

# AMSORB® PLUS

Safe CO<sub>2</sub> Absorption

Eliminates Hidden Dangers

The World's First Strong Alkali Free Absorbent  
... a Patient Safety First



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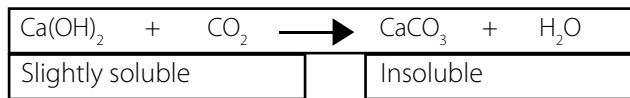
Contents	
AMSORB® PLUS - CO <sub>2</sub> Absorbent	01
Product Range	02 - 03
Colour Change	04
Composition of Absorbents	05 - 06
CO <sub>2</sub> Absorption Capacity	07
Gas Toxicity	08
Agent Adsorption	09
Alkalinity of Soda Lime	10
Desiccation	11
Background	12 - 13
Machine Compatability	14
Ordering Information	15
Frequently Asked Questions	16

**AMSORB® PLUS – absorbs carbon dioxide (CO<sub>2</sub>) from cellular respiration during anaesthesia. Unlike other absorbents it is not capable of degrading vapourous anaesthetic agent. Use of AMSORB® PLUS is supported by an extensive bibliography in peer-reviewed journals.**

**How AMSORB® PLUS Works**

The primary reaction is between CO<sub>2</sub> and calcium hydroxide (Ca(OH)<sub>2</sub>) and water. These form calcium carbonate (CaCO<sub>3</sub>) and water. Exothermic heat is a by-product of absorption. During absorption, Ca(OH)<sub>2</sub> is continually re-moistened until converted to CaCO<sub>3</sub>. Lesser chemicals, calcium chloride (CaCl<sub>2</sub>) and calcium sulphate (CaSO<sub>4</sub>) prolong the life of Ca(OH)<sub>2</sub> and increase the speed of absorption reaction by maintaining granule strength and optimising hydration.

**Chemical Reaction of Absorption**



Ca(OH)<sub>2</sub> is an ionic compound which is soluble in water at 0.5g.L at 20°C

- The ions are Ca<sup>++</sup> and OH<sup>-</sup> OH<sup>-</sup>
- CO<sub>2</sub> is soluble in water at 1 vol : 1 vol at 20°C
- CaCO<sub>3</sub> is an insoluble ionic compound Ca<sup>++</sup> and CO<sub>3</sub><sup>--</sup>
- Reactions take place in solution when particles are mobile and react on collision

A colour indicator is present, changing from WHITE (fresh) to VIOLET upon exhaustion or desiccation. The

indicator reacts to changes in granule hydration as absorption progresses; eventually remaining violet-coloured, once absorption is complete. Colouration also results from contact with ambient air or oxygen, if exposed to these.

**Medico-Legal Implications**

• **Carbon monoxide (CO)** is produced when passing sevoflurane, isoflurane and desflurane through certain brands of desiccated absorbent. CO is a potentially deadly toxin which users must ensure is not administered to patients, as carboxyhaemoglobin increases can trigger myocardial infarction or cause neurotoxicity in young or anaemic patients.

**AMSORB® PLUS DOES NOT PRODUCE CO**

• **Formaldehyde (HCOH)** is produced when passing sevoflurane through certain brands of desiccated absorbent. HCOH is a potent inhalation irritant and carcinogen and should never be administered to patients. PONV is caused by HCOH inhalation.

**AMSORB® PLUS DOES NOT PRODUCE HCOH**

• **Compound A** is produced when passing sevoflurane through certain brands of fresh or desiccated absorbent. Compound A has been proven to be nephro- and hepatotoxic in rats. Its effect in humans has not been established.

**AMSORB® PLUS DOES NOT PRODUCE COMPOUND A**

Coppens *et al.* The mechanisms of carbon monoxide production by inhalational agents. *Anaesthesia* 2006; vol. 61; pp. 462-468

Keijzer C *et al.* Carbon monoxide production from desflurane and six types of carbon dioxide absorbents in a patient model. *Acta Anaesthesiologica Scandinavica* 2005; vol. 49; pp. 815-818

Knolle E *et al.* Small Carbon Monoxide Formation in Absorbents Does Not Correlate with Small Carbon Dioxide Absorption. *Anesthesia & Analgesia* 2002; vol. 95; pp650-655

Bedi A *et al.* The in vitro performance of carbon dioxide absorbents with and without strong alkali. *Anaesthesia* 2001; vol. 56; pp. 1-6

Yamakage M *et al.* Carbon Dioxide Absorbents Containing Potassium Hydroxide Produce Much Larger Concentrations of Compound A from Sevoflurane in Clinical Practice. *Anesthesia & Analgesia* 2000; vol. 91; pp220-224

# Product Range



## AMAB3000

5.0 litre jerrycan  
Case Quantity - 2pcs



## AMAB3200

1.0kg cartridge  
Case Quantity - 12pcs



## AMAB3201

1.0kg cartridge (without sealing gasket)  
Case Quantity - 12pcs



## AMAB3400

1.0kg bag  
Case Quantity - 12pcs



## AMAB3800

Prefilled CAN-CAN® absorber 800g (1 litre) for GE Healthcare ADU II anaesthesia workstations  
Case Quantity - 6pcs



## AMAB3801

Prefilled G-CAN® absorber, 800g (1 litre) for GE Healthcare Aisys, Avance and Aespire anaesthesia workstations  
Case Quantity - 6pcs

Use of AMSORB® PLUS DOES NOT require approval of the anaesthesia machine manufacturer

## Product Range



### AMAB3802

Prefilled Q-CAN absorber, 800g (1 litre) for Anmedic anaesthesia workstations with Q circle system

Case Quantity - 6pcs



### AMAB4000

Prefilled BUBBLE-CAN® absorber, 1,000g (1.3 litre) for Dräger anaesthesia workstations excluding Apollo, Pallas and Primus

Case Quantity - 6pcs



### AMAB4001

Prefilled BUBBLE-CAN® UNIVERSAL absorber, 930g (1.2 litre) for all Dräger anaesthesia workstations including Apollo, Pallas and Primus

Case Quantity - 6pcs



### AMAB4000/001

BUBBLE-PLATE Adapter for Dräger anaesthesia workstations

Case Quantity - 1pc



### AMAB4000/002

BUBBLE-BLOC Adapter for Dräger anaesthesia workstations

Case Quantity - 1pc



### AMAB0001

Limescale removal fluid, 500mL spray

Case Quantity - 1pc

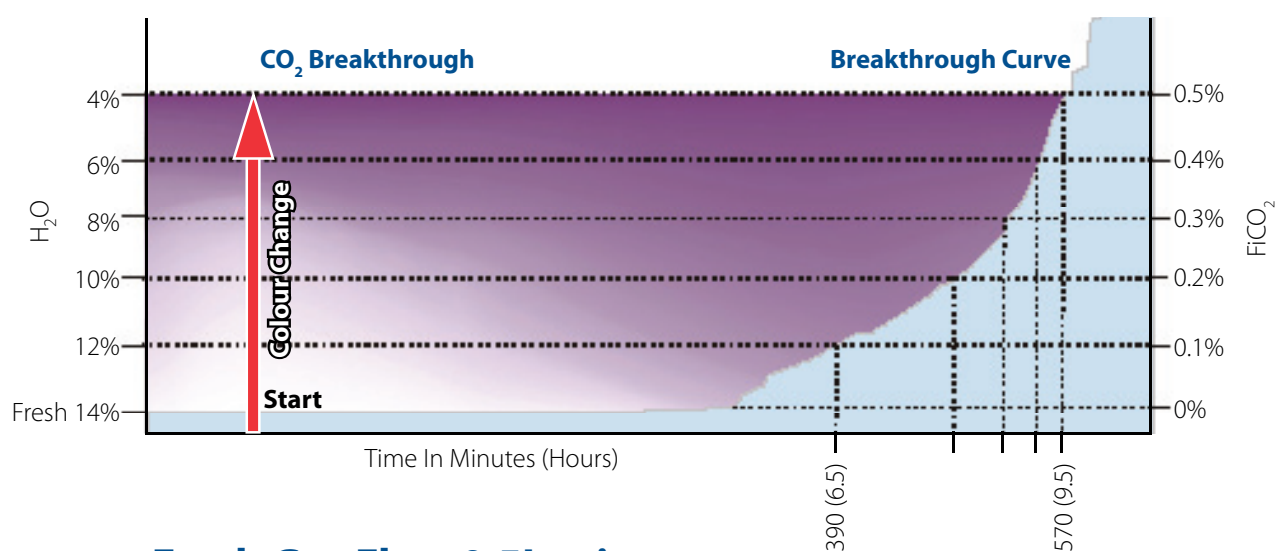
# Colour Change

## Colour Change

AMSORB® PLUS colour indicator reacts strongly and quickly to the dehydrating effects of CO<sub>2</sub> absorption or contact with anhydrous gas, such as oxygen. Whilst the colour change is an indication of the hydrated state and remaining capacity, depletion of the absorbent should be determined by capnometry and the absorbent changed when FiCO<sub>2</sub> has exceeded 0.5% volume or 5mmHg.

In the case of NaOH-containing (sodium hydroxide)

absorbents, colouration reverts to white when contact with CO<sub>2</sub> ceases, often after a few hours of non-use. This is due to the strongly alkaline nature of NaOH in soda lime. Desiccation of soda lime through contact with anhydrous gas or moisture loss through exposure to ambient air DOES NOT trigger the colour indicator in soda lime and the soda lime can be desiccated but coloured white, thus appearing fresh and safe for clinical use. Soda lime is potentially dangerous to use when desiccated, as CO<sub>2</sub> absorption may continue.



## Fresh Gas Flow 0.5L.min

Method: *in vitro* patient model. 1.0kg AMSORB® PLUS. Tidal volume 500mL, respiratory rate 12 breaths per minute, fresh gas flow 500mL.min. O<sub>2</sub> 250mL.min. CO<sub>2</sub> added to expiratory limb. Colour change is permanent at the time of CO<sub>2</sub> breakthrough to 0.5% volume and remains provided the granules are not subsequently rehydrated. Not all granules will change colour.

## Colour Reversal of Medisorb (GE Healthcare) Soda Lime

### Picture A:

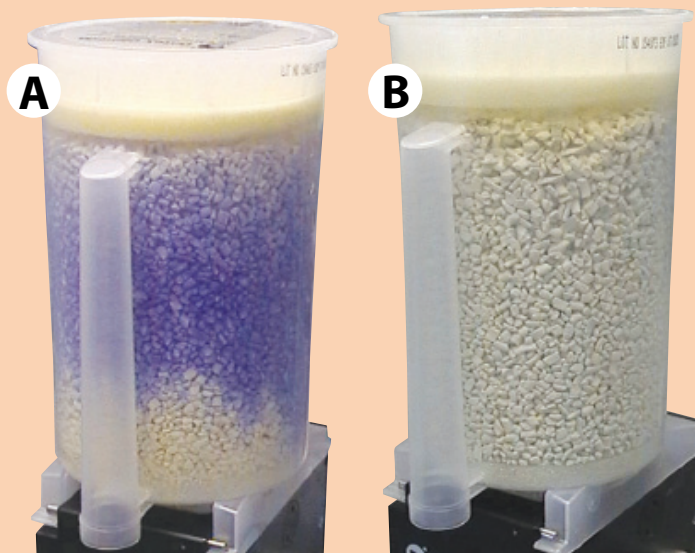
GE Multi-Absorber (REF 8008138)

Colour change at 0.5% FiCO<sub>2</sub>

### Picture B:

Colour change at 12 hours after test terminated

**Note absence of colour**



# Composition of Absorbents

## Composition of AMSORB® PLUS



Ca(OH) <sub>2</sub>	Calcium hydroxide	77 - 88%
CaSO <sub>4</sub> •0.5 H <sub>2</sub> O	Calcium sulphate hemihydrate	0.6 - 1.5%
CaCl <sub>2</sub>	Calcium chloride	2.0 - 3.5%
	Colour indicator	Trace
	H <sub>2</sub> O	10 - 18%

## Performance of Market Brands CO<sub>2</sub> Absorption Capacity

Product Name	Brand	Duration (min)	CO <sub>2</sub> Absorption (L.kg)
<b>AMSORB® PLUS</b>	<b>Armstrong Medical</b>	<b>290</b>	<b>145</b>
Drägersorb Free	Dräger Medical	300	150
Sodasorb	WR Grace	295	148
Drägersorb 800+	Dräger Medical	290	145
Sofnolime	Molecular Products	290	145
Carbolime	Allied Healthcare	275	138
Sodasorb LF	WR Grace	270	135
Medisorb	GE Healthcare	268	134
Spherasorb	Intersurgical	250	125
LoFloSorb	Intersurgical	150	75

Method: accelerated clinical simulation test using 500mL.min CO<sub>2</sub> in 500mL tidal volume at 12RR using 500mL O<sub>2</sub> as fresh gas flow.

# Composition of Absorbents

## Chemical Formulations and Performance

Product Name	Brand	NaOH*	Silicates	Other Additives	Permanent Colour Change	Agent Degradation**		
						Carbon Monoxide (CO)	Compound A	Formaldehyde
<b>AMSORB® PLUS</b>	<b>Armstrong Medical</b>	<b>0%</b>		<b>&lt;3% calcium chloride (CaCl<sub>2</sub>)</b>	<b>YES</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>
Drägersorb Free	Dräger Medical	0.5-2%		<3% calcium chloride	NO	insufficient evidence available		
Sodasorb	WR Grace	3.7%			NO	Yes	Yes	Yes
Drägersorb 800+	Dräger Medical	1-3%			NO	Yes	Yes	Yes
Sofnolime	Molecular Products	<3.5%			NO	Yes	Yes	Yes
Carbolime	Allied Healthcare	3%			NO	Yes	Yes	Yes
Sodasorb LF	WR Grace	<1%	1% quartz	trace phosphonic acid	NO	insufficient evidence available		
Medisorb	GE Healthcare	<3.5%			NO	Yes	Yes	Yes
Spherasorb	Intersurgical	1.3%	4% zeolite		NO	Yes	Yes	Yes
Sodalime	Carlo Erba	> 3.5%			NO	Yes	Yes	Yes
LoFloSorb	Intersurgical	0%	6.5% silica		NO	Yes	insufficient evidence available	

\* sources: internal data and Olympio MA *et al.* Carbon Dioxide Absorbent Desiccation Safety Conference Convened by APFS. APFS Newsletter Summer 2005, vol. 20, No. 2, pp. 25, 27-29

\*\* independently-published scientific literature





# Gas Toxicity

## CO Production

Review of independently published scientific literature for CO production of respective absorbent brands

Peak CO (ppm) from Desiccated Absorbent					13,317		
						8,000	9,045
		620					
			548	525			
	0						
Product	AMSORB® PLUS	Drägerorb 800+	Intersorb Plus	LoFloSorb	Medisorb	Sodasorb	Spherasorb
Brand	Armstrong	Dräger	Intersurgical	Intersurgical	GE Healthcare	WR Grace	Intersurgical
Publication	Struys, 2004	Knolle, 2002	Knolle, 2002	Keijzer, 2005	Keijzer, 2005	Fang, 1995	Keijzer, 2005

Struys MMRF *et al.* *Anaesthesia* 2004; vol. 59; pp. 584-589  
 Knolle E *et al.* *Anesthesia & Analgesia* 2002; vol. 95; pp. 650-655  
 Keijzer C *et al.* *Acta Anaesthesiologica Scandinavica* 2005; vol. 49; pp. 815-818  
 Fang ZX *et al.* *Anesthesia and Analgesia* 1995; vol. 80(6); pp. 1187-1193

## Agent Degradation

Some absorbents negatively impact patient safety. Their continued use raises ethical questions. Inability to determine when some absorbents are desiccated and hence potentially dangerous, demands that a safe absorbent is used.

Many absorbents are known to degrade anaesthetic vapour to produce toxic levels of CO and HCOH, when desiccated. CO is a toxin with affinity for haemoglobin greater than oxygen. HCOH is a potent respiratory tract irritant and carcinogen and has been shown to cause postoperative nausea and vomiting.

All absorbents desiccate through clinical use as well as through exposure to ambient air or gas flow. Absorbent hydration cannot be managed during

use. In absorbents other than AMSORB® PLUS, colouration, if present, is not a reliable indication of hydration. In all absorbents, the chemical reaction of CO<sub>2</sub> absorption forces moisture from the material. In many brands, this exponentially increases alkalinity; potentially enabling the absorbent to become sufficiently desiccated to degrade anaesthetic whilst

continuing to absorb CO<sub>2</sub>.

APSF (Anesthesia Patient Safety Foundation) states that absorbents that significantly degrade anaesthetic agents should not be used. This followed earlier notification by Abbott Laboratories that their drug Ultane (sevoflurane) was involved in adverse reactions with CO<sub>2</sub> absorbents.

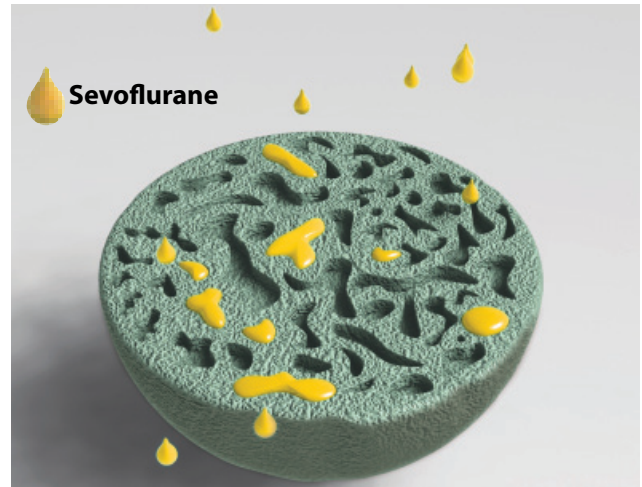


Bedi A *et al.* *The in vitro performance of carbon dioxide absorbents with and without strong alkali.* *Anaesthesia* 2001; vol. 56; pp. 1-6

# Agent Adsorption

## Agent Adsorption - Patient Awareness

Anaesthetic vapour condenses on desiccated soda lime and on new generation absorbents containing molecular sieve zeolites, quartz or silica. This process, called adsorption, temporarily binds anaesthetic vapour within the absorbent. Knolle (2002) reported adsorption using LoFloSorb (Intersurgical, UK) of 89% of the inflow of 0.5% isoflurane for over 60 minutes, in combination with production of CO. Adsorption is characterised by condensing and accumulation of the vapourised agent on the absorbent granules and re-vapourisation of the agent when canister temperature rises during CO<sub>2</sub> absorption; creating potential for reduced narcosis or blood toxicity from excessive drug exposure. This effect is greater at low fresh gas flow rates and when soda limes and LoFloSorb are used.



Clinical signs of adsorption will include inspired concentrations of the anaesthetic agent being different to the vapouriser setting. Recollection, by the patient of the surgical event or pain during surgery is possible,

given inadequate anaesthesia. Use of muscle relaxants could mask a patient's response to surgical stimuli, allowing patient awareness to go unchecked. Also, the cost of adsorption of vapour into the absorbent should be considered when choosing a brand of absorbent.

## Adsorption of Anaesthetic Vapour

Adsorption of 0.5% isoflurane by desiccated absorbent (% : mins)				<b>89% for &gt;60 min</b>	
					<b>50% for 33 mins</b>
				<b>31% for 20 mins</b>	
		<b>26% for 16 mins</b>			
	<b>20% for 15 mins</b>				
	<b>Product</b>	<b>AMSORB PLUS</b>	Drägersorb 800+	Intersorb Plus	LoFloSorb
<b>Brand</b>	<b>Armstrong</b>	Dräger	Intersurgical	Intersurgical	Intersurgical

**Publication** Knolle E *et al.* Small Carbon Monoxide Formation in Absorbents Does Not Correlate with Small Carbon Dioxide Absorption. *Anesthesia & Analgesia* 2002; vol. 95; pp650-655

## Cost of Adsorption

$$\frac{T \times \text{FGF} \times V_s}{200.0 \text{ molecular weight at } 20^\circ\text{C}} = \text{ml of liquid sevoflurane per time unit}$$

Vapour loss as 50%				
Time unit (min)	FGF (mL.min)	Vapouriser (%)	Vapour loss (%)	Molecular weight (g.mol) at 20°C at Vp 157mmHg
40	500	8	50	200.055

Equals	
Liquid loss (mL)	cost per time unit at \$0.60/mL
4.00	\$2.40

# Alkalinity of Soda Lime

## NaOH Concentration Increases as Soda Lime Desiccates

Exponential increases in alkalinity triggers degradation of anaesthetic vapour to toxic inhalants.

Safe disposal of soda lime must take account of increases in alkalinity brought about by desiccation.

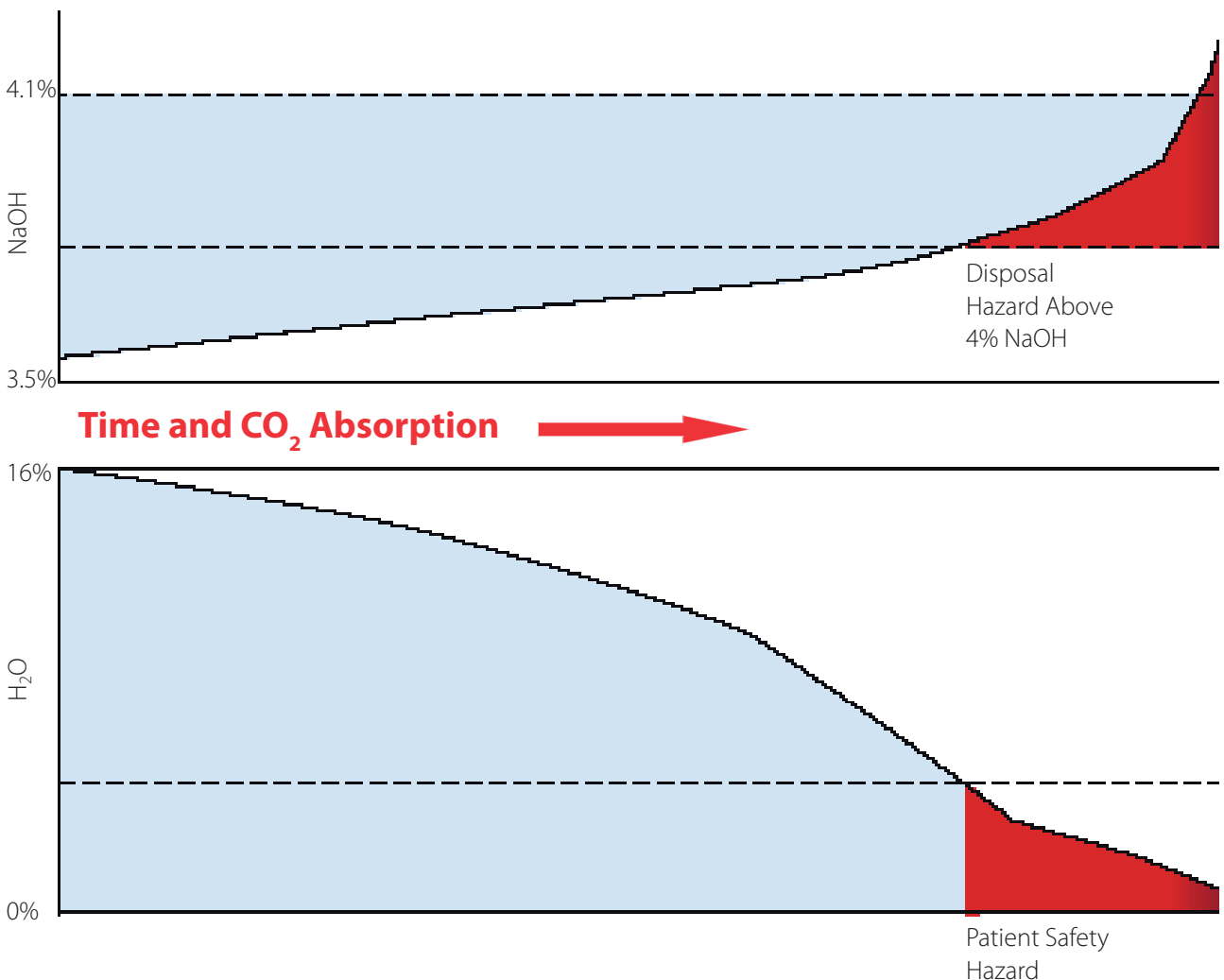
**Manufacturers of absorbents cannot declare the pH of their material at any stage, as determination of pH requires the absorbent sample to be converted to a solution. Adding water to a sample of soda lime allows NaOH and NaCO<sub>3</sub> to dissolve in**

**water, thus lowering the alkalinity of the material to provide a misleading pH value.** A declaration of pH for disposal of soda lime is inaccurate as it does not reflect the actual pH of the material. In some jurisdictions, alkalinity above certain thresholds requires special disposal methods to comply with environmental legislation.

AMSORB® PLUS is free from strong base chemicals and therefore cannot become strongly alkaline. Disposal is with non-contaminated clinical waste for landfill.

## Alkalinity Increases as Moisture Decreases

Progressive dehydration causes a 5-fold increase in the alkalinity of soda lime.



# Desiccation

## Retrograde Flow in Absorbents



AMSORB® PLUS BUBBLE-CAN® UNIVERSAL

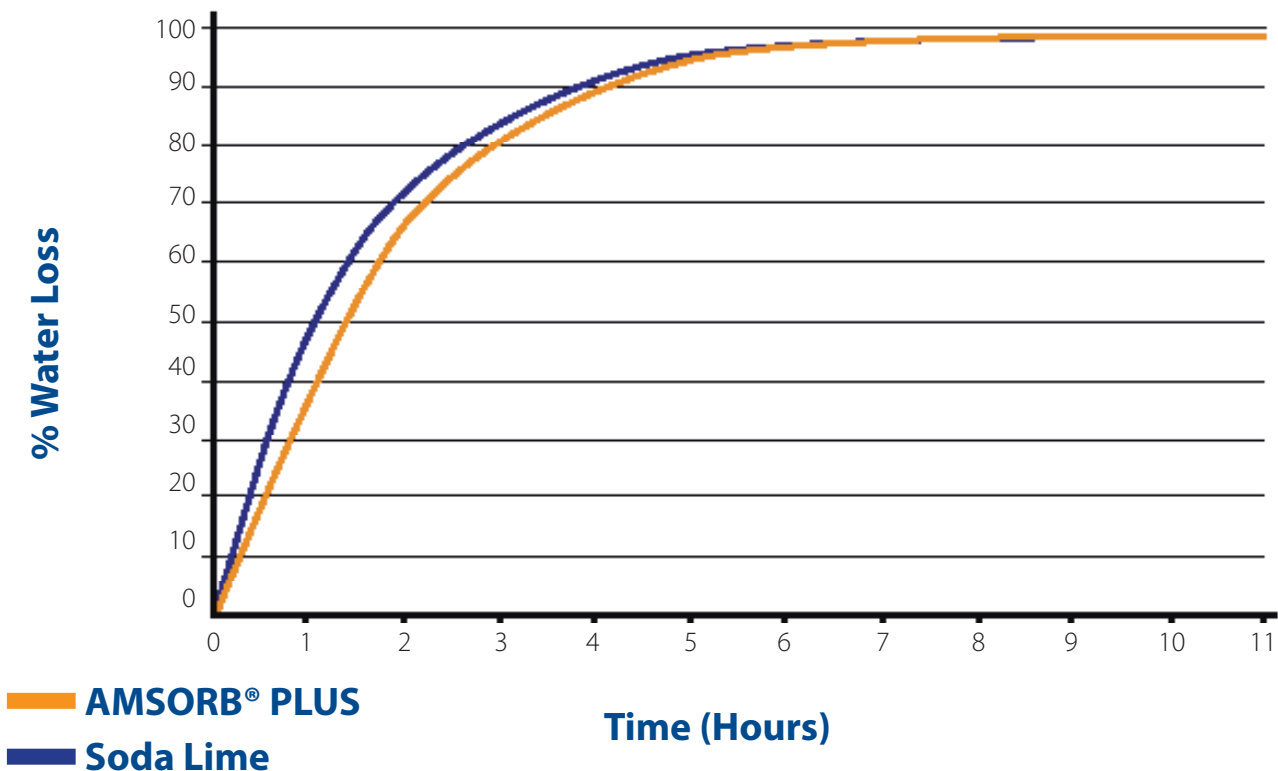
Gas flow desiccates all absorbents. Retrograde flow occurs when fresh gas flow is left running during non-use of an anaesthetic machine. Gas may pass over the top of the absorbent canister and desiccate the absorbent. In subsequent use of some absorbents, degradation of the anaesthetic agent may occur in conjunction with agent adsorption. **NaOH-containing absorbents will NOT change colour during gas flow desiccation. Instead they remain white but may be desiccated. Desiccated soda lime may absorb CO<sub>2</sub>.**

Colouration of AMSORB® PLUS confirms desiccation. Desiccated AMSORB® PLUS will not absorb CO<sub>2</sub>. To avoid retrograde flow, fresh gas flow should be turned off during periods of non-use of the anaesthetic machine.

## AMSORB® PLUS Rate of Dehydration

Moisture retention from passing 1.0L.min. O<sub>2</sub> through 1.0kg of fresh AMSORB® PLUS and fresh soda lime.

AMSORB® PLUS compares favourably to other absorbents in resisting moisture loss.



# Background

## Benefits of Prefilled Canisters

Prefilled canisters containing AMSORB® PLUS offer convenience and user safety. They facilitate rapid 'switch-out' of exhausted material without interruption to mechanical ventilation. CO<sub>2</sub> accumulation in the breathing circuit can be avoided.

## Absorbent Heat

Absorption of CO<sub>2</sub> by AMSORB® PLUS produces heat. The amount of heat depends on rate of respiration, fresh gas flow rate and the shape and volume of the absorber canister. An increase in gas temperature does not reduce the efficiency of the reaction; in most cases it improves it. A peak temperature of 45°C may be observed with AMSORB® PLUS. Such temperature has a positive effect on maintenance of core body temperature and mucocilliary function during surgery.

Clinical reports show use of sevoflurane, in combination with certain desiccated absorbents, creates conditions for anaesthetic agent degradation to flammable by-products CO and HCOH as a precursor to extreme heat leading to fire in the absorber canister.

Struys *et al* reported that temperatures within an absorber canister of fresh or desiccated AMSORB® PLUS did not exceed 40°C. Additionally, end-users have not reported elevated temperatures, nor have extensive in-house tests shown increased temperatures under any conditions. It logically follows that the chemical basis and sequelae for elevated temperature or fire is not possible when using AMSORB® PLUS, given its chemical make-up and inability to degrade anaesthetic vapour.

## Humidity Management in Breathing Circuits

Condensed water observed in the breathing system may originate from moisture in the patient's breath and from water produced by the exothermic reaction of absorption of CO<sub>2</sub>. It may evaporate as the canister heats up and may condense on cooler parts of the apparatus. This is normal. A water trap can be used in the breathing circuit to collect water condensate. Alternatively, there may be a drainable water collection sump located on the absorber canister. This should be drained regularly.

Woehlck HJ. Sleeping with Uncertainty : Anesthetics and Desiccated Absorbent. *Anesthesiology* 2004; vol. 101; pp. 276-278

Laster M *et al*. Fires from the Interaction of Anesthetics with Desiccated Absorbent. *Anesth Analg* 2004; vol. 99; pp. 769-774

Castro BA *et al*. Explosion within an Anesthesia Machine: Baralyme®, High Fresh Gas Flows and Sevoflurane Concentration. *Anesthesiology* 2004; vol.101; pp. 537-539

Fatheree RS *et al*. Acute Respiratory Distress Syndrome after and Exothermic Baralyme®-Sevoflurane Reaction. *Anesthesiology* 2004; vol.101; pp. 531-533

Junzheng WU *et al*. Spontaneous Ignition, Explosion, and Fire with Sevoflurane and Barium Hydroxide Lime. *Anesthesiology* 2004; vol.101; pp. 534-537

Holak E J *et al*. Carbon Monoxide Production from Sevoflurane Breakdown: Modeling of Exposures Under Clinical Conditions. *Anesthesia & Analgesia* 2003; vol. 96: pp. 757-764

Struys MMRF *et al*. Production of compound A and carbon monoxide in circle systems: an in vitro comparison of two carbon dioxide absorbents. *Anaesthesia* 2004; vol. 59; pp. 584-589

## Background

### AMSORB® PLUS and Bacteriostasis

Digestive enzymes of bacterial organisms such as MRSA and VRE are known to be susceptible to neutralisation by alkaline solutions. The weakly alkaline composition of AMSORB® PLUS provides an inhospitable environment for such organisms. Use of a breathing filter at the patient-end of a breathing circuit is a useful adjunct in protecting patients from respiratory-borne infection. These filters provide a sufficient level of protection against infectious liquid- and air-borne organisms such as HIV, MRSA and VRE, as such organisms are more likely to be found in the tubing system, connecting the patient to the absorber system, than in the absorber itself. If AMSORB® PLUS is intended to be used on a patient known to be infected with a contagious organism, the absorbent canister should be replaced before and after such use.

### Disposal Considerations

Dispose of AMSORB® PLUS as per the hospital's waste management programme for non-contaminated clinical waste. The material is safe to handle during its disposal. Unlike soda limes, AMSORB® PLUS does not contain strong base chemicals. Therefore, the material is non-hazardous, making it suitable for landfill. It will break down into harmless compounds.

### Storage Requirements

AMSORB® PLUS does not deteriorate in storage when in sealed containers at ambient humidity above 15°C. If exposed to ambient air it will absorb CO<sub>2</sub> and lose moisture to the air; either of which will deplete hydration and cause colouration to appear. Prefilled canisters should be kept within outer box packaging until use as light can damage the colour indicator.



# Machine Compatability

## Guaranteed Unlimited Compatability

Armstrong Medical Limited guarantees the unlimited compatibility of AMSORB® PLUS on anaesthesia machines in which loose-fill CO<sub>2</sub> absorbent is to be used or on those machines for which we provide a prefilled absorber canister.

### Selection of Anaesthesia Machines

Manufacturer	Model/s	1.0kg CARTRIDGES AMAB3201	CAN-CAN® AMAB3800	G-CAN® AMAB3801	Q-CAN AMAB3802	BUBBLE-CAN® AMAB4000	BUBBLE-CAN® UNIVERSAL AMAB4001	BUBBLE-BLOC ADAPTER AMAB4000/002
Anmedic	Falcon, Kite				●			
Dräger Medical	Cato, Cicero,							
	Fabius, Julian, Zeus					●	●	●
Dräger Medical	Apollo, Primus,							
	Pallas						●	●
GE Healthcare	ADU II, Aliseo		●					
GE Healthcare	Aestiva, Excel,	●						
	Modulus							
GE Healthcare	Aespire, Aisys,							
	Avance, Amingo			●				
Mindray/	AS3000	●						
Datascope								
Penlon	SP Prima	●						
Siemens	Kion	●						
Spacelabs	Frontline, Sirius	●						



# Ordering Information

Product Code	Description	Case Quantity
AMAB3000	5.0 litre jerican. Colour change - WHITE to VIOLET	2pcs
AMAB3200	1.0kg cartridge. Colour change - WHITE to VIOLET	12pcs
AMAB3201	1.0kg cartridge. Colour change - WHITE to VIOLET (WITHOUT SEALING GASKET)	12pcs
AMAB3400	1.0kg bag. Colour change - WHITE to VIOLET	12pcs
AMAB3600	1.5kg bag. Colour change - WHITE to VIOLET	12pcs
AMAB3800	Prefilled CAN-CAN® absorber, WHITE to VIOLET 800g (1 litre) for GE Healthcare ADU II anaesthesia workstations	6pcs
AMAB3801	Prefilled G-CAN® absorber, WHITE to VIOLET 800g (1 litre) for GE Healthcare Aisys, Avance and Aespire anaesthesia workstations	6pcs
AMAB3802	Prefilled Q-CAN absorber, WHITE to VIOLET 800g (1 litre) for Anmedic anaesthesia workstations with Q circle system	6pcs
AMAB4000	Prefilled BUBBLE-CAN® absorber, WHITE to VIOLET 1,000g (1.3 litre) for Dräger anaesthesia workstations <u>excluding</u> Apollo, Pallas and Primus	6pcs
AMAB4001	Prefilled BUBBLE-CAN® UNIVERSAL absorber, WHITE to VIOLET 930g (1.2 litre) for all Dräger anaesthesia workstations <u>including</u> Apollo, Pallas and Primus	6pcs
AMAB4000/001	BUBBLE-PLATE Adapter for Dräger anaesthesia workstations	1pc
AMAB4000/002	BUBBLE-BLOC Adapter for Dräger anaesthesia workstations	1pc
AMAB0001	Limescale removal fluid, 500mL spray	1pc

## Typical Performance Data

Absorption of CO <sub>2</sub>	>19.0% weight gain
Moisture Content	10 -18%
Clinical Simulation Test (500mL.CO <sub>2</sub> ,min)	>240 min.kg
Bulk Density	70 - 84%
Hardness	>90%
<b>Sieve Test</b>	
Retained on 8.00mm sieve	NIL
Retained on 4.00mm sieve	<7.0%
Retained on 2.36mm sieve	BALANCE
Passing 2.36mm sieve	<7.0%

# Frequently Asked Questions

## What are the advantages of using AMSORB® PLUS over other available absorbents?

- Does not generate CO under any clinical conditions; does not generate Compound A or any like compounds when used with sevoflurane; does not generate HCOH or methanol when used with sevoflurane
- Irreversible colour change, when fully exhausted; optimum CO<sub>2</sub> absorption; low resistance to gas flow; low dust levels with consistent granule size
- Non-corrosive to skin.

## What anaesthetic agents can be used with AMSORB® PLUS?

AMSORB® PLUS can be used safely with anaesthetic agents halothane, enflurane, isoflurane, desflurane and sevoflurane. No fresh gas flow restrictions apply.

## Does AMSORB® PLUS adsorb anaesthetic vapour?

Completely desiccated AMSORB® PLUS has least ability to adsorb anaesthetic vapour when compared to other absorbents (Knolle, 2002). Note that desiccated AMSORB® PLUS is incapable of absorbing CO<sub>2</sub> and therefore will not be in clinical use.

## When to cease using AMSORB® PLUS?

This is determined by capnometry. The absorbent is changed when FiCO<sub>2</sub> has exceeded 0.5% volume or 5mmHg. CO<sub>2</sub> breakthrough to 0.5% volume or 5mmHg may be associated with colouration of 50% of the total height of the absorber canister.

## Why does utilisation time vary?

Utilisation time is influenced by the following factors:

- Fresh gas flow rate; metabolic CO<sub>2</sub> production; tidal volume; respiratory rate
- Shape and volume of the absorber canister and design of breathing circuit
- Humidification management in the breathing circuit.

## Sometimes exhaustion is indicated by physiological signs or capnometry before the colour changes - why is this?

It may be that the apparatus is not working properly or is incorrectly assembled. There may be channeling of gases through the middle of the absorber canister. Condensed water may be interfering with the composition of sampled gases. Absorbent granules may have absorbed water which is preventing CO<sub>2</sub> absorption.

## Should water be added to AMSORB® PLUS?

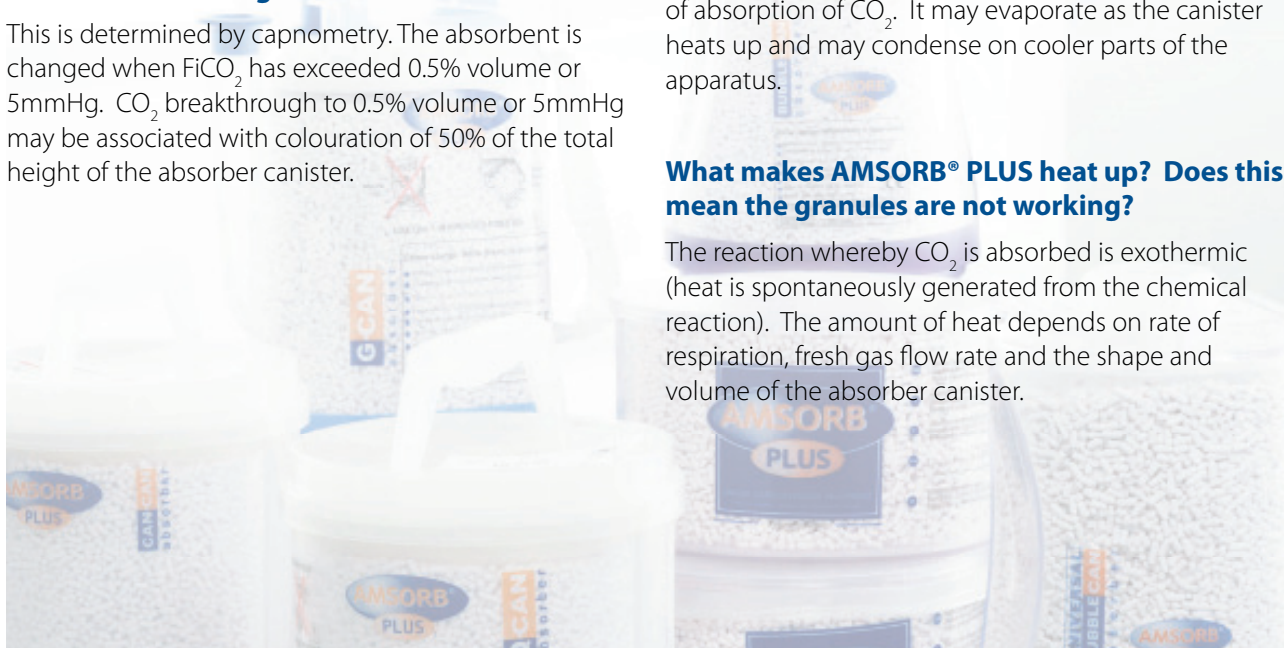
This should NEVER be done.

## What is the cause of water condensation in the breathing circuit?

This may originate from moisture in the patient's breath and from water produced by the exothermic reaction of absorption of CO<sub>2</sub>. It may evaporate as the canister heats up and may condense on cooler parts of the apparatus.

## What makes AMSORB® PLUS heat up? Does this mean the granules are not working?

The reaction whereby CO<sub>2</sub> is absorbed is exothermic (heat is spontaneously generated from the chemical reaction). The amount of heat depends on rate of respiration, fresh gas flow rate and the shape and volume of the absorber canister.





## Creating Support for Life



All Armstrong Medical products are manufactured to quality systems under ISO 13485 and EC Directive 93/42/EEC. For reliability, the properties of AMSORB® PLUS must conform to carefully controlled parameters and this applies not only to the chemical composition but also to the size of granule, its moisture content and porosity.

Distributed by:

Armstrong Medical manufacture a complete range of disposable respiratory products for anaesthesia and critical care applications. For supply of these products or any product within the Armstrong Medical range, please contact your local representative.