Shopping spree: A metal lathe can add considerable capacity to the farm workshop, but it pays to have a good idea of what you are looking for before heading out to buy one. Take extra care when buying a second hand unit, as it may not include all of the necessary attachments that a new one will. Photos: Ben White and Josh Giumelli

What to look for when buying a metal lathe

A metal lathe might seem like a luxury for many farm workshops, but the sheer versatility of this handy machine can add incredible capabilities to repair jobs.
By **Josh Giumelli**

The ability to tackle a wide range of 'one-off' machining jobs to a level of precision makes the metal lathe the undisputed king of machine tools. Turning, facing, boring, drilling, thread cutting, taper turning and milling are all possible on the lathe, and fitted with the right type of accessories, there is almost nothing it can't do.

While the purchase cost of a metal lathe might seem to be hard to justify in the short-term, the machine pays for itself over time by being able to quickly modify, repair or make parts when repairing machinery.

The biggest stumbling block for many when contemplating a metal lathe is the skill required to use it. Like with any workshop task such as welding, skills can be built on by using the tool and becoming familiar with its operation. There is much that can be learnt through books and online videos, and a little instruction from a knowledgeable person can go a long way.

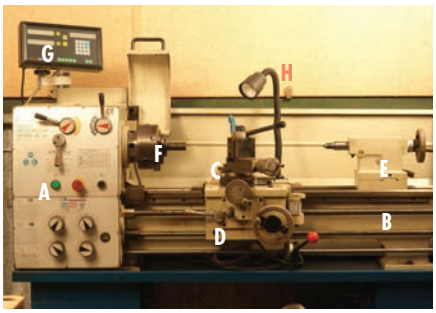
Invariably, any fitters working on farm are likely to have some machining experience, and having a lathe allows their skills to be put to good use. By having a lathe in the workshop, the scope of repairs that can be carried out in the workshop is increased and sending jobs out to a machinist or engineering firm can be avoided saving time and money.

This month we look at what to consider when buying a metal lathe, as it makes no sense to stumble in blindly and end up with something unsuitable. While many excellent second-hand machines are available through dispersal sales or auctions, you run the risk of buying a worn or damaged machine if you don't know what to look for. In addition, the range of accessories provided with a new machine is often missing from a used lathe and seeking replacements can often present a challenge.

For this reason, the purchase of a new machine is recommended, unless you have an experienced machinist check over a used machine. The cost of a new lathe is often not as excessive as you may imagine when compared to a second-hand unit, and often good deals can be had on run-out models, showroom stock or end-of-financial year sales. Expect to pay around $4000 to $6000 for a new lather suitable for the farm.

Next month's Workshop article –
basic metal lathe operations

Figure 1. Basic layout of a metal lathe



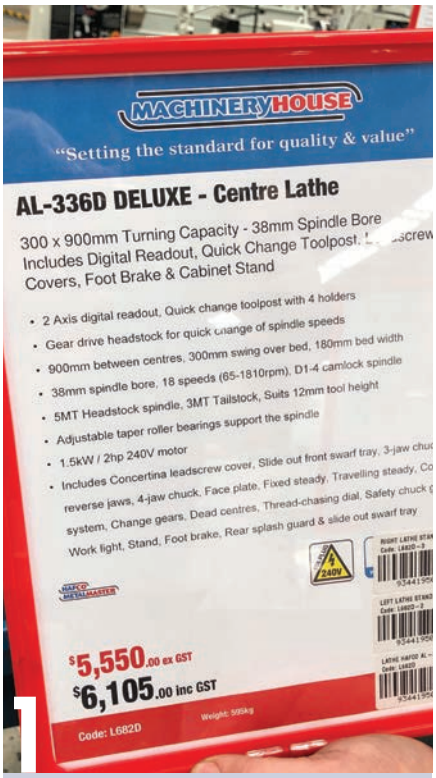
A: Headstock; B: Lathe bed; C: Carriage; D: Carriage apron; E: Tailstock; F: Spindle, fitted with chuck; G: Digital readout (DRO); H: Work light.

Figure 2. Metal lathe carriage functions

A: Gear change lever; B: Gear change lever; C: Lead screw forward/neutral/reverse lever; D: Power light; E: Emergency stop button; F: Inching button (aids changing gears); G to J: Automatic feed and lead screw gearbox.

The benefit of buying a new lathe is that it will come with the essential accessories that might be missing from a second-hand unit. Often, good deals can be found for a lathe with additional accessories thrown in such as tooling, quick-change toolposts and digital readouts.

VITAL STATISTICS



1

The basic turning capacity of a lathe is designated by the **swing** over the bed and the **distance between centres**. These basic measurements govern the size of the object a lathe can turn, although there are exceptions to this which we will cover later.

2

The swing is the maximum diameter of a workpiece that can be turned over the bed. If the centre height is 150mm, then the swing will be 300mm. Note the swing over the bed is larger than the swing over the carriage. Some turning operations will be limited for items which are too large for the carriage to fit under.

3

The distance between centres is the basic maximum length of an item that can be accommodated between the headstock and the tailstock. In general, the distance between centres does not take into account the length of the chuck mounted on the headstock. It refers to items mounted between two dead centres; one in the headstock and one in the tailstock, which will be a larger length than that pictured.

4

Many lathes feature a gap bed, which incorporates a removable section of bed directly underneath the chuck. While it can be hard to spot, it is a handy feature worth having. With the gap section of the bed removed, larger diameter items can be turned than the specified maximum swing over the bed. But obviously the carriage cannot fit under the work in this case.

5

The headstock on most lathes is hollow, which permits long items to hang out the left side of the headstock. Shown above is the view from the left side of the lathe through the headstock, looking towards the tailstock. This bore allows items longer than the distance between centres to be worked on, or simply positioned more conveniently in the chuck. Check the maximum spindle bore diameter, as the larger the better, provided the bore in the centre of the chuck is of sufficient size as well.

6

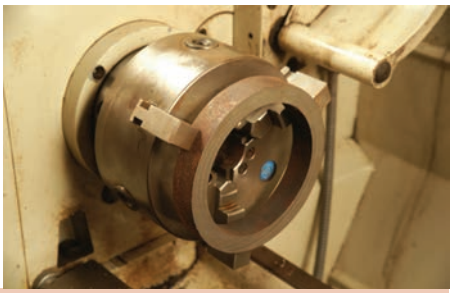
The headstock bore on the working side features a Morse taper socket, allowing the fitment of a dead centre. Morse tapers come in different sizes, but adapter sleeves are available. This lathe features a number five (5MT) headstock socket.

7

The tailstock sits at the right end of the lathe and can be slid along the bed and locked into place to support long work using a dead or live centre. The hand wheel is used for fine adjustment of the tailstock ram, and for applying pressure to the work. This is useful for instance when drilling, where the work rotates and the drill is held stationary in the tailstock ram. The ram has a Morse taper socket, 3MT on the lathe pictured. This allows fitment of various attachments such as centres, drill chucks or tapered shank drill bits.

ESSENTIAL ATTACHMENTS

The three-jaw chuck is the most useful work-holding device, and is self-centering just like a standard drill chuck. It is used to hold round or hexagonal work, either in the centre of the jaws, or hollow work which is gripped from inside using the steps on the chuck jaws.



Three-jaw chucks should be supplied with a second set of external jaws which are fitted when gripping larger diameter work from the outside. Check they are supplied with any new machine.

A four-jaw independent chuck is used to grip irregular-shaped work and should be included with any new machine. It is not self-centering, (although there are self-centering versions available), and jaws are individually adjusted. Note the chuck jaws are reversible to grip work from the inside or outside.

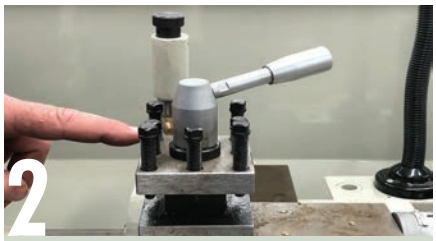
A faceplate should also be included with a new lathe. This is attached to the headstock in place of the chuck and is used to hold irregular-shaped objects, or where it is more convenient to bolt the object rather than grip it with a chuck.

Steadies are attachments which are often missing from second-hand lathes, and difficult to replace if missing. There are two types – fixed and travelling. The fixed steady pictured is bolted to the lathe bed and adjusted up to centre and support overly long work. Like the headstock bore, it allows work on shafts which may be longer than the lathe bed. In the image on the right, the tailstock has been removed completely, allowing the shaft to be held in the steady and the end faced off.

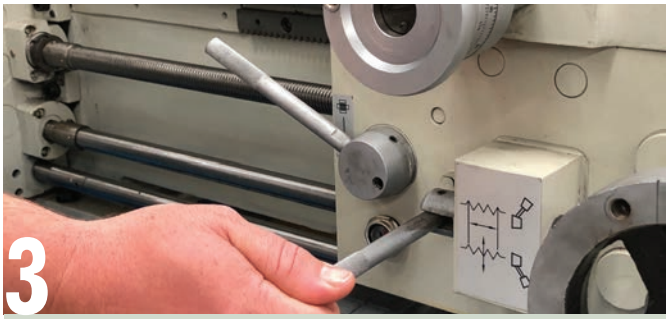
The travelling steady bolts to the carriage, and as a result travels with it. It is used to counteract the flex in a long, slender shaft when pressure from the tool is applied.

THE CARRIAGE

The metal lathe carriage houses a range of functions to manipulate the cutting tool (see Figure 2). The cross slide moves the toolpost in or out from the turning axis. Whether you work in the imperial or metric system, the cross slide hand wheel should feature graduations in both measurement systems. The same applies for the compound cross slide hand wheel.

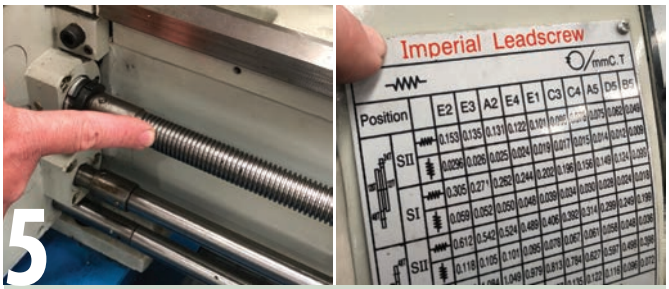


The tool post is where the cutting tools are attached. This standard-style turret toolpost can be equipped with more than one tool and then rotated to change between tools for different operations, but tool height must be adjusted using shims. An alternate option is the quick-change toolpost (discussed later).



The auto feed lever is used to engage the automatic movement of the tool. For most lathes, both the carriage and cross slide have auto feed, or in other words, the tool can be made to move along the axis or bed (carriage feed) for plain turning, or into the workpiece for facing (cross slide feed). Lower cost lathes will feature only auto feed on the carriage.

The split nut or half-nut lever engages the leadscrew for thread-cutting operations, which is the long threaded rod running the length of the bed (top left of picture). This locks the leadscrew to the carriage, moving it along the bed in the same fashion as the carriage auto feed. The leadscrew speed in relation to the headstock speed can be altered through a gearbox or series or change gears, giving a range of thread pitches for cutting different threads. Cheaper lathes use the half-nut as a form of carriage auto-feed.

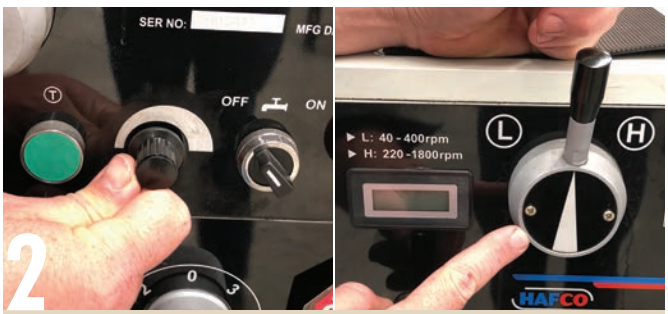


The leadscrew itself is either metric or imperial thread and is often protected from swarth by a telescopic shield. A lathe with an imperial leadscrew can cut both metric and imperial threads, and vice versa for a metric leadscrew. The shaft directly under the leadscrew drives the carriage and cross slide auto feeds. The shaft at the very bottom controls the spindle on/off/reverse direction.

As mentioned previously, the spindle control shaft is operated by a lever which is attached to the lathe carriage. It is used to set the spindle in motion, as well as reverse its direction. Note the threading dial directly above the lever; it is engaged with the leadscrew and is used to reference the position of the tool when taking multiple passes when thread cutting.

THE HEADSTOCK

If we turn our attention to the headstock, examine the range of spindle speeds available. Small lathes or older units feature belt drive spindles, where speed is changed by switching the belt position in much the same way as a drill press. Larger lathes feature a gearbox with a wider range of spindle speeds from sub-100rpm to almost 2000rpm. The lathes pictured have nine speeds which are selected by two levers at the top of the headstock. Note the spindle speed chart; a total of 18 spindle speeds are available by changing the motor drive belt position.



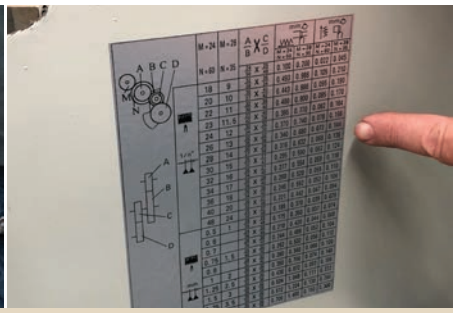
An alternate type of speed control used in some lathes is electronic variable speed. A small potentiometer dial (left) is used to adjust speed, while a dual-speed gearbox is used to provide a choice between low speed and high torque, or high speed and low torque. Note the digital tachometer screen to the left of the gear lever.

THE HEADSTOCK (continued)

A range of other functions are controlled from the headstock. This lever is used to reverse the direction of the leadscrew for cutting left-hand threads.

Other functions operated from the headstock may include (from left); Power indicator light, inching button (aids shifting spindle gear levers), coolant pump on/off, emergency stop button.

Apart from the spindle drive gearbox, the headstock houses the leadscrew drive gearbox, which is typically called the thread cutting gearbox. In some cases these gears will also alter the speed of the automatic feed. Gear positions are selected by these four knobs, giving a wide range of ratios and leadscrew speeds, which in turn give a range of thread pitches.



Lower cost lathes may feature a thread cutting gearbox with fewer options, while others may rely on a set of change gears to set the lead screw ratio of thread cutting. Most lathes will use some change gears in conjunction with the threading gearbox to expand the range of threads they are able to cut. When buying a lathe it is important to make sure it has the full set of change gears. It is also vital the thread cutting charts are included with the lathe, showing the change gear combinations to give the required thread pitches.

To cut certain metric threads on a lathe with an imperial leadscrew, and vice versa, a transposing gear featuring 120 and 127 teeth is used in the drivetrain.

OPTIONAL EXTRAS

Unless you purchase a very small lathe, you will need a substantial metal base to hold the unit at working height. It is well worth purchasing a base at the same time as the lathe if buying new, as it will fit the unit in question and contain a sump for the use of a coolant system (if fitted). It's a good thing to check on the showroom floor as some units may include the base in the purchase price.

A digital readout is a handy addition and makes precision work much easier. It displays the tool position in X and Z coordinates, rather than relying on reading the compound and cross slide handwheels, which is especially good if your eyesight is strained by small numbers. Once again, it is probably cheaper to buy it fitted than attempt to fit one later on.

A coolant system is far easier to operate if it is integrated into the lathe and the base. While coolant is not absolutely necessary for lathe operations, it is a welcome feature if included in the package. This flexible nozzle is attached to the carriage and thus travels with the tool. A sump in the base plate collects used coolant and filters it into a reservoir before pumping it back to the nozzle.

A quick-change toolpost (lathe) is great for increasing the speed at which work can be done on the lathe, as it allows tools to be swapped over in moments, and the tool height adjusted using a knurled nut, instead of using shims as with the standard turret-style tool post. It is important that a selection of tool holders (right) are included with the toolpost.