



A systematic procedure for leak detection in Tafonius

Scope: This document is for use with Tafonius and Junior machines for the detection of leaks in the patient circuit

You will need:

- 30-60 minutes of spare time
- 2 x spare drainage bungs
- 1 x Female Luer Stopper

You may need:

- An assistant
- 1 x tube RTV108 Silicon sealant
- 1 x tube cyanoacrylate (super-glue)
- Some Gaffer tape

When investigating a hard-to-find leak in the patient circuit of Tafonius it can be helpful to isolate areas of the patient circuit to quickly home in on the area that is leaking. The following is a suggested guide to help you quickly locate the area of leak and then the leak itself in Tafonius machines

Leaks in the patient circuit are detected when running an automatic or manual leak test. Values of over 500mls/min at 20cm H₂O test pressure are cause for concern and should be investigated.

The patient circuit is a low pressure circuit and begins in the heart of the machine where fresh gas is presented to the vaporiser. The outlet from the vaporiser is fed to the back of the valve block as a 6.0mm (1/4") rigid pipe, where it passes through a push-fit connector and is fed to the main cylinder. In early machines the fresh gas mixed with patient circuit gas at this point. In later machines (T27 through to T52 and J12 through to J29) the fresh gas is fed through a further length of 6.0mm pipe down to the bottom of the cylinder where it is added to the main circuit.

The patient circuit therefore has 6 main functional compartments:

1. The soda-lime tray
2. The main cylinder
3. The absorber pan and drainage tubes
4. The Dump Valve
5. The Valve Block
6. The internal fresh gas flow pipework comprising of Flow meters, manometer, vaporiser, vaporiser backbar, Air pump

When working through a leak detection procedure, different volumes of the patient circuit can be isolated to locate the problem.



Before you begin, connect the normal patient tubing and the Y-piece to the machine. The following tests can be run on either the standard circuit or the Foal circuit. Connect the oxygen supply.

The tests in this document assume that the common sites of leaks have already been tested and eliminated. If not, follow the document ***"Testing for leaks on the Tefonius large animal ventilator.pdf"*** BEFORE embarking on the test procedures outlined in this document.

IMPORTANT

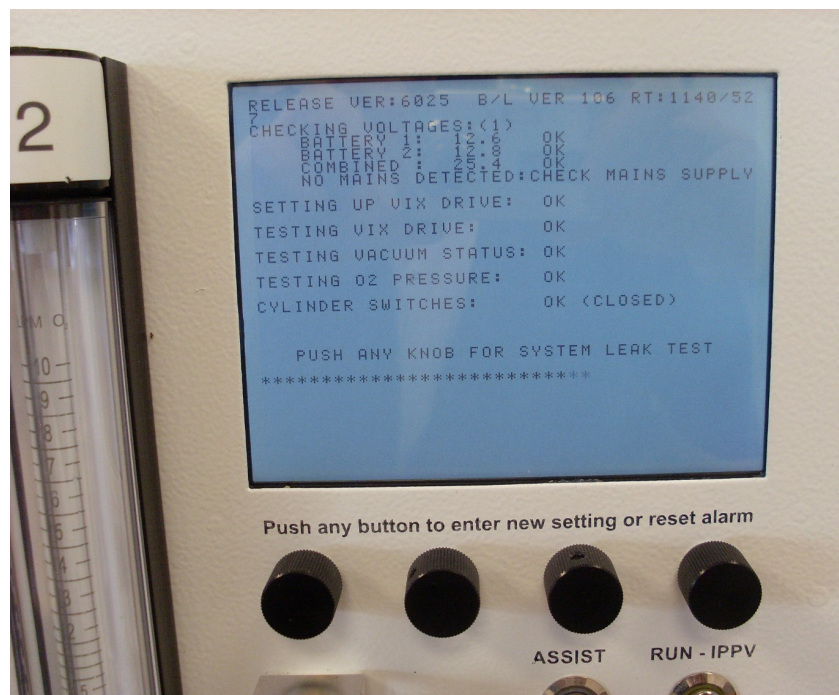
These tests and Isolation Procedures should only be done in Auxiliary Mode with the PC turned OFF



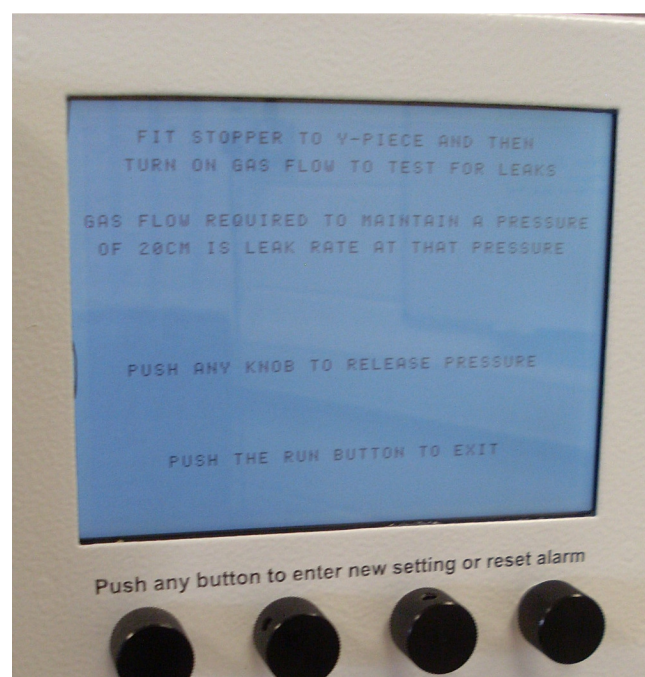
Running the leak test in Auxiliary mode



Start the machine in Auxiliary mode. Do not go into the Windows program. Press and hold one of the Auxiliary control knobs when the Auxiliary screen says, "PUSH ANY KNOB FOR SYSTEM LEAK TEST". If you miss the prompt, you will need to restart the machine to be prompted again.

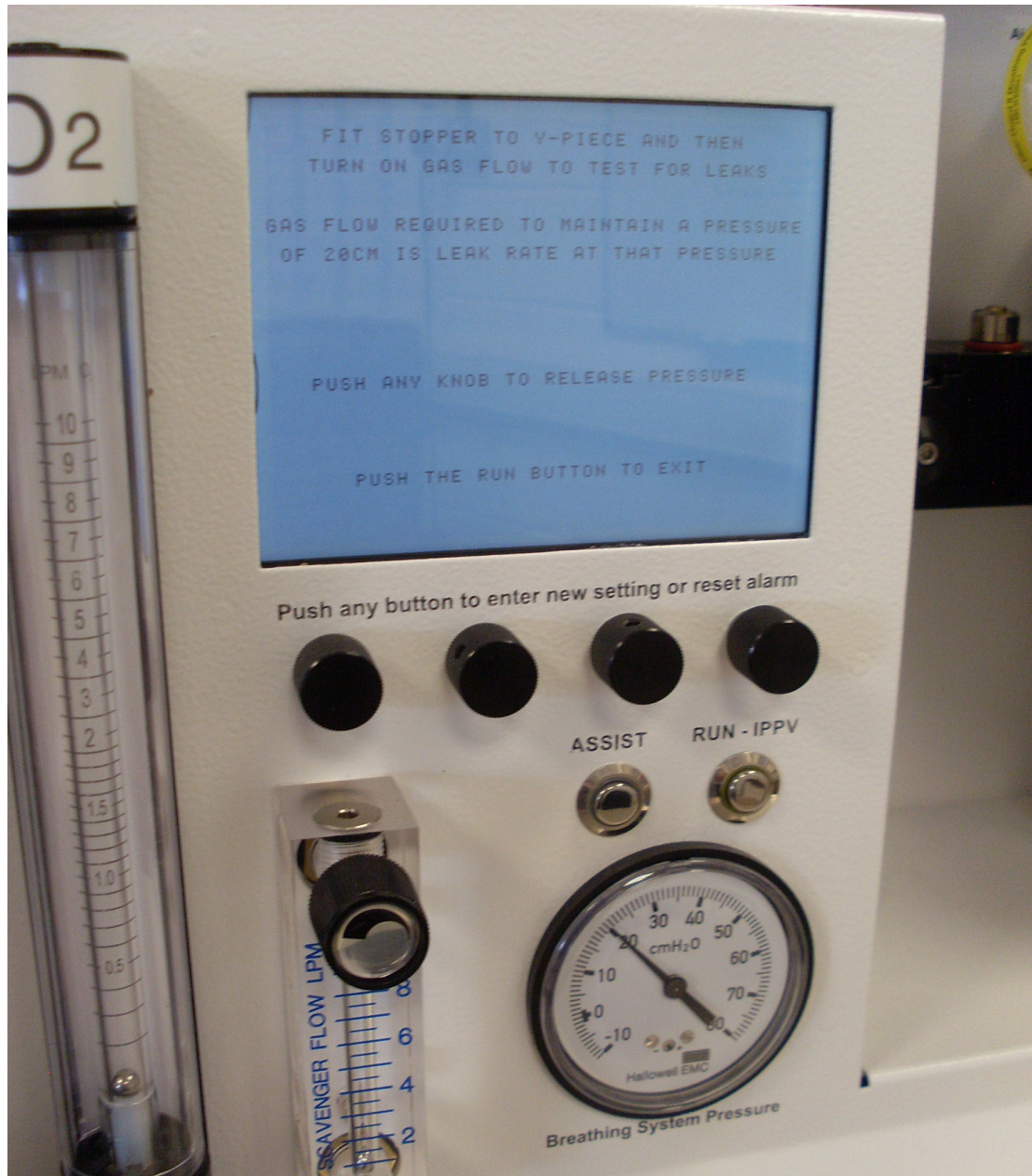


Once in this Auxiliary leak test mode, remain here for all of the following tests



Run the manual Leak Test

Add fresh gas to the patient circuit using the oxygen flow meter to increase the pressure, as shown by the manometer, to 20cm H₂O.



When the dial shows 20cm pressure, turn off the flow meter and observe the manometer. If the pressure starts to fall, add gas using the oxygen flow meter until the pressure is maintained at a steady 20cm pressure. Note the flow rate on the oxygen flow meter. This is the leak value of your machine at 20cm pressure. If the value is in excess of 500mls use the guide below to isolate and repair the leak.



Eliminate the Y-piece and test the 2" Patient Tubes

Remove the Patient tubes and Y-piece from the machine. Remove the two Patient tubes from the Y-piece. Disconnect the pressure sensor line from the Y-piece and cap it using the female luer stopper. Take one of the 2" patient tubes and connect it between the Inspiratory and Expiratory ports of the Valve Block as shown in the picture.



Run the Manual Leak Test.

If there is an improvement, then the leak lies in the Y-piece or the other 2" Patient hose. If there is no improvement then the leak could lie in the 2" Patient hose or in another part of the circuit. Test the other 2" Patient hose.

Leaks in the 2" Patient hose can usually be felt or heard, especially if the testing pressure is increased to 30 or 40 cm Pressure.

If the leak is not found, proceed to the next stage of testing - the Isolation Tests.

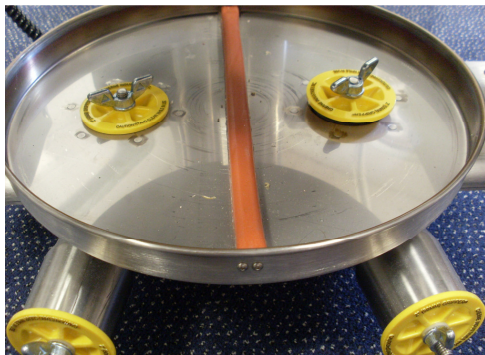
Result	Cause
Leak Improvement	Leak is in the Y-piece or other 2" hose
No change in leak	Leak is in connected 2" hose or the rest of the circuit
Leak Improvement with both 2" hoses	Leak is in the Y-piece



Isolation Tests

Note: Isolation Test 2 isolates all the metal parts of the ventilator and Isolation Test 1 only isolates the soda-lime canister and main cylinder. Since Isolation test 1 is very quick to run, it is suggested to run this test first.

Isolation Test #1: Isolating the soda-lime canister and main cylinder



It is common for the seal on the bottom of the soda-lime canister or the seal on the bottom of the main cylinder to wear and begin to leak over time. These two items can easily be cut out of the patient circuit by removing the soda-lime tray and inserting 2" stoppers in the 2" ports in the centre of the absorber pan

Now run the manual leak test and note the leak value. If this is very much smaller than before then there is a leak in the cylinder part of the system in either the soda-lime tray or main cylinder. Check and if necessary replace the main O-ring seals of the soda-lime canister and bottom of the cylinder. Check around the central piston bolt or nuts in the middle of the bottom of the piston. During a service this is sealed with silicon to prevent any leaks up around the bolt. If a leak is suspected around the bolt, use some RTV108 silicon to seal around the bolt/nuts. Now remove the 2" stoppers and run the Manual Leak Test to see if the leak has been fixed.

If the leak value when running Isolation Test 1 is still high then the leak is not in the cylinder part of the system. It could be in the absorber pan itself or in a part of the circuit not involving the metal parts of the ventilator. To rule out the absorber pan, run the following test.

Result	Cause
Leak Improvement	Leak is in the Soda-lime tray or main cylinder
No change in leak	Leak is in Absorber pan or rest of the circuit



Isolation Test #2: Isolating the main cylinder and the absorber pan

Undo the clamps from the bottom end of both of the short 2" hoses that link the valve block to the absorber pan 2" pipes. Disconnect the hoses. On newer machines the Expiratory side has an internal 6mm pipe running inside the 2" pipe. This will just pull out of the absorber pan pipe. Disconnect the short 2" hose from the Inspiratory side of the valve block and then link the short 2" expiratory hose to the inspiratory side, as shown in the picture. Feed the 6mm pipe into the valve block to allow you to connect the 2" hose to the valve block. This isolates all of the metal parts of the ventilator.



Now run the manual leak test and note the value. If the leak is very much reduced, then the leak lies in the metal part of the ventilator:
Absorber pan, manual take-off port (earlier models), drainage bungs, soda-lime canister, main cylinder

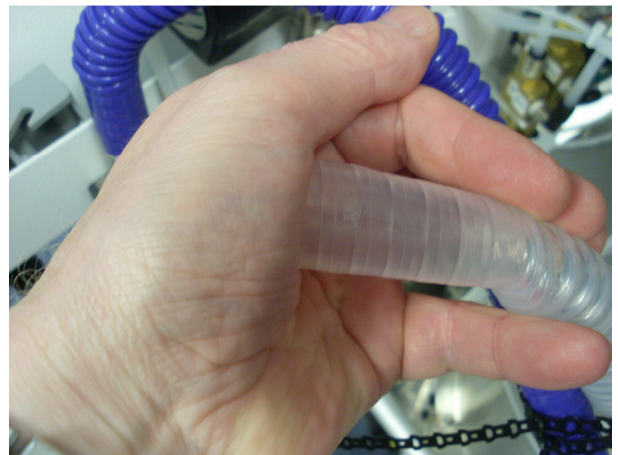
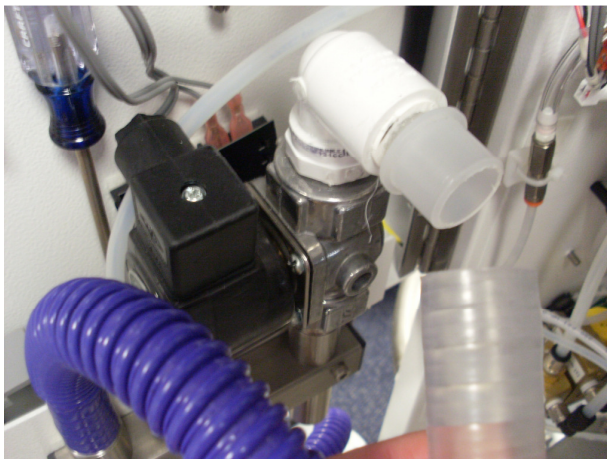
Result	Cause
Leak Improvement	Leak is in the Soda-lime tray, main cylinder or Absorber pan
No change in leak	Leak is in non-metal parts of the circuit

If the leak value when running Isolation Test 2 is still high then the leak is in the non-metal parts of the ventilator. Leaving the ventilator connections as they are proceed to Isolation Test 3.



Isolation Test #3: Isolating the Dump Valve & Dump tubing

Remove the tube from the connector at the Dump Valve and either plug it or press it against the palm of your hand to seal it. Run the Manual Leak Test.



If the leak value is improved then there is a leak in the Dump Valve unit. Look for loose or cracked parts of the Dump Valve unit.

If the leak value is unchanged then the leak must lie either in the Dump Valve tubing, Valve Block or in the internal pipe work of the machine. Reconnect the tube to the Dump Valve.

Result	Cause
Leak Improvement	Leak is in the Dump Valve
No change in leak	Leak is the Dump Valve tubing or the rest of the circuit

At the rear of the valve block, disconnect the Dump Valve tubing where it emerges from the Valve Block.

Temporarily block this exit with your thumb, ball of your hand or Gaffer tape and then run the Manual Leak Test again.

Result	Cause
Leak Improvement	Leak is in the Dump Valve or Dump valve tubing
No change in leak	Leak is the rest of the circuit



Testing the Valve Block

Due to the many connections to the valve block it is not possible to isolate the valve block. However, by this stage the only two compartments where the leak may still occur are in the Valve block, or the internal pipe work.

Makes sure that the Valve Block cover is properly fitted and secure and that the orange O-ring seals are present and not damaged before starting this part of the test.

To test the Valve block, increase the test pressure to 30cm and then feel/listen for leaks around the valve block. Use Leak Detector or soapy water to locate any leaks. Pay attention to the junction between the metal 2" inserts and the white plastic of the valve block as this is a potential source of leaks. If leaks are found at these points, make sure the areas are clean and dry and then use cyanoacrylate (super-glue) applied to the crack, which will disperse by capillary action and seal the leak.

If the leak still remains undetected, then it is likely to be in the internal hose connections of the machine. These are too numerous and varied between different machines to provide a diagnostic procedure to detect any leaks but it is worth opening the back door of Tafonius or the lid of Junior to determine if a leak can be heard or felt. If you are unsure about a possible leaking part, take a picture or video and send it to either Vetronic Services or Hallowell EMC.

Reconnection

Once all leak testing is completed, return the unit to its normal condition:

Fit the 2" hoses to the Y-piece and connect the Y-piece to the machine.

Remove the stopper from the Pressure Sensor line and connect the Pressure Sensor line to the Y-piece.

Remove the two 2" stoppers from the absorber pan, fit the soda-lime tray and close the cylinder.

Check that the hose to the Dump Valve is fitted and secure

Reconnect the short 2" hoses from the Valve Block to the absorber pan pipes, feeding the 6mm fresh gas feed into the exhaust limb before connecting and securing the 2" pipes.