

Supporting resource 2: Portable cylinder system options and equipment

This resource can be used independently or together with the **'Nitrous oxide toolkit: Reducing waste in NHS trusts'**.

What

This guide is designed to assist NHS trusts in understanding and selecting the most appropriate portable nitrous oxide cylinder systems based on their specific clinical needs, infrastructure and resource availability. It also includes suppliers and cost guidelines to help make informed purchasing decisions.

Who

Information is designed for project managers, pharmacists, anaesthetists, medical gas committees (MGC) and technical staff who use either nitrous oxide or nitrous oxide/oxygen mixture and are looking for alternatives to medical gas pipeline systems.



When



This information is valuable across multiple stages of nitrous oxide waste reduction efforts but may be most helpful when planning to pilot a portable cylinder system or deciding the best long-term approach to take.




Portable cylinder systems

Portable cylinder systems use compact, smaller gas cylinders. This makes them suitable for point-of-care use. They are an alternative to a medical gas pipeline system. Portable systems can be flexible, cost-effective and comparably low waste. There are different types of portable cylinder system that can be used in different clinical settings.




Approach	Description	Best for	Pros/cons	Equipment list	Photo
Cylinder on a trolley	<p>Cylinder trolleys are mobile carts that allow small cylinders to be stored in designated anaesthetic rooms, designated stations in clinical settings or secure spaces and moved to where they are needed.</p> <p>These trolleys can be purchased from medical gas suppliers or custom-made by hospital trusts.</p> <p>Pressure regulators and Schrader socket adaptors allow attachment to the anaesthetic machine via the gas supply hose.</p> <p>Trolleys should be assembled in a way to prevent them from toppling over if knocked. This may include a weighted trolley base or chains around cylinders to secure them.</p>	<p>Can be suitable for any clinical area where nitrous oxide or nitrous oxide/oxygen mixture is required.</p> <p>Trolleys are available to hold different size cylinders depending on clinical usage and single or multiple cylinders of the same or different gases.</p>	<p>Pros:</p> <ul style="list-style-type: none"> • Flexible and mobile • Easy to implement • Low cost <p>Cons:</p> <ul style="list-style-type: none"> • Some medical equipment may require software adjustment to avoid automatic checking for piped supply • Storage and safety considerations required 	<ul style="list-style-type: none"> • Cylinder trolley • Small nitrous oxide cylinders • Pressure regulator with pressure gauge • Schrader socket adaptor • Gas supply hose • Safety chains • Terminal unit caps • Cylinder wrench/spanner 	 <p>Examples of trolleys that can hold one cylinder</p>  <p>Example of a trolley that holds multiple cylinders (Image courtesy of Porter Instrument. Retrieved from https://www.porterinstrument.com)</p>




Approach	Description	Best for	Pros/cons	Equipment list	Photo
Portable cylinders on anaesthetic machines (without modification)	<p>Some trusts will have the equipment available to implement a portable system.</p> <p>For example, some anaesthetic machines are designed to directly accept small nitrous oxide cylinders without the need for additional equipment or modifications.</p>	Theatres with compatible anaesthetic machines.	<p>Pros:</p> <ul style="list-style-type: none"> No additional equipment required Easy to implement <p>Cons:</p> <ul style="list-style-type: none"> Limited to specific machine models 	<ul style="list-style-type: none"> Compatible anaesthetic machine Small nitrous oxide cylinders Terminal unit caps Cylinder wrench/spanner 	
Portable cylinders on anaesthetic machines (with modification)	<p>This approach involves modifying existing medical equipment.</p> <p>For example, anaesthetic machines can be modified to accept nitrous oxide cylinders by adding a yoke, a clamp-like device that secures the cylinder to the machine.</p> <p>An alternative option to the yoke is to install a cylinder holder to secure the cylinder on the machine and use a pressure regulator with a pressure gauge.</p> <p>Costs for these modifications vary.</p>	Anaesthetic rooms with relatively consistent use of nitrous oxide.	<p>Pros:</p> <ul style="list-style-type: none"> Allows consistent availability of supply in areas where it is deemed necessary Installing a cylinder holder and using a pressure regulator with a pressure gauge can be done by internal medical equipment technicians <p>Cons:</p> <ul style="list-style-type: none"> Higher cost compared to other options Requires coordination with clinical engineering and pharmacy procurement Some anaesthetic machines may require software updates to avoid automatic checking for a medical gas pipeline system supply 	<ul style="list-style-type: none"> Yoke OR pressure regulator with pressure gauge and cylinder holder Small nitrous oxide cylinders Gas supply hose Software updates (if required) Terminal unit caps Cylinder wrench/spanner 	<p>With yoke:</p>  <p>With pressure regulator:</p> 



Approach	Description	Best for	Pros/cons	Equipment list	Photo
Brackets on the walls	<p>This option involves vertically mounting cylinders to walls in clinical areas using brackets.</p> <p>This requires support from the estates and facilities team to install the brackets, and medical engineering to source appropriate equipment to connect to the medical equipment, such as anaesthetic machines.</p>	<ul style="list-style-type: none"> Clinical spaces with suitable wall space for bracketing Anaesthetic rooms that frequently use nitrous oxide Non-PFI buildings 	<p>Pros:</p> <ul style="list-style-type: none"> Allows consistent availability of supply in areas where it is deemed necessary Keeps cylinders organised and easily accessible Suitable for larger cylinder sizes <p>Cons:</p> <ul style="list-style-type: none"> Requires available wall space and installation May require additional cost from PFI contract restrictions to drilling walls Some anaesthetic machines may require software updates to avoid automatic checking for piped supply 	<ul style="list-style-type: none"> Wall brackets Portable nitrous oxide cylinders Pressure regulator with pressure gauge Gas supply hose Mounting hardware Safety chains Terminal unit caps Plastic cylinder wrench/spanner if for MRI 	
Mobile Nitrous Oxide Sedation System (Dentistry)	<p>A mobile stand specifically designed for dental sedation that accommodates multiple portable cylinders to enable a continuous flow of the gas when needed.</p> <p>The system integrates dental sedation flowmeters.</p>	<ul style="list-style-type: none"> Dentistry and other settings requiring conscious sedation. Where space permits a mobile stand. 	<p>Pros:</p> <ul style="list-style-type: none"> Flexible and mobile Easy to implement <p>Cons:</p> <ul style="list-style-type: none"> Storage and safety considerations required 	<ul style="list-style-type: none"> As a minimum, two portable nitrous oxide cylinders Continual flow of oxygen (e.g two portable oxygen cylinders) Dental sedation flowmeter Connection components Cylinder securing mechanisms Gas delivery hoses Cylinder wrench/spanner Terminal unit caps 	
Mixture of options	<p>A combination of approaches can be used depending on the specific needs and requirements of each clinical area within a hospital trust.</p> <p>This allows for customisation based on factors such as cylinder usage, available space, and existing equipment.</p>	<p>Trusts with diverse clinical setups and requirements.</p>	<p>Pros:</p> <ul style="list-style-type: none"> Allows for customisation Can optimise cost and resource allocation <p>Cons:</p> <ul style="list-style-type: none"> May require more planning and coordination 	<ul style="list-style-type: none"> See all previous options 	

Costs and supplies

The below table outlines the indicative costs of equipment that may be needed to set up a portable cylinder system. Not all of this equipment will be required, and trusts should select the equipment for each area based on the guidance above.

Equipment	Indicative Cost Range (£)*		
Nitrous oxide cylinders	Trust dependent		(shown with trolley)
Cylinder trolley	100 - 300		(shown with cylinder)
Pressure regulator with pressure gauge	100 - 250		(shown with cylinder)

Equipment	Indicative Cost Range (£)*		
Yoke (for anaesthetic machines)	200 - 500		(shown with cylinder)
Terminal unit caps (pack of 50)	20 - 70		
Gas supply hose	40 - 80		(Shown with cylinder and pressure regulator on modified anaesthetic gas machine)

Equipment	Indicative Cost Range (£)*	
Schrader valve/socket adaptor	70 - 150	
Wall bracket	50 - 150	 (bracket holding cylinder on left)
Cylinder wrench/spanner	5 - 15	
Warning signs and labels	10 - 30	
Quick-connect fitting	30 - 80 per fitting	

*The indicative cost range for equipment has been gathered from supplier websites and information provided by trusts. This information was gathered in early 2024. Please note these costs are for the item of equipment only and there may be additional costs for installation of equipment if needed.