

Short title: Checking anaesthesia delivery systems

1. Purpose

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.

2. Scope

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

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”.

Although this document does not explicitly consider systems which themselves solely deliver oxygen, including transport ventilators and high-flow nasal oxygen devices, some of the principles may apply.

3. Principles

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

3.1 Responsibilities

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

- 3.1.1 Servicing and maintaining equipment in accordance with the guidelines below.
- 3.1.2 Ensuring that relevant personnel are trained in the checking and use of anaesthesia delivery systems including the operation of alarms.
- 3.1.3 Maintaining an up-to-date checking protocol specific to each system.

3.2 Servicing of anaesthesia delivery systems should be:

- 3.2.1 Performed regularly, at specified intervals in accordance with the manufacturer’s documented service requirements and the requirements of AS/NZS 3551:2026, Management programs for medical equipment.
- 3.2.2 Recorded in detail and readily retrievable.
- 3.2.3 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.

3.3 Compliance with relevant College documents

- 3.3.1 System alarms should comply with *PS54(A) Position statement on the minimum safety requirements for anaesthesia machines and workstations for clinical practice*.

3.3.2 System monitoring should comply with *PG18(A) Guideline on monitoring during anaesthesia*.

3.4 A secondary means of oxygenation and positive pressure ventilation must be immediately available.

4. Anaesthesia delivery system checks

4.1 There are three levels of checks:

4.1.1 **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.

4.1.2 **Level two check** should be performed at the start of each anaesthetic list.

4.1.3 **Level three check** should be performed before commencing anaesthesia for each patient.

4.2 An individual within each facility should be assigned responsibility for:

4.2.1 Ensuring that each check complies with the protocols outlined in section 5.

4.2.2 Ensuring that each anaesthetising location has a checklist to support testing of each anaesthesia delivery system as required. This may be paper-based or electronically available.

4.2.3 Training and accrediting the personnel involved with each check, as follows:

4.2.3.1 Level one

Attendance at a manufacturer's course or a program developed in consultation with a qualified biomedical engineer.

4.2.3.2 Levels two and three

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

5. Protocols

5.1 Level one check

This check is to verify that the system is functional and complies with the relevant Australian or New Zealand standards.² It must 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 according to the manufacturer's requirement. As a minimum the check should include the following components:

5.1.1 Gas delivery devices

5.1.1.1 Test for and identify leaks. The correct function of the oxygen failure protections are to be tested, including audible and visible alarms and verification that no hypoxic gas mixture can be delivered after a simulated oxygen pipeline or cylinder failure.

5.1.1.2 Test to confirm gas pipelines are connected correctly within the anaesthesia delivery system.

5.1.1.3 Confirm correct function of non-return valves throughout the system.

5.1.1.4 Confirm the integrity of oxygen failure warning devices including audible and visible alarms and associated gas shut-off systems (see also *PS54(A) Position statement*

on the minimum safety requirements for anaesthesia machines and workstations for clinical practice).

5.1.1.5 Identify the composition and verify accuracy of flowrates of delivered gases.

5.1.1.6 Check performance of batteries, if fitted.

5.1.1.7 Check electrical safety.

5.1.2 Inhalational anaesthesia delivery devices

5.1.2.1 Ascertain that there are no leaks in the “on” and “off” state.

5.1.2.2 Check accuracy of delivered vapour concentration with regard to manufacturer's specifications.

5.1.2.3 Check function of any interlocking mechanisms.

5.1.2.4 Check performance of batteries, if fitted.

5.1.2.5 Check electrical safety if relevant

5.1.3 Ventilators

5.1.3.1 Check mechanical integrity.

5.1.3.2 Check pressure and volume delivery.

5.1.3.3 Check alarm functions.

5.1.3.4 Ensure operation meets manufacturer's specifications.

5.1.3.5 Check performance of batteries, if fitted.

5.1.3.6 Check electrical safety.

5.1.4 Intravenous and local anaesthesia delivery devices (infusion pumps)

5.1.4.1 Check mechanical integrity.

5.1.4.2 Calibrate output accuracy.

5.1.4.3 Calibrate occlusion pressure.

5.1.4.4 Check alarm functions.

5.1.4.5 Ensure operation of all user functions and parameters.

5.1.4.6 Check battery performance, if fitted.

5.1.4.7 Check electrical safety.

5.1.4.8 Check software version is current

5.1.5 Associated equipment

5.1.5.1 Confirm function of the waste gas scavenging system.

5.1.5.2 Confirm function of the patient suction system.

5.1.6 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.

5.2 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 and competent person (see section 4.2.3).

5.2.1 Service label

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

5.2.2 High pressure system

5.2.2.1 Reserve oxygen cylinder

Ensure that:

5.2.2.1.1 The cylinder pressure and contents are appropriate – as a guide, at least one-quarter full (higher if interruption of the gas supply line is anticipated).

5.2.2.1.2 The cylinder can be turned on and off, and is left off.

5.2.2.1.3 The cylinder-yoke fitting does not leak.

5.2.2.2 Gas supply lines

5.2.2.2.1 Ensure the pressures are appropriate (nominally 415kPa for oxygen and medical air ¹), and remain visible at all times.

5.2.2.2.2 If a hypoxic gas is ordinarily supplied to the machine by pipeline or cylinder, a simulated oxygen pipeline failure should be performed while oxygen and the hypoxic gas are being delivered into a test bag (test lung). Users should ensure that an audible and visual alarm occurs and the system prevents delivery of the hypoxic gas. If no hypoxic gas is ordinarily supplied to the machine by pipeline or cylinder a daily simulation of an oxygen pipeline failure is not required.

5.2.3 Low pressure system

5.2.3.1 Flow controls

5.2.3.1.1 Turn on each gas.

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

5.2.3.2 Inhalational anaesthesia delivery devices (vapourisers)

- 5.2.3.2.1 Ensure electricity is connected to vapourisers that require it.
- 5.2.3.2.2 Check the anaesthetic liquid level is within marked limits.
- 5.2.3.2.3 Ensure all filling ports are sealed.
- 5.2.3.2.4 Check correct seating, locking and interlocking of detachable vapourisers or cassettes.
- 5.2.3.2.5 Test for circuit leaks with a cassette installed or for each vapouriser in the “on” and “off” state.
- 5.2.3.3 Check for machine leaks upstream from the common gas outlet or breathing system, using a protocol appropriate for the anaesthesia delivery system.

5.2.3.4 **Breathing systems**

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

- 5.2.3.4.1 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.
- 5.2.3.4.2 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.
- 5.2.3.4.3 In addition to any automated machine check, test the integrity of the circle breathing system (‘two bag’ test). Test lung bags should be marked or of a different colour to those for clinical use.
 - 5.2.3.4.3.1 Connect a breathing bag to the final point of circuit connection to the patient airway access device, on the patient side of any filter used and connected to the patient Y-piece (or patient-end connector of coaxial circuits).
 - 5.2.3.4.3.2 Set an appropriate fresh gas flow (FGF) (generally 4L/min or more) and ventilate the breathing system to-and-fro manually by hand bagging using a test bag (“test lung”).
 - 5.2.3.4.3.3. Observe inflation and deflation of the attached breathing bags, associated movement of visible unidirectional valves and feel the system has normal resistance and compliance.
 - 5.2.3.4.3.4 Reduce the FGF to minimal levels and use the automatic ventilator to ventilate the test lung. Check that normal ventilation occurs and that circuit leak does not occur while turning any vaporiser on and off.
 - 5.2.3.4.3.5 At the conclusion of the test, check for easy gas spill through the adjustable pressure limiting valve by simultaneously squeezing the test bag and breathing bag and flush the circuit of any volatile agents.
- 5.2.3.4.4 Check compliance for each new breathing system if the ventilator uses automatic compliance compensation.

5.2.4 **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.

5.2.5 **Scavenging system**

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

5.2.6 **Emergency ventilation system**

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

5.2.7 **Intravenous and local anaesthesia delivery devices**

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

- 5.2.7.1 The device is appropriately powered by mains and/or batteries.
- 5.2.7.2 The device suits its intended function, especially in range of flow rate and occlusion pressure.
- 5.2.7.3 The anaesthetic drug container (eg syringe) can be correctly loaded, and is correctly labelled (see *PG51(A) Medication safety*).
- 5.2.7.4 The selected program is correct, with special attention to:
 - 5.2.7.4.1 Syringe/container type and volume.
 - 5.2.7.4.2 Anaesthetic drug type and concentration.
 - 5.2.7.4.3 Flow rate and units and/or Target Controlled Infusion settings.
 - 5.2.7.4.4 Alarm parameters.
- 5.2.7.5 An anti-reflux valve is installed in other connected intravenous lines if the intravenous line is shared.
- 5.2.7.6 An anti-siphon valve is installed in the anaesthetic drug delivery line if there is a risk of siphoning.
- 5.2.7.7 All connections to the device and to the patient are secure.
- 5.2.7.8 There is no leakage.
- 5.2.7.9 The device is functioning and drug is being actively delivered.

5.2.8 **Other apparatus to be used**

Any other apparatus should be checked according to work place protocols. Attention should be given to:

- 5.2.8.1 Equipment used for airway maintenance and intubation of the trachea.
- 5.2.8.2 Suction apparatus.

- 5.2.8.3 Breathing gas analysis devices (see *PG18 Monitoring*).
- 5.2.8.4 Monitoring equipment, especially the alarm limits and any necessary calibration (see *PG18 Monitoring*).
- 5.2.8.5 Other intravenous infusion devices and back up syringe pumps (if back up is required).
- 5.2.8.6 Breathing circuit humidifiers.
- 5.2.8.7 Breathing circuit filters (should be attached for the circuit pressure and 'two bag' test).

5.2.9 Final check

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

5.2.10 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 or readily accessible or retrievable electronically.

5.3 Level three check

Before starting anaesthesia for each patient, the anaesthetist is responsible for and should:

- 5.3.1 Check the inhalational anaesthesia delivery device (vapouriser) if it has been changed as in item 5.2.3.2.
 - 5.3.1.1 Check the amount of volatile agent in the vapouriser.
 - 5.3.1.2 Check the CO₂ absorber canister and replace as required.
- 5.3.2 Check the breathing system for leaks, particularly if it has been changed (including components eg patient filter) as in item 5.2.3.4.
- 5.3.3 Check the ventilator mode.
- 5.3.4 Check intravenous or local anaesthesia devices as in item 5.2.7.
 - 5.3.4.1 Check the anaesthetic drug container (eg syringe / infusion tubing) is correctly loaded and labelled.
- 5.3.5 Check other apparatus as in item 5.2.8.

This document is accompanied by a background paper (PG31BP) which provides more detailed information regarding the rationale and interpretation of the Guideline.

References

1. AS 2896:2021 Medical gas systems - Installation and testing of non-flammable medical gas pipeline systems
2. AS/NZS 3551:2026 Management programs for medical equipment

Related ANZCA documents

PG18 Guideline on monitoring during anaesthesia

PG51(A) Medication safety

PS54(A) Position statement on the minimum safety requirements for anaesthesia machines and workstations for clinical practice

PS55(A) Position statement on minimum facilities for safe administration of anaesthesia in operating suites and other anaesthetising locations

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