

PORTABLE ALTITUDE CHAMBER

INSTRUCTION MANUAL

Please print personal copies for all users of the PAC.

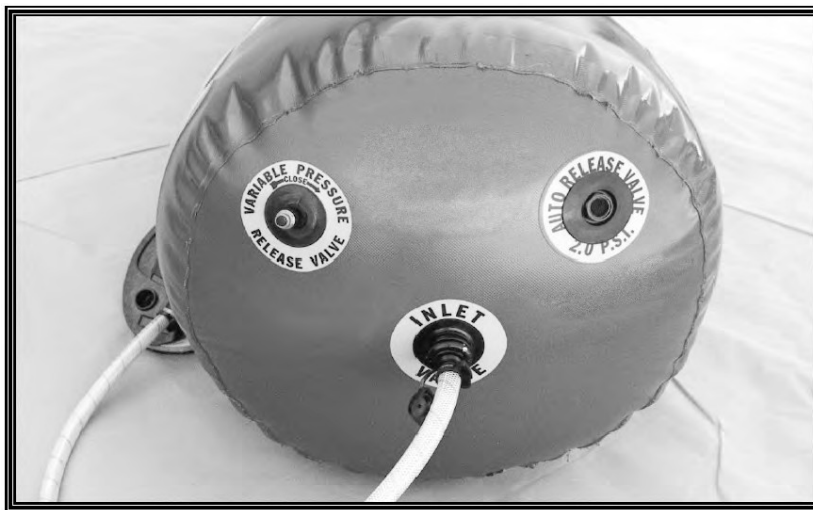
**A video of instruction can be found on
http://www.treksafe.com.au/pac/pac_use.htm**

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Portable Altitude Chamber

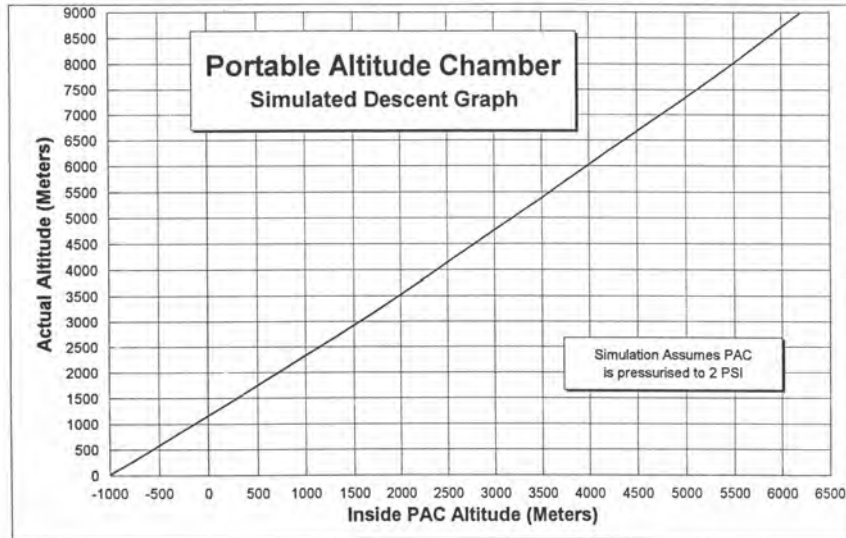


End View of Portable Altitude Chamber



INTRODUCTION

The Portable Altitude Chamber (PAC) is used to treat high altitude illness (AMS, HAPE and HACE). The PAC works by increasing the pressure in the chamber using a foot pump. At high altitude this increased pressure simulates a descent and delivers a significantly increased amount of oxygen to the patient.



When pumped up to its operating pressure of 2 PSI (when the *automatic release valve* is operating), the PAC delivers the equivalent of a moderate flow of oxygen (2 to 4L/min). The advantages of the PAC over bottled oxygen in the treatment of altitude illness are that it never runs out and is easy to carry. The disadvantage is that the patient is 'sealed-in' while the PAC is pressurized (it is therefore important to observe and maintain contact with the patient during the whole treatment time).

Given that descent is the only safe treatment if a person has severe AMS or HAPE (High Altitude Pulmonary Edema) or HACE (High Altitude Cerebral Edema), the PAC can be used to stabilize and improve the patient's condition before descending to a safe altitude where permanent recovery is possible. For severe AMS (Lake Louise score 6 or more) a safe altitude is usually a descent of at least 500 m to 1000 m. For HAPE (High Altitude Pulmonary Edema) or HACE (High Altitude Cerebral Edema) the safe altitude is a descent to low altitude (below 2000 m).

The golden rule for altitude illness: There should be NO further ascent if any symptoms of high altitude illness are present. Descent is the definitive treatment for HACE and HAPE.

Before using the PAC, you should have read this manual, watched the demonstration on http://www.treksafe.com.au/pac/pac_use.htm, seen a PAC demonstration and practiced using the PAC yourself. Before treating others, you should experience being inside the PAC for a full treatment cycle so that you know how it feels.

OPERATING INSTRUCTIONS

1. Before inflating the PAC on steep ground, secure it to a good anchor to prevent it from slipping, using the webbing loop on the underside of the PAC.
2. Place closed cell sleeping mats under the PAC to protect it from damage by stones or other sharp objects.
3. Place a sleeping mat inside the PAC for insulation and to protect the patient from condensation. On top of the mat place an unzipped sleeping bag for the patient to lie on as the internal temperature in the PAC can vary widely depending on outside conditions. Arrange a pillow.
4. In very cold conditions place sleeping bags over the PAC to reduce condensation inside. Provide shade from direct sunlight in hot weather.
5. If you have an altimeter, insert it into the mesh pocket in the window panel inside the PAC. With the altimeter visible from the outside, you can observe the rate of simulated descent/ascent experienced by the patient inside the PAC during inflation (when the PAC is being inflated, which is equivalent to descending) or deflation (when the PAC is being deflated, which is equivalent to ascending). It is not essential to have an altimeter for the PAC to function.
6. Put a water bottle, a vomit bag/container and a pee bottle inside the PAC. The interior of the PAC can be very cold in cold weather and very hot in hot weather so the patient should wear appropriate clothes and, as the inlet valve produces a stream of cooling air at head level, a warm hat.
7. Connect the pump to the *inlet valve* and close the *variable pressure release valve*. (This valve should only be closed or opened with **gentle finger pressure only (do not use excessive force)**). Make sure the zipper is open **completely**.
8. Some people are afraid of being inside a confined space such as the PAC. If the patient is well enough to understand, take your time to explain the operation of the PAC to them. If necessary, demonstrate how the PAC works before putting the patient inside. Reassure them that you will take them out of the PAC immediately if they ask. Tell them you will be able to talk to them at all times through the PAC walls.

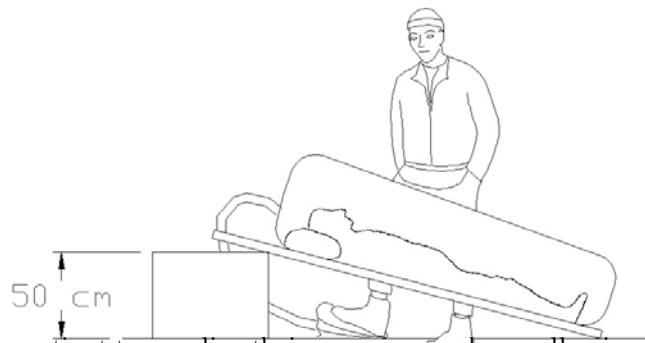
Note: the zipper can only be operated from the outside of the PAC; this is to prevent a sudden unzipping from the inside by a panicking patient, as this would cause damage to the patient's eardrums.

9. Show the patient how to equalise their ear pressure by repeatedly swallowing or yawning, or exhaling against a closed nose and lips (the Valsalva manoeuvre). This will usually prevent or relieve pain in the ears.
10. Help the patient inside the PAC. If the patient is unconscious or semiconscious, make sure they are lying propped on their side, in the 'safe airway' position (stable side/lateral position). Maintain eye and voice contact with the patient at all times to prevent panicking and to monitor their condition.
11. If the patient is cooperative, ask them to hold the walls of the PAC off their face and body using their arms and knees (this will speed up the inflation and reduce feelings of claustrophobia). Now commence pumping and close the zipper to inflate (pressurise) the PAC. Pump rapidly until the PAC walls begin to tension and then a little more slowly as the pressure inside the PAC will now rise relatively rapidly.

12. If the patient experiences ear pain while inflating the PAC, slow (or briefly stop) pumping while encouraging them to equalise their ear pressure (as explained in point 9 above). It may be necessary to reduce the pressure by opening the *variable pressure release valve* till ear pain is relieved. Instruct the patient to tell you once the pain has gone so you can then continue pressurisation (inflation) by closing the *variable pressure release valve* and resuming normal pumping.
13. The *automatic release valve* will start to hiss, the 'pressure cooker' sound (releasing air /flushing CO₂) when the PAC reaches its operating pressure of 2 pounds per square inch (2 psi). Also, as a visual sign, there is a small yellow tab over the valve that flutters when the *automatic release valve* is operating.
14. Check that the hissing noise is coming from the *automatic release valve* and NOT from leaks in the pump or hose! Check the hose and pump for leaks and make sure that the *automatic release valve* is releasing air once the bag is pressurized. When the *automatic release valve* starts to operate, the walls will feel very hard, almost rigid. Because of the *automatic release valve*, you cannot over-inflate the PAC.

Note: If you have well exceeded the estimated descent judged by the graph and the *automatic release valve* is still not working, see troubleshooting page 8.

15. Keep pumping! The PAC should be continuously flushed with fresh air at a rate of around one pump every 5 seconds (there is a slight build-up of CO₂ under normal operating conditions, but this small increase is actually beneficial). **Never let the rate of pumping fall below one pump every 5 seconds.**
16. Correct pumping technique is essential. The pumper can use walking poles to help balance and improve efficiency while pumping. If the pumper is too light they might not be able to compress the pump fully, thus failing to deliver enough air: give them a weighted rucksack.
17. Pumping is tiring and boring so swap pumpers regularly. Short breaks in pumping of up to one minute are OK if required to reorganise the situation. Try to limit breaks in pumping to a maximum of one breakevery 20 minutes.
18. If lying down makes the patient's symptoms worse, raise the head-end of the PAC. This may happen in cases of moderate to severe AMS, HAPE or HACE.
19. The inflated PAC is not a seat! Avoid pressing or sitting on it as this causes ear pain due to increase in the pressure.
20. To deflate (depressurise) the PAC, instruct the patient to equalize their ear pressure by swallowing or yawning repeatedly and to let you know if pain occurs. Now open the *variable pressure release valve* and stop pumping. If ear pain occurs, slow or stop the rate of deflation by partially or completely closing the *variable pressure release valve* and restart pumping until the pain subsides. Then continue deflating.



21. When the wall of the PAC has lost most of its tension, open the zipper completely. The patient can be kept in the open PAC while being examined or given oxygen, food or drink.
22. Make sure you open the zipper **completely** before the patient gets out of the PAC. Failure to do so may strain the zipper.

23. There is no recommended minimum treatment time so treat until symptoms disappear or the patient's condition is much improved. For severe AMS or HACE, treatment time is usually 4 to 6 hours. In severe HAPE, treatment time can be up to 8 hours or more. During long treatments, the PAC may be deflated every hour or two in order to assess the condition of the patient and attend to their needs.
24. If symptoms return ('rebound') after treatment, put the patient back in the PAC.
25. Drugs recommended for the treatment of altitude illness may be used in conjunction with the PAC.
26. The manufacturer does not recommend the use of bottled oxygen inside the sealed PAC. If you have it, give high flow bottled oxygen to the patient while preparing the PAC, and low flow *after* treatment in the PAC.

Note: the PAC is only used to treat the symptoms of high altitude illness. If symptoms are severe or worsening, or if symptoms of severe AMS, HACE or HAPE were present, **the patient must descend after treatment.**

CARE, REPAIR AND STORAGE

Your Portable Altitude Chamber has been made to the highest standards currently available but its life span will depend largely on the care with which it is used, rolled and stored. No material will last forever and PVC is subject to decay over time. It is recommended that your PAC should be inspected/serviced by the manufacturer 5 years after the date of manufacture, and every 2 or 3 years after that. (The date of manufacture is moulded into the joining seam approximately 30 cm from the securing loop on the bottom of the PAC).

Each PAC comes with a manufacturing guarantee of 5 years; however the PAC will be functional for longer, provided it is regularly tested at operating pressure. History shows PACs can be used well beyond 10 years if well maintained and kept in good order.

The materials and workmanship of your PAC are guaranteed at the time of delivery, but due to the variables of mountain operations no further warranties of performance can be made.

The PVC material used in your PAC is rated to withstand 3 years of continuous UV exposure at sea level. At high altitude, the rate of UV exposure is higher than at sea level. For this reason always try to shade your PAC from direct sunlight. The clear windows are rated down to -15°C; in colder conditions the windows may crack so use in warm tents or rooms, and/or cover with sleeping bags and protect from wind chill.

Do not expose the PAC to hydrocarbons (petrol, kerosene, oil, diesel, cooking oil) or other chemicals. If exposure does occur, wash immediately with warm soapy water and a soft cloth.

The PAC will leak if punctured, and must be treated carefully. If your PAC is severely damaged, you may return it to the manufacturer for inspection and possible repairs. All transportation costs remain the owner's responsibility. Obligation-free quotations will be supplied on request. Minor repairs may be carried out using the repair kit supplied.

Do not tamper with the *automatic release valve*. The release pressure has been set at the factory and must not be altered. If you inadvertently increase the output pressure, the PAC may burst. The resulting explosive decompression is dangerous.

Before each trip check the operation of the valves, pump, pump hose and the material of your PAC. The pump and hose are a vital part of this system and a leak in the hose or pump can adversely affect the CO₂ and oxygen levels in the PAC.

A newly manufactured PAC and some spare parts will have a strong PVC smell. Airing the PAC before use will allow the smell to rapidly dissipate.

Repair

Check your PAC regularly for cuts, or holes. Run your hand over the fully inflated PAC to detect leaks. Any weakness in the material should be reinforced by a glued patch. Occasionally the zip may develop tiny leaks: this is no problem as long as the *automatic release valve* is working (ie. you can hear it hiss and see the fluttering tab when the PAC is fully pressurised).

Do not use the PAC if the reinforcement material becomes exposed through the PVC coating or if there are small nicks in the walls or windows, as these may lead to larger tears and explosive decompression.

Use the manufacturer-supplied repair kit to patch any abraded areas, small holes or nicks as soon as you find them.

Do not repair the PAC with light gaffer tape. Gaffer tape may seal a small leak if applied on the inside of the PAC, but it will not strengthen the PAC around the weakening caused by the hole. Under pressure the hole may tear, leading to explosive decompression.

Repairs can be made on either the inside or outside of the PAC. Read carefully the repair notes found in the repair kit. Freshly glued patches on the inside of the PAC may cause discomfort to the patient due to the smell of the glue.

Note: 5-year overhauls as well as repairs and spares parts are available from the manufacturer. Contact Treksafe for details.

Troubleshooting

LEAKS

- Small leaks in the zipper are not a problem as long as the *automatic release valve* is working
- Leaks in the material need to be patched as explained above.
- Leaks in the pump or hose must be repaired immediately.

AUTOMATIC RELEASE VALVE NOT WORKING

- Check the *variable pressure release valve* is closed.
- Check for leaks in the chamber, bellows of the pump, hose and zip.
- In extremely cold conditions (especially if the PAC has been stored damp) the *automatic release valve* may be frozen. Warm the PAC to ambient tent or room temperature before use and warm the frozen valve with warm hands or similar (avoid damage due to excess heat).

Storage

Before storage check the PAC is dry, that there are no leaks in the pump, hose and chamber and that all components and valves are present and working. If this is not the case, arrange for repairs or replacement.

Always ensure your PAC is stored dry. Long periods of operation in cold areas will result in significant amounts of condensation appearing inside the PAC. Wipe the inside of the PAC with a clean soft dry cloth after use and ensure it is completely dry before storing. If stored damp, the PAC will grow moulds and fungi, which may weaken the wall, interfere with the valves or cause a smell.

Roll the PAC, do not fold it as folding can damage the zip. The windows are the most delicate part of the PAC so roll the PAC from the foot to the head so that the windows are wrapped over the larger diameter of roll.

Always store the PAC in its protective storage bag with the instruction manual and pump. When not in use, ensure the *inlet valve* and the *variable pressure release valve* are closed to prevent grit getting in. Store away from stoves, fuel, direct sunlight, tools, sharp objects, mountaineering hardware and vermin.

When taking the PAC out of storage, check that there are no leaks in the pump, hose and chamber and that all components and valves are present and working. Inflate the PAC fully to make sure everything is working and check for leaks.

Transport

When the PAC is being carried in an aircraft's hold, on trucks, or is being carried by porters or on animals, extra protection should be added around it (eg sleeping mats, etc).

An extra tough protective bag is available from the manufacturer.

For sales and advice, please contact:

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