

SAFETY

IN

SCHOOL WORKSHOPS

TECHNOLOGY EDUCATION SECTION
EDUCATION BUREAU
THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION
2020

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Preface to First Edition

In compiling these recommendations, the Education Bureau relied extensively on BS 4163: 1968, adapting the recommendations to suit local needs where it was considered necessary.

Extracts from BS 4163: 1968. Recommendations for Safety in Workshops of Schools and Colleges of Education are reproduced by permission of the British Standards Institution, from whom copies of the complete standard may be obtained.

1972

Preface to Second Edition

This booklet is revised and updated to keep abreast with the current development in safety standards. The following are also added:-

- Handling of Chemical Wastes
- Content of First Aid Cabinet
- Prevention of Blood-borne Diseases

1995

Preface to Third Edition

The following three topics are added in this booklet:-

- Ventilation
- Laser Cutter
- Working with Computers

2009

Preface to Fourth Edition

The following two topics are added in this booklet:-

- 3D Printer
- Appendix E: Related Guidelines and Webpages

2020

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SECTION 1

GENERAL

1. Introduction

Teachers have a vital part to play in safety in school workshops by their ability to anticipate a dangerous situation and to act before it develops. Teachers can, by their manner of handling tools and equipment, create care and confidence in their pupils. High standards of ability in both teaching and craftsmanship are very important. Methods of control will differ from teacher to teacher but a teacher must be fully aware of the hazards and must plan his work and organize his workshop and his teaching so that risks are, as far as possible, eliminated. Whatever methods are adopted, however, there is no substitute for the cultivation of vigilance and a sense of responsibility in the pupil.

2. Layout

The prevention of accidents in the school workshop depends to a great extent on the good design and layout of the room. A workshop that has been planned for convenient and efficient working conditions is a place where the first conditions for safe working have been established. Machines and work benches must be kept clean and tidy. When new rooms or alterations to existing rooms are being planned the following factors should be considered:-

- (1) The workshop must be big enough to allow the safe layout of equipment and to provide adequate working spaces at benches and machines so that pupils do not impede each other's movements or disturb each other.
- (2) Overcrowding contributes to accidents. The plan of the room and the layout of equipment should permit full supervision by the teacher.
- (3) There should be enough space between benches to allow pupils to move without interrupting other pupils at work. Gangways and working spaces should at all times be kept free from obstructions; they should never be used for storing materials or work in progress.
- (4) Machines should be sited so as to reduce the amount of unnecessary movement of the operator. An adequate free area around the machines is required giving the operator freedom from interference, and the machines should be arranged so as to eliminate risks to others from any flying particles, tools, or work which could be ejected accidentally. Screens can sometimes be helpful but it is essential that nothing should interfere with the teacher's full supervision of the room.

(5) It is desirable that all school workshop floors should be at one level. The floor surface needs to be provided and maintained in a non-slip condition and free from risks of tripping. In woodwork rooms it should be noted that sawdust may have a burnishing effect on wood floors. Spilt oil or water should be removed at once.

(6) Because of the varying heights of pupils using the same workshop it is difficult to ensure that benches always provide the right working height, important as this might always be. Some variety in the height of the benches provided can be helpful for the shortest pupils. Duckboards should not be used unless absolutely necessary, but if used should be painted around their perimeters with contrasting paint.

(7) The approved layout plan of the workshop should be on display in the workshop. Prior approval should be sought from the Education Bureau if changes or alterations are to be made to the layout of the workshop.

3. Electrical Safety

(1) All electrical wiring installation should comply with the Electricity (wiring) Regulation.

(2) Whenever electricity is used, the dangers of electrical shock and fire are ever present. The main causes of electrical accidents are carelessness, ignorance and inexperience, and teachers should make every effort to eliminate these causes by carefully planned courses and teaching methods.

(3) To prevent electrical shocks, all wiring to sockets and other outlets should be enclosed in earthed conduit or trunking whenever possible. Unprotected cable should not be used in any location where continual wear or abrasion is liable to be found. Bare wires or frayed cable should not be tolerated. A sufficient number of power sockets which are protected by a 30 mA residual current device should be installed around the room to supply all appliances which do not have a permanent, isolated supply, and these should, wherever possible, be switched socket outlets incorporating a pilot light. Three-pin earthed plugs should always be used. The metal chassis of appliances should be properly earthed. Multiple outlet adaptors should not be used under any circumstances. Broken or cracked sockets or plugs should be replaced immediately.

(4) To eliminate the risk of electrical fire, circuits should never be overloaded or over-fused. Wiring with faulty insulation should be renewed as soon as possible after detection and unreliable connectors should be replaced immediately.

(5) Maintenance and repair work should be carried out by a registered electrical worker.

(6) A sensitive residual current device (an earth leakage current breaker unit), should be used as back up protection in the workshop.

(7) It is essential to educate pupils to handle electrical equipment safely and to be aware of the danger of improper use.

(8) The use of two- or three-way adaptors should be avoided.

(9) Connecting leads must not be allowed to trail where they are liable to damage by impact or abrasion or where pupils may trip over them.

(10) Electrical apparatus should never be handled with damp or wet hands or when the user is standing on a wet surface.

(11) Portable equipment should be disconnected from the mains socket when not in use.

(12) Labels and notices should be displayed for every main switch/distribution board.

4. Lighting

(1) A good standard of both natural and artificial light is essential. Supplementary lighting to individual machines is sometimes necessary. This should be of a low voltage. It should not be regarded as a substitute for a satisfactory standard of general lighting. If possible illumination should be obtained by natural light, artificial light being used to supplement the natural light as necessary and to replace it during hours of darkness. It is important that the forge and brazing hearth areas have only subdued lighting.

(2) If installing fluorescent lighting in any workshop having moving machinery, steps must be taken to ensure that no stroboscopic effect is possible as a result of the supply frequency, i.e. moving parts must not appear to be stationary.

5. Storage

(1) Storage is required for bulk supplies, sundries, and partly constructed work. Good cupboard space can often be provided within the workshop for many of the sundries, but it is essential to have adequate space outside the workshop for other items. Proper racking facilities are required. Storage of metal bars in a vertical position can be dangerous, unless a safety chain or bar is used.

(2) Only limited supplies of acid or other chemicals should be kept in stock and these should be kept in a locked cupboard or container. The use of suitable (plastic) bottles which do not break when dropped is recommended. Acid in use should be kept, and used, close to a water supply. Its use should be closely supervised, with instructions posted as to its danger, the proper method of diluting and the action to be taken in an emergency.

6. First Aid

(1) A suitably equipped first aid box, fixed to a wall, should be easily accessible in every workshop. The contents of the box should be checked frequently. It is not sufficient that there should be first aid equipment in another part of the school. Workshop staff should have sufficient knowledge of first aid to be able to cope with injuries arising from ordinary workshop accidents, including electrical shock, with confidence and speed. (see Appendix A)

(2) Regulation 55(2) of Education Regulation states that “at least two teachers in every school shall be trained in administering first aid”. In addition school principals should encourage their staff to undergo some form of training in first aid. In the event of any serious injury, or whenever in doubt, medical aid should be sought without delay.

(3) Blood-borne disease (see Appendix B for information on the nature of blood-borne diseases and their prevention.)

7. Fire Precautions

(1) Fire service installations and equipment should be inspected by a registered Fire Service Installation Contractor of the appropriate class at least once in every twelve months in accordance with Fire Service (Installations and Equipment) Regulations. Portable fire extinguishers installed in school workshops located in government premises are to be inspected periodically by Fire Services Department.

(2) Fire extinguishers should be clearly marked to indicate the type of fire on which they may or may not be used, and staff should be familiar with the correct method of usage.

(3) Adequate means of escape in case of fire are essential and should be kept clear and free from obstructions at all times.

(4) Advice will be readily given by the Fire Services Department, who will inspect and advise on fire safety precautions on request. This advice must be sought at all times when it is proposed to use “dangerous goods” in any quantity. As a general guide, any dangerous goods in excess of the exempted quantity as specified in the Tables of Dangerous Goods (General) Regulations, Cap 295, Laws of Hong Kong, should be stored in an approved dangerous goods store.

8. Ventilation

In the event of practical sessions where gas appliances or chemicals will be used, and/or where a significant quantity of harmful dust or fume will be generated, the following safety precautions should be followed:

- (1) open all windows.
- (2) switch on all exhaust fans.
- (3) switch off all air-conditioners, if applicable.

SECTION 2

HAND TOOLS

(1) Contrary to popular belief, most workshop accidents in schools occur when hand tools are being used. The safety precautions regarding the use of hand tools are interlinked with sound teaching. The teacher therefore must strive to develop and teach a technique which combines safety with efficiency. This applies not only to tools actually in use but also to tools which are being carried, laid down, stored, sharpened or adjusted.

(2) It is the teacher's responsibility to ensure that all tools and equipment are in proper working order. The prevention of injury from hand tools depends on the careful instruction of the pupils in their use and on the maintenance of a high standard of tidiness and of good discipline in the workshop. During demonstrations by the teacher every opportunity must be taken to illustrate and point out safety precautions which should be practised by the pupils when carrying out the exercise.

(3) The use of the right tool for the particular job must be insisted upon. Frequent inspection of equipment is necessary. A tool that is not correctly sharpened is potentially dangerous, as pupils will not be able to exercise proper control due to their having to exert additional pressure on the tool.

(4) Teachers must try to minimize the need for pupils to carry tools in the workshop. Common bench tools should be in racks on, in, or near to benches, special tools should be stored in a place which is easily accessible to pupils.

(5) Pupils should be made aware of the following basic safety rules. They should:

1. wear an apron - with tapes tied at the *back*, or boiler suit.
2. roll up sleeves.
3. remove ties.
4. *walk* about the workshop - *not run*.
5. always keep both hands behind the cutting edge of tools.
6. return a tool to its place when it is no longer in use. An overcrowded and littered bench top is very dangerous.
7. never use any tool or machine unless they have been properly taught by the teacher and have received permission to do so.

(6) Major safety points for the teacher to consider are outlined below:-

(a) *Handles*

The importance of the correct handles being securely fixed on tools, e.g. chisels, files, hammers and planes, should always be emphasized. Wedges in hammer heads should always be kept tight. Files should never be used without the correct size of handle properly fitted.

(b) *Edge tools*

Edge tools should always be kept in good condition and this includes their frequent grinding/sharpening, and also their hardening and tempering.

(c) *Hammer heads*

The face of hammer heads should always be kept sound and in good shape.

(d) *Care of tools*

Mushrooming on the ends of metal working chisels must be removed regularly and must not be allowed to develop. Sharp tools should be carried carefully and should be moved about as little as possible. Sawing boards should always be well maintained to minimize risk of accident.

(e) *Storage*

Tools should be stored at appropriate height levels and sharp edged tools always kept in racks when not in use, never left lying about.

(f) *Vices*

All vices when not in use should be kept in a closed position with a half turn of slack to relieve tension.

(g) *Spanners*

The use of tubes or similar extensions on spanners to increase the applied torque should never be allowed. Adjustable spanner should not be used in workshops.

(h) Metal bars or other materials being worked on by hand should never be so held that they project into a gangway, nor should tools be left projecting from a bench.

SECTION 3

THE INSTALLATION AND USE OF MACHINE TOOLS AND ASSOCIATED EQUIPMENT

1. General Installation

(1) The machines installed in a workshop should be related to the scope of the work being attempted. Unnecessarily complex or large machines when used by inexperienced operators can increase the danger factor. Conversely, smaller and less robust machines can also introduce danger if they lack stability and adequate power.

(2) In the choice of machines, the weight of accessories must be considered in relation to the pupils using them. Pupils must not be left unaided to handle accessories which are too heavy for them. All machines must be used within the capacity for which they are designed and no accessories larger than those recommended by the manufacturer should be used.

(3) If flexible or anti-vibration methods of fixing are used for a machine they should be such as to avoid the creeping of the machine out of its correct position during use and to ensure absolute stability at all times. The manufacturer's instructions for machine installation should always be adhered to.

(4) When a new machine is installed in the workshop, the teacher-in-charge of the workshop should keep in record:

- (a) Brand name, model number, and serial number of the machine.
- (b) Date of installation by supplier.
- (c) Date of test for proper working condition as signed by the supplier.

2. Electrical Installation

(1) Each machine should be individually controlled by a starter mounted, where possible, on the machine and fitted with START and STOP push buttons, overload trip and no-volt release; the START/STOP switch should be positioned so that the pupil does not reach across moving parts to operate it. An isolating switch should also be provided on or near to each machine.

(2) The START and STOP buttons should be distinguished by shape as well as by colour. The START button should be shrouded or recessed and coloured green. The STOP button should have a mushroom type head and be coloured red, and for some purposes this can be regarded as an emergency button.

(3) All push buttons should be moisture-proof and oil-tight.

(4) In some instances where both hands may be used at the same time for operating a machine, an additional STOP switch should be fitted to the machine in the form of a red plate having as large a knock-off area as practicable. These switches should be operable by the foot or knee. Applications of this are given under the machine details where appropriate.

(5) Electrical wiring to machines should be securely guarded in trunking or conduit. All wiring to and in machines should be insulated with oil resistant material such as polyvinyl chloride (PVC), encased in flexible metallic tubing, where movement takes place. All machines should be adequately earthed.

(6) A sufficient number of power sockets should be installed around the workshop for use with ancillary equipment. Particularly on new installations and when possible on existing ones, switch socket outlets should incorporate a pilot light, especially when used as an isolating switch. Multiple outlet adaptors should not be used under any circumstance.

(7) A circuit breaker or contactor controlling all the machines in one workshop should be provided and safeguarded by lock and key, and should always be in an accessible and visible position suitably labelled to indicate its purpose in an emergency. The circuit should always be broken and the cabinet locked when the workshop is vacated.

(8) Emergency STOP push buttons of the mushroom headed type and suitably labeled should be installed at selected positions so that the pressing of anyone of the push buttons will immediately operate the circuit breaker or contactor and disconnect the supply from the machines. Once isolated in an emergency the main circuit breaker controlling the machine tools should only be reset by an authorized person. Only one reset button should be provided, located adjacent to the main circuit breaker or contactor.

(9) It is essential that no switch gear be placed in a store room outside the workshop.

(10) It is essential that all installations should be thoroughly examined by a registered electrical worker for electrical safety at least every six months. Inter-locked guards or door openings should be checked daily before the machine is brought into use.

3. Gas Installation

(1) The gas installation in a workshop should be carried out in consultation with the gas supply company and tested by a registered gas contractor on completion. The whole of the gas installation should be controlled by an easily accessible master valve.

(2) Non-return valves approved by the gas supply company should be fitted to the supply to brazing hearths, forges, crucible furnaces and other similar gas-air pressure equipment or alternatively to the main supply to the shop. Flexible tubing should be kept to a minimum and when used should be of a type approved by the gas supply company. Connections to soldering stoves and other small movable apparatus unless

permanently connected should be by means of bayonet type adaptors. The ON/OFF position of all gas cocks should be clearly indicated.

(3) In general, the use of LPG cylinders are not encouraged. If such are to be used, the gas cylinders should be housed in an appropriate designed chamber external to school premises. All gas installation work must only be undertaken by registered gas contractors.

4. Mechanical Safety

(1) All machines should be provided with efficient guards properly secured. In particular pulley wheels, driving belts and all revolving components should be satisfactorily guarded.

(2) Ideally, interlocking limit switches should be fitted to guards and doors giving access to moving parts of machines. Guards should be checked to ensure that they are fully effective before putting a machine to use and pupils should be taught to electrically isolate a machine before any adjustment is made to it.

(3) Belts and pulley guards should be made of unperforated material whenever practicable. While adequately protecting the user, the guards should be so designed as to allow access for inspection and maintenance.

(4) It is most important to ensure that all guards, especially those not incorporating interlocking switches, are correctly replaced and secured before a machine is started after any maintenance or cleaning.

(5) It is desirable that when V-belts are used in conjunction with stepped pulleys, a means should be provided for reducing the belt tension when altering spindle speeds. Belts should never be touched while the machine is running. The machine should always first be isolated from the power source.

(6) Eye screens should be provided on grinding machines. The screens should be of non-splinter material and resistant to abrasion, with a minimum of obstruction to vision. The area of the screen should be large enough to discourage the operator from looking around it. The screen should always be in place and maintained at its maximum transparency. Where safety screens are not provided operators must wear suitable face shields or safety spectacles.

5. Controls

(1) A machine should be stopped on every occasion when not in use even if it is left unattended for only a few moments. The operator should never leave a machine until it has come completely to rest.

(2) Mechanical controls which are in frequent use should be readily accessible from

the operating position and no control should be placed in any position which involves the operator leaning over any moving parts of the machine or its accessories.

6. Instruction Plates and Scale Rings

Instruction plates and scale rings should be of non-reflecting finish. They should be positioned so as to be easily read and well clear of moving parts. Scale rings should be of the largest convenient diameter.

7. Machine Lighting

(1) In addition to good general lighting, supplementary lighting is often necessary at the machines to ensure safety and efficiency.

(2) Only low voltage should be used.

(3) The position of the light should be adjustable by reliable means and the fitting inspected frequently to ensure mechanical and electrical security.

(4) The switch should be as near as possible to the light source and the operating position. The switch is normally on the transformer unit and when this is not accessible from the operator's position without leaning over the machine, it should be supplemented by a switch at the light source.

(5) Local lights should be provided with deep shades to prevent glare in the eyes of the operator and every effort should be taken to avoid glares from polished surfaces.

(6) Reflectors should always be supported by the bracket, not by the lamp holder.

8. Maintenance

(1) Machines must be kept in a clean condition at all times.

(2) The manufacturers' recommendations for routine servicing should be strictly observed.

(3) Regular maintenance in addition to routine servicing of machine tools is extremely important, particularly from the safety point of view. The use of machines by unskilled operatives increases the need for proper maintenance.

(4) Periodical maintenance should be carried out by qualified personnel and it is essential to have a planned maintenance scheme in any workshop and to keep proper records of the maintenance.

(5) Belts should only be replaced when the power supply is isolated and the machine is

at rest. This also applies to changing gear trains, tool setting, servicing, cleaning and maintenance operations.

9. Safety in Use

(1) No person, not even the teacher, should operate any machine without a second person being present in the workshop.

(2) Every machine should have adequate working space around it and be so placed that it can cause no interference with any adjacent machine or its operator.

(3) Sitting on or lying across machines, even though they are inoperative, leads to careless habits and should be forbidden.

(4) Only one pupil should be allowed to operate a machine at any one time and no other pupil should be in the vicinity. All work, tools, guards and safety devices attached to machines must be examined for security by the teacher before the machine is started. This applies particularly to the correct use of work holding and tool holding devices. The tool setting in relation to the work must always be carefully checked by the teacher before the machine is started, and where practicable a trial run, without power, should be made to check clearances.

(5) It should always be remembered that many accidents originate at the point of contact between the tool and the workpiece. Every effort should be made to break swarf automatically as it leaves the cutting tools. A special method of grinding the tool or fitting a chip breaking device will accomplish this. Swarf must not be removed by hand but by a rake provided for this purpose. The swarf must never be removed unless the machine is stationary. Never blow away chips and swarf with an air blower.

(6) The teacher must be alert to the following points and should convey the appropriate safety precautions to be observed to the pupil:-

(a) No pupil should be allowed to operate a machine without adequate instruction in its use, and a pupil should not be left unsupervised until the teacher is satisfied that he is competent. In particular the pupil should be conversant with the various levers and controls, especially the difference between the power feed and fast traverse levers; clear and precise rules appropriate to the machine should be displayed close to the machine and strictly observed.

(b) Measuring must never be attempted while either the workpiece or the cutter is moving.

(c) Pupils should at all times wear adequate protective clothing, e.g. boiler suit, overall or apron. When such clothing has sleeves they should be closely fitted at the wrists and there should be no loose ends. Otherwise sleeves, including shirt sleeves, should be rolled above the elbow. Loose ties or scarves should not be permitted and pupils with long hair should be required to keep it covered when

using machinery.

(d) Provision should be made to protect the eyes of pupils carrying out any machine operation where there is a risk of flying particles. Face shields or spectacles should be used when necessary and these should be appropriate to the operation in progress.

(e) Tools or equipment must never be placed on the working surfaces of any machine.

(f) If the supporting staff is required to operate the tools and equipment in the workshop in preparing materials for teaching, safety precautions should be enforced and users should obtain permission and instruction from the teacher-in-charge.

(g) Tools and equipment in the workshop should solely be used for teaching and learning purposes in order that the safety standard of the workshop could be maintained.

10. Health Risks

(1) If an operation produces any harmful dust or fumes or a significant quantity of any dust, local exhaust equipment should be provided to remove the dust or fumes as close as possible to their source, to prevent them spreading in the workroom.

(2) There may be a risk of dermatitis when using some resin based adhesives. Pupils should be instructed to wash their hands after using such adhesives. Protection may be obtained by the use of suitable barrier creams and by insistence on cleanliness. The dust from asbestos or asbestos cement products is particularly harmful and these materials should never be used nor installed in the workshop.

(3) Special ventilation arrangements may sometimes be needed also for the extraction of dust.

(4) Suitable mask should be worn in order to prevent from the inhaling of harmful dust or fumes when necessary.

(5) When operating machines and tools with a high noise level, the teacher is reminded that noise pollution should be reduced to a minimum to avoid disturbing the nearby environment.

SECTION 4

METALWORKING MACHINES IN GENERAL USE

1. Lathe

(1) The teacher must make every effort to ensure that the pupils KNOW the lathe and the safety precautions to be practised before allowing pupils to operate it.

(2) The pupils must be made aware of the dangers that can arise from wearing loose clothing, e.g. neckties, loose sleeves, etc. when working on the lathe. Their attention should be drawn to the risks arising from having long hair and the severe injuries that can arise if hair is caught in the machine. Pupils with long hair should be made to wear a net or cap that will keep the hair away from moving parts of the lathe.

(3) “One machine -- one pupil” should be the motto in every workshop. No other pupil should be near the machine; the operator’s full concentration should be directed to the machine.

(4) The teacher must ensure that chucks, collets, attachments and workpieces are secure before commencing any operation and that the correct spindle speed is selected in relation to the weight of the chuck and work being undertaken. Extra care should be taken when high speeds are being used. The chuck key must never be left in the chuck even for a moment. The lathe must be clean, free from chips and swarf, and at no time should loose tools or materials be kept on the lathe. It is important that the cutting tool and the work be held securely and with the least amount of over-hang. It is unsafe to have a long length of small diameter work extended from the chuck or collet unless it is supported by the tailstock centre and in certain circumstances the travelling steady. When using a chuck or collet it is essential that sufficient length be inserted to provide an adequate grip. The sharpness of the tool must be checked before starting any operation.

(5) When work is held between centres it must be carefully checked to ensure that it has been properly set up. The tailstock centre must be well lubricated and correctly adjusted. Work held on a face plate must be checked for rigidity and correct balance. The face plate should be turned by hand for a complete revolution to ensure the work will not strike any part of the lathe. Guards over belts, gears, etc. should never be removed unless the teacher has given permission and the power must be shut off at the isolating switch before doing so. Any gear train adjustment by the pupil must be checked by the teacher before proceeding with the operation. The lathe must come to a complete stop before changing the spindle speed or attempting to measure the work.

(6) Chucks, collets, face plates on any revolving work must not be brought to a standstill by hand friction.

(7) If it is unavoidable that a bar should project from the rear end of the headstock, it should be adequately guarded and its presence clearly indicated to passers-by.

(8) The moving direction and speed of the carriage and/or cross slide must be known before engaging automatic feed. Steps must be taken to prevent long lengths of swarf being produced.

(9) Before starting the machine the work should always be fully revolved by hand to ensure adequate clearance from the lathe bed and the work should be balanced. A check should also be carried out to see that the tool is correctly set and has the minimum of overhang.

(10) Care must be taken to ensure that the chuck is not fouled by the tool, compound slide or carriage. A saddle limit switch is a useful safeguard; it will stop the machine before the carriage reaches the chuck.

(11) The pupil must stop the machine if he hears any unusual noise coming from the lathe and immediately inform his teacher.

(12) The cutting tool must be moved away from the work when adjusting or measuring the work on the lathe.

(13) Pupils should never be allowed to lift chucks and heavy attachments alone. The hand must never be placed underneath the chuck when installing it on or removing it from the spindle. The chuck could slide or drop and cut or crush the fingers severely.

(14) File work on a lathe should be discouraged.

(15) The use of files or other hand tools to finish work should be discouraged. Emery cloth should not be used while work is rotating unless it is held in a properly designed holder. If, however, either of these operations are carried out the tool post should be moved well out of the way.

(16) Always use non-adjustable spanners of the correct size when securing or releasing work or cutting tools.

2. Shaping Machine

(1) The ram of the machine should be fully guarded for the full extent of the operating movement, and the guards should not be removed while the machine is in use.

(2) The machine should always be operated from the control side.

(3) The stroke of the ram should always be kept as short as possible but long enough to ensure there is sufficient non-cutting length at each end of the stroke. This length will vary according to the stroke speed.

(4) The stroke of the machine should not be set to allow the cutter to go past the front edge of the table. When a vice is used it should be of robust construction and correctly fitted and secured to resist the force of the stroke of the ram.

3. Drilling Machine

- (1) Drilling machines should not be used without an effective guard over the drill, chuck and spindle. Self adjusting guards are preferable. No part of the chuck spindle or drive which can be seen revolving should be left unguarded. Safety goggles should always be worn when working on machines.
- (2) Preferably, a foot operated cut-out switch should be incorporated and used to stop the machine.
- (3) The use of chucks with a quick mechanism should be discouraged.
- (4) It is essential always to ensure that the chuck key is removed from the chuck before starting the spindle. Where practicable a self-ejecting key should be used. A special receptacle should be provided for the key when it is not in use. The chuck should never be stopped by the use of hand friction.
- (5) The work to be drilled should be securely held on the table. Where practicable machine vices and clamps should be available and their use insisted upon at all times. At no time should any work being drilled be held in the hand.
- (6) If no column rack is provided the safety collar stop under the table and under the drill head should always be used.
- (7) Precautions should be taken to prevent long lengths of swarf developing from the drill, but where these are formed they should not be removed by hand.
- (8) Any pupil with a surgical bandage dressing on his hands should not be allowed to operate a drilling machine.
- (9) Persons with long hair should not be allowed to operate drilling machines without the hair being adequately covered.
- (10) Cutting large holes with special cutters may be dangerous. If it has to be done, it should be done only under close supervision of the teacher.

4. Double-ended Grinding / Polishing Machine

- (1) When first delivered wheels should be closely examined for any transit damage. Before wheels are used they should be “rung” by tapping lightly with a hammer shaft. If the wheel sounds cracked it should not be used. The wheel should be clean and dry when tested.
- (2) Wheels should always be stored in a dry place on their edges in racks, with the exception of wheels of resinoid rubber and shellac 6 mm thick and under, which should be stored on a flat surface to prevent warping.

(3) Machines should always be isolated before a wheel is changed. The wheels should only be used at the speeds recommended by the manufacturer. Generally soft wheels are preferable for hard metals, and hard wheels for soft metals, but the maker's recommendations should always be observed.

(4) If wet grinding needs to be done the wheel needs to be of a suitable type. Wheels should not be allowed to stand partly immersed in the coolant. This will seriously affect the balance of the wheel.

(5) If wheels are secured by flanges and a centre spindle nut the spindle should be of sufficient length and so threaded that the assembly is secured by a full nut length; care should be exercised that the clamping nut is tightened. No wheel used for peripheral grinding should be mounted without suitable flange plates. The diameter of the flanges should be not less than one-third of the wheel diameter.

(6) Both flanges should be of the same diameter and preferably of steel, with the inner flange a firm fixture on the spindle. To avoid convexity each flange should be recessed over its central area by 0.8 mm for a flange of 75 mm diameter or less, or 3 mm for a diameter over 75 mm.

(7) The spindle, wheels and flanges should be free from foreign matter before the wheel is mounted.

(8) There should be washers of blotting paper, or rubber insertion sheet, not more than 1.5 mm thick, between the flange plate and the wheel, care being taken that they are not corrugated, but resting flat against all surfaces. Washers are not recommended for a taper or dovetail wheel. The nuts should only be tightened enough to hold the wheel firmly. Excessive pressure may damage the wheel. Only hand pressure should be exerted, using a normal spanner, when tightening the nuts; never use additional force exerted by any other means, including lengthening the spanner handle by tubing.

(9) After satisfactorily mounting the wheel, the machine should be switched on and then kept running for at least one minute at full speed, keeping the area clear in case of bursts.

(10) Grinding wheels should never be mounted on a machine other than the type for which they are intended and never be used on make-shift apparatus. Their sizes must be within the limits specified by the machine manufacturer.

(11) The wheel should be provided with adequate guards. A fixed guard should cover the major part of the wheel, with an additional adjustable guard to leave exposed only the portion of the wheel in use. Guards should be of a material able to withstand the impact of pieces of a broken wheel.

(12) It is necessary to avoid vibration which can be dangerous, causes uneven wear and marks the work. It can be caused by incorrect wheel balance, lack of rigidity in the machine, loose bearings or wrong use of the work rest. If the wheel is belt driven incorrect fitting of the belt fasteners may be the cause.

(13) Grinding on the side of the wheel should always be avoided unless the correct wheel for this purpose is fitted.

(14) The user should wear an eye shield or safety spectacles when using the machine and the wearing of apron or overall should be encouraged.

(15) Under no circumstances should more than one person operate a grinding machine at any one time.

(16) The work rest should be adjusted as closely as possible to suit the work in hand. The work must never be forced against a cold wheel; the sudden heating up may cause the wheel to burst.

(17) Files and similar hardened brittle metal should never be ground in the hard state as they are liable to fracture.

(18) The article being ground should never be held in a cloth, apron or any form of pliers, but if necessary hand vices or similar locking grips can be used.

5. Polishing Heads

(1) The machine should be isolated electrically before a mop is changed. Mop heads should be properly stored in a rack when not in use.

(2) Mop heads outside the range of sizes specified by the manufacturer should not be used. The use of wire brushes is not recommended.

(3) Two pupils should not be allowed to use a double headed machine at one time, and care must be taken to ensure that the operator's attention is not distracted in any way when using the machine.

(4) Good stance and grasp are important. The pupil should know the direction of rotation and its implications. With the normal wheel which revolves so that the top moves towards the operator, the correct positioning of the work in relation to the wheel is vitally important; the safest point to apply the work is in nearer lower quarter of the wheel.

(5) The need to hold the work firmly and to keep the fingers firmly cupped around the outside of the article should be stressed. In no case should the grip be on the inside of the work.

(6) Holding any work in a cloth or apron should be forbidden, and care should be taken that the edge of the work does not catch up in the mop. If the article heats up it must be allowed to cool again to a safe temperature to handle.

(7) The danger of projecting spindle ends should be guarded against. Any part of the spindle and spindle ends exposed should be adequately guarded. Sleeve type guards and spindle covers are recommended.

(8) A face shield or safety spectacles should be worn at all times during buffing operations.

(9) It should be borne in mind that large wide faced mops can exercise considerable grip on the work and should be avoided. Full stitched mops should always be used where practicable. If coated abrasive wheels are used they need to be a good fit on the spindle. The teacher should make sure that the technique of their use is fully understood by the pupil.

6. Shearing Machine

(1) A blade guard should be provided at all time.

(2) Only one pupil at anyone time should operate the machine. Material should always be supported, if necessary manually, and a second person may assist with this.

(3) Only material within the capacity of the machine should be cut.

(4) The blade should not be distorted.

(5) The shearing edges should be maintained in good condition.

(6) When the machine is not in use it should be immobilized either by removing the handle or by the use of a locking pin or other device.

(7) A container for waste should be available.

(8) Industrial type gloves should be used to handle material.

7. Hacksawing Machine

(1) The work should be securely fixed, adequately supported and the length of any overhanging end of the bar should be clearly indicated.

(2) The automatic knock-off switch should be used at all times and regularly checked to ensure that it is in good working condition.

(3) If coolant is used precautions should be taken to prevent this soiling the floor and creating a dangerous slippery surface. This can be prevented by the use of a drip tray or absorbent material on the floor.

(4) The saw should not be manually assisted to increase the rate of cutting.

SECTION 5

METALWORKING MACHINES OF SPECIAL TYPES

These machines in particular can be a source of danger and the following recommendations should be strictly adhered to.

1. Milling Machine

(1) It is of primary importance that no milling machine be used for vertical or horizontal working without an efficient cutter guard. Such guarding is sometimes considered a nuisance by the operator but this should not deter its use.

(2) It is always necessary to fix the work in a centrally balanced position on the table. If a vice is used it must be of robust construction and be securely attached to the machine work table.

(3) If it is necessary to position work eccentrically in the vice jaws it is essential that the jaws be packed to maintain them in a near perfect parallel position.

(4) Safety limit stops are essential and should not be removed or used as length trip stops.

(5) It is important to ensure that the cutters are revolving in the correct direction, relative to the direction of feed.

(6) The cutter spindle should be stopped whenever it is not actually cutting.

(7) It is always necessary to isolate the machine when changing a cutter or arbor.

(8) Milling cutters have multiple sharp edges and require careful handling and storing.

(9) Arbor supports should be used when possible and cutters should always be keyed to the arbor .

(10) When using a gear driven dividing head the cover should be replaced after setting the train of gears.

(11) When knee braces are provided they should always be used.

(12) A milling cutter on which even one tooth is damaged should not be used.

(13) Adaptors, taper sockets, taper shanks, keys, etc., which have been damaged should not be used.

(14) Cutters must always be maintained with cutting edges in a sharp condition. Always wipe the spindle nose before installing an arbor, adaptor or cutter.

(15) The component should never be lifted from the table by inserting the fingers in a tee slot or tenon.

2. Surface Grinder

(1) Surface grinders have a high speed reciprocating table action. The machine should be so sited that the reciprocating table does not approach within 450 mm of any fixed structure. A fixed guard should be fitted at each end of the table. For flat grinding a ring or cup wheel should be used.

(2) When using magnetic blocks to hold components, it is essential to ensure that the magnets are switched on and that the work cannot be moved by hand. If the magnetic block being used is also held to the table by magnetism, it is necessary to ensure that the switch is in the ON position both to the table side and the work side of the block.

(3) Non-magnetic materials must not be ground on a magnetic block unless properly secured against any movement that could take place during the grinding operation.

(4) Table limit stops must NOT be removed under any circumstance.

(5) The pupil must be well instructed in the application of surface grinding before being left to operate the machine. It is emphasized that there is more danger in the incorrect use of this machine than of most others. In particular, the “cut” must be set as small as possible.

(6) Pupils should not have their hands on the machine when the table is auto traversing, as there is a danger of fingers being injured by the reversing dogs. A hinged cover should be fitted over the reversing trips.

3. Tool Post Grinder

(1) The equipment should be used only on a lathe for which it has been designed, or for which it is suitable without make-shift fitment.

(2) The equipment should be rigidly mounted.

(3) It should be ensured that the correct peripheral speed has been arranged for the size of grinding wheel being used, unless the lathe is of a single speed type.

(4) The wheel and belt guards should be replaced before use.

4. Finishing Machine

- (1) Abrasive belts should be examined before use and any torn or badly worn belts should not be used.
- (2) It is essential that the belts be mounted so that they run in the direction in which they are designed to work and that the “run off” end is properly guarded.
- (3) The correctness of the tracking should be checked by first rotating by hand.
- (4) Parts being finished should be held so that fingers do not come into contact with the band.
- (5) A dust extraction system may be necessary when the machines are likely to be used for lengthy periods.

5. Flypress

- (1) The hand-trapping area between the tool and die should be effectively guarded.
- (2) Precautions should be taken to reduce the risk of either the operator or persons in the vicinity being struck by the counterweight of the handle.

SECTION 6

WOODWORKING MACHINES IN GENERAL USE

1. Lathe

(1) Wood turning lathes should be placed where there is good natural lighting and away from those parts of the workshop that are in frequent use by pupils. They should be located at an angle of about 15 degrees to the wall in such a position that in the event of break up the object being turned will not be thrown into the room. As much space as possible should be allowed for the operating pupil to step back or sideways out of the path of a released object.

(2) Timber which is universally recognized as suitable for turning on the lathe is not easily available in Hong Kong. Therefore extreme care is necessary when timber is being selected for turning.

(3) Timber which is to be used in the lathe should be properly prepared to a roughly circular or octagonal shape. Care should also be exercised to detect defects in timber. Whilst built up or segmental work may be essential in patternmaking, the use of such jointed material for decorative and bowl shaped work is to be deprecated.

(4) The securing of work on the lathe is of prime importance and it should be safely secured either between centers or on a face-plate. An established and approved method should be used, bearing in mind the extra care needed because of the types of timber available in Hong Kong.

(5) Observance of a safe peripheral turning speed is important. This should be adjusted according to (a) bulk of object, (b) state of turned surface, (c) nature of material. Free turning should be checked before starting the lathe.

(6) Turning tools should be maintained sharp and must be a secure fit in their handles and should be of the long handled type. Tools made from old files should not be used. Ordinary wood chisels should never be used on the lathe.

(7) Not more than one pupil should be allowed to operate the machine at a time. Where a lathe has two operating positions work should be mounted only at the operating position in use.

(8) The pupil should be shown how to position the tool rest and how to hold the turning tool correctly and also should be shown how to use abrasive paper correctly with the tool rest removed well clear of the work.

(9) The eyes should be protected from flying chips by a face shield, visor or safety spectacles.

(10) If the machine is fitted with a brake the sudden application of this may cause the work to fly. Therefore the brake must be applied steadily with caution.

(11) The use of sanding attachment is not encouraged.

2. Drilling Machine

(1) Please refer to DRILLING MACHINE in Section D.

(2) When a mortising attachment is used care must be taken that the timber is adequately secured by clamps.

3. Grinding Machine

(1) Please refer to DOUBLE-ENDED GRINDING / POLISHING MACHINE in Section D.

SECTION 7

WOODWORKING MACHINES OF SPECIAL TYPES

1. Bandsaw

- (1) There must always be an effective, efficient means of starting and stopping the machine.
- (2) The machine should only be used by the teacher or his assistant if he is fully trained in its use.
- (3) For fixed machines the control switch should be capable of being locked OFF on all occasions when the machine is not in use, unless a locking device is incorporated in the machine itself.
- (4) It is necessary for blades to be of the correct pattern and to be sharp and free from distortion. Blunt or distorted blades are liable to break. If a machine is fitted with a brake this should be used with discretion.
- (5) The blade should always be correctly tensioned before use but the tension should be taken off when the blade is not in use.
- (6) The top guide, if not aligned properly, can cause blade damage. It should be adjusted to the lowest possible position and the section of the blade above it should be adequately guarded.
- (7) The guide blocks and table must always be properly adjusted and maintained in good condition.
- (8) Fingers should be kept away from the saw line and the machine should always come to rest before making any adjustment or before it is left unattended.

2. Circular Saw

- (1) There must always be an effective, efficient means of starting and stopping the machine.
- (2) The machine should only be used by the teacher or his assistant if he is fully trained in its use.
- (3) The control switch should be capable of being locked OFF on all occasions when the machine is not in use, if a locking device is not incorporated in the machine itself.

- (4) It is essential for the teeth of saw blades to be kept sharp and to the correct profiles. Blunt blades can cause accidents, and for this reason spare blades should always be available. A saw blade which has been overheated should be discarded. Timber should always be examined for defects and possible sources of hazard before sawing.
- (5) It is essential that the saw blade has adequate set, as insufficient set can cause timber to kick back.
- (6) The riving knife should always be in position. It should be thicker than the plate of the saw but thinner than the saw kerf.
- (7) The guard should be adjusted so that the clearance between the lowest point at the front of the guard and the top surface of the timber does not exceed 13 mm. If possible, the saw height above the table should be correctly set to suit the work being done.
- (8) A suitable push stick, or where necessary a correctly designed push block, should always be used to push the timber through the last 300 mm of every cut or with any shorter cut.
- (9) The saw blade should either be lowered below the table or adequately guarded when not in use. The part of the saw below the bench should be enclosed so far as practicable and the guards must be adequately secured. Sawdust should not be allowed to accumulate.
- (10) Saw spindle extensions should always be adequately guarded.
- (11) The floor surrounding every saw bench should be maintained in good condition and the surface kept free from material and in a non-slip condition.
- (12) Operations other than normal sawing are deprecated, but if attempted, efficient guarding is essential. "Stopped" work such as stopped groove and chamfer should never be attempted.
- (13) Whenever possible long pieces of timber should be cut by hand to suitable shorter lengths before cutting on the circular saw. If long lengths of timber are being cut they should be adequately supported.
- (14) Great care must be taken when sawing long timber.

3. Surface and Thicknessing Planer

- (1) These machines should only be used by the teacher or his assistant if he is fully trained in their use.
- (2) The control switch should be capable of being locked OFF on all occasions when the machine is not in use if a locking device is not incorporated in the machine itself.

- (3) The part of the cutter block exposed behind the fence should be guarded.
- (4) A “bridge” guard should be provided on every surface planer and should be used in the correct manner. “Swivel” guards are not recommended.
- (5) Great care should be taken with the secure and correct setting of the knives, table and fence. Insecure setting of the knives can cause them to fly; incorrect setting of the table in relation to the cutter block can result in the knives striking the tables; and inadequately secured fence can collapse when the machine is in operation.
- (6) When “flattening”, i.e. planing the wide side of the timber, the hand should never be on the portion of the timber that is passing the cutter.
- (7) Rebating should not be done unless the cutters are securely guarded.
- (8) “Stopped” work such as stopped rebate and chamfer must not be done.

SECTION 8

WOODWORKING MACHINES OF EXCEPTIONAL TYPES

1. Sanding machine (Belt and Disc)

- (1) Appropriate grade of abrasive paper should be examined before use and torn papers should not be used.
- (2) It is essential that the direction of rotation of the belt is towards the fence.
- (3) The fence should be set close to the abrasive surface, otherwise the timber can jam underneath.
- (4) All drill mechanisms should be provided with fixed guards, requiring the use of a tool for removal. The correct tracking should be checked first by rotating by hand.
- (5) A dust extraction system may be necessary.
- (6) The user's eyes should be protected.

2. Vertical Spindle Moulder

- (1) It is most important to note that this machine is potentially very dangerous and its use can only be justified in exceptional circumstances. The teacher should be fully qualified and experienced in its use; pupils should never use this machine.
- (2) A method of locking the machine out of action, if not incorporated in the machine, should be provided adjacent to it.
- (3) The cutters should be guarded as far as is practicable. If, due to the nature of the work, a fully effective guard cannot be used, then the work should be held in a suitable job holder as well as having a guard.
- (4) When practicable, false fences should be used to reduce unnecessary exposure of the cutters as far as possible.
- (5) It is essential to select the correct spindle speed according to the type of cutters in use.
- (6) Cutters must be adequately tightened, otherwise they may become loose and fly.
- (7) Excessive cutter projection, particularly on the French type head, unbalanced cutters and incorrect cutter settings are dangerous and may cause cutter breakage.

(8) Before the machine is started the head should be rotated by hand to ensure that the cutters do not foul fences or guards.

(9) A portable router should never be fixed in an inverted position below a work table for use as a vertical spindle moulder.

SECTION 9

ANCILLARY PROCESSES AND PLANT

1. Forging

When installing a forge the following considerations are of major importance: -

- (1) The floor in the area of the forge should be fireproof materials. It is desirable that the hot areas which may contain equipment for forging, heat treatment, brazing and casting should be less strongly lit than the main workshop area so that the color of the heated metal can be seen.
- (2) Dust and fumes are a potential source of danger. It is vital that the flue be properly designed to conduct efficiently any fumes to the outside atmosphere. The electricity supply to any extractor fan should be arranged independently of any emergency control to other equipment.
- (3) If solid fuel is used, it should be stored as conveniently adjacent to the forge as safety considerations permit and in such a manner that the floor is kept free of split fuel. The bulk storage of the fuel should be such that it is kept dry and free from foreign bodies such as stones.
- (4) It is recommended that gas ignition of the fuel should be standard practice.
- (5) Excessive noise from the extractor fan or any other equipment can be disconcerting and should be kept to a minimum.
- (6) A rack should be provided for the safe storage of forging tools. The range of tools should be adequate and of the correct size for the work to be undertaken and maintained in an undamaged and good condition. After use the tools should be quenched and returned to the rack.
- (7) It is essential that the anvil should be on a stable base and maintained in good condition. A badly damaged anvil face can be dangerous and it should not be used. The anvil height should, as far as practicable, relate to the height of the pupil using it.
- (8) The dangers of carrying around hot metal should be emphasized. Anvils and quenching tanks should be situated as close as possible to the hearth.
- (9) Not more than two pupils per anvil should be allowed to use the hearth at any one time and not more than two anvils should be provided for one forge.
- (10) It is recommended that when using the forge, pupils should wear protective equipment, e.g. strong footwear, leather aprons and eye protectors etc..

2. Brazing

- (1) The gas and air installation should satisfy the Electrical & Mechanical Services Department and the gas supply company.
- (2) The flexible tubing and all fittings should be of the highest quality and fully maintained to avoid gas leaks and the risk of explosions. The outlet of the feed tap should be directed downwards.
- (3) The position of electric switches and controls should be such that the pupil does not have to reach across the hearth in order to operate them.
- (4) Firebrick and other refractory materials must be used for the brazing base and these may also be used for screens. Asbestos products or common bricks must never be used as they can disintegrate violently under the application of local heating.
- (5) Generally one pupil only should be allowed to work at each hearth at one time.
- (6) Hot metal should be handled only with appropriate tools.
- (7) When bottled gas is used reference should always be made to the manufacturer to ascertain the correct type of torch. The cylinders should be housed in a well ventilated separated enclosure.
- (8) Compressed gas cylinders should always carry clear indications of the type of gas they contain and be provided with the correct type of pressure regulator for the particular gas. Any tubing and related fittings must be suitable for liquefied petroleum gases.

3. Soldering Iron and Soldering Gun

- (1) Soldering iron body should be made of steel, securely attached to a high strength plastic, or wood handle for good insulation.
- (2) The supply cable should enter the handle through a rubber grommet, secured inside with a screw-down type clamp or equivalent.
- (3) The soldering iron or soldering gun should be fitted with a 3-pin plug and properly fused.
- (4) The ON/OFF switch of soldering gun should be biased to the 'OFF' position to minimize fatigue during long periods of use.
- (5) The pistol grip type soldering gun should preferably have an indicator light activated from the main ON/OFF switch.
- (6) The soldering gun or the soldering iron should be used with a proper stand.

(7) Soft soldering should only be done where ventilation is sufficient to avoid the inhaling of harmful fumes.

4. Oxyacetylene Welding and Cutting

(1) This apparatus should only be used under the control of a teacher properly trained in its use and nothing less than a recognized certificate of training issued after a course of instruction in this subject should be accepted as evidence of such training.

(2) Acetylene and oxygen gases are Category 2 dangerous goods. Advice on their proper storage should be sought from Fire Services Department.

(3) Copper distribution tubes must not be used for acetylene gas, since copper will react with acetylene under pressure and give rise to an explosion. Cylinders and pipes should be colored in accordance with the recommendations of the suppliers. Each welding torch should be provided with its own individual regulator.

(4) It is essential to maintain good ventilation at all times.

(5) Irrespective of the rate of use a cylinder should not be retained in use for more than 12 months.

(6) Firebrick or other refractory materials must be used for the base and these may also be used for screens.

(7) No welding should take place on either a dense concrete or an asbestos cement base since these materials may disintegrate explosively under the applications of heat.

(8) It is highly dangerous if oil or grease is allowed to come into contact with any parts of welding or cutting equipment.

(9) Welding, cutting or any other processes involving the application of heat should not be carried out on closed vessels or tanks. No container which has previously held flammable materials should be welded or subjected to heat.

(10) Suitable goggles should be worn.

5. Electric Welding

(1) Electric welding is not suitable for general use in schools, but if used should be under the control of teachers properly trained in the use of electric welding apparatus. Nothing less than a recognized certificate issued after a course of instruction in this subject should be accepted as evidence.

- (2) For teaching purposes electric arc welding must be housed in its own room or arc welding bay which must be adequately screened from any pupils not taking part in the actual welding process because of the possibility of “arc eye” or “eye flash”. If portable screens are used they should be durable, fireproof, and completely stable. The walls of the welding compartment should be non-reflective and, ideally, painted black.
- (3) The installation of the equipment must be carried out by a competent electrician. Single operator sets are recommended.
- (4) Arc welding should always be carried out on a proper welding table.
- (5) It is essential to maintain good ventilation at all times.
- (6) Inspection and maintenance of the equipment should be carried out by a competent person at six-monthly intervals.
- (7) It is essential that all users of the equipment should wear a leather apron and gloves and must use a suitable face mask, preferably of the helmet type, at all times when using the equipment. Care should be taken that the correct filter glass is fixed to the visor of the mask.
- (8) Severe burning can be caused to anyone involved in excessive exposure to the radiation from the electric arc.
- (9) The equipment must have a proper earthed transformer; and an additional earth lead from the bench to the earth on the electric arc set should be fitted as an additional safety measure. The output voltage on open circuit should not rise above 50 volts.
- (10) The correct face shield should be worn when the weld is being dressed.

6. Casting and Foundry Work

- (1) Casting and foundry work in schools is usually limited to aluminium or zinc based alloys. When the work necessitates degassing processes being undertaken, the resulting fumes make the provision of exhaust ventilation essential. Exhaust gases from furnace should always be vented to the outside atmosphere.
- (2) Prominently posted instructions as well as verbal instruction on the danger of moisture in the presence of molten metal is vital. A fire smothering blanket should always be available.
- (3) The use of oil bonded sand will eliminate many of the difficulties and risks arising from the use of green moulding sand. It is vital that if green sand is used the moisture content should be kept to the minimum necessary for bonding of the sand.

(4) It is vital that anything brought in contact with the molten metal or the hot crucible, including additional melt, should be preheated to free it from moisture and it is desirable that casting be carried out in an area remote from a water supply. Metal moulds for surplus metals also require preheating.

(5) Metals should be melted in graphite or coated metal crucibles used in a suitable crucible furnace. Under no circumstances should aluminium alloys be melted in a plain iron pot. The use of brazing and smiths' hearths for the melting of such metals should not be allowed because of the dangers involved.

(6) Moulding boxes made of wood or light alloy are preferable to those made of iron. It is, however, essential in all instances that such boxes be adequately weighted whilst pouring.

(7) Before use all crucibles should be closely examined for cracks, splits or broken coating and should always be preheated.

(8) Scrap aluminium may also contain magnesium and for that reason its use should be discouraged.

(9) The crucible handles or tongs must be of good fit.

(10) All temperature checks should be by means of a pyrometer, the thermo-couple of which should be preheated before plunging in the metal. The sheath of the pyrometer should be of adequate length. Guesswork methods should not be used.

(11) It is desirable that, when pouring, the moulding box should be adjacent to the furnace. The mould should be placed at floor level on dry sand which should also form a dam round it in case of spilled metal whilst pouring is in progress.

(12) Pouring should only take place either by or under the direct supervision of a competent teacher and a clear space around the center of operations should be insisted upon. The crucible should be rested on sand after pouring, not on a stone or concrete floor.

(13) During the whole of the pouring operation spats or gaiters, special visors, heat-resistant gloves and a full length leather apron should be worn by any persons concerned with the pouring of the molten metal and any other persons including spectators should be kept at a safe distance.

7. Muffle Furnace Practice

(1) The installation should comply with the requirements of the gas supply company and Electrical & Mechanical Services Department.

(2) It is essential that gases generated during the process be discharged outside the building by efficient ventilation.

(3) Boxes used for heat treatment should be properly constructed of welded steel. Adequate provision should be made for removing the boxes from furnaces with suitable lifting or transfer devices and for placing them in a safe position.

(4) Temperatures should always be checked by pyrometer readings and never by guesswork.

8. Air Receiver

(1) It is important that an air receiver, i.e. a container for compressed air, be of good construction, sound material and of adequate strength. "Homemade" or improvised receivers must under no circumstances be used.

(2) Receivers should be installed outside the workshop whenever possible.

(3) No air receiver may be operated unless it is registered with the Labour Department and the requirements of the relevant ordinance and regulations must be strictly observed.

(4) The Safe Working Pressure (SWP) should be clearly marked and the receiver should be fitted with a suitable pressure gauge, safety valve and appliance for draining any condensate from the receiver. It should also be provided with an adequately sized opening to permit the receiver to be cleaned and to be thoroughly examined.

(5) Each receiver should be cleaned and examined by a competent person at least once in every two years and records of these examinations should be kept.

(6) A suitable reducing valve should be fitted in the supply line if the air pressure delivered by the compressor can exceed the Safe Working Pressure of the receiver.

(7) Water in the receiver should be drained at least once per week and the drain valve for this purpose should be readily accessible.

(8) Attention should be drawn to the danger associated with the use of compressed air and there should be rigid supervision to prevent "sky-larking" with air hoses, etc..

9. Pickling and Etching

(1) The use of a hot pickling bath is exceptional and can only be justified in special circumstances and when proper equipment is provided.

- (2) The pickling or etching bath should stand in an acid resistant tray, and should be situated as close as possible to the rinsing tank or sink. Troughs containing pickling or etching liquid should not be carried about the workshop.
- (3) The pickling or etching bath may be sited at bench level or at low level. If above floor level the lip of the bath should be approximately at bench level. If at low level, it should be so situated that accidental kicking of the bath or splashing of the acid is avoided. Protective goggles should be worn or a screen should be used because of danger to the eyes from accidental splashing.
- (4) The liquid contents should never be removed from the bath by an unauthorized person, and never be used for any purpose other than its proper use.
- (5) Acid solutions for pickling or etching should be made up by the teacher or workshop instructor, never by the pupils. When these solutions are made up water must always be put into the container first, the acid being carefully added as required. Water must never be added to the concentrated acid.
- (6) All chemicals should be in correctly labelled containers, and should be kept locked in a cupboard, the key retained by the teacher or workshop instructor. No more chemicals should be kept in the working area than is necessary.
- (7) All pupils should be instructed regarding the hazards arising from corrosive chemicals and precautions to be observed on their handling and use.
- (8) Pickling of hot metal is not recommended because of the danger from spitting acid.
- (9) Wearing of canvas shoes, sandals or shoes with openings at the toes or heels must be forbidden when using corrosive liquids. Anti-corrosive gloves should be worn wherever possible.
- (10) Any chemical splashes on the skin must be treated immediately by copious rinsing with water. Chemical splashes in the eyes should be treated by copious washing with clean water and medical attention should be obtained immediately.
- (11) All persons must wash their hands after completing their work.
- (12) Pickling or etching solutions should be rendered inactive by neutralizing agents such as slaked lime. They should then be disposed of in accordance with the Circular on Chemical Wastes (see Appendix D).
- (13) Reference should be made to Education Bureau publication "*Handbook on Safety in Science Laboratories*".

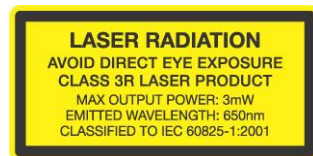
10. Laser Cutter

(1) Potential hazards of laser cutters are:

- (a) Eye and skin injuries;
- (b) High voltage stored in capacitors after the equipment is switched-off;
- (c) High voltage during operation;
- (d) Atmospheric contamination arising from vaporised targets; and
- (e) Associated fire hazards.

(2) Appropriate safety precautions should be taken when laser cutters are used in schools.

- (a) The teacher appointed as a Designated Laser Safety Officer must draw up a list of safety rules and operating procedures, and ensure that these are observed when the laser cutters are used.
- (b) Designate a Laser Controlled Area for the laser cutters.
- (c) Ensure that proper explanatory and warning labels are affixed to the laser cutters. When a laser is in operation, warning signs should be displayed in conspicuous locations both inside and outside the working area and on doors giving access to the area. Some examples of warning signs are shown below:



Explanatory Label (sample)



Warning Label (sample)

- (d) Prevent electrical shock (Please refer to the section on 'Electrical Safety').
- (e) Provide local exhaust system with opening close to the fume origin.
- (f) Provide appropriate fire fighting equipment.
- (g) Users are allowed to operate laser cutters provided that they have been trained in the equipment operation and laser safety.
- (h) Never view directly into a laser beam and any part of the skin should not be exposed to the direct beam..
- (i) Wear suitable protective goggles and clothing when operating or servicing laser cutters.
- (j) Specular reflective surface are avoided.
- (k) Do not use heat sensitive surfaces or other materials that may produce toxic substances.
- (l) Ensure that a totally enclosed system of the laser beam including the associated interlocks are fully effective before putting the laser cutters to use.
- (m) Follow the guidelines listed in the operation manuals of laser cutters.
- (n) Employ qualified or trained personnel for the maintenance or repair of laser cutters.

- (o) Any accidental exposure or even suspicion of exposure of the eyes to laser beam should be reported and medical treatment should be sought at once.
- (3) For further information, teachers should refer to the publications of the Electrical and Mechanical Services Department as listed below:
- Safety Guidelines for Laser Products
 - Laser Safety Guidance Notes for Industry, Display and Entertainment

11. 3D Printer

(1) General safety precautions:

- (a) 3D printers should be installed in a room equipped with an exhaust system to maintain indoor air circulation when using.
- (b) 3D printers should be operated under the guidance of qualified personnel and specified printing materials should be used.
- (c) Should not put any part of the body into a 3D printer while printing.
- (d) If the post-printing process requires the use of corrosive solution to dissolve the support material, wear protective gloves and safety goggles together with suitable protective clothing when processing.
- (e) Follow the guidelines listed in the operation manual of 3D printers.
- (f) Maintenance and repair of 3D printers should be conducted by qualified or trained personnel.

(2) Specific safety precautions for several types of commonly used 3D forming technology:

- (a) Fused Deposition Modelling (FDM)
 - i. Some printing materials (such as ABS plastics) will release toxic gases and volatile organic compounds when heated. If a 3D printer without enclosed casing is used, additional independent exhaust devices should be installed.
 - ii. Do not touch the hot extruder and heat bed to avoid being burned at high temperature
- (b) Binder Jetting (BJ)
 - i. Dust masks should be worn to prevent inhalation of powder. Wear suitable protective clothing and safety goggles.
- (c) Stereo Lithography Apparatus (SLA)
 - i. Good washing facilities should be available in the workplace to maintain a high level of cleanliness.
 - ii. When handling uncured resin, wear protective gloves or apply barrier cream, and use suitable tools to avoid contact with the skin. Dust masks, suitable protective clothing and safety goggles should be worn.
 - iii. When the skin is contaminated with resin, rinse immediately with clean water and soap. Do not use ketone or chlorinate solvents to clean.
 - iv. When handling resins with flammable solvents such as alcohol, do not

- get close to any sources of ignition.
- v. When using an ultraviolet lamp, do not look at the ultraviolet light for a long period to avoid damage of eyes.

SECTION 10

SURFACE FINISHING OF METALS

Surface finishing of metals in school workshops should be restricted to simple processes. Finishing processes, such as electroplating, anodizing and vitreous enamelling, which involve toxic hazards, should not normally be carried out in schools. Where such processes are demonstrated, however, the following precautions must be observed:-

1. Electroplating

- (1) Placards drawing attention to precautions in the use of cyanide and chromic acid should be kept posted in any area where these are used.
- (2) As far as practicable processes known to produce hazardous conditions should be segregated and removed from other processes or activities. All chrome-plating tanks should be provided with an efficient mechanical exhaust system which will remove vapour and spray given off from the process. Vapour exhausted from the tanks should be discharged to open air.
- (3) Floors and walls around plating tanks must be kept as clean and dry as possible and should be constructed of impervious material. Suitable drainage arrangements should be provided.
- (4) Provision must be made for washing hands frequently and splashes of any plating solutions or chemicals on the skin should be washed off at once.
- (5) There must be immediate first aid for cuts, scratches or skin infection, no matter how slight. No person with such ailments shall be employed on any plating process.
- (6) Splashes in the eyes should immediately be irrigated copiously with water and medical attention obtained.
- (7) Foodstuffs of any kind must not be taken into any areas where electroplating is being carried out and drinking vessels must not be kept there.
- (8) Electrical repairs and adjustments must only be dealt with by a competent electrician.
- (9) Protective clothing in the form of PVC or rubber gloves, aprons and footwear should be worn for work at plating baths.
- (10) Good general ventilation should always be provided in areas where electroplating is being carried out.

2. Anodizing

If anodizing is carried out using chromic acid solutions, the operations should be conducted in a place completely separated from other working areas. If sulphuric acid is used, there may be some emission of acid mist from the solution during anodizing. This is irritant by nature but is not likely to be troublesome in small scale anodizing if carried out under conditions of good general ventilation or if the anodizing bath is kept covered during processing.

3. Vitreous Enamelling

Vitreous enamels often contain toxic compounds and if possible the more toxic of these, e.g. those containing lead, should be avoided. If they are used the working areas should be kept scrupulously clean, personal hygiene should be of a high order and, unless manipulation and usage are only very small or occasional, exhaust ventilation should be provided to prevent any vitreous enamel dust becoming airborne, or gases and fumes generated in the muffle furnace from entering the workshop.

4. Cellulose and Other Paint Spraying

- (1) Cellulose or any other paint spraying process should not be carried out in schools, except in mechanically exhausted spray cabinets built of steel or other fire resisting materials.
- (2) All electrical equipment liable to be exposed to inflammable concentrations of vapour should be of flameproof construction.
- (3) Limited cellulose spraying can take place out of doors, but this should not be a regular part of the syllabus.

SECTION 11

GLASS FIBRE

The precautions to be taken are divided into three sections as follows:-

1. Dermatitis

(1) The dermatitis risk arises from the use of epoxy resins. Good washing facilities should be available to enable a high standard of cleanliness to be achieved. Resin contamination on the skin should be washed off at once. The use of protective gloves or suitable barrier creams will provide some measure of protection.

(2) Glass fibre can also be very irritating to the skin and is best removed by a stream of tap water. The skin should never be rubbed or penetration may take place.

2. Toxic Hazard

(1) The solvent normally used for glass fibre resin is styrene and it is the styrene vapour formed on evaporation which constitutes the main toxic hazard. It should be noted that this vapour is also an extreme fire hazard.

(2) If the construction of the glass fibre article is carried out in an exhaust fume cupboard the styrene vapour hazard should be eliminated. This however is not normally practicable and constructions are usually carried out in the open workshop. Small articles, provided that not too many are made at the same time and that they are made in a well ventilated workshop, normally produce concentrations of styrene vapour in air well below the ceiling value of 100 parts per million. (The ceiling value is the concentration of styrene vapour in air which should not be exceeded at any one time).

(3) When assessing the hazard from styrene vapour the following three factors should be taken into account:-

(a) Temperature. During hot weather the evaporation rate is greater and general ventilation should be increased, i.e. by opening all available doors and windows.

(b) The extent of the surface area of the resin being applied.

(c) General ventilation. A workroom with poor general ventilation is unsuitable. The rate of ventilation should be of the order of 6-8 air changes per hour. Inhalation of excessive quantities of vapour may have delayed reactions which are not immediately apparent.

(4) Boat construction is a common use for glass fibre. During this type of work the styrene vapour tends to collect inside the hull of the boat when the glass fibre is being laid with resin. If the breathing zone of the operator is inside the hull he is likely to be exposed to styrene fumes in excess of the ceiling value. Some form of forced ventilation is usually necessary in these circumstances either by blowing air into, or exhausting air from the hull of the boat. Where a large boat is under construction it is sometimes necessary to use both forms of ventilation, at opposite ends of the boat.

(5) The aromatic hydrocarbon odour of styrene can be detected at concentrations well below the ceiling value, at which level it smells quite strongly. At concentrations of 250-300 p.p.m. it is irritant and often causes watering of the eyes, but this depends to a certain extent on personal susceptibility.

3. Fire and Explosion Hazards

(1) Polyester or polyether with styrene both represent fire risks but their flash points are above normal ambient temperatures. Due to the danger of mixing accelerator and catalyst it is urged that a pre-accelerated resin be used to avoid explosion hazards. The danger occurs when the resins (Polyesters) require the adding of an accelerator. This must always be added to the resin before the catalyst is added, otherwise the wrong chemical reaction takes place, which could be hazardous. The main fire risk in this process is where volatile solvents, e.g. acetone or methyl ethyl ketone, are used for cleaning tools, moulds, etc. Partially cured resins can be cleaned from tools with special detergent solutions developed for this purpose.

(2) Organic peroxides are often used as catalysts for curing resins incorporated in glass fibre fabrications. These catalysts must generally be regarded as unstable substances which under certain conditions are liable to undergo rapid decomposition resulting in fire and possible explosion, especially if confined. The action of the peroxides is usually enhanced by the addition of an accelerator, usually a cobalt or manganese salt. Catalyst and accelerator should never be mixed together without the diluting effect of the resin or other additive. These should be dispensed using separate clean utensils which should be kept for that sole purpose to avoid confusion.

(3) Gross spillage of liquid peroxide preparations should be covered with sand, vermiculite or similar non-combustible absorbent material which should then be removed to open ground to burn off the peroxide. Rags should not be used for this purpose, but small spillage on work benches cannot be dealt with as described and rags must be used; these should then be isolated and destroyed by burning. On no account should the same rag be used to clean up miscellaneous spillage as this may result in contamination of the rag with both peroxide and accelerator.

(4) Organic peroxides should be stored in such a manner that they are protected against:

- (a) Heat, shock, frictional forces, flammable materials and all sources of ignition,
- (b) Contamination with accelerators, amines, heavy metal salts, concentrated acids and alkalis.

(5) The method of disposal of surplus resins is of considerable importance. These should be spread out over a large safe area to prevent heat generation and to avoid a possible fire.

SECTION 12

PLASTICS

1. Materials

- (1) It is essential that safety precautions be observed to avoid possible hazards that may arise in the manipulation and storage of plastic materials.
- (2) Instructions and warnings concerning specific hazards associated with particular materials and items of equipment issued by manufacturers should be followed scrupulously. Many plastic materials give rise to dust and fine particles when they are being sanded. Hand methods of abrading materials are advised; water should be used as a lubricant wherever possible to minimize heat and dust generated.
- (3) Harmful gases or vapour may be produced from the evaporation of solvents and cements. Work with plastics should be undertaken in adequately ventilated area.
- (4) Storage of large quantities of catalysts, resins, solvents and plastic materials will increase fire hazards and should be avoided.

2. Equipment

- (1) Ovens used for heating thermoplastic sheet materials should be thermostatically controlled at a temperature below the decomposition temperature of the plastic materials to be heated. These heated materials should be handled with care, and heat-resistant gloves should be used.
- (2) The cutting of expanded polystyrene by means of a hot wire cutter generates styrene fumes. The temperature of the wire should be controlled at the lowest possible temperature to enable cutting freely. If smoke is given off, it indicates the temperature is too high. The cutting of expanded polystyrene by a hot wire cutter should only be done in a well ventilated area.
- (3) Strip heater used for bending thermoplastic or acrylic sheet should be shielded to prevent the plastic sheet coming into contact with the heating element. The strip heater should be thermostatically controlled to prevent overheating.
- (4) Vacuum forming machine used for heating of plastic sheet may generate poisonous fumes and therefore care should be taken not to overheat the plastic sheet being vacuum formed.
- (5) Dip-coating unit should be installed in a well ventilated area. It is important that when operating the unit, the use of excessive quantity of powdered plastics in the reservoir should be avoided. The article to be coated should be heated to an appropriate temperature as overheating may generate harmful fume during the dip-coating process.

SECTION 13

PORTABLE POWER TOOLS

1. Types

As a general rule pupils are not allowed to use electric powered hand tools unless the teacher is satisfied that the pupils are competent to use them. If electric powered hand tools are used they should be of single purpose type, of robust construction, suitable for the purpose for which they will be employed. Power units for use with a variety of attachments should not be used in school workshops.

2. Flexible Cables

(1) Hand held tools should be provided with a non-detachable flexible power cable, and the flexible cable should incorporate an earth continuity conductor for permanently and reliably connecting to the earthing contact or terminal of the appliance. Some hand held tools of the double-insulated type can be used without an earthing lead, but double-insulated tools with provision for earthing should be fitted with an earthing lead as previously stated. Suitable plugs, preferably of the unbreakable rubber type, should be reliably connected to the flexible cable.

(2) Power cables to hand held tools should be kept as short as practicable to avoid a possible trip hazard from the trailing cable, and also to obviate possible damage to the cable caused by objects being dropped upon it. Where, because of the distance from the installed outlet, it is absolutely necessary for a fairly lengthy cable to be used, this should be run at high level, dropping down at the working position. With long cables the matter of voltage drop should be kept in mind. Multiple outlet adaptors should not be used under any circumstances.

3. Drill

Portable drills should be marked according to duty, together with the maximum diameter of the drill bit for which they are intended. In addition, chuck keys should not be fitted to the power cable by a metal attachment.

4. Electric

All electrical equipment in school workshop should be bonded to earth unless it is double-insulated. In either case, the electrical equipment should be fitted with a 13-A 3-pin rectangular plug, appropriately fused and complying with the current British Standard Specification. Any form of 2-pin plug should not be used.

SECTION 14

HANDLING OF CHEMICAL WASTES

With effect from May 1993, secondary schools with science laboratories and/or technical subjects workshops are required to comply with the Waste Disposal (Chemical Waste) (General) Regulation of the Waste Disposal Ordinance (Cap. 354) with respect to the registration as chemical waste producers; and the storage and disposal of chemical wastes (see EDB Circular No.1/1998B on CONTROL OF CHEMICAL WASTES IN SECONDARY SCHOOLS).

1. Spent Chemical Mixtures

(1) The waste collector will initially provide a set of four 20-litre plastic/steel pails (see Appendix D). These are for storage of spent:

halo-solvent
acid, FeCl₃, etchant
acid, HNO₃, etchant
engine oil

Additional pails will be made available as and when necessary (e.g. for schools with technical subject workshops that generate large volume of spent solvents or spent chemicals that require special treatment).

(2) These pails are delivered with completed chemical waste labels and colour dot labels. The colour dot label is for easy identification of wastes, e.g.

<u>Chemicals</u>	<u>Types of Hazards</u>	<u>Colour Dot Label</u>
Spent halo-solvent	Flammable, harmful	Violet
Spent acid, FeCl ₃ , etchant	Corrosive	Yellow
Spent acid, HNO ₃ , etchant	Irritant	Orange
Spent engine oil	Flammable	Burgundy

(3) A log sheet will be used as a record of the wastes being put into each pail. Every waste entering the pail must be properly logged by the chemical waste manager of the school. The filled log sheet must accompany the pail at time of collection.

(4) Spent chemicals containing the followings should never be mixed with, other chemical waste: highly reactive compounds, water reactive compounds, concentrated strong oxidizing or reducing agents. They should be stored separately in smaller bottles. These bottles should bear an individual log sheet, be labelled and stored.

(5) If the chemical waste manager has any doubt on mixing a new waste into a pail, then the waste should be stored in bottles separately.

(6) Chemical waste pails should always be stored in stainless steel (for organic wastes) or plastic (for inorganic wastes) catch trays, and be placed inside the storage cabinet.

(7) The chemical waste summary report is to be filled in and faxed to the waste collector when collection service is needed.

(8) According to the information provided, the trip ticket in triplicate will be issued for each collection. Upon collection, the chemical waste manager will retain one copy of the trip ticket.

2. Surplus or Expired Chemicals

(1) Leave chemical in original packing and label. If the original packing is not in good condition and presents a risk of leakage, wrap and seal the bottle in a polyethylene (FE) plastic bag, or other overpack of compatible nature.

(2) On each bottle, attach a second label bearing the following items: (i) name of school, (ii) name and contact telephone number of the person-in-charge, (iii) chemical name, (iv) quantities, (v) particular risks and safety precautions.

(3) Store these chemicals in stainless steel (for organic wastes) or plastic (for inorganic wastes) catch trays in chemical waste storage cabinet.

3. Spillage/Leakage of Liquid Waste

(1) Where the spillage/leakage is contained in the enclosed storage area, the waste can be transferred back into suitable containers by suitable handheld equipment, such as hand operated pumps, scoops or shovel. If the spillage/leakage quantity is small, it can be covered and mixed with suitable absorbing materials such as tissue paper, dry soft sand or vermiculite. The resultant slurry should be treated as chemical waste and transferred to suitable containers for disposal.

(2) For spillage/leakage in other areas, immediate action is required to contain the spillage/leakage. Suitable liquid absorbing materials such as tissue paper, dry soft sand or vermiculite should be used to cover the spill. The resultant slurry should be treated as chemical waste and transferred into containers for proper disposal.

4. Emergency Procedures due to Spillage, Leakage or Accidents

(1) Instruct untrained personnel to keep at a safe distance well away from the spillage area.

(2) If necessary, open windows, provide forced ventilation and close the door/doors of the room where the spillage or leakage took place.

(3) If the spillage or leakage involves highly toxic, volatile or hazardous waste, initiate emergency evacuation and call the emergency service.

(4) Only trained persons equipped with suitable protective clothing and equipment should be allowed to enter and clean up the waste spillage or leakage.

SECTION 15

WORKING WITH COMPUTERS

(1) With the advancement of information technology, computer related activities are widely conducted in school workshops. Users are reminded that regular and repetitive actions in operating computers may cause repetitive strain injuries and/or visual fatigue if a proper working posture has not been adopted.

(2) To avoid potential health risk, teachers have to consider the environmental factors in the school workshops, such as lighting condition, computer workstation design, and working posture in the workshop.

- (a) A workstation including the desk or display support, support for keyboard and mouse or other input device, and the chair should permit the users to adopt a healthy, comfortable posture without overloading the musculo-skeletal system.
- (b) The screen should give a clear, sharp, and steady image.
- (c) The room should have appropriate lighting level for the computer work area. Reflections and glare from the screens should be avoided.
- (d) During the activity, an occasional change of work postures for exercising different parts of the body or appropriate rest breaks are recommended.

(3) Further details are available as follows:

- “Healthy Use of Computers in the Classroom” which is available at the Education Bureau IT in Education webpage at <http://www.edb.gov.hk/index.aspx?langno=1&nodeID=7287>
- “A Guide to work with Computer” which is available at the Labour Department webpage at http://www.labour.gov.hk/eng/public/content2_9.htm
- “A Health Guide on Working with Display Screen Equipment” which is available at the Labour Department webpage at http://www.labour.gov.hk/eng/public/content2_9.htm

List of Contents to be included in the First Aid Cabinet

1. First aid box content list
2. Disposable plastic/vinyl gloves
3. Antiseptics, e.g. Salvon, tincture of iodine
4. Cotton wool
5. Forceps
6. Scissors
7. Sterile adhesive dressings (of different sizes)
8. Sterile dressing/gauze
9. Adhesive tapes
10. Bandages (of different sizes)
11. Safety pins
12. Triangular bandages
13. Sterile eye pad

Note:

- All the medicines should be labelled properly.
- The contents should be checked regularly to see if any refill is needed.
- The expiry date of medicine should be checked so that replacements can be made accordingly.

Prevention of Blood-borne Diseases in Schools

Apart from providing pupils with information on the nature of blood-borne diseases and their prevention, teachers should practise the following:

1. Always dress any wound.
2. Avoid direct contact with blood.
3. Wear disposable plastic gloves when handling wounds.
4. If direct contact with blood, tissues or tissue fluids has occurred, wash promptly and thoroughly with soap and water. Seek medical attention.
5. Teach pupils how to handle sharp objects properly at all times.
6. Equip the first aid box with cotton wool, gauze, forceps, disposable plastic gloves, antiseptic, etc., for emergency use.
7. Avoid actions which may lead to infections.
8. Seek medical advice in case of doubt.

Note:

For further information, teachers should refer to the pamphlet - GUIDELINES ON THE PREVENTION OF BLOOD-BORNE DISEASES IN SCHOOLS - which was compiled jointly by the Medical and Health Department and the former Education Department in 1994.

How to Handle Gas Leakage

If you smell Towngas/LP gas or suspect that there is a gas leak, you must take the following actions immediately:-

1. Extinguish all naked flames, and do not use matches.
2. Turn off the whole supply at the gas main control valve in the workshop/laboratory.
3. Open all doors and windows in the workshop/laboratory to get rid of gas.
4. Do not operate any electrical switches - whether on or off. Do not use the telephone.
5. Check all related equipment, e.g. 2-way gas taps, brazing hearth, to see if gas supply to such equipment is/are left on accidentally.
6. Leave the workshop/laboratory; and at a safe place telephone the Maintenance Service Centre of the gas company concerned.
7. **DO NOT TURN ON THE GAS UNTIL THE GAS LEAK HAS BEEN REPAIRED.**

Chemical Wastes Generated in School Workshops

1. The following liquid wastes are commonly generated in the school workshops. They are classified by the Waste Collector into four categories:-

- (a) Spent Halo-solvent
Enamel paints, brushing lacquer, cellulose thinner, turpentine, methylated spirit, shellac, chloroform, kerosene, acetone
- (b) Spent Acid, FeCl₃, Etchant
Ferric Chloride : Water = 1 : 10
Hydrochloric Acid 20%
- (c) Spent Acid, HNO₃, Etchant
Nitric Acid 20%
- (d) Spent Engine Oil
Engine Oil

2. The following examples are NOT regarded as chemical wastes:-

- (a) Neutralised salts that do not contain compounds listed in the Schedule of Substances and Chemicals*.
- (b) Apparatus rinse water and wiping tissue with low chemical contents.
- (c) Elemental heavy metals in stable form (e.g. lead, copper, chromium, nickel).
- (d) Household chemicals used in laboratories for cleaning (e.g. soap, detergents).
- (e) Dilute acids & alkalis with concentration below those stipulated in the Schedule of Substances and Chemicals*.

* See Annex I of EDB Circular No.1/1998B

Related Guidelines and Webpages

1. Managing Occupational Safety and Health in Schools
<https://www.labour.gov.hk/eng/public/os/D/school.pdf>
2. Occupational Safety and Health in Schools
[https://www.labour.gov.hk/eng/public/oh/Occupational Safety and Health in Schools_eng.pdf](https://www.labour.gov.hk/eng/public/oh/Occupational_Safety_and_Health_in_Schools_eng.pdf)
3. Occupational Safety and Health Ordinance
<https://www.elegislation.gov.hk/hk/cap509>