

BRIBIE & DISTRICT WOODCRAFTERS



BEGINNERS BOX MAKING COURSE



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Box Making for Beginners

Box Design

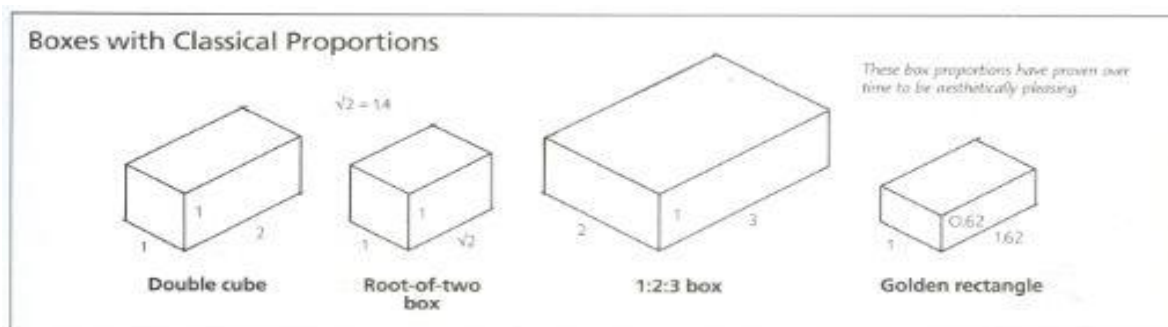
The design of a box can be subjective. There are many types of box designs and different construction methods used. When starting out as a box maker it is best to look at what other box makers have done. When you are at woodworking galleries, fairs or markets look what you think are the features of those boxes that appeal to you.

When designing a box there are two main decisions you need to make, the dimensions of the box and type of wood you are going to use.

Function and Proportion

What is going to be kept in the box as this will have a bearing of the shape and the dimensions. The box could be used for storing pens, jewellery or other special items. Some boxes have no real function other than to be a decorative. Once the function of the box is decided working out the proportion is next.

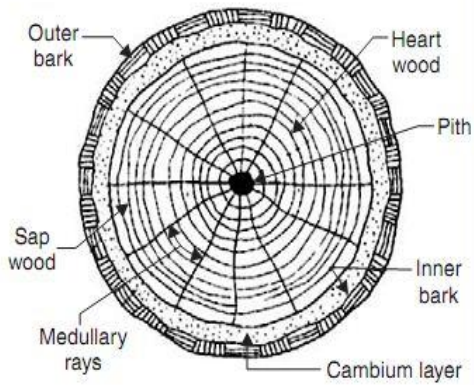
Most boxes are made using traditional proportions. These are proportions that have been used for centuries. Below are some examples of proportions.



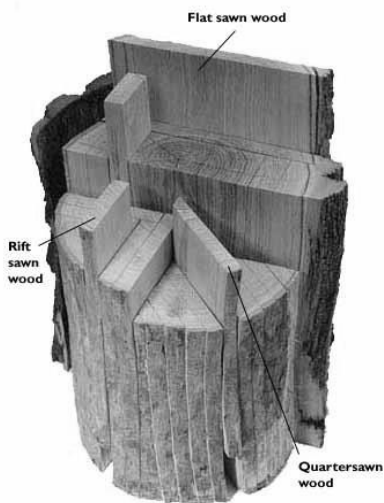
When considering the proportions for a box you will also need to look at the thickness of the wood you plan to use. Most boxes are made from wood either 10mm or 12mm thick. The smaller the box the thinner the wood and, the larger the box the thicker the wood. The thickness could range from 6mm for a really small box to 19mm for a really large box. In general if the circumference of the box is less than 750mm you would use 10mm thick wood if it is greater than 750mm you would use 12mm thick wood.

Timber Selection.

When selecting wood for a box is really comes down to personal taste. Some box makers have personal favourites when selecting timbers. The choice of timber usually depends on cost, hardness, appearance, workability and availability.



Parts of a tree



Cutting logs in timber

When timber is cut from logs, it is typically cut in one of three ways: quarter sawn, rift sawn or plain sawn. Each type of lumber is dependent on how the log is oriented and cut at the sawmill. The result is a particular orientation of the growth rings on the end grain of the board and is what defines the type of timber. The type of cut also determines the figure in a piece of wood and the wood's mechanical properties.

Plain Sawn Timber

Plain sawn is the most common and least expensive timber because it is easy to manufacture logs into timber. The annular rings are generally 30 degrees or less to the face of the board; this is often referred to as tangential grain. The resulting wood displays a cathedral pattern on the face of the board.

Quarter Sawn Timber

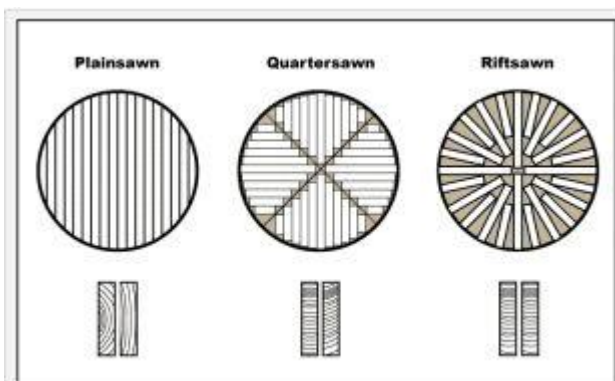
More expensive than plain sawn timber to produce. It has an amazing straight grain pattern that lends itself to design. Quarter sawn timber is defined as wood where the annular growth rings intersect the face of the board at a 60 to 90 degree angle. When cutting this timber at the sawmill, each log is sawed at a radial angle into four quarters, hence the name.

Rift Sawn Timber

Most expensive, least common.

Rift sawn wood can be manufactured either as a complement to quarter sawn timber or logs can be cut specifically as rift sawn. In rift sawn timber the annual rings are typically between 30-60 degrees, with 45 degrees being optimum. Manufactured by milling perpendicular to the log's growth rings producing a linear grain pattern with no flecking. This method produces

the most waste, increasing the cost of this timber. Rift sawn lumber is very dimensionally stable and has a unique linear appearance.



Softwoods and Hardwoods

Timbers are classified either as softwood or a hardwood. Hardwoods come from deciduous trees, trees which have leaves. They have thick cell walls and small cell cavities. Softwoods come from needle-bearing trees called conifers. They have thin cell walls and large cell cavities. Although most hardwoods are hard and softwood woods are fairly soft compared with hardwoods, some hardwoods seem soft and some softwoods are quite hard and sturdy.

Wood Structure

Hardwood

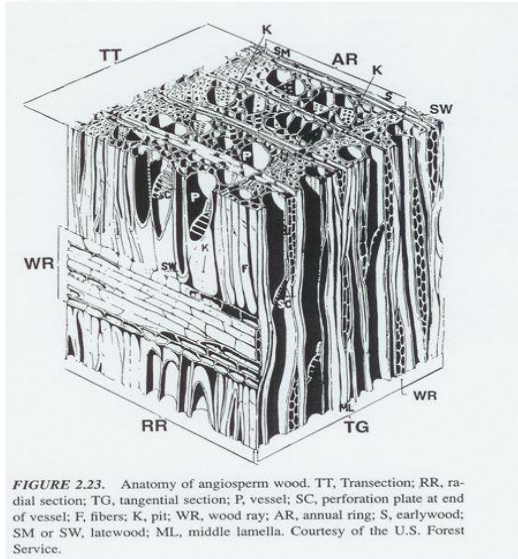


FIGURE 2.23. Anatomy of angiosperm wood. TT, Transverse; RR, radial section; TG, tangential section; F, vessel; SC, perforation plate at end of vessel; F, fibers; K, pit; WR, wood ray; AR, annual ring; S, earlywood; SM or SW, latewood; ML, middle lamella. Courtesy of the U.S. Forest Service.

Softwood

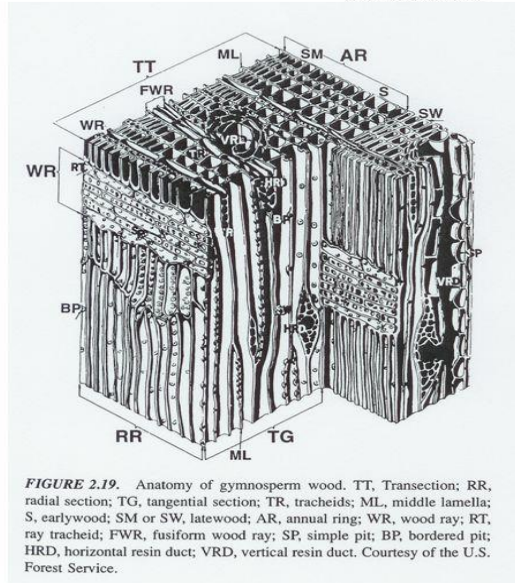


FIGURE 2.19. Anatomy of gymnosperm wood. TT, Transverse; RR, radial section; TG, tangential section; TR, tracheids; ML, middle lamella; S, earlywood; SM or SW, latewood; AR, annual ring; WR, wood ray; RT, ray tracheid; FWR, fusiform wood ray; SP, simple pit; BP, bordered pit; HRD, horizontal resin duct; VRD, vertical resin duct. Courtesy of the U.S. Forest Service.

Some Timbers Suitable For Box Making

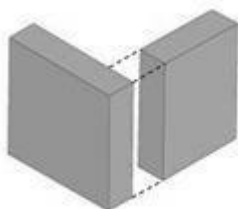
Softwoods	
Red & White Cedar	Has straight grain and course texture. Reddish brown in colour fading to silver grey. Easily worked with tools but because it is a soft timber care is needed to prevent marking.
Cypress	A highly durable Australian softwood timber. Its characteristic knottiness produces an attractive figure on exposed faces. Works well with tools but care is needed near knots.
Celery Top Pine	An attractive, durable and easily worked softwood, pale when cut and then darker with age. Works well with tools.
Huon Pine	Has a light straw colour, ageing to dull yellow. Grain is straight fine and even, sometimes with Birdseye figuring. Works well with tools.
Queensland Kauri	It is Australian native softwood with a fine even texture, pale cream to light or pinkish brown heartwood and a straight grain. Works well with tools.
Hoop Pine	It ranges in colour from light yellow brown to pale cream, with a fine and even texture. Easily worked with tools but care needed to prevent timber splitting. Because it is a soft timber care is needed to prevent marking.

Hardwoods	
Silky Oak.	Course even textured wood, usually straight grained. Reddish brown in colour with some varieties being pinkish in colour. Works well with tools.
Queensland Maple	A pink to brownish pink heartwood makes for a distinctive tree. It is prized for its attractive wavy or curly grain. Works well with tools.
Sassafras	A straight-grained and yellowish to brown in colour. Works well with tools but care needed to prevent timber splitting.
New Guinea Rosewood	An attractive timber with the heartwood can be either golden brown or a dark blood red. Sapwood pale yellow. Texture medium. Grain variable. Heartwood can be either golden brown or a dark blood red. Works well with most tools.
Mahogany	Medium textured wood with straight grain and even or interlocked grain. Reddish brown to deep red in colour.
Tasmanian Oak	A medium textured, straight grained wood. A hard wood but it works well with most tools.
Jacaranda	A light creamy coloured hard wood with medium texture. Usually straight grained and is figured with some brown streaked markings. Works well with tools.
Meranti	Ranges from pink to pinkish-brown with a coarse but even textured grain. It is light in weight compared with most hardwoods. Works well with tools however it does tend to fur up when sanded.

If you are making a box that is going to be handled frequently the hardness/softness of the wood is important to minimise scratches and dents. Also workability is a major factor when selecting timber. A timber that is cut and shaped cleanly and doesn't dull blades and cutter bits is the best option. A medium density timber is usually the best option for making boxes.

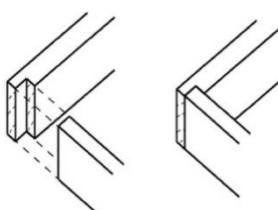
Joint Selection.

When you are designing a box you need to consider the type of joints that are best suited for that box. A good quality box does not rely on nails or screws to hold it together, instead it is held together by gluing the interlocking parts (joints) therefore, the more surface area of the joint the stronger.



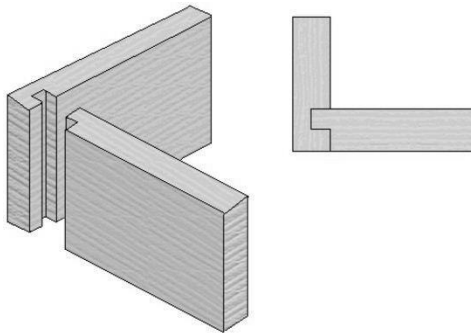
Butt Joint

This is the easiest joint to use. Its disadvantage is that it is not very strong if it is just glued. It is usually strengthened with dowels, nails or screws.



Rebate Joint

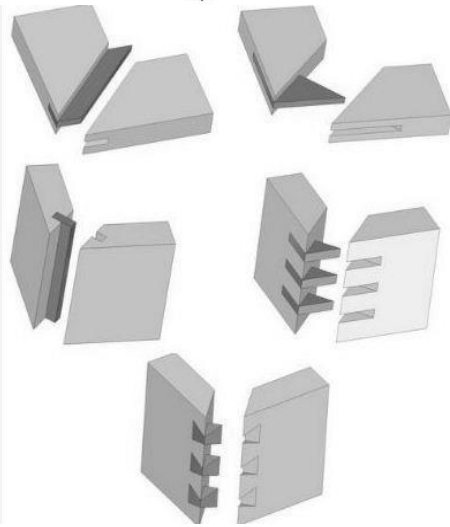
This joint is an improvement on the butt joint because there is more surface area for gluing.



Rabbet Joint

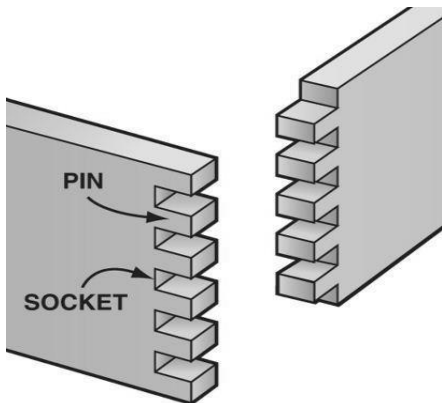
This is a common joint used in box making. The greater surface area makes a stronger glued joint. Also the full thickness of the board is shown which is preferred by some box makers.

Mitre Joint



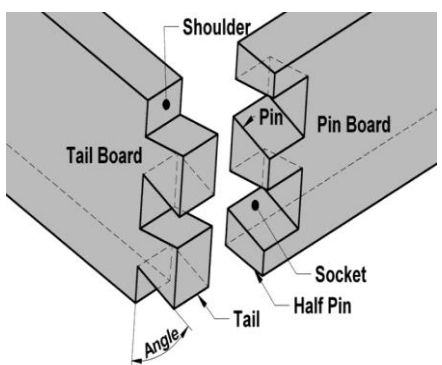
This joint is achieved by cutting the ends at 45 degrees which when assembled makes 90 degrees. Mitred joints can be strengthened by adding splines. These need to be cut and assembled when the box is assembled. (See joints on top and middle on left). Another type of spline called a key is fitted after the box has been glued up. (See joints on the right). Besides being a strong joint, splines and keys make an attractive feature especially when a contrasting timber is used.

Pin or Finger Joints

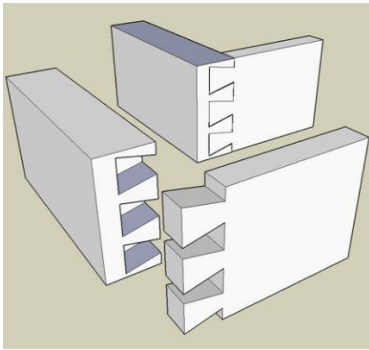


These are a very common joint for boxes and cabinets. They are easy to do because all of the surfaces are square. The size of the pin varies but the most common width of the pin is the same size as the thickness of the timber. They made a strong joint because of the surface area where the pin goes into the sockets.

Through Dovetail Joint



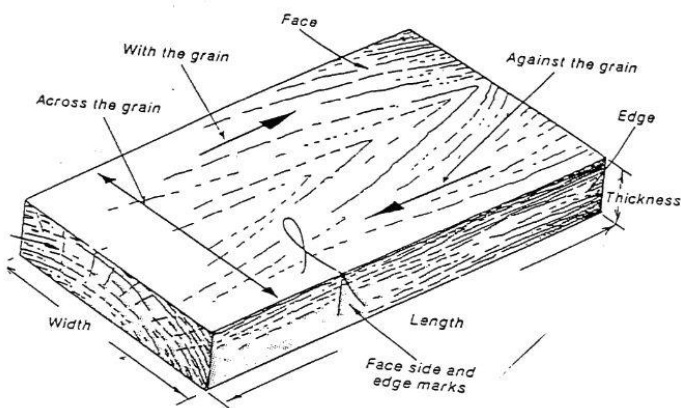
These are sometimes called plain or box dovetails. The shape resembles a dove's tail. The dovetail joint is very strong because of the way the 'tails' and 'pins' are shaped. This makes it difficult to pull the joint apart and virtually impossible when glued. The end grain of both boards is visible when the joint is assembled which makes an attractive feature.



Half-Blind Dovetail Joint

This joint is used when you do not want the end grain to be visible from the front of the item. The tails are housed in sockets in the ends of the board that is to be the front of the item so that their ends cannot be seen. Half-blind dovetails are commonly used to fasten drawer fronts to drawer sides. This is an alternative to the practice of attaching false fronts to drawers constructed using through dovetails.

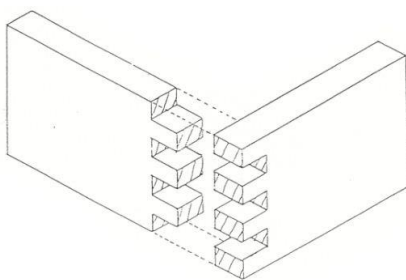
Marking Out



After the pieces have been cut to the correct length, using a pencil with a soft lead (2B) mark out the face & edge marks as shown on the illustration on the left.

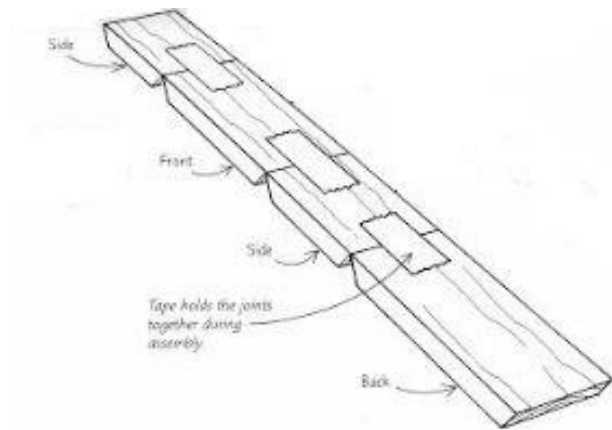


Now put the pieces together how they are to be assembled. On each corner place a number on each piece. This is let you which how it piece will fit so they don't get mixed up and you wonder why they fit properly.



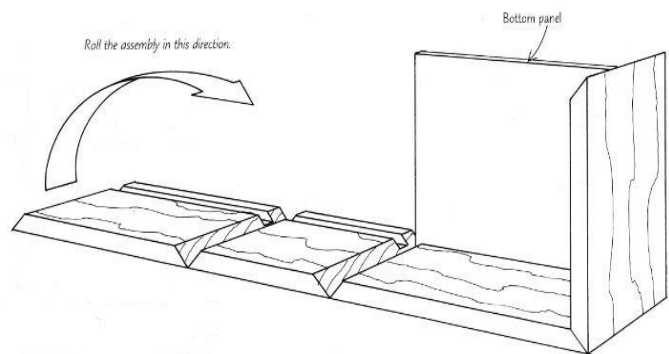
The next step will depend on the type of joint used and the method of cutting out that joint. Hand cut joints need more detailed marking out than joints that are to be cut out using machines. **Care and accuracy** when marking out will ensure that the joints fit correctly and avoid any disasters.

Assembling a Box



A good practice is to “dry fit” the box together. This is done without any glue to ensure that all the parts fit together correctly. If the box has loose joints such as mitre joints the outside should have masking tape applied to aid the assembly. When the box can be dry fitted successfully, sand down the insides to at least 400 grit as it is hard to sand there after the box is

assembled. Using good quality PVA wood glue, assemble the box and clamp if required to place the joints together correctly. Don't overdo the amount of glue you use and wipe away any access glue with a damp cloth. Check the corners are square and leave over night for the glue to dry.



Finishing

Rules for Sanding

Always sand in the direction of the wood grain (from end-to-end of the board) when possible. Sanding cross-grain(across the board) or diagonally to the grain tears the wood fibres, leaving more obvious scratches that then require more work to sand out.

Always begin sanding with a grit sandpaper that cuts through the problem (machine marks, gouges, scratches, etc.) efficiently and removes it without creating larger than necessary scratches that then have to be sanded out. Then sand out the scratches left by this grit sandpaper with a finer grit sandpaper and continue with finer and finer grits until you reach the scratch size that doesn't show under the finish.

You would typically begin sanding with 120 grit then, 150, 180, 240, 320, 400 and finish with 600. For an even smoother finish sand with 800 and 1000. The finer the finish the smoother the surface you will achieve and the less sanding you will need between coats.

Types of Finishes

The type of finish on a box is really down to personal preference. There are a number of different types of finishes but the main ones used are Danish Oil, Wipe-on Poly and Lacquer.

Danish Oils

Danish oil is the easiest finish to apply, simply wipe on and wipe off. It produces a soft satin sheen and a very thin "close-to-the-wood" appearance. Most Danish Oils are a blend of penetrating oil & varnish. Danish Oil penetrates deep into wood pores to protect from within and to enhance the natural look and feel of the wood. It creates the rich, warm glow of a traditional hand-rubbed finish. You just simply brush or wipe on and wipe off.

The first coat should be applied wet and left wet on the surface for 5 to 10 minutes, then wiped off. The excess of each coat has to be totally wiped off or the finish will dry sticky. Each coat requires overnight drying in a warm room, garage or shop. Two coats are necessary for good results. Once dry for about a week an even smoother finish can be obtained by applying a furniture polish.

Wipe-on Poly

Wipe on Poly is varnish or oil-based polyurethane varnish in any sheen (gloss or satin) thinned about half with mineral spirits (paint thinner). It is used when you want a protective and durable finish that is easy to apply and produces almost perfect results.

Wipe or brush on and wipe off all the excess. Allow to dry overnight or at least 6 hours in a warm place and sand each dried coat lightly with 400-grit sandpaper to remove dust nibs before applying the next coat. Apply at least 3 coats.

Lacquer

Lacquer provides the extremely high gloss finish. It is quite durable and resistant to damage; however, over time it can begin to dis-colour and become scratched. It is applied using a spray gun, because it is more viscous (thinner) than the other finishes. You'll need a high-volume; low-pressure (HVLP) spray gun and a well-ventilated and spacious workspace to apply it.

When deciding on what finish to use you need to consider the following;

Danish oil is good for natural look of the good piece of timber, but you won't achieve a high glossy finish.

Wipe-on Poly is easy to apply and comes in matt to gloss finishes.

Lacquer dries really fast, comes in a matt to high gloss finish but requires spray equipment to apply.

Start with which ever finishing method you feel the most comfortable using.

WORKSHOP SAFETY

To avoid accidents, a woodworker must practice good safety practices when working with tools or equipment. In a woodworking workshop all hand tools, portable power equipment, and woodworking machines have a specific use. Each piece of equipment has its own special hazards if not used properly. You must become very familiar with their use and maintenance in order to insure personal safety, gain maximum enjoyment, and produce useful projects that one can be proud of.

When working in the workshops observe the following safety rules:

- Always wear safety equipment such as safety glasses, face shields, dust masks, and hearing protection appropriate for the type of tool or equipment being used.
- Wear appropriate clothing such as work clothes, no loose fitting clothing or jewellery around moving equipment.
- Only use woodworking machines and tools you have been trained to use.
- Always use the correct tools and equipment for the job and only as per the correct Safe Operating Procedures.
- Be aware of other people working around you and void distractions at all times.
- Always check timber for nails, screws, staples, loose knots or other defects before using it.
- Use a push stick to push the stock into the cutting area whenever possible.
- Never make an adjustment with the power on and unplug the machine when changing blades, bits, etc.
- Check equipment is safe to use before using it.
- Report ant defective equipment.

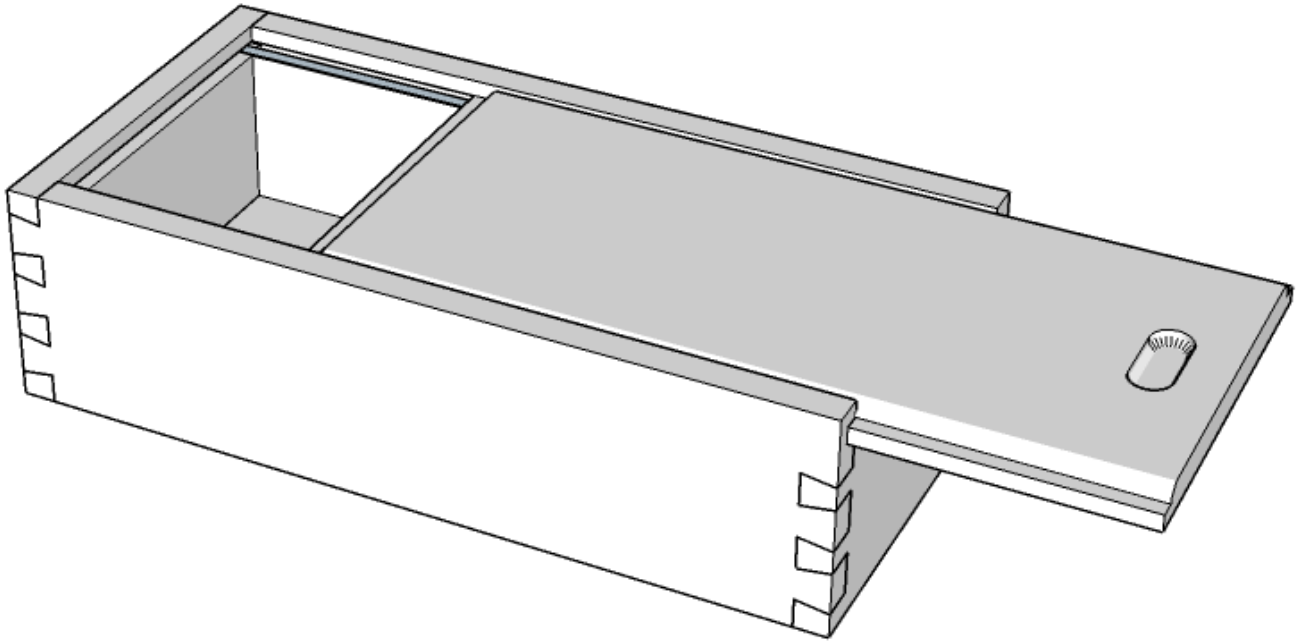
During this Box Making for Beginners Course you will be required to use hand tools as well as the following woodworking equipment:

- Bandsaw
- Circular Table Saw
- Compound Mitre Saw
- Router Table
- Linisher

You may also be using following woodworking equipment:

- Drum Sander
- Thicknessener
- Jointer
- Mitre Guillotine

Sliding Lid Box

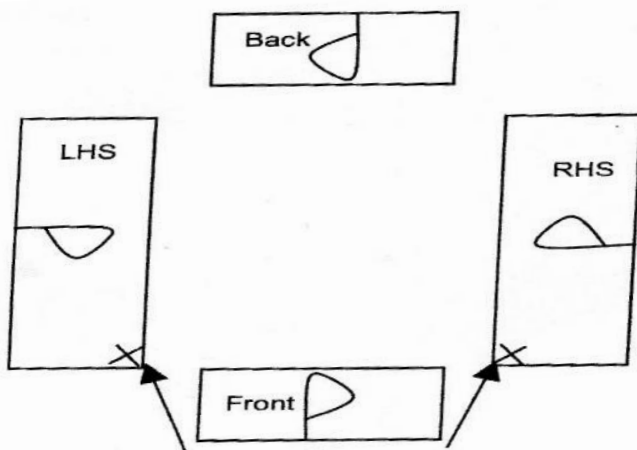
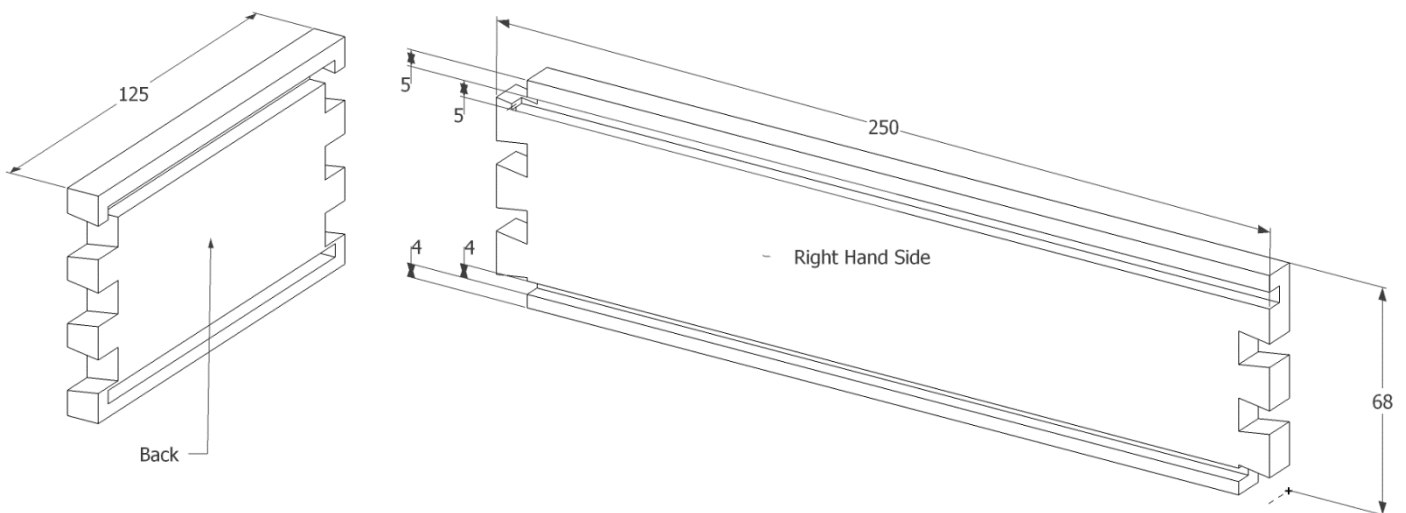


CUTTING LIST			
Part	Quantity	Material	Size
Front/Back	2	Camphor Laurel/Cedar	125 x 68 x 10
RH/LH Sides	2	Camphor Laurel/Cedar	250 x 68 x 10
Top Panel	1	Camphor Laurel/Cedar	250 x 117x 10
Base	1	Plywood	240 x 115 x 4

Procedure

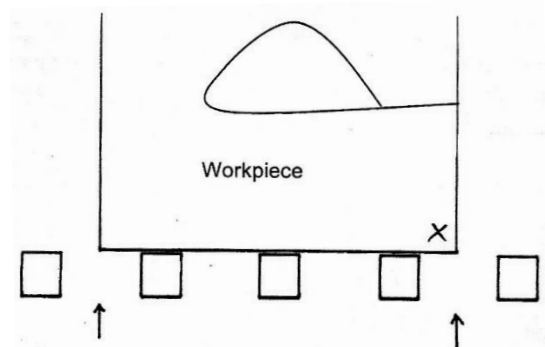
1. Using the table saw rip the timber to the correct width then, fit the sled to the table saw and cut the pieces to the correct length.

Detail of Main Parts



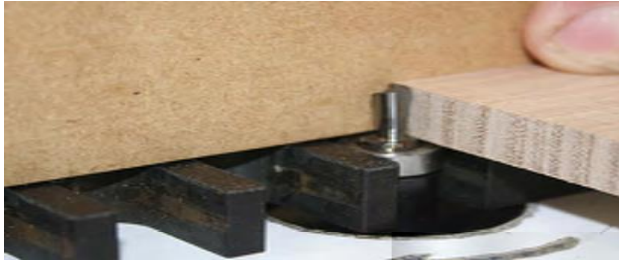
2. Mark the face & edge marks on the outside face of each piece, then place the pieces together how they are to be assembled matching the grain as much as possible. Number the ends of each piece how they will go together.
3. Mark a cross on the top front corner on both the long sides as you are not going to cut the dovetail slot that would normally go in this position.

4. Set up the Gifking's Dovetail Jig on the side of the jig marked "Dovetail". Align the ends of your first piece of timber so the ends are evenly spaced on the jig. Clamp both stops against the edges of your workpiece. Clamp your timber to the jig.



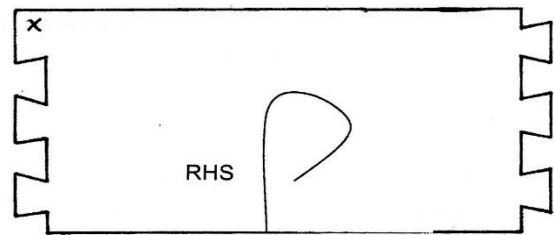
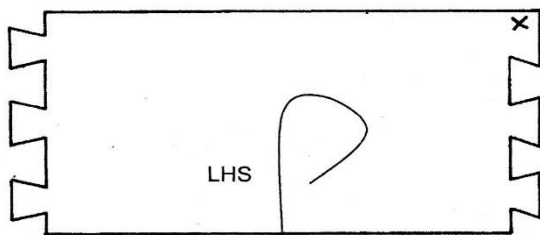
NOTE: When using this jig your face marks must always face outwards.

5. Fit the dovetail router bit in the router table. The height of your router bit **MUST** be the height of the jig plate plus the thickness of your timber plus 1/2mm as shown.



6. Cut the dovetail slots on both of your long pieces as shown below, making sure you don't cut the top slots marked "X".

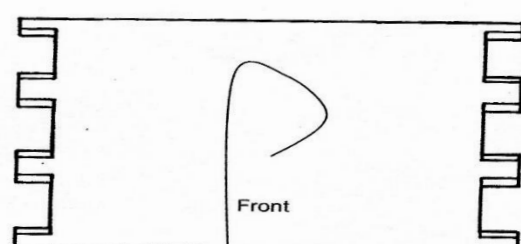
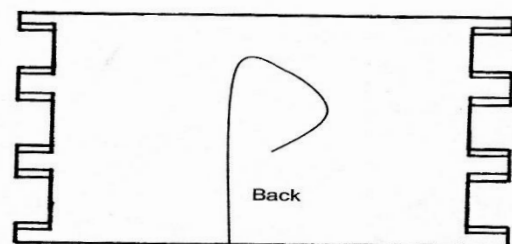
These are left to accommodate the slots for the sliding lid.



7. Turn the Jig around to the side marked "Straight". Place one of your back/front pieces of timber in between the stops which were set when you did the long pieces. Clamp your timber to the jig.

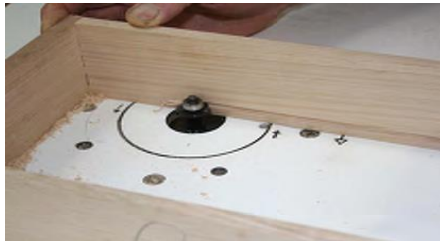
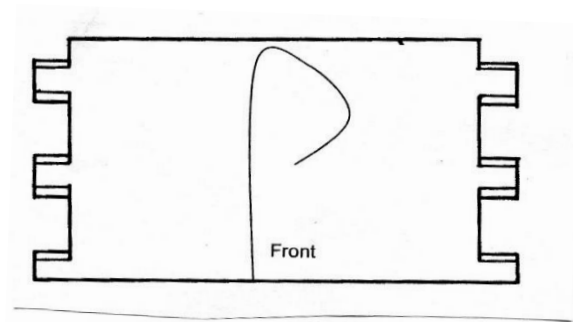
8. Fit the straight router bit in the router table. The height of your router bit **MUST** again be the height of the jig plate plus the thickness of your timber plus 1/2mm.

9. Cut the pins on the back piece as shown below. Now check the fit into the corresponding long pieces. If the fit is ok cut the pins on the front piece as shown below. If the fit is not ok, you will need to adjust the shims to obtain a good fit.



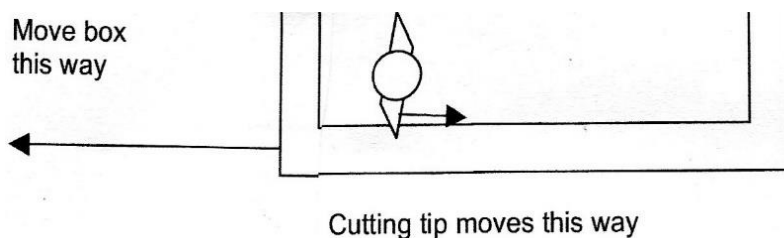
10. To enable the front piece to fit you will need to cut off the half pin from the top of this piece using the table saw.

11. The pieces can now be fitted together. Wrap masking tape around the box so that the joints are fitted tightly together.



12. Fit the rebate cutter into the router table using the large bearing and set it to the height of 4mm to the bottom of the cutter.

13. With the bottom of the box sitting on the router table run the cutter around the inside of the box as shown below. Now turn the box over so that the top of the box is sitting on the router table and run the cutter around the inside of the box again.



14. Now replace the large bearing with the small bearing and run the cutter around the inside of the box again on the bottom and the top. Check the fit of the plywood for the base and raise the cutter if necessary, to obtain a nice sliding fit.

15. With the box still taped together and measure the inside of the box. Record these two measurements then add 9mm to each of them. The depth of each groove for the base is 5mm so this size will give a 1mm clearance. This will be size of the plywood base.

16. The box can now be pulled apart.

Note: Care must be taken with the steps 17-20 to avoid damage to your work when completing the last part of the grooves needed. This was not able to be done when the box was assembled.

17. While the rebate cutter is still set up in the router table, run the left-hand side piece through the cutter enough to complete the groove for the lid. Stop the router before moving the piece away from the Router fence.

18. Now run the right-hand side piece through the cutter, this time you will need to start from inside the groove and take it through to the outside.

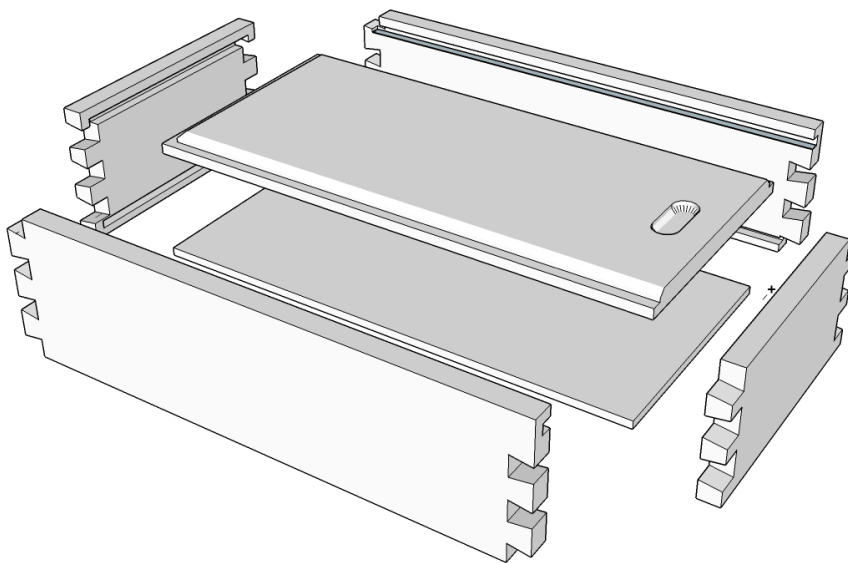
19. Now adjust the height of the rebate cutter to match the full height of the groove.

20 Repeat the operation on both pieces.

21. The Front Piece can now be trimmed down on the table saw to the bottom of the groove. This allows the lid to slide in the box.

20. The corners of the plywood base are now rounded off to match the diameter of the rebate cutter. (A 10-cent piece works well for marking the rounded corners). Now fit the plywood into the box.

21. Sand down the inside surfaces to 400g or finer. The box can now be glued and clamped together. Use a small square to check that the box is square. When the glue is dry sand the box, so all surfaces are flush.



22. Measure the size needed for the lid adding about 10mm to the length which can be trimmed up later.

23. Fit the panel raising cutter to the router table to 10mm from the outside of the cutter to the fence. The height of the cutter should ensure a good sliding fit in the

box. Run the lid around the cutter on both the long sides and the back edge only. **(Use a push block when doing the back edge)**.

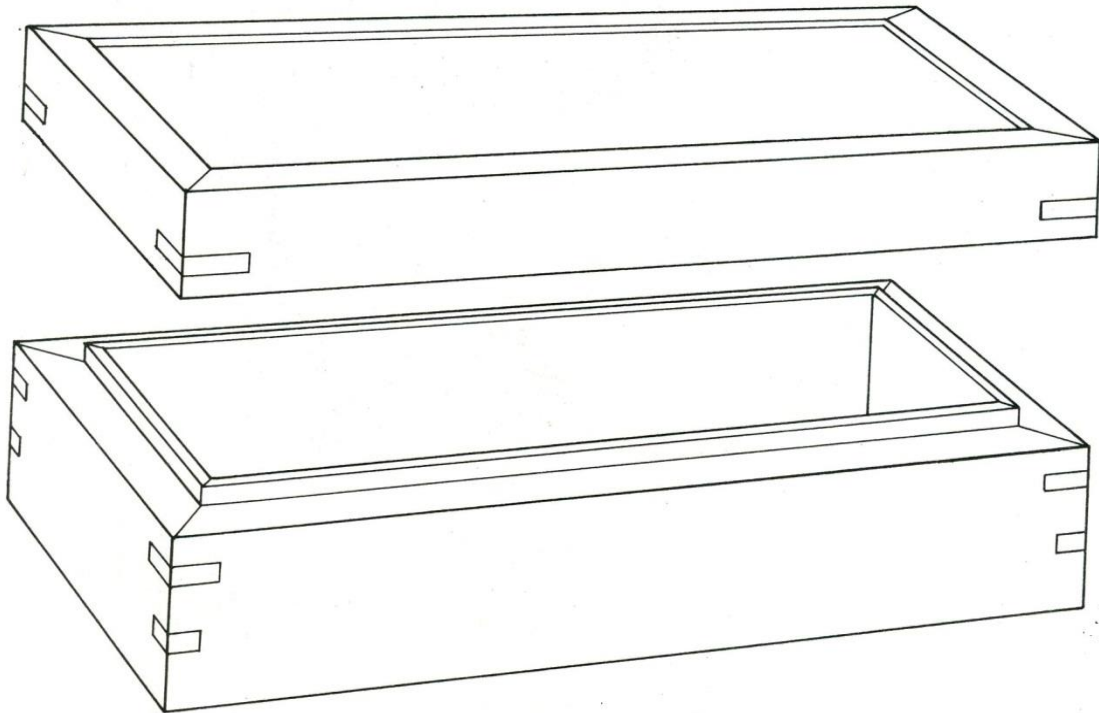
23. Now fit the lid to the box. Some sanding may be needed to ensure a good sliding fit. Mark the end of the lid and trim till it is flush with the front of the box.

24. Fit a ½ inch core box bit to the router table and set the height to 4mm and 13mm from the fence. Now set up 2 stops to allow a groove for the finger pull to be about 30mm to 40mm long. Carefully cut the finger pull by starting against one stop, pushing down the lid and moving it across to the other stop.

25. Sand down your box and lid to 400g or finer then apply 2 coats of clear finish sanding lightly between coats.

Well Done – Your box is finished and ready to use.

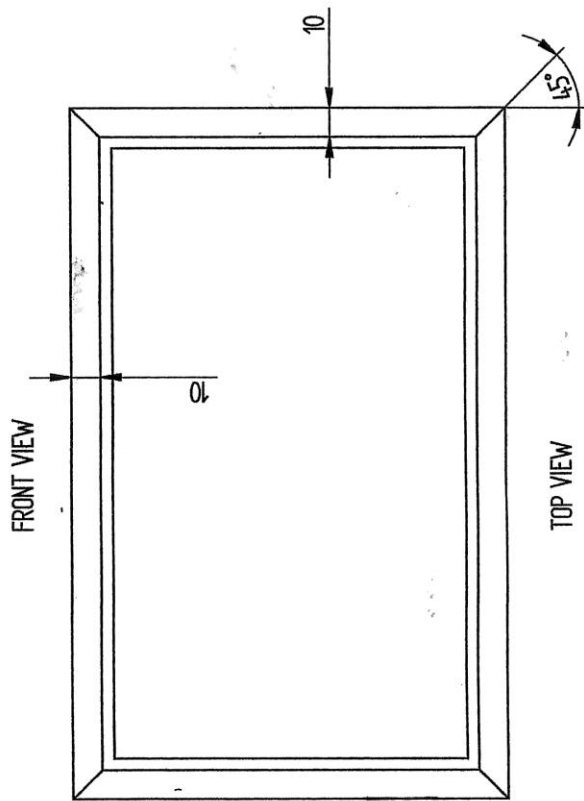
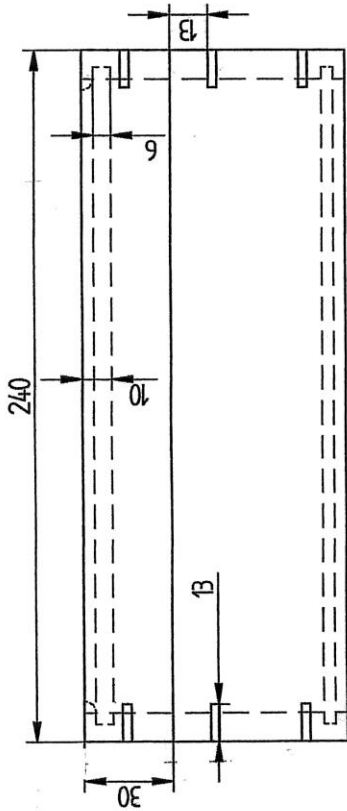
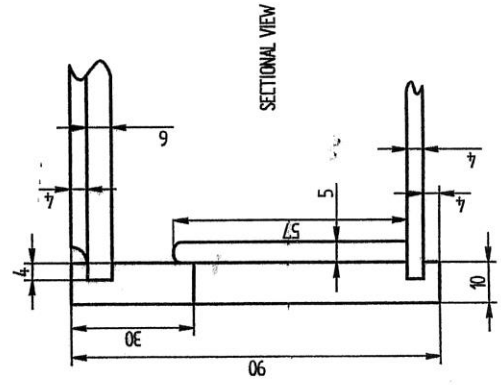
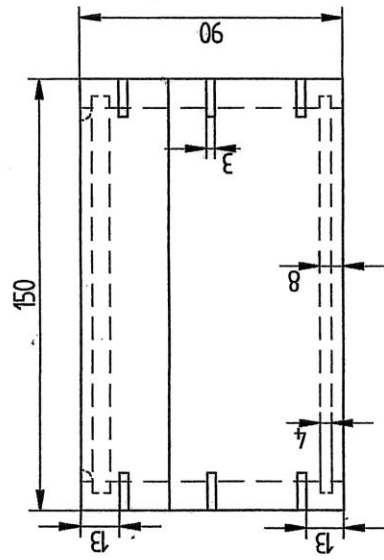
TRINKET BOX



CUTTING LIST			
Part	Quantity	Material	Size
Front/Back	2	Silky Oak	240 x 90 x 10
Sides	2	Silky Oak	150 x 90 x 10
Top Panel	1	Jacaranda/Cedar/ Rosewood	232 x 142 x 10
Base	1	Plywood	232 x 142 x 4
Side Inserts	2	To match top panel	130 x 57 x 6
Front/Back Inserts	2	To match top panel	220 x 57 x 6
Mitre Keys	12	Contracting timber	40 x 25 x 3

NOTE: This box will have a hinged lid.

TRINKET BOX



Trinket Box Procedure

1. Using the table saw rip the timber to the correct width then, using the compound mitre saw cut the pieces about 30mm longer than the size needed.
2. Mark the face & edge marks on the outside face of each piece, then place the pieces together how they are to be assembled matching the grain as much as possible. Number the ends of each piece how they will go together.
3. Set up the table saw so that the blade is about 4mm above the table and 4mm from the fence.
4. With the outside face on the top, start cutting a groove in each piece for the base plywood and the lid panel.
5. Adjust the fence so that it will widen the groove to the size of the plywood for the base. Cut both groove in each piece to this width.
6. Adjust the fence so that it will now widen the groove to 6mm (size needed for the lid panel). Cut the top groove only to 6mm wide.
7. Tilt the blade on the table saw to exactly 45 degrees.
8. Place the appropriate sled on the table saw and check it slides freely with the blade adjusted to the correct height to cut the box pieces.
9. Place the box pieces on the sled with the outsides up and cut a 45-degree mitre on the end of each of the 4 pieces.
10. From the mitred end just cut mark the length on one long and one short piece (90degrees down the face and 45 degrees on the edge).
11. Cut one of the long pieces to the correct size with the bevel on both ends. Using this piece, set up a stop on the sled and cut the second-long piece to size. Now repeat the same process for the 2 short pieces.
12. Dry fit the 4 pieces together and secure in a rubber band. Now measure the inside length and width. Add 7mm to these sizes to get the sizes needed for the plywood base and lid panel. **Note:** 7mm will give you 1mm clearance as the depth of the grooves is 4mm.
13. Cut the plywood base and the lid panel to the size required. **Note: A contrasting timber for the lid panel is recommended.**
14. Re-assemble the box parts with the plywood base to check it fits correctly.
15. Set up the router table with the panel raising bit about 3mm above the table and 8mm from the fence.
16. With the face of the lid panel down and using the large square edge push block, router one end. If the sizes are ok router the second end, then both the long sides. **Note: The ends are done first (against the grain) so that any chip out can be cleaned up when the cuts along the panel (with the grain) are done.**
17. Now turn the lid panel over and do the bottom side. If the lid panel won't fit into the groove, turn the lid panel over and move the router bit up slightly and take more off until the lid fits correctly in the groove.

18. Assemble the box again and check the lid fits correctly.
19. Dis-assemble the box and sand down the inside of the pieces, the plywood base, the lid panel and any edges that will be hard to sand down when the box is glued up. (sand to 400 grit)
20. Lay the box pieces out how it is to be assembled. Put masking tape along the outside faces. Apply glue on the mitre faces and a couple of dabs (only) in the centre of the grooves. **Note: Don't overdo the glue as it will run into the inside of the box and will be hard to remove later.**
21. Assemble the box and hold it together with the masking tape and place rubber bands around the box tightly. Wipe away any excess glue with a damp cloth.
22. When the glue is dry remove the masking tape and rubber bands and sand down any uneven surfaces.
23. Set up the box spline cutting jig on the table saw. Set the saw blade height to 12mm deep and the distance shown on the drawing.
24. Cut the grooves for the top and bottom splines. Now set the jig for the centre spline. **Note: this distance is from the top of the box.**
25. Cut some material for the splines from some contrasting timber (same thickness as the grooves). Glue in splines and allow to dry.
26. Trim down splines so that they are flush with the box.
27. Put a mark along one face so you will know how the box goes together when the lid is cut off.
28. Set up the table saw with the blade about 6mm above the table and 30mm from the fence.
29. With the top of the box against the fence run the box through the saw. After the first cut raise the blade so that the cut leaves about 1/4mm of material. **Note: This holds the box together to prevent it coming apart and getting caught on the blade.**
30. Sand down the excess left from the cut and sand down any sharp edges.
31. With the lid on the box, line up all the surfaces and tape the box together. **Note: Put a piece of paper under the lid where the hinges are to be fitted will help prevent the lid jamming when the hinges are fitted.**
32. Fit the hinges and latch.
33. Remove the hinges and latch and sand down the box to a smooth finish (400 grit).
34. Apply 2 coats of Danish oil sanding lightly between coats.
35. Refit hinges and latch and make adjustment if necessary, to ensure a good fit.
36. Line the bottom of the box with felt or thick cloth if you like depending on what you plan to use your box for.

Well Done – Your box is finished and ready to use.