



**Beekeeping Basics - Certificate II**  
**Participants Learning Guide**

**RTE2217A Construct and repair beehives**



**Australian Government**  
**Department of Agriculture,  
Fisheries and Forestry**



**Australian Honey Bee  
Industry Council**

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Judith Nettleingham and Bruce White assert their moral rights to be identified as the authors of this publication.

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## Introduction to this unit

**In this unit, you will learn about:**

- preparing to construct and repair beehives
- constructing and repairing beehives
- cleaning up when you have finished the work
- regulations that relate to beehives and to this work.

**Before you start this training, you should be confident about your skills to:**

- handle materials and equipment
- prepare materials and equipment for work
- select and use tools appropriate to task being performed
- work as part of a small team
- follow work instructions
- follow instructions on chemical and paint labels.

**You should know about:**

- construction and health standards to be maintained for beehives
- hive components and materials required to construct or repair them
- safe work practices.

**Why it is important**

Construction and repair of bee hive material is a very important aspect of any beekeeping operation. Correctly constructed beehive material should last at least 20 years; poorly constructed items may only last 2 to 3 years.

## Resources you will need for this unit

**For this unit of competency, you should have:**

- Participants Learning Guide (this booklet)
- Participants Assessment Workbook

- Bee Agskills: A Practical Guide to Farm Skills, NSW Department of Primary Industries 2007 available from <http://www.tocal.nsw.edu.au/reader/tocal-publications/bee-agskills>
- tools and equipment:
  - personal protective equipment:
    - face masks
    - gloves
    - overalls
    - safety goggles
    - steel capped boots
    - sunhats and sunscreen lotion if working outside
  - a number of beehives and components that need repairing
  - comb foundation (wax or plastic)
  - electric embedder
  - frame wiring board
  - frame wire
  - embedding board
  - eyelets
  - tools
    - drills
    - hammers
    - paint brushes
    - pliers
    - wire cutters
    - nail gun
  - jig for holding parts when working on them

- nails and staples
- wood working glue
- wax for preserving wood ware
- wax vat
- wood preserving vat
- wood preserver

The Participants Learning Guide is designed to introduce the topics and to provide you with some practical and written activities which will allow you to develop both your knowledge and skills in each area.

The Participant Assessment Workbook includes activities that you will be completing as part of your formal assessment for this unit.

Please record as much detail as you can as your responses to these activities will form part of your assessment.

You will need to send the Participants Assessment Workbook to your assessor. Check with assessor to find out if they need you to submit this Participants Learning Guide as well.

### **Important safety notes**

If your work requires the use of load-shifting equipment, you must have the appropriate licensing/training/certification required in your state or territory.

All power tools must have an up to date electric tag, tagged by an authorized person.

## 1. Beehives and why beekeepers use them

A hive may be any space or box in which bees can set up their home.

Feral bees build their hives in any convenient place including tree holes or in house cavities.



*This swarm has built comb under a balcony.*

*Source: Peter Perosh*

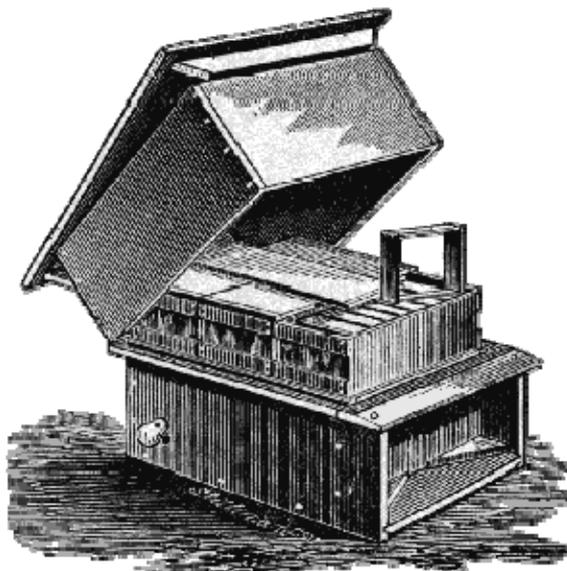
Because the purpose of beekeeping is to manage colonies of bees for their honey, wax and pollination value, beekeepers obviously need to be able to get easy access to the honey and to be able to check the colony for its health and to carry out beekeeping husbandry tasks, such as manipulating brood and introducing queens. In many countries, including Australia, beekeepers also want to be able to move their hives to new nectar and pollen sources at different times of the year.

While beekeeping has been carried on for thousands of years, it was only in relatively recent times that beekeepers adopted purpose-made boxes that could be fitted with removable frames.



*Traditional 'sleps' were made of plaited or woven straw. This skep is 42cm across by 38 cm high.*

In Australia, almost all beekeepers use Langstroth hive boxes. These were designed in 1851 by the Reverend Lorenzo Langstroth of Philadelphia, USA and consist of a hive body or box, which contains the removable frames for the bees to build their comb.



*The original Langstroth hive.*

Rev. Langstroth claimed that:

"...the chief peculiarity in my hive was the facility with which they could be removed without enraging the bees .... I could dispense with natural swarming, and yet multiply colonies with greater rapidity and certainty than by the common methods .... feeble colonies could be strengthened, and those which had lost their queen furnished with the

means of obtaining another. .... If I suspected that any thing was wrong with a hive, I could quickly ascertain its true condition, and apply the proper remedies."

*L.L. Langstroth in Langstroth on the Honey-Bee, 1860.*

Langstroth also identified the importance of 'bee space'. This is the space between combs and other hive parts which gives the bees proper room to work – it is normally a 8 – 10 mm gap.

A smaller space prevents them from building comb properly and a larger space encourages bees to build brace comb or burr comb. The right amount of bee space between frames also allows the beekeeper to lift and move frames without injury to the bees.

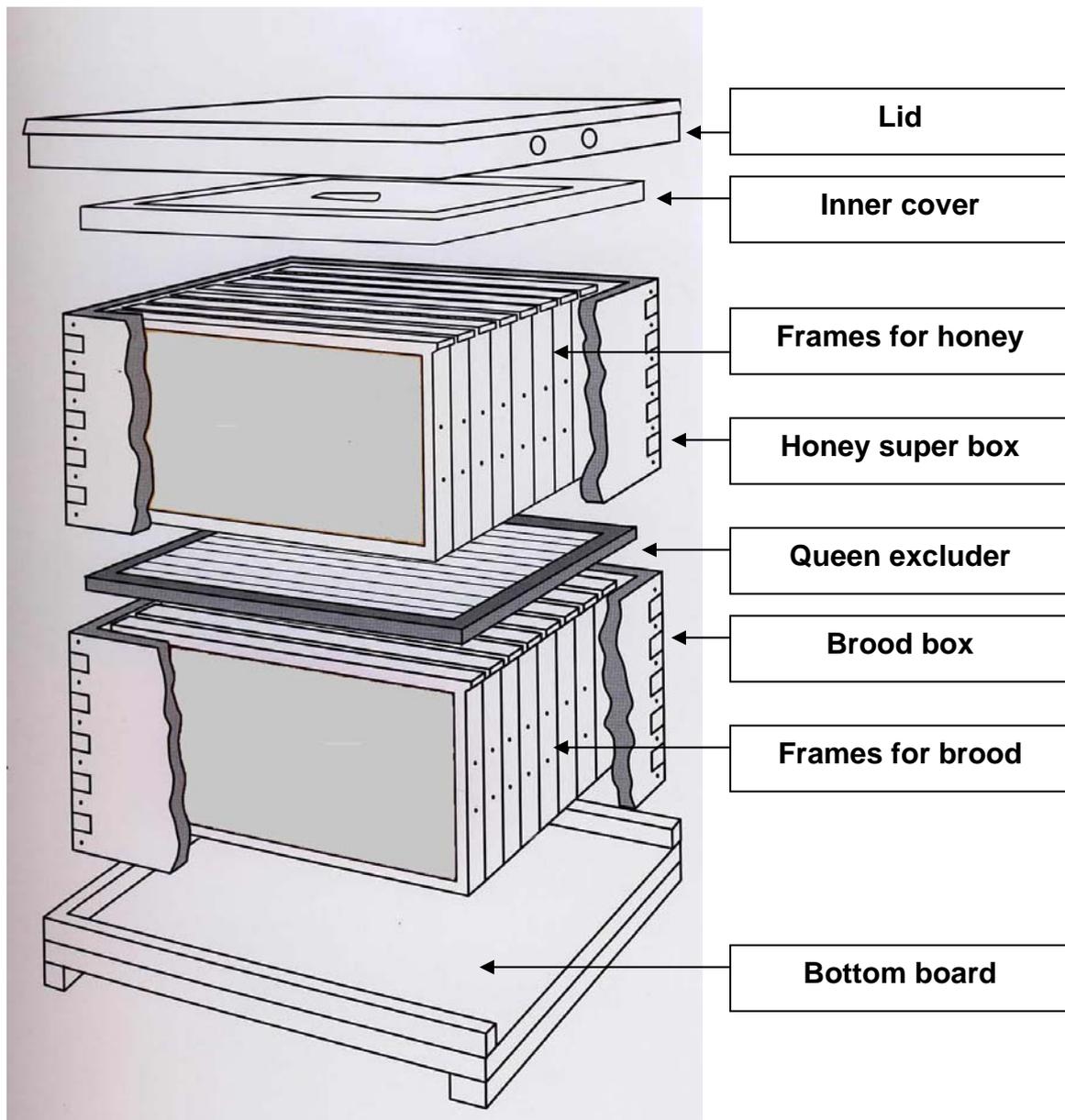


*Too much bee space allows bees to build burr or brace comb.*

*Source: [www.beecare.com](http://www.beecare.com)*

In Australia, apiary regulations require that all beekeepers must use hives with removable frames.

The following diagram shows the main parts of a modern Australian bee hive.



(diagram adapted from *Bee AgSkills*) The front cleat on the bottom board should jut out about 30mm to provide a landing for the bees.

## 2. Specifications for beehives

### Boxes

Boxes hold either 8,10 or 12 frames and come in different depths. The width varies according to the frames held. Boxes are referred to as:

Full depth (240 mm deep).

WSP (192 mm depth)

Ideal (144 mm depth)

Half (125 mm depth)

The depth between manufacturers may vary by a few millimetres. Langstroth frame depth suits the box size.

### Lids

There are two types of lids:

- migratory lids - the same external size as the box
- telescope lids – these fit over the box.

Most Australian beekeepers use the migratory lids as they make the boxes easier to stack, for example when moving them on trucks. Telescopic lids have the advantage of being harder to dislodge, for example in high winds.

### Bottom boards

Bottom boards are the same external size as the box except that the entrance juts out about 25mm to provide a landing for the bees with risers and two cleats to keep the bottom board off the ground

### Other components

These will vary according to preference of beekeeper:

- an inner cover that fits under the lid
- queen excluder
- fastener to hold the whole hive together.

### **Wood or plastic?**

Plastic boxes are available but more expensive to purchase. The advantage is that they don't need painting or preserving. Plastic boxes are not commonly used in Australia. Most of the information in this unit covers the assembly and repair of wooden boxes.

Often beekeepers and suppliers will refer to boxes as 'wood ware'.

### 3. Where to buy hives and hive components

There are many sources for beehives and components – the best place to look is in the advertisement in bee magazines and journals such as Honeybee News.

Field days are an excellent way to look at the variety of products available and to get advice on what will suit you and your budget best.

Your local beekeeping association will also be able to help with information about local suppliers.

#### **A few words of advice:**

Stick to one design with the same measurements – that way you can interchange components and have a stock of parts on hand that will fit any of your hives.

If buying second-hand, make sure that the materials are of standard size and construction, in good condition and that the hive has been irradiated or otherwise very thoroughly cleaned.

Factory-made equipment comes ready to assemble and is the most cost effective way of constructing beehives and components. However if you do want to make your own, stick to the standard sizes used by manufacturers.

## 4. Preparing to construct or repair beehives

### Set up your work area

#### Occupational health and safety

Check for any occupational health and safety hazards. This needs to become a habit before you start work on any task and while you are doing the task.

The best way to identify common hazards is to observe other people doing the tasks and to ask others, such as fellow workers, your supervisor or advisor.

Some workplaces have detailed written OHS policies or checklists that include:

- information about the common OHS risks for each task
- what actions must be taken to reduce or minimise the likelihood of that hazard happening
- how to report any hazards and who you must report to.

If there is a written OHS policy or checklist that covers the task of opening a hive, obtain a copy and, using a highlighter pen, mark the things that you are responsible for.

What are the likely OHS hazards that might occur while you are constructing or repairing a bee hive?

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How could you minimise harm to yourself or others?

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## **Tools and equipment**

Always check that the tools and equipment you need are available and in good working order. If any items look worn or damaged, or if any are missing, you need to deal with this before going any further.

## **Check for signs of disease or pests**

When repairing or repainting used equipment, you must check for any signs of pests or disease. By law, if you do notice something unusual or something that might indicate the presence of a pest or disease, you must report this and take the actions directed by your supervisor and/or apiary inspector. For example, if you notice signs of American foulbrood, the infected materials must be burned or sterilised by irradiation.

**Note:** This unit of competency does not cover the identification and reporting of pests and diseases of honeybees other than to draw your attention to how important this is. You should complete the unit *RTE3407A Identify and report unusual disease or plant pest signs*.

## 5. Constructing and repairing beehives

In addition to the various parts you will be assembling, you will need a large array of nails and screws.

### Nails/screws

Flat head, galvanized or cement coated nails or the equivalent screws or staples can be used. The following sizes are recommended:

Boxes	65 x 2.5 mm
Lid rim	50 x 2.5 mm
Centre Piece	30 x 1.4 mm
Tin cover	30 x 1.4 mm
Bottom Board	40 x 2.5 mm
Risers	25 x 1.4 mm
Cleats	65 x 2.5 mm
Frame top bars	30 x 1.4 mm
Frame bottom bar	25 x 1.4 mm
Frame tack	12 x 1.0 mm
Inner cover	30 x 1.4 mm

### Activity

Select and sort the screws, staples or nails you will need to construct an entire box.

### Making the lid

Factory-made migratory lids come in seven parts:

- two ends (for rim)
- two sides (for rim)
- centre piece
- masonite
- tin cover.

You also need:

- newspaper
- glue
- nails or screws as recommended above
- a small drill to drill the wood before nailing or screwing – this helps to reduce the risk of the wood splitting.

### Assembly sequence

1. Assemble, square and glue and nail the wooden rim together.
2. Insert the centre piece and glue and nail the wooden rim onto it.
3. Nail on the masonite cover, then place sheets of newspaper to cover the masonite. The newspaper provides insulation.
4. Nail on the metal cover.

Telescopic lids are assembled in the same way except there is no centre piece.

### **Activity**

Build a migratory-type lid. Make sure that the dimensions of the lid will suit the size of the box that you will be constructing.

### **Making the inner cover**

This sits between the lid and the frames. Some inner covers have the same external measurement as the boxes and can be purchased from a factory making beekeeping equipment. The parts are glued and nailed together.

A popular inner cover is a piece of Masonite or carpet cut smaller than the internal measurements of the box so the bees can get into the lid cavity.

Inner covers prevent bees from building burr comb in the lids.

### **Activity**

Make the inner cover to suit the lid and the box you will be constructing.

### **Making boxes**

Boxes can be either used as brood chambers or supers.

Factory-made boxes are purchased in parts - two ends and two sides. The end pieces will have hand holes on the outside of the box. Radiata pine is the most popular timber.

Boxes come in different depths and widths. The usual external measurements are:

	<b>Box Width</b>	<b>Box Length</b>
12 Frame	508 mm	508 mm
10 Frame	406 mm	508 mm
8 Frame	352 mm	508 mm

	<b>Box Depth</b>	<b>Frame size (end bar length)</b>
Full Frame	240 mm	232 mm
WSP	192 mm	182 mm
Ideal	144 mm	136 mm
Half Depth	125 mm	115 mm

These measurements have been converted from imperial (inch) measurements. Sometimes you will see the measurements rounded off to the nearest millimetre.

The frame depth of the end bar may vary a few millimetres between manufacturers.

What ever size you decide on it is wise to standardize all your boxes to that size so boxes and frames are interchangeable so management is more efficient.

Boxes can be purchased or made with rabbet corners, joints or finger joints (often called dovetail).

For each box you need:

- 2 end pieces
- 2 side pieces

- wood glue
- nails or screws (40 per bee box)
- a jig
- a wood plane
- small drill
- a rasp
- sandpaper.

It is important to nail or screw. For full depth boxes, use ten nails or screws for each of the 4 corners.

#### Assembly sequence

1. Boxes should be placed in a jig to keep them square during nailing.
2. Drilling a small hole before nailing will help prevent the timber from splitting.
3. Round the corners of wooden boxes with a rasp and sand paper the edges.
4. Camber the edges with a wood plane to improve the finished box appearance and to make the box more serviceable.

#### **Activity**

Build and finish off a box.

Repair a damaged or worn box.

#### **Bottom board**

The bottom board is the floor of the hive box. It consists of a board and two cleats to keep the bottom board off the ground so that the fork of a forklift can get under and lift the hive. It will also have risers to provide the entrance for the bees between the bottom board and the bottom of the frames.

Cleats are 50 x 50mm and as long as the width of the box. They are made of timber that is resistant to rot and white ants, usually cypress pine.

A bottom board sits on the cleats. It is made of galvanized iron, tempered hardboard or solid timber.

The width of the board matches the box size.

Some boards may be 25mm longer than the box length to provide a landing board for the bees.

Alternatively, some bottom boards have the front cleat jutting out 25mm to provide a landing for the bees.

Three or four risers sit on the top of the bottom board. Risers can vary in depth from 9 to 20mm high. If four risers are used, one is scalloped out to provide an entrance for the bees.

An entrance closer can also be attached to the bottom board.

Decide whether the landing for bees is being provided by longer cleats or by a longer board.

Some beekeepers nail the bottom boards to the brood boxes. Where this isn't done, these bottom boards are then referred to as loose bottoms. Loose bottoms have 20mm risers and often are used by commercial beekeepers.

Plastic bottoms are also available with the plastic cleats already screwed on.

For each bottom board you will need

- a board
- 2 cleats
- risers (usually 4)
- nails/screws
- a jig
- rasp
- sandpaper.

#### Assembly sequence

1. Nail or screw the cleats to the underside of the board using 65 x 2.5 mm nails for the cleats.

2. Nail or screw the risers to the top side of the board using 25 x 1.4 mm nails for the risers.
3. Cleat corners can be rounded with a rasp similar to the box corner rounding.
4. Nail the bottom board to the brood box as required.

### **Activity**

Decide whether you are going to use loose bottom boards or if you will nail it to the bottom of the brood box.

Build your bottom board.

### **Preserving wood ware before painting**

Beekeepers wood ware is mainly pine (*Radiata*) and without preserving will quickly develop dry rot. Most beekeepers prefer to treat their wood ware with 5% copper naphthenate.

Be absolutely sure preservatives do not contain insecticides.

Prepare the preservative according to the label instructions and the Material Safety Data Sheet.

Soak the completed box and wooden components from the bottom board, inner cover and lid after drilling and rasping. Be sure to follow the directions to ensure good penetration of the preservative.

Leave to dry for at least six weeks. If you don't, the paint will peel off!

### **Painting wood ware**

Paint the wood ware inside and out with successive coats of primer, undercoat and gloss. Gloss is popular and it keeps cleaner. However, some beekeepers also use acrylic paints. Paint must be lead-free. Avoid silver frost paint on the inside as it contains aluminium.

Pay special attention to the end grain. You should always use food-grade paint for the inside of the box. Many acrylic paints will be suitable but you must check. Always use gloves when painting or using wood preservatives.

## Dipping in wax

Some beekeepers dip boxes in a vat of micro-crystalline or paraffin wax which is heated to a temperature around 150-155 degrees Celsius.

Dipping time varies from six to ten minutes.

Some beekeepers regard dipping itself as sufficient preservative without the need to paint. However repainting while still hot pulls the paint into the wood as the wax cools. This is a popular treatment.



*Wax dipping to preserve beekeeping wood ware*

*Source: Bruce White*

## Caution

Because the wax mixture is at boiling point, there is always the very real risk of fire and serious burns.

## **Activity**

Decide what sort of preservative and other treatments you are going to apply.

Apply the preservative and treatments to the completed box, making sure that you work follow the requirements of the Materials Safety Data Sheets and original container labels for ANY chemical substances you are using.

## **Frames**

These hold brood and/or honey. A full depth frame of honey holds up to 2.75 kegs. of honey so must be correctly assembled.

Frames do not have any wood preservation treatments.

Frames consist of a

- top bar
- bottom bar
- two end bars.

They are available in different depths to suit the box they are used in, such as Full depth box, WSP box and so on.

By law, in Australia all honeybees must be kept in hives with removable frames.

Comb foundation is inserted into the frame to assist bees in making good quality comb.

Both plastic frames and plastic comb foundation are available. The following information relates mainly to wooden frames and wax foundation.

You will need:

- a roll of special tinned steel or stainless bee frame wire
- a special jig or wiring board
- sheets of comb foundation
- embedding board - a piece of wood slightly smaller than the internal measurement of the frame being embedded
- a method of embedding the wax sheet to the frame wire electric or manual
- nails and glue
- air gun and or stapler.

### Assembly sequence

*Note: refer to pages 18 and 19 of the Bee AgSkills book for photos*

1. Glue the joints and assemble the frame (Figure 10A page 17 Ag Skills workbook)

2. Nail the top bar using two 30 mm by 1.4 mm cement-coated or galvanized nails at each end of the top bar or a similar staple using an air gun. (Figure 10d PAGE 17 Ag Skills workbook)
3. Drive a nail into each side of the edges on the top bar 25 mm x 1.4 mm (Figure 10e page 17 Ag Skill workbook.)
4. Nail the bottom bar using two 25mm x 1.4 mm cement or galvanized nails at each end of the bottom bar or similar staple (Figure 10c page 17 Ag Skill workbook)
5. In the end bar, add eyelets to the holes using a nail. The holes will vary with frames depth. (Figure 10F page 18 Ag Skills workbook)
6. Place the frame into the wiring board jig
7. Drive tacks into the edge of the end bar near the end holes closest to the frame wire.
8. Place the wire through the holes in the end bar
9. Anchor the end of the wire by wrapping the wire around the tack driven into the end bar near the bottom bar and drive in the nail
10. Remove the wire from the rollers on the wire board
11. Tension the frame by using your fingers to tension the wire and to pull it tight.
12. Tie off the wire around the tack near the top bar and drive in the tack and break off the wire by twisting it.

Note: Wiring is not required if plastic foundation is to be used.

### **Activity**

Now assemble and wire a frame, following the sequence described above.

### Embedding wax comb foundation

The frame is then ready to be fitted with a sheet of comb foundation.

*Note: refer to pages 20 and 21 of the Bee AgSkills book for photos*

1. Insert the sheet of beeswax foundation into the top bar groove of the frame

2. Lower the frame over the embedding board so the wires of the frame are suspended on the board
3. With the wires facing you and the wax sheet underneath, use the electric embedder to melt the wax onto the wire. Apply sufficient electricity so the wire is heated to the point where it will melt into the sheet of wax but not through it.

A spur wheel hand-operated embedder can also be used with the same embedding board.

### **Activity**

If possible, try embedding foundation with an electric embedder and a spur wheel hand-operated embedder. Which did you find better? Why?

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## **Marking hives and components**

It is wise and required in some states to mark equipment with your government issued apiary registration number e.g. Victoria requires all brood boxes to be branded.

Brands can be punched or fire. When assembling equipment you should brand all lids, bottom boards, boxes and frames as this helps in tracing stolen equipment and for tracing back in the event of an outbreak of disease or pests.

## **Repairing equipment**

It is very important all beekeeping equipment be kept in good repair and bee proof.

Regular repainting of material keeps it like new for many years.

Dry rot is a significant problem for lids, bottom boards and boxes. If it is noticed, the material should be removed for repairs. Depending how serious the problem is the material can be repaired or replaced, depending on the policy of the owner. Dry rot can be detected by tapping on the material with a hammer. If dry rot is present, the surface is broken by the hammer blow. It is

possible to repair boxes, especially if the rabbet is damaged, with an on-end repair metal strip



*A metal strip is slipped over the damaged or worn end of a box.*

*Source: Bruce White*

Some beekeepers re-dip their boxes in paraffin or micro-crystalline wax and repaint them. Others sand down boxes to remove the paint and repaint sound boxes, lids and bottoms.

Often cleats or bottoms boards are replaced due to rot or white ant damage.

Frames are difficult to repair, wires can break. Bottom and top bars pull out leading to the combs collapsing. Lugs break off top bars. In these cases, it is better to melt down the wax and replace the frames with new ones.

## 6. Clean up on completion of work.

Once you have finished your construction or repair jobs, you need to:

- check that any tools and equipment that you used are still in good condition, ready for the next job. If not, you will need to arrange to replace or repair them.
- put tools and equipment away safely and in the correct place
- dispose of waste materials correctly. It is preferable to recycle or reuse waste materials rather than simply throwing them in the bin. Some waste products or materials may need to be disposed of in a particular way, for example, excess preservative or chemical drums.
- put boxes and components away according to the system in place at your workplace. Some businesses operate an inventory system so that they know how many items or stocks of raw materials they have on hand at any one time and where they are stored in the workshop or warehouse.
- note what materials you used. Especially if your workplace uses an inventory system, there will be set levels of stock items that need to be held, such as nails, screws or pre-cut timber. You may need to arrange for more supplies to be purchased.

### **Activity**

Ask your workplace supervisor about the inventory system that is used. Make sure you know what goes where.

Check whether you have authority to place orders for supplies or if this is something that your supervisor or another team member will do.

## 7. Regulations covering beehives and components:

There are regulations that cover different aspects of constructing beehives and their components. These are:

- Removable frames

Apiary Acts in various states and territories require beekeepers to use hives with removable frames.

- Marking of beehives

Most states and territories require beekeepers to mark their hive boxes with their registration number.

- Use of wood preservatives

Food Safety Acts and/or Health Acts require that if you are going to treat materials that come into contact with food, you must only use food grade treatments. Certain substances cannot be used.

- Disposal of waste products

All waste materials produced in the construction and repair of beehives must be disposed of according to local council and environmental regulations.

As the details of regulations vary from state to state, you must make sure that you know what the requirements are in the state or territory in which you are working.

## Final activities and assessment

Now that you have completed all the activities in this Learning Guide, take some time to practice constructing and repairing bee hives.

When you are ready, you can complete the assessment tasks that are listed in the Participants Assessment Workbook for this unit of competency.

## Useful references

*Bee Agskills: A Practical Guide to Farm Skills*, NSW Department of Primary Industries 2007

*The Bee Book: Beekeeping in Australia*, Peter Warhurst and Roger Goebel  
2nd edition Queensland Department of Primary Industries and Fisheries