Health and Safety Training in Design and Technology

Design and Technology Association

SPECIALIST EXTENSION LEVEL S10HS Grinding and Sharpening

Grinding and Sharpening

Forename: _____ Surname: _____

School / College / Institution_____

Course date: / /

These Training and Accreditation Guidelines are based on the following essential publications:

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- Health and Safety Training Standards in Design & Technology: D&T Association
- BS 4163:2014 BRITISH STANDARD Health and safety for design and technology in educational and similar establishments – Code of practice
- Model Risk Assessments for D&T in Secondary Schools and Colleges: CLEAPSS

Please tick against each of the standards below to confirm your knowledge, skills and understanding and that you have completed Assessment Tasks 1 and 2. The RDTHSC/Trainer will sign and date this form on successful completion of the tasks

Colleagues must be able to demonstrate, through practical activities, their capability using grinding and sharpening equipment, and their knowledge and understanding of:	
1. The types of grinding machines that can be safely used in school workshops, with reference to start/stop controls, methods of guarding, adjustment of work rests and spark arrestors, including: bench/pedestal grinding machines, horizontal grinding machines, wet grinding machines and drill bit sharpening machines	☐
2. The types and grading of bench stones that can be used to sharpen hand and machine tools	☐
3. HSE publication HSG 17, Safety in the use of Abrasive Wheels, revised in line with the Provision and Use of Work Equipment Regulations 1998 (PUWER 98)	☐
4. The hazards and risks arising from the use of abrasive wheels and the precautions to be observed. Abrasive wheels should only be mounted by appropriately trained and accredited colleagues	☐
5. Methods of marking abrasive wheels with their type, expiry date, size and maximum operating speed and the functions of all the components used with abrasive wheels such as flanges, blotters, bushes, nuts	☐
6. How to: assemble abrasive wheels correctly to make sure they are properly balanced and fit to use; store handle and transport abrasive wheels; inspect and test abrasive wheels for damage	☐
7. Appropriate methods of dressing abrasive wheels	☐
8. Safe working procedures for each piece of grinding equipment, including the use of grinding jigs	☐
9. The use of a range of bench stones, including an understanding of sharpening angles and the use of honing guides	☐
10. The use of suitable personal protective equipment, for example eye protection	☐
11. The requirements for routine maintenance as required by legislation and recommended by the manufacturer of the equipment. Identification of defects and the procedures for dealing with them. The use of maintenance logs	☐

RDTHSC/Trainer signature:_____

Date: _____

Colleagues must demonstrate their theoretical and practical knowledge, skills and understanding of the use of grinding and sharpening machinery and equipment in school workshops by completing the following assessment tasks. Please tick in the appropriate column(s) to confirm your knowledge and understanding and that you have completed the practical tasks set

Assessment Task 1
Knowledge and Understanding

1. The types of grinding machines that can be safely used in school workshops, with reference to start/stop controls, methods of guarding, adjustment of work rests and spark arrestors, including: bench/pedestal grinding machines, horizontal grinding machines, wet grinding machines and drill bit sharpening machines

Know that:

- The machines must be provided with:
  A means of electrical isolation using a fused switch-disconnector on or adjacent to the machine, controlled by a starter incorporating overload protection and no-volt release
  A conveniently positioned and accessible, stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency
- Off-hand grinding machines must be fitted with a suitable guard to enclose the wheels and spindles. The risk of a burst is inherent in every abrasive wheel. The guard should contain the wheel parts in the event of a burst and prevent the operator from coming into contact with the wheel. The guard should contain debris from grinding. The only gap in the guard should be at the front to allow access for the work piece
- Appropriate eye screens should be fitted to off-hand grinding machines to intercept sparks and particles
- The work rest on off-hand grinding machines should be adjusted as close as possible to the wheel to prevent the workpiece getting between the wheel and the rest, causing jamming, break-up of the wheel and possible injury to colleagues. The gap between the work rest and wheel should not exceed 3mm
- Adjustments to work rests should be made only when the grinding wheel is stationary and the isolator switch is in the 'off' position. Work rests should be examined periodically and maintained in good condition
- Some off-hand grinding machines have a work rest at the side of the wheel which allows the dangerous practice of side grinding. The use of work rests in this manner can cause the wheel to burst or break after being weakened by grooves worn in the side
- Spark arrester(s), where fitted, should be adjusted correctly
- Bench/pedestal off-hand grinding machines normally run at around 2850 rpm. To sharpen wood working tools, a slow running off-hand grinder, typically 1425rpm, is preferable to minimise the chance of overheating the tool and drawing the temper of the steel. The low-speed horizontal grinding machines and wet grinding machines used to sharpen woodworking tools almost eliminate the risk of overheating the edge of tools ☐

2. The types and grading of bench stones that can be used to sharpen hand and machine tools

Know that:

- A variety of types of bench stones can be used for sharpening or honing tools to form a cutting edge, including diamond stones, oil stones and water stones ☐

3. HSE publication HSG 17, Safety in the use of Abrasive Wheels, revised in line with the Provision and Use of Work Equipment Regulations 1998 (PUWER 98)

Know the key documents which covers the safe use of abrasive wheels in school workshops, i.e.

- PUWER 98, Approved Code of Practice and Guidance L22, covers the selection and use of work equipment in general and revoked the remaining provisions of the Abrasive Wheels Regulations 1970 which dealt with the training, competence and appointment of people to mount abrasive wheels. HSG 17 now expands on how the general requirements of PUWER 98 relate to abrasive wheels

- HSE publication HSG 17, Safety in the use of Abrasive Wheels, is available at http://www.hse.gov.uk/pubns/books/hsg17.htm

4. The hazards and risks arising from the use of abrasive wheels and the precautions to be observed. Abrasive wheels should only be mounted by appropriately trained and accredited colleagues

Know that:

- Accident statistics show that nearly half of accidents involving abrasive wheels are due to an unsafe system of work or operator error
- Overspeeding, damaged or incorrectly mounted abrasive wheels can break while rotating and be violently ejected from the grinding machine
- Contact with the wheel can cause cuts or abrasions
- Long hair, dangling jewellery or loose clothing can become entangled with the rotating wheel or spindle, dragging the user onto it
- Work pieces can be ejected violently from the machine if not held correctly
- Fingers or work pieces can become jammed between the wheel and rest
- Hot work pieces can cause burns
- Grinding machines can present a hazard of electric shock
- Sharp edges can cause cuts
- Inadvertent starting of the machine can present a hazard
- Abrasive material from wheels and fine particles of ground material are irritating to the eyes and to the respiratory system
- There should be sufficient space around grinding machines to ensure that the user is not pushed into the machine by a passer-by and the floor surface should not be slippery to avoid accidental slips while using the machines
- Wheels should be suitable for the material of the work piece and should be mounted correctly in accordance with the manufacturer's instructions
- The changing of abrasive wheels is a hazardous activity and should only be carried out by a competent person who has had relevant specialist training
- The HSE recommends that a record of those trained in the safe mounting of abrasive wheels should be kept, recording the trainee's name and the date of training. Successful completion and accreditation of S10HS Grinding and Sharpening provides appropriate evidence of meeting this recommendation

5. Methods of marking abrasive wheels with their type, expiry date, size and maximum operating speed and the functions of all the components used with abrasive wheels such as flanges, blotters, bushes, nuts

Know that:

- A range of grinding wheels can be fitted to off-hand grinding machines to match specific applications: e.g. carborundum wheels – suitable for general grinding of steel, aluminium oxide wheels – suitable for general tool sharpening, and silicon carbide wheels – suitable for sharpening TCT tools
- Selecting the correct wheel for the job is essential for safety. A grinding wheel may be dangerous if used for an application for which it is not intended
- The maximum speed of the spindle should be marked on every grinding machine. The speed marked on the wheel must be compatible with the speed of the machine spindle. Overspeeding is one of the main causes of wheel breakage
- The speed marked on the machine therefore should not exceed the speed marked on the wheel, blotter or identification label
- When ordering a new wheel, the most important factors are: wheel dimensions (i.e. diameter, bore and width), the speed of the machine or spindle on which the wheel is to be mounted, the type of grinding machine and the type of wheel to match the material to be ground or cut
- All organic bonded wheels for portable grinders have a shelf life and a use-by date 3 years from manufacture marked on the wheels

- Abrasive wheel are normally mounted between flanges at least one third of the diameter of the wheel
- Flanges should be of equal diameter and have the same recess diameter to create equal bearing surfaces on the wheel
- The bearing surfaces of flanges should be machined true and free from burrs
- The inner (driving) flange should be keyed, screwed, shrunk or otherwise secured to the spindle to prevent rotation, and the bearing surface should run true with the spindle
- The spindle should be long enough and threaded to a sufficient length to ensure that when the wheel and flanges are mounted, there will be enough thread for full engagement of the nut on the spindle. The thread should extend inside the flange but not into the hole in the wheel
- When the wheel is secured by means of a single central spindle nut, the thread should be such that the direction of tightening the nut is opposite to the direction of rotation of the wheel to ensure that the nut will not come loose as the wheel rotates
- Blotters of compressible material, usually cardboard not less than 0.2 mm thick and not more than 1.0 mm, as supplied by the wheel or machine manufacturer, should be used between the wheels and their flanges. The main purpose of blotters is to distribute the clamping force of the flanges evenly on the wheel, but they also prevent slipping at lower clamping forces and reduce wear on flanges. Blotters should be an easy fit on the spindle and should be slightly larger than the flanges
- Bushes are used to reduce the hole size in an abrasive wheel so that it can be mounted correctly on a small diameter spindle. Bushes should be hand-pressed into the hole of the wheel. They should be slightly less than the width of the wheel and blotters. Care should be taken to ensure that the bearing area of the flange is in contact with the wheel and not the bush

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6. How to: assemble abrasive wheels correctly to make sure they are properly balanced and fit to use; store handle and transport abrasive wheels; inspect and test abrasive wheels for damage (See also Assessment Task 2 below)

Know:

- How to store wheels, i.e. in suitable racks in a dry room, marked with the date they are received from the supplier, inorganic bonded wheels on their edges, organic bonded wheels laid flat
- Before mounting, all wheels should be closely inspected to ensure that they have not been damaged in storage or transit
- How to examine wheels, i.e. checking the soundness of inorganic bonded wheels using the 'ring' test and that if the wheel sounds dead, for example due to cracking, it should not be used
- The danger of an abrasive wheel bursting is considerably increased if it is not properly mounted
- The major stresses produced in an abrasive wheel under operating conditions tend to become greatest near the hole. It is therefore important that stresses due to mounting and driving are as far from the hole as practicable. This is done by recessing the side of the flange next to the wheel
- The abrasive wheel should fit freely but not loosely on the spindle. If it grips the spindle or flange location diameter, heat generated during the grinding operation could cause the spindle to expand and possibly crack the wheel
- Where the wheel is clamped by means of a single central nut, the nut should be tightened only enough to ensure that the flanges drive the wheel and prevent slip, by hand pressure on a spanner. Excessive clamping pressure may damage the wheel
- Before the wheel is run, the guard and spark arrestor should be properly adjusted and secured. If the machine is fitted with a work rest, it should be adjusted as close as possible to the wheel and the wheel should then be rotated by hand to ensure that it is clear all the way round
- New or re-fitted wheels should be run free at full operational speed for a short period before they are used, and during the trial run everyone should stand clear

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7. Appropriate methods of dressing abrasive wheels	
Know that: • A wheel 'out-of-round' will cause excessive vibration and periodic knocking of the work against the wheel. This can result in damage to the abrasive wheel surface, such as 'loading' or 'glazing', which impair the cutting action and may induce colleagues to compensate by additional pressure of the workpiece on the abrasive wheel • Wheels used for off-hand grinding should be trued frequently to eliminate general wear, out-of-balance conditions and loading or glazing. The work rest should then be re-adjusted • Hand dressers should be properly supported so that leverage may be applied without undue effort and care should be taken to prevent the possibility of dressing tools becoming jammed between the abrasive wheel and the work rest	☐
8. Safe working procedures for each piece of grinding equipment, including the use of grinding jigs	
Know that: • Pedestal grinders should be fixed securely to the floor and bench grinders securely fixed to a bench top • When wet grinding, prolonged immersion of a stationary wheel in coolant can throw the wheel out of balance when the machine is started. Care should be taken therefore to ensure that the wheel is not left in contact with the coolant • A variety of jigs can be used to keep tools at a specific angle while grinding, e.g. planes, chisels, gouges and woodturning tools • Drill bit sharpening machines can be used to maintain accurate cutting angles on drills. **N.B.** drills should never be sharpened on the side faces of an off-hand grinder	☐
9. The use of a range of bench stones, including an understanding of sharpening angles and the use of honing guides	
Know: • Typical selections of water stones available are graded from 800grit for initial grinding to 6000grit for fine finishing • Typical selections of diamond stones available are graded as 400 grit – medium and 1000grit – fine • Typical India oil stones available, made from aluminium oxide, are graded as course, medium and fine, also available as combination stones with course one side and fine the other • Water stones use water and oil stones use honing oil as cleaner to float debris away. Diamond stones are best used with lapping fluid or water • The correct sequence when sharpening hand tools, i.e. grinding to create a primary or grinding bevel, honing to flatten the back of the blade, honing to create the secondary or sharpening bevel and removal of the burr • Appropriate angles for sharpening wood and metalworking tools in school workshops • How to use honing guides or jigs to maintain specific angles while sharpening	☐
10. The use of suitable personal protective equipment, for example eye protection	
Know that: • Suitable eye protectors conforming to BS EN 166:2002 1B (medium energy impact) should be used while operating grinding machines • There are general safety measures which must be applied when using grinding machinery, i.e. long hair should be protected from entanglement, loose clothing should not be worn, jewellery should be removed, gloves should not be worn when working on off-hand grinders • A risk assessment should be carried out on dust inhalation at grinding machines. Normal room ventilation is likely to be sufficient for dust from grinding machines, but, depending on the materials and scale of use, additional measures might be required, e.g. local exhaust ventilation or respiratory protective equipment, using a dust mask to standard FFP1 when the risk assessment requires it • Appropriate signs should be provided in each area to advise staff and learners on the use of personal protective equipment (PPE)	☐

11. The requirements for routine maintenance as required by legislation and recommended by the manufacturer of the equipment. Identification of defects and the procedures for dealing with them. The use of maintenance logs	
Know: • Equipment should be maintained in line with the requirements of the 'Provision and Use of Work Equipment Regulations 1998', (i.e. by a person competent to repair and maintain machinery) • The need for electrical testing of equipment in line with 'The Electricity at Work Regulations 1989' • The need for good housekeeping around machines, e.g. floors should be kept clear of obstacles and tripping hazards • The requirements of routine maintenance, e.g. In relation to bench stones – the correct maintenance of diamond stones, oil stones and water stones In relation to grinding machines - the regular checking of the condition, cleanliness and correct position of eye screens; checking and correct adjustment of tool rests and spark arrestors; checking condition of grinding wheels; visually checking condition of electrical switches, conduit, cable etc. • The need to keep maintenance logs	☐

Colleagues must demonstrate their theoretical and practical knowledge, skills and understanding of the use of grinding and sharpening machinery and equipment in school workshops by completing the following assessment tasks. Please tick in the appropriate column(s) to confirm your knowledge and understanding and that you have completed the practical tasks set

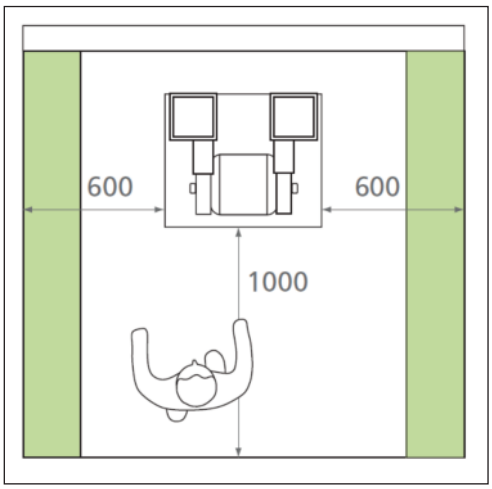
Assessment Task 2 Practical Skills	
Colleagues should know and demonstrate through practical activities how to safely undertake a variety of grinding operations commonly used in school workshops, with an emphasis on correct methods of working and safe techniques and covering the following Standards: **6. How to: assemble abrasive wheels correctly to make sure they are properly balanced and fit to use; inspect and test abrasive wheels for damage** **7. Appropriate methods of dressing abrasive wheels** **8. Safe working procedures for each piece of grinding equipment, including the use of grinding jigs** **9. Sharpening methods using different bench stones, including an understanding of angles and the use of honing guides**	
Off-hand grinding machine: **2.1 Mounting an abrasive wheel, to demonstrate:** • Selection of a wheel matched to the material to be ground • Checking that the speed marked on the machine does not exceed the speed marked on the wheel • Checking the wheel for damage and use of the 'ring test' • Checking the suitability of the spindle and nut, bushes, flanges and blotters • Appropriate tightening of the nut • The correct adjustment of the work rest, spark arrestor and eye screen • The use of suitable personal protective equipment • Checking the fit/balance of the wheel by running free	☐
2.2 Dressing an abrasive wheel, to demonstrate: • The use of suitable personal protective equipment • How to safely use different types of wheel dressers to correct general wear, out-of-balance conditions and loading or glazing	☐

2.3 Grinding tools, e.g.scribers, punches, cold chisels, lathe tool bits and woodturning tools to demonstrate: • The use of suitable personal protective equipment • The correct adjustment of the work rest, spark arrestor and eye screen • How to safely and securely hold tools at an appropriate angle • That wheels should not be brought to rest by applying pressure to the periphery or face	☐
2.4 Grinding mild steel, to demonstrate: • The use of suitable personal protective equipment • The correct adjustment of the work rest, spark arrestor and eye screen • How to safely and securely hold material, e.g. grinding a piece of 15 x 3 MS bar to radius an end and remove burrs	☐
Horizontal grinding machine: **2.5 Grinding chisels and plane irons, to demonstrate:** • The use of suitable personal protective equipment • Appropriate grinding angles • Use of tool rests and jigs to maintain angles	☐
Wet grinding machine: **2.6 Grinding chisels, plane irons and wood turning tools, to demonstrate:** • The use of suitable personal protective equipment • Appropriate grinding angles • Use of jigs to maintain angles of chisels and plane irons, and shape of wood turning tools	☐
Drill bit sharpening machine: **2.7 Grinding drills, to demonstrate:** • The use of suitable personal protective equipment • Correct procedure for using a drill grinding jig • Correct grinding angles	☐
Bench stones: **2.8 Care and maintenance of a variety of bench stones, to demonstrate:** • Choice of stones for different applications • The maintenance of diamond stones, oil stones and water stones	☐
2.9 Sharpening chisels, planes and marking knives, to demonstrate: • Appropriate sharpening angles • Use of honing guides or jigs to maintain angles	☐
2.10 Sharpening router cutters, to demonstrate: • Use of diamond stones • Honing the flat face only	☐

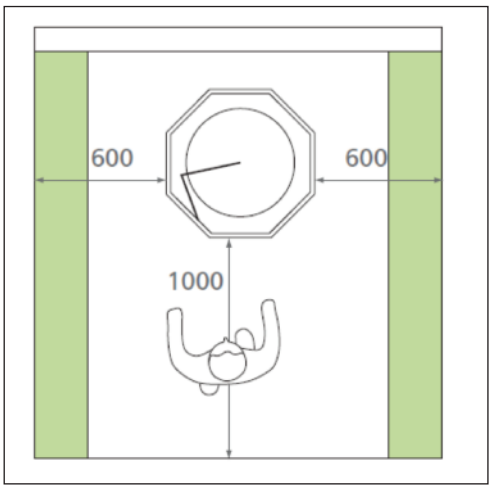
Supplementary materials

The space-allocation diagrams indicate the clear working space required on either side of the machines

Off-hand grinding machine



Horizontal grinding machine



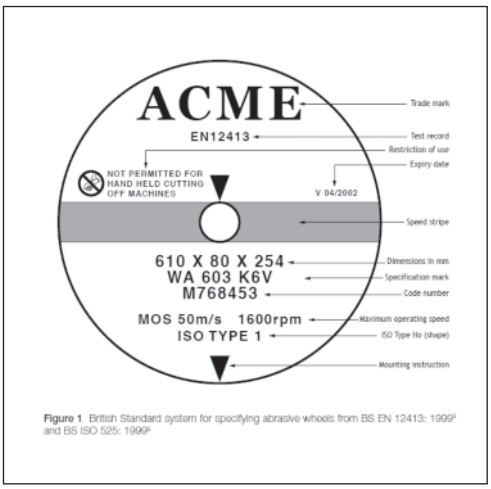


Figure 1 British Standard system for specifying abrasive wheels from BS EN 12413: 1999[2] and BS ISO 525: 1999[3]

British Standards System for specifying abrasive wheels (from HSG17)

The following references provide additional notes and guidance to support training sessions:

L254 Health and Safety Maintenance of D&T Workshop Equipment (CLEAPSS)

A set of short video sequences are available to accompany each of the recommended practical assessment tasks

These should be useful for RDTHSCs when preparing for training and for demonstrating techniques to colleagues during training, and by colleagues as a record of the practical tasks they have undertaken, following training