



Binding



Stability



Kinetics

MicroCal, LLC
 22 Industrial Drive East
 Northampton, MA 01060 USA
 Phone: +413 586 7720
 Fax: +413 586 0149
support@microcalorimetry.com

ThermoVac[®]

User's Manual



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General Remarks

Symbols used in this manual

- ! Warns the user of possible damage to the unit, draws attention to the risk of injury or contains safety notes and warnings.

Symbols used on the ThermoVac instrument



CAUTION Hot Surface. Do Not Touch.



Caution: Read the instruction manual before operating



Instrument (supply) ON



Instrument (supply) OFF



Protective Earth (Ground) Terminal

Operators Safety

- ! The points below are intended to enhance your safety awareness and to draw your attention to risks which only you, the operator, can prevent. MicroCal has set high standards for ourselves in developing and constructing the ThermoVac. Each unit constructed is fully tested to operational and safety standards. It should be noted that no amount of design or constructed safeguards can anticipate or prevent improper handling. It is intended that this instrument be operated only by responsible people trained in basic laboratory protocol in procedures and safety techniques. **This product is intended to operate from a power source that does not apply more than 260 V rms between the supply conductors or between either supply conductor and ground. A protective ground connection, by way of the grounding conductor in the power cord, is essential for safe operation**
- ! **To avoid any hazard, use only a fuse of the correct type, voltage rating and current rating as specified on the back of the ThermoVac. This is a 1 Amp 250 Volt Time-lag (Time Delay) fuse.**
- ! **To enhance safety always plug the instrument into a Ground Fault Circuit Interrupter (GFCI) device.**
- ! **A solution can become an electrical conductor when in contact with electricity and can create a hazard with the potential of burns or death. Use caution when using solutions near the instrument and adhere to the following items:**
 - ! **If any liquid is spilled on or around the instrument unplug the instrument immediately and wipe it up, if there is any possibility that some of the liquid may have leaked into the instrument case contact MicroCal immediately. DO NOT PLUG THE INSTRUMENT INTO ANY POWER MAINS, until the problem is resolved.**
- !
- ! **Repairs, alterations or modifications must only be carried out by specialist personnel. The MicroCal Service Department will be happy to serve you for any repair work or operational questions.**
- ! **This device is not designed to the Medical Devices Directive 93/42/EEC and should not be used for medical purposes and/or in the diagnosis of patients.**
- ! **Volatile or hazardous solutions should be used with extreme care in the ThermoVac, be careful not to spill any of the solution and always use Pyrex or Borosilicat glass to hold the sample. DO NOT USE THE PLASTIC VIALS. The operator should always follow proper laboratory procedures in handling and disposing of such materials (e.g. wear safety glasses and protective clothing) and always be careful when removing hot solutions from the Tube Holder.**
- ! **Use of this instrument, in a manner for which it was not specified by MicroCal, may impair the safety protection provided by the instrument.**
- ! **Normal maintenance of the ThermoVac should include cleaning up any spills or other contamination of the cover and Tube Holder.**

- ! **Normal maintenance should include visually inspecting the instrument for damage to the case.**
- ! **Normal maintenance should include visually inspecting the ac mains power cord for any break down of insulation.**
- ! **The user should ensure that all liquids should be removed from the Tube Holder, when the instrument is to be stored or otherwise left unused for longer than one week.**

Product Safety

We have used all means to design and produce the **ThermoVac** to prevent any damage to the instrument during normal usage. The instrument is solidly built using the latest in micro-technology in its components and design, but of course, this cannot prevent damage due to physical mistreatment. The attentiveness of the operator to the identification of materials which could corrode the anodized aluminum Tube Holder or the plastic cover and the responsible handling and usage of the instrument should insure a long service life for the ThermoVac.

- ! **The ThermoVac Tube Holder is constructed of anodized aluminum. The Top is made from plexiglass. The use of strong, volatile or hazardous materials in the degassing chamber may cause damage to the Tube Holder, Top, filter and/or vacuum pump and should be avoided.**
- ! **When using the ThermoVac for cleaning cells, do not allow the volume of fluid in the waste flask to accumulate such that it would rise up to the level of the side arm and be sucked into the thermovac's vacuum pump. this may cause the pump to become damaged.**
- ! **Use the glass tubes rather than plastic for another solvent other than water.**

Instrument Specifications

Model or Type	:	ThermoVac
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Performance Specifications		
Vacuum ("Hg)	:	28
Operating Temperature Range	:	2° to 80° C
Physical Specifications		
Dimensions (L x W x H in inches)	:	9.5 x 8.7 x 3.9
Weight (lbs.)	:	7.9

Safety Specifications

Electrical Specifications		
Electrical Ratings:		
Voltage	:	100 - 240 Volts
Frequency	:	50/60 Hz
Power	:	130 Watts
Fuses (2)	:	Primary=1.0 A, 250 V, Time Delay (T)
Output	:	Secondary/Data Connection only
Protective Earth Terminals	:	Internal/external marked
Mode of Operation	:	Continuous
Classification	:	Class I
Atmospheric Specifications		
Operating:		
Temperature	:	10° to 40° C
Humidity	:	L.T. 30% to 75%
Atmospheric Pressure	:	700 HPa to 1060 HPa
Storage: (in original shipping containers)		
Temperature	:	-40° to +70° C (with no liquids in Tube Holder)
Humidity	:	10% to 90%
Atmospheric Pressure	:	500 HPa to 1060 Hpa
Environmental Ratings		
Rated Supply Voltage Fluctuations	:	+/- 10%
Installation Category	:	II
Pollution Degree	:	2

Cleaning the ThermoVac Instrument Case

Always shut down the ThermoVac instrument and disconnect the mains power supply cord before cleaning the case. To clean the instrument case, use a damp, lint-free cloth. Avoid abrasives or solvents that can permanently damage the finish. With the damp cloth, gently wipe the external surfaces of the instrument.

- ! In case of spillage of a hazardous material the user is responsible for appropriate decontamination of the instrument, inside and out.
- ! When cleaning the instrument with anything other than a damp cloth, the instrument must be disconnected from the mains power supply.

European Users: CE Mark

MicroCal VP-DSC calorimeters carry the CE marking which confirms that they meet the applicable European Community Technical Directives.

Following the provisions of the applicable European council directives:

89/336/EEC, 93/68/EEC	Electromagnetic Compatibility
73/23/EEC, 93/68/EEC	Low Voltage

Is in conformity with the following harmonized standards:

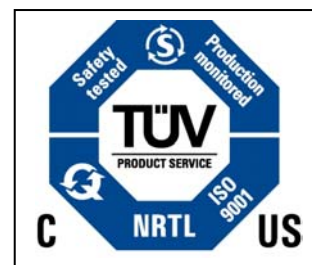
EN 61326:1998, A1:1998, A2:2001	Electrical equipment for measurement, control and laboratory use – EMC requirements
EN 61000-3-2:2000, A1:2001	Limits for harmonic currents emissions
EN 61000-3-3:1995	Limitation of voltage changes, fluctuations and flicker in low-voltage systems
EN 61010-1:2001, IEC 61010-1:2001	Safety requirements for electrical equipment for measurement, control and laboratory use
EN 61010-2-010:2003, IEC 61010-2-010:2003	Particular requirements for laboratory equipment for the heating of materials

Please refer to the manuals that came with the computer controller for information relating to the CE mark for this unit.

Instrument Safety Compliance

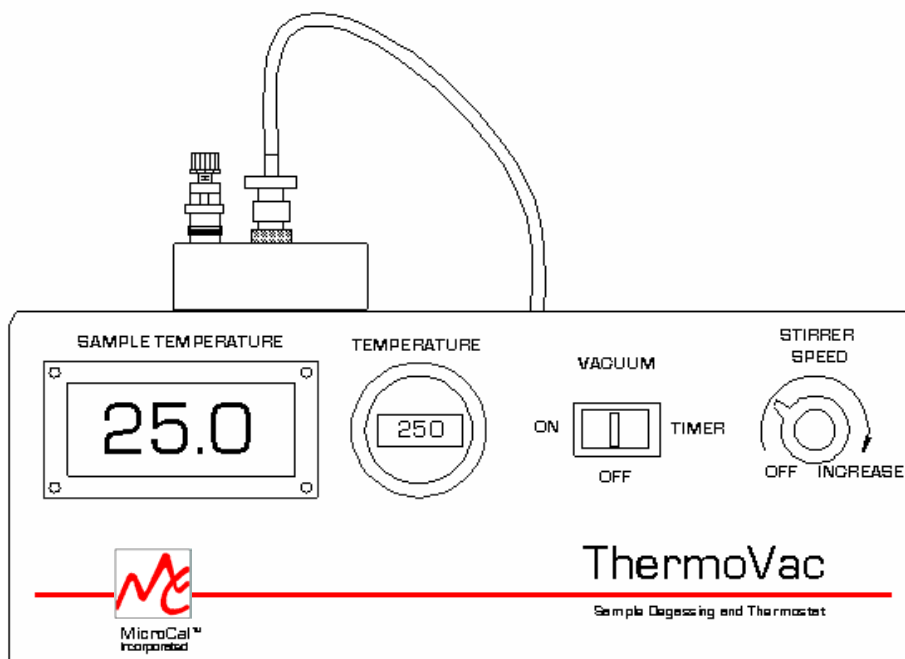
MicroCal VP-DSC calorimeters carry the CUE Safety Certification Mark, authorized by TÜV America, a division of TÜV Süddeutschland, to signify that:

- 1) the instrument has been tested by an accredited Certification Body and meets applicable Canadian electrical safety standards/requirements (CSA C22 NO. 61010-1-04).
- 2) the instrument has been tested by an NRTL (Nationally Recognized Testing Laboratory) and meets applicable United States electrical safety standards/requirements (UL 61010-1:2004).
- 3) the instrument has been tested by a Competent and Notified Body for applicable EU Directives and meets applicable safety standards/requirements (EN/IEC).



ThermoVac

To facilitate degassing samples and cleaning MicroCal's calorimeter cells, you have been provided with the ThermoVac accessory, a device for thermostating and degassing samples. The unit is capable of thermostating a sample at any temperature from 0 to 80 °C, pulling a vacuum of 28.4 inches of mercury and stirring the sample using small magnetic stir bars.



ThermoVac Accessories

The ThermoVac and accessories may include, but are not limited to the items listed below. A list of the actual items shipped with your order will be included in the documentation included with your shipment.

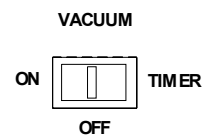
Quantity	Description
1	ThermoVac
3	Stir Bars (Small)
3	Stir Bars (Medium)
2	In-line filters
5	Test Tubes (Small) – for conserving sample volume
5	Test Tubes with Cap (Medium)
1	Test Tube Holder
1	Flask with Hose & Luer Lock Connector
2	Fuses (1A/250V) 5x20mm Slo-Blo

1	A.C. Mains Power Cord
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Front Panel Controls

VACUUM

The ThermoVac is capable of pulling a maximum vacuum of 28.4 inches of mercury. If the VACUUM switch is pushed to the right the vacuum pump will turn on and remain on for approximately 8 minutes, then the pump will shut off. If you desire to remove the vacuum before the preset time you must push the switch to the OFF position. When the switch is pushed to the left the vacuum pump will remain on until it is manually turned off.



TEMPERATURE

Use this dial to set the temperature, in °C, for thermostating the sample chamber. The rightmost digit sets the temperature value in tenths of a degree.

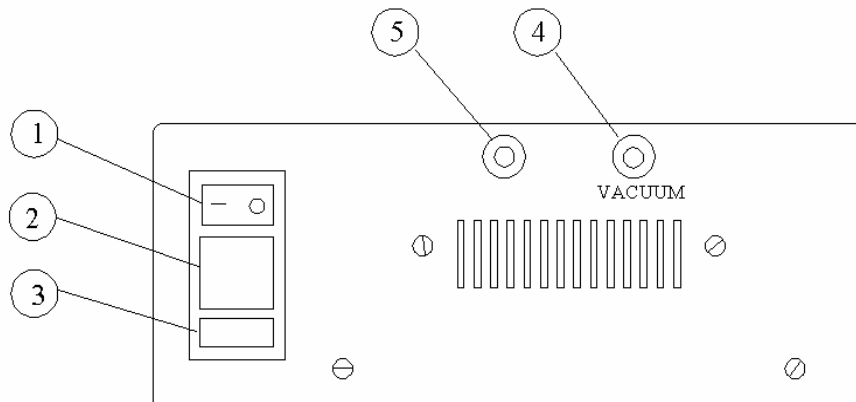
SAMPLE TEMPERATURE

Displays the current temperature of the sample chamber.

STIRRER SPEED

This switch will activate a rotating magnetic field that will stir your sample when a small magnetic stir bar is placed in the tube containing your sample. You may adjust the speed of the Stirrer motor from 0 RPM (OFF) to the maximum speed of 800 RPM (full turn clockwise).

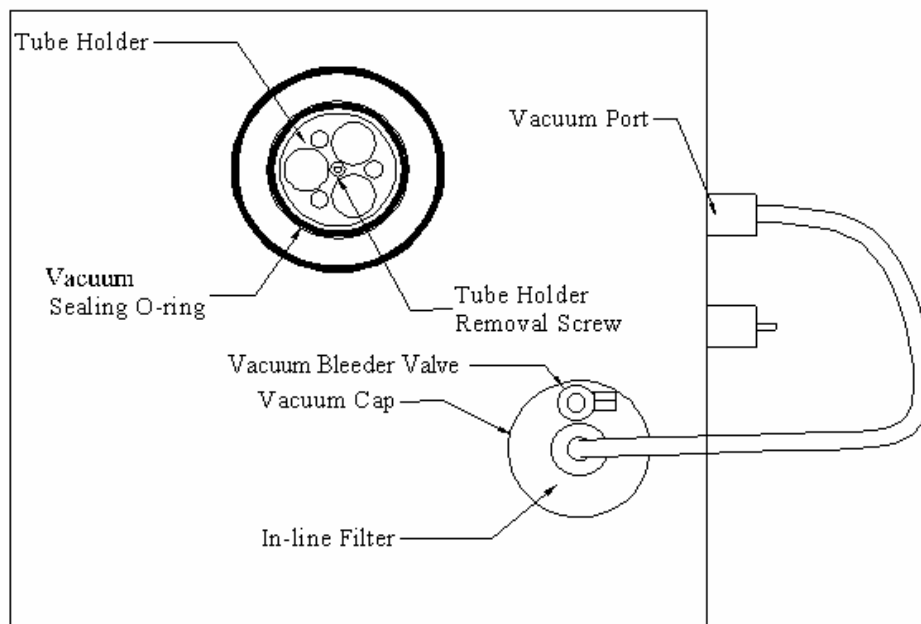
Rear Panel



1. Power Main Switch
2. 2 Power Fuses
3. IEC Inlet Power Recepticle
4. Vacuum Port
5. Pressure Port

Degassing Samples

Top View of ThermoVac



To degas the solutions, before placing them into the cells or injection syringe, please do the following.

- Turn on the Power Main Switch.
- Set the desired temperature for the solution.
- Place your solution to be degassed into a test tube, add a small stir bar and place the tube into one of the open cylinders of the Tube Holder insert.

Please Note: To conserve sample for loading into the injection syringe, use the small test tubes provided with the ThermoVac.

If you wish to use a beaker, larger than will fit into the Tube Holder, you may remove the Tube Holder by simply lifting it up. Due to the tight fit of the Tube Holder, it may be difficult to lift the Tube Holder out of the sample chamber, in this case you may use a 3/32" hex (Allen Key) wrench to turn a screw, located at the bottom of the center hole of the Tube Holder, to lift the Tube Holder out.

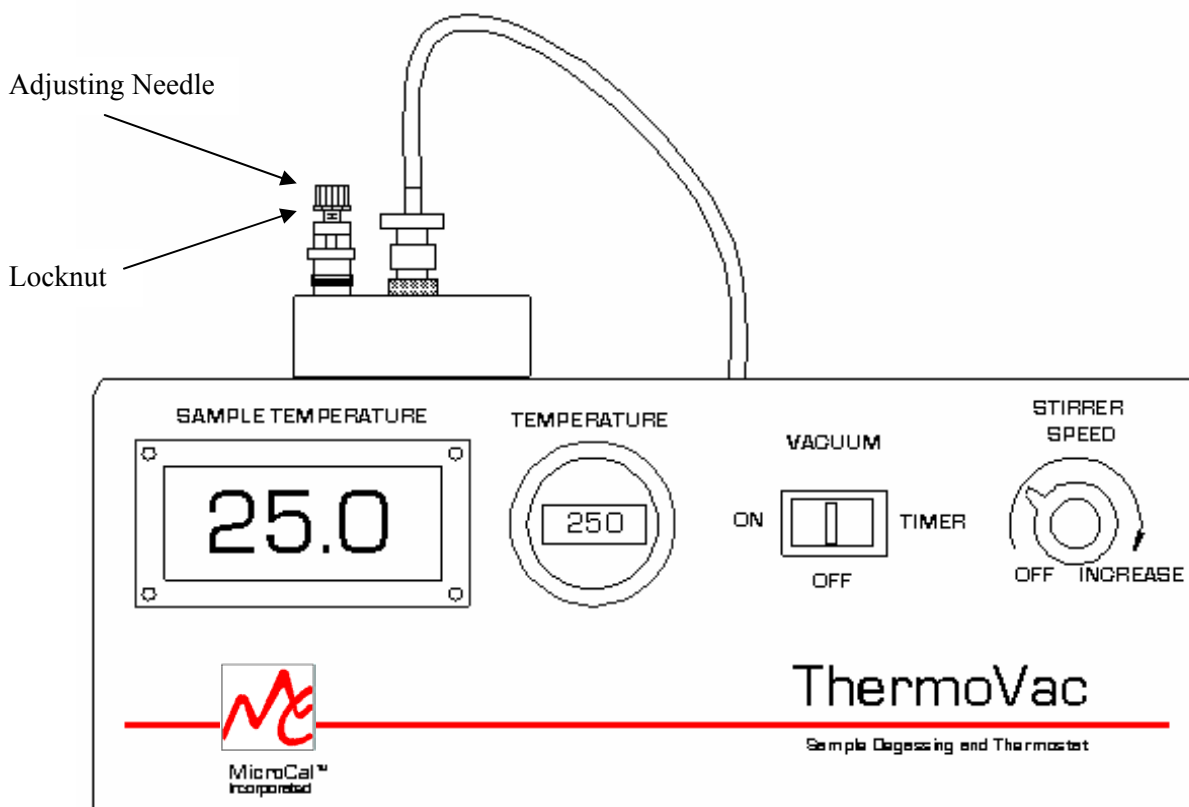
- Turn the stirring on and adjust the speed.
- Turn on the vacuum. Push the switch to the right to activate the vacuum for a preset (ca. 8 minutes) duration. Push the switch to the left if you wish to manually control the time for the vacuum. ***Refer to the next section, if your sample starts to foam.***
- Place the Vacuum cap on top of the sealing o'ring. The sound of the vacuum pump will change pitch to indicate the vacuum has sealed the Cap to the o'ring. Once the vacuum has sealed, the Vacuum Cap will be held firmly in place, till the vacuum pump shuts off.

For the first few minutes after the vacuum pump is turned off, the vacuum in the sample degassing chamber may remain fairly tight making the removal of the Vacuum Cap difficult. During this period, the easiest way to release the vacuum is to remove the tubing from the rear Vacuum Port or to twist off (turn counter-clockwise) the in-line filter.

Degassing Note: Foaming Samples

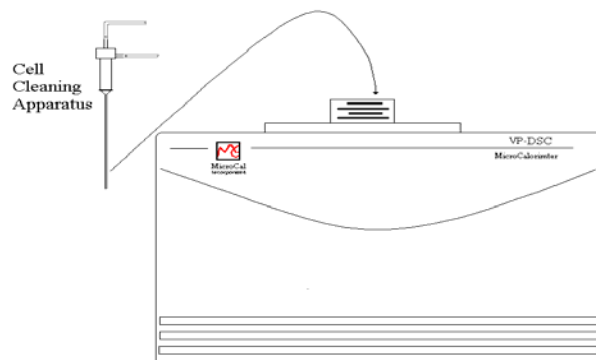
Normally, when you degas samples, you want to utilize the maximum vacuum of the ThermoVac. This is accomplished when the Vacuum Adjusting Needle is closed (i.e. turn the Locknut counter clockwise against the Adjusting Needle, then turn the Adjusting Needle and Locknut combination clockwise until it is finger tight).

It may happen when degassing samples (especially at elevated temperatures) that the samples will start to foam out of its container. When this happens, you may loosen the Adjusting Needle and Locknut (turn counter clockwise) to vent some air into the chamber. Typically, you would turn the Adjusting Needle and Locknut approximately $\frac{1}{2}$ to one full turn, counter clockwise. *PLEASE NOTE: If you vent in too much air, you may not be able to degas the sample adequately, vent in just enough air to prevent the sample from foaming out of its container (it may also be necessary to remove some of the sample out of its container).*

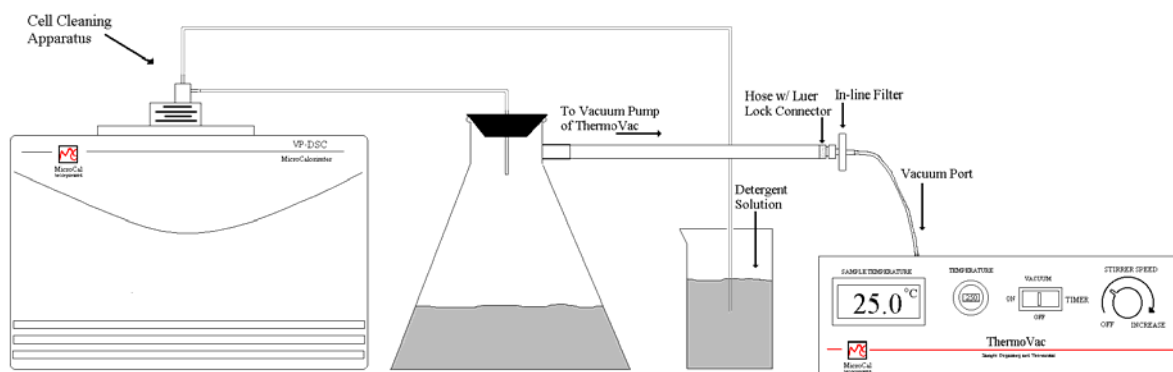


Using the ThermoVac for Cleaning the DSC Cells

- The ThermoVac may be used to flush copious amounts of Detergent solution followed by a thorough rinse with distilled water.
- Insert the long needle into the Sample cell and push down carefully until the o’ring has sealed.



- The end of the upper tubing of the Cell cleaning Apparatus is immersed into a beaker of 200-400 ml of detergent cleaning solution.
- The end of the lower tubing is connected to a one liter vacuum flask through the #8 rubber stopper.
- The side arm of the vacuum flask is attached to the Vacuum Port of the ThermoVac. Your Setup up should look like below.



- Turn on the ThermoVac vacuum pump. The vacuum will pull the detergent solution from the beaker, through the cell and into the waste flask. **NOTE: DO NOT ALLOW THE VOLUME OF FLUID IN THE WASTE FLASK TO ACCUMULATE SUCH THAT IT WOULD RISE UP TO THE LEVEL OF THE SIDE ARM AND BE SUCKED INTO THE THERMOVAC'S VACUUM PUMP. THIS MAY CAUSE THE PUMP TO BECOME DAMAGED.**
- Once sufficient detergent solution has passed through the cell, the hose is removed from the solution, rinsed free of detergent using a plastic wash bottle, and then placed into another beaker containing ca. 200-300 ml of water for rinsing.
- After rinsing with water, remove the tube from the rinse water and allow time for the vacuum to drain the fluid out of the hoses, then remove the cleaning apparatus from the cell.
- Remove the remaining water from the cell by using a long needle syringe.

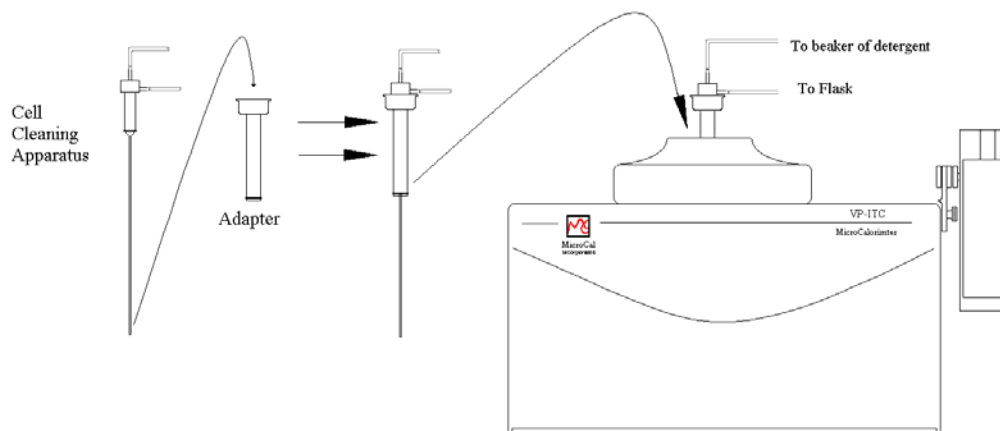
We do not recommend drying the cell before filling with your sample solution, but it should be rinsed twice with the buffer you are using for the experiment. Finally, it should be completely drained and filled with your sample solution in the manner described earlier.

Because a small amount of the buffer used for final rinsing will adhere to the walls of the cell and act to dilute your sample solution, you may wish to correct for this by lowering your sample concentration by 2% if you measured concentration before the sample was introduced into the cell.

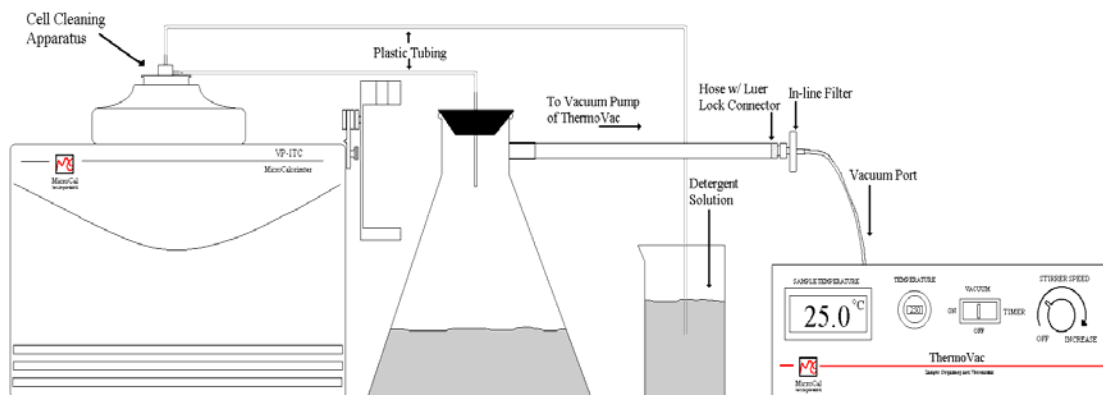
Using the ThermoVac for Cleaning the ITC Sample Cell

The ThermoVac may be used to flush copious amounts of Detergent solution followed by a thorough rinse with distilled water.

- Insert the Cell Cleaning Apparatus into the Adapter, until the top flange is touching the top of the Adapter (see below).
- Insert the long needle into the Sample cell and push down carefully until the o’ring has sealed, as shown below.



- The end of the plastic tubing from the upper tube of the Cell cleaning Apparatus is immersed into a beaker of 200-400 ml of detergent cleaning solution.
- The end of the plastic tubing from lower tube is connected to a one liter vacuum flask through the #8 rubber stopper.
- The side arm of the vacuum flask is attached to the Vacuum Port of the ThermoVac. Your Setup up should look like below.



-
- Turn on the ThermoVac vacuum pump. The vacuum will pull the detergent solution from the beaker, through the cell and into the waste flask. **NOTE: DO NOT ALLOW THE VOLUME OF FLUID IN THE WASTE FLASK TO BECOME SUCH THAT IT WOULD RISE UP TO THE LEVEL OF THE SIDE ARM AND BE SUCKED INTO THE THERMOVAC'S VACUUM PUMP. THIS MAY CAUSE THE PUMP TO BECOME DAMAGED.**
 - Once sufficient detergent solution has passed through the cell, the plastic tubing is removed from the solution, rinsed free of detergent using a plastic wash bottle, and then placed into another beaker containing ca. 200-300 ml of water for rinsing.
 - After rinsing with water, remove the plastic tubing from the rinse water and allow time for the vacuum to drain the fluid out of the plastic tubing, then remove the cleaning apparatus from the cell.
 - Remove the remaining water from the cell by using a long needle syringe.

We do not recommend drying the cell before filling with your sample solution, but it should be rinsed twice with the buffer you are using for the experiment. Finally, it should be completely drained and filled with your sample solution in the manner described earlier.

Because a small amount of the buffer used for final rinsing will adhere to the walls of the cell and act to dilute your sample solution, you may wish to correct for this by lowering your sample concentration by 2% if you measured concentration before the sample was introduced into the cell.