USGS Canister Desorption Equipment

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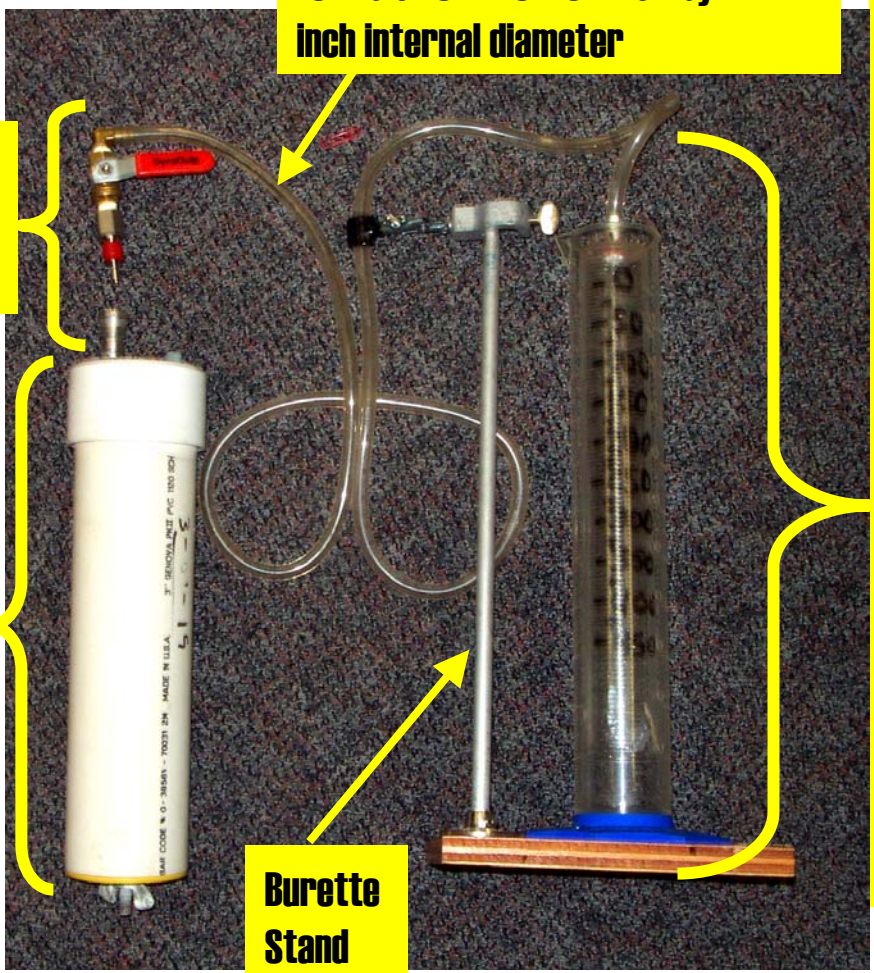
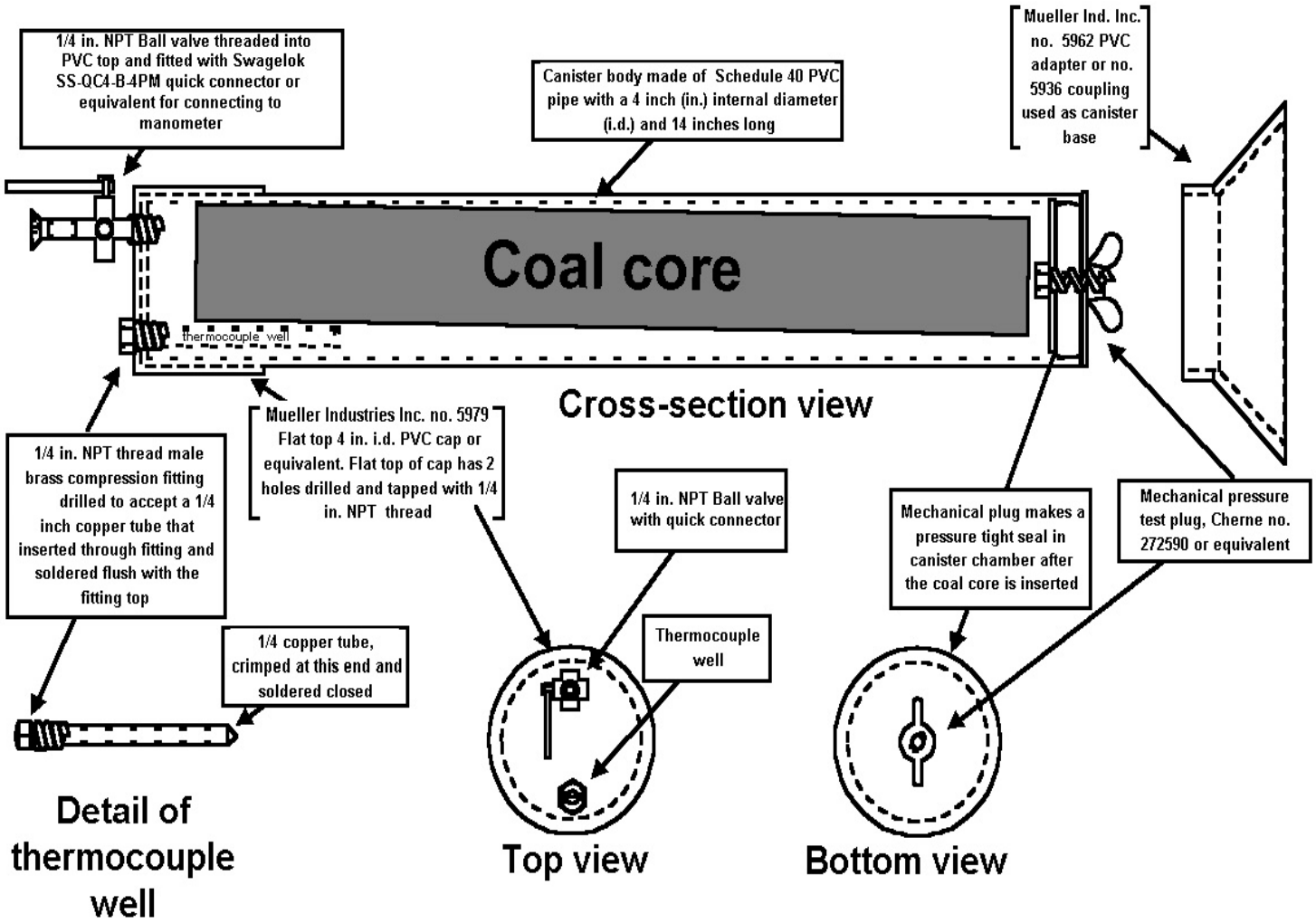
A pressure tight canister and manometer for gas volume measurement



Manometer made of nested 500 ml graduated cylinder in a 1000 ml graduated cylinder. The material we use because of its clarity is clear polymethylpentene (PMP) plastic . The manometer is constructed so that the inverted (base up) inner sliding cylinder rests on the bottom of the outside cylinder. The spout and base stand of a 500 ml cylinder is sawn off to allow this smaller diameter graduated cylinder, when inverted, to slide in side of a larger diameter 1000 ml cylinder. To zero the manometer, the hose is removed from the quick-connect and water is added to the outer cylinder. Water fills both cylinders to a marked zero point. A free space of 50 ml is left at the top to keep water out of the tube and to assure that the inner cylinder rests on the bottom. After each measurement the hose is opened to allow the inner cylinder to settle to the bottom and automatically rezero the manometer.

Manometer design as used by River Gas Company

The USGS Can -- a coal core desorption canister



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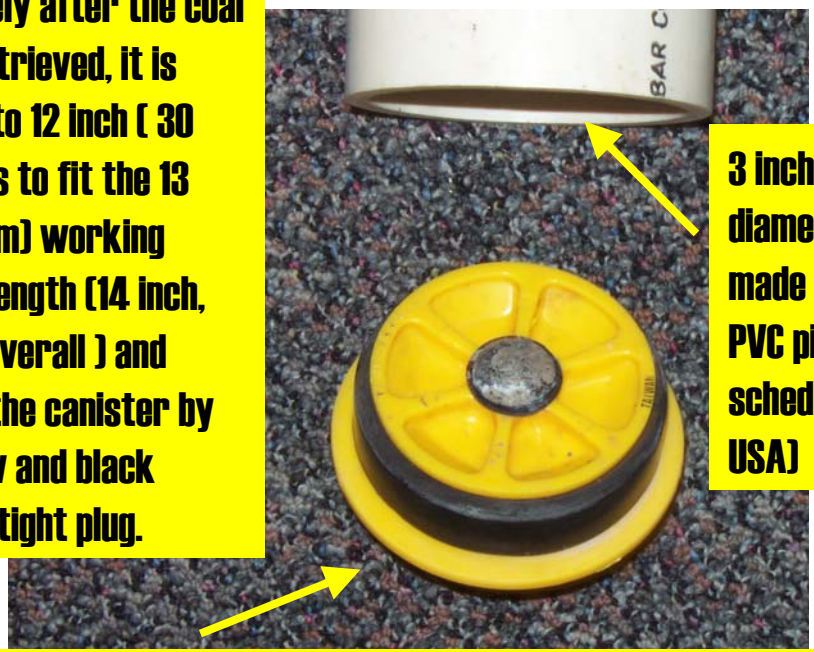
Pressure tight plug for insertion into canister end

Immediately after the coal core is retrieved, it is broken into 12 inch (30 cm) pieces to fit the 13 inch (33 cm) working canister length (14 inch, 35.5 cm overall) and closed in the canister by the yellow and black pressure tight plug.



3 inch (7.5 cm) diameter canister made from thick wall PVC pipe (called schedule 40 in the USA)

Shown is a 3 inch (7.5 cm) Cherne ® pressure test plug. Part # 270237 (5 psi rating)

Also used is the Sioux Chief 3 inch test plug (45 psi rating)

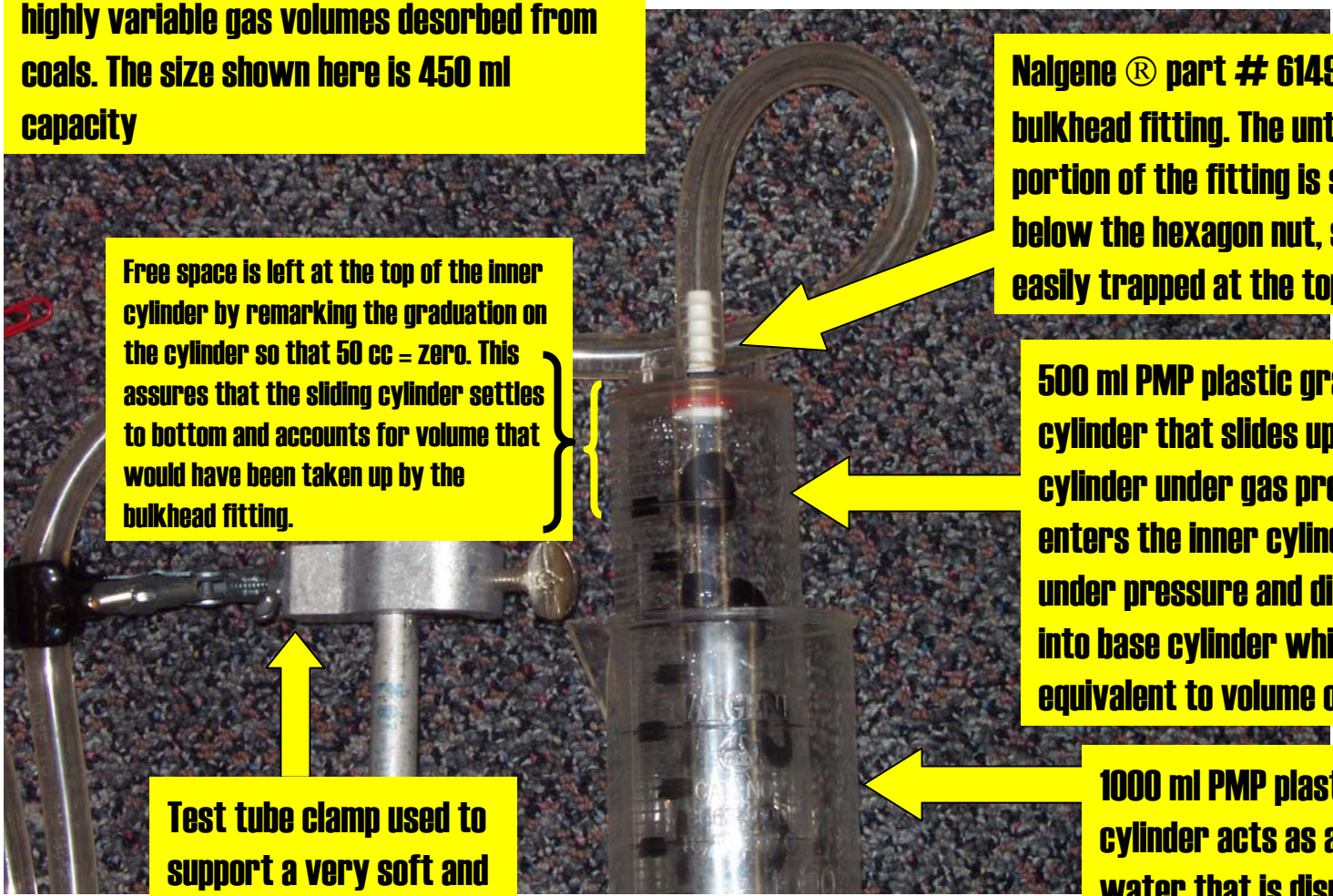
- Be sure that both sealing surfaces in the canister and on the plug are clean before closing
- Some workers add boiled water or distilled water to fill the remaining open space in the canister
- In any case, leave a 5 cm gap from the coal core to the end of the PVC pipe to allow space for the plug.
- If water is not added After sealing, the canister head space is purged with helium three times through the quick connect valves to remove air.

Pressure plug wing nut assembly

- The coal core is inserted as soon as possible upon reaching the surface. The pressure tight plug is then inserted in the open pipe end and is hand tightened using the wing nut only
- The time that the canister is closed should be noted. This is after helium purge has been completed if the head space purge method is used.
- The time the core was lifted off bottom and reached the surface should have been noted as well. These times are used for calculation of lost gas.

Detail of bulkhead fitting used to connect tubing to sliding graduated cylinder

We make several sizes of manometers to allow rapid measurements and deal with highly variable gas volumes desorbed from coals. The size shown here is 450 ml capacity



Nalgene ® part # 6149, 1/4 inch plastic bulkhead fitting. The unthreaded barbed portion of the fitting is sawn off just below the hexagon nut, so gas is not easily trapped at the top of the cylinder

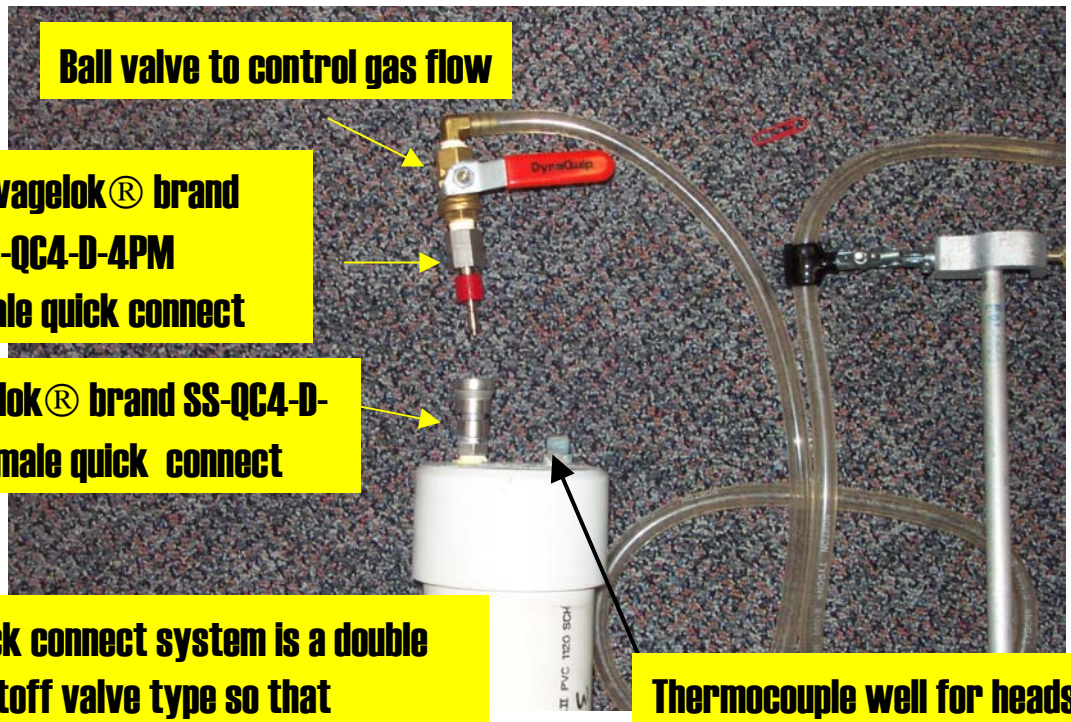
Free space is left at the top of the inner cylinder by remarking the graduation on the cylinder so that 50 cc = zero. This assures that the sliding cylinder settles to bottom and accounts for volume that would have been taken up by the bulkhead fitting.

500 ml PMP plastic graduated cylinder that slides up in the base cylinder under gas pressure. As gas enters the inner cylinder, it rises under pressure and displaces water into base cylinder which is equivalent to volume of gas

1000 ml PMP plastic graduated cylinder acts as a reservoir for the water that is displaced by gas

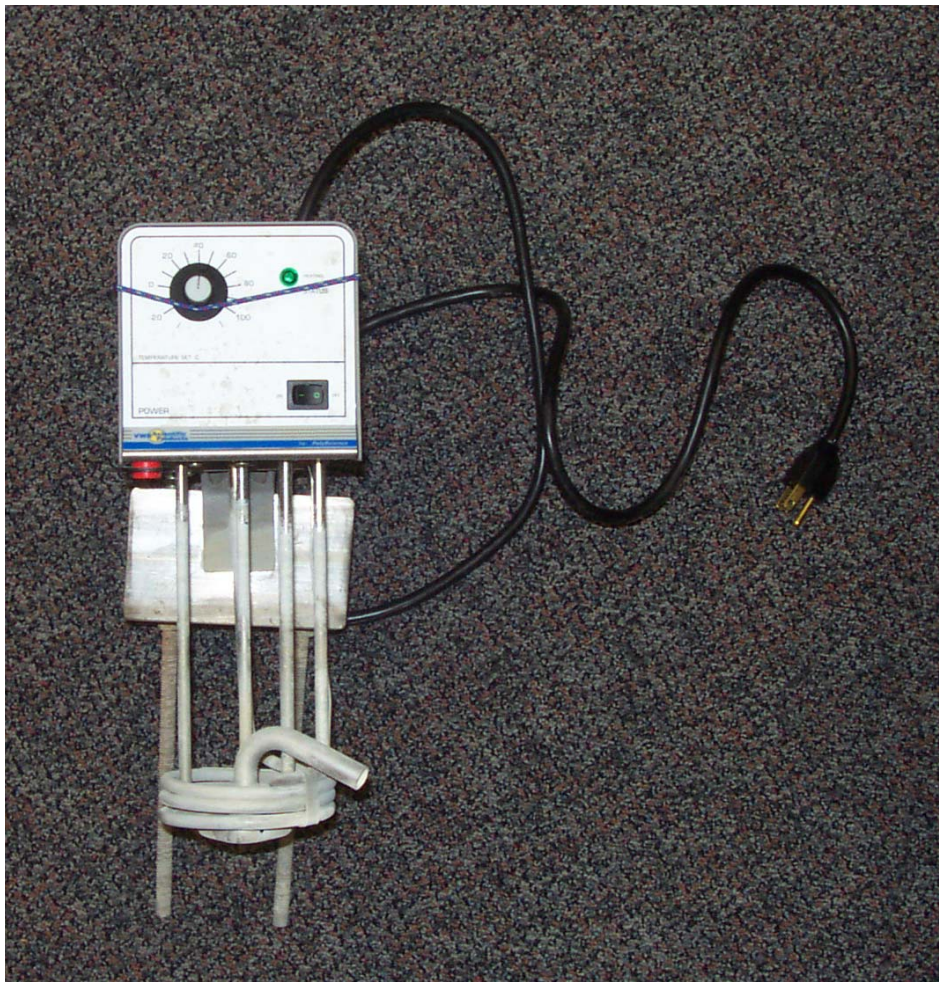
Test tube clamp used to support a very soft and flexible hose that leads to quick connect

Canister top showing quick connect, valve and thermocouple well assembly



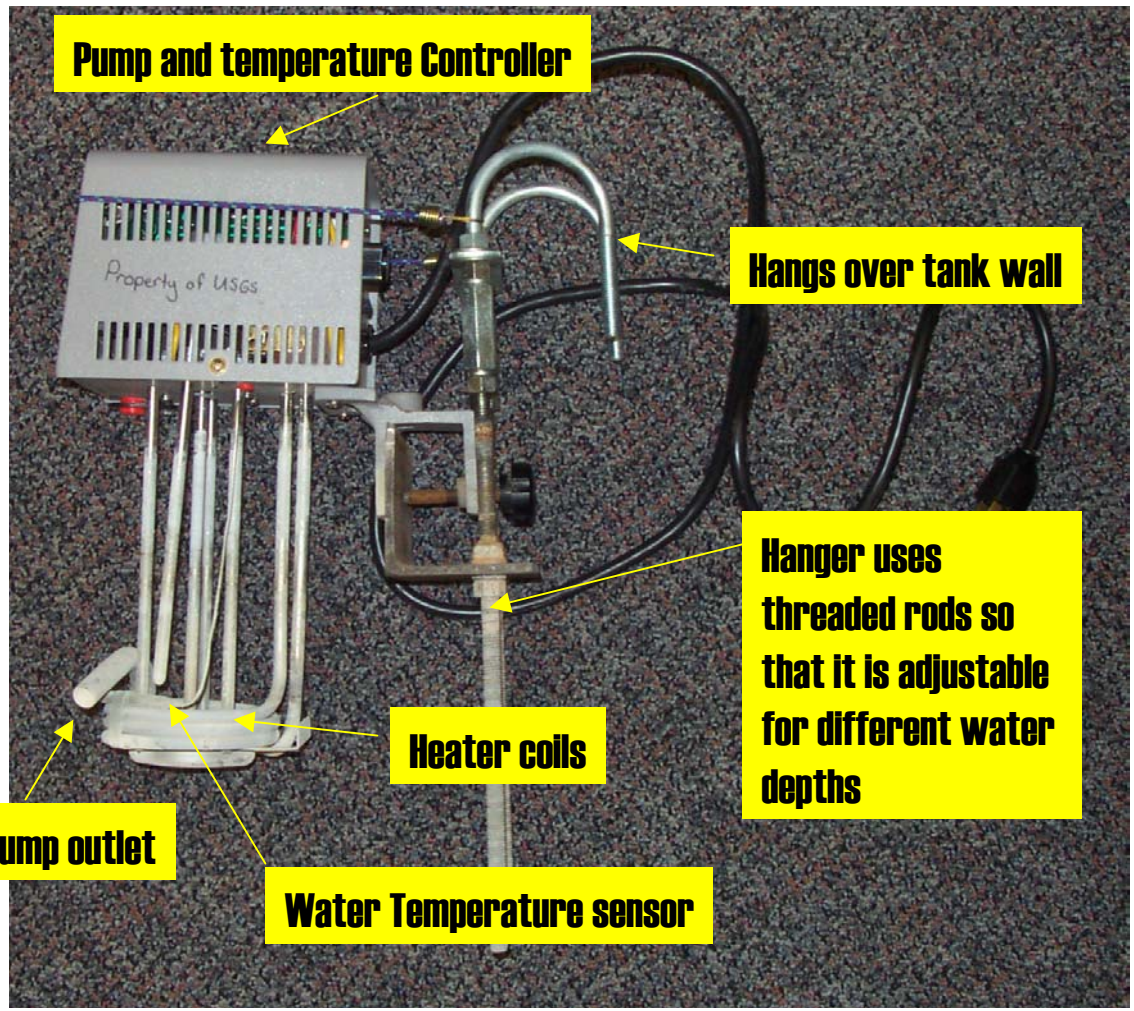
1. Ambient atmospheric pressure is measured using a digital barometer in the field. In the Laboratory we use a mercury barometer (see parts list)
2. The ambient temperature is measured from the manometer water using a thermocouple hooked to a digital thermometer (see accessory list). This value is used in the PVT calculations for gas volume at STP

Immersion heater for canister tank



- Polyscience ® model 71 Immersion heater with 1000 w heating capacity and 16 l/min flow.
- Used to heat tank water to in-situ coalbed temperature.
- Heating canisters to reservoir temperature allows accurate lost gas calculation.
- The water tank is deep enough to submerge the canisters to just below their top where the quick connect is located.

Side view of heater showing hanger that fits over tank wall



Accessory List

- Electronic thermometer: Cole Palmer ® Dual sensor J-T-E-K thermocouple capable thermometer
- Thermocouples: two each per thermometer: Omega ® subminiature thermocouples like Catalog # KHIN - 116G-RSC-3 (type K with molded handle and 3 inch grounded probe)
- Electronic barometer: Omega ® Model no. DPI 740
- Mercury barometer (for use in the laboratory, but not in the field) Princo ® model no 453 or model no. 469
- Electronic balance: Acculab ® HX 1210C. 10 Kg capacity with 1 g readability. This capacity works for the 14 inch long canisters. Larger balance capacity may be needed for longer canisters.
- Immersion heaters. We use Polyscience ® model 71. We have used Haake ® model C-10 but it has proven less durable.
- Immersion tanks for heating canisters
  - For low temperature operations at < about 50°C polyethylene plastic tanks can be used. Rubbermade® brand storage containers (40 gallon size) have been used in a double nested configuration to increase strength.
  - Higher temperatures require polypropylene (maximum service temperature 104°C). We use Nalgene ® cat no. 14200-0050.
  - The tanks should be tall enough to allow the cover to be used with the canisters in an upright position and small enough for the immersion heater to hold the tank water at reservoir temperature, about 120 liter (30 gallon) capacity works well with the Polyscience ® model 71 immersion heater.