



**Health and Safety Training in Design and Technology**  
 Design and Technology Association  
 Specialist Extension Level S2HS Centre lathe for metal cutting

**Centre lathe  
 for metal  
 cutting**

Forename: \_\_\_\_\_ Surname: \_\_\_\_\_

School / College/ Institution \_\_\_\_\_

Course date:    /    /

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

- 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 completion		
	Centre lathe	CNC lathe
<b>Colleagues must be able to demonstrate, thorough practical activities, their capability in using a centre lathe for metal cutting, and their knowledge and understanding of:</b>		
1. The types, including computer controlled, and functions of centre lathes commonly found in school workshops, particularly the controls, safety devices e.g. guards, routine maintenance and the specific hazards e.g. dangers of rotating parts, out-of-balance masses, power feeds	<input type="checkbox"/>	<input type="checkbox"/>
2. Safe holding of work pieces including the mounting and removal of chucks	<input type="checkbox"/>	<input type="checkbox"/>
3. Selection and mounting of the correct types of tool, tool-holder, speed, feed, coolant	<input type="checkbox"/>	<input type="checkbox"/>
4. Common faults caused by worn, damaged or incorrectly mounted tools; incorrectly mounted work; wrong depth of cut, speed or feed; and their associated early warning signs	<input type="checkbox"/>	<input type="checkbox"/>

RDTHSC/Trainer signature: \_\_\_\_\_

Date: \_\_\_\_\_



Colleagues must demonstrate their theoretical and practical knowledge, skills and understanding of the use of centre lathes in school workshops by completing the following assessment tasks

Please tick in the appropriate column to confirm your knowledge and understanding and that you have completed the practical tasks set

#### Assessment Task 1

##### Knowledge and Understanding

- The types, including computer controlled, and functions of centre lathes commonly found in school workshops, particularly the controls, safety devices e.g. guards, routine maintenance and the specific hazards e.g. dangers of rotating parts, out-of-balance masses, power feeds

Centre lathe

CNC lathe

##### Know that:

- The school/college should decide whether centre lathes and computer controlled lathes are suitable for use by particular groups of learners, based upon maturity and competence, the level of supervision and local authority/employer and national guidelines
- CNC lathes are generally considered to be safer than manual machines, with safety interlocks built into hardware and software. However, a centre lathe is often more appropriate for facing off and turning and for 'one off' pieces of work
- Learners should be fully instructed in the use of these machines before operating them, e.g. the hazards associated with the equipment and the risk control measures that are required
- Learners should be trained and instructed in safe operating methods by a competent member of staff who has attended a recognised training course
- Learners should be assessed and a record of their competence kept



##### Know the electrical installation requirements of lathes that can be used in school workshops:

- Emergency switching systems must be provided in each separate student work area
- The machine must be electrically isolated, using a fused switch-disconnector on or adjacent to the machine, controlled by a starter incorporating overload protection and no-volt release
- Isolation switches not incorporated in the equipment must be not more than 2 m away from the equipment and positioned so that they can be operated safely while the equipment is in use. The switch should be clearly marked with the name of the machine
- The machine should be provided with a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency
- It should be possible to lock the machine 'off' when not in use, e.g. when carrying out maintenance, by either padlocking the isolator or use of a key-switch



##### Know: the capacity of the machines, e.g.

- With reference to CNC lathes for example, to recognise the capabilities of the machines and material size and type which should not be exceeded



##### Know the method of powering and general mechanical operation, i.e.

- Speeds, including the method of adjustment where applicable
- Possible hazards associated with the use of specific parts of the machines and precautions which should be observed, e.g. that sharp edges on tools and work pieces can cause cuts; that work pieces, chuck keys, broken cutting tools, swarf etc. can be violently ejected from the lathe; that closing movements between parts under power feed can be a trapping hazard
- Details of guarding requirements, i.e.: guarding of the drive mechanisms by fixed guards (removable only with the use of a tool) or the use of interlocked guards; use of interlocked chuck guards to guard the spindle mandrel; guarding of feed shafts and lead screws; guarding of the headstock spindle end
- If feed shafts and lead screws are not sufficiently protected by the overhang of the bedways and/or saddle and swarf trays, an appropriate guard should be provided. As an alternative to guarding of the lead screw and feed shaft, the drive to these items can be disconnected by removal of a gear from the change wheel drive. If the drive shaft or lead screw is required, a special risk assessment showing how the additional hazards presented by the unguarded shaft will be removed or reduced might be appropriate

<ul style="list-style-type: none"> <li>• Stock bar should not project beyond the headstock. If this is unavoidable, the portion of stock bar projecting beyond the headstock should be guarded to prevent entanglement. The hole that allows a long stock bar to project should be covered by a metal plate secured with suitable screws or bolts when not in use</li> <li>• The procedure for isolating lathes, i.e. when they are left unattended, when the qualified staff are not in the work area, before adjusting any internal mechanisms and before cleaning is undertaken</li> <li>• To ensure that the lathe is always stopped before measuring or gauging</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Know:</b></p> <ul style="list-style-type: none"> <li>• 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)</li> <li>• The need to keep maintenance logs</li> <li>• The need for electrical testing of equipment in line with 'The Electricity at Work Regulations 1989'</li> <li>• The requirements of routine maintenance as recommended by the manufacturer of the equipment, e.g. cleaning, adjusting and lubricating the slideways, feed mechanisms, tool holders and chucks</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Know that:</b></p> <ul style="list-style-type: none"> <li>• Appropriate eye protection must be worn when operating lathes</li> <li>• A protective close-fitting apron or work coat/overall and substantial footwear should be worn</li> <li>• Appropriate signs should be provided in each area to advise colleagues and learners on the use of personal protective equipment (PPE)</li> <li>• There are general safety measures which must be applied when using metalworking machinery, i.e. long hair should be protected from entanglement, loose clothing should not be worn, gloves should not be worn; jewellery should be removed</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Know the type of working environment required, i.e.</b></p> <ul style="list-style-type: none"> <li>• Lighting – at least 500 lx should be provided for normal bench and machine work (taking into consideration the stroboscopic effect of fluorescent lighting units)</li> <li>• Heating and ventilation - work areas should be maintained at a temperature comfortable to work in when appropriate protective clothing is worn</li> <li>• Flooring – floors should be a level, non-slip surface, kept free of loose items and swarf</li> <li>• There should be sufficient space around machines to prevent operators from being pushed by passers by</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<b>2. Safe holding of work pieces including the mounting and removal of chucks</b>		
<p><b>Know:</b></p> <ul style="list-style-type: none"> <li>• The hazard of lifting heavy equipment such as chucks and faceplates and how to carry out an assessment and implement measures to minimise risks associated with lifting such items, e.g. by using lifting aids and correct lifting techniques</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Know:</b></p> <ul style="list-style-type: none"> <li>• A variety of ways in which work should be safely and securely held on lathes, i.e. the use of different chucks, three and four jaw, collet and drill chucks</li> <li>• How to safely mount chucks, secure work for turning and remove chucks after use</li> <li>• How to turn between centres</li> <li>• Chuck keys should be preferably spring-loaded, removed immediately after use and before starting the machine</li> <li>• Stock bar should not normally project beyond the headstock. If unavoidable, tube type guarding should be fitted, to prevent entanglement</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<b>3. Selection and mounting of the correct types of tool, tool-holder, speed, feed, coolant</b>		
<p><b>Know:</b></p> <ul style="list-style-type: none"> <li>• The types and applications of different lathe tools, including the use of tipped tools; basic cutting tool angles; correct setting and mounting of tools</li> <li>• Correct speeds and feeds for different metals and plastics</li> <li>• Files and abrasive tapes should not normally be used on centre lathes, a high proportion of all accidents at lathes involve the use of emery cloth and result in injuries such as broken and, occasionally, amputated fingers</li> <li>• Suitable implements should be used to avoid hand contact with swarf</li> <li>• Metalworking fluids should be selected as required for different materials and used carefully. For cooling - to avoid burning the tool or workpiece, for lubricating - to minimise tool wear and maximise surface finish and for slicing swarf - to avoid jamming and surface damage</li> </ul>		

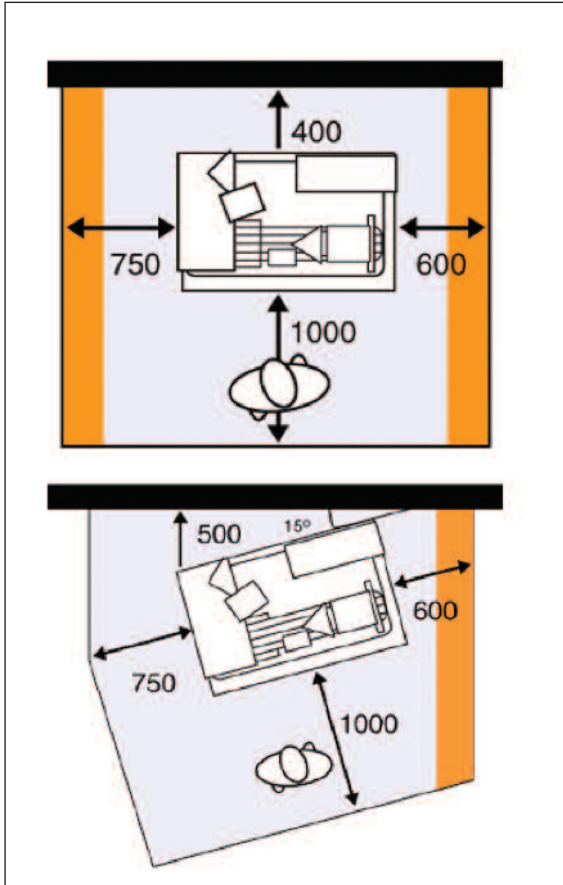
<ul style="list-style-type: none"> <li>• Coolant nozzles should not be adjusted while the machine is in operation</li> <li>• Contact with the skin should be kept to a minimum. On hands, metalworking fluids can cause skin problems such as dermatitis, as a mist it can cause respiratory diseases. Hands should be washed thoroughly after using fluids</li> <li>• Barrier creams or appropriate protective close fitting gloves may be worn</li> <li>• Metalworking fluids, if used, should be mixed and changed in accordance with the supplier's instructions. Where a coolant tank and pump is fitted the tank and system should be drained every 12 months, the system flushed through with clean water and the tank refilled with fresh coolant</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>4. Common faults caused by worn, damaged or incorrectly mounted tools; incorrectly mounted work; wrong depth of cut, speed or feed; and their associated early warning signs</b></p>		
<p>Know that:</p> <ul style="list-style-type: none"> <li>• Common faults include: poor surface finish, chatter, diameter not parallel, tailstock centre overheating, work incorrectly balanced on a faceplate, tool breaking</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>

<b>Colleagues must be able to demonstrate through practical activities, their capability in using a centre lathe for metal cutting</b>	Centre lathe	CNC lathe
<p><b>Assessment Task 2</b>  <b>Practical Skills</b>  <b>Machine Operation</b></p> <p><b>Working to drawings and step by step planning, to demonstrate:</b></p> <ul style="list-style-type: none"> <li>• How to use working drawings and to 'plan for making'</li> <li>• To sequence operations so that after completing one operation, the next may be performed without difficulty of holding or clamping the work piece</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Selecting, handling and mounting appropriate holding devices, to demonstrate:</b></p> <ul style="list-style-type: none"> <li>• Use of a suitable wooden board to protect the lathe bed, slides and tools while changing chucks and face plates</li> <li>• Threaded and camlock backplate mounting and securing methods for chucks etc</li> <li>• Three jaw self-centering chuck</li> <li>• Four jaw independent chuck</li> <li>• Collet chuck and draw bar</li> <li>• Morse taper sleeves and tailstock, 'Jacobs' drill chucks</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Undertake practical tasks, working safely and to an acceptable standard of accuracy and finish, using ferrous and non-ferrous metals and plastics, to demonstrate:</b></p> <ul style="list-style-type: none"> <li>• Facing off – round and square/rectangular bar</li> <li>• Drilling – combination centre drill, twist drill bit, morse taper shank drill</li> <li>• Parallel turning – using apron hand wheel and power feed</li> <li>• Taper turning – using the top slide for chamfers and cross slide for long tapers</li> <li>• Undercutting – using a parting tool to terminate a thread</li> <li>• Boring – using a boring bar</li> <li>• Screw cutting - using tailstock die holder and tailstock mandrel with thread cutting compound (e.g. Treflex)</li> <li>• Knurling – preferably with caliper type knurling tool</li> <li>• Parting off – preferably using a parting tool holder with adjustable blade</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Identify common faults, early warning signs, causes, and the preventative and corrective actions that should be taken, i.e.</b></p> <ul style="list-style-type: none"> <li>• Poor surface finish – wrong, blunt or poorly set tool, wrong lathe speed</li> <li>• Chatter - tool not at centre height, not firmly secured, backlash, wrong lathe speed</li> <li>• Diameter not parallel – using the wrong slide to move tool, tailstock off-centre</li> <li>• Tailstock centre overheating – dead centre worn, live centre not revolving, tailstock too tight, lack of lubrication, centre drilling too deep</li> <li>• Tool breaking – tool blunt, not secured, set below centre, wrong speed/feed, too deep a cut, backlash</li> <li>• Lathe vibrates – work piece not balanced (face plate, between centres)</li> </ul>		

## Supplementary materials

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

### Centre lathe



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

<http://www.toolmex.co.uk/new/products.html> - extensive, accessible lathe tool info & images

[www.axminster.co.uk](http://www.axminster.co.uk) – Axminster Power Tool Centre

[www.chesteruk.co.uk](http://www.chesteruk.co.uk) – Chester UK Ltd

[www.600lathes.co.uk](http://www.600lathes.co.uk) – Harrison and Colchester Lathes

[www.rennietool.co.uk](http://www.rennietool.co.uk) – Rennie Tool Co Ltd

[www.lathes.co.uk](http://www.lathes.co.uk) – an exhaustive list of machines, parts and machine manuals

<http://www.hse.gov.uk/metalworking/hse.htm> – metal working fluid hazards

<http://www.spectrum-safety.com/lubrication.asp#metalworking> – cutting fluid information

<http://www.renalli.com/safety-eye-face-protection.asp?cdir=2> – eye protection information

<http://www.hse.gov.uk/workplacetransport/safetysigns/mandatory.htm> – signs shown in the correct style with descriptive text as required by 'The Health and Safety (Safety Signs and Signals) Regulations' 1996

**Machining Plan**

Drawing

- Check before you start
- Always follow health and safety procedures
  - Always wear full protective equipment
  - Training is needed before using a machine
  - Machine setup must be checked and approved by staff
  - Permission is needed before start up
- Always work on your own, without distraction

Step by step machining plan	Tool (name/sketch)	Cutting speed	Time

Centre lathe turning tool shape examples

