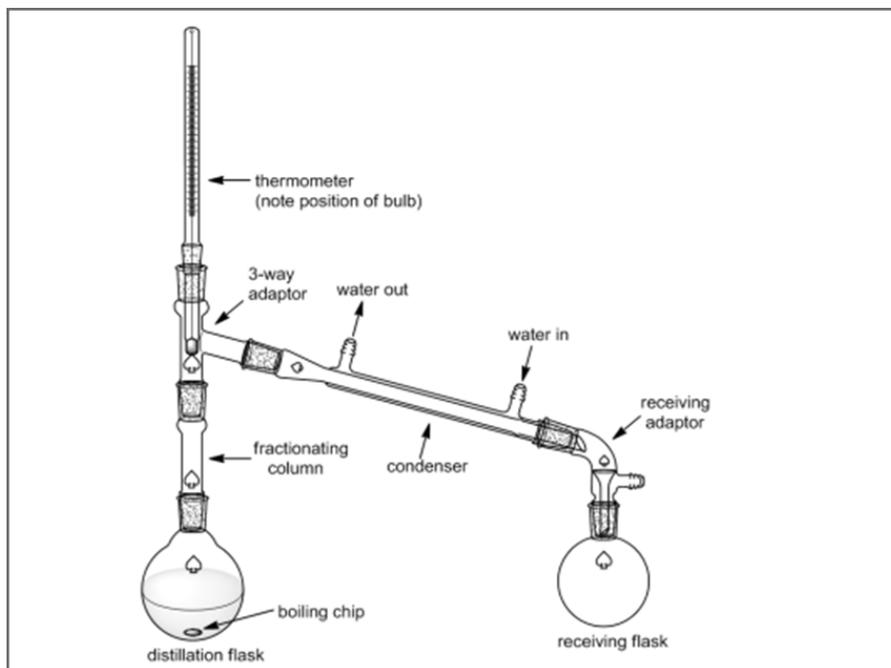


# DISTILLATION APPARATUS INFORMATION



## Distillation Flask (pot)

The distillation flask, or pot, is a round bottom flask containing the liquid to be distilled

Size of the distillation flask should be carefully considered when assembling the distillation apparatus. If the flask is too small, the liquid is likely to bump or foam over into the receiving flask without vaporization occurring. If the flask is too large, a substantial amount of the liquid may be lost as vapor filling the flask. The liquid should ideally fill the distillation flask from 1/2 to 2/3 of its capacity.

To promote boiling of a liquid, pieces of porous clay plate or silicon carbide chips may be added to the liquid before it is heated. The regular chips provide additional surface for bubbles of vapor to form. An alternative method for promoting even boiling is to agitate the liquid with a magnetic stirrer as it is being heated.



**CAUTION:** Never add boiling chips or a stir bar to a hot liquid. This may cause a seemingly calm liquid to boil suddenly and violently.

## Distilling Adapter (3-way adapter, distillation head)

The distilling adapter, or 3-way adapter, connects the distillation flask, condenser, and the thermometer. This type of adapter is also often referred to as the distillation head.

Ground glass joints used in the apparatus must be lined up and mated tightly to avoid leakage of the vaporization liquid. Leakage will result in loss of liquid and pollution of the laboratory environment.

In order for reliable temperature readings to be taken in the distilling adapter, vapors of the heated liquid must totally surround the thermometer bulb. To ensure proper contact, position the thermometer so that the bulb is below the adapter sidearm connected to the condenser.

## DISTILLATION OF ETHANOL

### Condenser (water-jacketed condenser)

The condenser cools the vapor, causing it to reliquify. The condenser then directs the cool, condensed liquid, the condensate, to the receiving flask.

The most common type of condenser is the water-jacketed condenser. With a water-jacketed condenser, a water supply is connected to the condenser with rubber hoses. The water flows into the condenser through the lower hose connection (the connection farthest from the distillation flask) and out of the condenser through the upper hose connection. Water flow should be adjusted so there is a slow, constant flow through the condenser.

When using a water-jacketed condenser, extra precaution is needed to ensure the security of hose connections so they do not dislocate when the water is turned on. Wire may be twisted around the hoses at the site of connection for additional security.

For the distillation of liquids with very high boiling points, it is common practice to cool the condenser with air instead of water. Thermal shock to glassware from a large temperature difference between cold water and hot vapor can crack the glassware, making air a more suitable cooling substance.

### Receiving Flask (receiver)

The container to collect the liquefied vapor is called the receiver. A round-bottomed flask, Erlenmeyer flask, bottle, or graduated cylinder are appropriate for use as the receiver. Connected to the receiver with an adapter is the condenser. The adapter serves to direct the condensate from the condenser to the receiver. Use of an adapter exposes the distillation apparatus to the atmosphere. If the liquid being collected has a low boiling point, it is good practice to cool the receiving flask with a cold water bath so that the condensed liquid will not evaporate and be lost to the atmosphere.

### Heat Source (heating mantle, hot plate, or bunsen burner)

If available a heating mantle may be used to provide the heat energy to drive the distillation. A lower cost alternative that may be considered is to use a hot plate. If a hot plate is used, position the hot plate under the flask leaving a small space (~1/4 inch) between the glass bottom and the plate. The gap prevents too much direct heat going into the flask. Shroud the bottom half of the bottle to the mantle surface with aluminum foil to direct the heat more effectively into the bottle. It is recommended that the heat settings on the plate are gradually increased over 15 minutes into ethanol distillation begins.

An alternative arrangement is to place an oil bath on top of the hot plate and place the round bottom flask into the oil bath to transfer heat into the round bottom.

An even lower cost alternative method to a hot plate as the heat source is a bunsen burner. A burner may be placed under the round bottom flask, with the temperature is controlled to the distillation flask through use of spacing between the flame tip and glass bottom. Due to the open flame hazards of the bunsen burner and danger of fire, it is recommended to use a heating mantle or hot plate when possible.

## **DISTILLATION OF ETHANOL**