

HOT PLATES, DRYING OVENS, AND OTHER HEATING DEVICES

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I. Principle

- A. Ovens are commonly used in the laboratory to remove water or other solvents from chemical samples and to dry laboratory glassware before its use. Other heating devices, such as hot plates and heating mantles, are used for a variety of purposes. Burns and other injuries can occur when heating devices are not used properly. Regardless of the type of heating device used, **never heat a sealed container; and always use the device as intended, especially when used with or near flammable or combustible solvents.** Follow these additional tips for the safe use of specific heating devices.

II. Drying Ovens

1. Because of the possible formation of explosive mixtures by volatile substances and the air inside an oven, laboratory ovens should be constructed so that their heating elements (which may become extremely hot) and their temperature controls (which may produce sparks) are physically separated from their interior atmospheres.
 - a. Small household ovens and other similar devices do not meet this requirement and, consequently, should not be used in laboratories.
 - b. Obviously, because of the spark potential, ovens should also be located away from potential fuel sources (i.e., common combustible material like cardboard and paper, organic solvent storage areas, etc.).
2. With the exception of vacuum drying ovens, laboratory ovens rarely have any means of preventing the discharge of material volatilized within them.
 - a. Thus it should be assumed that these substances will escape into the laboratory atmosphere but may also be present in sufficient concentration to form explosive mixtures within the oven itself.
 - b. This hazard may be reduced by venting the oven to an exhaust system.
3. Drying ovens should not be used to dry glassware that has been rinsed with organic solvents
4. Do not use mercury thermometers to monitor oven temperatures.
 - a. Accidental breakage of the thermometer will cause a serious hazard since uncontained mercury will volatilize very rapidly

III. Heating Devices:

- A. The actual heating element of any heating device should be enclosed in a glass, ceramic, or metal case. Heating devices (Such as heating mantles) require auto-transformers to control the temperature.
 - a. Auto-transformers must be wired according to code and have a two-pole switch, a three-prong plug, and a power overload device.
 - b. These devices are to be located away from areas where flammable vapors are produced.
- B. Unattended heating devices must be protected with overload circuitry and with a temperature-sensing device that will turn the power off in the event of overheating.
- C. When cooling water is used in connection with heating (as in the condenser of a solvent still), an automatic device to turn off the power when water flow is interrupted is absolutely necessary.

IV. Heating Mantles:

- A. When used with auto-transformers (variac or powerstat), make certain that the

auto-transformer is properly wired and located

- B. The temperature of heating mantles can be effectively controlled with solid state controllers with a feedback sensor sensing the temperature of the heated liquid.
- C. If a solid state controller is used, make sure that the feedback device is fail-safe (i.e., if the circuit opens the power is turned off).
- D. Always support the heating mantles with a ring to allow air circulations around it to prevent overheating of the exterior of the mantle
- E. Never support a heating mantle with combustible materials

V. Hot Plates/ Heated Stir Plates:

- 1. Hot plates with heating elements that are not totally enclosed must be discarded
- 2. Hot plates with temperature control devices must be spark-free.
- 3. If water or other liquid has been spilled onto the element, have the equipment electrically checked before use.
- 4. Allow plenty of time for the hot plate to cool before handling

VI. Personnel Protective Equipment:

- 1. Use thermal gloves or tongs to remove items from their heating units
- 2. Use protective eyewear when using ovens, hot plates, or other heating devices