Chest Drain

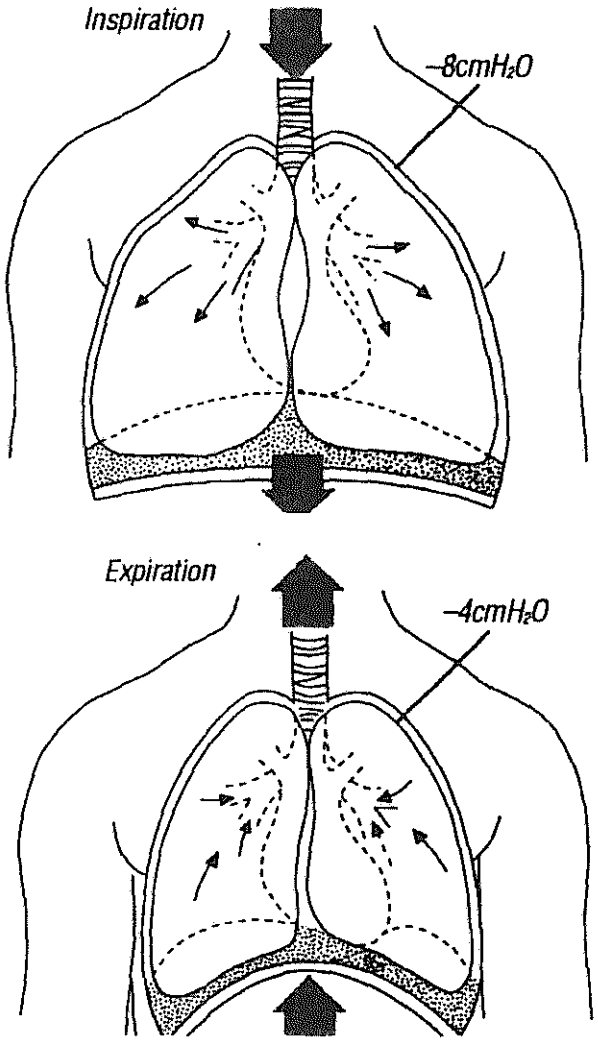
- Aims:

- To remove air / fluid from the pleural space

- To prevent air / fluid going back to pleural space

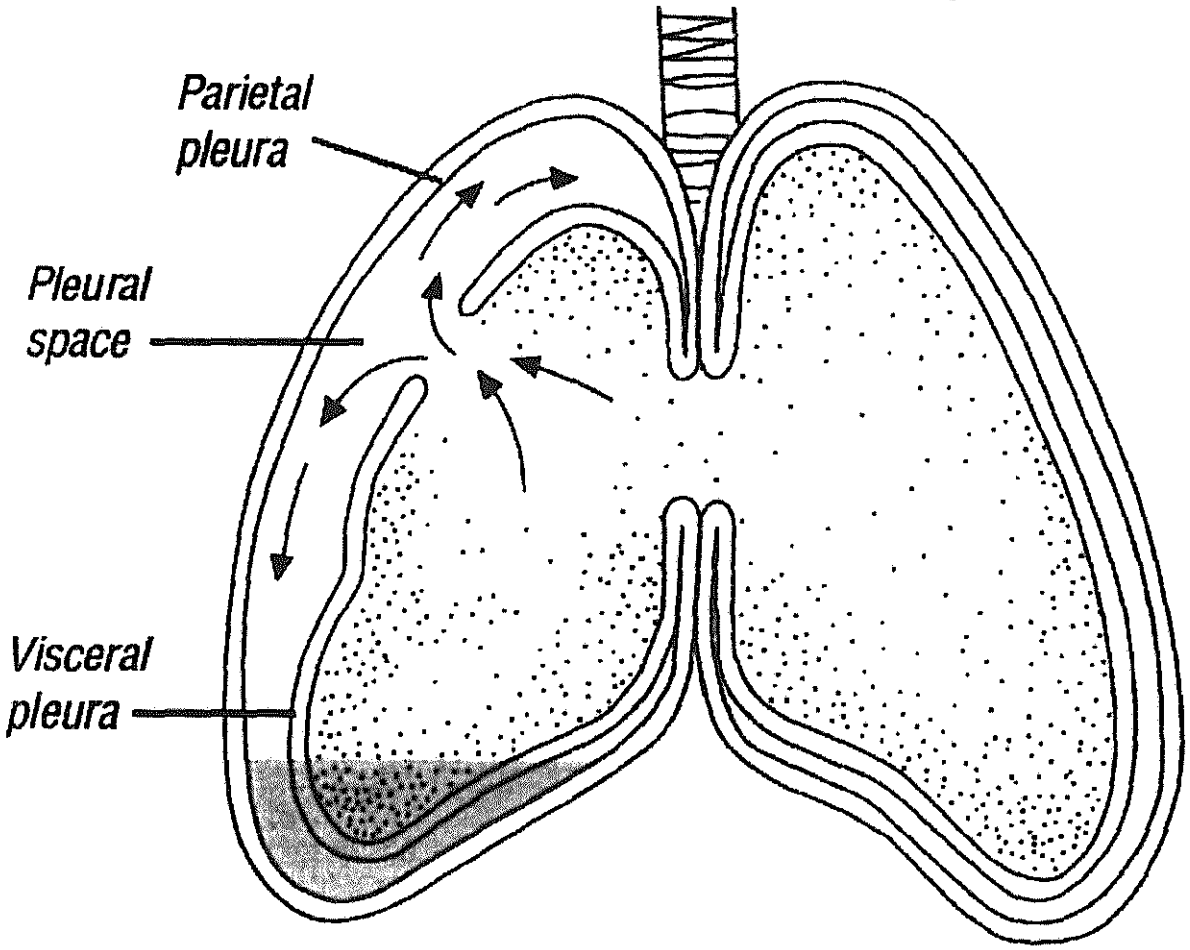
- To restore negative pressure in the pleural space so to re-expand the lungs

Mechanism of breathing

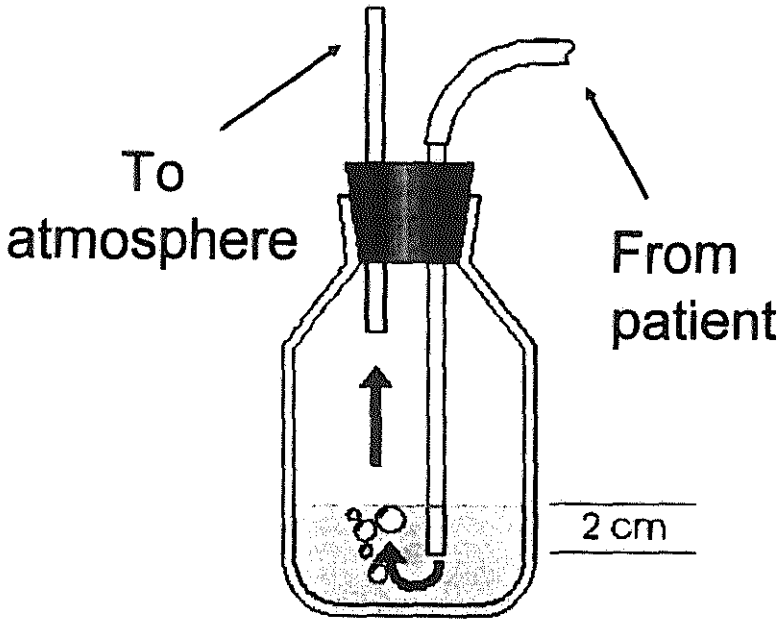


- **Negative pressure** in the pleural cavity is needed to keep the lungs expand.
- The degree of negativity changes with inspiration and expiration. Intrapleural pressure is approximately -8cmH2O when inspires, while the pressure falls to -4cmH2O when expires. With deep inspiration, intrapleural pressures can be even more negative.

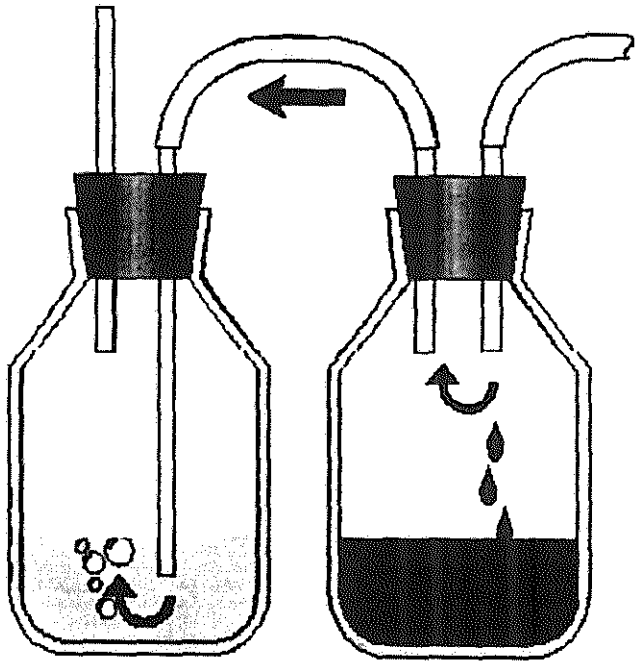
When air / fluid goes into the pleural cavity…



Chest drain systems: One bottle, Two bottles...

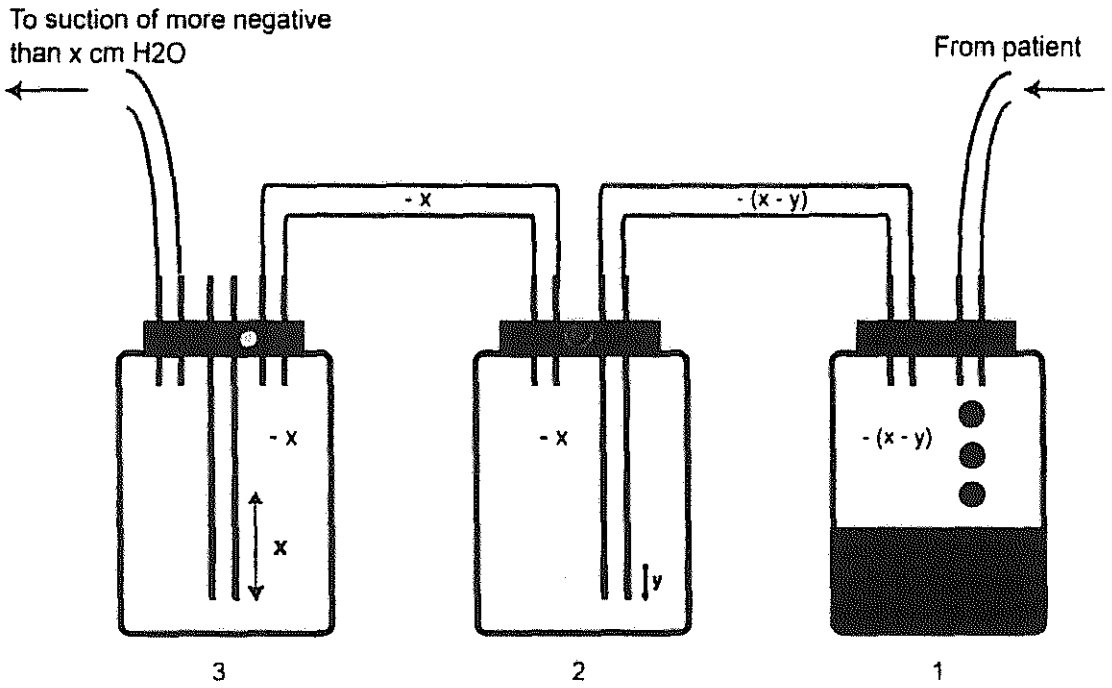


One-Bottle System



Underwater seal Drainage bottle

Two-Bottle System

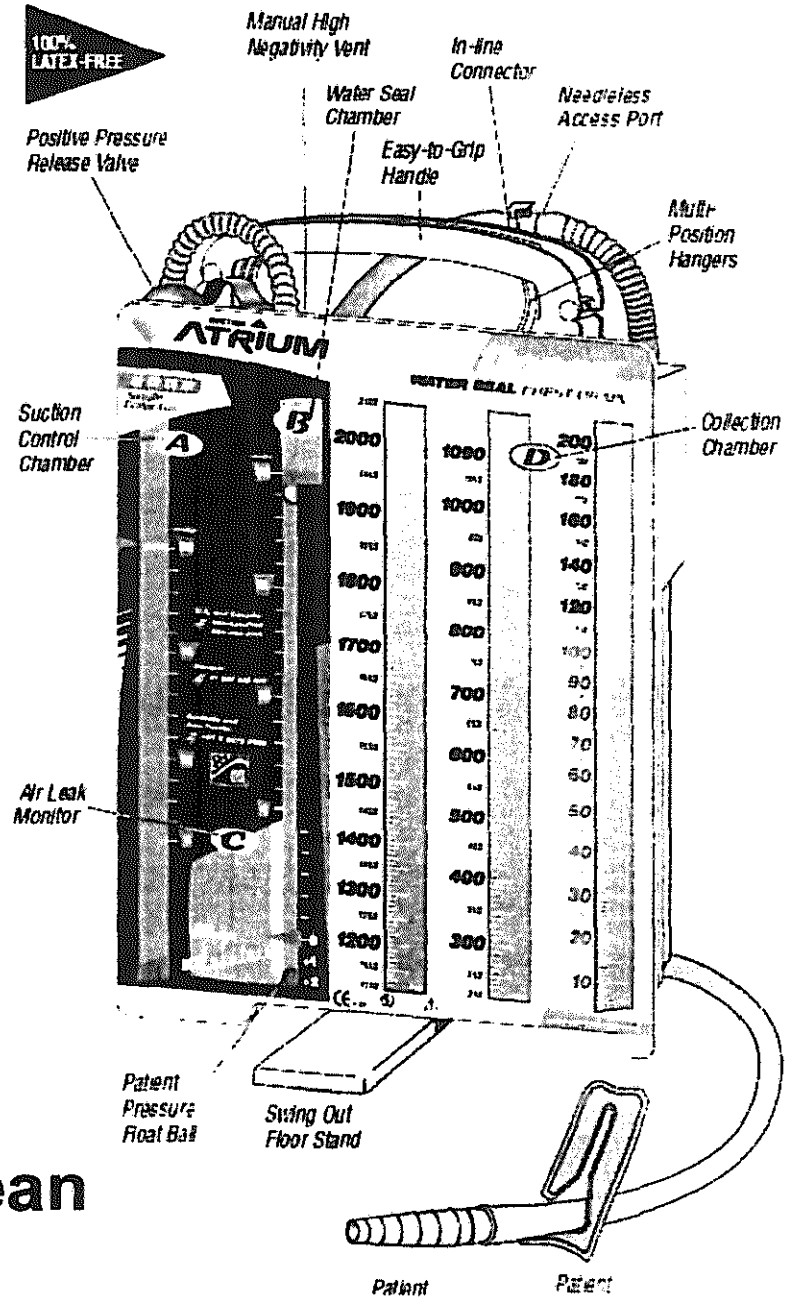


The ***depth of the water*** in the suction bottle determines the amount of negative pressure that can be transmitted to the chest, ***NOT the reading on the vacuum regulator!!***

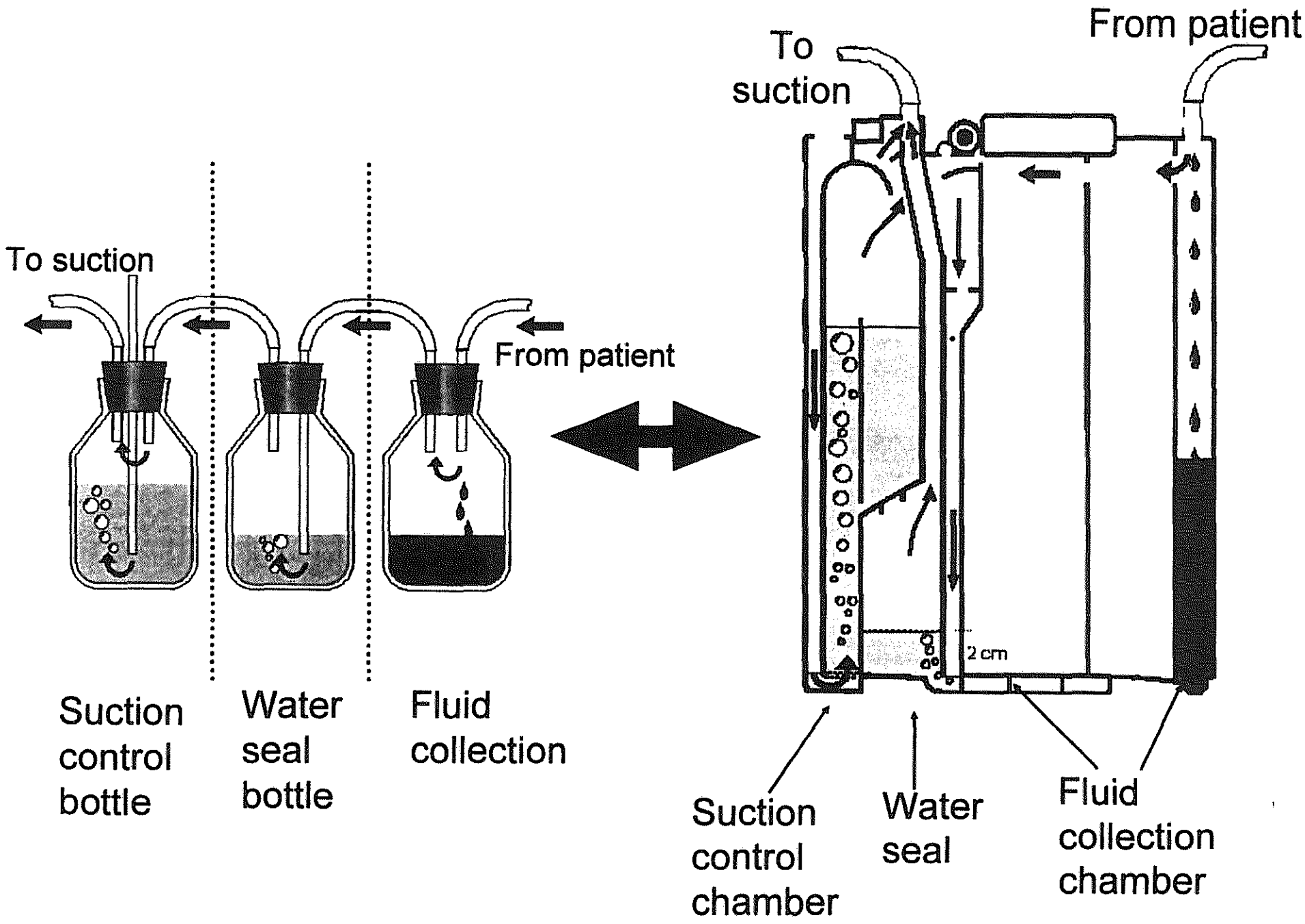
Pressure in each bottle: Actual suction pressure = - (depth of tube under water in suction control bottle - depth of tube under water in water-seal bottle)

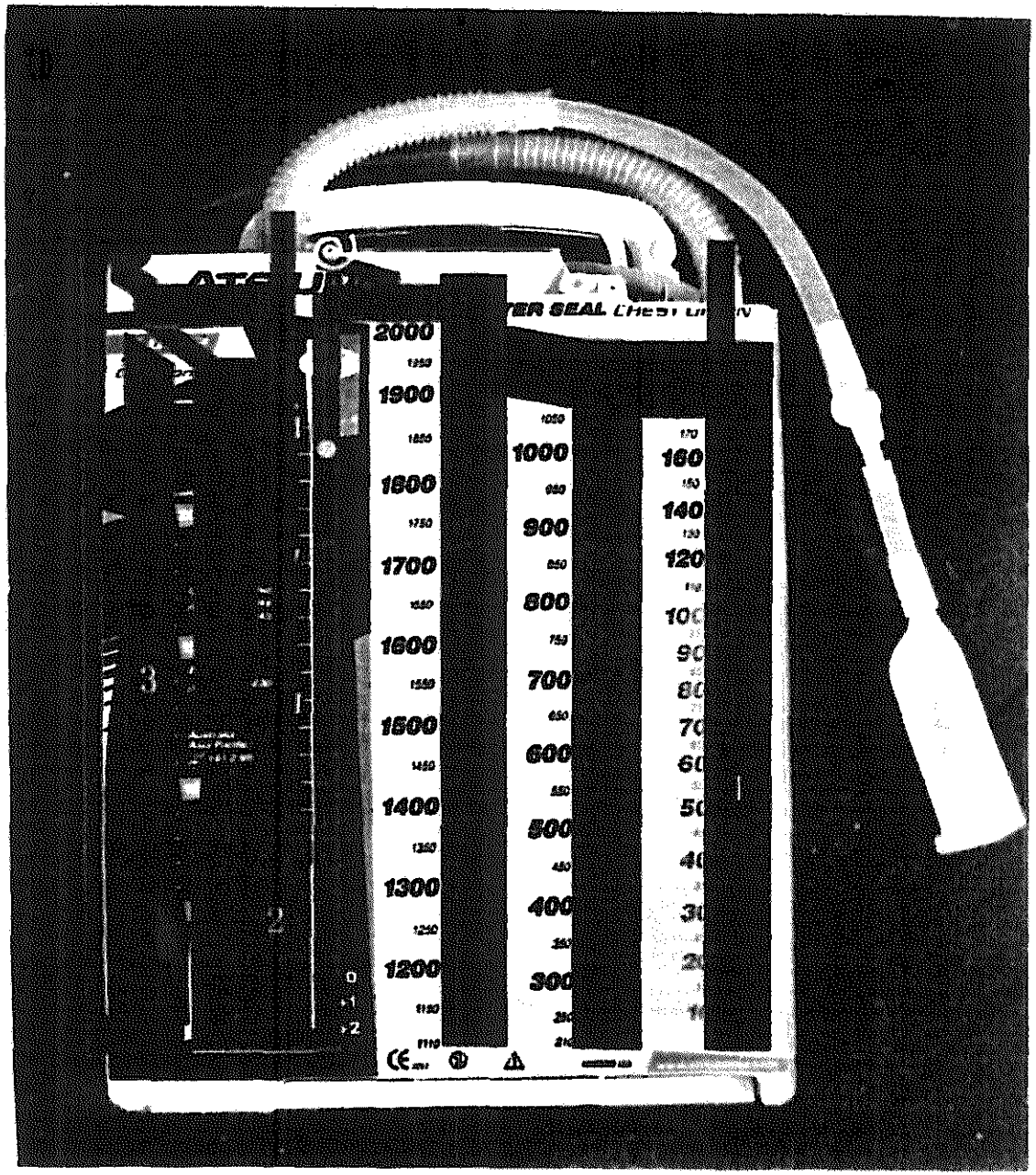
If the depth of insertion of the air vent in Bottle 3 is x cm, when a suction level of more than x cm H2O is applied, the pressure inside Bottle 3 is -x cm H2O, as is the pressure in Bottle 2. The depth of insertion of the water seal in Bottle 2 is y cm, where y is usually 2, and as a result the final pressure in Bottle 1, i.e. the actual suction pressure applied to the pleural cavity, is - (x-y) cm H2O. For example, for a -20 cmH2O suction, the actual suction pressure applied to the pleural cavity is only -18 cmH2O.

How about commercial chest drain system?



The Atrium Ocean System

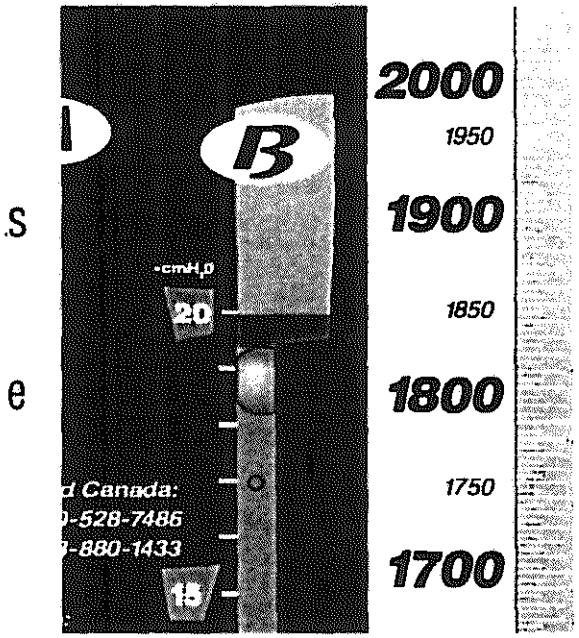

To suction
From patient
Suction control bottle
Water seal bottle
Fluid collection
To suction
From patient
2 cm
Suction control chamber
Water seal
Fluid collection chamber



It is actually a 3-bottle chest drainage system, but it is also ***sterile and compact, with overpressure and underpressure protection***, and it will not lose its fluid even when tipped.

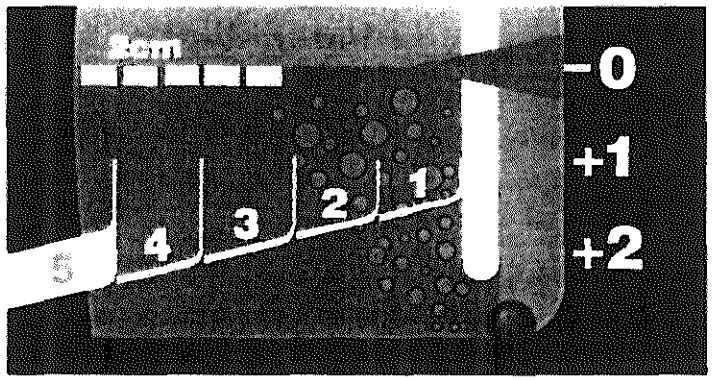
- **High –ve float valve**

Atrium's high negativity float valve, with its controlled release action, enables any thoracic patient to draw as much intrathoracic pressure as is required during each respiratory cycle. However, in prolonged episodes of extreme negative pressure, the controlled release system will automatically relieve excess vacuum to a lower pressure.



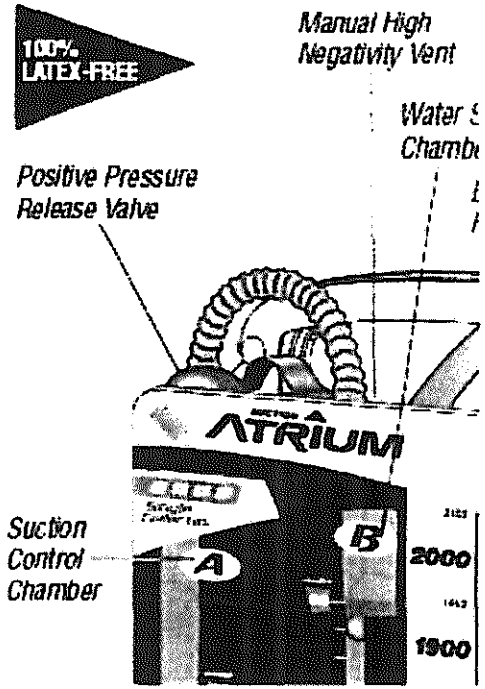
- **Air Leak Monitor**

Water seal is a window into the pleural space. If air is leaving the chest, bubbling will be seen here. Air leak meter (1-5) provides a way to "measure" the leak and monitor trend.



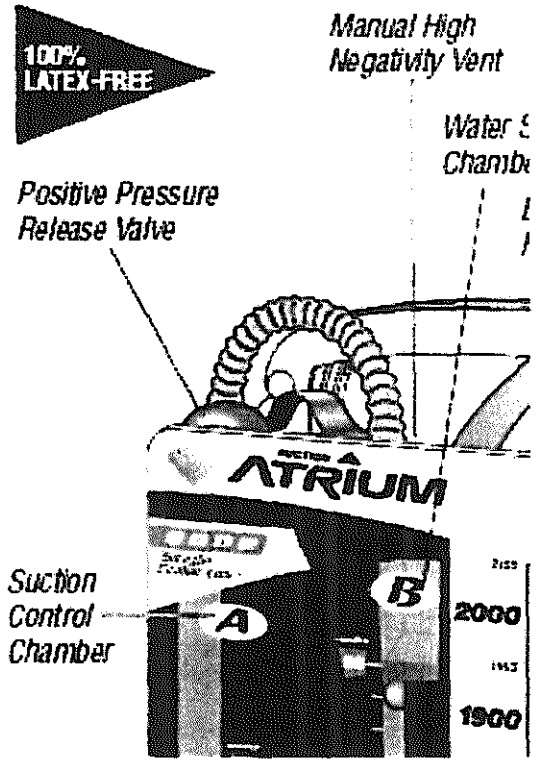
- **Positive Pressure Protection**

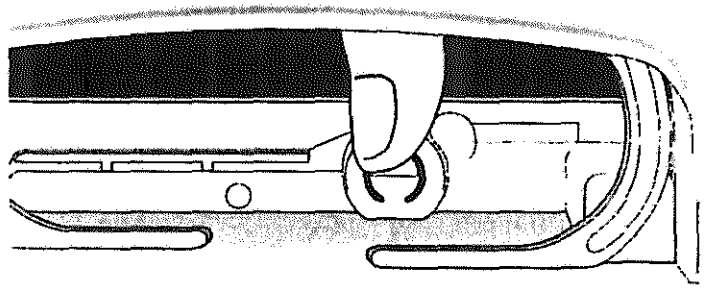
Atrium's positive pressure release valve, located on top of the drain, opens instantly to release accumulated positive pressure. The valve design is tamper-resistant and offers maximum air flow. Do not obstruct the positive pressure relief valve.

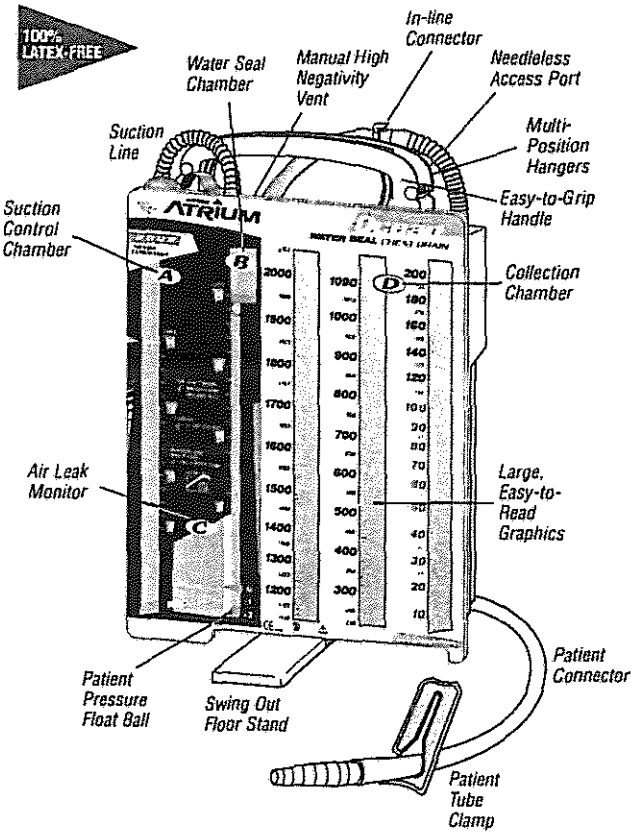


- **Manual High Negativity Vent**

To manually lower the height of the water seal column or patient pressure when connected to suction, temporarily depress the filtered manual vent, located on top of the drain, until the float valve releases and the water column lowers to the desired level. Do not lower water seal column when suction is not operating or when patient is on gravity drainage.







Ocean™

WATER SEAL CHEST DRAIN

Set Up

Step 1. Fill Water Seal (B) to 2cm Line - Hold funnel down and fill to top. Raise funnel to empty water into water seal to 2cm line.

Step 2. Fill Suction Control (A) to Desired Pressure Level - Remove vent plug, pour water to desired suction level. Replace vent plug.

Step 3. Connect Patient Tube to Patient - Connect chest drain to patient prior to initiating suction.

Step 4. Connect Suction to Chest Drain - Attach suction line to suction port on top of chest drain. Turn suction source on until constant, gentle bubbling occurs.

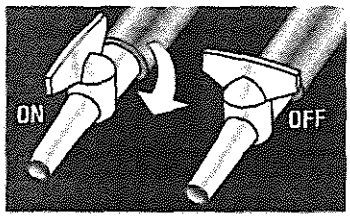
Have a question or need help in a hurry? Call Atrium toll free at 1-800-528-7486.

What To Check During System Operation

Suction Control Stopcock

Atrium's suction control stopcock conveniently regulates vacuum to the chest drain. It provides effective control of suction control bubbling and allows efficient use with any unregulated suction source. The stopcock must be ON for initial system set up and should not be turned OFF during patient use.

During patient transport or when suction is not operating, it is not recommended to turn the stopcock off or to clamp off suction tube.



Verifying System Operation

Water seal and suction control sections must be filled and maintained to prescribed levels to ensure proper operation and should be checked regularly when used for extended periods. Water seal should be maintained at 2cm line and suction control chamber should bubble **gently** when connected to suction. Adjust stopcock or suction source as needed to increase or decrease suction control bubbling.

Placement Of Unit

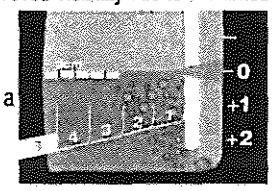
Always place chest drain below the patient's chest in an upright position. To avoid accidental knock-over, open the floor stand for secure placement on floor or hang the system bedside with the hangers provided.

System Disposal

Disposal of system and contents must be in accordance with approved hospital infection control standards.

Observing Water Seal For Patient Air Leaks

Atrium offers superior air leak detection with rapid air leak assessment and improved visibility due to the tinted water. When air bubbles are observed going from *right to left* in the air leak monitor, this will confirm a patient air leak.

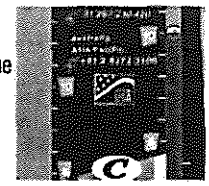


Continuous bubbling in the bottom of the water seal air leak monitor will confirm a persistent air leak.

Intermittent bubbling in the air leak monitor with float ball oscillation will confirm the presence of an intermittent air leak.

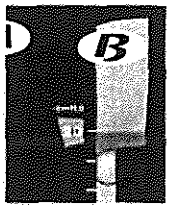
No bubbling with minimal float ball oscillation at bottom of the water seal will indicate no air leak is present.

Observing Calibrated Water Seal Column For Changes In Patient Pressure



Patient pressure can be determined by observing the level of the blue water and small float ball in the calibrated water seal column. With suction operating, patient pressure will equal the suction control setting plus the calibrated water seal column level only. For gravity drainage (no suction) patient pressure will equal the calibrated water seal column level only.

High Negativity Float Valve

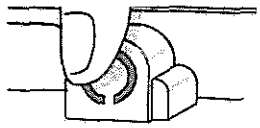


Atrium's high negativity float valve, with its controlled release action, enables any thoracic patient to draw as much intrathoracic pressure as is required during each respiratory cycle. During prolonged episodes of extreme negative pressure, Atrium's controlled release system will automatically relieve excess vacuum to a lower, more desirable pressure level.

Manual High Negativity Vent

To manually vent the system of high negative pressur depress the filtered manual vent located on top of the drain until bubbling occurs in the air leak monitor.

Do not use manual vent when suction is not operating or when the patient is on gravity drainage.



Do not use when suction is not operating

To Prescribe Suction Pressure Greater Than -20cmH_2O

Suction pressure greater than -20cmH_2O can be impose directly by a calibrated wall regulator or portable pump simply taping over the vent-plug with non-porous tape and reading vacuum pressure directly from regulator or pump. *Vacuum pressures greater than -40mmHg are n recommended.*

Sampling Patient Drainage

Sampling of patient drainage must be in accordance with approved hospital infection control standards. Selected models include a needleless luer port on th patient tube connector for sampling patient drainage Alcohol swab the luer port prior to syringe attachme (no needle). Fluid samples can also be taken directl from the patient tube by forming a temporary depen ent loop and inserting a 20 gauge needle at an obliq angle. Alcohol swab the patient tube prior to insertii syringe at a shallow angle. **Do not puncture patient tube with an 18 gauge or larger needle.**

Positive Pressure Protection

Atrium's positive pressure valve, located on top of drain, opens instantly to release accumulated positiv pressure. ***Do not obstruct the positive pressure valv***

System Disconnection

For models equipped with an in-line connector, ***close patient tube clamp prior to disconnecting*** chest drain patient tube from patient. Clamp off all indwelling thorac catheters prior to disconnecting chest drain from patien

Troubleshooting

Q **What happens when:**

■ There is no bubbling in the suction control chamber?

A Check to be sure the suction tubing is connected to the chest drain and to the wall regulator and the suction source is turned on. Adjusting Atrium's suction control stopcock is required for constant gentle bubbling.

■ There is vigorous bubbling in the suction control chamber?

A Vigorous bubbling causes quicker evaporation and produces excessive noise. Constant, gentle bubbling is all that is required to impose the prescribed amount of suction. Available on all models, Atrium's suction control stopcock, located on the suction tubing, can be used to adjust bubbling. The suction source regulator can also be adjusted to turn suction control bubbling up or down.

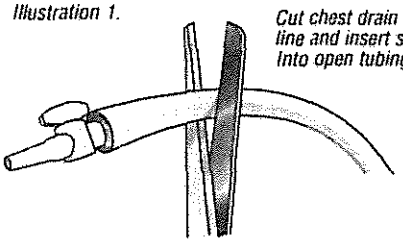
Q **Should the suction control stopcock be turned off for gravity drainage or for patient transport?**

A No. The patient is protected two ways; first by the one-way valve created by the water seal to maintain the desired patient vacuum pressure, and second, the patient is protected by the integral positive pressure valve in the event the stopcock is turned off. It is not necessary to turn off the stopcock, clamp, or cap the suction line during gravity drainage or patient transport. Both the water seal and the positive pressure valve provide maximum patient protection when either the suction line or stopcock remain open or closed.

Q **How can I connect multiple chest drains to one suction source easily?**

A With Atrium models equipped with a suction control stopcock, connection of two or more chest drains to a common suction source is made easier. Place a 1/4" x 1/4" x 1/4" Y connector on the wall suction tubing. Cut the drain suction tubing where indicated in *Illustration 1.* Now invert the cut sections of suction tubing as shown in *Illustration 2* and insert them into the suction tubing remaining on the chest drain.

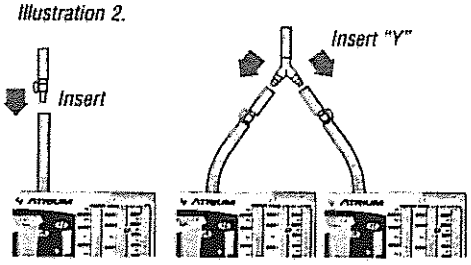
Illustration 1.



Cut chest drain suction line and insert stopcock into open tubing

Now you have two open ends of suction line tubing for the Y connector to be placed. Turn on suction and adjust Atrium's suction control stopcock on each drain to achieve constant, gentle bubbling with each.

Illustration 2.



Q **How do I confirm my patient has an air leak when there is:**

■ No bubbling in the water seal?

A If there are *no air bubbles observed going from right to left in the air leak monitor,* there is **no patient air leak.** In order to confirm that your patient's chest catheter(s) are patent, temporarily turn suction off and check for oscillation of the patient pressure float ball in the water seal column coinciding with patient respiration.

■ Bubbling present in the water seal?

A Whenever *constant* or *intermittent bubbling* is present in the water seal air leak monitor, this will **confirm an air leak is present.** Oscillation of the patient pressure float ball at the bottom of the water seal *without bubbling* **will indicate no apparent air leak.** Bubbling from right to left must be present to confirm an air leak. To determine the source of the air leak (patient or catheter connection), momentarily clamp the patient tube close to the chest drain and observe the water seal. If bubbling stops, the air leak may be from the catheter connections or the patient's chest. Check the catheter connectors and patient dressing for a partially withdrawn catheter. If bubbling continues after temporarily clamping the patient tube, this will indicate a system air leak requiring system replacement.

Q **How do I lower the water seal column?**

A Changes in your patient's intrathoracic pressure will be reflected by the height of the water in the water seal column. These changes are usually due to mechanical means such as milking or stripping patient drainage tubes, or simply by deep inspiration by your patient after all air leaks have subsided. If desired, the height of the water column and patient pressure can be reduced by temporarily depressing the *filtered* manual vent, located on top of the drain, *until the float valve releases* and the water column lowers to the desired level. ***Do not lower water seal column when suction is not operating or when patient is on gravity drainage.***

Q **Is it normal for the patient pressure float ball to fluctuate up and down (tidal) near the bottom of the water seal column?**

A Yes. Once your patient's air leak is resolved, you will generally observe moderate tidaling in the water seal column. Increases in intrathoracic pressure will cause the water level to rise (the ball rises) during patient inspiration and will lower or decrease (the ball drops) during expiration. This diagnostic tool will help to confirm patency of your patient's catheter(s). Minor "bouncing" of the water seal level can also be caused by vigorous bubbling of the suction control chamber. To accurately assess patient catheter patency, momentarily occlude suction to stop the suction control chamber bubbling and observe the water seal's physiological response.

Q **How do I dispose of the system?**

A Disposal of system and contents must be in accordance with approved hospital infection control standards.

ATRIUM

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