



CHECKLIST FOR ANAESTHETIC APPARATUS

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SECTION I - INTRODUCTION

Checking the correct functioning of anaesthetic apparatus before use is a mandatory procedure. In 1990 the Association of Anaesthetists of Great Britain and Ireland published a 'Checklist for Anaesthetic Machines' which gained widespread acceptance in the profession. This document recognised that changes in anaesthetic equipment and the introduction of microprocessor-controlled technology would necessitate revision of the document in the future and this new edition updates the procedure recommended in the previous document.

The principles set out in the original booklet have governed our amendments to the new edition. It should be emphasised that a major cause of anaesthetic misadventures is the use of a machine which has not been adequately checked by an anaesthetist for proper function beforehand. Anaesthetists rely heavily on their memory for essential facts when carrying out routine anaesthetic emergency procedures. The use of checklists and associated procedures should be seen as an integral part of training in anaesthesia.

This checklist should be applicable to all anaesthetic machines; it will take only a few minutes to perform and represents an important aspect of patient safety. It is not intended to supplant any pre-anaesthetic checking procedures issued by manufacturers, but should be used in conjunction with them. The aim is to strike the right level of checking so that it is not so superficial that its value is doubtful, nor so detailed that the procedure is impracticable. As before, the working party bases this checklist on the obligatory use of an oxygen analyzer on **every** anaesthetic machine. This approach will ensure that hypoxic mixtures are not delivered to patients and also detect misfilling of oxygen cylinders, contamination of liquid oxygen reservoirs and incorrect connections within the machine.

The checklist covers all aspects of the anaesthetic delivery apparatus from the gas supply pipelines to the machine and breathing systems and it should be easily performed in a few minutes. There is an outline check for breathing systems, lung ventilators, suction and monitoring equipment.

It is strongly recommended that a record of the checks performed should be kept; this is best done by the use of a specific logbook attached to

each anaesthetic machine. Labels and instructions attached to the apparatus should be noted (e.g. 'first user' notices attached by service engineers). **The 'first user' check after servicing is especially important and must be recorded as such.** It is not unknown for errors to occur in the reassembly of machines, and it is essential to confirm that it is correctly configured for use after servicing.

SECTION II - PROCEDURES

The following checks should be carried out at the beginning of each operating theatre session. **These checks are the responsibility of the anaesthetist and must not be delegated to other personnel.** In the event of a change of anaesthetist during an operating session the checked status of the anaesthetic machine must be agreed.

Before using any anaesthetic apparatus, ventilator, breathing system or monitor, it is essential to be fully familiar with it. This familiarisation process, which may entail study of the instruction manual, is particularly important when faced with new equipment and should be regarded as an essential part of the safety check. Similarly, a thorough understanding must be gained of any equipment assembled in an unfamiliar configuration.

A. ANAESTHETIC MACHINE

Check that the anaesthetic machine and relevant ancillary equipment are connected to the mains electrical supply (where appropriate) and switched on. Careful note should be taken of any information or labelling on the anaesthetic machine which might refer to its current status.

B. OXYGEN ANALYZER

1. The oxygen analyzer should be placed where it can monitor the composition of the gases leaving the common gas outlet.
2. The analyzer should be switched on, checked and calibrated according to the manufacturer's instructions.

C. MEDICAL GAS SUPPLIES

1. Identify and take note of the gases which are being supplied by pipeline, confirming with a 'tug test' that each pipeline is correctly inserted into the appropriate gas supply terminal.
2. Check that the anaesthetic apparatus is connected to a supply of oxygen and that an adequate reserve supply of oxygen is available from a spare cylinder.
3. Check that adequate supplies of any other gases intended for use are available and connected as appropriate. All cylinders should be securely seated and turned **off** after checking their contents.

Carbon dioxide cylinders should not normally be present on the anaesthetic machine. A blanking plug should be fitted to any empty cylinder yoke.

4. All pressure gauges for pipelines connected to the anaesthetic machine should indicate 400 kPa.
5. Check the operation of flowmeters, ensuring that each control valve operates smoothly and that the bobbin moves freely throughout its range without sticking. With only the oxygen flow control valve open and a flow of approximately 5 litres per minute, check that the oxygen analyzer display approaches 100%. **Turn off all flow control valves.**
6. Operate the emergency oxygen bypass control and ensure that flow occurs without significant decrease in the pipeline supply pressure. Confirm that the oxygen analyzer display approaches 100% during this test. Ensure that the emergency oxygen bypass control ceases to operate when released.

D. VAPORIZERS

1. Check that the vaporizer(s) for the required volatile agent(s) are fitted correctly to the anaesthetic machine, that any back bar locking mechanism is fully engaged and that the control knobs rotate fully through the full range(s). Ensure that the vaporizer is not tilted.
Turn off the vaporizers.
2. Check that the vaporizer(s) are adequately filled and that the filling port is tightly closed.
3.
 - (i) Set a flow of oxygen of 5 litres/min and, with the vaporizer turned off, temporarily occlude the common gas outlet. There should be no leak from any of the vaporizer fittings and the flowmeter bobbin should dip.
 - (ii) Turn each vaporizer on in turn and repeat this test. There should be no leak of liquid from the filling port. **After this test, ensure that the vaporizers and flowmeters are turned off.**
 - (iii) Should it be necessary to change a vaporizer at any stage, it is essential to repeat the leak test. Failure to do so is one of the commonest causes of critical incidents.
 - (iv) Removal of a vaporizer from a machine in order to refill it is not considered necessary.

E. BREATHING SYSTEM

1. Check all breathing systems which are to be employed. They should be visually inspected for correct configuration and assembly. All connections within the system and to the anaesthetic machine should be secured by 'push and twist'. Ensure that there are no leaks or obstructions in the reservoir bags or breathing system. A pressure leak test should be performed on the breathing system by occluding the patient end and compressing the reservoir bag. Each breathing system poses separate problems. Each should be checked as appropriate and in particular it is necessary to perform an occlusion

test on the inner tube of the Bain-type coaxial system, to ensure that it is correctly attached.

2. Check that the adjustable pressure limiting 'expiratory' valve can be fully opened and closed.
3. The correct operation of the unidirectional valves in a circle system should be carefully checked.
4. If it is intended to use very low fresh gas flows in a circle breathing system, there must be a means to analyse the oxygen concentration in the inspiratory limb. End tidal CO₂ and agent concentration must also be monitored in this situation.

F. VENTILATOR

1. Check that the ventilator is configured correctly for its intended use. Ensure that the ventilator tubing is securely attached. Set the controls for use and ensure that adequate pressure is generated during the inspiratory phase.
2. Check that a disconnect alarm is present and functions correctly.
3. Check that the pressure relief valve functions correctly at the set pressure.
4. Ensure that there is an alternative means to ventilate the patient's lungs in the event of ventilator malfunction.

G. SCAVENGING

The anaesthetic gas scavenging system should be switched on and functioning. Ensure that the tubing is attached to the appropriate expiratory port of the breathing system or ventilator.

H. ANCILLARY EQUIPMENT

1. All ancillary equipment which may be needed should be present, such as laryngoscopes, intubation aids (intubation forceps, bougies), etc.

Ensure that all sizes of face masks, airways, tracheal tubes and connectors are available.

2. Check that all laryngoscopes are working.
3. The suction apparatus must be functioning and all connections should be secure; test for the rapid development of an adequate negative pressure.
4. Check that the patient trolley, bed or operating table can be rapidly tilted head-down.

I. MONITORING

1. Ensure that the appropriate monitoring equipment is present, switched on and calibrated.
2. Set all necessary alarm limits, as appropriate.

The Association of Anaesthetists of Great Britain and Ireland cannot be held responsible for failure of an anaesthetic machine as a result of a defect not revealed by these procedures.

SECTION III - BIBLIOGRAPHY

The Westminster Inquiry. *The Lancet* 1977; ii: 175-176.

BRAHAMS D. Anaesthesia and the law. Awareness and pain during anaesthesia. *Anaesthesia*, 1989; **44**: 352.

LUNN J.N., MUSHIN W.W. *Mortality associated with anaesthesia*. London: The Nuffield Provincial Hospitals Trust, 1982.

COOPER J.B., NEWBOWER R.S., KITZ R.J. An analysis of major errors and equipment failures in anaesthesia management: considerations for prevention and detection. *Anesthesiology* 1984, **60**: 34-42.

CRAIG J., WILSON M.E. A survey of anaesthetic misadventures. *Anaesthesia* 1981; **36**: 933-936.

WARD C.S. Anaesthetic equipment. Physical principles and maintenance, 2nd ed. London: Balliere Tindall, 1985, p 117-120.

CUNDY J.F., BALDOCK G. Safety check procedures in anaesthetic machines. *Anaesthesia* 1982; **37**: 161-169.

PETTY C. *The Anesthesia Machine*. London: Churchill Livingstone, 1987, p217-218.

KUMAR V., BARCELLOS W.A., MEHTA M.P., CARTER J.G. An analysis of critical incidents in a teaching department for quality assurance. *A survey of mishaps during anaesthesia*. *Anaesthesia* 1988; **43**: 879-883.

NEWTON, N.I. In: ADAMS A.P., HENVILLE J. In: *Recent Advances in Anaesthesia & Analgesia*, 13th edn (eds Hewer C.L., Atkinson R.S.). London: Churchill Livingstone, 1979, p50-51.

FDA Checkout procedure. Anesthesia Apparatus Checkout Recommendations. August 1986 In: *Anesthesia Patient Safety Foundation Newsletter*, 1986, **1**(3): 15. (September).

Guidelines to the practice of anaesthesia as recommended by the Canadian Anaesthetists' Society 1987. Toronto: The Canadian

Anaesthetists' Society, 1 Eglinton Avenue East, Suite 208, Toronto, Ontario M4P 3A1.

Anesthesia apparatus checkout recommendations. Pre-use checkout and inspection procedure (based on North American Dräger Safety Guidelines). The North American Dräger Company: Pennsylvania, 1989.

Recommendations for standards of monitoring during anaesthesia and recovery, revised 1994. London: Association of Anaesthetists of Great Britain & Ireland, 9 Bedford Square, London WC1B 3RA.

SPRAGUE D.H., ARCHER G.W. Intra-operative hypoxia from an erroneously filled liquid oxygen reservoir. *Anesthesiology* 1975; **42**: 360-364.

HOLLAND R. 'Wrong gas' disaster in Hong Kong. *Anesthesia Patient Safety Newsletter* 1989; **4**(3): 26. (September).

HEALTH NOTICE, (84)13 HAZARD. *Health Service Management. Selectatec Vaporizer Systems.* London: Department of Health

SAFETY ACTION BULLETIN *Anaesthetic Vaporizers: servicing.* SAB(88)72. November 1988. London: Department of Health.

Health Equipment Information, No 150. *Evaluation of breathing attachments for anaesthetic apparatus to BS 3849: 1965.* London: Department of Health.

PAGE, J., Testing for leaks. *Anaesthesia* 1977; **32**: 673.

OLYMPIO M.A, GOLDSTEIN M.M., MATHEYS D.D., Instructional review improves performance of anesthesia apparatus checkout procedures. *Anesthesia and Analgesia* 1996 **83**(3): 618-622.

CLAYTON D.G., BARKER L., RUNCIMAN W.B., Evaluation of safety procedures in Anaesthesia and Intensive Care. *Anaesthesia and Intensive Care* 1993 **21**(5): 670-672

SAFETY NOTICE MDA SN 9636 (14.11.96) *Demountable anaesthetic agent vaporizers.*