

Kushed Procedures

Wood Turning Lathes

W7

600mm Centres (x 2)

- Nova 1624-44,
- Nova 3000

1100mm Centres

- Nova 1624-44 with
Extension Bed

350mm Centres

- JET





The Shed provides items such as welding masks and gloves.

Members are required to provide their own footwear, eyewear, hearing protection and masks.

Safety

This is a very high priority for our Shed members. There are some aspects that are mandatory under our insurance policies and some which the The Shed requires members to adhere to for everyone's benefit.

The Shed Safety Induction

It is a requirement of attendance at The Shed that members have reviewed the Safety Induction Presentation

Personal Protective Equipment

This is required in various forms depending upon the equipment being used or the activity being undertaken.

Protective eyewear is always mandatory when using machinery.

The Shed schedules a Coordinator and a First Aid Safety Officer for each day of attendance and their safety directions are final and must be adhered to.



Nova 1224-44

Key Features of Wood Turning Lathes

Wood Lathes drive a workpiece so that hand or tailstock-held tools can be applied to create a variety of rotational shapes, including holes.

- Lathes used for drilling or boring, usually use drills or cutters, held in tailstock chucks, fed into the work.
- Workpieces can also be sanded on lathes using abrasive cloths and papers.
- Workpieces are held in a variety of ways:
- Spindle work is usually held between centres, by a pronged centre at the headstock end to transfer torque from the motor to the workpiece and by a revolving dead centre at the tailstock end allowing the workpiece to spin freely and yet remain supported. A “ring” tailstock centre is better to use because it helps prevent splitting of work.
- The tailstock can be locked to anywhere along the lathe bed to accommodate workpieces of various lengths. Centres are Morse tapered to provide a friction fit into the swallows of the spindle or tailstock barrels. (“swallows” are tapered bores to accommodate centres, drill shanks and chuck tapers). Knock-out bars are used to remove items from the swallows.



Work being held by a combination of face plate and revolving dead centre

Workpieces can be attached to the headstock of the lathe by various methods including use of:

- **faceplates** (for cross grain work unless tailstock used also - screws can pull out of end grain attachments),
- screw fixing i.e. threaded live centre (cross grain only),
- **bell (cup) chucks** (longitudinal grain),
- **Scroll chucks** used for bowls or similar workpieces (with cross grain) and to hold work for “free end turning” such as egg cups, goblets, vases and cylindrical boxes (all of which can have longitudinal grain ie end grain at tailstock end)
- **friction or “paper chucks”** may be used where the work is lighter and does not require strong physical attachment and where a clean surface devoid of fixing marks is desired.

Workpieces may sometimes be held with a combination of the methods above together with a tailstock centre during part or all of the turning procedures.

IMPORTANT

Always rotate the work by hand after:

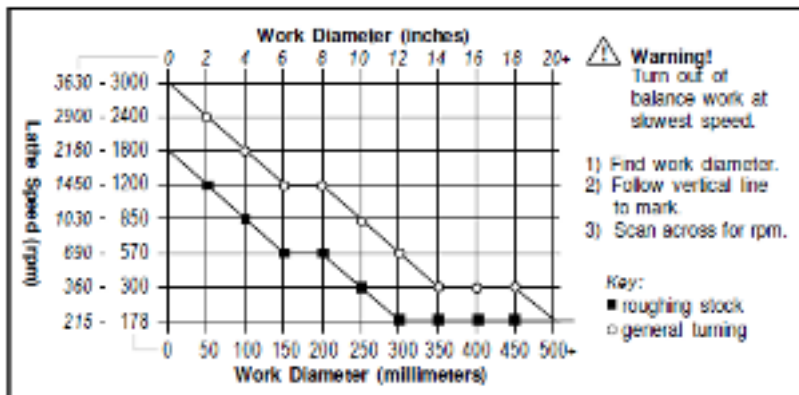
- Attaching wood to be turned
- Adjusting tool rests
- Using the locking/index pin
- Before turning the lathe on



*Scroll chuck being tightened
to bowl for hollowing*

- Never turn a lathe on when the chuck or faceplate is only partially screwed onto the spindle as it jams on the thread. Always firmly hand tighten these devices up against the shoulder or thread end on the spindle. Fit a low friction washer (plastic, leather or “Masonite”) if spindle has shoulder.
- The tool rest can slide along the lathe bed and be locked at any point. The height is adjustable, and it can also be rotated for bowl and taper turning. Rests of various lengths and shapes can be used.
- The Headstock on Nova Lathes may be rotated about a vertical axis to facilitate better access for faceplate turning and to accommodate work requiring a larger swing diameter.
- The two 1624/44 Nova lathes are fitted with a reverse switch. **Do not accidentally switch to reverse.** Reverse should not be used with “inboard” work as it creates a very high chance of the face plate or chuck unscrewing from the spindle. There are grub screws in the boss of the chucks which can tighten onto the spindle thread but this is very likely to damage the thread and is therefore undesirable. Reverse should only be used if “outboard” turning (attaching work to left end of spindle on left-hand threaded faceplate or chuck).

Recommended Turning Speeds



- Lathe speeds are adjusted by means of varying the combination of pulleys. A smaller drive pulley (motor end) will give a slower speed whereas a larger drive pulley will give a faster speed. The Jet Lathe has an electronic speed adjustment as well as pulley change option. The three Nova lathes have a slot window through which can be seen the belt position ie the speed setting.
- Cutting techniques will give a smoother finish and less vibration during turning than scraping methods, however, they are more difficult to learn and may be beyond some member's ability. Considerable practice is required to learn how to control the tool with cutting techniques and **CLOSE INITIAL COORDINATOR ASSISTANCE MUST BE OBTAINED** if attempting to learn these. Tool dig-ins with possible tear outs and even the possibility of the work being ripped off its fastening devices can more easily occur when using cutting techniques.
- Ideally, the lathe should be at a height such that its centre axis is between top and bottom of operator's forearm when it is bent at 90 degrees and the operator is fully standing with shoulder to elbow vertical. Platforms can be used to correct this but produce their own safety risks.



*Roughing Gouge being used to round and reduce diameter of spindle work
(Note corners can be ground slightly rounded on gouge and technique of “riding the bevel” can help stop “catches”)*

Tools used for turning fall into various categories which are determined by their shape. There are many variations to basic tool geometry and experienced woodturners often devise their own unique tool shapes. The main tool shapes at the Shed are colour coded and include:

- **Gouges– roughing** (Orange colour coded handles), bowl turning and detail or spindle (Purple colour coded handles). Gouges should be sharpened on the Tormek machine to maintain constant angles and avoid overheating.
- **Skew Chisels (Red handle colour coding)** – various sizes and can have straight or slightly curved cutting edges. Chisels should be sharpened on the Tormek machine to maintain constant angles and avoid overheating.
- **Mid-Sized Skew Chisel** (NB this is high speed tool steel and should not be quenched if dry ground)



*Bowl Turning Gouge being used to round outside of bowl “with-the-grain”.
(Using under-hand grip with thumb holding gouge down onto tool rest and tool tip “riding the bevel”)*

- **Scrapers (Green handle colour coding)** – can have rounded, straight, convex and compound shapes ground on the end of flat blades. Scrapers have a cutting burr which is formed by grinding on a coarse wheel or can involve honing and burnishing to achieve a smoother burr. Slightly softer tool steels tend to burr more readily.
- **Old files must not be ground to make scrapers** as their heat treatment is not suited to lathe tools and their brittleness may cause them to shatter



Mid-Sized Skew Chisel (NB this is high speed tool steel and should not be quenched if dry ground)





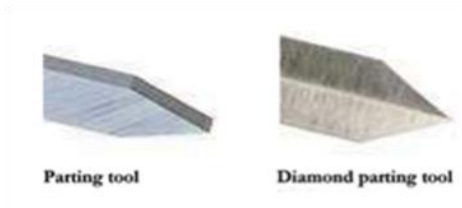
A round nosed scraper being used to flatten the face of work held in a scroll chuck.

(NB The scraper is being held with an under-hand grip and downward angle towards the work. This helps prevent dig-ins.)

- Most of the Shed's turning tools are made from high speed steel (HSS) which is tempered at 675°C as opposed to carbon tool steel which is tempered at 220°C. HSS should not need to be water quenched when grinding but ground so as to avoid overheating.
- The angles for grinding and sharpening of Shed woodturning tools have been chosen as the best compromise for our needs. These angles are to be maintained using our Shed devised sharpening techniques.
- **Operators who wish to sharpen tools other than scrapers must be accredited to do so.** Experienced woodturners may have developed their own set of angles to suit their style of turning and if they wish to use tools with different angles from our Shed tools, they must bring their own. They must not change the geometry of the Shed's turning tools.



Parting Tools



Tips for using tools safely

Lathe tools generally require skill levels in the following ascending order of difficulty: Scrapers, Parting Tools, Roughing Gouges, Bowl Turning Gouges, Detail Gouges and lastly Skew Chisels.

- Use of scrapers is the better (and recommended) option for operators who are less experienced, lack confidence or find tool control manually awkward. This is because scrapers are easier to manipulate and are far less likely to dig into the work. If they do catch, they will release in an arc away from the work whereas cutting tools will dig-in further because their arc of movement swings the tip into the work.
- Ensure scraper contact with work is at or slightly below centre height. Angling the scraper slightly downwards towards tip helps prevent “dig-ins”. If using a vee or round pointed scraper, only work with one side of the tip ie do not plunge tip deeply into work as this creates too much wedging force on the tool and it can catch.
- Scraping is better suited to harder timbers and for face plate work. It can tear the surface of soft to medium density timbers such as Hoop Pine and is less suited for use on spindle work.



Under-hand grip

- Scraping can produce pleasing results, although the speed of waste removal is slower and the quality of machined finish may be compromised. This can largely be overcome with well formed scraper burs, higher lathe speeds and in some cases, persistent sanding through various abrasive grades to remove torn grain.
- Choice of method of gripping lathe tools depends on personal preference and available tool rest shape.
- If using **over-hand grip**, ensure tool held down firmly on tool-rest so part of hand, e.g. heel, can rub on tool-rest for added control of depth of cut.
- **Under-hand grip** provides option of rubbing forefinger against tool-rest to act as “depth stop” and provide good control. Thumb on top of tool holds it down onto tool-rest and helps provide firm grip of tool.
- Tool rest should be set at height to suit chosen tool. If using scraper, set height slightly higher than thickness of tool below centre line of lathe.
- If using cutting tools ie gouges and skew chisels, set the height of the tool rest to give correct angle of approach such that grinding bevel can be at tangent to work surface and the tool can “ride the bevel”.



Timber to be turned needs to be sound (no spits, loose knots, poor glue joints or cracking). Close textured timbers such as Queensland Coachwood provide fine cutting and finishing qualities and are easier to turn than cranky grained, open pored timbers.

Timbers with inconsistent grain structure such as pronounced hard and soft growth ring characteristics, eg Radiata Pine, are poor timbers to turn, especially between centres because the softer parts of the grain tend to “tear out”.

Completed, turned work can be “burnished” with shavings and polished to a very high lustre on the lathe.

- Tool rest should be as close as possible to work to provide support **but must not be so close as to allow the tool to slip onto its grinding bevel.**
- Stand with feet apart and in well balanced position to be able to follow shape of cut.
- **Always use long handle (preferably against your body) to control the tool movement and move your whole body rather than just your hands.**
- **Never use a roughing gouge or skew chisel on faceplate cross grain work,**
- If using cutting tools to make “shaving” cuts, start by rubbing grinding bevel on work and rotate or raise handle till sharp edge begins to cut. Depth of cut controlled by rubbing bevel and raising angle of blade. **Never allow the tool to rotate to the point of having the corner of the cutting edge unsupported by the tool rest** as this can suddenly roll the tool into the work.
- The quality of lathework is dependent on the skill of the operator, the quality of the material (usually timber) being turned, the moisture content and texture of the timber, the cutting method chosen, the sharpness of the cutting tools, the rigidity in supporting the work, and the speed used during shaping.



See <https://www.youtube.com/watch?v=D8cUcAZwhdM>

NOTE: It is preferable that members who are using wood lathes extensively, also become accredited to sharpen turning tools by undergoing training and gaining Tool Sharpening Accreditation.

Members who restrict their techniques to scraping only can be trained only in the specific grinder use associated with lathe scraper sharpening as part of their Wood Turning Lathe Accreditation.

Support for long or fine, slender work

When workpieces are long and/or slender, **scraping is not advised** because it puts greater resisting torque loads on work. This type of work tends to vibrate and is difficult to turn at unsupported sections. It tends to want to climb up over or away from cutting tools.

This can partly be overcome with the aid of a steady rest which can be attached to the lathe bed between the supported ends of the work. There are various types, some of which have low friction or sealed bearing races in contact with the work. There can be two or three contacts angled onto the work to provide vee supports which help keep the work centred when cutting tools are applied.



- Never wear ear muffs for normal turning procedures as these impede sensing the operation of the lathe and can prevent the operator from hearing dangerous turning conditions.
- Always wear short sleeves as long sleeves can get caught in rotating lathe parts and/or work. Avoid wearing any loose clothing.
- Ensure long hair is fully restrained with hair net, ties or cap.
- Remove any jewellery, watches, rings, chains or necklaces.

Safety & Procedural Issues

If in doubt about the operation you are about to do, seek a Coordinator's assistance.

- Always wear eye protection – preferably a full face shield or industrial safety glasses with side-shields.
- Use of a dust mask is recommended and **must be worn** when carrying out sanding operations. MDF and some timbers, glues and finishes produce very fine and/or hooked fibres which can cause deep or obstinate lung penetration and, in some cases, are carcinogenic. Tasmanian Blackwood has a hooked fibre which can cause lung and/or throat irritation.
- Other timbers should be researched if dust properties are unknown so that adequate protection can be used. **No treated pine is to be turned because of toxicity of dust.** Ensure timber being turned is sound and has no nails, screws or other embedded metal in the area to be turned. Machining of areas where there are fastening screws **MUST** be avoided.



Ensure that centres are aligned

Fully electrically isolate the lathe for the following steps

- Ensure that the spindle speed setting is appropriate to the intended woodturning operation. Ensure motor lock- down is secure after altering speed setting and tensioning the belt. Refer to the table on the lathe for appropriate speed settings.
- Ensure that the belt guard and/or cover is in place.
- If using centre(s), always ensure centre taper(s) and inside the swallow(s) are clear of dirt and dust prior to assembly. Preferable to wipe clean regardless.
- If turning between centres on Nova lathes, check the centre alignment of the headstock prior to setting work up. This can be done by sliding the tailstock centre up to almost touch the pronged live centre. The headstock may have been rotated and not accurately returned to alignment if the centres are out of alignment. Re-align by loosening the headstock and rotating as required before relocking.
- The spindle can be locked with a locking pin to aid screwing and unscrewing of chucks or faceplates on and off the spindle.

Ensure the locking pin is released prior to starting the lathe.



Locking Pin

- On the Nova machines, failure of the locking pin to engage is an indication that the spindle pulley has come loose and moved to the left on the spindle shaft. Eventually this will lead to the pulley rubbing on the housing and making a noise. If pulley movement is evident, get a Coordinator to re-align the pulley and tighten the Allen keyed grub screw holding it and the key to the spindle shaft.
- The locking pin positions can be used as an indexing device to pre-determine an angle of rotation when the machine is turned by hand. This facility can be used, in combination with a router mounted on a suitably constructed jig, to rout flutes, reeding or grooves along a turned workpiece. Plunge cut mortises can also be cut at regular angular spacings with this method.
- Set up the wood to be turned using the appropriate method for chucking ie between centres, faceplate or scroll chuck operations. Use a soft-faced or wooden mallet to drive the pronged centre into diagonal saw cuts on the end of the work for between centre turning. **Do not pound the work onto the centre when in the lathe and do not force the centres into the wood with the tailstock.** as the force involved can wedge the centres too firmly into swallows (tapered bores).



Jacobs style chuck

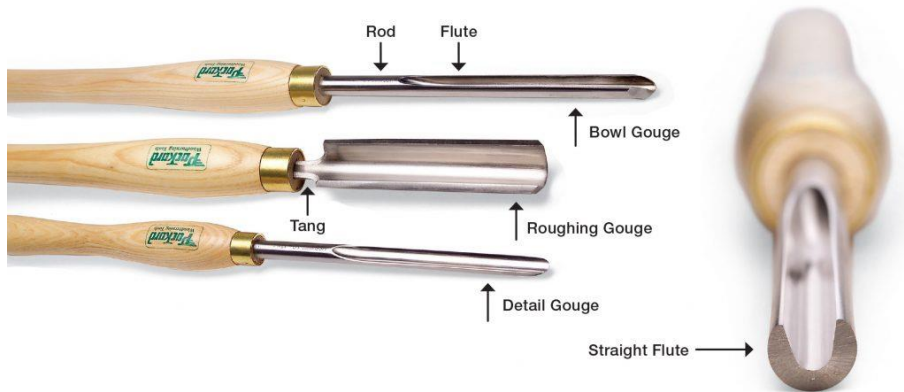
- If using a scroll chuck, select one with most appropriate jaws already fitted. **Special jaw changing procedures are required and jaws must be fitted to match numbering of the sliding mount. Do not screw jaws completely out of the chuck with a chuck key.**
- Remove the allen keyed screws to remove and replace jaws but only with Coordinator supervision.
- A Jacobs style chuck, fitted into the spindle taper, can be used to grip and drive small diameter work, **provided** it is supported at the other end with a tailstock centre which can help hold the chuck in the spindle.
- Ensure that the tailstock is firmly locked in place with the cam lock lever **and** barrel locking screw for between centre work or, clear of work area for faceplate work.
- Rotate workpiece by hand to ensure it is centred correctly and is clear of the tool rest. Rotate headstock on its vertical axis on Nova lathes if better access for bowl turning is desired. Ensure headstock is locked and cannot rotate before turning lathe on.



Stand to the side

- Rigorously test, by hand, that the workpiece is firmly attached to the faceplate / scroll chuck or between centres. Rotationally rock work backwards and forwards to test.
- Ensure that tool rest height adjustment, banjo (tool-rest bed attachment), tailstock bed lock and barrel locking screw are adjusted appropriately for task and are firmly locked. Tool rest gap should be minimal (and clear of tool grinding bevel) to avoid tool vibration and provide better support for tool. It also reduces downwards leverage on tool tip.
- For larger work, stand to the side, ensure no one else including other machine operators are in “firing line”, **Start and Stop** the lathe just enough to spin the work at a low speed to check whether it is suitably balanced and not causing undue vibration. Re-chuck to centre the work if necessary after possible trimming if needed (using a bandsaw or hand tools) to get a better balance.
- **Repeat step 19** and prepare for turning at a lower speed once reasonable balance of the work is achieved.

For between centre work, never loosen the tailstock when the lathe is operating.



Types of gouge tools

- Unless sanding, keep your hands clear of the rotating workpiece and chuck when lathe is in operation.
 - **Never use cabinet-making chisels, gouges or old files as turning tools.** Tools should have a long tang in the handle, a substantial handle and blade length, and a solid blade.
 - To achieve a better balance and the basic shape, commence turning with a roughing gouge (or heavy scraper) on spindle work. Avoid taking too deep a cut as dig-ins or split-outs can occur with out-of-round stock. **NB Never use a roughing gouge or skew chisel on cross-grain work.** e.g. bowls. Work outwards towards ends of spindle work.
 - Ensure any turning or measuring tools are not left on the bed of the lathe where they can roll off and cause injury or distraction if they fall. Place temporarily unused tools securely in the tray under the lathe or to the side on a bench.
 - **Ensure the lathe is switched off** to adjust belts as appropriate for speed of operation being carried out and to adjust tool rest to maintain the correct gap between the work and rest. Gap should be minimal.
- Never reach over a lathe which is turned on.**



- If signs of motor strain are evident (listen for slowing – particularly on Jet lathe) take lighter cuts or modify operation being carried out.
- **If any unusual sounds or vibrations are evident, immediately stop the lathe.** Determine the cause and rectify, if necessary, before resuming work.
- **Ensure that the tool is use is always held down in contact with the tool rest,** held with two hands and in a controlled and comfortable way such that the handle is resting against your body for full support.
- **Do not stand in the “firing line” of work in case the tool catches causing tear outs or work being ripped from securing devices.** Continue turning operations using various tools to achieve final shape. Re-chuck as necessary for work being turned eg reverse mounting of bowl on scroll chuck.
- Try to follow grain direction and work within your own capabilities and know techniques.
- Take particular care to avoid “dig-ins” of the cutting edge due to incorrect angle of tool approach and failure to “ride the bevel”.



When finished

Remove the workpiece from the lathe

Never leave the lathe whilst it is still rotating

Return the lathe to standard condition, tools and the lathe attachments to storage.

Clean the workspace and lathe, leave clean and free of shavings and dust.

To prevent risk of spontaneous combustion, wash finishing cloths and, when dry, place in waste bin.

- Always use sharp tools and **never** use tools for purposes other than their intended use.
- **Do not use sharp edged cutting tools as scrapers** as this will quickly blunt the cutting edge, then require excessive force leading to loss of tool control. Scrapers must have pronounced grinding burr to act as a cutting edge and should produce fine shavings NOT “saw dust”.
- **Never check measurements of work when the lathe is operating** e.g., when using callipers to check diameter or rule to measure lengths.
- Remove the tool rest before commencing sanding work. Fold the abrasive into three for grip and to act as a heat shield. **Sand on the under-side of the work which is rotating away from you.** Work through various abrasive grades.
- Do not sand work if further cutting is required because embedded abrasive particles will blunt tools.
- Use a brush or vacuum to remove all dust from sanding operations and hand burnish work with shavings. **Do not use compressed air to clean shavings or dust away.** It results in airborne dust and is likely to end up in eyes of anyone in vicinity.



Online and Shed DVD Resources

Web tutorials and the Shed's DVDs are excellent informers but beware of poor or incorrect practices in the wide range of approaches shown in DVD and Web presentations

Mike Darlow's Woodturning Disks 1 & 2 - On Disk 1, Mike demonstrates pushing skew chisel up off tool rest onto its grinding bevel. Beware that attempting this could cause a serious dig in. Also avoid following his example of use of callipers when machine is turned on. This is for very experienced turners only. (Videos require 5+ hours to view but give very thorough analysis, descriptions and demonstrations of turning processes)

"The Tormek TNT Sharpening System for Woodturners" DVD section on turning techniques – Note: use of cutting tools as scrapers on this DVD can be a misleading comparison with using properly sharpened scrapers. (Various times required to view sections – total approx. 25min)

<http://www.youtube.com/watch?v=pRMI-Exyf6g> - Good safety descriptions but no tool handling techniques shown. (3 min 45 sec)

<http://www.youtube.com/watch?v=gWDeiTAX54c> – Use of "paper chuck" method of holding faceplate and spindle work. (4.05 minutes)

<http://www.youtube.com/watch?v=IOhHeyoZLaY> – How **not to** demonstrate the danger of using a roughing gouge on cross-grain work – shows injury which results in drawing blood. (4.26 min)

<http://www.youtube.com/watch?v=rd988yk6lSE> – Further reinforcement on NOT using roughing gouge on cross grained work. Alternative clearly demonstrated. (11.03 min)

<http://www.youtube.com/watch?v=yMsZYsCmzIU> – First half of video shows useful tips. See if you can pick five undesirable practices from this "master" wood-turner. (28.5 min)



