



Figure 3. Miniscav scavenging unit

parts are no longer available. However, an element of confusion has arisen regarding the use of remaining systems—mostly being used in conjunction with:

1. A central anaesthetic gas scavenging system with air break in-line
2. A 'stand-alone' AGS system such as an APC or Purair 130.

As these are labelled as anaesthetic gas scavenging systems, the common perception is that they offer an 'active' draw on the breathing system connected. This is not the case, as the applicable standard is BS6834: 1987 which only allows for an induced flow rate of 0.5 L/min. This flow rate is primarily for use with GA circuits and does not apply to dental scavenging as outlined in HTM 02-01. The relevant sections for reference in that publication are Chapter 10: 10.5—Anaesthetic Gas Scavenging Disposal Systems and Appendix L 8, 9 and 10—Important notes for use of medical vacuum and anaesthetic gas scavenging.

### Methods of generating extraction flow rate

There are only three methods available:

1. Connection to a suitable dental vacuum system—using the high volume port (subject to it being externally vented and also

capable of sustaining the 45 L/min draw during the sedation procedure)

2. Connection to a centralised anaesthetic gas scavenging system—directly to the terminal by a special AGS probe adapter—but with no air break in-line
3. Connection to a Miniscav—standalone dedicated scavenger unit (Figure 3).

Any of the breathing systems outlined in the section above can be used with these systems.

### Maintenance

Once you have your equipment it is strongly recommended that regular maintenance is carried out. Guidelines on this subject can be vague. However, the document *Commissioning conscious sedation services in primary dental care Annex 1 checklist* (Department of Health, 2007) states that it is mandatory to have the equipment serviced according to the manufacturer's guidelines. The generally recognised service interval in the UK is once per annum. Units located in busy primary care departments may require maintenance at six monthly intervals. This ensures that the equipment is kept in optimum working order including calibration.

Certosimo F, Walton M, Hartzell D, Farris J (2002) Clinical evaluation of the efficacy of three nitrous oxide scavenging units during dental treatment. *Gen Dent* **50**(5): 430–5

Dental Sedation Teachers Group (2000) Standards in Conscious Sedation in Dentistry. Available at: <http://www.dstg.co.uk/teaching/standards-oct-02> (accessed 30 August 2012)

Department of Health (2003) Conscious sedation in the provision of dental care : report of an Expert Group on Sedation for Dentistry, Standing Dental Advisory Committee. Available at: [http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH\\_4069257](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4069257) (accessed 30 August 2012)

Department of Health (2006) Medical gases: Health Technical Memorandum 02-01: Medical gas pipeline systems. Part A: Design, installation, validation and verification. Available at: <http://www.uk.airliquide.com/file/otherelement/pj/htm%2002-01%20medical%20gases%20part%20a%20-%20design%20installation%20validation%20and%20verification89657.pdf> (accessed 30 August 2012)

Department of Health (2007) Commissioning conscious sedation services in primary dental care - June 2007. Available at: [http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH\\_075172](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_075172) (accessed 30 August 2012)



# The Sedation Solution for the 21st Century



Free help and advice offered on all aspects of Inhalation Sedation equipment, medical gases and scavenging of nitrous oxide.

If you are considering installing any of this equipment - why not give us a call on 01535 652444?

Our friendly, knowledgeable staff will be happy to discuss your requirements and advise.



R A Medical Limited  
Holmes House, Skipton Road, Keighley BD20 6SD  
Tel: 01535 652 444 Fax: 01535 653 333  
[www.ramedical.com](http://www.ramedical.com) - [info@ramedical.com](mailto:info@ramedical.com)



**Janet Pickles** is Chairwoman, RA Medical Services Ltd, Steeton, West Yorkshire

Email: [janet@ramedical.com](mailto:janet@ramedical.com)

## Learning outcomes

After reading this 'Guide to Inhalation Sedation Equipment', you should:

- Be aware of differences between inhalation sedation flowmeter types
- Understand the various types of medical gas supply to the flowmeter
- Ensure your scavenging complies with current regulations
- Ensure you have a programme for regular documented equipment maintenance in place



## Inhalation Sedation Equipment

This guide is supported by an educational grant from **RA Medical Services Ltd**  
Inhalation Sedation Specialists



# GUIDE TO... Inhalation sedation equipment

This guide describes the use of inhalation sedation equipment, looking at three core elements: Inhalation sedation flowmeters, dental scavenging, and medical gases

For trouble-free and successful administration of inhalation sedation, several basic recommendations should be followed prior to initial installation of the equipment. When determining a system, there are several choices to be made:

- Manufacturer: analogue or digital flowmeter
- Medical gas supply: pipeline system or stand-alone mobile 4 cylinder stand
- Scavenging requirements: breathing system type / method of removing waste gases.

However, once the specification has been determined and the equipment installed by a specialist company, then, with regular ongoing maintenance to ensure optimum equipment performance in accordance with manufacturer recommendations, most equipment of this category will offer the user many years of relatively trouble-free service. Indeed, there are quite a number of Cyprane Quantiflex flowmeters—mostly Mark II and Analogue MDM—still in regular use some 40+ years after production during the late 1960s / early 1970s at the factory then located in West Lane, Keighley, West Yorkshire.

## Inhalation sedation flowmeter types

In the 21st century there is quite a choice of dedicated sedation flowmeters to choose from, and in order to administer relative analgesia—or inhalation sedation, now the more common term of reference—a dedicated flowmeter must be used. *Standards in Conscious Sedation in Dentistry* (Society for the Advancement of Anaesthesia in Dentistry, 2000) states: ‘Dedicated purpose-designed relative analgesia machines for dentistry should be used. Such machines should conform to British Standards and be maintained according to manufacturer’s guidance with regular, documented servicing.’ This statement is repeated in *Conscious*

*Sedation in the Provision of Dental Care*, published by the Department of Health in 2003, and remains the defining regulation in force.

Flowmeters of this type have been widely available in the UK since the 1960s when the Quantiflex range, Mark I and II, and the Monitored Dial Mixer (MDM) were first produced under license by Cyprane. The Analogue MDM is still the most popular type of IS flowmeter and widely in use across Europe and the world. Large quantities were sold and it is not uncommon to come across units that are in the 40+ year old category and still going strong. Some smaller quantities of Mark II units also remain in use, although they are not as popular because they have separate oxygen and nitrous oxide flow controls meaning a percentage flow calculation has to be carried out. The 21st century flowmeter model is the Digital MDM (*Figure 1*), which also addresses the issue of infection control with its digital display and wipe clear touch screen. The current manufacturer is Porter Instruments, USA who purchased the nitrous oxide sedation division from Matrix in 2008.

There is a selection of other flowmeter models available: Porter MXR C3000, Accutron Ultra & Newport and the McKesson Mc1. Some older McKesson flowmeters may still also be encountered; an example of this is the 882. This unit was a RA / GA unit which had a glass bottle vaporiser attached, allowing the machine to be used for both relative analgesia and general anaesthesia. Since 2000 most of the units remaining in use have had the glass vaporiser removed, thereby returning the unit to a dedicated sedation flowmeter in line with current regulations.

When choosing a flowmeter, some thought must be given towards analogue or digital models. Elements to consider include: reliability,





performance, available mounting and infection control. Thus if infection control is a big issue then the choice might involve the Digital MDM, Porter MXR (Figure 2) or Accutron Ultra—all of which were designed with this function in mind. Other considerations might include:

- Type of flowmeter already familiar with
- Whether to be used with pipeline or four-cylinder stand
- General overall appearance
- Space in surgery.

### Medical gas supply options

All of the above flowmeter types, with the exception of the Accutron Newport which carries



Figure 1. Digital MDM flowmeter

integral mounting for four 'E' sized cylinders within its cabinet, require the addition of a medical gas supply (oxygen and nitrous oxide) in order to function. The subject is divided into two main areas:

#### Medical gas pipeline system

This is a complicated area, with the main standard applicable being HTM 02-01 published in May 2006. This 'best practice guidance' is aimed primarily at hospitals and larger healthcare premises and for smaller establishments is very difficult to apply successfully. However, the basics required are:

- Suitable location for larger cylinders—typically 'J' oxygen and 'G' nitrous oxide. The area should be secure and protected from weather and have good, flat access for ease of delivery / collection. Must also be correctly signed for compressed gases and have no electrical equipment in the same location
- A piped system to carry the gases. This can be achieved on several levels from braised copper through to a flexible pipeline system made from colour-coded low-pressure hoses with the end fittings crimped to BS EN ISO 5359:2008. All components used should be specifically for use with medical gases to reduce the risk of combustion
- At the surgery end, the pipework usually terminates in wall outlets (terminals) which are colour coded and gas specific for the oxygen and nitrous oxide, although a simple 'in-surgery' pipeline system may not have these, being connected directly to the RA Flowmeter with Diameter-Indexed Safety System (DISS) fittings. Some older flowmeters may have Non-Interchangeable Safety Thread (NIST) fittings instead
- The price depends on type of pipework system and number of outlets (surgeries) supplied, with a HTM 02-01 compliant system including auto-change manifolds and alarm panels costing many thousands of pounds and a simple in-surgery pipeline system only costing in the hundreds (approximate costing only).

#### Mobile 4 cylinder stand

This is a combined mounting and medical gas system consisting of a base with five legs





Figure 2. Porter MXR and stand with low mount

(some older models have four), column and yoke assembly (Figure 2). The yoke carries a mounting for four cylinders; two oxygen and two nitrous oxide: 'E' size with pin-indexed fittings to prevent interchange of gases. There are also two gas-specific regulators (one oxygen and one nitrous oxide) reducing the cylinder contents down to a working pressure of 60 psi. A gauge gives indication of cylinder contents—accurate only in the case of the oxygen cylinder. The nitrous oxide itself is in liquid form and the gauge will only register the gaseous amount above the liquid level. Some types of stand now also have cylinder restraint straps which prevent the cylinders clanging together when the stand is moved. This is an excellent feature as it prevents strain being put on the pins of the pin-index system. These can snap when subject to undue pressure (as when being moved over uneven surfaces) and result in the stand requiring urgent maintenance as damaged or missing pins could allow the medical gas

cylinders to be transposed, resulting in a potential hypoxic mix being administered.

### Scavenging of waste nitrous oxide

This is a vitally important subject and attention to detail should be exercised when choosing the correct system for individual application. There are two distinct areas of scavenging:

- Scavenger breathing system (or patient delivery circuit)
- Method of active removal of waste gases from surgery environment.

### Scavenger breathing systems

All dental breathing systems should be active—the definition of which is: 'An air flow rate of 45 L/min'. This is designed to comply with the Control of Substances Hazardous to Health exposure limit of 100 ppm over an 8-hour time-weighted average. Most of the current manufacturers produce a breathing system that complies with this; Porter (who offer both the Porter brown and the Autoclavable Nitrous Scavenger systems) and Accutron who also produce a version of this type of breathing system. The efficiency of these systems varies slightly depending on whether a single or double mask is used—the double mask being more efficient at scavenging as determined by various studies—the most well recognised of which is: 'Clinical evaluation of the efficacy of three nitrous oxide scavenging units during dental treatment' (Certosimo et al, 2002). This study concludes that the Porter brown double-mask breathing system is the most efficient. These systems can all be used with a variety of nasal hoods—single and double. Also available is a range of both autoclavable and single-patient-use elements to include tubing and connectors. These are designed to aid with determining a suitable infection control protocol including consideration of cost elements: autoclave vs disposable.

### Important historical note

While stating that all breathing systems should be active, there are still a small number of the very old type passive circuits in use. Manufacture of this system ceased by Porter Instruments in January 2009 and spare

