

Australian and New Zealand College of Anaesthetists (ANZCA)

Guidelines on Checking Anaesthesia Delivery Systems

1. INTRODUCTION

An anaesthesia delivery system includes any equipment that can deliver gases, vapours, local anaesthetic or intravenous anaesthetic agents to induce and/or maintain anaesthesia.

Failure of the anaesthesia delivery system can cause serious complications. This document is intended to assist practitioners and health facilities to minimise equipment-related risks.

This document applies wherever general anaesthesia, regional anaesthesia, local anaesthesia and/or sedation are administered by an anaesthetist. Henceforth, these activities are referred to as “anaesthesia”.

2. PRINCIPLES

The following principles apply to the checking of anaesthesia delivery systems.

2.1 Responsibilities

Each facility is required to designate an individual to be responsible for:

- 2.1.1 Servicing and maintaining equipment in accordance with the guidelines below.
- 2.1.2 Ensuring that relevant personnel are trained in the checking and use of anaesthesia delivery systems.
- 2.1.3 Maintaining an up-to-date checking protocol specific to each system.

2.2 Servicing of anaesthesia delivery systems should be:

- 2.2.1 Performed regularly, at specified intervals in accordance with the manufacturer’s documented service requirements.
- 2.2.2 Recorded in detail.
- 2.2.3 Noted on a label, displayed on the equipment in a prominent position. The label should list the date of the most recent service and the due date for the next service.



- 2.3 Compliance with relevant College documents
 - 2.3.1 System alarms should comply with *PS54 Statement on the Minimum Safety Requirements for Anaesthetic Machines and Workstations for Clinical Practice*.
 - 2.3.2 System monitoring should comply with *PS18 Recommendations on Monitoring During Anaesthesia*.
- 2.4 Confirmation that a secondary means of oxygenation and positive pressure ventilation is immediately available.

3. ANAESTHESIA DELIVERY SYSTEM CHECKS

- 3.1 There are three levels of checks:
 - 3.1.1 **Level one check** is a detailed check, performed by trained service personnel, of all systems before being placed into use. This applies to all new systems, as well as all systems after servicing or repair.
 - 3.1.2 **Level two check** should be performed at the start of each anaesthetic list.
 - 3.1.3 **Level three check** should be performed before commencing anaesthesia for each patient.
- 3.2 An individual within each facility should be assigned responsibility for:
 - 3.2.1 Ensuring that each check complies with the protocols outlined in section 4.
 - 3.2.2 Attaching checklists to each anaesthesia delivery system as required.
 - 3.2.3 Training and accrediting the personnel involved with each check, as follows:
 - 3.2.3.1 **Level one**

Attendance at a manufacturer's course or a program developed in consultation with a qualified biomedical engineer.
 - 3.2.3.2 **Levels two and three**

All anaesthesia personnel should be trained and accredited in these checking procedures.

4. PROTOCOLS

4.1 Level one check

This check is to verify that the system is functional and complies with the relevant Australian or New Zealand standards. It should be performed by a

suitably qualified person on all anaesthesia delivery systems before initial use and following service or repair. The check should be performed on the following components:

4.1.1 **Gas delivery devices**

- 4.1.1.1 Test for and identify leaks.
- 4.1.1.2 Test to confirm gas pipelines are connected correctly within the anaesthesia delivery system.
- 4.1.1.3 Confirm correct function of non-return valves throughout the system.
- 4.1.1.4 Confirm the integrity of oxygen failure warning devices and associated gas shut-off systems.
- 4.1.1.5 Identify the composition and verify accuracy of flowrates of delivered gases.
- 4.1.1.6 Check performance of batteries, if fitted.
- 4.1.1.7 Check electrical safety.

4.1.2 **Inhalational anaesthesia delivery devices**

- 4.1.2.1 Ascertain that there are no leaks in the “on” and “off” state.
- 4.1.2.2 Check any thermostat function.
- 4.1.2.3 Check accuracy of delivered vapour concentration with regard to manufacturer’s specifications.
- 4.1.2.4 Check function of any interlocking mechanisms.
- 4.1.2.5 Check performance of batteries, if fitted.
- 4.1.2.6 Check electrical safety.

4.1.3 **Ventilators**

- 4.1.3.1 Check mechanical integrity.
- 4.1.3.2 Check pressure and volume delivery.
- 4.1.3.3 Check alarm functions.
- 4.1.3.4 Ensure operation meets manufacturer’s specifications.
- 4.1.3.5 Check performance of batteries, if fitted.
- 4.1.3.6 Check electrical safety.

4.1.4 **Intravenous and local anaesthesia delivery devices**

4.1.4.1 Check mechanical integrity.

4.1.4.2 Calibrate output accuracy.

4.1.4.3 Calibrate occlusion pressure.

4.1.4.4 Check alarm functions.

4.1.4.5 Ensure operation of all user functions and parameters.

4.1.4.6 Check battery performance, if fitted.

4.1.4.7 Check electrical safety.

4.1.5 **Associated equipment**

4.1.5.1 Confirm function of the waste gas scavenging system.

4.1.5.2 Confirm function of the patient suction system.

4.1.6 **Documentation of the level one check**

This should include the date, the items checked, the results of the check, and the identity of the person performing the check.

4.2 **Level two check**

This check should be performed at the beginning of each anaesthetic list in accordance with the protocol specific for each device and system. In a given facility several different protocols may exist, each serving to verify the correct function of a specific anaesthesia delivery system and its associated devices. Some of the checks in this section may be part of an automated test sequence in electronically controlled systems. The checks in this section are ultimately the responsibility of the anaesthetist, however, the task may be delegated to a suitably trained person.

4.2.1 **Service label**

Confirm that the device and any removeable sub-assemblies have been appropriately serviced and are not past their service dates.

4.2.2 **High pressure system**

4.2.2.1 **Reserve oxygen cylinder**

Ensure that:

4.2.2.1.1 The pressure is appropriate.

4.2.2.1.2 The cylinder can be turned on and off.

4.2.2.1.3 The content is sufficient for its intended purpose.

4.2.2.1.4 The cylinder-yoke fitting does not leak.

4.2.2.2 Gas supply lines

4.2.2.2.1 Ensure the pressures are appropriate.

4.2.2.2.2 After completing the high pressure system checks, ensure the reserve cylinders are turned off.

4.2.3 Low pressure system

4.2.3.1 Flow controls

4.2.3.1.1 Turn on each gas.

4.2.3.1.2 Observe the appropriate operation of the corresponding mechanical or electronic flow indicator.

4.2.3.1.3 Verify the function of the oxygen supply failure warning and associated anti-hypoxic delivery system as in *PS54 Statement on the Minimum Safety Requirements for Anaesthetic Machines and Workstations for Clinical Practice*.

4.2.3.2 Inhalational anaesthesia delivery devices (vapourisers)

4.2.3.2.1 Ensure electricity is connected to vapourisers that require it.

4.2.3.2.2 Check the anaesthetic liquid level is within marked limits.

4.2.3.2.3 Ensure all filling ports are sealed.

4.2.3.2.4 Check correct seating, locking and interlocking of detachable vapourisers or cassettes.

4.2.3.2.5 Test for circuit leaks with a cassette installed or for each vapouriser in the "on" and "off" state.

4.2.3.3 Check for machine leaks upstream from the common gas outlet or breathing system, using a protocol appropriate for the anaesthesia delivery system.

4.2.3.4 Breathing systems

Inspect and manually check the breathing system(s) to be used, to ensure correct assembly, then commence the tests below:

- 4.2.3.4.1 Check the indicator colour of the carbon dioxide absorbent against the manufacturer's specifications. If the absorbent has been exposed to prolonged dry gas flow then it should be replaced, to avoid the potential for producing carbon monoxide.
- 4.2.3.4.2 Check the breathing system for leaks using an appropriate external test protocol or inbuilt automated test function. As a guide, the system should maintain a test pressure >30 cm H₂O at a gas flow of 300 ml/min.
- 4.2.3.4.3 In addition to any automated machine check, test the integrity of the circle breathing system. Connect a breathing bag to the patient Y-piece, set an appropriate fresh gas flow and ventilate the breathing system manually using a hand bag. Observe inflation and deflation of the attached breathing bag, associated movement of visible unidirectional valves and feel the system has normal resistance and compliance. At the conclusion of the test, check for easy spill through the adjustable pressure limiting valve by simultaneously squeezing the hand bag and breathing bag.
- 4.2.3.4.4 Check compliance for each new breathing system if the ventilator uses automatic compliance compensation.

4.2.4 Automatic ventilation system

This should be checked according to the manufacturer's recommendations. With the ventilator operating, confirm the function of the disconnection alarm and high pressure alarm.

4.2.5 Scavenging system

Check the scavenging system is properly connected, the scavenging flow is adjusted appropriately and external ports or mechanical valves are not blocked.

4.2.6 **Emergency ventilation system**

Verify the presence and function of an alternative method of providing oxygen and positive pressure ventilation.

4.2.7 **Intravenous and local anaesthesia delivery devices**

These should be checked according to the manufacturer's recommendation, and should verify that:

- 4.2.7.1 The device is appropriately powered by mains and/or batteries.
- 4.2.7.2 The device suits its intended function, especially in range of flow rate and occlusion pressure.
- 4.2.7.3 The anaesthetic drug container is correctly loaded and labelled.
- 4.2.7.4 The selected program is correct, with special attention to:
 - 4.2.7.4.1 Syringe/container type and volume.
 - 4.2.7.4.2 Anaesthetic drug concentration.
 - 4.2.7.4.3 Flow rate and units.
 - 4.2.7.4.4 Alarm parameters.
- 4.2.7.5 An anti-reflux valve is installed if an intravenous line is shared.
- 4.2.7.6 All connections to the device and to the patient are secure.
- 4.2.7.7 There is no leakage.
- 4.2.7.8 The device is functioning and drug is being actively delivered.

4.2.8 **Other apparatus to be used**

This should be checked according to specified protocols. Attention should be given to:

- 4.2.8.1 Equipment used for airway maintenance and intubation of the trachea.
- 4.2.8.2 Suction apparatus.
- 4.2.8.3 Breathing gas analysis devices.
- 4.2.8.4 Monitoring equipment, especially the alarm limits and any necessary calibration.

4.2.8.5 Intravenous infusion devices.

4.2.8.6 Breathing circuit humidifiers.

4.2.8.7 Breathing circuit filters.

4.2.9 **Final check**

Ensure vapourisers are turned off and the breathing system is purged with air or oxygen.

4.2.10 **Documentation of the level two check**

This should include the date, and identity of the person performing the check, and the record should be kept with the relevant anaesthetic machine or device.

4.3 Level three check

Before starting anaesthesia for each patient, the anaesthetist should:

4.3.1 Check the inhalational anaesthesia delivery device (vapouriser) if it has been changed as in item 4.2.3.2.

4.3.2 Check the breathing system if it has been changed as in item 4.2.3.4.

4.3.3 Check intravenous or local anaesthesia devices as in item 4.2.7.

4.3.4 Check other apparatus as in item 4.2.8.

RELATED ANZCA DOCUMENTS

PS18 Recommendations on Monitoring During Anaesthesia

PS31 BP Guidelines on Checking Anaesthesia Delivery Systems Background Paper

PS54 Statement on the Minimum Safety Requirements for Anaesthetic Machines and Workstations for Clinical Practice

PS55 Recommendations on Minimum Facilities for Safe Anaesthesia Practice in Operating Suites

Professional documents of the Australian and New Zealand College of Anaesthetists (ANZCA) are intended to apply wherever anaesthesia is administered and perioperative medicine practised within Australia and New Zealand. It is the responsibility of each practitioner to have express regard to the particular circumstances of each case, and the application of these ANZCA documents in each case. It is recognised that there may be exceptional situations (for example, some emergencies) in which the interests of patients override the requirement for compliance with some or all of these ANZCA documents. Each document is prepared in the context of the entire body of the College's professional documents, and should be interpreted in this way.

ANZCA professional documents are reviewed from time to time, and it is the responsibility of each practitioner to ensure that he or she has obtained the current version which is available from the College website (www.anzca.edu.au). The professional documents have been prepared having regard to the information available at the time of their preparation, and practitioners should therefore take into account any information that may have been published or has become available subsequently.

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