Technical Data : Plasticware

Physical Properties

Resin	Max use Temp °C	Bittleness Temp °C	Transparency	Sterilization						Flexi-bility	Water Absor ption %
				Auto-claving	Gas	Dry Heat	Radi-ation	Disin-fection	Specific Gravity		
HDPE	120	-100	Translucent	No	Yes	No	Yes	Yes	0.95	Rigid	20.01
LDPE	80	-100	Translucent	No	Yes	No	Yes	Yes	0.92	Excel	<0.01
PC	135	-135	Clear	Yes+	Yes	No	No	Yes	1.20	Rigid	0.35
PP	135	0	Translucent	Yes	Yes	No	No	Yes	0.90	Rigid	<0.02
PS	90	20	Clear	No	Yes	No	Yes	Some	1.05	Rigid	0.05

Sterilization

- Autoclaving (121°C, 15 psig for 20 minutes) Clean and rinse item with distilled water before autoclaving. Certain chemicals which have no appreciable effect on resins at room temperature may cause deterioration at autoclaving temperatures.
- ALWAYS COMPLETELY DISENGAGE THREADS BEFORE AUTOCLAVING.
- Gas - Ethylene oxide formaldehyde.
- Dry heat - 160°C for 120 minutes.
- Disinfectant - Benzalkonium chloride, formalin, ethanol etc.
- Radiation - gamma irradiated at 2.5 Mard with unstablized plastic. Sterilizing reduces mechanical strength. Do not use PC vessels for vaccum application if they have been Autoclaved.

Chemical Resistance

CLASSES OF SUBSTANCES AT ROOM TEMPERATURE	HDPE	LDPE	PC	PP	PS
ACIDS, DILUTE OR WEAK	●	●	●	●	●
ACIDS, STRONG AND CONCENTRATED	●	●	●	●	●
ALCOHOLS, ALIPHATIC	●	●	●	●	●
ALDEHYDES	●	●	●	●	●
BASES	●	●	●	●	●
ESTERS	●	●	●	●	●
HYDROCARBONS, ALIPHATIC	●	●	●	●	●
HYDROCARBONS, AROMATIC	●	●	●	●	●
HYDROCARBONS, HALOGENATED	●	●	●	●	●
KETONES	●	●	●	●	●
OXIDIZING AGENTS, STRONG	●	●	●	●	●

● 30 days of constant exposure cause no damage. Plastic may even tolerate for years.

● Little or no damage after 30 days of constant exposure to the reagents.

● Some effect after 7 days of constant exposure to the reagent like crazing, cracking, loses of strength or discolouration.

● Not recommended for continuous use. Immediate damage may occur.

Abbreviations

PP	Polypropylene
PC	Polycarbonate
HDPE	High Density Polyethylene
LDPE	Low Density Polyethylene
PS	Polystyrene
ABS	Acrylo Nitrile Butadiene Styrene
PTFE	Poly Tetra Flouro Ethylene
PMMA	Poly Methyl Methacrylate
TPX	Poly Methyl Pentene

Technical Data : Metalware

Mild Steel

Each of these standard samples has been analyzed by Chemists in United Kingdom and other countries representing the following interests associated with the Iron and Steel Industries.
The standards have been prepared under rigorous laboratory conditions, and are issued by the organizers under the auspices of the above body of co-workers.

Description	Special Features	ANALYSIS										
		Combined C	Silicon	Sulphur	Phosphorus	Manganese	Arsenic	Nickle	Chromium	Copper	Oxygen	Iron
Ordinary		%	%	%	%	%	%	%	%	%	%	%
Carbon Steels*	Complete Analysis and pure iron std.											
"A²"	for $K_2Cr_2O_7$ v.s. ...	0.037	0.034	0.020	0.008	0.043	0.031	0.059	0.013	0.067	0.04	99.64
"C"	C Standard only	0.091	------	0.02a	0.02a	0.50a	------	------	------	------	------	------
"E"	C and Mn Standard	0.114	------	0.02a	0.02a	0.492	------	------	------	------	------	------
"N¹"	Complete Analysis ...	0.153	0.176	0.050	0.036	0.527	0.03	0.26	------	0.04	------	------
"P"	High S and P Standard	0.205	0.06a	0.073	0.105	0.706	0.03a	------	------	------	------	------
"M"	C and Si standard ...	0.228	0.057	0.05a	0.03a	0.6a	0.03a	------	------	------	------	------
"O¹"	Complete Analysis ...	0.333	0.162	0.032	0.031	0.617	0.024	0.162	0.017a	0.037a	------	------
"H"	C, S and P Standard	0.428	0.15a	0.047	0.035	0.76a	------	------	------	------	------	------
"I"	C and Mn Standard	0.521	0.15a	0.04a	0.02a	0.726	------	------	------	------	------	------
"R"	C, S and Mn Standard	0.786	0.22a	0.053	0.06a	0.914	0.03a	------	------	0.02a	------	------
"S¹"	C and P Standard	0.921	0.07a	0.04a	0.051	0.6a	------	------	------	------	------	------
"U"	C, Mn and Ni Standard	1.203	0.17a	0.04a	0.05a	0.472	------	0.608	trace	0.05a	------	------
Nickel Steels												
"T"	Ni Standard only ...	0.3a	------	------	------	------	------	3.367	------	------	------	------
"O"	Ni, C and Mn Standard	0.325	------	------	------	0.590	------	3.985	------	------	------	------
Alloy Steels										V.	Co.	W.
"V"	Cr-V Steel, Complete Analysis	0.548	0.161	0.063	0.024	0.542	0.016a	------	0.861	0.273	------	------
"W"	Cr-V-W-Co Steel, Complete Analysis	0.695	0.187	0.075	0.028	0.101	------	0.44	3.01	0.791	4.67	16.21
Cast Iron		(DIFF)							Ti.	Tot'IC	Grap	hite
Hematite "A"	Complete Analysis	0.734	1.989	0.047	0.049	0.688	0.042	------	0.052	3.121	2.387	------
Hematite "B"	Low Phosphorus - Titaniferous ...	b.039	2.2a	0.031	0.026	0.6a	0.031	------	0.108	3.06b	2.67b	------
Basic "D"	P Standard only ...	3.0a	------	------	1.19	0.8a	------	------	------	3.0a	------	------
Slag					P_2O_5	SiO_2	CaO	MgO	Fe	Mn	Al_2O_3	V
Basic Slag "A"à	P_2O_5 and part Complete Analysis	-----	------	------	12.92	16.15	44.73	6.85	8.93	2.53	3.91a	0.45a
Ore		Fe	P.	CaO.	MgO.	Alk's	Al_2O_3	TiO_2	SiO_2	S.	CdH_2O	CO_2
Iron Ore "A" à	Complete Analysis ...	58.20	0.056	2.05	1.22	0.33	1.83	0.116	8.13	0.063	1.56	1.41
				Mn	O							
Mang. Ore "A"	Mn, O, SiO_2, P, Fe ...	1.3	0.222	51.3	14.3	------	------	------	6.49	------	------	------
Non-Ferrus		Pb.	Sb.	Sn.	Cu.	Fe.	Bi.	As.	Zn.			
White Met. "A"	Complete Analysis ...	82.6	12.04	4.64	0.33	0.06	0.03	0.06	0.08	------	------	------

(a) Approx — not a standardized figure, (b) Standardized at Organizing Headquarters only.
* In the preparation of the ordinary carbon steels special attention has been given to making them suitable as standard for the determination of carbon by colour.

Stainless Steel

Grade 316 is the standard molybdenum-bearing grade, second in importance to 304 amongst the austenitic stainless steels. The molybdenum gives 316 better overall corrosion resistant properties than Grade 304, particularly higher resistance to pitting and crevice corrosion in chloride environments. It has excellent forming and welding characteristics. It is readily brake or roll formed into a variety of parts for applications in the industrial, architectural, and transportation fields. Grade 316 also has outstanding welding characteristics. Post-weld annealing is not required when welding thin sections.

Grade 316L, the low carbon version of 316 and is immune from sensitisation (grain boundary carbide precipitation). Thus it is extensively used in heavy gauge welded components (over about 6mm). Grade 316H, with its higher carbon content has application at elevated temperatures, as does stabilised grade 316Ti.

The austenitic structure also gives these grades excellent toughness, even down to cryogenic temperatures.

Key Properties

These properties are specified for flat rolled product (plate, sheet and coil) in ASTM A240/A240M. Similar but not necessarily identical properties are specified for other products such as pipe and bar in their respective specifications.

Table 1. Composition ranges for 316 grade of stainless steels.

Grade		C	Mn	Si	P	S	Cr	Mo	Ni	N
316	Min	-	-	-	0	-	16.0	2.00	10.0	-
	Max	0.08	2.0	0.75	0.045	0.03	18.0	3.00	14.0	0.10
316L	Min	-	-	-	-	-	16.0	2.00	10.0	-
	Max	0.03	2.0	0.75	0.045	0.03	18.0	3.00	14.0	0.10
316H	Min	0.04	0.04	0	-	-	16.0	2.00	10.0	-
	Max	0.10	0.10	0.75	0.045	0.03	18.0	3.00	14.0	-

TYPICAL CHEMICAL PROPERTIES OF STAINLESS STEEL							
Chemical Composition (Max. unless otherwise noted)							
	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel
304 (Austenitic)	0.08	2.00	0.045	0.03	1.00	18.00 -20.00	8.00 -10.50

Aluminium

Weight: With a density of 2.7 g/cm3, Aluminium is approximately is one third as dense as steel.

Strength: Aluminium alloys commonly have tensile strengths of between 70 and 700 Mpa. The range for alloys used in extrusion is 150-300 Mpa.

Unlike most steel grades, aluminium does not become brittle at low temperatures. Instead, it's strength increases. At high temperatures, aluminium's strength decreases. At temperatures continuously above 100°C, strength is affected to the extent that the weakening must be taken into account.

Cast Iron

Cast iron is made by remelting pig iron, often along with substantial quantities of scrap iron and scrap steel, and taking various steps to remove undesirable contaminants such as phosphorus and sulfur. Depending on the application, carbon and silicon content are reduced to the desired levels, which may be anywhere from 2% to 3.5% and 1% to 3% respectively. Other elements are then added to the melt before the final form is produced by casting.

Comparative qualities of cast irons

Name	Nominal composition [% by weight]	Form and condition	Yield strength [ksi (0.2% offset)]	Tensile strength [ksi]	Elongation [%(in 2 inches)]	Hardness [Brinell scale]
Cast grey iron (ASTM A48)	C 3.4, Si 1.8, Mn 0.5	Cast	------	25	0.5	180
White	C 3.4, Si 0.7, Mn 0.6	Cast (as cast)	------	25	0	450
Mallcable iron (ASTM A47)	C 2.5, Si 1.0, Mn 0.55	Cast (annealed)	33	52	12	130
Ductile or modular iron	C 3.4, P 0.1, Mn 0.4, Ni 1.0, Mg 0.06	Cast	53	70	18	170
Ductile or modular iron (ASTM A339)	------	Cast (quench tempered)	108	135	5	310
Ni-hard type 2	C 2.7, Si 0.6, Mn 0.5, Ni 4.5, Cr 2.0	Sand-cast	------	55		550
Ni-resist type 2	C 3.0, Si 2.0, Mn 1.0, Ni 20.0, Cr 2.5	Cast	------	27	2	140

Brass

Brass is any alloy of copper and zinc; the proportions of zinc and copper can be varied to create a range of brasses, each of which has unique properties. In comparison bronze is principally and alloy of copper and tin. Despite this distinction, some type of brasses are called bronzes. Brass is a substitutional alloy. It is mainly used for making laboratory metalware like retort stands, retort clamps etc

Properties: Brass has higher malleability than copper or zinc. The relatively low melting point (900-940°C depending on composition) of brass and its flow characteristics make it a relatively easy material to cast. By varying the proportions of copper and zinc, the properties of the brass can be changed, allowing hard and soft brasses.

Today almost 90% of all brass alloys are recycled, Brass scrap is collected and transported to the foundry where it is melted and recast into billets. Billets are later heated up and extruded into the right form and size.

Brass Types: Common brass, or rivet brass, is 37% zinc brass, cheap and standard for cold working.

Silicon Rubber Tubing

Suitable for Laboratory, Pharmaceutical and Industrial use. It has specific advantages over other types such as latex, usual synthetic rubber and plastic tubing.

1. Silicon Rubber Tubing is suitable for use over a temperature range of -50°C to 250°C hence useful for transfer of hot liquids.
2. It can be sterilized by steam (autoclave) or by hot air. This finds applications for use under aseptic conditions.
3. The tubing is odourless. It does not impart any smell or taste to liquid passing through it. It is suitable for transfer of pharmaceutical liquids, beverages and other food preparations.
4. The Silicon Rubber used for making tubing is of superior grade. Tubing is not irritant to skin.
5. The tubing is highly elastic and hence suitable for use with peristaltic pump.
6. Silicon Rubber is attacked by strong acids, strong alkalies, oils, bromine, carbon tetrachloride and toluene. The tubing is not recommended for use with these materials.

   Silicon Rubber tubing is Transparent to Translucent.

Natural Rubber Tubing

made from Rubber Trees

Shore hardness	:	45
Density	:	1.13
Temperature range	:	-30°Cto 110°C light

It is resistant to dilute acid, alkalies, ammonia etc. Rubber Tubing light, flexible. For transferring gasses.

LOW EXPANSION BOROSILICATE GLASS

Form the 16th Century to, today, chemical research teams have used glass containers for a very basic reason the glass containers is transparent, almost invisible. And so the contents and the reaction are clearly visible, But because chemists must heat, cool and mix chemical substances, ordinary glass is not always adequate for laboratory works.

Laboratory works requires apparatus made in a glass - which can readily be moulded into any desired shape or from, which offers maximum inertness when in contact with the widest range of chemical substances, which can withstand thermal shock with fracture and high temperature work without deforming, and which will be resillient enough to survive the everyday knocks to which it will be subjected in normal laboratory handling, washing and sterilizing processes.

Chemical Composition

Glassco Glassware is a low alkali borosilicate composition. Its typical chemical composition is given under. It is virtually free of magnesia-lime-Zinc group and contains only traces of heavy metals.

PERCENTAGE BY WEIGHT	
SiO2	81%
B2O3	13%
Na2O	4%

Thermal Properties

As the Coefficient of thermal expansion of Borosilicate glass is low, the thermal stresses under a given

temperature gradient are consequently low and the glass can withstand higher temperature gradients and also sudden temperature changes/thermal shocks. Minute scratching of glass surface can however reduce its thermal resistance.

In general the 'Strain Point' should be regarded as the maximum safe operating temperature of Glassco glassware. When heated above 500°C the glass may acquire permanent stresses on cooling. All Glassco labware is annealed in modern ovens under strictly controlled conditions to ensure minimal residual stress in the products.

Cofficient of Linear Expansion	32.5x10-7°C
Strains Point	515°C
Annealing Point	565°C
Softening Point	820°C
Specific Heat	0.2
Thermal Conductivity (Cal/cm³/°C/Sec)	0.0027

Chemical Durability

Glassco Glassware in highly resistance to water, neutral and acid solutions, concentrated acids and their mixtures as well as to chloride, bromine, iodine, and organic matters. Even during extended period of reaction and at temperatures above 100°C, its chemical resistance exceeds that of most metals and other materials. It can withstand repeated dry and wet sterilisation without surface deterioration and subsequent contamination. Resistance to attack of various chemicals is shown under. Only hydroflioric acid, very hot phosphoric acid and alkaline solutions increasinglly attack the glass surface with rising concentration and temperature.

Fabrication with Borosilicate Glass

Due to low expansion of glass and easy workability, this glass can be shaped, formed, joined into complicated apparatus. It can be done even by an analyst in his own laboratory. He can keep on changing till he gets what he needs. In case where annealing in a controlled oven is difficult he can do so by flame annealing which is also great advantage.

CONTACT CHEMICAL	DURATION IN HOUR	LOSS IN WT. MG/M²
Water distilled at 100°C	6	10
Water Vapour Steam at 121°C	1	75
Acid HCl	6	100
80% H2So4at 130°C	12	140
Alkali- 1N soln. of NA2Co3 boiling	6	4000
Infusion Fluids Isotonic		
Nacl (0.85%) 121°C	2.5	70
Glucose (5%) 121°C	2.5	50

Optical Properties

Laboratory glassware made from Borosilicate Glass shows no noticeable absorption in the visible region of the spectrum. It appear consquently clear and colourless.

When treated with proper care Glassco laboratory apparatus will givea long and satisfactory service. The following prepared notes are to assist users in obtaining the maximum life and performance from their apparatus. Our sales department will be happy to advise on any aspect concerning the safe use of our products.

HEATING AND COOLING

Glass may suffer damage in three ways :

- It may break under thermal stress in the steady state, that is when there is established constant thermal gradient through the glass.
- It may break under the transient stress of a 'thermal shock', that is sudden heating or cooling.
- It may, if heated beyond certain temperature, acquire a permanent stress on cooling which could cause subsequent failure.

The following precautionary measures will assist in avoiding failures during heating and cooling procedures.

01. Never leave vessel unattended when evaporation work is being carried out. The vessel may crack or explode as dryness condition is approached if the heat source is not adjusted correctly. Lower the temperature gradually as the liquid level drops.
02. Always use caution when removing glassware from a heat source and avoid placing on a cold or damp surface. Although the ware can withstand extreme temperatures, sudden temperature changes may cause the vessel to break.
03. Always cool vessels slowly to prevent thermal breakage.
04. Never apply heat to badly scratched or etched vessel as the thermal strength will have been greatly reduced.
05. Never apply point source heating to a vessel as this will greatly increase the chance of breakage.
06. Always diffuse the heat source by using a metal gauze or air/water bath. Alternatively ensure even heating of the vessel byslow movement of the vessel in relation to the heat source.
07. Adjust Bunsen burner to get a large soft flame. It will heat slowly but also more uniformly. Uniform heat is critical factor for some chemical reactions.
08. Ensure that the flame contacts the vessel below the liquid level. Heating above that level will invite breakage of the vessels.
09. Always use anti-bumping devices in the vessel, such as powered pumice or glass wool rapid heating of the vessel and contents is required.
10. Never use material with sharp edges such as broken porcelain as an anti-bumping device. This will cause internal abrasions and reduce the mechanical and thermal strength of the vessel.
11. Thick walled glassware should not be subjected to direct flame or other localised heat source. Vessels of this type are best heated with the use of an electric immersion heater.
12. Avoid heating glassware over electric heaters with open elements. Uneven heat of this type can include localised stress and increase the chance of breakage.
13. Remember that the hot plate will retain heat long after the appliance has been switched off.
14. Always ensure that the surface of the hot plate is larger in area than the base of the vessel being heated. An under-sized plate of the job in hand will invite uneven heating and promote breakage of glassware.
15. Always ensure that manufacturer's instructions are Bollowed when electrical heat sources.

Mixing and Stirring

01. Always use a policemen's or similar device on stirring rods to prevent scratching the inside of a vessel.
02. When using a glass vessel with a magnetic stirrer always use a covered follower to prevent abrading the inside of the vessel.
03. When using glass or metal mechanical stirrer in a glass vessel always predetermine the height of the stirrer before use to ensure there is no contact between the stirrer blade and the bottom or sides of the vessel.
04. Never mix sulphuric acid and water inside a glass measuring cylinder. The heat of reaction can break the base of the cylinder.

Vacuum and Pressure

01 Never use a glassware beyond the recommended safe limit.

02 Always use a safety screen when working with glassware subjected to pressure of vacuum.

03 Never subject glassware to sudden pressure changes. Always apply and release positive and negative pressures gradually.

Joining and Separating glass apparatus

01. When storing glass stopcocks and joints, insert a thin strip of paper between joint surfaces to prevent sticking.
02. Never store stopcocks for long periods with lubricant still on the ground surfaces.
03. Glass stopcocks on Burettes and Separation Funnels should be lubricated frequently to prevent sticking.
04. If a ground joint sticks, separation can generally be achieved by carefully recking the cone in the socket, or gently tapping of the socket flange on a wooden surface, or by heating the socket and not the cone in a localised flame. The use of penetrating oil will often prove useful in aiding separation.
05. In using lubricants it is advisable to apply light coat of grease completely around the upper part of the joint. Use only a small amount and avoid greasing that part of the joint which contacts the inner part of apparatus.
06. Three type of lubricants are commonly use on standard taper joints

    (A) Hydrocarbon grease is the most widely used. It can be easily remove by most laboratory solvents, including acetone.

    (B) Because hydrocarbon grease is so easily removable, silicon grease is often preferred for higher temperature or high vacuum applications. It can be removed readily with chloroform.

    (C) For long term reflux or extraction reactions, a water soluble, organic and insoluble grease, such as glycerin, is suitable. Water will clean glycerin. There are other type of greases which can be used specifically when certain reagents are used in the Burettes or Separating Funnels.
07. The use of water, oil or glycerol is recommended on both tubing and rubber bung when inserting glass tubing into a bung. Always wear heavy protective gloves or similar protection when carrying out this operation.
08. Always fire polish rough ends of glass tubing before attempting to insert into flexible tubing. The lubricants recommended above may also prove useful.
09. Never attempt to pull a thermometer out of a rubber bung. Always cut the bung away.

PERSONAL SAFETY

01. Use tongs to asbestos gloves to remove all glassware from heat. Hot glass can cause severs burns.
02. Protective gloves, safety shoes, aprons, and goggles should be worn as safety chemical accidents, spilling or splattering.
03. Always flush the outside of acid bottle with water before opening. Do not put the stopper on the counter top where someone else may come in contact with acid residue.
04. Special care is needed when dealing with mercury. Even a small amount of mercury in the bottom of a drawer can poison the room atmosphere. Mercury toxicity is cumulative and the element's ability to amalgamate with a number of metals is well known. After an accident involving mercury, the area should be cleaned carefully until there are no globules remaining. All mercury containers should be kept well-stoppered.
05. Never drink from a beaker. A beaker left specifically for drinking is a menace to the laboratory. Do not taste chemicals for identification. Smell chemicals only when necessary and by waiting a small amount of vapour towards the nose.
06. Avoid pipeting by mouth, particularly when using concentrated acids, alkalis or potentially biohazardous materials. Use mechanical means such as a rubber bulb or an automatic dispenser.
07. Never fill receptacle with material other than that called for by the label. Label all containers before filling. Throw away contents of unlabelled containers.
08. To avoid breakage when clamping glassware, do not permit glass-to-metal contact and do not use excessive force to tighten the clamps.
09. Do not look down into a test tube being heated or containing chemicals and do not point its open end at another person. A reaction might cause the contents to be ejected, resulting in injury.
10. Spattering from acids, caustic materials and strong oxidizing solutions on the skin or clothing should be washed off immediately with large quantities of water.

11. When working with chlorine, hydrogen sulphide, carbon monoxide, hydrogen cyanide and other very toxic substances, always use a protective mask or perform these experiments under a fume hood on a well ventilated area.

12. In working with volatile materials, remember that heat causes expansion and confinement of expansion results in explosion. Remember also that danger exists even though external heat is not applied.

13. Perchloric acid is especially dangerous because it explodes on contact with organic materials. Do not use perchloric acid around wooden benches or tables. Keep perchloric acid, wear protective clothing.

14. When using hot plates and other electrical equipments, ensure the wire and plugs are in good condition. Never handle electrical connection with damp hands.

CLEANING

Successful experimental results can only be achieved by using a clean apparatus. In all instances laboratory glassware must be physically clean, in nearly all cases it must be chemically clean and in specific cases it must be bacteriologically clean or sterile. There must be no trace of grease and the safest criteria of cleanliness is the uniform wetting of the glass surface by distilled water-this being of the utmost importance for glassware used for volumetric methods. Any prevention of uniform wetting of the surface will introduce errors such as distortion of the meniscus and accuracy of volume.

GENERAL CLEANING

01. Cleaning of glassware which has contained hazardous materials must be solely undertaken by experienced personal.

02. Most new glassware is slightly alkaline in reaction. For precision chemical tests, new glassware should be soaked several hours in acid water (1% solution hydrochloric acid or nitric acid) before washing.

03. Glassware which is contaminated with blood clots, culture media, etc. must be sterilized before cleaning.

04. If glassware become induly clouded or dirty or contains coagulated organic matter, it must be cleaned with chromic acid cleaning solution. The dichromates should be handle with extreme care because it is a powerful corrosive

05. Wash glassware as quickly as possible after use but if delays are unavoidable, the articles should be allowed to soak in water.

06. Grease is removed by weak sodium carbonate solution or acetone or fat solvents. Never use strong alkalis.

07. Hot water with recommended detergents should be used and if glass is exceptionally dirty a cleaning power with a mild abrasive action can be applied, provided the surface is not scratched.

08. During washing all parts of the article should be throughly scrubbed with a brush selected for the shape and size of the glassware. Brushes should always be in good condition to avoid any abrasion of glassware.

09. When chromic acid solution is used, the item may be rinsed with the cleaning solution or it may be filled and allowed to stand. The amount of time should depend on amount of contamination on the glassware.

10. Special type of precipitate material may required removal with nitric acid, aqua regia or fuming sulphuric acid. These are very corrosive substances and should be used only when required.

11. It is imperative that all soap detergents and other cleaning fluids be removed from glassware before use. This is especially important with the detergents, slight traces of which will interfere with serologic and culture reactions. After cleaning, thoroughly rinse with tap water ensuring that containers are partly filled with water. shaken and emptied several times. Finally rinse with deionised or distilled water.
12. Drying can be undertaken either in baskets or on pages in air or at a temperature not exceeding 120°C.
13. Always protect clean glassware from dust by use of temporary closures or by placing in a dust free cabinet. For cleaning specific type of glassware, please refer the following pages.

Cleaning Specific Types of Glassware Pipettes

Place pipettes tips down, in a cylinder or tall jar of water immediately after use. Do not drop them into the jar, since this may break or chip the tips and render the pipettes useless for accurate measurements. A pad of cotton or glass wool at the bottom of the jar will help to prevent breaking of the tips. Be certain that the water level is high enough to immerse the greater portion or all or each pipette. At a convenient time, the pipettes may then be drained and placed and in a cylinder or jar of dissolved detergent or, if exceptionally dirty, in a jar of chromic acid cleaning solution. After soaking for several hours, or overnight, drain the pipettes and run tap water over and through then until all traces of dirt are removed. Soak the pipettes in distilled water for at least one hour. Remove from the distilled water, dry the outside with a cloth, shake out the water and dry.

Burettes (with glass stopcock)

01. Remove the stopcock key and wash the burette with detergent and water.
02. Rinse with tap water until all the dirt is removed. Then rinse with distilled water and dry.
03. Wash the stopcock key separately. Before the stopcock key is replaced in the buretts stopcock key are not interchangeable
04. Always cover burettes when not in use.

Culture Tubes

01. Culture tubes which have been used previously must be sterilized before cleaning. The best general method for sterilising culture tubes is by autoclaving for 30 minutes at 121°C (15ib. pressure). Media which solidify on cooling should be poured out while the tubes are emptied, brush with detergent and water, rinse throughly with tap water, rinse with distilled water, place in a basket and dry.
02. If tubes are to be filled with a medium which is sterilized by autoclaving, do not plug until the medium is added .Both medium & tubes are thus sterilized with one autoclave.
03. If the tubes are to be filled with a sterile medium or if they are to be sterilized by the fractional method then sterilize the tubes in the autoclave or dry air sterilizer before adding the medium..

Serological Tube

01. Serological Tubes should be chemically clean but need not be sterile. However, specimens of blood which are to be kept for some time at room temperature should be collected in a sterile container. It may be expendient to sterilize all tubes as routine.
02. To clean and sterilize tubes containing blood, discard the clots in a waste container and place the tubes in a large basket. Put the basket. with others, in a large bucket or boiler. Cover with water, add a fair quantity of soap or detergent and boil for 30 minutes. Rinse the tubes and clean with brush, rinse and dry with the usual precautions.
03. It is imperative when washing serological glassware that all acid, alkali and detergent be completely removed, Both acid and alkali in small amounts destroy complement and in large amounts produce hemolysis. Detergents interfere with serologic reactions.
04. Serological tubes and glassware should be kept separate from all other glassware and used for nothing except serologic procedures.