that need careful consideration when planning to administer an IV infusion include:

- The type of material the infusion line is made from
- The use of a valved infusion line
- The use of filters within the infusion line.

Taking these considerations into account, Vygon offers a range of products to assist the Clinician when selecting the most appropriate infusion line for the intended IV therapy.

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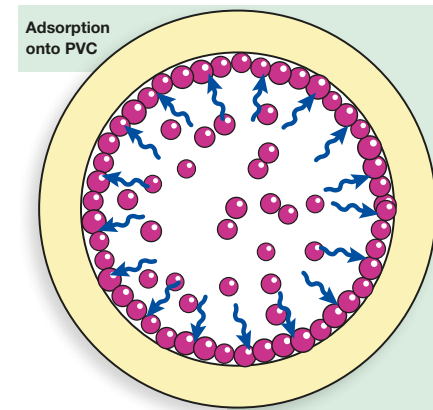
Material Choice

Why is material choice important?

Drug-plastic interaction is increasingly being recognised as a major problem¹ when intravenous solutions are infused via administration sets which are incompatible with many commonly used drugs.

If an infusion line is manufactured from PVC (which is not compatible with several commonly used drugs)

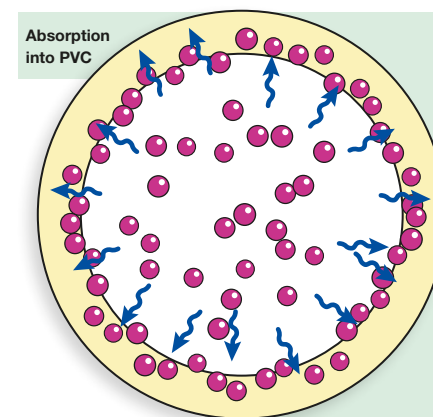
Adsorption, **Absorption** or **Permeation** may occur.



Adsorption

Adsorption occurs when the drug binds to the inner surface of a plastic drug infusion line, but does not penetrate any further. The initial effect is the reduction of drug concentration delivered to the patient. The inner surface then becomes saturated and the concentration of the drug in the solution increases rapidly.

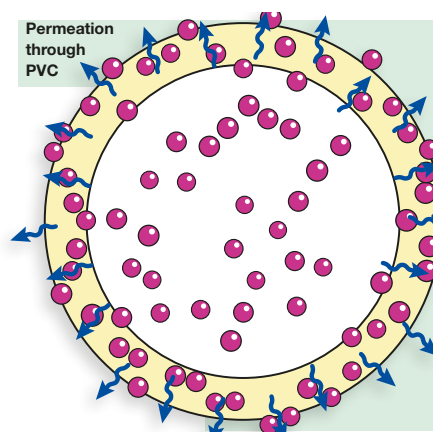
Substances which are most likely to adsorb are diazepam,² insulin,³ nitroglycerin,² propofol⁴ and interferons.



Absorption

Absorption occurs when the drug migrates into the wall of the plastic infusion line.¹ The drug concentration in the infusate is initially low and slowly begins to recover as the plastic becomes saturated.

Substances which are most likely to be absorbed are chlorpromazine and nimodipine.



Permeation

Permeation occurs when the drug migrates through the plastic wall and out onto the outer surface of the infusion line where it evaporates. Losses from permeation can be substantial and they continue throughout the duration of infusion as the plastic never becomes saturated.

Substances which are most affected by permeation are nitrates and chlomethiazole.

What are infusion lines commonly made from?

- Polyethylene (PE)
- Polyvinylchloride (PVC)
- Co-Extruded PE/PVC (Co-Ex)

What are the properties of these materials?

● Polyethylene (PE)

PE lines are compatible with all commonly used drugs. Many drugs are specifically indicated for use with PE lines.

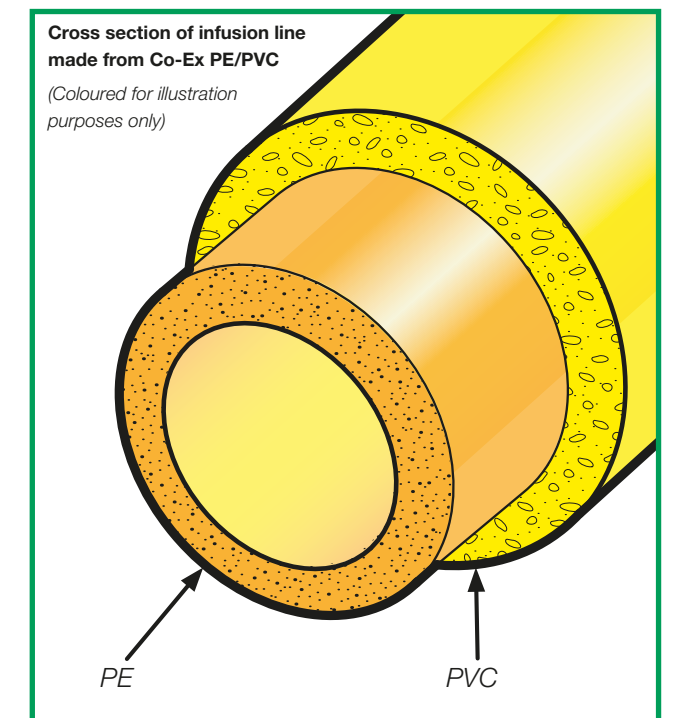
● Polyvinylchloride (PVC)

As previously mentioned, PVC lines are not compatible with a number of commonly used drugs. However, they are very soft and flexible which allows them to be clamped during an infusion procedure.

● Co-Extruded PE/PVC (Co-Ex)

Co-Ex lines constructed from PE/PVC offer the benefits of both materials. The result is a drug-compatible, fully clampable infusion line.

It is recommended that Co-Ex infusion lines should be used when safe, accurate and predictable delivery of a drug is required.



Valves

Why should valved infusion lines be considered when administering an IV infusion from a syringe pump?

The use of valved infusion lines when administering an IV solution via a syringe pump has been widely recommended for many years.⁵⁻⁷ These recommendations are in place to protect patients from the potentially fatal occurrence of 'syphonage' and 'back-tracking'. The types of solutions that are most commonly involved in these incidences are insulin, morphine, heparin and inotropes.

What is meant by drug syphonage and back-tracking?

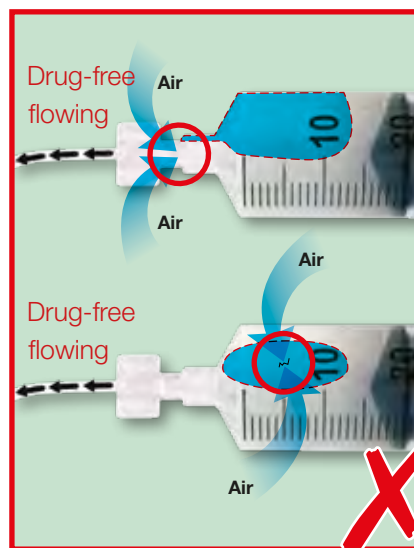


Syphonage

Syphonage or downloading, as pointed out by P.G.M. Wallace⁸ is when a drug free-flows from a syringe pump into the patient. This occurs in one of two ways, either by the height of the syringe being altered or when air becomes entrained into the syringe.

Height differences

Once a syringe is placed into a syringe pump and the infusion has commenced, the syringe **must not be removed** from the device unless the infusion has ended or the infusion line is clamped. If the syringe pump is positioned higher than the patient's heart, and the infusion line is not clamped, the drug will begin to syphon into the patient if you raise the syringe above the height of the pump.



Entrainment of air

Air can be entrained into syringes through a crack in the syringe or by an over/under-tightened connection between the syringe and the extension line.

Once the airtight seal is broken, a vent is created that permits air to enter the syringe barrel, eliminating the relative vacuum that exists in an intact syringe. Without the relative vacuum, medication can be delivered to the patient at an excessive rate. In laboratory testing, it has been found that aqueous solutions can be delivered by this means at flow rates in excess of 30ml/hr.

Back-tracking

Back-tracking occurs when a fluid flows away from the intended delivery point. This commonly occurs when two or more infusions are connected to a single access point such as a peripheral cannula.⁵

Consider the set-up to the right using a three-way tap. If the patient's cannula becomes blocked, or the three-way tap is turned the wrong way, there is a possibility for the two fluids to mix. The fluid flowing at the higher flow rate will flow towards the other along the path of least resistance.

Because the insulin is being delivered under pressure using a mechanical device (ie a syringe pump) this will override the lower pressure of a simple gravity infusion. The syringe pump will not alarm as the flow of insulin is not interrupted.

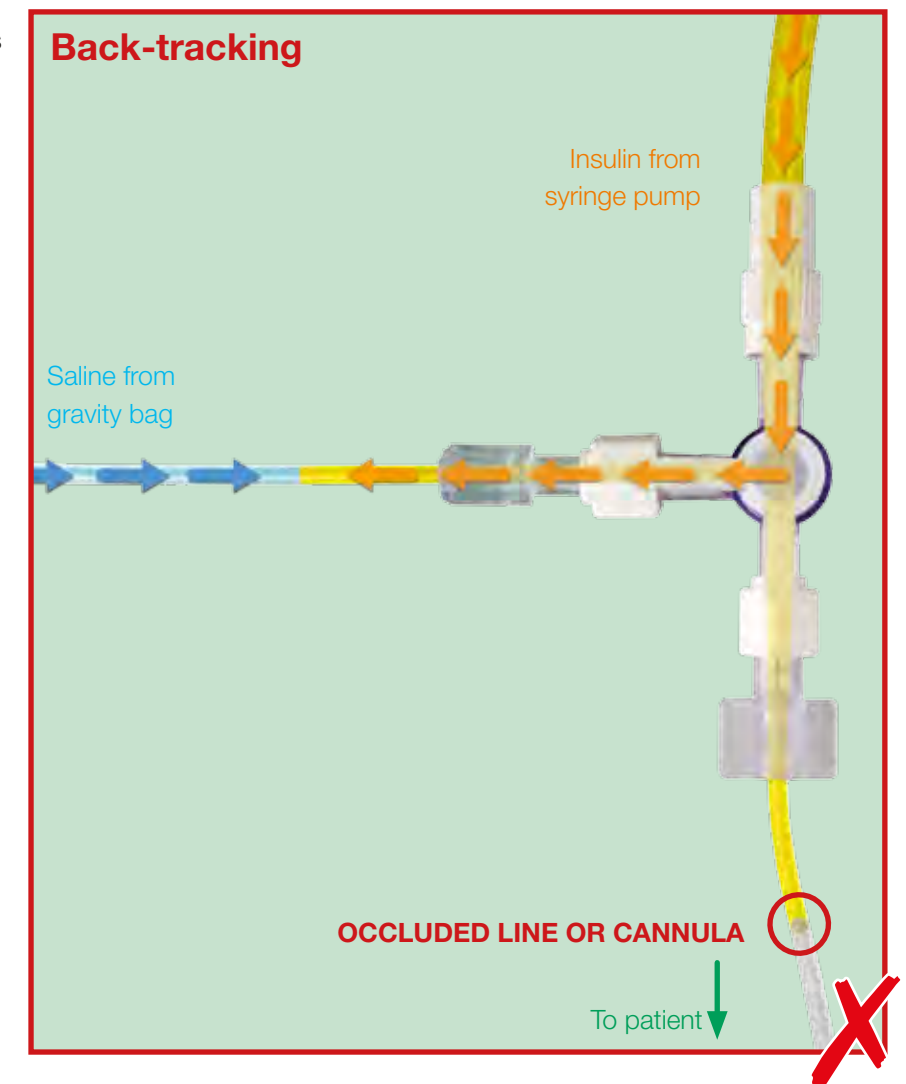
There are two serious issues when drugs back-track:

Interruption of Treatment

The patient fails to receive the prescribed medication as the drug is inadvertently administered into the gravity administration set. These are often critical drugs such as inotropes, insulin, morphine or heparin. Changes in patient physiology, eg heart rate and blood pressure, may therefore be detected before anyone is aware of any back-tracking.

Accidental Bolus

Should the blockage to the patient clear, or the three-way tap be turned back to its correct position, all the drug that has built up in the line and fluid bag can then flow into the patient as an uncontrolled, rapid bolus. This can lead to an overdose, speed shock, and occasionally death.⁵⁻⁷



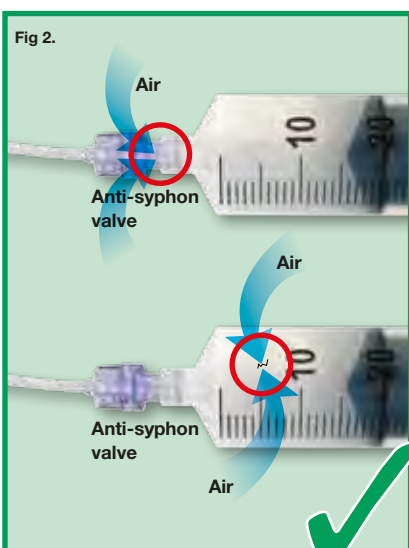
What can be done to reduce the risk of syphonage or back-tracking?



Reducing syphonage

To reduce the risk of syphonage, an anti-syphon valve (ASV), sometimes called an anti-free flow valve, should be used on all syringe pump extension lines.

As you can see from figure 1, even though the syringe has been elevated, the drug has not flowed into the patient. This is because the ASV needs a pumping pressure in excess of 155mm/Hg to allow any fluid to flow. This resistance is sufficient to ensure that the pressure caused by a vertical height increase of up to 80cm will not allow fluid to flow through the valve. It is recommended that infusion pumps and syringe pumps are not placed more than 100cm above the venous entry site.

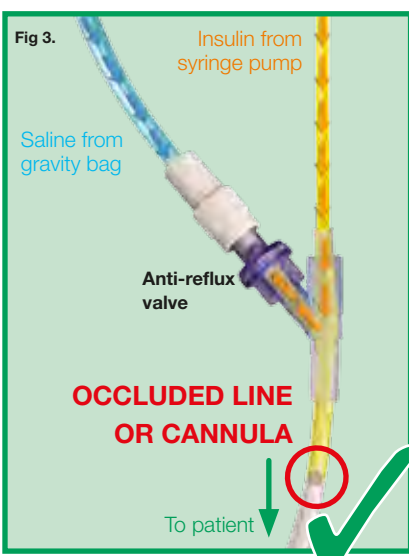


As you can see from figure 2, the entrained air does not cause the drug to be pushed into the patient. This is again due to the ASV needing a pressure of 155mm/Hg to allow fluid to flow through it. If there is a vent to the outside air, the pressure falls in the relative vacuum of the syringe. The pressure fall causes, the valve to close, which prevents the drug from free-flowing into the patient.

Note: An ASV also acts as an anti-reflux valve (ARV).

Reducing back-tracking

To reduce the risk of back-tracking, an anti-reflux valve (ARV), sometimes called a non-return valve or a back-check valve, should be used on syringe pump extension lines where a gravity set is intended to be connected.⁵



As you can see from the figure 3, the insulin cannot back-track along the gravity set as the ARV prevents any flow towards the gravity bag. In this example the syringe pump would eventually alarm as it would detect an occlusion and alert the clinician to the problem.

Training

What is the 'added value' of training?

The added value of training is our commitment to you in support of 'best practice' programmes employed within your NHS Trust or workplace. Customer Service is foremost in Vygon's approach to successful business and this extends to our product support/education programmes.

Why is training of 'added value'?

Our Sales Executives are educated to a standard that enables them to support 'best practice' in line with current clinical guidelines. This means that in relation to our products, your staff can be updated and informed of changes relating to current evidence-based practice and national guidance.



Bespoke In-Service Training

Following careful consultation, we can develop tailor-made and personalised training sessions in accordance with your local policies and protocols. In this way, we can help support you in the implementation of 'best practice' for your NHS Trust or workplace.



Night Training

We acknowledge that night staff can have problems gaining access to formal training upon the introduction of new products. Vygon can assist in addressing this issue by ensuring that all your night staff are fully supported with education and training.



Certificates

Maintaining an accurate record of staff training on new products is very important. Therefore we provide all grades of staff personalised certificates of attendance for our workshops. This allows your practice development teams to keep a record of all staff training. You can also request a list of workshop attendees for your own records.



Customer Support

Each customer has the support of their local Sales Executive, Regional Sales Manager, National Sales Manager, Business Development Manager and Sales Support Agents to ensure training meets all needs and expectations. Our experienced teams have the expertise to ensure smooth implementation of your custom-designed programme, encompassing the requirements of your NHS Trust or workplace.

Vygon (UK) Ltd has supplied medical and surgical devices to healthcare professionals for over 30 years. During this time Vygon has built a reputation for high quality products and excellence in customer service helping you to offer best practice solutions to your patients.

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