Care and Use — Cleaning Methods

Care should be exercised when using most cleaning solutions, as they can cause skin irritations or severe burns on contact. Dilute solutions become concentrated as the water evaporates; therefore, always flush the exposed area immediately with large quantities of water.

The list of methods given here is by no means complete, but offers a fairly wide variety and should cover all the usual contaminants, as well as the more important special cases.

Frequently it is desirable to give glassware a preliminary rinse or soak with organic solvent to remove grease, followed by a water rinse. The rinsing with water must be done thoroughly if acid will be used later to clean the glassware.

Unless autoclaving is necessary, glassware should be cleaned as soon as possible after use to avoid setting and caking of residues. Pipets, for example, may be placed in a convenient jar containing a weak antiseptic solution, immediately after use. Autoclaving is necessary to disinfect glassware that may have been used to contain potentially dangerous biological fluids.

There is a wide variety of cleaning agents available that will remove surface contaminants such as silicone and other organic and biological residues, blood residues, and other contaminants that may interfere with trace analyses. These cleaners are available in biodegradable, phosphate-free, and chromium-free formulations if desired and can be obtained from laboratory supply houses.

NOTE: If wiping or other mechanical cleaning action in necessary, it should be done gently using non-abrasive cleaners and wiping materials. The use of abrasive materials will damage the glass surface, degrading its inherent strength.

There are some specific contaminants that may require specialized cleaning methods, and some are given here:

1. Permanganate stains. Use a mixture of equal volume of 3% sulfuric acid and 3% hydrogen peroxide.

2. Iron stains. Use a solution containing one part hydrochloric acid and one part water.

3. Bacteriological material. Glassware should be soaked in a suitable disinfectant solution or steam autoclaved followed by cleaning with a suitable agent.

CAUTIONS: Before using any cleaning solution, refer to its Material Safety Data Sheet for precautions to be observed during use. Some of the cleaning materials used may leave trace residue unless rinsing process is carried out thoroughly. While such traces may not be harmful if the object of cleaning is to prepare the glassware for calibration, they can give trouble in certain laboratory operations. When glassware is to be calibrated, the final rinsings must be distilled water.

If an article is to be dried after cleaning, as is necessary for all vessels marked "To Contain," ethyl alcohol or acetone (American Chemical Society Specification) may be used. Drying may be hastened by blowing clean, dry air into the vessel (or sucking the air through the vessel).

Efficient air filters must be provided to remove any particles of oil or dirt from compressed air. Drying should be done in a fume hood.

Glassware Safety

You play by common, ordinary, everyday rules, the kinds of things you'd do naturally if you just took time to think about them:

1. Don't get cut – it hurts you and your productivity.
2. Don't drop glassware – avoid the bruises that lead to breakage.
3. Don't use chipped or broken glassware – it's dangerous and breaks more readily.
4. Don't mouth pipet – you could inhale a toxic substance, burn your mouth, or cut your lip.
5. Don't leave pipets sticking out of beakers or flasks – an invitation for an accident.
6. Insert tubing carefully. Use a protective towel for your hand and lubricate the tubing.
7. Dispose of broken glassware in a special receptacle.
8. Carry large containers carefully, using a bottle carrier.
9. Clean and rinse glassware very well with deionized water, then let it drain dry on a clean, lint-free towel.

To back up the rules, you need a formal laboratory safety program. It begins with a written safety policy, a safety committee, and regular safety inspections. That way, you can investigate accidents thoroughly, keep a record and analysis of them, and promote safety awareness all the time. It could lead you to the best safety record ever.

Fig. 4 Don't leave in detergent solutions for prolonged periods

Fig. 5 Don't pipet by mouth

Fig. 6 Don't apply direct heat

Care and Use — Cleanliness of Apparatus

The usual criterion of cleanliness of glass apparatus is uniform wetting of the surface by distilled water. Certain contaminants, especially grease, adhering to the walls prevent them from being uniformly wetted, and there is a tendency for water to collect into drops.

Imperfect wetting causes irregularities in capacity of volumetric glassware by distorting the meniscus, and also by affecting the volume of the residue adhering to the walls after emptying instruments calibrated to deliver the indicated volume.

Even when the surface of the vessel is uniformly wetted, variations in the apparent capacity still may occur, due to contamination of the liquid surface by minute quantities of fatty or other organic substances which produce a change in surface tension affecting the shape of the meniscus. The cleaning, rinsing, and drying, therefore, must be carried out in such a way as to prevent this from happening.

The choice of the procedure to be used in cleaning glassware depends on the nature of the contaminant. In many cases special reagents or methods must be used to remove a particular substance. Before listing the more important methods, it is desirable to make a few general statements.

Glass

Glasses used in chemical apparatus have excellent resistance to acids, except hydrofluoric. Strong alkaline solutions, such as hot caustic solutions, will attack any glass if contact is prolonged. This is true even though a particular glass may not exhibit any visible effect, due to the solubility of the reaction products. Dilute detergent solutions, up to about 2% strength, will have no serious effect on the glass unless the glass is exposed for unnecessarily long periods or the detergent is allowed to dry on the glass.

Colored Graduations

The scales and inscriptions of many items of Kimble glassware are colored by staining a thin layer of the glass. Since the colored portion is of the same composition as the glass object, the resistance to chemical attack is the same as that of the rest of the glass. Here, the color can be removed only by dissolving a layer of glass from the surface.

Some Kimble volumetric glassware has fused on, ceramic enamel printed lines and inscriptions. These fused-on enamels are quite resistant to acids and alkalies. In most cases they should last as long as the piece of apparatus if cared for properly. However, by their nature, they cannot be as resistant as the ware to which they adhere. Consequently, the graduated lines should not be subjected to prolonged immersion in acids or alkalies. Whenever the lines are wetted by reagents, they should be rinsed as soon as conveniently possible.

Safety Precautions

With many pieces of glassware, it is necessary or desirable to fill by suction when cleaning. ***Do not suck up acid or other cleaners by mouth.*** In fact, do not pipet by mouth at all. Use hand held, manual or electronic pipetting aids.

Abrasives

Do not use abrasives on glassware, particularly volumetric ware. The surface will be marred over time, and the resultant scratches may prevent proper drainage or act as resting places for adulterants which will be difficult to remove.

Water for Rinsing

When preparing a piece of glassware for calibration, rinsing with tap water should be followed by a thorough rinsing with distilled water. Sufficient material may be deposited on the surface by tap water to cause erratic results, particularly with small items, even though water wets the surface uniformly. Even in ordinary cleaning processes, the use of deionized water is recommended.

Adherent Organic Residues

Never attempt to remove such residues by the application of direct heat. Permanent strains may be introduced and, what is more important, the calibration of volumetric apparatus may be changed.

Care and Use — Ground-Glass Surfaces

Ground-glass joints and stopcocks should never be used when dry. Although ground-glass surfaces seal well without the use of lubricants, it is advisable to lubricate them to prevent sticking and breakage. Ground surfaces must be cleaned prior to lubrication—dust, dirt, and particulate matter may score the surface and cause leakage.

Different lubricants are used for these operating conditions:

Silicone grease—for high temperature and high vacuum
Glycerin—for long term reflux or extraction
Hydrocarbon grease—for general laboratory use

Lubricating Ground-Glass Joints

1. Lubricate joints that must be airtight and when glassware contains strong alkaline solutions.
2. Lubricate only the upper part of the inner joint. A properly lubricated joint appears clear, without striations.
3. Do not allow grease to come in contact with vapor or liquid and cause contamination.

Lubricating Stopcocks

Spread two circular bands of grease around the stopcock plug. Insert the plug into the barrel and twist several times until the assembly is completely transparent. Be careful not to use too much lubricant or the bore will become plugged.

Care and Use — HI-VAC® PTFE VALVES

1. Valves are assembled with FKM O-rings, suitable for use with oxidizing and NON-POLAR compounds at temperatures from -23 °C to 204 °C.
2. All elastomers have outgassing rates higher than glass. Long pump-down periods will typically reduce these rates by a factor of ten. Vacuum systems using PTFE valves normally operate at pressures up to 10^{-6} mm Hg. Heating of this valve during pump-down with an air heat gun will improve ultimate vacuum.
3. O-rings should be lubricated with a thin film of vacuum grease to prolong life and reduce leakage by allowing the o-ring to slip easily along the tube. Excess grease should be thoroughly wiped off.
4. Any leakage across the o-ring stem seal occurs mainly on the inward movement. Turning the stem in and out during pump-down helps evacuate the space between the two stem o-rings. One o-ring may be removed if preferred, improving performance under some conditions.
5. O-rings may be removed from the stem by pushing the o-ring into the groove with thumb and forefinger, distorting ring sufficiently to form a small loop which can be "picked up" and the o-ring pulled off of the stem without damaging surfaces.

Care and Use — Stopcocks with Plugs Made of Polytetrafluoroethylene (PTFE)

Kimble® stopcock plugs of PTFE are made of the most chemically inert material in laboratory use today. Only a few chemicals have any effect on PTFE and these only at elevated temperatures and pressures. The material is extremely tough, durable, and heat resistant, with practically zero moisture-absorption. It remains non-brittle even at sub-zero temperatures.

To obtain maximum performance from your stopcock plugs of PTFE, observe the following hints:

1. To clean new plugs, carefully disassemble, lift plug free of glass barrel, and rinse all parts of plug and barrel in acetone. After drying, reassemble and the stopcock is ready for use. (Do not use abrasive materials to clean either plug or barrel at any time.)
2. The washer of PTFE must always be placed adjacent to the end of the glass barrel, to secure minimal friction when turning. When properly tightened, the plug will be slightly more resistant to turning than a lubricated glass plug.
3. Plugs of PTFE can be easily scored around the bore if rotated when solid particles are lodged between plug and barrel or project beyond mating edges of glass parts. Once scored, the plug may leak.
4. Do not use a stopcock plug of PTFE on a vessel used for long-time storage of liquids known to attack glass, since the surface of the barrel may become roughened and leakage may occur between the plug and and barrel, causing a potential safety hazard.
5. If plugs of PTFE are used with liquids corrosive to glass, such as alkalies, rinse the stopcock thoroughly with water after use. Do not allow the liquid to evaporate. The concentrated solution remaining will attack the glass surface, and the eventual solids may also mar the surface of PTFE if the plug is then rotated.
6. When not in use, store in a dust-free area with plug loosened within the glass barrel Although tough and unbreakable, PTFE is softer than glass and has a tendency to conform to the glass surface, including eventual expansion into the hollow parts of the barrel.

Care and Use — Recommendations

A. TO AVOID SERIOUS AND PERSONAL INJURY, AVOID ABRASIONS
- An abrasion reduces the strength of glass, making it more susceptible to breakage under impact and/or thermal shock. Thermal shock may result from sudden changes in temperature or use on either a burner or hot plate. Serious injuries could result if breakage occurs while glass holds heated and/or corrosive liquid.

B. RECOMMENDED GLASSWARE CLEANING AND HANDLING PROCEDURES

PROPER CLEANING PROCEDURE

1. Washing machines may be used. Support racks on the washer must be well maintained. The support pins should be coated with a nonabrasive material to prevent metal to glass contact and scratching.

2. For manual washing, use only plastic core brushes that have soft non-abrasive bristles. Soft, clean sponges or other wiping materials may be used. DO NOT USE THESE BRUSHES OR WIPING MATERIALS WITH ABRASIVE CLEANERS. Keep them clean. Scotch Brite and similar scouring pads will scratch glass and should not be used.

3. Inspect the glassware before each use and discard if scratched on inner surfaces, chipped, cracked, or damaged in any way.

4. Many commercial glass cleaners are available. Follow the manufacturer's directions for the use of these products since some are corrosive and can damage the glass.

5. Organic solvents are acceptable cleaning agents when conditions warrant their use.

IMPROPER CLEANING PROCEDURE:

1. Do not place metal or other hard objects, such as spatulas, glass stirring rods, or brushes with metal parts, inside the glassware. This will scratch the glass and cause eventual breakage and injury.

2. Do not use strong alkaline products and hydrofluoric acid as cleaning agents; they are glass dissolvers and can damage the glassware and eventually cause breakage which can result in injury.

3. Do not use any abrasive cleansers, including soft cleansers (i.e. Ajax, Comet, Old Dutch, Soft Scrub, etc.), as these will scratch the glass and cause eventual breakage and injury.

4. Do not place hands inside glassware while wearing any jewelry, particularly diamond rings, as these will score the inside of the glassware and eventually cause breakage and injury.

5. Do not heat glassware to temperatures (>800°F) needed to burn out carbon residues. This will result in the introduction of permanent stresses in the glass that will eventually cause the glassware to break resulting in possible injury.

C. AVOID IMPACT - Glass will break as a result of impact. Use care when handling to avoid impacting hard objects, such a spigots, other glassware, counter tops, etc.

D. HEATING GLASSWARE

1. Use wire gauze when heating over open flame.

2. Use either low or medium heat settings when using a hot plate High hot plate settings will cause excessive localized heating of the glassware and will eventually cause breakage and possible injury.

3. Do not heat glassware designated as heavy duty unless recommended by manufacturer. Even though these items have added mechanical strength, they are more susceptible to breakage from thermal stock when heated.

4. Do not allow the contents of the container to boil dry as this may induce permanent stresses that will eventually cause breakage. Discard containers that have been boiled dry.

DO NOT evacuate or pressurize unless recommended in the current Kimble® Laboratory catalog.

E. CENTRIFUGE TUBES – RCF values can be significantly reduced if the glass tubes have been scratched or otherwise physically abused resulting in surface damage and lowered glass strength. Refer to the current Kimble® Laboratory catalog.

FILLING AND EMPTYING

The results obtained with volumetric apparatus depend not only on the accuracy with which the ware is calibrated, but also on the method of use. Insofar as possible, users should manipulate the instruments in exactly the same way as the manufacturer does when locating the calibration lines.

The instructions given here apply particularly to apparatus used with a liquid which wets the glass and must be followed in every respect to obtain the most accurate results when such apparatus is to be calibrated. Since mercury does not wet glass, the factors of importance are cleanliness, the use of an ascending meniscus when possible, and the tapping of the vessel before reading the meniscus.

The following rules have been suggested by NIST. (These requirements may seem at times to be unduly detailed, but they are based on exact knowledge of the behavior of the various types of apparatus as determined experimentally.)

Burets

Burets should be held in a vertical position and filled to about 10 mm above the 0 line. Any liquid on the outside of the tip is removed at this time with clean filter paper.

The setting to the 0 line is made by slowly emptying the excess liquid into a beaker or other receptacle with the side touching the edge of the tip. Any liquid remaining at the tip after setting has been made is touched-off against the wet side of the receptacle. When delivery is started, stopcocks should be completely open, even though it is necessary to slow the delivery near the end of a titration. If an exact quantity is desired, the liquid is slowed down when it is about 10 mm above the final line in order to set the meniscus accurately at this line. As soon as delivery has been completed the tip is touched to the side of the receiver and the latter removed from contact.

Measurements made in laboratories with burets ordinarily are from the 0 mark. Other initial points may be used on precision apparatus without serious error, but this is not advised with burets having very rapid delivery.

Cylinders

In filling a cylinder the liquid is allowed to flow down one side only. However, the entire wall is wetted for about 10 mm above the meniscus, by a gentle rotation of the cylinder or, preferably, by tipping it slightly in several directions. Here, a drainage time of about 2 minutes is allowed before completing the setting.

The delivery of the contents of a cylinder is accomplished in the same way as described for a flask.

(NOTE: These directions apply when highly accurate deliveries are wanted. In ordinary laboratory work where measurements are of approximate volumes only, no special precautions in filling and emptying cylinders are necessary.) You should bear in mind, however, that the accuracy you achieve is dependent on your method. Good method, consistently applied, will yield good results. Poor or sloppy methods will yield poor results.

Flasks

When a solution is made up to a definite strength in a volumetric flask, the entire neck usually is wet at the time the volume is adjusted, due to the mixing process. Consequently, in filling flasks the entire neck is wetted by the distilled water. A drainage time of about 2 minutes is allowed before completing the setting.

If a flask is calibrated to deliver its indicated capacity, the delivery is made by gradually inclining the flask, avoiding, as much as possible, agitation of the contents and sloshing around of the liquid. The process should take half a minute. At the end of the emptying the instrument should be nearly vertical and should be held so for another half minute. Then the drop adhering to the lip should be touched off against the wet surface of the receiving vessel.

Pipets

Pipets also are held in a vertical position and filled to about 10 mm above the 0 line. The technique of setting to this line is the same as used for burets. The rate of outflow at this point is controlled by slight pressure of the forefinger on the top.

With MEASURING and SEROLOGICAL PIPETS, delivery is unrestricted, unless the liquid descends so rapidly that it would be impossible to stop at the desired place. In this case, however, delivery should be as fast as possible while retaining control with a finger. The tip is touched to the side of the receiver when delivery is completed and then removed immediately, except for certain types of serological pipets. These are "calibrated for blowout", i.e., to deliver the indicated capacity when the small amount remaining in the tip after free delivery has ceased is blown out (with tip in contact with the wet side of the receiver, if possible) and added to the initial volume. As mentioned before, all blowout pipets are marked with either a wide opaque ring, two narrower opaque rings near the top, or two printed rings near the top.

(NOTE: With measuring pipets of small capacity, there may be a tendency for free delivery to cease before the liquid reaches the lowest graduation lines. If this is so, the tip should be kept in contact with the receiving vessel during the delivery, and not just to touch off the last drop when delivery is finished.)

VOLUMETRIC PIPETS are held in a vertical position and outflow is unrestricted. The tip is touched to the wet surface of the receiving vessel and kept in contact with it until the water has ceased to flow. A count of two is made and the tip then withdrawn horizontally from contact with the receiver. The water remaining in the tip is not blown out, except in the case of Ostwald pipets used in biochemical work. These pipets are usually "calibrated for blowout" and are marked also with an opaque ring near the top.