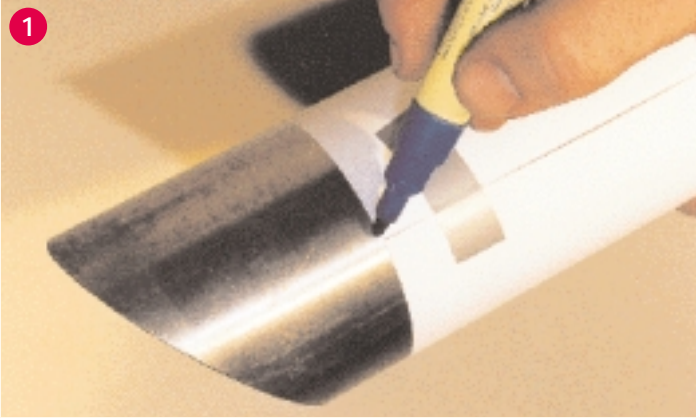




Accurate marking and sheet metal hole cutting

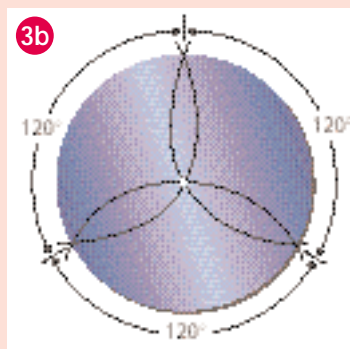
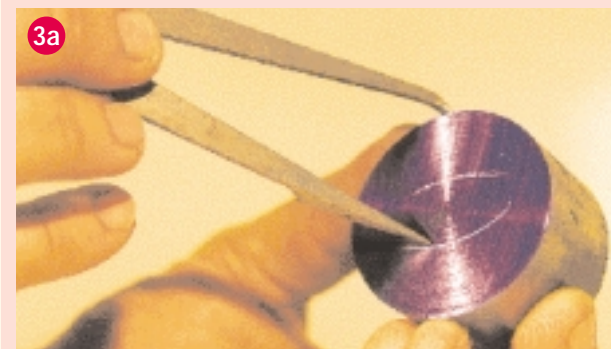
As on-site engineering and fabrication becomes common practice in farm workshops so does the need for precise measuring and marking out methods. These simple steps will improve accuracy without expensive or sophisticated equipment. Another way to improve a workshop's versatility and give a professional finish is to use more advanced forms of hole cutting in sheet metal.



1 A common problem in a workshop containing only hand tools is how to mark a pipe or tube correctly so that when it is cut the end will be square. A simple solution is to wrap a piece of paper around the pipe so the two ends overlap. To produce an accurate line the paper must have a square cut edge and be wrapped tightly around the pipe. Suitable paper is photocopying or writing paper for small diameter pipes and heavy brown wrapping paper off a roll for larger diameter pipes.



2 Where accurate or complex marking out is required for metalwork, using a mark-out die is recommended. The mark-out die allows scribe marks to be seen easily and marking out errors can be painted over quickly to prevent confusion when machining the metal. Mark-out die dries quickly and is easily removed with simple solvents.

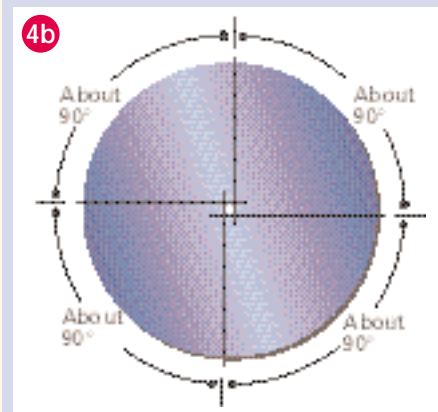


3a A pair of 'odd-leg' calipers is a useful tool for accurately marking out the centre of a round object. Use the calipers to scribe three arcs from the edge spaced at 120 degree intervals. Locate the outside leg of the caliper as close as possible to the surface edge for maximum accuracy. A compass or normal calipers are acceptable substitutes if odd-leg calipers are not available. **3b:** While exact 120° spacing of the points is not necessary when marking out a centre location, the closer the spacings to 120° the more accurate the result will be. Additional scribed arcs such as four at 90° will help account for surface irregularities.

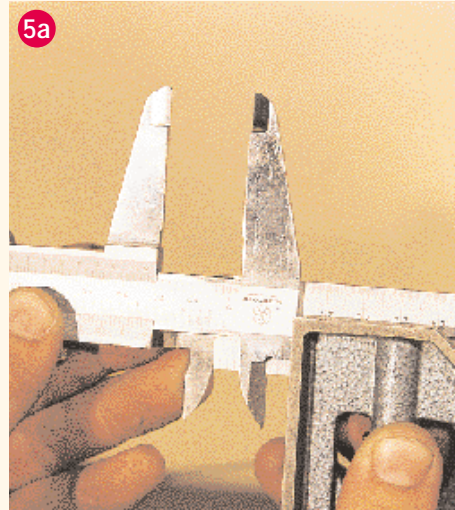
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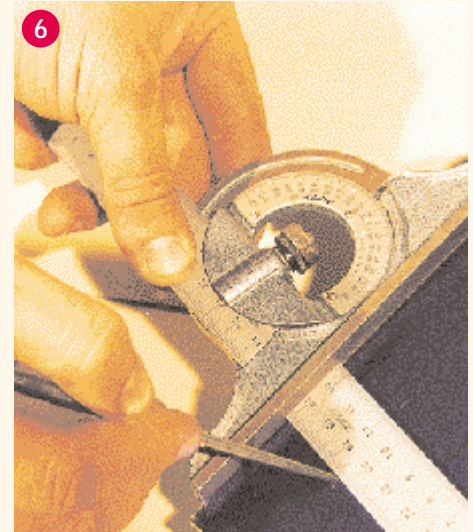
4a
A 'centre stock square' is a tool designed specifically for marking centre lines on round objects. This tool is usually bought as part of an engineering combination square set.



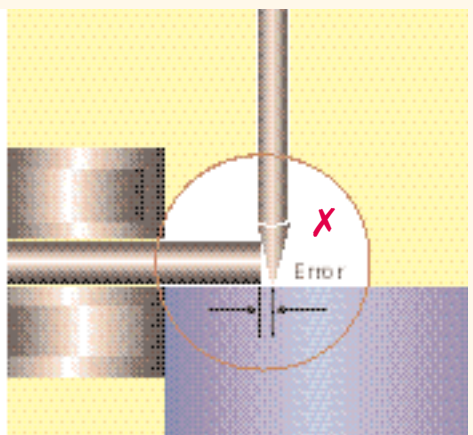
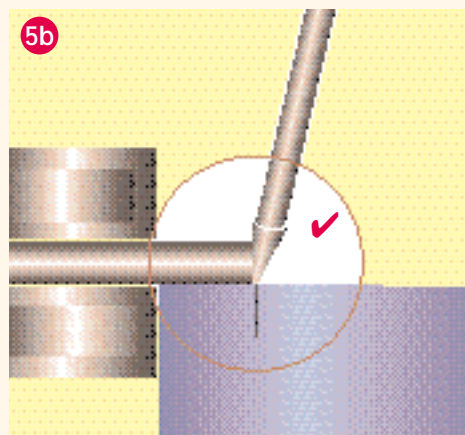
4b
For the most accurate centre location, scribe lines with the centre stock positioned at 90° intervals around the piece. Any inaccuracies in rule alignment within the stock will result in lines which do not intersect. An accurate location of the centre is the middle of the square produced by the lines.



5a
When marking out accurate measurements from the edge of a work piece, use an engineer's square to transfer a measurement rather than marking out directly from a tape measure or steel rule. For best results set the square using a vernier gauge.



6
A useful tool is the protractor square. This tool is usually bought as part of an engineering combination square set and is used to accurately read or mark any angles as well as aid in general marking out tasks.

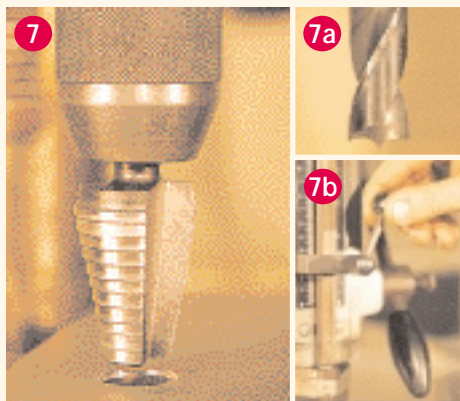


5b
To ensure accuracy when marking out measurements, lay the point face of the scribe against the edge of the square rule.

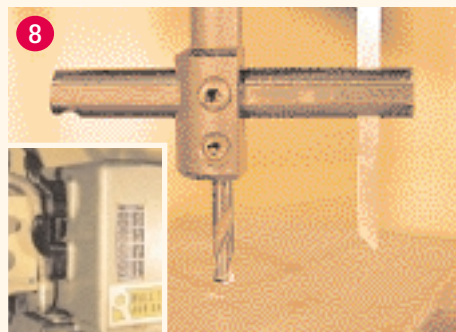
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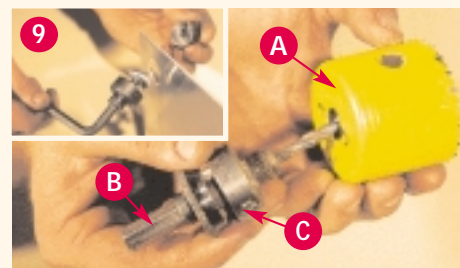
Selecting drills to cut sheet metal



The Uni-bit tool is available in size ranges capable of cutting holes from 3-40mm. Each of the stepped cutting shoulders will produce an accurate, neatly finished hole in metal or plastic up to 3mm thick. For thicker material the hole can be cut from both sides. Inset: Drills with this special point profile (7a) will make sheet metal and plastic drilling more manageable. Sheet metal drills are available or a normal drill can be ground carefully to produce this type of point profile. Careful setting of the 'depth stop' on a pedestal drill press (7b) will produce consistent, accurate holes rapidly without the need for after-finishing processes such as deburring. Setting the depth stop slightly lower will allow the next larger cutting shoulder of the Uni-bit tool to cut a neat chamfer around the surface edge of the hole.



Larger holes can be cut in sheet metal or plastic using the tool sometimes referred to as a fly-cutter or sheet metal cutter. This can be set for holes up to 200mm diameter. Ensure the piece to be cut is clamped firmly and the cutting surface is 'square' to the drilling axis so the blade is engaged around the full circumference of the hole. Check the tip of the cutting blade regularly and regrind when necessary. Monitor drilling pressure to prevent overheating of the cutting tip, distortion of the cutter bar or breakage of the cutting blade. Stand clear when cutting to prevent clothing becoming entangled in the cutter bar and to avoid injury. Inset: For larger holes, the speed at the cutting tip can be high, even at slow drilling speeds. Cutting speed can be calculated for a given hole diameter and drill speed and this figure should be compared with that recommended for the 'tool steel' cutter blade and the material being cut. If in doubt, use the slowest drill speed.




An effective and safe method of drilling large holes is by using a conventional hole saw. Quality hole saws have a one-piece fully welded cutter (A), hexagonal machined drive shaft (B), locking pins to prevent the cutter over-tightening on the arbor thread (C) and a facility for replacing and setting the depth of the drill bit. Keep cutting speed low and use wood under the sheet metal to prevent distortion. Inset: If both sides of the sheet metal can be accessed, a safe and simple method of producing large diameter holes is by using the 'hole punch', or 'chassis punch'. Once the punch has been assembled through the starter hole simply pull the cutter through using an allen key. 

TABLE 1 Cutting speeds

Cutting speed = hole circumference (m) x rpm
= metres per minute

Recommended cutting speeds

Mild steel — 18m per minute (maximum).

High tensile steel — 3.6m per minute (maximum).

Aluminium — 75m per minute (maximum).

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