Cutting Metric Threads on an Imperial Myford 7 Series Lathe with a Quick Change Gearbox

What is Needed

For customers who own an Imperial Myford ML7, ML-7R or Super 7 lathe, with a Quick Change gearbox later than 1956, Myford offer a metric conversion set Part No 1481/1 to enable a full range of metric threads to be cut ranging from 0.2 mm pitch through to 4.00 mm pitch.

The conversion set, comprises of a metric quadrant, to temporarily replace the normal quadrant on the side of the gearbox, and 12 gear wheels which enable the full range of metric threads to be cut. Included in the conversion set are removable gear studs and spacers to fit on the quadrant, and a chart showing the gear trains necessary to cut the various pitches. The conversion set, shown in **Fig.1** comes in a sturdy cardboard box with fitted compartments for each item which acts as a handy storage system to keep all the parts safely in place as shown in **Fig.2** .

Fig. 1 The Parts Included in The Kit

Fig .2 The Storage Arrangement

Changing The Lathe Over To Metric

In order to temporarily convert the lathe to metric screwcutting, it is first necessary to remove the existing gears and quadrant which reside under the cover to the left of the gearbox as shown in **Fig. 3.** The gears in this picture are set up for imperial screwcutting as opposed to being set for fine tool feed. Fine feed is not available with the metric conversion fitted. Changing the gear system to metric sounds complicated when written down, but in fact takes around five minutes to carry out.

Firstly isolate the lathe from the power then remove the large gear wheel from the end of the gearbox shaft and if necessary lock the main mandrel in order to loosen the holding nut. Then remove the nut holding the imperial quadrant and loosen the Allen key clamping the quadrant round the gearbox shaft bush. The quadrant can now be removed in one piece complete with gear train, leaving the gear cover looking as in **Fig.4**. Now choose the gear train required for the metric pitch that you wish to cut. There is a chart fixed inside the gear cover as shown in **Fig. 5** and a diagram is also included in the conversion kit. Do check that the charts match as some older machines used a different chart. If the charts do not match, then use the one supplied with the conversion kit. Fit the two gear studs loosely to the metric quadrant leaving the studs loose and able to slide in the slots in the quadrant. The 60 tooth and 63 tooth wheels are then fitted to the first stud with the 45 tooth and 50 tooth wheels being fitted to the second stud. These gears may be left in place as they are common to all metric pitches and it would only be necessary to slide them back and forth along the quadrant slots in order to accommodate and mesh with a changed gearbox driving gear. This is only required for 3 Pitches from 3.0 mm to 4.0 mm. The remainder take a 60 tooth gear on the gearbox shaft.

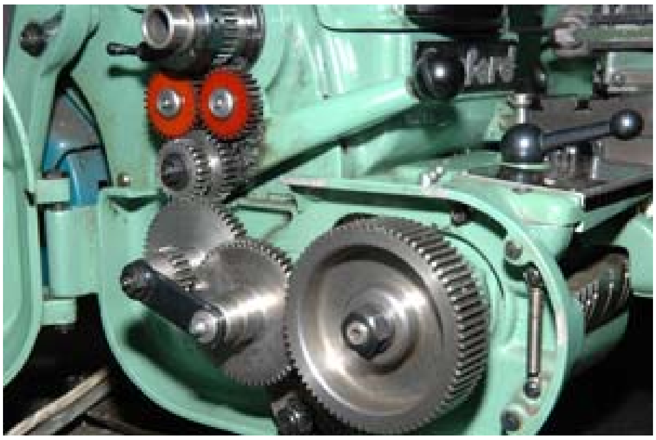

Fig. 3 The Imperial Gear Set-up

Fig. 4 Imperial Quadrant Removed

Fig. 5 The Metric Gear Chart

Fig. 6 The Gear Train for 1.25 mm Pitch

In practice it is usually only necessary to change the tumbler gear, swing the quadrant into mesh and then the normal controls on the Imperial gearbox are selected to do the rest. On this demonstration, a 1.25 mm pitch was required in order to cut an 8 mm x 1.25 thread and in order to do this, a 50 tooth gear was fitted to the tumbler stud and a 60 tooth gear was fitted to the gearbox driving shaft. The resulting gear train is illustrated in **Fig. 6** . The gear cluster on the tumbler stud is constructed so that the inner gear forms the shaft on which the outer gear is fixed and held captive by an integral key. In order to change this gear, it is necessary to slide the outer gear away from the inner gear, possibly levering them apart with a piece of hard wood or similar, if it hasn't been moved for some time, and then fitting the required gear in it's place.

In order to cut a pitch of 1.25 mm the gearbox coarse setting is set to position B (Medium) and the main gear selector is set to position 1. We are now ready to cut our thread.

Before starting the lathe, remember to put it into back gear, or disconnect the tumbler drive, otherwise your leadscrew will revolve at an alarming rate.

Differences between Imperial & Metric Screwcutting.

The first point to make about cutting metric threads, is that the leadscrew clasp nut must remain closed at all times until the thread has been completed. Old hands at cutting imperial threads will be used to the fact that by using a thread dial indicator shown in **Fig. 7** it is possible with the majority of imperial threads to free the clasp nut from the leadscrew, wind back the saddle to the start of the thread, and then use the thread dial indicator to accurately pick up the thread. This is not possible when cutting metric threads on an imperial machine. The gear train must remain intact and the saddle must be wound back by either running the lathe backwards under power, or by means of a Mandrel handle, whichever is preferred.

The second thing to note is that the angle of the thread is 60^o not the 55^o that you may have been used to with BSW and BSF threads. Grind your cutting tool to an accurate 60^o with (say) 7^o side rake and if you wish to be absolutely correct, just stone off the very end into a slightly rounded nose.

Fig. 8 shows a thread gauge being used against the work to check that the tool is at right angles to the work and is ground to the correct angle.

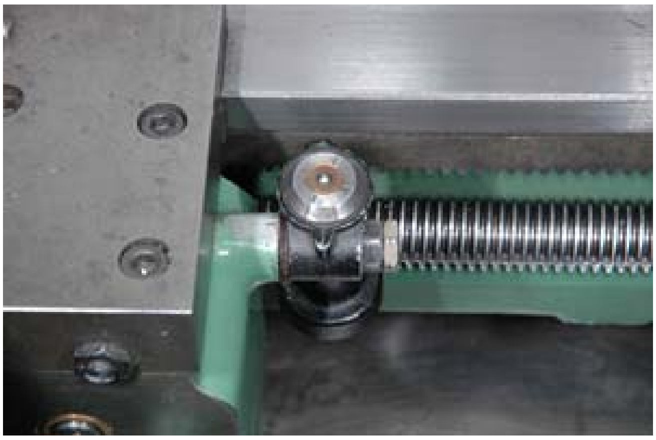

Fig. 7 You Cannot Use a Thread Dial Indicator

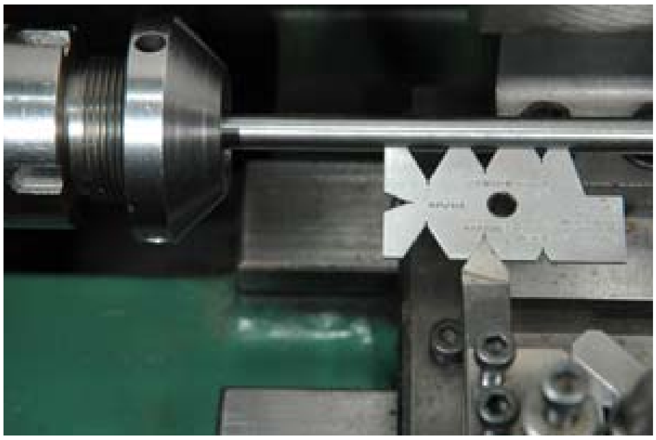

Fig. 8 Checking The Tool Angles

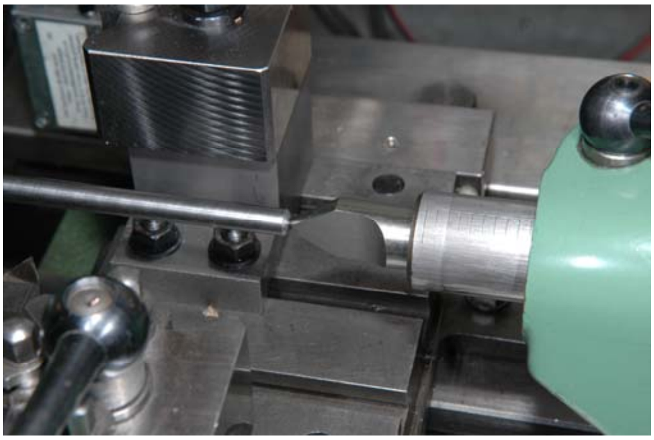

Fig. 9 Using a Half Centre

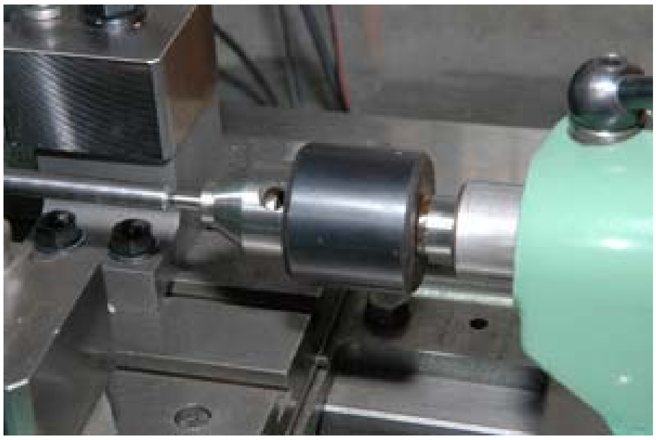

Fig. 10 Using a Fine Rotating Centre

When screwcutting threads of a relatively small diameter, it is necessary to ensure that the tailstock centre will not foul either the cutting tool nor the actual top slide during the screwcutting procedure. Ensuring that the top slide will not foul the tailstock is achieved by rotating the top slide to an angle as described below, but the actual tool clearance needs further thought. **Fig. 9** shows an 8 mm rod being set up for screwcutting, and a half centre (Myford part no 11412) has been placed in the tailstock so that the tool may move to the right of the work prior to beginning the cut. Alternatively a rotating centre with interchangeable centres may be used, selecting a fine point centre as illustrated in **Fig. 10** (Myford Part no 78254).

Cutting The Thread

As the leadscrew must be kept synchronised with the lathe mandrel during the entire operation, a careful approach to the task must be taken. Different lathe operators have a variety of methods to achieve this, but the most popular method of screwcutting with a permanently engaged clasp nut is as follows :-

The top slide is used to “put on the cut” and the top slide is swung round to an angle that is half of the angle of the thread. With ISO Metric threads, the thread angle is 60^o and so the top slide is rotated by 30^o (60 / 2) from the right angle position (60^o from normal) so that advancing the top slide will mean that the trailing edge of the tool will follow the line of the trailing edge of the thread and virtually all of the cutting will be done by the leading edge of the tool which has a 7^o side rake. If the tool were plunged directly into the work at 90^o as is sometimes the case with normal turning, then the trailing edge of the tool would be attempting to cut with a negative rake, giving an inferior finish to the work and putting unnecessary stress on both the work and the tool. **Fig. 11** shows the set-up.

The cross slide leadscrew is used solely to retract the cutting tool when reversing the lathe to return the tool to the start of the thread, and to then return the tool to the original position ready for the next cut.

Start by rotating the top slide as above and set the tool exactly at right angles to the work and exactly at centre height. Move the cross slide in towards the work until the tool is just touching the work. Trapping a piece of cigarette paper between the work and the tool will indicate this point. Zero BOTH the top slide dial and the cross slide dial – and zero the Digital Readout (DRO) if one is fitted. Move the saddle to the right so that the tool tip is well clear of the work and engage the clasp nut. Put on the cut using the top slide graduations as your guide, and engage either a slow back gear speed or fit a mandrel handle, whichever is your preference. Run the lathe until your tool has reached the end of the required thread and stop the lathe whilst leaving the clasp nut closed. Most operators prefer to take a minimal first cut of (say) one thou just to scratch the work and enable a check to be made that the correct thread pitch is being cut. Measure twice and cut once is always a good policy.

Once you have reached the end of the cut, use the cross slide to retract the tool well clear of the work and run the lathe in reverse to wind the tool back to the right, clear of the thread being cut. (all these instructions assume you are cutting a right hand thread). Move the cross slide back to the zero position on the dials, or back to zero on the DRO and put on the cut using the top slide. Continue this cycle until the thread has been cut to the full depth, finally checking the fit with a suitable nut or mating part. Use a good quality cutting oil during the progress to ensure a clean finish. (part nos. 80200 or 80201)

Determining the depth of thread is not quite straightforward as the top slide which is being used to measure the cut has been swung 60^o from it's normal position i.e. 30^o from the cross slide direction. In the illustration, an 8 mm x 1.25 mm thread is being cut. This has an outer diameter of 8 mm and a core diameter of 6.47 mm so the tool will need to move inwards by (8.00 – 6.47) / 2 = 0.765 mm at right angles to the work. Therefore in a right angled triangle, 0.765 is the adjacent side and the top slide travel is the hypotenuse with the angle of the triangle being 30^o , as shown in **Fig. 12.** Now Cosine = adjacent / hypotenuse, therefore Cos.30 ^{o} = Thread depth / top slide travel, or to express that another way:-

Top Slide Travel = Thread Depth / Cos. 30 ^{o}.   i.e. Top Slide Travel = 0.765 / 0.8660 = 0.8834 mm

Therefore our top slide must be advanced by 0.8834 mm (or .0348") to cut the thread, so we must advance the top slide by 35 thou on our imperial machine to achieve a theoretically good fit. Whilst this is a good guide, your tool tip would have to have exactly the correct rounding in order to work and it is best to try the thread when approaching completion. Most probably the cut will have to be increased to around 40 thou in order to achieve a good fit. If a good die is available, many engineers like to finish the thread by running a die down an almost completed thread in order to achieve the absolutely correct profile.

Fig. 11 Lathe Set-up for Screw Cutting

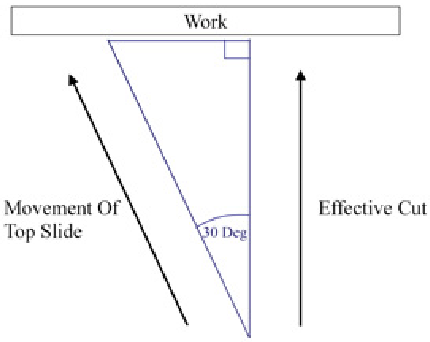

Fig. 12 Angle Calculation

Although the illustrated thread was cut without a relief groove at the end of the thread, it does make it extremely difficult to stop the lathe exactly at the correct point where the previous cut was stopped. For this reason it is advisable where other factors allow, to cut a groove prior to screwcutting where the end of the thread will terminate. This groove should be cut to the depth of the proposed thread.

Fig. 13 shows the screwcutting roughly half way through and **Fig. 14** shows the final thread being tried with a suitable nut prior to disengaging the leadscrew from the gear train. Using the metric conversion kit is quite simple and despite this long description of the process, is very convenient and effective in practice.

Fig. 13 Cutting The Thread

Fig. 14 Testing The Completed Thread