# Best Practice Guidelines for Checking the Drager Zeus Anaesthetic Machine

<table>
<thead>
<tr>
<th>Description</th>
<th>This document describes the NZATS best practice guidelines for checking a Drager Zeus anaesthetic machine.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LEVEL 2 MACHINE CHECK</strong></td>
<td></td>
</tr>
<tr>
<td><strong>PRELIMINARY CHECKS</strong></td>
<td></td>
</tr>
<tr>
<td>1. Check bulk gas warning lights / medical gas alarm panel is functioning.</td>
<td></td>
</tr>
<tr>
<td>2. Check resuscitation device for leaks; check all valves function correctly; confirm device has a re-breathing bag and oxygen tubing attached.</td>
<td></td>
</tr>
<tr>
<td>3. Turn machine and monitoring on</td>
<td></td>
</tr>
<tr>
<td>4. Check machine is plugged into an un-interrupted power supply and/or that battery is charging.</td>
<td></td>
</tr>
<tr>
<td>5. Check machine moves freely.</td>
<td></td>
</tr>
<tr>
<td>6. Check service dates on machine.</td>
<td></td>
</tr>
</tbody>
</table>

**ZEUS ELECTRONIC CHECKS**

<table>
<thead>
<tr>
<th>Checklist screen</th>
<th>Follow the tests on the right hand side of the screen.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Supplies safety</td>
</tr>
<tr>
<td></td>
<td>• Breathing system</td>
</tr>
<tr>
<td></td>
<td>• Suction and Y piece</td>
</tr>
</tbody>
</table>

Then start self test … **confirm with scroll wheel to start**

It takes 8 mins to complete.

Note: this set of tests checks the Ventilator, the circuit compliance, airway monitoring, vapourisers (Diva) and the auto control.

Enter your name as the person completing the check. Can be done whilst self test in progress.

At the completion of the Self test the machine will show………date time and green bar that states **Completed / operable**

### LEAK TEST & ONE GAS TESTS

**HIGH PRESSURE SYSTEM CHECKS**

1. **Select ventilator standby** – confirm
2. Disconnect wall gas supply
3. Connect filter and sample gas line to common gas outlet
4. Open ALL gas cylinder valves until pressure is registered on VCP and then close valves. Observe that pressure does not drop. Confirming that no leak is present.
5. **Select Vent standby** on the VCP to open Ventilator control window
6. **Select External fresh gas outlet** – confirm twice
7. Open oxygen cylinder: Check pressure registers above 5000 kPa and analyse contents. Gas analysis should confirm 100% oxygen (+/- 3). Close oxygen cylinder and drain oxygen from machine using oxygen flush.
   If an **air cylinder** is present:
   - Open air cylinder. Check contents above 5000 kPa and analyse gas. Analysis should confirm 21% oxygen (+/- 3). Close air cylinder and drain machine of air.
   
   If a **nitrous oxide cylinder** is present:
   **Select fresh gas control** select O2/N2O confirm twice
   - Open nitrous oxide cylinder. Ensure nitrous oxide is available by confirming pressure. Check nitrous oxide not flowing.
   - Analyse contents as follows:
     a. Turn ON the oxygen cylinder –
     b. set FiO2 at 50% **confirm**
     c. observing for 50% oxygen : 50% nitrous oxide reading on monitor (+/- 3).
     d. Turn OFF nitrous oxide cylinder and drain. Turn OFF oxygen cylinder and drain.
   - If only one cylinder key available – leave on the oxygen cylinder.

**LOW PRESSURE SYSTEM CHECKS**

- **ONE GAS TESTING**
  1. Plug oxygen probe into wall supply and tug test.
  2. Confirm oxygen pressure reads approximately 410 kPa.
  3. Confirm 100% oxygen (+/- 3)
  4. Check auxiliary oxygen supply – test flowmeter to maximum flows.
  5. Disconnect oxygen wall supply and drain machine using oxygen flush.
  6. Plug medical air probe into the wall supply and tug test.
  7. **Select fresh gas control** select O2/AIR **confirm twice**
  8. Confirm medical air pressure reads approximately 410 kPa.
  9. Confirm 21% oxygen (+/- 3) on monitor.
  10. Disconnect medical air probe at wall and drain machine of gas.
  11. Plug nitrous oxide probe into wall supply and tug test.
  12. Confirm nitrous oxide pressure reads approximately 410 kPa and that nitrous oxide is not flowing.
  13. Re-connect oxygen wall supply
  14. **Select fresh gas control** select O2/N2O **confirm twice**
  15. set FiO2 at 50% **confirm**
  16. Confirm 50% oxygen : 50% nitrous oxide (+/- 3) on monitor.
<table>
<thead>
<tr>
<th>ANTI-HYPOXIC DEVICE TEST</th>
<th>1. This test is done electronically in the self test mode</th>
</tr>
</thead>
</table>
| OXYGEN FAILURE ALARM TEST | 1. Set oxygen flow 50%.  
2. Disconnect oxygen wall supply.  
3. Confirm nitrous oxide supply is cut off and that audible oxygen failure alarm is sounding.  
4. As N2O cuts off then the machine switches to Air 21% visually confirm  
5. Confirm VCP displays *O2 supply failure*  
6. Re-connect wall supplies of all gases and tug test pipeline connections – including scavenging and suction.  
7. Re-confirm pressure  
8. Select START/STANDBY confirm. |
| OXYGEN FLUSH TEST | 1. This test is done electronically in the self test mode |
| CIRCUIT AND ABSORBER TESTS | Absorber checks  
1. Check colour of soda lime.  
2. Take the absorber ‘out of circuit’.  
Circuit checks  
1. Connect circuit and attach breathing filter to distal end. Remove gas sampling line. Connect reservoir bag to filter.  
2. Extend circuit tubing out and ensure it is clean and correctly connected to machine.  
3. Close APL valve. Pressurise the circuit using the ‘oxygen flush’ until the airway pressure gauge reads just above 30 cms H²O. Allow pressure to settle and confirm pressure holds for at least 5 seconds.  
4. Replace absorber cannister “in circuit”, ensuring it is seated correctly.  
5. Re-pressurise circuit as in 4 and confirm pressure holds for at least 5 seconds.  
6. Open APL valve. Observe passive spilling of the reservoir bags but ensure bags do not empty completely confirming that scavenging is patent but not overactive.  
7. Close APL valve. Squeeze both bags alternately ensuring free movement of the uni-directional valves and ensure that no resistance is detected in the circuit.  
8. Open APL valve and squeeze both reservoir bags simultaneously ensuring even and easy gas spill. |
**VENTILATOR TESTS**

1. Select Man/Spon confirm
2. Open APL valve
3. Observe bellows do not drop for 10 seconds.
4. Oxygen flow is set by default to 6L – check that the end expiratory pressure (Pmax) does not exceed 3 cms H²O on the VCP and that this correlates with the airway pressure gauge.
5. **Select Volume control confirm twice**
6. Set the ventilator settings as follows (or as per hospital protocol)

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode:</td>
<td>Volume control</td>
</tr>
<tr>
<td>Tidal volume:</td>
<td>500 mLs</td>
</tr>
<tr>
<td>Rate:</td>
<td>12 / min</td>
</tr>
<tr>
<td>I:E ratio:</td>
<td>1:2</td>
</tr>
<tr>
<td>P limit:</td>
<td>40 cms H²O</td>
</tr>
<tr>
<td>PEEP:</td>
<td>Off</td>
</tr>
</tbody>
</table>

7. Reduce oxygen to basal flows
8. Ensure:
   - End tidal volume Vte reaches set tidal volume Vt (+/- 10%) within 6-8 breaths.

**High pressure alarm**

1. Squeeze reservoir bag to simulate high airway pressure. Confirm that ‘AW pressure high’ (high airway pressure) appears on VCP and that an audible and visual alarm sounds.
2. Cycle ventilator for 2-3 breaths.

**Low pressure alarm**

1. As ventilator cycles, remove reservoir bag from circuit. Confirm leak or fresh gas low appears on the VCP and that an audible and visual alarm sounds.
   - Select start/ standby confirm
   - Re-connect sampling line to circuit.
   - Attach appropriate face mask.
   - Confirm APL valve open.

**SUCTION CHECKS**

1. Check suction tubing is clean and is approximately 2-3 M long.
2. Check suction unit is assembled correctly.
3. Turn suction on to ‘max’ setting and listen to flow to confirm system patent from suction tip to suction gauge. After 3 seconds occlude suction tubing and ensure a negative pressure of approximately -60 kPa is achieved within 10 seconds.
4. Check regulator is functioning correctly on ‘min’ setting by ensuring suction pressure can be regulated from minimum to maximum pressures.

Ensure machine ready for use

Guidelines for checking the Drager Zeus anaesthetic machineNSG – NZATS website – updated June 2013
| MONITORING EQUIPMENT CHECKS                      | 1. Pulse oximetry present and functioning  
|                                               | 2. ECG leads present  
|                                               | 3. Blood pressure cuff present – appropriate size for patient  
|                                               | 4. Temperature probe and cable available  
|                                               | 5. Stethoscope present  
|                                               | 6. Nerve stimulator available  
|                                               | 7. Pressure cables available  

All equipment must be clean.

| AIRWAY EQUIPMENT CHECKS                         | 1. Check for the presence and function of 2 laryngoscopes blades – sizes appropriate to patient.  
|                                               | 2. Check availability of following essential items:  
|                                               | a) Bougies & stylets  
|                                               | b) Selection of oropharyngeal airways  
|                                               | c) Syringe  
|                                               | d) Selection of LMA sizes  
|                                               | e) Selection of endotracheal tube sizes  
|                                               | f) Magill’s forceps  

| EMERGENCY DRUGS CHECK                          | 1. Check suxamethonium available and date check as per hospital protocol  
|                                               | 2. Check emergency drugs well stocked – including adrenaline, amiodarone, atropine.  

| ANCILLARY EQUIPMENT CHECKS                     | 1. Check intravenous cannulation and infusion equipment available  
|                                               | 2. Check infusion pumps available and check service dates  
|                                               | 3. Check warming equipment available and check service dates  

| DOCUMENTATION                                  | Sign / date machine checklist as per hospital policy  

| PROCEDURE FOR END DAY                          | 1. Clean machine as per hospital protocol.  
|                                               | 2. Turn machine **OFF**  
|                                               | 3. Turn scavenging **OFF** (if this function available)  

Guidelines for checking the Drager Zeus anaesthetic machineNSG – NZATS website – updated June 2013
# LEVEL 3 MACHINE CHECK

Can be done in standby mode

## CIRCUIT CHECKS

Check any **changed or new items** in the breathing circuit: filters, angle pieces, catheter mounts etc

### Circuit checks

1. Attach new breathing filter to distal end of circuit and connect reservoir bag to filter.
2. Extend circuit tubing out and ensure it is clean and correctly connected to machine.
3. Ensuring the absorber is ‘in circuit’, close APL valve and pressurise the machine using the ‘oxygen flush’ until the airway pressure gauge reads just above 30 cms H²O. Allow pressure to settle and then confirm pressure holds for at least 5 seconds.
4. Open APL valve. Observe passive spilling of the reservoir bags but ensure bags do not empty completely confirming that scavenging is patent but not overactive.
5. Close APL valve. Squeeze both bags alternately ensuring free movement of the uni-directional valves and ensure that no resistance detected in the circuit.
6. Open APL valve and squeeze both reservoir bags simultaneously ensuring even and easy gas spill.

## SUCTION TESTS

Replace used suction items: yankauer sucker, suction catheter, suction tubing, suction liner and re-check as follows;

1. Check suction tubing clean and is approximately 2-3 M in length.
2. Check suction unit is assembled correctly.
3. Turn suction on to ‘Max’ setting and listen to flow to confirm system patent from suction tip to suction gauge. After 3 seconds occlude suction tubing and ensure a negative pressure of approximately -60 kPa (500 mmHg) is achieved within 10 seconds.

## MONITORING

Ensure all monitoring is cleaned between patients as per hospital protocol.

1. Check Pulse oximetry present and functioning
2. ECG leads present
3. Blood pressure cuff present – appropriate size for patient
4. Temperature probe and cable available
5. Stethoscope present
6. Nerve stimulator available
7. Pressure cables available
<table>
<thead>
<tr>
<th>AIRWAY EQUIPMENT</th>
<th>Replace all soiled/disposable airway equipment and perform the following checks as per the Level 2 guidelines:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Check for the presence and function of 2 laryngoscopes blades – sizes appropriate to patient.</td>
</tr>
<tr>
<td></td>
<td>2. Check availability of following essential items:</td>
</tr>
<tr>
<td></td>
<td>a) Bougies &amp; stylets</td>
</tr>
<tr>
<td></td>
<td>b) Selection of oropharyngeal airways</td>
</tr>
<tr>
<td></td>
<td>c) Syringe</td>
</tr>
<tr>
<td></td>
<td>d) Selection of LMA sizes</td>
</tr>
<tr>
<td></td>
<td>e) Selection of endotracheal tube sizes</td>
</tr>
<tr>
<td></td>
<td>f) Magill’s forceps</td>
</tr>
<tr>
<td>DRUGS</td>
<td>Check suxamethonium and emergency drug levels adequate. Ensure adequate stock of all other drugs.</td>
</tr>
<tr>
<td>OTHER</td>
<td>o Re-confirm resuscitation device present.</td>
</tr>
<tr>
<td></td>
<td>o Trainee will be expected to demonstrate appropriate hand hygiene during Level 2 &amp; 3 checks.</td>
</tr>
</tbody>
</table>

These guidelines have been written by the NZATS for NZATS Approved Training Hospitals throughout New Zealand. They detail the minimum standard expected in the conduct of Level 2 and Level 3 machine checks before and during an anaesthesia session.